ANEXO 12

DATASHEET Y COTIZACIONES

Sterlite™

SM (G.652) Multi Tube Double Jacket ADSS Optical Fiber Cable

PRODUCT INFORMATION

Fiber

Single Mode Optical Fiber	Sterlite Fiber ITU.T - G.652 D
Maximum Cabled Fiber Attenuation dB/Km	1310nm : 0.35 & 1550nm : 0.25
PMDq	≤ 0.2 ps/ √km

Loose Tube

Water Blocking Element	Thixotropic gel to prevent water ingress in loose tube
Tube	Thermoplastic Material

Core

Central Strength Member	Fiber Reinforced Plastic to provide tensile strength and antibuckling properties.
Filler	Polyethylene Black
Water blocking elements	Water Swellable Yarns is added to prevent water ingress in the core of cable.
Core Wrapping	Binder and Water Blocking Tape.

Cable

Rip Cord	Twisted yarns
Inner Sheathing	UV Proof Black MDPE
Peripheral Strength Member	Aramid Yarns to meet the required tensile strength
Outer Sheathing	UV Proof Black HDPE

CONSTRUCTIONAL DETAILS

- BLACK OUTER JACKET
- ARAMID YARN
- CORE WRAPPING
- CENTRAL STRENGTH MEMBER
- LOOSE TUBE WITH FIBERS AND GEL
- WS YARNS
- BLACK INNER SHEATH
- RIPCORD(s)

Typical construction Diagram - Not to Scale

OPTICAL FIBER CABLE PERFORMANCE

MECHANICAL				ENVIRONMENTAL	
Crush Resistance	3000N/ 100mm			**Temp. Performance**	
Minimum Bend Radius		**Impact strength**	25Nm	**Installation**	-30˚C to + 70˚C
-During Installation	20 D	**Torsion**	± 180°	**Operation**	-40˚C to + 70˚C
-After Installation	15 D	**Cable Bend**	20 D x 4 Turns x 3cycles	**Storage**	-40˚C to + 70˚C
Water Penetration	1m head, 3m samples, 24 hrs.(Over Inner PE)				

Tests shall be carried out as per IEC Standards. Change in attenuations shall be < 0.05 dB.

PRINTING DETAILS

Printing details (White - Hot Foil Emb.)	STERLITE SM Fiber Count G652D ADSS 200m OFC Laser Symbol Telephone Symbol FITEL Year of Production Cable ID Meter Marking

The accuracy of marking shall be ± 0.5%. Occasional loss of printing & remarking shall be as per Bell core GR 20 and this supercedes the earlier markings.

Prepared By:- N. Nitesh	Approved By:-	Doc. No.:- XX/12-F-D-S3-2-AA-200mtr	Rev.:-1.0	Date:- 05-09-2013

Sterlite™

SM (G.652) Multi Tube Double Jacket ADSS Lite Optical Fiber Cable

CABLE CONSTRUCTION

Fiber Count	Fibers Per Tube	Tubes	Fillers	Color of Loose Tubes In Sequence	Fiber Color	Diameter of Cable (±5%)	Weight of Cable (±10%)	Max. Tensile Strength
Nos.	Nos.	Nos.	Nos.			mm	Kg/Km	kN
24	12	2	4	Blue,Orange,Filler, Filler,Filler,Filler.	Blue,Orange,Green, Brown,Slate,White, Red,Black,Yellow, Violet,Pink,Aqua.	12.9	125	6.3
48	12	4	2	Blue,Orange,Green, Brown,Filler,Filler.	Blue,Orange,Green, Brown,Slate,White, Red,Black,Yellow, Violet,Pink,Aqua.	12.9	125	6.3

Filler Color: Black

Sheath Color: Black

Jacket Color: Black

LOADING CONDITION

	Span Length	Sag %		Excess Load		
	mtr	Installation Sag	Vector Sag	Ice Load	Wind Speed	
	200	1.0%	4.1%	10 mm	60 Km / Hr	

Spacing : Cable shall be install at minimum distance of 1 mtr from 23kV Power Line.

Standard Length Details

Cable length (Km)   4 ± 5%

Order Tolerance: ± 5 %

Short Lengths :   Max 5 %, Customer Approval.

Sterlite™

SM (G.652) Multi Tube Double Jacket ADSS Optical Fiber Cable

PRODUCT INFORMATION

Fiber

Single Mode Optical Fiber	Sterlite Fiber ITU.T - G.652 D
Maximum Cabled Fiber Attenuation dB/Km	1310nm : 0.35 & 1550nm : 0.25
PMDq	≤ 0.2 ps/ √km

Loose Tube

Water Blocking Element	Thixotropic gel to prevent water ingress in loose tube
Tube	Thermoplastic Material

Core

Central Strength Member	Fiber Reinforced Plastic to provide tensile strength and antibuckling properties.
Filler	Polyethylene Black
Water blocking elements	Water Swellable Yarns is added to prevent water ingress in the core of cable.
Core Wrapping	Binder and Water Blocking Tape.

Cable

Rip Cord	Twisted yarns
Inner Sheathing	UV Proof Black MDPE
Peripheral Strength Member	Aramid Yarns to meet the required tensile strength
Outer Sheathing	UV Proof Black HDPE

CONSTRUCTIONAL DETAILS

- BLACK OUTER JACKET
- ARAMID YARN
- CORE WRAPPING
- CENTRAL STRENGTH MEMBER
- LOOSE TUBE WITH FIBERS AND GEL
- WS YARNS
- BLACK INNER SHEATH
- RIPCORD(s)

Typical construction Diagram - Not to Scale

OPTICAL FIBER CABLE PERFORMANCE

MECHANICAL				ENVIRONMENTAL	
Crush Resistance	3000N/ 100mm			**Temp. Performance**	
Minimum Bend Radius		**Impact strength**	25Nm	**Installation**	-30˚C to + 70˚C
-During Installation	20 D	**Torsion**	± 180°	**Operation**	-40˚C to + 70˚C
-After Installation	15 D	**Cable Bend**	20 D x 4 Turns x 3cycles	**Storage**	-40˚C to + 70˚C
Water Penetration	1m head, 3m samples, 24 hrs.(Over Inner PE)				
Tests shall be carried out as per IEC Standards. Change in attenuations shall be < 0.05 dB.					

PRINTING DETAILS

Printing details (White - Hot Foil Emb.)	STERLITE SM Fiber Count G652D ADSS 400m OFC Laser Symbol Telephone Symbol FITEL Year of Production Cable ID Meter Marking

The accuracy of marking shall be ± 0.5%. Occasional loss of printing & remarking shall be as per Bell core GR 20 and this supercedes the earlier markings.

Prepared By:- N. Nitesh	Approved By:-	Doc. No.:- XX/12-F-D-S3-2-AA-400mtr	Rev.:-1.0	Date:- 05-09-2013

Sterlite™

SM (G.652) Multi Tube Double Jacket ADSS Lite Optical Fiber Cable

CABLE CONSTRUCTION

Fiber Count	Fibers Per Tube	Tubes	Fillers	Color of Loose Tubes In Sequence	Fiber Color	Diameter of Cable (±5%)	Weight of Cable (±10%)	Max. Tensile Strength
Nos.	Nos.	Nos.	Nos.			mm	Kg/Km	kN
24	12	2	4	Blue,Orange,Filler, Filler,Filler,Filler.	Blue,Orange,Green, Brown,Slate,White, Red,Black,Yellow, Violet,Pink,Aqua.	13.5	135	12.97
48	12	4	2	Blue,Orange,Green, Brown,Filler,Filler.	Blue,Orange,Green, Brown,Slate,White, Red,Black,Yellow, Violet,Pink,Aqua.	13.5	135	12.97

Filler Color: Black

Sheath Color: Black

Jacket Color: Black

LOADING CONDITION

	Span Length	Sag %		Excess Load		
	mtr	Installation Sag	Vector Sag	Ice Load	Wind Speed	
	400	1.0%	4.1%	10 mm	60 Km / Hr	

Spacing : Cable shall be install at minimum distance of 1 mtr from 23kV Power Line.

Standard Length Details

Cable length (Km)   4 ± 5%

Order Tolerance: ± 5 %

Short Lengths :   Max 5 %, Customer Approval.

Sterlite™

SM (G.652) Multi Tube Double Jacket ADSS Optical Fiber Cable

PRODUCT INFORMATION

Fiber

Single Mode Optical Fiber	Sterlite Fiber ITU.T - G.652 D
Maximum Cabled Fiber Attenuation dB/Km	1310nm : 0.35 & 1550nm : 0.25
PMDq	≤ 0.2 ps/ √km

Loose Tube

Water Blocking Element	Thixotropic gel to prevent water ingress in loose tube
Tube	Thermoplastic Material

Core

Central Strength Member	Fiber Reinforced Plastic to provide tensile strength and antibuckling properties.
Filler	Polyethylene Black
Water blocking elements	Water Swellable Yarns is added to prevent water ingress in the core of cable.
Core Wrapping	Binder and Water Blocking Tape.

Cable

Rip Cord	Twisted yarns
Inner Sheathing	UV Proof Black MDPE
Peripheral Strength Member	Aramid Yarns to meet the required tensile strength
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CONSTRUCTIONAL DETAILS

- BLACK OUTER JACKET
- ARAMID YARN
- CORE WRAPPING
- CENTRAL STRENGTH MEMBER
- LOOSE TUBE WITH FIBERS AND GEL
- WS YARNS
- BLACK INNER SHEATH
- RIPCORD(s)

Typical construction Diagram - Not to Scale

OPTICAL FIBER CABLE PERFORMANCE

MECHANICAL				ENVIRONMENTAL	
Crush Resistance	3000N/ 100mm			**Temp. Performance**	
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-During Installation	20 D	**Torsion**	± 180°	**Operation**	-40˚C to + 70˚C
-After Installation	15 D	**Cable Bend**	20 D x 4 Turns x 3cycles	**Storage**	-40˚C to + 70˚C
Water Penetration	1m head, 3m samples, 24 hrs.(Over Inner PE)				

Tests shall be carried out as per IEC Standards. Change in attenuations shall be < 0.05 dB.

PRINTING DETAILS

Printing details (White - Hot Foil Emb.)	STERLITE SM Fiber Count G652D ADSS 600m OFC Laser Symbol Telephone Symbol FITEL Year of Production Cable ID Meter Marking

The accuracy of marking shall be ± 0.5%. Occasional loss of printing & remarking shall be as per Bell core GR 20 and this supercedes the earlier markings.

Prepared By:- N. Nitesh   Approved By:-   Doc. No.:- XX/12-F-D-S3-2-AA-600mtr   Rev.:-1.0   Date:- 05-09-2013

Sterlite™

SM (G.652) Multi Tube Double Jacket ADSS Lite Optical Fiber Cable

CABLE CONSTRUCTION

Fiber Count	Fibers Per Tube	Tubes	Fillers	Color of Loose Tubes In Sequence	Fiber Color	Diameter of Cable (±5%)	Weight of Cable (±10%)	Max. Tensile Strength
Nos.	Nos.	Nos.	Nos.			mm	Kg/Km	kN
24	12	2	4	Blue,Orange,Filler, Filler,Filler,Filler.	Blue,Orange,Green, Brown,Slate,White, Red,Black,Yellow, Violet,Pink,Aqua.	13.7	139	15.5
48	12	4	2	Blue,Orange,Green, Brown,Filler,Filler.	Blue,Orange,Green, Brown,Slate,White, Red,Black,Yellow, Violet,Pink,Aqua.	13.7	139	15.5

Filler Color: Black

Sheath Color: Black

Jacket Color: Black

LOADING CONDITION

	Span Length	Sag %		Excess Load		
	mtr	Installation Sag	Vector Sag	Ice Load	Wind Speed	
	600	1.0%	5.2%	10 mm	60 Km / Hr	

Spacing : Cable shall be install at minimum distance of 1 mtr from 23kV Power Line.

Standard Length Details

Cable length (Km)   4 ± 5%

Order Tolerance: ± 5 %

Short Lengths :   Max 5 %, Customer Approval.

Prepared By:- N. Nitesh   Approved By:-   Doc. No.:- XX/12-F-D-S3-2-AA-600mtr   Rev.:-1.0   Date:- 05-09-2013

Preformed Fittings and Accessories for ADSS

■ Dead-end Set for ADSS
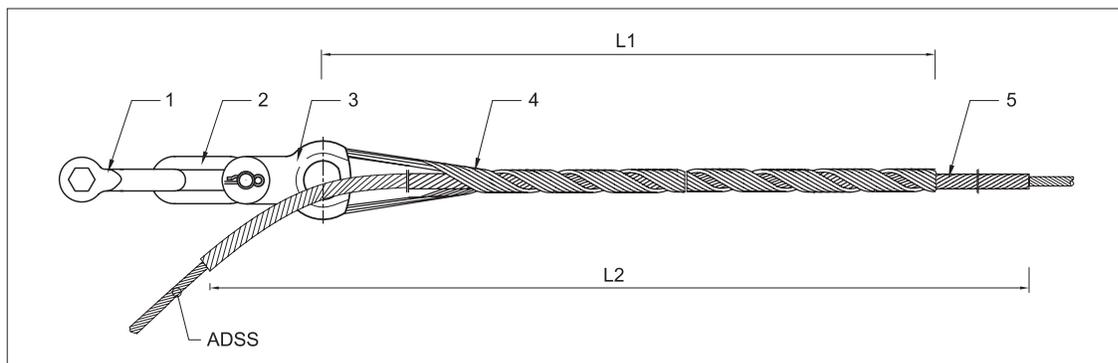
1. U shackle: Galvanized steel

2. Extensive link: Galvanized steel

3. Thimble Clevis: Galvanized cast iron

4. Dead-end component: Aluminum-clad steel with grit

5. Structural reinforcing rods: Aluminum-clad steel

Product Characteristic

• The helical formed wire inner and outer layer components are designed to transfer axial tensile loads and distribute radial compressive forces over the surface in contact with the ADSS to minimize effects on the central core and internal optical fibers.

• The inside of inner and outer rods covered with silicon carbide, increasing frictional force and damping effects.

• Minimum holding strength of dead-end set not less than 75% RTS of cable.

• Has excellent anti-fatigue characteristic.

• The installation is convenient, no special tools needed.

Consideration

• Once installed, structural reinforcing rods and dead-end component may be removed and reinstalled once for repositioning purpose. Do not reuse after this initial installation. The hardware components may be reused as long as they are in good condition. Do not modify any components.

• Right-hand lay is standard. Left-hand lay is available.

• Contact us in advance for the requirement of left-hand lay dead-end clamp.

• U shackle, PD Link and other hardware accessories may be ordered with the dead-end.

• The fittings can only be installed by experienced workers.

Catalogue Table of Dead-end for ADSS

Catalogue Number	Suitable strength(kN)	Span(m)	Structural reinforcing rods L2		Dead-end component L1	
			Length(mm)	Diameter(mm)	Length(mm)	Diameter(mm)
AN-015-****	≤15	≤150	1200	2.5	\	\
AN-030-****	16~30	151~300	1400	2.5	1000	3.5
AN-040-****	31~50	301~600	1500	2.5	1100	3.5
AN-050-****	51~80	601~700	2000	2.5	1500	4.0
AN-060-****	>80	701~1000	2200	2.5	1600	4.8

Note: **** is on behalf of diameter of ADSS;

If the strength of ADSS is less than 15kN, there is only one layer of rods.
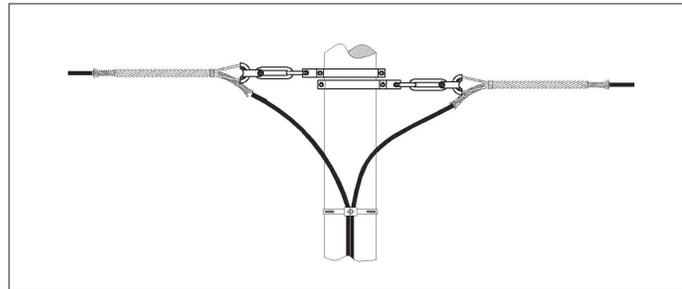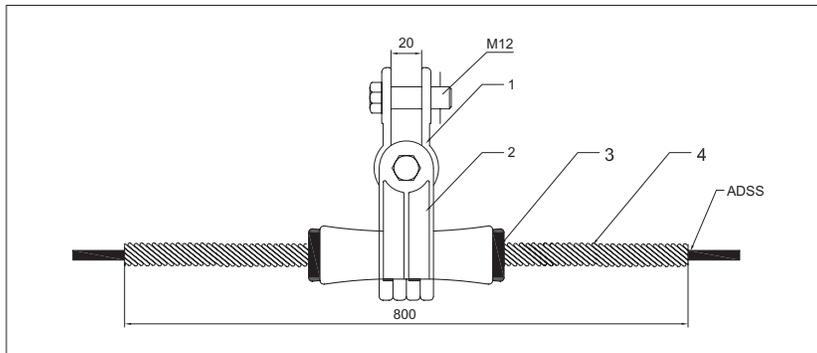
Installation Diagram
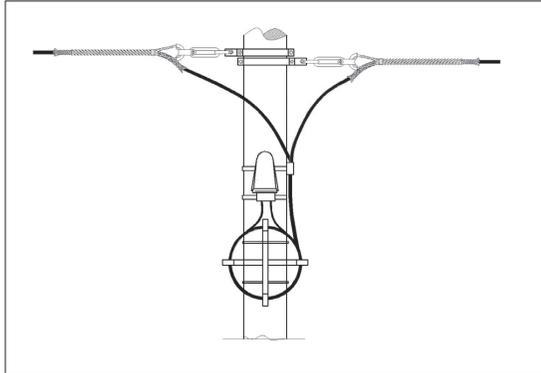
Joint Pole
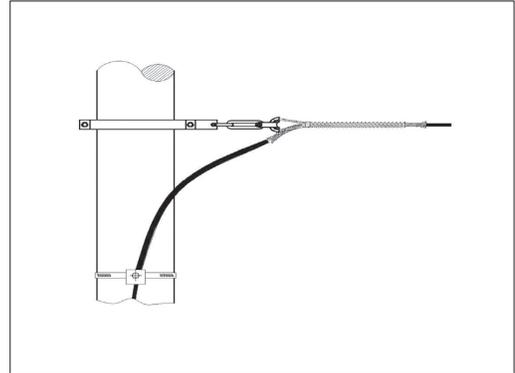
Terminal Pole

Pass Pole

The installation diagrams on tower are same as OPGW

■ Single Suspension Set
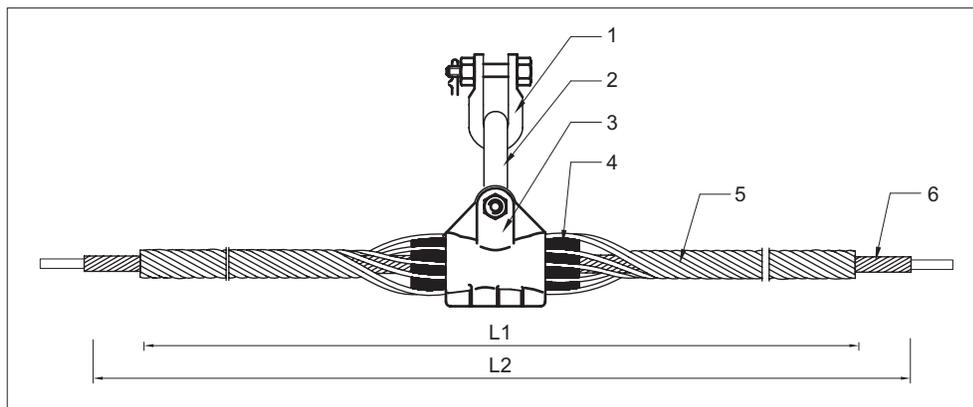
• Small span suspension set

1. U shackle: Galvanized steel

2. Housing: Aluminum alloy

3. Insert: EPDM

4. Reinforcing rods: Aluminum alloy

Products Characteristic

• Single structure, with only one layer rods;
• Suitable for span less than 150m, the turning corner less than 20°

• Normal suspension set

1. U shackle: Galvanized steel

2. Eye link: Galvanized steel

3. Housing: Aluminum alloy

4. Insert: EPDM

5. Outer rods: High strength aluminum alloy

6. Structural reinforcing rods: Aluminum-clad steel

Product Characteristic

• The suspension set provides superior cable and fiber protection at the support point. The combination of Structural reinforcing rods, Outer rods, boltless housing and resilient Insert reduces compression, clamping and bending stresses on cable. Negative weather related cable motion, such as Aeolian vibration, gallopin, and wind sway are also minimized.

• The insert for resistance to ozone attack, weathering, extreme high and low temperature variations. An aluminum alloy reinforcement is molded into the elastomer.

• The slip load of suspension set can reach approximate 10-20% of ADSS rated strength to offer sufficient holding strength for ADSS.

Consideration

• The maximum recommended line angle for a single suspension set is 30°. Double one is recommended for OPGW line angle between 30°and 60°.

• Once installed, do not reuse the rod components. The hardware components may be reused as desired as long as they are in good condition. Do not modify any components.

Catalogue Table of Normal Suspension set for ADSS

Catalogue Number	Span(m)	Structural reinforcing rods(mm)		Outer rods(mm)	
		Length L2	Diameter	Length L1	Diameter
AC-0100-****	≤150	800	2.5	\	\
AC-0200-****	151~300	\	\	1400	4.6
AC-0300-****	301~400	1800	3.0	1200	4.6
AC-0400-****	401~500	1900	3.0	1300	4.6
AC-0500-****	501~600	2000	3.0	1400	6.0
AC-0600-****	601~700	2100	3.0	1500	6.0
AC-0700-****	≥701	2200	3.0	1600	6.0

■ Double Suspension Set
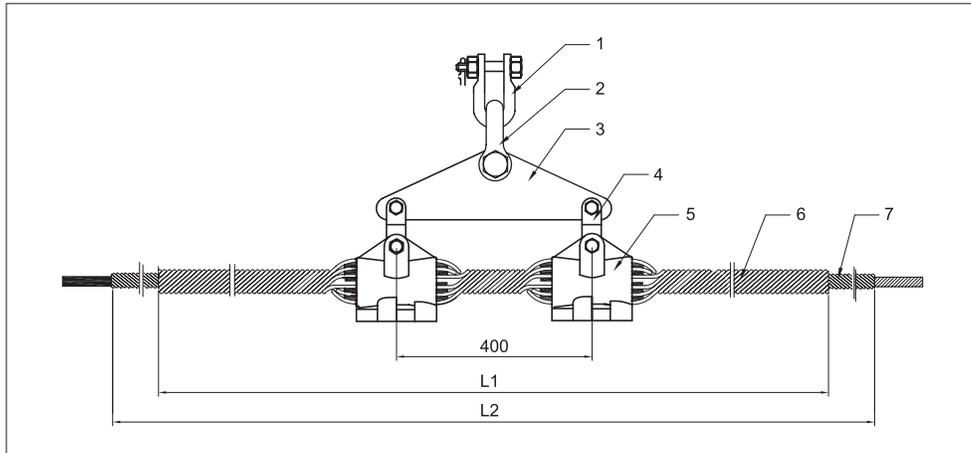
1. U shackle: Galvanized steel
2. Yoke plate: Galvanized steel
3. PS clevis: Galvanized steel
4. Housing: Aluminum alloy
5. Insert: EPDM
6. Outer rods: High strength aluminum alloy
7. Structural reinforcing rods: Aluminum-clad steel

Consideration

• Mainly used in long span rivers and valleys with large drop in level.
• Used on poles or tower which turning corner is from 30 degree to 60 degree.
• Normally, the span length of Yoke plate is 400mm. It can be adjusted according to customers' requirement.

Catalogue Table of Double suspension set

Catalogue Number	Suitable Range	Range Diameter(mm)	Structural reinforcing rods(mm)		Outer rods(mm)	
			Length L2	Diameter	Length L1	Diameter
ASC-****-400	RTS≤60kN Span≤800m	9.0~15.0	2260	3.0	1660	4.6
ASC-****-400		15.1~16.4	2360	3.0	1760	4.6
ASC-****-400		16.5~18.0	2460	3.0	1860	4.6
ASC-****-400		>18	2560	3.0	1960	4.6
ASC-****-400	RTS>60kN Span>800m	9.0~15.0	2260	3.0	1660	6.0
ASC-****-400		15.1~16.4	2360	3.0	1760	6.0
ASC-****-400		16.5~18.0	2460	3.0	1860	6.0
ASC-****-400		>18	2560	3.0	1960	7.9

Note: **** is on behalf of diameter of ADSS;
400 is on behalf of span length of Yoke plate.

■ Spiral Vibration Damper

Gripping section D   Damping section L
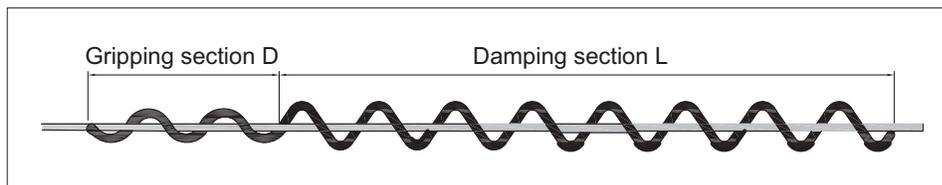
Product Characteristic

- Effectively reduces levels of Aeolian vibration on cables.
- Has a helically formed dampening section sized for interplay of damper and cable, to provide the action/reaction motion that opposes the natural vibration wave. A smaller gripping section gently grips the cable so
- that cable and fiber are not damaged or distorted and

there is no optical signal loss.
- ADSS cables tend to vibrate at higher levels than other cables of comparable size, mainly due to their relatively lighter weight. Also the soft nature of their jackets and internal construction requires special consideration.

Consideration

- Consult ZTT for recommendation on the number of damper required per span.

Catalogue Table of Spiral vibration damper

Catalogue number	Range diameter (mm)	D (mm)	L (mm)	Weight (kg)
FLN-10	Φ9.1～Φ11.0	350	1050	0.5
FLN-12	Φ11.1～Φ13.0			
FLN-14	Φ13.1～Φ15.0			
FLN-16	Φ15.1～Φ17.0			
FLN-18	Φ17.1～Φ19.1			
FLN-20	Φ19.1～Φ21.0			

■ Corona Coil
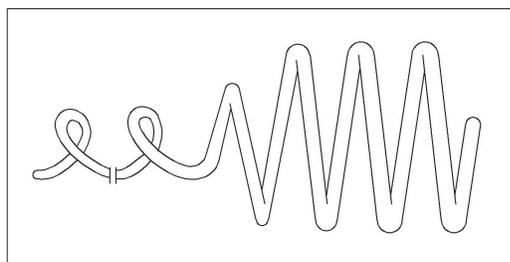
Product Characteristic

- Corona coils are made of aluminum alloy, intended to reduce electrical stress at the ends of the metal rods of Dead-ends and Suspensions applied on ADSS cables installed in high voltage electrical fields. They are made from a light weight material and are designed to suppress electrical arcing at the ends of metal rods which can occur on some lines and may damage the plastic

jacket of ADSS cables.
- The unit is secured in place by wrapping the unique gripping section directly over the Structural Reinforcing Rods of a dead-end and suspension. They will not interfere with the performance of the dead-end or the suspension.
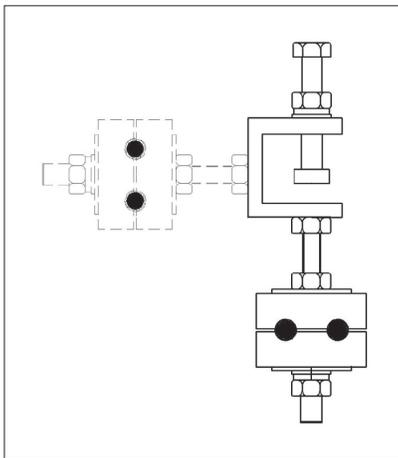
Consideration

- Position the Corona Coil so all the ends of the Structural Reinforcing Rods fall completely inside the coil section, and try to align the rods in the center of the coil.
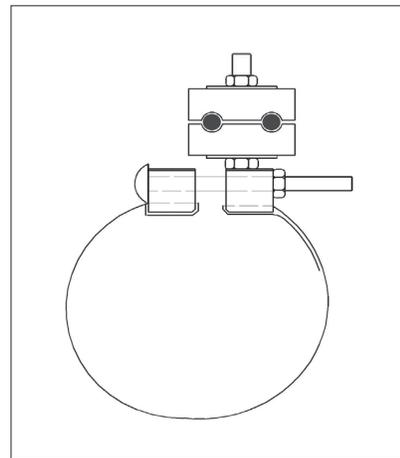- This product may be removed and reinstalled during the initial installation if it is in good condition.

Installation Diagram
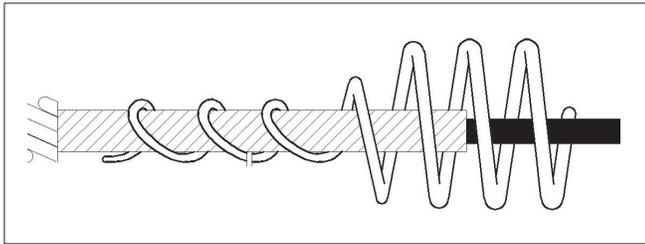
■ Downlead

For tower

For pole

Products Characteristic

- The downlead clamp is made of EPDM, protecting the cable well.
- The downlead for tower could be adjusted 90°in direction.

Consideration

- The diameter of pole must be available when order placed.

■ Cable Tray and Joint Box

The ADSS's cable tray and joint box are similar as OPGW's.

• For Dead-end and Suspension set

Catalogue Table

Catalogue Number	Suitable Range (mm)	Material	Breaking Load (KN)
TGX 070 165	For the diameter 165 Pole	Galv. Steel	70
TGX 070 190	For the diameter 190 Pole	Galv. Steel	70
TGX 070 210	For the diameter 210 Pole	Galv. Steel	70
TGX 070 230	For the diameter 230 Pole	Galv. Steel	70
TGX 070 260	For the diameter 260 Pole	Galv. Steel	70
TGX 070 300	For the diameter 300 Pole	Galv. Steel	70
TGX 070 400	For the diameter 400 Pole	Galv. Steel	70

• For Joint box and Cable

Catalogue Number	Suitable Range (mm)	Material	Breaking Load (KN)
TGJ 030 165	For the diameter 165 Pole	Galv. Steel	30
TGJ 030 190	For the diameter 190 Pole	Galv. Steel	30
TGJ 030 210	For the diameter 210 Pole	Galv. Steel	30
TGJ 030 230	For the diameter 230 Pole	Galv. Steel	30
TGJ 030 260	For the diameter 260 Pole	Galv. Steel	30
TGJ 030 300	For the diameter 300 Pole	Galv. Steel	30
TGJ 030 400	For the diameter 400 Pole	Galv. Steel	30

Fastened Fittings for Tower

For Straight tower(TTZX)   For Corner tower(TTZJ)   For Joint box and Cable tray(TTJG)

Catalogue Table

Catalogue table	Suitable Range	Material	Breaking Force (kN)
TTZX 070 080	Dimension of Linking Part≤80mm	Galv. steel	70
TTZX 070 100	Dimension of Linking Part 81~100mm	Galv. steel	70
TTZX 070 125	Dimension of Linking Part 101~125mm	Galv. steel	70
TTZX 070 145	Dimension of Linking Part 126~145 mm	Galv. steel	70
TTZX 070 165	Dimension of Linking Part 146~165 mm	Galv. steel	70
TTZX 070 200	Dimension of Linking Part 166~200 mm	Galv. steel	70
TTZJ 098 100	Dimension of Linking Part≤80mm	Galv. steel	98
TTZJ 098 125	Dimension of Linking Part 101~125mm	Galv. steel	98
TTZJ 098 145	Dimension of Linking Part 126~145mm	Galv. steel	98
TTZJ 098 165	Dimension of Linking Part 146~165 mm	Galv. steel	98
TTZJ 098 200	Dimension of Linking Part 166~200 mm	Galv. steel	98
TTJG 030 075	Dimension of Linking Part 56~75 mm	Galv. steel	30
TTJG 030 075	Dimension of Linking Part 80~100 mm	Galv. steel	30

OptiBox6

- Acepta hasta 6 adaptadores SC ó 12 adaptadores LC Duplex.

- Se puede instalar lado a lado

- Con canal para cables debajo de la caja

- Dimensiones: 25 x 15 x 5 cms.

Patch cords

Features

- 1.4 mm and 1.8 mm duplex cable
- Low smoke and free of halogen (LSFH™)
- Multimode and singlemode fiber
- Comprehensive LC family to suit specific application and needs
- Simple polarity flipping with duplex clips
- Colour coded OM4 multimode connector shrouds

Benefits

- Fast patching with push-pull LC technology
- Unlimited access with LC-HD
- Super low-loss OM4 performance

Excellence in connectivity

HUBER+SUHNER patch cords are manufactured with the highest quality materials and to the strictest of manufacturing processes. Our aim is to produce patch cords that add value to our customers either by reducing the cable size, enhancing performance or improving the overall usability.

In high density applications, customers can choose from one of four innovative LC connectors that reduce cable bulk and speed up the patching and re-patching process. Our unique «push-pull» LC design was the first major step in revolutionising the standard LC. With this major advancement, customers no longer need to limit their cabling designs to the restrictions of standard connectivity.

LC-XD uniboot
The LC-XD uniboot is designed to be used for the highest packing density. The connector has an innovative push-pull mechanism which allows efficient handling even in the smallest of spaces. Another feature is the ability of adjusting polarity without having to use any tools.

LC-HD
The LC-HD connector uses exactly the same shroud as the LC-HQ product but with the addition of an extension pin that protrudes outwards at the rear. This extension pin offers even better performance than the LC-HQ because the pin can be accessed even in the highest density environments. LC adaptors can be 360° stacked and accessibility is still better and faster than other LC solutions on the market.

LC-HQ
The LC-HQ connector allows LC adaptors to be placed side by side with minimal impact on insertion or removal. Due to its push-pull functionality, the connector can be removed from the adaptor simply by pulling or pushing the shroud. This is possible because with LC-HQ it is no longer necessary to access the small keys on the upper front face of the connector.

LC-Classic
The LC classic connector from HUBER+SUHNER is on the industry standard simplex or duplex LC which has a clip on the top face of the shroud for engaging the connector key mechanism. Unlike the HQ or HD type, the classic requires full finger access to the clip and subsequently is not optimised for environments where high packing density is required.

SC

The SC connector from HUBER+SUHNER is available as a simplex connector or as a duplex pair (using a retrofittable duplex clip). Customers can choose whether to have duplex clips fitted to the assemblies or not. Many of the LiSA fiber management products do not use an SC duplex adaptor footprint. In such cases, the connector can be supplied without the duplex clip.

Order code	Description
PCD	patch cord duplex fig.8
S-	straight polarity A-B/B-A
F-	flipped polarity A-A/B-B
	Side A
LC	LC connector type
SC	SC connector type
U	U = UPC (≥ 50dB)
A	A = APC (≥ 65dB)
M	M = PC (≥ 35dB)
D-	duplex classic
H-	duplex push-pull high density with extension finger (only LC)
P-	duplex push-pull (only LC)
S-	simplex
X-	XD LC uniboot (only LC)
	Side B
LC	LC connector type
SC	SC connector type
U	U = UPC (≥ 50dB)
A	A = APC (≥ 65dB)
M	M = PC (≥ 35dB)
D-	duplex classic
H-	duplex push-pull high density with extension finger (only LC)
P-	duplex push-pull (only LC)
S-	simplex
X-	XD LC uniboot
SM	SM standard, G.652.D
A2	SM lowbend r7.5, G.657.A2
O1	MM, G62.5, OM1
O2	MM, G50, OM2
O3	MM, G50, OM3
O4	MM, G50, OM4
14	1.4 mm
18	1.8 mm
E	easy strip cable
02.0	length of assembly in meters (ferrule tip to ferrule tip)
S	SM standard ≤ 0.3dB IEC 61300-3-4 method B
M	MM standard ≤ 0.25dB IEC 61300-3-4 method C
L	MM low-loss ≤ 0.15dB IEC 61300-3-4 method C

Note: minimum order quantity 50 assemblies

HUBER+SUHNER FIBER OPTICS

LiSA Fiber Management

Universal Splice Closure USC 600 For outdoor applications
Universelle Spleissmuffe USC 600 *Für Aussenanwendungen*

Picture shows assembled closure with SingleCircuit Management (SCM) /
Abbildung zeigt montierte Spleissmuffe mit Einzelfasermanagement (SCM)

Picture shows assembled closure with MultiCircuit Management (MCM) /
Abbildung zeigt montierte Spleissmuffe mit Mehrfasermanagement (MCM)

Delivery content: closure body and cable entry, 8 MCM splice cassettes inclusive 8 sandwich or 16 heatshrink splice holders OR SCM module system with 30 SCM splice cassettes inclusive 30 sandwich or heatshrink splice holders, universal mounting plate, mounting material for cassettes, fastening plate for strain relief for the middle port, 2 fastening plates for strain relief for outer ports, 8 set of fixing parts for cable strength members, cable ties, assembly instruction

Lieferumfang: *Muffenkörper und Muffeneingang, 8 MCM-Spleisskassetten inclusive 8 Sandwich- oder 16 Wärmeschrumpf-Spleisshalter ODER SCM-Modulsystem mit 30 SCM-Spleisskassetten inclusive 30 Sandwich- oder Wärmeschrumpf-Spleisshalter, universelle Trägerplatte, Befestigungsmaterial für Kassetten, Befestigungsplatte für Zugentlastung für mittleren Eingang, 2 Befestigungsplatten für Zugentlastung für äussere Eingänge, 8 Klemmteilesets für Zugentlastungselemente, Kabelbinder, Montageanleitung*
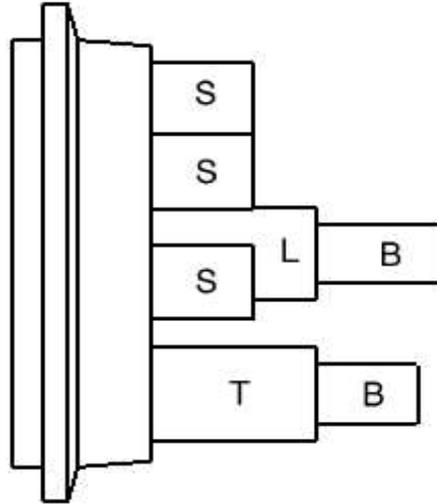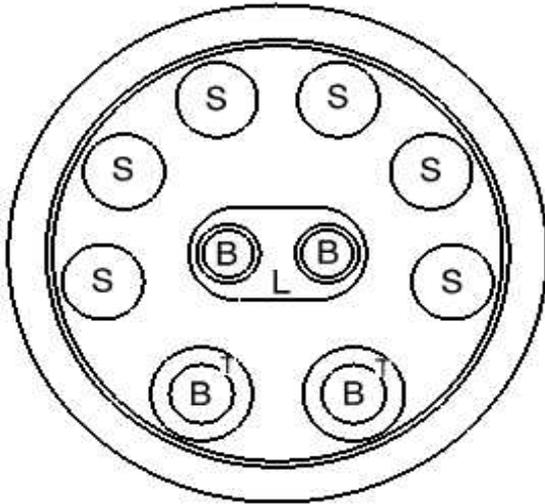
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LiSA Fiber Management

Closure entry / *Muffeneingang:*

Number of ports / *Anzahl Eingänge*	Ports / *Ein-gänge*	Inner diameter / *Innendurch-messer*	Cable diameter range/ *Kabeldurch-messer-bereich*	Port length / *Eingangslänge*	Heatshrink / *Schrumpf-schlauch*	Cable-lok™	Applications / *Anwendungen*
1	L	66x36mm	2x 8 - 24mm	73mm	Y	Y	For uncut cable / *für ungeschnittene Kabel*
2	T	37mm	8 - 36mm	73mm	Y	Y	For cutted cable / *Für geschnittene Kabel*
6	S	26.5mm	12 - 26mm	55mm	Y	Y	
4	B	19mm	6 - 18mm	55mm	Y	Y	

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LiSA Fiber Management

Technical data	*Technische Daten*	Value / *Wert*
Dimensions (DxL)	*Abmessungen (DxL)*	⌀205 x 600mm
Materials	*Materialien*	closure body thermoplastic PP, halogen free; mounting plate aluminium; splice cassettes thermoplastic ABS/PC, flame-retardant, halogen free, UL94 V-0 / *Muffenkörper aus thermoplastischem Kunststoff PP, halogenfrei; Trägerplatte aus Aluminium; Spleisskassetten aus thermoplastischem Kunststoff ABS/PC, flammwidrig, halogenfrei, UL94 V-0*
Weight	*Gewicht*	3.7kg (MCM); 4.1kg (SCM)
Colors	*Farben*	closure body black (RAL 9005); mounting plate metallic; splice cassettes pearl white (RAL 1013) / *Muffenkörper schwarz (RAL 9005); Trägerplatte metallisch; Spleisskassetten perlweiss (RAL 1013)*
Bending radius limitation	*Biegeradiusbegrenzung*	35mm for fibers / *für Lichtwellenleiter*
Installation temperature range	*Installationstemperatur*	-5 up to / *bis* +45°C
Operating temperature range	*Betriebstemperatur*	-30 up to / *bis* +60°C
Protection class	*Dichtheitsklasse*	IP 67 acc. / *gem.* DIN 40050
Packing Unit	*Verpackungseinheit*	1 Piece / *Stück*
Order code	*Bestellschlüssel*	See next table / *siehe nächste Tabelle*

Order code					
USC600-					Universal Splice Closure 600
	MCM-				MultiCircuit Management
	SCM-				SingleCircuit Management
		96-			Number of splice connections with MCM
		60-			Number of splice connections with SCM
			SW-		Splice holders for sandwich splice protectors
			HS-		Splice holders for heat shrink splice protectors
				A	Assembled
				U	Unmounted

Bestellschlüssel					
USC600-					*Universelle Spleissmuffe 600*
	MCM-				*MultiCircuit Management*
	SCM-				*SingleCircuit Management*
		96-			*Anzahl Spleissverbindungen mit MCM*
		60-			*Anzahl Spleissverbindungen mit SCM*
			SW-		*Spleisshalter für Sandwich-Spleissschütze*
			HS-		*Spleisshalter für Wärmeschrumpf-Spleissschütze*
				A	*montiert*
				U	*unmontiert*

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Cisco ASR 920 Series Aggregation Series Routers

Cisco® ASR 920 Series Aggregation Services Routers are full-featured converged access platforms designed for the cost-effective delivery of wireline and wireless services. They are temperature hardened, high-throughput, small form factor, low-power-consumption routers optimized for mobile backhaul, residential, and business service applications. The Cisco ASR 920 Router provides a comprehensive and scalable feature set of Layer 2 VPN (L2VPN) and Layer 3 VPN (L3VPN) services in a compact package. It also enables service providers to deploy Multiprotocol Label Switching (MPLS)-based VPN services from within the access layer. Designed around key Carrier Ethernet features that simplify network operation, the Cisco ASR 920 Series enables premium services with enhanced service-level agreement (SLA) capabilities. An optional "pay-as-you-grow" feature and service activation model gives service providers a flexible, cost-effective solution.

The Cisco ASR 920 Series Aggregation Services Routers (Figure 1) come in multiple versions with different port densities. Models include:

- Cisco ASR-920-12CZ-A
- Cisco ASR-920-12CZ-D
- Cisco ASR-920-4SZ-A
- Cisco ASR-920-4SZ-D

Figure 1.   Cisco ASR 920 Router

Major Applications

Broadband Access

The Cisco ASR 920 Router supports broadband access for delivering "any-play" services (voice, video, data, and mobility). Designed to support thousands of subscribers, quality of service (QoS) on the Cisco ASR 920 router is capable of scaling up to a large number of queues per device. This scalability, combined with a highly granular QoS algorithm (three-level hierarchical QoS), results in an enhanced broadband user experience. As a full-featured Layer 2 switch and Layer 3 router, the Cisco ASR 920 supports a variety of broadband applications including IPTV and video on demand (VoD), enhancing and extending the Cisco Evolved Programmable Network (EPN) architecture.

Converged Access for Mobile Applications

Deployed as a converged access platform for mobile backhaul, the Cisco ASR 920 Router can aggregate multiple base stations through multiple Ethernet and IP Interfaces and can use MPLS as a transport for mobile backhaul traffic.

The Cisco ASR 920 Router provides the timing services required in today's converged access networks by offering integrated support for the Building Integrated Timing Supply (BITS), 1 Pulse Per Second (1PPS) and Time Of Day (TOD) interfaces. The router also supports Synchronous Ethernet (SyncE) and IEEE-1588 and can act as the source for network clocking for time-division multiplexing (TDM), Synchronous Digital Hierarchy (SDH), and Synchronous Optical Network (SONET), SyncE, and Global Positioning Satellite (GPS) interfaces. In addition to the timing services, the Cisco ASR 920 Router can be deployed in small and outdoor environments due to its shallow depth and robust construction designed for extended temperature ranges.

Metro Ethernet Access

The Cisco ASR 920 Router is built to meet service provider requirements for Carrier Ethernet access. It is optimized for remote access and central offices for smaller aggregation sites where a full-featured, small-footprint converged platform is needed. The router offers service flexibility and delivers Layer 2, IP, and MPLS transport for advanced L2VPN, L3VPN, and multicast services.

Major Differentiators

The Cisco ASR 920 Router helps service providers deliver advanced services for Residential Broadband, Mobile and Metro Ethernet applications. This allows an operator to provide differentiated and cost-effective services to end users.

Flexible Deployment Options

The Cisco ASR 920 Router is designed with a 1RU compact form factor to accommodate deployment in small spaces. Available with a range of mounting options, the router can be deployed in space-constrained locations such as ETSI 300-mm deep cabinets. Extended temperature range supported by the Cisco ASR 920 Router allows the router to be deployed in locations with minimal environmental control. Small footprint and extended temperature range support allows service providers to extend the reach of their Carrier Ethernet networks to more challenging and remote locations.

Power Supply Unit (PSU): High Availability

Cisco ASR920 product family offers a choice of AC and DC power supplies. They are redundant and built into the chassis. The Ethernet interfaces are available in copper and fiber, with speed ranging from 10 Mbps to 10 Gbps.

Powered by the Cisco Carrier Ethernet ASIC

Powered by the Cisco Carrier Ethernet application-specific integrated circuit (ASIC), designed specifically for service providers, the Cisco ASR 920 series delivers essential Carrier Ethernet technologies including hierarchical quality of service (HQoS), MPLS, and Virtual Private LAN Services (VPLS). This custom and advanced ASIC design provides uninterrupted line rate performance while delivering complex services such as access control list (ACL) and HQoS. The Carrier Ethernet ASIC integrates Cisco traffic management innovation to deliver intelligent packet switching and routing operations.

Service Enhancement

In Cisco ASR 920 Router, each service is assigned enhanced QoS and security attributes. The ASR 920 Router accomplishes advanced per-traffic-class metering and offers bidirectional packet count and byte count statistics. The service offering is enhanced with operations, administration, and maintenance (OAM) functionality that includes Layer 2 Connectivity Fault Management (CFM), IP service-level agreement (SLA) for Layer 3, and MPLS OAM.

Benefits

MPLS in the Access layer

The Cisco ASR920 Series extends MPLS into the access layer by allowing service providers to initiate MPLS-based Layer 2 and Layer 3 VPN services from within the access layer. The Cisco ASR920 series gives service providers the ability to expand MPLS toward their network edge to gain the advantages of a single unified MPLS control plane across their networks. It offers full VPLS support allowing multipoint services definition. For additional flexibility, VPLS can be deployed as a full mesh or with a hierarchy (HVPLS).

Pay-as-You-Grow Investment Model

The ROI on an access element is heavily influenced by its location in the network and proximity to customers. The ability to deploy the Cisco ASR920 series and later activate features on demand delivers investment protection. This allows flexible timing for deploying MPLS, 10-Gigabit Ethernet services and boosting service capacity.

Advanced Service-Level Agreements

Service-aware quality of service (QoS) allows service providers to expand and differentiate their services portfolio with highly advanced and differentiating SLAs. The HQoS capabilities of the Cisco ASR920 series scale to eight queues per service, three levels of scheduling, and buffer volumes capable of accommodating today's most demanding wireline and wireless applications.

Mobile Timing and Synchronization Services

The Cisco ASR920 series provides the timing services required in converged access network to support mobile solutions including Radio Access Network (RAN) applications, and offers integrated support for the Building Integrated Timing Supply (BITS), 1 Pulse Per Second (1PPS) and Time Of Day (ToD) interfaces. The Cisco ASR920 series also supports synchronous Ethernet (SyncE) with Ethernet Synchronization Messaging Channel (ESMC) and Synchronization Status Messages (SSM) to allow excellent clock source traceability. The Cisco ASR920 series support IEEE-1588, and can act as the source for network clocking for TDM, SDH and SONET interfaces and SyncE.

Operational Efficiency for Carrier Ethernet Access Deployments

The Cisco ASR920 series features major enhancements that help service providers simplify and facilitate the management of their networks, resulting in diminishing operational costs. This unique feature set allows the Cisco ASR920 series to be deployed in a variety of applications including business service with 10-Gigabit Ethernet User Network Interface (UNI) and Ethernet mobile backhaul. These features enhance performance awareness, facilitate troubleshooting, and simplify service turn-up and restoration, ultimately reducing operational costs. "Dying gasp" for power indicators and four external alarm inputs to detect changes in remote sites further help service providers manage the health of network elements.

Universal Customer Premises Equipment

With all interfaces built in, this fixed-form-factor platform is versatile and can cover many deployment scenarios including Gigabit Ethernet and 10-Gigabit Ethernet deployments. The licensing mechanism supports enabling additional 1-Gigabit/10-Gigabit Ethernet interfaces as required for a particular deployment, allowing service providers to customize the configuration of the device and pay only when their services grow. With support for extended temperatures, the Cisco ASR920 series can be deployed in outside environments and remote locations.

Table 1.   Hardware Components for Cisco ASR 920 Router

Part Number	Description
ASR-920-12CZ-A	Cisco ASR920 Series - 12GE and 2-10GE - AC model
ASR-920-12CZ-D	Cisco ASR920 Series - 12GE and 2-10GE - DC model
ASR-920-4SZ-A	Cisco ASR920 Series - 2GE and 4-10GE - AC model
ASR-920-4SZ-D	Cisco ASR920 Series - 2GE and 4-10GE - DC model
ASR 920 Accessories	
A920-RCKMT-ETSI	ETSI Rack mount Option for the Cisco ASR 920
A920-RCKMT-19	EIA 19" Rack mount Option for the Cisco ASR 920
A920-RCKMT-23	EIA 23" Rack mount Option for the Cisco ASR 920
A920-RCKMT-C-ETSI	ETSI Rack mount Option for the Cisco ASR 920 Compact
A920-RCKMT-C-19	EIA 19" Rack mount Option for the Cisco ASR 920 Compact
A920-RCKMT-C-23	EIA 23" Rack mount Option for the Cisco ASR 920 Compact

Tables 2 through 4 list the product, power, and environmental specifications for the Cisco ASR 920 Router.
Table 5 provides safety and compliance information.

Table 2.   Cisco ASR 920 Router System Specifications

Description	Cisco ASR 920 Router
Physical Specifications (H * W * D)	ASR-920-12CZ-A, ASR-920-12CZ-D: 1.7 x 17.5 x 9.1 in. (44 x 444 x 233 mm),1 RU ASR-920-4SZ-A, ASR-920-4SZ-D: 1.7 x 15.5 x 9.1 in. (44 x 394 x 233 mm), 1 RU
Weight	ASR-920-12CZ-A: 8.6lbs (3.9 kg) ASR-920-12CZ-D: 7.9lbs (3.6kg) ASR-920-4SZ-A: 7.5lbs (3.4kg) ASR-920-4SZ-D: 6.8lbs (3.1kg)
Rack mounts	ETSI rack mount kit 19 in. rack mount kit 23 in. rack mount kit
Air flow	Front to back airflow
Power supplies	2 power supplies (AC or DC)

Table 3.   Power Specifications

Description	Cisco ASR 920 Router
Power consumption	ASR-920-12CZ-A: Max 100W, Typical: 80W ASR-920-12CZ-D: Max 100W, Typical: 80W ASR-920-4SZ-A: Max 95W, Typical: 75W ASR-920-4SZ-D: Max 95W, Typical: 75W
AC input voltage and frequency	Voltage range: 85V AC to 264V AC, nominal 100V AC to 240V AC Frequency Range: 47Hz to 63Hz, nominal 50Hz to 60Hz
DC input voltage	Voltage range: -19.2V DC to -72V DC, nominal -24V DC to -48V DC

Table 4.   Environmental Specifications

Description	Cisco ASR 920 Router
Operating environment and altitude[1]	-40ºC to 65ºC operating temperature (AC and DC operation) -60m to 1800m operating altitude (for full operating temperature range) Up to 4000m operating altitude (at up to +40ºC temperature)
Relative humidity	5% to 95%, noncondensing
Acoustic noise[3]	Acoustic noise peak operation maximum 48 dBA sound pressure level, bystander position for rack mount products at 20ºC operation as measured by ISO 7779 NAIS noise measurement test standard Acoustic noise peak operation compliant to the Network Equipment Building Standards (NEBS) GR-63-Core Issue 3 sound power level of 78dB at 27ºC operation as measured by the ANSI S12.10/ISO 7779 NAIS noise measurement test standard
Storage environment	Temperature: -40 to +70ºC altitude: 15,000 ft (4570m)
Seismic	Zone 4

[1] Optics used may limit the temperature range.
[2] Not more than the following in a one-year period: 96 consecutive hours, or 360 hours total, or 15 occurrences.
[3] The above are for normal (nonfailure) operation. When operating with a fan failure, the above may be exceeded.

Table 5.   Safety and Compliance

Type	Standards
Safety	• UL 60950-1, 2nd edition • CAN/CSA C22.2 No. 60950-1-07 2nd edition • IEC 60950-1, 2nd edition • EN 60950-1, 2nd edition • AS/NZS 60950.1:2003
Electromagnetic	• FCC CFR47 Part 15 Class A
Emissions compliance	• EN55022, class A • CISPR22, class A • ICES-003, class A • EN 300 386, class A • VCCI, class A • KN22, class A • EN61000-3-2 to EN61000-3-3

Type	Standards
Immunity compliance	• EN 300 386 • EN 61000-6-1 • EN 50082-1 • CISPR24 • EN 55024 • KN 24 • EN 50121-4 • EN/KN 61000-4-2 to EN/KN 61000-4-6 • EN/KN 61000-4-8 • EN/KN 61000-4-11
NEBS[1]	• GR-63-CORE Issue 4 • GR-1089-CORE Issue 6 • SR-3580 NEBS Level 4
ETSI	• ETS/EN 300 119 Part 4 • ETS/EN 300 019 - Storage: Class 1.2, Transportation: Class 2.3, In-Use/Operational: Class 3.2 • ETS/EN 300 753
Network synchronization	• ANSI T1.101 • GR-1244-CORE • GR-253-CORE • ITU-T G.703 clause 5 • ITU-T G.703 clause 9 • ITU-T G.781 • ITU-T G.813 • ITU-T G.823 • ITU-T G.824 • ITU-T G.8261/Y.1361 • ITU-T G.8262 • ITU-T G.8264 • IEEE1588-2008

[1] Notable exceptions: Fans do not have filters, and all cabling is provided through the front panel.

Warranty Information

Find warranty information on Cisco.com at the [Product Warranties](#) page.

Service and Support

Cisco offers a wide range of services programs to accelerate customer success. These innovative services programs are delivered through a unique combination of people, processes, tools, and partners, resulting in high levels of customer satisfaction. Cisco Services help you protect your network investment, optimize network operations, and prepare your network for new applications to extend network intelligence and the power of your business. For more information about Cisco Services, refer to [Cisco Technical Support Services](#) or [Cisco Advanced Services](#).

Cisco is committed to minimizing your total cost of ownership. Cisco offers a portfolio of technical support services to help ensure that Cisco products operate efficiently, remain highly available, and benefit from the most up-to-date system software. The services and support programs described in Table 6 are available as part of the Cisco Carrier Ethernet Switching Service and Support solution and are available directly from Cisco and through resellers.

Table 6.   Service and Support

Advanced Services	Features	Benefits
Cisco Total Implementation Solutions (TIS), available directly from Cisco **Cisco Packaged TIS, available through resellers**	• Project management • Site survey, configuration, and deployment • Installation, text, and cutover • Training • Major moves, adds, and changes • Design review and product staging	• Supplement existing staff • Help ensure functions meet needs • Mitigate risk
Cisco SP Base Support and Service Provider-Based Onsite Support, available directly from Cisco **Cisco Packaged Service Provider- Based Support, available through resellers**	• 24-hour access to software updates • Web access to technical repositories • Telephone support through the Cisco Technical Assistance Center (TAC) • Advance replacement of hardware parts	• Facilitate proactive or expedited problem resolution • Lower total cost of ownership by taking advantage of Cisco expertise and knowledge • Minimize network downtime

Cisco IOS XE Software for Cisco ASR 920 Series Aggregation Services Routers

More flexible, dynamic, and cost-efficient networks. Simplified operational processes. These are some of the key benefits service providers are pursuing with software-defined networking (SDN). And Cisco is at the forefront of SDN efforts. One more example is Cisco IOS® XE Software releases. Why? Because they support separation of the data plane and the control plane for Cisco® ASR 920 Series Aggregation Services Routers. This is a foundation of work by the Open Networking Foundation (ONF) on SDN that logically centralizes network intelligence and state while abstracting the underlying network infrastructure from the applications. Cisco IOS XE Software on the Cisco ASR 920 Router (Figure 1) includes licenses for Metro Access, Metro IP access, and advanced Metro IP access. These feature sets can be activated as they are needed, allowing for a "pay-as-you-grow" model.

Figure 1.   Cisco ASR 920 Router

Software Releases and Options

Cisco IOS XE Software for Cisco ASR 920 Series routers is designed to provide modular packaging so you can buy just the software features you need. And like all Cisco IOS Software, the code is divided into separate modules so you can update them separately to get new features more quickly. Cisco IOS XE Software also provides powerful resiliency. The Cisco ASR 920 Router is supported as of Cisco IOS XE Software Release 3.13.0S.

Consolidated Software Packages

Consolidated software packages contain a superset of all features. The individual feature sets can be activated once the correct feature licenses are applied to the router. Table 1 describes the two Cisco IOS XE universal consolidated packages supported on the Cisco ASR 920 Router and the functionality supported in this universal image. The functionality is enforced through the appropriate technology package licenses.

Table 1. Universal Cisco IOS XE Software Consolidated Package for Cisco ASR 920 Series Routers

Cisco IOS XE Consolidated Package	Part Number	Description
Cisco ASR 920 Series IOS XE - No Payload Encryption	SASR920NPEK9313S	• Provides a consolidated package • Offers only basic feature support without a license, including SSH and SNMPv3 support

Flexible Software Activation

Cisco ASR 920 Series routers support the Cisco IOS software activation feature. With this capability, Cisco IOS Software feature sets can be activated with software licenses, supporting a "pay as services grow" model. This model allows service providers to invest in software resources only when their businesses need them. All Cisco ASR 920 Series software licenses are available on a per-chassis basis. Cisco ASR 920 Series routers offer three Cisco IOS Software licenses:

- **Metro Access License:** Offers advanced quality of service (QoS), Carrier Ethernet Layer 2 features, Synchronous Ethernet (SyncE), and Ethernet operations, administration, and maintenance (OAM) capabilities.
- **Metro IP Access License:** Offers all capabilities of the Metro Access license with the addition of IEEE 1588-2008 Ordinary Clock and Transparent Clock, Bidirectional Forwarding Detection (BFD), Layer 3 features for advanced IP routing protocols, multi-VPN routing, and Layer 3 Multicast and Forwarding Customer Edge (multi-VRF CE) capabilities.
- **Advanced Metro IP Access License:** Adds the following capabilities to the Metro IP Services license: Multiprotocol Label Switching Transport Profile (MPLS-TP); MPLS, Ethernet over MPLS (EoMPLS), Circuit Emulation Service over Packet Switched Network (CESoPSN), and Structure Agnostic TDM over Packet (SAToP) pseudowires; Multi-Router Automatic Protection Switching (MR-APS); Multi-chassis Link Aggregation and Control Protocol (mLACP); MPLS traffic engineering (MPLS TE); MPLS Fast Reroute (MPLS FRR); and MPLS VPN support.

Table 2 lists the main features in the Cisco IOS Software licenses for Cisco ASR 920 Series routers. Availability of features is dependent on software release and implementation schedule.

Table 2. Feature Sets in Cisco ASR 920 Series Router Licenses

Features	Metro Access License	Metro IP Access License	Advanced Metro IP Access License
QoS, with deep buffers and hierarchical QoS (HQOS)	√	√	√
Layer 2: 802.1d, 802.1q	√	√	√
Ethernet Virtual Circuit (EVC)	√	√	√
Ethernet OAM (802.1ag, 802.3ah)	√	√	√
Multiple Spanning Tree (MST) and Resilient Ethernet Protocol (REP)	√	√	√
Synchronous Ethernet	√	√	√
IPv4 and IPv6 host connectivity	√	√	√
IP routing (RIP, OSPF, EIGRP, BGP, IS-IS)		√	√
PIM (SM, DM, SSM), SSM mapping		√	√
BFD		√	√
Multi-VRF CE (VRF lite) with service awareness (ARP, ping, SNMP, syslog, trace-route, FTP, TFTP)		√	√
IEEE 1588-2008 Ordinary Clock and Transparent Clock		√	√

Features	Metro Access License	Metro IP Access License	Advanced Metro IP Access License
MPLS (LDP and VPN)			√
MPLS TE and FRR			√
MPLS OAM			√
MPLS-TP			√
Pseudowire emulation (EoMPLS, CESoPSN, and SAToP)			√
VPLS and HVPLS			√
Pseudowire redundancy			√

Additional Feature Licenses

In addition to the above Cisco IOS feature set licenses, one additional license is used to activate new software functionality for Cisco ASR 920 Series routers in addition to the feature set capabilities.

- **IEEE 1588-2008 BC/MC license:** Allows service providers to activate IEEE 1588-2008 Boundary Clock (BC) or Master Clock (MC), or both, when required. One license is required for each chassis that needs IEEE 1588-2008 BC or MC functionality to be activated in the system.

Cisco IOS XE Release Schedule

The Cisco IOS XE software delivery schedule allows customers to qualify releases more quickly and have a definitive release schedule for new software images. This schedule includes:

- **Time-based releases:** Releases are planned for delivery every four months. New software features and hardware are introduced in each release. Releases have fewer incremental features included when compared with traditional Cisco IOS Software releases, reducing customer qualification time.

- **Two release support durations:** Each Cisco IOS XE Software release is classified as either a Standard Support or Extended Support release. A Standard Support release has a total engineering support lifetime of one year, with two scheduled rebuilds. The Extended Support release provides a total engineering support lifetime of two years, with four scheduled rebuilds. For more information about the Cisco IOS XE Software end-of-life policy and associated support milestones for specific Cisco IOS XE Software releases, visit http://www.cisco.com.

- **Rebuilds scheduled at regular intervals:** Rebuilds are created only for bug fixes, and no new features are included in a rebuild image. For Standard Support releases, the first rebuild image is released two months after the parent image's first customer shipment (FCS). The second rebuild image is released four months after the parent image's FCS. The Extended Support release provides four scheduled rebuilds. The first two of these rebuilds are released at two-month intervals after FCS of the affected Cisco IOS XE Software release, and the second two rebuilds are released at four-month intervals thereafter. Releases to correct critical problems (such as those identified by the Cisco Product Security Incident Response Team) are introduced as needed.

Part Numbers of License Options and Product Activation Keys

Table 3 lists part numbers for the Cisco ASR 920 Series software feature options.

Table 3. Cisco ASR 920 Series Software Options

Part Number	Product Name
Feature Set License Options	
ASR920-S-M	Cisco ASR 920 Series - Metro Access
ASR920-S-I	Cisco ASR 920 Series - Metro IP Access
ASR920-S-A	Cisco ASR 920 Series - Advanced Metro IP Access
Feature Set Product Activation Keys	
ASR920-S-M=	Cisco ASR 920 Metro Access Services Paper Product Activation Key (PAK)
L-ASR920-S-M=	Cisco ASR 920 Metro Access Services E-Delivery PAK
ASR920-S-I=	Cisco ASR 920 Metro IP Access Services Paper PAK
L-ASR920-S-I=	Cisco ASR 920 Metro IP Access Services E-Delivery PAK
ASR920-S-A=	Cisco ASR 920 Advanced Metro IP Access Services Paper PAK
L-ASR920-S-A=	Cisco ASR 920 Advanced Metro IP Access Services E-Delivery PAK
Feature Set Upgrade Product Activation Keys	
ASR920-S-M-I=	Cisco ASR 920 Metro Access to Metro IP Access Paper PAK
ASR920-S-M-A=	Cisco ASR 920 Metro Access to Advanced Metro IP Access Paper PAK
ASR920-S-I-A=	Cisco ASR 920 Metro IP to Advanced Metro IP Access Paper PAK
L-ASR920-S-M-I=	Cisco ASR 920 Metro Access to Metro IP Access E-Delivery PAK
L-ASR920-S-M-A=	Cisco ASR 920 Metro Access to Adv Metro IP Access E-Delivery PAK
L-ASR920-S-I-A=	Cisco ASR 920 Metro IP to Advanced Metro IP Access E-Delivery PAK
Feature Licenses	
ASR920-ATM	Cisco ASR 920 ATM License
ASR920-1588	Cisco ASR 920 IEEE 1588-2008 BC/MC License
Port Licenses	
ASR920-1G-6	Cisco ASR920 Series - 6 ports GE license
ASR920-10G-2	Cisco ASR920 Series - 12 ports GE license
ASR920-12G-2-10G	Cisco ASR920 Series - 12 ports GE and 2 ports 10G license
ASR920-2G-4-10G	Cisco ASR 920 Series - 2 ports GE and 4 ports 10G license
Port Licenses Product Activation Keys	
ASR920-1G-6=	Cisco ASR 920 Series - 6 ports GE license Paper PAK
ASR920-10G-2=	Cisco ASR 920 Series - 12 ports GE license Paper PAK
Feature Licenses Product Activation Keys	
ASR920-1588=	Cisco ASR 920 IEEE 1588-2008 BC/MC License Paper PAK
L-ASR920-1588=	Cisco ASR 920 IEEE 1588-2008 BC/MC License E-Delivery PAK

Major Features

Table 4 lists the features supported by Cisco IOS XE in Cisco ASR 920 Series routers. Availability of features is dependent on software release and implementation schedule.

Table 4. Cisco ASR 920 Series Router Software Features

Features
Ethernet Services
• Ethernet Flow Point (EFP) with support for: 　◦ 802.1q 　◦ Selective QinQ 　◦ Inner and Outer VLAN classification 　◦ VLAN local significance 　◦ One VLAN tag ingress push 　◦ Pop one VLAN tag 　◦ Pop two VLAN tags 　◦ Trunk-EFP construct for configuration simplification • IEEE 802.1s Multiple Spanning Tree (MST) • Resilient Ethernet Protocol (REP) • ITU G.8032 • 802.3ad/802.1ax Link Aggregation Control Protocol (LACP) • Layer 2 Protocol Tunneling (L2PT) • Virtual Private LAN Service (VPLS), Hierarchical VPLS (HVPLS), Virtual Private Wire Service (VPWS), Ethernet over MPLS (EoMPLS) • Pseudowire redundancy • Hot Standby Pseudowire • Multi-segment Pseudowire • Dual Rate
Layer 3 and MPLS Services
• Hot Standby Router Protocol (HSRP) • Layer 3 routing on Routed interfaces and Bridge Domain Interfaces (BDI) • Cisco Express Forwarding (CEF) load sharing of Equal Cost Paths (ECMP) • Open Shortest Path First (OSPF) • Border Gateway Protocol (BGP) • BGP 4-byte Autonomous System number (ASN) • BGP TCP Path MTU Discovery • BGP Prefix-Independent Convergence (PIC) Edge and Core for IPv4 and MPLS VPN • Intermediate System-to-Intermediate System (IS-IS) • Bidirectional Forwarding Detection (BFD) for OSPF, IS-IS, BGP, and static routes • BFD over Ethernet, Routed port interfaces • BFD for HSRP group client • Multi Protocol Label Switching (MPLS) • LDP with Label Edge Router (LER) and Label Switch Router (LSR) • MPLS L3VPN • MPLS Transport Profile (MPLS-TP) for Ethernet Pseudo Wires • MPLS Traffic Engineering Fast Re-Route (TE-FRR) • IP Loop Free Alternate Fast Re-Route (LFA FRR) • Remote Loop Free Alternate Fast Re-Route (R-LFA FRR)

Features

IPv6

- Hardware based IPv6 data forwarding
- Addressing and discovery
- Manual IPv6 interface addressing
- ICMPv6 (RFC 4443)
- IPv4 and IPv6 dual stack
- IPv6 static routing
- OSPF for IPv6 (RFC 5340)
- DHCPv6 with relay function
- BFD for OSPF, IS-IS, BGP and IPv6 static routes
- IPv6 Provider Edge (6PE)
- IPv6 VPN Provider Edge (6VPE)

QoS

- Modular QoS CLI (MQC)
- Hierarchical QoS (HQoS)
- Port shaper and Low Latency Queuing (LLQ) in the presence of an EFP
- IEEE 802.1p Class of Service (COS) based QoS
- Classification based on inner and outer CoS
- IP Precedence Type of Service (ToS) based QoS
- Differentiated Services Code Point (DSCP) based QoS
- Egress marking of COS, ToS, DSCP and MPLS EXP QoS fields
- Classification using Access Control List (ACL)
- 2-rate 3-color (2R3C) ingress Policing
- Differentiated Services Code Point (DSCP) traffic shaping
- Class-Based Weighted Fair Queuing (CBWFQ)
- Priority Queuing with up to 2 priority queues
- Weighted Random Early Detect (WRED)
- Egress shaping per queue
- Egress policing per queue

Timing

- IEEE 1588-2008 Ordinary Clock over Ethernet, IP
- IEEE 1588-2008 Boundary Clock over Ethernet, IP
- IEEE 1588-2008 precision time protocol (PTP) telecom profile for frequency synchronization - ITU-T G.8265.1/Y.1365.1
- Hybrid clocking
- Time of Day (ToD),1 Pulse Per Second (1PPS)
- Building Integrated Timing Supply (BITS)
- ITU-T SyncE with Ethernet Synchronization Messaging Channel (ESMC)
- Synchronization Status Messages (SSM)

OAM

- IEEE 802.1ag Connectivity Fault Management (CFM) over EFP
- IEEE 802.3ah Link OAM
- MPLS OAM
- ITU-T Y. 1731 Performance Management (PM) over EFP for Delay Measurement (DM) and Synthetic Loss Measurement (SLM)
- Ethernet Local Management Interface (E-LMI), as a provider edge (PE) device

Features
Security
• Authentication, authorization, and accounting (AAA) with TACACS+ and RADIUS • Secure Shell (SSH) Protocol v2 • MAC limiting per bridge domain (BD) • Storm control for Port Mode • Layer 3 Access Control Lists (ACL) for IPv4 and IPv6 • IPv4 unicast reverse path forwarding (uRPF) strict mode • MAC security capabilities • Dynamic Arp Inspection (DAI) • DHCP Snooping with option 82 insertion • DHCP Option 82 Configurable Circuit ID and Remote ID
Manageability
• Simple Network Management Protocol (SNMP) • MIBs • Dying Gasp message • Embedded Event Manager (EEM) • Cisco Discovery Protocol (CDP) • 802.1ab Link Layer Discovery Protocol (LLDP) • Port Level Local SPAN (SPAN) • ZTP • Support for Smart Call Home V2 and Cisco Smart Licensing • Cisco IOS Command Line Interface (CLI) • Cisco Prime™ Network: fault, provisioning and performance management

Warranty Information

Find warranty information on Cisco.com at the [Product Warranties](#) page.

Service and Support

Cisco offers a wide range of services programs to help accelerate customer success. These innovative services programs are delivered through a unique combination of people, processes, tools, and partners, resulting in high levels of customer satisfaction. Cisco Services help you protect your network investment, optimize network operations, and prepare your network for new applications to extend network intelligence and the power of your business. For more information about Cisco Services, refer to Cisco Technical Support Services or Cisco Advanced Services.

Cisco is committed to reducing your total cost of ownership. We offer a portfolio of technical support services to help ensure that Cisco products operate efficiently, remain highly available, and benefit from the most up-to-date system software. The services and support programs described in Table 5 are available as part of the Cisco Carrier Ethernet Switching Service and Support solution and are available directly from Cisco and through Cisco resellers.

Table 5.   Service and Support

Advanced Services	Features	Benefits
Cisco Total Implementation Solutions (TIS), available directly from Cisco **Cisco Packaged TIS, available through resellers**	• Project management • Site survey, configuration, and deployment • Installation, text, and cutover • Training • Major moves, adds, and changes • Design review and product staging	• Supplement existing staff • Help ensure functions meet needs • Mitigate risk
Cisco SP Base Support and Service Provider-Based Onsite Support, available directly from Cisco **Cisco Packaged Service Provider- Based Support, available through resellers**	• 24-hour access to software updates • Web access to technical repositories • Telephone support through the Cisco Technical Assistance Center (TAC) • Advance Replacement of hardware parts	• Facilitate proactive or expedited problem resolution • Lower total cost of ownership by taking advantage of Cisco expertise and knowledge • Reduce network downtime

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IV

Cisco ASR 903 Router Overview

The Cisco ASR 903 Router is a fully-featured aggregation platform designed for the cost-effective delivery of converged mobile and business services. With shallow depth, low power consumption, and an extended temperature range, this compact 3-rack-unit (RU) router provides high service scale, full redundancy, and flexible hardware configuration.

The Cisco ASR 903 Router expands the Cisco service provider product portfolio by providing a rich and scalable feature set of Layer 2 VPN (L2VPN) and Layer 3 VPN (L3VPN) services in a compact package. It also supports a variety of software features, including Carrier Ethernet features, Timing over Packet, and pseudowire.

The Cisco ASR 903 Router is positioned as a pre-aggregation router in IP RAN (GSM, UMTS, iMAX, CDMA, and LTE) networks or an aggregation router in Carrier Ethernet networks.

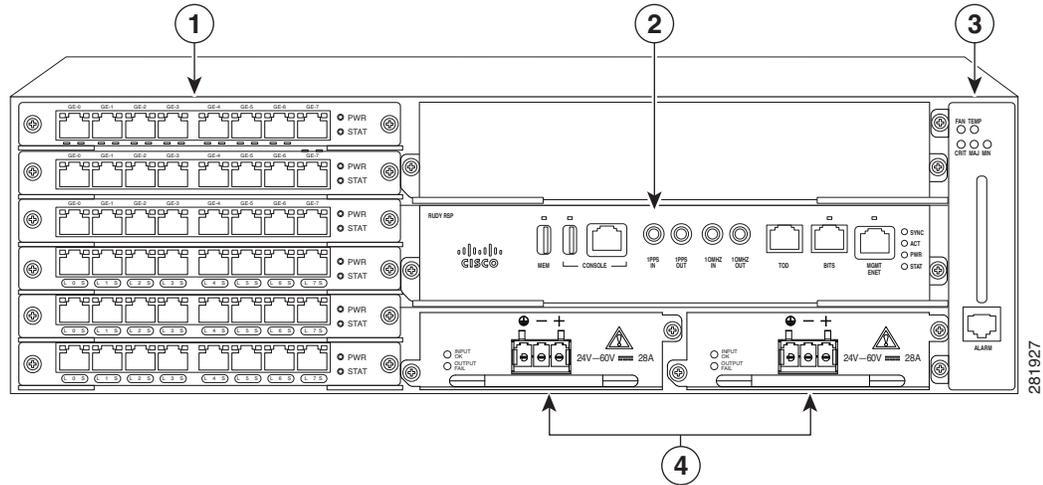# Cisco ASR 903 Router Features

The Cisco ASR 903 Router has the following hardware features:

- 3-RU modular chassis designed for installation in a 300 mm European Telecommunications Standards Institute (ETSI) cabinet
- Dedicated slots in the chassis that support the following:
  - Up to six interface modules
  - Up to two Route Switch Processors (RSP)
  - Up to two DC power supply units
  - One fan tray
- Network frequency, phase, and time inputs and outputs for network interfaces (SyncE and TDM), BITS, 1 PPS or 10 MHz and Timing over Packet (IEEE 1588-2008)
- Adjustable front and rear rail mounting locations
- Front panel access to power supplies, fan tray, RSPs, and interface modules
- Online insertion and removal (OIR) of RSP, interface modules, power supplies, and fan tray
- Discrete status LEDs on power supply, interface module, RSP, and fan tray units
- Four alarm dry contact inputs (either normally open or normally closed)
- Environmental monitoring and reporting functions
- LED indicators for critical, major, and minor alarms

- Side-to-side forced air cooling
- Temperature range of –40 to 149 degrees F (-40 to 65 degrees C) with DC power supply
- Temperature range of 32 to 104 degrees F (0 to 40 degrees C) with AC power supply

Figure iv-1 illustrates the Cisco ASR 903 Router chassis design.

Figure iv-1   Cisco ASR 903 Router Chassis Design

1	Interface modules
2	RSP unit
3	Fan tray
4	Redundant power units (two DC power units are shown)

System Specifications

Table iv-1 summarizes the system specifications and environmental requirements for the Cisco ASR 903 Router.

Table iv-1   Cisco ASR 903 Router System Specifications

Dimensions (Height x Width x Depth)	5.22 in. x17.44 in. x 10.565 in. (132.588 x 442.976 x 268.351 mm) **Note** This measurement includes handles from the power supply, fan tray, and interface modules installed in the chassis.
Weight	27.117 pounds (12.3 kg) **Note** This weight includes a redundant RSP and power supply.

Table iv-1   Cisco ASR 903 Router System Specifications

Operating Temperature	The Cisco ASR 903 Router supports the following temperature ranges with the DC power supply: • -60–4000 meters: -40 to 104 degrees F (-40 to + 40 degrees C) • -60–1800 meters: -40 to 149 degrees F (-40 to + 65 degrees C) The Cisco ASR 903 Router supports the following temperature ranges with the AC power supply: • -60—4000 meters: 32 to 104 degrees F (0 to 40 degrees C) • -60—1800 meters: 23 to 140 degrees F (-5 to 55 degrees C)
Nonoperating Temperature	-40ºF to 185ºF (-40ºC to +85ºC) storage temperature
Operating Humidity	5—95% operating noncondensing relative humidity
Operating Altitude	-60m to 1800m operating altitude for full operating temperature range; up to 4000m at up to 40ºC.
Nonoperating Altitude	4572 m storage altitude
Vibration	1.0 g from 1.0 to 150 Hz
Shock	30 G half sine 6 ms and 11 ms
Nonoperating Vibration	Random: 1.15 gRMS 3 to 200 Hz, 30 minutes/axis Sine: 10 to 500 Hz @ 0.8 G peak / 5 sweep cycles/axis
Operating Acoustics	< 55 dBa @ 27 degrees C

Power Supply Features

The Cisco ASR 903 Router support AC and DC power supplies. For more information about installing the Cisco ASR 903 Router power supplies, see the Installing the Power Supply, page 2-20 section. The power sections provide more information about the power supply:

• Redundancy, page iv-4

• Dying Gasp, page iv-4

• Status LEDs, page iv-4

• DC Power Specifications, page iv-4

• AC Power Specifications, page iv-6

Redundancy

The Cisco ASR 903 Router chassis includes a slot for an optional redundant power supply. The redundant power supply option provides a second power supply to ensure that power to the chassis continues uninterrupted if one power supply fails or input power on one line fails. Redundancy is supported either with identical power supplies or a combination of AC and DC power supply. The Cisco ASR 903 Router supports current sharing between the power supplies.

If you install a redundant power supply on the Cisco ASR 903 Router, we recommend that you connect each power supply to a separate input power source in order to ensure that the router maintains power in the event of a power interruption caused by an electrical failure, a wiring fault, or a tripped circuit breaker.

Dying Gasp

The Cisco ASR 903 Router DC power supply supports the Dying Gasp feature, which allows the router to provide an input power loss notification to the RSP so that the RSP can send appropriate SNMP traps or OAM messages and update log files on the router. With the DC power supply, the router supports a minimum input power loss detection time of 2 milliseconds (DC) and continued operation of at least 6 milliseconds (DC) after the notification.

Note Continued DC power supply operation may vary for voltages other than +24/-48V.

Status LEDs

LEDs are also provided on each power supply to indicate the status of the input power and the health of the power supply. For more information about the LEDs on the Cisco ASR 903 Router, see Chapter 4, "Troubleshooting."
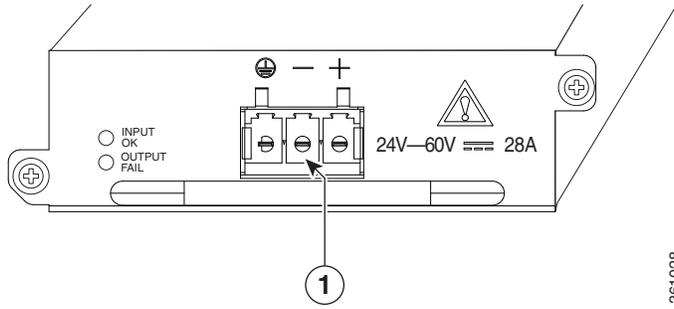
DC Power Specifications

The Cisco ASR 903 Router uses a +24/-48 Volts Direct Current (VDC) (-19 to -72 VDC supply tolerance) power supply. The power supply provides 550 W output power for system 12 V power. The power supply is field replaceable, hot-swappable, and operates separately from the fan tray. The power supply contains a front panel with mounting screws, a handle for insertion and removal, and two status LEDs. No ON/OFF switch is provided.

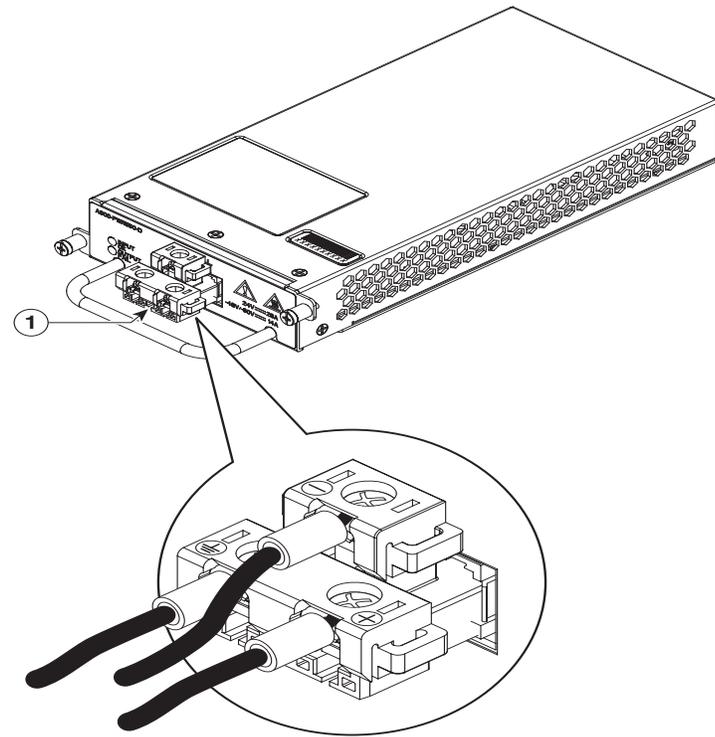The two DC PEM models supported on the router are:

- A900-PWR550-D—Uses a euro-style three-position terminal block connector, Figure iv-2
- A900-PWR550-D-E—Uses a T-shaped connector, Figure iv-3

Figure iv-2   **DC PEM Module (A900-PWR550-D) with Euro-style Connector**

1	Euro-style connector	—	

Figure iv-3   **DC PEM Module (A900-PWR550-D-E) with T-Shaped Connector**

1	T-shaped connector	—	

Table iv-2 summarizes the input power specifications for the Cisco ASR 903 Router DC power supply units.

Table iv-2   **DC Power Supply Specifications**

Part numbers	A900-PWR550-D, A900-PWR550-D-E
Input power specification	+24/-48 VDC
Minimum input voltage	-19.2 VDC

Table iv-2   DC Power Supply Specifications

Maximum input voltage	-72 VDC
Output voltage	+12 VDC
Wire gauge for DC input power connections	12 AWG minimum for -48/-60 VDC. 8 AWG minimum for 24 VDC. Connector accepts 8 AWG maximum.
Power dissipation	600 W

AC Power Specifications

Table iv-3   AC Power Supply Specifications

Part number	A900-PWR550-A
Input power specification	115VAC/ 230VAC
Input voltage	85/264 VAC
Minimum input voltage	85 VAC
Maximum input voltage	264 VAC
Minimum output voltage	12V
Maximum output voltage	12.4V
Power dissipation	600 W

Fan Tray

The fan tray modules supported on the router are:

- A903-FAN, Figure iv-4
- A903-FAN-E, Figure iv-5

The fan tray has the following hardware features:

- It provides side-to-side forced air cooling
- It provides redundant fans
- It is field replaceable
- It contains status LEDs
- It contains an alarm port with four external alarm inputs

For more information about air flow guidelines, see Air Flow Guidelines, page 1-11. For instructions on how to install the fan tray, see Installing the Fan Tray, page 2-11. For a summary of the LEDs on the fan tray, see "LED Summary" section on page 4-10

Fan Tray (A903-FAN)

The Cisco ASR 903 Router uses a modular fan tray that is separate from the power supply. The fan tray contains twelve fans and provides sufficient capacity to maintain operation indefinitely in the event of an individual fan failure.

Figure iv-4   *Cisco ASR 903 Router Fan Tray (A903-FAN)*
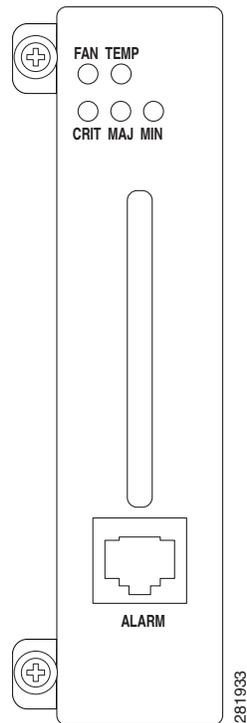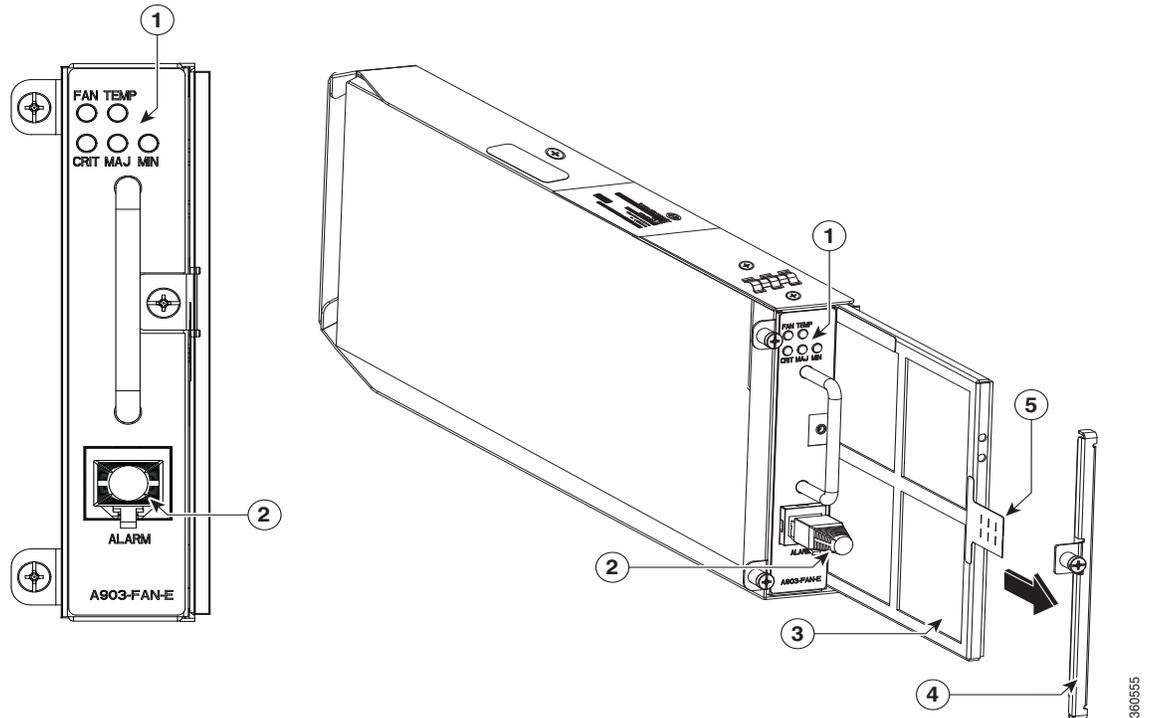

Fan Tray (A903-FAN-E)

The A903-FAN-E is a fan tray containing twelve (40 x 40 x 20 mm) fans and provides sufficient capacity to maintain operation indefinitely in the event of an individual fan failure. It has a 8 mm fan dust filter that prevents dust from entering the unit and avoids possible damage to the components. The fan tray is IEC60950-1 compliant.

Figure iv-5   Cisco ASR 903 Fan Tray with Dust Filter and Dummy Cover (A903-FAN-E)

1	LEDs	**4**	Dummy cover
2	Alarm	**5**	Pull tab
3	Dust filter		—

Dust Filter (A903-FAN-F)

The dust filter (see Figure iv-5) on the fan tray is a quadrafoam 45PPI filter which is 85 percent dust resistant. A dummy cover (A903-FAN-F-B) secures the dust filter in the chassis. For installing the fan filter, see "Installing the Dust Filter" section on page 2-11.

Note   Use the pull tab provided to easily access the filter.

Air Plenum

Air Plenum or air baffle assembly (see Figure 2-7) is used change the air flow pattern of the unit. When the router is installed with the plenum, the air flow pattern is changed from side-side to front-back. The air flow front-back pattern provides a rack installation bay with a cool front zone and hot rear zone. For installing the plenum, see "Installing the Chassis in the Air Plenum" section on page 2-6.

Note   When the air plenum and the fan filter are installed in the chassis, the system operating temperature is 55 degrees Celsius.

The air plenum is available from GAW (*www.GawTechnology.net*). To order an air plenum, contact the Sales and Marketing support staff at GAW (see Table 5-2).

RSP Modules

The Cisco ASR 903 Router is designed to use up to two RSP modules to handle the data plane, network timing, and control plane functionalities for the router. The RSP configuration allows you to use Cisco IOS software to control chassis management, redundancy, external management, and system status indications on the router.

The following sections describe the Cisco ASR 903 Router RSP:

- Supported RSP Features, page iv-11
- RSP Redundancy, page iv-12
- Network Timing Interfaces, page iv-12
- RSP Interfaces, page iv-13

RSP features include:

- Loading software onto processor-based interface modules
- Redundant RSP management—The RSP manages detection of RSPs, exchange of health and status information, role negotiation, function for detection, health and status exchange, role negotiation
- Packet processing
- Traffic management, including buffering, queuing, and scheduling, Ethernet MAC functions
- Network clocking functions including phase and time-of-day for BITS, 1 PPS, 10 MHz, and 1588 PTP clock references.
- Storage of software images, system configuration, OBFL, SysLog
- PTP packet processing including IEEE 1588-2008 for recovering network timing (frequency, phase, and time) from upstream PTP clocks, for generating PTP frequency and phase references as inputs to the SETS, and for distributing them to downstream PTP clocks
- External management interfaces (RS232 console, management ENET, USB console, USB storage) and system status LED indicators

Supported RSPs

The Cisco ASR 903 Router supports the following RSPs:

- A900-RSP1A-55—Provides 2 GB of SDRAM, 5 Mb of TCAM memory, 36Mb buffer table, 576-Mb forwarding memory, and 1,536-Mb packet buffer memory.
- A900-RSP1B-55—Provides 4 GB of SDRAM, 20 Mb of TCAM memory, 144-Mb buffer table, 1152-Mb forwarding memory, and 1,536-Mb packet buffer memory.
- A900-RSP2A-128—Provides 4 GB double data rate type three (DDR3) memory, 128 Gbps aggregate throughput.
- A900-RSP2A-64—Provides 4 GB double data rate type three (DDR3) memory, 64 Gbps aggregate throughput.

> **Note** The supported RSPs have different memory capacities, but they have the same interfaces and functionality.

Figure iv-6   A900-RSP2A-128 Module
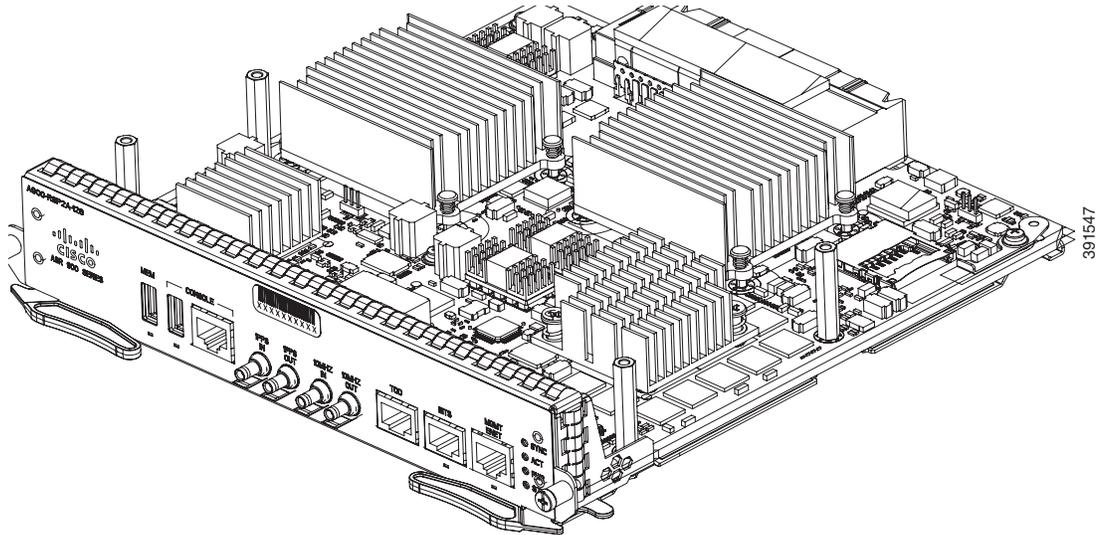
> **Note** Installing a mix of RSP modules in the chassis is *not* supported.

The RSPs do not provide external network interfaces for user traffic. All network interfaces are provided via separate IMs.

A900-RSP1 Supported Interface Modules

Table iv-4   A900-RSP1 Supported Interface Modules and Part Numbers

RSP Module	Interface Modules	Part Number	Slot
A900-RSP1A-55 **A900-RSP1B-55**	8-port Gigabit Ethernet SFP Interface Module (8X1GE)	A900-IMA8S	All
	8-port Gigabit Ethernet RJ45 (Copper) Interface Module (8X1GE)	A900-IMA8T	
	1-port 10 Gigabit Ethernet XFP Interface Module (1X10GE)	A900-IMA1X	0-3
	16 x T1/E1 Interface Module	A900-IMA16D	All
	4-Port OC3/STM-1 (OC-3) or 1-Port OC12/STM-4 (OC-12) Interface Module	A900-IMA4OS	
	14-port Serial Interface Module	A900-IMASER14A/S	

A900-RSP2 Supported Interface Modules

Note
- The combination IMs (A900-IMA8S1Z, A900-IMA8T1Z), and the A900-IMA2Z are *not* supported on the A900-RSP1A-55 and A900-RSP1B-55 modules on the Cisco ASR 903 Router.

- The combination IMs (A900-IMA8S1Z, A900-IMA8T1Z) are *not* supported on the A900-RSP2-64 RSP module on the Cisco ASR 903 Router.

Table iv-5   A900-RSP2 Supported Interface Modules and Part Numbers

RSP Module	Supported Interface Modules	Part Numbers	Slot
A900-RSP2A-128	8-port Gigabit Ethernet SFP Interface Module (8X1GE)	A900-IMA8S	All
	8-port Gigabit Ethernet RJ45 (Copper) Interface Module (8X1GE)	A900-IMA8T	
	1-port 10 Gigabit Ethernet XFP Interface Module (1X10GE)	A900-IMA1X	
	16 x T1/E1 Interface Module	A900-IMA16D	
	4-Port OC3/STM-1 (OC-3) or 1-Port OC12/STM-4 (OC-12) Interface Module	A900-IMA4OS	
	SFP Combo IM—8-port Gigabit Ethernet (8X1GE) + 1-port 10 Gigabit Ethernet (1X10GE)	A900-IMA8S1Z	
	Copper Combo IM—8-port Gigabit Ethernet (8X1GE) + 1-port 10 Gigabit Ethernet Interface Module(1X10GE)	A900-IMA8T1Z	
	2-port 10 Gigabit Ethernet Interface Module(2X10GE)	A900-IMA2Z	
A900-RSP2A-64	1-port 10 Gigabit Ethernet XFP Interface Module (1X10GE)	A900-IMA1X	0-2
	2-port 10 Gigabit Ethernet Interface Module (2X10GE)	A900-IMA2Z	
	4-Port OC3/STM-1 (OC-3) or 1-Port OC12/STM-4 (OC-12) Interface Module	A900-IMA4OS	
	8-port Gigabit Ethernet SFP Interface Module (8X1GE)	A900-IMA8S	3-5
	8-port Gigabit Ethernet RJ45 (Copper) Interface Module (8X1GE)	A900-IMA8T	
	16 x T1/E1 Interface Module	A900-IMA16D	

Supported RSP Features

The RSP provides the following features on the Cisco router:

- Centralized data plane, timing, and control plane functions for the system
- High-level control of interface modules
- Management functionalities for the router

- Control plane (host) CPU and associated memory in which IOS-XE and platform control software runs

- Nonvolatile memory for storage of software images, configurations, and system files

- Enabling and monitoring the health and presence of fan trays, interface modules, and power supplies

- Field replacement and hot-swap capabilities

Swapping of Interface Modules

The Ethernet interface modules support swapping on the Cisco A900-RSP2A module.

- 8-port Gigabit Ethernet SFP Interface Module (8X1GE)

- 8-port Gigabit Ethernet RJ45 (Copper) Interface Module (8X1GE)

- 1-port 10 Gigabit Ethernet XFP Interface Module (1X10GE)

- SFP Combo IM—8-port Gigabit Ethernet (8X1GE) + 1-port 10 Gigabit Ethernet (1X10GE)

- Copper Combo IM—8-port Gigabit Ethernet (8X1GE) + 1-port 10 Gigabit Ethernet Interface Module(1X10GE)

- 2-port 10 Gigabit Ethernet Interface Module(2X10GE)

Use the **hw-module subslot default** command before performing a swap of the modules. to default the interfaces on the interface module.

Note   Failure in executing the command may cause the interface to enter the Out of Service state. To recover from out of service state, perform the following:

- Insert the original IM and execute the **hw-module subslot 0/*bay* default** command. Swap the module. For more information, see *Cisco IOS Interface and Hardware Component Command Reference*.

- If the module does not come up, perform a reload of the router.

RSP Redundancy

The Cisco ASR 903 Router chassis includes two RSP slots to allow for redundant RSPs. When the router uses redundant RSPs, one RSP operates in the active mode and the other operates in the hot standby mode. Removal or failure of the active RSP results in an automatic switchover to the standby RSP.

Note   If you are using redundant RSPs, both the RSPs must be of the same type because a mixed configuration of two different RSP types is not supported.

Network Timing Interfaces

The RSP supports the following network timing interfaces:

- BITS input/output port—RJ48 jack

- 1 PPS input and output—Mini coax connectors

- 2.048 or 10 MHz input and output—Mini coax connectors

- Time of Day (ToD) or 1 PPS input or output port—Shielded RJ45 jack

Network timing interfaces support redundancy in a redundant RSP configuration. Network timing interfaces on a redundant RSP remain in operation while the RSP is in hot standby mode.

RSP Interfaces

Figure iv-7 summarizes the interfaces on the RSP module.

Figure iv-7   **RSP Interfaces Summary**
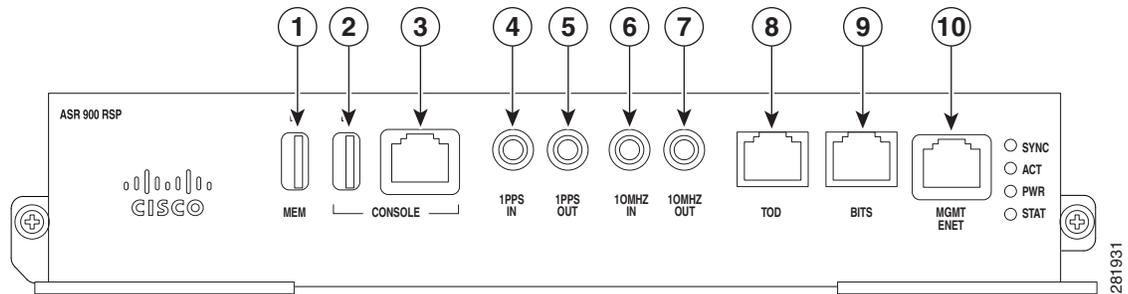
Label	Interface
1	USB memory port
2	USB console port
3	Console port
4	1 PPS input timing port
5	1 PPS output timing port
6	10 MHz input timing port
7	10 MHz output timing port
8	Time of Day (ToD) timing port
9	BITS timing port
10	Ethernet management port

The Cisco A900-RSP2A module has the following front panel interfaces. For information on cable pinout, see Pinouts, page 4-1.

- 1 USB Type-A Connector for USB-flash (Label = "MEM")
- 1 USB Type-A Connector for alternate console port (Label = "CONSOLE")
- RJ45 Connecter for Con/Aux (Label = "CONSOLE")
- RJ48 Jack for BITS interface. (Label = "BITS")
- RJ48 Jack for Time-of-Day interface. (Label= "TOD")
- RJ45 Connecter for Con/Aux (Label = "MGMT ENET")
- 4 Mini-Coax connectors (Label = "1PPS IN", "1PPS OUT", "10MHZ IN", "10MHZ OUT")

For more information about installing the RSP, see "RSP Installation" section on page 2-14. For more information about the RSP LEDs, see "RSP LEDs" section on page 4-10.

Interface Modules

The Cisco ASR 903 Router interface modules are a field-replaceable units. In addition to the ports provided on an RSP, the Cisco ASR 903 Router supports the following interface modules:

- Gigabit Ethernet SFP Interface Module, page iv-14
- Gigabit Ethernet RJ45 Interface Module, page iv-15
- 10 Gigabit Ethernet XFP Interface Module, page iv-16
- T1/E1 Interface Module, page iv-18
- OC-3 Interface Module, page iv-18
- Serial Interface Module, page iv-19
- 8x1 Gigabit Ethernet SFP+ 1x10 Gigabit Ethernet SFP+ Combination Interface Module, page iv-21
- 8x1 Gigabit Ethernet RJ45 + 1x10 Gigabit Ethernet SFP+ Combination Interface Module, page iv-23
- 2x1 10 Gigabit Ethernet SFP+ Interface Module, page iv-24

Note   For information about supported interface modules, see the *Release Notes for the Cisco ASR 903 Series Aggregation Services Router*.

Gigabit Ethernet SFP Interface Module

The Gigabit Ethernet Small Form-Factor Pluggable (SFP) interface module provides eight Gigabit Ethernet SFP modules. Figure iv-8 shows the 8 x 1 GE Gigabit Ethernet SFP interface module.

Figure iv-8   *8 x 1 GE Gigabit Ethernet SFP Interface Module*
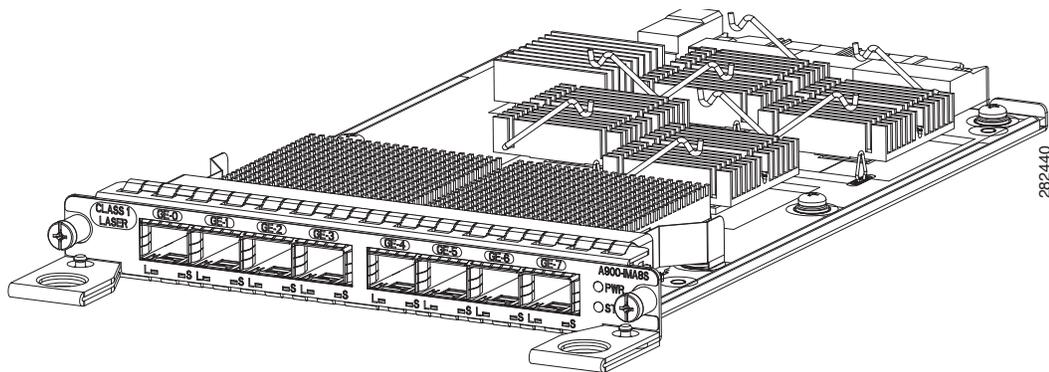
Supported SFP Modules

The Gigabit Ethernet SFP interface module supports the following SFP modules:

- GLC-BX-D
- GLC-BX-U
- GLC-EX-SMD
- GLC-FE-100BX-D

- GLC-FE-100BX-U
- GLC-FE-100EX
- GLC-FE-100FX
- GLC-FE-100FX-RGD
- GLC-FE-100LX
- GLC-FE-100LX-RGD
- GLC-FE-100ZX
- GLC-LH-SMD
- GLC-LH-SM-RGD
- GLC-SX-MMD
- GLC-SX-MM-RGD
- GLC-TE
- GLC-ZX-SMD
- GLC-ZX-SM-RGD
- SFP-GE-L
- SFP-GE-S
- SFP-GE-T
- SFP-GE-Z

For more information about installing an SFP Gigabit Ethernet module, see the "Interface Module Installation" section on page 2-18.

Gigabit Ethernet RJ45 Interface Module

The Gigabit Ethernet RJ45 interface module provides eight Gigabit Ethernet copper ports. Figure iv-9 shows the interface module.

Figure iv-9   8 x 1 GE Gigabit Ethernet RJ45 (Copper) Interface Module
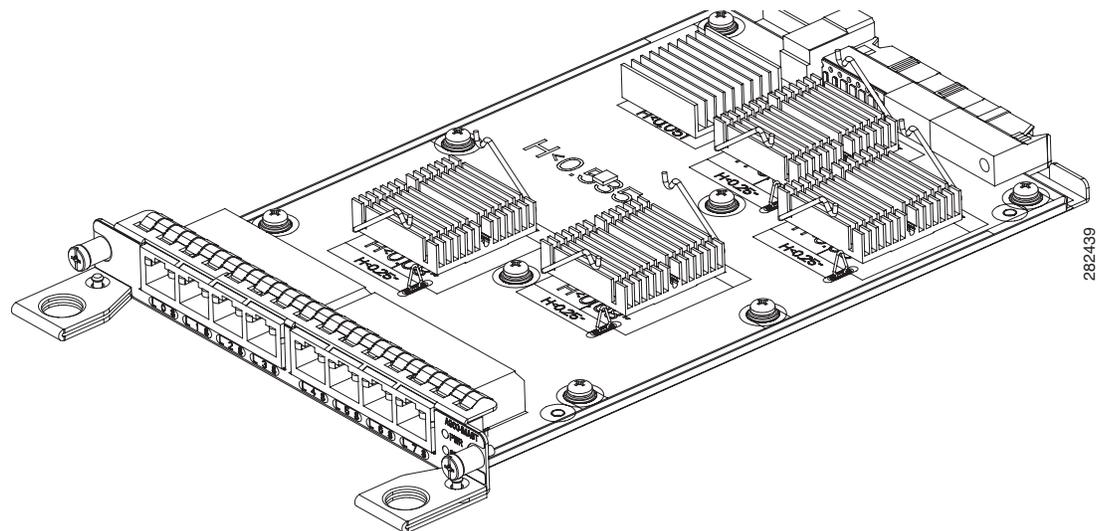
For more information about installing an RJ45 Gigabit Ethernet module, see the "Interface Module Installation" section on page 2-18.

10 Gigabit Ethernet XFP Interface Module

The 10 Gigabit Ethernet XFP interface module provides a single port supporting a 10 Gigabit Ethernet XFP module. Figure iv-10 shows the interface module.

Figure iv-10   1 x 10 GE Gigabit Ethernet XFP Interface Module
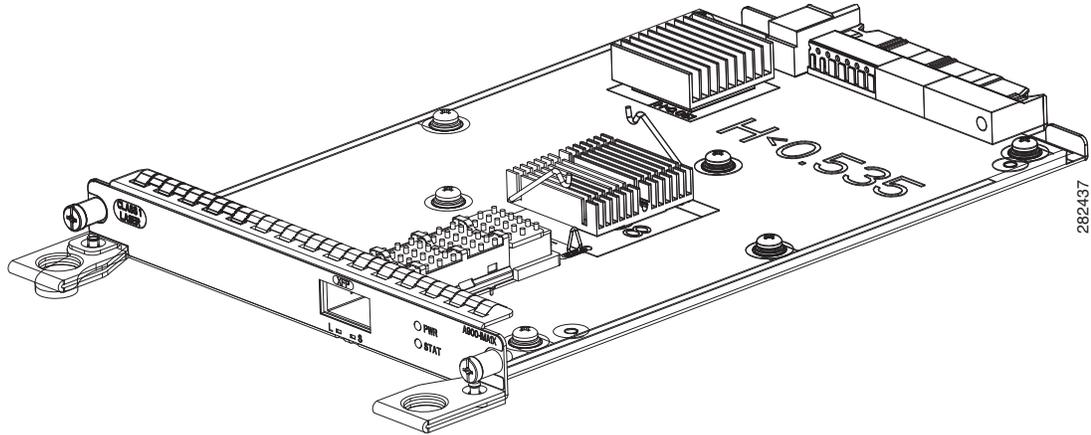
Note   10 Gigabit Ethernet interface modules are not supported in slots 4 and 5.

Supported XFP Modules

The 10 Gigabit Ethernet SFP interface module supports the following XFP modules:

- DWDM-XFP-30.33
- DWDM-XFP-31.12
- DWDM-XFP-31.90
- DWDM-XFP-32.68
- DWDM-XFP-34.25
- DWDM-XFP-35.04
- DWDM-XFP-35.82
- DWDM-XFP-36.61
- DWDM-XFP-38.19
- DWDM-XFP-38.98
- DWDM-XFP-39.77
- DWDM-XFP-40.56
- DWDM-XFP-42.14
- DWDM-XFP-42.94

- DWDM-XFP-43.73
- DWDM-XFP-44.53
- DWDM-XFP-46.12
- DWDM-XFP-46.92
- DWDM-XFP-47.72
- DWDM-XFP-48.51
- DWDM-XFP-50.12
- DWDM-XFP-50.92
- DWDM-XFP-51.72
- DWDM-XFP-52.52
- DWDM-XFP-54.13
- DWDM-XFP-54.94
- DWDM-XFP-55.75
- DWDM-XFP-56.55
- DWDM-XFP-58.17
- DWDM-XFP-58.98
- DWDM-XFP-59.79
- DWDM-XFP-60.61
- DWDM-XFP-C
- ONS-XC-10G-EP
- ONS-XC-10G-1470
- ONS-XC-10G-1490
- ONS-XC-10G-1510
- ONS-XC-10G-1530
- ONS-XC-10G-1550
- ONS-XC-10G-1570
- ONS-XC-10G-1590
- ONS-XC-10G-1610
- XFP10GER-192IR-L
- XFP-10GER-OC192IR
- XFP-10GER-OC192IR-RGD
- XFP10GLR-192SR-L
- XFP-10GLR-OC192SR
- XFP-10GLR-OC192SR-RGD
- XFP-10G-MM-SR
- XFP-10GZR-OC192LR
- XFP-10GZR-OC192LR-RGD

For more information about installing a 10GE XFP module, see the "Interface Module Installation" section on page 2-18.

T1/E1 Interface Module

The T1/E1 interface module provides connectivity for up to 16 T1/E1 ports through a 100-pin Amplimite connector. The T1/E1 interface module requires the use of a patch panel to provide RJ48 (T1) or BNC (E1) connectors. Figure iv-11 shows the interface module.

Figure iv-11   16 x T1/E1 Interface Module
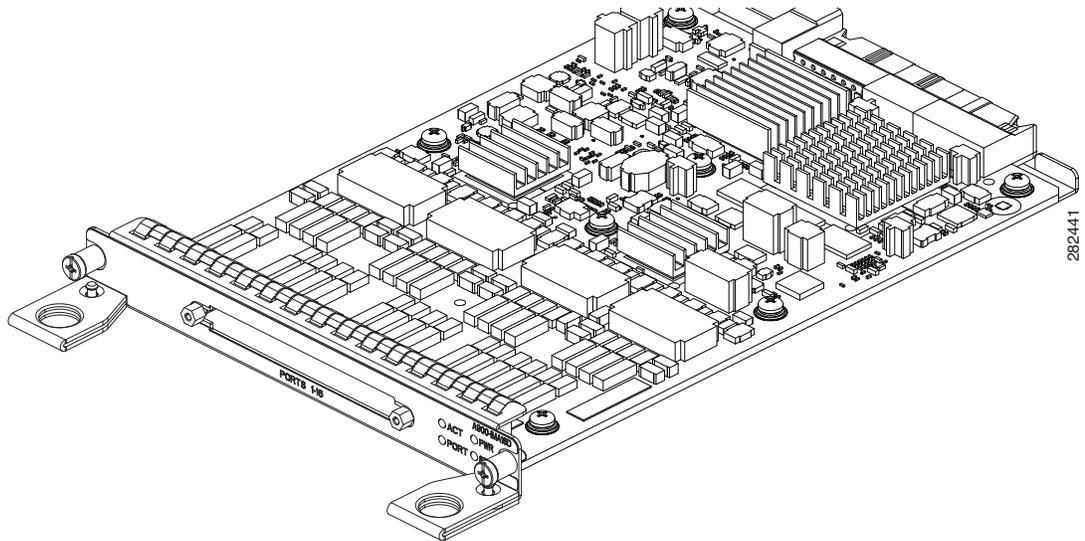
For more information about installing a T1/E1 interface module, see the "Interface Module Installation" section on page 2-18.

OC-3 Interface Module

The OC-3 interface module can operate as up to four STM-1 interfaces.

Note   The optical interface module is designed for OC-3 and OC-12 traffic, but OC-12 functionality is not currently supported.

Figure iv-12 shows the interface module.

Figure iv-12   4 x OC-3 Interface Module
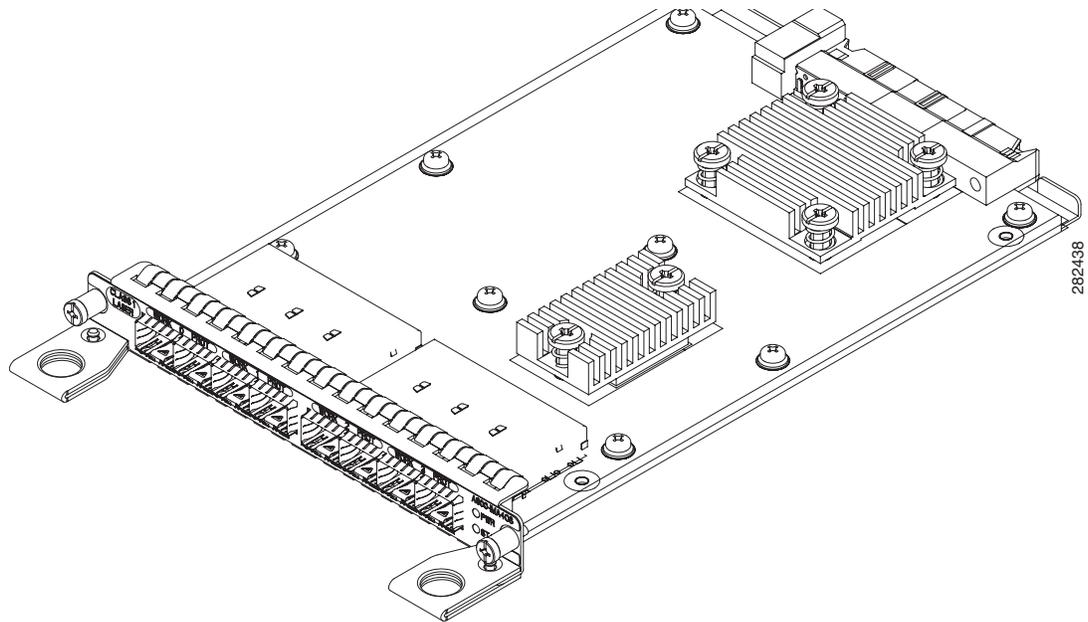
Supported SFP Modules

The optical interface module supports the following optical transceivers:

- ONS-SC-155-EL
- ONS-SI-155-I1
- ONS-SI-155-L1
- ONS-SI-155-L2
- ONS-SI-155-SR-MM

For more information about installing an optical interface module, see the "Interface Module Installation" section on page 2-18.

Serial Interface Module

The Cisco (A900-IMASER14A/S) is an 14 port serial interface module for the Cisco ASR 903 router. The Cisco ASR 903 Router module has the following interfaces:

- 12-in-1 Connector (6)—Supports Asynchronous RS-232 interfaces using EIA/TIA-232 DB-25 connectors
- 68-Pin Connector (2)—Supports up to 8 RS-232 and RS-485 interfaces in full or half duplex mode using 4 RS-232 connectors (DB-25, DB-9, or RJ-45).

Figure iv-13   *Serial Interface Module*
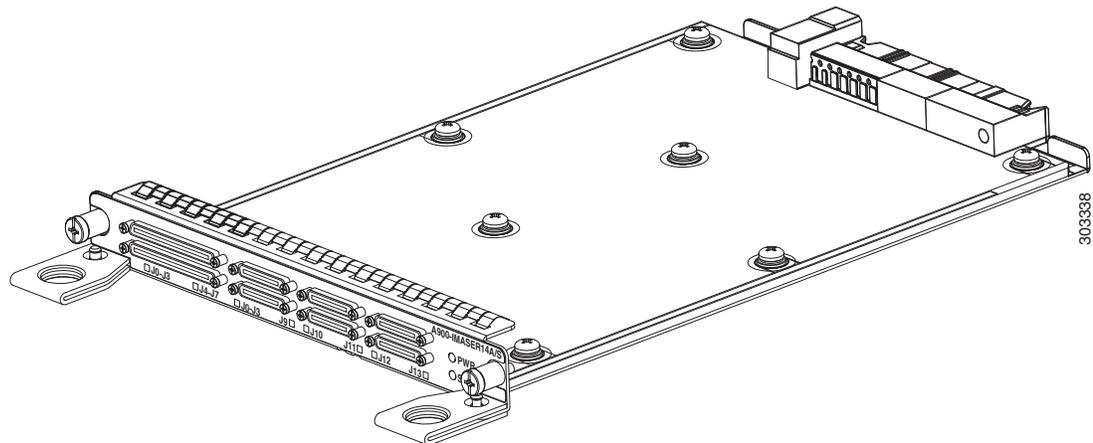
Figure iv-14   *Cisco ASR 903 Router Front Panel*
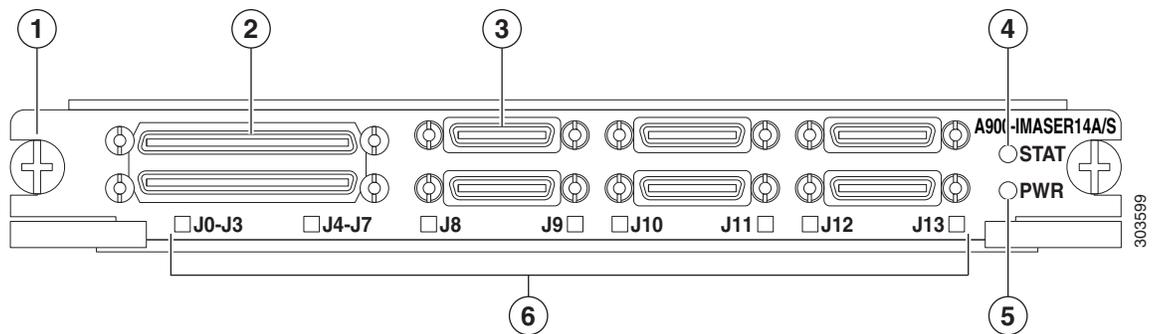
1	Captive screws (2)	2	68-Pin Connector (2)
3	12-in-1 Connector (6)	4	Status (STAT) LED
5	Power (PWR) LED	6	LEDs—The LEDs are as follows: • J0–J3 and J4–J7—Indicate the function of the 68-pin connectors • J8–J13—Indicate the status of the 12-in-1 connectors

For more information about using the LEDs to troubleshoot the Cisco ASR 903 Router, see LED Summary, page 4-10.

Supported Standards

The Cisco ASR 903 Router supports the following standards

Table 6   General Standards

Standard	Definition
IEEE 1613 2009	IEEE Standard for Environmental and Testing Requirements for Communications Networking Devices in Electric Power Substations
IEC 61850-3	IEC standard specifying general requirements for substation automation systems (SAS) communications and related system requirements.
IEC 60870-2-1:1995	IEC standard for substation environmental conditions
IEC 60870-2-2:1996	IEC standard for substation environmental conditions
IEC 61000-6-5:2001	IEC standard defining immunity for power station and substation environments

The serial interface module supports several cable types. For more information, see Connecting Serial Cables, page 2-48 and Serial Cable Pinouts, page 4-6.

8x1 Gigabit Ethernet SFP+ 1x10 Gigabit Ethernet SFP+ Combination Interface Module

The 8-port 1 Gigabit Ethernet SFP interface module with the 1-port 10 Gigabit Ethernet interface module is a high density combination interface module. This module supports 8 Gigabit Ethernet SFP ports and 1 10 Gigabit Ethernet SFP+ port.

Figure iv-15   8x1 GE SFP+ 1x10 GE SFP Interface Module
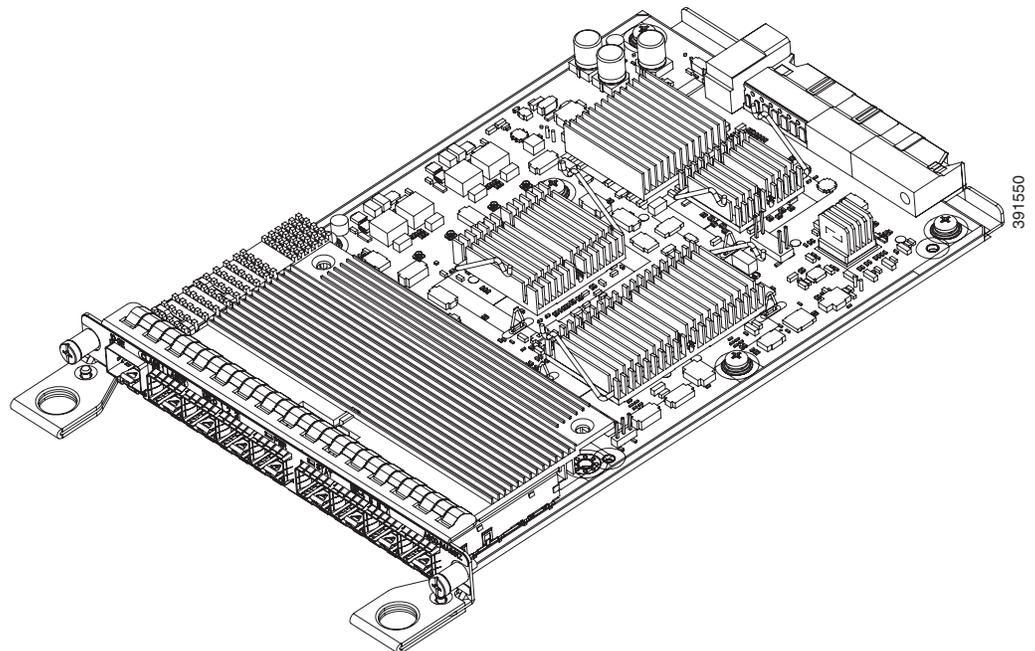
Supported SFP Modules

- GLC-FE-100LX
- GLC-FE-100BX-D
- GLC-FE-100BX-U
- GLC-FE-100EX
- GLC-FE-100ZX
- GLC-FE-100FX
- GLC-FE-100LX-RGD=
- GLC-FE-100FX-RGD=
- GLC-SX-MM-RGD
- GLC-LX-SM-RGD
- GLC-ZX-SM-RGD
- GLC-BX-D=
- GLC-BX-U=
- GLC-EX-SMD
- GLC-SX-MMD
- GLC-LH-SMD
- GLC-ZX-SMD
- SFP-GE-T
- SFP-GE-L
- SFP-GE-S
- SFP-GE-Z
- CWDM-SFP-xxxx=
- DWDM-SFP-xxxx=
- SFP-10G-SR
- SFP-10G-LR
- SFP-10G-ER
- SFP-10G-ZR
- SFP-10G-SR-X
- SFP-10G-LR-X

For more information about installing the 8X1 GE SFP + 1X10 SFP Gigabit Ethernet module, see the .

8x1 Gigabit Ethernet RJ45 + 1x10 Gigabit Ethernet SFP+ Combination Interface Module

This 8-port 1 Gigabit Ethernet RJ45 (Copper) interface module with the 1-port 10 Gigabit Ethernet interface module is a high density combination interface module. This module supports 8 Gigabit Ethernet Copper ports and 1 10 Gigabit Ethernet SFP+ port.

Figure iv-16   8x1 GE SFP+ 1x10 GE SFP Interface Module

Supported SFP Modules

- SFP-10G-SR
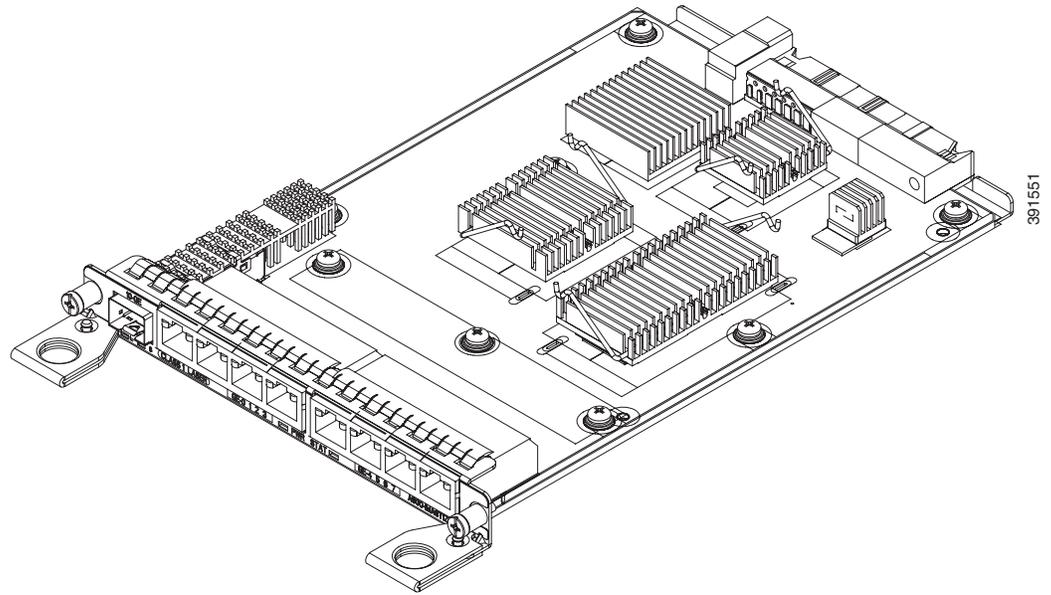- SFP-10G-LR
- SFP-10G-ER
- SFP-10G-ZR
- SFP-10G-SR-X
- SFP-10G-LR-X
- DWDM-SFP10G-xx.xx

For more information about installing the 8X1 GE RJ45 + 1X10 SFP Gigabit Ethernet module, see the "Interface Module Installation" section on page 2-18.

2x1 10 Gigabit Ethernet SFP+ Interface Module

The 2 port 10 Gigabit Ethernet interface module provides a dual port supporting a 10 Gigabit Ethernet SFP+ and XFP module.

Figure iv-17   *2X10 Gigabit Ethernet Interface Module*
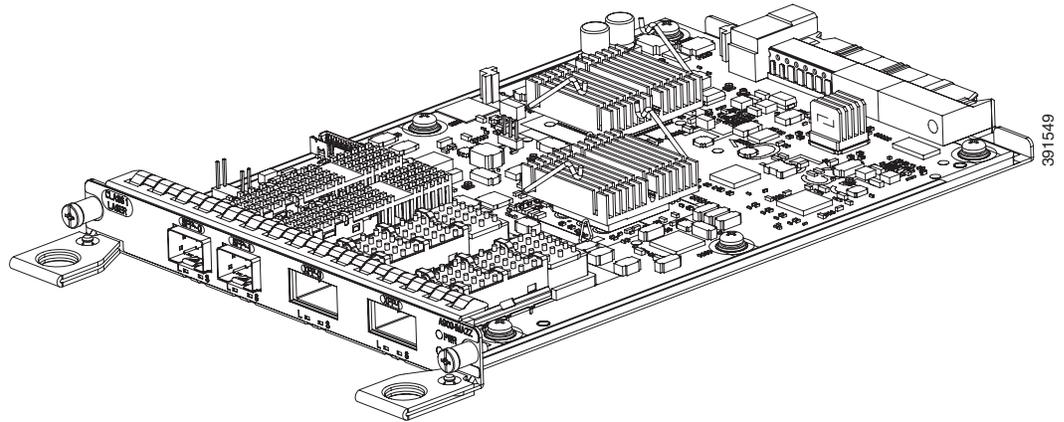
Supported XFP Modules

- XFP-10G-MM-SR=
- XFP-10GER-OC192IR=
- XFP-10GLR-OC192SR=
- XFP-10GZR-OC192LR=
- XFP-10GER-OC192IR-RGD=
- XFP-10GLR-OC192SR-RGD=
- XFP-10GZR-OC192LR-RGD=
- XFP10GER-192IR-L
- XFP10GLR-192SR-L
- DWDM-XFP-C
- DWDM-XFP-xxxx
- ONS-XC-10G-Epxx.x
- ONS-XC-10G-xxxx=
- DWDM-XFP-C
- DWDM-XFP-xxxx
- ONS-XC-10G-Epxx.x
- ONS-XC-10G-xxxx=

Supported SFP Modules

- SFP-10G-SR
- SFP-10G-LR
- SFP-10G-ER
- SFP-10G-ZR
- SFP-10G-SR-X
- SFP-10G-LR-X
- DWDM-SFP10G-xx.xx

For more information about installing the 2X10 GE SFP Gigabit Ethernet module, see the "Interface Module Installation" section on page 2-18.

Temperature Sensor

The Cisco ASR 903 Router has a temperature sensor to detect overtemperature conditions inside the chassis. The overtemperature detection trips at 75 degrees C +/- 5% with the ambient (inlet) trip point at 67 degrees C. This condition is reported to the processor as an interrupt, and the software takes action to generate the appropriate alarms.

Serial Number Label Location

Figure iv-18 shows the serial number label location on the Cisco ASR 903 Router.

Figure iv-18   Cisco ASR 903 Router Serial Number Location
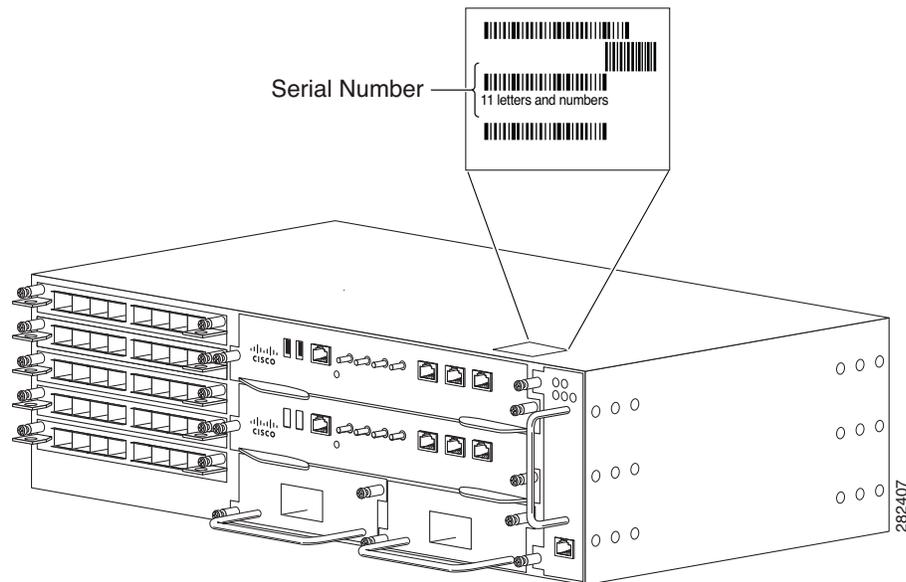
Interface Numbering

The Cisco ASR 903 Router chassis includes:

- Six interface module slots
- Two RSP module slots
- Two power supply slots
- One fan tray slot

Each network interface on a Cisco ASR 903 Router is identified by a slot number and a port number.

Figure iv-19 shows interface numbering in a Cisco ASR 903 Router.

Figure iv-19   Cisco ASR 903 Router Slot Numbers
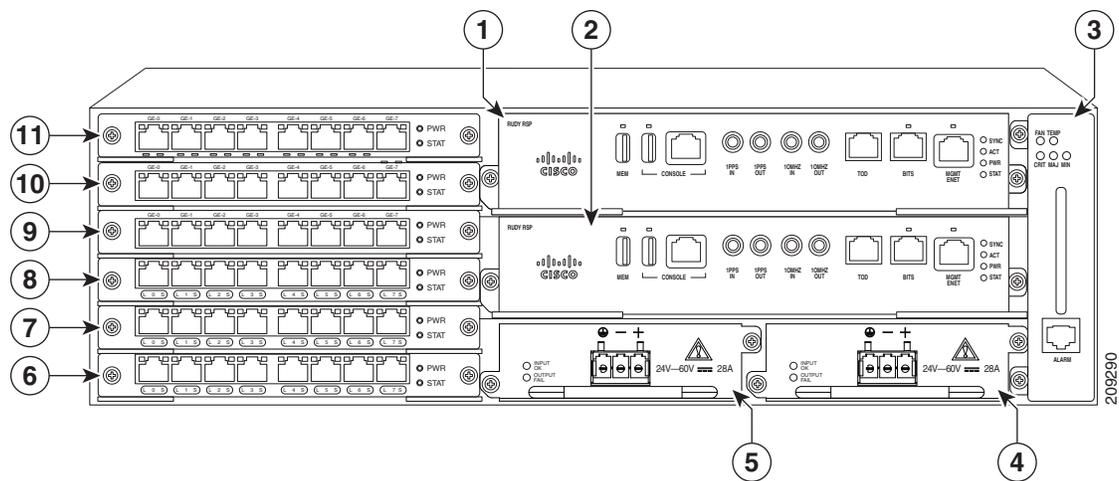
1	RSP slot 1
2	RSP slot 0
3	Fan tray slot
4	Power supply slot 1
5	Power supply slot 0
6	Interface module slot 0
7	Interface module slot 1
8	Interface module slot 2
9	Interface module slot 3
10	Interface module slot 4
11	Interface module slot 5

Following is an explanation of the slot or port numbering:

- The numbering format is Interface type slot or interface number. Interface (port) numbers begin at logical 0 for each interface type.

- Interface module slots are numbered from bottom to top, with logical interfaces on each module numbered from left to right. Interfaces are hard-wired. Therefore, port 0 is always logical interface 0/0, port 1 is always logical interface 0/1, and so on.

Regulatory Compliance

For regulatory compliance and safety information, see the *Regulatory Compliance and Safety Information for the Cisco ASR 903 Router* document.

Cisco ASR 900 Series Aggregation Services Router Interface Modules

Cisco® ASR 900 Series Aggregation Services Router interface modules (Figure 1) are designed to support a wide range of services, speeds, temperature ranges, and rich capabilities. They provide cost-effective delivery of converged mobile and business Ethernet services.

Figure 1. Cisco ASR 900 Series ASR Interface Modules

Ethernet Interface Modules

Cisco ASR 900 Series Ethernet interface modules are designed to give customers a high degree of flexibility and value. All Ethernet interface modules share a common core that supports time stamping on the module for Y.1731 operations, administration, and maintenance (OAM) delay measurement functions to achieve precise results for one-way and two-way delay measurement. The modules also provide time-stamping functions for the IEEE 1588-2008 protocol. These time stamps help ensure that the Cisco ASR 900 Series Aggregation Services Routers achieve outstanding results when deploying IEEE 1588-2008 protocols for frequency and phase synchronization. Not all customers will deploy IEEE 1588-2008 for synchronization; therefore, the Ethernet interface modules also support input and output frequency synchronization using synchronous Ethernet (SyncE).

All Cisco ASR 900 Series Ethernet interface modules support online insertion and removal (OIR), which contributes to a higher uptime for the Cisco ASR 900 Series routers.

Cisco ASR 900 Series 1-Port 10GE XFP Module

The Cisco ASR 900 Series 1-Port 10GE XFP Module provides physical connectivity using a single pluggable 10 Gigabit Ethernet XFP optic. The interface module supports both the LAN and WAN physical layer (PHY), which allows flexible and versatile deployment models.

The module is supported in slot 0 to slot 3 of the router in combination with the Cisco ASR 903 Route Switch Processor (RSP1). The module is supported in slot 0 to slot 2 with the Cisco ASR 900 RSP 2A-64. The module is supported in any slot with the Cisco ASR 900 RSP 2A-128.

Table 1 lists the pluggable optics that are supported in the Cisco ASR 900 Series 1-Port 10GE XFP Module, on the Cisco IOS® XE Software releases for the Cisco ASR 900 Series router.

Table 1.   10 Gigabit Ethernet Optics Supported in the 1-Port 10GE XFP Module

Optic Product Number	Supported As of Cisco IOS XE Release	Description
XFP10GER-192IR-L	3.8.0S	Cisco multirate XFP transceiver module for 10GBASE-ER/-EW Ethernet and OC-192/STM-64 intermediate-reach (IR-2), single-mode fiber (SMF), dual LC connector, low power (2.5W)
XFP10GLR-192SR-L	3.8.0S	Cisco multirate XFP transceiver module for 10GBASE-LR/-LW Ethernet and OC-192/STM-64 short-reach (SR-1), SMF, dual LC connector, low power (1.5W)
XFP-10GZR-OC192LR	3.8.0S	Cisco multirate XFP transceiver module for 10GBASE-ZR/-ZW Ethernet and OC-192/STM-64 long-reach, SMF, dual LC connector
XFP10GLR192SR-RGD	3.5.0S	Cisco multirate XFP transceiver module for 10GBASE-LR/-LW Ethernet and OC-192/STM-64 short-reach (SR-1), SMF, dual LC connector, industrial temperature range
XFP10GER192IR-RGD	3.5.0S	Cisco multirate XFP transceiver module for 10GBASE-ER/-EW Ethernet and OC-192/STM-64 intermediate-reach (IR-2), SMF, dual LC connector, industrial temperature range
XFP10GZR192LR-RGD	3.5.0S	Cisco multirate XFP transceiver module for 10GBASE-ZR/-ZW Ethernet and OC-192/STM-64 long-reach, SMF, dual LC connector, industrial temperature range
DWDM-XFP-C	3.5.0S	10GBASE-DWDM Tunable XFP (50-GHz ITU grid), dual LC connector
DWDM-XFP-xx.yy	3.8.0S	10GBASE-DWDM single wavelength XFP (100-GHz ITU grid), dual LC connector - 32 individual wavelength pluggable modules
ONS-XC-10G-EPxx.y=	3.8.0S	10GBASE-DWDM single wavelength Edge Performance XFP (100-GHz ITU grid), dual LC connector, 50-km reach - 40 individual wavelength pluggable modules
ONS-XC-10G-xxxx=	3.10.0S	10GBASE-CWDM single wavelength XFP (ITU G694.2), dual LC connector, 40-km reach - 8 individual wavelength pluggable modules
XFP-10G-MM-SR	3.5.0S	Cisco 10GBASE-SR Ethernet XFP transceiver module for multimode fiber (MMF), dual LC connector
XFP-10GLR-OC192SR	3.5.0S	Cisco multirate XFP transceiver module for 10GBASE-LR Ethernet and OC-192/STM-64 short-reach (SR-1) PoS applications, SMF, dual LC connector
XFP-10GZR-OC192LR	3.5.0S	Cisco multirate XFP transceiver module for 10GBASE-ZR Ethernet and OC-192/STM-64 long-reach PoS applications, SMF, dual LC connector

Cisco ASR 900 Series 2-Port 10GE XFP/SFP+ Module

The Cisco ASR 900 Series 2-Port 10GE XFP/SFP+ pluggable interface module delivers the highest performance per slot on the Cisco ASR 900 Series Routers. This interface module provides two 10 Gigabit Ethernet ports with physical connectivity, using either a pluggable 10 Gigabit Ethernet Enhanced Small Form Factor Pluggable (SFP+) or a pluggable 10 Gigabit Ethernet XFP optic per port. The interface module supports both LAN and WAN PHY, which allows flexible and versatile deployment models.

The module is supported in slot 0 to slot 2 with the Cisco ASR 900 RSP 2A-64. The module is supported in any slot with the Cisco ASR 900 RSP 2A-128. The module is not supported in combination with the Cisco ASR 903 RSP1 in any chassis.

Table 2 lists the pluggable optics that are supported in the Cisco ASR 900 Series 2-Port 10GE XFP/SFP+ Module, on the Cisco IOS XE Software releases for the Cisco ASR 900 Series router.

Table 2.   10 Gigabit Ethernet Optics Supported in the 2-Port 10GE XFP/SFP+ Module

Optic Product Number	Supported as of Cisco IOS XE Release	Description
XFP10GER-192IR-L	3.13.0S	Cisco multirate XFP transceiver module for 10GBASE-ER/-EW Ethernet and OC-192/STM-64 intermediate-reach (IR-2), single-mode fiber (SMF), dual LC connector, low power (2.5W)
XFP10GLR-192SR-L	3.13.0S	Cisco multirate XFP transceiver module for 10GBASE-LR/-LW Ethernet and OC-192/STM-64 short-reach (SR-1), SMF, dual LC connector, low power (1.5W)
XFP-10GZR-OC192LR	3.13.0S	Cisco multirate XFP transceiver module for 10GBASE-ZR/-ZW Ethernet and OC-192/STM-64 long-reach, SMF, dual LC connector
XFP10GLR192SR-RGD	3.13.0S	Cisco multirate XFP transceiver module for 10GBASE-LR/-LW Ethernet and OC-192/STM-64 short-reach (SR-1), SMF, dual LC connector, industrial temperature range
XFP10GER192IR-RGD	3.13.0S	Cisco multirate XFP transceiver module for 10GBASE-ER/-EW Ethernet and OC-192/STM-64 intermediate-reach (IR-2), SMF, dual LC connector, industrial temperature range
XFP10GZR192LR-RGD	3.13.0S	Cisco multirate XFP transceiver module for 10GBASE-ZR/-ZW Ethernet and OC-192/STM-64 long-reach, SMF, dual LC connector, industrial temperature range
DWDM-XFP-C	3.13.0S	10GBASE-DWDM Tunable XFP (50-GHz ITU grid), dual LC connector
DWDM-XFP-xx.yy	3.13.0S	10GBASE-DWDM single wavelength XFP (100-GHz ITU grid), dual LC connector - 32 individual wavelength pluggable modules
ONS-XC-10G-EPxx.y=	3.13.0S	10GBASE-DWDM single wavelength Edge Performance XFP (100-GHz ITU grid), dual LC connector, 50-km reach - 40 individual wavelength pluggable modules
ONS-XC-10G-xxxx=	3.13.0S	10GBASE-CWDM single wavelength XFP (ITU G694.2), dual LC connector, 40-km reach - 8 individual wavelength pluggable modules
XFP-10G-MM-SR	3.13.0S	Cisco 10GBASE-SR Ethernet XFP transceiver module for multimode fiber (MMF), dual LC connector
XFP-10GLR-OC192SR	3.13.0S	Cisco multirate XFP transceiver module for 10GBASE-LR Ethernet and OC-192/STM-64 short-reach (SR-1) PoS applications, SMF, dual LC connector
XFP-10GZR-OC192LR	3.13.0S	Cisco multirate XFP transceiver module for 10GBASE-ZR Ethernet and OC-192/STM-64 long-reach PoS applications, SMF, dual LC connector
SFP-10G-SR	3.13.0S	Cisco 10GBASE-SR Ethernet SFP+ transceiver module for MMF, 850 nm
SFP-10G-LR	3.13.0S	Cisco 10GBASE-LR Ethernet SFP+ transceiver module for SMF, 1310 nm
SFP-10G-ER	3.13.0S	Cisco 10GBASE-ER Ethernet SFP+ transceiver module for SMF and MMF, 1550 nm
SFP-10G-ZR	3.13.0S	Cisco multirate 10GBASE-ZR, 10GBASE-ZW and OTU2/OTU2e SFP+ transceiver module for SMF and MMF, 1550 nm
DWDM-SFP10G-xx.xx=	3.13.0S	Cisco multirate (LAN/WAN/OTU2/OTU2E) 10GBASE-DWDM single wavelength SFP+ module (100-GHz ITU grid) - 40 individual wavelength pluggable modules

Cisco ASR 900 Series 8-Port 1GE SFP Module

The Cisco ASR 900 Series 8-Port 1GE SFP Module delivers eight ports of Gigabit Ethernet and Fast Ethernet connectivity on the Cisco ASR 900 Series routers. The interface speed can be selected per interface, depending on the optic used. This interface module provides physical connectivity using eight SFP optics.

The module is supported in any slot of the Cisco ASR 902 or Cisco ASR 903 Router in combination with the Cisco ASR 900 RSP2A-128 or Cisco ASR 903 RSP1 module. The module is supported in slot 0, slot 2, and slot 3 of the Cisco ASR 902 Router and in slot 3, slot 4, and slot 5 of the Cisco ASR 903 Router in combination with the Cisco ASR 900 RSP2A-64 module.

When the module is inserted in slot 5 of the Cisco ASR 903 Router or slot 3 of the Cisco ASR 902 Router, in combination with the Cisco ASR 903 RSP1, port 0 of the interface module will not be usable.

Table 3 lists the pluggable optics that are supported in the Cisco ASR 900 Series 8-Port 1GE SFP Module, on the Cisco IOS XE Software releases for the Cisco ASR 900 Series router.

Table 3. Ethernet Optics Supported in the 8-Port 1GE SFP Module

Optic Product Number	Supported As of Cisco IOS XE Release	Description
GLC-FE-100FX-RGD	3.5.0S	100BASE-FX SFP module for Industrial Ethernet 100-MB ports, 1310 nm wavelength, 2 km over MMF
GLC-FE-100LX-RGD	3.5.0S	100BASE-LX SFP module for Industrial Ethernet 100-MB ports, 1310 nm wavelength, 10 km over SMF
GLC-FE-100LX	3.8.0S	100BASE-LX SFP for Fast Ethernet SFP ports, 1310 nm wavelength, 10 km over SMF
GLC-FE-100FX	3.8.0S	100BASE-FX SFP for Fast Ethernet SFP ports, 1310 nm wavelength, 2 km over MMF
GLC-FE-100ZX	3.10.0S	100BASE-ZX SFP for Fast Ethernet SFP ports, 1550 nm wavelength, 80 km over SMF
GLC-FE-100EX	3.10.0S	100BASE-EX SFP for Fast Ethernet SFP ports, 1310 nm wavelength, 40 km over SMF
GLC-FE-100BX-U	3.8.0S	100BASE-BX10-U SFP for Fast Ethernet SFP ports. Single-strand SMF up to 10 km, transmits on a 1310-nm channel and receives on a 1550-nm signal
GLC-FE-100BX-D	3.8.0S	100BASE-BX10-D SFP for Fast Ethernet SFP ports. Single-strand SMF up to 10 km, transmits on a 1550-nm channel and receives on a 1310-nm signal
GLC-EX-SMD	3.5.0S	1000BASE-EX SFP transceiver module for SMF, 1310-nm wavelength, extended operating temperature range and Digital Optical Monitoring (DOM) support, dual LC/PC connector
GLC-BX-D	3.5.0S	1000BASE-BX10 SFP module for single-strand SMF, 1490-nm TX/1310-nm RX wavelength, single LC/PC connector
GLC-BX-U	3.5.0S	1000BASE-BX10 SFP module for single-strand SMF, 1310-nm TX/1490-nm RX wavelength, single LC/PC connector
GLC-ZX-SM-RGD	3.5.0S	1000BASE-ZX SFP transceiver module for SMF, 1550-nm wavelength, industrial Ethernet, dual LC/PC connector
GLC-SX-MM-RGD	3.5.0S	1000BASE-SX SFP transceiver module for MMF, 850-nm wavelength, industrial Ethernet, dual LC/PC connector
GLC-LX-SM-RGD	3.5.0S	1000BASE-LX/LH SFP transceiver module for MMF and SMF, 1300-nm wavelength, industrial Ethernet, dual LC/PC connector
SFP-GE-T	3.5.0S	1000BASE-T SFP transceiver module for Category 5 copper wire, extended operating temperature range, RJ-45 connector
SFP-GE-L	3.10.0S	1000BASE-LX/LH SFP transceiver module for MMF and SMF, 1310-nm wavelength
SFP-GE-S	3.10.0S	1000BASE-SX SFP transceiver module for MMF, 850-nm wavelength
SFP-GE-Z	3.10.0S	1000BASE-ZX SFP transceiver module for SMF, 1550-nm wavelength
DWDM-SFP-xxxx (36 wavelengths)	3.6.0S	Cisco 1000BASE-DWDM Gigabit Ethernet SFP, with 36 different wavelengths ranging from 1561.42 nm to 1530.33 nm or ITU channel 20 to 59
CWDM-SFP-xxxx (8 wavelengths)	3.6.0S	Cisco CWDM Gigabit Ethernet SFP, with 8 different wavelengths ranging from 1470 nm to 1610 nm
GLC-ZX-SMD	3.6.0S	1000BASE-ZX SFP transceiver module for SMF, 1550-nm wavelength, dual LC/PC connector
GLC-SX-MMD	3.6.0S	1000BASE-SX SFP transceiver module for MMF, 850-nm wavelength, extended operating temperature range and DOM support, dual LC/PC connector
GLC-LH-SMD	3.6.0S	1000BASE-LX/LH SFP transceiver module for MMF and SMF, 1300-nm wavelength, extended operating temperature range and DOM support, dual LC/PC connector

Cisco ASR 900 Series 8-Port 1GE SFP and 1-Port 10GE SFP+ Module

The Cisco ASR 900 Series 8-Port 1GE SFP and 1-Port 10GE SFP+ Module delivers eight ports of Gigabit Ethernet and Fast Ethernet and one port of 10 Gigabit Ethernet connectivity on the Cisco ASR 900 Series routers.
The interface speed of the SFP interfaces can be selected per interface, depending on the optic used. For the 10 Gigabit Ethernet SFP+ port, the speed is not configurable. This interface module provides physical connectivity using eight SFP transceivers and one SPF+ transceiver.

The module is supported in any slot of the router in combination with the Cisco ASR 900 RSP2A-128 module and in slot 0 and slot 2 of the Cisco ASR 902 router in combination with the Cisco ASR 900 RSP2A-64 module.

The module is not supported in combination with the Cisco ASR 903 RSP1 module in any chassis. It is also not supported in the Cisco ASR 903 chassis in combination with the Cisco ASR 900 RSP2A-64 module.

Table 4 lists the pluggable optics that are supported in the Cisco 900 Series 8-Port 1GE SFP and 1-Port 10GE SFP+ Module, on the Cisco IOS XE Software releases for the Cisco ASR 900 Router.

Table 4.   Ethernet Optics Supported in the 8-Port 1GE SFP and 1-Port 10GE SFP+ Module

Optic Product Number	Supported as of Cisco IOS XE Release	Description
GLC-FE-100FX-RGD	3.13.0S	100BASE-FX SFP module for Industrial Ethernet 100-MB ports, 1310 nm wavelength, 2 km over MMF
GLC-FE-100LX-RGD	3.13.0S	100BASE-LX SFP module for Industrial Ethernet 100-MB ports, 1310 nm wavelength, 10 km over SMF
GLC-FE-100LX	3.13.0S	100BASE-LX SFP for Fast Ethernet SFP Ports, 1310 nm wavelength, 10 km over SMF
GLC-FE-100FX	3.13.0S	100BASE-FX SFP for Fast Ethernet SFP Ports, 1310 nm wavelength, 2 km over MMF
GLC-FE-100ZX	3.13.0S	100BASE-ZX SFP for Fast Ethernet SFP Ports, 1550 nm wavelength, 80 km over SMF
GLC-FE-100EX	3.13.0S	100BASE-EX SFP for Fast Ethernet SFP Ports, 1310 nm wavelength, 40 km over SMF
GLC-FE-100BX-U	3.13.0S	100BASE-BX10-U SFP for Fast Ethernet SFP Ports. Single-strand SMF up to 10 km, transmits on a 1310-nm channel and receives on a 1550-nm signal
GLC-FE-100BX-D	3.13.0S	100BASE-BX10-D SFP for Fast Ethernet SFP Ports. Single-strand SMF up to 10 Km, transmits on a 1550-nm channel and receives on a 1310-nm signal
GLC-EX-SMD	3.13.0S	1000BASE-EX SFP transceiver module for SMF, 1310-nm wavelength, extended operating temperature range and Digital Optical Monitoring (DOM) support, dual LC/PC connector
GLC-BX-D	3.13.0S	1000BASE-BX10 SFP module for single-strand SMF, 1490-nm TX/1310-nm RX wavelength, single LC/PC connector
GLC-BX-U	3.13.0S	1000BASE-BX10 SFP module for single-strand SMF, 1310-nm TX/1490-nm RX wavelength, single LC/PC connector
GLC-ZX-SM-RGD	3.13.0S	1000BASE-ZX SFP transceiver module for SMF, 1550-nm wavelength, industrial Ethernet, dual LC/PC connector
GLC-SX-MM-RGD	3.13.0S	1000BASE-SX SFP transceiver module for MMF, 850-nm wavelength, industrial Ethernet, dual LC/PC connector
GLC-LX-SM-RGD	3.13.0S	1000BASE-LX/LH SFP transceiver module for MMF and SMF, 1300-nm wavelength, industrial Ethernet, dual LC/PC connector
SFP-GE-T	3.13.0S	1000BASE-T SFP transceiver module for Category 5 copper wire, extended operating temperature range, RJ-45 connector
SFP-GE-L	3.13.0S	1000BASE-LX/LH SFP transceiver module for MMF and SMF, 1310-nm wavelength
SFP-GE-S	3.13.0S	1000BASE-SX SFP transceiver module for MMF, 850-nm wavelength
SFP-GE-Z	3.13.0S	1000BASE-ZX SFP transceiver module for SMF, 1550-nm wavelength
DWDM-SFP-xxxx (36 wavelengths)	3.13.0S	Cisco 1000BASE-DWDM Gigabit Ethernet SFP, with 36 different wavelengths ranging from 1561.42 nm to 1530.33nm or ITU channel 20 to 59
CWDM-SFP-xxxx (8 wavelengths)	3.13.0S	Cisco CWDM Gigabit Ethernet SFP, with 8 different wavelengths ranging from 1470 nm to 1610 nm
GLC-ZX-SMD	3.13.0S	1000BASE-ZX SFP transceiver module for SMF, 1550-nm wavelength, dual LC/PC connector
GLC-SX-MMD	3.13.0S	1000BASE-SX SFP transceiver module for MMF, 850-nm wavelength, extended operating temperature range and DOM support, dual LC/PC connector
GLC-LH-SMD	3.13.0S	1000BASE-LX/LH SFP transceiver module for MMF and SMF, 1300-nm wavelength, extended operating temperature range and DOM support, dual LC/PC connector
SFP-10G-SR	3.13.0S	Cisco 10GBASE-SR Ethernet SFP+ transceiver module for MMF, 850 nm
SFP-10G-LR	3.13.0S	Cisco 10GBASE-LR Ethernet SFP+ transceiver module for SMF, 1310 nm

Optic Product Number	Supported as of Cisco IOS XE Release	Description
SFP-10G-ER	3.13.0S	Cisco 10GBASE-ER Ethernet SFP+ transceiver module for SMF and MMF, 1550 nm
SFP-10G-ZR	3.13.0S	Cisco multirate 10GBASE-ZR, 10GBASE-ZW and OTU2/OTU2e SFP+ transceiver module for SMF and MMF, 1550 nm
DWDM-SFP10G-xx.xx=	3.13.0S	Cisco multirate (LAN/WAN/OTU2/OTU2E) 10GBASE-DWDM single wavelength SFP+ module (100-GHz ITU grid) - 40 individual wavelength pluggable modules

Cisco ASR 900 Series 8-Port 1GE RJ45 Module

The Cisco ASR 900 Series 8-Port 1GE RJ45 Module delivers eight ports of Gigabit Ethernet, Fast Ethernet, and Ethernet connectivity on the Cisco ASR 900 Series routers. The interface speed can be software selected per interface. This interface module provides physical connectivity using eight RJ-45 connectors.

The module is supported in any slot of the Cisco ASR 902 Router or Cisco ASR 903 Router in combination with the Cisco ASR 900 RSP2A-128 or Cisco ASR 903 RSP1 Module. The module is supported in slot 0, slot 2, and slot 3 of the Cisco ASR 902 Router and slot 3, slot 4, and slot 5 of the Cisco ASR 903 Router in combination with the Cisco ASR 900 RSP2A-64 module.

When the module is inserted in slot 5 of the Cisco ASR 903 Router or in slot 3 of the Cisco ASR 902 Router, in combination with the Cisco ASR 903 RSP1, port 0 of the interface module will not be usable.

Cisco ASR 900 Series 8-Port 1GE RJ45 and 1-Port 10GE SFP+ Module

The Cisco ASR 900 Series 8-Port 1GE RJ45 and 1-port 10GE SFP+ Module delivers eight ports of Gigabit and Fast Ethernet and one port of 10 Gigabit Ethernet connectivity on the Cisco ASR 900 Series Routers. The interface speed of the copper interfaces can be software selected per interface. This interface module provides physical connectivity using eight RJ-45 connectors and one SFP+ transceiver slot.

The module is supported in slots 0 to 5 of the router. When inserted in slot 5 in the Cisco ASR 903 Router, or in slot 3 in the Cisco ASR 902 Router, in combination with the Cisco ASR 903 RSP1, port 0 of the interface module will not be usable.

The module is supported in any slot of the Cisco ASR 902 Router or Cisco ASR 903 Router in combination with the Cisco ASR 900 RSP2A-128 nodule, and in slot 0 and slot 2 of the Cisco ASR 902 Router in combination with the Cisco ASR 900 RSP2A-64 module.

The module is not supported in combination with the Cisco ASR 903 RSP1 module in any chassis. It is also not supported in the Cisco ASR 903 Router chassis in combination with the Cisco ASR 900 RSP2A-64 module.

Table 5 lists the pluggable optics that are supported in the Cisco ASR 900 Series 8-Port 1GE RJ45 and 1-Port 10GE SFP+ Module, on the Cisco IOS XE Software releases for the Cisco ASR 900 routers.

Table 5. Ethernet Optics Supported in the 8-Port 1GE RJ45 and 1-Port 10GE SFP+ Module

Optic Product Number	Supported as of Cisco IOS XE Release	Description
SFP-10G-SR	3.13.0S	Cisco 10GBASE-SR Ethernet SFP+ transceiver module for multimode fiber (MMF), 850 nm
SFP-10G-LR	3.13.0S	Cisco 10GBASE-LR Ethernet SFP+ transceiver module for single-mode fiber (SMF), 1310 nm
SFP-10G-ER	3.13.0S	Cisco 10GBASE-ER Ethernet SFP+ transceiver module for SMF and MMF, 1550 nm

Optic Product Number	Supported as of Cisco IOS XE Release	Description
SFP-10G-ZR	3.13.0S	Cisco multirate 10GBASE-ZR, 10GBASE-ZW and OTU2/OTU2e SFP+ transceiver module for SMF and MMF, 1550 nm
DWDM-SFP10G-xx.xx=	3.13.0S	Cisco multirate (LAN/WAN/OTU2/OTU2E) 10GBASE-DWDM single wavelength SFP+ module (100-GHz ITU grid) - 40 individual wavelength pluggable modules

Multiservice Interface Modules

The Cisco ASR 900 Series Router multiservice interface modules are designed to help customers connect to legacy networks and transition to packet networks. The multiservice interface modules support connections to Point-to-Point Protocol (PPP), Multilink PPP, ATM, Inverse Multiplexing over ATM (IMA), and High-Level Data Link Control (HDLC) links. In addition to these protocols, the interface modules can be used to transport time-division multiplexing (TDM) and ATM interfaces over an IP/Multiprotocol Label Switching (MPLS) packet network using Pseudowire Emulation (PWE) services, such as Circuit Emulation Services over Packet Switched Network (CESoPSN) and Structure-Agnostic Transport over Packet (SAToP) transport. Software support for the interface module hardware capabilities will be delivered over time in the several Cisco IOS XE software releases scheduled for the Cisco ASR 900 Series routers. Software support is described in the Cisco IOS XE Software for Cisco ASR 900 Series Aggregation Services Routers data sheet, which will contain updates for new capabilities when they are supported.

All Cisco ASR 900 Series Router multiservice interface modules support OIR, which contributes to a higher uptime for the Cisco ASR 900 Series Routers.

Cisco ASR 900 Series 14-Port Serial Module

The Cisco ASR 900 Series 14-Port Serial Module delivers 14 ports of asynchronous RS-232 to facilitate connectivity to devices that require RS-232 connectivity. Coupled with the Raw Socket feature and functionality, this interface module is a key enabler to provide transport of traditional async serial-based protocols, such as SCADA across IP/MPLS networks. These scenarios help ease the migration from traditional serial-based devices to next-generation IP-enabled devices by adding to the flexible set of connectivity options on the Cisco ASR 903 Router.

The module is supported in all interface module slots on the Cisco ASR 900 Series routers. The protocols supported on the module are software configurable per interface, which allows for flexible deployment and efficient use of the hardware.

The interface module uses six standard Cisco 12-in-1 connectors along with two high-density 68-pin connectors to provide the 14 ports of asynchronous RS-232. Supported cables for both the 12-in-1 connectors and the 68-pin connectors are listed in Table 6.

Table 6.   Asynchronous RS-232 Cables Supported in the 14-Port Serial Interface Module

Cable Product ID	Supported As of Cisco IOS XE Release	Description
CAB-HD4-232MT	3.10.0S	4-port EIA-232 DTE cable, 68-pin port, 10 ft. length, male DB-25 connector
CAB-HD4-232FC	3.10.0S	4-port EIA-232 DCE cable, 68-pin port, 10 ft. length, female DB-25 connector
CAB-QUAD-ASYNC-F	3.10.0S	4-port EIA-232 DTE cable, 68-pin port, 10 ft. length, female RJ-45 connector
CAB-QUAD-ASYNC-M	3.10.0S	4-port EIA-232 DTE cable, 68-pin port, 10 ft. length, male RJ-45 connector
CAB-9AS-M	3.10.0S	4-port EIA-232 DTE cable, 68-pin port, 10 ft. length, male DB-9 connector

Cable Product ID	Supported As of Cisco IOS XE Release	Description
CAB-SS-232MT	3.10.0S	4-port EIA-232 DTE cable, 12-in-1 port, 10 ft. length, male DB-25 connector
CAB-SS-232FC	3.10.0S	4-port EIA-232 DCE cable, 12-in-1 port, 10 ft. length, female DB-25 connector

Cisco ASR 900 Series 16-Port T1/E1 Module

The Cisco ASR 900 Series 16-Port T1/E1 Module delivers 16 ports of T1 or E1 connectivity on the Cisco ASR 900 Series routers. The interface module can be software configured as either T1 mode or E1 mode per interface module in a Cisco ASR 900 Series platform. This interface module provides physical connectivity using a single high-density connector and requires a breakout cable and third-party patch panel for individual port connections.

The module is software configurable for 16 T1 or 16 E1 ports; mixing of T1 and E1 ports on the same interface module is not supported. The module is supported in all slots on the Cisco ASR 900 Series routers and can be clocked from a line or from an internal clock source. The protocols supported on the module are software configurable per interface, which allows for flexible deployment and efficient use of the hardware.

Cisco ASR 900 Series 4-Port OC-3/STM-1 or 1-Port OC-12/STM-4 Module

The Cisco ASR 900 Series 4-Port OC-3/STM-1 or 1-Port OC-12/STM-4 Module delivers four active ports of OC-3 or Synchronous Transport Module level 1 (STM-1) connectivity or one active port of OC-12 or STM-4 connectivity on the Cisco ASR 900 Series routers. The interface module supports:

- Channelized OC-3 to clear channel T1, clear channel DS3 and channelized T1/E1
- Channelized OC-12 to clear channel T1/E1
- Clear channel OC-3
- Channelized STM-1 to clear channel T1/E1 and channelized T1/E1
- Channelized STM-4 to clear channel T1/E1

The module is supported in all interface module slots on the Cisco ASR 900 Series routers and can be clocked from a line or from an internal clock source.

By using per-port software licenses, this module delivers a true multiservice and multirate capability in a small form factor in combination with a pay-as-you-grow pricing model. The interface module can be software configured as either Synchronous Optical Networking (SONET) mode or Synchronous Digital Hierarchy (SDH) mode per module in the ASR 900 Series configuration.

The interface module hardware has been designed for high availability; this includes Access Circuit Redundancy (ACR), 1+1 Automatic Protection Switching (APS) across two modules, and SDH Linear Multiplexer Section Protection (MSP) protocols. Support of these capabilities is software dependent and described in the Cisco IOS XE Software for Cisco ASR 900 Series Routers data sheet.

This interface module provides physical connectivity using pluggable SFP optics.

Table 7 lists the pluggable optics that are supported in the Cisco ASR 900 Series 4-Port OC-3/STM-1 or 1-Port OC-12/STM-4 Module on the Cisco IOS XE Software releases for the Cisco ASR 900 Series Routers.

Table 7. Optics Supported in the 4-Port OC-3/STM-1 or 1-Port OC-12/STM-4 Module

Optic Product ID	Supported As of Cisco IOS XE Release	Description
ONS-SI-155-SR-MM	3.6.0S	OC-3/STM-1, short reach (SR), 1310 nm, multimode (MM), SFP, industrial temperature range
ONS-SI-155-I1	3.6.0S	OC-3/STM-1 intermediate reach (IR), 1310 nm, SFP, industrial temperature range
ONS-SI-155-L1	3.6.0S	OC-3/STM-1 long reach (LR), 1310 nm, SFP, industrial temperature range
ONS-SI-155-L2	3.6.0S	OC-3/STM-1 LR, 1550 nm, SFP, industrial temperature range
ONS-SC-155-EL	3.10.2S	STM-1 Electrical SFP, Commercial temperature range
ONS-SI-622-SR-MM	3.9.0S	OC-12/STM-4, SR, 1310 nm, MM, SFP, industrial temperature range
ONS-SI-622-I1	3.9.0S	OC-12/STM-4 IR, 1310 nm, SFP, industrial temperature range
ONS-SI-622-L1	3.9.0S	OC-12/STM-4 LR, 1310 nm, SFP, industrial temperature range
ONS-SI-622-L2	3.9.0S	OC-12/STM-4 LR, 1550 nm, SFP, industrial temperature range

Ordering Information

Table 8 lists the part numbers for the Cisco ASR 900 Series interface modules.

Table 8. Cisco ASR 900 Series Interface Modules

Part Number	Description
A900-IMA8T	ASR 900 8-Port 10/100/1000 Ethernet Interface Module
A900-IMA8T=	ASR 900 8-Port 10/100/1000 Ethernet Interface Module, Spare
A900-IMA8T1Z	ASR 900 Combo 8 port 10/100/1000 and 1 port 10GE Interface Module
A900-IMA8T1Z=	ASR 900 Combo 8 port 10/100/1000 and 1 port 10GE Interface Module, Spare
A900-IMA8S	ASR 900 8-Port SFP Gigabit Ethernet Interface Module
A900-IMA8S=	ASR 900 8-Port SFP Gigabit Ethernet Interface Module, Spare
A900-IMA8S1Z	ASR 900 Combo 8 port SFP GE and 1 port 10GE IM
A900-IMA8S1Z=	ASR 900 Combo 8 port SFP GE and 1 port 10GE IM, spare
A900-IMA1X	ASR 900 1-port 10GE XFP Interface Module
A900-IMA1X=	ASR 900 1-port 10GE XFP Interface Module, spare
A900-IMA2Z	ASR 900 2 port 10GE SFP+/XFP Interface Module
A900-IMA2Z=	ASR 900 2 port 10GE SFP+/XFP Interface Module, spare
A900-IMASER14A/S	ASR 900 14 port Serial Interface Module (Sync/Async)
A900-IMASER14A/S=	ASR 900 14 port Serial Interface Module (Sync/Async), Spare
A900-IMA16D	ASR 900 16-Port T1/E1 Interface Module
A900-IMA16D=	ASR 900 16-Port T1/E1 Interface Module, Spare
A900-IMA4OS	ASR 900 4-Port OC-3/STM1 or 1-Port OC-12/STM4 Interface Module
A900-IMA4OS=	ASR 900 4-Port OC-3/STM1 or 1-Port OC-12/STM4 Interface Module, Spare

Software and Licensing

Cisco IOS Licenses

Cisco ASR 900 Series Routers are supported in Cisco IOS XE Software, which is designed to provide modular packaging, feature velocity, and powerful resiliency.

With the Cisco ASR 903 Router supported as of Cisco IOS XE Software Release 3.5.0S, and the Cisco ASR 902 Router supported as of Cisco IOS XE Software Release 3.12.0S, the concept of Cisco software activation is also introduced to the Cisco ASR 900 Series routers. Feature and software licenses details are provided in the Cisco IOS XE Software for Cisco ASR 900 Series Routers data sheet.

Feature Licenses

In addition to Cisco IOS licenses, two licenses are used for specific ATM and TDM services and OC-3 and STM-1 ports. These two additional feature licenses for the Cisco ASR 900 Series Router are:

- **ATM license:** Allows service providers to enable ATM functionality on TDM interfaces when required. One license is required for each Cisco ASR 900 Series router that needs ATM functionality. This includes support for ATM pseudowires over MPLS (ATMoMPLS), ATM local switching, ATM interworking, and local ATM termination. This license requires the system to have at least one T1/E1, OC-3/STM-1, or OC-12/STM-4 card installed.
- **OC-3 port license:** Allows service providers to enable one OC-3/STM-1 port, supporting a pay-as-you-grow strategy and simplified spare part management. One license is required for each OC-3/STM-1 port that needs to be enabled on the Cisco ASR 900 Series Router (requires the purchase of a combined OC-3, STM-1, OC-12, and STM-4 combination interface module).
- **OC-12 port license:** Allows service providers to enable one OC-12/STM-4 port, supporting a pay-as-you-grow strategy and simplified spare part management. One license is required for each OC-12/STM-4 port that needs to be enabled on the Cisco ASR 900 Series Router (requires the purchase of a combined OC-3, STM-1, OC-12, and STM-4 combination interface module).

Table 9 lists the Cisco ASR 900 Series router feature licenses and product activation keys (PAKs).

Table 9.   Cisco ASR 900 Series Router Feature Licenses

Part Number	Supported As of Cisco IOS XE Release	Description
Port and Feature Licenses		
FLSASR902-ATM	3.12.0S	ASR 902 ATM License
FLSASR903-ATM	3.5.0S	ASR 903 ATM License
FLSASR900-1OC3	3.6.0S	ASR 900 1 Port OC-3/STM-1 License
FLSASR900-1OC12	3.9.0S	ASR 900 1 Port OC-12/STM-4 License
Port and Feature Licenses Product Activation Keys		
FLSASR902-ATM=	3.12.0S	ASR 902 ATM License Paper PAK
L-FLSASR902-ATM=	3.12.0S	ASR 902 ATM License E-Delivery PAK
FLSASR903-ATM=	3.5.0S	ASR 903 ATM License Paper PAK
L-FLSASR903-ATM=	3.5.0S	ASR 903 ATM License E-Delivery PAK
FLSASR900-1OC3=	3.6.0S	ASR 900 1 Port OC-3/STM-1 License Paper PAK
L-FLSASR900-1OC3=	3.6.0S	ASR 900 1 Port OC-3/STM-1 License E-Delivery PAK

Part Number	Supported As of Cisco IOS XE Release	Description
FLSASR900-1OC12=	3.9.0S	ASR 900 1 Port OC-12/STM-4 License Paper PAK
L-FLSASR900-1OC12=	3.9.0S	ASR 900 1 Port OC-12/STM-4 License E-Delivery PAK

Product Specifications

Table 10 lists the general specifications and Table 11 lists the safety and compliance specifications of the Cisco ASR 900 Series interface modules.

Table 10.   Cisco ASR 900 Series Interface Module Specifications

Features	Description
Product compatibility	• All Cisco ASR 900 Series interface modules of any capacity are compatible with the Cisco ASR 900 RSP2A-128 route switch processor in an ASR 903 or an ASR 902 router chassis. • The Cisco ASR 900 RSP2A-64 module in combination with the Cisco ASR 903 router supports the 1-port 10GE, the 2-port 10GE and the OC-3/STM-1 interface modules in slot 0, slot 1, and slot 2. The other modules of less than STM-1/OC-3 combined interface capacity are supported in slot 3, slot 4, and slot 5. The interface modules with the combined eight Gigabit Ethernet ports and one 10 Gigabit Ethernet port are not supported on the ASR 903 router in combination with the Cisco ASR 900 RSP2A-64 module. • The Cisco ASR 900 RSP2A-64 module in combination with the Cisco ASR 902 router supports the 1-port 10GE, the 2-port 10GE and the OC-3/STM-1 interface modules in slot 0, slot 1, and slot 2. The 8-port Gigabit Ethernet module, as well as the legacy TDM interface modules of less than STM-1/OC-3 combined interface capacity, are supported in slot 0, slot 2, and slot 3. The interface modules with the combined eight Gigabit Ethernet ports and one 10 Gigabit Ethernet port are supported on the ASR 902 router in slot 0 and slot 2. • All ASR 900 Series interface modules of 10G or lower combined interface capacity are compatible with the Cisco ASR 903 RSP1A and RSP1B route switch processors in an ASR 903 or an ASR 902 router chassis. • With the Cisco ASR 903 RSP1A and RSP1B route switch processors, all ASR 900 Series interface modules of less than 9G combined interface capacity can be inserted into any slot of an ASR 903 router chassis and in any slot of an ASR 902 router chassis. The 1-port 10GE XFP Module can be inserted in slots 0 through 3 of an ASR 902 chassis or ASR 903 chassis with the Cisco ASR 903 RSP1A or RSP1B route switch processors. • When inserted in slot 5 of an ASR 903 chassis or in slot 2 of an ASR 902 chassis, with RSP1A or RSP1B, the 8-port 1GE SFP module cannot use port 0/5/0. • A maximum of two 14-port asynchronous serial interface modules are supported per ASR 903 chassis.
Port density	• 8-port Gigabit Ethernet, SFP, and RJ-45 version • 8-port Gigabit Ethernet and 1-port 10 Gigabit Ethernet SFP+, in a Gigabit Ethernet SFP and RJ-45 version 1-port 10 Gigabit Ethernet, XFP • 2-port 10 Gigabit Ethernet, SFP+/XFP • 14-port Asynchronous Serial RS-232 • 16-port T1/E1 TDM • 4-port OC-3/STM-1 TDM or 1-Port OC-12/STM-4
Power draw	• 8-port Gigabit Ethernet SFP: 17W max • 8-port Gigabit Ethernet SFP and 1-port 10 Gigabit Ethernet SFP+: 25W max • 8-port Gigabit Ethernet RJ-45: 17W max • 8-port Gigabit Ethernet RJ-45 and 1-port 10 Gigabit Ethernet SFP+: 25W max • 1-port 10 Gigabit Ethernet XFP: 13W max • 2-port 10 Gigabit Ethernet SFP+/XFP: 25W max • 14-port Asynchronous Serial RS-232: 31W max • 16-port T1/E1 TDM: 14W max • 4-port OC-3/STM-1 TDM: 30W max
Environmental specifications[1]	-40ºC to 65ºC (-40ºF to 149ºF) operating temperature (DC operation) -5ºC to 55ºC (23ºF to 131ºF) operating temperature (AC operation)[2] 0ºC to 40ºC (32ºF to 104ºF) operating temperature (AC operation) -60 m to 1800 m (-196 ft to 5905 ft) operating altitude (for full operating temperature range) Up to 4000 m (13,123 ft) operating altitude (at up to +40ºC/104ºF temperature)
Relative humidity	5% to 95%, noncondensing
Storage environment	Temperature: -40 to +70ºC (-40ºF to 158ºF) altitude: 4570 m (15,000 ft)
MTBF at 40ºC (104ºF) operating temperature	700.000 hours

Features	Description
Reliability and availability	OIR field-replaceable SFP optics modules
	Support for both 1+1 SONET Automatic Protection Switching (APS) and SDH Linear Multiplexer Section Protection (MSP) protocols
	Single Interface Module software reset
	Rolling software upgrade, interface module by interface module
SONET/SDH multiplexing granularity	Up to 336 T1 or 252 E1 per OC-12/STM-4 interface module
	Up to 84 T1 or 63 E1 ports per OC-3/STM-1 port and up to 336 T1 or 252 E1 per OC-3/STM-1 interface module
	Up to 1024 nxDS-0 channels (where n is 1 to 31) per STM-1 interface module
	Channelized OC-3 to T1
	Channelized STM-1 to E1, full-rate T1, channelized T1/E1 and fractional T1/E1 for Circuit Emulation Pseudo Wires
	• Support for SONET Virtual Tributary 1.5 (VT1.5) mapping: OC-3 <-> STS-3 <-> STS-1 <-> VTG <-> VT1.5 <-> T1
	• Support for ITU-T G.707 (SDH CEPT/ETSI) Virtual Container 12 (VC-12) mapping: STM-1 <-> AUG <-> AU-4 <-> VC-4 <-> TUG-3 <-> TUG-2 <-> TU-12 <-> VC-12 <-> E1
	• Support for ITU-T G.707 (SDH-ANSI) Virtual Container 11 (VC-11) mapping: STM-1 <-> AUG <-> AU-3 <-> VC-3 <-> TUG-2 <-> TU-11 <-> VC-11 <-> T1

[1] Optics/Transceivers used may limit the temperature range.

[2] Not more than the following in a 1-year period: 96 consecutive hours, or 360 hours total, or 15 occurrences.

[3] The above are for normal (non-failure) operation. When operating with a fan failure, the above may be exceeded.

Table 11. Safety and Compliance

Type	Standards
Safety	• UL 60950-1, 2nd edition
	• CAN/CSA C22.2 No. 60950-1-07 2nd edition
	• IEC 60950-1, 2nd edition
	• EN 60950-1, 2nd edition
	• AS/NZS 60950.1:2003
Electromagnetic	• FCC CFR47 Part 15, Class A
Emissions compliance	• EN55022, class A
	• CISPR22, class A
	• ICES-003, class A
	• EN 300 386, class A
	• VCCI, class A
	• KN22, class A
	• EN61000-3-2 to EN61000-3-3
Immunity compliance	• EN 300 386
	• EN 61000-6-1
	• EN 50082-1
	• CISPR24
	• EN 55024
	• KN 24
	• EN 50121-4
	• EN/KN 61000-4-2 to EN/KN 61000-4-6
	• EN/KN 61000-4-8
	• EN/KN 61000-4-11
Network equipment building systems (NEBS)[1]	• GR-63-CORE Issue 3
	• GR-1089-CORE Issue 5
	• SR-3580 NEBS Level 3
Power substation system standards	• IEC 61850-3 (2002)
	• IEEE 1613 (2009)
ETSI	• ETS/EN 300 119 Part 4
	• ETS/EN 300 019 - Storage: Class 1.2, Transportation: Class 2.3, In-Use/Operational: Class 3.2
	• ETS/EN 300 753

Type	Standards	
Telecom	T1: • ITU-T G.703 • ITU-T G.824 • TIA-968-B • IC CS-03 • HKTA 2028 • ID0002 • DSPR Technical Conditions • ANSI T1.403 E1: • ITU-T G.703/G.704 • ITU-T G.823 • AS/ACIF S016 • ETSI TBR12/13 • RRA 2009-38 (RRL 2005-96) • IDA TS DLCN	SONET/SDH subrate: • GR-253-CORE • ANSI T1.105 • ITU G.957 • ITU G.783 • ITU G.707 Ethernet: • DSPR Technical Conditions • RRA 2009-38 (RRL 2005-96) • IEEE 802.3-2005 • IEEE 802.3z • IEEE 802.3ab • IEEE 802.3ae
Network synchronization	• GR-1244-CORE • GR-253-CORE • ANSI T1.101 • ITU-T G.813 • ITU-T G.703 clause 5 • ITU-T G.703 clause 9 • ITU-T G.823 • ITU-T G.824 • ITU-T G.8261/Y.1361 • ITU-T G.781 • ITU-T G.8262 • ITU-T G.8264 • IEEE1588-2008	

[1] Notable exceptions: All cabling is provided through the front panel.

Warranty Information

Find warranty information on Cisco.com at the <u>Product Warranties</u> page.

Service and Support

Cisco offers a wide range of services programs to accelerate customer success. These innovative services programs are delivered through a unique combination of people, processes, tools, and partners, resulting in high levels of customer satisfaction. Cisco Services help you protect your network investment, optimize network operations, and prepare your network for new applications to extend network intelligence and the power of your business. For more information about Cisco Services, refer to Cisco Technical Support Services or Cisco Advanced Services.

Cisco is committed to minimizing your total cost of ownership. Cisco offers a portfolio of technical support services to help ensure that Cisco products operate efficiently, remain highly available, and benefit from the most up-to-date system software. The services and support programs described in Table 12 are available as part of the Cisco Carrier Ethernet Switching Service and Support solution and are available directly from Cisco and through resellers.

Table 12.   Service and Support

Advanced Services	Features	Benefits
Cisco Total Implementation Solutions (TIS), available directly from Cisco **Cisco Packaged TIS, available through resellers**	• Project management • Site survey, configuration, and deployment • Installation, text, and cutover • Training • Major moves, adds, and changes • Design review and product staging	• Supplement existing staff • Help ensure functions meet needs • Mitigate risk
Cisco SP Base Support and Service Provider-Based Onsite Support, available directly from Cisco **Cisco Packaged Service Provider-Based Support, available through resellers**	• 24-hour access to software updates • Web access to technical repositories • Telephone support through the Cisco Technical Assistance Center (TAC) • Advance replacement of hardware parts	• Facilitate proactive or expedited problem resolution • Lower total cost of ownership by taking advantage of Cisco expertise and knowledge • Reduce network downtime

Cisco IOS XE Software for Cisco ASR 900 Series Aggregation Services Routers

Cisco IOS® Software is always evolving to provide you with more features of higher quality. Cisco IOS XE Software releases provide a modular structure for Cisco® ASR 900 Series Aggregation Services Routers. Why is modularity important? The software significantly enhances quality and performance by taking advantage of the separation of the data plane and the control plane.

Cisco IOS XE Software on the Cisco ASR 903 Router (Figure 1) and Cisco ASR 902 Router includes licenses for Metro Services, Metro IP Services, and Metro Aggregation Services. Feature sets can be activated as you need them so you pay only for what you use.

Figure 1. Cisco ASR 903 Router

Software Releases and Options

The Cisco ASR 900 Series is supported in Cisco IOS XE S Software as of Cisco IOS XE Software Release 3.5.0S. The release is designed to provide modular packaging, feature velocity, and powerful resiliency. The Cisco ASR 902 Router is supported as of Cisco IOS XE Software Release 3.12.0S.

Consolidated Software Packages

Two consolidated software packages contain a superset of all features. The individual feature sets can be activated once the correct feature licenses are applied to the router. Table 1 describes the two Cisco IOS XE universal consolidated packages supported on the Cisco ASR 903 Router and the functionality supported in each of these universal images. The functionality is enforced through the appropriate technology package licenses.

Table 1. Universal Cisco IOS XE Software Consolidated Packages for Cisco ASR 900 Series Router

Cisco IOS XE Consolidated Package	Part Number	Description
Cisco ASR 903 Series RSP1 IOS XE - No Payload Encryption	SASR903R1NPEK9	• Provides a consolidated package • Offers only basic feature support without a license, including SSH and SNMPv3 support
Cisco ASR 900 Series RSP2 IOS XE - No Payload Encryption	SASR900R2NPEK9	• Provides a consolidated package • Offers only basic feature support without a license, including SSH and SNMPv3 support

Flexible Software Activation

The Cisco ASR 900 Series supports the Cisco IOS software activation feature. With this capability, Cisco IOS Software feature sets can be activated with software licenses, supporting a "pay as services grow" model. This model allows service providers to invest in software resources only when their businesses need it. All Cisco ASR 900 Series software licenses are on a per-chassis basis. Cisco ASR 900 Series routers offer three Cisco IOS Software licenses:

- **Metro Services license:** Offers advanced quality of service (QoS), Carrier Ethernet Layer 2 features, Synchronous Ethernet (SyncE) and Ethernet operations, administration, and maintenance (OAM) capabilities.

- **Metro IP Services license:** Offers all capabilities of the Metro Services license with the addition of IEEE 1588-2008 Ordinary Clock and Transparent Clock, Bidirectional Forwarding Detection (BFD), Layer 3 features for advanced IP routing protocols, multi-VPN routing, and Layer 3 Multicast and Forwarding Customer Edge (multi-VRF CE) capabilities.

- **Metro Aggregation Services license:** Adds the following capabilities to the Metro IP Services license: Multiprotocol Label Switching Transport Profile (MPLS-TP); MPLS, Ethernet over MPLS (EoMPLS), Circuit Emulation Service over Packet Switched Network (CESoPSN), and Structure Agnostic TDM over Packet (SAToP) pseudowires; Multi-Router Automatic Protection Switching (MR-APS); Multi-chassis Link Aggregation and Control Protocol (mLACP); MPLS traffic engineering (TE); MPLS Fast Reroute (FRR); and MPLS VPN support.

Table 2 lists the main features in the Cisco IOS licenses for the Cisco ASR 900 Series Router. Availability of features is dependent on software release and implementation schedule.

Table 2. Feature Sets in Cisco ASR 900 Series Router Licenses

Metro Services	Metro IP Services	Metro Aggregation Services
Baseline	**All features in Metro Services plus:**	**All features in Metro IP Services plus:**
QoS, with deep buffers and hierarchical QoS (HQOS)	IP routing (RIP, OSPF, EIGRP, BGP, IS-IS)	MPLS (LDP and VPN)
Layer 2: 802.1d, 802.1q	PIM (SM, DM, SSM), SSM mapping	MPLS TE and FRR
Ethernet Virtual Circuit (EVC)	BFD	MPLS OAM
Ethernet OAM (802.1ag, 802.3ah)	Multi-VRF CE (VRF lite) with service awareness (ARP, ping, SNMP, syslog, trace-route, FTP, TFTP)	MPLS-TP
Multiple Spanning Tree (MST) and Resilient Ethernet Protocol (REP)	IEEE 1588-2008 Ordinary Clock and Transparent Clock	Pseudowire emulation (EoMPLS, CESoPSN, and SAToP)
Synchronous Ethernet		VPLS and HVPLS
IPv4 and IPv6 host connectivity		Pseudowire redundancy
		MR-APS and mLACP

Additional Feature Licenses

In addition to the preceding Cisco IOS feature-set licenses, two additional licenses are used to activate new software functionality for the Cisco ASR 900 Series router in addition to the feature-set capabilities.

- **ATM license:** Allows service providers to activate ATM functionality on TDM interfaces when required. One license is required for each Cisco ASR 900 Series router that needs ATM functionality to be activated in the system. This includes support for ATM pseudowires over MPLS (ATMoMPLS), ATM local switching, ATM interworking, and local ATM termination. This license requires the system to have at least one T1/E1, OC-3/STM-1, or OC-12/STM-4 card installed.

- **IEEE 1588-2008 BC/MC license:** Allows service providers to activate IEEE 1588-2008 Boundary Clock (BC) or Master Clock (MC), or both, when required. One license is required for each chassis that needs IEEE 1588-2008 BC or MC functionality to be activated in the system.

Cisco IOS XE Software Release Schedule

The Cisco IOS XE software delivery schedule allows customers to qualify releases more quickly and have a definitive release schedule for new software images. This schedule is summarized in the following highlights.

- **Time-based releases:** Releases are planned for delivery three times a year (every four months). New software features and hardware are introduced in each release. Releases have fewer incremental features included when compared with traditional Cisco IOS Software releases, reducing customer qualification time.

- **Two release support durations:** Each Cisco IOS XE Software release is classified as either a Standard Support or Extended Support release. A Standard Support release has a total engineering support lifetime of one year, with two scheduled rebuilds. The Extended Support release provides a total engineering support lifetime of two years, with four scheduled rebuilds. For more information about the Cisco IOS XE Software end-of-life policy and associated support milestones for specific Cisco IOS XE Software releases, visit http://www.cisco.com.

- **Rebuilds scheduled at regular intervals:** Rebuilds are created only for bug fixes, and no new features are included in a rebuild image. For Standard Support releases, the first rebuild image is released two months after the parent image's first customer shipment (FCS). The second rebuild image is released four months after the parent image's FCS. The Extended Support release provides four scheduled rebuilds. The first two of these rebuilds are released at two-month intervals after FCS of the affected Cisco IOS XE Software release, and the second two rebuilds are released at four-month intervals thereafter. Releases to correct critical problems (such as those identified by the Cisco Product Security Incident Response Team) are introduced as needed.

Part Numbers for License Options and Activation Keys

Table 3 lists part numbers for the Cisco ASR 900 Series software feature options.

Table 3.　Cisco ASR 900 Series Software Options

Part Number	Product Name
Feature Set License Options	
SLASR902-M	Cisco ASR 902 Metro Services
SLASR902-I	Cisco ASR 902 Metro IP Services
SLASR902-A	Cisco ASR 902 Metro Aggregation Services
SLASR903-M	Cisco ASR 903 Metro Services

Part Number	Product Name
SLASR903-I	Cisco ASR 903 Metro IP Services
SLASR903-A	Cisco ASR 903 Metro Aggregation Services
Feature Set Product Activation Keys	
SLASR902-M=	Cisco ASR 902 Metro Services Paper PAK
L-SLASR902-M=	Cisco ASR 902 Metro Services E-Delivery PAK
SLASR902-I=	Cisco ASR 902 Metro IP Services Paper PAK
L-SLASR902-I=	Cisco ASR 902 Metro IP Services E-Delivery PAK
SLASR902-A=	Cisco ASR 902 Metro Aggregation Services Paper PAK
L-SLASR902-A=	Cisco ASR 902 Metro Aggregation Services E-Delivery PAK
SLASR903-M=	Cisco ASR 903 Metro Services Paper PAK
L-SLASR903-M=	Cisco ASR 903 Metro Services E-Delivery PAK
SLASR903-I=	Cisco ASR 903 Metro IP Services Paper PAK
L-SLASR903-I=	Cisco ASR 903 Metro IP Services E-Delivery PAK
SLASR903-A=	Cisco ASR 903 Metro Aggregation Services Paper PAK
L-SLASR903-A=	Cisco ASR 903 Metro Aggregation Services E-Delivery PAK
Feature Set Upgrade Product Activation Keys	
SLASR902-M-I=	Cisco ASR 902 Metro to Metro IP Paper PAK
SLASR902-M-A=	Cisco ASR 902 Metro to Metro Aggregation Paper PAK
SLASR902-I-A=	Cisco ASR 902 Metro IP to Metro Aggregation Paper PAK
L-SLASR902-M-I=	Cisco ASR 902 Metro to Metro IP E-Delivery PAK
L-SLASR902-M-A=	Cisco ASR 902 Metro to Metro Aggregation E-Delivery PAK
L-SLASR902-I-A=	Cisco ASR 902 Metro IP to Metro Aggregation E-Delivery PAK
SLASR903-M-I=	Cisco ASR 903 Metro to Metro IP Paper PAK
SLASR903-M-A=	Cisco ASR 903 Metro to Metro Aggregation Paper PAK
SLASR903-I-A=	Cisco ASR 903 Metro IP to Metro Aggregation Paper PAK
L-SLASR903-M-I=	Cisco ASR 903 Metro to Metro IP E-Delivery PAK
L-SLASR903-M-A=	Cisco ASR 903 Metro to Metro Aggregation E-Delivery PAK
L-SLASR903-I-A=	Cisco ASR 903 Metro IP to Metro Aggregation E-Delivery PAK
Feature Licenses	
FLSASR902-ATM	Cisco ASR 902 ATM License
FLSASR902-1588	Cisco ASR 902 IEEE 1588-2008 BC/MC License
FLSASR903-ATM	Cisco ASR 903 ATM License
FLSASR903-1588	Cisco ASR 903 IEEE 1588-2008 BC/MC License
Feature Licenses Product Activation Keys	
FLSASR902-ATM=	Cisco ASR 902 ATM License Paper PAK
L-FLSASR902-ATM=	Cisco ASR 902 ATM License E-Delivery PAK
FLSASR902-1588=	Cisco ASR 902 IEEE 1588-2008 BC/MC License Paper PAK
L-FLSASR902-1588=	Cisco ASR 902 IEEE 1588-2008 BC/MC License E-Delivery PAK
FLSASR903-ATM=	Cisco ASR 903 ATM License Paper PAK
L-FLSASR903-ATM=	Cisco ASR 903 ATM License E-Delivery PAK
FLSASR903-1588=	Cisco ASR 903 IEEE 1588-2008 BC/MC License Paper PAK
L-FLSASR903-1588=	Cisco ASR 903 IEEE 1588-2008 BC/MC License E-Delivery PAK

Major Features

Table 4 lists the features supported by Cisco IOS XE in the Cisco ASR 900 Series router. Availability of features is dependent on software release, RSP version, and implementation schedule. Check release notes for additional details.

Table 4.   Cisco ASR 900 Series Router Software Features

Features
Ethernet Services
- Ethernet Flow Point (EFP) with support for: 802.1q   - Selective QinQ   - Inner and Outer VLAN classification   - VLAN local significance   - One VLAN tag ingress push   - Pop one VLAN tag   - Pop two VLAN tags   - Trunk-EFP construct for configuration simplification   - IEEE 802.1s Multiple Spanning Tree (MST)   - Resilient Ethernet Protocol (REP)   - ITU G.8032   802.3ad/802.1ax Link Aggregation Control Protocol (LACP)   - Multi-chassis Link Aggregation Control Protocol (mLACP)   - Layer 2 Protocol Tunneling (L2PT)   - Virtual Private LAN Service (VPLS), Hierarchical VPLS (HVPLS), Virtual Private Wire Service (VPWS), Ethernet over MPLS (EoMPLS)   - Static Multicast MAC addresses   - IGMP snooping on Ethernet Flow Point   - Link Pass Through   - Pseudowire redundancy   - Hot Standby Pseudowire   - Multi-segment Pseudowire
TDM and ATM services
- Clear Channel and Channelized T1 and E1 ports on the 16 port T1/E1 interface module   - RAW socket transport on the 14-port Serial Interface Module   - Channelized OC-3/STM-1 mode on the 4 port OC-3/STM-1 Interface Module   - Packet over SONET (PoS) mode using PPP over SONET/SDH on the 4 port OC-3/STM-1 Interface Module - RFC 2615   - HDLC   - Point to Point Protocol (PPP) - RFC 1661   - Multilink PPP (ML-PPP), with maximum 16 T1 or E1 links per ML-PPP bundle - RFC 1990   - PPP Challenge Handshake Authentication Protocol (CHAP) - RFC 1994   - Pseudowire setup and maintenance using the Label Distribution Protocol (LDP) - RFC 4447   - Structure-Agnostic Time Division Multiplexing (TDM) over Packet (SAToP) - RFC 4553   - Encapsulation methods for transport of ATM over MPLS networks for AAL 0 and AAL 5 - RFC 4717   - Pseudowire Emulation Edge-to-Edge (PWE3) ATM Transparent Cell Transport Service - RFC 4816   - Circuit Emulation Service over Packet Switched Network (CESoPSN) - RFC 5086   - DS0 channels on the OC-3, STM-1 and T1/E1 Interfaces only for CESoPSN services   - Single Router Automated Protection switching (SR-APS) for CESoPSN, SATOP, HDLC, PPP and ML-PPP on STM-1 and OC-3 interfaces   - Multi Router Automated Protection switching (MR-APS) for CESoPSN, SATOP, HDLC, PPP and ML-PPP on STM-1 and OC-3 interfaces   - Access Circuit Redundancy (ACR) for ATM, CESoPSN and SATOP   - Pseudowire redundancy   - Hot Standby Pseudowire   - Multi-Segment Pseudowire   - IETF ATM PWE3 over MPLS   - ATM N:1 (N = 1) virtual channel connection (VCC) cell mode and ATM N:1 (N = 1) virtual path (VP) Cell Relay Mode

Features
● ATM cell packing
● ATM IMA v1.0, 1.1 on the 16 port T1/E1 and on the 4 port OC-3/STM-1 interface module
● ATM AAL0 (for AAL2 voice and data) and AAL5
● ATM Class of Service (CoS) features constant bit rate (CBR) and unspecified bit rate (UBR) and per virtual circuit queuing
● Egress Quality of Service (QoS) on ML-PPP, PPP, PoS and HDLC interfaces

Layer 3 and MPLS Services
● Hot Standby Router Protocol (HSRP)
● Virtual Router Redundancy Protocol (VRRP)
● Layer 3 routing on Routed interfaces and Bridge Domain Interfaces (BDI)
● Cisco Express Forwarding (CEF) load sharing of Equal Cost Paths (ECMP)
● Open Shortest Path First (OSPF)
● Border Gateway Protocol (BGP)
● BGP 4-byte Autonomous System number (ASN)
● BGP TCP Path MTU Discovery
● BGP Prefix-Independent Convergence (PIC) Edge and Core for IPv4 and MPLS VPN
● Intermediate System-to-Intermediate System (IS-IS)
● Bidirectional Forwarding Detection (BFD) for OSPF, IS-IS, BGP, and static routes
● BFD over Ethernet, Routed port, HDLC and PPP interfaces
● BFD for HSRP group client
● Multi Protocol Label Switching (MPLS)
● LDP with Label Edge Router (LER) and Label Switch Router (LSR)
● MPLS L3VPN
● MPLS Transport Profile (MPLS-TP) for Ethernet, TDM and ATM Pseudo Wires
● MPLS Traffic Engineering Fast Re-Route (TE-FRR)
● IP Loop Free Alternate Fast Re-Route (LFA FRR)
● Remote Loop Free Alternate Fast Re-Route (R-LFA FRR)
● Internet Group Management Protocol (IGMP) version 1 - RFC 1112
● IPv4 and IPv6 multicast
● Protocol Independent Multicast sparse mode (PIM-SM), PIM Source Specific Multicast (PIM SSM), PIM SSM mapping
● IGMPv2 - RFC 2236
● IGMPv3 - RFC 3376
● IGMP group limiting
● Multicast Listener Discovery (MLD)
● Multicast VPN (MVPN) based on IETF Rosen Draft

IPv6
● Hardware based IPv6 data forwarding
● Addressing and discovery
● Manual IPv6 interface addressing
● ICMPv6 (RFC 4443)
● IPv4 and IPv6 dual stack
● IPv6 static routing
● OSPF for IPv6 (RFC 5340)
● DHCPv6 with relay function
● BFD for OSPF, IS-IS, BGP and IPv6 static routes
● IPv6 Provider Edge (6PE)
● IPv6 VPN Provider Edge (6VPE)

QoS
● Modular QoS CLI (MQC)
● Hierarchical QoS (HQoS)
● Port shaper and Low Latency Queuing (LLQ) in the presence of an EFP
● IEEE 802.1p Class of Service (COS) based QoS
● Classification based on inner and outer CoS
● IP Precedence Type of Service (ToS) based QoS
● Differentiated Services Code Point (DSCP) based QoS

Features
● Egress marking of COS, ToS, DSCP and MPLS EXP QoS fields
● Classification using Access Control List (ACL)
● 2-rate 3-color (2R3C) ingress Policing
● Differentiated Services Code Point (DSCP) traffic shaping
● Class-Based Weighted Fair Queuing (CBWFQ)
● Priority Queuing with up to 2 priority queues
● Weighted Random Early Detect (WRED)
● Egress shaping per queue
● Egress policing per queue
● Resource Reservation Protocol (RSVP) Call Admission Protocol (CAC)

Timing
● IEEE 1588-2008 Ordinary Clock over Ethernet, IP and MPLS
● IEEE 1588-2008 end-to-end Transparent Clock over Ethernet, IP and MPLS
● IEEE 1588-2008 Boundary Clock over Ethernet, IP and MPLS
● IEEE 1588-2008 precision time protocol (PTP) telecom profile for frequency synchronization - ITU-T G.8265.1/Y.1365.1
● Hybrid clocking
● T1/E1 line timing
● OC-3/STM-1 Line Timing
● Global navigation satellite system (GNSS) ports; Time of Day (ToD), 10MHz, 1 Pulse Per Second (1PPS)
● Building Integrated Timing Supply (BITS)
● ITU-T SyncE with Ethernet Synchronization Messaging Channel (ESMC)
● Synchronization Status Messages (SSM)

OAM
● IEEE 802.1ag Connectivity Fault Management (CFM) over EFP
● IEEE 802.3ah Link OAM
● MPLS OAM
● ITU-T Y.1731 Fault Management (FM) over EFP
● ITU-T Y. 1731 Performance Management (PM) over EFP for Delay Measurement (DM) and Synthetic Loss Measurement (SLM)
● Ethernet Local Management Interface (E-LMI), as a provider edge (PE) device
● CFM extensions for microwave adaptive code modulation (ACM) actual air bandwidth exchange

Security
● Authentication, authorization, and accounting (AAA) with TACACS+ and RADIUS
● Secure Shell (SSH) Protocol v2
● MAC limiting per bridge domain (BD)
● Storm control for Port Mode
● Layer 3 Access Control Lists (ACL) for IPv4 and IPv6
● IPv4 unicast reverse path forwarding (uRPF) strict mode
● MAC security
● Dynamic Arp Inspection (DAI)
● DHCP Snooping with option 82 insertion
● DHCP Option 82 Configurable Circuit ID & Remote ID

Manageability
● Simple Network Management Protocol (SNMP)
● MIBs
● Dying Gasp message
● Embedded Event Manager (EEM)
● Cisco Discovery Protocol (CDP)
● 802.1ab Link Layer Discovery Protocol (LLDP)
● Port Level Local SPAN (SPAN)
● Port Level Remote SPAN (RSPAN)
● Cisco IOS Command Line Interface (CLI)
● Cisco Prime™ Network: fault, provisioning and performance management
● Cisco® Network Virtualization (nV) technology Satellite mode for Ethernet interfaces

Warranty Information

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Service and Support

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Table 5.   Service and Support

Advanced Services	Features	Benefits
Cisco Total Implementation Solutions (TIS), available directly from Cisco **Cisco Packaged TIS, available through resellers**	● Project management ● Site survey, configuration, and deployment ● Installation, text, and cutover ● Training ● Major moves, adds, and changes ● Design review and product staging	● Supplement existing staff ● Help ensure functions meet needs ● Mitigate risk
Cisco SP Base Support and Service Provider-Based Onsite Support, available directly from Cisco **Cisco Packaged Service Provider- Based Support, available through resellers**	● 24-hour access to software updates ● Web access to technical repositories ● Telephone support through the Cisco Technical Assistance Center (TAC) ● Advance Replacement of hardware parts	● Facilitate proactive or expedited problem resolution ● Lower total cost of ownership by taking advantage of Cisco expertise and knowledge ● Reduce network downtime

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Product Overview

The Cisco Metro Ethernet (ME) 3400E Ethernet Access switch—referred to as *the switch*—is an Ethernet access switch that you can connect to other network devices, such as routers, other switches, a home access gateway (HAG), or a computer.

- Setting Up the Switch, page 1-1
- Switch Models, page 1-1
- Front Panel, page 1-2
- Rear Panel, page 1-12
- Power Supply Features, page 1-13
- Fans, page 1-14
- Management Options, page 1-14

Setting Up the Switch

See the *Cisco ME 3400E Ethernet Access Switch Getting Started Guide* on the documentation CD for instructions on how to initially configure your switch. The getting started guide also covers switch management options, basic rack-mounting procedures, port and module connections, power connection procedures, and troubleshooting help.

For instructions on setting up your switch using the command-line interface (CLI), see Appendix C, "Configuring the Switch with the CLI-Based Setup Program."

Switch Models

You can deploy the switch as a backbone switch, aggregating 10BASE-T, 100BASE-TX, 1000BASE-T, and fiber-optic Ethernet traffic from other network devices.

See the switch software configuration guide for examples that show how you might deploy the switch in your network.

Table 1-1   Cisco ME 3400E Models and Descriptions

| Switch Model	Description
Cisco ME 3400E-24TS-M	24 10/100 FastEthernet downlink ports and 2 dual-purpose ports (2 10/100/1000BASE-T copper ports and 2 SFP[1] module slots); supports removable AC- and DC-power supplies.
Cisco ME 3400EG-12CS-M	12 dual-purpose ports and 4 SFP-module slots; supports removable AC- and DC-power supplies.
Cisco ME 3400EG-2CS-A	2 dual-purpose ports and 2 SFP-module slots, AC-power input.

1. SFP = small form-factor pluggable.

Front Panel

Figure 1-1 shows the Cisco ME 3400E-24TS-M front panel. The 10/100 Fast Ethernet downlink ports are grouped in pairs. The first member of the pair (port 1) is above the second member (port 2) on the left. Port 3 is above port 4, and so on. The dual-purpose ports are numbered 1 and 2. You can configure the dual-purpose ports as either copper-based 10/100/1000 ports or as fiber-optic SFP-module ports. See the "SFP Modules" section on page 1-5 for more information.

Figure 1-1   Cisco ME 3400E-24TS-M Front Panel
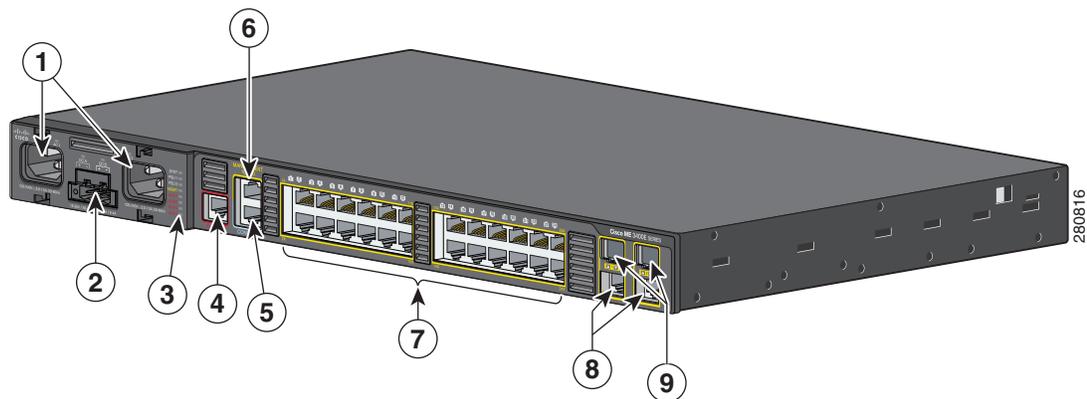
1	AC-power input connectors 1 and 2	**6**	Ethernet management port
2	DC-power input connectors (supports power feeds A and B)	**7**	10/100 Fast Ethernet downlink ports 1 to 24
3	LEDs	**8**	10/100/1000 ports
4	Alarm input port	**9**	SFP-module slots
5	Console port		

The Cisco ME 3400EG-12CS-M has 12 dual-purpose ports, numbered 1 to 12, and supports both AC and DC power. You can configure these as either copper-based 10/100/1000 ports or as fiber-optic SFP-module ports. The Gigabit Ethernet uplink SFP-module slots are numbered 13 to 16.

Figure 1-2   Cisco ME 3400EG-12CS-M Front Panel
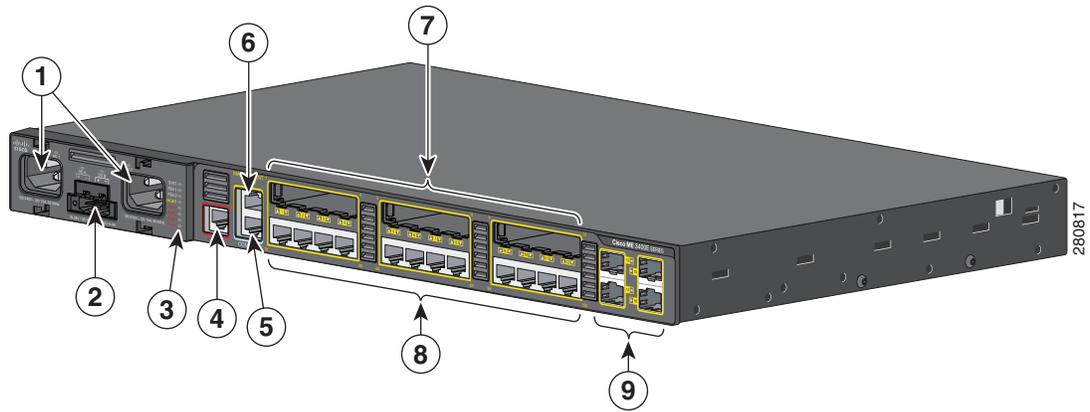
1	AC-power input connectors 1 and 2	6	Ethernet management port
2	DC-power input connectors A and B	7	SFP-module slots
3	LEDs	8	10/100/1000 ports
4	Alarm input port	9	Gigabit Ethernet SFP-module slots
5	Console port		

The Cisco ME 3400EG-2CS-A has two dual-purpose ports, numbered 1 and 2. See Figure 1-3. You can configure these ports as either copper-based 10/100/1000 ports or as fiber-optic SFP-module ports. The Gigabit Ethernet uplink SFP-module slots are numbered 3 and 4.
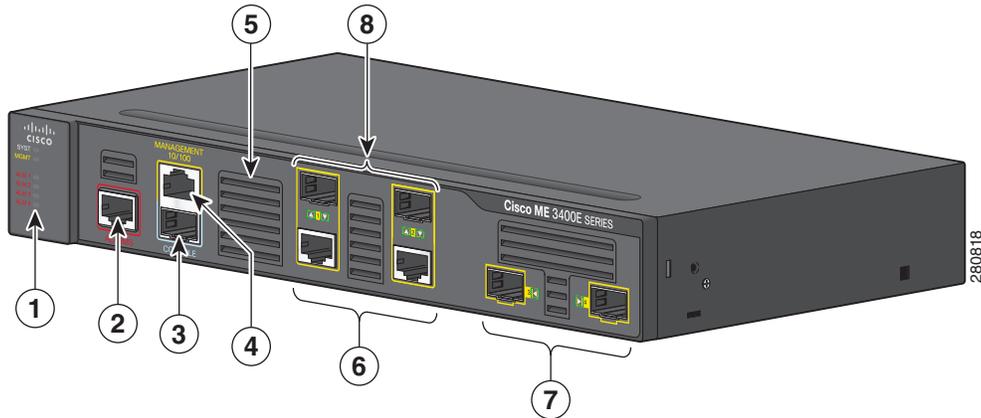
Figure 1-3   Cisco ME 3400EG-2CS-A Front Panel

1	LEDs	5	Air intake vents
2	Alarm input port	6	10/100/1000 ports
3	Console port	7	Gigabit Ethernet SFP-module slots
4	Ethernet management port	8	SFP-module slots

AC- and DC-Power Input Connectors

The Cisco ME 3400E-24TS-M and the Cisco ME 3400EG-12CS support combinations of power-supply modules: two AC, two DC, or one AC and one DC. The two AC- and one DC-power connectors on the front panel accommodate the mixture of AC- and DC-power-supply modules. The DC-power connector has the standard A and B feeds for DC redundancy. See Chapter 3, "Installing and Removing AC- and DC-Power-Supply Modules."

Alarm Input Port

The switch supports four alarm inputs. The alarm input is a dry-contact alarm port. Use the CLI to define each alarm input to respond to a normally open or closed dry-contact closure and to define the alarm severity as minor, major, or critical. When a condition triggers an alarm, the console displays an alarm message, and the corresponding Alarm LED responds (see the "Alarm LEDs" section on page 1-11).

Management Port

You can connect the switch to a host such as a Windows workstation or a terminal server through the 10/100 Ethernet management port or the console port. The 10/100 Ethernet management port connection uses a standard RJ-45 crossover or straight-through Ethernet cable. The console port connection uses the supplied RJ-45-to-DB-9 female cable.

The Ethernet management port operates in any combination of half duplex, full duplex, or 10 or 100 Mb/s, and its traffic is isolated from the other ports. See Table 1-7 for descriptions of the Ethernet management port LEDs. See the "10/100 Ethernet Management Port" section on page B-3 for pinout information.

For console port and adapter pinout information, see the "Console Port Adapter Pinouts" section on page B-7.

10/100 Fast Ethernet Ports

You can set the 10/100 ports on the switch to operate in any combination of half duplex, full duplex, or 10 or 100 Mb/s. You can set the ports for speed and duplex autonegotiation. The default setting is autonegotiate.

When set for autonegotiation, the port senses the speed and duplex settings of the attached device and advertises its own capabilities. If the connected device also supports autonegotiation, the switch port negotiates the best connection (the fastest line speed that both devices support and full-duplex transmission if the attached device supports it) and configures itself accordingly. In all cases, the attached device must be within 328 feet (100 meters).

Dual-Purpose Ports

You can configure the dual-purpose ports on the switch as either 10/100/1000 ports or as SFP-module ports. You can set the 10/100/1000 ports to autonegotiate. You can also configure them as fixed 10, 100, or 1000 Mb/s (Gigabit) Ethernet ports.

By default, the switch dynamically selects the medium for each dual-purpose port (10/100/1000BASE-T or SFP). When a link is achieved on one media type, the switch disables the other media type until the active link goes down. If links are active on both media, the SFP-module port has priority, but you can manually designate the port as an RJ-45 port or an SFP port by using the **media-type** interface configuration command.

You can configure the speed and duplex settings consistent with the selected media type. For information on configuring interfaces, see the switch software configuration guide.

SFP Modules

The switch Gigabit Ethernet SFP modules are used for connections to other devices. These transceiver modules are field-replaceable, providing the uplink interfaces when inserted in an SFP-module slot. You can use any combination of SFP modules. The SFP modules have LC connectors for fiber-optic connections or RJ-45 connectors for copper connections.

For more information on configuring interfaces, see the switch software configuration guide.

Table 1-2   Supported Cisco SFP Modules

Part Number	Description
GLC-FE-100BX-D GLC-FE-100BX-U	100BASE-BX10
GLC-FE-100EX	100BASE-EX
GLC-FE-100FX	100BASE-FX
GLC-FE-100LX	100BASE-LX10
GLC-FE-100ZX	100BASE-ZX
GLC-BX-D GLC-BX-U	1000BASE-BX10
GLC-LH-SM SFP-GE-L	1000BASE-LX/LH
GLC-SX-MM GLC-GE-S	1000BASE-SX
GLC-T[1] SFP-GE-T[1]	1000BASE-T and 10/100/1000BASE-T
SFP-GE-ZX-SM	1000BASE-ZX
CWDM-xxxx-SFP	CWDM
DWDM-xxxx-SFP	DWDM

1. Supported on SFP-only ports, not supported on dual-purpose ports.

Note The Cisco ME 3400E-24TS-M does not support 1000BASE-T SFP modules.

For more information about SFP modules, see your SFP module documentation and the "Installing and Removing SFP Modules" section on page 2-19. For cable specifications, see Appendix B, "SFP Module Connectors."

SFP Module Patch Cable

The switch supports the SFP-module patch cable, a 0.5-meter, copper, passive cable with SFP module connectors at each end (see Figure 1-4). The patch cable connects two switches in a cascaded configuration.

Figure 1-4   SFP-Module Patch Cable
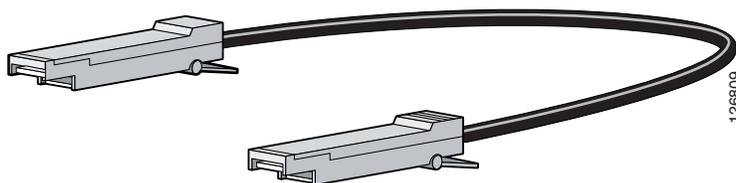
See the "Inserting and Removing the SFP Module Patch Cable" section on page 2-21 for more information about using the SFP module patch cable.

You can order the SFP module patch cable (part number CAB-SFP-50CM=).

UNIs, NNIs, and ENIs

The switch supports user-network interfaces (UNIs), network node interfaces (NNIs), and enhanced network interfaces (ENIs). UNIs are typically connected to a host, such as customer premises equipment (CPE) or a home access gateway. NNIs are typically connected to a router or to another switch. ENIs have the same functionality as UNIs, but can be configured to support protocol control packets for Cisco Discovery Protocol (CDP), Spanning-Tree Protocol (STP), Link Layer Discovery Protocol (LLDP), EtherChannel Link Aggregation Control Protocol (LACP), or Port Aggregation Protocol (PAgP). Every port is in an UNI, ENI, or NNI mode at any time, but not all ports have to all be set the same.

By default, the dual-purpose ports on the Cisco ME 3400E-12CS-M and on the Cisco ME 3400EG-2CS-A are configured as UNIs, and the SFP-only uplink ports are configured as NNIs. You must specifically configure ports to be ENIs; no ports are ENIs by default. By default, the 10/100 ports on the Cisco ME 3400E-24TS-M are UNIs, and the dual-purpose ports are NNIs.

A port can be reconfigured from UNI to NNI or an ENI, and the reverse. When a port is reconfigured as another interface type, it inherits all the characteristics of that interface type. For information on configuring interfaces, see the switch software configuration guide.

LEDs

You can use the switch system and port LEDs to monitor switch activity and performance.

- Switch LED Panels, page 1-8
- Power-Supply Module LEDs, page 1-9
- Ethernet Management Port LED, page 1-10
- Alarm LEDs, page 1-11
- Port LEDs, page 1-11
- Dual-Purpose Port LEDs, page 1-11

Product Overview

The Cisco Metro Ethernet (ME) 3600X switch is an Ethernet access switch.

The Cisco ME 3800X switch is a carrier Ethernet aggregation switch.

Throughout this document, the Cisco ME 3800X and ME 3600X are referred to as *the switch*.

- Setting Up the Switch, page 1-1
- Switch Models, page 1-1
- Front Panel, page 1-2
- Rear Panel, page 1-10
- Power Supply Module Features, page 1-11
- Fan Module, page 1-12
- Management Options, page 1-13

Setting Up the Switch

See the *Cisco ME 3800X and ME 3600X Switch Getting Started Guide* on Cisco.com for instructions on how to initially configure your switch. The getting started guide also covers switch management options, basic rack-mounting procedures, port and module connections, power connection procedures, and troubleshooting.

For instructions on setting up your switch using the CLI, see Appendix C, "Configuring the Switch with the CLI-Based Setup Program."

Switch Models

You can deploy the switch as a backbone switch, aggregating 10BASE-T, 100BASE-TX, 1000BASE-T, and fiber-optic Ethernet traffic from other network devices.

See the switch software configuration guide for examples that show how you might deploy the switch in your network.

Table 1-1   Cisco ME 3800X and ME 3600X Models and Descriptions

Switch Model	Description
Cisco ME-3800X-24FS-M	24 Gigabit Ethernet small form-factor pluggable (SFP) downlink ports and 2 SFP+ (10 Gigabit) uplink ports; supports removable, hot-swappable AC and DC input power supply and fan modules.
Cisco ME-3600X-24FS-M	24 Gigabit Ethernet SFP downlink ports and 2 SFP+ (10 Gigabit) uplink ports; supports removable, hot-swappable AC and DC input power supply and fan modules.
Cisco ME-3600X-24TS-M	24 10/100/1000BASE-T copper downlink ports and 2 SFP+ (10 Gigabit) uplink ports; supports removable, hot-swappable AC and DC input power supply and fan modules.

Front Panel

Note   The front panel is the same for the Cisco ME 3800X-24FS-M and Cisco ME 3600X-24FS-M.

Figure 1-1 shows the Cisco ME 3800X-24FS-M front panel.

The SFP downlink ports are grouped in pairs. The first member of the pair (port 1) is above the second member (port 2). Port 3 is above port 4, and so on.

Figure 1-1   Cisco ME 3800X-24FS-M Front Panel
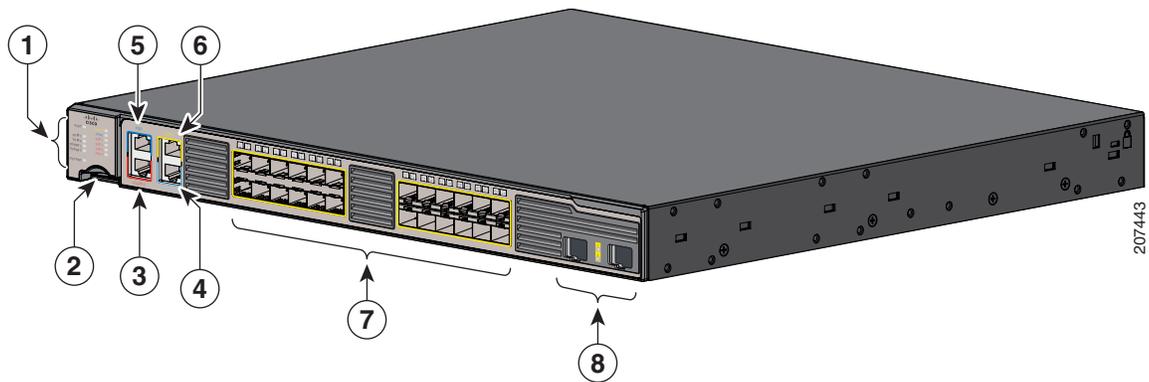
1	LEDs	**5**	BITS port
2	SD flash card slot	**6**	Ethernet management port
3	Alarm input port	**7**	SFP module ports (downlink)
4	Console port	**8**	SFP+ module slots (uplink)

Figure 1-2 shows the Cisco ME-3600X-24TS-M. The copper 10/100/1000Base-T/TX downlink ports are grouped in pairs. The first member of the pair (port 1) is above the second member (port 2). Port 3 is above port 4, and so on.
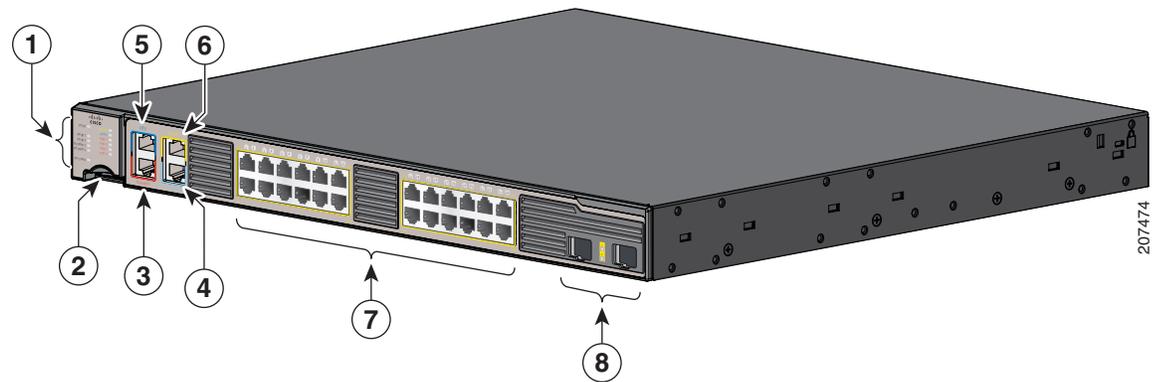
Figure 1-2   Cisco ME-3600X-24TS-M Front Panel

1	LEDs	**5**	BITS port
2	SD flash card slot	**6**	Ethernet management port
3	Alarm input port	**7**	10/100/1000BASE-T/TX ports (downlink)
4	Console port	**8**	SFP+ module slots (uplink)

BITS Port

The Building Integrated Timing Supply (BITS) port is an RJ-45 interface that provides external synchronized clocking through a timing signal generator (TSG). The BITS input is an external timing reference that must be traceable to a stratum 3 clock or better. The BITS port on the switch can be configured to accept either a T1 or an E1 framed input. Although this clock input is T1 or E1 framed, it does not carry data and cannot be used for any other purpose than to derive clocking for the system.

Alarm Input Port

The switch supports four alarm inputs. The alarm input is a dry-contact alarm port. Use the CLI to define each alarm input to respond to a normally open or closed dry-contact closure and to define the alarm severity as minor, major, or critical. When a condition triggers an alarm, the console displays an alarm message, and the corresponding Alarm LED responds (see the "Alarm LEDs Description" section on page 1-9).

Management and Console Port

You can connect the switch to a host such as a Windows workstation or a terminal server through the 10/100/1000 Ethernet management port or the console port. The 10/100/1000 Ethernet management port connection uses a standard RJ-45 crossover or straight-through Ethernet cable. The console port connection uses a RJ-45-to-DB-9 female cable.

The Ethernet management port operates in any combination of 10, 100, or 1000 Mb/s, and its traffic is isolated from the other ports. See Table 1-7 for descriptions of the Ethernet management port LEDs. See the "10/100/1000 Ethernet Management Port" section on page B-3 for pinout information.

For console port and adapter pinout information, see the "Console Port Adapter Pinouts" section on page B-8.

10/100/1000 Gigabit Ethernet Ports

The 10/100/1000 Ethernet ports use standard RJ-45 connectors with Ethernet pinouts. The maximum cable length is 328 feet (100 meters). The 100BASE-TX and 1000BASE-T traffic requires Category 5, Category 5e, or Category 6 unshielded twisted pair (UTP) cable. The 10BASE-T traffic can use Category 3 or Category 4 UTP cable.

The autonegotiation feature is enabled by default. The switch ports configure themselves to operate at the speed of attached devices. If the attached device does not support autonegotiation, you can explicitly set the switch port speed and the duplex parameters. To maximize performance, either let the ports autonegotiate both speed and duplex, or set the port speed and duplex parameters on both ends of the connection.

For simplified cabling, the automatic medium-dependent interface crossover (auto-MDIX) feature is enabled by default. The switch detects the required cable type for copper Ethernet connections and configures the interface accordingly. You can use either a crossover or a straight-through cable for connections to a switch 10/100/1000 Ethernet port, regardless of the type of device on the other end of the connection.

SFP+ and SFP Modules

The switch 10-Gigabit Ethernet SFP+ modules are used for connections to other devices. These transceiver modules are field-replaceable, providing the uplink interfaces when inserted in an SFP+ module slot. You can use any combination of SFP+ or SFP modules. The SFP+ modules have LC connectors for fiber-optic connections. The SFP+ module slots support SFP+ and 1000BASE-X SFP modules. The SFP+ module slots do not support 100BASE-X and 1000BASE-T modules.

Use only Cisco SFP+ or SFP modules on the switch. Each Cisco module has an internal serial EEPROM that is encoded with security information.

For more information on configuring interfaces, see the switch software configuration guide.

Table 1-2   Supported Cisco SFP+ Modules

Part Number	Description
SFP-10G-LR=	10GBASE-LR
SFP-10G-SR=	10GBASE-SR
SFP-10G-LRM=	10GBASE-LRM
SFP-H10GB-CU1M=	1-meter copper SFP+ cable
SFP-H10GB-CU3M=	3-meter copper SFP+ cable
SFP-H10GB-CU5M=	5-meter copper SFP+ cable

Table 1-3   Supported Cisco SFP Modules

Part Number	Description
GLC-FE-100BX-D GLC-FE-100BX-U	100BASE-BX10
GLC-FE-100EX	100BASE-EX
GLC-FE-100FX	100BASE-FX
GLC-FE-100LX	100BASE-LX10
GLC-FE-100ZX	100BASE-ZX
GLC-BX-D GLC-BX-U	1000BASE-BX10
GLC-LH-SM SFP-GE-L	1000BASE-LX/LH
GLC-SX-MM GLC-GE-S	1000BASE-SX
GLC-T SFP-GE-T	10/100/1000BASE-T
GLC-ZX-SM	1000BASE-ZX
CWDM-SFP-xxxx	CWDM
DWDM-SFP-xxxx	DWDM
CAB-SFP-50CM	SFP interconnect cable (50 cm)

For more information about SFP+ and SFP modules, see your SFP+ and SFP module documentation and the "Installing and Removing SFP+ and SFP Modules" section on page 2-15. For cable specifications, see Appendix B, "SFP and SFP+ Module Connectors."

SFP Module Patch Cable

The SFP downlink ports supports the SFP module patch cable, a 0.5-meter, copper, passive cable with SFP module connectors at each end. This cable is only used with 1-Gigabit Ethernet SFP ports to connect two switches in a cascaded configuration.

See the "Inserting and Removing the SFP+ Module Patch Cable" section on page 2-17 for more information about using the SFP module patch cable.

You can order the SFP module patch cable (part number CAB-SFP-50CM=).

SD Memory Slot

The switch has an SD (secure digital) memory slot for additional non-volatile storage. You can save configurations or Cisco IOS images and transfer them to other systems. The memory slot supports standard SD (1 MB and 2 GB) memory cards or SDHC (4 GB) memory cards.

LEDs

You can use the switch system and port LEDs to monitor switch activity and performance.

- Switch LED Panels, page 1-7
- System LED Description, page 1-7
- Power Supply Module Input LED Description, page 1-8
- Power Supply and Fan LED Description, page 1-8
- Ethernet Management Port LED Description, page 1-8
- Alarm LEDs Description, page 1-9
- Sync LED Description, page 1-9
- SD Card LED Description, page 1-9
- Port LEDs Description, page 1-10

Cisco ASR 9001 Router

Product Overview

Part of the Cisco® ASR 9000 Series, the Cisco ASR 9001 Router (Figure 1) is a compact high-capacity Provider Edge (PE) router that delivers 120 Gbps of nonblocking, full-duplex fabric capacity in a two-rack-unit (2RU) form factor. Based on the same Cisco IOS® XR software image as the other routers in the Cisco ASR 9000 Series, the Cisco ASR 9001 Router delivers the features and services found on the ASR 9000 Series platforms, allowing customers to standardize on the same Cisco IOS XR image. The Cisco ASR 9001 Router has an Integrated Route Switch Processor (RSP) and two modular bays that support 1 GE, 10 GE, and 40 GE Modular Port Adapters (MPAs). The base chassis has four integrated 10 GE Enhanced Small Form-Factor Pluggable (SFP+) ports, a GPS input for stratum-1 clocking, Building Integrated Timing Supply (BITS) ports, and management ports.

Figure 1.   Cisco ASR 9001 Router
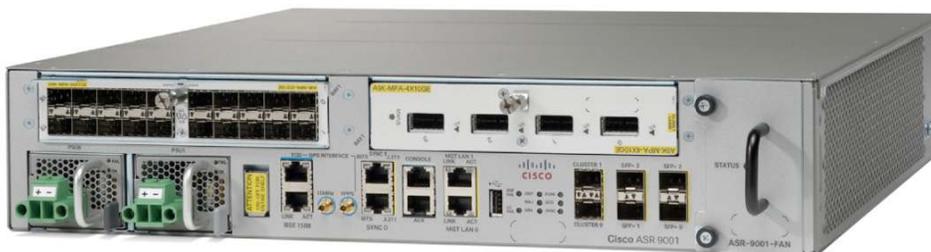
Cisco ASR 9000 Series Aggregation Services Routers deliver exceptional scale, service flexibility, and high availability to Carrier Ethernet transport networks. The routers are powered by Cisco IOS XR Software, an innovative self-healing, distributed operating system designed for always-on operation. This is the same operating system that powers industry-leading routers such as the Cisco CRS Carrier Routing System, bringing the same reliability, scalability, performance, and comprehensive features that have made the Cisco CRS the dominant entity in the service provider core. Cisco IOS XR Software also allows for an end-to-end IP/MPLS solution to service provider requirements based on the same software, thereby reducing the operational complexity of managing multiple operating systems. The Cisco ASR 9000 Series further enhances the IP Next-Generation Network (IP NGN) Carrier Ethernet design for converged, resilient, intelligent, and scalable transport of consumer, business, wholesale, and mobile services.

Cisco ASR 9000 Series Carrier Ethernet applications include business services such as Layer 2 and Layer 3 VPN (L2VPN and L3VPN), IPTV, Content Delivery Networks (CDNs), mobile backhaul transport networks, and broadband network gateway (BNG). Features supported include Ethernet Services; L2VPN; IPv4, IPv6, and L3VPN; Layer 2 and Layer 3 multicast; IP over dense wavelength-division multiplexing (IPoDWDM), Synchronous Ethernet (SyncE), Ethernet operations, administration, and maintenance (EOAM) and MPLS OAM, Layer 2 and Layer 3 access control lists (ACLs), hierarchical quality of service (HQoS), MPLS Traffic Engineering Fast Reroute (MPLS TE-FRR), Multichassis Link Aggregation (MC-LAG), Integrated Routing and Bridging (IRB) and Cisco Nonstop Forwarding (NSF) and Nonstop Routing (NSR).

Note: Site to Site IPSec VPN is not currently supported on the ASR 9001 platform.

The integrated RSP has 8 GB RAM and is capable of holding serveral millions of routes, which makes the Cisco ASR 9001 Router useful as a dedicated route-reflector appliance.

Features and benefits of the Cisco ASR 9001 Router are listed in Table 1.

Table 1.   Features and Benefits of Cisco ASR 9001 Router

Feature	Benefit
Scalable fabric	Designed to support high 1/10/40 Gigabit densities in a 2RU form factor Provides built-in scalability for investment protection
Integrated port	Four 10 GE services-enabled SFP+ ports
Integrated route processor with 8 GB RAM	Runs Cisco IOS XR, a carrier-class operating system with high memory capacity suitable for a dedicated route-reflector application
Distributed forwarding plane architecture	Allows MPA cards to support independent forwarding for enhanced performance and scale
Control plane extension ports	Two 10 G out-of-band Ethernet communications ports support Network Virtualization (nV) technology for high-availability cluster applications
Hardware-based IEEE 1588 support	Delivers timing services over the packet network efficiently and reliably
Two independent clock source connections: BITS and Synchronization Supply Unit (SSU) with DOCSIS® Timing Interface (DTI)	Offers redundant, centralized network synchronization support
GPS	Provides option for Stratum-1 clocking
Embedded USB memory (eUSB) port	Provides access to USB flash memory devices for software image loading and recovery
Front-panel LEDs	Provides visual indication of RSP status (active or standby), power management, and activity on compact flash and hard disk drive (HDD)
Management ports	Provides easy access to system console
Power supply	Redundant AC or DC power supplies

Product Specifications

Table 2 provides details about the Cisco ASR 9001 Router. The system is designed for high performance and high reliability. The Cisco ASR 9001 has an integrated RSP capable of supporting fabric bandwidth up to 120 Gbps.

Table 2.   Specifications for Cisco ASR 9001 Router

Category	Part Number or Specification
Chassis	ASR 9001
Integrated interfaces	4 x 10 GE SFP+
Modular port adapters	20 x 1 GE, 2 x 10 GE, 4 x 10 GE, 1 x 40 GE
Redundancy	Power supply redundancy
Power supply part number	• A9K-750W-AC • A9K-750W-DC
Physical specifications	• Height: 3.472 inches (88.2 mm) • Width: 17.42 inches (442 mm) • Depth: 18.5 inches (470 mm) • Weight of chassis: 30.2032 lbs (13.7 kg) • Weight of chassis with two MPAs: 36.37623 lbs (16.5 kg)
Power inputs	• Worldwide ranging AC (90-265V; 50-60 Hz) • Worldwide ranging DC (-48V to -72V)
Power consumption	375 watts typical, 425 watts maximum

Category	Part Number or Specification
Environmental conditions	• Operating temperature: 32 to 104°F (0 to 40°C) • Storage temperature: -40 to 167°F (-40 to 75°C) • Relative humidity: 10 to 90%, noncondensing • Regulatory compliance
Environmental Specifications	
Operating temperature (nominal)	41 to 104ºF (5 to 40ºC)
Operating temperature (short-term)	23 to 131ºF (-5 to 55ºC)
Operating humidity (nominal) (relative humidity)	10 to 85%
Operating humidity (short-term)	5 to 90% Note: Not to exceed 0.024 kg water or dry air
Storage temperature	-40 to 158ºF (-40 to 70ºC)
Storage (relative humidity)	5 to 95% Note: Not to exceed 0.024 kg water or dry air
Operating altitude	-1800m
Air flow	Side to side
Compliance	
Network Equipment Building Standards (NEBS)	Cisco ASR 9001 is designed to meet: • SR-3580: NEBS Criteria Levels (Level 3) • GR-1089-CORE: NEBS EMC and Safety • GR-63-CORE: NEBS Physical Protection • VZ.TPR.9205: Verizon TEEER
ETSI standards	Cisco ASR 9001 is designed to meet (qualification in progress): • EN300 386: Telecommunications Network Equipment (EMC) • ETSI 300 019 Storage Class 1.1 • ETSI 300 019 Transportation Class 2.3 • ETSI 300 019 Stationary Use Class 3.1 • EN55022: Information Technology Equipment (Emissions) • EN55024: Information Technology Equipment (Immunity) • EN50082-1/EN-61000-6-1: Generic Immunity Standard
EMC standards	Cisco ASR 9001 is designed to meet: • FCC Class A • ICES 003 Class A • AS/NZS 3548 Class A • CISPR 22 (EN55022) Class A • VCCI Class A • BSMI Class A • IEC/EN 61000-3-2: Power Line Harmonics • IEC/EN 61000-3-3: Voltage Fluctuations and Flicker • EN 50121-4: Railway EMC
Immunity	Cisco ASR 9001 is designed to meet: • IEC/EN-61000-4-2: Electrostatic Discharge Immunity (8kV Contact, 15kV Air) • IEC/EN-61000-4-3: Radiated Immunity (10V/m) • IEC/EN-61000-4-4: Electrical Fast Transient Immunity (2kV Power, 1kV Signal) • IEC/EN-61000-4-5: Surge AC Port (4kV CM, 2kV DM) • IEC/EN-61000-4-5: Signal Ports (1kV) • IEC/EN-61000-4-5: Surge DC Port (1kV) • IEC/EN-61000-4-6: Immunity to Conducted Disturbances (10Vrms) • IEC/EN-61000-4-8: Power Frequency Magnetic Field Immunity (30A/m) • IEC/EN-61000-4-11: Voltage DIPS, Short Interruptions, and Voltage Variations • EN 50121-4: Railway EMC

Category	Part Number or Specification
Safety	Cisco ASR 9001 is designed to meet: • UL/CSA/IEC/EN 60950-1 • IEC/EN 60825 Laser Safety • ACA TS001 • AS/NZS 60950 • FDA: Code of Federal Regulations Laser Safety

Ordering Information

Table 3 provides ordering information for the Cisco ASR 9001 Router.

Table 3.   Ordering Information

Product Description	Supported Software Release	Part Number
ASR 9001 Router with 4 x 10 GE	Cisco IOS XR Software Release 4.2.1 or later	ASR-9001
AC Power Entry module	Cisco IOS XR Software Release 4.2.1 or later	A9K-750W-AC
DC Power Entry module	Cisco IOS XR Software Release 4.2.1 or later	A9K-750W-DC
20 x 1 GE Modular Port Adapter	Cisco IOS XR Software Release 4.2.1 or later	A9K-MPA-20x1GE
2 x 10 GE Modular Port Adapter	Cisco IOS XR Software Release 4.2.1 or later	A9K-MPA-2x10GE
4 x 10 GE Modular Port Adapter	Cisco IOS XR Software Release 4.2.1 or later	A9K-MPA-4x10GE
1 x 40 GE Modular Port Adapter	Cisco IOS XR Software Release 4.2.3 or later	A9K-MPA-1x40GE

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Cisco ASR 9000 Series Modular Line Cards

Product Overview

The Cisco® ASR 9000 Series modular line cards provide customers with a flexible solution supporting multiple combinations of Ethernet ports, all in a single slot of the Cisco ASR 9000 Series Aggregation Services Routers. Modular line cards support a wide range of interfaces and densities offering the benefits of network scalability with lower initial costs and ease of upgrades. The Cisco ASR 9000 modular line cards and modular port adapter portfolio continues the Cisco focus on investment protection along with consistent feature support, broad interface availability, and the latest technology.

Using the modular line cards, the Cisco ASR 9000 Series can support customer applications including video-on-demand, Internet Protocol Television (IPTV), point-to-point video, Internet video, and cloud-based computing. These line cards can also be used to deliver economical, scalable, highly available, line-rate Ethernet and IP/Multiprotocol Label Switching (IP/MPLS) edge services. The Cisco ASR 9000 Series line cards and routers are designed to provide the fundamental infrastructure for scalable Carrier Ethernet and IP/MPLS networks, supporting profitable business, residential, and mobile services (Figure 1).

Figure 1.   Cisco ASR 9000 Series Modular Line Cards

Features and Benefits

The Cisco ASR 9000 Series modular line cards are fully compatible with the Cisco ASR 9922, 9010, and 9006 systems, route switch processors (RSPs), and line cards. No hardware upgrade to the chassis or cooling system is required. Total bandwidth is dependent on the number and type of RSPs installed.

The new line cards deliver the ability to mix and match modular port adapters so that customers can customize each slot in the Cisco ASR 9000 to their specific port demands. As an example, a 4-port 10-Gigabit Ethernet modular port adapter can be matched with a 20-port 1-Gigabit Ethernet modular port adapter, all in a single slot.

Each Cisco ASR 9000 Series modular line card provides simultaneous support for both Layer 2 and Layer 3 services and features, helping operators to qualify and stock a single line card that can be deployed in any combination of Layer 2 and Layer 3 applications. These capabilities help to reduce capital expenditures (CapEx) and operating expenses (OpEx), as well as reduce the time required to develop and deploy new services. The Cisco modular line cards set a new standard for service density, allowing operators to offer predictable, managed transport services while optimizing the use of network assets.

The line cards, with their synchronization circuitry and dedicated backplane timing traces for accessing the RSP's Stratum-3 subsystem, provide standards-based line-interface functions for delivering and deriving transport-class network timing, allowing support of network-synchronized services and applications such as mobile backhaul and time-division multiplexing (TDM) migration. Coupled with the Cisco RSP-440 route switch processor, the line cards can also be used for applications requiring IEEE 1588v2 synchronization services. Recognizing that real-time media dominate next-generation services, Cisco has integrated media-monitoring technology into the Cisco Modular line cards. This multimedia technology allows real-time monitoring and statistics collection of real-time video and voice flows, facilitating proactive maintenance and management of today's interactive services.

Addressing the advantages of consolidating IP and dense wavelength-division multiplexing (DWDM) networking, G.709 with Advanced Forward Error Correction (FEC) is provided. G.709 provides visibility into the DWDM transmission system to permit rapid detection and recovery from transmission-layer and DWDM impairments. G.709 can also be configured for proactive protection if signal degradation is detected; it prevents traffic loss and link outage. Advanced FEC extends transmission-layer performance, delivering extended performance over an amplified system without the cost of regeneration or transponders.

Table 1 lists the features and benefits of the Cisco modular line cards. Specific feature and scale support is hardware and software dependent.

Table 1.   Features and Benefits of Cisco ASR 9000 Series Modular Line Cards

Feature	Benefit
Interface Support	
Pluggable 1-Gigabit Small Form-Factor Pluggable (SFP), 10-Gigabit SFP (XFP), and 40-Gigabit Quad SFP (QSFP) interfaces	Provide the capability to mix and match interface types across a single line card; for a complete list of supported interfaces, please see Cisco ASR 9000 Transceiver Modules: Line Card Support data sheet
G.709 and Advanced FEC	Standard G.709 providing transmission-layer operations, administration, and maintenance (OA&M); G.709 Standard FEC and Advanced FEC for enhanced transmission system performance
Scalable and Integrated Multiservice Support	
Layer 2 and Layer 3 services	Combined IP, MPLS, Ethernet, Layer 2 VPN (L2VPN), and Layer 3 VPN (L3VPN) services
Evolutionary Monitoring	
Carrier-class OA&M	NetFlow, IEEE 802.1ag, IEEE 802.3ah, ITU Y.1731, IP service-level agreement (IP SLA), virtual circuit connectivity verification (VCCV), ping, and traceroute
Video monitoring (VidMon)	VidMon, providing real-time monitoring of video flows, including issuance of alarm upon degradation
Carrier-Grade OS	
Cisco IOS® XR Software	Modular, patchable, restartable, scalable, highly available, carrier-core and edge-proven operating system
T-Class Synchronization	
Synchronous Ethernet	Derives and provides synchronization from and to Ethernet interfaces, Cisco ASR 9000 Series RSPs, and network synchronization interfaces
IEEE 1588-2008	Cisco ASR 9000 Series support of the IEEE 1588-2008 protocol provides the capability to distribute precision time

Line Card Types

The Cisco ASR 9000 Series modular line cards are available in Service Edge Optimized and Packet Transport Optimized variants.

- Service Edge Optimized line cards are designed for customer deployments requiring enhanced quality of service (QoS).
- Packet Transport Optimized line cards are designed for network deployments where basic QoS is required.

Different line card types may be mixed within the same system.

Feature licenses are also available to turn on advanced features on the line cards, as described in the "Software Licensing" section later in this document.

Product Specifications

Table 2 provides product specifications for the Cisco ASR 9000 Series modular line cards.

Table 2.   Product Specifications

Description	Specification
Chassis compatibility	Compatible with the Cisco ASR 9922, 9010, 9006 and 9001 systems
Port density	Up to 2 modular port adapters are supported per line card..
Ethernet	- IEEE 802.3 compliant - 10 Gigabit Ethernet PHY monitoring - IEEE 802.x flow control - Full-duplex operation - Per-port byte and packet counters for policy drops; oversubscription drops; cyclic redundancy check (CRC) error drops; packet sizes; and unicast, multicast, and broadcast packets
Card density	Maximum number of line cards per system: Cisco ASR 9922 = 20, Cisco ASR 9010 = 8, and Cisco ASR 9006 = 4
Options	Each line card is available as either a Service Edge Optimized (enhanced QoS) or Packet Transport Optimized (basic QoS) line card.
Reliability and availability	Line card online insertion and removal (OIR) support without system impact
Network Equipment Building Standards (NEBS)	Cisco ASR 9000 Series Routers are designed to meet: - SR-3580: NEBS Criteria Levels (Level 3) - GR-1089-CORE: NEBS EMC and Safety - GR-63-CORE: NEBS Physical Protection
Operating temperature (nominal)	41 to 104ºF (5 to 40ºC)
Operating temperature (short-term)[1]	23 to 131ºF (–5 to 55ºC)
Operating humidity (nominal) relative humidity	10 to 85%
Storage temperature	–40 to 158ºF (–40 to 70ºC)
Storage relative humidity	5 to 95% Note: Not to exceed 0.024 kg of water per kg of dry air
Operating altitude	–60 to 4000m (up to 2000m conforms to IEC, EN, UL, and CSA 60950 requirements)

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[1] Short-term refers to a period of not more than 96 consecutive hours and a total of not more than 15 days in 1 year. (This number refers to a total of 360 hours in any given year, but no more than 15 occurrences during that 1-year period.)

Description	Specification
ETSI standards	Cisco ASR 9000 Series Routers are designed to meet: • EN300 386: Telecommunications Network Equipment (EMC) • ETSI 300 019 Storage Class 1.1 • ETSI 300 019 Transportation Class 2.3 • ETSI 300 019 Stationary Use Class 3.1 • EN55022: Information Technology Equipment (Emissions) • EN55024: Information Technology Equipment (Immunity) • EN50082-1/EN-61000-6-1: Generic Immunity Standard
EMC standards	Cisco ASR 9000 Series Routers are designed to meet: • FCC Class A • ICES 003 Class A • AS/NZS 3548 Class A • CISPR 22 (EN55022) Class A • VCCI Class A • BSMI Class A • IEC/EN 61000-3-2: Power Line Harmonics • IEC/EN 61000-3-3: Voltage Fluctuations and Flicker
Immunity	Cisco ASR 9000 Series Routers are designed to meet: • IEC/EN-61000-4-2: Electrostatic Discharge Immunity (8kV Contact, 15kV Air) • IEC/EN-61000-4-3: Radiated Immunity (10V/m) • IEC/EN-61000-4-4: Electrical Fast Transient Immunity (2kV Power, 1kV Signal) • IEC/EN-61000-4-5: Surge AC Port (4kV CM, 2kV DM) • IEC/EN-61000-4-5: Signal Ports (1kV) • IEC/EN-61000-4-5: Surge DC Port (1kV) • IEC/EN-61000-4-6: Immunity to Conducted Disturbances (10Vrms) • IEC/EN-61000-4-8: Power Frequency Magnetic Field Immunity (30A/m) • IEC/EN-61000-4-11: Voltage DIPS, Short Interruptions, and Voltage Variations
Safety	Cisco ASR 9000 Series Routers are designed to meet: • UL/CSA/IEC/EN 60950-1 • IEC/EN 60825 Laser Safety • ACA TS001 • AS/NZS 60950 • FDA: Code of Federal Regulations Laser Safety

Weights and Dimensions

Table 3 shows the different physical dimensions and associated weight of the ASR 9000s modular line cards and modular port adapters.

Table 3.   Physical Dimensions

PID	Physical Dimensions	Weight
A9K-MOD80-SE/TR	14.5 W x 1.72 H x 22.40 L 14.5 W x 1.72 H x 24.25 L (including ejector levers)	17.5 lbs. (est.) (7.93 Kg)
A9K-MOD160-SE/TR	14.5 W x 1.72 H x 22.4 L 14.5 W x 1.72 H x 24.25 L (including ejector levers)	18 lbs. (8.16 Kg)
A9K-MPA-20x1GE	6.37 W x 1.36 H x 6.70 L 6.37 W x 1.36 H x 8.30 L (including Jackscrew)	34 oz. (0.96 Kg)
A9K-MPA-2x10GE	6.37 W x 1.36 H x 6.70 L 6.37 W x 1.36 H x 8.30 L (including Jackscrew)	28 oz. (0.7 Kg)
A9K-MPA-4x10GE	6.37 W x 1.36 H x 6.70 L 6.37 W x 1.36 H x 8.30 L (including Jackscrew)	31 oz. (0.87 Kg)

PID	Physical Dimensions	Weight
A9K-MPA-8x10GE	6.37 W x 1.36 H x 6.70 L 6.37 W x 1.36 H x 8.30 L (including Jackscrew)	1.75 lbs (0.79 Kg)
A9K-MPA-1x40GE	6.37 W x 1.36 H x 6.70 L 6.37 W x 1.36 H x 8.30 L (including Jackscrew)	26 oz. (est.)(0.7 Kg)
A9K-MPA-2x40GE	6.37 W x 1.36 H x 6.70 L 6.37 W x 1.36 H x 8.30 L (including Jackscrew)	28 oz. (0.7 Kg)

Pluggable Interfaces

The Cisco ASR 9000 Series Modular Line Cards support a wide range of SFP, XFP, and QSFP pluggable interfaces. Please see the Cisco ASR 9000 Transceiver Modules: Line Card Support data sheet for a complete list.

System Requirements

The Cisco ASR 9000 Series Modular Line Cards may be deployed in the 20-slot, 10-slot and 6-slot chassis, with Cisco IOS XR Software Release 4.2.0 or later. Table 4 shows the system software requirements.

Table 4. System Software Requirements

Hardware Part Number	Software Release Support
A9K-Mod80 –TR/SE	Cisco IOS XR 4.2.0
A9K-Mod160 –TR/SE	Cisco IOS XR 4.2.1

Software Licensing

Line Card Feature Licenses

In addition to the two optimization versions of the Cisco modular line cards, optional per-line-card feature licenses can be used to turn on advanced features on the line cards. Layer 3 VPN licenses provide access to VPN Routing and Forwarding (VRF) instances on a per-line-card basis. They include the Infrastructure VRF license to support up to 8 VRF instances and Advanced IP licenses to support up to full-scale VRF instances. The Advanced Optical license enables G.709 and FEC for DWDM systems on a per-line-card basis. The Advanced Video license enables inline video monitoring feature on a per-line-card basis. Table 5 lists the line card feature licenses.

Table 5. Feature Licenses for Cisco ASR 9000 Series Modular Line Cards

License Part Number	Feature Description
A9K-IVRF-LIC	Infrastructure VRF license to enable up to 8 VRF instances per Modular line card
A9K-MOD80-AIP-SE	Advanced IP license to enable full-scale VRF instances per Service Edge Optimized Mod80 line card
A9K-MOD80-AIP-TR	Advanced IP license to enable full-scale VRF instances per Packet Transport Optimized Mod80 line card
A9K-MOD80-OPT-LIC	Advanced Optical license to enable G.709 and FEC per Mod80 line card
A9K-MOD80-VID-LIC	Advanced Video license to enable inline video monitoring per Mod80 line card
A9K-MOD160-AIP-SE	Advanced IP license to enable full-scale VRF instances per Service Edge Optimized Mod160 line card
A9K-MOD160-AIP-SE	Advanced IP license to enable full-scale VRF instances per Packet Transport Optimized Mod160 line card
A9K-MOD160-OPT-LIC	Advanced Optical license to enable G.709 and FEC per Mod160 line card
A9K-MOD160-VID-LIC	Advanced Video license to enable inline video monitoring per Mod160 line card

System-Level Feature Licenses

Cisco modular line cards also support the deployment of advanced features based on Cisco ASR 9000 Series system-level licenses. The Lawful Intercept license enables lawful intercept for surveillance of packet streams that flow through Cisco ASR 9000 ports. The Advanced Mobile license enables the IEEE 1588-2008 protocol to distribute precision time and frequency across the network. The Broadband Network Gateway (BNG) license enables high-scale Ethernet BNG with session and subscriber awareness. Inline video monitoring on Cisco Modular line cards can also be enabled using a system-level Advanced Video License. Table 6 lists the system licenses supported by Cisco Modular line cards.

Table 6.　System-Level Feature Licenses Supported by Cisco Modular Line Cards

License Part Number	Feature Description
A9K-LI-LIC	Lawful Intercept license to enable lawful intercept of packet streams for surveillance
A9K-MOBILE-LIC	Advanced Mobile license to enable IEEE 1588-2008 protocol to distribute precision timing and frequency
A9K-BNG-LIC-8K	Broadband Network Gateway license to enable high scale Ethernet BNG with session/subscriber awareness
A9K-SYS-VID-LIC	Advanced Video license to enable inline video monitoring for all linecards in the system

Ordering Information

Table 7 provides ordering information for the Cisco ASR 9000 Series modular line cards and modular port adapters.

Table 7.　Ordering Information

Part Number	Product Description
A9K-MOD80-SE	ASR 9000 Mod80 Modular Line Card, Service Edge Optimized, requires modular port adapters
A9K-MOD80-TR	ASR 9000 Mod80 Modular Line Card, Packet Transport Optimized, requires modular port adapters
A9K-MOD160-SE	ASR 9000 Mod160 Modular Line Card, Service Edge Optimized, requires modular port adapters
A9K-MOD160-TR	ASR 9000 Mod160 Modular Line Card, Packet Transport Optimized, requires modular port adapters
A9K-MPA-20x1GE	ASR 9000 20-port 1-Gigabit Ethernet Modular Port Adapter, requires SFP optics
A9K-MPA-2x10GE	ASR 9000 2-port 10-Gigabit Ethernet Modular Port Adapter, requires XFP optics
A9K-MPA-4x10GE	ASR 9000 4-port 10-Gigabit Ethernet Modular Port Adapter, requires XFP optics
A9K-MPA-8x10GE	ASR 9000 8-port 10-Gigabit Ethernet Modular Port Adapter, requires SFP+ optics
A9K-MPA-1x40GE	ASR 9000 1-port 40-Gigabit Ethernet Modular Port Adapter, requires QSFP optics
A9K-MPA-2x40GE	ASR 9000 2-port 40-Gigabit Ethernet Modular Port Adapter, requires QSFP optics

Downloading the Software

Visit the Cisco Software Center to download Cisco IOS Software.

Cisco Services for the Cisco ASR 9000 Series

Through a lifecycle services approach, Cisco delivers comprehensive support to service providers to help them successfully deploy, operate, and optimize their IP Next-Generation Networks (IP NGNs). Cisco Services for the Cisco ASR 9000 Series Aggregation Services Routers provide the services and proven methodologies that help assure service deployment with substantial return on investment, operational excellence, optimal performance, and high availability. These services are delivered using leading practices, tools, processes, and lab environments developed specifically for Cisco ASR 9000 Series deployments and post-implementation support. The Cisco Services team addresses your specific requirements, mitigates risk to existing revenue-generating services, and helps accelerate time to market for new network services.

For more information about Cisco Services, contact your local Cisco account representative or visit http://www.cisco.com/go/spservices.

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Cisco UCS C220 M3 High-Density Rack Server (Small Form Factor Disk Drive Model)

OVERVIEW

The Cisco® UCS C220 M3 rack server is designed for performance and density over a wide range of business workloads from web serving to distributed database.

The enterprise-class UCS C220 M3 server extends the capabilities of Cisco's Unified Computing System portfolio in a 1U form factor with the addition of the Intel Xeon E5-2600 v2 and E5-2600 series processor family CPUs that deliver significant performance and efficiency gains. In addition, the UCS C220 M3 server provides 16 DIMM slots, up to 8 drives and 2 x 1 GbE LAN-on-motherboard (LOM) ports delivering outstanding levels of density and performance in a compact 1U package.

Figure 1   **Cisco UCS C220 M3 High-Density SFF Rack Server**

Front View

Rear View

DETAILED VIEWS

Chassis Front View

Figure 2 shows the Cisco UCS C220 M3 High-Density SFF Rack Server.

Figure 2   Chassis Front View
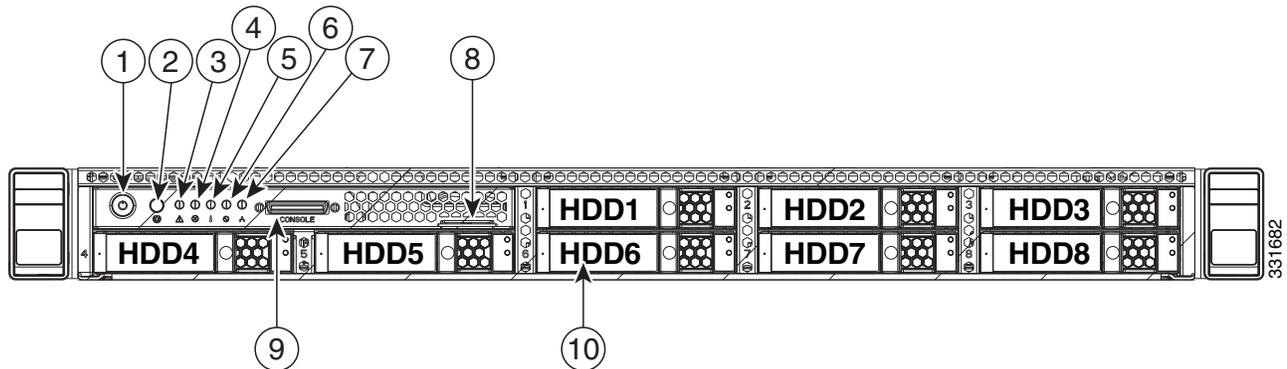
1	Power button/power status LED	6	Power supply status LED
2	Identification button/LED	7	Network link activity LED
3	System status LED	8	Asset tag (serial number)
4	Fan status LED	9	KVM connector (used with KVM cable that provides two USB, one VGA, and one serial connector)
5	Temperature status LED	10	Drives (up to eight hot-swappable 2-5-inch drives)

For more information about the KVM cable connection, see *KVM CABLE, page 71*.

Chassis Rear View

Figure 3 shows the external features of the rear panel.

Figure 3   Chassis Rear View
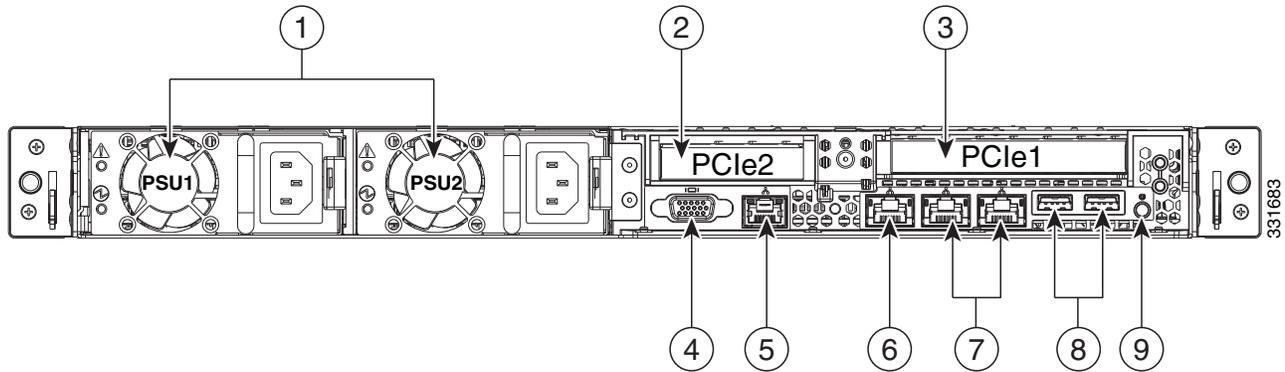
1	Power supplies (up to two)	6	One 10/100/1000 Ethernet dedicated management port
2	Slot 2: Low-profile PCIe slot on riser: (half-height, half-length, x16 connector, x8 lane width)	7	Dual 1-GbE ports (LAN1 and LAN2)
3	Slot 1: Standard-profile PCIe slot on riser: (full-height, half-length, x24 connector, x16 lane width) (supports Cisco Virtual Interface Card (VIC)	8	USB ports
4	VGA video connector	9	Rear Identification button/LED
5	Serial port (RJ-45 connector)[1]	—	—

Notes . . .

1. For details of the serial port pinout, see *Serial Port Details, page 64*.

TECHNICAL SPECIFICATIONS

Dimensions and Weight

Table 37 UCS C220 M3 Dimensions and Weight

Parameter	Value
Height	1.7 in. (4.32 cm)
Width	16.92 in.(43.0 cm)
Depth	28.5 in. (72.4cm)
Front Clearance	3 in. (76 mm)
Side Clearance	1 in. (25 mm)
Rear Clearance	6 in. (152 mm)
Weight	
Maximum (8 HDDs, 2 CPUs, 16 DIMMs, 2 power supplies)	35.6 lbs (16.2 kg)
Minimum (1 HDD, 1 CPU, 1 DIMM, 1 power supply)	26.8 lbs (12.1 kg)
Bare (0 HDD, 0 CPU, 0 DIMM, 1 power supply)	22 lbs (10 kg)

Power Specifications

The general power specifications for the C220 M3 SFF server 450 W (AC) power supply are listed in *Table 38*.

Table 38 UCS C220 M3 SFF 450 W Power Supply Specifications

Description	Specification
AC input voltage	90 to 264 VAC self-ranging, 100 to 120 VAC nominal 200 to 240 VAC nominal
AC input frequency	Range: 47 to 63 Hz (single phase, 50 to 60 Hz nominal)
Maximum AC input current	6.0 A peak at 100 VAC 3.0 A peak at 208 VAC
Maximum AC inrush current	11 A
Maximum output power for each power supply	450 W

Table 38 UCS C220 M3 SFF 450 W Power Supply Specifications *(continued)*

Description	Specification
Power supply output voltage	Main power: 12 VDC
	Standby power: 12 VDC
Power supply efficiency	CSCI Platinum

> NOTE: AC input connector is an IEC 320 C-14 15A/250VAC power inlet.

The general power specifications for the C220 M3 SFF server 650 W (AC) power supply are listed in *Table 39*.

Table 39 UCS C220 M3 SFF 650 W AC Power Supply Specifications

Description	Specification
AC input voltage	90 to 264 VAC self-ranging,
	100 to 120 VAC nominal
	200 to 240 VAC nominal
AC input frequency	Range: 47 to 63 Hz (single phase, 50 to 60 Hz nominal)
Maximum AC input current	7.6 A peak at 100 VAC
	3.65 A peak at 208 VAC
Maximum AC inrush current	11 A
Maximum output power for the power supply	650 W
Power supply output voltage	Main power: 12 VDC
	Standby power: 12 VDC
Power supply efficiency	CSCI Platinum

> NOTE: AC input connector is an IEC 320 C-14 15A/250VAC power inlet.

The general power specifications for the C220 M3 SFF server 930 W (DC) power supply are listed in *Table 40*

Table 40 UCS C240 M3 SFF Power Specifications 930 W DC power supply)

Description	Specification
Class	■ RSP1
Input	
DC input voltage range	■ 40 to 72 VDC (self-ranging, 48 to 60 VDC nominal)
DC line input current (steady state)	■ 23 A peak at 48 VDC
Output	
12 V main power output	■ 930 W
12 V standby power output	■ 30 W
Power supply output voltage	■ Main power: 12 VDC ■ Standby power: 12 VDC
Rated output load	■ 2.5 A minimum (within 40 - 72 VDC range)

For configuration-specific power specifications, use the Cisco UCS Power Calculator at this URL:

https://express.salire.com/Go/Cisco/Cisco-UCS-Power-Calculator.aspx

Environmental Specifications

The power specifications for the C220 M3 server are listed in *Table 41*.

Table 41 UCS C220 M3 Environmental Specifications

Parameter	Minimum
Temperature operating	41 to 104° F (5 to 40° C) derate the maximum temperature by 1°C per every 305m of altitude above sea level
Temperature nonoperating	–40 to 149°F (–40 to 65°C)
Humidity (RH) nonoperating, non-condensing	10 to 90%
Altitude operating	0 to 3,000 m (0 to 10,000 ft.)
Altitude nonoperating	0 to 12,192 m (0 to 40,000 ft.)
Sound Power level, Measure A-weighted per ISO7779 LWAd (Bels) Operation at 73°F (23°C)	5.4
Sound Pressure level, Measure A-weighted per ISO7779 LpAm (dBA) Operation at 73°F (23°C)	37

Compliance Requirements

The regulatory compliance requirements for C-Series servers are listed in *Table 42*.

Table 42 UCS C-Series Regulatory Compliance Requirements

Parameter	Description
Regulatory Compliance	Products should comply with CE Markings per directives 2004/108/EC and 2006/95/EC
Safety	UL 60950-1 Second Edition CAN/CSA-C22.2 No. 60950-1 Second Edition EN 60950-1 Second Edition IEC 60950-1 Second Edition AS/NZS 60950-1 GB4943 2001
EMC - Emissions	47CFR Part 15 (CFR 47) Class A AS/NZS CISPR22 Class A CISPR22 Class A EN55022 Class A ICES003 Class A VCCI Class A EN61000-3-2 EN61000-3-3 KN22 Class A CNS13438 Class A
EMC - Immunity	EN55024 CISPR24 EN300386 KN24

CISCO

Cisco Catalyst 4500-X Series Fixed 10 Gigabit Ethernet Aggregation Switch

PB696811

Overview

Cisco® Catalyst® 4500-X Series Switch (Figure 1) is a fixed aggregation switch that delivers best-in-class scalability, simplified network virtualization, and integrated network services for space-constrained environments in campus networks. It meets business growth objectives with unprecedented scalability, simplifies network virtualization with support for one-to-many (Cisco Easy Virtual Networks [EVN]) and many-to-one (Virtual Switching System[i] [VSS]) virtual networks, and enables emerging applications by integrating many network services.

The Cisco Catalyst 4500-X Series offers key innovations, including:

- **Platform scalability:** Delivers up-to 800 Gbps of switching capacity, scaling to 1.6-terabit capacity with VSS[i]. Future-proof investment with modular uplink and auto-detect 10 Gigabit Ethernet and 1 Gigabit Ethernet ports.
- **High availability:** These switches deliver the network availability demanded by business-critical enterprise applications through comprehensive high-availability capabilities, including VSS and EVN. Furthermore, innovative features such as redundant hot swappable fans and power supplies with AC to DC, and DC to AC failover remove single point of failure in network.
- **Application monitoring:** Enhanced application monitoring through Flexible Netflow and eight ports of line rate bidirectional Switched Port Analyzer (SPAN)/Remote Switched Port Analyzer (RSPAN). In addition Cisco IOS® XE Software provides the ability to host third-party applications.
- **Security:** Support for Cisco TrustSec™ technology as well as robust control plane policing (CoPP) to address denial of service attacks.

Figure 1. Cisco Catalyst 4500-X Series Switch Family

Cisco Catalyst 4500-X Series Switch Family

Cisco Catalyst 4500-X Series provides scalable, fixed-campus aggregation solutions in space-constrained environments. The solution provides flexibility to build desired port density through two versions of base switches along with optional uplink module. Both the 32- and 16-port versions can be configured with optional network modules and offer similar features. The Small Form-Factor Pluggable Plus (SFP+) interface supports both 10 Gigabit Ethernet and 1 Gigabit Ethernet ports, allowing customers to use their investment in 1 Gigabit Ethernet SFP and upgrade to 10 Gigabit Ethernet when business demands change, without having to do a comprehensive upgrade of the existing deployment. The uplink module is hot swappable.

Following are key offering from this product family:

- 32 x 10 Gigabit Ethernet Port switch with optional module slot (Figure 2)
- 16 x 10 Gigabit Ethernet Port switch with optional module slot[ii] (Figure 3)
- 8 x 10 Gigabit Ethernet Port uplink module (Figure 4)

Figure 2.   32 x 10 Gigabit Ethernet Port Switch with Optional Uplink Module Slot

Figure 3.   16 x 10 Gigabit Ethernet Port Switch with Optional Uplink Module Slot

Figure 4.   8 x 10 Gigabit Ethernet Port Uplink Module

In addition, both 32 port and 16 port versions are available with front-to-back and back-to-front airflow. The front-to-back airflow switch comes with matching burgundy color fan and power supply handle to indicate warm side. Similarly back-to-front airflow switch fan and power supply handles are color coded blue to indicate cool side. Figure 5 and Figure 6 show rear view of the switch with front-to-back and back-to-back airflow respectively.

Figure 5. Front-to-Back Airflow Rear View

Figure 6. Front-to-Back Airflow Rear View

Cisco Catalyst 4500-X switch provides redundant hot swappable fans and power supplies (Figure 7) for highest resiliency with no single point of failure.

Figure 7. Redundant Fan and Power Supply

Cisco Catalyst 4500-X Switch Series Feature Highlights

Cisco Catalyst 4500-X Series Switch provides nonblocking 10 Gigabit Ethernet per port bandwidth and Cisco IOS Flexible NetFlow for optimized application visibility. In addition to this, the enterprise-class Cisco Catalyst 4500-X offers the following:

- **Performance and scalability**
  - 800-Gbps switching capacity with 245 Mpps of throughput
  - External USB and SD card support for flexible storage options
  - 10/100/1000 RJ-45 console and management port
  - IPv6 support in hardware, providing wired-network-rate forwarding for IPv6 networks and support for dual stack with innovative resource utilization
  - Dynamic hardware forwarding-table allocations for ease of IPv4-to-IPv6 migration
  - Scalable routing (IPv4, IPv6, and multicast) tables, Layer 2 tables, and ACL and quality of service (QoS) entries to make use of eight queues per port and comprehensive security policies per port
- **Infrastructure services**
  - Cisco IOS XE Software, the modular open application platform for virtualized borderless services
  - Maximum resiliency with redundant components, Nonstop Forwarding/Stateful Switchover (NSF/SSO), and In-Service Software Upgrade (ISSU) support in a VSS[i] enabled system

- Network virtualization through Multi-VRF technology for Layer 3 segmentation
- Automation through Embedded Event Manager (EEM), Cisco Smart Call Home, AutoQoS, and Auto SmartPorts for fast provisioning, diagnosis, and reporting

- **Cisco Borderless Networks services**

  - Optimized application performance through deep visibility with Flexible NetFlow supporting rich Layer 2/3/4 information (MAC, VLAN, TCP flags) and synthetic traffic monitoring with IP service-level agreement (SLA)

  - Medianet capabilities to simplify video quality of service, monitoring, and security. In addition, multicast features such as Protocol Independent Multicast (PIM) and Source-Specific Multicast (SSM) provide enterprise customers with the additional scalability to support multimedia applications

- **Investment protection and reduced TCO**

  - Cisco Catalyst 4500-X Series eliminates the need for standalone solutions by integrating many network services. Customers can lower the total cost of ownership while streamlining management and accelerating deployment time. Integrated network services available on Cisco Catalyst 4500-X Series include:

    - Application visibility and control (Flexible NetFlow, Cisco IOS Embedded Event Manager)
    - Security with Cisco TrustSec
    - Troubleshooting video or any User Datagram Protocol-based flows (Mediatrace)
    - Video network readiness assessment (built-in traffic simulator)
    - Ability to run third-party applications (Wireshark)

Table 1. Ordering Information

Product Number	Description
Base Switch PIDs	
WS-C4500X-16SFP+[ii]	Catalyst 4500-X 16 Port 10GE IP Base with Single Power Supply, Front-to-Back Cooling i.e. Port Side to Power Supply Cooling
WS-C4500X-24X-ES	Catalyst 4500-X 24 Port 10GE Enterprise Services with Dual Power Supply
WS-C4500X-32SFP+	Catalyst 4500-X 32 Port 10GE IP Base, Front-to-Back Cooling i.e. Port Side to Power Supply Cooling
WS-C4500X-40X-ES	Catalyst 4500-X 40 Port 10G Enterprise Services with Dual Power Supply
C4KX-NM-8SFP+	Catalyst 4500-X 8 Port 10GE Network Module
WS-C4500X-F-16SFP+[ii]	Catalyst 4500-X 16 Port 10GE IP Base, Back-to-Front Cooling i.e. Power Supply to Port Side Cooling
WS-C4500X-F-32SFP+	Catalyst 4500-X 32 Port 10GE IP Base, Back-to-Front Cooling i.e. Power Supply to Port Side Cooling
FRU and OIR FANs	
C4KX-FAN-F	Catalyst 4500-X Back-to-Front Cooling Fan
C4KX-FAN-R	Catalyst 4500-X Front-to-Back Cooling Fan
Power Supply	
C4KX-PWR-750AC-F	Catalyst 4500-X 750W AC Back-to-Front Cooling Power Supply
C4KX-PWR-750AC-R	Catalyst 4500-X 750W AC Front-to-Back Cooling Power Supply
C4KX-PWR-750DC-F	Catalyst 4500-X 750W DC Back-to-Front Cooling Power Supply
C4KX-PWR-750DC-R	Catalyst 4500-X 750W DC Front-to-Back Cooling Power Supply
Accessories	
CAB-CON-C4K-RJ45	Console Cable 6ft with RJ-45-to-RJ-45
SD-X45-2GB-E	Cisco Catalyst 4500 2-GB SD card

Product Number	Description
USB-X45-4GB-E	Cisco Catalyst 4500 4-GB USB device
Software	
S45XU-33-1511SG	Cisco Catalyst 4500-X Cisco IOS Software XE Release 3.3.0 SG noncrypto universal image
S45XUK9-33-1511SG	Cisco Catalyst 4500-X Cisco IOS Software XE Release 3.3.0 SG crypto universal
C4500X-LIC=	Base product ID for software upgrade licenses on Catalyst 4500-X (paper delivery)
C4500X-IPB	Catalyst 4500-X IP BASE software license (paper delivery)
C4500X-IP-ES	Catalyst 4500-X IP BASE to Enterprise Services upgrade license (paper delivery)
L-C4500X-LIC=	Catalyst 4500-X Base product ID for software upgrade licenses (electronic delivery)
L-C4500X-IPB	Catalyst 4500-X IP BASE software license (electronic delivery)
L-C4500X-IP-ES	Catalyst 4500-X IP BASE to Enterprise Services upgrade license (electronic delivery)

For additional information, visit http://www.cisco.com/go/4500x.

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[i] Software Roadmap 2nd Half of CY2012
[ii] Target 2nd Half of CY2012

CHAPTER 1

Introducing the Cisco ASA 5585-X With Cisco MultiScale™

This chapter describes the Cisco ASA 5585-X with Cisco MultiScale™ and includes the following sections:

- Product Overview, page 1-1
- Chassis Features, page 1-4
- Specifications, page 1-11
- Memory Configurations, page 1-12
- Power Supply Module Requirements, page 1-13
- SFP/SFP+ Modules, page 1-14

Note Read through the entire guide before beginning any of the installation procedures.

Warning **Only trained and qualified personnel should install, replace, or service this equipment.** Statement 49

Caution Read the safety warnings in the *Regulatory Compliance and Safety Information for the Cisco ASA 5585-X Adaptive Security Appliance* document and follow proper safety procedures when performing the steps in this guide.

Product Overview

The ASA 5585-X adaptive security appliance featuring MultiScale is a 2RU, two-slot chassis. Supporting one of the highest performance density firewalls in the market, the design of the ASA 5585-X provides high scalability not only in throughput, but also high connection speed as well as maximum connections. Connection speed and maximum connection requirements are growing much faster than throughput in most customer data center networks. The capabilities of the ASA 5585-X help you simultaneously meet scalability challenges in throughput, connection capacity, and connection speed in the data center.

Each ASA 5585-X chassis accommodates up to two AC power supply modules, which contain integrated fans; you can alternatively install a fan module in the second bay. The Security Services Processor (SSP) resides in slot 0 (the bottom slot) and in slot 1 (the top slot) you can install an additional SSP, an optional Intrusion Prevention System Security Services Processor (IPS SSP), an optional Cisco ASA 5585-X CX Security Services Processor (ASA CX SSP), or up to two network modules. All port numbers are numbered from right to left beginning with 0.

Note The ASA 5585-X supports dual firewall mode for the ASA 5585-X SSP-40 and ASA 5585-X SSP-60 models. The SSPs must match; that is, SSP-40s together and SSP-60s together in one chassis.

Note Dual firewall mode is only supported in certain versions of ASA software. For more information, refer to the Cisco ASA Compatibility document found at this URL: http://www.cisco.com/en/US/docs/security/asa/compatibility/asamatrx.html

The ASA 5585-X series comes in four models:

- ASA 5585-X with Security Services Processor-10
- ASA 5585-X with Security Services Processor-20
- ASA 5585-X with Security Services Processor-40
- ASA 5585-X with Security Services Processor-60

In addition to world-class performance, the ASA 5585-X deploys encrypted traffic inspection, port density (up to 20 interfaces depending on the model), and feature performance matching, that is, performance parity between firewall and IPS functions. All ASA 5585-X series adaptive security appliances ship with a core SSP; the additional SSP, IPS SSP, ASA CX SSP, or network module is optional. You must have the core SSP to run the other modules.

Optional redundant, hot-swappable power supply modules are available as well as hot-swappable fan modules in case of a fan failure.

Note Online insertion and removal (OIR) of the SSP, IPS SSP, ASA CX SSP, and network module is not supported at this time. SFP/SFP+, power supply module, and fan module OIR is supported.

ASDM

Additionally, the adaptive security appliance software supports Cisco Adaptive Security Device Manager (ASDM). ASDM delivers world-class security management and monitoring through an intuitive, easy-to-use web-based management interface. Bundled with the adaptive security appliance, ASDM accelerates adaptive security appliance deployment with intelligent wizards, robust administration tools, and versatile monitoring services that complement the advanced integrated security and networking features offered by the market-leading suite of the adaptive security appliance. Its secure, web-based design enables anytime, anywhere access to adaptive security appliances.

The SSP provides environmental monitoring, which tracks the operational status of the fan and power supply modules. In addition, it tracks the temperatures of the CPUs and the ambient temperature of the system.

IDM

The IPS SSP supports the Intrusion Prevention System Device Manager (IDM) 7.1. IDM delivers security management and monitoring through an intuitive, easy-to-use web-based management interface. IDM is a Java Web Start application that enables you to configure and manage your IPS SSP. IDM is bundled with IPS 7.1. You can access it through Internet Explorer or Firefox web browsers.

IME

The Intrusion Prevention System Manager Express (IME) 7.1 also supports the IPS SSP. IME is a network management application that provides system health, events, and collaboration monitoring in addition to reporting and configuration for up to ten sensors. IME monitors sensor health using customizable dashboards and provides security alerts through RSS feed integration from the Cisco Security Intelligence Operations site. It monitors global correlation data, which you can view in events and reports. It monitors events and lets you sort views by filtering, grouping, and colorization. IME also supports tools such, as ping, trace route, DNS lookup, and whois lookup for selected events. It contains a flexible reporting network. It embeds the IDM configuration component to allow for a seamless integration between the monitoring and configuration of IPS devices. Within IME you can set up your sensors, configure policies, monitor IPS events, and generate reports. IME works in single application mode—the entire application is installed on one system and you manage everything from that system.

PRSM

The Cisco Prime Security Manager (PRSM) lets you manage one ASA CX SSP (PRSM Single Device mode) or multiple ASA CX SSPs (PRSM Multiple Device mode). By adding your ASA CX SSPs to the PRSM inventory, you can apply consistent policies among your devices. All configuration is done through PRSM and then deployed to the managed devices, and all events generated by managed devices are shown in PRSM.

ASA 5585-X SSP-10

The ASA 5585-X SSP-10 provides firewall, VPN support, and 10 interfaces (2 SFP/SFP+ and 8 copper Gigabit Ethernet). The SSP-10 has one power supply module and one fan module. You can replace the fan module with another power supply module for a redundant power supply configuration. The SSP-10 has one CPU, three DIMM modules, one embedded crypto accelerator, and one dual-port 10-GB uplink for the SFP/SFP+ interfaces.

You can also order it with the IPS SSP-10, which adds intrusion prevention system protection, and an additional 10 interfaces, or the ASA CX SSP-10, which adds context-aware firewall protection and an additional 10 interfaces.

ASA 5585-X SSP-20

The ASA 5585-X SSP-20 provides firewall, VPN support, and 10 interfaces (2 SFP/SFP+ and 8 copper Gigabit Ethernet). The SSP-20 has one power supply module and one fan module. You can replace the fan module with another power supply module for a redundant power supply configuration. The SSP-20 has one CPU, 6 DIMM modules, two embedded crypto accelerators, and one dual-port 10-GB uplink for the SFP/SFP+ interfaces.

You can also order it with the IPS SSP-20, which adds intrusion prevention system protection, and an additional 10 interfaces, or the ASA CX SSP-20, which adds context-aware firewall protection and an additional 10 interfaces.

ASA 5585-X SSP-40

The ASA 5585-X SSP-40 provides firewall, VPN support, and 10 interfaces (4 SFP/SFP+ and 6 copper Gigabit Ethernet). The SSP-40 has one power supply module and one fan module. You can replace the fan module with another power supply module for a redundant power supply configuration. The SSP-40 has two CPUs, 6 DIMM modules, three embedded crypto accelerators, and two dual-port 10-GB uplinks for the SFP/SFP+ interfaces.

You can also order it with another SSP-40 or the IPS SSP-40, which adds intrusion prevention system protection, and an additional 10 interfaces.

ASA 5585-X SSP-60

The ASA 5585-X SSP-60 provides firewall, VPN support, and 10 interfaces (4 SFP/SFP+ and 6 copper Gigabit Ethernet). The SSP-60 ships with two power supply modules; however, the SSP-60 can function with only one power supply module. Although the SSP-60 with IPS SSP-60 can also operate with only one power supply module, we recommend that you install two power supply modules for extended reliability since the power supply modules operate in load-sharing mode. If one fails in this configuration, the other power supply module can still handle the full load until the failed power supply module is replaced. The SSP-60 has two CPUs, 12 DIMM modules, four embedded crypto accelerators, and two dual-port 10-GB uplinks for the SFP/SFP+ interfaces.

You can also order it with another SSP-60 or the IPS SSP-60, which adds intrusion prevention system protection, and an additional 10 interfaces.

⚠

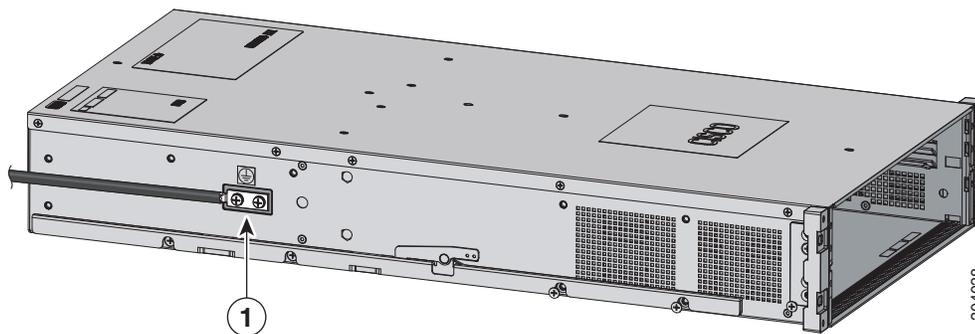**Caution**   If you remove a power supply or fan module, replace it immediately to prevent disruption of service.

Chassis Features

This section describes the ASA 5585-X chassis features and indicators.

Figure 1-1 shows the grounding lug on the left side of the chassis (when facing the front of the chassis).
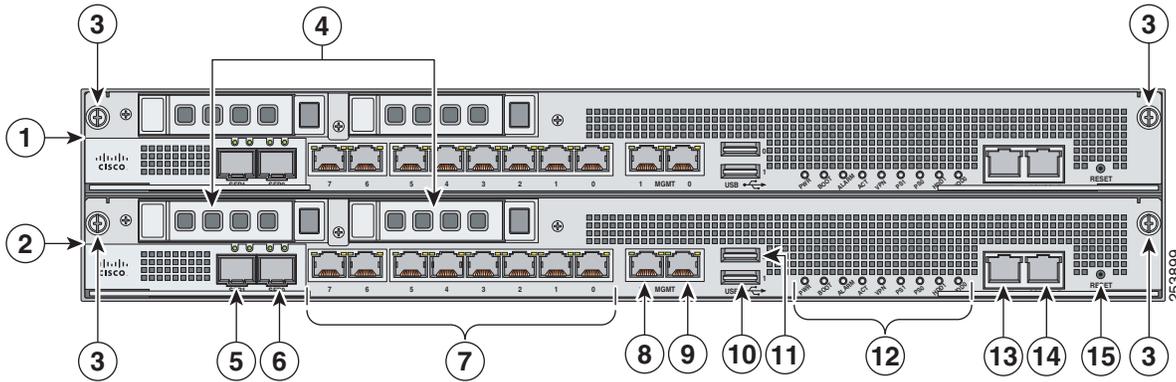
Figure 1-1   ASA 5585-X Side Chassis View

1	Grounding lug		

Figure 1-2 shows the front view of the ASA 5585-X SSP-10 with IPS SSP-10 in the top slot. The illustration shows ASA 5585-X SSP-10 with IPS SSP-10, but it also applies to the ASA 5585-X SSP-10 with ASA CX SSP-10 in the top slot, and the ASA 5585-X SSP-20 with either the IPS SSP-20 or ASA CX SSP-20 in the top slot.

Figure 1-2 **ASA 5585-X SSP-10 With IPS SSP-10 Front Panel View**

1	IPS SSP, ASA CX SSP, or network module (slot 1)	2	Core SSP (slot 0)
3	SSP/IPS SSP/ASA CX SSP removal screws	4	Reserved hard disk drive bays in bottom slot ASA CX SSP hard disk drives in top slot[1]
5	TenGigabitEthernet 0/9 (SSP in slot 0) TenGigabitEthernet 1/9 (IPS SSP or ASA CX SSP in Slot 1) (10-Gb fiber, SFP, or SFP+)	6	TenGigabitEthernet 0/8 (SSP in slot 0) TenGigabitEthernet 1/8 (IPS SSP or ASA CX SSP in slot 1) (10-Gb fiber, SFP, or SFP+)
7	GigabitEthernet 0/0 through 0/7(SSP in slot 0) GigabitEthernet 1/0 through 1/7 (IPS SSP or ASA CX SSP in slot 1) (from right to left, 1-Gb copper, RJ45)	8	Management 0/1 (SSP in slot 0) Management 1/1 (IPS SSP or ASA CX SSP in slot 1) (GigabitEthernet RJ45)
9	Management 0/0 (SSP in slot 0) Management 1/0 (IPS SSP or ASA CX SSP in slot 1) (GigabitEthernet RJ45)	10	USB port
11	USB port	12	Front panel indicators
13	Auxiliary port (RJ45)[2]	14	Console port (RJ45)
15	Eject[3]		

1. Hard disk drives are currently only supported for the ASA CX SSP, which resides in the top slot.

2. The RJ-45 Auxiliary port (labeled AUX on the chassis) is reserved for internal use at Cisco. The port is not functional in shipping versions of the chassis; therefore, customers cannot connect to this port to run the adaptive security appliance CLI.

3. Reserved for future use for OIR.

shows the front view of ASA 5585-X SSP-40 with IPS SSP-40. The illustration shows ASA 5585-X SSP-40 with IPS SSP-40 in the top slot, but it also applies to the ASA 5585-X SSP-40 with an SSP-40 in the top slot, or the ASA 5585-X SSP-60 with an SSP-60 or IPS SSP-60 in the top slot.

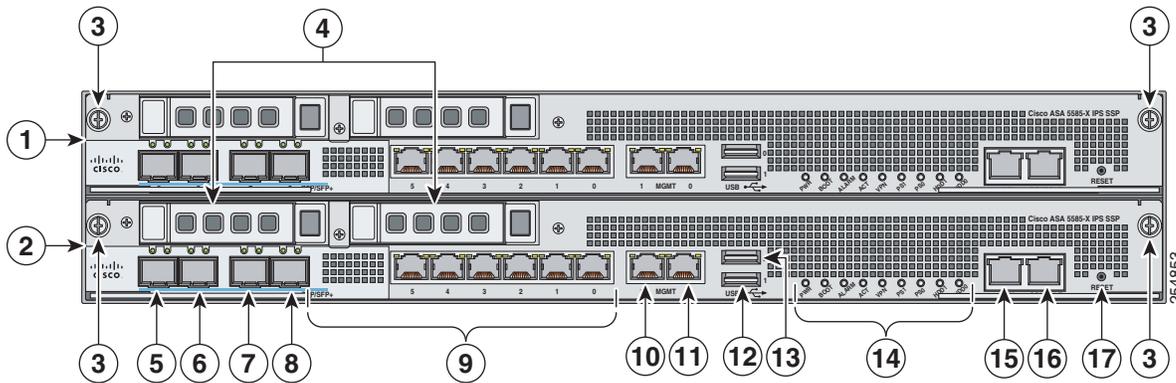*Figure 1-3*   *ASA 5585-X SSP-40 With IPS SSP-40 Front Panel View*

1	IPS SSP, additional SSP, or network module (slot 1)	2	Core SSP (slot 0)
3	SSP/IPS SSP removal screws	4	Reserved bays for hard disk drives[1]
5	TenGigabitEthernet 0/9 (SSP in slot 0) TenGigabitEthernet 1/9 (IPS SSP in slot 1) (10-Gb fiber, SFP, or SFP+)	6	TenGigabitEthernet 0/8 (SSP in slot 0) TenGigabitEthernet 1/8 (IPS SSP in slot 1) (10-Gb fiber, SFP, or SFP+)
7	TenGigabitEthernet 0/7 (SSP in slot 0) TenGigabitEthernet 1/7 (IPS SSP in slot 1) (10-Gb fiber, SFP, or SFP+)	8	TenGigabitEthernet 0/6 (SSP in slot 0) TenGigabitEthernet 1/6 (IPS SSP in slot 1) (10-Gb fiber, SFP, or SFP+)
9	GigabitEthernet 0/0 through 0/5 (SSP in slot 0) GigabitEthernet 1/0 through 1/5 (IPS SSP in slot 1) (from right to left, 1-Gb copper, RJ45)[2]	10	Management 0/1 (SSP in slot 0) Management 1/1 (IPS SSP in slot 1) (GigabitEthernet RJ45)
11	Management 0/0 (SSP in slot 0) Management 1/0 (IPS SSP in slot 1) (GigabitEthernet RJ45)	12	USB port
13	USB port	14	Front panel indicators
15	Auxiliary port (RJ45)[3]	16	Console port (RJ45)
17	Eject[4]		

1. Hard disk drives are not supported at this time. The hard disk drive bays are empty.

2. The IPS ports are GigabitEthernet1/0 through 1/5.

3. The RJ-45 Auxiliary port (labeled AUX on the chassis) is reserved for internal use at Cisco. The port is not functional in shipping versions of the chassis; therefore, customers cannot connect to this port to run the adaptive security appliance CLI.

4. Reserved for future use for OIR.

Figure 1-4 shows the front panel indicators.

Figure 1-4   ASA 5585-X Front Panel Indicators
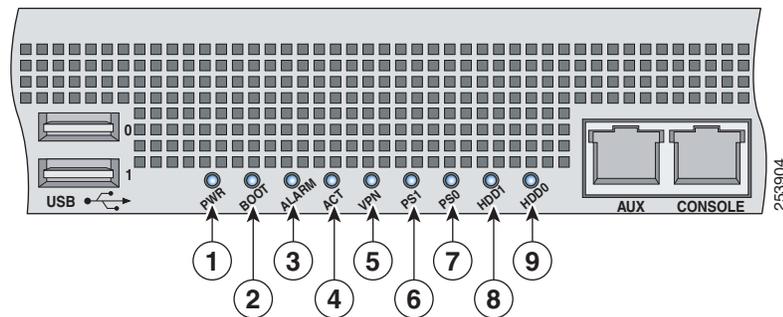
1	PWR	**2**	BOOT
3	ALARM	**4**	ACT
5	VPN	**6**	PS1
7	PS0	**8**	HDD1
9	HDD2		

Table 1-1 describes the front panel indicators on the ASA 5585-X.

Table 1-1   ASA 5585-X Front Panel Indicators

Indicator	Description
PWR	Indicates whether the system is off or on: • Off—No power. • Green—System has power.
BOOT	Indicates how the power-up diagnostics are proceeding: • Flashing green—Power-up diagnostics are running or the system is booting. • Green—System has passed power-up diagnostics. • Amber—Power-up diagnostics failed.
ALARM	Indicates whether a component has failed: • Off—No alarm. • Flashing yellow—Critical alarm. Major failure of hardware component or software module, temperature over the limit, power out of tolerance, or OIR is ready to remove the module.[1]
ACT	Indicates the status of an HA pair: • Green—Status of a unit that is part of a failover pair that is in active mode. • Amber—Status of a unit that is part of a failover pair that is in standby mode.
VPN	Indicates whether a VPN tunnel has been established: • Green—VPN tunnel is established.

Table 1-1   **ASA 5585-X Front Panel Indicators (continued)**

Indicator	Description
PS1	Indicates the state of the power supply module installed on the right when facing the back panel: • Off—No power supply module present or no AC input. • Green—Power supply module present, on, and good. • Amber—Power or fan module off or failed.
PS0	Indicates the state of the power module installed on the left when facing the back panel: • Off—No power supply module present or no AC input. • Green—Power supply module present, on, and good. • Amber—Power or fan module off or failed.
HDD1	Indicates activity on the hard disk drive:[2] • Off—No hard disk drive present. • Flashing green—hard disk drive activity. • Amber—hard disk drive failure.
HDD2	Indicates activity on the hard disk drive:[2] • Off—No hard disk drive present. • Flashing green—hard disk drive activity. • Amber—hard disk drive failure.

1. OIR is not available at this time.

2. The hard disk drives are only supported on the ASA CX SSP.

Figure 1-5 shows the back panel features.

Figure 1-5   *ASA 5585-X Back Panel Features*
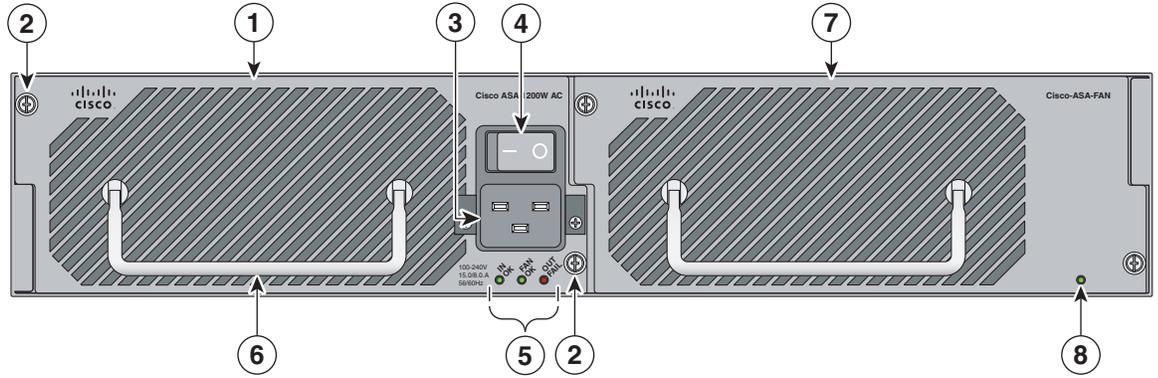
1	Power supply module (corresponds to PS1 indicator)	**2**	Power supply module/fan module removal screws
3	Power supply module plug	**4**	Toggle On/Off switch for power supply module
5	Power supply module indicators	**6**	Power supply module or fan module handle
7	Fan module	**8**	Fan module indicator

Figure 1-6 shows the power supply module indicators.

Figure 1-6   *ASA 5585-X Power Supply Module Indicators*
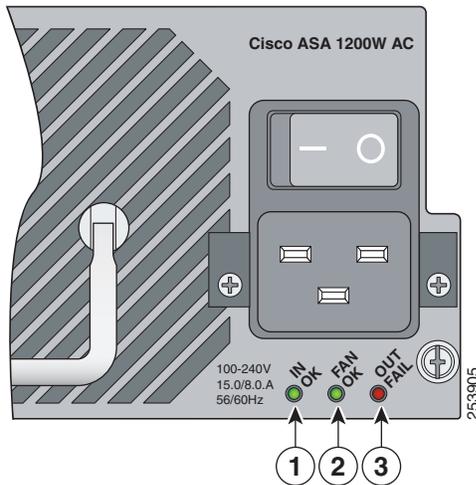
1	IN OK	**2**	FAN OK
3	OUT FAIL		

Table 1-2 describes the power supply module and fan module indicators.

Table 1-2   Power Supply Module and Fan Module Indicators

Indicator	Description
IN OK	Indicates status of power supply module: • Off—No AC power cord connected or AC power switch off. • Green—AC power cord connected and AC power switch on.
FAN OK	Indicates status of fan module • Off—Fan module failure or AC power switch off. • Green—AC power cord connected, AC power switch on, and internal fan is running.
OUT FAIL	• Red—Output voltage failure[1]

1. The power supply module has three output voltages—3.3V, 12V, and 50V.

Table 1-3 describes the Ethernet port indicators.

Table 1-3   Ethernet Port Indicators

Indicator	Description

Gigabit Ethernet (RJ45)	• Left side:
	  – Green—Physical activity
	  – Flashing green—Network activity
	• Right side:
	  – Not lit—10 Mbps
	  – Green—100 Mbps
	  – Amber—1000 Mbps

Table 1-3   Ethernet Port Indicators (continued)

Indicator	Description

10-Gigabit Ethernet Fiber (SFP+)/1-Gigabit Ethernet Fiber (SFP)	• Left side:
	  – Off—No 10-Gigabit Ethernet physical link
	  – Green—10-Gigabit Ethernet physical link
	  – Flashing green[1]—Network activity
	• Right side:
	  – Off—No 1-Gigabit Ethernet physical link
	  – Green—1-Gigabit Ethernet physical link
	  – Flashing green[1]—Network activity

Management port	• Left side:
	  – Green—Physical activity
	  – Flashing green—Network activity
	• Right side:
	  – Not lit—10 Mbps
	  – Green—100 Mbps
	  – Amber—1000 Mbps

1. Flashing is in proportion to the percentage of number of packets or bytes received.

Specifications

Table 1-4 lists the specifications for the ASA 5585-X.

Table 1-4   ASA-5585-X Specifications

Dimensions and Weight	
Height	3.47 in (8.8 cm)
Width	19 in (48.3 cm)
Depth	26.5 in (67.3 cm)
Weight	50 lb (22.7 kg) with 1 SSP and 1 power supply module 62 lb (28.20 kg) with SSP, IPS SSP, and 2 power supply modules
Form factor	2 RU, standard 19-inch rack-mountable
Power	
AC Input	
Rated input voltage (per power supply module)	100 to 240 VAC
Rated input frequency	50 to 66 Hz
Rated input power (per power supply module)	1161 W @ 100 VAC 1598 W @ 200 VAC

Table 1-4   *ASA-5585-X Specifications (continued)*

Rated input current (per power supply module)	12A (100 VAC) 8A (200 VAC)
Typical heat dissipation	1280 BTU/hr (1 SSP) 2200 BTU/hr (2 SSPs)
Power supply output steady state (typical)	320 W (1 SSP) 670 W (1 SSP and 1 IPS SSP)
Maximum peak	370 W (1 SSP) 770 W (1 SSP and 1 IPS SSP)
DC Input	
Rated input voltage (per power supply module)	-48 VDC to -60 VDC
Rated input power (per power supply module)	1353 W @ -48 VDC 1403 W @ -60 VDC
Rated input current (per power supply)	33 A
Maximum heat dissipation	5450 BTU/hr
Power supply output steady state (typical)	320 W (1 SSP) 670 W (1 SSP and 1 IPS SSP)
Maximum peak	370 W (1 SSP) 770 W (1 SSP and 1 IPS SSP)
Environment	
Temperature	Operating 32 to 104°F (0 to 40°C) Nonoperating -40°F to 158°F (-40°C to 70°C)
Airflow	Front to back
Relative humidity (noncondensing)	Operating 10% to 90% Nonoperating 5% to 95%
Altitude	Operating 0 to 10,000 ft (3,050 m) Nonoperating 0 to 30,000 ft (9,144 m)
Noise	65 dBa max

Memory Configurations

The ASA 5585-X has up to 6 DIMM modules per CPU. DIMM population is platform-dependent. Table 1-5 shows the memory configurations.

Table 1-5   *ASA 5585-X Memory Configurations*

Model	SSP Memory	IPS SSP Memory
ASA 5585-X with SSP-10	6-GB DRAM	6-GB DRAM
ASA 5585-X with SSP-20	12-GB DRAM	12-GB DRAM

Table 1-5   ASA 5585-X Memory Configurations (continued)

Model	SSP Memory	IPS SSP Memory
ASA 5585-X with SSP-40	12-GB DRAM	24-GB DRAM
ASA 5585-X with SSP-60	24-GB DRAM	48-GB DRAM

Note   The IPS SSP or ASA CX SSP must be at the same level as the SSP model; for example, if you have the ASA 5585-X SSP-10, you can only install the IPS SSP-10.

Power Supply Module Requirements

Table 1-6 lists the power supply module requirements for the AC and DC power supply modules.

Table 1-6   Power Supply Module Requirements

AC Power Supply Module	50 V	12 V	3.3 V_STBY
Output Voltage			
Maximum	52.0 V	12.2 V	3.45 V
Nominal	50.0 V	12.0 V	3.35 V
Minimum	48.0 V	11.8 V	3.25 V
Output Current @ 200 VAC			
Maximum	17.3 A	27.0 A	1.5 A
Minimum	0	0	0
Output Current @ 100 VAC			
Maximum	17.3 A	27.0 A	1.5 A
Minimum	0	0	0
DC Power Supply Module	**50 V**	**12 V**	**3.3 V_STBY**
Output Voltage			
Maximum	52.0 V	12.45 V	3.45 V
Nominal	50.0 V	12.0 V	3.35 V
Minimum	48.0 V	12.05 V	3.25 V
Output Current @ -48 VDC			
Maximum	17.3 A	23.0 A	1.5 A
Minimum	0	0	0
Output Current @ -60 VDC			
Maximum	17.3 A	23.0 A	1.5 A
Minimum	0	0	0

SFP/SFP+ Modules

The SFP/SFP+ module is a hot-swappable input/output device that plugs into the SFP/SFP+ ports and provides Gigabit Ethernet connectivity. The SFP and SFP+ modules are optional and not included with the ASA 5585-X. You can purchase them separately. For 1 Gb, you need SFP. For 10Gb, you need SFP+. The two ports are the same, but you can only use 10 Gb if you buy a license for the SSP-10 and IPS-20. Otherwise, the ports are restricted to 1 Gb. The ports are always 10 Gb-enabled for the SSP-40 and IPS-60. The interfaces are called TenGigabitEthernet 0/x for the SSP and TenGigabitEthernet 1/x for the ASA 5585-X IPS SSP whether they are 10 Gb-enabled or not.

Table 1-7 lists the SFP/SFP+ modules that the ASA 5585-X supports.

Table 1-7   SFP/SFP+ Modules

1G SFP Module	
GLC-SX-MM	1000 Base-SX SFP module
GLC-SX-MMD	1000BASE-SX short wavelength, with DOM
GLC-LH-SM	1000 Base-LX/LH SFP module
GLC-LH-SMD	1000BASE-LX/LH long-wavelength, with DOM
GLC-EX-SMD	1000 Base-EX SFP module, SMF, 1310nm, DOM
GLC-T	1000BASE-T standard
10G SFP+ Module	
SFP-10G-ER	10G ER SFP+ module
SFP-10G-SR	10G SR SFP+ module
SFP-10G-LRM	10G LRM SFP+ module
SFP-10G-LR	10G LR SFP+ module
SFP-H10GB-ACU7M	10GBASE-CU SFP+ Cable 7 Meter, active
SFP-H10GB-ACU10M	10GBASE-CU SFP+ Cable 10 Meter, active
SFP-H10GB-CU1M	10GBASE-CU SFP+ cable 1 meter, passive
SFP-H10GB-CU3M	10GBASE-CU SFP+ cable 3 meter, passive
SFP-H10GB-CU5M	10GBASE-CU SFP+ cable 5 meter, passive

Cisco ONS 15216 4-Channel Optical Add/Drop Multiplexers

The Cisco ONS 15216 4 Channel Optical Add/Drop Multiplexers (OADMs) are a set of passive OADMs that allow the Cisco ONS 15454 Multiservice Transport Platform (MSTP) to address the edge of the optical network in a cost-effective manner without sacrificing operational ease of use. The Cisco ONS 15216 4 Channel OADMs are well suited to applications with minimal wavelength requirements and tight space and power constraints, such as cell site and customer premises terminations. Ten models are available, covering a 40-channel 100-GHz channel plan.

Figure 1. The Cisco ONS 15216 4 Channel Optical Add/Drop Multiplexer

Applications

The Cisco ONS 15216 4 Channel OADM supports standard network topologies such as point-to-point and ring. With the introduction of omnidirectional and colorless reconfigurable optical add-drop multiplexer (ROADM) functionality on the Cisco ONS 15454 MSTP, the combined products allow additional network topologies, such as the termination of a spur or rings, originating on a Cisco ONS 15216 4 Channel OADM, into the colorless ports of the ROADM node (Figure 2). This configuration does not consume a ROADM degree, allowing the node to scale beyond eight directions of connectivity in a mesh-ROADM application.

Figure 2. OADM Nodes in a Spur Configuration Interconnecting with a Colorless Mesh ROADM Node
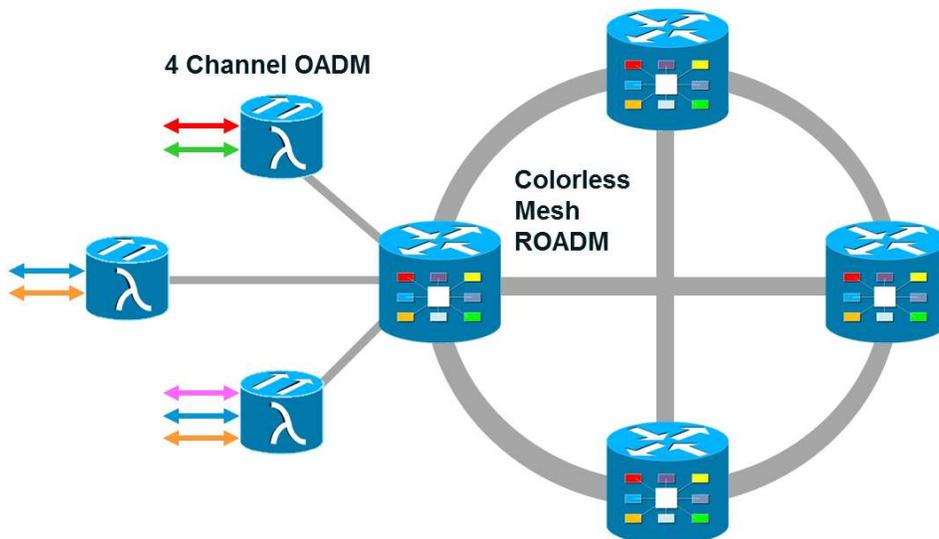
Another application for the Cisco ONS 15216 4-channel OADMs is as the add/drop stage of a single-module ROADM node. When only a small number of channels are required to add/drop at a ROADM node, using one or more 4-channel OADMs can save costs and space compared to the typical configuration using the Cisco ONS 15216 Mux/Demux 40 Channel Patch Panel. When the number of add/drop channels exceeds the deployed capacity of the OADMs, additional units can be added or replaced with a Cisco ONS 15216 Mux/Demux 40 Channel Patch Panel without affecting the service of existing pass-through channels.

Figure 3.   An OADM Used as the Add/Drop Stage of a Single-Module ROADM
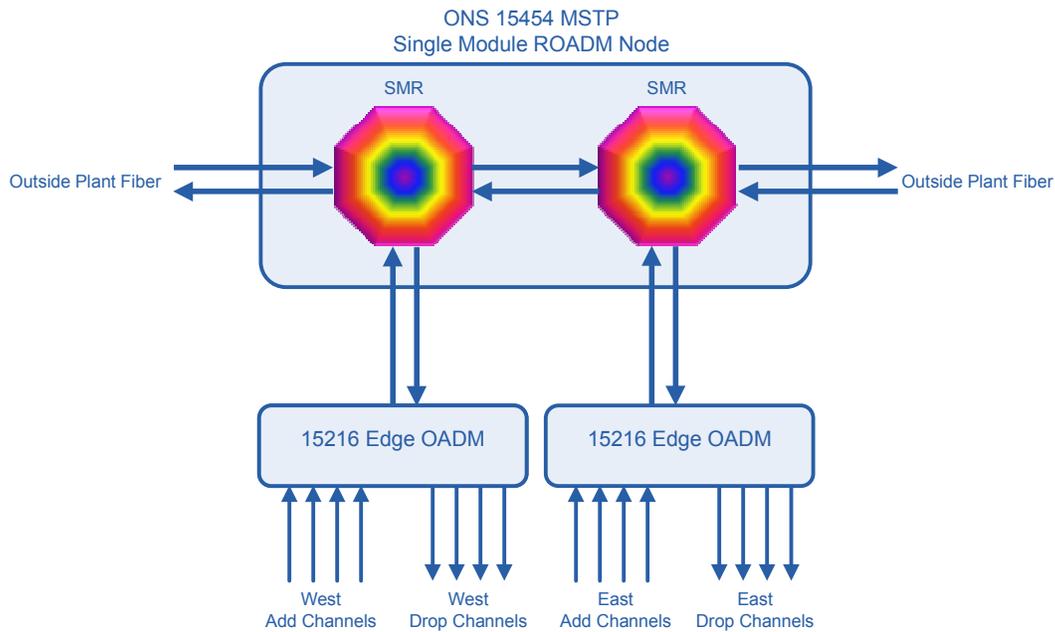
Edge Mounting Bracket

A Cisco ONS 15216 4 Channel OADM occupies a single position in the Cisco ONS 15216 Edge Mounting Bracket. The mounting bracket occupies one rack unit (1RU) and mounts into a standard-19-inch rack. It has four positions for mounting OADMs.

Figure 4.   Up to Four OADMs Mount into a 1RU Edge Mounting Bracket

Features and Benefits

The Cisco ONS 15216 4 Channel OADM provides the following customer benefits:

- Cost-effective DWDM add/drop capability
- Best-in-class operational efficiency, with zero electrical power requirements
- High port density: four OADMs can be mounted in a 1RU bracket
- Low optical insertion loss for improved distance and performance
- USB port for passive inventory management

- Cisco Transport Controller (CTC) manageability for advanced fault isolation
- CTP support for efficient network design verification

Product Specifications

Tables 1 through 4 provide optical, mechanical, and compliance specifications for the Cisco ONS 15216 4 Channel OADMs.

Table 1. Cisco ONS 15216 4 Channel OADM Channel Plan

Product ID	Channel ID	Frequency (THz)	Wavelength (nm)
15216-FLD-4-30.3=	1	195.9	1530.33
15216-FLD-4-30.3=	2	195.8	1531.12
15216-FLD-4-30.3=	3	195.7	1531.90
15216-FLD-4-30.3=	4	195.6	1532.68
15216-FLD-4-33.4=	5	195.5	1533.47
15216-FLD-4-33.4=	6	195.4	1534.25
15216-FLD-4-33.4=	7	195.3	1535.04
15216-FLD-4-33.4=	8	195.2	1535.82
15216-FLD-4-36.6=	9	195.1	1536.61
15216-FLD-4-36.6=	10	195.0	1537.40
15216-FLD-4-36.6=	11	194.9	1538.19
15216-FLD-4-36.6=	12	194.8	1538.98
15216-FLD-4-39.7=	13	194.7	1539.77
15216-FLD-4-39.7=	14	194.6	1540.56
15216-FLD-4-39.7=	15	194.5	1541.35
15216-FLD-4-39.7=	16	194.4	1542.14
15216-FLD-4-42.9=	17	194.3	1542.94
15216-FLD-4-42.9=	18	194.2	1543.73
15216-FLD-4-42.9=	19	194.1	1544.53
15216-FLD-4-42.9=	20	194.0	1545.32
15216-FLD-4-46.1=	21	193.9	1546.12
15216-FLD-4-46.1=	22	193.8	1546.92
15216-FLD-4-46.1=	23	193.7	1547.72
15216-FLD-4-46.1=	24	193.6	1548.51
15216-FLD-4-49.3=	25	193.5	1549.32
15216-FLD-4-49.3=	26	193.4	1550.12
15216-FLD-4-49.3=	27	193.3	1550.92
15216-FLD-4-49.3=	28	193.2	1551.72
15216-FLD-4-52.5=	29	193.1	1552.52
15216-FLD-4-52.5=	30	193.0	1553.33
15216-FLD-4-52.5=	31	192.9	1554.13
15216-FLD-4-52.5=	32	192.8	1554.94
15216-FLD-4-55.7=	33	192.7	1555.75
15216-FLD-4-55.7=	34	192.6	1556.55
15216-FLD-4-55.7=	35	192.5	1557.36
15216-FLD-4-55.7=	36	192.4	1558.17

Product ID	Channel ID	Frequency (THz)	Wavelength (nm)
15216-FLD-4-58.9=	37	192.3	1558.98
15216-FLD-4-58.9=	38	192.2	1559.79
15216-FLD-4-58.9=	39	192.1	1560.61
15216-FLD-4-58.9=	40	192.0	1561.42

Table 2.   Optical Specifications

Parameters	Minimum	Maximum
Maximum input optical power	500 mW	
Add/drop insertion loss	1.0 dB	2.5 dB
Express insertion loss	0.5 dB	1.5 dB
Drop adjacent channel isolation	25 dB	
Drop nonadjacent channel isolation	40 dB	
Add adjacent channel isolation	25 dB	
Add nonadjacent channel isolation	40 dB	
Return loss	45 dB	
Monitor add/drop loss	17.5 dB	21.5 dB
Filter type	Thin film filter	Thin film filter
Polarization dependent loss (PDL)	0.2 dB	0.2 dB
Polarization mode dispersion (PMD)	0.1 ps	0.1 ps
Group delay ripple		10 ps
Chromatic dispersion (CD)		± 40.0 ps/nm

Table 3.   Environmental and Mechanical Specifications for Cisco ONS 15216 4 Channel OADM and Edge Mounting Bracket

Device	Parameters	Minimum	Maximum
15216-HD-EXT-PNL= 15216-FLD-4-xx.x=	Operating temperature range	32℉ (0℃)	158℉ (+70℃)
15216-HD-EXT-PNL= 15216-FLD-4-xx.x=	Storage temperature range	−40℉ (−40℃)	185℉ (+85℃)
15216-HD-EXT-PNL=	Height		1.744 in. (44.298 mm)
	Width		19 in. (482.6 mm)
	Depth		0.394 in. (10.018 mm)
	Weight		0.5 lb (0.22679618 kg)
	Humidity	5% noncondensing	95% noncondensing
15216-FLD-4-xx.x=	Height		0.669 in. (16.993 mm)
	Width		7.047 in (178.994 mm)
	Depth		6.496 in. (164.998 mm)
	Weight		2 lb (0.91 kg)
	Humidity	5% noncondensing	95% noncondensing
	USB port power	400 mW	600 mW
Connector type	LC UPC II		
USB	Type A		

Table 4.   Regulatory Compliance

Description	Specification
Safety	GR-1089 UL60950/CSA 22.2 No. 60950-00 IEC 60950
Environmental	GR-63-CORE

Table 5 provides ordering information for the Cisco OSC OADM and Edge Mounting Bracket.

Table 5.   Ordering Information

Part Number	Product Name
15216-HD-EXT-PNL=	Edge Mounting Bracket
15216-FLD-4-30.3=	Edge 4-Ch Bi-Directional OADM Mod1530.33 to 1532.68
15216-FLD-4-33.4=	Edge 4-Ch Bi-Directional OADM Mod1533.47 to 1535.82
15216-FLD-4-36.6=	Edge 4-Ch Bi-Directional OADM Mod1536.61 to 1538.98
15216-FLD-4-39.7=	Edge 4-Ch Bi-Directional OADM Mod1539.77 to 1542.14
15216-FLD-4-42.9=	Edge 4-Ch Bi-Directional OADM Mod1542.94 to 1545.32
15216-FLD-4-46.1=	Edge 4-Ch Bi-Directional OADM Mod1546.12 to 1548.51
15216-FLD-4-49.3=	Edge 4-Ch Bi-Directional OADM Mod1549.32 to 1551.72
15216-FLD-4-52.5=	Edge 4-Ch Bi-Directional OADM Mod1552.52 to 1554.94
15216-FLD-4-55.7=	Edge 4-Ch Bi-Directional OADM Mod1555.75 to 1558.17
15216-FLD-4-58.9=	Edge 4-Ch Bi-Directional OADM Mod1558.98 to 1561.42

To place an order, visit the Cisco Ordering Home Page. To download software, visit the Cisco Software Center.

For More Information

For more information, visit ONS 15216, or contact your local account representative. Also visit Cisco End-of-Life Policy and Subscribe to receive end-of-life and end-of-sale information.

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Cisco ONS 15454 M2 Multiservice Transport Platform

Product Overview

The Cisco® ONS 15454 M2 Multiservice Transport Platform (MSTP) sets the industry benchmark forcompact, simple, fast, and intelligent dense wavelength-division multiplexing (DWDM) solutions. Its compact form, simplicity, and low power consumption reduce capital expenditures (CapEx) and operating expenses (OpEx). The Cisco ONS 15454 M2 (Figure 1) is compatible with the existing portfolio of Cisco ONS 15454 MSTP line cards, thereby offering a multitude of MSTP applications in a smaller footprint. From access aggregation solutions with the integrated AC power module to core applications such as optical line amplifiers with an optical service channel (OSC), the flexible Cisco ONS 15454 M2 supports a broad range of solutions.

Figure 1.   Cisco ONS 15454 M2 Multiservice Transport Platform

Key Features and Benefits

The Cisco ONS 15454 M2 chassis has one slot for the control card and two slots for service cards.These two line-card slots provide increased power and cooling capability over the original Cisco ONS 15454 chassis, and a usable high-speed backplane for future applications. You can configure the M2 with integrated DC or AC power inputs. The DC power module has inputs for redundant A and B feeds. The integrated AC power module has a single input and is universal in that it accepts a power input ranging from 110to 240VAC, 50 to 60 Hz. With its front-facing connections, the M2 is ideal for cabinet installations and ETSI front-connection requirements, making this platform truly global.

Although a single processor card controls the node, the Cisco ONS 15454 M2 has a built-in memory module to backup the software package, IP address, and circuit database (Figure 2). This backup capability improves mean time to repair (MTTR) and increases operational simplicity. Also new to the M2 is the ability to connect, via through

a USB port, to a Cisco ONS passive device for inventory management. Some Cisco ONS 15216 passive devices, such as the single-module reconfigurable optical add/drop multiplexer (SM-ROADM) patch panel, have an erasable programmable ROM (EEPROM) in the device that the M2 can be readable by the M2 and therefore will show up appears in the Cisco Transport Controller inventory management pane.

You can mount the Cisco ONS 15454 M2 MSTP in 19-, 21-, or 23-inch racks or cabinets.Brackets come with the Shelf Assembly and can also be ordered as spares.Optional air deflectors can be used in 21" and 23" installations With 19-inch brackets, the airflow is right to left; with 21-inch brackets, airflow can be selected as right to left; right front in, and left front out; left up out; or left back out. With 23-inch brackets, airflow is from right front in to left back out.

The Cisco ONS 15454 M2 MSTP has a single high-capacity fan-tray assembly where the three fans are individually monitored and controlled. If a single fan fails (unlikely), you receive a fan fail alarm and the other fans increase in speed to provide sufficient airflow to give you time to safely replace the fan tray.

Doors are optional and hence do not come with the Shelf Assembly. They can be ordered as spares.

Specifically designed for the new M2 platform are new control cards that consolidate the functions of the control card, OSC termination, and increased alarms into just one card. Virtually all MSTP applications that were possible with the original 12-service-slot MSTP chassis are now supported in the more compact M2 chassis. The OSC now also supports Fast Ethernet and Gigabit Ethernet connections, in addition to OC-3/STM-1, giving you more bandwidth for use with the user data channel.

Figure 2.   Cisco ONS 15454 M2 MSTP Modules
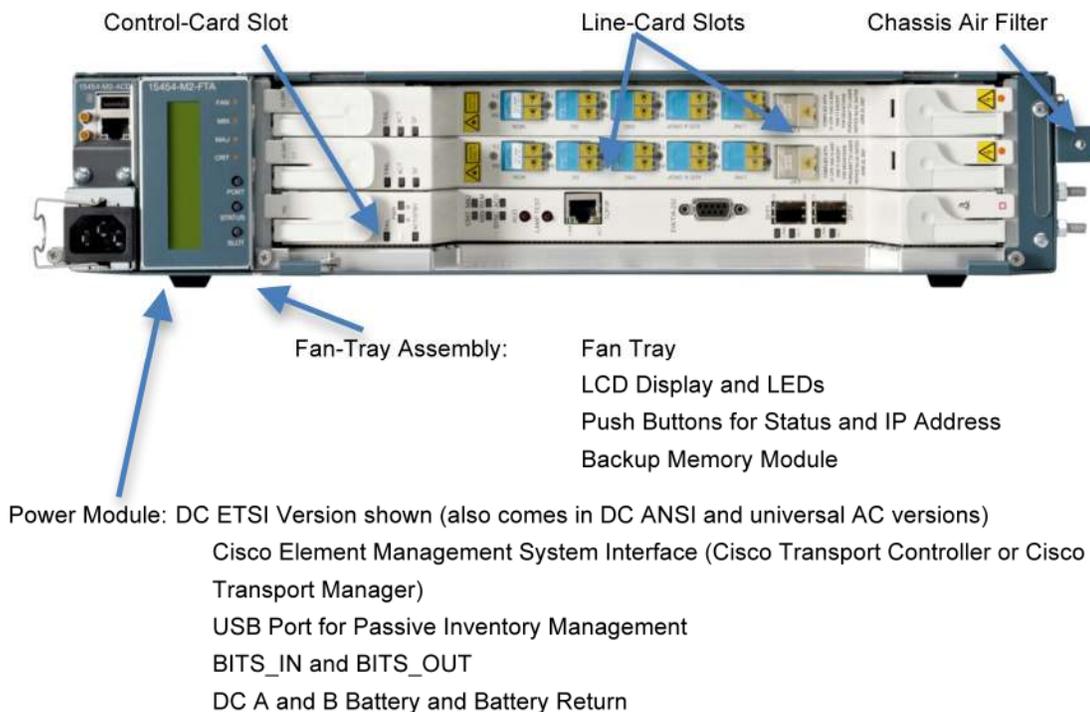
The Cisco ONS 15454 M2 MSTP provides capital and operational efficiency by addressing the increasing demand for bandwidth and multiple services at the edge of the network. It uses the existing Cisco Transport Controller management and integrates well with other optical transport platforms. With innovative technology, the Cisco ONS 15454 M2 MSTP pushes intelligence to the edge of the network, thus allowing the optimization of next-generation networks across multiple layers and removing costly optical-electrical-optical (OEO) devices for network segmentation or regeneration.

The Cisco ONS 15454 M2 MSTP carries on the existing features such as multilayer graphical network, node, and card visibility; A-to-Z network-based service provisioning; and graphical software wizards to simplify and speed user operations for such tasks as initial network turn-up; service provisioning; and network, node, and bandwidth upgrades. The Cisco ONS 15454 M2 MSTP takes advantage of the embedded software architecture and control plane to introduce a level of operational simplicity unheard of in DWDM networks.

In addition to the integrated software features, the Cisco ONS 15454 M2 MSTP is supported by an easy-to-use but powerful network design tool, the Cisco Transport Planner. The Cisco Transport Planner is a user-friendly, Java-based application (fully developed and tested by Cisco) for modeling and optimizing DWDM networks based on the user's network parameters.

Topology Flexibility

One recent core network trend is the consolidation of multiple Layer 2/3 networks into a single IP/Multiprotocol Label Switching (IP/MPLS) infrastructure. In spite of this Layer 2/3 convergence, however, the underlying transport layer (Layer 1) of many service provider core networks has continued to use SONET/SDH. Many service provider networks globally still use SONET/SDH today, creating OpEx and CapEx concerns for service providers as well as the challenges of profitability and return on investment (ROI). Some network inefficiencies result from the way core transport networks are built out today to support the IP or service layer over the SONET/SDH layer, supported by an underlying DWDM infrastructure. The OEO conversions and the associated electrical processing directed by the layered network architecture result in an additional cost in terms of space, because many racks of shelves may be required in a service provider point of presence (POP), as well as the additional power and cooling that is necessary because of the active electronics components that they contain.

You can configure the Cisco ONS 15454, ONS15454 M6, and ONS 15454 M2 MSTP chassis to support any edge, metro, regional, or core DWDM topology, allowing you to use a unified solution for the overall network, independently from the topology and reach. The ultimate topology flexibility is achieved through a set of fully reconfigurable optical add/drop multiplexers (ROADMs). Multidegree ROADMs (2 through 8 degrees of freedom) allow wavelengths to remain in the optical domain while being passed from one ring or network segment to another, further eliminating the need for OEO conversions and using the ability of core routers to initiate DWDM-compatible wavelengths.

The Cisco ONS 15454 M2 MSTP with the single-module ROADM offers a tremendous decrease in footprint, power requirements, and patch-cable complexity over the first-generation ROADM. You can use the SM-ROADM in an M2 for edge DWDM solutions where east and west are on separate nodes.

Product Specifications

Table 1 lists the modules that make up the Cisco ONS 15454 M2 MSTP.

Table 1. Cisco ONS 15454 M2 Modules

Module	Part Number
Common Equipment for the Cisco ONS 15454 M2	
Shelf Assembly with brackets	15454-M2-SA
Chassis door (optional), and deep door version	15454-M2-DR, 15454-M2-DDR
Fan-Tray Assembly with LCD Status and Backup Memory	15454-M2-FTA, 15454-M2-FTA2
Chassis air filter	15454-M2-FTF
Power Options	
DC power module with ANSI power connector	15454-M2-DC
With element management solution connection	
With USB connection to passive Cisco ONS device for inventory management	
With Building Integrated Timing Supply (BITS) 1 input and output	
DC power module with ETSI power connector	15454-M2-DC–E
With element management solution connection	
With USB connection to passive Cisco ONS device for inventory management	
With BITS 1 input and output	
AC power module with universal IEC power connector	15454-M2-AC
With element management solution connection	
With USB connection to passive Cisco ONS device for inventory management	
With BITS 1 input and output	
Brackets and Air Deflectors (Optional spares)	
19-in., 21-in., and 23-in. brackets	15454-M2-BRKT
21-in. air deflectors	15454-M2-DEFL21
23-in. air deflectors	15454-M2-DEFL23
Wall-mount bracket	15454-M2-WM
Common Equipment for the Cisco ONS 15454 M6 and M2	
Transport Node Controller (TNC) card	15454-M-TNC
Transport Shelf Controller (TSC) card	15454-M-TSC
Enhanced TNC card	15454-M-TNCE
Enhanced TSC card	15454-M-TSCE
Slot Filler Cards	
Line-card blank	15454-BLANK
Line-card slot-detectable filler	15454-M-FILLER
Control-card slot-detectable filler	15454-M-T-FILLER
Cisco ONS 15454 M6 power-module blank filler	15454-M6-PWRFLR

Table 2. Cisco ONS 15454 M6 Cables

Product Name	Description	Length	Gauge	Connector 1	Connector 2
15454-M-120TMGCBL(=)	BITS IN/OUT cable for ANSI	0.6 m	COAX 23 AWG	DIN 1.0/2.3	2 WIRE WRAP PINS
15454-M2-DCCBL-LE(=)	DC power cable for ETSI left exit	10 m	12 AWG	Power D-Sub 2 poles	none
15454-M6-DCCBL-LE(=)	DC power cable for ETSI left exit	10 m	8 AWG	Power D-Sub 3 poles	none
15454-M6-DCCBL-RE(=)	DC power cable for ETSI right exit	10 m	8 AWG	Power D-Sub 3 poles	none
15454-M-ACCBL-L(=)	AC power cable ANSI 110 Vac left exit	3 m	15A – 125V	C13	NEMA 5-15P
15454-M-ACCBL-L2(=)	AC power cable ANSI 220 Vac left exit	3 m	15A – 250V	C13	NEMA 6-15P
15454-M-ACCBL-R(=)	AC power cable ANSI 110 Vac right exit	3 m	15A – 125V	C13	NEMA 5-15P

Product Name	Description	Length	Gauge	Connector 1	Connector 2
15454-M-ACCBL-R2(=)	AC power cable ANSI 220 Vac right exit	3 m	15A – 250V	C13	NEMA 6-15P
15454-M-ACL6-L(=)	AC power cable for Data Center	3 m	15A – 250V	C13	NEMA WD 6 L6-20P
15454-M-ACL6-R(=)	AC power cable for Data Center	3 m	15A – 250V	C13	NEMA WD 6 L6-20P
15454-M-ALMCBL(=)	SCSI Alarm cable	20 m	28 AWG	Mini SCSI	None
15454-M-ALMCBL2(=)	SCSI Alarm cable limited to 8 inputs	20 m	24 AWG	Mini SCSI	None
15454-M-CBL-LARG(=)	AC power cable – ARG left exit	3 m	10A – 250V	C13	IRAM 2073 – IEC 60884-1
15454-M-CBL-LAUS(=)	AC power cable – AUS left exit	3 m	10A – 250V	C13	AS/NZS 3112: 2000
15454-M-CBL-L-CHI(=)	AC power cable – China left exit	3 m	10A – 250V	C13	GB2099.1/GB1002
15454-M-CBL-L-EU(=)	AC power cable – EU left exit	3 m	10A – 250V	C13	CEE 7 STANDARD SHEET VII
15454-M-CBL-L-IND(=)	AC power cable – India left exit	3 m	10A – 250V	C13	IS 1293
15454-M-CBL-L-JPN(=)	AC power cable – Japan left exit	3 m	15A – 125V	C13	JIS C8303 & JIS C8306
15454-M-CBL-LKOR(=)	AC power cable – KOR left exit	3 m	10A – 250V	C13	K60884-01
15454-M-CBL-L-UK(=)	AC power cable – UK left exit	3 m	10A – 250V	C13	BS 1363/A & SS145/A
15454-M-CBL-RARG(=)	AC power cable – ARG right exit	3 m	10A – 250V	C13	IRAM 2073 – IEC 60884-1
15454-M-CBL-RAUS(=)	AC power cable – AUS right exit	3 m	10A – 250V	C13	AS/NZS 3112: 2000
15454-M-CBL-R-CHI(=)	AC power cable – China right exit	3 m	10A – 250V	C13	GB2099.1/GB1002
15454-M-CBL-R-EU(=)	AC power cable – EU right exit	3 m	10A – 250V	C13	CEE 7 STANDARD SHEET VII
15454-M-CBL-R-IND(=)	AC power cable – India right exit	3 m	10A – 250V	C13	IS 1293
15454-M-CBL-R-JPN(=)	AC power cable – Japan right exit	3 m	15A – 125V	C13	JIS C8303 & JIS C8306
15454-M-CBL-RKOR(=)	AC power cable – KOR right exit	3 m	10A – 250V	C13	K60884-01
15454-M-CBL-R-UK(=)	AC power cable – UK right exit	3 m	10A – 250V	C13	BS 1363/A & SS145/A
15454-M-TMGCBL(=)	BITS IN/OUT cable for ETSI	20 m	COAX 23 AWG	DIN 1.0/2.3	none
15454-M-USBCBL(=)	USB cable for passive devices	3 m	28#/1P + 24#/2C + AEB	USB "A" MALE	USB "A" MALE

Table 3 provides details about physical and operational parameters of the Cisco ONS 15454 M2 MSTP.

Table 3.　　Product Specifications

Item	Specification
Power Requirements	Maximum
M2 fan-tray assembly	40W
M2 AC power module	300W
M2 DC ANSI power module	30W
M2 DC ETSI power module	30W
Physical Dimensions	
Rack mounting	19- or 23-in.(483- or 584-mm, respectively) EIA rack-mounting 19-in. (83-mm) rack-mounting or 21-in. (533-mm) cabinet mounting
Shelf assembly	
Cisco ONS 15454 M2 shelf assembly	(H x W x D): 3.46 x 17.18 x 11.02 in. (87.9 x 436.4 x 280 mm)

Item	Specification
Environmental Conditions	
Storage temperature	–40 to 158ºF (–40 to 70ºC)
Operating temperature	Normal: 32 to 131ºF (0 to 55ºC)
	Short-term[1]: 23 to 131ºF (–5 to 55ºC)
Relative humidity	Normal: 5 to 85%, noncondensing
	Short-term[2]: 5 to 90% but not to exceed 0.024 kg water/kg of dry air

[1]Refers to a period of not more than 96 consecutive hours anda total of not more than 15 days in 1 year.

[2]Refers to a total of 360hours in any given year, but no more than 15 occurrences during that1-year period.)

Regulatory Standards Compliance

Table 4 summarizes regulatory standards compliance and agency approvals.

Table 4.   Regulatory Standards Compliance and Agency Approvals

ANSI (Cisco ONS 15454) System	ETSI (Cisco ONS 15454E) System
Supported Countries	
- Canada - United States - Korea	- Europe - Latin America - Japan - Asia Pacific - MiddleEast and Africa
EMC (Class A)	
- ICES-003 Issue 4(2004) - GR-1089-CORE,Issue 4 (Type 2 and Type 4 equipment) - GR-1089-CORE – Issue 03 (Oct 2002) (Objective O3-2 – Section 3.2.1 – Radiated Emissions requirements with all doors open) - FCC 47CFR15, Class A subpart B (2006)	- EN 300 386 v1.3.3 (2005) and v1.4.1 (2007) - CISPR 22 – Fifth edition (2005-04) Class A and the amendment 1 (2005-07) - CISPR 24 – First edition (1997-09) and amendment 1 (2001-07) and amendment 2 (2002-10). - EN 55022:1998 Class A – CENELEC Amendment A2:2003 - EN 55024:1998 – CENELEC Amendment A1:2001 and Amendment A2:2003 - Resolution 237 (Brazil) - VCCI V-3/2006.04 - EN 61000-6-1:2001 - EN 61000-6-2:1999
Safety	
- UL/CSA 60950 -1 First Edition(2003) - GR-1089-CORE, Issue 4 (Type 2 and Type 4 equipment)	- UL/CSA 60950 -1 First Edition (2003) - IEC 60950-1 (2001/10)/Amendment 11:2004 to EN 60950-1:2001, 1st Edition (with all country deviations)
Environmental	
GR-63-CORE, Issue 3 (2006)	- ETS 300-019-2-1 V2.1.2 (Storage, Class 1.1) - ETS 300-019-2-2 V2.1.2 (Transportation, Class 2.3) - ETS 300-019-2-3 V2.1.2 (Operational, Class 3.1E) - EU WEEE regulation - EU RoHS regulation
Power and Grounding	
GR-1089-CORE, Issue 4	ETS 300 132-2
Optical Safety	
- EN or IEC-60825-2 Third edition (2004-06) - EN or IEC 60825-1 Consol. Ed. 1.2 – incl. am1+am2 (2001-08) 21CFR1040 (2004/04) (Accession Letter and CDRH Report) - IEC-60825-2 Third edition (2004-06) - ITU-T G.664 (2006)	

ANSI (Cisco ONS 15454) System	ETSI (Cisco ONS 15454E) System
Miscellaneous	

- Acoustic noise
  - GR-63-CORE, Issue 3 (2006)
  - ETS 300 753 ed.1 (1997-10)
- Rain, sand, dust, and moisture proofing
  - AS 1939-1990, 4.2, IP 53
- Mechanical shock andbumps
  - AS1099- 2.27
- Customer-specific requirements
  - AT&T Network Equipment Development Standards (NEDS) Generic Requirements, AT&T 802-900-260
  - SBC TP76200MP
  - Verizon SIT.NEBS.NPI.2002.010

Ordering Information

To place an order, visit the Cisco Ordering homepage and refer to Table 4. To download software, visit the Cisco Software Center.

Table 5. Ordering Information

Product ID	Description
Common Equipment	
15454-M2-SA= 15454-M2-DR= 15454-M2-DDR=	Shelf assembly, Cisco ONS 15454 M2 Chassis Door, Cisco ONS 15454 M2 Chassis Deep Door, Cisco ONS 15454 M2
15454-M2-FTA= 15454-M2-FTA2= 15454-M2-FTF=	Fran Tray assembly, Cisco ONS 15454 M2 2ndgen Fan Tray assembly, Cisco ONS 15454 M2 Chassis Air Filter, Cisco ONS 15454 M2
15454-M2-DC= 15454-M2-DC-E= 15454-M2-AC=	DC Power Supply Module, Cisco ONS M2 DC ETSI Power Supply Module, Cisco ONS M2 AC Power Supply Module, Cisco ONS M2
15454-M2-BRKT= 15454-M2-DEF21= 15454-M2-DEF23= 15454-M2-WM=	19"/23" and 21" Brackets, Cisco ONS 15454 M2 21" Air deflector, Cisco ONS 15454 M2 23" Air deflector, Cisco ONS 15454 M2 Wall mount bracket, Cisco ONS M2
15454-M-SHIPKIT=	Shipkit, Cisco ONS 15454 M6 and Cisco ONS 15454 M2
15454-M-TNC-K9= 15454-M-TSC-K9= 15454-M-TNCE-K9= 15454-M-TSCE-K9=	Transport Node Controller Transport Shelf Controller Enhanced Transport Node Controller Enhanced Transport Shelf Controller
15454-BLANK= 15454-M-FILLER= 15454-M-T-FILLER=	Shelf slot-filler panel, fits any slot in Cisco ONS 15454 ANSI shelf assembly Shelf line-slot filler card, fits line-card slots in Cisco ONS 15454 M6 and ONS 15454 M2 chassis Shelf control-slot filler card, fits control-card slots in Cisco ONS 15454 M6 and ONS 15454 M2 chassis

Warranty

The following warranty terms apply to the Cisco ONS 15454 M2 MSTP as well as services you may use during the warranty period. Your formal warranty statement appears in the Cisco Information Packet that accompanies your Cisco product.

- Hardware warranty duration: Five years
- Software warranty duration: One year
- Hardware replacement, repair, or refund procedure: Cisco or our service center will use commercially reasonable efforts to ship a replacement part for delivery within15 working days after receipt of the defective product at Cisco's site. Actual delivery times of replacement products may vary depending on customer location.

Product warranty terms and other information applicable to Cisco products are available at: http://www.cisco.com/go/warranty.

Service and Support

Cisco Services make networks, applications, and the people who use them work better together.

Today, the network is a strategic platform in a world that demands better integration among people, information, and ideas. The network works better when services, together with products, create solutions aligned with business needs and opportunities.

The unique Cisco Lifecycle approach to services defines the requisite activities at each phase of the network lifecycle to help ensure service excellence. With a collaborative delivery methodology that joins the forces of Cisco, our skilled network of partners, and our customers, we achieve the best results.

For More Information

For more information about the Cisco ONS 15454 Multiservice Transport Platform, contact your local Cisco account representative or visit Cisco at:www.cisco.com/go/optical or www.cisco.com/go/IPoDWDM.

Printed in USA

C78-600520-03   03/12

Cisco Carrier Packet Transport (CPT) 600 Series

Product Overview

The Cisco[®] Carrier Packet Transport (CPT) 600 sets the industry benchmark as a carrier-class converged access and aggregation platform for Unified Packet Transport architectures. Cisco CPT product family represents an exciting new paradigm in the world of Packet Transport with exceptional pay as you grow scalability, carrier-class reliability, incredible flexibility, and TDM like ease of packet service provisioning, OAM and protection capability.

Figure 1.   Cisco CPT 600 Carrier Packet Transport (with front cover (left), without front cover (right))


The CPT platform has great revenue potential for service providers by providing TDM like Ethernet Private lines as well as multipoint capabilities for Business, Residential, Mobile Backhaul, Data Center, and Video Services. These next generation of services can be readily deployed at low operational costs using the Cisco Transport Controller (CTC) and Cisco PRIME that allow fast and simple network turn up, A to Z provisioning and OAM features.

First to market with advanced standards based MPLS-Transport Profile (TP) management for ethernet aggregation and transport, MPLS-TP combines the feature richness of MPLS with the simplicity of transport operational models. In addition to MPLS-TP, the CPT family can support IP/MPLS and native ethernet based transport solutions, giving the customers data plane and control plane flexibility as the network evolves.

Its small form, simplicity, unique set of integrated features, and low power consumption reduce capital and operational expenditures. The CPT family reduces total cost of ownership based on its innovative satellite architecture that centralizes the management and allows scalable ethernet fan-out. The Cisco CPT 50 series satellite panel can be an extension of the CPT 600 Packet Transport Fabric and Modules thereby extending the service interface up by a factor of 10.

The Cisco CPT architecture is designed to provide a la carte options to deploy Packet Transport, MSTP or OTN switched networks. Allowing the customer to reduce day one costs and grow capabilities as required.
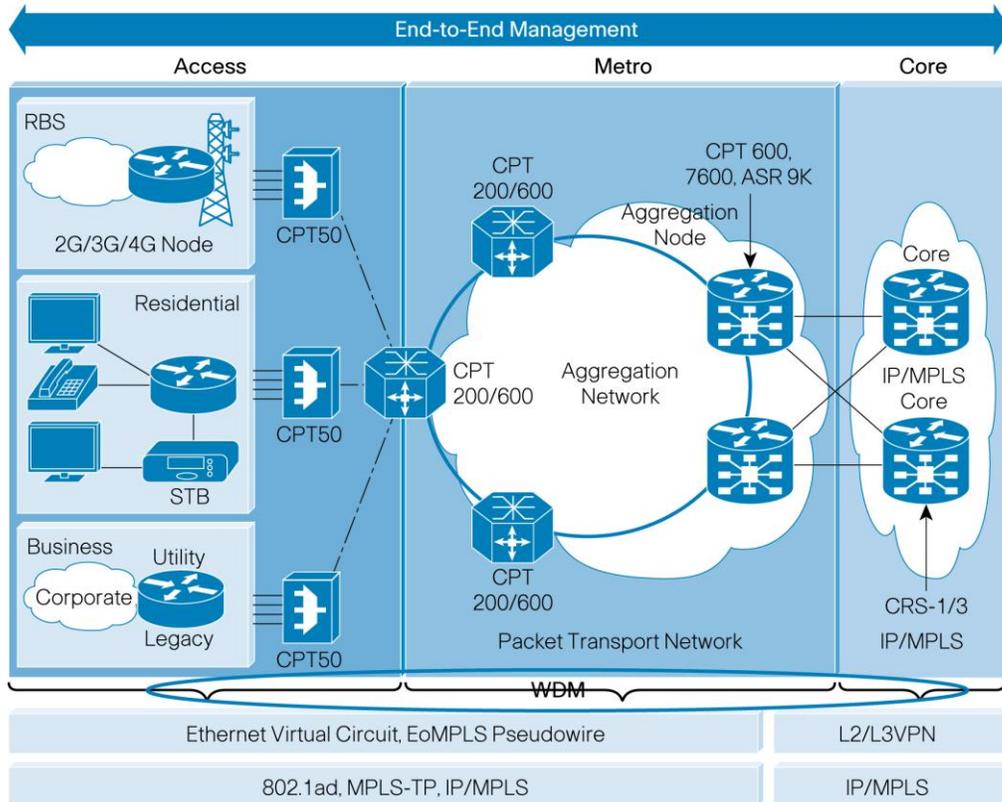
Key Features and Benefits

The Cisco CPT 600 chassis has two slots for redundant control cards and six slots for service cards. These six line card slots connect across the backplane to provide redundant aggregation and switching capability. The Cisco CPT 600 can be configured with integrated and redundant DC or AC power inputs. A single power module could be used for low-power and low-cost configurations. The DC power module has connectors for both ANSI or ETSI style battery and battery return connections, making it universal. The AC power module has a single input and is universal in that it accepts a power input ranging from 110 VAC to 240 VAC, 50 Hz to 60 Hz.

The Electrical Connection Unit is a narrow, front-facing termination panel for all your management, alarm, and multi-shelf connections. With all connections to the Cisco CPT 600 being front-facing, this platform is ideal for cabinet installations and ETSI front connection requirements, making this a truly global platform.

Although the node can be configured with redundant control or processor cards, simplex mode or single control card operation is permitted. The Cisco CPT 600 has a built-in memory module to back up the software package, IP address, and circuit database, making simplex mode more attractive in cost-sensitive applications. This built-in backup memory improves mean time to repair (MTTR) and increases operational simplicity. The ECU also has inputs for BITS and ToD (Time of Day) for support of SyncE and IEEE1588 Precision Timing Protocol.

The Cisco CPT 600 can be mounted in 19-, 21-, or 23-inch racks/cabinets and has brackets with integrated air deflectors to support the following options. With 19-inch brackets, the airflow is right to left. With 21-inch brackets, airflow can be selected as right to left; or right front in, and left front out; or left up out, or left back out. With 23-inch brackets, airflow is from right front in to left back out.

The Cisco CPT 600 has a single high-capacity fan tray assembly where the three fans are individually monitored and controlled. In the unlikely event that a single fan fails, the user will receive a fan fail alarm and the other fans will increase in speed to provide sufficient airflow to allow the user time to safely replace the fan tray.

Figure 2.   Cisco CPT 600 Modules
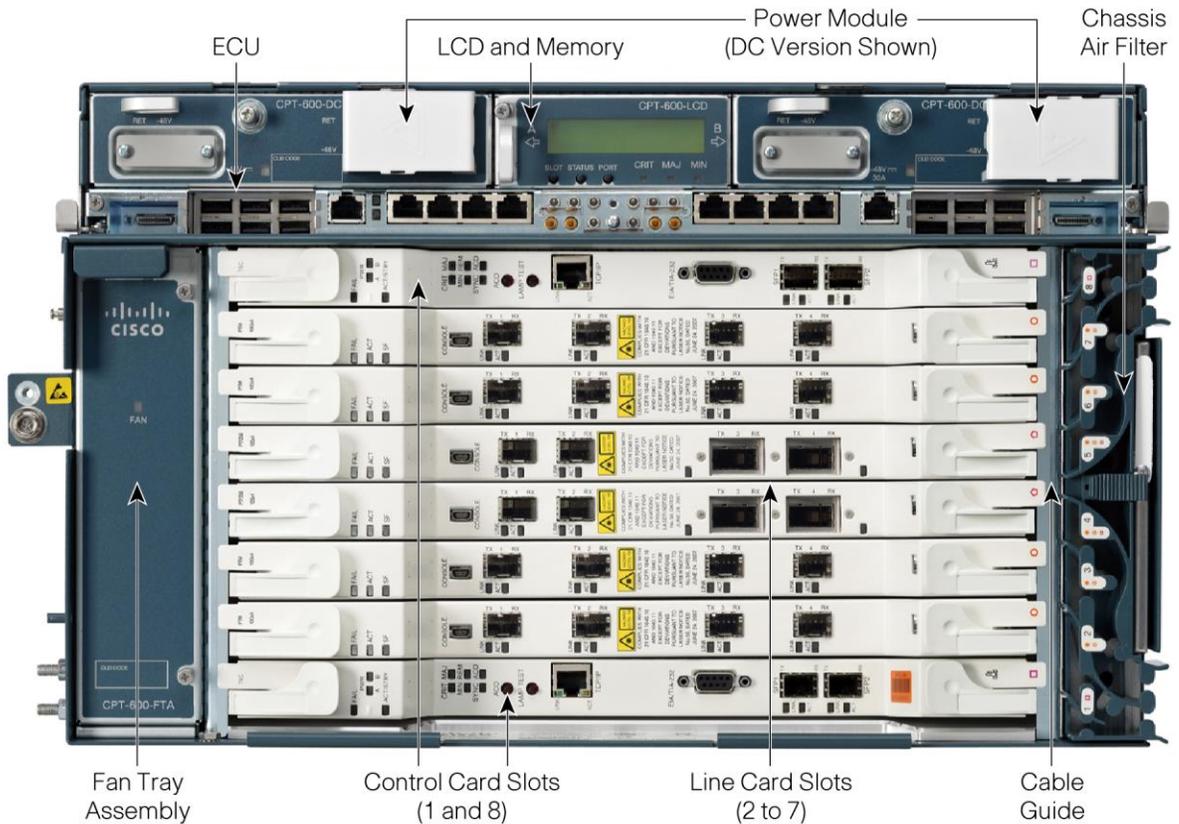
The Cisco CPT 600 and control cards have features like multilayer graphical network, node, and card visibility; A-to-Z network-based service provisioning; and graphical software wizards to simplify and speed user operations for such tasks as initial network turn-up; service provisioning; and management of satellite panels.

In addition to the integrated software features, the Cisco CPT 600 is supported by an easy-to-use but powerful network design tool. This tool is a user-friendly, Java-based application (fully developed and tested by Cisco) for modeling and optimizing MPLS-TP networks based on the user's network parameters.

Topology Flexibility

Cisco CPT 600 platform and cards provide both dense hierarchical QoS and support for Layer 2 services and features, using MPLS-TP, MPLS or Layer 2 Ethernet based technologies. With up to 64K queues per card, 16,000 service interfaces, 256K MAC addresses in a 6 RU NEBS/ETSI compliant chassis. The platform and control cards also contain synchronization circuitry, a Stratum-3 clock and dedicated backplane timing traces enabling transport-class network timing, support of network-synchronized services and applications such as mobile backhaul and migration of TDM services.

Product Specifications

Table 1 lists the modules that make up the Cisco CPT 600.

Table 1.   Cisco CPT 600 Modules

Model	Unit Name
COMMON EQUIPMENT Product ID for the Cisco CPT-600	**CPT-600 (Assemble to Order)**
Shelf assembly	Shelf assembly configurable with or without a door
Fan-tray assembly	Fan tray with chassis air filter
External connection unit	Integrated multi-shelf connection
	Element Management Solution connection
	Voice-over-IP connection
	Alarms connection
	USB connection to passive Cisco ONS devices for inventory management
	BITS 1 and BITS 2 input and output (ANSI and ETSI)
LCD status and backup memory	LCD display for node status with backup memory
Power options	DC Power module with ANSI and ETSI connectors
	AC Power module with universal IEC power connector
Brackets and air deflectors	19-in. version
	21-in. version
	23-in. version
COMMON CARDS for Cisco CPT 600, CPT 200	
Transport Node Controller card (TNC) Transport Shelf Controller card (TSC)	Control, Timing and Synchronization
Transport Node Controller card (TNCE) Transport Shelf Controller card (TSCE)	Support for SyncE and IEEE1588 PTP
Slot filler cards	Line card blank
	Line card slot detectable filler
	Control card slot detectable filler
	ONS Power module blank filler

Regulatory Standards Compliance

Table 2 summarizes regulatory standard compliance and agency approvals.

Table 2.   Regulatory Standard Compliance and Agency Approvals

ANSI System	ETSI System
Supported Countries	
• Canada • United States • Korea	• Europe • Latin America • Japan • Asia Pacific • Middle-East and Africa
EMC (Class A)	
• ICES-003 Issue 4 (2004) • GR-1089-CORE, Issue 4 (Type 2 and Type 4 equipment) • GR-1089-CORE – Issue 03 (Oct 2002) (Objective O3-2 – Section 3.2.1 – Radiated Emissions requirements with all doors open) • FCC 47CFR15, Class A subpart B (2006)	• EN 300 386 v1.3.3 (2005) and v1.4.1 (2007) • CISPR 22 – Fifth edition (2005-04) Class A and the amendment 1 (2005-07) • CISPR 24 – First edition (1997-09) and amendment 1 (2001-07) and amendment 2 (2002-10). • EN 55022:1998 Class A – CENELEC Amendment A2:2003 • EN 55024:1998 – CENELEC Amendment A1:2001 and Amendment A2:2003 • Resolution 237 (Brazil) • VCCI V-3/2006.04 • EN 61000-6-1:2001 • EN 61000-6-2:1999
Safety	
• UL/CSA 60950 -1 First Edition (2003) • GR-1089-CORE , Issue 4 (Type 2 and Type 4 equipment)	• UL/CSA 60950 -1 First Edition (2003) • IEC 60950-1 (2001/10)/Amendment 11:2004 to EN 60950-1:2001, 1st Edition (with all country deviations)
Environmental	
• GR-63-CORE, Issue 3 (2006)	• ETS 300-019-2-1 V2.1.2 (Storage, Class 1.1) • ETS 300-019-2-2 V2.1.2 (Transportation, Class 2.3) • ETS 300-019-2-3 V2.1.2 (Operational, Class 3.1E) • EU WEEE regulation • EU RoHS regulation
Power & Grounding	
• GR-1089-CORE, Issue 4	• ETS 300 132-2
Optical Safety	
• EN or IEC-60825-2 Third edition (2004-06) • EN or IEC 60825-1 Consol. Ed. 1.2 – incl. am1+am2 (2001-08) • 21CFR1040 (2004/04) (Accession Letter and CDRH Report) • IEC-60825-2 Third edition (2004-06) • ITU-T G.664 (2006)	
Miscellaneous	

• Acoustic Noise
  ◦ GR-63-CORE, Issue 3 (2006)
  ◦ ETS 300 753 ed.1 (1997-10)
• Rain, Sand, Dust and Moisture Proofing
  ◦ AS 1939-1990, 4.2, IP 53
• Mechanical Shock & Bumps
  ◦ AS1099- 2.27
• Customer specific requirements
  ◦ AT&T Network Equipment Development Standards (NEDS) Generic Requirements, AT&T 802-900-260
  ◦ SBC TP76200MP
  ◦ Verizon SIT.NEBS.NPI.2002.010	

Ordering Information

To place an order, visit the Cisco Ordering home page. To download software, visit the Cisco Software Center.

Table 3 provides ordering information.

Table 3.   CPT 600

Product ID	Description
CPT-600	Carrier Packet Transport 600 Platform

Warranty

The following are warranty terms that apply to the Cisco CPT 600 as well as services you may use during the warranty period. Your formal Warranty Statement appears in the Cisco Information Packet that accompanies your Cisco product.

- Hardware Warranty Duration: One (1) Year

- Software Warranty Duration: One (1) Year

- Hardware Replacement, Repair, or Refund Procedure: Cisco or its service center will use commercially reasonable efforts to ship a replacement part for delivery within fifteen (15) working days after receipt of the defective product at Cisco's site. Actual delivery times of replacement products may vary depending on Customer location.

Product warranty terms and other information applicable to Cisco products are available at: http://www.cisco.com/go/warranty.

Service and Support

Cisco Services make networks, applications, and the people who use them work better together.

Today, the network is a strategic platform in a world that demands better integration between people, information, and ideas. The network works better when services, together with products, create solutions aligned with business needs and opportunities.

The unique Cisco Lifecycle approach to services defines the requisite activities at each phase of the network lifecycle to help ensure service excellence. With a collaborative delivery methodology that joins the forces of Cisco, our skilled network of partners, and our customers, we achieve the best results.

For More Information

For more information about the Cisco CPT 600, contact your local account representative or visit Cisco at: www.cisco.com/go/optical or www.cisco.com/go/IPoDWDM.

Cisco ONS 15454 Transport Node Controller and Transport Shelf Controller Cards

Product Overview

The Cisco® Transport Node Controller (TNC) and Transport Shelf Controller (TSC) and the enhanced versions (TNCE and TSCE, respectively) are next-generation system processors for the Cisco ONS 15454 M6 and ONS 15454 M2 Multiservice Transport Platforms (MSTPs) and the Cisco Carrier Packet Transport (CPT) 600 and CPT 200 platforms (Figure 1). The Cisco TNC, TNCE, TSC, and TSCE cards perform system initialization, provisioning, alarm reporting, maintenance, diagnostics, IP address detection and resolution, SONET and SDH data-communications-channel (DCC) termination, system DC input-voltage monitoring, and system fault detection, and they support multishelf connections. The TNC and TNCE cards also have two optical service channels that support a supervisory data channel (SDC), distribution of synchronous clocking, and a 100-Mbps user data channel (UDC). The enhanced versions, TNCE and TSCE, support the IEEE1588v2 Precision Timing Protocol (PTP) and time of day (ToD) with pulse per second (PPS), in addition to support for Synchronous Ethernet (SyncE)/Source Specific Multicast (SSM) and traditional SONET and SDH Building Integrated Timing Supply (BITS) timing, which the TNC and TSC also support. The cards reside in slots 1 and 8 in the Cisco ONS 15454 M6 and Cisco CPT 600, and slot 1 in the Cisco ONS 15454 M2 and Cisco CPT 200. In the Cisco ONS 15454 M6 and Cisco CPT 600, the card can be equipped as active and standby, providing 1:1 equipment protection. In the Cisco ONS 15454 M2, ONS 15454 M6, CPT 200, and CPT 600, a single card is used in simplex mode.

The Cisco TNC, TNCE, TSC, and TSCE cards incorporate a highly stable Layer 3 internal timing reference to provide system timing based on input received from an external BITS source or from an incoming SONET or SDH optical signal. Synchronous status messaging helps the system select the best timing sources, and a holdover mode maintains timing accuracy when preprovisioned synchronization references are not available.

Figure 1.   Cisco ONS 15454 TNC Card and ONS 15454 TSC Card

Nonvolatile database storage for communication, provisioning, and system control is provided, allowing full database recovery and survivability with complete system power loss. In addition, short-term clock recovery is also supported, reducing the need to reset the calendar and ToD settings after a brownout or complete power outage. Unique to the Cisco ONS 15454 M6, ONS 15454 M2, CPT 600, and CPT 200 is a memory module built into the chassis. This external memory is synchronized with the memory of the TNC, TNCE, TSC, and TSCE, thereby providing a backup to the node IP address, software package, and circuit database. This synchronization provides faster time to recovery when the node is used in simplex mode during a control-card replacement.

The Cisco TNC, TNCE, TSC, and TSCE cards have 2 built-in interface ports for accessing the system: an RJ-45 connector and an RS-232. The RJ-45 port provides 10BASE-T Ethernet connectivity to the system, providing local and remote access to the craft-management system, Cisco Transport Controller, through a common web interface. You can also use this port for interconnection to customer operations support systems (OSSs) and network management systems (NMSs), providing integration to external element management systems (EMSs), NMSs, and OSSs.

The Cisco TNC, TNCE, TSC, and TSCE cards provide security enhancements, allowing you to configure the front panel and Cisco ONS 15454 M6, ONS 15454 M2, CPT 600, and CPT 200 chassis Ethernet interfaces as regenerators or provision them with individual IP and MAC addresses for segregated craft and DCC access. The RS-232 port provides a serial ASCII interface for local craft access using VT100 emulation so that you can enter Transaction Language 1 (TL1) commands directly over a Telnet session without the assistance of a browser.

The front panels of the Cisco TNC, TNCE, TSC, and TSCE cards provide multicolored LEDs for a quick view of the status of the card activity, raised network alarms, shelf voltage input, LAN interface, and synchronization. Two front-panel buttons allow you to quiet an active external audible alarm (alarm-cutoff button) or test the working state of system LEDs. The Cisco TNC and TSC cards are supported beginning with the Cisco ONS 15454 MSTP Release 9.2.0 system software for both the Cisco ONS 15454 M6 and ONS 15454 M2 platforms. The Cisco TNCE and TSCE cards are supported beginning with the Cisco ONS 15454 MSTP Release 9.3.0 system software for both the Cisco ONS 15454 M6 and ONS 15454 M2 platforms, and the Cisco CPT 9.3.0 system software for both the Cisco CPT 600 and CPT 200 platforms. Deployed networks may consist of Cisco ONS 15454 nodes equipped with Cisco Timing, Communications, and Control Two (TCC2), TCC2P, or TCC3 processor cards.

Features and Benefits

The Cisco ONS 15454 TNC, TNCE, TSC, and TSCE cards provide the following feature set:

- Eighty-four section DCC (SDCC) and multiplex section DCC (MSDCC) terminations allow the interconnection of multiring and linear systems on a single-shelf assembly, reducing networking costs.
- Eighty-four SDCC tunnels or SDCC-to-line DCC (LDCC) tunnels provide interface flexibility for transparent transport of third-party DCC overhead channels.
- Integrated system input-voltage monitoring facilitates proactive identification of DC power-system problems.
- Time-and-date clock recovery after brownout or power loss prevents clock reprogramming.
- A complete shelf lamp test through a faceplate pushbutton simplifies technician LED maintenance testing.
- Local and remote craft user access allows technicians to access nodes from anywhere.
- Local audible alarm cutoff squelches office audible or visual alert systems.
- Through the Cisco ONS 15454 M6 Electrical Connection Unit (ECU), the cards support connection to up to six subtended shelves or to the master shelf.
- The cards support up to 24 dry-contact external alarms.

Additionally, the Cisco TNC and TNCE cards offer the following enhanced features:

- Using Small Form-Factor Pluggable (SFP) ports, these cards support up to two optical service channels that contain SDC, timing, and UDC.

The enhanced TNCE and TSCE cards add the following enhanced features:

- These cards support the IEEE1588v2 Precision Timing Protocol with ToD and PPS.

Feature Availability

Table 1 outlines the feature availability supported on the Cisco ONS 15454 TNC, TNCE, TSC, and TSCE.

Table 1.   Feature Availability

Feature	Availability
DCC terminations	84 SDCC and MSDCC terminations
DCC tunnels	28 SDCC tunnels or LDCC terminations OC-3/STM-1: • DCC D1–D3 = 194 kbps implemented • DCC D4–D12 = 576 kbps implemented • UDC/VoIP 100 kbps (Packet over SONET into VC-4 payload) Gigabit Ethernet (the 1-Gbps payload is shared) • Data Communications Network (DCN) variable bandwidth (maximum: 100 Mbps) • VoIP/UDC variable bandwidth (maximum: 100 Mbps)
Generic communications channel (GCC)	160 GCCs GCC0 may be ~350 kbps (OTU1), ~1.3 Mbps (OTU2), 5.2 Mbps (OTU3), ~12 Mbps (OTU4)
BITS timing	1.544 MHz, 2.08 MHz, 6.312 MHz, 64 kHz, and 10 MHz TNCE and TSCE add IEEE1588v2 PTP, 10 MHz, 1 PPS
Optical service channel (OSC) using TNC	Two SFP ports Port 1 can be OC-3/STM-1, Fast Ethernet, or Gigabit Ethernet Port 2 can be Fast Ethernet or Gigabit Ethernet
SFP options	ONS-SC-OSC-ULH= SFP: OC-3/STM-1 or Fast Ethernet OSC SFPs Ultra long-haul (ULH): Commercial temperature ONS-SE-155-1510= SFP: OC-3/STM-1, coarse wavelength-division multiplexing (CWDM), 1510 nm, EXT ONS-SC-Z3-1510= SFP: OC-48/STM-16 or Gigabit Ethernet, CWDM, 1510 nm

Summary

The Cisco ONS 15454 M6, ONS 15454 M2, CPT 600, and CPT 200 equipped with TNC, TNCE, TSC, or TSCE cards offer significant advantages:

- Smaller footprint, lower power: The new TNC and TNCE cards aggregate the functions of what took 4 cards in the Cisco ONS 15454 and collapse it into 1 card.

- Integrated OSC: Each TNC and TNCE can be configured with one or two SFP ports to provide the OSC termination. In addition to OC-3/STM-1, the OSC can be configured with Fast Ethernet or Gigabit Ethernet for increased bandwidth and compatibility in future packet transport architectures.

- Integrated multishelf management: The TNC, TNCE, TSC, and TSCE, coupled with the Cisco ONS 15454 M6 ECU, can support up to 30 subtended shelves in a cascade configuration without the need of an external switch or separate Ethernet switch card.

- Increased processing power: These new cards have a significant increase in memory and processing power to support higher-level functions such as intelligent control plane, and to ensure that the nodes will be compatible with future versions as more features come available.

Product Specifications

Tables 2 and 3 outline the specifications for the Cisco ONS 15454 TNC, TNCE, TSC, and TSCE cards.

Table 2.   Product Specifications

Compliance	
Countries	Canada European Union Hong Kong Japan Korea Mexico United States Australia China European Union Hong Kong Korea Mexico New Zealand Singapore
Electromagnetic compliance (EMC) – Class A	ETSI 300-386-TC Telcordia Technologies Network Equipment Building Standards (NEBS) GR-1089-CORE, Issue 3 (Level 3, Type 2 and Type 4) CISPR 22, CISPR 24 IC ICES-003 Issue 3, 1997 FCC 47CFR15 EN55022, EN55024
Product safety	Telcordia Technologies NEBS GR-1089-CORE, Issue 3 Level IEC 60950-1/EN 60950-1, 1st Edition UL and cUL/CSA 60950-1 1st Edition (Level 3, Type 2 and Type 4)
Environmental	Telcordia Technologies NEBS GR-63-CORE, Level 3 ETS 300 019-2-1 (Storage, Class 1.1) ETS 300 019-2-2 (Class 2.3) ETS 300 019-2-3 (Class 3.1E)
Customer requirements	AT&T Network Equipment Design Specification (NEDS) Verizon TCG Checklist MCI/Worldcom ESD

Table 3.   Product Specifications

Attribute	TNC/TNCE Value	TSC/TSCE Value
Hardware Components		
Processor speed	1 GHz	
Nonvolatile memory (Flash)	4 GB	
Volatile memory (synchronous dynamic RAM)	1 GB	
Physical Card Interfaces		
LAN	RJ-45 and 10BASE-T Ethernet	
Craft	DB-9, RS-232 serial, and data terminal equipment (DTE)	
TL1	9.6 K baud	
Management		
Card LEDs		
Failure (FAIL)	Red	
Status (ACT/STBY)	Green/yellow	
System LEDs		
Critical (CRIT)	Red	
Major (MAJ)	Red	

Attribute	TNC/TNCE Value	TSC/TSCE Value
Minor (MIN)	Yellow	
Remote (REM)	Red	
Synchronization (SYNC)	Green	
Alarm cutoff (ACO)	Green	
Power A (PWR-A)	Green/amber/red	
Power B (PWR-B)	Green/amber/red	
Port LEDs		
LAN link (LINK)	Green	
LAN activity (ACT)	Amber (flash)	
Input Voltage Monitoring (per input)		
For –48 VDC nominal systems • Less than –40.5 VDC • –40.5 to –56.7 VDC • Greater than –56.7 VDC For –60 VDC nominal systems • Less than –50.0 VDC • –50.0 to –72.0 VDC • Greater than –72.0 VDC	GR-499-CORE and ETS 300 132-2 • Major alarm, red LED • Normal, green LED • Major alarm, red LED ETS 300 132-2 Annex A • Major alarm, red LED • Normal, green LED • Major alarm, red LED	
Power		
Maximum	120W	120W
Physical		
Size (H x W x D)	Single card slot: 12.65 x 0.72 x 9.00 in. (32.13 x 1.83 x 22.86 cm)	
Weight	2.05 lb (0.93 kg)	
Operating Environment		
Temperature	–40 to 149°F (–40 to 65°C)	
Humidity	5 to 95%, noncondensing	
Storage Environment		
Temperature	–40 to 185°F (40 to 85°C)	
Humidity	5 to 95%, noncondensing	

System Requirements

Table 4 outlines the system requirements for deploying the Cisco ONS 15454 TNC and TSC cards.

Table 4.   System Requirements

Component	Cisco ONS 15454 M6 MSTP and CPT 600	Cisco ONS 15454 M2 MSTP and CPT 200
Processor	1 + 1 or 1	1
System software	Release 9.2.0 or later for TNC and TSC Release 9.3.0 or later for TNCE and TSCE	Release 9.2.0 or later for TNC and TSC Release 9.3.0 or later for TNCE and TSCE
Shelf-slot compatibility	1 and 8	1

Ordering Information

Table 5 lists the ordering information for the Cisco ONS 15454 TNC and TSC cards. To place an order, visit the Cisco Ordering Home Page and refer to Table 5. To download software, visit the Cisco Software Center.
http://www.cisco.com/cisco/software/type.html?mdfid=278281788&i=rm

Table 5.   Ordering Information

Product Description	Part Number
Transport Node Controller for M2, M6 chassis	15454-M-TNC-K9
Transport Shelf Controller for M2, M6 chassis	15454-M-TSC-K9
Enhanced Transport Node Controller for M2, M6, CPT200, CPT600	15454-M-TNCE-K9
Enhanced Transport Shelf Controller for M2, M6, CPT200, CPT600	15454-M-TSCE-K9

Cisco Services

Cisco offers a wide range of services programs to accelerate customer success. These innovative services programs are delivered through a unique combination of people, processes, tools, and partners, resulting in high levels of customer satisfaction. Cisco Services can help you protect your network investment, optimize network operations, and prepare your network for new applications to extend network intelligence and the power of your business. For more information about Cisco Services, refer to Cisco Technical Support Services or Cisco Advanced Services.

For More Information

For more information about the Cisco Optical Solution, visit
http://cisco.com/en/US/products/hw/optical/ps2006/index.html or contact your local Cisco account representative.

Printed in USA

C78-602903-01   03/11

Cisco CPT Packet Transport Fabric 256G Fabric Card with 4x10GE

The Cisco® Carrier Packet Transport (CPT) 200 and 600 sets the industry benchmark as a carrier-class converged access and aggregation platform for Unified Packet Transport architectures. Cisco CPT product family represents an exciting new paradigm in the world of Packet Transport with exceptional pay as you grow scalability, carrier-class reliability, incredible flexibility, and TDM like ease of packet service provisioning, OAM and protection capability.

Product Overview

The Cisco CPT 200 and 600 Packet Transport Fabric (PTF) Line Card is a non-blocking switch fabric that delivers economical, scalable, highly available, and Packet Transport services through a Unified Multiprotocol Label Switching (MPLS) network layer. The PTF 256 Gigabit non-blocking switch fabric interconnects all Packet Transport line cards over the backplane while providing scalability and high availability active-active architecture. In addition, the PTF delivers four 10-Gigabit Ethernet ports that can be used for User-to-Network Interfaces, Network-to-Network Interfaces, and enables extension of GE interfaces through the CPT 50 satellite architecture. The PTF enable the Cisco CPT 200 and 600 provide a robust MPLS-Transport Profile (TP) infrastructure to deliver scalable Private Line, Business, Residential, Mobile Backhaul, Data Center, and Video Services (Figure 1).

Figure 1. Cisco CPT Packet Transport Fabric (PTF) Line Card

Features and Benefits

Cisco CPT 200 and 600 PTF offers:

- 256 Gbps of non-blocking fully redundant switching fabric
- Distributed forwarding and control planes for higher performance
- Modularized system components in both hardware and software, isolating failure and faults to subsystem and component
- Hardware-based signaling for the fabric: support for near zero packet loss on switchover
- Built-in redundancy in hardware components such as the route switch processor (RSP), switch fabric, control-plane chassis control bus, and power supplies, thereby avoiding a single point of failure
- 4 port of 10Gbps Ethernet Interfaces that operate as UNI, NNI, & Satellite architecture extension
- Hardware based Bidirectional Forwarding Detection (BFD) processing and control that provide transport SLA detection times

With integrated synchronization circuitry and dedicated backplane timing traces for accessing the shelf controllers Stratum-3 subsystem, the CPT 200 and 600 PTF Line Card provides standards-based line-interface functions for delivering and deriving transport-class network timing, enabling support of network-synchronized services and applications such as mobile backhaul and migration of TDM services.

The PTF also consolidating Unified MPLS transport and DWDM networking by integrating the G.709 OTN layer with both I.7 and I.4 Enhanced Forward Error Correction (EFEC) into two 10GE ports. The G.709 provides visibility into the DWDM transmission system to permit rapid detection and recovery from transmission-layer and DWDM impairments and G.709 can also be configured for proactive protection if signal degradation is detected; it prevents traffic loss and link outage. The Enhanced Forward Error Correction extends transmission-layer performance, delivering extended performance over an amplified system without the cost of regeneration or transponders.

Product Specifications

Table 1.

Description	Specification
Interface Support	
Pluggable SFP+ Interfaces	SFP+ interfaces provide mix/match interface types across a single line card. For a complete list of supported interfaces, please see the Cisco CPT pluggable configuration guide.
Pluggable XFP Interfaces with OTN G.709	Standard G.709 providing transmission-layer OA&M; G.709 Standard FEC and Enhanced FEC (both I.4 & I.7 support) for extended transmission system performance
Scalable and Integrated Multiservice Support	
Layer 2 Transport	Carrier Ethernet, MPLS-Transport Profile (TP) and IP/MPLS-(TE)
Layer 2 and Layer 2+ services	Carrier Ethernet - EPL, EVPL, ELAN, EVPLAN MPLS-TP – P2P Circuits (VPWS), Multipoint (VPLS), Hierarchy Multipoint (H-VPLS), Ring VPLS (Optimized for Video Broadcast applications) IP/MPLS(TE) – P2P Circuits (VPWS), Multipoint (VPLS), Hierarchy Multipoint (H-VPLS), Ring VPLS (Optimized for Video Broadcast applications)
Service Scale	
MAC Address	256K
Point to Point Ethernet Virtual Circuit (EVC)	16K
VPWS	3.5K
PW Redundancy	2.5K

Description	Specification		
Point to Multi-Point Ethernet Virtual Circuit (EVC)	4K with 8K members		
VPLS	1K		
MPLS-TP LSP Un-Protected	2K		
MPLS-TP LSP Protected	1K		
REP	32 Segments		
Multicast Groups	2K		
Policers	8K Policers 2-rate 3-color (2R3C)		
Egress queues	64K Queues (3-level H-QoS)		
Switch Fabric	256 Gbps Non-Blocking		
Ethernet OAM			
CFM	**Interval**	**Remote MEPs**	**Local MEPs**
	100 ms	100	100
	1 sec	1000	1000
	10 sec	8000	8000
	1 min	16000	16000
	10 min	16000	16000
EFM	Per Interface		
ITU Y.1731 (FM)	Same as CFM		
ITU Y.1731 (DM)	**Type**	**Interval**	**# of Sessions**
	Line Card	1 sec	100
	System	1 sec	1000
MPLS-TP OAM			
BFD	**Interval**	**# of Sessions**	
	3.3 ms	1000	
High Availability			
High Availability features	Stateful Switchover (SSO) In Service Software Upgrade (ISSU) MPLS-TP 1:1 path protection Link Aggregation (LAG) Resilient Ethernet Protocol (REP)		
Multicast			
Multicast features	IGMP snooping v1, v2, and v3 Multicast VLAN registration (MVR)		

Product Specifications

Table 2.   Product Specifications

Description	Specification
Evolutionary Monitoring	
Carrier-class Operations, Administration, and Maintenance (OA&M)	IETF MPLS-TP Continuity Checks (CC) Bidirectional Forwarding Detection (BFD) (RFC5860) IETF MPLS-TP Continuity Verification (CV) LSP Ping and LSP Traceroute IP/MPLS OAM Virtual Circuit Connectivity Verification (VCCV), Ping, and Traceroute Connectivity Fault Management (802.1ag) Ethernet Link OAM (802.3ah) ITU Y.1731 Fault Management & Delay Management

Description	Specification
Network Timing and Synchronization	
Synchronous Ethernet	Derive and provide synchronization from BITS and Ethernets interfaces on CPT 200 and 600
IEEE 1588v2 PTP	Derive, Provide, and Transparently passes timing and frequency information on all CPT 200 and 600 Ethernet interfaces
Product Functionality, Benefits and Specifications	
Software Support	• Cisco Transport Controller: End-to-End Network Point and Click Provisioning, Maintenance, & Alarm Correlation. • Integrated Robust Command Line Interface (CLI)

MPLS-Transport Profile (TP)	• IETF Standard Based MPLS-Transport Profile:
	  ◦ RFC 5317
	  ◦ RFC 5654
	  ◦ RFC 5921
	  ◦ RFC 5880
	  ◦ RFC 5960
	  ◦ RFC 5586
	  ◦ RFC 5951
	  ◦ RFC 5950

Flexible Ethernet services	• Ethernet Virtual Connections (EVCs): Ethernet services are supported using individual EVCs to carry traffic belonging to a specific service type or end user through the network. EVC-based services can be used in conjunction with MPLS-based L2VPNs and native Ethernet switching deployments. • Flexible VLAN classification: VLAN classification into Ethernet flow points (EFPs) includes single-tagged VLANs, double-tagged VLANs (QinQ and 802.1ad), contiguous VLAN ranges, and noncontiguous VLAN lists. • IEEE Bridging: The line cards support native bridging based on IEEE 802.1Q, IEEE 802.1ad, and QinQ VLAN encapsulation mechanisms. • Resilient Ethernet protocol (REP): The REP provides a resilient, fast-convergence mechanism for aggregating and connecting to Ethernet-based access rings.
L2VPN services	• MPLS-TP Circuit with Ethernet over MPLS-TP (EoMPLS-TP): EoMPLS-TP transports Ethernet frames across an MPLS-TP LSPs using pseudowires. Individual EFPs or traffic from an entire port can be transported over an MPLS-TP network using pseudowires to an egress interface or sub-interface. • Virtual Private LAN Services (VPLS): These services are included in a class of VPN that supports the connection of multiple sites in a single bridged domain over a MPLS-TP network. VPLS presents an Ethernet interface to customers, simplifying the LAN and WAN boundary for service providers and customers, and enabling rapid and flexible service provisioning, because the service bandwidth is not tied to the physical interface. All services in a VPLS appear to be on the same LAN, regardless of location. • Pseudowire redundancy: Pseudowire redundancy supports the definition of a backup pseudowire to protect a primary pseudowire in case of failure. • Multi-segment pseudowire stitching: Multi-segment pseudowire stitching is a method for interworking two pseudowires together to form a cross-connect relationship.
SPAN	• Span is a technique of replicating the ingress or egress frames in a specific port to a specified list of destination ports. It is a monitoring feature used to monitor the traffic that is coming out of a port or an EFP. The monitored traffic can be used to debug the network and can also be used by law enforcement agencies.
High Availability	• MPLS-TP: 1:1 MPLS TP LSP delivers protection switching for networks with sub-50ms APS switching for link, node, path failures. • Bidirectional Forwarding Detection (BFD): BFD is a detection protocol that is designed to provide fast forwarding path-failure detection times for all media types, encapsulations, topologies, and routing protocols • 802.3ad Link Aggregation Bundles: The line cards support a bundle of multiple links to provide added resiliency and the ability to load balance traffic over multiple member links.
Multicast	• IGMP v2 and v3 snooping: This Layer 2 mechanism efficiently tracks multicast membership on an L2VPN network. Individual IGMP joins are snooped at the VLAN level or pseudowire level. In residential broadband deployments, this scenario enables the network to send only channels that are being watched to downstream users. • Multicast VLAN Registration (MVR): MVR optimizes the control plane (IGMP) load between the router and switch. MVR feature enables switch to aggregate different JOINs received on different VLANs (from the receivers) into one JOIN (on a single VLAN, which could be the same as or different from the VLANs of the receiving ports) towards the router. The switch then distributes (replicate) the received content into the relevant ports.

Description	Specification
Ethernet OA&M	• Connectivity Fault Management (CFM) Ethernet layer OAM protocol provides end-to-end provider edge (PE to PE) and/or customer edge to customer edge (CE to CE) fault management. CFM includes proactive connectivity monitoring, fault verification, and fault isolation for large Ethernet metropolitan-area networks (MANs) and WANs. CFM is defined by IEEE 802.1ag standard.
	• Ethernet Link OAM is a protocol for installing, monitoring, and troubleshooting Ethernet metropolitan-area networks (MANs) and Ethernet WANs. It relies on an optional sublayer in the data link layer of the Open Systems Interconnection (OSI) model. Ethernet Link OAM is defined by IEEE 802.3ah standard.
	• Remote Ethernet Port Shutdown. The Remote Ethernet Port Shutdown replicates a local link failure over an EoMPLS pseudowire to a remote link shutdown the remote Ethernet port down. Bot UNI interfaces connected to the EoMPLS pseudowire will shutdown in the event of a pseudowire failure.
	• ITU Y.1731 Fault Management and Delay Management. The ITU-T Y.1731 feature provides OAM functions for fault management and performance monitoring functionality for service providers in a large network. ITY Y.1731 includes Ethernet Alarm Indication Signal (ETH-AIS), Ethernet Remote Defect Indication (ETH-RDI), Ethernet Locked Signal (ETH-LCK) functionality for fault detection and isolation. ITU Y.1731 Delay Management (DM) provides a standard Ethernet PM function that includes measurement of Ethernet frame delay and frame delay variation.
MPLS OA&M	• IP/MPLS OA&M: LSP Ping & LSP Trace Route
	• Pseudo-Wire: Virtual Circuit Connectivity Verification (VCCV), Ping, Traceroute, Static Status Message to LDP Status Message Translation
	• MPLS-TP OA&M: GACH/GAL & MPLS-TP LSP BFD OAM
Manageability	Cisco Prime Suite is the industry's most advanced optical transport domain manager. It delivers the full power of the Cisco Carrier Packet Transport products to a customer's operation personnel and back office systems alike.
	• A carrier-class Element Management System (EMS), Cisco Prime Suite: Lowers network operations, administration, maintenance, and provisioning costs
	• Provides fault, configuration, performance, and user access security management capabilities
	• Features a comprehensive client/server-based platform that scales to manage the equivalent of 3000 CPT50, CPT200, CPT600 network elements and up to 100 simultaneous user sessions
	• Offers network provisioning, surveillance, and performance monitoring features that help customers rapidly deploy and maintain revenue-generating services that are built on Cisco Optical Networking and Voice Gateway Systems
	The intelligent Cisco Prime Suite High Availability Agent is designed to automatically detect problems, attempt to restart processes, and fail over to a secondary Sun UNIX server if required.
	The Cisco Prime Suite High Availability solution:
	• Significantly reduces the risk of losing data
	• Optimizes the Cisco Prime Suite platform to provide continuous service in the event of a failure does occur
	• Helps ensure constant visibility in a customer's network
Security	Cisco Transport Software: Cisco Transport Software provides comprehensive network security features, including access control lists (ACLs); control-plane protection; authentication, authorization, and accounting (AAA) and RADIUS; Secure Shell (SSH) Protocol; SNMPv3; and Hypertext Transfer Protocol Secure (HTTPS);
	Security: Many critical security features are supported:
	• 802.1ad Layer 2 Control Protocol (L2CP) and bridge-protocol-data-unit (BPDU) filtering
	• MAC limiting per EFP or bridge domain
	• Unicast, multicast, and broadcast storm-control blocking on any interface or port
	• Unknown Unicast Flood Blocking (UUFB)
Connectivity	2x10-Gbps 802.3 Ethernet SFP+ Ports
	2x10-Gbps 802.3 Ethernet with OTN G.709 wrapping with I.4 & I.7 Enhanced FEC XFP Ports
Memory	2 GB DRAM
Environmental and Compliance Standardization	
Physical dimensions (H x W x D); Weight	13.035 x 0.975 x 10.085 in. (33.1089 x 2.4765 x 25.6159 cm) 2.69 lbs. (1.22 kg)
Power	Max Power 210 Watts Nominal Power 147 Watts
Network Equipment Building Standards (NEBS)	GR-1089 Issue 5, GR-63 Issue 3
Operating temperature (nominal)	5°C to 55°C
Operating humidity (nominal) (relative humidity)	5–85% noncondensing, operation is guaranteed up to 95% noncondensing

Description	Specification
Storage temperature	–40°C to 70°C
Storage (relative humidity)	93% noncondensing
Operating altitude	13,123.36 feet (4000 meters)

Warranty Information

Find warranty information on Cisco.com at the Product Warranties page.

Ordering Information

To place an order, visit the Cisco Ordering Home Page. To download software, visit the Cisco Software Center.

Table 3.   Ordering Information

Product Name	Part Number
Packet Transport Fabric 256G Fabric Card with 4x10GE	CPT-PTF256-10Gx4=

Cisco Services

Cisco Services make networks, applications, and the people who use them work better together.

Today, the network is a strategic platform in a world that demands better integration between people, information, and ideas. The network works better when services, together with products, create solutions aligned with business needs and opportunities.

The unique Cisco Lifecycle approach to services defines the requisite activities at each phase of the network lifecycle to help ensure service excellence. With a collaborative delivery methodology that joins the forces of Cisco, our skilled network of partners, and our customers, we achieve the best results.

For More Information

For more information about the Cisco CPT Packet Transport Fabric and Packet Transport Module, visit www.cisco.com/en/US/products/hw/optical/ps1996/index.html for the product home page or contact your local account representative or Enter Cisco alias.

Cisco CPT Packet Transport Module 4x10GE

The Cisco® Carrier Packet Transport System (CPT) 200 and 600 sets the industry benchmark as a carrier-class converged access and aggregation platform for integrated packet transport architectures. Cisco CPT product family offers exceptional pay as you grow scalability, carrier-class reliability, incredible flexibility, and TDM like ease of packet service provisioning, OAM and protection capability.

Product Overview

The Cisco CPT 200 and 600 Packet Transport Module (PTM) Line Card is a 40G line rate packet that delivers economical, scalable, highly available, and Packet Transport services through a unified Multiprotocol Label Switching (MPLS) network layer. In addition, the PTM delivers four 10-Gigabit Ethernet ports that can be used for User-to-Network Interfaces (UNI), Network-to-Network Interfaces (NNI), and enables extension of GE interfaces through the CPT 50 satellite architecture. The PTM enables Cisco CPT 200 and 600 provide a robust MPLS-Transport Profile (TP) infrastructure to deliver scalable Private Line, Business, Residential, Mobile Backhaul, Data Center, and Video Services (Figure 1).

Figure 1. Cisco CPT Packet Transport Module (PTM) Line Card

Features and Benefits

Cisco CPT 200 and 600 PTM offers:

- 40 Gbps of line-rate fully redundant switching fabric
- Distributed forwarding and control planes for higher performance
- Modularized system components in both hardware and software, isolating failure and faults to subsystem and component
- Hardware-based signaling for the fabric: support for near zero packet loss on switchover
- Built-in redundancy in hardware components such as the control-plane chassis control bus, and power supplies, thereby avoiding a single point of failure
- 4 port of 10 Gbps Ethernet Interfaces that operate as UNI, NNI, and Satellite architecture extension

With integrated synchronization circuitry and dedicated backplane timing traces for accessing the shelf controllers Stratum-3 subsystem, the CPT 200 and 600 PTM Line Card provides standards-based line-interface functions for delivering and deriving transport-class network timing, enabling support of network-synchronized services and applications such as mobile backhaul and migration of TDM services.

Product Specifications

Table 1.

Description	Specification
Interface Support	
Pluggable SFP+ Interfaces	SFP+ interfaces provide mix/match interface types across a single line card. For a complete list of supported interfaces, please see the Cisco CPT pluggable configuration guide.
Scalable and Integrated Multiservice Support	
Layer 2 Transport	Carrier Ethernet, MPLS-Transport Profile (TP) and IP/MPLS-(TE)
Layer 2 and Layer 2+ services	Carrier Ethernet – EPL, EVPL, ELAN, EVPLAN MPLS-TP – P2P Circuits (VPWS), Multipoint (VPLS), Hierarchy Multipoint (H-VPLS), Ring VPLS (Optimized for Video Broadcast applications) IP/MPLS(TE) – P2P Circuits (VPWS), Multipoint (VPLS), Hierarchy Multipoint (H-VPLS), Ring VPLS (Optimized for Video Broadcast applications)
Service Scale	
MAC Address	256K
Point to Point Ethernet Virtual Circuit (EVC)	16K
VPWS	3.5K
PW Redundancy	2.5K
Point to Multi-Point Ethernet Virtual Circuit (EVC)	4K with 8K members
VPLS	1K
MPLS-TP LSP Un-Protected	2K
MPLS-TP LSP Protected	1K
REP	32 Segments
Multicast Groups	2K
Policers	8K Policers 2-rate 3-color (2R3C)
Egress queues	64K Queues (3-level H-QoS)

Description	Specification		
Ethernet OAM			
CFM	**Interval**	**Remote MEPs**	**Local MEPs**
	100 ms	100	100
	1 sec	1000	1000
	10 sec	8000	8000
	1 min	16000	16000
	10 min	16000	16000
EFM	Per Interface		
ITU Y.1731 (FM)	Same as CFM		
ITU Y.1731 (DM)	**Type**	**Interval**	**# of Sessions**
	Line Card	1 sec	100
	System	1 sec	1000
MPLS-TP OAM			
BFD	Interval	# of Sessions	
	3.3 ms	1000	
High Availability			
High Availability features	Stateful Switchover (SSO)		
	In Service Software Upgrade (ISSU)		
	MPLS-TP 1:1 path protection		
	Link Aggregation (LAG)		
	Resilient Ethernet Protocol (REP)		
Multicast			
Multicast features	IGMP snooping v1, v2, and v3		
	Multicast VLAN registration (MVR)		

Product Specifications

Table 2.   Product Specifications

Description	Specification
Evolutionary Monitoring	
Carrier-class Operations, Administration, and Maintenance (OA&M)	• IETF MPLS-TP Continuity Checks (CC) Bidirectional Forwarding Detection (BFD) (RFC5860)
	• IETF MPLS-TP Continuity Verification (CV) LSP Ping and LSP Traceroute
	• IP/MPLS OAM Virtual Circuit Connectivity Verification (VCCV), Ping, and Traceroute
	• Connectivity Fault Management (802.1ag)
	• Ethernet Link OAM (802.3ah)
	• ITU Y.1731 Fault Management & Delay Management
Network Timing and Synchronization	
Synchronous Ethernet	Derive and provide synchronization from BITS and Ethernets interfaces on CPT 200 and 600
IEEE 1588v2 PTP	Derive, Provide, and Transparently passes timing and frequency information on all CPT 200 and 600 Ethernet interfaces
Product Functionality, Benefits and Specifications	
Software Support	• Cisco Transport Controller: End-to-End Network Point and Click Provisioning, Maintenance, & Alarm Correlation.
	• Integrated Robust Command Line Interface (CLI)

Description	Specification

MPLS-Transport Profile (TP)	• IETF Standard Based MPLS-Transport Profile:
	  ◦ RFC 5317
	  ◦ RFC 5654
	  ◦ RFC 5921
	  ◦ RFC 5880
	  ◦ RFC 5960
	  ◦ RFC 5586
	  ◦ RFC 5951
	  ◦ RFC 5950

Flexible Ethernet services	• Ethernet Virtual Connections (EVCs): Ethernet services are supported using individual EVCs to carry traffic belonging to a specific service type or end user through the network. EVC-based services can be used in conjunction with MPLS-based L2VPNs and native Ethernet switching deployments. • Flexible VLAN classification: VLAN classification into Ethernet flow points (EFPs) includes single-tagged VLANs, double-tagged VLANs (QinQ and 802.1ad), contiguous VLAN ranges, and noncontiguous VLAN lists. • IEEE Bridging: The line cards support native bridging based on IEEE 802.1Q, IEEE 802.1ad, and QinQ VLAN encapsulation mechanisms. • Resilient Ethernet protocol (REP): The REP provides a resilient, fast-convergence mechanism for aggregating and connecting to Ethernet-based access rings.
L2VPN services	• MPLS-TP Circuit with Ethernet over MPLS-TP (EoMPLS-TP): EoMPLS-TP transports Ethernet frames across an MPLS-TP LSPs using pseudowires. Individual EFPs or traffic from an entire port can be transported over an MPLS-TP network using pseudowires to an egress interface or sub-interface. • Virtual Private LAN Services (VPLS): These services are included in a class of VPN that supports the connection of multiple sites in a single bridged domain over a MPLS-TP network. VPLS presents an Ethernet interface to customers, simplifying the LAN and WAN boundary for service providers and customers, and enabling rapid and flexible service provisioning, because the service bandwidth is not tied to the physical interface. All services in a VPLS appear to be on the same LAN, regardless of location. • Pseudowire redundancy: Pseudowire redundancy supports the definition of a backup pseudowire to protect a primary pseudowire in case of failure. • Multi-segment pseudowire stitching: Multi-segment pseudowire stitching is a method for interworking two pseudowires together to form a cross-connect relationship.
SPAN	Span is a technique of replicating the ingress or egress frames in a specific port to a specified list of destination ports. It is a monitoring feature used to monitor the traffic that is coming out of a port or an EFP. The monitored traffic can be used to debug the network and can also be used by law enforcement agencies.
High Availability	• MPLS-TP: 1:1 MPLS TP LSP delivers protection switching for networks with sub-50ms APS switching for link, node, path failures. • Bidirectional Forwarding Detection (BFD): BFD is a detection protocol that is designed to provide fast forwarding path-failure detection times for all media types, encapsulations, topologies, and routing protocols • 802.3ad Link Aggregation Bundles: The line cards support a bundle of multiple links to provide added resiliency and the ability to load balance traffic over multiple member links.
Multicast	• IGMP v2 and v3 snooping: This Layer 2 mechanism efficiently tracks multicast membership on an L2VPN network. Individual IGMP joins are snooped at the VLAN level or pseudowire level. In residential broadband deployments, this scenario enables the network to send only channels that are being watched to downstream users. • Multicast VLAN Registration (MVR): MVR optimizes the control plane (IGMP) load between the router and switch. MVR feature enables switch to aggregate different JOINs received on different VLANs (from the receivers) into one JOIN (on a single VLAN, which could be the same as or different from the VLANs of the receiving ports) towards the router. The switch then distributes (replicate) the received content into the relevant ports.
Ethernet OA&M	• Connectivity Fault Management (CFM) Ethernet layer OAM protocol provides end-to-end provider edge (PE to PE) and/or customer edge to customer edge (CE to CE) fault management. CFM includes proactive connectivity monitoring, fault verification, and fault isolation for large Ethernet metropolitan-area networks (MANs) and WANs. CFM is defined by IEEE 802.1ag standard. • Ethernet Link OAM is a protocol for installing, monitoring, and troubleshooting Ethernet metropolitan-area networks (MANs) and Ethernet WANs. It relies on an optional sublayer in the data link layer of the Open Systems Interconnection (OSI) model. Ethernet Link OAM is defined by IEEE 802.3ah standard. • Remote Ethernet Port Shutdown. The Remote Ethernet Port Shutdown replicates a local link failure over an EoMPLS pseudowire to a remote link shutdown the remote Ethernet port down. Bot UNI interfaces connected to the EoMPLS pseudowire will shutdown in the event of a pseudowire failure. • ITU Y.1731 Fault Management and Delay Management. The ITU-T Y.1731 feature provides OAM functions for fault management and performance monitoring functionality for service providers in a large network. ITY Y.1731 includes Ethernet Alarm Indication Signal (ETH-AIS), Ethernet Remote Defect Indication (ETH-RDI), Ethernet Locked Signal (ETH-LCK) functionality for fault detection and isolation. ITU Y.1731 Delay Management (DM) provides a standard Ethernet PM function that includes measurement of Ethernet frame delay and frame delay variation.

Description	Specification
MPLS OA&M	• IP/MPLS OA&M: LSP Ping & LSP Trace Route • Pseudo-Wire: Virtual Circuit Connectivity Verification (VCCV), Ping, Traceroute, Static Status Message to LDP Status Message Translation • MPLS-TP OA&M: GACH/GAL and MPLS-TP LSP BFD OAM
Connectivity	4x10-Gbps 802.3 Ethernet SFP+ Ports
Memory	2 GB DRAM
Description	Specification
Environmental and Compliance Standardization	
Physical dimensions (H x W x D); Weight	13.035 x 0.975 x 10.085 in., 2.30 pounds (US) 513.1990 x 2.4765 x 25.6159 cm, 1.04 kg
Power	Max Power 128 Watts Nominal Power 89 Watts
Network Equipment Building Standards (NEBS)	GR-1089 Issue 5, GR-63 Issue 3
Operating temperature (nominal)	50°C to 55°C
Operating humidity (nominal) (relative humidity)	5–85% noncondensing, operation is guaranteed up to 95% noncondensing
Storage temperature	–40°C to 70°C
Storage (relative humidity)	93% noncondensing
Operating altitude	13,123.36 feet (4000 meters)

Warranty Information

Find warranty information on Cisco.com at the Product Warranties page.

Ordering Information

To place an order, visit the Cisco Ordering Home Page. To download software, visit the Cisco Software Center.

Table 3.   Ordering Information

Product Name	Part Number
Packet Transport Module 4x10GE	CPT-PTM-10Gx4=

Cisco Services

Cisco Services make networks, applications, and the people who use them work better together.

Today, the network is a strategic platform in a world that demands better integration between people, information, and ideas. The network works better when services, together with products, create solutions aligned with business needs and opportunities.

The unique Cisco Lifecycle approach to services defines the requisite activities at each phase of the network lifecycle to help ensure service excellence. With a collaborative delivery methodology that joins the forces of Cisco, our skilled network of partners, and our customers, we achieve the best results.

For More Information

For more information about the Cisco CPT Packet Transport Module (PTM), contact your local account representative or visit Cisco at: www.cisco.com/go/CPT.

Cisco ONS 15454 CE 8-Port 10/100Base-T Ethernet Card

The Cisco® Carrier Ethernet (CE) Card (Figure 1) for the Cisco ONS 15454 Multiservice Provisioning Platform (MSPP) helps enable the delivery of true carrier-class, private-line Ethernet services. Through its portfolio of Ethernet service cards, the Cisco ONS 15454 has helped enable service providers and enterprises to effectively and efficiently migrate their networks from offering/transporting only time-division-multiplexing (TDM) services to networks capable of multiservice delivery over a single, converged architecture and eliminating the need for multiple overlay infrastructures. The introduction of the CE-Series module, with generic framing procedure (GFP), virtual concatenation (VCAT), and link capacity adjustment scheme (LCAS) helps service providers and enterprises maximize bandwidth utilization and promote industrywide interoperability for Ethernet private line services.

Figure 1.   Cisco ONS 15454 CE 8-Port 10/100Base-T Ethernet Card

The Cisco ONS 15454 MSPP is the optical industry's first metro optical transport platform. The Cisco ONS 15454 combines supercharged SONET/SDH transport, integrated optical networking (ITU grid wavelengths and dense wavelength-division multiplexing [DWDM], for example), and unprecedented multiservice interfaces on demand (TDM, Ethernet/IP, and storage, for example) to deliver radical economic benefits. The Cisco ONS 15454 provides the functions of multiple network elements in a single platform. As a critical component of a complete, end-to-end advanced service architecture from Cisco Systems®, the Cisco ONS 15454 delivers a scalable optical transport mechanism and intelligent Ethernet/IP support required to cost-effectively deliver next-generation voice and data services.

Cisco continues its tradition of converged network services leadership with the introduction of the CE-Series and the Cisco ONS 15454 MSPP CE 8-port 10/100Base-T Ethernet Card, which helps enable the efficient delivery of private-line Ethernet services without a major overhaul or redesign of existing transport infrastructure.

Ethernet Card Overview

The Cisco CE 8-port Ethernet Card is a single-slot line card offering 8-port, 10/100-Mbps Ethernet via standard RJ-45 interfaces. Traffic from the eight interfaces is encapsulated into a SONET/SDH payload using either GFP or framing based on high-level data link control (HDLC). The resulting packet-over-SONET/SDH (POS) traffic is then mapped into a SONET circuit for transport across the network. These circuits form a one-to-one relationship with the eight front-panel ports and are referred to as virtual concatenated groups (VCGs). Each VCG uses low-order or high-order contiguous and/or virtual concatenation mechanisms to determine circuit sizing. The card also supports LCAS, which allows hitless dynamic adjustment of SONET/SDH link bandwidth. Additionally, each card supports packet processing, classification, queuing based on quality of service (QoS), and traffic-scheduling features, all required for supporting advanced services delivery.

The Cisco ONS 15454 MSPP CE 10/100Base-T Ethernet Card includes these features:

- 8-port 10/100Base-T, RJ-45 connectors
- 4 x 150 Mbps (4 x STS-3/VC4) SONET/SDH transport bandwidth per card
- Each 10/100Base-T port mapped to SONET/SDH POS using GFP-F (ITU-T G.7041) or LAN Extension (LEX) (HDLC) encapsulation
- Each POS can consist of high-order contiguous concatenation (CCAT) (SONET – STS-1, STS-3c; SDH – VC4) or VCAT (STS-1-1v, STS-1-2v, STS-1-3v) circuits
- Each POS port can consist of low-order contiguous concatenation (CCAT) (SDH – VC3) or VCAT (SONET – VT1.5-Xv where X=1–64; SDH – VC12-Xv where X=1–63, VC3-1v, VC3-2v, VC3-3v) circuits
- In-service capacity increment/decrement (ITU-T G.7042 LCAS)
- Sub-50-millisecond (ms) SONET/SDH protection/restoration of transport circuits
- Transparent to Layer 2 bridging, switching, Ethernet MAC control protocols (Cisco EtherChannel® technology, 802.1x, Cisco Discovery Protocol, VLAN Trunking Protocol [VTP], Spanning Tree Protocol), and VLAN (802.1Q and QinQ)
- Ethernet link functions: autonegotiation, link speed auto sense, full/half duplex, flow control (802.3x)
- QOS Capabilities – Packet prioritization based upon IP type of service (ToS) or 802.1P
- Maximum packet size supported: 1548 bytes
- A-to-z provisioning (Cisco Transport Controller and Cisco Transport Manager), TL-1 provisioning
- Simple Network Management Protocol (SNMP) alarms and Remote Monitoring (RMON) performance monitoring
- Cisco Transport Controller/Cisco Transport Manager/TL-1 management
- Interoperation with (over SONET/SDH) G-Series and ML-Series cards
- Back-pressure flow control
- Terminal and facility loopback
- Link integrity support

Product Applications

Cisco ONS 15454 CE 8-port Ethernet Card provides the flexibility to meet the demands of a wide variety of private line Ethernet applications found within service provider and enterprise networks. Figures 2 and 3 outline a few of the applications that can be met using the CE-Series cards.

Cisco ONS 15454 CE 8-port Ethernet Card and the Cisco ONS 15310-CL CE Card are fully interoperable, allowing service providers to efficiently extend the Carrier Ethernet services across the metro and farther out into the access networks.

Reliable Enterprise Networking

When the Cisco ONS 15454 is equipped with the CE-Series card, enterprise users can build highly reliable multiservice networks to support data, voice, and video applications. Additionally, a network based on a Cisco ONS 15454 provides the flexibility to support traditional TDM-based services along with Ethernet services. The Cisco ONS 15454 provides transport scalability from 155 Mbps (OC-3/STM-1) up to 320 Gbps (thirty-two 10-Gbps wavelengths), positioning the enterprise network for future growth.

Figure 2.   Reliable Enterprise Networking
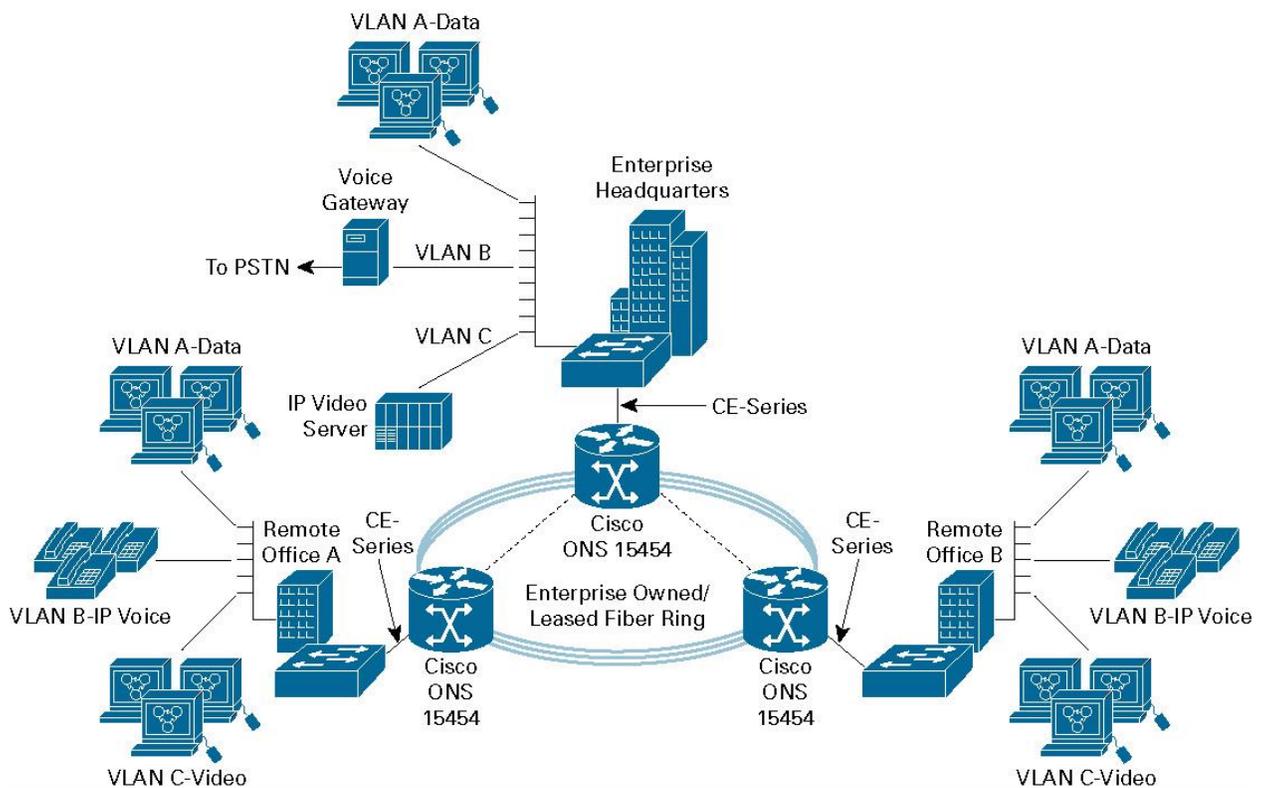
Private Line Carrier Ethernet

A metropolitan network that supports a wide range of service capabilities allows service providers to offer a tariff mix to meet each customer's needs. The Cisco ONS 15454 provides the foundation for building an advanced multiservice network over an extremely reliable SONET/SDH infrastructure (Figure 3). The Cisco ONS 15454 CE 8-port Ethernet Card helps enable the delivery of data services, such as transparent LAN services (TLS) or Internet access, over a carrier-class optical infrastructure supporting traditional TDM services. The CE-Series Ethernet Card, with VCAT and LCAS functions, helps service providers offer a wide variety of Ethernet service-level agreements (SLAs). VCAT provides a more efficient use of the transport bandwidth for data user interfaces, and LCAS provides an effective way for a service provider to change the allocated bandwidth to each customer. Additionally, provisioning of an Ethernet circuit over a network equipped with a CE 8-port Ethernet Card is easily accomplished through the use of the Cisco ONS 15454's embedded a-to-z circuit provisioning wizard for network-level circuit creation. The CE 8-port Ethernet Card also supports TL-1-based provisioning to simplify integration with many embedded service provider management systems.

Figure 3. Reliable Enterprise Network Using SDH/SONET Infrastructure
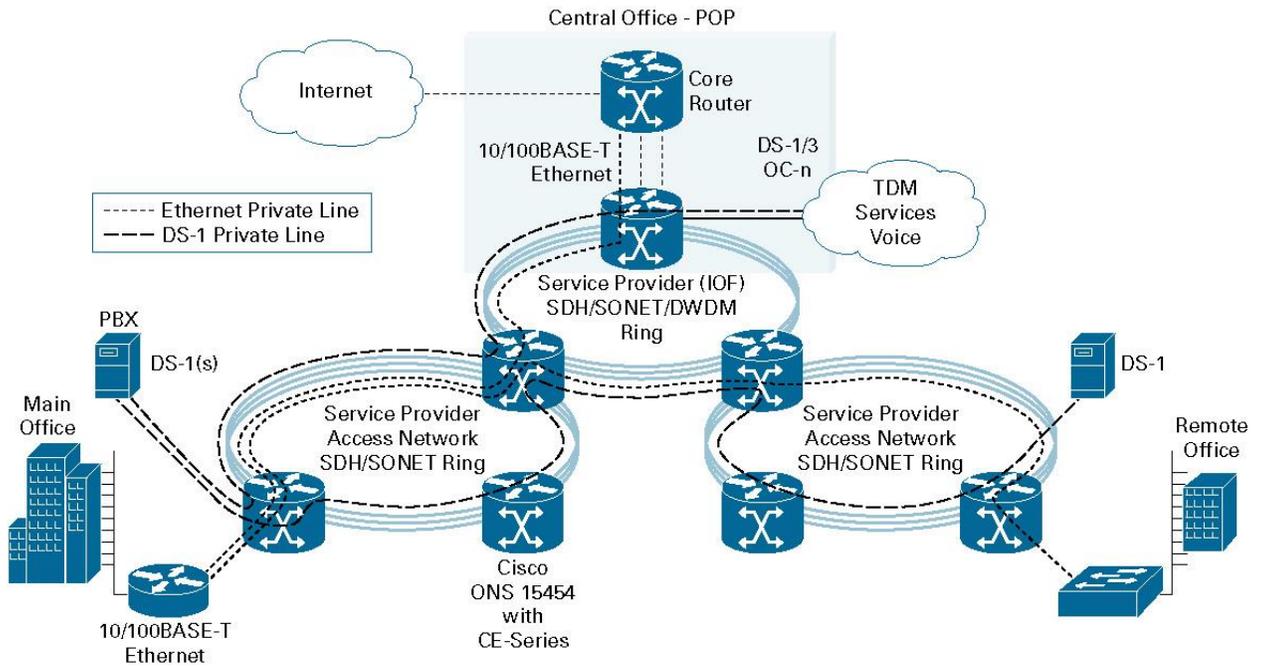
Specifications

Table 1 outlines valid SONET circuit combinations for the Cisco ONS 15454 CE 100Base-T Ethernet Card according to service type, and Tables 2 and 3 indicate the total number of services available per card. Table 4 lists various product specifications for the CE-Series Ethernet Card.

Table 1.   Valid SONET Circuit Combinations

	Service Type	SONET Circuit Type	SDH Circuit Type
1	Line Rate 100Base-T	STS-3c STS-1-3v STS-1-2v	VC4 VC3-2v VC3-3v VC12-50v
2	Sub Rate 100Base-T	STS-1 STS-1-1v VT1.5-Xv (X=1–64)	VC3 VC3-1v VC12(n = 1–49)
3	Line Rate 10Base-T	STS-1 VT1.5-Xv (X=7)	VC12 (n = 5)
4	Sub Rate 10Base-T	VT1.5-Xv (X=1–5)	VC12 (n = 1–4)

Table 2.   Maximum Number of Services per Card in a SONET Chassis

Service Mix Options per Card	100Base-T – Line Rate		100Base-T – Sub Rate	10Base-T – Line Rate or Sub Rate	Total Active Services per Card
	STS-3c, ST-1-3V	STS-1-2v	STS-1	VT1.5-Xv (X=1-7)	
1	4	0	0	0	4
2	3	1	1	0	5
3	3	0	3	0	6
4	3	0	0	4 (X=1–21)*	7*
5	2	2	2	0	6
6	2	1	4	0	7
7	2	1	1	4 (X=1–21)	8*
8	2	0	6	0	8
9	2	0	3	3 (X=1–28)	8
10	2	0	0	6 (X=1–28)	8
11	1	3	3	0	7
12	1	2	5	0	8
13	1	2	2	3 (X=1–28)	8
14	1	1	1	5 (X=1–28)	8
15	1	0	7	0	8
16	1	0	3	4 (X=1–42)	8
17	1	0	0	7 (X=1–28)	8
18	0	4	4	0	8
19	0	3	3	2 (X=1–42)	8
20	0	0	8	0	8
21	0	0	4	4 (X=1–42)	8
22	0	0	0	8 (X=1–42)	8

*This LO-VCAT circuit combination is achievable if one of the first two circuits created on the card is a LO-VCAT circuit. If the first two circuits created on the card are HO-VCAT or CCAT STS circuits, then a maximum of six LO-VCAT circuits can be added on the card.

Table 3. Maximum Number of Services per Card in a SDH Chassis

Service Mix Options per Card	100Base-T – Line Rate		100Base-T – Sub Rate	10Base-T – Line Rate or Sub Rate	Total Active Services per Card
	VC4, VC-3-3V	VC-3-2v	VC-3	VC-12-Xv	
1	4	0	0	0	4
2	3	1	1	0	5
3	3	0	3	0	6
4	3	0	0	3 (X=1–21)	6
5	2	2	2	0	6
6	2	1	4	0	7
7	2	1	1	3 (X=1–21)*	7
8	2	0	6	0	8
9	2	0	3	3 (X=1–21)	8
10	2	0	0	6 (X=1–21)	8
11	1	3	3	0	7
12	1	2	5	0	8
13	1	2	2	3 (X=1–21)*	8
14	1	1	1	5 (X=1–21)*	8
15	1	0	7	0	8
16	1	0	3	2 (X=1–32) plus 2 (X=1–31)	8
17	1	0	0	7 (X=1–21)	8
18	0	4	4	0	8
19	0	3	3	1 (X=1–32) plus 1 (X=1–31)	8
20	0	0	8	0	8
21	0	0	4	2 (X=1–32) plus 2 (X=1–31)	8
22	0	0	0	4 (X=1–32) plus 4 (X=1–31)	8

*This LO-VCAT circuit combination is achievable if the VC-12 circuits are created before the VC-3 circuits.

Table 4. Product Specifications

Attributes	Description
Ports	Eight 10/100Base-T Ethernet ports
Port speed	10/100 Mbps
Duplex	Full, half, and autonegotiation
Flow control	Supported
Transport	Up to 8 "Virtual" POS (VCG) ports supporting LO/HO-VCAT
Transport bandwidth per card	Up to 4 x 150 Mbps
Transport bandwidth allocation on "virtual" POS (VCG) ports	SONET – VT1.5-xv (X=1–64), STS-1, STS-1-1v, STS-1-2v, STS-1-3v, and STS-3c SDH – VC12-xv (X=1–63), VC3, VC3-1v, VC3-2v, VC3-3v and VC4
Transport bandwidth adjustment	Optional using the ITU-T G.7042 LCAS mechanism
Ethernet over SONET encapsulation	ITU-T G.7041 GFP-F, Cisco LEX, and Cisco HDLC options
QoS	802.1p and IP TOS based prioritization
Service provisioning	Carrier Ethernet 100Base-T Card: a-to-z service provisioning on Cisco Transport Controller, TL-1-based service provisioning

Attributes	Description
Maximum power	50W
Operating temperature	32 to 122°F (0 to 50°C)
Operating humidity	Noncondensing 5–95%
Dimensions (H x W x D)	12.65 x 0.72 x 9.99 in. (32.13 x 1.83 x 22.86 cm)

Regulatory Compliance

EMC (Class A)

- NEBS Bellcore GR-1089-CORE, Issue 3 (Level 3, Type 2, and Type 4)
- IC ICES-003 Issue 3, 1997
- FCC 47CFR15
- ETSI 300-386-TC
- EN55022, EN55024

Product Safety

- NEBS Bellcore GR-1089-CORE, Issue 3 (Level 3, Type 2, and Type 4)
- IEC 60950-1/EN 60950-1, First Edition (CB report/certificate with all country deviations)
- UL and cUL/CSA 60950-1 First Edition

Environmental

- NEBS Bellcore GR-63-CORE, Level 3
- ETS 300 019-2-1 (Storage, Class 1.1)
- ETS 300 019-2-2 (Transportation, Class 2.3)
- ETS 300 019-2-3 (Operational, Class 3.1E)

System Requirements

The Cisco ONS 15454 system requirements for operation of the CE 8-Port 10/100Base-T Ethernet Card are outlined in Table 5.

Table 5.   System Requirements

System Parameter	SONET	SDH
Shelf assembly	SA-ANSI, SA-HD, NEBS3E	SA-ETSI
Electrical Interface Assembly (EIA) panels or FMECs	Not required	Not required
Processor	TCC2 or TCC2P	TCC2 or TCC2P
Cross-connect	XC-VT XC-10G XC-VXC-10G	XC-VXL-2.5 XC-VXL-10G XC-VXC-10G
System software	Release 5.0 or later (SONET)	Release 6.0 or later (SDH)
Slot compatibility	Slots 1 to 6, 12 to 17	Slots 1 to 6, 12 to 17

Ordering information

To place an order, visit the Cisco Ordering Home Page. Table 6 outlines the ordering code for the Cisco ONS 15454 CE 8-Port 10/100Base-T Ethernet Card.

Table 6.   Ordering Information

Product Description	Part Number
10/100 Mpbs Ethernet card, CE-Series, 8 ckt, SONET system	15454-CE-100T-8=
10/100 Mpbs Ethernet card, CE-Series, 8 ckt, SDH system	15454E-CE-100T-8=

Service and Support

Cisco Systems offers a wide range of services programs to accelerate customer success. These innovative services programs are delivered through a unique combination of people, processes, tools, and partners, resulting in high levels of customer satisfaction. Cisco services help you to protect your network investment, optimize network operations, and prepare the network for new applications to extend network intelligence and the power of your business. For more information about Cisco services, see Cisco Technical Support Services or Cisco Advanced Services.

For More Information

For more information about the Cisco ONS 15454, visit http://www.cisco.com/en/US/products/hw/optical/ps2006/ps2010/index.html or contact your local account representative.

Cisco ML-Series for the Cisco ONS 15454 Multiservice Provisioning Platform: Providing Multilayer Services for Metro Optical Ethernet

The Cisco® ML-Series interface cards provide exceptional Ethernet switching and IP routing capabilities for multiservice provisioning platforms (MSPPs). Cisco Systems® has coupled the market-leading optical capabilities of the Cisco ONS 15454 MSPP with proven Cisco IOS® Software to deliver profitable Metro Ethernet and IP solutions over a multiservice network architecture.

BACKGROUND

Information connectivity is becoming ubiquitous as businesses and consumers look for ways to improve their productivity. Access to this information can be over a wide variety of networks, including the many forms of wire-line (DSL, T1, E1, dialup, cable modem, fiber to the premises, and so on) and wireless (cell, 802.11, WiMAX, and so on) vehicles. The main benefit of this information connectivity is user access to a wide variety of information that can be located anywhere in the world.

Ethernet technology has become the protocol of choice for the LAN environment. It is also becoming increasingly commonplace in metropolitan-area networks (MANs) with the release of Fast Ethernet and Gigabit Ethernet (GE) interfaces on DSL access multiplexers (DSLAMs), fixed wireless, and private branch exchanges (PBXs). Thus, service providers are creating tariffs to efficiently interconnect to and transport users' data traffic using Ethernet handoffs, and they must deploy metropolitan (metro) transport equipment that will permit them to deliver these services cost-effectively and with the reliability required by their service-level agreements (SLAs). Although Ethernet-based services are growing, they are still not the dominant share of the market demand. Therefore, the service provider's metro networking equipment must support both traditional time-division multiplexing (TDM) services as well as newer Ethernet services without a major upgrade – this explains why the multiservice provisioning platform has taken hold in the metro marketplace.

PRODUCT OVERVIEW

The Cisco ML-Series cards for the Cisco ONS 15454 MSPP (Figure 1) are industry-leading Ethernet and IP switching modules for integration into a SONET/SDH optical transport platform. The cards extend the multiservice capabilities and flexibility offered by the Cisco ONS 15454 platform.

Figure 1.   Cisco ML-Series Cards for Cisco ONS 15454 MSPP

Through the integration of the industry's most widely deployed and tested Ethernet and IP technology, Cisco IOS Software, with the industry's most successful multiservice provisioning platform, the Cisco ONS 15454, service providers and enterprise customers are provided with a single integrated platform for delivering true carrier-class Metro Ethernet, TDM, and optical transport services and applications.

The Cisco MultiLayer-Series (ML-Series) for the Cisco ONS 15454 consists of three interface cards: the Cisco MultiLayer (ML) 100X-8, MultiLayer (ML) 100T-12, and MultiLayer (ML) 1000-2 models. The Cisco ML100X-8 is an 8-port, 100-Mbps Ethernet interface card that supports the 100BASE-FX short-reach Small Form-Factor Pluggable (SFP) and 100BASE-LX long-reach SFP. The Cisco ML100T-12 is a 12-port, 10/100-Mbps Ethernet module. The Cisco ML1000-2 is a 2-port Gigabit Ethernet module using SFP optical interface modules. The Cisco ML-Series cards use a common hardware and software base, providing the same Layer 2 and Layer 3 feature set. These single-slot cards can be installed in any of the 12 multiservice interface slots in a Cisco ONS 15454 shelf assembly and can be mixed and matched within the assembly or network to provide flexible architectures to meet the user's application needs. Each card has virtual interfaces that are mapped to SONET/SDH optical interfaces for transport with other services between network elements over 155-Mbps to 10-Gbps optical line rates. Packet transport bandwidth over the chosen optical interface is provisionable, allowing efficient matching and scalability of ingress to transport traffic requirements, based upon oversubscription requirements.

The Cisco ML-Series cards support proprietary Resilient Packet Ring (SW-RPR), which provides increased bandwidth usage over a SONET/SDH ring. SW-RPR features also include shortest-path selection and spatial reuse for bridging. The Cisco ML-Series offers standards-based 802.17b RPR. In addition to the features of SW-RPR, 802.17b RPR benefits include steering protection and standardized ring fairness.

The Cisco ML-Series cards offer an advanced set of quality-of-service (QoS) features to allow the network administrator to fine-tune the network and create and support a wide range of SLAs. Some of the features and benefits are listed in Table 1.

Table 1. Features and Benefits for QoS

Feature	Benefit
Flexible packet classification	Classifies packets based on input port, VLAN, class of service (CoS), IP Precedence, or IP-differentiated services code points (DSCPs), allowing the service provider to tailor packet handling based on the user's traffic
Policing	Through highly granular per-flow and input port policing, allows the service provider to contain a user to the SLA bandwidth requirements, reducing the likelihood that a user will flood the network
Priority marking	Provides a mechanism, when using either .1Q or Q, in Q features for a service provider to reclassify (mark) a packet with a wrapper Ethernet 802.1p value, allowing downstream nodes to treat the packet differently and transparently transporting the original CoS bits of the packet across a service provider network
Per-class queuing	Provides fair access to excess network resources, allows allocation of bandwidth to support SLAs, and helps ensure that applications with high network resource requirements are adequately serviced
Weighted Deficit Round-Robin (WDRR) scheduling	Adds weighting capabilities to deficit round-robin scheduling to provide fair access to excess bandwidth as well as throughput to each class

The Cisco ML-Series cards offer important advantages in service provider network architectures, permitting new, profitable services as well as simplifying service activation. Some of these capabilities are outlined in Table 2.

Table 2. Features and Benefits for Service Provider Network Architectures

Feature	Benefit
Admission control	During service provisioning, the Cisco ML-Series card verifies that QoS resources have not been accidentally overcommitted.
Network scaling and flexibility	The Cisco ML-Series cards support VLAN-ID translation. This capability allows the service provider to change the ingress VLAN tags (802.1Q or 802.1Q in .1Q) to avoid VLAN collisions within the network (resulting from the use of the same VLAN ID by different customers) and translate them back at the egress of the network.
Network resiliency	Support for RPR or SONET/SDH provides resiliency of less than 50 ms for data services, depending on the service offering.
Efficient bandwidth use	The use of RPR technology allows full use of the network bandwidth during normal network operation of a properly designed network.
SLA management	The Cisco IOS Software IP SLA tool monitors packet latency, jitter, and loss over metro optical networks or a combination of metro optical and IP and Multiprotocol Label Switching (MPLS) networks. The IP SLA tool can be used with Cisco IOS Software devices and other vendor devices. Comprehensive performance management statistics are provided at the interface or subinterface level (VLAN) for proactive SLA tracking and network problem identification.
Packet over SONET/SDH (PoS) virtual ports support	PoS support allows the service provider to transport Ethernet traffic originating on a Cisco ML-Series card over an optical interface and terminate the signal on an optical port of existing Layer 2 and Layer 3 equipment, eliminating the need to bookend the Cisco ML-Series cards within the network.
Reduced interface costs	The use of the Cisco ML-Series cards and shared bandwidth transport allows the service provider to benefit from statistically multiplexing the edge traffic before handing off a more efficiently filled interface to the core router or switch.

APPLICATIONS

The Cisco ONS 15454 ML-Series cards provide the flexibility to meet the demands of a wide variety of network applications found within many service providers' transport networks. The following figures show a few of the applications that can be cost-effectively deployed using the Cisco ONS 15454 with the Cisco ML-Series cards.

Ethernet Service Delivery

The Cisco ONS 15454 with either the Cisco ML100X-8 or ML1000-2 Cisco ML-Series cards can be used for efficient 100BASE-FX and Gigabit Ethernet service delivery over fiber to better reach customers from a central office or point of presence (POP), refer to Figure 2. In addition, when the Cisco ONS 15454 with the Cisco ML-Series cards is placed in a telco wiring closet in the basement of a customer building, fiber from the riser can be used to more efficiently deliver 100BASE-FX and Gigabit Ethernet services. Customers can use the Cisco ML-Series cards to offer a wide range of Ethernet services with Layer 2 switching, RPR, and advanced QoS capabilities.

Figure 2. Ethernet Service Delivery
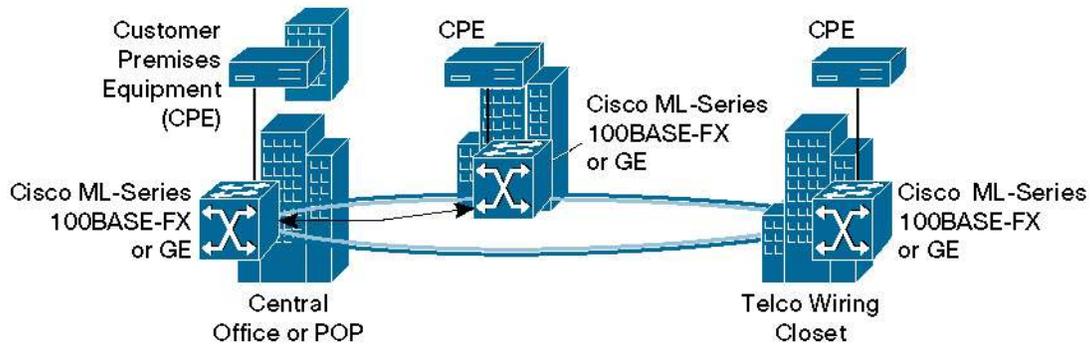
Interoffice Facility Networks

All traditional local exchange carriers (LEC) have used SONET/SDH technology to interconnect their central offices. With the explosion of data-related services and the growth of termination equipment with integrated Ethernet interfaces and protocols, these carriers increasingly need to transport data traffic more efficiently. Using the Cisco ML-Series cards to interconnect data traffic between the remote terminal equipment and the central core router provides transport bandwidth efficiency by statistically multiplexing and aggregating traffic for efficient router port use, reducing the quantity of core router interfaces. Management benefits are garnered through the integration of data switching into the optical platform, reducing the number of data-communication-network (DCN) ports. Figure 3 shows an interoffice facility (IOF) transport network.

Figure 3. IOF Transport Network
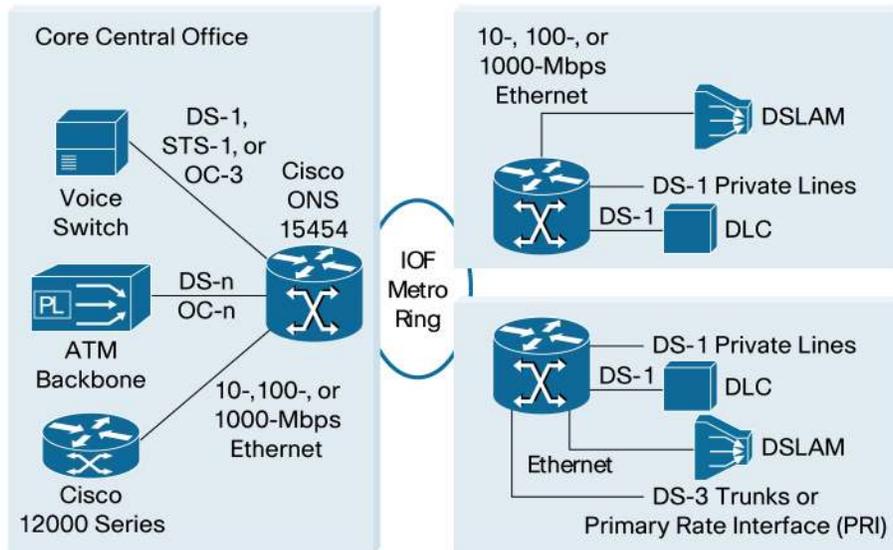
Metro Data Services Network

Metropolitan networks deliver services to end-user customers. A metropolitan network that supports a wide range of service capabilities allows the service provider to offer a tariff mix to meet customer needs. The Cisco ONS 15454 provides the foundation for building an advanced multiservice network over an extremely reliable SONET/SDH infrastructure (refer to Figure 4). Data services delivery, such as transparent LAN services (TLS) or Internet access, are supported by the Cisco ONS 15454 ML-Series cards through the use of 802.1Q in the .1Q VLAN protocol, VLAN translation, input rate limiting, and advanced QoS features, including queue bandwidth control and traffic

priority marking. These flexible features allow the service provider to build, control, and guarantee the delivery of the SLAs offered for each service type. To help service provider technicians manage and use the network, the Cisco ML-Series cards integrate Cisco IOS Software, the industry's best-known Layer 2 and Layer 3 technology, reducing training time and cost.

Figure 4. Metro Data Services Network TLS
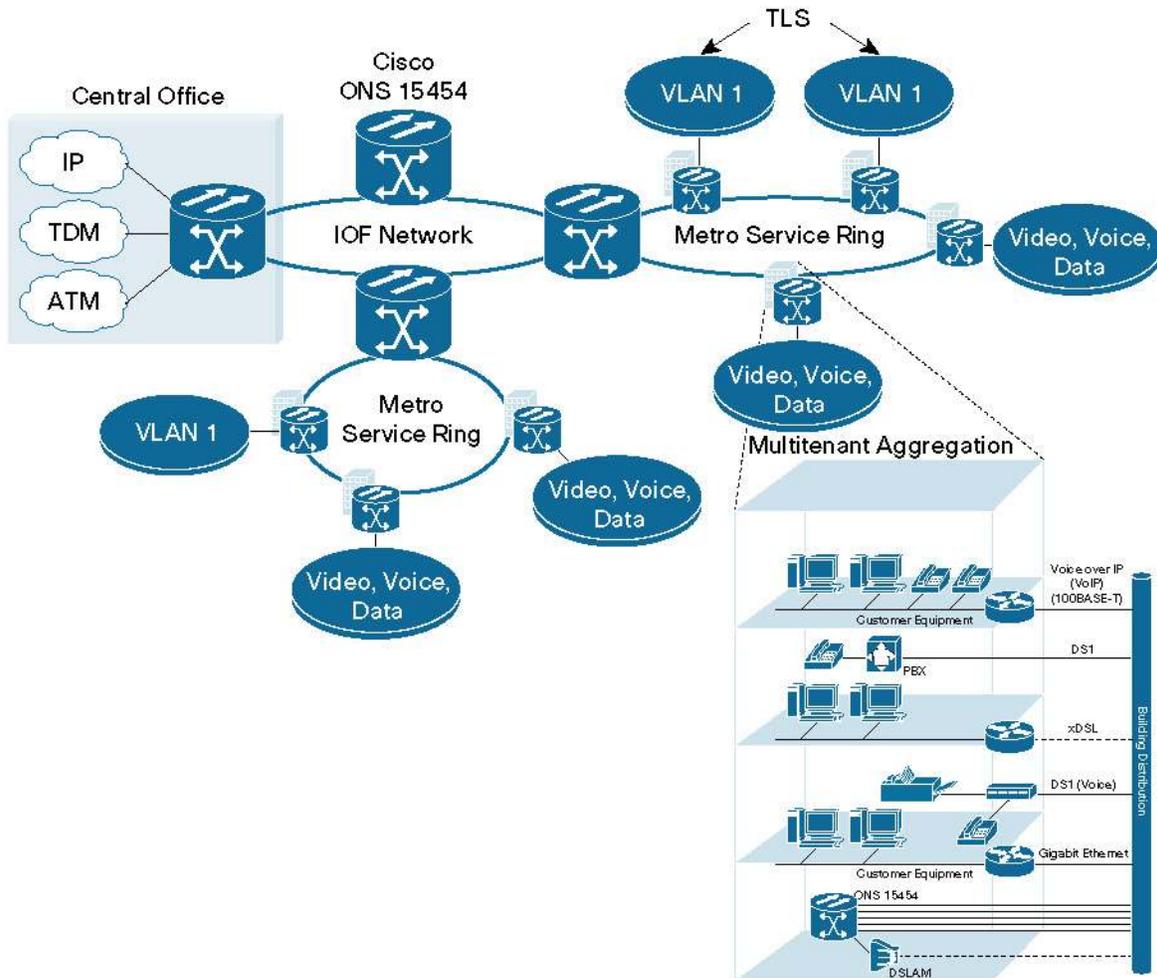
Cable Television Data Transport

Cable television operators are experiencing rapid growth of subscribers to their data services. The Cisco ONS 15454 with Cisco ML-Series cards provides a solution to efficiently transport the increasing data on cable television networks. The Cisco solution allows the cable operator to aggregate data traffic, using the Cisco ML-Series cards, from multiple secondary headends and statistically multiplex it onto shared transport bandwidth for handoff to a core router at the master headend (Figure 5). Cable modem traffic is bursty, and the sharing of bandwidth allows better use of optical transport resources compared to dedicated point-to-point connections. The advanced QoS capabilities of the Cisco ML-Series cards allow the cable network engineer to design the network to support the committed information rate (CIR) necessary for the types of services being offered, such as Web browsing, VoIP, and video on demand (VoD). The Cisco ML-Series cards allow the user to build traffic queues and associate priority and bandwidth with each queue type, allowing the transport demands of each service to be met. The Cisco ONS 15454 platform supports in-service bandwidth upgrades and allows the transport network to scale from 155 Mbps to 320 Gbps using dense wavelength-division multiplexing (DWDM) so that growth demands should be easily met.

Figure 5. Cable Television Data Networking
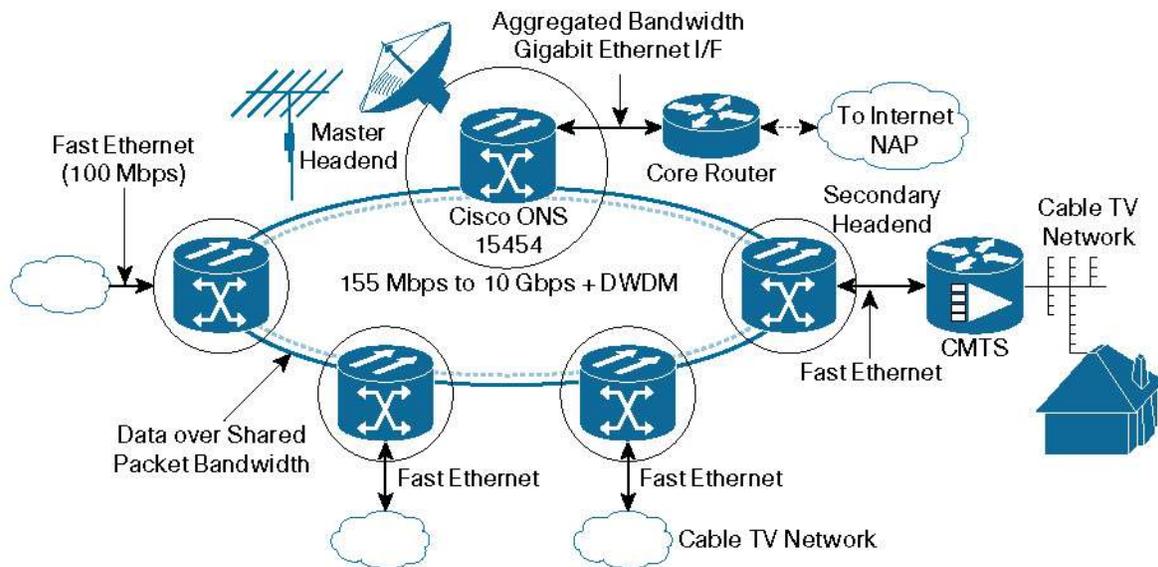
THE CISCO ADVANTAGE

The Cisco ONS 15454 MSPP solution offers significant advantages over traditional optical network elements combined with external Layer 2 and Layer 3 devices. These advantages are summarized as follows.

Integrated Multiservice Capabilities

The Cisco ONS 15454 MSPP solution supports traditional TDM-based, private-line services (for example, DS-1/E-1, DS-3/E-3, and OC-*n*/STM-*n*) along with advanced Ethernet-based services, simplifying service provider migration to new data tariffs and interface flexibility for enterprise users.

Flexible Architectures

The Cisco ONS 15454 platform supports two- or four-fiber bidirectional line switched ring (BLSR) or multiplex section-shared protection ring (MS-SPR), unidirectional path switched ring (UPSR) or multiplex section protection (MSP), linear automatic protection switching (APS) or subnetwork connection (SNC), and path-protected mesh networking (PPMN) architectures. The Cisco ML-Series services cards can be deployed over any of these architectures and protection schemes, allowing the service provider to build a network that meets the customer's SLA requirements. The platform facilitates in-service optical bandwidth expansion using card upgrades, allowing customers to expand their networks to match demand without major replacement, and allowing network expenditures to better match revenue and bandwidth requirements.

Efficient Network Management

Management is simplified through a common DCN network connection and user access for Ethernet and optical functions.

Unified Software Load

One software load supports transport and data capabilities, eliminating unnecessary guesswork from ordering, installation, and upgrades.

Familiar, Proven Cisco IOS Software Technology

The Cisco ML-Series cards incorporate Cisco IOS Software technology, the leading Ethernet and IP delivery vehicle. Most data networking professionals are well trained on Cisco IOS Software, reducing the need for additional training and improving service deployment timelines.

The Cisco ONS 15454, the industry-leading metro optical transport platform, delivers supercharged SONET/SDH transport, integrated optical networking, outstanding multiservice interfaces, and competitive economic benefits.

CISCO ML-SERIES ETHERNET CARDS FOR CISCO ONS 15454 FEATURES AND SPECIFICATIONS

Compact Design

- Single-width card slot design for increased shelf flexibility and scalability
- Up to 12 Cisco ML-Series cards per shelf assembly

Data Architecture Options

- Hub and spoke
- Point to point
- RPR with optional Dual RPR Interconnect (DRPRI) or Redundant Interconnect for fail-safe ring-to-ring networking
- 802.17b standard RPR with optional Redundant Interconnect for fail-safe ring-to-ring and ring-to-node networking

Optical Transport Options

- UPSR or subnetwork connection protection (SNCP)
- Two-fiber and four-fiber BLSR or MS-SPR
- APS or MSP (1 + 1 unidirectional or bidirectional)
- Path-protected mesh network (PPMN)
- Unprotected (0 + 1)

Network Architecture Flexibility

- Ring
- Multiple rings
- Linear add-drop multiplexer
- Terminal

REGULATORY COMPLIANCE

Table 3 summarizes regulatory compliance for the Cisco ONS 15454 MSPP solution.

Table 3. Regulatory Compliance

Countries	
SONET System • Canada • USA • Mexico • Korea • Japan • EU	**SDH System** • EU • Australia • New Zealand • Singapore • China • Mexico • Hong Kong • Korea
EMC Emissions (Radiated, Conducted) • ICES-003 • GR-1089-CORE • 47CFR15 • VCCI V-3/2000.04 • CISPR24	• EN 300 386-TC • EN50081-1 • EN55022 • AS/NZS3548, Amendment 1 + 2 1995
EMC Immunity • GR-1089-CORE • CISPR24 • EN50082-2	• EN300-386-TC • EN55024
Safety • CAN/CSA-C22.2 No. 60950-00 Third Ed., 12/ 1/2002 • GR-1089-CORE • GR-63-CORE • TS001	• UL 1950 Third Ed., 12/1/2000 • EN60950 (to A4) • IEC60950/EN60950, 3rd Ed. • AS/NZS3260 Supplement 1, 2, 3, 4, 1997
Environmental • GR-63-CORE • AT&T Network Equipment Design Specification	• ETS 300-019 (Class 3.1E) (Note 2)
Structural Dynamics • GR-63-CORE • AT&T Network Equipment Design Specification	• ETS 300-019 (Class 3.1E) (Note 2)
Power and Grounding • SBC (TP76200MP) • ETS 300-132-1 (DC power)	• ETS 300-253 (grounding)

SYSTEM REQUIREMENTS

Table 4 lists system requirements for the Cisco ONS 15454 MSPP solution.

Table 4. System Requirements

Component	Cisco ONS 15454 SONET	Cisco ONS 15454 SDH
Processor	TCC+or TCC2	TCC2
Cross-connect	Cisco 15454 XC[1], XC-VT, XC-10G, or XC-VXC-10G	Cisco 15454 XC-10G, XC-VXL-10G, XC-VXL-2.5G, or XC-VXC-10G
Shelf assembly	Network Equipment Building Standards (NEBS), NEBS3E, and ANSI versions with appropriate fan tray assembly	European Telecommunications Standards Institute (ETSI) version with SDH 48V fan tray assembly
System software	Cisco ML100T-12 and ML1000-2: Revision 4.0.0 or greater Cisco ML100X-8: Revision 6.0.0 or greater	Cisco ML100T-12 and ML1000-2: Revision 4.0.0 or greater Cisco ML100X-8: Revision 6.0.0 or greater
Slot compatibility	Cisco 15454 XC and XC-VT: Slots 5, 6, 12, and 13 Cisco 15454 XC-10G and XC-VXC-10G: Slots 1 to 6 and 12 to 17	Cisco 15454 XC-10G, XC-VXL-2.5G, XC-VXL-10G, and XC-VXC-10G: Slots 1 to 6 and 12 to 17

1. The Cisco ML100X-8 card is not compatible with the Cisco 15454 XC cross-connect.

SPECIFICATIONS

Table 5 lists the specifications for the Cisco ML-Series cards.

Table 5. Specifications for Cisco ML-Series Cards

Attribute	Cisco ML100T-12 and ML100X-8	Cisco ML1000-2
Client Interfaces		
Ports		
• Card	Cisco ML100T-12: 12 RJ-45 Cisco ML100X-8: Eight SFPs (100BASE-FX or 100BASE-LX)	Two SFP slots (SX or LX SFP)
• Shelf (maximum 12 cards)	Up to 144	Up to 24
• Rack (maximum four shelves)	Up to 576	Up to 96
Speed	Cisco ML100T-12: 10/100 Mbps Cisco ML100X-8: 100 Mbps	1000 Mbps
Autonegotiation of duplex mode	Cisco ML100T-12: Yes Cisco ML100X-8: Fixed at 100 Mbps	Yes
Flow control pause	Yes	Yes
SONET/SDH Virtual Interfaces		
Ports	Two	Two
Circuit size	SONET: STS-1, -3c, -6c, -9c, -12c, and -24c (virtual concatenation: STS-1-2v, STS-3c-2v, and STS-12c-2v) SDH: VC-3, -4, -4-2c, -4-3c, -4-4c, and -4-8c (virtual concatenation: VC-3-2v, VC-4-2v, and VC-4-4c-2v)	SONET: STS-1, -3c, -6c, -9c, -12c, and -24c (virtual concatenation: STS-1-2v, STS-3c-2v, and STS-12c-2v) SDH: VC-3, -4, -4-2c, -4-3c, -4-4c, and -4-8c (virtual concatenation: VC-3-2v, VC-4-2v, and VC-4-4c-2v)
Maximum card bandwidth	SONET: STS-48 SDH: VC-4-16	SONET: STS-48 SDH: VC-4-16
Encapsulation	Generic framing procedure framing (GFP-F) and virtual concatenation (VCAT) Cisco High-Level Data Link Control (HDLC) Point-to-Point Protocol (PPP) (RFC 2615) and Bridge Control Protocol (BCP) (RFC 2878) LAN extension (LEX) (Cisco G-Series compatible)	GFP-F and VCAT Cisco HDLC PPP (RFC 2615) and BCP (RFC 2878) LEX (Cisco G-Series compatible)

Attribute	Cisco ML100T-12 and ML100X-8	Cisco ML1000-2
Protocols		
Layer 3 switching	IP switching, static routes, Routing Information Protocol Version 2 (RIPv2), Enhanced Interior Gateway Routing Protocol (EIGRP), Open Shortest Path First (OSPF), Border Gateway Protocol (BGP), Intermediate System-to-Intermediate System (IS-IS), Hot Standby Router Protocol (HSRP), VPN routing and forwarding (VRF-lite with OSPF, BGP, and RIP), QoS, IP Multicast (Protocol Independent Multicast dense mode [PIM-DM], PIM sparse mode [PIM-SM], PIM-SM-DM, Internet Group Management Protocol [IGMP], Source Specific Multicast [SSM], and Multiprotocol BGP [MBGP])	
Layer 2 switching	Ethernet switching and bridging (802.1D), VLAN (802.1Q), priority (802.1p), spanning tree (802.1D), rapid spanning tree (Rapid Spanning Tree Protocol [RSTP], 802.1w), flow control (802.3x), Cisco Fast EtherChannel® technology, Cisco Gigabit EtherChannel technology, PoS Channel (PEC), 802.1Q in 802.1Q, per VLAN rapid spanning tree (PVRSTP) switching	
QoS		
Classifiers (ingress: 254 classes)	IP Precedence Input interface (port) Bridge group (VLAN) Priority (802.1p) DSCPs	IP Precedence Input interface (port) Bridge group (VLAN) Priority (802.1p) DSCPs
Policing	1-Mbps rate limiting (sustained rate and burst) Dual CIR and peak information rate (PIR) leaky bucket (port) Admission control to prevent overcommitment	1-Mbps rate limiting (sustained rate and burst) Dual CIR and PIR leaky bucket (port) Admission control to prevent overcommitment
Queuing	400+ scheduling queues Load and committed bandwidth-based buffer control, 4000 packet buffers, and tail drop Low-latency queues	400+ scheduling queues Load and committed bandwidth-based buffer control, 4000 packet buffers, and tail drop Low-latency queues
Schedulers	WDRR	WDRR
Cisco Modular QoS command-line interface (CLI)	Supported	Supported
Statistics		
Ethernet ports		
• Receive	Bytes, packets, unicast packets, multicast packets, broadcast packets, giants, frame-check-sequence (FCS) errors, runts, jabber, and alignment errors	
• Transmit	Bytes, packets, unicast packets, multicast packets, broadcast packets, giants, and collisions	
Virtual ports (PoS)		
• Receive	Pre-HDLC bytes, post-HDLC bytes, packets, short, runts, long, cyclic-redundancy-check (CRC) errors, input drop packet, and input abort packet	
• Transmit	Pre-HDLC bytes, post-HDLC bytes, packets, and port drop counter	
Security		
Access control list (ACL)	Standard IP on input and output of routed packets Standard IP on input of bridged packets Extended IP to limit control-plane access 4000 entries per card	
Ethernet		
Bridge groups (card)	255	255
Supported 802.1Q VLAN range	1 to 4095	1 to 4095
Hierarchical VLANs (.1Q in .1Q)	255	255
Spanning-tree instances (802.1D)	255	255
Per-VLAN rapid spanning tree (PVRST) instances	255	255
Maximum-transmission-unit (MTU) sizes	64 to 9000 bytes	64 to 9000 bytes
Link aggregation	Cisco Fast EtherChannel links (maximum four links per	Cisco Gigabit EtherChannel links (maximum 2 links per

Attribute	Cisco ML100T-12 and ML100X-8	Cisco ML1000-2
• Client interfaces • Virtual interfaces (Pos channel)	group), 2 ports per link or 1 link	group), 2 ports per link or 1 link
Cable	Cisco ML100T-12: Shielded twisted-pair (STP) Ethernet cable, RJ-45 plug connector (NEBS locations) Cisco ML100X-8: Optical fiber, LC connector, single- or multimode (refer to Table 6)	Optical fiber, LC connector, single- or multimode (refer to Table 6)
Performance		
Layer 2 and Layer 3 switching	Up to 5.0 Mbps	Up to 5.0 Mbps
Management Interfaces		
Data	Cisco IOS Software CLI through console port, Telnet, configured user (client) port, or Cisco transport controller window Simple Network Management Protocol (SNMP) traps	
Transport (SONET/SDH)	Cisco transport controller or Transaction Language One (TL-1) using Telnet or serial port SNMP traps and TL-1 autonomous messages	
Cisco ML-Series card • Console port	RJ-11 jack and data communications equipment (DCE)	RJ-11 jack and DCE
TCC card • LAN access and Cisco transport	RJ-45 jack and 10BASE-T	RJ-45 jack and 10BASE-T
Controller • Serial port	DB-9 jack	DB-9 jack
Security	Multilevel access control, data, and transport planes	
Card LEDs • Failure (FAIL) • Status (ACT) Port LEDs (per port) • Link (LINK) • Activity (ACT)	Red Green Green Amber (flash)	Red Green Green Amber (flash)
Performance Monitoring		
SONET (virtual ports)	Path terminating equipment (PTE); the following SONET/SDH path alarms are supported: • Alarm indication signal (AIS) • Loss of pointer (LoP) • Unequipped (UNEQ) • Remote failure indicator (RFI) • Trace identifier mismatch (TIM) • Bit error rate signal fail/signal degrade (SF/SD) • Path trace (J1 byte) – Transmit and receive	
SNMP traps	Spanning Tree Protocol traps: Bridge-MIB (RFC 1493) Authentication trap: RFC 1157 Link-up and Link-down traps for Ethernet ports: IF-MIB (RFC 1573) and SONET/SDH MIB (RFC 2558)	
Power		
Card	53W	49W
Physical		
Size	Single card slot 12.65 H x 0.72 W x 9.00 D (in.) 32.13 H x 1.83 W x 22.86 D (cm)	Single card slot 12.65 H x 0.72 W x 9.00 D (in.) 32.13 H x 1.83 W x 22.86 D (cm)
Weight	2.59 lb (1.17 kg)	2.48 lb (1.12 kg)
Operating Environment		
Temperature	23 to 131°F (–5 to 55°C)	23 to 131°F (–5 to 55°C)
Humidity	5 to 95%, noncondensing	5 to 95%, noncondensing
Storage Environment		

Attribute	Cisco ML100T-12 and ML100X-8	Cisco ML1000-2
Temperature	–40 to 185°F (–40 to 85°C)	–40 to 185° F (–40 to 85°C)
Humidity	5 to 95%, noncondensing	5 to 95%, noncondensing

ORDERING INFORMATION

Table 6 lists ordering information for the Cisco ONS 15454 MSPP solution.

Table 6.   Ordering Information

Part Number	Description
15454-ML100X-8	100 Mbps BASE-FX/LX Ethernet card, eight SFP connections, Layer 2 and Layer 3 switching, SONET (ANSI) system
15454E-ML100X-8	100 Mbps BASE-FX/LX Ethernet card, eight SFP connections, Layer 2 and Layer 3 switching, SDH (ETSI) system
ONS-SE-100-LX10	SFP – 100-Mbps Long Reach – 1310 nm – SM – LC, EXT-TEMP
ONS-SE-100-FX	SFP – 100-Mbps Short Reach – 1310 nm – MM – LC, EXT-TEMP
15454-ML100T-12	10/100-Mbps Ethernet card, 12 ports, RJ-45, Layer 2 and Layer 3 switching, SONET (ANSI) system, includes console cable
15454E-ML100T-12	10/100-Mbps Ethernet card, 12 ports, RJ-45, Layer 2 and Layer 3 switching, SDH (ETSI) system, includes console cable
15454-ML1000-2	1000-Mbps Ethernet card, 2 SFP slots, Layer 2 and Layer 3 switching, SONET (ANSI) system
15454E-ML1000-2	1000-Mbps Ethernet card, 2 SFP slots, Layer 2 and Layer 3 switching, SDH (ETSI) system
15454-CONSOLE-02	Cable, console, Cisco ML-Series, RJ-11 plug to RJ-45 jack, 22 in. (55.9 cm) long, SONET (ANSI) system
15454E-CONSOLE-02	Cable, console, Cisco ML-Series, RJ-11 plug to RJ-45 jack, 22 in. (55.9 cm) long, SDH (ETSI) system

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Cisco ONS 15454 CE-Series 10-Port Multirate Ethernet Card

The 10-port multirate Ethernet card for the Cisco® ONS 15454 Multiservice Provisioning Platform (MSPP) enables the delivery of true carrier-class Ethernet Private Line services.

Product Overview

Through its portfolio of Ethernet service cards, the Cisco ONS 15454 MSPP has enabled service providers and enterprises to effectively and efficiently expand their network capability from transporting only time-division multiplexing (TDM) services to delivering multiple services over a single, converged architecture and eliminating the need for multiple overlay infrastructures. With the introduction of the Cisco ONS 15454 CE-Series 10-Port Multirate Ethernet Card (CE-MR), the Cisco CE-Series card portfolio – which includes the 10/100 Mbps (CE-100) and the 1000 Mbps (CE-1000) cards on the Cisco ONS 15454 and 15310 platforms – gives service providers the ability to scale from 1.5-Mbps to 1-Gigabit Ethernet Private Line services. Additionally, the Cisco CE-MR card provides the service flexibility for customers to deploy multirate Ethernet services (10,100, 1000 Mbps) over a single card by supporting 10 Small Form-Factor Pluggable (SFP)-based multirate ports.

The Cisco CE-MR (Figure 1) meets important requirements for an end-to-end Ethernet Private Line application with features such as generic framing procedure (GFP), virtual concatenation (VCAT), software link capacity adjustment scheme (LCAS and SW-LCAS), link integrity, and comprehensive Ethernet and SONET statistics – including bandwidth utilization statistics and flow control. The Cisco CE-MR, with GFP and VCAT, helps service providers and enterprises maximize bandwidth utilization and promote industry-wide interoperability for Ethernet Private Line services. With LCAS, the Cisco CE-MR gives service providers the flexibility to dynamically add and remove bandwidth on Ethernet Private Line services. Ethernet and SONET statistics provide service-monitoring capabilities. For example, bandwidth utilization statistics reveal the usage patterns of end customers – data that can be critical for operations personnel or for network and business planners. Features such as link integrity provide faster convergence capability to end customers' Layer 2 networks connected through Ethernet private lines.

The Cisco ONS 15454 MSPP is the optical industry's first metro optical transport platform. It combines supercharged SONET/SDH transport, integrated optical networking (ITU grid wavelengths and DWDM, for example), and unprecedented multiservice interfaces on demand (such as TDM, Ethernet/IP, and storage) to deliver enormous economic benefits. The Cisco ONS 15454 provides the functions of multiple network elements in a single platform. As a critical component of a complete, end-to-end, advanced service architecture from Cisco, the Cisco ONS 15454 delivers a scalable optical transport mechanism and the intelligent Ethernet/IP support to cost-effectively deliver next-generation voice and data services.

Cisco continues its tradition of converged network services leadership with the introduction of the CE-MR card to the Cisco CE-Series, enabling the efficient delivery of Ethernet Private Line services without a major overhaul or redesign of existing transport infrastructure.

Figure 1. Cisco ONS 15454 CE-Series 10-Port Multirate Ethernet Card
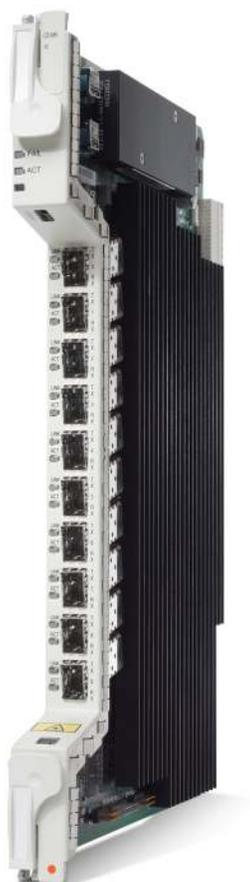
The Cisco CE-MR card includes the following features:

- Ten multirate SFP-based Ethernet ports

- Support for 10/1000/1000 Mbps SFP optics: 10/100/1000 Mbps BASE-T; 100 Mbps FX, LX, BX; 1000 Mbps SX, LX, ZX

- 10-Gbps SONET/SDH transport bandwidth per card

- Each multirate Ethernet port mapped to SONET/SDH (POS) using GFP-F (ITU-T G.7041) or LAN Extension (LEX) High-Level Data Link Control (HDLC) encapsulation

- Each POS can consist of high-order (HO) VCAT (SONET: STS-1-nv where n=1 to 21, STS-3C-nv where n=1 to 7; SDH: VC-4-nv where n=1 to 7), (LO) VCAT (SONET: Vt1.5-nv where n=1 to 64; SDH: VC-3-nv where n=1 to 21, VC12 where n=1 to 63) or contiguous concatenation (CCAT) (SONET: STS-1, -3c, -6c, -9c, -12c, -24c, -48c; SDH: VC-4, -4-2c, -4-3c, -4-4c, -4-8c, -4-16c) circuits

- Dynamic capacity increment/decrement (LCAS or SW-LCAS) to VCAT circuits

- Sub-50-millisecond (ms) SONET/SDH protection/restoration of CCAT transport circuits

- Transparent to Layer 2 bridging, switching, Ethernet MAC control protocols (Cisco EtherChannel® technology, 802.1x, Cisco Discovery Protocol, VLAN Trunking Protocol [VTP], Spanning Tree Protocol), and VLAN (802.1Q and QinQ)

- Ethernet link functions: autonegotiation, link speed auto sense, full/half duplex, flow control (802.3x)

- QoS capabilities: Packet prioritization based upon IP type of service (ToS) or 802.1P

- Jumbo packet support: 9600 bytes

- A-to-Z provisioning (Cisco Transport Controller and Cisco Transport Manager), Transaction Layer 1 (TL1) provisioning

- Simple Network Management Protocol (SNMP) alarms and Remote Monitoring (RMON) performance monitoring

- Cisco Transport Controller/Cisco Transport Manager/TL1 management

- Interoperation (over SONET/SDH) with Cisco G-Series and ML-Series cards

- Back-pressure flow control

- Terminal and facility loopback

- Link integrity support

Applications

The Cisco CE-MR provides the flexibility to meet the demands of a wide variety of Ethernet Private Line applications found within service provider and enterprise networks. Figures 2 and 3 outline a few of the applications that can be met using the Cisco CE-MR cards.

Reliable Enterprise Networking

When the Cisco ONS 15454 MSPP is equipped with the CE-MR card, enterprise users can build highly reliable multiservice networks to support data, voice, and video applications. Additionally, a network based on a Cisco ONS 15454 provides the flexibility to support traditional TDM-based services along with Ethernet services. The Cisco ONS 15454 provides transport scalability from 155 Mbps (OC-3/STM-1) up to 320 Gbps (32 10-Gbps wavelengths), positioning the enterprise network for future growth (Figure 2).

Figure 2.   Reliable Enterprise Networking
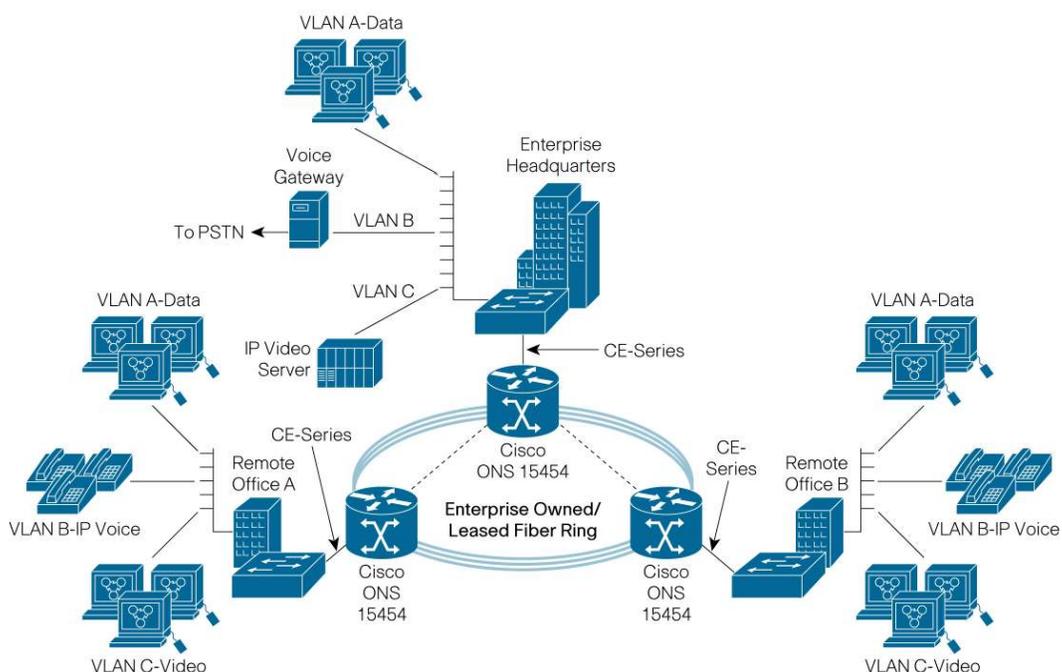
Private Line Carrier Ethernet

A metropolitan network that supports a wide range of service capabilities allows service providers to offer a tariff mix to meet each customer's needs. The Cisco ONS 15454 provides the foundation for building an advanced multiservice network over an extremely reliable SONET/SDH infrastructure (Figure 3). The Cisco ONS 15454 with CE-Series cards facilitates the delivery of data services such as transparent LAN services (TLS) or Internet access over a carrier-class optical infrastructure supporting traditional TDM services. The Cisco CE-MR card, with VCAT and LCAS functions, helps service providers offer a wide variety of Ethernet service-level agreements (SLAs). Virtual concatenation (VCAT) provides a more efficient use of the transport bandwidth for data user interfaces, and link capacity adjustment scheme (LCAS) provides an effective way for a service provider to change the allocated bandwidth to each customer. Additionally, provisioning an Ethernet circuit over a network equipped with a Cisco CE-MR card is easily accomplished through the use of the Cisco ONS 15454's embedded A-to-Z circuit provisioning wizard. The Cisco CE-MR card also supports TL1-based provisioning to simplify integration with many embedded service provider management systems.

Figure 3.   Reliable Enterprise Network Using SDH/SONET Infrastructure
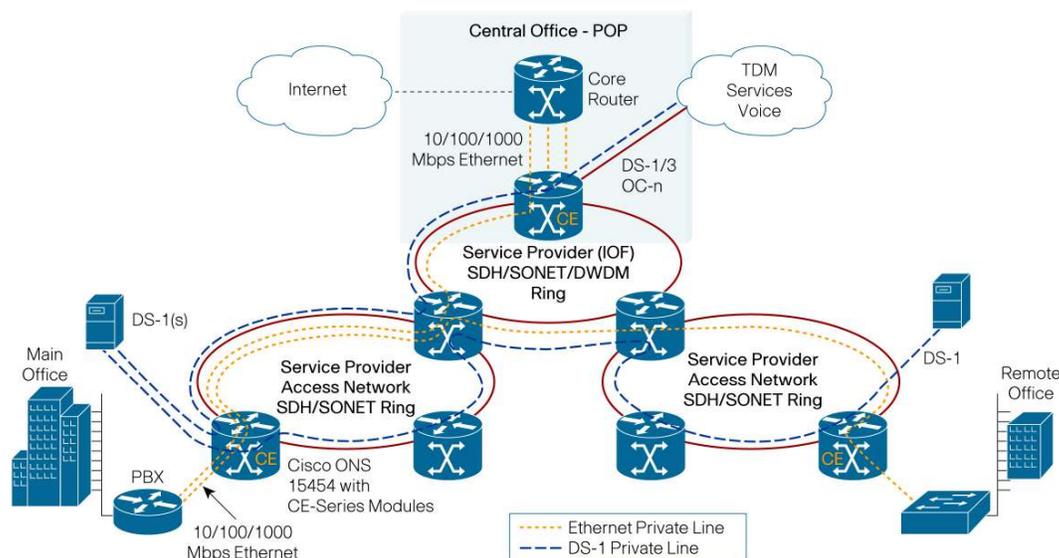
Product Specifications

Compact Design

- Single-width card slot design for increased shelf flexibility and scalability
- Up to 12 Cisco CE-Series cards per shelf assembly
- Up to 120 Ethernet ports (10/100/1000 Mbps) per shelf assembly

Data Architecture Options
- Point-to-point
- Hub-and-spoke using multiple circuits

Optical Transport Options

- Unidirectional-path switched ring (UPSR) and subnetwork connection protection (SNCP)
- 2-fiber and 4-fiber bidirectional line switched ring (BLSR) and multiplex section-shared protection ring (MS-SPR)
- Automatic protection switching (APS) and subnetwork connection (SNC) (1+1 uni- or bidirectional)
- Path-protected mesh networking (PPMN)
- Unprotected (0+1)

Table 1 outlines valid SONET and SDH circuit combinations for the Cisco CE-MR card according to service type. Table 2 lists various product specifications for the Cisco CE-MR card.

Table 1.   SONET and SDH Circuit Combinations

	Service Type	SONET Circuit Type	SDH Circuit Type
1	Line-rate 1000 Mbps	STS-1-21v STS-3C-7v STS-24C STS-48c	VC4-7v VC4-8C VC-4-16c VC3-21v
2	Sub-rate 1000 Mbps	STS-1-nv , n = 1 to 20 STS-3C-nv, n = 1 to 6 STS-1, -3c, -6c, -9c, -12c	VC4-nv, n = 1 to 6 VC-4, -4-2c, -4-3c, -4-4c VC3-nv, n = 1 to 20
3	Line-rate 100 Mbps	STS-3c STS-1-3v STS-1-2v	VC4 VC3-2v VC3-3v VC12-50v
4	Sub-rate 100 Mbps	STS-1 STS-1-1v VT1.5-Xv (X = 1 to 64)	VC3 VC3-1v VC12 (n = 1 to 49)
5	Line-rate 10 Mbps	STS-1 VT1.5-Xv (X = 7)	VC12 (n = 5)
6	Sub-rate 10Mbps	VT1.5-Xv (X = 1 to 6)	VC12 (n = 1 to 4)

Table 2.   Product Specifications

Attributes	Description
Ports	10 SFP ports
Port speed	10/100/1000 Mbps
SFP types	10/100/1000 Mbps BASE-T; 100 Mbps FX, LX, BX; 1000 Mbps SX, LX, ZX
Duplex	Full and autonegotiation
Flow control	Supported
Transport	Up to 10 "Virtual" POS (VCG) ports supporting HO-VCAT and LO-VCAT
Transport bandwidth per card*	10 Gbps in Cisco ONS 15454 slots 5,6,12,13 2.5 Gbps in Cisco ONS 15454 slots (1–4, 14–17)
Transport bandwidth allocation on "virtual" POS (VCG) ports	SONET: STS-1-nv (n = 1 to 21), STS-3C-nv (n = 1 to 7), vt1.5-nv (n = 1 to 64), STS-1, -3c, -6c, -9c, -12c, -24c, -48c; SDH: VC-4-nv (n = 1 to 7), VC3-nv (n = 1 to 21), vc12-nv (n = 1 to 63), VC-4, -4-2c, -4-3c, -4-4c, -4-8c, -4-16v
Transport bandwidth adjustment	LCAS and SW-LCAS (dynamic addition and removal of bandwidth)
Ethernet-over-SONET encapsulation	ITU-T G.7041 GFP-F, Cisco LEX, and Cisco HDLC options
QoS	802.1p and IP TOS-based prioritization
Frame size	64 to 9600 bytes

Attributes	Description
Link integrity	Yes
Service provisioning	A-to-Z service provisioning on Cisco Transport Controller, TL1-based service provisioning
Maximum power	100W
Operating temperature	23 to 131°F (–5 to 55°C)
Operating humidity	Noncondensing 5–95%
Dimensions (H x W x D)	12.65 x 0.72 x 9.99 in. (32.13 x 1.83 x 22.86 cm)

*Bandwidth usage restrictions when using LO-VCAT

Regulatory Compliance

EMC (Class A)

- NEBS Bellcore GR-1089-CORE, Issue 3 (Level 3, Type 2, and Type 4)
- IC ICES-003 Issue 3, 1997
- FCC 47CFR15
- ETSI 300-386-TC
- EN55022, EN55024
- CISPR 22, CISPR 24
- VCCI V-3/2000.04
- EN61000-6-1
- Resolution 237 (Brazil)

Product Safety

- NEBS Bellcore GR-1089-CORE, Issue 3 (Level 3, Type 2, and Type 4)
- IEC 60950-1/EN 60950-1, First Edition (CB report/certificate with all country deviations)
- UL and cUL/CSA 60950-1, First Edition

Laser Safety

- EN or IEC-60825-2
- IEC 60825-1 Amendment 2 (2001-01)
- CSA60950-1 or IEC 60950-1/EN60950-1
- 21CFR1040 (Accession Letter and CDRH Report)

Environmental

- NEBS Bellcore GR-63-CORE, Level 3
- ETS 300 019-2-1 (Storage, Class 1.1)
- ETS 300 019-2-2 (Transportation, Class 2.3)
- ETS 300 019-2-3 (Operational, Class 3.1E)

System Requirements

Table 3 outlines the Cisco ONS 15454 system requirements for operation of the Cisco CE-MR card.

Table 3. System Requirements

System Parameter	SONET	SDH
Shelf assembly	SA-ANSI, SA-HD	SA-ETSI
Electrical Interface Assembly (EIA) panels or FMECs	Not required	Not required
Processor	TCC2 or TCC2P	TCC2 or TCC2P
Cross-connect	XC-10G XC-VXC-10G	XC-VXL-2.5 XC-VXL-10G XC-VXC-10G
System software	Release 8.5 or later (SONET)	Release 8.5 or later (SDH)
Slot compatibility	Slots 1 to 6, 12 to 17	Slots 1 to 6, 12 to 17

Ordering information

To place an order, visit the Cisco Ordering Home Page. Table 4 outlines the ordering information for the Cisco ONS 15454 CE-Series 10-Port Multirate Ethernet Card.

Table 4.   Ordering Information

Product Description	Part Number
Cisco CE-Series 10/100/1000-Mbps multirate Ethernet card, 10 ports, SONET system	15454-CE-MR-10=
Cisco CE-Series 10/100/1000-Mbps multirate Ethernet card, 10 ports, SDH system	15454E-CE-MR-10=
SFP – 10/100/1000 Ethernet BASE-T multirate copper RJ-45	ONS-SE-ZE-EL=
SFP – 10/100/1000 Ethernet BASE-T multirate copper RJ-45	ONS-SE-ZE-EL
SFP – 1000BASE-SX Gigabit Ethernet, 850 nm, MM, I-TEMP	ONS-SI-GE-SX=
SFP – 1000BASE-SX Gigabit Ethernet, 850 nm, MM, I-TEMP	ONS-SI-GE-SX
SFP – 1000BASE-LX Gigabit Ethernet, 1310 nm, SM, I-TEMP	ONS-SI-GE-LX=
SFP – 1000BASE-LX Gigabit Ethernet, 1310 nm, SM, I-TEMP	ONS-SI-GE-LX
SFP – 1000BASE-ZX Gigabit Ethernet, 1550 nm, SM, I-TEMP	ONS-SI-GE-ZX=
SFP – 1000BASE-ZX Gigabit Ethernet, 1550 nm, SM, I-TEMP	ONS-SI-GE-ZX
SFP – 100 Mbps Short Reach – 1310 nm, MM, LC, I-TEMP	ONS-SI-100-FX=
SFP – 100 Mbps Short Reach – 1310 nm, MM, LC, I-TEMP	ONS-SI-100-FX
SFP – 100 Mbps Long Reach – 1310 nm, SM, LC, I-TEMP	ONS-SI-100-LX10=
SFP – 100 Mbps Long Reach – 1310 nm, SM, LC, I-TEMP	ONS-SI-100-LX10
SFP – 10/100 BX-U, EXT	ONS-SE-100-BX10U=
SFP – 10/100 BX-U, EXT	ONS-SE-100-BX10U
SFP – 10/100 BX-D, EXT	ONS-SE-100-BX10D=
SFP – 10/100 BX-D, EXT	ONS-SE-100-BX10D

Service and Support

Cisco offers a wide range of services programs to accelerate customer success. These innovative services programs are delivered through a unique combination of people, processes, tools, and partners, resulting in high levels of customer satisfaction. Cisco services help you to protect your network investment, optimize network operations, and prepare the network for new applications to extend network intelligence and the power of your business. For more information about Cisco services, see Cisco Technical Support Services or Cisco Advanced Services.

For More Information

For more information about the Cisco ONS 15454 MSPP, visit http://cisco.com/en/US/products/hw/optical/ps2006/ps2010/index.html or contact your local account representative.

Cisco ONS Pluggable Optics Series Modules for the Carrier Packet Transport (CPT) Platform

This document provides technical descriptions, applications, and compatibility information for the Small Form-Factor Pluggable (SFP) and 10-Gigabit Small Form-Factor Pluggable (XFP and SFP+) optics modules used in the Cisco® Carrier Packet Transport product family.

Summary

Cisco offers a comprehensive range of pluggable optical modules for the Cisco ONS Family of multiservice platforms. The wide variety of modules gives you flexible and cost-effective options for all types of client interfaces. Cisco offers a range of gigabit interface converters (GBICs) for Gigabit Ethernet use, a wide variety of SFP modules, and has recently introduced XFP modules. These small, modular optical interface transceivers offer a convenient and cost-effective solution for a variety of applications in the data center, campus, metropolitan-area access and ring network, storage area network, and long-haul network.

Technical Overview

SFP Module

A SFP transceiver module (Figure 1) is a bidirectional device with a transmitter and receiver in the same physical package. The module interfaces to the network through a connector interface on the electrical ports and through an LC termination connector on the optical ports. Electrical interfaces and dimensions are defined in the SFF-8472 industry-standard multisource agreement (MSA).

Figure 1. SFP Transceiver Modules for the Cisco ONS Family

A schematic of the SFP transceiver module functional block diagram is illustrated in Figure 2. It contains three parts: the transmitter, receiver, and Electrically Erasable Programmable Read-Only Memory (EEPROM) storage chip. This block diagram is intended for information purposes only and does not illustrate design requirements.

Figure 2. SFP Module Block Diagram
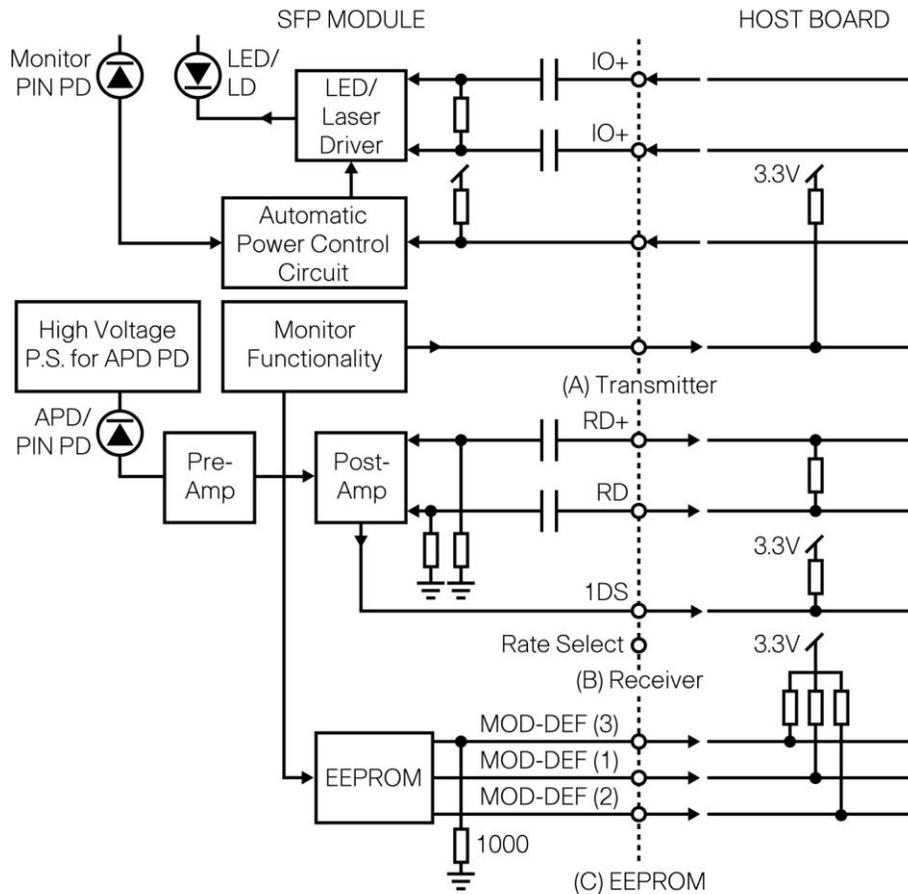
- Transmitter: In the transmit direction, the SFP transceiver module receives the electrical signal and transmits this data in an optical signal by using a laser driver that controls the laser diode. The optical output power is held constant by an automatic power control circuit.
- Receiver: In the receive direction, the SFP transceiver module receives a nonreturn to zero (NRZ) optical signal and converts it to an electrical equivalent. The receive portion of the module will use some kind of amplifier to control the converted electrical signal.
- EEPROM: This type of SFP transceiver is identified by the standard two-wire serial interface used in EEPROM with an I2C interface (with serial ID functions) that is part of the GBIC specifications and the SFF-8472 MSA. In addition, EEPROM offers an enhanced monitoring interface for optical transceivers as described in SFF-8472, which allows real-time access to the device to support monitoring of received optical power, laser bias current, laser optical output power, etc.

XFP Module

The XFP transceiver module (Figure 3) is a bidirectional device with a transmitter and receiver in the same physical package. The XFP module contains a 30-pin surface mount connector on the electrical interface and a duplex LC connector on the optical interface.

Figure 3. XFP Transceiver Module for the Cisco ONS Family

Figure 4 shows an XFP transceiver module functional block diagram. It contains two parts: the transmitter and the receiver.

Figure 4. XFP Module Block Diagram
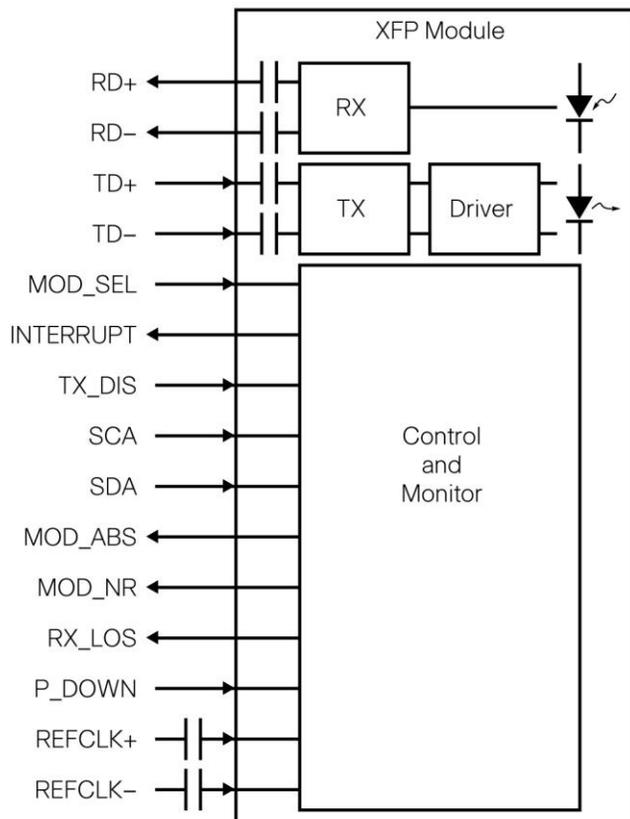
- Transmitter :In the transmit direction, the transceiver module receives a 10-Gbps electrical data signal and transmits the data as an optical signal through an electrical to optical converter. The optical output power is held constant by an automatic power control circuit. The transmitter also contains a Clock Data Recovery (CDR) circuit. The function of this circuit is to attenuate and reshape any jitter received on the electrical interface.
- Receiver: In the receive direction, the transceiver module receives a 10-Gbps optical signal and converts it to an electrical equivalent. The receiver contains a CDR circuit.

SFP+ Module

The SFP+ transceiver (Figure 5) is an evolution of the SFP optic developed for 1-Gbps Ethernet and 1-Gbps, 2-Gbps and 4-Gbps Fibre Channel. It extends the data rate up to 11.10 Gbps while meeting low power and low electromagnetic interference (EMI) requirements for datacom and storage applications.

Similar to SFP, the SFP+ module is a bidirectional device with a transmitter and receiver in the same physical package. It has a 20-pin connector on the electrical interface and a duplex LC connector on the optical interface.

Figure 5.   SFP+ Transceiver Module for the Cisco ONS Family

Figure 6 shows an SFP+ transceiver module functional block diagram. It contains two parts: the transmitter and the receiver.

A possible SFP+ module functional block diagram is shown in. It contains three parts: a (A) Transmitter, (B) Receiver, and (C) I2C Management interface. This architecture does not exclude other possible implementations that can be compliant to the SFP+ specs (such as CDR-based designs).

Figure 6.   SFP+ Module Block Diagram
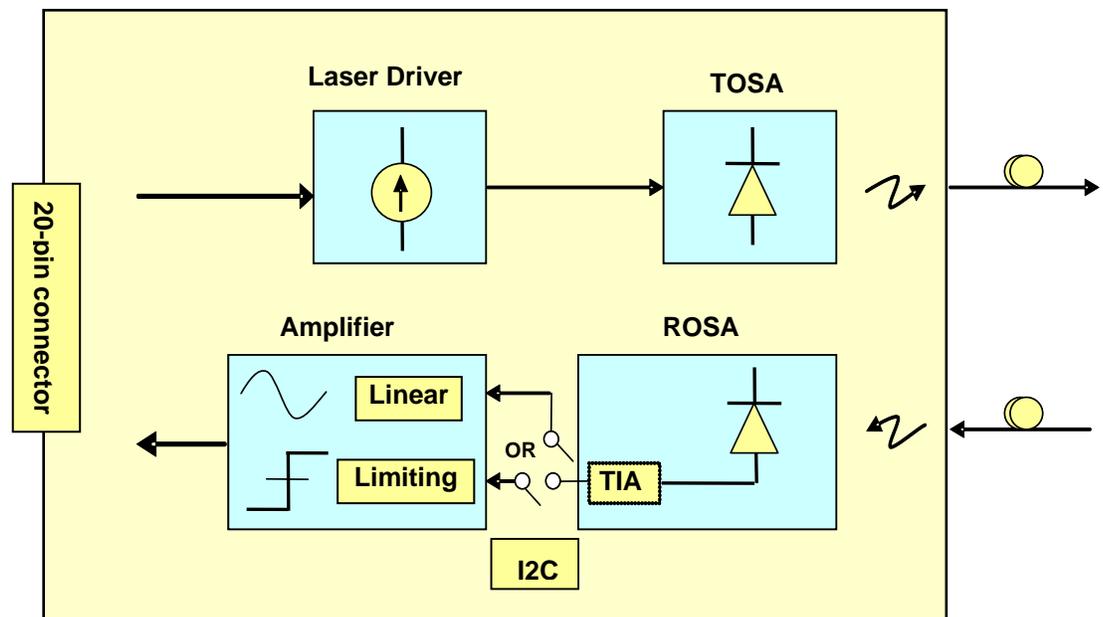
The block diagram shows two different SFP+ module implementations, one based on linear and one based on limiting receiver

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(A) Transmitter

In the transmit direction, the SFP+ transceiver module receives a 8.5- to 10.3125-Gbps electrical signal (signaling rate) from the host board Asic/SerDes and converts the data to an optical signal through the laser driver that controls the laser diode in the Transmitter Optical Sub-Assembly (TOSA).

To receive a clean electrical 1-Gbps signal for optical transmission, the preemphasis from host ASIC provides the precompensation and wave-shaping of the transmit waveform. This effectively eliminates the need for equalizers or retimers in the SFP+ module, thus saving power and cost to the SFP+ module.

(B) Receiver

In the receive direction, the transceiver module receives a 8.5/10.3125 Gbps optical signal through a photodiode mounted together with a trans-impedance preamplifier(TIA), and converts it to an electrical equivalent. Depending on the SFP+ architecture, either a limiting or a linear electrical interface will be implemented on the module.

For a limiting interface, the host ASIC Receive Equalizer compensates the printed circuit board (PCB) trace impairment between the module and the ASIC.

For a linear interface, the host Electronic Dispersion Compensation (EDC) provides the adaptive signal processing that is capable of compensating for impairments due to optical fiber, connector, electro-optics and PCB trace effects.

It is worth noting that cost tradeoffs favor the limiting interface, but the linear interface provides better performance.

(C) I2C Management Interface

The third functional capability of the SFP+ module is the 2-wire serial, I2C, interface. I2C is used for serial ID, digital diagnostics and module control functions. The enhanced digital diagnostics monitoring interface allows real-time access to the device, allowing monitoring of received optical power, laser bias current, laser optical output power, etc.

Pluggable Modules: List and Description

Cisco ONS Family modules have well-defined product IDs, making it easy for you to order the appropriate module.

The product ID is structured as follows: ONS-"AB"-"CCC"-"DD":.

- **A** = S for SFP, G for GBIC, and X for XFP
- **B** = C for commercial temperature (0 to 70°C), E for extended temperature (–10 to 85°C), and I for industrial temperature (–40 to 85°C)
- **CCC** = Supported bit-rate or signal type: 155 Mbps for OC-12/STM-1 signal or 2 GF for a tri-rate Gigabit Ethernet, Fibre Channel, and 2G Fibre Channel signal support
- **DD** = Supported reach: S1 for short-reach/intra-office 1310 nm interface or SX for Ethernet

There are still some older product IDs for the Cisco ONS 15454 platform, but those IDs will migrate toward the newer ID scheme for the Cisco ONS Family.

Data SFP Modules

Cisco offers a wide range of different data SFP modules capable of transmitting Gigabit Ethernet, Fibre Channel, IBM Fiber Connection (FICON), and Enterprise Systems Connection (ESCON) signal format. Table 1 provides details.

Table 1.   Data SFP Modules

Product ID	Product Description	Part Number	Applicable Standard	Temperature Range (°C)
ONS-SI-100-LX10=	SFP – 100 Mbps Long Reach – 1310 nm – SM – LC, ITEMP	10-2294-01	100BASE LX IEEE-802.3	–40 to +85
ONS-SI-100-FX=	SFP – 100 Mbps Short Reach – 1310 nm – MM – LC, ITEMP	10-2350-01	100BASE FX IEEE-802.3	–40 to +85
ONS-SE-GE-BXU=	SFP – 1000BASE-BX U – GE Bidirectional Upstream – Ext Temp		100BASE BX-U IEEE-802.3	–10 to +85
ONS-SE-GE-BXD=	SFP – 1000BASE BX D – GE Bidirectional Downstream Ext Temp		1000BASE BX-D IEEE-802.3	–10 to +85
ONS-SI-GE-SX=	SFP – 1000BASE-SX Gigabit Ethernet, 850 nm, MM, I-TEMP	10-2295-01	1000BASE SX IEEE-802.3	–40 to +85
ONS-SC-GE-LX=	1000BASE LX SFP – 1310 nm – LC – C Temp	10-2298-01	1000BASE LX IEEE-802.3	0 to +70
ONS-SI-GE-LX=	SFP – 1000BASE-LX Gigabit Ethernet, 1310 nm, SM, I-TEMP	10-2300-01	1000BASE SX IEEE-802.3	–40 to +85
ONS-SI-GE-ZX=	SFP – 1000BASE-ZX Gigabit Ethernet, 1550 nm, SM, I-Temp	10-2296-01	1000BASE ZX IEEE-802.3	–40 to +85
ONS-SE-GE-ZX=	SFP – 1000BASE-ZX Gigabit Ethernet, 1550, SM, Ext-Temp	10-2354-01	1000BASE ZX IEEE-802.3	–10 to +85

Electrical SFP Modules

Cisco also offers electrical SFP modules for the Universal Terminal Support (UTS) platform. See Table 2 for reference.

Table 2.   Electrical SFP Modules

Product ID	Product Description	Part Number	Applicable Standard	Temperature Range (°C)
ONS-SE-ZE-EL=	SFP – 10/100/1000 Ethernet BASE-T Multirate Copper RJ-45	10-2351-01	IEEE-802.3	–10 to +85

CWDM SFP Modules

Cisco offers a wide range of coarse wavelength-division multiplexing (CWDM) ITU-T compliant SFP modules. Table 3 lists the details.

Table 3.   CWDM SFP Modules

Product ID	Product Description	Part Number	Applicable Standard	Temperature Range (°C)
ONS-SE-2G-1470=	SFP – OC-48/STM-16/GE, CWDM, 1470 nm Ext Temp	10-2461-01	ITU-T G.694.2	0 to +85
ONS-SE-2G-1490=	SFP – OC-48/STM-16/GE, CWDM, 1490 nm Ext Temp	10-2462-01	ITU-T G.694.2	0 to +85
ONS-SE-2G-1510=	SFP – OC-48/STM-16/GE, CWDM, 1510 nm Ext Temp	10-2463-01	ITU-T G.694.2	0 to +85
ONS-SE-2G-1530=	SFP – OC-48/STM-16/GE, CWDM, 1530 nm Ext Temp	10-2464-01	ITU-T G.694.2	0 to +85
ONS-SE-2G-1550=	SFP – OC-48/STM-16/GE, CWDM, 1550 nm Ext Temp	10-2465-01	ITU-T G.694.2	0 to +85
ONS-SE-2G-1570=	SFP – OC-48/STM-16/GE, CWDM, 1570 nm Ext Temp	10-2466-01	ITU-T G.694.2	0 to +85

Product ID	Product Description	Part Number	Applicable Standard	Temperature Range (°C)
ONS-SE-2G-1590=	SFP – OC-48/STM-16/GE, CWDM, 1590 nm Ext Temp	10-2467-01	ITU-T G.694.2	0 to +85
ONS-SE-2G-1610=	SFP – OC-48/STM-16/GE, CWDM, 1610 nm Ext Temp	10-2468-01	ITU-T G.694.2	0 to +85

XFP List and Description

Grey XFP Modules

Cisco offers a wide range of Grey XFP modules for the UTS Platform. Table 4 lists the details.

Table 4. GREY XFP Modules

Product ID	Product Description	Part Number	Applicable Standard	Temperature Range (°C)
ONS-XC-10G-S1=	XFP – OC-192/STM-64/10GE – 1310 SR – SM LC	10-2012-03	ITU G694 I-64.1 GR253 SR-1 10GE BASE LR 1200-SM-LL-L IB-1x-DDR-LX	0 to +70
ONS-XC-10G-I2=	XFP – OC-192/STM-64/10GE – 1550 IR2 – SM LC	10-2193-02	ITU G694 S-64.2b GR253 IR-2 10GE BASE-ER	0 to +70
ONS-XC-10G-L2=	XFP – OC-192/STM-64 – 1550 LR2 – SM LC	10-2194-02	ITU G959.1 P1L1-2D2 GR253 LR-2 10GE BASE-ZR	0 to +70
ONS-XC-10G-SR-MM=	XFP – Ultra Short Reach MM –10GE BASE SR	10-2420-01	1200-MX-SN-I / 10GE BASE-SR	0 to +70

DWDM XFP Modules

Cisco offers a complete set of DWDM XFP modules. Table 5 lists the details.

Table 5. DWDM XFP Modules

Product ID	Product Description	Part Number	Applicable Standard	Temperature Range (°C)
ONS-XC-10G-C=	10G Multirate Full C Band Tunable DWDM XFP, 50 GHz, LC	10-2480-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP30.3=	10G MR, XFP,Edge Performance 1530.33, 100 GHz, LC	10-2577-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP31.1=	10G MR, XFP,Edge Performance 1531.12, 100 GHz, LC	10-2579-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP31.9=	10G MR, XFP,Edge Performance 1531.90, 100 GHz, LC	10-2580-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP32.6=	10G MR, XFP,Edge Performance 1532.68, 100 GHz, LC	10-2581-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP33.4=	10G MR, XFP,Edge Performance 1533.47, 100 GHz, LC	10-2582-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP34.2=	10G MR, XFP,Edge Performance 1534.25, 100 GHz, LC	10-2578-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP35.0=	10G MR, XFP,Edge Performance 1535.04, 100 GHz, LC	10-2611-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP35.8=	10G MR, XFP,Edge Performance 1535.82, 100 GHz, LC	10-2604-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP36.6=	10G MR, XFP,Edge Performance 1536.61, 100 GHz, LC	10-2615-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP37.4=	10G MR, XFP,Edge Performance 1537.40, 100 GHz, LC	10-2608-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP38.1=	10G MR, XFP,Edge Performance 1538.19, 100 GHz, LC	10-2610-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP38.9=	10G MR, XFP,Edge Performance 1538.98, 100 GHz, LC	10-2612-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP39.7=	10G MR, XFP,Edge Performance 1539.77, 100 GHz, LC	10-2609-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP40.5=	10G MR, XFP,Edge Performance 1540.56, 100 GHz, LC	10-2607-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP41.3=	10G MR, XFP,Edge Performance 1541.35, 100 GHz, LC	10-2606-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP42.1=	10G MR, XFP,Edge Performance 1542.14, 100 GHz, LC	10-2605-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP42.9=	10G MR, XFP,Edge Performance 1542.94, 100 GHz, LC	10-2603-01	ITU G694, GR2918	0 to +70

Product ID	Product Description	Part Number	Applicable Standard	Temperature Range (°C)
ONS-XC-10G-EP43.7=	10G MR, XFP,Edge Performance 1543.73, 100 GHz, LC	10-2590-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP44.5=	10G MR, XFP,Edge Performance 1544.53, 100 GHz, LC	10-2602-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP45.3=	10G MR, XFP,Edge Performance 1545.32, 100 GHz, LC	10-2601-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP46.1=	10G MR, XFP,Edge Performance 1546.12, 100 GHz, LC	10-2589-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP46.9=	10G MR, XFP,Edge Performance 1546.92, 100 GHz, LC	10-2588-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP47.7=	10G MR, XFP,Edge Performance 1547.72, 100 GHz, LC	10-2600-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP48.5=	10G MR, XFP,Edge Performance 1548.51, 100 GHz, LC	10-2599-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP49.3=	10G MR, XFP,Edge Performance 1549.32, 100 GHz, LC	10-2587-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP50.1=	10G MR, XFP,Edge Performance 1550.12, 100 GHz, LC	10-2598-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP50.9=	10G MR, XFP,Edge Performance 1550.92, 100 GHz, LC	10-2597-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP51.7=	10G MR, XFP,Edge Performance 1551.72, 100 GHz, LC	10-2596-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP52.5=	10G MR, XFP,Edge Performance 1552.52, 100 GHz, LC	10-2614-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP53.3=	10G MR, XFP,Edge Performance 1553.33, 100 GHz, LC	10-2595-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP54.1=	10G MR, XFP,Edge Performance 1554.13, 100 GHz, LC	10-2586-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP54.9=	10G MR, XFP,Edge Performance 1554.94, 100 GHz, LC	10-2585-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP55.7=	10G MR, XFP,Edge Performance 1555.75, 100 GHz, LC	10-2594-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP56.5=	10G MR, XFP,Edge Performance 1556.55, 100 GHz, LC	10-2613-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP57.3=	10G MR, XFP,Edge Performance 1557.36, 100 GHz, LC	10-2584-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP58.1=	10G MR, XFP,Edge Performance 1558.17, 100 GHz, LC	10-2583-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP58.9=	10G MR, XFP,Edge Performance 1558.98, 100 GHz, LC	10-2593-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP59.7=	10G MR, XFP,Edge Performance 1559.79, 100 GHz, LC	10-2576-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP60.6=	10G MR, XFP,Edge Performance 1560.61, 100 GHz, LC	10-2592-01	ITU G694, GR2918	0 to +70
ONS-XC-10G-EP61.4=	10G MR, XFP,Edge Performance 1561.43, 100 GHz, LC	10-2591-01	ITU G694, GR2918	0 to +70

CWDM XFP Modules

Cisco offers a complete set of CWDM XFP modules. Table 6 lists the details.

Table 6.   CWDM XFP Modules

Product ID	Product Description	Part Number	Applicable Standard	Temperature Range (°C)
ONS-XC-10G-1470=	OC192/10GE/OTU2, CWDM, 1470mn, XFP C-Temp, 40km range	10-2548-01	ITU G694.2	0 to +70
ONS-XC-10G-1490=	OC192/10GE/OTU2, CWDM, 1490mn, XFP C-Temp, 40km range	10-2551-01	ITU G694.2	0 to +70
ONS-XC-10G-1510=	OC192/10GE/OTU2, CWDM, 1510mn, XFP C-Temp, 40km range	10-2552-01	ITU G694.2	0 to +70
ONS-XC-10G-1530=	OC192/10GE/OTU2, CWDM, 1530nm, XFP C-Temp, 40km range	10-2553-01	ITU G694.2	0 to +70
ONS-XC-10G-1550=	OC192/10GE/OTU2, CWDM, 1550nm, XFP C-Temp, 40km range	10-2554-01	ITU G694.2	0 to +70
ONS-XC-10G-1570=	OC192/10GE/OTU2, CWDM, 1570nm, XFP C-Temp, 40km range	10-2555-01	ITU G694.2	0 to +70
ONS-XC-10G-1590=	OC192/10GE/OTU2, CWDM, 1590nm, XFP C-Temp, 40km range	10-2556-01	ITU G694.2	0 to +70
ONS-XC-10G-1610=	OC192/10GE/OTU2, CWDM, 1610nm, XFP C-Temp, 40km range	10-2557-01	ITU G694.2	0 to +70

SFP+ Modules

Cisco offers a complete set of SFP+ modules for the CPT platform. Table 7 and 8 list the details.

Table 7. Grey SFP+ Modules

Product ID	Product Description	Part Number	Applicable Standard	Temperature Range (°C)
ONS-SC+-10G-SR=	SFP+ SR - Commercial Temp	10-2620-01	10GE BASE SR	0 to +70
ONS-SC+-10G-ER=	SFP+ ER - Commercial Temp	10-2619-01	10GE BASE-ER	0 to +70
ONS-SC+-10G-LR=	SFP+ LR - Commercial Temp	10-2618-01	10GE BASE-LR	0 to +70

Table 8. Active Cable

Product ID	Product Description	Part Number	Applicable Standard	Temperature Range (°C)
ONS-SC+-10G-CU1=	10GBASE-CU SFP+ Cable 1 Meter	37-1188-01	10GE	0 to +70
ONS-SC+-10G-CU3=	10GBASE-CU SFP+ Cable 3 Meter	37-1197-01	10GE	0 to +70
ONS-SC+-10G-CU5=	10GBASE-CU SFP+ Cable 5 Meter	37-1198-01	10GE	0 to +70
ONS-SC+-10G-CU7=	10GBASE-CU SFP+ Cable 7 Meter	37-1196-01	10GE	0 to +70

SFP Technical Details

SONET/SDH SFP Modules

The Cisco SFP modules are compatible with SONET/SDH standards, and support the digital diagnostic functions specified in the SFF-8742 MSA.

Data SFP Modules

The Data SFP modules for the Cisco ONS Family are compatible with the IEEE 802.3 and support the digital diagnostic functions specified in the SFF-8742 MSA.

Table 9. Ethernet Pluggable Modules: Optical Specifications

Product ID	Operating Wavelength Range (nm)	Transmit Power Range (dBm)	Receiver Power Range (dBm)	Maximum Dispersion (ps/nm)	Maximum Target Distance
ONS-SI-GE-SX=	770–860	–9.5 to 0	–17 to 0[1]	—	0.5 to 500m (50/125 μm fiber) 0.5 to 300m (62.5/125 μm fiber)
ONS-SI-GE-LX=	1270–1355	–9.5 to –3	–19 to –3[2]	—	10km
ONS-SI-GE-ZX=	1500–1580	0 to +5	–23 to –3	1200–1600[3]	80km
ONS-SE-100-BX10U=	1260–1360 (TX) 1480–1580 (RX)	–14 to –8	–28.2 to –7	—	10 km
ONS-SE-100-BX10D=	1480–1580 (TX) 1260–1360 (RX)	–14 to –8	–28.2 to –7	—	10 km

1: Minimum Stressed Sensitivity (10^{-12}): -12.5(62.5um) and -13.5(50um) dBm

2: Minimum Stressed Sensitivity (10^{-12}): -14.4 dBm

3: The indicated dispersion range corresponds to the approximate worst-case dispersion for 80 km G.652/G.654 fiber over the wavelength range 1500–1580 nm.

CWDM and DWDM SFP Modules

Cisco offers a full set of CWDM SFP modules and DWDM SFP modules for GE applications. Table 10, Table 10, and Table 12 list the optical parameters.

Table 10. CWDM SFP Modules: Optical Specifications

Product ID	Receiver Wavelength Range (nm)	Spectral Width (nm)	Transmit Power Range (dBm)	Receiver Power Range (dBm)
ONS-SE-2G-xxxx=	1460-1620	1	-1 to +4	-28 to -9 (BER 10-12)

Note: "xxxx" ranges from 1470 to 1610.

Table 11. DWDM SFP Module: Optical Specifications

Product ID	Receiver Wavelength Range (nm)	Transmitter Stability (pm)	Spectral Width (pm)	Transmit Power Range (dBm)
ONS-SC-2G-xx.x=	1260–1620[11]	–100 to +100 (100 GHz spacing)	200	0 to +4

Note: "xx.x" ranges from 30.3 to 60.6.

1: Receiver sensitivity specified over 1528–1561 nm only, with 2dB degradation permitted outside of this range.

Table 12. DWDM SFP Modules: Optical Performance

Optical Performance					
Power-Limited Performances					
		2G DWDM SFP		**4G DWDM SFP**	
Input power range	dBm	–9 to –28	At BER=10e-12 with SONET framed PRBS23 at OSNR of 21dB, 0.1nm BW	–9 to –22	At BER=10e-12 with SONET framed PRBS23 at OSNR of 26dB, 0.1nm RBW
Dispersion tolerance	ps/nm	–800 to +2400	Power Penalty=3dB, OSNR=21dB at 0.1nmBW (Noise Penalty=0dB)	–800 to +1600	–9 to –20 dBm with OSNR=26dB at 0.1nm RBW (Noise Penalty=0dB)
Noise-Limited Performances					
Input power range	dBm	–9 to –22	At BER=10e-12 with SONET framed PRBS23 at OSNR of 16dB at 0.1nm bandwidth	–9 to –18	At BER=10e-12 with SONET framed PRBS23 at OSNR of 22dB at 0.1nm bandwidth
Dispersion tolerance	ps/nm	–800 to +2400	Noise Penalty=3dB, OSNR=19dB at 0.1nmBW (Power Penalty=0dB)	–800 to +1600	–9 to –18 dBm with OSNR=25dB at 0.1nmBW (Power Penalty=0dB)

Grey XFP Modules

Cisco offers a full set of Grey XFP modules for 10-Gbps applications. Table 13 lists the optical parameters.

Table 13. Grey XFP Modules: Optical Specifications

Product ID	Transmitter Wavelength Range (nm)	Transmit Power Range (dBm)	Receiver Wavelength Range (nm)	CD Robustness (ps)	Receiver Power Range (dBm)
ONS-XC-10G-S1=	1260–1335	–6 to –1 [1] –8.2 to +0.5 [2]	1260–1565	6.6	–11 to –1 [1] –14.4 to +0.5 [2,3]
ONS-XC-10G-I2=	1530–1565	–1 to +2	1260–1565	800	–14 to +2
ONS-XC-10G-L2=	1530–1565	0 to +4	1260–1565	1600	–24 to –7
ONS-XC-10G-SR-MM=	840–860	–7.3 to –1	840–860	–	–9.9 to –1

1: SONET/SDH application

2: 10GE/10G Fibre Channel application

3: Stressed receiver sensitivity (maximum) in OMA is -10.3 dBm

DWDM XFP Modules

Cisco offers a full set of DWDM XFP modules for 10-Gbps applications. Table 14, table 15 and Table 16 list optical parameters

Table 14.   DWDM XFP Modules: Optical Specifications

Product ID	Receiver Wavelength Range (nm)	Transmitter Stability (pm)	Spectral Width (pm)	Transmit Power Range (dBm)
ONS-XC-10G-EPxx.x=	1260–1607[11]	–100 to +100 (100 GHz spacing)	200	–1 to +3
ONS-XC-10G-C=	1260–1607[11]	–25 to +25 (50 GHz spacing)	200	0 to +3

Note: "xx.x" ranges from 30.3 to 61.4.

Table 15.   Fixed Wavelength DWDM XFP Modules: Optical Performance

Optical Performance			
Short Wavelength Performances			
Input power range	dBm	–7 to –20	At BER=10e-12 (at 1310 nm ± 20nm) applicable at 9.9G, 10.3G only
Long Wavelength Performances C Band NO-FEC Applications Power-Limited			
Input power range	dBm	–7 to –23	At BER=10e-12 applicable at 9.9G, 10.3G only 23dB OSNR (0.5nm RBW)
Input power range	dBm	–7 to –20	At BER=10e-12 (–500 to +1100 ps/nm) applicable at 9.9G, 10.3G only – 23dB OSNR (0.5nm RBW)
Long Wavelength Performances C Band NO-FEC Applications Noise-Limited			
Input power range	dBm	–7 to –18	At BER=10e-12 applicable at 9.9G, 10.3G only 17dB OSNR (0.5nm RBW)
Input power range	dBm	–7 to –18	At BER=10e-12 (–500 to +1100 ps/nm) applicable at 9.9G, 10.3G only – 20dB OSNR (0.5nm RBW)
Long Wavelength Performances C Band FEC Applications Noise-Limited			
Input power range	dBm	–7 to –18	At BER PREFEC <10e-5 applicable at 10.7G, 11.1G only -- 11dB OSNR (0.5nm RBW)
Input power range	dBm	–7 to –18	At BER PREFEC <10e-5 (-500 to +1100 ps/nm) applicable at 10.7G, 11.1G only – 12dB OSNR (0.5nm RBW)
Long Wavelength Performances C Band E-FEC Applications Power-Limited			
Input power range	dBm	–7 to –27	At BER PREFEC <7*10e-4 applicable at 10.7G, 11.1G only – 23dB OSNR
Input power range	dBm	–7 to –24	At BER PREFEC <7*10e-4 (–500 to +1100 ps/nm) applicable at 10.7G, 11.1G only – 23dB OSNR (0.5nm RBW)
Long Wavelength Performances C Band E-FEC Applications Noise-Limited			
Input power range	dBm	–7 to –18	At BER PREFEC <7*10e-4 applicable at 10.7G, 11.1G only – 8dB OSNR (0.5nm RBW)
Input power range	dBm	–7 to –18	At BER PREFEC <7*10e-4 (–500 to +1100 ps/nm) applicable at 10.7G, 11.1G only – 9dB OSNR (0.5nm RBW)

Table 16.   Full C Band Tuneable Wavelength DWDM XFP Modules: Optical Performance

Optical Performance			
Short Wavelength Performances			
Input power range	dBm	–7 to –20	At BER=10e-12 (at 1310 nm ± 20nm) applicable at 9.9G, 10.3G only
Long Wavelength Performances C Band NO-FEC Applications Power-Limited			
Input power range	dBm	–7 to –24	At BER=10e-12 applicable at 9.9G, 10.3G only 23dB OSNR (0.5nm RBW)
Input power range	dBm	–7 to –22	At BER=10e-12 (–500 to +1600 ps/nm) applicable at 9.9G, 10.3G only – 23 dB OSNR (0.5nm RBW)
Long Wavelength Performances C Band NO-FEC Applications Noise-Limited			
Input power range	dBm	–7 to –22	At BER=10e-12 applicable at 9.9G, 10.3G and 10.5 only 19dB OSNR (0.5nm RBW)
Input power range	dBm	–7 to –20	At BER=10e-12 (–500 to +1600 ps/nm) applicable at 9.9G, 10.3G and 10.5G only – 19dB OSNR (0.5nm RBW)

Optical Performance			
Long Wavelength Performances C Band FEC Applications Noise-Limited			
Input power range	dBm	–7 to –18	At BER PREFEC <10e-5 applicable at 10.7G, 11.1G only – 8.5dB OSNR (0.5nm RBW)
Input power range	dBm	–7 to –18	At BER PREFEC <10e-5 (–400 to +1000 ps/nm) applicable at 10.7G, 11.1G only – 10dB OSNR (0.5nm RBW)
Long Wavelength Performances C Band E-FEC Applications Power-Limited			
Input power range	dBm	–7 to –27	At BER PREFEC <7*10e-4 applicable at 10.7G, 11.1G only – 19dB OSNR
Input power range	dBm	–7 to –26	At BER PREFEC <7*10e-4 (–400 to +1300 ps/nm) applicable at 10.7G, 11.1G and 11.3G only – 19dB OSNR (0.5nm RBW)
Long Wavelength Performances C Band E-FEC Applications Noise-Limited			
Input power range	dBm	–7 to –20	At BER PREFEC <7*10e-4 applicable at 10.7G, 11.1G only – 5dB OSNR (0.5nm RBW)
Input power range	dBm	–7 to –20	At BER PREFEC <7*10e-4 (–400 ps/nm) applicable at 10.7G, 11.1G and 11.3G only – 7.5dB OSNR (0.5nm RBW)
Input power range	dBm	–7 to –20	At BER PREFEC <7*10e-4 +1300 ps/nm) applicable at 10.7G, 11.1G and 11.3G only – 7dB OSNR (0.5nm RBW)

CWDM XFP Modules

Cisco offers a full set of CWDM XFP modules for 10-Gbps applications. Table 14 lists optical parameters.

Table 17.   CWDM XFP Modules: Optical Specifications

Product ID	Wavelength Range Rx (nm)	Sensitivity Rx (dBm)	Stability Tx (nm)	Dispersion Tolerance (ps/nm)	Tx Power Range (dBm)	Supported Bit Rate	Target Distance
ONS-XC-10G-xxxx=	1450-1620	–14	+/– 6.5	0 to +800	+3 to +7	OC-192 STM-64 10GE OTU2 OTU2e (up to 11.1Gbps) 10G FC	40km (OTU2 and 10GE) 10km (OC-192/STM-064)

Note: "xxxx" ranges from 1470 to 1610.

Electrical SFP Modules

Cisco offers multiple options for copper SFP modules. Table 18 lists the main characteristics.

Table 18.   Electrical SFP Module Specifications

Product ID	Bit Rate	Connector	Typical Distance
ONS-SE-ZE-EL=	10/100/1000 Mbps	RJ-45	100m

SFP+ Modules

Cisco offers multiple options for SFP+ modules. Table 18 and Table 20 list the main characteristics.

Table 19.   SFP+ modules

Product ID	Transmitter Wavelength Range (nm)	Transmit Power Range (dBm)	Receiver Wavelength Range (nm)	Optical Reach	Receiver Power Range (dBm)
ONS-SC+-10G-SR=	840-860	–7.3 to –1.3	840-860	26 m (FDDI-Grade / 62.5 micron) 33 m (OM1 /62.5 micron) 66 m (50.0 micron) 82 m (OM2 / 50.0 micron) 300 m (OM3 / 50.0 micron)	–11.1 (in OMA) to –1
ONS-SC+-10G-LR=	1260–1355	–8.2 to +0.5	1260–1355	10km	–12.6 (in OMA) to 0.5

Product ID	Transmitter Wavelength Range (nm)	Transmit Power Range (dBm)	Receiver Wavelength Range (nm)	Optical Reach	Receiver Power Range (dBm)
ONS-SC+-10G-ER=	1530–1565	–4.7 to +4	1530–1565	40km	–14.1 (in OMA) to -1

Table 20. Active Cables

Product ID	Interface standard compliance	Cable Length	Connector
ONS-SC+-10G-CU1=	SFF-8431, Appendix E, SFF-8432 and SFF-8472	1m	SFP+ MSA
ONS-SC+-10G-CU3=	SFF-8431, Appendix E, SFF-8432 and SFF-8472	3m	SFP+ MSA
ONS-SC+-10G-CU5=	SFF-8431, Appendix E, SFF-8432 and SFF-8472	5m	SFP+ MSA
ONS-SC+-10G-CU7=	SFF-8431, Appendix E, SFF-8432 and SFF-8472	7m	SFP+ MSA

Compatibility Matrix

Table 21indicates which SFP modules are available on different CPT boards

Table 21. Cisco ONS and CPT Compatibility Matrix

Product ID	Cisco UTS Boards		
	CPT-50-44GE	CPT-PTM-10Gx4	CPT-PTF256-10Gx4=
ONS-SI-100-LX10=	X		
ONS-SI-100-FX=	X		
ONS-SE-GE-BXU=	X		
ONS-SE-GE-BXD=	X		
ONS-SI-GE-SX=	X		
ONS-SI-GE-LX=	X		
ONS-SI-GE-ZX=	X		
ONS-SE-ZE-EL=	X		
ONS-SE-2G-xxxx[1]	X		
ONS-SC+-10G-SR=	X	X	X
ONS-SC+-10G-LR=	X	X	X
ONS-SC+-10G-ER=	X	X	X
ONS-SC+-10G-CU1=[4]	X	X	X
ONS-SC+-10G-CU3=[4]	X	X	X
ONS-SC+-10G-CU5=[4]	X	X	X
ONS-SC+-10G-CU7=[4]	X	X	X
ONS-XC-10G-S1=		X	X
ONS-XC-10G-I2=		X	X
ONS-XC-10G-L2=		X	X
ONS-XC-10G-xxxx[1]		X	X
ONS-XC-10G-EPxx.x=[3]		X	X
ONS-XC-10G-C=		X	X

1: For CWDM SFP and XFP modules, "xxxx" ranges from 1470 to 1610

2: For DWDM SFP modules, "xx.x" ranges from 30.3 to 60.6, wavelength 28.7, 33.4, 41.3, 49.3, 57.3 requires Release 8.5

3: For DWDM XFP modules, "xx.x" ranges from 30.3 to 61.4

4: Copper cable shall be maintained within same line of racks

SFP Physical Details

Tables 22 through 26 list reliability data, power consumption, and cable type to be used for each pluggable module.

Table 22. Data SFP Modules

Product ID	MTBF in Hours	Maximum Power Consumption (W)	Supported Cable Connection
ONS-SI-100-LX10=	9,970,080	1W	LC-LC
ONS-SI-100-FX=	9,970,080	1W	LC-LC
ONS-SI-GE-SX=	7,919,921	1W	LC-LC
ONS-SI-GE-LX=	9,970,080	1W	LC-LC
ONS-SI-GE-ZX=		1W	LC-LC
ONS-SE-GE-BXU=	6,250,000	1W	LC-LC
ONS-SE-GE-BXD=	6,250,000	1W	LC-LC

Table 23. Electrical SFP Modules

Product ID	MTBF in Hours	Maximum Power Consumption (W)	Supported Cable Connection
ONS-SE-ZE-EL=	4,068,349	1	RJ-45 STP CAT5e and CAT6

Table 24. Grey XFP Modules

Product ID	MTBF in Hours	Maximum Power Consumption (W)	Supported Cable Connection
ONS-XC-10G-S1=	3,039,506	2.5	LC-LC
ONS-XC-10G-I2=	3,279,693	3	LC-LC
ONS-XC-10G-L2=	2,711,429	3	LC-LC
ONS-XC-10G-SR-MM=	1,974,000	1.5	LC-LC

DWDM Pluggable Modules

Table 25. xWDM SFP Modules

Product ID	MTBF	Maximum Power Consumption (W)	Supported Cable Connection
ONS-SC-2G-xx.x=	5,346,554	1	LC-LC
ONS-SC-Z3-xxxx=	2,070,393	1.1	LC-LC
ONS-XC-10G-EPxx.x=	2,711,000	3.5	LC-LC
ONS-XC-10G-C=	1,000,000	3.5	LC-LC
ONS-XC-10G-xxxx=	2,711,000	3.5	LC-LC

SFP+ Pluggable Modules

Table 26. SFP+ Modules Physical Data

Product ID	Maximum Power Consumption (W)	Supported Cable Connection
ONS-SC+-10G-SR=	1	LC-LC
ONS-SC+-10G-LR=	1	LC-LC
ONS-SC+-10G-ER=	1.1	LC-LC
ONS-SC+-10G-CU1=	1	N/A
ONS-SC+-10G-CU3=	1	N/A
ONS-SC+-10G-CU5=	1	N/A
ONS-SC+-10G-CU7=	1	N/A

Ordering Information

You can order all the available pluggable interfaces from Cisco.com. Please check the Pricing Tool for further information: www.cisco.com/cgi-bin/front.x/pricing?Request=ShowCurrentPriceSrch.

Please select ONS Pluggable Optics Series as the Product Family.

Third-Party Equipment

The use of third-party equipment in place of Cisco ONS SFP products is not recommended, for the following reasons.

- Cisco can guarantee service-level agreements (SLAs) only on parts that have undergone the Cisco test plan and validation process. Without comprehensive testing and validation, SFP products may display anomalous behavior that can impact host-board performance.
- Cisco SFP modules reserve specific EEPROM fields to store inventory data such as Product ID, Part Number, Serial Number, and CLEI CODE that are specific to Cisco SFP modules and are required for SLAs.
- The Cisco Technical Assistance Center (TAC) and Cisco Customer Advocacy can only support Cisco modules and boards for the Cisco ONS Family products.

Lead Time

Please check the Lead-Time Tool to identify standard lead-time for various Cisco ONS Family products: http://www.cisco.com/cgi-bin/front.x/leadtimes.cgi

A different approach is used for DWDM SFP/XFP modules. Based upon customer usage, Cisco has identified and selected particular high-usage wavelengths, and will maintain shorter lead times on these items.

Short lead-time DWDM SFP or XFP modules are those from 1546.1 to 1560.6, with a 4 skip 1 approach.

Unforecasted pluggable optics on different lambdas could require 16 weeks of delivery time.

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Cisco Aironet 1600 Series Access Point

Industrial Design

- Sleek design with internal antennas, ideal for office environments
- Extended operating temperature, ideal for factories, warehouses, and other indoor industrial environments
- Versatile RF coverage with optional external antennas
- UL 2043 plenum-rated for above-ceiling installation options or suspended from drop ceilings

Easy Installation and Power Efficient

- 802.11n performance with existing PoE switches
- Sleek design blends into a variety of indoor environments

Easy-to-Install Multipurpose Mounting Bracket

- Designed for easy replacement of existing access points
- Locks for theft protection

Deployment Options

- Controller-based or standalone deployment options

Secure Connections

- Supports rogue access point detection and denial-of-service attacks
- Management frame protection detects malicious users and alerts network administrators

Cisco ClientLink 2.0 Beamforming

- Faster mobile client connections
- Support for all client types without any client requirements or dependencies
- More efficient use of mobile device batteries

Cisco CleanAir Express[*] Spectrum Intelligence

- Identifies, classifies and provides automatic remedial actions for different types of interference
- Locates and visualizes sources of interference

Cisco VideoStream Technology

- Efficient multicast-to-unicast conversion
- Video call admission control to prevent oversubscription
- Queue prioritization to help ensure best user experience for corporate videos

The new Cisco Aironet® 1600 Series Access Point is an enterprise-class, entry-level, 802.11n-based access point designed to address the wireless connectivity needs of small and medium-sized enterprise networks.

The Aironet 1600 Series delivers great performance at an attractive price for customers while providing advanced functionality such as CleanAir Express[*] for better cover through spectrum intelligence and Clientlink 2.0 for entry level networks that have a mixed client base. In addition to these features, the Aironet 1600 series includes 802.11n-based 3x3 multiple-input multiple-output (MIMO) technology with two spatial streams, making it ideal for small and medium-sized enterprises.

The Aironet 1600 Series also provides at least six times the throughput of existing 802.11a/g networks. As part of the Cisco® Aironet Wireless portfolio, the Cisco Aironet 1600 Series access point provides low total cost of ownership and investment protection by integrating seamlessly with the existing network. With an entry-level path to 802.11n migration, the Aironet 1600 Series can add capacity to the network for future growth for expanding applications and bandwidth.

Designed with rapidly evolving mobility needs in mind, the Cisco Aironet 1600 Series Access Point addresses the bring-your-own-device (BYOD) trend by providing advanced functionality at the right price point.

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[*] Available via future release.

RF Excellence

Building on the Cisco Aironet heritage of RF excellence, the Cisco Aironet 1600 Series delivers secure and reliable wireless connections. Enterprise-class chipsets and optimized radios deliver a robust mobility experience with:

- 802.11n with 3x3 multiple-input multiple-output (MIMO) technology with two spatial streams, which sustains 300-Mbps rates over a greater range for more capacity and reliability than competing access points
- Radio resource management (RRM): Automated self-healing optimizes the unpredictability of RF to reduce dead spots and help ensure high-availability client connections
- CleanAir Express: Effectively detects RF interference and provides basic spectrum analysis capability while simplifying ongoing operations
- Cisco ClientLink 2.0 technology: Improves downlink performance to all mobile devices including 802.11n while improving battery life on mobile devices such as smartphones and tablets
- Cisco BandSelect technology: Improves 5-GHz client connections in mixed-client environments
  Cisco VideoStream technology: Uses multicast to improve rich-media applications
- Building on the Cisco All of these features help ensure the best possible end-user experience on the wireless network. Cisco also offers the industry's broadest selection of 802.11n antennas delivering optimal coverage for a variety of deployment scenarios

Scalability

The Cisco Aironet 1600 Series is a component of the Cisco Unified Wireless Network, which can scale to up to 18,000 access points with full Layer 3 mobility across central or remote locations on the enterprise campus, in branch offices, and at remote sites. The Cisco Unified Wireless Network is the industry's most flexible, resilient, and scalable architecture delivering secure access to mobility services and applications, and offering the lowest total cost of ownership and investment protection by integrating seamlessly with the existing wired network

Cisco Network Assistant

For quick and easy setup of your access points, Cisco Network Assistant provides a centralized network view with a user-friendly GUI that simplifies configuration, management and troubleshooting. Using Cisco Network Assistant you can easily discover and initialize your network of stand-alone access points.

Cisco Network Assistant is available free, and can be downloaded here: http://www.cisco.com/go/cna.

Product Specifications

Table 1 lists the product specifications for Cisco Aironet 1600 Series Access Points.

Table 1.   Product Specifications for Cisco Aironet 1600 Series Access Points

Item	Specification
Part Numbers	**The Cisco Aironet 1600i Access Point: Indoor environments, with internal antennas** • AIR-CAP1602I-x-K9 Dual-band controller-based 802.11a/g/n • AIR-CAP1602I-xK910 Eco-pack (dual-band controller-based 802.11a/g/n) 10 quantity access points • AIR-SAP1602I-x-K9 Dual-band stand-alone 802.11a/g/n • AIR-SAP1602I-xK9-5 Eco-pack (dual-band stand-alone 802.11a/g/n) 5 quantity access points **The Cisco Aironet 1600e Access Point: Indoor, challenging environments, with external antennas** • AIR-CAP1602E-x-K9 Dual-band controller-based 802.11a/g/n • AIR-CAP1602E-xK910 Eco-pack (dual-band 802.11a/g/n) 10 quantity access points • AIR-SAP1602E-x-K9 Dual-band stand-alone 802.11a/g/n • AIR-SAP1602E-xK9-5 Eco-pack (dual-band stand-alone 802.11a/g/n) 5 quantity access points

Item	Specification
	Cisco SMARTnet® Service for the Cisco Aironet 1600 Series Access Point with internal and external antennas
	• CON-SNT-C1602I*x* - SMARTnet 8x5xNBD 1600i access point (dual-band 802.11 a/g/n, Controller-based), (e.g. CON-SNT-C1602IE for AP1600 internal antenna for E Domain, Controller based)
	• CON-SNT-C1602E*x* - SMARTnet 8x5xNBD 1600e access point (dual-band 802.11 a/g/n, Controller-based), (e.g. CON-SNT-C1602EA for AP1600 external antenna for A Domain, Controller based)
	• CON-SNT-S1602I*x* - SMARTnet 8x5xNBD 1600i access point (dual-band 802.11 a/g/n, Stand-alone), (e.g. CON-SNT-S1602IE for AP1600 internal antenna for E Domain, stand-alone)
	• CON-SNT-S1602E*x* - SMARTnet 8x5xNBD 1600e access point (dual-band 802.11 a/g/n, Stand-alone), (e.g. CON-SNT-S1602EA for AP1600 external antenna for A Domain, Stand-alone)
	Cisco Wireless LAN Services
	• AS-WLAN-CNSLT Cisco Wireless LAN Network Planning and Design Service
	• AS-WLAN-CNSLT Cisco Wireless LAN 802.11n Migration Service
	• AS-WLAN-CNSLT Cisco Wireless LAN Performance and Security Assessment Service
	Regulatory domains: (x = regulatory domain)
	Customers are responsible for verifying approval for use in their individual countries. To verify approval and to identify the regulatory domain that corresponds to a particular country, please visit: http://www.cisco.com/go/aironet/compliance.
	Not all regulatory domains have been approved. As they are approved, the part numbers will be available on the Global Price List.
Software	• Cisco Unified Wireless Network Software (available in Q4CY12)
	• Cisco IOS® Software Release (available in Q4CY12)
802.11n	• 3 x 3 multiple-input multiple-output (MIMO) with two spatial streams
	• Maximal ratio combining (MRC)
	• 20- and 40-MHz channels
	• PHY data rates up to 300 Mbps
	• Packet aggregation: A-MPDU (Tx/Rx), A-MSDU (Tx/Rx)
	• 802.11 dynamic frequency selection (DFS) (Bin 5)
	• Cyclic shift diversity (CSD) support
Data Rates Supported	**802.11a: 6, 9, 12, 18, 24, 36, 48, and 54 Mbps**

802.11g: 1, 2, 5.5, 6, 9, 11, 12, 18, 24, 36, 48, and 54 Mbps

802.11n data rates (2.4 GHz[1] and 5 GHz):

MCS Index[2]	GI[3] = 800ns		GI = 400ns	
	20-MHz Rate (Mbps)	40-MHz Rate (Mbps)	20-MHz Rate (Mbps)	40-MHz Rate (Mbps)
0	**6.5**	13.5	7.2	15
1	13	27	14.4	30
2	19.5	40.5	21.7	45
3	26	54	28.9	60
4	39	81	43.3	90
5	52	108	57.8	120
6	58.5	121.5	65	135
7	65	135	72.2	150
8	13	27	14.4	30
9	26	54	28.9	60
10	39	81	43.3	90
11	52	108	57.8	120
12	78	162	86.7	180
13	104	216	115.6	240

[1] 2.4 GHz: 2 GHz does not support 40 MHz.

[2] MCS Index: The Modulation and Coding Scheme (MCS) index determines the number of spatial streams, the modulation, the coding rate, and data rate values.

[3] GI: A Guard Interval (GI) between symbols helps receivers overcome the effects of multipath delays.

Item	Specification				
	14	117	243	130	270
	15	130	270	144.4	300
Frequency Band and 20-MHz Operating Channels	**A Regulatory Domain:** • 2.412 to 2.462 GHz; 11 channels • 5.180 to 5.320 GHz; 8 channels • 5.500 to 5.700 GHz; 8 channels (excludes 5.600 to 5.640 GHz) • 5.745 to 5.825 GHz; 5 channels **C Regulatory Domain:** • 2.412 to 2.472 GHz; 13 channels • 5.745 to 5.825 GHz; 5 channels **E Regulatory Domain:** • 2.412 to 2.472 GHz; 13 channels • 5.180 to 5.320 GHz; 8 channels • 5.500 to 5.700 GHz; 8 channels (excludes 5.600 to 5.640 GHz) **I Regulatory Domain:** • 2.412 to 2.472 GHz; 13 channels • 5.180 to 5.320 GHz; 8 channels **K Regulatory Domain:** • 2.412 to 2.472 GHz; 13 channels • 5.180 to 5.320 GHz; 8 channels • 5.500 to 5.620 GHz; 7 channels • 5.745 to 5.805 GHz; 4 channels		**N Regulatory Domain:** • 2.412 to 2.462 GHz; 11 channels • 5.180 to 5.320 GHz; 8 channels • 5.745 to 5.825 GHz; 5 channels **Q Regulatory Domain:** • 2.412 to 2.472 GHz; 13 channels • 5.180 to 5.320 GHz; 8 channels • 5.500 to 5.700 GHz; 11 channels **R Regulatory Domain:** • 2.412 to 2.472 GHz; 13 channels • 5.180 to 5.320 GHz; 8 channels • 5.660 to 5.700 GHz; 3 channels • 5.745 to 5.805 GHz; 4 channels **S Regulatory Domain:** • 2.412 to 2.472 GHz; 13 channels • 5.180 to 5.320 GHz; 8 channels • 5.500 to 5.700 GHz; 11 channels • 5.745 to 5.825 GHz; 5 channels **T Regulatory Domain:** • 2.412 to 2.462 GHz; 11 channels • 5.280 to 5.320 GHz; 3 channels • 5.500 to 5.700 GHz; 8 channels (excludes 5.600 to 5.640 GHz) • 5.745 to 5.825 GHz; 5 channels **Z Regulatory Domain:** • 2.412 to 2.462 GHz; 11 channels • 5.180 to 5.320 GHz; 8 channels • 5.500 to 5.700 GHz; 8 channels (excludes 5.600 to 5.640 GHz) • 5.745 to 5.825 GHz; 5 channels		
Note: This varies by regulatory domain. Refer to the product documentation for specific details for each regulatory domain.					
Maximum Number of Nonoverlapping Channels	**2.4 GHz** • 802.11b/g: ◦ 20 MHz: 3 • 802.11n: ◦ 20 MHz: 3		**5 GHz** • 802.11a: ◦ 20 MHz: 24 • 802.11n: ◦ 20 MHz: 24 ◦ 40 MHz: 11		
Note: This varies by regulatory domain. Refer to the product documentation for specific details for each regulatory domain.					
Receive Sensitivity	**2.4 GHz** **802.11b** -101 dBm @ 1 Mb/s -99 dBm @ 2 Mb/s -92 dBm @ 5.5 Mb/s -89 dBm @ 11 Mb/s	**2.4 GHz** **802.11g** -93 dBm @ 6 Mb/s -93 dBm @ 9 Mb/s -92 dBm @ 12 Mb/s -90 dBm @ 18 Mb/s -87 dBm @ 24 Mb/s -85 dBm @ 36 Mb/s -80 dBm @ 48 Mb/s -79 dBm @ 54 Mb/s	**5 GHz** **802.11a** -92 dBm @ 6 Mb/s -91 dBm @ 9 Mb/s -91 dBm @ 12 Mb/s -89 dBm @ 18 Mb/s -86 dBm @ 24 Mb/s -83 dBm @ 36 Mb/s -79 dBm @ 48 Mb/s -78 dBm @ 54 Mb/s		

Item	Specification			
	2.4 GHz **802.11n (HT20)**		**5 GHz** **802.11n (HT20)**	**5 GHz** **802.11n (HT40)**
	-93 dBm @ MCS0		-92 dBm @ MCS0	-88 dBm @ MCS0
	-91 dBm @ MCS1		-89 dBm @ MCS1	-87 dBm @ MCS1
	-89 dBm @ MCS2		-88 dBm @ MCS2	-85 dBm @ MCS2
	-86 dBm @ MCS3		-85 dBm @ MCS3	-82 dBm @ MCS3
	-83 dBm @ MCS4		-82 dBm @ MCS4	-79 dBm @ MCS4
	-78 dBm @ MCS5		-77 dBm @ MCS5	-74 dBm @ MCS5
	-77 dBm @ MCS6		-76 dBm @ MCS6	-73 dBm @ MCS6
	-76 dBm @ MCS7		-75 dBm @ MCS7	-72 dBm @ MCS7
	-93 dBm @ MCS8		-91 dBm @ MCS8	-88 dBm @ MCS8
	-90 dBm @ MCS9		-88 dBm @ MCS9	-86 dBm @ MCS9
	-88 dBm @ MCS10		-87 dBm @ MCS10	-84 dBm @ MCS10
	-85 dBm @ MCS11		-84 dBm @ MCS11	-81 dBm @ MCS11
	-81 dBm @ MCS12		-81 dBm @ MCS12	-78 dBm @ MCS12
	-77 dBm @ MCS13		-76 dBm @ MCS13	-73 dBm @ MCS13
	-76 dBm @ MCS14		-75 dBm @ MCS14	-72 dBm @ MCS14
	-74 dBm @ MCS15		-73 dBm @ MCS15	-70 dBm @ MCS15
Maximum Total Transmit Power	**2.4 GHz** 802.11b 22 dBm (3 antennas enabled) 802.11g 22 dBm (3 antennas enabled) 802.11n (HT20) 22 dBm (3 antennas enabled)		**5 GHz** 802.11a 22 dBm (3 antennas enabled) 802.11n non-HT duplicate mode 22 dBm (3 antennas enabled) 802.11n (HT20) 22 dBm (3 antennas enabled) 802.11n (HT40) 22 dBm (3 antennas enabled)	

Note: The maximum power setting will vary by channel and according to individual country regulations. Refer to the product documentation for specific details.

Item	Specification					
Available Total Transmit Power Settings	**2.4 GHz**			**5 GHz**		
	Enabled antennas:			Enabled antennas:		
	1	2	3	1	2	3
	17 dBm	20 dBm	22 dBm	17 dBm	20 dBm	22 dBm
	14 dBm	17 dBm	19 dBm	14 dBm	17 dBm	19 dBm
	11 dBm	14 dBm	16 dBm	11 dBm	14 dBm	16 dBm
	8 dBm	11 dBm	13 dBm	8 dBm	11 dBm	13 dBm
	5 dBm	8 dBm	10 dBm	5 dBm	8 dBm	10 dBm
	2 dBm	5 dBm	7 dBm	2 dBm	5 dBm	7 dBm

Note: The maximum power setting will vary by channel and according to individual country regulations. Refer to the product documentation for specific details.

Item	Specification
Integrated Antenna	2.4 GHz, gain 4.0 dBi, horizontal beamwidth 360° 5 GHz, gain 4.0 dBi, horizontal beamwidth 360°
External Antenna (Sold Separately)	- Certified for use with antenna gains up to 6 dBi (2.4 GHz and 5 GHz) - Cisco offers the industry's broadest selection of 802.11n antennas delivering optimal coverage for a variety of deployment scenarios
Interfaces	10/100/1000BASE-T autosensing (RJ-45) - Management console port (RJ-45)
Indicators	Status LED indicates boot loader status, association status, operating status, boot loader warnings, boot loader errors
Dimensions (W x L x H)	Access point (without mounting bracket): 8.7 x 8.7 x 1.84 in. (22.1 x 22.1 x 4.7 cm)
Weight	1.9 lbs. (0.86 kg)

Item	Specification
Environmental	**Cisco Aironet 1600i** • Nonoperating (storage) temperature: -22 to 158°F (-30 to 70°C) • Nonoperating (storage) Altitude Test -25°C, 15,000 ft. • Operating temperature: 32 to 104°F (0 to 40°C) • Operating humidity: 10 to 90% percent (noncondensing) • Operating Altitude Test -40°C, 9843 ft. **Cisco Aironet 1600e** • Nonoperating (storage) temperature: -22 to 158°F (-30 to 70°C) • Nonoperating (storage) Altitude Test - 25°C, 15,000 ft. • Operating temperature: -4 to 122°F (-20 to 50°C) • Operating humidity: 10 to 90 percent (noncondensing) • Operating Altitude Test -40°C, 9843 ft
System Memory	• 256 MB DRAM • 32 MB flash
Input Power Requirements	• AP1600: 44 to 57 VDC • Power Supply and Power Injector: 100 to 240 VAC; 50 to 60 Hz
Powering Options	• 802.3af Ethernet Switch • Cisco AP1600 Power Injectors (AIR-PWRINJ4=, AIR-PWRINJ5=) • Cisco AP1600 Local Power Supply (AIR-PWR-B=)
Power Draw	• AP1600: 12.95 W **Note:** When deployed using PoE, the power drawn from the power sourcing equipment will be higher by some amount dependent on the length of the interconnecting cable. This additional power may be as high as 2.45W, bringing the total system power draw (access point + cabling) to 15.4W.
Warranty	Limited Lifetime Hardware Warranty

Compliance	**Standards**
	• **Safety:**
	  ◦ UL 60950-1
	  ◦ CAN/CSA-C22.2 No. 60950-1
	  ◦ UL 2043
	  ◦ IEC 60950-1
	  ◦ EN 60950-1
	• **Radio approvals:**
	  ◦ FCC Part 15.247, 15.407
	  ◦ RSS-210 (Canada)
	  ◦ EN 300.328, EN 301.893 (Europe)
	  ◦ ARIB-STD 33 (Japan)
	  ◦ ARIB-STD 66 (Japan)
	  ◦ ARIB-STD T71 (Japan)
	  ◦ AS/NZS 4268.2003 (Australia and New Zealand)
	  ◦ EMI and susceptibility (Class B)
	  ◦ FCC Part 15.107 and 15.109
	  ◦ ICES-003 (Canada)
	  ◦ VCCI (Japan)
	  ◦ EN 301.489-1 and -17 (Europe)
	  ◦ EN 60601-1-2 EMC requirements for the Medical Directive 93/42/EEC
	• **IEEE Standard:**
	  ◦ IEEE 802.11a/b/g, IEEE 802.11n, IEEE 802.11h, IEEE 802.11d
	• **Security:**
	  ◦ 802.11i, Wi-Fi Protected Access 2 (WPA2), WPA
	  ◦ 802.1X
	  ◦ Advanced Encryption Standards (AES), Temporal Key Integrity Protocol (TKIP)
	• **EAP Type(s):**
	  ◦ Extensible Authentication Protocol-Transport Layer Security (EAP-TLS)
	  ◦ EAP-Tunneled TLS (TTLS) or Microsoft Challenge Handshake Authentication Protocol Version 2 (MSCHAPv2)
	  ◦ Protected EAP (PEAP) v0 or EAP-MSCHAPv2

Item	Specification
	◦ Extensible Authentication Protocol-Flexible Authentication via Secure Tunneling (EAP-FAST)
	◦ PEAPv1 or EAP-Generic Token Card (GTC)
	◦ EAP-Subscriber Identity Module (SIM)
	• **Multimedia:**
	◦ Wi-Fi Multimedia (WMM™)
	• **Other:**
	◦ FCC Bulletin OET-65C
	◦ RSS-102

Limited Lifetime Hardware Warranty

The Cisco Aironet 1600 Series Access Point comes with a Limited Lifetime Warranty that provides full warranty coverage of the hardware for as long as the original end user continues to own or use the product. The warranty includes 10-day advance hardware replacement and ensures that software media is defect-free for 90 days. For more details, visit: http://www.cisco.com/go/warranty.

Cisco Wireless LAN Services

Realize the full business value of your technology investments faster with intelligent, customized services from Cisco and our partners. Backed by deep networking expertise and a broad ecosystem of partners, Cisco Wireless LAN Services enable you to deploy a sound, scalable mobility network that enables rich media collaboration while improving the operational efficiency gained from a converged wired and wireless network infrastructure based on the Cisco Unified Wireless Network. Together with partners, we offer expert plan, build, and run services to accelerate your transition to advanced mobility services while continuously optimizing the performance, reliability, and security of that architecture after it is deployed. For more details, visit: http://www.cisco.com/go/wirelesslanservices.

For More Information

For more information about the Cisco Aironet 1600 Series, visit http://www.cisco.com/go/wireless or contact your local account representative.

Cisco 5500 Series Wireless Controllers

Maximum Performance and Scalability

- Support for up to 500 access points and 7000 clients
- 802.11n optimized for up to nine times the performance of 802.11a/g networks
- Enhanced uptime with the ability to simultaneously configure and manage 500 access points per controller

Improved Mobility and Services

- Larger mobility domain for more simultaneous client associations
- Faster radio resource management (RRM) updates for uninterrupted network access when roaming
- Intelligent RF control plane for self-configuration, self-healing, and self-optimization
- Efficient roaming improves application performance such as toll quality, voice, and consistent streaming of video and data backup

Licensing Flexibility and Investment Protection

- Additional access point capacity licenses may be added over time

Cisco OfficeExtend Solution

- Secure, simple, cost-effective mobile teleworker solution
- Up to 500 remote access points per controller
- Supports Cisco® Unified IP Phones for reduced cell phone charges

Comprehensive Wired/Wireless Security

- Full Control and Provisioning of Wireless Access Points (CAPWAP) access-point-to-controller encryption
- Supports rogue access point detection and denial-of-service attacks
- Management frame protection detects malicious users and alerts network administrators

Enterprise Wireless Mesh

- Dynamic wireless mesh networks support indoor and outdoor connectivity for areas that are difficult to wire

Environmentally Responsible

- Support for adaptive power management to turn off access point radios during off-peak hours to reduce power consumption
- OfficeExtend solution reduces costs and supports green best practices by reducing commuting time and saving on gas, vehicle mileage, and insurance costs

The Cisco® 5500 Series Wireless Controller, shown in Figure 1, is a highly scalable and flexible platform that enables systemwide services for mission-critical wireless networking in medium-sized to large enterprises and campus environments. Designed for 802.11n performance and maximum scalability, the 5500 Series offers enhanced uptime with:

- RF visibility and protection
- The ability to simultaneously manage up to 500 access points
- Superior performance for reliable streaming video and toll-quality voice
- Sub-second stateful failover of all access points and clients from the primary to standby controller

Figure 1 Cisco 5500 Series Wireless LAN Controller

Features

Optimized for high-performance wireless networking, the Cisco 5500 Series Controller offers improved mobility and prepares the business for the next wave of mobile devices and applications. The 5500 Series supports a higher density of clients and delivers more efficient roaming, with at least nine times the throughput of existing 802.11a/g networks.

The 5500 Series automates wireless configuration and management functions and allows network managers to have the visibility and control needed to cost-effectively manage, secure, and optimize the performance of their wireless networks. With integrated Cisco CleanAir® technology, the 5500 Series protects 802.11n performance by providing cross-network access to real-time and historic RF interference information for quick troubleshooting and resolution.

The Cisco 5508 Wireless Controller supports Cisco Application Visibility and Control(AVC), the technology that includes the Network-Based Application Recognition 2 (NBAR-2) engine, Cisco's deep packet inspection (DPI) capability. The NBAR-2 engine can classify applications, applies quality of service (QoS) setting to either drop or mark the traffic, and prioritizes business-critical applications in the network. Cisco AVC uses NetFlow Version 9 to export the flows to Cisco Prime™ Infrastructure or a third-party NetFlow Collector. The 5508 also supports Bonjour Services Directory to enable Bonjour Services to be advertised and utilized in a separate Layer 3 network. Wireless Policy engine is a wireless profiler and policy feature on the Cisco 5500 Series Wireless Controller that enables profiling of wireless devices and enforcement of policies such as VLAN assignment, QoS, ACL and time-of-day-based access.

As a component of the Cisco Unified Wireless Network, this controller provides real-time communications between Cisco Aironet® access points, the Cisco Wireless Control System (WCS), and the Cisco Mobility Services Engine to deliver centralized security policies, wireless intrusion prevention system (IPS) capabilities, award-winning RF management, and QoS.

Software Licensing Flexibility

Base access point licensing offers flexibility to add up to 500 additional access points as business needs grow. The licensing structure supports a variety of business mobility needs as part of the basic feature set, including the Cisco OfficeExtend solution for secure, mobile teleworking and Cisco Enterprise Wireless Mesh, which allows access points to dynamically establish wireless connections in locations where it may be difficult or impossible to physically connect to the wired network.

Table 1 lists the features of the Cisco 5500 Series Wireless LAN Controllers.

Table 1.   Cisco 5500 Series Wireless LAN Controller Features

Feature	Benefits
Scalability	• Supports 12, 25, 50,100, 250, or 500 access points for business-critical wireless services at locations of all sizes
High Performance	• Wired speed, nonblocking performance for 802.11n networks
RF Management	• Provides both real-time and historical information about RF interference impacting network performance across controllers, via systemwide Cisco CleanAir technology integration
OfficeExtend	• Supports corporate wireless service for mobile and remote workers with secure wired tunnels to the Cisco Aironet® 1130 or 1140 Series Access Points • Extends the corporate network to remote locations with minimal setup and maintenance requirements (zero-touch deployment) • Improves productivity and collaboration at remote site locations • Separate SSID tunnels allow both corporate and personal Internet access • Reduced CO2 emissions from decrease in commuting • Higher employee job satisfaction from ability to work at home • Improves business resiliency by providing continuous, secure connectivity in the event of disasters, pandemics, or inclement weather
Comprehensive End-to-End Security	• Offers control and provisioning of wireless access points (CAPWAP)-compliant DTLS encryption to help ensure full-line-rate encryption between access points and controllers across remote WAN/LAN links
Enterprise Wireless Mesh	• Allows access points to dynamically establish wireless connections without the need for a physical connection to the wired network • Available on select Cisco Aironet access points, Enterprise Wireless Mesh is ideal for warehouses, manufacturing floors, shopping centers and any other location where extending a wired connection may prove difficult or aesthetically unappealing
High Performance Video	• Integrates Cisco VideoStream technology as part of the medianet framework to optimize the delivery of video applications across the WLAN

Feature	Benefits
End-to-End Voice	• Supports Unified Communications for improved collaboration through messaging, presence, and conferencing • Supports all Cisco Unified IP Phones for cost-effective, real-time voice services
High Availability	• An optional redundant power supply that helps to ensure maximum availability
Environmentally Responsible	• Organizations may choose to turn off access point radios to reduce power consumption during off peak hours
Mobility, Security and Management for IPv6 & Dual-Stack Clients	• Secure, reliable wireless connectivity and consistent end-user experience • Increased network availability through proactive blocking of known threats • Equips administrators for IPv6 troubleshooting, planning, and client traceability from a common wired and wireless management system

Table 2 lists the product specifications for Cisco 5500 Series Wireless Controllers.

Table 2. Product Specifications for Cisco 5500 Series Wireless Controllers

Item	Specifications
Wireless	IEEE 802.11a, 802.11b, 802.11g, 802.11d, WMM/802.11e, 802.11h, 802.11k, 802.11n, 802.11r, 802.11u, 802.11w, 802.11ac.
Wired/Switching/Routing	IEEE 802.3 10BASE-T, IEEE 802.3u 100BASE-TX specification, 1000BASE-T. 1000BASE-SX, 1000-BASE-LH, IEEE 802.1Q Vtagging, and IEEE 802.1AX Link Aggregation.
Data Request For Comments (RFC)	• RFC 768 UDP • RFC 791 IP • RFC 2460 IPv6 (pass through Bridging mode only) • RFC 792 ICMP • RFC 793 TCP • RFC 826 ARP • RFC 1122 Requirements for Internet Hosts • RFC 1519 CIDR • RFC 1542 BOOTP • RFC 2131 DHCP • RFC 5415 CAPWAP Protocol Specification • RFC 5416 CAPWAP Binding for 802.11
Security Standards	• WPA • IEEE 802.11i (WPA2, RSN) • RFC 1321 MD5 Message-Digest Algorithm • RFC 1851 The ESP Triple DES Transform • RFC 2104 HMAC: Keyed Hashing for Message Authentication • RFC 2246 TLS Protocol Version 1.0 • RFC 2401 Security Architecture for the Internet Protocol • RFC 2403 HMAC-MD5-96 within ESP and AH • RFC 2404 HMAC-SHA-1-96 within ESP and AH • RFC 2405 ESP DES-CBC Cipher Algorithm with Explicit IV • RFC 2406 IPsec • RFC 2407 Interpretation for ISAKMP • RFC 2408 ISAKMP • RFC 2409 IKE • RFC 2451 ESP CBC-Mode Cipher Algorithms • RFC 3280 Internet X.509 PKI Certificate and CRL Profile • RFC 3602 The AES-CBC Cipher Algorithm and Its Use with IPsec • RFC 3686 Using AES Counter Mode with IPsec ESP • RFC 4347 Datagram Transport Layer Security • RFC 4346 TLS Protocol Version 1.1

Item	Specifications
Encryption	• WEP and TKIP-MIC: RC4 40, 104 and 128 bits (both static and shared keys) • AES: CBC, CCM, CCMP • DES: DES-CBC, 3DES • SSL and TLS: RC4 128-bit and RSA 1024- and 2048-bit • DTLS: AES-CBC • IPSec: DES-CBC, 3DES, AES-CBC
Authentication, Authorization, and Accounting (AAA)	• IEEE 802.1X • RFC 2548 Microsoft Vendor-Specific RADIUS Attributes • RFC 2716 PPP EAP-TLS • RFC 2865 RADIUS Authentication • RFC 2866 RADIUS Accounting • RFC 2867 RADIUS Tunnel Accounting • RFC 2869 RADIUS Extensions • RFC 3576 Dynamic Authorization Extensions to RADIUS • RFC 3579 RADIUS Support for EAP • RFC 3580 IEEE 802.1X RADIUS Guidelines • RFC 3748 Extensible Authentication Protocol • Web-based authentication • TACACS support for management users
Management	• SNMP v1, v2c, v3 • RFC 854 Telnet • RFC 1155 Management Information for TCP/IP-Based Internets • RFC 1156 MIB • RFC 1157 SNMP • RFC 1213 SNMP MIB II • RFC 1350 TFTP • RFC 1643 Ethernet MIB • RFC 2030 SNTP • RFC 2616 HTTP • RFC 2665 Ethernet-Like Interface types MIB • RFC 2674 Definitions of Managed Objects for Bridges with Traffic Classes, Multicast Filtering, and Virtual Extensions • RFC 2819 RMON MIB • RFC 2863 Interfaces Group MIB • RFC 3164 Syslog • RFC 3414 User-Based Security Model (USM) for SNMPv3 • RFC 3418 MIB for SNMP • RFC 3636 Definitions of Managed Objects for IEEE 802.3 MAUs • Cisco private MIBs
Management Interfaces	• Web-based: HTTP/HTTPS • Command-line interface: Telnet, Secure Shell (SSH) Protocol, serial port • Cisco Wireless Control System (WCS)
Interfaces and Indicators	• Uplink: 8 (5508) 1000BaseT, 1000Base-SX and 1000Base-LH transceiver slots • Small Form-Factor Pluggable (SFP) options (only Cisco SFPs supported): GLC-T, GLC-SX-MM, GLC-LH-SM, GLC-SX-MMD, GLC-LH-SMD, GLC-TE • LED indicators: link • Service Port: 10/100/1000 Mbps Ethernet (RJ45). • Service Port: 10/100/1000 Mbps Ethernet (RJ45) For High Availability for future use • LED indicators: link • Utility Port: 10/100/1000 Mbps Ethernet (RJ45) • LED indicators: link • Expansion Slots: 1 (5508) • Console Port: RS232 (DB-9 male/RJ-45 connector included), mini-USB • Other Indicators: Sys, ACT, Power Supply 1, Power Supply 2

Item	Specifications
Physical and Environmental	• Dimensions (WxDxH): 17.30 x 21.20 x 1.75 in. (440 x 539 x 44.5 mm) • Weight: 20 lbs (9.1 kg) with 2 power supplies • Temperature: Operating temperature: 32 to 104°F (0 to 40°C); Storage temperature: -13 to 158°F (-25 to 70°C) • Humidity: Operating humidity: 10 95%, noncondensing. Storage humidity: up to 95% • Input power: 100 to 240 VAC; 50/60 Hz; 1.05 A at 110 VAC, 115W Maximum; 0.523 A at 220 VAC, 115W Maximum; Test Conditions: Redundant Power Supplies, 40C, Full Traffic. • Heat Dissipation: 392 Btu/hour at 110/220 VAC Maximum
Regulatory Compliance	CE Mark Safety: • UL 60950-1:2003 • EN 60950:2000 • EMI and susceptibility (Class A) • U.S.: FCC Part 15.107 and 15.109 • Canada: ICES-003 • Japan: VCCI • Europe: EN 55022, EN 55024

Tables 3 and Table 4 list the ordering and accessories information for Cisco 5500 Series Wireless Controllers.

Table 3.   Ordering Information for Cisco 5500 Series Wireless Controllers

Part Number	Product Name	Cisco SMARTnet® Service 8x5xNBD
AIR-CT5508-12-K9	5500 Series Wireless Controller for up to 12 Cisco access points	CON-SNT-CT0812
AIR-CT5508-25-K9	5500 Series Wireless Controller for up to 25 Cisco access points	CON-SNT-CT0825
AIR-CT5508-50-K9	5500 Series Wireless Controller for up to 50 Cisco access points	CON-SNT-CT0850
AIR-CT5508-100-K9	5500 Series Wireless Controller for up to 100 Cisco access points	CON-SNT-CT08100
AIR-CT5508-250-K9	5500 Series Wireless Controller for up to 250 Cisco access points	CON-SNT-CT08250
AIR-CT5508-500-K9	5500 Series Wireless Controller for up to 500 Cisco access points	CON-SNT-CT08500
AIR-CT5508-500-2PK	2 Pack 5500 Series Wireless Controller for up to 500 Cisco access points each (1000 access points total)	CON-SNT-AIRC552P
AIR-CT5508-HA-K9	Cisco 5508 Series Wireless Controller for High Availability	CON-SNT-CT5508HA

Table 4.   Accessories for Cisco 5500 Series Wireless Controllers

Part Number	Product Name
AIR-PWR-5500-AC=	5500 Series Wireless Controller Redundant AC Power Supply
AIR-FAN-5500=	5500 Series Wireless Controller Fan Tray
AIR-CT5500-RK-MNT	5500 Series Wireless Controller Spare mounting kit

Additive Capacity Upgrade Licenses

Tables 5 and 6 list additive capacity upgrade licenses for the Cisco 5500 Series.

Table 5. Ordering Information for Cisco 5500 Series Wireless Controllers Additive Capacity Licenses (e-Delivery Product Authorization Keys [PAKs])

	Part Number	Product Description	Cisco SMARTnet Service 8x5xNBD
e-License	L-LIC-CT5508-UPG	Primary upgrade SKU: Pick any number or combination of the following options under this SKU to upgrade one or many controllers under one product authorization key	CON-SNT-LCTUPG
	L-LIC-CT5508-5A	5 AP Adder License for the 5508 Controller (eDelivery)	CON-SNT-LICT55A
	L-LIC-CT5508-25A	25 AP Adder License for the 5508 Controller (eDelivery)	CON-SNT-LCT25A
	L-LIC-CT5508-50A	50 AP Adder License for the 5508 Controller (eDelivery)	CON-SNT-LCT50A
	L-LIC-CT5508-100A	100 AP Adder License for the 5508 Controller (eDelivery)	CON-SNT-LCT100A
	L-LIC-CT5508-250A	250 AP Adder License for the 5508 Controller (eDelivery)	CON-SNT-LCT250A

Table 6. Ordering Information for Cisco 5500 Series Wireless Controllers Additive Capacity Licenses (Paper PAKs)

	Part Number	Product Description	Cisco SMARTnet Service 8x5xNBD
Paper License	LIC-CT5508-UPG	Primary upgrade SKU: Pick any number or combination of the following options under this SKU, to upgrade one or many controllers under one product authorization key.	CON-SNT-LCTUPG
	LIC-CT5508-5A	5 AP Adder License for the 5508 Controller	CON-SNT-LICT55A
	LIC-CT5508-25A	25 AP Adder License for the 5508 Controller	CON-SNT-LCT25A
	LIC-CT5508-50A	50 AP Adder License for the 5508 Controller	CON-SNT-LCT50A
	LIC-CT5508-100A	100 AP Adder License for the 5508 Controller	CON-SNT-LCT100A
	LIC-CT5508-250A	250 AP Adder License for the 5508 Controller	CON-SNT-LCT250A

The additive capacity licenses allow for the increase in access point capacity supported by the controller up to a maximum of 500 access points. As an example, if a controller was initially ordered with support for 250 access points, that capacity could be later increased to up to 500 access points by purchasing a 250-access-point additive capacity license (1x-LIC-CT5508-250A).

A certificate with a PAK is required to add additional access point capacity on the Cisco 5500 Series Wireless Controller.

The certificate may be expedited via email. If a paper certificate is required for customs, it should be ordered to ship via U.S. mail. Each additive capacity license and PAK must be registered prior to installation.

Ordering and installing the Cisco 5500 Series Wireless Controller additive capacity licenses is a three-step process:

1. Select the correct SKU for email or paper delivery.
2. Register the PAK certificate (see Registering PAK Certificate).
3. Install the license on the Cisco 5500 Series Wireless Controller (see Installing License).

Please review the Cisco Wireless LAN Controller Configuration Guide, Release 6.0 or later, for detailed ordering, registration, and installation information for the 5500 Series additive capacity licenses.

Electronic delivery of the same PAKs is available by ordering the e-License SKUs as listed in Table 5. If a paper certificate is required, please use the SKUs listed in Table 6.

PAK Certificate Registration

Customers are required to register a PAK certificate for all upgrade licenses for the Cisco 5500 Series Wireless Controllers. Customer email address and host name are required to register the PAK certificate at: http://www.cisco.com/go/license.

Installing License on Cisco WCS Server

Follow these steps to install a license file. If you need additional help, contact Cisco Technical Assistance Center (TAC) at 800 553-2447 or tac@cisco.com.

1. Install Cisco WCS software if not already completed.
2. Save the license file (.lic) to a temporary directory on your hard drive. (You will receive an email from Cisco with an attached license file)
3. Open a supported version of the Internet Explorer browser.
4. In the location or address field, enter the following URL, replacing IP address with the IP address or host name of the Cisco WCS server: **https: // <IP address>**.
5. Log in to the Cisco WCS server as system administrator. (Be aware that usernames and passwords are case-sensitive.)
6. From the Help menu, select **Licensing**.
7. On the Licensing page, from the Command menu, select **Add License**.
8. On the Add License page, click **Browse** to navigate to the location where you saved the .lic file.
9. Click **Download**. The Cisco WCS server imports the license.

Table 7 shows the optional DTLS license for Cisco 5500 Series Wireless Controllers.

Datagram Transport Layer Security (DTLS) is required for all OfficeExtend deployments to encrypt the Data Plane traffic. **Customers planning to install this device physically in Russia must order the controller with DTLS disabled and then obtain a physical PAK in order to enable a DTLS license and should not download the license from Cisco.com.** Please consult your local government regulations to ensure that Data DTLS encryption is permitted.

If a customer chooses SWC5500K9-60, SWC5500K9-70 or SWC5500K9-72, DTLS Data Encryption is enabled by default. When a customer orders the 5500 Series and chooses either SWC5500LPE-K9-70 or SWC5500LPE-K9-72 in the Optional Licenses tab, data DTLS Encryption is disabled.

The DTLS Paper PAK license is designated for customers who purchase a controller with DTLS disabled due to import restrictions but get permission to add DTLS support after initial purchase. This optional DTLS license is required for Cisco OfficeExtend deployment.

Table 7.   Optional Licensing for Cisco 5500 Series Wireless Controllers (PAKs)

Part Number	Description
LIC-CT5508-LPE-K9	5508 Wireless Controller DTLS License (Paper PAK)
L-LIC-CT55-LPE-K9=	Cisco 5508 Controller DTLS License (electronic Certificate)

Other customers can simply use the procedure outlined below in order to download the DTLS license from Cisco.com.

To obtain a data DTLS license, follow these steps:

Step 1.   Browse to http://cisco.com/go/license

Step 2.   On the Product License Registration page, choose **Licenses Not Requiring a PAK**

Step 3.   Choose **Cisco Wireless Controllers DTLS License** under Wireless

Step 4.   Complete the remaining steps to generate the license file. The license will be provided online or via email

Step 5.   Copy the license file to your TFTP server

Step 6.   Install the license by browsing to the WLC Web Administration Page:

Management --> Software Activation --> Commands --> Action: Install License

Step 7.   Browse to: Cisco 5508 Wireless Controller Software Download Page

http://www.cisco.com/cisco/software/release.html?mdfid=282600534&release=7.0.230.0&relind=AVAILAB LE&softwareid=280926587&rellifecycle=ED&reltype=latest

Step 8.   Choose the release that corresponds to the SW running on your WLC

Step 9.   Choose the **NON LDPE** software release: AIR-CT5500-K9-X-X-XX.aes

Step 10. Complete the remaining steps to download the software

Service and Support

Realize the full business value of your wireless network and mobility services investments faster with intelligent, customized services from Cisco and our partners. Backed by deep networking expertise and a broad ecosystem of partners, Cisco professional and technical services enable you to successfully plan, build, and run your network as a powerful business platform. Our services can help you successfully deploy the Cisco 5500 Series Wireless Controller and integrate mobility solutions effectively to lower the total cost of ownership and secure your wireless network.

To learn more about Cisco Wireless LAN service offers, visit: http://www.cisco.com/go/wirelesslanservices.

Summary

The Cisco 5500 Series Wireless Controller is designed for 802.11n performance and offers maximum scalability for enterprise and service provider wireless deployments. It simplifies deployment and operation of wireless networks, helping to ensure smooth performance, enhance security, and maximize network availability. The Cisco 5500 Series Wireless Controller manages all the Cisco access points within campus environments and branch locations, eliminating complexity and providing network administrators with visibility and control of their wireless LANs.

For More Information

For more information about Cisco wireless controllers, contact your local account representative or visit:
http://www.cisco.com/en/US/products/ps6366/index.html.

For more information about the Cisco Unified Wireless Network framework, visit:
http://www.cisco.com/go/unifiedwireless.

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Cisco Catalyst 2960-C and 3560-C Series Compact Switches

Cisco® Catalyst® compact switches (Figure 1) easily extend an intelligent, fully managed Cisco Catalyst wired switching infrastructure, including end-to-end IP and Borderless Network services, with a single Ethernet cable or fiber from the wiring closet. These attractive, small form-factor Gigabit and Fast Ethernet switches are ideal for connecting multiple devices on the retail sales floor and in classrooms, hotels, and factories and for extending wireless LAN networks: wherever space is at a premium and multiple cable runs could be challenging.

Cisco Catalyst 2960-C and 3560-C Series Compact Switches highlights:

- Extend a highly secure, intelligent, managed Cisco Catalyst infrastructure with a single Ethernet cable or fiber from the wiring closet
- Support for advanced security and services, including voice, video, and Cisco Borderless Network services, to remote endpoints
- Power over Ethernet (PoE) pass-through enables the compact switch to draw power from the wiring closet and pass it to end devices (selected models)
- Attractive, small form factor and fanless operation fit in confined spaces where multiple cable runs could be challenging
- Easy to deploy, manage and extend the network loop free
- Enhanced limited lifetime hardware warranty

Figure 1.   Cisco Catalyst Compact Switches

Cisco Catalyst 2960-C Series Compact Switches   Cisco Catalyst 3560-C Series Compact Switches

Switch Configurations

Table 1 compares switch models.

Table 1.   Available Cisco Catalyst Compact Switch models

Model	Ethernet Ports	PoE Output Ports	Available PoE Power	Uplinks	MACsec
2960C-8TC-L	8 x 10/100 Fast Ethernet	N/A		2 x 1G copper or 2 x 1G SFP	N/A
2960C-8TC-S	8 x 10/100 Fast Ethernet	N/A		2 x 1G copper or 2 x 1G SFP	N/A
2960CPD-8TT-L	8 x 10/100 Fast Ethernet	N/A		2 x 1G (PoE+ input)	N/A
2960C-8PC-L	8 x 10/100 Fast Ethernet	8 PoE	124W	2 x 1G copper or 2 x 1G SFP	N/A
2960CPD-8PT-L	8 x 10/100 Fast Ethernet	8 PoE	Up to 30.8W[1]	2 x 1G (PoE+ input)	N/A
2960C-12PC-L	12 x 10/100 Fast Ethernet	12 PoE	124W	2 x 1G copper or 2 x 1G SFP	N/A
2960CG-8TC-L	8 x 10/100/1000 Gigabit Ethernet	N/A		2 x 1G copper or 2 x 1G SFP	N/A
3560C-8PC-S	8 x 10/100 Fast Ethernet	8 PoE+	124W	2 x 1G copper or 2 x 1G SFP	N/A
3560C-12PC-S	12 x 10/100 Fast Ethernet	12 PoE+	124W	2 x 1G copper or 2 x 1G SFP	N/A
3560CG-8TC-S	8 x 10/100/1000 Gigabit Ethernet	N/A		2 x 1G copper or 2 x 1G SFP	Yes
3560CG-8PC-S	8 x 10/100/1000 Gigabit Ethernet	8 PoE+	124W	2 x 1G copper or 2 x 1G SFP	Yes
3560CPD-8PT-S	8 x 10/100/1000 Gigabit Ethernet	8 PoE	Up to 23.8W[2]	2 x 1G (PoE+ input)	Yes

Cisco Catalyst 2960-C and 3560-C Series Software

Cisco Catalyst 2960-C Series compact switches ship with the LAN Base version of Cisco IOS® Software, as available on other Cisco Catalyst 2960 Series Switches. Similarly, Cisco Catalyst 3560-C compact switches ship with the IP Base version of Cisco IOS Software, as with other 3560 Series switches. Neither series of compact switches can be upgraded.

Cisco Catalyst 2960-C switches deliver advanced Layer 2 switching with intelligent Layer 2 through 4 services for the network edge, such as voice, video, and wireless LAN services. The IP Base feature set on Cisco Catalyst 3560-C switches adds baseline enterprise services, including support for routed access, Cisco TrustSec®, media access control security (MACsec), and other Cisco Borderless Network services.

The LAN Base feature set offers enhanced intelligent services that include comprehensive Layer 2 features. The IP Base feature set provides baseline enterprise services in addition to all LAN Base features. IP Base also includes the support for routed access, MACsec, and Open Shortest Path First (OSPF).

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[1] Using UPOE uplinks.
[2] Using UPOE uplinks.

Applications

Cisco Borderless Networks and Access Switching

Borderless Networks, a Cisco next-generation architecture, deliver the new workspace experience, connecting anyone, anywhere, using any device, to any resource - securely, reliably, transparently. The Cisco Borderless Networks architecture addresses primary IT and business challenges to help create a truly borderless experience by bringing interactions closer to the employee and customer. Innovations in switching help organizations deliver ease of operation, green efficiency, security, and performance to accelerate the way IT delivers and scales those services on the network.

Cisco Compact Switches for Retail

Major retailers are increasingly moving customer-facing IP-based applications and services to the middle of the sales floor. A typical transaction area on the floor will often include multiple point-of-sale terminals, card readers, IP phones, and printers. Free-standing kiosks, which allow customers to access online catalogs with click-to-chat capabilities and other applications, are being deployed. Cisco Catalyst compact switches extend fully managed IP services, including end-to-end PCI-compliant solutions, to the floor with a single Ethernet cable or fiber. Because of their quiet operation, attractive appearance, and flexible mounting options, they are ideally suited for mounting in confined spaces on the floor.

Cisco Compact Switches for Education

Video and distance learning applications have become a common part of the curriculum for K-12 and higher education. Support for IP phones and secure wired and wireless connectivity in the classroom are also common requirements. Yet schools and universities must often work within limited budgets and aging facilities, making wiring runs from a central point in the building to multiple devices in the classroom cost prohibitive. Cisco Catalyst compact switches extend fully managed IP services to the classroom with a single Ethernet cable or fiber. Quiet operation and flexible mounting options make them ideally suited for classrooms or confined areas nearby.

Cisco Compact Switches Extend Enterprise Networks

Enterprises often look to extend the reach of their networks - to bring wired connectivity to more employees and to support new wireless deployments. Running additional Ethernet cables for individual devices might be impractical, but the same security, services, and management must be supported. Cisco Catalyst 2960-C and 3560-C Series compact switches extend the wired Cisco access infrastructure, 8 or 12 ports at a time, with a single Ethernet cable or fiber, all while delivering the same services as the Cisco Catalyst switches in the wiring closet. PoE, quiet operation, and flexible mounting options allow placement in confined spaces.

Cisco Networked Sustainability: Good for Business, Better for Environment

- **PoE pass-through** gives the ability to power PoE end devices through drawing PoE from the wiring closet. The Cisco Catalyst 3560CPD-8PT-S and 2960CPD-8PT-L have eight downlink ports with two PoE input ports that allow it to be powered by another switch. These switches do not need a power supply and receives power over the uplink from an upstream PoE or Cisco Universal Power over Ethernet (Cisco UPOE™) device, providing deployment flexibility and availability. These switches are ideal for wiring and space-constrained applications.

- **Cisco EnergyWise** is an innovative architecture, added to the Cisco Catalyst 3560-C and 2960-C Series compact switches, that enables the measurement of power consumption in the network infrastructure and network-attached devices. EnergyWise encompasses a highly intelligent network-based approach to communicate messages that measure and control energy between network devices and endpoints. The network discovers Cisco EnergyWise-manageable devices, monitors their power consumption, and takes action based on business rules to reduce power consumption.
- **Efficient switch operation:** Cisco Catalyst 3560-C and 2960-C Series compact switches use hardware components created by Cisco providing optimum power saving, low-power operations for industry best-in-class power management, and power consumption capabilities. The Cisco Catalyst 3560-C ports are capable of reduced power modes so that ports not in use can move into a lower power utilization state.
- **IEEE 802.3at or PoE+:** Available on the Cisco Catalyst 3560-C is the latest in PoE technology, allowing capable devices to be powered with power output up to 30W per port. Table 2 outlines switch models and power capacity for the Cisco Catalyst 3560-C and 2960-C Series compact switches.

Table 2.   Switch PoE and PoE+ Power Capacity

Switch Model	Powering Options	Available PoE Power (W)
WS-C2960CPD-8PT-L	1 PoE Uplink	0W
	2 PoE Uplinks	7W
	1 PoE+ Uplinks	7W
	1 PoE+ and 1 PoE Uplinks	15.4W
	2 PoE+ Uplinks	22.4W
	1 Cisco UPOE Uplink	30.8W
	Auxiliary Input	22.4W (30.8W[*])
WS-C3560CPD-8PT-S	1 PoE+	0W
	2 PoE+	15.4W
	1 Cisco UPOE Uplink	23.8W
	Auxiliary Input	15.4W (23.8W[*])
WS-C2960C-8PC-L	Internal Power Supply	124W
WS-C2960C-12PC-L	Internal Power Supply	124W
WS-C3560C-12PC-S	Internal Power Supply	124W
WS-C3560C-8PC-S	Internal Power Supply	124W
WS-C3560CG-8PC-S	Internal Power Supply	124W
(*) When the Auxiliary AC input is used as a backup to a Cisco UPOE powered switch		

Cisco Operational Excellence: Reducing Operating Costs

Cisco Catalyst 3560-C and 2960-C Series compact switches make deployment easy: reduce switch installation, configuration, troubleshooting time, and operational costs.

- **Cisco Catalyst Smart Operations** is a set of features to enhance operational excellence:
  - **Cisco Smart Install** is a transparent plug-and-play technology to configure the Cisco IOS Software image and switch configuration without user intervention. Smart Install utilizes dynamic IP address allocation and the assistance of other switches to facilitate installation, providing transparent network plug and play.

- ◦ **Cisco Smart Configuration** provides a single point of management for a group of switches and in addition adds the ability to archive and back up configuration files to a file server or switch. A group of switches can be upgraded or configured from a single point in the network.
- ◦ **Cisco Auto SmartPorts** provides automatic configuration as devices connect to the switch port, allowing autodetection and plug and play of the device onto the network. It configures the port with predefined configurations encapsulating years of Cisco networking expertise, including security, IP telephony, availability, QoS, and manageability features with minimal effort and expertise.
- ◦ **USB file storage and console** for file backup, distribution, and simplified operations allow the user to back up and boot from a USB device and allow for Mini USB console access along with traditional RS-232 console connectivity.
- ◦ **Cisco Smart Troubleshooting** is an extensive array of debug diagnostic commands and system health checks within the switch, including Generic Online Diagnostics (GOLD).

- **Easy-to-Use Deployment and Control Features**
  - ◦ **Automatic QoS (AutoQoS)** simplifies QoS configuration in voice over IP (VoIP) networks by issuing interface and global switch commands to detect Cisco IP phones, classify traffic, and help enable egress queue configuration.
  - ◦ **Dynamic Host Configuration Protocol (DHCP)** autoconfiguration of multiple switches through a boot server eases switch deployment.
  - ◦ **Auto-Negotiation** on all ports automatically selects half- or full-duplex transmission mode to optimize bandwidth.
  - ◦ **Dynamic Trunking Protocol (DTP)** facilitates dynamic trunk configuration across all switch ports.
  - ◦ **Port Aggregation Protocol (PAgP)** automates the creation of Cisco Fast EtherChannel groups or Gigabit EtherChannel groups to link to another switch, router, or server.
  - ◦ **Link Aggregation Control Protocol (LACP)** allows the creation of Ethernet channeling with devices that conform to IEEE 802.3ad. This feature is similar to Cisco EtherChannel technology and PAgP.
  - ◦ **Automatic Media-Dependent Interface Crossover (MDIX)** automatically adjusts transmit and receive pairs if an incorrect cable type (crossover or straight-through) is installed.
  - ◦ **Unidirectional Link Detection Protocol (UDLD)** and Aggressive UDLD allow unidirectional links caused by incorrect fiber-optic wiring or port faults to be detected and disabled on fiber-optic interfaces.
  - ◦ **Switching Database Manager (SDM)** templates for access, routing, and VLAN deployment allow the administrator to easily maximize memory allocation to the desired features based on deployment-specific requirements.
  - ◦ **Local Proxy Address Resolution Protocol (ARP)** works in conjunction with Private VLAN Edge to minimize broadcasts and maximize available bandwidth.
  - ◦ **Internet Group Management Protocol (IGMP)** Snooping for IPv4 and IPv6 MLD v1 and v2 Snooping provide fast client joins and leaves of multicast streams and limit bandwidth-intensive video traffic to only the requestors.
  - ◦ **Multicast VLAN Registration (MVR)** continuously sends multicast streams in a multicast VLAN while isolating the streams from subscriber VLANs for bandwidth and security reasons.
  - ◦ **Per-port Broadcast, Multicast, and Unicast Storm Control** prevents faulty end stations from degrading overall systems performance.

- **Voice VLAN** simplifies telephony installations by keeping voice traffic on a separate VLAN for easier administration and troubleshooting.
- **Cisco VLAN Trunking Protocol (VTP)** supports dynamic VLANs and dynamic trunk configuration across all switches.
- **Remote Switch Port Analyzer (RSPAN)** allows administrators to remotely monitor ports in a Layer 2 switch network from any other switch in the same network.
- For enhanced traffic management, monitoring, and analysis, the **Embedded Remote Monitoring (RMON)** software agent supports four RMON groups (history, statistics, alarms, and events).
- **Layer 2 Traceroute** eases troubleshooting by identifying the physical path that a packet takes from source to destination.
- **Trivial File Transfer Protocol (TFTP)** reduces the cost of administering software upgrades by downloading from a centralized location.
- **Network Timing Protocol (NTP)** provides an accurate and consistent timestamp to all intranet switches.

Network Management

The Cisco Catalyst 3560-C and 2960-C Series Switches offer a superior CLI for detailed configuration and administration. These switches are also supported in the full range of Cisco network management solutions.

Cisco Prime Infrastructure

Cisco Prime™ network management solutions provide comprehensive network lifecycle management. Cisco Prime Infrastructure provides an extensive library of easy-to-use features to automate the initial and day-to-day management of your Cisco network. Cisco Prime integrates hardware and software platform expertise and operational experience into a powerful set of workflow-driven configuration, monitoring, troubleshooting, reporting, and administrative tools, including:

- Support for new technologies and services from initial deployment to day-to-day administration and management, such as EnergyWise, identity, Cisco Auto Smartports, Cisco Smart Install, and much more
- Configuration management tools built from Cisco experience and Cisco Validated Design recommendations
- Monitoring and troubleshooting capabilities that incorporate Cisco hardware best practices and diagnostics features
- Automation in managing hardware inventories, security vulnerabilities (PSIRTS), and platform end-of-life and support cycles

For detailed information about Cisco Prime, visit http://www.cisco.com/go/prime.

Cisco Network Assistant

A PC-based network management application designed for small and medium-sized business (SMB) networks with up to 250 users, Cisco Network Assistant offers centralized network management and configuration capabilities. This application also features an intuitive GUI where users can easily apply common services across Cisco switches, routers, and access points.

For detailed information about Cisco Network Assistant, visit http://www.cisco.com/go/cna.

Enhanced Work Space Experience for End Users

Borderless Security

The Cisco Catalyst compact switches provide superior Layer 2 threat defense capabilities for mitigating man-in-the-middle attacks (such as MAC, IP, and ARP spoofing). TrustSec, a primary element of Borderless Security Architecture, helps enterprise customers secure their networks, data and resources with policy-based access control, identity and role-aware networking, pervasive integrity, and confidentiality.

The borderless security is enabled by the following feature sets in the Cisco Catalyst 3560-C and 2960-C Series compact switches:

- Threat defense
- Cisco TrustSec
- Other advanced security features

Threat Defense

Cisco Integrated Security Features are an industry-leading solution available on Cisco Catalyst switches that proactively protects your critical network infrastructure. Delivering powerful, easy-to-use tools to effectively prevent the most common and potentially damaging Layer 2 security threats, Cisco Integrated Security Features provide robust security throughout the network. Cisco Integrated Security Features include Port Security, DHCP Snooping, Dynamic ARP Inspection, and IP Source guard.

- **Port Security** secures the access to an access or trunk port based on MAC address. It limits the number of learned MAC addresses to deny MAC address flooding.
- **DHCP Snooping** prevents malicious users from spoofing a DHCP server and sending out bogus addresses. This feature is used by other primary security features to prevent a number of other attacks such as ARP poisoning.
- **Dynamic ARP Inspection (DAI)** helps ensure user integrity by preventing malicious users from exploiting the insecure nature of the ARP protocol.
- **IP source guard** prevents a malicious user from spoofing or taking over another user's IP address by creating a binding table between the client's IP and MAC address, port, and VLAN.

Cisco TrustSec

TrustSec secures access to the network, enforces security policies, and delivers standard-based security solutions such as 802.1X enabling secure collaboration and policy compliance. TrustSec capabilities reflect Cisco thought leadership, innovations, and commitment to customer success. These new capabilities include:

- **IEEE 802.1AE MACsec** with prestandard 802.1X-REV Key management: industry's first fixed switches with prestandard 802.1X-Rev key management. Available on Cisco Catalyst 3560-C Series Switches, MACsec provides Layer 2, line rate Ethernet data confidentiality and integrity on host facing ports, protecting against man-in-the-middle attacks (snooping, tampering, and replay).
- **Flexible authentication** that supports multiple authentication mechanisms including 802.1X, MAC Authentication Bypass, and web authentication using a single, consistent configuration.
- **Open mode** that creates a user friendly environment for 802.1X operations.

- **Integration of device profiling technology and guest access** handling with Cisco switching to significantly improve security while reducing deployment and operational challenges.
- **RADIUS Change of Authorization and Downloadable ACLs** for comprehensive policy management capabilities.
- **802.1X Supplicant with Network Edge Access Transport (NEAT)** enables extended secure access where compact switches in the conference rooms have the same level of security as switches inside the locked wiring closet.

Other Advanced Security Features

Other Advanced Security features include but are not limited to:

- **Private VLAN Edge** provides security and isolation between switch ports, which helps ensure that users cannot snoop on other users' traffic.
- **Multidomain Authentication** allows an IP phone and a PC to authenticate on the same switch port while placing them on appropriate voice and data VLAN.
- **Port-Based ACLs** for Layer 2 interfaces allow security policies to be applied on individual switch ports.
- **Secure Shell (SSH) Protocol, Kerberos, and Simple Network Management Protocol Version 3 (SNMPv3)** provide network security by encrypting administrator traffic during Telnet and SNMP sessions. SSH Protocol, Kerberos, and the cryptographic version of SNMPv3 require a special cryptographic software image because of U.S. export restrictions.
- Bidirectional data support on the **Switched Port Analyzer (SPAN)** port allows Cisco Intrusion Detection System (IDS) to take action when an intruder is detected.
- **TACACS+ and RADIUS Authentication** facilitates centralized control of the switch and restricts unauthorized users from altering the configuration.
- **MAC Address Notification** allows administrators to be notified of users added to or removed from the network.
- **Multilevel Security on Console Access** prevents unauthorized users from altering the switch configuration.
- **Bridge Protocol Data Unit (BPDU) Guard** shuts down Spanning Tree PortFast-enabled interfaces when BPDUs are received to avoid accidental topology loops.
- **Spanning Tree Root Guard (STRG)** prevents edge devices not in the network administrator's control from becoming Spanning Tree Protocol root nodes.
- **IGMP Filtering** provides multicast authentication by filtering out nonsubscribers and limits the number of concurrent multicast streams available per port.
- **Dynamic VLAN Assignment** is supported through implementation of VLAN Membership Policy Server client capability to provide flexibility in assigning ports to VLANs. Dynamic VLAN facilitates the fast assignment of IP addresses.

Table 3 shows switch hardware information.

Table 3.   Cisco Catalyst 3560-C and 2960-C Series Compact Switch Hardware

Description	Specification		
Performance		**Cisco Catalyst 3560-C**	**Cisco Catalyst 2960-C**
	Forwarding Bandwidth	10 Gbps	10 Gbps
	Flash memory	64 MB	64 MB
	Memory DRAM	128 MB	128 MB
	Max VLANs	1005	255[*]
	VLAN IDs	4000	4000
	Maximum transmission unit (MTU)	Up to 9000 bytes	Up to 9000 bytes
	Jumbo frames	9018 bytes	9018 bytes
	Forwarding rate 64 Byte Packet Cisco Catalyst 3560-C		
	WS-C3560CG-8PC-S	14.9 mpps	
	WS-C3560CPD-8PT-S	14.9 mpps	
	WS-C3560CG-8TC-S	14.9 mpps	
	WS-C3560C-8PC-S	4.2 mpps	
	WS-C3560C-12PC-S	4.8 mpps	
	Forwarding rate 64 Byte Packet Cisco Catalyst 2960-C		
	WS-C2960CG-8TC-L	14.9 mpps	
	WS-C2960CPD-8PT-L	4.2 mpps	
	WS-C2960CPD-8TT-L	4.2 mpps	
	WS-C2960C-8TC-L	4.2 mpps	
	WS-C2960C-8TC-S	4.2 mpps	
	WS-C2960C-8PT-L	4.2 mpps	
	WS-C2960C-12PT-L	4.8 mpps	
	Resource Cisco Catalyst 3560-C, 2960-C		
	See the release notes for the SDM Templates for 3560-C and 2960-C. ● 2960-C: http://www.cisco.com/en/US/docs/switches/lan/catalyst2960c_3560c/software/release/12.2_55_ex/release/notes/ol23942.html. ● 3560-C: http://www.cisco.com/en/US/docs/switches/lan/catalyst2960c_3560c/software/release/12.2_55_ex/release/notes/ol24071.html.		
Connectors and cabling	**Cisco Catalyst 3560-C and 2960-C with SFP-based ports:** ● 10BASE-T ports: RJ-45 connectors, 2-pair Category 3, 4, or 5 unshielded twisted-pair (UTP) cabling ● 100BASE-TX ports: RJ-45 connectors, 2-pair Category 5 UTP cabling ● 1000BASE-T ports: RJ-45 connectors, 4-pair Category 5 UTP cabling ● 1000BASE-T SFP-based ports: RJ-45 connectors, 4-pair Category 5 UTP cabling ● 1000BASE-SX -LX/LH, -ZX, -BX, -T[*], -FX[*], and CWDM SFP-based ports: LC fiber connectors (single/multimode fiber) ● 100BASE-LX, -BX, -FX: SFP-based ports: LC fiber connectors (single/multimode fiber) [*]GLC-T and GLC-GE-100FX are not supported For the complete list of SFPs supported, see http://www.cisco.com/en/US/docs/interfaces_modules/transceiver_modules/compatibility/matrix/OL_6981.html.		

Description	Specification		
Power connectors	• Customers can provide power to a switch by using the internal power supply. The connector is located at the back of the switch. The internal power supply is an autoranging unit (3560CPD-8PT-S, 2960CPD-8TT-L, 2960CPD-8PT-L do not require a power supply). • The internal power supply supports input voltages between 100 and 240VAC. • Use the supplied AC power cord to connect the AC power connector to an AC power outlet. **Note:** The Cisco Catalyst 3560CPD-8PT-S, 2960CPD-8PT-L and 2960CPD-8TT-L have an option for an external power adapter if desired.		
Indicators	• Per-port status: Link integrity, disabled, activity, speed, full-duplex • System status: System, RPS, link status, link duplex, link speed		
Dimensions (H x W x D)	**Cisco Catalyst 2960-C**	**Inches**	**Centimeters**
	WS-C2960CPD-8TT-L	1.75x10.6x6.8	4.44x26.9x17.2
	WS-C2960CPD-8PT-L	1.75x10.6x6.8	4.44x26.9x17.2
	WS-C2960CG-8TC-L	1.75x10.6x8.4	4.44x26.9x21.3
	WS-C2960C-8TC-L	1.75x10.6x8.4	4.44x26.9x21.3
	WS-C2960C-8TC-S	1.75x10.6x8.4	4.44x26.9x21.3
	WS-C2960C-8PC-L	1.75x10.6x9.4	4.44x26.9x23.8
	WS-C2960C-12PC-L	1.75x10.6x9.4	4.44x26.9x23.8
	Cisco Catalyst 3560-C	**Inches**	**Centimeters**
	WS-C3560CG-8TC-S	1.75x10.6x8.4	4.44x26.9x21.3
	WS-C3560CG-8PC-S	1.75x10.6x9.4	4.44x26.9x23.8
	WS-C3560CPD-8PT-S	1.75x10.6x7.6	4.44x26.9x19.4
	WS-C3560C-8PC-S	1.75x10.6x9.4	4.44x26.9x21.3
	WS-C3560C-12PC-S	1.75x10.6x9.4	4.44x26.9x21.3
Weight	**Cisco Catalyst 2960-C**	**Pounds**	**Kilograms**
	WS-C2960CPD-8TT-L	2.4	1.08
	WS-C2960CPD-8PT-L	2.4	1.08
	WS-C2960C-8TC-L	2.8	1.27
	WS-C2960C-8TC-S	2.8	1.27
	WS-C2960CG-8TC-L	3.0	1.35
	WS-C2960C-8PC-L	4.1	1.86
	WS-C2960C-12PC-L	4.1	1.86
	Cisco Catalyst 3560-C	**Pounds**	**Kilograms**
	WS-C3560CG-8TC-S	3.0	1.35
	WS-C3560CPD-8PT-S	3.3	1.50
	WS-C3560C-8PC-S	4.1	1.86
	WS-C3560C-12PC-S	4.1	1.86
	WS-C3560CG-8PC-S	4.3	1.92

Description	Specification				
Environmental ranges		**Cisco Catalyst 3560-C**		**Cisco Catalyst 2960-C**	
	Operating[*] temperature up to 5000 ft (1524 m)	-5°C to +45°C [**]	+23°F to +113°F	-5°C to +45°C [**]	+23°F to +113°F
	Operating[*] temperature up to 10,000 ft (3048 m)	-5°C to +45°C	+23°F to +113°F	-5°C to +45°C	+23°F to +113°F
	Storage temperature up to 15,000 ft (4572 m)	-25°C to +70°C	-13°F to +158°F	-25°C to +70°C	-13°F to +158°F
	Operating altitude	Up to 3048 m	Up to 10,000 ft	Up to 3048 m	Up to 10,000 ft
	Storage altitude	Up to 4000 m	Up to 15,000 ft	Up to 4000 m	Up to 15,000 ft
	Operating relative humidity	5% to 95% noncondensing		5% to 95% noncondensing	
	Storage relative humidity	5% to 95% noncondensing		5% to 95% noncondensing	
	[*] Minimum ambient temperature for cold start is 0°C (+32°F). [**] FE SKUs only GE SKU have a max operation temp of 40C.				
Acoustic noise	ISO 7779 and ISO 9296: Bystander positions operating to an ambient temperature of 25°C.				
	Model	**Sound pressure LpA (Typical)**		**Model**	**Sound pressure LpA (Typical)**
	Cisco Catalyst 3560-C	0dB (fanless)		Cisco Catalyst 2960-C	0dB (fanless)
Mean time between failure (MTBF)	**Cisco Catalyst 3560-C**	**MTBF**		**Cisco Catalyst 2960-C**	**MTBF**
	3560CG-8PC-S	355,830		2960CPD-8PT-L	346,590
	3560CG-8TC-S	488,549		2960CPD-8TT-L	471,888
	3560CPD-8PT-S	333,354		2960CG-8TC-L	542,482
	3560C-8PC-S	373,635		2960C-8TC-L	516,980
	3560C-12PC-S	357,027		2960C-8TC-S	516,980
				2960C-8PC-L	373,635
				2960C-12PC-L	357,027

[*] The 2960-C LAN Lite only supports 64 VLANs.

Table 4 shows switch power specifications.

Table 4.   Power Specifications for Cisco Catalyst 3560-C and 2960-C Series Compact Switch

Description	Specification			
Measured 100% throughput power consumption	**Cisco Catalyst 3560-C**	**Switch Power Consumption Watts**	**Cisco Catalyst 2960-C**	**Switch Power Consumption Watts**
	3560CPD-8PT-S	Single Uplink = 21W[1] Dual Uplink = 22W[1]	2960CPD-8PT-L	Single Uplink = 12W[1] Dual Uplink = 15W[1]
	3560CG-8PC-S	24W	2960CPD-8TT-L	Single Uplink = 12W[1] Dual Uplink = 15W[1]
	3560CG-8TC-S	20W	2960CG-8TC-L	18W
	3560C-8PC-S	17W	2960C-8TC-L	11W
	3560C-12PC-S	19W	2960C-8TC-S	11W
			2960C-8PC-L	17W
			2960C-12PC-L	19W

Description	Specification							
Measured 5% throughput power consumption	**Cisco Catalyst 3560-C**	**Switch Power Consumption Watts**			**Cisco Catalyst 2960-C**	**Switch Power Consumption Watts**		
	3560CPD-8PT-S	Single Uplink = 20W[1] Dual Uplink = 21W[1]			2960CPD-8PT-L	Single Uplink = 12W[1] Dual Uplink = 15W[1]		
	3560CG-8PC-S	24W			2960CPD-8TT-L	Single Uplink = 12W[1] Dual Uplink = 15W[1]		
	3560CG-8TC-S	18W			2960CG-8TC-L	18W		
	3560C-8PC-S	17W			2960C-8TC-L	11W		
	3560C-12PC-S	19W			2960C-8TC-S	11W		
					2960C-8PC-L	17W		
					2960C-12PC-L	18W		
Measured 100% throughput power consumption (with maximum possible PoE loads)	**Cisco Catalyst 3560-C**	**Switch Power Consumption Watts**			**Cisco Catalyst 2960-C**	**Switch Power Consumption Watts**		
	3560CPD-8PC-S	40W			2960CPD-8PT-L	43W		
	3560CG-8PC-S	165W			2960C-8PC-L	157W		
	3560C-8PC-S	158W			2960C-12PC-L	158W		
	3560C-12PC-S	159W						
AC/DC input voltage and current	**Cisco Catalyst 3560-C**				**Cisco Catalyst 2960-C**			
		I/P Voltage	I/P Current			I/P voltage	I/P Current	
	3560CPD-8PT-S	37-57VDC	.01-.6A		2960CPD-8PT-L	37-57VDC	.01-.6A	
	3560CG-8PC-S	100-240 VAC	1.7-.8A		2960CPD-8TT-L	37-57VDC	.01-.3A	
	3560CG-8TC-S	100-240 VAC	.37-.2A		2960CG-8TC-L	100-240 VAC	.34-.2A	
	3560C-8PC-S	100-240 VAC	1.6-.8A		2960C-8TC-L	100-240 VAC	.21-.1A	
	3560C-12PC-S	100-240 VAC	1.6-.8A		2960C-8TC-S	100-240 VAC	.21-.1A	
					2960C-8PC-L	100-240 VAC	1.6-.8A	
					2960C-12PC-L	100-240 VAC	1.6-.8A	
	Note: For the AC values of the 3560CPD and 2960CPD SKUs see Hardware Installation Guide.							
Power rating	**Cisco Catalyst 3560-C**				**Cisco Catalyst 2960-C**			
		Watts	KVA	BTU		Watts	KVA	BTU
	3560CPD-8PT-S	51	.05	174	2960CPD-8PT-L	15	.05	174
	3560CG-8PC-S	165	.17	109[1]	2960CPD-8TT-L	15	.02	174
	3560CG-8TC-S	20	.05	67	2960CG-8TC-L	18	.04	60
	3560C-8PC-S	158	.16	85[1]	2960C-8TC-L	11	.03	38
	3560C-12PC-S	159	.16	74[1]	2960C-8TC-S	11	.03	38
					2960C-8PC-L	157	.16	88[1]
					2960C-12PC-L	158	.16	91[1]
	[1] Switch dissipation only (excludes PoE which is dissipated at the end device). Power measurement are best and worst case. Best Case is 1 PoE Connection. Worst case is 2 PoE+ connections.							
PoE and PoE+	• Maximum power supplied per Port for PoE+ is 30W • Maximum power supplied per port for PoE: 15.4W							

Table 5 shows switch management and standards support.

Table 5. Management and Standards Support for Cisco Catalyst 3560-C and 2960-C Series Compact Switch

Description	Specification	
Management	• BRIDGE-MIB • CISCO-CABLE-DIAG-MIB • CISCO-CDP-MIB • CISCO-CLUSTER-MIB • CISCO-CONFIG-COPY-MIB • CISCO-CONFIG-MAN-MIB • CISCO-DHCP-SNOOPING-MIB • CISCO-ENTITY-VENDORTYPE-OID-MIB • CISCO-ENVMON-MIB • CISCO-ERR-DISABLE-MIB • CISCO-FLASH-MIB • CISCO-FTP-CLIENT-MIB • CISCO-IGMP-FILTER-MIB • CISCO-IMAGE-MIB • CISCO-IP-STAT-MIB • CISCO-LAG-MIB • CISCO-MAC-NOTIFICATION-MIB • CISCO-MEMORY-POOL-MIB • CISCO-PAGP-MIB • CISCO-PING-MIB • CISCO-POE-EXTENSIONS-MIB • CISCO-PORT-QOS-MIB • CISCO-PORT-SECURITY-MIB • CISCO-PORT-STORM-CONTROL-MIB • CISCO-PRODUCTS-MIB • CISCO-PROCESS-MIB • CISCO-RTTMON-MIB • CISCO-SMI-MIB • CISCO-STP-EXTENSIONS-MIB • CISCO-SYSLOG-MIB	• CISCO-TC-MIB • CISCO-TCP-MIB • CISCO-UDLDP-MIB • CISCO-VLAN-IFTABLE • RELATIONSHIP-MIB • CISCO-VLAN-MEMBERSHIP-MIB • CISCO-VTP-MIB • ENTITY-MIB • ETHERLIKE-MIB • IEEE8021-PAE-MIB • IEEE8023-LAG-MIB • IF-MIB • INET-ADDRESS-MIB • OLD-CISCO-CHASSIS-MIB • OLD-CISCO-FLASH-MIB • OLD-CISCO-INTERFACES-MIB • OLD-CISCO-IP-MIB • OLD-CISCO-SYS-MIB • OLD-CISCO-TCP-MIB • OLD-CISCO-TS-MIB • RFC1213-MIB • RMON-MIB • RMON2-MIB • SNMP-FRAMEWORK-MIB • SNMP-MPD-MIB • SNMP-NOTIFICATION-MIB • SNMP-TARGET-MIB • SNMPv2-MIB • TCP-MIB • UDP-MIB • ePM MIB
Standards	• IEEE 802.1D Spanning Tree Protocol • IEEE 802.1p CoS Prioritization • IEEE 802.1Q VLAN • IEEE 802.1s • IEEE 802.1w • IEEE 802.1x • IEEE 802.1AB (LLDP) • IEEE 802.3ad • IEEE 802.3af • IEEE 802.3ah (100BASE-X single/multimode fiber only) • IEEE 802.3x full duplex on 10BASE-T, 100BASE-TX, and 1000BASE-T ports • IEEE 802.3 10BASE-T specification • IEEE 802.3u 100BASE-TX specification • IEEE 802.3ab 1000BASE-T specification • IEEE 802.3z 1000BASE-X specification	• 100BASE-BX (SFP) • 100BASE-FX (SFP) • 100BASE-LX (SFP) • 1000BASE-BX (SFP) • 1000BASE-SX (SFP) • 1000BASE-LX/LH (SFP) • 1000BASE-ZX (SFP) • 1000BASE-CWDM SFP 1470 nm • 1000BASE-CWDM SFP 1490 nm • 1000BASE-CWDM SFP 1510 nm • 1000BASE-CWDM SFP 1530 nm • 1000BASE-CWDM SFP 1550 nm • 1000BASE-CWDM SFP 1570 nm • 1000BASE-CWDM SFP 1590 nm • 1000BASE-CWDM SFP 1610 nm • RMON I and II standards • SNMPv1, SNMPv2c, and SNMPv3

Description	Specification	
RFC compliance	• RFC 768: UDP • RFC 783: TFTP • RFC 791: IP • RFC 792: ICMP • RFC 793: TCP • RFC 826: ARP • RFC 854: Telnet • RFC 951: Bootstrap Protocol • RFC 1542: BOOTP Extensions • RFC 959: FTP • RFC 1058: RIP Routing • RFC 1112: IP Multicast and IGMP • RFC 1157: SNMPv1 • RFC 1166: IP Addresses • RFC 1253: OSPF Routing • RFC 1256: ICMP Router Discovery • RFC 1305: NTP • RFC 1492: TACACS+ • RFC 1493: Bridge MIB • RFC 1542: Bootstrap Protocol • RFC 1583: OSPFv2 • RFC 1643: Ethernet Interface MIB • RFC 1723: RIPv2 Routing • RFC 1757: RMON	• RFC 1812: IP Routing • RFC 1901: SNMPv2C • RFC 1902-1907: SNMPv2 • RFC 1981: MTU Path Discovery IPv6 • FRC 2068: HTTP • RFC 2080: RIP for IPv6 • RFC 2131: DHCP • RFC 2138: RADIUS • RFC 2233: IF MIB • RFC 2236: IP Multicast • RFC 2328: OSPFv2 • RFC 2273-2275: SNMPv3 • RFC 2373: IPv6 Aggregatable Addrs • RFC 2453: RIPv2 Routing • RFC 2460: IPv6 protocol • RFC 2461: IPv6 Neighbor Discovery • RFC 2462: IPv6 Autoconfiguration • RFC 2463: ICMP IPv6 • RFC 2474: DiffServ Precedence • RFC 2597: Assured Forwarding • RFC 2598: Expedited Forwarding • RFC 2571: SNMP Management • RFC 2740: OSPF for IPv6 • RFC 3046: DHCP Relay Agent Information Option • RFC 3101, 1587: NSSAs • RFC 3376: IGMPv3 • RFC 3580: 802.1x RADIUS
Note: RFC, MIB and Standards compliance is dependant on IOS Level		

Table 6 shows switch safety and compliance information.

Table 6.   Safety and Compliance

Description	Specification
Safety standards	• UL 60950-1 • CAN/CSA 22.2 No. 60950-1 • EN 60950-1 • IEC 60950-1 • CE Marking • GB 4943 • IEC 60825
Electromagnetic emissions certifications	• FCC Part 15, CFR 47, Class A, North America • EN 55022 (CISPR22) and EN 55024 (CISPR24), CE marking, European Union • AS/NZS, Class A, CISPR22:2004 or EN55022, Australia and New Zealand • VCCI Class A, V-3/2007.04, Japan • KCC (Formerly MIC, GB17625.1-1998) Class A, KN24/KN22, Korea • ANATEL, Brazil • CCC, China • GOST, Russia
Environmental	Reduction of Hazardous Substances (ROHS) 6
Telco	Common Language Equipment Identifier (CLEI) code

Safety Compliance and Product Approval Status

For further information on safety and compliance documentation, visit the Product Approval Status tool at
http://tools.cisco.com/cse/prdapp/jsp/externalsearch.do?action=externalsearch&page=EXTERNAL_SEARCH.

Cisco Enhanced Limited Lifetime Hardware Warranty

Cisco Catalyst 2960-C and 3560-C Series Switches come with an enhanced limited lifetime hardware warranty
(E-LLW) that includes 90 days of Cisco Technical Assistance Center (TAC) support and next-business-day
hardware replacement free of change. (See Table 7.)

Your formal warranty statement, including the warranty applicable to Cisco software, appears in the Cisco
information packet that accompanies your Cisco product. We encourage you to review carefully the warranty
statement shipped with your specific product before use. Cisco reserves the right to refund the purchase price as
its exclusive warranty remedy. For additional information on warranty terms, visit
http://www.cisco.com/go/warranty.

Adding a Cisco technical services contract to your device coverage provides access to the Cisco TAC beyond the
90-day period allowed by the E-LLW. It also can provide a variety of hardware replacement options to meet critical
business needs, as well as updates for licensed premium Cisco IOS Software, and registered access to the
extensive Cisco.com knowledge base and support tools.

Footnotes

[1]. Cisco operating system updates include the following: maintenance releases, minor updates, and major updates within the
licensed feature set.
[2]. Advance hardware replacement is available in various service-level combinations. For example, 8x5xNBD indicates that
shipment will be initiated during the standard 8-hour business day, 5 days a week (the generally accepted business days within
the relevant region), with next business day (NBD) delivery. Where NBD is not available, same day ship is provided.
Restrictions apply; review the appropriate service descriptions for details.

Table 7.   Enhanced Limited Lifetime Hardware Warranty

	Cisco Enhanced Limited Lifetime Hardware Warranty
Device covered	Applies to Cisco Catalyst 2960-C and 3560-C Series compact switches.
Warranty duration	As long as the original customer owns the product.
EoL policy	In the event of discontinuance of product manufacture, Cisco warranty support is limited to 5 years from the announcement of discontinuance.
Hardware replacement	Cisco or its service center will use commercially reasonable efforts to ship a replacement for next business day delivery, where available. Otherwise, a replacement will be shipped within 10 working days after receipt of the RMA request. Actual delivery times might vary depending on customer location.
Effective date	Hardware warranty commences from the date of shipment to customer (and in case of resale by a Cisco reseller, not more than 90 days after original shipment by Cisco).
TAC support	Cisco will provide during business hours, 8 hours per day, 5 days per week basic configuration, diagnosis, and troubleshooting of device-level problems for up to a 90-day period from the date of shipment of the originally purchased Cisco Catalyst 2960 and 3560 product. This support does not include solution or network-level support beyond the specific device under consideration.
Cisco.com access	Warranty allows guest access only to Cisco.com.

Software Policy for Cisco Catalyst 3560-C and 2960-C Series Compact Switches

Customers with Cisco Catalyst LAN Base and IP Base software feature sets will be provided with updates and bug fixes designed to maintain the compliance of the software with published specifications, release notes, and industry standards compliance as long as the original end user continues to own or use the product or up to one year from the end-of-sale date for this product, whichever occurs earlier. This policy supersedes any previous warranty or software statement and is subject to change without notice.

Cisco and Partner Services for Next-Generation Cisco Catalyst Compact Switches

Enable the innovative, secure, intelligent edge in the Borderless Network Architecture using personalized services from Cisco and our partners. Through a discovery process that begins with understanding your business objectives, we help you integrate the next-generation Cisco Catalyst fixed switches into your architecture and incorporate network services onto that platform. Sharing knowledge and leading practices, we support your success every step of the way as you deploy, absorb, manage, and scale new technology. Choose from a flexible suite of support services designed to meet your business needs and help you maintain high-quality network performance while controlling operational costs. (See Table 8.)

Table 8.   Technical Services Available for Cisco Catalyst 3560-C and 2960-C Series Compact Switches

Technical Services
Cisco SMARTnet® Service • Around-the-clock, global access to the Cisco Technical Assistance Center (TAC) • Unrestricted access to the extensive Cisco.com knowledge base and tools • Next-business-day, 8x5x4, 24x7x4, and 24x7x2 advance hardware replacement and onsite parts replacement and installation available • Ongoing operating system software updates within the licensed feature set • Proactive diagnostics and real-time alerts on Smart Call Home enabled devices
Cisco Smart Foundation Service • Next business day advance hardware replacement as available • Business hours access to SMB TAC (access levels vary by region) • Access to Cisco.com SMB knowledge base • Online technical resources through Smart Foundation Portal • Operating system software bug fixes and patches
Cisco Focused Technical Support Services • 3 levels of premium, high-touch services are available: • Cisco High-Touch Operations Management Service • Cisco High-Touch Technical Support Service • Cisco High-Touch Engineering Service • Valid Cisco SMARTnet or SP Base contracts on all network equipment are required

Ordering Information

Tables 9 and 10 give ordering information for the Cisco Catalyst 3560-C and 2960-C Series compact switches and accessories.

To place an order, visit the Cisco Ordering homepage at
http://www.cisco.com/en/US/ordering/or13/or8/order_customer_help_how_to_order_listing.html.

Table 9. Ordering Information for Cisco Catalyst 3560-C and 2960-C Series Compact Switches

Cisco Catalyst 3560-C Compact Switches	
WS-C3560CG-8TC-S	3560C Switch 8 GE, 2 x Dual Purpose Uplink, IP Base
WS-C3560CG-8PC-S	3560C Switch 8 GE PoE+, 2 x Dual Purpose, IP Base
WS-C3560CPD-8PT-S	3560C PD PSE Switch 8 GE PoE, 2 x 1G Copper Uplink, IP Base
WS-C3560C-8PC-S	3560C Switch 8 FE PoE+, 2 x Dual Purpose Uplink, IP Base
WS-C3560C-12PC-S	3560C Switch 12 FE PoE+, 2 x Dual Purpose Uplink, IP Base
Cisco Catalyst 2960-C Compact Switches	
WS-C2960CPD-8TT-L	2960C PD Switch 8 FE, 2 x 1G, PoE+ LAN Base
WS-C2960CPD-8PT-L	2960C PD PSE Switch 8 FE PoE, 2 x 1G, PoE+ LAN Base
WS-C2960CG-8TC-L	2960C Switch 8 GE, 2 x Dual Purpose Uplink, LAN Base
WS-C2960C-8TC-L	2960C Switch 8 FE, 2 x Dual Purpose Uplink, LAN Base
WS-C2960C-8TC-S	2960C Switch 8 FE, 2 x Dual Purpose Uplink, LAN Lite
WS-C2960C-8PC-L	2960C PoE Switch 8 FE PoE, 2 x Dual Purpose Uplink, LAN Base
WS-C2960C-12PC-L	2960C PoE Switch 12 FE PoE, 2 x Dual Purpose Uplink, LAN Base

Table 10. Ordering Information for Cisco Catalyst 3560-C and 2960-C Series Compact Switch Accessories

Part Number	Description
CMP-CBLE-GRD=	Cable guard for the 3560-C and 2960-C compact switches
CMP-MGNT-TRAY =	Magnet and Mounting Tray for 3560-C and 2960-C compact switches
PWR-ADPT=	Power Adapter for the 3560-C and 2960-C compact switches
PWR-CLP	Power Clip for the 3560-C and 2960-C compact switches
CMP-DIN-MNT=	DIN Rail Mount for 3560-C and 2960-C compact switches
RCKMNT-19-CMPCT=	19-Inch Rack Mounting Brackets
RCKMNT-23-CMPCT=	23- and 24-Inch Rack Mounting Brackets

For more information about Cisco products, contact:

- United States and Canada: (toll free) 800 553-NETS (6387)
- Europe: 32 2 778 4242
- Australia: 612 9935 4107
- Other: 408 526-7209
- Internet: http://www.cisco.com

Convertidor de fibra multimodo de 10/100 Base-TX a 100Base-FX con conector tipo SC

TFC-110MSC (b1)

El Convertidor de medios de fibra serie TFC-110 de TRENDnet transforma un medio UTP/STP 10/100Base-TX en un medio 100Base-FX y viceversa. El puerto 10/100Base-TX autodetecta velocidades de conexión de 10 ó 100Mbps, autonegocia el modo half/full dúplex, y autoselecciona los tipos de medios MDI-X / MDI-II. La conexión de fibra puede ser a través de un conector multimodo SC, MT-RJ o modo sencillo SC, además dispone de un interruptor deslizante para selección de modo half/full dúplex. Este convertidor le ofrece a su Conmutador/Hub la capacidad de interconectarse con conexiones de fibra a una distancia de hasta 2 km. Con un chasis opcional para montaje en rack de 16 ranuras de EIA-19", los convertidores serie TFC son la solución perfecta para varias conversiones de medios de fibra a través de su red.

Características

- Compatible con los estándares IEEE 802.3 10Base-T y IEEE 802.3u 100Base-TX / 100Base-FX
- Un puerto RJ-45 con autonegociación 10/100Base-TX
- Autonegociación de velocidades de conexión a 10/100Mbps y modo Half/Full dúplex en puerto de TX
- Auto MDIX para puerto 10/100Base-TX
- Un puerto de fibra a 100Mbps con conector tipo SC multimodo
- Selector de modo Half/Full dúplex en puerto de fibra
- Estatus de los indicadores LED para la Potencia, Enlace/Actividad, Full-Dúplex y Velocidad
- Para montaje en pared
- Sistema de chasis opcional de 19" con alimentación eléctrica redundante (TFC-1600), con capacidad para hasta 16 convertidores de medios serie TFC
- Garantía limitada de 3 años

Convertidor de fibra multimodo de 10/100Base-TX a 100Base-FX con conector tipo SC
TFC-110MSC (b1)

Especificaciones Técnicas

Hardware	
Estándares	• IEEE802.3 10Base-T , IEEE 802.3u 100Base-TX y 100Base-FX
Compatibilidad con tamaño de estructura	• Ethernet estándar hasta 1522 bytes
Medios de Red	• 100Base-TX: Cat. 5, EIA/TIA-568 UTP/STP de 100 ohmios, hasta 100 metros • 100Base-FX: Cable de fibra óptica multimodo de 50/125 o 62.5/125 µm, hasta 2 Km
Longitud de onda	• 1300nm
Protocolo	• CSMA/CD
Puertos	• 1 x 10/100Base-TX • 1 x 100Base-FX
Velocidad de transferencia de datos	• 100Mbps (Half-Dúplex), 200Mbps (Full-Dúplex)
LEDs de diagnóstico	• Potencia, Enlace/Actividad, Full Dúplex y Velocidad
Adaptador de alimentación	• 7,5VDC, 1,5A (máx. 7,2 vatios)
Temperatura	• Operación: 0°~ 40°C (32°~ 104°F) • Almacenamiento: -25°~ 70°C (-13°~ 158°F)
Humedad	• Operación: 10% ~ 90% • Almacenamiento: 5% ~ 90% (sin condensación)

Productos Relacionados

TFC-1600	Sistema chassis de 16 ranuras para la serie de convertidores de medio fibra óptica TFC
TFC-110MSC	Convertidor de fibra multimodo de 10/100Base-TX a 100Base-FX con conector tipo SC
TFC-110MM	Convertidor de fibra de 10/100Base-TX a multimodo 100Base-FX con conector MT-RJ
TFC-110MST	Convertidor de fibra multimodo de 10/100Base-TX a 100Base-FX con conector tipo ST
TFC-110S15	Convertidor de fibra modo sencillo de 10/100Base-TX a 100Base-FX (15 km) con conector tipo SC
TFC-110S30	Convertidor de fibra modo sencillo de 10/100Base-TX a 100Base-FX (15 km) con conector tipo SC
TFC-110S30	Convertidor de fibra modo sencillo de 10/100Base-TX a 100Base-FX (60 km) con conector tipo SC
TFC-110S100	Convertidor de fibra modo sencillo de 10/100Base-TX a 100Base-FX (100 Km) con conector tipo SC

Informacion de la orden

TRENDNET ®

20675 Manhattan Place,Torrance, CA 90501 USA
Tel: 1-310-961-5500
Fax: 1-310-961-5511
Web: www.trendnet.com
Email: sales@trendnet.com

Para ordenar por favor llame:

1-888-326-6061

TRENDNET®

Fiber Converters

• Guía de instalación rápida (1)

1. Antes de iniciar

Contenidos del paquete

- Convertidor de fibra
- Guía de instalación rápida multilingüe
- Alimentación eléctrica de CA

Requisitos mínimos

- Un chasis TFC-1600 (opcional) o una superficie firme y nivelada capaz de sostener el peso del Convertidor de fibra.
- Conmutador Ethernet a 10/100Mbps
- Cables de fibra compatibles con el conector del convertidor de fibra y las especificaciones multimedia
- Cable Cat.5, Cat.5e, Cat.6 RJ-45 para ethernet

Equipo Opcional

- Rack estándar de EIA 19"
- Chasis TFC-1600 (opcional)

2. Instalación del hardware

Instalación de 2 convertidores de fibra de forma independiente

1. Conecte un cable de ethernet RJ-45 desde el puerto ethernet de los convertidores de fibra hasta un puerto ethernet del conmutador (como el E TE100-S24G).

2. Conecte el cable de fibra a los convertidores.

3. Conecte el adaptador de corriente a la parte posterior del convertidor.
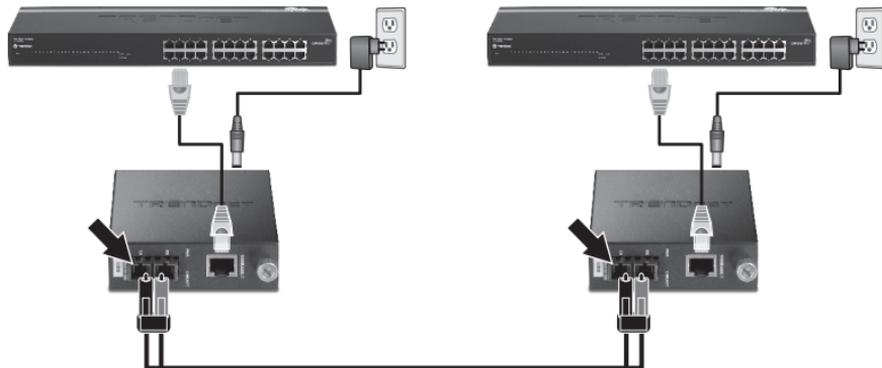
Nota:

• Para el TFC-110MM/MST/MSC/110S15/S15i/S30/S30i/S60/S60i/S10, los cables TX y RX se deben colocar al revés en la conexión de fibra contraria.

• El TFC-15MS100 convierte de fibra multimodo a fibra de modo sencillo, puede conectarse a un conmutador dotado de conectores de fibra tipo SC multimodo (como el TEG-424WS con módulos de fibra) para extender la distancia hasta 15 kilómetros con fibra en modo sencillo

• Cableado

  • Cable de fibra óptica multimodo: TFC-110MSC, TFC-110MST, TFC-110MM

  • Cable de fibra óptica monomodo: TFC-110S15, TFC-110S30, TFC-110S60, TFC-110S100, TFC-110S15i, TFC-110S30i, TFC-110S60i

  • Cable de fibra óptica trenzado para TFC-110S20D3i, TFC-110S20D5i, TFC-110S40D3, TFC-110S40D5, TFC-110S40D3i, TFC-110S40D5i

Instalación del convertidor de fibra sobre un chasis

1. Destornille la tapa del compartimiento deseado del chasis.

2. Afloje el tornillo de ajuste manual y saque el convertidor de la caja de metal.

3. Inserte el convertidor de medios en una ranura disponible y apriete el tornillo de ajuste manual.

3. Indicadores LED y conmutadores Dip

LED	Color	Secuencia	Función		
			TFC-110MM/MST/MSC/ 110S15/S30/S60/S100/ TFC-110S20D3i/S20D5i/ S40D3/S40D5/S40D3i/S40D5i	**TFC-110S15i/30i/60i**	**TFC-15MS100**
PWR (Alimentación)	Verde	Sólido	Dispositivo encendido		
	N/D	Apagado	Dispositivo apagado		
100M	Verde	Sólido	100/200Mbps (Half/Full Dúplex)		N/D
	N/D	Apagado	10/20Mbps (Half/Full Dúplex)		N/D
FDX / COL (TX)	Verde	Sólido	Conexión en el extremo TX en modo full dúplex		N/D
	Verde	Parpadeando	Se detecta colisión de datos		N/D
	N/D	Apagado	Conexión en el extremo TX en modo half dúplex		N/D
FDX / COL (FX)	Verde	Sólido	Conexión en el extremo de fibra en modo full dúplex		N/D
	Verde	Parpadeando	Se detecta colisión de datos		N/D
	N/D	Apagado	Conexión en el extremo de fibra en modo half dúplex		N/D
LINK/ACT (TX) (Enlace / actividad)	Verde	Sólido	Conectado a 10/20 Mbps o 100/200 Mbps (Half/Full Dúplex)		N/D
	Verde	Parpadeando	10/20 Mbps o 100/200 Mbps (Half/Full Dúplex) (Transmisión y recepción de datos)		N/D
	N/D	Apagado	El enlace está desconectado		N/D
LINK/ACT (FX) (Enlace / actividad)	Verde	Sólido	Conectado a 100/200 Mbps (Half/Full Dúplex)		N/D
	Verde	Parpadeando	100/200 Mbps (Half/Full Dúplex) (Transmisión y recepción de datos)		N/D
	N/D	Apagado	El enlace está desconectado		N/D
LINK/ACT (Enlace / actividad)	Verde	Sólido	N/D	N/D	Conectado a 100/200Mbps (Half/Full Dúplex)
	Verde	Parpadeando	N/D	N/D	100/200 Mbps (Half/Full Dúplex) (Transmisión y recepción de datos)
	N/D	Apagado	N/D	N/D	El enlace está desconectado
FAIL (TX)	Red	Sólido	N/D	El enlace TX está desconectado	N/D
	N/D	Apagado	N/D	El enlace TX está conectado	N/D
FAIL(FX)	Red	Sólido	N/D	El enlace de fibra está desconectado	N/D
	N/D	Apagado	N/D	El enlace de fibra está conectado	N/D

Conmutador	Acción	Función	
		TFC-110MM/MST/MSC/ 110S15/S30/S60/S100	TFC-110S15i/30i/60i/20D3i/20D5i/40D3i/40D5i
1	Encendido	Half-Duplex	Fibra Half Dúplex
	Apagado	Full-Dúplex	Fibra Full-Dúplex
2	Encendido	N/D	TX Forced Mode (Modo forzoso)
	Apagado	N/D	TX Auto-Negotiation (Autonegociación)
3	Encendido	N/D	TX 10M
	Apagado	N/D	TX 100M
4	Encendido	N/D	TX Half-Dúplex (Half-Dúplex)
	Apagado	N/D	TX Full Dúplex (Full-Dúplex)
5	Encendido	N/D	LLR Enable (Activado)
	Apagado	N/D	LLR Disable (Desactivado)
6	Encendido	N/D	LLR Enable (Activado)
	Apagado	N/D	LLR Disable (Desactivado)

Nota:

• Después de cambiar las configuraciones del conmutador DIP, reinicie el conversor de fibra.

• Las siglas LLCF significan Link Loss Carry Forward. Cuando LLCF está activado, los puertos no transmiten una señal de enlace hasta que reciban una señal de enlace desde el puerto contrario. La pérdida de enlace se "transfiere" al conmutador administrado o hub que envía el enlace. LLCF se puede usar tanto en puertos de cobre como de fibra.

• LLR significa Link Loss Return. Cuando LLR está activado, el transmisor de puerto de fibra se apaga si su receptor no puede detectar un enlace válido. Si uno de los conductores ópticos es malo, la tarjeta con LLR activado devolverá una condición de no enlace a su enlace de socios LLR se utiliza para detectar problemas de enlace sólo en el puerto de fibra Si LLR no está activo en un convertidor de fibra, el convertidor de fibra opuesto debe tener LLR desactivado.

5

4. Especificaciones técnicas

Capacidad de potencia									
Modelo	Medios	Conectores	Longitud de onda		Potencia óptica de salida (dBm)		Potencia óptica de entrada (dBm)		Capacidad de potencia (dBm)	Distancia
			Transmit (TX)	Receive (RX)	Min.	Maks.	Min. (Czułość)	Maks.		
TFC-110MSC	MMF (fibra multimode)	RJ-45/SC (Duplex)	1300nm		-19	14	-32	-14	13	2 kilómetros
TFC-110MST	MMF	RJ-45/ST (Duplex)	1300nm		-19	14	-32	-14	13	2 kilómetros
TFC-110MM	MMF	RJ-45/MT- RJ (Duplex)	1300nm		-23.5	14	-31	-33.5 (typ.)	7.5	2 kilómetros
TFC-110S15	SMF (fibra multimode)	RJ-45/SC (Duplex)	1310nm		-20	0	-32	0	12	15 kilómetros
TFC-110S30	SMF	RJ-45/SC (Duplex)	1310nm		-15	-8	-34	0	19	30 kilómetros
TFC-110S60	SMF	RJ-45/SC (Duplex)	1310nm		-5	0	-35	0	30	60 kilómetros
TFC-110S100	SMF	RJ-45/SC (Duplex)	1550nm		-5	0	-35	0	30	100 kilómetros
TFC-110S15i	SMF	RJ-45/SC (Duplex)	1310nm		-20	0	-32	0	12	15 kilómetros
TFC-110S30i	SMF	RJ-45/SC (Duplex)	1310nm		-15	-8	-34	0	19	30 kilómetros
TFC-110S60i	SMF	RJ-45/SC (Duplex)	1310nm		-5	0	-35	0	30	60 kilómetros
TFC-110S20D3i	SMF	RJ-45/SC (Simplex)	1310nm	1550nm	-14	-8	-31	0	17	20 kilómetros
TFC-110S20D5i	SMF	RJ-45/SC (Simplex)	1550nm	1310nm	-14	-8	-31	0	17	20 kilómetros
TFC-110S40D3	SMF	RJ-45/SC (Simplex)	1310nm	1550nm	-8	-3	-34	-3	26	40 kilómetros
TFC-110S40D5	SMF	RJ-45/SC (Simplex)	1550nm	1310nm	-8	-3	-34	-3	26	40 kilómetros
TFC-110S40D3i	SMF	RJ-45/SC (Simplex)	1310nm	1550nm	-8	-3	-34	-3	26	40 kilómetros
TFC-110S40D5i	SMF	RJ-45/SC (Simplex)	1550nm	1310nm	-8	-3	-34	-3	26	40 kilómetros
TFC-15MS100	MMF (1)	SC (Duplex)	1300nm		-23.5	-14	-31	0	7.5	2 kilómetros
	SMF (2)	SC (Duplex)	1310nm		-20	0	-32	0	12	15 kilómetros

Общая информация о лицензиях GPL/LGPL

GPL/LGPL informações Gerais

GPL/LGPL üldinformatsioon

Limited Warranty

TRENDnet warrants its products against defects in material and workmanship, under normal use and service, for the following length of time from the date of purchase. Warranty: 3 year limited warranty (When Applicable: 1 year warranty for power adapter, power supply, and cooling fan components.) Visit TRENDnet.com to review the full warranty policy, rights, and restrictions for this product.

Technical Support

If you are having issues installing your new product, TRENDnet's website has the latest in software updates, documentation, and product support. Visit us at www.trendnet.com.

Register Your Product

To ensure the highest level of customer service and support, please take a moment to register your product Online at: www.trendnet.com/register. Thank you for choosing TRENDnet.

Garantie Limitée

TRENDnet garantit ses produits contre les défauts matériels et de fabrication, dans des conditions normales d'utilisation et de service, pour les durées suivantes, à compter de la date de leur achat. Limitée: 3 ans de garantie limitée (Si applicable: 1 an de garantie sur l'adaptateur secteur, l'alimentation en énergie et les composants du ventilateur de refroidissement.) Visitez TRENDnet.com pour lire la politique complète de garantie, les droits et les restrictions s'appliquant à ce produit.

Support Technique

Si vous rencontrez des problèmes pour installer votre nouveau produit, veuillez consulter notre site Internet pour les mises à jour de logicielles, de documentation et de support du produit. Visitez-notre site sur www.trendnet.com.

Enregistrez votre produit

Afin d'être sûr de recevoir le meilleur niveau de service clientèle et le meilleur support possibles, veuillez prendre le temps d'enregistrer votre produit en ligne sur: www.trendnet.com/register. Nous vous remercions d'avoir choisi TRENDnet.

Begrenzte Garantie

TRENDnet garantiert, dass seine Produkte bei normaler Benutzung und Wartung während der nachfolgend genannten Zeit ab dem Kaufdatum keine Material- und Verarbeitungsschäden aufweisen. Garantie: 3-Jahres-Garantie (Soweit zutreffend: 1 Jahr Garantie für Netzteil, Stromkabel und Ventilator.) Alle Garantiebedingungen, Rechte und Einschränkungen für dieses Produkt finden Sie auf TRENDnet.com.

Technischer Support

Bei Problemen mit der Installation Ihres neuen Produktes, schauen Sie sich zuerst auf der Webseite von TRENDnet nach den neuesten Software-Updates, Dokumentation und Produkt-Support um. Besuchen Sie uns auf www.trendnet.com.

Registrieren Sie Ihr Produkt

Nehmen Sie sich bitte einen Moment Zeit und registrieren Sie Ihr Produkt online, so dass Sie unsere umfassenden Support- und Kundendienstleistungen in Anspruch nehmen können: www.trendnet.com/register. Vielen Dank für den Kauf eines TRENDnet-Produkts.

Garantía Limitada

TRENDnet garantiza sus productos contra defectos en los materiales y mano de obra, bajo uso y servicio normales, durante el siguiente periodo de tiempo a partir de la fecha de compra. Garantía: 3 años (Cuando proceda: 1 año de garantía para componentes de adaptadores de corriente, fuente de alimentación y ventiladores de refrigeración.) Visite TRENDnet.com para revisar la política de garantía, derechos y restricciones para este producto.

Soporte Técnico

Si usted está teniendo problemas para instalar su nuevo producto, el sitio web de TRENDnet tiene lo último en actualizaciones de software, documentación y soporte técnico. Visítenos a www.trendnet.com

Registre su producto

Para asegurar los más altos niveles de servicio y apoyo al cliente, registre su producto en línea en: www.trendnet.com/ register. Gracias por elegir TRENDnet.

Ограниченная гарантия

Гарантия компании TRENDnet распространяется на дефекты, возникшие по вине производителя, при соблюдении условий эксплуатации и обслуживания в течение установленного периода с момента приобретения. (Продукт: Ограниченная гарантия: Трехлетняя ограниченная гарантия (Распространяется: На протяжении 1 года на силовые адаптеры, источники питания и компоненты вентилятора охлаждения) Полную версию гарантийных обязательств, а также права пользователя и ограничения при эксплуатации данного продукта смотрите на вебсайте TRENDnet.com.

Техническая поддержка

Если у вас возникли вопросы по установке нового продукта, на сайте компании TRENDnet вы найдете обновления программного обеспечения, документацию и техническую поддержку. Посетите нас на www.trendnet.com.

Зарегистрируйте свой продукт

Для того, чтобы воспользоваться сервисным обслуживанием и поддержкой на высшем уровне, предлагаем вам зарегистрировать свой продукт в режиме онлайн з д е с ь : http://www.trendnet.ru/products/registration.php. Благодарим Вас за то, что Вы выбрали TRENDnet.

Garantia Limitada

TRENDnet garante seus produtos contra defeitos em material e mão de obra, sob condições normais de uso e serviço, pelo seguinte tempo a partir da data da compra. Garantia: Garantia limitada de 3 anos. (Quando aplicável: 1 ano de garantia para adaptador de tensão, fonte e componentes de ventoinhas). Visite TRENDnet.com para conhecer a política de garantia completa, direitos e restrições para este produto.)

Piiratud garantii

TRENDneti tavatingimustes kasutatavatel ja hooldatavatel toodetel on järgmise ajavahemiku jooksul (alates ostukuupäevast) tootmis-ja materjalidefektide garantii. garantii: 3-aastane piiratud garantii. (Garantii kohaldatakse: toiteadapteri, toiteallika ja jahutusventilaatori osadel on 1-aastane garantii.) Täisgarantii põhimõtete, õiguste ja piirangute kohta leiate lisateavet saidilt TRENDnet.com.

Suporte Técnico

Se você encontrar dificuldades na instalação de seu novo produto, o website da TRENDnet dispõe das atualizações mais recentes de software, documentação e suporte de produtos. Visite-nos www.trendnet.com.

Tehniline tugi

Kui sul on küsimusi oma uue toote paigaldamisele, TRENDneti kodulehel on viimased tarkvara uuendused, dokumentatsioon ja tootetugi. Külasta meie kodulehte www.trendnet.com.

Registre Seu Produto

Para garantir o alto nível do service e suporte ao consumidor, por favor tire um minuto para registra seu produto Online em: www.trendnet.com/register. Agradecemos por ter escolhido TRENDnet.

Teie seadmete registreerimine

Et kindlustada teid parima teeninduse ja toega, palun leidke moment, et registreerida teie toode OnLines-www.trendnet.com/register. Täname, et te valisite TRENDnet'i.

Certifications

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interference.
(2) This device must accept any interference received. Including interference that may cause undesired operation.

FC CE PC

Waste electrical an electronic products must not be disposed of with household waste. Please recycle where facilities exist. Check with your Local Authority or Retailer for recycling advice.

Note

The Manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate the equipment.

Advertencia

En todos nuestros equipos se mencionan claramente las caracteristicas del adaptador de alimentacón necesario para su funcionamiento. El uso de un adaptador distinto al mencionado puede producir daños fisicos y/o daños al equipo conectado. El adaptador de alimentación debe operar con voltaje y frecuencia de la energia electrica domiciliaria exitente en el pais o zona de instalación.

TRENDnet®

Product Warranty Registration

Please take a moment to register your product online.
Go to TRENDnet's website at http://www.trendnet.com/register

TRENDnet
20675 Manhattan Place, Torrance, CA 90501. USA

Convertidor de fibra multimodo de 1000Base-T a 1000Base-LX con conector tipo-SC
TFC-1000MSC

El convertidor de medios de fibra serie TFC-1000 de TRENDnet transforma medios 1000Base-T(Gigabit Cobre) a medios 1000Base-SX/LX (Gigabit Fibra) y viceversa. El puerto 1000Base-T admite una conexión full-dúplex Gigabit a una velocidad por cable con conector RJ45. La conexión Gigabit fibra soporta un láser óptico de onda corta (SX) u onda larga (LX) con conector tipo SC multimodo o modo sencillo. Este convertidor le ofrece a su conexión Gigabit Cobre la capacidad de interconectarse a enlaces de fibra a una distancia de hasta 550 metros. Con el chasis de montura en rack EIA-19" de 16 ranuras, la serie de convertidores TFC son la solución perfecta para varios medios de fibra.

Características

• Compatible con IEEE 1000Base-T y 1000Base-SX

• Un puerto RJ-45 1000Base-T

• Un puerto 1000Base-SX con conector tipo SC

• Estatus de los indicadores LED para la Potencia, Enlace/Actividad, Full-Dúplex y Velocidad

• Para montaje en pared

• Sistema de chasis opcional de 19" con alimentación eléctrica redundante (TFC-1600), con capacidad para hasta 16 convertidores de medios serie TFC

• Garantía limitada de 3 años

Convertidor de fibra multimodo de 1000Base-T a 1000Base-LX con conector tipo-SC
TFC-1000MSC

Especificaciones

Hardware	
Estándares	• IEEE 1000Base-T y 1000Base-SX
Compatibilidad con tamaño de estructura	• Sin límites (Ethernet estándar e infraestructura Jumbo)
Medios de Red	• 1000Base-T: Cat. 5, EIA/TIA-568 UTP/STP de 100 ohmios, hasta 100 metros. • 1000Base-SX: Cable de fibra óptica multimodo de 50/125 µm, hasta 550 metros. De 62,5/125 µm hasta 220 metros
Longitud de onda	• 850nm
Protocolo	• CSMA/CD
Puertos	• 1 de 1000Base-T • 1 de 1000Base-SX
Velocidad de transferencia de datos	• 1000Mbps
LEDs de diagnóstico	• Potencia, Enlace/Actividad, Full-Dúplex y Velocidad
Adaptador de alimentación	• 7,5VDC, 1,5A (máx. 7,2 vatios)
Temperatura	• Operación 0° ~ 40° C (32° ~ 104° F) • Almacenamiento: -25° ~ 70° C (-13° ~ 158° F)
Humedad	• Operación 10% ~ 90% • Almacenamiento: 5% ~ 90% (sin condensación)

Productos Relacionados

TFC-1600	Sistema chassis de 16 ranuras para la serie de convertidores de medio fibra óptica TFC
TFC-1000MSC	Convertidor de fibra multimodo de 1000Base-T a 1000Base-LX con conector tipo-SC
TFC-1000S20	Convertidor de fibra modo sencillo de 1000Base-T a 1000Base-LX (20Km) con conector tipo-SC
TFC-1000S50	Convertidor de fibra modo sencillo de 1000Base-T a 1000Base-LX (50 Km) con conector tipo-SC
TFC-1000S70	Convertidor de fibra modo sencillo de 1000Base-T a 1000Base-LX (70 Km) con conector tipo-SC

Informacion de la orden

TRENDNET ®

20675 Manhattan Place,Torrance, CA 90501 USA
Tel: 1-310-961-5500
Fax: 1-310-961-5511
Web: www.trendnet.com
Email: sales@trendnet.com

Para ordenar por favor llame:

1-888-326-6061

Fiber Converters

TFC-1000 Series

• Guía de instalación rápida (1)

1. Antes de iniciar

Contenidos del paquete

- Convertidor de fibra
- Guía de instalación rápida multilingüe
- Alimentación eléctrica de CA

Si cualquiera de los contenidos anteriores se encuentra, por favor contacte a su distribuidor.

Requisitos mínimos

- Un entorno bastante fresco y seco
- Un ambiente donde no haya generadores de campos electromagnéticos fuertes (como motores), vibraciones, polvo o exposición directa a la luz solar
- Un chasis TFC-1600 (opcional) o una superficie firme y nivelada capaz de sostener el peso del Convertidor de fibra.
- 1000Mbps Gigabit Ethernet Switch
- Cables de fibra para conexiones multimodo o de modo sencillo
- Cat. 5e or Cat. 6 RJ-45 Ethernet Cable

Equipo Opcional

- Rack estándar de 19"
- Chasis TFC-1600
- Módulo Mini-GBIC (por ejemplo, TEG-MGBSX, TEG-MGBS10, TEG-MGBS40, TEG-MGBS80, TEG-MGBS10D35, TEG-MGBS40D35) para ranuras Mini-GBIC (sólo para TFC-1000MGB/TFC-1000MGA)

2. Hardware Installation

Instalación de 2 convertidores de fibra de forma independiente

1. Conecte un cable de ethernet RJ-45 desde el puerto ethernet de los convertidores de fibra hasta un puerto ethernet del conmutador (como el TEG-S24Dg).
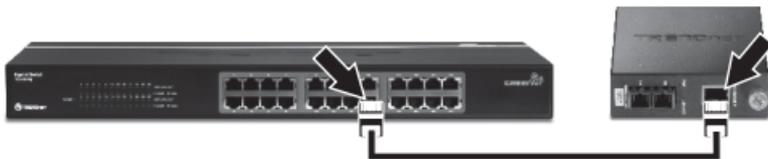
2. Conecte el cable de fibra a los convertidores.

3. Conecte el adaptador de corriente a la parte posterior del convertidor.

Nota:

1. Para el TFC-1000MSC / S20/ S50 / S70, los cables TX y RX se deben colocar al revés en la conexión de fibra contraria.

2. Cableado

    a. Cable de fibra óptica multimodo: TFC-1000MSC, TFC-1000MGB/ TFC-1000MGA con módulo TEG-MGBSX

    b. Cable de fibra óptica monomodo: TFC-1000S20, TFC-1000S50, TFC-1000S70, TFC-1000MGB/TFC-1000MGA con módulo TEG-MGBS10/TEG-MGBS40/ TEG-MGBS80

    c. Cable de fibra óptica trenzado: TFC-1000S10D3, TFC-1000S10D5, TFC-1000S40D3, TFC-1000S40D5, TFC-1000MGB /TFC-1000MGA con módulo TEG-MGBS10D35/ TEG-MGBS40D35

Instalación del convertidor de fibra sobre un chasis

1. Destornille la tapa del compartimiento deseado del chasis.

2. Afloje el tornillo de ajuste manual y saque el convertidor de la caja de metal.

3. Inserte el convertidor de medios en una ranura disponible y apriete el tornillo de ajuste manual.

La instalación ha sido completada.

3. Indicadores LED y conmutadores Dip

Indicadores LED

Indicadores LED	Color	Secuencia	Función
PWR (Corriente)	Verde	Sólido	Dispositivo encendido
		Apagado	Dispositivo apagado
LINK/ACT	Verde	Sólido	2000 Mbps (Full Dúplex) (por puerto)
	Verde	Intermitente	2000Mbps (Full Dúplex) (Transmisión y recepción de datos)(por puerto)
		Apagado	El enlace está desconectado

Conmutadores DIP

Conmutador	Acción	Función
1	**Encendido**	TX Forced Mode (Modo forzoso)
	Apagado	TX Auto-Negotiation (Autonegociación)
2	**Encendido**	LLR Enable (Activado)
	Apagado	LLR Disable (Desactivado)

Nota:

1. Después de cambiar las configuraciones del conmutador DIP, reinicie el conversor de fibra.

2. LLR significa Link Loss Return. Cuando LLR está activado, el transmisor de puerto de fibra se apaga si su receptor no puede detectar un enlace válido. Si uno de los conductores ópticos es malo, la tarjeta con LLR activado devolverá una condición de no enlace a su enlace de socios LLR se utiliza para detectar problemas de enlace sólo en el puerto de fibra Si LLR no está activo en un convertidor de fibra, el convertidor de fibra opuesto debe tener LLR desactivado.

4

Declaration of Conformity

TRENDNET

Company Information:

Company Name:
TRENDnet, Inc.

Company Address:
20675 Manhattan Place
Torrance, CA 90501
USA

Product Information:

Product Description:
1000Base-TX to 1000Base-SX/LX Fiber Converter

CE

Model Number:
TFC-1000MSC, TFC-1000S20, TFC-1000S50, TFC-1000S70
TFC-1000MGB, TFC-1000MGA, TFC-1000S10D3,
TFC-1000S10D5 1000S40D3, TFC-1000S40D5

Brand name:
TRENDnet

Technical Standards:

EN 55022 : 2006 Class A
EN 61000-3-2 : 2006 Class A
EN 61000-3-3 : 1995 + A1 : 2001 + A2 : 2005
EN 55024 : 1998 + A1 : 2001 + A2 : 2003

Declaration:

The product is herewith confirmed to comply with the requirements of Directive 2004/108/EC of the Council (European Parliament) on the EMC directive and Energy-related products Directive 2009/125/EC.

I hereby declare that the products and devices mentioned above are consistent with the standards and provisions of the guidelines.

Sonny Su	Director of Technology
Full Name	Position / Title

May 27, 2011	
Date	Signature

Limited Warranty

TRENDnet warrants its products against defects in material and workmanship, under normal use and service, for the following lengths of time from the date of purchase.

Fiber Converters– 3 Years Limited Warranty

AC/DC Power Adapter, Cooling Fan, and Power Supply carry a 1 year warranty.

If a product does not operate as warranted during the applicable warranty period, TRENDnet shall reserve the right, at its expense, to repair or replace the defective product or part and deliver an equivalent product or part to the customer. The repair/replacement unit's warranty continues from the original date of purchase. All products that are replaced become the property of TRENDnet. Replacement products may be new or reconditioned. TRENDnet does not issue refunds or credit. Please contact the point-of-purchase for their return policies.

TRENDnet shall not be responsible for any software, firmware, information, or memory data of customer contained in, stored on, or integrated with any products returned to TRENDnet pursuant to any warranty.

There are no user serviceable parts inside the product. Do not remove or attempt to service the product by any unauthorized service center. This warranty is voided if (i) the product has been modified or repaired by any unauthorized service center, (ii) the product was subject to accident, abuse, or improper use (iii) the product was subject to conditions more severe than those specified in the manual.

Warranty service may be obtained by contacting TRENDnet within the applicable warranty period and providing a copy of the dated proof of the purchase. Upon proper submission of required documentation a Return Material Authorization (RMA) number will be issued. An RMA number is required in order to initiate warranty service support for all TRENDnet products. Products that are sent to TRENDnet for RMA service must have the RMA number marked on the outside of return packages and sent to TRENDnet prepaid, insured and packaged appropriately for safe shipment. Customers shipping from outside of the USA and Canada are responsible for return shipping fees. Customers shipping from outside of the USA are responsible for custom charges, including but not limited to, duty, tax, and other fees.

WARRANTIES EXCLUSIVE: IF THE TRENDNET PRODUCT DOES NOT OPERATE AS WARRANTED ABOVE, THE CUSTOMER'S SOLE REMEDY SHALL BE, AT TRENDNET'S OPTION, REPAIR OR REPLACE. THE FOREGOING WARRANTIES AND REMEDIES ARE EXCLUSIVE AND ARE IN LIEU OF ALL OTHER WARRANTIES,

EXPRESSED OR IMPLIED, EITHER IN FACT OR BY OPERATION OF LAW, STATUTORY OR OTHERWISE, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. TRENDNET NEITHER ASSUMES NOR AUTHORIZES ANY OTHER PERSON TO ASSUME FOR IT ANY OTHER LIABILITY IN CONNECTION WITH THE SALE, INSTALLATION MAINTENANCE OR USE OF TRENDNET'S PRODUCTS.

TRENDNET SHALL NOT BE LIABLE UNDER THIS WARRANTY IF ITS TESTING AND EXAMINATION DISCLOSE THAT THE ALLEGED DEFECT IN THE PRODUCT DOES NOT EXIST OR WAS CAUSED BY CUSTOMER'S OR ANY THIRD PERSON'S MISUSE, NEGLECT, IMPROPER INSTALLATION OR TESTING, UNAUTHORIZED ATTEMPTS TO REPAIR OR MODIFY, OR ANY OTHER CAUSE BEYOND THE RANGE OF THE INTENDED USE, OR BY ACCIDENT, FIRE, LIGHTNING, OR OTHER HAZARD.

LIMITATION OF LIABILITY: TO THE FULL EXTENT ALLOWED BY LAW TRENDNET ALSO EXCLUDES FOR ITSELF AND ITS SUPPLIERS ANY LIABILITY, WHETHER BASED IN CONTRACT OR TORT (INCLUDING NEGLIGENCE), FOR INCIDENTAL, CONSEQUENTIAL, INDIRECT, SPECIAL, OR PUNITIVE DAMAGES OF ANY KIND, OR FOR LOSS OF REVENUE OR PROFITS, LOSS OF BUSINESS, LOSS OF INFORMATION OR DATE, OR OTHER FINANCIAL LOSS ARISING OUT OF OR IN CONNECTION WITH THE SALE, INSTALLATION, MAINTENANCE, USE, PERFORMANCE, FAILURE, OR INTERRUPTION OF THE POSSIBILITY OF SUCH DAMAGES, AND LIMITS ITS LIABILITY TO REPAIR, REPLACEMENT, OR REFUND OF THE PURCHASE PRICE PAID, AT TRENDNET'S OPTION. THIS DISCLAIMER OF LIABILITY FOR DAMAGES WILL NOT BE AFFECTED IF ANY REMEDY PROVIDED HEREIN SHALL FAIL OF ITS ESSENTIAL PURPOSE.

Governing Law: This Limited Warranty shall be governed by the laws of the state of California. Some TRENDnet products include software code written by third party developers. These codes are subject to the GNU General Public License ("GPL") or GNU Lesser General Public License ("LGPL").

Go to http://www.trendnet.com/gpl or http://www.trendnet.com Download section and look for the desired TRENDnet product to access to the GPL Code or LGPL Code. These codes are distributed WITHOUT WARRANTY and are subject to the copyrights of the developers. TRENDnet does not provide technical support for these codes. Please go to http://www.gnu.org/licenses/gpl.txt or http://www.gnu.org/licenses/lgpl.txt for specific terms of each license.

TRENDNET ®

Product Warranty Registration

Please take a moment to register your product online.
Go to TRENDnet's website at http://www.trendnet.com/register

Certifications
This equipment has been tested and found to comply with FCC and CE Rules.
Operation is subject to the following two conditions:
(1) This device may not cause harmful interference.
(2) This device must accept any interference received. Including interference that may cause undesired operation.

FC CE PГ

Waste electrical and electronic products must not be disposed of with household waste.   Please recycle where facilities exist. Check with you Local Authority or Retailer for recycling advice.

<u>NOTE:</u> THE MANUFACTURER IS NOT RESPONSIBLE FOR ANY RADIO OR TV INTERFERENCE CAUSED BY UNAUTHORIZED MODIFICATIONS TO THIS EQUIPMENT. SUCH MODIFICATIONS COULD VOID THE USER'S AUTHORITY TO OPERATE THE EQUIPMENT.

ADVERTENCIA
En todos nuestros equipos se mencionan claramente las caracteristicas del adaptador de alimentacón necesario para su funcionamiento. El uso de un adaptador distinto al mencionado puede producir daños fisicos y/o daños al equipo conectado. El adaptador de alimentación debe operar con voltaje y frecuencia de la energia electrica domiciliaria existente en el pais o zona de instalación.

TRENDnet
20675 Manhattan Place
Torrance, CA 90501. USA

Cisco 5500 Series Wireless Controllers

Maximum Performance and Scalability

- Support for up to 500 access points and 7000 clients
- 802.11n optimized for up to nine times the performance of 802.11a/g networks
- Enhanced uptime with the ability to simultaneously configure and manage 500 access points per controller

Improved Mobility and Services

- Larger mobility domain for more simultaneous client associations
- Faster radio resource management (RRM) updates for uninterrupted network access when roaming
- Intelligent RF control plane for self-configuration, self-healing, and self-optimization
- Efficient roaming improves application performance such as toll quality, voice, and consistent streaming of video and data backup

Licensing Flexibility and Investment Protection

- Additional access point capacity licenses may be added over time

Cisco OfficeExtend Solution

- Secure, simple, cost-effective mobile teleworker solution
- Up to 500 remote access points per controller
- Supports Cisco® Unified IP Phones for reduced cell phone charges

Comprehensive Wired/Wireless Security

- Full Control and Provisioning of Wireless Access Points (CAPWAP) access-point-to-controller encryption
- Supports rogue access point detection and denial-of-service attacks
- Management frame protection detects malicious users and alerts network administrators

Enterprise Wireless Mesh

- Dynamic wireless mesh networks support indoor and outdoor connectivity for areas that are difficult to wire

Environmentally Responsible

- Support for adaptive power management to turn off access point radios during off-peak hours to reduce power consumption
- OfficeExtend solution reduces costs and supports green best practices by reducing commuting time and saving on gas, vehicle mileage, and insurance costs

The Cisco® 5500 Series Wireless Controller, shown in Figure 1, is a highly scalable and flexible platform that enables systemwide services for mission-critical wireless networking in medium-sized to large enterprises and campus environments. Designed for 802.11n performance and maximum scalability, the 5500 Series offers enhanced uptime with:

- RF visibility and protection
- The ability to simultaneously manage up to 500 access points
- Superior performance for reliable streaming video and toll-quality voice
- Sub-second stateful failover of all access points and clients from the primary to standby controller

Figure 1 Cisco 5500 Series Wireless LAN Controller

Features

Optimized for high-performance wireless networking, the Cisco 5500 Series Controller offers improved mobility and prepares the business for the next wave of mobile devices and applications. The 5500 Series supports a higher density of clients and delivers more efficient roaming, with at least nine times the throughput of existing 802.11a/g networks.

The 5500 Series automates wireless configuration and management functions and allows network managers to have the visibility and control needed to cost-effectively manage, secure, and optimize the performance of their wireless networks. With integrated Cisco CleanAir® technology, the 5500 Series protects 802.11n performance by providing cross-network access to real-time and historic RF interference information for quick troubleshooting and resolution.

The Cisco 5508 Wireless Controller supports Cisco Application Visibility and Control(AVC), the technology that includes the Network-Based Application Recognition 2 (NBAR-2) engine, Cisco's deep packet inspection (DPI) capability. The NBAR-2 engine can classify applications, applies quality of service (QoS) setting to either drop or mark the traffic, and prioritizes business-critical applications in the network. Cisco AVC uses NetFlow Version 9 to export the flows to [Cisco Prime™ Infrastructure](#) or a third-party NetFlow Collector. The 5508 also supports Bonjour Services Directory to enable Bonjour Services to be advertised and utilized in a separate Layer 3 network. Wireless Policy engine is a wireless profiler and policy feature on the Cisco 5500 Series Wireless Controller that enables profiling of wireless devices and enforcement of policies such as VLAN assignment, QoS, ACL and time-of-day-based access.

As a component of the Cisco Unified Wireless Network, this controller provides real-time communications between Cisco Aironet® access points, the Cisco Wireless Control System (WCS), and the Cisco Mobility Services Engine to deliver centralized security policies, wireless intrusion prevention system (IPS) capabilities, award-winning RF management, and QoS.

Software Licensing Flexibility

Base access point licensing offers flexibility to add up to 500 additional access points as business needs grow. The licensing structure supports a variety of business mobility needs as part of the basic feature set, including the Cisco OfficeExtend solution for secure, mobile teleworking and Cisco Enterprise Wireless Mesh, which allows access points to dynamically establish wireless connections in locations where it may be difficult or impossible to physically connect to the wired network.

Table 1 lists the features of the Cisco 5500 Series [Wireless LAN Controllers](#).

Table 1.   Cisco 5500 Series Wireless LAN Controller Features

Feature	Benefits
Scalability	• Supports 12, 25, 50,100, 250, or 500 access points for business-critical wireless services at locations of all sizes
High Performance	• Wired speed, nonblocking performance for 802.11n networks
RF Management	• Provides both real-time and historical information about RF interference impacting network performance across controllers, via systemwide Cisco CleanAir technology integration
OfficeExtend	• Supports corporate wireless service for mobile and remote workers with secure wired tunnels to the Cisco Aironet® 1130 or 1140 Series Access Points • Extends the corporate network to remote locations with minimal setup and maintenance requirements (zero-touch deployment) • Improves productivity and collaboration at remote site locations • Separate SSID tunnels allow both corporate and personal Internet access • Reduced CO2 emissions from decrease in commuting • Higher employee job satisfaction from ability to work at home • Improves business resiliency by providing continuous, secure connectivity in the event of disasters, pandemics, or inclement weather
Comprehensive End-to-End Security	• Offers control and provisioning of wireless access points (CAPWAP)-compliant DTLS encryption to help ensure full-line-rate encryption between access points and controllers across remote WAN/LAN links
Enterprise Wireless Mesh	• Allows access points to dynamically establish wireless connections without the need for a physical connection to the wired network • Available on select Cisco Aironet access points, Enterprise Wireless Mesh is ideal for warehouses, manufacturing floors, shopping centers and any other location where extending a wired connection may prove difficult or aesthetically unappealing
High Performance Video	• Integrates Cisco VideoStream technology as part of the medianet framework to optimize the delivery of video applications across the WLAN

Feature	Benefits
End-to-End Voice	• Supports Unified Communications for improved collaboration through messaging, presence, and conferencing • Supports all Cisco Unified IP Phones for cost-effective, real-time voice services
High Availability	• An optional redundant power supply that helps to ensure maximum availability
Environmentally Responsible	• Organizations may choose to turn off access point radios to reduce power consumption during off peak hours
Mobility, Security and Management for IPv6 & Dual-Stack Clients	• Secure, reliable wireless connectivity and consistent end-user experience • Increased network availability through proactive blocking of known threats • Equips administrators for IPv6 troubleshooting, planning, and client traceability from a common wired and wireless management system

Table 2 lists the product specifications for Cisco 5500 Series Wireless Controllers.

Table 2.   Product Specifications for Cisco 5500 Series Wireless Controllers

Item	Specifications
Wireless	IEEE 802.11a, 802.11b, 802.11g, 802.11d, WMM/802.11e, 802.11h, 802.11k, 802.11n, 802.11r, 802.11u, 802.11w, 802.11ac.
Wired/Switching/Routing	IEEE 802.3 10BASE-T, IEEE 802.3u 100BASE-TX specification, 1000BASE-T. 1000BASE-SX, 1000-BASE-LH, IEEE 802.1Q Vtagging, and IEEE 802.1AX Link Aggregation.
Data Request For Comments (RFC)	• RFC 768 UDP • RFC 791 IP • RFC 2460 IPv6 (pass through Bridging mode only) • RFC 792 ICMP • RFC 793 TCP • RFC 826 ARP • RFC 1122 Requirements for Internet Hosts • RFC 1519 CIDR • RFC 1542 BOOTP • RFC 2131 DHCP • RFC 5415 CAPWAP Protocol Specification • RFC 5416 CAPWAP Binding for 802.11
Security Standards	• WPA • IEEE 802.11i (WPA2, RSN) • RFC 1321 MD5 Message-Digest Algorithm • RFC 1851 The ESP Triple DES Transform • RFC 2104 HMAC: Keyed Hashing for Message Authentication • RFC 2246 TLS Protocol Version 1.0 • RFC 2401 Security Architecture for the Internet Protocol • RFC 2403 HMAC-MD5-96 within ESP and AH • RFC 2404 HMAC-SHA-1-96 within ESP and AH • RFC 2405 ESP DES-CBC Cipher Algorithm with Explicit IV • RFC 2406 IPsec • RFC 2407 Interpretation for ISAKMP • RFC 2408 ISAKMP • RFC 2409 IKE • RFC 2451 ESP CBC-Mode Cipher Algorithms • RFC 3280 Internet X.509 PKI Certificate and CRL Profile • RFC 3602 The AES-CBC Cipher Algorithm and Its Use with IPsec • RFC 3686 Using AES Counter Mode with IPsec ESP • RFC 4347 Datagram Transport Layer Security • RFC 4346 TLS Protocol Version 1.1

Item	Specifications
Encryption	• WEP and TKIP-MIC: RC4 40, 104 and 128 bits (both static and shared keys) • AES: CBC, CCM, CCMP • DES: DES-CBC, 3DES • SSL and TLS: RC4 128-bit and RSA 1024- and 2048-bit • DTLS: AES-CBC • IPSec: DES-CBC, 3DES, AES-CBC
Authentication, Authorization, and Accounting (AAA)	• IEEE 802.1X • RFC 2548 Microsoft Vendor-Specific RADIUS Attributes • RFC 2716 PPP EAP-TLS • RFC 2865 RADIUS Authentication • RFC 2866 RADIUS Accounting • RFC 2867 RADIUS Tunnel Accounting • RFC 2869 RADIUS Extensions • RFC 3576 Dynamic Authorization Extensions to RADIUS • RFC 3579 RADIUS Support for EAP • RFC 3580 IEEE 802.1X RADIUS Guidelines • RFC 3748 Extensible Authentication Protocol • Web-based authentication • TACACS support for management users
Management	• SNMP v1, v2c, v3 • RFC 854 Telnet • RFC 1155 Management Information for TCP/IP-Based Internets • RFC 1156 MIB • RFC 1157 SNMP • RFC 1213 SNMP MIB II • RFC 1350 TFTP • RFC 1643 Ethernet MIB • RFC 2030 SNTP • RFC 2616 HTTP • RFC 2665 Ethernet-Like Interface types MIB • RFC 2674 Definitions of Managed Objects for Bridges with Traffic Classes, Multicast Filtering, and Virtual Extensions • RFC 2819 RMON MIB • RFC 2863 Interfaces Group MIB • RFC 3164 Syslog • RFC 3414 User-Based Security Model (USM) for SNMPv3 • RFC 3418 MIB for SNMP • RFC 3636 Definitions of Managed Objects for IEEE 802.3 MAUs • Cisco private MIBs
Management Interfaces	• Web-based: HTTP/HTTPS • Command-line interface: Telnet, Secure Shell (SSH) Protocol, serial port • Cisco Wireless Control System (WCS)
Interfaces and Indicators	• Uplink: 8 (5508) 1000BaseT, 1000Base-SX and 1000Base-LH transceiver slots • Small Form-Factor Pluggable (SFP) options (only Cisco SFPs supported): GLC-T, GLC-SX-MM, GLC-LH-SM, GLC-SX-MMD, GLC-LH-SMD, GLC-TE • LED indicators: link • Service Port: 10/100/1000 Mbps Ethernet (RJ45). • Service Port: 10/100/1000 Mbps Ethernet (RJ45) For High Availability for future use • LED indicators: link • Utility Port: 10/100/1000 Mbps Ethernet (RJ45) • LED indicators: link • Expansion Slots: 1 (5508) • Console Port: RS232 (DB-9 male/RJ-45 connector included), mini-USB • Other Indicators: Sys, ACT, Power Supply 1, Power Supply 2

Item	Specifications
Physical and Environmental	• Dimensions (WxDxH): 17.30 x 21.20 x 1.75 in. (440 x 539 x 44.5 mm) • Weight: 20 lbs (9.1 kg) with 2 power supplies • Temperature: Operating temperature: 32 to 104°F (0 to 40°C); Storage temperature: -13 to 158°F (-25 to 70°C) • Humidity: Operating humidity: 10 95%, noncondensing. Storage humidity: up to 95% • Input power: 100 to 240 VAC; 50/60 Hz; 1.05 A at 110 VAC, 115W Maximum; 0.523 A at 220 VAC, 115W Maximum; Test Conditions: Redundant Power Supplies, 40C, Full Traffic. • Heat Dissipation: 392 Btu/hour at 110/220 VAC Maximum
Regulatory Compliance	CE Mark Safety: • UL 60950-1:2003 • EN 60950:2000 • EMI and susceptibility (Class A) • U.S.: FCC Part 15.107 and 15.109 • Canada: ICES-003 • Japan: VCCI • Europe: EN 55022, EN 55024

Tables 3 and Table 4 list the ordering and accessories information for Cisco 5500 Series Wireless Controllers.

Table 3. Ordering Information for Cisco 5500 Series Wireless Controllers

Part Number	Product Name	Cisco SMARTnet® Service 8x5xNBD
AIR-CT5508-12-K9	5500 Series Wireless Controller for up to 12 Cisco access points	CON-SNT-CT0812
AIR-CT5508-25-K9	5500 Series Wireless Controller for up to 25 Cisco access points	CON-SNT-CT0825
AIR-CT5508-50-K9	5500 Series Wireless Controller for up to 50 Cisco access points	CON-SNT-CT0850
AIR-CT5508-100-K9	5500 Series Wireless Controller for up to 100 Cisco access points	CON-SNT-CT08100
AIR-CT5508-250-K9	5500 Series Wireless Controller for up to 250 Cisco access points	CON-SNT-CT08250
AIR-CT5508-500-K9	5500 Series Wireless Controller for up to 500 Cisco access points	CON-SNT-CT08500
AIR-CT5508-500-2PK	2 Pack 5500 Series Wireless Controller for up to 500 Cisco access points each (1000 access points total)	CON-SNT-AIRC552P
AIR-CT5508-HA-K9	Cisco 5508 Series Wireless Controller for High Availability	CON-SNT-CT5508HA

Table 4. Accessories for Cisco 5500 Series Wireless Controllers

Part Number	Product Name
AIR-PWR-5500-AC=	5500 Series Wireless Controller Redundant AC Power Supply
AIR-FAN-5500=	5500 Series Wireless Controller Fan Tray
AIR-CT5500-RK-MNT	5500 Series Wireless Controller Spare mounting kit

Additive Capacity Upgrade Licenses

Tables 5 and 6 list additive capacity upgrade licenses for the Cisco 5500 Series.

Table 5. Ordering Information for Cisco 5500 Series Wireless Controllers Additive Capacity Licenses (e-Delivery Product Authorization Keys [PAKs])

	Part Number	Product Description	Cisco SMARTnet Service 8x5xNBD
e-License	L-LIC-CT5508-UPG	Primary upgrade SKU: Pick any number or combination of the following options under this SKU to upgrade one or many controllers under one product authorization key	CON-SNT-LCTUPG
	L-LIC-CT5508-5A	5 AP Adder License for the 5508 Controller (eDelivery)	CON-SNT-LICT55A
	L-LIC-CT5508-25A	25 AP Adder License for the 5508 Controller (eDelivery)	CON-SNT-LCT25A
	L-LIC-CT5508-50A	50 AP Adder License for the 5508 Controller (eDelivery)	CON-SNT-LCT50A
	L-LIC-CT5508-100A	100 AP Adder License for the 5508 Controller (eDelivery)	CON-SNT-LCT100A
	L-LIC-CT5508-250A	250 AP Adder License for the 5508 Controller (eDelivery)	CON-SNT-LCT250A

Table 6. Ordering Information for Cisco 5500 Series Wireless Controllers Additive Capacity Licenses (Paper PAKs)

	Part Number	Product Description	Cisco SMARTnet Service 8x5xNBD
Paper License	LIC-CT5508-UPG	Primary upgrade SKU: Pick any number or combination of the following options under this SKU, to upgrade one or many controllers under one product authorization key.	CON-SNT-LCTUPG
	LIC-CT5508-5A	5 AP Adder License for the 5508 Controller	CON-SNT-LICT55A
	LIC-CT5508-25A	25 AP Adder License for the 5508 Controller	CON-SNT-LCT25A
	LIC-CT5508-50A	50 AP Adder License for the 5508 Controller	CON-SNT-LCT50A
	LIC-CT5508-100A	100 AP Adder License for the 5508 Controller	CON-SNT-LCT100A
	LIC-CT5508-250A	250 AP Adder License for the 5508 Controller	CON-SNT-LCT250A

The additive capacity licenses allow for the increase in access point capacity supported by the controller up to a maximum of 500 access points. As an example, if a controller was initially ordered with support for 250 access points, that capacity could be later increased to up to 500 access points by purchasing a 250-access-point additive capacity license (1x-LIC-CT5508-250A).

A certificate with a PAK is required to add additional access point capacity on the Cisco 5500 Series Wireless Controller.

The certificate may be expedited via email. If a paper certificate is required for customs, it should be ordered to ship via U.S. mail. Each additive capacity license and PAK must be registered prior to installation.

Ordering and installing the Cisco 5500 Series Wireless Controller additive capacity licenses is a three-step process:

1. Select the correct SKU for email or paper delivery.
2. Register the PAK certificate (see Registering PAK Certificate).
3. Install the license on the Cisco 5500 Series Wireless Controller (see Installing License).

Please review the Cisco Wireless LAN Controller Configuration Guide, Release 6.0 or later, for detailed ordering, registration, and installation information for the 5500 Series additive capacity licenses.

Electronic delivery of the same PAKs is available by ordering the e-License SKUs as listed in Table 5. If a paper certificate is required, please use the SKUs listed in Table 6.

PAK Certificate Registration

Customers are required to register a PAK certificate for all upgrade licenses for the Cisco 5500 Series Wireless Controllers. Customer email address and host name are required to register the PAK certificate at: http://www.cisco.com/go/license.

Installing License on Cisco WCS Server

Follow these steps to install a license file. If you need additional help, contact Cisco Technical Assistance Center (TAC) at 800 553-2447 or tac@cisco.com.

1. Install Cisco WCS software if not already completed.

2. Save the license file (.lic) to a temporary directory on your hard drive. (You will receive an email from Cisco with an attached license file)

3. Open a supported version of the Internet Explorer browser.

4. In the location or address field, enter the following URL, replacing IP address with the IP address or host name of the Cisco WCS server: **https: // <IP address>**.

5. Log in to the Cisco WCS server as system administrator. (Be aware that usernames and passwords are case-sensitive.)

6. From the Help menu, select **Licensing**.

7. On the Licensing page, from the Command menu, select **Add License**.

8. On the Add License page, click **Browse** to navigate to the location where you saved the .lic file.

9. Click **Download**. The Cisco WCS server imports the license.

Table 7 shows the optional DTLS license for Cisco 5500 Series Wireless Controllers.

Datagram Transport Layer Security (DTLS) is required for all OfficeExtend deployments to encrypt the Data Plane traffic. **Customers planning to install this device physically in Russia must order the controller with DTLS disabled and then obtain a physical PAK in order to enable a DTLS license and should not download the license from Cisco.com.** Please consult your local government regulations to ensure that Data DTLS encryption is permitted.

If a customer chooses SWC5500K9-60, SWC5500K9-70 or SWC5500K9-72, DTLS Data Encryption is enabled by default. When a customer orders the 5500 Series and chooses either SWC5500LPE-K9-70 or SWC5500LPE-K9-72 in the Optional Licenses tab, data DTLS Encryption is disabled.

The DTLS Paper PAK license is designated for customers who purchase a controller with DTLS disabled due to import restrictions but get permission to add DTLS support after initial purchase. This optional DTLS license is required for Cisco OfficeExtend deployment.

Table 7.   Optional Licensing for Cisco 5500 Series Wireless Controllers (PAKs)

Part Number	Description
LIC-CT5508-LPE-K9	5508 Wireless Controller DTLS License (Paper PAK)
L-LIC-CT55-LPE-K9=	Cisco 5508 Controller DTLS License (electronic Certificate)

Other customers can simply use the procedure outlined below in order to download the DTLS license from Cisco.com.

To obtain a data DTLS license, follow these steps:

Step 1.   Browse to http://cisco.com/go/license

Step 2.   On the Product License Registration page, choose **Licenses Not Requiring a PAK**

Step 3.   Choose **Cisco Wireless Controllers DTLS License** under Wireless

Step 4.   Complete the remaining steps to generate the license file. The license will be provided online or via email

Step 5.   Copy the license file to your TFTP server

Step 6.   Install the license by browsing to the WLC Web Administration Page:

Management --> Software Activation --> Commands --> Action: Install License

Step 7.   Browse to: Cisco 5508 Wireless Controller Software Download Page

http://www.cisco.com/cisco/software/release.html?mdfid=282600534&release=7.0.230.0&relind=AVAILAB LE&softwareid=280926587&rellifecycle=ED&reltype=latest

Step 8.   Choose the release that corresponds to the SW running on your WLC

Step 9.   Choose the **NON LDPE** software release: AIR-CT5500-K9-X-X-XX.aes

Step 10. Complete the remaining steps to download the software

Service and Support

Realize the full business value of your wireless network and mobility services investments faster with intelligent, customized services from Cisco and our partners. Backed by deep networking expertise and a broad ecosystem of partners, Cisco professional and technical services enable you to successfully plan, build, and run your network as a powerful business platform. Our services can help you successfully deploy the Cisco 5500 Series Wireless Controller and integrate mobility solutions effectively to lower the total cost of ownership and secure your wireless network.

To learn more about Cisco Wireless LAN service offers, visit: http://www.cisco.com/go/wirelesslanservices.

Summary

The Cisco 5500 Series Wireless Controller is designed for 802.11n performance and offers maximum scalability for enterprise and service provider wireless deployments. It simplifies deployment and operation of wireless networks, helping to ensure smooth performance, enhance security, and maximize network availability. The Cisco 5500 Series Wireless Controller manages all the Cisco access points within campus environments and branch locations, eliminating complexity and providing network administrators with visibility and control of their wireless LANs.

For More Information

For more information about Cisco wireless controllers, contact your local account representative or visit: http://www.cisco.com/en/US/products/ps6366/index.html.

For more information about the Cisco Unified Wireless Network framework, visit: http://www.cisco.com/go/unifiedwireless.

Cisco 880 Series Integrated Services Routers

The Cisco® 880 Series Integrated Services Routers (ISRs) combine Internet access, security, voice, and wireless services onto a single, secure device that is simple to use and manage for small businesses and enterprise small branch offices and teleworkers. The Cisco 880 Series delivers features including firewall, content filtering, VPNs, and wireless LANs (WLANs) at broadband speeds to small offices. Easy deployment and centralized management features enable enterprises or service providers to deploy the Cisco 880 Series in small branch offices or small businesses.

Product Overview

Cisco 880 Series Integrated Services Routers are fixed-configuration routers that provide collaborative business solutions for secure voice and data communication to small businesses and enterprise teleworkers. They offer concurrent broadband services over third-generation (3G), Metro Ethernet, and multiple DSL technologies to provide business continuity. Wireless 802.11n and 3G offer LAN and WAN mobility. The routers provide the performance required for concurrent services, including firewall, intrusion prevention, content filtering, and encryption for VPNs; optional 802.11g/n for mobility; and quality-of-service (QoS) features for optimizing voice and video applications. In addition, the web-based Cisco Configuration Professional configuration tool simplifies setup and deployment. Centralized management capabilities give network managers visibility and control of the network configurations at the remote site.

Cisco 880 Series Integrated Services Routers offer:

- High performance for broadband access in small offices and small branch-office and teleworker sites
- Collaborative services with secure analog, digital voice, and data communication
- Business continuity and WAN diversity with redundant WAN links: Fast Ethernet, Multimode G.SHDSL (Ethernet in the First Mile [EFM] and ATM), Multimode DSL (very-high-data-rate DSL 2 [VDSL2] and asymmetric DSL 2 and 2+ [ADSL2 and ADSL2+, respectively]), 3G, and ISDN
- Voice-enabling features:
  - Cisco Unified Communications Manager Express (5 user), which offers innovative key system and small private-branch-exchange (PBX) capabilities for small and medium-sized business customers
  - Survivable Remote Site Telephony (SRST) voice continuity for enterprise small branch-office and teleworker sites
  - Cisco Unified Border Element (Cisco UBE) IP-IP voice gateway functions for connecting to Session Initiation Protocol (SIP) trunking services as a replacement for Primary Rate Interface (PRI) or foreign-exchange-office (FXO) voice connectivity to the service provider. **Note:** Cisco Unified Border Element support for the Cisco 880 Series has feature limitations as compared to the Cisco Integrated Services Routers Generation 2 (ISR G2) Routers. Go to http://www.cisco.com/go/cube for the full set of Cisco Unified Border Element features. Cisco Unified Border Element limitations on Cisco 880 Routers are listed later in this document.

- Enhanced security, including:
  - Firewall with advance application and control for email, Instant Messaging (IM), and HTTP traffic
  - Site-to-site remote-access and dynamic VPN services: IP Security (IPsec) VPNs (Triple Data Encryption Standard [3DES] or Advanced Encryption Standard [AES]), Dynamic Multipoint VPN (DMVPN), Group Encrypted Transport VPN with onboard acceleration, and Secure Sockets Layer (SSL) VPN
  - Intrusion prevention system (IPS): An inline, deep-packet inspection feature that effectively mitigates a wide range of network attacks
  - Content filtering: A subscription-based integrated security solution that offers category-based reputation rating; keyword blocking; and protection against adware, malware, spyware, and Uniform Resource Locator (URL) blocking
- Four-port 10/100 Fast Ethernet managed switch with VLAN support; two ports support Power over Ethernet (PoE) for powering IP phones or external access points
- Secure 802.11g/n access-point option based on draft 802.11n standard with support for autonomous or Cisco Unified WLAN architectures
- Newer Cisco 880 Series (part numbers C881-K9, C886VA-K9, C886VAJ-K9, C887VA-K9, and C887VA-M-K9), which are fanless, providing a quiet, comfortable working environment in small offices
- CON/AUX port for console or external modem
- One USB 1.1 port for security eToken credentials, booting from USB, and loading configuration
- Easy setup, deployment, and remote-management capabilities through web-based tools and Cisco IOS® Software

Figure 1 shows a Cisco 881 Integrated Services Router.

Figure 1. Cisco 881 Integrated Services Router with Integrated 802.11n Access Point

Tables 1 and 2 list the routers that currently make up the Cisco 880 data, voice, and SRST series, respectively.

Table 1. Cisco 880 Series Data Models

Models	WAN Interface	LAN Interfaces	802.11g/n Option	Embedded 3G	Integrated ISDN Dial Backup
C881	10/100-Mbps Fast Ethernet	4-port 10/100-Mbps managed switch	No	No	No
Cisco 881	10-/100-Mbps Fast Ethernet	4-port 10-/100-Mbps managed switch	Yes (Cisco 881W)	Yes (Cisco 881G)	No
C886VA	Multimode VDSL2/ADSL2/2+ over ISDN	4-port 10-/100-Mbps managed switch	No	No	Yes
C886VAJ	Multimode VDSL/ADSL Annex J over ISDN	4-port 10-/100-Mbps managed switch	No	No	Yes

Models	WAN Interface	LAN Interfaces	802.11g/n Option	Embedded 3G	Integrated ISDN Dial Backup
Cisco 886VA	Multimode VDSL2/ADSL2/2+ over ISDN	4-port 10-/100-Mbps managed switch	Yes (Cisco 886VAW)	Yes (Cisco 886VAG)	Yes
Cisco 887VA	Multimode VDSL2/ADSL2/2+ over basic telephone service	4-port 10-/100-Mbps managed switch	Yes (Cisco 887VAW)	Yes (Cisco 887VAG)	No
Cisco 886	ADSL2/2+ over ISDN (Annex B)	4-port 10-/100-Mbps managed switch	Yes (Cisco 886W)	Yes (Cisco 886G)	Yes
C887	Multimode VDSL/ADSL over POTS	4-port 10-/100-Mbps managed switch	No	No	No
C887VA-M	Multimode VDSL/ADSL Annex-M over POTS	4-port 10-/100-Mbps managed switch	No	No	No
Cisco 887	ADSL2/2+ over basic telephone service (Annex A)	4-port 10-/100-Mbps managed switch	Yes (Cisco 887W)	Yes (Cisco 887G)	Yes
Cisco 887V	VDSL2 over basic telephone service	4-port 10-/100-Mbps managed switch	Yes (Cisco 887V)	Yes (Cisco 887VG)	Yes
Cisco 888	G.SHDSL (ATM)	4-port 10-/100-Mbps managed switch	Yes (Cisco 888W)	Yes (Cisco 888G)	Yes
Cisco 888E	G.SHDSL (EFM)	4-port 10-/100-Mbps managed switch	Yes (Cisco 888W)	Yes (Cisco 888EG)	Yes
Cisco 888EA	Multimode G.SHDSL (EFM/ATM)	4-port 10-/100-Mbps managed switch	No	No	Yes

Table 2.   Cisco 880 Series Voice Models

Models	WAN Interface	LAN Interfaces	Voice Ports	802.11g/n Option
Cisco881V	10-/100-Mbps Fast Ethernet	4-port 10-/100-Mbps managed switch	4 foreign-exchange-station (FXS) ports, 2 Basic Rate Interface(BRI) ports, and 1 foreign-exchange-office (FXO) port for public-switched-telephone-network (PSTN) fallback	No
Cisco887VA-V	Multimode VDSL2/ADSL2/2+ over POTS	4-port 10-/100-Mbps managed switch	4 foreign-exchange-station (FXS) ports and 2 Basic Rate Interface(BRI) ports	Yes (Cisco887VA-V-W-K9)
Cisco 881 SRST	10-/100-Mbps Fast Ethernet	4-port 10-/100-Mbps managed switch	4 foreign-exchange-station (FXS) ports and 1 FXO port for public-switched-telephone-network (PSTN) fallback	Yes (Cisco 881 SRSTW)
Cisco 888 SRST	G.SHDSL	4-port 10-/100-Mbps managed switch	4 FXS ports and 1 Basic Rate Interface (BRI) port for PSTN fallback	Yes (Cisco 888 SRSTW)
Cisco 881 with Cisco Unified Border Element	10-/100-Mbps Fast Ethernet	4-port 10-/100-Mbps managed switch	No	No
Cisco 886VA with Cisco Unified Border Element	Multimode VDSL2/ADSL2/2+ over ISDN	4-port 10-/100-Mbps managed switch	No	No
Cisco 887VA with Cisco Unified Border Element	Multimode VDSL2/ADSL2/2+ over basic telephone service	4-port 10-/100-Mbps managed switch	No	No
Cisco 888E with Cisco Unified Border Element	G.SHDSL (EFM)	4-port 10-/100-Mbps managed switch	No	No
Cisco 888 with Cisco Unified Border Element	G.SHDSL (ATM)	4-port 10-/100-Mbps managed switch	No	No

The Cisco 880 Series is ideal for small branch offices and teleworkers who need to be connected to larger enterprise networks as well as small businesses for either voice or data applications. These routers help extend corporate networks to secure remote sites while giving users access to the same applications found in a corporate office. When users require WLAN access, visibility and control of network security are even more critical at the remote site. The Cisco 880 Series meets this need with a single device that combines integrated 802.11g/n capabilities with security features such as Wi-Fi Protected Access (WPA), including authentication with IEEE 802.1x with Cisco Extensible Authentication Protocol (LEAP) and Protected EAP (PEAP) and encryption with WPA Temporal Key Integrity Protocol (TKIP). (Refer to the wireless solution overview and security data sheet for more information.) The Cisco 880 Series models that include the integrated access point can use either autonomous or Cisco Unified WLAN modes. In Cisco Unified WLAN mode, as part of an enterprise WLAN architecture, all WLAN functions are centrally managed through Cisco Wireless LAN Controllers and the Cisco Wireless Control System (WCS).

Service providers and value-added resellers can take advantage of the Cisco 880 Series to provide a true business-class broadband service. Business customers are using broadband access to connect to the Internet or to connect offices together, and they require a platform that incorporates voice and security without sacrificing performance. The Cisco 881V and Cisco 887VA-V voice routers offer industry-leading voice gateway capability with the ability enable Cisco Unified Communications Manager Express or SRST as required. Many of these customers are connecting computers in offices through WLANs; having a single device for both WAN and WLAN access provides a new option for managed services. These customers also require a higher level of support to keep their networks operational. Services with these customers should be simple to set up, while allowing a level of remote management and troubleshooting to address support inquiries quickly. The Cisco 880 Series meets the requirements of small offices and managed services providers.

Figure 2 shows deployment scenarios.

Figure 2.   Deployment Scenarios
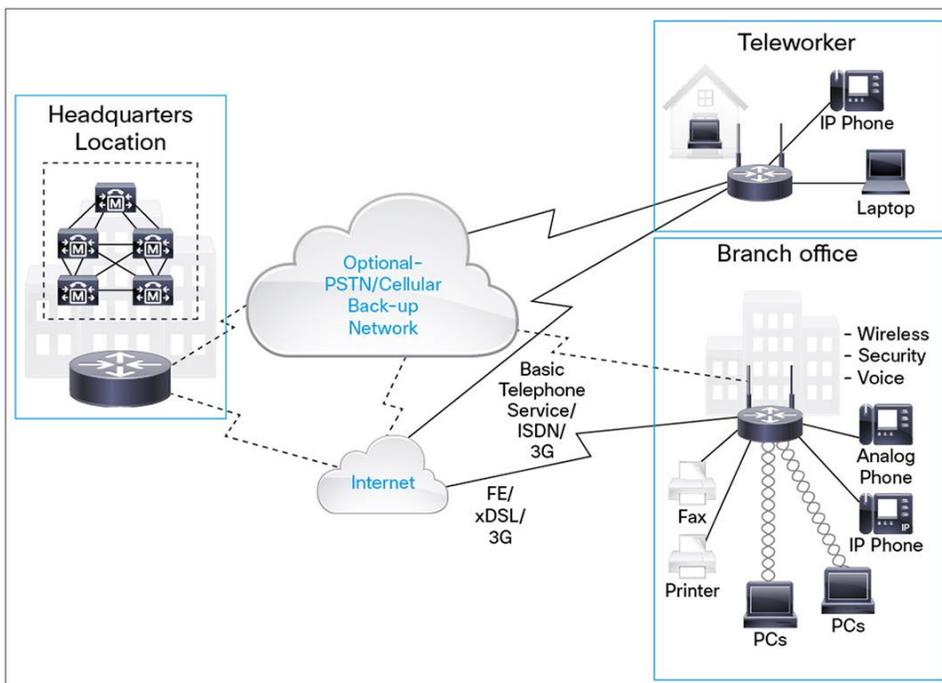
Applications

The Cisco 880 Series is ideally suited for deployment in a small office or in a small office that is part of a large network, most often with a secure VPN connection. These types of offices can include the following:

- Small remote office: The Cisco 880 Series can connect users in a small remote office, such as an insurance, lawyer, or sales office. When connecting to the main office, VPN encryption and integrated security such as firewall and intrusion prevention protect the network at the perimeter. The Cisco 880 with the Cisco Unified Border Element Series can also support connection to SIP trunking voice-over-IP (VoIP) services the service provider offers. Additionally, IT managers can centrally manage the remote site to quickly troubleshoot any network problems. For added reliability, customers can also use the integrated 3G or ISDN backup or connect through an external modem if the primary broadband link fails. Integrated secure unified WLAN connectivity simplifies the deployment and management devices at the remote site. Redundant WAN links offer business continuity, enabling nondisruptive business operation.

- Virtual office: The Cisco 880 Series is ideal for corporate teleworkers who have a mix of broadband connection types such as DSL, 3G, and Metro Ethernet. The Cisco 880 Voice Gateway and SRST Series provides a secure virtual office with all the collaborative services such as data, voice, and fax services. SRST helps ensure voice services are operational in case of WAN link failure, and redundant WAN links help ensure business continuity. QoS features in the Cisco 880 Series allow for connection of an IP or analog phone to the router, giving voice traffic precedence over data applications. Integrated WLAN support in the Cisco 880 Series helps ensure that if wireless connectivity is used it is secure. (Refer to the Cisco Virtual Office Solution, http://www.cisco.com/go/cvo, for more information.)

- Remote call-center agent: Similar to teleworking applications, this solution extends the Cisco IP Contact Center solution for telephone call-center agents to remote sites. With a high-quality, secure connection through the Cisco 880 Series, call-center agents can be dispersed away from costly call-center facilities while maintaining secure and productive voice and data access in their homes. SRST and business-continuity solutions in the Cisco 880 Series provide reliability and continuous business operation. Alternatively, the remote call-center agent can be provided with SIP trunking service with service demarcation provided by Cisco Unified Border Element features, and the central call center can forward calls to the remote call-center agent through the remote-office SIP trunk.

- Retail VPN: Retail stores migrating from dialup connections for point-of-sale transactions can use the Cisco 880 Series to take advantage of low-cost broadband access with the required security to comply with payment-card-industry (PCI) and other data security requirements. They can then add multiple devices and applications to the store network to take advantage of the increased bandwidth and also incorporate optional WLAN support to enable secure mobility and enhance productivity.

- Managed services: Service providers and value-added resellers can use the Cisco 880 Series as a platform to offer differentiated business-class security, voice, and WLAN services for small business customers. With built-in analog and digital voice ports and the ability to upgrade to a five-user Cisco Unified Communications Manager Express IP PBX, service providers can now offer all the Cisco Unified Communications benefits to small and medium-sized businesses. The SIP trunking connectivity features of the Cisco 880 with the Cisco Unified Border Element Series Router can provide the high-quality VoIP service needed through the service provider cloud.

Features and Benefits

Table 3 lists the features and benefits of the Cisco 880 Series Integrated Services Routers.

Table 3. Features and Benefits of Cisco 880 Series Routers

Feature	Benefit
Increased performance to run concurrent services	• Cisco 880 Series Router performance allows customers to take advantage of broadband network speeds while running secure, concurrent data, voice, video, and wireless services.
Enhanced security	• An integrated stateful and application inspection firewall provides network perimeter security. • High-speed IPsec 3DES and AES encryption offers data privacy over the Internet. • Intrusion prevention enforces security policy in a larger enterprise or service provider network. • Content filtering offers category-based URL classification and blocking, thus providing increased productivity and better use of company resources.
WAN diversity	• Multiple WAN links include Fast Ethernet, multimode VDSL2/ADSL2/2+, multimode G.SHDSL, 3G, and ISDN.
Redundant WAN links	• Redundant WAN links provide business continuity and WAN diversity.
Four-port 10-/100-Mbps managed switch	• The Cisco 880 Series allows for connection of multiple devices in a small office, with the ability to designate a port as the network edge. • An optional external PoE adapter powers IP phones and external access points to avoid individual power supplies or power injectors. • VLANs allow for secure segmentation of network resources.
CON/AUX port	• A single dual-purpose port provides direct connection to a console or external modem for management or backup access points.
Optional 802.11g/n access point	• This broadband router offers a secure integrated access point in a single device. • This integrated Wi-Fi access point offers IEEE 802.11n 2.0 standard support for mobile access to high-bandwidth data, voice, and video applications through the use of multiple-input, multiple-output (MIMO) technology that provides increased throughput, reliability, and predictability. • The Cisco 880 Series supports both autonomous and unified modes.
Real-time clock	• A built-in real-time clock maintains an accurate date and time for applications that require an accurate time stamp, such as logging and digital certificates.
Voice gateway (supported on 881V and 887VA-V voice models)	• The Cisco 881V and 887VA-V models provide voice gateway functions with the ability to upgrade to a five-user Cisco Unified Communications Manager Express or five-user SRST).
SRST (supported on SRST voice models)	• SRST provides business continuity for voice when the WAN link fails by switching calls to the PSTN.
Cisco Unified Border Element (supported on Cisco Unified Border Element voice models)	• Support for SIP trunk connectivity, including demarcation and interworking, is based on a Cisco Unified Border Element feature license. • Transcoding of media is **not** supported on the Cisco 880 Series Cisco Unified Border Element feature set.
Cisco Configuration Professional	• Cisco Configuration Professional uses smart wizards and task-based tutorials, which resellers and customers can use to quickly and easily deploy, configure, and monitor a Cisco access router without requiring knowledge of the Cisco IOS Software command-line interface (CLI).

Unified wireless management	• Configuration and management of access points is automated and simplified without manual intervention.
	• A unified hybrid remote-edge access point (HREAP) provides the following:
	  ◦ WLAN services to remote and branch offices without deploying a WLAN controller at each location
	  ◦ Central configuration and control of unified WLAN services for remote offices through a WAN link
	  ◦ Flexibility in setting up wireless access at remote locations by specifying how traffic is to be bridged or tunneled

Summary

Cisco 880 Series Integrated Services Routers combine increased network performance with advanced security to allow small-office customers to get the most from their broadband connections for both data and voice applications. With models supporting different broadband technologies such as DSL, 3G, and Metro Ethernet, the Cisco 880 Series can be deployed at any small-office location. Optional integrated 802.11g/n wireless capabilities provide true business-class WAN and WLAN access in a single solution. With the Cisco 880 Series, enterprise IT managers and service providers can take advantage of a solution that can be easily set up at the remote site and can be centrally managed to reduce ongoing operational costs.

Product Specifications

Cisco IOS Software Support

Table 4 lists the minimum Cisco IOS Software releases and the default Cisco IOS Software feature sets.

Table 4. Cisco IOS Software Releases and Default Cisco IOS Software Feature Sets

Models	Universal Image	Default Feature Set	First Cisco IOS Software Release
Cisco 881	Data	Advanced Security	12.4(20)T
Cisco 881 SEC, Embedded 3G	Data	Advanced IP	12.4(20)T, 15.1(4)M
Cisco 881V	Voice	Advanced IP*	15.1(4)M
Cisco 881 SRST	Voice	Advanced IP*	12.4(20)T
Cisco 886VA and 887VA	Data	Advanced Security	15.1(2)T
Cisco 886VA and 887VA WLAN	Data	Advanced Security	15.1(3)T
Cisco 886VA and 887VA Embedded 3G	Data	Advanced Security	15.1(4)M
Cisco 886 and 887	Data	Advanced Security	12.4(22)YB3
Cisco 886 and 887 SEC, 3G	Data	Advanced IP	12.4(22)YB3
Cisco 887V	Data	Advanced Security	12.4(22)YB, 12.4(24)T
Cisco 887V SEC, 3G	Data	Advanced IP	12.4(22)YB, 12.4(24)T
Cisco 887V WLAN	Data	Advanced Security	15.0(1)M
Cisco 887V 3G	Data	Advanced IP	15.0(1)M
Cisco 887VA-V	Voice	Advanced IP	15.1(4)M
Cisco 887VA-V-W	Voice	Advanced IP	15.1(4)M
Cisco 888	Data	Advanced Security	12.4(20)T
Cisco 888 SEC, 3G	Data	Advanced IP	12.4(20)T, 15.1(4)M
Cisco 888 SRST	Voice	Advanced IP*	12.4(20)T
Cisco 888E	Data	Advanced Security	15.1(1)T
Cisco 888E Embedded 3G	Data	Advanced IP	15.1(4)M
Cisco 888EA	Data	Advanced Security	15.2(2)T
Cisco 881, 886VA, 887VA, 888, 888E with Cisco Unified Border Element	Voice	Advanced IP	15.1(4)M
C881-K9, C886-K9, C886VAJ-K9, C887VA-K9, and C887VA-M-K9	Data	Advanced Security	15.3(3)M2, 15.4(1)T
Access-point software (ap801)	-	-	12.4(10b)JA3

* Cisco 881V, 887VA-V, 881 SRST, and 888 SRST run the Cisco 880 voice universal image, which shares the same data and security features as the Advanced IP feature sets of Cisco 880 data models.

Tables 5 and 6 list Cisco IOS Software features of the Cisco 880 Series.

Table 5. Cisco IOS Software Features on Cisco 880 Series: Advanced Security Feature Set (Default)

Feature	Description
IP and IP services features	• Routing Information Protocol Versions 1 and 2 (RIPv1 and RIPv2) • Generic routing encapsulation (GRE) and Multipoint GRE (MGRE) • Cisco Express Forwarding • Standard 802.1d Spanning Tree Protocol • Layer 2 Tunneling Protocol (L2TP) • Network Address Translation (NAT) • Dynamic Host Configuration Protocol (DHCP) server, relay, and client • Dynamic Domain Name System (DNS) • DNS Proxy • DNS Spoofing • Access control lists (ACLs)
ATM features (ADSL and G.SHDSL ATM models only)	• ATM Variable Bit Rate real-time (VBR-rt) • ATM Unspecified Bit Rate (UBR), Constant Bit Rate (CBR), and Variable Bit Rate non-realtime (VBR-nrt) • ATM operations, administration, and maintenance (OA&M) support for F5 Continuity Check; segment and end-to-end loopback; and Integrated Local Management Interface (ILMI) support • TX ring adjustment • Virtual-circuit (VC) bundling • Per-VC queuing • Per-VC traffic shaping • 10 ATM virtual circuits on the 886, 887, and 888 models • 4 ATM virtual circuits on the 886VA and 887VA models • RFCs 1483 and 2684 • Point-to-Point Protocol over ATM (PPPoA) • PPP over Ethernet (PPPoE)
Switch features	• Auto Media Device In/Media Device Cross-Over (medium dependent interface (MDI)/MDI crossover (MDX) • Eight 802.1Q VLANs • MAC filtering • Two-port 802.3af and Cisco compliant PoE • Switched Port Analyzer (SPAN) • Storm Control • Smartports
Security features	Secure connectivity: • SSL VPN for secure remote access • Hardware-accelerated DES, 3DES, AES 128, AES 192, and AES 256 • Public-key-infrastructure (PKI) support • 20 IPsec tunnels • Cisco Easy VPN Client and Server • NAT transparency Zone-based policy firewall: • Stateful inspection transparent firewall • Advanced application inspection and control • Secure HTTP (HTTPS), FTP, and Telnet authentication proxy • Dynamic and static port security

Feature	Description
QoS features	• Low-Latency Queuing (LLQ) • Weighted Fair Queuing (WFQ) • Class-Based WFQ (CBWFQ) • Class-Based Traffic Shaping (CBTS) (on Fast Ethernet WAN ports and DSL ports in Packet Transport Mode [PTM] only) • Class-Based Traffic Policing (CBTP) • Policy-Based Routing (PBR) • Class-Based QoS MIB • Class of service (CoS)-to-differentiated services code point (DSCP) mapping
Management features	• Cisco Configuration Professional • Cisco Configuration Express • Cisco Configuration Engine support • Cisco AutoInstall • IP service-level agreement (SLA) • Cisco IOS Embedded Event Manager (EEM) • CiscoWorks • Cisco Security Manager • Telnet, Simple Network Management Protocol Version 3 (SNMPv3), Secure Shell (SSH) Protocol, CLI, and HTTP management • RADIUS and TACACS+ • Out-of-band management with ISDN S/T port or external modem through virtual auxiliary port • Cisco WCS for management of unified access points in models supporting WLAN
High-availability features	• Virtual Router Redundancy Protocol (VRRP) (RFC 2338) • Hot Standby Router Protocol (HSRP) • Multigroup HSRP (MHSRP) • Dial backup with external modem through virtual auxiliary port • Dial backup with ISDN S/T port (select DSL models only) • 3G backup (3G models only)
Number of recommended users	20

Table 6.   Cisco IOS Software Features on Cisco 880 Series: WLAN Features (Available with Wireless Option)

Feature	Description
WLAN hardware	• IEEE 802.11n draft 2.0 standards-based access point with 802.11 b/g compatibility • Automatic rate selection for 802.11g/n • Captive omnidirectional 2-dBi gain dipole antennas • 2 x 3 MIMO radio operation • Removable antennas on Cisco 881W models • Wi-Fi 802.11n Draft v2.0 certified
WLAN software features	• Autonomous or unified access point • Cisco WCS support for monitoring of autonomous-mode access points • Option to maximize throughput or maximize range • Software-configurable transmit power • Radio roles, including access point, root bridge, nonroot bridge, and workgroup bridge • Wi-Fi Multimedia (WMM) certification • Traffic specifications (TSPEC) Call Admission Control (CAC) to ensure voice quality is maintained • Unscheduled Automatic Power Save Delivery (UPSD) to reduce latency

Feature	Description
WLAN security features	- Standard 802.11i - WPA and AES (WPA2) - EAP authentication: Cisco LEAP, PEAP, Extensible Authentication Protocol Transport Layer Security (EAP TLS), Extensible Authentication Protocol-Flexible Authentication via Secure Tunneling (EAP-FAST), Extensible Authentication Protocol-Subscriber Information Module (EAP-SIM), Extensible Authentication Protocol-Message Digest Algorithm 5 (EAP-MD5), and Extensible Authentication Protocol-Tunneled TLS (EAP-TTLS) - Static and dynamic Wired Equivalent Privacy (WEP) - Temporal Key Integrity Protocol/Simple Security Network (TKIP/SSN) encryption - MAC authentication and filter - User database for survivable local authentication using LEAP and EAP-FAST - Configurable limit to the number of wireless clients - Configurable RADIUS accounting for wireless clients - Pre-shared keys (PSKs) (WPA-small office or home office [WPA-SOHO])
Certifications	
Service set identifiers (SSIDs)	16
Wireless VLANs	8
Encrypted wireless VLANs	8
Multiple broadcast service set identifiers (MBSSIDs)	16

Cisco IOS Software Advanced IP Services Feature Set (Optional Software Upgrade)

The Advanced IP Services software image has all the features of the Advanced Security software image with the addition of the features listed in Tables 7 through 10.

Table 7. Cisco IOS Software Features on Cisco 880 Series: Advanced IP Services Feature Set (Optional Software Upgrade)

Feature	Description
IP and IP services features	- IPv4 and IPv6 Multicast - Open Shortest Path First (OSPF) - Border Gateway Protocol (BGP) - Enhanced Interior Gateway Routing Protocol (EIGRP) - Virtual Route Forwarding (VRF) Lite - Next Hop Resolution Protocol (NHRP) - Layer 2 Tunneling Protocol Version 3 (L2TPv3) - Bidirectional Forwarding Detection (BFD) - Web Cache Communication Protocol (WCCP)
Switch features	- Internet Group Management Protocol Version 3 (IGMPv3) snooping - 802.1x
Security features	Secure connectivity: - DMVPN - Tunnel-less Group Encrypted Transport VPN - IPsec stateful failover - VRF-aware IPsec - IPsec over IPv6 - Adaptive control technology - SIP application layer gateway Cisco IOS Firewall: - Firewall stateful failover - VRF-aware firewall

Feature	Description
	Content Filtering: • Subscription-based content filtering with Trend Micro • Support for Websense and SmartFilter • Cisco IOS Software black and white lists Integrated threat control: • IPS • Control Plane Policing • Flexible Packet Matching • Network foundation protection
QoS features	• Class-Based Weighted Random Early Detection (CBWRED) • Network-Based Application Recognition (NBAR) • Link fragmentation and interleaving (LFI) • Resource Reservation Protocol (RSVP) • Real-Time Transport Protocol (RTP) header compression (cRTP) • Differentiated Services (DiffServ) • QoS preclassify and prefragmentation • Hierarchical QoS (HQoS)
Metro Ethernet features	• Ethernet Operations, Administration, and Maintenance (Ethernet OAM) • Ethernet Local Management Interface (Ethernet LMI) • Hierarchial QOS (HQoS)
IPv6 features	• IPv6 addressing architecture • IPv6 name resolution • IPv6 statistics • IPv6 translation: Transport packets between IPv6-only and IPv4-only endpoints (NAT-PT) • Internet Control Message Protocol Version 6 (ICMPv6) • IPv6 DHCP
Unified WLAN management	Unified access-point features: • Supported by wireless LAN controller and Cisco WCS • Configurable local or central switching for HREAP mode • Radio management through Cisco WCS • Transparent roaming with Mobility Groups

Table 8.   Cisco IOS Software Features on Cisco 880V Series: Advanced IP Services Feature Set

Feature	Description
Cisco Voice Gateway	4 FXS ports and 2 Basic Rate Interface (BRI) port for PBX connectivity; 1 FXO port is available on the Cisco 881V SKU
Cisco Unified Communications Manager Express (Cisco UCME)/SRST version	Ability to upgrade to 5-user license of Cisco UCME/SRST; Version 8.6 and later are supported
Call-control signaling	H.323 Versions 1, 2, 3, and 4; Media Gateway Control Protocol (MGCP) 0.1 and 1.0; Skinny Client Control Protocol (SCCP); and SIP call-control protocols are supported.
ITU standard voice codecs	G.711, G.729, G.729a/b, G.723.1, G.726, and G.728, which are standards-based compression technologies allowing transmission of voice across IP, are supported. The G.711 standard employs 64-kbps pulse code modulation (PCM) using either mu-law or a-law. Other codecs employ lower bit rates.
Cisco Unified Communications Manager support	For SRST features for IP phones, refer to the SRST data sheet at: http://www.cisco.com/en/US/products/sw/voicesw/ps2169/products_data_sheets_list.html. Cisco Unified Communications Manager support for analog and digital ports come with Releases 7.1(5), 8.5(1), and 8.6(2).

Feature	Description
Telephony interface signaling support	Cisco 880 V supports the following signaling protocols: • FXS loop-start and ground-start signaling • FXO • Inbound signaling (such as dual-tone multifrequency [DTMF] and multifrequency support) • BRI QSIG
Voice features	• Echo cancellation: This feature cancels echo on tail circuits up to 64 msec (configurable tail length). • Silence suppression and voice activity detection (VAD): Bandwidth is used only when someone is speaking. During silent periods of a phone call, bandwidth is available for data traffic. • Comfort-noise generation: This feature reassures the phone user that the connection is being maintained, even when no voice packets are being transmitted. • Caller ID support: Per-port caller ID (with per-call unblocking) is configurable over analog FXS. • Dial-plan mapping: This feature simplifies configuration and management through automatic mapping of dialed phone numbers to IP addresses.
Voice port-specific features	• FXS: FXS provides battery polarity reversal detection and initiation for disconnect supervision and far-end answer supervision. • ISDN BRI network side and phantom power: The BRI port provides the ability to connect a private branch exchange (PBX) or private automatic branch exchange (PABX) configured as user side directly to the router. It also provides phantom power to accommodate equipment that requires it. • LED indicators show voice-processing resources and port status.
Fax and modem	• Fax and modem pass-through allows fax and modem traffic to pass through a voice port. • Fax Relay provides a more robust protocol for fax transmission over packet networks. It also supports the T.37 and T.38 fax protocols.
High-performance flexible digital-signal-processor (DSP) architecture	• Channel capacity: Cisco 880V supports up to four voice channels. • Flexible DSP architecture: There is no need to specify codec complexity at configuration. An appropriate codec is dynamically selected when a call is established, while DSP resources are allocated optimally. • Feature upgrades: The DSP architecture allows for addition of new features through simple code updates.

Table 9.   Cisco IOS Software Features on Cisco 880 SRST Series: Advanced IP Services Feature Set

Feature	Description
Cisco SRST version	SRST 7.0 and later are supported.
Call-control signaling	H.323 Versions 1, 2, 3, and 4, Media Gateway Control Protocol MGCP 0.1 and 1.0, Skinny Client Control Protocol (SCCP), and SIP call-control protocols are supported.
ITU standard voice codecs	G.711, G.729, G.729a/b, G.723.1, G.726, and G.728, which are standards-based compression technologies allowing transmission of voice across IP, are supported. The G.711 standard employs 64-kbps pulse code modulation (PCM) using either mu-law or a-law. Other codecs employ lower bit rates.
Cisco Unified Communications Manager support	For SRST features for IP phones, refer to the SRST data sheet at: http://www.cisco.com/en/US/products/sw/voicesw/ps2169/products_data_sheets_list.html. Cisco Unified Communications Manager support for analog and digital ports comes with Releases 6.1(3), 7.0(2), and 7.1(3).
Telephony interface signaling support	Cisco 880 SRST supports the following signaling protocols: • FXS loop-start and ground-start signaling • FXO • Inbound signaling (such as dual-tone multifrequency [DTMF] and multifrequency support) • BRI QSIG
Voice features	• Echo cancellation: This feature cancels echo on tail circuits up to 64 msec (configurable tail length). • Silence suppression and voice activity detection (VAD): Bandwidth is used only when someone is speaking. During silent periods of a phone call, bandwidth is available for data traffic. • Comfort-noise generation: This feature reassures the phone user that the connection is being maintained, even when no voice packets are being transmitted. • Caller ID support: Per-port caller ID (with per-call unblocking) is configurable over analog FXS. • Dial-plan mapping: This feature simplifies configuration and management through automatic mapping of dialed phone numbers to IP addresses.

Feature	Description
Voice port-specific features	• FXS: FXS provides battery polarity reversal detection and initiation for disconnect supervision and far-end answer supervision.
	• ISDN BRI network side and phantom power: The BRI port provides the ability to connect a private branch exchange (PBX) or private automatic branch exchange (PABX) configured as user side directly to the router. It also provides phantom power to accommodate equipment that requires it.
	• LED indicators show voice-processing resources and port status.
Fax and modem	• Fax and modem pass-through allows fax and modem traffic to pass through a voice port.
	• Fax Relay provides a more robust protocol for fax transmission over packet networks. It also supports the T.37 and T.38 fax protocols.
High-performance flexible digital-signal-processor (DSP) architecture	• Channel capacity: Cisco 880 SRST supports up to four voice channels.
	• Flexible DSP architecture: There is no need to specify codec complexity at configuration. An appropriate codec is dynamically selected when a call is established, while DSP resources are allocated optimally.
	• Feature upgrades: The DSP architecture allows for addition of new features through simple code updates.

Table 10.   Cisco IOS Software Features on Cisco 880 Series with Cisco Unified Border Element: Advanced IP Services Feature Set

Feature	Description
Cisco Unified Border Element version	Cisco Unified Border Element 7.0 and later are supported.
Call-control signaling	H.323 Versions 1, 2, 3, and 4; MGCP 0.1 and 1.0; SCCP; and SIP call-control protocols are supported.
ITU standard voice codecs	G.711, G.729, G.729a/b, G.723.1, G.726, and G.728, which are standards-based compression technologies that allow transmission of voice across IP, are supported. The G.711 standard employs 64-kbps pulse code modulation (PCM) using either mu-law or a-law. Other codecs employ lower bit rates.
Cisco Unified Communications Manager support	For SRST features for IP phones, refer to the SRST data sheet at: http://www.cisco.com/en/US/products/sw/voicesw/ps2169/products_data_sheets_list.html. Cisco Unified Communications Manager support for analog and digital ports comes with Releases 6.1(3), 7.0(2), and 7.1(3).
Telephony interface signaling support	Cisco 880 SRST supports the following PSTN trunk signaling protocols: • FXS loop-start and ground-start signaling • FXO • Inbound signaling (such as dual-tone multifrequency [DTMF] and multifrequency support) • BRI QSIG Cisco 880 Cisco Unified Border Element supports the following VoIP trunk signaling protocols: • Up to 15 SIP-to-SIP sessions. (no H.323 support) **Note:** The Cisco 880 with Cisco Unified Border Element does **not** include DSP feature support such as transcoding or transrating. **Note:** The Cisco 880 with Cisco Unified Border Element does **not** support concurrent operation of SRST or Cisco Unified Communications Manager Express.
Voice features	• Echo cancellation: This feature cancels echo on tail circuits up to 64 msec (configurable tail length).
	• Silence suppression and VAD: Bandwidth is used only when someone is speaking. During silent periods of a phone call, bandwidth is available for data traffic.
	• Comfort-noise generation: This feature reassures the phone user that the connection is being maintained, even when no voice packets are being transmitted.
	• Caller ID support: Per-port caller ID (with per-call unblocking) is configurable over analog FXS.
	• Dial-plan mapping: This feature simplifies configuration and management through automatic mapping of dialed phone numbers to IP addresses.
Voice port-specific features	• FXS: FXS provides battery polarity reversal detection and initiation for disconnect supervision and far-end answer supervision.
	• ISDN BRI network side and phantom power: The BRI port provides the ability to connect a PBX or PABX configured as user side directly to the router. It also provides phantom power to accommodate equipment that requires it.
	• LED indicators show voice-processing resources and port status.

System Specifications

Tables 11 and 12 list the system specifications for the Cisco 880 Series Routers.

Table 11.   System Specifications

Feature	Description
Default and maximum flash memory	• 128 MB on Cisco 880 Series data, embedded 3G wireless WAN (WWAN), and Cisco Unified Border Element models • 256 MB on Cisco 880 Series Voice and SRST models • 256 MB on newer C881-K9, C886VA-K9, C886VAJ-K9, C887VA-K9 and C887VA-M-K9 models
WAN	• Fast Ethernet • Multimode VDSL2 and ADSl2/2+ over ISDN with ISDN backup • Multimode VDSL2 and ADSl2/2+ over basic telephone service • ADSL2/2+ over ISDN with ISDN backup • ADSL2/2+ over basic telephone service with ISDN backup • VDSL2 over basic telephone service with ISDN backup • Multimode G.SHDSL (2- and 4-wire support) with ISDN backup • Fast Ethernet and 3G WAN for Code Division Multiple Access (CDMA) and high-speed downlink packet access (HSDPA)
LAN switch	Managed 4-port 10/100BASE-T with autosensing Media Device In/Media Device Cross-Over (MDI/MDX) for auto crossover
Standard 802.11g/n access point based on IEEE 802.11n draft 2.0 standard	Optional on all models
Console or auxiliary port	RJ-45
One USB 1.1 port for advanced security features such as security tokens or USB flash memory	• One USB 1.1 port on Cisco 880 Series Routers • USB devices supported: ◦ USB eTokens ◦ USB flash memory **Note:** The USB 1.1 port cannot be used for connecting external devices other than those specified at: http://www.cisco.com/en/US/prod/collateral/modules/ps6247/product_data_sheet0900aecd80232473.html.
ISDN BRI S/T	Available on: • Cisco 886, 886VA, 887, 887V, 888, and 888EA for out-of-band management and dial backup or primary
3G express card modem	Available on: • Cisco 881G, 886G, 887G, 887VG, and 888G for out-of-band management and backup or primary • Cisco 888G for out-of-band management and backup or primary **Note:** Cisco 887VG currently ships with HSPA modem only.
External power supply	Universal 100 to 240 VAC input; 60W, 12 VDC output
Physical dimensions and weight	Product dimensions, nonwireless models (H x W x D): • 1.9 x 12.8 x 9.8 in. (48 x 325 x 249 mm) (includes rubber feet) • 1.75 x 12.8 x 9.8 in. (44 x 325 x 249 mm) (without rubber feet) Product dimensions, wireless models (H x W x D): • 1.9 x 12.8 x 10.4 in. (48 x 325 x 264 mm) (includes rubber feet) • 1.75 x 12.8 x 10.4 in. (44 x 325 x 264 mm) (without rubber feet; excludes antennas) • Weight: 5.5 lb (2.5 kg) maximum
Power	Product power specifications: • AC input voltage: 100 to 240 VAC • Frequency: 50 to 60 Hz • Maximum output power: 60W • Output voltages: 12 VDC Optional internal PoE with external adapter: • Maximum output power: 80W • External output voltage: 48 VDC

Feature	Description
Approvals and compliance	Emissions: • 47 CFR Part 15: 2006 • CISPR22: 2005 • EN300386: V1.3.3: 2005 • EN55022: 2006 • EN61000-3-2: 2000 [Inc amd 1 and 2] • EN61000-3-3: 1995 [+ amd 1: 2001] • ICES-003 Issue 4: 2004 • KN 22: 2005 • VCCI: V-3/2006.04 Immunity: • CISPR24: 1997 [+ amd 1 and 2] • EN300386: V1.3.3: 2005 • EN50082-1: 1992 • EN50082-1: 1997 • EN55024: 1998 [+ amd 1 and 2] • EN61000-6-1: 2001 The following are supported on teleworker models: • AS/NRZ 3548: 1992 Class B • CFR 47 Part 15 Class B • EN60555-2 Class B • EN55022 Class B • ICES-003, Issue 2, Class B, April 1997S
Certifications	

Environmental operating range	• Nonoperating temperature: -4 to 149°F (-20 to 65°C)
	• Nonoperating humidity: 5 to 95% relative humidity (noncondensing)
	• Nonoperating altitude: 0 to 15,000 ft (0 to 4570m)
	• Operating temperature
	  ◦ At sea level: 32 to 104°F (0 to 40°C)
	  ◦ Up 10,000 ft: 32 to 77°F (0 to 25°C)
	  ◦ Derating 2.7°F/10,000 ft (1.5°C/1,000 ft)
	• Operating humidity: 10 to 85% relative humidity (noncondensing)
	• Operating altitude: 0 to 10,000 ft (0 to 3000m)

Table 12.   Wireless LAN and 3G Specifications

SRST Specifications	
SRST specifications	• Packet fax and voice DSP module PVDM2-16 FXS voice-port specifications: • Tip and ring interfaces for each FXS port (subscriber line interface card [SLIC]) • Ring voltage • Ring frequency • Ring waveform • Ring load • Ringer Equivalence Number (REN) • Loop resistance • On- and off-hook characteristics • On-hook voltage (tip and ring) • Off-hook current • RJ-11 FXS port terminating impedance option BRI voice-port specifications: • Interface type • Compliance • Safety conformance • ITU compliance • Interface • ISDN digital access • Physical connector • Phantom power
Wireless Specifications	
Radio frequency band	• 2.4 GHz
Data rates supported	• 802.11b: 1, 2, 5.5, 6, 9, and 11 Mbps • 802.11g: 1, 2, 5.5, 6, 9, 11, 12, 18, 24, 36, 48, and 54 Mbps • 802.11n: 1, 2, 5.5, 6, 9, 11, 12, 18, 24, 36, 48, 54, and m0-m15
Maximum transmit power (2-channel aggregate)	**Note:** Maximum power setting is subject to changes by channel and by region, depending on regulations. • 802.11b 20 dBm • 802.11g 17 dBm • 802.11n 16 dBm
3G specifications	
Data rates	• CDMA: 850 and 1900 MHz • HSDPA: 850, 900, 1900, and 2100 MHz

DSL Specifications

Tables 13 through 21 list the DSL features specifications and DSL access multiplexer (DSLAM) interoperability support for the Cisco 880 Series Routers. For more information and details about DSLAM and line-card interoperability, please refer to the following document: What Is Cisco ISR and ISR G2 xDSL Interoperability?

Table 13.   DSL Features Specifications

DSL Specifications	

Multimode DSL (VDSL2 and ADSL2/2+)
(886VA and 887VA models)
	• Broadcom Chipset
	• Dying gasp
	• IEEE 802.1q VLAN tagging
	• Independent DSL firmware loading
	VDSL2
	• ITU G.993.2 (VDSL2)
	• 997 and 998 band plans
	• VDSL2 profiles: 8a, 8b, 8c, 8d, 12a, 12b, and 17a
	• U0 band support (25-276 kHz)
	• Ethernet PTM mode only based on IEEE 802.3ah 64/65 octet encapsulation
	• DELT Diagnostics Mode
	ADSL2/2+
	• ADSL over basic telephone service with Annex A and Annex B ITU G. 992.1 (ADSL), G.992.3 (ADSL2), and G.992.5 (ADSL2+)
	• ADSL over basic telephone service with Annex M (extended upstream bandwidth) G.992.3 (ADSL2) and G.992.5 (ADSL2+)
	  ◦ Cisco 887VA-M is optimized for PSD Mask EU-64 M9.
	  ◦ Cisco 887VA-M supports UK Annex M.
	• G.994.1 ITU Ghs
	• Reach-extended ADSL2 (G.922.3) Annex L for increased performance on loop lengths greater than 16,000 feet from central office
	• T1.413 ANSI ADSL DMT issue 2 compliance
	• DSL Forum TR-067 conformity
	• Inpulse Noise Protection (INP) and extended INP
	• Downstream Power Back-Off (DPBO)
	• ATM mode only

ADSL specifications
(886 and 887 models)
	• ST-Microelectronics 20190 Chipset
	• ADSL over basic telephone service with Annex A and Annex B ITU G. 992.1 (ADSL), G.992.3 (ADSL2), and G.992.5 (ADSL2+)
	• ADSL over basic telephone service with Annex M (extended upstream bandwidth) G.992.3 (ADSL2) and G.992.5 (ADSL2+)
	  ◦ Cisco 887-M is optimized for PSD Mask EU-64 M9.
	  ◦ Cisco 887M supports UK Annex M only with Huawei 5300 DSLAM and its EADB line card with customer-premises-equipment (CPE) firmware Version 4.0.17.
	• G.994.1 ITU G.hs
	• Reach-extended ADSL2 (G.922.3) Annex L for increased performance on loop lengths greater than 16,000 feet from central office
	• T1.413 ANSI ADSL DMT issue 2 compliance
	• DSL Forum TR-067 conformity
	• Does not provide interoperability with carrierless amplitude modulation/phase modulation (CAP)-based ADSL lines
	• Dying gasp
	• IEEE 802.1q VLAN tagging with Cisco IOS Software Release 15.1(1)T or later

DSL Specifications	
VDSL2 specifications (887V models)	• Broadcom Chipset • ITU G.993.2 (VDSL2) over basic telephone service only • 997 and 998 band plans, over basic telephone service only • VDSL2 profiles supported: 8a, 8b, 8c, 8d, 12a, 12b, and 17a • U0 band support (25276 kHz) • Ethernet PTM mode only based on IEEE 802.3ah 64/65 octet encapsulation • DELT Diagnostics Mode • IEEE 802.1q VLAN tagging
G.SHDSL (ATM mode) specifications (Cisco 888)	• Conexant/Ikanos Chipset • 2- and 4-wire modes • Symmetrical WAN speeds up to 2.304 Mbps over a single copper pair and up to 4.608 Mbps over two copper pairs using ITU-T G.991.2 Annex A and Annex B • Wetting current (Section A.5.3.3 of G.991.2) • Dying gasp; uses power status bit (Section 7.1.2.5.3 of G.991.2) for signaling
G.SHDSL (EFM mode) specifications (Cisco 888E)	• Conexant/Ikanos Chipset • 2-wire mode • Symmetrical WAN speeds up to 2.304 Mbps over a single copper pair using ITU-T G.991.2 Annex A and Annex B • Symmetrical WAN speeds from 768 kbps to 5.696 Mbps over a single copper pair using ITU-T G.991.2 Annex F and Annex G • Symmetrical WAN speeds up to 22.784 Mbps over four copper pairs using IEEE 802.3ah EFM bonding • Wetting current (Section A.5.3.3 of G.991.2) • Dying gasp; uses power status bit (Section 7.1.2.5.3 of G.991.2) for signaling • Rate adaption
Multimode G.SHDSL (EFM/ATM) specifications (Cisco 888EA)	• Lantiq Chipset • 4-pair support • Compliance with standard based on ITU Recommendation G.991.2 • Support for G.SHDSL Annexes A (U.S. signaling) and B (European signaling) • Support for Annexes F and G • Symmetrical WAN speeds up to 1 x 2304 kbps over single copper pair, up to 2 x 2304 kbps over two copper pairs, up to 3 x 2304 kbps over three copper pairs, and up to 4 x 2304 kbps over four copper pairs using ITU-T G.991.2 Annexes A and B • Symmetrical WAN speeds up to 1 x 5696 kbps over single copper pair, up to 2 x 5696 kbps over two copper pairs, up to 3 x 5696 kbps over three copper pairs, and up to 4 x 56964 kbps over four copper pairs using ITU-T G.991.2 Annexes F and G • Support for EFM bonding; supports up to four SHDSL pairs bonding • In ATM mode, support for maximum of 8 permanent virtual circuits (PVCs) • Support for dying gasp and wetting current • Support for point-to-point configuration • Support for 802.1Q, QinQ, trunk, and VLAN tagging • Support for ATM CoS and IP QoS features, 802.1P, and DSCP • Support for EFM (IEEE 802.3ah) OA&M • Ability to configure multiple G.SHDSL EFM EHWICs per Cisco 1921, 1941, 2900, and 3900 Series Routers • Compliance with single RJ-45 connector system requirements

Table 14.   Multimode DSL DSLAM Interoperability for Cisco 887VA

DSLAM	VDSL2 over Basic Telephone Service Line-Card Chipset
ZTE 9806	Broadcom
Huawei MA5600	Broadcom

Table 15.   Multimode DSL DSLAM Interoperability for Cisco 886VA

Siemens HIX 5300	Infineon
ECI 480	Infineon
Alcatel ASAM 7300	Globespan

Table 16.   ADSL-over-ISDN DSLAM Interoperability for Cisco 886

DSLAM	ADSL2/2+ over ISDN Line-Card Chipset
Siemens HIX 5300	Infineon
ECI 480	Infineon
Alcatel ASAM 7300	Globespan

Table 17.   ADSL over Basic Telephone Service DSLAM Interoperability for Cisco 887 and 887M

DSLAM	ADSL2/2+ over Basic Telephone Service Line-Card Chipset
Alcatel ASAM 7300	Broadcom (Annex A and Annex M)
ECI 480	Infineon (Annex A and Annex M)
Ericsson	Broadcom (Annex A and M)
Huawei 5600	Globespan (Annex A only)
Lucent Stinger	Globespan (Annex A and Annex M)

Table 18.   VDSL2 DSLAM Interoperability for Cisco 887V

DSLAM	VDSL2 over Basic Telephone Service Line-Card Chipset
ZTE 9806	Broadcom
Huawei MA5600	Broadcom

Table 19.   G.SHDSL DSLAM Interoperability for Cisco 888

DSLAM	G.SHDSL (2- and 4-Wire) Line-Card Chipset
ECI Hi-Focus SAM 480	Infineon
Alcatel ASAM7300	Conexant/Ikanos
Lucent Stinger	Conexant/Ikanos
Siemens Hix-5300	Infineon

Table 20.   G.SHDSL DSLAM Interoperability for Cisco 888E

DSLAM	G.SHDSL (2- and 4-Wire) Line-Card Chipset
Huawei 5603	Infineon
Alcatel ISAM 7302	Infineon
Hatteras HN4000e	Infineon

Table 21.   Multimode G.SHDSL DSLAM Interoperability for Cisco 888EA-K9

DSLAM	G.SHDSL (4-Pair) Line-Card Chipset
Huawei 5603	Infineon
Alcatel ISAM 7302	Infineon
Hatteras HN4000e	Infineon
Alcatel ASAM 7300	
Lucent Stringer	
ECI 480	
Alcatel ISAM_7330_FTTN	
Actelis ML698	

Ordering Information

Table 22 lists ordering information for the Cisco 880 Series. To place an order, visit the Cisco ordering homepage.

Table 22. Ordering Information

Part Number	Product Name
Ethernet	
C881-K9	Cisco 881 Ethernet Security Router
CISCO881-K9	Cisco 881 Ethernet Security Router
C881-CUBE-K9	Cisco 881 Ethernet Security Router with integrated CUBE Licenses
CISCO881-SEC-K9	Cisco 881 Ethernet Security Router with Advanced IP Services
CISCO881W-GN-A-K9	Cisco 881 Ethernet Security Router with 802.11n FCC Compliant
CISCO881W-GN-E-K9	Cisco 881 Ethernet Security Router with 802.11n ETSI Compliant
CISCO881W-GN-P-K9	Cisco 881 Ethernet Security Router with 802.11n Japan Compliant
Ethernet and 3G	
CISCO881G-K9	Cisco 881 Ethernet Security Router with 3G
CISCO881GW-GN-A-K9	Cisco 881 Ethernet Security Router with 3G, 802.11n FCC Compliant
CISCO881GW-GN-E-K9	Cisco 881 Ethernet Security Router with 3G, 802.11n ETSI Compliant
CISCO881G-S-K9	Cisco 881G Ethernet Security Router with 3G Sprint
CISCO881G-V-K9	Cisco 881G Ethernet Security Router with 3G Verizon
CISCO881G-A-K9	Cisco 881G Ethernet Security Router with 3G GSM North America
C881G-U-K9	Secure Router with WAN FE and Embedded 3.5G HSPA with SMS/GPS
C881G-S-K9	Secure Router with WAN FE and Embedded 3G EVDO Rev A with SMS/GPS for Sprint Networks
C881G-V-K9	Secure Router with WAN FE and Embedded 3G EVDO Rev A with SMS/GPS for Verizon Wireless Networks
C881G-B-K9	Secure Router with WAN FE and Embedded 3G EVDO Rev A with SMS/GPS for BSNL Networks
C881G+7-K9	Secure Router with WAN FE and Embedded 3.7G HSPA+ Release 7 with SMS/GPS
C881G+7-A-K9	Secure Router with WAN FE and Embedded 3.7G HSPA+ Release 7 with SMS/GPS for AT&T Networks
Multi-mode DSL (VDSL2 and ADSl2/2+)	
C886VA-K9	Cisco 886 VDSL/ADSL over ISDN Multi-mode Router
C886VAJ-K9	Cisco 886 VDSL/ADSL Annex J over ISDN Multi-mode Router
CISCO886VA-K9	Cisco 886VA router with VDSL2/ADSL2+ over ISDN
CISCO886VA-SEC-K9	Cisco 886VA Secure router with VDSL2/ADSL2+ over ISDN
C886VA-CUBE-K9	Cisco 886VA Secure router with VDSL2/ADSL2+ over ISDN and integrated CUBE licenses
C887VA-K9	Cisco 887 VDSL/ADSL over POTS Multi-mode Router
C887VAM-K9	Cisco 887 VDSL/ADSL Annex M over POTS Multi-mode Router
CISCO887VA-K9	Cisco 887VA router with VDSL2/ADSL2+ over POTS
CISCO887VA-SEC-K9	Cisco 887VA Secure router with VDSL2/ADSL2+ over POTS
CISCO887VA-M-K9	Cisco 887VA Annex M router
C887VA-CUBE-K9	Cisco 887VA router with VDSL2/ADSL2+ over ISDN and integrated CUBE licenses
Multi-mode DSL (VDSL2 and ADSl2/2+) with WLAN	
C886VA-W-E-K9	Cisco 886VA router with VDSL2/ADSL2+ over ISDN with 802.11n ETSI Compliant
C887VA-W-A-K9	Cisco 887VA router with VDSL2/ADSL2+ over POTS with 802.11n FCC Compliant
C887VA-W-E-K9	Cisco 887VA router with VDSL2/ADSL2+ over POTS with 802.11n ETSI Compliant
C887VAM-W-E-K9	Cisco 887VA Annex M router with 802.11n ETSI Compliant

Part Number	Product Name
Multi-mode DSL (VDSL2 and ADSI2/2+) with Embedded 3G	
C886VAG+7-K9	Secure Router with VDSL2/ADSL2+ over ISDN and Embedded 3.7G HSPA+ Release 7 with SMS/GPS
C887VAG-S-K9	Secure Router with VDSL2/ADSL2+ over POTS and Embedded 3G EVDO Rev A with SMS/GPS for Sprint Networks
C887VAG+7-K9	Secure Router with VDSL2/ADSL2+ over POTS and Embedded 3.7G HSPA+ Release 7 with GPS
C887VAMG+7-K9	Secure Router with Raiders VDSL2/ADSL2+ over POTS (Annex M) and Embedded 3.7G HSPA+ Release 7 with GPS
ADSL2/2+	
CISCO886-K9	Cisco 886 ADSL2/2+ Annex B Router
CISCO886-SEC-K9	Cisco 886 ADSL2/2+ Annex B Security Router with Advanced IP Services
CISCO886W-GN-E-K9	Cisco 886 ADSL2/2+ Annex B Router with 802.11n ETSI Compliant
CISCO887-K9	Cisco 887 ADSL2/2+ Annex A Router
CISCO887-SEC-K9	Cisco 887 ADSL2/2+ Annex A Security Router with Advanced IP Services
CISCO887W-GN-A-K9	Cisco 887 ADSL2/2+ Annex A Router with 802.11n FCC Compliant
CISCO887W-GN-E-K9	Cisco 887 ADSL2/2+ Annex A Router with 802.11n ETSI Compliant
CISCO887M-K9	Cisco 887 ADSL2/2+ Annex M Router
CISCO887MW-GN-E-K9	Cisco 887 ADSL2/2+ Annex M Router with 802.11n ETSI Compliant
ADSL2/2+ and 3G	
CISCO886G-K9	Cisco 886 ADSL2/2+ Annex B Router with 3G
CISCO886GW-GN-E-K9	Cisco 886 ADSL2/2+ Annex B Router with 3G, 802.11n ETSI Compliant
CISCO887G-K9	Cisco 887 ADSL2/2+ Annex A Router with 3G
CISCO887GW-GN-A-K9	Cisco 887 ADSL2/2+ Annex A Router with 3G, 802.11n FCC Compliant
CISCO887GW-GN-E-K9	Cisco 887 ADSL2/2+ Annex A Router with 3G, 802.11n ETSI Compliant
VDSL2	
CISCO887V-K9	Cisco 887 VDSL2 over POTS Router
CISCO887V-SEC-K9	Cisco 887 VDSL2 over POTS Security Router with Advanced IP Services
CISCO887VW-GNA-K9	Cisco 887V VDSL2 Router with 802.11n FCC Compliant
CISCO887VW-GNE-K9	Cisco 887V VDSL2 Router with 802.11n ETSI Compliant
VDSL2 and 3G	
CISCO887VG-K9	Cisco 887V VDSL2 Router with 3G
CISCO887VGW-GNA-K9	Cisco 887V VDSL2 Router with 3G, 802.11n FCC Compliant
CISCO887VGW-GNE-K9	Cisco 887V VDSL2 Router with 3G, 802.11n ETSI Compliant
G.SHDSL (ATM)	
CISCO888-K9	Cisco 888 G.SHDSL Router
C888-CUBE-K9	Cisco 888 G.SHDSL Router with integrated CUBE licenses
CISCO888-SEC-K9	Cisco888 G.SHDSL Security Router with Adv IP Services
CISCO888W-GN-A-K9	Cisco 888 G.SHDSL Router with 802.11n FCC Compliant
CISCO888W-GN-E-K9	Cisco 888 G.SHDSL Router with 802.11n ETSI Compliant
G.SHDSL (EFM)	
CISCO888E-K9	Cisco 888E G.SHDSL Router with 802.3ah EFM Support
CISCO888EW-GN-A-K9	Cisco 888E G.SHDSL Router with 802.11n FCC Compliant and 802.3ah EFM Support
CISCO888EW-GN-E-K9	Cisco 888E G.SHDSL Router with 802.11n ETSI Compliant and 802.3ah EFM Support
C888E-CUBE-K9	Cisco 888E G.SHDSL Router with 802.3ah EFM Support and integrated CUBE licenses

Part Number	Product Name
Multimode G.SHDSL (EFM/ATM)	
C888EA-K9	Cisco Multimode 888EA G.SHDSL (EFM/ATM) Router with 802.3 ah EFM Support
G.SHDSL (ATM) and 3G	
CISCO888G-K9	Cisco 888 G.SHDSL Router with 3G
CISCO888GW-G-NA-K9	Cisco 888 G.SHDSL Router with 3G, 802.11n FCC Compliant
CISCO888GW-G-NE-K9	Cisco 888 G.SHDSL Router with 3G, 802.11n ETSI Compliant
G.SHDSL (EFM) and 3G	
C888EG+7-K9	Secure Router with Ethernet over G.SHDSL (EFM) and Embedded 3.7G HSPA+ Release 7 with SMS/GPS
Voice Gateway	
C887VA-V-K9	Cisco887, V/ADSL2 WAN, 4 FXS, 2BRI, 1ISDN
C887VA-V-W-E-K9	Cisco887, V/ADSL2, 4 FXS, 2BRI, 1ISDN, 2.4GHz
C881-V-K9	Cisco881, FE WAN, 4 FXS, 2BRI, 1FXO
SRST	
C881SRST-K9	Cisco 881 SRST Ethernet Security Router with FXS, FXO
C881SRSTW-GN-A-K9	Cisco 881 SRST Ethernet Security Router with FXS, FXO; 802.11n FCC Compliant
C881SRSTW-GN-E-K9	Cisco 881 SRST Ethernet Security Router with FXS, FXO; 802.11n ETSI Compliant
C888SRST-K9	Cisco 888 SRST G.SHDSL Router with FXS, BRI
C888SRSTW-GN-A-K9	Cisco 888 SRST G.SHDSL Router with FXS, BRI; 802.11n FCC Compliant
C888SRSTW-GN-E-K9	Cisco 888 SRST G.SHDSL Router with FXS, BRI; 802.11n ETSI Compliant
Teleworker	
C881W-GN-A-K9	Cisco 881 Ethernet Security Router with 802.11n FCC Compliant
C881W-GN-E-K9	Cisco 881 Ethernet Security Router with 802.11n ETSI Compliant
C881W-GN-P-K9	Cisco 881 Ethernet Security Router with 802.11n Japan Compliant
POE	
800-IL-PM=2	2 port 802.3af capable inline power module for 880 routers
DRAM	
MEM8XX-256U512D	256-MB DRAM upgrade to 512 MB for Cisco 880 Series Routers
MEM8XX-256U768D	512-MB DRAM upgrade to 768 MB for Cisco 880 Series Routers
MEM8XX-512U768D	512-MB DRAM upgrade to 768 MB for Cisco 880 Series Routers
MEM8XX-512U1GB[**]	512-MB DRAM upgrade to 1GB for Cisco 880 Series Routers
3G Modem	
PCEX-3G-CDMA-V	Cisco 3G EVDO Rev A/0/1xRTT Modem-Verizon Networks
PCEX-3G-CDMA-S	Cisco 3G EVDO Rev A/0/1xRTT Modem-Sprint Networks
PCEX-3G-CDMA-B	Cisco 3G EVDO Rev A/0/1xRTT Modem-BSNL Networks
PCEX-3G-HSPA-US	Cisco 3.5G HSPA/UMTS/EDGE/GPRS Modem-AT&T Network Only
PCEX-3G-HSPA-G	Cisco 3.5G HSPA/UMTS/EDGE/GPRS Modem-Global Networks (Global SKU, excluding USA)
Cisco IOS Universal Software for Cisco 880	
S880DUDK9[*]	Cisco 880 Series IOS UNIVERSAL DATA
S880VUDK9[*]	Cisco 880 Series IOS UNIVERSAL VOICE
Software License for Cisco 880 Data	
SL-880-ADSEC (default)	Cisco 880 Advanced Security Image Feature License
SL-880-AIS (upgrade option)	Cisco 880 Advanced IP Services Image Feature License

Part Number	Product Name
SL-880-ADVSEC-NPE	Cisco 880 Advanced Security NPE License PAK (Paper)
SL-880-AIS-NPE (upgrade option)	Cisco 880 Advanced IP Services NPE License PAK (Paper)
Software License for Cisco 880 Data (Bulk)	
L-SL-800-SEC-K9	Advanced IP e-Delivery PAK for Cisco 800 Series
Software License for Cisco 880 SRST and CUBE	
SL-SRST880-AIS (included by default)	Cisco 880 Advanced IP Services Image Feature License
SL-880-AIS and SL-880-ADVSEC (included by default)	Cisco 880 Advanced IP Services and Security Image Feature License for 3G, Embedded 3G and CUBE models
Security Services	
SL-CNFIL-88x-1Y	One year subscription to Content Filtering for Cisco 881/888-URL/Phishing
SL-CNFIL-8xx-TRI	30 day free trial license for 88x series
SSL	
FL-WEBVPN-10-K9	Feature License SSL VPN for Up to 10 Users (incremental), for 12.4T based IOS releases only
FL-SSLVPN10-K9	Feature License SSL VPN for Up to 10 Users (incremental), for 15.x based IOS releases only
Router Software	
C880data-universalk9-mz	Universal image for Cisco 880 ISR Data Router Series
C880voice-universalk9-mz	Universal image for Cisco 880 SRST and CUBE Router Series
Access Point Software	
ap801-k9w7-tar	Autonomous software image for ap801
ap801-rcvk9w8-tar	LWAPP recovery image for ap801

[*] Each software part number has the Cisco IOS Software release number at the end of the string. For example, the part number of IOS 12.4(20)T data universal image for Cisco 880 series is S880DUK9-12420T.
[**] This Memory license is only valid for C881-K9, C886VA-K9, C886VAJ-K9, C887VA-K9, and C887VA-M-K9

Cisco License Manager is a secure client- and server-based application used to manage Cisco IOS Software activation and licenses. For more information about Cisco License Manager, visit http://www.cisco.com/go/clm.

Cisco Services for the Branch Office

Services from Cisco and our certified partners can help you reduce the cost and complexity of branch-office deployments. We have the depth and breadth of experience across technologies to architect a blueprint for a branch-office solution to meet your company's needs. Planning and design services align technology with business goals and can increase the accuracy, speed, and efficiency of deployment. Technical services help maintain operational health, strengthen software application functions, solve performance problems, and lower expenses. Optimization services are designed to continually improve performance and help your team succeed with new technologies. For more information, please visit http://www.cisco.com/go/services.

RADWIN 5000 – HPMP

Sector Base Station RW-5200-0250

Data Sheet

HBS 5200 SERIES

Sector Base Station - RW-5200-0250

RADWIN RW-5200-0250 is a Sector Base Station Radio unit, providing up to 200Mbps net aggregate throughput and delivering access connectivity for up to 16 Subscriber Units (HSU).

RW-5200-0250 supports from 4.9 to 6 GHz and complies with FCC, IC (Canada), WPC (India), MII (China) and universal regulations. RADWIN RW-5200-0250 is connectorized for use with an external antenna.

Product Highlights

- High Capacity sector Base Station
- Up to 200 Mbps aggregated throughput
- Guaranteed Service level Agreement (SLA) per HSU
- Outstanding short and constant latency
- Support up to 16 HSUs
- Long range – up to 40 km/25 miles
- Single radio supporting multiple bands
- Advanced MIMO, OFDM and Diversity technologies
- Excellent operation in nLOS and NLOS scenarios
- Robust and reliable to operate in tough conditions, extreme temperatures
- Ease of operation and maintenance

RADWIN

HBS 5200-0250 - Product Specifications

CONFIGURATION	
Architecture	Outdoor Unit Connectorized for External Antenna
PoE to ODU Interface	Outdoor CAT-5e; Maximum cable length: 100m for 10/100BaseT and 75m for 1000BaseT
RADIO	
Capacity	200 Mbps net aggregate throughput @40MHz
	100 Mbps net aggregate throughput @20MHz
Subscriber Units (HSUs) support	Up to 16 HSUs
Range	Up to 40 km / 25 miles
Channel Bandwidth	Configurable: 5 ,10 , 20 and 40 MHz
Modulation	2x2 MIMO-OFDM (BPSK/QPSK/16QAM/64QAM)
Adaptive Modulation & Coding	Supported
Bandwidth allocation	Symmetric and Asymmetric
DFS	Supported
End to End Latency	Typical: 3.5msec @ 2 HSUs; 15msec @ 16 HSUs
Diversity	Supported
Spectrum Viewer	Supported
Max Tx Power	25 dBm (*)
Duplex Technology	TDD
Error Correction	FEC k = 1/2, 2/3, 3/4, 5/6
Encryption	AES 128
Ethernet Interface	10/100BaseT, 1000BaseT (supported via indoor PoE device)
Layer 2	Bridging learning of 5K MAC addresses
QoS	Supported Packet classification to 4 queues according to 802.1p and Diffserv
VLAN	Supported 802.1Q, 802.1P, QinQ
TDD Intra Site Synchronization	Supported
TDD Inter Site Synchronization	Supported through common GPS receiver per site

SUPPORTED BANDS RW-5200-0250		
5.8 GHz FCC/IC*	**5.725 - 5.850 GHz**	**FCC 47CFR, Part 15, Subpart C and IC RSS-210**
5.8 GHz MII	5.730 - 5.845 GHz	MII for 5.8 GHz
5.8 GHz WPC India	5.825 - 5.875 GHz	WPC GSR-38
5.4 GHz FCC	5.480 - 5.715 GHz	FCC 47CFR, Part 15, Subpart E
5.4 GHz IC	5.480 - 5.715 GHz	IC RSS-210
5.3 GHz FCC/IC	5.255 - 5.350 GHz	FCC 47CFR, Part 15, Subpart E and IC RSS-210
4.9 GHz FCC/IC	4.940 - 4.990 GHz	FCC 47CFR, Part 90, Subpart Y and IC RSS-111
6.0 GHz Universal	5.690 - 6.060 GHz	Universal
5.9 GHz Universal	5.730 - 5.960 GHz	Universal
5.4 GHz Universal	5.465 - 5.730 GHz	Universal
5.3 GHz Universal	5.140 - 5.345 GHz	Universal
5.0 GHz Universal	4.990 - 5.160 GHz	Universal
4.9 GHz Universal	4.890 - 5.010 GHz	Universal
*Default Band		

MECHANICAL	
ODU Dimensions	19.5(w) x 27.0(h) x 8.0(d) cm
ODU Weight	1.8 kg / 3.6 lbs
POWER	
Power Feeding	Power provided over ODU-IDU cable using PoE
Power Consumption	<25W
ENVIRONMENTAL	
Operating Temperatures	-35°C to 60°C / -31°F to 140°F
Humidity	100% condensing, IP67 (totally protected against dust and against immersion up to 1m)
SAFETY	
FCC/IC (cTUVus)	UL 60950-1, UL 60950-22, CAN/CSA C22.2 60950-1, CAN/CSA C22.2 60950-22
ETSI	EN/IEC 60950-1, EN/IEC 60950-22
EMC	
FCC	47 CFR Class B, Part15, Subpart B
ETSI	EN 300 386, EN 301 489-1, EN 301 489-4
CAN/CSA-CEI/IEC	CISPR 22-04 Class B
AS/NZS	CISPR 22-2004 Class B

Note (*) –Subject to regulation in each country

Ordering Info
Part Number: RW-5200-0250
Description: RADWIN HBS 5200 Series, Base Station Radio Connectorized for external antenna (2xN-type), supporting multi frequency bands at 5.x GHz, factory default 5.8 GHz FCC/IC

RADWIN

RADWIN 5000 – HPMP

Sector Base Station RW-5050-0250

Data Sheet
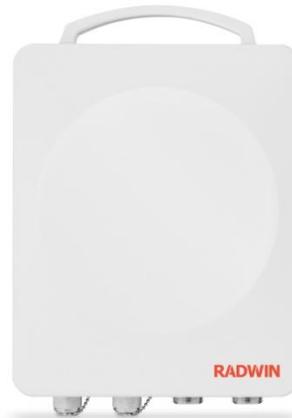
RADWIN

Sector Base Station - RW-5050-0250

RADWIN RW-5050-0250 is a Sector Base Station Radio unit, providing up to 50Mbps net aggregate throughput and delivering access connectivity for up to 16 Subscriber Units (HSUs).
RW-5050-0250 supports 4.9 to 6 GHz and complies with FCC, IC (Canada), WPC (India), MII (China) and universal regulations.
RADWIN RW-5050-0250 is connectorized for use with an external antenna.

Product Highlights

- High Capacity sector Base Station
- Up to 50 Mbps aggregated throughput
- Guaranteed Service level Agreement (SLA) per HSU
- Outstanding short and constant latency
- Support up to 16 HSUs
- Long range – up to 40 km/25 miles
- Single radio supporting multiple bands
- Advanced MIMO, OFDM and Diversity technologies
- Excellent operation in nLOS and NLOS scenarios
- Robust and reliable to operate in tough conditions, extreme temperatures
- Ease of operation and maintenance

RADWIN

HBS 5050-0250 - Product Specifications

CONFIGURATION	
Architecture	Outdoor Unit Connectorized for External Antenna
PoE to ODU Interface	Outdoor CAT-5e; Maximum cable length: 100m for 10/100BaseT and 75m for 1000BaseT
RADIO	
Capacity	50 Mbps net aggregate throughput @ 10MHz Channel BW
Subscriber Units (HSUs) support	Up to 16 HSUs
Range	Up to 40 km / 25 miles
Channel Bandwidth	Configurable: 5 and 10 MHz
Modulation	2x2 MIMO-OFDM (BPSK/QPSK/16QAM/64QAM)
Adaptive Modulation & Coding	Supported
Bandwidth allocation	Symmetric and Asymmetric
DFS	Supported
End to End Latency	Typical: 3.5msec @ 2 HSUs; 15msec @ 16 HSUs
Diversity	Supported
Spectrum Viewer	Supported
Max Tx Power	23 dBm (*)
Duplex Technology	TDD
Error Correction	FEC k = 1/2, 2/3, 3/4, 5/6
Encryption	AES 128
Ethernet Interface	10/100BaseT, 1000BaseT (supported via indoor PoE device)
Layer 2	Bridging learning of 5K MAC addresses
QoS	Supported Packet classification to 4 queues according to 802.1p and Diffserv
VLAN	Supported 802.1Q, 802.1P, QinQ
TDD Intra Site Synchronization	Supported
TDD Inter Site Synchronization	Supported through common GPS receiver per site

SUPPORTED BANDS RW-5050-0250		
5.8 GHz FCC/IC*	**5.725 - 5.850 GHz**	**FCC 47CFR, Part 15, Subpart C and IC RSS-210**
5.8 GHz MII	5.730 - 5.845 GHz	MII for 5.8 GHz
5.8 GHz WPC India	5.825 - 5.875 GHz	WPC GSR-38
5.4 GHz FCC	5.480 - 5.715 GHz	FCC 47CFR, Part 15, Subpart E
5.4 GHz IC	5.480 - 5.715 GHz	IC RSS-210
5.3 GHz FCC/IC	5.255 - 5.350 GHz	FCC 47CFR, Part 15, Subpart E and IC RSS-210
4.9 GHz FCC/IC	4.940 - 4.990 GHz	FCC 47CFR, Part 90, Subpart Y and IC RSS-111
6.0 GHz Universal	5.690 - 6.060 GHz	Universal
5.9 GHz Universal	5.730 - 5.960 GHz	Universal
5.4 GHz Universal	5.465 - 5.730 GHz	Universal
5.3 GHz Universal	5.140 - 5.345 GHz	Universal
5.0 GHz Universal	4.990 - 5.160 GHz	Universal
4.9 GHz Universal	4.890 - 5.010 GHz	Universal
*Default Band		

MECHANICAL	
ODU Dimensions	19.5(w) x 27.0(h) x 8.0(d) cm
ODU Weight	1.8 kg / 3.6 lbs
POWER	
Power Feeding	Power provided over ODU-IDU cable using PoE
Power Consumption	<25W
ENVIRONMENTAL	
Operating Temperatures	-35°C to 60°C / -31°F to 140°F
Humidity	100% condensing, IP67 (totally protected against dust and against immersion up to 1m)
SAFETY	
FCC/IC (cTUVus)	UL 60950-1, UL 60950-22, CAN/CSA C22.2 60950-1, CAN/CSA C22.2 60950-22
ETSI	EN/IEC 60950-1, EN/IEC 60950-22
EMC	
FCC	47 CFR Class B, Part15, Subpart B
ETSI	EN 300 386, EN 301 489-1, EN 301 489-4
CAN/CSA-CEI/IEC	CISPR 22-04 Class B
AS/NZS	CISPR 22-2004 Class B

Note (*) –Subject to regulation in each country

Ordering Info
Part Number: RW-5050-0250
Description: RADWIN HBS 5050 Series, Base Station Radio Connectorized for external antenna (2xN-type), supporting multi frequency bands at 5.x GHz, factory default 5.8 GHz FCC/IC

RADWIN

RADWIN 2000

RW-2050-A125 ODU Unit - Data Sheet

A-Series

RW-2050-A125

RW-2050-A125 is a carrier-class radio supports the 5.x GHz bands FCC, IC (Canada), MII (China), WPC (India) and Universal regulations (factory default: 5.8 GHz FCC/IC).

RW-2050-A125 Packing native TDM and Ethernet services over a single wireless link and provides 25 Mbps net aggregate throughput (up to 4XE1/T1 plus Ethernet).

RW-2050-A125 comes with an integrated antenna.

Product Highlights

- 25 Mbps Ethernet net throughput and up to 4E1s/T1s

- Adaptive asymmetric throughput – dynamic allocation between uplink and downlink

- Single radio supporting multiple bands (5.x GHz)

- Advanced MIMO, OFDM and Diversity technologies

- Robust and reliable to operate in tough conditions, extreme temperatures and non line-of-sight scenarios

RADWIN

Product Specifications

Configuration

Architecture	Outdoor Unit with Integrated Antenna
IDU to ODU Interface	Outdoor CAT-5e; Maximum cable length: 100m for 10/100BaseT and 75m for 1000BaseT

Radio

Capacity	25 Mbps net aggregate throughput and up to 4E1/T1s
Range	Up to 40 km / 25 miles
Channel Bandwidth	Configurable: 5,10 and 20 MHz
Modulation	2x2 MIMO-OFDM (BPSK/QPSK/16QAM/64QAM)
Adaptive Modulation & Coding	Supported
Automatic Channel Selection	Supported
Diversity	Supported
Spectrum View	Supported
Max Tx Power	25 dBm
Duplex Technology	TDD
Error Correction	FEC k = 1/2, 2/3, 3/4, 5/6
Encryption	AES 128
Ethernet Interface	10/100/1000BaseT
Supported Indoor Units	IDU-C Series (RW-72XX-2000), IDU-E Series (RW-71XX-1000) RADWIN PoE devices (RW-9921-101X)
QoS	Packet classification to 4 queues according to 802.1p and Diffserv, Dynamic scheduling according to air interface changes
VLAN	Supported
Ethernet Ring Protection	Supported, including Ethernet 1+1
Monitored Hot Standby (MHS)	1+1 with RADWIN 2000 link or WinLink 1000 link

Supported Bands

Band	Occupied Frequency Range			Radio Compliance
	Channel BW 5MHz	Channel BW 10MHz	Channel BW 20MHz	
5.8 GHz FCC/IC*	**5.7275-5.8475 GHz**	**5.725-5.850 GHz**	**5.725-5.850 GHz**	**FCC 47CFR,Part 90,Subpart C and IC RSS-210**
5.4 GHz FCC/IC	5.4775-5.7175 GHz	5.480-5.715 GHz	5.480-5.715 GHz	FCC 47CFR,Part 15,Subpart E
5.2 GHz FCC/IC	5.2525-5.3475 GHz	5.255-5.345 GHz	5.255-5.345 GHz	FCC 47CFR,Part 15,Subpart E and IC RSS-210
4.9 GHz FCC/IC	4.9425-4.9875 GHz	4.940-4.990 GHz	4.940-4.990 GHz	FCC 47CFR,Part 90,Subpart Y and IC RSS-111
5.8 GHz MII China	5.7375-5.8375 GHz	5.735-5.840 GHz	5.730-5.845 GHz	MII for 5.8 GHz
5.8 GHz WPC India	5.8325-5.8675 GHz	5.830-5.870 GHz	5.825-5.875 GHz	WPC GSR-38
5.4 GHz Universal	5.4725-5.7225 GHz	5.470-5.725 GHz	5.465-5.730 GHz	
5.1 GHz Universal	5.1475-5.3375 GHz	5.145-5.340 GHz	5.140-5.345 GHz	
5.0 GHz Universal	4.9975-5.525 GHz	4.995-5.155 GHz	4.990-5.160GHz	
5.9 GHz Universal	5.7275-5.9525 GHz	5.725-5.955 GHz	5.720-5.960 GHz	

* Factory Default

Mechanical

Dimensions	24.1(w) x 19.7(h) x 7.7(d) cm
Weight	1.3 kg / 2.8 lbs

Power

Power Feeding	Power provided over ODU-IDU cable
Power Consumption	<12W

Environmental

Operating Temperatures	-35°C - 60°C / -31°F – 140°F
Humidity	100% condensing, IP67 (totally protected against dust and against immersion up to 1m)

Safety

FCC/IC (cTUVus)	UL 60950-1, UL 60950-22, CAN/CSA C22.2 60950-1, CAN/CSA C22.2 60950-22
ETSI	EN/IEC 60950-1, EN/IEC 60950-22

EMC

FCC	CFR47 Class B, Part15, Subpart B
ETSI	EN 300 386, EN 301 489-1, EN 301 489-4
CAN/CSA-CEI/IEC	CISPR 22-04 Class B
AS/NZS	CISPR 22-2004 Class B

RADWIN

Integrated Antenna

Minimum Peak Gain	15.5 ± 1.0 dBi
VSWR	1.5 : 1 (typ) 1.7 : 1 (max)
3 dB Beamwidth AZ.	15° (typ)
3 dB Beamwidth EL.	30° (typ)
Polarization	Dual Linear (Vertical and Horizontal)
Sidelobes Level	ETSI EN 302 085 V1.1.2, TS1-TS3
Cross Polarization	ETSI EN 302 085 V1.1.2, TS1-TS3
F/B Ratio	-20 dB (max)
Port To Port Isolation	40 dB (min)
Lightning Protection	DC grounded
Antenna Pattern	

Elevation @ 5.8GHz
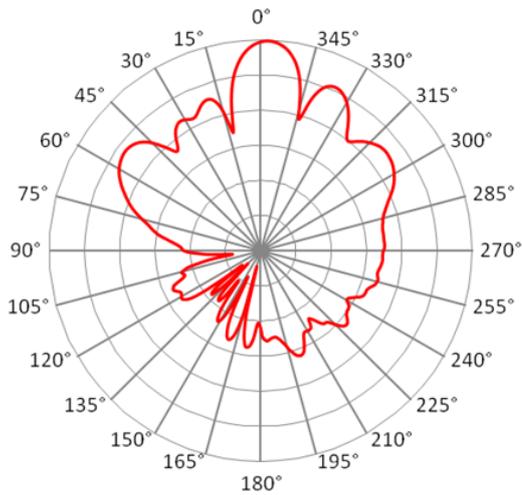
Azimuth @ 5.8GHz
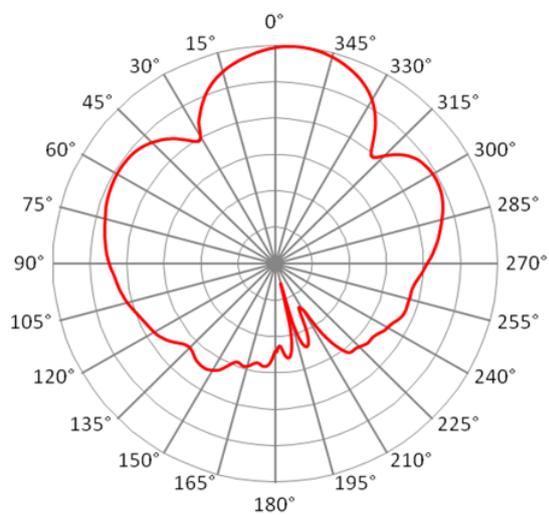
Ordering Information

Part Number: RW-2050-A125

Description: RADWIN 2000 A-Series ODU with integrated antenna, supporting multi frequency bands at 5.x GHz,

factory default 5.8 GHz FCC/IC

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RADWIN

RADWIN 2000 A-Series

RW-2050-A225

RW-2050-A225

RW-2050-A225 is a carrier-class radio supports the 5.x GHz bands FCC, IC (Canada), MII (China) and WPC (India) regulations (factory default: 5.8 GHz FCC). The multi-band radio is part of the RADWIN 2000 A-Series that delivers 25Mbps throughput and extended range.

Packing native TDM and Ethernet over a single wireless link, the RADWIN 2000 A-Series provides 25 Mbps net aggregate throughput (up to 4XE1/T1 plus Ethernet)

RADWIN RW-2050-A225 is connectorized for use with external antennas.

Product Highlights

- 25 Mbps Ethernet net throughput and up to 4E1s/T1s
- Native TDM transport
- Adaptive asymmetric throughput – dynamic allocation between uplink and downlink
- Single radio supporting multiple bands (5.x GHz)
- Advanced MIMO, OFDM and Diversity technologies
- Robust and reliable to operate in tough conditions, extreme temperatures and non line-of-sight scenarios

RADWIN

Product Specifications

Configuration

Architecture	Outdoor Unit Connectorized for External Antenna
IDU to ODU Interface	Outdoor CAT-5e cable; Maximum cable length: 100m

Radio

Capacity	25 Mbps net aggregate throughput (up to 4E1s/T1s plus Ethernet)
Range	Up to 120 km / 75 miles
Channel Bandwidth	Configurable: 5,10,20 MHz
Modulation	2x2 MIMO-OFDM (BPSK/QPSK/16QAM/64QAM)
Adaptive Modulation & Coding	Supported
Automatic Channel Selection	Supported
Diversity	Supported
Spectrum View	Supported
Max Tx Power	25 dBm
Duplex Technology	TDD
Error Correction	FEC k = 1/2, 2/3, 3/4, 5/6
Encryption	AES 128
Ethernet Interface	10/100BaseT
Supported Indoor Units	IDU-C Series (RW-72XX-2000), IDU-E Series (RW-71XX-1000) RADWIN PoE devices (RW-9921-101X) ,
QoS	Packet classification to 4 queues according to 802.1p and Diffserv, Dynamic scheduling according to air interface changes
VLAN	Supported
Ethernet Ring Protection	Supported, including Ethernet 1+1
Monitored Hot Standby (MHS)	1+1 with RADWIN 2000 link or WinLink 1000 link

Supported Bands

Band	Occupied Frequency Range			Radio Compliance
	Channel BW 5MHz	Channel BW 10MHz	Channel BW 20MHz	
5.8 GHz FCC/IC*	5.7275-5.8475 GHz	5.725-5.850 GHz	5.725-5.850 GHz	Non FCC certified
5.9 GHz Universal	5.7375-5.9525 GHz	5.735-5.955 GHz	5.730-5.960 GHz	
5.8 GHz MII China	5.7375-5.8375 GHz	5.735-5.840 GHz	5.730-5.845 GHz	MII for 5.8 GHz
5.8 GHz WPC India	5.8325-5.8675 GHz	5.830-5.870 GHz	5.825-5.875 GHz	WPC GSR-38
5.4 GHz Universal	5.4725-5.7225 GHz	5.470-5.725 GHz	5.465-5.730 GHz	
5.3 GHz Universal	5.1475-5.3375 GHz	5.145-5.340 GHz	5.140-5.345 GHz	
4.9 GHz Universal	4.8975-4.9925 GHz	4.895-4.995 GHz	4.890-5.000 GHz	

* Factory Default

Mechanical

Dimensions	17.1(w) x 19.6(h) x 7.2(d) cm
Weight	1.1 kg / 2.4 lbs

Power

Power Feeding	Power provided over ODU-IDU cable
Power Consumption	<10W

Environmental

Operating Temperatures	-35°C to 60°C / -31°F to 140°F
Humidity	100% condensing, IP67 (totally protected against dust and against immersion up to 1m)

Safety

FCC/IC (cTUVus)	UL 60950-1, UL 60950-22, CAN/CSA C22.2 60950-1, CAN/CSA C22.2 60950-22
ETSI	EN/IEC 60950-1, EN/IEC 60950-22

EMC

|	
FCC	CFR47 Class B, Part15, Subpart B
ETSI	EN 300 386, EN 301 489-1, EN 301 489-4
CAN/CSA-CEI/IEC	CISPR 22-04 Class B
AS/NZS	CISPR 22-2004 Class B

Ordering Information

Part Number: RW-2050-A225

Description:

RADWIN 2000 A-Series ODU Connectorized for external antenna (2xN-type), supporting multi frequency bands at 5.x GHz, factory default 5.8 GHz FCC/IC

DS RW-2050-A225/04.12

RADWIN

RADWIN B-Series

RW-2050-B350

RW-2050-B350

 RW-2050-B350 is a carrier-class radio supporting the 5.x GHz bands and complying with FCC, IC (Canada), MII (China) and WPC (India) regulations (factory default: 5.8 GHz FCC/IC).

The multi-band radio is part of the RADWIN 2000 B-Series that delivers highest capacity and extended range for carriers' backhaul needs.

Packing native TDM and Ethernet over a single wireless link, the RADWIN 2000 B-Series provides 50 Mbps net aggregate throughput (up to 8E1/T1 plus Ethernet) at a range of up to 120 km/75 miles.

RADWIN RW-2050-B350 includes an embedded antenna and connectors for use with external antennas, offering a single Small Form Factor radio configuration

Product Highlights

- 50 Mbps Ethernet net throughput and up to 8E1s/T1s
- Native TDM transport
- Single Small Form factor with embedded antenna and connectorized for external antenna
- Long range – up to 120 km/75 miles
- Adaptive asymmetric throughput   – dynamic allocation between uplink and downlink
- Single radio supporting multiple bands 5.x GHz
- Advanced MIMO, OFDM and Diversity technologies
- Robust and reliable to operate in tough conditions, extreme temperatures and non line-of-sight scenarios

RADWIN

Product Specifications

Configuration

Architecture	Small Form Factor ODU Unit with embedded antenna and Connectorized for External Antenna
IDU to ODU Interface	Outdoor CAT-5e cable; Maximum cable length: 100 m

Radio

Capacity	50 Mbps net aggregate throughput (up to 8E1s/T1s plus Ethernet)
Range	Up to 120 km / 75 miles
Channel Bandwidth	Configurable: 5,10, or 20 MHz
Modulation	2x2 MIMO-OFDM (BPSK/QPSK/16QAM/64QAM)
Adaptive Modulation & Coding	Supported
Automatic Channel Selection	Supported
Diversity	Supported
Spectrum View	Supported
Max Tx Power	25 dBm
Duplex Technology	TDD
Error Correction	FEC k = 1/2, 2/3, 3/4, 5/6
Encryption	AES 128
Supported Indoor Units	IDU-C Series (RW-72XX-2000), IDU-E Series (RW-71XX-1000) RADWIN PoE device (RW-9921-001X)
QoS	Packet classification to 4 queues according to 802.1p and Diffserv, Dynamic scheduling according to air interface changes
Packet processing	100,000
VLAN	Supported
Ethernet Ring Protection	Supported, including Ethernet 1+1
Hub Site Synchronization (HSS)	Up to 16 collocated links (RADWIN 2000 and/or WinLink 1000)
Monitored Hot Standby (MHS)	1+1 with RADWIN 2000 link or WinLink 1000 link

Supported Bands

Band	Occupied Frequency Range	Radio Compliance
5.8 GHz FCC/IC*	**5.725 - 5.850 GHz**	**FCC 47CFR, Part 90, Subpart C and IC RSS-210**
5.9 GHz Universal	5.730 - 5.950 GHz	
5.8 GHz FCC/IC	5.725 - 5.850 GHz	FCC 47CFR, Part 15, Subpart C and IC RSS-210
5.8 GHz MII China	5.730 - 5.845 GHz	MII for 5.8 GHz
5.8 GHz WPC India	5.825 - 5.875 GHz	WPC GSR-38
5.4 GHz FCC	5.480 - 5.715 GHz	FCC 47CFR, Part 15, Subpart E
5.4 GHz IC	5.480 - 5.715 GHz	IC RSS-210
5.4 GHz Universal	5.490 - 5.710 GHz	
5.3 GHz FCC/IC	5.260 - 5.340 GHz	FCC 47CFR, Part 15, Subpart E and IC RSS-210
5.3 GHz Universal	5.140 - 5.345 GHz	

* Factory Default

Mechanical

Dimensions	19.5(w) x 27.0(h) x 8.0(d) cm
Weight	1.8 kg / 3.6 lbs

Power

Power Feeding	Power provided over ODU-IDU cable
Power Consumption	<35W (IDU + ODU)

Environmental

Operating Temperatures	-35°C - 60°C / -31°F – 140°F
Humidity	100% condensing, IP67 (totally protected against dust and against immersion up to 1m)

Safety

FCC/IC (cTUVus)	UL 60950-1, UL 60950-22, CAN/CSA C22.2 60950-1, CAN/CSA C22.2 60950-22
ETSI	EN/IEC 60950-1, EN/IEC 60950-22

EMC

FCC	CFR47 Class B, Part15, Subpart B
ETSI	EN 300 386, EN 301 489-1, EN 301 489-4
CAN/CSA-CEI/IEC	CISPR 22-04 Class B
AS/NZS	CISPR 22-2004 Class B

RADWIN

Integrated Antenna	
Minimum Peak Gain	15.0 ± 1.0 dBi @ 5.15-5.47 GHz 15.5 ± 1.0 dBi @ 5.47-5.875 GHz 12.5 ± 1.0 dBi @ 5.875-6.02 GHz
VSWR	1.5 : 1 (typ) 2 : 1(max)
Azimuth 3 dB Beamwidth	35° (typ)
Elevation 3 dB Beamwidth	15° (typ)
AZ & EL Beam Squint	± 2.5° Port V & Port H
Polarization	Dual Linear (Vertical and Horizontal)
Sidelobes Level	ETSI EN 302 085 V1.1.2, TS1-TS3
Cross Polarization	ETSI EN 302 085 V1.1.2, TS1-TS3
F/B Ratio	20 dB (max
Port To Port Isolation	40 dB (min)
Lightning Protection	DC grounded

Antenna Pattern	
Elevation @ 5.8GHz	Azimuth @ 5.8GHz

Ordering Information

Part Number: RW-2050-B350

Description:

RADWIN 2000 B- Series ODU with embedded antenna and connectorized, supporting 5.x GHz multi frequency bands ,

 factory default 5.8 GHz FCC/IC

For external antennas, see the RADWIN Product Catalog.

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RADWIN

RADWIN 2000 C-Series

RW-2049-0200

RW-2049-0200

RW-2049-0200 is a carrier-class radio supporting the 2.4 GHz, 4.9 GHz and 5.x GHz bands and complying with FCC, IC (Canada), MII (China) and WPC (India) regulations (factory default: 4.9 GHz FCC). The multi-band radio is part of the RADWIN 2000 C-Series that delivers high capacity and extended range for carriers' backhaul needs.

Packing native TDM and Ethernet over a single wireless link, the RADWIN 2000 C-Series provides 200 Mbps net aggregate throughput (up to 16 E1/T1plus Ethernet) at a range of up to 120 km/75 miles.

RADWIN RW-2049-0200 is connectorized for use with external antennas.

Product Highlights

- 200 Mbps Ethernet net throughput and up to 16E1s/T1s
- Native TDM transport
- GBE support
- Single Small Form factor with embedded antenna and connectorized for external antenna
- Long range – up to 120 km/75 miles
- Adaptive asymmetric throughput – dynamic allocation between uplink and downlink
- Single radio supporting multiple bands (2.4 GHz, 4.9 GHz and 5.x GHz)
- Advanced MIMO, OFDM and Diversity technologies
- Robust and reliable to operate in tough conditions, extreme temperatures and non line-of-sight scenarios

RADWIN

Product Specifications

Configuration

Architecture	Outdoor Unit Connectorized for External Antenna
IDU to ODU Interface	Outdoor CAT-5e cable; Maximum cable length: 100m

Radio

Capacity	100 Mbps net aggregate throughput (up to 16 E1s/T1s plus Ethernet)
Range	Up to 120 km / 75 miles
Channel Bandwidth	Configurable: 5,10, 20 or 40MHz
Modulation	2x2 MIMO-OFDM (BPSK/QPSK/16QAM/64QAM)
Adaptive Modulation & Coding	Supported
Automatic Channel Selection	Supported
Diversity	Supported
Spectrum View	Supported
Max Tx Power	26 dBm
Duplex Technology	TDD
Error Correction	FEC k = 1/2, 2/3, 3/4, 5/6
Encryption	AES 128
Supported Indoor Units	IDU-C Series (RW-72XX-2000), IDU-E Series (RW-71XX-1000) RADWIN PoE device (RW-9921-001X)
QoS	Packet classification to 4 queues according to 802.1p and Diffserv, Dynamic scheduling according to air interface changes
VLAN	Supported
Ethernet Ring Protection	Supported, including Ethernet 1+1
Hub Site Synchronization (HSS)	Up to 16 collocated links (RADWIN 2000 and/or WinLink 1000)
Monitored Hot Standby (MHS)	1+1 with RADWIN 2000 link or WinLink 1000 link

Supported Bands

Band	Occupied Frequency Range	Radio Compliance
4.9 GHz FCC/IC*	**4.940 - 4.990**	**FCC 47CFR, Part 90, Subpart Y and IC RSS-111**
5.8 GHz FCC/IC	5.725 - 5.850 GHz	FCC 47CFR, Part 15, Subpart C and IC RSS-210
5.8 GHz MII China	5.730 - 5.845 GHz	MII for 5.8 GHz
5.9 GHz Universal	5.730 - 5.950 GHz	
5.8 GHz WPC India	5.825 - 5.875 GHz	WPC GSR-38
5.4 GHz FCC	5.480 - 5.715 GHz	FCC 47CFR, Part 15, Subpart E
5.4 GHz IC	5.480 - 5.715 GHz	IC RSS-210
5.4 GHz Universal	5.490 - 5.710 GHz	
5.3 GHz FCC/IC	5.260 - 5.340 GHz	FCC 47CFR, Part 15, Subpart E and IC RSS-210
5.3 GHz Universal	5.140 - 5.345 GHz	
4.9 GHz Universal	4.890 - 5.010	
2.4 GHz FCC/IC	2.402 - 2.472	FCC 47CFR, Part 15, Subpart C and IC RSS-210

* Factory Default

Mechanical

Dimensions	19.5(w) x 27.0(h) x 8.0(d) cm
Weight	1.8 kg / 3.6 lbs

Power

Power Feeding	Power provided over ODU-IDU cable
Power Consumption	<35W (IDU + ODU)
Environmental	
Operating Temperatures	-35°C - 60°C / -31°F – 140°F
Humidity	100% condensing, IP67 (totally protected against dust and against immersion up to 1m)

Safety

FCC/IC (cTUVus)	UL 60950-1, UL 60950-22, CAN/CSA C22.2 60950-1, CAN/CSA C22.2 60950-22
ETSI	EN/IEC 60950-1, EN/IEC 60950-22

EMC

FCC	CFR47 Class B, Part15, Subpart B
ETSI	EN 300 386, EN 301 489-1, EN 301 489-4
CAN/CSA-CEI/IEC	CISPR 22-04 Class B
AS/NZS	CISPR 22-2004 Class B

RADWIN

Ordering Information

Part Number: RW-2049-0200

Description:

RADWIN 2000 C-Series ODU Connectorized for external antenna (2x N-type), supporting 2.3 and 2.4 GHz frequency bands

For external antennas, see the RADWIN Product Catalog.

RADWIN

RADWIN 2000 C-Series

RW-2050-0200

RW-2050-0200

RW-2050-0200 is a carrier-class radio sup-
porting the 2.4 GHz and 5.x GHz bands and
complying with FCC, IC (Canada), MII (China)
and WPC (India) regulations (factory default:
5.8 GHz FCC). The multi-band radio is part of
the RADWIN 2000 C-Series that delivers high
capacity and extended range for carriers'
backhaul needs.

Packing native TDM and Ethernet over a sin-
gle wireless link, the RADWIN 2000 C-Series
provides 200 Mbps net aggregate throughput
(up to 16 E1/T1plus Ethernet) at a range of
up to 120 km/75 miles.

RADWIN RW-2050-0200 is connectorized for
use with external antennas.

Product Highlights

- 200 Mbps Ethernet net throughput and up to 16E1s/T1s
- Native TDM transport
- GBE support
- Single Small Form factor with embedded antenna and connectorized for external antenna
- Long range – up to 120 km/75 miles
- Adaptive asymmetric throughput – dynamic al-location between uplink and downlink
- Single radio supporting multiple bands (2.4 GHz and 5.x GHz)
- Advanced MIMO, OFDM and Diversity   tech-nologies
- Robust and reliable to operate in tough conditions, extreme temperatures and

RADWIN

Product Specifications

Configuration

Architecture	Outdoor Unit Connectorized for External Antenna
IDU to ODU Interface	Outdoor CAT-5e cable; Maximum cable length: 100m @100BaseT and 70m @1000BaseT

Radio

Capacity	200 Mbps net aggregate throughput (up to 16 E1s/T1s plus Ethernet)
Range	Up to 120 km / 75 miles
Channel Bandwidth	Configurable: 5,10,20 or 40 MHz
Modulation	2x2 MIMO-OFDM (BPSK/QPSK/16QAM/64QAM)
Adaptive Modulation & Coding	Supported
Automatic Channel Selection	Supported
Diversity	Supported
Spectrum View	Supported
Max Tx Power	25 dBm
Duplex Technology	TDD
Error Correction	FEC k = 1/2, 2/3, 3/4, 5/6
Encryption	AES 128
Ethernet Interface	10/100/1000BaseT
Supported Indoor Units	IDU-C Series (RW-72XX-2000), IDU-E Series (RW-71XX-1000) RADWIN PoE device (RW-9921-001X)
QoS	Packet classification to 4 queues according to 802.1p and Diffserv, Dynamic scheduling according to air interface changes
VLAN	Supported
Ethernet Ring Protection	Supported, including Ethernet 1+1
Hub Site Synchronization (HSS)	Up to 16 collocated links (RADWIN 2000 and/or WinLink 1000)
Monitored Hot Standby (MHS)	1+1 with RADWIN 2000 link or WinLink 1000 link

Supported Bands

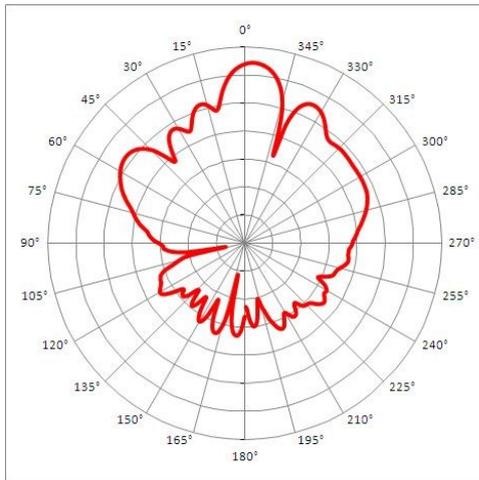| Band	Occupied Frequency Range	Radio Compliance
5.8 GHz FCC/IC*	**5.725 - 5.850 GHz***	**FCC 47CFR, Part 90, Subpart C and IC RSS-210**
5.9 GHz Universal	5.730 - 5.950 GHz	
5.8 GHz MII China	5.730 - 5.845 GHz	MII for 5.8 GHz
5.8 GHz WPC India	5.825 - 5.875 GHz	WPC GSR-38
5.4 GHz FCC	5.480 - 5.715 GHz	FCC 47CFR, Part 15, Subpart E
5.4 GHz IC	5.480 - 5.715 GHz	IC RSS-210
5.4 GHz Universal	5.490 - 5.710 GHz	
5.3 GHz FCC/IC	5.260 - 5.340 GHz	FCC 47CFR, Part 15, Subpart E and IC RSS-210
5.3 GHz Universal	5.140 - 5.345 GHz	
2.4 GHz FCC/IC	2.4 GHz FCC/IC	FCC 47CFR, Part 15, Subpart C and IC RSS-210

* Factory Default

Mechanical

Dimensions	19.5(w) x 27.0(h) x 8.0(d) cm
Weight	1.8 kg / 3.6 lbs

Power

Power Feeding	Power provided over ODU-IDU cable
Power Consumption	<35W (IDU + ODU)
Environmental	
Operating Temperatures	-35°C - 60°C / -31°F – 140°F
Humidity	100% condensing, IP67 (totally protected against dust and against immersion up to 1m)

Safety

FCC/IC (cTUVus)	UL 60950-1, UL 60950-22, CAN/CSA C22.2 60950-1, CAN/CSA C22.2 60950-22
ETSI	EN/IEC 60950-1, EN/IEC 60950-22

EMC

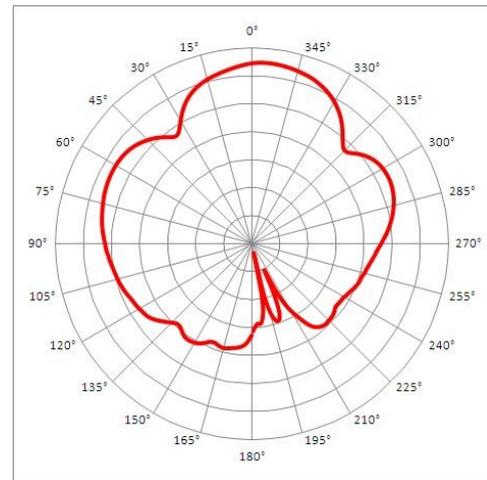|	
FCC	CFR47 Class B, Part15, Subpart B
ETSI	EN 300 386, EN 301 489-1, EN 301 489-4
CAN/CSA-CEI/IEC	CISPR 22-04 Class B
AS/NZS	CISPR 22-2004 Class B

RADWIN

Ordering Information

Part Number: RW-2050-0200

Description:

RADWIN 2000 C-Series ODU Connectorized for external antenna (2x N-type), supporting multi frequency bands at 2.x GHz and 5.x GHz,

factory default 5.8 GHz FCC/IC

 For external antennas, see the RADWIN Product Catalog.

RADWIN

RW-9612-5764

Product Data Sheet

RW-9612-5764 is a 5.70 – 6.425 GHz, 24 dBi Dual Polarization 1.2 Ft Flat panels Antenna, compatible with RADWIN 2000 portfolio

Antenna Pattern

Port V at 5.8 GHz

Port H at 5.8 GHz
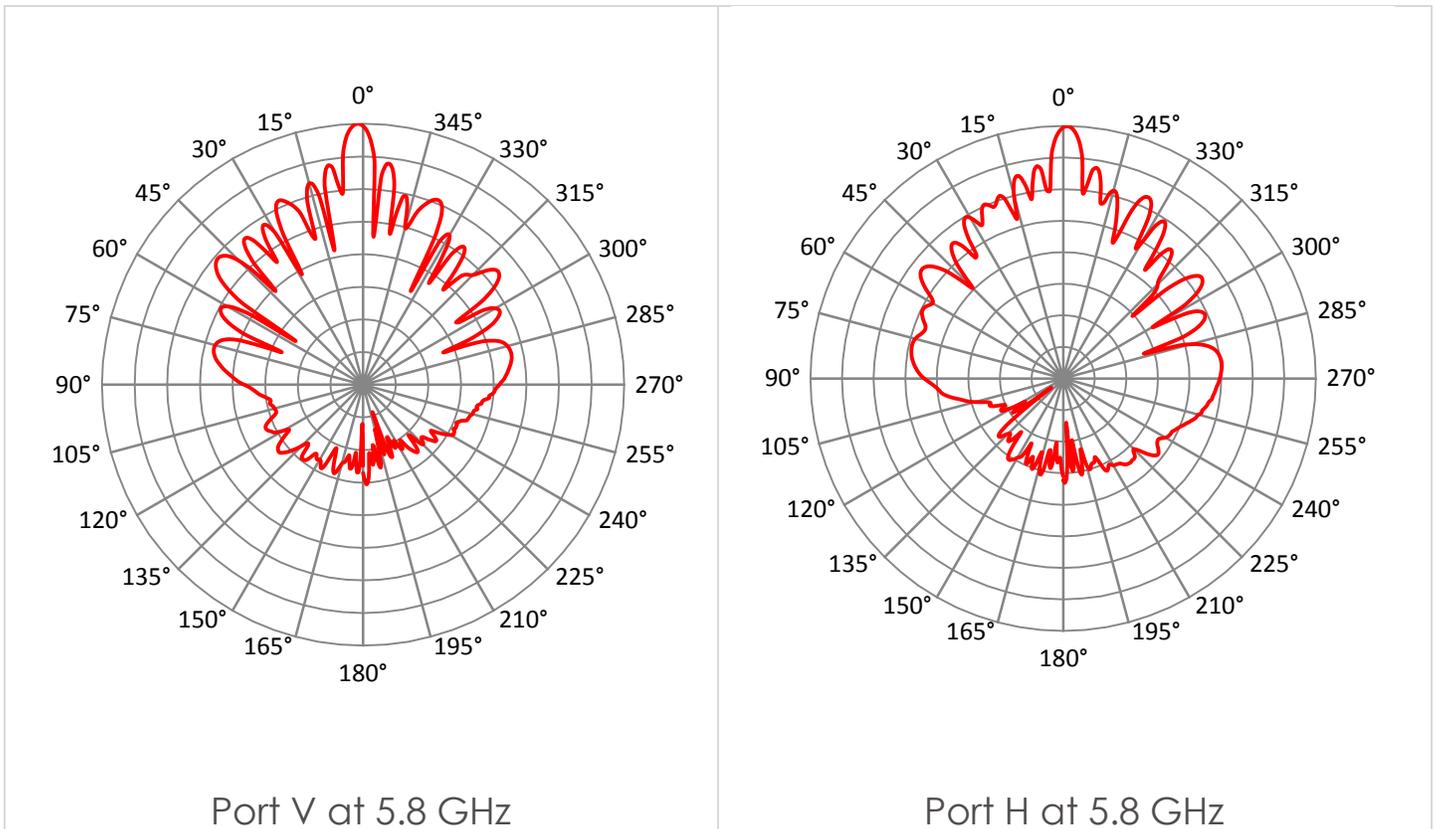
RW-9612-5764 - Product Specifications

ELECTRICAL	
Frequency Range	5.7 - 6.425 GHz
Gain port V	24.5dBi ± 1.0 dB
port H	23.5dBi ± 1.0 dB
VSWR	2.0 : 1 (max) 1.5 : 1 (typ)
3 dB Beam width	8° (typ)
Polarization	Dual Linear (Vertical & Horizontal)
Side lobes Level	ESTI EN 302 326-3 V1.1.2 DN3
Cross Polarization	ESTI EN 302 326-3 V1.1.2 DN3
Port To Port Isolation	-25 dB (max) , -30 dB (typ)
F/B Ratio	-40 dB (max)
Input Impedance	50 (ohm)
Input Power	6 W (max)
Lightning Protection	DC Grounded
MECHANICAL	
Dimensions (LxWxD)	371 x 371 x 40 mm (max)
Weight	2.5 (kg) (max)
Connector	Two N type Female
Radome	Plastic
Base Plate	Aluminum with chemical conversion coating
RF Cable	2 coax cables with N-type connectors, 1.2m, supplied
Mounting Kit	Supplied
ENVIRONMENTAL	
Temperature	-45°C to +70°C (IEC 68-2-1, IEC 68-2-2, IEC 68-2-14)
Humidity	Up to 95% (ETSI EN300-2-4, T4.1E)
Water Tightness	IEC 529, IP67
Flammability	UL 94, class HB
Solar Radiation	ASTM G53
Salt Spray	IEC 68-2-11
Ice and Snow	Up to 25mm
Wind Speed	Survival 220 km/h
	Operation 160 km/h
Wind Load (Survival)	Front Thrust 39.6 kg
	Side Thrust 4.3 kg

Ordering Info

Part Number: RW-9612-5764

Description: Flat panel antenna, 1.2 ft, dual polarization, gain 24dBi, 5.7-6.425 GHz bands

RADWIN

RW-9622-5001

Product Data Sheet

RW-9622-5001 is a 4.90 – 6.425 GHz, 28 dBi Dual Polarization Flat panels Antenna, compatible with RADWIN 2000 portfolio

Antenna Pattern

Port V at 5.8 GHz

Port H at 5.8 GHz

RADWIN
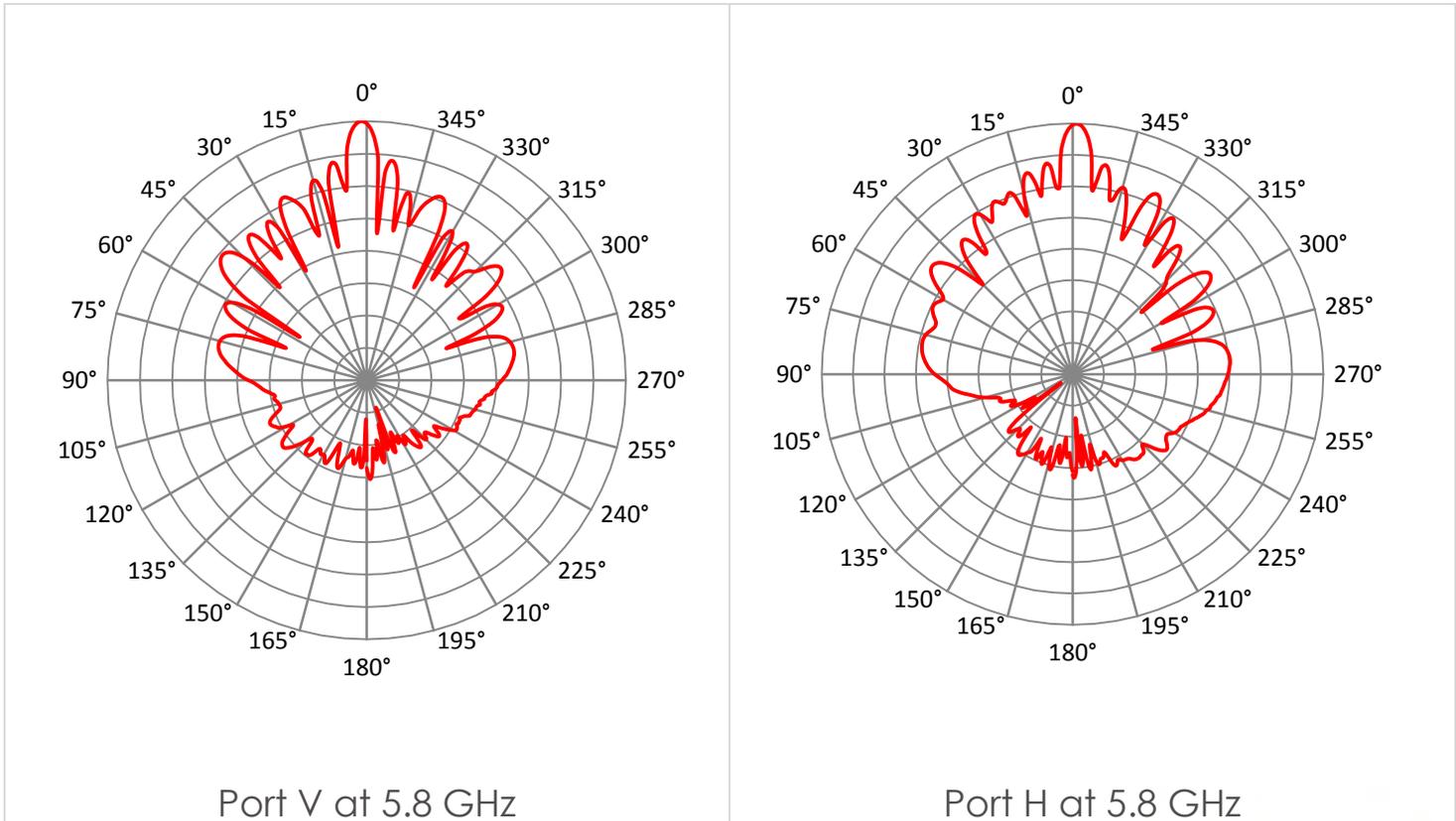
RW-9622-5001 - Product Specifications

ELECTRICAL	
Frequency Range	4.9 - 6.425 GHz
Gain port V	28.0dBi ± 1.0 dB
port H	27.0dBi ± 1.0 dB
VSWR	2.0 : 1 (max) 1.5 : 1 (typ)
3 dB Beam width	5° (typ)
Polarization	Dual Linear (Vertical & Horizontal)
Side lobes Level	ESTI EN 302 326-3 V1.1.2 DN3
Cross Polarization	ESTI EN 302 326-3 V1.1.2 DN3
Port To Port Isolation	-25 dB (max) , -30 dB (typ)
F/B Ratio	-40 dB (max)
Input Impedance	50 (ohm)
Input Power	6 W (max)
Lightning Protection	DC Grounded

MECHANICAL	
Dimensions (LxWxD)	600 x 600 x 51 mm (max)
Weight	5 (kg) (max)
Connector	Two N type Female
Radome	Plastic
Base Plate	Aluminum with chemical conversion coating
RF Cable	2 coax cables with N-type connectors, 1.2m, supplied
Mounting Kit	Supplied

ENVIRONMENTAL	
Temperature	-45°C to +70°C (IEC 68-2-1, IEC 68-2-2, IEC 68-2-14)
Humidity	Up to 95% (ETSI EN300-2-4, T4.1E)
Water Tightness	IEC 529, IP67
Flammability	UL 94, class HB
Solar Radiation	ASTM G53
Salt Spray	IEC 68-2-11
Ice and Snow	Up to 25mm
Wind Speed	Survival 220 km/h
	Operation 160 km/h
Wind Load (Survival)	Front Thrust 103.6 kg
	Side Thrust 8.9 kg

Ordering Info

Part Number: RW-9622-5001

Description: Flat panel antenna, 2ft, dual polarization, gain 28dBi, 4.9-6.425 GHz bands

RADWIN

RW-9732-4958

The RW-9732-4958 is a 3 ft dish, dual polarization antenna, compatible with RADWIN 2000 portfolio

Product Specifications

Electrical	
Frequency Range	4.90 – 5.75 GHz
Minimum Peak Gain	32 dBi 30 dBi @ 4900 – 5150
VSWR	1.8 : 1 (max)
3 dB Beam-width	4° (typ)
Polarization	Dual Linear (Vertical and Horizontal)
Side Lobes Level	-32 dB
Cross Polarization	-34 dB
Front to Back	-38 dB
Input Impedance	50 Ohm
Input Power	100 Watt (max)
Lightning Protection	DC grounded
Mechanical	
Diameter	927mm
Weight	10kg
Connector	Two N-type female
Radome	Fiberglass ,UV protected
RF Cable	Coax cable with N-type connectors, 1.2m, supplied
Mounting Kit	Supplied
Environmental	
Temperature	-40°C to +70°C
Water Tightness	IP65
Flammability	UL94
Salt Spray	IEC 68-2-11
Ice and Snow	Up to 10mm
Wind Speed (Survival)	200 km/h
Wind Load (Survival)	Front Thrust 26.6 kg Side Thrust 1.3 kg
Regulatory Compliance	
ETSI	EN 302 085 and EN 300 833 Class 1
Antenna Pattern	

Vertical at 5.725 GHz   Horizontal at 5.725 GHz

Ordering Info
Part Number: RW-9732-4958
Description: Dish antenna 3ft, dual polarization, gain 32dBi, 4.900 – 5.875 GHz

RADWIN
The Wireless Choice

Hub Aggregation

IDU-H

IDU-H Aggregation unit

RADWIN's IDU-H (RW-7300-2006) is part of the RADWIN Indoor Unit Portfolio. The IDU-H product line comprises of carrier grade 1U 19'' rack mounted half width indoor devices. An IDU-H aggregates Ethernet traffic for up to six ODUs. It delivers their traffic to two high speed uplink Ethernet ports and two SFP ports.

RADWIN IDU-H Main Features:

- A single source of power supporting up to six ODUs (all types)

- Supports Legacy PoE ports (10/100/1000Mbps)

- Two uplink Ethernet ports (10/100/1000baseT Ethernet)

- Two uplink 1000Mbps SFP ports

Product Specifications

Ethernet Interface	
PoE interfaces	6 x PoE in legacy mode ports (10/100/1000Mbps) , up to 25W per port ,Support all RADWIN ODUs*
Ethernet ports	2 x RJ-45 PHY ports of 10/100/1000 Mbps Based-T Ethernet Auto-negotiation 10/100/1000Mbps
SFP Interfaces	2 x SFP ports of 1000 Mbps (standard MSA)
LAN Interface Line Impedance	100Ω
MAC Address Entries	Up to 1K MAC Address entries (same as in IDU-C)
Maximum Frame Size	2048 Bytes
Latency	3 msec
Mechanical	
Dimensions	1U x Half 19" width
Weight	<1.5 kg
Power	
Power Feeding	44VDC - 56VDC, Dual redundant inputs, 3 pin female DC connector **
Power Consumption	150W @ Maximal Power feeding
Environmental	
Operating Temperatures	-40°C to 60°C / -40°F to 140°F
Humidity	90% non-condensing
Storage Temperatures	-40°C to 70°C / -40°F to 158°F, Humidity 95%
Safety	
TUV	UL/EN/IEC 60950
CAN/CSA	60950 C22.2
EMC	
FCC	47CFR Class B, Part15, Subpart B
ETSI	EN 300 386 V1.3.2; 301 489-4 V1.3.1; 301 489-1 V1.4.1; 55022:1998; 61000-3-2:2000; 61000-3-3:1995; 55024:1998
CAN/CSA-CEI/IEC; AS/NZS	CISPR 22-02

* Doesn't support RADWIN 2000 A series and RADWIN HSU 505 series

**AC power adapters with plugs for various countries can be ordered separately (see product RW-9921-007X in RADWIN Product Catalog).

PoE Device RW-9921-001X

RADWIN's Power over Ethernet (PoE) device provides data and power to RADWIN 2000 and WinLink 1000 outdoor units. The PoE device is available with a variety of AC cables with different plug types (see ordering information below).

Product Specifications

Interfaces	
Ethernet ports	10/100 BaseT Impedance 100Ω
PoE output	RJ-45 connector
Ethernet input	RJ-45 connector
AC input on device	Standard socket IEC320 C14 type
AC cable	Variety of AC plugs available (see below)
Ethernet / ODU	RJ-45 connector
Electrical	
AC Input Voltage	100-240VAC nominal, 85-265VAC max range
Input Frequency	47-63Hz
Input Current	1.5A max at 90VAC, 0.75A max at 265VAC
Output Voltage and Current	Typical: 55VDC, 0-1A Range: 50-58VDC
Protection	Short circuit protection Auto recovery Over voltage protection
Indication	Green led for normal operation
Environmental	
Operating Temperatures	0°C - 40°C/32°F - 104°F
Humidity	90% non-condensing
Safety	
UL	60950
C-UL	60950
TUV/GS	IEC/EN 60950
EMC	
ESD	61000-4-2
RS	61000-4-3
EFT	61000-4-4
Surge	61000-4-5
CS	61000-4-6
DIPS	61000-4-11
EMI	FCC part 15 class B, CISPR Pub 22 class B
Mechanical	
Case	Plastic
Dimensions	16cm(W) x 6.3cm(D) x 3.33cm(H)
Weight	250g/0.55lb

Ordering Information

RW-9921-001X	PoE device for RADWIN radios, with AC power feeding (see note)

Note:
Replace X with a digit from the list according to AC plug type required:
1 – European AC plug
2 – US AC Plug
3 – UK AC Plug
4 – Indian AC Plug
5 – Australian AC Plug
6 – AC open connector
7 – Argentina AC Plug
8 – South Africa AC Plug

Examples: RW-9921-0011 for European AC plug, RW-9921-0034 for Indian AC plug.

DS RW-9921-001X/01/12.09

RADWIN Accessories

RW-9924-0006 Lightning Protector

Product Data Spec

RADWIN Accessories

Lightning Protector- RW-9924-0006

RADWIN RW-9924-0006 is an external lightning protection unit supporting data and signal surge protection over PoE.

RADWIN RW-9924-0006 offers outdoor data line series protection designed to support Ethernet applications including 10/100 and 1000 BaseT interfaces with PoE.

RW-9924-0006 incorporates high-power gas discharge tube and current transistor protection in a single protector unit.

Product Highlights

- Support data rates of up to 1000Mbps
- Enclosure rating of IP67 for all outdoor conditions
- Small form factor
- High data voltage protection
- Fast response with RADWIN ODU outdoor and indoor products
- Pole and Wall mounting kits
- Simple installations

RADWIN

RW-9924-0006 - Product Specifications

Electrical	
Compatible Interfaces	10/100/1000BaseT
Data Rates	Up to 1000Mbps
Nominal Operational Voltage	48 VDC
Maximum Operational Voltage	60 VDC - 650 mA
Maximum Continues current	1 A
Impedance	90 to 110 Ohm
Connection type	RJ45 CAT5e STP (shielded)
Pin-out	8 wires + shielding
Pins Protected	All pins protected
Response time	<5 microseconds (with ODU)
Nominal discharge currents	
Line to Line	500 A @ 8/20µs
Line to Ground	2000 A @ 8/20 µs
Impulse Discharge Current	
20000 A, 8/20 µs	1 operation minimum
10000 A, 8/20 µs	> 10 operations
2000 A, 10/350 µs	1 operation
200 A, 10/1000 µs	> 300 operations
200 A, 10/700 µs	> 500 operations
Impulse Spark-over	
DC Spark-over ±20 % @ 100 V/s	150 V
100 V/µs	350 V
1000 V/µs	500 V
Capacitance	< 2 pF
DC Holdover Voltage	80V
Mechanical	
Enclosure	Metal
Connection to bonding Network	Screw
Dimensions	150mm
Weight	220 gram (0.22Kg)
Environmental	
Operating temperature	-40 to +60
Storage temperature	-50 to +70
Enclosure rating	IP67
Humidity	100% non condensing

Ordering Info
Part Number: RW-9924-0006
Description: External Lightning Protection Unit supporting 100BaseT and 1000BaseT interfaces and signal surge protection over power over Ethernet (including 0.5m CAT5e cable and mounting kit)

RADWIN

rocket M

Powerful 2x2 MIMO AirMax BaseStation Platforms

Models: M2, M2GPS, M3, M365, M365GPS, M5, M5GPS, M900

Ultimate in RF Performance

Seamlessly Integrates with AirMax BaseStation and Rocket Antennas

Incredible Range and Speed

UBIQUITI
NETWORKS

Overview

Versatile

Rocket M is a rugged, hi-power, very linear 2x2 MIMO radio with enhanced receiver performance. It features incredible range performance (50+km) and breakthrough speed (150+Mbps real TCP/IP).

Rocket M combines the "brains" in one robust unit; it can be paired with your choice of AirMax BaseStation or Rocket Antennas. This versatility gives network architects unparalleled flexibility and convenience.

On the right is one example of how Rockets can be deployed:

1 Internet Backbone
2 ISP Network
3 RocketDish with Rocket M
4 RocketDish with Rocket M
5 AirMax BaseStation with Rocket M
6 Corporate building with NanoStation M client.
7 House with NanoStation M client.
8 Small business with NanoStation M client.
9 Lightpole with NanoStation M daisy-chained to a PicoStation M to create a wireless hotspot.

PTP (Point to Point) BACKHAUL LINK

PTMP (Point to Multi-Point) LINKS

Integrated AirMax Technology

Unlike standard WiFi protocol, Ubiquiti's Time Division Multiple Access (TDMA) AirMax protocol allows each client to send & receive data using pre-designated time slots scheduled by an intelligent AP controller.

This "time slot" method eliminates hidden node collisions & maximizes air time efficiency. It provides many magnitudes of performance improvements in latency, throughput, & scalability compared to all other outdoor systems in its class.

Intelligent QoS Priority is given to voice/video for seamless access.

Scalability High capacity and scalability.

Long Distance Capable of high speed 50km+ links

Latency Multiple features dramatically reduce noise.

GPS Synchronization*

Rocket M GPS units have integrated Ubiquiti AirSync technology. AirSync enhances the hardware and software of Rocket M to utilize GPS signals for precision timing.

GPS Signal Reporting AirOS was upgraded to take full advantage of the new GPS hardware in Rocket M GPS units; easily manage/monitor GPS satellite signals.

No Co-location Interference Synchro-nized transmission among Rocket M GPS powered BaseStations effectively eliminates co-location interference.

External GPS Antenna Included weather-proof external GPS Antenna (Rocket M GPS).

Two Ethernet Ports Second Ethernet port (only Rocket M GPS) capable of providing power to a secondary device using PoE.

Channel Re-use Frequency reuse for increased scalability.

Easy Installation

Rocket M and AirMax BaseStation/ Rocket Antennas have been designed to seamlessly work together.
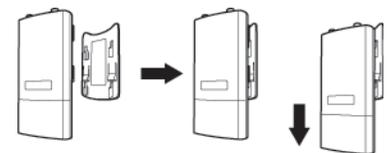
Installing Rocket M on AirMax BaseStation and Rocket Antennas requires no special tools, you simply snap it securely into place with the universal Rocket mount built into the antennas.

* Only Rocket M GPS Models

www.ubnt.com

Datasheet

rocketM

Models

[top - Rocket M GPS Series] **RM2-GPS** (2.4 GHz), **RM365-GPS** (3.65-3.675 GHz), **RM5-GPS** (5 GHz)
[bottom - Rocket M Series] **RM2** (2.4 GHz), **RM3** (3.4-3.7 GHz), **RM365** (3.65-3.675 GHz), **RM5** (5GHz), **RM900** (900 MHz)

www.ubnt.com

Datasheet

Software

airOS

AirOS is an intuitive, versatile, highly developed Ubiquiti firmware technology. It is exceptionally intuitive and was designed to require no training to operate. Behind the user interface is a powerful firmware architecture which enables hi-performance outdoor multipoint networking.

Protocol Support

Ubiquiti Channelization

Spectral Width Adjust

ACK Auto-Timing

AAP Technology

GPS Signal Reporting*

www.ubnt.com/airos

airView

Integrated on all Ubiquiti M products, AirView provides Advanced Spectrum Analyzer Functionality: Waterfall, waveform, and real-time spectral views allow operators to identify noise signatures and plan their networks to minimize noise interference.

Waterfall Aggregate energy over time for each frequency.

Waveform Aggregate energy collected.

Real-time Energy is shown real-time as a function of frequency.

Recording Automize AirView to record and report results.

www.ubnt.com/airview

airControl

AirControl is a powerful and intuitive web based server network management application which allows operators to centrally manage entire networks of Ubiqutii devices.

Network Map

Monitor Device Status

Mass Firmware Upgrade

Web UI Access

Manage Groups of Devices

Task Scheduling

www.ubnt.com/aircontrol

* Only Rocket M GPS Models

Datasheet

rocketM

www.ubnt.com

Specifications

System Information	
Processor Specs	Atheros MIPS 24KC, 400MHz
Memory Information	64MB SDRAM, 8MB Flash
	M	M GPS
Networking Interface	1 X 10/100 BASE-TX (Cat. 5, RJ-45) Ethernet	2 X 10/100 BASE-TX (Cat. 5, RJ-45) Ethernet

Regulatory / Compliance Information			
	M900, M2, M5, M2 GPS, M5 GPS	M3	M365, M365 GPS
Wireless Approvals	FCC Part 15.247, IC RS210, CE	-	FCC Part 90Y
RoHS Compliance	YES		

Physical / Electrical / Environmental	
Enclosure Size	17 x 8 x 3cm (length, width, height)
Weight	0.5kg
Enclosure Characteristics	Outdoor UV Stabilized Plastic
Mounting Kit	Pole Mounting Kit included
Power Supply	24V, 1A POE Supply included
Power Method	Passive Power over Ethernet (pairs 4, 5+; 7, 8 return)
Operating Temperature	-30C to 75C
Operating Humidity	5 to 95% Condensing
Shock and Vibration	ETSI300-019-1.4
	M	M GPS
RF Connector	2x RP-SMA (Waterproof)	2x RP-SMA and 1x SMA (Waterproof)
	M (Except M5), M GPS (Except M5 GPS)	M5, M5 GPS
Max Power Consumption	6.5 Watts	8 Watts

Compatible Antennas				
M900	M2, M2 GPS	M3	M365, M365 GPS	M5, M5 GPS
AirMax Sector 900M-13-120	AirMax Sector 2G-16-90 2G-15-120	AirMax Sector 3G-18-120	AirMax Sector 3G-18-120	AirMax Sector 5G-17-90 5G-16-120 5G-20-90 5G-19-120
	Rocket Dish 2G-24	Rocket Dish 3G-26	Rocket Dish 3G-26	
				Rocket Dish 5G-30 5G-34

Specifications (cont.)

Operating Frequency Summary (MHz)				
M900	M2, M2 GPS	M3	M365, M365 GPS	M5, M5 GPS
902-928	2412-2462	3400-3700	3650-3675	5470-5825*

Rocket M900 - Operating Frequency 902-928 MHz							
OUTPUT POWER: 28 dBm							
900 MHz TX POWER SPECIFICATIONS					900 MHz RX POWER SPECIFICATIONS		
AirMax	MCS0	28 dBm	+/- 2 dB		AirMax	MCS0	-96 dBm	+/- 2 dB
	MCS1	28 dBm	+/- 2 dB			MCS1	-95 dBm	+/- 2 dB
	MCS2	28 dBm	+/- 2 dB			MCS2	-92 dBm	+/- 2 dB
	MCS3	28 dBm	+/- 2 dB			MCS3	-90 dBm	+/- 2 dB
	MCS4	28 dBm	+/- 2 dB			MCS4	-86 dBm	+/- 2 dB
	MCS5	24 dBm	+/- 2 dB			MCS5	-83 dBm	+/- 2 dB
	MCS6	22 dBm	+/- 2 dB			MCS6	-77 dBm	+/- 2 dB
	MCS7	21 dBm	+/- 2 dB			MCS7	-74 dBm	+/- 2 dB
	MCS8	28 dBm	+/- 2 dB			MCS8	-95 dBm	+/- 2 dB
	MCS9	28 dBm	+/- 2 dB			MCS9	-93 dBm	+/- 2 dB
	MCS10	28 dBm	+/- 2 dB			MCS10	-90 dBm	+/- 2 dB
	MCS11	28 dBm	+/- 2 dB			MCS11	-87 dBm	+/- 2 dB
	MCS12	28 dBm	+/- 2 dB			MCS12	-84 dBm	+/- 2 dB
	MCS13	24 dBm	+/- 2 dB			MCS13	-79 dBm	+/- 2 dB
	MCS14	22 dBm	+/- 2 dB			MCS14	-78 dBm	+/- 2 dB
	MCS15	21 dBm	+/- 2 dB			MCS15	-75 dBm	+/- 2 dB

Rocket M2 / M2 GPS - Operating Frequency 2412-2462 MHz							
OUTPUT POWER: 28 dBm							
2.4 GHz TX POWER SPECIFICATIONS					2.4 GHz RX POWER SPECIFICATIONS		
	DataRate	Avg. TX	Tolerance			DataRate	Avg. TX	Tolerance
11g	1-24 Mbps	28 dBm	+/- 2 dB		11g	1-24 Mbps	-97 dBm min	+/- 2 dB
	36 Mbps	26 dBm	+/- 2 dB			36 Mbps	-80 dBm	+/- 2 dB
	48 Mbps	25 dBm	+/- 2 dB			48 Mbps	-77 dBm	+/- 2 dB
	54 Mbps	24 dBm	+/- 2 dB			54 Mbps	-75 dBm	+/- 2 dB
11n / AirMax	MCS0	28 dBm	+/- 2 dB		11n / AirMax	MCS0	-96 dBm	+/- 2 dB
	MCS1	28 dBm	+/- 2 dB			MCS1	-95 dBm	+/- 2 dB
	MCS2	28 dBm	+/- 2 dB			MCS2	-92 dBm	+/- 2 dB
	MCS3	28 dBm	+/- 2 dB			MCS3	-90 dBm	+/- 2 dB
	MCS4	27 dBm	+/- 2 dB			MCS4	-86 dBm	+/- 2 dB
	MCS5	25 dBm	+/- 2 dB			MCS5	-83 dBm	+/- 2 dB
	MCS6	23 dBm	+/- 2 dB			MCS6	-77 dBm	+/- 2 dB
	MCS7	22 dBm	+/- 2 dB			MCS7	-74 dBm	+/- 2 dB
	MCS8	28 dBm	+/- 2 dB			MCS8	-95 dBm	+/- 2 dB
	MCS9	28 dBm	+/- 2 dB			MCS9	-93 dBm	+/- 2 dB
	MCS10	28 dBm	+/- 2 dB			MCS10	-90 dBm	+/- 2 dB
	MCS11	28 dBm	+/- 2 dB			MCS11	-87 dBm	+/- 2 dB
	MCS12	27 dBm	+/- 2 dB			MCS12	-84 dBm	+/- 2 dB
	MCS13	25 dBm	+/- 2 dB			MCS13	-79 dBm	+/- 2 dB
	MCS14	23 dBm	+/- 2 dB			MCS14	-78 dBm	+/- 2 dB
	MCS15	22 dBm	+/- 2 dB			MCS15	-75 dBm	+/- 2 dB

Datasheet

* Only 5745 - 5825 MHz is supported in the USA

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Specifications (cont.)

Rocket M3 - Operating Frequency 3400-3700 MHz							
OUTPUT POWER: 25 dBm							
TX POWER SPECIFICATIONS					RX POWER SPECIFICATIONS		
AirMax	MCS0	25 dBm	+/- 2 dB		MCS0	-94 dBm	+/- 2 dB
	MCS1	25 dBm	+/- 2 dB	AirMax	MCS1	-93 dBm	+/- 2 dB
	MCS2	25 dBm	+/- 2 dB		MCS2	-90 dBm	+/- 2 dB
	MCS3	25 dBm	+/- 2 dB		MCS3	-89 dBm	+/- 2 dB
	MCS4	24 dBm	+/- 2 dB		MCS4	-86 dBm	+/- 2 dB
	MCS5	23 dBm	+/- 2 dB		MCS5	-83 dBm	+/- 2 dB
	MCS6	22 dBm	+/- 2 dB		MCS6	-77 dBm	+/- 2 dB
	MCS7	20 dBm	+/- 2 dB		MCS7	-74 dBm	+/- 2 dB
	MCS8	25 dBm	+/- 2 dB		MCS8	-93 dBm	+/- 2 dB
	MCS9	25 dBm	+/- 2 dB		MCS9	-91 dBm	+/- 2 dB
	MCS10	25 dBm	+/- 2 dB		MCS10	-89 dBm	+/- 2 dB
	MCS11	25 dBm	+/- 2 dB		MCS11	-87 dBm	+/- 2 dB
	MCS12	24 dBm	+/- 2 dB		MCS12	-84 dBm	+/- 2 dB
	MCS13	23 dBm	+/- 2 dB		MCS13	-79 dBm	+/- 2 dB
	MCS14	22 dBm	+/- 2 dB		MCS14	-78 dBm	+/- 2 dB
	MCS15	20 dBm	+/- 2 dB		MCS15	-75 dBm	+/- 2 dB

Rocket M365 / M365 GPS - Operating Frequency 3650-3675 MHz							
OUTPUT POWER: 25 dBm							
TX POWER SPECIFICATIONS					RX POWER SPECIFICATIONS		
AirMax	MCS0	25 dBm	+/- 2 dB		MCS0	-94 dBm	+/- 2 dB
	MCS1	25 dBm	+/- 2 dB	AirMax	MCS1	-93 dBm	+/- 2 dB
	MCS2	25 dBm	+/- 2 dB		MCS2	-90 dBm	+/- 2 dB
	MCS3	25 dBm	+/- 2 dB		MCS3	-89 dBm	+/- 2 dB
	MCS4	24 dBm	+/- 2 dB		MCS4	-86 dBm	+/- 2 dB
	MCS5	23 dBm	+/- 2 dB		MCS5	-83 dBm	+/- 2 dB
	MCS6	22 dBm	+/- 2 dB		MCS6	-77 dBm	+/- 2 dB
	MCS7	20 dBm	+/- 2 dB		MCS7	-74 dBm	+/- 2 dB
	MCS8	25 dBm	+/- 2 dB		MCS8	-93 dBm	+/- 2 dB
	MCS9	25 dBm	+/- 2 dB		MCS9	-91 dBm	+/- 2 dB
	MCS10	25 dBm	+/- 2 dB		MCS10	-89 dBm	+/- 2 dB
	MCS11	25 dBm	+/- 2 dB		MCS11	-87 dBm	+/- 2 dB
	MCS12	24 dBm	+/- 2 dB		MCS12	-84 dBm	+/- 2 dB
	MCS13	23 dBm	+/- 2 dB		MCS13	-79 dBm	+/- 2 dB
	MCS14	22 dBm	+/- 2 dB		MCS14	-78 dBm	+/- 2 dB
	MCS15	20 dBm	+/- 2 dB		MCS15	-75 dBm	+/- 2 dB

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rocketM

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Specifications (cont.)

Rocket M5 / M5 GPS - Operating Frequency 5470-5825 MHz*							
OUTPUT POWER: 27 dBm							
5 GHz TX POWER SPECIFICATIONS					5 GHz RX POWER SPECIFICATIONS		
	DataRate	Avg. TX	Tolerance			DataRate	Avg. TX	Tolerance
11a	6-24 Mbps	27 dBm	+/- 2 dB		11a	6-24 Mbps	-94 dBm min	+/- 2 dB
	36 Mbps	25 dBm	+/- 2 dB			36 Mbps	-80 dBm	+/- 2 dB
	48 Mbps	23 dBm	+/- 2 dB			48 Mbps	-77 dBm	+/- 2 dB
	54 Mbps	22 dBm	+/- 2 dB			54 Mbps	-75 dBm	+/- 2 dB
11n / AirMax	MCS0	27 dBm	+/- 2 dB		11n / AirMax	MCS0	-96 dBm	+/- 2 dB
	MCS1	27 dBm	+/- 2 dB			MCS1	-95 dBm	+/- 2 dB
	MCS2	27 dBm	+/- 2 dB			MCS2	-92 dBm	+/- 2 dB
	MCS3	27 dBm	+/- 2 dB			MCS3	-90 dBm	+/- 2 dB
	MCS4	26 dBm	+/- 2 dB			MCS4	-86 dBm	+/- 2 dB
	MCS5	24 dBm	+/- 2 dB			MCS5	-83 dBm	+/- 2 dB
	MCS6	22 dBm	+/- 2 dB			MCS6	-77 dBm	+/- 2 dB
	MCS7	21 dBm	+/- 2 dB			MCS7	-74 dBm	+/- 2 dB
	MCS8	27 dBm	+/- 2 dB			MCS8	-95 dBm	+/- 2 dB
	MCS9	27 dBm	+/- 2 dB			MCS9	-93 dBm	+/- 2 dB
	MCS10	27 dBm	+/- 2 dB			MCS10	-90 dBm	+/- 2 dB
	MCS11	27 dBm	+/- 2 dB			MCS11	-87 dBm	+/- 2 dB
	MCS12	26 dBm	+/- 2 dB			MCS12	-84 dBm	+/- 2 dB
	MCS13	24 dBm	+/- 2 dB			MCS13	-79 dBm	+/- 2 dB
	MCS14	22 dBm	+/- 2 dB			MCS14	-78 dBm	+/- 2 dB
	MCS15	21 dBm	+/- 2 dB			MCS15	-75 dBm	+/- 2 dB

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* Only 5745 - 5825 MHz is supported in the USA

TOUGHCable

OUTDOOR CARRIER CLASS SHIELDED

Protect your networks from the most brutal environments with Ubiquiti's industrial-grade shielded ethernet cable, TOUGHCable.

Increase Performance Dramatically improve your ethernet link states, speeds, and overall performance with Ubiquiti TOUGHCables.

Extreme Weatherproof TOUGHCables have been built to perform even in the harshest weather and environments.

Eliminate ESD Attacks Protect your networks from devastating ESD Attacks, TOUGHCables eliminate ESD attacks and ethernet hardware damage.

Extended Cable Support TOUGHCables have been developed to have increased power handling performance for extended cable run lengths.

Twisted Pair
ESD Drain Wire
Separation
Cable Shield
Weatherproof Jacket

LEVEL 1
SHIELDING PROTECTION

Twisted Pair
Anti-Crosstalk Divider
ESD Drain Wire
Cable Shield
Secondary Cable Shield
Weatherproof Jacket

LEVEL 2
SHIELDING PROTECTION

Bulletproof your networks

TOUGHCable is currently available in two versions: Level 1 Shielding Protection and Level 2 Shielding Protection.

Level 1 is a Category 5e (100Mbps Ethernet Support) Outdoor Carrier Class Shielded Cable.

Level 2 is a Category 6 (1Gbps Ethernet Support) Outdoor Carrier Class Shielded Cable that is also capable of providing enhanced Category 5e performance.

Additional Information:
• 24 AWG copper conductor pairs
• ESD Drain Wire: 26 AWG integrated ESD Drain wire to prevent ESD attacks & damage.
• PVC outdoor rated jacket
• 0.35um foil shield
• Multi-Layered Shielding
• 1000ft (304.8m) length

Learn more:
www.ubnt.com/toughcable

ESD Attacks are overwhelmingly the leading cause for device failures. The diagram below illustrates the areas vulnerable to ESD Attacks in a defenseless network.

By using a grounded Ubiquiti POE adapter (included) along with Ubiquiti TOUGHCable (sold separately), you can effectively eliminate ESD Attacks.

OUTDOOR

MAIN

ESD

ESD

Unshielded cable with no ESD Drain

POE Adapter with no earth ground

LAN

ESD

Ubiquiti TOUGHCable

Ubiquiti POE Adapter

Datasheet

rocket M

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NanoStation***M***
NanoStation loco***M***

Compact, Hi-Power, 2x2 MIMO AirMax TDMA Station

Models: NSM2, NSM3, NSM365, NSM5, LOCOM2, LOCOM5, LOCOM9

Cost Effective, Hi-Performance

Compact and Versatile Design

Powerful integrated Antenna

UBIQUITI
NETWORKS

Leading Edge Industrial Design

The original NanoStation set the bar for the world's first low-cost and efficiently designed outdoor broadband CPE. The new NanoStation M and NanoStation Loco M take the same concept to the future with new redesigned sleek and elegant form-factors along with integrated AirMax (MIMO TDMA Protocol) Technology.

The low cost, hi-performance, and small form factor of NanoStation M and NanoStation Loco M make them extremely versatile and ideal in several different applications (see diagrams on right for some usage examples).

Usage Examples

PTMP CLIENT LINKS
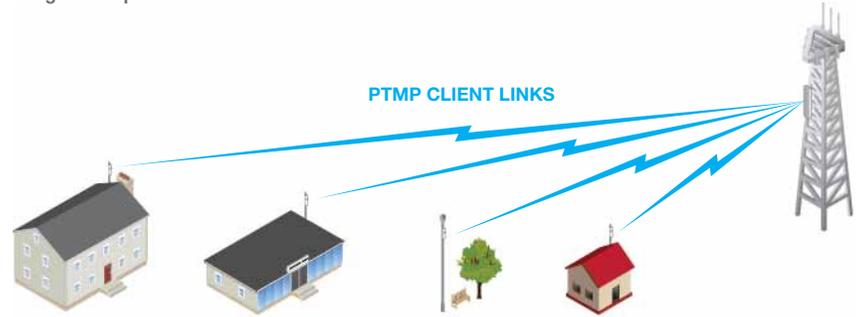
NanoStation M as powerful clients in an AirMax PTMP (point to multi-point) network setup.
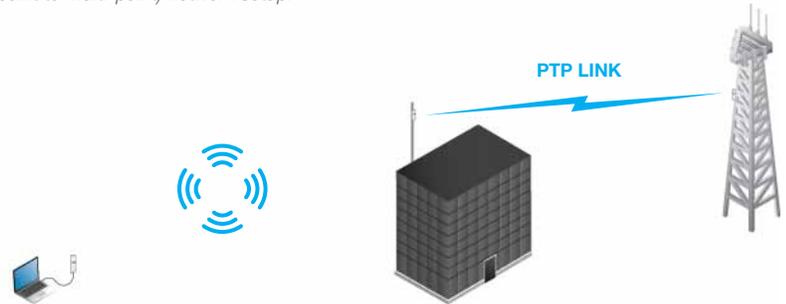
PTP LINK

NanoStation M as a powerful wireless client.

Use two NanoStation M to create a PTP link.

Integrated AirMax Technology

Unlike standard WiFi protocol, Ubiquiti's Time Division Multiple Access (TDMA) AirMax protocol allows each client to send & receive data using pre-designated time slots scheduled by an intelligent AP controller.

This "time slot" method eliminates hidden node collisions & maximizes air time efficiency. It provides many magnitudes of performance improvements in latency, throughput, & scalability compared to all other outdoor systems in its class.

Intelligent QoS Priority is given to voice/video for seamless access.

Scalability High capacity and scalability.

Long Distance Capable of high speed 50km+ links

Latency Multiple features dramatically reduce noise.

Dual Ethernet Connectivity *

The New NanoStation M provides a secondary ethernet port with software enabled POE output for seamless IP Video integration.

Intelligent POE **

Remote hardware reset circuitry of NanoStation M allows for device to be reset remotely from power supply location. In addition, any NanoStation can easily become 802.3af 48V compliant through use of Ubiquiti's Instant 802.3af adapter (sold separately).
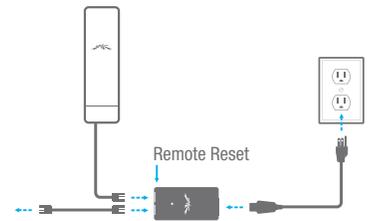
Remote Reset

* Only NanoStation M models.
** Remote reset is an additional option. Nanostation M comes standard as 24V without remote reset.

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NanoStation M NanoStation Loco M | **Datasheet**

[top] **NSM2** (2.4GHz, 10.4-11.2dBi), **NSM3** (3.4-3.7GHz, 12.2-13.7dBi), **NSM365** (3.65GHz, 12.2-13.7dBi), **NSM5** (5GHz, 14.6-16.1dBi)
[bottom left] **LOCOM9** (900MHz, 8dBi) [bottom right] **LOCOM2** (2.4GHz, 8.5dBi), **LOCOM5** (5GHz, 13dBi)

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NanoStation**M** NanoStation|○○○**M** | **Datasheet**

airOS

AirOS is an intuitive, versatile, highly developed Ubiquiti firmware technology. It is exceptionally intuitive and was designed to require no training to operate. Behind the user interface is a powerful firmware architecture which enables hi-performance outdoor multipoint networking.

Protocol Support

Ubiquiti Channelization

Spectral Width Adjust

ACK Auto-Timing

AAP Technology

Multi-Language Support

www.ubnt.com/airos

airView

Integrated on all Ubiquiti M products, AirView provides Advanced Spectrum Analyzer Functionality: Waterfall, waveform, and real-time spectral views allow operators to identify noise signatures and plan their networks to minimize noise interference.

Waterfall Aggregate energy over time for each frequency.

Waveform Aggregate energy collected.

Real-time Energy is shown real-time as a function of frequency.

Recording Automize AirView to record and report results.

www.ubnt.com/airview

airControl

AirControl is a powerful and intuitive web based server network management application which allows operators to centrally manage entire networks of Ubiqutii devices.

Network Map

Monitor Device Status

Mass Firmware Upgrade

Web UI Access

Manage Groups of Devices

Task Scheduling

www.ubnt.com/aircontrol

NanoStation**M** NanoStation |ᴏᴏᴏ**M** | Datasheet

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Specifications

System Information	
Processor Specs	Atheros MIPS 24KC, 400MHz
	LOCOM9	LOCOM, NSM
Memory Information	64MB SDRAM, 8MB Flash	32MB SDRAM, 8MB Flash
	LOCOM	NSM
Networking Interface	1 X 10/100 BASE-TX (Cat. 5, RJ-45) Ethernet	2 X 10/100 BASE-TX (Cat. 5, RJ-45) Ethernet

Regulatory / Compliance Information				
	LOCOM9	M2, M5**	NSM3	NSM365
Wireless Approvals	FCC Part 15.247, IC RS210	FCC Part 15.247, IC RS210, CE	-	FCC Part 90Z
RoHS Compliance	YES			

Physical / Electrical / Environmental / Antenna			
Enclosure Characteristics	Outdoor UV Stabilized Plastic		
Mounting Kit	Pole Mounting Kit included		
Power Method	Passive Power over Ethernet (pairs 4, 5+; 7, 8 return)		
Operating Temperature	-30C to 75C		
Operating Humidity	5 to 95% Condensing		
Shock and Vibration	ETSI300-019-1.4		
	LOCOM9	LOCOM	NSM
Dimensions	164 x 72 x 199 mm	163 x 31 x 80 mm	294 x 31 x 80 mm
Weight	0.9 kg	0.18 kg	0.4 kg 0.5 kg (M3/M365)
Power Supply (included)	24V, 1A POE	24V, 0.5A POE	24V, 0.5A POE 24V, 1A POE (M3/M365)
Max Power Consumption	6.5 Watts	5.5 Watts	8 Watts
Antenna Gain	8 dBi	8 dBi (M2) 13 dBi (M5)	11 dBi (M2) 13.7 dBi (M3/M365) 16 dBi (M5)
Polarization	Dual Linear		
RF Connector	External RP-SMA	-	-

Operating Frequency Summary (MHz)				
LOCOM9	M2**	NSM3	NSM365	M5**
902-928	2412-2462	3400-3700	3650-3675	5470-5825*

* Only 5745 - 5825 MHz is supported in the USA
** Applies to both NanoStation M and NanoStation Loco M models

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NanoStation M   NanoStation Loco M | Datasheet

Specifications (cont.) - LOCOM9

NanoStation Loco M9 - Operating Frequency 902-928 MHz								
OUTPUT POWER: 28 dBm								
900 MHz TX POWER SPECIFICATIONS					**900 MHz RX POWER SPECIFICATIONS**			
AirMax	MCS0	28 dBm	+/- 2 dB		AirMax	MCS0	-96 dBm	+/- 2 dB
	MCS1	28 dBm	+/- 2 dB			MCS1	-95 dBm	+/- 2 dB
	MCS2	28 dBm	+/- 2 dB			MCS2	-92 dBm	+/- 2 dB
	MCS3	28 dBm	+/- 2 dB			MCS3	-90 dBm	+/- 2 dB
	MCS4	28 dBm	+/- 2 dB			MCS4	-86 dBm	+/- 2 dB
	MCS5	24 dBm	+/- 2 dB			MCS5	-83 dBm	+/- 2 dB
	MCS6	22 dBm	+/- 2 dB			MCS6	-77 dBm	+/- 2 dB
	MCS7	21 dBm	+/- 2 dB			MCS7	-74 dBm	+/- 2 dB
	MCS8	28 dBm	+/- 2 dB			MCS8	-95 dBm	+/- 2 dB
	MCS9	28 dBm	+/- 2 dB			MCS9	-93 dBm	+/- 2 dB
	MCS10	28 dBm	+/- 2 dB			MCS10	-90 dBm	+/- 2 dB
	MCS11	28 dBm	+/- 2 dB			MCS11	-87 dBm	+/- 2 dB
	MCS12	28 dBm	+/- 2 dB			MCS12	-84 dBm	+/- 2 dB
	MCS13	24 dBm	+/- 2 dB			MCS13	-79 dBm	+/- 2 dB
	MCS14	22 dBm	+/- 2 dB			MCS14	-78 dBm	+/- 2 dB
	MCS15	21 dBm	+/- 2 dB			MCS15	-75 dBm	+/- 2 dB

NanoStation Loco M9 - Antenna Information (for integrated 2x2 MIMO Antenna)	
NanoStation Loco M9 also features a RP-SMA connector for a higher gain external antenna	
Gain	7.5 dBi
Cross-pol Isolation	28 dB minimum
Max VSWR	1.3:1
Beamwidth	60 deg. (H-pol) / 60 deg (V-pol) / 60 deg (Elevation)

Return Loss

Vertical Azimuth

Vertical Elevation

Horizontal Azimuth

Horizontal Elevation

Specifications (cont.) - LOCOM2

NanoStation Loco M2 - Operating Frequency 2412-2462 MHz							
OUTPUT POWER: 23 dBm							
2.4 GHz TX POWER SPECIFICATIONS					**2.4 GHz RX POWER SPECIFICATIONS**		
	DataRate	Avg. TX	Tolerance		DataRate	Avg. TX	Tolerance
11b / g	1-24 Mbps	23 dBm	+/- 2 dB	11b / g	1-24 Mbps	-83 dBm	+/- 2 dB
	36 Mbps	21 dBm	+/- 2 dB		36 Mbps	-80 dBm	+/- 2 dB
	48 Mbps	19 dBm	+/- 2 dB		48 Mbps	-77 dBm	+/- 2 dB
	54 Mbps	18 dBm	+/- 2 dB		54 Mbps	-75 dBm	+/- 2 dB
11n / AirMax	MCS0	23 dBm	+/- 2 dB	11n / AirMax	MCS0	-96 dBm	+/- 2 dB
	MCS1	23 dBm	+/- 2 dB		MCS1	-95 dBm	+/- 2 dB
	MCS2	23 dBm	+/- 2 dB		MCS2	-92 dBm	+/- 2 dB
	MCS3	23 dBm	+/- 2 dB		MCS3	-90 dBm	+/- 2 dB
	MCS4	22 dBm	+/- 2 dB		MCS4	-86 dBm	+/- 2 dB
	MCS5	20 dBm	+/- 2 dB		MCS5	-83 dBm	+/- 2 dB
	MCS6	18 dBm	+/- 2 dB		MCS6	-77 dBm	+/- 2 dB
	MCS7	17 dBm	+/- 2 dB		MCS7	-74 dBm	+/- 2 dB
	MCS8	23 dBm	+/- 2 dB		MCS8	-95 dBm	+/- 2 dB
	MCS9	23 dBm	+/- 2 dB		MCS9	-93 dBm	+/- 2 dB
	MCS10	23 dBm	+/- 2 dB		MCS10	-90 dBm	+/- 2 dB
	MCS11	23 dBm	+/- 2 dB		MCS11	-87 dBm	+/- 2 dB
	MCS12	22 dBm	+/- 2 dB		MCS12	-84 dBm	+/- 2 dB
	MCS13	20 dBm	+/- 2 dB		MCS13	-79 dBm	+/- 2 dB
	MCS14	18 dBm	+/- 2 dB		MCS14	-78 dBm	+/- 2 dB
	MCS15	17 dBm	+/- 2 dB		MCS15	-75 dBm	+/- 2 dB

NanoStation Loco M2 - Antenna Information	
Gain	8.5 dBi
Cross-pol Isolation	20 dB minimum
Max VSWR	1.4:1
Beamwidth	60 deg. (H-pol) / 60 deg (V-pol) / 60 deg (Elevation)

Return Loss

Vertical Azimuth

Vertical Elevation

Horizontal Azimuth

Horizontal Elevation

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NanoStation**M** NanoStation loco**M**

Specifications (cont.) - LOCOM5

NanoStation Loco M5 - Operating Frequency 5470-5825 MHz*							
OUTPUT POWER: 23 dBm							
5 GHz TX POWER SPECIFICATIONS					**5 GHz RX POWER SPECIFICATIONS**		
	DataRate	Avg. TX	Tolerance		DataRate	Avg. TX	Tolerance
11a	6-24 Mbps	23 dBm	+/- 2 dB	11a	6-24 Mbps	-83 dBm	+/- 2 dB
	36 Mbps	21 dBm	+/- 2 dB		36 Mbps	-80 dBm	+/- 2 dB
	48 Mbps	19 dBm	+/- 2 dB		48 Mbps	-77 dBm	+/- 2 dB
	54 Mbps	18 dBm	+/- 2 dB		54 Mbps	-75 dBm	+/- 2 dB
11n / AirMax	MCS0	23 dBm	+/- 2 dB	11n / AirMax	MCS0	-96 dBm	+/- 2 dB
	MCS1	23 dBm	+/- 2 dB		MCS1	-95 dBm	+/- 2 dB
	MCS2	23 dBm	+/- 2 dB		MCS2	-92 dBm	+/- 2 dB
	MCS3	23 dBm	+/- 2 dB		MCS3	-90 dBm	+/- 2 dB
	MCS4	22 dBm	+/- 2 dB		MCS4	-86 dBm	+/- 2 dB
	MCS5	20 dBm	+/- 2 dB		MCS5	-83 dBm	+/- 2 dB
	MCS6	18 dBm	+/- 2 dB		MCS6	-77 dBm	+/- 2 dB
	MCS7	17 dBm	+/- 2 dB		MCS7	-74 dBm	+/- 2 dB
	MCS8	23 dBm	+/- 2 dB		MCS8	-95 dBm	+/- 2 dB
	MCS9	23 dBm	+/- 2 dB		MCS9	-93 dBm	+/- 2 dB
	MCS10	23 dBm	+/- 2 dB		MCS10	-90 dBm	+/- 2 dB
	MCS11	23 dBm	+/- 2 dB		MCS11	-87 dBm	+/- 2 dB
	MCS12	22 dBm	+/- 2 dB		MCS12	-84 dBm	+/- 2 dB
	MCS13	20 dBm	+/- 2 dB		MCS13	-79 dBm	+/- 2 dB
	MCS14	18 dBm	+/- 2 dB		MCS14	-78 dBm	+/- 2 dB
	MCS15	17 dBm	+/- 2 dB		MCS15	-75 dBm	+/- 2 dB

NanoStation Loco M5 - Antenna Information	
Gain	13 dBi
Cross-pol Isolation	20 dB minimum
Max VSWR	1.4:1
Beamwidth	45 deg. (H-pol) / 45 deg (V-pol) / 45 deg (Elevation)

Return Loss

Vertical Azimuth

Vertical Elevation

Horizontal Azimuth

Horizontal Elevation

NanoStation M   NanoStation loco M | Datasheet

Specifications (cont.) - NSM2

NanoStation M2 - Operating Frequency 2412-2462 MHz							
OUTPUT POWER: 28 dBm							
2.4 GHz TX POWER SPECIFICATIONS					**2.4 GHz RX POWER SPECIFICATIONS**		
	DataRate	Avg. TX	Tolerance			DataRate	Avg. TX	Tolerance

	DataRate	Avg. TX	Tolerance		DataRate	Avg. TX	Tolerance
11b / g	1-24 Mbps	28 dBm	+/- 2 dB	**11b / g**	1-24 Mbps	-97 dBm min	+/- 2 dB
	36 Mbps	26 dBm	+/- 2 dB		36 Mbps	-80 dBm	+/- 2 dB
	48 Mbps	25 dBm	+/- 2 dB		48 Mbps	-77 dBm	+/- 2 dB
	54 Mbps	24 dBm	+/- 2 dB		54 Mbps	-75 dBm	+/- 2 dB
11n / AirMax	MCS0	28 dBm	+/- 2 dB	**11n / AirMax**	MCS0	-96 dBm	+/- 2 dB
	MCS1	28 dBm	+/- 2 dB		MCS1	-95 dBm	+/- 2 dB
	MCS2	28 dBm	+/- 2 dB		MCS2	-92 dBm	+/- 2 dB
	MCS3	28 dBm	+/- 2 dB		MCS3	-90 dBm	+/- 2 dB
	MCS4	27 dBm	+/- 2 dB		MCS4	-86 dBm	+/- 2 dB
	MCS5	25 dBm	+/- 2 dB		MCS5	-83 dBm	+/- 2 dB
	MCS6	23 dBm	+/- 2 dB		MCS6	-77 dBm	+/- 2 dB
	MCS7	22 dBm	+/- 2 dB		MCS7	-74 dBm	+/- 2 dB
	MCS8	28 dBm	+/- 2 dB		MCS8	-95 dBm	+/- 2 dB
	MCS9	28 dBm	+/- 2 dB		MCS9	-93 dBm	+/- 2 dB
	MCS10	28 dBm	+/- 2 dB		MCS10	-90 dBm	+/- 2 dB
	MCS11	28 dBm	+/- 2 dB		MCS11	-87 dBm	+/- 2 dB
	MCS12	27 dBm	+/- 2 dB		MCS12	-84 dBm	+/- 2 dB
	MCS13	25 dBm	+/- 2 dB		MCS13	-79 dBm	+/- 2 dB
	MCS14	23 dBm	+/- 2 dB		MCS14	-78 dBm	+/- 2 dB
	MCS15	22 dBm	+/- 2 dB		MCS15	-75 dBm	+/- 2 dB

NanoStation M2 - Antenna Information	
Gain	10.4-11.2 dBi
Cross-pol Isolation	23 dB minimum
Max VSWR	1.6:1
Beamwidth	55 deg. (H-pol) / 53 deg (V-pol) / 27 deg (Elevation)

Return Loss

Vertical Azimuth

Vertical Elevation

Horizontal Azimuth

Horizontal Elevation

www.ubnt.com

NanoStation**M** NanoStation | **Datasheet**

NanoStation M3 (3400-3700 MHz) / NanoStation M365 (3650-3675 MHz)							
OUTPUT POWER: 25 dBm							
TX POWER SPECIFICATIONS					RX POWER SPECIFICATIONS		
AirMax	MCS0	25 dBm	+/- 2 dB	AirMax	MCS0	-94 dBm	+/- 2 dB
	MCS1	25 dBm	+/- 2 dB		MCS1	-93 dBm	+/- 2 dB
	MCS2	25 dBm	+/- 2 dB		MCS2	-90 dBm	+/- 2 dB
	MCS3	25 dBm	+/- 2 dB		MCS3	-89 dBm	+/- 2 dB
	MCS4	24 dBm	+/- 2 dB		MCS4	-86 dBm	+/- 2 dB
	MCS5	23 dBm	+/- 2 dB		MCS5	-83 dBm	+/- 2 dB
	MCS6	22 dBm	+/- 2 dB		MCS6	-77 dBm	+/- 2 dB
	MCS7	20 dBm	+/- 2 dB		MCS7	-74 dBm	+/- 2 dB
	MCS8	25 dBm	+/- 2 dB		MCS8	-93 dBm	+/- 2 dB
	MCS9	25 dBm	+/- 2 dB		MCS9	-91 dBm	+/- 2 dB
	MCS10	25 dBm	+/- 2 dB		MCS10	-89 dBm	+/- 2 dB
	MCS11	25 dBm	+/- 2 dB		MCS11	-87 dBm	+/- 2 dB
	MCS12	24 dBm	+/- 2 dB		MCS12	-84 dBm	+/- 2 dB
	MCS13	23 dBm	+/- 2 dB		MCS13	-79 dBm	+/- 2 dB
	MCS14	22 dBm	+/- 2 dB		MCS14	-78 dBm	+/- 2 dB
	MCS15	20 dBm	+/- 2 dB		MCS15	-75 dBm	+/- 2 dB

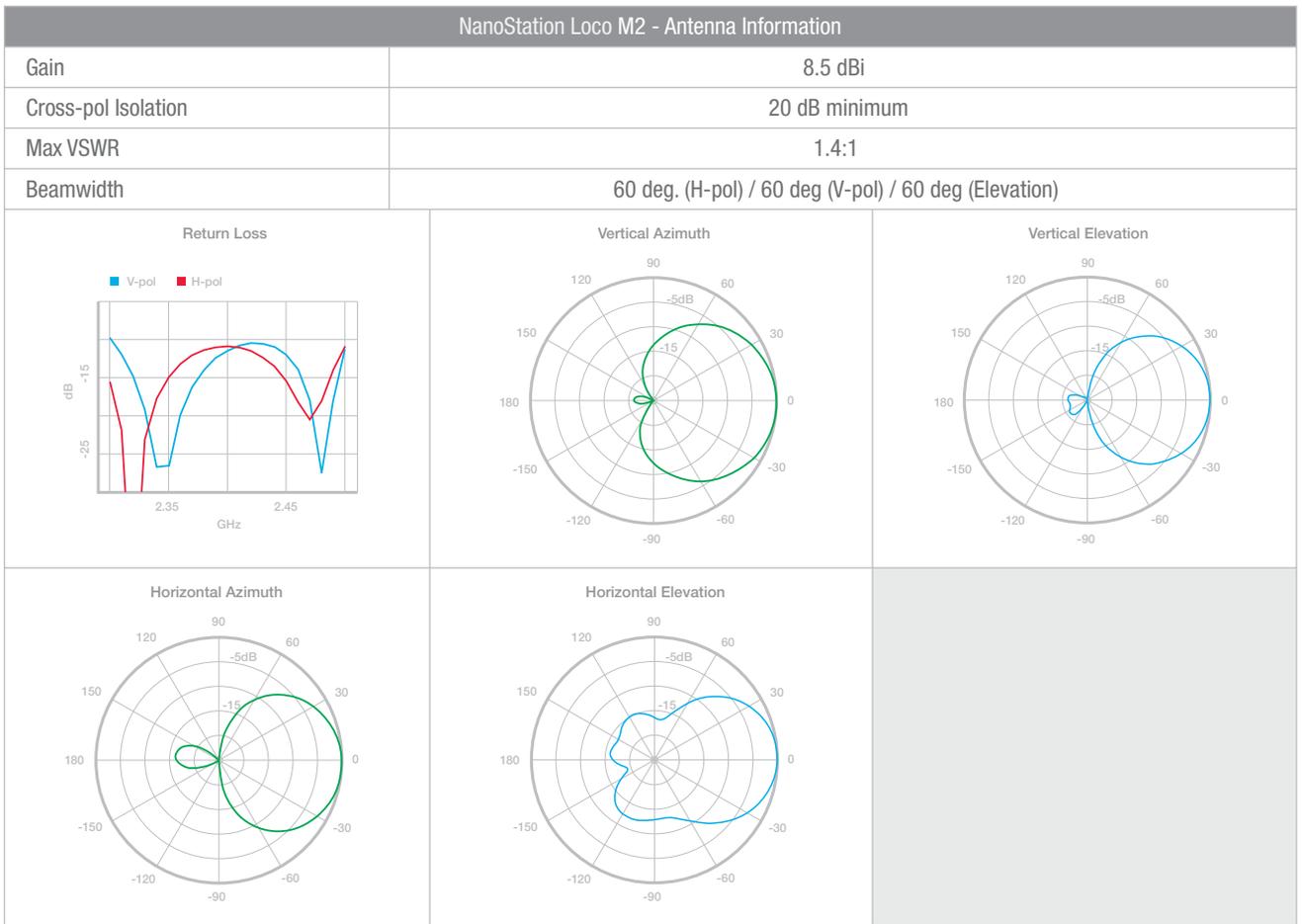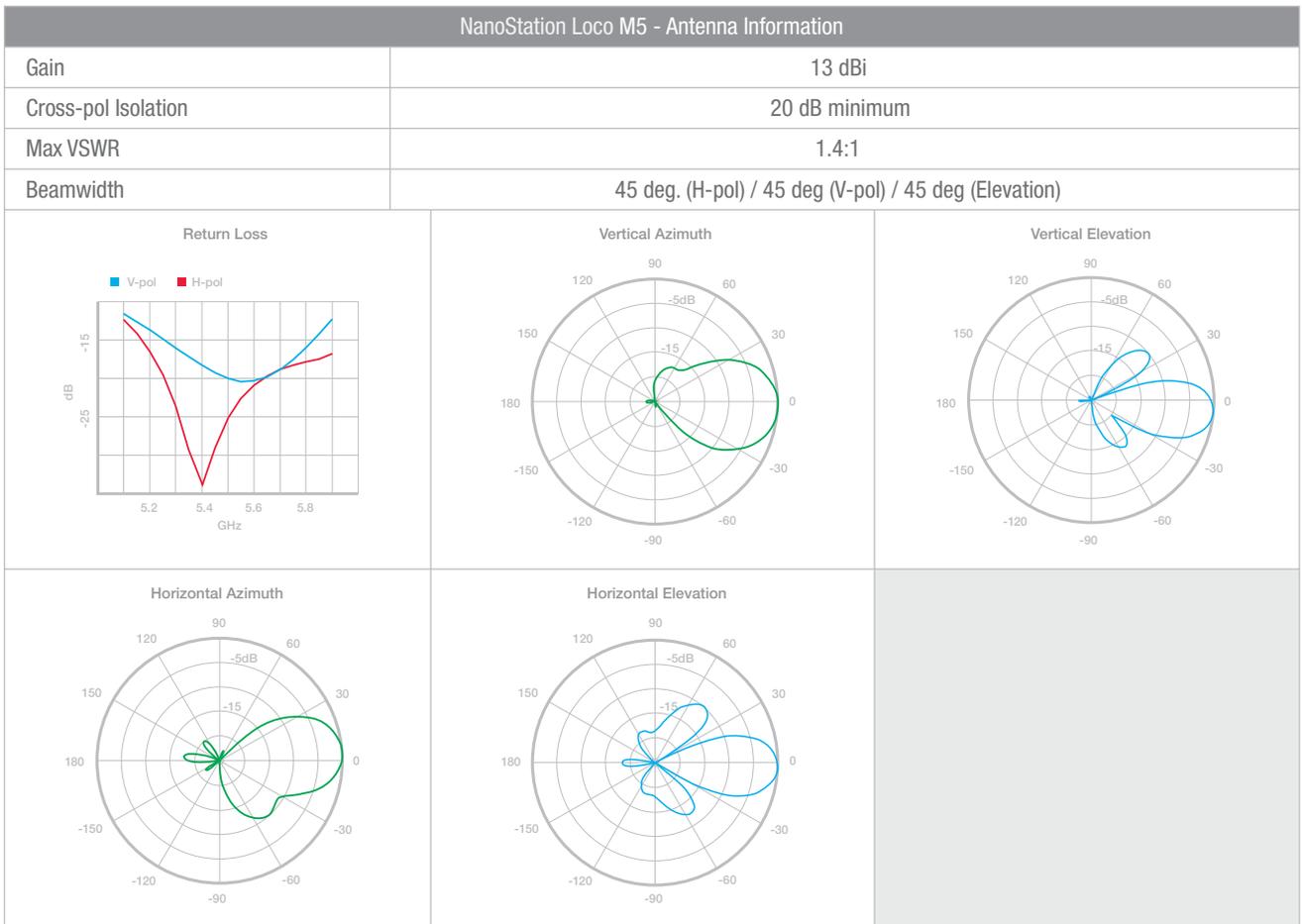| NanoStation M3 / M365 - Antenna Information	
Gain	12.2 - 13.7 dBi
Cross-pol Isolation	28 dB minimum
Max VSWR	1.4:1
Beamwidth	60 deg. (H-pol) / 60 deg (V-pol) / 20 deg (Elevation)

Return Loss

Vertical Azimuth

Vertical Elevation

Horizontal Azimuth

Horizontal Elevation

www.ubnt.com

NanoStation**M** NanoStation |ooo**M** | Datasheet

Specifications (cont.) - NSM5

NanoStation M5 - Operating Frequency 5470-5825 MHz							
OUTPUT POWER: 27 dBm							
5 GHz TX POWER SPECIFICATIONS				5 GHz RX POWER SPECIFICATIONS			
	DataRate	Avg. TX	Tolerance		DataRate	Avg. TX	Tolerance
11a	6-24 Mbps	27 dBm	+/- 2 dB	11a	6-24 Mbps	-94 dBm min	+/- 2 dB
	36 Mbps	25 dBm	+/- 2 dB		36 Mbps	-80 dBm	+/- 2 dB
	48 Mbps	23 dBm	+/- 2 dB		48 Mbps	-77 dBm	+/- 2 dB
	54 Mbps	22 dBm	+/- 2 dB		54 Mbps	-75 dBm	+/- 2 dB
11n / AirMax	MCS0	27 dBm	+/- 2 dB	11n / AirMax	MCS0	-96 dBm	+/- 2 dB
	MCS1	27 dBm	+/- 2 dB		MCS1	-95 dBm	+/- 2 dB
	MCS2	27 dBm	+/- 2 dB		MCS2	-92 dBm	+/- 2 dB
	MCS3	27 dBm	+/- 2 dB		MCS3	-90 dBm	+/- 2 dB
	MCS4	26 dBm	+/- 2 dB		MCS4	-86 dBm	+/- 2 dB
	MCS5	24 dBm	+/- 2 dB		MCS5	-83 dBm	+/- 2 dB
	MCS6	22 dBm	+/- 2 dB		MCS6	-77 dBm	+/- 2 dB
	MCS7	21 dBm	+/- 2 dB		MCS7	-74 dBm	+/- 2 dB
	MCS8	27 dBm	+/- 2 dB		MCS8	-95 dBm	+/- 2 dB
	MCS9	27 dBm	+/- 2 dB		MCS9	-93 dBm	+/- 2 dB
	MCS10	27 dBm	+/- 2 dB		MCS10	-90 dBm	+/- 2 dB
	MCS11	27 dBm	+/- 2 dB		MCS11	-87 dBm	+/- 2 dB
	MCS12	26 dBm	+/- 2 dB		MCS12	-84 dBm	+/- 2 dB
	MCS13	24 dBm	+/- 2 dB		MCS13	-79 dBm	+/- 2 dB
	MCS14	22 dBm	+/- 2 dB		MCS14	-78 dBm	+/- 2 dB
	MCS15	21 dBm	+/- 2 dB		MCS15	-75 dBm	+/- 2 dB

NanoStation M5 - Antenna Information	
Gain	14.6 - 16.1 dBi
Cross-pol Isolation	22 dB minimum
Max VSWR	1.6:1
Beamwidth	43 deg. (H-pol) / 41 deg (V-pol) / 15 deg (Elevation)

Return Loss

Vertical Azimuth

Vertical Elevation

Horizontal Azimuth

Horizontal Elevation

* Only 5745 - 5825 MHz is supported in the USA   www.ubnt.com

NanoStation **M** NanoStation | **Datasheet**

TOUGHCable
OUTDOOR CARRIER CLASS SHIELDED

Protect your networks from the most brutal environments with Ubiquiti's industrial-grade shielded ethernet cable, TOUGHCable.

Increase Performance Dramatically improve your ethernet link states, speeds, and overall performance with Ubiquiti TOUGHCables.

Extreme Weatherproof TOUGHCables have been built to perform even in the harshest weather and environments.

Eliminate ESD Attacks Protect your networks from devastating ESD Attacks, TOUGHCables eliminate ESD attacks and ethernet hardware damage.

Extended Cable Support TOUGHCables have been developed to have increased power handling performance for extended cable run lengths.

Twisted Pair
ESD Drain Wire
Separation
Cable Shield
Weatherproof Jacket

LEVEL1
SHIELDING PROTECTION

Twisted Pair
Anti-Crosstalk Divider
ESD Drain Wire
Cable Shield
Secondary Cable Shield
Weatherproof Jacket

LEVEL2
SHIELDING PROTECTION

Bulletproof your networks

TOUGHCable is currently available in two versions: Level 1 Shielding Protection and Level 2 Shielding Protection.

Level 1 is a Category 5e (Up to 1Gbps Ethernet Support) Outdoor Carrier Class Shielded Cable.

Level 2 is a Category 5e Enhanced Gigabit Performance (1Gbps Ethernet Support) Outdoor Carrier Class Shielded Cable.

Additional Information:
- 24 AWG copper conductor pairs
- ESD Drain Wire: 26 AWG integrated ESD Drain wire to prevent ESD attacks & damage.
- PVC outdoor rated jacket
- 0.35um foil shield
- Multi-Layered Shielding
- 1000ft (304.8m) length
- Use with TOUGHCable Connectors (sold separately) for optimal performance

Learn more:
www.ubnt.com/toughcable

ESD Attacks are overwhelmingly the leading cause for device failures. The diagram below illustrates the areas vulnerable to ESD Attacks in a defenseless network.

By using a grounded Ubiquiti POE adapter (included) along with Ubiquiti TOUGHCable (sold separately), you can effectively eliminate ESD Attacks.

OUTDOOR
ESD
MAIN
ESD
Unshielded cable with no ESD Drain
POE Adapter with no earth ground
LAN
ESD

Ubiquiti TOUGHCable
Ubiquiti POE Adapter

NanoStation**M** NanoStation|oco**M** | **Datasheet**
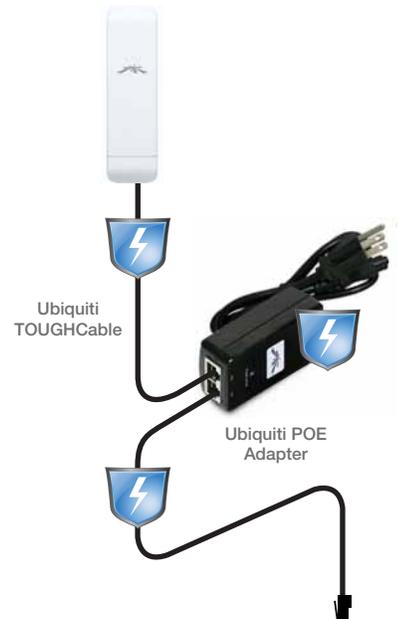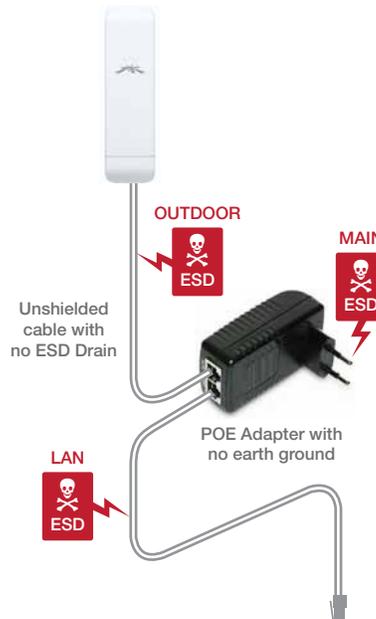
UBIQUITI
NETWORKS

TERMS OF USE: The Ubiquiti radio device must be professionally installed. Shielded ethernet cable and earth grounding must be used as conditions of product warranty. It is the installers responsibility to follow local country regulations including operation within legal frequency channels, output power, and Dynamic Frequency Selection (DFS) requirements.

For further information, please visit www.ubnt.com.

All specifications in this document are subject to change without notice.   NSM-DS-042911

airMAX™ Omni

Next-Gen 2x2 Dual Polarity MIMO Omni Antenna

Models: AMO-2G10, AMO-2G13, AMO-3G12, AMO-5G10, AMO-5G13

High Performance, Long Range

Seamlessly Integrates with RocketM

360° Coverage

UBIQUITI
NETWORKS

Overview

Omnidirectional Coverage

airMAX Omni is a Carrier Class 2x2 Dual Polarity MIMO Omnidirectional Antenna that was designed to seamlessly integrate with RocketM radios (RocketM sold separately).

Pair the RocketM's radio with the airMAX Omni's reach to create a powerful, 360° omnidirectional basestation.. This seamless integration gives network architects unparalleled flexibility and convenience.

On the right is one example of how airMAX Omni can be deployed:

Omni PtMP (Point to Multi-Point) Link Example

RocketDish with RocketM
(PtP Backhaul)

Internet Backbone

ISP Network

Corporate Campus with NanoBridgeM Clients

RocketDish with RocketM
(PtP Backhaul)

airMAX Omni with RocketM (PtMP)

Mobile Computer with airGridM Client
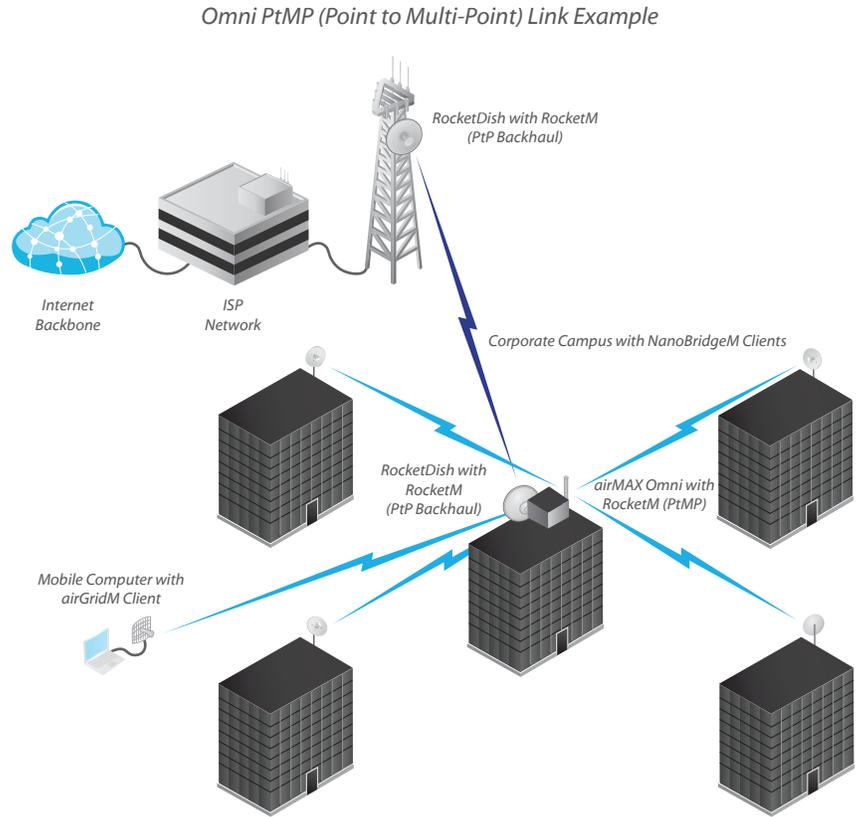
airMAX Omni antennas provide wide 360° coverage and utilize airMAX technology to produce carrier-class performance and power.

Utilize airMAX Technology*

Unlike standard Wi-Fi protocol, Ubiquiti's Time Division Multiple Access (TDMA) airMAX protocol allows each client to send and receive data using pre-designated time slots scheduled by an intelligent AP controller.

This "time slot" method eliminates hidden node collisions and maximizes airtime efficiency. It provides many magnitudes of performance improvements in latency, throughput, and scalability compared to all other outdoor systems in its class.

Intelligent QoS Priority is given to voice/video for seamless streaming.

Scalability High capacity and scalability.

Long Distance Capable of high-speed, carrier-class links.

Latency Multiple features dramatically reduce noise.

*   When Omni is paired with RocketM

Packet Prioritization

VOIP DATA VOIP VOIP VOIP

Frame

Time Slot 4

Time Channel

Time Slot 1 Time Slot 2 Time Slot 3 Time Slot 4
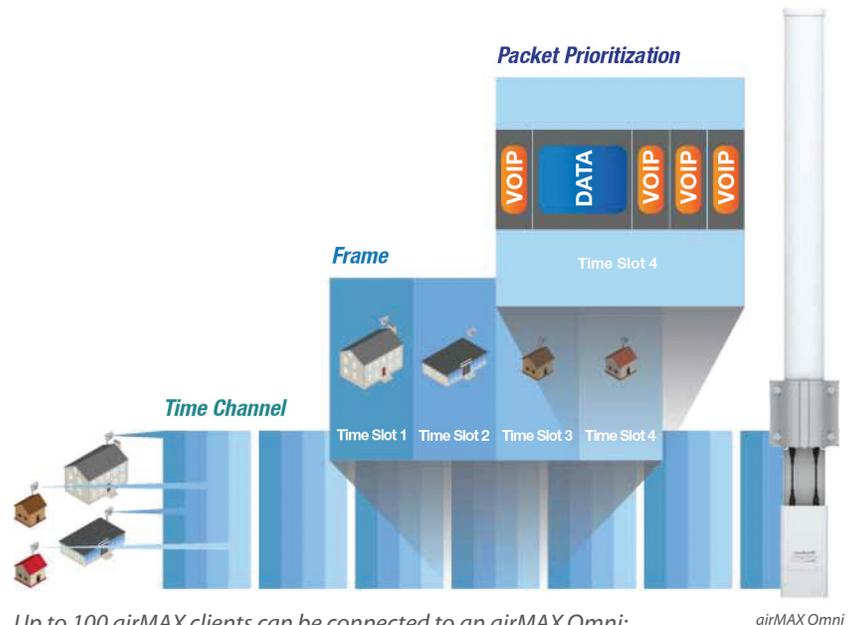
airMAX Omni

Up to 100 airMAX clients can be connected to an airMAX Omni; four airMAX clients are shown to illustrate the general concept.

Models

AMO-5G10
(5 GHz, 10 dBi)

AMO-5G13
(5 GHz, 13 dBi)

AMO-3G12
(3 GHz, 12 dBi)

AMO-2G10
(2.4 GHz, 10 dBi)

AMO-2G13
(2.4 GHz, 13 dBi)

Software

airOS™

airOS is an intuitive, versatile, highly developed Ubiquiti firmware technology. It is exceptionally intuitive and was designed to require no training to operate. Behind the user interface is a powerful firmware architecture, which enables high-performance, outdoor multipoint networking.

- Protocol Support
- Ubiquiti Channelization
- Spectral Width Adjustment
- ACK Auto-Timing
- AAP Technology
- Multi-Language Support
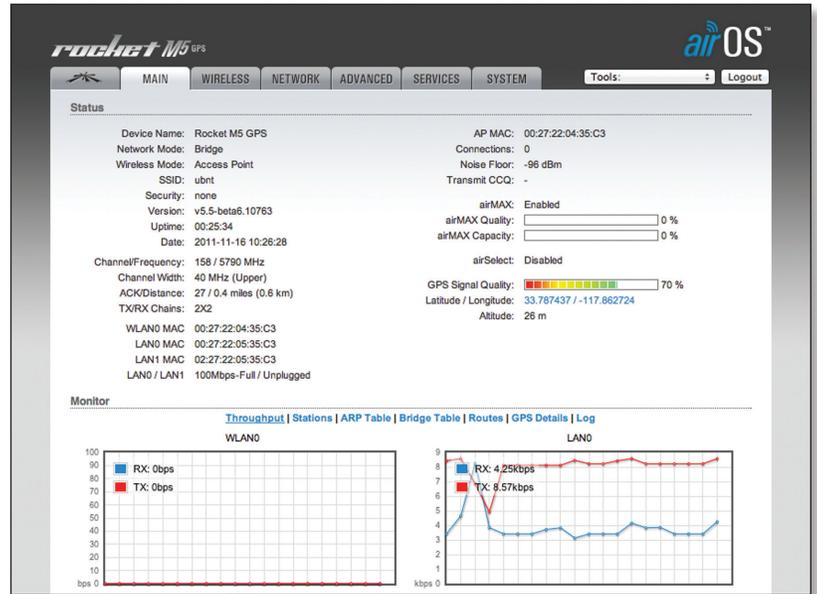
airView™

Integrated on all Ubiquiti M products, airView provides Advanced Spectrum Analyzer Functionality: Waterfall, waveform, and real-time spectral views allow operators to identify noise signatures and plan their networks to minimize noise interference.

- **Waterfall** Aggregate energy over time for each frequency.
- **Waveform** Aggregate energy collected.
- **Real-time** Energy is shown real-time as a function of frequency.
- **Recording** Automize AirView to record and report results.

airControl™

airControl is a powerful and intuitive, web-based server network management application, which allows operators to centrally manage entire networks of Ubiquiti devices.

- Network Map
- Monitor Device Status
- Mass Firmware Upgrade
- Web UI Access
- Manage Groups of Devices
- Task Scheduling

www.ubnt.com/airmax#airMaxAntennas
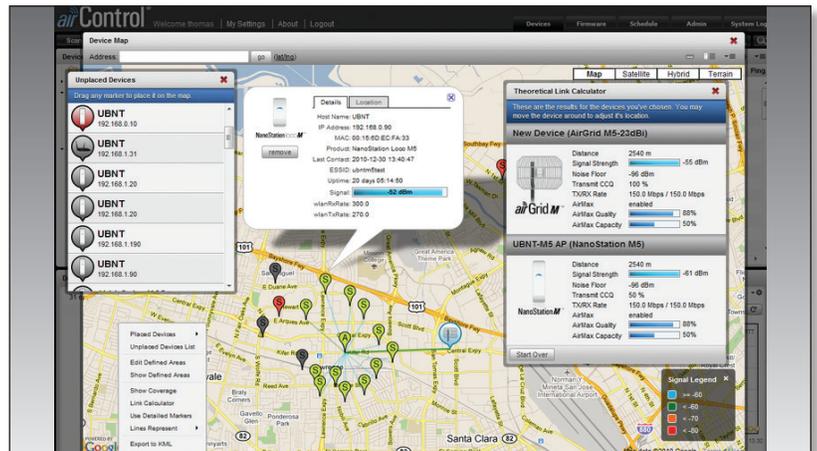
Specifications

Antenna Characteristics					
Model	AMO-2G10	AMO-2G13	AMO-3G12	AMO-5G10	AMO-5G13
Dimensions* (mm)	1030 X 122 X 84	1390 X 122 X 105	1012 X 122 X 105	582 X 90 X 65	799 X 90 X 65
Weight*	2.1 kg	2.4 kg	2.05 kg	0.68 kg	0.82 kg
Frequency Range	2.35 - 2.55 GHz	2.35 - 2.55 GHz	3.4 - 3.7 GHz	5.45 - 5.85 GHz	5.45 - 5.85 GHz*
Gain	10 dBi	13 dBi	12 dBi	10 dBi	13 dBi
Elevation Beamwidth	12°	7°	8°	12°	7°
Max VSWR	1.7:1	1.7:1	1.6:1	1.6:1	1.5:1
Downtilt	4°	2°	4°	4°	2°
Wind Survivability	125 mph	125 mph	125 mph	125 mph	125 mph
Wind Loading	14 lb @ 100 mph	16 lb @ 100 mph	16 lb @ 100 mph	10 lb @ 100 mph	12 lb @ 100 mph
Polarization	Dual-Linear	Dual-Linear	Dual-Linear	Dual-Linear	Dual-Linear
Cross-pol Isolation	25 dB min.	25 dB min.	25 dB min.	25 dB min.	25 dB min.
ETSI Specification	EN 302 326 DN2	EN 302 326 DN2	EN 302 326 DN2	EN 302 326 DN2	EN 302 326 DN2
Mounting	Universal Pole Mount, RocketM Bracket, and Weatherproof RF Jumpers Included				

*   Dimensions and weight include pole mount and exclude RocketM (RocketM sold separately)

AMO-2G10 Antenna Information
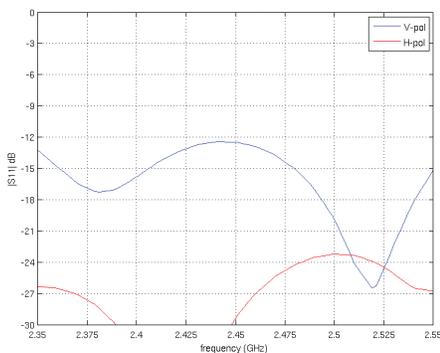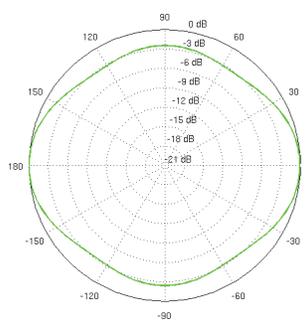
Return Loss

Vertical Azimuth

Vertical Elevation

Horizontal Azimuth

Horizontal Elevation

airMAX™ Omni

airMAX™ Omni

AMO-2G13 Antenna Information

Return Loss
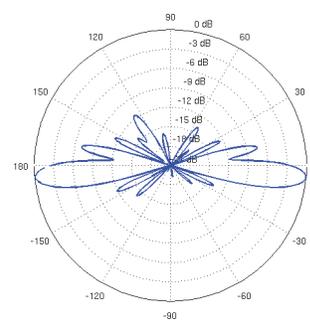
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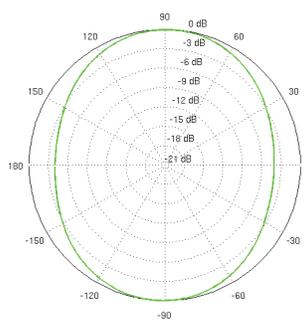
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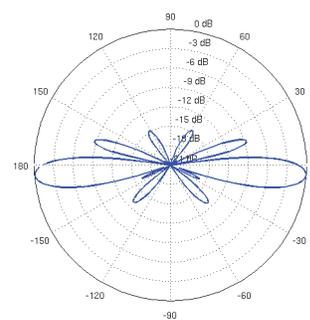
Horizontal Azimuth

Horizontal Elevation
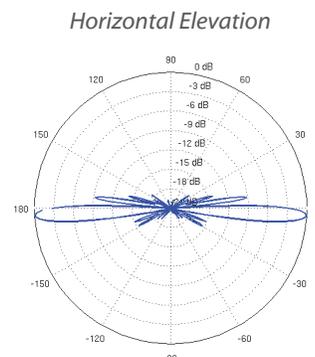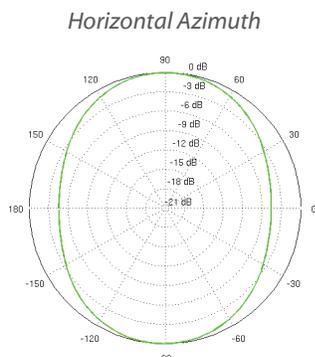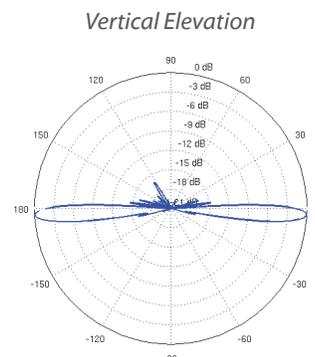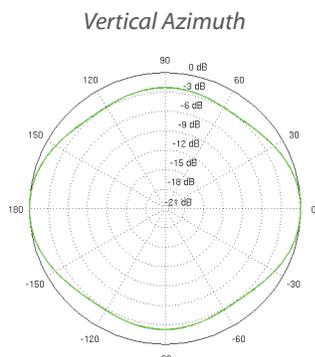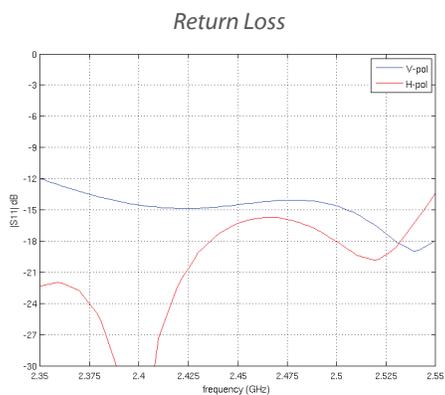
AMO-3G12 Antenna Information

Return Loss

Vertical Azimuth

Vertical Elevation

Horizontal Azimuth

Horizontal Elevation

www.ubnt.com/airmax#airMaxAntennas
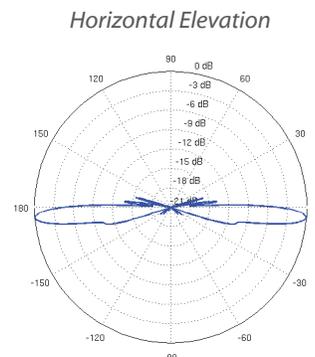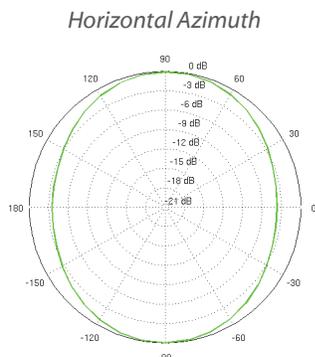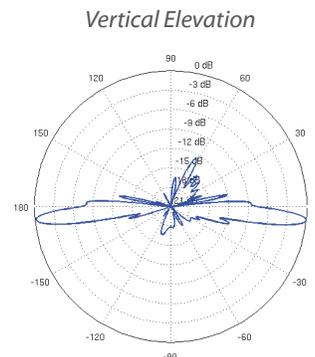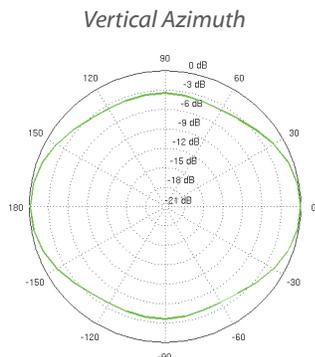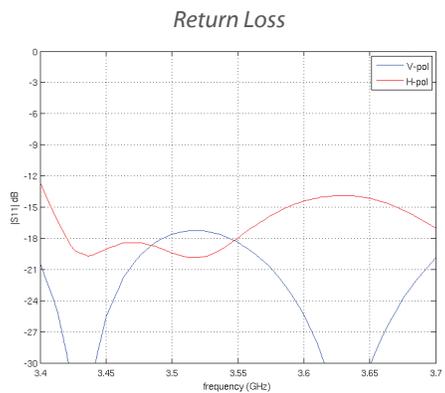
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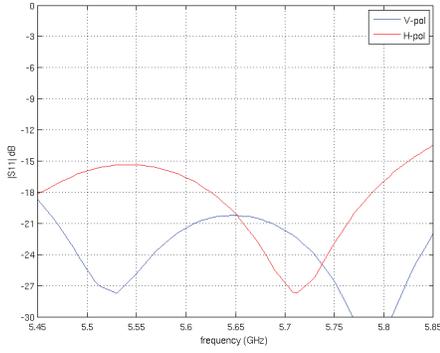
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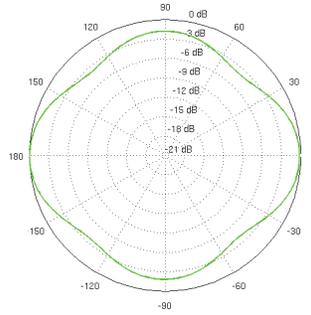
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Vertical Elevation
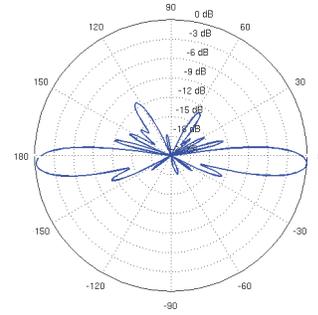
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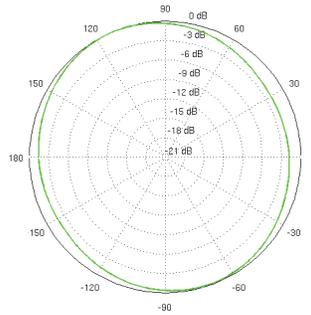
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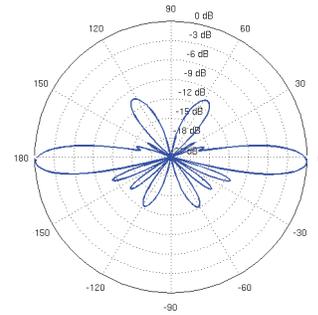
AMO-5G13 Antenna Information

Return Loss
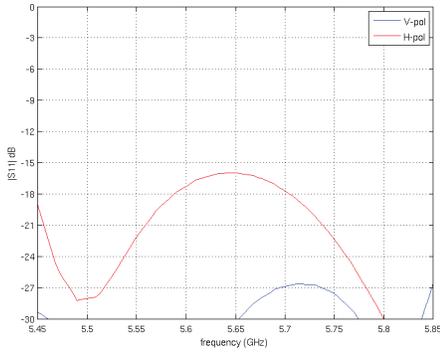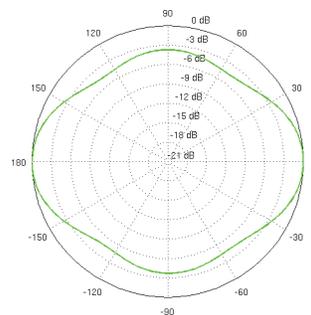
Vertical Azimuth

Vertical Elevation
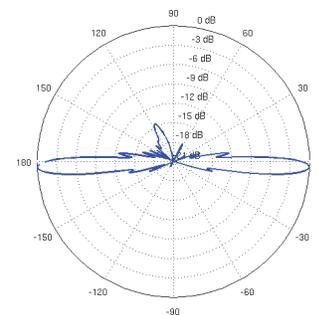
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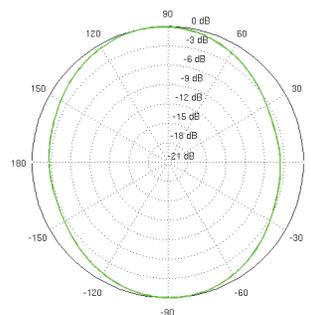
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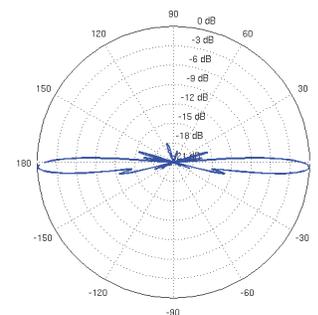
TOUGHCable™

OUTDOOR CARRIER CLASS SHIELDED

Protect your networks from the most brutal environments with Ubiquiti Networks' industrial-grade, shielded Ethernet cable, TOUGHCable.

Increase Performance
Dramatically improve your Ethernet link states, speeds, and overall performance with Ubiquiti TOUGHCables.

Extreme Weatherproof
Designed for outdoor use, TOUGHCables have been built to perform even in the harshest weather and environments.

ESD Damage Protection
Protect your networks from devastating electrostatic discharge (ESD) attacks.

Extended Cable Support
TOUGHCables have been developed to increase power handling performance for extended cable run lengths.

Bulletproof your networks

TOUGHCable is currently available in two versions: PRO Shielding Protection and CARRIER Shielding Protection.

TOUGHCable PRO is a Category 5e, outdoor, carrier-class shielded cable with an integrated ESD drain wire.

TOUGHCable CARRIER is a Category 5e, outdoor, carrier-class shielded cable that features an integrated ESD drain wire, anti-crosstalk divider, and secondary shielding. It is rated to provide optimal performance on Gigabit Ethernet networks.

Additional Information:

• 24 AWG copper conductor pairs
• 26 AWG integrated ESD drain wire to prevent ESD attacks and damage
• PE outdoor-rated, weatherproof jacket
• Multi-layered shielding
• Available in lengths of 1000 ft (304.8 m)

TOUGHCable Connectors

Specifically designed for use with Ubiquiti TOUGHCables and available in 100-pc. bags, TOUGHCable Connectors protect against ESD attacks and Ethernet hardware damage, while allowing rapid field deployment without soldering.

ESD attacks are the leading cause for device failures. The diagram below illustrates the areas vulnerable to ESD attacks in a network.

By using a grounded Ubiquiti Power over Ethernet (PoE) Adapter along with Ubiquiti TOUGHCable and TOUGHCable Connectors, you can effectively protect against ESD attacks.

Unshielded cable with no ESD drain

OUTDOOR ESD

MAIN ESD

LAN ESD

PoE adapter with no earth ground

Ubiquiti TOUGHCable

Ubiquiti PoE Adapter

TERMS OF USE: Ubiquiti radio devices must be professionally installed. Shielded Ethernet cable and earth grounding must be used as conditions of product warranty. TOUGHCable is designed for outdoor installations. It is the installer's responsibility to follow local country regulations, including operation within legal frequency channels, output power, indoor cabling requirements, and Dynamic Frequency Selection (DFS) requirements.

For further information, please visit www.ubnt.com.

All specifications in this document are subject to change without notice.

UBIQUITI NETWORKS™

www.ubnt.com

RR101112

DEMONSTRATION SOFTWARE
Job: TORRE CUADRADA 30M - 100KMH
TORRE AUTOSOPORTADA 30M
VELOCIDAD DE VIENTO VERIFICACION 100KMH

20 sep 2012
11:31 a.m.

30.00m
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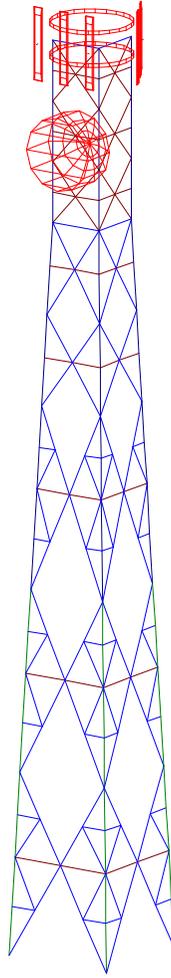
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SECTOR-1A SECTOR-1B SECTOR-1C SECT-1I

PLATAF
SECTOR-1D SECTOR-1E SECTOR-1F SECT

DISH-1

DISH-2

DESCANSO

12.00m
EA4X4X1/4

TORRE CUADRADA DE 30M - VISTA GENERAL LOAD

DEMONSTRATION SOFTWARE
Job: TORRE CUADRADA 30M - 100KMH
TORRE AUTOSOPORTADA 30M
VELOCIDAD DE VIENTO VERIFICACION 100KMH

20 sep 2012
11:29 a.m.

Design Ratios - % of Code Capacity:
<= 50
<= 95
<= 100
<= 105
<= 110
> 110

Z

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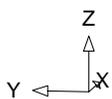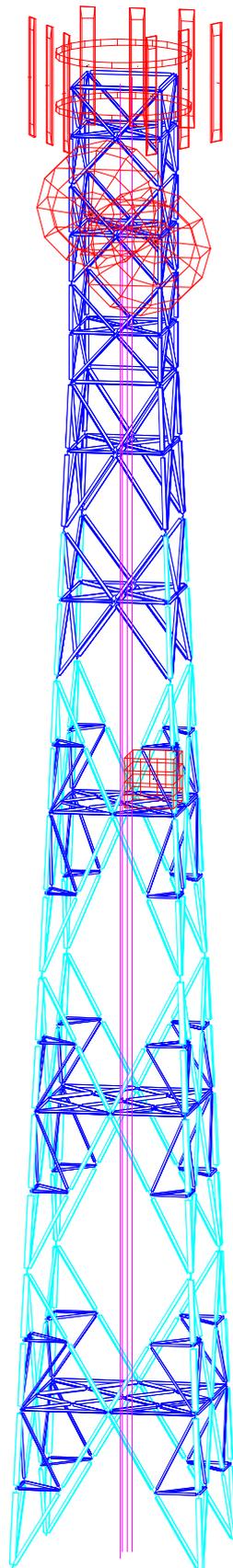
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TORRE CUADRADA DE 30M - RATIOS 100KMH

DEMONSTRATION SOFTWARE
Job: TORRE CUADRADA 30M - 100KMH
TORRE AUTOSOPORTADA 30M
VELOCIDAD DE VIENTO VERIFICACION 100KMH

20 sep 2012
11:30 a.m.

Z

Y ←—⟋—→ X

theta: 100 phi: 10

TORRE CUADRADA DE 30M - VISTA GENERAL

TELEPARTES

Puerta frontal-1

TELEPARTES

QUOTATION

RFQ Reference	108
Quotation Number	13-108
Quotation Date	September 11, 2013
Quotation Validity	November 11, 2013

BUYER DETAILS MTC FITEL Area de Formulación de Proyectos

Name	Mercedes Mercado
Address	
Country of Delivery	Peru
Contact Person	Mercedes Mercado / Ing. Juan Carlos Carpio
Phone	**6157800 Anexo 2606**
Fax	
Email	mmercador@mtc.gob.pe

MANUFACTURER / SELLER / EXPORTER DETAILS

Name	STERLITE TECHNOLOGIES LIMITED
Address	Camarones 4619
	Buenos Aires Argentina
Country of Manufacture	India
Contact Person	Raúl Andrés Fleman
Phone	+54 911 5856 7000
Fax	
Email	raul.fleman@sterlite.com

PROJECT : Regional Tumbes – PERU

PRICE OFFER DETAILS

Sr	Product Name (Specification Reference)	UoM	Quantity	Currency	Unit Price	Extended Amount
				US$	US$/ Mt	US$
1	Double Jacket Dielec ADSS 24 FO G652D Span 200 Mt Code : 02/12-F-D-S3-2-AA-200Mt	Mt	12.900.000,0	USD	0,955	12.319.500,00
2	Duble Jacket Dielec ADSS 24 FO G652D Span 400 Mt Code : 02/12-F-D-S3-2-AA-AT-6.5KN	Mt	1.950.000,0	US$	1,210	2.359.500,00
3	Duble Jacket Dielec ADSS 24 FO G652D Span 600 Mt Code : 02/12-F-D-S3-1-AA-AT-10.5KN	Mt	150.000,0	US$	1,298	194.700,00

4	Double Jacket Dielec ADSS 48 FO G652D Span 200 Mt	Mt	12.900.000	US$	1,265	16.318.500,00
	Code : 04/12-F-D-S3-2-AA-200Mt					
5	Double Jacket Dielec ADSS 48 FO G652D Span 400 Mt	Mt	1.950.000	US$	1,520	2.964.000,00
	Code : 04/12-F-D-S3-2-AA-400Mt					
6	Double Jacket Dielec ADSS 48 FO G652D Span 600 Mt	Mt	150.000	US$	1,631	244.650,00
	Code : 04/12-F-D-S3-2-AA-600Mt					
	TOTAL QUANTITY (Mt)		30.000.000,0 0		TAL VALUE	34.400.850,00

Amount in Words: Thirty four Million four hundred thousand, eigth hundred fifty American Dollars

DELIVERY DETAILS
INCOTERMS   CIF Callao – PERU
Mode of Shipment   Maritime
Freight Cost   Included
Insurance Cost   Included
Payment Terms   Letter of Credit or Bank Guarantee – 30 days from Bill of Lading
Delivery Schedule   4 to 5 weeks Ex Works for first 1.000 Km + transit time 8 to 9 weeks
                                   Delivery cronogram = 1.000 Km per each 4 weeks.

NOTES
1. This document must be read in conjunction with Sterlite's Standard Terms & Conditions of Sale (Ref: STL/TOS/Sep11)
2. This is an electronically generated document and hence does not require any authorization signature.

ANNEXURES
1. Sterlite's Standard Terms & Conditions of Sale (Ref: STL/TOS/Sep11)
2. Product specification sheets as above, mentioned in our price offer.

Telmark Supply S.A.C
Jr. Fray Luis de León 747
San Borja, Lima 41 - Perú
Telf. +511 225 5826 /225 5865
ventas@telmarkperu.com
RUC: 20547974787

www.telmarkperu.com

COTIZACIÓN N° TSS00859-2

Facturar a:	**FONDO DE INVERSION EN TELECOMUNICACIONES - FITEL**
Dirección:	**Jr. Zorritos Nro. 1203- LIMA - LIMA**
RUC:	**20514935590**

Entregar :	**FONDO DE INVERSION EN TELECOMUNICACIONES - FITEL**
Dirección:	**Jr. Zorritos Nro. 1203- LIMA - LIMA**
RUC:	**20514935590**

Item	Marca	Código / Modelo	Descripción	Cantid.	Uni. de Medida	Precio de Lista	Dcto (%)	Valor de venta Unitario	Valor de venta Total	Despacho Stock	Despacho Pendiente	Plazo de entrega de Pendientes (días)
1	ZTT	ASNT-030-1290	SET DE RETENCIÓN DOBLE PARA SPAN DE 150 A 300 METROS PARA CABLES CON 12.9MM OD	8910	SET	72.00	0	72.00	641,520.0	0	8910	70
2	ZTT	ASNT-050-1350	SET DE RETENCIÓN DOBLE PARA SPAN DE 301 A 600 METROS PARA CABLES CON 13.5MM OD	1484	SET	90.11	0	90.11	133,723.2	0	1484	70
3	ZTT	ASNT-050-1370	SET DE RETENCIÓN DOBLE PARA SPAN DE 301 A 600 METROS PARA CABLES CON 13.7MM OD	309	SET	90.11	0	90.11	27,844.0	0	309	70
4	ZTT	TGX-070-230	ABRAZADERA PARA FIJACIÓN DE SUSPENSIONES Y RETENCIONES PARA POSTES DE 230MM DE DIÁMETRO	20788	UNI	28.16	0	28.16	585,390.1	0	20788	70
5	ZTT	TTZX-098-100	ABRAZADERA ANGULAR PARA FIJACIÓN DE SUSPENSIONES Y RETENCIÓN PARA TORRES METALICAS CON PERFIL DE 100MM	618	UNI	28.16	0	28.16	17,402.9	0	618	70
6	ZTT	A-YLJ-G	CRUCETA GUARDA CABLE DE 1000MM DE ALTO Y 11KG DE CARGA PARA POSTES DE 230MM DE DIÁMETRO	100	UNI	43.41	0	43.41	4,341.0	0	100	70
7	ZTT	A-Y-G	ABRAZADERA PARA FIJACIÓN DE CABLE DE BAJADA PARA POSTES DE 230MM DE DIÁMETRO	100	UNI	18.43	0	18.43	1,843.0	0	100	70
8	ZTT	FYH-14	CORONA COIL PARA CABLES CON 14MM OD	100	UNI	7.68	0	7.68	768.0	0	100	70
9	ZTT	FLN-14	AMORTIGUADOR HELICOIDAL PARA CABLES CON 14MM OD	100	UNI	10.75	0	10.75	1,075.0	0	100	70

Validez de la oferta	Plaza de entrega de productos en stock	Factura parcial	Forma de pago	Vendedor	Precio	Moneda	Total	803,087.23
15 DÍAS	**-**	**NO**	**-**	**BPT**	**SIN IGV**	**USD ($)**		

CONDICIONES GENERALES

1.- EL PLAZO DE ENTREGA INDICADO CUENTA A PARTIR DEL PRIMER DÍA ÚTIL POSTERIOR A LA RECEPCIÓN DE LA ORDEN DE COMPRA FINAL.

2.- PARA COMPRAS MAYORES A US$ 250 (SIN IGV), EL PRECIO INCLUYE LA ENTREGA EN VUESTRAS OFICINAS O ALMACÉN EN LIMA METROPOLITANA

3.- PRECIOS EN BASE A TRASLADO MARÍTIMO Y SUJETOS A LA COMPRA DE LA TOTALIDAD DEL VOLUMEN SOLICITADO

OBSERVACIONES

1.- NO INCLUYE INSTALACIÓN, ENSAMBLAJE O PRUEBAS DE NINGÚN TIPO

INFORMACIÓN BANCARIA DE TELMARK SUPPLY S.A.C.

● CTA. CTE. DÓLARES, **BANCO SCOTIBANK**
DIRECCIÓN DEL BANCO: Avenida Derteano 102, San Isidro, Lima-Perú
BENEFICIARIO: Telmark Supply S.A.C.
N° CUENTA: 000-4094669
SWIFT CODE: BSUDPEPL
CÓDIGO INTERBANCARIO: 009 091 000004094669 01

● CTA. CTE SOLES, **BANCO SCOTIBANK**
DIRECCIÓN DEL BANCO: Avenida Derteano 102, San Isidro, Lima-Perú
BENEFICIARIO: Telmark Supply S.A.C.
N° CUENTA: 9566147
SWIFT CODE: BSUDPEPL
CÓDIGO INTERBANCARIO: 009 091 000009566147 06

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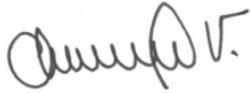
Freddy Tueros Venegas
Gerente Comercial
Telmark Supply S.A.C.

www.hubersuhner.com
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soporte.peru@hubersuhner.com

COTIZACIÓN PRODUCTOS PASIVOS PARA FIBRA ÓPTICA

	NODO DE ACCESO						
Item	Referencia Huber+Suhner	PN	Cantidad	Metro/Kit/Pieza	Precio Unitario USD	Total en USD	Foto
1	Caja de pared para 12 hilos de fibra óptica - OptiBox 6	84084946	1	piece	USD 90.00	USD 90.00	
5	Jumpers Duplex, 2mm, 10 metros, LC/PC-LC/PC	TBD	6	piece	USD 41.00	USD 246.00	
6	Cable de fibra óptica 12 hilos, SM, 60 metros, Antiroedor	TBD	60	metro	USD 2.00	USD 120.00	
7	Mufa USC500 / SCM con 4 cassettes SCM x 12 fusiones = 48 fibras	TBD	1	piece	USD 420.00	USD 420.00	
					TOTAL USD	**USD 876.00**	

Precios:

Los precios son en términos DDP Lima, Perú (Incoterms 2000).

Los precios son en dólares américanos y estos precios podrán ser reajustados de acuerdo a variaciones en el dólar a nivel mundial.

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COTIZACIÓN PRODUCTOS PASIVOS PARA FIBRA ÓPTICA

NODO DE DISTRITO							
Item	**Referencia Huber+Suhner**	**PN**	**Cantidad**	**Metro/Kit/Pieza**	**Precio Unitario USD**	**Total en USD**	**Foto**
1	Wall Box WCB7 – 13U	84084946	1	piece	USD 1,555.26	USD 1,555.26	
2	ODR Tray Unit 3U (Capacidad para 6 Fiber Tray)	84016901	1	piece	USD 553.87	USD 553.87	
3	Fiber Tray para 24FO con 2 adaptadores MTP - y LCPC en los extremos monomodo	84204696	2	piece	USD 679.25	USD 1,358.50	
4	ODR Cross-connect unit	84004196	1	piece	USD 435.84	USD 435.84	
5	Jumpers Duplex, 2mm, 10 metros, LC/PC-LC/PC	TBD	24	piece	USD 41.00	USD 984.00	
6	Cable Óptico Masterline, SM, Fusión – MTP (48 Hilos), 60 metros, Antiroedor	TBD	1	piece	USD 1,250.00	USD 1,250.00	
7	Mufa USC500 / MCM con 4 cassettes SCM x 12 fusiones = 48 fibras	TBD	1	piece	USD 420.00	USD 420.00	
					TOTAL USD	**USD 6,557.47**	
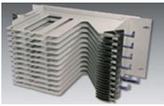
Precios:

Los precios son en términos DDP Lima, Perú (Incoterms 2000).

Los precios son en dólares américanos y estos precios podrán ser reajustados de acuerdo a variaciones en el dólar a nivel mundial.

HUBER+SUHNER

COTIZACIÓN PRODUCTOS PASIVOS PARA FIBRA ÓPTICA

PROVINCIAS DE REGION						
Item	Referencia Huber+Suhner	PN	Cantidad	Metro/Kit/Pieza	Precio Unitario USD	Total en USD	Foto
1	Gabienete NGR6S-18	TBD	1	piece	USD 2,090.56	USD 2,090.56	
2	ODR Tray Unit 3U (Capacidad para 6 Fiber Tray)	TBD	2	piece	USD 553.87	USD 1,107.74	
3	Fiber Tray para 24FO con 2 adaptadores MTP - y LCPC en los extremos monomodo. (Color AZUL)	TBD	2	piece	USD 679.25	USD 1,358.50	
	Fiber Tray para 24FO con 2 adaptadores MTP - y LCPC en los extremos monomodo. (Color AMARILLO)	TBD	2	piece	USD 679.25	USD 1,358.50	
4	ODR Cross-connect unit	TBD	1	piece	USD 435.84	USD 435.84	
5	Jumpers duplex, 2mm, 5 metros, LC/PC-LC/PC	TBD	48	piece	USD 38.89	USD 1,866.72	
6	Cable Óptico Masterline, SM, Fusión – MTP (48 Hilos), 60 metros, Antiroedor	TBD	1	piece	USD 1,250.00	USD 1,250.00	
7	Cable Multifibra, SM, MTP – LC/PC, 15 metros, 24 Hilos (2 conectores MTP x 12 fibras).	TBD	2	piece	USD 673.02	USD 1,346.04	
8	Mufa USC500 / MCM con 4 cassettes MCM x 12 fusiones = 48 fibras	TBD	1	piece	USD 420.00	USD 420.00	
				TOTAL USD		**USD 11,233.90**	

Precios:

Los precios son en términos DDP Lima, Perú (Incoterms 2000).

Los precios son en dólares américanos y estos precios podrán ser reajustados de acuerdo a variaciones en el dólar a nivel mundial.

Configset ID: 7485721
Configset Name: FITEL-ASR920
Created On: 8 abr 2014
Created By: glch
Last Update On: 23 jun 2014
Last Update By: glch
Main Currency: USD
Price List: Global Price List - US

Line Number	Item Name	Description	Service Duration	Lead Time	Included Item	Quantity	ListPrice	Extended ListPrice	Discount %	Selling Price
Products										
1.0	**ASR-920-24SZ-M**	ASR 920 Series Router Chassis	N/A	21 days	No	1	6,000.00	6,000.00	0	6,000.00
1.1	ASR920-S-A	Cisco ASR920 Series - Advanced Metro IP Access	N/A	21 days	No	1	3,000.00	3,000.00	0	3,000.00
1.2	ASR-920-PWR-D	ASR 920 DC Power Supply	N/A	21 days	No	2	800.00	1,600.00	0	1,600.00
1.3	SASR920NPEK9313S	Cisco ASR 920 Series IOS XE - NO PAYLOAD ENCRYPTION	N/A	21 days	No	1	0.00	0.00	0	0.00
1.4	ASR920-1G-12	Cisco ASR920 Series - 2 ports 10GE upgrade license	N/A	21 days	No	1	1,000.00	1,000.00	0	1,000.00
1.5	A920-RCKMT-19	EIA 19in Rack mount Option for the Cisco ASR 920	N/A	35 days	Yes	1	0.00	0.00	0	0.00
								Products SubTotal		**11,600.00**

Configset Total $ 11,600

Line Number	Item Name	Description	Service Duration	Lead Time	Included Item	Quantity	ListPrice	Extended ListPrice	Discount %	Selling Price
Products										
1.0	**ASR-903**	ASR 903 Series Router Chassis	N/A	21 days	No	1	3,000.00	3,000.00	0	3,000.00
1.1	A903-FAN	ASR 903 FAN Tray	N/A	21 days	No	1	1,000.00	1,000.00	0	1,000.00
1.2	SLASR903-A	ASR 903 Metro Aggregation Services	N/A	21 days	No	1	6,000.00	6,000.00	0	6,000.00
1.3	A900-PWR550-D	ASR 900 550W DC Power Supply	N/A	21 days	No	2	1,400.00	2,800.00	0	2,800.00
1.4	SASR903R1NPEK9312S	Cisco ASR 903 RSP1 IOS XE UNIVERSAL - NO PAYLOAD ENCRYPTION	N/A	21 days	No	1	0.00	0.00	0	0.00
1.5	A900-RSP2A-128	ASR 900 Route Switch Processor 2 - 128G Base Scale	N/A	NPH	No	2	12,000.00	24,000.00	0	24,000.00
1.6	A900-IMA8S	ASR 900 8 port SFP Gigabit Ethernet Interface Module	N/A	21 days	No	1	3,500.00	3,500.00	0	3,500.00
1.7	A900-IMA8S1Z	ASR 900 Combo 8 port SFP GE and 1 port 10GE Interface Module	N/A	NPH	No	1	4,500.00	4,500.00	0	4,500.00
1.8	A900-IMA2Z	ASR 900 2 port 10GE SFP+/XFP Interface Module	N/A	NPH	No	1	4,000.00	4,000.00	0	4,000.00
1.9	A900-CONS-KIT-U	ASR 900 USB Console Cabling Kit	N/A	21 days	Yes	1	0.00	0.00	0	0.00
1.10	A900-IMA-BLANK	ASR 900 Interface Module Type-A Blank Cover	N/A	21 days	Yes	3	0.00	0.00	0	0.00
1.11	A903-RCKMNT-19IN	ASR 903 EIA /JIS 19in Rack Mount Kit	N/A	35 days	Yes	1	0.00	0.00	0	0.00
								Products SubTotal		**48,800.00**
Services										
1.0.1	CON-SNTP-ASR903	SMARTNET 24X7X4 ASR 903 Series Router Chassis	12 month(s)	N/A	No	1	528.00	528.00	0	528.00
1.2.0.1	CON-SNTP-SLASR93A	SMARTNET 24X7X4 ASR 903 Metro Aggregation Services	12 month(s)	N/A	No	1	660.00	660.00	0	660.00
1.5.0.1	CON-SNTP-A900A128	SMARTNET 24X7X4 ASR 900 Route Switch	12 month(s)	N/A	No	2	2,112.00	4,224.00	0	4,224.00
1.6.0.1	CON-SNTP-IMA8S	SMARTNET 24X7X4 ASR 900 8 port SFP Gigabit Ethernet	12 month(s)	N/A	No	1	616.00	616.00	0	616.00
1.7.0.1	CON-SNTP-A9008SIZ	SMARTNET 24X7X4 ASR 900 Combo 8 port	12 month(s)	N/A	No	1	792.00	792.00	0	792.00
1.8.0.1	CON-SNTP-A900MA2Z	SMARTNET 24X7X4 ASR 900 2 port 10GE	12 month(s)	N/A	No	1	704.00	704.00	0	704.00
								Services SubTotal		**7,524.00**
								Configset Total		**56,324.00**

Configset Name:	Proyectos Regionales
Created On:	1 sep 2013
Created By:	Dpto.Venta
Last Update On:	3 sep 2013
Last Update By:	Dpto.Venta
Main Currency:	USD
Price List:	Global Price List - US

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CISCO™

Line Number	Item Name	Description	Service Duration	Lead Time	Included Item	Quantity	ListPrice	Extended ListPrice	Discount %	Selling Price
Products										
1.0	**ME-3400-24FS-A**	Cisco ME 3400 Switch - 24FX SFP + 2 SFP AC	N/A	21 days	No	1	2,495.00	2,495.00	0	2,495.00
1.1	S340XAK9T-12260EZ	Cisco ME 340X SERIES IOS METRO ACCESS TAR	N/A	21 days	No	1	1,000.00	1,000.00	0	1,000.00
1.2	CAB-AC-ME	AC power cord (North America)	N/A	21 days	No	1	0.00	0.00	0	0.00
1.3	RCKMNT-ETSI-1RU	ETSI Rackmount for ME products	N/A	21 days	No	1	75.00	75.00	0	75.00
2.0	**ME-3600X-24FS-M**	10GE SFP+	N/A	21 days	No	1	10,995.00	10,995.00	0	10,995.00
2.1	ME3600X-10G	ME3600X 10GE Upgrade License	N/A	21 days	No	1	2,995.00	2,995.00	0	2,995.00
2.2	S360XVK9T-15303S	Cisco ME 360X SERIES IOS UNIVERSAL TAR	N/A	0 days	No	1	0.00	0.00	0	0.00
2.3	CAB-ME-CON	Console Cable for ME Products	N/A	21 days	No	1	0.00	0.00	0	0.00
2.4	PWR-ME3KX-DC	ME3600X/ME3800X DC Power Supply	N/A	21 days	No	1	1,195.00	1,195.00	0	1,195.00
2.5	PWR-ME3KX-DC	ME3600X/ME3800X DC Power Supply	N/A	21 days	No	1	1,195.00	1,195.00	0	1,195.00
2.6	ME3600X-A	ME3600X Advanced Metro IP Access License	N/A	21 days	No	1	3,995.00	3,995.00	0	3,995.00
2.7	RCKMNT-ME3KX-ETSI	Switches	N/A	21 days	No	1	75.00	75.00	0	75.00
3.0	**ME-3800X-24FS-M**	SFP+2 10GE SFP+	N/A	21 days	No	1	21,995.00	21,995.00	0	21,995.00
3.1	S380XVK9T-15303S	Cisco ME 380X SERIES IOS UNIVERSAL TAR	N/A	21 days	No	1	0.00	0.00	0	0.00
3.2	CAB-ME-CON	Console Cable for ME Products	N/A	21 days	No	1	0.00	0.00	0	0.00
3.3	PWR-ME3KX-DC	ME3600X/ME3800X DC Power Supply	N/A	21 days	No	1	1,195.00	1,195.00	0	1,195.00
3.4	PWR-ME3KX-DC	ME3600X/ME3800X DC Power Supply	N/A	21 days	No	1	1,195.00	1,195.00	0	1,195.00
3.5	ME3800X-A	ME3800X Metro Aggregation Services License	N/A	21 days	No	1	9,995.00	9,995.00	0	9,995.00
3.6	RCKMNT-ME3KX-ETSI	Switches	N/A	21 days	No	1	75.00	75.00	0	75.00
4.0	**GLC-T=**	1000BASE-T SFP	N/A	14 days	No	1	395.00	395.00	0	395.00
5.0	**GLC-SX-MMD=**	DOM	N/A	14 days	No	1	500.00	500.00	0	500.00
6.0	**GLC-LH-SMD=**	1310nm DOM	N/A	14 days	No	1	995.00	995.00	0	995.00
7.0	**GLC-EX-SMD=**	1310nm DOM	N/A	14 days	No	1	1,995.00	1,995.00	0	1,995.00
8.0	**GLC-ZX-SMD=**	1550nm DOM	N/A	14 days	No	1	3,995.00	3,995.00	0	3,995.00
9.0	**SFP-10G-SR=**	10GBASE-SR SFP Module	N/A	14 days	No	1	995.00	995.00	0	995.00
10.0	**SFP-10G-LR=**	10GBASE-LR SFP Module	N/A	49 days	No	1	3,995.00	3,995.00	0	3,995.00
11.0	**SFP-10G-ER=**	10GBASE-ER SFP Module	N/A	14 days	No	1	10,000.00	10,000.00	0	10,000.00
12.0	**SFP-10G-ZR=**	Cisco 10GBASE-ZR SFP10G Module for SMF	N/A	14 days	No	1	16,000.00	16,000.00	0	16,000.00
13.0	**DWDM-SFP-3268=**	DWDM SFP 1532.68 nm SFP (100 GHz ITU grid)	N/A	70 days	No	1	5,995.00	5,995.00	0	5,995.00
14.0	**DWDM-SFP10G-32.68=**	ITU grid)	N/A	14 days	No	1	20,000.00	20,000.00	0	20,000.00
15.0	**15216-HD-EXT-PNL=**	Mechanical Frame - 4 slots - 1 RU	N/A	28 days	No	1	220.00	220.00	0	220.00
16.0	**15216-FLD-4-30.3=**	1532.68	N/A	28 days	No	1	3,300.00	3,300.00	0	3,300.00
17.0	**15216-LC-LC-10=**	Fiber patchcord - LC to LC - 6m	N/A	28 days	No	1	90.00	90.00	0	90.00
18.0	**15216-LC-LC-15=**	Fiber patchcord - LC to LC - 12m	N/A	28 days	No	0	110.00	0.00	0	0.00
19.0	**ME-3600X-24TS-M**	10GE SFP+	N/A	21 days	No	1	8,995.00	8,995.00	0	8,995.00
19.1	S360XVT-15303S	CRYPTO TAR	N/A	21 days	No	1	0.00	0.00	0	0.00
19.2	PWR-ME3KX-DC	ME3600X/ME3800X DC Power Supply	N/A	21 days	No	1	1,195.00	1,195.00	0	1,195.00
19.3	PWR-ME3KX-DC	ME3600X/ME3800X DC Power Supply	N/A	21 days	No	1	1,195.00	1,195.00	0	1,195.00
19.4	ME3600X-A	ME3600X Advanced Metro IP Access License	N/A	21 days	No	1	3,995.00	3,995.00	0	3,995.00
19.5	RCKMNT-ME3KX-ETSI	Switches	N/A	21 days	No	1	75.00	75.00	0	75.00
20.0	**ME-3400E-24TS-M**	Combo	N/A	35 days	No	1	2,395.00	2,395.00	0	2,395.00
20.1	S340XIT-12250SE	W/O CRYPTO TAR	N/A	21 days	No	1	2,995.00	2,995.00	0	2,995.00
20.2	ME34X-PWR-DC	ME3400E DC power supply	N/A	21 days	No	1	400.00	400.00	0	400.00
20.3	ME34X-PWR-DC-R	ME3400E redundant DC power supply	N/A	21 days	No	1	1,200.00	1,200.00	0	1,200.00
20.4	RCKMNT-ETSI-1RU	ETSI Rackmount for ME products	N/A	21 days	No	1	75.00	75.00	0	75.00
								Products SubTotal		**149,470.00**

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Name				PID	Quantity	Unit Price	Total Price
Site1							
	Mech Unit						
		2 service slot MSTP chassis 2nd gen fan tray		15454-M2-FTA2=	2	$ 175.00	$ 350.00
		2 service slot MSTP chassis DC ETSI filter with memory		15454-M2-DC-E=	2	$ 125.00	$ 250.00
		2 service slot MSTP shelf, includes M-SHIPKIT,M2-FTF,BRKTS		15454-M2-SA=	2	$ 700.00	$ 1,400.00
		Edge Mounting Bracket		15216-HD-EXT-PNL=	2	$ 220.00	$ 440.00
	Common Unit						
		15454 ETSI Blank Module (Slot Filler)		15454E-BLANK=	2	$ 115.00	$ 230.00
	Pwr Cable						
		DC power cable for M2 ETSI left exit		15454-M2-DCCBL-LE=	2	$ 300.00	$ 600.00
		USB cable for passive devices		15454-M-USBCBL=	2	$ 80.00	$ 160.00
	SW License						
		15454 ANSI ETSI MSTP Rel. 9.6.0 Pkgs., DVD, RTU License		15454-R9.6.0SWK9=	2	$ 1,995.00	$ 3,990.00
		15454 ETSI MSTP R9.6.0 SW, Pre-loaded on TCC3, TNC/E, TS		SF15454ME-R9.6.0K9	2	$ -	$ -
	Opt Common Unit						
		Transport Shelf Controller Ethernet PTP for M2, M6 Chassis		15454-M-TSCE-K9=	2	$ 3,250.00	$ 6,500.00
	Amplifier						
		ONS 15454 Optical Pre-Amplifier Module		15454-OPT-PRE=	2	$ 18,500.00	$ 37,000.00
	Oadm						
		Edge 4-Ch Bi-Directional OADM Mod 1530.33 to 1532.68		15216-FLD-4-30.3=	2	$ 3,300.00	$ 6,600.00
	DWDM Trunk Pluggabl						
		1000BASE-DWDM 1532.68nm GBIC (100GHz ITU grid)		15454-GBIC-32.6=	2	$ 5,995.00	$ 11,990.00
	Attenuator						
		Bulk Attenuator - LC Connector - 15dB		15216-ATT-LC-15=	2	$ 200.00	$ 400.00
	Opt Cable						
		Fiber patchcord - LC to LC - 2m		15454-LC-LC-2=	2	$ 90.00	$ 180.00
		Fiber patchcord - LC to LC - 6m		15216-LC-LC-10=	2	$ 90.00	$ 180.00
		Fiber patchcord - LC to SC - 6m		15216-LC-SC-10=	2	$ 90.00	$ 180.00
	AlarmCable						
		SCSI Alarm cable 24AWG 8 inputs		15454-M-ALMCBL2=	2	$ 75.00	$ 150.00

Chasises M2	$	3,430.00
Controladoras	$	10,490.00
Muxes	$	6,600.00
Amplificadores	$	37,000.00
SFPs	$	11,990.00
Fibras, cables, atenuad	$	1,090.00
Total	**$**	**70,600.00**

Name			PID	Quantity	Unit Price	Total Price
Site1						
	Mech Unit					
		2 service slot MSTP chassis 2nd gen fan tray	15454-M2-FTA2=	2	$ 175.00	$ 350.00
		2 service slot MSTP chassis DC ETSI filter with memory	15454-M2-DC-E=	2	$ 125.00	$ 250.00
		2 service slot MSTP shelf, includes M-SHIPKIT,M2-FTF,BRKTS	15454-M2-SA=	2	$ 700.00	$ 1,400.00
		Edge Mounting Bracket	15216-HD-EXT-PNL=	2	$ 220.00	$ 440.00
	Pwr Cable					
		DC power cable for M2 ETSI left exit	15454-M2-DCCBL-LE=	2	$ 300.00	$ 600.00
		USB cable for passive devices	15454-M-USBCBL=	2	$ 80.00	$ 160.00
	SW License					
		15454 ANSI ETSI MSTP Rel. 9.6.0 Pkgs., DVD, RTU License	15454-R9.6.0SWK9=	2	$ 1,995.00	$ 3,990.00
		15454 ETSI MSTP R9.6.0 SW, Pre-loaded on TCC3, TNC/E, TS	SF15454ME-R9.6.0K9	2	$ -	$ -
	Opt Common Unit					
		Transport Shelf Controller Ethernet PTP for M2, M6 Chassis	15454-M-TSCE-K9=	2	$ 3,250.00	$ 6,500.00
	Amplifier					
		15454 MSTP - Optical Amplifier - C-band - 17dB Gain	15454-OPT-EDFA-17=	2	$ 20,000.00	$ 40,000.00
		ONS 15454 Optical Pre-Amplifier Module	15454-OPT-PRE=	2	$ 18,500.00	$ 37,000.00
	Oadm					
		Edge 4-Ch Bi-Directional OADM Mod 1530.33 to 1532.68	15216-FLD-4-30.3=	2	$ 3,300.00	$ 6,600.00
	DWDM Trunk Pluggable					
		1000BASE-DWDM 1532.68nm GBIC (100GHz ITU grid)	15454-GBIC-32.6=	2	$ 5,995.00	$ 11,990.00
	Attenuator					
		Bulk Attenuator - LC Connector - 15dB	15216-ATT-LC-15=	2	$ 200.00	$ 400.00
		Bulk Attenuator - LC Connector - 3dB	15216-ATT-LC-3=	2	$ 200.00	$ 400.00
	Opt Cable					
		Fiber patchcord - LC to LC - 2m	15454-LC-LC-2=	2	$ 90.00	$ 180.00
		Fiber patchcord - LC to LC - 6m	15216-LC-LC-10=	2	$ 90.00	$ 180.00
		Fiber patchcord - LC to SC - 6m	15216-LC-SC-10=	2	$ 90.00	$ 180.00
	AlarmCable					
		SCSI Alarm cable 24AWG 8 inputs	15454-M-ALMCBL2=	2	$ 75.00	$ 150.00

Chasises M2	$	3,200.00
Controladoras	$	10,490.00
Muxes	$	6,600.00
Amplificadores	$	77,000.00
SFPs	$	11,990.00
Fibras, cables, atenuadore	$	1,490.00
Total	**$**	**110,770.00**

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Name			PID	Quantity	Unit Price	Total Price
Site1						
	Mech Unit					
		6 service slot MSTP chassis 2nd gen fan tray	15454-M6-FTA2=	2	$ 200.00	$ 400.00
		6 service slot MSTP chassis LCD Display with backup Memory	15454-M6-LCD=	2	$ 80.00	$ 160.00
		6 service slot MSTP chassis external cable connections	15454-M6-ECU=	2	$ 150.00	$ 300.00
		6 service slot MSTP shelf, includes M-SHIPKIT,M6-FTF,BRKTS	15454-M6-SA=	2	$ 800.00	$ 1,600.00
		6 slot MSTP chassis 30A DC power filter	15454-M6-DC=	4	$ 125.00	$ 500.00
	Common Unit					
		15454 ETSI Blank Module (Slot Filler)	15454E-BLANK=	4	$ 115.00	$ 460.00
		SFP - OC3/STM1/FE Optical Service Channel SFPs ULH - C-TE	ONS-SC-OSC-ULH=	2	$ 2,500.00	$ 5,000.00
	Pwr Cable					
		DC power cable for ETSI left exit	15454-M6-DCCBL-LE=	2	$ 300.00	$ 600.00
		DC power cable for ETSI right exit	15454-M6-DCCBL-RE=	2	$ 300.00	$ 600.00
		USB cable for passive devices	15454-M-USBCBL=	2	$ 80.00	$ 160.00
	SW License					
		15454 ANSI ETSI MSTP Rel. 9.6.0 Pkgs., DVD, RTU License	15454-R9.6.0SWK9=	2	$ 1,995.00	$ 3,990.00
		15454 ETSI MSTP R9.6.0 SW, Pre-loaded on TCC3, TNC/E, TS	SF15454ME-R9.6.0K9	4	$ -	$ -
	Opt Common Unit					
		Transport Node Controller Ethernet PTP for M2, M6 Chassis	15454-M-TNCE-K9=	4	$ 6,500.00	$ 26,000.00
	Amplifier					
		17dB Gain, Amp	15454-OPT-AMP-17C=	2	$ 17,000.00	$ 34,000.00
		ONS 15454 RAMAN AMPLIFIER	15454-OPT-RAMP-C=	2	$ 55,000.00	$ 110,000.00
	Mux Demux					
		ONS 15216 40ch Mux/DeMux Exposed Faceplate Patch Panel (	15216-EF-40-ODD=	2	$ 20,000.00	$ 40,000.00
	DWDM Trunk Pluggabl					
		1000BASE-DWDM 1560.61nm GBIC (100GHz ITU grid)	15454-GBIC-60.6=	2	$ 5,995.00	$ 11,990.00
	Opt Cable					
		Fiber patchcord - LC to LC - 2m	15454-LC-LC-2=	6	$ 90.00	$ 540.00
		Fiber patchcord - LC to SC - 6m	15216-LC-SC-10=	4	$ 90.00	$ 360.00
	SMR					
		SM ROADM 1-PRE-AMP 100GHZ-CBAND-10ch License Restric	15454-SMR1-LIC=	2	$ 16,500.00	$ 33,000.00
	AlarmCable					
		SCSI Alarm cable 24AWG 8 inputs	15454-M-ALMCBL2=	2	$ 75.00	$ 150.00

Chasís M6	$	4,320.00
Controladora	$	34,990.00
Mux	$	40,000.00
Amplificador	$	144,000.00
SFPs	$	11,990.00
Fibras, cables, atenuad	$	34,050.00
Total	**$**	**269,350.00**

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Line Number	Item Name	Description	Service Duration	Lead Time	Included Item	Quantity	ListPrice	Extended ListPrice	Discount %	Selling Price
Products										
1.0 ASR-9001		ASR 9001 Chassis	N/A	21 days	No	1	53,600.00	53,600.00	0	53,600.00
1.1	A9K-MPA-20X1GE	ASR 9000 20-port 1GE Modular Port Adapter	N/A	21 days	No	1	15,000.00	15,000.00	0	15,000.00
1.2	A9K-750W-DC	ASR 9000 750W DC Power Supply for ASR-9001	N/A	21 days	No	2	1,800.00	3,600.00	0	3,600.00
1.3	A9K-CORE	Cisco ASR9000; No Physical Part; For Tracking Only	N/A	21 days	No	1	0.00	0.00	0	0.00
1.4	ASR-9001-FAN	ASR 9001 Fan Tray	N/A	21 days	No	1	2,800.00	2,800.00	0	2,800.00
1.5	ASR-9001-TRAY	ASR 9001 Cable Management Tray	N/A	21 days	No	1	0.00	0.00	0	0.00
1.6	A9K-9001-AIP-LIC	ASR 9001 AIP License	N/A	21 days	No	1	20,000.00	20,000.00	0	20,000.00
1.7	A9K-9001-MPA-FILR	ASR 9001 MPA Filler	N/A	21 days	Yes	1	0.00	0.00	0	0.00
1.8	ASR-9001-2P-KIT	ASR 9001 2 Post Mounting Kit	N/A	21 days	No	1	0.00	0.00	0	0.00
1.9	XR-A9K-PXK9-04.03	Cisco IOS XR IP/MPLS Core Software 3DES	N/A	0 days	No	1	15,000.00	15,000.00	0	15,000.00
2.0 N7K-C7004-S2		Nexus 7004 Bundle (Chassis 1xSUP2) No Power Supplies	N/A	21 days	No	1	32,000.00	32,000.00	0	32,000.00
2.1	N7KS2NPEK9-62	Cisco NX-OS 6.2 No Payload Encryption for SUP2 Nexus 7000	N/A	21 days	No	1	0.00	0.00	0	0.00
2.2	N7K-ADV1K9	Nexus 7000 Advanced LAN Enterprise License (VDC CTS ONLY)	N/A	21 days	No	1	20,000.00	20,000.00	0	20,000.00
2.3	N7K-LAN1K9	Nexus 7000 LAN Enterprise License (L3 protocols)	N/A	21 days	No	1	15,000.00	15,000.00	0	15,000.00
2.4	N7K-SUP2	Nexus 7000 - Supervisor 2 Includes External 8GB USB Flash	N/A	21 days	Yes	1	0.00	0.00	0	0.00
2.5	N7K-USB-8GB	Nexus 7K USB Flash Memory - 8GB (Log Flash)	N/A	21 days	Yes	1	0.00	0.00	0	0.00
2.6	N7K-F248XP-25E	Nexus 7000 F2-Series 48 Port 1/10G (SFP+) Enhanced	N/A	21 days	No	1	44,000.00	44,000.00	0	44,000.00
2.7	N7K-DC-3KW	Nexus 7000 - 3.0KW DC Power Supply Module	N/A	21 days	No	2	8,000.00	16,000.00	0	16,000.00
3.0 N7K-C7009-B2S2		Nexus 7009 Bundle (Chassis 1xSUP2 x5xFAB2) No Power Supplies	N/A	21 days	No	1	60,000.00	60,000.00	0	60,000.00
3.1	N7KS2NPEK9-62	Cisco NX-OS 6.2 No Payload Encryption for SUP2 Nexus 7000	N/A	21 days	No	1	0.00	0.00	0	0.00
3.2	N7K-ADV1K9	Nexus 7000 Advanced LAN Enterprise License (VDC CTS ONLY)	N/A	21 days	No	1	20,000.00	20,000.00	0	20,000.00
3.3	N7K-LAN1K9	Nexus 7000 LAN Enterprise License (L3 protocols)	N/A	21 days	No	1	15,000.00	15,000.00	0	15,000.00
3.4	N7K-SUP2	Nexus 7000 - Supervisor 2 Includes External 8GB USB Flash	N/A	21 days	Yes	1	0.00	0.00	0	0.00
3.5	N7K-USB-8GB	Nexus 7K USB Flash Memory - 8GB (Log Flash)	N/A	21 days	Yes	1	0.00	0.00	0	0.00
3.6	N7K-F248XP-25E	Nexus 7000 F2-Series 48 Port 1/10G (SFP+) Enhanced	N/A	21 days	No	1	44,000.00	44,000.00	0	44,000.00
3.7	N7K-C7009-FAB-2	Nexus 7000 - 9 Slot Chassis - 110Gbps/Slot Fabric Module	N/A	21 days	Yes	5	0.00	0.00	0	0.00
3.8	N7K-DC-6.0KW	Nexus 7000 - 6.0KW DC Power Supply Module (Cables Included)	N/A	21 days	No	2	16,000.00	32,000.00	0	32,000.00
4.0 N2K-C2248TP		N2K-C2248TP-1GE (48x100/1000-T+4x10GE) airflow/power option	N/A	14 days	No	1	9,000.00	9,000.00	0	9,000.00
4.1	N2248TP-FD-BUN	Standard airflow/DC pack: N2K-C2248TP-1GE 2DC PS 1Fan	N/A	14 days	No	1	800.00	800.00	0	800.00
5.0 N2K-C2232PP		N2K-C2232PP-10GE (32x1/10GE+8x10GE) airflow/power option	N/A	14 days	No	1	9,000.00	9,000.00	0	9,000.00
5.1	N2232PP-FD-BUN	Standard airflow/DC pack: N2K-C2232PP-10GE 2DC PS 1Fan	N/A	14 days	No	1	800.00	800.00	0	800.00
6.0 ASR-9001-S		ASR 9001 Chassis with 60G Bandwidth	N/A	21 days	No	1	38,600.00	38,600.00	0	38,600.00
6.1	A9K-MPA-4X10GE	ASR 9000 4-port 10GE Modular Port Adapter	N/A	21 days	No	1	35,000.00	35,000.00	0	35,000.00
6.2	A9K-750W-DC	ASR 9000 750W DC Power Supply for ASR-9001	N/A	21 days	No	2	1,800.00	3,600.00	0	3,600.00
6.3	A9K-CORE	Cisco ASR9000; No Physical Part; For Tracking Only	N/A	21 days	No	1	0.00	0.00	0	0.00
6.4	ASR-9001-FAN	ASR 9001 Fan Tray	N/A	21 days	No	1	2,800.00	2,800.00	0	2,800.00
6.5	ASR-9001-TRAY	ASR 9001 Cable Management Tray	N/A	21 days	No	1	0.00	0.00	0	0.00
6.6	A9K-9001-AIP-LIC	ASR 9001 AIP License	N/A	21 days	No	1	20,000.00	20,000.00	0	20,000.00
6.7	XR-A9K-PXK9-04.03	Cisco IOS XR IP/MPLS Core Software 3DES	N/A	21 days	No	1	15,000.00	15,000.00	0	15,000.00
6.8	A9K-9001-S-BAYFLR	ASR 9001-S Disabled Bay Filler	N/A	21 days	Yes	1	0.00	0.00	0	0.00
7.0 ASA5585-S10-K9		ASA 5585-X Chassis with SSP10 8GE 2GE Mgt 1 AC 3DES/AES	N/A	21 days	No	1	29,995.00	29,995.00	0	29,995.00
7.1	ASA5585-PWR-DC	ASA 5585-X DC Power Supply	N/A	21 days	No	2	4,000.00	8,000.00	0	8,000.00
7.2	ASA-SSP-10-INC	ASA 5585-X SSP-10 with 8GE2SFP incl with bundle	N/A	21 days	Yes	1	0.00	0.00	0	0.00
7.3	ASA5500-ENCR-K9	ASA 5500 Strong Encryption License (3DES/AES)	N/A	14 days	Yes	1	0.00	0.00	0	0.00
7.4	ASA5585-BLANK-HD	ASA 5585-X Hard Drive Blank Slot Cover	N/A	21 days	Yes	2	0.00	0.00	0	0.00
7.5	ASA5585-BLANK-F	ASA 5585-X Full Width Blank Slot Cover	N/A	21 days	Yes	1	0.00	0.00	0	0.00
7.6	SF-ASA558X-8.4-K8	Software release ASA 8.4.5	N/A	14 days	No	1	0.00	0.00	0	0.00
7.7	ASA-VPN-CLNT-K9	Cisco VPN Client Software (Windows Solaris Linux Mac)	N/A	14 days	Yes	1	0.00	0.00	0	0.00
8.0 PRIME-1-PERFMGR-K9		Prime Performance Mgr.1.x (DCT Top Level Ordering Use Only)	N/A	0 days	No	1	0.00	0.00	0	0.00
8.1	PERFMGR-1.4-K9	Prime Performance Mgr.1.4 - Base Application	N/A	0 days	No	1	10,000.00	10,000.00	0	10,000.00
8.2	PERFMGR-1-GR-B-RTM	Prime Performance Mgr.1.x - Group B Right To Manage	N/A	0 days	No	1	599.00	599.00	0	599.00
8.3	PERFMGR-1-GR-C-RTM	Prime Performance Mgr.1.x - Group C Right To Manage	N/A	0 days	No	1	1,999.00	1,999.00	0	1,999.00
8.4	PERFMGR-1-GR-D-RTM	Prime Performance Mgr.1.x - Group D Right To Manage	N/A	0 days	No	1	3,499.00	3,499.00	0	3,499.00
8.5	PERFMGR-1-GR-A-RTM	Prime Performance Mgr.1.x - Group A Right To Manage	N/A	0 days	No	1	69.00	69.00	0	69.00
9.0 PRIME-4-NETWORK-K9		Prime Network 4.x - Physical	N/A	0 days	No	1	0.00	0.00	0	0.00
9.1	NETWORK-4.0-K9	Prime Network 4.0 - Base Application	N/A	0 days	No	1	10,000.00	10,000.00	0	10,000.00
9.2	ASR9001-NETW4RTM	Prime Network 4 - Cisco ASR 9001 - Right To Manage	N/A	0 days	No	1	3,775.00	3,775.00	0	3,775.00
9.3	ME3400-NETW4RTM	Prime Network 4 - Cisco ME-3400 - Right To Manage	N/A	0 days	No	1	105.00	105.00	0	105.00
9.4	ME3600X-NETW4RTM	Prime Network 4 - Cisco ME 3600X - Right To Manage	N/A	0 days	No	1	475.00	475.00	0	475.00
9.5	ME3800X-NETW4RTM	Prime Network 4 - Cisco ME 3800X - Right To Manage	N/A	0 days	No	1	775.00	775.00	0	775.00
9.6	NX7000-NETW4RTM	Prime Network 4 - Cisco Nexus 7000 - Right To Manage	N/A	0 days	No	1	10,545.00	10,545.00	0	10,545.00
9.7	NX2000-NETW4RTM	Prime Network 4 - Cisco Nexus 2000 - Right To Manage	N/A	0 days	No	1	575.00	575.00	0	575.00
10.0 GLC-T=		1000BASE-T SFP	N/A	14 days	No	1	395.00	395.00	0	395.00
11.0 GLC-SX-MMD=		1000BASE-SX SFP transceiver module MMF 850nm DOM	N/A	14 days	No	1	500.00	500.00	0	500.00
12.0 GLC-LH-SMD=		1000BASE-LX/LH SFP transceiver module MMF/SMF 1310nm DOM	N/A	14 days	No	1	995.00	995.00	0	995.00
13.0 GLC-EX-SMD=		1000BASE-EX SFP transceiver module SMF 1310nm DOM	N/A	14 days	No	1	1,995.00	1,995.00	0	1,995.00
14.0 GLC-ZX-SMD=		1000BASE-ZX SFP transceiver module SMF 1550nm DOM	N/A	14 days	No	1	3,995.00	3,995.00	0	3,995.00
15.0 SFP-10G-SR=		10GBASE-SR SFP Module	N/A	14 days	No	1	995.00	995.00	0	995.00
16.0 SFP-10G-LR=		10GBASE-LR SFP Module	N/A	49 days	No	1	3,995.00	3,995.00	0	3,995.00
17.0 SFP-10G-ER=		10GBASE-ER SFP Module	N/A	14 days	No	1	10,000.00	10,000.00	0	10,000.00
18.0 SFP-10G-ZR=		Cisco 10GBASE-ZR SFP10G Module for SMF	N/A	14 days	No	1	16,000.00	16,000.00	0	16,000.00
19.0 DWDM-SFP-3268=		DWDM SFP 1532.68 nm SFP (100 GHz ITU grid)	N/A	70 days	No	1	5,995.00	5,995.00	0	5,995.00
20.0 DWDM-SFP10G-32.68=		10GBASE-DWDM 1532.68 nm SFP10G (100-GHz ITU grid)	N/A	14 days	No	1	20,000.00	20,000.00	0	20,000.00
21.0 15216-HD-EXT-PNL=		Mechanical Frame - 4 slots - 1 RU	N/A	28 days	No	1	220.00	220.00	0	220.00
22.0 15216-FLD-4-30.3=		Edge 4-Ch Bi-Directional OADM Mod 1530.33 to 1532.68	N/A	28 days	No	1	3,300.00	3,300.00	0	3,300.00
23.0 15216-LC-LC-10=		Fiber patchcord - LC to LC - 6m	N/A	28 days	No	1	90.00	90.00	0	90.00
								Products SubTotal		**514,486.00**

CISCO

Line Number	Item Name	Description	Service Duration	Quantity	ListPrice	Extended ListPrice	Discount %	Selling Price
Products								
1.0	**UCSC-C220-M3S**	UCS C220 M3 SFF w/o CPU mem HDD PCIe PSU w/ rail kit	N/A	1	2,860.00	2,860.00	0	2,860.00
1.1	UCS-CPU-E5-2670	2.60 GHz E5-2670 115W 8C/20MB Cache/DDR3 1600MHz	N/A	2	4,275.00	8,550.00	0	8,550.00
1.2	UCS-MR-1X162RY-A	16GB DDR3-1600-MHz RDIMM/PC3-12800/dual rank/1.35v	N/A	6	625.00	3,750.00	0	3,750.00
1.3	A03-D146GC2	146GB 6Gb SAS 15K RPM SFF HDD/hot plug/drive sled mounted	N/A	4	692.00	2,768.00	0	2,768.00
1.4	UCS-HDD900GI2F106	900GB 6Gb SAS 10K RPM SFF HDD/hot plug/drive sled mounted	N/A	4	1,592.00	6,368.00	0	6,368.00
1.5	CAB-C13-C14-2M	Power Cord Jumper C13-C14 Connectors 2 Meter Length	N/A	2	0.00	0.00	0	0.00
1.6	UCSC-PSU-650W	650W power supply for C-series rack servers	N/A	2	630.00	1,260.00	0	1,260.00
1.7	UCS-RAID-9266CV	MegaRAID 9266CV-8i w/TFM + Super Cap	N/A	1	1,686.00	1,686.00	0	1,686.00
1.8	UCSC-HS-C220M3	Heat Sink for UCS C220 M3 Rack Server	N/A	2	0.00	0.00	0	0.00
1.9	UCSC-PCIF-01F	Full height PCIe filler for C-Series	N/A	1	0.00	0.00	0	0.00
1.10	UCSC-RAIL1	Rail Kit for C220 C22 C24 rack servers	N/A	1	0.00	0.00	0	0.00
1.11	VMW-VS5-ENT-3A	VMware vSphere 5 Enterprise (1 CPU) 3yr Support Required	N/A	2	5,391.00	10,782.00	0	10,782.00
2.0	**UCSC-C220-M3S**	UCS C220 M3 SFF w/o CPU mem HDD PCIe PSU w/ rail kit	N/A	1	2,860.00	2,860.00	0	2,860.00
2.1	UCS-CPU-E5-2670	1600MHz	N/A	2	4,275.00	8,550.00	0	8,550.00
2.2	UCS-MR-1X162RY-A	rank/1.35v	N/A	2	625.00	1,250.00	0	1,250.00
2.3	A03-D146GC2	mounted	N/A	1	692.00	692.00	0	692.00
2.4	UCS-HDD300GI2F105	mounted	N/A	4	1,216.00	4,864.00	0	4,864.00
2.5	UCSC-RAIL1	Rail Kit for C220 C22 C24 rack servers	N/A	1	0.00	0.00	0	0.00
2.6	VMW-VS5-ENT-3A	Required	N/A	2	5,391.00	10,782.00	0	10,782.00
2.7	UCSC-PCIF-01F	Full height PCIe filler for C-Series	N/A	1	0.00	0.00	0	0.00
2.8	CAB-C13-C14-2M	Length	N/A	2	0.00	0.00	0	0.00
2.9	UCSC-PSU-650W	650W power supply for C-series rack servers	N/A	2	630.00	1,260.00	0	1,260.00
2.10	UCS-RAID-9266CV	MegaRAID 9266CV-8i w/TFM + Super Cap	N/A	1	1,686.00	1,686.00	0	1,686.00
2.11	N20-BBLKD	UCS 2.5 inch HDD blanking panel	N/A	3	0.00	0.00	0	0.00
2.12	UCSC-HS-C220M3	Heat Sink for UCS C220 M3 Rack Server	N/A	2	0.00	0.00	0	0.00
						Products SubTotal		**69,968.00**
Services								
1.0.1	CON-SNTP-C220M3SF	SMARTNET 24X7X4 UCS C220 M3 SFF w/o	month(s)	1	544.50	544.50	0	544.50
1.11.0.1	CON-ISV1-VS5ENT3A	ANNUAL	month(s)	2	2,741.43	5,482.86	0	5,482.86
2.0.1	CON-SNTP-C220M3SF	SMARTNET 24X7X4 UCS C220 M3 SFF w/o	month(s)	1	544.50	544.50	0	544.50
2.6.0.1	CON-ISV1-VS5ENT3A	ANNUAL	month(s)	2	2,741.43	5,482.86	0	5,482.86
						Services SubTotal		**12,054.72**
						Configset Total		**82,022.72**

CISCO

Line Number	Item Name	Description	Lead Time	Quantity	ListPrice	Extended ListPrice	Discount %	Selling Price
Products								
1.0	**N5K-C5548P-FA**	Nexus 5548P 1RU Chassis 2 PS 2 Fan 32 Fixed 10GE Ports	14 days	1	25,600.00	25,600.00	0	25,600.00
1.1	N55-DL2	Nexus 5548 Layer 2 Daughter Card	14 days	1	0.00	0.00	0	0.00
1.2	N5KUK9-521N1.1	Nexus 5000 Base OS Software Rel 5.2(1)N1(1)	14 days	1	0.00	0.00	0	0.00
1.3	SFP-10G-LR	10GBASE-LR SFP Module	28 days	4	3,995.00	15,980.00	0	15,980.00
1.4	SFP-GE-T	1000BASE-T SFP (NEBS 3 ESD)	14 days	10	440.00	4,400.00	0	4,400.00
1.5	N5548-ACC-KIT	Nexus 5548 Chassis Accessory Kit	14 days	1	0.00	0.00	0	0.00
1.6	N5548P-FAN	Nexus 5548P Fan Module	14 days	2	0.00	0.00	0	0.00
1.7	N55-M-BLNK	Nexus 5500 Module Blank Cover	14 days	1	0.00	0.00	0	0.00
1.8	N55-PDC-750W	Nexus 5500 750W DC Power Supply	14 days	2	1,000.00	2,000.00	0	2,000.00
2.0	**N3K-C3064-T-BA-L3**	Nexus 3064-T Rev AF (port side intake) AC P/S LAN Ent Bun	14 days	1	33,000.00	33,000.00	0	33,000.00
2.1	NXA-PAC-500W-B	Nexus sw 500W AC PSU Reversed AF (port-side intake)	14 days	2	0.00	0.00	0	0.00
2.2	CAB-9K12A-NA	Power Cord 125VAC 13A NEMA 5-15 Plug North America	8 days	2	0.00	0.00	0	0.00
2.3	N3K-BAS1K9	Nexus 3000 Base License	14 days	1	0.00	0.00	0	0.00
2.4	N3K-C3064-ACC-KIT	Nexus 3064PQ Accessory Kit	14 days	1	0.00	0.00	0	0.00
2.5	N3K-C3064-FAN-B	Nexus 3064 Fan Module Back-to-Front Airflow	14 days	1	0.00	0.00	0	0.00
2.6	N3K-LAN1K9	Nexus 3000 LAN Enterprise License	14 days	1	0.00	0.00	0	0.00
2.7	QSFP-4SFP10G-CU1M	QSFP to 4xSFP10G Passive Copper Splitter Cable 1m	14 days	1	650.00	650.00	0	650.00
2.8	SFP-10G-SR	10GBASE-SR SFP Module	14 days	4	995.00	3,980.00	0	3,980.00
2.9	N3KUK9-503U4.1	NX-OS Release 5.0(3)U4(1)	14 days	1	0.00	0.00	0	0.00
3.0	**WS-C6504-E**	Catalyst 6500 Enhanced 4-slot chassis 5RU no PS no Fan Tray	21 days	1	3,000.00	3,000.00	0	3,000.00
3.1	VS-S2T-10G	Cat 6500 Sup 2T with 2 x 10GbE and 3 x 1GbE with MSFC5 PFC4	21 days	1	28,000.00	28,000.00	0	28,000.00
3.2	S2TIBK9N-15102SY	Cisco CAT6000-VS-S2T IOS IP BASE NPE	21 days	1	0.00	0.00	0	0.00
3.3	MEM-C6K-INTFL1GB	Internal 1G Compact Flash	21 days	1	0.00	0.00	0	0.00
3.4	VS-F6K-PFC4	Cat 6k 80G Sys Daughter Board Sup2T PFC4	21 days	1	0.00	0.00	0	0.00
3.5	VS-SUP2T-10G	Catalyst 6500 Supervisor Engine 2T Baseboard	21 days	1	0.00	0.00	0	0.00
3.6	MEM-SUP2T-2GB	Catalyst 6500 2GB memory for Sup2T and Sup2TXL	21 days	1	0.00	0.00	0	0.00
3.7	X2-10GB-SR	10GBASE-SR X2 Module	14 days	2	1,995.00	3,990.00	0	3,990.00
3.8	WS-X6848-SFP-2T	Catalyst 6500 48-port GigE Mod: fabric-enabled with DFC4	21 days	1	25,000.00	25,000.00	0	25,000.00
3.9	WS-F6K-DFC4-A	Cat 6k 80G Sys Daughter Board DFC4A for ABA Cards	21 days	1	0.00	0.00	0	0.00
3.10	WS-X6848-SFP	Catalyst 6500 48 Port 1G SFP Baseboard	21 days	1	0.00	0.00	0	0.00
3.11	PWR-2700-DC/4	2700W DC Power Supply for Cisco 7604/6504-E	21 days	2	3,500.00	7,000.00	0	7,000.00
3.12	FAN-MOD-4HS	High-Speed Fan Module for 7604/6504-E	21 days	1	0.00	0.00	0	0.00
4.0	**WS-C6503-E**	Catalyst 6500 Enhanced 3-slot chassis 4RU no PS no Fan Tray	21 days	1	2,500.00	2,500.00	0	2,500.00
4.1	VS-SUP2T-10G	Catalyst 6500 Supervisor Engine 2T Baseboard	21 days	1	0.00	0.00	0	0.00
4.2	MEM-SUP2T-2GB	Catalyst 6500 2GB memory for Sup2T and Sup2TXL	21 days	1	0.00	0.00	0	0.00
4.3	X2-10GB-SR	10GBASE-SR X2 Module	14 days	2	1,995.00	3,990.00	0	3,990.00
4.4	WS-X6848-TX-2T	C6k 48-port 10/100/1000 GE Mod: fabric enabled RJ-45 DFC4	21 days	1	15,000.00	15,000.00	0	15,000.00
4.5	WS-F6K-DFC4-A	Cat 6k 80G Sys Daughter Board DFC4A for ABA Cards	21 days	1	0.00	0.00	0	0.00
4.6	WS-X6848-GE-TX	48 PORT 1G COPPER BASEBOARD	21 days	1	0.00	0.00	0	0.00
4.7	PWR-1400-AC	1400W AC pwr/sup for CISCO7603 and Catalyst WS-C6503 chassis	21 days	2	745.00	1,490.00	0	1,490.00
4.8	PEM-20A-AC+	PwrEntryMod use w/1400W AC P/S for CISCO7603 WS-C6503	21 days	2	250.00	500.00	0	500.00
4.9	CAB-7513AC	AC POWER CORD NORTH AMERICA (110V)	21 days	2	0.00	0.00	0	0.00

6.0	**WS-C4500X-32SFP+**	Catalyst 4500-X 32 Port 10G IP Base Front-to-Back No P/S	14 days	1	28,000.00	28,000.00	0	28,000.00	
6.1	C4500X-IPB	IP Base license for Catalyst 4500-X	14 days	1	0.00	0.00	0	0.00	
6.2	C4KX-NM-BLANK	Catalyst 4500X Network Module Blank	14 days	1	0.00	0.00	0	0.00	
6.3	C4KX-PWR-750DC-R	Catalyst 4500X 750W DC front to back cooling power supply	14 days	1	3,000.00	3,000.00	0	3,000.00	
6.4	C4KX-PWR-750DC-R/2	Catalyst 4500X 750W DC front to back cooling 2nd PWR supply	14 days	1	3,000.00	3,000.00	0	3,000.00	
6.5	S45XU-33-1511SG	CAT4500-X Universal Image	21 days	1	0.00	0.00	0	0.00	
6.6	GLC-T	1000BASE-T SFP	14 days	10	395.00	3,950.00	0	3,950.00	
6.7	SFP-10G-SR	10GBASE-SR SFP Module	14 days	4	995.00	3,980.00	0	3,980.00	
7.0	**WS-C3850-48T-L**	Cisco Catalyst 3850 48 Port Data LAN Base	14 days	1	8,900.00	8,900.00	0	8,900.00	
7.1	PWR-C1-440WDC	440W DC Config 1 Power Supply	14 days	1	500.00	500.00	0	500.00	
7.2	PWR-C1-440WDC/2	440W DC Config 1 secondary Power Supply	14 days	1	500.00	500.00	0	500.00	
7.3	C3850-NM-4-10G	Cisco Catalyst 3850 4 x 10GE Network Module	14 days	1	4,000.00	4,000.00	0	4,000.00	
7.4	S3850UK9-32-0SE	CAT3850 UNIVERSAL	14 days	1	0.00	0.00	0	0.00	
7.5	STACK-T1-50CM	50CM Type 1 Stacking Cable	14 days	1	0.00	0.00	0	0.00	
7.6	SFP-10G-SR=	10GBASE-SR SFP Module	14 days	4	995.00	3,980.00	0	3,980.00	
8.0	**WS-C3750X-48T-L**	Catalyst 3750X 48 Port Data LAN Base	14 days	1	8,900.00	8,900.00	0	8,900.00	
8.1	C3KX-PWR-440WDC	Catalyst 3K-X 440W DC Power Supply	14 days	1	500.00	500.00	0	500.00	
8.2	C3KX-PWR-440WDC/2	Catalyst 3K-X 440W DC Secondary Power Supply	14 days	1	500.00	500.00	0	500.00	
8.3	S375XVK9T-15002SE	CAT 3750X IOS UNIVERSAL WITH WEB BASE DEV MGR	14 days	1	0.00	0.00	0	0.00	
8.4	C3KX-NM-10G	Catalyst 3K-X 10G Network Module option PID	14 days	1	2,500.00	2,500.00	0	2,500.00	
8.5	CAB-STACK-50CM	Cisco StackWise 50CM Stacking Cable	14 days	1	0.00	0.00	0	0.00	
8.6	PI-MSE-PRMO-INSRT	Insert Packout - PI-MSE	14 days	1	0.00	0.00	0	0.00	
8.7	SFP-10G-SR=	10GBASE-SR SFP Module	14 days	4	995.00	3,980.00	0	3,980.00	
9.0	**ASR-9000V-DC-E=**	44-Port GE + 4-Port 10GE ASR 9000v DC Power ETSI Chassis	21 days	1	25,000.00	25,000.00	0	25,000.00	
9.1	ASR-9000V-FAN	ASR-9000V Fan Tray with Filter	21 days	1	200.00	200.00	0	200.00	
9.2	A9K-NVSAT1-LIC=	NV Host License for 1 nV Client	21 days	1	5,000.00	5,000.00	0	5,000.00	
9.3	SFP-10G-SR=	10GBASE-SR SFP Module	14 days	4	995.00	3,980.00	0	3,980.00	
9.4	SFP-GE-T=	1000BASE-T SFP (NEBS 3 ESD)	14 days	10	440.00	4,400.00	0	4,400.00	
10.0	**ME2600X-44FA-D-K9=**	ME2600X Ethernet Access Switch 44xGE SFP w/ 4x10GE SFP+ -48V	21 days	1	25,200.00	25,200.00	0	25,200.00	
10.1	SL-ME2600X-B	ME2600X Base Features License	21 days	1	1,995.00	1,995.00	0	1,995.00	
10.2	S2600XUK9-15202SA	Cisco ME2600X Ethernet Access Switches UNIVERSAL	21 days	1	0.00	0.00	0	0.00	
10.3	SFP-10G-SR=	10GBASE-SR SFP Module	14 days	4	995.00	3,980.00	0	3,980.00	
10.4	SFP-GE-T=	1000BASE-T SFP (NEBS 3 ESD)	14 days	10	440.00	4,400.00	0	4,400.00	
						Products SubTotal		**387,380.00**	

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Line Number	Item Name	Description	Quantity	ListPrice	Extended ListPrice	Selling Price
Products						
1.0	**AIR-CT5508-500-K9**	Cisco 5508 Series Wireless Controller for up to 500 APs	1	104,995.00	104,995.00	104,995.00
1.1	SWC5500K9-75	Cisco Unified Wireless Controller SW Release 7.5	1	0.00	0.00	0.00
1.2	AIR-PWR-CORD-AP	AIR Line Cord Asia Pacific (APAC)	1	0.00	0.00	0.00
1.3	LIC-CT5508-500	500 AP Base license	1	0.00	0.00	0.00
1.4	LIC-CT5508-BASE	Base Software License	1	0.00	0.00	0.00
1.5	PI-MSE-PRMO-INSRT	Insert Packout - PI-MSE	1	0.00	0.00	0.00
1.6	AIR-PWR-5500-AC	Cisco 5500 Series Wireless Controller Redundant Power Supply	1	1,495.00	1,495.00	1,495.00
2.0	**AIR-CT5760-1K-K9**	Cisco 5700 Series Wireless Controller for up to 1000 APs	1	200,000.00	200,000.00	200,000.00
2.1	CAB-TA-AR	Argentina AC Type A Power Cable	2	0.00	0.00	0.00
2.2	AIR-CT5760-RK-MNT	5760 Wireless Controller Rack Mount kit	1	0.00	0.00	0.00
2.3	AIR-CT5760-K9	Cisco 5700 Series Wireless Controller Base SKU	1	0.00	0.00	0.00
2.4	LIC-CT5760-1K	1000 AP Base license	1	0.00	0.00	0.00
2.5	LIC-CT5760-BASE	Cisco 5760 Controller AP Base license (0AP count)	1	0.00	0.00	0.00
2.6	SW5760LPE-K9-32SE	Cisco 5760 WIRELESS CONTROLLER SW Release3.2 W/O DTLS	1	0.00	0.00	0.00
2.7	PWR-C1-350WAC	350W AC Config 1 Power Supply	1	0.00	0.00	0.00
2.8	PWR-C1-350WAC/2	350W AC Config 1 SecondaryPower Supply	1	500.00	500.00	500.00
3.0	**WS-C2960C-8PC-L**	Catalyst 2960C Switch 8 FE PoE 2 x Dual Uplink Lan Base	1	1,107.70	1,107.70	1,107.70
3.1	CAB-AC	AC Power Cord (North America) C13 NEMA 5-15P 2.1m	1	0.00	0.00	0.00
3.2	CON-SNT-C296C8PC	SMARTNET 8X5XNBD Catalyst 2960C Switch 8 FE PoE 2 x Dual	3	54.06	162.18	162.18
4.0	**AIR-CAP1602I-A-K9**	802.11a/g/n Ctrlr-based AP Int Ant A Reg Domain	1	736.70	736.70	736.70
4.1	AIR-AP-T-RAIL-R	Ceiling Grid Clip for Aironet APs - Recessed Mount (Default)	1	0.00	0.00	0.00
4.2	AIR-AP-BRACKET-1	802.11n AP Low Profile Mounting Bracket (Default)	1	0.00	0.00	0.00
4.3	SWAP1600-RCOVRY-K9	Cisco 1600 Series IOS WIRELESS LAN RECOVERY	1	0.00	0.00	0.00
4.4	CON-SNT-C1602IA	SMARTNET 8X5XNBD 802.11a/g/n Ctrlr-ba	3	29.68	89.04	89.04
				Products SubTotal		**309,085.62**

Configset ID: 7485693
Configset Name: FITEL-PrimeInfrastructure
Created On: 8 abr 2014
Created By: glch
Last Update On: 8 abr 2014
Last Update By: glch
Main Currency: USD
Price List: Global Price List - US

Line Number	Item Name	Description	Service Duration	Lead Time	Included Item	Quantity	ListPrice	Extended ListPrice	Discount %	Selling Price
Products										
1.0	**R-PI2X-K9**	Cisco Prime Infrastructure 2.x	N/A	21 days	No	1	0.00	0.00	0	0.00
1.1	L-PILMS42-KIT	Prime Infrastructure - LMS License Kit	N/A	21 days	Yes	1	0.00	0.00	0	0.00
1.2	L-PILMS42A-1K	Prime Infrastructure LMS 4.2A - 1K Device Base Lic	N/A	21 days	Yes	1	0.00	0.00	0	0.00
1.3	L-PILMS42A-500	Prime Infrastructure LMS 4.2A - 500 Device Base Lic	N/A	21 days	Yes	1	0.00	0.00	0	0.00
1.4	L-PI2X-BASE	Prime Infrastructure 2.x Base License	N/A	21 days	No	1	95.00	95.00	0	95.00
1.5	R-PI20-SW-K9	Prime Infrastructure 2.0 Software	N/A	21 days	No	1	25.00	25.00	0	25.00
1.6	L-PI2X-LF-500	Prime Infrastructure 2.x - Lifecycle - 500 Device Lic	N/A	21 days	No	1	37,000.00	37,000.00	0	37,000.00
1.7	L-PI2X-LF-1K	Prime Infrastructure 2.x - Lifecycle - 1K Device Lic	N/A	21 days	No	1	69,000.00	69,000.00	0	69,000.00
								Products SubTotal		**106,120.00**
Services										
1.0.1	CON-ESW-PI2XK9B	ESSENTIAL SW NULL SKU-No line item services included	12 month(s)	N/A	No	1	0.00	0.00	0	0.00
1.4.0.1	UCSS-UPIB-1-1	Prime Infra Base PASS-1yr	12 month(s)	N/A	No	1	10.00	10.00	0	10.00
1.4.0.2	CON-ESW-PI2XBASE	ESSENTIAL SW Prime Infrastructure 2.x Base License	12 month(s)	N/A	No	1	12.00	12.00	0	12.00
1.5.0.1	CON-ESW-PI20SW	ESSENTIAL SW Prime Infrastructure 2.0 Software	12 month(s)	N/A	No	1	3.00	3.00	0	3.00
1.6.0.1	UCSS-UPIL-1-500	Prime Infra Lifecycle 500 PASS-1yr	12 month(s)	N/A	No	1	3,700.00	3,700.00	0	3,700.00
1.6.0.2	CON-ESW-PI2XLF5H	ESSENTIAL SW PI 2.x - Lifecycle - 500 Device Lic	12 month(s)	N/A	No	1	4,810.00	4,810.00	0	4,810.00
1.7.0.1	UCSS-UPIL-1-1K	Prime Infra Lifecycle 1K PASS-1yr	12 month(s)	N/A	No	1	6,900.00	6,900.00	0	6,900.00
1.7.0.2	CON-ESW-PI2XLF1K	ESSENTIAL SW PI 2.x - Lifecycle - 1K Device Lic	12 month(s)	N/A	No	1	8,970.00	8,970.00	0	8,970.00
								Services SubTotal		**24,405.00**

Cotización Red Inalámbrica - Proyecto Regional

P/N	Descripción del Producto	Cant.	PV Total
RW-2049-0200	Radwin 2000 Serie-C ODU 4.9-5.X GHz conectorizado/Antena Externa	2	$6,632.00
RW-2050-B350	Radwin 2000 Serie-C ODU 5.8-5.X GHz embedida/Antena Externa	2	$3,136.00
RW-2050-A225	Radwin 2000 Serie-A ODU 5.8-5.X GHz conectorizado/ Antena externa	14	$12,674.67
RW-2050-A125	Radwin 2000 Serie-A ODU 5.8-5.X GHz con antena Integrada	8	$7,722.67
RW-9921-0012	Inyector PoE-AC	26	$2,530.67
RW-9924-0006	Supresor de Picos exteriores 100/1000BaseT PoE c/ patch cord	26	$3,778.67
HG4958DP-30D	Antena Plato 4.9-5.8 GHz 30 dBi Polarización Dual 2xN-hembra	18	$4,344.00
H6-NPNP-1.5M	Cable Superflex 1/4" N-Macho/N-Macho Preconectorizado 1.5 m	36	$1,872.00
AL6-NMNFBW-9	N-Male to N-Female Bulkhead 0-6 GHz 90V Lightning Protector	36	$1,440.00
HGLN-CAT5-2	Protector de Sobretensión F/UTP Cat.5E Interiores	26	$1,005.33
AT0040101	Cable F/UTP Cat5.e Exteriores preconectorizado de 25m (ODU-IDU/PoE)	7	$420.00
AT0040103	Cable F/UTP Cat5.e Exteriores preconectorizado de 50m (ODU-IDU/PoE)	13	$1,300.00
AT0040104	Cable F/UTP Cat5.e Exteriores preconectorizado de 75m (ODU-IDU/PoE)	6	$880.00
			$47,736.00

Access (12) RW5000 with Omni

P/N	Descripción del Producto	Cant.	PV Total
RW-5050-0250	BS radio connectorized supporting multiple band 5.X FCC/IC GHz	12	$36,176.00
RW-5505-0A50	SU Radio 5 Mbps c/integrated antenna	36	$19,536.00
RW-9921-0012	Inyector PoE-AC	48	$19,536.00
HG5812U-Pro	Antena Omnidireccional 5.8Ghz, 12dBi	12	$956.80
H6-NPNP-1.5M	Cable Superflex 1/4" N-Macho/N-Macho Preconectorizado 1.5 m	12	$624.00
AL6-NMNFBW-9	N-Male to N-Female Bulkhead 0-6 GHz 90V Lightning Protector	12	$480.00
HGLN-CAT5-2	Protector de Sobretensión F/UTP Cat.5E Interiores	12	$464.00
AT0040103	Cable F/UTP Cat5.e Exteriores preconectorizado de 50m (ODU-IDU/PoE)	12	$1,200.00
AT0040104	IDU/ODU cable 75m	12	$1,760.00
			$80,732.80

RNMS

P/N	Descripción del Producto	QTD	
RW-9941-2024	RNMS PLATINUM with 24 months warranty and service package	1	$56,977.74
RW-9941-1024	RNMS BASIC with 24 months warranty and service package	1	$8,287.67

MARIO VASQUEZ
Gerente de Ingenieria
Área Comercial
NEXUS TECHNOLOGY S.A.C.
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☎ +51-1-617-0432 / +51-1-617-0400

Señores:

Nº Cotización: AU14011001

MINISTERIO DE TRANSPORTES Y COMUNICACIONES

Atención:

Ing. Jesus Sipan Reyes

Asunto: Gabinete outdoor para 20 UR y 2 bancos de baterías

Estimados señores,
Por medio de la presente les hacemos llegar nuestros más cordiales saludos y a su vez de acuerdo a lo conversado adjuntamos nuestra mejor propuesta económica de nuestros productos la cual se detalla a continuación.

PROPUESTA ECONÓMICA

Item	Descripción	Unid.	Cant.	Valor Unit. S/.	Valor Total S/.
1	GABINETE DE PISO "MINISHELTER" PARA LA INTEMPERIE IP55 MEDIDAS: 960X960X2100MM MATERIAL: PLANCHA GALVANIZADA DE ORIGEN X 1.5MM (ASTM A653) ACABADO: PINTURA ELECTROSTATICA EN POLVO BLANCA INCLUYE: -02 Bandejas para Baterías (Capacidad de Carga: 250Kg) -03 Sensores de Puerta Abierta -01 Luz LED -100 Cintillos -20 Tornillo + Tuerca Enjaulada + Arandela Plastica -10 Prensaestopas (02 Medidas) -01 Barra de Tierra 30x5mm + Aisladores + 07 Terminales -01 Zocalo/Base con Ingreso de Cables (Capacidad de Carga: 650kg) -Espuma Aislante en las paredes laterales del Gabinete -Filtros frontales para su debida ventilación -01 Carga de Silicona -01 Kit de ventilacion (5 ventiladores de 48 VDC o 220 VAC	UNID	100.0	6,500.00	650,000.00

* A PARTIR DEL 01 DE JULIO DEL 2013 SOMOS AGENTES DE PERCEPCION SEGÚN DS N° 091-2013/EF	Sub Total S/.	650,000.00
	I.G.V. (18%)	117,000.00
	Total General S/.	767,000.00

Condiciones de la Oferta:

• Condición de Pago: FACTURA 60 DIAS
• Las tarifas están sujetas al Impuesto General a las Ventas, actualmente 18%
• Precios expresados en NUEVOS SOLES
• Tiempo de Entrega: 45 día(s) útil(es)
• Garantía contra defectos de Fabricación: 1 año(s). No incluyen los equipos electrónicos.
• Incluye Entrega SOBRE CAMION dentro de Lima Metropolitana.
• Incluye Embalaje Estándar con esquinero de cartón corrugado y strech film.
• Gabinete desarmable en 2 partes

Quedamos a la espera de sus gratas ordenes.

www.telepartes.com.pe

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