CFIP Lumina Series

Full Outdoor Unit

Technical Description & Configuration Guide

Product code: I0DGETD1

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1 Overview

This document briefly describes the **CFIP Lumina** series **Full Outdoor Unit** (FODU) covering the built-in management system, configuration functionality, hardware features, etc.

1.1 CFIP Full Outdoor Units

CFIP product family is the new next generation product line which is targeting on growing demands for data transmission over microwave radio.

As a result the primary traffic interface for CFIP Lumina radio is Gigabit Ethernet. As CFIP is capable of providing bit rate of **up to 366Mbps**, it is a great addition to SAF portfolio. CFIP Lumina radio and modem performance allows achieving perfect system capacity by employing 256-decision states modulation scheme by user's choice. Apart from the **full system capacity of 366Mbps**, it is possible to configure the radio to any of 14, 20, 28, 30, 40, 50 and 56 MHz channels as well as to any of **4QAM, 16QAM**, **32QAM, 64QAM, 128QAM and 256QAM modulations**, thus providing various capacities to suit particular needs.

SAF Tehnika JSC has employed most modern design solutions and components to create high performance compact radio with **low power consumption** – 25-40W (standard power) and 29-52W (high power) per radio.

CFIP Lumina 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.

1.2 CFIP Feature Summary

1.2.1 Main Features

- Full Outdoor solution
- Capacity: up to **366 Mbps**
- Channel Bandwidth: **14/20/28/30/40/50/56 MHz**
- Modulations: **4QAM, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM**
- Interfaces: **1000Eth (optical)** or **10/100/1000Eth (electrical)**
- Traffic: Ethernet only

- Frequency bands: **6 / 7 / 8 / 10 / 11 / 13 / 15 / 17 / 18 / 23 / 24 / 26 / 38** GHz
- Green Radio – **25-40W** (standard power) and **29-52W** (high power) power consumption per radio
- **ACM** and **ATPC** with **QoS** four priority queues
- **802.1Q VLAN** support

1.2.2 Mechanical Features

- Compact unit, **285x285x80mm (11.2x11.2x3.1in.)**, **3.9kg (8.5lbs),** antenna adaption backwards compatible with all **CFM** and **CFQ** series units
- **3 handles** for user convenience
- Safe and easy to use **4 side locking** arrangement
- All connectors on the side of the unit, always at **45°** regarding vertical axis for both V and H polarization

***Figure 1.1**: CFIP Lumina Full Outdoor Unit*

1.2.3 Interfaces/Management

- CFIP Lumina unit provides **4** or **5 connectors** (depending on model) and a grounding screw
- **User and NMS traffic** is carried over **FO cable** or **Cat.5e cable** (depending on the model)
- Ethernet traffic supports **QoS** and **4 priority queues**, essential for ACM use
- **User** and **NMS traffic** could be treated as a single data stream or separated by tagging with different **VLAN** tags
- **Twin BNC connector** of the unit enables terminal access into the unit
- **BNC connector** provides RSSI voltage signal to assist unit alignment
- Web, Telnet and SNMP are available as **NMS** interfaces into the unit

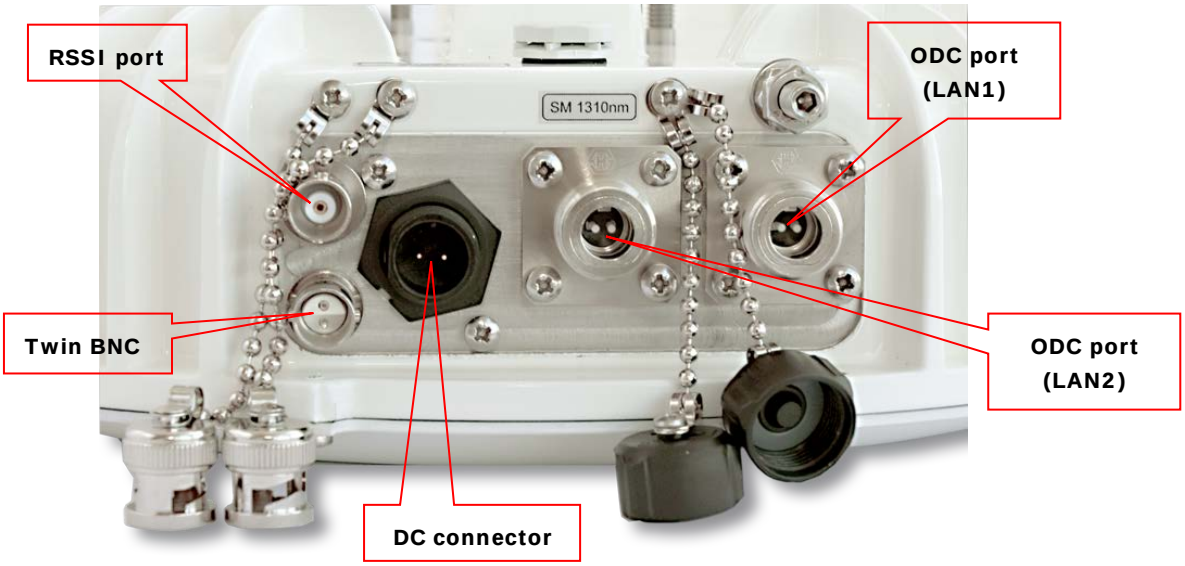


***Figure 1.2**: Optical CFIP Lumina FODU connectors*

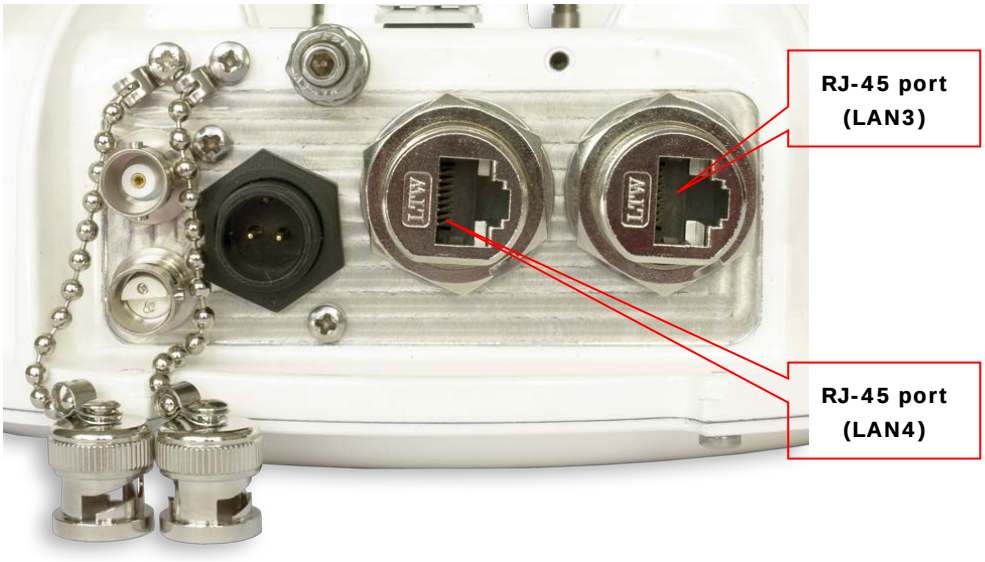


***Figure 1.3**: Electrical CFIP Lumina FODU connectors*

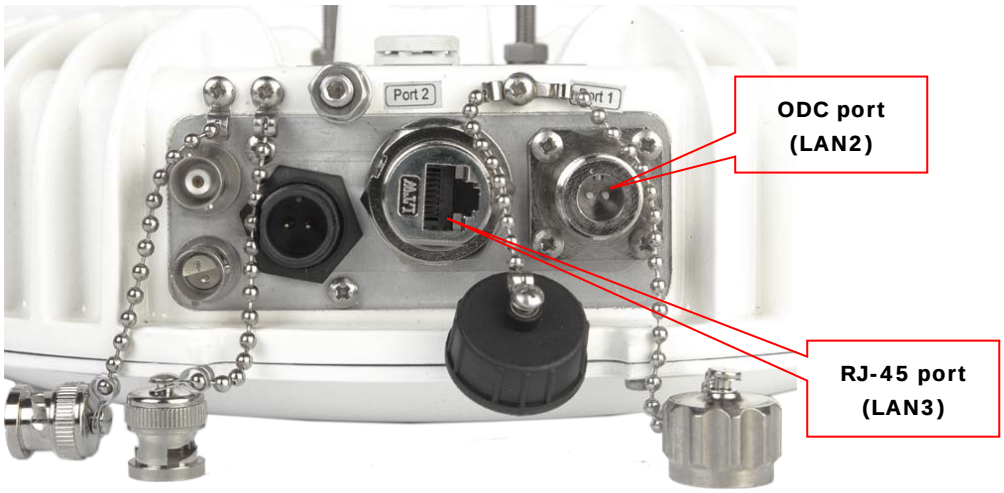


***Figure 1.4**: Hybrid CFIP Lumina FODU connectors*

1.3 Radio Parameters

- CFIP Lumina is a good example of latest achievements in modem and transceiver development, providing both excellent radio parameters (System Gain), due to use of **QAM modulations** and efficient despite it consumes small amount of power Tx/Rx part of the system.
- RSL Threshold at BER 10^{-6}, 56MHz, 256QAM, 366Mbps: **-64 dBm** (CFIP Lumina 6GHz).
- **ACM** (Adaptive Coding and Modulation), hitless ACM opens new possibilities depending on network designers strategy
- **ATPC**, Automatic Transmitter Power Control, for increased deployment density capability.
- **Very high flexibility** allows configuring the system to various channel bandwidths, modulation schemes and capacity settings

1.4 Application Examples

1.4.1 Carrier Gigabit Ethernet Trunk Distribution with CFIP Lumina

- Superb for extending Fiber Optics network over high capacity radio;
- Ideal for crossing mountains and interconnecting Gigabit Ethernet networks;
- Designed for building Ethernet backhaul network

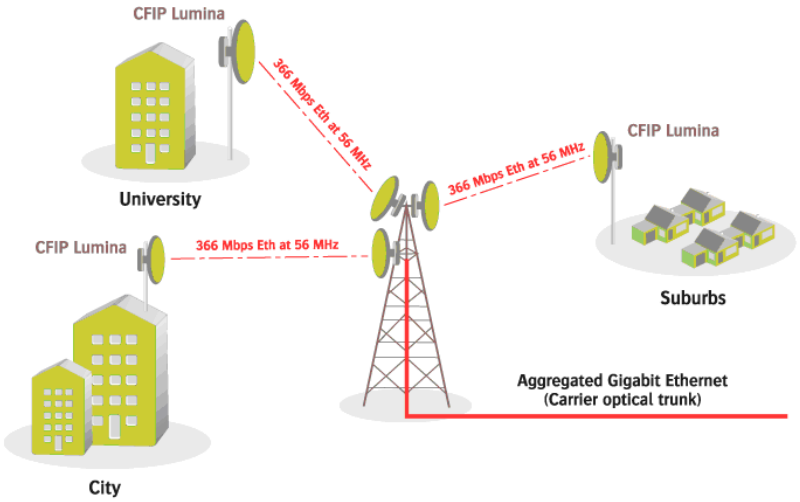


***Figure 1.5** CFIP Lumina application*

1.4.2 2+0 protected link aggregation

A chain of 2+0 radios with full protection by employing single external Ethernet switch per site. For more details refer to ***Chapter 4.5***.

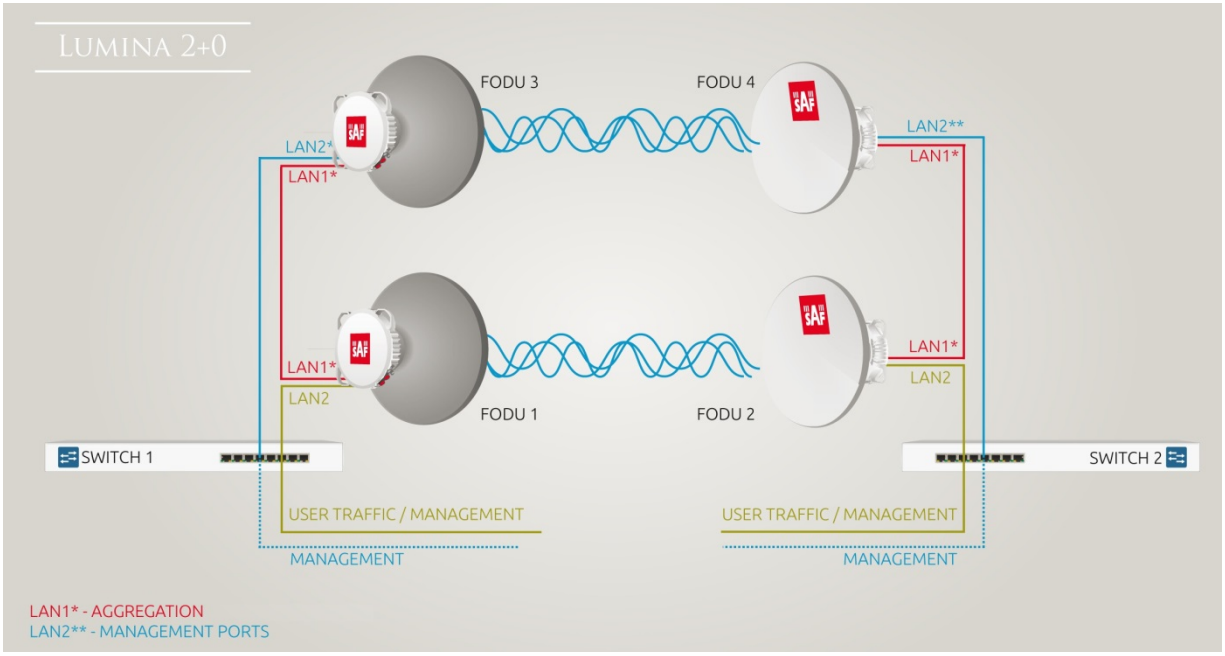


Figure 1.6 *CFIP Lumina 2+0 link aggregation*

1.4.3 CFIP Lumina East/West Chain

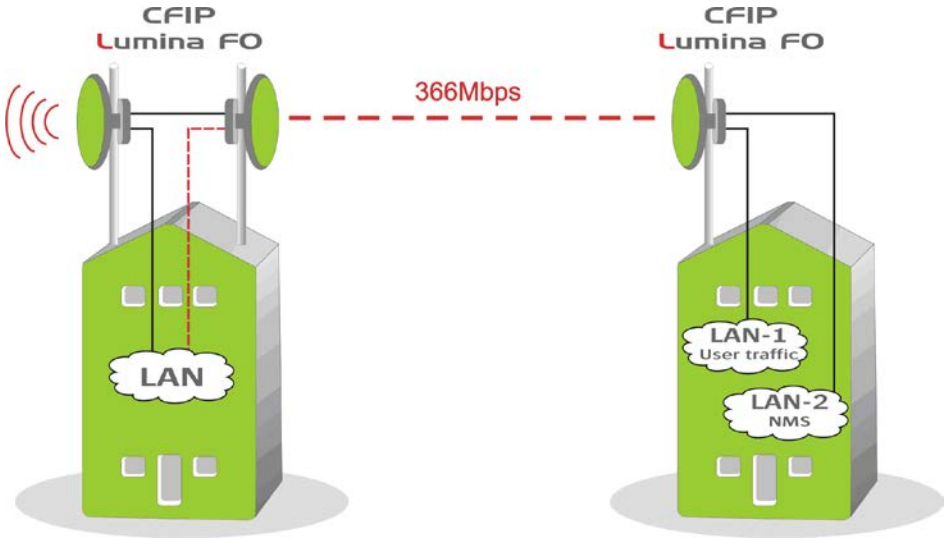


Figure 1.7 *CFIP Lumina East/West chain*

1.4.4 CFIP Lumina ring topology

- Utilization of STP protocol allows CFIP Lumina operation in ring topology

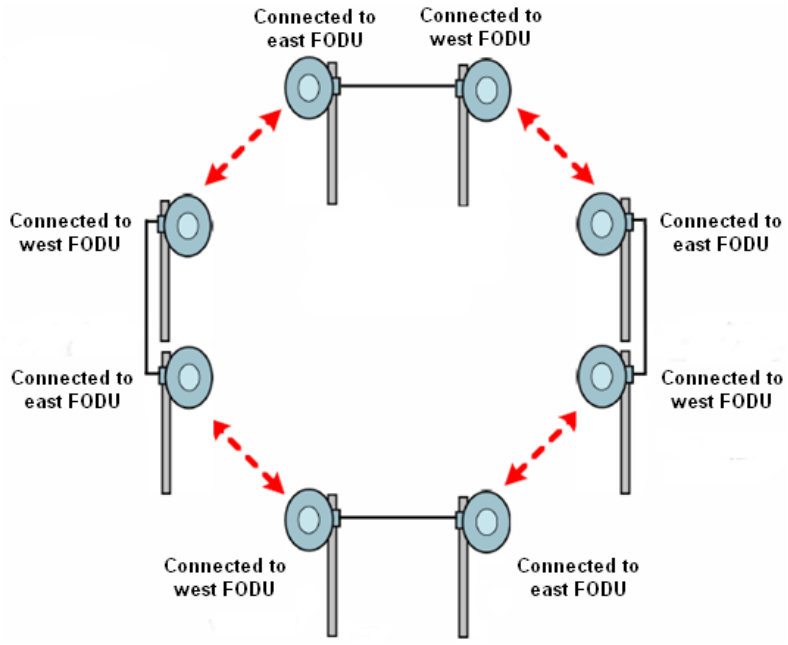


Figure 1.8 *CFIP Lumina operation in ring topology*

1.5 Technical specifications

III CFIP Lumina FODU technical specification									
Frequency range (GHz)	6	7/8	10/11	13/15	17	18/23	24	26	38
Channel Bandwidths (MHz)[1]	14 - 56								
Modulation	4QAM / 16QAM / 32QAM / 64QAM / 128QAM / 256QAM								
Capacity (Mbps)	24 – 366								
III Performance									
Configuration	1+0, Ring/Mesh (with STP), 2+0 (built-in Ethernet aggregation), 1+1 (Hot Stand-By)								
Frequency stability (ppm)	+/-7								
Traffic Interfaces	1 or 2 Gigabit Ethernet (electrical or optical)								
III Ports									
Flange	N-type	UBR 84	UBR 100	UBR 140	Circular 13mm	UBR 220	Circular 10mm	UBR 260	UBR 320
Ethernet	Optical 1 or 2 ODC ports Electrical 1 or 2 RJ-45 Hybrid 1 ODC and 1 RJ-45								
DC power connector	2-pin waterproof circular								
RSL port, RSSI, BNC connector	Output voltage vs. RSL: 0 to 1.4V vs. -90 to -20dBm								
Serial port for configuration	RS-232, Twin BNC connector								
III Management features									
Management port	Ethernet VLAN or Separate Ethernet (RJ-45 or ODC)								
SNMP	Yes, SNMP traps, MIB, SNMP v1/v2c								
EMS	Web based, HTTP								
ATPC feature	Yes								
ACM feature	Hitless 0ms								
Loopbacks	Yes, modem, IF loopback								

III Ethernet	
Switch type	Managed Gigabit Ethernet Layer 2
Max frame size	9728 bytes
MAC table	4K entries; automatic learning and aging
Packet buffer	128KB; non-blocking store&forward
Flow Control	802.3x
VLAN support	802.1Q (up to 4K VLAN entries)
QinQ (Double Tagging)	Yes
QoS	64 level DiffServ (DSCP) or 8 level 802.1p mapped in 4 prioritization queues with VLAN support
QoS queuing	Fixed or weighted (configurable ratio)
Spanning Tree Protocol	802.1D-2004 RSTP, 802.1Q-2005 MSTP
III Mechanical & Electrical	
Stationary use	Ref. ETSI EN 300 019-2-4, class 4.1E; non weather-protected locations
Temperature Range	-33°C to +55°C
Dimensions: HxWxD, mm / weight, kg	288x288x80 / 3.9
Built-in DC port surge protection	Conforms to ETSI EN 301 489-1; EN 61000-4-5; IEC 61000-4-5
Input DC voltage	-40.5V to -57V DC (conforms to ETSI EN 300 132-2)
Max. power consumption	SP: 25-40 W; HP: 29-52 W

III CFIP Lumina Rx sensitivity, payload capacity

BW[1], MHz	Modulation	FEC[2]	6 GHz	7 GHz	8 GHz	10 GHz	11 GHz	13 GHz	15 GHz	17[4] / 18 GHz	23 GHz	24 GHz	26 GHz	38 GHz	Capacities, Mbps
20	4QAM	Strong	-92	-91	-90.5	-90	-91	-91	-90.5	-91.5	-90.5	-90.5	-92.5	-86.5	24
	16QAM	Strong	-84.5	-84.5	-84.5	-84	-85	-85	-84.5	-85.5	-83	-83	-86.5	-79	49
	32QAM	Strong	-82	-82	-81.5	-81.5	-82	-82	-81.5	-82.5	-80.5	-80.5	-83.5	-76.5	63
	64QAM	Strong	-80	-79	-78.5	-78.5	-79	-79	-78.5	-79.5	-78.5	-78.5	-81	-74.5	82
	128QAM	Strong	-77	-76	-75.5	-75	-76	-76	-75.5	-76.5	-75.5	-75.5	-77.5	-71.5	98
	256QAM	Strong	-73.5	-72	-72	-71.5	-72	-73	-72	-73	-72	-72	-74	-68	115
		Weak	-70	-66	-65.5	-66.5	-67	-67	-66.5	-67.5	-68.5	-68.5	-68.5	-64.5	125
30	4QAM	Strong	-90	-89	-89	-88.5	-89.5	-89.5	-89	-89.5	-88.5	-88.5	-91	-84.5	37
	16QAM	Strong	-84	-83	-82.5	-82.5	-83.5	-83	-82.5	-83.5	-82.5	-82.5	-84.5	-78.5	74
	32QAM	Strong	-81	-80	-80	-79.5	-80.5	-80.5	-80	-80.5	-79.5	-79.5	-81.5	-75.5	95
	64QAM	Strong	-78.5	-77	-77	-76.5	-77.5	-77.5	-77	-78	-77	-77	-79	-73	123
	128QAM	Strong	-75.5	-74	-74	-73.5	-74.5	-74.5	-74	-75	-74	-74	-76	-70	147
	256QAM	Strong	-72	-70.5	-70.5	-70.5	-71	-71	-70.5	-71.5	-70.5	-70.5	-72.5	-66.5	172
		Weak	-69	-68.5	-65.5	-65.5	-67	-66.5	-66.5	-69	-67.5	-67.5	-70	-63.5	184
50	4QAM	Strong	-87.5	-86.5	-87	-86.5	-87.5	-87	-87	-87	-86	-86	-88.5	-82	63
	16QAM	Strong	-81.5	-80.5	-80.5	-80	-81	-81	-80.5	-81.5	-80	-80	-82.5	-76	125
	32QAM	Strong	-79	-77.5	-78	-77.5	-78.5	-78	-78	-78.5	-77.5	-77.5	-79.5	-73.5	158
	64QAM	Strong	-76	-75	-74.5	-74.5	-75.5	-75	-75	-76	-74.5	-74.5	-77	-70.5	207
	128QAM	Strong	-73	-72	-71.5	-71.5	-72.5	-72	-71.5	-72.5	-71.5	-71.5	-73.5	-67.5	249
	256QAM	Strong	-69.5	-68	-68	-67.5	-68.5	-68.5	-68	-69.5	-68	-68	-70.5	-64	290
		Weak	-66	-64.5	-63.5	-63.5	-64.5	-64.5	-64	-66	-64.5	-64.5	-67	-60.5	313

III CFIP Lumina Rx sensitivity, payload capacity

BW[1], MHz	Modulation	FEC[2]	6 GHz	7 GHz	8 GHz	10 GHz	11 GHz	13 GHz	15 GHz	17[4] / 18 GHz	23 GHz	24 GHz	26 GHz	38 GHz	Capacities, Mbps
28	4QAM	Strong	-90.5	-89.5	-89	-88.5	-89.5	-89.5	-89	-90	-89	-89	-91.5	-85	35
	16QAM	Strong	-84.5	-83	-83	-82.5	-83.5	-83.5	-83	-84	-83	-83	-85	-79	69
	32QAM	Strong	-81.5	-80	-80	-80	-80.5	-80.5	-80.5	-80.5	-80	-80	-82	-76	88
	64QAM	Strong	-79	-77.5	-77.5	-77	-78	-77.5	-77	-78	-77.5	-77.5	-79.5	-73.5	115
	128QAM	Strong	-75.5	-74.5	-74	-73.5	-74.5	-74.5	-74	-75.5	-74	-74	-76.5	-70	139
	256QAM	Strong	-72.5	-71	-70.5	-70.5	-71	-71	-70.5	-72	-71	-71	-73	-67	162
		Weak	-69	-67	-66	-66	-67	-67	-66.5	-69	-67.5	-67.5	-70	-63.5	175
40	4QAM	Strong	-89	-87.5	-88	-87.5	-88	-88	-88	-88	-87.5	-87.5	-89.5	-83.5	50
	16QAM	Strong	-82.5	-81.5	-81.5	-81	-82	-82	-81.5	-82.5	-81	-81	-83.5	-77	98
	32QAM	Strong	-80	-78.5	-79	-78.5	-79.5	-79.5	-79	-79.5	-78.5	-78.5	-80.5	-74.5	127
	64QAM	Strong	-77	-76	-75.5	-75.5	-76.5	-76	-76	-77	-75.5	-75.5	-78	-71.5	164
	128QAM	Strong	-74	-73	-72.5	-72.5	-73.5	-73	-72.5	-73.5	-72.5	-72.5	-74.5	-68.5	196
	256QAM	Strong	-70.5	-69.5	-69	-68.5	-69.5	-69.5	-69	-70.5	-69	-69	-71	-65	229
		Weak	-68	-67	-64.5	-64.5	-65.5	-65	-65	-67.5	-66.5	-66.5	-68.5	-62.5	245
56	4QAM	Strong	-87	-85.5	-86	-85.5	-87	-86.5	-86	-87	-85.5	-85.5	-88	-81.5	72/67[3]
	16QAM	Strong	-81	-80	-79.5	-79.5	-80.5	-80	-79.5	-80.5	-79.5	-79.5	-82	-75.5	145/135[3]
	32QAM	Strong	-78	-77	-77.5	-77	-78	-77.5	-77	-77.5	-76.5	-76.5	-79	-72.5	186
	64QAM	Strong	-75.5	-74.5	-74	-73.5	-74.5	-74.5	-74	-75.5	-74	-74	-76	-70	241
	128QAM	Strong	-72	-71	-71	-70.5	-71.5	-71.5	-71	-72	-70.5	-70.5	-73	-66.5	289
	256QAM	Strong	-68.5	-67.5	-67	-66.5	-68	-67.5	-67	-68.5	-67	-67	-69.5	-63	337
		Weak	-64	-63	-63	-62.5	-63.5	-63	-62.5	-64.5	-62.5	-62.5	-65	-58.5	366

III CFIP Lumina Tx power

Modulation	Standard / High Tx Power, dBm					
	6, 7, 8 GHz	10, 11, 13, 15 GHz	17 GHz[4,5]	18, 23, 26 GHz	24 GHz[4,5,6]	38 GHz
4QAM	+19 / +27	+19 / +25	-25…+5	+19	-20…0	+17
16QAM	+18 / +26	+18 / +24	-25…+4	+18	-20…-1	+16
32QAM	+17 / +25	+17 / +23	-25…+3	+17	-20…-2	+15
64QAM	+15 / +23	+15 / +21	-25…+1	+15	-20…-4	+13
128QAM	+15 / +23	+15 / +21	-25…+1	+15	-20…-4	+13
256QAM	+12 / +20	+12 / +18	-25…-2	+12	-20…-7	+10

[1] According to ETSI channel plan

[2] Forward Error Correction (FEC) can be optimized either for sensitivity (Strong FEC) or for capacity (Weak FEC)

[3] Higher capacity is available in 16QAM and 4QAM if using 32QAM-256QAM with ACM enabled

[4] For non-degraded Rx sensitivity refer to radio frequency loopback procedure (pages 50-51) for maximum Tx level according to Rx level observed.

[5] Tx power should not exceed EIRP limitation. Please consult the local spectrum regulating authority.

[6] Output Tx range may differ for previous hardware and software versions.

1.6 Cable Requirements

Fibre optics cable

Single mode 2 channel fibre with 2 fibre ODC plug is required for management and user data. Length of the fibre optics cable using default single mode 1310nm SFP module is up to 10 kilometres (6.2 miles). SAF Tehnika JSC can provide pigtail cable with ODC-LC connectors and length of 3, 10, 25 or 50 meters (10, 33, 82, 164 ft.).

***Figure 1.9**: CFIP Lumina ODC-LC cable*

DC power cable

CFIP Lumina power supply voltage must be between 40.5–57 V DC. 2-wire outdoor cable with dedicated 2-pin LTW DC connector assembly is needed to connect to CFIP Lumina. Any polarity can be used. Preferable outer diameter of power cable is 6mm in order to match CFIP Lumina FODU side connector. Cross-sectional area shall be not less than 0.75 square mm (AWG 18) for installations up to 260 meters / 853 feet (35W load power). If this area is less than 0.75 square mm, the allowed maximum length of the cable is reduced due to a higher voltage drop.

Wire cross section	Lmax @ 50W	Lmax @ 35W	Lmax @ 25W
0.75mm^2	180m / 590ft	260m / 853ft	380m / 1246ft
0.5mm^2	120m / 393ft	180m / 590ft	250m / 820ft
0.25mm^2	60m / 196ft	90m / 295ft	125m / 410ft

AWG	Lmax @ 50W	Lmax @ 35W	Lmax @ 25W
18	206m / 677ft	294m / 967ft	412m / 1353ft
20	129m / 426ft	185m / 608ft	259m / 851ft
24	51m / 168ft	73m / 240ft	102m / 337ft

(!) Power connector can be soldered in any polarity layout.

(!) It is mandatory requirement to ground power supply of CFIP Lumina FODU appropriately.

Optional accessory power adapter cable with screw terminal (P/N I0ACGE04/I0ACGE05 (0.3/1.0m)) does not require soldering and can accept power cable up to AWG14 with maximum cable length up to 745m / 2444ft (35W):

AWG	Lmax @ 50W	Lmax @ 35W	Lmax @ 25W
14	521m / 1711ft	744m / 2444ft	1043m / 3422ft
16	327m / 1076ft	468m / 1537ft	655m / 2151ft

***Figure 1.10**: CFIP Lumina power adapter cable with screw terminal*

RS-232 Serial Connection

The ASCII console must be connected to the RS-232 serial port with Twin-BNC connector. This requires a twisted pair (TP) cable with common shield (foil and plaited shield); the cable must be suitable for Twin-BNC connector.

Using a proper cable, the operation is guaranteed for up to 10 m (33 ft.) of cable.

RSSI BNC

To connect the digital multimeter to the CFIP Lumina 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 (see example in ***Figure 1.4***).

***Figure 1.11.** Cable for connecting the voltmeter to the CFIP Lumina RSSI port*

1.7 AC/DC power adapter requirements

Table below helps choosing the most appropriate power adapter from SAF Tehnika accessories list for standard and high power CFIP Lumina radios. Note that table summarizes maximum power consumption; normally consumption is 10-20% less. One should be aware that High Power versions of the CFIP Lumina radios in some frequencies have maximum power consumption above 50 W and such aspects as power losses in the cable from AC/DC adapter to FODU and loses in PoE injector/splitter, if such is used, must be taken in to consideration. For further details on power adapters please see table in Chapter 11

CFIP Lumina high power

Band (GHz)	Max power consumption (W)	Min recommended PSU power (W)
6	40	60
7	33	60
8	33	60
10	40	60
11	40	60
13	34	60
15	34	60
17	34	60
18	32	60
23	34	60
24	29	60
26	32	60
38	37	60

CFIP Lumina high power

Band (GHz)	Max power consumption (W)	Min recommended PSU power (W)
6	52	**80**
7	45	60
8	45	60
10	52	**80**
11	52	**80**
13	46	60
15	46	60
38	49	**80**

(!) It is mandatory requirement to ground power supply of CFIP Lumina FODU appropriately.

1.8 SFP (Small Form-Factor Pluggable Transceiver)

Initial version of CFIP Lumina is equipped with internal 1310 nm Single-mode Transceiver, (1000Base-LX) SFP module (P/N I0AOM001) with following features:

- Compliant with IEEE 802.3z Gigabit Ethernet Standard;
- Compliant with Fiber Channel 100-SM-LC-L standard;
- Industry standard small form pluggable (SFP) package;
- Duplex LC connector;
- Class 1 laser product complies with EN 60825-1.

Figure 1.12. *CFIP Lumina SFP 1310nm SM transceiver*

On demand CFIP Lumina at factory premises can be equipped with alternative SFP modules. Specifications of available SFP modules:

Part number	Product name	Wavelength	Media	Distance	Application	Tx power	RSL threshold	Temp
I0AMOM01	SFP 850nm MM Transceiver 1000Base-SX 3.3V	850 nm	MMF	550 m / 1800 ft.	1000Base-SX	-9.5..-4 dBm	<-18 dBm	-20..+85C -4..185F
I0AOM001	SFP 1310nm SM Transceiver1000Base-LX 3.3V	1310 nm	SMF	10 km / 6.21 miles	1000Base-LX	-9.5..-3 dBm	<-20 dBm	-40..+85C -40..185F

1.9 CFIP Lumina with FO Gigabit Ethernet Port

1. Lumina and customer equipment connectivity options via FO cables:
   - by ordering ODC-2xLC outdoor patch cord of appropriate length 3 – 200 meter patch cords can be ordered)
   - by using outdoor box to connect ODC-2xLC to LC connectorized FO cable to equipment at customer premises
   - by welding ODC terminated FO cable to FO cable to equipment at customer premises and appropriately sealing the weld

2. As Lumina FODU DC-in port has a built in surge arrestor solution, SAF only recommends to use surge arrestor at the DC source end of the cable

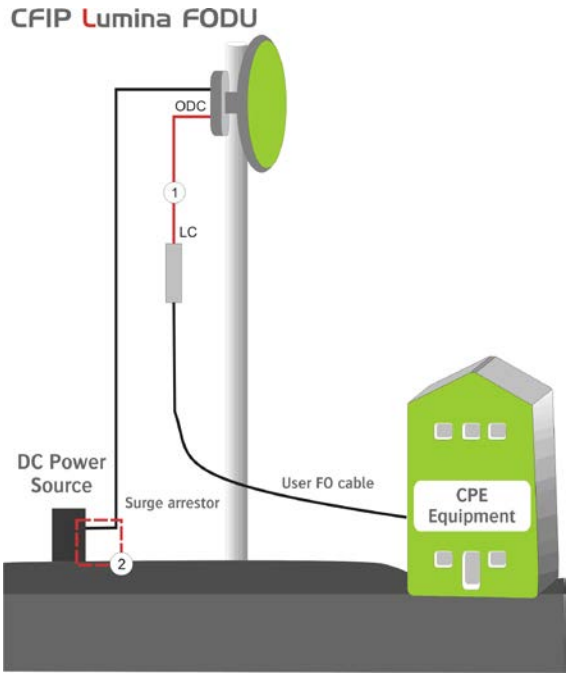


Figure 1.13. *Optical CFIP Lumina site*

1 – ODC-LC cable
2 – Surge arrestor on power cable

1.10 CFIP Lumina with RJ-45 Gigabit Ethernet Port

Electrical Gigabit interface is vulnerable to overvoltage jumps, thus elevated surge protection should be implemented – one surge arrestor should be placed at FODU, another before user equipment. Configuration with separate power and Ethernet cables is shown on ***Figure 1.13***.

Proprietary PoE injector + splitter solution provides sufficient protection of both power and Ethernet interfaces, besides allows using single cable to the splitter located near CFIP Lumina FODU (***Figure 1.14***).

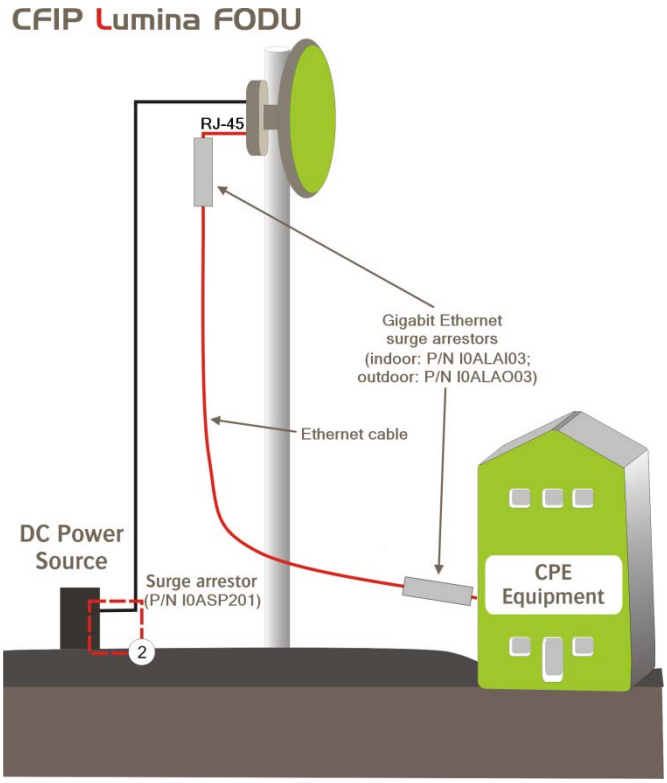


Figure 1.14. *Electrical CFIP Lumina site*

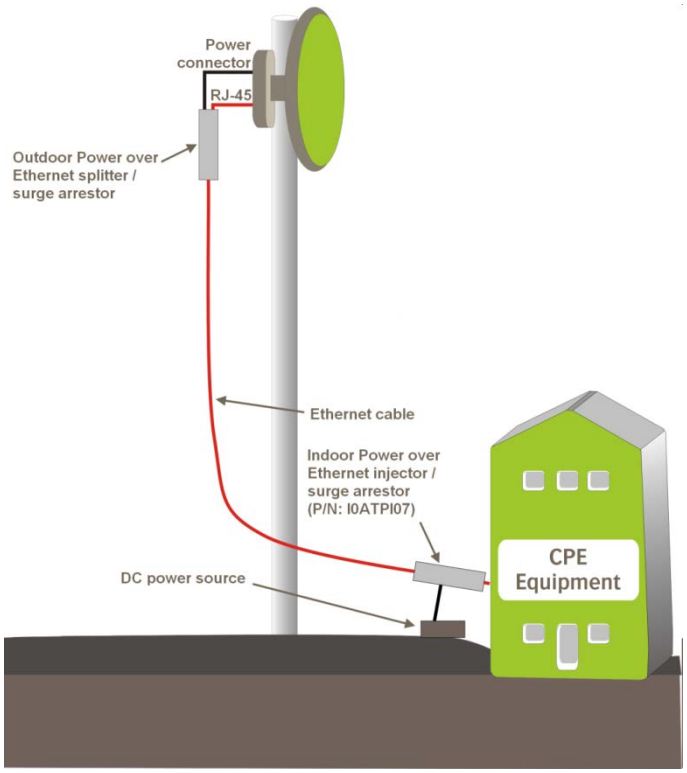


Figure 1.15. *Electrical CFIP Lumina site*

1.11 Labelling

The label can be found on the front side of the unit.

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

- Model name ("CFIP-18-Lumina"). The FODU model name example is:
  - CFIP-18-Lumina for 18GHz FODU,
  - CFIP-23-Lumina for 23GHz FODU, etc
- Product Number (I18GUT05LB): product number contains information in which band side (L, H) the FODU operates. Letters A, B, C or D indicate specific subband.
- Unit Serial Number (3638305 00811); the serial number uniquely identifies the unit.

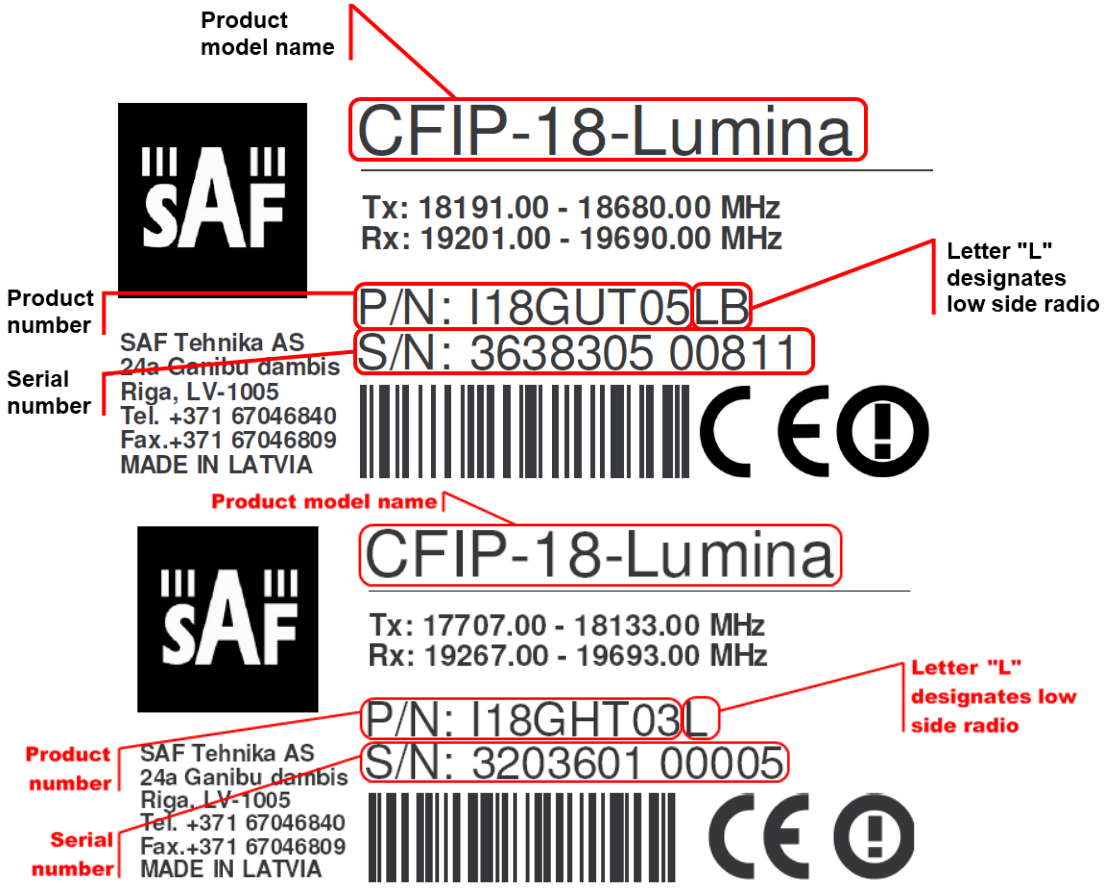


***Figure 1.16**. Label of the CFIP Lumina Low band side, operating in 18 GHz band*

P/N Translation:

"**I**" designates CFIP series product;

"**18**" designates Frequency range (18 GHz) of the Unit;

"**G**" designates standard power CFIP Lumina with 20-56 MHz channel bandwidth support;

S – high power CFIP Lumina with 20-56 MHz channel bandwidth support;

N – standard power CFIP Lumina with 14-56 MHz channel bandwidth support;

H – high power CFIP Lumina with 14-56 MHz channel bandwidth support

"**H**" designates Gigabit Ethernet 1x Electrical;

E – 2x electrical;

O – 2x optical, SM;

M – 2x optical, MM;

L – 1x optical, SM;

N – 1x optical, MM;

U – 1x optical, SM + 1x electrical;

J – 1x optical, MM + 1x electrical

"**T**" designates no capacity limitation;

N - capacity limitation up to 50Mbps;

L – capacity limitation up to 100Mbps;

K – capacity limitation up to 184Mbps

"**03**" designates the version number of the Unit;

"**L**" designates the band side in which FODU operates (H, L);

Please note that frequency range is set from the central frequency of the first 20 MHz channel to the central frequency of the last 20 MHz channel (see the Figure below).

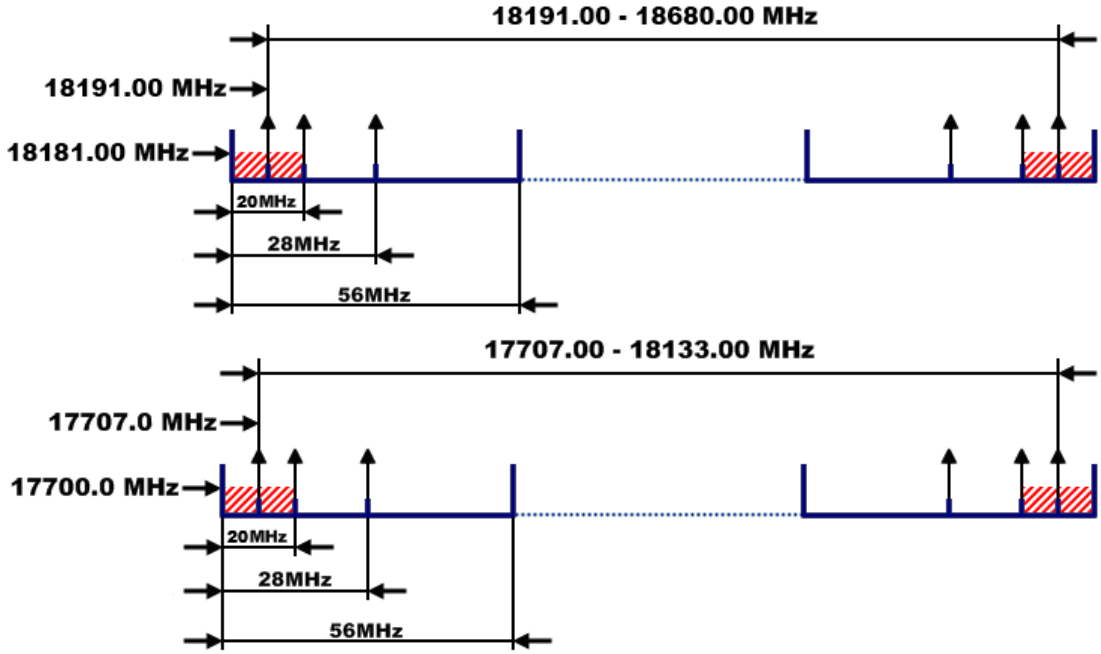


***Figure 1.17**. Frequency range of low and high side CFIP Lumina 18 GHz FODUs*

The Figure explains Tx frequency range of low and high side CFIP Lumina 18 GHz radios.

2 Installation and configuration

There are four ways to adjust and read settings and operation parameters of the CFIP Lumina equipment:

1. using Web terminal (Ethernet interface),
2. using Telnet terminal (Ethernet interface),
3. using NMS or SNMP terminal (Ethernet interface), or
4. using ASCII console connected to the serial port.

It is highly recommended to perform initial configuration in the lab – using testing suite or bouncing signal from the ceiling.

2.1 Assembling CFIP Lumina weatherproof DC Connector

(!) Assembling of weatherproof DC connector does not require any additional tools; all below mentioned operations can be done manually.

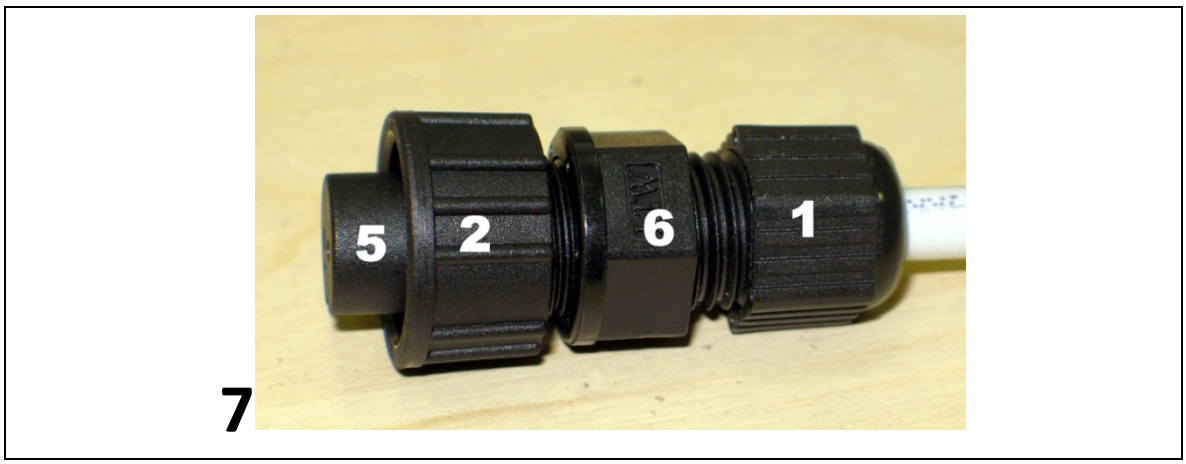


Figure 2.1. *Assembling weatherproof DC power connector*

1. You will need: (1-6) DC connector components and (7) ready 2-wire DC power cable.
2. Wider sealing rubber ring should be fitted inside from the front end of (6).
3. Narrower sealing rubber ring should be fitted inside from the rear end of (6).
4. Parts of the DC connector should be put on the cable in the sequence as shown
5. DC power cable should be soldered in any polarity layout.
6. Afterwards, part (6) should be tightened on to part (5).
7. Assembled DC power connector after tightening the last part (1)

2.2 Passive Power over Ethernet injector and splitter

Optionally to power up CFIP Lumina you can use SAF proprietary Power over Ethernet injector and splitter set (P/N I0ATPI11; I0ATPS03).

Figure 2.2. *Power over Ethernet injector and splitter*

Both units are designed to be used together providing Gigabit Ethernet and power interfaces via single Ethernet cable (Cat5e or better) to CFIP Lumina FODU. Instead of running two separate cables for power and Ethernet, this solution allows to run just one cable from inside equipment to the radio outside.

The non-IEEE PoE injector and splitter both have a built-in lightning and surge protection preventing transient over-voltages from damaging CFIP Lumina radio and user's indoor equipment. Polarity layout is indicated above power connector and the injector is protected against reversed polarity.

The injector has a built-in DC/DC converter which can be manually with a jumper switched between two modes. In the first mode output voltage is the same as input. In the second mode input voltage can vary from 30 to 50 V, but on the output it will be stabilized to 55 V. The second mode is designed to diminish the negative influence of long cable or insufficient input voltage from power supply.

(!) Power supply should be connected in polarity layout depicted on injector's housing.

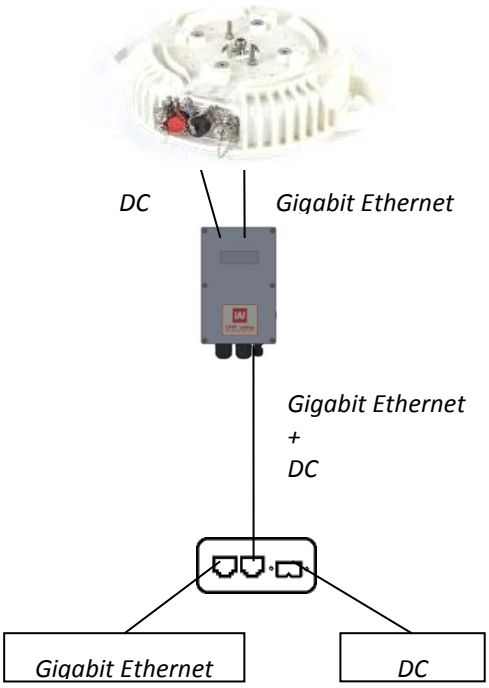
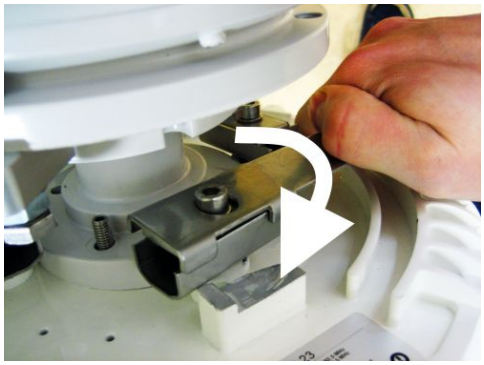


Figure 2.3. *Interconnection of Power over Ethernet injector, splitter and CFIP Lumina*

2.3 Attaching CFIP Lumina FODU to antenna

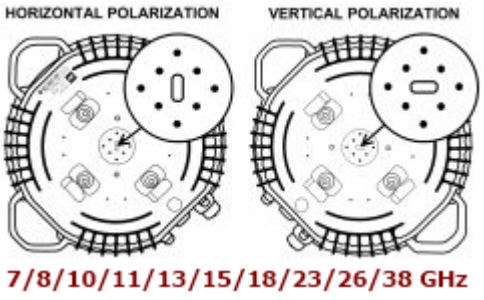
You need only tightening one tool to attach CFIP Lumina to the antenna.

Use two guidance pins for fixing polarization and 4 side lockings for attachment. Lockings should be tightened in diagonal sequence.



Licensed frequency bands 6 – 38 GHz

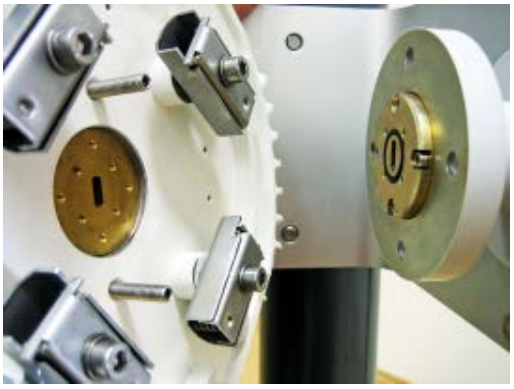
Pair radios in licensed frequency bands 6 - 38 GHz use same polarization for Tx/Rx channels on both ends of the link – either horizontal, or vertical.



(!) 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)



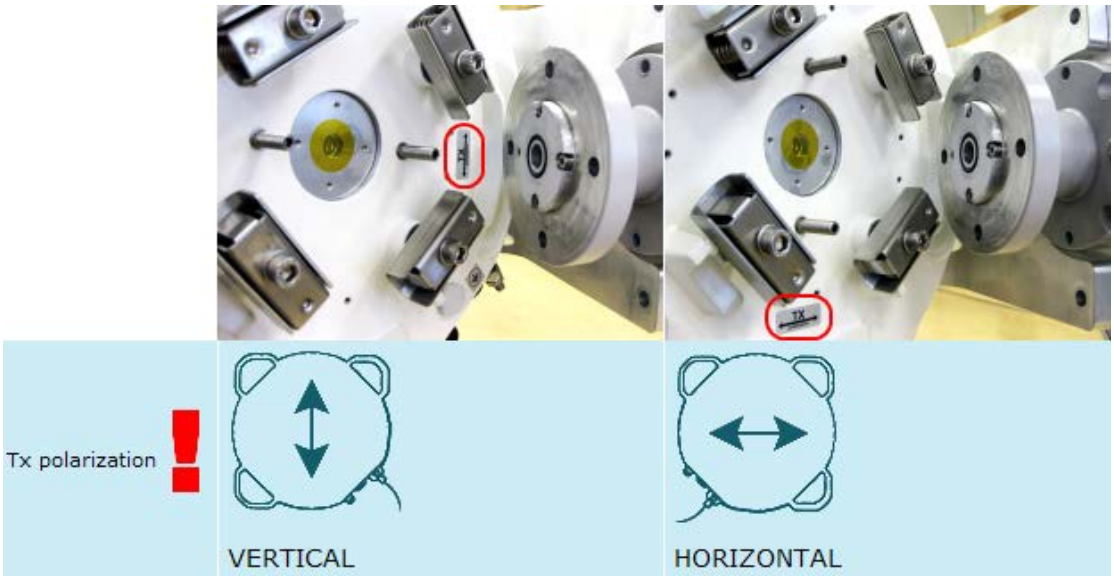
23GHz (horizontal polarization)

(!) Lockings should be positioned in way it is shown on picture.

Unlicensed frequency bands 17/24 GHz

Pair radios in unlicensed frequency bands 17/24 GHz use both polarizations simultaneously via circular flange – radios on opposite side of the link should be installed with 90 degree offset.

Example of 24GHz antenna and FODU mating on local and remote sides of the link and appropriate indication in Web GUI:



(!) Lockings should be positioned in way it is shown on picture.

2.4 Resetting the CFIP Lumina

Depending on the method used, the user may reset the whole terminal or the management controller individually, see table below for details.

Reset action unplugging power source.	Restarts both the multiplexer module and the management module. Resets all management counters.
Resetting with Restart CPU button in Web GUI 'Configuration → System configuration' window or using command prompt command "**system reset**"	Restarts CPU of the management controller. Resets all management counters.
Resetting with command prompt command "**system reset cold**"	Restarts modem and CPU of the management controller. Resets all management counters.

2.5 Web Interface

This section describes operation of Web interface.

2.5.1 ODC Port

ODC port is used to connect the CFIP Lumina to a PC or Ethernet network for Web, SNMP and Telnet management.

(!) The length of single mode FO cable can be up to 10 kilometres (6.2 miles).

2.5.2 Ethernet Management Connection Configuration

Before you proceed to initial link setup with Web GUI, you must perform Ethernet connection configuration by following these steps:

1) In "MS Windows" operational system go to Start → Settings → Network connections (or Start → Settings → Control panel → Network connections)

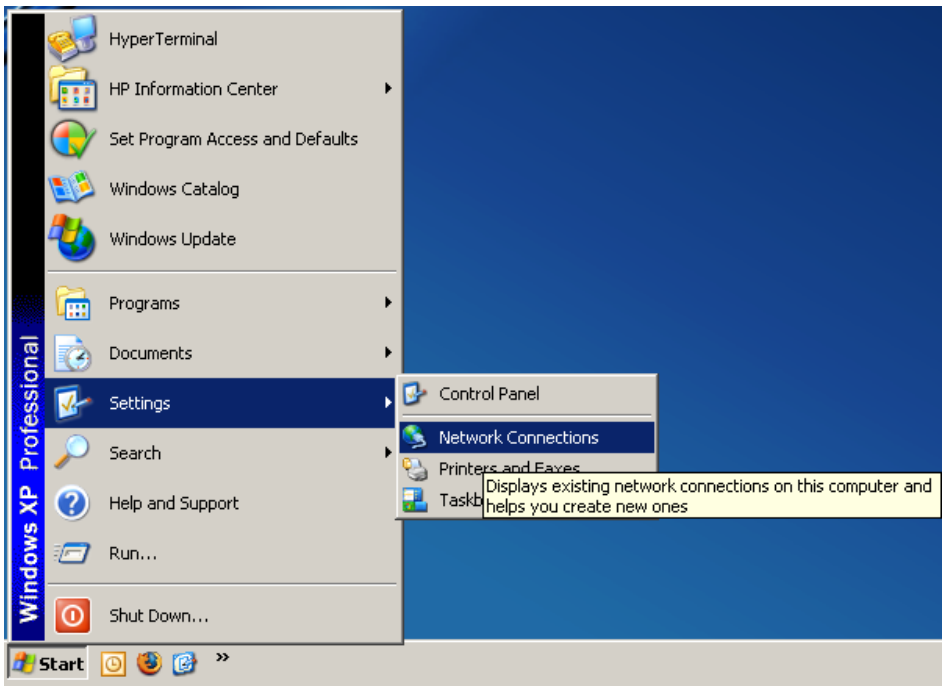


Figure 2.4.

2) Find 'Local Area Connection', click right mouse button on it and choose 'Properties'

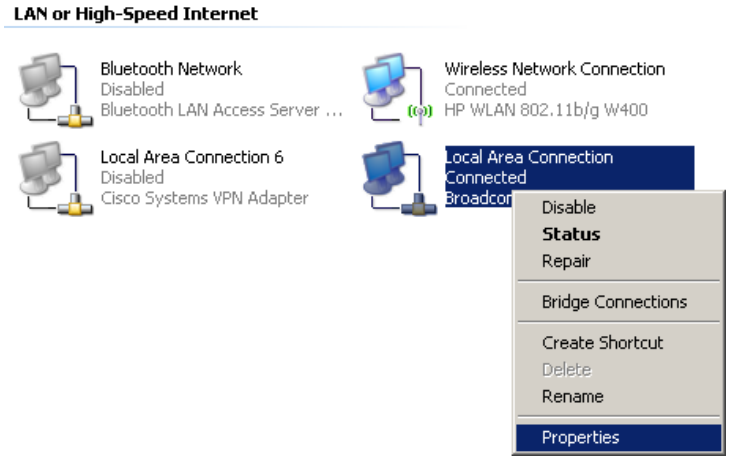


Figure 2.5.

3) Click on 'Internet Protocol (TCP/IP)' from the list in the dialog box and then click on 'Properties'

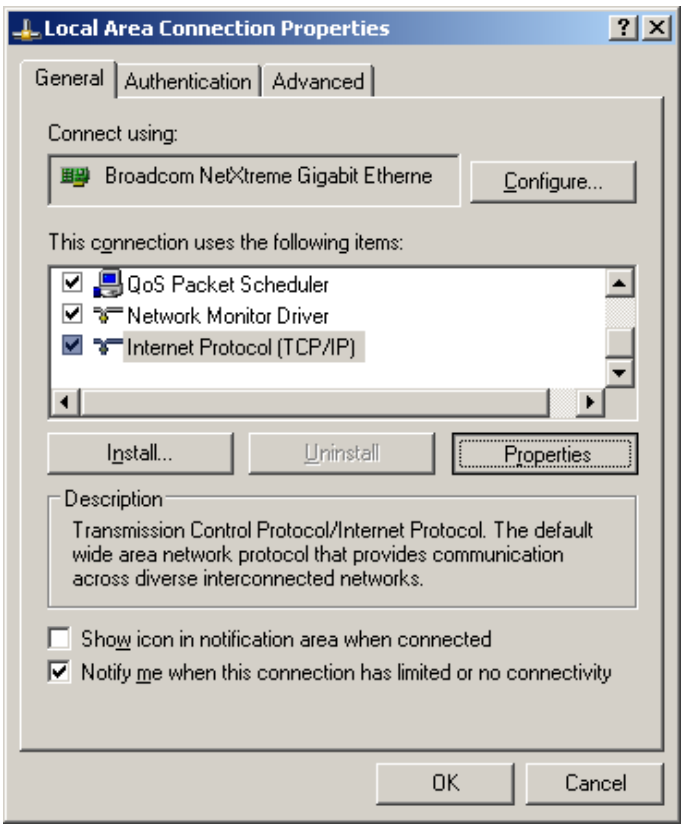


Figure 2.6.

4) In the dialog box enter the following values (so that your PC is in the same subnet as default CFIP Lumina addresses):

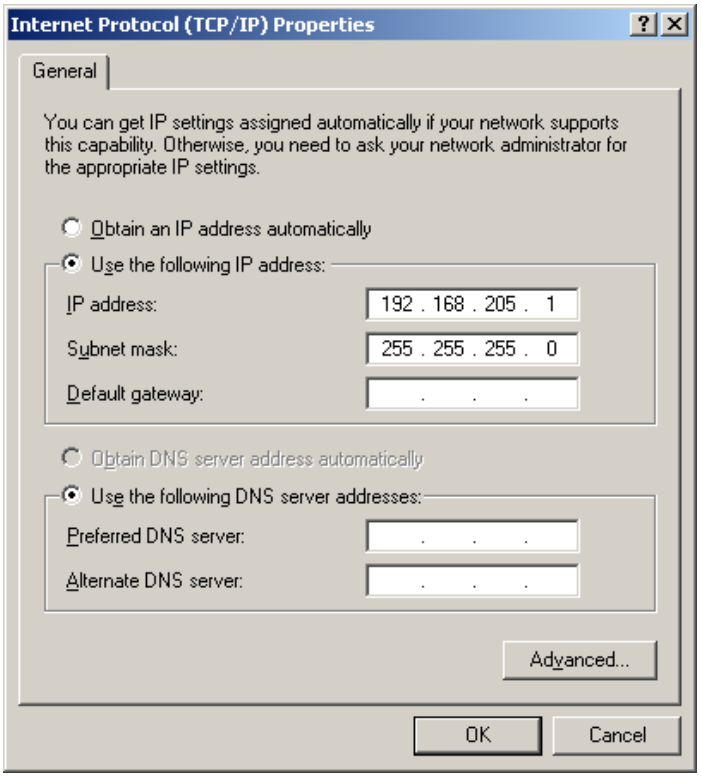


Figure 2.7.

Now you are ready to connect to Web GUI or establish Telnet connection.

2.5.3 Connecting to Web Interface

It is recommended to use the following web-browsers (and all later versions):

- IE v. 6.0
- Mozilla Firefox v. 2.0.0.11
- Safari v. 3.0
- Opera v. 9.50
- Google Chrome

After web browsers selection, open it and enter address of the FODU (**Figure 2.8**).

(!) It is important to know the Side parameter of the FODU to which you want to connect; whether the factory settings are loaded in FODU.

If Low Side -> IP: 192.168.205.10

If High Side -> IP: 192.168.205.11

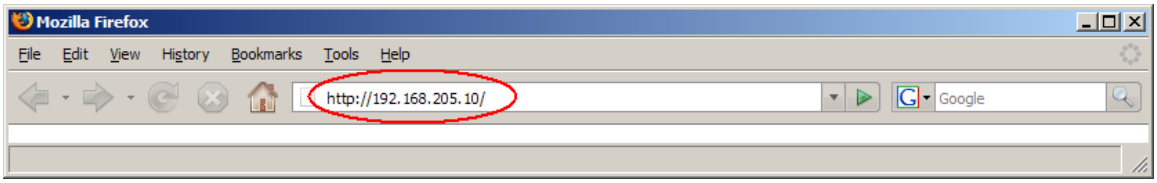


Figure 2.8. *CFIP Lumina IP address*

(!) The default username and password for Web access are:

– username: *admin*

– password: *changeme*

If the IP address is correct and you have suitable browser version, you will see confirmation text. After confirmation you will be redirected to Web interface page. In case of not valid IP address you will not obtain the configuration interface. In case your browser is not accepted, you will see the text informing about that. You can push the button “Continue Anyway” to be redirected to Web interface page.

At first “Configuration→Configuration wizard” should be run in order to perform basic link configuration (by default Tx power is disabled and parameters of remote side will not be seen).

If configuration was made correct, you will see the main window of the WEB Interface. If there are problems in the field displaying Local and/or Remote system values (configured values are not the same for Local and Remote, or there is a problem with parameter value), the appropriate cell will be highlighted in red colour.

(!) If you are not obtaining the correct Web page, try to clear browser cookies, cache and offline data and restart the browser.

(!) All the commands executed from Web GUI will be interpreted as CLI commands and will be executed as in CLI.

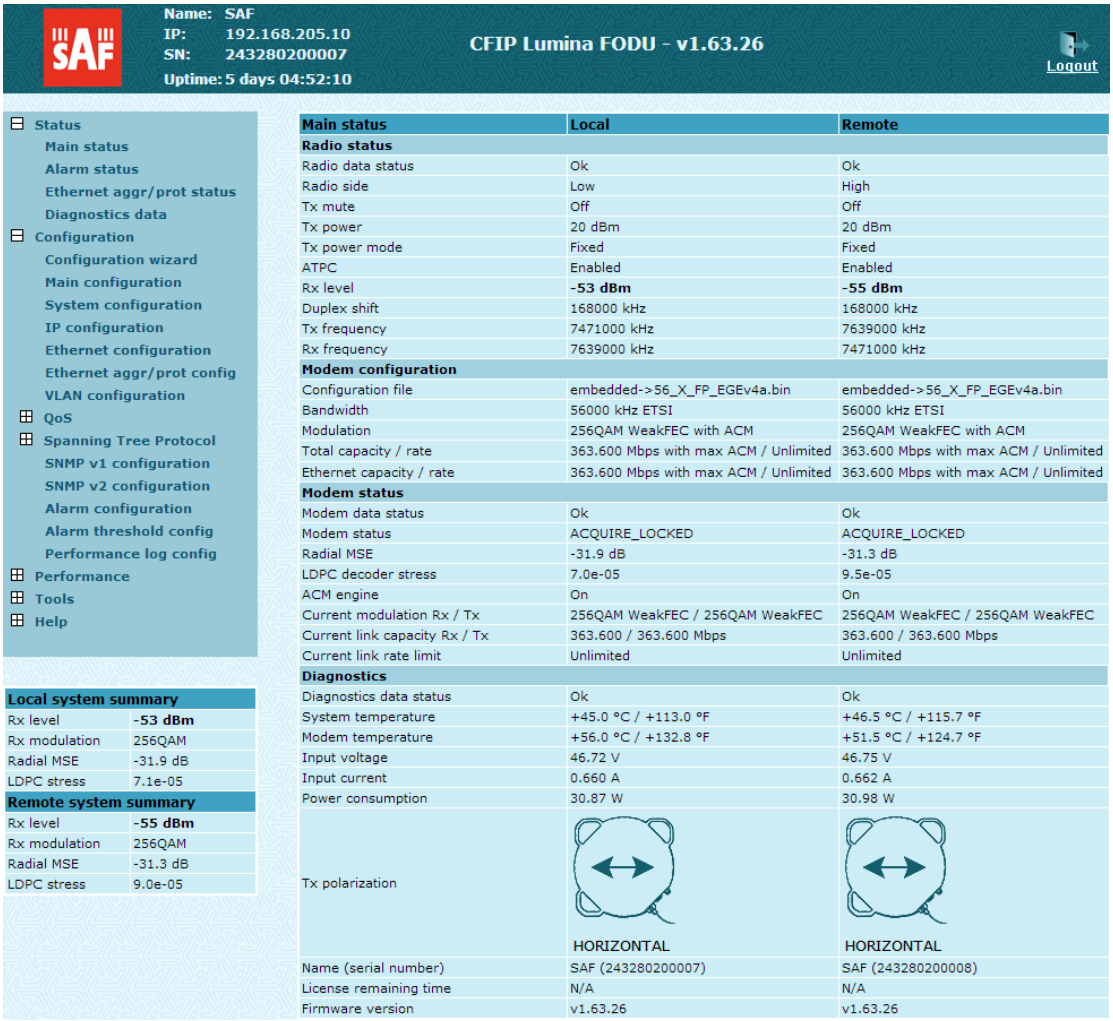


Figure 2.9. *Web Interface - main window*

(!) Note that CFIP Lumina 17 and 24 GHz (unlicensed) utilize both polarizations, and radios must be installed with 90 degrees offset regarding remote side. This, as well as position of cables can be verified in *Main status* Tx polarization row. Licensed 6/7/8/10/11/13/15/18/23/26/38 GHz radios on contrary should be installed with same polarization on both ends of the link (for 6GHz polarization is determined by antenna).

2.5.4 Interface Description

WEB interface consists of four parts, they are:

1. Top panel, that allows to log out and gives information about device type, software version, device name, IP, serial number and uptime;
2. Menu panel that is used to open links to other pages;
3. Status summary for local and remote devices: this section is available while browsing other pages.
4. The main panel where the new pages selected from the menu panel are loaded for display;

Also, special marks are used:

– Entries highlighted in red indicate that specific parameters do not comply with the norms of normal operation. For example: value is out of range; local value is not equal to the remote value and vice versa (only in some places); no value data (N/D).
– If the entry is highlighted in yellow, this means warning condition.

– If the value place reads ‘N/D’, this means ‘No Data’.
– If the value place reads ‘N/A’, this means ‘Not Available’.

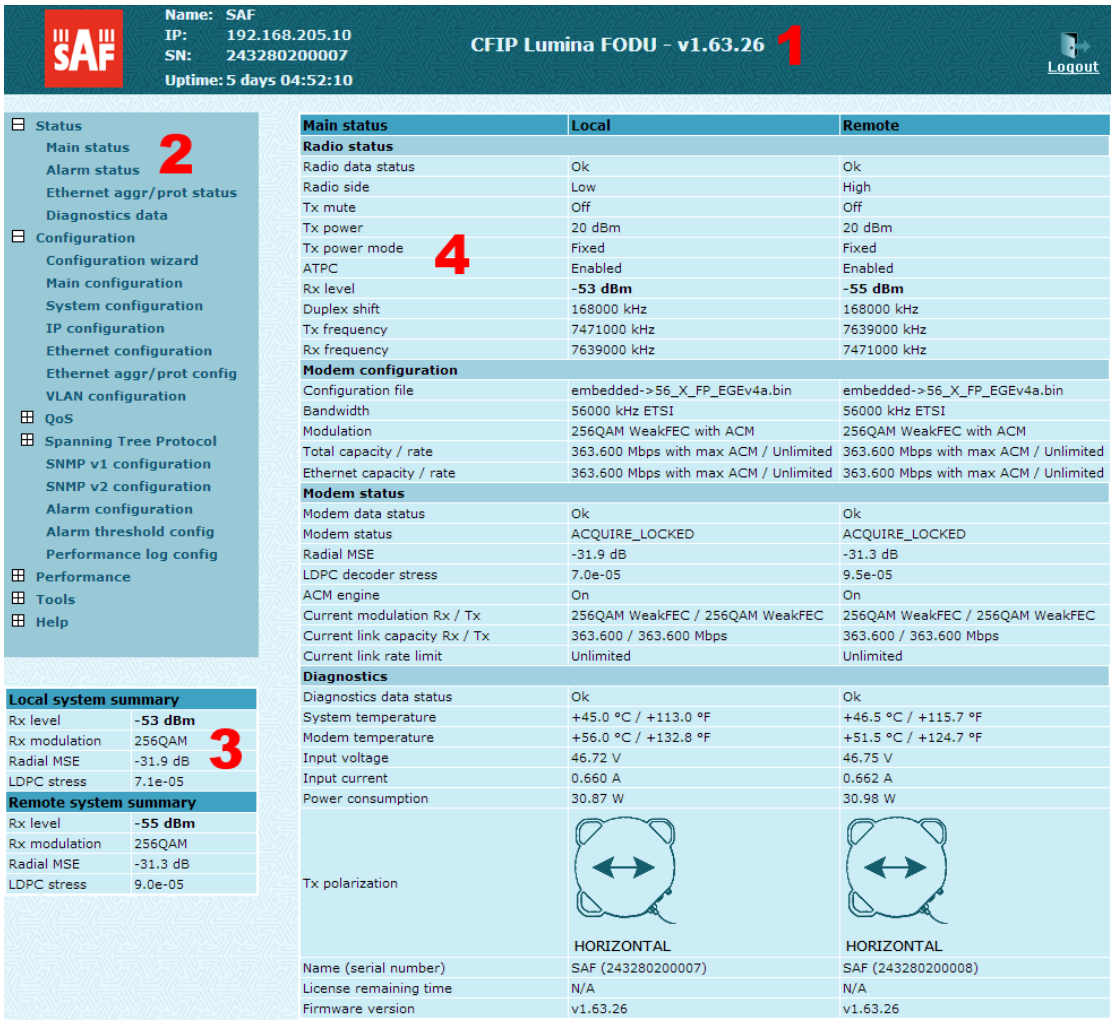


Figure 2.10. *Web Interface - main window with section numbering*

2.5.5 Command Execution

There is a “IP configuration” page shown in ***Figure 2.11***. The entire page is divided into smaller fragments:

1. The header of page;
2. Sub-header of single type configuration parameters;
3. Configuration parameter name;
4. Configuration parameter **current** value;
5. Execution controls related to a single type configuration parameters.
6. Write to config file button, which generates “**cfg write**” CLI command, which saves changed configuration;
7. Comments (not on every page).

„Execute for both” is available in “Main configuration” section during configuration of modem or ATPC parameters for local and remote radio sides simultaneously.. Connection between both management CPUs must be established in order to complete successfully configuration execution for both sides.

„Rollback on” feature is intended to maintain connectivity of the CFIP link by cancelling last erroneous configuration changes and reverting to previous successful configuration used. Rollback will activate only if you lose connection to WEB interface of CFIP Lumina after configuration changes applied, and reverting process will take approx. 3 minutes.

After parameter value editing, when the focus from this object is removed, this parameter value edit box may be highlighted in red, meaning that entered value is not valid.

If *„Execute configuration"* or *„Execute for both"* buttons are pressed, and one or several configuration values edit boxes is/are highlighted in red, the user will see error message with the explanation text.

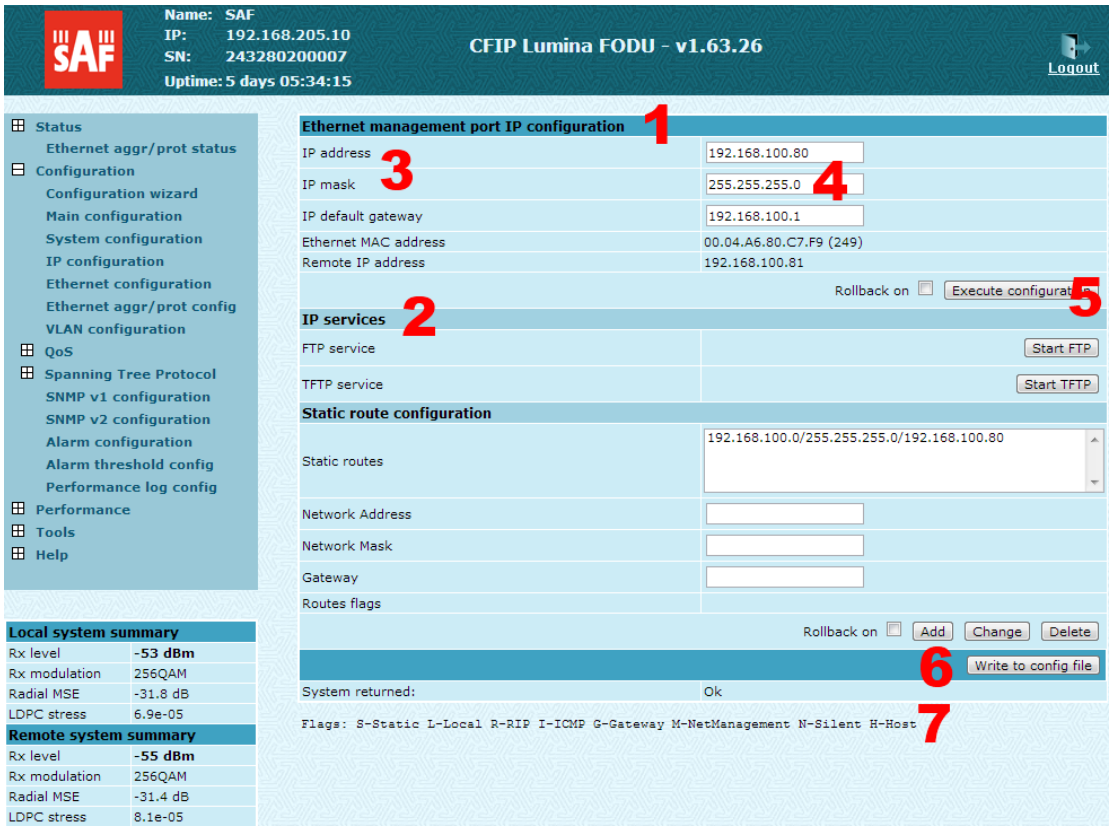


Figure 2.11. *Web Interface - IP configuration page with numbering*

2.5.6 Initial Configuration with Web GUI

The connected laptop should be in the same subnet as manageable CFIP Lumina in order to observe it. Therefore laptop Ethernet port settings should be set as follows: (in 'Microsoft Windows' go to *Control panel → Network Connections → Local Area Connection → Properties → Internet Protocol (TCP/IP) → Properties*):

- IP address 192.168.205.1;
- netmask 255.255.255.0;
- everything else is blank.

(!) CFIP Lumina must be powered up using dedicated power supply with load power at least 60W. See Chapter 1.7 for details.

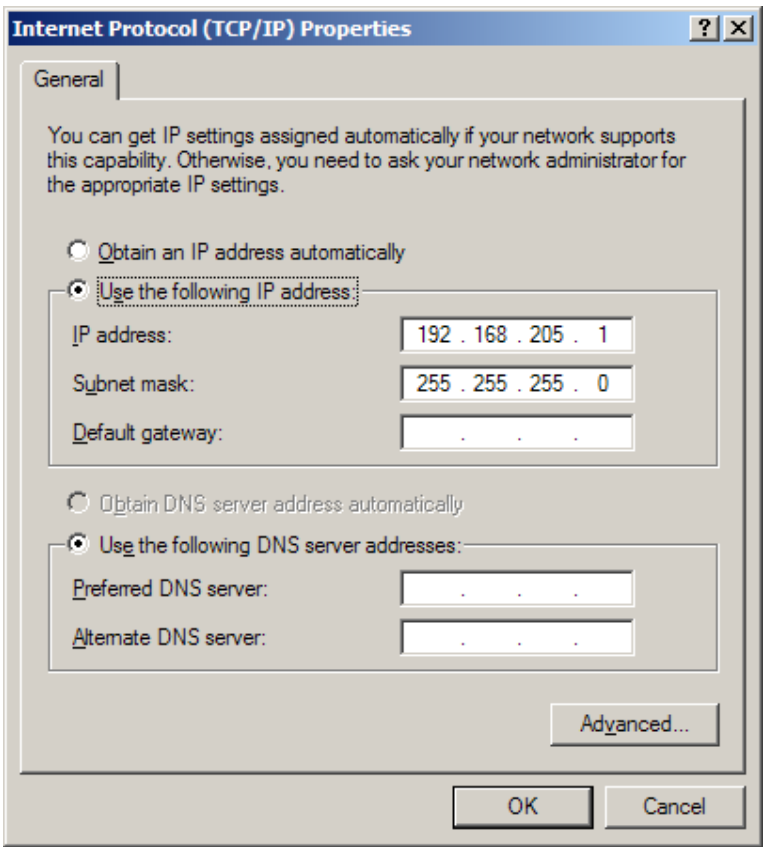


Figure 2.12.

The next step is to connect to CFIP Lumina by entering IP in the browser address line – which is by default 192.168.205.10 for the low side and 192.168.205.11 for the high side. In case you are not sure which side you are managing at the moment, you can try both default IP addresses.

Currently supported browsers you can use are "Internet Explorer", "Mozilla Firefox", "Apple Safari", "Opera" and "Google Chrome".

Figure 2.13. *Supported browsers: "Internet Explorer", "Mozilla Firefox", "Apple Safari", "Opera" and "Google Chrome"*

When you are connected to the CFIP Lumina, you will see the window similar to the one shown in ***Figure 2.9***.

To start simple configuration process, you must proceed with the configuration wizard which will set up the main parameters of the link to make it work. So, the first step is to go to '*Configuration → Configuration wizard*' as shown below in the ***Figure 2.14.***

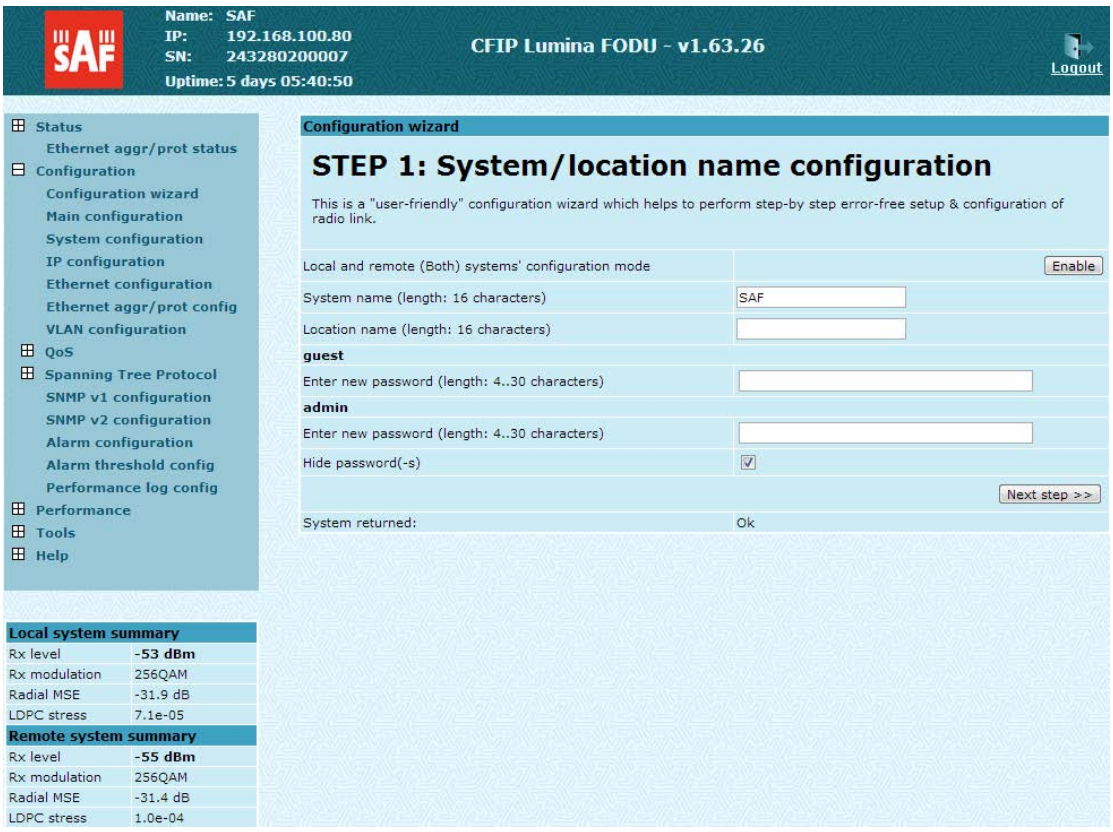


Figure 2.14. *Starting configuration wizard.*

Initially, you can specify preferable system name, passwords for guest and admin accounts.

(!) Default password for "admin" account is *changeme*.
"guest" account is disabled by default!

The next time you will try to access the Web GUI management, you will be asked to enter the user name (guest or admin) and user password.

(!) It is highly recommended to name the system after its geographical location.

By default, system name is 'SAF'.

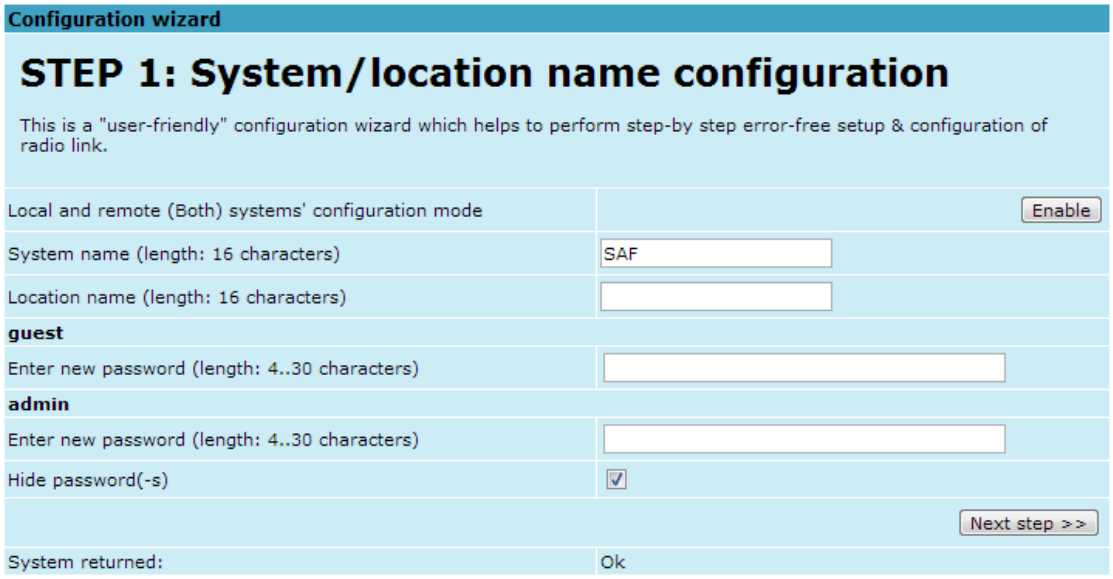


Figure 2.15. *STEP 1. Defining system name and passwords for "guest" and "admin" accounts.*

After accepting and pressing 'Next step >>' button, you will be redirected to the second configuration wizard screen, where you will be asked to define the network IP settings by entering IP

address, IP mask and default gateway. Remote IP address is automatically shown when link is established.

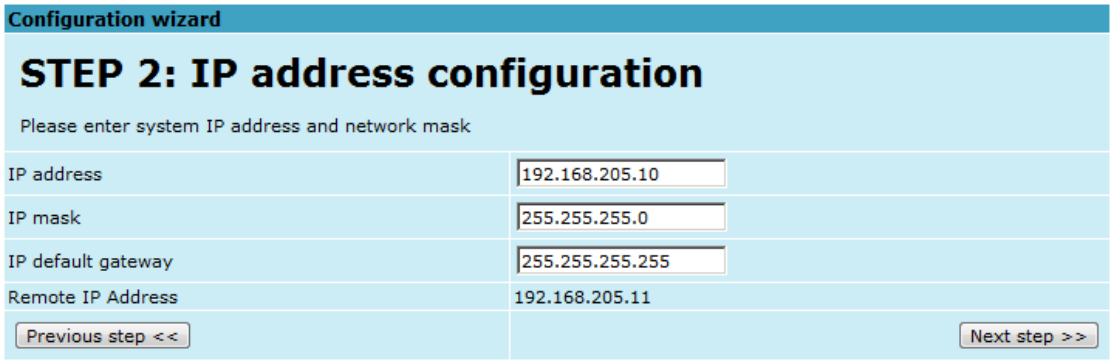


Figure 2.16. *STEP 2. Defining IP address, mask and default gateway*

The third screen of the wizard is devoted to the modem and radio configuration and requires specifying utilized bandwidth (14, 20, 28, 30, 40, 50 or 56 MHz – ETSI or ANSI (FCC)), modulation type (4QAM, 16QAM, 32QAM, 64QAM, 128QAM or 256QAM), Tx power (range depends on modulation chosen), Tx power mode (whether power changes when ACM downshifts or upshifts modulations) and Tx frequency (range depends on bandwidth chosen); besides, the modem and radio data status is being shown. Enabling "Fixed Tx power" will not increase Tx power when ACM downshifts modulation order.

These configuration parameters will determine overall link capacity.

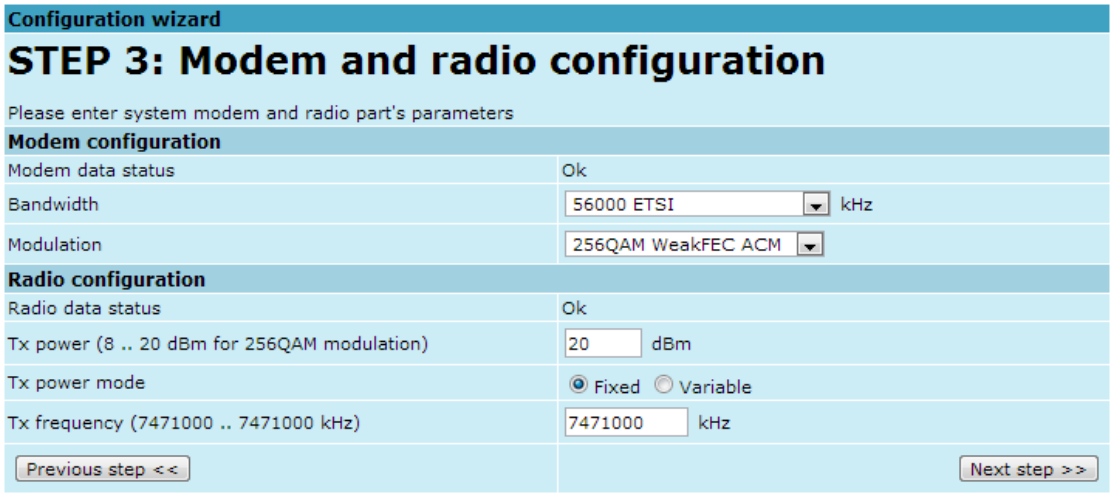


Figure 2.17. *STEP 3. Defining modem bandwidth, modulation, Tx power and frequency*

For CFIP Lumina 17 and 24 GHz Tx power should not exceed equivalent isotropically radiated power (EIRP) limitation.

(!) In the table below please see interdependence between antenna used and allowed CFIP Lumina 17 and 24 GHz Tx output power range.

	Antenna size/gain			
	17 GHz		**24 GHz**	
	30cm (1ft) / 32.2dBi	**60cm (2ft) / 37.8dBi**	**30cm (1ft) / 35.0dBi**	**60cm (2ft) / 40.3dBi**
Tx power (ETSI)	-20…-13 dBm	-20…-18 dBm	-20…-15 dBm	-20 dBm
Tx power (FCC)	-	-	-20…-3 dBm	-20…-8 dBm
Tx power (IC)	-	-	-20…-0 dBm	-20…-0 dBm

The final screen allows checking the selected settings and applying them. The optional settings are as follows:

– *Clear cfg file before the new settings will take place* – resetting or keeping all the other parameters, not mentioned here, after configuration execution

– *Set local machine time* – uses the time of your laptop
– *Write this configuration into cfg file* – configuration is automatically written in configuration file

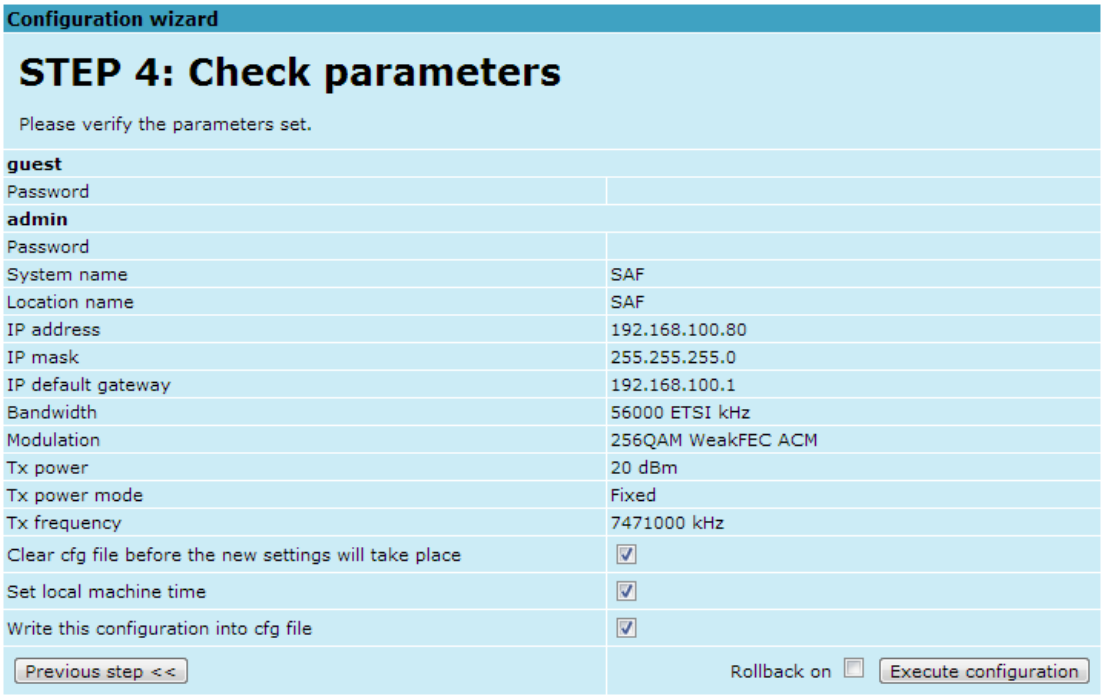


Figure 2.18. *STEP 4. Checking settings and executing configuration*

To verify the settings, we can go to 'Main status' page (Status→Main status). If there are no 'red fields' after completing configuration wizard on both ends of the link, everything is set correctly and the link is up.

2.6 Command Prompt Interface

CFIP equipment can be monitored and configured by using command interface described in this chapter.

This process is performed by connecting to Telnet terminal via Ethernet port; Telnet management supports only one client.

Command line management interface offers wider configuration and monitoring functionality. The available commands for Telnet management are found in detailed explanation of Web GUI windows, as well as in tables of additional commands.

(!) – To end Telnet session press Ctrl+D. Opening the session again, the prompt will appear to enter username and password.

– Default username is *admin* and password - *changeme*

(!) Syntactic notes for command prompt commands

– Commands are in **bold** font.
– All arguments (variables) are in *italic* font.
– Subcommands and keywords are in regular font.
– Arguments in square brackets ([ ]) are optional but required arguments are in angle brackets (<>).

– Alternative keywords are grouped in braces ({}) and separated by vertical bars (|).
– The purpose of each command will be displayed if command is typed with "?" at the end (or any unrecognizable string) is entered, e.g., *radio ?*

The management system is automatically restarted if it freezes. This is performed by the watchdog timer. Restarting of the management system does not affect (interrupt) the Ethernet traffic.

2.6.1 RS-232 Serial Management Port

RS-232 serial management port provides terminal management via connected PC or another terminal device or modem.

The terminal connected to serial management port provides the same management functionality as Telnet interfaces (refer to ***Chapter 2.3.2***). In order to interconnect the CFIP Lumina and the management terminal directly through serial ports, a "straight through" modem cable is required.

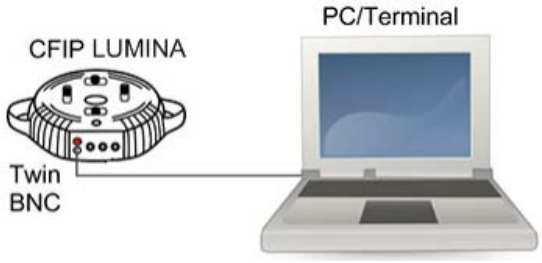


Figure 2.19. *Serial connection to CFIP Lumina*

To connect PC to RS232 management port using *Hyper Terminal* program (program is included in any Windows version), proceed as described below.

1. Connect the PC to the RS232 serial port by means of "straight through" or modem serial cable (null-cable).

2. Run "Hyper Terminal" program.

3. Make a *New connection* and enter connection name.

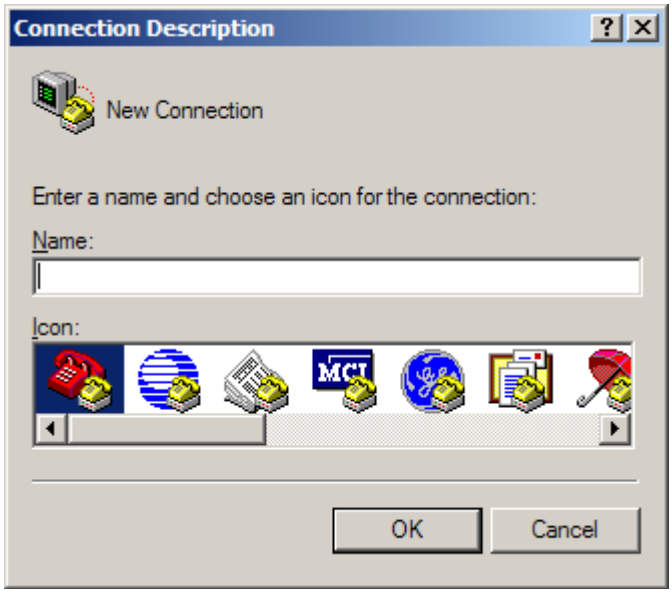


Figure 2.20.

4. Choose port (COM1 or COM2).

Figure 2.21.

5. Set port settings (bits per second: 19200, data bits: 8, parity: none, stop bits: 1, data flow control: none).

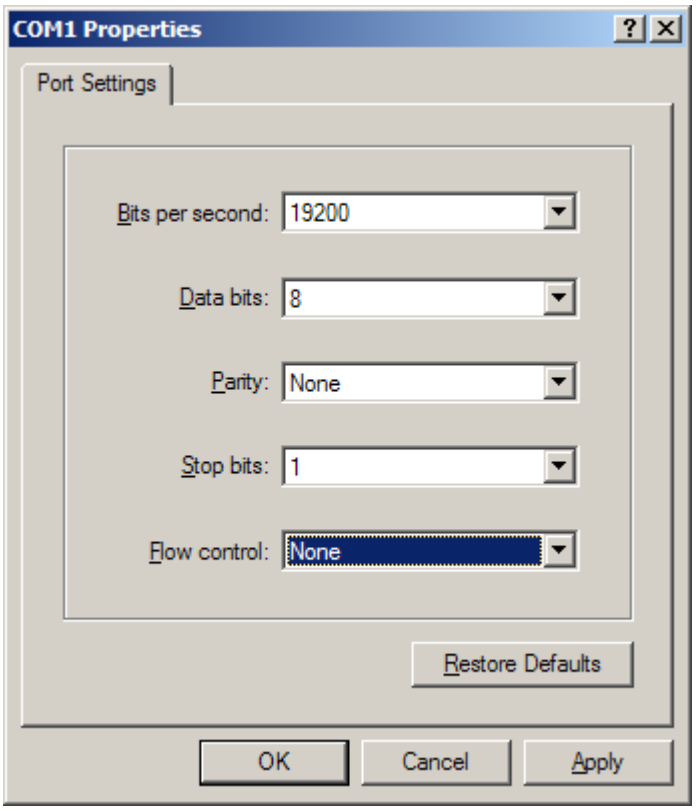


Figure 2.22.

6. Press OK

7. Press Enter. Password is disabled by default.

If successfully connected, the prompt should appear as in the picture below. See ***Chapters 3-7*** for available commands.

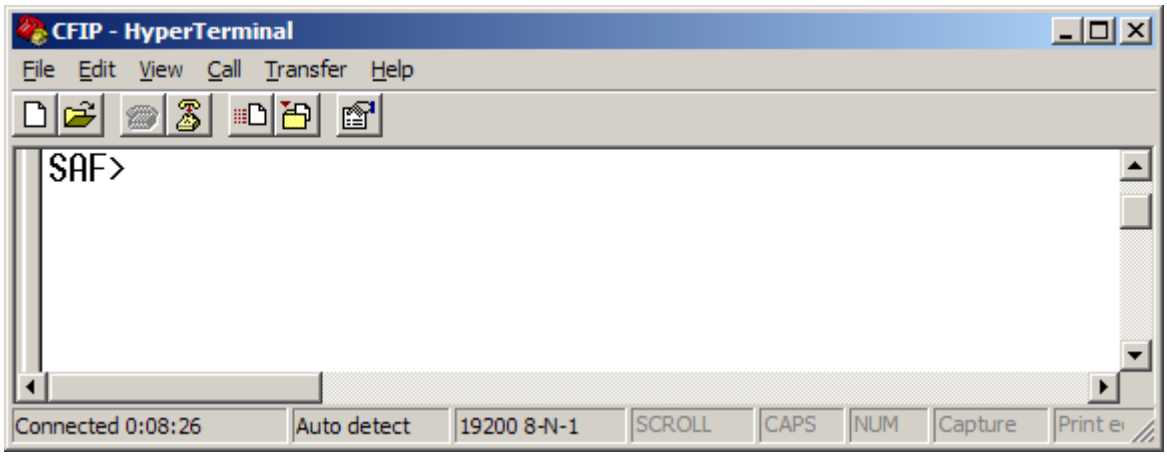


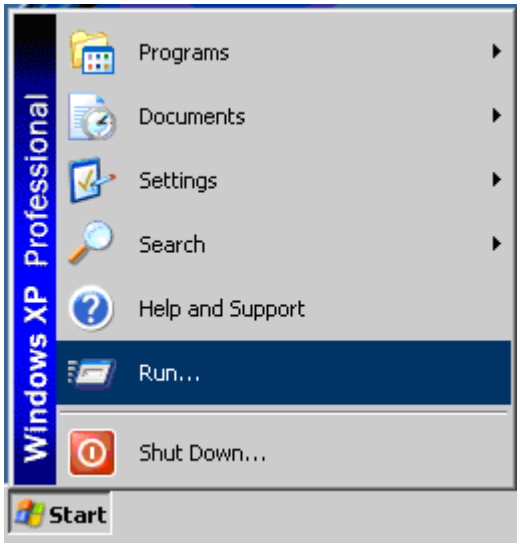
Figure 2.23.

2.6.2 Telnet connection

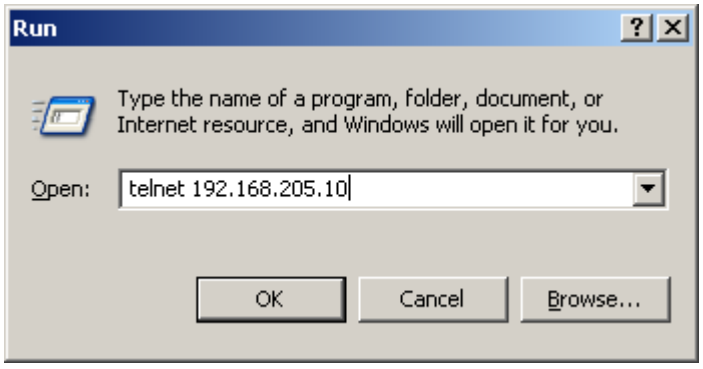
Telnet connection to CFIP Lumina is carried out using Ethernet management connection. Please refer to ***Chapter 2.2.2*** for Ethernet management port connection details.

When you are ready to connect to Telnet interface, please follow these steps:

1) Go to Start → Run…



2) Type in *"**telnet** <ip_addr>"*, where *<ip_addr>* is IP address of the CFIP Lumina you want to connect to (refer to CFIP Lumina label - explanation in ***Chapter 1.8***)



3) If the Ethernet management connection is configured properly, you will see a window similar to the one shown below, where you will be asked to enter login and password. Default login is identical to WEB login name – user name is *admin* and password – *changeme*.

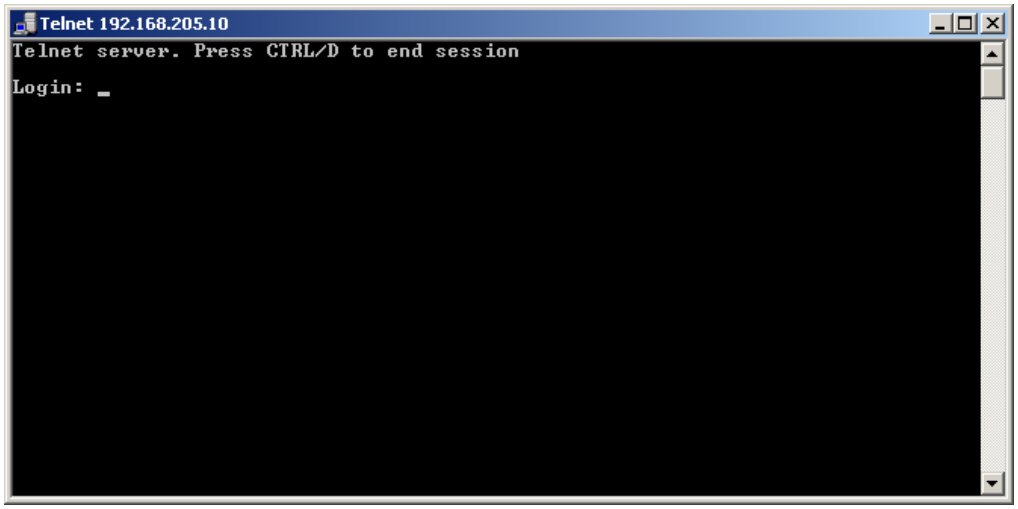


Figure 2.24.

After you have correctly entered the login and password, you are ready to work with all the available command prompt commands.

2.6.3 Initial Configuration with Command Prompt

Configuration steps using command prompt are as follows:

1. Check the system settings with command '**status**'
2. Configuration required parameters:

(!) Before you set the parameters listed below, you must know what frequency and bandwidth you are allowed to use and at what power you are allowed to transmit.

(!) In the table below please see interdependence between antenna used and allowed CFIP Lumina 17 and 24 GHz Tx output power range.

	Antenna size/gain			
	17 GHz		24 GHz	
	30cm (1ft) / 32.2dBi	60cm (2ft) / 37.8dBi	30cm (1ft) / 35.0dBi	60cm (2ft) / 40.3dBi
Tx power (ETSI)	-20…-13 dBm	-20…-18 dBm	-20…-15 dBm	-20 dBm
Tx power (FCC)	-	-	-20…-3 dBm	-20…-8 dBm
Tx power (IC)	-	-	-20…-0 dBm	-20…-0 dBm

- Tx power with the command '**radio txpower** [<power dBm>]';
- Tx frequency with the command '**radio freq** [<freq KHz>]';
- Channel bandwidth and modulation with the command '**modem set** <20000|28000|30000|40000|50000|56000> <min modulation> <max modulation> <WeakFEC|StrongFEC>', where you can choose among 14, 20, 28, 30, 40, 50 or 56 MHz values;
- Name of CFIP Lumina with the command '**system name** <name>'. Default name is 'SAF';
- IP address with the command '**net ip addr** <addr>', if it is necessary;
- IP mask with the command '**net ip mask** <mask>' , if it is necessary;
- IP default gateway with the command '**net ip gw** <gw>' , if it is necessary;

3. Save settings with the command '**cfg write**'; restarting with the command '**system reset**';
4. Check the settings made, modem and radio status with the commands '**status**', '**modem status**' and '**radio status**' respectively.

3 Status in Web GUI

Status menu and submenu items in Web GUI summarize current system status and configurations, alarm status, Ethernet 2+0/1+1 aggregation/protection status, inventory information and provide ability to download troubleshooting data. Following information is available both for *admin* and *guest* user accounts.

3.1 Main status

”Main status” submenu page shows all main system parameters, and, in case of failure or any other problem, it indicates specific parameter in red colour.

To have better understanding of ”Main status” page, explanation of each parameter is provided below.

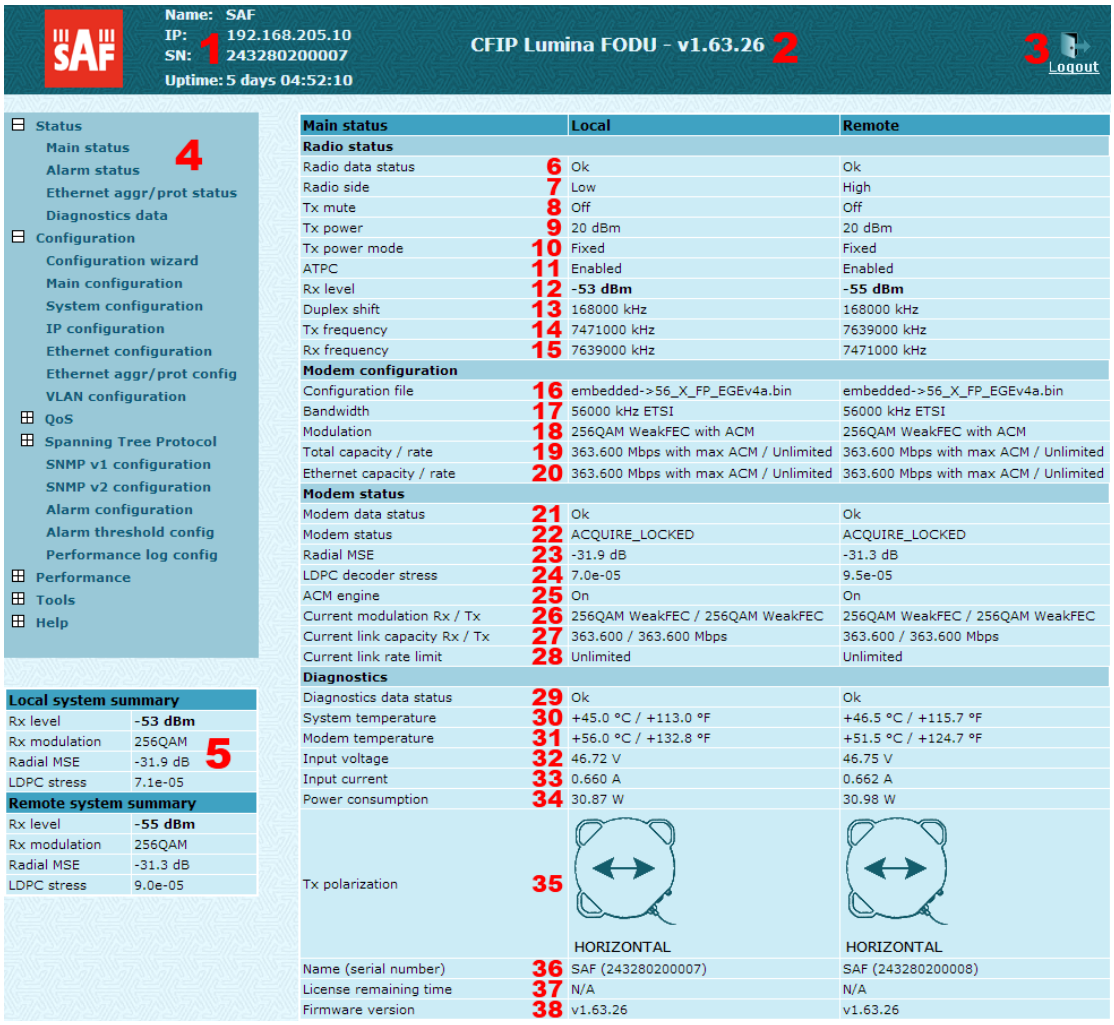


Figure 3.1. *“Main status” page*

1. Shows the name of CFIP Lumina you are connected to, its IP address, serial number and uptime since the last restart. If uptime is displayed in red, the connection to Web server was lost;
2. Shows firmware version of CFIP Lumina you are connected to;
3. Logout button allows ending current Web GUI management session and logging in with different user account if necessary. After pressing the button, you are automatically redirected to the login page;
4. The tree of Web GUI sections;

5. Shows short summary of the main operational parameters of local and remote system.
    - Rx level (or RSL) at both ends must not differ significantly from the previously calculated value.
    - Modulation indicates which modulation mode is used. For better operation the same modulation must be set at both ends.
    - Radial MSE is explained below in the **Chapter 3.1.1**.
    - LDPC is explained below in the **Chapter 3.1.2**.
6. *Radio data status* – shows if management CPU was able to read data from radio;
7. *Radio side* – shows the radio side of local and remote CFIP (command line – ***radio side***);
8. *Tx mute* – shows if transmitter is currently muted;
9. *Tx power* – shows current transmitter power in dBm. Factory default setting is "Off" (command line - ***radio status*** or ***status***);
10. *Tx power mode* – shows whether fixed or variable Tx power mode is activated. In case of "fixed" Tx power mode output power will not change when ACM downshifts or upshifts modulations. In case of "variable" Tx power mode output power will increase when ACM downshifts modulations and decrease when ACM upshifts modulations (command line – ***radio fixedpower*** *[disable|enable} or 0|1*);
11. *ATPC* – shows if ATPC is enabled or disabled (command line – ***atpc status***);
12. *Rx level* – shows current level of received signal. It must not differ significantly from the previously calculated value (command line - ***radio status*** or ***status***);
13. *Duplex shift* – shows the margin between the transmitting and receiving frequencies (command line - ***radio status***);
14. *Tx frequency* – shows the transmitting frequency (command line - ***radio status***);
15. *Rx frequency* – shows the receiving frequency (command line - ***radio status***);
16. *Configuration file* – shows which configuration the modem is currently using. It should match on both sides of the link (command line – ***modem configuration***);
17. *Bandwidth* – shows width of currently utilized bandwidth in MHz (command line – ***modem status*** or ***status***);
18. *Modulation* – shows modulation mode set (command line – ***modem status*** or ***status***);
19. *Total capacity / rate* – shows Ethernet + n*E1 total capacity set and license rate limitation. If no license applied or license does not limit Ethernet rate, "Unlimited" will be shown (command line – ***modem status*** or ***status*** *and* ***ethernet rate***);
20. *Ethernet capacity / rate* – shows Ethernet capacity from total capacity configured and license rate limitation. If no license applied or license does not limit Ethernet rate, "Unlimited" will be shown (command line – ***modem status*** or ***status*** *and* ***ethernet rate***);
21. *Modem data status* – shows if management CPU was able to read data from modem;
22. *Modem status* – indicates the acquired status of the modem. 'ACQUIRE_IN_PROGRESS' will appear during start-up, when modem acquires required parameters, but in normal operation mode 'ACQUIRE_LOCKED' will be seen. Any other options designate failure (command line – ***modem status*** or ***status***);
23. *Radial MSE* – shows radial mean square error value. Refer to ***Chapter 3.1.1.*** for detailed description (command line - ***modem status*** or ***status***);
24. *LDPC decoder stress* – shows the load of LDPC (low-density parity-check code) decoder. Refer to ***Chapter 3.1.2.*** for detailed description (command line – ***modem status*** or ***status***);

25. *ACM engine* – shows if ACM (Adaptive Coding and Modulation) engine is running (command line – ***modem status*** or ***status***);
26. *Current modulation Rx / Tx* – shows the modulation modes currently utilized (command line – ***modem status***);
27. *Current link capacity Rx / Tx* – shows the current capacities in both directions (command line – ***modem status***);
28. *Current link rate limit* – shows the current Ethernet capacities in both directions. "Unlimited" is shown in case no limit is applied (command line – ***modem status***);
29. *Diagnostics data status* – shows if system parameters are in acceptable margins (command line - ***diagnostics***);
30. *System temperature* – shows the device internal temperature in degrees by Celsius and Fahrenheit (command line - ***diagnostics*** or ***status***);
31. *Modem temperature* – shows the temperature on modem in degrees by Celsius and Fahrenheit (command line - ***diagnostics or status***);
32. *Input voltage* – shows the input voltage of PSU in volts (command line - ***diagnostics***);
33. *Input current* – shows the input current of PSU in amperes (command line - ***diagnostics***);
34. *Power consumption* – shows the amount of power consumed by PSU in watts (command line - ***diagnostics***);
35. *Tx polarization* – shows transmission polarization and position of connectors and cables (command line - ***diagnostics***);
36. *Name (serial number)* – shows system name and serial number (command line – ***system name*** and ***system inventory***);
37. *License remaining time* – shows amount of time (in seconds) remaining for active time limited license (if applicable); in case of no license "N/A" is being shown; in case of unlimited time license "Unlimited" is being shown (command line – ***license status***);
38. *Firmware version* – shows current firmware version. Make sure it is the same on both ends of the link (command line – ***ver***)

3.1.1 Radial MSE

Radial MSE is a method for estimating the signal to noise ratio. ACM engine uses normalized MSE, which is the inverse of SNR. It is calculated by dividing the estimated MSE level with the energy of the received constellation. Radial MSE peak value threshold is dependent on modulation used and LDPC code rate.

If the Radial MSE value exceeds following thresholds, BER at the output of LDPC decoder will reach the value of $1.0 \cdot 10^{-6}$:

4QAM StrongFEC	16QAM StrongFEC	32QAM StrongFEC	64QAM StrongFEC	128QAM StrongFEC	256QAM StrongFEC	256QAM WeakFEC
-8.4 dB	-13.2 dB	-16.3 dB	-19.2 dB	-22.1 dB	-25.1 dB	-27.3 dB

3.1.2 LDPC

The **LDPC** is monitored for the number of errors being corrected on the input of LDPC decoder (see ***Figure 3.2***).

***Figure 3.2** LDPC decoder structure*

LDPC stress value thresholds @ BER $1.0 \cdot 10^{-6}$:

- for Strong FEC mode ~ $4.0 \cdot 10^{-2}$;
- for Weak FEC mode ~ $1.0 \cdot 10^{-3}$

As long as LDPC stress value is under the specified thresholds, the amount of errors (and BER itself) on the output of LDPC remains at zero level.

3.2 Alarm status

Table on "Alarm status" page summarizes current alarms by showing alarm group number, date and time the alarm occurred and its name.

Alarm status			
Alarm gr.	**Date**	**Time**	**Alarm**
38	2012-10-02	14:18:54	Ethernet interface

Full list of alarms is available in "Alarm configuration" page where it is possible to disable alarm if necessary. For further details please refer to ***Chapter 5.1***.

3.3 Ethernet aggr/prot status

Ethernet aggregation/protection status page shows summary of current 2+0/1+0 aggregation/protection status if such is enabled. In case of no configuration "Aggregation/protection is disabled" will be shown.

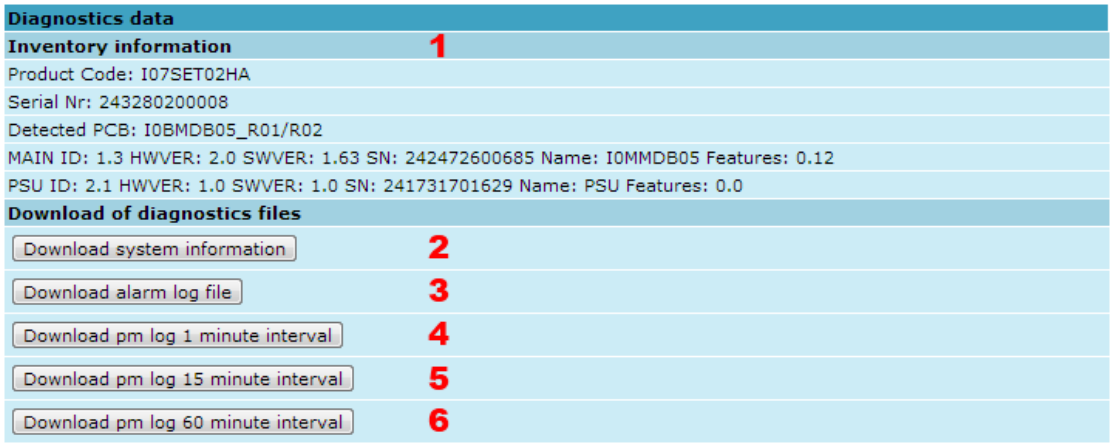
Ethernet aggregation/protection status	
	Clear max N/D time
Local Master device Nr. 1 Aggregation status	
ID	#010
Mode	Aggregation
Role	Master
State	Active
Previous state	Start
Max N/D time	0.00 of 0.60 sec
Alarms	
None	
Local Slave device Nr. 2 Aggregation status	
ID	#020
Mode	Aggregation
Role	Slave
State	Active
Previous state	Broken
Max N/D time	2.73 of 0.60 sec
Alarms	
None	
Remote Master device Nr. 1 Aggregation status	
ID	#010
Mode	Aggregation
Role	Master
State	Active
Previous state	Start
Max N/D time	4.74 of 0.60 sec
Alarms	
None	

1. Clear max N/D time – clear maximum no data time;
2. State – displays current device state status – Active or Standby;

3. Previous state – displays previous device state status;
4. Max N/D time: - displays maximum disconnection time between devices;
5. Alarms - displays alarm notifications:
   - Local modem Airloss – there is no radio connection between local and remote device
   - LAN1-4 link down – media is disconnected;
   - No data from device Nr.1-4 – media is connected but not receiving aggregation information from aggregated device;
   - No data from remote device – local device is not receiving aggregation information from remote device.

3.4 Diagnostics data

"Diagnostics data" page summarizes system inventory and troubleshooting information.



1. *Inventory information* - displays the CFIP Lumina product code, serial number and additional hardware information;
2. *Download system information* - allows saving system information (output from "full system information page") in separate txt file on your hard disk drive. Same functionality is available in "Configuration→System configuration→Service information→Download system information" (***Chapter 4.2.5***);
3. *Download alarm log file* - allows saving alarm log file in separate txt file on your hard disk drive. Same functionality is available in "Performance→Alarm log→>Alarm-event log file<" (***Chapter 5.1.4***);
4. *Download pm log 1 minute interval* - allows saving performance log file for 1 minute intervals in separate txt file on your hard disk drive. Same functionality is available in "Performance→Performance log→Performance log file download: 1 min interval" (***Chapter 5.2.3***);
5. *Download pm log 15 minute interval* - allows saving performance log file for 15 minutes intervals in separate txt file on your hard disk drive. Same functionality is available in "Performance→Performance log→Performance log file download: 15 min interval" (***Chapter 5.2.3***);
6. *Download pm log 60 minute interval* - allows saving performance log file for 60 minutes intervals in separate txt file on your hard disk drive. Same functionality is available in "Performance→Performance log→Performance log file download: 60 min interval" (***Chapter 5.2.3***).

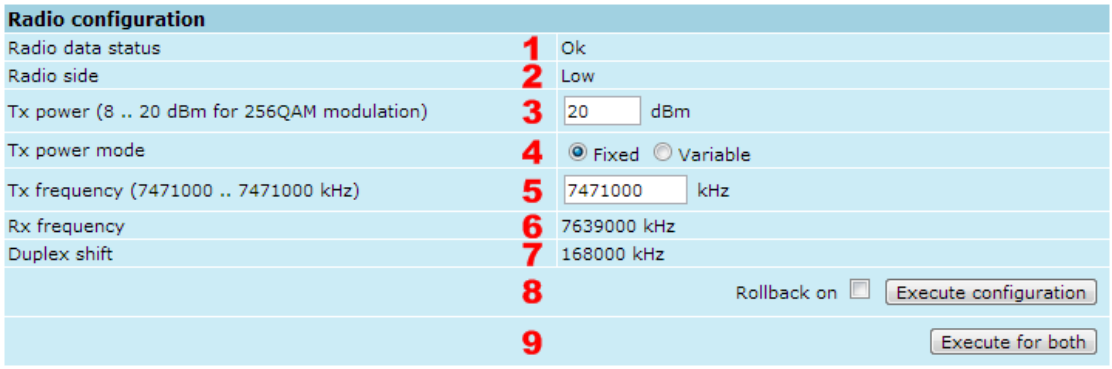
4 Configuration in Web GUI

Configuration section in Web interface allows customizing your system to suit your specific needs.

4.1 Main Configuration

The main configuration window provides the configuration of most vital system parameters, including the ones in configuration wizard as well as some other important parameters. Below is a short explanation of provided customization fields.

4.1.1 Radio Configuration



1. *Radio data status* – shows if management CPU was able to read data from radio;
2. *Radio side* – shows if radio side you are currently viewing is low or high (command line – ***radio side***);
3. *Tx power* – allows you to define transmitter power. If the RSL is too high (much higher than normal -50dBm), you might want to lower transmitter power. Too high Rx level (> -20 dBm) may even result in synchronization loss. The minimum and maximal values you can choose are dependent on modulation type and CFIP model. Maximal and minimal Tx power values are shown in the brackets. Value entry will be disabled if ACM or/and ATPC is enabled. Please disable both in order to change the value (command line - ***radio txpower*** *[<power dBm>]*);

(!) In the table below please see interdependence between antenna used and allowed CFIP Lumina 17 and 24 GHz Tx output power range.

	Antenna size/gain			
	17 GHz		24 GHz	
	30cm (1ft) / 32.2dBi	60cm (2ft) / 37.8dBi	30cm (1ft) / 35.0dBi	60cm (2ft) / 40.3dBi
Tx power (ETSI)	-20…-13 dBm	-20…-18 dBm	-20…-15 dBm	-20 dBm
Tx power (FCC)	-	-	-20…-3 dBm	-20….-8 dBm
Tx power (IC)	-	-	-20…-0 dBm	-20….-0 dBm

4. *Tx power mode* – Tx power will remain constant during ACM operation (modulation downshifting / upshifting) if "fixed" mode is selected otherwise variable Tx power will be applied (command line – ***radio fixedpower*** *[disable|enable or 0|1]);*
5. *Tx frequency* – allows you to enter preferable transmitter frequency, hence defining utilized channel (command line - ***radio txfreq*** *[<freq KHz>]*);
6. *Rx frequency* – shows current receiver utilized frequency (command line - ***radio freq***);
7. *Duplex shift* – shows duplex shift value between the transmitter frequency and receiver frequency (command line - ***radio duplexshift***);

8. Pressing *„Execute configuration”* applies changes made to the corresponding section only for the local side CFIP Lumina. If *„Rollback on”* is selected, configuration will be reverted in case of erroneous configuration changes applied.
9. Pressing *„Execute for both”* applies changes made to the corresponding section both for local and remote side CFIP Lumina.

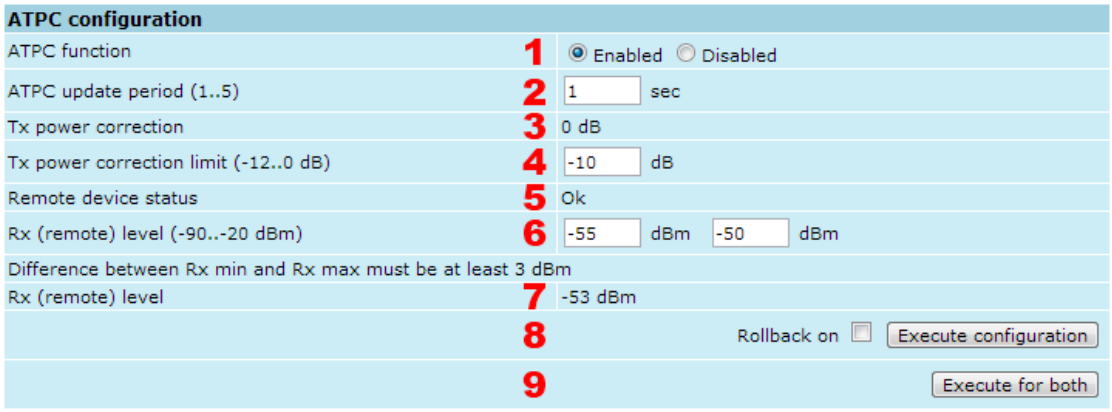
4.1.2 ATPC Configuration

To configure ATPC, it is necessary to set Rx (remote) “min” and “max” values and enable the ATPC feature.

ATPC update period and ATPC delta are recommended to be left unchanged.

It is also possible to change the limit of Tx power correction.

(!) Note, that ATPC is mechanism for reducing Tx power, that’s why to make proper use of ATPC, transmitter power (Tx power) must be set to the maximum value.



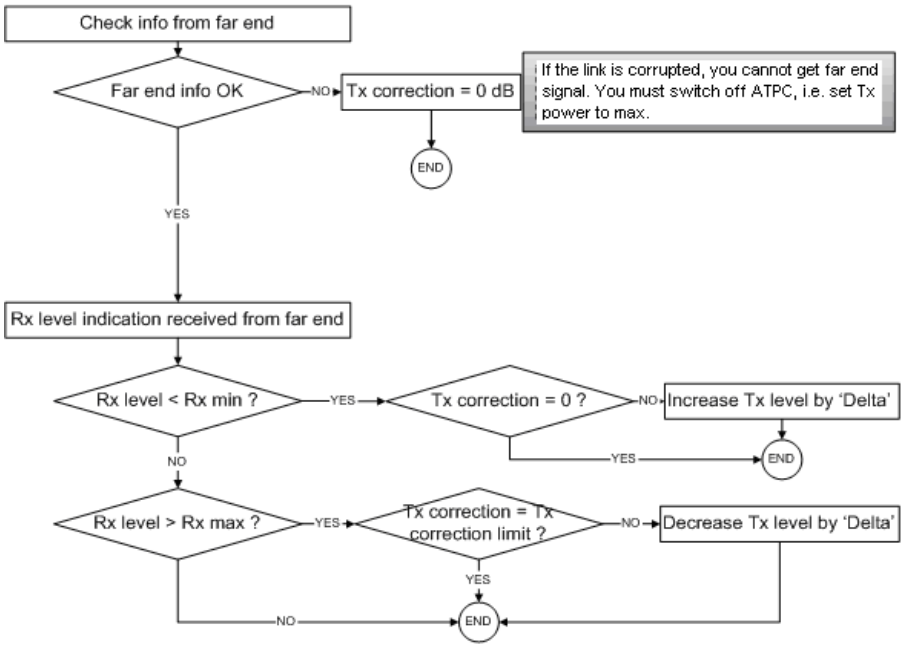
1. *ATPC function* – allows enabling or disabling ATPC (Automatic Transmit Power Control). By default this feature is disabled (command line – ***atpc*** *[enable|disable]*);
2. *ATPC update period (1..5)* – allows defining the period in seconds in which ATPC parameters are being updated. By default the update period is 1 second (command line – ***atpc delay*** *<power change delay time 1..5 sec>*);
3. *Tx power correction* – displays the amount of transmitter power in decibels ATPC has currently corrected (command line – ***atpc status***);
4. *Tx power correction limit* – allows defining the amount of dB ATPC will be able to correct regarding initial Tx power value (command line – ***atpc limit*** *<tx power correction limit>*);
5. *Remote device status* – shows if management CPU was able to read data from remote management CPU;
6. *Rx (remote) level maximum (-60..-20 dBm)* – allows defining the maximum Rx level. ATPC Tx power correction will be performed only in case of exceeding this defined maximum Rx level (command line – ***atpc rxmax*** *<rx level max>*);
7. *Rx (remote) level minimum (-90..-50 dBm)* – allows defining the minimum Rx level. ATPC Tx power correction will be performed only in case of exceeding this defined maximum Rx level (command line – ***atpc rxmin*** *<rx level min>*);
8. By pressing *„Execute configuration”* changes made to the corresponding section apply only for the local side CFIP Lumina FODU. If *„Rollback on”* is selected, configuration will be reverted in case erroneous configuration changes are applied.
9. Pressing *„Execute for both”* applies changes made to the corresponding section both for local and remote side CFIP Lumina FODUs.

ATPC Algorithm

ACM can be implemented together with **automatic transmit power control (ATPC)**, complimentary features that enhance overall system performance. ATPC reduces the average transmitted power as well as CCI and adjacent-channel interference (ACI), which is caused by extraneous power from a signal in an adjacent channel. It also enables a more efficient and cost-effective network frequency plan and deployment, as well as eliminating some of the receivers' "upfade" problems by changing the transmitted power according to the link momentary conditions. The lower average Tx power also extends the equipment's mean time between failures.

ATPC can be used together with ACM to control the transmitted power in any given ACM profile. Different algorithms can be implemented to achieve maximal spectral efficiency or minimal transmitted power using both features in combination. One implementation could target maximal spectral efficacy by trying to reach the highest ACM profile, while the other is willing to compromise on some of the spectral efficiency enabling CCI and ACI reduction. In any chosen algorithm, ATPC reduces the average transmitted power, benefiting each ACM profile and any link condition.

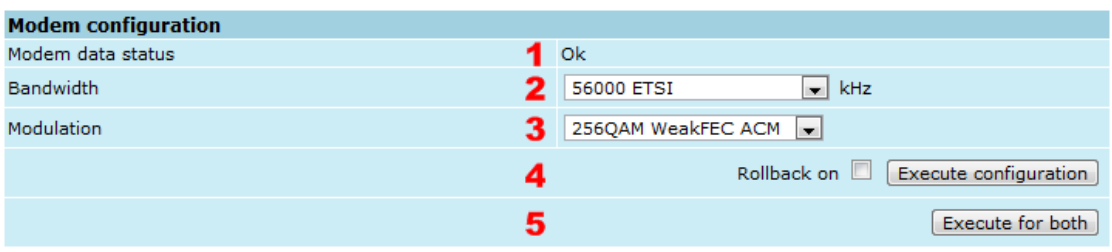
The local CFIP Lumina receives information (each second) about Rx level from the far-end CFIP Lumina through the service channel; depending on the received Rx level parameter, the local CFIP Lumina adjusts the transmitter power in accordance with the algorithm shown below.



Rx level - the the Rx level figure received from the far-end
Rx max - maximum permissible Rx level at the far-end
Rx min - minimum permissible Rx level at the far-end
Tx correction
Tx correction limit
Delta - the value by which the Tx power is increased or decreased according to far-end Rx level indication (1 dBm by default)

Figure 4.1. *ATPC algorithm*

4.1.3 Modem Configuration



1. *Modem data status* – shows if management CPU was able to read data from modem;
2. *Bandwidth* – allows choosing between 14, 20, 28, 30, 40, 50 and 56 MHz ETSI and ANSI (FCC) bandwidths available. The default value is 14 MHz (for P/N I**G******/I**S******) or 20MHz (for P/N I**N******/I**H******). Bandwidth should be configured according to license granted by regulator institution. The wider bandwidth you have, the higher will be the overall link bitrate. Maximum bitrate of 366 Mbps is available using 56 MHz bandwidth (command line – ***modem set*** *<bandwidth> <min_modulation> <max_modulation> <strongFEC|weakFEC>*);
3. *Modulation* – allows choosing between 256QAM, 128QAM, 64QAM, 32QAM, 16QAM and 4QAM modulations. The default value is 4QAM. The higher is the modulation order, the higher is the overall link bitrate, but worse RSL threshold. Maximum bitrate of 366 Mbps is available using 256QAM modulation in Weak FEC mode (command line – ***modem set*** *<bandwidth> <min_modulation> <max_modulation> <strongFEC|weakFEC>*). See below the explanation for **Adaptive Coding** and **Modulation** and **FEC** modes;
4. Pressing *„Execute configuration"* applies changes made to the corresponding section only for the local side CFIP Lumina. If *„Rollback on"* is selected, configuration will be reverted in case of erroneous configuration changes applied.
5. Pressing *„Execute for both"* applies changes made to the corresponding section both for local and remote side CFIP Lumina link.

Adaptive code and modulation (ACM) technology allows operators to achieve high-capacity data transmission over microwave links and improve the link utilization. This reduces both operational and capital expenditures for maintaining high-capacity links. ACM can maintain the highest link spectral efficiency possible at any given time in any link condition.

In traditional voice-dominated wireless backhaul transmission networks, service availability levels of 99.995% are the norm.

However, newer services such as Internet browsing, video streaming and video conferencing can operate at more relaxed availability levels. With use of QoS prioritizing ACM can allocate the required availability based on the priority. As a result, high-priority services such as voice enjoy 99.995% availability, while low-priority services like video streaming are allocated lower priorities.

Use of QoS prioritizing defines which services should be transmitted under any link condition and which services should be adapted whenever the link condition is degraded and the link payload is decreased.

For example, when bad weather has decreased the channel capacity of a link, ACM maintains high-priority services – such as voice data – with full bandwidth capacity while adapting the bandwidth capacity of low- and mid-priority services such as Internet browsing (see ***Figure 4.2***).

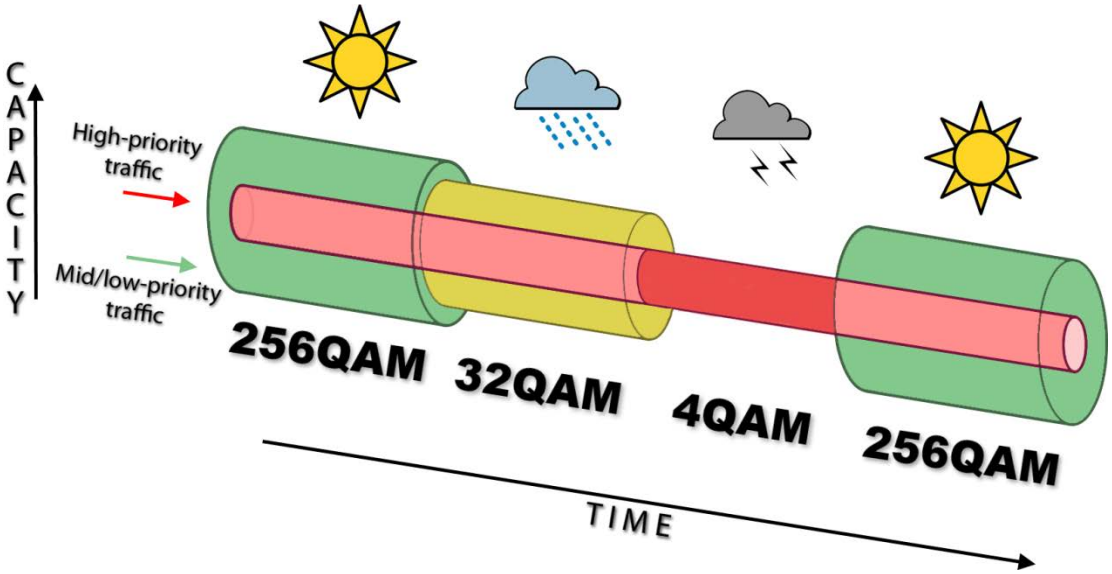


Figure 4.2. *ACM bandwidth capacity adaptation*

Full modulation range: 256QAM, 128QAM, 64QAM, 32QAM, 16QAM, 4QAM

Traffic can be mapped into different priorities, which define the level of service for each application. ***Figure 4.3*** illustrates how different services – such as rich voice and video – are mapped into different classes of availability (CoA) such as 99.995% or 99.687%.

The implementation of multiple priorities increases the available capacity up to 10 times that of standard links. When conditions are clear, the wireless link operates at maximum capacity and provides all services with the full data rate. When link conditions are poor – during harsh rain, for example – predefined high-availability services such as voice are not affected. However, the capacity of low-priority services is adapted dynamically to the changing link conditions. This is done by provisioning bandwidth according to the link conditions and traffic priority.

An ACM profile defines the link parameters (modulation) for a given range of the Radial MSE. The Radial MSE range of each profile defines the threshold for switching from one ACM profile to another. Each ACM profile has a different spectral efficiency, derived from its modulation.

The receiver continuously monitors the link condition based on Radial MSE value.

Once the estimators at the receiver side show that the link performance is not suitable for the current ACM profile, an ACM switching process will be initiated. In case of degradation in the link performance, the new ACM profile will include lower modulation, decreasing the link bitrate. The ACM switching rate is measured in dB/s and is a key feature of ACM systems.

In general, the higher the switching rate, the better the system's immunity to rapid Radial MSE changes. When the switching is being executed, the payload rate is being modified to fit the aggregated data rate to the new available link data rate.

Alternatively, ACM can also be used to increase the link distance, resulting in added link spectral efficiency. The same concept is implemented as previously, with the margins that were kept for 99.995-percent bandwidth availability now used to increase the link distance. Whenever the link conditions are degraded, the system will switch to an ACM profile with lower spectral efficiency to enable maintaining the link.

The following real-world example illustrates the benefits of ACM. Consider a CFIP link operating at 23 GHz with 56 MHz channel spacing and 45.9 dBi (120 cm) antenna gain. The link is operating in a moderate rain region similar to central Europe with a distance of 15 kilometers.

The system operation is set to a minimal payload of 69 Mbps Ethernet for 99.995% availability.

Most of the time system would support a 366Mbps Ethernet connection instead of 69 Mbps connection. The system automatically monitors the link conditions and changes the capacity without interrupting the data transmission (hitless changes), as shown in ***Figure 4.3***.

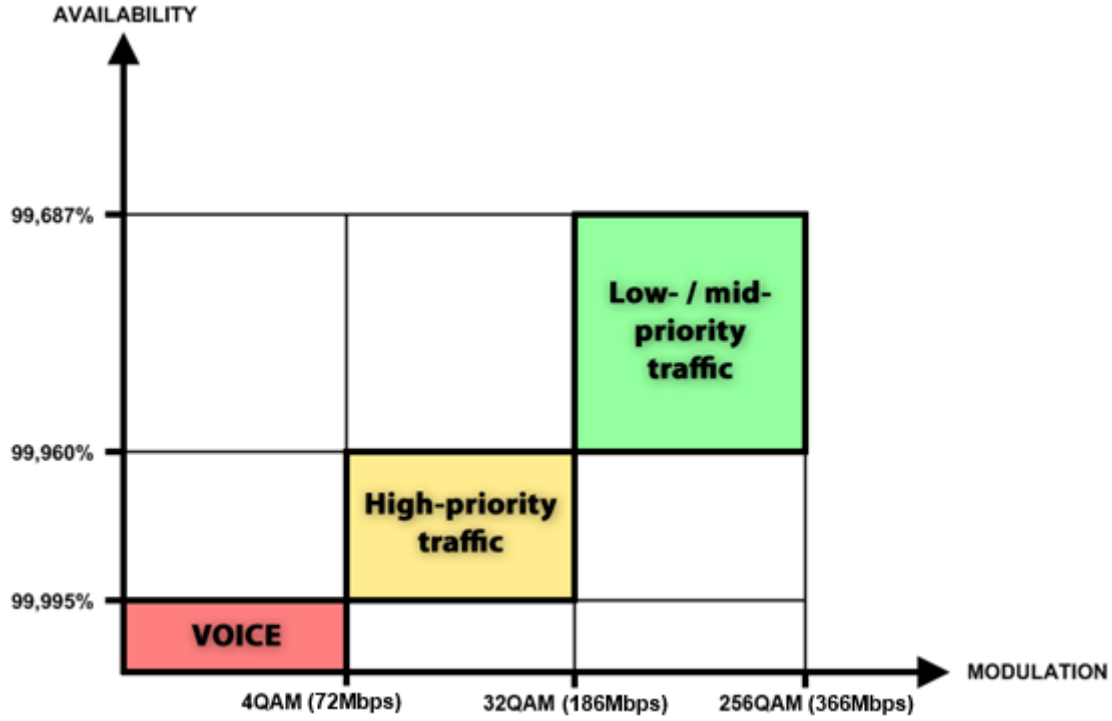


Figure 4.3. *Link availability and classes of services*

In comparison similar system using 256QAM and providing similar capacity would provide only 99,687% of availability. Besides, lack of ACM would not provide higher availability. You would have to decrease the distance, decrease modulation or increase antenna sizes to achieve 99,995% availability for the given link.

This example demonstrates how the new technology, based on an ACM mechanism, can play a key role in the development of cost-effective next-generation wireless access networks, by taking advantage of traffic evolution from synchronous TDM traffic to packet IP-based traffic.

The **FEC** mode (Weak or Strong) allows increasing overall capacity of the link in terms of deteriorating RSL sensitivity threshold.

For more details refer to table in ***Section 1.6***.

4.1.4 Loopback Configuration

Loopback tests are accessible using local or remote management methods.

For safety purposes all loopbacks (local and remote) can be set on a fixed time interval only. If no time interval is specified, the default value is 60 seconds (1 minute).

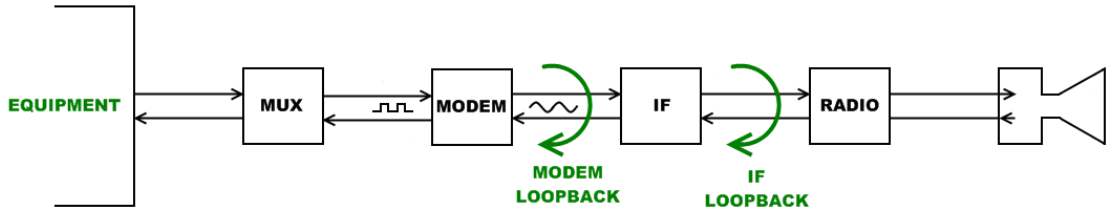
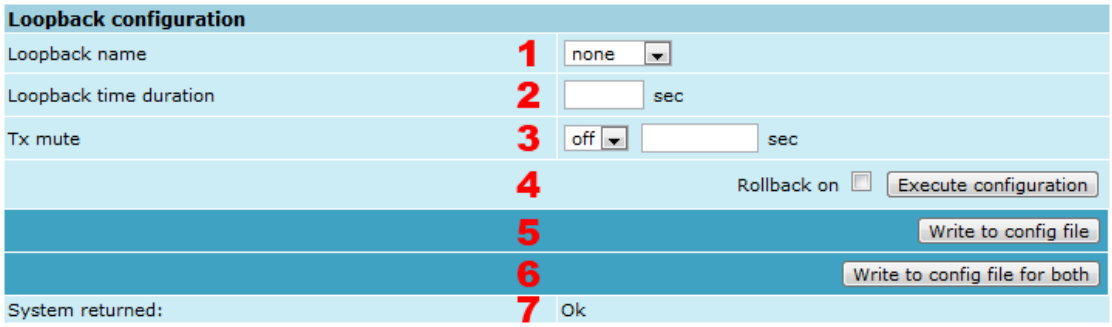


Figure 4.4. *Loopback modes*

- **MODEM** loopback mode loops signal back to local end after the modem;
- **IF** loopback mode loops signal back to local end by linking intermediate frequencies.



1. *Loopback name* – allows choosing loopback mode (command line – ***loopback*** *{status | none | if | modem}} [<time>]*);
2. *Loopback time duration* – allows choosing loopback activity time in seconds (command line – ***loopback*** *{status | none | if | modem}} [<time>]*);
3. *Tx mute* – allows muting transmitter to limited time interval in seconds;
4. Pressing *„Execute configuration"* applies changes made to the corresponding section only for the local side CFIP Lumina. If *„Rollback on"* is selected, configuration will be reverted in case of erroneous configuration changes applied.
5. *Write to config file* – saves all changes made (command line – ***cfg write***);
6. *Write to config file for both* – saves all changes made for local and remote side (command line – ***cfg write***);
7. *System returned* - in case of error or incorrectly entered parameter value, or other problems in the whole page – the info message will be displayed here. Otherwise it says "Ok".

Radio frequency loopback

In order to check performance of CFIP Lumina 17 and 24 GHz, radio frequency loopback should be used:

a. In "Tools→Command line" enter command "radio txpower -10" in order to set transmit output power to -10 dBm;
b. In "Tools→Command line" enter command "loopback rf <time_in_second>", where" <time_in_seconds> should be substituted by sufficient time of loopback operation;

(!) During radio frequency loopback CFIP Lumina flange should be directed in open space avoiding surfaces that could bounce signal back (clearance should be at least 5m).

Radio frequency loopback can be run with antenna connected and will test radio performance together with antenna. In this case clearance should be extended.

c. Observe Rx level during radio frequency loopback operation ("Status → Main status" → Rx level" or "System summary")
d. Using chart below Tx power shouldn't be set (for ATPC) above Maximum Tx power at appropriate Rx level observed:

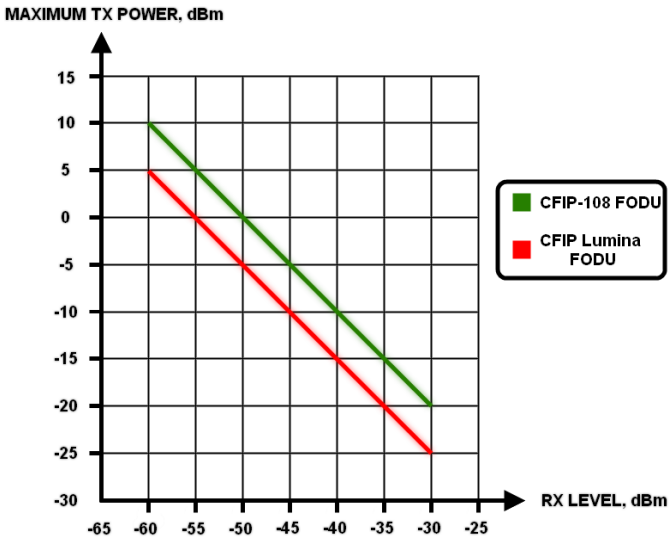


Figure 4.5. *CFIP Lumina radio frequency loopback graph*

For example, if radio frequency loopback indicated Rx level = -55dBm, CFIP Lumina can operate with Tx power up to 0dBm.

Additional radio and modem configuration commands in Telnet/serial interface	
Command	***Description***
modem status	Shows the status of modem parameters
modem allowed [<bandwidth>]	Displays available modulations
modem setfile <file> <modulation min> <modulation max> {StrongFEC|WeakFEC}	Allows configuring modem from external modem configuration file
modem factory *[max]*	Resets modem settings to factory defaults (minimum bandwidth, minimum modulation). 'max' option will set maximum configuration (maximum bandwidth, maximum modulation + ACM).
modem ipremote [on | off]	Allows enabling manual remote IP specifying (*modem ipremote off*). By default remote IP is being obtained automatically (*modem ipremote on*).
modem counters [show | clear]	Shows modem performance counters according to G.826 standard.
radio factory *[max]*	Resets radio settings to factory defaults. By default Tx power will be turned off. 'max' option will switch Tx power to the maximum value after restart.
radio duplexshift [<DS KHz>]	Allows switching to different duplexshift if supported.
radio side [L|H]	Allows switching radio side if supported (CFIP Lumina 17 and 24 GHz).

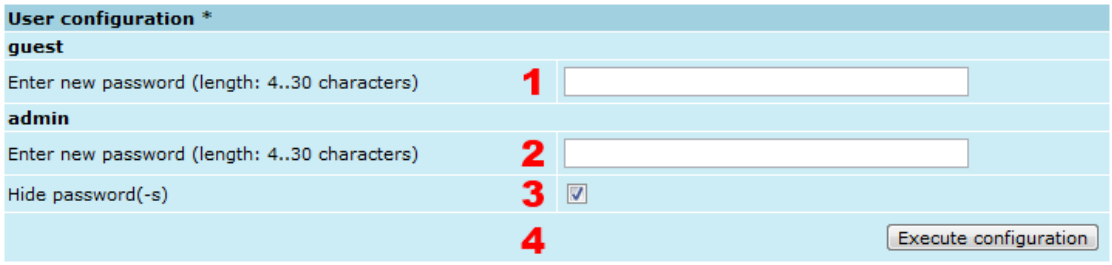
Additional loopback commands in Telnet/serial interface	
Command	***Description***
Loopback status	Displays status of loopback mode.
Loopback *{status | none | if | modem} [<time>]*	Sets the specified loopback mode.

4.2 System Configuration

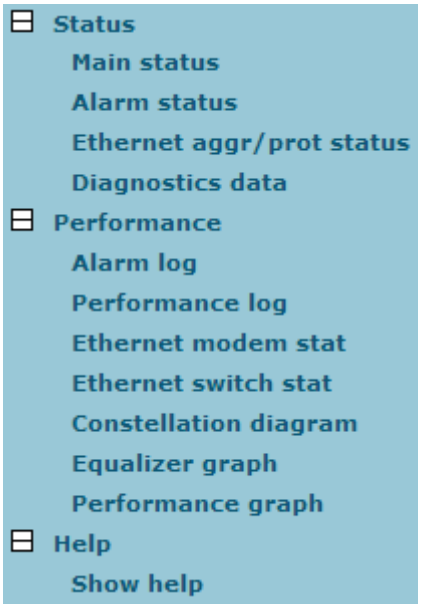
The system configuration window provides the configuration of web access, Telnet and FTP interfaces; allows changing system name, web data refresh time and system time.

Explanation of customization fields:

4.2.1 User Configuration



1. **guest** – *Enter new password (length: 4..30 characters)* – allows entering preferable 'guest' account password and enabling the account. By default guest account is disabled. Maximal length of the password cannot exceed 30 symbols. Guest account has only monitoring privileges. The following Web GUI sections are available:



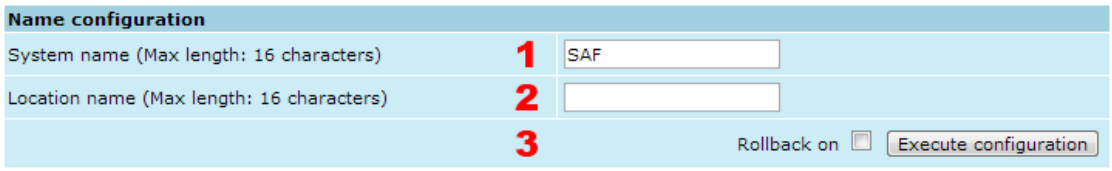
2. **admin** – *Enter new password (length: 4..30 characters)* – allows entering preferable 'admin' account password. Maximal length of the user name cannot exceed 30 symbols. By default password for 'admin' account is '*changeme*'. Admin account has full control of the CFIP configuration process.
3. **Hide password(-s)** – Hides typed in password. This option unchecked will display typed in password in plaintext.
4. Pressing *„Execute configuration"* applies changes made to the corresponding section only for the local side CFIP Lumina. If *„Rollback on"* is selected, configuration will be reverted in case of erroneous configuration changes applied.

More detailed status controls are available in command prompt, which include:

Additional user management commands in Telnet/serial interface	
Command	***Description***
access login *<name> <password>*	Logs on as a user specified by <name> and <password>.
access logout	Logs current user out.

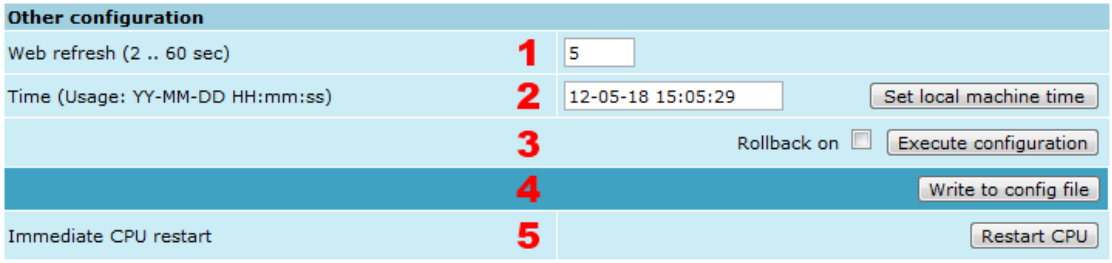
access set *<guest|admin> <password> [plaintext]*	Allows specifying a new password for a specific account (admin or guest). '*plaintext*' option will save the password in plaintext in configuration script without encrypting it (by default saved passwords in configuration file are encrypted).
access show	Shows user name and password's hash of the user currently logged on.
access list	Shows the list of usernames and passwords the current account is able to manage (if logged on as admin, 'guest' and 'admin' account passwords will be seen).

4.2.2 Names Configuration



1. *System name (Max length: 16 characters)* – allows entering preferable system name. Maximum length of the system name cannot exceed 16 symbols. Default name is 'SAF' (command line – ***system name*** *<name>*);
2. *Location name (Max length: 16 characters)* – allows entering preferable system location name. Maximum length of the location name cannot exceed 16 symbols. By default system location is not specified (command line – ***system location*** *<name>*);
3. Pressing *„Execute configuration"* applies changes made to the corresponding section only for the local side CFIP Lumina. If *„Rollback on"* is selected, configuration will be reverted in case of erroneous configuration changes applied.

4.2.3 Other configuration



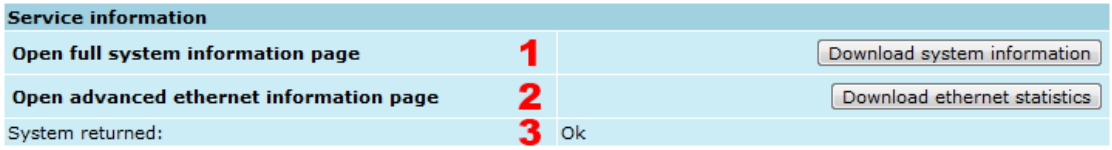
1. *Web refresh (2 .. 60 sec)* – allows specifying time interval of Web data refreshing. The default value is 5 seconds. You can choose between 2 and 60 seconds (command line – ***web refresh*** *<web refresh time>*);
2. *Time (Usage: YY-MM-DD HH:mm:ss)* – allows changing system date and time manually by entering date and time in specific syntax. "*Set local machine time*" button forces system to use the time set on your PC or laptop, from which you are connected to the Web interface (command line – ***system time*** *[yyyy-mm-dd hh:mm:ss]*);
3. Pressing *„Execute configuration"* applies changes made to the corresponding section only for the local side CFIP Lumina. If *„Rollback on"* is selected, configuration will be reverted in case of erroneous configuration changes applied.
4. *Write to config file* - saves to configuration file all the changes made (command line – ***cfg write***);
5. Restarts CFIP Lumina you are connected to (command line – ***system reset***);

(!) Note that after restarting the CFIP will use only those settings, which are written to the configuration file. Other settings will be set to default values.

4.2.4 Upgrade Software

1. *Choose file* – allows choosing location of software upgrade file (e.g. cfipl153.elf.ezip) stored on your hard disk. Software upgrade file must have *.elf.ezip extension.

4.2.5. Service information



1. *Open full system information page / Download system information* – allows to open/save full system information page. Links on the top of opened page ("Open full system information page") allow you to save full system information page and alarm log in separate txt files on your hard disk drive;
2. *Open advanced ethernet information page / Download ethernet statistics* – allows to open/save advanced Ethernet statistics. Link on the top of opened page ("Open advanced ethernet information page") allows you to save advanced Ethernet statistics page in separate txt file on your hard disk drive;
3. *System returned* - in case of error or incorrectly entered parameter value, or other problems in the whole page – the info message will be displayed here. Otherwise it says "Ok".

(!) Note that Advanced Ethernet information page resets all counters and gathers Ethernet information. Please wait until information is gathered and displayed.

Additional system commands in Telnet/serial interface	
Command	***Description***
System status	Displays the name of the device and its uptime.
System inventory [show]	Displays the CFIP Lumina product code, serial number and additional information.
System aliases [list | all | basic | off | add | remove | clear]	**list** – shows the alias list and whether the aliases are going to be used. The user can choose whether to see all the aliases (adding the argument "all"), built-in aliases ("built-in"), or optional aliases ("optional") , or user aliases ("user"); **all** – all the aliases will be used; **basic** – only basic (built-in, hidden and user) aliases will be used; **off** – no aliases will be used; **add** – if two arguments are given, creates an alias of the second argument, named as the first argument. If one argument given, alias command tries and loads the aliases from a file specified by the argument; **remove** – removes the alias specified by the argument; **clear** – removes all the user aliases.
System commands [show | help]	**show** – displays all available commands; **help** – displays available help messages for all commands.
System reset [cold]	Restarts CPU of the management controller. Resets all management

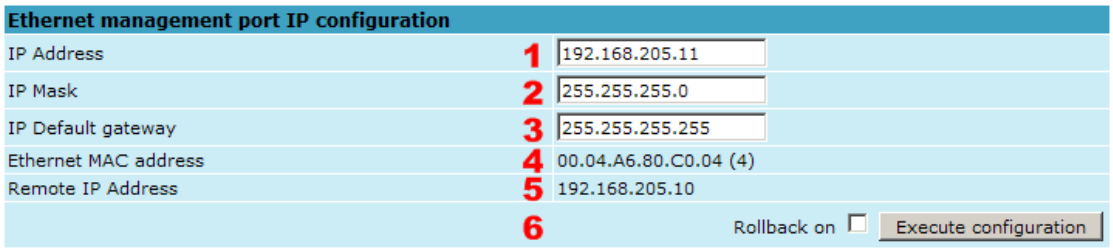
	counters. **cold** – Restarts modem as well.
System contact <contact>	Allows to specify contact person for this managed node.
Ver	Displays hardware and software version of FODU, as well as built date.

4.3 IP Configuration Window

The IP configuration window provides configuration of the Ethernet management port addressing, IP services and routes. Settings listed here are essential for building a network or other specific traffic purposes.

Explanation of customization fields:

4.3.1 Ethernet management port IP configuration



1. *IP Address* – allows specifying IP address of CFIP Lumina you are currently logged in. Default IP address is 192.168.205.10 or 192.168.205.11 – depending on which side the specific CFIP Lumina is – low side has 192.168.205.10 IP address and high side – 192.168.205.11 (command line – ***net ip addr*** *<addr>*);

   (!) Note that CFIP Lumina IP addresses need to be in the same subnet.

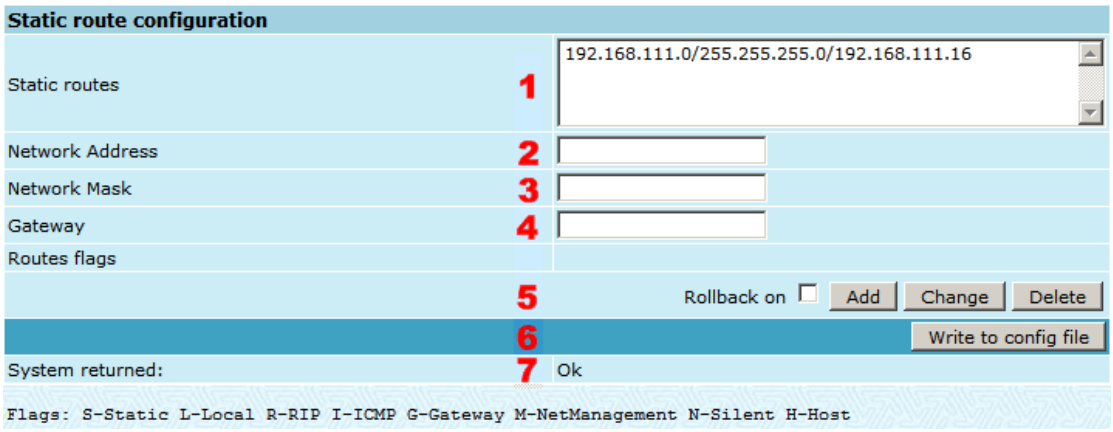
2. *IP Mask* – allows specifying IP mask of CFIP Lumina you are currently logged in. Default IP mask is 255.255.255.0, and it should not be changed unless you are owning network with huge amount of hops (command line – ***net ip mask*** *<mask>*);
3. *IP Default gateway* – allows specifying gateway of CFIP Lumina you are currently logged in. Default gateway is 255.255.255.255 which means that there is no gateway specified (command line – ***net ip gw*** *<gw>*);
4. *Ethernet MAC address* – shows the MAC address of CFIP Lumina you are currently connected to (command line – ***net mac***);
5. *Remote IP Address* – shows IP address of remote (far-end) CFIP Lumina to ensure communication between link sides (command line – ***net ip remaddr*** *<remaddr>*);
6. Pressing *„Execute configuration"* applies changes made to the corresponding section only for the local side CFIP Lumina. If *„Rollback on"* is selected, configuration will be reverted in case of erroneous configuration changes applied.

4.3.2 IP Services

1. *FTP service* – starts FTP service for file access and software update of your CFIP Lumina. By default FTP service is not running (command line – ***net start ftp***);
2. *TFTP service* – starts TFTP service for file transfer between both CFIP Lumina link sides. By default TFTP service is not running (command line – ***net start tftp***).

4.3.3 Static Route Configuration

(!) Do not make any changes to default route; otherwise, management connection to CFIP will be lost.



1. *Static routes* – shows the list of existing static routes, as well as allows you to choose specific route you are willing to change or delete. By default there is one route which depends on earlier entered IP settings (command line – ***net route***);
2. *Network address* – allows specifying network address for the route changing/adding (command line – ***net route add|delete*** *<dest addr> [MASK <mask>] <gateway>*);
3. *Network mask* - allows specifying network mask for changing/adding the route (command line – ***net route add|delete*** *<dest addr> [MASK <mask>] <gateway>*);
4. *Gateway* - allows specifying gateway for the route changing/adding (command line – ***net route add|delete*** *<dest addr> [MASK <mask>] <gateway>*);
5. After entering addresses or selecting a specific route, buttons "Add", "Change" and "Delete" allow you to modify CFIP Lumina routes. If *„Rollback on"* is selected, configuration will be reverted in case of erroneous configuration changes applied.
6. Writes to configuration file all the changes made on the whole page (command line – ***cfg write***);
7. *System returned* - in case of error or incorrectly entered parameter value, or other problems on the whole page – the info message is being shown here. Otherwise it says "Ok".

Additional network configuration commands in Telnet/serial interface	
Command	***Description***
net ping *<ip>*	This command is for troubleshooting purposes to verify the service channel connectivity, - it sends ICMP packet to the specified IP address and waits for a reply.
net telnet *<host> [<port>]*	Opens Telnet session with the FODU, *host* – IP address of the FODU management Ethernet port.
net tftp *<host> {get | put} <source> [<destination>]*	Uploads or downloads (put/get) file (<source>) to or from the host unit (<host>).
net discovery *<host> [<port>]*	Provides list of other CFIP equipment in the same subnet.
web trace *{show | on | off}*	Web trace allows you to see commands being executed through Web interface when you're using serial or telnet connection. *Show* – shows web trace status (on or off), *on* – turns web trace on, *off* – turns web trace off.

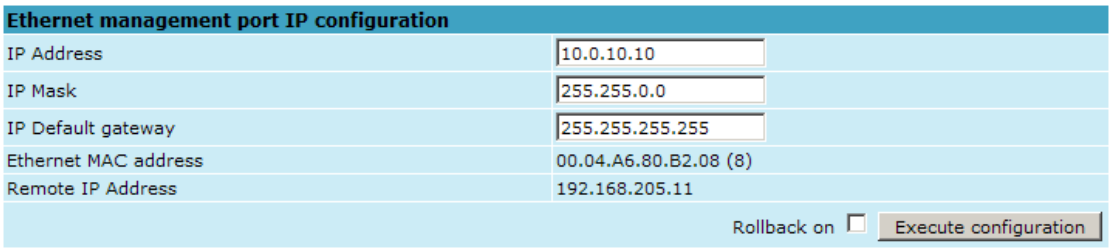
web timeout <time in minutes>	Allows setting the time, after which the Web GUI presumes no connectivity state. By default the value is set to 15 minutes.
web alert *<on | off>*	Allows disabling error message in case of no connectivity to Web GUI. By default this parameter is enabled (on).

Below is the explanation of the procedure of network IP configuration in case of network IP Class area change.

For the purpose of illustration, we use B class IP network address 10.0.10.11 for the remote side CFIP and 10.0.10.10 for the local side CFIP, while the IP address of our management PC LAN adapter is 10.0.0.1.

The steps of the configuration procedure are as follows:

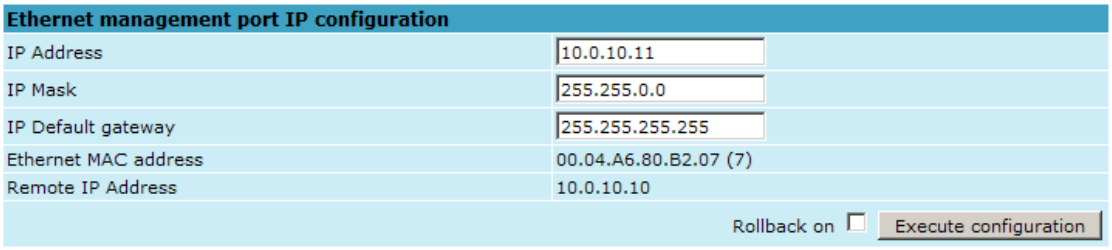
1) Enter the remote side (far-end) Web GUI first (in the following case it is 192.168.205.10) and go to **"IP configuration"**. The configuration in this particular example will look in the following way:



(!) *„Rollback on"* should not be selected!

Press *„Execute configuration"*.

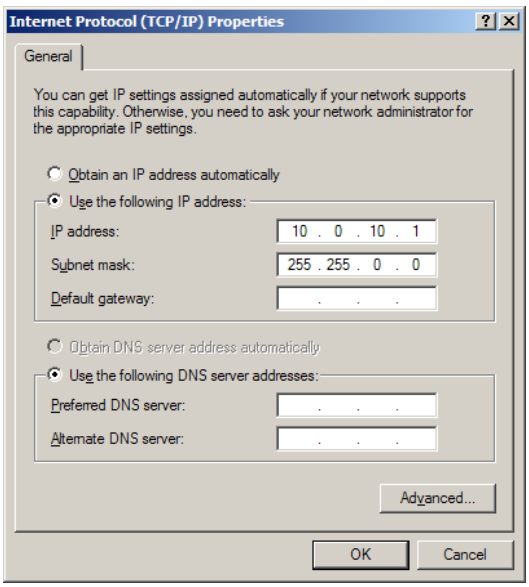
2) Enter the local side (close-end) Web GUI and go to **"IP configuration"**. The configuration will look in the following way:



(!) *„Rollback on"* should not be selected!

Press *„Execute configuration"*.

3) In "MS Windows" go to "Control panel → Network Connections". In LAN "Properties" find "Internet Protocol TCP/IP" and click on its "Properties" (detailed description is in ***Chapter 2.2.3***. Configuration of LAN Ethernet port must be as follows:



4) Go to the remote side Web GUI, choose "Tools → Configuration file" and press "Cfg write".

5) Repeat step 4) for the local side Web GUI.

4.4 Ethernet Configuration

The Ethernet configuration window provides the speed settings for all four LAN ports of Ethernet switch as well as shows the current status of all four LAN ports (command line – ***ethernet stat***).

Explanation of customization fields:

Ethernet configuration

Ethernet status and configuration

Ethernet BPDU 1			(•) Transparent ( ) Filter		
2	**LAN 1**	**LAN 2**	**LAN 3**	**LAN 4**	**WAN**
Port state 3	N/A	N/A	Ok	Ok	Ok
Link 4	N/A	N/A	Off	100 Mbps	1000 Mbps
Duplex (actual) 5	N/A	N/A	Full	Full	Full
Rx flow 6	N/A	N/A	Off	On	On
Tx flow 7	N/A	N/A	Off	On	On
Rx state 8	N/A	N/A	On	On	On
Tx state 9	N/A	N/A	On	On	On
Speed (set) 10	N/A	N/A	auto	auto	
Ethernet flowcontrol 11	N/A	N/A	(•) On ( ) Off	(•) On ( ) Off	Auto [✓] Auto
12				Rollback on [ ]	Execute configuration

Ethernet ingress/egress rate configuration 13

Port	Ingress rate	Egress rate
LAN 1	N/A	N/A
LAN 2	N/A	N/A
LAN 3 (64 .. 1024000 Kbit/s)	Disabled Kbit/s	Disabled Kbit/s
LAN 4 (64 .. 1024000 Kbit/s)	Disabled Kbit/s	Disabled Kbit/s
WAN (64 .. 1024000 Kbit/s)	Disabled Kbit/s	Disabled Kbit/s
MNG (64 .. 1024000 Kbit/s)	Disabled Kbit/s	Disabled Kbit/s

14		Rollback on [ ] Execute configuration
15		Write to config file
System returned: 16	Ok	

1. *Ethernet BPDU* – allows tunelling BPDU packets transparently by internal CFIP Lumina's switch (Transparent) or filtering and dropping BPDU packets (Filter) (command line – ***ethernet BPDU*** <*transparent* | *filter*>);

2. Represents all four LAN (Local Area Network) ports of the CFIP Lumina's switch;

   Port 1 and 2 correspond to optical Ethernet ports #1 and #2 (second available for 2-port optical CFIP Lumina).

   Port 3 and 4 correspond to electrical Ethernet ports #1 and #2 (second available for 2-port electrical CFIP Lumina).

(!) Hybrid CFIP Lumina with both optical and electrical Ethernet ports will have LAN Ports 2 and 3 active.

   Unavailable CFIP Lumina ports appear as N/A.

3. *Port state* – shows operation status of each port;
4. *Link* – shows whether link with appropriate port is established;
5. *Duplex (actual)* – shows if port is currently operating in full or half duplex mode;
6. *Rx flow* – shows if 'flow control' is enabled or disabled for regress traffic;
7. *Tx flow* – shows if 'flow control' is enabled or disabled for egress traffic;
8. *Rx state* – shows if regress activity is allowed;
9. *Tx state* – shows if egress activity is allowed;
10. *Speed (set)* – shows current operation mode of each port and allows to set manual speed setting (10hdx/10fdx/100hdx/100fdx/1000fdx) (command line – ***ethernet set*** *<1 | 2 | 3 | 4> connection <auto | 10hdx | 10fdx | 100hdx | 100fdx | 1000fdx>*);

(!) It is not possible to change speed/duplex setting for CFIP Lumina optical ports (LAN 1 and LAN 2).

11. *Ethernet flowcontrol* – allows manually disabling or enabling flow control for specific port. Default option is auto (from autonegotiation). Uncheck "auto" in order to enable manual force mode.
12. Pressing *„Execute configuration"* applies changes made to the corresponding section only for the local side CFIP Lumina. If *„Rollback on"* is selected, configuration will be reverted in case of erroneous configuration changes applied;
13. *Ethernet ingress/egress rate configuration* – allows configuring ingress and egress rates on available Ethernet switch ports. In case ver.2 license with Ethernet rate limitation is applied, according Ethernet limitation will be indicated as ingress rate limitation will be indicated for WAN port;
14. Pressing *„Execute configuration"* applies changes made to the corresponding section only for the local side CFIP Lumina. If *„Rollback on"* is selected, configuration will be reverted in case of erroneous configuration changes applied;
15. Writes to configuration file all the changes made on the whole page (command line – ***cfg write***);
16. *System returned* - in case of error or incorrectly entered parameter value, or other problems on the whole page – the info message is being shown here. Otherwise it says "Ok".

4.5 Link aggregation and protection

4.5.1 Link aggregation 2+0 and protection 1+1

Link aggregation in 2+0 mode allows utilizing up to 732 Mbps Ethernet Layer 2 throughput (256QAM @ 56MHz) by using independent frequency pair for each link. Link protection in 1+1 HSB (Hot Stand-By) mode allows utilizing up to 366Mbps by using single frequency pair for both links. Traffic is being balanced (2+0) or protected (1+1) by internal switches of Master link. In case of link

aggregation 2+0 traffic distribution between two links is based upon the source and destination MAC addresses of Ethernet packets. Link aggregation (2+0) requires multiple MAC to MAC address pair connections as path for each connection is chosen based upon Ethernet frame's source and destination MAC addresses.

In case of link aggregation 2+0 OMT, dual-polarized antenna or coupler can be used; in case of link protection 1+1 only coupler can be used (as single frequency pair is being utilized).

When active link is down, in 2+0 mode all connections are being switched to second active link, but in 1+1 – to the standby link, which becomes active. Switchover time is below 160ms.

Necessary equipment for CFIP Lumina link aggregation 2+0 and protection 1+1 setup

1. 2 CFIP Lumina links, each CFIP Lumina FODU with 2 Ethernet ports
2. 2 Gigabit Ethernet switches with at least 4 ports. There are no special requirements for external switch (*SOHO* switches can be used).

General configuration guide

1. Do not interconnect CFIP Lumina with each other and do not plug CFIP Lumina into switches before you have finished the configuration.
2. Choose one link which will operate as "Master". Other link will operate as "Slave"
3. Configure each link separately in mode you would like to operate. All CFIP Lumina links should operate in the same operational mode (bandwidth, modulation, Ethernet capacity)
4. In case of link aggregation 2+0 different frequencies should be set for master and slave links, in case of link protection 1+1 – same frequency pair for both links.
5. Choose different IP addresses for each CFIP Lumina unit. Please see example given in ***Figure 4.5.***
6. Remote IP address for all units should be entered manually. In order to do that in "Tools→Command line" should be entered "*modem ipremote off*" command and afterwards appropriate remote IP address entered in "Configuration→IP configuration"
7. When you have configured both links proceed with 2+0 or 1+1 configuration

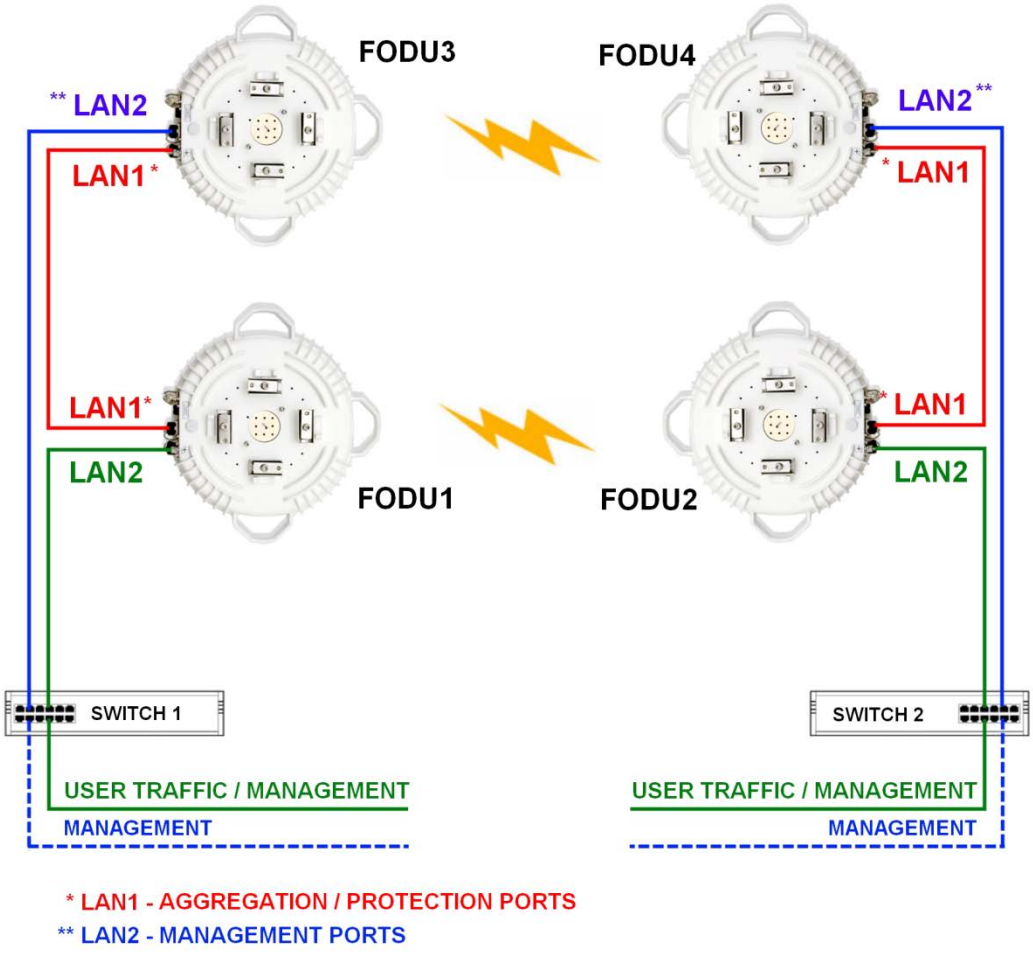
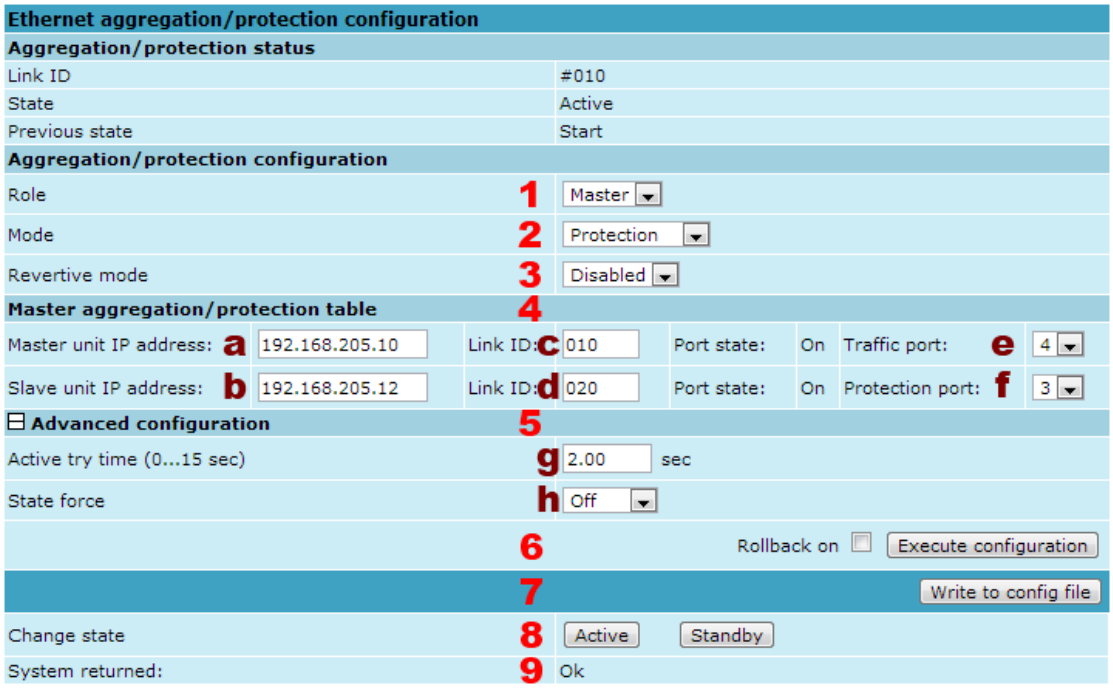


Figure 4.5. Link aggregation 2+0 / protection 1+1 setup

FODU1 IP address - 192.168.205.10 – Master local unit
FODU2 IP address - 192.168.205.11 – Master remote unit
FODU3 IP address - 192.168.205.12 – Slave local unit
FODU4 IP address - 192.168.205.13 – Slave remote unit

Configuration for Master unit:



1. *Role* – choose *"Master"*;
2. *Mode* – choose "Aggregation" for link aggregation 2+0 or "Protection" for link protection 1+1;
3. *Revertive mode* – in case of "enabled" setting link will automatically reconfigure back to 2+0 operation when unit/cable/link failure is resolved. In case of "disabled" setting link will continue to operate in 1+0 mode; In order to activate 2+0 manually, it is necessary to press "Change state: Active" button on any of two Slave units.
4. In "Master aggregation/protection table" set the following:
    - *a* IP address of Master unit (you are configuring)
    - *b* IP address of Slave unit (directly connected to Master unit *a*)
    - *c* Link ID for Master link (same Link ID should be set on second Master unit)
    - *d* Link ID for Slave link (same Link ID should be set on second Slave unit)
    - *e* LAN port number which will be used as Traffic port (connection to external switch)
    - *f* LAN port number which will be used as Aggregation/Protection port (connection with Slave unit)
5. Only for link protection 1+1:
    - *g* Active try time – change only if required
    - *h* State force – use only for testing purposes in order to force unit to Active state
6. Change state – use only for testing purposes in order switch working link;
7. Pressing *„Execute configuration"* applies changes made to the corresponding section only for the local side CFIP Lumina. If *„Rollback on"* is selected, configuration will be reverted in case of erroneous configuration changes applied;
8. Writes to configuration file all the changes made on the whole page (command line – ***cfg write***);
9. *System returned* - in case of error or incorrectly entered parameter value, or other problems on the whole page – the info message is being shown here. Otherwise it says "Ok".

Configuration for Slave unit:

1. *Role* – choose *"Slave"*;
2. *Mode* – choose "Aggregation" for link aggregation 2+0 or "Protection" for link protection 1+1;
3. *Revertive mode* – in case of "enabled" setting link will automatically reconfigure back to 2+0 operation when unit/cable/link failure is resolved. In case of "disabled" setting link will continue to operate in 1+0 mode; In order to activate 2+0 manually, it is necessary to press "Change state: Active" button (h) on any of two Slave units.
4. In "Slave aggregation/protection table" set the following:

a IP address of Master unit (directly connected to Slave unit *b*)
b IP address of Slave unit (you are configuring)
c Link ID for Master link (same Link ID should be set on second Master unit)
d Link ID for Slave link (same Link ID should be set on second Slave unit)
e LAN port number which will be used as Management port (connection to external switch)
f LAN port number which will be used as Aggregation/Protection port (connection with Master unit)

5. Only for link protection 1+1:
   g Active try time – change only if required
   h State force – use only for testing purposes in order to force unit to Active state
6. Change state – use to manually reactivate 2+0 mode if "Revertive mode" was disabled;
7. Pressing *„Execute configuration"* applies changes made to the corresponding section only for the local side CFIP Lumina. If *„Rollback on"* is selected, configuration will be reverted in case of erroneous configuration changes applied;
8. Writes to configuration file all the changes made on the whole page (command line – ***cfg write***);
9. *System returned* - in case of error or incorrectly entered parameter value, or other problems on the whole page – the info message is being shown here. Otherwise it says "Ok".

4.6 VLAN Configuration

The VLAN configuration window provides configuration of port-based Ethernet Virtual Local Area Networks (VLANs), allowing using up to 4095 different VLAN IDs. It is possible to assign 2 modes to your VLANs – Trunk (VLAN tagged packets are passed through on egress and ingress directions) and Access (VLAN tagged packets are untagged on egress direction).

In order to add VLAN tag to untagged packets on ingress direction, according "Default VLAN" (5) should be specified. By default "Default VLAN" value on all ports is VLAN ID 1.

When upgrading from any firmware prior to 1.63.xx, "Default VLAN" VID 0 will be changed to VID 1, but if "Default VLAN" VID was other than "0", it will remain the same.

Additionally starting from 1.63.xx firmware all ports (except WAN) by default are configured as Access VLAN ID 1.

(!) When upgrading from any firmware prior to 1.63.xx you had VLAN configuration applied, management access will be available with previously specified management VLAN ID (as Default VLAN ID will remain the same), but it will be required to delete VLAN ID 1 from VLAN configuration table in order to make any further changes to VLAN configuration table.

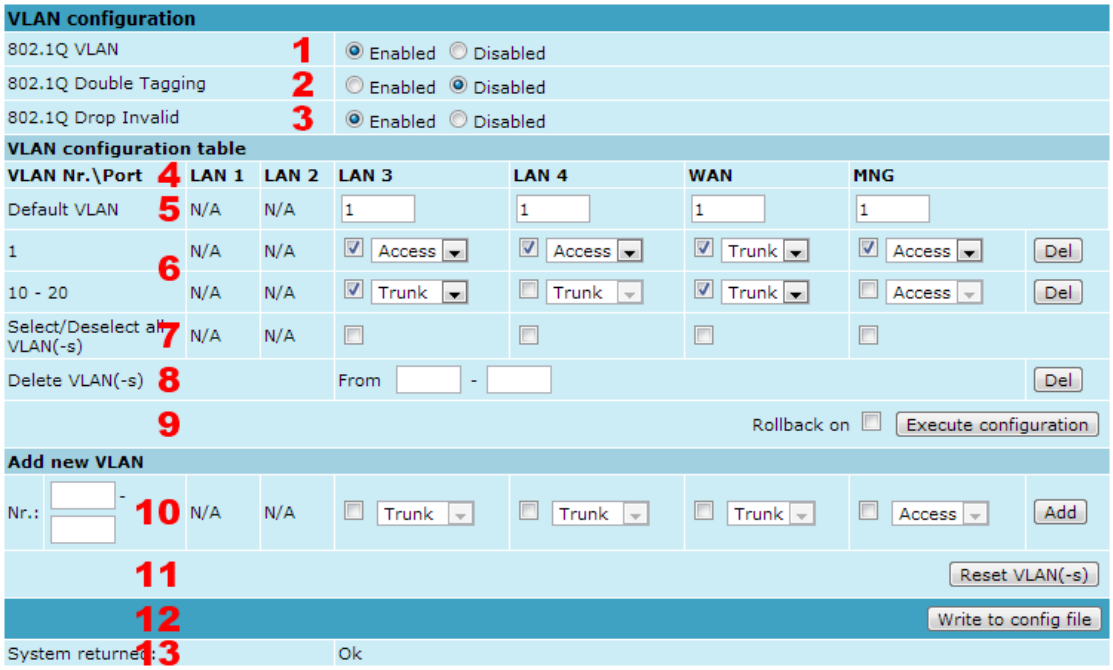


Figure 4.5. *VLAN configuration*

1. *802.1Q VLAN* – enables support of 802.1Q VLAN (command line – ***ethernet vlan*** [enable | disable]);
2. *802.1Q Double Tagging* – enables double tagging feature, which is useful for ISP applications. When the ISP aggregates incoming traffic from each individual customer, the extra tag (double tag) can provide an additional layer of tagging to the existing IEEE 802.1Q VLAN. The ISP tag (extra tag) is a way of separating individual customers from other customers. Using the IEEE 802.1Q VLAN tag, a user can separate the individual customer's traffic; With enabled QinQ feature, client VLAN (C-tag) stays with default Ether type 0x8100 and Service tag (S-tag) is added with Ether type 0x9100.
3. *802.1Q Drop Invalid* – frames without corresponding entry in VLAN table are being dropped;
4. *VLAN Nr.\Port* – displays all 6 ports of the switch;
5. *Default VLAN* – specifies default VID for nonIEEE 802.1Q frames;
6. VLAN table displays the list of set VLAN IDs and appropriate VLAN types on all available switch ports;
7. *Select/Deselect all VLAN(-s)* – Allows selecting or deselecting all VLANs of the corresponding port;
8. You can delete single VLANs or VLAN ranges by entering preferable VID range and pressing "*Del*" button;
9. Pressing *„Execute configuration"* applies changes made to the corresponding section only for the local side CFIP Lumina. If *„Rollback on"* is selected, configuration will be reverted in case of erroneous configuration changes applied;
10. You can add new VLANs by entering preferable VID, enabling appropriate port, choosing VLAN type and pressing "*Add*" button;
11. *Reset VLAN(-s)* – resets the whole VLAN configuration (command line – ***ethernet vlan reset***);
12. Writes to configuration file all the changes made on the whole page (command line – ***cfg write***);
13. *Execution status* - in case of error or incorrectly entered parameter value, or other problems on the whole page – the info message is being shown here. Otherwise it says "Ok".

To ensure correct operation of VLANs, both individual VLAN IDs and general 802.1Q VLAN should be enabled.

4.6.1 Ethernet Switch Port Status and Settings

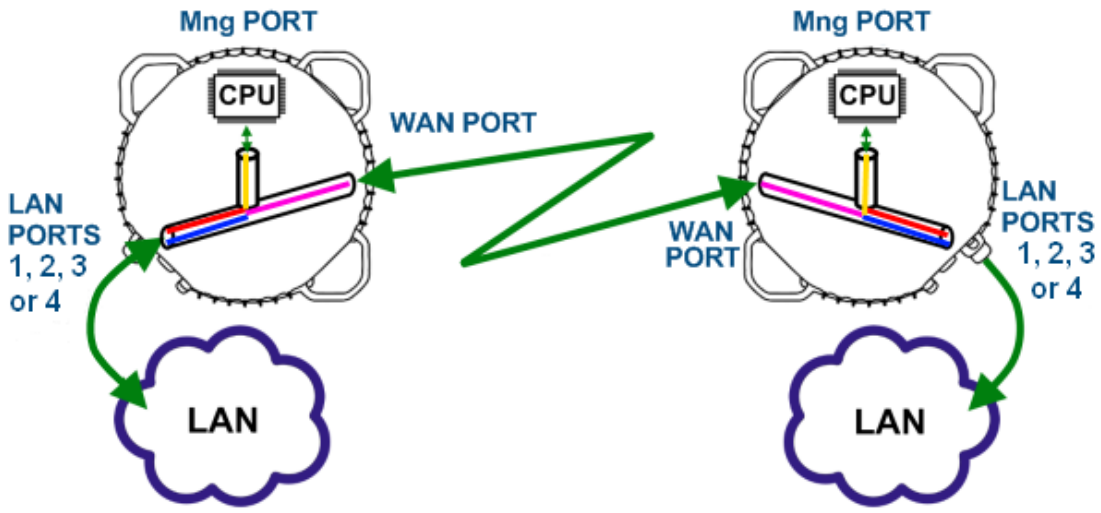


Figure 4.6.

Switch LAN ports 1, 2, 3 and/or 4 (depends on CFIP Lumina model) are connected to LAN interface.

Switch WAN port is connected to WAN interface, modem and radio part.

Switch Management port is connected to Management CPU.

4.6.2 Ethernet Switch VLAN Status and Settings

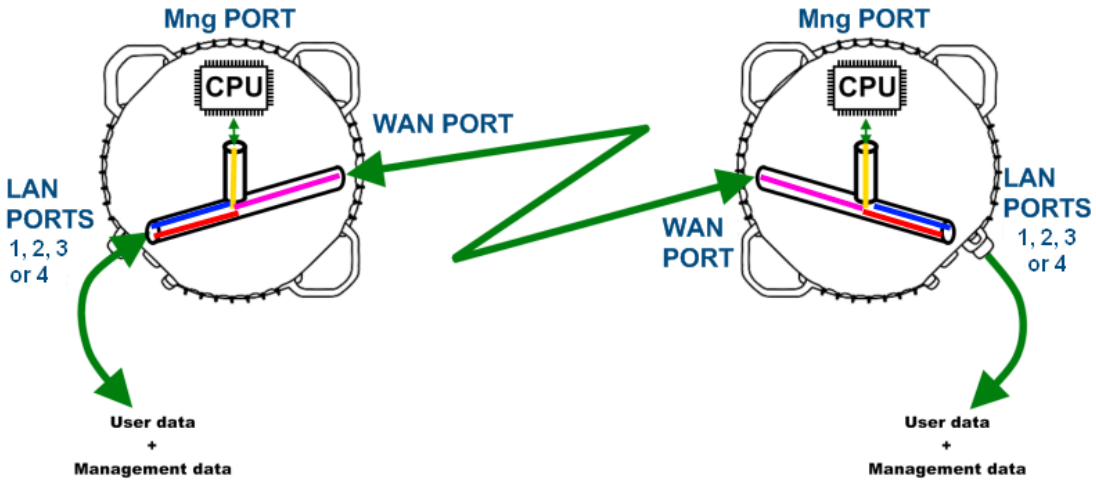


Figure 4.7. *System without VLANs*

When VLANs are not used (***Figure 4.7***), user data and management data are not separated either logically, or physically.

When using VLANs (***Figure 4.8***), it is necessary to use external switch. These switches add/remove VLAN tags per port basis. Thus, management data and user data have different VLAN tags and are logically separated.

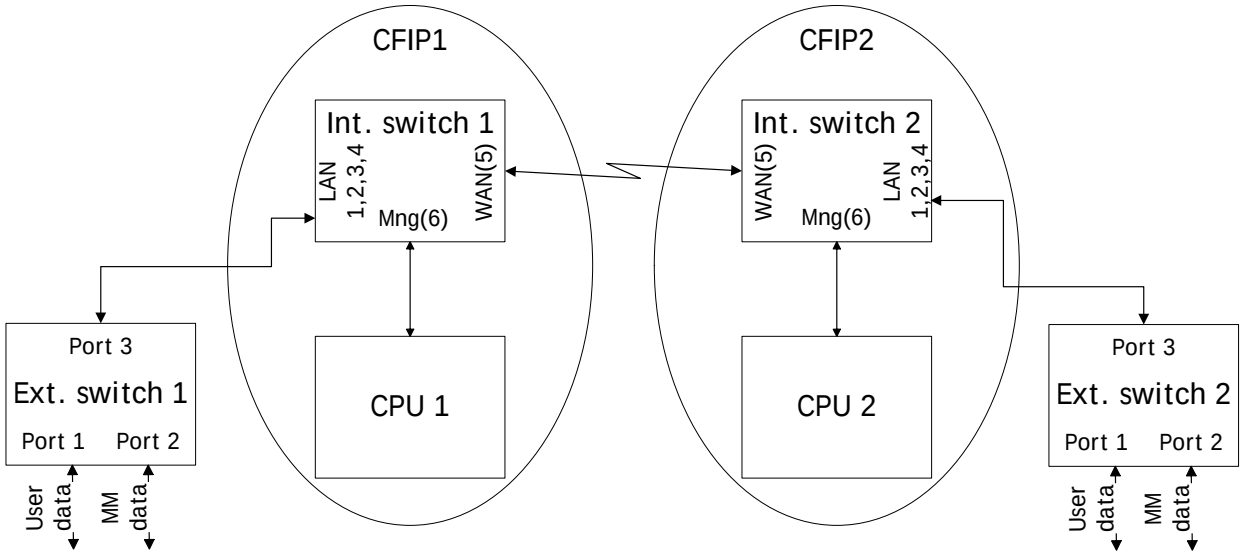


Figure 4.8. *System with VLANs*

System with two separate VLANs – A and B**.** ***Figure 4.9.*** represents ports membership to VLANs.

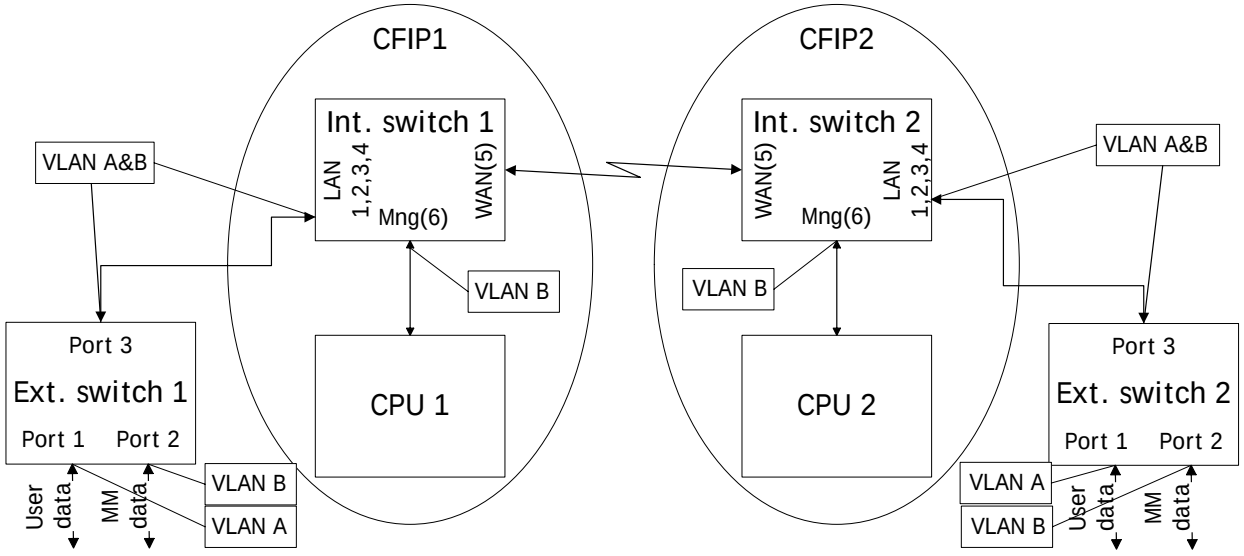


Figure 4.9. *VLANs and ports membership*

LAN and WAN ports of Int. switch 1 and switch 2 are sending and receiving packets according to VLAN IDs configured, and adding VLAN tags for packets outgoing from Management port. Additionally, VLAN tag is removed at Management (P6) port of Switch 1 and Switch 2.

VLAN A is Trunk VLAN Type on ports LAN (P1-P4) & WAN (P5).

VLAN B is Trunk VLAN Type on ports LAN (P1-P4) & WAN (P5) and Access VLAN Type on Management (P6).

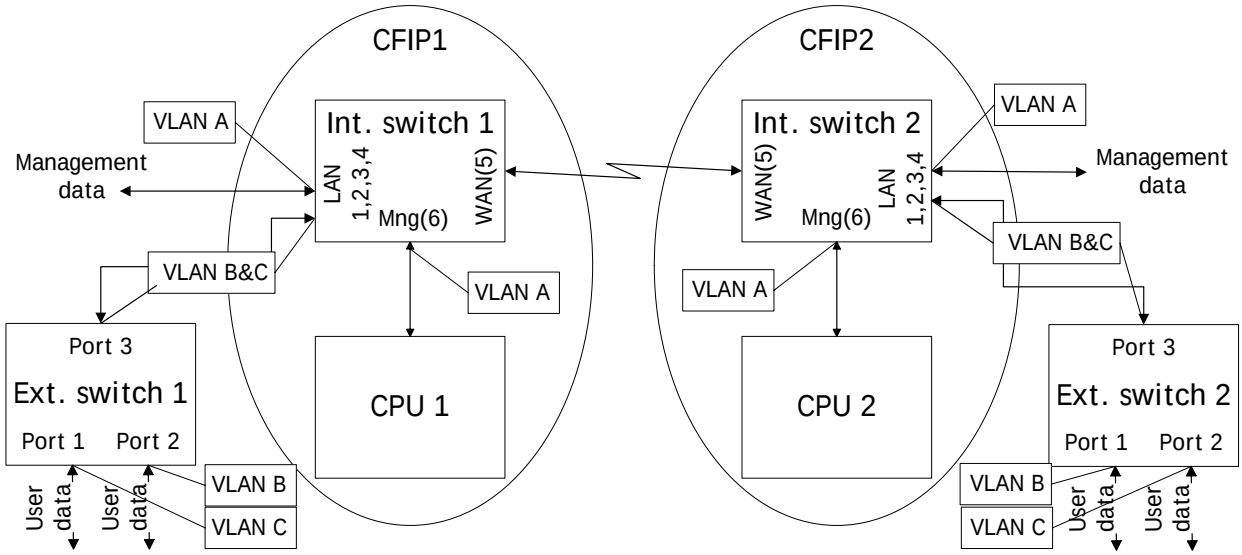


Figure 4.10. *Configuration with management and user VLANs on separate LAN ports*

For both switches:

VLAN A is configured as:

- Trunk type VLAN ID on LAN (P1-4) & WAN (P5) ports;
- Access type VLAN ID and Default VLAN ID on Management (P6) port allowing to remove tag on the egress direction and add tag on the ingress direction.

VLAN B and C are configured as:

- Trunk type VLAN IDs on LAN (P1-4) & WAN (P5) ports.

Limitations and rules on using VLAN:

- Supports up to 4095 full range VLAN IDs.
- Only one VLAN with unique IDs is allowed. When adding a different VLAN with the same IDs, the old VLAN is deleted (also the other types of VLANs).
- Simultaneous use of Access and Trunk Type VLANs on LAN (P1-P4) is not allowed.
- After the VLAN table initialization is completed, 802.1Q VLAN mode must be enabled.
- WAN (P5) allows using only Trunk VLAN Type and Management (P6) – only Access VLAN Type
- In order to pass untagged packets through the link, VLAN ID "0" should be added as Trunk VLAN Type on LAN (P1-4) and WAN (P5).

Steps required for VLAN configuration:

1) Add preferable VLAN IDs in "Configuration→VLAN Configuration" in Web GUI on both sides of the link;

2) Enable "802.1Q VLAN" for remote unit first, then for the local unit;

3) Configure switches for VLAN tag encapsulation on both ends of the link;

4) Reconnect to Web GUI via configured Management VLAN ID.

Example of VLAN usage:

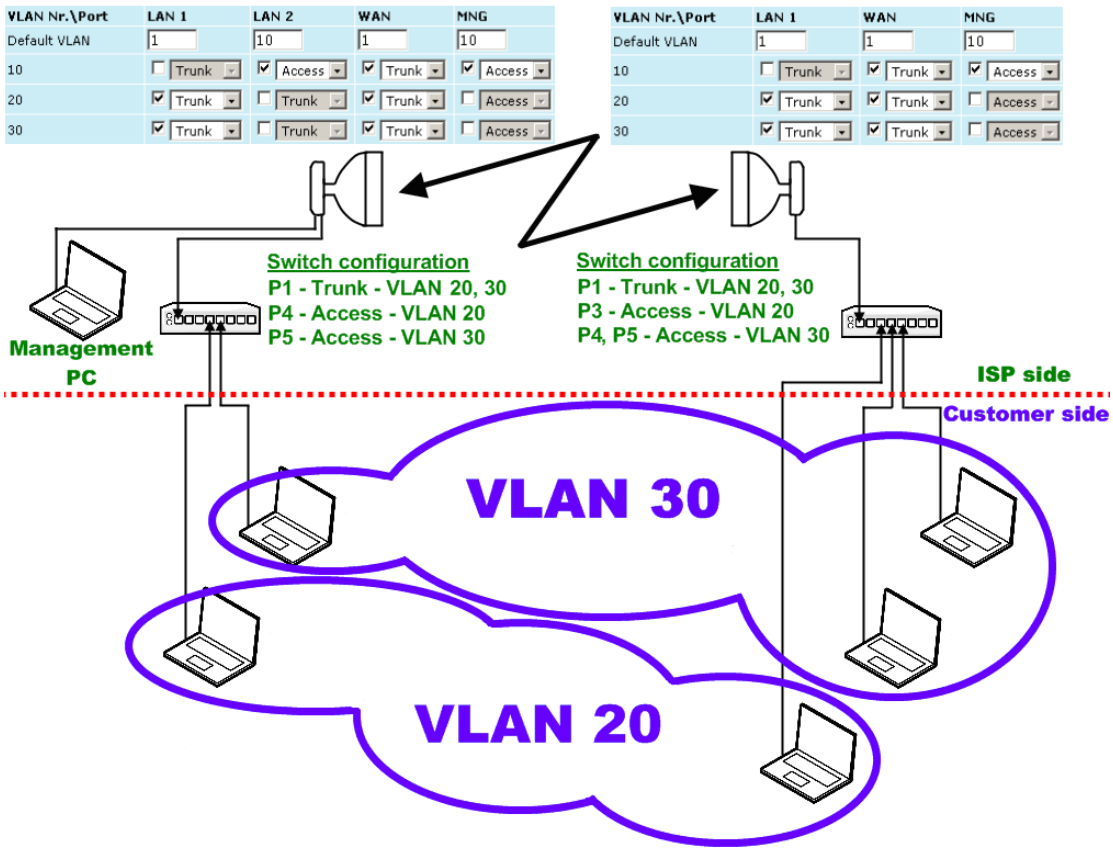
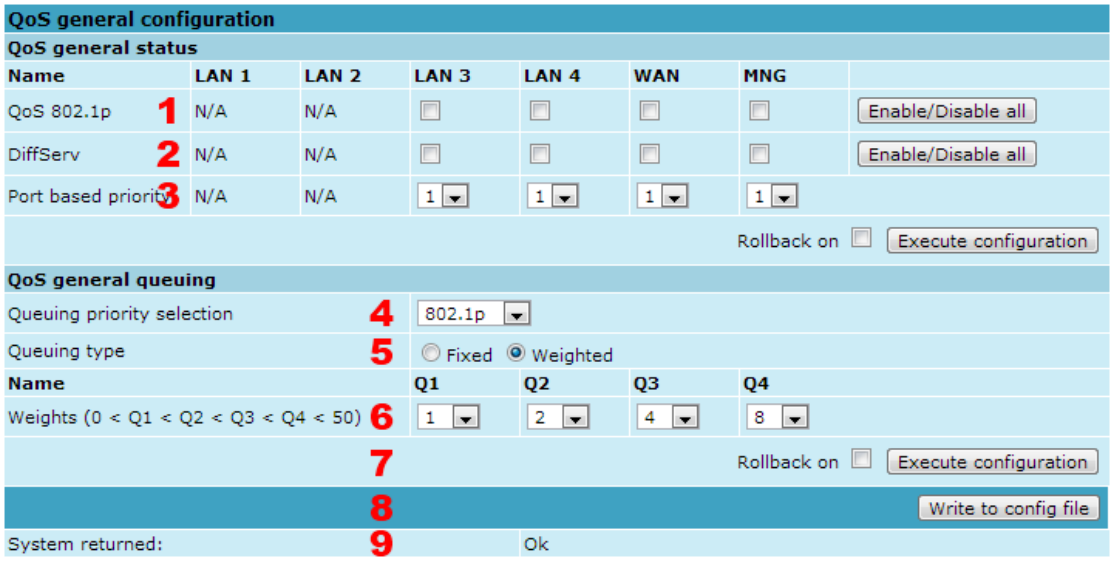


Figure 4.11. *VLAN configuration on one CFIP Lumina LAN port on right side of the link and on two CFIP Lumina LAN ports on left side of the link*

4.7 QoS

4.7.1 General Configuration

QoS status provides control over main QoS parameters, accordingly allowing enabling or disabling QoS 802.1p, DiffServ or port based priorities and change priority queuing mode.



1. *QoS 802.1p* – enables or disables 802.1p priorities for any available switch port – LAN1/2/3/4, WAN or Mng (command line – ***ethernet QoS 802.1p*** *{[enable | disable <Port>] | [map]}*);

2. *DiffServ* – enables or disables DiffServ (DSCP) priorities for any available switch port – LAN1/2/3/4, WAN or Mng (command line – ***ethernet QoS DSCP*** *[enable | disable <port>] | map)*;
3. *Port based priority* – allows passing packets from available ports directly to a specific priority queue. By default port based priority queuing passes packets from all ports to lowest (1) priority queue (command line – ***ethernet QoS port*** *<port> <priority>);*
4. *Queuing priority selection* – allows to select primary QoS method, upon which queueing decision shall be made;
5. *Queuing type* – allows choosing fixed priority queuing mode or weighted queuing mode;
6. *Weights (0<Q1<Q2<Q3<Q4<50)* – allows specifying correlation of all four queues. Queue values should correspond to limitations. Default correlation is 1:2:4:8.
7. Pressing *„Execute configuration"* applies changes made to the corresponding section only for the local side CFIP Lumina. If *„Rollback on"* is selected, configuration will be reverted in case of erroneous configuration changes applied;
8. Writes to configuration file all the changes made on the whole page (command line – ***cfg write***);
9. *Execution status* - in case of error or incorrectly entered parameter value, or other problems on the whole page – the info message is being shown here. Otherwise it says "Ok".

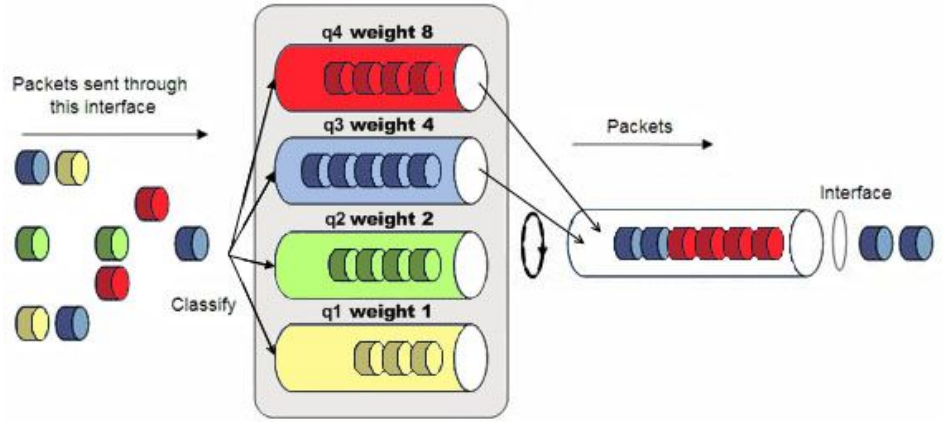


Figure 4.12. *Weighted priority queuing mode*

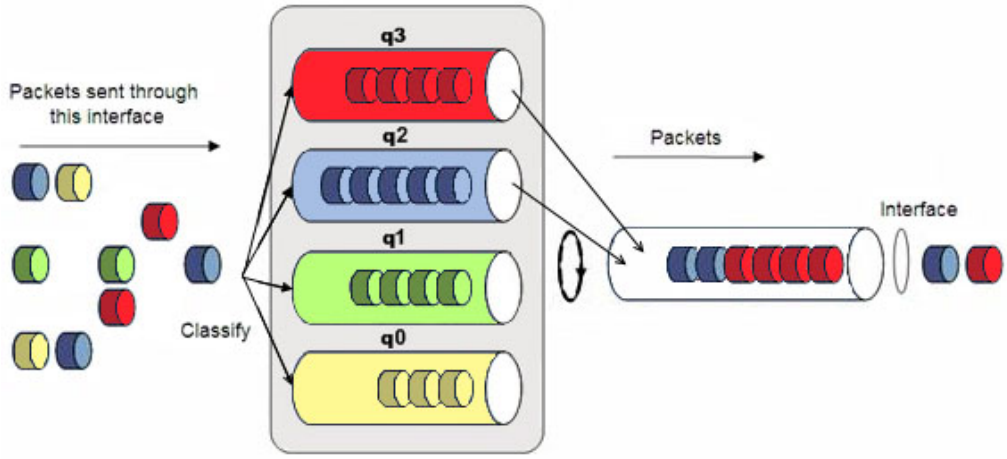


Figure 4.13. *Fixed priority queuing mode*

In case of weighted priority queuing mode, highest (q3) priority buffer may pass up to 8 consecutive packets subsequently proceeding to lower priority buffer (q2), which may pass up to 4 consecutive packets. This means that highest priority after passing 8 consecutive packets will wait no longer than until 7 packets of lower priorities pass (4(q2)+2(q1)+1(q0)).

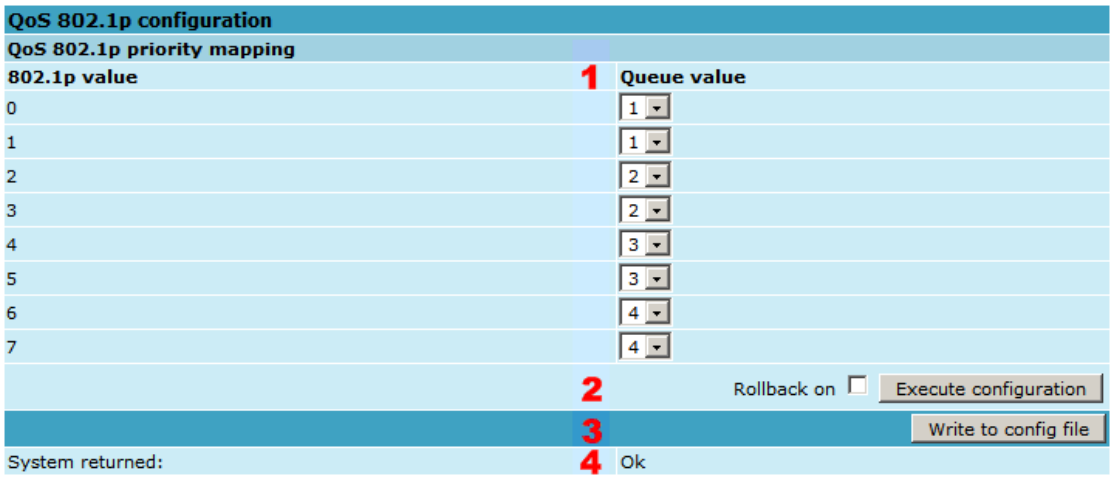
If any queues are empty, the highest non-empty queue gets one more weighting. For example, if q2 is empty, q3:q2:q1:q0 becomes (8+1):0:2:1.

In case of fixed queuing mode, highest priority buffer (q3) will pass packets as long as its buffer is full.

By default weighted priority queuing mode is enabled.

4.7.2 QoS 802.1p Configuration

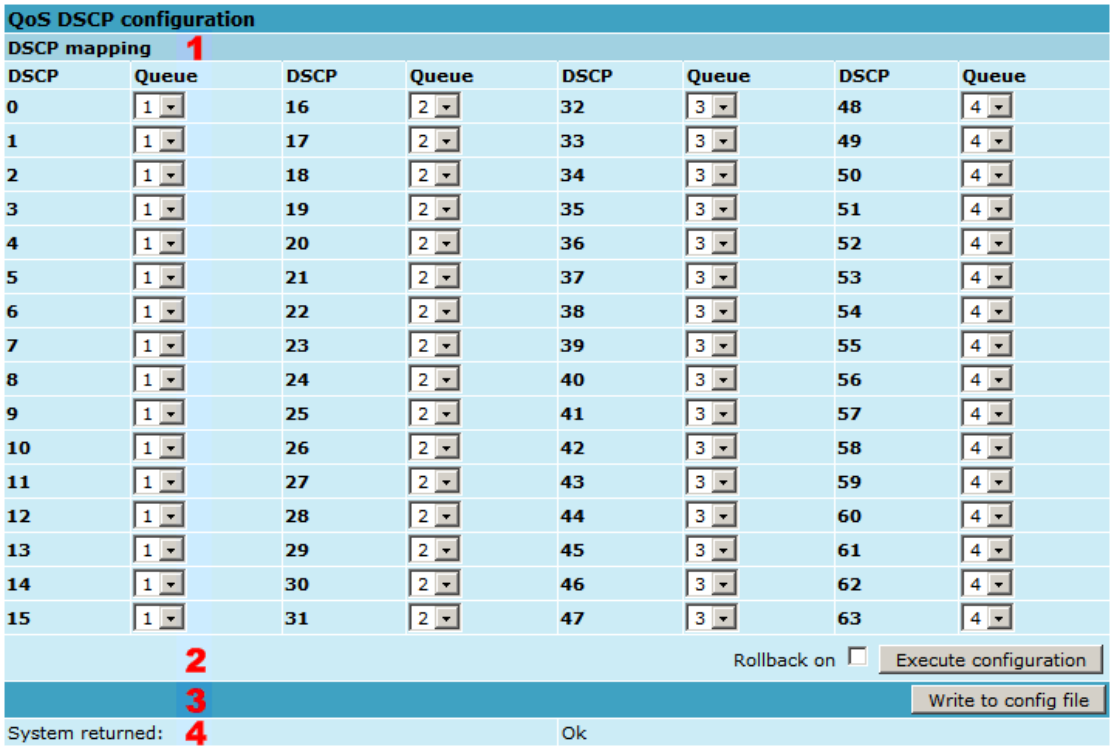
QoS 802.1p provides configuration of QoS 802.1p priority mapping. You are able to map 8 different traffic 802.1p values (0 – 7) into 4 priority queues (1 – 4).



1. *QoS 802.1p priority mapping* – allows assigning queue values to specific 802.1p values.
2. Pressing *„Execute configuration"* applies changes made to the corresponding section only for the local side CFIP Lumina. If *„Rollback on"* is selected, configuration will be reverted in case of erroneous configuration changes applied;
3. Writes to configuration file all the changes made on the whole page (command line – ***cfg write***);
4. *System returned* - in case of error or incorrectly entered parameter value, or other problems on the whole page – the info message is being shown here. Otherwise it says "Ok".

4.7.3 DSCP Configuration

QoS DSCP provides mapping of different traffic DSCP classes to priority queues.

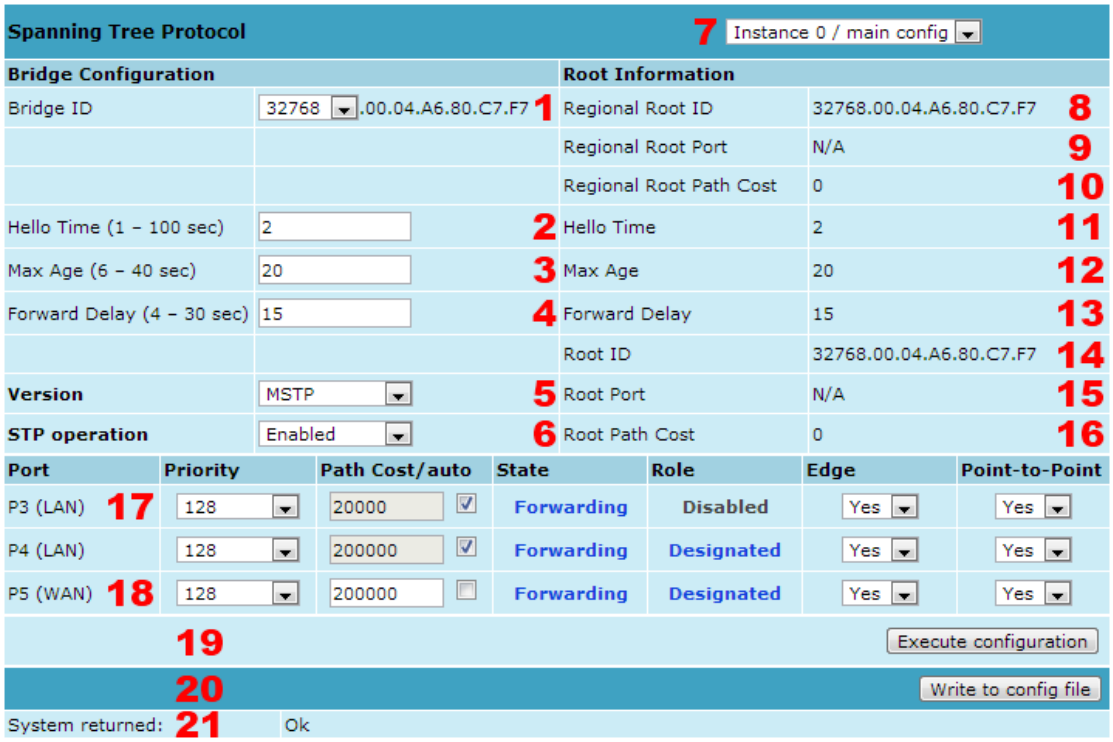


1. *DSCP mapping* – allows assigning queues for different DSCP classes. You may have up to 64 different traffic DSCP classes;
2. Pressing *„Execute configuration"* applies changes made to the corresponding section only for the local side CFIP Lumina. If *„Rollback on"* is selected, configuration will be reverted in case of erroneous configuration changes applied;
3. Writes to configuration file all the changes made on the whole page (command line – ***cfg write***);
4. *System returned* - in case of error or incorrectly entered parameter value, or other problems on the whole page – the info message is being shown here. Otherwise it says "Ok".

4.8 Spanning Tree Configuration

Implementation of Standard IEEE 802.1D-2004 (Spanning Tree Protocol) is compatible with Rapid STP and Multiple STP Standard IEEE 802.1Q-2005 , as well as having additional capability for automatic WAN port Path Cost calculation and non-standard mode for faster network convergence.

4.8.1 Spanning Tree Configuration



Bridge configuration - Values 2-4 take effect only if a given Bridge is Root:

1. *Bridge ID* – value from (0..61440)*;* this parameter and MAC address determine whether a given Bridge is Root Bridge. Advantage is given to the combination of *Priority* and *Address*, which is numerically smaller;
2. *Hello Time (1 – 100 sec)* – time gap, between which the BPDU packets are being sent;
3. *Max Age (6 – 40 sec)* – this parameter determines time period, during which the received BPDU packets' information is stored for a separate port;
4. *Forward Delay (4 – 30 sec)* – time period that determines time a separate port stays in *Listening* and *Learning* conditions;
5. *Version* – allows to switch STP versions between STP, RSTP or MSTP;
6. *STP operation* – Enable or Disable STP operation;
7. Change between MST instances configuration when MSTP operation mode is enabled;

Root information – displays the data only when STP/RSTP/MSTP is enabled:

8. *Regional Root ID* – displays the Bridge ID for *instance 0** of current Root bridge;
9. *Regional Root Port* – currently selected root port for *instance 0** is being shown;
10. *Root Path Cost* – displays the path cost port for *instance 0** from current bridge to root bridge;
11. *Hello Time* – displays the current hello time;
12. *Max Age* – displays the current max age;
13. *Forward Delay* – displays the current forward delay;
14. *Bridge ID* – displays the Bridge ID of current Root bridge;
15. *Root Port* – currently elected root port is being shown;
16. *Root Path Cost* – displays the path cost from current bridge to root bridge;

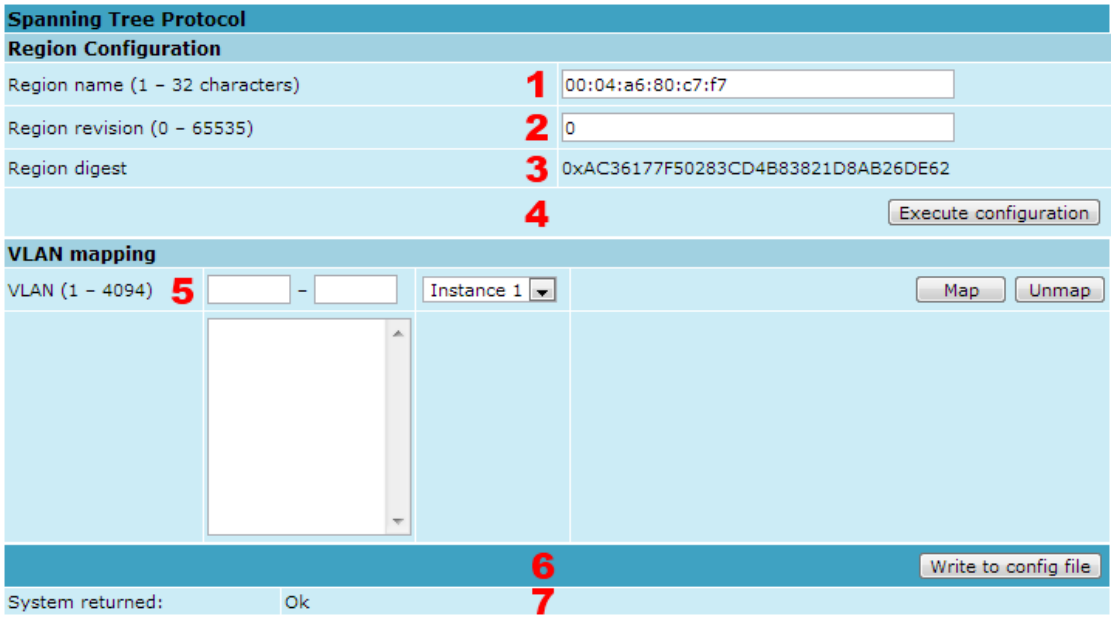
17. *P1..4 (LAN)* – STP parameters of available LAN ports;
18. *P5 (WAN)* – STP parameters of WAN port:

- *Priority (0..240)* – Port Priority. Combination of Priority, Port number and Path Cost determines whether the port will be selected as Root port or will be blocked on the occasion of loop, etc;
- *Path cost (1..200000000)* – this parameter setting depends on the capacity of a separate port;
- *State* – port condition. Can be one of the following: *Disabled*, *Blocking*, *Listening*, *Learning* or *Forwarding*;
- *Role* – role of the particular port. Can be one of the following: *Root, Designated, Alternate, Backup or Disabled;*
- *Edge* – specifies whether this particular port is Edge port or not;
- *Point-to-point* – specifies whether there is point-to-point connection from particular port or not;

19. By pressing *„Execute configuration"* changes made to the corresponding section apply only for the local side;
20. *Write to config file* - saves to configuration file all the changes made on the whole page (command line – ***cfg write***);
21. *System returned* - in case of error or incorrectly entered parameter value, or other problems on the whole page – the info message is being shown here. Otherwise it says "Ok".

* Instance 0 carries all STP-related information and refers only when MSTP is enable

4.8.2 Region, mapping configuration for MSTP



1. *Region name (0 – 32 characters)* – displays region name. By default device's MAC address;
2. *Region revision (0- 65545)* – displays region revision;
3. *Region digest* – hash value calculated over VLANs to Multiple Spanning Tree Instance mapping table contents and region revision;

4. By pressing *„Execute configuration"* changes made to the corresponding section apply only for the local side;
5. *VLAN (1 – 4094)* – map VLAN ID or VLAN IDs range for each instance. Up to seven instances;
6. *Write to config file* - saves to configuration file all the changes made on the whole page (command line – ***cfg write***);
7. *System returned* - in case of error or incorrectly entered parameter value, or other problems on the whole page – the info message is being shown here. Otherwise it says "Ok".

4.8.3 Spanning Tree Status

Spanning tree status shows current STP status at all available ports.

Spanning Tree Protocol Statistics					
Instance 0 (CST)			LAN 3	LAN 4	WAN
Rx MSTP BPDUs 1			0	0	0
Rx RSTP BPDUs 2			0	0	0
Rx Conf. BPDUs 3			0	0	0
Rx TCN BPDUs 4			0	0	0
Bad MSTP BPDUs 5			0	0	0
Bad RSTP BPDUs 6			0	0	0
Bad Conf. BPDUs 7			0	0	0
Bad TCN BPDUs 8			0	0	0
Tx MSTP BPDUs 9			0	3111	3111
Tx RSTP BPDUs 10			0	0	0
Tx Conf. BPDUs 11			0	0	0
Tx TCN BPDUs 12			0	0	0
Fwd Transitions 13			0	1	1
Time Since Top Chg 14					00:00:00
Top Change Count 15					0

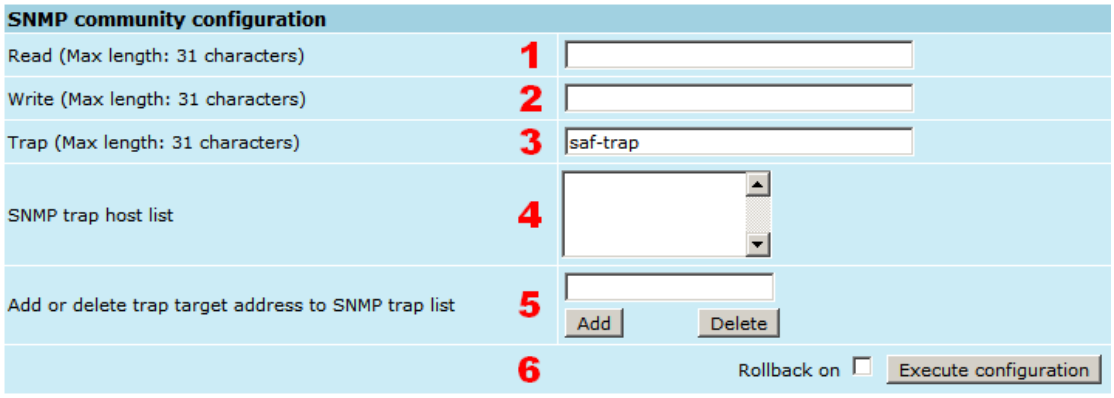
1. *Rx MSTP BPDUs* – displays how many MSTP BPDUs packets received;
2. *Rx RSTP BPDUs* – displays how many RSTP BPDUs packets received
3. *RX Conf BPDUs* – displays how many STP BPDUs packets received;
4. *RX TCN BPDUs* – displays how many topology changing notification BPDUs packets received;
5. *Bad MSTP BPDUs* – displays how many bad MSTP BPDUs packets received;
6. *Bad RSTP BPDUs* – displays how many bad RSTP BPDUs packets received;
7. *Bad Conf BPDUs* – displays how many bad STP BPDUs packets received;
8. *Bad TCN BPDUs* – displays how many bad topology changing notifications BPDUs packets received;
9. *Tx MSTP BPDUs* – displays how many MSTP BPDUs packets send;
10. *Tx RSTP BPDUs* – displays how many RSTP BPDUs packets send;
11. *Tx Conf BPDUs* - displays how many STP BPDUs packets send;
12. *Tx TCN BPDUs* – displays how many topology changing notification BPDUs packets send;
13. *Fwd Transitions* – displays how many times port has been changed to forward status;
14. *Times Since Top Chg* – displays time since last topology change in HH:MM:SS;
15. *Top Change Count* - displays total change count for all port.

4.9 SNMP v1/v2 Configuration

The SNMP v1/v2 configuration pages provide configuration of SNMP communities, host and trap addresses. SAF NMS system will work only when SNMP is properly configured.

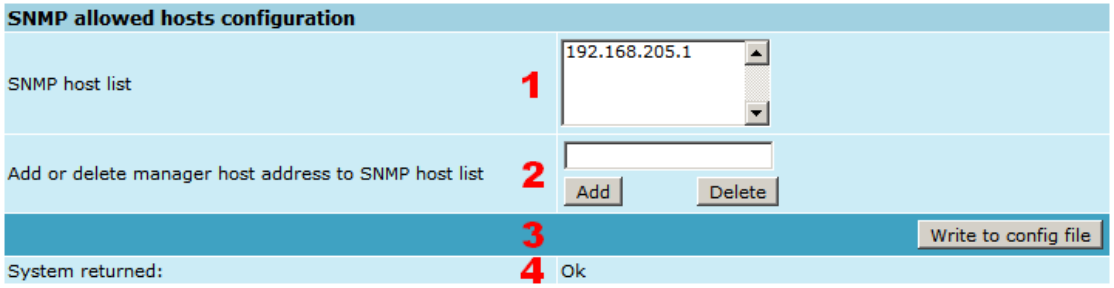
Explanation of customization fields:

4.9.1 SNMP community configuration



1. *Read* - specifies SNMP v1/v2 community name of the agent to enable parameters to be read (not configured) (command line – ***snmp community read*** *<communityname>* and ***snmp2 community read*** *<communityname>*);
2. *Write* – specifies the community name of the agent to enable parameters to be written (configured) (command line – ***snmp community write*** *<communityname>* and ***snmp2 community write*** *<communityname>*);
3. *Trap* – specifies SNMP v1/v2 trap community name for trap authentication in monitoring applications (command line – ***snmp community trap*** *<communityname>* and ***snmp2 community trap*** *<communityname>*);
4. *SNMP trap host list* – shows the list of IP addresses of the management terminal with the installed Trap Manager software, based on SNMP v1/v2 platform. The CFIP Lumina management controller sends SNMP traps to the Trap Manager with IP address specified here. The SNMP Trap Manager is a PC with installed SNMP trap management software. The default Trap Manager IP address is *255.255.255.255* meaning that no trap packets are sent by the management controller*;*
5. Allows to add or delete SNMP v1/v2 trap host IP addresses from the list (command line – ***snmp trap*** *<IP addresses of trap receivers>* and ***snmp2 trap*** *<IP addresses of trap receivers>*);
6. Pressing *„Execute configuration"* applies changes made to the corresponding section only for the local side CFIP Lumina. If *„Rollback on"* is selected, configuration will be reverted in case of erroneous configuration changes applied.

4.9.2 SNMP Allowed Hosts Configuration



1. *SNMP host list* – shows the list of available SNMP v1/v2 hosts; adds or deletes the host IP address to the CFIP Lumina SNMP v1/v2 host table. If the SNMP host

connected to the CFIP Lumina is not added to the CFIP SNMP v1/v2 host table, CFIP Lumina will not respond to the SNMP requests from that host. If *„Rollback on"* is selected, configuration will be reverted in case of erroneous configuration changes applied.

2. Allows to add or delete SNMP host IP addresses from the list (command line – ***snmp host*** *{add | delete | list | reset} <ipaddr>* and ***snmp2 host*** *{add | delete | list | reset} <ipaddr>*);
3. Writes to configuration file all the changes made on the whole page (command line – ***cfg write***);
4. *System returned* - in case of error or incorrectly entered parameter value, or other problems on the whole page – the info message is being shown here. Otherwise it says "Ok".

5 Performance and Alarm Management

5.1 Alarm Management

5.1.1 Alarms and Events Structure

All alarms and events are placed in indexed table. Low level raw alarms and events are placed in the first table. Raw alarms and events are merged in groups, which are placed in the second indexed group table. Raw alarm table and group table are related one to many, or one to one if each alarm has a separate group (see ***Figure 5.1***.). Group is in *SET* state if one or more group members are in *SET* state. If there is no info about any group member alarm or event state, then there is no info about group state too.

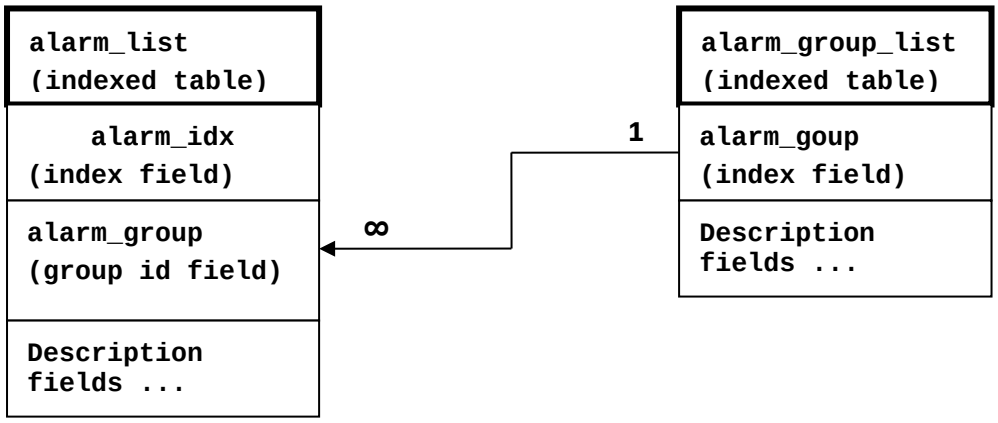


Figure 5.1. *Alarm and group table relation*

5.1.2 Alarms-Events and Groups Tables

Most groups write log when group state changes (Set/Reset), but some groups are only rising.

Alarms events and event groups:

Alarm ID	Group ID	Alarm-Event name	Description
1	1	==> System Start	Software started [Only rising]
2	2	Invalid device license	License is not valid
3	3	License expired	License validity has expired
4	4	License will soon expire	License validity will soon expire
5	5	Log was Cleared	Entered when 'Log Clear' command was called [Only rising]
6	6	Log ERROR	Log data structure missing
7	7	Log TEST	Log test was made
8	8	Counters was Cleared	System performance counters were cleared [Only rising]
9	9	Config was Written	Configuration was written [Only rising]
10	10	System CPU restart ==>	Entered when system restart was called [Only rising]
11	11	No data from system temperature sensor	No data from temperature sensor connected via I2C interface

12	12	System temperature fault	Temperature is out of defined range
13	13	No data from main PSU ADC	No data from the main PSU ADC
14	14	Main supply voltage failure	Main supply voltage is out of defined range
15	15	Main supply current failure	Main supply current is out of defined range
16	16	Main supply power failure	Main supply power is out of defined range
17	17	No data from power supply ADC	No data from ADC connected via I2C interface
18	18	1,0V failure	Power supply voltage out of defined range
19	18	1,2V failure	Power supply voltage out of defined range
20	18	1,5V failure	Power supply voltage out of defined range
21	18	2,5V failure	Power supply voltage out of defined range
22	18	3,3V failure	Power supply voltage out of defined range
23	18	5,0V failure	Power supply voltage out of defined range
24	18	Permanent 7,5V failure	Power supply voltage out of defined range
25	18	Switchable 7,5V failure	Power supply voltage out of defined range
26	18	12,0V failure	Power supply voltage out of defined range
27	18	-5,0V failure	Power supply voltage out of defined range
28	19	No data from RADIO	No data from radio (for future compatibility)
29	20	Rx level alarm	Rx alarm level is out of defined range
30	21	Tx PLL error alarm	Tx PLL failure
31	22	Rx PLL error alarm	Rx PLL failure
32	23	No data from MODEM	No data from MODEM connected via UART interface
33	24	Acquire status alarm	Modem acquire failure status
34	25	Last acquire error status	Modem last acquire failure status
35	26	Radial MSE	Radial MSE is out of defined range
36	27	LDPC decoder stress	LDPC decoder stress is out of defined range
37	28	Tx ACM profile was changed	ACM profile was changed
38	29	RX carrier offset	Error in Rx carrier offset
39	30	No data from modem temperature sensor	No data from modem temperature sensor
40	31	Modem temperature fault	Modem temperature is out of defined range
41	32	ATPC Tx power correction was changed	ATPC Tx power correction was changed
42	33	Rollback initiate system CPU restart ==>	System restart was called by rollback [Only rising]
43	34	System CPU reset was WDT initiated ==>	System restart was called by watchdog [Only rising]
44	35	PM log flash write error	Error while writing pm log to flash

45	36	Command from interface	Message about command execution from particular interface
46	37	Message of event	Informative message
47	38	Eth interface	Ethernet LAN port state change
48	39	Aggregation state was changed	Event of aggregation state change in aggregation 2+0 or protection 1+1 configurations
49	40	Aggregation events	Event of aggregation 2+0 or protection 1+1 configurations
50	41	Keepalive Ethernet switch reset	Ethernet switch does not respond and thus is reset

5.1.3 Alarm Status Window

"*Status → Alarm status*" in navigation bar shows you all the current alarms.

Date and time represents the time the alarm appeared, so you can easily evaluate for how long the alarm has been active. 'Alarm gr.' is the number of alarm group in which the specific alarm is grouped. Complete list of alarm individual IDs and group IDs can be seen in the table above or using the command '**alarm list**' in the command prompt.

To configure representation of alarms, refer to ***Chapter 5.1.5***.

Alarm status

Alarm gr.	Date	Time	Alarm
31	2008-11-22	12:39:36	Ethernet interface

***Figure 5.2**. Alarm status window*

5.1.4 Alarm Log

To view alarms history, go to "*Performance → Alarm log*"'.

Alarm log shows 21 latest alarm entries per page and about 2000 latest alarm entries in total.

Alarm entries are mostly distributed in two groups – *"Set"'* when alarm appears and *"Reset"* when alarm disappears.

To view earlier log entries, please enter the number of log entry and press *"Previous 21"* or *"Next 21"* to view 21 entries before or after entered entry number.

Note that the alarm ID (for example, '032' in the ***Figure 5.3.***) here is an individual ID, not a group ID.

You also have fast access to alarm filtering, where it is possible to choose which alarm ID you are willing to search among all log entries. To configure detailed and permanent alarm representation, refer to the next chapter.

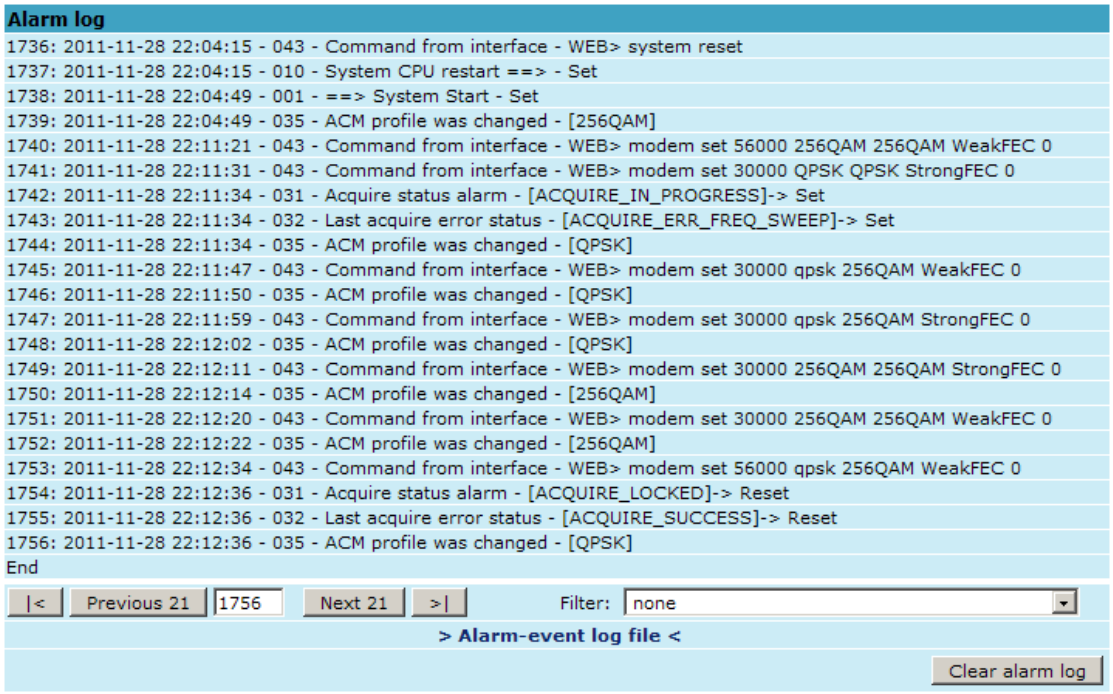


***Figure 5.3**. Alarm log window*

5.1.5 Alarm and Alarm Threshold Configuration

The alarm configuration screen allows you to configure alarm representation. You have a choice to see specific alarm groups globally in alarm status (**Global**), in alarm log (**Log**) or in NMS system (**SNMP**). By default all alarms are enabled.

Alarm & log configuration	Global	Log	SNMP
[1] ==> System Start	☑	☑	☑
[2] Invalid device license	☑	☑	☑
[3] License expired	☑	☑	☑
[4] License will soon expire	☑	☑	☑
[5] Log was Cleared	☑	☑	☑
[6] Log ERROR	☑	☑	☑
[7] Log TEST	☑	☑	☑
[8] Counters was Cleared	☑	☑	☑
[9] Config was Written	☑	☑	☑
[10] System CPU restart ==>	☑	☑	☑
[11] No data from system temperature sensor	☑	☑	☑
[12] System temperature fault	☑	☑	☑
[13] No data from main PSU ADC	☑	☑	☑
[14] Main supply voltage failure	☑	☑	☑
[15] Main supply current failure	☑	☑	☑
[16] Main supply power failure	☑	☑	☑
[17] No data from power supply ADC	☑	☑	☑
[18] Power supply voltage failure	☑	☑	☑
[19] No data from RADIO	☑	☑	☑
[20] Rx level alarm	☑	☑	☑
[21] Tx PLL error alarm	☑	☑	☑
[22] Rx PLL error alarm	☑	☑	☑
[23] No data from MODEM	☑	☑	☑
[24] Acquire status alarm	☑	☑	☑
[25] Last acquire error status	☑	☑	☑
[26] Radial MSE	☑	☑	☑
[27] LDPC decoder stress	☑	☑	☑
[28] Tx ACM profile was changed	☑	☑	☑
[29] RX carrier offset	☑	☑	☑
[30] No data from modem temperature sensor	☑	☑	☑
[31] Modem temperature fault	☑	☑	☑
[32] ATPC Tx power correction was changed	☑	☑	☑
[33] Rollback initiate system CPU restart ==>	☑	☑	☑
[34] System CPU reset was WDT initiated ==>	☑	☑	☑
[35] PM log flash write error	☑	☑	☑
[36] Event of command execution starting	☑	☑	☑
[37] Message of event	☑	☑	☑
[38] Ethernet interface *	☑	☑	☑
[39] Aggregation state was changed	☑	☑	☑
[40] Aggregation events	☑	☑	☑
			Execute configuration
			Write to config file
System returned:	Ok		

***Figure 5.4**. Alarm configuration window*

Alarm threshold configuration screen allows you to define specific threshold levels to bound alarms to desirable values, so that you are able to adapt alarm system to your individual needs.

Alarms in bold font represent group alarms and alarms in normal font – individual alarms.

Alarm threshold configuration

Set all fields to default — Set to default

Alarm ID	Alarm name	Low value	High value	Delta value	Alarm value	
12	System temperature fault	-33.0 C	85.0 C	1.0 C	Value = 56.5 C	Def: ☑
14	Main supply voltage failure	36.00 V	57.00 V	1.00 V	Value = 46.77 V	Def: ☑
15	Main supply current failure	0.000 A	1.000 A	0.010 A	Value = 0.818 A	Def: ☑
16	Main supply power failure	0.00 W	36.00 W	0.50 W	Value = 35.30 W	Def: ☑
18	1,0V failure	0.85 V	1.15 V	0.03 V	Value = 0.99 V	Def: ☑
19	1,2V failure	1.15 V	1.32 V	0.03 V	Value = 1.23 V	Def: ☑
20	1,5V failure	1.43 V	1.57 V	0.03 V	Value = 1.50 V	Def: ☑
21	2,5V failure	2.40 V	2.70 V	0.03 V	Value = 2.51 V	Def: ☑
22	3,3V failure	3.15 V	3.60 V	0.03 V	Value = 3.39 V	Def: ☑
23	5,0V failure	4.50 V	5.50 V	0.03 V	Value = 4.96 V	Def: ☑
24	Permanent 7,5V failure	6.75 V	8.25 V	0.05 V	Value = 7.50 V	Def: ☑
25	Switchable 7,5V failure	6.75 V	8.25 V	0.05 V	Value = 7.45 V	Def: ☑
26	12,0V failure	10.80 V	13.20 V	0.05 V	Value = 12.03 V	Def: ☑
27	-5,0V failure	-5.50 V	-4.50 V	0.03 V	Value = -5.03 V	Def: ☑
29	Rx level alarm	-84 dBm	-30 dBm	1 dBm	Value = -37 dBm	Def: ☑
35	Radial MSE		-11.4 dB	1.0 dB	Value = -23.9 dB	Def: ☑
36	LDPC decoder stress		3.0e-03		Value = 3.4e-06	Def: ☑
38	RX carrier offset	-700 kHz	700 kHz	10 kHz	Value = 0 kHz	Def: ☑
40	Modem temperature fault	-33.0 C	95.0 C	1.0 C	Value = 61.5 C	Def: ☑

Execute configuration

Write to config file

System returned: Ok

***Figure 5.5**. Alarm threshold configuration window*

5.1.6 Alarm Management Commands

To manage alarms in command prompt, the commands are as follows:

Alarm management commands	
Command	***Description***
Log show [*<start line>*]	The management controller maintains event log, - events include configuration changes, management controller restarts, and local site alarm changes. The "**log show**" or "**log**" commands display the latest 20 log entries, the log entries are numbered, - entry with the largest number is the latest event. The "log show" command can be followed up with an entry number to display the latest 20 entries beginning from the entry specified by the number, e.g., "*log show 100*" will display entries 100…120.
Log filter *<alarm ID> [<num>]*	Filters event list by specific alarm ID. <start line> ; works similarly to 'log show' command.

Alarm management commands

Command	*Description*
Log file *<file name>*	Makes event log file with specified filename.
Alarm stat	Lists alarm groups currently set.
Alarm list	Displays the list of all alarms, their group IDs and alarm IDs.
Alarm groups	Displays the list of all alarms and their group IDs.
Alarm cfg *<group ID> [<global> <led> <aux> <log> <snmp>]*	Allows defining detailed alarm representation settings. [*<global> <led> <aux> <log> <snmp>*] must be defined in a row of '1's or '0's of 5 values for specified group ID with *<group ID>*. '1' means the values are 'on' and '0' – 'off'.
Alarm threshold *{stat} | {<Alarm ID> lo|hi|delta <value>}*	Sets threshold values outside which alarm status will be shown.

5.2 Performance Management

The main aim of the *performance management* is to register mostly critical device performance event values in predefined time intervals.

5.2.1 Performance Management Data Collection

The performance parameters are collected within time intervals of 1 min., 15 min. and 1 hour. List reserved space for every time interval is 1440 records (see ***Figure 5.6***.).

Second-by-second the input performance event values are stored by updating previous second values. The register is called *current register*. The *current register* contains the performance values collected second-by-second from the reset instant to the present second.

At the end of period the contents of current registers are transferred to the history registers (records), with a time-date stamp to identify the period, after which the current register must be reset.

Some current register values are passed to the threshold crossing control unit for triggering threshold crossing notification.

Optionally, the same values are output to the Message Communication Function (MCF) to be forwarded to the managing system.

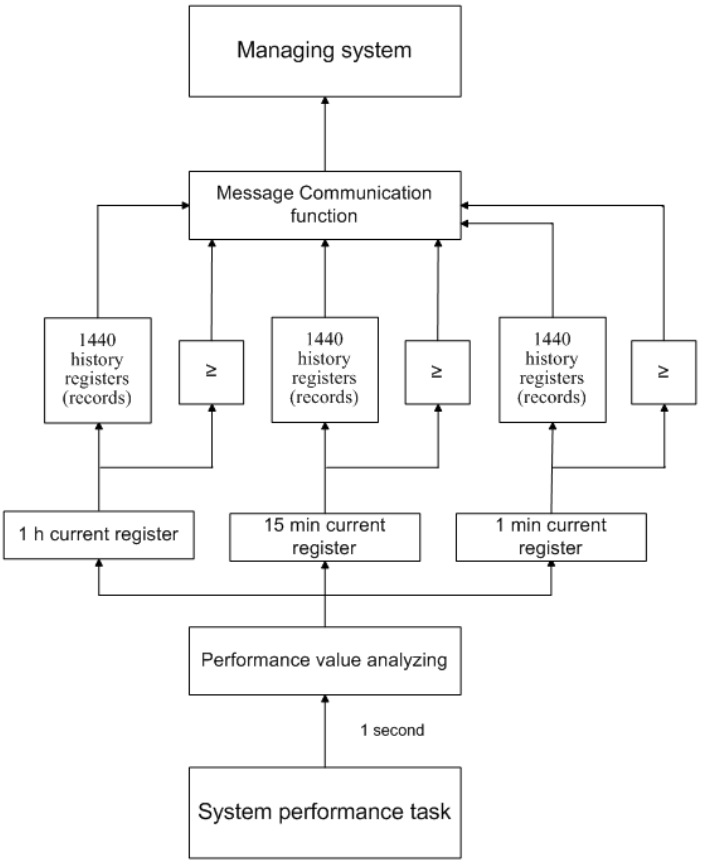


Figure 5.6. *Functional architecture for data collection, history and thresholding treatment*

5.2.2 Performance Values

Threshold Seconds (TS)

The TS is defined as one second period during which the detected value is outside of predefined thresholds. The current value of the counter associated with TS should be readable by the managing system on request. In case a threshold associated to TS counter is changed, the current value of the counter should be reset to zero.

Tide Mark (TM)

The TM is a mechanism that records the maximum and the minimum value reached during measurement period. The tide mark values are automatically reset to the current value assumed at the beginning of each measurement period. The TM is therefore composed of two values: the minimum and the maximum value. Comparison between the current value and the minimum and maximum values is performed on a second basis.

5.2.3 Performance Management in Web GUI

The main performance management tool in the CFIP Lumina is Web interface, allowing user to review performance measurements in a very convenient and visualized way.

Going to 'Performance → Performance log' in navigation panel on the left side of the Web GUI window will lead you to the log parameters' selection screen, where you will be able to choose between 9 different parameters to display in summarizing performance log or pick 'ALL' to display all 9 parameters in conjoint log which is shown in ***Figure 5.7.***

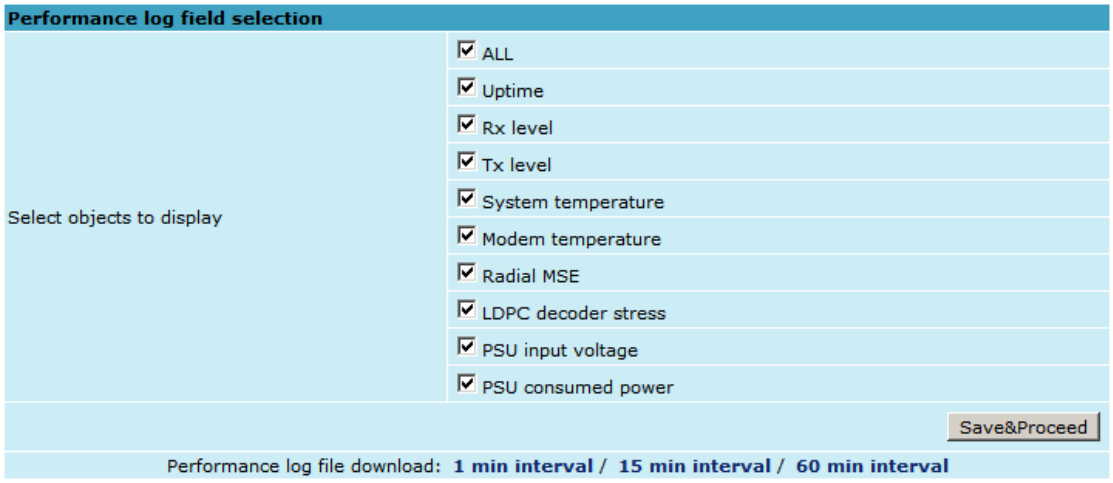


Figure 5.7 *Selecting performance log parameters*

Performance log

			Radio						System				Modem								Power supply unit					
Nr	Date	Time	Rx level			Tx level			Uptime	Temperature, C			Radial MSE			LDPC decoder stress			Temperature, C			Input voltage, V			Consumed power, W		
			Min	Max	TS	Min	Max	TS	Val	Min	Max	TS	Min	Max	TS	Min	Max	TS	Min	Max	TS	Min	Max	TS	Min	Max	TS
1419	08-11-08	22:24	-37	-37	0	8	8	0	18:45:11	56.5	56.5	0	-35.8	-21.3	0	7.6e-07	1.4e-05	0	61.5	61.5	0	46.77	46.77	0	38.30	38.30	0
1420	08-11-08	22:25	-37	-37	0	8	8	0	18:46:11	56.5	56.5	0	-35.8	-22.2	0	5.1e-07	2.4e-05	0	61.5	61.5	0	46.77	46.77	0	38.30	38.30	0
1421	08-11-08	22:26	-37	-37	0	8	8	0	18:47:11	56.5	56.5	0	-30.0	-23.9	0	5.3e-07	1.5e-05	0	61.5	61.5	0	46.77	46.77	0	38.30	38.30	0
1422	08-11-08	22:27	-37	-37	0	8	8	0	18:48:11	56.5	56.5	0	-29.5	-23.7	0	6.1e-08	1.5e-05	0	61.5	61.5	0	46.77	46.80	0	38.30	38.32	0
1423	08-11-08	22:28	-37	-37	0	8	8	0	18:49:11	56.5	56.5	0	-31.0	-23.1	0	4.8e-07	1.5e-05	0	61.5	61.5	0	46.77	46.80	0	38.30	38.32	0
1424	08-11-08	22:29	-37	-37	0	8	8	0	18:50:11	56.5	56.5	0	-33.1	-22.3	0	1.7e-07	1.4e-05	0	61.5	61.5	0	46.77	46.77	0	38.30	38.30	0
1425	08-11-08	22:30	-37	-37	0	8	8	0	18:51:11	56.5	56.5	0	-35.3	-22.2	0	1.5e-08	1.7e-05	0	61.5	61.5	0	46.77	46.77	0	38.30	38.30	0
1426	08-11-08	22:31	-37	-37	0	8	8	0	18:52:11	56.5	56.5	0	-36.3	-21.5	0	3.2e-07	1.5e-05	0	61.5	61.5	0	46.77	46.77	0	38.30	38.30	0
1427	08-11-08	22:32	-37	-37	0	8	8	0	18:53:11	56.5	56.5	0	-35.8	-21.9	0	2.3e-07	1.2e-05	0	61.5	61.5	0	46.77	46.77	0	38.30	38.30	0
1428	08-11-08	22:33	-37	-37	0	8	8	0	18:54:11	56.5	56.5	0	-36.0	-21.8	0	3.3e-07	1.3e-05	0	61.5	61.5	0	46.77	46.77	0	38.30	38.30	0
1429	08-11-08	22:34	-37	-37	0	8	8	0	18:55:11	56.5	56.5	0	-36.0	-22.1	0	3.0e-08	1.0e-05	0	61.5	61.5	0	46.77	46.77	0	38.30	38.30	0
1430	08-11-08	22:35	-37	-37	0	8	8	0	18:56:11	56.5	56.5	0	-35.7	-21.8	0	7.6e-08	1.8e-05	0	61.5	61.5	0	46.77	46.77	0	38.30	38.30	0
1431	08-11-08	22:36	-37	-37	0	8	8	0	18:57:11	56.5	56.5	0	-35.9	-21.6	0	2.4e-07	1.7e-05	0	61.5	61.5	0	46.77	46.77	0	38.30	38.30	0
1432	08-11-08	22:37	-37	-37	0	8	8	0	18:58:11	56.5	56.5	0	-35.7	-21.5	0	5.9e-07	1.0e-05	0	61.5	61.5	0	46.77	46.80	0	38.30	38.32	0
1433	08-11-08	22:38	-37	-37	0	8	8	0	18:59:11	56.5	56.5	0	-36.0	-21.5	0	1.2e-07	1.7e-05	0	61.5	61.5	0	46.77	46.77	0	38.30	38.30	0
1434	08-11-08	22:39	-37	-37	0	8	8	0	19:00:11	56.5	56.5	0	-35.5	-21.7	0	1.2e-07	1.2e-05	0	61.5	61.5	0	46.77	46.77	0	38.30	38.30	0
1435	08-11-08	22:40	-37	-37	0	8	8	0	19:01:11	56.5	56.5	0	-35.4	-21.8	0	5.1e-07	1.4e-05	0	61.5	61.5	0	46.77	46.77	0	38.30	38.30	0
1436	08-11-08	22:41	-37	-37	0	8	8	0	19:02:11	56.5	56.5	0	-35.6	-21.2	0	2.1e-07	1.3e-05	0	61.5	61.5	0	46.77	46.80	0	38.30	38.32	0
1437	08-11-08	22:42	-37	-37	0	8	8	0	19:03:11	56.5	56.5	0	-35.8	-21.4	0	1.7e-07	1.5e-05	0	61.5	61.5	0	46.77	46.77	0	38.30	38.30	0
1438	08-11-08	22:43	-37	-37	0	8	8	0	19:04:11	56.5	56.5	0	-35.7	-21.5	0	2.4e-07	1.5e-05	0	61.5	61.5	0	46.77	46.77	0	38.30	38.30	0
1439	08-11-08	22:44	-37	-37	0	8	8	0	19:05:11	56.5	56.5	0	-36.0	-22.1	0	5.5e-07	1.7e-05	0	61.5	61.5	0	46.77	46.77	0	38.30	38.30	0
1440	08-11-08	22:45	-37	-37	0	8	8	0	19:06:11	56.5	56.5	0	-35.8	-21.7	0	2.6e-07	2.5e-05	0	61.5	61.5	0	46.77	46.77	0	38.30	38.30	0

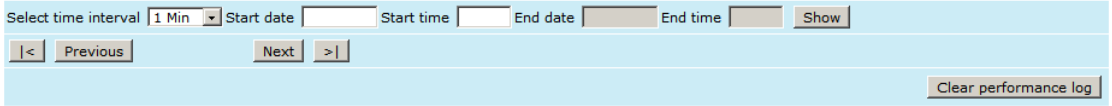


Figure 5.8 *Performance log window*

Time interval can be chosen between 1 min, 15 min or 1 hr. You can also define the start time and the start date. When start values are defined, it is also possible to define the end time and the end date.

TS (threshold seconds) show the amount of seconds in a chosen period (1min, 15min or 1h) when the parameter has been out of bounds set by performance thresholds in 'Configuration → Performance log configuration'.

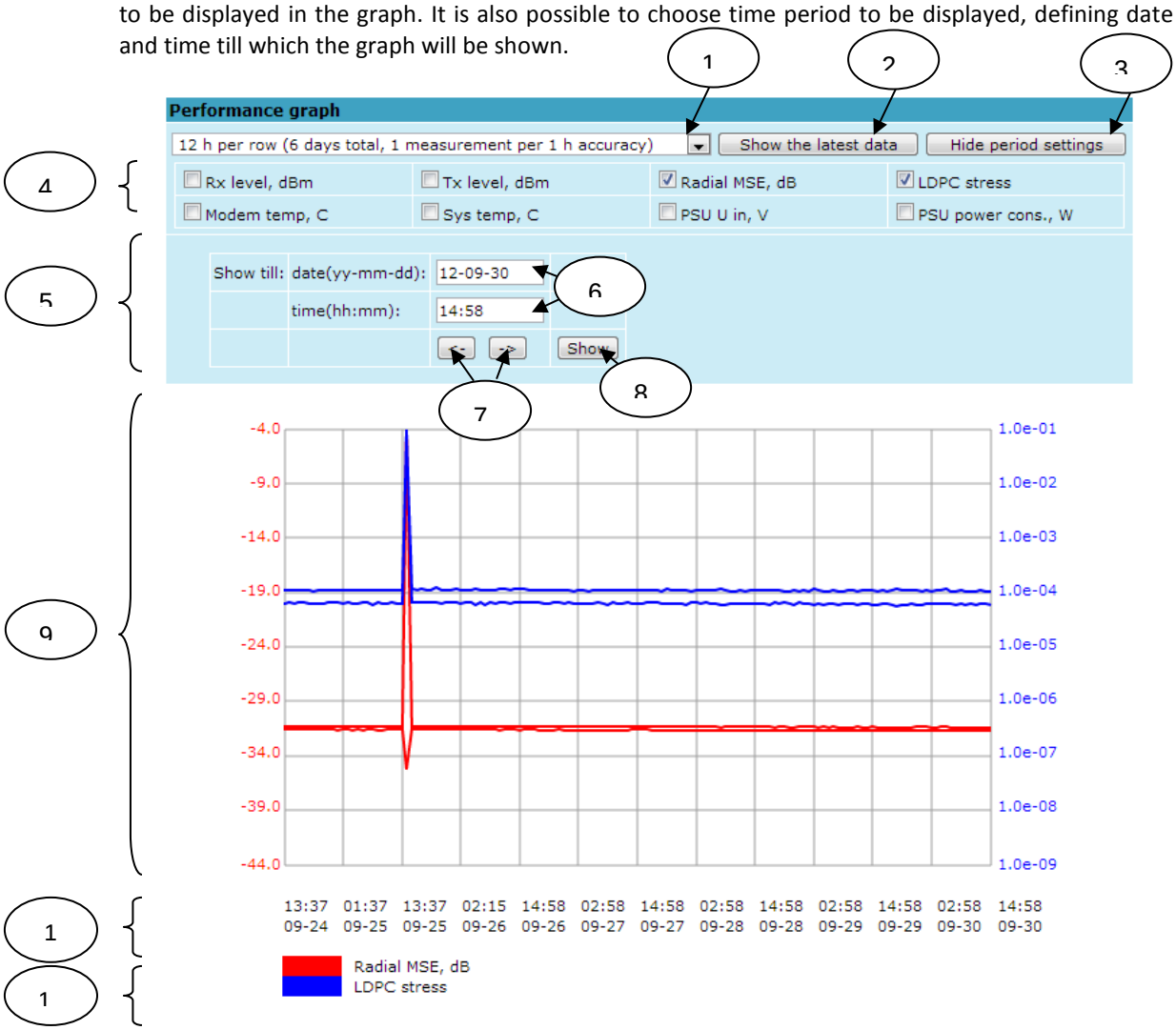
To define thresholds from where TS (threshold seconds) will be counted, you must go to 'Configuration → Performance log configuration' and enter preferable threshold values. Refer to sections **5.2.1.** and **5.2.2.** for further details on threshold seconds.

Performance log configuration					
	All to default				
Rx level	min (-120)	-90 dBm	max (-20)	-30 dBm	auto
Tx level	min (-30)	-30 dBm	max (40)	35 dBm	auto
System temperature	min (-50)	-33.0 C	max (90)	+85.0 C	auto
Modem temperature	min (-50)	-33.0 C	max (90)	+85.0 C	auto
Radial MSE			max (-10)	-12.0 dB	auto
LDPC decoder stress			max (1)	5.0e-03	auto
PSU input voltage	min (35)	40.00 V	max (60)	50.00 V	auto
PSU consumed power	min (1)	5.00 W	max (55)	40.00 W	auto
				Execute configuration	
				Write to config file	
System returned:	Ok				

Figure 5.9 *Performance log configuration window*

The main advantage in terms of demonstration means is obtained from 'Performance graphs', which are found in 'Performance → Performance graph' section.

You are able to choose between 8 parameters – Rx level, Tx level, Radial MSE, LDPC stress, Modem temperature, System temperature, Input voltage and Power consumption – and to view their graphs. It is possible to choose between 8 scales – from 12 last minutes to the maximum of 6 last days to be displayed in the graph. It is also possible to choose time period to be displayed, defining date and time till which the graph will be shown.



If you cannot see the graph, click here to install an SVG viewer from http://www.adobe.com/svg/viewer/install/

Figure 5.10 *Performance graph showing system temperature and Rx level in period of last 6 hours*

1. Time scale selector. User can select the scale and accuracy (1 / 15 / 60 minutes). The lower the accuracy, the longer period will be available for data (mechanism of the performance management system)
2. Updates the performance graph; the latest data is shown
3. Shows / hides period settings (point 5)
4. Performance data selector. Only two performance parameters can be selected at a time
5. Period settings. Allows the user to specify time period for the graph
6. Date and time fields. The date format is “yy-mm-dd”, the time format is “hh:mm”
7. Sets date and time fields (point 6) one screen back / forth
8. Shows / updates the performance graph using the period settings (point 5)
9. Performance graph. Displays two performance parameters. Each parameter is shown with the minimum and maximum curves, which are in the same color. The curves in red have the scale on the left, while the curves in blue have the scale on the right
10. Time scale. Shows the time scale chosen from the time scale selector (point 1) for the performance data available. If no data is available for the according moment, “__:__” is shown
11. Legend for the curves of the performance graph. Contains the color, the name and the unit of measurement, if available.

In case no performance data has been recorded, or the period specified has no data, “No data” is shown (instead of points 9, 10, 11).

5.2.4 Constellation Diagram

A constellation diagram is a representation of a signal modulated by the digital modulation schemes 256QAM, 128QAM, 64QAM, 32QAM, 16QAM or 4QAM. It displays the signal as a two-dimensional scatter diagram in the complex plane at symbol sampling instants. Measured constellation diagram can be used to recognize the type of interference and distortion in a signal.

For the purpose of analyzing the received signal quality, some types of corruption are evident in the constellation diagram. For example:

1) Gaussian noise is displayed as fuzzy constellation points:

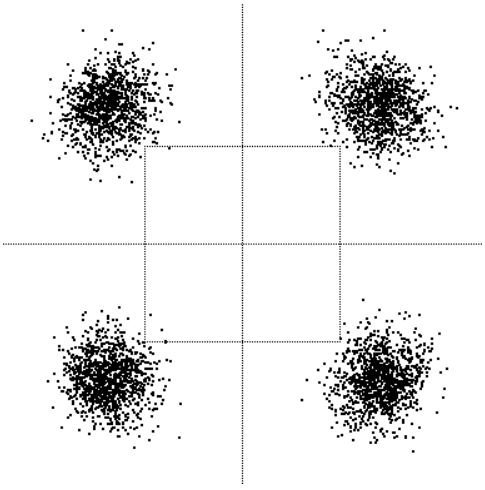


Figure 5.11. *Gaussian noise (4QAM)*

2) Non-coherent single frequency interference is displayed as circular constellation points:

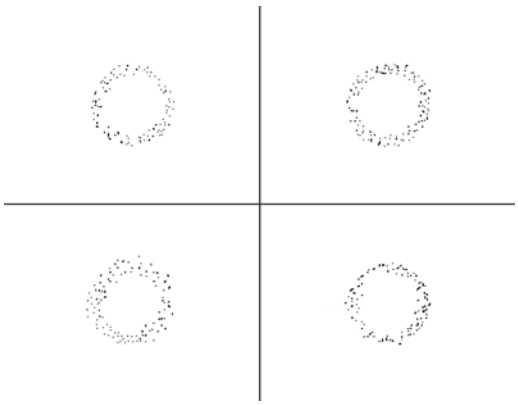


Figure 5.12. *Non-coherent single frequency interference (4QAM)*

3) Phase noise is displayed as rotationally spreading constellation points:

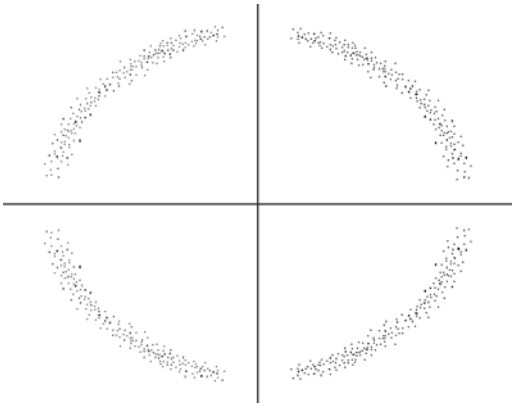


Figure 5.13. *Phase noise (4QAM)*

4) Amplitude compression causes the corner points to move towards the centre:

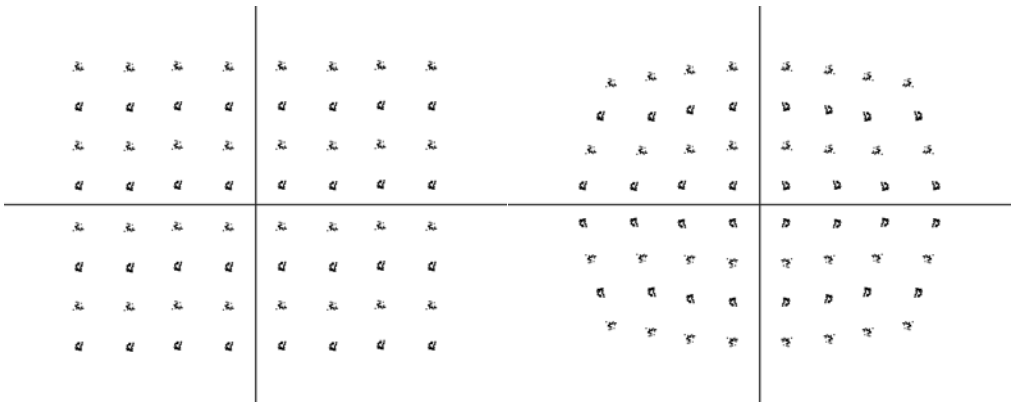


Figure 5.14. *Amplitude compression (64QAM)*

Examples of CFIP constellation diagrams under excellent conditions are shown below:

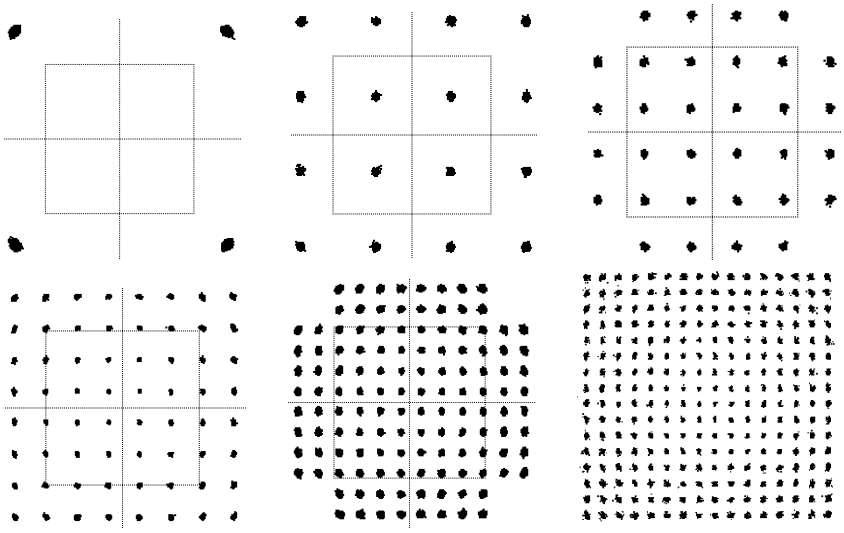
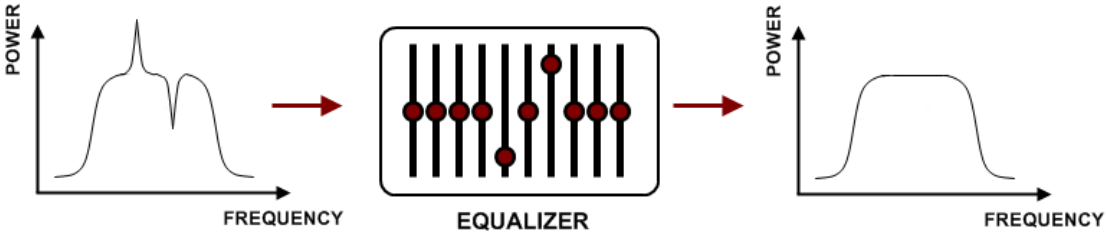


Figure 5.15. *Constellation diagram – 4QAM, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM*

5.2.5 Adaptive Equalizer

CFIP Lumina features adaptive equalizer, which is a filter that automatically adapts to time-varying properties of a communication channel with selective fading, having a target to compensate the inequalities in frequency response, mitigating the effects of multipath propagation. In wireless telecommunications, using QAM modulation this filter equalizes not only a separate quadrature channel, but provides a cancellation of cross-interference between them.

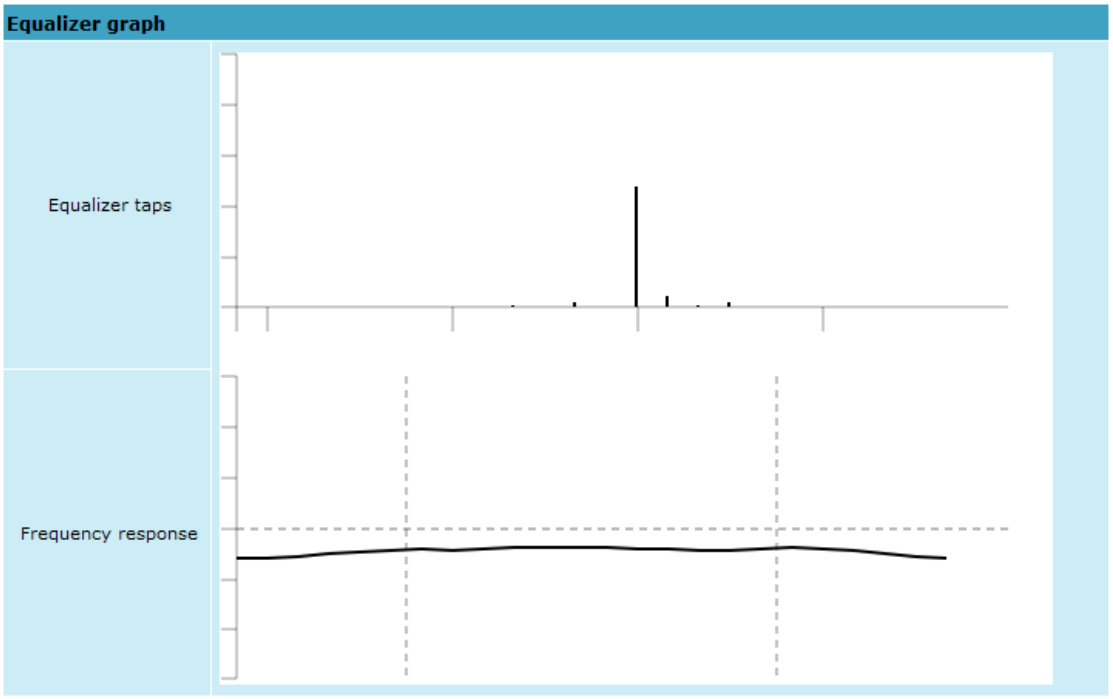
In current CFIP device an adaptive equalizer is realized as complex-arithmetic 24-taps digital FIR (Finite Impulse Response) filter. In other words, equalizer is a selective frequency amplifier and attenuator, a device, which application to IF (Intermediate Frequency) band-limited signal is schematically shown in the picture below:



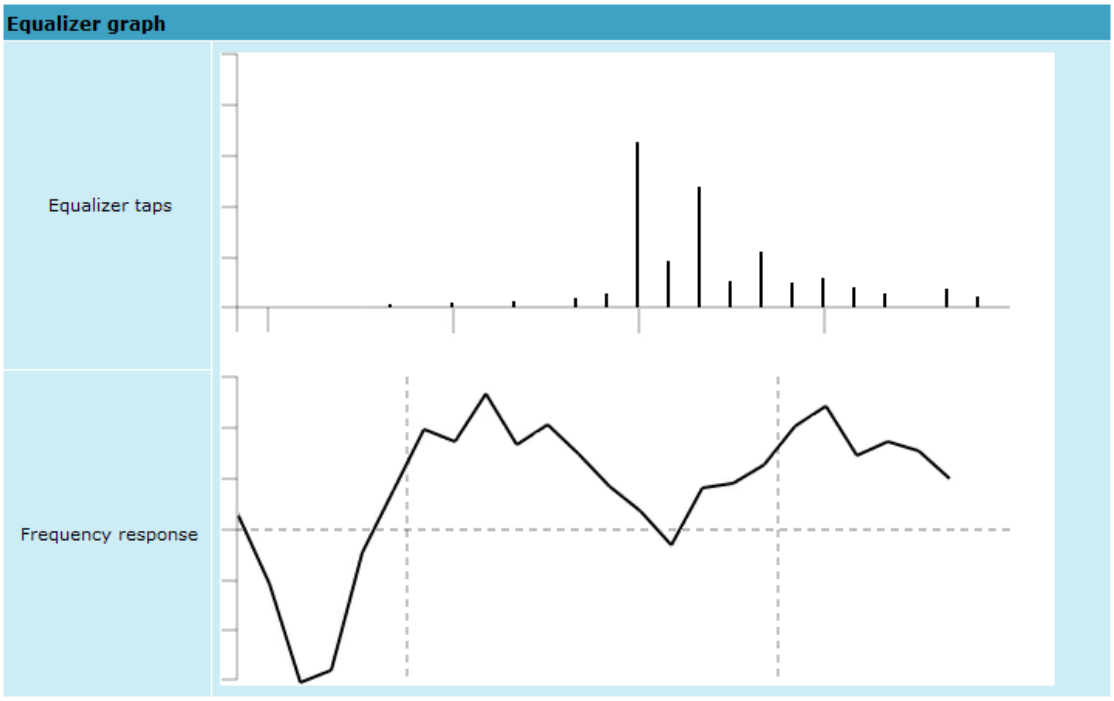
Equalizer graph

Equalizer graph window shows adaptive equalizer taps' coefficients, which at a set time moment minimize multipath fading effect in channel.

Example of equalizer taps' coefficients and its frequency response in case of a normal operation is shown below:



During normal operation frequency response curve is smooth and the only equalizer tap towers are in the centre of equalizer taps graph, otherwise frequency response curve will appear jagged and many equalizer taps will become visible. The latter case most probably will indicate to multipath issue, which must be inspected with use of precise and accurate path profiling. An example of multipath caused equalization is shown on the picture below. Taps mainly on the right side designate a weaker reflected signal in comparison with the main signal.



5.2.6 Performance Management Commands

It is also possible to view performance log in command prompt.

The list of available commands is the following:

Additional performance management commands in Telnet/serial interface	
Command	***Description***
pm log *<interval> {<last rec count>|{<start date>|<start time>|<end date>|<end time>}}*	Lists performance management log with selected *<interval>* of 1min, 15min or 1hr. Allows choosing the number of last records to be shown *(<last rec count>)* or to define start and end time and date. Note that end time and date values must be entered after entering start time or date respectively.
pm select *{Up_TIME . Rx_LEVEL . Tx_LEVEL . RADIAL_MSE . LDPC_STRES . MOD_TEMPER . SYS_TEMPER . PSU_U_IN . PSU_POW.} | {ALL | NOT}*	Allows selecting the system parameters to be monitored and shown in the performance management log.
pm logclear	Clears performance log.
pm threshold stat | auto | *{{Rx_LEVEL | Tx_LEVEL | RADIAL_MSE | LDPC_STRES | MOD_TEMPER | SYS_TEMPER | PSU_U_IN | PSU_POW} {min|max <value>} | auto }*	Sets threshold levels for parameters from where TS (Threshold Seconds) are counted and shown in the performance log.

5.3 Ethernet modem statistics

Ethernet modem statistics window shows the full Ethernet and framing statistics of CFIP modem since unit start or statistics reset. All statistics are also accessible using command prompt command ***ethernet statistics all***.

Explanation of fields:

Ethernet modem statistics					
Statistics for 00:00:30	1				
Modem state	2	Ok			
	3				Clear statistics
Name		**Rx**	**Name**		**Tx**
Truncated frames	4	0	Vlan tags	26	0
Long events	5	0	Backpres. events	27	0
Vlan tags detected	6	0	Pause frames	28	0
Unsup. opcodes	7	0	Control frames	29	0
Pause frames	8	0	Wire byte counter	30	65738
Control frames	9	0	Underruns	31	0
Dribble nibbles	10	0	Giants	32	0
Broadcasts	11	0	Late collisions	33	0
Multicasts	12	0	Max collisions	34	0
Dones	13	316	Excessive defers	35	0
Jumbo frames	14	0	Non-exc. defers	36	0
Length check errors	15	0	Broadcasts	37	1
CRC errors	16	0	Multicasts	38	1
Code errors	17	0	Dones	39	339
False carrier errors	18	0	Length check errors	40	0
Rx Dv event	19	0	CRC errors	41	0
Prev. pkt dropped	20	0	Collisions	42	0
Byte counter	21	64173	Byte counter	43	65738
Name		**GFP**	**Name**		**QoS**
FCS errors	22	0	Rx Q1 frames	44	316
CHEC errors	23	0	Rx Q1 dropped	45	0
Dropped frames	24	0	Rx Q2 frames	46	0
Delineation errors	25	0	Rx Q2 dropped	47	0
			Tx frames	48	339
			Tx dropped	49	0

1. Shows time period during which statistics have been gathered;
2. *Modem state* – shows if the modem is operating correctly;
3. *Clear statistics* – resets all statistics counters (not available for “guest” account);
4. *Truncated frames* – number of truncated received frames;
5. *Long events* – frames having byte count greater than MAXIMUM FRAME SIZE parameter (1518, 1536 or 1916 bytes);
6. *Vlan tags detected* – VLAN tagged frames;
7. *Unsup. opcodes* – frames recognized as control frames but contained an Unknown Opcode;
8. *Pause frames* – frames received are control frames with valid PAUSE opcodes;
9. *Control frames* – frames received as control frames;
10. *Dribble nibbles* – indicates that following the end of the packet additional 1 to 7 bits are received. A single nibble, named the dribble nibble, is formed but not sent to the system;
11. *Broadcasts* – packets, which destination address contained broadcast address;
12. *Multicasts* – packets, which destination address contains multicast address;
13. *Dones* – reception of packets successfully completed;
14. *Jumbo frames* – frame Type/Length field larger than 1518 (Type Field) bytes;
15. *Length check errors* – frame length field in the packet does not match the actual data byte length and is not a Type Field;

16. *CRC errors* – frame CRC do not match the internally generated CRC;
17. *Code errors* – one or more nibbles are signalled as errors during reception of the packet;
18. *False carrier errors* – indicates that following the last received statistics vector, a false carrier was detected, noted and reported with next received statistics. The false carrier is not associated with this packet. False carrier is activated on the receiving channel that does not result in a packet receive attempt being made;
19. *Rx Dv event* – indicates that the last receiving event seen is too short to be a valid packet;
20. *Prev. pkt dropped* – indicates that since the last RSV, a packet is dropped (i.e. interframe gap too small);
21. *Byte counter* – total number of bytes received on the wire, not counting collided bytes;
22. *FCS errors* – number of generic framing procedure (GFP) frames with CRC errors received by the de-encapsulation block;
23. *CHEC errors* – number of generic framing procedure (GFP) frames with CHEC errors received by the de-encapsulation block;
24. *Dropped frames* – number of generic framing procedure (GFP) frames that were dropped in the de-encapsulation block;
25. *Delineation errors* – number of 'lost of synchronization' events;
26. *Vlan tags* – number of VLAN tagged packets, 32-bit counter;
27. *Backpres. events* – carrier-sense-method backpressure was previously applied;
28. *Pause frames* – frames transmitted are control frames with a valid PAUSE opcodes;
29. *Control frames* – frames transmitted are control frames;
30. *Wire byte counter* – total number of bytes transmitted on the wire, including all bytes from collided attempts;
31. *Underruns* – underruns occur during frame transmission;
32. *Giants* – frames having byte count greater than the MAXIMUM FRAME SIZE parameter (1516, 1536 or 1916 bytes);
33. *Late collisions* – Collisions occurred beyond the collision window (512 bit times);
34. *Max collisions* – packets aborted after number of collisions exceeded the RETRANSMISSION MAXIMUM parameter;
35. *Excessive defers* – packets deferred in excess of 6,071 nibble times in 100 Mbps mode, or 24,287 bit-times in 10 Mbps mode;
36. *Non-exc. defers* – packets deferred for at least one attempt, but less than an excessive defer;
37. *Broadcasts* – packets, which destination address contained broadcast address;
38. *Multicasts* – packets, which destination address contained multicast address;
39. *Dones* – transmission of packets successfully completed;
40. *Length check errors* – frame length field in the packet does not match the actual data byte length and is not a Type Field;
41. *CRC errors* – frame CRC do not match the internally generated CRC;
42. *Collisions* – number of collisions the current packet incurred during transmission attempts;
43. *Byte counter* – total count of bytes transmitted on the wire not including collided bytes;
44. *Rx Q1 frames* – number of frames received on Q1;
45. *Rx Q1 dropped* – number of frames dropped on Q1;
46. *Rx Q2 frames* – number of frames received on Q2;
47. *Rx Q2 dropped* – number of frames dropped on Q2;
48. *Tx frames* – number of frames passed through TX FIFO;

49. *Tx dropped* – number of frames dropped in TX FIFO.

5.4 Ethernet switch statistics

Ethernet switch statistics window shows the full Ethernet statistics of CFIP switch since unit start or statistics reset. All statistics are also accessible using command prompt command ***ethernet counters*** <1|2|3|4|5|6|All|Clear>.

Explanation of fields:

Ethernet switch statistics

Statistics for 17:22:03 **1**

2 Clear statistics

Value		P1 (LAN)	P2 (LAN)	P3 (LAN)	P4 (LAN)	P5 (WAN)	P6 (Mng)
TxOctets	3	0	0	0	17598292	121658634	112540314
TxDropPkts	4	0	0	0	0	0	0
TxQ0PKT	5	0	0	0	79549	642426	613903
TxBroadcastPkts	6	0	0	0	474	1016	1132
TxMulticastPkts	7	0	0	0	0	0	0
TxUnicastPkts	8	0	0	0	79075	641410	612771
TxCollisions	9	0	0	0	0	0	0
TxSingleCollision	10	0	0	0	0	0	0
TxMultiCollision	11	0	0	0	0	0	0
Transmit	12	0	0	0	0	0	0
TxLateCollision	13	0	0	0	0	0	0
TxExcessiveCollision	14	0	0	0	0	0	0
TxFrameInDiscards	15	0	0	0	0	0	0
TxPausePkts	16	0	0	0	0	0	0
TxQ1PKT	17	0	0	0	0	0	0
TxQ2PKT	18	0	0	0	0	0	0
TxQ3PKT	19	0	0	0	0	0	0
RxOctets	20	0	0	0	29149721	114755186	107757145
RxUndersizePkts(runts)	21	0	0	0	0	0	0
RxPausePkts	22	0	0	0	0	0	0
RxPkts64Octets	23	0	0	0	77634	475	1863
RxPkts64to127Octets	24	0	0	0	13520	124912	125044
RxPkts128to255Octets	25	0	0	0	76	463447	450187
RxPkts256to511Octets	26	0	0	0	156	25065	12503
RxPkts512to1023Octets	27	0	0	0	38410	809	10
RxPkts1024to1522Octets	28	0	0	0	0	421	49
RxOversizePkts	29	0	0	0	0	0	0
RxJabbers	30	0	0	0	0	0	0
RxAlignmentErrors	31	0	0	0	0	0	0
RxFCSErrors	32	0	0	0	0	0	0
RxGoodOctets	33	0	0	0	29149721	114755186	107757145
RxDropPkts	34	0	0	0	0	0	0
RxUnicastPkts	35	0	0	0	128959	614834	589477
RxMulticastPkts	36	0	0	0	0	0	0
RxBroadcastPkts	37	0	0	0	837	295	179
RxSAChanges	38	0	0	0	0	1	1
RxFragments	39	0	0	0	0	0	0
RxExcessSizeDisc	40	0	0	0	0	0	0
RxSymbolError	41	0	0	0	0	0	0
RxPkts1523to2047Octets	42	0	0	0	0	0	0
RxPkts2048to4095Octets	43	0	0	0	0	0	0
RxPkts4096to8191Octets	44	0	0	0	0	0	0
RxPkts8192to9728Octets	45	0	0	0	0	0	0
RxDiscard	46	0	0	0	0	0	0

1. Shows the time during which statistics have been gathered;
2. *Clear statistics* – resets all statistics counters (not available for “guest” account);
3. *TxOctets* - The total number of good bytes of data transmitted by a port (excluding preamble but including FCS);
4. *TxDropPkts* - This counter is incremented every time a transmit packet is dropped due to lack of resources (e.g., transmit FIFO underflow), or an internal MAC sublayer transmit error not counted by either the TxLateCollision or the TxExcessiveCollision counters;
5. *TxQ0PKT* - The total number of good packets transmitted on COS0, which is specified in MIB queue select register when QoS is enabled;

6. *TxBroadcastPkts* - The number of good packets transmitted by a port that are directed to a broadcast address. This counter does not include errored broadcast packets or valid multicast packets;
7. *TxMulticastPkts* - The number of good packets transmitted by a port that are directed to a multicast address. This counter does not include errored multicast packets or valid broadcast packets;
8. *TxUnicastPkts* - The number of good packets transmitted by a port that are addressed to a unicast address;
9. *TxCollisions* - The number of collisions experienced by a port during packet transmissions;
10. *TxSingleCollision* - The number of packets successfully transmitted by a port that have experienced exactly one collision;
11. *TxMultiCollision* - The number of packets successfully transmitted by a port that have experienced more than one collision;
12. *TxDeferred Transmit* - The number of packets transmitted by a port for which the first transmission attempt is delayed because the medium is busy. This only applies to the Half Duplex mode, while the Carrier Sensor Busy;
13. *TxLateCollision* - The number of times that a collision is detected later than 512 bit-times into the transmission of a packet;
14. *TxExcessiveCollision* - The number of packets that are not transmitted from a port because the packet experienced 16 transmission attempts;
15. *TxFrameInDiscards* – The number of valid packets received which are discarded by the forwarding process due to lack of space on an output queue (not maintained or reported in the MIB counters). This attribute only increments if a network device is not acting in compliance with a flow control request, or the sum of the drop count when the packet is dropped on the flow control;
16. *TxPausePkts* - The number of PAUSE events at each port;
17. *TxQ1PKT* – The total number of good packets transmitted on COS1, which is specified in MIB queue select register when QoS is enabled;
18. *TxQ2PKT* – The total number of good packets transmitted on COS2, which is specified in MIB queue select register when QoS is enabled;
19. *TxQ3PKT* - The total number of good packets transmitted on COS3, which is specified in MIB queue select register when QoS is enabled;
20. *RxOctets* - The number of data bytes received by a port (excluding preamble, but including FCS), including bad packets;
21. *RxUndersizePkts(runts)* - The number of good packets received by a port that are less than 64 bytes long (excluding framing bits, but including the FCS);
22. *RxPausePkts* - The number of PAUSE frames received by a port;
23. *RxPkts64Octets* - The number of received packets (including error packets) that are 64 bytes long;
24. *RxPkts65to127Octets* - The number of received packets (including error packets) that are between 65 and 127 bytes long;
25. *RxPkts128to255Octets* - The number of received packets (including error packets) that are between 128 and 255 bytes long;
26. *RxPkts256to511Octets* - The number of received packets (including error packets) that are between 256 and 511 bytes long;
27. *RxPkts512to1023Octets* - The number of received packets (including error packets) that are between 512 and 1023 bytes long;
28. *RxPkts1024to1522Octets* - The number of received packets (including error packets) that are between 1024 and 1522 bytes long;
29. *RxOversizePkts* - The number of good packets received by a port that are greater than 1522 bytes (tagged) and 1518 bytes (untagged). This counter alone is incremented for packets in the range 1523–1536 bytes inclusive, whereas both this

counter and the RxExcessSizeDisc counter are incremented for packets of 1537 bytes and higher;

30. *RxJabbers* – The number of packets received by a port that are longer than 1522 bytes and have either an FCS error or an alignment error;
31. *RxAlignmentErrors* - The number of packets received by a port that have a length (excluding framing bits, but including FCS) between 64 and 1522 bytes, inclusive, and have a bad FCS with a nonintegral number of bytes;
32. *RxFCSErrors* – The number of packets received by a port that have a length (excluding framing bits, but including FCS) between 64 and 1522 bytes inclusive, and have a bad FCS with an integral number of bytes;
33. *RxGoodOctets* – The total number of bytes in all good packets received by a port (excluding framing bits, but including FCS);
34. *RxDropPkts* - The number of good packets received by a port that were dropped due to a lack of resources (e.g., lack of input buffers) or were dropped due to a lack of resources before a determination of the validity of the packet was able to be made (e.g., receive FIFO overflow). The counter is only incremented if the receive error was not counted by the RxExcessSizeDisc, the RxAlignmentErrors, or the RxFCSErrors counters;
35. *RxUnicastPkts* – The number of good packets received by a port that are addressed to a unicast address;
36. *RxMulticastPkts* – The number of good packets received by a port that are directed to a multicast address. This counter does not include errored multicast packets or valid broadcast packets;
37. *RxBroadcastPkts* – The number of good packets received by a port that are directed to the broadcast address. This counter does not include errored broadcast packets or valid multicast packets;
38. *RxSAChanges* – The number of times the SA of good receive packets has changed from the previous value. A count greater than 1 generally indicates the port is connected to a repeater-based network.
39. *RxFragments* – The number of packets received by a port that are less than 64 bytes (excluding framing bits) and have either an FCS error or an alignment error;
40. *RxExcessSizeDisc* – The number of good packets received by a port that are greater than 1536 bytes (excluding framing bits but including the FCS) and were discarded due to excessive length. The RxOversizePkts counter alone is incremented for packets in the range 1523–1536 bytes inclusive, whereas both this counter and the RxOversizePkts counter are incremented for packets of 1537 bytes and higher;
41. *RxSymbolError* – The total number of times a valid-length packet was received at a port and at least one invalid data symbol was detected. The counter only increments once per carrier event and does not increment on detection of a collision during the carrier event;
42. *RxPkts1523to2047Octets* – The number of received packets (including error packets) that are between 1523 and 2047 bytes long;
43. *RxPkts2048to4095Octets* – The number of received packets (including error packets) that are between 2048 and 4095 bytes long;
44. *RxPkts4096to8191Octets* – The number of received packets (including error packets) that are between 4096 and 8191bytes long;
45. *RxPkts8192to9728Octets* - The number of received packets (including error packets) that are between 8192 and 9728bytes long;
46. *RxDiscard* - The number of good packets received by a port that were discarded by the Forwarding Process.

6 Miscellaneous Controls in Web Graphic User Interface

These controls are located in the Navigation Panel under the “Tools” item.

6.1 Ethernet/Configuration files

This section allows working with CFIP system and Ethernet configuration script.

The management module has RAM and EEPROM chips onboard. When CFIP is booted up, bootstrap is loaded from the EEPROM into RAM. The bootstrap contains the parameters that were previously stored in EEPROM using **write** and/or **cfg write** commands. These parameters are stored in EEPROM in the form of script and during boot up, the script parameters are loaded into RAM. These parameters can be freely changed in run-time, - changing the data in RAM. If the CFIP is shut down without saving the current configuration (script) in EEPROM, the original configuration will be restored from EEPROM during next boot-up time.

Example of script can be observed on the screenshot below.

The script can be edited:

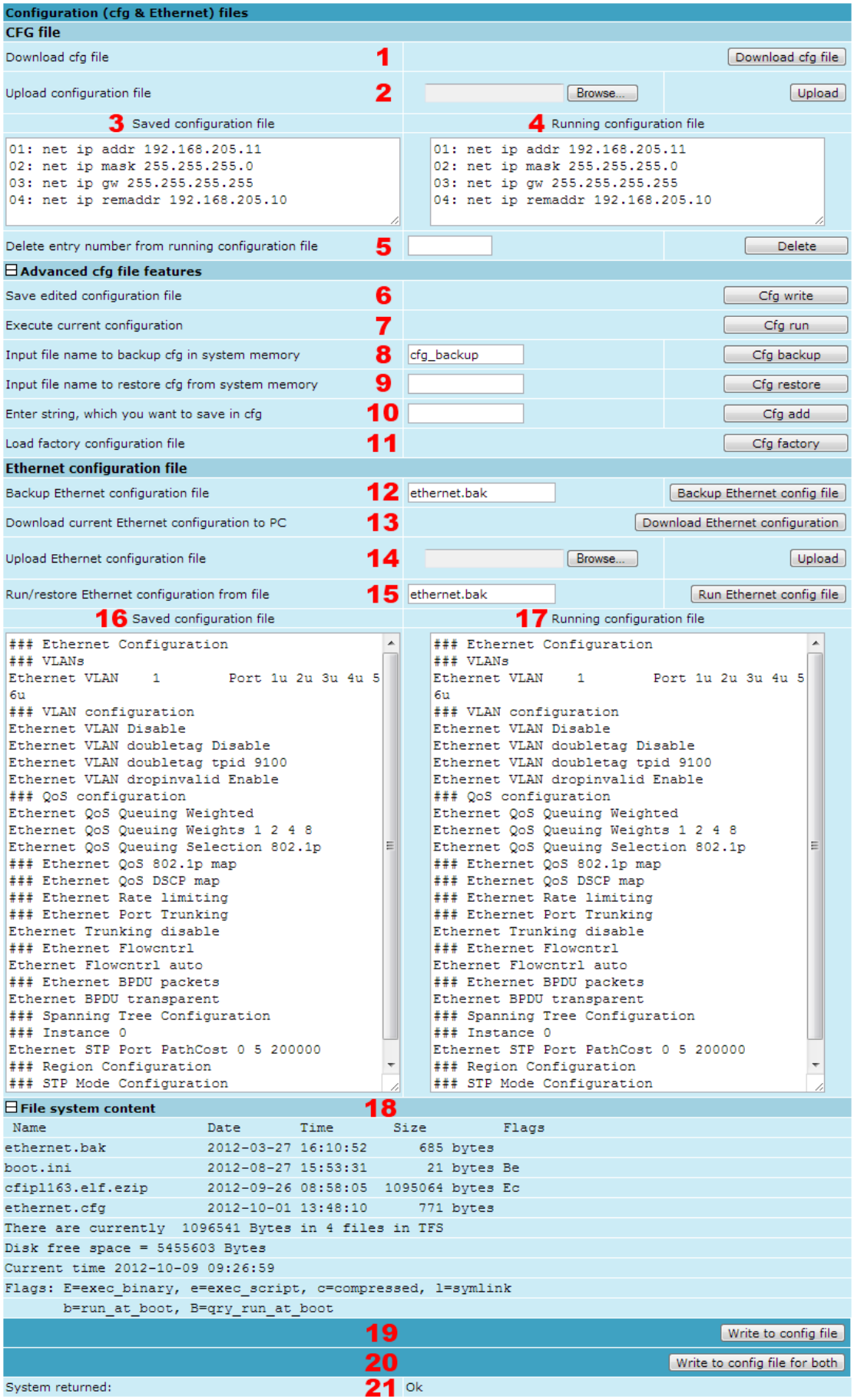
– string can be added to system configuration script by simply entering required string (see Nr. 10 on the screenshot below) or by executing command in CLI or in the appropriate Web GUI section (the script will be supplemented with the new string or the instant string entry will be updated);

– string can be deleted from system configuration script by entering appropriate line number (see Nr. 5 on the screenshot below) or by using “**cfg delete** <string#>” in CLI.

The changes can be saved in EEPROM by pressing “Cfg write” button (see Nr. 6 on the screenshot below) or by entering “**cfg write**” command in CLI.

(!) Note! The parameters that are not specified in the configuration script will have their default values when the CFIP Lumina is restarted.

Explanation of customization fields:



1. *Download cfg file* – allows downloading system configuration file and saving it on your hard drive.

2. *Upload configuration file* - allows uploading system configuration file to CFIP Lumina flash memory. In order to load configuration file from system memory, *cfg restore* should be used (refer to number 9);
3. Saved configuration file - shows contents of system configuration file saved in EEPROM memory. Commands contained in this configuration file are executed at every system start-up;
4. Running configuration file - shows currently running system configuration file (command line – ***cfg show***). In order to save current configuration use command ***cfg write***;
5. *Delete entry number from running configuration file* – allows deleting a specific line from currently running system configuration (refer to number 4); (command line – ***cfg delete*** *<line>*);
6. *Save edited configuration file* – allows save running system configuration permanently in EEPROM memory (changes applied since the last start of the system) (command line – ***cfg write***);
7. *Execute current configuration* – executes commands present in currently running system configuration file (command line – ***cfg run***);
8. *Input file name to backup cfg in system memory* – allows choosing file name under which currently running system configuration file will be saved in the CFIP flash memory (command line – ***cfg backup*** *<file>*);
9. *Input file name to restore cfg from system memory* – allows loading system configuration file from backup file located in flash memory (command line – ***cfg restore*** *<file>*). To view the contents of flash memory refer to number 18;
10. *Enter string, which you want to save in cfg* – allows you to enter desirable command, which will be added to running system configuration file as the last line (command line – ***cfg add*** *<cmdline>*);
11. *Load factory configuration file* – Resets system configuration by loading in EEPROM the script with default settings. This command performs the following actions (in the following order):

    1. clears the currently saved system configuration file from EEPROM,
    2. creates and stores new system script in EEPROM the with the following settings:

       - net ip addr 192.168.205.10 or 192.168.205.11 (as marked on the label)
       - net ip remaddr 192.168.205.11 or 192.168.205.10
       - net ip mask 255.255.255.0
       - net ip gw – 255.255.255.255 (default gateway - none)
       - SNMP trap 255.255.255.255 (none)

    3. restarts the management controller.

    (command line – ***cfg factory***);
12. *Backup Ethernet configuration file* – allows choosing file name under which currently running Ethernet configuration file will be saved in the CFIP flash memory (command line – ***ethernet config*** *<file>*);
13. *Download current Ethernet configuration to PC* – allows downloading Ethernet configuration file and saving it on your hard drive.
14. *Upload Ethernet configuration file* – allows uploading Ethernet configuration file to CFIP Lumina flash memory. In order to load Ethernet configuration file from system memory, appropriate dialog should be used - refer to number 15;
15. *Run/restore Ethernet configuration from file* – allows loading Ethernet configuration file from backup file located in flash memory. To view the contents of flash memory refer to number 18;

16. Saved configuration file - shows contents of system configuration file saved in EEPROM memory. Commands contained in this configuration file are executed at every system start-up;
17. Running configuration file - shows currently running system configuration file (command line – ***eth config***). In order to save current configuration use command ***cfg write***;
18. *File system content* – shows contents of internal flash memory (command line – ***tfs ls***);
19. *Write to config file* – saves all changes made (command line – ***cfg write***);
20. *Write to config file for both* – saves all changes made for local and remote side (command line – ***cfg write***);
21. *System returned* - in case of error or incorrectly entered parameter value, or other problems in the whole page – the info message will be displayed here. Otherwise it says "Ok".

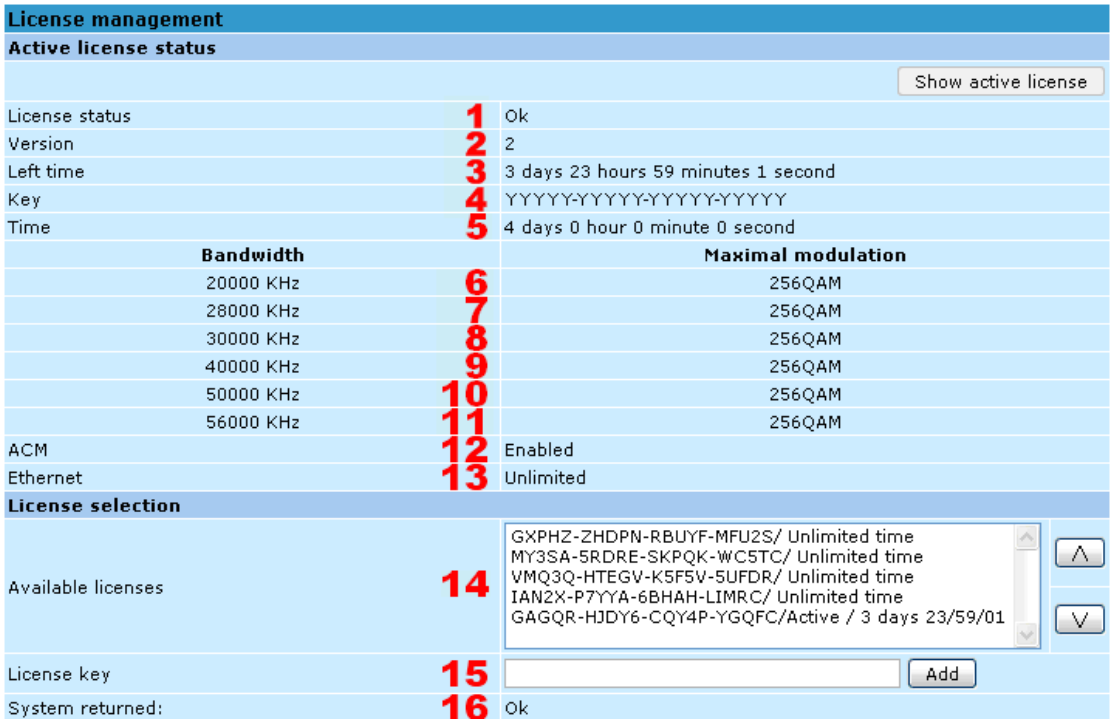
Additional commands for script editing in Telnet/serial interface	
Command	***Description***
Cfg load	Loads the configuration script from EEPROM into RAM.
Cfg clear	Clears the script stored in RAM.
Cfg insert *<line> <cmdline>*	Inserts typed command line with specified line number into configuration script stored in RAM.
Cfg cmd *<file with commands>*	Restarts CPU of management controller and loads configuration script from the specified file.
Cfg group	Groups commands in configuration script.

6.2 License Management

License management allows specifying data transmission parameters and functionality for specific time period or for unlimited time.

CFIP without licensing option will operate with full functionality, but CFIP with licensing option but without activated licenses will operate with minimum functionality (14 or 20 MHz channel bandwidth (depending on model), 4QAM modulation, no ACM). Functionality may be expanded using appropriate license key.

Explanation of fields:

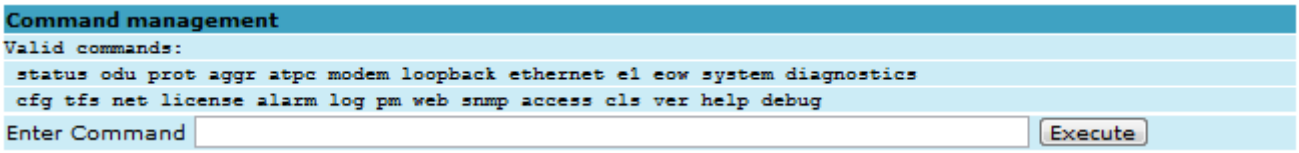


1. *License status* – shows if management CPU was able to read license data (command line – ***license status***);
2. *Version* – shows what the license version of selected license key is. 1 – License without Ethernet rate limiting, 2 – license with Ethernet rate limiting (command line – ***license status***);
3. *Left time* – shows the amount of time left for the active license (command line – ***license status***);
4. *Key* – displays currently active license (command line – ***license status***);
5. *Time* – shows the overall time for the active license (command line – ***license status***);
6. *20000 KHz* – shows the maximum modulation that can be used together with 20 MHz channel bandwidth (command line – ***license status***);
7. *28000 KHz* – shows the maximum modulation that can be used together with 28 MHz channel bandwidth (command line – ***license status***);
8. *30000 KHz* – shows the maximum modulation that can be used together with 30 MHz channel bandwidth (command line – ***license status***);
9. *40000 KHz* – shows the maximum modulation that can be used together with 40 MHz channel bandwidth (command line – ***license status***);
10. *50000 KHz* – shows the maximum modulation that can be used together with 50 MHz channel bandwidth (command line – ***license status***);
11. *56000 KHz* – shows the maximum modulation that can be used together with 56 MHz channel bandwidth (command line – ***license status***);
12. *ACM* – shows if adaptive coding and modulation (ACM) is allowed for the active license (command line – ***license status***);
13. *Ethernet* – shows Ethernet rate limitation for active or currently selected license. Ethernet rate of version 1 licenses will always be “Unlimited” (command line – ***license status***);
14. *Available licenses* – shows the list of entered licenses. To activate any license, select it. “Add” button will transform into “Activate”, which should be pressed (command line – ***license list***);
15. *License key* – allows entering a license key. Entering a license key twice, activates it (command line – ***license key*** <*key*>);

16. *System returned* – in case of error or incorrectly entered parameter value, or other problems on the whole page – info message will be displayed here.. Otherwise it says “Ok”.

6.3 Command Line

In the command line you are able to execute all the commands to manage the CFIP Lumina which are available through serial/telnet interface. This dialog box translates commands to Telnet commands and sends them to the device. The initial screen shows you the available commands. To view help on a command, type in “<command> **?**”, where <command> stands for the specific command.



Additional command prompt commands	
Command	***Description***
Cls	Clears the screen.
Help *<command>*	Provides help messages for commands.

7 File System

The software used by the CFIP management controller is organized in files, which are stored on Flash disk.

Firmware and boot configuration files

The following files are required for the CFIP to start:

– 'boot.ini' file, - device boot configuration file. This file is a text file and contains the name of the firmware file which must be executed on start-up. The file name can be freely changed, but its default name is 'boot.ini'; hereinafter, it is assumed that this file has default filename. The most important factor concerning this file is that it must be uploaded with 'B' and 'e' attribute flags (flags are case sensitive!), only then it will be treated as executive script.

  Attribute flags for 'boot.ini' file:
  B – query run at boot; **e** – executive script
  For information how to upload files in the Flash disk, please refer to ***Chapter 7***.

– Firmware file, - this file is the main firmware executable for the appropriate CFIP model. The file name can be freely changed, but its default name will contain the version and CFIP model, e.g., 'cfipl000.elf.ezip'. The most important factor concerning this file is that it must be uploaded with 'E' and 'c' attribute flags, otherwise this file will not be used as the firmware.

  Attribute flags for firmware file:

  E – executable binary; **c** - compressed

Notes:

– The files are uploaded from PC to Flash disk using TFTP/FTP (via Ethernet management port), or using Xmodem protocol (via RS232 serial port), for more information about file upload please refer to ***Chapter 7***; configuration backup files are created by CFIP management system.
– The flash disk may store other files as well, for example - previous firmware versions, configuration backup files, - up to 6.5 Mb (about 6 firmware files).
– The attribute flags for files are case sensitive.
– The file names can be changed, but it is very important that the file has the necessary attribute flags; otherwise, the file will not be used either as firmware, or as 'boot.ini' type file.
– There are no file extensions in the file system; either file, when edited, is treated as ASCII text file.
– When uploading the file, if the Flash disk stores the file with the same filename as for the file being uploaded, it will be overwritten with the new file.

Configuration backup files

Using '*cfg backup <filename>*' command, the user can create the backup file of the current CFIP configuration. The configuration backup file is a text file and, when created, contains the current configuration script, - the same configuration script that is stored in EEPROM. Please refer to ***Chapter 7*** for more information on configuration script.

The configuration backup files are stored on Flash disk, where they can be edited or downloaded to PC. The backup configuration file can be applied in run-time, by consecutively entering '*cfg restore <filename>*' and '*cfg run*' commands. Note: the configuration restored from file is not stored in EEPROM and, therefore it will be lost during CFIP restart. To save it in EEPROM use *'write'* command.

The user can create and store several configuration files to quickly revert to other CFIP site configurations.

Working with files

The following commands are intended to operate with files stored on Flash disk in the management controller.

tfs edit <file>	Edits the specified file. This command is applied for editing configuration backup files and boot configuration file (boot.ini). For example, *edit boot.ini,Be* – file 'boot.ini' will be opened for editing. 'Be' specifies that this file will be saved with attributes 'B' and 'e'. If boot.ini file is intended to be modified, it should always be opened specifying 'B' and 'e' flags as in the example above, this will ensure that file is saved with these attributes (flags). To close the file and save changes press Ctrl+Z, to close the file without saving changes press Ctrl+Q. The configuration backup files do not require specific attributes.
tfs ls	Displays the list of files stored on the Flash disk and the number of bytes, both free and used by these files. 'tfs dir' can also be used.
tfs cat <filename>	Displays the contents of the text file. 'tfs type' can also be used.
tfs del <filename>	Deletes the specified file from Flash disk. 'tfs rm' can also be used.

7.1 Security Commands

General tips

Telnet server supports one user only, web server supports up to 32 users simultaneously. By default the username and password for Web server, FTP server and Telnet terminal is:

– Username (login): *admin*

– Password: *changeme*

The username and password can be changed in Web GUI "System configuration → User configuration"

'***access set*** *<username> <password> [plaintext]*' command.

Take note of upper case and lower case type: it should be taken into account for the password!

The passwords may contain spaces; if using space(s), the password should be entered in quotation marks.

For Telnet, FTP and Web GUI the password can be changed by simply entering the security command '***access set*** *<username> <password> [plaintext]*' while logged on and then saving the configuration in EEPROM by using '*write*' command.

To terminate Telnet session press Ctrl+D.

(!) "guest" account is unable to change its access password.

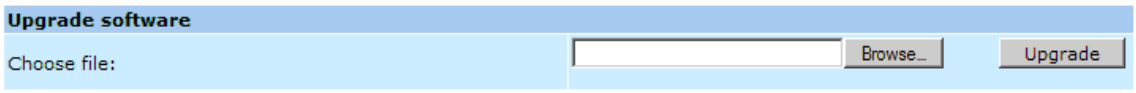
(!) Specification of the password should always be followed by saving the configuration script (using "**cfg write**" command); otherwise, the password request will be ignored after the restart of the unit.

8 Software Update

To simplify the firmware update process, SAF Tehnika JSC provides special update package, as a new version is available. This update pack is available as archive (e.g. zip), which includes firmware file (with *.elf.ezip,Ec extension), upgrade instructions, release notes and MIB files for SNMP protocol. The latest CFIP series firmwares are available in the following URL:

https://www.saftehnika.com/downloads/firmware/cfip (registration required)

The main method for firmware upgrade is being done via Web GUI, which automates the whole firmware upgrade process. To perform software upgrade from Web GUI, please go to "Configuration → System configuration" and in "Upgrade software" section press "Browse…" button and locate firmware upgrade file (e.g. cfipf000.elf.ezip,Ec) on your hard disk.



Although upgrade procedure usually takes less than 1 min., Management CPU might initiate defragmentation of flash memory and upgrade process may take up to 3-5 minutes. Please do not unplug power until firmware upgrade procedure is finished - Web GUI will automatically reconnect and login page will appear.

Besides there are other various ways how the user can update the CFIP management software by uploading the appropriate firmware file to the CFIP Lumina flash disk and further editing boot configuration file if necessary. The file upload can be performed:

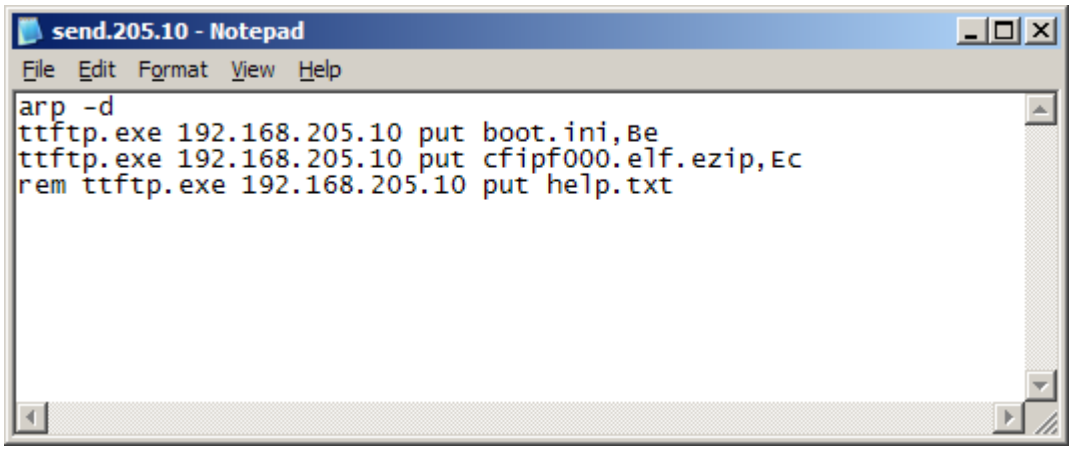
- via Ethernet management port using update package,
- via Ethernet management port using FTP,
- via Ethernet management port using TFTP, or
  via RS232 serial port using Xmodem protocol.

Following chapters describe other methods how to update software.

8.1 Update Software with Update Pack

To update CFIP software using the update pack, proceed as follows:

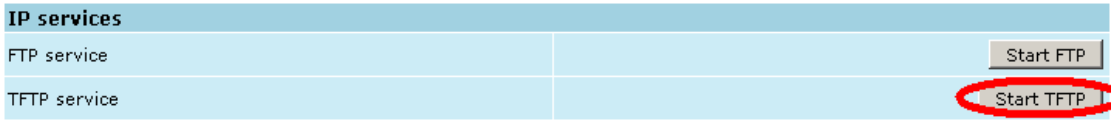
- uncompress the package;
- change the CFIP IP address to 192.168.205.10, *or* edit 'send.205.xx' files by replacing "192.168.205.10" with actual CFIP IP address;



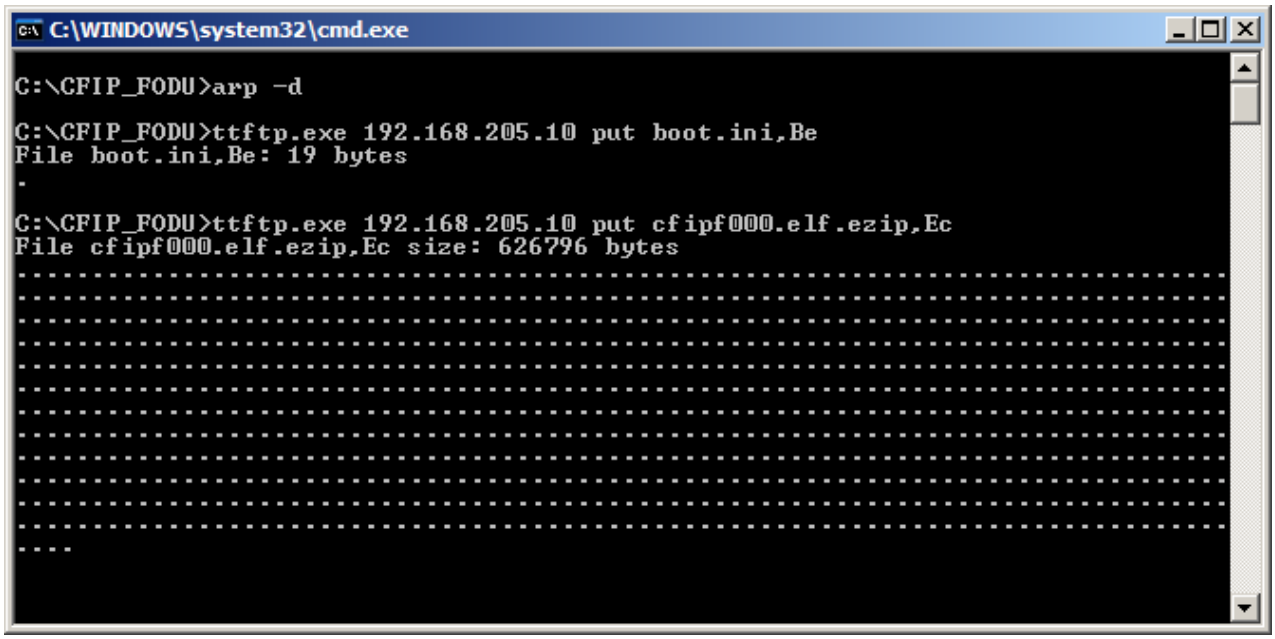
  - **arp –d** *ip_addr* [*if_addr*] deletes the host specified by ip_addr. If another host with a duplicate IP address exists on the network, the ARP cache may have had the MAC address for the other computer placed in it. **arp –d** is used to delete an entry that may be incorrect. By default no host is specified.
  - ***rem*** *ttftp.exe 192.168.205.10 put help.txt* prefix ignores command execution

– *ttftp.exe 192.168.205.10 put cfipl000.elf.ezip,Ec* uploads firmware file named 'cfipl000.elf.ezip' with attribute flags 'E' and 'c' to host CFIP with IP address 192.168.205.10.

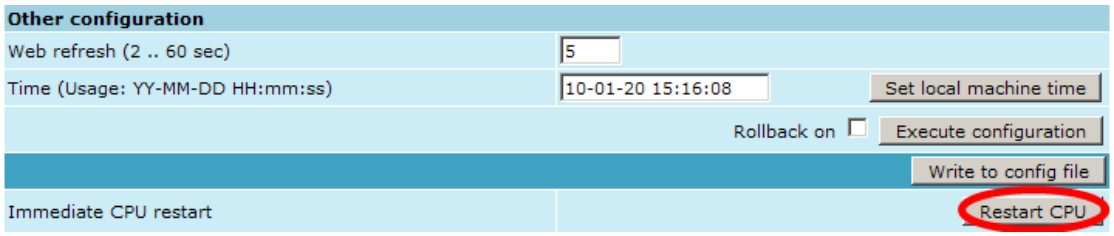
– Start TFTP on both link sides in 'Configuration → IP configuration':



– run 'send.205.xx.cmd' to perform update, where „xx" represents last number of actual CFIP IP address. In case the memory is full, upload will halt and error message will be displayed. In this case user must first delete some files to free enough memory on the CFIP Flash disk. Update process screen is shown below:



– To activate new firmware, first restart the management CPU of the remote link side CFIP Lumina and then the local side CFIP Lumina (traffic flow won't be interrupted) in 'Configuration → System configuration':



8.2 File Upload via Ethernet Management Port (TFTP)

Assuming that the CFIP IP settings are properly configured, proceed as follows:

1. Connect the CFIP to network or directly to PC;
2. Make sure TFTP is running on CFIP (by default, the TFTP is switched off); to run TFTP on CFIP, connect to CFIP with Telnet client and enter the following command: '*start tftp*';
3. Run the program that enables to use TFTP service, for example command interpreter (cmd.exe) if you are using Windows, see ***Figure 7.1***;
4. For example, to upload the firmware file 'cfip000.elf.ezip' with attribute flags 'E' and 'c', enter command:

tftp –i 192.168.205.11 put C:\files\cfipl000.elf.ezip cfipl001.elf.ezip,Ec

where:

'-i' – key which specifies that file must be transferred in binary image transfer mode;

'192.168.205.11' – CFIP Ethernet management port IP address (host);

'C:\files\cfipl000.elf.ezip' – firmware file (source);

'cfipl001.elf.ezip' –file name in the CFIP flash memory (destination);

'Ec' – file attribute flags 'E' and 'c'; the attribute flags are separated from file name or source with comma (only comma and no space) and there are no commas or spaces between flags;

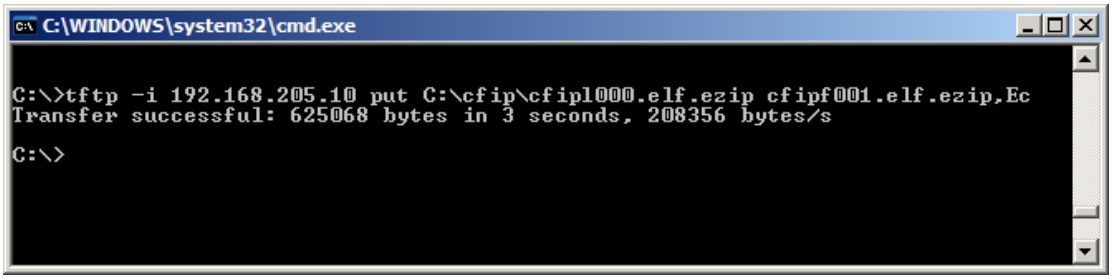


Figure 7.1. *Command interpreter cmd.exe*

5. If uploaded file is large (like firmware file), it is recommended to defragment Flash disk. Use '*tfs clean*' command from Telnet or ASCII terminal to perform defragmentation.

6. If the uploaded file is the firmware file which should be used by CFIP, it is necessary to edit 'boot.ini' file by deleting the entry with the old file name and to write file name of the new firmware file; the 'boot.ini' file must be saved with 'B' and 'e' flags (file attributes). For more information how to edit files, please refer to the chapter *Working with files* in ***Chapter 6.4***.

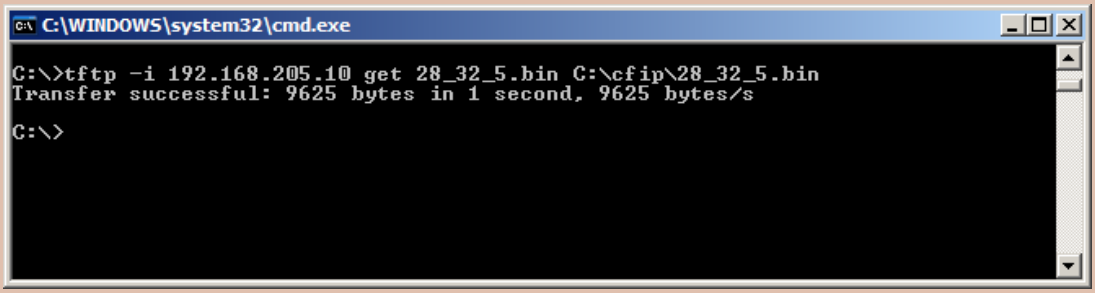
(!) To copy file from CFIP Flash disk to PC hard disk via TFTP, use the following command:

tftp -i 192.168.205.11 get filename destination_filename

where

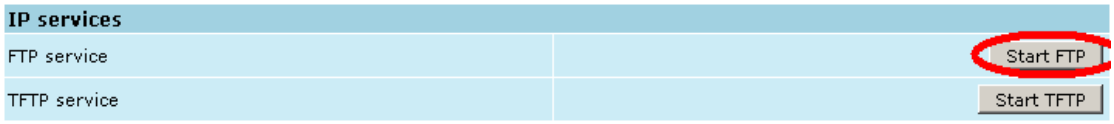
'192.168.205.11' – CFIP port IP address (host);

'filename' – file to be copied from CFIP to PC; 'destination_filename' – destination path where the file will be saved on PC hard disk.



8.3 File Upload via Ethernet Management Port (FTP)

Before uploading file via FTP, make sure the CFIP FTP server is running. To start it, go to 'Configuration → IP configuration' in Web GUI and press 'Start FTP':



1. Open command window.

2. Start FTP client by entering "***ftp***" command ("*ftp>*" prompt will appear).
3. Connect to CFIP FTP server using command "***open*** *<CFIP_IP_address>*". Type in username and password when prompted (by default username is *admin* and password is *changeme*).
4. Enter the command "***type binary***" to make sure the binary transfer mode is selected.
5. Use command "***send*** *<local file> <remote file>, <flags>*" to upload files to CFIP Flash disk. For example:

send c:\boot.ini boot.ini,Be

Use flags 'E' and 'c' if the file is a firmware file; if the file is a boot configuration file (boot.ini), the flags must be 'B' and 'e' ('**Be**'); the flags for configuration backup files may not be specified.

Use command "***ls***" to list files on CFIP flash disk.

Use command "***delete*** *<filename>*" to delete the file from the CFIP Flash disk.

6. Proceed with steps 5. and 6. in ***Chapter 7.1***.

You can also use any preferable FTP client if you wish.

8.4 File Upload via Serial Port (Xmodem)

File upload via serial port takes much longer time compared to use of TFTP and should be used only in case Ethernet connection with the CFIP management system is not available, or does not start normally.

1. Connect the ASCII console to the CFIP serial port, make connection with the following properties: Bits per second: 19200; Data bits: 8; Parity: none; Stop bits: 1; Flow control: none; if using 'Hyper Terminal' program, please refer to ***Chapter 2.3.1*** for information how to make a connection.
2. Type 'restartcpu' and, while CFIP is booting, press any key when 'boot.ini?' prompt appears. This will stop executing script in 'boot.ini' file and the CFIP will remain in MicroMonitor mode. This is the system start-up mode which loads the management system firmware;

   Note: While you are in MicroMonitor mode, the 'uMON>' prompt will be displayed, instead of normal prompt with CFIP name (default 'SAF>').
3. In MicroMonitor mode enter the following command:

   xmodem –cd –F <file_path-no_flags> -f Ec

   where

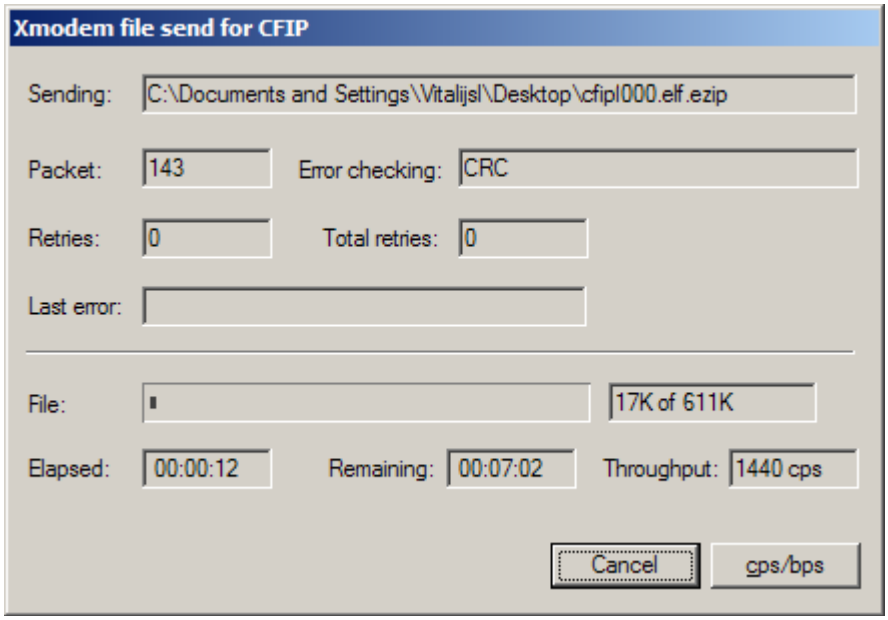
   <file_path-no_flags> - file name with no flags specified

   '**Ec**' – file flags, in case the file is firmware file - 'E' and 'c' flags must be used; if the file is boot configuration file (boot.ini), the flags must be '**Be**' ('B' and 'e'); the flags for configuration backup files may not be specified, in that case the command will be

   xmodem –cd –F <file_path-no_flags>

   After xmodem command execution, proceed to the next step.
4. Use terminal emulation software with file upload function, such as *Hyper Terminal* (in Windows) to upload the firmware file to CFIP as binary image (use binary transfer mode), using *Xmodem* protocol.

   If you are using *Hyper Terminal*, proceed as follows: from menu select 'Transfer→Send File…', then select file and in 'protocol' box select *Xmodem* protocol and press 'Send' button. The following box should appear:



When upload is complete, the following information will be displayed (***Figure 7.2.***):

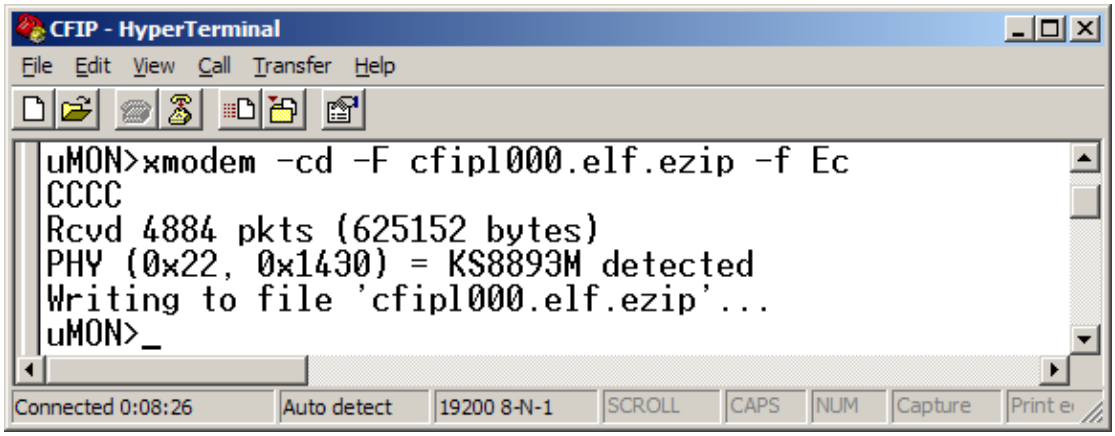


Figure 7.2.

5. Enter '*reset*' command to exit from MicroMonitor mode and restart the CFIP.
6. Proceed with steps 5. and 6. in ***Chapter 7.1***.

9 CFIP Discovery Protocol

Discovery Protocol is Layer 3 Network protocol. This feature allows gathering information from connected CFIP devices. The protocol discovers the IP address and software version of connected CFIP unit. Discovery protocol uses UDP packets sent on port 78.

Discovery Protocol feature may be useful, when the IP address of connected device is unknown and there is no possibility to establish connection through serial management port in order to find out the IP address.

9.1 CFIP Unit Discovery Procedure

In order to discover the IP address and software version of CFIP unit proceed with the following steps:

- Connect your PC to CFIP unit through PoE injector
- Download Discovery Protocol (available from saftehnika.com webpage in **„Download→Tools”** section (registration required))
- Open the cmd window on your PC (Go to "Start->Run.." and enter "cmd")
- Check for the IP address of your PC Ethernet adapter connected to CFIP unit by executing the command "ipconfig"
- Navigate to the folder containing previously downloaded and unzipped Discovery Protocol using “cd” command
- Now the necessary Discovery Protocol command can be executed (e.g. "dp sight <scan_addr>", where <scan_addr> should be substituted by Ethernet adapter IP address of your PC.)

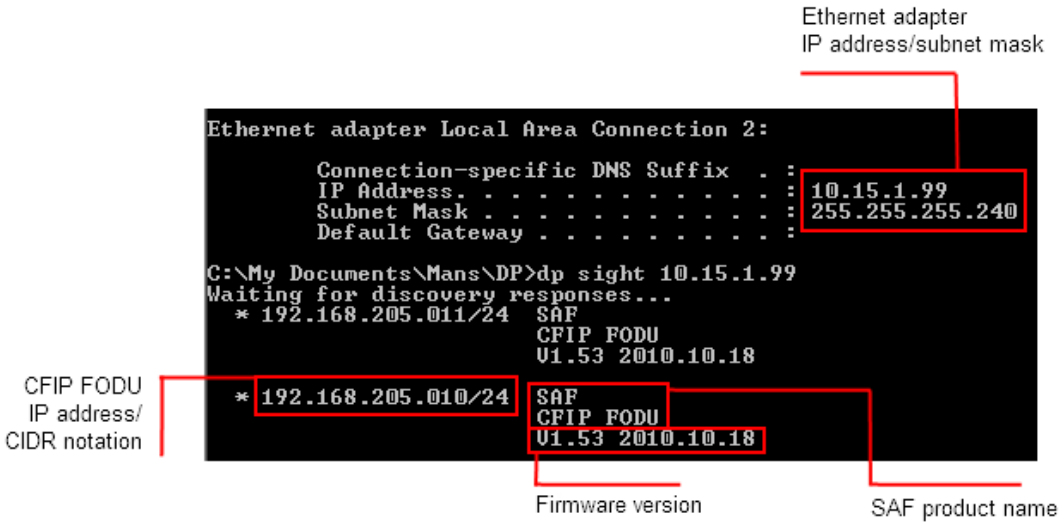
Discovery Protocol Commands:

Discovery protocol commands	
Command	**Description**
dp sight <local_addr>	Allows to find out the IP address and firmware version of CFIP unit without knowing the IP subnet.
dp scan <local_addr> <scan_addr>	This command gathers the information in the specified subnet. It sends discovery packets to the broadcast address <scan_addr> and returns the IP address and firmware version of CFIP unit.
dp remote <local_addr> <remote_addr> <scan_addr>	Allows to find out the IP address and firmware version of CFIP remote unit. This procedure allows bypassing routers as the response packets are unicast packets.

9.2 Discovery Protocol Performance Examples

9.2.1 Discovery of IP Address and Firmware Version in Case The Subnet of CFIP Unit is Unknown

For this purpose the command “dp sight <local_addr>” should be executed in ‘cmd’. Instead of <local_addr> place the IP address of your PC Ethernet adapter that is connected to CFIP unit. Refer to figure below for example.



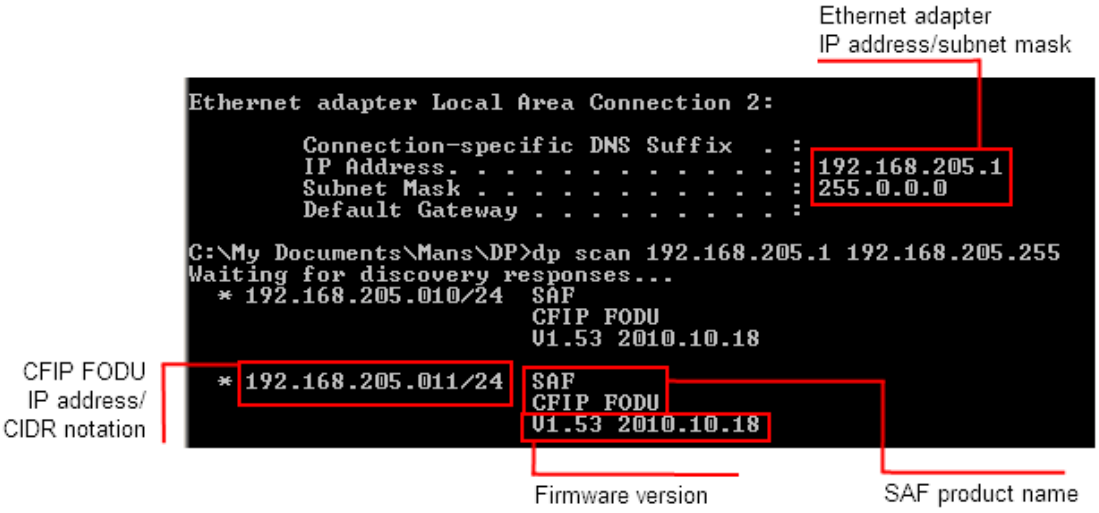
(!) Note that IP addresses of Ethernet adapter and CFIP units may belong to different subnets. This command sends discovery messages on broadcast address 255.255.255.255 to all devices in network. All CFIP devices connected to this network are responding with its own IP address/CIDR notation and firmware version.

CIDR notation (routing prefix) is related to network mask that is also necessary in order to manage CFIP unit. The IP address of your PC Ethernet adapter and CFIP unit should be from the same subnet in order to manage the CFIP unit. In the table below some examples are given for CIDR notation and subnet mask relation.

CIDR notation	Network mask
/24	255.255.255.0
/25	255.255.255.128
/26	255.255.255.192
/27	255.255.255.224
/28	255.255.255.240
/29	255.255.255.248
/30	255.255.255.252

9.2.2 Discovery of IP Address and Firmware Version in Case The Subnet of CFIP Unit is Known

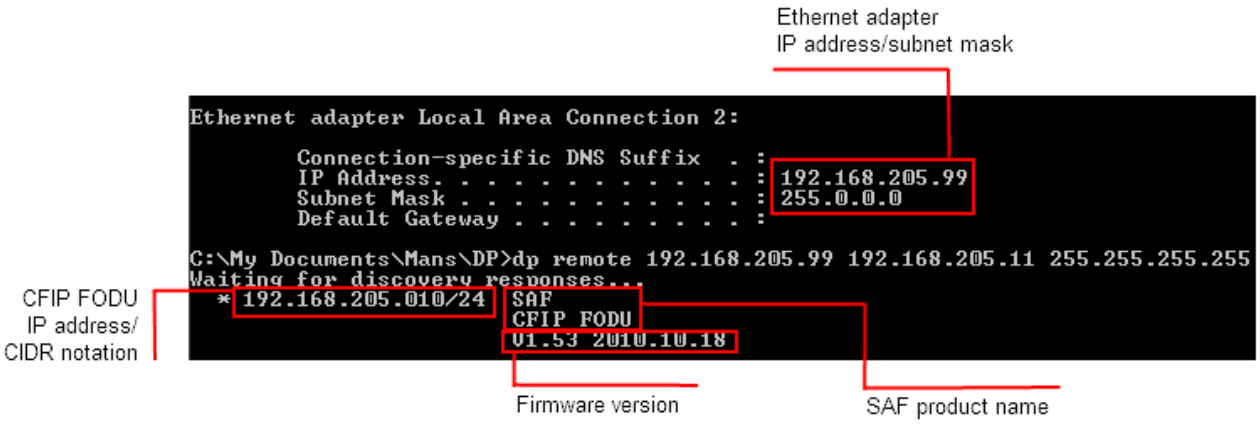
For this purpose the command “dp scan <local_addr> <scan_addr>” should be executed in ‘cmd’. Instead of <local_addr> place the IP address of your PC Ethernet adapter that is connected to CFIP unit and instead of <scan_addr> place the broadcast address of specified subnet. Refer to figure below for example.



(!) Note that IP address of Ethernet adapter should belong to the same subnet as CFIP units, i.e. the subnet of CFIP units should be known. The subnet mask of Ethernet adapter and CFIP units may differ. This command sends discovery messages on specified broadcast address to all devices in the specified subnet. All CFIP devices from specified subnet are responding with its own IP address/CIDR notation and firmware version

9.2.3 Discovery of IP Address and Firmware Version of Remote CFIP Unit Connected to Router In Case one IP address of Remote Units is Known

For this purpose the command “dp remote <local_addr> <remote_addr> <scan_addr>” should be executed in ‘cmd’. Instead of <local_addr> place the IP address of your PC Ethernet adapter that is connected to router/CFIP unit. Instead of <remote_addr> place the IP address of one of the remote CFIP units known to you. Instead of <scan_addr> place the broadcast address. Refer to figure below for example.

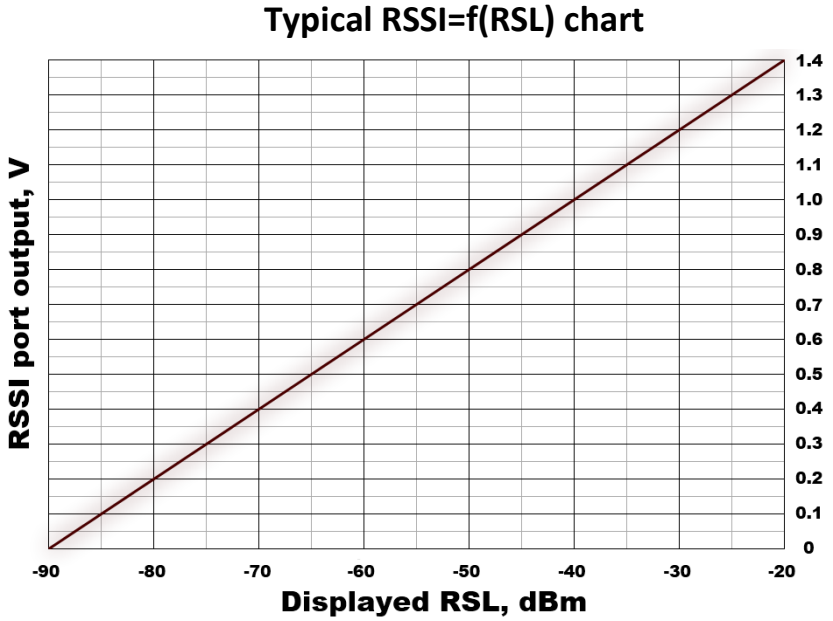


(!) Note that one IP address of remote CFIP units should be known. The remote host sends discovery packets to specified broadcast address and the responses are delivered to the local host. This allows finding out the IP address and firmware version of neighboring devices of a known remote device. The bypassing of a router is possible as the response packets are unicast.

10 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 CFIP vs. RSSI port output voltage (RSSI – Received Signal Strength Indicator). The RSSI port is located on FODU. 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

11 Pinouts

11.1 ODC connector

Optical interface of CFIP Lumina is available using ODC connector. Pinout is shown in Figure 9.1.

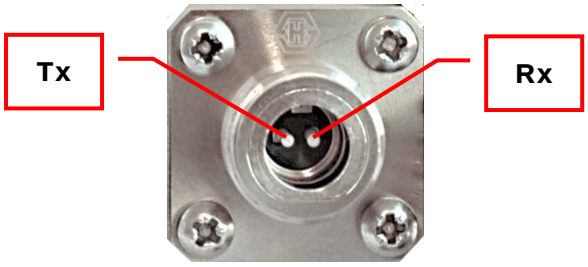
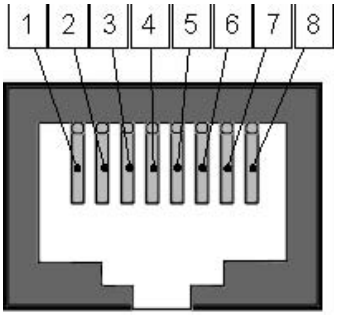


Figure 9.1. *CFIP Lumina ODC connector pinout*

11.2 RJ-45 connector

The pinouts of that socket are as follows:



1 – Bi-directional A+
2 – Bi-directional A-
3 – Bi-directional B+
4 – Bi-directional C+
5 – Bi-directional C-
6 – Bi-directional B-
7 – Bi-directional D+
8 – Bi-directional D-

Figure 9.2. *CFIP Lumina RJ-45 connector pinout*

11.3 Twin BNC Connector

Twin BNC connector is used for RS-232 serial port. RS-232 – USB convector cable can be used. Pinouts are shown in picture below.

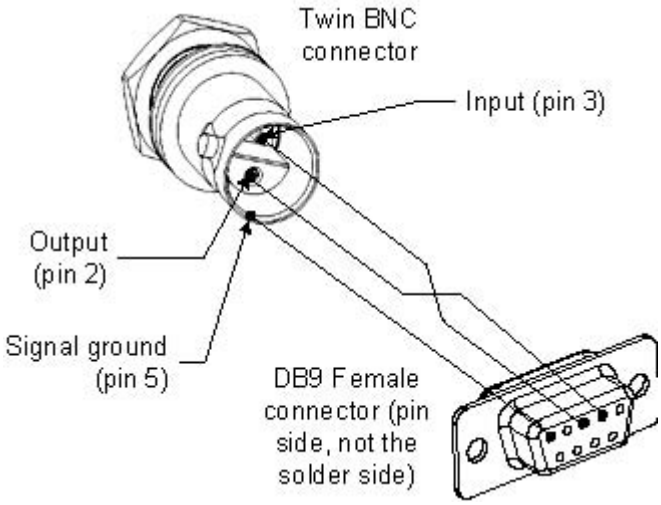


Figure 9.3. *RS-232 port pinouts, pin numbers refer to DB9 female connector*

11.4 DC power connector

DC power connector can be connected in any preferable layout:

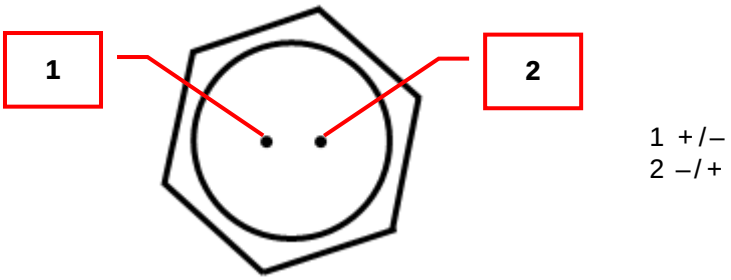
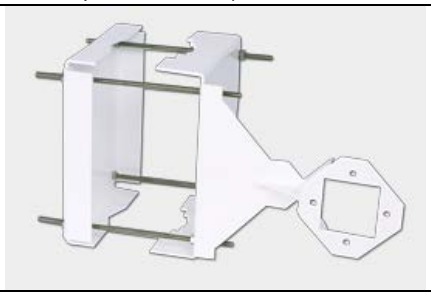
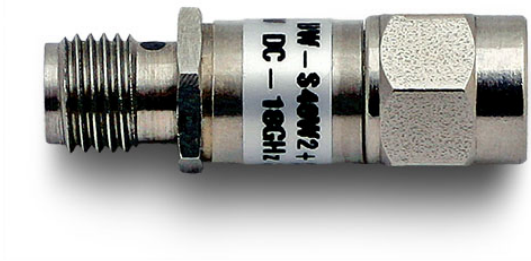
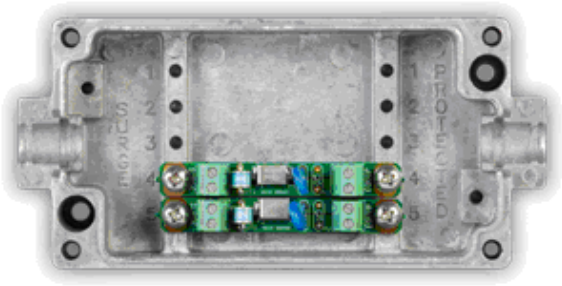


Figure 9.4. *DC power connector pinout*

12 Available accessories

	
FODU RJ-45 connector 8P shield solid P/N FOACNR02	SFP 850nm MM Transceiver 1000Base-SX 3.3V P/N: I0AMOM01 SFP 1310nm SM Transceiver 1000Base-LX 3.3V P/N: I0AOM001
	
Test equipment For further details see Chapter 11.2	O-ring - rubber gasket to be fitted between 0.25m antenna and FODU P/N CLAOR001; CLAOR002
	
RSSI cable for ODU align 1m BNC – 2 plug-in P/N CLGCRS01	CFIP FODU Mounting Bracket (for 1xFODU P/N: CLGRFB05; for 2xFODU P/N: CLGRFB06)
	
Indoor Power over Ethernet injector P/N I0ATPI11	Outdoor Power over Ethernet splitter P/N I0ATPS03

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>Hermetic connector for power cable
P/N: I0ACNP01</td><td>CFIP Lumina LC-ODC cable
3m SM P/N: I0ACO001 | 3m MM P/N: I0ACM001
10m SM P/N: I0ACO002 | 10m MM P/N: I0ACM002
50m SM P/N: I0ACO003 | 50m MM P/N: I0ACM003</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Coaxial attenuator 40 dB
P/N CLA40A01</td><td>SAF adapted OMT for Arkivator 0.3/0.6/0.99/1.2m antenna for dual-pol
For further details see Chapter 11.2</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>AC/DC Power adapter 40-50V/1,5-1,2A (63W)
For further details see Chapter 11.1</td><td>ODU twin BNC RG108A connector for RS-232 console port for FODUs
P/N FOACNT01</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Surge protection for CFIP Lumina 48VDC cable, 2A
P/N I0ASP201</td><td>CFIP Lumina RJ-45 cable connector case</td></tr>
</table>

FODU cable TWIN BNC - DB9 (2m).
P/N FOACTW01

12.1 AC/DC power adapters

Power (W)	Injector (P/N)	Power adapter (P/N)	Connector supplied	Standard
60	-	I0AB4806	Terminal block	ETSI, EU plug
60	-	I0AB4805	Terminal block	FCC, USA plug
60	-	I0AB4817	Terminal block	AUS plug
60	I0ATPI07	I0AB4812	-	ETSI, EU plug
60	I0ATPI07	I0AB4813	-	FCC, USA plug
60	I0ATPI07	I0AB4819	-	AUS plug
80	-	I0AB4808	Terminal block	ETSI, EU plug
80	-	I0AB4809	Terminal block	FCC, USA plug
80	I0ATPI07	I0AB4810	-	ETSI, EU plug
80	I0ATPI07	I0AB4811	-	FCC, USA plug
80	I0ATPI07	I0AB4818	-	AUS plug

12.2 Other Available Accessories

- Power cable 2x0,75mm, CU, outdoor (P/N I0ACGE01)

CFIP Test Equipment

Test equipment 6 GHz	P/N: C06TST02	Test equipment 6 GHz
Test equipment 7/8 GHz	P/N: C08TST02	7/8GHz test suite, contains two waveguide-to-coaxial adapters, two attenuators, 40 dB, coaxial cable, 40 cm long
Test equipment 10/11 GHz	P/N: C11TST02	Test equipment 10/11 GHz
Test equipment 13/15 GHz	P/N: C15TST02	13/15GHz test suite, contains two waveguide-to-coaxial adapters, two attenuators, 40 dB, coaxial cable, 40 cm long
Test equipment 18/23GHz	P/N: C22TST02	18/23GHz test suite, contains two waveguide-to-coaxial adapters, two attenuators, 40 dB, coaxial cable, 40 cm long
Test kit 24 GHz	P/N: C24TST02	Test kit 24 GHz
Test equipment 26GHz	P/N: C26TST02	26 GHz test suite, contains flexible waveguide, waveguide attenuators (60dB)
Test equipment 38GHz	P/N: C38TST02	38 GHz test suite, contains flexible waveguide, waveguide attenuators (60dB)

UBR-PBR Waveguides

P/N	Name	Description
C07WF201	7/8GHz Flexible Waveguide 60cm UBR-PBR	Flexible Waveguide 2ft/60cm, 7-8GHz for connection of ODU to antenna (if installed separately) /for connection between splitter and antenna (1+1 protected installation)
C07WF301	7/8GHz Flexible Waveguide 90cm UBR-PBR	7/8GHz Flexible Waveguide 90cm UBR-PBR
C11WF301	10/11GHz Flex Waveguide 90cm PBR-UBR	10/11GHz Flex Waveguide 90cm PBR-UBR
C15WF301	13-15 GHz Flexible Waveguide 3ft/90cm UBR	13-15 GHz Flexible Waveguide 3ft/90cmUBR
C15WF201	13/15GHz Flexible Waveguide 60cm UBR-PBR	Flexible Waveguide 2ft/60cm, 13-15Ghz for connection of ODU to antenna (if installed separately) /for connection between splitter and antenna (1+1 protected installation)
C13WF301	13GHz Flexible Waveguide 90cm UBR-PBR	13/15 GHz Flexible Waveguide 90cm UBR-PBR
C22WF101	18/23GHz Flexible Waveguide 1ft/30cm	18/23GHz Flexible Waveguide 1ft/30cm
C22WF201	18/23GHz Flexible Waveguide 2ft/60cm	18-23GHz flexible waveguide to connect 18/23GHz coupler to antenna
C22WF401	18/23GHz Flexible Waveguide 4ft/120cm	18/23GHz Flexible Waveguide 4ft/120cm

OMT

OMT (Arkivator) 7GHz	P/N: C07OM31001i	7Ghz OMT (orthomode transducer) SAF adapted for direct mount to Arkivator 0.3, 0.6, 0.99 and 1.2m antennas
OMT (Arkivator) 11GHz	P/N: C11OM31001i	11Ghz OMT (orthomode transducer) SAF adapted for direct mount to Arkivator 0.3, 0.6, 0.99 and 1.2m antennas
OMT (Arkivator) 13GHz	P/N: C13OM31001i	13Ghz OMT (orthomode transducer) SAF adapted for direct mount to Arkivator 0.3, 0.6, 0.99 and 1.2m antennas
OMT (Arkivator) 15GHz	P/N: C15OM31001i	15Ghz OMT (orthomode transducer) SAF adapted for direct mount to Arkivator 0.3, 0.6, 0.99 and 1.2m antennas
OMT (Arkivator) 18GHz	P/N: C18OM31001i	18Ghz OMT (orthomode transducer) SAF adapted for direct mount to Arkivator 0.3, 0.6, 0.99 and 1.2m antennas
OMT (Arkivator) 23GHz	P/N: C23OM31001i	23Ghz OMT (orthomode transducer) SAF adapted for direct mount to Arkivator 0.3, 0.6, 0.99 and 1.2m antennas
OMT (Arkivator) 26GHz	P/N: C26OM31001i	26Ghz OMT (orthomode transducer) SAF adapted for direct mount to Arkivator 0.3, 0.6, 0.99 and 1.2m antennas
OMT (Arkivator) 38GHz	P/N: C38OM31001i	38Ghz OMT (orthomode transducer) SAF adapted for direct mount to Arkivator 0.3, 0.6, 0.99 and 1.2m antennas

13 List of Abbreviations

AC – Alternating Current
ACI – Adjacent-Channel Interference
ACM – Adaptive Coding and Modulation
ASCII - American Standard Code for Information Interchange
ATPC – Automatic Transmit Power Control
BER – Bit-Error Ratio
BNC connector - Bayonet Neill-Concelman coaxial connector
CCI – Co-Channel Interference
CLI – Command-Line Interface
CPU – Central Processing Unit
CRC – Cyclic Redundancy Check
DC – Direct Current
DiffServ – Differentiated Services
DSCP - Differentiated Services Code Point
EEPROM - Electrically Erasable Programmable Read-Only Memory
ETS – European Telecommunication Standard
ETSI – European Telecommunications Standards Institute
FIR – Finite Impulse Response
FO – Fiber Optics
FODU – Full Outdoor Unit
FTP – File Transfer Protocol
GFP – Generic Framing Procedure
GND - Ground
GUI – Graphical User Interface
IEEE - Institute of Electrical and Electronics Engineers
IF – Intermediate Frequency
ISP – Internet Service Provider
ITU-T – International Telecommunication Union – Telecommunication Standardization Sector
LAN – Local Area Network
LDPC – Low-Density Parity-Check Code
LED – Light-Emitting Diode
LTE – Long-Term Evolution
MAC – Media Access Control
MSE – Mean Square Error
NMS – Network Management System
PC – Personal Computer
PDH – Plesiochronous Digital Hierarchy
PLL – Phase-Locked Loop
PoE - Power over Ethernet
QAM - Quadrature amplitude modulation
QoS – Quality of Service
RAM – Random Access Memory
RSL – Received Signal Level
RSSI – Received Signal Strength Indicator
Rx – Receive

SNMP - Simple Network Management Protocol

SNR – Signal-to-Noise Ratio

STP – Spanning Tree Protocol

TCP/IP – Internet Protocol Suite (Transmission Control Protocol / Internet Protocol)

TDM – Time-Division Multiplexing

TFTP – Trivial File Transfer Protocol

TM – Tide Mark

TP – Twisted Pair

TS – Threshold Seconds

Tx – Transmission

UART – Universal Asynchronous Receiver/Transmitter

USB – Universal Serial Bus

VLAN – Virtual Local Area Network

WAN – Wide Area Network

14 SAF Tehnika JSC Contacts

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