The SKYWAN 5G satellite IP router features an integrated MF-TDMA modem and a DVB-S2 receiver. Depending on the network type you need – star, multi star, hybrid or 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, 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 TDMA inbound carriers are needed in one place, you can easily cascade units into one stack, where the node controller unit manages all and a single modulator avoids extra output power backoff. Since the optional available DVB outbound channel is not used for signalisation, multiple independent DVB carriers can be used in one network. In addition to ACM support in DVB, automatic registration at the DVB gateway simplifies operation.

Applications

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

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

Dual Waveform

- Dual demodulator TDMA + DVB-S2
- BPSK – 16APSK (24 MODCODs) for TDMA
- TDMA mod/demod up to 12 Mps/20Mbps
- COTM support with Doppler Shift compensation and COTM antenna interface
- DVB-S2 receiver unicast IP output up to 80 Mbps
- ACM in DVB-S2 with auto registration at DVB-Hub

IP Services

- Software defined WAN router supporting changes at runtime
- 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
- Built-in automatic geographical redundancy of master node
TECHNICAL SPECIFICATIONS
SKYWAN 5G (SINCE V1.6.138)

VSAT NETWORK

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network Topology</td>
<td>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 over MF-TDMA control link</td>
</tr>
<tr>
<td>Supported Satellites/Transponders</td>
<td>Geostationary, transparent bent-pipes, cross-strapped transponders, HTS spot beams, meshed over HTS spot beams</td>
</tr>
<tr>
<td>Type &amp; Number of Modems</td>
<td>1x MF-TDMA modulator, 1x TDMA demodulator, 1x DVB-S2 receiver (ETSI)</td>
</tr>
<tr>
<td>Access Type TDMA</td>
<td>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 (ACM) for QPSK up to 16APSK</td>
</tr>
<tr>
<td>Access Type TDM/VDB-S2</td>
<td>DVB-S2 receiver with Adaptive Coding and Modulation (ACM)/MPE and ULE</td>
</tr>
<tr>
<td>Stacking</td>
<td>Cascading of multiple units to one stack for up to 4 TDMA demodulators</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Modulation &amp; FEC Code Rates</th>
<th>TDMA (Turbo-ϕ)</th>
<th>TDM – DVB-S2(X)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPSK: 1/3, 2/5, 4/9, 1/2, 2/3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>QPSK: 1/3, 2/5, 4/9, 1/2, 2/3, 3/4, 4/5, 5/6, 6/7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8PSK: 2/3, 3/4, 4/5, 5/6, 6/7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16APSK: 2/3, 3/4, 4/5, 5/6, 6/7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>QPSK 1/2: 2.4 dB</td>
<td>QPSK 1/2: 1.2 dB</td>
<td>QPSK 9/10: 7.3 dB</td>
</tr>
<tr>
<td>8PSK 2/3: 5.8 dB</td>
<td>16APSK 3/4: 8.2 dB</td>
<td>32APSK 4/5: 9.9 dB</td>
</tr>
<tr>
<td>0.4, 0.2, 0.1</td>
<td>0.35, 0.25, 0.20, 0.15, 0.10, 0.05</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>User Data Rate</th>
<th>Up to 20 Mbps per Tx or Rx unit, carrier user data rate starting at ~64 kbps, slot assigned traffic starting at ~4 kbps</th>
</tr>
</thead>
<tbody>
<tr>
<td>VSAT Data Throughput</td>
<td>Tx 20 Mbps/Rx up to 120 Mbps per stack/Switching packet rate in total up to 65,000 pps</td>
</tr>
</tbody>
</table>

BASEBAND INTERFACES

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAN Interface</td>
<td>Four GbE RJ-45 ports, VLAN/VRF/GRE/Jumbo Frames (max 1,600 Byte) configurable per port, local switching</td>
</tr>
<tr>
<td>IP Features</td>
<td>IPv4/IPv6 (tunnel)/Static Routing/OSPF/BGP/Multi VRF support (up to 8) including Virtual Channel Groups (VCGs) and VLAN/GRE/Multicast Forwarding/IGMPv2/IGMPv3/DiffServ/Class Selector/DSCE/OpenAMP/DHCPServer</td>
</tr>
<tr>
<td>Traffic Processing</td>
<td>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) option: Encryption (AES-256) based on plugin board</td>
</tr>
<tr>
<td>Serial RS232/Console</td>
<td>SUB-DB-9S socket for management access via command line interface</td>
</tr>
<tr>
<td>Aux-Port</td>
<td>8 pin connector DIN 45326 – contains Rx lock signal (5 VDC) indicator and Tx inhibit with cable detect support</td>
</tr>
<tr>
<td>Display and 5-button switch</td>
<td>Notification of status information (reception level, IP-address etc.)</td>
</tr>
<tr>
<td>USB-A 2.0 ports</td>
<td>1x front panel port for image updates and configuration uploads, 1x rear port</td>
</tr>
</tbody>
</table>

RF INTERFACES

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rear View with Interfaces</td>
<td>E-IIB14129 SKYWAN 5G</td>
</tr>
<tr>
<td>10 MHz Reference Port</td>
<td>–</td>
</tr>
<tr>
<td>Tx Modulator Port</td>
<td>F-connector (75 Ohm female)</td>
</tr>
<tr>
<td>L-Band 950 – 2150 MHz/-3 … -43 dBm</td>
<td>L-Band 950 – 2150 MHz/-3 … -43 dBm</td>
</tr>
</tbody>
</table>

6dB range, 18 dB range with HW revision ≥A5
TDMA ACM sw support is provided with next major release (Dec 2020)

2 Patent EP 2871895 A1
3 facilitating data exchange with compliant antenna control units (ACUs)
**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

**10 MHz Reference Signal**

- 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**

- Software configurable 0/13/18 VDC support, 22 kHz signal – internal/external PLL

**BUC**

- Software enabled internal 24 VDC support, up to 85 W on IDU F-/SMA-connector (typical 6-8 W Ku)

**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 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:
  - versus supply voltage changes Vs ±5 %: ≤5 x 10⁻⁹
  - versus load changes 50 Ω ±10 %: ≤5 x 10⁻⁹
- **Aging**
  - ±1 x 10⁻⁶ 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
  - 10 kHz: -155 dBc

### Redundancy

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

**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. 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

### Security Architecture

- Secure logins (https), role based views/LDAP support, all management interfaces via ssh only

**NMS Platform**

- SKYWAN 5G NMS – virtual appliance, optional: pre-installed on NMS server machine
### NMS Architecture

Web based application/identical GUI look and feel on NMS and IDU reduces training to a minimum/central NMS server, can be placed everywhere (only IP connectivity needed) mainly for planning & configuration, network runs without NMS always on or connected, NMS Redundancy, NETCONF (RFC 6241)

### 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)

### 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

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

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