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BreezeNET® B130/B300 GigE
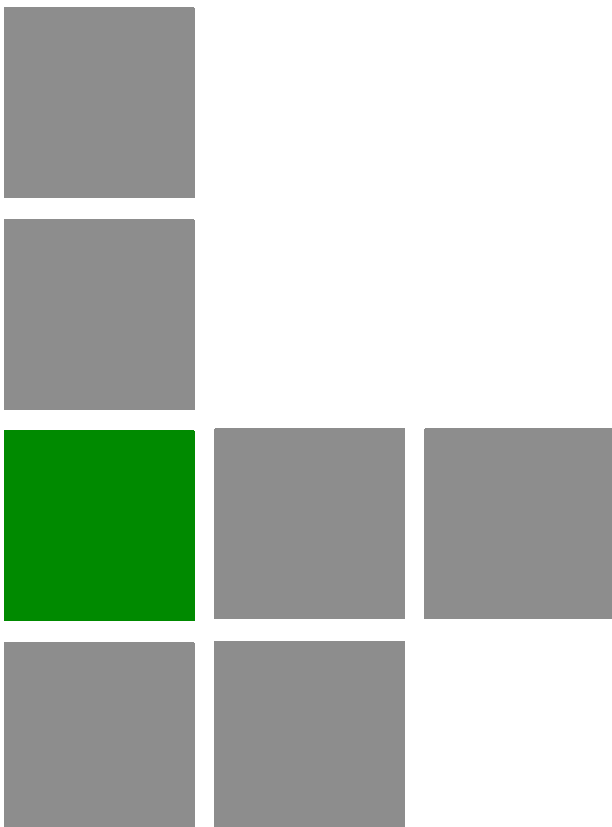
Technical User Manual

Document History

Changed Item	Description	Date
First revision	Document's first revision	April 2009
Section 2.2	Added BNB 130	November 2009
Third revision	Added GigE functionality	July 2010

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Radio Frequency Interference Statement

The Slave equipment has been tested and found to comply with the limits for a class B digital device, pursuant to ETSI EN 301 489-1 rules and Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment notwithstanding use in commercial, business and industrial environments. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

The Master equipment has been tested and found to comply with the limits for a class A digital device, pursuant to part 15 of the FCC rules and to EN 301 489-1 rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in commercial, business and industrial environments. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction

manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at the user's own expense.

FCC Radiation Hazard Warning

To comply with FCC RF exposure requirement, the antenna used for this equipment must be fixed-mounted on outdoor permanent structures with a separation distance of at least 2 meters from al persons.

Antenna Compliance Statement

This device has been designed to operate with the antennas listed in Table 2-5, and having a maximum gain of 28 dBi. Antennas not included in this list or having a gain greater than 28 dBi are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the Equivalent Isotropically Radiated Power (EIRP) is not more than that permitted for successful communication.

R&TTE Compliance Statement

This equipment complies with the appropriate essential requirements of Article 3 of the R&TTE Directive 1999/5/EC.

Safety Considerations - General

For the following safety considerations, "Instrument" means the BreezeACCESS units' components and their cables.

Safety Considerations - DC Powered Equipment

Restricted Access Area: The DC powered equipment should only be installed in a Restricted Access Area.

Installation Codes: The equipment must be installed according to the latest edition of the country national electrical codes. For North America, equipment must be installed in accordance with the US National Electrical Code and the Canadian Electrical Code.

■ The equipment must be connected directly to the DC Supply System grounding electrode conductor.

■ All equipment in the immediate vicinity must be grounded in the same way, and not be grounded elsewhere.

- The DC supply system is to be local, i.e. within the same premises as the equipment.

- There shall be no disconnect device between the grounded circuit conductor of the DC source (return) and the point of connection of the grounding electrode conductor.

Caution

To avoid electrical shock, do not perform any servicing unless you are qualified to do so.

Line Voltage

Before connecting this instrument to the power line, make sure that the voltage of the power source matches the requirements of the instrument.

Radio

The instrument transmits radio energy during normal operation. To avoid possible harmful exposure to this energy, do not stand or work for extended periods of time in front of its antenna. The long-term characteristics or the possible physiological effects of radio frequency electromagnetic fields have not been yet fully investigated.

Outdoor Units and Antennas Installation and Grounding

Ensure that outdoor units, antennas and supporting structures are properly installed to eliminate any physical hazard to either people or property. Make sure that the installation of the outdoor unit, antenna and cables is performed in accordance with all relevant national and local building and safety codes. Even where grounding is not mandatory according to applicable regulation and national codes, it is highly recommended to ensure that the outdoor unit and the antenna mast (when using external antenna) are grounded and suitable lightning protection devices are used so as to provide protection against voltage surges and static charges. In any event, AlvarionThe Supplier is not liable for any injury, damage or regulation violations associated with or caused by installation, grounding or lightning protection.

Disposal of Electronic and Electrical Waste

Disposal of Electronic and Electrical Waste

Pursuant to the WEEE EU Directive electronic and electrical waste must not be disposed of with unsorted waste. Please contact your local recycling authority for disposal of this product.

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About this Manual

This User Manual is a description of Alvarion devices and contains installation and configuration guidelines, recommendations and troubleshooting sections, and supplementary materials. The document is intended to be used by Qualified RF engineers/technicians and IT professionals. Qualified personnel should have skills and experience in the following areas:

- Outdoor/indoor radio equipment installation

- Outdoor wireless networks

- TCP/IP networking protocols

- Safety procedures and instructions for installing antenna equipment

- Professional manage of electrical equipment and accessories

Safety procedures and instructions for working on towers and heights

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List of Tables

List of Figures

Chapter 1

Getting Started

In This Chapter:

1.1   Scope of Document

This document consists of the following chapters:

- ◼ "Getting Started" on page 1 - This chapter includes the information about this document purpose and structure.

- ◼ "Hardware Description" on page 6 - This chapter shows the devices appearance and all plugs and connectors.

- ◼ "Basic Configuration Instructions" on page 35 - This chapter includes basic recommendations for primary link configuration, including interfaces configuration and MINT protocol usage. Also there is a description of how to perform basic manipulations with device's configuration including its updating, importing and exporting.

- ◼ "Link Configuration" on page 50 - The chapter contains basic recommendations for making preliminary choices and decisions while planning and deploying a wireless network based on the Devices. It also describes a set of tools that can help while improving the link quality and statistics gathering.

- ◼ "Configuration Via Web Interface" on page 66 - This chapter describes the device's built-in services, features and tools which were not described in previous parts of the document.

- ◼ "Supplementary Information" on page 93 - Contains supplementary information (specifications, connectors soldering scheme).

1.2   Abbreviations

The following abbreviations are used in this document:

■ ODU - Outdoor Unit

■ IDU - Indoor power supply Unit

■ RF cable - Radio Frequency cable to connect ODU and external antenna in case connectorized version of the unit is used

■ LOS - Line-of-Sight

■ STP cable - Shielded Twisted Pair cable (STP Cat5E) to connect ODU and IDU

■ PTP - Point-to-Point topology

■ MINT - Microwave Interconnection NeTworks

1.3   Document Marks

CAUTION
All caution warnings are marked with a special warning sign. One should pay a great deal of attention to what is written in the Warning sections.

NOTE
All notes are marked with a special note sign. Notes usually contain useful comments or hints to the described section of the document.
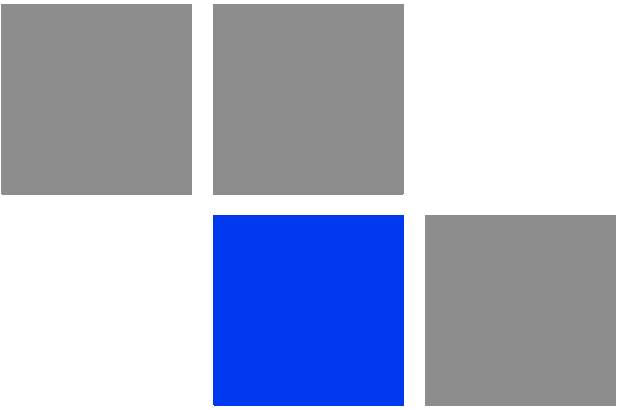
Chapter 2

Hardware Description

In This Chapter

2.1   Power supply units (IDU)

2.1.1   IDU-BS-G
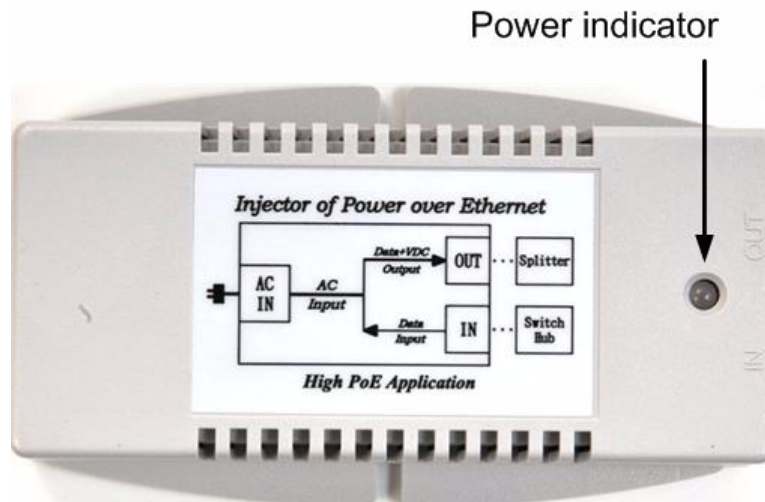
Figure 2-1: IDU-BS-G Top View
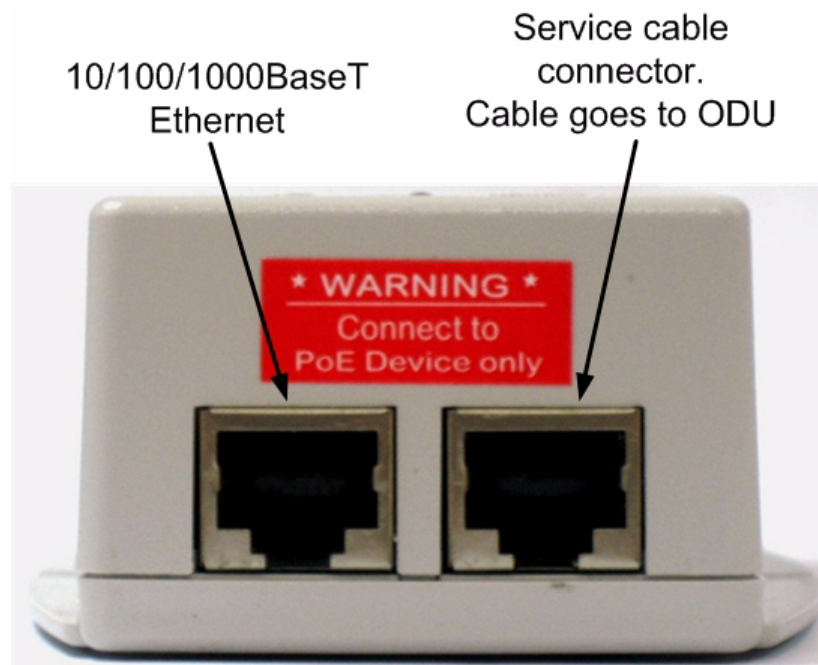
Figure 2-2: IDU-BS-G Front Panel
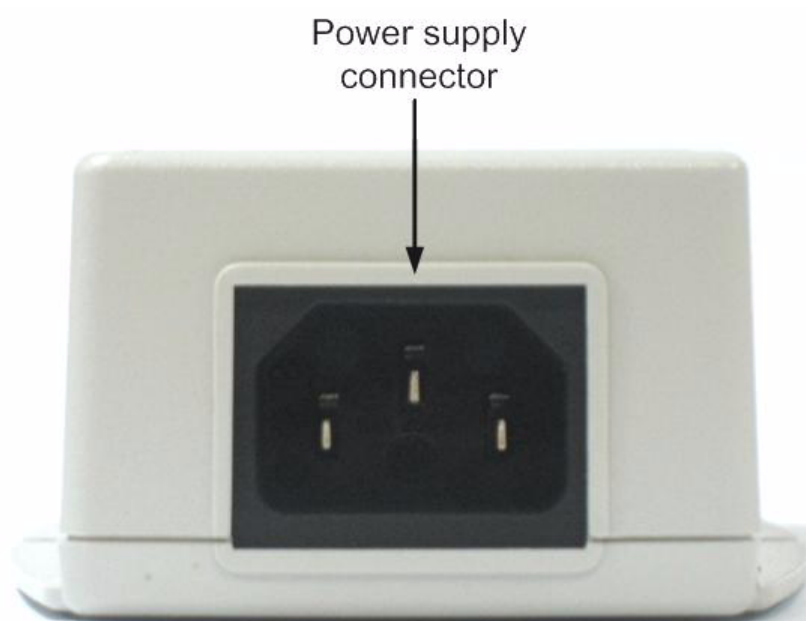
Figure 2-3: IDU-BS-G Rear Panel
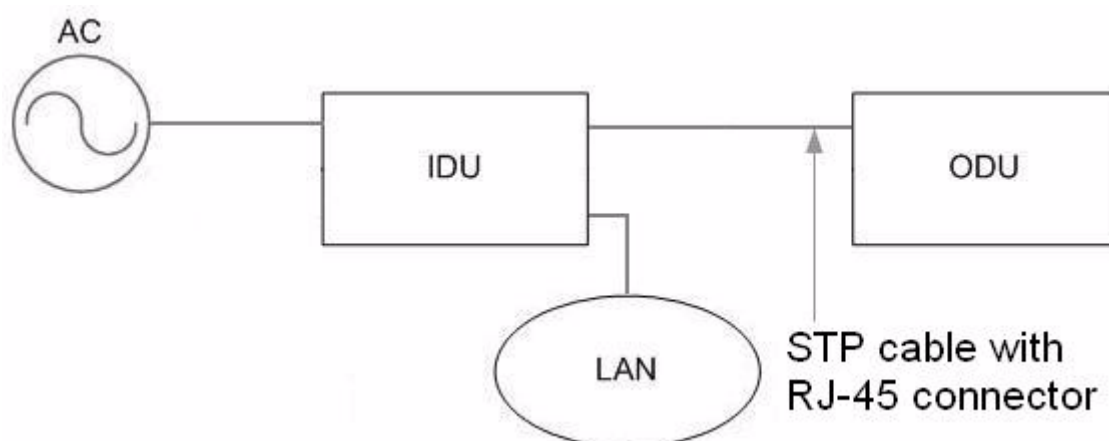
Figure 2-4: Connection scheme for IDU-BS-G

2.2   Outdoor Units (ODU)

There are two versions of outdoor units (BreezeNET B130 GigE and BreezeNET B300 GigE), each available in two hardware configurations. BreezeNET B130 GigE is a limited version of the BreezeNET B300 GigE model, with a maximum bitrate of 130 Mbps. BreezeNET B130 GigE units can be upgraded to BreezeNET B300 GigE by acquiring an appropriate license and by following the indications described in the "Upgrading Procedure from BreezeNET B130 GigE to BreezeNET B300 GigE" document.

> **NOTE**
>
> Although the BreezeNET B130's maximum bitrate is limited to 130 Mbps, the *Ltest* utility (see "Ltest" on page 52) is not. Thus, the full radio link capacity (of up to 250 Mbps net throughput) of the BreezeNET B130 units may be sampled.

The two firmware configurations and the two hardware versions combine to a total of four types of units:

Table 2-1: Types of Units

Hardware Configuration	300 Mbps Max. Bitrate	130 Mbps Max. Bitrate
Units with integrated 23dBi panel antenna	BU/RB-B300-5X-GigE	BU/RB-B130-5X-GigE
Units with two external antenna RF connectors	BU/RB-B300D-5X-GigE	BU/RB-B130D-5X-GigE

2.2.1   BU/RB-B130D/B300D-5X-GigE
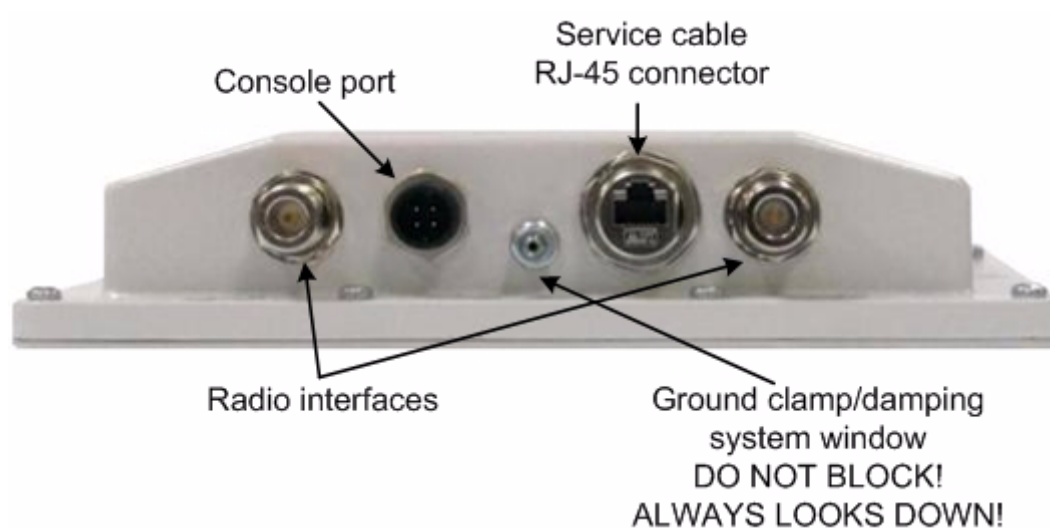
Figure 2-5: BU/RB-B130D/B300D-5X-GigE Front Panel
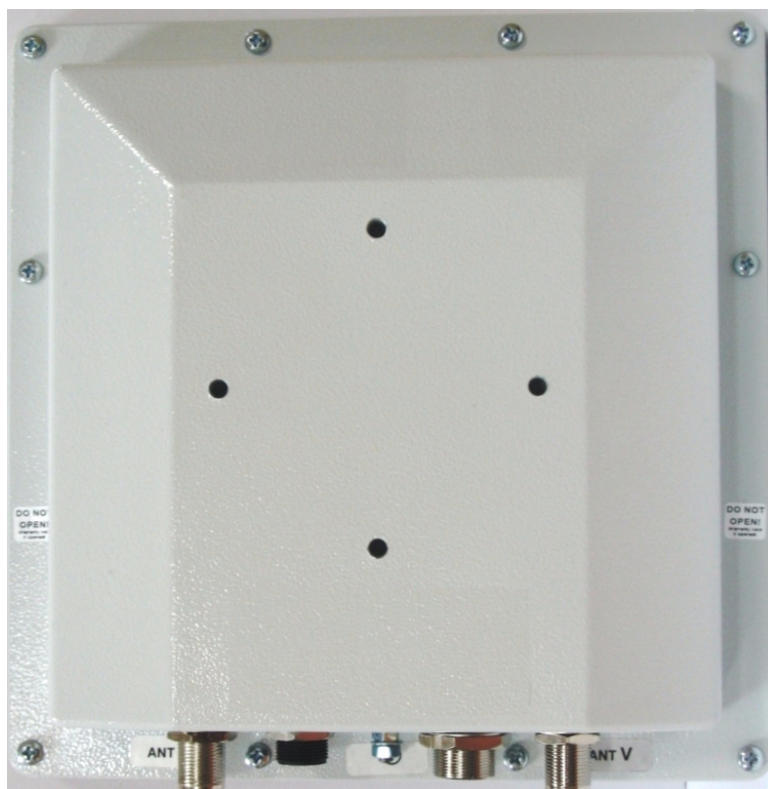
Figure 2-6: BU/RB-B130D/B300D-5X-GigE Top View

2.2.2   BU/RB-B130/B300-5X-GigE
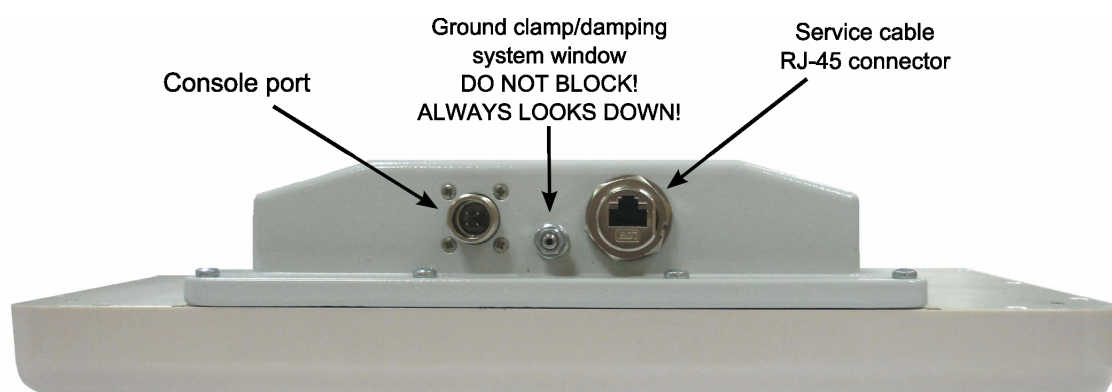
Figure 2-7: BU/RB-B130/B300-5X-GigE Front Panel
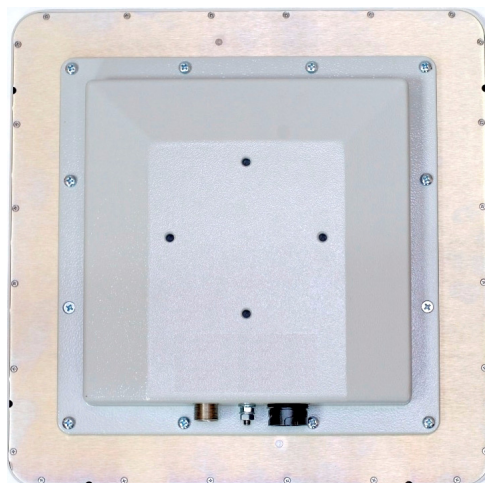
Figure 2-8: BU/RB-B130/B300-5X-GigE Top View

2.2.3   ODU LED Indicators Description

ODU units have two LED indicators (red and green) located in the Console connector. These LEDs are useful in monitoring the device status during the installation procedure. LEDs modes and Device status correspondence is shown in the following table:

Table 2-2: ODU LED Indicators Description

Red Indicator	Green Indicator	Device Status
Off	Off	Device is switched off of in the process of start-up booting
Off	Blinking	Device is booted. No radio connection. Searching for another device to establish radio connection to.
Blinking	On	Radio connection established. The more data is transmitted through the radio channel the more frequently red indicator is blinking.
On	Off	MINT is stopped.

2.3   Installation Preparations

2.3.1   Required Components and Accessories

Before the installation, please make sure you have all necessary parts and accessories:

■   Device

■   Antenna

■   Low loss antenna cable for the required frequency range

■   Antenna pole (if necessary)

■   Required grounding system

■   Accessories and tools

2.3.2   Antenna Placement

When planning an antenna placement for PTP link, in order to obtain the maximal coverage range and best performance for the Device, one need to consider that LOS requirements must be fulfilled for the path between two antennas. Moreover, it is of vital importance that the certain zone that surrounds the signal propagation path must be free from obstructions. One should understand that the radio beam is not as thin as, for example, laser beam. Radio beam, also called as a 1st Fresnel zone, has a profile of a rugby ball. Its exact form and size depend upon the frequency and the signal propagation path length.

If most of the 1st Fresnel zone is obstructed, a major part of a electromagnetic energy will be lost which leads to a severe signal quality degradation and, as a result, to coverage range decreasing.

Below is an incomplete list of possible obstructions on the signal propagation path:

■   Neighboring buildings

■   Trees

■   Bridges

■ Power lines

To obtain the best results, it is necessary to perform a precise analysis of a signal propagation path zone and possible obstructions that may cover a part of the 1st Fresnel zone (usually the analysis is performed at the highest points of the signal propagation path).

NOTE

While planning, it is strongly recommended to consult high-qualified and experienced technicians

General recommendation for antennas placement are the following:

■ Install antennas as high as possible over specific level. In case of flat surface - it will be ground level, in case of vegetation and forest - it will be tree heights, in urban environment - it will be the highest building in the observed area (specific level definition).

■ Avoid tree and vegetation along with wave propagation path, influence of trees can increase depending on seasons (ice, dew, leaves);

■ Proximity of other antennas should be avoided (at least 2 meters);

■ Reflecting surfaces should be considered (building with reflective windows, water surfaces or wet grounds);

■ When installing antenna over water surface, one should tune height bracket within 1-3 meter range variation, because it can yield signal level variation from minimum to maximum.

■ If seasonal changes influence on the signal quality, so then the most probable reasons would be either the connectors are not protected enough from humidity, summer vegetation or ice covered cabling and connectors during winter.

2.3.3   Antenna Poles Usage

Antenna installation is performed on a special facility called antenna pole. The pole is used for strong antenna tightening at the installation site. Poles might have different modifications depending on the installation requirements.

2.3.4   Poles with Stretching

Usually this kind of poles are used when installing antenna on a flat surface and permits one to raise it to a significant height for providing optimal conditions for signal propagation.

2.3.5   Wall Mounted Pole

Usually these kinds of poles are used when there is no need to elevate antenna to the rooftop and there is the possibility to mounting it on a wall. This installation is significantly simpler than that implementation with poles. Mostly it is used for subscriber side deployments.

2.3.6   Antenna Poles Requirements

Ease of antenna mounting and sufficient mechanical durability should provide reliable fastening in conditions of high windy loads. Poles should have round profile for ease of azimuth adjustment. Typical pole diameter is 30 to 50 mm.

2.3.7   Grounding when Using IDU-BS-G

Antenna should be placed on the mast on the level that is at least 1 meter lower than a mast's top. In this case it is of big probability that the lightning strikes the mast and not the antenna. The mast is to be grounded on the grounding contour according to your local standards. When the lightning strikes the antenna, the current goes through the coaxial cable which grounds ODU clamp with the mast - the mast is grounded via the grounding contour. The direct lightning strike to the STP service cable (ODU-IDU) is partially terminated on the grounded IDU case. Partial termination means that the direct lightning strike will probably destroy an STP cable. The service cable pickups from the electromagnetic impulses are terminated on the IDU case by the winding shield, and further - on the IDU grounding. IDU is grounded via a three-conductor power cord and a plug containing a ground. The data & power wires pickups are terminated via IDU protection scheme (three-conductor power cord and a plug containing a ground).

CAUTION

⚠️ Antenna pole, tower, ODU and lightning arrestor should be connected to the first common grounding contour. Cable thickness should be no less than 10AWG using corrosion-steady connectors. It is highly recommended to entrust grounding contour development to the skilled personnel.

A special attention should be paid if antenna used is not DC-shorted. In this case additional lightning arrestor should be used between the antenna and ODU. Suggested grounding diagram is shown on the picture below.
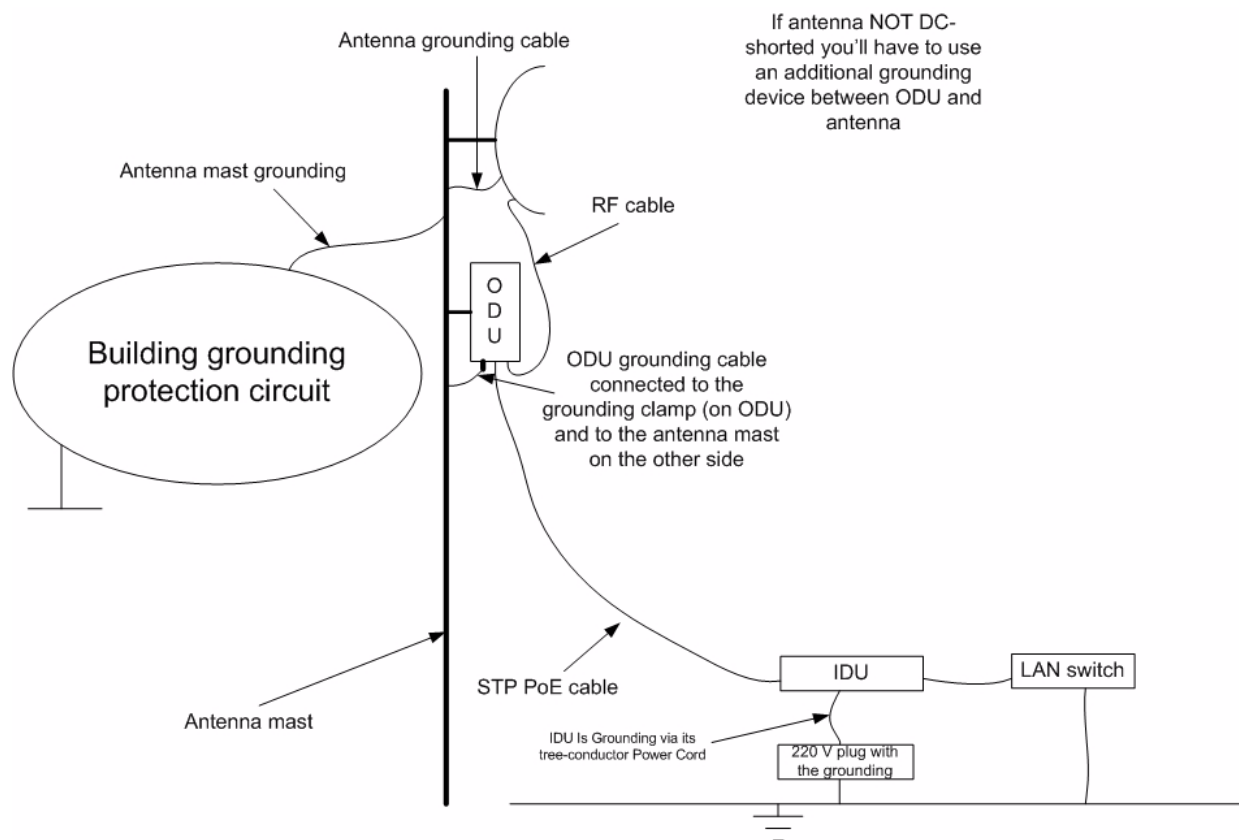
Figure 2-9: Grounding

2.3.8   Antenna Alignment

To obtain maximal system performance antennas must be precisely aligned one towards another according to LOS requirements. General recommendations for antenna alignment are the following:

■ Align antennas using optical equipment (binoculars, spyglass) accompanied by mobile phone actions coordination

■ Use GPS receiver and area map

■ Use build-in Device features. These features allow evaluating current channel/signal quality and perform precise antenna alignment

2.3.9   Precaution Measures

Before you start the installation please read this section very carefully.

Antennas are installed on the roof tops or on the building walls. This work must be accomplished only by personnel having special skills and experience in this area.

Antennas and cables are electric conductors. Incidental electrostatic strikes may occur during the system installation. This can lead to equipment damaging or may hurt the personnel. While installing or changing the elements of the antenna-feeder system one should make sure that open metal parts are temporarily grounded.

Do not install the antenna close to the electric power lines. Antenna and antenna pole have to be installed in such a way that while their assembling, disassembling and repairing they did not have any contact with power lines.

Basic precaution measures that must be fulfilled during the installation are the following:

■ Do not stay on the roof top in windy or rainy weather, during the thunderstorm or when the working zone is covered with snow or ice

■ Do not touch the antennas, antenna poles, cables and lighting arrestors during the thunderstorm

■ Antenna placement should not be close to electric or telephone lines. Safe distance is a distance that is a sum of the two antenna poles heights and antenna height

2.3.10 Service Cable Soldering Procedure

The following instruction shows the "RJ-45" (modification 2) connector soldering procedure.

Table 2-3: RJ-45 Connector Soldering Procedure
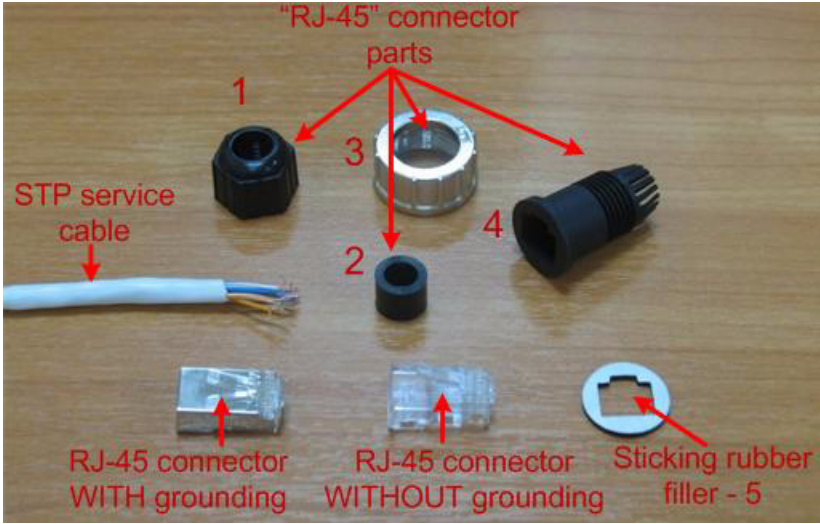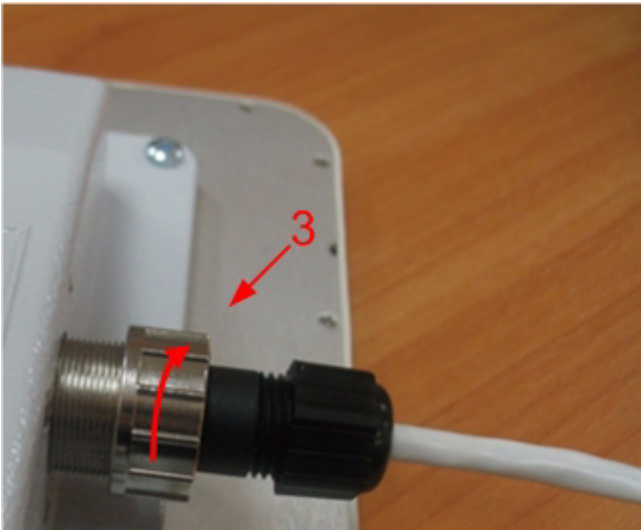
Illustration	Description
	Step 1. Peel STP service cable and prepare "RJ-45" connector parts. Use RJ-45 connector without grounding here (RJ-45 connector with grounding is used for connecting service cable to IDU).
	Step 2. Stick rubber filler - 5 on the Part 4, previously having removed protective white layer from rubber filler -5. Insert Part 2 inside part 4 up to the stop. Part 2 must be entirely within Part 4.

Table 2-3: RJ-45 Connector Soldering Procedure

Illustration	Description
	Step 3. Put connector parts on the STP service cable as shown. Attach RJ-45 connector without grounding to the STP service cable according to the "RJ-45" soldering scheme (in the "Supplementary information" chapter of this manual) and crimp the connector using a crimp tool. **Please tightly crimp the RJ-45 connector. Not crimped or badly crimped connector damages the unit when assembled into it which is not considered as a warranty case.**
	Step 4. Put Part 4 on the attached in the previous step RJ-45 connector.
	Step 5. Screw Part 2 on Part 4. This fixes the "RJ-45" connector on the cable. Check that the connector is properly fixed on the cable.

Table 2-3: RJ-45 Connector Soldering Procedure

Illustration	Description
	Step 6. Assemble the connector to the unit.
	Step 7. Fix the connector by screwing Part 3. Now the connector is hermetically attached to the unit.

2.3.11   Tools Required at the Installation Site

1   Screwdrivers set

2   Pliers

3   Soldering iron 40 W

4   Spanners set

5   Connectors isolating set

»   Raw rubber

»   Thermal shrinkage tube

»   Scissors

»   Fan

»   Mantling gun

6   Additional equipment

»   GPS receiver or area map (with compass and alidade)

»   Big zoom binoculars

2.4   BU/RB-B130D/B300D-5X-GigE

2.4.1   Installation Guidelines

1   Unpack the equipment

2   Check items integrity

3   Prepare RF-cables of the required length. The recommended maximal RF cable length is 1 meter.

4   Install and isolate the connectors on the RF cables
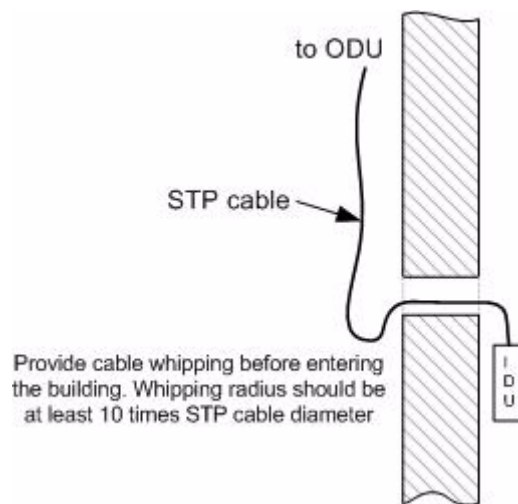
Figure 2-10: BU/RB-B130D/B300D-5X-GigE Installation 1

5   Determine the STP cable length that is used to connect IDU and ODU. The total cable length between LAN (behind IDU) and ODU should not be longer than 100 meters. Service cable connecting IDU and ODU should be STP Cat 5E cable.

6   Install (solder) connector for ODU on the STP cable and isolate it

7   If it is possible to lay STP cable with a connector on the IDU side, install (solder) connector for IDU on the STP cable and isolate it

8   Lay the STP cable "from top to bottom" - from ODU to IDU

9   If step 7 is not accomplished, after the STP cable has been laid, install (solder) connector for IDU

10 Install ODU on the mounting bracket connectors down and tighten it

11 Connect the ODU-IDU cable to the ODU

12 Isolate the ODU connector joint place

13 Once the antenna and antenna pole are installed they must be grounded via lightning protection grounding contour. Antenna's position must be lower than the highest antenna pole point at least by 2 antenna heights. If antenna is NOT DC-shorted (see antenna technical documentation), the additional lightning arrestor must be used which is placed between ODU and antenna and is grounded to the antenna pole grounding contour.
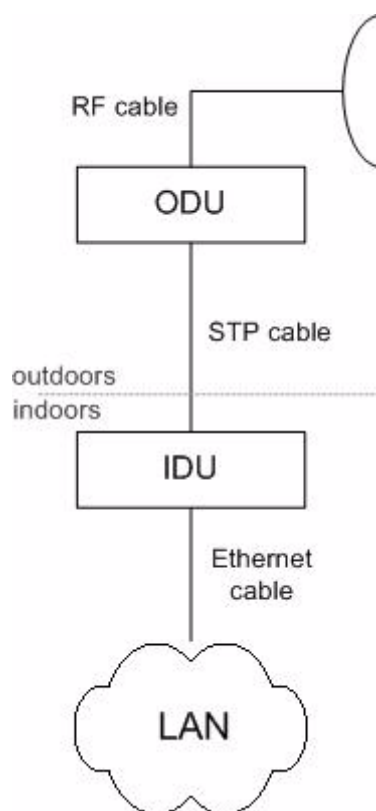
Figure 2-11: BU/RB-B130D/B300D-5X-GigE Installation 2

14 Connect RF cables to the antenna. Twist the connectors tightly

15 Connect RF cables to the ODU previously having touched RF cable connectors case with ODU connector case

16 Isolate RF connectors from both sides (ODU and antenna)

17 Connect the STP cable to IDU previously having touched IDU connector case with STP cable connector case

18 Provide grounding for IDU

19 Connect Ethernet cable to IDU

20 Provide power supply for IDU

21 Connect to the Device using Telnet protocol

CAUTION

It is extremely important to install ODU connectors down!

2.5   BU/RB-B130/B300-5X-GigE

2.5.1   Installation Guidelines

1   Unpack the equipment

2   Check items integrity

3   Determine the STP cable length that is used to connect IDU and ODU. The total cable length between LAN (behind IDU) and ODU should not be longer than 100 meters.
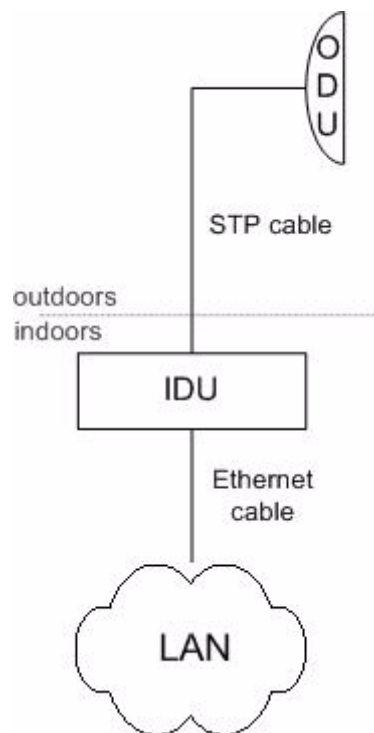
Figure 2-12: BU/RB-B130/B300-5X-GigE Installation 1

4   Install (solder) connector for ODU on the STP cable and isolate it

5   Lay the STP cable "from top to bottom" - from ODU to IDU

6   After the STP cable has been laid, use distribution box to switch from STP cable to UTP cable with RJ-45 connectors. Service cable connecting IDU and ODU should be STP Cat 5E cable.

7   Install ODU on the mounting bracket according to the direction required for the link. Do not tight it too hard unless the antenna alignment is not complete. Install ODU connectors down.

8 Connect the ODU-IDU cable to the ODU

9 Isolate the ODU connector joint place

10 Once the ODU and antenna pole are installed they must be grounded via lightning protection grounding contour. ODU position must be lower than the highest antenna pole point at least by 2 ODU heights
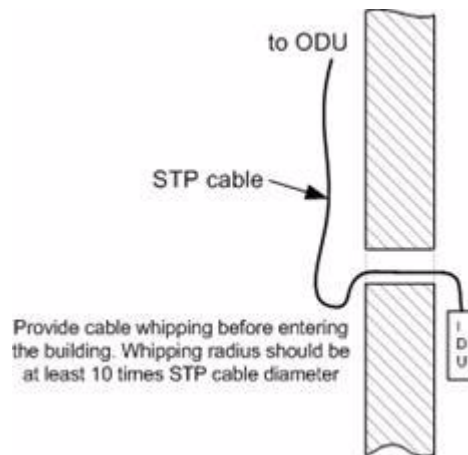
Figure 2-13: BU/RB-B130/B300-5X-GigE Installation 2

11 Connect the UTP cable to IDU

12 Provide grounding for IDU

13 Connect Ethernet cable to IDU

14 Provide power supply for IDU

15 Connect to the Device using Telnet protocol

CAUTION

It is extremely important to install ODU connectors down!

2.6   Mounting Kit (MOUNT-KIT-85)

The default mounting kit packed with all the device models is MOUNT-KIT-85.

MOUNT-KIT-85 features:

■ Material: casted Aluminum

■ Adjustment: two axis (vertical and horizontal)

■ Mounting options:

» standard pole (30-85 mm)

» wall

» thick pipe (>85 mm, horizontal/vertical) using additional fasteners (not included to the package)

■ RoHS compliant

2.6.1   Assembly
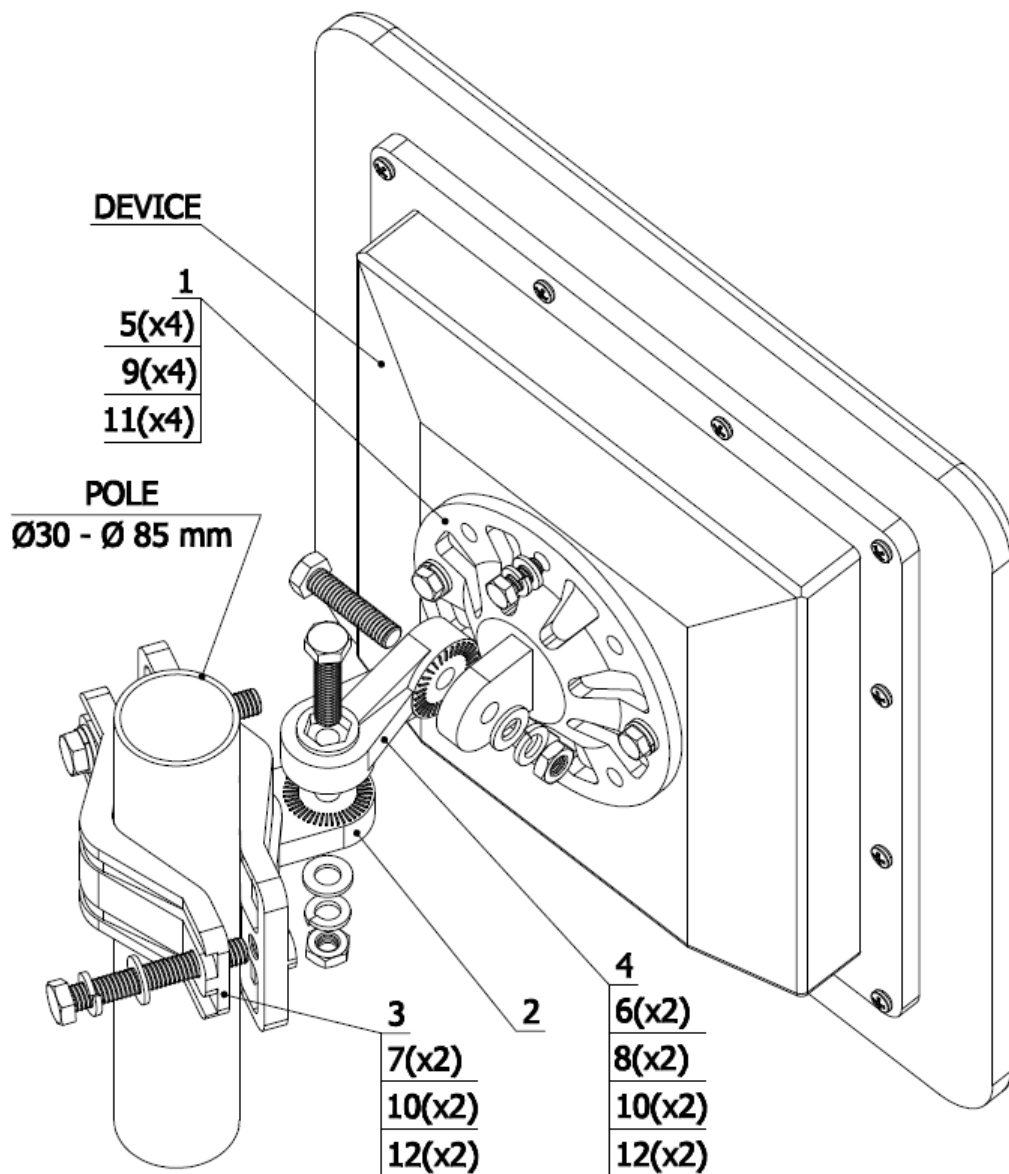
Figure 2-14: Mounting Kit

INSTALLATION INSTRUCTION

STEP 1:
Attach the Basement to the back of the device, using items 5, 9, 11.

STEP 2:
Tighten the Bracket and the Bracer to the pole, using items 7, 10, 12.

STEP 3:
Attach the Lever between the Bracket and the Basement, using items 6, 8, 10, 12.
Do not fasten the nuts!

STEP 4:
Adjust the required tilt and fasten all nuts at the required position.

CONFIGURATION KIT

ITEM	DESCRIPTION	QTY
1	BASEMENT	1
2	BRACKET	1
3	BRACER	1
4	LEVER	1
5	BOLT M6X14	4
6	BOLT M8X35	2
7	BOLT M8X80	2
8	NUT M8	2
9	WASHER FLAT M6	4
10	WASHER FLAT M8	4
11	WASHER SPRING M6	4
12	WASHER SPRING M8	4

Figure 2-15: Mounting Instructions

2.6.2   Possible Variants of the Installation
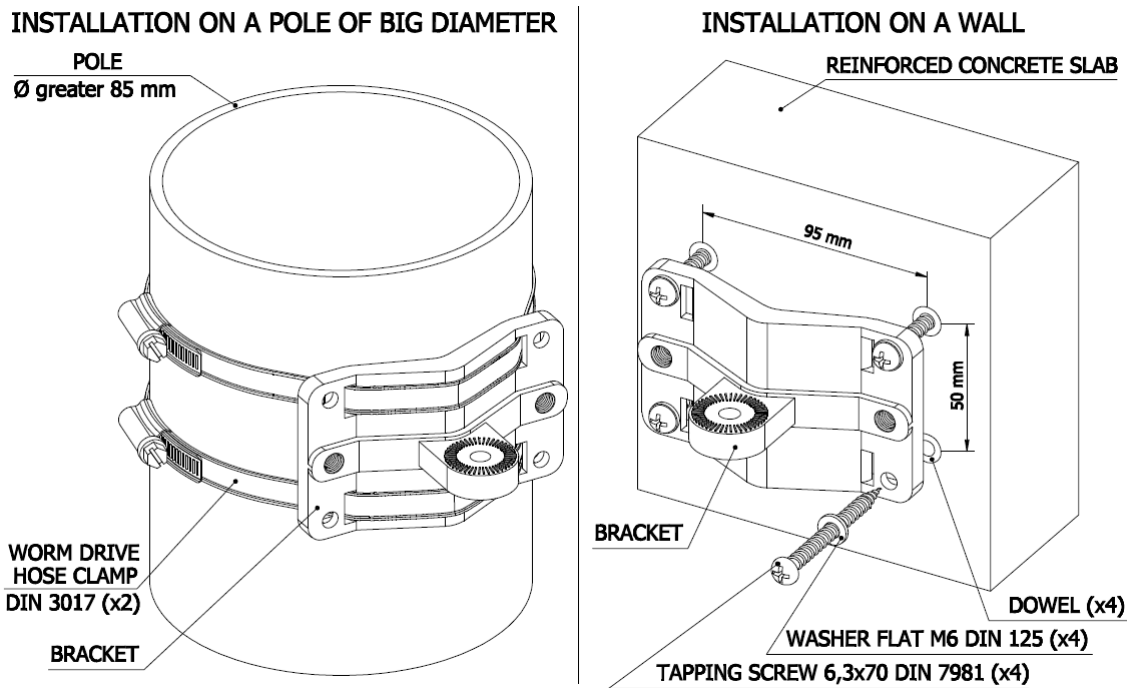
Figure 2-16: Installation Variants

CAUTION

MOUNT-KIT-85 does NOT contain worm drive hose clamps or other additional fixtures used in possible variants of installation.

2.7   Specifications

2.7.1   Radio

Table 2-4: Radio Specifications

Item	Description	
Frequency	ETSI (5.470 - 5.725 GHz)	Center frequencies range 5.475 - 5.720 GHz (in 5MHz steps) for 5MHz BW
		Center frequencies range 5.475 - 5.720 GHz (in 5MHz steps) for 10MHz BW
		Center frequencies range 5.480 - 5.700 GHz (in 20MHz steps) for 20MHz BW
		Center frequencies range 5.490 - 5.690 GHz (in 20MHz steps) for 40MHz BW
	ETSI (5.725 - 5.875 GHz)	Center frequencies range 5.730 - 5.870 GHz (in 5MHz steps) for 5MHz BW
		Center frequencies range 5.730 - 5.870 GHz (in 5MHz steps) for 10MHz BW
		Center frequencies range 5.740 - 5.860 GHz (in 20MHz steps) for 20MHz BW
		Center frequencies range 5.750 - 5.850 GHz (in 20MHz steps) for 40MHz BW
	FCC (4.940 - 4.990 GHz)	Center frequencies range 4.945 - 4.985 GHz (in 5MHz steps) for 5MHz BW
		Center frequencies range 4.945 - 4.985 GHz (in 5MHz steps) for 10MHz BW
		Center frequencies range 4.960 GHz for 20MHz BW
		Center frequencies range 4.970 GHz for 40MHz BW

Table 2-4: Radio Specifications

Item	Description	
	FCC (5.250 - 5.350 GHz)	Center frequencies range 5.255 - 5.345 GHz (in 5MHz steps) for 5MHz BW
		Center frequencies range 5.255 - 5.345 GHz (in 5MHz steps) for 10MHz BW
		Center frequencies range 5.260 - 5.340 GHz (in 20MHz steps) for 20MHz BW
		Center frequencies range 5.270 - 5.330GHz (in 20MHz steps) for 40MHz BW
	FCC (5.470 - 5.725 GHz)	Center frequencies range 5.475 - 5.720 GHz (in 5MHz steps) for 5MHz BW
		Center frequencies range 5.475 - 5.720 GHz (in 5MHz steps) for 10MHz BW
		Center frequencies range 5.480 - 5.700 GHz (in 20MHz steps) for 20MHz BW
		Center frequencies range 5.490 - 5.690 GHz (in 20MHz steps) for 40MHz BW
	FCC (5.725 - 5.850 GHz)	Center frequencies range 5.730 - 5.845 GHz (in 5MHz steps) for 5MHz BW
		Center frequencies range 5.730 - 5.845 GHz (in 5MHz steps) for 10MHz BW
		Center frequencies range 5.740 - 5.840 GHz (in 20MHz steps) for 20MHz BW
		Center frequencies range 5.750 - 5.830 GHz (in 20MHz steps) for 40MHz BW
	Universal	Center frequencies range 4.915 - 5.945 GHz (in 5MHz steps) for 5MHz BW
		Center frequencies range 4.915 - 5.945 GHz (in 5MHz steps) for 10MHz BW
		Center frequencies range 4.920 - 5.940 GHz (in 20MHz steps) for 20MHz BW
		Center frequencies range 4.930 - 5.930 GHz (in 20MHz steps) for 40MHz BW
Modulation	OFDM modulation, BPSK, QPSK, QAM16, QAM64	
Radio Type	OFDM TDD	
Channel BW	5 MHz / 10 MHz / 20 MHz / 40 MHz	
Maximal Net Throughput	250 Mbps	

Table 2-4: Radio Specifications

Item	Description
Output Power (at antenna port)	Up to 18 dBm (dependant upon regulation)

2.7.2   Antenna

Table 2-5: Antenna Specifications

Item	Description
External Antenna	ANT, T.S, 4.9-6 GHz, 9°, dual polarized, 23 dBi / ANT, T.S, 4.9-6 GHz, 6°, dual polarized, 28 dBi
Integrated Antenna	ANT, T.S, 4.9-6 GHz, 9°, dual polarized, 23 dBi

2.7.3   Data Communication

Table 2-6: Data Communication Specifications

Item	Description
Standard and Network Compliance	IEEE 802.3 CSMA CD, ARP filter/proxy, MAC/IP filtering, layer 2 switch, Ethernet 10/100/1000BaseT
VLAN Support	802.1q transparent or frame tagging and re-tagging
QoS	QoS enforcer classification and traffic limiting based on: IP ToS/DSCP/802.1p tags, VLAN/IP/MAC address and protocol
Security	Storm/flood protection, password protection, over-the-air payload encryption, IP Firewall

2.7.4   Configuration Management

Table 2-7: Configuration Management Specifications

Item	Description
Management Options	Configure/monitor SNMP traps, WEB interface, CLI (telnet, serial console, remote shell)
Remote Management Access	From wired LAN, wireless link
Allocation of IP Address	DHCP client / server / relay
SW Upgrade	Via FTP / WEB interface
Configuration Upload / Download	Via FTP / WEB interface
SNMP Agents	SNMP V1 / SNMP V3, MIB II, private MIB

2.7.5   Electrical Characteristics

Table 2-8: Electrical Characteristics Specifications

Item	Description
Power Consumption	Up to 20W
Input Power	AC, 100-240 VAC, 50-60 Hz (DC 10.5-32 UDC with OPS-DC add-on module)
Indoor-outdoor Cable	CAT-5 shielded, 90m max
AC Power Indoor Unit	3 pin AC power plug
Connectors	RJ-45

2.7.6   Physical and Environmental

Table 2-9: Physical and Environmental Specifications

Item	Description
Dimensions RB/BU	IDU: 5 x 4 x 2 cm (0.14 kg) / ODU with integrated antenna: 30 x 30 x 8 cm (3.7 kg) / ODU with external antenna 24 x 24 x 5 cm (2.1 kg)
Operating Temperature	ODU: -40°C to 60°C / IDU: 0°C to 40°C
Operating Humidity	ODU: 100% humidity, condensing (exceeds IP65 rating) / IDU: 95% humidity, non-condensing

2.7.7   Standards and Regulations

Table 2-10: Standards and Regulations Compliance

Item	Description
Radio	ETSI EN 301 893 V1.5.1 / ETSI EN 302 502 V1.2.1
EMC	ETSI EN 301 489-1 V1.4.1
Protection and Safety	ETSI EN 60950-1
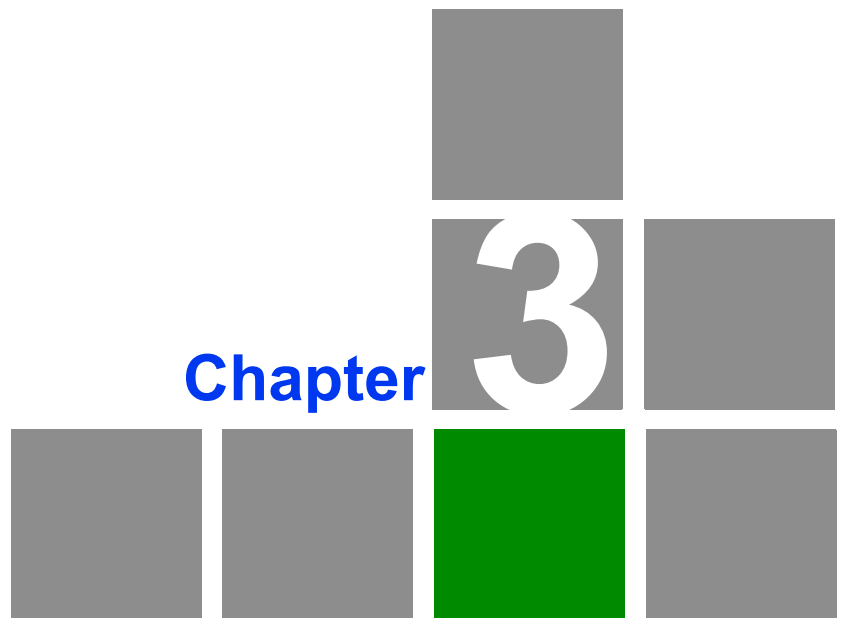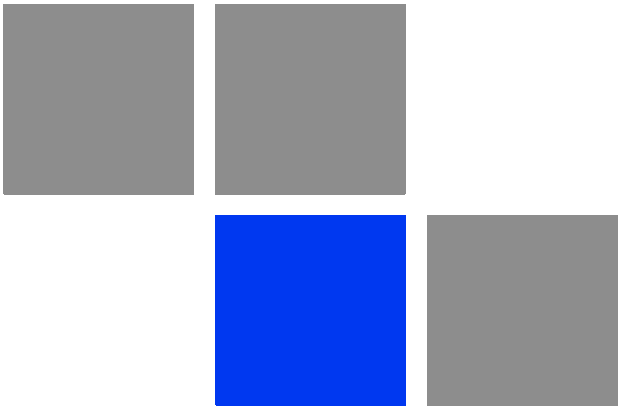
Chapter 3

Basic Configuration Instructions

In This Chapter:

3.1   Initial Settings Configuration Procedure

Before starting new device, one should perform initial configuration. The configuration can be performed either using serial console port or using Telnet protocol. In order to configure the device using Console port, follow the instructions below:

■ Device should be connected with host (e.g. Hyper Terminal)

■ Set serial interface properties to 38400 baud rate, 8 bit, 1 stop bit, parity off, flow control disabled

■ Enable emulation mode ANSI or VT100, keyboard VT100

To connect using Telnet protocol from the wired LAN run Telnet with 10.10.10.1 IP-address that is configured for the Ethernet interface of the device by default.

If all above procedures are completed correctly, you will see the WANFleX OS prompt:

```
Login:
```

Every new device has got default login and password settings as written below:

```
Login: admin
Password: private
```

After default authorization there will be standard console prompt:

```
console>
```

Now the device is ready for the initial configuration procedure. The most relevant thing to be done at this phase is to define device name/user/password.

```
system name Test
system user root
system password qwerty
```

NOTE

Part of commands in **bold** must be typed in CLI (Command Line Interface). The rest of the command name is optional and can be skipped while typing.

Once this is completed, ONLY the specified username and password can be used to access the device. DO NOT FORGET THESE PARAMETERS.

3.2   Device Interfaces

The Device has several physical and logical interfaces:

- **lo0** - loopback interface, used for system interaction needs

- **null0** - logical interface, can be used for auxiliary addresses assignation (for NAT module, for example); for routes aggregation for RIP protocol. Addresses (subnets) are announced to the network but every packet transmitted through this interface is destroyed

- **eth0** - Ethernet 10/100/1000 Mbits interface

- **rf5.0** - radio interface. See device's labeling it learn your radio interface name

- **vlanX** - interfaces supporting VLAN 802.1q tagging

All configured interfaces of the device can be reviewed using the following command:

```
ifconfig -a
```

3.3   Command Line Interface (CLI)

For device's management and configuration a Unix-like command line language is used. Every command starts having the power right after Enter key is pressed. However, each command lifetime duration is limited within one configuration session. In order to save a current configuration "config save" command is used.

Several commands can be grouped in one line using ";" character. If a wrong-syntax line is met in the group, the rest of the string is checked anyway and the wrong command is ignored. Command name can be shortened unless the ambiguity occurs.

If your terminal supports VT100 or ANSI standard you can move around the list of recently executed commands using cursor keys. Numbered list of these commands can be reviewed by "**!h**" command. Any command from this list can be available using "**!<NUMBER>**" command. TAB key performs substring search of recently executed commands.

Ctrl/R combination refreshes the command string if its content was disturbed by system messages.

The command executed with no arguments prints a short hint about its keys, parameters and syntax.

Context help can be obtained by printing "**?**" in any position of the line.

3.4 Lost Password Recovery

The password for the device can be recovered remotely.

Recovery procedure can be done with the help of graphical "ERConsole" utility.
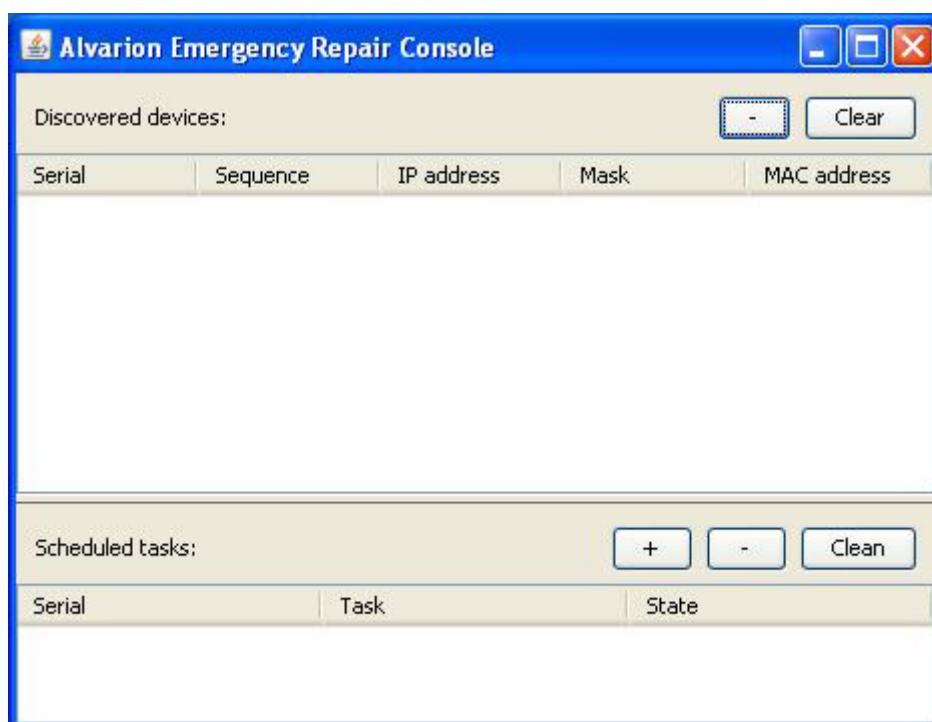
Figure 3-1: ERConsole (Step 1)

Below is a description of ERConsole's utility recovery procedure:

1 Connect a computer and a device that should be repaired to one physical Ethernet segment.

NOTE

It is recommended to put a switch between the unit and the PC from which ERConsole is executed.

---

2 Start the ERConsole utility on the computer by running the ERConsole.jar file.

Utility will be running in a waiting mode.

3 Restart the device. During its restart, the ERConsole utility will determine the device and will show necessary information about it in the "Discovered devices" section of the main window.
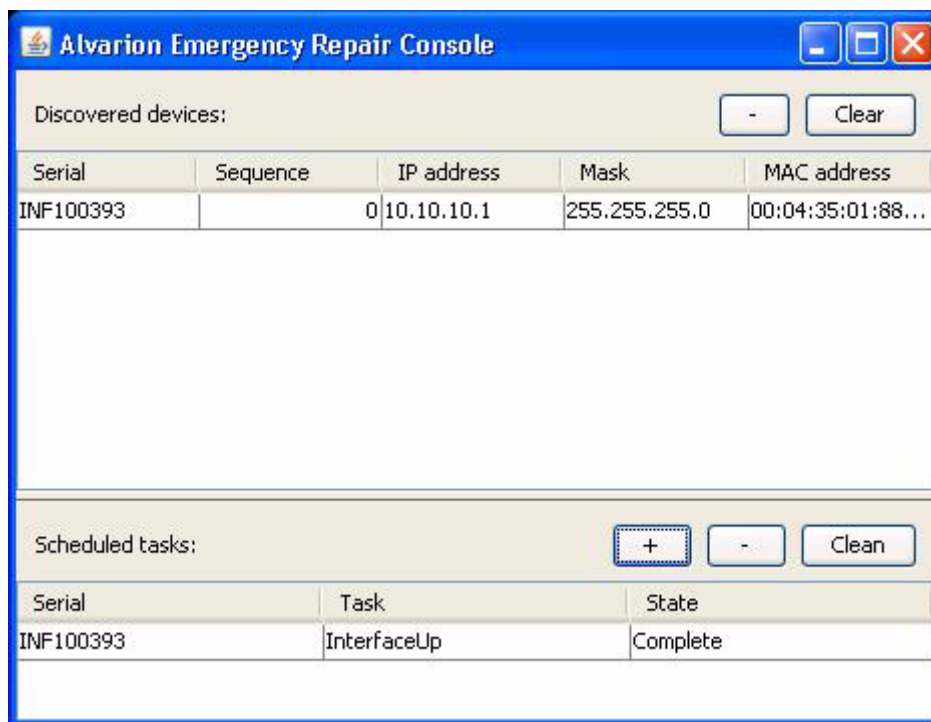
Figure 3-2: ERConsole (Step 2)

4 Send "Serial" and "Sequence" fields values to the Technical Support.

5 You will be given a factory password for the device.

6 Click the "+" button in the "Scheduled tasks" section of the main window.

7 In the opened "New task" window choose "Reset configuration" in the "Command" field. Then enter Serial number and factory password in the corresponding fields. Click "Ok".
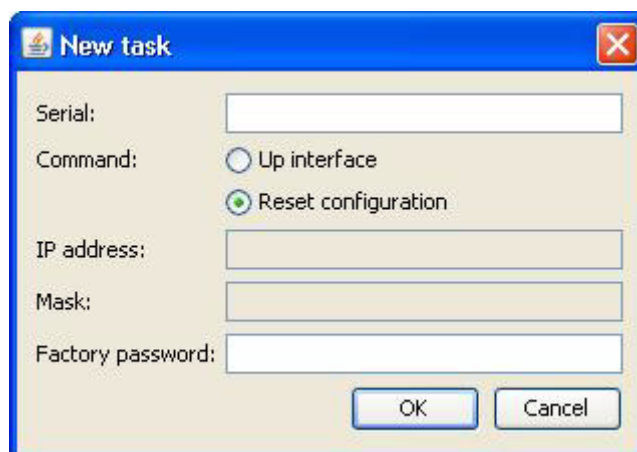
Figure 3-3: ERConsole (Step 3)

8 Restart the device.

After device restart the ERConsole utility will reset device configuration.

CAUTION

The ERConsole reports as "complete" also a failed action because it does not have a mechanism to verify if the unit accepted the password or not.

---

9 Login the device with Serial number as a login name and new password that was received from tech support.

CAUTION

Password must be inserted without spaces in order to be accepted by the device.

---

10 Reconfigure device username and password.

CAUTION

The "config clear" command followed by a reboot must be performed in order to make available the radio interface and start unit configuration from default settings.

The ERConsole utility's "New task" window also allows setting the unit's IP-address on its Ethernet interface (eth0) without login to device. To perform this procedure, follow the steps below:

1 Firstly, do steps 1-3 as described above.

2 Press the "+" button in the "Scheduled tasks" section of the main window.

3 In the opened "New task" window choose "Up interface" in the "Command" field. Then type the wanted IP-address and network mask in the corresponding fields of the window and press the "OK" button.
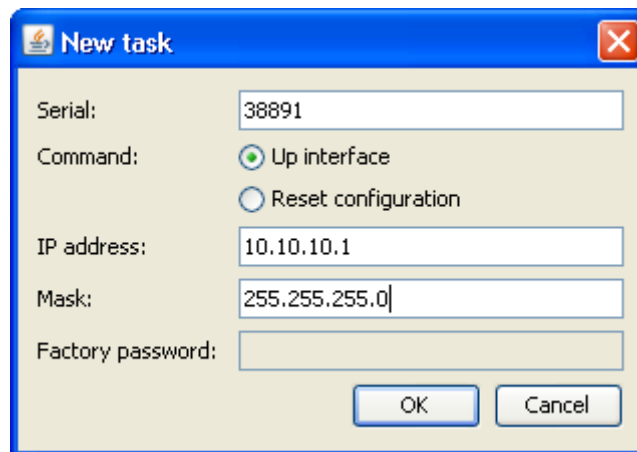

Figure 3-4: ERConsole (Step 4)

4 Restart the device.

After the device restarts, the "ERConsole" utility will add the wanted IP-address into its Ethernet interface configuration.

3.5 Configuration Manipulations

3.5.1 Printing and Saving Your Configuration

You can easily review your current device's configuration by executing "**co**nfig **sh**ow" command. The output of the command is sorted by the configuration sections (e.g. "System parameters", "Interfaces configuration" etc).

You can review some particular parts of the configuration specifying the part of the configuration you want to see.

Example:

```
config show ifc
```

This command will print the interfaces configuration.

In order to save your configuration "config save" command is used. It saves the current system configuration in the device's flash memory for subsequent permanent use. All modifications to the system parameters, if not saved by this command, are valid only during the current session (until the system reset occurs).

3.5.2 Import/Export

Export/import of the device's configuration is performed using "**co**nfig **ex**port" and "**co**nfig **im**port" commands correspondingly. "**Co**nfig **ex**port" saves the device configuration on a remote server and "**co**nfig **im**port" reloads it from a remote server. The information is transferred using FTP.

Example:

```
config export user:secret@192.168.1.1/var/conf/test.cfg
```

"**Config import**" command writes the uploaded file directly into the Flash memory without changing the active configuration in RAM. In order to make a new configuration active, right after "**config import**" command implementation finishes the device should be rebooted. If "**config save**" command is run before rebooting, Flash memory is overwritten by the copy of the active configuration. This action will erase the uploaded configuration file.

3.5.3 IP Address Formats

Many commands of the operating system require specification of IP addresses.

In OS WANFleX, the IP-addressees may be specified in traditional numeric format. Optionally, the mask may be specified either by its bit length (the specified number of leading bits in the mask are set to 1, the remaining bits are reset to 0) or numeric value. The IP address 0/0 denotes all possible IP addresses.

Therefore, the possible formats to specify IP-addresses are:

nn.nn.nn.nn (no mask is used)

nn.nn.nn.nn/N (N is the bit length of the mask)

nn.nn.nn.nn:xxx.xxx.xxx.xxx (xxx.xxx.xxx.xxx is the numerical value of the mask)

Example:

The 192.168.9.0/24 address describes the network address 192.168.9.0 and the mask with leading 24 bits on.

The same set of addresses may be denoted as 192.168.9.0:255.255.255.0.

3.6   Ethernet Interface Configuration

In the most basic form Ethernet interface can be configured as follows:

```
ifconfig eth0 1.1.1.1/24 up
```

UP flag means than the interface is turned to UP state.

Also you can specify the following parameters for the Ethernet interface:

■ Media type. By default media type is selected automatically (**media auto** parameter).

■ Assign aliases to the Ethernet interface (**alias** key word)

Full information about interfaces configuration can be reviewed in OS WanFlex User Guide - **ifconfig** command.

3.7 Radio Interface Configuration

Radio interface configuration is performed using "**rfconfig**" command. In its most basic form one need to configure the following parameters of the radio interface:

- Frequency (**freq** parameter) in MHz. For example, 5260.

- Bitrate (**bitr** parameter). Bit transfer rate in kBits/sec.

- System identifier (**SID** parameter). A hexadecimal number in the range of 1H to FFFFFFH. All devices that are supposed to see each other on the same radio link must have the same identifier.

NOTE

Radio interface state is not saved in the configuration. That means that if you put radio interface to the **down** state after rebooting it will be in the **up** state.

To learn your device's radio module capabilities type the command:

```
rfconfig <IF-NAME> capabilities
```

<IF-NAME> - radio interface name. Can be read on the device's labeling located on the case.

Radio interface configuration is performed using "**rfconfig**" command.

Example:

```
rfconfig rf5.0 freq 5260 bitr 130000 sid 01010101
```

Additional important parameters and settings for the radio interface:

- **rf5.0** - radio interface name in this case. In order to obtain radiointerface name either see the ODU/Device labeling or execute "**ifc -a**" command.

- **txpwr** - transmitting power selection. Available power levels can be obtained using "**cap**abilities" parameter as shown above.

Example:

```
rfconfig rf5.0 freq 5260 bitr 300000 sid 10203040
rfconfig rf5.0 txpwr 18
```
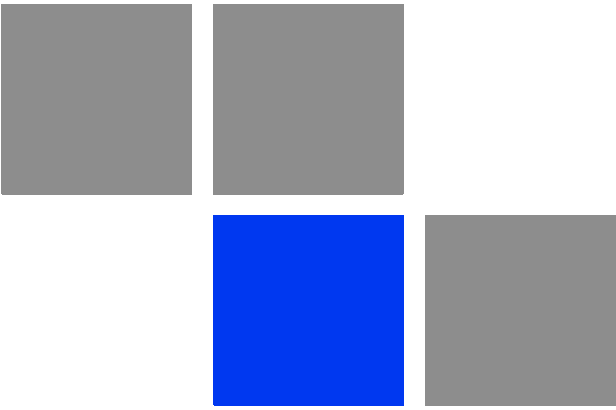
Chapter 4

Link Configuration

In This Chapter:

- ■

4.1   Link Diagnostic Tools

4.1.1   Ltest

Ltest utility allows precise test of a radio link. It is recommended for antenna alignment when installing a new device or for testing of existing radio link.

Ltest can work in standard, alignment and bandwidth modes.

Standard mode:

In standard mode Ltest measures signal levels, retries, lost packets and acks.

To start Ltest in this mode:

```
ltest rf5.0 <Mac-address of a device on the other side of the radio link>
```

When "**ltest**" command starts it will show you output information that contains testing results. You can see Ltest output below:
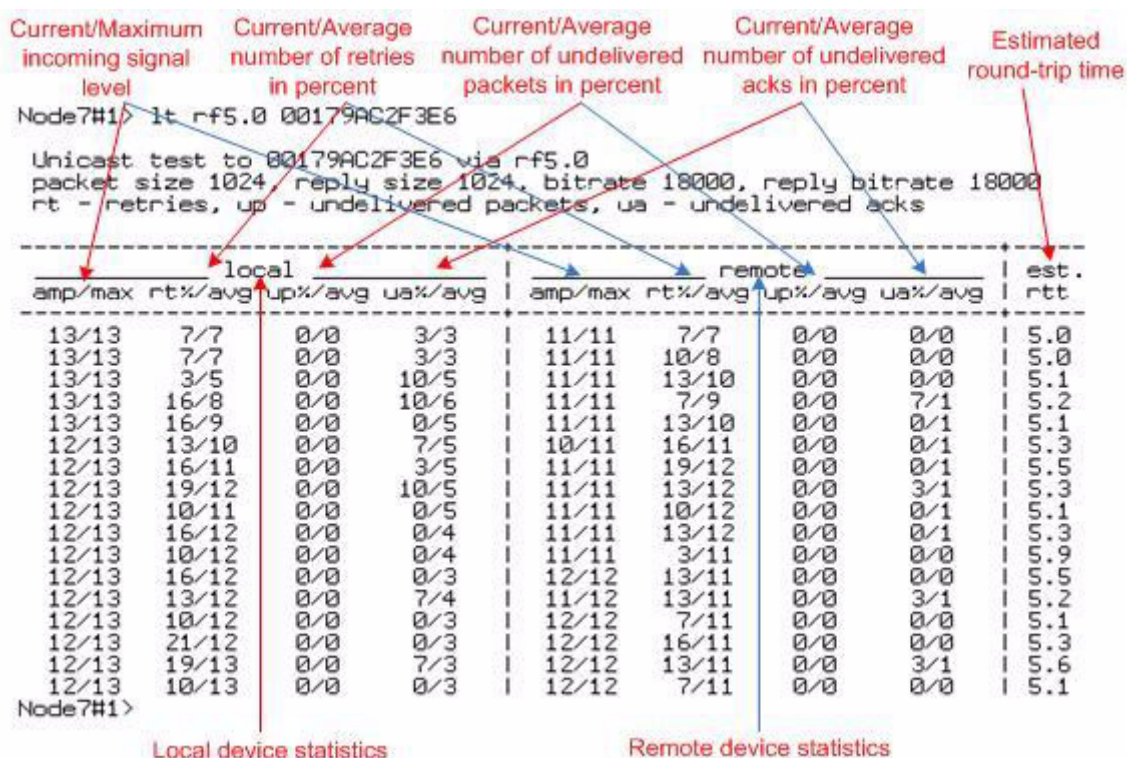

Figure 4-1: Ltest

For successful radio link establishing the following factors have to be considered:

1   It is recommended to start antenna alignment with searching maximum signal level on a minimal possible bitrate. Afterwards automatic MINT mechanisms will set the most appropriate bitrate if **autobitrate** mode will be enabled.

2   Current incoming signal level in "amp/max" columns (see "ltest" command output) must be between 12 and 40.

When it is more than 40 it is recommended to lower amplifier power.

If maximal signal level is less than 12 it is recommended to lower bitrate or channel width (for example, from 20MHz to 10MHz on the both sides of the radio link).

In some cases signal level that is less then 12 may be enough for radio link operation. In this case one has to be guided by such parameters as number of retries, number of undelivered packets and number of undelivered acks. If the number of undelivered packets and the number of undelivered acks is null, the number of retries is small and all these parameters are constant in time then the radio link, most often, will be operating properly.

3   Number of retries value in "rt%" columns must be as close to zero as possible.

4   Number of undelivered packets value in "up%" columns must be zero; if this value is not zero then the radio link couldn't be exploit.

5   Number of undelivered acks value in "ua%" columns must be zero; if this value is not zero then the radio link couldn't be exploit.

ALL described parameters must be observed in the both (**Local** and **Remote**) sections of the "**ltest**" command output.

Alignment mode:

The difference of this mode from the standard one is that "ant.amps" column is used instead of "amp/max". "Ant.amps" column indicates signal levels for each of two antennas of a device divided by ":" correspondingly.

To start Ltest in this mode:

```
ltest rf5.0 <Mac-address> -align [L,R]
```

Ltest output in alignment mode:

```
Unicast test to 000E8E1DF5E1 via rf5.0 with no priority
packet size 1024, reply size 1024, align, tx antennas: local(0), remote(1)
rt - retries, up - undelivered packets, ua - undelivered acks

----------------------------------------+----------------------------------------+-----
_____ local _____ |  _____ remote _____ | est.
ant.amps rt%/avg up%/avg ua%/avg | ant.amps rt%/avg up%/avg ua%/avg | rtt
----------------------------------------+----------------------------------------+-----
14:43:00    0/0      0/0      0/0  | 44:15:00    0/0      0/0      0/0  | 6.6
```

Figure 4-2: Ltest Align

Bandwidth mode (Bandwidth meter):

Bandwidth meter is used to test the following radio link characteristics: speed in kilobits per second, speed in packets per second, number of retries and errors.

Use the following "ltest" command options for testing:

- **-tu [seconds]** - Unidirectional test: packets are transmitted only from the current side to the specified address ("target" option)

- **-tb [seconds]** - Bidirectional test: packets are transmitted in both directions

"Seconds" parameter allows setting test period (5 seconds by default). Maximum value is 60 seconds.

To start Ltest in this mode:

```
ltest rf5.0 <Mac-address> -tb
```

"Ltest" command output in Bandwidth meter mode:

Figure 4-3: Ltest Bandwidth Meter

4.1.2   Muffer

The **muffer** module makes it possible to rapidly test the electromagnetic environment, visually estimate the efficiency of the utilization of the air links, reveal sources of interference, and estimate their power.

Several operating regimes of the **muffer** module provide for different levels of details in test results.

4.1.2.1   Review Mode

This regime is enabled by the review option. It makes possible to have a general estimation of emissions and interference within specified frequency range.

NOTE

Normal operation of the radio is not possible in this mode.

This regime can be useful on the first steps of link configuration. One can observe the activity on the selected list of frequencies and make decisions of what frequencies can be used for the link so that the link did not interfere with other sources of signals.
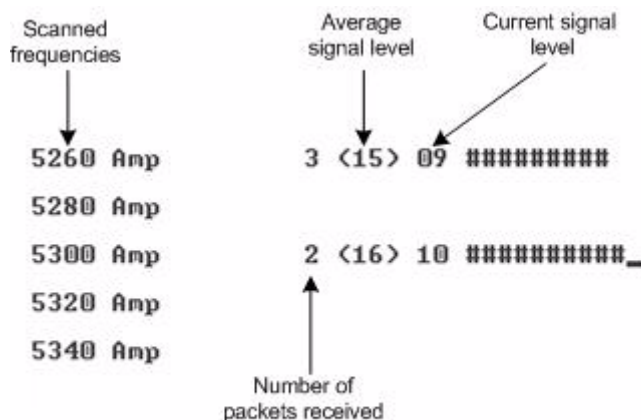

Figure 4-4: Muffer Review Mode

The picture above shows the output of **review** mode.

To run the **review** mode please type the following command:

```
muffer <IF-NAME> review
```

Once the link is established you can use this mode to review the activity on the configured for frequency for the link. If no activity is observed that means that the signal from the remote side is being broken by the interference sources or by the obstacles on the signal propagation path.

4.1.2.2   MAC2 Mode

This regime performs MAC-address analysis to estimate the efficiency of utilization of the air link. The analysis is carried out at the frequency previously specified by rfconfig command. The **mac2** regime checks both data packets and the link-level ACK messages sent by protocol supported devices.

NOTE

Normal operation of the radio is not possible in this mode.

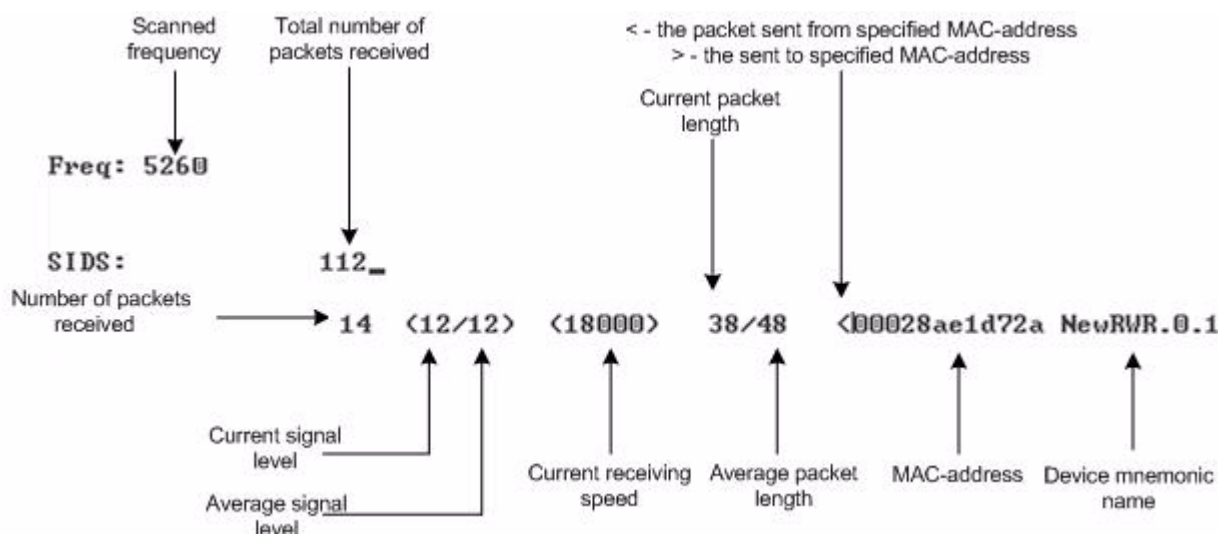The picture below shows the output **mac2** regime.

Figure 4-5: Muffer MAC2 Mode

Like in review mode this regime provides with the information about a current activity but on the configured frequency.

To run the **review** mode please type the following command:

```
muffer <IF-NAME> mac2
```

4.1.2.3   Statistics

The statistics gathering is used for estimating link load intensity. The amount of packets sent and received, and the number of retransmissions is shown for each MAC address participating in the data exchange.

The statistics output is presented in the picture below.

Figure 4-6: Muffer Statistics Mode

The following decisions can be made by analyzing the outputted parameters:

- If the number of repeated packets is comparable with total number of packets that means that you might have an interference source on the selected frequency. For normally operating link the percentage of repeated packets should not exceed 10%. It is extremely important to obtain a permanent zero value for the average number of repeats per packet. If the value is not zero that means that the link is NOT working properly and requires further improvement

- If total percentage of repeated packets and the percentage of packets that were repeated at least once are close to each other that might mean that you have got a permanent source of interference. Otherwise, it means that a strong interference source appears from time to time breaking your signal

- Concerning the fact that statistics module outputs the information for each MAC-address separately, you can reveal the problem for some specific unit on the wireless network

The "**muffer stat**" command shows the statistics only from registered devices.

To view **statistics** type the following command:

```
muffer stat
```

To reset all counters please type

```
muffer stat clear
```

4.1.2.4   Other Modes of Muffer

The **muffer** also has the following modes:

■ **mac** mode. Compared to the **mac2** mode this mode does not take link-level ACK messages sent by protocol support devices into account

■ **mac2** mode. This mode is used to detect impulse interference and doesn't disturb radio model normal operation.

■ **mac3** mode. Compared to mac2 mode this mode also performs calculation of impulse interference.

■ **mynet** mode. This mode performs the radio testing without disturbing radio module's normal operation, but taking into account only packets from within the given network

■ **Sensor** mode. In this mode shows the radio environment testing results on the screen in a visual-digital format.

4.1.3 Load Meter

Load meter is a powerful tool that allows estimating the load of a system interface specified by interface parameter. By default, the information is displayed on one line and updated every second; the load is measured in kilobytes.

Below picture shows the load meter output for the radio interface outputted in line-by-line mode with one second interval.
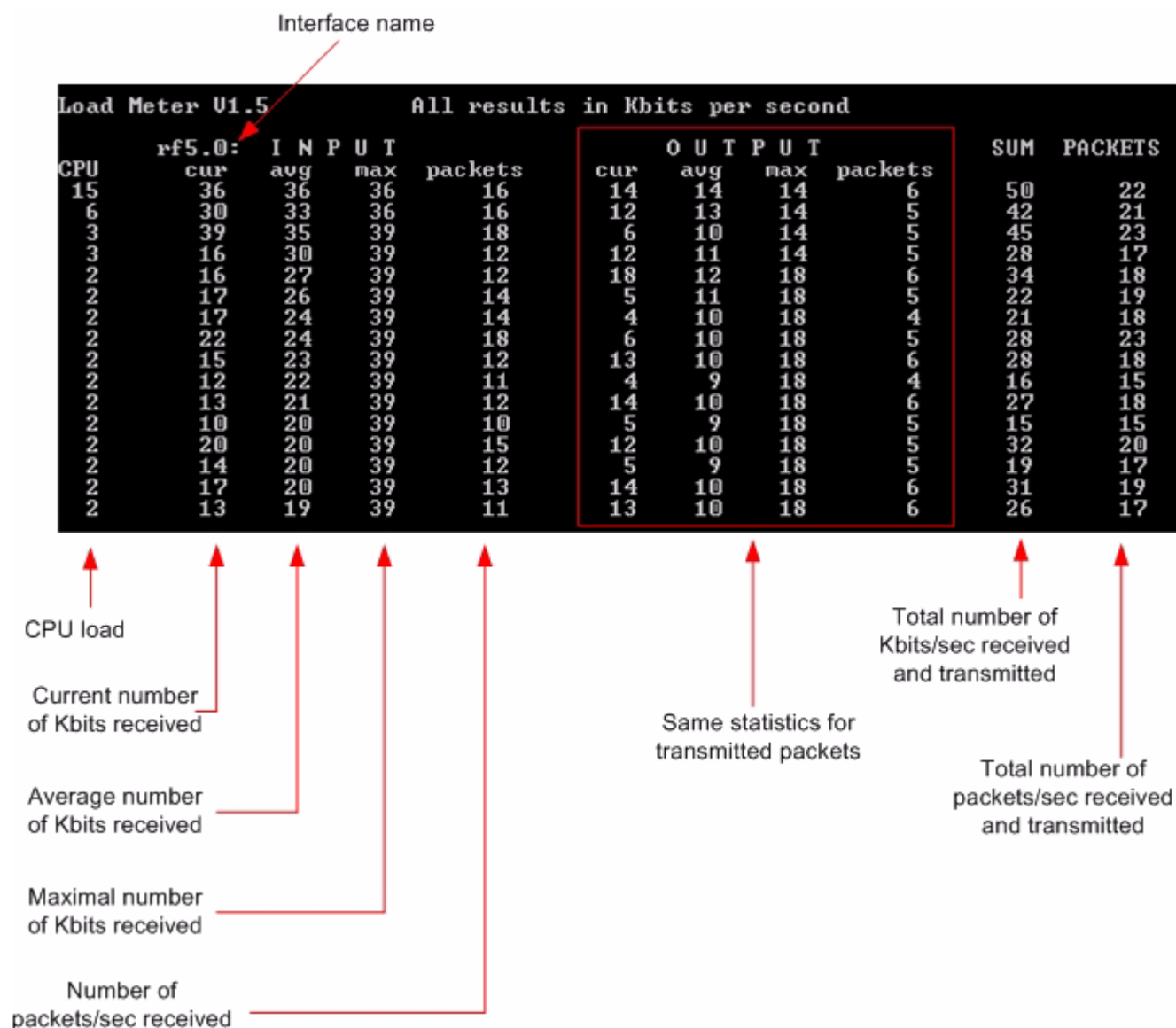
Figure 4-7: Load Meter

To run load meter like it is shown above, please type:

```
loadm -l <IF-NAME>
```

4.1.4   Acquiring Interfaces Statistics

Interface statistics can be acquired using **netstat** module which includes two modes:

■ Routing tables output (using "-**r**" parameter with the command)

■ Interfaces statistics output (using "-**i**" parameter with the command)

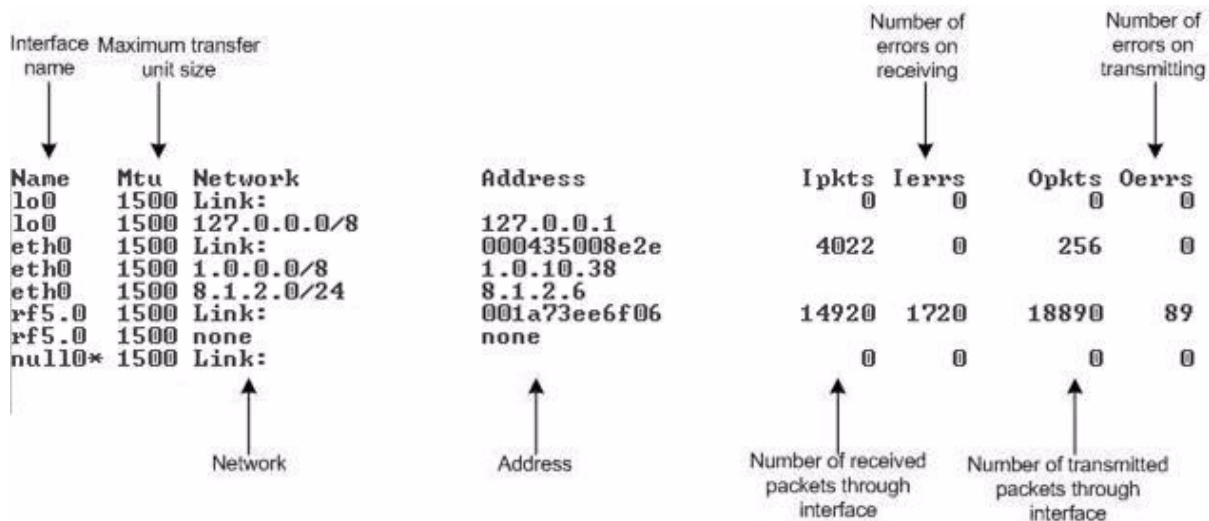Below picture shows the example of interfaces statistics output.

Figure 4-8: Netstat

NOTE

If the interface has several aliases the statistics is still measured for physical interface in a whole. For example, see rf5.0 or eth0 interfaces above. The numbers shown in 4 right columns correspond in physical interface.

4.1.5   RapidView

RapidView - is a special diagnostic device that is used for equipment comfort installation, antenna alignment and configuration.

Device allows getting the following information:

■ Radio link establishment indication

■ Visual monitoring of radio signal levels

■ Receiving retries information

■ Diagnostic of RF and Ethernet interfaces

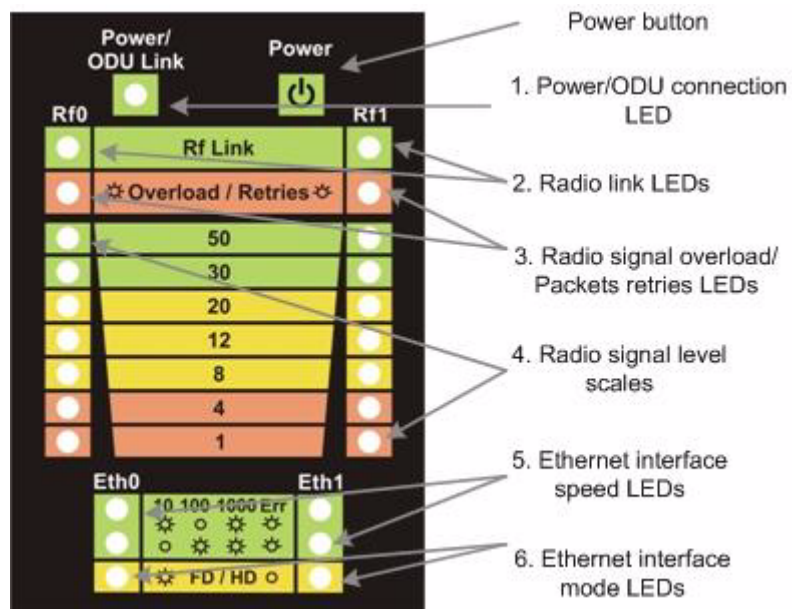**Figure 4-9: RapidView Top**

Figure 4-10: RapidView Back

Figure 4-11: RapidView Indicator Panel

4.1.5.1   How to Use

Turning on:

1   For turning RapidView on simply push the "Power button".

2   Device LEDs will light up for 2 seconds.

3   Device will perform constant tries to connect to ODU. If device's power is normal Power/ODU connection LED (1) will blink 1 time per second. If device's power is low LED 1 will blink 4 times per second in turn with not lighting intervals.

4   Once ODU link is established, LED 1 stops blinking (if power is normal) and device's interfaces status are shown by LEDs 2-6.

5   1 time per second device updates its status output.

6   If ODU link will be broken, LEDs 2-6 will go out after 2 seconds and LED 1 will start blinking 1 time per second.

Diagnostic device connection to ODU should be done via console port of the ODU. Once link is up between ODU and diagnostic device the following record is put in ODU system log:

```
 Connected test unit. Begin service communication over console.
 Test unit detected: rf0 - rf5.0
```

Exact radio interface names depend on wireless equipment configuration.

When diagnostic device is unplugged from the following record is put in ODU system log:

```
 Test unit disconnected. Return to normal console mode.
```

LEDs modes description:

ODU status monitoring via diagnostic device is performed by its LEDs indication. LEDs modes and ODU status correspondence is shown in the following table:

Table 4-1: Indicator LEDs

LEDs	Function
1. Power/ODU connection LED	Shows diagnostic device power status and diagnostic device-ODU connection status. **Constant lighting** - diagnostic device-ODU connection established, diagnostic device power is normal. **Blinking 1 time per second** - diagnostic device power is normal, diagnostic device-ODU connection is not established. **Blinking 4 times per second** - diagnostic device-ODU connection established, diagnostic device power is low (change batteries). **Frequent blinking with intervals** - diagnostic device power is low, diagnostic device-ODU connection is not established.
2. Radio link LEDs	Show whether radio link is established on certain ODU's radio interface. **Constant lighting** - radio link is established. What ODU's radio interface to show by what column RF0 or RF1 is chosen by the following way: for RF0 column is taken radio interface with the least number, for RF1 the other interface. For example, there are the following radio interfaces on ODU: rf5.0. Then for RF0 column rf5.0 will be taken, for RF1 - rf5.1. When no radio link then LEDs 2-4 are not lighting.
3. Radio signal overload/Packets retries LEDs	Show receiving radio signal level overload and number of packet retries information. **Constant lighting** -receiving radio signal level on the interface is too high. **Blinking 4 times per second** - number of retries >= 50% **Blinking 2 times per second** - number of retries >= 28% **Blinking 1 time per second** - number of retries >= 7% If certain radio interface (radio module) is not present on the device then all corresponding LEDs of this radio interface is off. If ODU has certain radio interface but it is not activated (for example, not entered "mint rf5.0 start" command) then LED 3 is blinking 1 time per second whereas LEDs 2 and 4 are not lighting. If ODU has certain radio interface but it is not activated (for example, not entered "mint rf5.0 start" command) then LED 3 is blinking 1 time per second whereas LEDs 2 and 4 are not lighting. If ODU has certain radio interface activated ("mint rf5.0 start" command entered) then LED 3 is blinking 4 times per second whereas LEDs 2 and 4 are not lighting.

Table 4-1: Indicator LEDs

LEDs	Function
4. Radio signal level scales	Show receiving signal level of the established radio link. Each LED can be in 4 modes: **Not lighting** - radio signal level is lower than scale value. **Blinking** - the more frequently is blinking the nearer signal level is to given scale value. **Constant lighting** - signal level is higher or equal to scale value.
5. Ethernet interface speed LEDs	Show speed of corresponding Ethernet interface. There are LEDs for the Ethernet interface. <table><tr><td></td><td>10 Mbps</td><td>100 Mbps</td><td>1000 Mbps</td><td>Error</td></tr><tr><td>Upper LED</td><td>Lighting</td><td>Not lighting</td><td>Lighting</td><td>Blinking</td></tr><tr><td>Lower LED</td><td>Not lighting</td><td>Lighting</td><td>Lighting</td><td>Blinking</td></tr></table>
6. Ethernet interface mode LEDs	**Constant lighting** - Full Duplex. **Not lighting** - Half Duplex. IF Ethernet connection is established but corresponding ODU's interface is not enabled then LEDs 5, 6 indicate connection configuration by blinking 1 time per second.
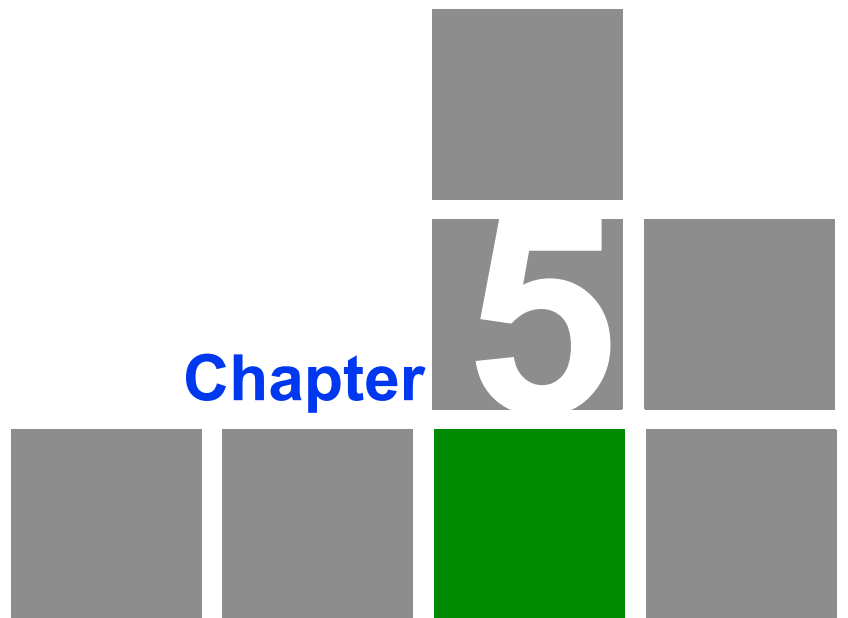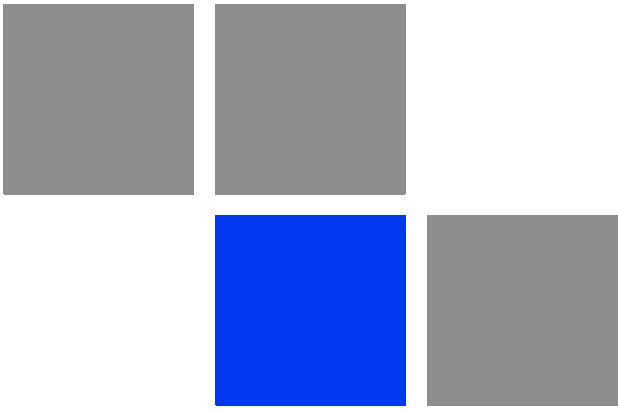
Chapter 5

Configuration Via Web Interface

In This Chapter:

5.1   Overall Functionality Overview

Web-interface is used for the following purposes:

- View and change system parameters of the device

- View and change system interface parameters of the device

- View and change radio link parameters

- View and change network parameters of the device

- Monitoring statistics for all interfaces

- Monitoring radio link statistics

5.2   Run Requirements

In order to run and properly use the application, the following requirements must be met:

■ Web-browser

■ OS WANFleX for MINT

■ Web-interface support activated on the device (*"webcfg start" command*)

To connect to the device via Web-browser type: *http://<device IP address> (by default **http://10.10.10.1**).*

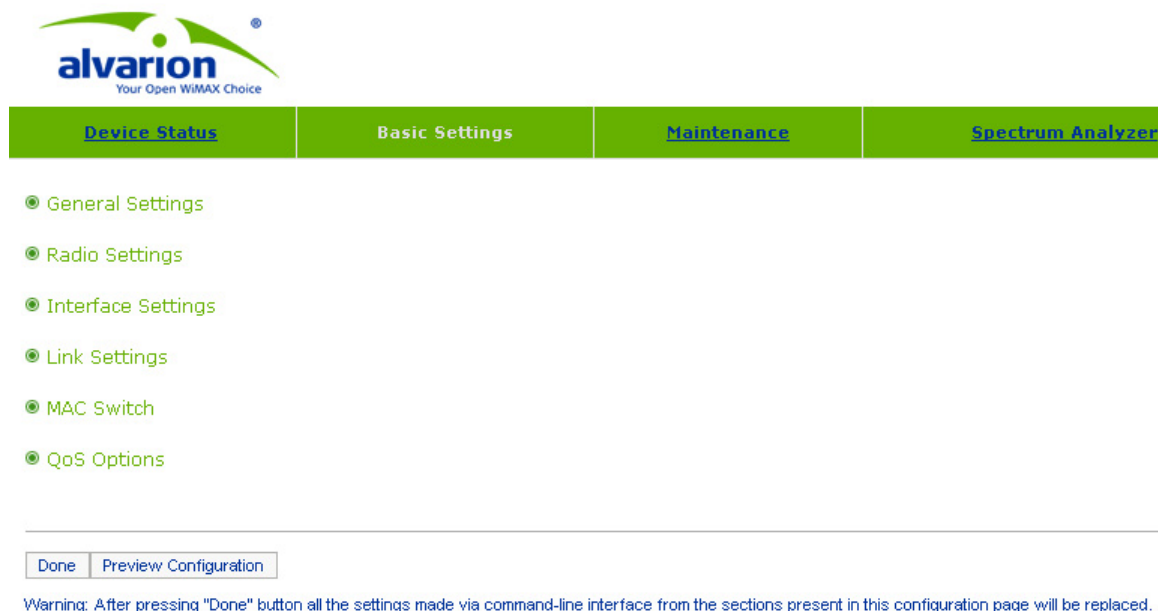| CAUTION |
| --- |
| Web session time-out is 30 minutes. |

5.3   Basic Settings

Figure 5-1: Basic Settings

On the "Basic Settings" page the device configuration is performed. All the parameters that are available for configuration are divided into the dedicated sections (e.g. "General settings", "Radio Settings").

To show/hide the parameters of the section just click the section's header.

The listing and description of all the sections can be found below in this chapter.

To view the commands that will be executed on the device after pressing the "Done" button, please use "Preview Configuration" button.

To apply the configuration changes to the unit use "Done" button.

NOTE
After pressing "Done" button unit's current configuration will be updated according to the parameters set on the "Basic Settings" tab. Unit will be turned into the switch mode.

5.3.1 General Settings

Figure 5-2: General Settings

This section allows viewing/setting general parameters used for device access:

■ Device name - general device name

■ User Name - User Name used as Login

■ Password - Secret Password used to login to the unit

■ Confirm Password - Password confirmation

■ Keep current system password" check-box - saves currently used password in the unit's configuration and locks "Password" and "Confirm Password" fields. In case this check-box is leaved unchecked and "Password" and "Confirm Password" fields are empty some web browsers may spontaneously put random data into them so that after the configuration is applied the password will be unknown to the user.

5.3.2   Radio Settings

Figure 5-3:

This section allows viewing/setting the following radio parameters:

■ Interface -available radio interface

■ Type - network type of the node (Master, Slave)

■ Channel Width - operating channel bandwidth of the radio in MHz. Must be
equal at both sides of the link

■ DFS - allows starting DFS (Dynamic Frequency Selection) service or DFS
without Radar Detection

■ Frequency - central operating frequency in MHz. Must be equal at both sides
of the link.

■ Frequency range list - list of frequencies allowed for choosing by DFS service

■ TX Power - output power of the radio in dBm. "Auto" field enables ATPC
function (recommended)

■ Tx Bitrate - fixed operating bitrate (if numerical value chosen) or auto bitrate
(Automatic Modulation Control) if "Auto" is chosen. "Autobitrate" is
recommended

5.3.3 Interface Settings

Figure 5-4: Interface Settings

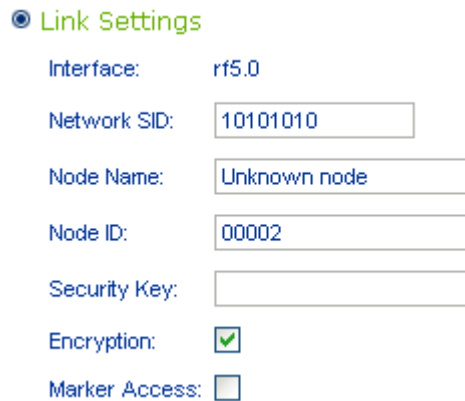This section allows viewing/setting the following network parameters:

■ ethX Settings - Ethernet interface settings (e.g. eth0):

■ "Up" check-box enables/disables the interface

■ "DHCP" check-box allows starting DHCP client on the interface

■ IP-address field allows assigning an IP-address to the interface. One can assign more than one IP-address to the interface by using "+" button. "X" button clears the corresponding IP-address. "Remove" button deletes the corresponding IP-address.

rfX Settings - RF interface settings (e.g. rf5.0):

Please see "ethX Settings" description above.

Default Gateway - sets an IP-address for the Default Gateway.

5.3.4   Link Settings

Figure 5-5: Link Settings

This section allows viewing/setting the following link parameters:

■ Interface - available radio interface

■ Network SID - Network System Identifier (8-digit HEX figure). All units that are supposed to see each other on the same radio link must have the same SID value

■ Node Name - the network name for the node

■ Node ID - the sequential number for the node. The parameter is optional

■ Security Key - key word to encode protocol messages. The key can be up to 64 characters long and should not contain spaces (or should be put in quotes). All units that are supposed to see each other on the same radio link must have the same Security Key

■ Encryption - enables hardware-accelerated AES-128 encryption for all the traffic

■ Marker Access - turns marker access (Polling) mode on. This mode is recommended for long PTP links (7+ km). Should be enabled just at one side of the PTP link (do not enable polling at both sides, otherwise wireless connection will fail!)

5.3.5   MAC Switch

Figure 5-6: MAC Switch

This section allows stating the switch mode on the unit and creating multiple switch groups.

■   "Create Switch Group" button - creates a new switch group

■   "ethX" and "rfx" check-boxes allows including the corresponding interfaces into the switch group

■   Enabled - enables the corresponding switching group

■   STP - enables Spanning Tree Protocol feature at the switching group

■   IGMP - enables IGMP-Snooping feature at the switching group

■   Repeater - starts the repeater mode. In this mode the group switches the packets simply by sending them to all the device's interfaces except the one the packet was received from.

■   Admin - sets the switching group as the admin group. All the packets originated by the unit itself (e.g. RIP/OSPF or ping) leave the MINT network via the admin group. If "No Admin Group" is selected such packets isn't able to leave the network

■   "X" button - deletes the group

■   Up and down arrows allows to change the group's order

■ Group Rules - allows adding rules that defines what packets should be processed by the group

■ Default Action - the action (permit or deny) taken on the packet if it doesn't match to any rule

■ Help - displays help guidelines for rules creation using "Group Rules" subsection

■ Management VLAN - sets a Management VLAN ID. When set the device access and configuration are possible only via Management VLAN

■ "Enable Switch" check-box - starts switching on the unit.

5.3.5.1   Group Rules

Figure 5-7: Group Rules

This subsection of the "MAC Switch" section allows adding rules that defines what packets should be processed by the group.

■ Match - a field where a rule shall be typed in. To view the rules help please use the "Help" button in the "MAC Switch" section (described above).

■ Validate - checks if the rule typed in the "Match" field has the right syntax

■ Action - the action (permit or deny) taken on the packet if it matches the rule

■ "X" button - deletes the rule

■ Up and down arrows allows to change the rule's order

■ New Rule - creates a new rule's entry in the "Group Rules" subsection

5.3.6   QoS Options

Figure 5-8: QoS Options

This section allows managing traffic prioritization.

5.3.6.1   Auto Prioritization

This set of check-boxes allows enabling/disabling automatic traffic prioritization for different types of packets.

■ RTP Packets - enables automatic prioritization for real time packets

■ Dot1p Tags - enables automatic prioritization for packets labeled with IEEE 802.1p priority

■ IP ToS - enables automatic prioritization for packets labeled with ToS

■ TCP Acknowledgments - enables automatic prioritization for TCP Acks.

5.3.6.2   Miscellaneous

These options allow choosing the prioritization policy applied to the traffic queues and enabling ICMP prioritization.

■ "Strict Prioritization" check-box enables "Strict Priority" prioritization policy (otherwise, by default, "Weighted Fair Queuing" policy is used).

■ "ICMP Prioritization" check-box enables prioritization of ICMP (Internet Control Message Protocol) packets

5.4   Device Status

Figure 5-9: Device Status

"Device status" sheet allows viewing interface and radio link statistic. One can set "Auto Refresh" option to refresh the statistics automatically. Refreshment frequency can be set by "Auto Refresh Time" parameter. Device statistics can be also refreshed manually by "Refresh" button.

"Interface Statistics" section displays the following parameters of all device's interfaces:

- Interface name

- Interface MAC Address

- Status

- Mode

- Packets (Rx/Tx)

- Errors (Rx/Tx)

"Wireless Links Statistics" section displays all neighbor devices that it may physically "hear" and that satisfy the given criteria. The following radio link parameters are displayed:

■ Link Quality (color indication of a connection quality: red - bad connection, yellow - "not very good" connection, green - good connection)

■ Unit's interface, to which neighbor is connected

■ Neighbor's name

■ Neighbor's MAC address

■ Distance

■ Control Level (dB) Rx/Tx - signals levels for minimal available bitrate

■ Current Level (dB) Rx/Tx - signals levels for current bitrate

■ Bitrate Rx/Tx

■ Retries (%)

■ Errors

■ Load (Rx/Tx) in kbps

■ Load (Rx/Tx) in pps

5.4.1   Extended Link Diagnostic

Once the unit is wirelessly connected to the remote neighbor it is possible to make extended diagnostic and optimization of this link. To do this just mouse-click on the row containing data of the wireless link you want to test (as on the picture shown below):

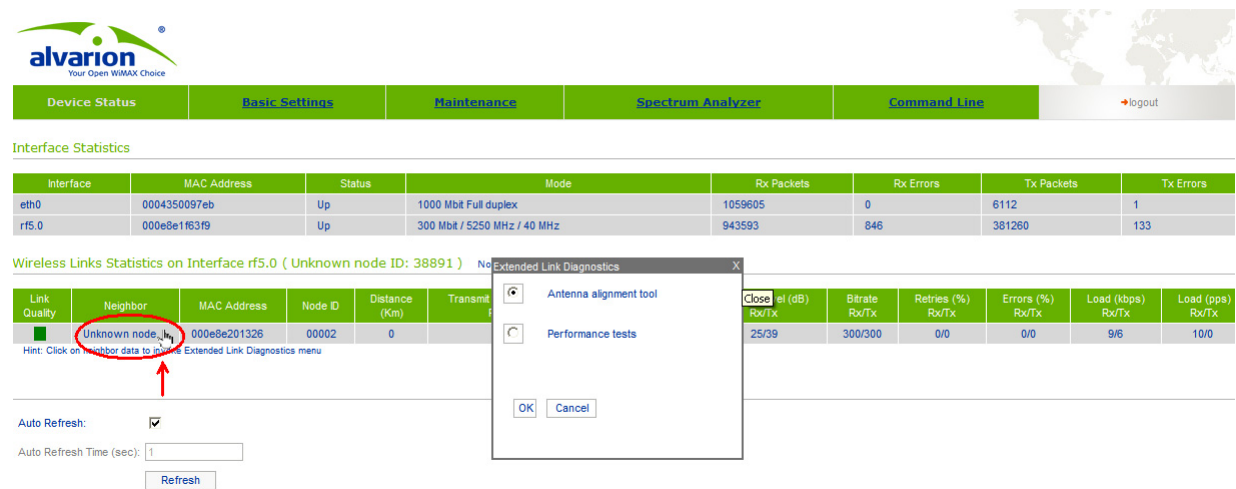**Figure 5-10: Extended Link Diagnostics**

Then choose "Antenna alignment tool" or "Performance tests" from the appeared "Extended Link Diagnostic" window.

5.4.1.1 Antenna Alignment Tool

Graphical antenna alignment tool visualize antenna alignment process making it quicker, easier and comfortable for the user.
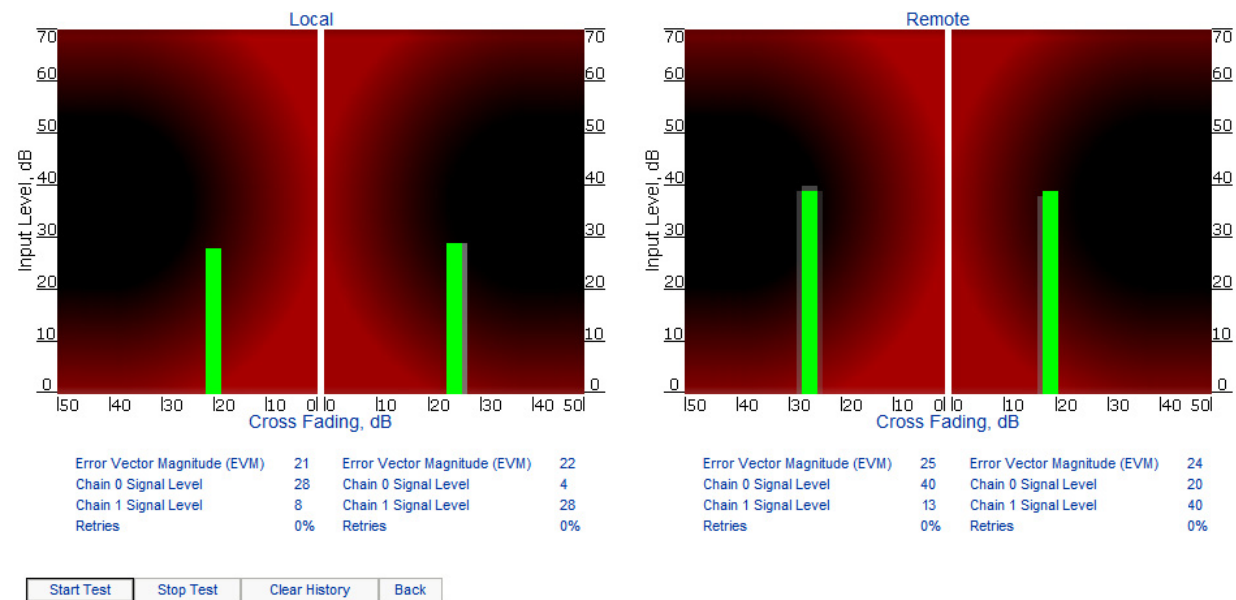
"Antenna alignment tool" page view is shown below:

Figure 5-11: Antenna Alignment

"Start Test"/"Stop Test" buttons at the bottom of the page start/stop the alignment test.

"Back" button returns to the "Device Status" page.

Once the test is started antenna alignment can be monitored using graphical and text indicators. Indicators for both local and remote devices are displayed together on the same page that allows viewing the alignment process for both sides of the link.

Each side of the link (local and remote) has two similar test indicator sets corresponding to two antenna polarizations (rx chains) of the device (one for Vertical polarization and another for Horizontal). This allows controlling the alignment process for each antenna polarizations for local and remote devices simultaneously.

Text indicators are the following:

- Error Vector Magnitude (EVM) - indicator of the measured input signal quality. It should be as high as possible. The recommended level is not less than 21.

- Chain 0 Signal Level - input signal level indicator of antenna number 0 (vertical polarization).

- Chain 1 Signal Level - input signal level indicator of antenna number 1 (horizontal polarization).

- Retries - percentage of transmit packet retries.
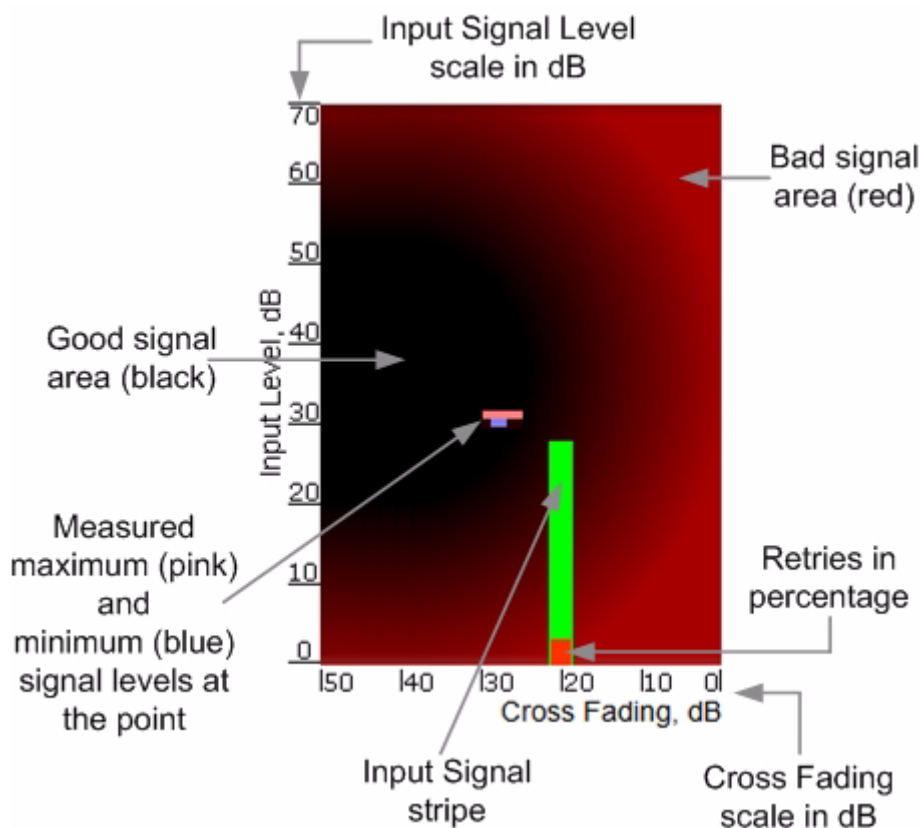
Graphical indicator:

Figure 5-12: Antenna Alignment Graphical Indicator

The main item in the graphical indicator is Input Signal stripe.

The height of the Input Signal stripe is measured by Input Signal Level scale in dB. The higher is the stripe the stronger is the signal.

The stripe can change it location along the Cross Fading scale that shows how much influence the corresponding device antenna has on the other one, i.e. how much vertically and horizontally polarized signals influence each other. The higher value has the stripe according to the Cross Fading scale (the farther stripe is from the 0 dB value) the less influence antennas have on each other.

The top of the Input Signal stripe can be located in black (Good signal) or red (Bad signal) background areas or somewhere in washed border between them. It means the signal is good, bad or average correspondingly. When aligning the antenna it is recommended to try to achieve the stripe top to be located in the black area.

At the bottom of the Input Signal stripe may appear a special red sub-stripe. This sub-stripe indicates the presence of packet retries and its percentage of the total transmitted packets number.

The Input Signal stripe may itself change the color indicating the quality of the received signal (EVM). The possible stripe colors are:

■ Green - signal quality is good

■ Yellow - signal quality is worse but acceptable

■ Red - signal quality is bad.

During alignment test the Input Signal stripe may be moving along Cross Fading scale and increase or decrease in height indicating the changes in the received signal. When the top of the stripe is changing its location moving from one point on the background area to the other it commonly leaves pink and blue marks that indicate measured maximum and minimum levels of the signal at the particular point. Thus it makes possible to observe the "history" of the signal changes. To clear the marks use "Clear History" button at the bottom of the page.

Main recommendations when using "Antenna alignment tool":

1 It is recommended to start antenna alignment with searching maximum signal level on a minimal possible bitrate. Afterwards automatic MINT mechanisms will set the most appropriate bitrate when "Autobitrate" mode will be enabled.

2 Input signal level should be between 12 and 50. ATPC is recommended to be enabled.

If signal level it is more than 50 it is recommended to lower amplifier power (ATPC will do it automatically).

If maximal signal level is less than 12 it is recommended to lower channel width (for example, from 20MHz to 10MHz).

In some cases signal level that is less than 12 may be enough for radio link operation. In this case one has to be guided by such parameters as number of retries and Error Vector Magnitude. If the number of retries is small and EVM is more than 21 (Input Signal stripe is green) then the radio link, most often, will be operating properly.

3 Retries value should be zero or as low as possible.

4 The top of an Input Signal stripe should be located in the black area.

5 The signal quality should be good: EVM value should be more than 21, Input Signal stripe color should be green.

6 Input signals of the two antennas of the device should have similar Cross fading values (Input Signal stripes should be located symmetrically relating to the 0 dB value).

ALL described recommendations should be applied to both (Local and Remote) sections.
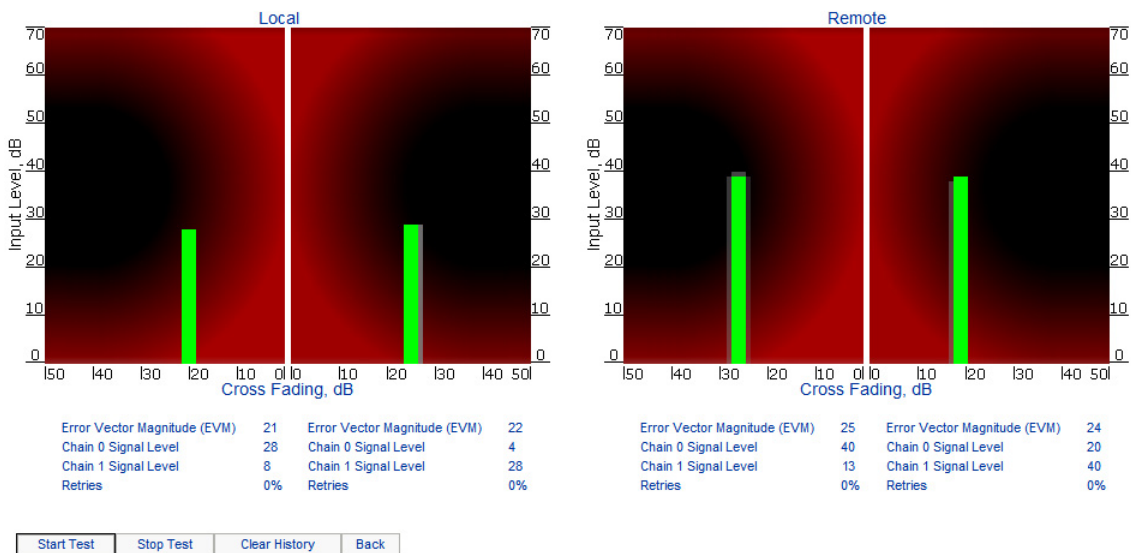
Link samples:

◼ Good link sample

Figure 5-13: Good Link Sample

◼ Bad link sample

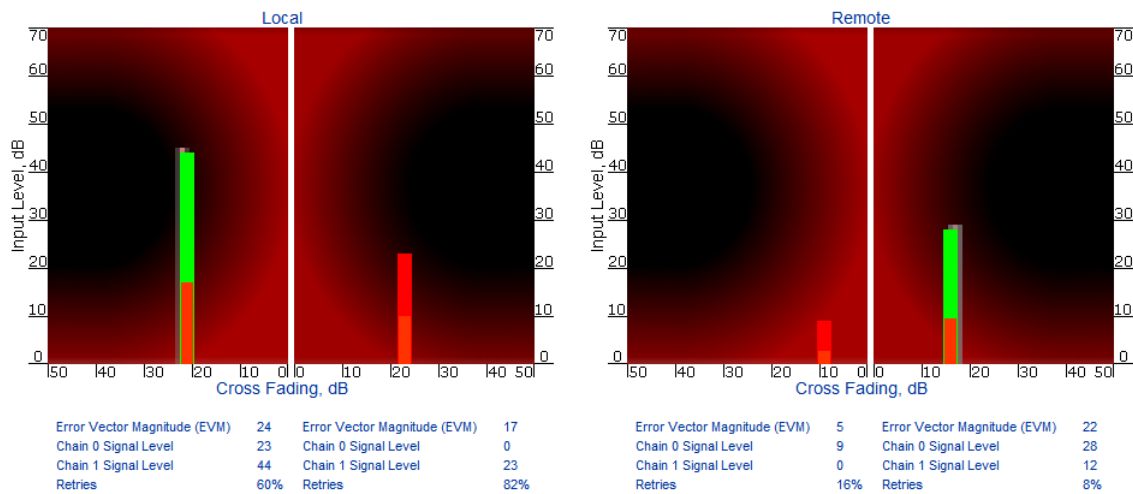|	Local			Remote	
Error Vector Magnitude (EVM)	24	Error Vector Magnitude (EVM)	17	Error Vector Magnitude (EVM)	5	Error Vector Magnitude (EVM)	22
Chain 0 Signal Level	23	Chain 0 Signal Level	0	Chain 0 Signal Level	9	Chain 0 Signal Level	28
Chain 1 Signal Level	44	Chain 1 Signal Level	23	Chain 1 Signal Level	0	Chain 1 Signal Level	12
Retries	60%	Retries	82%	Retries	16%	Retries	8%

Figure 5-14: Bad Link Sample

5.4.1.2   Performance Tests

"Performance tests" page allows performing link throughput tests on all the bitrates that are available for the configured channel bandwidth.

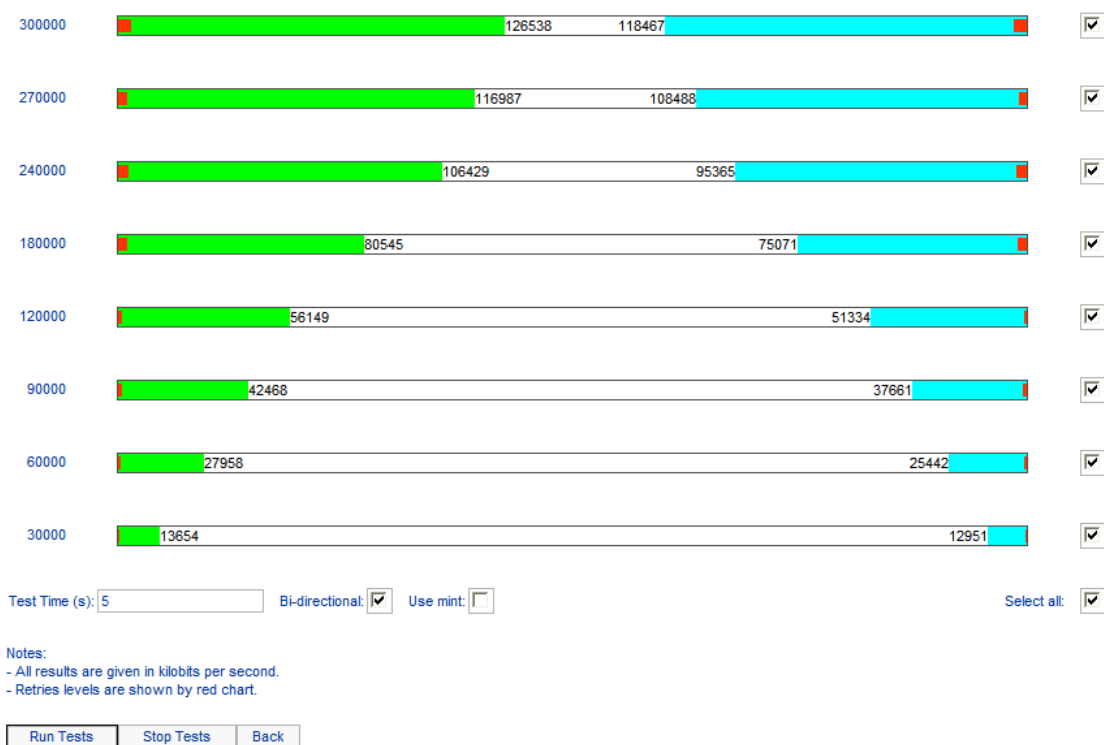"Performance tests" page view is shown below:

Figure 5-15: Performance Test

"Run Tests"/"Stop Tests" buttons at the bottom of the page start/stop the performance tests.

"Exit Test" button returns to the "Device Status" page. Test results will be deleted after pressing "Exit Test" button.

Each row corresponding to a certain bitrate value can be selected or deselected for participating in the performance test by using a check-box on the right of it. By using "Select all" check-box all the bitrates could be selected/deselected at once.

Three more parameters are available for management:

■ "Bi-directional" check-box that allows choosing between making bi-directional (when checked) and unidirectional (unchecked) performance tests.

■ "Use mint" check-box allows performing "real-life" testing when all the traffic and link parameters are controlled and managed by MINT functions such as ATPC and autobitrate (in ordinary test ATPC and autobitrate are not used). In this mode the statistics for errors and retries is not available.

■ "Test time" parameter allows setting the duration of the test for each bitrate in seconds (5 seconds by default).

The bitrates list on the "Performance test" page consists of the bitrates that corresponds to the channel bandwidth set on the unit (5/10/20/40MHz). To perform the tests for the bitrates related to the other channel bandwidth you need to reconfigure channel bandwidth ("Channel Width" parameter in the "Radio Setting" section of the "Basic Settings" page) on both units that form the tested link.

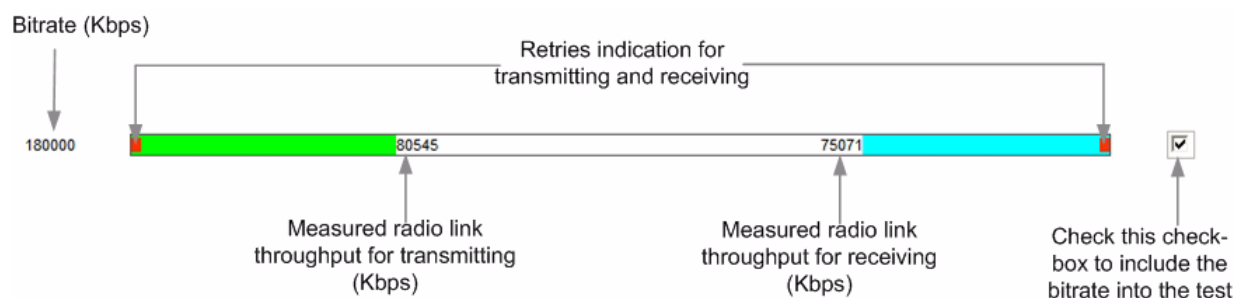Bi-directional performance test output description for 180 Mbps bitrate (40MHz channel bandwidth):

Figure 5-16: Performance Test Sample

5.5   Maintenance

Figure 5-17: Maintenance

"Firmware" section shows current firmware version, firmware build date, serial number and system up time.

"Upload"/"Download" sections allow uploading and downloading license files, firmware and configuration on/off the device.

The following buttons can be used:

■ "Reboot" button - reboots the device.

■ "Restore Factory Settings" button - restores factory default configuration.

■ "View Current License" button - shows current device license parameters in a separate window

■ "View Current Configuration" button - shows the full running device configuration in text format in a separate window

"Create Diagnostic Card" button - creates a text file that contains complete information set from the device such as: full device configuration listing, system log output, license information, "mint map detail" command output, interfaces statistics and so on.

5.6   Spectrum Analyzer

Figure 5-18: Spectrum Analyzer

"Spectrum Analyzer" tab provides deep analysis of radio emission sources. In this mode device scans the radio spectrum on all available frequencies. To obtain information as complete as possible, the scanning process may take some time.

The following parameters can be set to manage "Spectrum Analyzer" operation:

■ Unit's radio interface

■ Start frequency, determining the initial frequency for scanning in MHz.

■ Stop frequency, determining the ending frequency for scanning in MHz.

■ Band - bandwidth in MHz.

CAUTION

40MHz band value is not available.

■ Step - scanning frequency step in MHz.

NOTE

It is recommended to set 1 MHz "step" value to get more precise scanning results.

CAUTION

40MHz step value is not available.

■ Channel mask - specifies which antenna will scan the radio environment. "Auto" value set scanning by both antennas.

■ Scan Duration - time period for scanning in seconds. After the end of this time period scanning will be stopped and radio interface will be back to normal mode operation

■ Enable Grid - draws grid lines and highlights the special frequency channel on the scan output. Special highlighted frequency channel can be used to mark a channel that the device is currently working on or that is planned for using

■ Grid Width -bandwidth value for the highlighted frequency channel in MHz

■ Grid Frequency - central operating frequency for the highlighted frequency channel

■ Gradient Max RSSI - shows gradient-color marked "Max RSSI" values on the Spectrum Analyzer output screen.

To start/stop "Spectrum Analyzer" use "Start Sensor Test"/"Stop Sensor Test" buttons.

"Last Snapshot" button outputs the final scanning results. It is used when doing a spectrum scan at the remote unit on the other side of the radio link. When

running a spectrum scan at such a unit (accessible via the RF interface), connection to this unit will be lost for a scan time. "Last Snapshot" button allows viewing scan results after the connection is up again.

You can get detailed information about scanned radio signals on a specific frequency. Just point a cursor on the needed frequency and you will see a hint with exact Signal level (dBm), Frequency (MHz), Noise Floor (dBm), RSSI (dBm), High RSSI (dBm), Max RSSI (dBm) values.

CAUTION

If the web page is refreshed either via Web Browser refresh button or the refresh button located on the Device Status page of the unit's Web Interface the Spectrum Analyzer will stop.
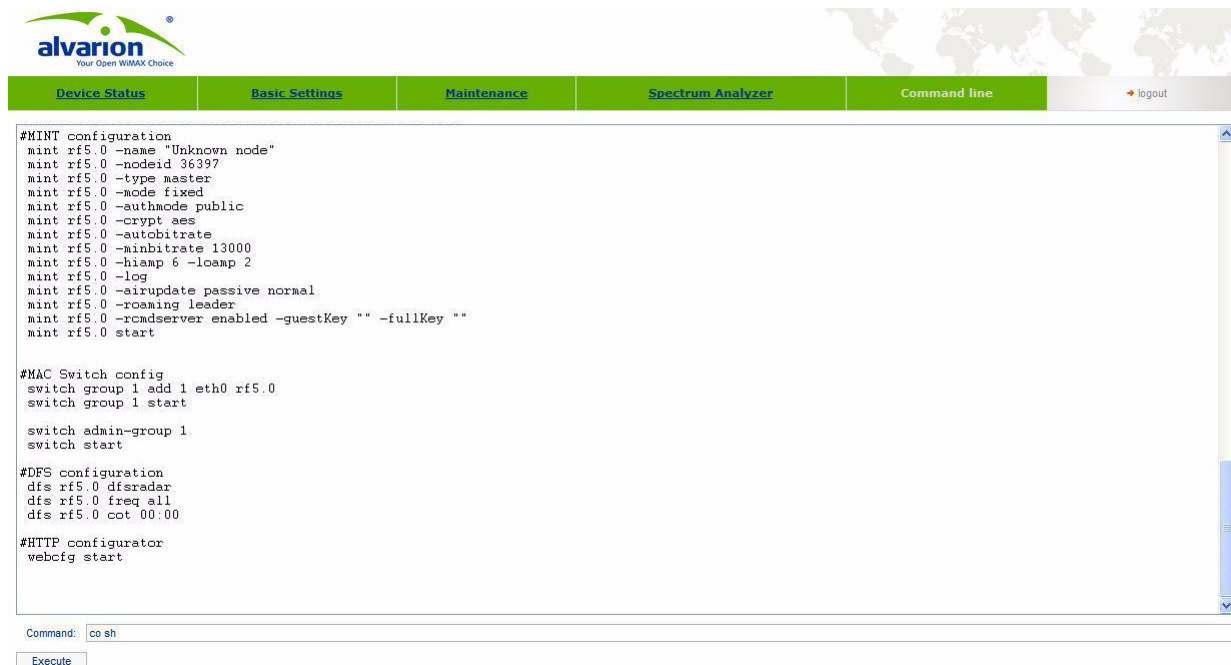
5.7   Command Line Emulation

Figure 5-19: Command Line Emulator

"Command line" tab emulates CLI (command line interface) in the Web-interface. It allows managing and monitoring the device by using all the commands and functions that are available via standard CLI.

To type the commands use "Command" field and then press either "Execute" button on the screen or "Enter" key on your keypad. The commands output are shown in the window above.
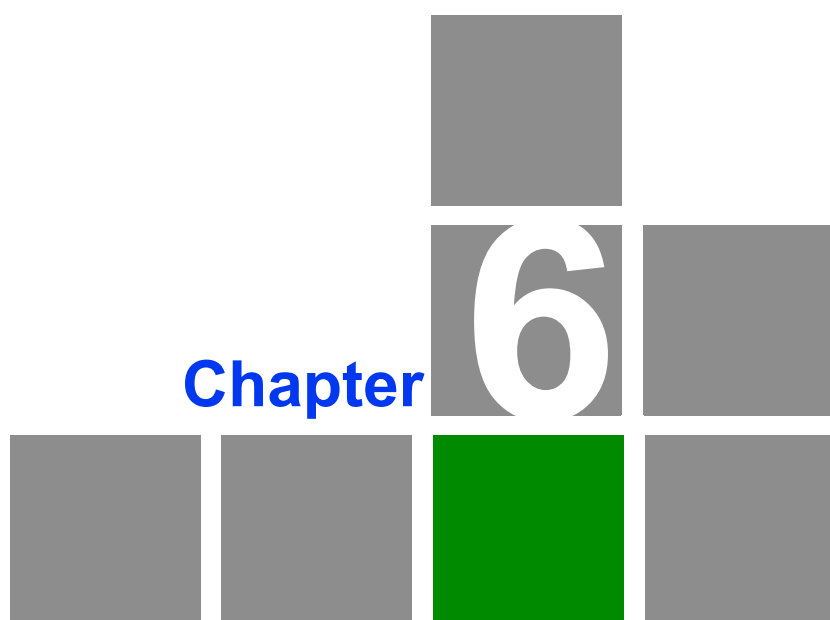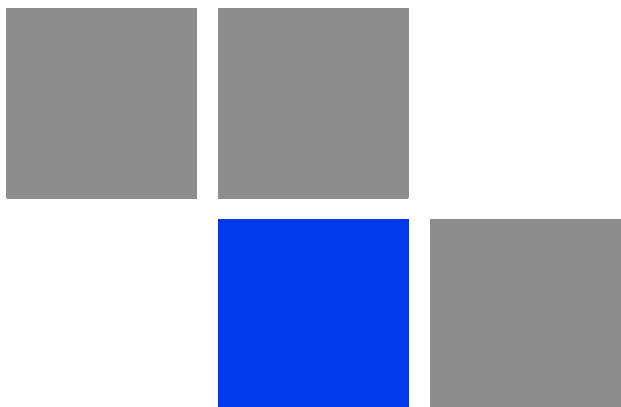
Chapter 6

Supplementary Information

In This Chapter:

6.1   "RJ-45" Service Cable Connector Soldering Scheme

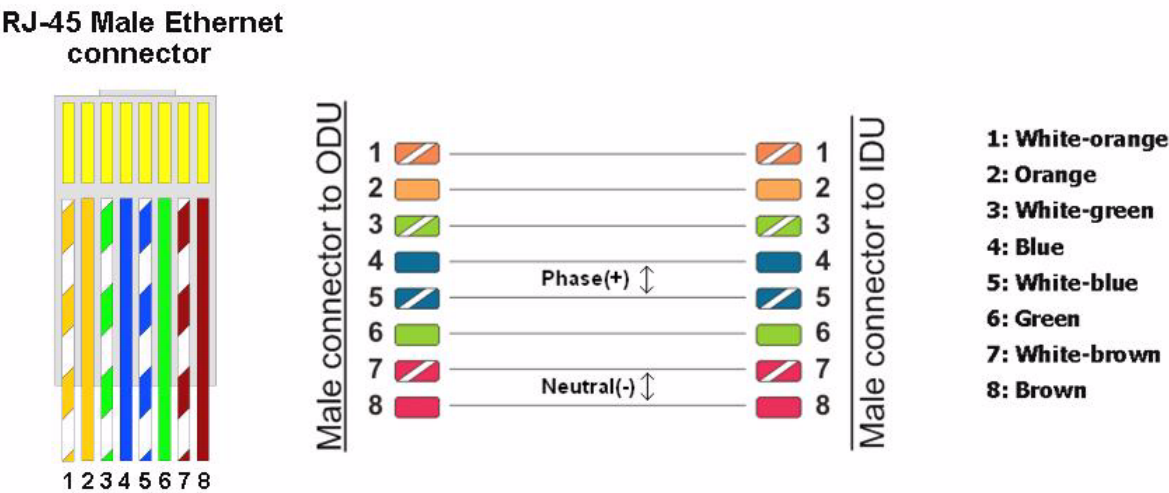**Figure 6-1: Service Cable Connector Soldering Scheme**
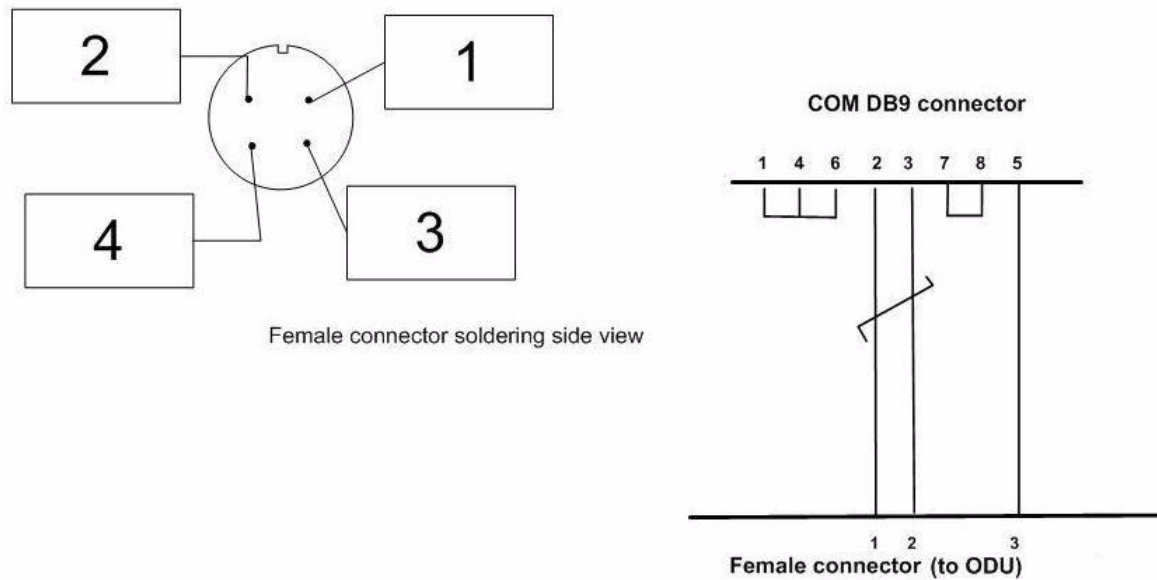
6.2 Console Cable Connector Soldering Scheme

Figure 6-2: Console Cable Connector Soldering Scheme