ZYXEL

Amber Wu
Product Line Manager

ZYXEL
Your Networking Ally

Understanding DAS Solutions.

Active DAS, Passive DAS vs Zyxel DAS

What Causes Poor Mobile Signal?

Distance

Farther away from a base station, weaker mobile signal received. A BTS can transmit at higher power e.g. 50 - 60W, the limitation still resides in a cellular phone which transmits at a max. power of 2W only.

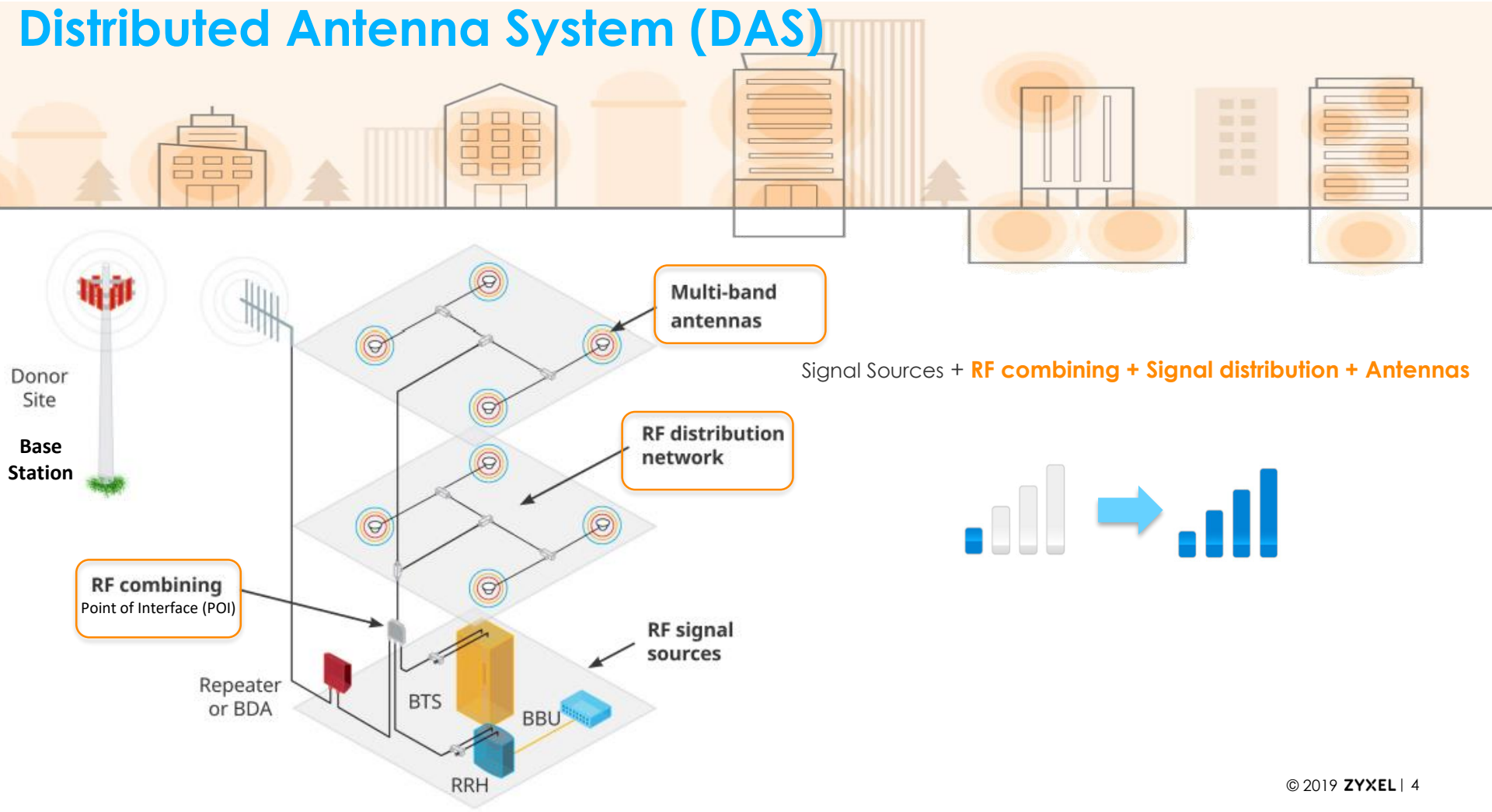
Terrain

Mountains, hills, or high buildings impact direct line of sight to a base station and cellular signal propagation. Cellular signal cannot penetrate into tunnels or undergrounds.

Building Materials

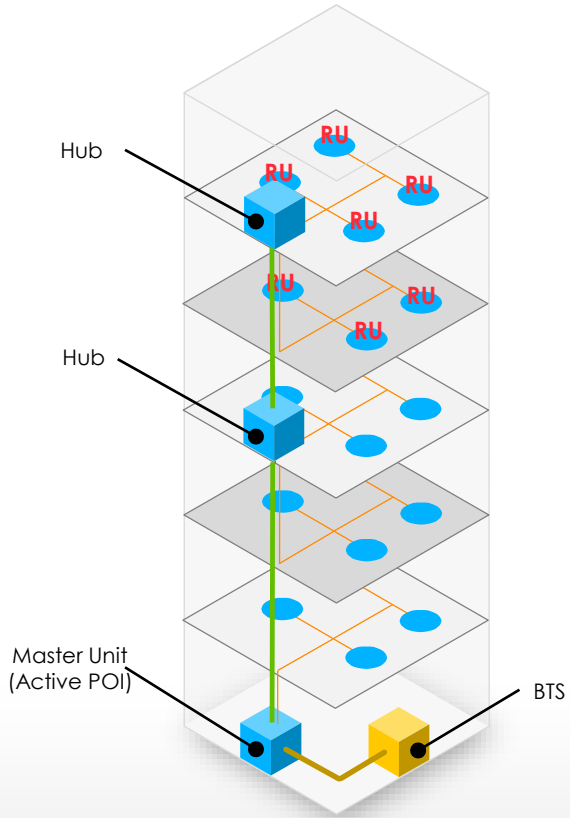
Construction materials used in walls and insulation in buildings such as metal, glass, concrete and energy-efficient materials can slow or stop cellular signal penetration.

Distributed Antenna System (DAS)



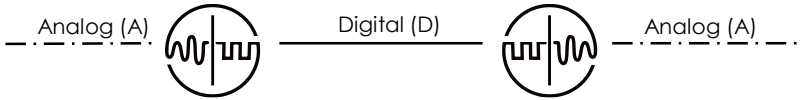
Signal Sources + **RF combining + Signal distribution + Antennas**

Traditional Active DAS Solution



Designed for very large scale deployments

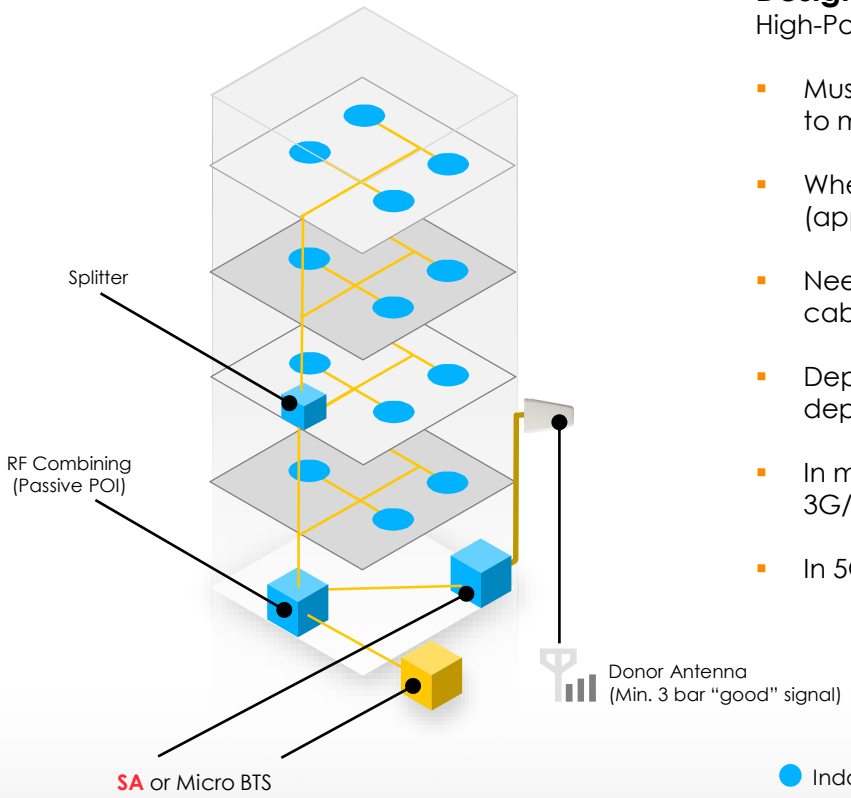
- Highly scalable for Stadiums, Airports etc. but costly due to the need to convert Analog to Digital and then back, Digital to Analog.



- Additional power source required for each fiber device.
- Architecture is same regardless of size, difficult to scale down for smaller deployments (sub 80,000m^2).
- Can introduce latency due the Analog to Digital conversion.
- Requires support from Tier1 Telco in most cases, for direct access to BTS (Base Station Subsystem).

Fiber cable
Coax
Remote Unit + Antennas
Fiber or CAT6/CAT7 cable
RU Signal Amplifier

Traditional Passive DAS / Repeater Solution

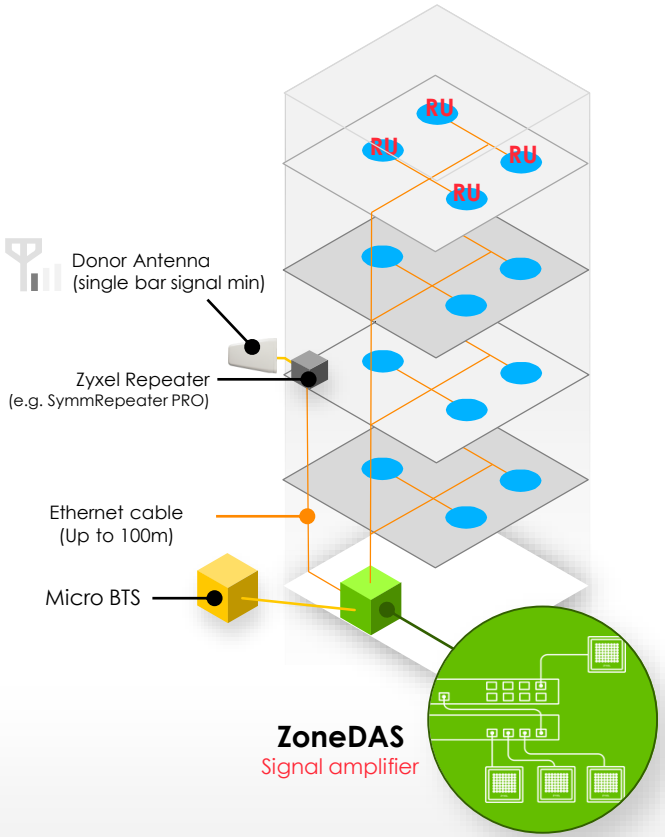


Designed for smaller deployments max 10,000m²
High-Power BTS/Repeater + Passive DAS

- Must use passive components, large diameter (carrier grade) cabling to minimize signal loss in cable.
- When using repeater, the signal strength needs to be 3 bars minimum (approx. -80 dBm RSRP) otherwise the deployment will not function.
- Need very skilled RF engineers for complex calculations to calculate cable loss for each point before deploying.
- Deployment is lengthy (survey takes at least 1 month) + Long Physical deployment with carrier grade coax.
- In most cases Passive DAS can only deliver voice (not data services 3G/4G)
- In 5G era, the upper frequency limit of coaxial cable is 2.7GHz.

Indoor Antennas (Passive)
SA Signal Amplifier (High Power Repeater)
Coax 1/2" (12.7mm)
Coax 7/8" (22.23mm)

Zyxel Ethernet Active DAS Solution



Designed for Easy Planning & Flexible Deployments

- Flexible 2 tier or 3 tier approach for simpler and more efficient installation.
- When using repeater, the signal strength can be as low as 1 bar signal strength.
- Unique technology that allow RF over Ethernet removing the need for complex calculations and reducing cost by utilizing standard RJ45 cabling
- Guaranteed for both Voice and Data services.
- Support hybrid signal source and multi-carriers co-location for smooth data and voice quality
- Rapid / scalable deployment with simple installation process/ modular design / PoE to power each RU built directly into each ZoneDAS or ZoneDAS One unit.

Remote Unit (embedded Antennas)
RU Signal Amplifier
Coax
Ethernet cable (CAT 5e)

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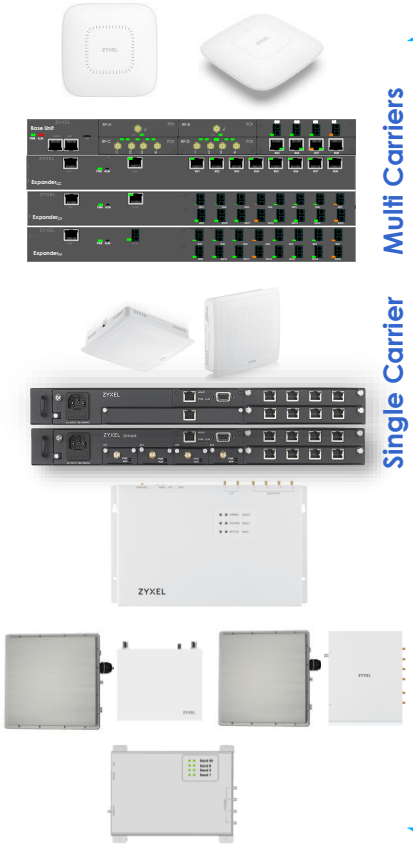
Your Networking Ally

Market Position – 2G/3G/4G/5G & Co-Location



Multi Carriers

Single Carrier

JMA WIRELESS
COMMSCOPE
SOLiD
COBHAM
HUAWEI
ERICSSON
SUNWAVE Solutions
Rosenberger
Comba
High Power China Cellular Repeater+ Passive DAS
Small Power China Cellular Repeater

80,000m² ~
40,000 ~ 80,000m²
10,000 ~ 40,000m²
2,500 ~ 10,000m²
100 ~ 2,500m2 floor space

Airports & Stations
Stadiums
College Campuses
Convention Centers
Shopping Malls/Plazas
Complex Buildings/Office
Hospitals
Hotels & Resorts
High-Rises
Community Apartments
Elevators, High Floor Areas Basements
Warehouse & Factory
Small Offices

Indoor BTS

Off-Air Signal

DAS Product Solution – Flexible & Easy to Use

ZoneDAS One Active DAS System

Base Unit

Expander$_{CC}$ (Copper -Copper)

Expander$_{FC}$ (Fiber-Copper)

Expander$_{FF}$ (Fiber-Fiber)

Remote Unit
23dBm (200mw)
Active Antennas

Remote Unit with
4 external connectors
17dBm (50mw)

Line Extender
(Copper-Copper)

Fiber Converter
(Fiber-Copper)

MagicOffice Repeater
- Quad-band Repeater
- Single level Amplification for Offices

MultiSite Repeater
- Tri-band Repeater
- Single level or Multi-level Amplification

SymmRepeater^{Enterprise}
- Ultra High Gain Dual-band Repeater
- Two-level Amplification for Weak Signal or Long Distance

40,000m²

- ZoneDAS One

  If the design proposal requires more than 7 x MultiSites, propose ZoneDAS One instead

ZoneDAS One for Multiple Operators

ZoneDAS for Single Operator

Convention Centers
Shopping Malls/Plazas
Complex Buildings/Office

Stadiums
Airports & Stations
College Campuses

10,000m²

- MultiSite Cascaded

  7 x MultiSites = 7 x 3,600m² (25,200m²)

- SymmRepeater Enterprise

  (weak outdoor signal) +

  MultiSites

Hospitals

Hotels, Resorts

Apartments
High-Rises

Basements

Warehouses

Factories

2,500m²

- MagicOffice

Small Shops

Small Offices

Special Forces

- SymmRepeater PRO
- SymmRepeater Enterprise

Pro

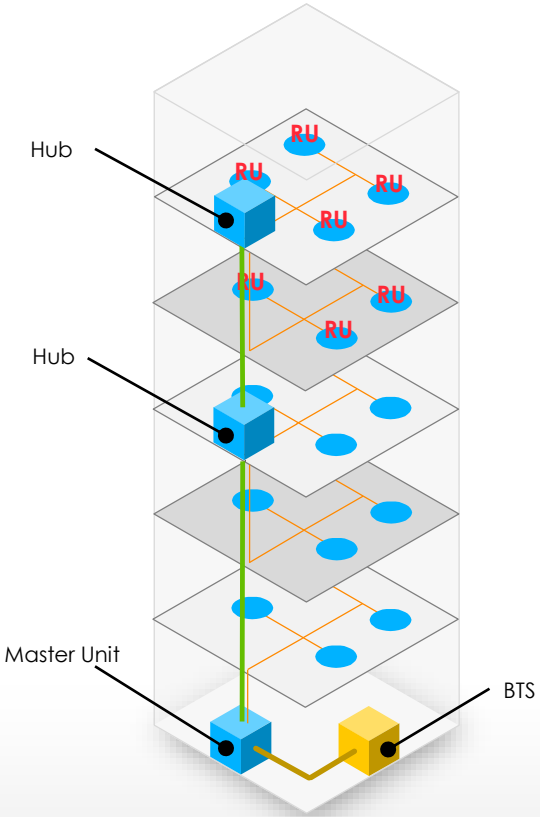
Enterprise

Elevators

High Floor Areas

Tunnels

Traditional Active DAS Solution



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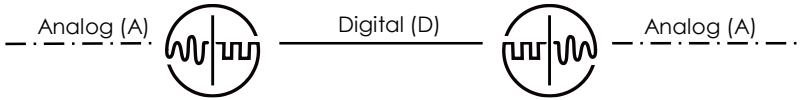

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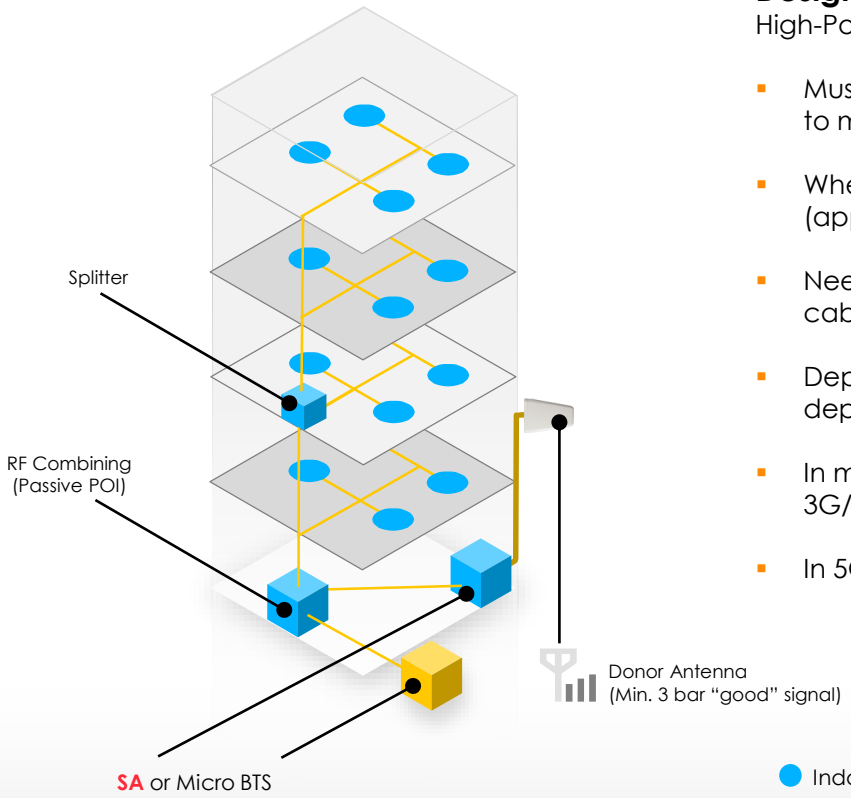

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Traditional DAS Deployment Phases (**approximation**) & Steps

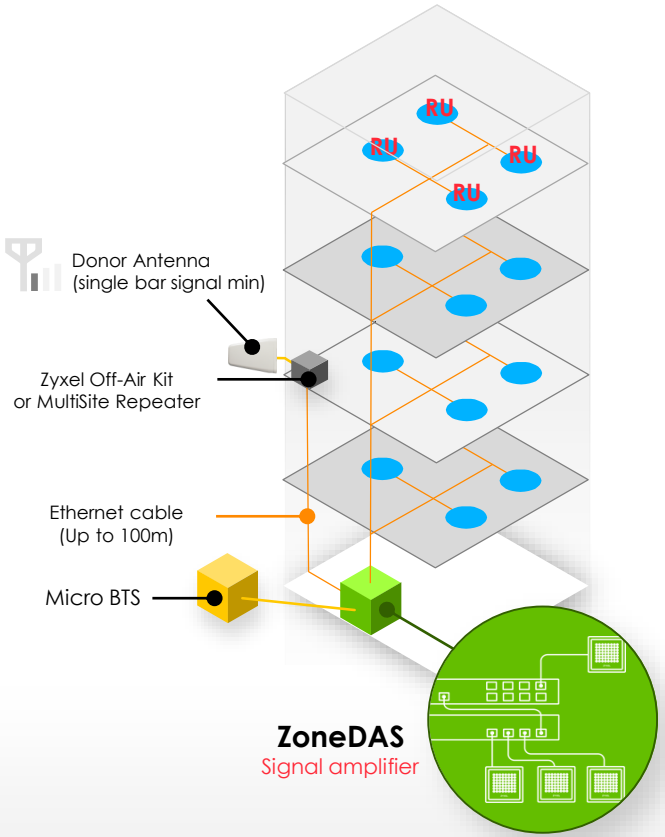
	Deployment Step	Resource
	Design & RF Survey	RF Engineer
	Installation	PM Construction Crew Technicians
COMMISIONING	Validation od DAS Completion	PM Construction Crew RF Engineers
COMMISIONING	Baseline Measurement	Construction Crew RF Engineers
COMMISIONING	DAS Parameter Normalization CW Testing	RF Engineers
COMMISIONING	Maximize Sensitivity	RF Engineers
	RAN Integration Pre Optimization Testing	RF Engineers Cell Technicians
	On Air Optimization Acceptance	PM RF Engineers

Source: Anritsu

Sl No	Antenna No	Length of cable			Splitter				Coupler					Connector Loss		Antenna Gain		Total losses (dB)	Antenna EIRP (dBm)	Link Budget Calculation	
		1/2 inch	7/8 inch	Loss	2 way	3 way	4 way	Loss	6 dB		10 dB		Total Loss	Qty	Loss					Up Link (RSSI at Micro BTS)	Down Link (RSSI at Mobile)
									Tap Loss	Through Loss	Tap Loss	Through Loss				Ceiling	Directional				
1	1	61	0	4.27	1	0	1	9	1	0	0	0	6	8	4	1	0	23.27	16.73	-49.48	-42.48
2	2	25	0	1.75	1	0	1	9	1	0	0	0	6	8	4	1	0	20.75	19.25	-46.96	-39.96
3	3	55	0	3.85	0	0	2	12	0	1	0	0	1.5	8	4	1	0	21.35	18.65	-47.56	-40.56
4	4	62	0	4.34	0	0	2	12	0	1	0	0	1.5	8	4	1	0	21.84	18.16	-48.05	-41.05
5	5	77	0	5.39	0	0	2	12	0	1	0	0	1.5	8	4	1	0	22.89	17.11	-49.1	-42.1
6	6	85	0	5.95	0	0	2	12	0	1	0	0	1.5	8	4	1	0	23.45	16.55	-49.66	-42.66
7	7	92	0	6.44	0	0	3	18	0	0	0	0	0	8	4	1	0	28.44	11.56	-54.65	-47.65
8	8	97	0	6.79	0	0	3	18	0	0	0	0	0	8	4	1	0	28.79	11.21	-55	-48
9	9	65	0	4.55	0	0	3	18	0	0	0	0	0	8	4	1	0	26.55	13.45	-52.76	-45.76
10	10	77	0	5.39	0	0	3	18	0	0	0	0	0	8	4	1	0	27.39	12.61	-53.6	-46.6
11	11	65	0	4.55	0	0	3	18	0	0	0	0	0	8	4	1	0	26.55	13.45	-52.76	-45.76
12	12	47	0	3.29	0	0	3	18	0	0	0	0	0	8	4	1	0	25.29	14.71	-51.5	-44.5
13	13	65	0	4.55	0	0	3	18	0	0	0	0	0	8	4	0	1	26.55	17.45	-52.76	-41.76
14	14	57	0	3.99	0	0	3	18	0	0	0	0	0	8	4	0	1	25.99	18.01	-52.2	-41.2
15	15	32	0	2.24	0	0	3	18	0	0	0	0	0	8	4	1	0	24.24	15.76	-50.45	-43.45
16	16	62	0	4.34	0	0	3	18	0	0	0	0	0	8	4	1	0	26.34	13.66	-52.55	-45.55
17	17	47	0	3.29	0	0	3	18	0	0	0	0	0	8	4	1	0	25.29	14.71	-51.5	-44.5
18	18	57	0	3.99	0	0	3	18	0	0	0	0	0	8	4	1	0	25.99	14.01	-52.2	-45.2
19	19	44	0	3.08	0	0	2	12	1	0	0	0	6	8	4	1	0	25.08	14.92	-51.29	-44.29
20	20	59	0	4.13	0	0	3	18	0	1	0	0	1.5	10	5	1	0	28.63	11.37	-54.84	-47.84
21	21	54	0	3.78	0	0	3	18	0	1	0	0	1.5	10	5	1	0	28.28	11.72	-54.49	-47.49

RF CABLES - COAXIAL CABLE 1/4, 1/2, 7/8

Zyxel Ethernet Active DAS Solution



Designed for Easy Planning & Flexible Deployments

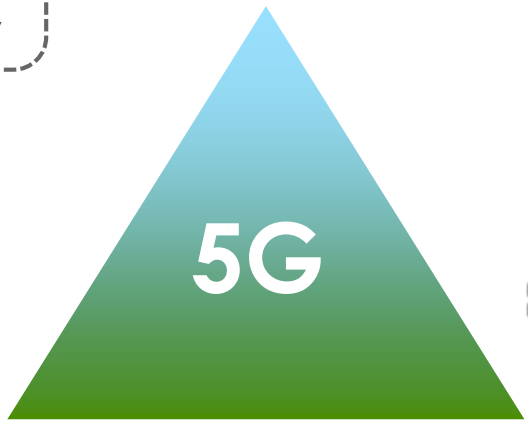
- Flexible 2 tier or 3 tier approach for simpler and more efficient installation.
- When using repeater, the signal strength can be as low as 1 bar signal strength.
- Unique technology that allow RF over Ethernet removing the need for complex calculations and reducing cost by utilizing standard RJ45 cabling
- Guaranteed for both Voice and Data services.
- Support hybrid signal source and multi-carriers co-location for smooth data and voice quality
- Rapid / scalable deployment with simple installation process/ modular design / PoE to power each RU built directly into each ZoneDAS or ZoneDAS One unit.

Remote Unit (embedded Antennas)
RU Signal Amplifier
Coax
Ethernet cable (CAT 5e)

5G-NR

System Capacity (Home/Internet)
- Peak DL speed: 20 Gbps
- Edge area 100 Mbps
- Enhanced spectral efficiency

eMBB
enhanced Mobile-Broadband



URLLC
Ultra Reliable & Low Latency Communications

mMTC
massive Machine-Type Communications

Mission-Critical (Industrial Use)
- Low latency, < 1ms (1 millisecond=1000 μs)
- Ultra reliability
- High availability

Extreme Density (M2M IOT)
- Device connections: 1million/km^2
- Energy optimization
- Low complexity

5G: 1st Wave NSA
(Non-Standalone Access)
- **Multi-Gbps data rates**
  With large bandwidths (100 MHz)
- **Much more capacity**
  With dense spatial reuse
- **Lower latency**
  Bringing new opportunities

FR1 (450MHz ~6000 MHz)
- Sub-6GHz: 3.5GHz, n77/78 (TDD)
- Re-farming: 700MHz, 2100MHz

6GHz ----------
FR2: (millimeter wave)
- mmWave: 24GHz or above (Millimeter wave)

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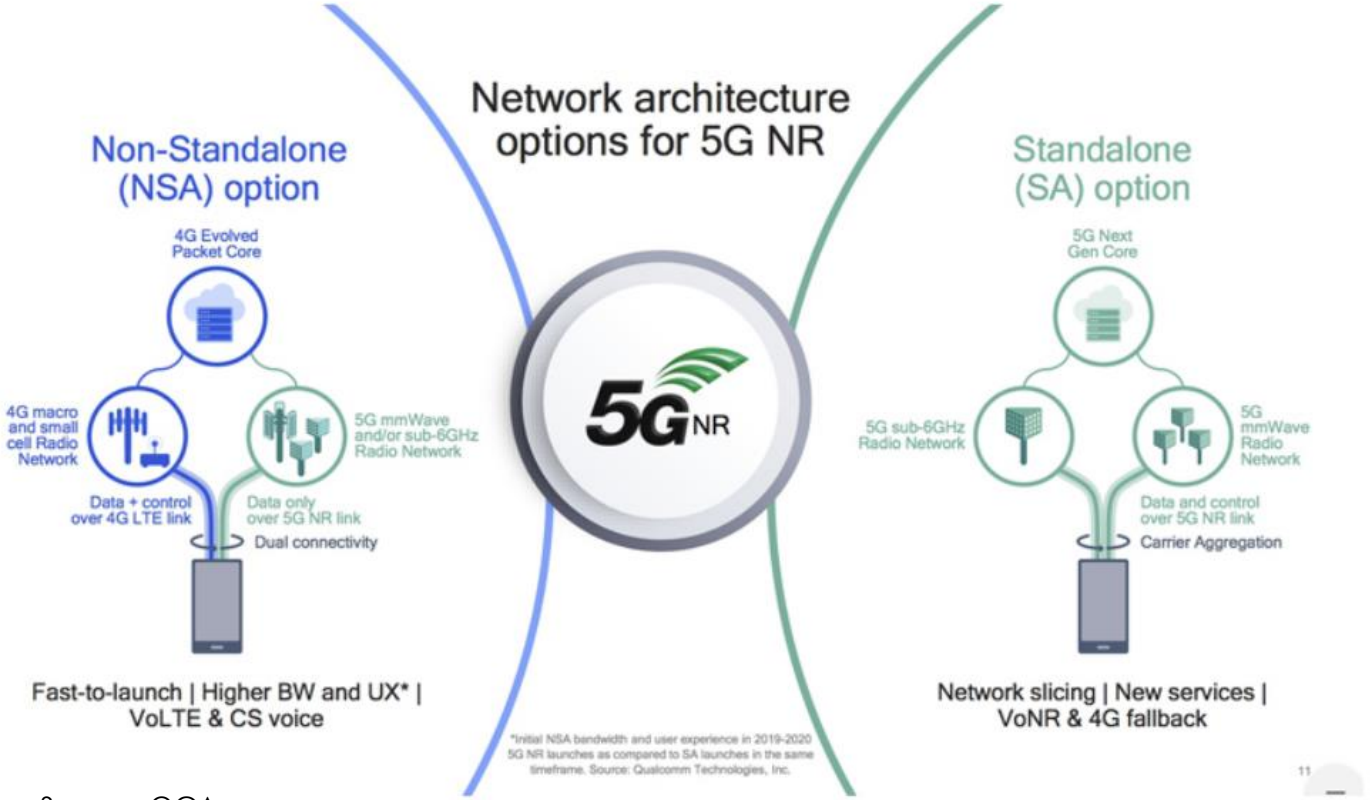
The difference between NSA and SA deployment option



Source: QCA

1st Wave (Early) 5G Deployments & Example Usage Models

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Re-farming: Outdoor & Macro coverage
Carrier bandwidth: e.g. 1, 5,10 and 20 MHz

600 MHz	LTE/5G	North America
700 MHz	LTE/5G	APAC, EMEA, LatAm

Full coverage with <1 GHz

Macro

Sub-6 GHz: Indoor & Outdoor
Carrier bandwidth: e.g. 100 MHz

3.3-3.4	LTE/5G	APAC, Africa, LatAm
3.4-3.6	LTE/5G	Global
3.55-4.2	LTE/5G	US
3.6-3.8	5G	Europe
4.5	5G	Japan China

Dense urban high data rates at 3.5 – 4.5 GHz

small Cell

mmWave: 24GHz or above
Carrier bandwidth: e.g. 400 MHz

28	5G	US, Korea Japan
39	5G	US

Hotspot 10 Gbps at 28/39 GHz

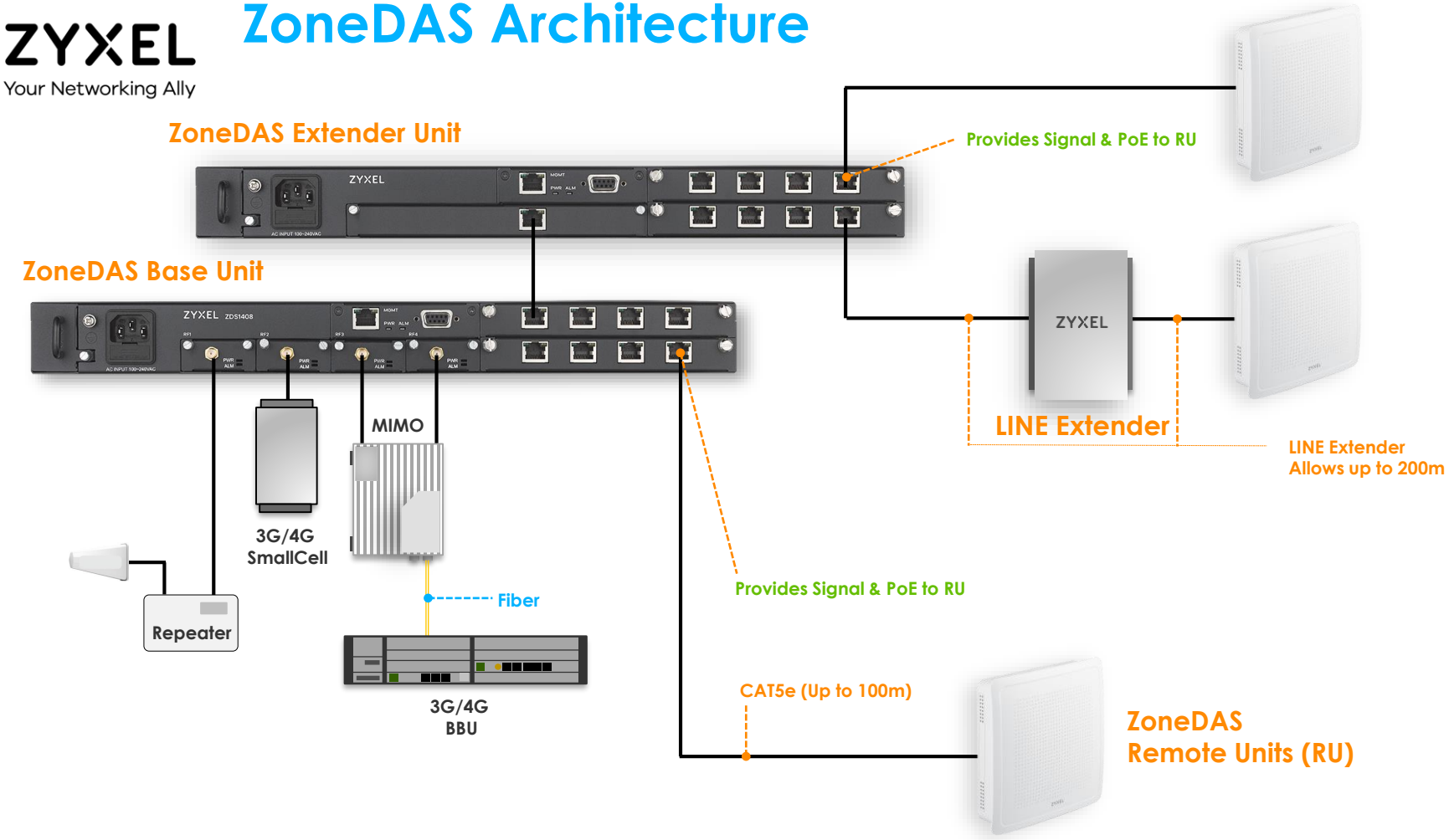
24.25-27.5	5G	WRC-19 band
31.8-33.4	5G	WRC-19 band (Fra, UK)
~40,~50,~70	5G	WRC-19 bands

Future mmwave options

Ultra small Cell

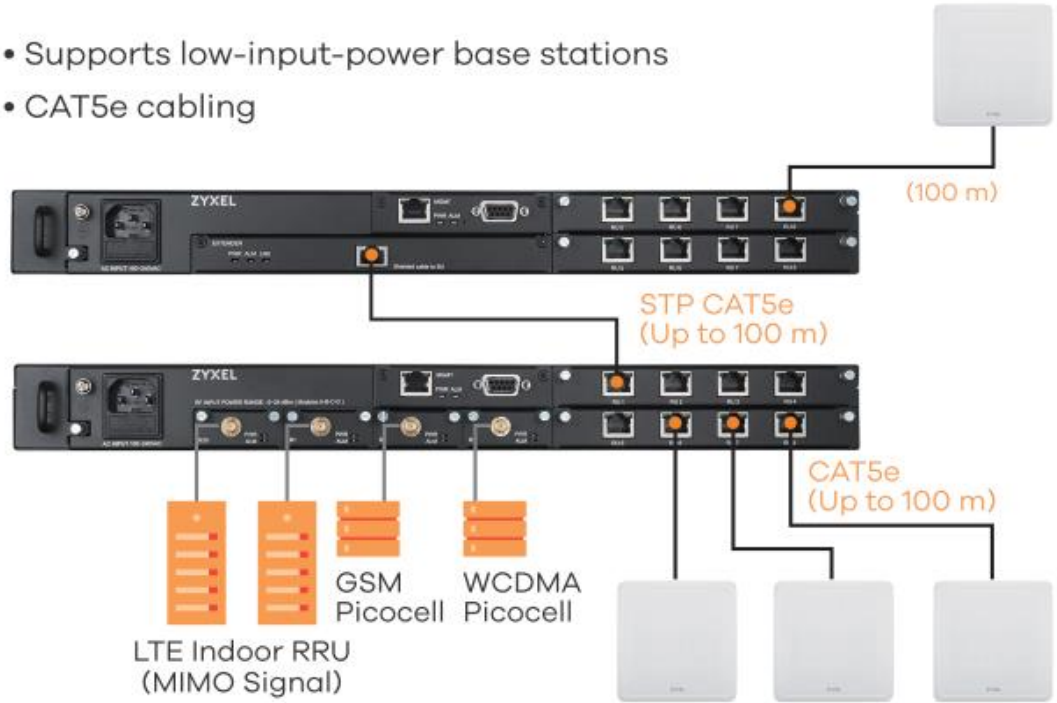
Source: Nokia

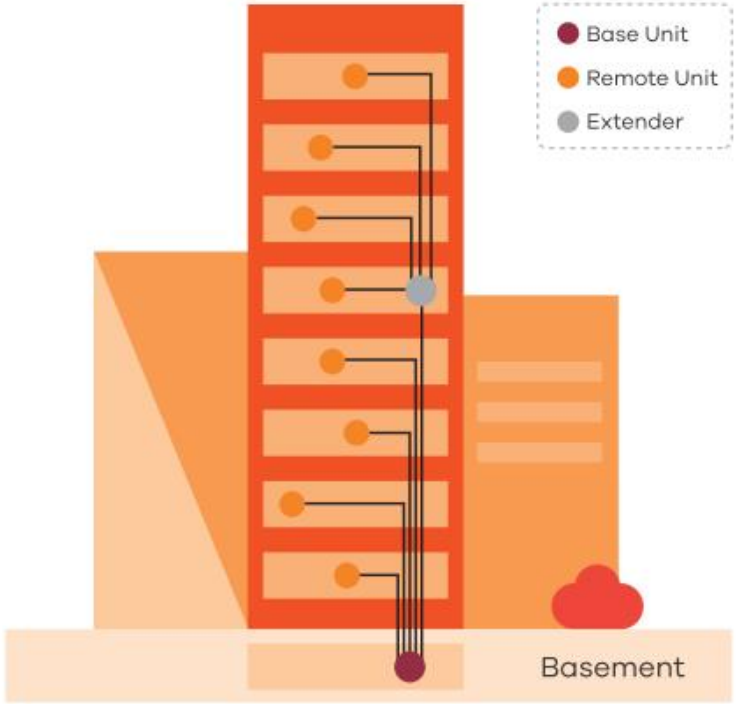
ZoneDAS Architecture



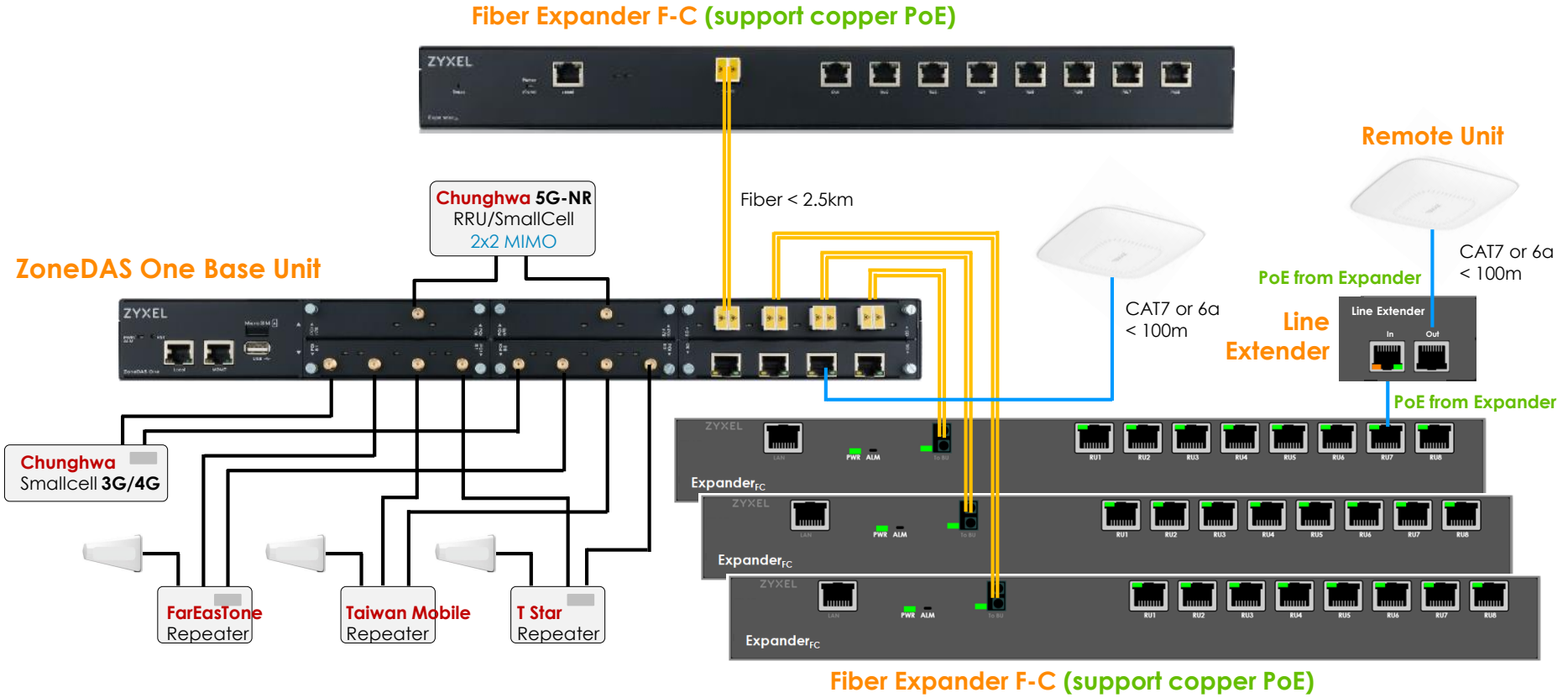
In-Building Cellular
ZoneDAS Family

- Supports low-input-power base stations
- CAT5e cabling





ZoneDAS One Architecture



In-Building Cellular
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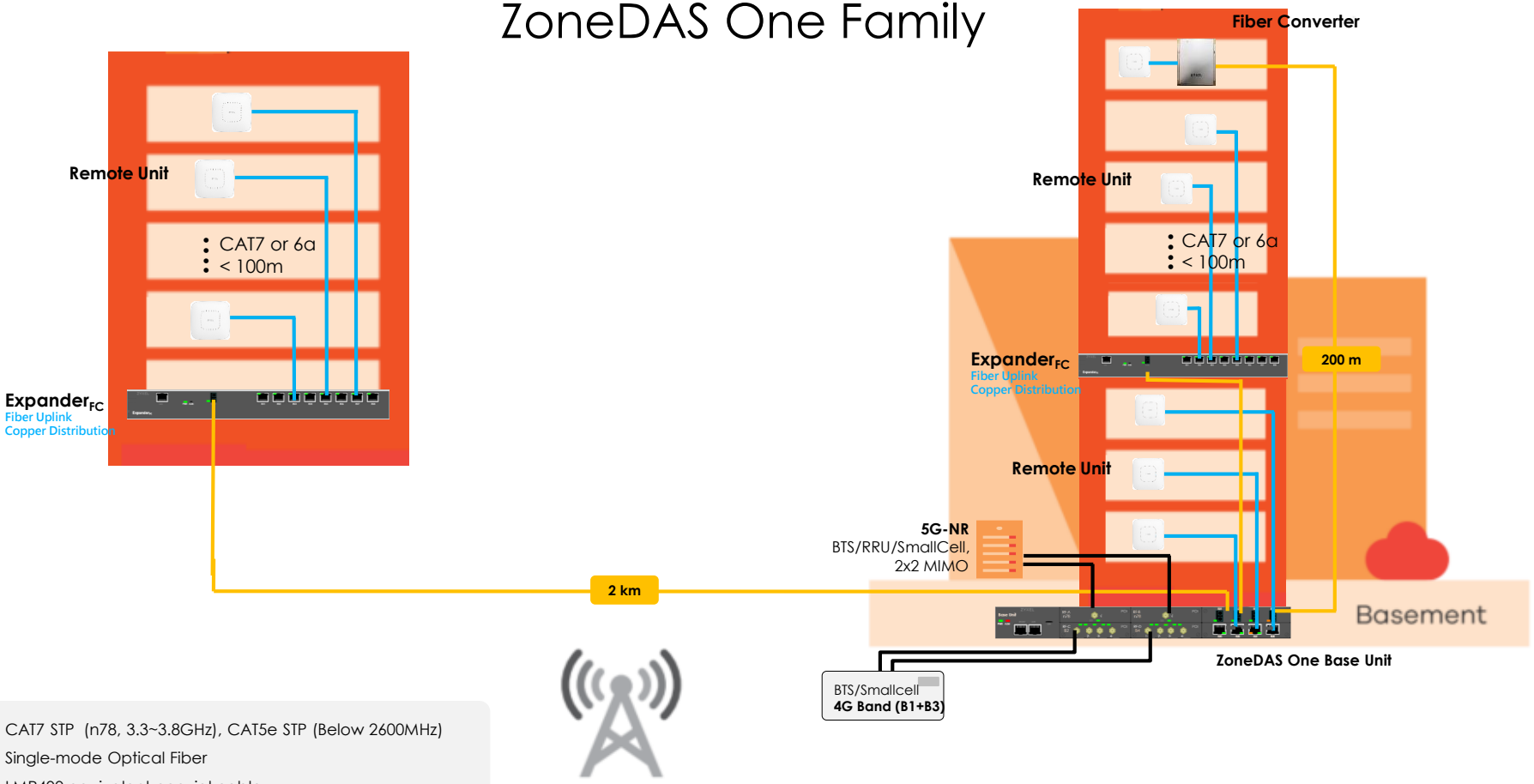

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Ethernet Active DAS Family.

In-Building Coverage Solutions.

ZoneDAS One Family – Flexible and Easy to Use

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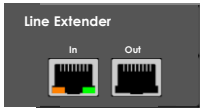
Base Unit

3 Types

- Expander$_{CC}$ (Copper-Copper)
- Expander$_{FC}$ (Fiber-Copper)
- Expander$_{FF}$ (Fiber-Fiber)

Line Extender

Fiber Converter



Remote Unit

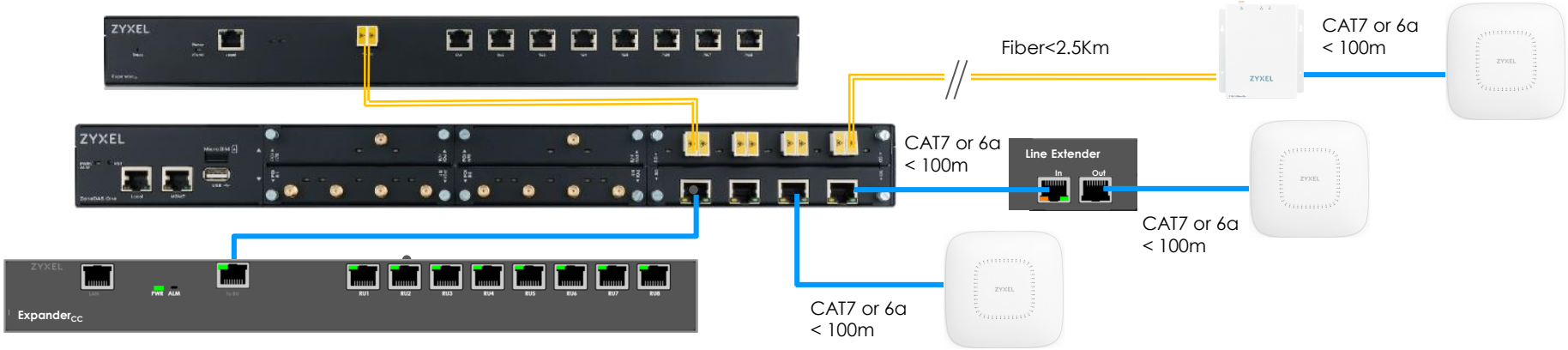
Ultra-slim form factor

40,000m^2 or above

Scenario

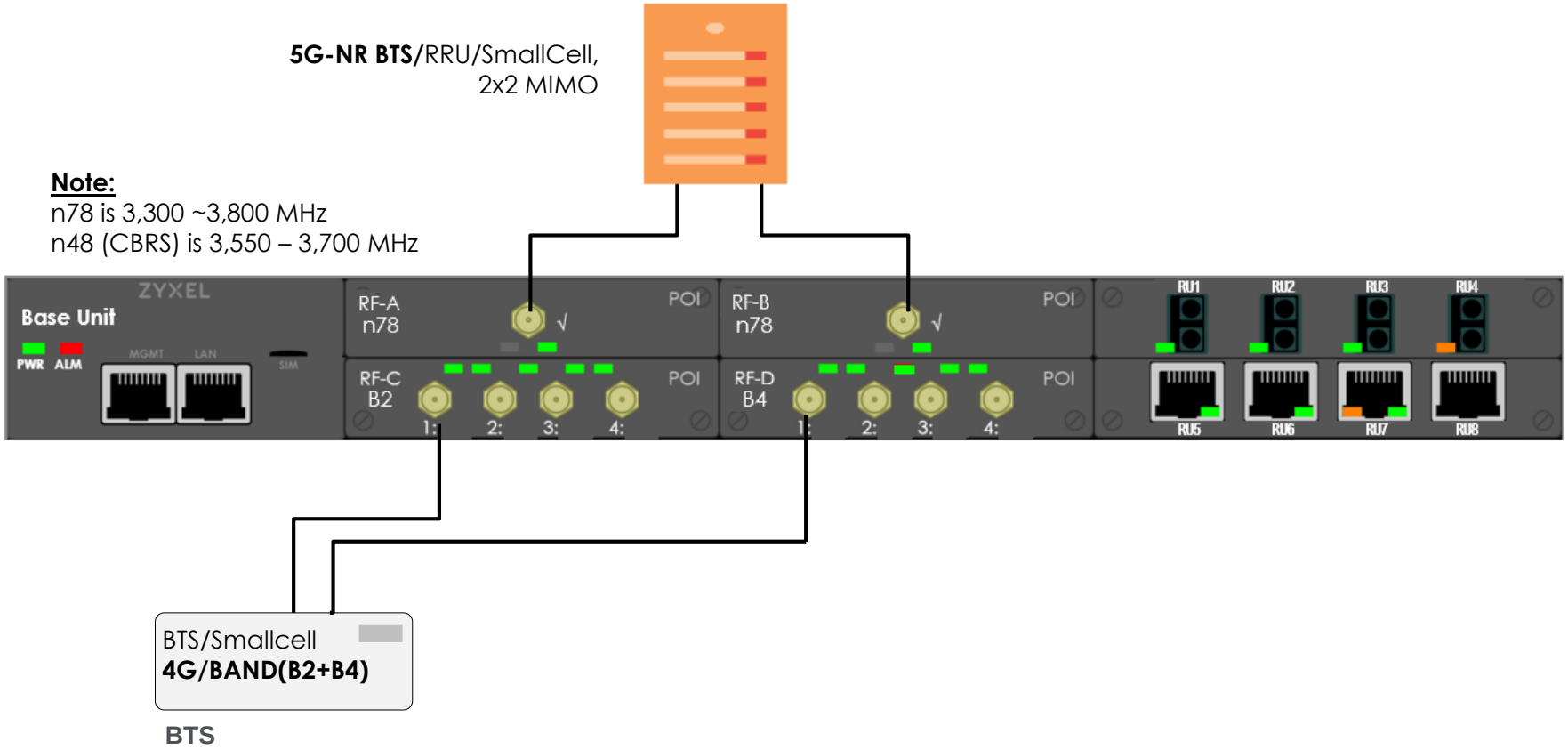
- Airports & Stations
- Stadiums
- College Campuses
- Convention Centers
- Shopping Malls/Plazas
- Complex Buildings/Offices

Base Unit

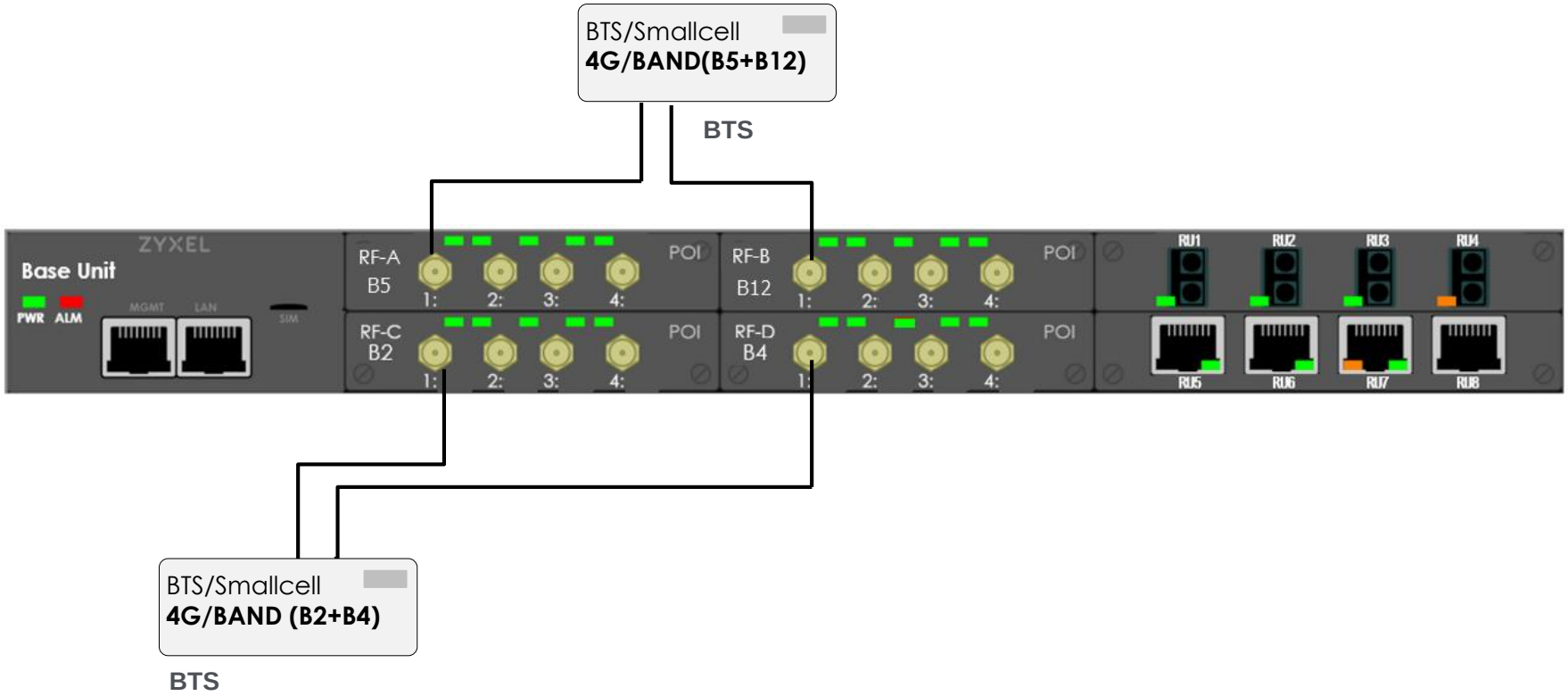


- Total relay bandwidth: **320MHz DL/ 250MHz UL (FDD mode); 400MHz DL/ 280 MHz UL (5G-NR TDD)**
- Band 1/2/3/4/5/7/8/12/13/20/28/39/40/41/n78 selectable by hardware module
- End-to-end delay: **< 3 micro-sec (plus 400m CAT6a delay)**
- Signal Quality: **256QAM** quality
- 4-ports **smart POI** with SMA interface on each band
- **Analog** RF signal source; BTS or Repeater (Vendor Independent)
- Support up to **4 x n78 5G-NR TDD module** (100MHz max. relay bandwidth on each module)
- LC/duplex Expansion module (Optional)
- OTA/LAN management interfaces; Carrier-grade NMS
- 1U/19" rack-mount

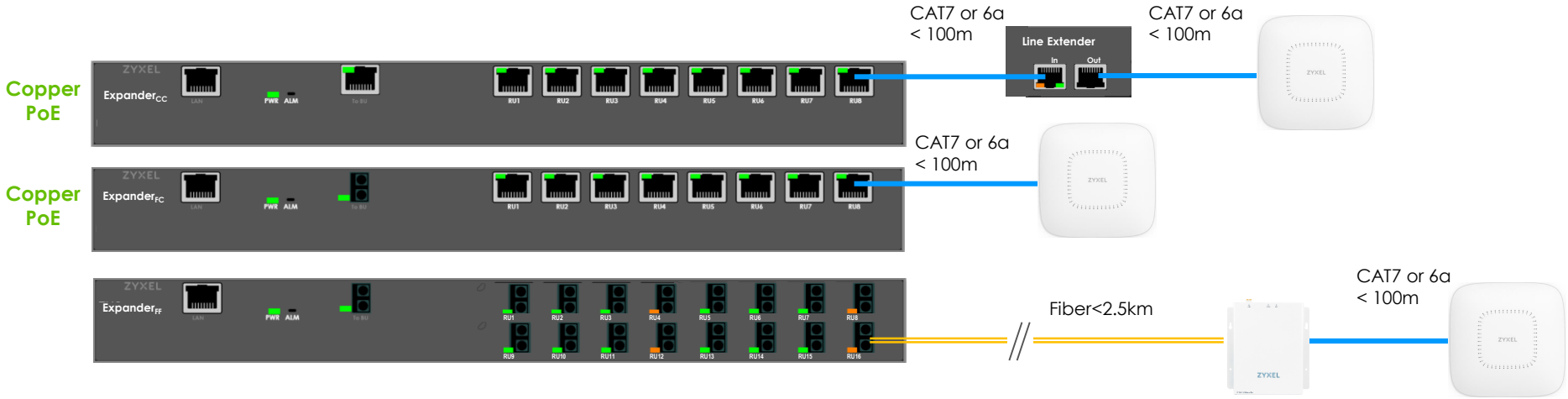
ZoneDAS One Base Unit (LTE/5G)



ZoneDAS One Base Unit - LTE



Expander/LINE Extender/Fiber Converter

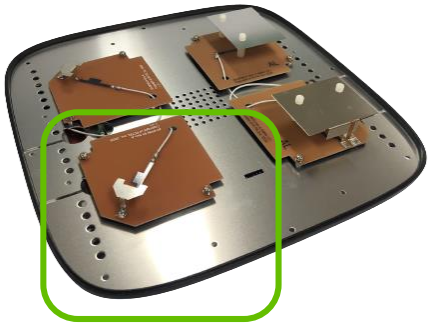


- LC/duplex fiber or CAT7 or 6a interface signal expander
- Copper port provides PoE power source to RU or Line Extender at remote
- LC/APC port connects to a Fiber Converter via a pair of LC cables, the Fiber Converter then converts signal to copper
- 1U/19" rack-mount
- Expander Models are: $Expander_{FC}$, $Expander_{CC}$, $Expander_{FF}$

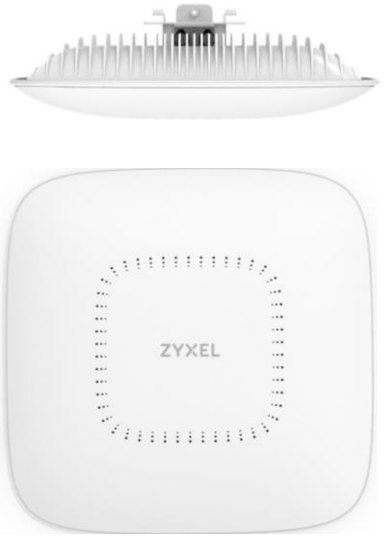
- LINE Extender is a CAT7 or 6a extender
- Fiber Converter is a fiber to copper converter

Remote Unit – Active Antenna Design up to 200mW

- Total relay bandwidth: **320MHz DL/ 250MHz UL (FDD mode)**, **400MHz DL/ 280 MHz UL (5G-NR TDD)**
- Band 1/2/3/4/5/7/8/12/13/20/28/39/40/41/n78 **selectable** by hardware module
- **23dBm** (200mW) output power per band, max. 4 bands (antenna gain excluded)
- Built-in Omni antennas on each band
- Omni antenna gain: max. 3dBi
- PoE power feeding from copper SD port
- Ultra-slim and **fan-less** design
- Dimension: 270 x 270 x 80 mm
- Weight: 2.7Kg
- Ceiling-mount



Band Module

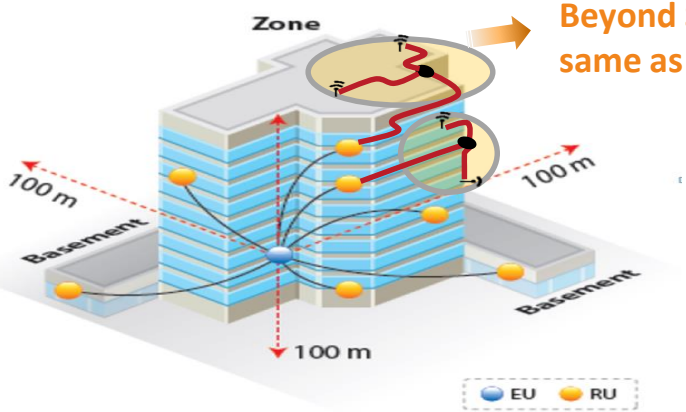


Remote Unit – RU4C

for external antennas, ideal for multiple partition space e.g. hotels

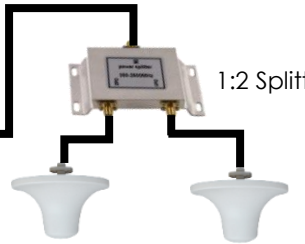
SMA Jack

RF Combined Output
4 x 17dBm

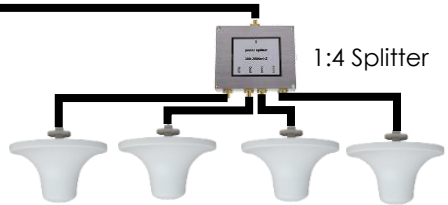


Beyond SMA connectors, antenna installation is same as Passive DAS deployment

SMA Plug



1:2 Splitter



1:4 Splitter

SMA Jack

CAT7 or 6a <100m

½ inch or LMR400 equivalent coaxial cable (50 Ohm)

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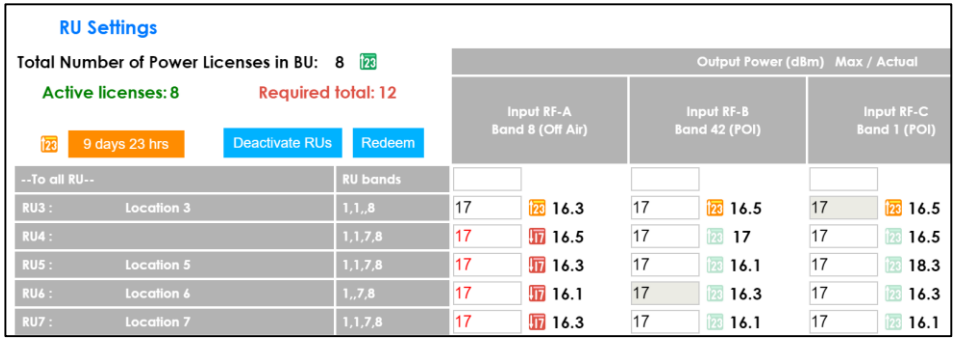
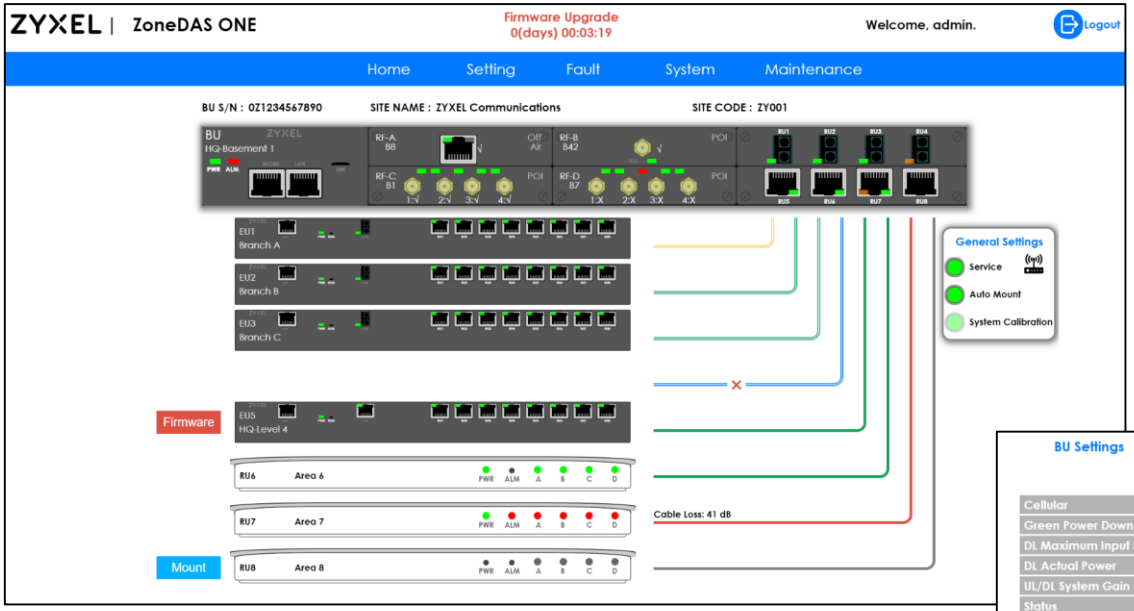
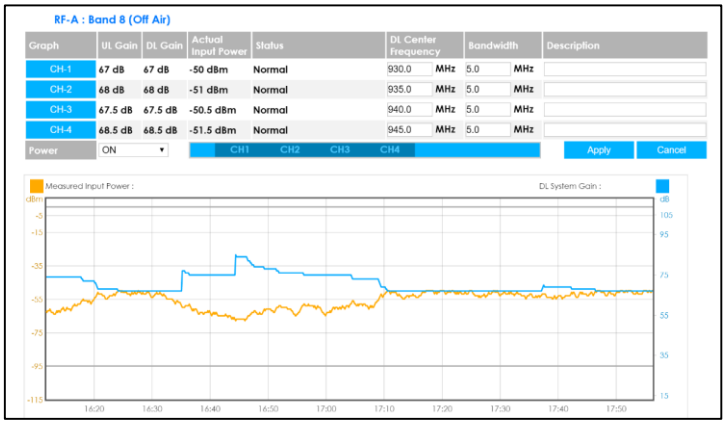
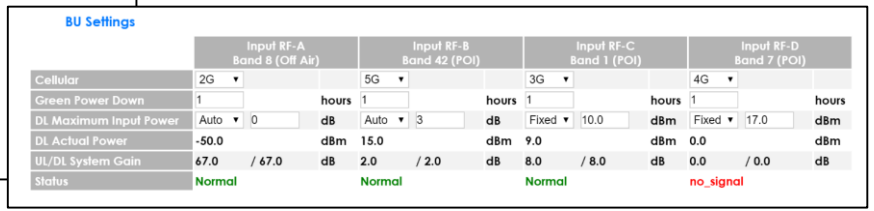
Mgmt. Console

- ✓ Support http/https protocol
- ✓ Intuitive User Interface(UI) built into the device
- ✓ Real-time power/thermal monitoring.
- ✓ Easy configuration, Plug-n-Play









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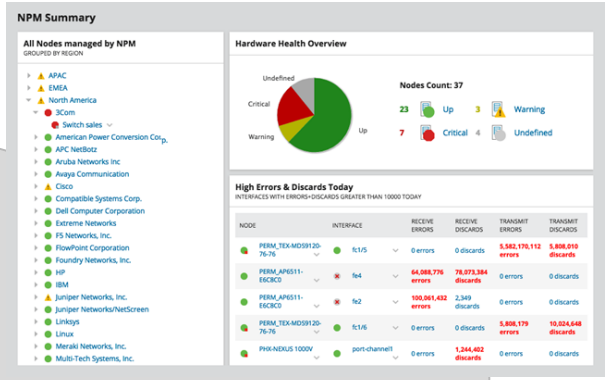
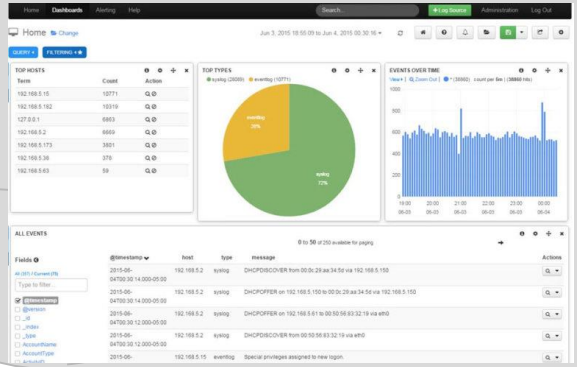
Carrier Grade NMS



Network Management System



SNMP BROWSE
SNMP GET

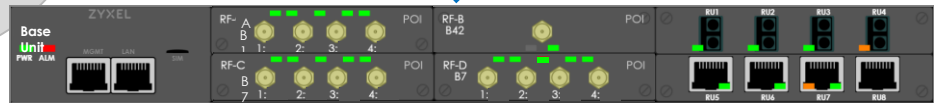
SNMP TRAP

Syslog Messages

OpenVPN Tunnel

SNMP SET

Syslog Server



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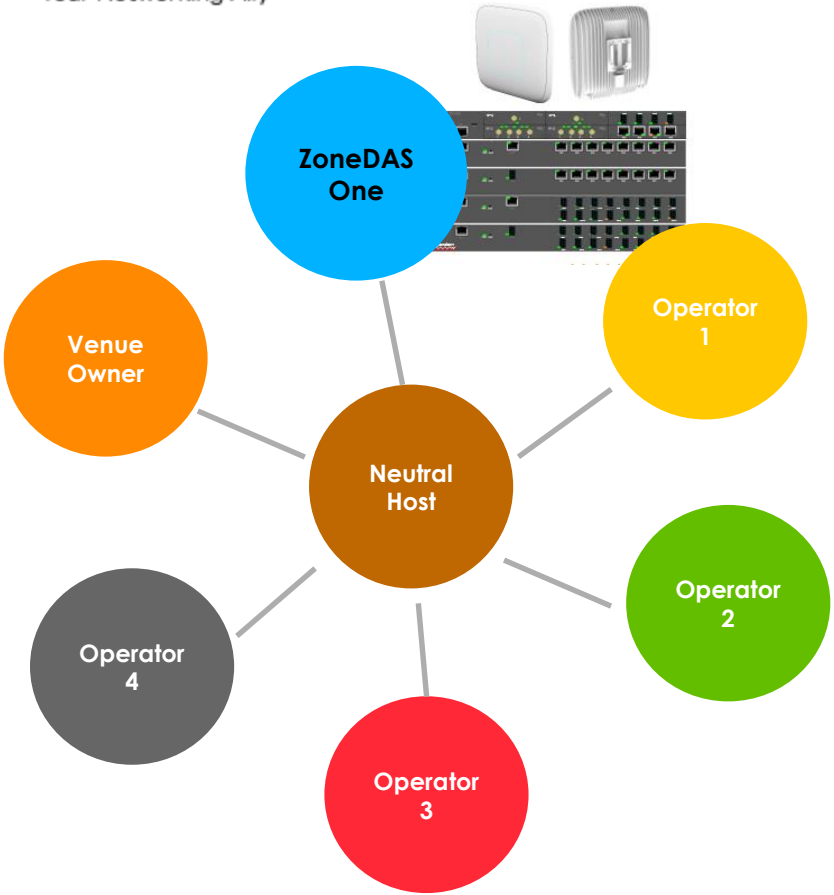
Perfect DAS Solution for Neutral Host Deployment



Key Features:

- **Ethernet (CAT7 or 6a) Active DAS**
- **4 band** selectable, **analog**-based system
- Bandwidth: **320MHz DL/ 250MHz UL (FDD mode), 400MHz DL/ 280 MHz UL (5G-NR TDD)**
- Perfect for **Multi-Carriers co-location**
- **Multi-system** co-exist (2G/ 3G/ 4G/ 5G/ NB-IoT)
- **No more RF link budget calculation**
- **"Off-air"** signal source applicable
- Support **copper** and/or single mode **fiber** installation
- Signal coverage up to **64** x active antennas (with **200mW/23dBm** output power in 4 bands)

TCO ZoneDAS One vs Off-Air Passive DAS

Off-Air Passive DAS
One Project takes **Months**

For System Integrator (SI)

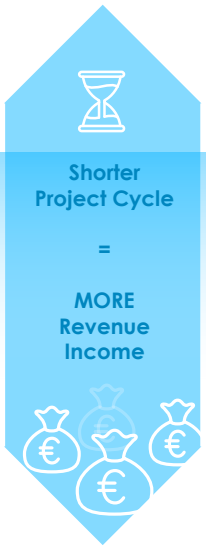
For End Customer

High TCO $10/m² not cost effective solution for Hospitality or Enterprise deployments.

- Need skillful RF engineer to calculate link budget, splitter/cable loss and etc.
- Planning and site survey takes at least 1 month.
- High cost carrier grade coax cables.
- Longer deployment cycle man-days, takes 1~1.5 months per install.

Zyxel ZoneDAS Series
One Project can be done in **2 Days**

For System Integrator (SI)



For End Customer

Low TCO $3/m² Suitable for Hospitality or Enterprise deployments.

- ✓ Easy planning.
- ✓ Easy Cabling both in cost and deployment (RJ45 & CATV cables).
- ✓ Active DAS with auto power & auto leveling support, Plug-n-Play, 2-day deployment.
- ✓ Suitable for IT-based SI.

Key Takeaway for ZYXEL Active DAS Family.

For IT-based System

- ZoneDAS series has been designed to be a “installer-friendly” solution in DAS market.
- Ability to deploy with RJ45, with simply plug & play functionality.
- Enable existing IT-based System Integrator to pursue new business opportunities.

Zyxel walks with you side-by-side from initial planning to real deployment, as a strong backup for your project success!!

For IBS System Integrators

- ZoneDAS series significantly shortens the project cycle from months to days, meaning more we can help with business growth (more projects in same timescales as traditional deployment methods).
- ZoneDAS series deployment is flexible and scalable solution up to 80,000 m2, ZoneDASseries has a lower TCO than Traditional DAS solution, while providing supreme Voice and Data quality.
- ZoneDAS series has been approved by Tier 1 operators in France and Italy.

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Scenario

- ✓ Airports & Stations
- ✓ Stadiums
- ✓ College Campuses
- ✓ Convention Centers
- ✓ Shopping Malls/Plazas
- ✓ Complex Buildings/Offices

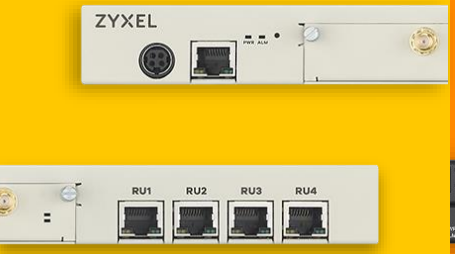
ZoneDAS One

Flexible and Easy to Use

- Capable with Off-Air, Micro Base Station or Hybrid Signal Source
- Multi-system co-exist for 2G/ 3G/ 4G/ 5G/ NB-IoT
- Possibility to combine FDD and TDD in the same remote unit
- 4 Bands selectable & built-in smart POI , ideal for full band co-construction/sharing
- Applicable to Extra-Low Voltage (ELV) installation with copper or fiber
- No more RF link budget calculation
- Signal coverage up to 64 x active antennas (4 x 23 dBm PA, 200mW/4 bands)
- Power supply via PoE, flexible installation either from central or at remote node
- Carrier-grade Network Management System
- Intuitive GUI like existing ZoneDAS product
- International Tier-1Carrier Certified & CE RED Certified

ZoneDAS Family – Target at Single Carrier

SlimDAS



- **SlimDAS**
  - Up to 2 Bands
  - Up to 4 Rus
  - 2,500~10,000m2 Coverage

ZoneDAS

- **ZoneDAS**
  - Up to 4 Bands
  - Up to 8 RUs
  - 10,000~20,000m2 Coverage

ZoneDAS Extender

- **SlimDAS + Extender**
  - Up to 32 RUs
  - 10,000~80,000m2 Coverage
- **ZoneDAS + Extender:**
  - Up to 64 Rus
  - 20,000~160,000m2 Coverage

Remote Unit (RU)

- **Remote Unit (RU)**
  - Up to 4 Bands (20Mhz each)
  - Supports Voice + Data
  - Up-to 50x50m^2

Design Concept - Simple and Flexible

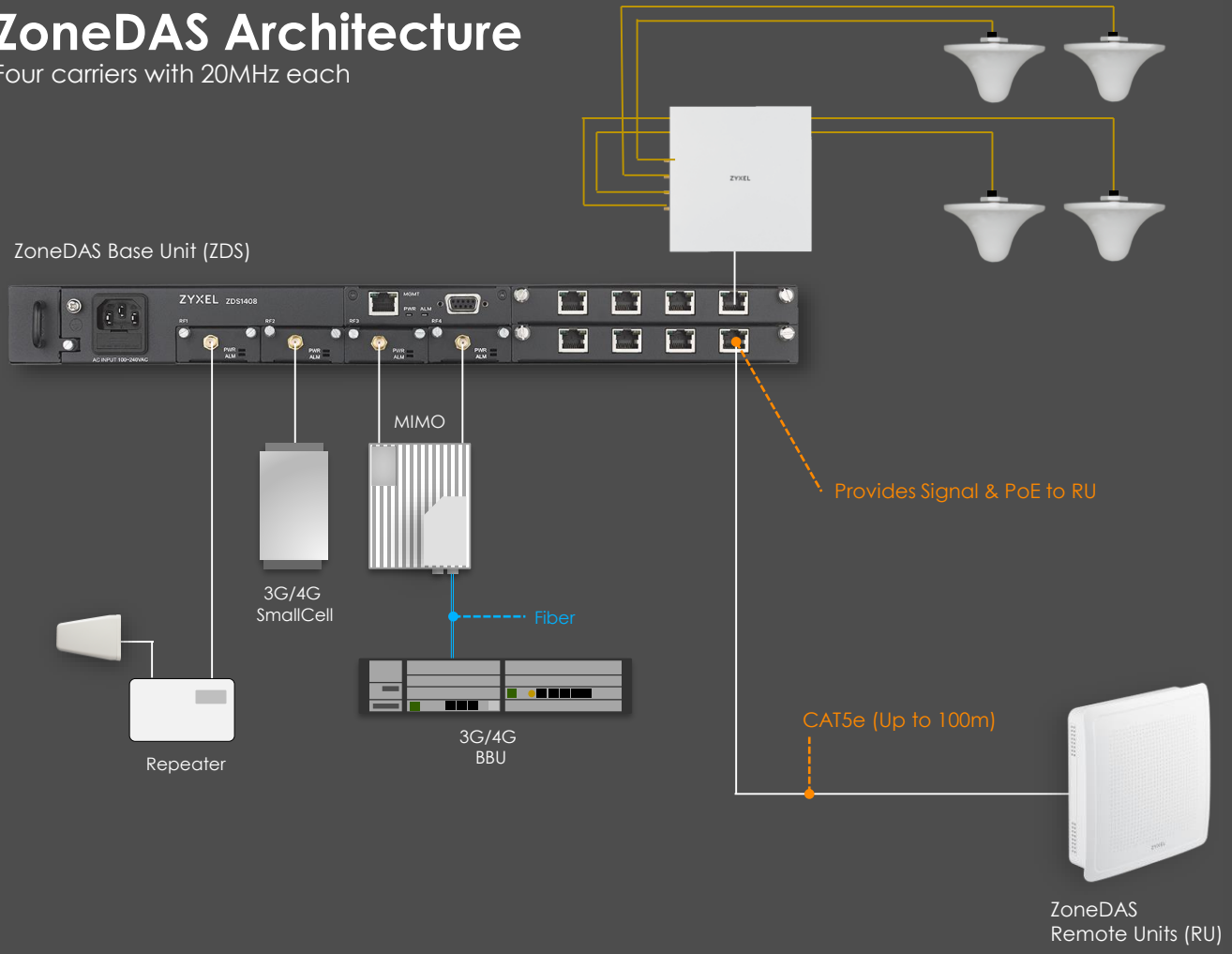
Relay Bandwidth (4x 20MHz)	4x SISO	2x SISO 1x $MIMO_{2x2}$	2x $MIMO_{2x2}$	1x $MIMO_{4x4}$
Multi-System	GSM	UMTS	LTE FDD	TD LTE
Multi-Band	Band 1/2/3/4/5/7/8/12/13/17/20/28/38/39/40/41			
Multi-Carrier	Operator A	Operator B	Operator C	Operator D

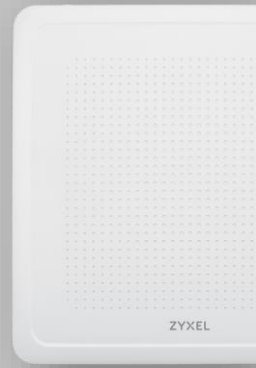
Key Features:

- ✓ WiFi RF planning, LAN cabling
- ✓ Remote power feeding (PoE)
- ✓ Analog-based system
- ✓ Signal sources: BTS or/and Repeater
- ✓ Coverage: 2,500 ~ 40,000m^2
- ✓ Distance from BTS to antenna: 400m (Delay < 3μs)
- ✓ Carrier-grade management

ZoneDAS Architecture

Four carriers with 20MHz each





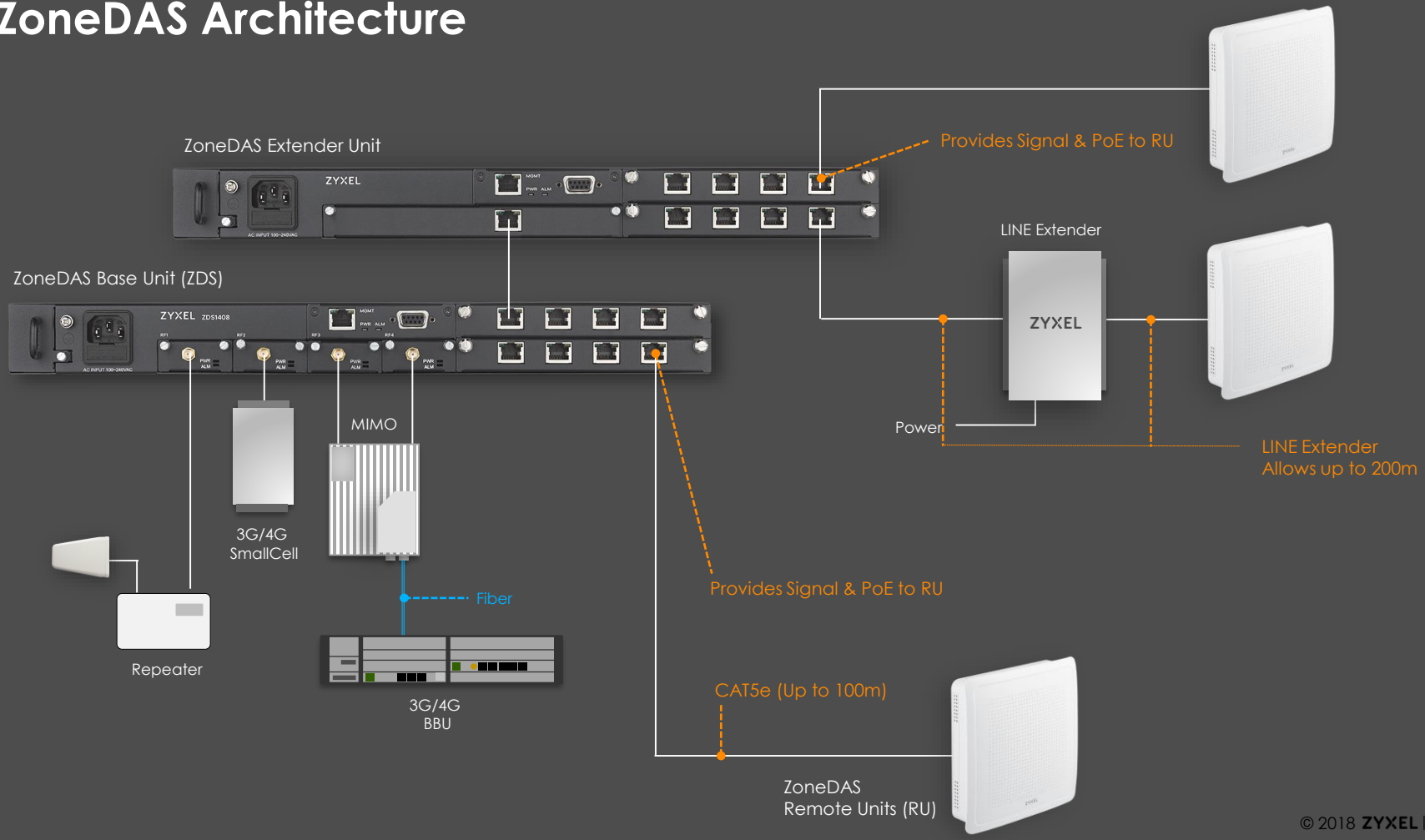
RU Output power

configurable from 14~23 dBm

RU Coverage Space

Hotel:	25x25m^2
Office:	35x35m^2
Open Area:	50x50m^2

ZoneDAS Architecture



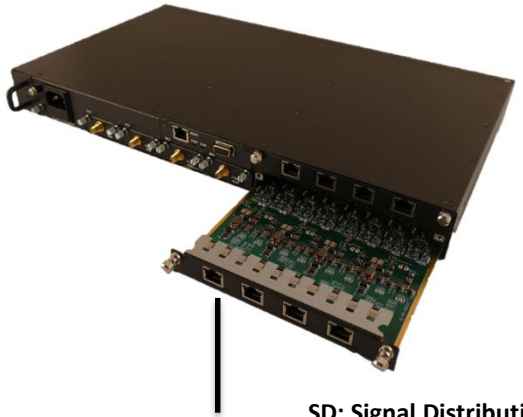
Base Unit

BU Chassis

- 2x SD module slots
- 4x RF module slots
  (4xSISO/2xSISO+1xMIMO/2x MIMO
  with Intra-band/Inter-band CA supported)
- Hot-swap fan module
- Management Interfaces: 10/100
  RJ45 FastEthernet and console
- AC power input: 100~240V
- Max. power consumption: 450W
  (full configuration and max. output power)
- 1U, 19" rack-mount

RF Module (BTS Mode)

- Band Selectable
  B1/2/3/4/5/7/8/12/13/17/20/28/38/39/40/41
- Low input power range: 0~24dBm
- ALC range: 24dBm~33dBm
- Damage over 33dBm(2Watt)
- Max. output power: -25dBm
- Continuous 20MHz service channel
- SMA connector



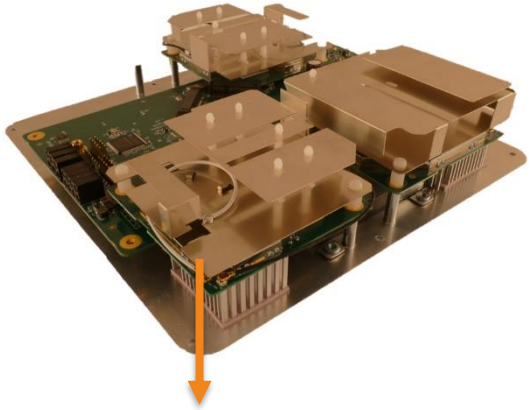
SD: Signal Distribution

SD Module

- 4x RJ45 ports (connect to 4xRUs)
- Up to 100m CAT5e cabling
- PoE power feeding to RUs
- Each port can carry 4 separate RF channels
- Max. -10dBm output power @240MHz IF frequency

Remote Unit
Build-in antenna SKU

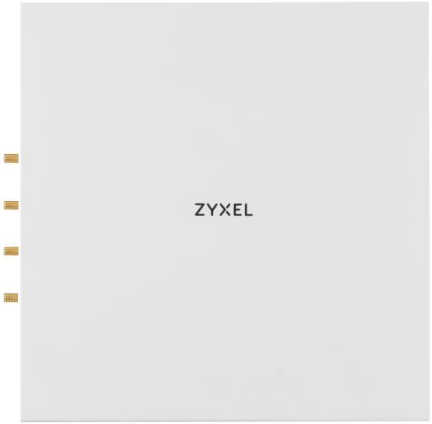
RU Box
- RJ45 interface (PoE)
- Power consumption: 6.5W, RF Modules excluded
- 4 Slots for RF modules
- Antenna isolation between RU modules: 20dB
- Replaceable silent-fan module (L10: 80,000 hours)
- Mount-kit for ceiling/wall mount

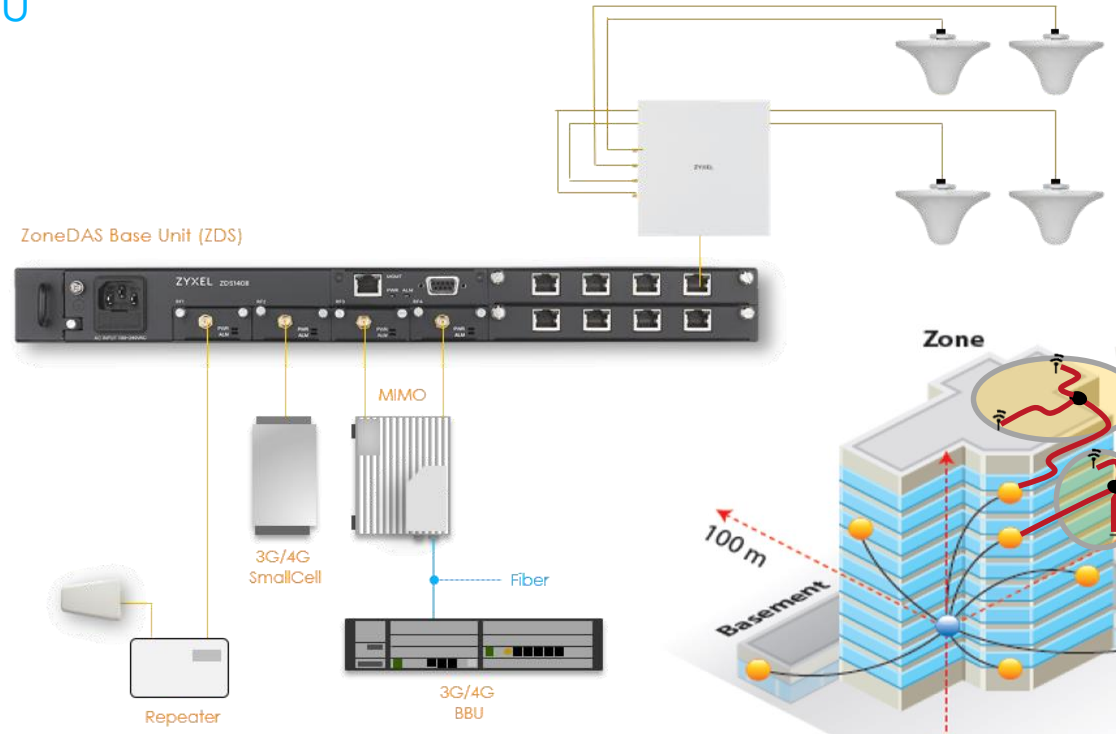


RF Module
- Band Selectable
  B1/2/3/4/5/7/8/12/13/17/20/28/38/39/40/41
- Output power range: 14 ~ 23dBm
  (antenna gain excluded)
- Build-in dual antennas – with software switch
  Omni for ceiling mount with ~3dBi gain
  Panel for wall mount with ~6dBi gain
- Max. power consumption: 9W per module

Remote Unit – RU-4C

External antenna SKU





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Scenario
- ✓ College Campuses
- ✓ Convention Centers
- ✓ Shopping Malls/Plazas
- ✓ Complex Buildings/Offices

ZoneDAS
Flexible and Easy to Use

- Capable with Off-Air, Micro Base Station or Hybrid Signal Source
- Multi-system co-exist for 2G/ 3G/ 4G/ 5G (Re-farming from 4G)
- WiFi RF planning, LAN cabling
- Analog-based system, 4 Bands selectable by hardware module
- Distance from BTS to antenna: 400m (Delay < 3μs via CAT5e cable)
- Applicable to Extra-Low Voltage (ELV) installation with Ethernet cable
- No more RF link budget calculation
- Signal coverage up to 64 x active antennas (4 x 23 dBm PA, 200mW/4 bands)
- Power feeding to Remote Unit via PoE
- Intuitive GUI, Carrier-grade Network Management System
- International Tier-1Carrier Certified & CE RED Certified

Success References

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Belgium's Car Show Room

Success Story

Mercedes Benz Dealership uses Zyxel CAT5 DAS to Achieve In-Building Cellular Connectivity

INDUSTRY	CUSTOMER	COUNTRY	SOLUTION
Automobile	Mercedes Benz	Belgium	Zyxel SlimDAS

Overview

Challenges

- Establish cellular connectivity throughout the dealership, including show room, service area, and office space.
- Obtain a wired (not off-air) signal source from the operator(s) to ensure a first class experience for Mercedes Benz customers.
- Minimize cost, especially recurring fees.

Results

- Strong cellular signal throughout the building, with clear voice calls and fast data transfer speeds.
- SlimDAS enabled the Mercedes Benz dealership to provide the coverage of 3 small cells for the upfront and monthly cost of just one femtocell.
- With room to spare for future expansion, the dealership can add service bays and/or showroom space without paying for or bothering with small cell deployment.

Solution

- Zyxel SlimDAS
- One femtocell from Orange as the signal source

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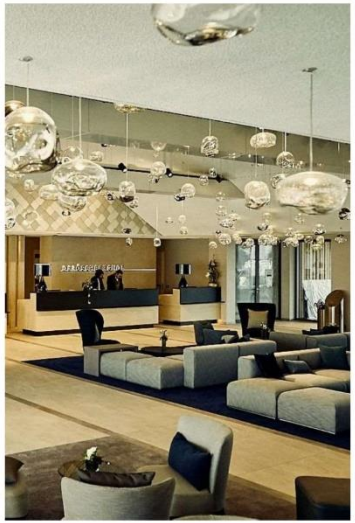
Germany's Resort



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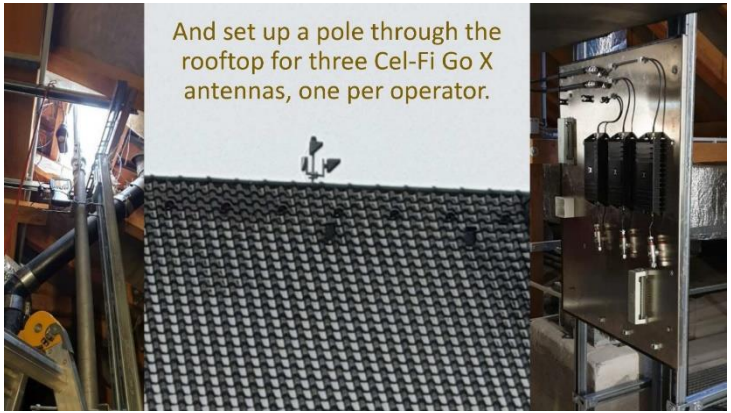
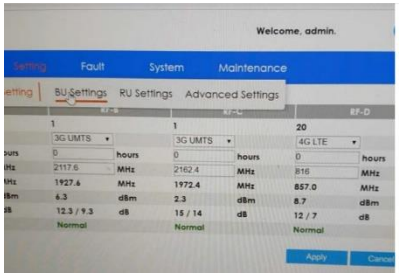
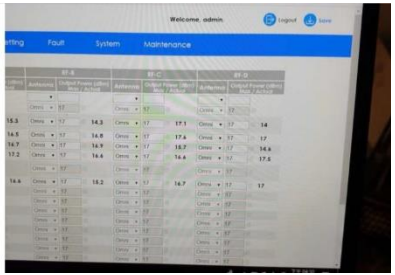
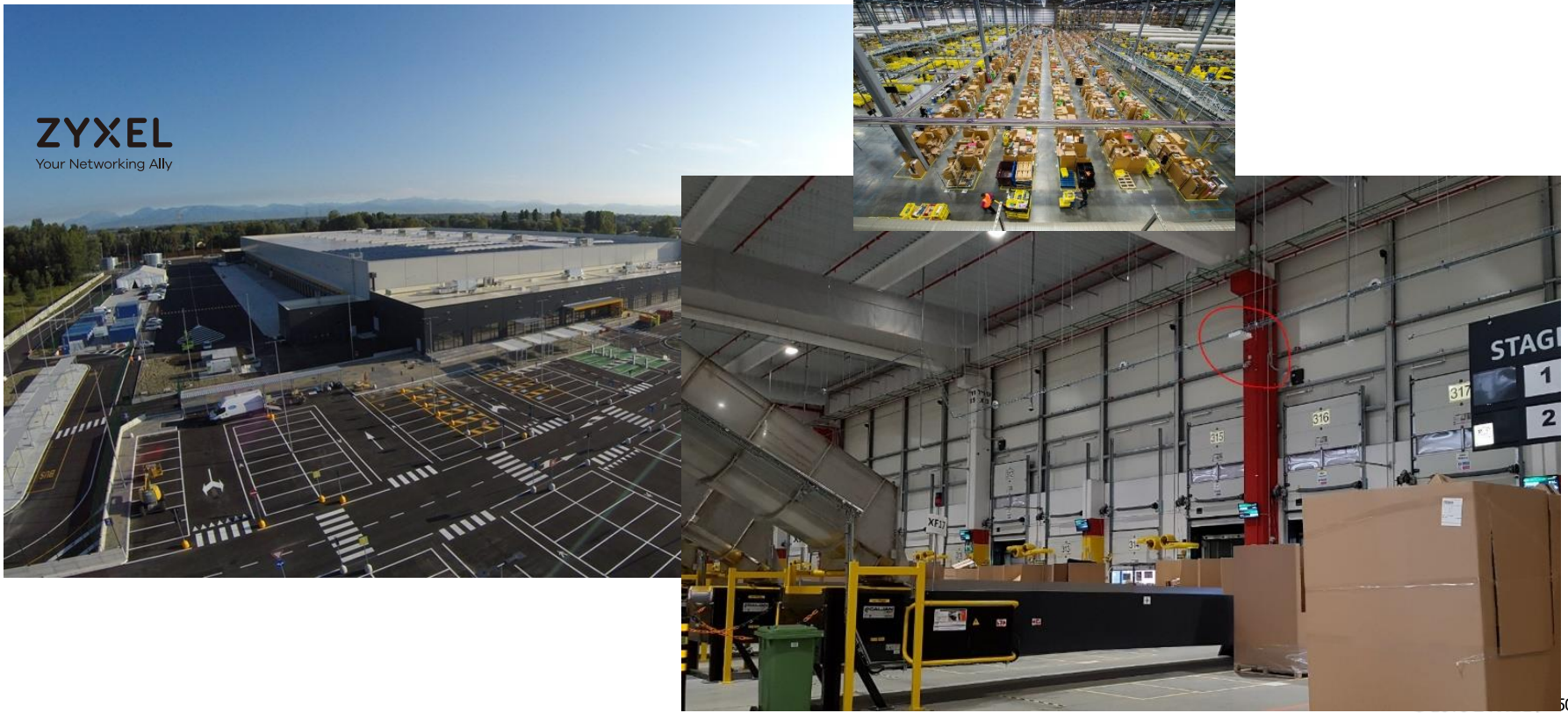






All RUs are connected to a patch panel that then connects to the BU.

Italy's Warehouse



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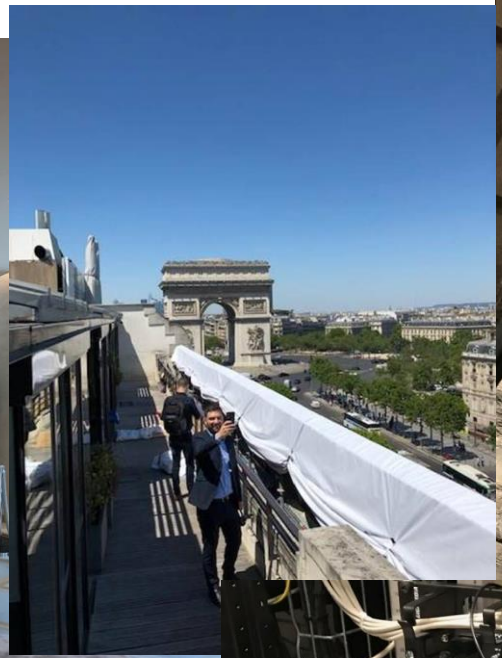
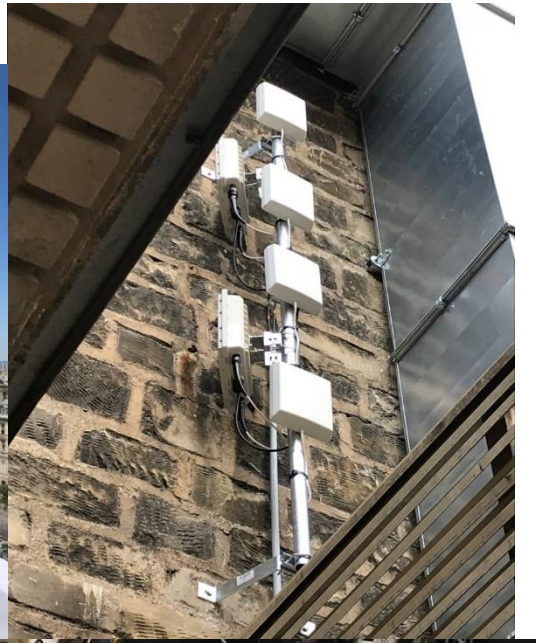
France's Show Room





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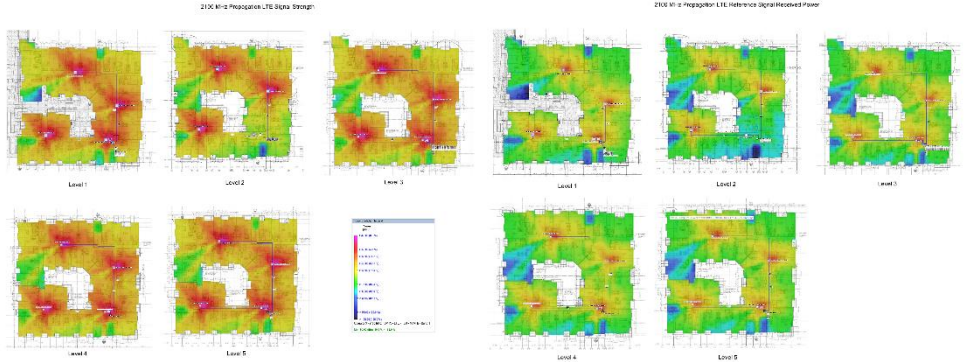
Los Angeles' Apartment



Equipment List Report

Project name: **Design company:**
Project creation date: **Designer:**

Type	Manufacturer	Model	Description	Qty
Antenna	Advanced RF Technologies	AD-PA-1900-2600-DIN	High-Isolation Donor Antenna / 1900 MHz - 2600 MHz / 18 - 20.5 dBi / 19 - 14 degree beam	4
Cable	CommScope	AL4RPV-50	HELIAX® Plenum Rated Air Dielectric Coaxial Cable - Corrugated Aluminum - 1/2 in - Off White PVC Jacket	534.42 feet
Cable	Generic	CAT-6	CAT-6 - 24 AWG min. - 100m Maximum Cable Length	2377.00 feet
Network Equipment	Zyxel	Extender	Zyxel extender 8 output ports, RU only connectable	2
Repeater	SureCall	Fusion5X	All-Carrier Cellular Signal Booster - 72 dB Gain - N-Female Connectors - 700 Band (728-746 MHz / 746-757 MHz DL | 698-716 MHz / 776-787 MHz UL) - 850 Band (869-894 MHz DL | 824-849 MHz UL) - 1900 PCS Band (1930-1995 MHz DL | 1850-1915 MHz UL) - 2100 AWS Band (2110-2155 MHz	1
Repeater	Nextivity Inc	G32-2/4/5/12/13X	Cel-Fi GO X: Band 2 (1850-1910/1930-1990 MHz), Band 4 (1710-1755/2110-2155 MHz, Band 5 (824-849/869-894 MHz, Band 12 (699-716/729-746 MHz) and Band 13 (777-787/746-756	3
Connector	CommScope	L4TNM-PSA	N Male Positive Stop for 1/2 in AL4RP V-50, LDF450A, HL4RPV50 cable	16
Connector	Generic	RJ-45	RJ-45 connector	44
Radio Transceiver	Zyxel	RU ceiling mount	omni internal Remote Unit zyxel	20
Network Equipment	Zyxel	ZONEDAS	ZONEDAS Base Unit 8 output ports connectable to RU/exntender 4 RF input signals	1

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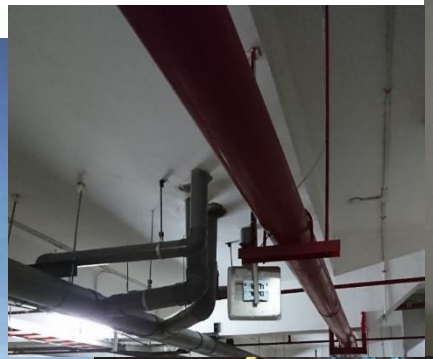
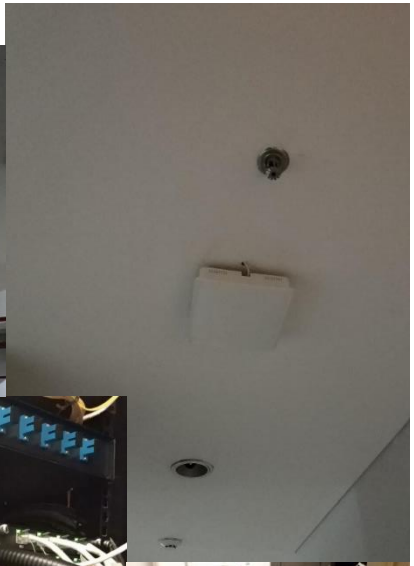
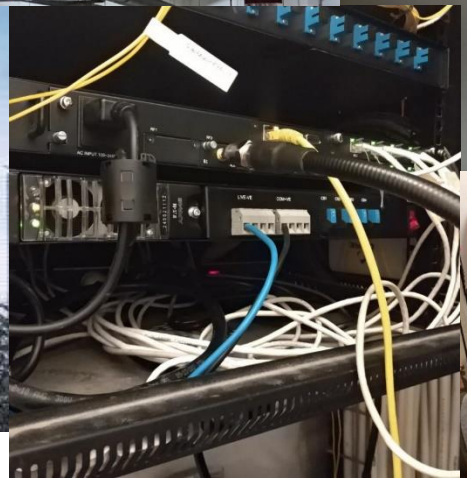
Indonesia's Residences







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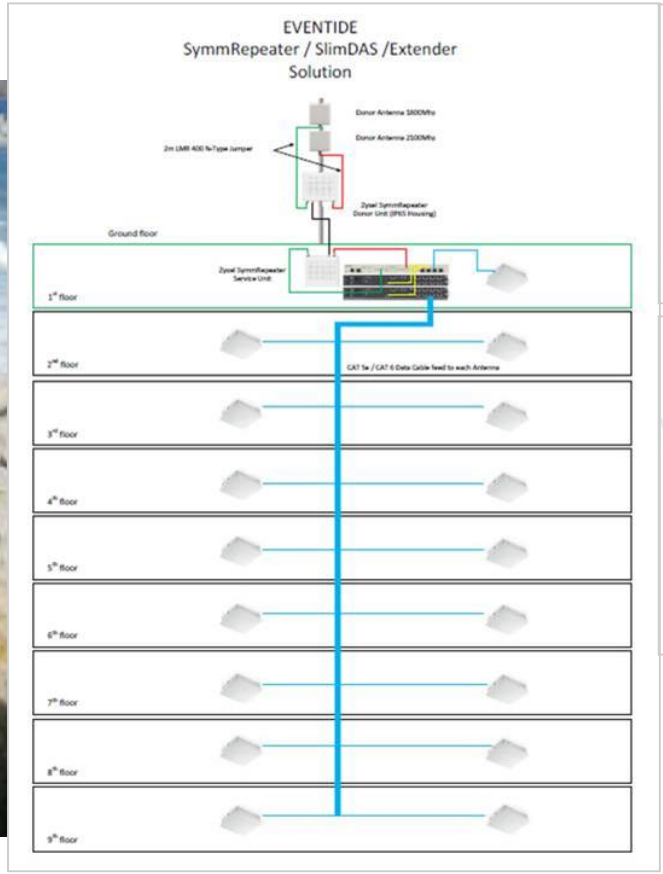
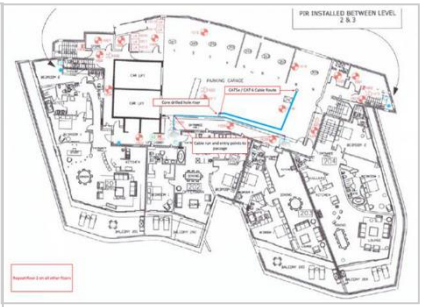
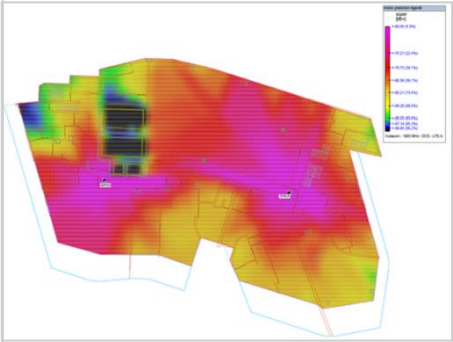
South Africa's Apartments







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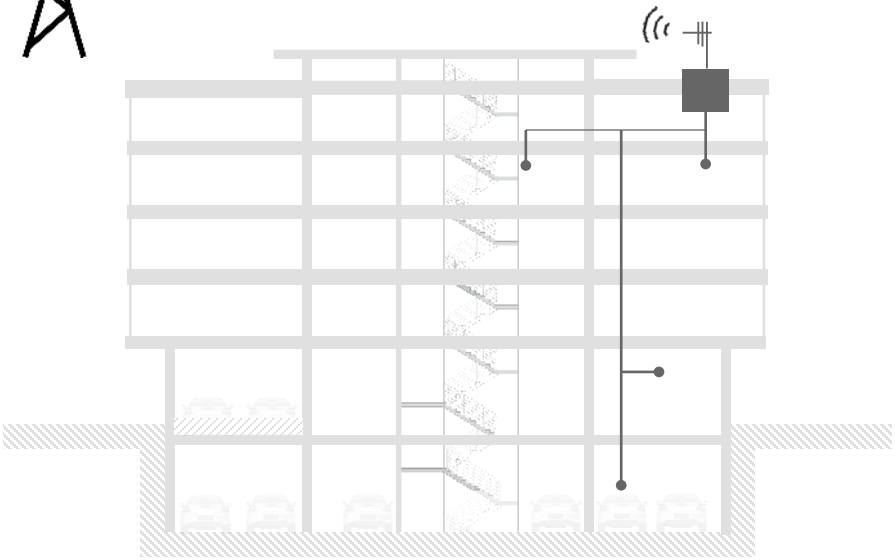
Your Networking Ally

Repeater Family

In-Building Coverage Solutions.

Traditional Repeater Application & Their Issues

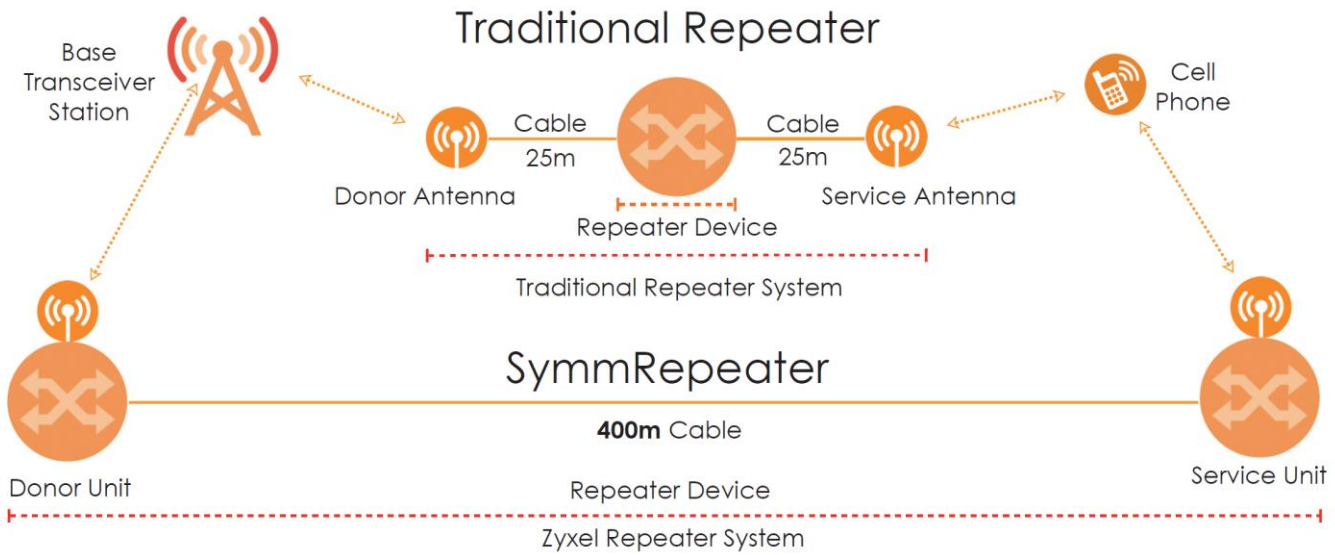


Traditional Repeater's Challenges

- **1- level signal amplification** only.
- **Mobile device is limited to 1W output power.** Uplink is always a crucial challenge.
- **Complex planning** and **link budget calculation** for large multi-floors deployment.
- **Cannot guarantee voice and data** quality
- Typical coverage is up to 2,500m^2

What scenarios SymmRepeater^{Enterprise} excel at?

Demand for ubiquitous coverage within the building keeps increasing. Elevators, high floor areas, underground parking lots and basements are the most challenging areas for mobile signal coverage. Traditional repeaters cannot respond the demand perfectly due to its limit of system gain and end-to-end system length.



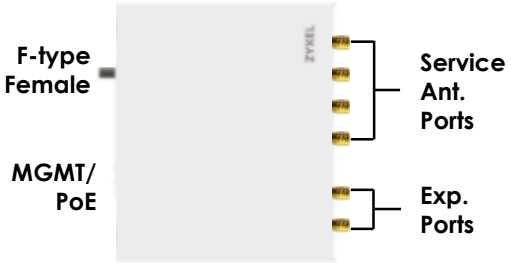
SymmRepeater Enterprise

SymmRepeater Enterprise

Outdoor signal strength
(> -115dBm RSRP)

Donor Unit (IP65)

Service Unit (Indoor)



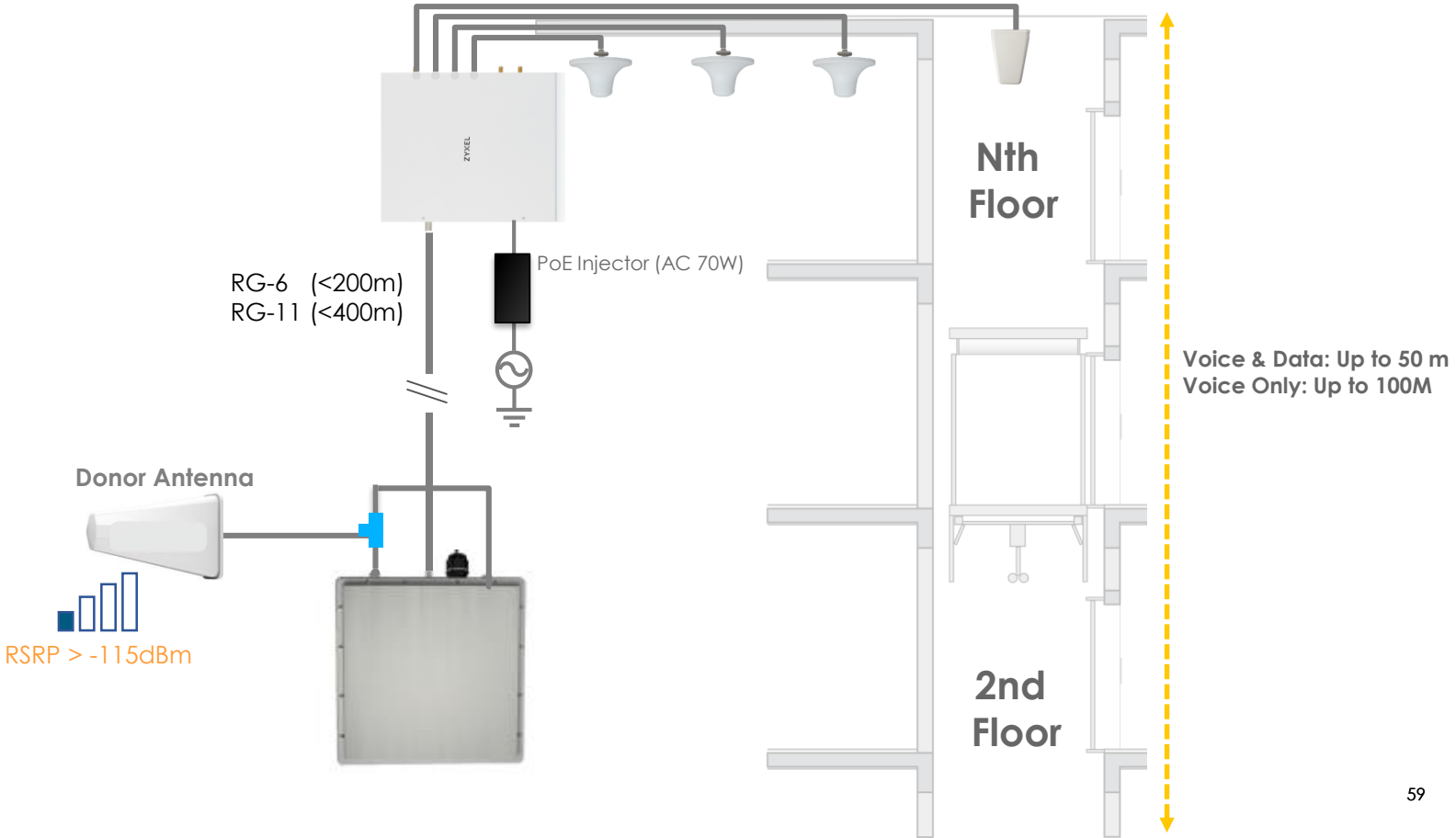
Symmetric Architecture Design

- Dual bands selectable
- **2 level** signal amplification through RG-6 or RG-11 cable. RG-6 up to 200m, RG-11 up to 400m.
- Outstanding **oscillation avoidance**
- System gain **up to 100dB**
- Auto gain control (AGC), auto signal levelling
- **UL** power up to **23dBm**, same as a 4G LTE mobile.
- **DL** power up to **17dBm** per antenna port
- Auto uplink mute, no interference to carrier base station, making the SymmRepeater Enterprise invisible for operators.
- Guarantee high quality Voice and Data.
- Ideal for high-rise buildings, tunnels and elevators.
- Hard-line or soft coaxial cables applicable, suitable for ELV (Extra-Low-Voltage) SI as well

High-floor Areas/Elevators

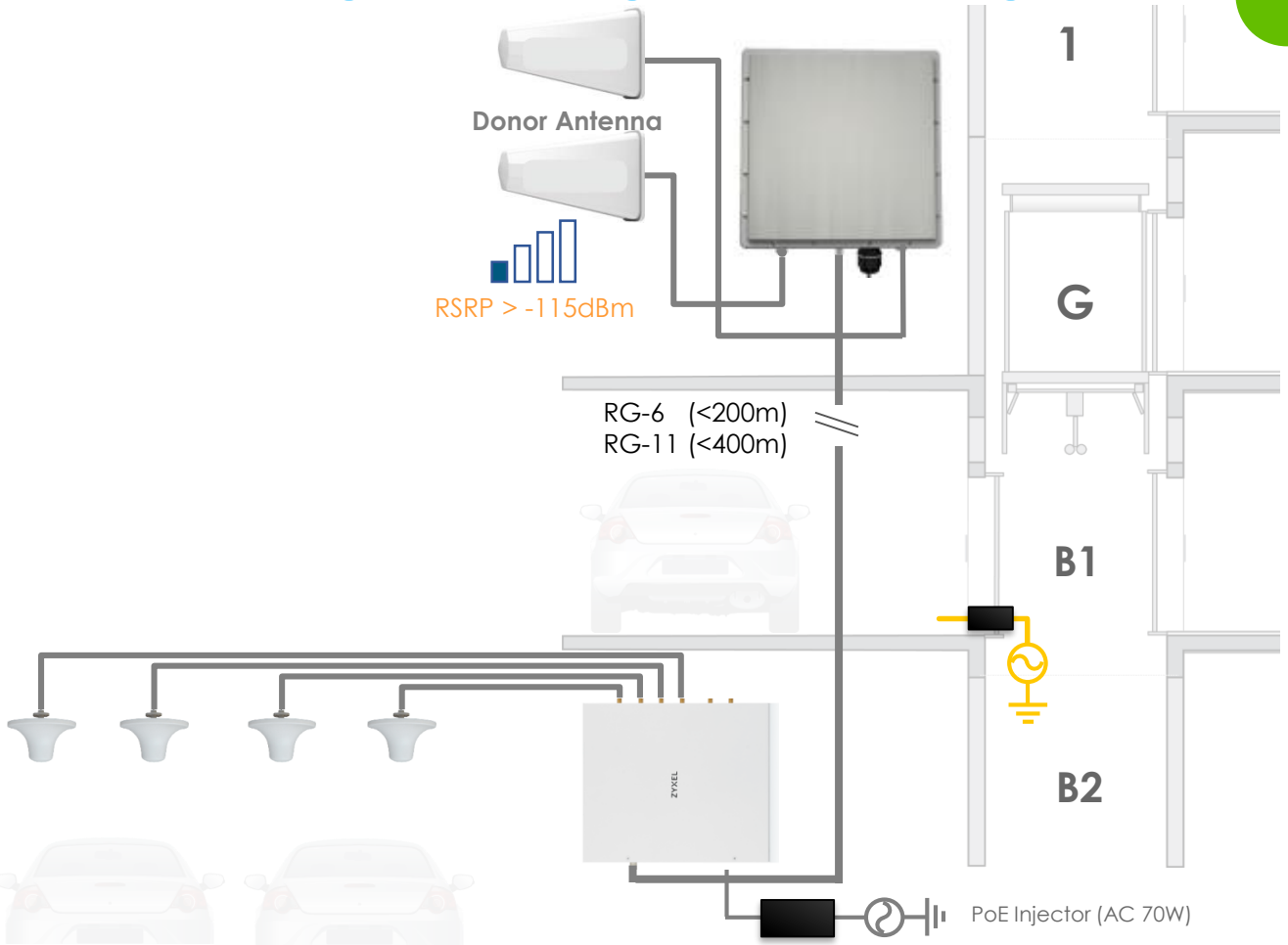
Coverage up to 4 elevators

SymmRepeater Enterprise



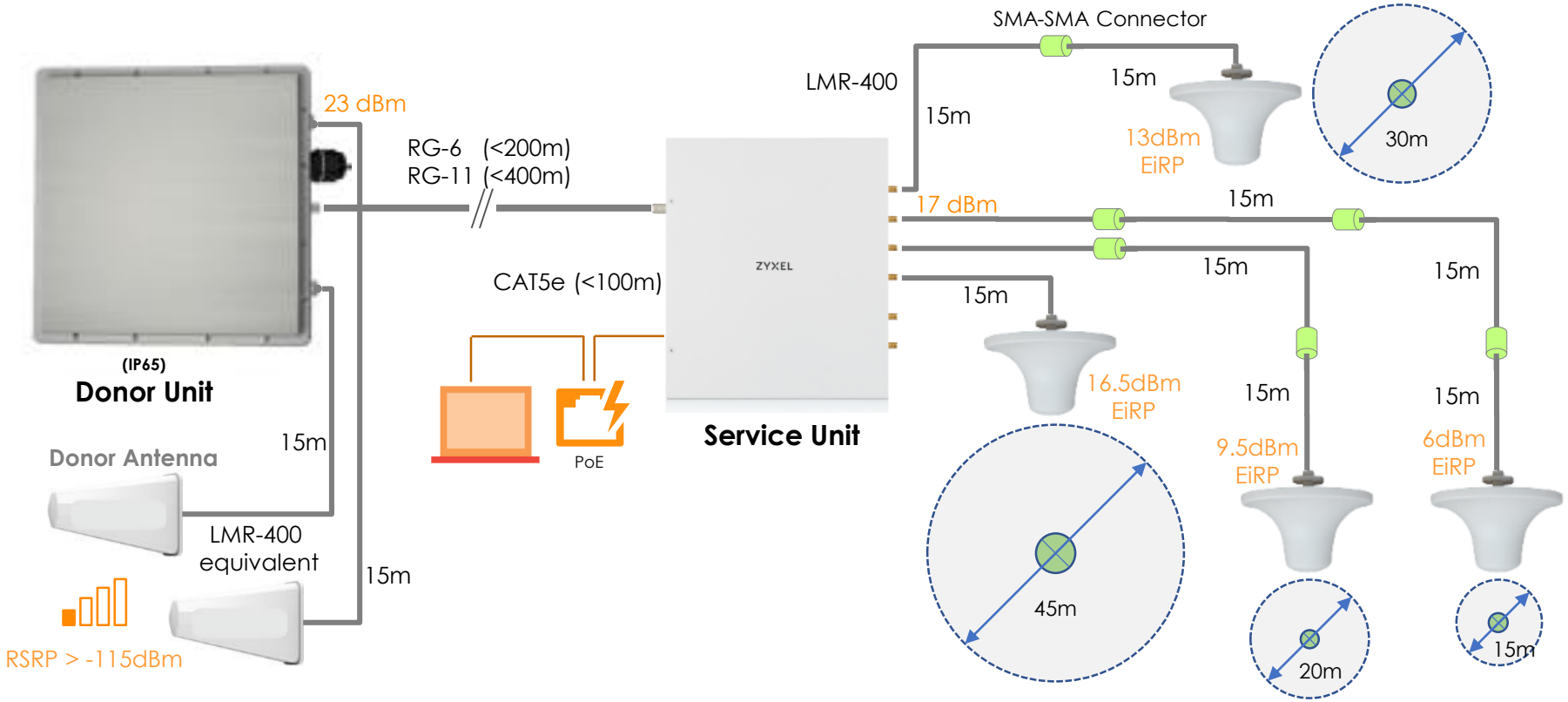
Deep Underground Signal Coverage

SymmRepeater Enterprise



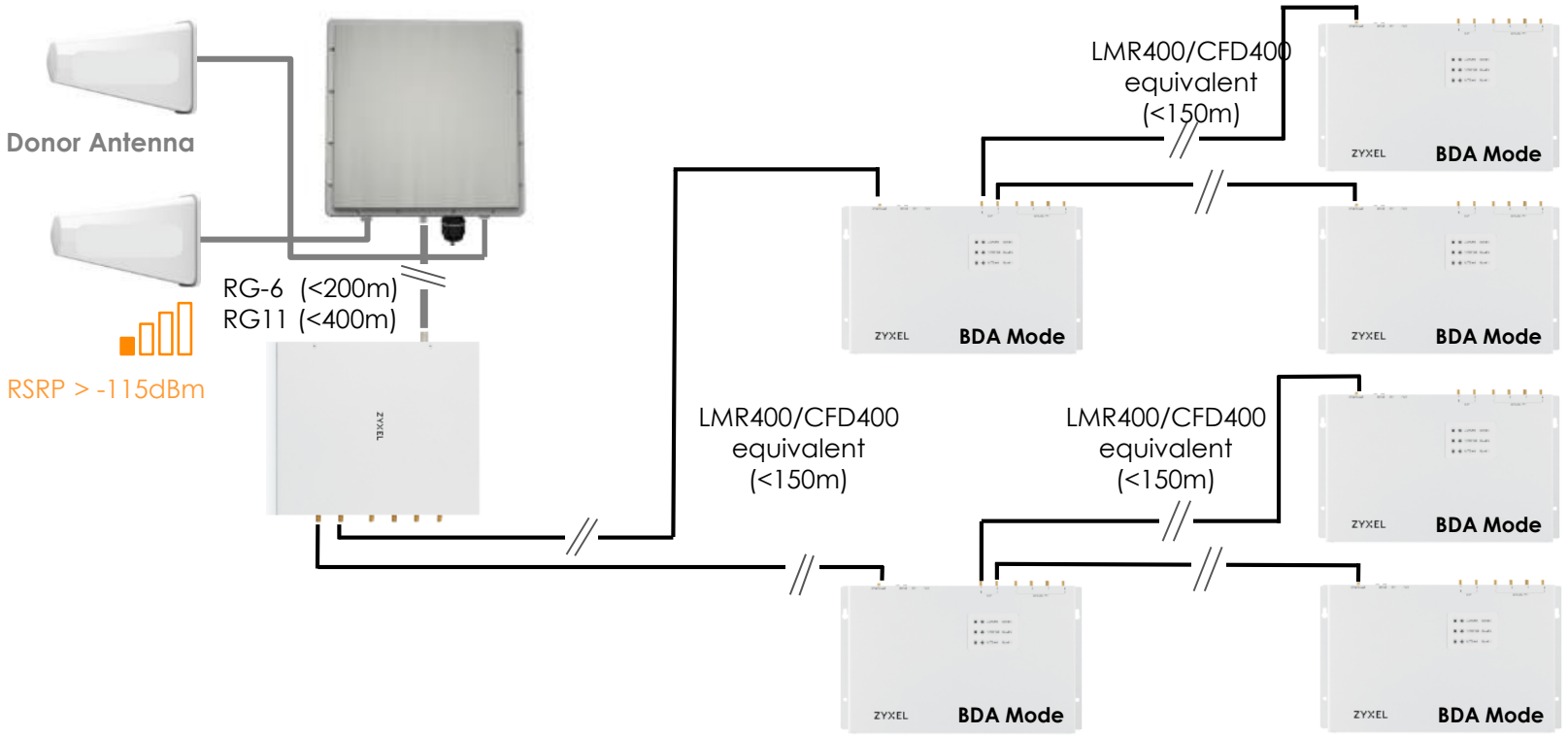
Simple Planning – No Splitters

Each SymmRepeater^{Enterprise} covers 900 x 4 = 3,600m^2



SymmRepeater^{Enterprise} Cascades 6 Nodes

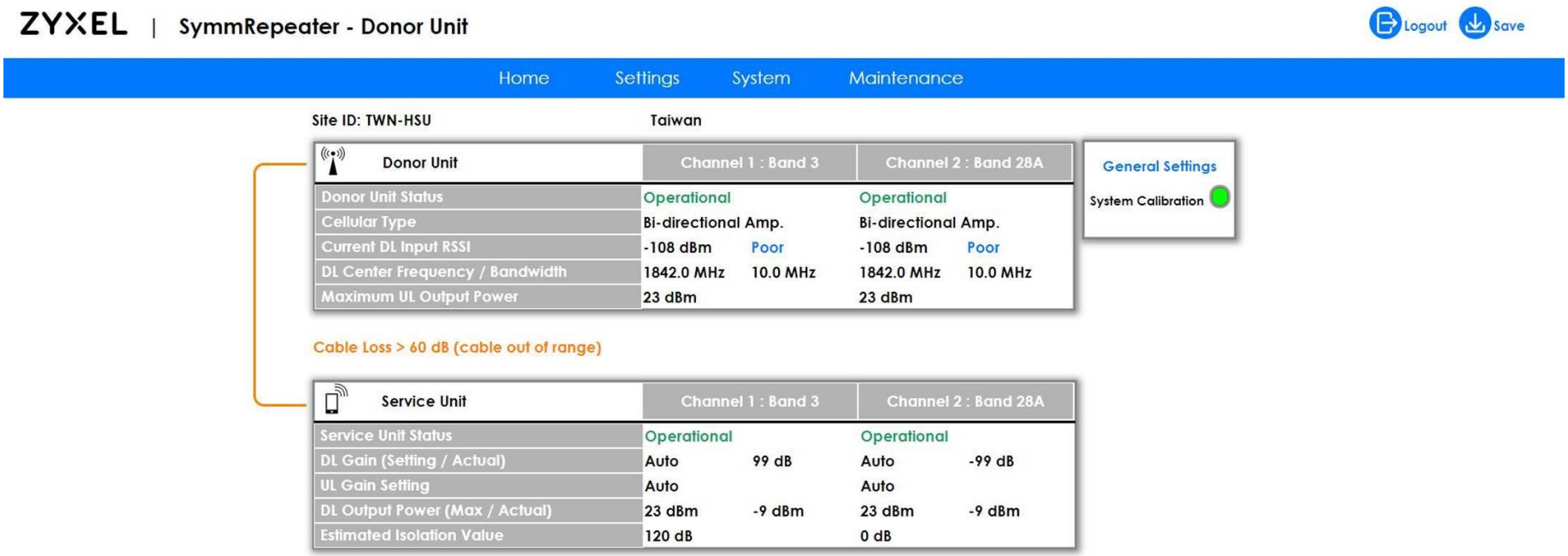
Works with MultiSite, up to 28 x 50mw service antenna ports



Note: BDA = Bi-Directional Amplification

Web GUI

- Support http/https protocol
- WYSIWYG interface
- Real-time cable loss monitoring
- Plug-n-Play configuration



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Luxury Apartment in Taipei, Taiwan

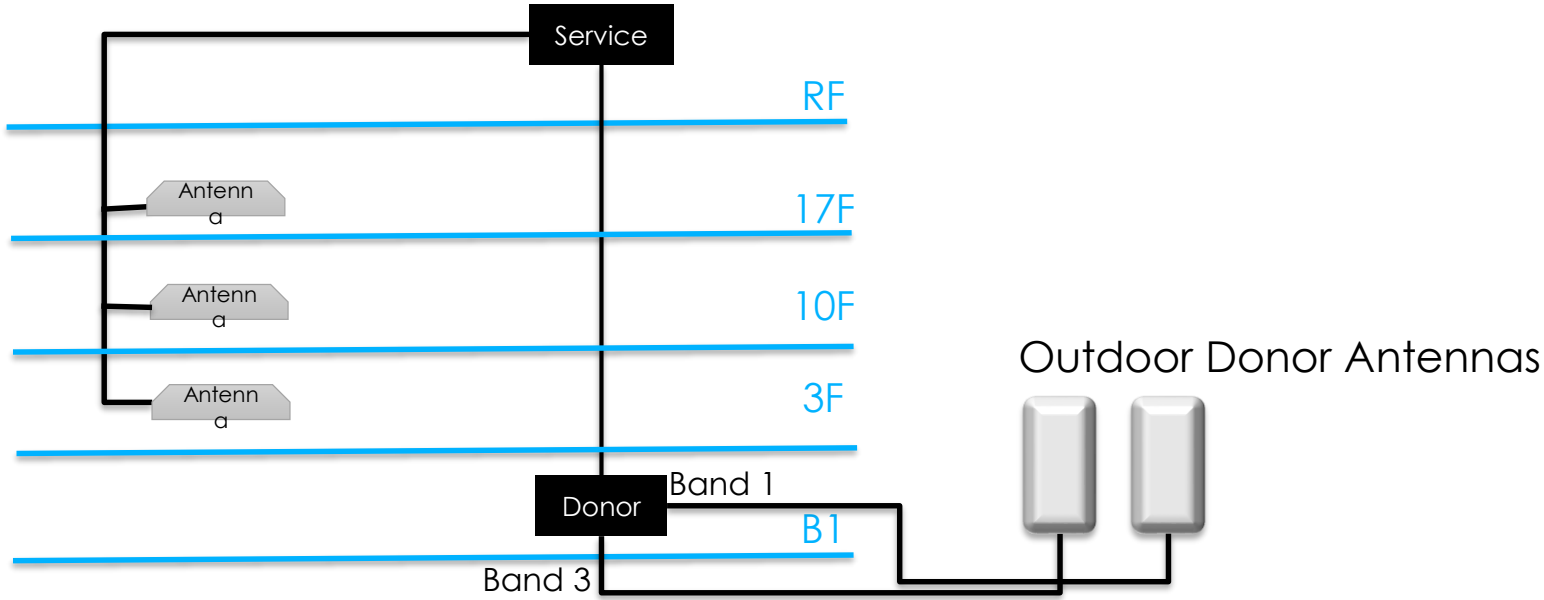
Donor Antenna Installation

Service Units Installation

Donor Units Installation

Chunghua Telecom – Elevator Signal Coverage Enhancement at Luxury Apartment (皇翔御琚)

The proposal is to improve elevator signal coverage for 3 lifts at Building A, including Resident Lift, VIP Lift and Service Lift. Service antennas are installed inside the elevator tunnel at the Floor 3, 10, 17 to improve 3G U2100 and LTE L1800 signal.



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Your Networking Ally

Scenario
- ✓ Elevators
- ✓ High floor areas
- ✓ Underground parking lots
- ✓ Basements

SymmRepeater Enterprise
Ultra High Gain, Long Distance Repeater

- **Dual-band** selectable (B1,3,7,8,20,28a,28b), support **full band or single sub-carrier**
- Frontend & backend **2-level amplification**.
- Frontend-to-backend extension up to **400m** with soft coaxial cables
- Capable to **extend with MultiSite Repeater** for greater signal coverage
- Multi-system co-exist, compatible with 2G/ 3G/ 4G/ **5G-NR$_{FDD}$**/ NB-IoT
- UL Power up to **23dBm**
- Ultra-high system gain up to **100dB**, perfect for outdoor poor signal **(RSRP>-115dBm)**
- Support **4 x 17dBm** service antenna ports (50mW in dual-band)
- Isolation detection, Downlink Sleep, **Uplink Mute**, Invisible to BTS
- Power supply via **PoE**, either from Donor Unit or Service Unit
- Web GUI support, system heartbeat monitoring via Syslog (interval configurable)
- CE RED Certified

SymmRepeater^{Pro}

Outdoor signal strength
(> -115dBm RSRP)

Donor Unit

IP65

or

Indoor

Service Unit

IP65

or

Indoor

Symmetric Architecture Design

- Dual bands selectable
- **2 level** signal amplification through RG-6 or RG-11 cable. RG-6 up to 200m, RG-11 up to 400m.
- Outstanding **oscillation avoidance**
- System gain **up to 100dB**
- Auto gain control (AGC), auto signal levelling
- **UL** power up to **23dBm**, same as a 4G LTE mobile.
- **DL** power up to **23dBm** per antenna port (non-combined)
- Auto uplink mute, no interference to carrier base station, making the SymmRepeater^{Pro} invisible for operators.
- Guarantee high quality Voice and Data.
- Ideal for tunnels, elevators, temp. coverage improvement or Mountain areas.
- Hard-line or soft coaxial cables applicable, suitable for ELV (Extra-Low-Voltage) SI as well

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Your Networking Ally

Scenario

- ✓ Tunnels
- ✓ Elevators
- ✓ Temp. coverage improvement
- ✓ Mountain areas

SymmRepeater Pro

Ultra High Gain, Long Distance Repeater

- **Dual-band** selectable (B1,3,7,8,20,28a,28b), support **full band or single sub-carrier**
- Frontend & backend **2-level amplification**.
- Frontend-to-backend extension **up to 400m** with soft coaxial cables
- Capable to extend with MultiSite Repeater for greater signal coverage
- Multi-system co-exist, compatible with 2G/ 3G/ 4G/ **5G-NR$_{FDD}$**/ NB-IoT
- UL Power up to **23dBm,** DL power up to **23dBm**
- Ultra-high system gain **up to 100dB**, perfect for outdoor poor signal (**RSRP>-115dBm**)
- Support **2 x 23dBm** service antenna ports (200 mW, non-combined)
- Isolation detection, Downlink Sleep, **Uplink Mute**, Invisible to BTS
- Power supply via **PoE**, either from Donor Unit or Service Unit
- Web GUI support, system heartbeat monitoring via Syslog (interval configurable)
- CE RED Certified

Who Needs MultiSite?

Any business venue owner knows that a strong mobile signal almost represents revenue, service quality & productivity. Poor mobile signal quality or coverage creates customer complaint and low productivity issues. A mobile repeater is the answer to solve the problem, esp. for residential buildings, multi-floor office/basement, hotels/resorts, hospitals, mid-size warehouses.

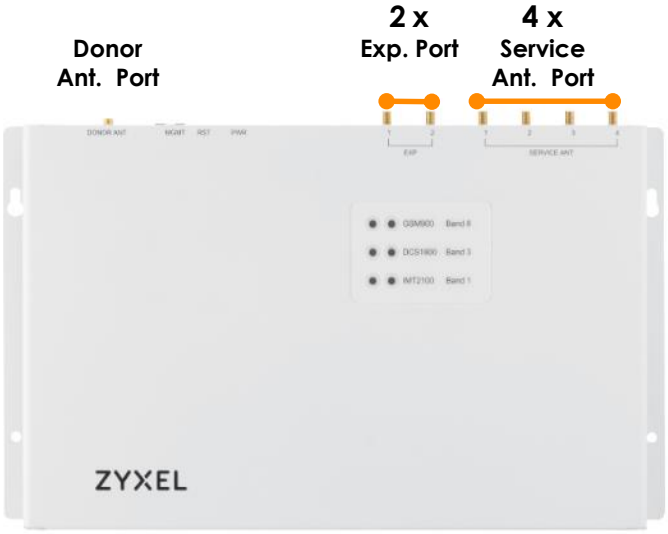
THE BEST SOLUTION

7
Nodes
cascade
maximum

7 X 3,600
square meter
coverage
Space

MultiSite Repeater

Outdoor signal strength
(> -100dBm RSRP)



Positioning

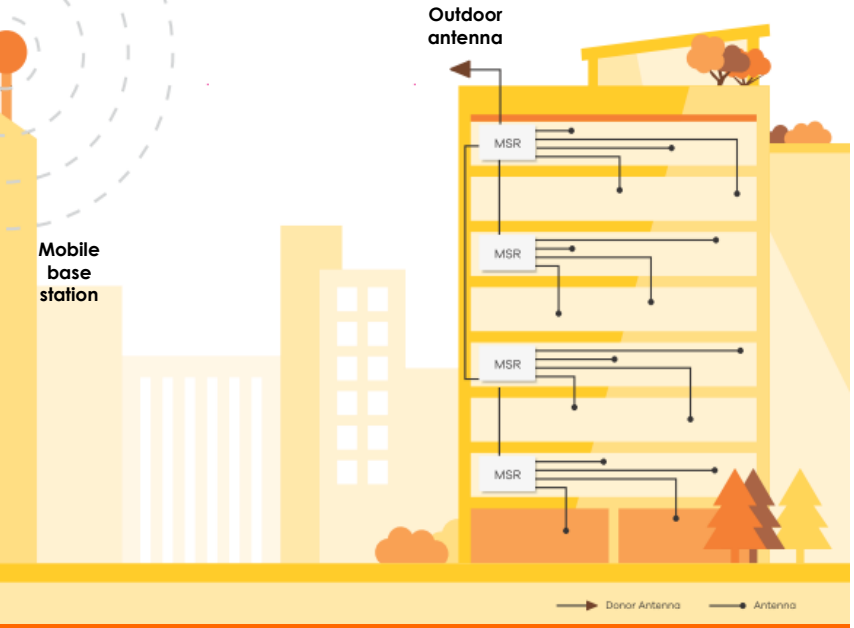
- For **large multi-floor scenarios** such as residential buildings, multi-floor office/basement, hotels/resorts, hospitals, mid-size warehouses requiring mobile network indoor coverage improvement.
- Up to **7 x 3,600m²**

Benefits

- **2G, 3G, 4G, 5G-NR$_{FDD}$, NB-IoT support.**
- **3 bands support simultaneously.**
- **Multi-level signal amplification.**
- **Channelized** (single operator) or **full band.**
- **Worry-free installation with selected tool kit.**
  Choose the one which fits the environment the best.
- **Easy coverage planning.**
  4 x SMA service antenna ports, each covers a 30x30m floor space with a 25m soft coaxial cable.
- **Cascadable up to 7 x MultiSite.**

MultiSite Quick Overview

MultiSite Repeater (MSR) installation scheme



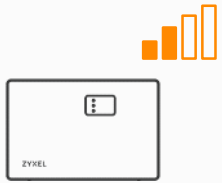
Coverage Space: up to 7 x 3600m²

Product Features

- Path length (from donor to service ant.):
  - up to **100m** single node
  - up to **300m** multi-nodes
- **3 bands selectable**
  (**B1,3,7,8,20,28a,28b**, by part code definition)
- UL Power: up to **17dBm**
- DL Power: up to **17dBm per port**
- System Gain: up **80dB**
- **256QAM EVM <3.5% (vs. 5G requirement < 4.5%)**
- **End-to-end latency <1.3μs**
  (vs. 5G requirement < 1ms)
- **SMA Female** connectors, impedance **50 Ohm** for Donor & Service antennas.
- Real-time isolation detection, auto gain control (AGC), **uplink mute**

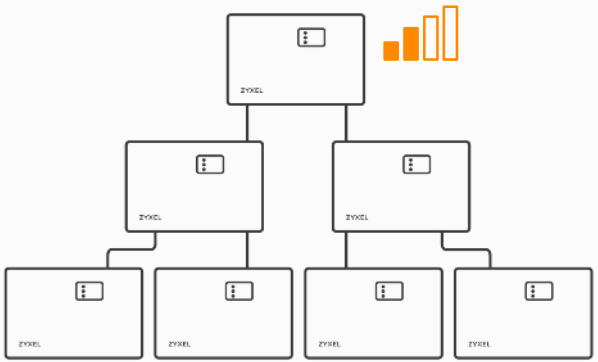
MultiSite Application Diagram

Work Alone



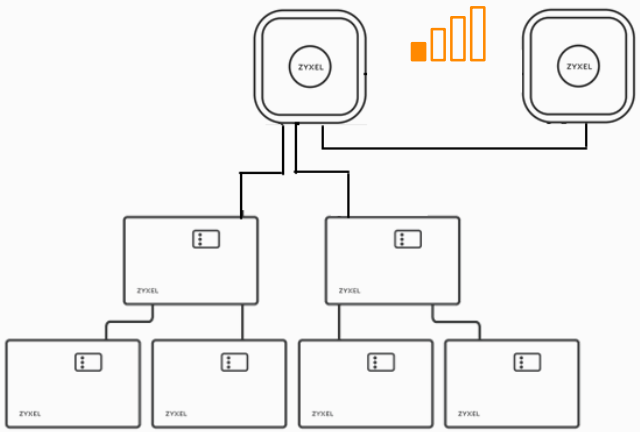
Coverage Space:
3600m^2

Work With Other MultiSites



Coverage Space:
Up to 7 x 3600m^2

Work With SymmRepeater Enterprise

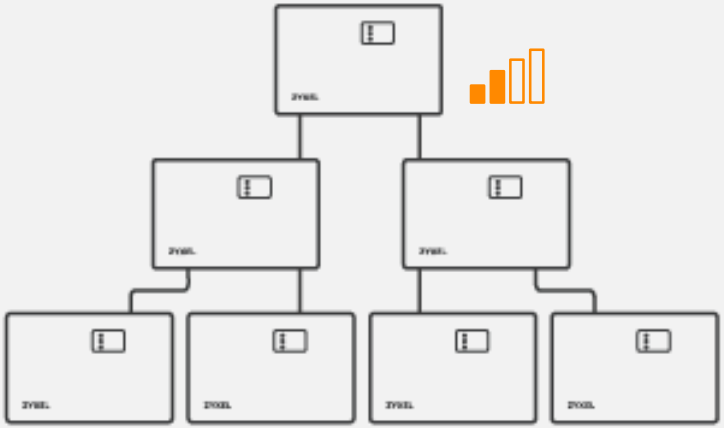


Coverage Space:
Up to 7 x 3600m^2

MultiSite Deployment Scenario

Work with Other MultiSites

Coverage Space:
up to 7 x 3600m²



Ideal for multi-floor deployments, e.g. supermarkets, residential buildings, multi-floors offices/basements, hospitalities and warehouses.

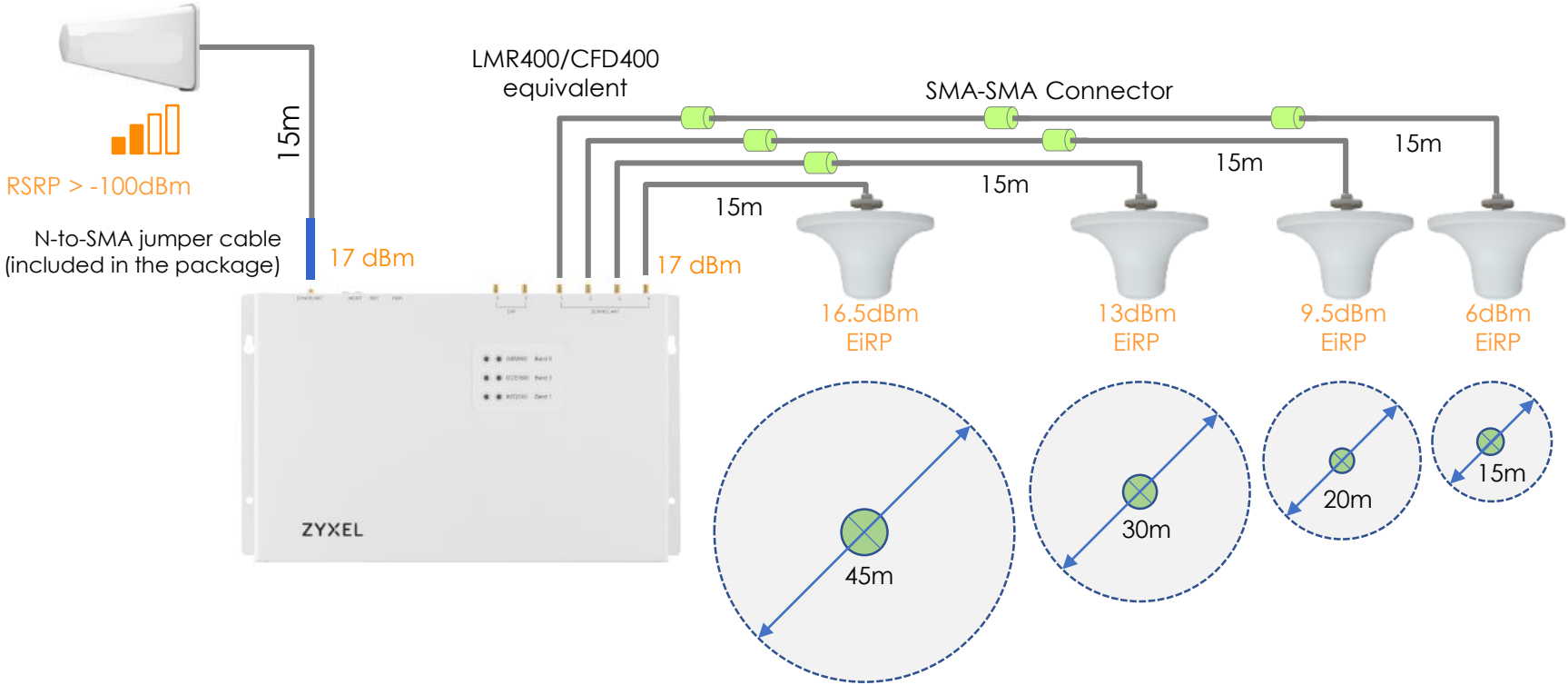
MultiSite Repeater Cascades Up to 7 Nodes

Up to 28 x 50mw service antenna ports

Note: BDA = Bi-Directional Amplification

MultiSite Installation

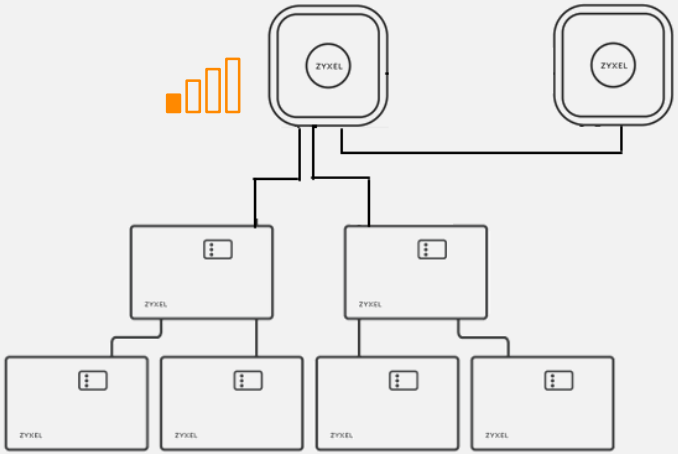
With LMR400/CFD400 Coaxial Extension Cable



MultiSite Deployment Scenario

Work with SymmRepeater[Enterprise]

Coverage Space:
up to 7 x 3600m²



Ideal for remote industrial parks, country hotels/inns, high-floor areas, metro underground shopping streets or parking space.

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Your Networking Ally

Scenario

- ✓ Complex buildings/Offices
- ✓ Hospitals
- ✓ Hotels & Resorts
- ✓ High-Rises
- ✓ Multi-floor Basement
- ✓ Elevators

MultiSite
Cascadable Digital Repeater

- **Tri-band** selectable (B1,3,7,8,20,28a,28b)
- Support **full band or up to 3 sub-carriers**
- Multi-system co-exist, compatible with 2G/ 3G/ 4G/ **5G-NR$_{FDD}$**/ NB-IoT
- **Cascadable up to 7 x MultiSite Node**
  - Signal coverage **up to 28 x 17dBm** service antenna ports (50mW in tri-band)
  - System cable length up to 150m in radius with soft coaxial cable
- Applicable to Extra-Low Voltage (ELV) installation with soft coaxial cable or traditional IBS installation with hardline coaxial cables
- Real-time isolation detection, Downlink Sleep, **Uplink Mute**, Invisible to BTS
- UL power up to **17dBm**, System gain up to **80dB**
- Power by **PoE**,
- Web GUI support, system heartbeat monitoring via Syslog (interval configurable)
- CE RED Certified

MagicOffice
The Ideal Solution For Indoor Signal Enhancement

Positioning

- ✓ For small offices, bars, restaurants, or shops requiring mobile network indoor coverage improvement
- ✓ Up to 900m^2 coverage.

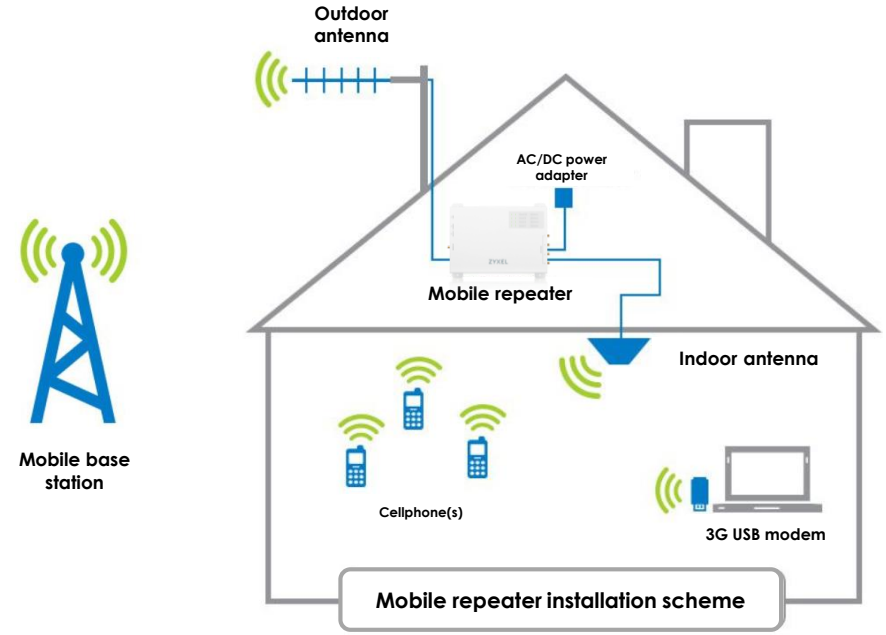
Benefits

- ✓ 2G, 3G, 4G, 5G-NR$_{FDD}$, NB-IoT support
- ✓ 4 Band (B1-3-8-20/ B1-3-8-28a) support simultaneously
- ✓ Guarantee Voice & Data performance
- ✓ Worry-free installation with selected tool kit
  Choose the one which fit the environment the best.
- ✓ Easy coverage planning
  4 x SMA service antenna ports, each covers a 15x15m floor space with a 25m soft coaxial cable.

MagicOffice Quick Overview

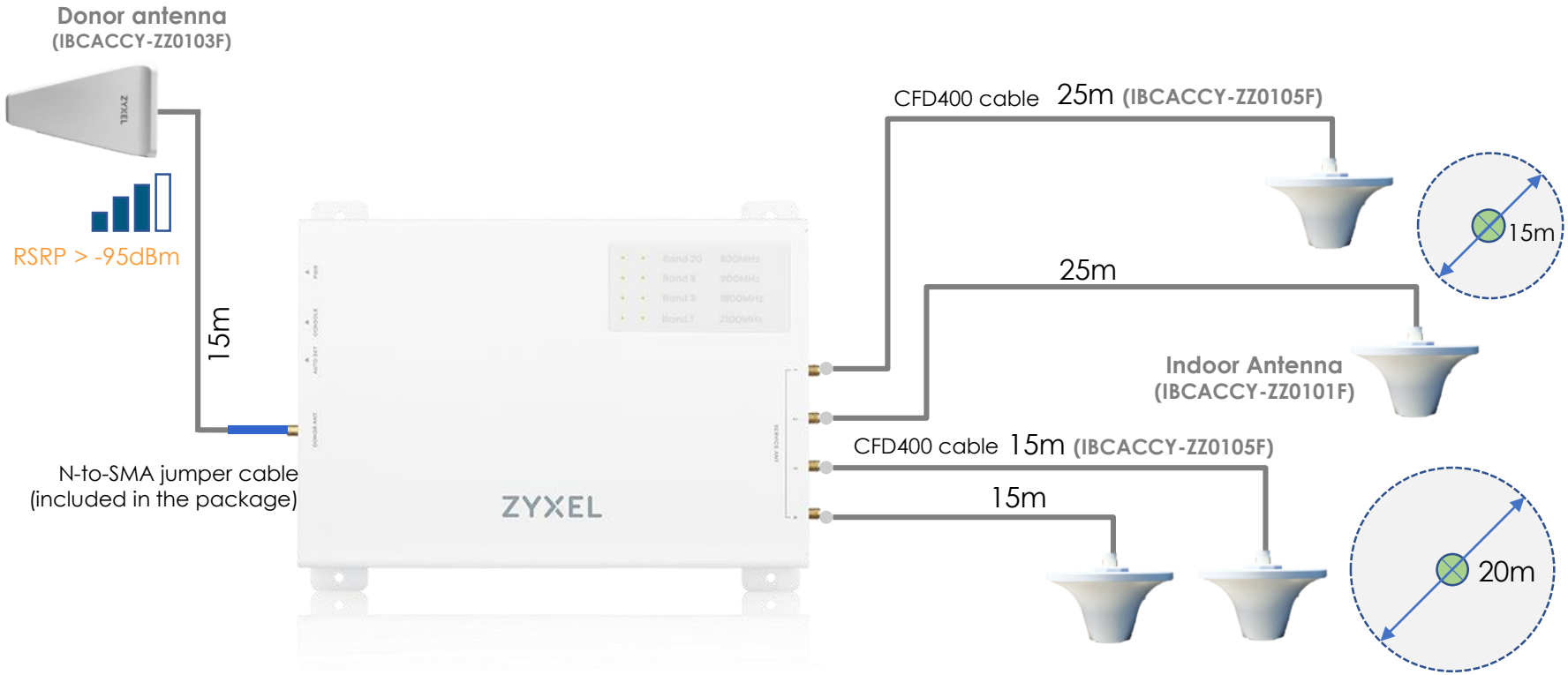
Product Features

- Path length (donor -to service ant.): up to **60m**
- **4 bands fixed (Band 1-3-8-20/ Band 1-3-8-28a)**
- **Full band** or **channelized** configuration support
- UL Power: up to **17dBm**
- DL Power: up to **10dBm per port**
- System Gain: up **75dB**
- **SMA Female** connectors, impedance **50 Ohm** for Donor & Service antennas.
- Real-time isolation detection, auto gain control (AGC), **uplink mute**



Coverage Space: up to 900m²

MagicOffice Installation
With CFD-400 Equivalent Coaxial Extension Cable



ZYXEL
Your Networking Ally

Scenario

- ✓ Large building
- ✓ Small Office
- ✓ Factories & Warehouses
- ✓ Underground car park

MagicOffice
Digital Full Band Repeater

- Soft coaxial cable (LMR-400 equivalent) installation, ideal for ELV system integrators
- Antennas/coaxial cables optional packages available
- Multi-system co-exist, compatible with 2G/ 3G/ 4G/ **5G-NR$_{FDD}$**/ NB-IoT
- **4 Bands** support: **Band 1-3-8-20/ Band 1-3-8-28a (DL:758-788)**
- Support **full band** or **channelized** configuration
- UL Power up to **17dBm**, System gain up to **75dB**
- Support 4 x **10dBm** service antenna ports (10mW in quad-band)
- Real-time isolation detection, Downlink Sleep, **Uplink Mute**, Invisible to BTS
- CE RED Certified

2G (GSM) Signal Strength and Quality

2G (GSM) Signal strength is defined by only one value: **RSSI** – Received Signal Strength Indicator; RSSI is a negative value, and the closer to 0, the stronger the signal.

Signal strength	RSSI (dBm)	Description
Excellent	>= -70 dBm	Strong signal with maximum data speeds
Good	-70 dBm to -85 dBm	Strong signal with good data speeds
Fair	-86 dBm to -100 dBm	Fair but useful, fast and reliable data speeds may be attained, but marginal data with drop-outs is possible
Poor	< -100 dBm	Performance will drop drastically
No signal	-110 dBm	Disconnection

3G (UMTS) Signal Strength and Quality

Received Signal Code Power (RSCP) denotes the power measured by a receiver on a particular physical communication channel. It is used as an indication of signal strength, as a handover criterion, in downlink power control, and to calculate path loss. RSCP is also called Receiver Side Call Power.

Signal strength	RSSI (dBm)	RSCP (dBm)	Description
Excellent	>= -70	-60 to 0	Strong signal with maximum data speeds
Good	-70 to -85	-75 to -60	Strong signal with goodta speeds
Fair	-86 to -100	-85 to -75	Fair but useful, fast and reliable data speeds may be attained, but marginal data with drop-outs is possible
Poor	< -100	-95 to -85	Performance will drop drastically, Marginal data with drop-outs is possible
No signal	-110	-124 to -95	Disconnection. Performance will drop drastically, closer to RSCP -124 disconnects are likely

4G (LTE) Signal Strength and Quality

RSRP: the Reference Signal Received Power is the power of the LTE Reference Signals spread over the full bandwidth and narrowband

Signal strength	RSRP (dBm)	RSRQ (dB)	SINR (dB)	Description
Excellent	>= -80	>= -10	>= 20	Strong signal with maximum data speeds
Good	-80 to -90	-10 to -15	13 to 20	Strong signal with good data speeds
Fair to poor	-90 to -100	-15 to -20	0 to 13	Reliable data speeds may be attained, but marginal data with drop-outs is possible. When this value gets close to -100, performance will drop drastically
No signal	<= -100	<= -20	<= 0	Disconnection

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No best solution, only most suitable solution

Each IBS architecture has its own strengths and weaknesses.

As a result, **there is no "one size-fits-all" solution that works perfectly for every application.** It is expected that the multiple IBS architectures presented in this document will be available for a long time to come, each finding favor in a different segment of the global IBS market.

86