User manual

Phoenix G2 IDU

VER 1.10

FW 0403_04

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To get up to date information about accessories and their availability, please contact sales representative.

IDU does not contain serviceable parts. Warranty will not be applicable in the event IDU has been hermetically unsealed.

SAF Tehnika, JSC is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate the equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Contents

Chapter 1: OVERVIEW

This document briefly describes the PhoeniX G2 series TDM/ASI/IP split mount system (IDU+ODU) covering the built-in management system, configuration functionality, hardware features, etc.
The Phoenix G2 is a robust and versatile dual-channel Indoor Unit designed for High Capacity point-to-point microwave networks. Two integrated modems in one Indoor Unit provide excellent ability to connect two active ODUs and aggregate or switch the traffic between two links. The device operates with SAF ODUs and allows to build wireless links in protected (hitless 1+1 HSB, SD, FD), aggregate (2+0) and "Dual End Station" configurations. Due to its design and license keys the device is fully scalable and allows a seamless upgrade of transmission capacity, unlock the additional functionality and expand with more interface ports (e.g., E1/T1 for TDM application or DVB-ASI for video broadcasting). The open device architecture is prepared for growing along with customer needs in the future.
The primary traffic interface for PhoeniX G2 split mount system is Gigabit Ethernet. As PhoeniX G2 system is capable of providing bit rate of up to 452Mbps, it is a great addition to SAF portfolio. PhoeniX G2 radio and modem performance allows achieving high system capacity by employing 1024-decision states modulation scheme by user's choice. Apart from the full system capacity of 452Mbps, it is possible to configure the radio to any of 10, 14, 20, 25, 28, 30, 40, 50, 56 and 60 MHz channels as well as to any of QPSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 512QAM and 1024QAM modulations, thus providing various capacities to suit particular needs.
SAF Tehnika has employed most modern design solutions and components to create high performance split mount system with low power consumption – 43-85W per system.
PhoeniX G2 system is a perfect building block for any modern future proof wireless network, including mobile service providers, fixed data service operators, enterprise customers, municipal and governmental networks among others.

PhoeniX G2 IDU features summary

Main features:

- Split mount system solution
- 1+0, 1+1 (HSB, FD, SD) and 2+0 configuration schemes
- 1+1 Full protection split mode utilizing two IDU units
- Integrated XPIC mechanism
- Capacity: up to 452 Mbps over single channel, 904 Mbps aggregated capacity
- Channel Bandwidth ETSI and ANSI: 7/10/14/20/25/28/30/40/50/56/60 MHz
- Modulations: QPSK/16QAM/32QAM/64QAM/128QAM/256QAM/512QAM/1024QAM
- Interfaces: 10 / 100 / 1000 Eth
- Traffic: Ethernet (4xSFP, 3xLAN), E1 (up to 64E1),ASI (up to 16 ASI streams)
- TDM and ASI port extension by means of " External MUX Module (EMM)"
- Frequency bands: 2.3* / 4 / 6 / 7 / 8 / 10 / 11 / 13 / 15 / 18 / 23 / 26 / 38 GHz
- Hitless ACM and ATPC functions
- 802.1Q VLAN support
- AES256 encryption
- SyncE, PTP 1588v2 synchronization
- Standard management access: HTTPS, SNMP v2&3, Telnet, SSH
- Two integrated wide-band modems in one indoor unit for different Point-to-Point applications
- Single USB port for local management access

** The 2.3GHz radio unit complies with FCC part 27*

For 2.3GHz radio, end-user is responsible for limiting systems E.I.R.P within allowed operational license to be in line with Tx Power plus antenna gain and minus attenuation in cabling between radio and antenna. For example, to assuming the operational license allows 2000W E.I.R.P and radio Tx power is set at 36 dBm and there is 0 dB cable loss between radio and antenna, then antenna max allowed gain is 26.9 dBi.

For compliance with Canada General Population Limit the minimum safe operational distance is 5.5 meters.

IDU mechanical features

- 1U high
- Power consumption <30W
- Dimensions 45x210x240 mm, weight 2.22 kg

Figure 1.1 *Phoenix G2 IDU*

ODUs mechanical features

- Compact unit, 288x288x80mm, 3.5kg (SP/HP ODUs); 280x437x110mm, 7.5kg (VHP ODU)
- 3 handles (SP/HP ODU) and 1handle (VHP ODU) for user convenience
- Safe and easy to use 4 side locking/tightening arrangement
- All connectors on the side of the unit, always at 45° regarding vertical axis for both V and H polarization on the SP/HP ODUs
- All the connectors downwards on the VHP ODU
- Power consumption: 13-39W (SP/HP ODUs) and 39-55W (VHP ODU)

Figure 1.2 *Phoenix G2 ODUs*

IRFU mechanical features

- Indoor radio unit (IDU+IRFU)
- 2U high
- Power consumption: 13-39W
- Dimensions 90x430x260 mm, weight 5.8 kg.

Figure 1.3 *Phoenix G2 IRFU*

Labelling

The label contains the following information (see samples in the picture below):

Product model name (PhoeniX G2 IDU for PhoeniX G2 Indoor Unit, CFIP-18-PhoeniX for 18GHz Outdoor Unit, etc).
Product Number / Model Number (P/N or M/N) (EAGXU002, S18RFU05LA): product/model number contains information about the unit.
Serial Number (355260100007): the serial number uniquely identifies the unit.

Figure 1.4 *Label of the PhoeniX G2 Indoor Unit*

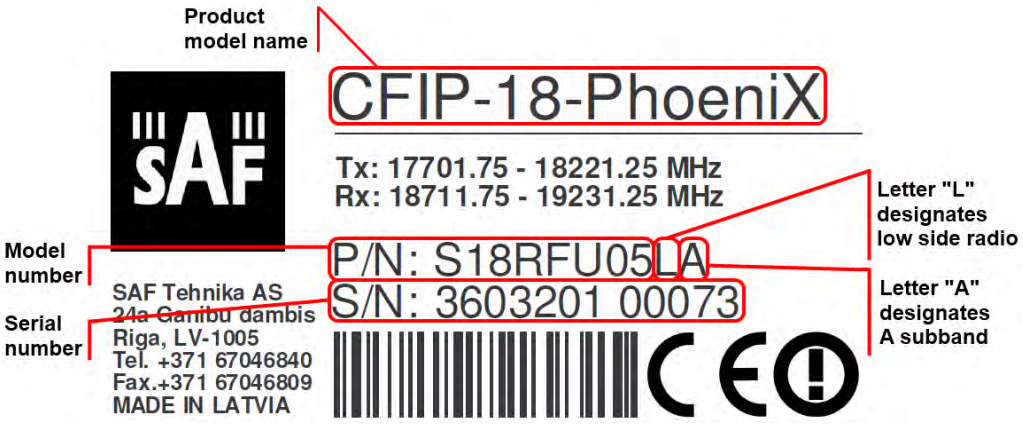


Figure 1.5 *Label of the PhoeniX G2 ODU*

P/N Translation for CFIP PhoeniX G2 ODU:

- “S” designates CFIP split mount series product;
- “18” designates Frequency range (18 GHz) of the Unit;
- “RF” designates standard power radio;
- “U” designates unified band ODU operating 7 - 60MHz;
- “05” designates the version number of the Unit;
- “L” designates the band side in which ODU operates (H, L);
- “A” designates the subband in which ODU operates (A, B, C).

Figure 1.6 *Label of the PhoeniX G2 IRFU*

P/N Translation for CFIP PhoeniX G2 IRFU:

- “S” designates CFIP split mount series product;
- “06” designates Frequency range (6 GHz) of the Unit;
- “RI” designates IRFU radio;
- “U” designates unified band radio operating 7 - 60MHz;
- “01” designates the version number of the Unit;
- “L” designates the band side in which ODU operates (H, L);
- “A” designates the subband in which ODU operates (A, B, C).

IDU front panel interfaces and LEDs

Phoenix G2 IDU has following interfaces:

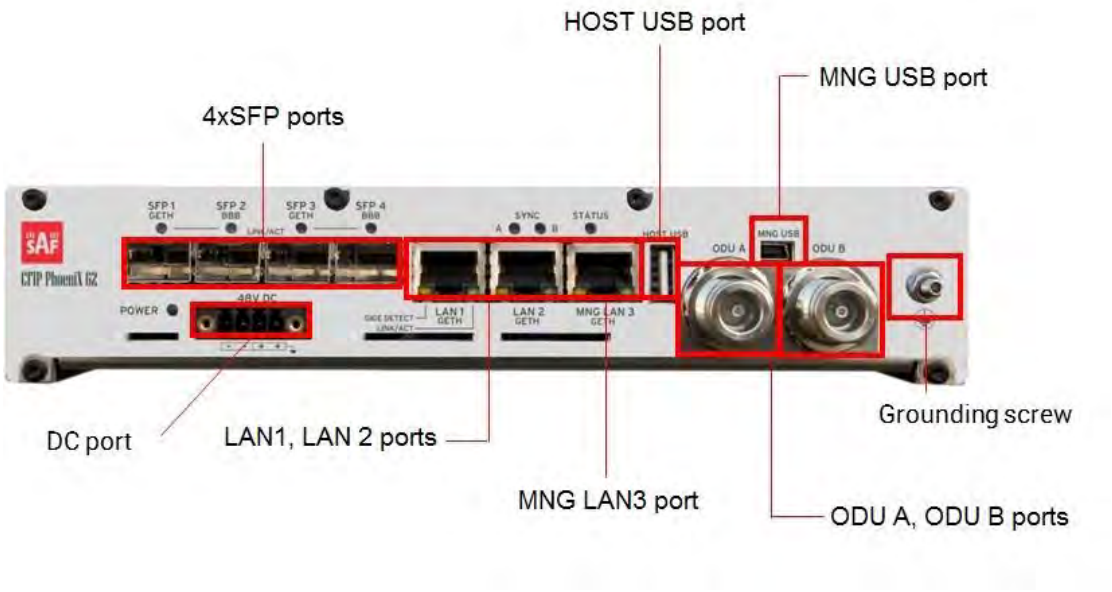


Figure 1.7 *PhoeniX G2 IDU interfaces*

DC port

48V power supply connection. Input DC voltage operating range is -40.5V to -57V (max current up to 3A). 4-wire DC power connector with screw terminals included. Polarity layout indicated on the front panel. Any 2 wire power cable of good quality which fits well in SAF Tehnika's supplied 4 pole "screw on" power connector could be used.

4xSFP ports

SFP slots 1 to 4 for Gigabit Ethernet traffic. Any type of SFP modules can be used (Single-mode or Multi-mode optical fibre). SFP ports are used also for interconnecting IDUs in case of 1+1 full protection configuration, and for IDU interconnection with EMM modules. 2.5 Gbps optical fibre cable and SFP modules must be used to interconnect Phoenix G2 IDUs in 1+1 full protection mode. 1 Gbps optical fibre cable and SFP modules can be used to interconnect Phoenix G2 IDU with EMM modules.

LAN1, LAN2 ports

10/100/1000Base-Tx Ethernet traffic ports (RJ-45)

MNG LAN3 port

10/100/1000Base-Tx port, which is out-of-band management by default and provides access to the management via web GUI, Telnet or SSH communication facilities. It can be re-configured for traffic purposes as well

HOST USB port

USB port reserved for flash memory

MNG USB port

USB mini port dedicated for local management access via its own IP address.

ODU A, ODU B ports

N-type female 50Ω coaxial ports for connecting ODUs. Any type of 50 Ω coaxial cable of good quality can be used to interconnect the Phoenix G2 IDU and ODUs. The cable should be equipped with N–type male connectors on each end.

Grounding screw

Grounding screw for equipment grounding

Phoenix G2 IDU front panel alarm LED indications:

LED name	Description
SYNC (A,B)	**Orange –** OK, synchronization of link (A and/or B) established **Orange blinks –** loss of synchronization
STATUS	**Orange –** OK, no alarms present **Orange blinks –** one or several alarms are active
SFP (1-4)	**Orange –** SFP port connected **Off –** SFP port not connected
Power	**Green** – power supply is OK

Ethernet RJ-45 connector LED indications:

LED color	Description
Yellow	**ON** – link speed is 1000Mbps/s **OFF** – link speed is 100Mbps/s
Green	**ON –** Ethernet link is up **Blinking –** activity on port's egress/ingress directions

Application Examples

PhoeniX G2 1+0 configuration:

- Basic split-mount 1+0 system with up to 452 Mbps Ethernet

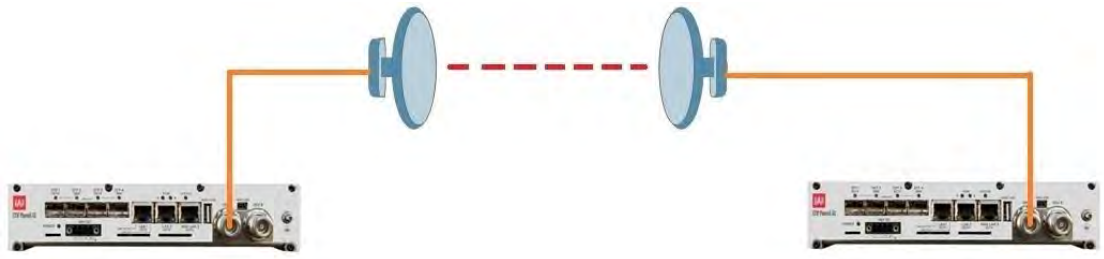


Figure 1.8 *PhoeniX G2 1+0 configuration*

PhoeniX G2 1+0 Dual (repeater) configuration:

- Dual-core modem allows to use one IDU as repeater node
- Both ODUs are working to different directions (East/West)

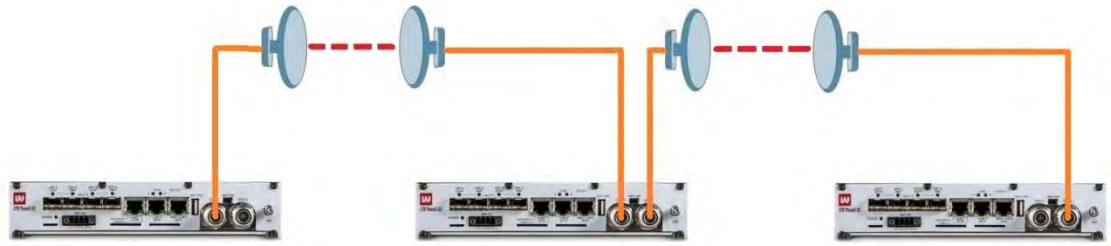


Figure 1.9 *PhoeniX G2 1+0 Repeater configuration*

PhoeniX G2 1+1 Frequency Diversity (FD):

- FD protected (1+1) configuration is used with single antenna and OMT (orthomode transducer) or a coupler at each side of the link
- Each pair of ODUs utilizes its own frequency channel (f_{low}, f_{high}, f'_{low}, f'_{high})
- The outgoing (Tx) traffic at each site is passed to both ODUs, and both are always transmitting
- The incoming (Rx) traffic is picked from one of the ODUs
- 1+1 configuration provides hardware redundancy and mitigates multipath fading
- Both Tx and Rx switching is hitless

PhoeniX G2 1+1 Hot Standby (HSB):

- HSB protected (1+1) configuration is used with single antenna and a coupler at each side of the link
- Both the incoming (Rx) and outgoing (Tx) traffic is switched to either one link or other, only single ODU at each side is transmitting
- Protects modem and radio from failure

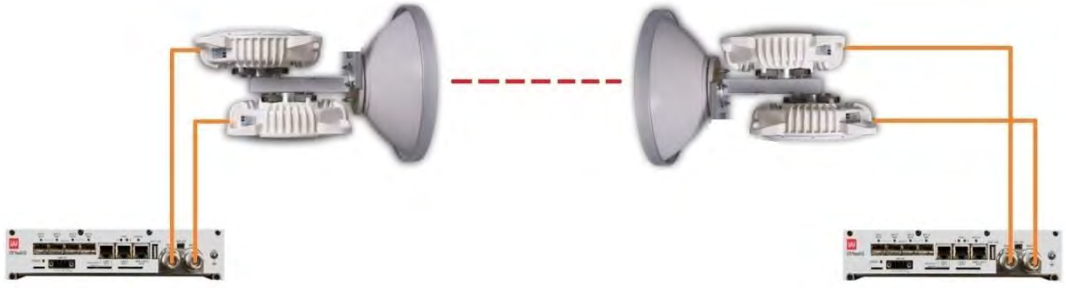


Figure 1.10 *PhoeniX G2 1+1 FD and HSB configuration with coupler*

PhoeniX G2 1+1 Space Diversity (SD):

- SD protected (1+1) configuration is used with two antennas at each side of the link
- Both the incoming (Rx) and outgoing (Tx) traffic is switched to either one link or other, only single ODU at each side is transmitting
- In Space Diversity mode antennas are located 10-12 meters apart hence allows avoiding frequency selective fading - multipath (e.g. reflection over water, air refraction, etc.)
- Rx switching is hitless , Tx switching <50ms

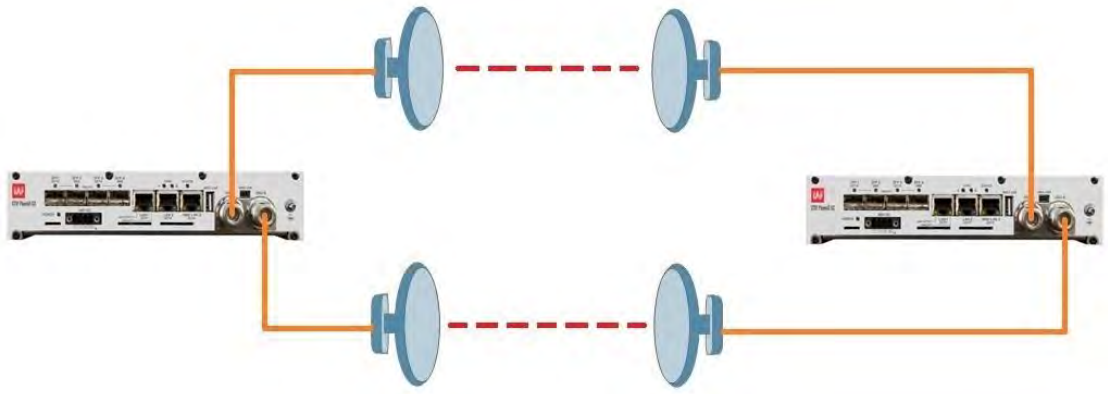


Figure 1.11 *PhoeniX G2 1+1 SD configuration*

PhoeniX G2 1+1 Full protection configuration:

- 1+1 HSB, FD and SD full protection is provided. SD supports only fixed hot-swap role – primary or secondary
- This protection type protects the link also against IDU, power supply and interface failures
- In case of protection, when the Primary link fails, the secondary re-configures itself to the Primary role

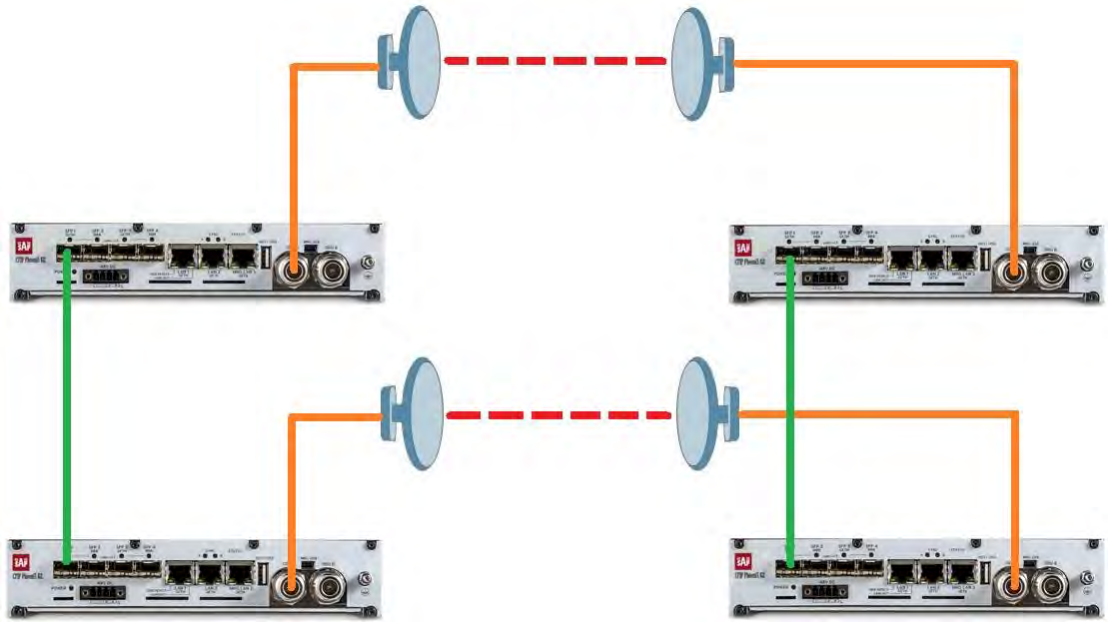


Figure 1.12 *PhoeniX G2 1+1 full protection configuration*

2.5 Gbps SFP modules must be used for both IDU FO interconnection. In Design Type 511 both SFP ports work in “Forced 2G5” mode.

PhoeniX G2 2+0/2+0 XPIC configurations:

- 2+0 configuration is used to aggregate payload traffic (capacity doubling). In this case 2 frequency channels are required
- 2+0 XPIC configuration is used to aggregate payload traffic using 1 frequency channel in both polarizations Vertical and Horizontal simultaneously

- Layer 1Link bonding is supported as aggregation technique

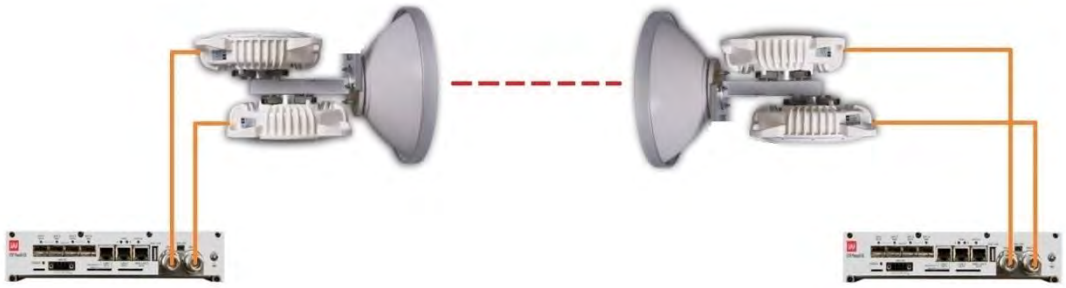


Figure 1.13 *PhoeniX G2 2+0/2+0 XPIC configurations*

PhoeniX G2 2+2 FD/2+2 XPIC configurations:

- 2+2 FD configuration is used to aggregate payload traffic (capacity doubling) using 2 frequency pairs. HSB/SD and FD protection is provided for the aggregated links.
- 2+2 XPIC configuration is used to aggregate payload traffic using 1 frequency channel in both polarizations Vertical and Horizontal simultaneously. HSB/SD and FD protection is provided for the aggregated links.
- Layer 1Link bonding is supported as aggregation technique

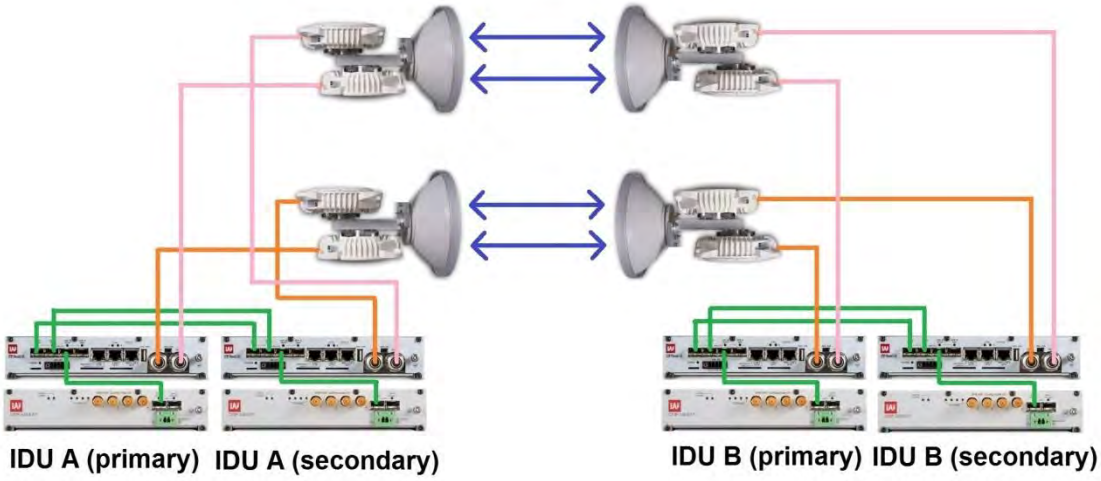


Figure 1.14 *PhoeniX G2 2+2 FD/2+2 XPIC configurations*

Both IDUs in each side of the link are interconnected with 2 optical cables on ports SFP1 and SFP2. 2.5 GB SFP modules must be used for this interconnection. SFP3 or SFP4 ports can be used for the IDU interconnection with EMM modules.

EMM extension modules description

ASI EMM extension module

The ASI EMM extension module provides ASI interface extension for Phoenix G2 IDUs. The ASI EMM module multiplexes up to 4 ASI channels into the compact stream which is directed over

the fibre optic (FO) connection to/from the Phoenix G2 IDU. The ASI EMM module features 4 x ASI built-in ports (one BNC per ASI channel) and 2 x SFP 1000Base-SX ports.

The compact, simple to configure, and easily scalable design enables cascading with other EMM extension devices (e.g. ASI EMM and/or E1/T1 EMM). The configuration is performed in the web GUI of the IDU, in section Config → Ports → EMM.

Maximum speed for single ASI channel is 216 Mbps. The actual ASI channel speed is auto-detected by the system and is displayed in Config → Ports → MUX section.

Each ASI channel can be independently configured into Tx or Rx mode. Following port combinations are possible:

- 4x ASI Tx (unidirectional)
- 3x ASI Tx and 1x ASI Rx (bidirectional)
- 2x ASI Tx and 2x ASI Rx (bidirectional)
- 1x ASI Tx and 3x ASI Rx (bidirectional)
- 4x ASI Rx (unidirectional)

Up to 4 EMM modules can be connected into the cascade and thus get the maximum quantity of external ports (ASI EMM and E1/T1 EMM modules combination is possible). Maximum 4 EMM modules can be cascaded and in case of ASI EMM modules the maximum count of ASI channels is 16. SFP 1000Base-SX on the left side **SFP 2 UPLINK 2** is dedicated for the modules interconnection into cascade. The configuration of all EMM modules is performed from the web GUI of the IDU.

ASI EMM extension module has following interfaces/connectors:

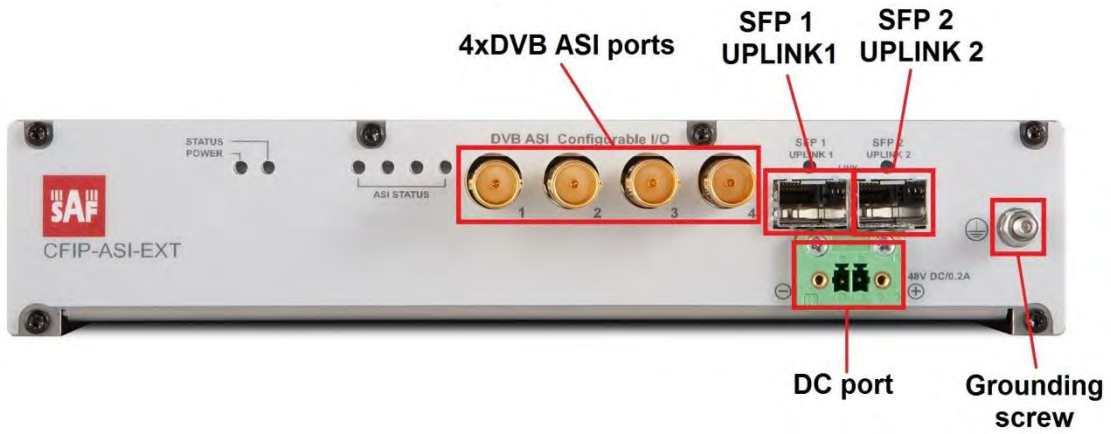


Figure 1.15 *ASI EMM extension module interfaces*

4xDVB ASI ports

Four configurable Input / Output DVB-ASI ports (75 Ohm).

SFP 1 UPLINK 1

Primary SFP port reserved for connection to the IDU or to primary EMM extension module in EMM extension module chain.

SFP 2 UPLINK 2

Secondary SFP port reserved for connection to secondary / next EMM extension module in EMM module chain or for connection to relay IDU in add/drop configuration.

DC port

48V power supply connection. Input DC voltage operating range is -20V to -72V (max current up to 3A). 2-wire DC power connector with screw terminals included. Polarity layout indicated

on the front panel. Any 2 wire power cable of good quality which fits well in SAF Tehnika's supplied 2 pole "screw on" power connector could be used.

Grounding screw

Grounding screw for equipment grounding

ASI EMM module front panel alarm LED indications:

LED name	Description
STATUS	**Orange –** OK, module enabled, proper communication with the IDU **Orange blinks –** WARNING, module is not enabled in the system or no communication with IDU, or configuration is not finished yet **Off** – ERROR, firmware is not loaded into EMM module HW
POWER	**Green –** power supply is OK **Off** – no power supply
SFP 1/2 LINK	**Orange blinks –** signal detected and synchronized, valid communication with the IDU **Off –** no correct signal detected
ASI STATUS	***ASI port in Tx mode:*** **Orange blinks –** ASI signal is presented, sending the data **Off** – no data (IDLE status) ***ASI port in Rx mode:*** **Orange** – signal detected, but its status is IDLE or Nosync mode **Orange blinks –** incoming ASI signal **Off** – no ingress signal detected

Interconnection of Phoenix G2 IDU and ASI EMM module must be done using optical cable and SFP modules. For 1+0 and 2+0 configurations any of all 4 SFP ports on the IDU can be used for connection to EMM module. In 1+1 full redundancy configuration SFP ports 3 and 4 can be used to connect to EMM module. On EMM module SFP port 1 can be used to connect to Phoenix G2 IDU and SFP port 2 must be used to connect to the next cascaded EMM module.

Figure 1.16 *Phoenix G2 IDU and ASI EMM module interconnection*

Application of 1+0 link connection with ASI EMM modules:

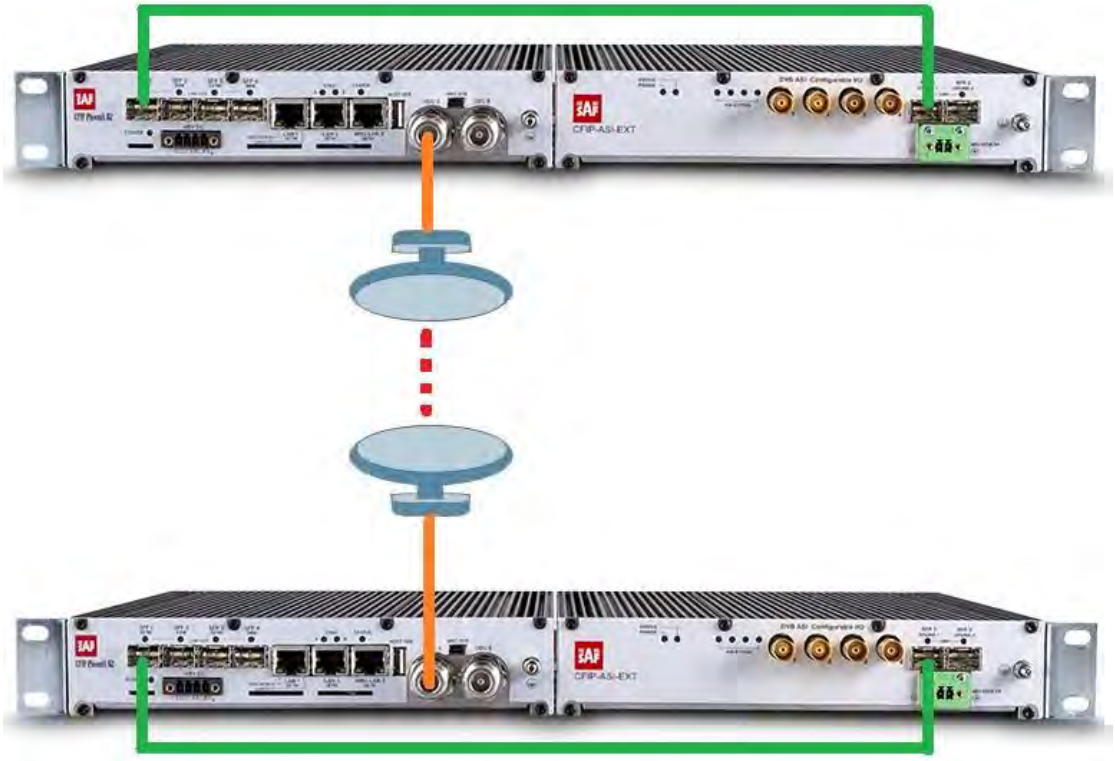


Figure 1.17 *1+0 link with ASI EMM modules*

Application of 1+1 link connection with ASI EMM modules:

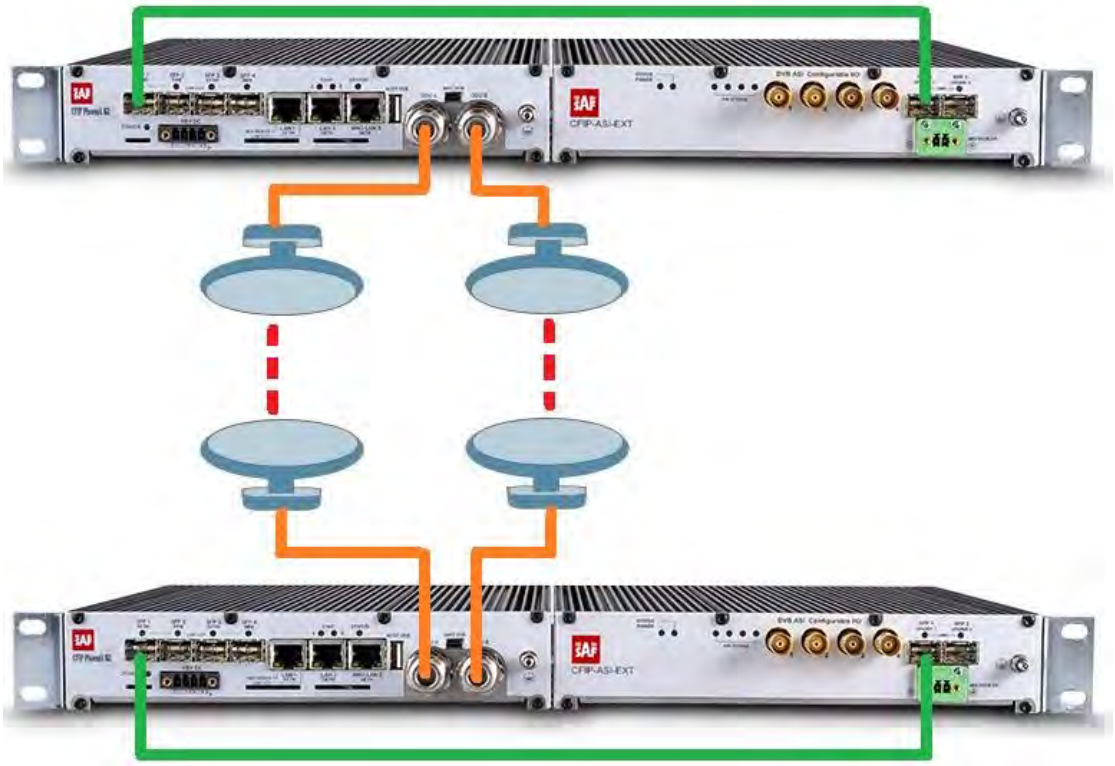


Figure 1.18 *1+1 link with ASI EMM modules*

Application of 1+1 full protection link connection with ASI EMM modules:

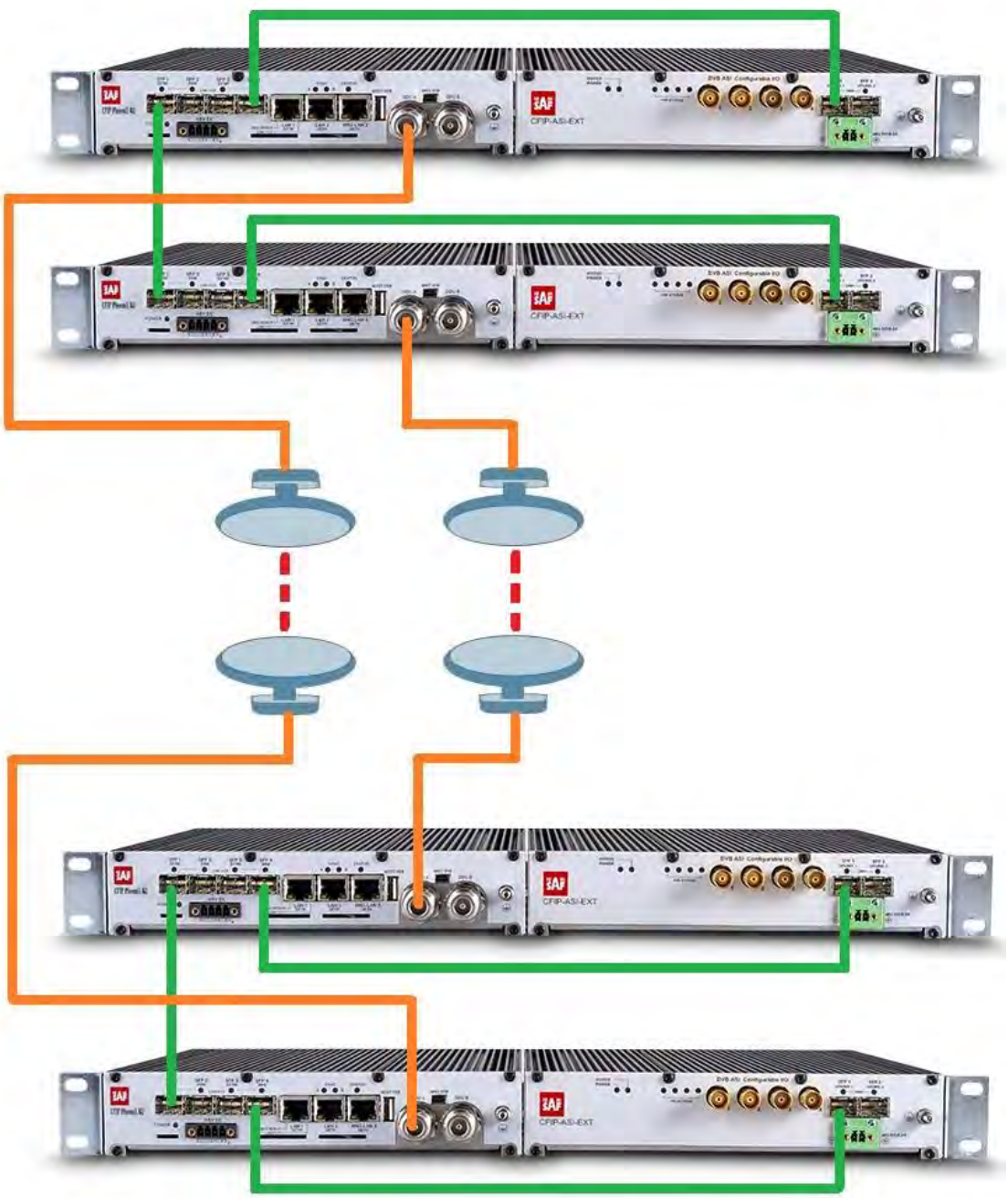


Figure 1.19 *1+1 full protection link with ASI EMM modules*

In 1+1 Full protection mode EMM modules can be connected only to SFP3 and SFP4 ports of the Phoenix G2 IDU. SFP1 port is for both Phoenix G2 IDU interconnection and SFP2 port is reserved for 2+2 modes

1+0 retranslation application with ASI EMM modules:

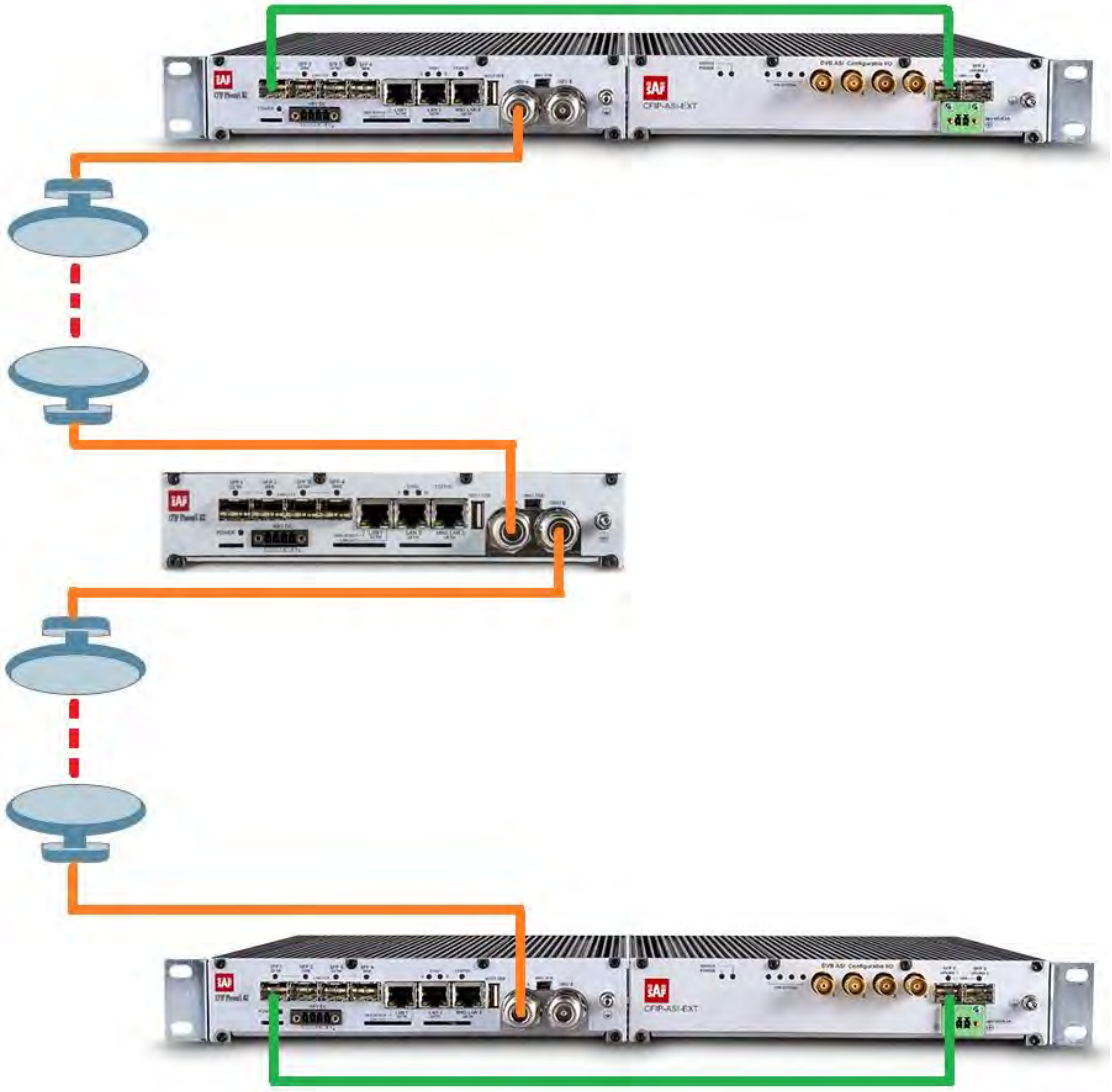


Figure 1.20 *1+0 retranslation link with ASI EMM modules*

The retranslation IDU in ***Figure 1.20*** is configured in 1+0 Dual mode.

1+0 retranslation application with 2xASI streams '*Drop*' in the retranslation site. Other 2xASI streams are forwarded to the end-point:

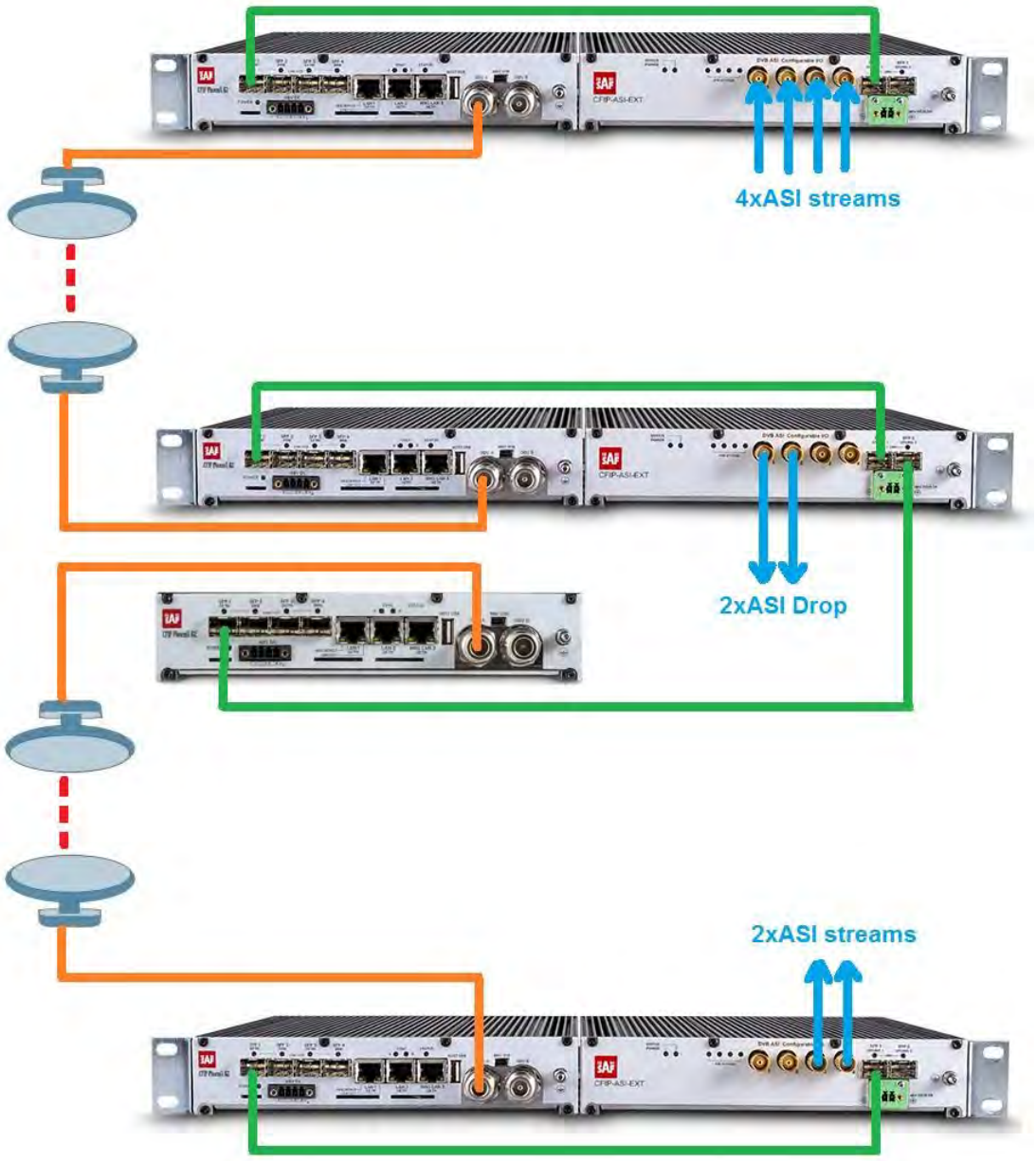


Figure 1.21 *1+0 retranslation link with ASI stream Drop*

1+0 retranslation application example with 2xASI streams '*Drop*' and 2xASI streams '*Add*' in the retranslation site:

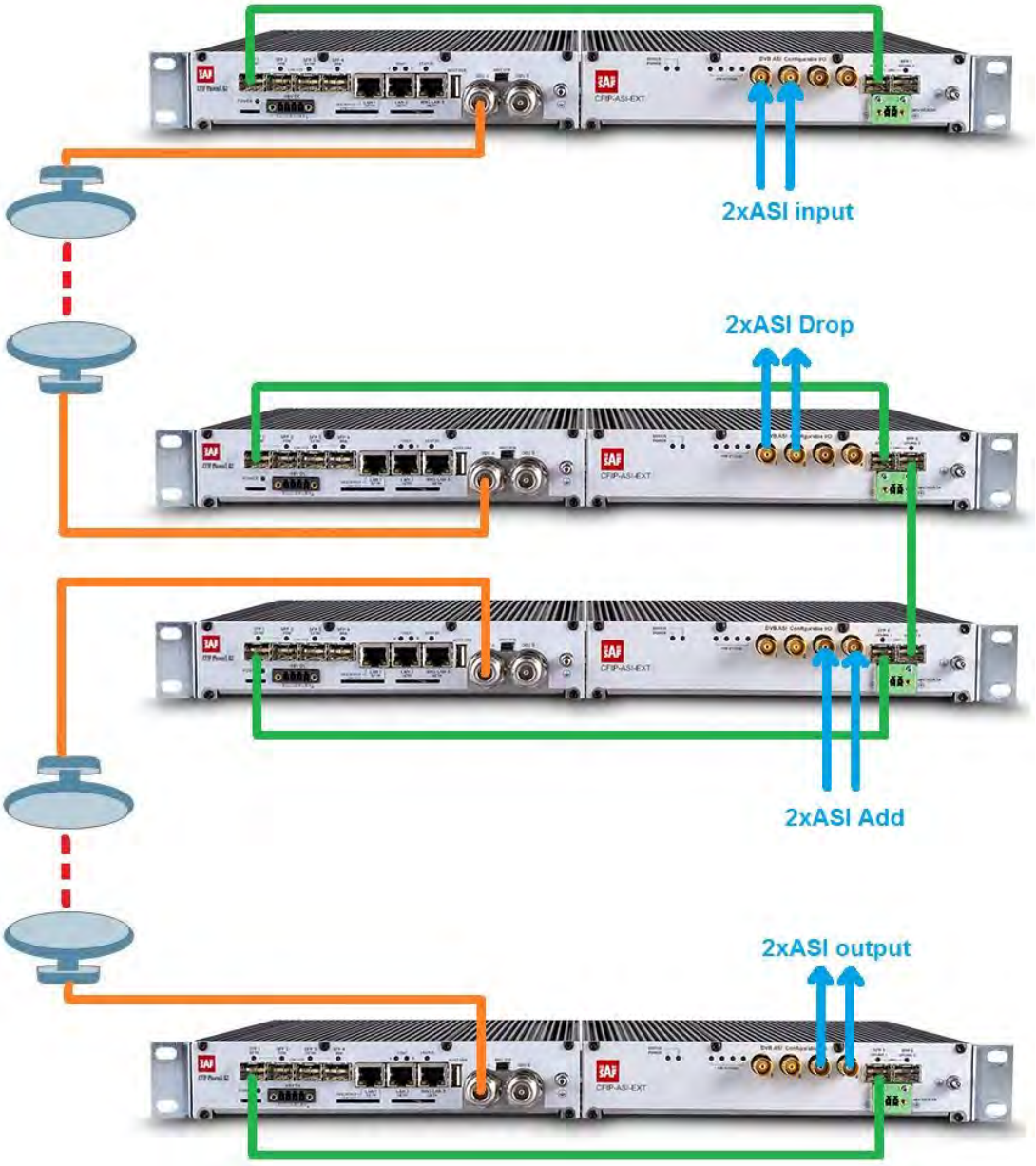


Figure 1.22 *1+0 retranslation link with ASI stream Add/Drop*

E1/T1 EMM extension module

The E1/T1 EMM extension module provides E1/T1 interface extension for Phoenix G2 IDUs. The E1/T1 EMM module multiplexes up to 16 E1/T1 channels into the compact stream which is directed over the fibre optic (FO) connection to/from the Phoenix G2 IDU. The E1/T1 EMM module features 16 x E1/T1 built-in ports (one RJ-45 per e1/t1 channel) and 2 x SFP 1000Base-SX ports.

The compact, simple to configure, and easily scalable design enables cascading with other EMM extension devices (e.g. E1/t1 EMM and/or ASI EMM). The configuration is performed in the web GUI of the IDU, in section Config → Ports → EMM.

Maximum speed for single E1 channel is 2.048 Mbps and for single T1 channel is 1.544 Mbps. The actual/total E1/T1 channels speed is auto-detected by the system and is displayed in Config → Ports → MUX section.

Up to 4 EMM modules can be connected into the cascade and thus get the maximum quantity of external ports (E1/T1 EMM and ASI EMM modules combination is possible). Maximum 4 EMM modules can be cascaded and in case of E1/t1 EMM modules the maximum count of E1/t1 channels is 64. SFP 1000Base-SX on the left side **SFP 2 UPLINK 2** is dedicated for the modules interconnection into cascade. The configuration of all EMM modules is performed from the web GUI of the IDU.

E1/T1 EMM extension module has following interfaces/connectors:

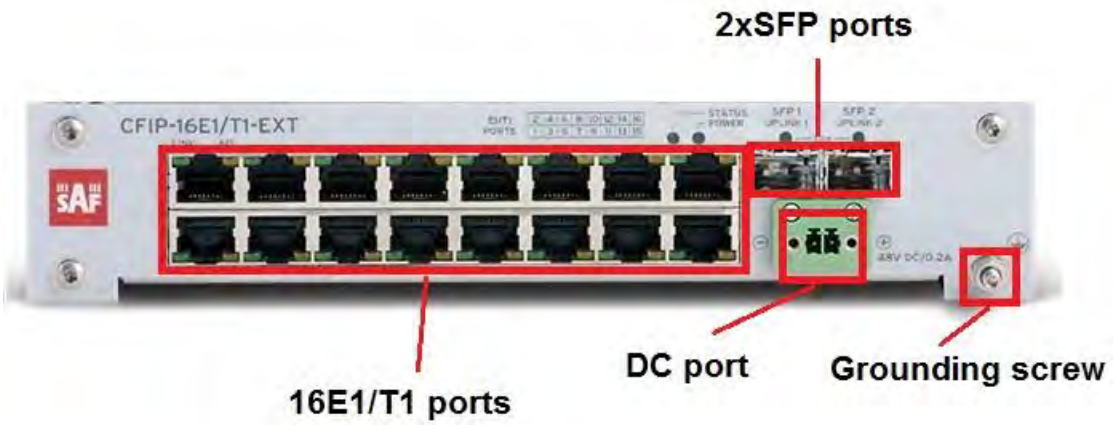


Figure 1.23 *E1/T1 EMM extension module interfaces*

16xE1/T1 ports

16 configurable Input / Output E1/T1 ports (120 Ohm).

SFP 1 UPLINK 1

Primary SFP port reserved for connection to the IDU or to primary EMM extension module in EMM extension module chain.

SFP 2 UPLINK 2

Secondary SFP port reserved for connection to secondary / next EMM extension module in EMM module chain or for connection to relay IDU in add/drop configuration.

DC port

48V power supply connection. Input DC voltage operating range is -20V to -72V (max current up to 3A). 2-wire DC power connector with screw terminals included. Polarity layout indicated on the front panel. Any 2 wire power cable of good quality which fits well in SAF Tehnika's supplied 2 pole "screw on" power connector could be used.

Grounding screw

Grounding screw for equipment grounding

E1/T1 EMM module front panel alarm LED indications:

LED name	Description
STATUS	**Orange –** OK, module enabled, proper communication with the IDU **Orange blinks –** WARNING, module is not enabled in the system or no communication with IDU, or configuration is not finished yet **Off** – ERROR, firmware is not loaded into EMM module HW
POWER	**Green –** power supply is OK **Off** – no power supply
SFP 1/2 LINK	**Orange blinks –** signal detected and synchronized, valid communication with the IDU **Off –** no correct signal detected
E1/T1 STATUS	***LINK:*** **Green –** E1/T1 signal detected at the port **Off** – no link at the port ***AIS (Alarm Indication Signal):*** **Orange** – AIS signal detected **Off** – no AIS on the port

The position and indexing of 16 E1 user ports indicates the legend below:

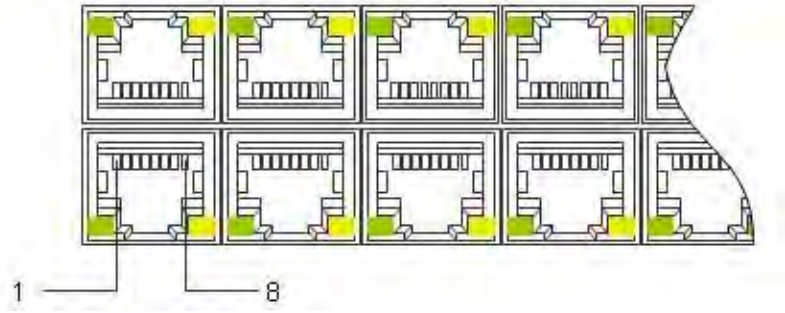


Figure 1.24 *Indexing of E1/T1 ports*

The legend of e1/t1 port pins is following:

Pin1 – Rx-

Pin2 – Rx+

Pin4 – Tx-

Pin5 – Tx+

All the E1/T1 ports are protected against ESD (electrostatic discharge), CDE (Cable Discharge Events), and lightning.

In the case of connecting 16E1 balanced RJ-45 interface to customer's unbalanced BNC E1 interface ports the following cable must be used:

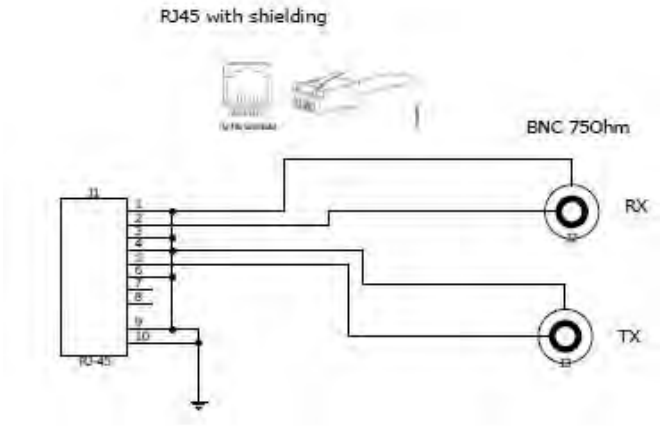


Figure 1.25 *Cable for interconnecting to unbalanced E1/T1 CPE*

Pinout for such cable is following:

Pin	Signal
1	Rx ring
2	Rx tip
3	GND (over resistor 0805 0R)
4	Tx ring
5	Tx tip
6	GND (over resistor 0805 0R)
7	NC
8	NC

Interconnection of Phoenix G2 IDU and E1/T1 EMM module must be done using optical cable and SFP modules. For 1+0 and 2+0 configurations any of all 4 SFP ports on the IDU can be used for connection to EMM module. In 1+1 full redundancy configuration SFP ports 3 and 4 can be used to connect to EMM module. On EMM module SFP port 1 can be used to connect to Phoenix G2 IDU and SFP port 2 must be used to connect to the next cascaded EMM module.

Figure 1.26 *Phoenix G2 IDU and E1/T1 EMM module interconnection*

Application of 1+0 link connection with E1/T1EMM modules:

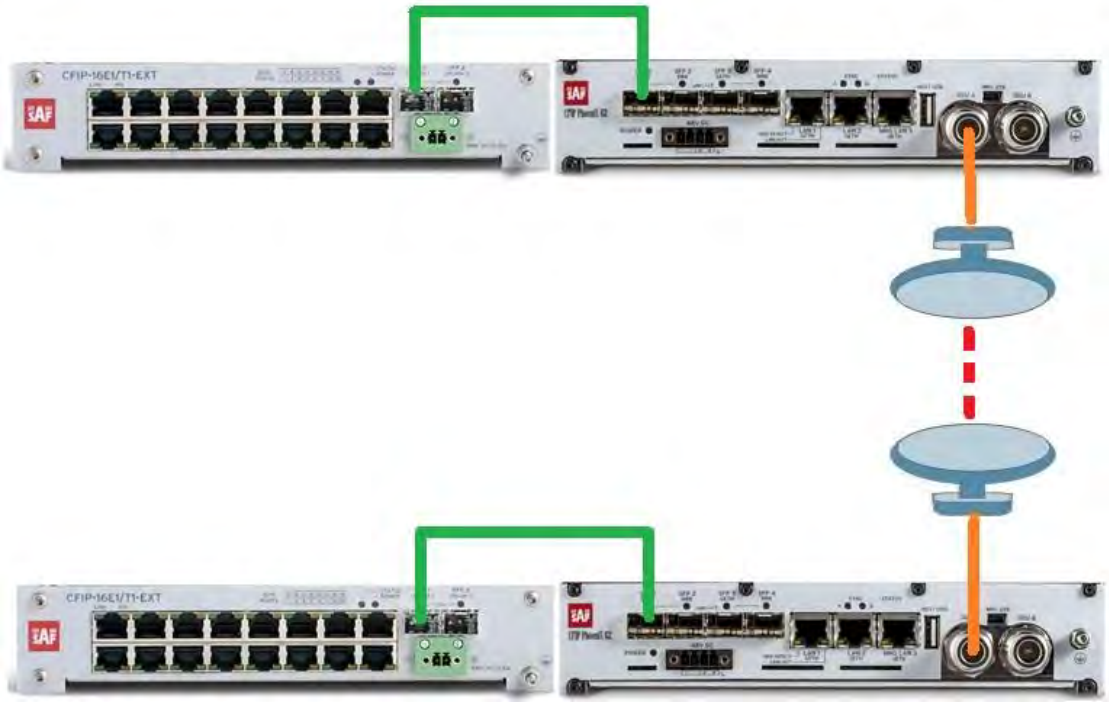


Figure 1.27 *1+0 link with E1/T1 EMM modules*

Application of 1+1 link connection with E1 EMM modules:

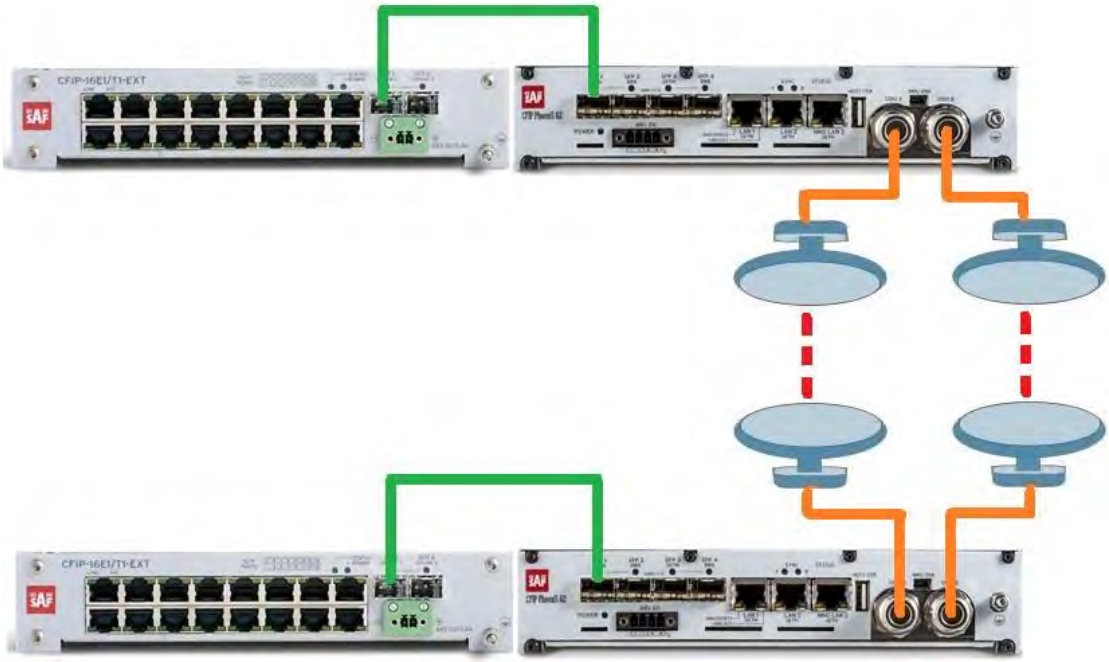


Figure 1.28 *1+1 link with E1/T1 EMM modules*

Application of 1+1 full protection link connection with E1/T1 EMM modules:

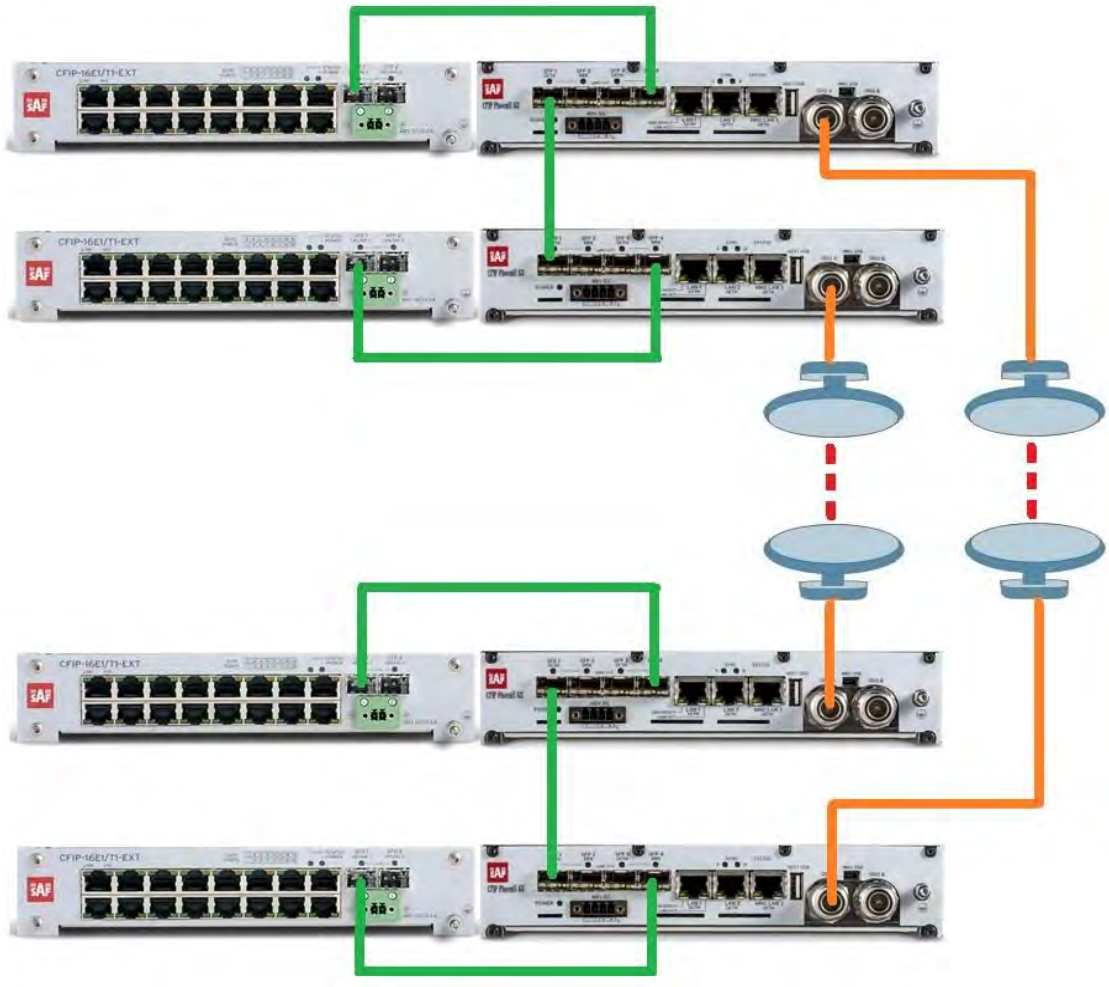


Figure 1.29 *1+1 full protection link with E1/T1 EMM modules*

In 1+1 Full protection mode EMM modules can be connected only to SFP3 and SFP4 ports of the Phoenix G2 IDU. SFP1 port is for both Phoenix G2 IDU interconnection and SFP2 port is reserved for 2+2 modes

1+0 retranslation application with E1/T1 EMM modules:

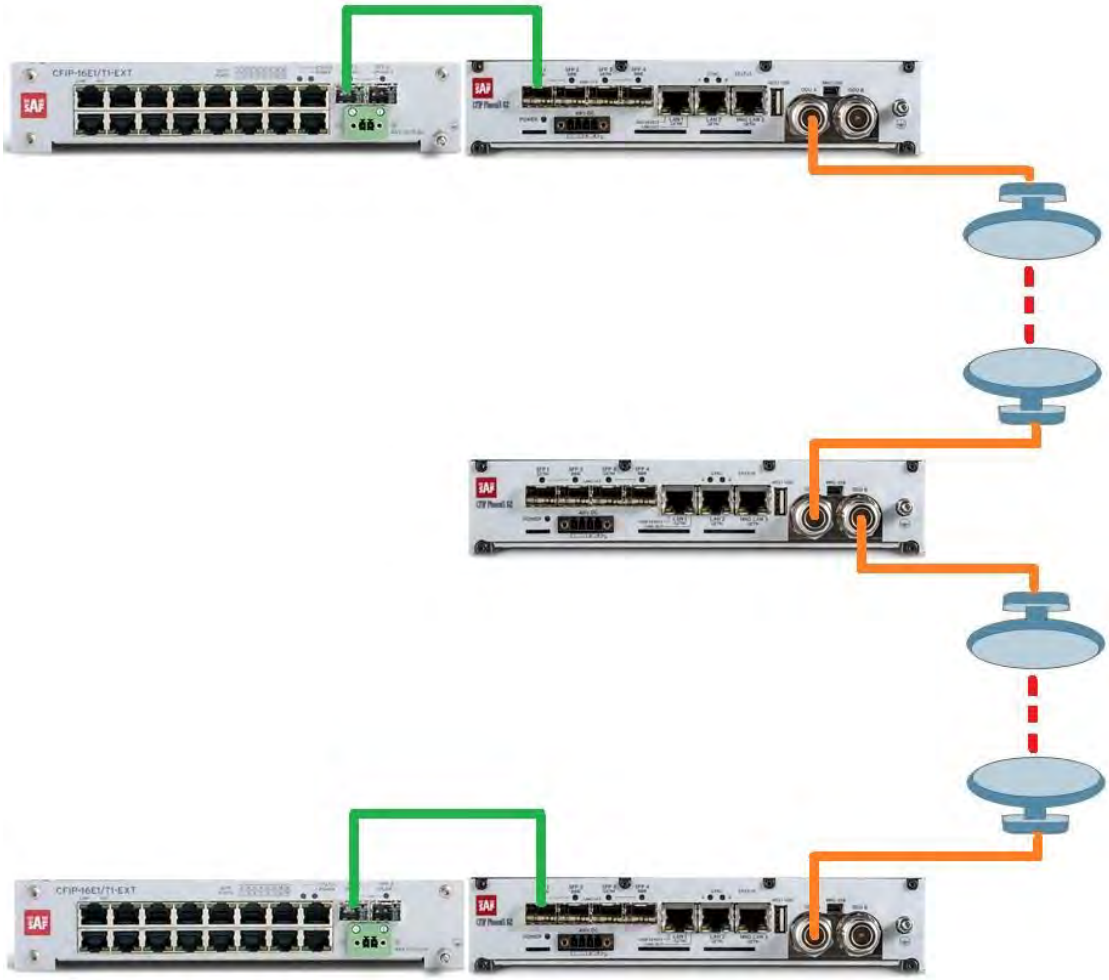


Figure 1.30 *1+0 retranslation link with E1/T1 EMM modules*

The retranslation IDU in ***Figure 1.30*** is configured in 1+0 Dual mode.

1+0 retranslation application with E1/T1 Add/Drop in the retranslation site:

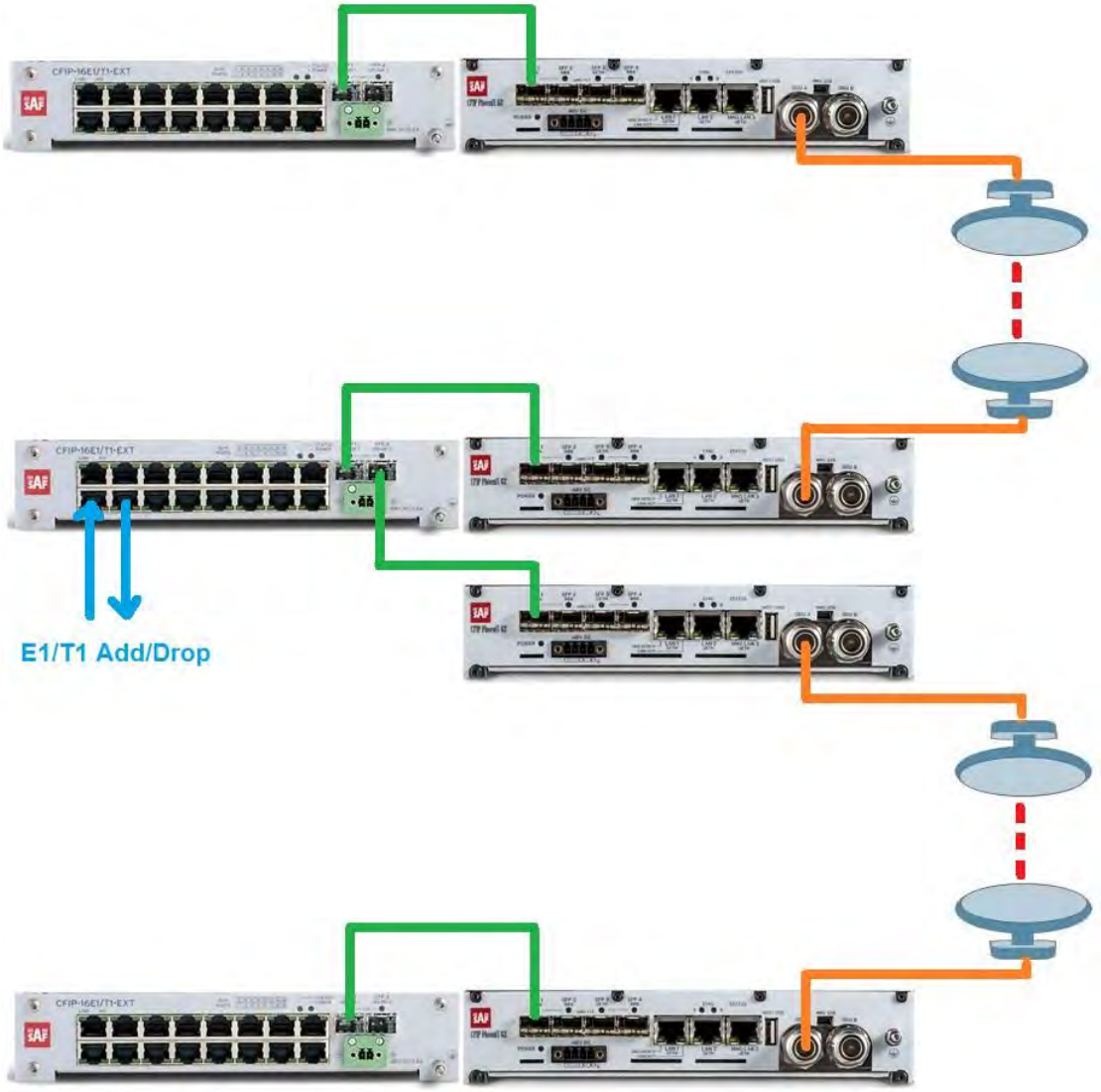


Figure 1.31 *1+0 retranslation link with E1/T1 Add/Drop*

Phoenix G2 ODU and IRFU interfaces and ports

SP/HP ODU

Phoenix G2 Standard Power (SP)/High Power (HP) ODU has following interfaces:

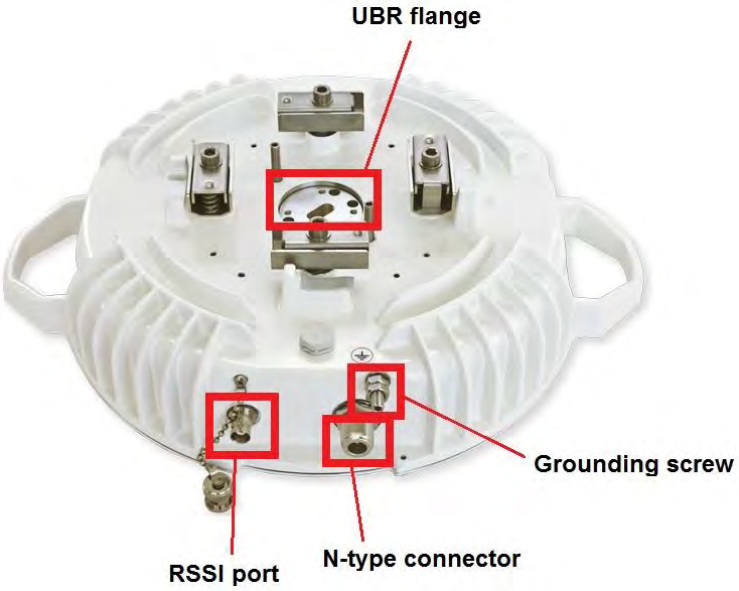


Figure 1.32 *SP/HP ODU interfaces*

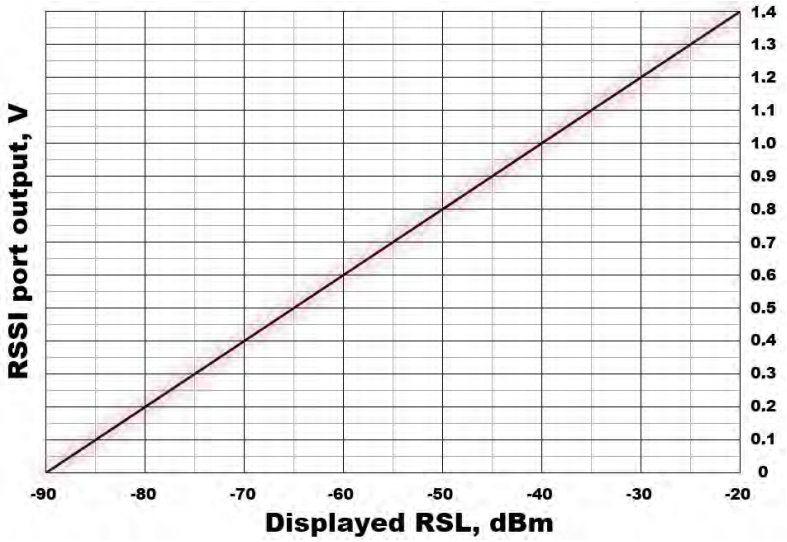
UBR flange

Standard UBR flange for ODU interconnection with antenna. Flange size depends on the frequency used.

RSSI port

RSSI (Received Signal Strength Indicator) port is used to adjust the alignment of antenna for best performance (for both rough and fine adjustment); this can be done using digital multimeter which is connected to the RSSI port. The output of the RSSI port is DC voltage and varies depending on received signal level.

The following chart and table shows typical relationship of the received signal level (Rx level) displayed by Phoenix G2 vs. RSSI port output voltage. The evaluated Rx level has the error +/-2 dB.



Displayed RSL, dBm	RSSI, V
-90	0
-85	0,1
-80	0,2
-75	0,3
-70	0,4
-65	0,5
-60	0,6
-55	0,7
-50	0,8
-45	0,9
-40	1
-35	1,1
-30	1,2
-25	1,3
-20	1,4

Figure 1.33 *Typical RSSI=f(RSL) chart*

N-type connector

N-type Female connector for ODU interconnection to IDU with coaxial cable

Grounding screw

Grounding screws should be interconnected with grounding cable and connected to ground circuit

SP/HP ODU with SAF2 adaptation interface

Phoenix G2 Standard Power (SP)/High Power (HP) ODU with SAF2 adaptation has following interfaces:

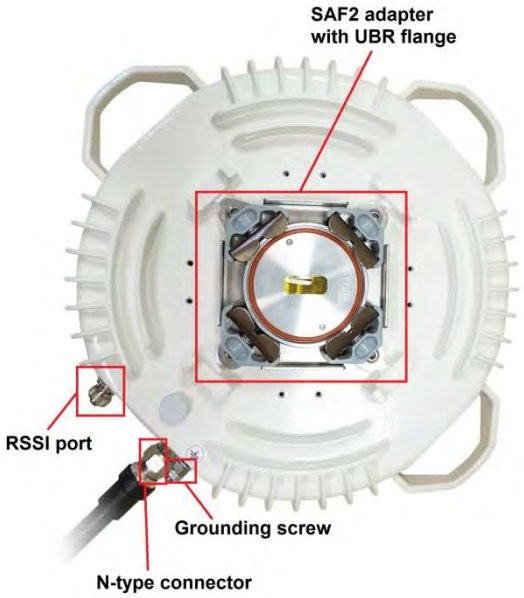


Figure 1.34 *SP/HP ODU with SAF2 interfaces*

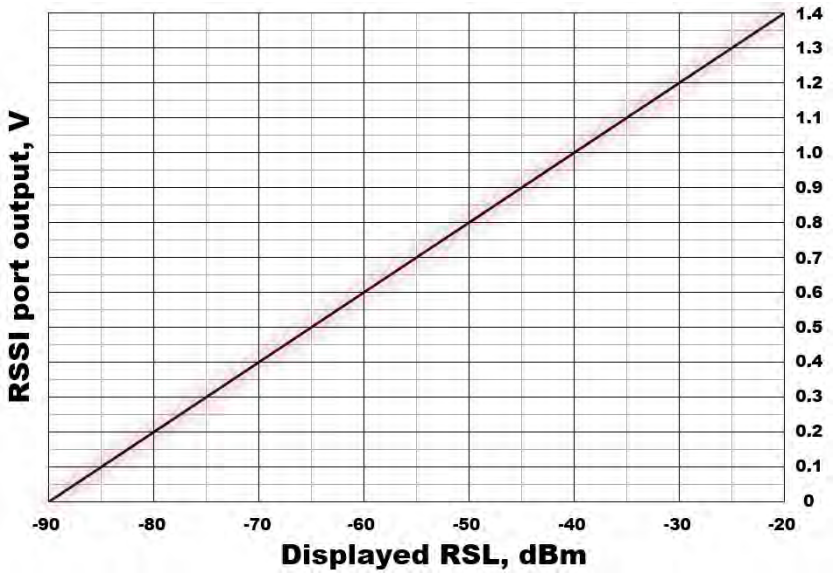
SAF2 adapter with UBR flange

Standard UBR flange for ODU interconnection with antenna equipped with SAF2 interface. Flange size depends on the frequency used.

RSSI port

RSSI (Received Signal Strength Indicator) port is used to adjust the alignment of antenna for best performance (for both rough and fine adjustment); this can be done using digital multimeter which is connected to the RSSI port. The output of the RSSI port is DC voltage and varies depending on received signal level.

The following chart and table shows typical relationship of the received signal level (Rx level) displayed by Phoenix G2 vs. RSSI port output voltage. The evaluated Rx level has the error +/-2 dB.



Displayed RSL, dBm	RSSI, V
-90	0
-85	0,1
-80	0,2
-75	0,3
-70	0,4
-65	0,5
-60	0,6
-55	0,7
-50	0,8
-45	0,9
-40	1
-35	1,1
-30	1,2
-25	1,3
-20	1,4

Figure 1.35 *Typical RSSI=f(RSL) chart*

N-type connector

N-type Female connector for ODU interconnection to IDU with coaxial cable

Grounding screw

Grounding screws should be interconnected with grounding cable and connected to ground circuit

VHP ODU

Phoenix G2 Very High Power (VHP) ODU has following interfaces:

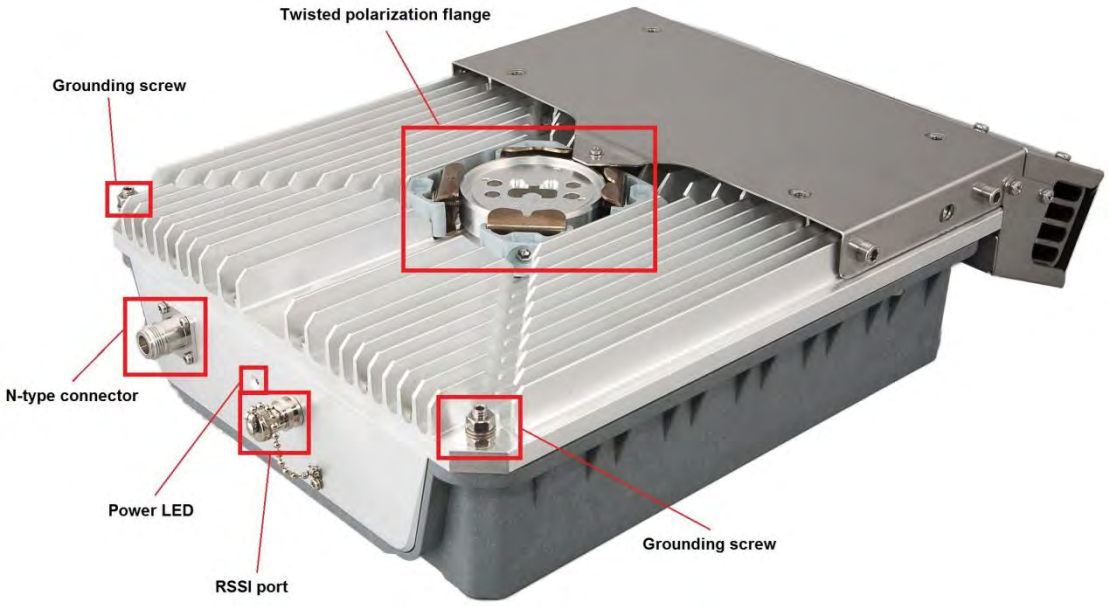


Figure 1.36 *VHP ODU interfaces*

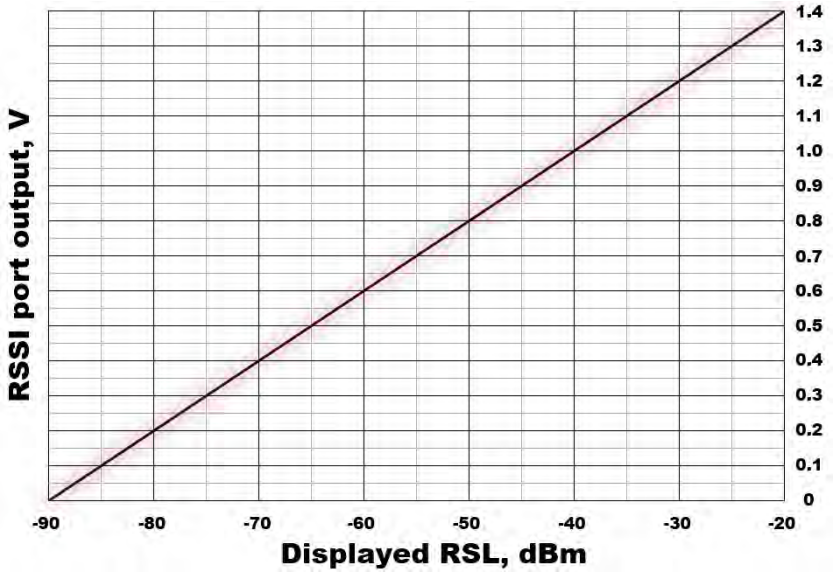
Twisted polarization flange

VHP ODU features twisted polarization flange and resulting signal polarization is determined by interface on antenna/OMT. To change signal polarization, only the antenna interface should be rotated, as radio always remains in vertical position.

RSSI port

RSSI (Received Signal Strength Indicator) port is used to adjust the alignment of antenna for best performance (for both rough and fine adjustment); this can be done using digital multimeter which is connected to the RSSI port. The output of the RSSI port is DC voltage and varies depending on received signal level.

The following chart and table shows typical relationship of the received signal level (Rx level) displayed by Phoenix G2 vs. RSSI port output voltage. The evaluated Rx level has the error +/-2 dB.



Displayed RSL, dBm	RSSI, V
-90	0
-85	0,1
-80	0,2
-75	0,3
-70	0,4
-65	0,5
-60	0,6
-55	0,7
-50	0,8
-45	0,9
-40	1
-35	1,1
-30	1,2
-25	1,3
-20	1,4

Figure 1.37 *Typical RSSI=f(RSL) chart*

N-type connector

N-type Female connector for ODU interconnection to IDU with coaxial cable

Power LED

Indicates if the ODU is powered ON

Grounding screw

Grounding screws should be interconnected with grounding cable and connected to ground circuit

IRFU with built-in diplexer

Phoenix G2 IRFU with built-in diplexer has following interfaces:

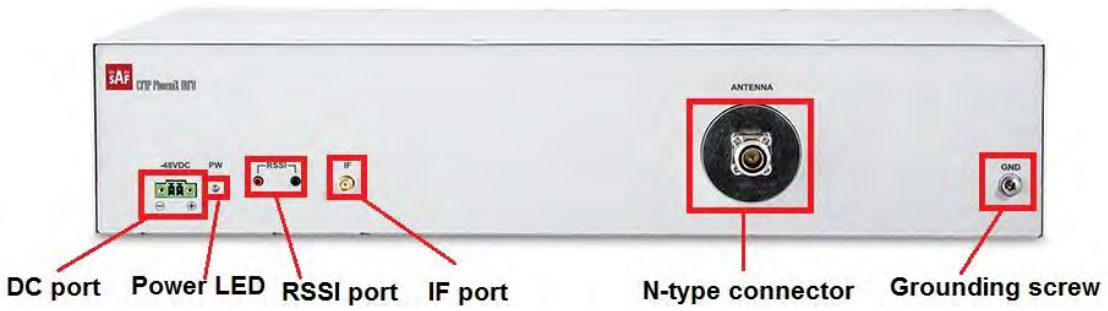


Figure 1.38 *IRFU interfaces*

DC port

48V power supply connection. Input DC voltage operating range is -40.5V to -57V (max current up to 3A). 2-wire DC power connector with screw terminals included. Polarity layout indicated on the front panel. Any 2 wire power cable of good quality which fits well in SAF Tehnika's supplied 2 pole "screw on" power connector could be used.

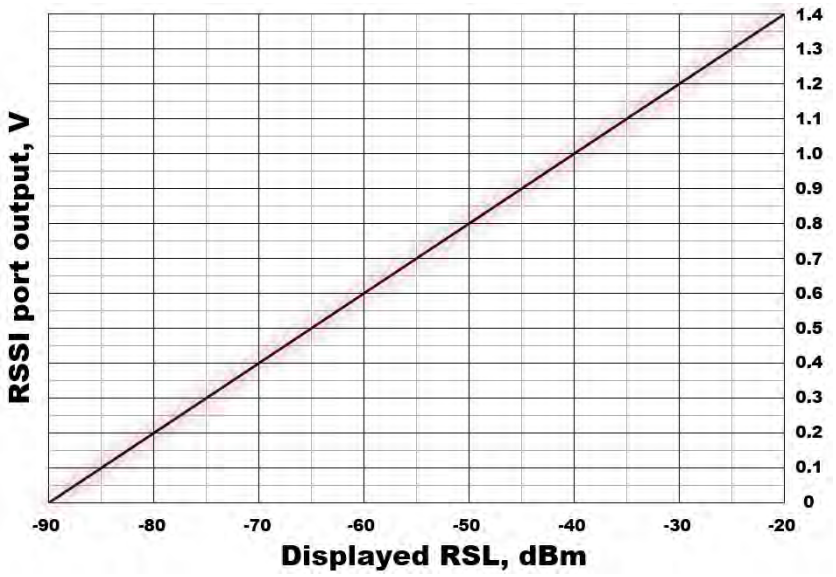
Power LED

Indicates if the IRFU is powered ON

RSSI port

RSSI (Received Signal Strength Indicator) port is used to adjust the alignment of antenna for best performance (for both rough and fine adjustment); this can be done using digital multimeter which is connected to the RSSI port. The output of the RSSI port is DC voltage and varies depending on received signal level.

The following chart and table shows typical relationship of the received signal level (Rx level) displayed by Phoenix G2 vs. RSSI port output voltage. The evaluated Rx level has the error +/-2 dB.



Displayed RSL, dBm	RSSI, V
-90	0
-85	0,1
-80	0,2
-75	0,3
-70	0,4
-65	0,5
-60	0,6
-55	0,7
-50	0,8
-45	0,9
-40	1
-35	1,1
-30	1,2
-25	1,3
-20	1,4

Figure 1.39 *Typical RSSI=f(RSL) chart*

IF port

SMA IF connector for connection to IDU

N-type connector

N-type Female connector for IRFU interconnection to antenna with coaxial cable

Grounding screw

Grounding screws should be interconnected with grounding cable and connected to ground circuit

IRFU without built-in diplexer

Phoenix G2 IRFU without built-in diplexer has following interfaces:

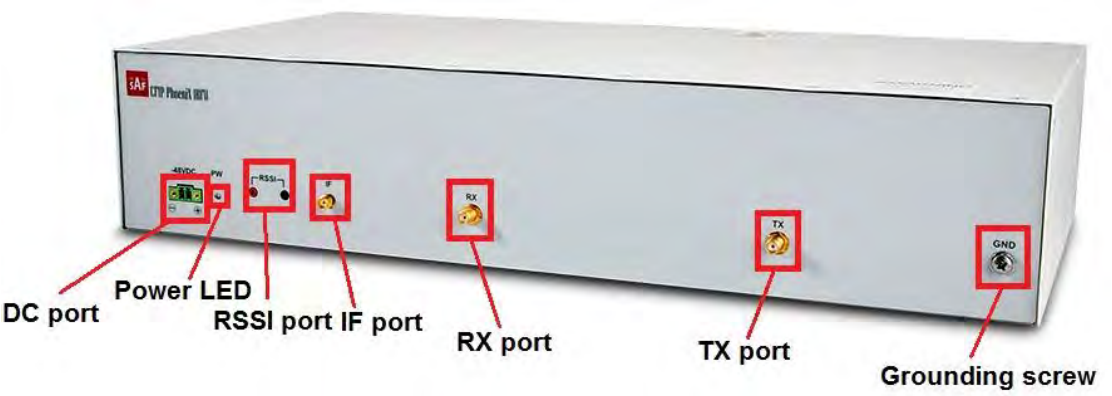


Figure 1.40 *IRFU interfaces*

DC port

48V power supply connection. Input DC voltage operating range is -40.5V to -57V (max current up to 3A). 2-wire DC power connector with screw terminals included. Polarity layout indicated on the front panel. Any 2 wire power cable of good quality which fits well in SAF Tehnika's supplied 2 pole "screw on" power connector could be used.

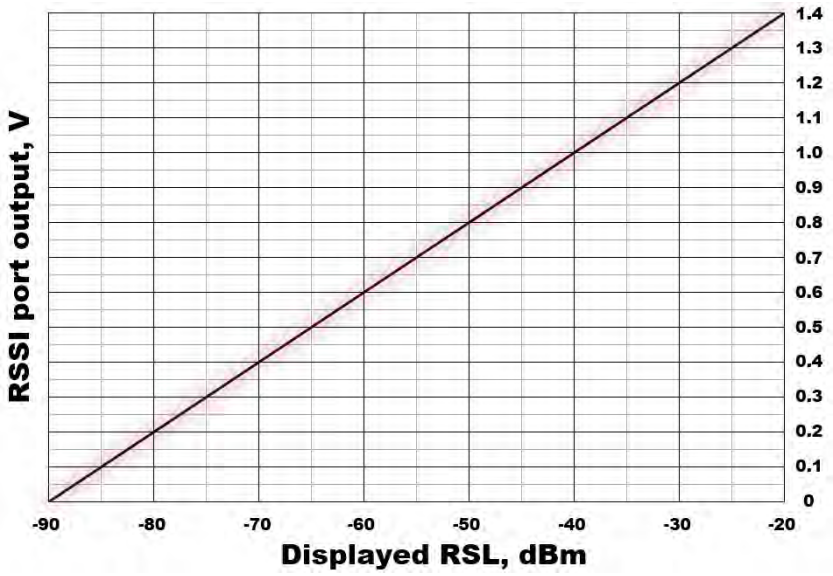
Power LED

Indicates if the IRFU is powered ON

RSSI port

RSSI (Received Signal Strength Indicator) port is used to adjust the alignment of antenna for best performance (for both rough and fine adjustment); this can be done using digital multimeter which is connected to the RSSI port. The output of the RSSI port is DC voltage and varies depending on received signal level.

The following chart and table shows typical relationship of the received signal level (Rx level) displayed by Phoenix G2 vs. RSSI port output voltage. The evaluated Rx level has the error +/-2 dB.



Displayed RSL, dBm	RSSI, V
-90	0
-85	0,1
-80	0,2
-75	0,3
-70	0,4
-65	0,5
-60	0,6
-55	0,7
-50	0,8
-45	0,9
-40	1
-35	1,1
-30	1,2
-25	1,3
-20	1,4

Figure 1.41 *Typical RSSI=f(RSL) chart*

IF port

SMA IF connector for connection to IDU

RX port

SMA connector for IRFU Rx interconnection with external branching unit

TX port

SMA connector for IRFU Tx interconnection with external branching unit

Grounding screw

Grounding screws should be interconnected with grounding cable and connected to ground circuit

On some IRFU devices optional RJ-45 control port can be available for interconnection with IBU device which is equipped with active switch. In case if the IRFU is equipped with the Control port, additional LED indications are available on:

LED name	Description
POWER	**Green –** power supply is OK **Off** – no power supply
Control (optional)	**Green –** works correctly **Off –** not connected, cable fault

IBU without active switch

Phoenix G2 IBU (Indoor Branching Unit) without built-in active switch has following interfaces on the front panel:

Figure 1.42 *IBU front panel interfaces*

RX1 and RX2 ports

SMA connector for IBU interconnection with corresponding IRFU Rx port

TX1 and TX2 ports

SMA connector for IBU interconnection with corresponding IRFU Tx port

Backpanel of the IBU:

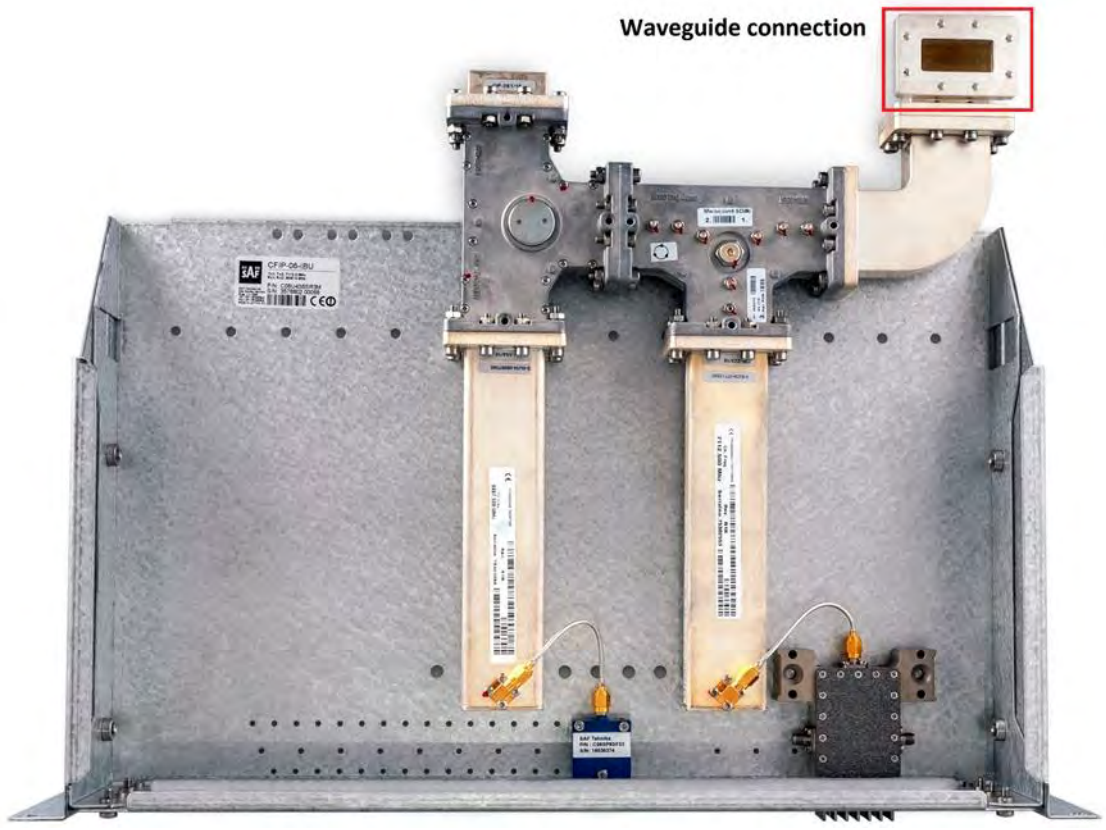


Figure 1.43 *IBU top-back panel interfaces*

Waveguide connection

Interconnection with waveguide.

The ***Figure 1.43*** shows the IBU P/N C06U43BSR3M with outgoing CMR137 (UER70) waveguide flange. For other options refer to the IBU product datasheet or SAF representative.

Example of IRFU and IBU interconnection using the 1+1 or 2+0 application with single IDU:

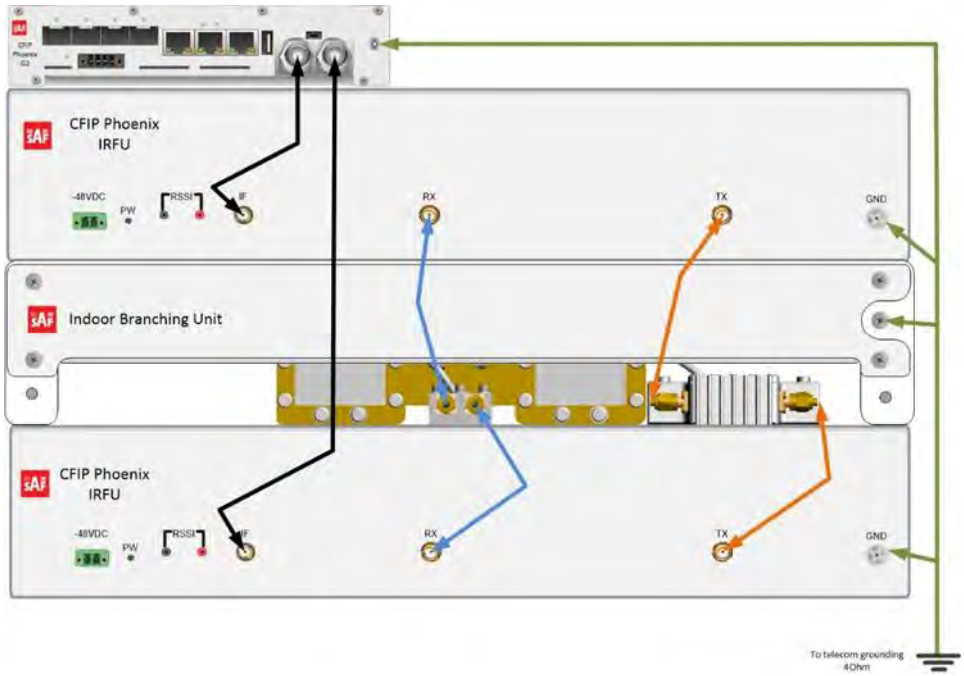


Figure 1.44 *IRFU and IBU interconnection using single IDU*

Example of IRFU and IBU interconnection using the 1+1 full redundancy application with two IDUs:

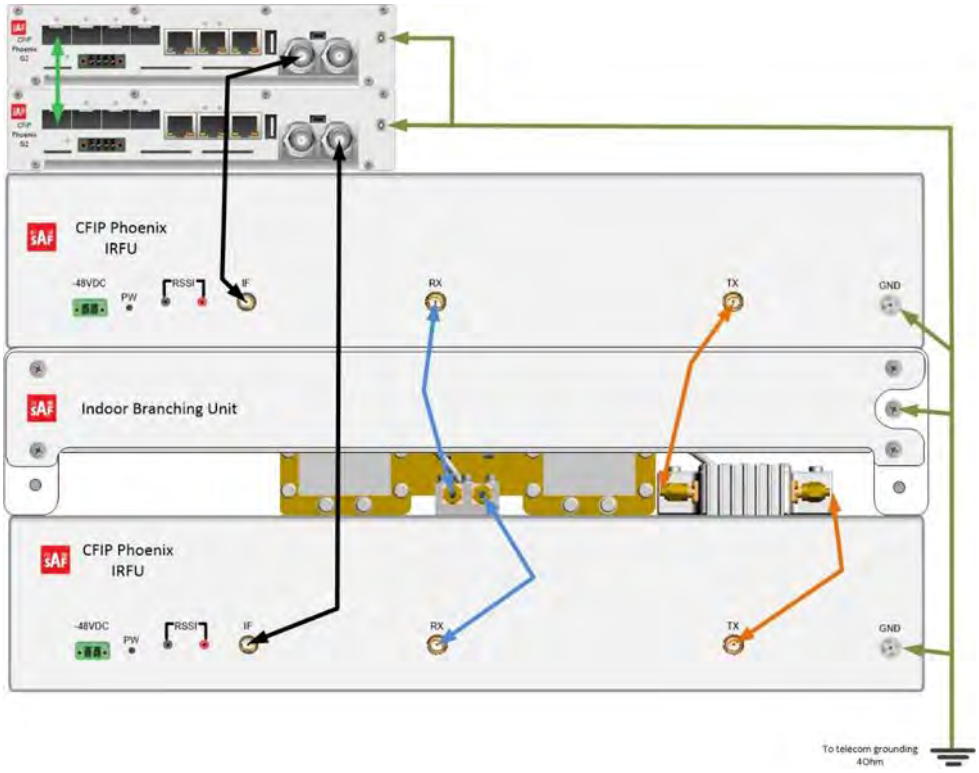


Figure 1.45 *IRFU and IBU interconnection using two IDUs*

IBU with active switch

Phoenix G2 IBU with built-in active switch has following interfaces on the front panel:

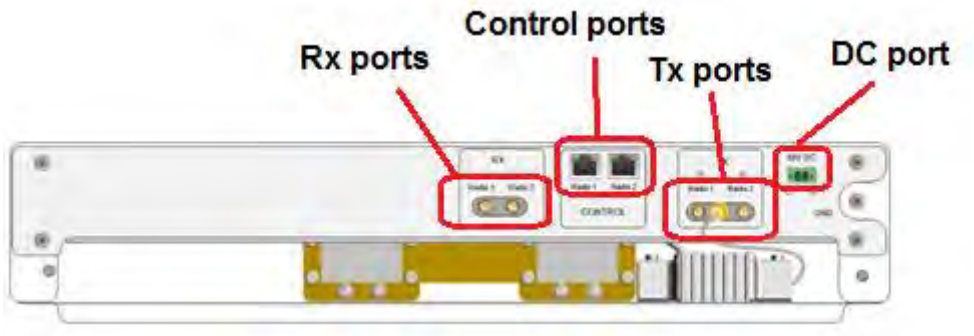


Figure 1.46 *IBU with active switch front panel interfaces*

RX1 and RX2 ports

SMA connector for IBU interconnection with corresponding IRFU Rx port

TX1 and TX2 ports

SMA connector for IBU interconnection with corresponding IRFU Tx port

Radio 1 and Radio 2 Control ports

RJ-45 connector for IBU interconnection with corresponding IRFU Control port

DC port

48V power supply connection. Input DC voltage operating range is -40.5V to -57V (max current up to 3A). 2-wire DC power connector with screw terminals included. Polarity layout indicated on the front panel. Any 2 wire power cable of good quality which fits well in SAF Tehnika's supplied 2 pole "screw on" power connector could be used.

Phoenix G2 IBU front panel alarm LED indications:

LED name	Description
Control (Radio 1/2)	**Green –** normal operation – control cable connected, IRFU is powered on **Off** – control cable unplugged or damaged, or IRFU is not powered on
TX (Radio 1/2)	**Green –** Normal operation – Tx part is active or in active search during the switchover **Off –** Tx part is in standby state, normal operation **Red** – alarm condition – both Tx are working simultaneously, faulty control cable or IRFU is not powered on *

** In case of 1+1 configuration the IRFU must not be powered on via DC port, that is why in this case the Red LED is acceptable*

Example of IRFU and IBU interconnection using the 1+1 or 2+0 application with single IDU:

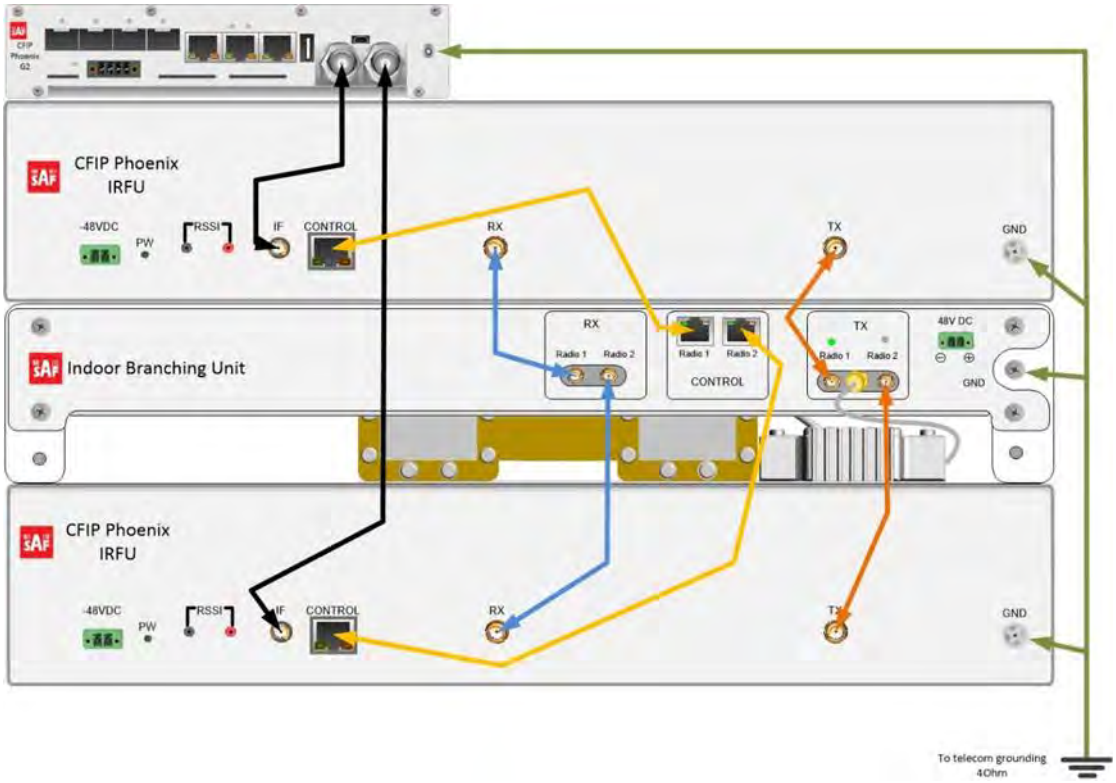


Figure 1.47 *IRFU and IBU interconnection using single IDU*

It is not recommended to use external PSU for powering the IRFU via DC port in 1+1 configuration, as the redundancy functionality may be lost

Example of IRFU and IBU interconnection using the 1+1 full redundancy application with two IDUs:

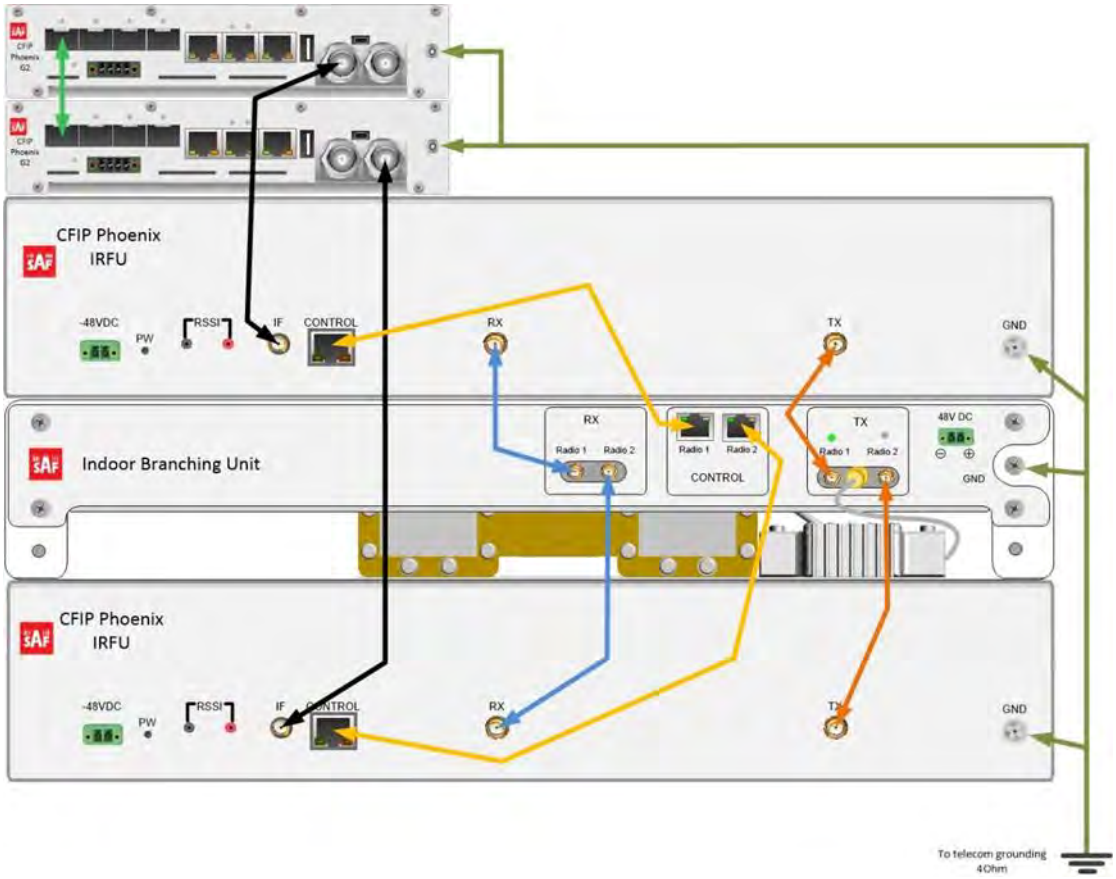


Figure 1.48 *IRFU and IBU interconnection using two IDUs*

Chapter 2: INSTALLATION

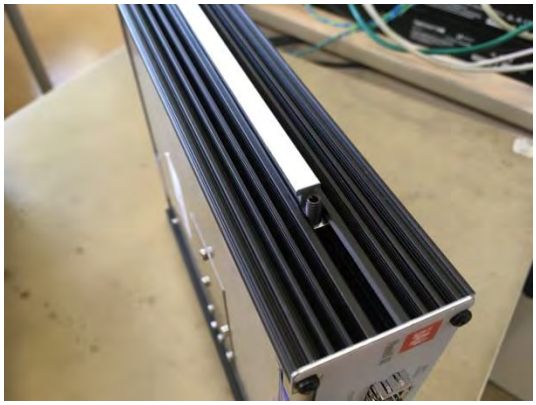
Getting started

The installation of Phoenix G2 IDU and ODU link involves the following steps:

- Install the Phoenix G2 IDU in 19" rack: as the IDU is ½ width of the 19" inch rack position, there are two options how to install it in the rack:
  Option one: Single device installation: attach blank panel and bracket to the IDU (all included in the package). Install the IDU in the rack using attached blank panel and rack mount bracket.

Figure 2.1 *Single device installation*

Option two: Dual device installation: interconnect two devices (IDU and EMM, or IDU with IDU) using dual device mount kit, attach brackets to each device. Brackets are included in the package of IDUs; dual device mount kit is included in EMM module package, and can be ordered as an optional accessory if two IDUs must be interconnected.
Dual device mounting kit includes aluminium mounting profile (P/N EASMEX03) which must be inserted in side panel grooves of IDUs thus fastening both devices together. In order to fix it and avoiding of both IDU movements use mounting plate (P/N WAKMEXS1.001) for fixation. The mounting plate must be attached to IDUs on back-panel using already existing screws from the IDUs. Those screws must be removed and used for attaching the mounting plate to IDUs.



1 Insert the aluminium mounting profile in side panel grooves of IDUs, fix it using setscrew with square nut

2 Remove 2 existing screws from both IDUs back panel

3 Attach the mounting plate to IDUs and fix it to IDUs using the same existing screws

4 Final view of back panel of interconnected IDUs

Install both devices in the rack using attached rack mount brackets.

Figure 2.2 *Dual device installation*

- Ground Phoenix G2 IDU by interconnecting it's grounding screw with the grounding point of the rack
- In case if the Phoenix G2 IDU will be used in **1+0 Ch1** mode, connect ODU to the IDU's IF port **ODU A** with coaxial cable before turning on the power
- In case if the Phoenix G2 IDU will be used in **1+0 Ch2** mode, connect ODU to the IDU's IF port **ODU B** with coaxial cable before turning on the power
- In case if the Phoenix G2 IDU will be used in modes **1+1 Dual**, **2+0** or **1+1**, connect ODUs to the IDU's IF ports **ODU A** and **ODU B** with coaxial cables before turning on the power

In case of IDU tests in the lab without ODU, the IDU can be powered on without ODU connected, it will not damage the unit

Attaching Phoenix G2 ODU to antenna

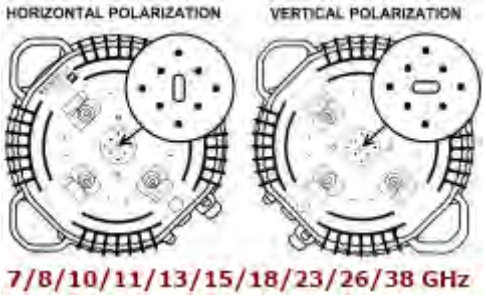
SP/HP ODU

Tools required: SAF tightening tool

In order to attach SP/HP ODU to SAF adopted antenna use two guidance pins for fixing polarization and 4 side lockings for attachment. Lockings should be tightened in diagonal sequence.

Figure 2.3 *Locking of ODU with tightening tool*

Pair radios in licensed frequency bands 6 - 38 GHz use same polarization for Tx/Rx channels on both ends of the link – either horizontal, or vertical.



In case of 6GHz (N-Type connectors) polarization is determined by antenna and should be same on both ends of the link.

Examples:

7GHz (vertical polarization)

23GHz (horizontal polarization)

For extra protection from sun radiation it is recommended to install sun shield to cover the radio.

In order to attach the SP/HP ODU to SAF non-adapted antenna separated ODU mounting bracket (P/N S0SPKS03) and flexible waveguide/coaxial cable is required

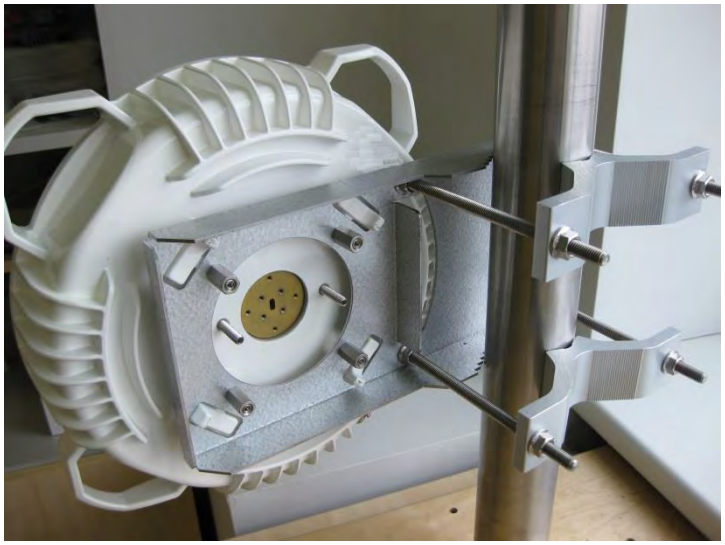


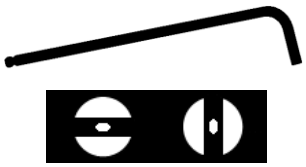
Figure 2.4 *SP/HP ODU with mounting bracket*

For instructions how to connect SP/HP ODU to mounting bracket refer to “SAF mounting bracket installation V1.0” document

VHP and SP/HP ODU with SAF2 adaptation interface

Tools required: Size 5 Allen wrench, 240mm

Level (not supplied)



Phoenix G2 VHP ODU features twisted polarization flange and resulting signal polarization is determined by Interface on antenna/OMT. To change signal polarization, please rotate only the antenna interface, as radio always remains in vertical position.

SP/HP ODU with SAF2 adaptation interface supports standard UBR flange which must match with the flange position on antenna. To change the signal polarization, please rotate the antenna interface and accordingly the ODU as well.

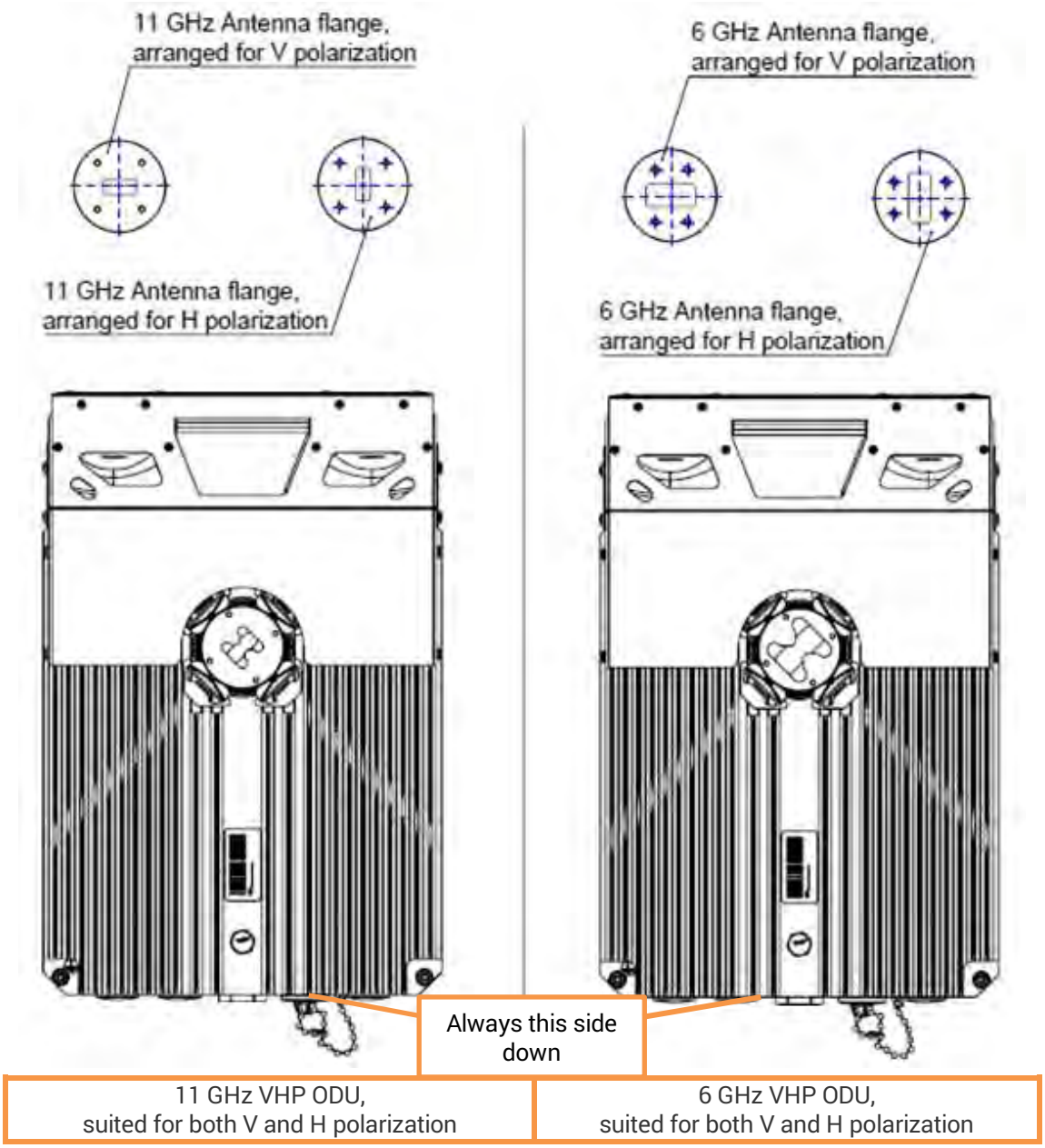
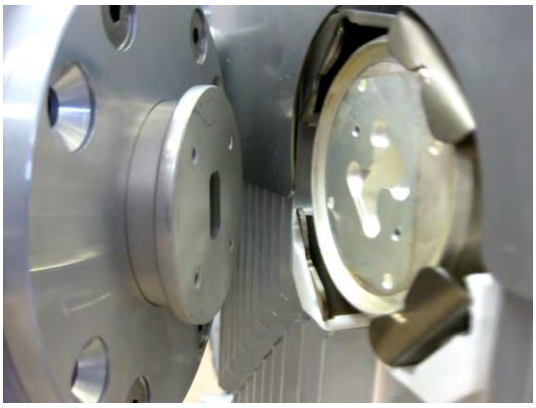


Figure 2.5 *VHP ODU flange*

Examples of VHP ODU polarizations:

Example of vertical polarization interconnection



Example of horizontal polarization interconnection

Examples of SP/HP ODU with SAF2 adaptation interface polarizations:

Example of vertical polarization

Example of horizontal polarization

As both those ODUs have the same SAF2 interface, the steps of ODU interconnection with antenna for both are the same and are given below:

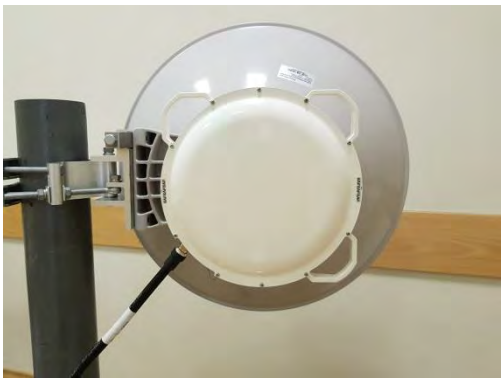
1 Put VHP ODU on antenna adapter flange by hooking half-turn loosened clamp at the top and leaving the completely loosened clamp at the bottom. Make sure O-ring is in place and the adapter flange fits into the VHP ODU transition flange socket.

Note! The protective sticker should be removed before attaching the VHP ODU to the antenna.

2 Tighten bottom fixation clamps.

3 Use air level to verify that VHP ODU is properly levelled. Tighten all four fixation clamps properly.

4 Final view of assembled VHP ODU 1+0 setup.



5 Final view of assembled SP/HP ODU with SAF2 adapter in Horizontal polarization

6 Final view of assembled SP/HP ODU with SAF2 adapter in Vertical polarization

Acceptable angle of polarization tolerance of SP/HP ODU is up to 30°

If any further assistance is required please contact techsupport@saftehnika.com

Cable requirements

IDU-ODU cable:

IDU–ODU cable is a 50 Ω coaxial cable intended to interconnect the Indoor Unit with the Outdoor Unit. Any type of 50 Ω cable of good quality can be used; the cable should be equipped with N–type male connectors on each end. There are two N–type male connectors included in each radio unit delivery that fit RG–213 cables or other cables with a surface diameter of 10 mm. As the attenuation of the cable is essential particularly at 350 MHz frequency, its usage is restricted, - the attenuation of the signal should not exceed 15 dB at 350 MHz.

Figure 2.6 *PhoeniX G2 IDU-ODU cable*

DC power cable:

Due to low power consumption of the PhoeniX G2 split mount system, there are no special requirements for the cable used to connect the IDU to the DC power source. Any 2 wire power cable of good quality which fits well in SAF Tehnika's supplied single block 4 pole "screw on" power connector could be used. The power connector is 2 pole, type 2ESDV-04P.

USB B Serial Connection:

USB B management port must be used for management access with alternative IP address. This requires USB cable (USB A connector – computer side / USB mini B connector – IDU side).

Figure 2.7 *PhoeniX G2 USB management cable*

RSSI BNC cable:

To connect the digital multimeter to the PhoeniX G2 ODU RSSI port in order to adjust the antenna alignment, a coaxial cable with BNC connector on one end and appropriate termination on other end can be used.

Figure 2.8 *Cable for connecting the multimeter to the PhoeniX G2 ODU RSSI port*

Optical cable:

Optical cable supporting 1 Gbps must be used to interconnect PhoeniX G2 IDU and EMM (ASI or E1) modules. Either Single-mode or Multi-mode optical fiber can be used. The same type SFP modules have to be installed in both devices PhoeniX G2 IDU and EMM. In order to interconnect two Phoenix G2 IDUs for 1+1 Full redundancy configuration 2.5 Gbps optical cable and SFP modules must be used.

Figure 2.9 *Optical cable and SFP modules for Phoenix G2 IDU and EMM module interconnection*

Powering Phoenix G2 IDU/ODU

Next step is to interconnect LLM IDU DC power connector with power source using power cable. In case AC/DC Power supply, 48VDC, 80W (EU - P/N I0AB4810, US – P/N I0AB4811, AUS - I0AB4818) provided by SAF Tehnika JSC is used to power up PhoeniX G2 IDU, interconnect IDU and power source through appropriate connectors. Otherwise perform the following steps to ensure that PhoeniX G2 IDU is powered up correctly:

1. It is necessary to interconnect PhoeniX G2 IDU DC power connector (located on left side of front panel) with power source. For this purpose power cable is required. Any 2 wire power cable of good quality which fits well in SAF Tehnika's supplied 4 pole "screw on" power connector could be used. The power cable connector is 4 pole, type 2ESDV-04. This connector has screw clamp terminals that accommodate 24 AWG to 12 AWG wire. The recommended wire size for construction of power cables under 3 meters in length, supplying -48 V DC, is 18 AWG. The opposite end of the power cable should have a termination appropriate for the power supply being used. The power cable should be of sufficient length to avoid tension in the cable and provide a service loop for connection, but not be of excessive length. Using the power cable connector of type 2ESDV-04, pins 1/2 (labelled '-') should be connected to the power supply terminal supplying -48 V DC, while pins 3/4 (labelled '+') should be grounded. Refer to ***Figure 2.10***.

Note that pins 3/4 ('+') of the PhoeniX G2 IDU DC Power connector (***Figure 2.10***) is connected to the IDU chassis ground internal to the IDU. Use of a power supply with an inappropriate ground reference may cause damage to PhoeniX G2 IDU and/or the power supply.

2. Connect the power cable to the -48 V DC power supply, and place the voltmeter probes at the unconnected ends of the power cable, with the positive voltmeter probe on pin 1/2 ('-') of the cable connector and the negative probe on pin 3/4 ('+'). The connector screw terminal screw heads may be used as convenient monitor points. Refer to ***Figure 2.10***.
3. Turn on the –48 V DC supply. Verify that the digital voltmeter reads between -36 V DC and -57 V DC when monitoring the cable points specified above. Adjust the power supply output voltage and/or change the connections of the power supply to achieve this reading.
4. With the negative voltmeter probe still on pins 3/4 ('+') of the power cable connector (and the power supply still on), put the positive voltmeter probe to the PhoeniX G2 IDU

chassis and verify a potential of zero volts between the IDU chassis and cable pins 3/4 ('+'). If the measured potential is not zero, the power supply may be grounded incorrectly and should not be used for PhoeniX G2 IDU powering. Note that this measurement assumes that PhoeniX G2 IDU is installed and properly grounded. If that is not the case, the same measurement can be made between cable pins 3/4 ('+') and a convenient ground (such as an AC outlet third-wire ground).

5. Turn the -48 V DC supply off.
6. Plug the power cable into PhoeniX G2 IDU front panel DC Power connector (**DC port**). Place the voltmeter probes on the cable connector screw terminal screw heads as described in step 2 above. Refer to ***Figure 2.10***. Note that PhoeniX G2 IDU does not have a power on/off switch. When DC power is connected, the digital radio powers itself up and is operational. There can be up to 500 mW of RF power present at the antenna port. The antenna should be directed safely when power is applied.
7. Turn on the -48 V DC power supply, and verify that the reading on the digital voltmeter is as specified in step 3 above.

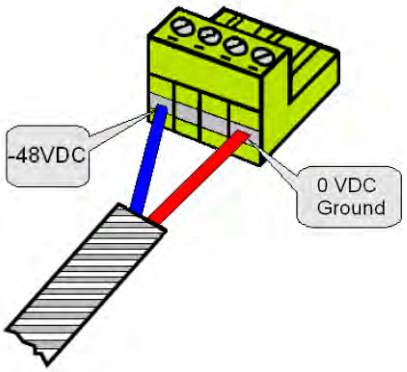


Figure 2.10 *Phoenix G2 IDU DC Power Cable Connector of type 2ESDV-04*

Depending on the ODU type and supported frequency the power consumption of one Phoenix G2 IDU and 2xODUs can be up to 180 W. So this should be taken in account when choosing power adaptor.

Powering External Multiplexer Modules (EMM)

The External Multiplexer Module (ASI, E1/T1) unit (if used) must be connected to the power supply separately, with a nominal voltage of -48 VDC and GND must be connected to the positive pole. Connector type 2-pin MC 1,5/ 2-STF-3,81 is supported. Its power consumption is <9 W.

Powering Phoenix G2 IRFU

PhoeniX G2 IRFU (if used) can be powered via coaxial IF cable or using separate power supply, providing at least 60W load power.

Note that pin 2 ('+') of the PhoeniX G2 IRFU DC Power connector is connected to the IDU's internal chassis ground. Use of a power supply with an inappropriate ground reference may cause damage to PhoeniX G2 IRFU and/or the power supply.

Chapter 3: WEB GUI

Initial configuration

System requirements

To access PhoeniX G2 IDU Web GUI you will need a PC with the following system requirements:

Operating system

- Microsoft Windows XP / Vista / 7 / 8/10;
- Linux

Web browser

- Google Chrome;
- Mozilla Firefox;
- Internet Explorer 8 (or above)

Ethernet management connection configuration

Before proceeding with initial link setup in Web GUI, you must adjust IPv4 settings of your LAN adapter to 10.10.10.0 subnet. IP address should be other than default IP address (10.10.10.10).

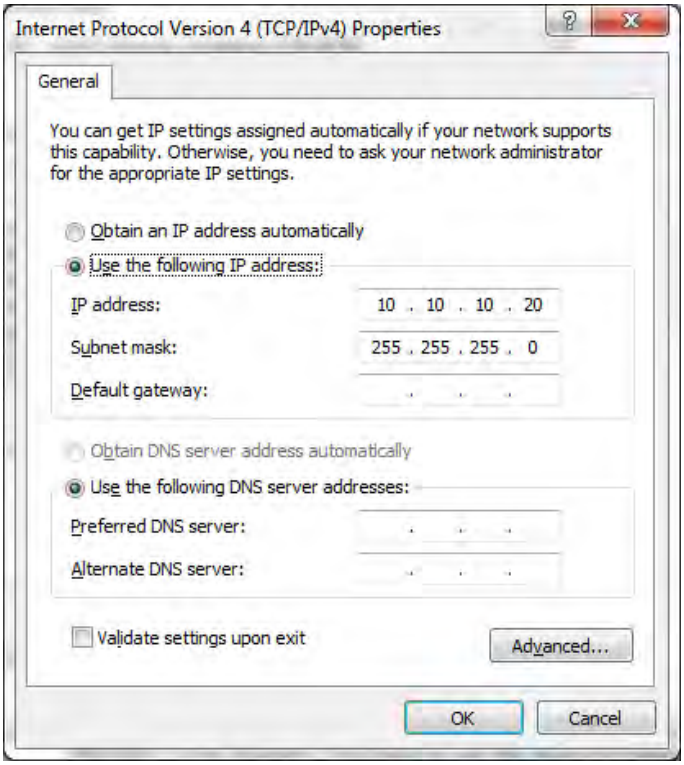


Figure 3.1 *TCP/IPv4 Properties*

After applying these settings you are ready to connect to Web GUI or establish SSH/Telnet connection.

USB Management connection configuration

In case MNG USB B serial port is used for Web GUI access, following steps can be taken:

- Interconnect PC with USB B port of the IDU using USB/USB mini B cable (USB A connector – computer side / USB mini B connector – IDU side). USB cable is shown in ***Figure 2.6***
- If the connection is done for the first time, wait while device driver software will be installed automatically. If it does not happen automatically, contact SAF Technical support.
- If driver is successfully installed, in PC's Network Connection panel new network adapter will appear:

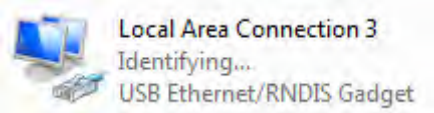


Figure 3.2 *PC IP USB setup – USB network adapter*

- Adjust IPv4 settings of USB Ethernet network adapter to 10.10.11.0 subnet. IP address should be other than default IP address (10.10.11.10).

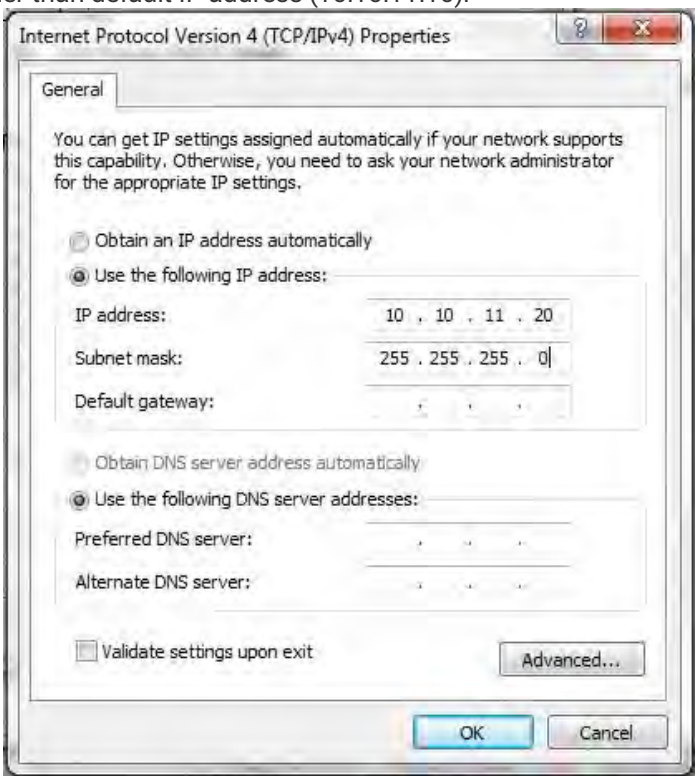


Figure 3.3 *TCP/IPv4 Properties*

After applying these settings you are ready to connect to Web GUI.

Accessing PhoeniX G2 IDU Web GUI

1. Connect your PC to MNG LAN 3 port on PhoeniX G2 IDU with Ethernet patch cable.
2. Launch your Web browser and in address field enter PhoeniX G2 IDU IP address. Default IP address is 10.10.10.10.

Another management access options are following:

- LAN 3 port - IP Address 10.10.10.10, Netmask 255.255.255.0 - factory default
- LAN 3 port - IP Address 192.168.10.10, Netmask 255.255.255.0 - configurable alternative
- MNG USB port - IP Address 10.10.11.10, Netmask 255.255.255.0 - factory default
- MNG USB port - IP Address 192.168.11.10, Netmask 255.255.255.0 - configurable alternative

Depending on your WEB Browser you may be warned that the device has a self-signed certificate and thus it is not secure to connect to it. To avoid this message you have to either setup device certificates or allow an exception for the target IP. This exception needs to be set up once per each IP address and WEB browser.

3. Press "Enter" key.
4. Login screen will appear.
5. Enter username and password. Default credentials are as follows:
   - Username: **admin**
   - Password: **secret**

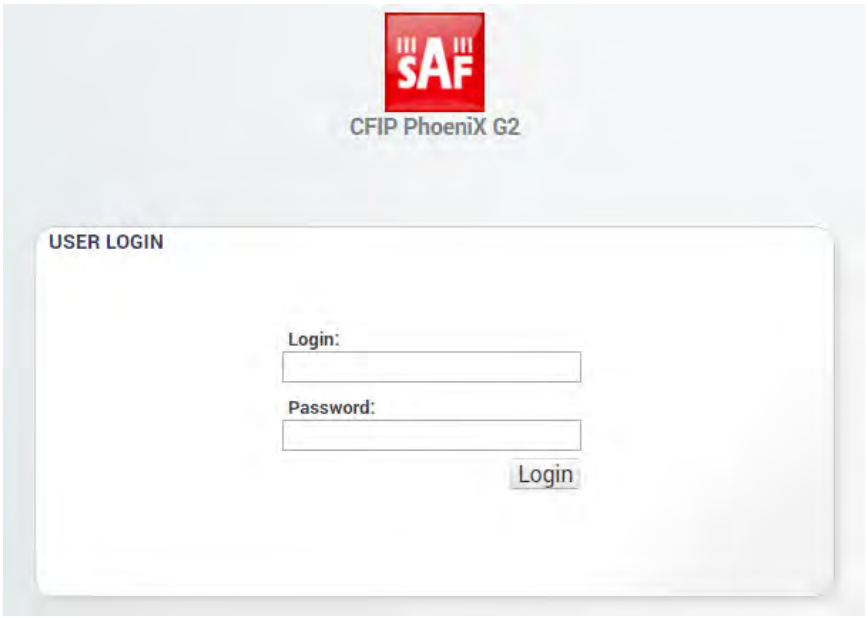


Figure 3.4 *Login screen*

6. Press Login button.

The WEB GUI interface requires enabled JavaScript in your browser.

There are three access levels available. Default access details for each level are following:

ACCESS level	LOGIN name	Password
Administrator	admin	secret
User	user	test
Guest	guest	*no password*

Web GUI description

The WEB GUI is designed as a standalone web application which receives status updates from the device. This communication is done asynchronously; thus it may take a while until the change is reflected in the GUI. WEB interface consists of five parts, those parts are following:

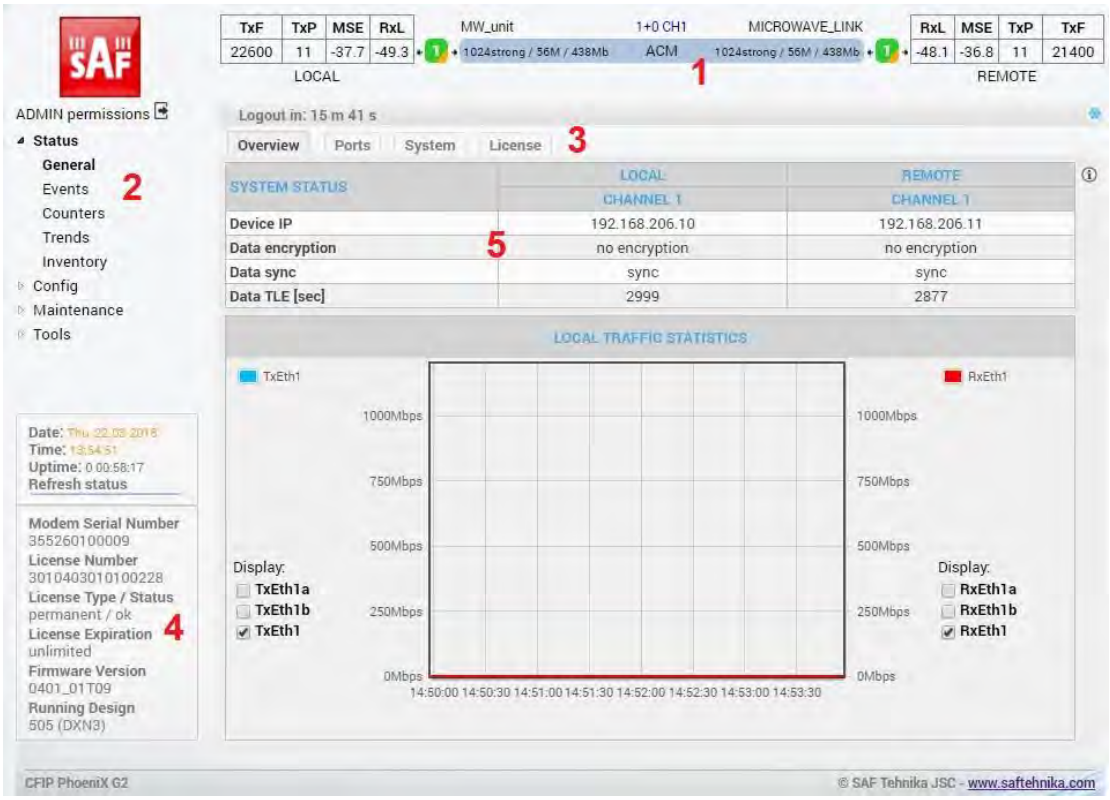


Figure 3.5 *PhoeniX G2 web GUI*

Web GUI is divided into 5 sections:

1 Header and status bar

The header displays the actual link condition. The RF path diagram varies depending on the used Design and Mode setting. In the Split 511 design, the actual Local Primary unit is displayed in the first header row, the Local Secondary on the second row. Bold font highlights the actually managed unit. The physically linked RF units are always in the same row. The displayed speed is average maximal throughput per last second. Meaning of the used graphics is described in the following picture:

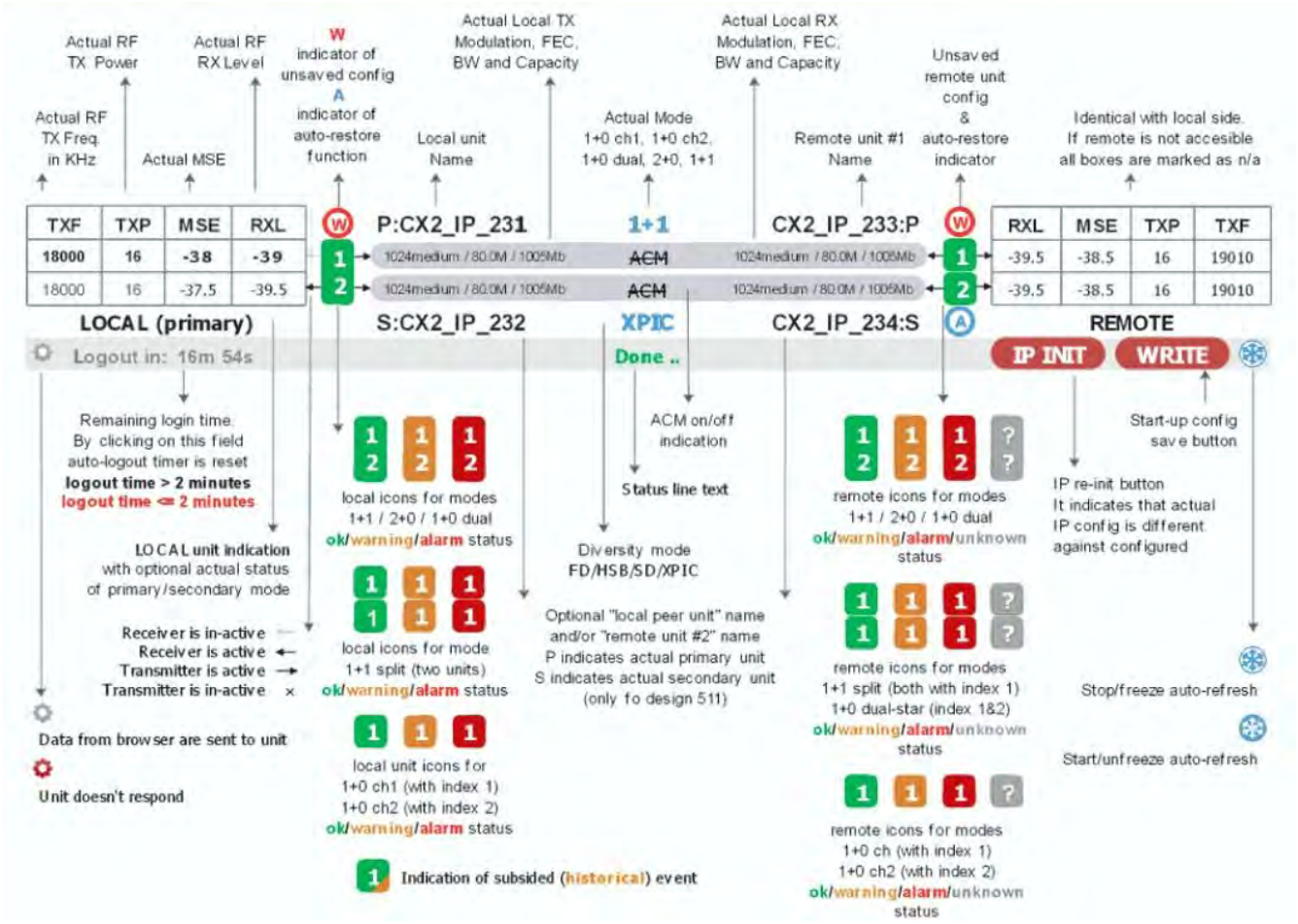


Figure 3.6 *PhoeniX G2 web GUI header and status bar*

2 Two level menu and Login/Logout box

Allows navigating between main pages and sub-pages. The user can expand the menu tree structure either by using the arrows on the left or using double-click on the desired section. The menu tree structure is sorted in the following manner to allow successive configuration and monitoring: :

- **Status** - informational section designed for link performance monitoring
- **Config** - configuration section. The user can perform 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 section. It is highly recommended to save and reboot the device once the first complete configuration is done.
- **Maintenance** - a device management section which houses tools for device configuration backups, FW/License 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.

3 Third level menu

Allows navigating between 3rd level pages of each subpage

4 Side bar frames

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

- **Date** – system date

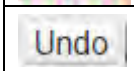
- **Time** – system time
- **Uptime** – time since startup
- **Refresh status** – indicates the amount of time until the next GUI refresh. The bar changes its colour to red if the GUI auto-refresh is frozen through the  button. The refresh interval of information shown in the GUI is automatically calculated 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.
- **Modem Serial Number** – device Serial Number. It is shown only when it 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.

5 Information field

Shows monitoring and configuration pages chosen in menu.

Button conversion and configuration box description

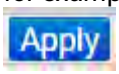
There are multiple buttons available across the GUI interface. Buttons have distinctive colors depending on the effect on the system: pressing the red button may cause immediate data drop or direct overwriting of start-up parameters in flash memory; pressing the grey button has not effect; pressing the 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 the device reboot; and the white button has only data refreshing option, but such action does not alter the running or stored configuration. Most common button types used in the WEB GUI are following:

Button	Function
	Opens Help/information page
	Shown in the status bar when there are unsaved changes on a connected device in the link. Using this button, you update the startup configuration by actually running configuration on all linked units.
	Shown when a value is modified directly in flash memory but command activation requires either parameter initialization or system reboot, for example, IP settings.
	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 the user data outage, but it disconnects all active management sessions (GUI, CLI, SNMP).
	Apply all the changes at current GUI page or in a respective frame.
	Revert all unconfirmed changes in a respective frame.
	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 colour of configuration value entered in a setting box indicates the status of the following value:

- **black** – unmodified value
- **blue** – modified but non-applied value
- **red** – entered value does not match the allowed range
- **purple** – the actual configuration does not match the required modem settings.

Setting input boxes may change its border colour 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 

button is hidden until the problem is fixed.

Configuration of basic system parameters

In order to establish the link, following main configuration steps should be performed:

1) **Step 1** – in web GUI navigate to "Config → System → Mode" and specify ***Design Type***, ***Duplex mode*** and ***Functional Mode***. With those settings user defines the basic configuration of the equipment:
   a) 1+0 single channel configuration,
   b) 1+0 dual channel configuration,
   c) 1+1 (HSB, FD, SD, XPIC) standard redundancy configuration,
   d) 1+1 (HSB, FD, SD) full redundancy configuration,
   e) 2+0 FD aggregation configuration,
   f) 2+0 XPIC aggregation configuration
   g) Bidirectional transmission
   h) Unidirectional transmission

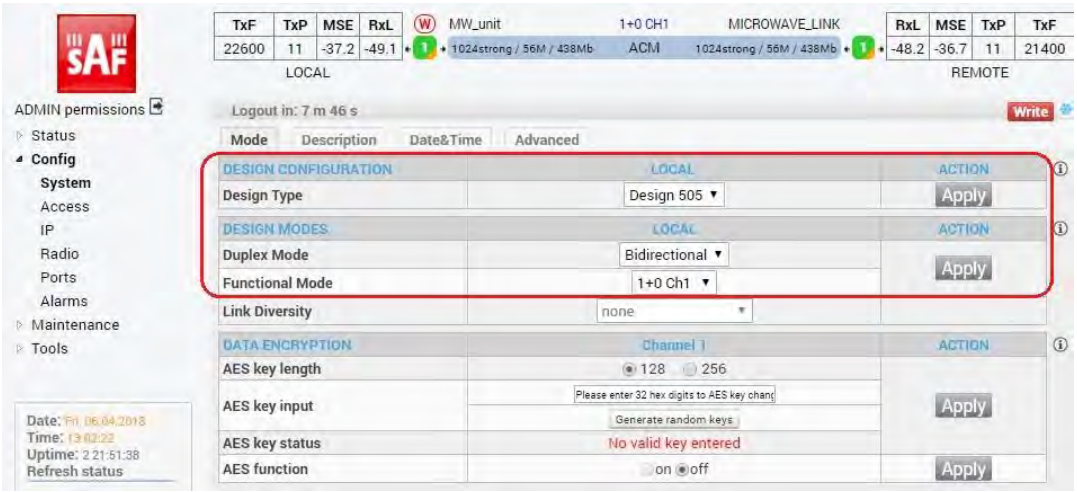


Figure 3.7 *Design and modes configuration*

2) **Step 2** – in web GUI "Config → IP → Addresses" configure ***IP address/subnet mask*** and ***Gateway IP*** address of the IDU.

Figure 3.8 *IP address configuration*

3) **Step 3** – in web GUI "Config → Radio → Parameters" set ***Bandwidth*** and Max ***RxACM Profile*** settings for modem, and ***Tx Frequency***, ***Tx Power Limit*** and ***Tx Mute Config*** settings for radio

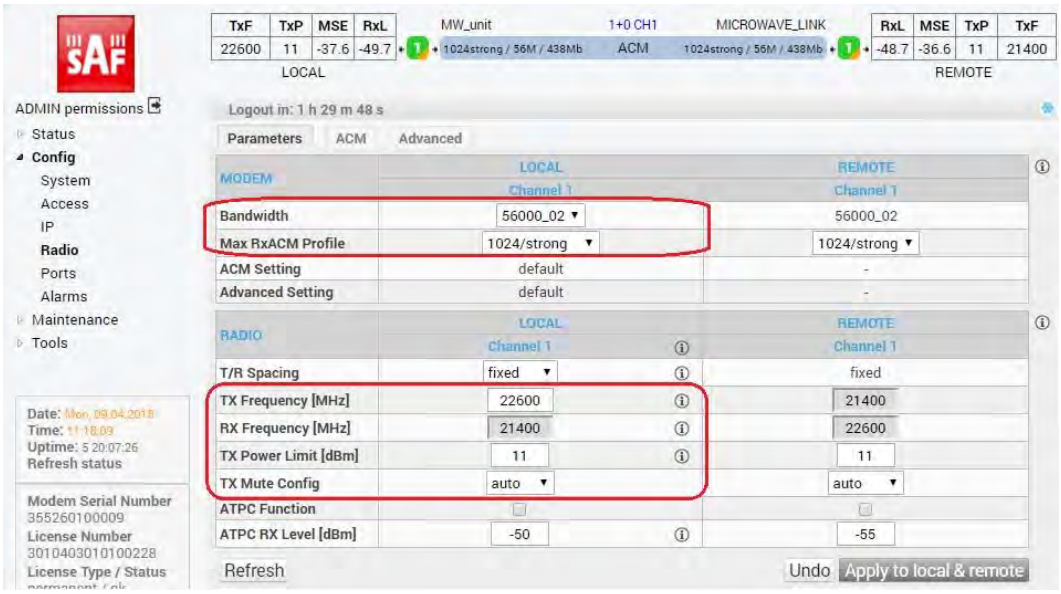


Figure 3.9 *Modem and Radio parameters configuration*

4) **Step 4** – in web GUI "Config → Ports → EthVLAN" specify **port grouping** to enable required type of management access and port groups.

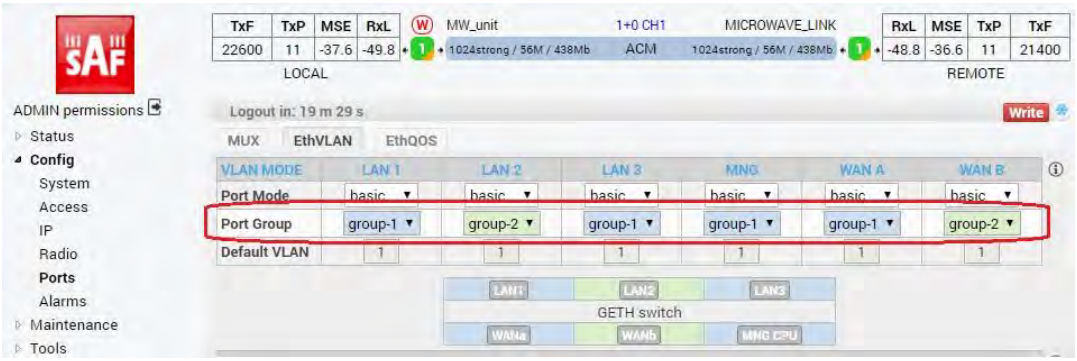


Figure 3.10 *Port group configuration*

5) **Step 5** – save configuration by pressing 

button.

Management channel configuration options

There are several options for accessing the remote side management from or via local device:

- In-Band management
  - User data and management data share the common link capacity and are separated by a VLAN
- Out-of-Band management
  - Using internal management channel (NAT) through separate management channel
  - Management alone in a separate traffic channel

In-Band Management

In-Band management configuration with management traffic separation by means of VLAN is a preferred scheme when just one ETH connection (management & data traffic) into microwave link is accomplished. Communication with the remote side is ensured by sharing the capacity for data and management traffics through internal ETH switch. The management data together with the user data are brought via the common Gigabit cable from the external Ethernet switch to the device, and the same VLAN is then used in the whole management network for management traffic separation. For Port group and VLAN configuration refer to Config → Ports → MUX and Config → Ports → EthVLAN

The advantages of such option are following:

- Fast management access to local and remote device
- Just one Ethernet cable is required for data and management traffic connection

The disadvantages of such option are following:

- Management traffic shares capacity with the data traffic
- It is required to know what is the type of customer traffic, especially VLAN configuration at provider and customer side

Out-Band Management

1) **Using Internal Management Channel (NAT)**:
   Out-Band management configuration with NAT is a preferred scheme when just one link is supervised and management access is originated from provider side of the link. Management and data traffic must be separated at provider side in this mode. Communication with the remote side is ensured through fixed internal management channel. Management traffic is routed through management CPU inside the device. The device has an option to auto-configure the NAT setting under section Config → IP → Advanced.
   For the NAT auto-configuration it is possible to enable one or both of these options:
   a) **WEB** – this option will add automatic NAT records for accessing the remote device's WEB GUI. The default values are as follows (the IP portion is only an example and depends on actual running IP configuration):

1443 192.168.3.91:443	Remote IDU's GUI accessible on local port 1443
2443 192.168.3.92:443	Second remote (in 505 1+0 dual mode with two separate remotes) or direct FO neighbor (in Split Protection mode) IDU's GUI accessible on local port 2443
3443 192.168.3.93:443	Indirect remote FO neighbor (ergo 'cross-corner' in split protection mode) IDU's GUI accessible on local port 3443

b) **SSH** – this option will add automatic NAT record for accessing the remote IDU's SSH. The default values are as follows (the IP portion is only an example and depends on actual running IP configuration):

1022 192.168.3.91:22	Remote IDU's GUI accessible on local port 1022
2022 192.168.3.92:22	Second remote (in 505 1+0 dual mode with two separate remotes) or direct FO neighbor (in Split Protection mode) IDU's GUI accessible on local port 2022
3022 192.168.3.93:22	Indirect Remote FO neighbor (ergo 'cross-corner' in split protection mode) device's GUI accessible on local port 3022

Example:

The local device has IP address of 192.168.3.90 and remote 192.168.3.91, the NAT records of local device for accessing the remote will be these:

- 1443 192.168.3.91:443
- 1022 192.168.3.91:22

To access the remote device's GUI, it is required to open a new page in WEB browser and navigate to address 192.168.3.90:1443. Note this is the address of the local device plus port which is then redirected according to the appropriate NAT record to the remote side. The SSH access is realized in the same manner.

The advantage of such option is following:

- Separate management channel for local and remote device access. The whole system capacity is available for data traffic

The disadvantage of such option is following:

- The management traffic uses dedicated slower channel; therefore, management responses are little longer in comparison to the In-Band management scheme

2) **Management in a Separate Channel:**
Out-Band management configuration in a separate channel is a preferred scheme when more links in series are managed, and the management access is originated from any device in such link or from provider's management node. The communication with the remote side is ensured by means of a configurable separated traffic channel. Management and data traffic are separated at provider side, and they are then kept separated by a reserved standalone channel through radio links. Management access is available also from opposite side (customer side) by a similar configuration of the channel separation.
This configuration can be achieved on the section Config → Ports → EthVLAN where user have to put the MNG, the dedicated management LAN3 port and one WAN channel into the same group. Simultaneously user needs to put the remaining WAN port, and user data LAN port into a different group than the management ports are in. Finally, on the section Config → Ports → MUX, user has to configure the speed limit for both management and data. It is recommended to assign 2Mbits for the management channel. The management channel should have the highest priority. Note that the port priority is falling from left to right.

The advantages of such option are following:

- Easy configuration
- Allows ICMP packet transfer (ping)

The disadvantages of such option are following:

- One whole traffic channel has to be dedicated to such management
- The management and data have to be separated in the switch before the device
- A network loop risk when link operates within a single network

Status

Status → General → Overview

It indicates overall system status.

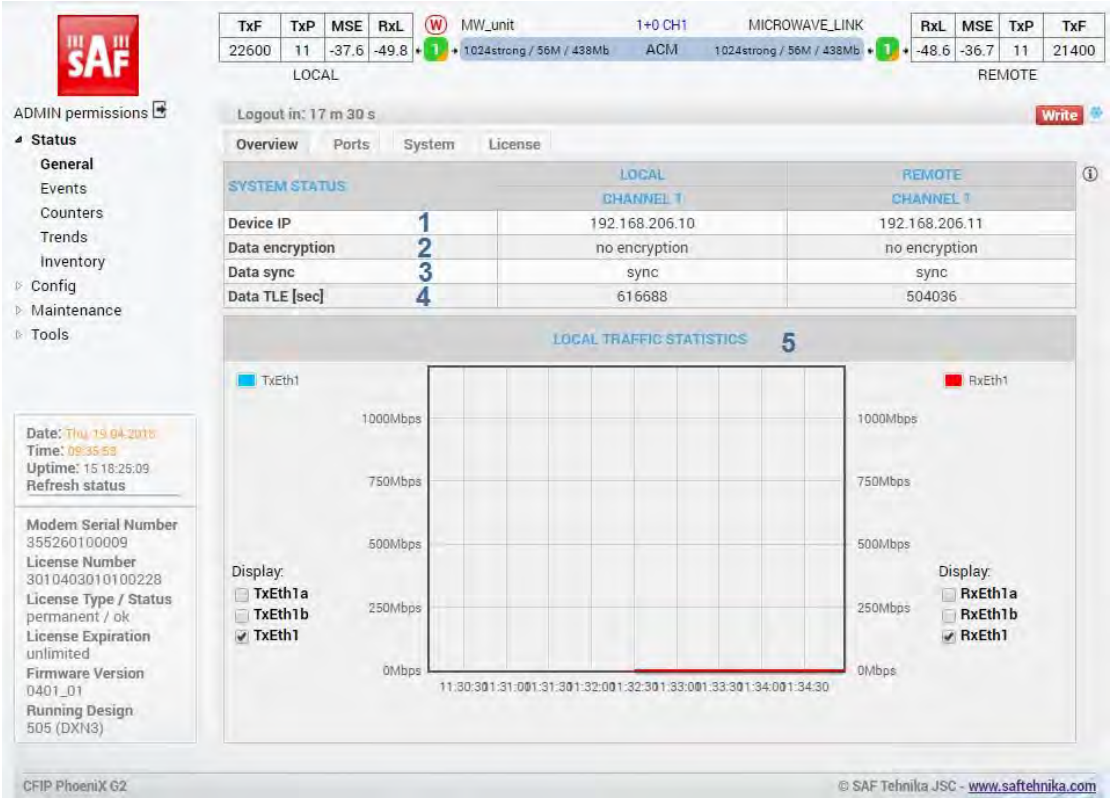


Figure 3.11 *Status → General → Overview screen*

1) ***Device IP*** – IP addresses of devices in the link;
2) ***Data encryption*** – encryption status;
3) ***Data sync*** – modem synchronization status;
4) ***Data TLE [sec]*** – time since last error occurrence;
5) ***Local Traffic Statistics*** – an interactive graph depicting the link throughput since login.

Status → General → Ports

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

Figure 3.12a *Status → General → Ports screen*

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

It is possible to change those settings in Config → Ports page.

If any of EMM modules are connected to the IDU and enabled, additional EMM information will appear in this section:

Figure 3.12b *Status → General → Ports screen*

5) ***EMM module status*** – shows summary status of all attached EMM cards;
6) ***EMM RX port status*** – shows detailed status of all ports of each attached EMM. For detailed description of all possible values, please refer to page Config → Ports → EMM

Status → General → System

This section displays modem unit status, RF/IF unit status, telemetry status and running IP configuration.

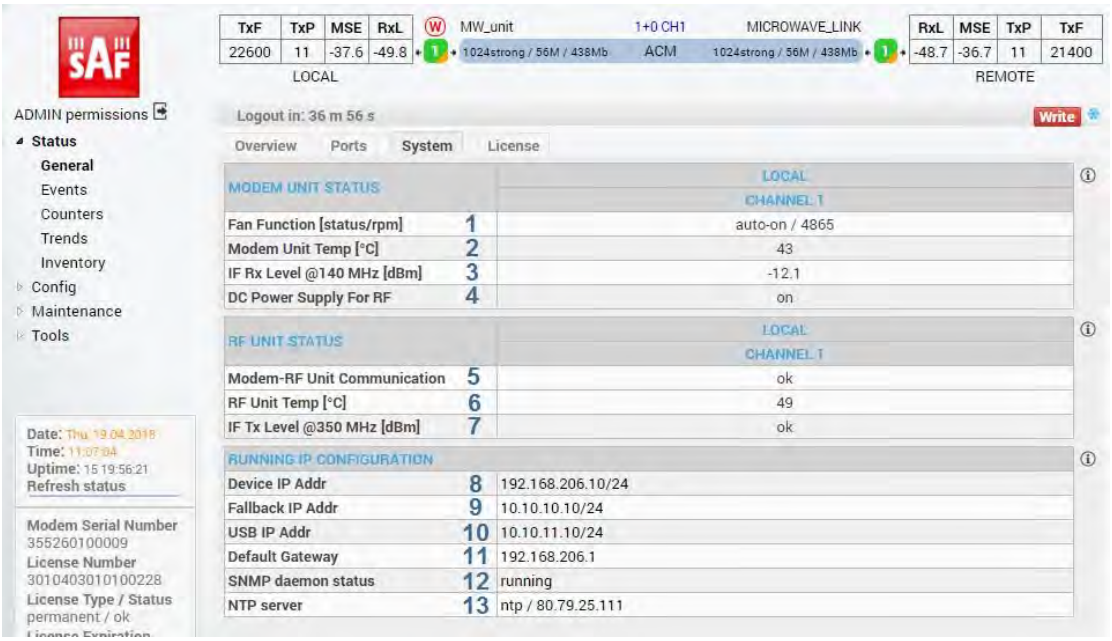


Figure 3.13 *Status → General → System screen*

1) ***Fan Function*** – shows the actual fan configuration status and actual spinning speed;
2) ***Modem Unit Temp*** – temperature of the modem part;
3) ***IF Rx Level @140 Mhz*** – the IF signal strength detected on thecable input of the modem part;
4) ***DC Power Supply For RF*** – the actual status of power supply for the radio part;
5) ***Modem-RF Unit Communication*** – status of telemetry communication between the device and radio part;
6) ***RF Unit Temp –*** temperature read from the radio part;
7) ***IF Tx Level @350 MHz*** – the IF signal strength detected on the cable input of the radio part;
8) ***Device IP Addr*** – the IP address of this IDU;
9) ***Fallback IP Addr*** – the fallback IP address of this IDU;
10) ***USB IP Addr*** – the fallback USB IP address of this IDU;
11) ***Default Gateway*** – the default gateway IP address of this IDU;
12) ***SNMP daemon status*** – the status of the inbuilt SNMP daemon;
13) ***NTP server*** – the time synchronization server configuration.

Status → General → License

This section 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 pressing the Generate license request button, a License Request (licreq_SN_timestamp.afw) file will be generated and downloaded. It will be required for extending of time-limited License. It can be downloaded from Maintenance → Files → Exports page.

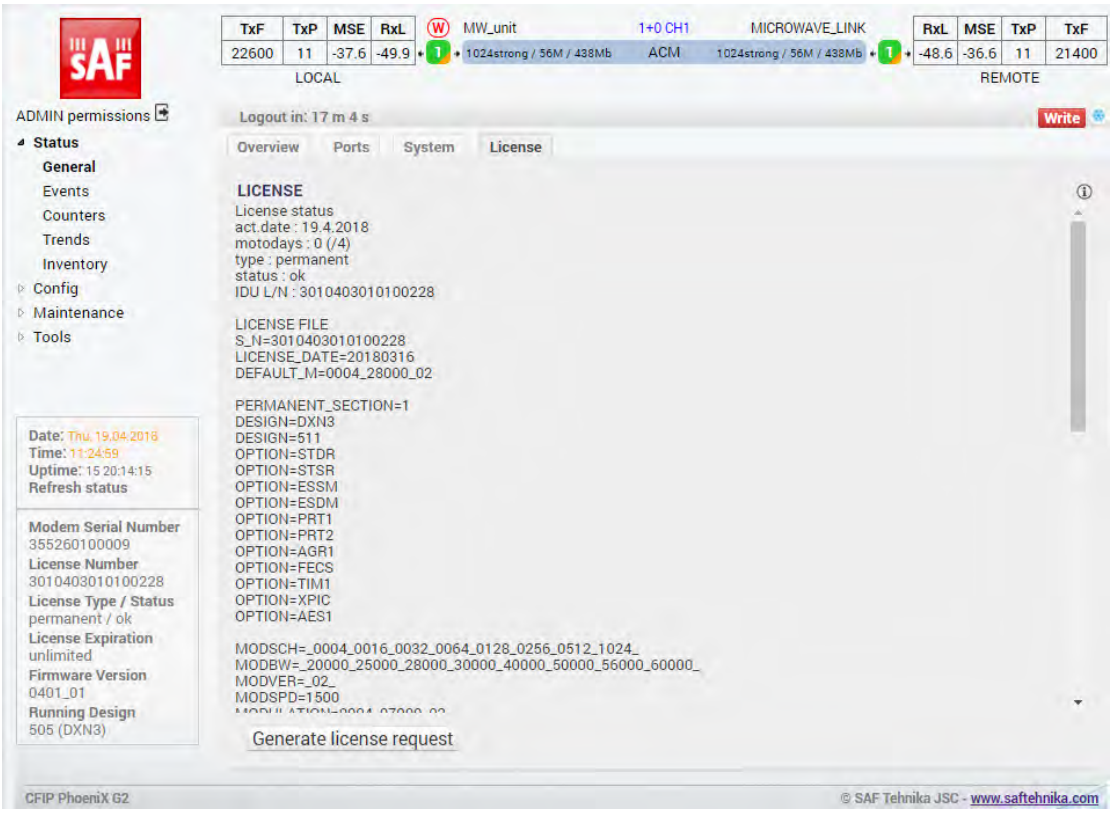


Figure 3.14 *Status → General → License screen*

Status → Events → Actual

This section contains the list of alarms which are active at the current moment. It should be empty when the equipment works properly and without alarms.

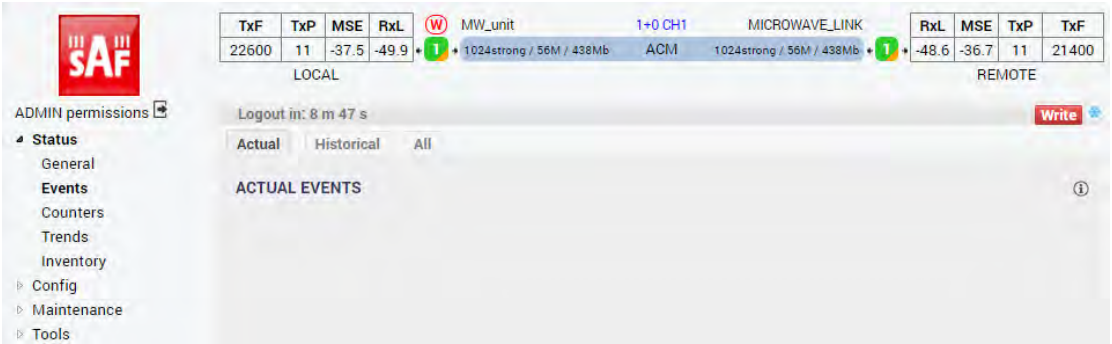


Figure 3.15 *"Status → Events → Actual" page*

Status → Events → Historical

This section contains the list of alarms which occurred in the past, but which are no longer active. By pressing Alarm History Validation button the alarms are manually acknowledged and the status of the device will be evaluated only from alarms which occurred after the manual validation.

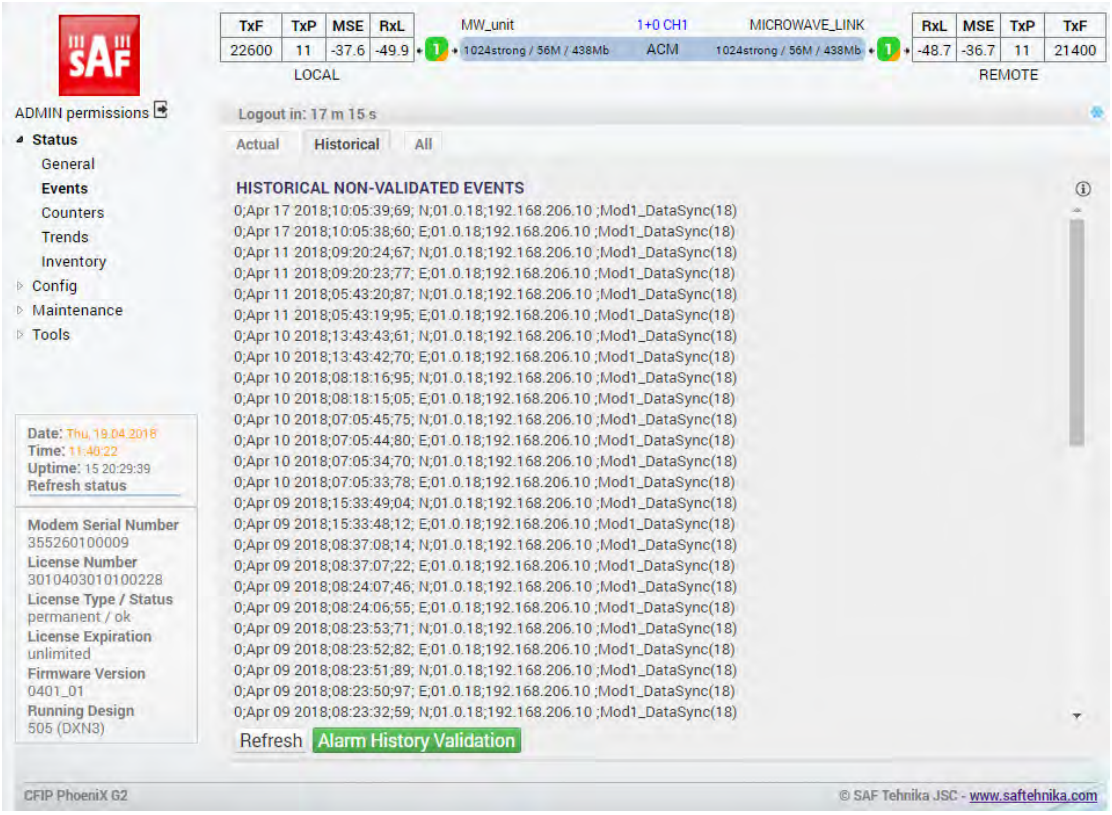


***Figure 3.16** "Status → Events → Historical" page*

Status → Events → All

This section contains the conjunction of both Actual and Historical alarms.

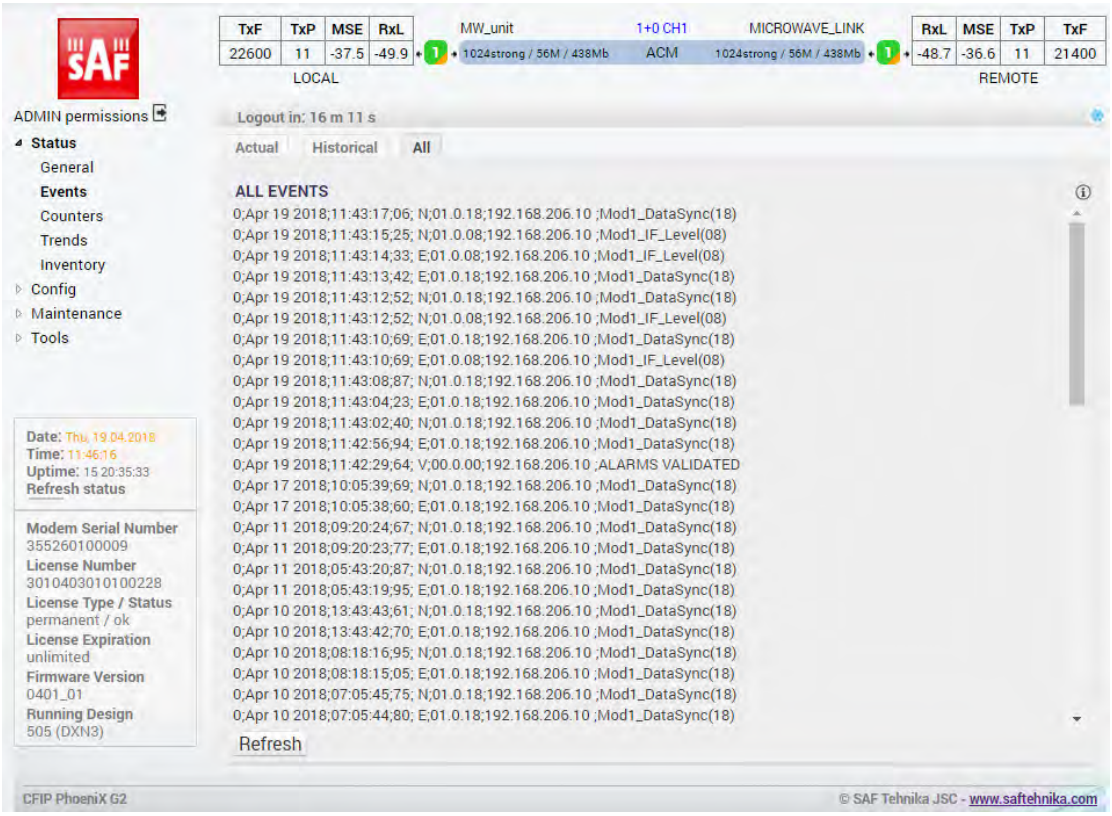


***Figure 3.17** "Status → Events → All" page*

Status → Counters → Modem

This section displays basic modem performance counters and built-in Bit Error Rate (BER) counters. For BER counter only unassigned capacity will be used (Refer to Config → Ports → MUX section)

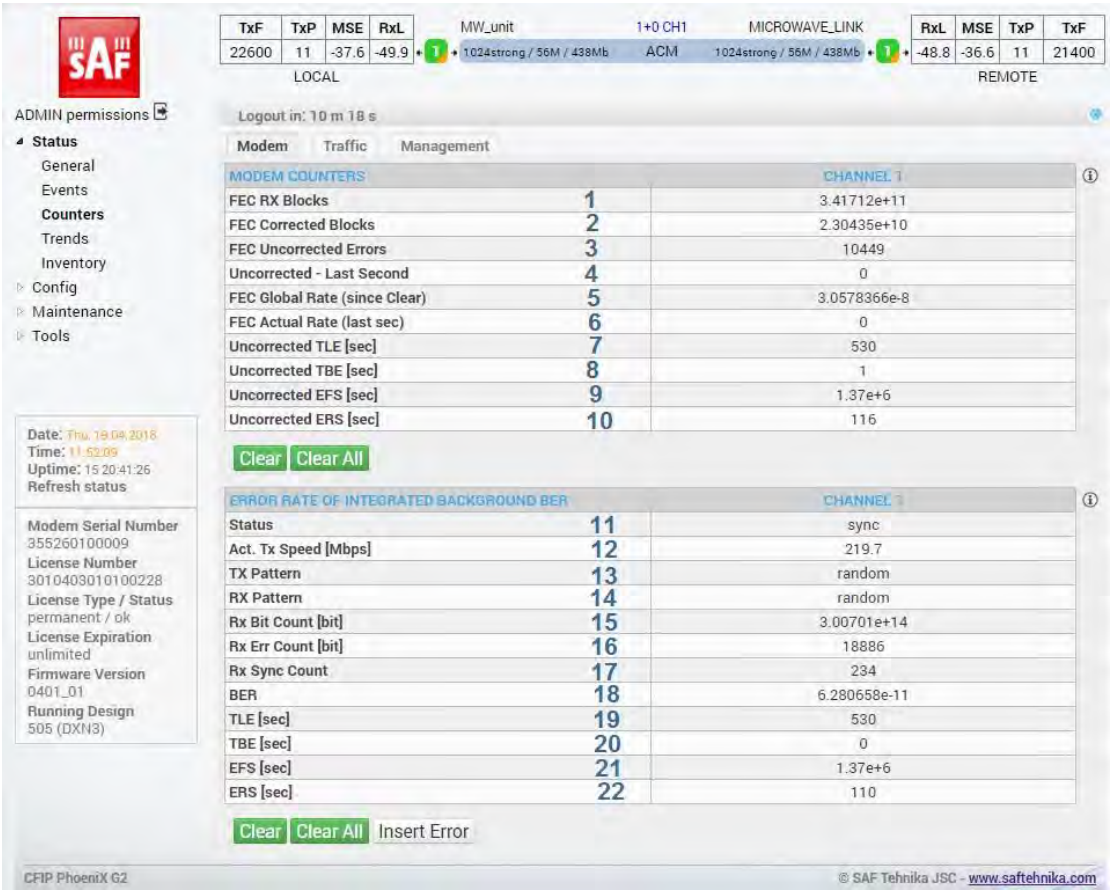


***Figure 3.18** "Status → Counters → Modem" page*

1) ***FEC RX Blocks*** – the overall number of received airframes
2) ***FEC Corrected Blocks*** – the number of air-frames which were repaired by FEC (Forward Error Correction). This number represents a fragment of the FEC RX Blocks
3) ***FEC Uncorrected Errors*** – the number of air-frames which could not be repaired by FEC. This number represents a fragment of the FEC RX Blocks
4) ***Uncorrected – Last Second*** – the number of air-frames which could not be repaired during the last second
5) ***FEC Global Rate*** – the ratio of FEC Uncorrected Errors / FEC RX Blocks
6) ***FEC Actual Rate*** – same as above but for latest second only
7) ***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
8) ***Uncorrected TBE*** – time between last two error events
9) ***Uncorrected EFS*** – error free seconds; it should correspond to time since pressing the Clear button
10) ***Uncorrected ERS*** – error seconds; number of seconds during which errors occurred
11) ***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

12) ***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
13) ***TX Pattern*** – shows transmission pattern for BER tester frames
14) ***RX Pattern*** – shows receiving pattern of BER tester frames
15) ***Rx Bit Count*** – shows number of received bits (BER)
16) ***RX Err Count*** – shows number of received error bits (BER)
17) ***Rx Sync Count*** – number of synchronizations of the BER tester
18) ***BER*** – ratio of Rx Bit Count and Rx Err Count
19) ***TLE*** – time since last BER error; a number of seconds from the last error occurrence. It should correspond to time since pressing the 

button
20) ***TBE*** – time between the last two BER error events
21) ***EFS*** – error free seconds of the BER tester; it should correspond to time since pressing the 

button
22) ***ERS*** – error seconds; number of seconds during which a BER error occurred

By pressing the 

button, the values of counters will be cleared. By pressing the 

button, the values of counters on all Counter pages will be cleared.

By pressing the 

button, one error will be inserted into data streams of both modems.

Status → Counters → Traffic

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

By pressing the 

button, the values of counters will be cleared. By pressing the 

button, the values of counters on all Counter pages will be cleared.

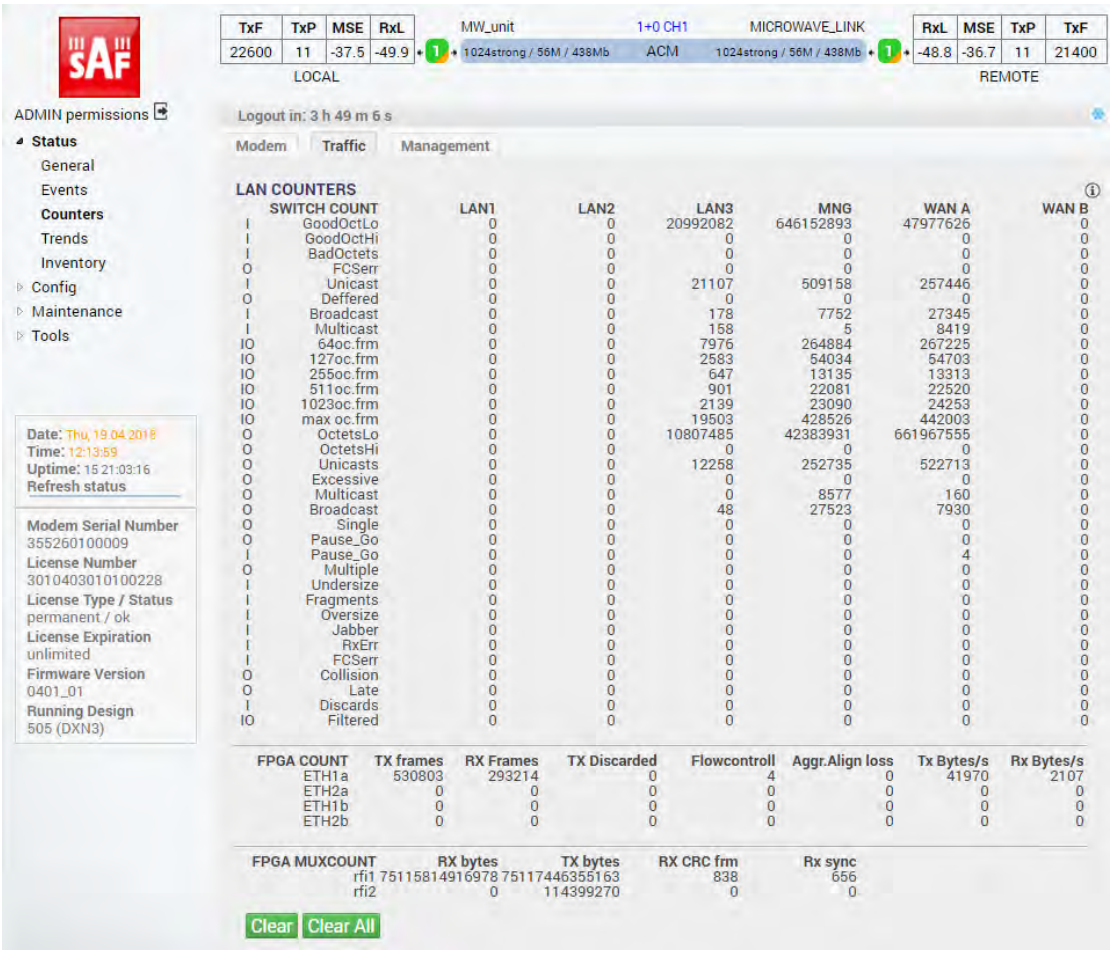


***Figure 3.19** "Status → Counters → Traffic" page*

Status → Counters → Management

This section displays IP statistics of IDU's interfaces.

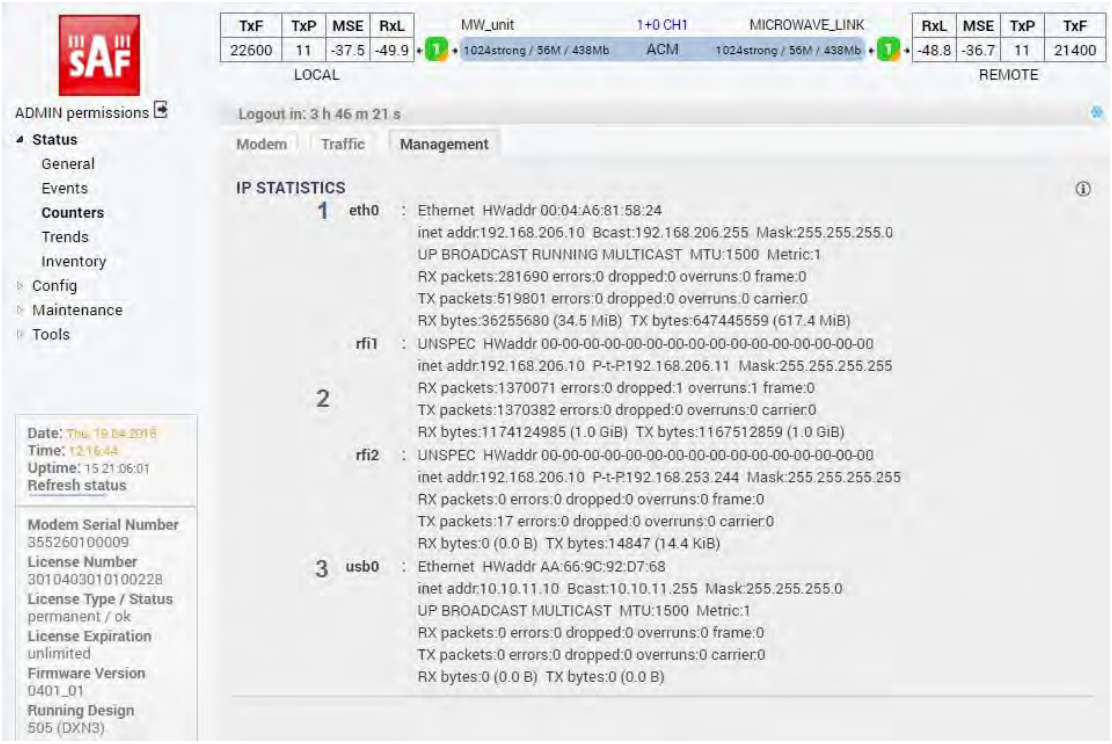


***Figure 3.20** "Status → Counters → Management" page*

1) ***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.
2) ***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
3) ***usb0*** – an onboard service USB port which is dedicated to local service IP access

Status → Trends → Actual

The graph in this section displays the selected values in dependence on time. If the connection with remote side is established, the values from the remote unit also will be displayed. The graph is dynamic and is updated with the latest values at each GUI auto-refresh. It is possible to decrease the pooling period to 1/2 of normal refresh interval by means of the

button. 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 calculated dynamically from server response time. The actual interval is displayed in the browser console.

For depiction it is possible to choose from the following options:

- **TxPower** – depicts the transmitter signal output level
- **RxL/MSE** – received signal level/quality of the received signal
- **Temperature** – displays the temperature of modem and radio

The 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.

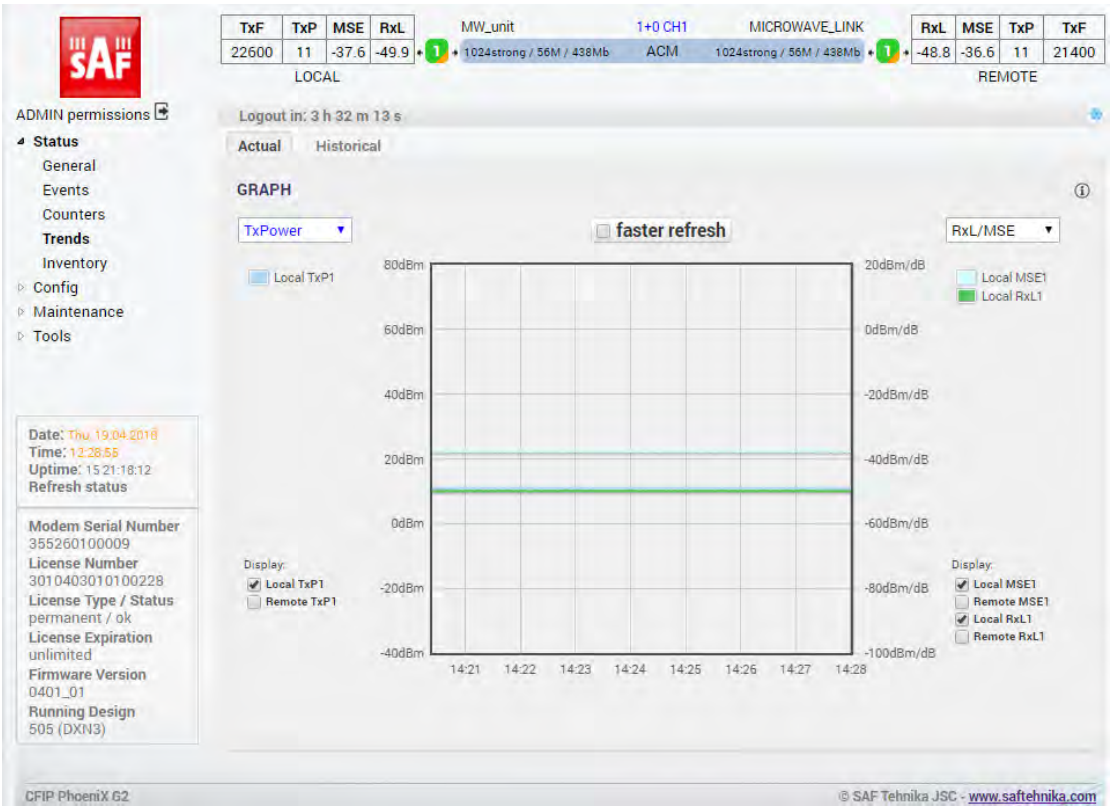


***Figure 3.21** "Status → Trends → Actual" page*

Status → Trends → Historical

The graph in this section displays the selected values in dependence on time. If the connection with remote side is established, the values from the remote unit are will be displayed.

For depiction it is possible to choose from following options:

- ***TxPower*** – depicts the transmitter signal output level
- ***RxL/MSE*** – received signal level/quality of the received signal
- ***Temperature*** – displays the temperature of modem and radio
- ***ETH_Count*** – displays the transmission capacity for the transmission and admission on the selected ports of the IDU
- ***Sync/Modul*** – 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.

It is possible to zoom the graph by means of mouse selection of the interested range; and reset the zoom by pressing the zoom out button.

The 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.

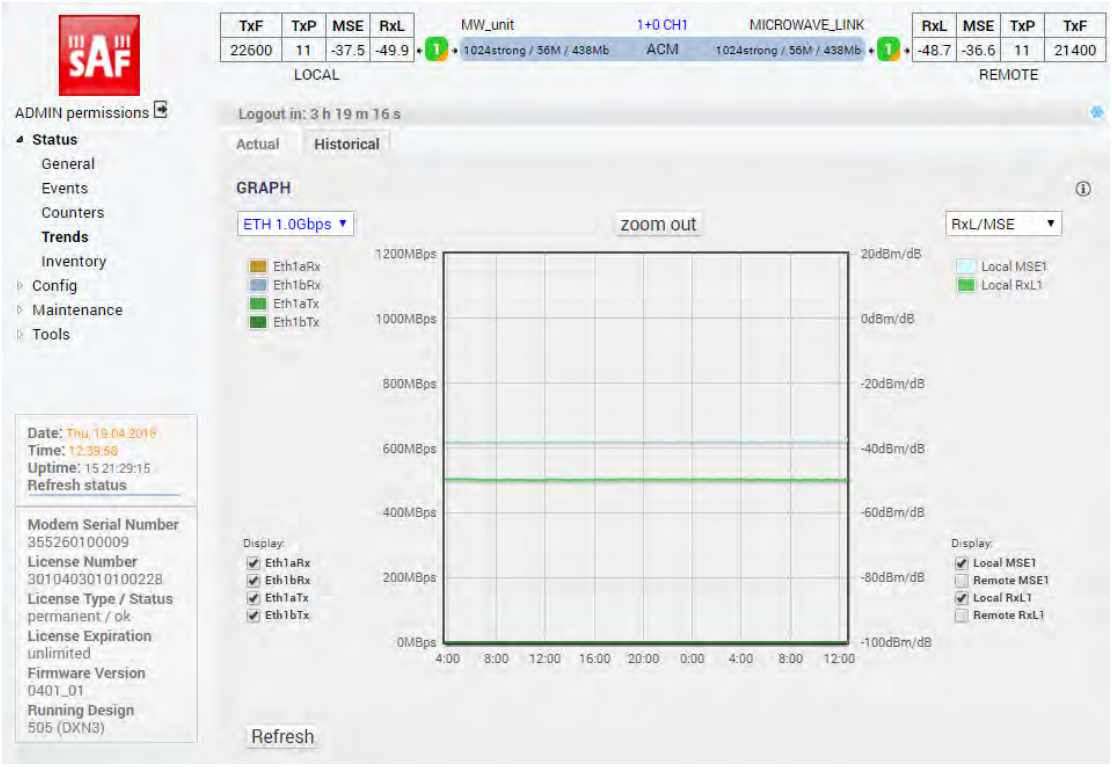


***Figure 3.22** "Status → Trends → Historical" page*

Status → Inventory

This section shows the device hardware/software information as well as radio part information.

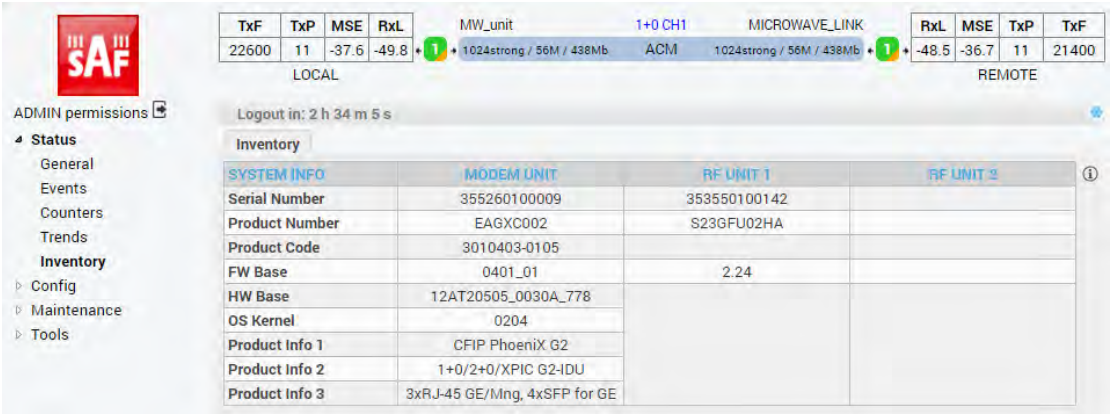


***Figure 3.23a** "Status → Inventory" page*

If any of EMM modules are connected to the IDU and enabled, additional EMM information will appear in this section:

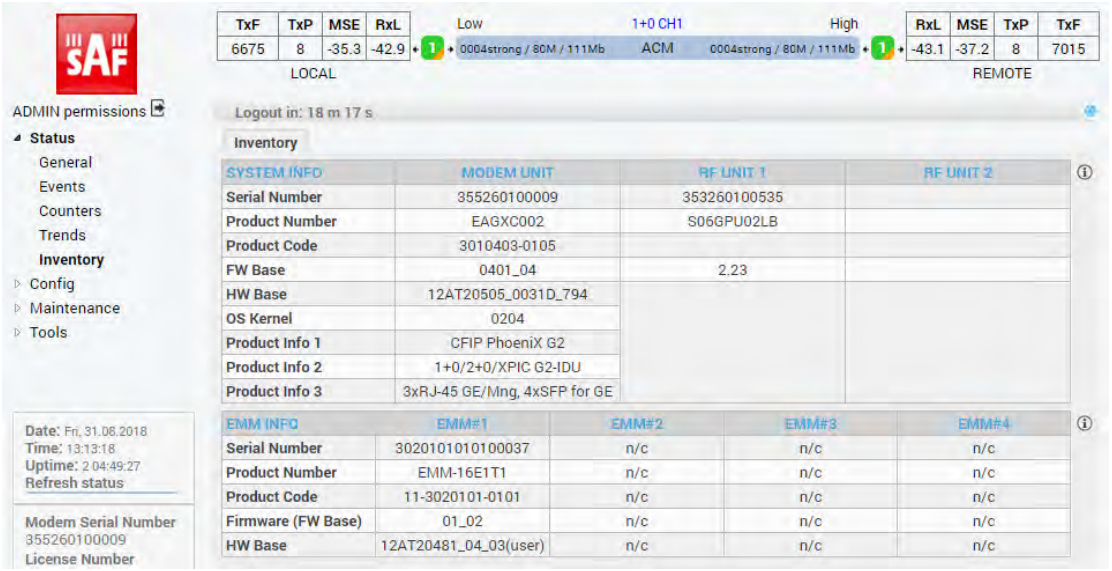


***Figure 3.23b** "Status → Inventory" page*

Config

Config → System → Mode

In this section the user can select specific Design Type which specifies the main function of the system/link.

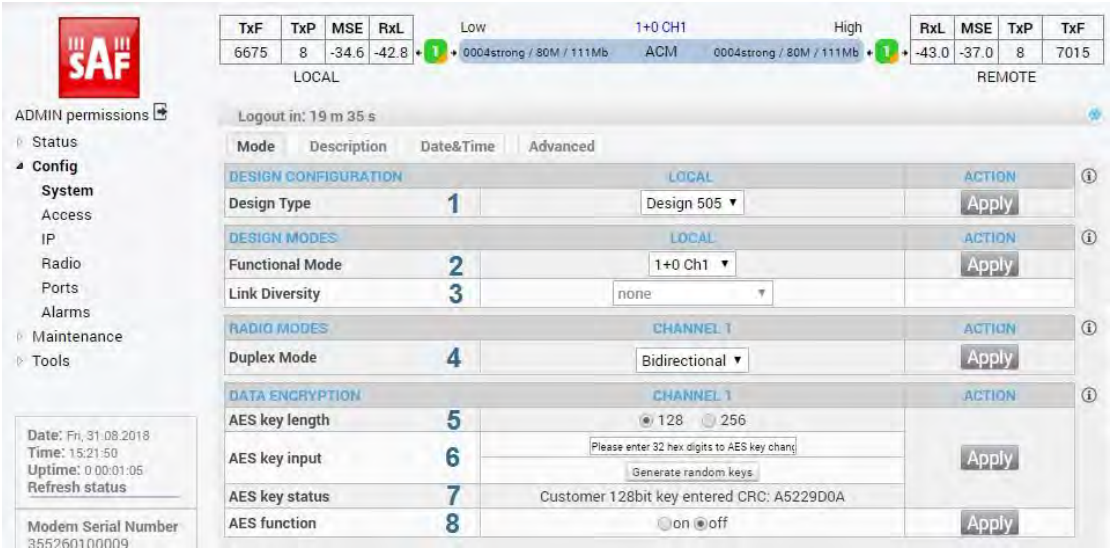


***Figure 3.24** "Config → System → Mode" page, Design 505 configuration*

1) ***Design Type*** – following two design types are supported (depending on the license):
   a) ***Design 505*** – a single IDU on each side of the link. Available modes are 1+0 (ch1, ch2, dual FD and dual XPIC), 1+1 (FD, HSB, SD, XPIC) and 2+0 (FD, XPIC). This design supports AES encryption if licensed.
   b) ***Design 511*** – two or more IDUs on each side of the link. This design type should be selected for application where full protection is required. Two or more interconnected IDUs are used on each side of a link in this configuration. At the moment there is only Split 1+1 (FD, HSB, SD) mode available. Note that the AES encryption is not available in this design.

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

It may happen that The link to the remote side will be lost after design type change. In this case local access to all devices must be ensured before design type change. The remote side IDU/ODU has to be configured separately.

Following configuration fields will appear when Design type ***Design 505*** will be chosen:

2) ***Functional Mode*** – above mentioned Radio modes in ***Design 505*** can be combined with following Functional modes:
   a) ***1+0 Ch1/2*** – simple one channel end station which uses physical channel Nr.1/2
   b) ***1+0 Dual*** – advanced 1+0 mode which separately uses both physical channels. Can be used also as repeater configuration.
   c) ***2+0*** – capacity aggregation mode which combines the capacity of both physical channels.
   d) ***1+1*** – protection mode which combines the capacity of both physical channels.
3) ***Link Diversity*** modes – those modes are available when choosing above mentioned **1+1** or **2+0** Functional modes:
   a) ***FD*** – frequency diversity configuration with frequency separation in both physical channels of the system. Supported by **2+0** and **1+1** functional modes
   b) ***SD*** – space diversity configuration with single Tx channel, two Rx channels and two antennas in both directions. Supported by **1+1** functional mode. This mode does not support Tx switch-over.
   c) ***HSB/SD*** – hot standby/space diversity configuration with single Tx channel at a time and two Rx channels in both directions. Supported by **1+1** functional mode. This mode will switchover the Tx in case of Primary Tx failure

It is recommended not to use ACM when 1+1 SD or 1+1 HSB/SD modes are used with separated antennas in each side of the link. In some circumstances the ACM in combination with 1+1 SD mode might not work properly. For more details please refer to SAF technical support at techsupport@saftehnika.com

   d) ***XPIC*** – cross-polarization diversity with automatic attenuation of interfering signal from the X-polarized channel. Supported by **2+0** and **1+1** functional modes

The following AES settings will be available if they are included in the license. Those settings may be available for one or two channels depending on the configuration of the Functional Mode.

4) ***Duplex Mode*** – this setting determinates duplex/simplex function of the configured link and has an essential influence on whole system function:
   a) ***Rx Only*** – half-duplex/simplex link with only Rx channel. In this case the automatic ACM function should be set to the manual profile by the user.
   b) ***Tx Only*** – half-duplex/simplex link with Tx only channel. In this case the automatic ACM function should be set to the manual profile by the user.

The simplex configuration considerably limits the functionality of the system. The ACM function will not work as well as remote side monitoring from Tx only side, etc.

   c) ***Bidirectional*** – full duplex link with Tx and Rx channels
5) ***AES key length*** – One of two ASI key lengths can be selected for the AES encryption: 32 hex digits key (128 bits) or 64 hex digit key (256 bits). If there is no specific requirement of 128-bit key usage, the 256-bit key is recommended.
6) ***AES key input*** – A 32 hex digit key (128 bits) or 2x 32 hex digit keys (256 bits) must be entered for each channel in order to properly initialize the AES function. The same key have to be entered on local and remote channels. It is possible to use the Generate random keys button to generate a random key(s).