INSTALLING
RELIABILITY

ACM
TDMA
DVB-S2
P2P (SCPC)

www.ndsatcom.com

SKYWAN 5G

The SKYWAN 5G satellite IP router features three modems in ONE: SCPC, MF-TDMA modem and a DVB-S2 receiver. Depending on the network type you need – point to point, star, multi star, hybrid, full mesh – SKYWAN 5G's unique hardware design reliably fits all existing topologies within the VSAT world. Each unit can act either as a HUB or so-called Master Station or as SCPC modem or remote in a large network, thus highlighting its agile network role. Geographical redundancy of the Master Station is already built-in. The device is so flexible that you can change your topology at a later point, use the unit for other networks or even split or pool networks together.
If additional carriers are needed in one place, you can easily cascade units into one stack, where a unit manages all and a single modulator avoids extra output power backoff. The optional DVB channel is used exclusively for user traffic allowing multiple independent DVB carriers in one network. In addition to ACM support in DVB, the unprecedented ACM for MF-TDMA and SCPC tunes every link at any time under all weather conditions protecting your investments in SKYWAN VSAT networks.

APPLICATIONS

- Air Traffic Control Networks
- Broadcast/Satcom-on-the-Move
- Disaster Recovery & Emergency Response
- Private Enterprise Networks
- Governmental & Administration Networks
- Defence
- Cellular Backhaul/Mesh Interconnection of Cells
- Energy Sector, Oil & Gas

5G HIGHLIGHTS AND KEY FEATURES

Get all-in-one – the reliable ONE solution
Gain flexible topology – star to mesh networks
Gain space & portability – smallest unit available
Gain powerful performance – with easy interface
Generate savings – lower cost of ownership

The ONE / Network Node
- One unit does it all – simplified logistics
- Cascading of stacked units to one node
- Centralized configuration by NMS appliance

Triple Modem System
- 3 access schemes: SCPC / TDMA / DVB-S2
- COTM: Doppler Shift compensation and OpenAMIP
- ACM: SCPC/MF-TDMA remote-to-remote/DVB-S2

IP Services
- High packet processing rate for Layer 2 and 3
- IP router incl. OSPF, BGP, GRE, VRF, VLAN etc.
- Service Quality based on PHB classes and multiple transmission queues

Security
- Secure management and reconfiguration at runtime
- Secure software deployment per multicast
- Built-in automatic geographical redundancy of master node

TECHNICAL SPECIFICATIONS
SKYWAN 5G (SINCE V2.0.161)

VSAT NETWORK

Network Topology	P2P/Star/Hybrid/True Full Mesh, Multi-Master: fully-redundant network control function with seamless switchover/DVB-S2 star overlay/Multiple DVB-S2 Gateways per network/Dynamic DVB-S2 Receiver assignment over MF-TDMA control link	
Supported Satellites/ Transponders	Geostationary, transparent bent-pipes, cross-strapped transponders, HTS spot beams, meshed over HTS spot beams	
Type & Number of Modems	1x MF-TDMA or P2P modulator, 1x TDMA or P2P demodulator, 1x DVB-S2 receiver (ETSI)	
Access Type TDMA	MF-TDMA with fast frequency hopping in Tx (16 channel) and fixed Rx home channel, pure data channels, Beam Switching, Communication-On-The-Move (COTM) with Doppler shift compensation. Bandwidth-on-Demand DAMA/real-time/non-real-time/guaranteed throughput/ QoS classes, TDMA Adaptive Coding and Modulation[1] (ACM) for QPSK up to 16APSK, cascading of units to one node with up to 4 TDMA demodulators, up to 4+4 redundancy option	
Access Type TDM/DVB-S2	DVB-S2 receiver with Adaptive Coding and Modulation (ACM)/MPE and ULE	
Access Type P2P	Point-to-point connection with exclusive bandwidth assignment (SCPC), link aggregation option follows stacking concept, 1+1 or 2+1 redundancy option	
Modulation & FEC Code Rates	**P2P (Turbo-ϕ)** QPSK: 1/3, 2/5, 4/9, 1/2, 2/3, 3/4, 4/5, 5/6, 6/7 8PSK: 2/3, 3/4, 4/5, 5/6, 6/7 16APSK: 2/3, 3/4, 4/5, 5/6, 6/7 **MF-TDMA (Turbo-ϕ)** BPSK: 1/3, 2/5, 4/9, 1/2, 2/3 QPSK: 1/3, 2/5, 4/9, 1/2, 2/3, 3/4, 4/5, 5/6, 6/7 8PSK: 2/3, 3/4, 4/5, 5/6, 6/7 16APSK: 2/3, 3/4, 4/5, 5/6, 6/7	**TDM – DVB-S2(X)** QPSK: 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10 8PSK: 3/5, 2/3, 3/4, 5/6, 8/9, 9/10 16APSK: 2/3, 3/4, 4/5, 5/6, 9/10 32APSK: 3/4, 4/5
Eb/No (BER 10^{-7}, incl. 0.5 dB margin)	QPSK 1/2: 2.4 dB 8PSK 2/3: 5.8 dB 16APSK 3/4: 8.2 dB	QPSK 1/2: 1.2 dB 8PSK 9/10: 7.3 dB 16APSK 9/10: 8.4 dB 32APSK 4/5: 9.9 dB
Roll-off	0.1, 0.2, 0.4	0.05, 0.10, 0.15, 0.20, 0.25, 0.35
Modem Symbol Rate	200 ksps – 12 Msps, variable in 1 ksps increments	Up to 45 Msps, variable in 1 sps increments
User Data Rate	**P2P:** Up to 20 Mbps per direction, up to 40 Mbps per direction with link aggregation **MF-TDMA:** Up to 20 Mbps per Tx or Rx unit, carrier user data rate starting at ~64 kbps, slot assigned traffic starting at ~4 kbps	**TDM – DVB-S2(X):** Up to 80 Mbps unicast/ 60 Mbps multicast user data rate on LAN port, starting at 3 kbps **MF-TDMA + DVB-S2 Receiver:** Tx 20 Mbps/ Rx up to 120 Mbps per stack **Peak Packet Rate:** in total up to 65,000 pps

BASEBAND INTERFACES

LAN Interface	Four GbE RJ-45 ports, VLAN/VRF/GRE/Jumbo Frames (max 1,600 Byte) configurable per port, local switching
IP Features	IPv4/IPv6 (tunnel)/Static Routing/OSPF/BGP/Multi VRF support (up to 8) including Virtual Channel Groups (VCGr[2]) and VLAN/GRE/Multicast Forwarding/IGMPv2/IGMPv3/DiffServ/Class Selector/DSCP/OpenAMIP[3]/DHCP Server/DNS Service
Traffic Processing	Load Balancing/Header Compression/Traffic Filtering with real-time flow detection and Shaping for QoS based on configurable PHB rules (up to 14 classes per VRF), high priority real-time service supporting “red phone” application Option: Encryption (AES-256) based on plugin board
Serial RS232/Console	SUB DB-9S socket for management access via command line interface
Aux-Port	8 pin connector DIN 45326 – contains Rx lock signal (5 VDC) indicator and Tx inhibit with cable detect support

[1] 6 dB range, 18 dB range with HW rev. ≥A5

[2] Patent EP 2871895 A1

[3] facilitating data exchange with compliant antenna control units (ACUs)

TECHNICAL SPECIFICATIONS
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BASEBAND INTERFACES

Display and 5-button switch	Notification of status information (reception level, IP-address etc.)
USB-A 2.0 ports	1x front panel port for image updates and configuration uploads, 1x rear port

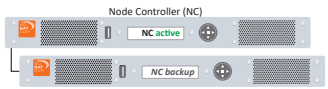
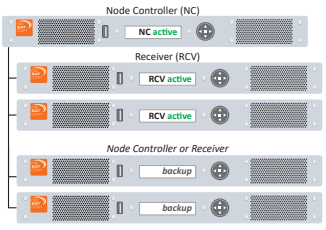
RF INTERFACES

	E-11B14129 SKYWAN 5G	E-11B17369 SKYWAN 5G-SR
Rear View with Interfaces		
10 MHz Reference Port	–	SMA-connector (50 Ohm female)
Tx Modulator Port	F-connector (75 Ohm female) L-Band 950 – 2150 MHz/-3 … -43 dBm	SMA-connector (50 Ohm female) L-Band 950 – 2150 MHz/-3 … -43 dBm
Rx Demodulator Port	F-connector (75 Ohm female) L-Band 950 – 2150 MHz/0 … -70 dBm common used Rx port for DVB-S2 and TDMA receiver	SMA-connector (50 Ohm female) L-Band 950 – 2150 MHz/0 … -70 dBm common used Rx port for DVB-S2 and TDMA receiver
10 MHz Reference Signal	Configurable by software on Tx and Rx port	Configurable by software on Tx and Rx port, always on at 10 MHz REF OUT port
Frequency Step Size	Tx and Rx center frequency configurable in 100 Hz steps	
LNB Support on Rx Port	Software configurable 0/13/18 VDC support, 22 kHz signal – internal/external PLL, 10 MHz reference signal	
BUC Support on Tx Port	Software enabled internal 24 VDC support, up to 85 W on IDU F-/SMA-connector (typical 6-8 W Ku), 10 MHz reference signal	
Note: LNB and BUC must operate with either SKYWAN 5G provided reference clock or from an alternative source with minimum performance according to 10 MHz Reference Signal Specification.		
Others	Radios with L-Band interface – Ka, Ku, Ext Ku, C, X	
Shared Amplifier	Multiple SKYWAN 5G modulators can be operated in a multi-carrier MF-TDMA setup utilizing the same RF-transmitter without requiring a back-off. Depending on the configured mode, traffic is routed through a single SKYWAN 5G unit or all transmitters are scheduled in sequence to prevent parallel transmission	

10 MHZ REFERENCE SIGNAL SPECIFICATION

Nominal Frequency	10 MHz; frequency tolerance ≤±2 x 10^{-7} (60 minutes after power on)		
Power Level	Tx: typ. +4 dBm (+3 dBm ... +7 dBm, <-40 dBm when switched off) Rx: typ. -1 dBm (-3 dBm ... +1 dBm, <-46 dBm when switched off) 10 MHz REF OUT: min. +8 dBm		
Frequency Stability	within operating temperature range:		±25 x 10^{-9}
	versus supply voltage changes Vs ±5 %:		±5 x 10^{-9}
	versus load changes 50 Ω ±10 %:		±5 x 10^{-9}
Aging	±1 x 10^{-9} per day	±1 x 10^{-7} per year	±6 x 10^{-7} per 10 years
Phase Noise	1 Hz: -85 dBc	10 Hz: -115 dBc	100 Hz: -140 dBc
	1 kHz: -145 dBc	10 kHz: -155 dBc	100 kHz: -155 dBc

REDUNDANCY

Type	1+1 node redundancy, hot standby	N+M node redundancy, hot standby
		

TECHNICAL SPECIFICATIONS
SKYWAN 5G (SINCE V2.0.161)

REDUNDANCY	
Interconnection	LAN Ethernet connection with external switch
External Switch Requirement	VLAN (802.1Q) capable switch with high MTBF and redundant power supply
Switchover	Automatic, no operator intervention required. Operational parameters are mirrored to backup unit for seamless switchover
Failure Detection	Active monitoring of keep alive signals
Stacking	In a network node with stacked units, the backup unit is agnostic for the function it takes over, it can replace either a Node Controller or a Receiver or a Transceiver in P2P mode. Up to 4 active units plus up to 4 backup units form the N+M redundant node
Operator Support	NMS integrated configuration and monitoring, status display in NMS and SKYWAN 5G front panel

NETWORK MANAGEMENT	
NMS Agent	One per node, controls cascaded and redundant modules for MF-TDMA and P2P, controls attached DVB-Gateway(s)
Security Architecture	Secure logins (https), role based views/LDAP support, all management interfaces via ssh only
IDU Management Interfaces	Remote access with in-band management (from central NMS station over satellite), additional SNMP access for monitoring, local access via WEB-GUI and CLI or integrated console port (RS 232), NETCONF (RFC 6241)
Architecture	Web based local GUI for station surveillance, look and feel identical on NMS and IDU, central NMS for planning & configuration (NETCONF RFC 6241) and monitoring (SNMP), network runs without NMS always on or connected NMS, TDMA and P2P links can be defined in one NMS network, any IDU can become either a TDMA node or a P2P node
Multi-Language Support	Multi-Language WebUI for NMS and modem, all text can be translated and customized by the operator with the SKYWAN 5G Translation Editor

MECHANICAL/ENVIRONMENTAL	
Dimensions (H x W x D)	44.45 mm (1 RU) x 483 mm (19“) x 410 mm (Packing box: 580 x 540 x 159 mm)
Weight	Below 3.4 kg (Packing box: 5 kg)
Input Power/ Power Consumption	100 – 260 V AC , 50/60 Hz , 40 VA nominal (without BUC/LNB)
Operating Temperature/ Humidity	0 °C ... +55 °C, 5 % – 85 % non-condensing
Storage Temperature/ Humidity	-40 °C ... +70 °C, 5 % – 95 % non-condensing
Altitude	Up to 5,000 m above sea level
Compliance	Fully CE compliant with RoHS and REACH, Anatel certified, no export limitations for product
Radio Standards	EN 301 428 Ku-Band VSAT, EN 301 443 C-Band VSAT
Safety	EN 62368-1 Safety IT Equipment (CB Scheme)
Emission Standards	EN 61000-6-3 Generic Emission Standard, EN 61000-3-2 Harmonics, EN 55022 Emission IT Class B, EN 61000-3-3 Flicker
Immunity Standard	EN 61000-6-1 Generic Immunity Standard, EN 55024 Immunity IT

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