

TORO+

Digital Microwave Link

Split-Mount



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TORO+



User Guide

System: TORO+

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Chapter 1 - Basic information.

1.1 Introduction.

TORO+ is a universal IDU designed for split-architecture high-performance Point-to-Point (PtP) digital microwave links with adjustable data rate from 10 up to 1000Gbps in single port. The whole system is designed especially for network operators interested in IP based transports and backhaul infrastructure.

TORO+ supports both ETSI and ANSI licensed frequency bands. TORO+ boasts hitless Adaptive Code Modulation (ACM), excellent system gain, and bandwidths for both ETSI and ANSI standards.

THIS PRODUCT USER GUIDE IS WRITTEN IN THE FORM OF COMPLETE MICROWAVE SYSTEM DESCRIPTION (IDU & ODU & ANTENNA) UNDER TECHNOSYSTEM OWN BRAND NAME TORO+.

1.2 Safety Information.

TORO+ complies with the basic requirements of European R&TTE Directive 1999/5/EC Article 3 and meets the requirements contained in the harmonized standards R & TTE, in accordance with article 5 of the directive. TORO+ complies also with the basic requirements of FCC rules according to the table below.

Table 1 : Requirements and harmonized ETSI standards

Essential requirements under Article 3	Harmonized standards under Article 5
Article 3.1 (a): Protection of health and safety of users (contained requirements of Directive 73/23/EEC and council recommendation 1999/519/EC)	Article 3.1 (a): Protection of health and safety of users (contained requirements of Directive 73/23/EEC and council recommendation 1999/519/EC)
EN 60950-1 (2006)	EN 60950-1 (2006)
EN 60950-22 (2006)	EN 60950-22 (2006)

Table 2: Requirements and harmonized FCC standards

Essential requirements	Standards
US FCC limits	System has been tested for compliance with FCC Part 101 and the general requirements of Part 2. The limits for digital devices pursuant to Parts 15.107 and 15.109 Class A have been applied.

The product complies with the basic requirements for this type of equipment and all the above technical standards. Operation of equipment is safe under normal conditions of use set out in this User Guide.

Modifying or tampering with TORO+ product's internal components can cause a malfunction and might invalidate its warranty.

1.3 Device labels.

For quick identification each device includes a Product Label giving the Product type, Product number, Producer and Serial number (S/N) with bar code and, if needed, any other complementary information (frequency range, ...).

1.3.1 The ODU code description.

For quick identification each device includes a Product Label giving the Product type, Product number, Producer and Serial number (S/N) with bar code and, if needed, any other complementary information (frequency range, ...).

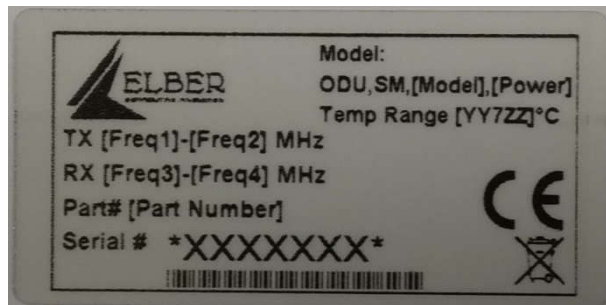


Figure 1: The label of outdoor unit

1.3.1.1 Basic Information.

ODU,SM,[Model],[Power] outdoor unit specification (TECHNOSYSTEM labelling).

- SM Identifies the product series, ask your local representative for more details.
- [Model] Determines the main frequency band (in GHz) and related sub-band.
- [Power] Determines transmitter's version between Standard Power (SP) or High Power (HP)
- Temp Range[YY/ZZ]°C
 - YY Identifies minimum operating temperature recommended.
 - ZZ Identifies maximum operating temperature recommended.

1.3.1.2 Sub-band information.

TX [Freq1]-[Freq2] MHz Identifies start [freq1] and stop [freq2] frequencies of diplexer pass-band for transmitting section

RX [Freq3]-[Freq4] MHz Identifies start [freq3] and stop [freq4] frequencies of diplexer pass-band for receiving section.

1.3.1.3 Part Number information.

Part# [Part Number]

Part Number has following syntax:

ESKODU/xx/[Model]/[Power] where

- ESKODU Identifies the commercial name of the ODU
- xx Identifies the product configuration between
 - FD = Full duplex
 - TX = Transmitter Mono
 - RX = Receiver Mono
- [Model] Determines the main frequency band (in GHz) and related sub-band.
- [Power] Determines transmitter's version between Standard Power (SP) or High Power (HP)

1.3.1.4 Serial Number information.

Serial #

Serial Number has following syntax:

xyzzzz where

- x Identifies ODU manufacturer (E=Technosystem)
- yy Identifies frequency band

- zzzz Progressive Serial Number

1.3.2 The IDU code description.



Figure 2: The label of indoor unit

- **P/N:** TORO+ indoor unit identifier (TECHNOSYSTEM labelling).
- **S/N:** Serial Number of IDU

1.3.3 The EMM code description.



Figure 3: The label of EMM

EMM-xxx Identification of external multiplexer module (EMM).

Identifier “xxx” specifies the type of module (16xE1/T1, 4xASI, ...).

Example:

EMM-16E1/T1 The EMM module with ports 16xE1/T1 (G.703/G.704).

Chapter 2 - Technical Description.

2.1 Introduction.

Digital microwave system TORO+ is designed in split mount version, the IDU - ODU architecture. There is only one universal IDU hardware version available with bandwidth up to 60 MHz and applicable maximal output power. The indoor unit (TORO+) is universal with respect to ETSI and ANSI bandwidth standards and universal for all frequency bands, and its configuration then depends on the loaded software license key. The outdoor units are unique for each frequency band and sub-band.

2.2 System description.

Signal received by parabolic antenna is carried via a waveguide adapter to the receiving filter in outdoor unit. The task of outdoor unit (ODU) is to convert the frequency of received/transmitted signal to/from IF. The resulting converted signal is together with management channel carried via the coaxial cable to the TORO+ indoor unit (IDU). The signal is demodulated inside the IDU, followed by recovery of user data and management data intended for communication with ODU. As a source of user data can be used a signal for/from the Gigabit Ethernet ports or EMM modules connected over SFP module. Data for the transmission are processed similarly in the reverse order than the received signal.

The TORO+ system is technically characterized by the following basic features.

- Standard licensed ETSI and ANSI frequency bands.
- Modulation schemes.
 - QPSK, 8PSK, 16/32/64/128/256/512/1024 QAM.
- Channel bandwidth.
 - ETSI standards 7/14/28/40/56/80 MHz
 - ANSI standards 10/20/25/30/40/50/60/80 MHz
- Reed Solomon with Weak/Medium/Strong modes
- Hitless Adaptive modulation (ACM).
- Two functional options (SW setting / License Key).
 - AES128/256 – AES encryption for high system security.
 - PTP1588 – option which ensure IEEE1588 support.
- Integrated traffic ports.
 - 3x Gigabit Ethernet ports (10/100/1000Base-T) for user data traffic and/or management access.
 - 4x SFP slots for additional GIGE port extension, EMM module connection or IDU interconnection (protection, aggregation).
- Integrated management ports.
 - USB-B – for separate IP management access.
 - USB-A – configuration restoration and backup by means of USB Flash memory.
- SyncE support implemented on request.
- Integrated data verification system of received corrupted packets (CRC).
- Integrated BER tester and measurement of the nature of received signal (MSE, modulation diagram of received data).
- ATPC function support (Automatic Transmit Power Control).

- Integrated spectral analyser for the detection of the free channel, or alternatively for detection of interference with the particular band.
- Unified standard management IP access – TELNET, HTTP, SNMP v.2c.
- Secure management IP access - SSH, HTTPS, SNMP v.3.

2.3 Indoor Unit (IDU).

The basic function of the TORO+ Indoor Unit is the data multiplexing and at the same time it is the digital modem of the whole system. Both functions are easily configurable by software. The core of the unit is DSP module that generates a signal for the intermediate frequency output to outdoor unit and processes intermediate frequency input from the outdoor unit.

The indoor unit is fitted with three 1000Base-T (RJ45) user ports, where one port can be reserved either for an individual management connection or as a standard user port. 4 SFP slots are intended either for additional Gigabit Ethernet connection or for IDU interconnection (1+1/2+0/2+2) or for port extension by means of EMM module.

There is the USB-B port available in IDU for the independent management connection, second USB port (USB-A) is reserved for flash memory stick (configuration backup, logs,...).

Management system is based on IP protocol. Outdoor unit management is integrated directly into the command set of the indoor unit and is an integral part of this unit's software. For the management itself there is used, either character-oriented IP access (TELNET, SSH) or web-based GUI (HTTP, HTTPS) or SNMP based system management.

The IDU unit should be connected to power supply with a nominal voltage of -48 VDC and GND must be connected to the positive pole.

2.3.1 IDU front panel description.

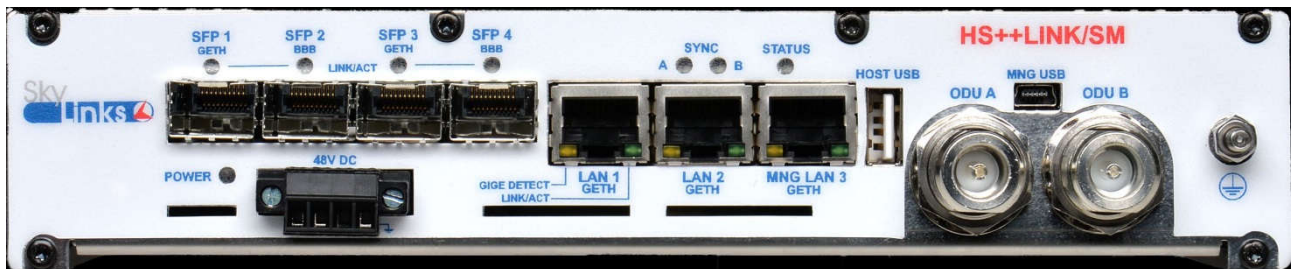


Figure 4: The front panel of the Indoor unit

2.3.1.1 Connectors on the IDU front panel

- **TRAFFIC LAN 1/2** – Gigabit Ethernet user ports for Ethernet connection.
- **MNG LAN 3** – by default it is reserved for management access (out of band management), but can be configured also for user data traffic.
- **SFP 1 GIGE/PROTECT** – user port for alternative Gigabit Ethernet connection or IDU interconnection in case of protected or aggregate design selection.
- **SFP 2 GIGE/EMM** – user port for alternative Gigabit Ethernet connection or EMM module connection.
- **SFP 3 GIGE/PROTECT** – user port for alternative Gigabit Ethernet connection or IDU interconnection in case of protected or aggregate design selection.
- **SFP 4 GIGE/EMM** – user port for alternative Gigabit Ethernet connection or EMM module connection.
- **HOST USB** – USB interface for connecting USB memory.
- **MNG USB** – USB interface for an alternative IP access.

- **-48 VDC** – power supply connector, + pole is grounded inside the device.
- **ODU A/B** – N connector for connecting ODU over coaxial cable (IF connection).
- Grounding connector.

2.3.1.2 LED indicators on the IDU front panel – system status

- **SYNC A/B** – indication of modem synchronization (digital modem).
 - Lights – synchronization OK.
 - No light – loss of synchronization.
- **LOCAL STATUS** – indication of the LOCAL device status.
 - Lights – status OK.
 - Flashes – status WARNING.
 - No light – status UNKNOWN.
- **POWER** – indication that IDU is under power.
 - Lights – power ON.
 - No light – power OFF.

2.3.1.3 LED indicators on the IDU front panel – ports status

- **SFP 1/2/3/4 LINK** – indication of presented signal at SFP port.
 - Lights – signal detected and synchronized.
 - Flashes – incorrect result from auto-detection process.
 - No light – no correct signal detected.
- **LAN 1/2/3 GIGE DETECT** – indication of Gigabit ETH mode on appropriate port.
 - Lights – GIGE mode ON.
 - No light – no GIGE mode detected.
- **LAN 1/2/3 LINK/ACT** – indication of link and data activity on appropriate ETH port.
 - Lights – Ethernet link detected.
 - Flashes – data activity (Rx/Tx) at appropriate port.
 - No light – no Ethernet link.

2.3.2 Block diagram of the TORO+ Indoor Unit.

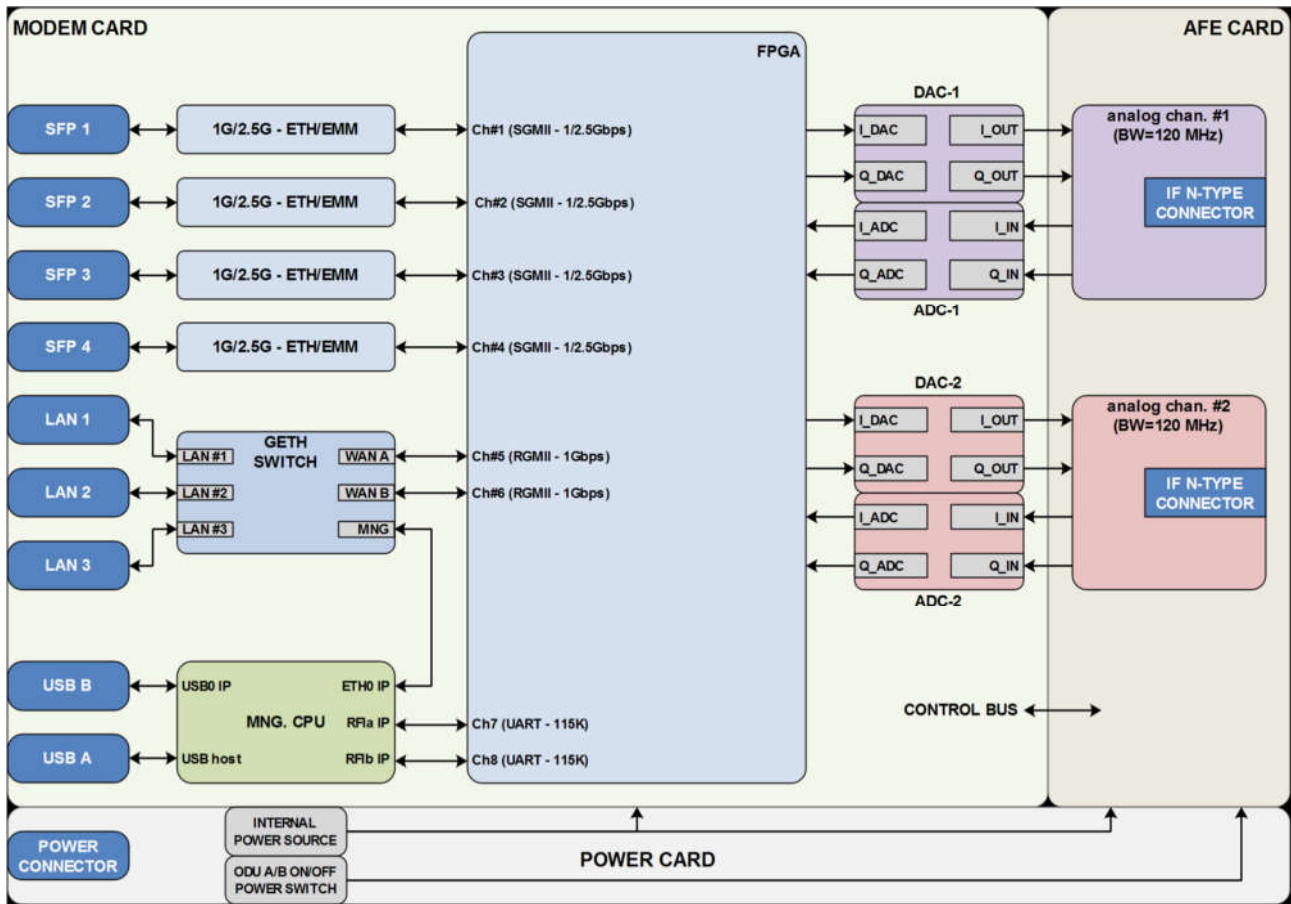


Figure 5: Block diagram of the Indoor Unit

The function of the Indoor unit is evident from the block diagram in Figure 2.

TORO+ IDU consists of two main boards. Interface Card performs the function of data interface, packet processor and management unit. Modem Card performs the function of digital modem (DSP) and analogue modem (analog front end with mixers and filters).

Data are first processed by integrated Six Port Gigabit Ethernet Switch, where two WAN ports of this switch are connected into universal Packet Processor (PBPS – Priority Based Packet System). SFP interfaces are also directly connected into universal Packet Processor. Function of Packet Processor depends on selected design and it is described in the section which explains such particular designs. Digital modem then adds synchronization marks, FEC to the data stream and creates a digitally modulated signal, which is led to the block of analog signal processing. All these parts are interconnected inside the device over high-speed bus and are operated from the central processor unit CPU. This block (CPU) is also accessible via management interfaces and allows the user to perform all the settings both locally and remotely through the IP interface in the TORO+ IDU.

The function of Packet Processor is specific in dependence on selected design. Generally, Packet Processor uses priority scheme which ensures that data at the internal port ETH 4 are processed with the highest priority whereas data at the internal port ETH 1 with the lowest priority.

2.3.3 Block diagram of 2+0 mode.

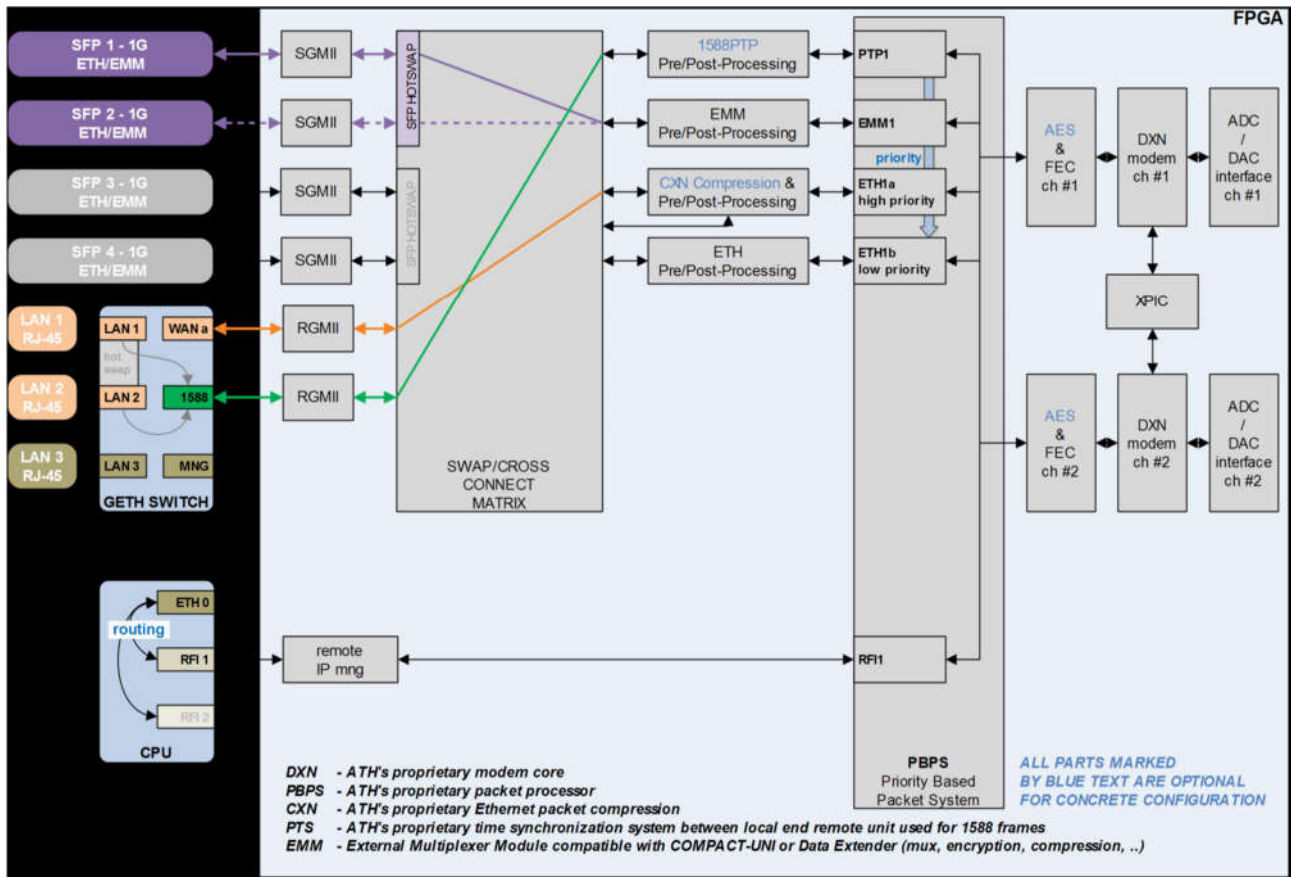


Figure 6: 2+0 Functional Block Scheme Example

2.3.3.1 Main Advantages

- IDU ready to build protected and aggregate links
- Prepared for interface expansion with E1's, T1's and ASI
- Remotely configurable and scalable in simple operation
- Compression on Ethernet for increased capacity
- Support of RADIUS Server authentication for the users' access
- Small IDU footprint (half-rack) for scarce space installations

2.3.3.2 Ideal for

- Fixed and mobile networks
- Enterprise and private communication networks carrying data, voice and HD video
- High capacity backhuls and backbone routes
- Critical infrastructure protection
- Future capacity growth and additional functionality enabled with license keys
- Easy branding and customization to OEM customers

2.3.4 IDU block scheme in terms of IP.

The following Figure 9 depicts a simplified block diagram of the TORO+ IDU in terms of IP management.

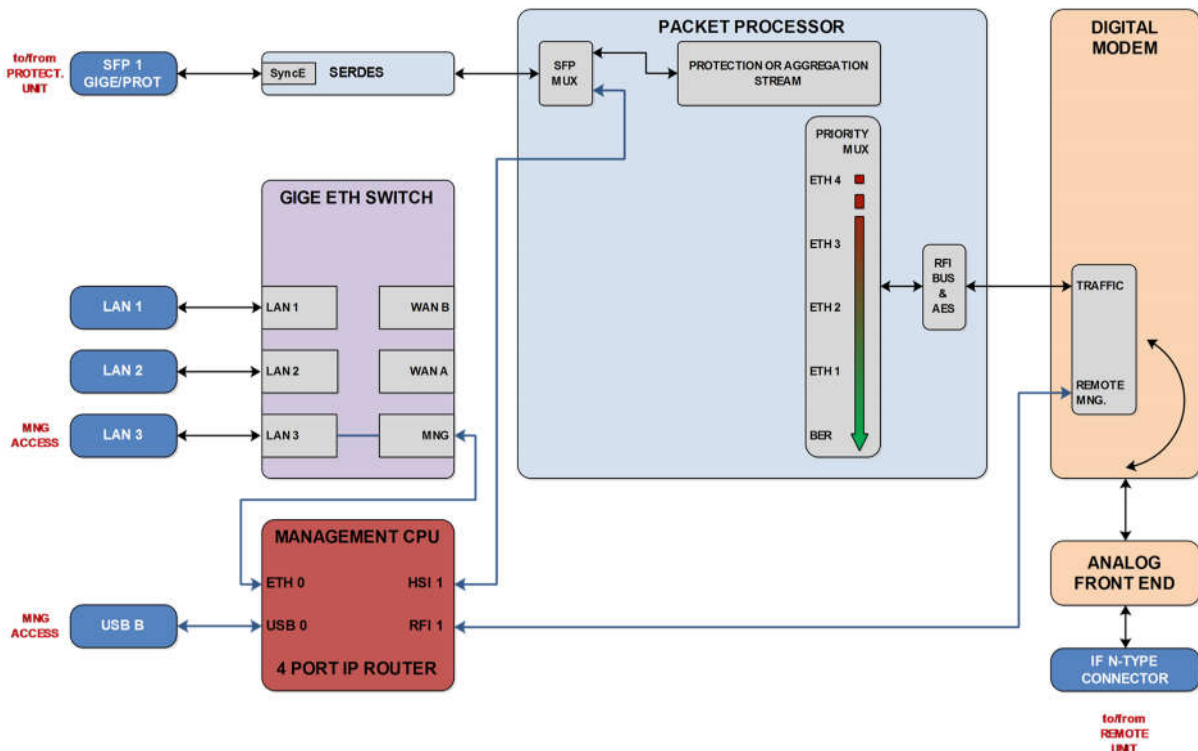


Figure 7: Detailed block diagram of IP management scheme

The processor itself performs the function of an IP router. The individual IP frames routing is based on standard routing rules, in this case on static routing.

1. Four IP ports enter the processor (MANAGEMENT CPU)
 - **ETH 0** – Ethernet port of CPU with its own MAC address and all the standard features of Ethernet interface, Primary / Secondary addresses and appropriate subnet masks are assigned to this interface.
 - **RFI 1** – ppp (point-to-point) type of interface which interconnects local CPU with the remote side CPU accessible through the separate channel inside air-frame.
 - **HSI 1** – ppp (point-to-point) type of interface which interconnects local CPU with the protection unit CPU or EMM module accessible through the separate channel inside Fiber Optic-frame.
 - **USB 0** – USB port which is reserved for local IP access.
2. Each device supports the following basic IP settings
 - **The primary IP address, including the mask** – in the basic configuration, this address is identical to the ports ETH 0, RFI 1 and HSI 1 (ppp unnumbered mode), the mask indicates the range of addresses connected directly to the ETH 0 interface.
 - **The address of the remote radio unit (rrfi1)** – together with this address there is automatically assigned a static route of the remote device connected via port RFI 1 (microwave connection).
 - **The address of protection unit (rhsi1)** – together with this address there is automatically assigned a static route of the protection unit connected via port HSI 1 (Fiber Optic Connection).
 - **Default gateway** – the address from assigned subnet for routing the frames which have different IP address than from the range of IP addresses included in the routing table.
3. Each device supports also the following advanced IP settings

- **The secondary IP address, including the mask** – the address is assigned to the port ETH 0, the mask indicates the range of addresses connected directly to the ETH 0 interface. When no conflict with address range 10.10.10.0/24 exists, there is not necessary to change this address.
- **The USB IP address, including the mask** – this address is assigned to the port USB 0, the mask indicates the range of addresses connected directly to such interface. When no conflict with address range 10.10.11.0/24 exists, there is not necessary to change this address.
- **The RFI1 port IP address** – it is possible to set specific IP address for internal ppp port and change ppp mode from unnumbered to numbered one.
- **The HSI1 port IP address** – it is possible to set specific IP address for internal ppp port and change ppp mode from unnumbered to numbered one.
- **The File Transfer specification** – this setting specifies file transfer destination. Local USB A port can be selected (default) or FTP server by means of FTP IP specification can be used either for firmware update from CLI or for log files storage.
- **The Remote Time Server** – this setting selects whether remote time server is used for time synchronization. NTP or RDATE type can be selected for this function, appropriate IP address of selected server must be entered.
- **Static routes** – the user can define additional static routes as well.
- **NAT** – possibility of the address translation according to the rules in the NAT table.

All above explained parameters have an influence on the type of management access either directly on the managed unit or on the whole microwave network.

2.4 Outdoor Unit (ODU).

Outdoor microwave unit TORO+ is available for full range of standard licensed frequency bands and specific unlicensed bands. Microwave units for licensed frequency bands have the same mechanical construction. Microwave link TORO+ of point-to-point type (in the basic configuration 1+0) consists of two Outdoor Radio Units (ODU). ODU performs the up-conversion from IF frequency from IDU (350 MHz) to the desired transmission band, and vice versa, performs the down-conversion from received frequency band to IF frequency (140 MHz) for the receiving part of the IDU. Power supply for ODU is delivered through the coaxial cable (used for the connection between IDU - ODU) as well as the software access to ODU, its management and configuration is possible only from the Indoor Unit. The management of ODU is integrated directly in the command set of the Indoor Unit and it is an integral part of the IDU software. For an easy primary setting of the optimal received signal level the ODU is fitted with BNC connector where the measured DC voltage [mV] is directly proportional to the level of Received Signal Strength (RSSI).

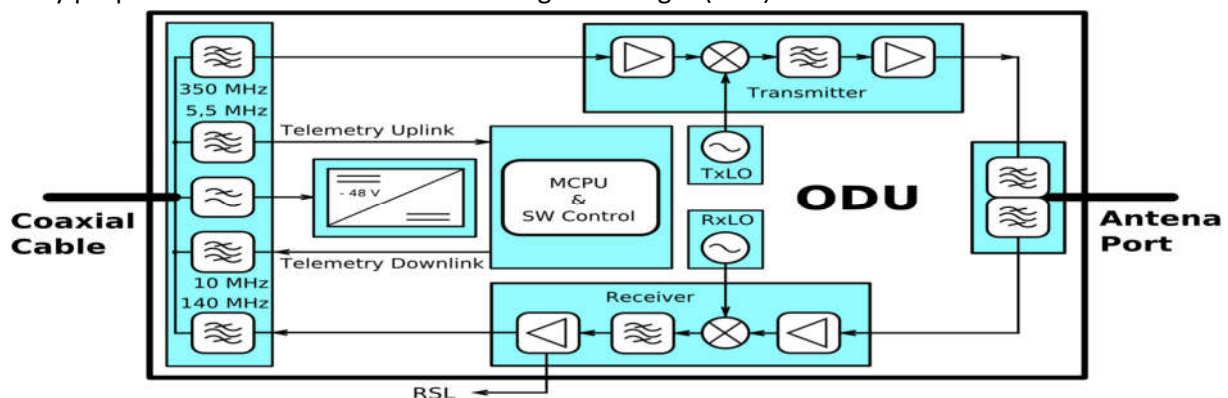


Figure 8: Block diagram of the Outdoor Unit

Outdoor unit is an integral part of the antenna system. ODU is mounted behind the parabolic antenna. In dependence on requested application distances there are available antennas with diameters of 30, 60, 99 and 120 cm.

2.4.1 ODU for licensed frequency bands.

Outdoor units in the version for the license frequency bands meet the international standards and requirements for this type of equipment (especially ETSI EN 302 217). The modulation scheme is adjustable from QPSK to 1024QAM, the output power is in the range between 0 to 32dBm depending on the selected frequency band and the type of modulation scheme. A maximum transmission data rate is 500 Mbps in 1+0 mode.

For technical reasons, each frequency band is covered by more (three or four) pairs of microwave units, where one pair is tuneable in the low portion of the band (in low sub-band), the second/third pair in the middle portion of the band (in middle sub-band) and the last pair in the high portion of the band (in high sub-band). Each pair then consists of two radio units (ODU), where one unit transmits in the upper part and the second unit in the bottom part of the given sub-band, the frequency separation is then known as the duplex spacing (Tx/Rx).

In consequence of the statement above the ODU, that is tuneable in lower part of the particular sub-band of given frequency, can work only with ODU tuneable in higher part of the same sub-band of the same frequency.

All the fundamental ODU technical parameters, in respect of requested data throughput, such as the transmitting power (Output Tx), sensitivity for the given type of modulation and bandwidth (BW) for each available frequency are set forth in separate documentation "Technical Specification".

There are only two connectors accessible on the ODU, N connector for connecting with the IDU via coaxial cable and BNC connector for measurement of Received Signal Strength (RSSI). Next to the BNC connector is located grounding screw.



Figure 9: Preview of Outdoor Unit for licensed bands

Attaching the ODU to the antenna is done with an integrated waveguide transition (Microwave adapter) and it is mechanically realized with four flexible clips.

2.5 Antennas.

Outdoor microwave units are designed for direct assembly on microwave parabolic antennas to form together a compact entity. Microwave adapter which is part of the antenna kit allows the transition between the flange of antenna and the microwave ODU. There are available parabolic antennas with diameters of 30, 60, 99 and 120 cm (or 180 cm). Antennas can be used for horizontal and for vertical polarization, the right-side and left-side assembly as well.

Part of the delivery is a robust antenna mast mount including the mechanical part permitting fine calibration of azimuth and elevation after final assembly to a pole, etc.

Another possibility is the interconnection of microwave unit and parabolic antenna through a flexible waveguide. This alternative method of connection is suitable for installation of microwave link to antennas from a different manufacturer. (Flexible waveguide is not included in the antenna shipment by default. Suitability of antennas from other suppliers must be consulted with the manufacturer in advance).

Alternatively, directional coupler for 1+1 HSB protection configuration or OMT (orthomode transducer) adapter for cross polarization configuration (aggregate 2+0) can be used for two ODUs mounting behind the antenna.

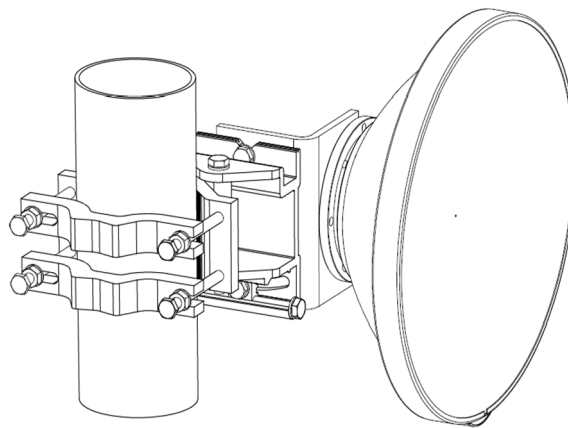


Figure 10: Parabolic antenna

2.6 Accessories.

For perfect installation of microwave link and its proper function it is recommended to use only the following parts and accessories. When using alternatives, not approved by the manufacturer, he nor distributor does take responsibility for the malfunction of the link.

NOTE: ALL ACCESSORIES, EXCLUDING IDU GROUNDING KIT, ARE NOT INCLUDED IN STANDARD DELIVERY.

2.6.1 Power supply.

The recommended power supply is 90 watts regulated switching power supply PS-230/48 with 48 VDC and 1.9 A output which is an optional accessory equipment to the delivery of microwave link. From one switching power supply PS-230/48 it is recommended to power only one side of the microwave link.

That means 1x IDU+ODU. When you connect more devices, it may overload the power supply and the function of entire microwave link may be incorrect.

Alternative power supply:

Mean Well, GS90 series- GS90A48-P1M.

2.6.2 Coaxial cable.

For connecting together Indoor Unit and Outdoor Unit of microwave link at each terminal we recommend using low-loss coaxial cable Belden, type H1000 PE impedance 50 Ohm, designed for outdoor installations

(new code RF400). In general, the maximum distance between the IDU and ODU is 200 m. For more than 50 meters it is recommended to ground the cable each 50 meters.

For distances of up to 50 m it can be used cable type RG8X:

- Belden - RF 240.
- Belden - H155 PE.
- Draka - MRC240 AFB
- Nordix - LMR240

Always in design for outdoor use, that means with PE sheath!

For distances over 50 m it can be used cable type RG8:

- Draka - 2.7/7.3AF
- Nordix - LMR400
- Cavel - LL50/4

Always in design for outdoor use, that means with PE sheath!

2.6.3 N-connector.

We recommend using only brand-name N-connectors (male) e.g. Rosenberger, Telegartner, Amphenol.

Recommended crimp N-type connectors for the cable type RG8 (H1000/RF400/ MRC400) are:

- Amphenol - 172102H243
- Telegartner - J01020A0127
- Rosenberger - 53S101-1N9N5

Recommended screw N-type connectors for the cable type RG8 (H1000/RF400/ MRC400) are:

- Telegartner - J01020A0149
- Rosenberger - 53S10A-0N9N3

Recommended crimp N-type connectors for the cable type RG8X (RF240, MRC240 AFB, 1.4/3.8AF, LMR240, H155 PE) are:

- Amphenol - 72135
- Telegartner - J01020A0119
- Rosenberger - 53S104-1Y8N3

2.6.4 Coaxial cable grounding kit.

To ensure sufficient lightning protection of the radio units we recommend to install grounding kits on the cable with length over 50 m (each 50 m for long cables) and on the cable at the building entrance.

Recommended types are:

- FI.MO.TEC Spa - KMT 11-N
- BM Funktechnik - EGK RG8 (PN-990009)

2.6.5 Ethernet cable with RJ-45 connectors.

Twisted pair type CAT5e from Belden manufacturer is a suitable Ethernet cable.

2.6.6 Surge suppressors.

When the coaxial cable is entering the building, it is necessary to install a RF surge suppressor. The surge suppressor greatly eliminates the damages resulting from excess voltage.

Recommended surge suppressor type is:

- Telegartner - J01028A0033

2.6.7 *Grounding kit.*

The part of every delivery of Compact Indoor Unit is grounding wire. We recommend grounding the IDU to the rack cabinet using the enclosed Grounding kit. Ground the ODU to the place the unit is mounted to (mast mount, pole etc.) the similar way.

NOTE: IDU GROUNDING KIT IS INCLUDED IN STANDARD IDU DELIVERY. ODU GROUNDING KIT IS NOT INCLUDED IN STANDARD DELIVERY, IT IS AN OPTIONAL ACCESSORY.

2.6.8 *N plug to N jack right angle adaptor for Compact Indoor unit.*

R/A adaptor is a recommended accessory for connecting the coaxial cable to TORO+ IDU unit under 90° angle. We recommend to use only brand-name R/A adaptors e.g. Rosenberger, Telegartner, Amphenol.

Recommended R/A adaptors types are:

- Amphenol - 172126
- Rosenberger - 53S201-K00N5
- Telegartner - J01024J1096

Chapter 3 - Installation.

3.1 Introduction.

The installation of TORO+ microwave system and its start-up can perform only manufacturer's authorized partner. Manufacturer's authorized partner is also liable for elimination of possible failures and troubles in warranty period. The equipment must be installed according to country national electrical codes. Power distribution to which the device will be connected has to meet the requirements of current valid standards, for example EN 332000-6 in the Czech Republic.

3.2 Required installation tools.

List of installation tools necessary for perfect installation (not included in the delivery).

Table 3: List of necessary installation tools

Cross screwdriver	for IDU rack cabinet installation
Engineer's wrench	M7, M10, M13, M17
Vulcanize isolation tape	for N and BNC connector insulation
DC voltmeter	for RSSI measurement on ODU
BNC - DC voltmeter reduction	for RSSI measurement

3.3 Unpacking the device.

After unpacking the device, please, check that the delivery contains all the parts including the related accessories. Complete list of parts as stated on "Packing list" is included in every delivery.

3.4 Antenna installation.

3.4.1 Mounting the antenna mast mount.

On the pictures below (Figure 15-Figure 18) you can see the step by step instructions how to mount the antenna mast mount to the pole with the diameter of min. 50 mm and 120 mm in maximum. Make sure that your installation will endure even very strong winds. Only after rigorous mounting of the mast mount to the required place you are allowed to install parabolic antenna and microwave unit!

- mounting the antenna mast mount to a pole according to the pole diameter.

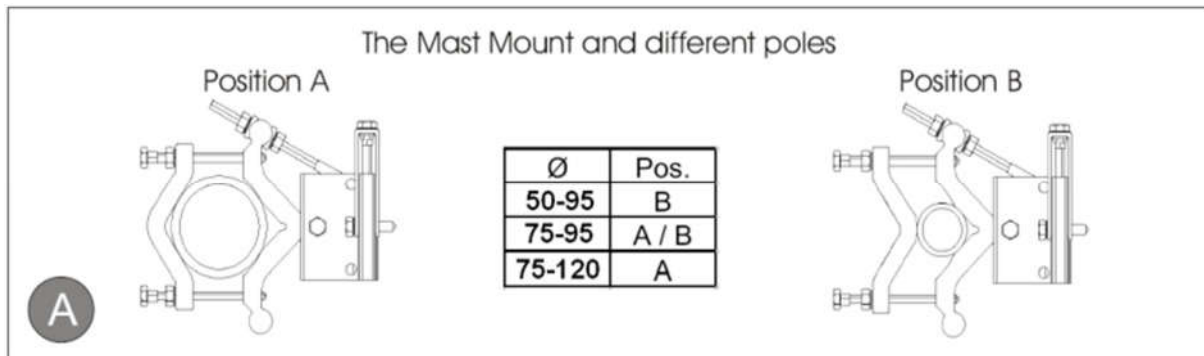


Figure 11: Mounting the antenna mast mount

- right-side or left-side mounting

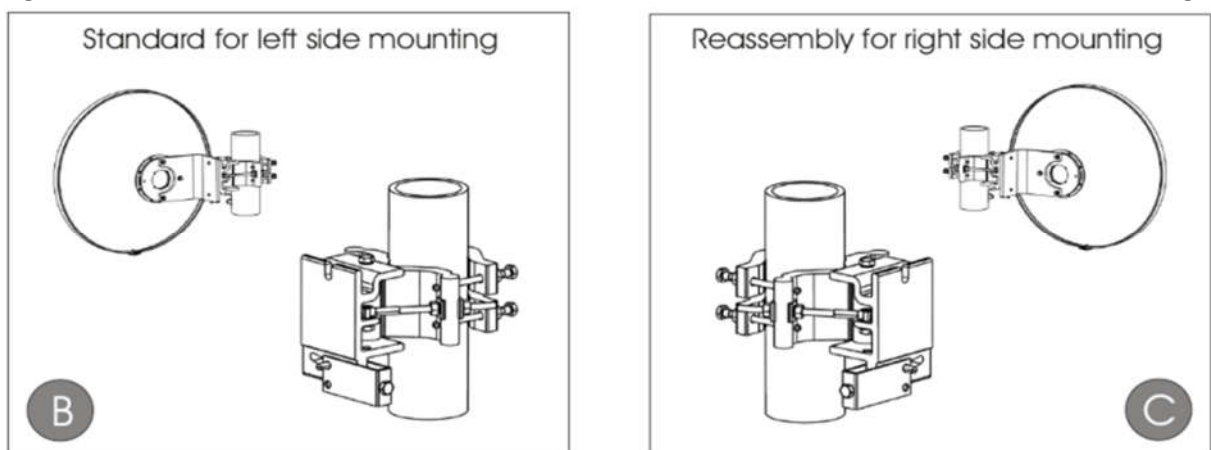


Figure 12: Right/Left-side mounting

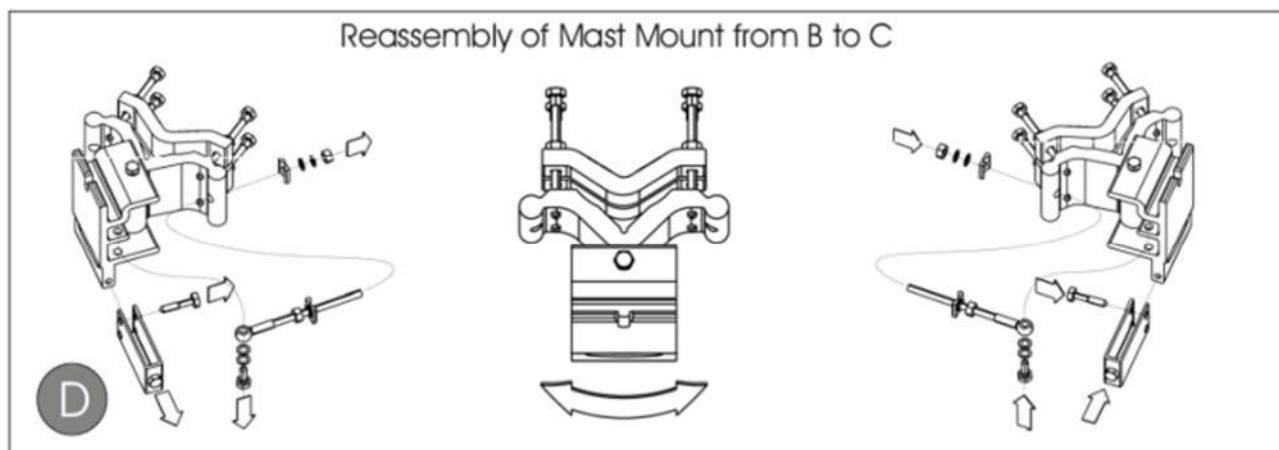


Figure 13: Conversion of mast mount from B (left) to C (right) mounting

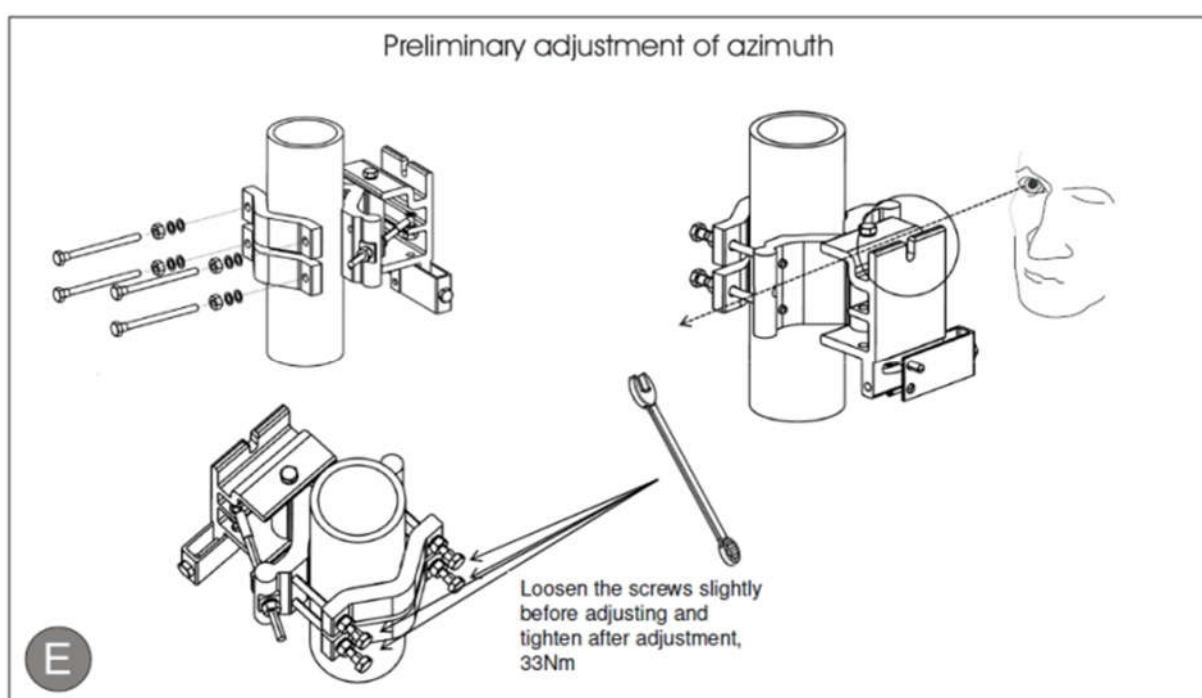


Figure 14: Preliminary azimuth adjustment

- preliminary azimuth adjustment.

3.4.2 Mounting the antenna kit for licensed frequency bands.

On the pictures below (Figure 19) you can see the individual steps for mounting the antenna kit to the parabolic antenna itself and subsequently its attachment to antenna mast mount.

Put together the antenna “Al bracket” with “Al mounting board”. Use three screws M13 and washers. Make sure that the four “hooks” from the clasp system are fixed at the corners of the “Al mounting board” first. Fix the waveguide adapter to the antenna flange with four screws M10 and washers. Adapter slot horizontal



Figure 15: Preparing the Al bracket and mounting board, right side mounting

(Figure 18) = vertical polarization and vice versa.

ATTENTION: PUT A SEALING O-RING BETWEEN THE ADAPTER AND THE ANTENNA FLANGE. DO NOT FORGET TO TEAR OFF THE PROTECTING FOIL ON ANTENNA WAVEGUIDE FIRST.

NOTE: WAVEGUIDE ADAPTER ENSURES COMPACT ATTACHMENT OF ODU TO THE PARABOLIC ANTENNA. IF YOU USE FLEXIBLE WAVEGUIDE INSTEAD OF MICROWAVE ADAPTER, THEN YOU CAN UTILISE A WIDE RANGE OF ANTENNAS FROM OTHER MANUFACTURERS.



Figure 16: Mounting the waveguide adapter

Mount the AL set (prepared in step 1) on the antenna flange with four screws M13 and washers (Figure 19).



Figure 17: Mounting AI set on parabolic antenna flange

Make sure that there is fastened the hanging screw M17 and washer in the upper hole on the antenna AI bracket (see this screw in Figure 19, top right corner) for hanging the parabolic antenna on the pre-installed mast mount. Make sure that the drain hole on the antenna faces downwards as shown in Figure 19.

3.5 Attaching the antenna to the mast mount.

On the picture below (Figure 20) you can see the final assembly of the parabolic antenna and the mast mount.

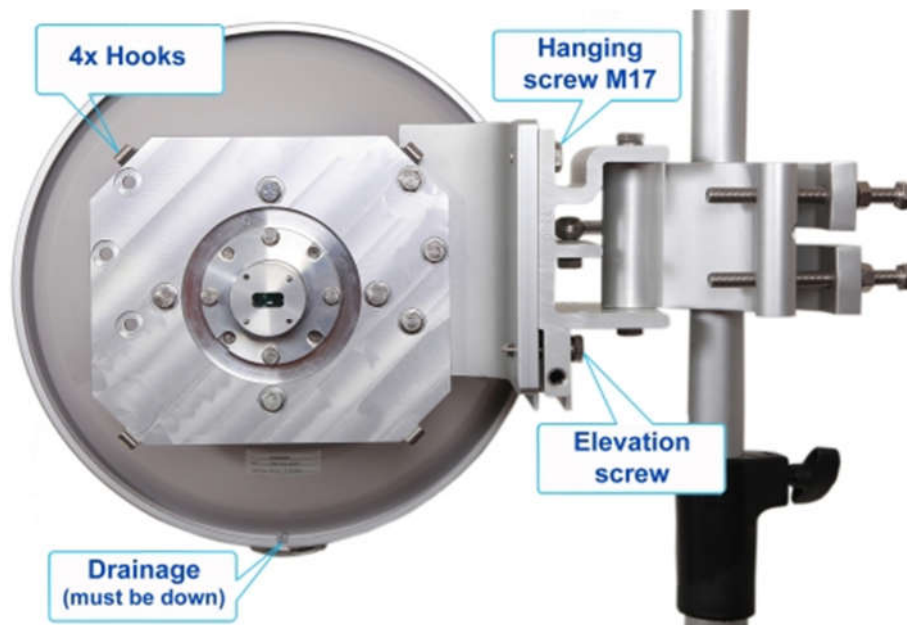


Figure 18: Final attaching of the parabolic antenna to the mast mount

3.6 ODU installation.

3.6.1 Setting the polarization.

The polarization depends only on the ODU position and relevant adapter rotation. There is an arrow symbol on the ODU case, that explicitly identifies the polarization. If the arrow points downwards or turning ODU by 180° upwards, it is vertical polarization. Horizontal polarization is turned by 90° relative to vertical polarization.

3.7 IDU installation.

The Compact IDU format was designed in accordance with mounting requirements for standard 19" rack cabinet so that it occupies the least possible height. The result is 1U height and ½ width of the standard 19" rack position. Therefore, you are able to put 2 IDUs alongside each other into 1 rack slot. Both the devices are then connected with a special "Dual IDU mount kit" (optional accessory). The depth of the unit's position towards 19" rack cabinet could be then changed just by shifting the brackets holding the IDUs in their slots.

ATTENTION: DO NOT FORGET TO GROUND THE INDOOR UNIT WITH THE GROUNDING SCREW LOCATED ON THE FRONT PANEL OF THE IDU TO THE RACK CABINET BY MEANS OF GROUNDING KIT (GROUNDING KIT IS INCLUDED IN THE STANDARD IDU DELIVERY PACKAGE).

3.8 Cabling installation.

3.8.1 IDU - ODU interconnection.

Low-loss coaxial cable with a specified impedance of 50 Ohm which is terminated on both sides with the N connectors serves for IDU and ODU units interconnection. One example could be the coaxial cable marked as BELDEN H 1000. The assumed length of cable in use between IDU and ODU is 200 m in maximum.

ATTENTION: IT IS NECESSARY TO CHECK THE CABLE IMPEDANCE OR EVEN BETTER TO MEASURE THE CABLE IMPEDANCE MATCHING BEFORE INTERCONNECTING THE ODU AND THE IDU WITH THE CABLE.

3.8.2 Connecting of management interfaces.

Use management Ethernet cable (included in standard IDU delivery) or management USB-B cable (not in standard IDU delivery).

After connecting the management Ethernet cable into the port LAN 3 on IDU front panel, it is possible to perform the primary configuration of microwave link and subsequently the management of the entire system.

Or connect the management USB cable (USB A – computer side / USB B – IDU side) into the port marked MNG / USB B (used primary for local management).

3.8.3 Connecting power supply.

The device is powered from a DC source -48 VDC where the positive pole is grounded. Before powering up the system do not forget to properly ground the ODU unit through the grounding screw to the antenna mast to which it is attached. Similarly, properly ground the IDU unit to the rack cabinet.

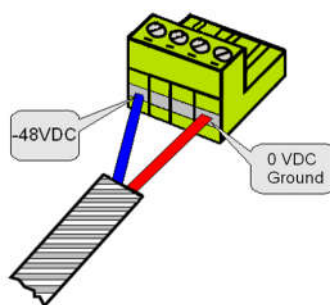


Figure 19: DC connector pinout for IDU

ATTENTION: PAY CLOSE ATTENTION TO THE CORRECT POWER SUPPLY PINOUT POLARITY. POWER SUPPLY POLE 0 VDC IS EVER INTERNALLY GROUNDED INSIDE IDU!

3.8.4 Grounding.

For reliable and safe function of the whole system a proper IDU and ODU grounding is necessary. Grounding cable for IDU is a standard part of accessories, which are packed together with IDU in shipping box. The grounding of ODU is provided by means of grounding screw (M8).

3.9 Powering up the system.

After careful checking of the coaxial cable installation (between IDU - ODU) and careful units grounding proceed to the IDU powering up. It is necessary to wait about 20 seconds before the IDU gets into normal operating state after its powering up. When the device is starting up watch the system status diodes POWER, SYNC, LOCAL STATUS, REMOTE STATUS and ODU STATUS.

3.9.1.1 Standard system LED behaviour during start-up process

- POWER LED should light after power up.
- All system LED should be off for a period of about 10 seconds after power up.
- All system LED should light for a period of about 4 seconds after previous state.
- All system LED should flash-up for a period of about 3 seconds after previous state.
- Normal LED function then indicates current system state. Following status of system LED indicates correct initial start-up.
 - POWER lights.
 - SYNC is off.
 - LOCAL STATUS is flashing-up.
 - ODU STATUS lights.

We can proceed to the initial link configuration and antennas alignment when the IDU starts up.

3.10 Preparing for link configuration.

For the initial configuration, use PC with Ethernet interface or with the USB port.

3.10.1 PC setup with LAN adapter.

In the case you are using management Ethernet cable for initial configuration you must first set your computer IP address from the range which corresponds to the default IDU factory setup. By default each IDU has from the factory the same IP address for ETH port (secondary IP address).

Default IDU ETH IP settings.

IP address 10.10.10.10, net-mask 255.255.255.0.

Therefore, it is necessary to set the PC address in the range of 10.10.10.1-254, except for the device own IP address (10.10.10.10). We recommend setting the computer as follows:

Computer LAN adapter settings. IP address 10.10.10.1, net-mask 255.255.255.0.
Follow with the next step described in the figure below for computer IP settings.

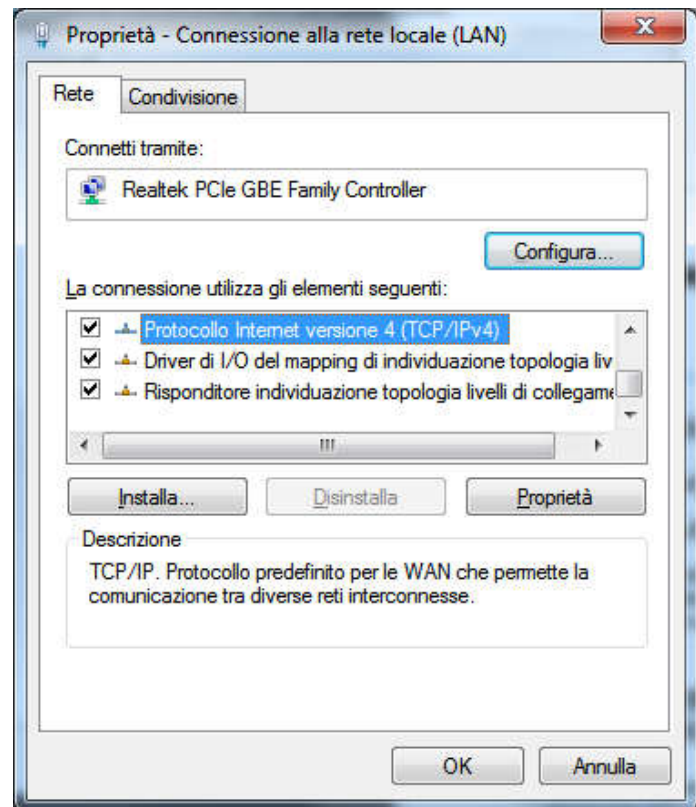


Figure 20: PC LAN setup – Internet protocol

3.10.2 PC setup with USB adapter.

In the case you are using management USB cable for initial configuration you must first install USB/IP driver on your computer with MS Windows OS (Linux based OS doesn't require additional driver installation).

Follow the steps described in paragraphs below:

- Connect the IDU to your computer (USB type A / USB type B cable is required).
- Wait for Windows driver installer prompt and select appropriate driver file (usb-gadget-eth.inf). Ask producer's representative for driver file before the installation process.
- Follow the instructions of your OS.
- After such installation the USB connection will be identified as an additional network adapter.



Figure 22: PC IP USB setup – USB network adapter

It necessary to assign correct IP address to your USB network adapter after proper driver installation. By default, each IDU has from the factory the same IP address for USB port (USB IP address).

3.10.2.1 Default IDU USB IP settings

IP address 10.10.11.10, net-mask 255.255.255.0.

Therefore, it is necessary to set the PC address in the range of 10.10.11.1 – 254, except for the device own IP address (10.10.11.10). We recommend to set the computer as follows:

3.10.2.2 Computer USB adapter settings

IP address 10.10.11.1, net-mask 255.255.255.0.

Follow the similar steps described for LAN adapter configuration above, just select USB adapter instead of LAN adapter.

3.10.3 Basic link set up.

It is necessary to proceed with the basic link settings only once the mechanical link installation is done so that you can align the antennas and test the connection functionality in a short test.

3.10.4 Login.

First of all, connect with the web browser to the local IDU (via Ethernet or USB cable) typing 10.10.10.10 or alternatively 10.10.11.10 address into the web address bar.

The IDU login window appears as in Figure 23. There you must insert:

Login "admin".

Password "secret".

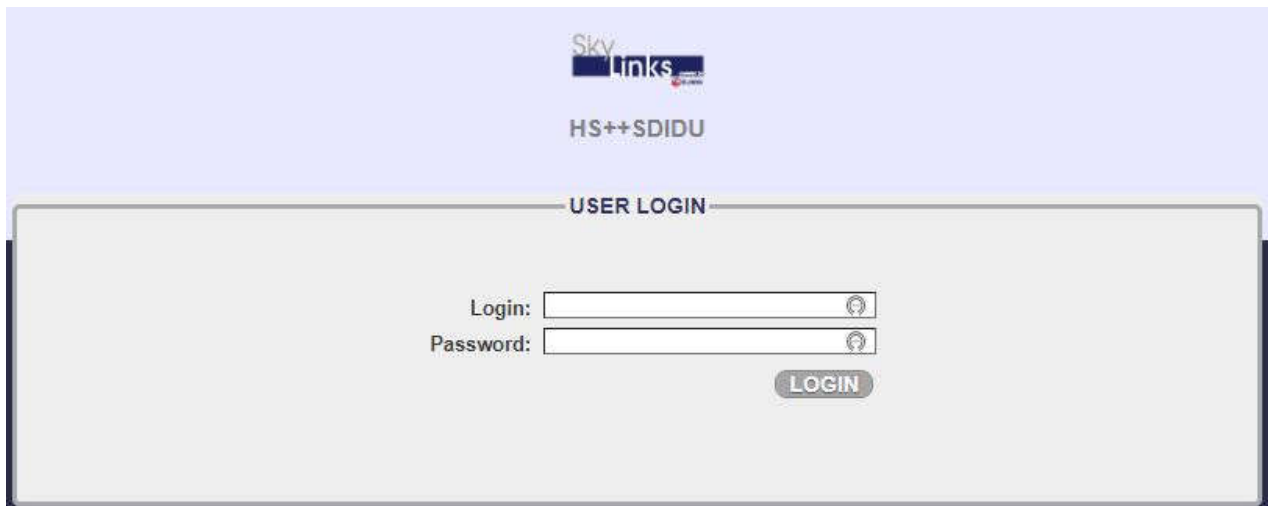


Figure 23: LOGIN window

3.10.5 IP setting.

MAIN ADDRESS SETTINGS		REQUIRED	CONFIGURED
Device IP / Mask		192.168.11.151 / 20	192.168.11.151/20
Default Gateway IP		192.168.0.254	192.168.0.254

OPTIONAL ADDRESS SETTINGS		REQUIRED	CONFIGURED
USB IP / Mask	☒ 10.10.11.10/24 ☐ 192.168.11.10/24		10.10.11.10/24
Fallback IP / Mask	☒ 10.10.10.10/24 ☐ 192.168.10.10/24		10.10.10.10/24

UNDO SAVE

Figure 24: IP address configuration – GUI page “IP / Address”

It is recommended to enter basic IP configuration of local and unit (IDU) at the very beginning. This step is necessary for proper communication between local and remote side and optionally for ensuring remote access to IDU devices from customer's network. In our example we use basic type of out-of-band management access (factory default configuration). Our examples suppose that remote IP access will be provided from the direction of first equipment. For this mode we have set following IP addresses:

For first link site:

- Device IP / Mask = 192.168.11.102/20.
- Default Gateway IP = 192.168.0.254.

For opposite link site

- Primary IP / Mask = 192.168.11.103/20.
- Default Gateway IP = 192.168.0.254.

Select in your web browser menu “IP / Address” (Figure 28). Enter the above assigned primary IP address / net-mask, default gateway IP address and IP address of remote IDU on both sites. Confirm entered values by pressing **SAVE** button.

NOTE: IT IS NECESSARY TO ASSIGN JUST CORRECT PRIMARY IP AND REMOTE UNIT IP ADDRESSES FOR INSTALLATION PURPOSES. INFORMATION FROM REMOTE UNITS CANNOT BE DISPLAYED WHEN

THIS STEP IS SKIPPED. NEXT IP SETTINGS CAN BE APPLIED DURING COMPLETE LINK CONFIGURATION.

For applying any IP configuration into the running system, it is necessary to subsequently confirm IP settings with pressing **IP Init** button in the upper/right side of the GUI. Without this confirmation just IP temporary file is changed, but IP changes aren't applied into the running system yet.



Figure 25: IP setting confirmation

3.10.6 Basic radio settings.

Further it is necessary to set the basic radio parameters which will be used for the final completion of the link installation. According to the Telecommunication Authority allocated parameters (Tx frequency, Tx power) and requested data throughput we set the microwave link into a functional configuration.

3.10.6.1 Equipment 1 configuration parameters - example

- TX Frequency [MHz] = 4420 set assigned Tx frequency for the High Sub band.
- Tx Power Limit [dBm] = 36 set the required maximum output power.
- ATPC Function = off turn off the ATPC (must be off during the installation).
- TX Mute Config = auto unmuted output power.
- Bandwidth = 28000_02 set the modulation to the most sensitive in assigned BW (28MHz in our case).
- Max Rx ACM Profile = 1024/weak set the modulation to the most sensitive in assigned BW (1024QAM FEC Weak in our case).

3.10.6.2 Equipment 2 configuration parameters - example

- TX Frequency [MHz] = 4732 set assigned Tx frequency for the Low Sub band.
- Tx Power Limit [dBm] = 35dBm set the required maximum output power.
- ATPC Function = off turn off the ATPC (must be off during the installation).
- TX Mute Config = auto unmuted output power.
- Bandwidth = 28000_02 set the modulation to the most sensitive in assigned BW (28MHz in our case).
- Max Rx ACM Profile = 1024/weak set the modulation to the most sensitive in assigned BW (1024QAM FEC Weak in our case).

Parameters		ACM		Advanced	
		LOCAL		REMOTE	
MODEM		CHANNEL 1	CHANNEL 2	CHANNEL 1	CHANNEL 2
Bandwidth		28000_02	28000_02	28000_02	28000_02
Max TxACM Profile		1024/weak	1024/weak	1024/weak	1024/weak
Max RxACM Profile		1024/weak	1024/weak	1024/weak	1024/weak
ACM Mode		auto p1		auto p1	
Advanced Setting		default	default	-	-
		LOCAL		REMOTE	
RADIO		CHANNEL 1	CHANNEL 2	CHANNEL 1	CHANNEL 2
T/R Spacing		fixed	fixed	fixed	fixed
TX Frequency [MHz]		4732	4732	4420	4420
RX Frequency [MHz]		4420	4420	4732	4732
TX Power Limit [dBm]		36	36	36	36
TX Mute Config		auto	auto	auto	auto
ATPC Function		☐	☐	☐	☐
ATPC RX Level [dBm]		-55	-55	-55	-55
REFRESH		UNDO		APPLY TO LOCAL & REMOTE	

Figure 26: Radio parameters setting – GUI page “Radio / Parameters”

Set all the other parameters as depicted in the Figure 30 and confirm them with **APPLY TO LOCAL** button. Then save this new configuration into start-up memory with the button **WRITE** at the top of GUI page. Configure the opposite side in the same way.

ATTENTION: DO NOT FORGET TO SAVE THE CONFIGURATION WITH WRITE BUTTON.

3.11 Antenna alignment.

Antenna alignment is performed with both terminals operating in normal weather conditions. Aligning the antenna is performed in both horizontal and vertical direction using a DC voltmeter. The highest is the measured voltage, the highest is the received signal level. The voltage level is measured directly on the output BNC connector (Figure 31) on the microwave ODU (RSSI – Received Signal Strength Indication). It is recommended to use an appropriate BNC reduction.

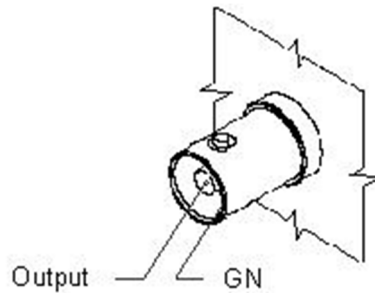


Figure 27: Pinout of RSSI connector on ODU

Typical **Received Signal Level Voltage** for licensed bands is described in Figure 32.

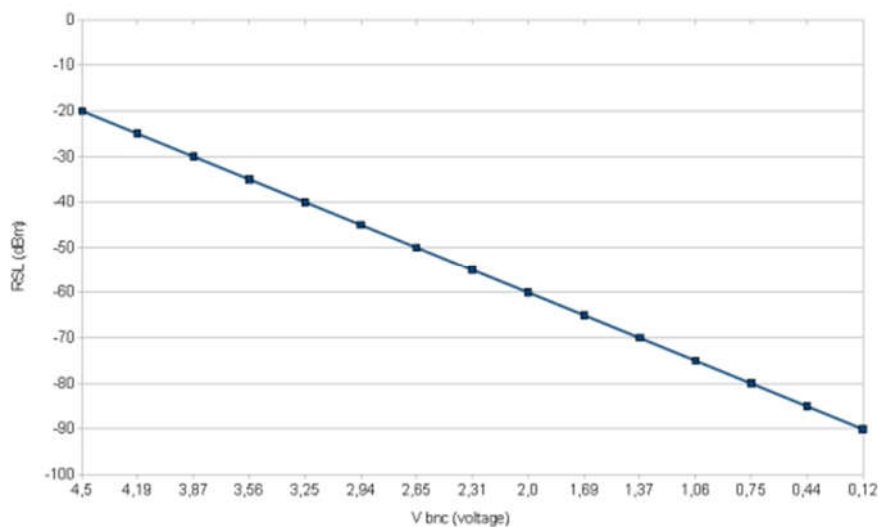


Figure 28: Curve of dependence RSL [dBm] on RSSI voltage [V]

Antenna alignment might be performed only in favourable weather conditions. Adverse weather conditions are to be considered e.g. the rain, fog, snow, smog, etc. when the value of the measured signal varies significantly, and so the measurement is very inaccurate!

The following figures (Figure 33-Figure 34) depict the final adjustment of the azimuth and the elevation of the parabolic antennas. It is necessary to tighten all screws after the final adjustment.

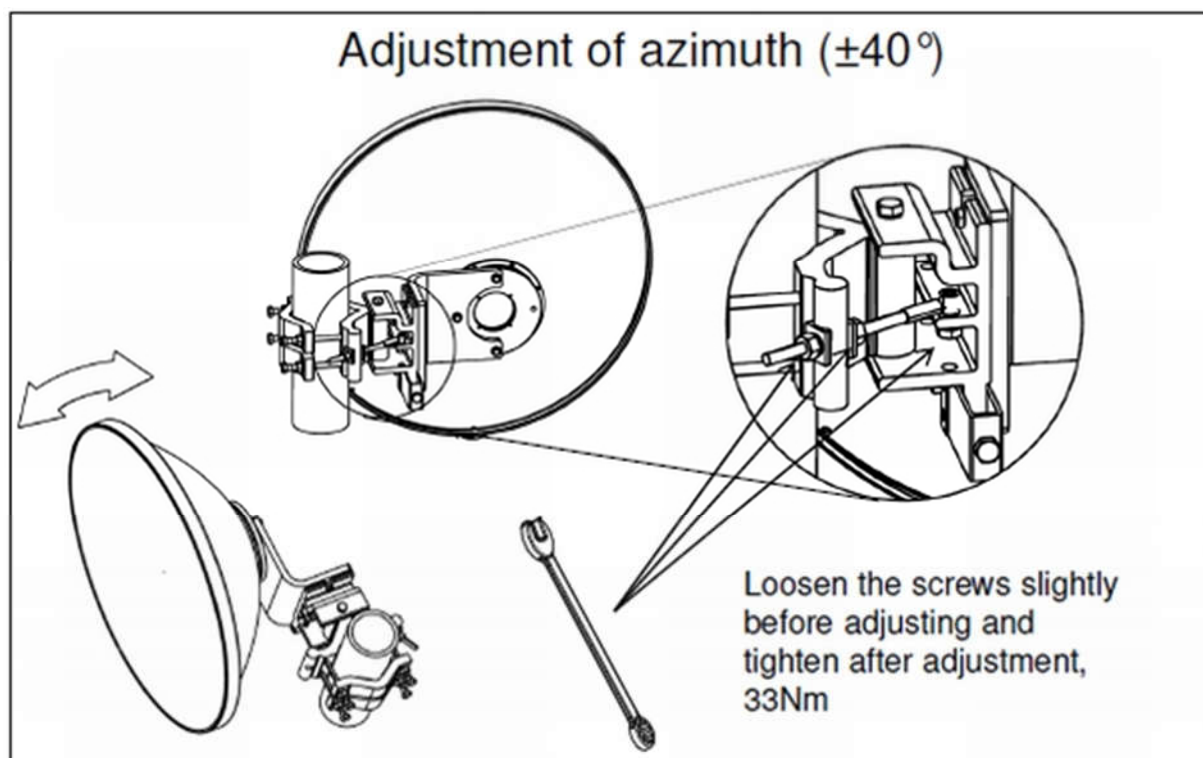


Figure 29: Final adjustment of the azimuth

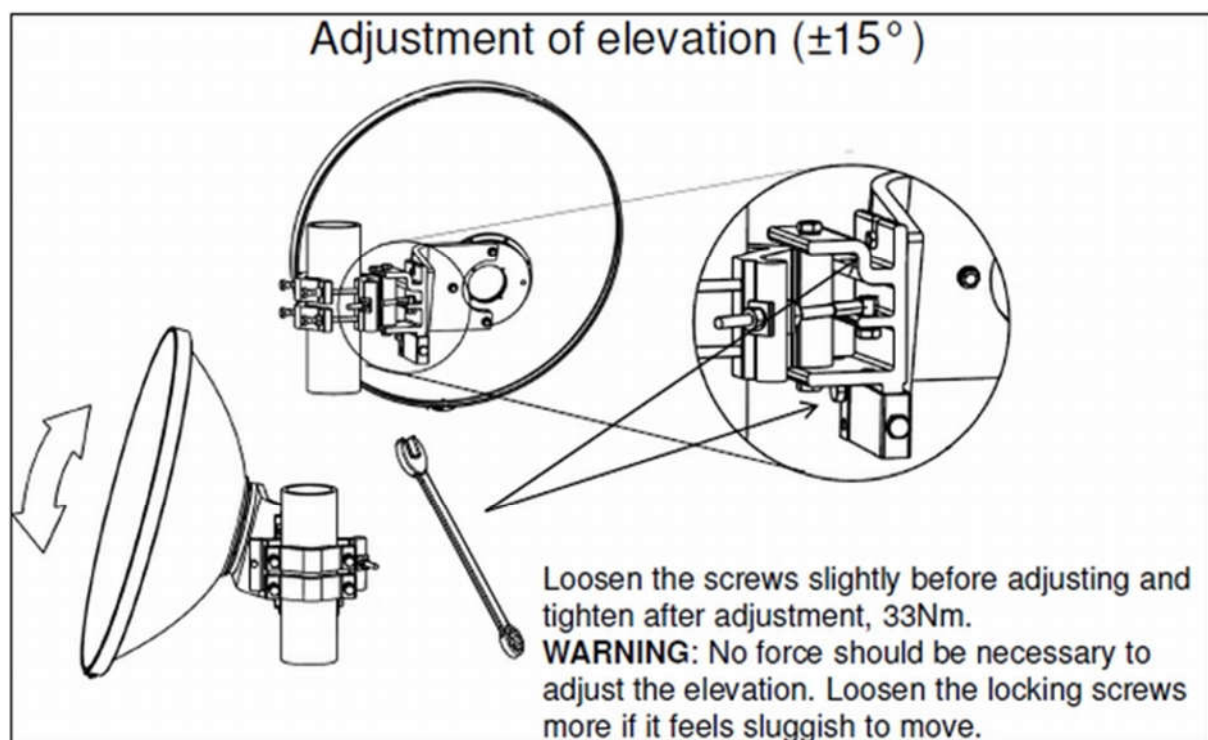


Figure 30: Final adjustment of the elevation

NOTE: WHEN ALIGNING THE ANTENNAS WATCH OUT FOR THE POSSIBILITY OF "FALSE" ALIGNMENT ON THE SIDE LOBES FROM REMOTE ANTENNA. IT IS IMPORTANT TO IDENTIFY MAIN ANTENNA LOBE, BY ROTATING THE ANTENNA TO HAVE THE MAXIMUM RSL VOLTAGE. THE VALUE OF RSL SHOULD ALWAYS CORRESPOND TO THE EXPECTED CALCULATED VALUE OF RECEIVED SIGNAL STRENGTH.

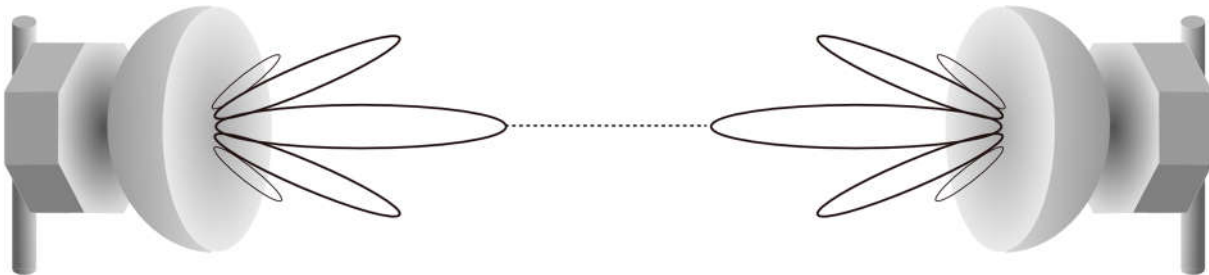


Figure 32: Good alignment

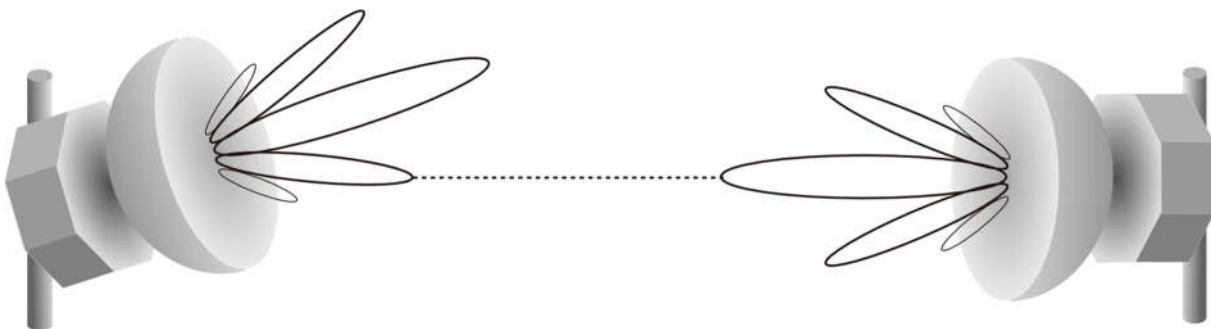


Figure 31: Bad alignment

3.12 The functional test.

Before connecting the user's ports and the link commissioning it is recommended to do a quick test of the basic device functions to verify proper microwave link installation and its error-free condition. For that, it is again necessary to connect your PC and check the basic radio parameters.

3.12.1 Obtaining the basic link information.

Connect your PC according to the procedure described above and use "General / Status" page for obtaining the required information (Figure 37).

Tx Power – The figure should have a value corresponding to the assignment from Telecommunication Authority.

Rx Level – The figure should be in the range of -35 to -60 dBm and should correspond to the expected level resulted from preliminary link calculation (tolerance + / - 3 dBm). Approximately the same value (+ / - 3 dBm) should be measured also on the opposite site as well.

MSE – Data should be in the range of -40 (better) to -20 dB (worse).

MSE parameter indicates quality of received signal. The MSE (mean square error) parameter refers to the average of the squared difference between the actual received symbols and the idealised points. The closer the points are in the state diagram the better. Displayed MSE value is normalised type of MSE parameter.

The values of MSE thresholds for each modulation is presented in the Technical Specification document.

The same evaluation needs to be done on the other terminal too. If the icon of the opposite terminal is not green (in the header of local terminal) it is not a problem now because it has not been made a final adjustment of all the microwave link parameters yet.

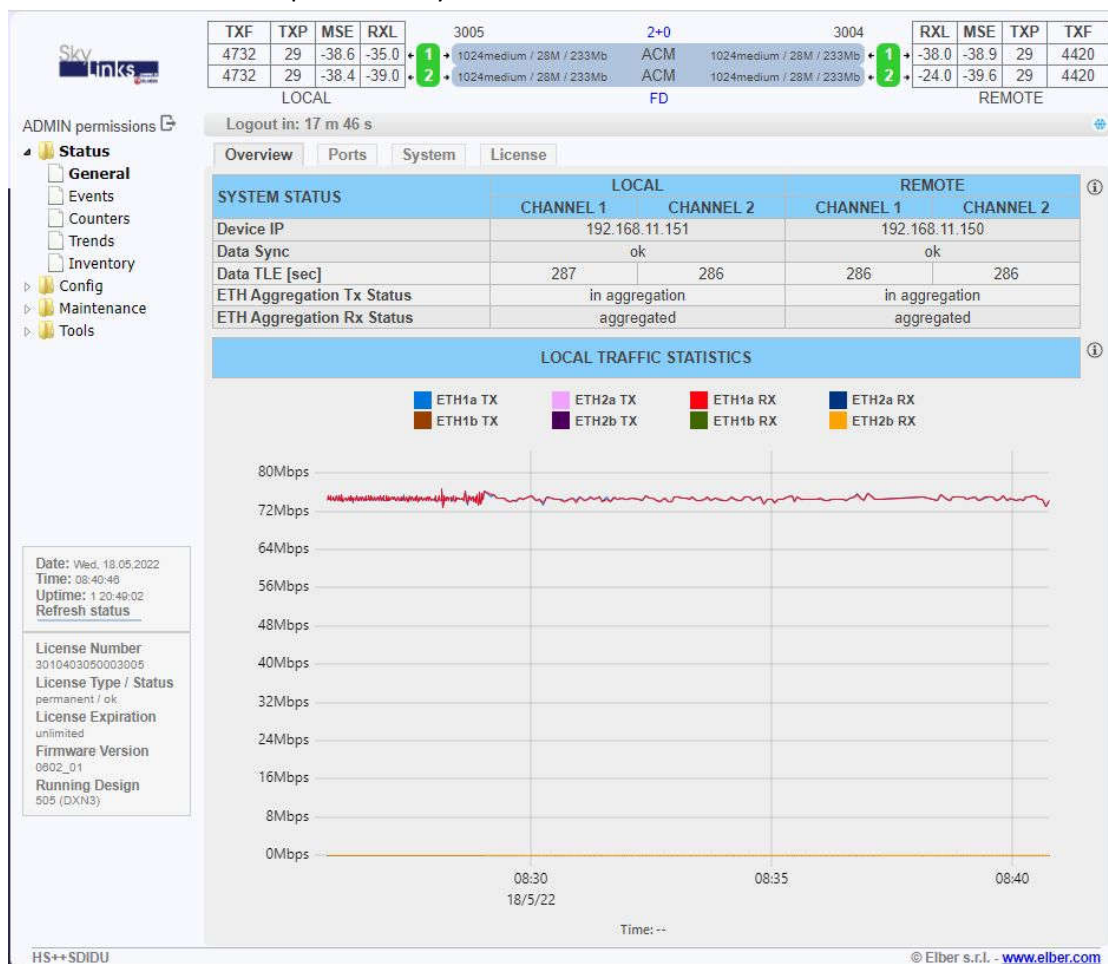


Figure 33: Main microwave link parameters – GUI page “General / Overview”

If the measured values do not match the above stated ranges, it will be necessary to do a detailed control of the link adjustment.

3.12.2 Five-minute link quality measurement (optional).

The next step is a five-minute measurement test of the microwave link. The real required modulation scheme should be configured.

When updated configuration is done and MSE level stands with expected level, press button **CLEAR ALL** on page “Status/Counters” and then see the link statistics after about 5 minutes.

The result is then depicted in the Figure 38 below. To perform this test there is no need to have any data connection into LAN ports.

Modem	Traffic	Management	EMM
MODEM COUNTERS			
FEC RX Blocks	3.34680e+6	3.34680e+6	
FEC Corrected Errors	64165	49808	
FEC Uncorrected Blocks	0	0	
FEC Uncorrected Blocks in Last Second	0	0	
FEC Global Rate since Clear	0	0	
FEC Actual Rate in Last second	0	0	
Uncorrected TLE [sec]	27	27	
Uncorrected TBE [sec]	0	0	
Uncorrected EFS [sec]	27	27	
Uncorrected ERS [sec]	0	0	
Consecutive ERS [sec]	0	0	
CLEAR CLEAR ALL			
INTEGRATED BACKGROUND BER COUNTERS			
Status	sync	sync	
Actual TX Speed [Mbps]	76.934	149.72	
TX Pattern	random	random	
RX Pattern	random	random	
RX Bit Count [bit]	2.03590e+9	3.68666e+9	
RX Error Count [bit]	0	0	
RX Sync Count	0	0	
BER	0.000000e+0	0.000000e+0	
TLE [sec]	27	27	
TBE [sec]	0	0	
EFS [sec]	27	27	
ERS [sec]	0	0	
CLEAR CLEAR ALL INSERT ERROR			

Figure 34: Basic radio link statistics – GUI page “Status / Counters”

RX Blocks – The number of correctly received air frames, large number.

Uncorrected Blocks – The number of frames which couldn't be corrected by FEC; the figure should be “0”.

Protected Bytes – Important just for protection mode, the figure should be “0”.

TLE – Time since last error; number of seconds from last error occurrence. It should correspond to the time since pressing the button **CLEAR** on the main page “Count/Basic” and it should be the same as EFS value.

TBE – Time between last two error events, the figure should be “0”.

EFS – Error free seconds; it should correspond to the time since pressing the button **CLEAR** on the page “Count/Basic”.

ERS – Error seconds; number of seconds during which the errors occurred; the figure should be “0”.

If test results are different compared to expected values, you must perform a detailed check of the microwave link installation. Similar results must be read out on the opposite terminal of the link as well or from column marked REMOTE.

3.13 Connection of external equipment.

Microwave system TORO+ is equipped with Gigabit Ethernet ports. At the same time, it is possible to insert the standard SFP modules into the free SFP slots which allow to connect external modules EMM or additional Gigabit Ethernet equipment's.

3.13.1 Connecting Gigabit Ethernet port.

Gigabit Ethernet 10/100/1000 Mbps port pinout is given in Figure 39. The user must make sure that all the four pairs of the cable according to required pinout are wired.

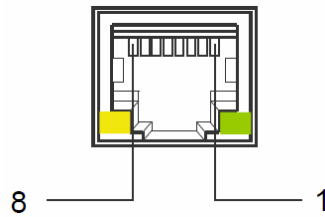


Figure 35: Gigabit Ethernet port pinout

Pin 1 - DA+, Pin 2 - DA-

Pin 3 - DB+, Pin 6 - DB-

Pin 4 - DC+, Pin 5 - DC-

Pin 6 - DD+, Pin 7 - DD-

ATTENTION: IT IS NECESSARY TO PREVENT ANY POSSIBLE ETHERNET LOOPS BEFORE CONNECTING THE ETHERNET CABLE TO THE GIGABIT ETHERNET PORTS. THEREFORE, CORRECT PORTS SETTING MUST BE CARRIED OUT BEFORE MORE THAN ONE ETHERNET CABLE IS INSERTED INTO IDU.

3.13.2 Connecting the external EMM module via port SFP 1.

Depending on the customer's application the number of IDU ports can be extended by means of specific external multiplexer module (EMM). The EMM-16E1T1 is mostly connected into the port SFP 1 of IDU by means of a Fiber Optic cable.

IDU and EMM module must be then equipped with SFP module for connecting the Fiber Optic cable.

The recommended SFP type is:

SIGNAMAX 065-79SXMG (www.signamax.com).

The SFP module should be inserted before IDU power-up but can be plugged also when system is under power. Appropriate Fiber Optic cable with LC connectors must be used for TORO+ and EMM interconnection (usually 0.5 m long cable is adequate).

After the installation of the microwave link itself it is necessary to carry out the complete set-up of all the required link parameters including IP management settings. It is recommended to write these parameters such as IP addresses, Tx frequency, Tx power, etc. in advance into a well-arranged table. Save this data list, in a case of a later replacement of a unit, previous configuration can be restored easily.

Further we will continue with description of the link set-up from a web interface. The link set-up using text commands is not part of this manual.

ATTENTION: DO NOT USE THE BROWSER FUNCTIONS "BACK" AND "PAGE REFRESH" DURING THE SET-UP OR FOR VIEW OF THE

PREVIOUS WINDOW. USE ONLY THE MAIN MENU AND SUBMENU FOLDERS AND GUI BUTTONS OF TORO+ DEVICE.

3.14 Connection and Login.

3.14.1 The local access over Ethernet LAN interface.

For the IDU set-up via a management LAN port (LAN 3 by default) there is only required a connection between PC and port LAN 3 on IDU front panel with the proper Ethernet cable.

3.14.2 The local access over USB-B interface.

For the IDU set-up via a USB port there is only required a connection between PC and USB-B port on IDU front panel with the proper USB cable.

3.14.3 LOGIN from the Web browser.

Before connecting the Ethernet management cable into the port LAN 3 or a USB management cable into port USB B at the IDU it is necessary to configure the computer's network connection.

The TORO+ comprises of the secondary IP address for access via LAN port, which is set by manufacturer to default value 10.10.10.10 with the network mask 255.255.255.0.

the USB IP address for access via USB port, which is set by manufacturer to default value 10.10.11.10 with the network mask 255.255.255.0.

After proper configuration of the computer's network connection a Web browser could be launched. Enter the secondary IP address of the TORO+, that is 10.10.10.10 into the address bar of the Web browser (example for connection over LAN 3 port). After entering this address, the login window appears.

The login into the device is active until the logout of the device is performed. Thus, it is not possible to configure the IDU from two terminals at the same time (only one terminal could be in the set-up mode at one moment). It means just one user with User or Administrator rights can be logged in.

There is an automatic timeout in the device – after period of 20 minutes from the last action (in the Web environment) any user is automatically logged out.

For the standard configuration we recommend to login in the USER mode. Administrator level is superior to the User level. When the Administrator tries to login the system and the User is already in the system, an alert window asks if the Administrator wants to logout the User, because there may be logged only one of them at one moment, see Figure 36.



Figure 36: Alert Window about already logged User

Chapter 4 - GUI Configuration

4.1 WEB GUI.

The WEB GUI interface is designed as a standalone web application which receives status updates from the device. This communication is asynchronous; thus, it may take a while until a change is reflected in the GUI. The refresh interval of information shown in the GUI is automatically calculated by the device depending on actual transmission speed between the WEB browser and the device. The minimum refresh interval is 2 seconds, the maximal then 30 seconds. The indication of the next refresh is shown in the Side Bar Information Frame.

4.1.1 Buttons & other setting elements

There are multiple buttons available across the GUI interface. Buttons have distinctive colors depending on the effect on the system: pressing a red button may cause immediate data drop or overwriting of essential parameters, pressing a gray button has not an effect, pressing a blue button alters the running configuration but such configuration needs to be stored by means of the WRITE button else it will not persist through device reboot, and finally a white button has only such effect as data refreshing, but such action does not alter the running or stored configuration. Most common button types used in the WEB GUI are:

Button	Function
	A help page for adjacent frame or parameter details.
	Shown in the status bar when there are unsaved changes on any device in the link. By this button, you update the startup configuration with current settings.
	Shown when modifying a value which is kept separately of the startup configuration, for example, IP settings or device name.
	Shown when there are pending changes in the IP settings. By pressing this button, the device performs a network interfaces reset. Note this action does not cause user data outage, but it disconnects all active management sessions (GUI, CLI, SNMP).
	Apply all changes.
	Shown only on pages which contain values which are not automatically refreshed. It pulls information from the device and renders it on the screen.

The color of configuration value entered in a setting box indicates the status of such value:

- **black** – unmodified value
- **blue** – modified but non-applied value
- **red** – entered value does not match the allowed range or is incorrectly set

Moreover, setting input boxes may change its border color to **red** if the entered value is not applicable, for example, invalid IP address or a character in an integer-type field. In such event, the Apply buttons are hidden until the problem is fixed.

4.1.2 Header & Status Bar

TXF	TXP	MSE	RXL		3005	2+0	3004		RXL	MSE	TXP	TXF
4732	29	-38.5	-35.0	1	1024medium / 28M / 233Mb	ACM	1024medium / 28M / 233Mb	1	-37.0	-39.1	29	4420
4732	muted	0.0	-40.0	2	0004strong / 28M / 43Mb	ACM	0004strong / 28M / 43Mb	2	-72.0	0.0	29	4420
LOCAL					XPIC				REMOTE			

Figure 37: Header

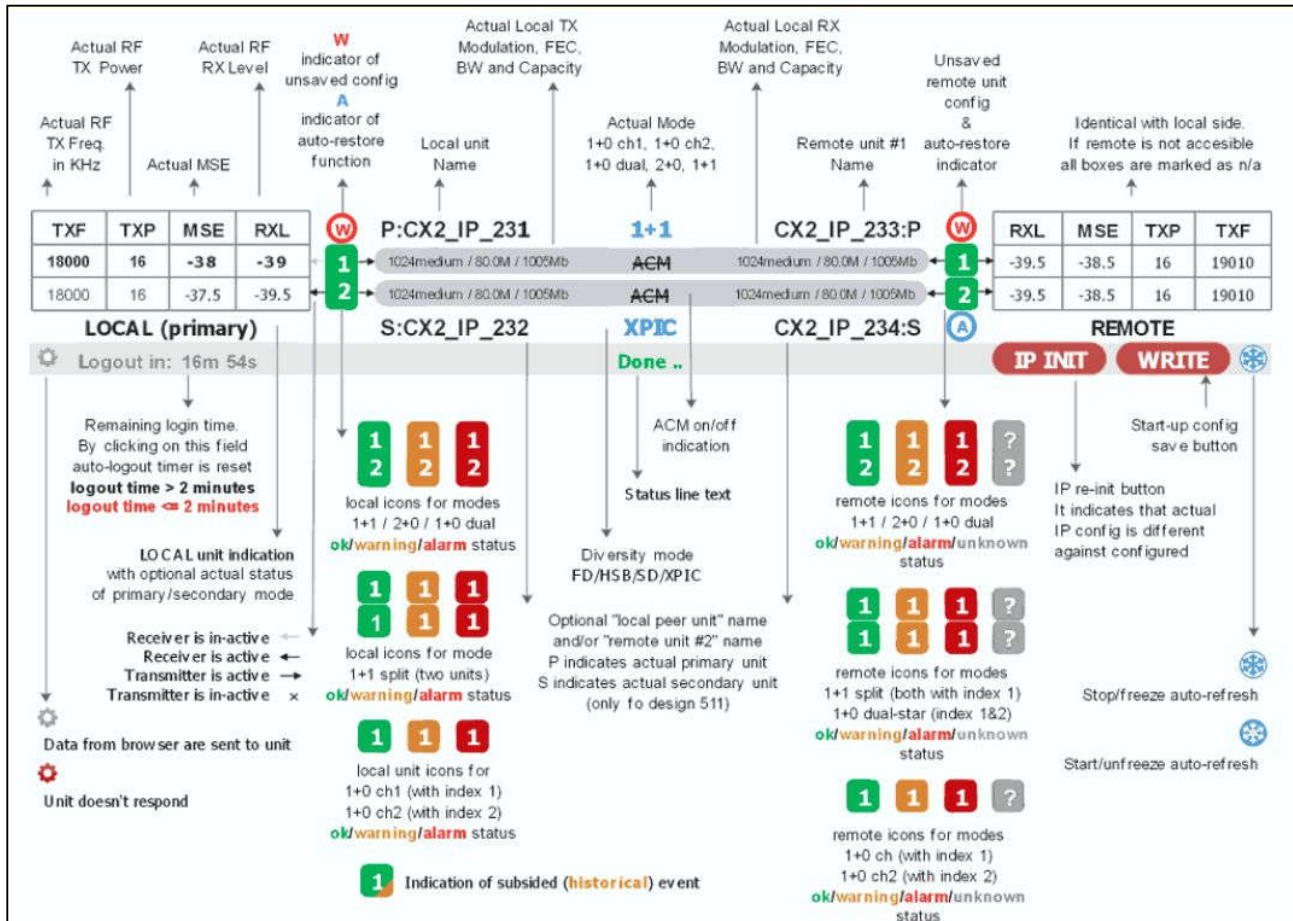


Figure 38: Header Legend

The header displays the actual link condition. The RF path diagram varies depending on the used *Design* and *Mode* setting. In the *Split 511/513 design*, the actual Local *Primary* unit is displayed and highlighted in the first header row, the Local *Secondary* on the second row. The physical RF units are always in the same row. The displayed speed is average maximal throughput in last second. Meaning of the used graphics is described in the picture above.

The status bar consists of various information, described from left to right:

Element	Function
	Indicates ongoing communication from the WEB GUI into the device.
Logout in: 19 m 30 s	Time until the actual session expires. You can reset this timer by Applying any settings or by clicking on the timer.
Response text	Confirmation or error response from the device shown after settings attempt.
	Shown when there are pending changes in the IP settings. By pressing this button, the device performs a network interfaces

	reset. Note this action do not cause user data outage, but it disconnects all active management sessions (GUI, CLI, SNMP)
	Shown in the status bar when there are unsaved changes on any device in the link. Using this button, you update the startup configuration with current settings.
	You can toggle freeze of the WEB GUI auto-refreshing using this button. This may be useful when you want to capture information before it is refreshed. Note such freeze do not pause the auto-logout timer.

4.1.3 Menu

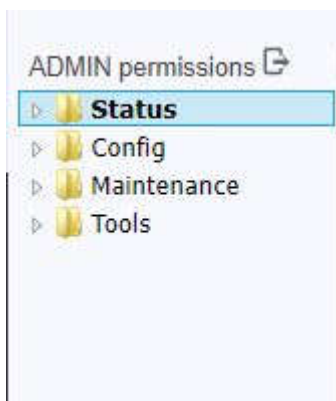


Figure 39: Menu

The main menu located on the left side allows user navigation between all major sections of the GUI. Above the menu, it is displayed the administrative role of the current login and the logout button. The user can expand the folder structure either by using the arrows on the left or using a double-clicking on the desired folder. The folder structure is sorted in such manner to allow successive configuration and monitoring:

- **Status** – Informational section designed for link performance monitoring.
- **Config** – Configuration section. The user should do configuration of all necessary parameters from top to bottom as some options may override consecutive settings, for example, the Design and Mode change invokes a preset load and changes page layout of the Ports and IP sections. It is highly recommended to save and reboot the device once the configuration is done.
- **Maintenance** – A device management section which houses tools for device configuration backups, FW/Licence upgrade, log files and troubleshooting sections, and reboot.
- **Tools** – Set of various tools for advanced debugging tasks such as Ping, Terminal, Constellation and Spectrum analysis.

4.1.4 Side Bar Information Frame



Figure 40: Side Bar Info Frame

The Side Bar located on the left GUI edge shows the summary of important device information:

- **Date** – System date.
- **Time** – System time.
- **Uptime** – Time since startup.
- **Refresh status** – Indicates the amount of time until next GUI refresh. The bar changes its color to **red** if the GUI auto-refresh is frozen by the freeze button.
- **Modem Serial Number** – Device Serial Number. It is shown only when differs from the *License Number*.
- **License Number** – The license number.
- **License Type / Status** – Shows if the license is permanent or time-limited and its status.
- **License Expiration** – Shows the remaining time until the license expires.
- **Firmware Version** – Version of the device firmware.
- **Running Design** – Active design type

4.2 Status/General/Overview



Figure 41: Overview of GUI window

4.2.1 SYSTEM STATUS

Overall system status:

- **Device IP** – IP addresses of devices in the link
- **Data Encryption** – encryption status
- **Data Sync** – modem synchronization status
 - ok / rx source – no protection alarms active/actual rx source
 - backup / rx source – protection alarms active, running from the backup line / actual rx source
 - data loss – no data passing through
 - ok – the correct status
 - noMSE – missing modulation signal
 - hiFEC – high Forward Error Correcting
 - noFO – missing interconnection with the peer
- **Data TLE** – time since last error occurrence
- **ETH Aggregation Tx Status** – possible values are:
 - in aggregation – aggregation active
 - to ch1/2 only – not aggregated, channel 1/2 only
- **ETH Aggregation Rx Status** – possible values are:
 - aggregated – aggregation active

- aggregated / not aligned – aggregation active but streams not aligned correctly
- from ch1/2 only – not aggregated, channel 1/2 only
- no data sync – not aggregated, no data sync

4.2.2 EMM STATUS

The status of attached EMM chain. Note this frame will be shown only when an EMM card is attached and enabled.

- **EMM Type** – the type of connected EMM card
- **EMM Status** – the current EMM status. Possible values are:
 - ok – EMM card operable
 - warning – EMM card has an active alarm
 - not connected – no EMM card detected on this position
 - offline – EMM card configured but not connected
 - bad type – EMM card configured as another type than actually connected
 - update FW – incompatible FW loaded in this card. Use the inbuilt FW wizard for upgrading

4.2.3 LOCAL TRAFFIC STATISTICS

An interactive graph depicting the link throughput since login

4.3 Status/General/Ports

Overview		Ports		System		License											
PORT STATUS		SFP 1		SFP 2		SFP 3		SFP 4		LAN 1		LAN 2		LAN 3			
Link Status		SFP Gbit FD		SFP module not present		SFP module not present		SFP module not present		LAN 100Mbit FULL		LAN 100Mbit FULL		LAN Gbit FULL			
Mode		force_x		auto_x		auto_x		auto_x		auto		auto		auto			
Flow Control		force on		force on		force on		force on		off		off		off			
VLAN Groups		---		---		---		---		grp1		grp2		grp3			
EMM UPLINK STATUS		EMM 1				EMM 2				EMM 3				EMM 4			
EMM SFP1/SFP2		ok / loss				-				-				-			
EMM PORT STATUS		P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16
EMM1	16E1T1	ok	loss	loss	loss	loss	loss	loss	loss	loss	loss	loss	loss	loss	loss	loss	loss
EMM2	none																
EMM3	none																
EMM4	none																

Figure 42: Status/General/Ports window

4.3.1 Port Status

This frame provides a summary status of all physical IO ports of the device.

- **Link Status** – status of a port as detected by the device (speed, duplex mode, link, administrative down status)
- **Mode** – actual port settings (speed/duplex, administrative down)
- **Flow Control** – actual duplex flow control mechanism settings
- **VLAN group** – actual port separation

You can change these setting on the *Config/Ports* page.

4.3.2 EMM Uplink Status.

Summary of all attached EMM cards

4.3.3 EMM port Status.

The detailed status of all ports of each attached EMM. For detailed description of all possible values, please refer to the *Config/Ports/EMM* page

4.4 Status/General/System.

Overview

Ports

System

License

MODEM UNIT STATUS		CHANNEL 1	CHANNEL 2
Fan Function [status/rpm]	auto-on / 6825		
Modem Unit Temperature [°C]	52		
Modem Analogue Board Temp [°C]	56.9		
IF RX Level @140 MHz [dBm]	-14.6	-15	
DC Power Supply for RF	on	on	
RF UNIT STATUS		CHANNEL 1	CHANNEL 2
Management Access	ok	ok	
Radio Unit Temperature [°C]	43.5	44	
RUNNING IP CONFIGURATION			
Device IP Address	192.168.11.151/20		
Fallback IP Address	10.10.10.10/24		
USB IP Address	10.10.11.10/24		
Default Gateway	192.168.0.254		
SNMP Daemon Status	not running		
NTP Server	ntp / 80.79.25.111		

Figure 43: Status/General/System Window

4.4.1 Modem Unit Status

This frame shows the system status of the modem.

- **Fan Function** – shows the actual ventilator configuration status and actual spinning speed
- **Modem Unit Temperature** – temperature of the modem part
- **IF RX Level @140 Mhz** – the IF signal strength detected on cable input of the modem part
- **DC Power Supply for RF** – the actual status of power supply for the radio part

4.4.2 RF Unit Status

The basic status details of the RF part(s).

- **Management Access** – status of telemetry communication between the device and radio part
- **Radio Unit Temperature** – temperature read from the radio part

4.4.3 Running IP Configuration

This frame contains information about running IP configuration.

- **Device IP Address** – the IP address of this device
- **Fallback IP Address** – the fallback IP address of this device
- **USB IP Address** – the fallback USB IP address of this device
- **Default Gateway** – the default gateway IP address of this device
- **SNMP Daemon Status** – the status of the inbuilt SNMP daemon

- **NTP Server** – the time synchronization server configuration

4.5 Status/General/License



Figure 44: Status/General/License window

This window displays the content and status of the currently used license with available modulation schemes and options as well as remaining license time when a time-limited license is in use.

By means of pressing the GENERATE LICENSE REQUEST, you can generate and download a License Request (licreq_SN_timestamp.afw) file which will be required for extending of time-limited License. It can be downloaded from Maintenance/Files/Exports window

4.6 Status/Events.

Actual Historical All				
ALL EVENTS				
ID	Time	Type	Status	Descr.
0.00	May 18 2022 09:54:31.54	Info	Validation	ALARMS VALIDATED
0.19	May 18 2022 09:49:06.97	Minor	OK	Modem1 Frame Error Rate OK, 0 ended after 00:00:05
0.19	May 18 2022 09:49:01.90	Minor	Alarm	Modem1 Frame Error Rate 297, over threshold 10
0.18	May 18 2022 09:48:59.97	Minor	OK	Modem1 Data Sync OK ended after 00:01:05
0.13	May 18 2022 09:48:59.97	Minor	OK	Radio1 Rx Level OK, -34dBm ended after 00:01:03
0.11	May 18 2022 09:48:59.96	Minor	OK	Modem1 MSE OK, -38.6dB ended after 00:01:05
0.13	May 18 2022 09:47:56.93	Minor	Alarm	Radio1 Low Rx Level -75dBm, outside range -65 ... -5
0.08	May 18 2022 09:47:55.82	Major	OK	Modem1 IF Cable Level OK -18.2dBm ended after 00:00:01
0.18	May 18 2022 09:47:54.81	Minor	Alarm	Modem1 Data Sync Loss
0.11	May 18 2022 09:47:54.80	Minor	Alarm	Modem1 MSE 0dB, outside range -50 ... -24
0.08	May 18 2022 09:47:54.79	Major	Alarm	Modem1 IF Cable Level -18.1dBm, not AGC lock
0.00	May 18 2022 09:37:54.73	Info	Validation	ALARMS VALIDATED
0.16	May 18 2022 09:33:53.28	Major	OK	Radio1 HW Alarm OK ended after 00:00:00
0.16	May 18 2022 09:33:52.33	Major	Alarm	Radio1 HW Alarm (LockIF-Tx, LockIF-Rx)
0.19	May 18 2022 09:33:35.24	Minor	OK	Modem1 Frame Error Rate OK, 0 ended after 00:00:04
0.14	May 18 2022 09:33:31.34	Minor	OK	Radio1 Transmitter OK ended after 00:00:07
0.19	May 18 2022 09:33:30.41	Minor	Alarm	Modem1 Frame Error Rate 180, over threshold 10
0.13	May 18 2022 09:33:30.41	Minor	OK	Radio1 Rx Level OK, -37dBm ended after 00:00:06
0.18	May 18 2022 09:33:28.24	Minor	OK	Modem1 Data Sync OK ended after 00:00:06
0.11	May 18 2022 09:33:28.23	Minor	OK	Modem1 MSE OK, -39dB ended after 00:00:06
0.19	May 18 2022 09:33:24.29	Minor	OK	Modem1 Frame Error Rate OK, 0 ended after 00:00:07
0.17	May 18 2022 09:33:24.28	Major	OK	Radio1 Communication OK ended after 00:00:03
0.14	May 18 2022 09:33:24.28	Minor	Alarm	Radio1 Transmitter Muted
0.13	May 18 2022 09:33:24.28	Minor	Alarm	Radio1 Low Rx Level 0dBm, outside range -65 ... -5
0.18	May 18 2022 09:33:22.23	Minor	Alarm	Modem1 Data Sync Loss
0.11	May 18 2022 09:33:22.22	Minor	Alarm	Modem1 MSE 0dB, outside range -50 ... -24
REFRESH				

Figure 45: Status/Events/All window

This frame contains information about current and historical alarm events. The displayed content can be selected by means of these selectors:

- **Actual** – The list of alarms which are active at the particular moment. Under standard circumstances should be empty.
- **Historical** – The same as above for alarms which occurred in the past but which are no longer active. Moreover, an extra button ALARM HISTORY VALIDATION will be shown. By pressing this button, you are letting the unit know that you reviewed such historical alarm so the status of the device will be evaluated only from alarms which occurred after the manual validation.
- **All** – The conjunction of both Actual and Historical alarms.

4.7 Status/Counters/Modem

Modem	Traffic	Management	EMM
MODEM COUNTERS			
	CHANNEL 1	CHANNEL 2	①
FEC RX Blocks	3.34680e+6	3.34680e+6	
FEC Corrected Errors	64165	49808	
FEC Uncorrected Blocks	0	0	
FEC Uncorrected Blocks in Last Second	0	0	
FEC Global Rate since Clear	0	0	
FEC Actual Rate in Last second	0	0	
Uncorrected TLE [sec]	27	27	
Uncorrected TBE [sec]	0	0	
Uncorrected EFS [sec]	27	27	
Uncorrected ERS [sec]	0	0	
Consecutive ERS [sec]	0	0	
CLEAR CLEAR ALL			
INTEGRATED BACKGROUND BER COUNTERS			
	CHANNEL 1	CHANNEL 2	①
Status	sync	sync	
Actual TX Speed [Mbps]	76.934	149.72	
TX Pattern	random	random	
RX Pattern	random	random	
RX Bit Count [bit]	2.03590e+9	3.68666e+9	
RX Error Count [bit]	0	0	
RX Sync Count	0	0	
BER	0.000000e+0	0.000000e+0	
TLE [sec]	27	27	
TBE [sec]	0	0	
EFS [sec]	27	27	
ERS [sec]	0	0	
CLEAR CLEAR ALL INSERT ERROR			

Figure 46: Status/Counters/Modem window

4.7.1 Modem Counters.

Basic counters frame

- **FEC RX Blocks** – the overall number of received Reed Solomon blocks
- **FEC Corrected Errors** – the number of errors which were repaired by FEC (Forward Error Correction)
- **FEC Uncorrected Blocks** – the number of Reed Solomon blocks which could not be repaired by FEC. This number represents a fragment of the FEC RX Blocks
- **FEC Uncorrected Blocks in Last Second** – the number of air-frames which could not be repaired during the last second
- **FEC Global Rate** – the ratio of FEC Uncorrected Errors / FEC RX Blocks
- **FEC Actual Rate** – same as above but for latest second only
- **Uncorrected TLE** – time since last error; a number of seconds from the last error occurrence. It should correspond to the time since pressing the CLEAR button
- **Uncorrected TBE** – time between last two error events
- **Uncorrected EFS** – error free seconds; it should correspond to time since pressing the CLEAR button
- **Uncorrected ERS** – error seconds; the number of seconds during which errors occurred
- **Consecutive ERS** – consecutive error seconds; the number of successive seconds during which errors occurred. When the AUTO-RESTORE CONFIGURATION is enabled, it will automatically reload the startup configuration when this counter reaches 600 seconds. Every error-free second resets this counter.

Note, to prevent outage on working channels, all operating channels need to reach this threshold before the auto-restore is executed.

By pressing the CLEAR button, the values of counters will be erased. By pressing the CLEAR ALL button, the values of counters on all Counter pages will be erased.

4.7.2 *Error Rate of Integrated Background BER.*

Built-in Bit Error Rate counters frame. Please note that only unassigned capacity will be used for BER tester (See *Config/Ports/MUX* page).

- **Status** – BER tester synchronization status (sync|nosync) or n/a when there is no active link to the remote side or free capacity left for the BER tester
- **Actual TX Speed** – shows reserved transmission speed for BER tester. This value roughly equals to half of the unassigned capacity which is used for the BER tester
- **TX Pattern** – shows transmission pattern for BER tester frames
- **RX Pattern** – shows receiving pattern of BER tester frames
- **RX Bit Count** – shows number of received bits (BER)
- **RX Error Count** – shows number of received error bits (BER)
- **RX Sync Count** – number of synchronizations of the BER tester
- **BER** – ratio of Rx Bit Count and Rx Err Count
- **TLE** – time since last BER error; a number of seconds from the last error occurrence. It should correspond to time since pressing the CLEAR button
- **TBE** – time between the last two BER error events
- **EFS** – error free seconds of the BER tester; it should correspond to time since pressing the CLEAR button
- **ERS** – error seconds; number of seconds during which a BER error occurred

By pressing the CLEAR button, the values of counters will be erased. By pressing the CLEAR ALL button, the values of counters on all Counter pages will be erased.

By pressing the INSERT ERROR BUTTON, one error will be inserted into data stream of both modems.

4.8 Status/Counters/Traffic.

Modem

Traffic

Management

EMM

LAN COUNTERS

ETH SWITCH

LAN1

LAN2

LAN3

MNG

WAN A

WAN B

In_GoodOctLo

93440836

93476208

42841

39529

93801438

93831852

In_GoodOctHi

0

0

0

0

0

0

In_BadOctets

0

0

0

0

0

0

Out_FCSerr

0

0

0

0

0

0

In_Unicast

1262807

1263245

20

34

1267641

1268049

Out_Deffered

0

0

0

0

0

0

In_Broadcast

0

0

118

0

0

0

In_Multicast

0

0

112

0

0

0

InOut_64OcFrm

0

0

119

119

0

0

InOut_65to127OcFrm

2524416

2525328

60

61

2534066

2534897

InOut_128to255OcFrm

0

0

39

39

0

0

InOut_256to511OcFrm

0

0

16

16

0

0

InOut_512to1023OcFrm

0

0

25

25

0

0

InOut_1024toMaxOcFrm

0

0

25

25

0

0

Out_OctetsLo

93458374

93491970

39529

42937

462853696

93846060

Out_OctetsHi

0

0

0

0

0

0

Out_Unicasts

1262978

1263881

34

20

1267806

1268235

Out_Excessive

0

0

0

0

0

0

Out_Multicast

0

0

0

112

0

0

Out_Broadcast

0

0

0

119

0

0

Out_Single

0

0

0

0

0

0

Out_PauseGo

0

0

0

0

0

0

In_PauseGo

0

0

0

0

0

0

Out_Multiple

0

0

0

0

0

0

In_Undersize

0

0

0

0

0

0

In_Fragments

0

0

0

0

0

0

In_Oversize

0

0

0

0

0

0

In_Jabber

0

0

0

0

0

0

In_RxErr

0

0

0

0

0

0

In_FCSerr

0

0

0

0

0

0

Out_Collision

0

0

0

0

0

0

Out_Late

0

0

0

0

0

0

In_Discards

0

0

0

0

0

0

InOut_Filtered

0

0

0

0

0

0

PACKET MUX COUNTERS

PBPM PORTS

ETH1a

ETH2a

ETH1b

ETH2b

EMM ch1

TX Frames

1263191

0

1263107

0

--

RX Frames

1263172

0

1263097

0

--

TX Discarded

0

0

0

0

--

Flow Control

0

0

0

0

--

Aggr Align loss

0

0

0

0

--

TX Bytes/s

9317932

0

9317277

0

270540

RX Bytes/s

9317858

0

9317332

0

270405

PBPM MODEM

GPM1

GPM2

RX Bytes

291998548

287728171

TX Bytes

291998668

293476935

RX CRC Errors

0

0

RX Sync

0

1

CLEAR

CLEAR ALL

Figure 47: Status/Counters/Traffic Window

This page provides a detailed overview of data frames flow. The frame consists of the LAN COUNTERS which are captured by the device's switch and the FPGA COUNTERS which are captured by the modem.

By pressing the CLEAR button, the values of counters will be erased. By pressing the CLEAR ALL button, the values of counters on all Counter pages will be erased.

4.9 Status/Counters/Management.

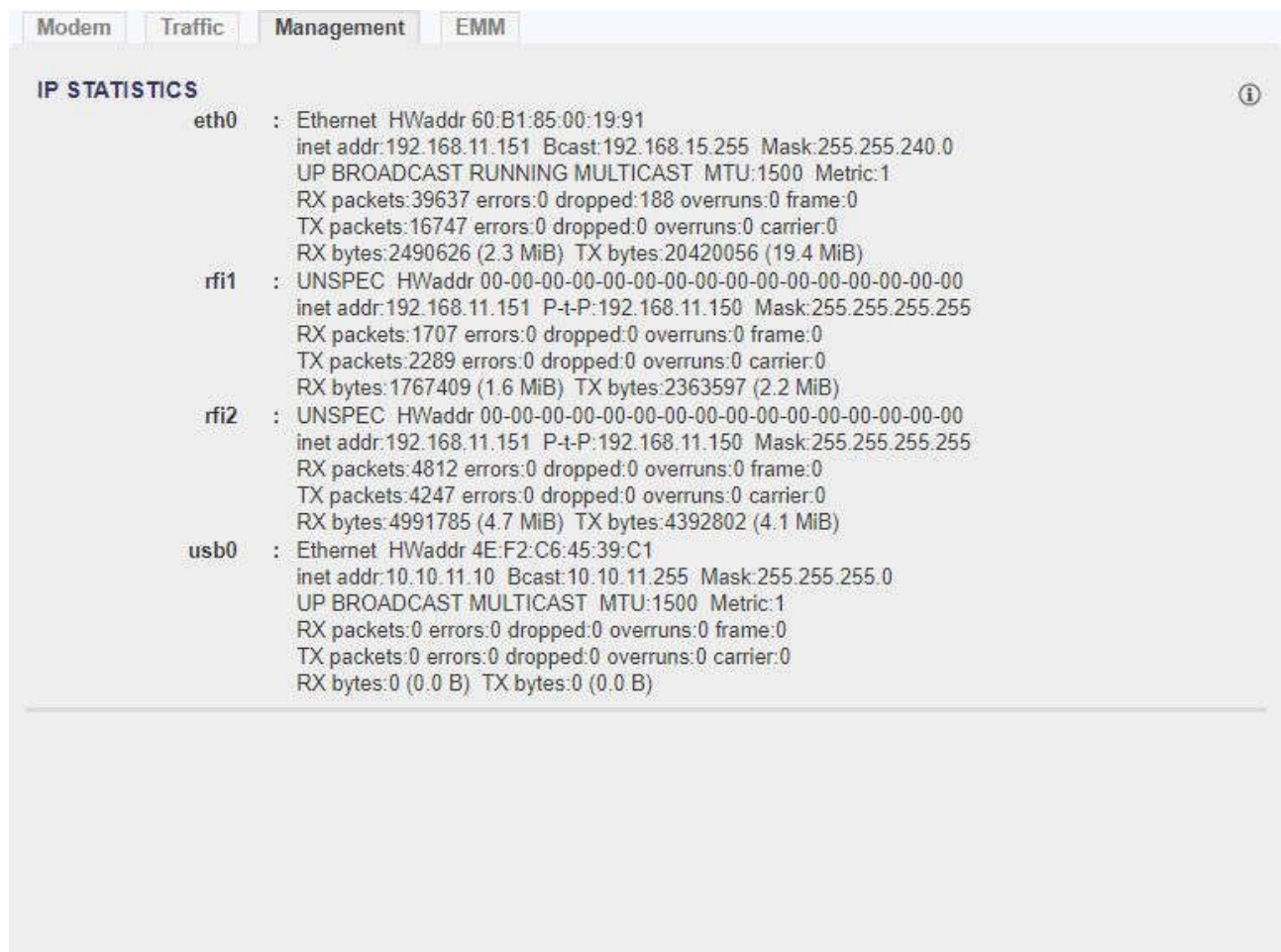


Figure 48: Status/Counters/Management window

This frame provides IP statistics of device's interfaces:

- **eth0** – Ethernet port of MNG CPU with its own MAC address and all the standard features of Ethernet interface. Device/Fallback addresses and appropriate subnet masks are assigned to this interface.
- **Rfi1/2** – ppp (point-to-point protocol) type of interface which interconnects local MNG CPU with the remote side MNG CPU accessible through the separate channel inside air-frame
- **usb0** – an onboard service USB port which is dedicated to local service IP access

4.10 Status/Counters/EMM.

Modem

Traffic

Management

EMM

EMM CARD #1		EMM DEBUG BER COUNTERS	
EMM Type		4ASI	
Signal Direction		Debug BER unsupported by this EMM card	

No supported EMM card connected

ASI EMM BER counters. Please note some rows may not be available due to current settings or used EMM HW revision.

- **EMM Type** – the type of the connected EMM card
- **BER Signal Direction** – Rx or Tx BER direction column
- **Tested Channel** – channel number on which is the BER enabled
- **Status** – the current BER status. It could have these values:
 - **sync** – the port is receiving a BER signal
 - **nsync** – no BER signal detected
 - **transmitting** – the port is transmitting a BER signal
 - **idle** – the received signal is homologous. It is usually indication of an error
- **TX Speed** – the current Tx/Rx speed of the BER tester
- **TX/RX Bit Count** – the overall BER tester bit count. It has to be errased manually
- **RX Error Count** – the number of detected errors in the receiving BER stream
- **RX Sync Count** – the number of re-sync events during the BER test
- **BER** – the actual Bit-Error-Ratio (BER)

4.11 Status/Trends/Actual.

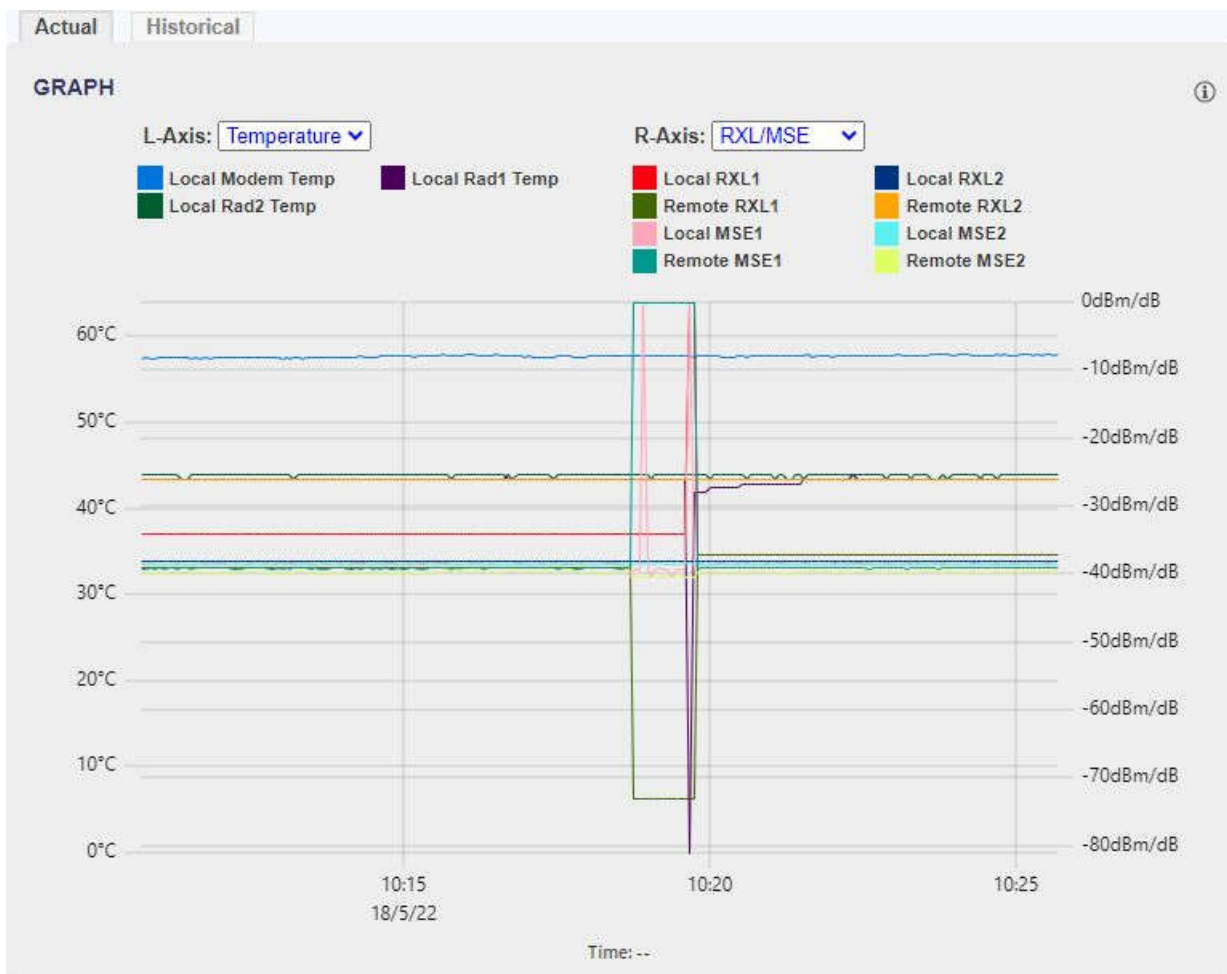


Figure 49: Status/Trends/Actual Window

The graph displays the selected values in dependence on time. If the connection with remote is established, the values from the remote unit are also displayed. This graph is dynamic and thus updated with newest values with each GUI auto-refresh. You can decrease the pooling period to 1/2 of normal refresh interval by means of the FASTER REFRESH button. Please note that it can take up to several seconds before the faster refresh is activated. Also, note that every such refresh will cause zoom reset. The normal refresh interval is computed dynamically from server response time. The actual interval is displayed in the browser console. For depiction it is possible to choose from following options:

- **TX Power** – depicts the transmitted level of signal output
- **RXL/MSE** – received level of the signal output/quality of the received signal
- **Temperature** – displays the temperature of modem and radio

Please note that resolution of the displayed data will be lower for older records and higher for the newest. This time segmentation is 10 minutes, 1 minute and 1 second

4.12 Status/Trends/Historical

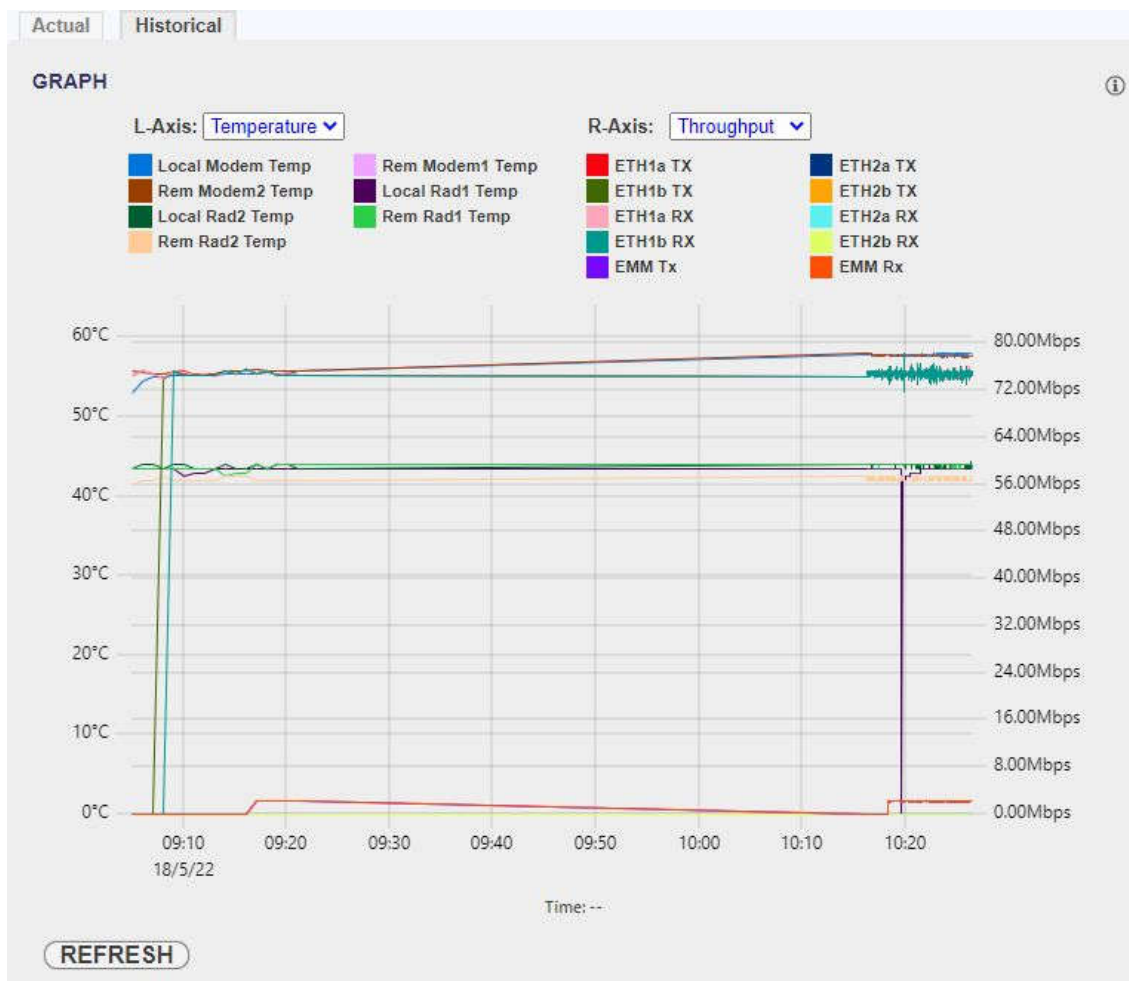


Figure 50: Status/Trends/Historical window

The graph displays the selected values in dependence on time. If the connection with remote is established, the values from the remote unit are also displayed.

For depiction it is possible to choose from following options:

- **TX Power** – depicts the transmitted level of signal output
- **RXL/MSE** – received level of the signal output/quality of the received signal
- **Temperature** – displays the temperature of modem and radio
- **ETH_Count** – displays the transmission capacity for transmission and admission on the selected ports of the device
- **Sync/QAM** – value MLOCK = 1 displays modem synchronization, value MLOCK = 0 shows that there was no synchronization. If ACM is active, the most appropriate modulation for signal transmission or admission is found. Individual modulations are indicated by their amount of states

Please note that resolution of the displayed data will be lower for older records and higher for the newest. This time segmentation is 10 minutes, 1 minute and 1 second.

4.13 Status/Inventory.

Inventory

SYSTEM INFO		MODEM UNIT	RF UNIT 1	RF UNIT 2	①
Serial Number	3010403050003005		51136-136.01E050324	51136-136.01E050000	
Product Number	HS++SDIDU		TX06-RX0101	TX06-RX0101	
Product Code	3010403-0500				
Board ID	CX2-ABN01				
FW Base	0602_01		51104-00103-01	51104-00103-01	
HW Base	12AT20505_003EE_998				
OS Kernel	0205				
Product Info 1	HS++LINK/SM				
Product Info 2	Indoor Unit				
Product Info 3	GigabitETH				

EMM INFO		EMM#1	EMM#2	EMM#3	EMM#4	①
Serial Number	3020101010300165		n/c	n/c	n/c	
Product Number	EMM-16E1T1		n/c	n/c	n/c	
Product Code	15-3020101-0103		n/c	n/c	n/c	
FW Base	01_02		n/c	n/c	n/c	
HW Base	12AT20481_04_03(user)		n/c	n/c	n/c	

Figure 51: Status/Inventory window

4.13.1 System Info.

This frame shows the device information as well as radio part information

4.13.2 EMM Info.

This frame shows the EMM inventory information

4.14 Config/System/Mode.

Logout in: 19 m 35 s

Mode	Description	Date&Time	Advanced
DESIGN CONFIGURATION			
LOCAL (primary)		ACTION	
Design Type	Design 511	APPLY	
DESIGN MODES			
LOCAL (primary)		ACTION	
Functional Mode	2+2 Split	APPLY	
Link Protection Diversity	HSB/SD - Hot standby	FO peer connected - it's role will be set automatically.	
Link Aggregation Diversity	FD		
Device Start-up Role	Auto secondary		
Pri-Sec LAN Interconnection	Off (default)	APPLY	
Running Role Swapping	swap device role (primary/secondary)		APPLY
RADIO MODES			
CHANNEL 1		CHANNEL 2	
Duplex Mode	Bidirectional	Bidirectional	APPLY
ACM MODE			
LOCAL (primary)		ACTION	
ACM Profile Table	p1_005_01		
ACM Control	Automatic advanced	APPLY	
REFRESH		UNDO	

Figure 52: Config/System/Mode window

4.14.1 Design Configuration.

Depending on the content of the license file, the user can select specific Design Type which completely changes the system function. At the moment there are two designs available:

- **Design 505** – A single mount device on each side of the link. Available modes are 1+0 (ch1, ch2, dual FD and dual XPIC), 1+1 (FD, HSB/SD, SD, XPIC) and 2+0 (FD, XPIC). This design supports AES encryption if licensed.
- **Design 511** – Two or more devices on each side of the link.
This design type should be selected for applications where modem HW protection is required. Two or more interconnected IDUs are used on each side of a link in this configuration, serving fallback. Please note that the AES encryption is not available in this design.
- **Design 513** – This design is designed for the one-channel modem version. It supports AES encryption

Important notes:

The design change will load a configuration preset for given design. That means the device should be re-configured by the user after such change accordingly. It is recommended to reboot the device after such re-configuration.

The link to the remote side will be lost. Please ensure you have local access to all devices before such change. The remote device has to be configured accordingly by the user.

4.14.2 Design Modes.

Selection of the desired mode. The content of this menu depends on available system modes defined in the device license.

Please note that it is recommended to save the configuration and reboot the device after Mode change.

The available modes are:

Functional Mode – above mentioned Radio modes can be combined with following Functional modes:

- **1+0 Ch1/2** – simple one channel end station which uses physical channel Nr.1/2
- **1+0 Dual** – advanced 1+0 mode which separately uses both physical channels
- **2+0 Dual** – capacity aggregation mode which combines the capacity of both physical channels. This Mode supports following **Link Diversity** Modes:
 - **FD** – frequency diversity configuration with frequency separation in both physical channels of the device
 - **XPIC** – cross-polarization diversity with automatic attenuation of interfering signal from the X-polarized channel
- **1+0 Star** – the mode where is the Channel 1 directed to the West remote and Channel 2 to the East remote device
- **1+1 Dual** – capacity aggregation mode which combines the capacity of both physical channels. This Mode supports following **Link Diversity** Modes:
 - **FD** – frequency diversity configuration with frequency separation in both physical channels of the device
 - **SD** – space diversity configuration with single Tx channel, two Rx channels and two antennas in both directions
 - **HSB/SD** – hot standby configuration with single Tx channel at a time and two Rx channels in both directions
 - **XPIC** – cross-polarization diversity with automatic attenuation of interfering signal from the X-polarized channel
- **Device Start-up Role** – Hot-Swap configuration settings:
 - **Auto primary** – Auto hot-swap enabled, the device will be configured as 'primary' during start-up. The device will swap it's role if a protection Alarm occurs. Note the 'Auto secondary' setting MUST be set on the peer (FO) device! Also, note that a change in this settings will not change the running device role.
 - **Auto secondary** – Auto hot-swap enabled, the device will be configured as 'secondary' during start-up. The device will swap it's role if a protection Alarm occurs. Note the 'Auto primary' setting MUST be set on the peer (FO) device! Also, note that a change in this settings will not change the running device role.
 - **Fixed primary** – Hot-Swap disabled. The device role will be always 'primary'. Note that the 'Fixed secondary' role should be set on the peer device (FO). Also, note that changing this setting will result in an immediate automatic role switch on both local devices (if interconnected).
 - **Fixed secondary** – Hot-Swap disabled. The device role will be always 'secondary'. Note that the 'Fixed primary' role should be set on the peer device (FO). Also, note that changing this setting will result in an immediate automatic role switch on both local devices (if interconnected).
- **Pri-Sec LAN Interconnection** – Allows specific switch port behavior for active Secondary-role device. Note it should be configured identically on both Pri/Sec devices.
 - **Off (default)** – The port grouping follows the per-device setting independently of the active protection role. The Secondary unit's LAN1 & LAN2 are in the *standby* state.
 - **Summed mode1** – LAN1 & LAN2 ports are active and grouped, enabling the Secondary and Primary unit LAN interconnection.
- **Running Role Swapping** – This option is available only when the *Device Start-up Role* is configured in the 'Auto' mode. By means of pressing this button, you can swap running roles of local devices

4.14.3 Radio Modes.

The duplex radio mode settings. This setting determinates the duplex/simplex function of the configured link and has an essential influence on whole system function. The available options depend on the license file. The available modes are:

- **Rx Only** – half-duplex/simplex link with only Rx channel. Note the automatic ACM function should be set to the manual profile by the user.
- **Tx Only** – half-duplex/simplex link with Tx only channel. Note the automatic ACM function should be set to the manual profile by the user.
- **Bidirectional** – full duplex link with Tx and Rx channels

Please note that the simplex configuration limits the device functionality considerably. The ACM function will not work as well as remote side monitoring from Tx only side, etc.

4.14.4 ACM Mode.

Specifies the currently used ACM calibration table:

- **default** - the factory default profile with a single calibration definition that is used across all bandwidths.
- **custom** - the ACM profile definitions, which are tailored for the specific bandwidths. Each bandwidth can have its own ACM profile. Used for specific applications.

The available modes are:

- **Automatic** – automatic change of QAM/FEC according to channel with worse receive signal quality guarantees hitless protection in 1+1 mode, recommended for all configurations except unidirectional duplex mode.
- **Manual** – fixed QAM/FEC for RX and TX direction, applicable for all functional and duplex modes.
- **Automatic advanced** – designed especially for protection modes for automatic change of QAM/FEC according to channel with better receive signal quality. It guarantees the highest throughput in 1+1 and 2+2 configurations, recommended only for protection modes.
- **Semi-manual** – designed especially for unidirectional duplex. It has fixed QAM/FEC for TX direction, while the receiver can sync to any QAM/FEC. Recommended only for unidirectional duplex mode.

4.15 Config/System/Description.

The screenshot shows a web interface for configuring a device. At the top, there are four tabs: 'Mode', 'Description', 'Date&Time', and 'Advanced'. The 'Description' tab is selected. Below the tabs, there is a section titled 'USER DEFINED DESCRIPTION' with a blue header bar and an information icon (i) on the right. This section contains three input fields: 'Device Name' with the value '3005', 'Location' with the value 'LOCATION1', and 'Custom Text' with the value 'user text1'. At the bottom right of the form, there are two buttons: 'UNDO' and 'APPLY & SAVE'.

Figure 53: Config/Radio/Description window

The info frame serves number of optional user-defined description fields:

- **Device Name** – the device name shown in the header/web page title
- **Location** – location of device
- **Custom Text** – free field for user input

Valid characters are [a-zA-Z0-9_!@#%()-+=:,.?/] (including []) and without space character in device name)

4.16 Config/System/Date&Time.

Mode	Description	Date&Time	Advanced
DATE AND TIME SETTINGS ⓘ			
Date		18.05.2022	☐ Set current browser time
Time		11:34:58	
Time Zone		extended ▼	
			UTC
REMOTE TIME SERVER		REQUIRED	CONFIGURED ⓘ
Server Type		ntp ▼	ntp
Server IP		80.79.25.111	80.79.25.111
UNDO SAVE			

Figure 54: Config/System/Date&Time window

4.16.1 Date and Time Settings.

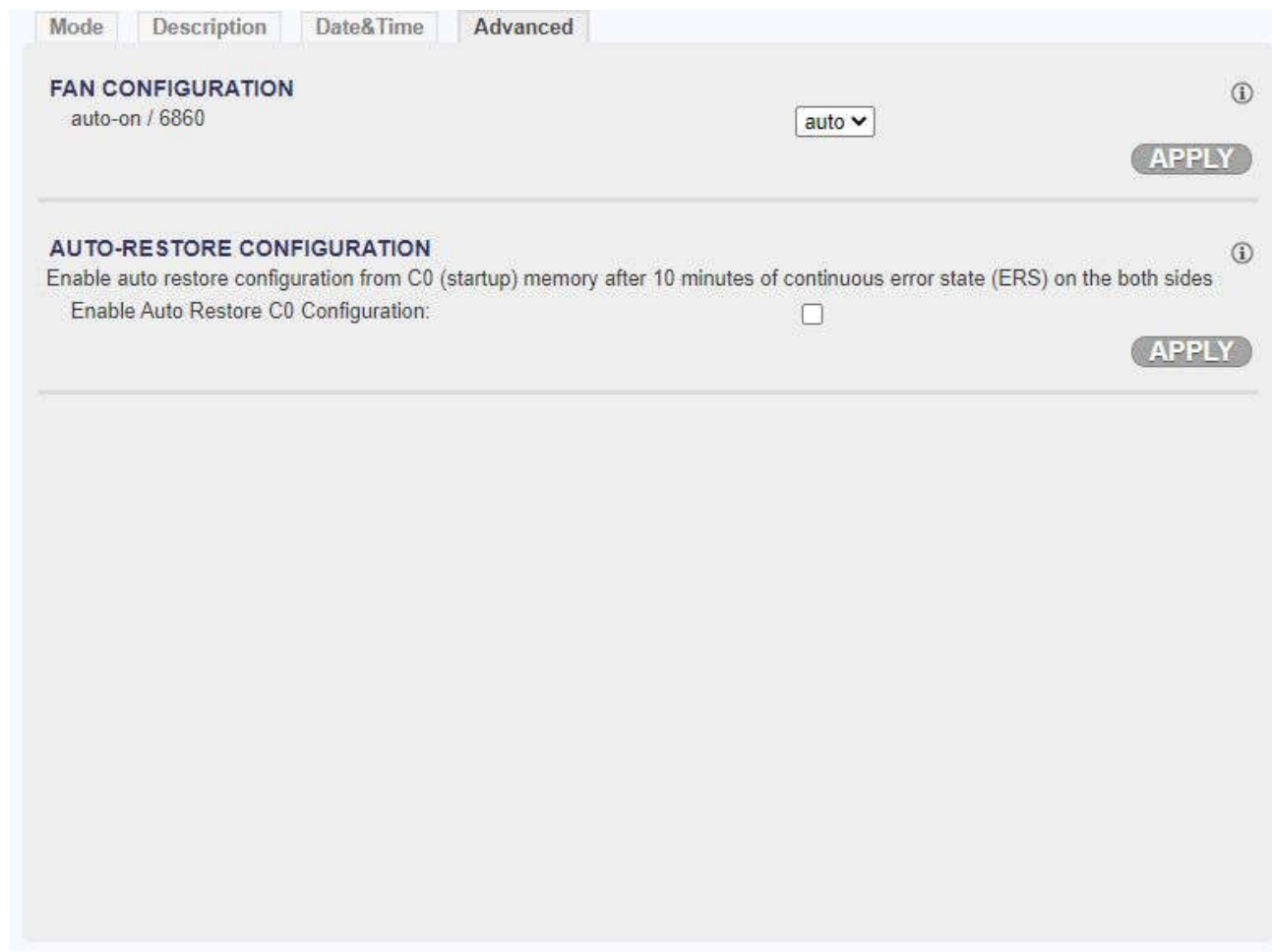
The frame with date, time and time zone settings. Please note that the date and time settings may not be available if a time limited license is in use.

Important: Please note that Date/Time change will cause an automatic logout of the WEB GUI.

4.16.2 Remote Time Server.

Network time protocol / rdate protocol settings. When you select ntpds value, the device will be used as local NTP server. The NTP synchronization is directed by the protocol itself while the rdate synchronization is initialized once per 24 hours and during startup of the device.

4.17 Config/System/Advanced.



The screenshot displays the 'Advanced' tab of a configuration window. It contains two main sections: 'FAN CONFIGURATION' and 'AUTO-RESTORE CONFIGURATION'. The 'FAN CONFIGURATION' section shows 'auto-on / 6860' and a dropdown menu set to 'auto', with an 'APPLY' button. The 'AUTO-RESTORE CONFIGURATION' section includes a description and a checkbox for 'Enable Auto Restore C0 Configuration', which is currently unchecked, followed by another 'APPLY' button.

Mode	Description	Date&Time	Advanced
FAN CONFIGURATION			
auto-on / 6860		auto ▼	
APPLY			
AUTO-RESTORE CONFIGURATION			
Enable auto restore configuration from C0 (startup) memory after 10 minutes of continuous error state (ERS) on the both sides			
Enable Auto Restore C0 Configuration:		☐	
APPLY			

Figure 55: Config/System/Advanced window

4.17.1 Fan Configuration.

The configuration of the inbuilt ventilator. Options are following:

- on – ventilator always on
- off – ventilator always off
- auto – ventilator is autoregulated by the device (default)

The thresholds for auto mode are $\geq 40^{\circ}\text{C}$ to turn the ventilator on, $\leq 30^{\circ}\text{C}$ to turn the ventilator off.

4.17.2 Auto-Restore Configuration.

When the checkbox is selected the start-up configuration (C0) is loaded after 10 minutes of the continuous error state. It is recommended to disable this function during initial link configuration and installation. By default, it is off.

4.18 Config/Access/Users.

ROLE NAME	LOGIN NAME ⓘ	PASSWORD ⓘ	CONFIRM PASSWORD	PASSWORD STRENGTH ⓘ
GUEST	guest			
USER	user			
ADMIN	admin			

☐ Require secure passwords

Figure 56: Config/Access/Users Window

ROLE NAME – level of the access rights

- **GUEST** – read-only access
- **USER** – standard management access
- **ADMIN** – enhanced management access - enhanced settings, passwords, FW upgrade, etc.

Require secure passwords – only secure passwords will be accepted. Secure password is 8 or more characters long, contains lowercase, uppercase and numbers. More secure password consists of at least 13 characters and contains combination of lower/uppercase characters, numbers and symbols (! @ # % () _ - + = [] : , . ? /). Please do not use other characters (^ & \$ { } \ |).

- **LOGIN NAME** – user name for selected level of the access; the number of characters in the input field have to be in range from 4 to 12. Valid characters are [a-z, A-Z, 0-9, _]. You cannot use user names already present in system (root, daemon, username present in other access level...).
- **PASSWORD** – password for selected level of the access. The number of characters in the input field have to be in range from 0 to 19. Password for ADMIN have to be in range from 1 to 19.
- **CONFIRM PASSWORD** – has to be the same as **PASSWORD**.

4.19 Config/Access/Protocols.

The screenshot shows the 'Config/Access/Protocols' window with tabs for 'Users', 'Protocols', and 'Certs&Keys'. The 'Protocols' tab is active, displaying a table for 'MANAGEMENT ACCESS'. The table has three columns: protocol name, a checkbox, and action buttons. The protocols listed are HTTPS, SSH; HTTPS with Client Certificate; HTTP; TELNET; SNMP; SSH with KEY; and SSH User/Password Login Enabled. The checkboxes for HTTPS, SSH, TELNET, and SSH with KEY are checked. The checkboxes for HTTPS with Client Certificate, HTTP, and SNMP are unchecked. The TELNET checkbox is highlighted with a blue checkmark. To the right of the SNMP row, there is a 'v3 only' label and a gear icon. Action buttons include 'UPLOAD CERTIFICATES' and 'RESET CERTIFICATES' for HTTPS, SSH; 'UPLOAD KEYS' and 'RESET KEYS' for SSH with KEY; and 'UNDO' and 'SAVE' at the bottom right.

MANAGEMENT ACCESS		
HTTPS, SSH	☒	UPLOAD CERTIFICATES
HTTPS with Client Certificate	☐	RESET CERTIFICATES
HTTP	☐	
TELNET	☒	
SNMP	☐	v3 only » ⚙
SSH with KEY	☒	UPLOAD KEYS
SSH User/Password Login Enabled	☒	RESET KEYS

UNDO SAVE

Figure 57: Config/Access/Protocols Window

Management protocols and security configuration

- **HTTPS, SSH** – still on – cannot be turned off.
By default, self-signed SC is used. This causes a browser security warning. To avoid this warning, you can upload your own server certificate (SC) and upload the appropriate client certificate (CC) to the user browser.
- **HTTPS with Client Certificate** – https access is possible only if the client (browser) has installed client certificate (CC). The option is available only if the device has uploaded the CA certificate signing CC. Reset of the CA certificate is possible only if this option is not checked.
- **HTTP, TELNET, SNMP** – to increase the security of the device you can disable unencrypted access (http, telnet, SNMP v2) and turn on only encrypted SSH, HTTPS and SNMP v3 (SNMP can be set only on the Config/IP/SNMP page).
- **SSH with KEY** – You can provide SSH keys in order to log in via SSH terminal without using a password.
- **SSH User/Password Login Enabled** – You can switch off SSH login using username/password. You have to be sure that login without password works! Reset of the SSH key is possible only if this option is enabled.

4.20 Config/Access/Certs&Keys.

The screenshot shows a web interface with three tabs: 'Users', 'Protocols', and 'Certs&Keys'. The 'Certs&Keys' tab is active and contains three sections:

- SERVER CERTIFICATE + PRIVATE KEY (.PEM)**: Includes a file selection button 'Scegli file' (labeled 'Nessun file selezionato'), an 'UPLOAD' button, and certificate details: 'Loaded certificate: Subject: C = CZ, ST = Czech Republic, CN = *, O = CERTIFICATE', 'Validity to: Nov 16 13:01:18 2038 GMT', and 'SHA1 Fingerprint=C6:04:B5:87:3D:86:30:80:0A:4E:00:16:16:6E:1A:4F:AD:42:EC:A3'.
- CERTIFICATION AUTHORITY CERTIFICATE (.PEM)**: Includes a file selection button 'Scegli file' (labeled 'Nessun file selezionato'), an 'UPLOAD' button, and status: 'Loaded certificate: Not loaded', 'Validity to: Unspecified', and 'Unspecified'.
- SSH PUBLIC RSA KEYS (ID_RSA.PUB)**: Includes file selection buttons for 'ADMIN:', 'USER:', and 'GUEST:' (all labeled 'Nessun file selezionato'), three 'UPLOAD' buttons, and status: 'Admin key is loaded: no', 'User key is loaded: no', and 'Guest key is loaded: no'.

Figure 58: Config/Access/Certs&Keys Window

4.20.1 Server Certificate+Private Key (.PEM)

A tool for HTTPS server certificate import. Below the frame is shown basic information of actual HTTPS certificate. By default, a self-signed certificate is loaded. It causes a browser security alert.

4.20.2 Certification Authority Certificate (.PEM)

You can secure your access by means of a personal certificate loaded in your browser. In this frame, you can import a Certification Authority who signed your personal certificate.

Below the frame is shown basic information about actual authority certificate.

4.20.3 SSH Public RSA Keys (ID_RSA.PUB)

You can secure your SSH connection by means of importing your own public SSH key. It is usually stored in your home directory as `"/.ssh/id_rsa.pub"`.

Attention! The other file `"id_rsa"` (without extension) stored in the same directory is your PRIVATE key! It must not leave your home directory and/or computer!

You can load a key for each user role. Statuses are shown in the frame below.

4.21 Config/IP/Addresses.

Addresses	SNMP	Advanced
MAIN ADDRESS SETTINGS		
Device IP / Mask	192.168.11.151 / 20	192.168.11.151/20
Default Gateway IP	192.168.0.254	192.168.0.254
OPTIONAL ADDRESS SETTINGS		
USB IP / Mask	☒ 10.10.11.10/24 ☐ 192.168.11.10/24	10.10.11.10/24
Fallback IP / Mask	☒ 10.10.10.10/24 ☐ 192.168.10.10/24	10.10.10.10/24

UNDO SAVE

Figure 59: Config/IP/Addresses Window

4.21.1 Main Address Settings.

Every device in the local network has its own and unique primary IP address. Thanks to this IP address it is possible to access each equipment in your network. While setting up the IP address, pay attention to the configuration which needs to follow general IP addressing rules (IP address, IP netmask, IP gateway). The customer has to ensure that correct IP addresses are assigned and configured for all units in the microwave network.

The description of particular setting and display boxes:

- **Device IP / Mask** – IP address assigned to port ETH0 (device local address) with the appropriate net-mask specification. Netmask value is inserted in form of a decimal number which corresponds to numbers in binary subnet mask presentation. Such net-mask for subnet mask 255.255.255.0 is presented as decimal number 24. Local network has its own and unique primary IP address.
- **Default Gateway IP** – default Gateway IP address is used by CPU when connection outside of IP range defined in system routing table is required. Such IP address must be a member of the above defined Device IP subnet.

This frame shows the REQUIRED and CONFIGURED IP settings. REQUIRED settings will be stored by the SAVE button. In order to activate the new setting please use the IP INIT button (you will be logged out, but user traffic will not be dropped) or WRITE the settings and reboot the device.

4.21.2 Optional Address Settings.

Optional IP address settings

- **USB IP / Mask** – it specifies IP address for USB0 management port. When default USB IP address is in collision with other network configuration it can be changed with this parameter. Factory default value is 10.10.11.10/24
- **Fallback IP / Mask** – it specifies fallback IP address for ETH0 management port. When default fallback IP address is in collision with other network configuration it can be changed with this parameter. Factory default value is 10.10.10.10/24

4.22 Config/IP/SNMP.

The screenshot displays the 'Config/IP/SNMP' window with three tabs: 'Addresses', 'SNMP', and 'Advanced'. The 'SNMP' tab is active, showing the 'SNMP CONFIGURATION' section with fields for 'Enable' (checkbox), 'Version' (dropdown set to 'v3 only'), 'Port' (text box with '161'), 'Trap Version' (dropdown set to 'v3'), 'Trap Port' (text box with '162'), 'Trap IP Addresses' (three text boxes, all set to 'none'), and 'Daemon Status' (text box with 'not running'). Below this is the 'COMMUNITY SETTINGS' section with columns for 'READ ONLY ACCESS' and 'READ WRITE ACCESS'. It includes 'Community String' (text box with 'public') and 'IP Address / Mask' (three text boxes, all set to 'none'). The 'SNMPv3' section follows, with columns for 'READ ONLY ACCESS' and 'READ WRITE ACCESS'. It includes 'User Name' (text box with 'public'), 'Auth and Privacy Password' (text box with '.....'), 'Confirm Password' (text box with '.....'), 'Trap Engine ID' (text box with '0x1234567890ABCDEF'), and 'Encryption' (radio buttons for 'AES' and 'DES', with 'AES' selected). At the bottom right are 'UNDO' and 'SAVE' buttons.

SNMP CONFIGURATION			
Enable	☐		
Version	v3 only		
Port	161		
Trap Version	v3		
Trap Port	162		
Trap IP Addresses	none	none	none
Daemon Status	not running		

COMMUNITY SETTINGS		READ ONLY ACCESS	READ WRITE ACCESS
Community String		public	private
IP Address / Mask		none	none
		none	none
		none	none

SNMPv3		READ ONLY ACCESS	READ WRITE ACCESS
User Name		public	private
Auth and Privacy Password			
Confirm Password			
Trap Engine ID	0x1234567890ABCDEF	DEFAULT GENERATE	
Encryption	AES DES		

UNDO SAVE

Figure 60: Config/IP/SNMP Window

4.22.1 SNMP Configuration.

This window provides the configuration options of the inbuilt SNMP server:

- **Enable** – this check box enables the SNMP daemon in the device
- **Version** – SNMP v2c or SNMP v3 can be used for SNMP access to device
- **Port** – the parameter specifies which port will be used for SNMP communication. The same configuration must be set also in SNMP agent station
- **Trap Version** – specifies which SNMP trap version should be used for traps
- **Trap Port** – the parameter specifies the destination port on which SNMP traps will be sent to. The same configuration must be set also in SNMP agent station

- **Trap Address 1-3** – up to three IP addresses can be configured as the destination for SNMP trap distribution. Trap message events are configured in the same way as the alarm setting. Note the SNMP v3 traps can be sent to only one address
- **Daemon Status** – the current status reported by the SNMP daemon

4.22.2 Community Settings.

These settings are required only for the SNMPv2 protocol. For SNMPv3 has no effect.

- **Community String** – the parameter specifies community string for secure SNMP management access (a different setting for read-only and read/write access can be entered, valid for SNMP v2). The number of characters in the input field has to be in the range from 1 to 15. Valid characters are [a-z, A-Z, 0-9, _]
- **IP Address / Mask** – up to three IP subnets can be configured as permitted IP source for SNMP management access. Please note that the Mask parameter is mandatory.

4.22.3 SNMPv3.

These settings are required only for the SNMPv3 protocol. For SNMPv2 has no effect.

- **User Name** – username configuration for secure SNMP access with SNMP v3 protocol (a different setting for read-only and read/write access can be entered). The number of characters in the input field has to be in the range from 4 to 15. Valid characters are [a-z, A-Z, 0-9, _]
- **Auth and Privacy Password** – password configuration for secure SNMP access with SNMP v3 protocol, the identical password must be entered into Confirm Password box (a different setting for read only and read/write access can be entered). The number of characters in the input field has to be in the range from 8 to 15. Valid characters are [a-z, A-Z, 0-9, _]
- **Trap Engine ID** – the SNMP v3 Trap EngineID of generated SNMP v3 traps. The same EngineID must be set in the receiving agent. This hexadecimal number is automatically prefixed with the required '0x'. The allowed characters are [A-F, 0-9]. The number must not begin with 0 or be assembled only with 'F' values and has to be between 12 and 26 characters long including the prefix. Note the other SNMP v3 trap parameters are inherited off the READ ONLY ACCESS settings.

Example: 0x123456789ABCDEF

- Default – this will fill in the MAC address of the device. Possible '0' at the beginning of the string will be replaced with 'F'
- Generate – this will fill in a random valid hexadecimal number of length ranging between 12-14 characters including prefix
- **Encryption** – the encryption protocol for the SNMPv3
 - CFB-AES-128
 - CBC-DES

4.23 Config/IP/Advanced.

AddressesSNMPAdvanced

STATIC ROUTES - INPUT VALUES

Route IP / MASK

Gateway IP

ADDDELETE

NAT - INPUT VALUES

LocalPort DestIP:Port

ADDDELETEDELALL

Default NAT to Remote Unit

☐ WEB ☐ SSH

SET

RADIUS - INPUT VALUES

IP:DestPort SecString Timeout

ADDDELETEDELALL

IP SETTING

REQUIRED

SAVED

Route

default via 192.168.0.254

NAT

Default WEB NAT: off
Default SSH NAT: off

Radius Server

USB SETTING

USB Autologs

☒

SET

SAVE

RUNNING IP CONFIGURATION

Routes

default via 192.168.0.254 dev eth0
10.10.10.0/24 dev eth0src 10.10.10.10
10.10.11.0/24 dev usb0src 10.10.11.10
192.168.0.0/20 dev eth0src 192.168.11.151
192.168.11.150 dev rf12src 192.168.11.151 metric 100
192.168.11.150 dev rf11src 192.168.11.151 metric 110

NATs

Radius Server

Figure 61: Config/IP/Advanced Window

4.23.1 Static Routes – Input Values.

For a specific configuration of management access, it is sometimes necessary to add or delete static routes. You can DELETE an already specified route by simply specifying it in the *Route IP / MASK*. It is not necessary to specify the *Gateway IP* for route deletion.

Please remember to store the new configuration using the SAVE button and to re-initialise the configuration using the IP INIT button.

- **Route IP / MASK** – IP address from the routed network and the appropriate network mask must be inserted. Routed network range is calculated from inserted values.
- **Gateway IP** – the correct IP address gateway for above-mentioned network must be inserted.

4.23.2 NAT – Input Values.

For a specific configuration of management access, it is sometimes necessary to add or delete NAT records. This is especially required for Out of band type of management access.

- **LocalPort DestIP:Port** – the NAT record must be inserted in the following format: local_port destination_ip: port (example: '10443 192.168.1.2:443' => local port 10443 redirects to the port 443 (secure web - https) of the unit with IP 192.168.1.2)

- **Default NAT to Remote Unit** – By this setting you can enable or disable the automatically generated NAT records for WEB and SSH management access. Please note that these records will work only when there is active connection between this and the targeted device.

WEB

This will add automatic NAT record for accessing the remote device's WEB GUI. The default values follow (the IP portion is only example and depends on actual running IP configuration):

- 1443 192.168.3.91:443 - Remote device's GUI accessible on local port 1443 (e.g. https://localIP:1443)
- 2443 192.168.3.92:443 - Second Remote (in *Star* mode) or direct FO neighbour (in *Split Protection* mode) device's GUI accessible on local port 2443
- 3443 192.168.3.93:443 - Indirect Remote FO neighbour (ergo 'cross-corner' in *split protection* mode) device's GUI accessible on local port 3443

SSH

This will add automatic NAT record for accessing the remote device's SSH . The default values follow (the IP portion is only example and depends on actual running IP configuration):

- 1022 192.168.3.91:22 - Remote device's GUI accessible on local port 1022
- 2022 192.168.3.92:22 - Second Remote (in *Star* mode) or direct FO neighbour (in *Split Protection* mode) device's GUI accessible on local port 2022
- 3022 192.168.3.93:22 - Indirect Remote FO neighbour (ergo 'cross-corner' in *split protection* mode) device's GUI accessible on local port 3022

4.23.3 Radius – Input Values.

Radius access configuration

- **IP:DestPort SecString Timeout** – the definition of remote Radius server
 - IP – IP address of the Radius server
 - DestPort – destination port
 - SecString – password of Radius Server login. The recommended length of the password is from 4 to 50 characters
 - Timeout – connection time-out between the device and Radius Server. Recommended value is 1 – 5 second

4.23.4 IP Settings.

This frame informs the user about the REQUIRED and CONFIGURED IP settings. REQUIRED settings will be stored by means of the SAVE button. In order to activate the new setting please use the SAVE & IP INIT button (you will be logged out, but data will not be dropped) or SAVE the IP settings and reboot the device.

4.23.5 USB Settings.

This checkbox enables auto save logs on USB flash just after inserting it.

4.23.6 Running IP Configuration.

This frame shows the device's active IP Route table, NAT records and Radius Server configuration.

In order to populate this table with a new configuration, you have to re-initialize the IP configuration by means of IP INIT button.

4.24 Config/Radio/Parameters.

Parameters ACM Advanced				
MODEM	LOCAL		REMOTE	
	CHANNEL 1	CHANNEL 2	CHANNEL 1	CHANNEL 2
Bandwidth	28000_02 ▼	28000_02 ▼	28000_02	28000_02
Max TxACM Profile	1024/weak ▼	1024/weak ▼	1024/weak ▼	1024/weak ▼
Max RxACM Profile	1024/weak ▼	1024/weak ▼	1024/weak ▼	1024/weak ▼
ACM Mode	auto p1 ⚙		auto p1	
Advanced Setting	default	default	-	-

RADIO	LOCAL		REMOTE	
	CHANNEL 1 ⓘ	CHANNEL 2 ⓘ	CHANNEL 1	CHANNEL 2
T/R Spacing	fixed ▼ ⓘ	fixed ▼ ⓘ	fixed	fixed
TX Frequency [MHz]	4732 ⓘ	4732 ⓘ	4420	4420
RX Frequency [MHz]	4420 ⓘ	4420 ⓘ	4732	4732
TX Power Limit [dBm]	36 ⓘ	36 ⓘ	36	36
TX Mute Config	auto ▼	auto ▼	auto ▼	auto ▼
ATPC Function	☐	☐	☐	☐
ATPC RX Level [dBm]	-55 ⓘ	-55 ⓘ	-55	-55

REFRESH UNDO APPLY TO LOCAL & REMOTE

Figure 62: Config/Radio/Parameters Window

4.24.1 Modem.

This frame contains the most important modem setting. It allows configuration of both local and remote side parameters. Note that the remote settings feature requires an active radio connection to the remote side in order to provision and apply the remote settings. Also note that you have to store any changed setting separately in both local and remote side.

- **Bandwidth** – the bandwidth of the transmitting modulation. The number after the underscore indicates the variant of the modulation:
 - **_01** – uses narrower frequency spectrum and lesser throughput than the **_02** bandwidths. Usable for applications where the set frequency is on the bandwidth edge affected by the outer RF interferences
 - **_02** – modulations optimized for highest possible bandwidth and throughput of the corresponding transmitting mask
 - **_03** – a special variant with different meaning across different applications:
 - wide BW: 80MHz only; uses extra narrow frequency spectrum to avoid internal interferences on 80MHz BW's. This allows for the maximal sensitivity at cost of throughput
- **Modulations** – Each modulation can have multiple Forward Error Correction variants:
 - **weak** – weak FEC, highest throughput speed (special constellations only)
 - **medium** – optimal FEC, medium throughput speed
 - **strong** – strong FEC, lowest throughput speed

- **Max TxACM Profile** – The highest possible Tx modulation at a given bandwidth. While the automatic ACM mode is enabled, this value will be the highest possible modulation. Otherwise, the value set will be the actual Tx modulation.
- **Max RxACM Profile** – The highest possible Rx modulation at a given bandwidth. While the Semi-Manual ACM mode is enabled, this value will be the highest possible modulation. Otherwise, the value set will be the actual Rx modulation.
- **ACM Mode** – Indicates the active ACM mode and profile. The gear icon leads to the device mode settings where the ACM mode can be changed. Note the changing the ACM mode can lead to a loss of synchronization.
- **Advanced Setting** – When the gear icon is displayed, it indicates that the Radio Advanced settings do not match the factory default settings and leads the user to the Advanced radio settings page. If the Advanced radio settings are set to defaults, such information will be displayed instead.

4.24.2 Radio.

This section contains the most important radio setting. It allows configuration of both local and remote side parameters. Note that the remote settings feature requires an active radio connection to the remote side in order to provision and apply the remote settings. Also note that you have to store any changed setting separately in both local and remote side.

- **T/R Spacing** – TX / RX frequency distance mode. Note that available options depend on the attached radio type and its capabilities.
- **TX Frequency** – Transmission frequency can be set within the frequency range noted under the respective info icon in accordance with radio sub-band specification (read from the radio part). Such displayed range is the edge to edge flat diplexer frequency scope increased/decreased by one half of the used modulation bandwidth.
- **RX Frequency** – If *fixed* T/R spacing is selected the Receive frequency will be calculated automatically. If *manual* T/R spacing is selected the Receive frequency has to be calculated and specified manually.
- **TX Power Limit** – Maximum transmission power parameter defines the maximum power level which is required for optimal transmission conditions. The operating TxPower then depends on:
 - configured ATPC values (if ATPC is enabled)
 - radio part power limit (depends on the used RF band and selected modulation)
- **TX Mute Config** – Transmitter mute configuration. Three modes of this parameter can be selected:
 - *auto* mute mode is the standard selection for this parameter. In this mode is the radio part automatically muted when required by design or when abnormal transmission conditions are detected by the device.
 - *mute* mode for fixed radio mute configuration
 - *unmute* option is available only on remote channels when there is not Rx connection from such remote channel. When selected the unmute command is sent to the remote side which, if listening, will attempt to unmute its respective Tx part.
- **ATPC Function** – Automatic Transmit Power Control enables or disables the ATPC feature. The transmitted power is automatically adjusted to ensure that the remote side will receive signal of strength defined in its respective *ATPC RxL Level* settings with hysteresis of +/- 2dBm (hitless regulation). Please note that this function will not work in Simplex links as it requires bi-directional communication.

Text color legend:

- **black** – unmodified value
- **blue** – modified but non-applied value
- **red** – entered value does not match the allowed range or is incorrectly set

4.25 Config/Radio/ACM.

Parameters
ACM
Advanced

ACM FLEXIBILITY
ACM Profile Table
p1_005_01

ACM ADVANCED SETTINGS
CHANNEL 1
CHANNEL 2
Usual Value
Note
ACM Offset
0.0
0.0
0
-3.0 ... +3.0

ACM PROFILE SETTINGS
Modem 1
Modem 2

ACM_nr	Enable	Mod/FEC	Capacity	ThrLow	ThrHigh	Enable	Mod/FEC	Capacity	ThrLow	ThrHigh
ACM_01	☐	0004/strong	43.5	-10.00	-11.30	☐	0004/strong	43.5	-10.00	-11.30
ACM_02	☒	0004/medium	46.7	-11.65	-12.95	☒	0004/medium	46.7	-11.65	-12.95
ACM_03	☒	0016/strong	87.1	-16.45	-17.75	☒	0016/strong	87.1	-16.45	-17.75
ACM_04	☒	0032/strong	108.9	-19.45	-20.75	☒	0032/strong	108.9	-19.45	-20.75
ACM_05	☒	0032/medium	116.8	-21.15	-22.45	☒	0032/medium	116.8	-21.15	-22.45
ACM_06	☒	0064/strong	130.6	-22.55	-23.85	☒	0064/strong	130.6	-22.55	-23.85
ACM_07	☒	0064/medium	140.1	-24.25	-25.45	☒	0064/medium	140.1	-24.25	-25.45
ACM_08	☒	0128/strong	152.4	-25.50	-26.80	☒	0128/strong	152.4	-25.50	-26.80
ACM_09	☒	0128/medium	163.5	-27.20	-28.50	☒	0128/medium	163.5	-27.20	-28.50
ACM_10	☒	0256/strong	174.2	-28.55	-29.85	☒	0256/strong	174.2	-28.55	-29.85
ACM_11	☒	0256/medium	186.9	-30.25	-31.45	☒	0256/medium	186.9	-30.25	-31.45
ACM_12	☒	0512/strong	196.0	-31.50	-32.80	☒	0512/strong	196.0	-31.50	-32.80
ACM_13	☒	0512/medium	210.2	-33.20	-34.50	☒	0512/medium	210.2	-33.20	-34.50
ACM_14	☒	1024/strong	217.7	-34.55	-35.85	☒	1024/strong	217.7	-34.55	-35.85
ACM_15	☒	1024/medium	233.6	-36.25	-37.55	☒	1024/medium	233.6	-36.25	-37.55
ACM_16	☒	1024/weak	245.5	-39.30	-40.60	☒	1024/weak	245.5	-39.30	-40.60

SET ALL
UNDO
APPLY

Figure 63: Config/Radio/ACM Window

4.25.1 ACM Flexibility.

Specifies the currently used ACM calibration table:

- **default** - the factory default profile with a single calibration definition that is used across all bandwidths.
- **custom** - the ACM profile definitions, which are tailored for the specific bandwidths. Each bandwidth can have its own ACM profile. Used for specific applications.

4.25.2 ACM Advanced Settings.

The Hitless Adaptive modulation (ACM) settings.

- **ACM Offset** – The MSE offset off the pre-set ThrLow and ThrHigh constants (see ACM profiles)

4.25.3 ACM Profile Settings.

The list of available modulations for the selected ACM profile.

- **ACM_nr** – designation of the modulation

- **Enable** – enables a modulation for ACM switching
 - "I" means unlicensed modulation
 - "e" means error setting
 - "D" means not available in the selected profile
- **Mod/FEC** – bandwidth/forward error correction level
- **Capacity** – maximal throughput
- **ThrLow** – The MSE threshold value for switching from this respective modulation to a lower Rx modulation
- **ThrHigh** – The MSE threshold value for switching to this respective modulation

Note: the ACM settings of local and remote devices should match.

4.26 Config/Radio/Advanced.

Parameters ACM Advanced			
RADIO ADVANCED SETTINGS	CHANNEL 1	CHANNEL 2	USUAL VALUE
Radio Type	Skylinks (1) ▼	Skylinks (1) ▼	various
Radio Filter	auto ▼	auto ▼	auto
Radio Power Supply	on ▼	on ▼	on
Radio Frequency Range	auto ▼	auto ▼	auto
Actual Carrier Offset [Hz]	592	-2761	various
Carrier Offset Compensation	☐	☐	off
MODEM ADVANCED SETTINGS	CHANNEL 1	CHANNEL 2	USUAL VALUE
Modem IF Output	unmuted ▼	unmuted ▼	unmuted
Modem Signal Type	qam ▼	qam ▼	qam
CW Frequency [Hz]	0	0	0

UNDO APPLY

Figure 64: Config/Radio/Advanced Window

4.26.1 Radio Advanced Settings.

This frame provides various options for advanced radio part settings:

- **Radio Type** – selection of the attached radio type. Note this setting is available only on supported systems
- **Radio Filter**
 - auto – Filter is selected automatically according to the modulation BW (default)
 - narrow – Manual selection of narrow radio filter
 - wide – Manual selection of wide radio filter

- **Radio Power Supply**
 - on – enables power output to the respective radio part
 - off – disables power output to the respective radio part
- **Radio Frequency Range**
 - auto – the unit automatically calculates the usable frequency range by subtracting/adding half of the current bandwidth from the radio frequency edges
 - hw – the radio frequency limits are used. Note this is suitable only for special use cases
- **Actual Carrier Offset** – the current radio carrier offset. For the 3.5MHz bandwidth, it must be in the range from -40 000 to +40 000. Note this value will differ with each refresh.
- **Carrier Offset Compensation** – enabling this option enables the automatic radio carrier offset calibration. Note the calibration is bound to the currently attached ODU only and should be repeated when the ODU is replaced by means of disabling and re-enabling this checkbox. Use this option when there is no modem synchronization on very narrow bandwidths (3.5MHz). Unchecking this option resets the calibration. Please note enabling the auto-calibration will cause data to drop for about 3 sec. The calibration requires modem sync. The calibration may be done on a higher bandwidth or on the QPSK modulation when there is not possible to achieve the synchronization on the desired narrow modulation.

4.26.2 *Modem Advanced Settings.*

This frame provides various options for advanced modem part settings:

- **Modem Signal Type** – Specification of modulation output. It is possible to replace standard modulated signal with carrier signal (CW) in this drop-down menu. The possible modes follow:
 - qam – TxIF modulated signal is presented at IF output from the device (default)
 - cw – Carrier signal with given frequency is presented at IF output
- **CW Frequency** – carrier signal frequency settings

4.27 Config/Ports/Mux.

The screenshot shows the 'Config/Ports/Mux' window with the 'MUX' tab selected. The window is divided into several sections: 'DATAFLOW CONFIGURATION', 'PORT CONFIG', 'ETH SWITCH', 'SWAP', and 'PBPM'. The 'PORT CONFIG' section contains a table with columns for SFP1, SFP2, SFP3, SFP4, LAN1, LAN2, and LAN3. The 'ETH SWITCH' section shows a diagram of the internal switch with ports LAN1, LAN2, LAN3, WANa, WANb, and MNG CPU. The 'SWAP' section shows channel select and connected port settings. The 'PBPM' section shows traffic channel, speed limit, and aggregation speed settings. At the bottom, there are 'REFRESH', 'UNDO', and 'APPLY' buttons.

DATAFLOW CONFIGURATION							
PORT	SFP1	SFP2	SFP3	SFP4	LAN1	LAN2	LAN3
Status	SFP Gbit FD	SFP module not present	SFP module not present	SFP module not present	LAN 100Mbit FULL	LAN 100Mbit FULL	LAN Gbit FULL
Hot Standby	off	off	off	off	off	off	-
Mode	force1G	auto1GX	auto1GX	auto1GX	auto	auto	auto
MDIX	-	-	-	-	auto	auto	auto
Flow Control	force-on	force-on	force-on	force-on	force-off	force-off	force-off
1588	off	off	off	off	off	off	off

ETH SWITCH

Diagram showing internal switch connections: LAN1, LAN2, LAN3, WANa, WANb, MNG CPU, and CPU.

SWAP							
Channel Select	SFP1	SFP2	SFP3	SFP4	LAN1	LAN2	LAN3
Channel Select	EMM1	none	none	none	ETH1a	ETH1b	RFI1 RFI2
Connected Port	off	sfp1	wana	wanb	off	none	none

PBPM							
Traffic Channel	SFP1	SFP2	SFP3	SFP4	LAN1	LAN2	LAN3
Traffic Channel	PTP1	EMM1	ETH1a	ETH1b	PTP2	EMM2	ETH2a ETH2b
Speed Limit	auto	2.28	350	100	auto	0	0
Avail Aggr Speed	2.28 EMM(ch2) + 464.92 Mbps ETH						
Modem Speed	233.6 Mbps active				233.6 Mbps active		

Buttons: REFRESH, UNDO, APPLY

Figure 65: Config/Ports/Mux Window

In respect of management access type, traffic modification (number of independent channels over air) and the aggregation function preference the user has to select the relevant Mode type (see the Mode settings) before starting any port settings. **Each Mode uses similar but not identical port configuration scheme.** By default the internal ETH switch is divided into four groups. Such setting prevents potential loops at connected LAN ports for all Modes. The port settings consists of several configuration layers labelled leftmost of the configuration window:

4.27.1 PORTS.

- **SFP1** – 2.5G optical interface for Primary/Secondary modem interconnection (1+1 & 2+2 mode)
- **SFP2** – 2.5G optical interface for Primary/Secondary modem interconnection (2+2 mode)
- **SFP3** – 1G optical interface for user data or EMM card chain
- **SFP4** – 1G optical interface for user data or EMM card chain
- **LAN1-2** – ethernet 1G (data) interface
- **LAN3** – ethernet 1G (management) interface

4.27.2 PORT CONFIG section:

- **Status** – status of a port as detected by the device (speed, duplex mode, link, administrative down status).
- **Hot standby** – automatic switch over between ports according to actual link status

- **Mode** – This drop-down menu displays and defines the actual port mode (speed/duplex, administrative down)
- **MDIX** – It is possible to set particular ETH cable crossing like auto/mdi/mdx by means of this configuration
- **Flow Control** – Informative field displays the actual duplex flow control mechanism settings. Flow control setting is available from page Ports / EthQOS
- **1588** – Precision time protocol source

4.27.3 ETH SWITCH section:

This block illustrates the ETH switch fragmentation into groups and also their interconnection with physical LAN ports and internal WAN ports. The group configuration is performed on ETH VLAN page

4.27.4 SWAP section:

- **Channel Select** – Settings of data multiplexor. By this setting you can cross connect a particular Switch port with a Mux Channel.
- **Connected Port** – Current settings of the SWAP block

4.27.5 PBPM section:

Priority Based Packet Multiplexer settings

- **Traffic Channel** – shows boundary between the selected channel and port
 - - PTPx – Precision time protocol channel
 - - EMMx – EMM channel. Speed will be computed automatically
 - - ETHxa – High priority data channel. Speed can be limited - see field colour and bubble help
 - - ETHxb – Low priority data channel. Speed can be limited - see field colour and bubble help
- **Speed Limit** – speed value for transmitting data with priority falling from left to right
- **Avail Aggr Speed** – it indicates the available aggregated capacity. It depends on channels statuses, asymmetry and license speed limits. Available aggregated capacity may be less than sum of available channels capacities.

4.27.6 Available Speed Section:

it indicates the available capacity of appropriate channel. This value depends on the actual modulation scheme and license speed limits.

4.28 Config/Ports/EthVLAN.

MUX
EthVLAN
EMM

ETH SETTINGS	LAN 1	LAN 2	LAN 3	MNG	WAN A	WAN B
QOS Modes	weighted	weighted	weighted	weighted	weighted	weighted
Priority Policy	All	All	All	All	All	All
Port Priority	0	0	0	0	0	0
Priority Override	off	off	off	off	off	off

PRIMARY ROLE SETTING	LAN 1	LAN 2	LAN 3	MNG	WAN A	WAN B
VLAN MODE						
Port State	active	active	active	active	active	active
Port Mode	basic	basic	basic	basic	basic	basic
Port Group	group-1	group-2	group-3	group-3	group-1	group-3
Default VLAN	1	1	30	30	1	30

SECONDARY ROLE SETTING	LAN 1	LAN 2	LAN 3	MNG	WAN A	WAN B
VLAN MODE						
Pri-Sec LAN	Off (default)					
Port State	standby	standby	active	active	standby	standby
Port Mode	basic	basic	basic	basic	basic	basic
Port Group	group-1	group-2	group-3	group-3	group-1	group-3
Default VLAN	1	1	30	30	1	30

VTU SETTINGS	ACTION	VLAN N.	FID	QOS PRI	LAN 1	LAN 2	LAN 3	MNG	WAN A	WAN B
	add			off	Deny	Deny	Deny	Deny	Deny	Deny

LISTING OF ACTUAL VTU VALUES

```

PORTBAS. | LAN1 | LAN2 | LAN3 | MNG | WANA | WANB
GRP pri: 1 2 3 3 1 3
GRP sec: off
GROUP : 1 2 3 3 1 3
MODE : basic basic basic basic basic basic
DEFAULT: 1 1 30 30 1 30
  
```

VTU Table

#	VLAN	FID	L1	L2	L3	MN	WA	WB	PRI
1	11	11	T	D	D	D	T	D	0
2	12	12	D	T	D	D	T	D	1
3	30	30	D	D	U	U	D	U	-

UNDO
APPLY

Figure 66: Config/Ports/EthVLAN Window

4.28.1 ETH Settings

This frame makes it possible to configure extended QOS modes which are important for a specific traffic prioritization. The system uses four priority queues for each port where frames, with an assigned initial frame priority, an initial queue priority and an override queue priority, are mapped onto four output queues according to QPRI settings. A final frame queue priority is derived from the assigned initial queue or the override queue priority and it is used for deciding what queue will be used for frame buffering. The queue with a higher number is egressed with higher priority than the queues with lower numbers. The assigned initial frame priority is then used for replacing of frame's PRI bits in 802.3ac VLAN tag section, when the frame is egress tagged.

- QOS Modes**
 - weighted** – In the weighted scheme an 8, 4, 2, 1 round robin weighting is applied to the four priorities (8 frames from Q3, 4 frames from Q2, 2 frames from Q1 and 1 frame from Q0). This approach prevents the lower priority frames from being starved out with only a slight delay to the higher priority frames.
 - strict 3xxx** – Strict priority for queue 3 and weighted round robin for queues 2,1 and 0. Queues 2,1,0 are served only when Q3 is empty.
 - strict 32xx** – Strict priority for queues 3,2 and weighted round robin for queues 1 and 0. Queues 1,0 are served only when Q3 and Q2 are empty.
 - strict 3210** – Strict priority for all queues. Lower priority queues are served only when higher priority queues are empty.
- Priority policy** – This drop-down menu defines the initial ingress queue policy. It defines the initial rules for what output queue will be assigned to every ingress frame.

- **Port Priority** – The configuration of default port priority. Value 0 up to 7 can be entered (0 is default value)
- **Priority Override** – It offers the possibility to replace an initial queue priority with a new priority. The new priority is assigned to each frame whose VLAN ID is defined in the VTU table with properly configured QOS PRI value.
 - **off** – QOS override is disabled
 - **vtu** – Queue priority override information (OQPRI). When this parameter is set to off state, override process is not active for appropriate VTU record, even though Priority override is enabled on the port.

4.28.2 Vlan Mode.

VLAN configuration is primarily used for the separation of management traffic from other customer data traffics. It can be useful to configure ETH VLANs also for customer traffic and filter ingress data traffic using these settings in some specific applications. The description of particular configuration and display boxes:

4.28.2.1 Role settings tables

In split protection, there is a possibility to set up specific port settings of the Secondary unit in accordance with the *Pri-Sec LAN Interconnection mode*. The table *SECONDARY ROLE SETTING* shows the current mode and port state settings for the case when this unit operates in the secondary protection role. Note this table can not be modified apart from the Pri-Sec LAN Interconnection mode presets.

- **Port State** – indicates the current port state settings. Possible values are Active & Standby. Used mainly for the split-protection modes with *Pri-Sec LAN Interconnection*.
- **Port Mode** – it is possible to set-up the required VLAN mode separately for each ETH switch port. It is recommended to leave all ports in basic mode (802.1Q disabled at the port) and edit VTU records first. The user has to be sure with correct VLAN configuration and has to set also his network into the similar VLAN support. VLAN Port modes are described below:
 - **basic** – T802.1Q VLAN mode is disabled. Only port group rules are applied. It is a transparent mode where VLAN settings in VTU table are ignored.
 - **Ingress policy** – both untagged or tagged frames are accepted at port entry and exit only those ports of ETH switch which are members of the same group as the input port. The port default VLAN number is assigned as frame VID for next internal switch processing.
 - **Egress policy** – frames are transmitted unchanged
 - **access** – 802.1Q VLAN mode is enabled. VTU rules in conjunction with port group rules are applied. Such port is a member of just one VLAN defined in VTU table whose VID is identical with port Default VLAN number. This port is configured in such VLAN VTU record as untagged.
 - **Ingress policy** – only untagged frames are accepted at entry port. Internal frame VID of such untagged frame is automatically assigned from port's Default VLAN. Frames are allowed to exit only those ports that belong to the frame's VLAN and are inside the same group as the input port.
 - **Egress policy** – frames are transmitted untagged from this port. The egressing frame's VID is checked against VTU table and if VID doesn't exist in VTU table such frame is filtered (discarded).
 - **trunk** – 802.1Q VLAN mode is enabled. VTU rules in conjunction with port group rules are applied. Port can be a member of more tagged VLANs according to VID extracted from VLAN tag and one untagged VLAN defined by port Default VLAN.
 - **Ingress policy** – only such frames are accepted, whose VID assigned from VLAN tag (tagged frames) or port's Default VLAN (untagged frames) exist in VTU table, and the entry port is a member of such VLAN. Frames are allowed to exit only those ports that belong to the frame's VLAN and are inside the same group as the input port.
 - **Egress policy** – frames are transmitted untagged or tagged according to the specification in VTU record table. The egressing frame's VID is checked against VTU table and if VID doesn't exist in VTU table such frame is filtered (discarded).
 - **hybrid** – When frame's VID exists in VTU table the rules for trunk port are used when VID does not exist in VTU table, then the basic rules are applied.

- **Port Group** – This parameter defines a port's based grouping and defines separate MAC address table domains inside the internal switch to allow full MAC address tables (ATU table) isolating. Only the ports from the same group can communicate with one another. The other ports are entirely separated. It is possible that isolated networks (different groups) can use the same MAC addresses without any collision in the internal ETH switch ATU table.
- **Default VLAN** – This parameter is configured automatically depending on records in the VTU table. Default VLAN is updated for the port which is marked as untagged in the VTU record. VLAN No.1 cannot be added into VTU table since it is a default VLAN for internal purposes. The port cannot be configured into access mode when Default VLAN of this port is 1. When Default VLAN value for the trunk port is 1, then the port accepts tagged frames only.

Important! Improper settings of these parameters may cause network loopbacks or inability to manage the device. Please carefully check your settings before confirmation.

4.28.3 VTU Settings.

Configuration of VTU records

- **ACTION** – It adds or removes VTU records. A VTU record cannot be deleted when contains untagged port which is configured in access mode. Just simple VLAN NO. specification is required for VTU record erase.
- **VLAN N.** – The VLAN number of edited VLAN (added or deleted). Please note the VLAN No. 0 & 1 are reserved by the system and cannot be set; thus the valid VLAN No. is from 2 to 4095
- **FID** – Defines the MAC address database table for each VTU VLAN record. When more than one VLAN is added into the same FID table then such VLANs will share the same MAC address database; thus they will not be completely isolated. Usually, it is desired that each VLAN has its unique FID. Please note that the port Groups 1-4 are assigned to the MAC address databases FIDs 1-4, and thus these FIDs shouldn't be used for VTU VLAN separation (especially for VTU VLANs 2-4) unless the MAC table sharing between such defined VLAN and a particular port Group is the desired state.
- **QOS PRI** – When VTU override mode is selected then the QOS priority value of the original frame is overridden. This configuration has influence only on the internal frame processing by means of queue controller (QPRI defined by OQPRI instead of IQPRI bits), but frames are still egressed with the initial priority assignment (FPRI is without any change).
- **LAN 1-WAN B** – It defines VLAN mode for each port in configured VLAN.
 - **Deny** – Port is not a member of edited VLAN. Ports which are defined in different Groups should be set into this mode.
 - **Untag** – Port is a member of edited VLAN as untagged.
 - **Tag** – Port is a member of edited VLAN as tagged.

Please note the LAN3 port cannot be tagged as it is intended to be always available for local management access.

4.28.4 LISTING OF ACTUAL VTU VALUES.

List of VTU records (defined VLANs) in the ETH switch. The abbreviations in this list correspond to the first letter of the port mode definition in VTU records.

4.29 Config/Ports/EMM.

MUX					EthVLAN					EthQOS					EMM									
EMM					EMM#1					EMM#2					EMM#3					EMM#4				
EMM Type					4ASI					none					none					none				
EMM Status					ok					not connected					not connected					not connected				
EMM Enable					☒					☐					☐					☐				
EMM Add/Drop ID					auto					auto					auto					auto				
EMM Add/Drop Range					1..4					n/c					n/c					n/c				
EMM Mode																								
EMM CARD #1					ASI 1					ASI 2					ASI 3					ASI 4				
Channel Enable					☒					☒					☒					☒				
Mode					Rx					Rx					Tx					Tx				
Data Source															Remote Ch3					Local P1				
Channel Speed Limit [Mbps]					214					214					214					214				
PCR Lock					-					-					noLock					noLock				
Link Status					loss					loss					noSync					noSync				
Debug BER Mode															Unsupported									

REFRESH UNDO APPLY

Figure 67: Config/Ports/EMM [4xASI]

MUX					EthVLAN					EthQOS					EMM									
EMM					EMM#1					EMM#2					EMM#3					EMM#4				
EMM Type					16E1T1					none					none					none				
EMM Status					ok					not connected					not connected					not connected				
EMM Enable					☒					☐					☐					☐				
EMM Add/Drop ID					auto					auto					auto					auto				
EMM Add/Drop Range					1..16					n/c					n/c					n/c				
EMM Mode					E1																			
EMM CARD #1					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16				
Enable					☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐					
LLOOP					☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐					
RLOOP					☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐					
Coax mode					☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐					
Termination [Ω]					120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120				
Link Status					ok	loss	loss	loss	loss	loss	loss	loss	loss	loss	loss	loss	loss	loss	loss	loss				

REFRESH UNDO APPLY

Figure 68: Config/Ports/EMM [16E1/T1]

4.29.1 EMM.

The monitoring and setup of EMM cards basic functions.

- **EMM Type** – it displays the type of connected EMM card. The 'none' type indicates that particular position is empty, the 'RELAY-SYS' indicates that the relay IDU is connected directly to device's SFP port (relay application) or to EMM secondary SFP port (add/drop configuration).
- **EMM Enable** – this check box enables generation/reception of data frames to/from Fiber Optic stream. When EMM is enabled then EMM occupies an appropriate range of traffic port channels (described below).
- **EMM Add/Drop ID** – In auto mode EMM card occupies port-channel range according to its position in EMM chain. For Add/Drop application it is sometimes necessary to set different (manual) Add/Drop ID, especially when EMM card should drop port channels from specific Add/Drop range.
- **EMM Add/Drop Range** – it displays appropriate port-channel range according to the EMM card position and EMM Add/Drop ID setting.
- **EMM Mode** – it selects the mode of connected EMM 16E1T1 card

4.29.2 EMM CARD [4xASI].

Settings for EMM-4ASI

- **Enable** – this checkbox selects which ASI ports are configured for DVB ASI connection. The necessary link capacity is automatically allocated according to the amount of all ASI Rx streams.
- **Link Status** – it displays the actual status of ASI port

In Rx mode:

- **ok** - a valid ASI signal is presented at the appropriate input port
- **ok** - a valid ASI signal is presented at the appropriate input port, but the port is not enabled for traffic application.
- **Idle** - ASI signal detected and successfully synchronized, but the signal does not contain user data (MPEG stream is missing).
- **Idle** - ASI signal detected and successfully synchronized but the signal does not contain user data (MPEG stream is missing) and the particular port is not enabled for traffic application.
- **noSync** - indicates that synchronization was not established for current receiving ASI signal.
- **noSync** - indicates that synchronization was not established for current receiving ASI signal and the port is not enabled for traffic application.
- **loss** - no signal detected at ASI input port.
- **loss** - no signal detected at ASI input port and the port is not enabled for traffic application.

In Tx mode:

- **ok** - a valid inbound signal is presented and transmitted via appropriate ASI port.
- **ok** - a valid inbound signal is presented, but the port is not enabled for transmission.
- **Idle** - the low-level code is detected, but the MPEG code was lost in the service.
- **Idle** - the low-level code is detected, but the MPEG code was lost in the service, and the particular port is not enabled for traffic application.
- **noSync** - high-level MPEG code was not detected.
- **noSync** - high-level MPEG code was not detected, and the particular port is not enabled for traffic application.
- **PCR Lock** – in Rx always 'lock', in Tx:
 - **lock** – PCR recovery loop is locked
 - **noLock** – PCR interval is not guaranteed

- **Mode** – specifies if the particular port operates in Rx (ingress from coaxial cable) or Tx (egress to coaxial cable) mode.
- **Data Source** – specifies the source for Tx signal. Either remote ASI port (Remote CH1-4) or one of available local ASI Rx port (Local Ch1-4) can be chosen. This setting is available in Tx mode only.
- **Speed Limit** – maximal data rate for inbound traffic to avoid overloading of overall link capacity. This setting is available in Rx mode only.

4.29.3 EMM CARD [16E1/T1].

Settings for EMM-16E1T1

- **Enable** – this checkbox selects what G.703 ports are configured for customer traffic connection. Such ports require appropriate capacity allocation from IDU, even though customer traffic is not carried (e.g. cable is disconnected).
- **Link Status** – it displays the actual status of G.703 port or appropriate internal traffic channel.
- **Termination** – it displays the actual impedance matching of G.703 port according to Coax mode setting.
- **LLOOP** – local loopback configuration, incoming data from the G.703 port to modem are sent to the modem and simultaneously looped back to the G.703 port. This is a debugging function.
- **RLOOP** – remote loopback configuration, incoming data from the modem to G.703 port are sent to such port and simultaneously looped back to the modem. This is a debugging function.
- **Coax Mode** – this checkbox changes the G.703 mode from standard 120Ω balanced to 75Ω unbalanced.

4.30 Config/Alarms/General.

General		EMM		LOCAL		REMOTE		THRESHOLDS	DETAILS
		CH 1	CH 2	CH1	CH2				
SYSTEM ALARMS									
● License	DEF	☒	☒		☒				
● HW Alarm	DEF	☒	☒		☒				none
● SW Alarm	DEF	☒	☒		☒				none
● Temperature	DEF	☒	☒		☒			-5..90 °C	59.5 °C
● Fan	DEF	☒	☒		☒			> 1000 rpm	6825 rpm
● Radio Response	DEF	☒	☒	☒	☒				
● EMM1 Response	PRT DEF	☐	☒		☒				
● EMM2 Response	PRT	☐	☒		☒				
● EMM3 Response	PRT	☐	☒		☒				
● EMM4 Response	PRT	☐	☒		☒				
RADIO ALARMS									
● HW Alarm	DEF	☒	☒	☒	☒				none
● TX Power	DEF	☒	☒	☒	☒				
● Temperature	DEF	☒	☒	☒	☒			-25..60 °C	43.5 °C
● IF Level Detection	DEF	☒	☒	☒	☒				
○ Mute	DEF	☒	☒	☒	☒				
○ RX Level (RSSI)	DEF	☒	☒	☒	☒			-65 ⓘ -65 ⓘ	-35 / -38 dBm
MODEM / MUX ALARMS									
○ Aggregation	DEF	☐	☒		☒				
○ Data Sync	DEF	☒	☒	☒	☒				
● IF Level Detection	DEF	☒	☒	☒	☒				
○ MSE	DEF	☒	☒	☒	☒			-24 ⓘ -24 ⓘ	-38.6 / -38.3 dB
○ Frame Error Rate	DEF	☒	☒	☒	☒			10 ⓘ 10 ⓘ	0 / 0 ErrFrames/5s
PORTS ALARMS									
○ LAN1 Link	PRT	☐	☒		☒				
○ LAN2 Link	PRT	☐	☒		☒				
○ LAN3 Link	PRT	☐	☒		☒				
○ SFP1 Link	DEF	☐	☒		☒				
○ SFP2 Link	PRT	☐	☒		☒				
○ SFP3 Link	PRT	☐	☒		☒				
○ SFP4 Link	PRT	☐	☒		☒				

SET ALL UNSET ALL SET ALL OK ADD DEFAULTS UNDO APPLY

Figure 69: Config/Alarms/General Window

In this frame are listed possible events with direct, immediate impact on the link operability.

- **DEF** – Static recommended defaults. These alarms are activated after ADD DEFAULTS button press
- **PRT** – These alarms, when enabled and activated, invokes the role switching in auto split protection modes

Note: For correct protection role switching, the user must appropriately configure all the **PRT** switch alarms. Only such alarm which is enabled and listed as **PRT** will be used for protection switching provided that there are no protection alarms active on the peer unit.

Description of available alarms:

- **License** – This alarm will be raised when the license file is about to expire or is expired already, or contains an invalid data
- **HW Alarm** – A hardware problem with the device such as non-working ventilator
- **SW Alarm** – A software problem such as incompatible mode selection on the local and remote side or mismatch in used FW version.
- **Temperature** – The temperature of the modem part
- **Fan** – The detected ventilator rounds are under the threshold
- **Radio Response** – The status of communication with the radio part
- **EMM 1-4 Response** – The status of bidirectional FO communication with respective EMM card
- **HW Alarm** – The status as reported by the radio part

- **TX Power** – Transmitting Power status
- **Temperature** – The temperature of the radio part
- **IF Level Detection** – This alarm indicates bad radio IF input (350 MHz)
- **Mute** – The mute configuration does not match the actual radio mute status
- **RX Level** – The receiving level threshold
- **Aggregation** – Status of the Aggregation
- **Data Sync** – This alarm indicates the actual status of packet processor (PBPS) synchronization.
- **IF Level Detection** – This alarm indicates a low or high level of modem input (140 MHz)
- **MSE** – Link quality indicator threshold settings and status. You can check the usual MSE values in the ACM profile table under the menu Radio/ACM.
- **Frame Error Rate** – The threshold for error frames per 5s
- **LAN1/2/3 Link** – Status of the LAN port Link
- **SFP1/2/3/4 Link** – Status of the SFP port Link

4.31 Config/Alarms/EMM.

General
EMM

EMM#1 - 4ASI		LOCAL		REMOTE	LOCAL	
		CH 1		CH 1	THRESHOLDS	DETAILS
EMM HW+SW	DEF	☐				none
SFP2 Link	PRT	☐				
P1 Link	PRT	☐				
P1 Sync	PRT	☐				
P1 Idle	PRT	☐				
P1 Lock	PRT	☐				
P2 Link	PRT	☐				
P2 Sync	PRT	☐				
P2 Idle	PRT	☐				
P2 Lock	PRT	☐				
P3 Link	PRT	☐				
P3 Sync	PRT	☐				
P3 Idle	PRT	☐				
P3 Lock	PRT	☐				
P4 Link	PRT	☐				
P4 Sync	PRT	☐				
P4 Idle	PRT	☐				
P4 Lock	PRT	☐				

SET ALL
UNSET ALL
SET ALL OK
ADD DEFAULTS
UNDO
APPLY

Figure 70: Config/Alarms/EMM [4xASI] Window

Alarms for EMM-4ASI

- **EMM HW+SW** – Overall EMM status. Possible values are:
 - fifo overflow – Overall EMM Rx stream speed exceeded the available link throughput
 - src ID – Mishmash in remote EMM settings. For example when you try to operate ASI card against a 16E1/T1 card.
- **SFP2 Link** – Status of secondary SFP port Link

- **ASI Px Link**
 - in Tx – Will be always ok
 - in Rx – Status of ASI Rx port Link
- **ASI Px Idle** – An unexpected pause in user data (MPEG stream is missing)
- **ASI Px Sync** – Synchronisation status to current ASI signal. Can occur when there is, for example, RF link synchronization event or when ASI data are corrupted.
- **ASI Px Lock**
 - in Tx – ASI PCR lock status. After a synchronization, it can take up to a minute until it is correctly aligned. Other events which could result in this alarm are ACM modulation shifting, Protection shifting, a variable ASI stream speed or a link error.
 - in Rx – Will be always ok

General
EMM

EMM#1 - 16E1T1		LOCAL CH 1	REMOTE CH 1	LOCAL THRESHOLDS	DETAILS
EMM HW+SW	DEF	☐			none
SFP2 link	PRT	☐			
P1 link	PRT DEF	☐			
P1 ais	PRT	☐			
P2 link	PRT	☐			
P2 ais	PRT	☐			
P3 link	PRT	☐			
P3 ais	PRT	☐			
P4 link	PRT	☐			
P4 ais	PRT	☐			
P5 link	PRT	☐			
P5 ais	PRT	☐			
P6 link	PRT	☐			
P6 ais	PRT	☐			
P7 link	PRT	☐			
P7 ais	PRT	☐			
P8 link	PRT	☐			
P8 ais	PRT	☐			
P9 link	PRT	☐			
P9 ais	PRT	☐			
P10 link	PRT	☐			
P10 ais	PRT	☐			
P11 link	PRT	☐			
P11 ais	PRT	☐			
P12 link	PRT	☐			
P12 ais	PRT	☐			
P13 link	PRT	☐			
P13 ais	PRT	☐			
P14 link	PRT	☐			
P14 ais	PRT	☐			
P15 link	PRT	☐			
P15 ais	PRT	☐			
P16 link	PRT	☐			
P16 ais	PRT	☐			

SET ALL
UNSET ALL
SET ALL OK
ADD DEFAULTS
UNDO
APPLY

Figure 71: Config/Alarms/EMM [16E1/T1] Window

Alarms for EMM-16E1T1

- **EMM HW+SW** – Overall EMM status. Possible values are:
 - clk recovery – No data to transfer. Generating AIS instead.

- fifo overflow – Overall EMM Rx stream speed exceeded the available link throughput
- src ID – Mishmash in remote EMM settings. For example, when you try to operate 16E1/T1 card against an ASI card.
- **SFP2 Link** – Status of secondary SFP port Link
- **Px link** – Status of E1/T1 port Link
- **Px ais** – Receiving AIS signal:
 - E1: Two or fewer 0 in each of two consecutive 512-bit streams received
 - T1: Fewer than nine 0s contained in 8192 bits.

This alarm indicates a problem on the E1/T1 source device attached to this port.

4.32 Maintenance/Configuration/Save&Run.



Figure 72: Maintenance/Configuration/Save&Run Window

4.32.1 Update, Show or Run start-up system configuration.

This frame allows to store, display/export and execute the start up configuration.

- **WRITE** – store the actual configuration
- **SHOW C0** – shows the device's stored startup configuration as list of commands. Note that the order of commands in this frame matters. Also note that this configuration is not automatically updated unless this button is pressed again.
- **RUN C0** – this will execute the current start up memory content. Note that this action will cause data loss and lost of all unsaved configuration changes.

4.32.2 Run or Show start-up IP configuration.

This frame allows to display/export stored IP settings of the device and reinit all IP interfaces.

- **SHOW IP** – shows the device IP configuration as list of commands. Note that this configuration is not automatically updated unless this button is pressed again.
- **IP INIT** – this will execute the current start up memory IP settings content as well as re-init of IP interfaces. Note that this action will not cause user data loss but it will disconnect all active management sessions.

4.33 Maintenance/Configuration/Backup&Restore

The screenshot shows a web interface with three tabs: 'Save&Run', 'Backup&Restore' (selected), and 'Factory default'. The main content area is divided into two sections. The first section, 'COMPLETE CONFIGURATION BACKUP & RESTORE – INTERNAL STORAGE', includes a warning: 'Backup configuration into internal permanent non-volatile memory' and '!!! ATTENTION, previous backup will be rewritten !!!'. A 'BACKUP' button is present. Below this, it states 'No config file in local memory.' The second section, 'COMPLETE CONFIGURATION RESTORE – EXTERNAL STORAGE', includes a warning: 'Restore configuration from backup file in external storage' and '!!! ATTENTION all actual stored settings will be lost !!!'. It features a file selection button labeled 'Scegli file' with the text 'Nessun file selezionato' and an 'UPLOAD AND EXECUTE' button.

Figure 73: Maintenance/Configuration/Backup&Restore Window

4.33.1 Complete configuration backup & restore – internal storage.

This frame allows to BACKUP the start up configuration into the internal restart persistent memory. Please note that only stored configuration will be backed up. Only one backup is allowed.

Please note that this backup is not automatically updated after firmware upgrade and thus it should be re-generated by the user manually.

The RESTORE button will appear if there is a configuration file stored. Such file can be downloaded from this frame directly.

Important notes:

- After pressing the *RESTORE* button the start-up configuration will be immediately replaced by the restored configuration.
- The restored configuration is **not automatically activated**. You have to invoke the *run c0* or perform soft reboot in order to activate it.
- Please note that the RESTORE should be performed on the same FW version as it was created!

4.33.2 Complete configuration restore – external storage.

On this frame you can select and upload previously saved configuration file (*.afw) from external location.

Important

notes:

- After pressing the *Upload and Execute* button the start-up configuration will be immediately replaced by the restored configuration.
- The restored configuration **is not automatically activated**. You have to invoke the *run c0* or perform soft reboot in order to activate it.
- Please note that the RESTORE should be performed on the same FW version as it was created!

4.34 Maintenance/Configuration/Factory default.



Figure 74: Maintenance/Configuration/Factory default

Restores the configuration of the device to its factory pre-set values including credentials, radio and IP settings.

Note: Please make sure that you have physical access to the device and that you know the Factory Default IP addresses (10.10.10.10 for MNG or 10.10.11.10 for USB port) and default credentials.

Note: The device will be rebooted automatically!

4.35 Maintenance/Firmware/Upgrade.

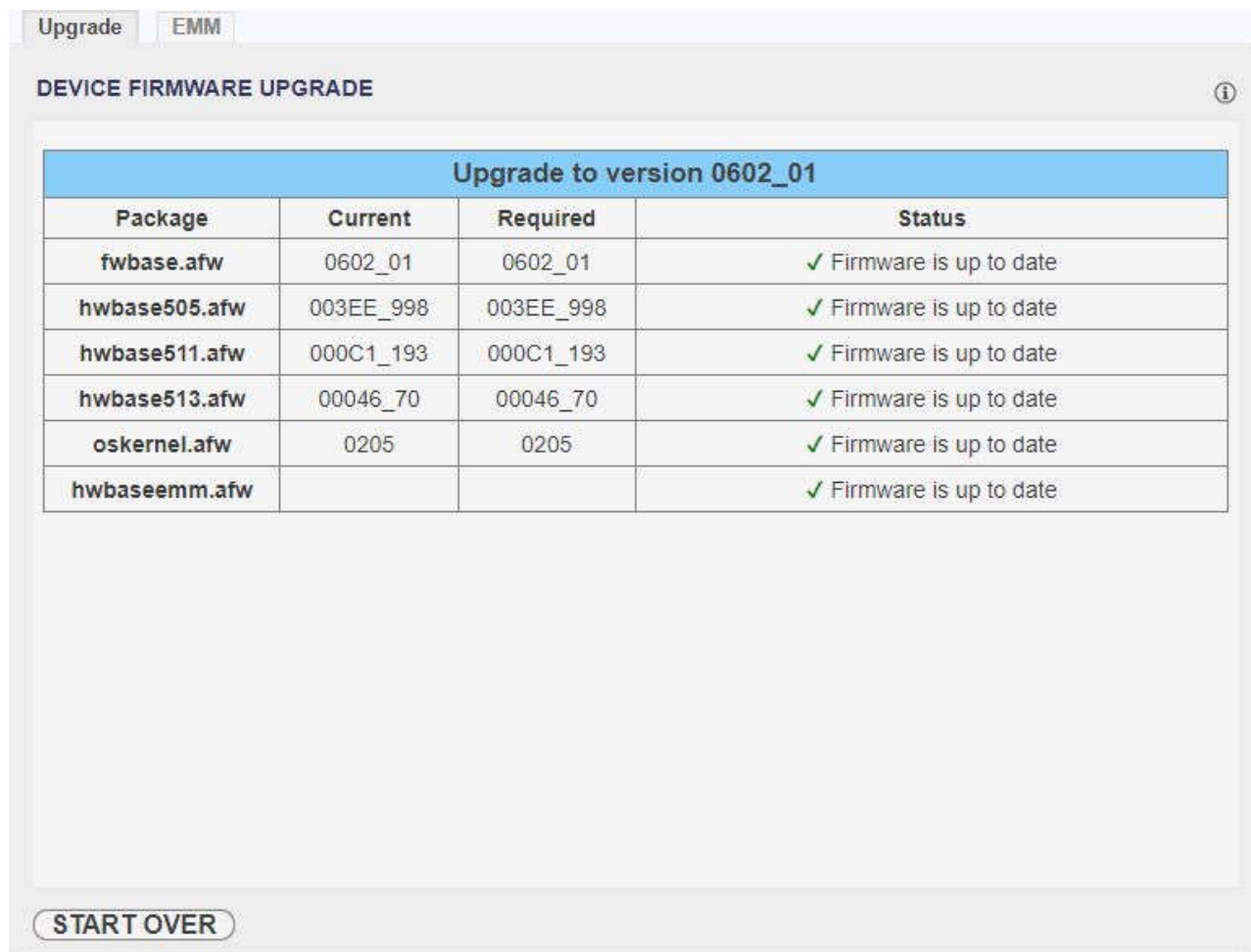


Figure 75: Maintenance/Firmware/Upgrade window

Drag and drop or select the **whole folder** with the desired firmware to start the upgrade procedure. A common firmware folder has the following structure:

- XYY_ZZ:
 - checkversions.afw
 - fwbase.afw
 - hwbaseXYZ.afw

The wizard will evaluate the content of the uploaded *checkversions.afw* and will advise the FW parts, which requires upload and/or upgrade. Once this part is done, you will be presented with some or all of these options:

Button	Function
START OVER	Resets the wizard and allows to choose a different FW folder.
UPLOAD ONLY	Uploads all the required FW parts into the device internal storage but will not start the upgrade procedure so that it can be invoked manually later by the Install button
INSTALL	Shown when all necessary parts are stored in the device and ready for installation. This will start the upgrade procedure and reboot the device upon completion.
UPLOAD & INSTALL	Shown when packages are needed for the upload and upgrade. All required parts will be automatically uploaded and installed by the wizard. This will start the upgrade procedure and reboot the device upon completion.

Important notes:

- Firmware upgrade initialized by an Install button will cause data drop - approximately one minute for the modem part plus about 30 seconds per each attached EMM card.
- Firmware versions should match all devices in the link.
- After the firmware upgrade, you should re-generate all pertinent configuration backups if such exists.
- All files uploaded are restart-persistent. This allows uploading all required parts in advance and initializing the upgrade later on, for example, nighttime.
- Always upgrade the over-link managed side first!

4.36 Maintenance/Firmware/EMM.

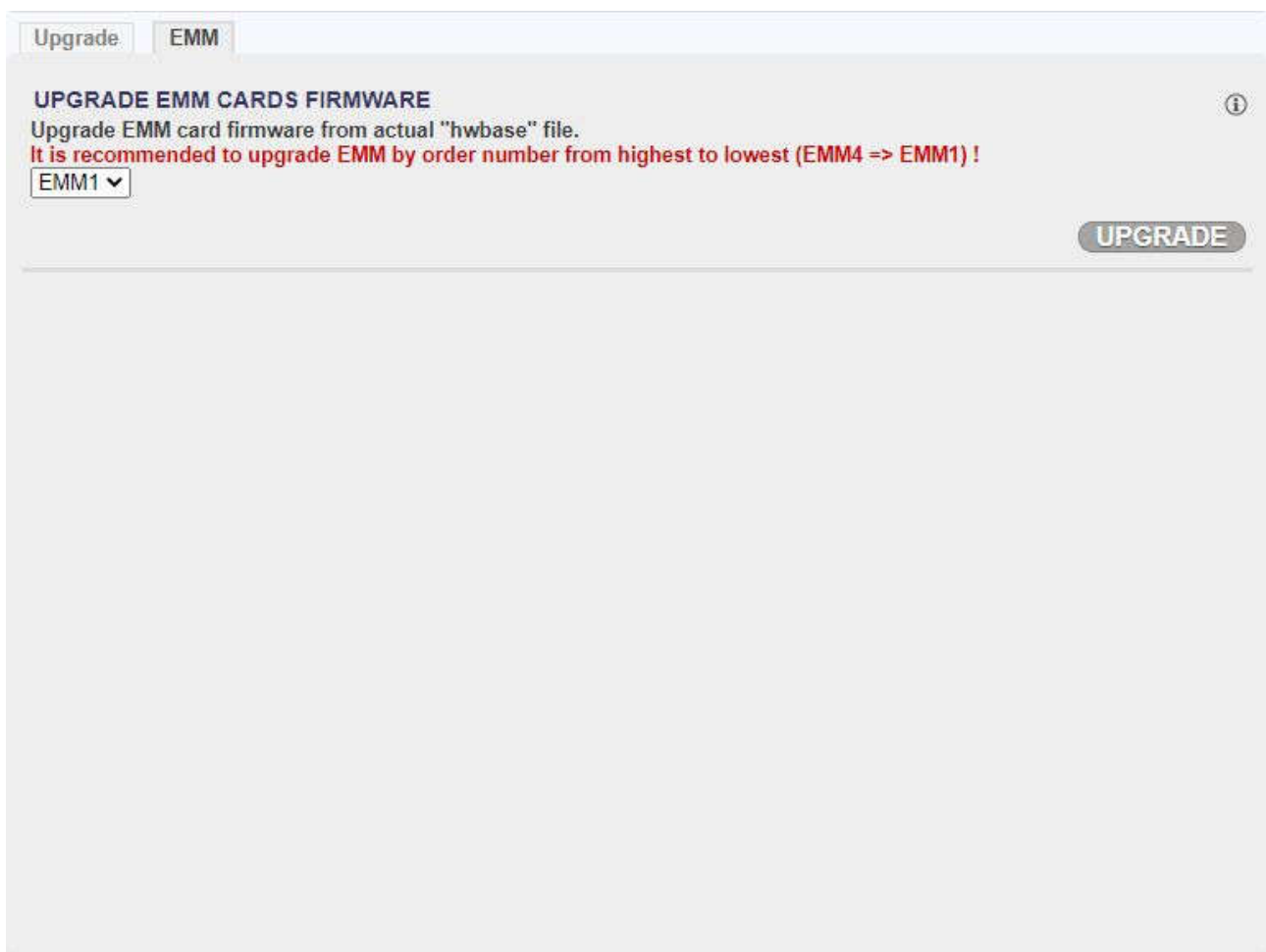


Figure 76: Maintenance/Firmware/EMM Window

This frame allows to upgrade firmware in attached EMM cards. Please note that it is recommended to update EMM cards in reverse order:

EMM4->EMM3->EMM2->EMM1

Also note that there will be a data drop for about 15 seconds per one module.

4.37 Maintenance/Files/Export.

Exports Upload

GENERATE FILES INTO VOLATILE MEMORY ⓘ

Please read help for informations

☐ Generate ALL

☐ Generate Log File

☐ Generate License Request File

☐ Generate Configuration File

GENERATE

EXPORT GENERATED FILES FROM VOLATILE MEMORY

Remove all generated files from temporary volatile memory

REMOVE

Figure 77: Maintenance/Files/Export Window

This frame allows to collect various device reports as a downloadable archive in order to provide such files for off-site problem diagnostics and backup. The selected files can be collected by means of pressing the GENERATE button which will result in appropriate number of downloadable files listed in the sub-section EXPORT GENERATED FILES FROM VOLATILE MEMORY. Please note that such files are erased during restart of the device or by means of the REMOVE button.

- **Generate ALL** – selects all below listed items for file generation at once.
- **Generate Log File** – archive of various log files for debugging purposes with link configuration and condition as plain text files.
- **Generate License Request** – a binary file with current license status. This file is meant for extending license expiration date.
- **Generate Configuration File** – a binary file with complete configuration of the device. This file can be used for backing up the configuration or for transfer of such configuration into another device. Please note that the configuration transfer should be done only between devices with matching firmware versions. Also, please note that this file cannot be read by the user.

4.38 Maintenance/Files/Upload.

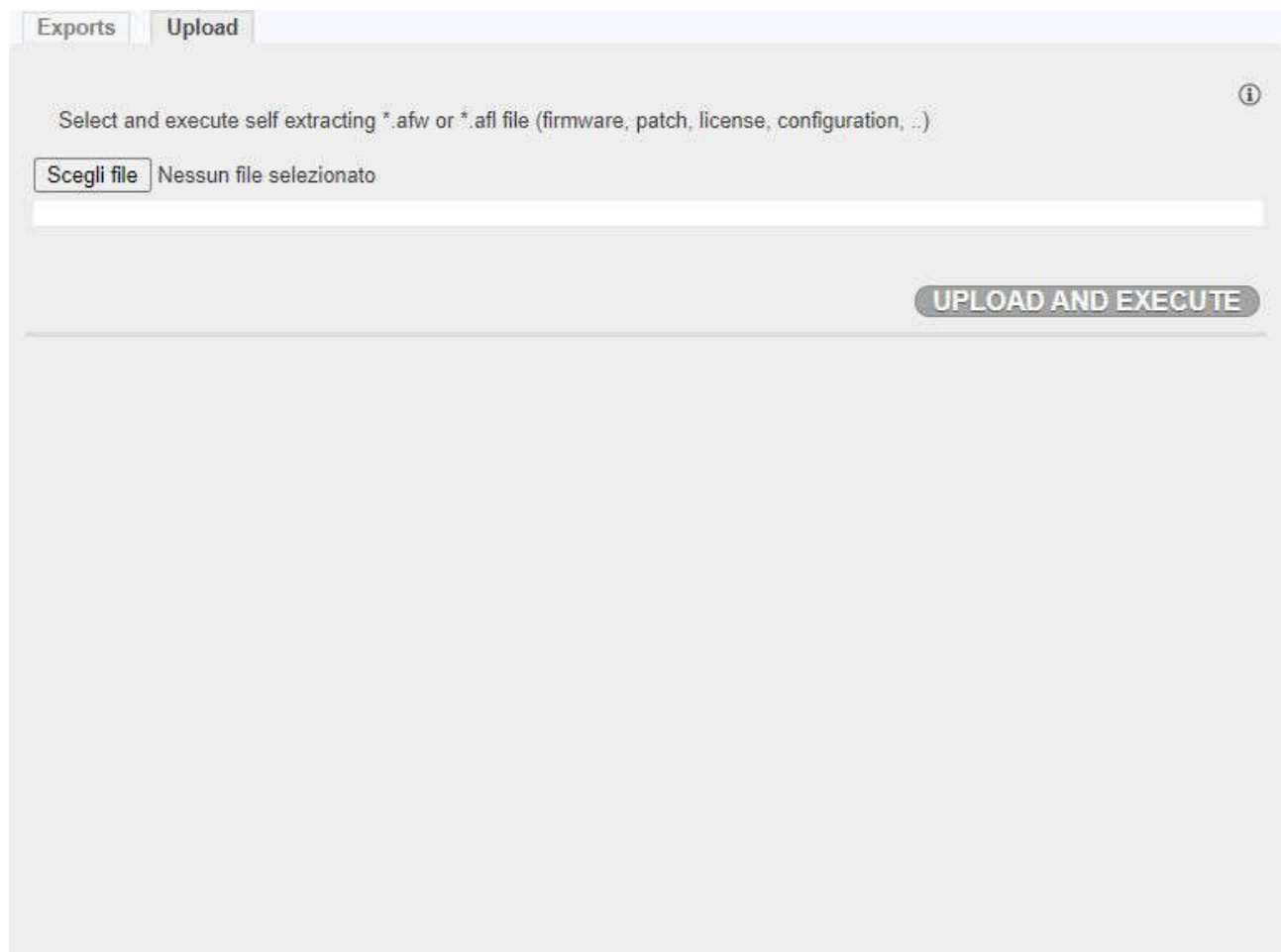


Figure 78: Maintenance/Files/Upload Window

In order to upgrade device's firmware, configuration or license the user should select the appropriate file and press the UPLOAD AND EXECUTE button. The common format of files is:

- **Firmware** – (load files in this order)
 - hwbaseXXX.afw – software for internal HW parts
 - oskernel.afw – operating system
 - fwbase.afw – application software (WEB, SNMP, commands , etc.)
- Configuration
 - fwconf_OriginatingSN_Timestamp.afw
- License
 - licSN.afw

The name of files does not matter but the extension does. Please note that the device file validation is case sensitive so *.afw does not equal to *.AFW.

Firmware upgrade procedure

In order to manually upgrade the device:

- save the current configuration by means of pressing the WRITE button
- gradually select all files in order as described above. Please note that after uploading of the fwbase.afw file the device performs automatic reboot

Please note that firmware downgrade is not officially supported and such action can cause malfunction of the device. The full upgrade procedure is described in Firmware_Release_Notes document which is
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distributed together with new firmware versions. Also, please note that the firmware upgrade will not alter any customizing options except for explicitly stated cases described in the Firmware_Release_Notes document. All devices in a link should operate the same firmware version.

4.39 Maintenance/Logs.

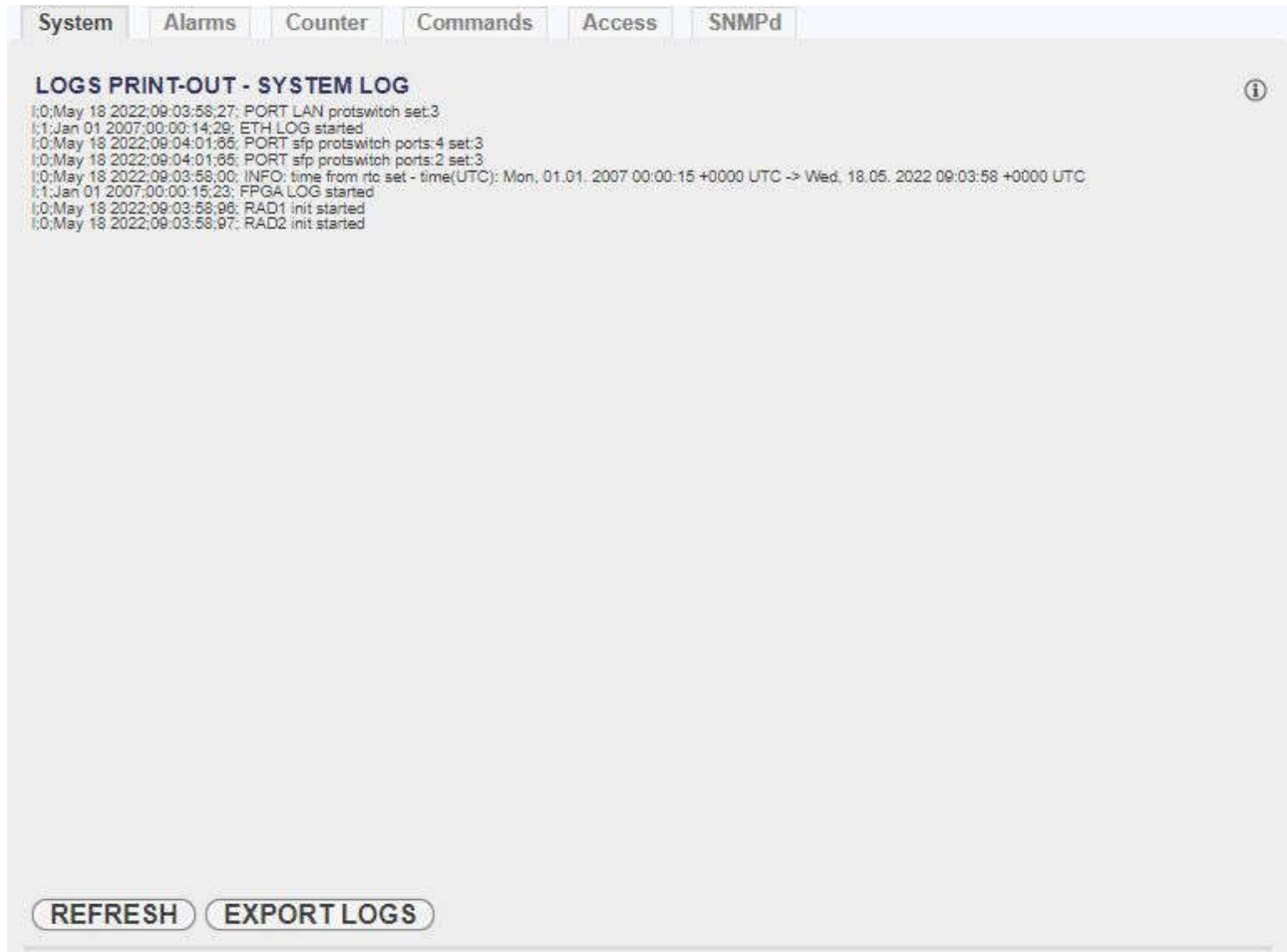


Figure 79: Maintenance/Logs/System Window

This frame provides historical data of the device condition. Sections enlisted under this page are independent on the current alarm settings so all events will be recorded. The historic span of these information depends on the link condition – a lot of events will cause quicker filling of these logs and sooner overwriting of the oldest records.

- **System Log** – System events such as license action, radio configuration changes, etc.
- **Alarm Log** – The alarm log
- **Counter Log** – System counter events. When an error is detected or resolved this file is appended by the actual link parameters in such moment
- **Commands Log** – History of performed commands
- **Access Log** – Authentication history
- **SNMPd Log** – Reports of the internal SNMP daemon

4.40 Maintenance/Troubleshooting/Assistant.

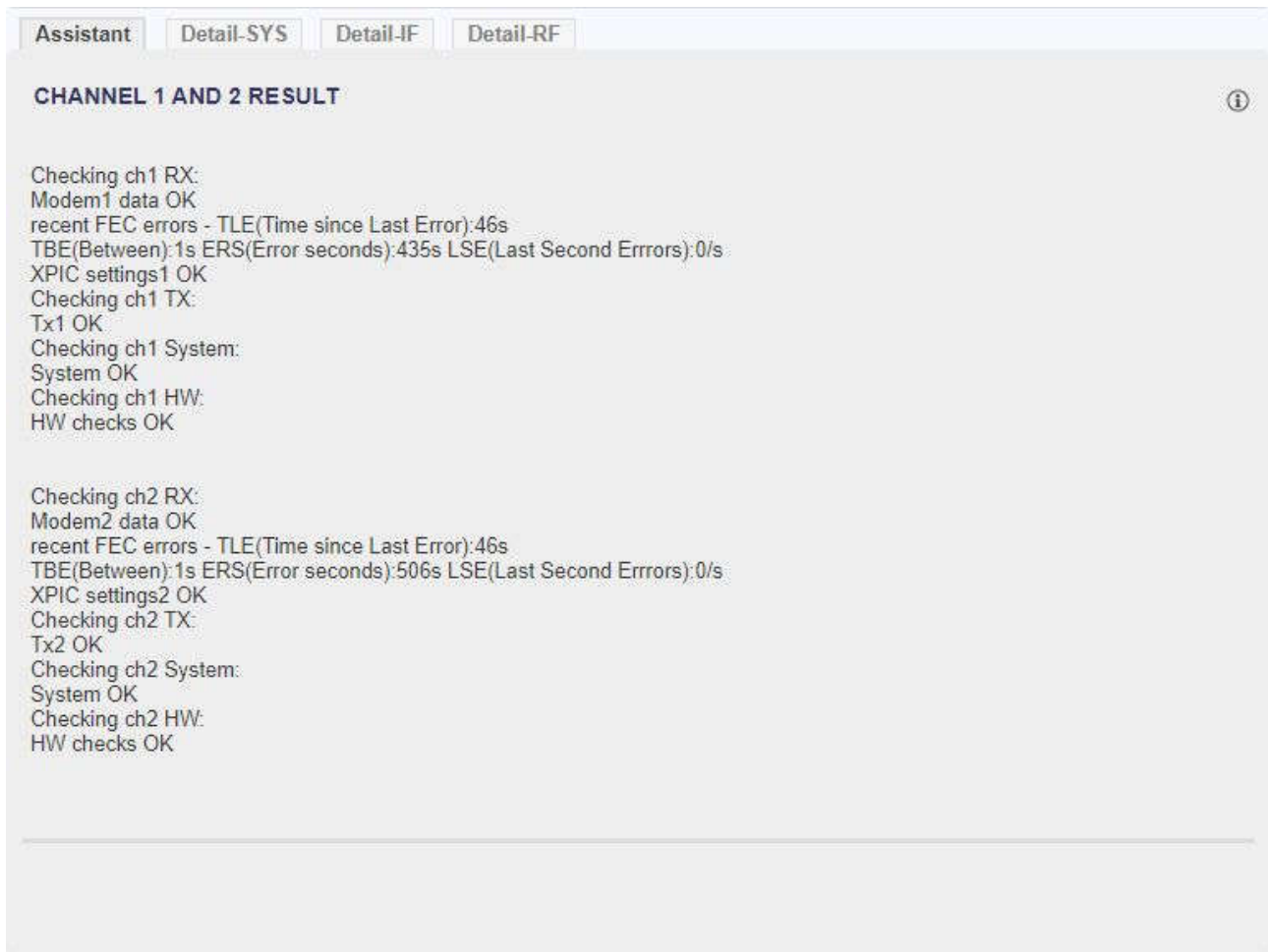


Figure 80: Maintenance/Troubleshooting/Assistant Window

Troubleshooting assistant which can point out possible issues such as misconfiguration, non-default settings and other device performance issues.

4.41 Maintenance/Troubleshooting/Detail-SYS.

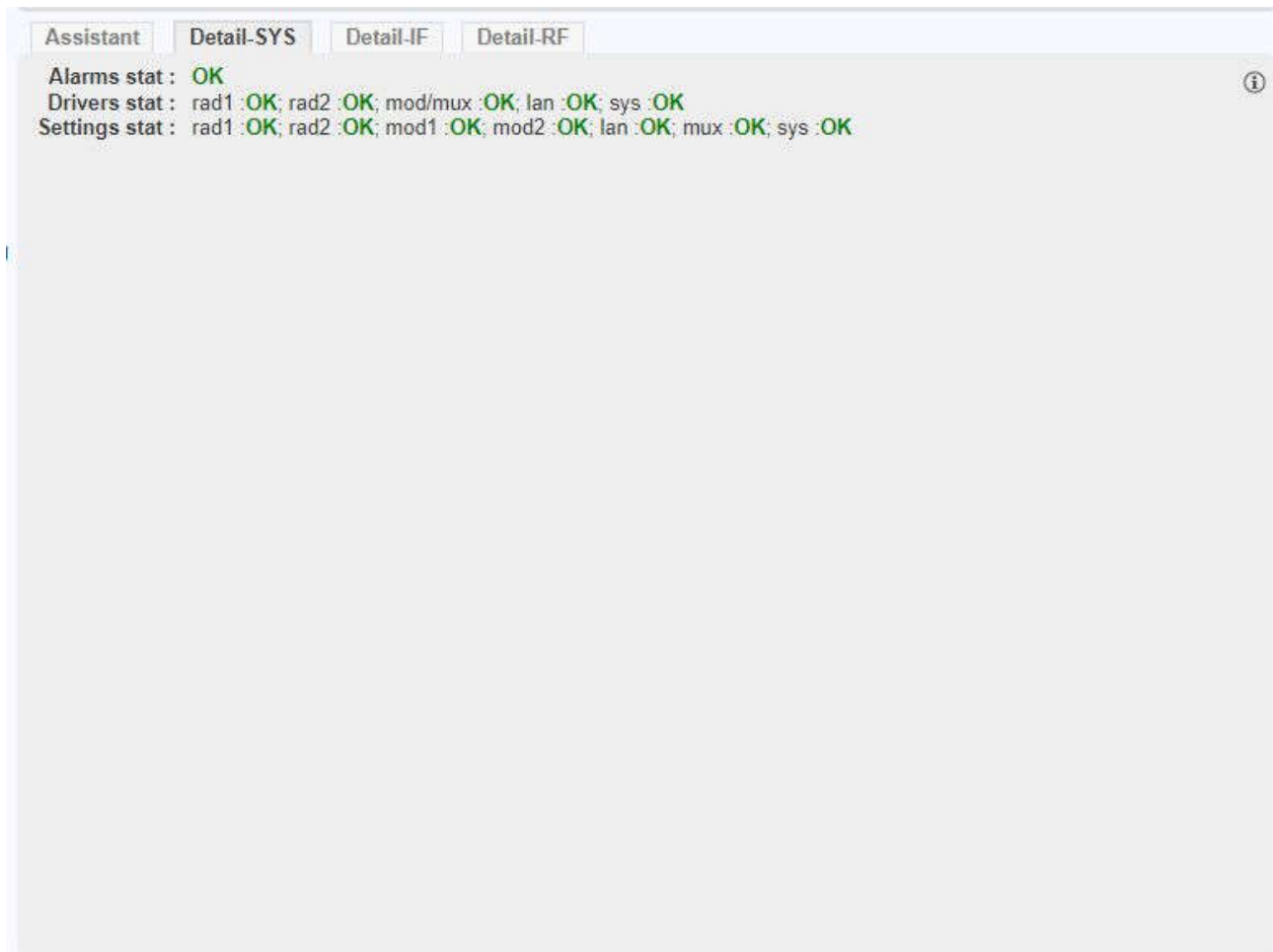


Figure 81: Maintenance/Troubleshooting/Detail-SYS Window

Device status summary. Additional debug information will be shown in case of error state.

- **Alarms stat** – Actual device alarm status. Note that only enabled alarms are considered.
- **Drivers stat** – Actual status of low-level drivers. An eventual error suggests unsuccessful or on-going communication between respective driver and the system driver. The system driver is responsible for interpretation of device status to front ends (CLI, GUI, SNMP).
- **Settings stat** – Actual configuration status. An eventual error suggests that a required setting could not be set.

4.42 Maintenance/Troubleshooting/Detail-IF.

Assistant	Detail-SYS	Detail-IF	Detail-RF
MODULATIONS CONFIG			
ModulationR1 :	1024_28000_02	weak	
ModulationR2 :	1024_28000_02	weak	
MODEM_CONFIG	#1	#2	
Channel Fce :	Aggreg	Aggreg	
Modems Cfg :	modem	modem	
ACM P-Table :	p1_005_01		
ACM Control :	auto	auto	
ACM UserMask :	0xffff	0xffff	
XPIC :	on	on	
Signal Source :	data	data	
Signal Type :	qam	qam	
Cw Freq :	0	0	
Scrambler :	code0	code1	
ERR_reg :	44444fff	22222fff	
MODULATOR			
IF Output :	unmuted	unmuted	
SymRate[Sps] :	25390625	25390625	
MaxTxS[Mbps] :	245	245	
ActTxQAM/FEC :	1024/m	1024/w	
ActTxS[Mbps] :	233	245	
DEMODULATOR			
Modem Sync :	ok	ok	
MSE(SNR)[dB] :	-38.50	-38.30	
ActRxQAM/FEC :	1024/m	1024/m	
ActRxS[Mbps] :	233	233	
IF RxL[dBm] :	-14.60	-14.90	
AGC Locked :	ok	ok	
Carrier Offs :	486	-2836	
Carrier Corr :	0	0	
Resync count :	2119	3192	
Last error :	SYNC	OK	SYNC OK
EXTENDED INFO			
ACM REG :	1f10e0e	1f10f0e	
ExtAGC[V] :	1.6484	1.6403	
CALIBRATION			
IFCalibT :	51.1	50.5	
IFCalibK :	-0.01272260	-0.01269030	
IFCalibQ :	11.31	11.20	
DCcorr :	ff74ff92	ff74ff9c	
IQgainCorr :	1f901f8	1f901f8	
OutAtt :	2	2	
Abrd S/N :	109	109	
GLOBAL			
PLL Lcks(1f) :	0x1f		
ADC Meas :	168001202	168001202	
DAC Meas :	224001603	224001603	
MODULATORS			
Spac/Pilots :	64/221	64/221	
DataSym :	14113	14113	
DEMODULATORS			
Decimators :	4	4	
Fsymb :	25390801	25390801	
Fsys :	224001603	224001603	
IAGcGain :	33125	33854	
IAGcThr :	4300	4300	
EAGcGain :	8356377	8405533	
EAGcThr :	9000	9000	
MSE_short :	b2a	d3b	
MSE_long :	b79	c22	
DCOFF :	5963796	26279913	
MMSEsec :	-38.44	-38.22	
MMSEabs :	-0.42	-0.42	
InternalAgc :	4283	4313	
ExternalAgc :	8959	8927	

Figure 82: Maintenance/Troubleshooting/Detail-IF Window

This frame provides summary of basic and advanced status details of the IF part.

4.43 Maintenance/Troubleshooting/Detail-RF.

Assistant	Detail-SYS	Detail-IF	Detail-RF
RADIO1-READED		RADIO2-READED ⓘ	
RSSI : -37dBm		RSSI : -23dBm	
T/R Spacing : 312.000		T/R Spacing : 312.000	
TXF Range : 4400 4699		TXF Range : 4400 4699	
CH Plan : 7 0 4403 500 1 42		CH Plan : 7 0 4403 500 1 42	
TXP Range : 0 36 34 32		TXP Range : 0 36 34 32	
RAD_SN : 51136-131.01E050341		RAD_SN : 51136-131.01E050342	
RAD_PN : 51136-131.01E050341		RAD_PN : 51136-131.01E050342	
RAD_FW_REV : 51104-00103-01		RAD_FW_REV : 51104-00103-01	
RAD_CFILE : TX01-RX0601		RAD_CFILE : TX01-RX0601	
IF_PN_SN : 00000000000000000000000000000000		IF_PN_SN : 00000000000000000000000000000000	
MW_PN_SN : ASS-51143-FD000000000077L		MW_PN_SN : ASS-51143-FD000000000021L	
HPA_PN_SN : 00000000000000000000000000000000		HPA_PN_SN : 00000000000000000000000000000000	
CPSU_PN_SN : ASS-34850-FDCBHEE1930123		CPSU_PN_SN : ASS-34850-FDCBHEE1648021	
RadioType : 1		RadioType : 1	
0 0 5 6 0		0 0 5 6 0	
LastResp - 0,		LastResp - 0,	
Debug : nrespnt - 0		Debug : nrespnt - 0	
dbg : 1701		dbg : 1701	
variant : 0 1		variant : 0 1	

Figure 83: Maintenance/Troubleshooting/Detail-RF Window

This frame provides summary of basic and advanced radio parameters. These values are collected directly from respective parts and reflects the actual state of such parts.

4.44 Maintenance/Reboot.

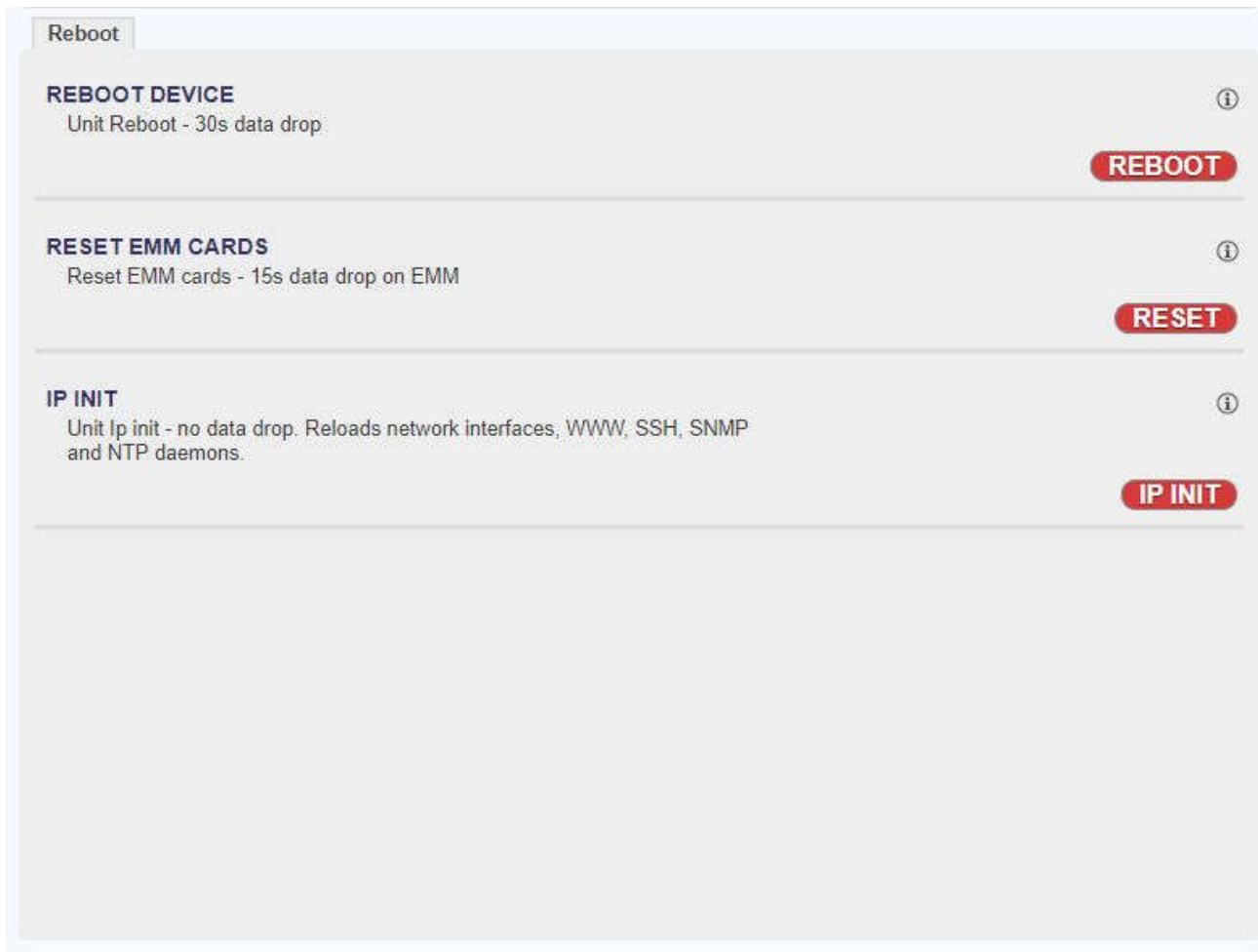


Figure 84: Maintenance/Reboot/Reboot Window

4.44.1 Reboot Device.

After pressing the REBOOT button the device will perform soft-reboot. Please note that this operation will cause data drop.

4.44.2 Reset EMM Cards.

After pressing the RESET button the EMM cards will be initialized. Please note that this operation will cause data drop.

4.44.3 IP INIT.

After pressing the IP INIT button the device will perform reinit IP interfaces, SSH, WEB, SNMP and NTP daemons.

4.45 Tools/Terminal.

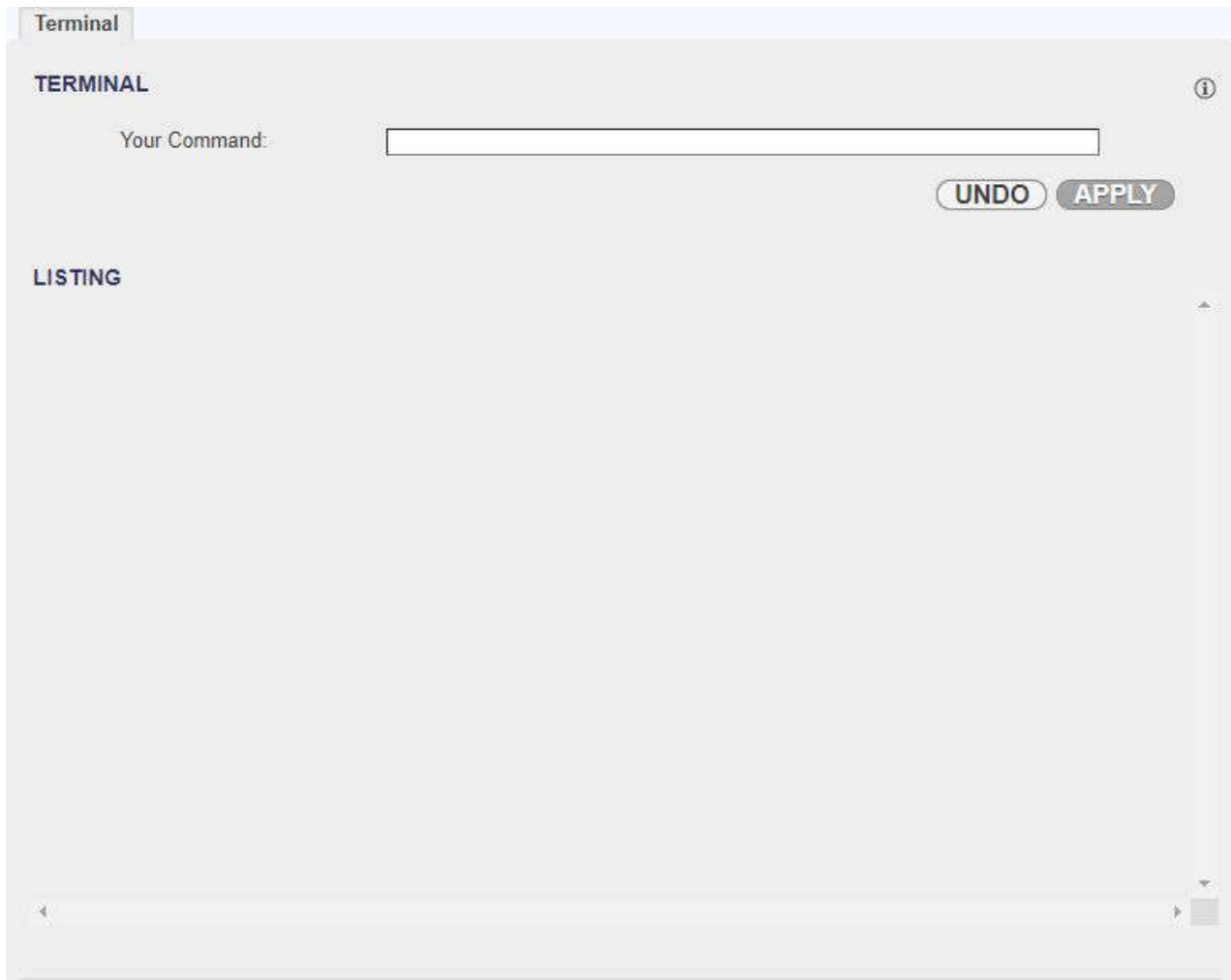


Figure 85: Tools/Terminal/Terminal Window

Inbuilt terminal window for interacting with device's CLI (Command Line Interface) directly from GUI. For list of all available commands please execute command '?'. Also note that nested commands support the question mark help as well, for example command 'show ?' will print out all available *show* commands.

4.46 Tools/IP Ping.

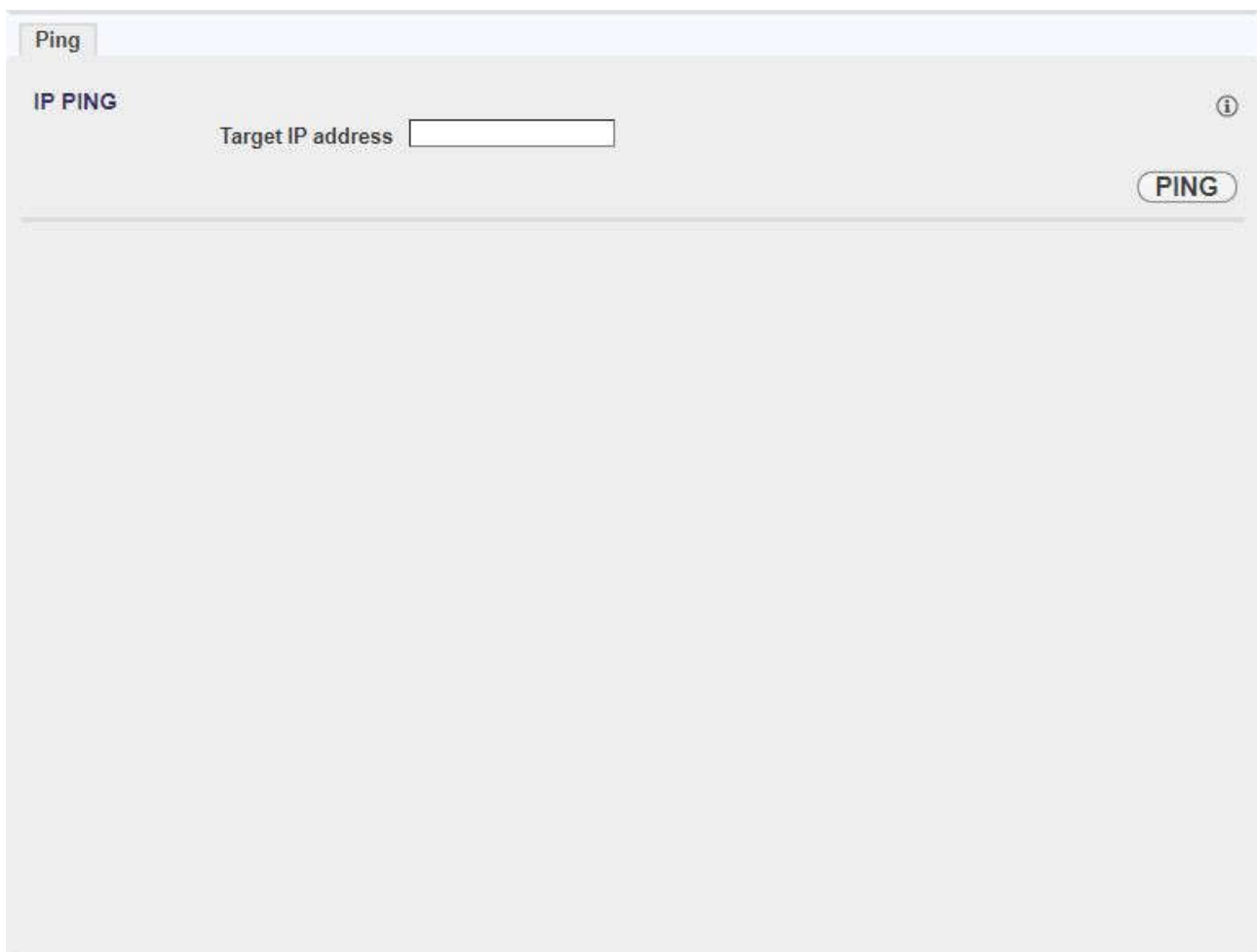


Figure 86: Tools/IP Ping/Ping Window

Send ICMP ECHO_REQUEST to network hosts

- **Target IP address** – IP address of the host

4.47 Tools/Sp. Analyzer.

SPECTRUM ANALYSER		CHANNEL 1
Local TX Mute Duration (sec)	150	MUTE
Delay before Start (sec)	0	ANALYSE
Auto Mute Remote Radio	☐	Warning: This action will cause a data drop!
Delay Status		

SPECTRUM ANALYSER OUTPUT

Channel 1 analyze 18/5/2022, 15:05:15
Proceeding analyzer - RAD1, please wait...
txmute done
narrow filter applied
ConfMode changed to 1 - hw limits
STARTRxF=4388000
ENDRxF=4687000
FSTEP=14000
4388.0:-37.0:*****
4402.0:-37.0:*****
4416.0:-37.0:*****
4430.0:-37.0:*****
4444.0:-37.0:*****
4458.0:-57.0:*****
4472.0:-57.0:*****
4486.0:-64.0:*****
4500.0:-74.0:*****
4514.0:-81.0:*****
4528.0:-82.0:*****
4542.0:-82.0:*****
4556.0:-82.0:*****
4570.0:-82.0:*****
4584.0:-82.0:*****
4598.0:-82.0:*****
4612.0:-82.0:*****
4626.0:-81.0:*****
4640.0:-81.0:*****
4654.0:-78.0:*****
4668.0:-73.0:*****
4682.0:-71.0:*****
ConfMode restored to 0
Rx frequency restored to 4420000
2 filter restored
mute config restored
ok

CLEAR ANALYSER DATA

Figure 87: Tools/Sp. Analyzer/Channel1 Window

Integrated spectral analyser for free channel lookup, or alternatively for detection of interference within the particular band.

The frequency scanning consists of 3 automated steps:

1. local transmitter is muted
2. local Rx frequency is sequentially tuned from lowest to highest
3. the local Rx level is recorded for each frequency

This frame consists of two parts:

4.47.1 SPECTRUM ANALYSER.

The spectrum analyser configuration frame.

- **Local TX Mute Duration** – You can use this option to manually mute the local radio for the specified duration. During this period you should perform the frequency scan on the remote device. This will not invoke the frequency scanning.
- **Delay Before Start** – Delay before start of frequency analysis in seconds
- **Auto Mute Remote Radio** – Allows auto mute of remote radio if possible (this function requires synchronization with remote side)
- **Delay status** – A remaining delay time countdown

4.47.2 SPECTRUM ANALYSER OUTPUT .

The spectrum analyser output frame. It displays the analyser results collected since last device reboot.

Note: The radio frequency scan can take between 30sec to 2min depending on used radio type and bandwidth. During frequency scanning, there will be data drop.

4.48 Tools/Constellation

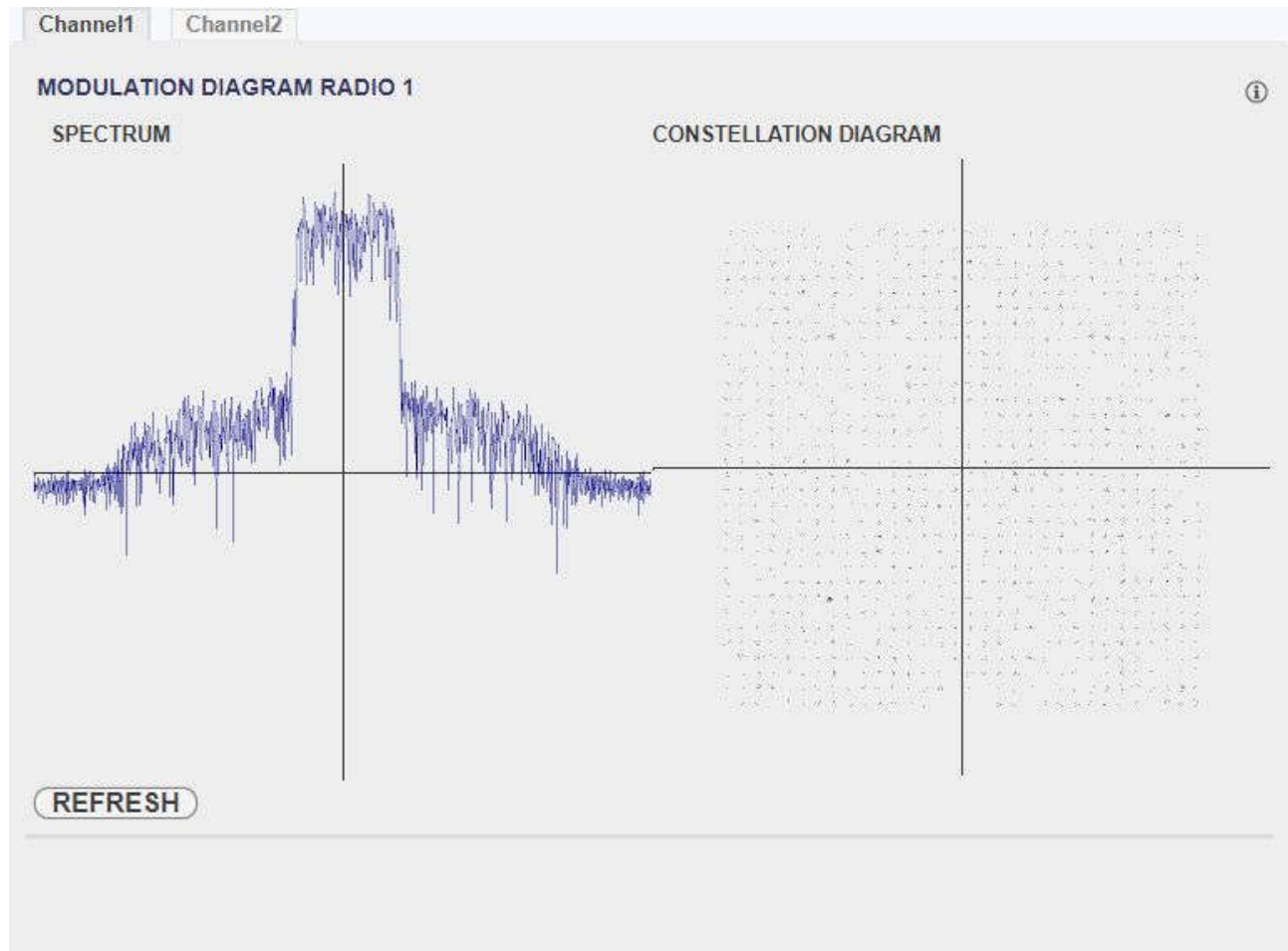


Figure 88: Tools/Constellation/Channel1 Window

This frame provides actual spectrum and constellation diagram outputs.

- **SPECTRUM** – A simplified Rx spectrum plot.
- **CONSTELLATION DIAGRAM** – A representation of a signal modulated by the digital modulation schemes. Two-dimensional scatter diagram in the complex plane at symbol sampling instants. Measured constellation diagram can be used to recognize the type of interference and distortion in a signal.
 - gaussian noise is displayed as fuzzy constellation points
 - non-coherent single frequency interference is displayed as circular constellation points
 - phase noise is displayed as rotationally spreading constellation points
 - amplitude compression causes points located in the corner to move towards the centre

Chapter 5 - System Application

5.1 1+0 Single mode.

- Basic point to point microwave link configuration
- Remote unit in either 1+0 Single or 1+0 Dual function
- Maximal throughput up to 630 Mbps

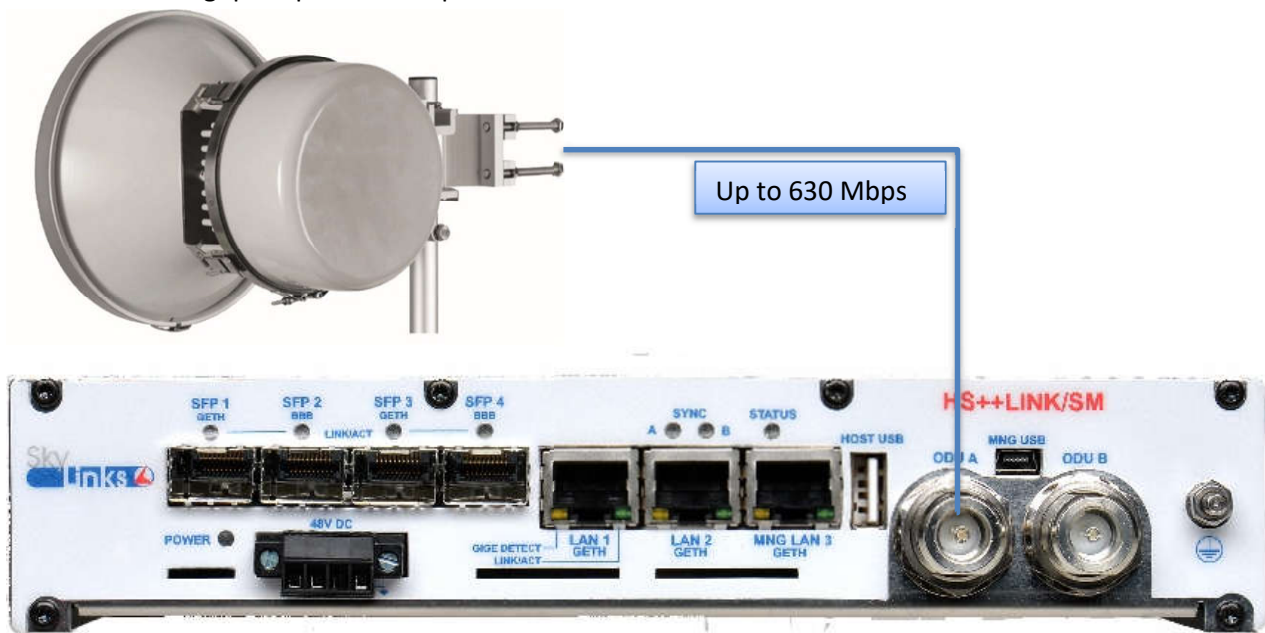


Figure 89: 1+0 Single Mode

5.2 1+0 Dual Mode.

- Two separate microwave links with one central IDU
- Relay station or star microwave link topology
- Maximal throughput up to 630 Mbps in each direction

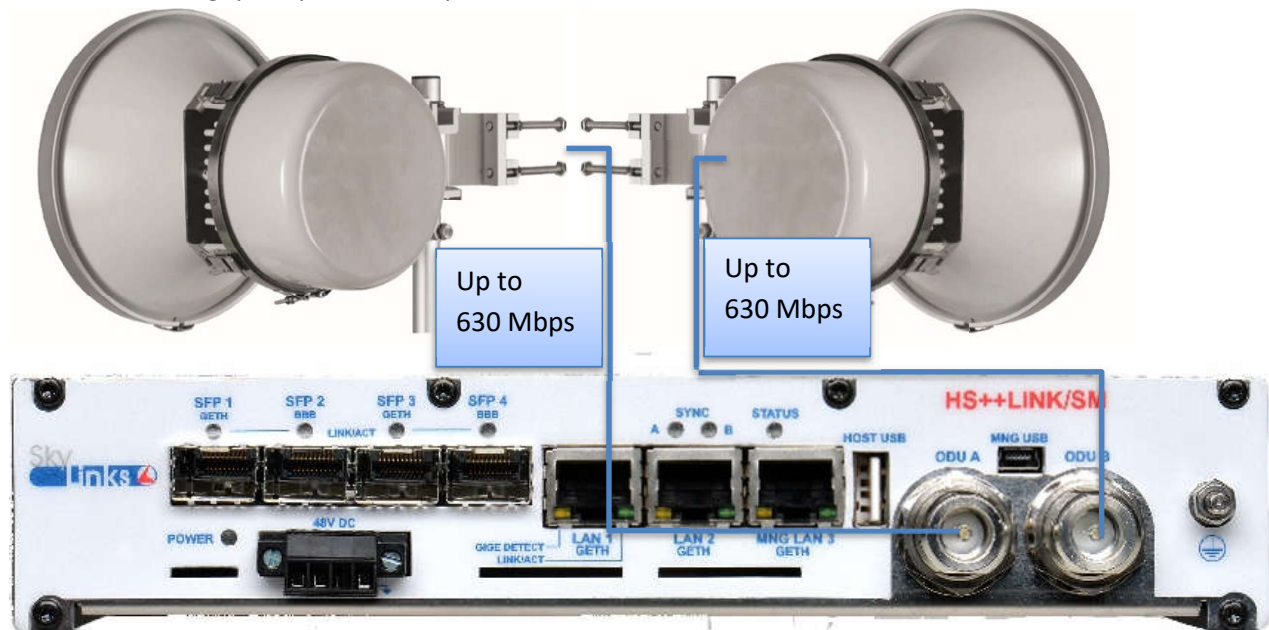


Figure 90: 1+0 Dual Mode

5.3 1+1 Protection.

- FD/HSB/SD/XPIC protection modes supported
- Hitless protection established by one IDU
- Maximal throughput up to 630 Mbps

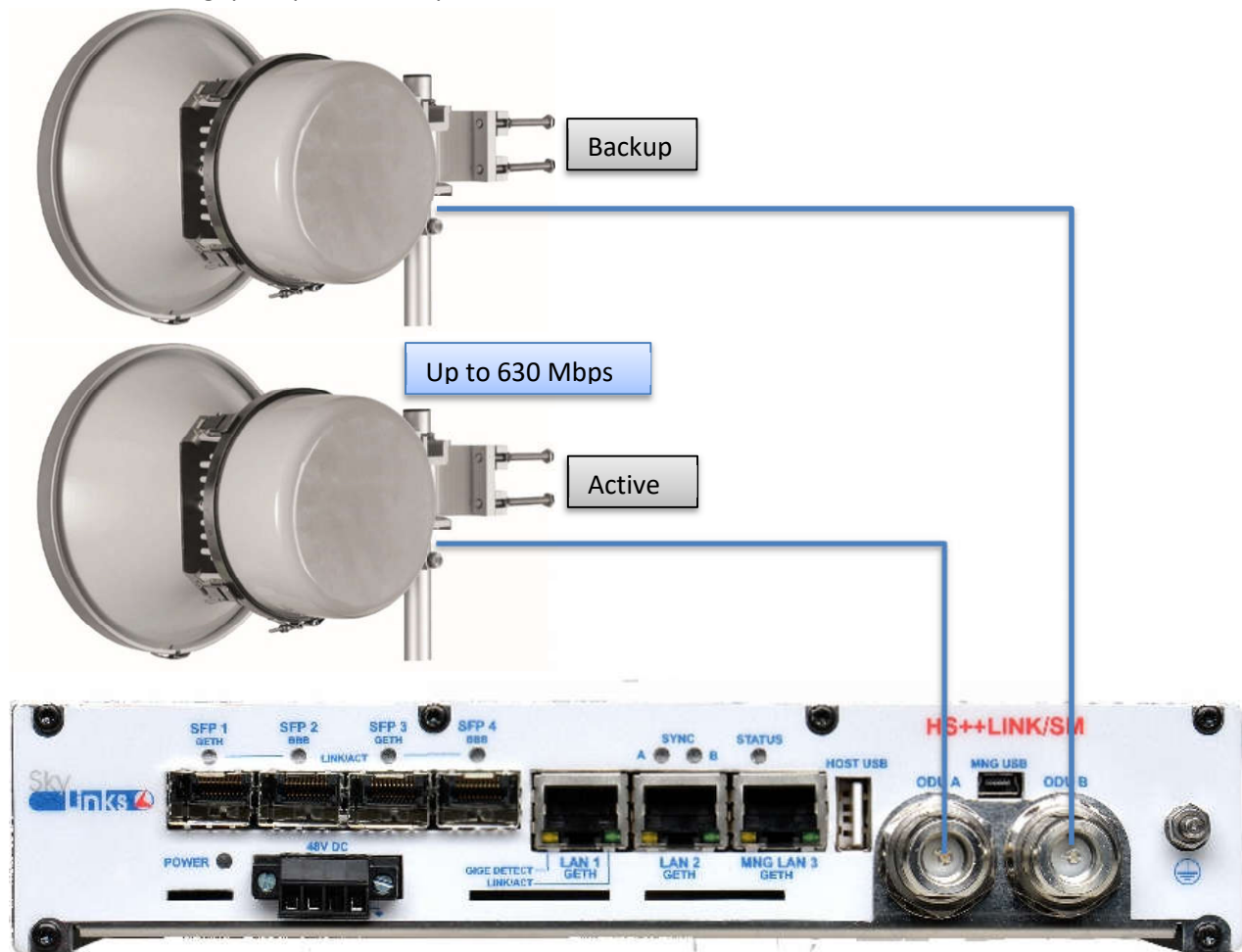


Figure 91: 1+1 Protection

5.4 2+0 Aggregation.

- FD/XPIC aggregated modes supported
- Combined with semi-protection function
- Maximal throughput up to 1.26 Gbps

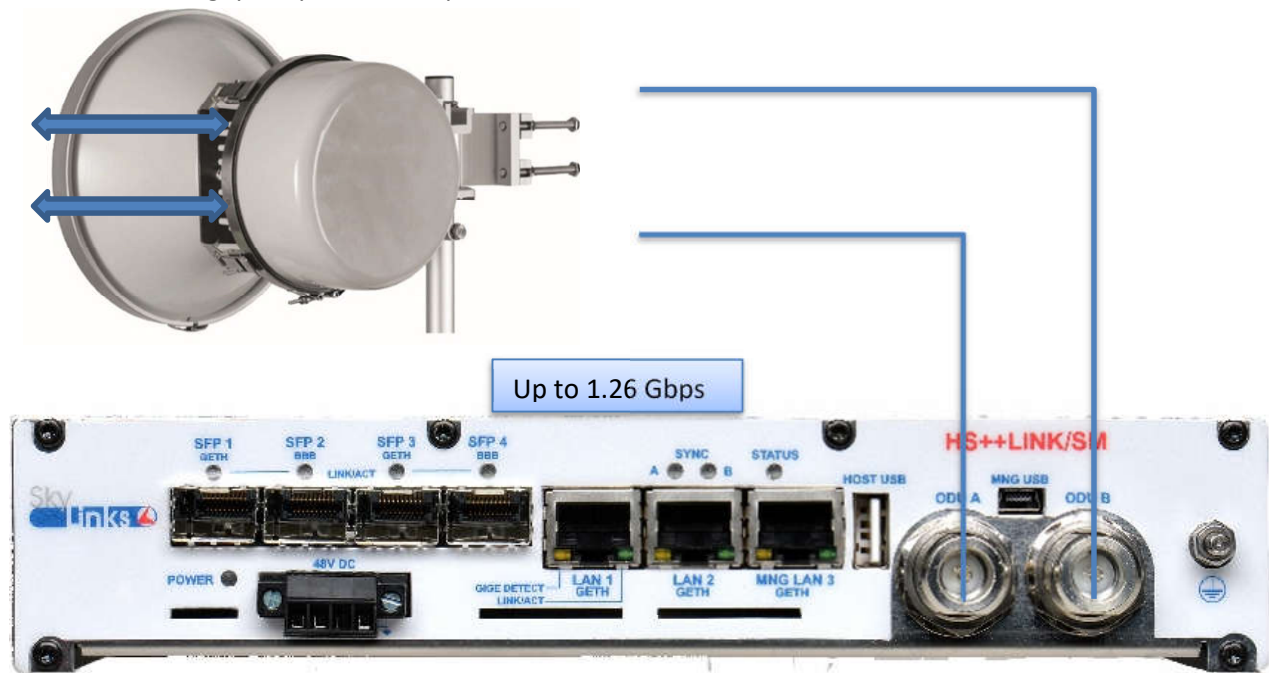


Figure 92: 2+0 Aggregate

5.5 1+1 Hybrid Application ETH & DVB-ASI

- Example port extension by means of EMM card
- Combined with hitless protection
- Maximal throughput up to 630 Mbps

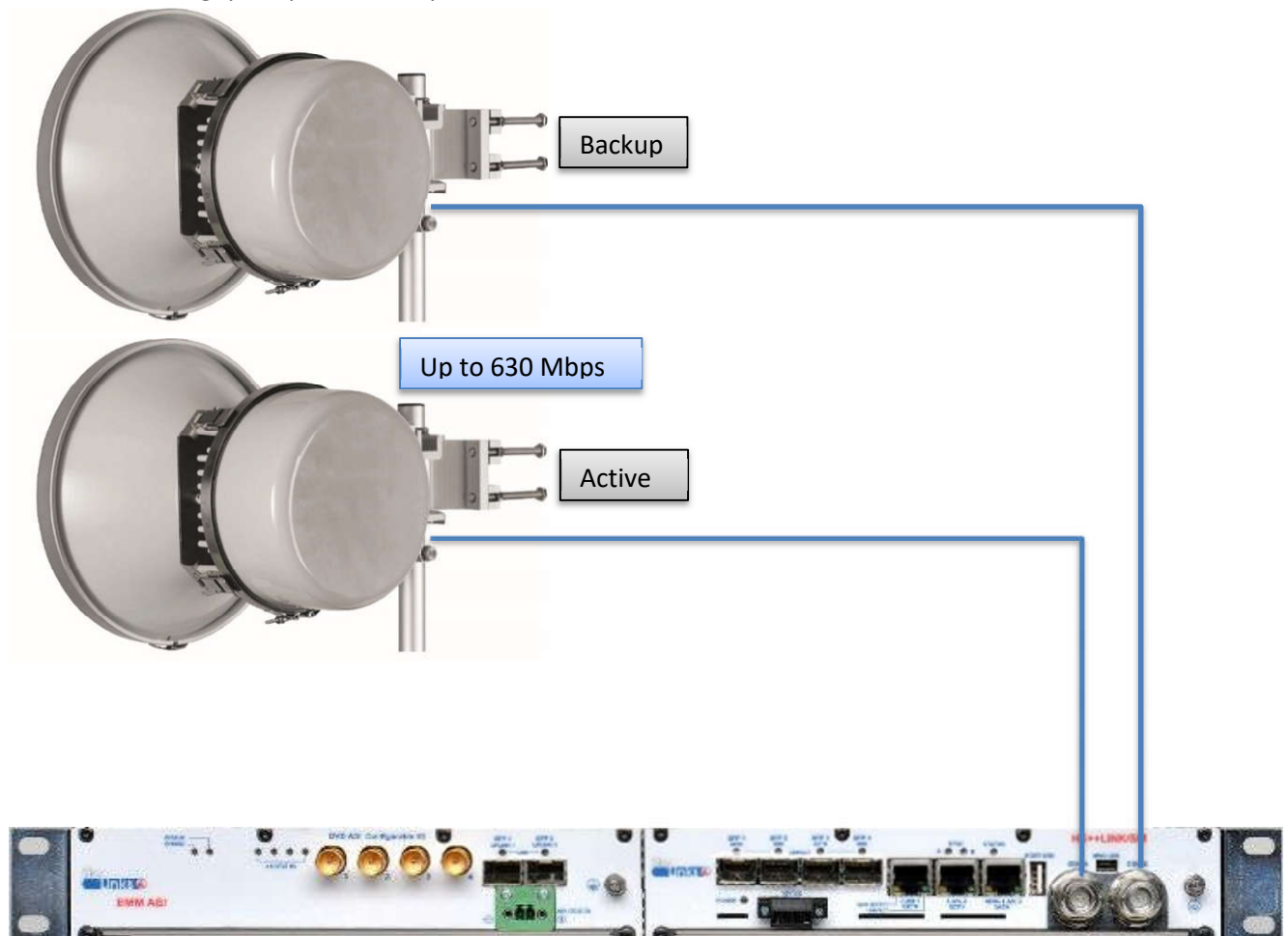


Figure 93: Hybrid ETH & DVB-ASI

5.6 Split 1+1 Protection.

- FD/HSB/SD advanced protection modes
- Hitless protection with two IDUs
- Automatic primary/secondary unit reconfiguration
- Maximal throughput up to 630 Mbps

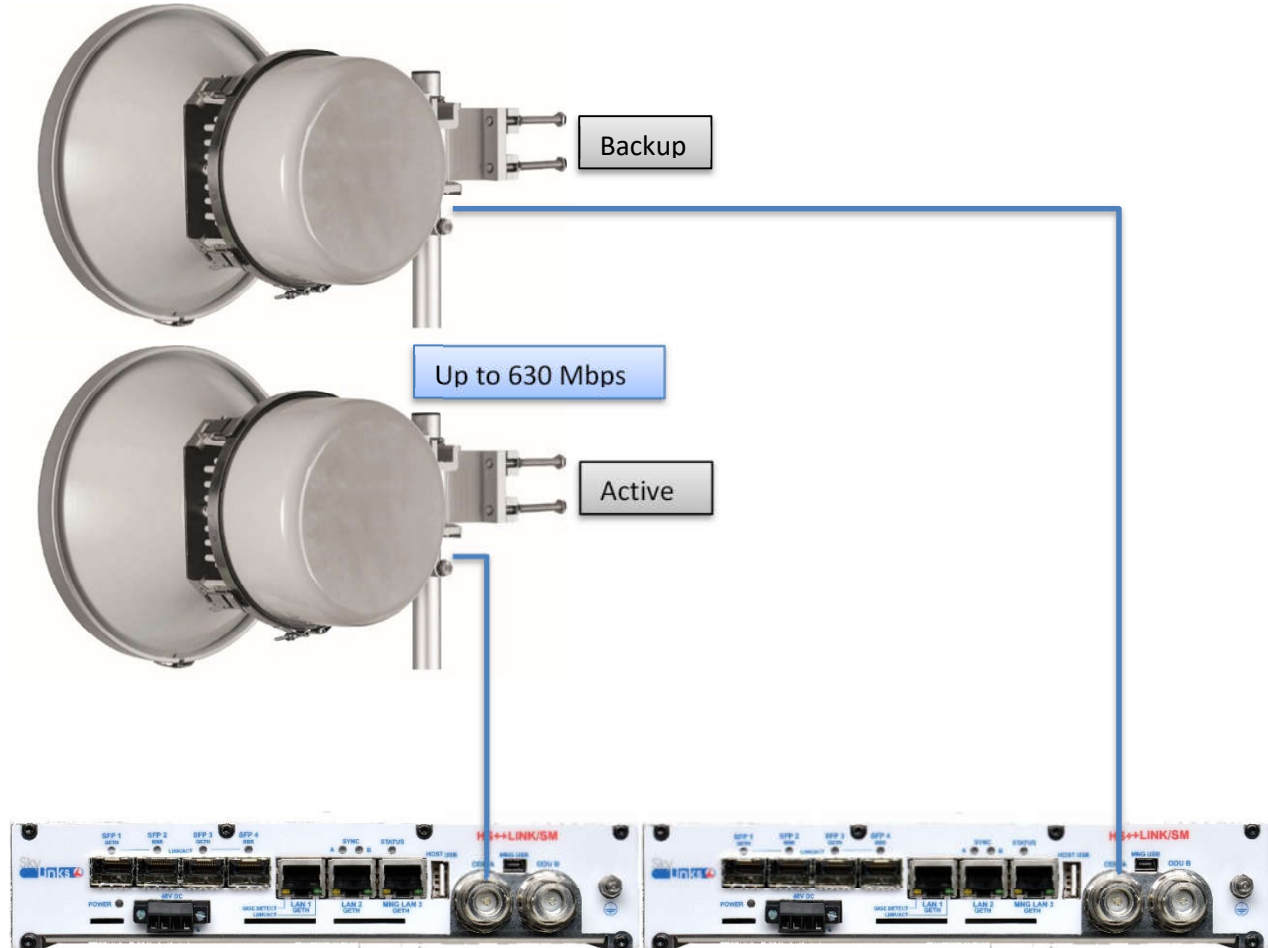


Figure 94: Split 1+1 Protection

5.7 Split 2+2 Aggregation/Protection.

- XPIC aggregation with n+2 FD/HSB/SD protection
- Automatic primary/secondary unit reconfiguration
- Maximal throughput up to 1.26 Gbps

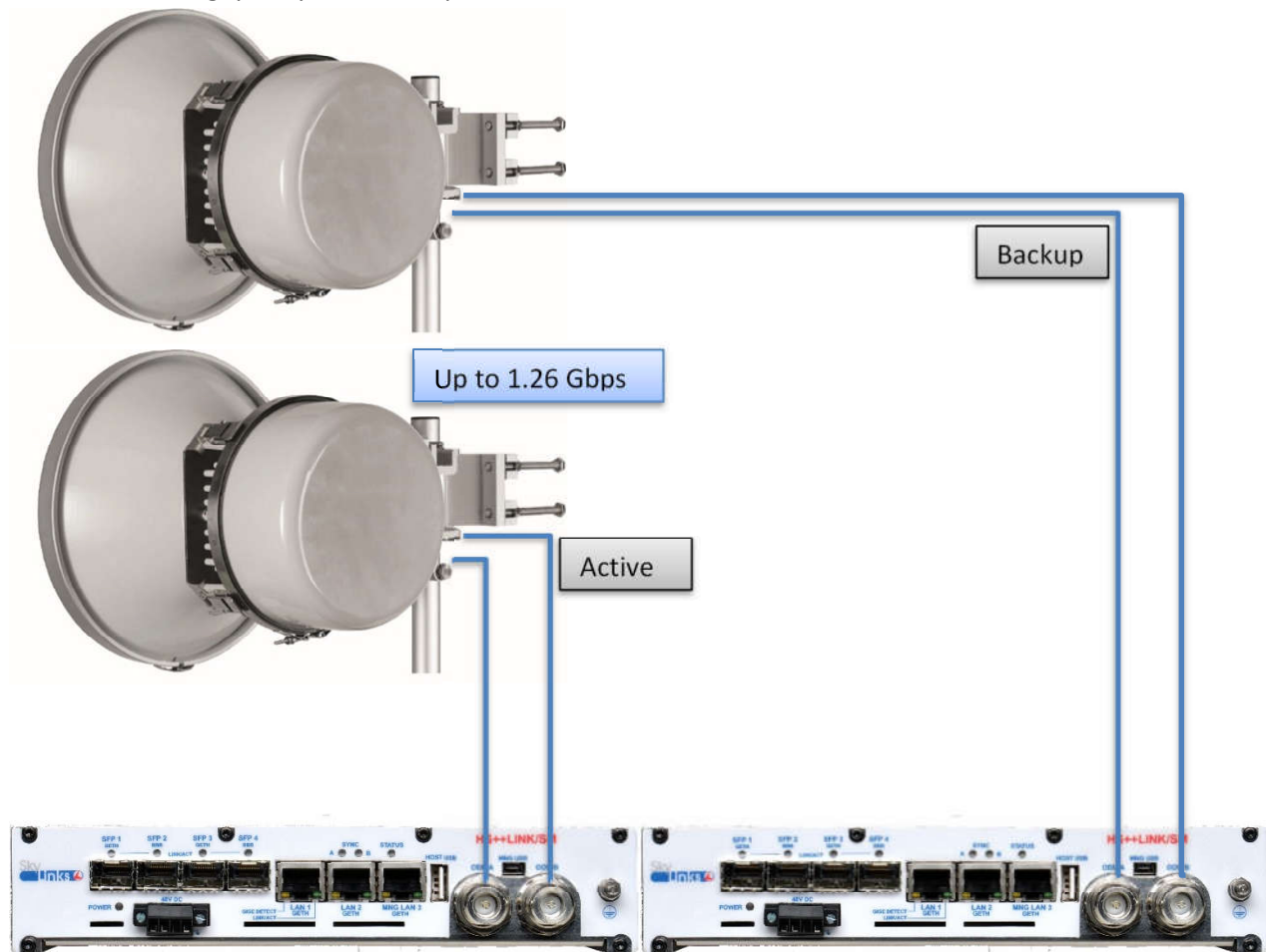


Figure 95: Split 2+2 Aggregation/Protection

Chapter 6 - Technical Parameters

6.1 General.

Table 4: System Parameters

Item	Parameter	Value
Frequency	Operating frequency range	6 to 42 GHz
	Frequency plans	According to CEPT/ITU-R recommendations
	T/R spacing	According to CEPT/ITU-R recommendations
Modulation	Modulation schemes	QPSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 512QAM and 1024QAM
	ACM	Hitless adaptive modulation
	ETSI Bandwidths	7/14/28/56/80 MHz
	ANSI Bandwidths	10/20/25/30/40/50/60/80 MHz
Transmission	Capacity allocation	Priority based packet system (PBRs) gen.3
	Path configuration	CX1 with design 505 • 1+0 ch1 CX1 with design 511 • Split 1+1 FD/HSB/SD protection CX2 with design 505 • 1+0 ch1, 1+0 ch2, 1+0 dual (star topology) • 2+0 FD/XPIC aggregation • 1+1 FD/HSB/SD/XPIC protection CX2 with design 511 • Split 1+1 FD/HSB/SD protection • Split 2+2 XPIC&FD/HSB/SD aggregation & protection
	Forward error correction	Reed Solomon with Weak/Medium/Strong modes
	Compression function	Online Ethernet L1 header compression
	Data Security	AES-128/256 Encryption

Item	Parameter	Value
	Max. Real Data Throughput	Up to 1.26 Gbps in 2+0 mode at 80MHz channel

6.2 IDU Specification.

Table 5: IDU Traffic Interfaces

Item	Parameter	Value
1000Base-T	Number of Ports	3x (RJ-45). 4x SFP (1000BaseSX/LX)
	Basic function	user traffic interface/management
	VLAN	Up to 4096 VLANs, IEEE 802.1q
	QoS	Source Port, IEEE 802.1p, IPv4 TOS/DSCP, IPv6 TC, VLAN VID, SA/DA
	MAC table	up to 8192 addresses
	Maximum Frame Size	Up to 2048 / 10240 bytes
EMM-16E1/T1	Number of Ports	16 (16xRJ-45)
	Interface	G.703-E1 120/75 ohm for E1 mode. T1.102-T1/100 ohm for T1 mode
	Coding	HDB3 for E1mode, B8ZS for T1 mode
	Speed	2.048 Mbps for E1 mode, 1.554Mbps for T1 mode
	IDU interface	4x SFP 1000Base-SX (proprietary GIGE protocol)
EMM-ASI	Number of Ports	4xTx / 3xTx&1Rx / 2xTx&2Rx / 1xTx&3Rx / 4xRx
	Interface	4x BNC (DVB-ASI)
	Coding	8B/10B, MPEG-2 TS
	Speed for ASI channel	8-216 Mbps

Item	Parameter	Value
	IDU interface	4x SFP 1000Base-SX (proprietary GIGE protocol)

Table 6: Ethernet traffic parameters

Item	Parameter	Value
ETH Compression efficiency (L1)	64Byte Frames	Max. 21.5% from available ETH speed
	512Byte Frames	Max. 2.9% from available ETH speed
	1518Byte Frames	Max. 0.3% from available ETH speed
L1 Throughput 256QAM/56MHz Medium FEC	64Byte Frames	477.3 Mbps
	512Byte Frames	387.8 Mbps
	1518Byte Frames	375.0 Mbps
L1 CT Latency 256QAM/56MHz Medium FEC	64Byte Frames	82.1 usec
	512Byte Frames	100.9 usec
	1518Byte Frames	141.3 usec

6.3 Network Management System.

Table 7: Management Parameters

Item	Parameter	Value
Ports	Main NMS ports	ETH port LAN-3
	Additional NMS ports	USB-B in IP mode USB-B in serial mode
NMS form	Protocols	HTTP, HTTPS, SNMP v1/v2c./v.3, TELNET, SSH
	In-Band management	via VLAN
	Out-of-Band management	115 kbps
IP addresses	Addresses type	Primary IP/ Secondary IP / RFI / USB
	Additional function	Static Routes, NAT, Ping, Telnet

Item	Parameter	Value
GUI	Type	WEB based
SNMP	Version	SNMP v1, SNMP v2c, SNMP v3
	Read access	Complete MIB
	Write access	Subset of link parameter
Security	Licenses	Time limited / permanent
	Access levels	guest/user/admin with password security

6.4 Miscellaneous.

Table 8: Miscellaneous

Item	Parameter	Value
IDU Mechanical	Dimensions [w x h x d]	210 mm x 44 mm x 240 mm
	Weight	2.2 kg
	Protection	IP31 (EN 60529)
ODU Mechanical	Dimensions [w x h x d]	278 mm x 92 mm x 239 mm
	Weight	4.3 kg
	Protection	IPx6 (EN 60529)
Input Voltage Level	IDU	-20 VDC up to -60 VDC
	ODU	-30 VDC up to -60 VDC
Consumption	IDU only	CX1 modification • < 22 W (all ports connected) CX2 modification • < 30 W (all ports connected)
	ODU only	< 35 Watts
	IDU+ODU	CX1 modification • < 47 W (all ports connected) CX2 modification • < 55 W (all ports connected)

Item	Parameter	Value
	IDU and 2x ODU (standard)	< 85 W (with CX2)
	Maximum ODU current	up to 1.9 ADC
Operational Conditions	IDU Temperature	-5° to +45°C
	IDU Humidity	0 to 95%, Non-condensing
	ODU Temperature	-33° to +55°C
	ODU Cold Start	Operational at -45°C, not guaranteed all specification
	ODU Humidity	0 to 100%

6.5 Antennas.

Table 9: Antenna Gain (Faini THP)

Gain	Ant. diameter	6 [GHz]	7 [GHz]	8 [GHz]	10 [GHz]	13 [GHz]	15 [GHz]	18 [GHz]	24 [GHz]
dB	30 cm	-	-	-	-	31.1	31.8	34.3	36.1
	60 cm	28.1	28.8	30.8	34.3	35.8	36.9	38.8	42.1
	80 cm	30.1	31.7	33.3	36.7	38.4	39.5	42.0	43.3
	120 cm	33.3	35.5	36.8	39.8	41.7	42.7	44.8	47.1
	180 cm	37.1	39.1	40.4	43.2	45.3	46.0	48.1	49.5

Table 10: Antenna Dimension (Faini THP)

Antenna type	Parameter	Value
30 cm	Antenna Dimension [HxWxD]	385x586x219 mm
	Box Dimension [HxWxD]	400x400x600
	Weight with Mast mount	12 kg
60 cm	Antenna Dimension [HxWxD]	653x679x345 mm
	Box Dimension [HxWxD]	600x750x750
	Weight with Mast mount	18 kg

Antenna type	Parameter	Value
80 cm	Antenna Dimension [HxWxD]	842x842x441 mm
	Box Dimension [HxWxD]	700x920x930
	Weight with Mast mount	26 kg
120 cm	Antenna Dimension [HxWxD]	1260x1260x808 mm
	Box Dimension [HxWxD]	1530x480x1380
	Weight with Mast mount	78 kg
180 cm	Antenna Dimension [HxWxD]	1878x1878x1098 mm
	Box Dimension [HxWxD]	2090x600x1970
	Weight with Mast mount	130 kg

6.6 Accessories.

Table 11: External Power Supply Parameters

Power supply	85 VAC - 240 VAC
Input power	48 VDC $\pm$ 5%
Input frequency	47 Hz - 63 Hz
Operation temperature	0°C - 40°C
Protection	Surge and power guard, short-circuit protection
EMI	EN55022, EN55024
Dimensions H x W x D (cm)	3,7 x 6,5 x 16,7

Table 12: Basic parameters of CNT-400 cable

Impedance	50 Ω
Cable Diameter Over Jacket	10,29 mm
Operation temperature	-40°C - +85°C
Min. temperature for installation	-40°C
Min. bend radius	25.4 mm
Weight	100 (g/m)

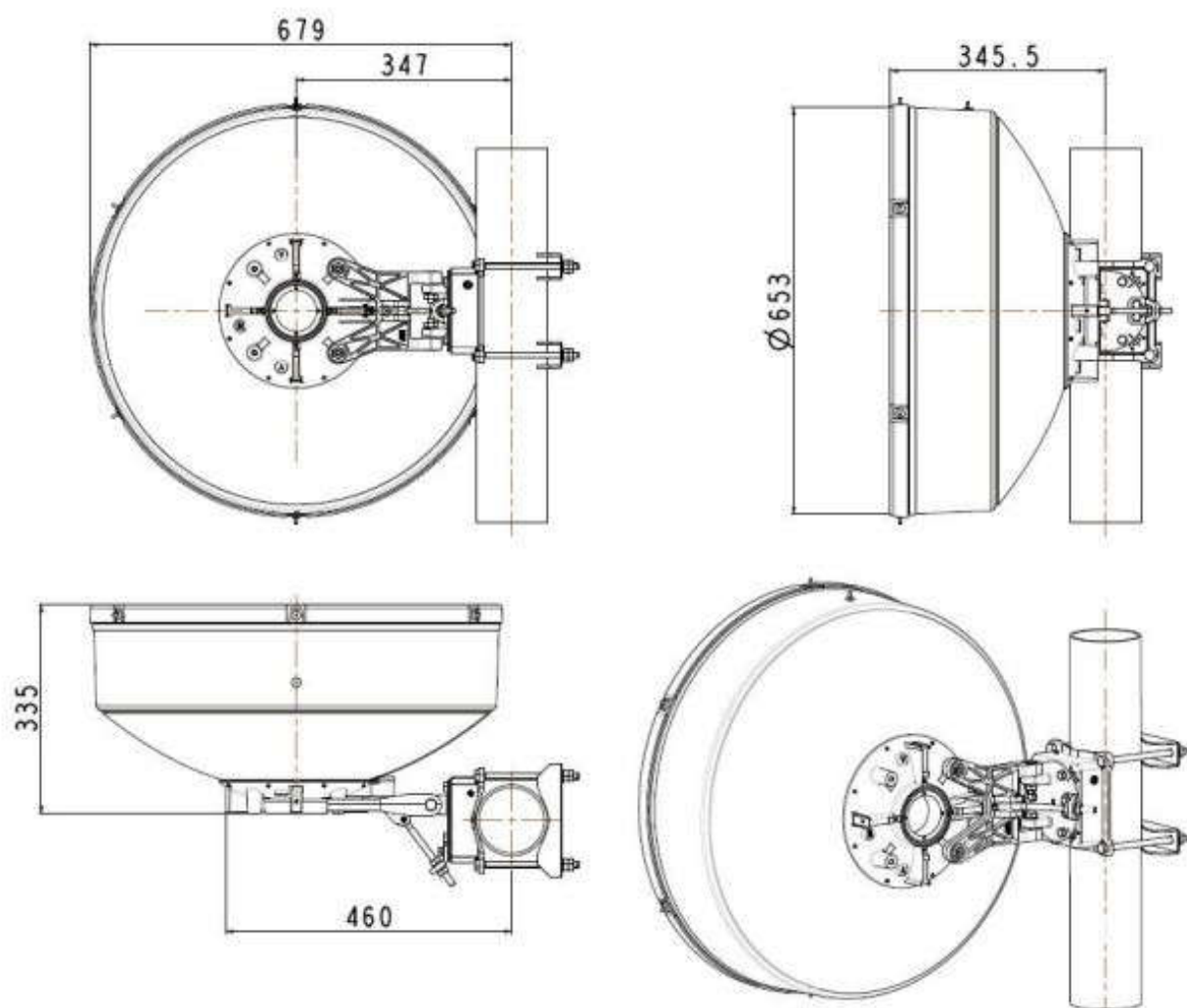


Figure 96: Faini THP 06-0525 Dimensions

Chapter 7 - Abbreviation list.

AGC	automatic gain control on RF cable.
AIS	continual sequence of ones on E1 data according to norm.
ANEG	auto negotiation - automatic speed and duplex set-up on LAN ports.
ATPC	automatic control of output power at ODU on the basis of Rx level at remote unit.
ATU	table of MAC addresses.
BER	bit error rate (from last clearing).
EFS	error free seconds.
ERS	error seconds.
FER	Frame Error Rate (per minute).
HWADDR	MAC address of eth interface.
IDU	Compact Indoor Unit.
MDIX	configuration for wires crossover on LAN ports.
MSE	dispersion of dots from ideal location in I/Q diagram after demodulation. The sharper the dots of status diagram are – the better.
MUX	data multiplexer (aggregating of several parallel streams into one serial stream and back).
NAT	network address translation – translation of IP addresses (and ports).
ODU	Outdoor Unit.
PBPS	packet multiplexer.
RFI	RF interface – interface towards PBPS.
RSL	received signal level in dBm.
RSSI	received Signal Strength Indication – received signal strength in mV, measured on BNC outdoor unit connector.
SNMP	Simple Network Management Protocol – protocol for remote system management.
TBE	time between errors.
TLE	time since last error occurrence.
VLAN ID	VLAN number.
VLAN	virtual LAN – the possibility to create more logical networks on one physical medium.
VTU	table of rules for VLANs.
W0-3W0-3	names of memories in device (W0 is boot memory).