Manuel détaillé des équipements de la gamme OEM Hypercable Wi200 –
Utilisation et Configuration avancée des équipements Radio et des Switchs périphériques.

Radio Verte-Green Radio

Conforme au Développement Durable
Compliant with Sustainable Development

L'IHM (GUI) interface WEB des FH Wi 200 et Wi 700 est en Français, voir également le manuel d'installation spécifique 24GHz en Français.

1   Overview

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

1.1 HYPERCABLE CFIP Full Outdoor Units

HYPERCABLE 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 HYPERCABLE CFIP radio is Fast Ethernet. In addition, HYPERCABLE CFIP is capable of delivering **up to 4E1** interfaces for legacy connectivity or any other use. As HYPERCABLE CFIP is capable of providing bit rate of **up to 108Mbps** to all interfaces combined, it is a great addition to SAF portfolio. This product family provides perfect solution for a user looking for higher capacity than PDH E3 without need for STM-1 capacity. HYPERCABLE CFIP radio and modem performance allows to achieve perfect system capacity by employing 128-level modulation scheme by user's choice. Apart from the **full system capacity of 108Mbps**, it is possible to configure the radio to any of 3.5, 7, 14 and 28 MHz channels as well as to any of **QPSK**, **16APSK, 32APSK, 64QAM** and **128QAM modulations**, thus providing various capacities to suit particular needs.

Hypercable SAF Tehnika has employed most modern design solutions and components to create high performance compact radio with **low power consumption** – 19-25W per radio, thus we have a capability to feed the unit by using Power over Ethernet (at least 25W) means.

HYPERCABLE CFIP 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 HYPERCABLE CFIP Feature Summary

1.2.1 Main Features

- Full Outdoor solution
- Capacity: up to **108 Mbps**
- Channel Bandwidth: **3.5/7/14/28** MHz
- Modulations: **QPSK, 16APSK, 32APSK, 64QAM, 128QAM**
- Interfaces: **10/100Eth+4E1**
- Traffic: Ethernet only, Eth+1E1 to Eth+4E1
- Frequency bands: **7 / 8 / 10 / 11 / 13 / 15 / 18 / 23 / 38** GHz
- **Power over Ethernet**
- Green Radio – **19-25W** of power consumption
- **ACM** and **ATPC** with **QoS** four priority queues
- **802.1Q VLAN** support

1.2.2 Mechanical Features

- Compact unit, **285x285x80mm**, **3.5kg**, 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: HYPERCABLE CFIP Full Outdoor Unit

1.2.3 Interfaces/Management

* HYPERCABLE CFIP FODU unit provides **4 connectors** and a grounding screw
* **User, NMS traffic** and **DC power** are fed over **Cat. 5e** or above cable and weather protected RJ-45 connector
* 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
* **4 ports** of balanced **E1** interfaces are provided over weather protected **18pin connector**
* **Twin BNC connector** of the unit enables terminal access into the unit
* **BNC connector** provides AGC voltage signal to assist unit alignment
* Web, Telnet and SNMP are available as **NMS** interfaces into the unit

Figure 1.2*: HYPERCABLE CFIP FODU connectors*
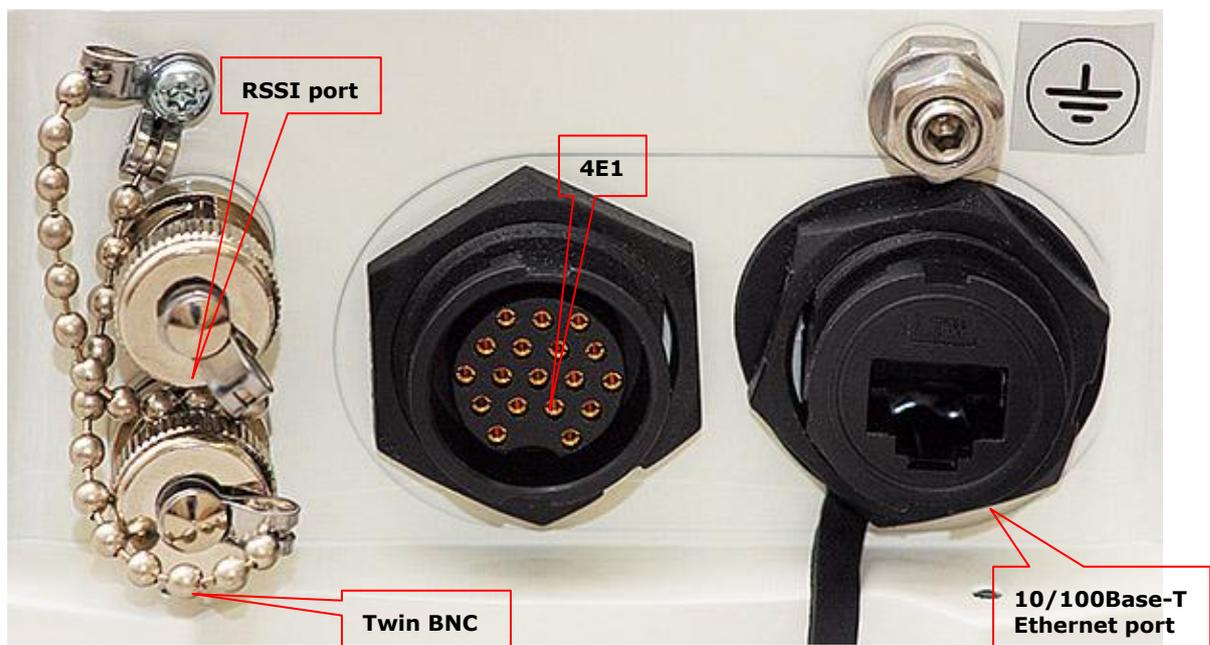
Figure 1.3*: Detailed view of HYPERCABLE CFIP FODU connectors*

1.3 Radio parameters

- HYPERCABLE CFIP is a good example of latest achievements in modem and transceiver development, providing both excellent radio parameters (System Gain), due to use of **APSK and QAM modulations** and efficient despite it consumes small amount of power power Tx/Rx part of the system.
- RSL Threshold at BER 10^{-6}, 28MHz, 32APSK, 100Mbps: **-77 dBm**.
- System Gain with guaranteed max Tx power and Rx sensitivity is **93 dB**.
- HYPERCABLE CFIP provided the capability to replace typical 34Mbps PDH radio to **108Mbps** system by retaining the antenna size/distance
- **ACM** (Adaptive Coding and Modulation), hitless ACM opens whole lot of 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 4E1 + Ethernet with HYPERCABLE CFIP FODU

- HYPERCABLE CFIP is a perfect tool for replacing the existing low capacity E1 radio system by preserving E1 connectivity where needed and adding high capacity Ethernet channel for future use, perfect for overlaying GSM network with 3G/WiMax and LTE (Long Term Evolution) services;
- Suitable for transition from TDM to Ethernet based networks;
- HYPERCABLE CFIP FODU supports SNMP protocol for NMS.
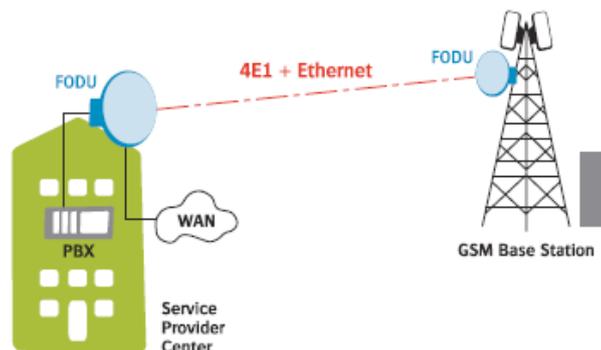
1.4.2 Low Power Active Repeater with HYPERCABLE CFIP FODU

- Extends network to non line-of-sight locations;
- Ideal for crossing mountains and interconnecting Ethernet networks;
- Low power consumption allows the use of battery backed alternative power sources like solar panel and small wind turbine for off-grid remote sites.
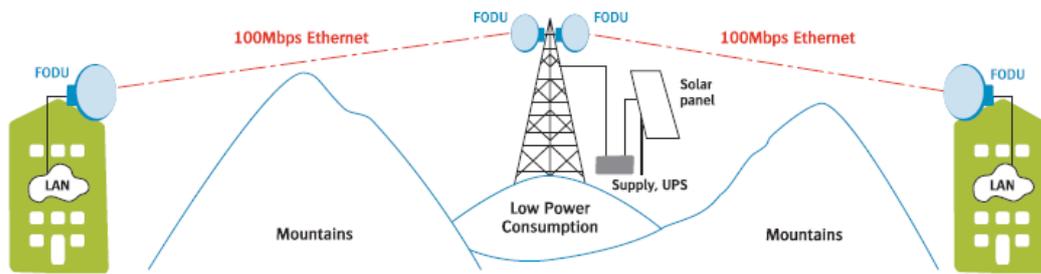
1.4.3 Metro Ethernet and Mesh Networks with HYPERCABLE CFIP FODU

- Suitable for any 100Mbps Ethernet network topology – star, ring, mesh network;
- Full Outdoor solution with Power over Ethernet cable is efficient for All Outdoor Base station connectivity;
- Last Mile Access for demanding power user and many other applications;
- Gigabit Ethernet backhaul can be supported with SAF CFQ Series products.
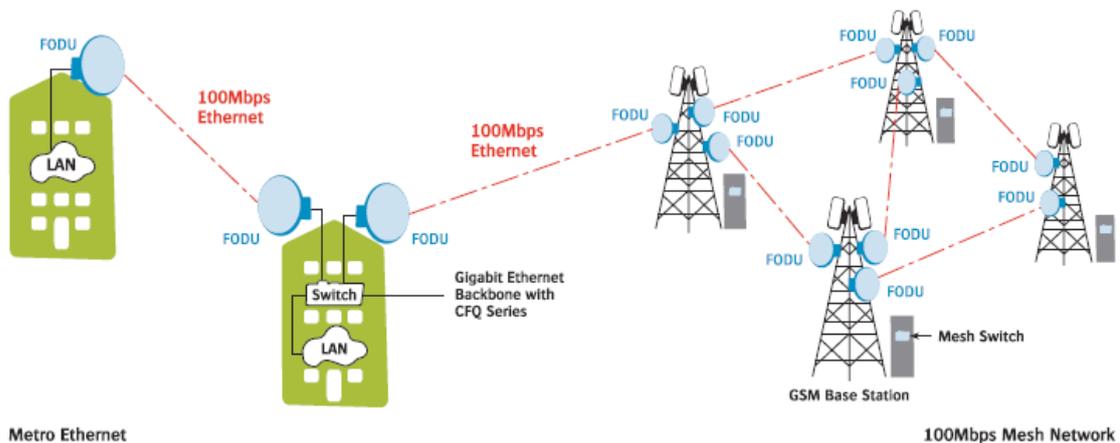
1.5 Technical Specification

░ CFIP FODU TECHNICAL SPECIFICATION

Frequency range (GHz)	7/8/10/11/13/15/18/23/24/26*/38
Channel bandwidth (MHz)**	3.5, 7, 13.75/14, 27.5/28
Modulation	QPSK / 16APSK / 32APSK / 64QAM / 128QAM
Capacity (Mbps)	100; 108 with 4xE1 wayside channels

░ PERFORMANCE

Configuration	1+0, 2+0 Frequency Diversity
Frequency stability (ppm) incl. aging	+/-7
Traffic Interfaces	100Mbps Fast Ethernet (RJ-45) / 4xE1 (18-pin connector)
Guaranteed max Tx power (dBm)	(see page 10 page for details)
RSL Threshold at BER 10^{-6}, 28MHz, 32APSK, 108Mbps (dBm)	(see page 10 page for details)
Adaptive Coding and Modulation (ACM)	Hitless

░ PORTS

Flange	HYPERCABLE CFIP-7 and HYPERCABLE CFIP-8: UBR84 HYPERCABLE CFIP-10 and HYPERCABLE CFIP-11: UBR100 HYPERCABLE CFIP-13 and HYPERCABLE CFIP-15: UBR140 HYPERCABLE CFIP-18 and HYPERCABLE CFIP-23: UBR220 HYPERCABLE CFIP-24: Circular 10mm HYPERCABLE CFIP-26: UBR260 HYPERCABLE CFIP-38: UBR320
Ethernet with power over Ethernet cable	RJ-45 (data traffic, management port, power)
4xE1	18-pin connector
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

░ MANAGEMENT FEATURES

TCP/IP	WEB, SNMP, Telnet - local and remote
ASCII Terminal	Serial via Twin-BNC
Monitoring	Via Telnet, WEB GUI, SAF NMS, SNMP Manager
Loopbacks	Yes, E1, modem, IF loopback

░ ETHERNET

QoS	64 level DiffServ (DSCP) or 8 level 802.1p mapped in 4 prioritization queues with VLAN support
Max frame size	1916 bytes

Flow Control	Yes
802.1q VLAN support	Up to 15 concurrent traffic VLANs

⊞ 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 / 3.5
Input DC voltage	-48 V DC ±10%
Max. power consumption	19-25W

⊞ RSL AT 10^{-6} BER (DBM) AND TOTAL PAYLOAD CAPACITY (MBPS)

Modulation	FEC***	Channel bandwidth (MHz)					
		7		**14**		**28**	
		RSL dBm	Bit rate Mbps	RSL dBm	Bit rate Mbps	RSL dBm	Bit rate Mbps
QPSK	Strong	-95	8.6	-92	17.3	-89	34.5
	Weak	-92	10.1	-90	20.1	-86	40.8
16APSK	Strong	-88	17.2	-85	34.6	-82	69.6
	Weak	-86	19.8	-83	40.4	-79	82.6
32APSK	Strong	-85	21.4	-82	43.3	-78	100.0
	Weak	-82	24.7	-80	50.6	-76	108.2
64QAM	Strong	-82	28.4	-79	57.3	*	
	Weak	-78	31	-76	63.1		
128QAM	Strong	*		-75	68.7		
	Weak			-72	74.4		

⊞ CFIP Tx POWER

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

∗ Under development

∗∗ According to ETSI channel plan

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

∗∗∗∗ Output Tx range may differ for previous hardware and software versions

1.6 Cable Requirements

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 of cable.

4E1

The user equipment is connected to the HYPERCABLE CFIP FODU via twisted-pair cable (at least 8 pairs, - 16 wires), see **Chapter 9** for pinouts. The 18-pin connector is suited for cables with the diameter from 4 to 10.5 mm.

E1 signals will be carried properly over at least 100 m of TP cable. The length of cable is restricted by the maximum allowable attenuation, which must not exceed 6 dB.

10/100Base-T

Cat. 5e UTP or better cable is required for power supply, management of device and data traffic.

HYPERCABLE CFIP FODU can be used with any Hypercable SAF Tehnika additionally provided Power over Ethernet sourcing equipment (provided power >25 W). Used voltage is 48 V DC ± 10%, though the nominal voltage is 48 V, over two of the four available pairs on a Cat. 5e cable. It is possible to use passive injectors, utilizing spare leads. Refer to **Chapter 9** for detailed information about pinouts.

Length of Cat. 5e cable must not exceed 100 meters.

RSSI BNC

To connect the digital multimeter to the HYPERCABLE CFIP FODU 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 1.4.** Cable for connecting the voltmeter to the HYPERCABLE CFIP FODU RSSI port*

1.7 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 ("HYPERCABLE CFIP-xx"). The FODU model name example is:
    - HYPERCABLE CFIP-13 for 13GHz FODU,
    - HYPERCABLE CFIP-23 for 23GHz FODU, etc, where:
    xx - frequency band of the FODU.
- Product Number (I23FEE01L): 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 (3163901 00001); the serial number uniquely identifies the FODU.

Figure 1.5*. Labels of the CFIP-24 FODU Low and High band side, operating in 24 GHz band*

Please note that frequency range is set from the central frequency of the first 7 MHz channel to the central frequency of the last 7 MHz channel (see the Figure below).
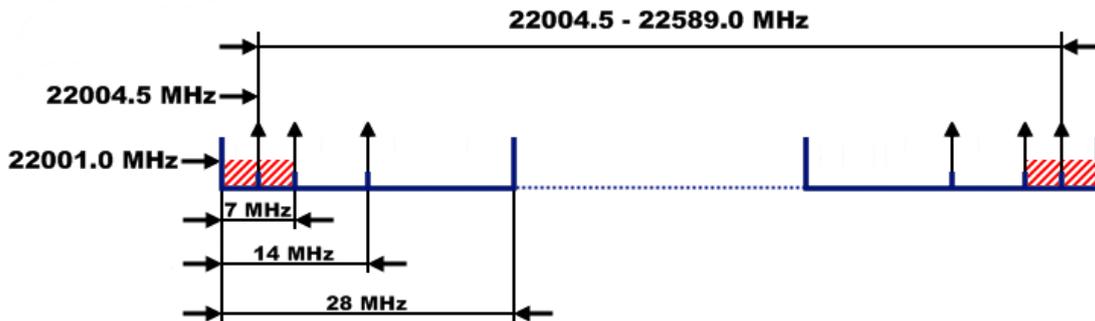
Figure 1.6*. Frequency range of the HYPERCABLE CFIP-23 FODU*

The Figure explains Tx frequency range of low side HYPERCABLE CFIP-23 FODU radio. (Take note that 24 GHZ is another design)

2   Configuration and Management

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

1. using Web terminal connected to the 10/100Base-T management port,
2. using Telnet terminal connected to the 10/100Base-T management port,
3. using NMS or SNMP terminal, connected to the 10/100Base-T management port, or
4. using ASCII console connected to the serial port.

2.1   Resetting the HYPERCABLE CFIP FODU

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.

2.2   Web interface

This section will describe the points necessary for working with the Web interface.

2.2.1   10/100Base-T Port

The 10/100Base-T management port is used to connect the HYPERCABLE CFIP to a PC or Ethernet network for Web, SNMP and Telnet management.

(!) The 10/100Base-T port cable length must not exceed 100 meters.

2.2.2   Assembling the HYPERCABLE CFIP FODU Ethernet cable connector

(!) Attention! Be aware that length of RJ45 connectors may vary! This is the reason why weatherproof connector enclosure has room for longest possible RJ45 connector.
This instruction will show you how to correctly assemble weathered connector and have best possible connection of RJ45 connector with socket.

Figure 2.1. Assembling Ethernet weatherproof connector

1. Prepare the cable as shown in the picture. <u>DO NOT</u> assemble weathered connector!

2. Plug RJ45 connector into the Ethernet socket.

3. Align weathered connector body and put it in place.

4. Fix the connector to the socket with screw. Note that cable sealing screw is still not fixed at this moment.

5. Push the RJ45 connector into the socket by pushing the cable and at the same time seal and fix the cable using cable sealing screw.

6. Assembled cable. Fix the cable to the mast as close as possible to FODU. Do not bend it! The radius of bending should not be less than 10cm.

7. Example of incorrect position of connector – improper alignment. Note, that it is too deep in the connector.

8. Example of correct positioning of RJ45 connector during weatherproof connector assembly.

2.2.3 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)
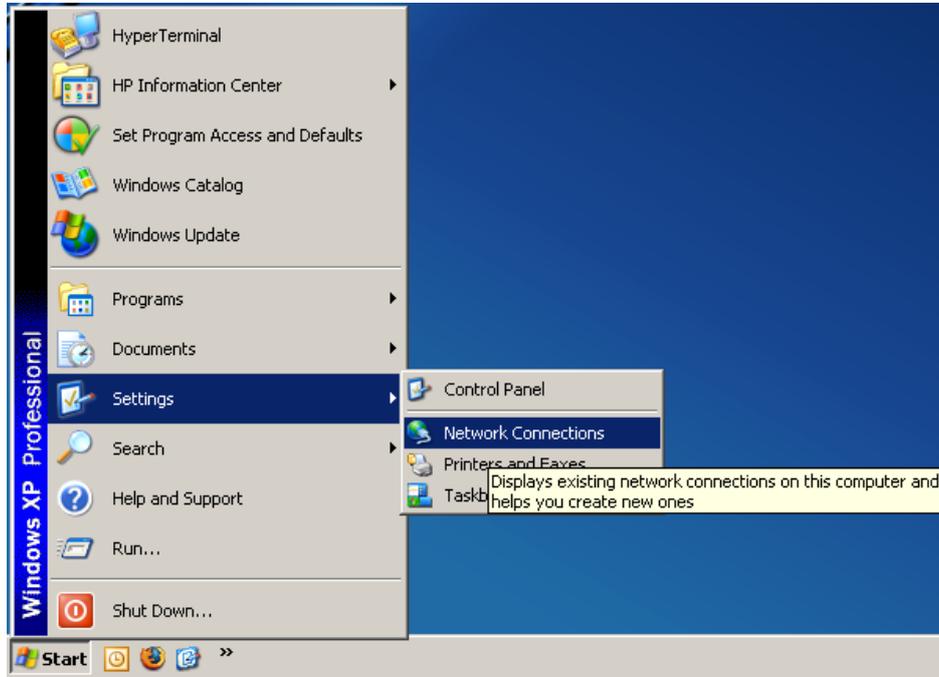
2) Find 'Local Area Connection', click right mouse button on it and choose 'Properties'

3) Click on 'Internet Protocol (TCP/IP)' from the list in the dialog box and then click on 'Properties'
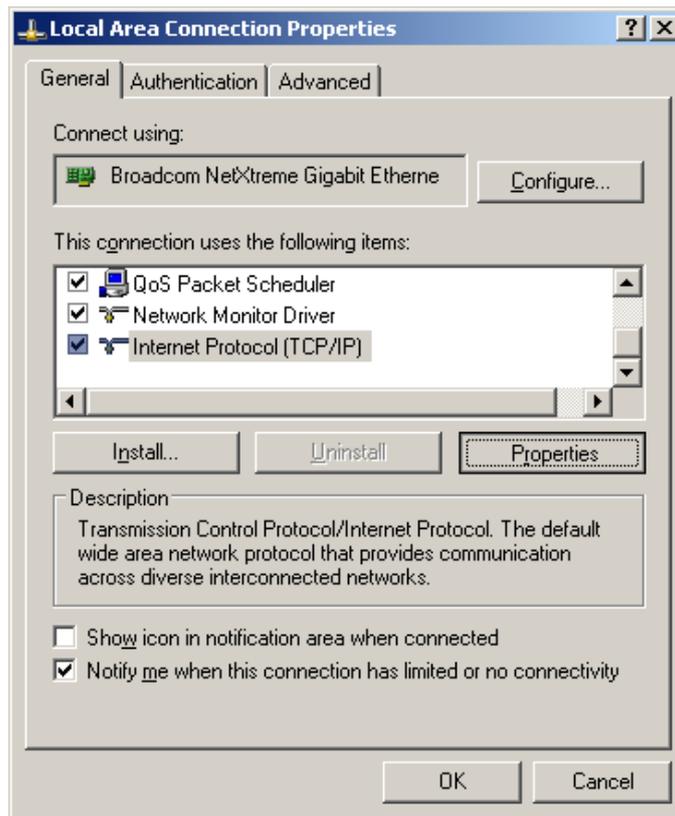
4) In the dialog box enter the following values (so that your PC is in the same subnet as default HYPERCABLE CFIP addresses):
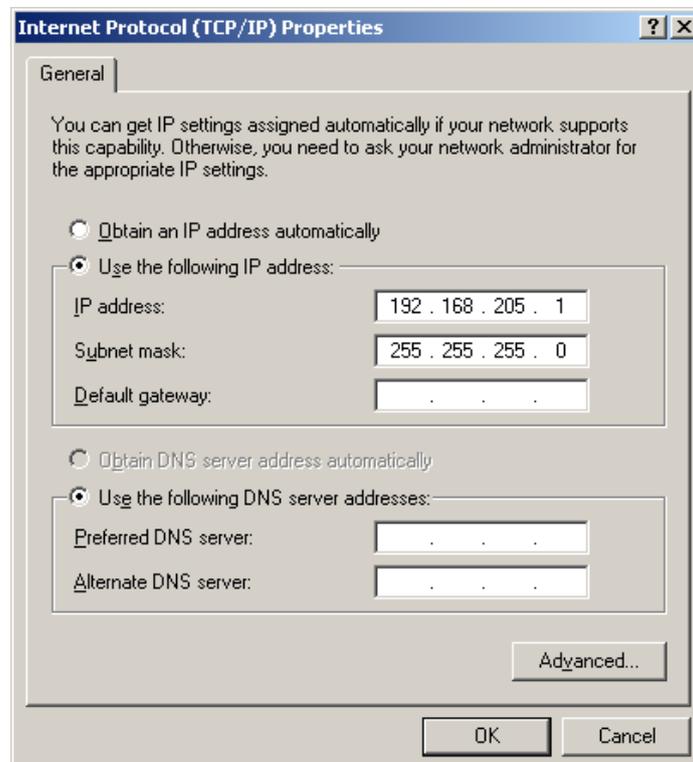
Now you are ready to connect to Web GUI or establish Telnet connection.

2.2.4 Power over Ethernet injection

You must have Power over Ethernet sourcing equipment (provided power>25W) to connect the laptop to the HYPERCABLE CFIP FODU. It is possible to use passive injectors, utilizing spare leads. Refer to **Chapter 9** for detailed information on pinouts. Power over Ethernet injector can be purchased from Hypercable SAF Tehnika as an optional accessory. Below is an example of a passive and active Power over Ethernet injector, as well as its application scheme.

Figure 2.6. *Passive Power over Ethernet injector (P/N I0ATPI01)*
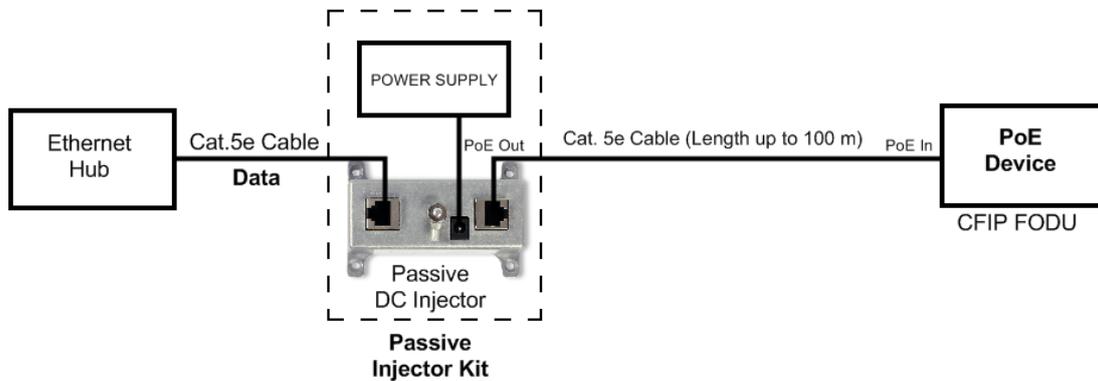
Figure 2.7. *Power over Ethernet passive injector application*

This passive injector features shielded RJ-45 jacks. This along with the metal housing helps reduce the effects of EMI. A ground lug and terminal is provided directly on the injector housing providing superior grounding. The cast aluminium housing includes integral mounting feet for easy installation.

Figure 2.8. *Power over Ethernet active injector (P/N I0ATPI02) front and back views*

This active injector is Power over Ethernet supply with integral DC injector, so separate power supply and injector is not required. Injector is enclosed in impact resistant polycarbonate housing.

2.2.5 Termination panel for 4 E1 and with power injector (HYPERCABLE CFIP-TP4)

Along with the HYPERCABLE CFIP Full Outdoor Unit, the HYPERCABLE CFIP-TP4 panel (P/N I0GTP401) can be used for HYPERCABLE CFIP interface termination; the HYPERCABLE CFIP-TP4 panel terminates the following ports:

• **E1 ports**: the unit passes four balanced E1 signals coming from the FODU to the termination panel, providing four unbalanced 75Ω E1 ports with the BNC connector or four balanced 120Ω E1 ports with the RJ-45 socket (see **Figure 2.9.** for details).

• **WAN port**: Ethernet 10/100Base-T port for connection with the equipment at user side;

• **FODU port**: Ethernet 10/100Base-T for connection with the HYPERCABLE CFIP FODU;

• **4E1 port**: balanced interface for 4 E1 channels to/from the HYPERCABLE CFIP FODU;

• **Grounding screw**: for proper grounding of the termination panel.

Additionally, the termination panel provides power to the HYPERCABLE CFIP FODU by means of the Power over Ethernet (not 802.3af) technology, which utilizes spare leads on the cable to the HYPERCABLE CFIP FODU from the FODU port connector and provides appropriate voltage (48V) and power (>25W) (see the Figure below).
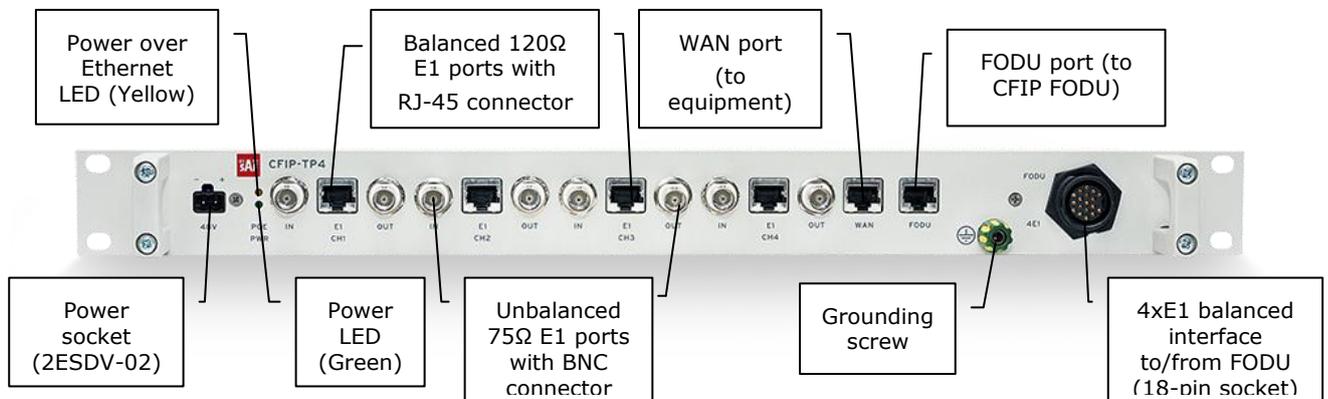
Figure 2.9. *Termination panel for the HYPERCABLE CFIP FODU; the E1 port numbers on the front panel correspond to the HYPERCABLE CFIP FODU port numbering.*

The termination panel also features full surge protection, meeting ITU-T
K.20/K.21/K.44/K.45 recommendations and ETSI ETS 301 489 standard.

> **(!)** The panel does not provide serial management port (RS-232); the serial port can only be used by directly connecting to the FODU.

Power LEDs on the termination panel show if the power is being fed to the termination panel (Green LED), and if the HYPERCABLE CFIP FODU is powered on (Yellow).

The HYPERCABLE CFIP-TP4 unit is optional and can be used with any of the HYPERCABLE CFIP Full Outdoor Units. It is frequency and capacity independent.

HYPERCABLE CFIP-TP4 panel mechanical data:
- Dimensions (HxWxD): 44 x 482.6 x 54 mm;
- Weight: 0.6 kg.

2.2.6 Connection with 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

After web browsers selection, open it and enter address of the FODU (**Figure 2.10**).

> **(!)** 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
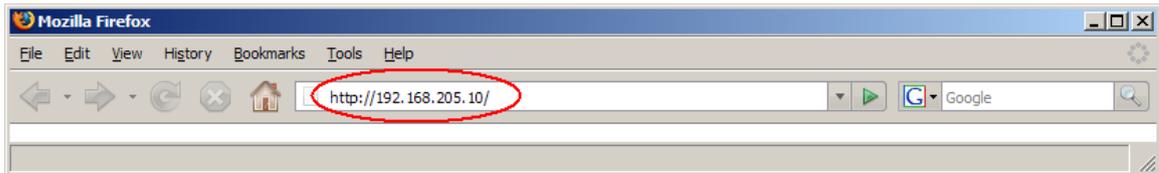
Figure 2.10. HYPERCABLE CFIP FODU IP address

> **(!)** 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 in the field displaying Local and/or Remote system values there are problems (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 2.11. *Web Interface - main window*

2.2.7 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 displayed;

Also, special marks are used:

− Entries highlighted in red indicate that specific parameters do not comply with the norms of standard 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).
− Entry highlighted in yellow indicates warning.
− 'N/D' in value place corresponds to 'No Data'.
− 'N/A' in value place corresponds to 'Not Available'.

Figure 2.12. *Web Interface - main window with section numbering*

2.2.8 Command execution

There is a "Main configuration" page shown in *Figure 2.13*. The entire page is divided into smaller fragments:
1. The header of page;
2. Sub-header of single type configuration parameters;
3. Execution controls related to a single type configuration parameters.
4. "Execute configuration" button executes configuration changes only on the local side HYPERCABLE CFIP FODU, but "Execute for both" executes configuration changes on both remote and local side HYPERCABLE CFIP FODUs. Enabling rollback feature allows going back to previous configuration in case of management connectivity loss.
5. Write to config file button, which generates "**cfg write**" CLI command, which saves changed configuration;
6. Configuration parameter name;
7. Configuration parameter **current** value;
8. 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 HYPERCABLE 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 HYPERCABLE CFIP FODU 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.
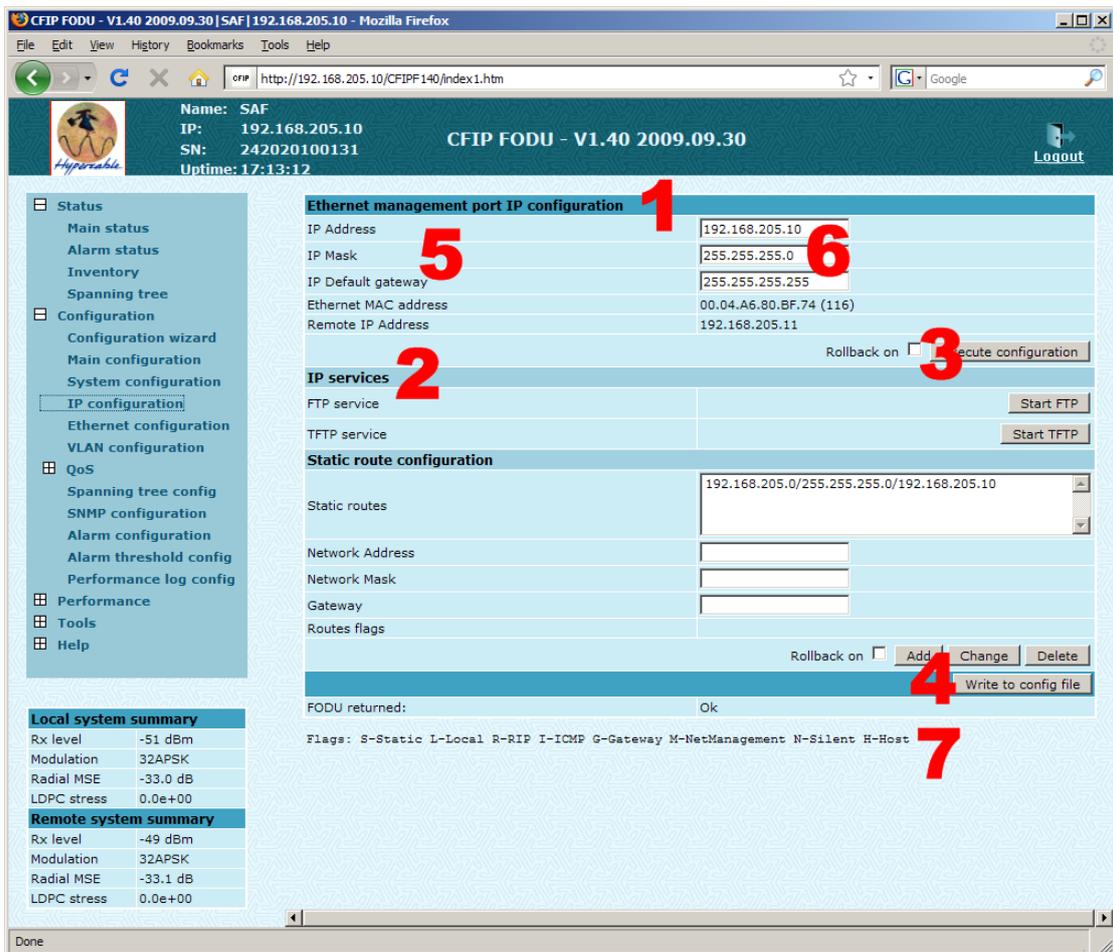
Figure 2.13. *Web Interface - IP configuration page with numbering*

2.2.9 Initial configuration with Web GUI

The connected laptop should be in the same subnet as manageable HYPERCABLE CFIP 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.

(!) HYPERCABLE CFIP FODU must be powered up using dedicated Power over Ethernet injector with load power at least 25W. See Chapter 2.2.4 for details.
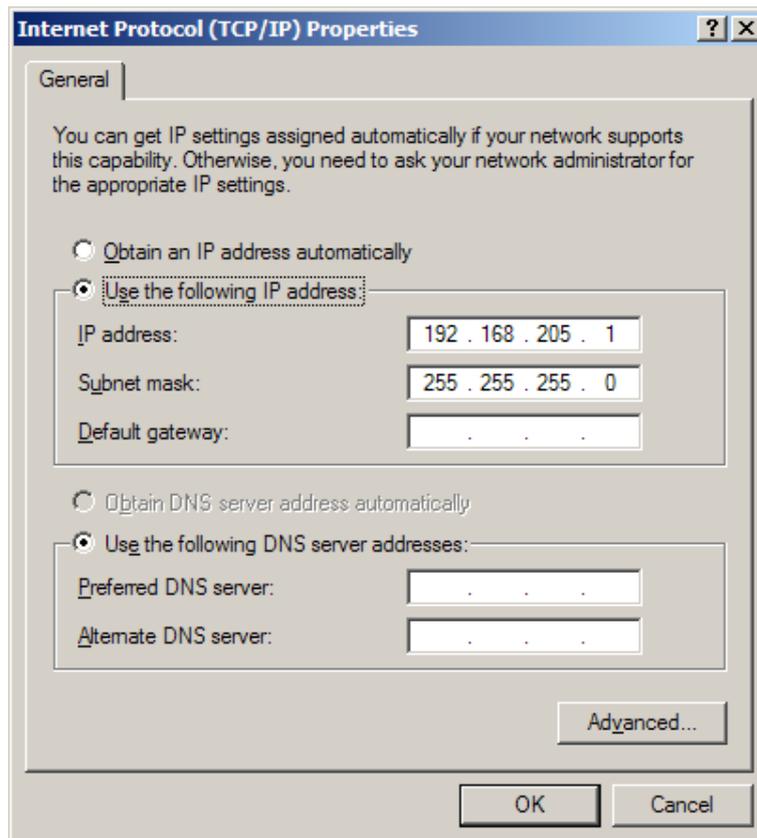
The next step is to connect to HYPERCABLE CFIP FODU by entering IP in the browser address line – which is by default 192.168.205.10 for the low side and 192.168.205.11 for the high side. In case you are not sure which side you are managing at the moment, you can try both default IP addresses.

Currently supported browsers you can use are 'Internet Explorer', 'Mozilla Firefox', 'Opera', and 'Safari'.

Figure 2.14. Supported browsers: 'Internet Explorer', 'Firefox', 'Safari' and 'Opera'

When you are connected to the HYPERCABLE CFIP FODU, you will see the window similar to the one shown in *Figure 2.11*.

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 2.15*.
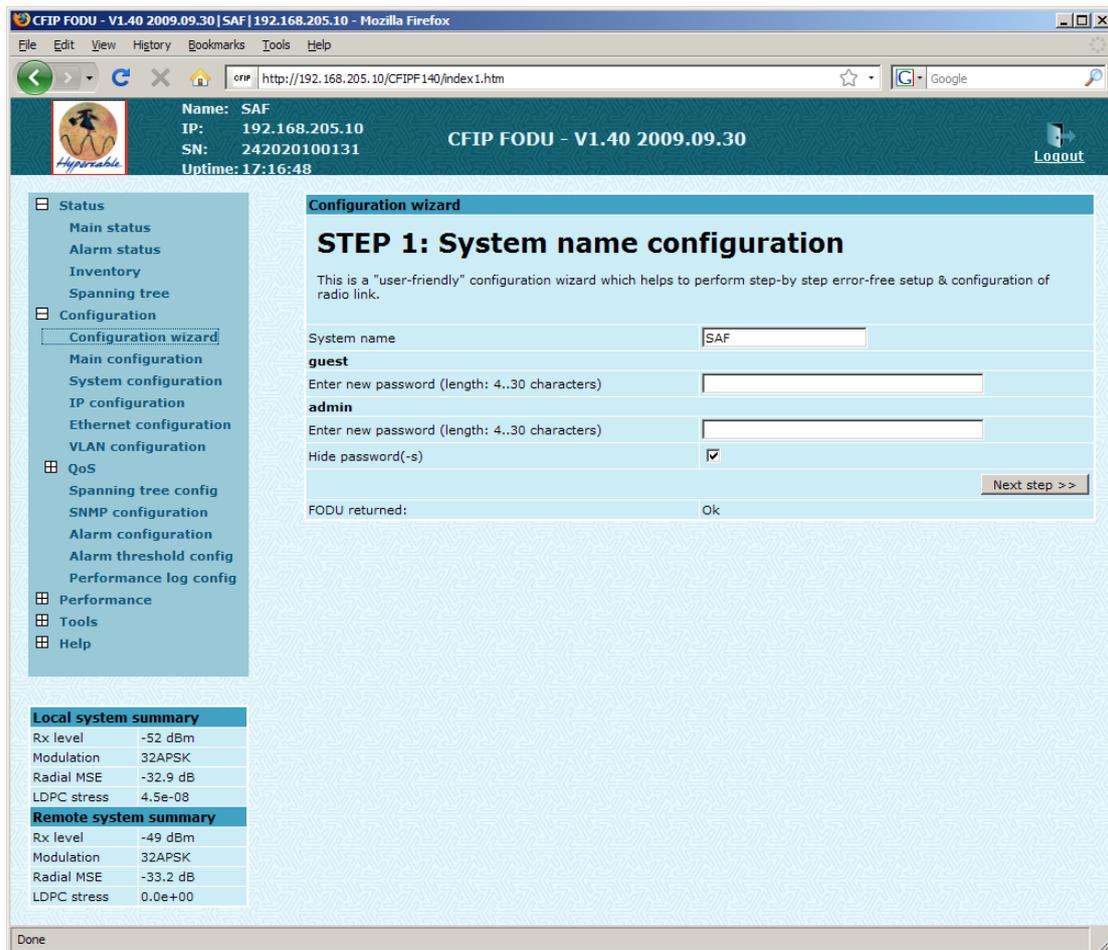
Figure 2.15. *Starting configuration wizard.*

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 'Hypercable'.

Figure 2.16. *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, default gateway and remote link side IP address.

Figure 2.17. *STEP 2. Defining IP address, mask, default gateway and remote IP address*

The third screen of the wizard is devoted to the modem configuration and requires specifying utilized bandwidth (3.5, 7, 14 or 28 MHz), modulation type (QPSK, 16APSK, 32APSK, 64QAM or 128QAM) and the number of E1 channels (from 0 to 4 possible channels); besides, the modem data status is being shown.

These configuration parameters will determine overall link capacity.

Figure 2.18. *STEP 3. Defining modem bandwidth, modulation and the number of E1 channels*

The next step is radio configuration. It primarily shows the radio data status and allows specifying the main radio parameters – Tx power (depends on frequency band and the modulation chosen) and Tx frequency which should be certainly already known to you regarding the channel plan and the frequency regulation issues.

Tx power for HYPERCABLE CFIP 24GHz equipment should not trespass Equivalent isotropically radiated power (EIRP) limitation of 20 dBm.

(!) In the table below please see interdependence between antenna used and allowed Tx output power range (EIRP ≤ 20 dBm).

	A tenna size/gain		
	30cm / 35.0dBi	**60cm / 40. dBi**	**120cm / 46.2dBi**
Tx power	-30…-15 dBm	-30…-21 dBm	-30…-27 dBm

Configuration wizard

STEP 4: Radio configuration

Please enter FODU radio part parameters

Radio data status	Ok
Tx power (-2 .. 17 dBm)	`17` dBm
Tx frequency (22014000 .. 22582000 KHz)	`22318000` KHz

Back step <<   Next step >>

Figure 2.19. STEP 4. Defining radio Tx power and frequency

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 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

Configuration wizard

STEP 5: Check parameters

Please verify the parameters set.

guest	
Password	
admin	
Password	
System name	SAF
IP address	192.168.205.10
IP mask	255.255.255.0
IP default gateway	255.255.255.255
Remote IP address	192.168.205.11
Bandwidth	28000 KHz
Modulation	32APSK WeakFEC ACM
E1 channels	0 ()
Tx power	-2 dBm
Tx frequency	22374000 KHz
Clear cfg file before the new settings will take place	☐
Set local machine time	☐
Write this configuration into cfg file	☐

Back step <<   Rollback on ☐   Execute configuration

Figure 2.20. STEP 5. Checking settings and executing configuration

To verify the settings, we can go to 'Status' or the main screen, which is the first option in the navigation panel. If there are no 'red fields', everything is set correctly and the link is up.

2.3 Command prompt interface

HYPERCABLE 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 management port; Telnet management supports only one client.

Command line management interface offers the widest 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.

– For default (factory) usernames and passwords please refer to **Chapter 6.1.**

(!) 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 is not affecting (interrupting) the E1/Ethernet traffic.

2.3.1 RS-232 Serial Management Port

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

The terminal connected to the serial management port provides the same management functionality as Telnet interfaces (refer to **Chapter 2.3.2**). In order to interconnect HYPERCABLE CFIP FODU and management terminal directly through serial ports, a "straight through" modem cable is required.
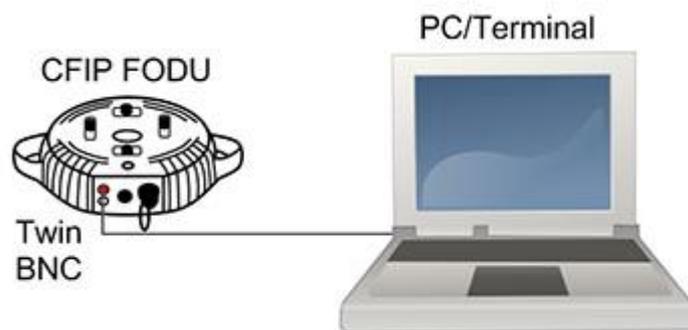
Figure 2.21. Serial connection options to HYPERCABLE CFIP FODU

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.

4. Choose port (COM1 or COM2).

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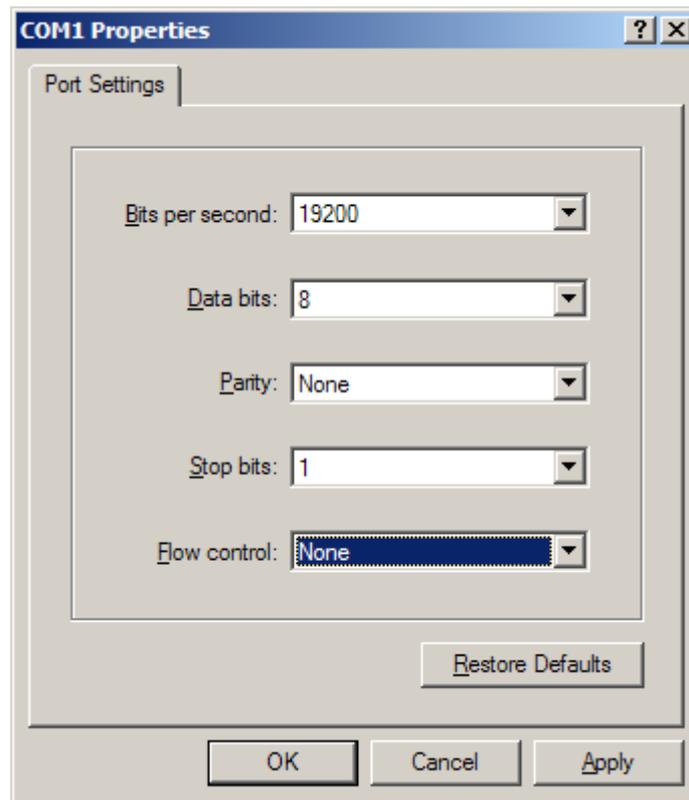
6. Press OK

7. Press Enter. Password is disabled by default.

In case of successful connection the prompt should appear as in the picture below. See **Chapters 3-7** for available commands.
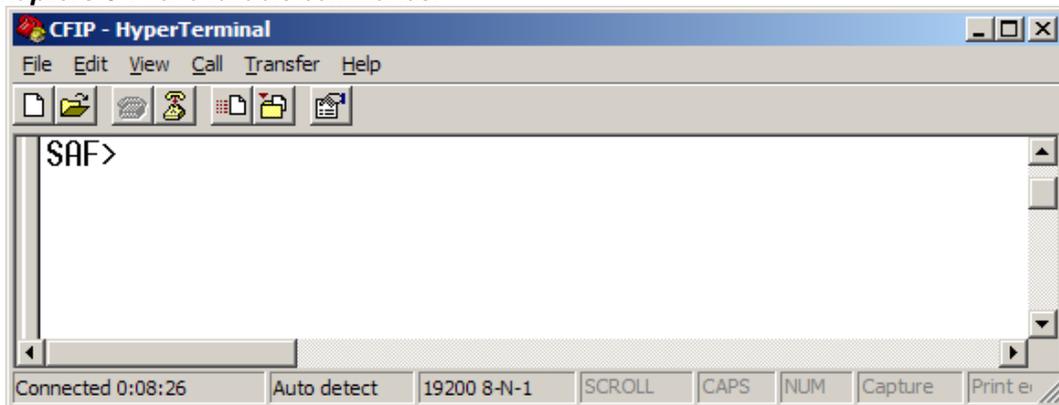
2.3.2 Telnet connection

The Telnet connection to the HYPERCABLE CFIP FODU is carried out using the 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…"
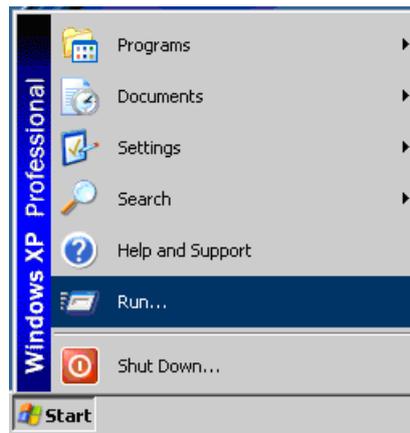
2) Type in *"**telnet** <ip_addr>"*, where *<ip_addr>* is IP address of the HYPERCABLE CFIP FODU you want to connect to (refer to HYPERCABLE CFIP FODU label - explanation in *Chapter 1.8*)
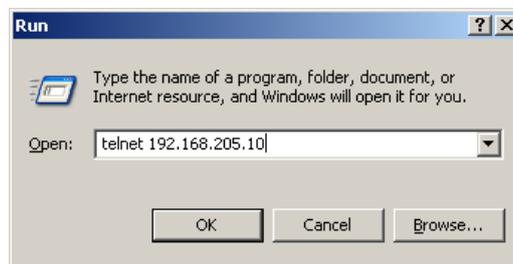
3) If the Ethernet management connection is configured properly, you will see a window similar to the one shown below, where you will be asked to enter login and password. Default login is identical to WEB login name – user name is *admin* and password – *changeme*.
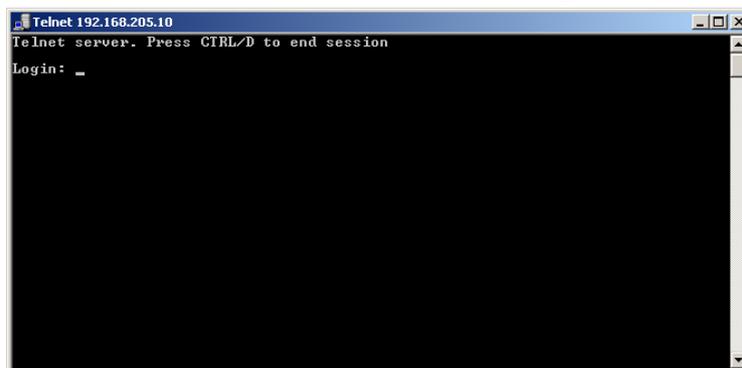
After you have correctly entered the login and password, you are ready to work with all the available command prompt commands.

2.3.3 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 above mentioned parameters, you must know what frequency and bandwidth you

(!) In the table below please see interdependence between antenna used and allowed Tx output power range (EIRP ≤ 20 dBm).

	Antenna size/gain		
	30cm / 35.0dBi	**60cm / 40.3dBi**	**120cm / 46.2dBi**
Tx power	-30…-15 dBm	-30…-21 dBm	-30…-27 dBm

- Tx power with the command '**radio txpower** [<power dBm>]';
- Tx frequency with the command '**radio freq** [<freq KHz>]';
- Channel bandwidth with the command '**modem set** <3500|7000|14000|28000> <min modulation> <max modulation> <WeakFEC|StrongFEC> <channel_mask>', where you can choose bandwidth among 3.5, 7, 14 or 28 MHz, adjust weak FEC for better capacity or strong FEC for better sensitivity and choose appropriate PDH mask (default value is '0');
- Number of E1 channels with the command '**e1 set** <number of PDH ports>';
- Name of HYPERCABLE CFIP FODU 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 window

The main window in Web GUI is status window, which shows all main system parameters, and, in case of failure or any other problem, it tints a specific parameter in red.

To have better understanding on status window, we will go through every field of the status window.

1. Shows the name of this HYPERCABLE CFIP FODU, its IP address, serial number and uptime since the last restart. If uptime is displayed in red, the connection to HYPERCABLE CFIP management port was lost;
2. Shows the firmware version this HYPERCABLE CFIP FODU is currently using;
3. Logout button allows ending the current Web GUI management session and logging in as a different user 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. The same modulation must be set at both ends.
- Radial MSE is explained below in the **Chapter 3.1**.
- LDPC is explained below in the **Chapter 3.2**.

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 HYPERCABLE CFIP (command line – **radio side**);

8. *Tx mute* – shows if transmitter is currently muted;

9. *Tx power* – shows current transmitter power in dBm (command line - **radio status** or **status**);

10. *ATPC* – shows the amount of current ATPC correction in dBm (command line – **atpc status**);

11. *Rx level* – shows current level of received signal. It must not differ significantly from the previously calculated value (command line - **radio status** or **status**);

12. *Duplex shift* – shows the margin between the transmitting and receiving frequencies (command line - **radio status**);

13. *Tx frequency* – shows the transmitting frequency (command line - **radio status**);

14. *Rx frequency* – shows the receiving frequency (command line - **radio status**);

15. *Configuration file* – shows which configuration the modem is currently using (command line – **modem configuration**);

16. *Bandwidth* – shows width of currently utilized bandwidth in MHz (command line – **modem status** or **status**);

17. *Modulation* – shows modulation mode set (command line – **modem status** or **status**);

18. *Total capacity* – shows total capacity set (command line – **modem status**);

19. *Ethernet capacity* – shows Ethernet capacity set (command line – **modem status** or **status**);

20. *E1 channels* – shows the number of E1 channels set. The number must be equal at both ends (command line – **modem status** or **status**);

21. *Modem data status* – shows if management CPU was able to read data from modem;

22. *Modem status* – indicates the acquire 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. *Last acquire error* – indicates the reason of the modem acquisition error. In normal operation mode 'ACQUIRE_SUCCESS' will be seen, any other option designates the reason of acquisition error (command line - **modem status** or **status**);

24. *Radial MSE* – shows radial mean square error value. Refer to **Chapter 3.1.** for detailed description (command line - **modem status** or **status**);

25. *LDPC decoder stress* – shows the load of LDPC (low-density parity-check code) decoder. Refer to **Chapter 3.2.** for detailed description (command line – **modem status** or **status**);

26. *Bandwidth (calculated)* – shows the actual value of bandwidth in MHz calculated from Rx/Tx symbol rate (command line – **modem status**);

27. *ACM engine* – shows if ACM (Adaptive Coding and Modulation) engine is running (command line – **modem status** or **status**);

28. *Current modulation Rx / Tx* – shows the modulation modes currently utilized (command line – **modem status**);

29. *Current total capacity Rx / Tx* – shows the current capacities in both directions (command line – **modem status**);

30. *Current Ethernet capacity Rx / Tx* – shows the current Ethernet capacities in both directions (command line – **modem status**);

31. *E1 status* – shows if the E1 channel is connected or not and shows status of LOS and AIS indications. To see the status, click on the text (command line – **e1 status**);

32. *Diagnostics data status* – shows if system parameters are in acceptable margins (command line - **diagnostics**);

33. *System temperature* – shows the device internal temperature in degrees by Celsius (command line - **diagnostics** or **status**);

34. *Modem temperature* – shows the temperature on modem in degrees by Celsius (command line - **diagnostics or status**);

35. *Input voltage* – shows the input voltage in volts (command line - **diagnostics**);

36. *Current* – shows the current in amperes (command line - **diagnostics**);

37. *Consume power* – shows the amount of power consumed in watts (command line - **diagnostics**).

38. *Tx polarization* – shows transmission polarization and position of connectors and wires at the local side (command line - **diagnostics**).

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

	QPSK	16APSK	32APSK	64QAM	128QAM
Strong FEC	-8.2 dB	-13.5 dB	-15.5 dB	-19.1 dB	-22.5 dB
Weak FEC	-11.1 dB	-16.6 dB	-18.9 dB	-21.8 dB	-25.6 dB

3.2 LDPC

The **LDPC** is monitored for the number of errors being corrected on the input of LDPC decoder (see **Figure 3.1**).
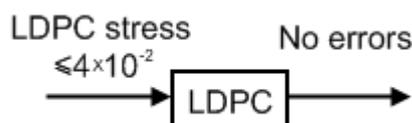
Figure 3.1 LDPC decoder operation

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

- for standard settings $\approx 4.0 \cdot 10^{-2}$;

- for "wide" option $\approx 1.0 \cdot 10^{-3}$

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.

4 Detailed configuration in Web graphic user interface

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 HYPERCABLE CFIP model. Maximal and minimal Tx power values are shown in the brackets. (command line - **radio txpower** *[<power dBm>]*);

(!) In the table below please see interdependence between antenna used and allowed Tx output power range (EIRP ≤ 20 dBm).

	Antenna size/gain		
	30cm / 35.0dBi	60cm / 40 3dBi	120cm / 46.2dBi
Tx power	-30…-15 dBm	-30…-21 dBm	-30…-27 dBm

4. *Tx frequency (22014000 .. 22582000 KHz)* – allows you to enter preferable transmitter frequency, hence defining utilized channel (command line - **radio txfreq** *[<freq KHz>]*);
5. *Rx frequency* – shows the current receiver utilized frequency (command line - **radio freq**);
6. *Duplex shift* – shows the duplex shift between the transmitter frequency and receiver frequency (command line - **radio duplexshift**);
7. *Tx mute* – allows turning transmitter power off. It may be effective when diagnosing on interference existence – when transmitter power of one side is off, you should not experience significant RSL on the other side (command line - **radio txmute** *[on|off]*);

8. By pressing "Execute configuration" changes made to the corresponding section apply only for the local side HYPERCABLE CFIP PhoeniX. 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 HYPERCABLE CFIP FODUs.

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.

ATPC configuration		
ATPC function	**1**	⦿ Enabled ○ Disabled
ATPC update period (1..5)	**2**	1 sec
ATPC delta (1 .. 5 dB)	**3**	1 dB
Tx power correction	**4**	0 dB
Tx power correction limit (-19..-1 dB)	**5**	-15 dB
Remote device status	**6**	Ok
Rx (remote) level maximum (-60..-20 dBm)	**7**	-50 dBm
Rx (remote) level minimum (-90..-50 dBm)	**8**	-60 dBm
Rx level max/min boundaries depend on each other		
Rx (remote) level		-58 dBm
	9	Rollback on ☐ Execute configuration
	10	Execute for both

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. *ATPC delta (1 .. 5 dB)* – allows defining ATPC delta - an increment or decrement in which Tx power will be changed. It is highly unadvisable to change this parameter (command line – **atpc delta** *<tx power correction step 1..5 dBm>*);

4. *Tx power correction* – displays the amount of transmitter power in decibels ATPC has currently corrected (command line – **atpc status**);

5. *Tx power correction limit (-19..-1 dB)* – 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 -19..-1 dB>*);

6. *Remote device status* – shows if management CPU was able to read data from remote management CPU;

7. *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 -60..-20 dBm>*);

8. *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 - 90..-50 dBm>*);

9. By pressing "Execute configuration" changes made to the corresponding section apply only for the local side HYPERCABLE CFIP PhoeniX. If "Rollback on" is selected, configuration will be reverted in case erroneous configuration changes are applied.

10. Pressing "Execute for both" applies changes made to the corresponding section both for local and remote side HYPERCABLE CFIP 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 HYPERCABLE CFIP FODU receives information (each second) about Rx level from the far-end HYPERCABLE CFIP FODU through the service channel; depending on the received Rx level parameter, the local HYPERCABLE CFIP FODU adjusts the transmitter power in accordance with the algorithm shown below.

Figure 4.1. *ATPC algorithm*
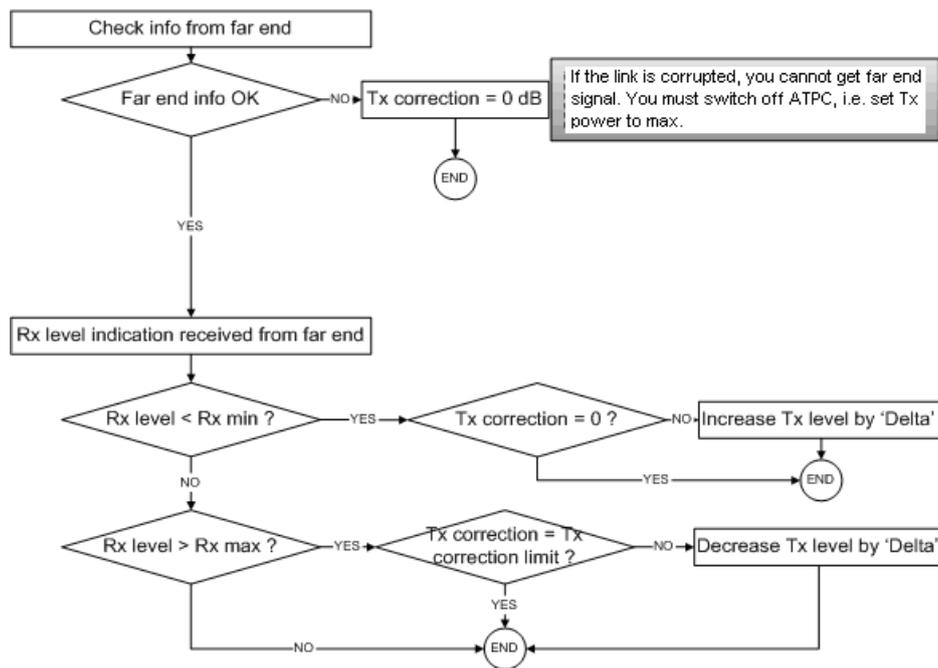
Rx level - the the Rx level figure received from the far-end
Rx max - maximum permissible Rx level at the far-end
Rx min - minimum permissible Rx level at the far-end
Tx correction
Tx correction limit
Delta - the value by which the Tx power is increased or decreased
according to far-end Rx level indication (1 dBm by default)

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 3.5, 7, 14 and 28 MHz bandwidths available. The default value is 3.5 MHz. This option is dependent on what bandwidth you have purchased. The wider bandwidth you have, the higher will be the overall link bitrate. The maximum bitrate of 108 Mbps is available using 28 MHz bandwidth (command line – '**modem set** <3500|7000|14000|28000> <min modulation> <max modulation> <WeakFEC|StrongFEC> <channel_mask>);

3. *Modulation* – allows choosing between QPSK, 16APSK, 32APSK, 64QAM and 128QAM modulations. The default value is QPSK. The higher modulation order is, the higher the overall link bitrate, but worse RSL. The maximum bitrate of 108 Mbps is available using 32APSK modulation in Weak FEC mode or 64QAM modulation in Strong FEC mode (command line – **modem set** <3500|7000|14000|28000> <min modulation> <max modulation>

<WeakFEC|StrongFEC> <channel_mask>). See below the explanation for **Adaptive Coding** and **Modulation** and **FEC** options;

4. *E1 channels* – allows to enable preferable E1 channels. When the total capacity is over 100Mbps, number of E1 channels does not influence the total Ethernet capacity (100Mbps), otherwise Ethernet capacity is *<total capacity>* - *<number of E1 channels>*2,048 [Mbps]. By default E1 channels are turned off (command line – *e1 set* *<Number of E1 channels>*);

5. By pressing "Execute configuration" changes made to the corresponding section apply only for the local side HYPERCABLE CFIP PhoeniX. If "Rollback on" is selected, configuration will be reverted in case erroneous configuration changes are applied.

6. Pressing "Execute for both" applies changes made to the corresponding section both for local and remote side HYPERCABLE CFIP FODUs.

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 E1 channels – with full bandwidth capacity while adapting the bandwidth capacity of low- and mid-priority services such as Internet browsing (see **Figure 4.2**).
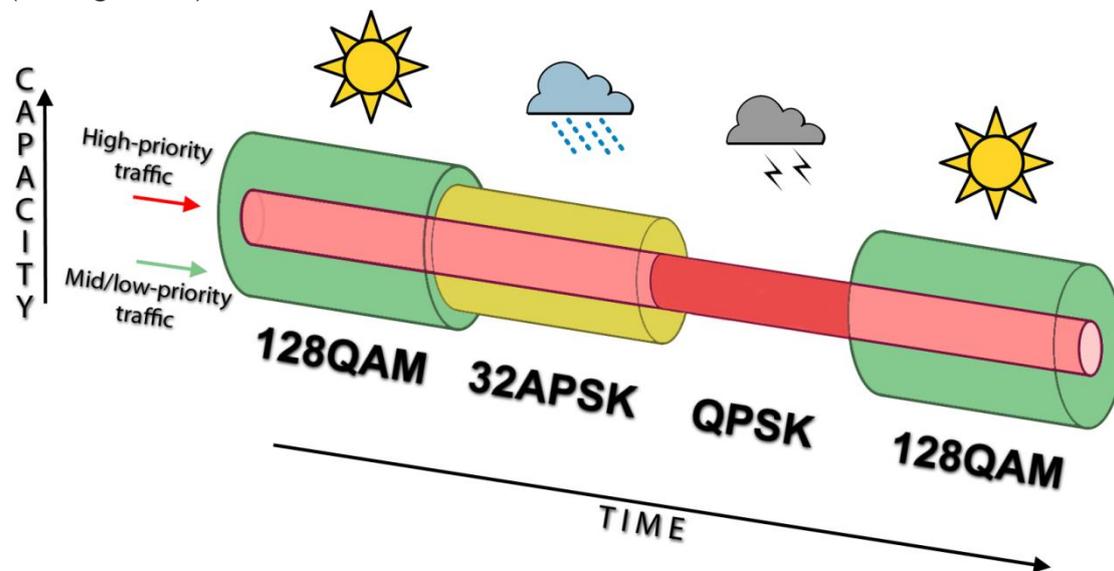
Figure 4.2. ACM bandwidth capacity adaptation

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 99.985%.

(!) Figure 4.3. represents intermediate modulations. Full range of modulations available is 128QAM, 64QAM, 32APSK, 16APSK, QPSK if '128QAM + ACM' is selected.

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 HYPERCABLE CFIP link operating at 23 GHz with 28 MHz channel spacing and 45.9 dB (120 cm) antenna gain. The link is operating in a moderate rain region similar to central Europe with a distance of 30 kilometers.

The system operation is set to a minimal payload of four E1 connections plus 34 Mbps Ethernet for 99.995% availability.

Using the new ACM technology, the system was able to operate most of the time at 108 Mbps, depending on the link conditions.

Most of the time system would support a 366Mbps Ethernet connection instead 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*.
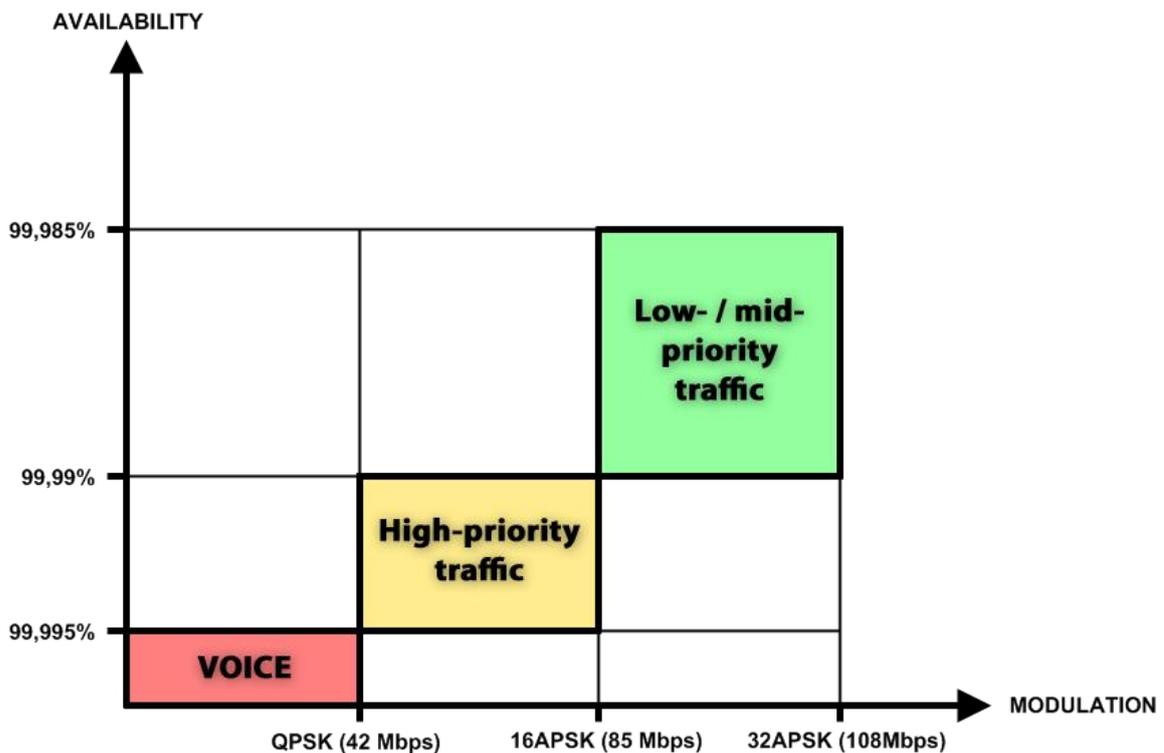
Figure 4.3. *Link availability and classes of services*

In comparison similar system using 32QAM and providing similar capacity would provide only 99,981% 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 **Weak FEC** option allows increasing overall capacity of the link in terms of deteriorating RSL sensitivity threshold. Note, that using 32APSK with total capacity of 100Mbps, HYPERCABLE CFIP automatically uses **Strong FEC** mode with better sensitivity, but incrementally enabling E1 channels, HYPERCABLE CFIP adapts it's forward error correction, till the maximum 108Mbps capacity (100Mbps Ethernet + 4E1) is enabled and HYPERCABLE CFIP operates in **Weak FEC** mode. For more details refer to table in **Chapter 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).
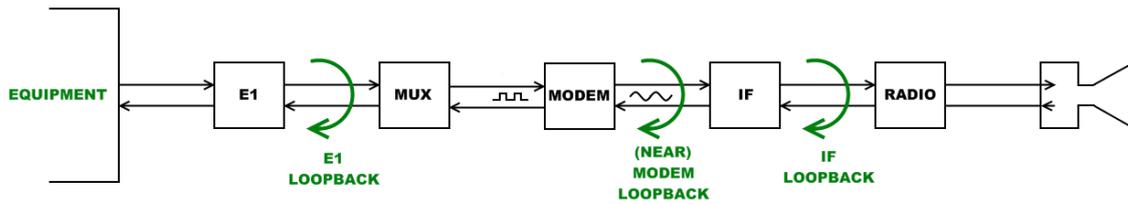
Figure 4.2. *Loopback modes*

- **E1** loopback mode loops signal back to local end in bounds of E1 interface. E1 loopback mode must be set on the particular channel you are wishing to test. If no E1 channels are selected, E1 loopback mode is not available;

- **NEAR** 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* – allows choosing loopback mode and its activity time in seconds (command line – **loopback**) *{status | none | if | modem | e1{1|2|3|4}} [<time>]}*.

2. By pressing "Execute configuration" changes made to corresponding section apply only for the local side HYPERCABLE CFIP Lumina 24GHz. If "Rollback on" is selected, configuration will be reverted in case erroneous configuration changes are applied.

3. Writes to configuration file all changes made in the whole page (command line – **cfg write**);

4. *FODU returned -* in case of error or incorrectly entered parameter value, or other problems in the whole page – info message will be displayed here. Otherwise it says "Ok".

Additional radio and modem configuration commands in Telnet/serial interface	
Command	**Description**
modem status	Shows all the modem parameters.
modem configuration show	Displays current configuration file.
modem configuration *<file>*	Uses separate configuration file.
modem configuration embedded	Switches back to the embedded configuration last used.
modem configuration embedded	Switches back to the embedded configuration last used.
modem factory	Resets modem settings to factory defaults.
modem ipremote [on | off]	Allows enabling manual remote IP specifying. By default remote IP is being obtained automatically.
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.

Additional loopback commands in Telnet/serial interface	
Command	**Description**
Loopback status	Displays status of loopback mode.

Loopback *{status	none	if	modem	e1{1|2|3|4}} [<time>]*	Sets the specified loopback mode.

Radio frequency loopback

In order to check performance of HYPERCABLE CFIP-108 24GHz or HYPERCABLE CFIP Lumina 24GHz, 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;

    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:
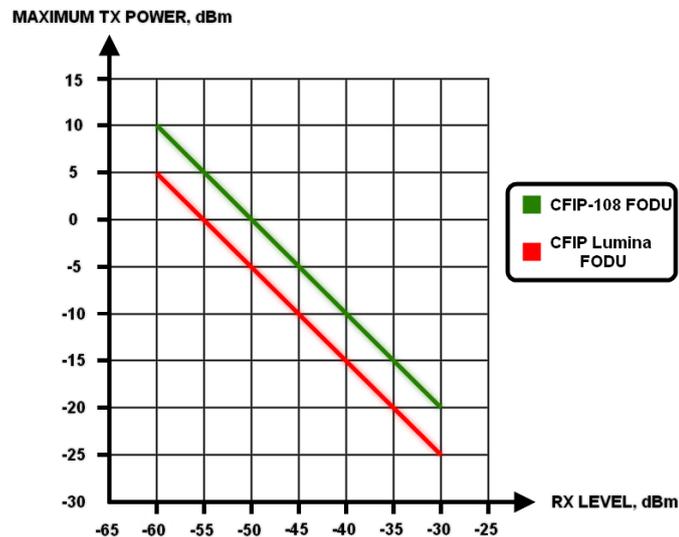
For example, if radio frequency loopback indicated Rx level = -55dBm, Tx power shouldn't be set above 0dBm for HYPERCABLE CFIP Lumina 24 GHz and above +5dBm for HYPERCABLE CFIP-108 24GHz..

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:
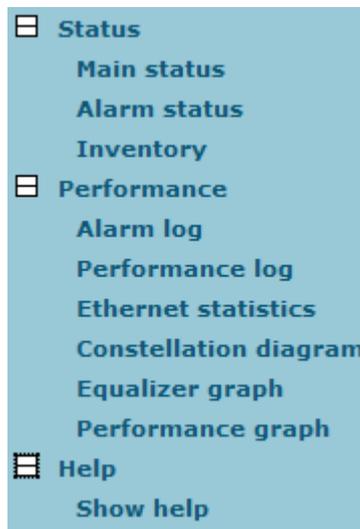
2. **admin** – *Enter new password (length: 4..30 characters)* – allows entering preferable 'admin' account password. Maximal length of the user name cannot exceed 30 symbols. By default password for 'admin' account is '*changeme*'. Admin account has full control of the HYPERCABLE CFIP configuration process.

3. **Hide password(-s)** – Hides typed in password. This option unchecked will display typed in password in plaintext.

4. By pressing "Execute configuration" changes made to the corresponding section apply only for the local side HYPERCABLE CFIP PhoeniX. If "Rollback on" is selected, configuration will be reverted in case erroneous configuration changes are 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 of a 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
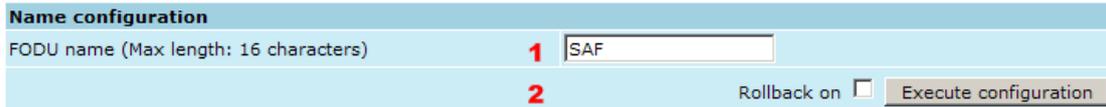
1. *FODU name (Max length: 17 characters)* – allows entering preferable system name. It is recommended to name the system after its geographic location. Maximum length of the user name cannot exceed 17 symbols. Default name is 'SAF' (command line – **system name** *<name>*);
2. By pressing "Execute configuration" changes made to the corresponding section apply only for the local side HYPERCABLE CFIP PhoeniX. If "Rollback on" is selected, configuration will be reverted in case erroneous configuration changes are applied.

4.2.3 Other configuration

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 HYPERCABLE CFIP FODU 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.
Ver	Displays hardware and software version of FODU, as well as built date.

1. *Web refresh (2 .. 600 sec)* – allows specifying time interval of Web data refreshing. The default value is 5 seconds. You can choose between 2 and 600 seconds (10 minutes) (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. By pressing "Execute configuration" changes made to the corresponding section apply only for the local side HYPERCABLE CFIP PhoeniX. If "Rollback on" is selected, configuration will be reverted in case erroneous configuration changes are applied.

4. *Write to config file* - saves to configuration file all the changes made on the whole page (command line – **cfg write**);

5. Restarts HYPERCABLE CFIP FODU you are connected to. ((command line – **system reset**);

> **(!)** Note that after restarting the HYPERCABLE CFIP will use only those settings, which are written to the configuration script. Other settings will be restored to previously saved or reset to default values (if configuration was never saved).

4.2.4 Upgrade software

1. *Choose file* – allows choosing location of software upgrade file (e.g. Hypercable CFIPf142.elf.ezip,Ec) stored on your hard disk. Software upgrade file must have *.elf.ezip,Ec extension;

2. *FODU 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".

4.3 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 HYPERCABLE CFIP FODU you are currently logged in. Default IP address is 192.168.205.10 or 192.168.205.11 – depending on which side the specific HYPERCABLE CFIP FODU 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 HYPERCABLE CFIP IP addresses need to be in the same subnet.

2. *IP Mask* – allows specifying IP mask of HYPERCABLE CFIP FODU 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 HYPERCABLE CFIP FODU 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 HYPERCABLE CFIP FODU you are currently logged in (command line – ***net mac***);

5. *Remote IP Address* – shows IP address of remote (far-end) HYPERCABLE CFIP FODU to ensure communication between link sides (command line – ***net ip remaddr*** *<remaddr>*);

6. By pressing "Execute configuration" changes made to the corresponding section apply only for the local side HYPERCABLE CFIP PhoeniX. If "Rollback on" is selected, configuration will be reverted in case erroneous configuration changes are applied.

4.3.2 IP services

1. *FTP service* – starts FTP service for file access and software update of your HYPERCABLE CFIP FODU. By default FTP service is not running (command line – ***net start ftp***);

2. *TFTP service* – starts TFTP service for file transfer between both HYPERCABLE CFIP FODU 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 HYPERCABLE CFIP will be lost.

Static route configuration

Static routes	**1** 192.168.205.0/255.255.255.0/192.168.205.10
Network Address	**2** 192.168.205.0
Network Mask	**3** 255.255.255.0
Gateway	**4** 192.168.205.10
Routes flags	SL......
	5 Rollback on ☐ Add Change Delete
	6 Write to config file
FODU returned:	**7** Ok

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 HYPERCABLE CFIP FODU routes. If "Rollback on" is selected, configuration will be reverted in case of erroneous configuration changes applied.

6. *Write to config file* - saves to configuration file all the changes made on the whole page (command line – **cfg write**);

7. *FODU 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 a special packet to the specified address and then 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 FODU (<host>).
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.

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 HYPERCABLE CFIP and 10.0.10.10 for the local side HYPERCABLE 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:

Ethernet management port IP configuration	
IP Address	10.0.10.10
IP Mask	255.255.0.0
IP Default gateway	255.255.255.255
Ethernet MAC address	00.04.A6.80.B2.08 (8)
Remote IP Address	192.168.205.11
	Rollback on ☐ Execute configuration

(!) "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:

Ethernet management port IP configuration	
IP Address	10.0.10.11
IP Mask	255.255.0.0
IP Default gateway	255.255.255.255
Ethernet MAC address	00.04.A6.80.B2.07 (7)
Remote IP Address	10.0.10.10
	Rollback on ☐ Execute configuration

(!) "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 configuration of the Ethernet LAN, WAN and management ports as well as shows the current status of all three ports (command line – **ethernet stat**).

Explanation of customization fields:

4.4.1 Ethernet status

Ethernet status		Port 1 (LAN)		Port 2 (WAN)		Port 3 (Mng)	
Link	**2**	On		On			
Speed	**3**	100 Mb		100 Mb		100 Mb	
Duplex	**4**	Full		Full		Full	
Flow control	**5**	Rx	Tx	Rx	Tx	Rx	Tx
		On	On	On	On	Off	Off
Rx	**6**					Enabled	
Tx	**7**					Enabled	
Bandwidth limit	**8**					Full	

1. Represents all three ports of the HYPERCABLE CFIP FODU switch – Local Area Network (LAN) port, Wide Area Network (WAN) port and Management (Mng) port;
2. *Link* – shows operation status of each port;
3. *Speed* – shows operation speed of each port;
4. *Duplex* – shows if port is operating in full or half duplex mode;
5. *Flow control* – shows if 'flow control' is enabled or disabled for each port;
6. *Rx* – shows if regress activity is allowed on *Mng* port;
7. *Tx* – shows if egress activity is allowed on *Mng* port;
8. *Bandwidth limit* – shows if Mng port is using bandwidth limiting. If not - 'Full' is being shown.

4.4.2 Ethernet configuration

Ethernet configuration		
LAN connection	**1**	auto ▼
LAN flow control	**2**	⦿ Enabled ○ Disabled
Mng bandwidth	**3**	Full ▼
	4	Rollback on ☐ Execute configuration
	5	Write to config file
FODU returned:	**6**	Ok

1. *LAN connection* – allows choosing LAN speed and duplex. You are able to choose between 10 Mbps Half Duplex (10hdx), 10 Mbps Full Duplex (10fdx), 100 Mbps Half Duplex (100hdx), 100 Mbps Full Duplex (100fdx) and auto mode. By default 'auto' mode is on (command line – **ethernet set lan connection** [auto|10hdx|10fdx|100hdx|100fdx]);
2. *LAN flow control* – allows enabling or disabling LAN flow control (command line – **ethernet set lan flowcntrl** enable|disable);
3. *Mng bandwidth* – allows limiting bandwidth for the Management port. Possible choices are 128 Kbps, 256 Kbps, 512 Kbps, 1 Mbps, 2 Mbps, 4

Mbps and Full (command line – ***ethernet set mng bandwidth*** *[128 | 256 | 512Kbps | 1 | 2 | 4Mbps | Full]*);

4. By pressing "Execute configuration" changes made to the corresponding section apply only for the local side HYPERCABLE CFIP PhoeniX. If "Rollback on" is selected, configuration will be reverted in case erroneous configuration changes are applied.

5. Pressing "Execute configuration" applies changes made to the corresponding section;

6. *Write to config file* - saves to configuration file all the changes made on the whole page (command line – ***cfg write***);

7. *FODU 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 VLAN configuration

The VLAN configuration window provides configuration of port-based Ethernet Virtual Local Area Networks (VLANs), allowing using up to 16 different VLAN IDs. It is possible to assign 3 different modes to your VLANs – Trunk (LAN port is interconnected with WAN port and Management port is not accessible – useful for configuring customer VLANs), Management (all ports are interconnected) and Access (all VLAN tagged packets are being untagged at LAN egress port and tagged at LAN ingress port).

(!) Note, that Trunk and Access type VLANs cannot be configured together.

Figure 4.3. *VLAN configuration*

1. *802.1Q VLAN* – shows if support of 802.1Q VLAN is enabled (command line – ***ethernet vlan***);

2. *Management VLAN ID* – allows specifying Management VLAN ID. When already configured, shows current Management VLAN ID (command line – ***ethernet vlan*** *<VLAN ID>* ***management***);

3. *LAN port mode* – specifies LAN port operation mode for user traffic VLANs – with tagging/untagging packets (Access) or passing through already tagged packets (Trunk) (command line – ***ethernet vlan*** *<VLAN ID>* [Trunk | Access]);

4. By pressing "Execute configuration" changes made to the corresponding section apply only for the local side HYPERCABLE CFIP PhoeniX. If "Rollback on" is selected, configuration will be reverted in case erroneous configuration changes are applied.

5. *Trunk VLAN number* – allows to specify and add Trunk VLAN ID. If "Rollback on" is selected, configuration will be reverted in case of erroneous

configuration changes applied (command line – **ethernet vlan** *<VLAN ID>* [Trunk | Access]);

6. *Reset VLAN* – resets the whole VLAN configuration (command line – **ethernet vlan reset**);

7. *Write to config file* - saves to configuration file all the changes made on the whole page (command line – **cfg write**);

8. *FODU 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".

Before configuring VLANs, please ensure the configuration intended to be set is correct.

4.5.1 Ethernet switch port status and settings
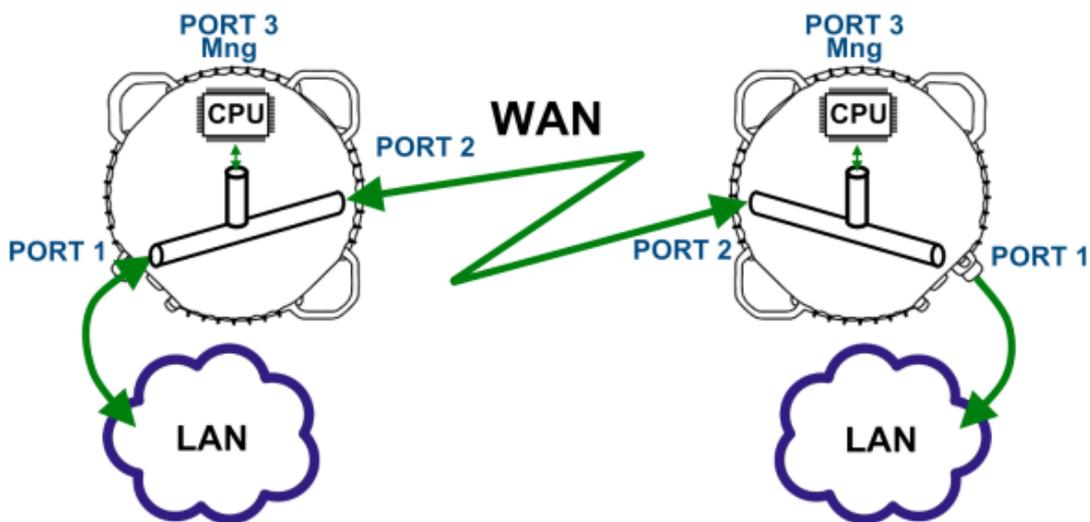
Figure 4.4.

Switch port 1 (LAN) is connected to LAN interface.

Switch port 2 (WAN) is connected to WAN interface, modem and radio part.

Switch port 3 (Mng) is connected to LAN Management CPU.

4.5.2 Ethernet switch block (functional) diagram
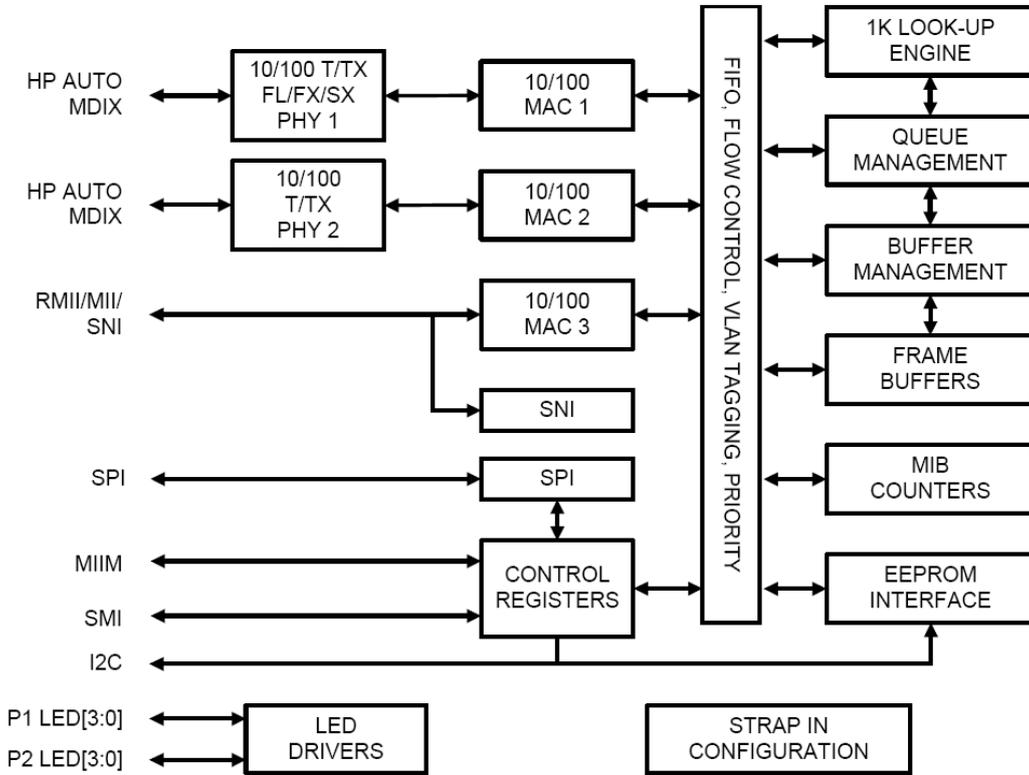
Figure 4.5. *Ethernet switch block diagram*

4.5.3 Ethernet switch VLAN status and settings
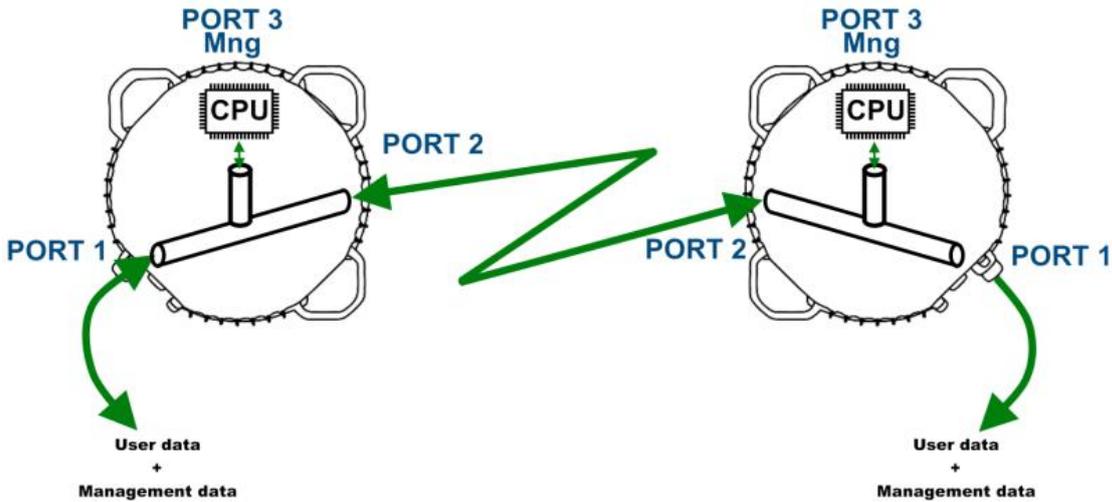
Figure 4.6. *System without VLANs*

When VLANs are not used (**Figure 4.6**), user data and management data are not separated either logically, or physically.

When using VLANs (**Figure 4.7**), it is necessary to use external switches (Switch 3 and Switch 4). These switches add/remove VLAN tags per port basis. Thus, management data and user data have different VLAN tags and are logically separated.
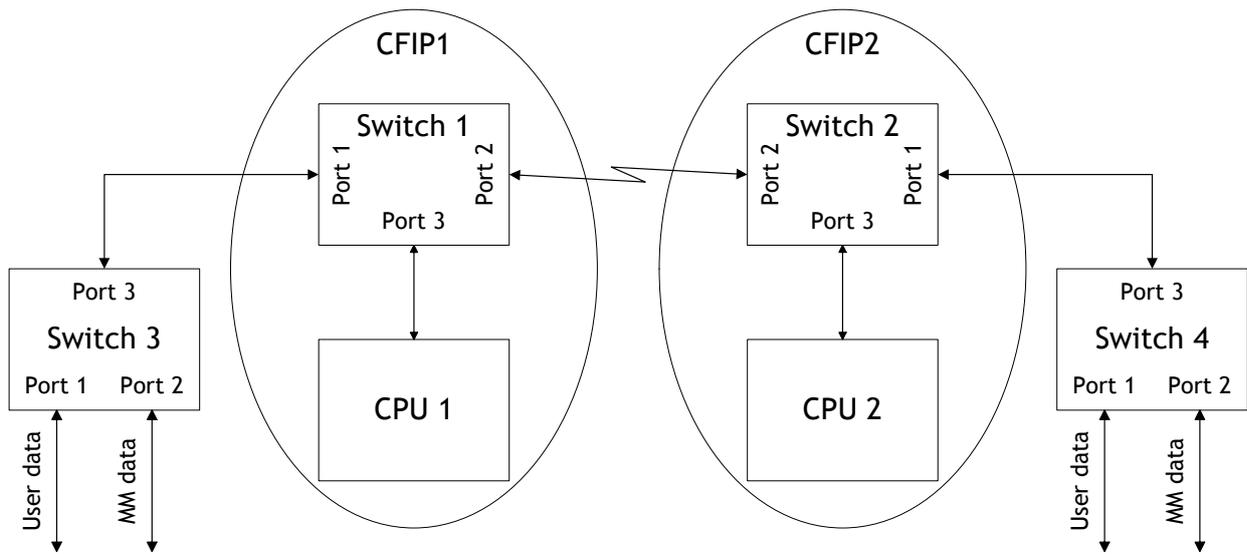
Figure 4.7. *System with VLANs*

System with two separate VLANs – A and B**. *Figure 4.8.*** represents ports membership to VLANs.
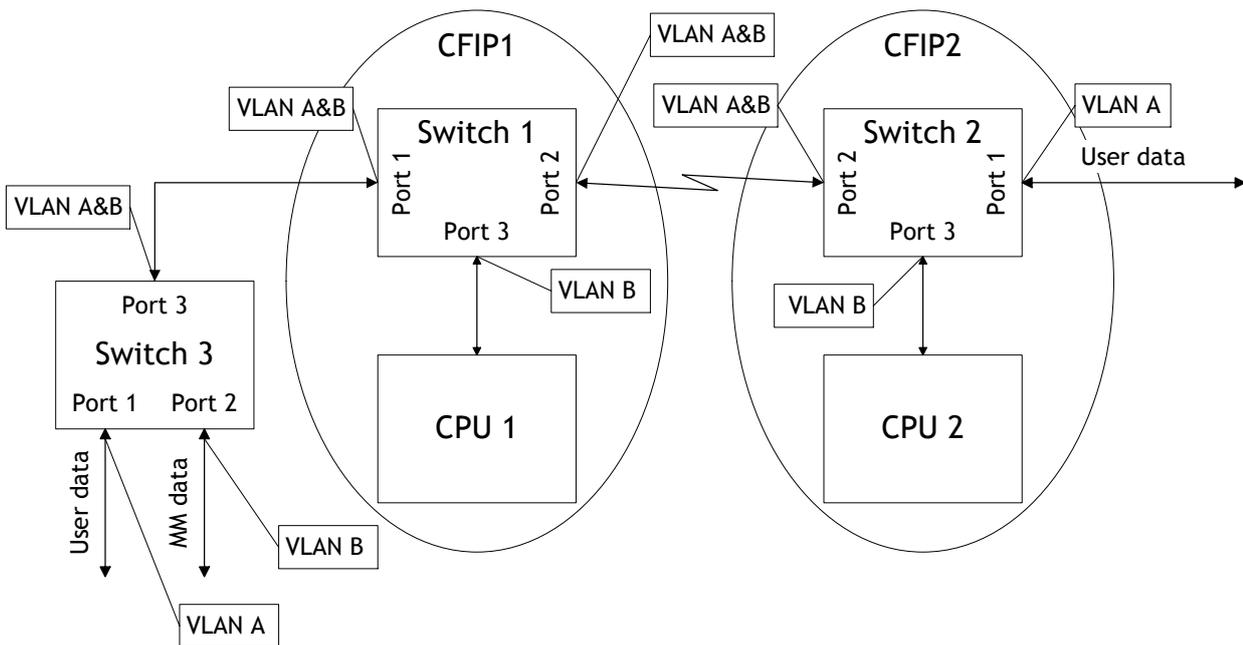
Figure 4.8. *VLANs and ports membership*

Port 1 and port 2 of Switch 1 and Switch 2 are sending data according to VLAN ID and destination address, and adding VLAN tags for packets outgoing from port 3. Additionally, VLAN tag is removed at port 3 of Switch 1 and Switch 2.

VLAN A is the Trunk type VLAN with port 1 & 2 membership.
VLAN B is the Management type VLAN with port 1 & 2 & 3 membership.
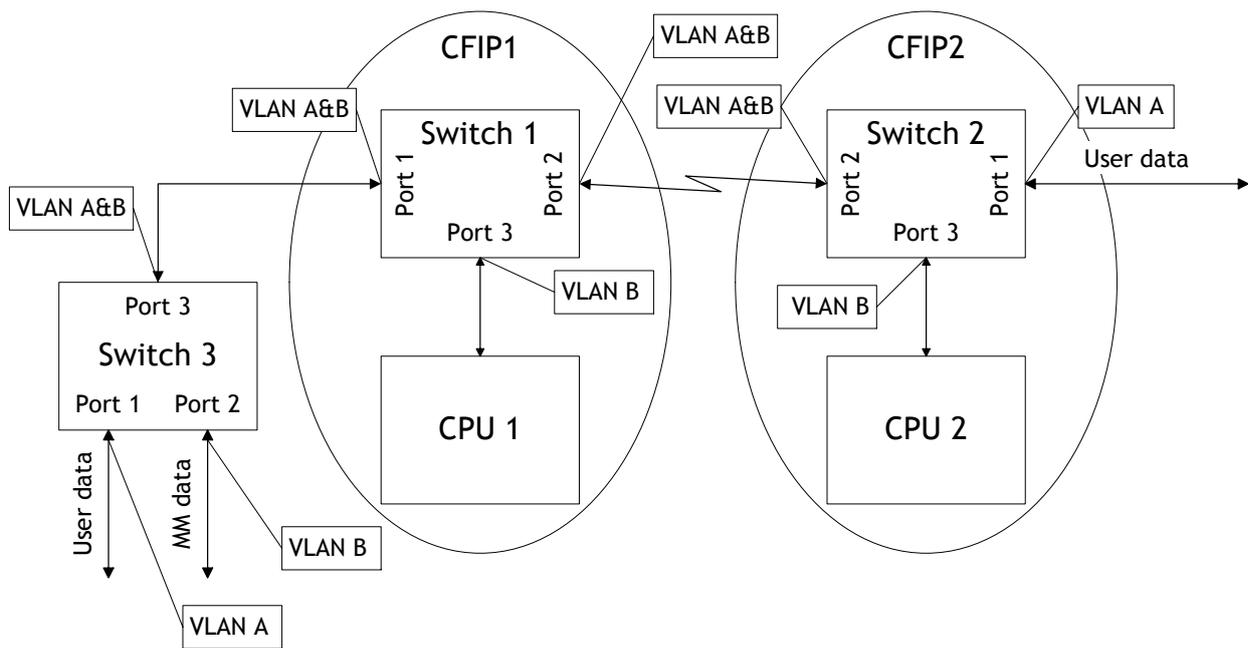
Figure 4.9. *Configuration with management access from one side of the link*

For Switch 1:

VLAN A is the Trunk type VLAN with ports 1 & 2 membership

VLAN B is the Management type VLAN with ports 1 & 2 & 3 membership when removing VLAN tags while packet is being sent to port and inserting tag while packet is transmitting to ports 2 & 1.

For Switch 2:

VLAN A is the Access type VLAN with ports 1 & 2 membership with removing and inserting VLAN tags while packet is being transmitted to ports 1 and 2, respectively.

VLAN B is the Management type VLAN with ports 2 & 3 membership with removing and inserting VLAN tags while packet is being transmitted to ports 3 and 2, respectively.

Limitations and rules on using VLAN:

- Supports up to 16 full range VLAN IDs. If hardware VLAN table is full, software responds with the error message: "*Error: VLAN table is full.*"
- 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 is not allowed.
- Use the "*Access*" VLAN type only for remote FODU, because after setting the "*Access*" VLAN type, access to the management CPU from LAN port is **blocked**!
- In order to pass untagged packets through the link, "**Ethernet vlan 0 traffic**" should be added

Steps required for VLAN configuration:

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

2) Set preferable VLAN configuration in "VLAN configuration" of remote link side HYPERCABLE CFIP FODU Web management;

> **(!)** Attention! VLAN tagging already must be configured on the switch and known to you; otherwise, incorrect VLAN configuration may disable access to management port.

3) Set preferable VLAN configuration in "VLAN configuration" of local link side HYPERCABLE CFIP FODU Web management.

Examples of VLAN usage:

CFIP VLAN configuration
VLAN 10 - Management
VLAN 20 - Traffic
VLAN 30 - Traffic

CFIP VLAN configuration
VLAN 10 - Management
VLAN 20 - Traffic
VLAN 30 - Traffic

Switch configuration
P1 - Trunk - VLAN 10, 20, 30
P3 - Access - VLAN 10
P4 - Access - VLAN 20
P5 - Access - VLAN 30

Switch configuration
P1 - Trunk - VLAN 20, 30
P3 - Access - VLAN 20
P4, P5 - Access - VLAN 30

Management PC

ISP side
Customer side

VLAN 30

VLAN 20

Figure 4.10. VLAN configuration with VLAN tag encapsulation on the ISP side

CFIP VLAN configuration
VLAN 10 - Management
VLAN 20 - Traffic

CFIP VLAN configuration
VLAN 10 - Management
VLAN 20 - Endpoint

Switch configuration
P1 - Trunk - VLAN 10, 20
P3 - Access - VLAN 10
P4, P5 - Access - VLAN 20

Management PC

ISP side
Customer side

Switch configuration
No configuration

VLAN 20
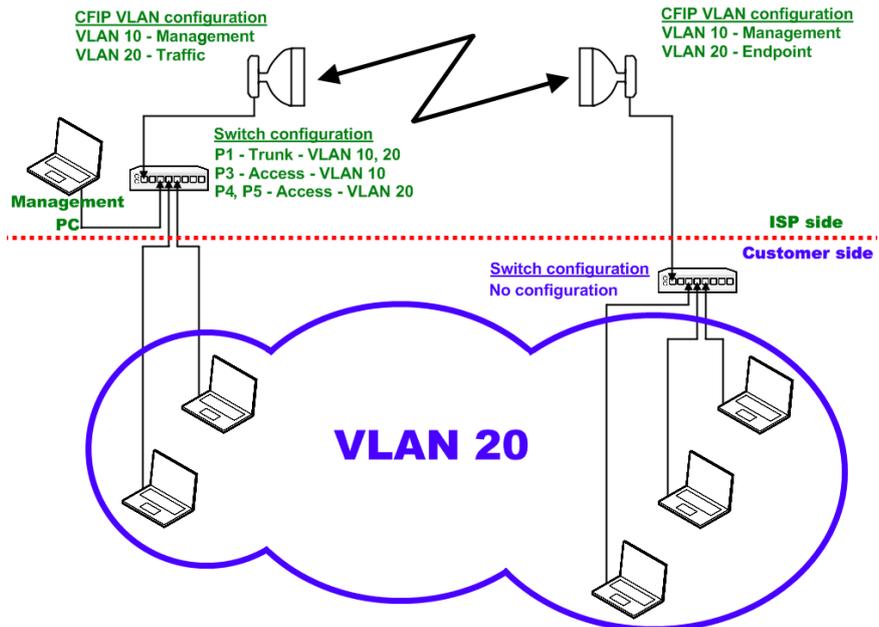
Figure 4.11. VLAN configuration with 'Access' VLAN

4.6   QoS

HYPERCABLE CFIP FODU priority queuing uses fixed queuing mode, in which highest priority buffer (q4) will pass packets as long as its buffer is full.

By default weighted priority queuing mode is enabled.
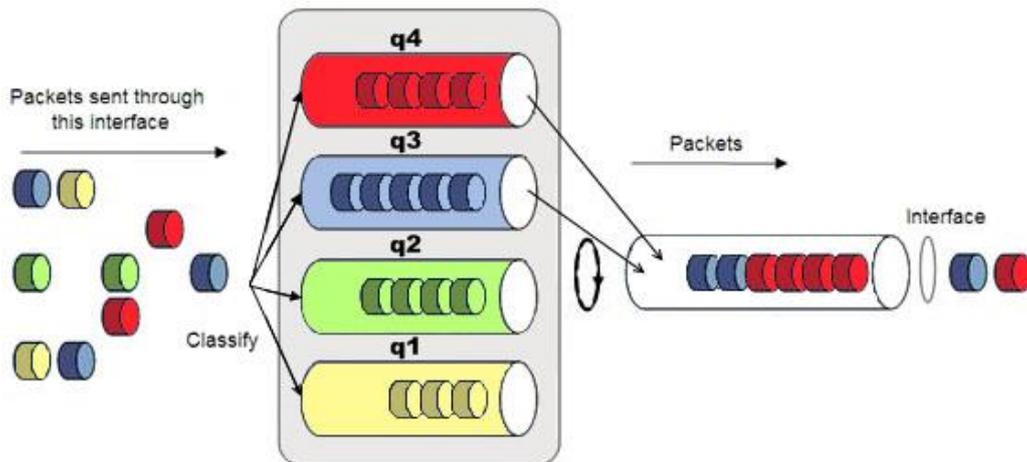
Figure 4.13. *Fixed priority queuing mode*

4.6.1 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* – enables or disables 802.1p priorities for all three ports – LAN, WAN and Mng (command line – **ethernet QoS 802.1p {[enable | disable <Port>] | [map]}**);
2. *DiffServ* – enables or disables DiffServ (DSCP) priorities for all three ports – LAN, WAN and Mng (command line – **ethernet QoS DSCP [enable | disable <port>] | map)**;
3. *Port based priority* – allows passing packets from ports (LAN, WAN or Mng) 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. *QoS 802.1p priority mapping* – allows assigning queue values to specific 802.1p values.

5. By pressing "Execute configuration" changes made to the corresponding section apply only for the local side HYPERCABLE CFIP PhoeniX. If "Rollback on" is selected, configuration will be reverted in case erroneous configuration changes are applied.

6. *Write to config file* - saves to configuration file all the changes made on the whole page (command line – **cfg write**);

7. *FODU 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".

4.6.2 DSCP configuration

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

1. *QoS 802.1p* – enables or disables 802.1p priorities for all three ports – LAN, WAN and Mng (command line – **ethernet QoS 802.1p** *{[enable | disable <Port>] | [map]}*);

2. *DiffServ* – enables or disables DiffServ (DSCP) priorities for all three ports – LAN, WAN and Mng (command line – **ethernet QoS DSCP** *[enable | disable <port>] | map)*;

3. *Port based priority* – allows passing packets from ports (LAN, WAN or Mng) 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. *DSCP mapping* – allows assigning queues for different DSCP classes. You may have up to 64 different traffic DSCP classes;

5. Pressing "Execute configuration" applies changes made to the corresponding section only for the local side HYPERCABLE CFIP FODU. If "Rollback on" is selected, configuration will be reverted in case of erroneous configuration changes applied;

6. *Write to config file* - saves to configuration file all the changes made on the whole page (command line – *cfg write*);

7. *FODU 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 Spanning Tree Configuration

Implementation of 802.1D-1998 STP (Spanning Tree Protocol) is compatible with Rapid STP and Multiple STP, as well as having additional capability for automatic WAN port Path Cost calculation and non-standard mode for faster network convergence.

4.7.1 Spanning Tree Configuration

Spanning tree configuration						
Bridge settings		**1**				
STP state		**2**	Enabled			
Address		**3**	00.04.A6.80.BF.77			
Priority (0..65535)		**4**	32768			
Max Age (6..40)		**5**	20	s		
Hello Time (1..100)		**6**	2	s		
Forward Delay (4..30)		**7**	15	s		
Fast Mode		**8**	Disabled			
Port 1 LAN		**9**	**Port 2 WAN**			**13**
State	Forwarding	**10**	State	Forwarding		**14**
Priority (0..65535)	128	**11**	Priority (0..65535)	128		**15**
Path Cost (1..200000000)	200000	**12**	Path Cost Selection	Manual		**16**
			Path Cost (1..200000000)	200000		**17**
			Path Cost Mode	Long		**18**
			Path Cost Offset (0..200000)	0		**19**
		20			Execute configuration	
		21			Write to config file	
Command execution status	Ok	**22**				

1. *Bridge settings* - Values 5-9 take effect if a given Bridge is Root;

2. *STP state* – allows enabling or disabling STP support. In "Disabled" mode the switch passes through BPDU (Bridge Protocol Data Unit) packets;

3. *Address* – the MAC address of the unit;

4. *Priority (0..65535)* – 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;

5. *Max Age (6..40)* – this parameter determines time period, during which the received BPDU packets' information is stored for a separate port;

6. *Hello Time (1..100)* – time gap, between which the BPDU packets are being sent;

7. *Forward Delay (4..30)* – time period that determines time a separate port stays in *Listening* and *Learning* conditions;

8. *Fast Mode* – allows to enable or disable "Fast Mode", in which STP operates ten times faster but is not compatible with other standardized STP devices;

9. *Port 1 LAN* – STP parameters of LAN port;

10. *State* – port condition. Can be one of the following: *Disabled*, *Blocking*, *Listening*, *Learning*, *Forwarding* or *Broken*;

11. *Priority (0..65535)* – 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;

12. *Path cost (1..200000000)* – this parameter setting depends on the capacity of a separate port;

13. *Port 2 WAN* – STP parameters of WAN port;

14. *State* – port condition. Can be one of the following: *Disabled*, *Blocking*, *Listening*, *Learning*, *Forwarding* or *Broken*;

15. *Priority (0..65535)* – 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;

16. *Path cost selection* – path cost for WAN port can be set manually (default) or calculated automatically with "byACM" option enabled, which operates according to ACM switching;

17. *Path cost* – this parameter setting depends on the capacity of a separate port; setting is disabled when automatic "Path cost selection" is enabled;

18. *Path cost mode* - automatic Path Cost mode of WAN port. Can be Short or Long;

19. *Path cost offset* - offset of the WAN port automatic Path Cost;

20. By pressing "Execute configuration" changes made to the corresponding section apply only for the local side HYPERCABLE CFIP PhoeniX. If "Rollback on" is selected, configuration will be reverted in case erroneous configuration changes are applied.

21. *Write to config file* - saves to configuration file all the changes made on the whole page (command line – **cfg write**);

22. *FODU 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".

4.7.2 Spanning Tree Status

Spanning tree status shows current STP status at all available ports. Description of parameters is in Chapter 4.7.1. Besides information about currently elected Root port is being shown.

Spanning tree status			
Bridge information		**Root information**	
STP status	Enabled	Port	N/A
Fast Mode	Disabled	Root Path Cost	0
Address	00.04.A6.80.BF.77	Address	00.04.A6.80.BF.77
Priority	32768	Priority	32768
Max Age	20 s	Max Age	20 s
Hello Time	2 s	Hello Time	2 s
Forward Delay	15 s	Forward Delay	15 s
Number of Topology Changes	2		
Time Since Topology Change	940 s		
Port 1 LAN		**Port 2 WAN**	
State	Forwarding	State	Forwarding
Forward Transitions	1	Forward Transitions	1
Priority	128	Priority	128
Path Cost	200000	Path Cost	200000
		Path Cost Mode	Long
		Path Cost Offset	0

4.8 SNMP configuration

The SNMP configuration window provides the configuration of SNMP communities, host and trap addresses. SAF NMS system will work only when SNMP is properly configured.

Explanation of customization fields:

4.8.1 SNMP community configuration

SNMP community configuration		
Read (Max length: 31 characters)	**1**	saf-public
Write (Max length: 31 characters)	**2**	saf-private
SNMP trap address	**3**	255.255.255.255
	4	Rollback on ☐ Execute configuration

1. *Read* - Specifies the SNMP community name of the agent to enable parameters to be read (not configured). By default read community name is not specified (command line – **snmp community read** *<communityname>*);

2. *Write* – Specifies the community name of the agent to enable parameters to be written (configured). By default community name for writing parameters is not specified (command line – **snmp community write** *<communityname>*);

3. *SNMP trap address* – Sets the IP address of the management terminal with the installed Trap Manager software, based on SNMP platform. The HYPERCABLE CFIP FODU 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 (command line – **snmp trap** *<ipaddr>*);

4. Pressing "Execute configuration" applies changes made to the corresponding section only for the local side HYPERCABLE CFIP FODU. If "Rollback on" is selected, configuration will be reverted in case of erroneous configuration changes applied.

4.8.2 SNMP allowed hosts configuration

1. *SNMP host list* – shows the list of available SNMP hosts; adds or deletes the host IP address to the HYPERCABLE CFIP SNMP host table. If the SNMP host connected to the HYPERCABLE CFIP is not added to the HYPERCABLE CFIP SNMP host table, the HYPERCABLE CFIP 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. (command line – *snmp host* *{add | delete} <ipaddr>*);

2. *Write to config file* - saves to configuration file all the changes made on the whole page (command line – *cfg write*);

3. *FODU 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.
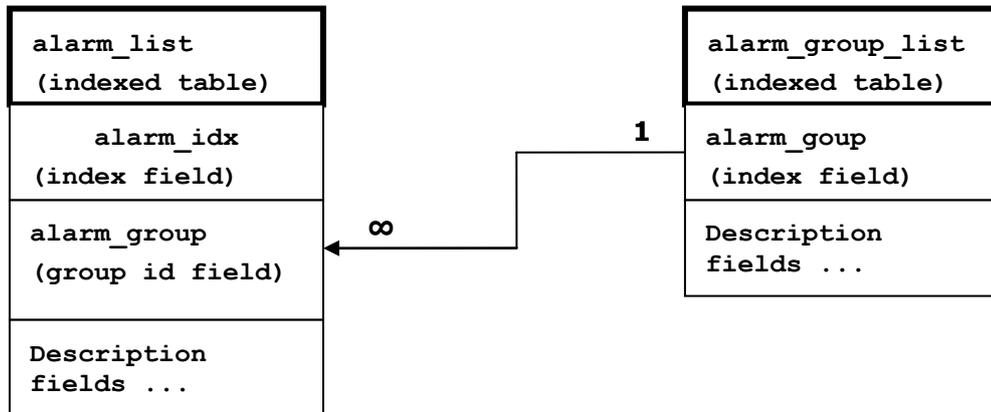
Figure 5.1. *Alarm and group table relation*

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
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
18	18	1,2V failure	Power supply voltage out of defined range
19	18	1,5V failure	Power supply voltage out of defined range
20	18	3,3V failure	Power supply voltage out of defined range
21	18	5,0V failure	Power supply voltage out of defined range
22	18	Permanent 7,5V failure	Power supply voltage out of defined range
23	18	Switchable 7,5V failure	Power supply voltage out of defined range
24	18	12,0V failure	Power supply voltage out of defined range
25	18	-5,0V failure	Power supply voltage out of defined range
26	19	No data from RADIO	No data from radio (for future compatibility)
27	20	Rx level alarm	Rx alarm level is out of defined range
28	21	Tx PLL error alarm	Tx PLL failure
29	22	Rx PLL error alarm	Rx PLL failure
30	23	No data from MODEM	No data from MODEM connected via UART interface
31	24	Acquire status alarm	Modem acquire failure status
32	25	Last acquire error status	Modem last acquire failure status
33	26	Radial MSE	Radial MSE is out of defined range
34	27	LDPC decoder stress	LDPC decoder stress is out of defined range
35	28	ACM profile was changed	ACM profile was changed
36	29	RX carrier offset	Error in Rx carrier offset
37	30	No data from modem temperature sensor	No data from modem temperature sensor

38	31	Modem temperature fault	Modem temperature is out of defined range
39	32	ATPC Tx power correction was changed	ATPC Tx power correction was changed
40	33	Rollback initiate system CPU restart ==>	System restart was called by rollback [Only rising]
41	34	System CPU reset was WDT initiated ==>	System restart was called by watchdog [Only rising]
42	35	PM log flash write error	Error while writing pm log to flash
43	36	Command from interface	Message about command execution from particular interface
44	37	Message	Informative message
45	38	E1 interface	E1 interface failure
46	39	Ethernet interface	No connection to Ethernet LAN port

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 5.2.5**.

Alarm status			
Alarm gr.	Date	Time	Alarm
30	2008-11-22	12:39:36	E1 interface
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.

Alarm log

0001: 2009-05-05 17:12:35 - 005 - Log was Cleared - Set
0002: 2009-05-05 17:12:49 - 041 - Command from interface - TASK> modem modulation 16APSK wide ACM
0003: 2009-05-05 17:12:52 - 031 - Acquire status alarm - [ACQUIRE_IN_PROGRESS]-> Set
0004: 2009-05-05 17:12:52 - 032 - Last acquire error status - [ACQUIRE_ERR_FREQ_SWEEP]-> Set
0005: 2009-05-05 17:12:52 - 033 - Radial MSE - [2.7]-> Set
0006: 2009-05-05 17:12:54 - 027 - Rx level alarm - [-91]-> Set
0007: 2009-05-05 17:12:54 - 027 - Rx level alarm - [-39]-> Reset
0008: 2009-05-05 17:12:54 - 031 - Acquire status alarm - [ACQUIRE_LOCKED]-> Reset
0009: 2009-05-05 17:12:54 - 032 - Last acquire error status - [ACQUIRE_SUCCESS]-> Reset
0010: 2009-05-05 17:12:54 - 033 - Radial MSE - [-26.2]-> Reset
0011: 2009-05-05 17:12:55 - 035 - ACM profile was changed - [16APSK]
0012: 2009-05-05 17:13:04 - 041 - Command from interface - WEB> log show
0013: 2009-05-05 17:13:23 - 041 - Command from interface - WEB> cfg rollback on
0014: 2009-05-05 17:13:23 - 041 - Command from interface - WEB> cfg rollback exe
0015: 2009-05-05 17:13:25 - 041 - Command from interface - WEB> cfg rollback accept
0016: 2009-05-05 17:13:44 - 041 - Command from interface - WEB> cfg show
0017: 2009-05-05 17:13:45 - 041 - Command from interface - WEB> cfg write
0018: 2009-05-05 17:13:45 - 009 - Config was Written - Set
0019: 2009-05-05 17:13:47 - 041 - Command from interface - WEB> cfg show
0020: 2009-05-05 17:14:06 - 041 - Command from interface - WEB> log show
End

| |< | Previous 21 | 20 | Next 21 | >| | Filter: | none ▼ |

> Alarm-event log file <

Clear alarm log

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] 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] E1 interface	☑	☑	☑
[39] Ethernet interface	☑	☑	☑
			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					
Alarm ID	**Alarm name**	**Low value**	**High value**	**Delta value**	**Alarm value**
4	License will soon expire	1296000 s			Value = 80352000 s
12	System temperature fault	-33.0 C	85.0 C	1.0 C	Value = 42.0 C
14	Main supply voltage failure	36.00 V	57.00 V	1.00 V	Value = 46.92 V
15	Main supply current failure	0.000 A	0.700 A	0.010 A	Value = 0.432 A
16	Main supply power failure	0.00 W	25.00 W	0.50 W	Value = 20.29 W
18	1,2V failure	1.15 V	1.32 V	0.03 V	Value = 1.27 V
19	1,5V failure	1.43 V	1.57 V	0.03 V	Value = 1.49 V
20	3,3V failure	3.15 V	3.60 V	0.03 V	Value = 3.40 V
21	5,0V failure	4.50 V	5.50 V	0.03 V	Value = 5.06 V
22	Permanent 7,5V failure	6.75 V	8.25 V	0.05 V	Value = 7.67 V
23	Switchable 7,5V failure	6.75 V	8.25 V	0.05 V	Value = 7.64 V
24	12,0V failure	10.80 V	13.20 V	0.05 V	Value = 11.95 V
25	-5,0V failure	-5.50 V	-4.50 V	0.03 V	Value = -5.04 V
27	Rx level alarm	-68 dBm	-30 dBm	1 dBm	Def: ☑ Value = -47 dBm
33	Radial MSE		-29.0 dB	1.0 dB	Def: ☑ Value = -32.6 dB
34	LDPC decoder stress		1.0e-04		Def: ☑ Value = 3.3e-05
36	RX carrier offset	-700 kHz	700 kHz	10 kHz	Value = 11 kHz
38	Modem temperature fault	-33.0 C	95.0 C	1.0 C	Value = 51.5 C
					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. <num> works similarly to 'log show' command.
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 management commands

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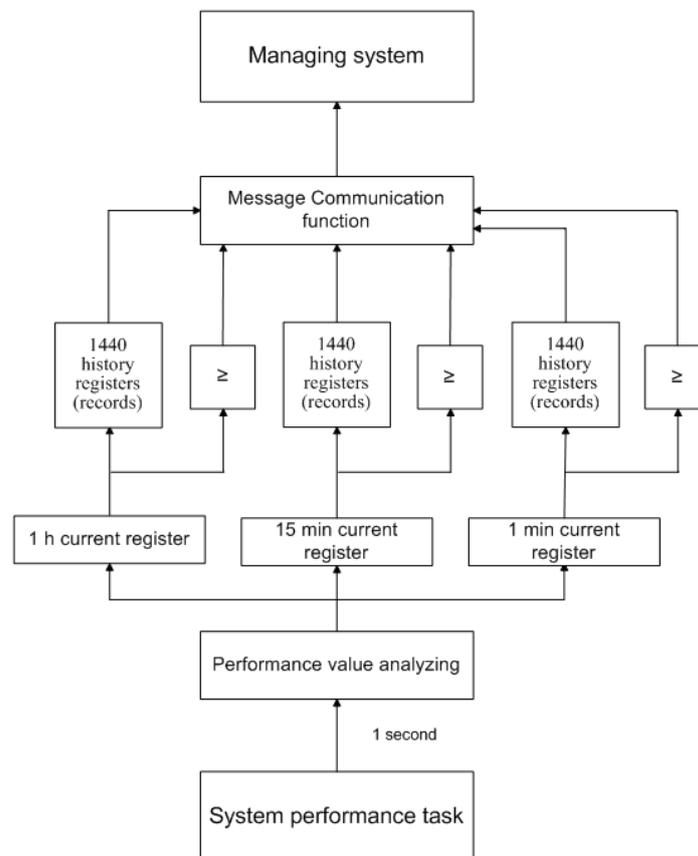
Figure 5.6. Functional architecture for data collection, history and thresholding treatment

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 a 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 HYPERCABLE CFIP FODU 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 6 different parameters to display in summarizing performance log or pick 'ALL' to display all 6 parameters in conjoint log which is shown in *Figure 5.7.*

Performance log field selection

Select objects to display	
	☐ ALL
	☑ Uptime
	☑ Rx level
	☑ Tx level
	☑ System temperature
	☑ Radial MSE
	☑ LDPC decoder stress

[Save&Proceed]

Figure 5.7 *Selecting performance log parameters*

Performance log

Nr	Date	Time	Radio						System				Modem					
			Rx level			Tx level			Uptime	System temp, C			Radial MSE			LDPC decoder stress		
			Min	Max	TS	Min	Max	TS	Val	Min	Max	TS	Min	Max	TS	Min	Max	TS
1419	09-05-05	16:54	-42	-42	0	17	17	0	8164	48.0	48.0	0	-30.0	-29.6	0	0.0e+00	9.2e-07	0
1420	09-05-05	16:55	-42	-42	0	17	17	0	8224	48.0	48.0	0	-30.1	-29.6	0	0.0e+00	1.2e-06	0
1421	09-05-05	16:56	-42	-42	0	17	17	0	8284	48.0	48.0	0	-30.0	-29.5	0	0.0e+00	9.2e-07	0
1422	09-05-05	16:57	-42	-42	0	17	17	0	8344	48.0	48.0	0	-30.0	-29.6	0	0.0e+00	1.2e-06	0
1423	09-05-05	16:58	-42	-42	0	17	17	0	8404	48.0	48.0	0	-30.0	-29.5	0	0.0e+00	1.0e-06	0
1424	09-05-05	16:59	-42	-42	0	17	17	0	8464	48.0	48.0	0	-30.2	-29.5	0	0.0e+00	1.9e-06	0
1425	09-05-05	17:00	-42	-42	0	17	17	0	8524	48.0	48.0	0	-30.0	-29.6	0	0.0e+00	1.4e-06	0
1426	09-05-05	17:01	-42	-42	0	17	17	0	8584	48.0	48.0	0	-30.1	-29.6	0	0.0e+00	1.3e-06	0
1427	09-05-05	17:02	-42	-42	0	17	17	0	8644	48.0	48.0	0	-30.0	-29.5	0	0.0e+00	2.5e-06	0
1428	09-05-05	17:03	-42	-42	0	17	17	0	8704	48.0	48.0	0	-30.1	-29.6	0	0.0e+00	1.1e-06	0
1429	09-05-05	17:04	-42	-42	0	17	17	0	8764	48.0	48.0	0	-30.0	-29.6	0	0.0e+00	9.4e-07	0
1430	09-05-05	17:05	-42	-42	0	17	17	0	8824	48.0	48.0	0	-30.0	-29.6	0	0.0e+00	1.4e-06	0
1431	09-05-05	17:06	-42	-42	0	17	17	0	8884	48.0	48.0	0	-30.0	-29.6	0	0.0e+00	1.7e-06	0
1432	09-05-05	17:07	-42	-42	0	17	17	0	8944	48.0	48.0	0	-30.0	-29.6	0	0.0e+00	2.3e-06	0
1433	09-05-05	17:08	-42	-42	0	17	17	0	9004	48.0	48.0	0	-30.1	-29.6	0	0.0e+00	1.4e-06	0
1434	09-05-05	17:09	-42	-42	0	17	17	0	9064	48.0	48.0	0	-30.1	-29.6	0	0.0e+00	1.4e-06	0
1435	09-05-05	17:10	-42	-42	0	17	17	0	9124	48.0	48.0	0	-30.0	-29.6	0	0.0e+00	2.3e-06	0
1436	09-05-05	17:11	-42	-42	0	17	17	0	9184	48.0	48.0	0	-30.0	-29.6	0	0.0e+00	1.4e-06	0
1437	09-05-05	17:12	-42	-42	0	17	17	0	9249	48.0	48.0	0	-30.0	-29.6	0	0.0e+00	1.0e-06	0
1438	09-05-05	17:13	-42	-37	0	16	17	0	9311	48.0	48.0	0	-30.3	2.7	3	0.0e+00	SyncLos	3
1439	09-05-05	17:14	-41	-41	0	16	16	0	9371	48.0	48.0	0	-30.5	-29.8	0	0.0e+00	0.0e+00	0
1440	09-05-05	17:15	-41	-41	0	16	16	0	9431	48.0	48.0	0	-30.4	-29.6	0	0.0e+00	0.0e+00	0

Select time interval [1 Min ▼] Start date [ ] Start time [ ] End date [ ] End time [ ] [Show]

[|<] [Previous]   [Next] [>|]

[Clear performance log]

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.

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 5 parameters – Rx level; Tx level; System temperature; Radial MSE and LDPC stress – 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.
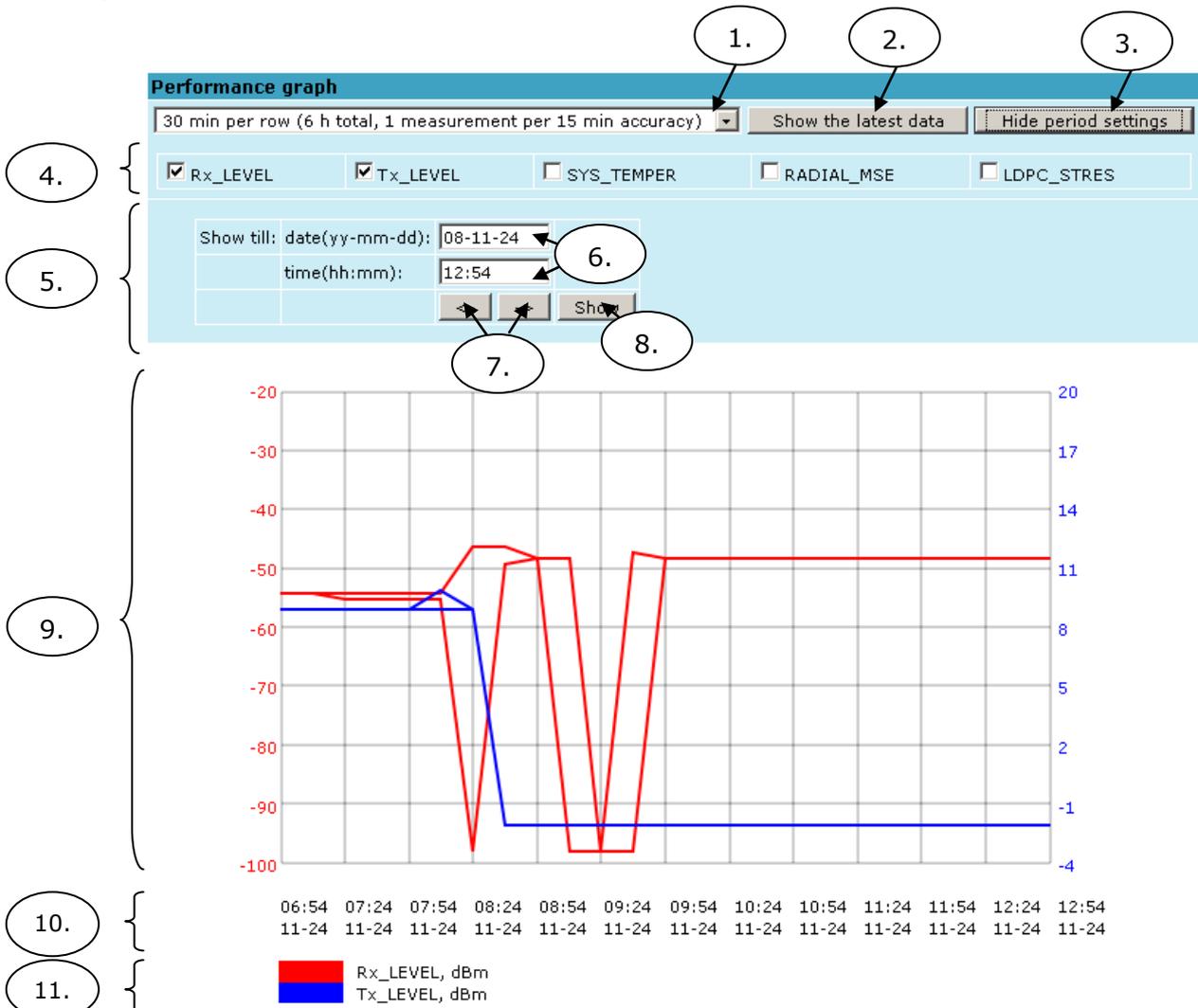
Figure 5.10 *Performance graph showing system temperature and Rx level in period of last 6 hours*

1. Time scale selector. User can select the scale and accuracy (1 / 15 / 60 minutes). The lower 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 32APSK, 16APSK or QPSK. 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:
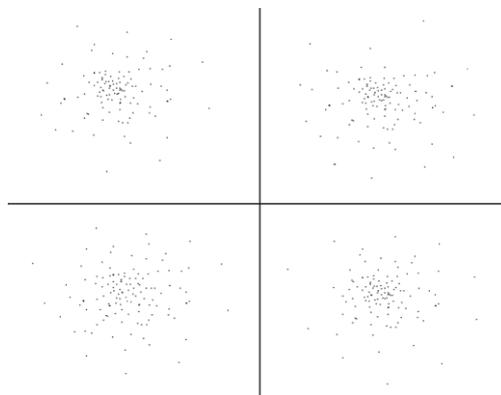
Figure 5.11. *Gaussian noise (QPSK)*

2) Non-coherent single frequency interference is displayed as circular constellation points:
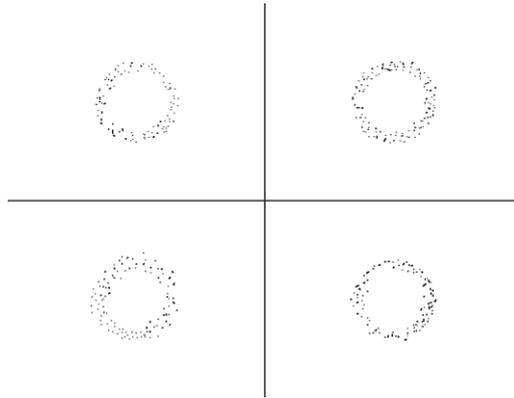
Figure 5.12. *Non-coherent single frequency interference (QPSK)*

3) Phase noise is displayed as rotationally spreading constellation points:
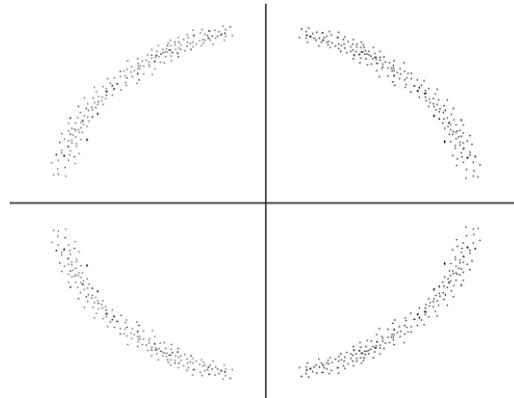
Figure 5.13. *Phase noise (QPSK)*

4) Amplitude compression causes the corner points to move towards the centre:
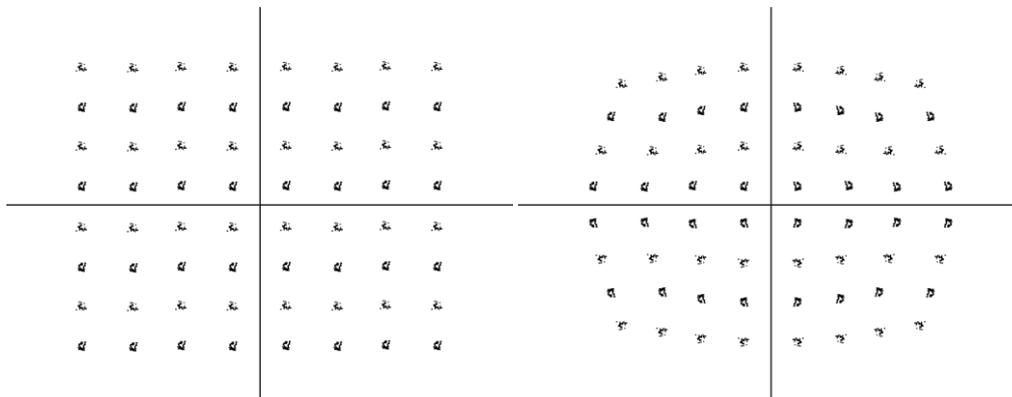
Figure 5.14. *Amplitude compression (64QAM)*

Examples of HYPERCABLE CFIP constellation diagrams under excellent conditions are shown below:
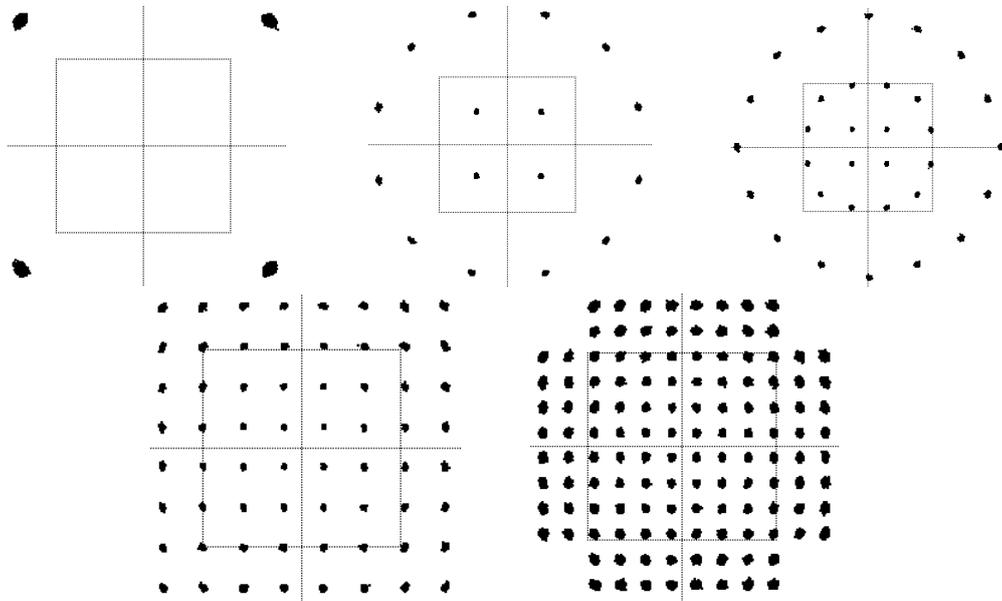
Figure 5.15. *Constellation diagrams – QPSK, 16APSK, 32APSK, 64QAM, 128QAM*

5.2.5 Adaptive Equalizer

HYPERCABLE CFIP FODU 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 HYPERCABLE 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) bandlimited signal is schematically shown in the picture below:
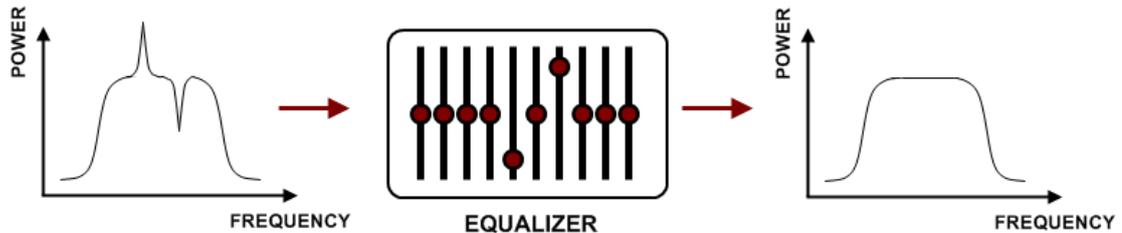
Equalizer graph

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:
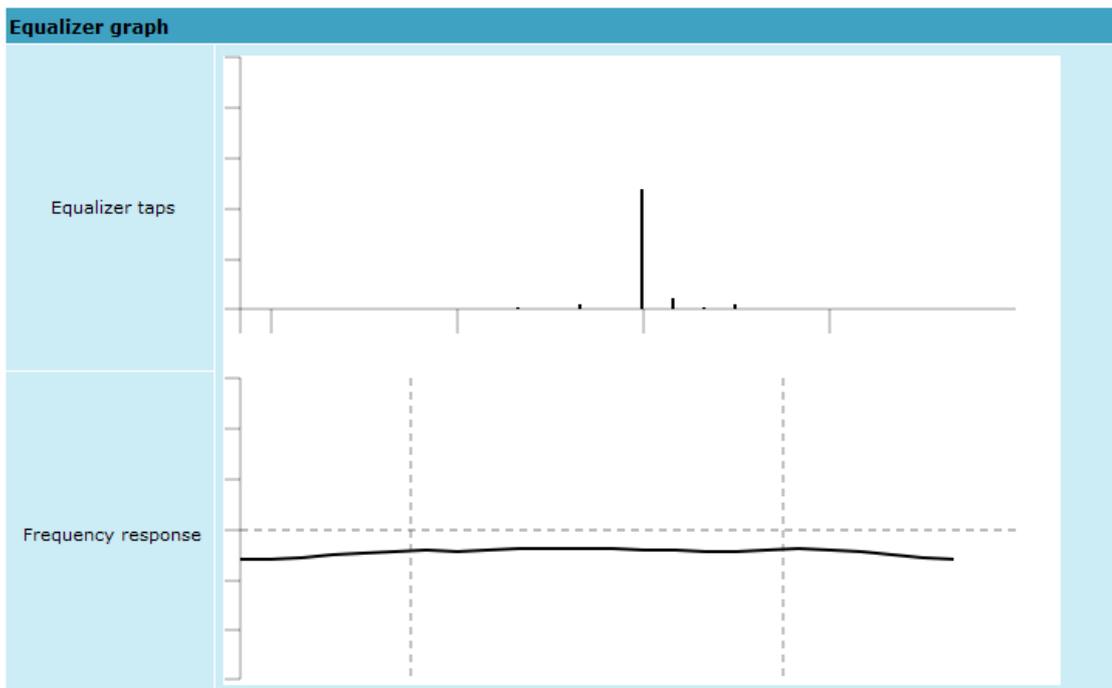
Equalizer graph

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.

Equalizer graph
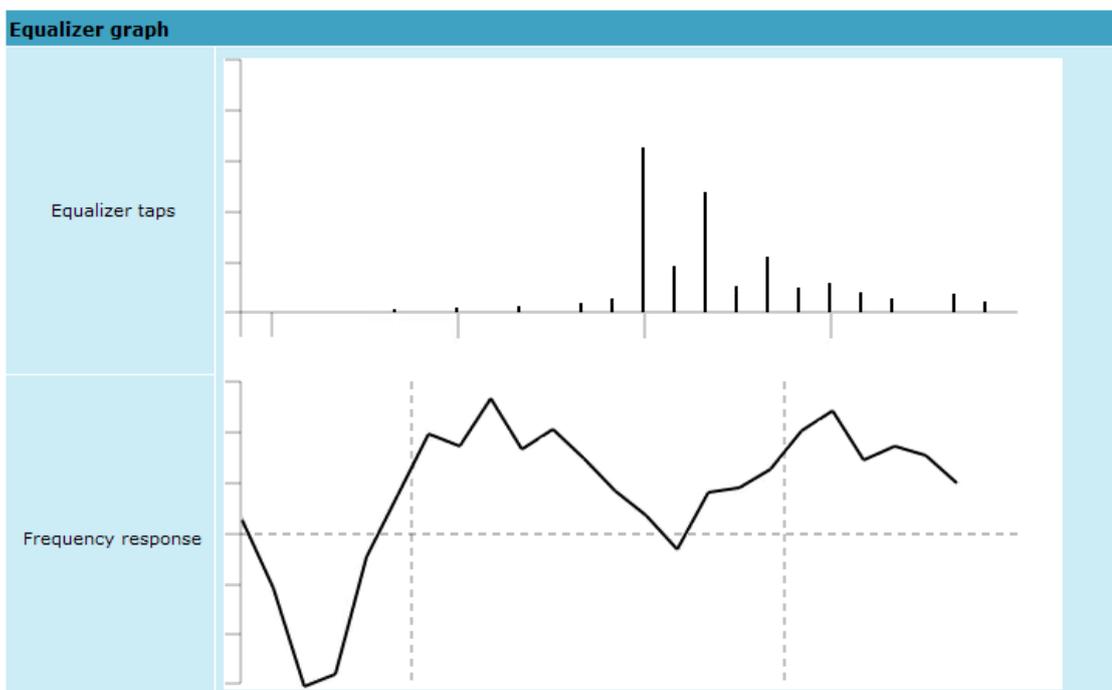
5.2.6 Performance management commands

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 . SYS_TEMPER . RADIAL_MSE . LDPC_STRES.}	{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	SYS_TEMPER	RADIAL_MSE	LDPC_STRES} {min|max <value>}|auto }	Sets threshold levels for parameters outside which TS (Threshold Seconds) are counted and shown in the performance log.

5.3 Ethernet statistics

Ethernet statistics window shows the full statistics of HYPERCABLE CFIP Ethernet switch <u>since unit start or statistics reset</u>. All statistics are also accessible using command prompt command ***ethernet statistics***.

Explanation of fields:

Ethernet statistics			
Statistics for 1 day 22:40:03 **1**			
Modem state	Ok **2**		
		3	Clear statistics
Name	**Rx**	**Name**	**Tx**
Truncated frames **4**	0	Vlan tags **26**	0
Log 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**	3357985167
Control frames **9**	0	Underruns **31**	0
Dribble nibbles **10**	0	Giants **32**	0
Broadcasts **11**	11036	Late collisions **33**	0
Multicasts **12**	11054	Max collisions **34**	0
Dones **13**	21245712	Excessive defers **35**	0
Out of range errors **14**	0	Non-exc. defers **36**	0
Length check errors **15**	0	Broadcasts **37**	21383
CRC errors **16**	0	Multicasts **38**	21437
Code errors **17**	0	Dones **39**	21282030
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**	3364556166	Byte counter **43**	3357985167
Name	**GFP**	**Name**	**QoS**
FCS errors **22**	0	Rx Q1 frames **44**	21245712
CHEC errors **23**	10758	Rx Q1 dropped **45**	0
Dropped frames **24**	0	Rx Q2 frames **46**	0
Delineation errors **25**	10758	Rx Q2 dropped **47**	0
		Tx frames **48**	21282031
		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 contained multicast address;
13. *Dones* – reception of packets successfully completed;
14. *Out of range errors* – 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. Note: bits 19 through 16 are the collision count on any successfully transmitted packet and as such will not show the possible maximum count of 16 collisions;

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.

6 Miscellaneous controls in Web graphic user interface

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

6.1 Configuration file

This section allows working with HYPERCABLE CFIP configuration script.

The management module has RAM and EEPROM chips onboard. When HYPERCABLE 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 HYPERCABLE 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 by simply entering required string (see Nr. 7 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 by entering appropriate line number (see Nr. 2 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. 3 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 HYPERCABLE CFIP is restarted

Explanation of customization fields:

1. Window shows contents of configuration script. Commands contained in this configuration script are executed at every system start-up (command line – *cfg show*);

2. *Delete entry #* – allows deleting a specific line of configuration script. You must type the number represented in configuration script to proceed with deleting and press 'Delete' button (command line – *cfg delete <line>*);

3. *Save edited configuration file* – to confirm the changes made, you must write configuration script into EEPROM, otherwise changes will not be saved (command line – **cfg write**);

4. *Execute current configuration* – executes commands present in configuration script (command line – **cfg run**);

5. *Input file name to backup cfg in FODU memory* – allows choosing file name under which current configuration script will be saved in the HYPERCABLE CFIP flash memory (command line – **cfg backup** *<file>*);

6. *Input file name to restore cfg from FODU memory* – allows loading configuration script from previously saved backup file (command line – **cfg restore** *<file>*). To view the contents of flash memory, go to 'Tools --> Command line' and type in 'tfs ls';

7. *Enter string, which you want to save in cfg* – allows you to enter desirable command, which will be added to the configuration script as the last line (command line – **cfg add** *<cmdline>*);

8. *Load factory configuration file* – Resets the configuration by loading in EEPROM the script with default settings. This command performs the following actions (in the following order):

    1. clears the current script from EEPROM,

    2. creates and stores in EEPROM the new script 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**);

9. *To save cfg file on your computer click here* – allows downloading configuration script and saving it on your hard drive.

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 to specify data transmit parameters and functionality for specific time period or for unlimited time.

HYPERCABLE CFIP without licensing option will operate with full functionality, but HYPERCABLE CFIP with licensing option but without activated licenses will operate with

minimum functionality (3.5MHz channel bandwidth, QPSK modulation, Strong FEC, no ACM, no E1 channels). Functionality may be expanded using appropriate license key.

Explanation of fields:

1. *License status* – shows if management CPU was able to read license data;
2. *Left time* – shows the amount of time left for the active license;
3. *Key* – displays currently active license;
4. *Time* – shows the overall time for the active license;
5. *3500 KHz* – shows the maximum modulation that can be used together with 3.5 MHz channel bandwidth;
6. *5000 KHz* – shows the maximum modulation that can be used together with 5 MHz channel bandwidth;
7. *7000 KHz* – shows the maximum modulation that can be used together with 7 MHz channel bandwidth;
8. *10000 KHz* – shows the maximum modulation that can be used together with 10 MHz channel bandwidth;
9. *14000 KHz* – shows the maximum modulation that can be used together with 14 MHz channel bandwidth;
10. *20000 KHz* – shows the maximum modulation that can be used together with 20 MHz channel bandwidth;
11. *28000 KHz* – shows the maximum modulation that can be used together with 28 MHz channel bandwidth;
12. *ACM* – shows if adaptive coding and modulation (ACM) is allowed for the active license;
13. *E1 channels* – shows the amount of E1 channels that can be used with the active license;
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. With up and down arrows you can change order of entered licenses;
15. *License key* – allows entering a license key. Entering a license key twice, activates it;

16. *FODU 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 HYPERCABLE CFIP FODU 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.

6.4 File system

The software used by the HYPERCABLE 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 HYPERCABLE 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 HYPERCABLE CFIP model. The file name can be freely changed, but its default name will contain the version and HYPERCABLE CFIP model, e.g., 'Hypercable CFIPf000.elf.ezip,Ec'. 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 HYPERCABLE CFIP management system.
- The flash disk may store other files as well, for example - previous firmware versions, configuration backup files, - up to 7.7 Mb (about 9 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 HYPERCABLE 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 HYPERCABLE CFIP restart. To save it in EEPROM use *'write'* command.

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

Working with files

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

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 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 del <filename>	Deletes the specified file from Flash disk.
	'tfs rm' can also be used.

6.5 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 HYPERCABLE CFIP.

7   Software Update

To simplify the software update process, Hypercable SAF Tehnika 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), boot configuration file (with *.ini extension) and other files needed for update process. To receive update pack, please contact your Hypercable SAF Tehnika distributor.

The main method for software upgrade is Web GUI software upgrade, which automates the whole software 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 software upgrade file (e.g. Hypercable CFIPf000.elf.ezip,Ec) on your hard disc (see Chapter 4.2.4 for detailed explanation of Web GUI upgrade).

Besides there are other various ways how the user can update the HYPERCABLE CFIP management software by uploading the appropriate firmware file to the HYPERCABLE CFIP FODU 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.

7.1   Update Software with Update Pack

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

− uncompress the package;
− change the HYPERCABLE CFIP IP address to 192.168.205.10, *or* edit 'send.205.xx' files by replacing "192.168.205.10" with actual HYPERCABLE 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 Hypercable CFIPf000.elf.ezip,Ec* uploads firmware file named 'Hypercable CFIPf000.elf.ezip' with attribute flags 'E' and 'c' to host HYPERCABLE CFIP with IP address 192.168.205.10.
- Start TFTP on both link sides in 'Configuration → IP configuration':

IP services	
FTP service	Start FTP
TFTP service	Start TFTP

- run 'send.205.xx.cmd' to perform update, where „xx" represents last number of actual HYPERCABLE 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 HYPERCABLE CFIP Flash disk. Update process screen is shown below:

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

Other configuration		
Web refresh (2 .. 600 sec)	5	
Time (Usage: YY-MM-DD HH:mm:ss)	08-11-28 11:33:00	Set local machine time
		Execute configuration
		Write to config file
Immediate CPU restart		Restart CPU
FODU returned:	Ok	

7.2 File Upload via Ethernet management port (TFTP)

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

1. Connect the HYPERCABLE CFIP to network or directly to PC;
2. Make sure TFTP is running on HYPERCABLE CFIP (by default, TFTP is switched off); to run TFTP on HYPERCABLE CFIP, connect to HYPERCABLE 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

4. For example, to upload the firmware file 'Hypercable CFIP000.elf.ezip' with attribute flags 'E' and 'c', enter command:

tftp –i 192.168.205.11 put C:\files\Hypercable CFIPf000.elf.ezip Hypercable CFIPf001.elf.ezip,Ec

where:

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

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

'C:\files\Hypercable CFIPf000.elf.ezip' – firmware file (source);

'Hypercable CFIPf001.elf.ezip' –file name in the HYPERCABLE 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;
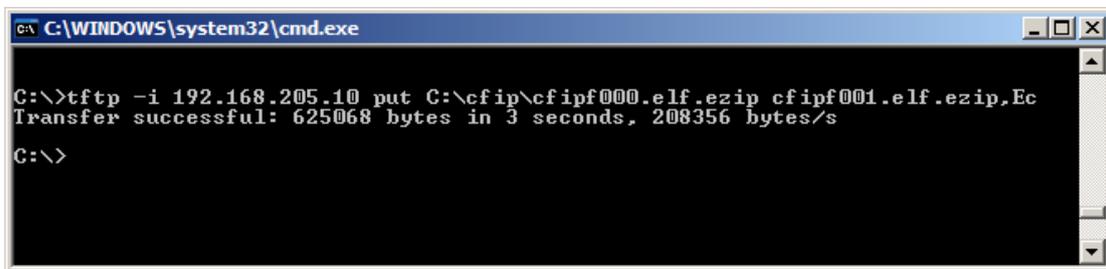
Figure 7.1. Command interpreter cmd.exe

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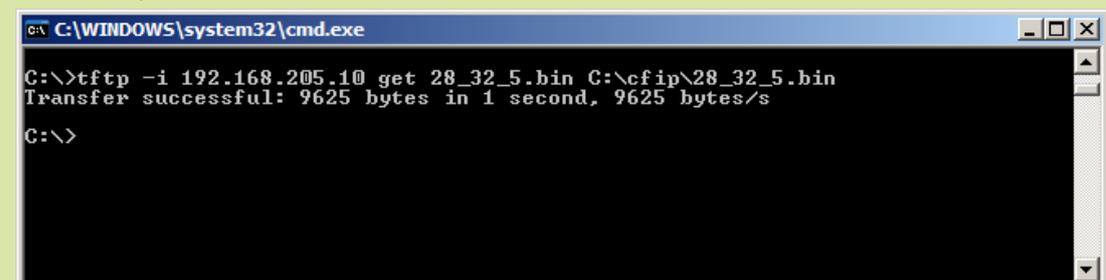
(!) To copy file from HYPERCABLE CFIP Flash disk to PC hard disk via TFTP, use the following command:

tftp -i 192.168.205.11 get filename destination_filename

where

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

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

7.3 Uploading file via Ethernet management port (FTP)

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

IP services		
FTP service		Start FTP
TFTP service		Start TFTP
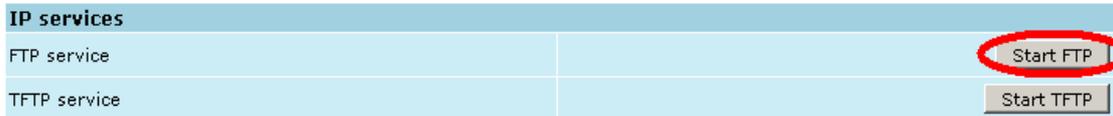
1. Open command window.

2. Start FTP client by entering "***ftp***" command ("*ftp>*" prompt will appear).

3. Connect to HYPERCABLE CFIP FTP server using command "***open*** *<HYPERCABLE 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 HYPERCABLE 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 HYPERCABLE CFIP flash disk.

   Use command "***delete*** *<filename>*" to delete the file from the HYPERCABLE 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.

7.4 Uploading file 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 HYPERCABLE CFIP management system is not available, or does not start normally.

1. Connect the ASCII console to the HYPERCABLE 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 HYPERCABLE CFIP is booting, press any key when 'boot.ini?' prompt appears. This will stop executing script in 'boot.ini' file and the HYPERCABLE 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 HYPERCABLE 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 HYPERCABLE 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:
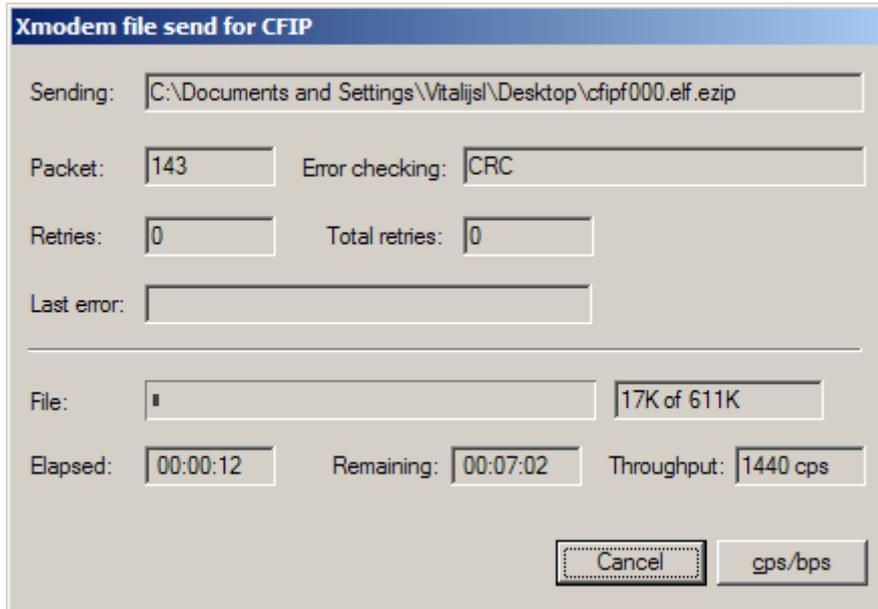
When upload is complete, the following information will be displayed (**Figure 7.2.**):
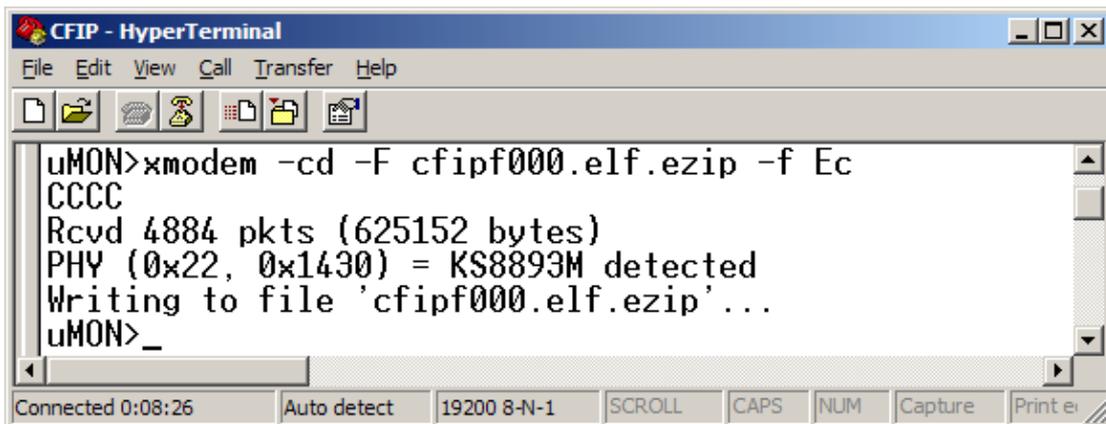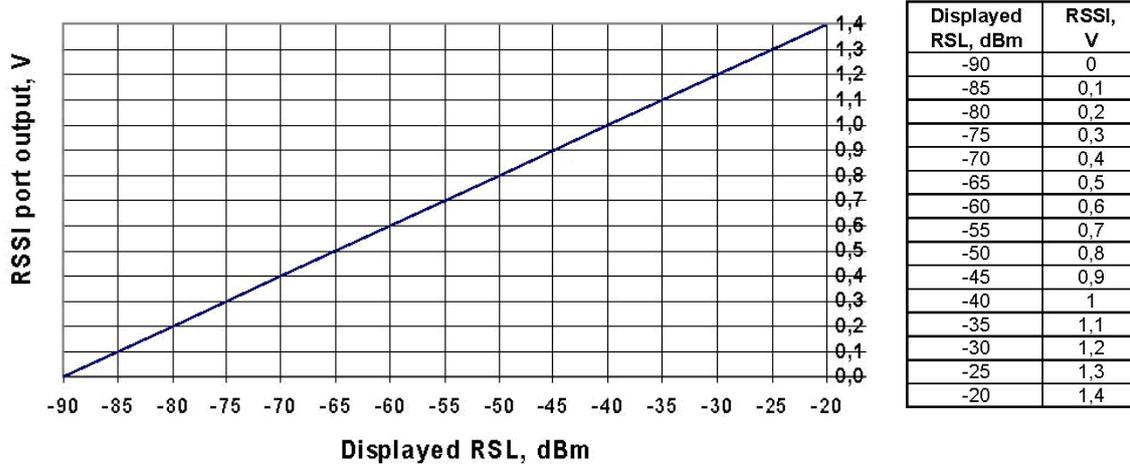

Figure 7.2.

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

8 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 HYPERCABLE 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 dBm.
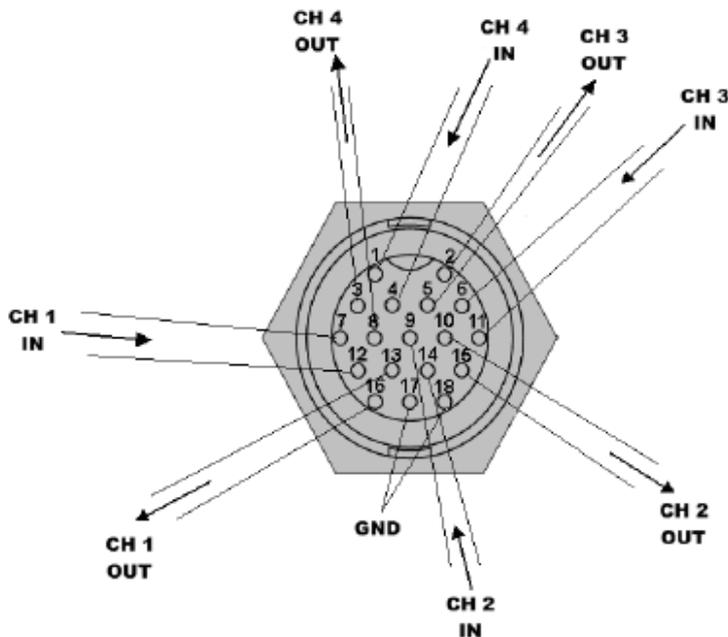
Typical RSSI=f(RSL) chart

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

9 Pinouts

9.1 18-pin connector

The pinouts for the 18-pin port connector (on the HYPERCABLE CFIP FODU) are given on the picture below. The displayed pin layout corresponds to the cable connector solder side.

7 & 12	Input E1 CH 1
13 & 16	Output E1 CH 1
9 & 14	Input E1 CH 2
10 & 15	Output E1 CH 2
6 & 11	Input E1 CH 3
2 & 5	Output E1 CH 3
1 & 4	Input E1 CH 4
3 & 8	Output E1 CH 4
17 & 18	GND

All the E1 Input/Output signals are 120 Ω balanced.

The GND pins are not mentioned for lightning protection; there is a special grounding screw (M6) on the front of the unit intended for lightning protection; the HYPERCABLE CFIP Full ODU must be grounded using the grounding screw.

9.2 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.
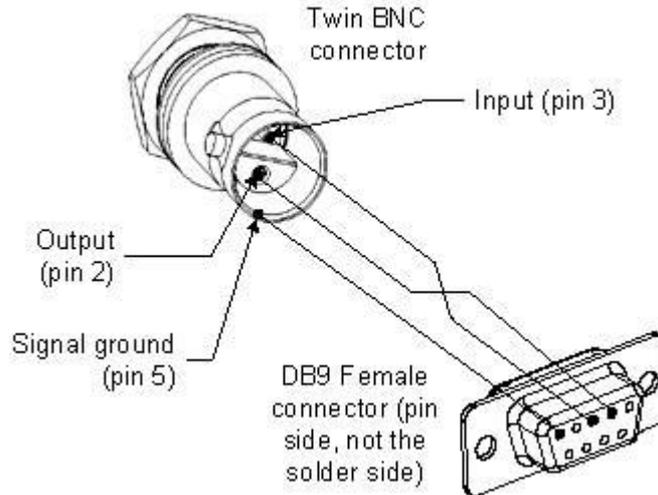

Figure 9.1. *RS-232 port pinouts, pin numbers refer to DB9 female connector*

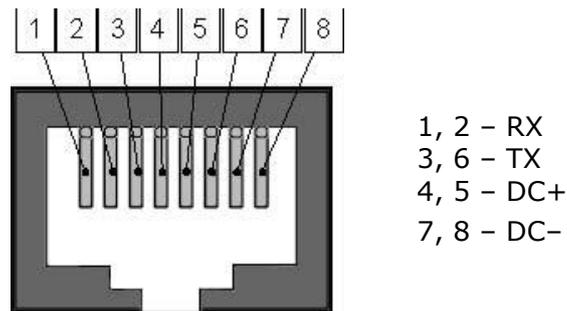## 9.3 Sealed RJ-45 socket

The pinouts of that socket are as follows:

1, 2 – RX
3, 6 – TX
4, 5 – DC+
7, 8 – DC−

Figure 9.2. *RJ-45 socket pin number*

Available accessories

FODU RJ-45 LTW cable connector case P/N FOACNR03	FODU 18-pin cable connector, hermetically sealed, intended for cable connecting to FODU with termination panel or user equipment P/N FOACNL01
FODU RJ45 connector 8P shield solid P/N FOACNR02	AC/DC for passive injector 100-240V/48V/0.75A P/N CFGB4806
13/15GHz Flexible Waveguide 60cm UBR-PBR P/N C15WF201	18/23GHz Flexible Waveguide 2ft/6 P/N C22WF201

HYPERCABLE CFIP Lightning Protection RJ45 Indoor P/N I0ALAI01	Power over Ethernet Passive Injector w.Integral HP CAT5E P/N I0ATPI03
BNC connector for antenna RSSI alignment	FODU twin BNC RG108A connector for RS-232 console port for FODUs P/N FOACNT01
Lightning arrestor for Ethernet patch cable	Lightning arrestor for E1 10-pair cable
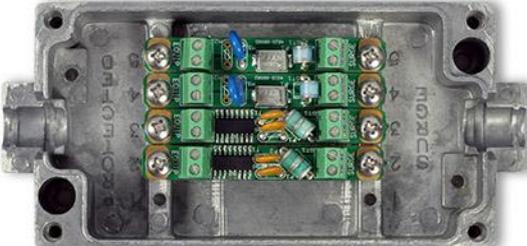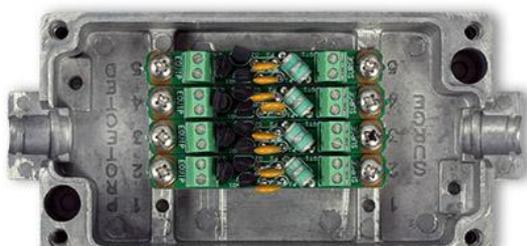
HYPERCABLE CFIP Power over Ethernet Injector, 100-240V, 2xRJ45 P/N I0ATPI02	HYPERCABLE CFIP Lightning Protection RJ45 Outdoor P/N I0ALAO01
Test equipment 13/15 GHz (See the list of available test equipment below)	Coaxial attenuator 40 dB P/N CLA40A01
FODU UTP cable cat5 4P outdoor solid P/N FOACET02	HYPERCABLE CFIP-TP4 terminal power injector w.4E1 P/N I0GTP401
HYPERCABLE CFIP FODU Mounting Bracket (for 1xFODU P/N: CLGRFB05; for 2xFODU P/N: CLGRFB06)	O-ring - rubber gasket to be fitted between 0.25m antenna and FODU
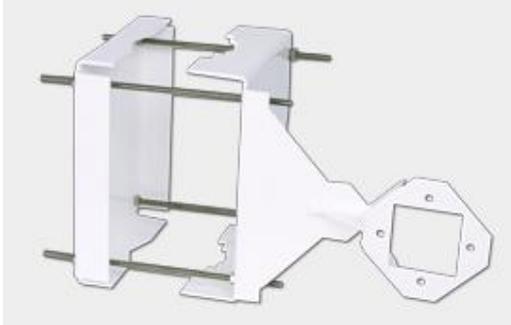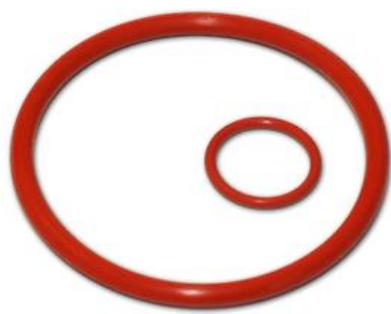
RSSI cable for ODU align 1m BNC − 2 plug-in P/N CLGCRS01	FODU cable TWIN BNC - DB9 (2m) P/N FOACTW01

9.4 Other available accessories

- FODU cable 10P FTP 3kat outdoor solid (P/N FOAC1001)

HYPERCABLE CFIP Test Equipment

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 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)
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 kit 24 GHz	P/N: C24TST02	Test kit 24 GHz

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

10 List of abbreviations

3G – third generation
AC – Alternating Current
ACI – Adjacent-Channel Interference
ACM – Adaptive Coding and Modulation
AGC – Automatic Gain Control
AIS – Alarm Indication Signal
APSK – Amplitude and Phase Shift Keying
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
EMI – Electromagnetic Interference
ETS – European Telecommunication Standard
ETSI – European Telecommunications Standards Institute
FIR – Finite Impulse Response
FODU – Full Outdoor Unit
FTP – File Transfer Protocol
GFP – Generic Framing Procedure
GND - Ground
GSM - Global System for Mobile communications
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
LOS – Loss Of Signal
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

QPSK - Quadrature Phase-Shift Keying

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

STM-1 – Synchronous Transport Module – 1

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

UTP – Unshielded Twisted Pair

VLAN – Virtual Local Area Network

WAN – Wide Area Network

11 Hypercable SAF Tehnika JSC Contacts

Hypercable SAF Tehnika A/S technical support can be reached by:
- Email: infot@hypercable.fr
- Telephone: + (0) 4 78 48 74 75