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IPLINK

User Manual

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Conventions

NOTE: Notes are used to convey additional information.

⚠ CAUTION: Cautionary notes are given where potential equipment damage could occur.

⚠ WARNING: A warning is shown where there is potential for personal injury, danger or death. This warning should be read and understood before attempting to carry out work on the equipment in use or any associated equipment.

Vislink Product Support

Field repairs are not supported for this product. Return the unit for factory repair.

⚠ CAUTION: If any field repairs are attempted, there is a risk of damage to the equipment. If the equipment is under warranty, this may also affect the warranty coverage.

Service/Support Contacts:

Region	Contact Details
Worldwide	UKsupport@vislink.com +44 (0) 1442 431410 +44 (0) 1787 226227
Americas	USsupport@vislink.com +1 978 671 5929 888 777 9221

When contacting Technical Support, please include the following information:

- Model number and serial number of the unit (located on a label on the bottom of each unit).

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- Approximate date of purchase.

  ……

Document History

Version	Date	Modification
A	18/11/2015	First release of document.
B	15/2/2016	Updated template for look and feel. Updated the Introduction section for system description information. Updated RF Power output level information. Updated rear panel images. Updated section 7 for the optional External Expansion Module. Added Section 8 to include content for the External High Power Amp. General non-technical updates.

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1. Introduction

Figure 1-1 IPLink Front Panel

IPLink is an Internet Protocol-centric microwave radio specifically designed for broadcasting. Its all-indoor, full duplex, bi-directional platform provides both GigE Ethernet data plus ASI interfaces. The IPLink transceiver combines the features of a broadcast digital microwave point-to-point radio system with the modern efficiencies of a high-capacity long-distance bi-directional IP microwave radio design.

It allows the broadcaster to smoothly migrate from the traditional ASI transport platform to a future IP-centric system architecture. The system delivers ultra-high linear RF output performance coupled with the reliability that Low Density Parity Check forward error correction (LDPC FEC) affords in controlling errors in data transmissions over long or unreliable microwave paths.

A key advantage of the IPLink is that it allows BAS 7 & 13 GHz simplex links to be transformed into affordable duplex IP Ethernet microwave systems within a T/R channel spacing as close as 75 MHz systems are available in Simplex, Duplex, Hot-Standby and Spatial Diversity Receive configurations. IPLink digital microwave system is designed to operate at channel bandwidths up to 56 MHz and modulations from QPSK to 256QAM.

IPLink is designed for high-performance Point-to-Point (PtP) digital microwave links with adjustable data rate from 10 to 360 Mbps, modulation and channel bandwidth dependent. The IPLink includes a user selectable Adaptive Code Modulation (ACM) feature that provides transport stream continuity based upon a data rate that automatically scales according to the quality of the wireless link. The IPLink is specifically designed to address wireless IP-centric transport requirements where interface with legacy ASI infrastructures are still necessary.

The IPLink supports both ETSI (European Telecommunications Standards Institute) and ANSI (American Standards Association) licensed frequency bands and channel bandwidths standards.

1.1. System Description

The IPLink is an all-indoor microwave radio system that connects with tower mounted antennas via elliptical waveguide. It consists of a high RF output transceiver (TX/RX) with an Ethernet baseband IP modem, all housed within a 2RU x 19" EIA rack-mount chassis. Transmit and Receive frequency channel spacing is user selectable within a 75 MHz T/R separation. Non-protected (1+0) and hot-standby (1+1) system configurations are available. The IPLink provides up to three GigE and four ASI (optional) user interfaces and includes a robust web-based remote system management and monitoring GUI. Additional ASI or E1/T1 circuits may be connected to the system via a high-speed optical interface expansion chassis.

1.2. Key Features

The IPLink system is technically characterized by the following basic features:

- All-indoor, space efficient 2RU x 19" (48 cm) rack-mount
- Ultra-high linear broadband RF power amplifiers
- Exceptional System Gain & Unparalleled Receiver Sensitivity
- High capacity ASI & Gigabit Ethernet IP data transport
- Automatic Transmitter Power Control
- Adaptive Code Modulation to adjust data rates based on link connectivity
- User selectable modulations from QPSK to 256 QAM
- ANSI and ETSI channel bandwidths
- Intuitive Web-based GUI for monitoring/control

1.3. Technical Characteristics

- Standard licensed ETSI and ANSI frequency bands
- 6, 7, 8 & 13 GHz RF Band Support
- Modulation schemes:
  - QPSK, 8 PSK, 16/32/64/128/256 QAM
- Channel bandwidth
  - ETSI standards 7/14/27.5/28/40 and 56 MHz
  - ANSI standards 10/20/25/30/40/50 and 60 MHz
- LDPC based Forward Error Correction
- Hitless Adaptive modulation (ACM)
- Four basic design modes (SW setting):
  - Simplex – one-way data stream over air
  - Duplex – bi-directional data streams over air
  - PROTECTED – 1+0 configuration in HSB/SD/FD modification
  - AGGREGATE – 2+0 configuration with true capacity doubling
- Two functional options (SW setting):
  - AES128, AES256 – AES encryption for high system security
  - PTP1588 – option which ensures IEEE1588 support
- Integrated traffic ports:
  - 2x Gigabit Ethernet ports (10/100/1000Base-T) 2 for user data traffic and one dedicated for management access (can be configured for data traffic)
  - 2x Fiber optic interfaces, one for GigE port extension, and another for EMM module connection or IPLink interconnection (protection, aggregation)
- SyncE support in each design mode
- Integrated data verification system of received corrupted packets (CRC)
- Integrated BER tester and measurement of the nature of received signal (MSE, modulation diagram of received data)
- ATPC function support (Automatic Transmit Power Control)
- Integrated spectral analyzer for the detection of the free channel, or alternatively for detection of interference with the particular band
- Unified standard management IP access – TELNET, HTTP, SNMP v.2c
- Secure management IP access - SSH, HTTPS, SNMP v.3

1.4. Applications

- Studio-to-Transmitter Links (STL)
- Transmitter-to-Studio Links (TSL)
- Inter-city Relay Backhauls (ICR)
- Multi-hop Microwave Relay Systems
- High-capacity IP Microwave Systems

The core of the unit is DSP module that generates a signal for the intermediate frequency output to the internal RF transceiver unit and processes radio frequency (RF) input/output from/to the antenna.

As stated above, IPLink is fitted with three 1000Base-T (RJ45) user ports, where one port is typically reserved for system management. Two fiber optic interfaces are intended either for additional Gigabit Ethernet connection or for IPLink interconnection (1+1/2+0) (labeled as SFP) or for capability extension by connection via EMM (External Multiplexer Module Option).

The Management system is based on TCP Internet Protocol (TCP/IP). The RF unit's management is integrated directly into the command set of IPLink; an integral part of this unit's software. For the management itself there is used, either character-oriented IP access (TELNET, SSH) or Web based GUI (HTTP, HTTPs) or SNMP based system management. The IPLink unit should be connected to power supply with a nominal voltage of 115-120 or 220-240 VAC.

2. Specifications

Component	Features	Details
RF	RF Power Output Level (prior to filter branching)	+34dBm to +27dBm[1] @ 6 GHz, +33dBm to +26dBm @ 7 GHz +32 dBm to +25 dBm @ 8 GHz ,+29dBm to +22dBm[1] @ 13 GHz
	RF Band Support[2]	6.425 – 7.125 GHz (FCC TV-BAS) 7.100 – 7.900 GHz (ETSI) 7.725 – 8.500 GHz (ETSI) 12.700 – 13.250 GHz (FCC TV-BAS)
	Channel Filter Branching Network Assemblies[3]	50 MHz typ. T/T & R/R @ 7 & 13 GHz FCC-BAS 75 MHz typ. T/R @ 7 & 13 GHz FCC-BAS Waveguide Interface: WR137 @ 6 GHz, WR75 @ 13 GHz
	Automatic Transmitter Power Control (ATPC)	-
Data Transport	Modulation	QPSK, 8PSK, 16 QAM, 32 QAM, 64 QAM, 128 QAM & 256 QAM
	Data Throughput Capacity (one-way)	10 Mbps to 350 Mbps
	Adaptive Code Modulation	hitless 0ms
	Encryption	AES 256
Power	100W (power consumption) switching	AC (90-132V & 180-264V @ 47 – 63 Hz)
User Interface	Ethernet (payload)	2 x 100/1000 Base-T, RJ-45 Gigabit Ethernet line rates scalable up to 360 Mbps IPv4 and IPv6 VLAN 802.1Q 64 level DiffServ (DSCP) QoS or 8 level 802.1p in 4 prioritization queues with VLAN support
	A SI (payload)	4 x ASI simplex transmit (BNC-F) 4 x ASI simplex receive (BNC-F) 4 x ASI individually configured per direction for duplex (BNC-F)
	Local and Remote Link Web-Browser Management	1 x 100/1000 Base-T (RJ-45)
	System Management Interface	Hot-Standby (1+1) and Space Diversity 1 x DB9 for RF PA & RSL switching 1 x DB9 for alarm fault switching
Mechanical	Dimensions	2 RU x 19” (48cm) EIA Rack Mount 16.5” depth (42cm) exclusive of filter branching
	Weight	18 lbs. (8.2 kg) approx.
Environmental	Temperature Range	0° to +50°C (+32° to +122°F) Operational -40° to +70°C (-40° to +158°F) Storage
	Humidity	90% max. non-condensing
Regulatory	FCC Type Certification in Accordance with CFR 47 Part, Subpart J	CFR 47, Part 74, subpart J CFR 47, Part 101, subparts C, H and I
	FCC part 15 EMC unintentional emission radiators	-
	ETSI: EN 301 489-1, 489-28, EN 302 064-1	-
	Safety per EN/CE EN60950	-

Table 2-1 Specifications Overview

[1] - Modulation dependent.

[2] - Consult factory for additional RF band support.

[3] - Consult factory for additional WG interface availability.

3. Front Panel

Figure 3-1 Front Panel Overview

Drawing ID	Function
1	Power switch
2	MNG LAN
3	LCD Touchscreen
4	Link LED
5	LOC Alarm LED

Table 3-1 Front Panel ID

3.1. Power Switch

System power on/off – when lit, power is applied to the transceiver.

3.2. MNG LAN

1x RJ45, Local Area Network host communication port.

Provides 10/100/1000 Base-T Ethernet connection to a PC via a Web browser for local or remote control of the radios that form the link.

3.3. LCD Touchscreen

The front panel touchscreen conveys local and remote, read-only, setup information. System configuration can be set with the Web interface when you connect to the front panel Management LAN Ethernet port and connect with the IP address shown at the bottom of the touchscreen.

When you press the touchscreen for at least 10 seconds, a secondary screen displays, showing information about the presence of an optional High Power Amplifier (HPA) and/or redundant power supplies (PSU).

3.3.1. Main Screen

Figure 3-2 Main Screen Overview

The main screen displays the following information:

- Transmission Frequency (MHz)
- Receiver Frequency (MHz)
- Modulation Status:
  - First three digits refer to modulation type (e.g. 004 = 4PSK, 016=16QAM)
  - Next five digits refer to bandwidth in kHz
  - Final two digits refer to waveform type (always use 03 for IPLink indoor unit)
- Transmission Power (dBm)
- Receiver Level (dBm)
- System Throughput (Mb/s)
- Alarms
- Current IP Address and Netmask

3.3.2. Secondary Screen

On the secondary screen the following items will be displayed:

- HPA Attached – Indicates the presence of an optional High Power Amplifier (HPA). When this is enabled an alarm will indicate if the HPA is unresponsive. In most situations this option will be turned off.
- PSU (Redundant Power Supply) Enabled – Configures the unit to be aware of the presence of an optional redundant power supply (PSU). An alarm will also be indicated should such power supplies be inactive.
- SW Version – Displays the software version.
- Exit – Press this button to return to the primary touch screen.

3.4. Link LED

This LED is lit green when the transceiver establishes a connection with a remote transceiver. If there is no connection, the LED will be lit red.

3.5. LOC Alarm LED

Indicates the current alarm status of the Local IPLink transceiver.

If there are no alarms, then this LED is lit green. If there is a minor alarm (Alert), the LED will be lit amber. If there is a major alarm, the LED will be lit red.

4. Rear Panel

Figure 4-1 Rear Panel Overview

Drawing ID	Function	Additional Information
6	ASI ports	-
7	SFP ports	The SFP ports are used for external EMM extension as well as 1+1 and diversity configurations
8	Ethernet ports	-
9	9-pin D-Sub type male (Alarm)	Alarm interface
10	9-pin D-sub type female (Control)	Control interface
11	RF Out	RF Output to filter branching network.
12	RF In	RF Input from filter branching network RF out.
13	AC power	-

Table 4-1 Rear Panel ID

4.1. ASI Ports

Four BNCs, ASI configurable input or output.

4.2. SFP Ports

Two fibre optic control for expansion modules.

4.3. Ethernet Ports

Two RJ-45, 10/100/1000 Base-T data traffic.

4.4. 9-Pin D-Sub Type Male (Alarm)

Alarm relay closure - the Normally Closed signals are closed when the unit is operating correctly, and will be open when there is an alarm. Alarm 1 and alarm 2 trigger at the same time, they are two separate poles off in the same relay.

Pin	Signal
1	Alarm 1 Relay common
2	Alarm 1 Relay Normally Closed
3	Alarm 2 Relay Normally Open
4	NC
5	NC
6	Alarm 1 Relay Normally Open
7	Alarm 2 Relay common
8	Alarm 2 Relay Normally Closed
9	NC

Table 4-2 9-Pin D-Sub Type Male Pinout

4.5. 9-Pin D-Sub Type Female (Control)

This connector is used to communicate with an external DHPA (rack mounted Digital High-Power Amp).

Pin	Signal
1	NC
2	RS282 TX
3	RS282 RX
4	NC
5	GND
6	NC
7	NC
8	NC
9	NC

Table 4-3 9-Pin D-Sub Type Female Pinout

4.6. RF In

SMA 50Ω female connector – RF signal in from antenna.

4.7. RF Out

SMA 50Ω female connector – RF signal in from antenna.

4.8. AC Power

Provides AC power to the unit.

5. Prearing for Operation

5.1. Unpacking the IPLink

Before you install your IPLink transceiver, carefully unpack your new equipment to avoid accidental damage:

- Locate all parts and accessories and verify that they are listed on the packing list. DO NOT discard the container or packing material until you have inspected the equipment and are sure there is no shipping damage. The container and packing must be available in case you need to file a damage claim with the shipping carrier.
- Inspect the equipment for damage and that it is clean and dry.
- Inspect the cables, connectors, switches, and displays to ensure that they are not broken, damaged, or loose.

If you discover damage after unpacking the system, report the damage as follows:

- Immediately file a claim with the shipping carrier.
- Forward a copy of the damage report to Vislink Customer Service.
- Contact Vislink Customer Service to determine the disposition of the equipment. See inside the front page for contact information.

5.2. Power Requirements

The IPLink has the following power requirements:

Supply Voltage:

- AC (90-132V & 180-264V @ 47 – 63 Hz)

Power Consumption:

- 100W nominal

⚠ CAUTION: Ensure that the power supplied matches the power required by the equipment.

5.3. Bands and Frequencies

5.3.1. RF PaRAMeters

RF Power Output Level (prior to filter branching):

- +34dBm to +27dBm* @ 6 GHz
- +33dBm to +26dBm* @ 7 GHz
- +32dBm to +25dBm* @ 8 GHz
- +29dBm to +22dBm* @ 13 GHz

* (modulation dependent)

5.3.2. RF Band Support

The IPLink uses the following frequency bands:

- 6.425 – 7.125 GHz (FCC TV-BAS)
- 7.100 – 7.900 GHz (ETSI)
- 7.725 – 8.500 GHz (ETSI)
- 12.700 – 13.250 GHz (FCC TV-BAS)

*Consult factory for additional RF band support

⚠ WARNING: High levels of RF power are present in the unit. Exposure to RF or microwave power can cause burns and may be harmful to health. Remove power from the unit before disconnecting any RF cables and before inspecting damaged cables and/or antennas. Avoid standing in front of high gain antennas (such as a dish antenna) and never look into the open end of a waveguide or cable where RF power may be present.

5.4. Mounting IPLink

The 2RU IPLink generates heat during normal operation. Give careful consideration to mounting the transceiver to direct heat away from the housing. For adequate cooling, ensure that discretionary cooling or ventilating equipment is used in the local and remote installations.

5.5. Connecting IPLink

Figure 4-1 shows the overview of the rear panel connections to and from the IPLink transceiver. Use the Management Ethernet port (MNG ETH) on the front panel to connect to a switch or router or to connect to a modem for an internet connection. Connecting the local IPLink to the internet allows you to configure it via its web interface (see Section 6). You can connect to it a numbers of way using the correct IP address via a compatible web browser i.e. using a tablet or PC.

NOTE: All connectors should be tool-tight. Thumb tight connections are not suitable for reliable operation.

5.5.1. Power Cycling IPLink

After applying power to the IPLink, it will take approximately 20 seconds before it begins normal operating state. When the transceiver is starting up, watch the system status diodes LINK, LOC ALARM.

5.5.2. Standard System LED Behavior during Start-Up Process

The following list shows the process and behaviour of each LED on the IPLink:

- POWER LED on the power switch should light after power up.
- Once the link is established between the two radios, the LINK led will turn green.
- If no alarms are present, the LOC ALARM led will turn green. If alarms are present, then the LOC ALARM led turns red.

5.6. System Configurations

The following illustrations highlight the possible system configurations.

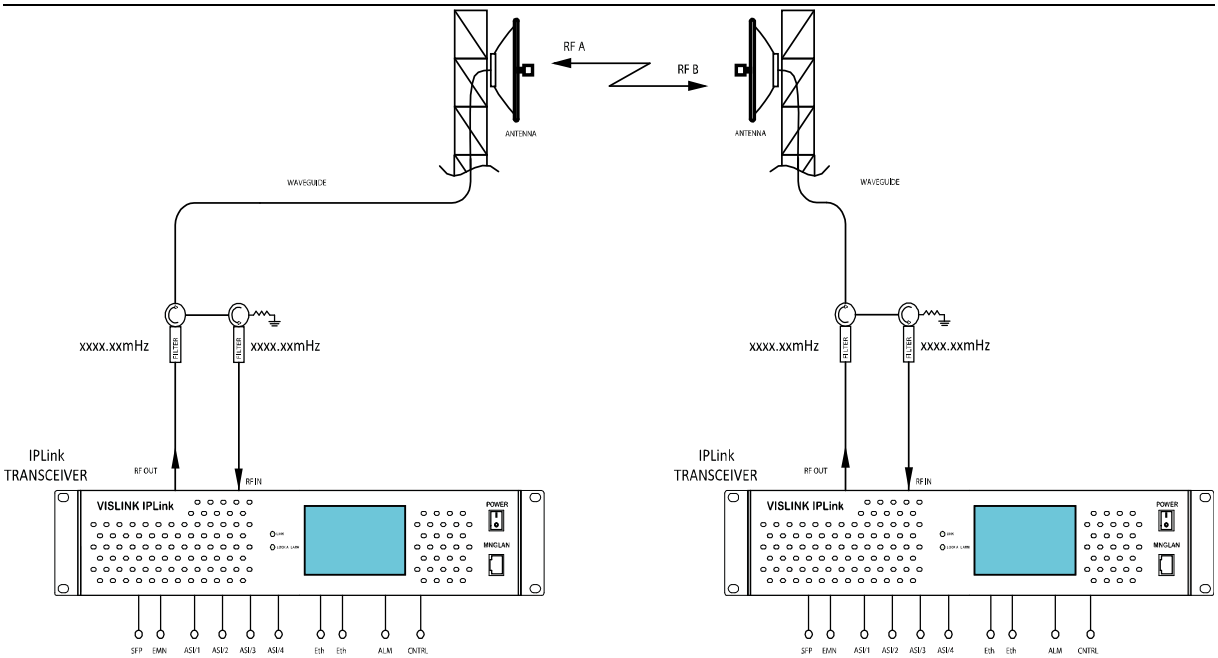

Figure 5-1 Duplex System

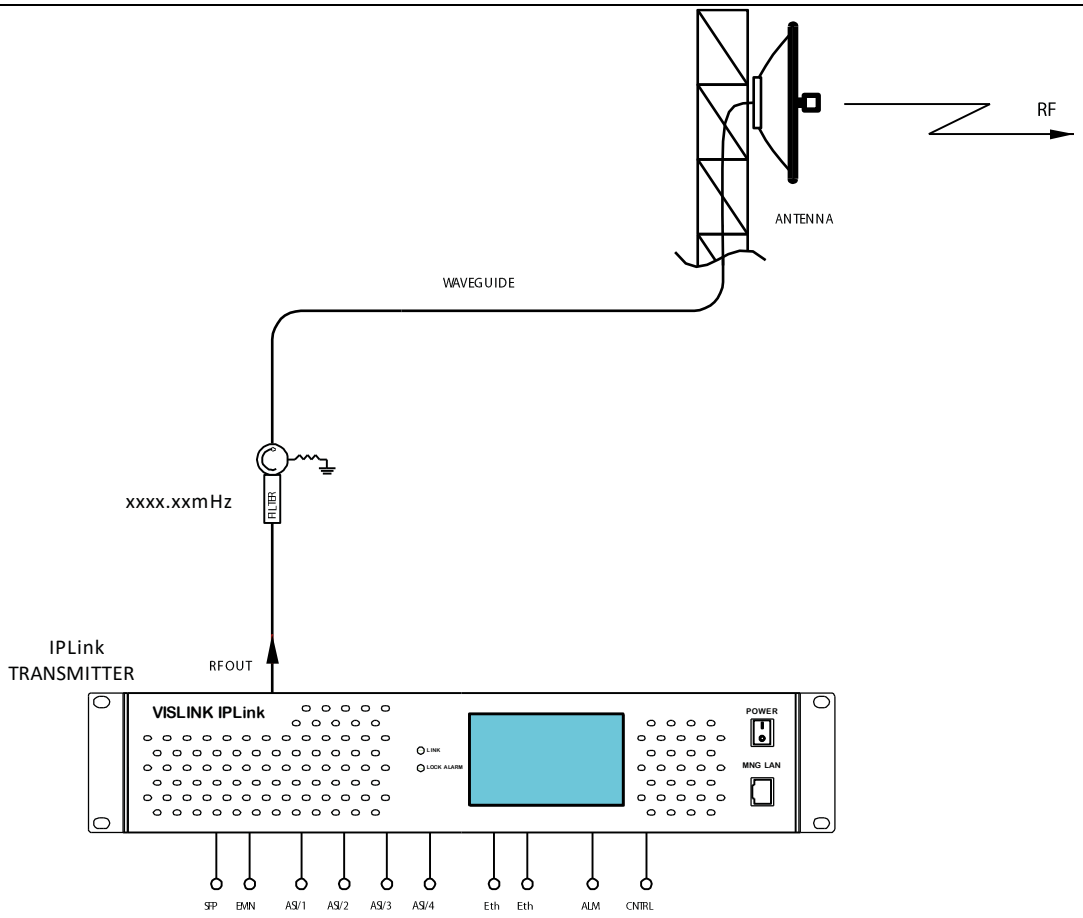

Figure 5-2 Transmitter

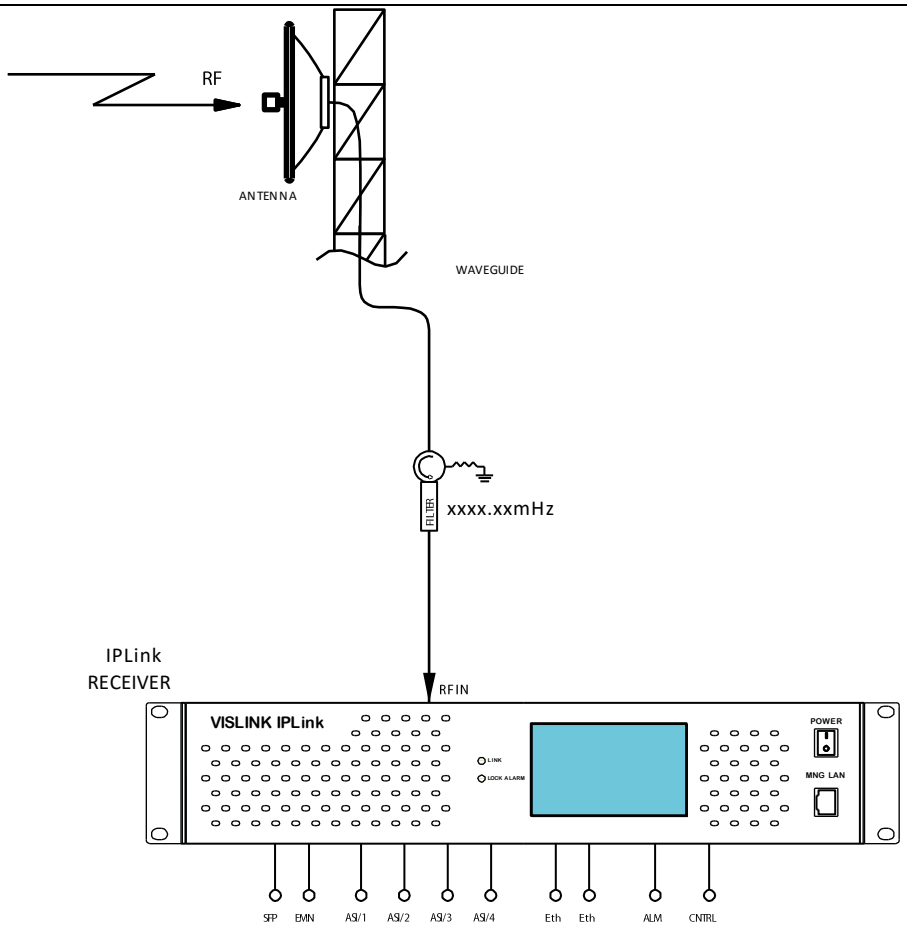

Figure 5-3 Receiver

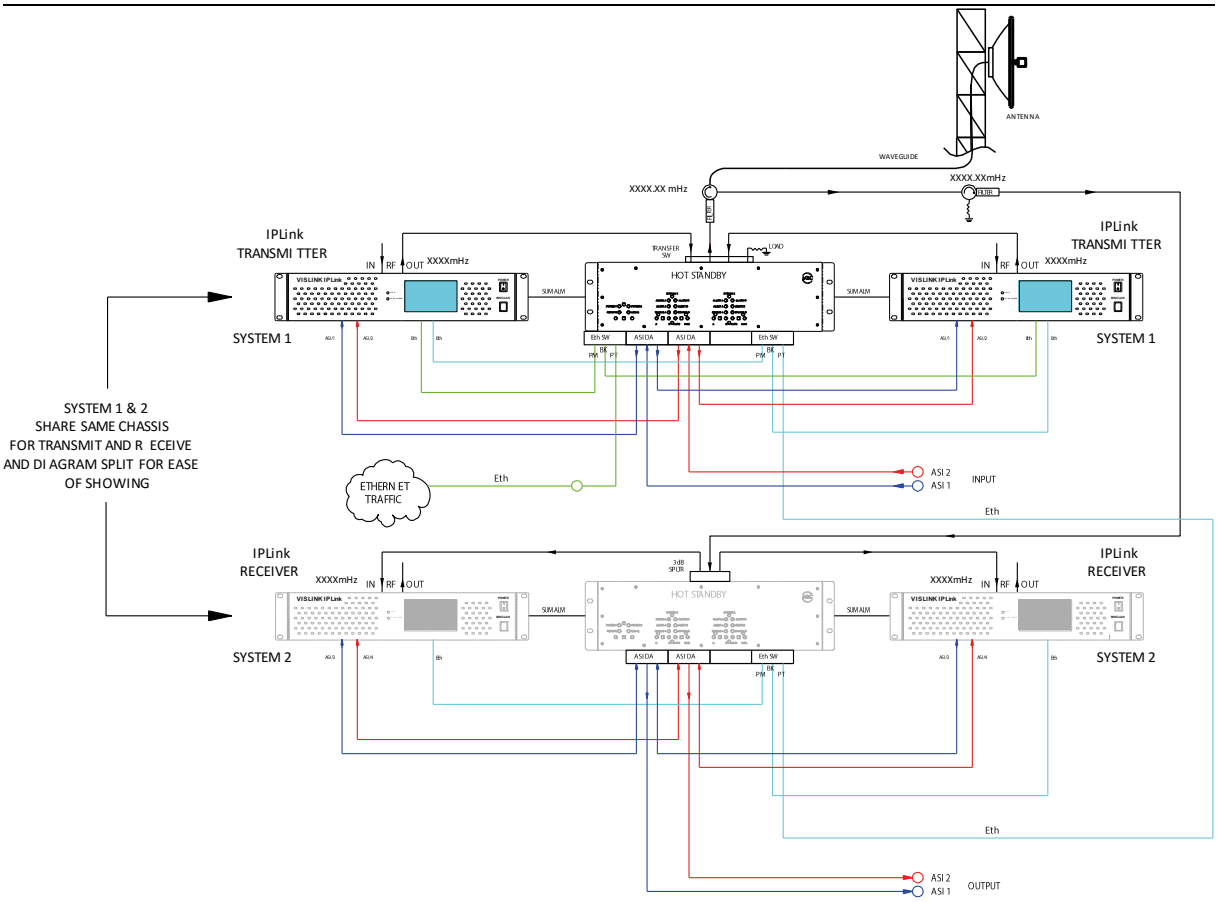

Figure 5-4 Duplex Hot-Standby

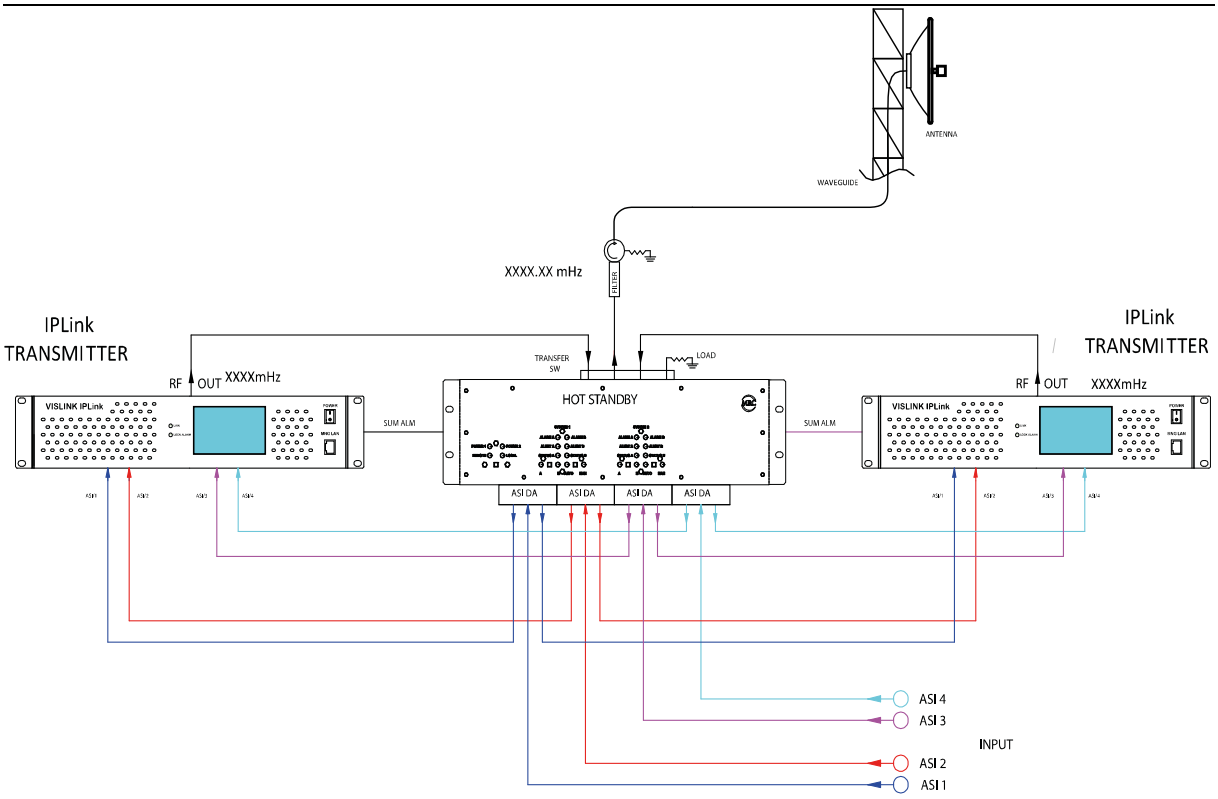

Figure 5-5 Transmitter – Hot Standby

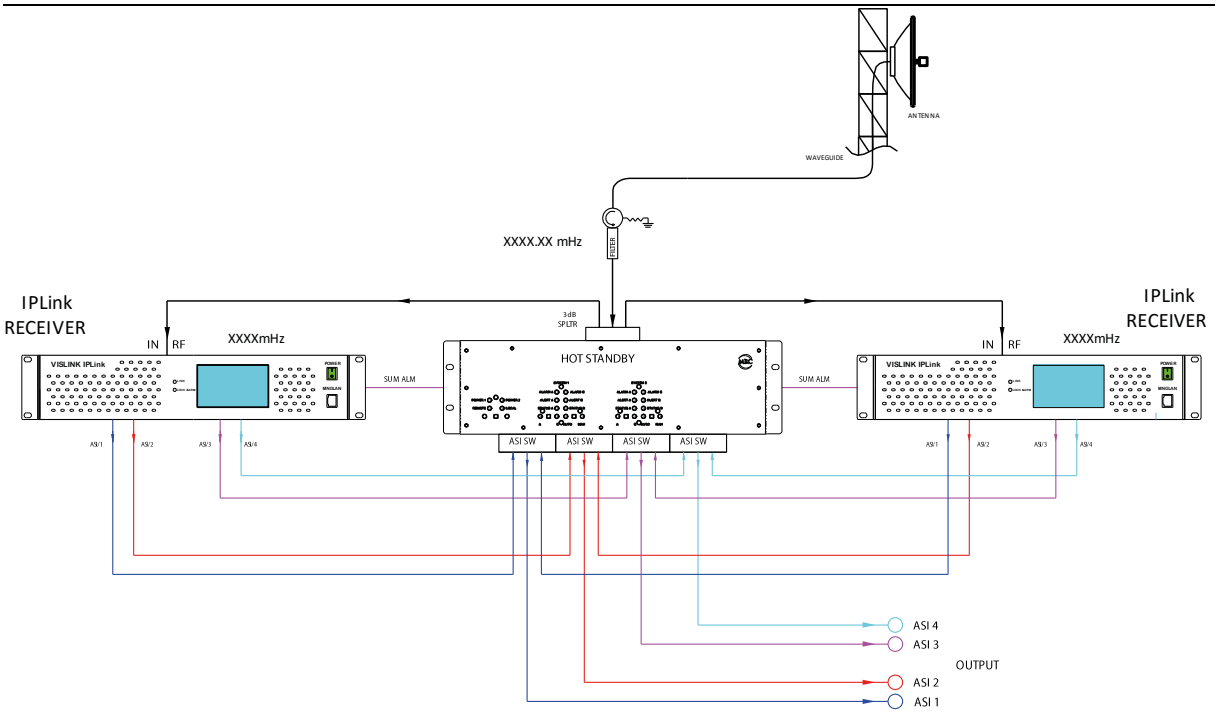

Figure 5-6 Receiver – Hot Standby

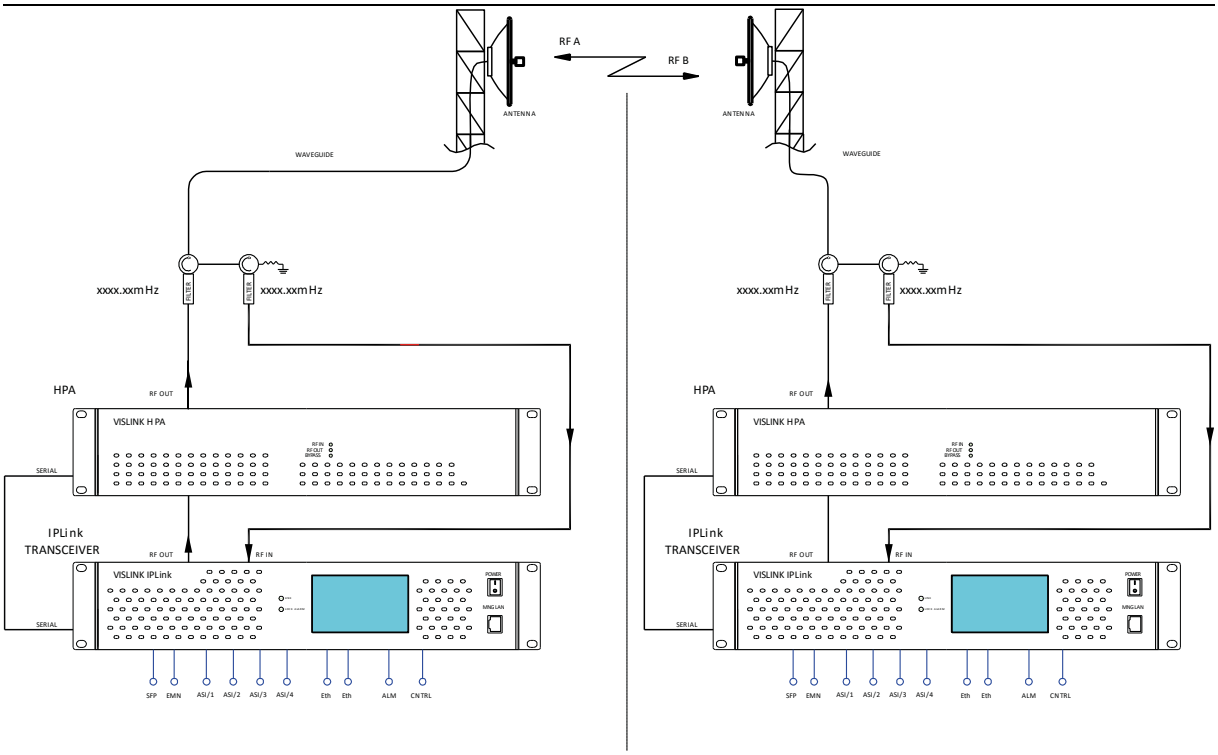

Figure 5-7 Duplex with HPA

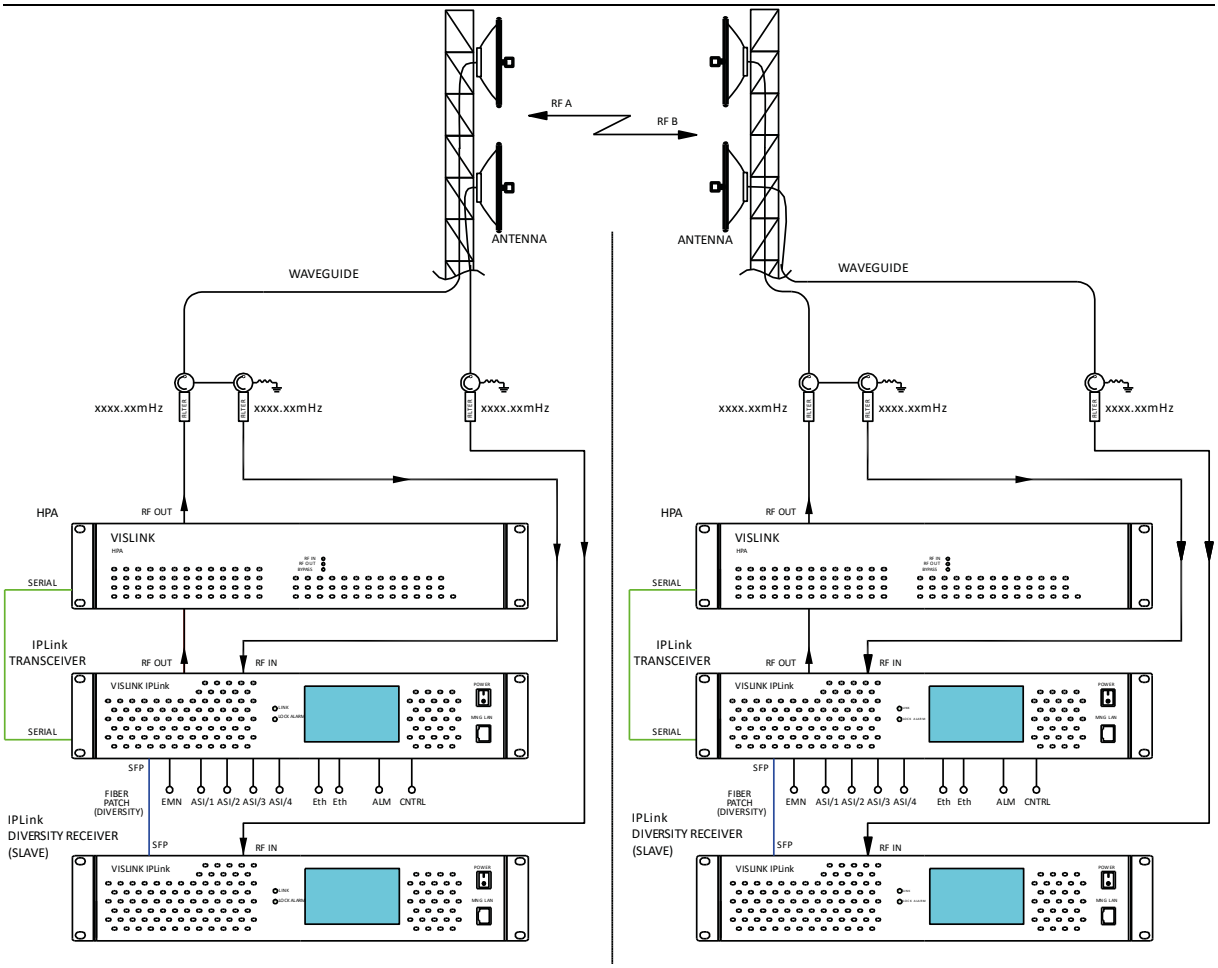

Figure 5-8 Duplex Diversity with HPA

6. Web Interface

6.1. Login

Connect a PC to the local Management port (MNG LAN) located on the front panel of the IPLink transceiver and open a Web browser. Navigate to the IPLink Browser by inserting the specific radio IP address (found on front panel display, factory set subnet of 192.168.0.xxx) using the URL field of either Google Chrome, Mozilla Firefox version 3.xx and higher, browsers which are recommended, (IE 5 and above or OPERA 9.xx and above are also compatible) on proper connection the IPLink the login window will be displayed as shown below.

To login you can use the default credentials:

- Login: admin
- Password: secret

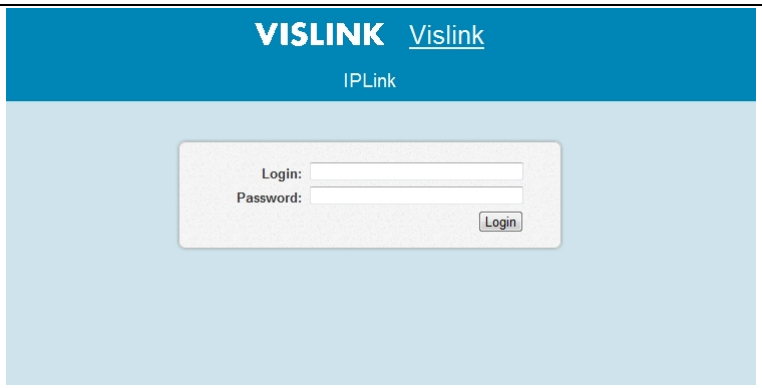

Figure 6-1 Login Page

6.2. Web Interface Layout

After a successful login to the management system, the General Tab of the Web interface appears. The main window is divided into a few essential sections as displayed below.

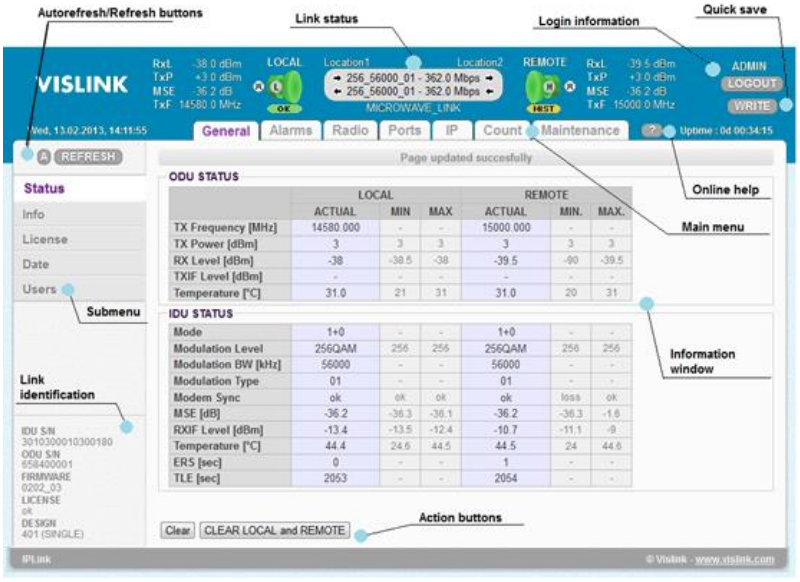

Figure 6-2 Web Interface Overview

6.3. General Tab

After logging in, the General Tab, Status Page displays. This page presents the current status of the RF Unit and the IPLink control system. The General Tab consists of five pages, as described in the following sections.

The General Tab's Status page displays basic link parameters between the local and remote IPLink transceivers.

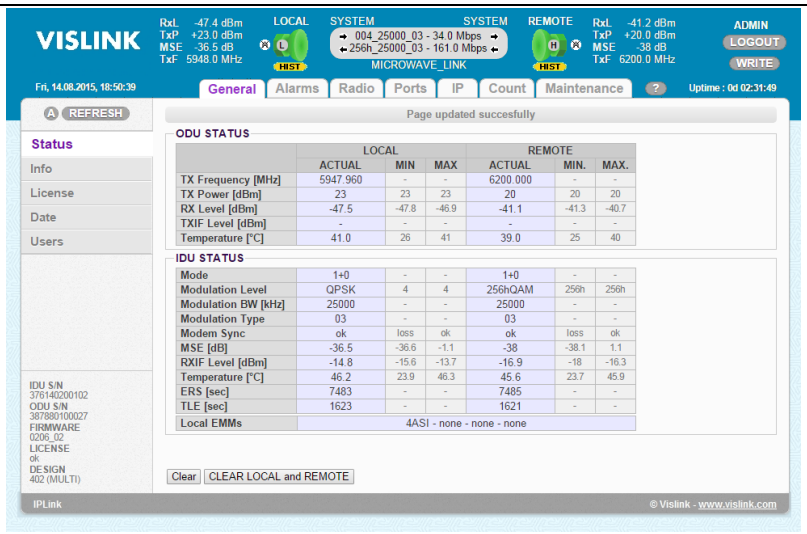

Figure 6-3 Status Page Overview

The General Tab's Status page displays basic link parameters between the local and remote IPLink transceivers.

6.3.1. ODU Status

The RF unit (labelled ODU) is monitored for the following parameters:

- TX Frequency – shows the Local and Remote transmitting frequency.
- TX Power – displays the current transmitting power.
- RX Level – shows the current level of received signal.
- Temperature – presents the internal temperature of the RFU module in degrees Celsius.

6.3.1.1. IDU Status

The IPLink control modules (labelled IDU) are monitored for the following parameters:

- Mode – shows the current mode of IPLink. This value depends on selected design and configuration. Possible values are: master/2+0; master/HSB; master/SD; master/FD; slave/2+0; slave/HSB; slave/SD; slave/FD; 1+0.
- Modulation Level – displays the current modulation level.
- Modulation BW – this field displays the current bandwidth
- Modulation Type – modulation is either 01 or 03. For the IPLink system, the system should always be configured as an 03 type under the Radio tab.
- Modem Sync – shows the status of synchronization between the local and remote radio- possible values are ok and loss.
- MSE – normalized MSE is signal quality indicator (positive value of MSE is similar to SNR). Absolute and Radial MSE values can be found in Radio Tab, Details Page.
- Temperature – shows the device internal temperature in degrees by Celsius.
- ERS – error second; number of seconds during which at least one error occurred.
- TLE – time since last error; number of seconds from the last error occurrence.

6.3.1.2. Clear

This button clears all counters and validates all alarms on local/remote side. Use of this button should lead to OK system status.

6.3.1.3. Clear Local and Remote

Use this button to clear both the status of both the local and remote transceivers.

6.3.2. Protection Page

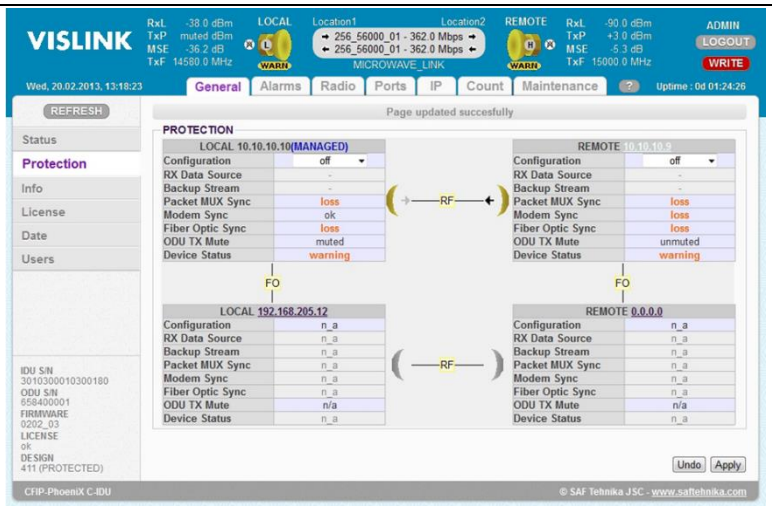

Figure 6-4 Protection Page Overview

The page shown in Figure 6-4 will only be available if the design type is set to Protected 1+1 and the unit is licensed for the content(see Maintenance Tab – Advanced Page – Design Type (see Section 6.9.5.1).

By default, the protection mode is off when this design mode is initially selected. This prevents any possible configuration mistakes such as radio interferences, port loopbacks, etc. TX Power is muted and all traffic ports are down in Protection off mode.

NOTE: All Radio, IP and Port parameters should be configured to their desired values before setting the protection mode.

The graphical antenna icons (-RF-) on this provide a visual indication of the state of the entire protected link (green – no alarm) and the mode of appropriate RFU transmitter (black arrow indicates that transmitter is not muted, number of arrows indicates TX mode – FD/SD+HSB).

6.3.2.1. Protection

- Configuration – this drop-down list displays and allows for the selection of actual/configured protection mode. It is recommended to ensure the correct system interconnection at both remote and neighbour units before setting the required protection mode at MASTER SIDE. Slave side will be configured automatically. The possible modes are:
  - master/FD, slave/FD – this mode configures frequency diversity mode when two transmitters and two receivers operate on different carrier frequencies but identical to the corresponding transmitter at the far end. This protection mode protects against Multipath Fading and also against point-to-point system HW failure.
  - master/SD, slave/SD – this mode configures space diversity mode when one transmitter is used (customer can manually select transmitter at master or slave unit) and two receivers operate on just one carrier frequency. Two antennas at each installation side should be used. When both master and slave units are without receive signal or without synchronization, opposite transmitter side stays without change. This protection mode usually protects against Multipath Fading.
  - master/HSB, slave/HSB – this mode configures hot standby protection mode when one transmitter is used at actual time (customer can manually select transmitter at master or slave unit) and two receivers operate on just one carrier frequency. One antenna with directional coupler at each installation side should be used. When both master and slave units are without receive signal or without synchronization, opposite transmitters are swapped (actual one is muted and second one is unmuted) to ensure correct system function. This protection mode protects against point-to-point system HW failure. Protection is hitless for Rx failures, when transmitters are swapped, then short drop in traffic occurs.
- RX Data Source – this box displays what a traffic stream either from master link (main) or slave link (backup) is actually running on master unit.
- Backup Stream – this box displays that main and backup streams are aligned at master unit during normal system function. Aligned status must be shown when master Modem is synced. When master is without Modem sync, then this status is irrelevant.
- Packet MUX Sync – this box displays actual Packet MUX synchronization at master and slave unit. Packet MUX synchronization at master side must be ok during correct protection operation, even if the master's modem sync is lost.
- Fibre Optic Sync – this parameter shows actual Fibre Optic interconnection status between master and slave unit.
- RFU TX Mute – muted or unmuted status indicates whether appropriate RFU transmitter is active (unmuted) or in standby/non-functional mode (muted).
- Device Status – this value shows alarm status of appropriate units.

6.3.3. Aggregation Page

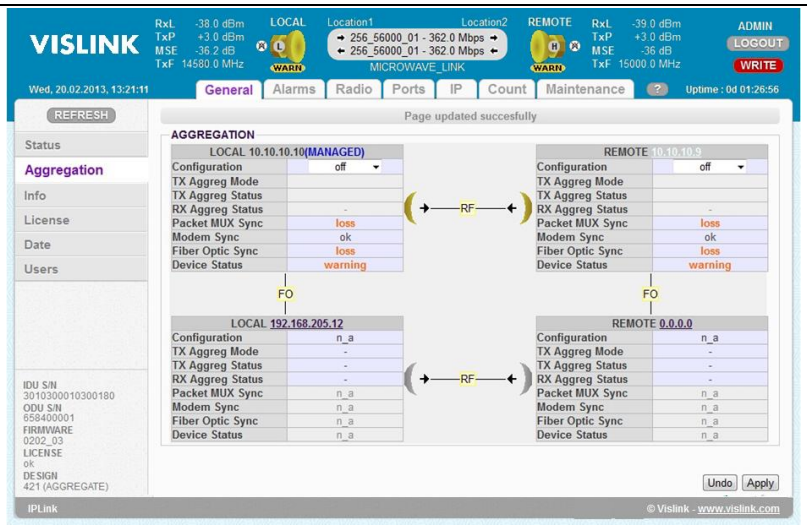

Figure 6-5 Aggregation Page Overview

The page shown above will only be available if the design type is set to Aggregate 2+0 and the unit is licensed for the content (see Section 6.9.5.1).

By default, the aggregation mode is off when this design mode is initially selected. This prevents any possible configuration mistakes such as radio interferences, port loopbacks, etc. TX Power is muted and all traffic ports are down in Protection off mode.

NOTE: All Radio, IP and Port parameters should be configured to their desired values before setting the aggregation mode.

The graphical antenna icons (-RF-) on this provide a visual indication of the link state (green – no alarm).

6.3.3.1. Aggregation

- Configuration – this drop-down list displays and allows for the selection of actual/configured aggregation mode. It is recommended to ensure correct system interconnection at both remote and neighbour units at first before setting the required aggregation mode at MASTER SIDE. Slave side will be configured automatically. The possible modes are:
  - master/2+0 – this selection configures master mode for aggregation scheme, when two transceivers operate on two different carrier frequencies. It is also possible to use cross-polar configuration in a specific case for aggregation scheme (contact local representative for more details). This aggregation mode controls aggregation process on both units.
  - slave/2+0 – this selection configures slave mode for aggregation scheme. This aggregation mode uses the highest priority channel ETH 4 for data transmission over slave link.
  - off – this selection disables aggregation function. The function in this mode is similar to function of design MULTI but with just three channels over air.
- TX Aggreg Mode – this drop-down list sets the specific TX aggregation modes. The possible modes are:
  - auto – TX data stream is automatically divided into two links according to momentary available capacity of each link.
  - master only – Aggregation is disabled in this mode. TX data stream is manually directed to master link only.
  - slave only – Aggregation is disabled in this mode. TX data stream is manually directed to slave link only.
- TX Aggreg Status – this box displays the actual TX status that is especially important for auto aggregation mode. In this mode the aggregation block automatically decides what direction will be used for TX data transmission:
  - aggregate – data is transferred over both links (normal mode).
  - master only – data is transferred over master link (slave link is down or in some trouble or mode is manually set to master only).
  - slave only – data is transferred over slave link (master link is down or in some trouble or mode is manually set to slave only).
- RX Aggreg Mode –displays the status of the receiving part in an aggregation block:
  - ok – receiving block operates properly, both traffic directions are aligned.
  - alignment drops – incorrect order of packet is detected at receiving side, which indicates abnormal packet delay at master or slave link.
  - packet discards – indicates packet losses at master or slave link.
- Packet MUX Sync – this box displays the actual Packet MUX synchronization at master and slave unit.
- Fibre Optic Sync – this parameter shows actual Fibre Optic interconnection status between master and slave unit.
- Device Status – this value shows alarm status of relevant unit.

6.3.4. Info Page

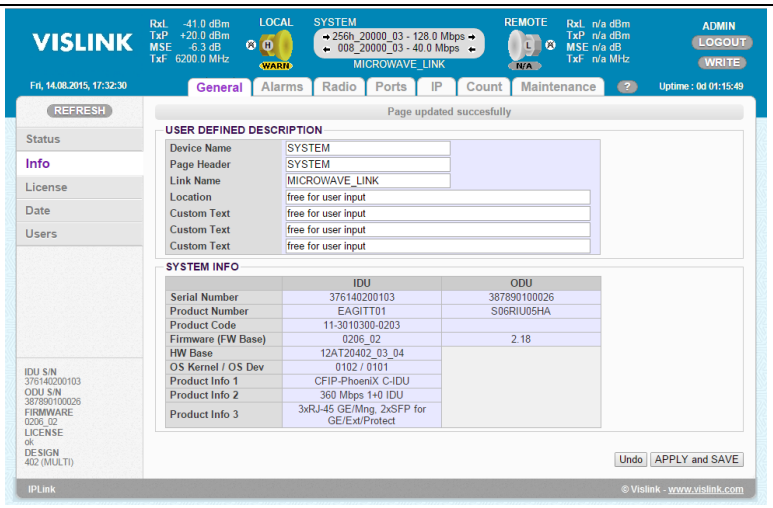

Figure 6-6 Info Page Overview

The Information Page allows the modification of descriptive fields that can be defined within certain parameters.

6.3.4.1. User Defined Description

The User Defined Description provides IPLink information and user-defined strings.

- Device Name – up to 13 characters, displayed by the LOCAL unit at page header.
- Page Header – up to 25 characters, displayed as window or tab header in your OS.
- Link Name – up to 25 characters, displayed between LOCAL and REMOTE icon at page header.
- Custom Text – up to four customer specific descriptors may be entered with a maximum length of 80 characters per line.

6.3.4.2. System Information

The System Information section provides IPLink firmware and manufacturer information.

- HW Base – hardware application - also design version
- FW Base – GUI, applications, utilities and command processor
- OS Kernel – operating system kernel
- OS Dev – device drivers
- INFO – ODU - firmware and manufacturer information from ODU

6.3.4.3. Undo

Use this button to cancel any changes made.

6.3.4.4. Apply and Save

Use this button to make changes to the settings made in the Information Page. Be sure to select the write button if these changes are to be saved permanently.

6.3.5. License Page

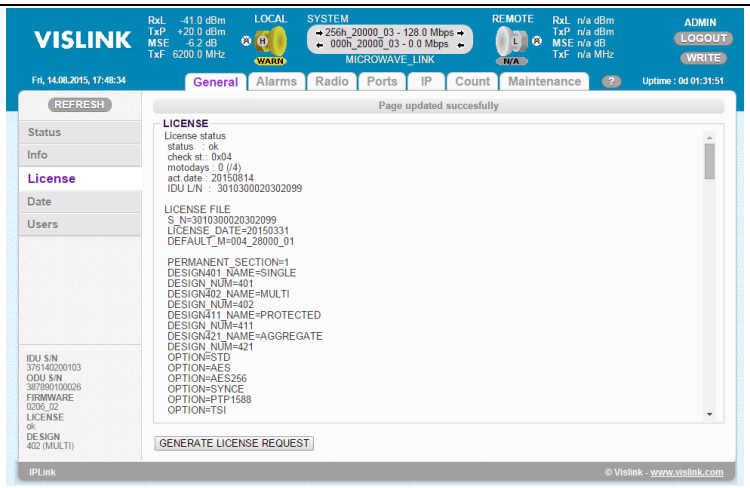

Figure 6-7 Licence Page Overview

The General Tab's License page lists pertinent information in regards of the licenses purchased for the IPLink control system.

6.3.5.1. License

These lists provide the following information:

- License Status
  - status – status of the current license; possible states are ok or blocked.
  - check st. – hexadecimal code of status.
  - motodays – 1 motoday = 6 hours, when motodays value reaches LICx_MOTOD, time-limited license will expire.
  - act.date – the actual date stored in the IPLink transceiver.
- License File:
  - S_N=xxx – Serial Number must be the same as listed on the revision page.
  - LICENSE_NAME – name of the License.
  - LICENSE_DATE – displays the date of activation.
  - LICENSE_CODE – intended for internal purposes only.
  - DEFAULT_M – modulation that will be used as the default after proceedings, such as design change, are implemented.
  - DESIGN_NUM=xxx – available designs in permanent license.
  - OPTION=xxx – available options in permanent license.
  - MODULATION=xxx – available modulations in permanent license.
  - LICx_MOTOD=xxx – stop-limit number of motodays for time-limited license.
  - LICx_EXPD=xxx – the date when a time-limited license expires.
  - LICx_MODULATION=xxx – available modulations in time-limited license.

6.3.5.2. Generate License Request

This button provides the facility to generate a License Request file that is required for extending a Time Limited License. When this button is selected, the Web browser will automatically switch to the Maintenance tab (see Section 6.9) from which the licenses available for the IPLink may be renewed or revised.

6.3.6. Date Page

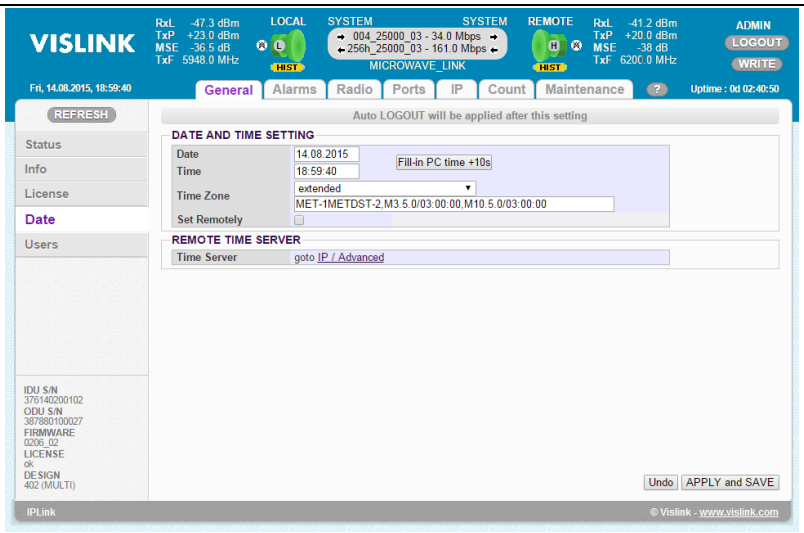

Figure 6-8 Date Page Overview

The General Tab's Date Page provides a means to set the Time Zone for the Date and Time and Remote Time Server.

6.3.6.1. Date and Time Setting

When time-limited licenses are presented Date and Time are read-only fields:

- Date – allows change of system date manually by entering the following syntax:
  - (DD.MM.YYYY).
- Time – allows change of system time manually by entering the following syntax:
  - (HH:MM:SS).
- Time Zone – we recommended using the UTC format or for Middle European Time (with daylight saving feature) use:
  - MET-1METDST-2,M3.5.0/03:00:00,M10.5.0/03:00:00

NOTE: A detailed description of TZ setting options can be found. Time Zones for North and South America are also selectable using the Time Zone drop-down entry field.

6.3.6.1.1. Fill-in PC time + 10s

This button forces the system to use the time set on the PC or tablet running the web browser. It adds ten seconds to the time and will be applied after confirmation by the Apply and Save button.

6.3.6.2. Remote Time Server

Settings of Date and Time synchronization features (NTP, RDATE) can be found in (see Section 6.7.4).

6.3.6.3. Undo

Use this button to cancel any changes made.

6.3.6.4. Apply and Save

Use this button to make changes to the settings made in the Date Page. Be sure to select the Write button if these changes are to be saved permanently.

6.3.7. Users Page

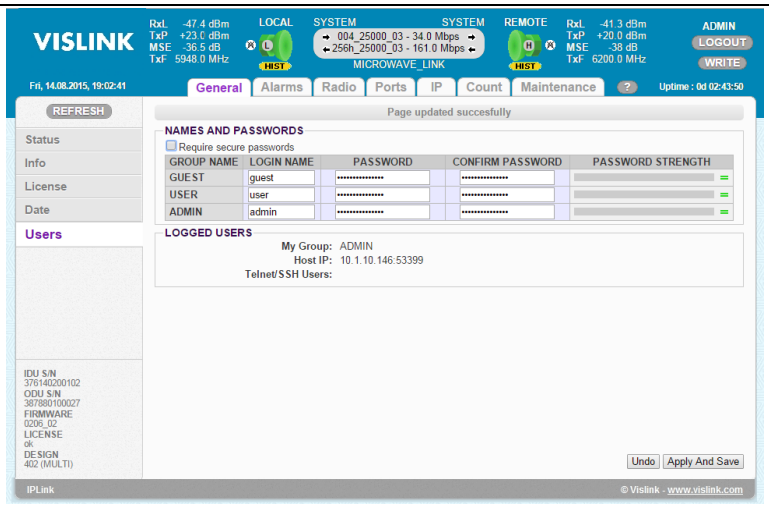

Figure 6-9 Users Page Overview

User access settings include names and passwords and the following information. The system allows for up to three Guest users to be logged in, and one User or Admin connection at any time.

6.3.7.1. Names and Passwords

6.3.7.1.1. Require Secure Passwords

If this box is ticked, any passwords created must be at least eight characters long and contain at least one uppercase letter, one lowercase letter and a number. More secure passwords consist of at least thirteen characters and will contain a combination of lower and uppercase characters, numbers and symbols:

- (! @ # % * ( ) _ - + = [ ] : ; ' , . ? /). Please do not use these characters (^ & “ $ { } \ |).

6.3.7.1.2. Users Table

- GROUP NAME – this column indicates the level of the access rights:
  - GUEST – the Guest user has read-only access.
  - USER – the User has standard management access.
  - ADMIN – the Admin user is allowed enhanced management access - enhanced settings, password settings, firmware and software upgrade capability, etc.
- LOGIN NAME – this field displays the user name for selected level of the access. The number of characters in the Login input field must be within the range of 1 to 12. Valid characters are (a-z, A-Z, 0-9, _). All user names created must be unique.
- PASSWORD – this field shows the password for selected level of the access. The number of characters in the password input field must be within the range of 1 to 15 (or 8 to 15 if the Require Secure Passwords option is ticked)
- CONFIRM PASSWORD – this field provides validation of your initial PASSWORD entry.
- PASSWORD STRENGTH – indicates the password's ability to resist unauthorized access.

6.3.7.2. Logged Users

- My Group – the group name of the actual session
- Host IP – IP and port of current session
- Telnet/SSH Users – list of other connected sessions

6.3.7.3. Undo

Use this button to cancel any changes made.

6.3.7.4. Apply and Save

Use this button to make changes to the settings made in the Users Page. Be sure to select the Write button if these changes are to be saved permanently.

6.4. Alarms Tab

The Alarms Tab provides the means to display three pages of information.

6.4.1. Configuration and Status Page

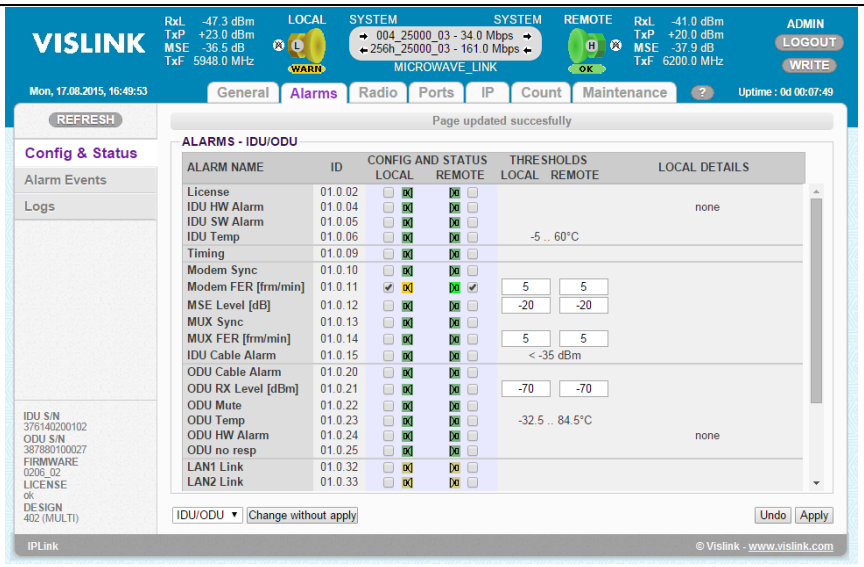

Figure 6-10 Configuration and Status Page Overview

This page is presented in the form of a table from which it is possible to configure the following modes:

- The selection of actually configured alarm group [IDU/ODU vs. EMMs (External Multiplexer Module)].
- An activation of individual alarm ID that influences IPLink status. Such an activated alarm ID will generate a log of alarm events in the internal alarm log file and SNMP trap message, if this feature is configured in the IP setting. When only one activated alarm ID is in the warning status, then IPLink exists in warning status as well. This state is indicated with the yellow colour of the local unit icon at the top of the Configuration and Status Page.
- The activation of an alarm ID in both local and remote units from the one unit (from actually managing unit).
- The set-up of concrete alarm threshold values for a specific alarm IDs. The actual value is then compared with such defined alarm threshold level values.

It is also possible to check the status of alarms on this page.

- Monitoring of the actual alarm status of both active and also of inactive alarm IDs.
- Checking comparison values with configured and with default defined thresholds.
- Checking detailed description for specific alarm.

Icons are displayed for each alarm to assist in rapid comprehension of the status of the Alarm Identification:

- Local Side
- Remote Side

Selected alarms – influence to global system status:

- No Alarm
- Warning

Non-selected alarms – no influence to global system status:

- No Alarm
- Warning

6.4.1.1. System Alarms

- License – ID 01.0.02 (critical). This alarm ID indicates actual license status:
  - No alarm = License OK.
  - Warning = License is in blocked or remote_violation status.
- Protection Alarm – ID 01.0.03. This alarm ID indicates actual protection status:
  - No alarm = Protection parameters (Rx Data Source and Backup Stream) are in normal status (Rx Data Source=Main, Backup Stream=aligned).
  - Warning = One or more protection parameters are in abnormal state.
- IDU HW Alarm – ID 01.0.04 (critical). This alarm ID indicates actual status of HW (hardware). Explicit reason for such HW alarm event is then described in column LOCAL DETAILS in the Web interface:
  - No alarm = all internal HW blocks work properly.
  - Warning = one or more internal HW blocks indicate abnormal function.
- IDU SW Alarm – ID 01.0.05 (critical). This alarm ID indicates actual status of SW (software):
  - No alarm = all internal SW blocks work properly.
  - Warning = one or more internal SW blocks indicate abnormal function.
- IDU Temp – ID 01.0.06. This alarm ID indicates actual status of temperature:
  - No alarm = Actual temp. is within the range of -5 up to +60°C.
  - Warning = Actual temp. is without the range of -5 up to +60°C.

6.4.1.2. Modem and Mux Alarms

- Modem Sync – ID 01.0.10 (critical). This alarm ID indicates actual status of modem synchronization:
  - No alarm = Modem synchronized.
  - Warning = Modem sync loss.
- Modem FER [frm/min] – ID 01.0.11. This alarm ID indicates status of modem frame (air-frame) error rate in the last 60 seconds with respect to the configured threshold:
  - No alarm = Actual modem FER value is lower than the FER threshold defined in the same alarm row.
  - Warning = Actual modem FER value is higher or equal to the FER threshold defined in the same alarm row.
- MSE Level [dB] – ID 01.0.12. This alarm ID indicates actual modem MSE value in dB with respect to configured threshold:
  - No alarm = Actual MSE value is lower than the MSE threshold defined in the same alarm row.
  - Warning = Actual MSE value is higher or equal to the MSE threshold defined in the same alarm row.
- MUX Sync – ID 01.0.13 (critical). This alarm ID indicates actual status of packet processor (PBPS) synchronization:
  - No alarm = PBPS synchronized.
  - Warning = PBPS sync loss.
- MUX FER [frm/min] – ID 01.0.14. This alarm ID indicates status of packet processor frame (PBPS frame) error rate in the last 60 seconds with respect to configured threshold:
  - No alarm = Actual PBPS FER value is lower than the FER threshold defined in the same alarm row.
  - Warning = Actual PBPS FER value is higher or equal to the FER threshold defined in the same alarm row.
- IDU Cable Alarm – ID 01.0.15 (critical). This alarm ID indicates actual status of IF level at the input:
  - No alarm = Actual IF level (at 140MHz) is higher than -35dBm.
  - Warning = Actual IF level (at 140MHz) is lower or equal to -35dBm.

6.4.1.3. RFU Alarms

- ODU Cable Alarm – ID 01.0.20 (critical). This alarm ID indicates actual status of IF level at the RFU input:
  - No alarm = Actual RFU IF level (at 350MHz) is in the specified range defined with appropriate RFU type.
  - Warning = Actual RFU IF level (at 350MHz) is out of the specified range defined with appropriate RFU type.
- ODU RX Level [dB] – ID 01.0.21. This alarm ID indicates status of RF received level at the RFU receiver with respect to configured threshold:
  - No alarm = Actual RFU Rx Level is higher than the Rx Level threshold defined in the same alarm row.
  - Warning = Actual RFU Rx Level is lower or equal to the Rx Level threshold defined in the same alarm row.
- ODU Mute – ID 01.0.22. This alarm ID indicates actual RFU Mute status:
  - No alarm = RFU is unmuted (auto unmute).
  - Warning = RFU is muted (auto mute or manual mute).
- ODU Temp – ID 01.0.23. This alarm ID indicates actual status of RFU temperature:
  - No alarm = Actual temp. is in the range of -25 up to +60°C.
  - Warning = Actual temp. is out of the range of -25 up to +60°C.
- ODU HW Alarm – ID 01.0.24 (critical). This alarm ID indicates actual status of RFU HW (hardware). Explicit reason for such HW alarm event is then described in the column LOCAL DETAILS in the Web interface:
  - No alarm = all internal HW blocks work properly.
  - Warning = one or more internal HW blocks indicate abnormal function.
- ODU no resp – ID 01.0.25 (critical). This alarm ID indicates incorrect or missing communication between the local and the local RFU:
  - No alarm = -RFU communication is without losses.
  - Warning = -RFU communication failure.

6.4.1.4. Interface Alarms

- LAN1 Link – ID 01.0.32. This alarm ID indicates actual status of link at LAN 1 port:
  - No alarm = Link OK condition at port LAN 1.
  - Warning = NO Link at port LAN 1.
- LAN2 Link – ID 01.0.33. This alarm ID indicates actual status of link at LAN 2 port:
  - No alarm = Link OK condition at port LAN 21.
  - Warning = NO Link at port LAN 2.
- LAN3 Link – ID 01.0.34. This alarm ID indicates actual status of link at LAN 3 port:
  - No alarm = Link OK condition at port LAN 3.
  - Warning = NO Link at port LAN 3.

- SFP1 Link – ID 01.0.36. This alarm ID indicates actual status of link at SFP 1 port:
  - No alarm = Link OK condition at port SFP 1.
  - Warning = NO Link at port SFP 1.
- SFP2 Link – ID 01.0.37. This alarm ID indicates actual status of link at SFP 2 port:
  - No alarm = Link OK condition at port SFP 2.
  - Warning = NO Link at port SFP 2.

6.4.1.5. Undo

Use this button to cancel any changes made.

6.4.1.6. Apply

Use this button to make changes to the settings made in this page. Be sure to select the Write button if these changes are to be saved permanently.

6.4.2. Alarm Events Page

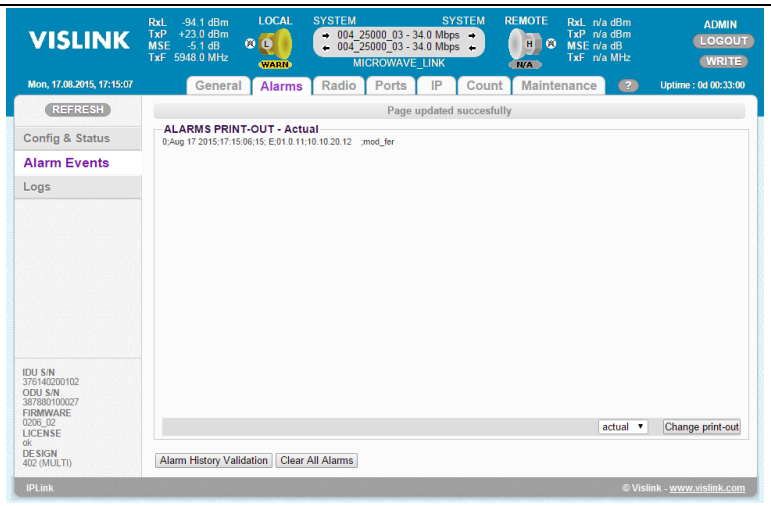

Figure 6-11 Alarm Events Page Overview

Alarm events are generated for all activated alarm identifications (as set under the Alarms tab – Configurations and Status page).

6.4.2.1. Alarm Print-Out

The alarm shown displays the date and time as well as the IP Address of the IPLink transceiver.

6.4.2.1.1. Change Print-Out

This button is used to change the alarms displayed in conjunction with the drop-down list to its left. The drop-down list provides the facility to select Actual, History or All alarms, and once the desired choice has been made, selecting this button will update the display.

6.4.2.2. Alarm History Validation

Select this button to validate all alarms.

6.4.2.3. Clear All Alarms

This button will clear the previously generated alarms. The cleared alarms will be saved by the unit and viewable in the Alarms Log Page for future reference.

6.4.3. Alarm Logs Page

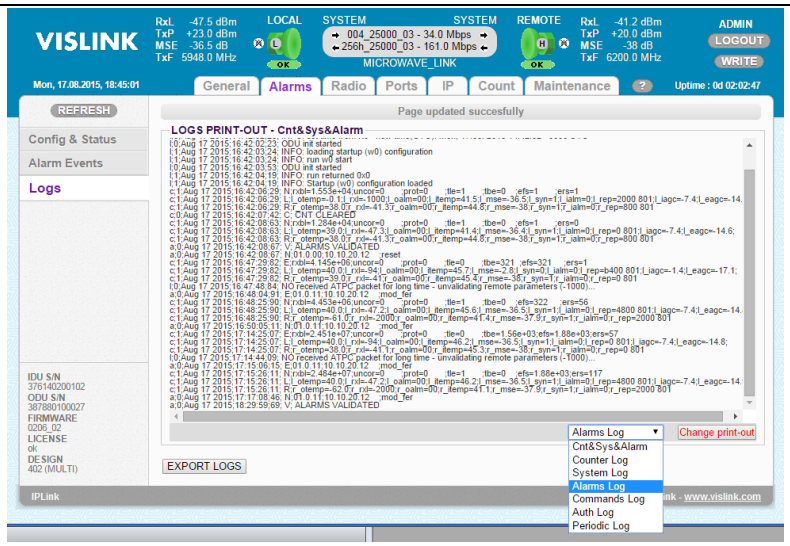

Figure 6-12 Alarm Logs Page Overview

This page provides the facility to display seven different log files that can be selected using the drop-down list at the bottom of the page.

6.4.3.1. Logs Print-Out

6.4.3.1.1. Change Print-Out

This button is used to change the log displayed in conjunction with the drop-down list to its left. The drop-down list provides the facility to one of the logs listed below, and once the desired choice has been made, selecting this button will update the display:

- Cnt&Sys&Alarm Log – this setting displays the Counter, System and Alarm logs.
- Counter Log – only the Counter log is displayed. This logs information about counter clears and validations as well as RF errors. This log is appended with basic link parameters while an error occurs and again when the error disappears. By the Error is meant the ERS (Error Second). This counter measures any errors on RFI, which signifies data that weren't received correctly via the IPLink transceiver. These errors signify that the link is failing, usually due to low MSE, synchronization issues and other such issues.
- System Log – only the System log is displayed. The System log displays general IDU information such as start-up information, ACM&ATPC, and ODU responses.
- Alarms Log – only the Alarms log is displayed.
- Commands Log – the Commands log history is displayed. This log is appended every time a CLI command is executed (set commands only)
- Auth Log – the Authentication of Credentials log is displayed, tracking login events. This logs user, protocol and IP history of management connections

- Period Log – only the Period log is displayed. The Periodic log is the same as Counter log but the records are appended periodically instead of only error events. Note the format is for table processors (such as Excel) - first row describes value of the cell (MSE, RxL, etc.). The time between logs can be changed by command 'set auto logdelay XXX' where XXX is the time in seconds. It is set to 10-11 minutes by default.

6.4.3.2. Export Logs

When this button is selected, the Web browser will automatically switch to the Maintenance Tab – Files Page (see Section 6.9.3) from which log files can be selected to download.

6.5. Radio Tab

The Radio Tab displays the following pages as regards the IPLink transceiver.

6.5.1. Parameters Page

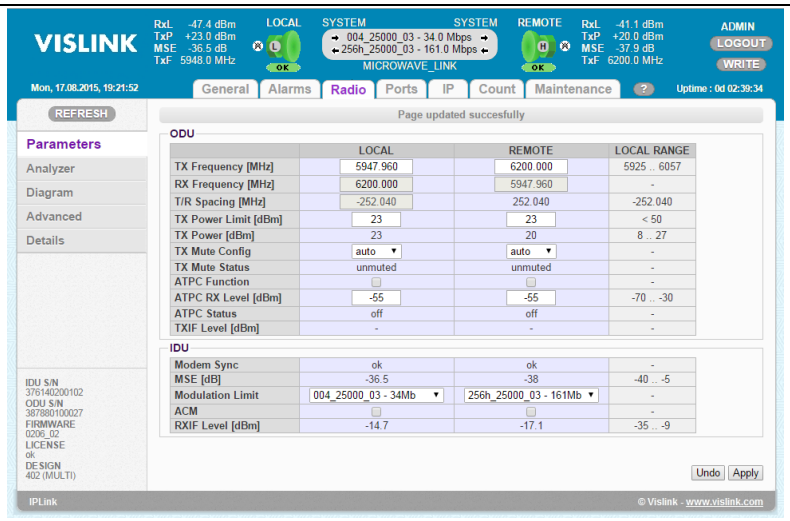

Figure 6-13 Parameters Page Overview

Figure 6-13 displays a typical Radio Parameters page for an IPLink transceiver. Parameters for both local and remote transceivers can be set together in one configuration step.

6.5.1.1. ODU

The ODU throughout the Web interface refers to the internal RF head:

- TX Frequency – transmission (TX) frequency can be set within the displayed frequency range. Values should be increased or decreased by one half of the used modulation bandwidth if it is close to the displayed limits.
- RX Frequency – receiving (RX) frequency is usually set automatically. RX Frequency is adjusted by changing the T/R spacing.
- T/R Spacing – sets the frequency offset between TX and RX.
- TX Power Limit – this field displays the maximum transmission power.
- TX Power – the output RF power level that is just transmitted only from the RF Unit. The LOCAL RANGE column displays the TX Power scope of used RF Unit under actual conditions (band, modulation).

- TX Mute Config – Transmitter Mute Configuration: In Automatic Mute Mode, the RF Unit is automatically muted when abnormal transmission conditions are detected:
- initial TX Frequency is outside of available range,
- ODU disconnection,
- specific protection mode.
- TX Mute Status – actual Transmitter Mute Status:
- ATPC Function – Automatic Transmit Power Control. The transmitted power is automatically adjusted to ensure that the optimum Rx Level is met.
- ATPC RX Level – required level of Automatic Transmit Power Control. This field specifies the optimal receive level used for ATPC function.
- ATPC Status – status of ATPC loop.
- off – indicates that ATPC function is disabled.
- ok – indicates that ATPC loop has regulated required level.
- out of range – indicates that ATPC loop cannot reach the required level.
- TXIF Level – transmission of IF level at the RF Unit input (350 MHz) indicates the signal strength of the IF input into the RF Unit.

6.5.1.2. IDU

This set of parameters refers to the IPLink control systems:

- Modem Sync – demodulator synchronization status is the basic indicator of proper functioning of the IPLinkDU transceiver.
- ok – indicates that the demodulator is synchronized with received airframe.
- loss – indicates that the demodulator is not synchronized with received airframe.
- MSE – Mean Square Error is a basic quality of signal indicator. The MSE value is a normalized presentation of MSE value. If Modem sync is not in OK status, the MSE parameter might display unpredictable values.
- Modulation Limit – optimal modulation scheme selects either fixed modulation scheme for no-ACM mode or defines the highest modulation scheme that can be used in the ACM mode.
- ACM – Automatic Change of Modulation. In the case of selection of this mode, the switch-over without loss of communication among several modulation schemes is permitted depending on the actual MSE level.
- RX IF Level – received IF level at IPLink input (150 MHz) indicates the signal strength of IF input into IPLink. This value may indicate that the cable may be damaged should the value in this field is erroneous.

6.5.1.3. Undo

Use this button to cancel any changes made.

6.5.1.4. Apply

Use this button to make changes to the settings made in this page. Be sure to select the Write button if these changes are to be saved permanently.

6.5.2. Analyzer Page

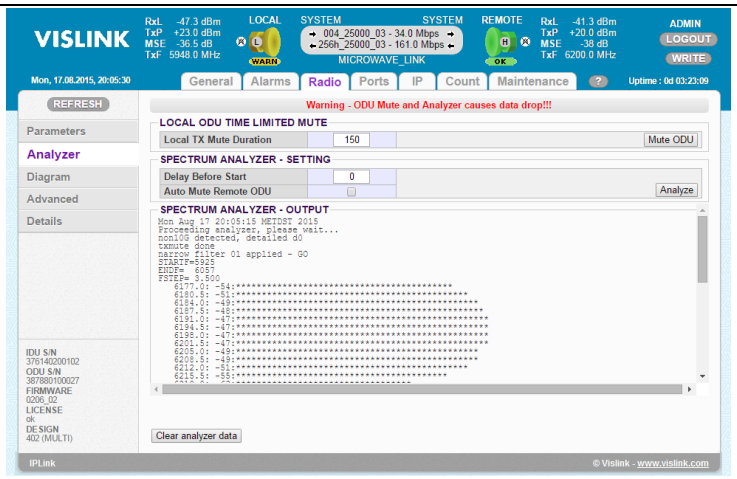

Figure 6-14 Analyser Page Overview

The Analyser Page offers a frequency analyser and utilities.

6.5.2.1. Local ODU Time Limited Mute

This option allows specification of TX Mute Duration for Frequency analyser or special purposes.

6.5.2.2. Spectrum Analyser – Setting

- Delay Before Start - allows specification of delay before start of frequency analysis.
- Auto Mute Remote ODU – allows auto mute of remote RF Unit if possible (this function requires synchronization of remote side).

6.5.2.3. Spectrum Analyser – Output

This section displays the spectrum analysis.

6.5.2.4. Clear Analyser Data

Select this button to clear the displayed analysis.

6.5.3. Diagram Page

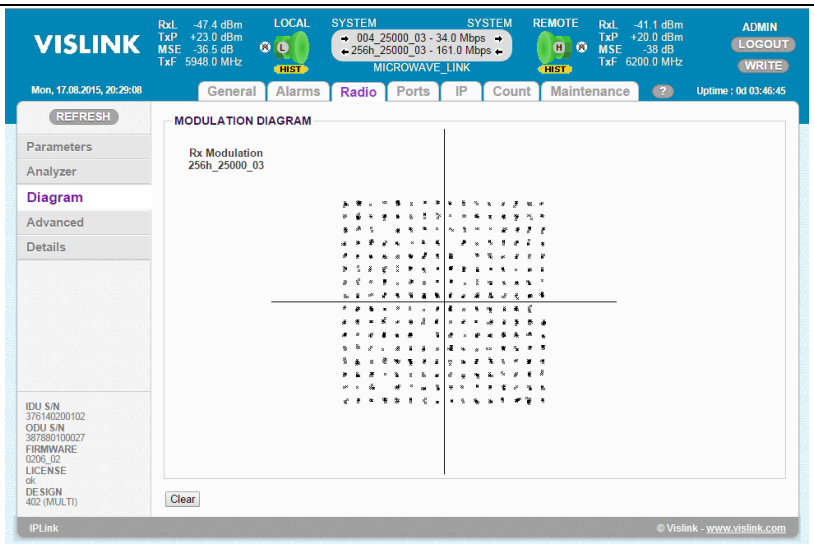

Figure 6-15 Diagram Page Overview

This page presents a representation of a signal modulated by the digital modulation schemes. It is a two-dimensional scatter diagram in the complex plane at symbol sampling instants. This measured constellation diagram can be used to recognize the type of interference and distortion in a signal.

6.5.3.1. Modulation Diagram

- Gaussian noise is displayed as indistinct constellation points.
- Non-coherent single frequency interference is displayed as circular constellation points.
- Phase noise is displayed as rotationally spreading constellation points.
- Amplitude compression causes points located in the corner to move towards the centre.

6.5.3.2. Clear

Use this button to clear the current diagram.

6.5.4. Advanced Page

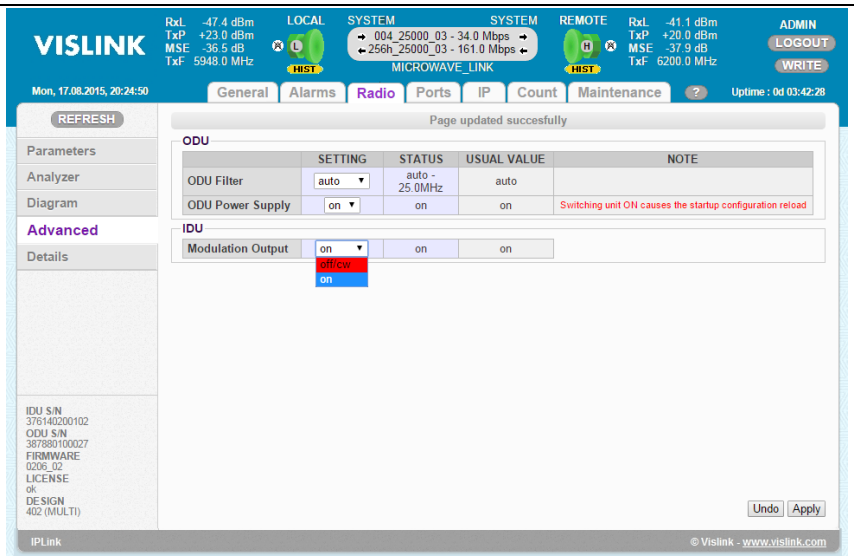

Figure 6-16 Advanced Page Overview

This page provides extended radio parameters settings that are usually required for maintenance and operation purposes.

6.5.4.1. ODU

ODU Filter – the integrated filter inside IPLink may be changed by means of this drop-down menu. The possible modes are as follows:

- automatic – filter is selected automatically according to the modulation bandwidth (default).
- narrow – manual selection of RF Unit narrow filter.
- wide – manual selection of RF Unit wide filter.

Concrete filter width for narrow or wide mode depends on the RF Unit settings. Wide-band ODU uses 30MHz/60MHz filters for narrow/wide modes. Narrow-band RF Unit uses 10MHz/30(40) MHz filters for narrow/wide modes.

ODU Power Supply – it is possible to turn-off power supply for RF Unit by means of this drop-down menu:

- on – RF Unit is powered (default)
- off – the IPLink transceiver is turned-off.

Start-up configuration (RUN W0) is initiated after the switch from OFF to ON mode. Data drop will occur after this switch.

6.5.4.2. IDU

Modulation Output – the standard modulated signal can be replaced with carrier signal (CW) in this drop-down menu. The possible modes follow:

- on – transmitter IF modulated signal is presented at IF output from IPLink (default).
- off/cw – carrier signal with frequency 350 MHz is presented at IF output.

6.5.4.3. Undo

Use this button to cancel any changes made.

6.5.4.4. Apply

Use this button to make changes to the settings made in this page. Be sure to select the Write button if these changes are to be saved permanently.

6.5.5. Details Page

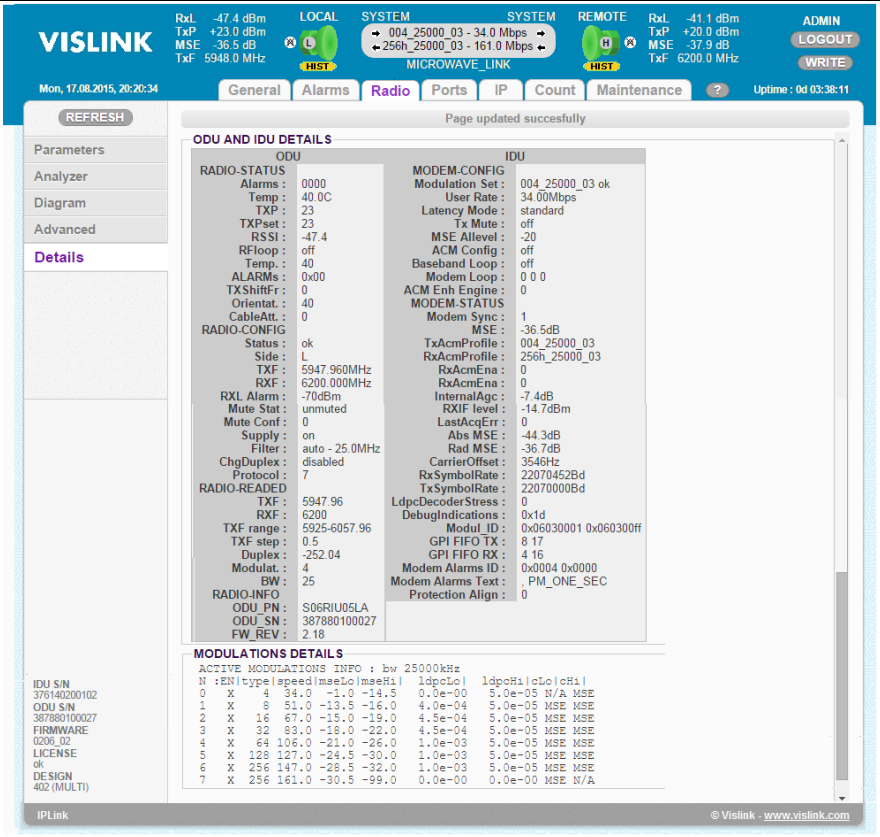

Figure 6-17 Details Page Overview

This page presents detailed, read-only information for the IPLink and details concerning its Modulation status.

6.5.5.1. ODU and IDU Details

These fields display the extended status details for all connected units for the IPLink control system and RF Unit.

6.5.5.2. Modulation Details

This section shows details of threshold values for the ACM function. The following information describes the column headers:

- N – numeric mark of modulation.
- EN – shows if the modulation is enabled for ACM or not.
- Type – bandwidth of the modulation.
- Speed – data rate of the modulation.
- mseLo – MSE threshold for decreasing of the active modulation.
- mseHi – MSE threshold for increasing of the active modulation.
- ldpcLo – low density parity check (linear error correcting code) threshold for decreasing of the active modulation.
- ldpcHi – low density parity check (linear error correcting code) threshold for increasing of the active modulation.
- cLo – condition used for modulation shift – MSE or LDPC.
- cHi – condition used for modulation shift – MSE or LDPC.

6.6. Ports Tab

The Ports Tab provides a means to configure IPLink ports. The pages offered are as follows.

6.6.1. Parameters Page

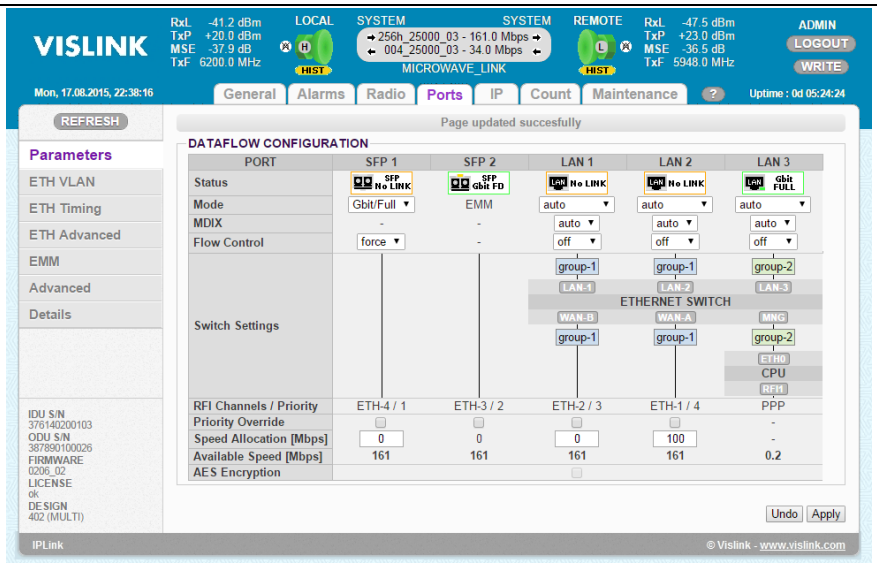

Figure 6-18 Parameters Page Overview

6.6.1.1. Dataflow Configuration

- Status – this graphical symbol describes the actual status of particular Local Area Network (LAN) port. The status of these ports includes such parameters as speed, duplex mode, link, and administrative down status.
- Mode – this drop-down list displays and defines the actual port mode (auto-negotiation on/off, speed/duplex, administrative down).
- The Small Form-factor Pluggable transceiver (SFP) Modes include:
  - Auto
  - Gbit/Full
  - Disabled
- The LAN Modes include:
  - Auto
  - Gbit/Full
  - 10 M/Half
  - 10 M/Full
  - 100 M/Half
  - 100 M/Full
  - Disabled
- MDIX – it is possible to set particular Ethernet (ETH) cable crossing such as auto/mdi/mdx by means of this configuration. Use the drop-down list to select automatic, mdi or mdx.
- Flow Control – this setting manages duplex flow control mechanism for both SFP and Ethernet ports.
  - off – flow control is disabled.
  - on – flow control is enabled during auto-negotiation process.
  - force – flow control is active, even connected device does not support it.
- Switch Settings – this block illustrates the ETH switch fragmentation into groups and also their interconnection with physical LAN ports and internal Wide Area Network (WAN) ports. The group configuration is performed on Ports/ETH VLAN page.
- RFI Channels/Priority – this field describes internal names of packet processor ports and actual priority.
- Priority Override – this indicates the possibility of increasing the port's priority.
- Speed Allocation – the over air speed of particular packet processor channel can be reduced by means of this parameter. When the rate in this input field is higher than the value displayed in the row below (Available Speed) then the full capacity is specified for this channel. The speed priority allocation proceeds from left to right.
- Available Speed – this field indicates the available speed of the appropriate channel. This value depends on selected actual modulation scheme.
- AES Encryption – this line displays when the AES encryption block is enabled or disabled, where supported.

6.6.1.2. Undo

Use this button to cancel any changes made.

6.6.1.3. Apply

Use this button to make changes to the settings made in this page. Be sure to select the Write button if these changes are to be saved permanently.

6.6.2. ETH VLAN Page

Figure 6-19 ETH VLAN Page Overview

The Ethernet Virtual Local Area Network Page provides a means to configure the IPLink VLAN settings for your system operational requirements. VLAN configuration is used for the separation of management traffic from other data traffic.

6.6.2.1. VLAN Mode Setting

- Port Mode – the following are the modes of Wide Area Network (WAN) and LAN Ports selectable for the IPLink. It is recommended to leave all ports in basic mode and edit VTU records first. The user has to be sure with correct VLAN configuration and has to set also his network into the similar VLAN support:
  - basic – transparent mode in which VLAN settings in VTU table are ignored. Frames are transmitted unchanged but they exit only those ports that are inside the same group.
  - access – port is a member of just one untagged VLAN defined with Default VLAN for the port. Only such untagged packets are accepted, whose VLAN number (VID), which is assigned from port's Default VLAN, exist in VTU table. Frames are transmitted untagged and they are allowed to exit only those ports that are members of the frame's VLAN and are inside the same group.
  - trunk – port can be a member of more tagged VLANs (VID extracted from VLAN tag) and one untagged VLAN defined with Default VLAN for such port. Only such frames are accepted, whose VLAN number (assigned from VLAN tag or port's Default VLAN) exists in VTU table and Ingress port is member of VLAN. Frames are transmitted untagged or tagged according to the specification in VTU record for

each port/VLAN and they are allowed to exit only those ports that are members of the frame's VLAN and are inside the same group.

- hybrid – when frame's VLAN number exists in VTU table the rules for trunk port are used, when the number does not exist, basic rules are applied.

- The Management Local Area Network (MNG LAN) can be set to either basic or access LAN Port Mode.
- Port Group – this parameter defines a separate MAC address table domain inside the internal switch and defines also the group of ports that can communicate to each other. The IPLink includes three separate VLAN Groups.
- Default VLAN – this parameter is configured automatically with a new record into the VTU table. Default VLAN is updated for the port that is marked as untagged in the VTU record.

6.6.2.2. VTU Setting

The VTU is a table of rules for Virtual Local Area Networks:

- ACTION – this adds or removes VTU records. A VTU record cannot be removed when it contains an untagged port which is configured into access mode (simple VLAN NO.) Specification is required for VTU record erase.
- VLAN NO. – the VLAN number of edited VLAN (added or deleted). Every VLAN can be defined for only one Port Group, multiple records of the same VLAN for more groups is not allowed.
- GROUP – this defines the port Group for which is VLAN edited.
- QoS PRI – when VTU override mode is selected then the QoS priority value of original frame is override. This configuration has influence only on the internal frame processing by means of queue controller (QPRI defined by OQPRI instead of IQPRI bits), but frames are egressed still with the initial priority assignment (FPRI is without any change).
- LAN 1-WAN B – this drop-down list defines the VLAN mode for each port in the configured VLAN.
  - deny – port is not a member of edited VLAN. Ports that are defined in different Groups should be set into this mode.
  - untag – port is a member of edited VLAN as untagged.
  - tag – port is a member of edited VLAN as tagged.

6.6.2.3. Listing of Actual VTU Values

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

6.6.2.4. Undo

Use this button to cancel any changes made.

6.6.2.5. Apply

Use this button to make changes to the settings made in this page. Be sure to select the Write button if these changes are to be saved permanently.

6.6.3. ETH Timing Page

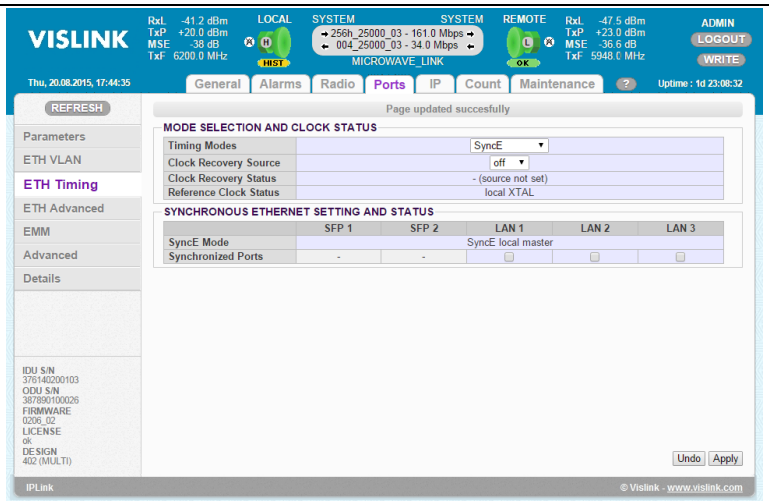

Figure 6-20 ETH Timing Page Overview

This page will dynamically change, depending on the Timing Modes value selected.

6.6.3.1. Mode Selection and Clock Status

- Timing Modes (with respect to ETH SyncE) – Synchronous Ethernet mode ensures transmission of timing reference derived from a selected LAN port at the reference side of the link to the remote synchronized side of the same link. The drop-down field allows you to select form the following modes:
  - Internal – Internal (IDU) clocks are recovered from local XTAL (Crystal oscillator) - so the time is not taken from external clock sources. Such IDU is the source of the clocks. When selecting this Timing Mode, the Synchronous Ethernet Timing and Status fields do not display and the Clock Recovery Source is off by default.
  - SyncE – When this Timing Mode is selected, the SyncE Mode and Synchronized Ports fields are displayed in the Synchronous Ethernet Setting and Status fields grouping.
  - SyncE & 1588 – When this Timing Mode is selected, the SyncE Mode and Synchronized Ports fields are displayed in the Synchronous Ethernet Setting and Status fields grouping along with the 1588 Setting and Status field grouping also displays. This is IEEE 1588v2 protocol describing packet timing.
  - TSI – the TSI Time Synchronization Interface is one-direction distribution of precise time synchronization pulses (1PPS=1 pulse per second) and 10 MHz precise frequency signal from Master to Slave side over the link Timing.
- Clock Recovery Source (with respect to SyncE Reference) – this parameter defines the port that is selected for clock synchronization at configured IPLink. The available modes are:
  - lan1-3 – clock reference is a specific PHY port LAN 1-3.
  - sfp1-2 – clock reference is a specific SFP port SFP 1-2.
  - rf – clock reference is a RF timing receiver (locked to remote IPLink transceiver).

- Clock Recovery Status – displays PLL lock status (locked / unlocked) and source reference signal status (source ok, source error, source not set).
- Reference Clock Status – displays internal clock reference that is used for system timing. Local XTAL is displayed when no SyncE reference is selected or PLL is not locked. Recovered CLK is a status when system CLKs are locked to external unit.

6.6.3.2. Synchronous Ethernet Setting and Status

This section is only displayed when SyncE or SyncE&1588 is selected for the Timing Modes:

- Synchronized Ports – it is possible to select ports that are synchronized to SyncE mode reference in these boxes. Radio part (rf) is synchronized automatically when SyncE Reference is configured to LAN 1-3 / SFP 1-2 sources. Use the check boxes to select LAN 1, 2 or 3.

6.6.3.3. 1588 Setting and Status

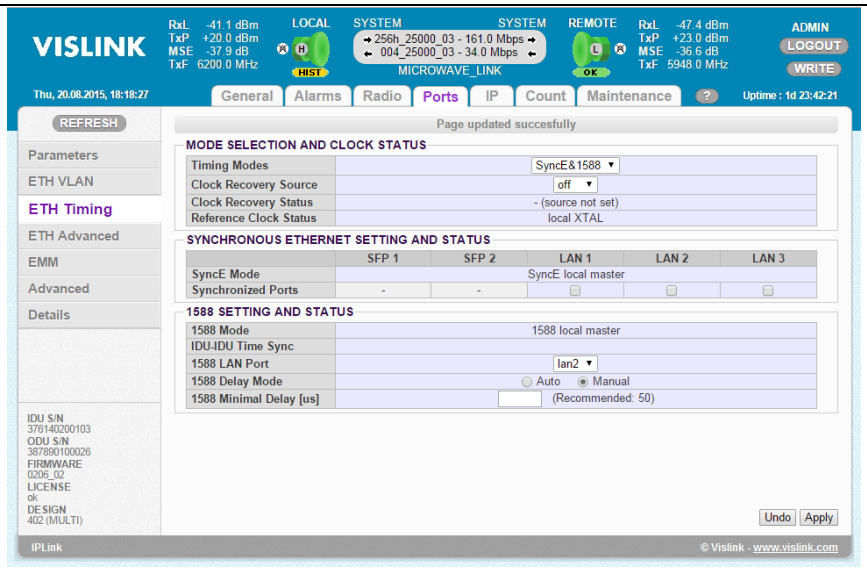

Figure 6-21 1588 Setting and Status Overview

This section is only displayed when SyncE&1588 is selected for the Timing Modes:

- 1588 Mode – the 1588 Local Master is shown by default.
- IDU-IDU Time Sync - status of timing (1588 or TSI) synchronization of local with remote IPLink.
- 1588 LAN Port – this drop-down entry field allows the selection of LAN Ports 1, 2 or 3.
- 1588 Delay Mode - allows the radio button selection of Auto or Manual.
- 1588 Minimal Delay [µs (micro seconds)] – the 1588 Minimal Delay entry field displays the recommended duration of 50 µs.

6.6.3.4. TSI Setting and Status

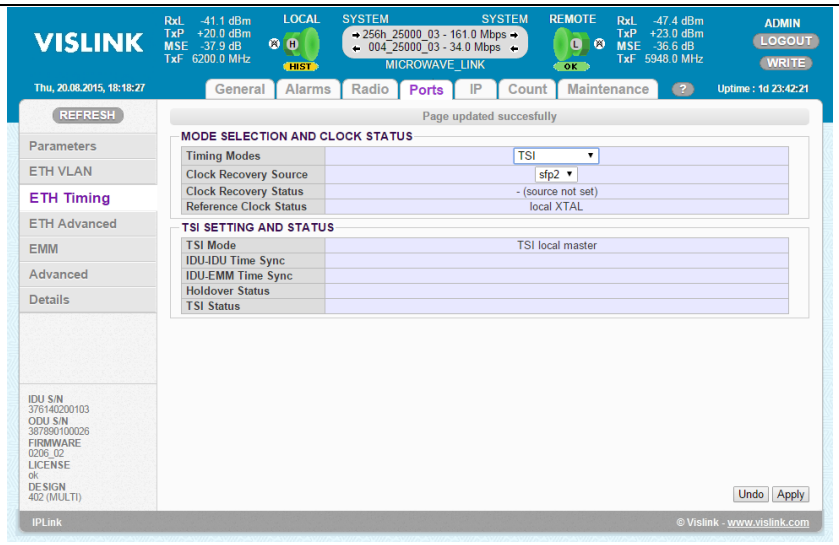

Figure 6-22 TSI Setting and Status Overview

This section is only displayed when TSI is selected for the Timing Modes.

Possible Holdover Status values are:

- Warming up – displayed after start of the EMM-ASI&TSI, it will be displayed until the Temperature stabilized oscillator reaches operating temperature.
- tracking set-up – this displays during alignment of the Timing module to external clock source.
- track to PPSREF - this displays after alignment of the Timing module to external clock source after reaching inaccuracy less than 50ns.
- sync to PPSREF – this displays after full alignment of the Timing module to external source.
- PSREF unstable – this displays when the Timing module finds inaccurate source signal (accuracy less than 10e-8).
- NoPPSREF (Holdover) – this displays when there is no source signal detected. The Timing module is automatically switched to holdover mode generating its own 1PPS and 10MHz signal until the source of clocks is recovered. If the source is lost during service, the Timing module will sustain (holdover) last known frequency with accuracy of 10e-8 until the source is recovered.
- fault – this displays when a hardware error occurs - contact your supplier. TSI Status fields display in the TSI Time Synchronization Interface, its function is one-direction distribution of precise time synchronization pulses (1PPS=1 pulse per second) and 10 MHz precise frequency signal from Master to Slave side over the link Setting and Status fields grouping. The Clock Recovery Source drop-down field allows the selection of sfp2 or rf (Radio Frequency side – from radio side).

6.6.3.5. Undo

Use this button to cancel any changes made.

6.6.3.6. Apply

Use this button to make changes to the settings made in this page. Be sure to select the Write button if these changes are to be saved permanently.

6.6.4. ETH Advanced Page

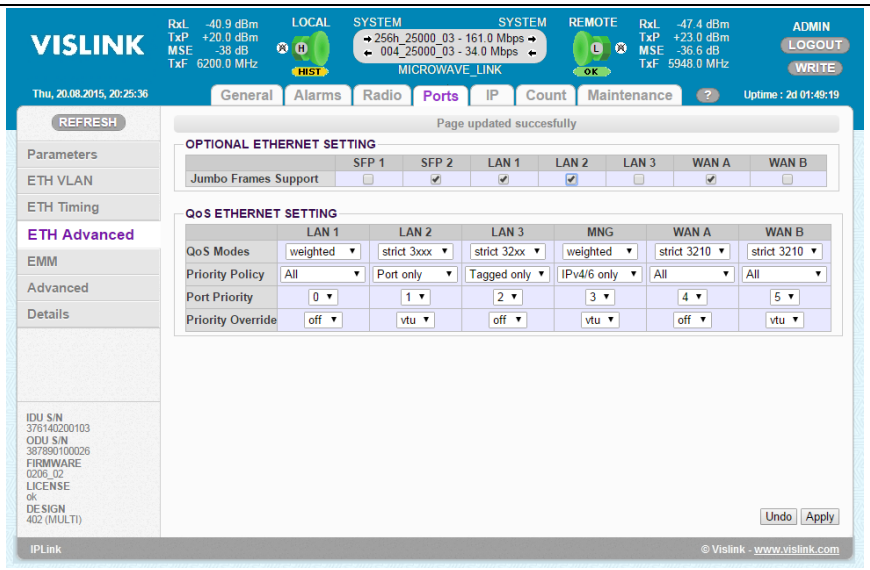

Figure 6-23 ETH Advanced Page Overview

6.6.4.1. Optional Ethernet Settings

The Optional Ethernet Setting comprises the check box selection of Jumbo Frame Support for the two fibre ports as well as the local area and wide area network Ethernet ports:

- Jumbo Frames Support – selection of what ports will support Jumbo Frames (each with a length of up to 10 kB). There exist different Jumbo frames mode settings for the ETH switch ports and the SFP ports.
  - In SINGLE design – Jumbo Frame setting for LAN and WAN port is significant. The setting of SFP boxes does not affect the proper Ethernet functioning.
  - In MULTI design – all the boxes in selection have an influence on Jumbo Frames functioning.
  - In PROTECTED design – Jumbo frames setting for port SFP 1 (protection port) does not affect correct protection function.

6.6.4.2. QoS Ethernet Settings

The QoS Ethernet Setting for the local area and wide area network Ethernet ports, including the Management (MNG) port.

Configuration of extended QoS modes is significant as regards specifying traffic priority. The IPLink system uses four priority queues for each port where frames have assigned initial frame priority.

- QoS Modes – this drop-down list displays the defined egress queue policy function. The function is independent of any other QoS configurations.

- weighted – in the weighted scheme an 8, 4, 2, 1 round robin weighting is applied to the four priorities (8 frames for Q3, 4 frames for Q2, 2 frames for Q1 and 1 frame for Q0). This approach prevents the lower priority frames from being limited with only a slight delay to the higher priority frames.
- strict 3xxx – strict priority for queue 3 and weighted round robin for queues 2, 1 and 0. Queues 2, 1, 0 work only when Q3 is empty.
- strict 32xx – strict priority for queues 3, 2 and weighted round robin for queues 1 and 0. Queues 1, 0 served only when Q3 and Q2 are empty.
- strict 3210 – strict priority for all queues. Lower priority queues work only when higher priority queues are empty.

- Priority Policy – this drop-down list displays the initial ingress queue policy. It defines the initial rules for what output queue will be assigned to every ingress frame.
  - All
  - Port only
  - Tagged only
  - IPv4/6 only
- Port Priority – this drop-down list displays the default port priority. Values from 0 up to 7 can be selected.
- Priority Override – is intended for use to replace an initial queue priority with a new priority.
  - off – QoS override is disabled.
  - vtu – queue priority override information (OQPRI) is derived from bits [2:1] of QoS PRI parameter.

6.6.4.3. Undo

Use this button to cancel any changes made.

6.6.4.4. Apply

Use this button to make changes to the settings made in this page. If these changes are to be saved permanently, select the Write button.

6.6.5. EMM Page

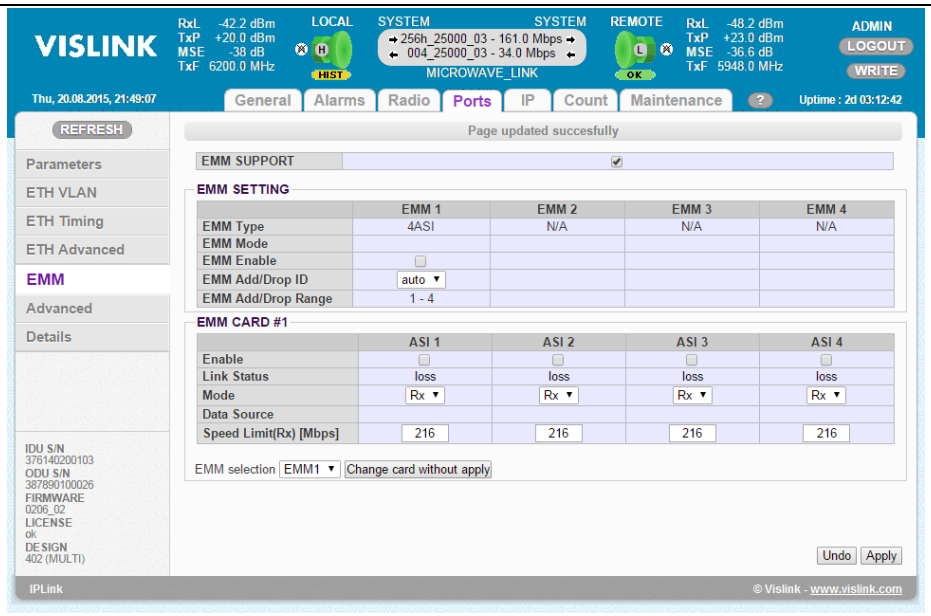

Figure 6-24 EMM Page Overview

This page provides a means of monitoring and setting up basic functions of the External Multiplexer Module [EMM or the Extension card IPLink-ASI-EXT (future option)]. This optional module provides an ASI extension for IPLink.

The EMM's compact, simple to configure and easily scalable design enables cascading with other IPLink extension devices (e.g. IPLink-16E1/T1-EXT). The IPLink Web interface can be used to configure a cascading IPLink system.

The real overall capacity for ASI is allocated in the PBPS based on true selected ASI ports in the Web interface of IPLink. Priority Base Packet System (PBPS) is proprietary multiplexer system.

6.6.5.1. EMM Support

This tick box changes the mode of the SFP2 port from standard Gigabit ETH to proprietary EMM mode. When EMM mode is enabled by this tick box, IDU will communicate with all connected EMMs.

6.6.5.2. EMM Setting

- EMM Type – this field displays the type of connected EMM card. N/A indicates that concrete position is empty, RELAY-IDU indicates that the relay IDU is connected directly to IDU SFP port (relay application) or to EMM slave SFP port (add/drop configuration).
- EMM Enable – selection of this check box enables generation/reception of data frames to/from Fibre Optic stream. When EMM is enabled then EMM occupies appropriate range of traffic port channels (described below).
- EMM Add/Drop ID – in auto mode, EMM card occupies port channel range according to its position in EMM chain. For Add/Drop application it is sometimes necessary to

adjust (manual) Add/Drop ID, especially when EMM card should drop port channels from specific Add/Drop range.

- EMM Add/Drop Range – this field displays the appropriate port channel range according to the EMM card position and EMM Add/Drop ID setting.

6.6.5.3. EMM Card #1

6.6.5.3.1. Settings for EMM-16E1T1

For each number of E1/T1 port (channel), red colour indicates alarm status of appropriate internal channel (check alarm page for more details regarding this status).

- Enable – this check box selects what G.703 ports are configured for customer traffic connection. Such ports require appropriate capacity allocation from IPLink, even though customer traffic is not carried out (e.g. cable is disconnected).
- Line Status – displays the actual status of G.703 port or appropriate internal traffic channel.
- Termination – displays the actual impedance matching of G.703 port according to Coax mode setting.
- LLOOP – local loop-back configuration, incoming data from G.703 port are looped.
- RLOOP – remote loop-back configuration, receiving data from Fibre Optic stream are looped.
- DLOOP – dual loop-back configuration, both data directions are looped inside IDU.
- Coax Mode – this tick box changes G.703 mode from standard 120 ohm balanced to 75 ohm unbalanced.

6.6.5.3.2. Settings for EMM-4ASI

- Enable – this check box selects which ASI ports are configured for DVB ASI connection. The necessary link capacity is automatically allocated according to amount of all ASI Rx streams.
- Link – displays the actual status of ASI port
- In Rx mode:
  - Ok – a valid ASI signal is presented at appropriate input port.
  - Ok – a valid ASI signal is presented at appropriate input port, but the port is not enabled for traffic application.
  - Idle – ASI signal detected and successfully synchronized, but the signal does not contain user data (MPEG stream is missing).
  - Idle – ASI signal detected and successfully synchronized but the signal does not contain user data (MPEG stream is missing) and the particular port is not enabled for traffic application.
  - Nosync – indicates that synchronization was not established for current receiving ASI signal.
  - Nosync – indicates that synchronization was not established for current receiving ASI signal and the port is not enabled for traffic application.
  - Loss – no signal detected at ASI input port.
  - Loss – no signal detected at ASI input port and the port is not enabled for traffic application.

- In TX mode:
  - Ok – a valid inbound signal is presented and transmitted via appropriate ASI port.
  - Ok – a valid inbound signal is presented, but the port is not enabled for transmission.
  - Idle – ASI signal detected and successfully synchronized but the signal does not contain user data (MPEG stream is missing).
  - Idle – ASI signal detected and successfully synchronized but the signal does not contain user data (MPEG stream is missing), and the particular port is not enabled for traffic application.
- Mode – specifies if the particular port operates in Rx (ingress from coaxial cable) or TX (egress to coaxial cable) mode.
- Data Source – specifies source for TX signal. Either remote ASI port (Remote CH1-4) or one of available local ASI Rx port (Local Ch1-4) can be chosen. This setting is available in TX mode only.
- Speed Limit (Rx) [Mbps] – maximal data rate for inbound traffic to avoid overloading of overall link capacity. This setting is available in Rx mode only.

6.6.5.4. Undo

Use this button to cancel any changes made.

6.6.5.5. Apply

Use this button to make changes to the settings made in this page. Be sure to select the Write button if these changes are to be saved permanently.

6.6.6. Advanced Port Settings Page

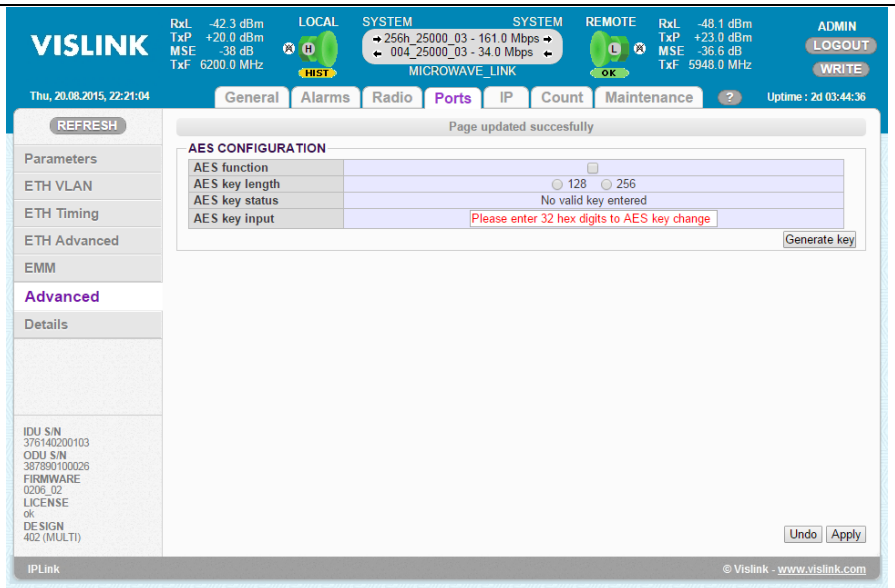

Figure 6-25 Advanced Port Settings Page Overview

This page provides a means to configure extended modes associated with packet processing.

6.6.6.1. AES Configuration

- AES Function – this check box enables or disables AES encryption functioning. Function of AES is subject to a valid license option and an incorporated valid AES key. When the AES Function check box is selected, the entire stream of traffic from the packet processor is encrypted with included AES key. The parallel IPLink transceiver must be defined in the same way and with an identical AES key. An out of band management channel is not encrypted in this mode, thus remote access to remote IPLink is possible.
- AES Key Length – this option allows for the selection of the key length as either 128 or 256 bits.
- AES Key Status – this informational line shows status of the actual AES key and also last four digits of the entered valid key.
- AES Key Input – the 32-hex digit-key (128 bits) or 64-hex digit-key (256 bits) must be entered for initial key definition or change prior to initiation of AES functioning.

6.6.6.1.1. Generate Key

This button can be used to auto-generate an AES key.

6.6.6.2. Undo

Use this button to cancel any changes made.

6.6.6.3. Apply

Use this button to make changes to the settings made in this page. Be sure to select the Write button if these changes are to be saved permanently.

6.6.8. Port Settings Details Page

Figure 6-26 Port Settings Details Page Overview

The Details Page displays a read-only list of the current Port Settings that have been written to the control processors. This page provides a means to ascertain whether the Port Settings have been correctly saved. The Details Page lists the following:

- Timing Mode
- SyncE Source
- SEdst L123
- Clock R Status
- Clock (Clk) Source
- Clock Mod (Clkmod) Source
- SyncE

6.7. IP Configuration Tab

This section provides an explanation of basic IP configuration of local and remote IPLink transceivers.

6.7.1. Address Page

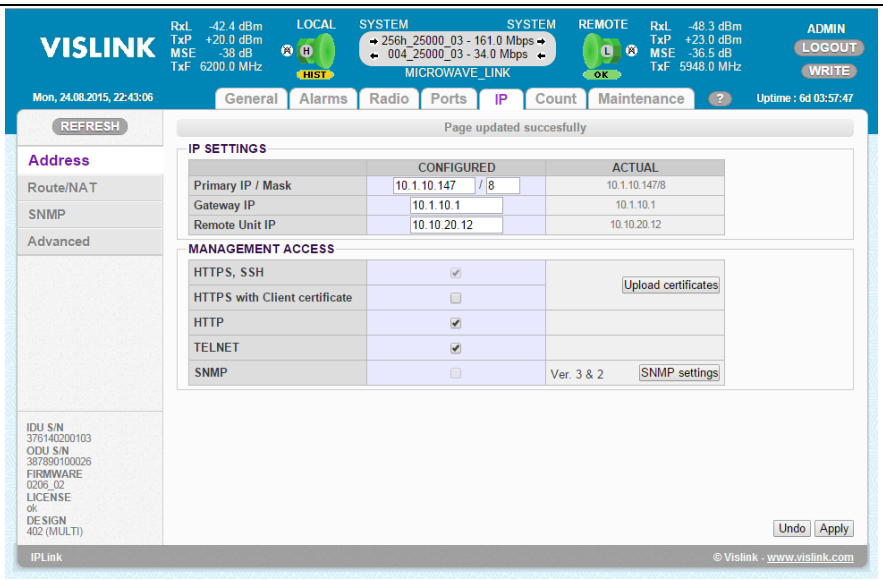

Figure 6-27 Address Page Overview

6.7.1.1. IP Settings

We recommend beginning by setting the basic IP configuration of the local and remote IPLink units. This step is necessary for the proper communication between local and remote transceivers:

- Primary IP / Mask – the Primary IP address is assigned to port ETH0 (local address) with appropriate net-mask specification. Net-mask value is entered slash notation that corresponds to numbers in binary subnet mask presentation. As such, the net-mask for subnet mask 255.255.255.0 is presented as decimal number 24 that is a class C address.
- Default Gateway IP – the default Gateway IP address is used with CPU, when connection outside IP range which is defined in system routing table, is required. As such the IP address must be a part of above-mentioned routing table. The routing table can be checked on the Static Route and NAT Settings Page.
- Remote Unit IP – the remote IP address specifies a remote unit IP connected over RF link. Such address is necessary for automatic message exchange between these IPLink transceivers and also for correct out-of-band management functioning. Subnet mask is not required for this IP specification, because PtP protocol is used.

6.7.1.2. Management Access

- HTTPS, SSH – for http access a self-generated server certificate (SC) can be uploaded. For client (browser) access, it will be necessary to allow an exception for the SC on your browser or to install the CA certificate signed by the appropriate SC.

- HTTPS with Client Certificate – the secure https access is only possible if the client (browser) has installed a client certificate (CC). This option is only available if the IPLink has uploaded the CA certificate signed by the appropriate CC.
- HTTP – this tick box provides the facility to enable or disable http access.
- TELNET – this tick box provides the facility to enable or disable telnet access.
- SNMP – this tick box provides the facility to enable or disable SNMP access. Selecting the adjacent SNMP settings button will automatically switch the Web browser to display the SNMP Settings page (see Section 6.7.3) for editing the SNMP parameters.

It is recommended to enter basic IP configuration of local and remote units at the very beginning. This step is necessary for proper communication between local and remote side and optionally for ensuring remote access to IPLink devices from your network.

6.7.1.3. Undo

Use this button to cancel any changes made.

6.7.1.4. Apply

Use this button to make changes to the settings made in this page. Be sure to select the Write button if these changes are to be saved permanently.

6.7.2. Static Route and NAT Settings Page

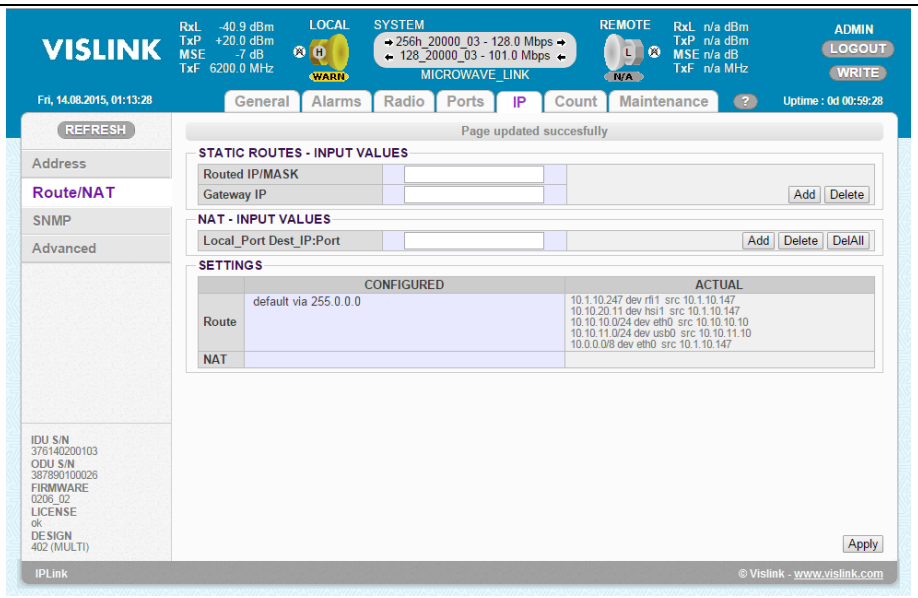

Figure 6-28 Static Route and NAT Settings Page Overview

For a specific configuration of management access, it is sometimes necessary to add/change/delete static routes or NAT records. This is especially required for Out of band type of management access. Each static route and/or NAT record must be entered separately.

6.7.2.1. Static Routes – Input Values

- Routed IP/MASK – the IP address from a routed network and the appropriate network mask must be incorporated. The Routed network range is calculated from included values.
- Gateway IP – the correct IP address gateway for above-mentioned network must be entered.

6.7.2.2. NAT – Input Values

Network Address Translation (NAT) is a methodology of remapping one IP address space into another by modifying network address information in Internet Protocol (IP) datagram packet headers while they are in transit across a traffic routing device. The technique was originally used for ease of rerouting traffic in IP networks without renumbering every host. It has become a popular and essential tool in conserving global address space allocations in face of IPv4 address exhaustion:

- LocalPort DestIP: Port – the NAT record must be entered in the form of the following command:
  - local_port destination_ip: port.

NOTE: local_port – represents the number of a port on local IP which is used for address translation, it must be followed with space.
destination_ip – this IP address represents the address of the destination/remote unit.

6.7.2.3. Settings

This section displays the configured information.

6.7.2.4. Apply

Use this button to make changes to the settings made in this page. Be sure to select the Write button if these changes are to be saved permanently.

6.7.3. SNMP Settings Page

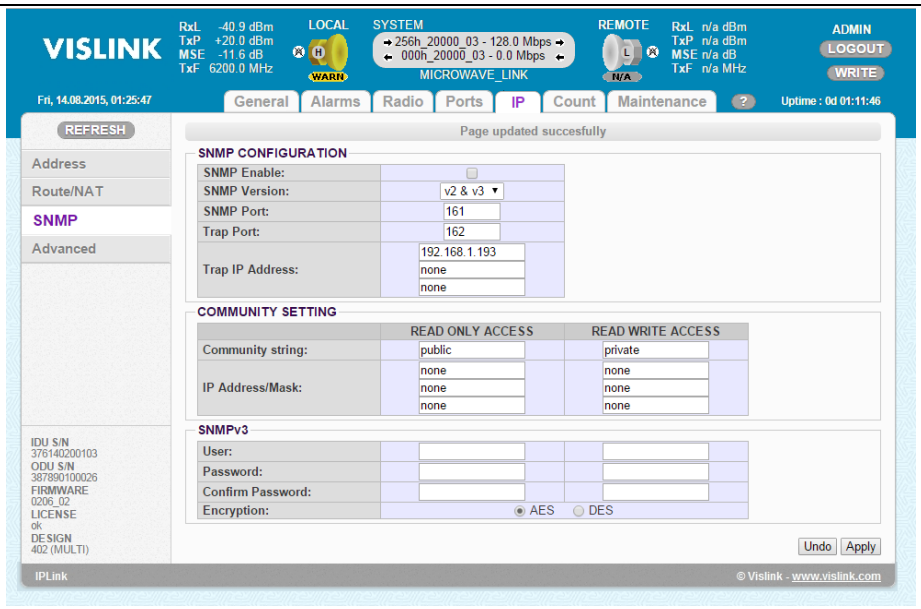

Figure 6-29 SNMP Settings Page Overview

Simple Network Management Protocol (SNMP) is an Internet-standard protocol for managing devices on IP networks. SNMP exposes management data in the form of variables on the managed systems, which describe the system configuration. These variables can then be queried (and sometimes adjusted) by managing applications.

6.7.3.1. SNMP Configuration

- SNMP Enable – Selecting this check box enables SNMP management access for IPLink.
- SNMP Version – SNMP v2c or SNMP v3 can be used for SNMP access.
- SNMP Port – the parameter specifies which port will be used for SNMP communication. The same configuration must be used also at SNMP agent station.
- Trap Port – the parameter specifies which port will be used for SNMP trap type messages. The same configuration must be used also at SNMP agent station.
- Trap Address – up to three IP addresses can be configured as destination for SNMP trap distribution. Trap message events are configured in the same way as the alarm setting.

6.7.3.2. Community Setting

- Community String – the parameter specifies community string for secure access to IPLINK SNMP management (different settings for read only and read/write access can be entered, valid for SNMP v2). The number of characters in the input field must range from 1 to 15. Valid characters are:
  - [a-z, A-Z, 0-9, _]
- IP Address/Mask – up to three IP addresses or subnets can be configured as possible IP source for SNMP management access.

6.7.3.3. SNMPv3

- User – this field lists the user name configuration for secure SNMP access to SNMP v3 protocol (different settings for read only and read/write access can be entered). The number of characters in the input field must range from 4 to 15. Valid characters are:
  - [a-z, A-Z, 0-9, _].
- Password – this field presents the password configuration for secure SNMP access to SNMP v3 protocol, the identical password must be entered into Confirm Password box (different settings for read only and read/write access can be entered). The number of characters in the input field must range from 8 to 15. Valid characters are:
  - [a-z, A-Z, 0-9, _].
- Parameters – there exist three SNMP v3 Parameters:
  - auth protocol: SHA
  - priv protocol: CFB-AES-128 or CBC-DES
  - security level: Auth, Priv (for public & private)
- Encryption – there are two radio buttons with which to select either AES or DES Encryption.

6.7.3.4. Undo

Use this button to cancel any changes made.

6.7.3.5. Apply

Use this button to make changes to the settings made in this page. Be sure to select the Write button if these changes are to be saved permanently.

6.7.4. Advanced IP Settings Page

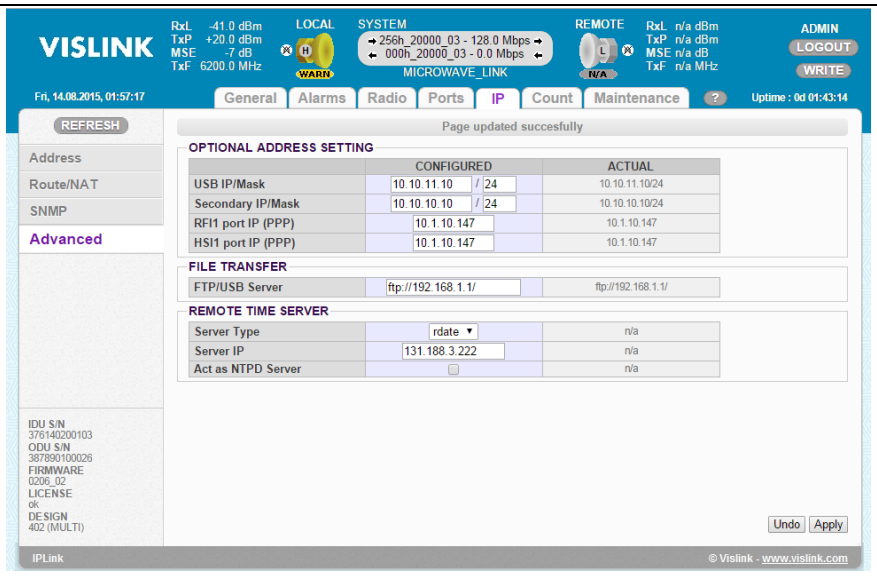

Figure 6-30 Advanced IP Settings Page Overview

This page of the IP Tab enables the change of extended IP configuration which usually remains in default state. This may be necessary for support of specific management modes.

6.7.4.1. Optional Address Setting

- USB IP/MASK – Not used for IPLink
- Secondary IP/MASK – this field specifies secondary IP address for ETH 0 management port. When default IP secondary address is in collision with other network configuration, it can be changed with this parameter.
- RFI1 port IP (PTP) – this field specifies internal IP address for RFI 1 port (connected to remote unit). Default RFI1 IP address uses the same value as ETH 0 port (unnumbered mode). It can be helpful to set numbered point to point (PtP) mode for a specific network configuration.
- HSI1 port IP (PTP) – this field specifies internal IP address for HSI 1 port (connected to neighbour unit). Default HSI 1 IP address uses the same value as ETH 0 port (unnumbered mode). It can be helpful to set numbered PtP mode for a specific network configuration.

6.7.4.2. File Transfer

- FTP/USB Server – when ftp://IP/directory_structure/ is entered into the box, an external FTP server is used as destination/source address for backup and/or restoration of IDU configuration.

NOTE: The USB is not used for IPlink.

6.7.4.3. Remote Time Server

- Server Type – two types of time server can be specified for a time synchronization: ntp or rdate. The most useful setting is ntp mode. When none is selected, no time synchronization is required.
- Server IP – this field specifies a remote time server IP when ntp or rdate mode are selected in the Server Type box.
- Act as NTPD Server - when this tick box and ntp type of time server are selected then the configured unit operates as NTPD reference server. Time at remote units can be synchronized with this configured unit.

6.7.4.4. Undo

Use this button to cancel any changes made.

6.7.4.5. Apply

Use this button to make changes to the settings made in this page. Be sure to select the Write button if these changes are to be saved permanently.

6.8. Count Tab

6.8.1. Basic Page

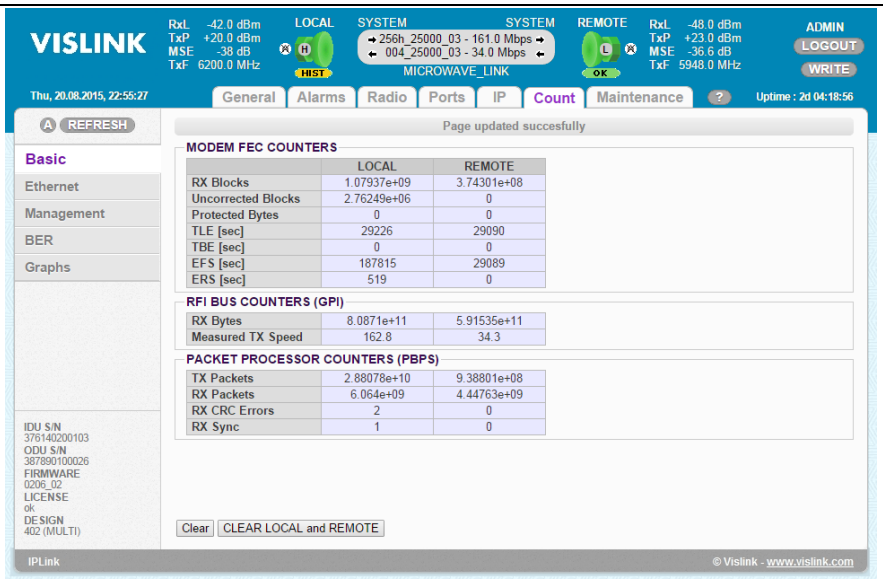

Figure 6-31 Basic Page Overview

6.8.1.1. Modem FEC Counters

- RX Blocks – this field displays the number of correct received airframes, large number.
- Uncorrected Blocks – this field displays the number of frames that couldn't be corrected by FEC.
- Protected Bytes – this field displays the number of Protected Bytes that is important for protection mode.
- TLE – this field displays the time since the last error; the number of seconds from the last error occurrence. The displayed values should correspond to time since you have pressed the Clear Local and Remote button.
- TBE – this field displays the time between the last two error events.
- EFS – this field displays the error free seconds; it describes the value since the last registered error or the value since you have pressed the Clear Local and Remote button in seconds.
- ERS – error seconds; number of seconds during which errors occurred.

6.8.1.2. RFI Bus Counters (GPI)

- RX Bytes – this field displays the counter of incoming bytes on modem output (from modem to user).
- Measured TX Speed – this field displays the speed measured in the user – modem direction.

6.8.1.3. Packet Processor Counters (PBPS)

- TX Packets – this field displays the number of send frames (from user to modem).
- RX Packets – this field displays the number of received frames (from modem to user).
- RX CRC Errors – this field displays each packet is secured by CRC; this particular counter counts packets with faulty CRC.
- RX Sync – this field displays the number of cases in which desynchronization and synchronization of frames took place.
- TX Words – this field displays the number of send words (characters) on the opposite side of port SFP1 (possible only in Protection mode).
- RX Words – this field displays the number of received words (characters) from the opposite side of port SFP1 (possible only in Protection mode).
- RX CRC Errors – this field displays the number of received words (characters), which were identified as faulty.

6.8.1.4. Clear

Selecting this button will clear the information in the Local column only.

6.8.1.5. Clear Local and Remote

Use this button to clear both the local and remote settings.

6.8.2. Ethernet Page

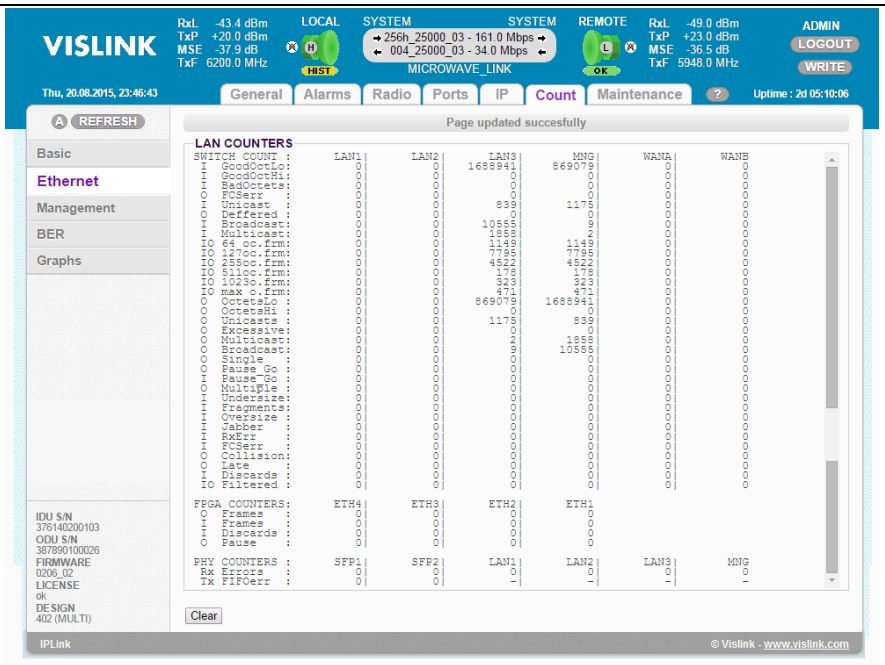

Figure 6-32 Ethernet Page Overview

This page lists the counters from the Ethernet switch.

6.8.2.1. LAN Counters

A listing of the LAN counters typically displayed on the Ethernet Page are as follows:

Input BadOctets	Output FCSerr
Input Unicast	Output Deferred
Input Broadcast	Input Multicast
Input/Output 64 oc.frm	Input/Output 127oc.frm
Input/Output 255oc.frm	Input/Output 511oc.frm
Input/Output 1023o.frm	Input/Output max o.frm
Output OctetsLo	Output OctetsHi
Output Unicasts	Output Excessive
Output Multicast	Output Broadcast
Output Single	Output Pause_Go
Input Pause_Go	Output Multiple
Input Undersize	Input Fragments
Input Oversize	Input Jabber
Input RxErr	Input FCSerr
Output Collision	Output Late
Input Discards	Input O Filtered
FPGA COUNTERS: for ETH 1-4	Output Frames
Input Frames	Input Discards
Output Pause	PHY COUNTERS: for SFP1 & SFP2, LAN1-3 & MNG Ports
Rx Errors	Tx FIFOerr

6.8.2.2. Clear

Selecting this button will clear the information.

6.8.3. Management Page

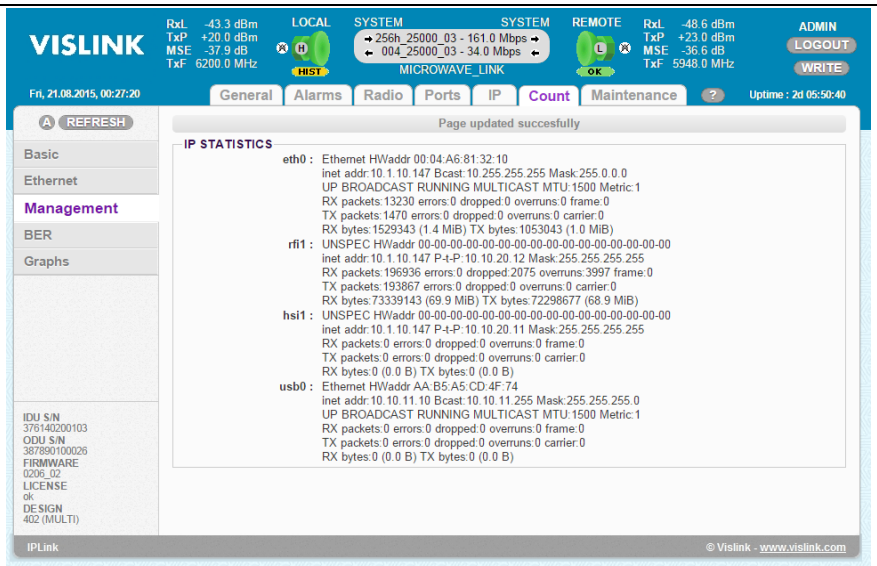

Figure 6-33 Management Page Overview

The Management Page displays the following read-only IP Statistics:

- eth0 – this section displays the Ethernet port of CPU with its own MAC address and all the standard features of Ethernet interface, Primary / Secondary addresses and appropriate subnet masks are assigned to this interface.
- rfi1 – this section displays the PtP (point-to-point protocol) type of interface which interconnects local CPU with the remote side CPU accessible through the separate channel inside air-frame.
- hsi1 – this section displays the PtP (point-to-point protocol) type of interface which interconnects local CPU with the protection unit CPU or EMM module accessible through the separate channel inside Fibre Optic-frame.
- usb0 – this section displays the USB port which is specified for local IP access. No access for IPLink.

6.8.4. BER Page

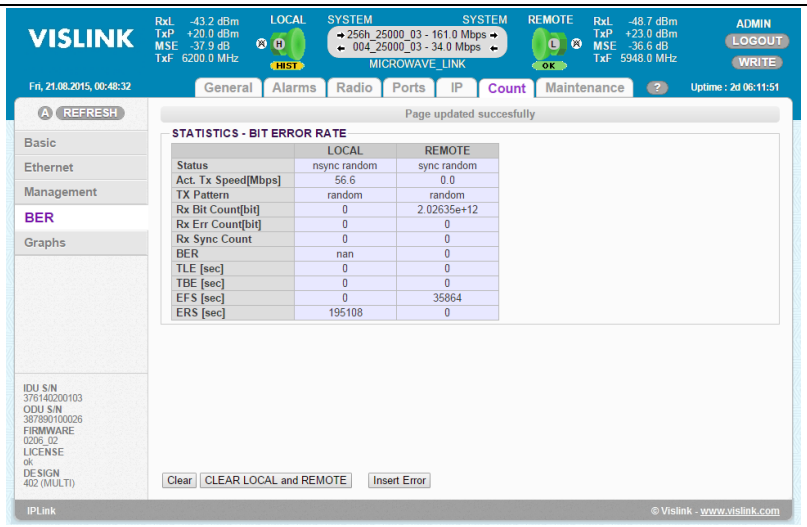

Figure 6-34 BER Page Overview

6.8.4.1. Statistics – Bit Error Rate

The Bit Error Rate Page displays the following read-only Bit Error Rate Statistics:

- Status – states the status of BER tester.
- Act. TX Speed – states the reserved speed of BER tester (adjusted to connection speed).
- TX Pattern – displays transmission pattern of BER tester frame.
- RX Bit Count – displays the number of transmitted bytes.
- RX Err Count – displays the number of faulty bytes.
- TLE – the number of seconds since the last error occurrence.
- TBE – time between two subsequent errors.
- EFS – error free second counter.
- ERS – count of seconds in which error in transmission occurred.

6.8.4.2. Clear

Selecting this button will clear the information in the Local column only.

6.8.4.3. Clear Local and Remote

Selecting this button will clear the information in both the local and remote columns.

6.8.4.4. Insert Error

Selecting this button will enter one error into data stream.

6.8.5. Graphs Page

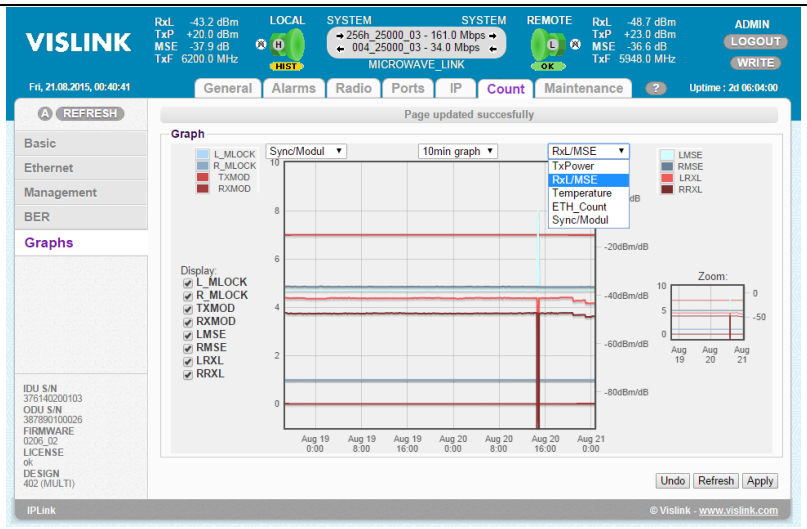

Figure 6-35 Graphs Page Overview

Graphs describe the selected values with respect to time. When the setting for connection with a remote unit is correct, the values from the remote unit are displayed.

6.8.5.1. Graph

Choices of graphical depictions possible correlate between the following options:

- TxPower – this graphic parameter depicts transmitted level of signal output by means of ODU unit.
- RxL/MSE – this graphic parameter received level of signal output at ODU/ quality of received signal.
- Temperature – this graphic parameter displays temperature of IDU and ODU units.
- ETH_Count – this graphic parameter displays transmission capacity for transmission and admission on selected ports of device.
- Sync/Modul – this graphic value MLOCK = 1 displays modem synchronization, value MLOCK = 0 shows that there is no synchronization. If ACM is active, the most appropriate modulation for signal transmission or admission is found. Individual modulations are indicated according their amount of states.

Time Segments for depiction can be selected after 1 second, 1 minute and 10 minutes.

In case there is a detailed view of depicted values, it is necessary to mark the required area by holding the mouse left button. The selected area is displayed at the miniature window on the right side of the graph. If you want to see the complete view again, mark the whole area at the miniature window on right side.

Proposed items for selected variation can be seen left from a graph. It is necessary to use the tick boxes for activation/deactivation of depiction in graph.

- ETH1-Tx
- ETH1-Rx
- ETH2-Tx
- ETH2-Rx
- ETH3-Tx
- ETH3-Rx
- ETH4-Tx
- ETH4-Rx

6.8.5.2. Undo

Use this button to cancel any changes made.

6.8.5.3. Refresh

Select this button to update the current display to reflect any changes in values.

6.8.5.4. Apply

Use this button to make changes to the settings made in this page. Be sure to select the Write button, if these changes are to be saved permanently.

6.9. Maintenance Tab

6.9.1. Configuration Page

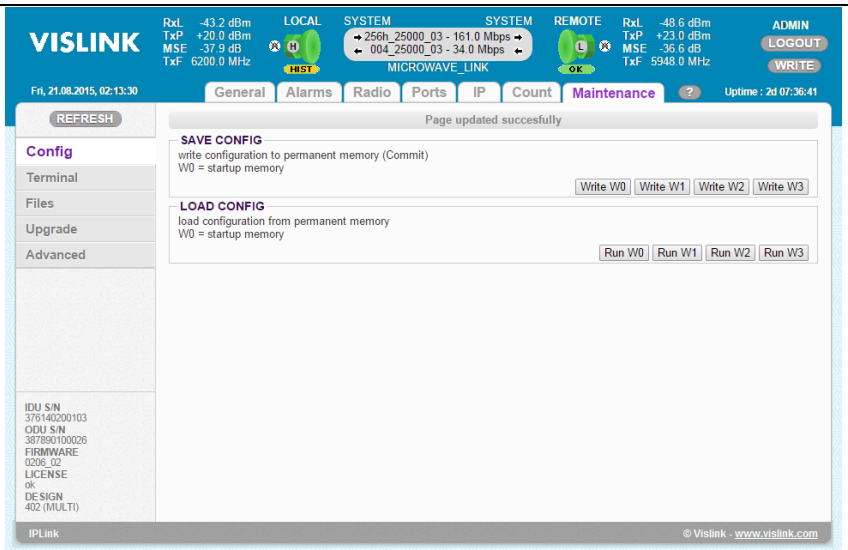

Figure 6-36 Graphs Page Overview

The Configuration Page provides a means to save and load configured link parameters.

6.9.1.1. Save Config

To save configuration changes to permanent memory, so that the settings will be restored after a power cycle, the Write button (located at the top left and available on every web page) must be selected.

In this section, the Write W0 button will perform the same action as the Write button. The Write W1, W2 and W3 buttons provide the facility to save different configurations to memory (however these will not be automatically restored after a power cycle).

6.9.1.2. Load Config

When configurations have been saved, this section provides the facility to recall any of the four saved settings.

6.9.2. Terminal Page

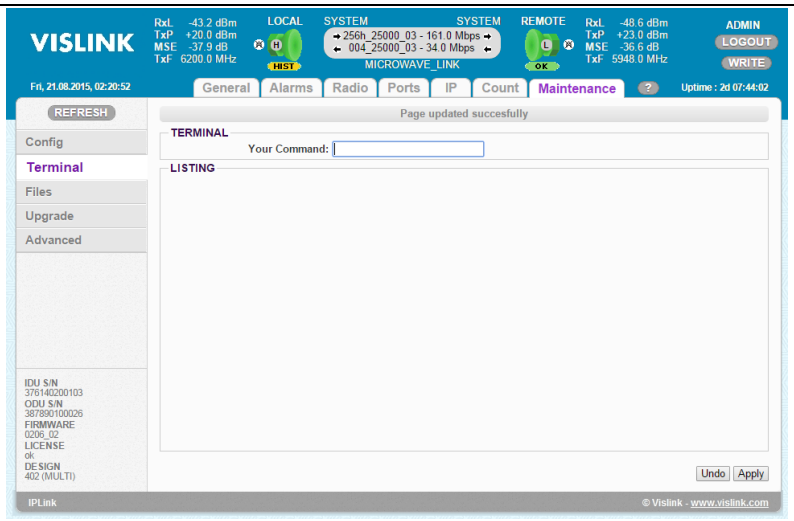

Figure 6-37 Terminal Page Overview

This page provides the means to enter commands as listed below.

- show manual – shows manual with full description of all CLI commands
- ? – shows all available commands and their syntax
- show ? – shows all available parameters of show command
- show [command] – shows status of the link and details about stored configuration
- set ? – shows all available parameters of set command
- set [command] – sets selected parameters of link

6.9.3. Files Page

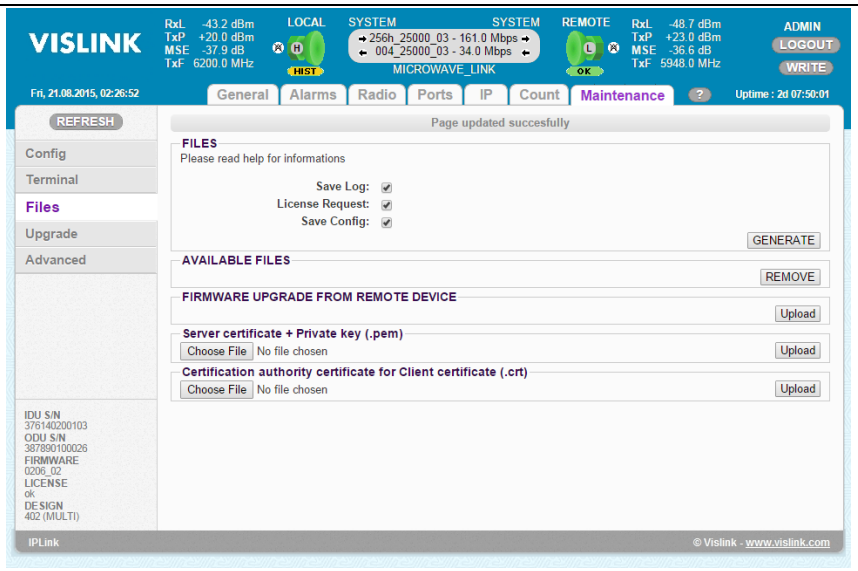

Figure 6-38 Files Page Overview

The Files page of the Maintenance Tab enables the saving of files and remote firmware updates.

It is recommended to make a backup of complete IDU configuration for an eventual system fault. In order to guarantee quick system repair or units replacement this backup configuration should be stored on reliable medium.

6.9.3.1. Files

This section allows for files to be selected for download. Clicking on the Generate button will prepare the files for download via the web browser. Files can also be transferred to an ftp server (See section 6.7.4.2).

6.9.3.2. Available Files

This section allows for old files on the system to be deleted by clicking on the Remove button.

6.9.3.3. Firmware Upgrade from Remote Device

This section provides the facility to upload an afw package from a PC to the unit.

For remote firmware update use the following command on the remote side terminal:

- update fw rfi1 <filename>.afw

6.9.3.4. Server Certificate + Private Key (.pem)

This section provides the facility to upload a server certificate and corresponding private key for HTTPS connections. On the client (browser) access, it will be necessary to allow an exception for this SCF, or to upload the certificate of CA signed by this SC.

6.9.3.5. Certification Authority Certificate for Client Certificate (.crt)

This section provides the facility to upload a CA certificate signed by CC used to identify the client (browser) for https connections.

6.9.4. Upgrade Page

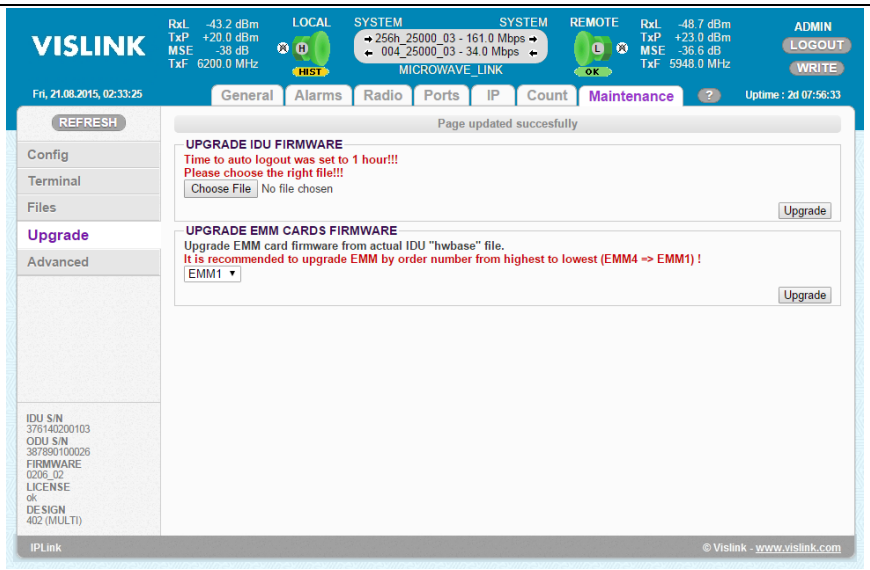

Figure 6-39 Upgrade Page Overview

This page provides a means to upgrade IPLink and EMM Firmware and Licenses.

6.9.4.1. Upgrade IDU Firmware

6.9.4.1.1. License Upgrade

New license is active after one of the following events:

- New license is checked by selection on GUI General/License page.
- New modulation is selected.
- When periodical license update loop is over (once per 6 hours).

6.9.4.1.2. Firmware Upgrade

IDU firmware is divided into four sections:

- hwbase.afw – software for internal HW parts.
- oskernel.afw – operating system.
- dev.afw – drivers for OS.
- fwbase.afw – application software (WEB, SNMP, commands, etc.).

Assistance packages in every firmware release:

- checkversions.afw – compares the firmware version in IDU with the newest version.
- fw_all.afw – compares version of firmware in IDU with the newest version and then automatically upload the different parts.

6.9.4.2. Upgrade EMM Cards Firmware

Select EMM card for which new firmware should be updated and press the Upgrade button. Check terminal window and press continue when upgrade process is successful.

6.9.5. Advanced Page

Figure 6-40 Advanced Page Overview

6.9.5.1. Design Type

According to the content of a license file, a user can select a specific Design Type that changes the complete system function. Change of design involves reboot of FPGA and correct hwbase software loading. The setting must be applied by selecting the Apply button. Possible selections are:

- SINGLE – one independent traffic channel over air.
- MULTI – up to four independent traffic channels over air.
- PROTECTED 1+1 – link protection by means of two IDUs.
- AGGREGATE 2+0 – speed aggregation by means of two IDUs.

6.9.5.2. Fans Configuration

Not Applicable for IPLink.

6.9.5.3. Auto Configuration

Start-up configuration is loaded after ten minutes of continuous error state when the tick box is selected. It is recommended to disable this function during link configuration and installation.

6.9.5.4. Factory Default

Two different factory settings are available.

6.9.5.4.1. Run Default Config

This parameter restores the default configuration of the most important IDU parts but some of the customer specific settings will remain without change (design type, IP section, TX/RX frequencies, TX Power, modulation type). It provides the facility to keep the remote connection with IDU but it also helps to return default configuration of extended configuration modes. The restored configuration must be then stored into start-up memory by pressing the Write button.

6.9.5.4.2. Restore Factory Default

This feature restores the complete factory default configuration. All stored configuration will be lost. This selection should be used only when local management access to IDU is ensured.

6.9.5.5. Reboot Device

IDU is restarted after this selection.

6.9.5.6. Reset EMM Cards

All connected EMM cards are restarted after this selection.

This page is intentionally unused.

7. Optional External IPLink Expansion Module

An external 1 RU x 19" rack-mount Expansion Module can provide the addition of ASI and/or EI/T1 channels. There are three different expansion modules available; 4 ASI channels, 16 E1/T1 circuits and 4 ASI channels with 16 E1/T1 circuits. The Expansion Modules are interconnected via the “EMM” optical connector located on the rear panel of the IPLink transceiver and the “SFP” port located on the front panel of the Expansion Module. A maximum of four External Expansion Modules can be interconnected in series to an IPLink radio terminal.

Management of all External Expansion Modules are configured and monitored by the IPLink’s internal management system and accessed via radios GUI.

External Expansion Module units are powered by an external AC to -48 VDC power supply with the GND connected to the positive pole.

7.1. E1/T1 IPLink Expansion Module

The IPL-IDU-E1T1-EXPI provides E1/T1 extension for IPLink. The module enables multiplexing up to 16 E1 / T1 circuits. The multiplexer features a basic unit with 16 x E1/T1 built-in ports and 2 x SFP 1000Base-SX ports. Four IPL-IDU-E1T1-EXP Expansion modules can be interconnected together providing up to a maximum of 64 x E1/T1 circuits:

- E1/T1 PORTS – RJ-45 connectors for G.703 signals connection (by default unbalanced)
- SFP 1 UPLINK1 – master SFP port reserved for connection to IPLink or to master Extension module card in Extension module chain
- SFP 2 UPLINK2 – slave SFP port reserved for connection to slave Extension module card in Extension module chain or to relay IPLink in add/drop configuration
- -48 VDC – power supply connector, + pole is grounded inside the device
- Grounding connector

Figure 7-1 and show the pinouts for the 16 E1 user ports.

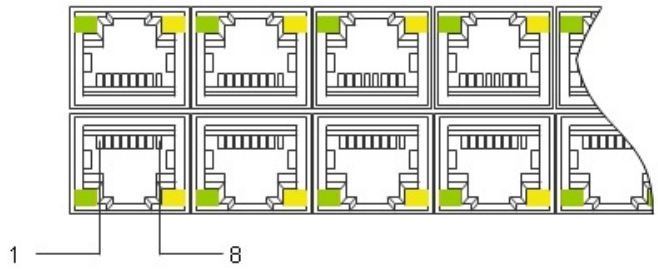

Figure 7-1 EI User Port Pinout Overview

Pin	Signal
1	Rx-
2	Rx+
4	Tx-
5	Tx+

Table 7-1 EI User Port Pinout

All the ports are protected against ESD (electrostatic discharge), CDE (Cable Discharge Events), and lightning. In case of connecting 16E1 balanced RJ45 interface to your unbalanced BNC E1 interface ports the following cable must be used in conjunction with a shielded RJ45 connector:

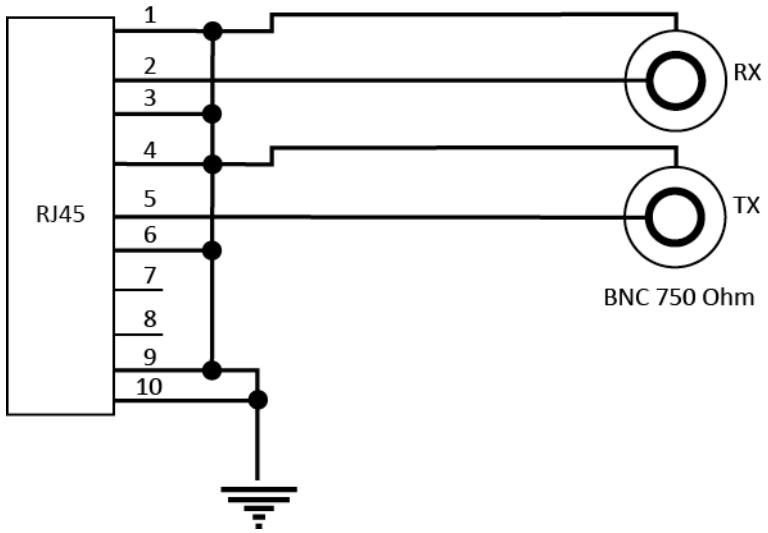

Figure 7-2 RJ45 Ethernet to BNC E1 Cabling Overview

Pinout for this cable is as follows:

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

Table 7-2 RJ45 Ethernet to BNC E1 Cabling Pinout

7.1.1. LED Indicators on the IPL-IDU-E1T1-EXP – System Status

- STATUS – indication of the LOCAL Extension module status:
  - Lights – status OK (card enabled, proper communication with IPLink)
  - Flashes – status WARNING (card is not enabled in the system or no communication with IPLink)
  - No light – status ERROR (a firmware is not loaded into Extension module HW)
- POWER – indication that EMM is under power (green LED):
  - Lights – power ON
  - No light – power OFF

7.1.2. LED Indicators on the IPLink – IPL-IDU-E1T1-EXP – Port Status

- SFP 1/2 LINK – indication of presented signal at SFP port:
  - Flashes – signal detected and synchronized, valid communication with IPLink
  - No light – no correct signal detected
- LINK – indication of G.703 link status on appropriate port (green LED):
  - Lights – signal detected at port
  - No light – no link at port
- AIS – indication of AIS signal at appropriate G.703 port:
  - Lights – AIS signal detected
  - No light – no AIS at appropriate G.703 port

7.1.3. Technical Specification of IPL-IDU-E1T1-EXP Module

Item	Parameter	Details
IPL-IDU-E1T1-EXP	Number of Ports	16 (16xRJ-45)
	Interface	G.703-E1 balanced 120Ω for E1 mode G.703-E1 unbalanced 75Ω for E1 mode T1.102-T1/100Ω for T1 mode
	Specification Compliance	T1.102, AT&T Pub 62411, T1.231, T1.403, ITU-T G.703, G.742, G.775, G.823, ETS 300 166, and ETS 300 233
	Coding	HDB3 for E1 mode, B8ZS for T1 mode
	Speed	2.048 Mbps for E1 mode, 1.554Mbps for T1 mode
	IPLink Direction Interface	1 x SFP 1000 Base-SX (proprietary GIGE protocol) for connection with IPLink
	EXT Module Extension Interface	1 x SFP 1000 Base-SX (proprietary GIGE protocol) for connection with additional EMM module
	EXT Module Scalability	Up to 64 E1/T1 with combination of 4x EMM-16E1/T1 modules in series

Table 7-3 Traffic Interfaces

Item	Parameter	Details
Ports	Main NMS ports	2 x SFP 1000 Base-SX (proprietary GIGE protocol) from IPLink
NMS Form	Protocols	Proprietary
	Management Speed	1Mbps
GUI	Type	Web–based as additional function of IPLink
SNMP	Version	SNMP v1, SNMP v2c, SNMP v3 IPLink support
	Read access	Complete MIB IPLink support
	Write access	Sub-set of link parameter IPLink support
Security	Licenses	Time limited/permanent IPLink Support
	Access levels	Guest/User/Admin with password security IPLink Support

Table 7-4 Network Management System

Item	Parameter	Details
Mechanical	Dimensions	224mm (width) x 44mm (height) x 134mm (depth)
	Weight	1.3kg
	Protection	EN 60529 (IP31)
Input Voltage Level	EMM only	-20 VDC up to -60 VDC (standard version)
Power Consumption	IPLink-16 x E1/T1-EXT	< 9 W
Environmental Operational Conditions	Temperature	-5°C to +45°C
	Humidity	0 to 95%, non-condensing
	Altitude	4,500 meters
Compliance	Operation	ETSI EN 300 019, Part 1-3, Class 3.2
	Storage	ETSI EN 300 019, Part 1-1, Class 1.2
	Transportation	ETSI EN 300 019, Part 1-2, Class 2.3
	Power	EN 300 132-2
	EMC	EN 55022 class B, EN 61000-4-2,3,4,5,6,8,11 EN 61000-3-2,3
	Safety	IEC 60950-1/EN 60950-1

Table 7-5 Miscellaneous

7.2. Integrated ASI Module – IPL-IDU-ASI-EXP

This option provides ASI functionality for IPLink. The integrated IPLink-ASI-EXT card enables multiplexing up to four additional ASI channels.

The real overall capacity for ASI is allocated in the PBPS based on true selected ASI ports using the IPLink Web interface. Priority Base Packet System (PBPS) is proprietary multiplexer system.

IPL-IDU-ASI-EXPEach ASI channel can be independently configured into TX or Rx mode. ASI Rx is from the perspective of the radio, e.g. ASI into the device. ASI TX is transmitted from the device. Following port combinations are available by this setting:

- 4x ASI TX (unidirectional)
- 3x ASI TX, 1x ASI Rx (bidirectional)
- 2x ASI TX, 2x ASI Rx (bidirectional)
- 1x ASI TX, 3x ASI Rx (bidirectional)
- 4x ASI Rx (unidirectional)

The Priority Base Packet System (PBPS - proprietary multiplexer system) is used for 1 up to 4 ASI channels multiplexing. The data PBPS stream is first completed with management data channel for communication with the connected IPLink and subsequently is packed into standard Ethernet frame. The PBPS packets from IPLink-ASI-EXT are then combined with another PBPS packets from internal data sources (Ethernet) assembled on IPLink according to default priority scheme.

7.2.1. Technical Specification for IPL-IDU-ASI-EXPEXT

Item	Parameter	Details
IPL-IDU-ASI-EXP	Number of Traffic Ports	4 (4 x BNC)
	Interface	Unbalanced 75Ω
	Tx Output Voltage (p-p)	800 mV
	Min Rx. Sensitivity	200 mV (for D21.5 idle pattern)
	Specification Compliance	DVB-ASI, EN/ISO/IEC 13818-1, ETS 300 429
	Coding	8B/10B, MPEG-2 TS
	Port Speed	270 Mbps at BNC port
	Max. speed for ASI channel	216 Mbps
	ASI channel shaping	8-216 Mbps
	Packet format	188 bytes/204 bytes (with FEC)

Table 7-6 Traffic Interfaces

Item	Parameter	Details
Mechanical	Dimensions	224mm (width) x 44mm (height) x 134mm (depth)
	Weight	1.3kg
	Protection	EN 60529 (IP31)
Input Voltage Level	IPLink-EXT only	-20 VDC up to -60 VDC (standard version)
Power Consumption	IPLink-ASI-EXT	< 9 W
Environmental Operational Conditions	Temperature	-5°C to +45°C
	Humidity	0 to 95%, non-condensing
	Altitude	4,500 meters
Compliance	Operation	ETSI EN 300 019, Part 1-3, Class 3.2
	Storage	ETSI EN 300 019, Part 1-1, Class 1.2
	Transportation	ETSI EN 300 019, Part 1-2, Class 2.3
	Power	EN 300 132-2
	EMC	EN 55022 class B, EN 61000-4-2,3,4,5,6,8,11 EN 61000-3-2,3
	Safety	IEC 60950-1/EN 60950-1

Table 7-7 Miscellaneous

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8. Optional External High Power Amplifier

The range of the IPLink's transmission may be increased by use of the IPLink DHPA (rack mounted digital power amplifier). The DHA boost the power by 8dB nominal (up to 12.5W linear output power) providing long range transmissions of up to 100km.

8.1. Front Panel Overview

Figure 8-1 Optional External DHPA Front Panel Overview

8.1.1. Power Switch

System power on/off – when lit, power is applied to the transceiver.

8.1.2. LEDs

On power up the three LEDs will flash orange twice to act as a visual confirmation that the LEDs are working. If all three LEDs remain off the supply, PSU or other hardware has failed.

After initialisation the LEDs will indicate the following:

State	Description
Red (slow flash)	Unit waiting for operational setup (control input)
Orange (slow flash)	Unit waiting for stable RF input power to be present
Green	RF input in range
Red	Unit could not achieve RF output level or hardware failure

Table 8-1 RF-In LED

State	Description
Red	RF output level out of range
Orange (slow flash)	Unit adjusting RF output level
Green	RF output in range
Red (quick flash)	Unit could not achieve RF output level or hardware failure

Table 8-2 RF-Out LED

State	Description
Green	Bypass active – unit not amplifying RF
Off	Bypass not active – unit amplifying RF
Red	Bypass relay failure – relay status does not match command value

Table 8-3 Bypass LED

8.2. Rear Panel

Figure 8-2 Optional External HP Amp Rear Panel Overview

8.2.1. AC Power

Provides AC power to the unit.

8.2.2. USB

USB type B connector for software upgrades.

8.2.3. Remote (9-Pin D-Sub Type Female)

This connector is currently only used for factory configuration.

8.2.4. IPLink (9-Pin D-Sub Type Male)

This connector is used for communicating with an external DHPA (rack mounted PA).

Pin	Signal
1	NC
2	RS282 TX
3	RS282 RX
4	NC
5	GND
6	NC
7	NC
8	NC
9	NC

Table 8-4 9-pin D-sub Pinouts

8.2.5. RF Out

SMA 50Ω female connector – RF signal out to antenna.

8.2.6. RF In

SMA 50Ω female connector – RF signal in from IPLink.

Appendix A Safety Information

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

Essential requirements under Article 3	Harmonized standards under Article 5
Article 3.1 (a): Protection of health and safety of users (contained requirements of Directive 73/23/EEC and council recommendation 1999/519/EC)	EN 60950-1 (2006) EN 50 385 (2002)
Article 3.1 (b): Electromagnetic compatibility (contained requirements of Directive 2004/108/EC)	ETSI EN 301 489-1 V 1.6.1(2008) ETSI EN 301 489-4 V1.3.1(2002)
Article 3.2: Requirements for effectively use the frequency spectrum	ETSI EN 302 217-1 V1.2.1 (2007)

Table A-1 Requirements and Harmonized ETSI standards

Essential requirements	Standards
US FCC limits	System has been tested for compliance with FCC Part 74, Part 101 and the General requirements of Part 2. The limits for digital devices pursuant to Parts 15.107 and 15.109 Class A has been applied.

Table A-2 Requirements and Harmonized FCC Standards

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

NOTE: Modifying or tampering with IPLink´s internal components can cause a malfunction and might invalidate its warranty.

The IPLink is a fixed transceiver. This unit, operated without an antenna, will not create RF energy exceeding 1.0 mW/cm2, the FCC limit for exposure. Once connected to an antenna, the potential for harmful exposure will be greatly enhanced.

In this situation, a certain distance from the radiator is to be maintained. Calculations need to be performed to understand what that safe margin for exposure is. This is known as the Maximum Permissible Exposure (MPE) limit.

NOTE: Hazardous RF radiation limits and recommended distances may vary by country. Ensure that all applicable state and federal regulations are observed when using this transmitter.

Calculations provided are for common antennas often utilized in the ENG environment. The following formula used is that suggested by OET 65.

Table A-3 shows the MPE minimum safe distances from the antenna.

Antenna Gain (dBi)	0	2	3	5	11
Safe Distance (cm)	2	2	2	3	5
Safe Distance (inch)	0.79	0.79	0.79	1.18	1.97

Table A-3 MPE Minimum Safe Distances

Vislink, in accordance with the requirements set forth by the FCC, provides this information as a guide to the user. It is assumed that the users of this equipment are licensed and qualified to operate the equipment per the guidelines and recommendations contained within the product user guides and in accordance with any FCC rules that may apply.

A.1. Calculating MPE

EIRP = P * [10(G / 10)] = (AntiLog of G/10) * P

P = RF power delivered to the antenna in mW

G = Power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the centre of radiation of the antenna in centimetres

S = MPE in mW/cm² (milliwatts per square centimetres)

A.1.1. Conversions

dBi to numeric gain = AntiLog (dBi/10) Feet to centimetres = Feet * 30.48

Centimetres to Feet = cm * 0.0328

4 π = 12.57

A.1.2. User Input

RF power delivered to the antenna = Watts

Antenna gain (referenced to isotropic antenna) = dBi

Distance from the centre of radiation = Feet

A.1.3. Calculation Steps

1. [P] RF power input. Watts to milliwatts = Watts * 1000
2. [G] Antenna gain dBi. Numeric gain = AntiLog (dBi/10)
3. [EIRP] Multiply P * G
4. [R] Centimeters to feet = Centimeters * .0328
5. Square R
6. Multiply $R^2 * 4\pi$
7. [S] Divide ($R^2 * 4\pi$) into EIRP
8. Power Density in milliwatts per square centimeters

NOTE: At frequencies above 1500 MHz, S must not be greater than 1.

A.1.4. Reference

FCC OET Bulletin 65, August 1997 - Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.

The following tables show the permissible exposure distance for various antennas. Data will vary based on the actual transmitter, output power, frequency, and antenna utilized. One table provides the permissible output of the transmitter for low-power digital modulation, and the other table for high-power digital modulation.

This information is provided, in accordance with the requirements set forth by the FCC, as a guide for you assuming that users of this equipment are licensed and qualified to operate the equipment per the guidelines and recommendations contained within the product user guides and in accordance with any FCC rules that may apply.

A.1.5. Low Power

Antenna Gain (dBi)	0	29	36	40	43
Minimum Safe Distance from Antenna (cm)	9	252	563	893	1261
Minimum Safe Distance from Antenna (inch)	3.54	99.19	221.60	351.48	496.33

Table A-4 MPE Low Power Minimum Safe Distances

A.1.6. High Power

Antenna Gain (dBi)	0	29	36	40	43
Minimum Safe Distance from Antenna (cm)	13	356	797	1262	1783
Minimum Safe Distance from Antenna (inch)	5.12	140.12	313.70	496.72	701.79

Table A-5 MPE High Power Minimum Safe Distances

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Appendix B Payload Capacity, Bitrates & TX Power

B.1. IPLink RF Output (Before Branching Filtering)

TX Power (+/- 1dBm) across Frequency Band.

RF Output Range	Modulation	RF Module Output
6.425 – 7.125 GHz	QPSK	+34 dBm
	8PSK	+32 dBm
	16 QAM	+33 dBm
	32 QAM	+32 dBm
	64 QAM	+30 dBm
	128 QAM	+30 dBm
	256 QAM	+27 dBm
6.425 – 7.125 GHz	QPSK	+33 dBm
	8PSK	+32 dBm
	16 QAM	+32 dBm
	32 QAM	+31 dBm
	64 QAM	+29 dBm
	128 QAM	+29 dBm
	256 QAM	+26 dBm
7.725 – 8.500 GHz	QPSK	+32 dBm
	8PSK	+31 dBm
	16 QAM	+31 dBm
	32 QAM	+30 dBm
	64 QAM	+28 dBm
	128 QAM	+28 dBm
	256 QAM	+25 dBm
13.000 GHz	QPSK	+29 dBm
	8PSK	+28 dBm
	16 QAM	+28 dBm
	32 QAM	+27 dBm
	64 QAM	+25 dBm
	128 QAM	+25 dBm
	256 QAM	+22 dBm

Table B-1 RF Module Output

B.2. Bit Rates Transmission Power for IPLink

Data throughput include strong LDPC forward error correction overhead.

Channel Bandwidth	Modulation	Throughput	Measured RSL Threshold
25 MHz	QPSK	39 Mbps	-90.00 dBm
	8PSK	58 Mbps	-84.90 dBm
	16 QAM	77 Mbps	-88.00 dBm
	32 QAM	97 Mbps	-79.70 dBm
	64 QAM	120 Mbps	-77.40 dBm
	128 QAM	140 Mbps	-74.40 dBm
	256 QAM	162 Mbps	-72.20 dBm
	256h QAM	166 Mbps	-68.42 dBm
30 MHz	QPSK	41 Mbps	-88.40 dBm
	8PSK	61 Mbps	-83.90 dBm
	16 QAM	80 Mbps	-82.00 dBm
	32 QAM	99 Mbps	-78.50 dBm
	64 QAM	127 Mbps	-76.10 dBm
	128 QAM	150 Mbps	-72.90 dBm
	256 QAM	176 Mbps	-69.90 dBm
	256h QAM	192 Mbps	-66.40 dBm

Table B-2 Channel Bandwidth

Appendix C Configuration Notes

This appendix provides examples of typical configurations that can be used to begin data transmission from local to remote IPLink transceivers

C.1. Introduction

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

⚠ CAUTION: Do not use the browser functions back or page refresh during the set-up or for viewing a previous window. Use only the Main menu, submenu folders and Web interface buttons of IPLink transceiver.

C.2. Connection and Login

C.2.1. Local Access over Ethernet LAN Interface

To setup the IPLink via the management LAN port (see Section 3.2**Error! Reference source not found.**) create a connection between the IPLink and the PC to be used for configuration, via an Ethernet cable to the RJ45 connector on the front panel.

C.2.2. Login from the Web Interface

Before attempting to connect to the unit from a PC it will be necessary to configure the computer's network connection. The secondary IP address for access via LAN port is set by default to 10.10.10.10/8 (network mask 255.0.0.0).

After configuring the computer's network connection, a Web browser can be launched. Enter the secondary IP address of IPLink, i.e. 10.10.10.10, into the address bar of the Web browser (example for connection over MNG LAN port). Once the browser has found the unit the Login page will be displayed (see Section 6.1).

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

There is an automatic timeout in the device – after period of 10 minutes of inactivity (in the Web environment) any user is automatically logged out.

For the standard configuration we recommend to login in the User mode. Administrator level is superior to the User level. When the Administrator tries to login the system and the User is already in the system, an alert window asks if the Administrator wants to force the logout of the User (as only one connection is allowed at a time, as described above).

C.3. General System Configurations

C.3.1. Info Page

It is recommended to fill in the General tab – Info page (see Section 6.3.4) table with complete link identification. This will be helpful for the next system description.

C.3.2. Date Page

It is recommended to accurately set the Date and Time information in the General tab – Date page (see Section 6.3.6) for all IPLink systems within the microwave network. This will be helpful especially for alarm event and log analysis.

C.3.3. Access Rights

It is possible to monitor and manage the microwave link IPLink after the login into the system only, both locally and remotely. Dependent on the login level (after entering a Login and a Password) the relevant access rights are automatically granted to the user, which affect the scope of the management capabilities for the microwave link. These login levels must be respected both in access from Web interface as well as from a Telnet, SSH or SNMP connections. It is recommended to change default login names and passwords for access into managed networks, which may be configured via the General tab – Users page (see Section 6.3.7).

C.3.4. Alarm Configuration

A proper alarm configuration helps to effectively solve potential troubleshooting events and/or disclose any system instability. From the configuration point of view all of the most important alarm settings are available from the Web interface under the Alarms tab – Configuration and Status page (see Section 6.4.1).

C.4. Radio Configuration

The basic Radio configuration is available from the Web Interface Radio Tab – Parameters page (see Section 6.5.1). Parameters for both local and also for a remote unit can be set together in one configuration step when appropriate boxes for local and remote unit are edited.

The modulation scheme settings and the channel bandwidth affect the final data rate (data throughput) and sensitivity (link distance) of the microwave link. Generally speaking, the narrower the bandwidth and the lower the modulation are, then the lower the data rate but greater the sensitivity will be.

Dependent on the type of supplied license (limit for maximum data rate) the modulation type can be changed (type of modulation can be adjusted or changed up to a maximum transmission capacity). Microwave link can be ordered with the different licenses in accordance with actual price list and business policy. The transmission capacity can then be changed in the range of 10 Mbps up to a maximum data rate of supplied license, maximum 365 Mbps for 1+0 mode.

The microwave link can be supplied with a higher type of modulation (with higher data rate) for a limited period via a time-restricted license, e.g. for temporary testing. After the expiration of this period the maximum type of modulation is automatically downgraded to

the default modulation from license and the user data transmission capacity is disabled (0 Mbps). It will not affect the out-of-band management channel.

The modulations are named according to the combination of the following parameters. Behind the modulation code, there is written the overall Capacity – real data throughput. Modulation name coding is described in the following example.

Example: 128_28000_01:

- 256 – code for 256 QAM, other possibilities are 4/8/16/32/64/128/256
- 56000 – code for 56 MHz bandwidth, other possibilities are:
  - 07000, 10000, 14000, 20000, 27500, 28000, 30000, 40000, 50000, 56000, 60000
- 01 – code for modulation version

Any change must be finally confirmed with pressing the Apply button. All the basic parameters can be configured for local and remote terminal from this page when the proper connection is established. Save all changes and configurations by selecting the Write button.

C.5. Port Configurations

C.5.1. Design Mode – Single

Port settings in Single mode use the simplest configuration scheme, as just one independent traffic channel is available for configuration. The internal ETH switch is divided into two separate groups. Group 1 is reserved for management purposes (out of band type of management) and Group 2 is generally designated for traffic purposes.

The customer can use up to three LAN ports (SFP 1, LAN 1, LAN 2) for traffic connection into and allocate the maximum speed for ETH traffic over RF link.

C.5.2. Design Mode – Multi

Port settings in Multi-mode offer an option to select up to four independent over air traffic channels. The internal ETH switch is divided into three separate groups. Group 1 is usually reserved for management purposes (out of band type of management), Group 2 is designated for the first traffic channel (the lowest priority), and Group 3 is designated for the second traffic channel (higher priority).

The other two traffic channels are connected directly to SFP PHYs, so no ETH switch is the part of such LAN interconnection. Traffic channel ETH 4 has the highest priority inside the packet processor structure.

The Speed Allocation set-up is different in comparison with Single mode. The overall allocated traffic capacity (the sum of all ports capacity) should be in the range of available speed for actual modulation scheme. When the adaptive modulation mode (ACM) is enabled, then the user must consider which lower priority channels do not need the free capacity allocation in the case of switch to lower level modulation scheme.

C.5.3. Design Mode – Protected 1+1

Port settings for Protected 1+1 mode are similar to Multi mode, but only three independent over air traffic channels are available. Port SFP 1 is reserved for protection function (interconnection with neighbour).

There also exists a difference between master and slave units. All standard traffic ports (LAN 1, LAN 2, SFP 2) are automatically disabled (DOWN) at slave unit. This prevents from the multipath Ethernet loops. The same ports are also disabled when protection mode is configured into off mode.

C.5.4. Design Mode – Aggregate 2+0

Port settings for Aggregate 2+0 mode are different for master and slave units. Traffic port SFP 1 and channel ETH-1 at master unit are reserved for the aggregation function, next two channels ETH-2 can be used for next independent traffic streams.

The channel ETH-2 at the slave unit is reserved for the slave aggregation stream (correct speed must be set); other ETH channel (ETH 1) is available for next independent data source.

C.5.5. ETH VLAN Settings

VLAN configuration is basically used for the separation of management traffic from other customer data traffic. It can be useful to configure ETH VLANs also for customer traffic and filter ingress data traffic by means of these settings in some specific applications. See Ports tab – ETH VLAN page (see Section 6.6.2).

C.6. ETH Advanced Settings

C.6.1. QoS Ethernet Setting

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

C.6.2. Priority Abbreviations

- FPRI – initial frame priority 0 up to 7 (bits [2:0])
- QPRI – queue priority 0 up to 3 (bits [1:0])
- IQPRI – initial queue priority 0 up to 3 (bits [1:0])
- OQPRI – queue override priority 0 up to 3 (bits [2:1] from QOS PRI value)
- PRI_T – PRI bits from 802.ac VLAN tag
- PRI_IP – hex value of IP v4/6 frame's TOS/DiffServ/TC bits [7:2]

C.6.3. Port Default Priority

- FPRI_D – port default frame priority, defined with Port Priority value
- QPRI_D – port default queue priority, defined with next mapping table:
  - QPRI_D – 0 when FPRI_D=0/1
  - QPRI_D – 1 when FPRI_D=2/3
  - QPRI_D – 2 when FPRI_D=4/5
  - QPRI_D – 3 when FPRI_D=6/7

C.6.4. IEEE Tag Priority

- FPRI_T – IEEE Tag frame priority, defined with value of PRI bits from VLAN tag
- QPRI_T – IEEE Tag queue priority, defined with next mapping table:
  - QPRI_T – 0 when FPRI_T=0/1
  - QPRI_T – 1 when FPRI_T=2/3
  - QPRI_T – 2 when FPRI_T=4/5
  - QPRI_T – 3 when FPRI_T=6/7

C.6.5. IP v4/6 Priority

- FPRI_IP – IPv4/6 frame priority, defined with following figure:
  - FPRI_IP – QPRI_IP*2 + FPRI_D[0]
  - or, defined in another way:
  - FPRI_IP[2:1] – QPRI_IP[1:0]
  - FPRI_IP[0] – FPRI_D[0]
  - QPRI_IP – IPv4/6 queue priority, defined with next mapping table (hex values)
- QPRI_IP – 0 when PRI_IP=00/04/08/0c/10/14/18/1c/20/24/28/2c/30/34/38/3c:
  - QPRI_IP – 1 when PRI_IP=40/44/48/4c/50/54/58/5c/60/64/68/6c/70/74/78/7c
  - QPRI_IP – 2 when PRI_IP=80/84/88/8c/90/94/98/9c/a0/a4/a8/ac/b0/b4/b8/bc
  - QPRI_IP – 3 when PRI_IP=c0/c4/c8/cc/d0/d4/d8/dc/e0/e4/e8/ec/f0/f4/f8/fc

C.6.6. Priority Policy

This setting in the Ports tab – ETH Advanced page (see Section 6.6.4) defines the initial ingress queue policy. It defines the initial rules for what output queue will be assigned to every ingress frame.

The following rules are in place for priority assignment (from the top to the bottom order):

9. All:

- Tagged IPv4/6 frames:
  - IQPRI = QPRI_T
  - FPRI = FPRI_T
- Tagged non IPv4/6 frames:
  - IQPRI = QPRI_T
  - FPRI = FPRI_T
- Untagged IPv4/6 frames:
  - IQPRI = QPRI_IP
  - FPRI = FPRI_IP
- Untagged non IPv4/6 frames:
  - IQPRI = QPRI_D
  - FPRI = FPRI_D

10. Port only:

- All frame types:
  - QPRI = QPRI_D
  - FPRI = FPRI_D

11. Tagged only:

- tagged frames:
  - IQPRI = QPRI_T
  - FPRI = FPRI_T
- untagged frames:
  - QPRI = QPRI_D
  - FPRI = FPRI_D

12. IPv4/6 only:

- IPv4/6frames:
  - IQPRI = QPRI_IP
  - FPRI = FPRI_IP
- Non-IPv4/6 frames:
  - IQPRI = QPRI_D

- FPRI = FPRI_D

C.6.7. Firmware and License Upgrade

Firmware and license upgrade is available only when logged in as an ADMIN user. We recommend verification of the loaded version of firmware in the unit before upgrading or updating the license of microwave link. It is possible that the older firmware does not recognize the new designs, options or functions contained in new license key and will not run properly.

Both Firmware and License upgrade are available from the Maintenance Tab – Upgrade Page (Section 6.9.4) and use the same update process.

C.6.8. License Upgrade

Proper license file must be selected and confirmed by OK button. Upgrade process is then monitored via the processing window. New license is active after one of next events:

- New license is checked by selection of the General/License page.
- New modulation is selected.
- When periodical license update loop is over (once per 6 hours).

C.6.9. Firmware Upgrade

Firmware is divided into four sections dependent on their functions. For every firmware release it is not necessary to update all the parts, but only these ones that are different compared to the latest version. There is basic firmware parts description in the following text:

- hwbase.afw – software for internal HW parts
- oskernel.afw – operating system
- dev.afw – drivers for OS
- fwbase.afw – application software (Web, SNMP, commands, etc.)

Assistance packages are also contained in every firmware release:

- checkversions.afw – this package compares the firmware version in the unit with the newest version and prints the information about which parts are necessary to upload.
- fw_all.afw – this package compares the current version of firmware in the unit with the newest version and then automatically uploads the different parts.

C.6.11.Recommended Steps for Firmware Update

1. Login to the Web interface as an ADMIN user.
2. Save currently running configuration by selecting the Write Button, which is available on each Web interface page.
3. Compare currently running versions of each firmware parts (os_kernel, os_dev, hw_base and fw_base) with the newest version by one of two below given steps:
    a. manually compare data shown in General Tab – Info Page with the new version of description file version.txt
    b. go to Maintenance Tab – Upgrade Page, select package checkversions.afw and use the print-out for information, what parts should be upgraded.
4. Next choose one of the following steps.
    c. select the file fw_all.afw from the provided SW package. The entire file will be uploaded into the device, system compares the different versions and writes the different parts of the firmware into flash memory.

NOTE: This procedure is not suitable for slow access to management.

    d. Step by step select the files hwbase.afw, oskernel.afw, dev.afw and fwbase.afw in this order (if there is not necessary to upload any part, please continue with another file) and wait for the process completion.

5. After the last file is uploaded, restart the device by clicking the Reboot button, available from the Maintenance Tab – Advanced Page.

NOTE: During restart there is a data drop for about twenty seconds.

6. Login again as an ADMIN user and update start-up memory configuration with the new functional settings available in the new firmware. Save the new configuration with Write Button, which is available on each page.
7. Make a new initialization from the start-up memory by selecting Run_W0 button found in the Maintenance Tab – Configuration Page.

NOTE: During initialization there is data drop of about five seconds.

Appendix D Abbreviation List

Abbreviation	Description
AGC	Automatic Gain Control (on RF cable)
ANSI	American Standards Association
AIS	Continual sequence of ones on E1 data according to norm
ANEG	Auto-Negotiation – automatic speed and duplex set-up on LAN ports
ASI	Asynchronous Serial Interface is a streaming data format that often carries an MPEG Transport Stream (MPEG-TS). An ASI signal can carry one or multiple SD, HD or audio programs that are already compressed, not like an uncompressed SD-SDI (270 Mbit/s) or HD-SDI (1.485 Gbit/s). An ASI signal can be set at varying transmission speeds and is dependent on the engineering requirements. For example, an ATSC (US digital standard for broadcasting) has a maximum bandwidth of 19.392658 Mbit/s. Generally, the ASI signal is the final product of video compression, either MPEG2 or MPEG4, ready for transmission to a transmitter or microwave system or other device. Sometimes it is also converted to fibre, RF or SMPTE310 for other types of transmission. There are two transmission formats commonly used by the ASI interface; the 188-byte format and the 204-byte format. The 188-byte format is the more common ASI transport stream. When optional Reed–Solomon error correction data are included, the packet can stretch an extra 16 bytes to 204 bytes total.
ATPC	Automatic control of output power at RFU on the basis of Rx level at remote unit
ATU	Table of MAC addresses
BER	Bit Error Rate
DHPA	Digital High-Power Amp
EFS	Error Free Seconds
EMM	External Multiplexer Module (or the Extension card IPLink-ASI-EXT), provides ASI extension for IPLink. The IPLink-ASI-EXT card enables multiplexing up to four ASI channels into compact stream that is directed over Fibre optic connection to/from IPLink. The multiplexer features a basic unit with 4 x ASI built-in ports (one BNC per ASI channel) and 2 x SFP 1000Base-SX ports. The compact, simple to configure, and easily scalable design enables cascading with other IPLink extension devices (e.g. IPLink-16E1/T1-EXT). Use the IPLink Web interface to configure cascading IPLink system. The real overall capacity for ASI is allocated in the PBPS based on true selected ASI ports in the Web interface of IPLink. Priority Base Packet System (PBPS) is proprietary multiplexer system.
EMM alarm	This alarm state indicates that the indicated expansion module is disconnected or powered off.
ERS	Error seconds
ETSI	European Telecommunications Standards Institute
FER	Frame Error Rate (per minute)
HWADDR	MAC address of Ethernet interface
MDIX	Configuration for wires crossover on LAN ports

Abbreviation	Description
MSE	Dispersion of dots from ideal location in I/Q diagram after demodulation. The sharper the dots of status diagram are the better (value should be in interval -40 to -32dB). MSE thresholds for each modulation with bandwidth 28MHz are: 128QAM -24 dB 64QAM -21 dB 32QAM -18 dB 16QAM -15 dB 8PSK -13 dB QPSK -9 dB
MUX	Data multiplexer (aggregating of several parallel streams into one serial stream and back)
NAT	Network Address Translation – translation of IP addresses (and ports). Network address translation (NAT) is a methodology of remapping one IP address space into another by modifying network address information in Internet Protocol (IP) datagram packet headers while they are in transit across a traffic routing device. The technique was originally used for ease of rerouting traffic in IP networks without renumbering every host. It has become a popular and essential tool in conserving global address space allocations in face of IPv4 address exhaustion.
RFU	Radio Frequency Unit
PBPS	Packet Multiplexer
RFI	RF interface – interface towards PBPS
RSL	Received Signal Level in dBm
RSSI	Received Signal Strength Indication – received signal strength in mV, measured on BNC outdoor unit connector.
SDI	Serial Digital Interface
SFP	A Small Form-factor Pluggable transceiver is a compact, hot-pluggable transceiver used for both telecommunication and data communications applications. The form factor and electrical interface are specified by a multi-source agreement (MSA). It interfaces a network device motherboard (for a switch, router, media converter or similar device) to a fibre optic or copper networking cable. SFP transceivers are designed to support SONET, gigabit Ethernet, Fibber Channel, and other communications standards.
SNMP	Simple Network Management Protocol – protocol for remote system management
TBE	Time Between Errors
TDM	Time-Division Multiplexing is a method of transmitting and receiving independent signals over a common signal path by means of synchronized switches at each end of the transmission line so that each signal appears on the line only a fraction of time in an alternating pattern.
TLE	Time since Last Error occurrence
UART	A Universal Asynchronous Receiver/Transmitter is a computer hardware device that translates data between parallel and serial forms. UARTs are commonly used in conjunction with communication standards such as TIA, RS-232, RS-422 or RS-485. The universal designation indicates that the data format and transmission speeds are configurable. The electric signalling levels and methods, such as differential signalling, etc., are handled by a driver circuit external to the UART. A UART is usually an individual (or part of an) integrated circuit used for serial communications over a computer or peripheral device serial port. UARTs are now commonly included in microcontrollers.
VLAN	Virtual Local Area Network – the possibility to create more logical networks on one physical medium. A virtual LAN is any broadcast domain that is partitioned and isolated in a computer network at the data link layer (OSI layer 2).

Abbreviation	Description
	To subdivide a network into virtual LANs, one configures a network switch or router. Simpler network devices can only partition per physical port (if at all), in which case each VLAN is connected with a dedicated network cable (and VLAN connectivity is limited by the number of hardware ports available). More sophisticated devices can mark packets through tagging, so that a single interconnect (trunk) may be used to transport data for multiple VLANs. Grouping hosts with a common set of requirements regardless of their physical location by VLAN can greatly simplify network design. A VLAN has the same attributes as a physical local area network but it allows for end stations to be grouped together more easily even if they are not on the same network switch. VLAN membership can be configured through software instead of physically relocating devices or connections. Most enterprise-level networks today use the concept of virtual LANs. Without VLANs, a switch considers all interfaces on the switch to be in the same broadcast domain. To physically replicate the functions of a VLAN would require a separate, parallel collection of network cables and equipment separate from the primary network. However, unlike physically separate networks, VLANs share bandwidth, so VLAN trunks require aggregated links and/or quality of service prioritization.
VLAN ID	VLAN Identification
VTU	Table of rules for VLANs
W0-3	Names of memories in device (W0 is boot memory)

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