

InfiNet Wireless R5000

Technical User Manual

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This equipment has been tested and found to comply with the limits for a Class B digital device

Hereby, InfiNet Wireless declares that this equipment is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.


	<p>The CE Marking on this equipment indicates compliance with the following:</p> <p>This device conforms to Directive 1999/5/EC on Radio Equipment and Telecommunications Terminal Equipment as adopted by the European Parliament And Of The Council.</p>
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I. Getting Started

This Technical User Manual contains the description of InfiNet Wireless equipment including installation and configuration guidelines, recommendations and troubleshooting sections, 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

1. Scope of this document

This document consists of the following chapters:

Getting started

This chapter includes the information about this document purpose and structure.

Hardware description

This chapter shows the devices appearance and all plugs and connectors.

Installation procedure

The chapter describes the steps to be taken when installing the equipment at the installation sites and installation site requirements.

Device configuration procedure

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 configuring

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

Services, features and tools

This chapter describes device's built-in services, features and tools which were not described in previous parts of the document

The chapter contains different recommendations for some particular cases of InfiNet Wireless devices usage including building high-speed autonomous links and multi-sectored base station design.

Supplementary information

The chapter contains supplementary information (specifications, connectors soldering schemes and InfiNet Wireless products matrix).

2. General products description

InfiNet Wireless products offer scalable, robust, flexible and cost-effective broadband wireless access solutions for carrier-class networks. Wireless routing equipment from InfiNet Wireless is designed to implement and expand carrier-class networks for high-speed Internet access, enterprise campus networks, primary links for the Last Mile and backhauling traffic between cell towers and multiple access points.

InfiNet Wireless Devices are especially applicable to regions with complex wired infrastructures where infrastructure upgrades require costly or time-consuming activities. Many deployments have been accomplished in regions with a dearth of wired infrastructure where wireless solution is the only viable option for both voice and data networks. The deployment of InfiNet Wireless Devices minimizes both capital and operational investments for the creation of network infrastructure.

Key product features:

- Wide range of frequency bands
- Outstanding performance
- Powerful QoS capabilities
- Best-in-Industry networking feature set
- Flexible management
- Powerful integrated diagnostic tools

The InfiNet Wireless Devices can support flexible topologies including point-to-point links, point-to-multipoint links, MESH networks, high-speed transport connections (backbones) and relay-points building. They have been designed to prevent internal and external interference using such product features as software selectable transmit power control, static frequency selection, asymmetrical bit-rate/transmit power rates selection for base and subscriber units. In order to maintain link availability, solve the "hidden node" problem and reduce the collision rate, the product employs dynamic adaptive non-collision polling MAC protocol that dynamically redistributes data streams between active and inactive subscribers. Autobitrate mechanism is an optional powerful feature that provides link reliability in case of changing conditions on the path of the link.

The data network built on InfiNet Wireless products is implemented as a routed and switched IP network which reduces flooding and broadcast messages specific to bridged networks and to implementation of Quality-of-Service (QoS) features set. QoS definitions per subscriber's data flows are effectively mapped on MAC level flow attributes.

Each device in the network can be configured using serial console port, Telnet protocol, WEB-interface and NMS system.

The software/firmware is fully upgradeable for all InfiNet Wireless Devices. New firmware images can be downloaded from the Repository on the InfiNet Wireless support web-site <http://support.infinetwireless.com> for its further uploading on the device.

3. Abbreviations

The following abbreviations are used in this document:

- BS – Base Station
- CPE – Customer Premises Equipment (also called **subscriber** or **subscriber unit**)
- ODU – Outdoor Unit
- IDU – Indoor power supply Unit
- RF cable – Radio Frequency cable to connect ODU and antenna/Device and antenna for 5000-O and 5000-I modifications correspondingly
- LOS – Line-of-Sight
- STP cable – Shielded Twisted Pair cable (STP Cat5E) to connect ODU and IDU
- PTP – Point-to-Point topology
- PTM – Point-to-Multipoint topology
- MINT – Mesh Interconnection Networking Technology protocol

4. Document marks



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



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

5. Additional information

Additional information which is not included in this Manual can be found in the following sources:

- WANFlE X OS User Guide
- Our web-site: www.infinetwireless.com

- Our support site: <http://support.infinetwireless.com>

II. Hardware description

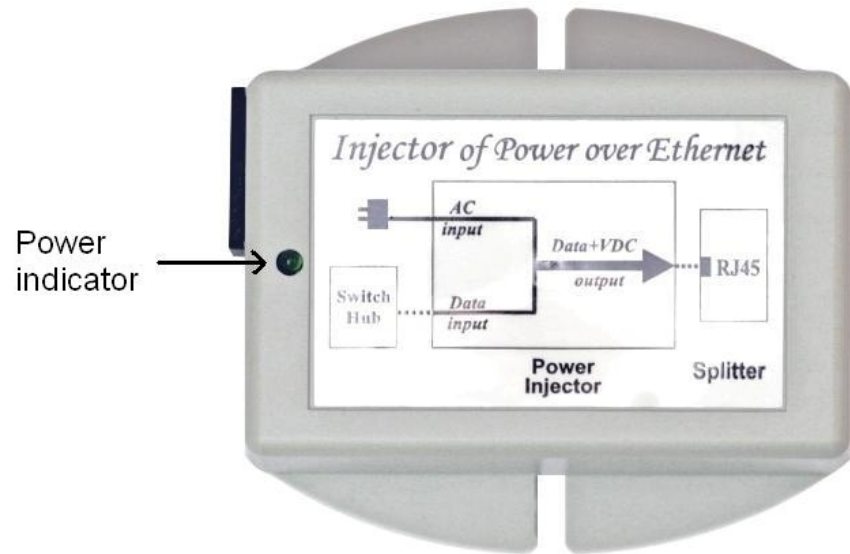
1. Power supply units (IDU)

All outdoor equipment is equipped with indoor power supply units. Exact type of IDU which is used with each device model is specified in different models description (see below).

IDU-CPE

Used with *R5000-Smn* and *R5000-Lmn* only.

Top view



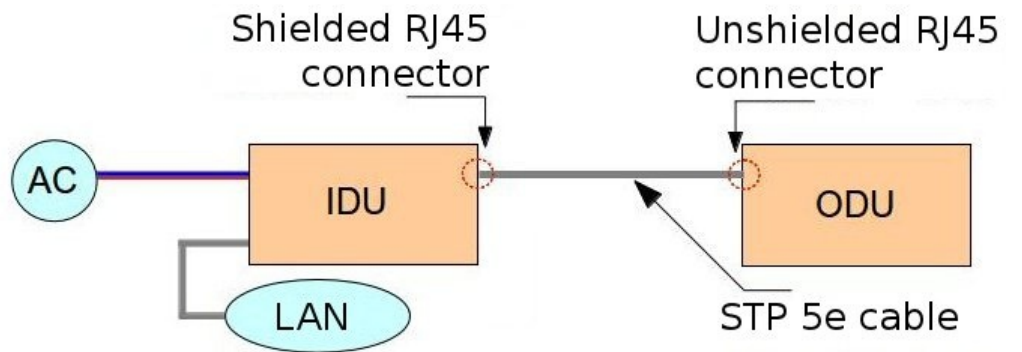
Front panel



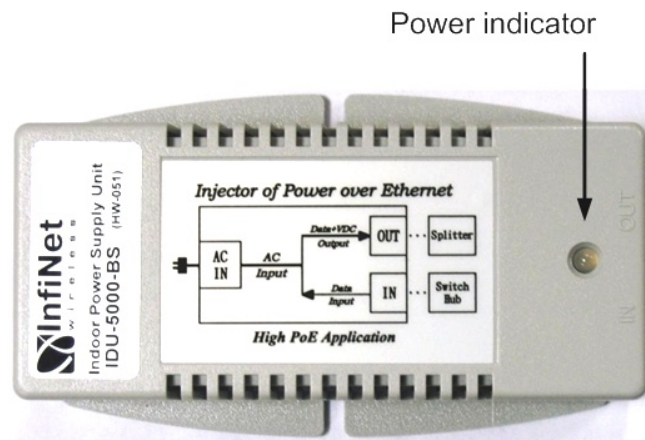
Rear panel



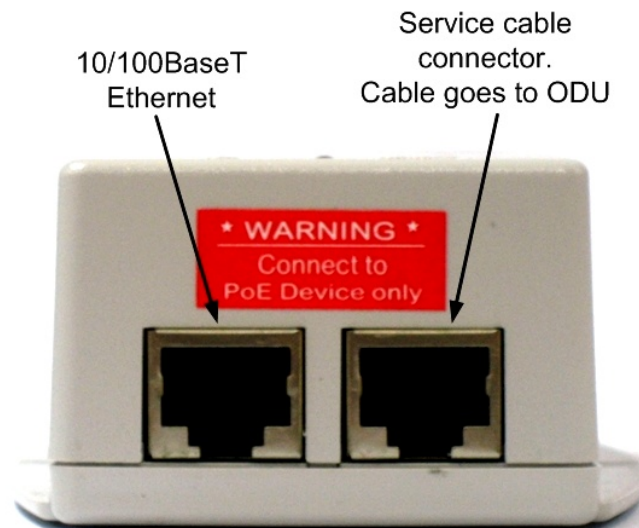
Connection scheme for IDU-CPE



Top view

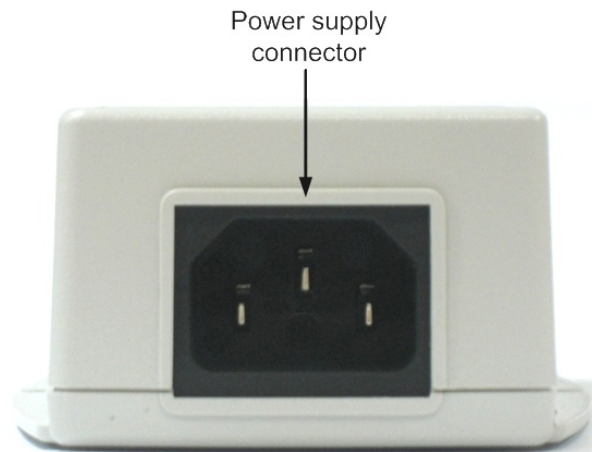


Front panel

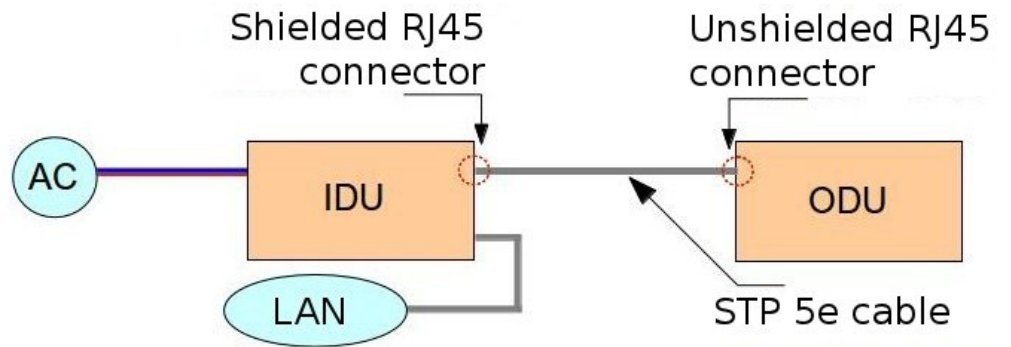


*IDU-BS-G model has 10/100/1000BaseT Ethernet port

Rear panel



Connection scheme for IDU-BS-G



Injector IDU-LA-G

Injector IDU-LA-G may be used for the following purposes:

1. To serve as a line protection unit for indoor network equipment connected to the second Ethernet port on ODU.
2. To connect third-party DC power sources to ODU (for example, to power the unit from solar power or wind power sources).

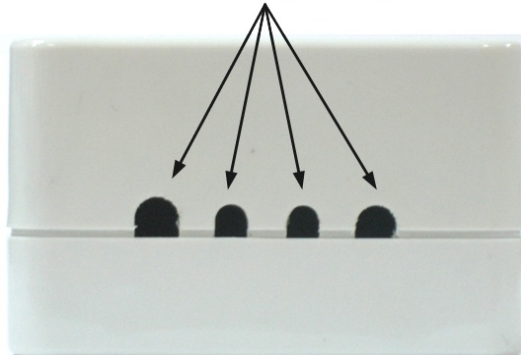
In both cases IDU-LA-G should be properly grounded (please refer to the "Grounding when using IDU-LA-G" section of this manual).

Top view

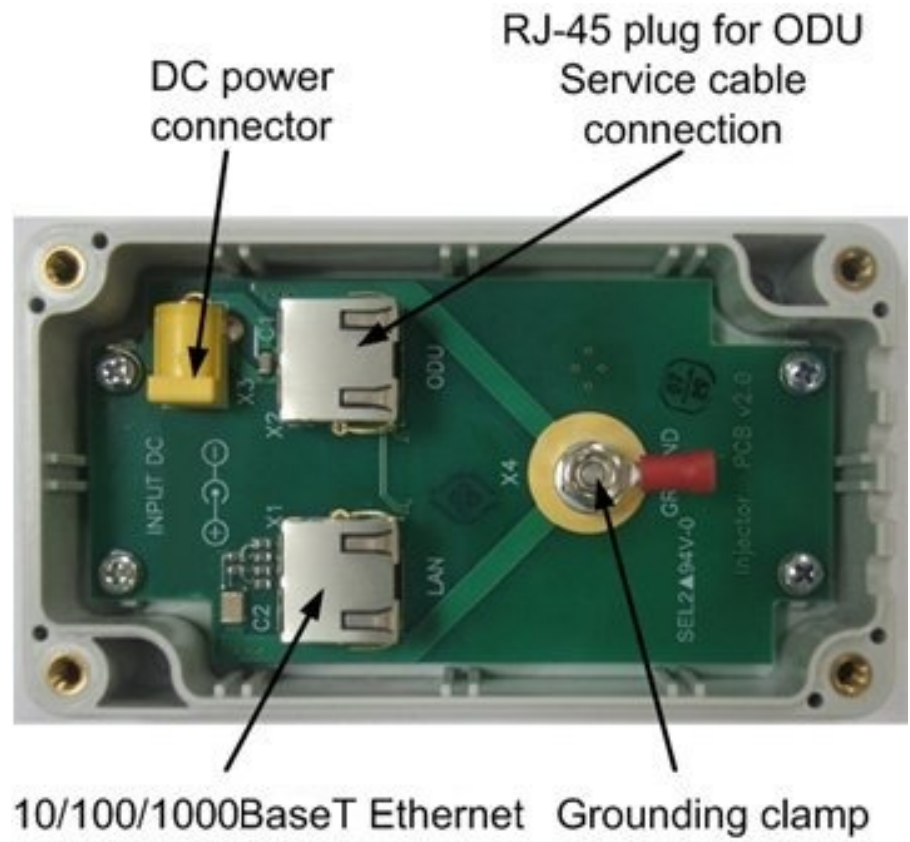


Front panel

Holes for power cord, Ethernet cable,
ODU Service cable and grounding conductor



Inside view



Supported power ratings

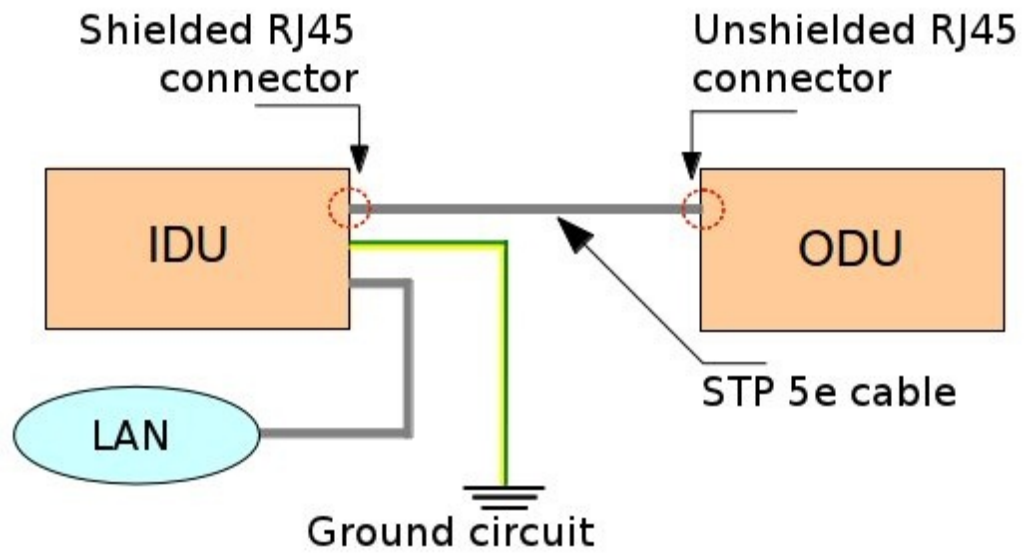
Model	Power rating
R5000-Smnb/Smn	+9VDC... +56VDC
R5000-Lmn	
R5000-Smnc	

R5000-Mmxb/Mmx R5000-Omxb/Omx	±43VDC ... ±56VDC
----------------------------------	-------------------

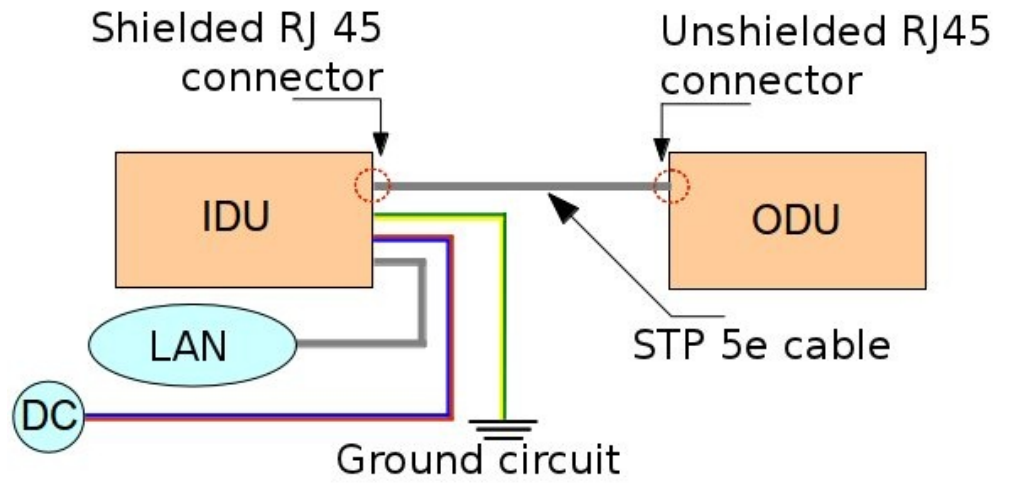


WARNING! Exposing unit to the unsupported voltage will result in irreparable damage to the unit! Always observe power requirements!

Connection scheme for IDU-LA-G (for second Ethernet port)



Connection scheme for IDU-LA-G (for third-party power sources)



2. Outdoor Units (ODU)

InfiNet Wireless Smbn/Smn

IDU

Default factory option for R5000-Smbn/Smn

IDU-CPE

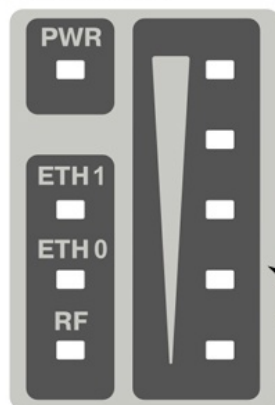
Supported power voltage

+9...+56VDC

ODU:

Top view

Power indicator



Signal level

Interfaces indicators



Eth1

Eth0

IDU

Default factory option for R5000-Lmn

IDU-CPE

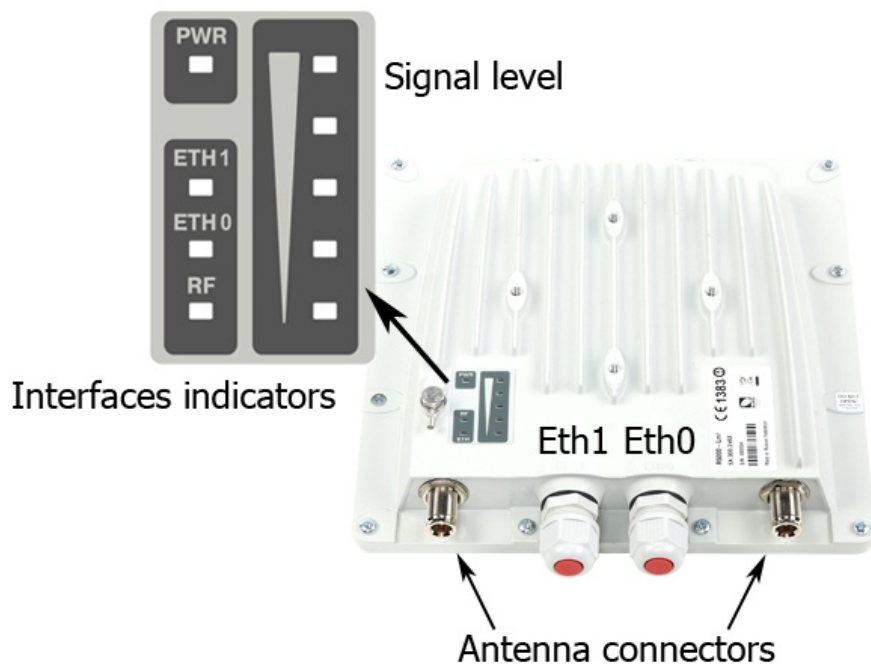
Supported power voltage

+9...+56VDC

ODU

Top view

Power indicator



IDU

Default factory option for R5000-Mmxb/Mmx

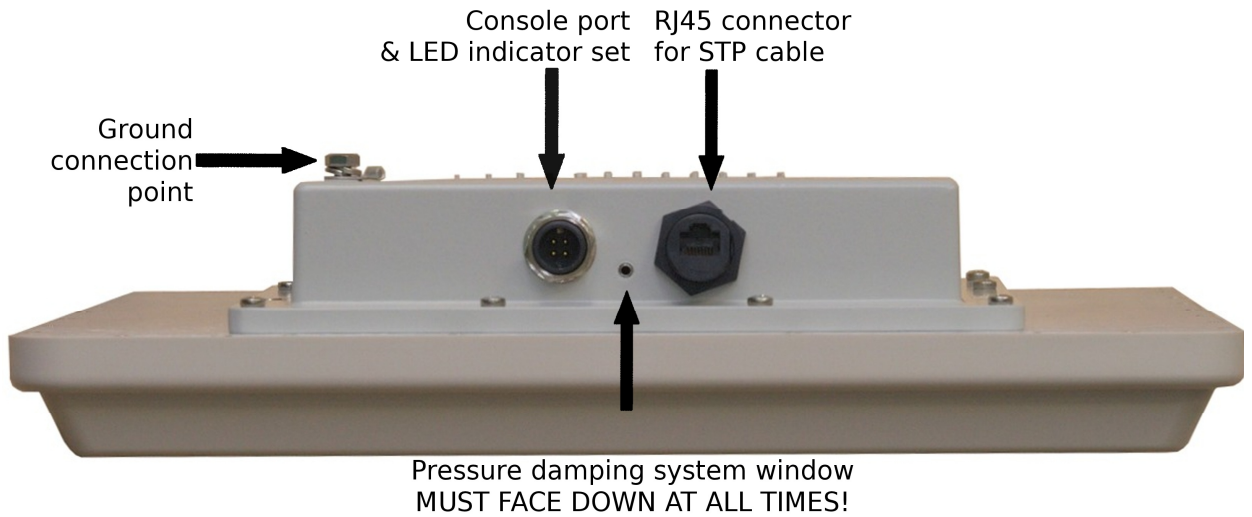
IDU-BS-G

Supported power voltage

$\pm 43 \dots \pm 56 \text{VDC}$

ODU

Front panel



Top view



IDU

Default factory option for R5000-Omxb/Omx

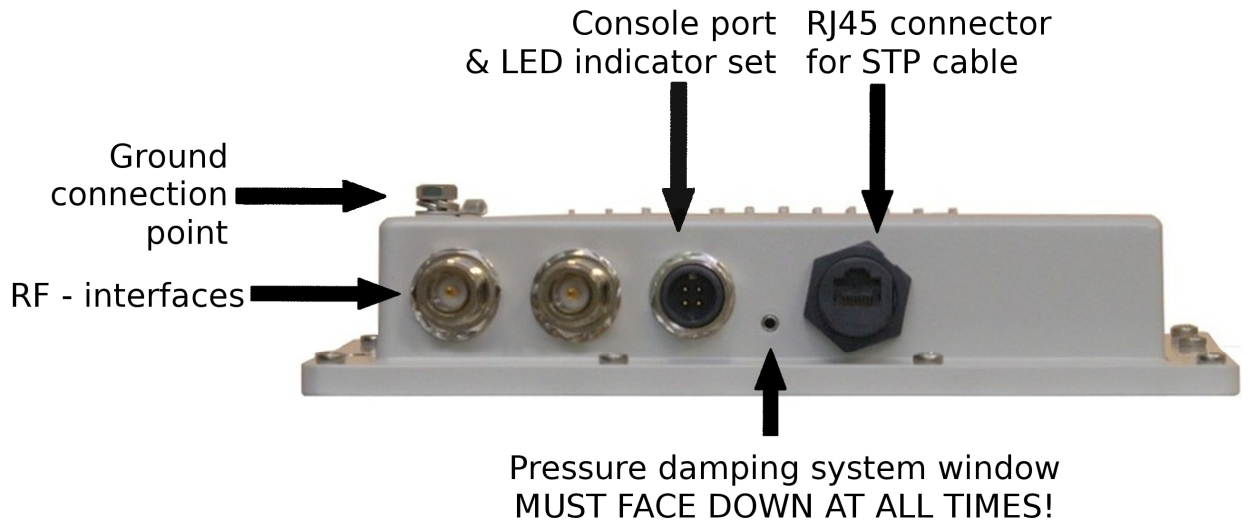
IDU-BS-G

Supported power voltage

±43...±56VDC

ODU

Front panel



Top view



IDU

Default factory option for R5000-Smnc

IDU-CPE

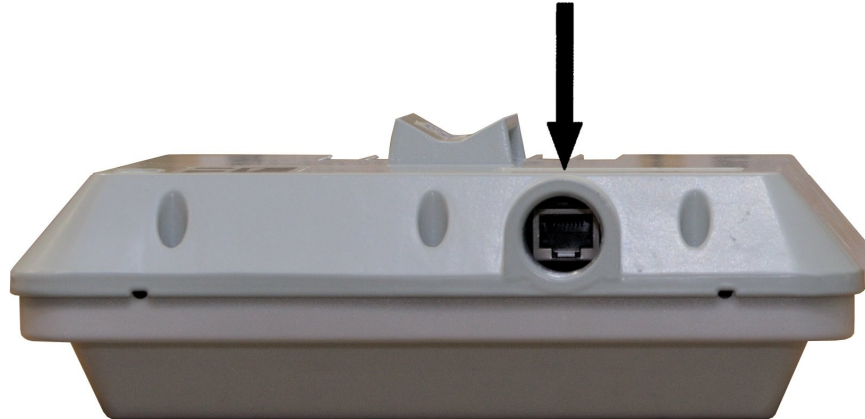
Supported power voltage

+9...+56VDC

ODU

Front panel

RJ45 connector for STP cable



Top view



ODU LED indicators description

InfiNet Wireless 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:

Red indicator	Green indicator	Device status
Off	Off	Device is switched off or 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.

R5000-Smnc model has a special LED indicator set located at the back of each device designed to provide basic status information.

LED	Status	Device status
PWR	On	The device is powered on
RF	Blinking	RF-link is being established
	On	RF-link established
ETH	On	Wired link established
Signal level		This scale displays current RF signal level and is designed to provide assistance in device alignment and link quality estimation

III. Installation procedure

1. Installation preparations

Required components and accessories

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

- InfiNet Wireless Device
- Antenna
- Low loss antenna cable for the required frequency range
- Antenna pole (if necessary)
- Required grounding system
- Accessories and tools

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).

When planning the antenna placement for Point-to-Multipoint connections, one must consider the necessity of a circular or sector coverage areas. In this respect, it is not recommended to use omni-directional antennas when sector antennas can be used.



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.

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.

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.

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.

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.

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.



The end of the STP service cable that is connected to IDU should be assembled with a Shielded RJ-45 connector. The other end of the STP service cable (connected to ODU) should be assembled with unshielded (standard) RJ-45 connector.

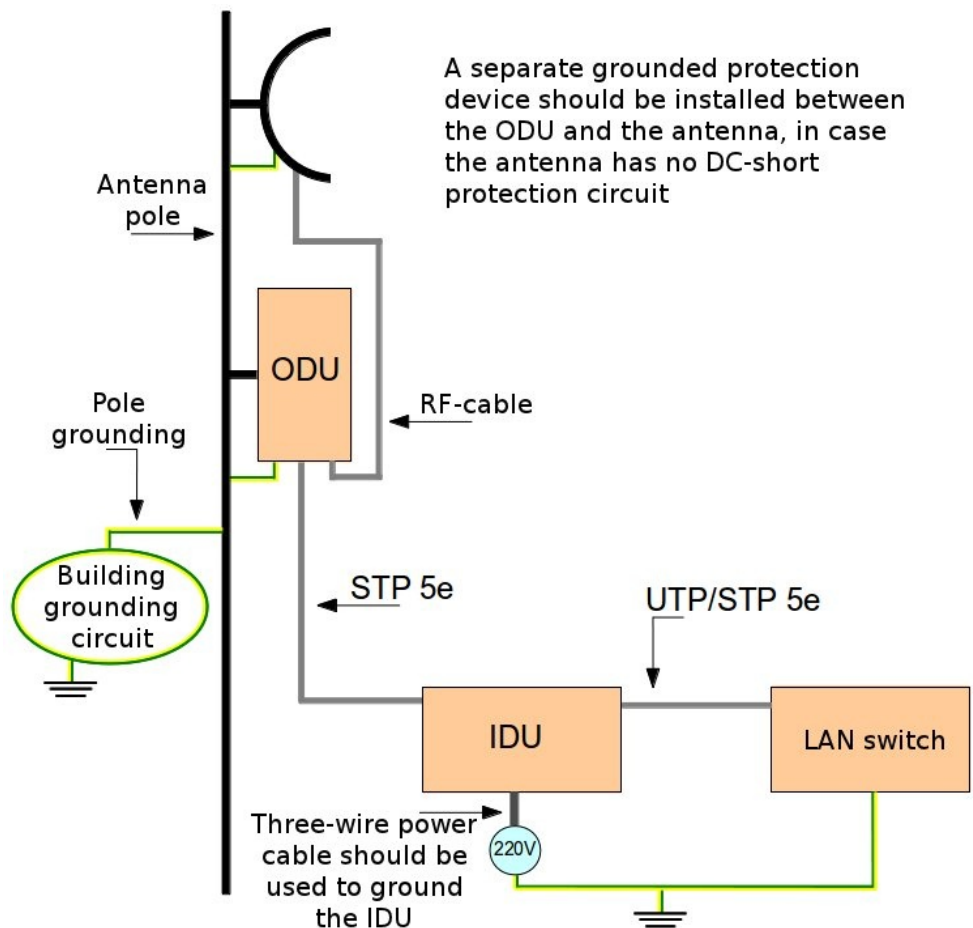
IDU is grounded via a three-conductor power cord and a plug containing a ground. The data & power wires pickups are terminated via IDU protection scheme (three-conductor power cord and a plug containing a ground).

ODU grounding contour are connected with 100kOhm resistor, and that provides no static charge accumulation on the ODU case if there are some problems with its connection to the grounding contour.



Antenna pole, tower, ODU and lightning arrester should be connected to the first common grounding contour. Cable thickness should be no less than 10AWG using corrosion-steady connectors. IDU should be grounded to the same contour as customer LAN, having the second common grounding contour.

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



Grounding when using IDU-LA

Antenna must 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 grounding contour.



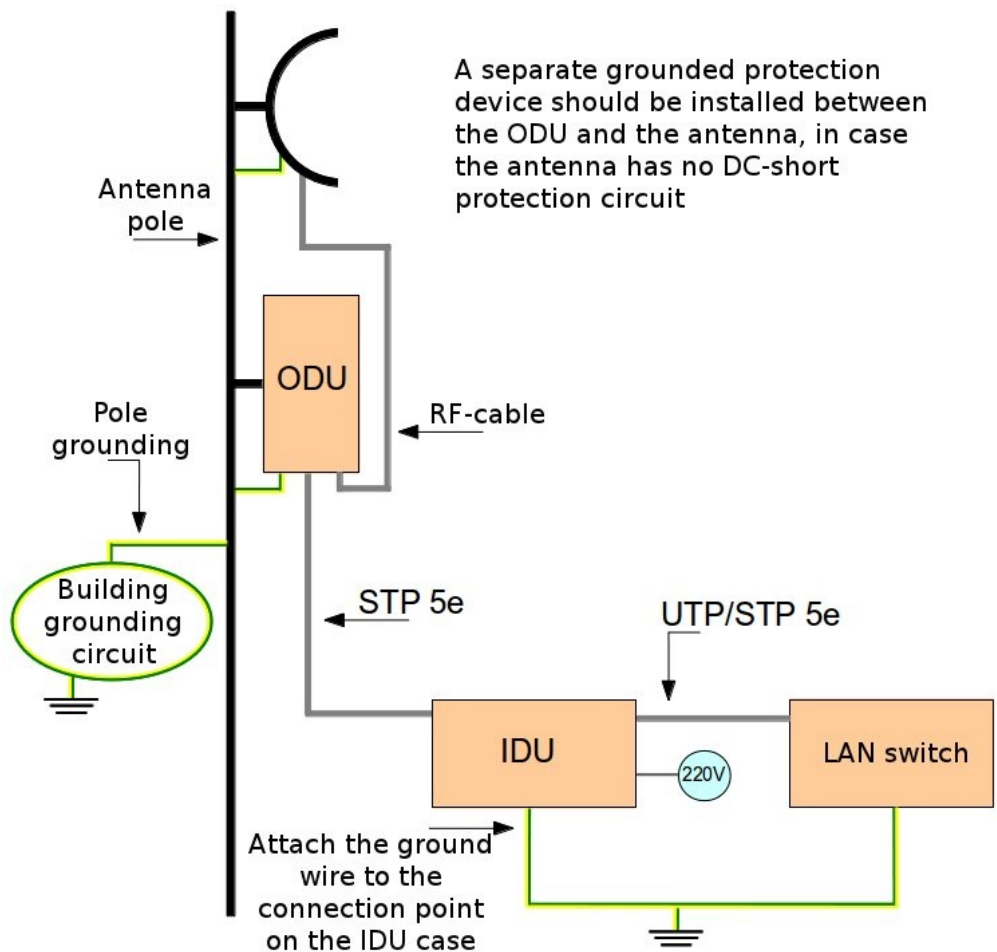
The end of the STP service cable that is connected to IDU should be assembled with a Shielded RJ-45 connector. The other end of the STP service cable (connected to ODU) should be assembled with unshielded (standard) RJ-45 connector.

The data & power wires pickups are terminated via IDU protection scheme (discharger and additional air gap). ODU and IDU grounding contours are connected with 100kOhm resistor, and that provides no static charge accumulation on the ODU case if there are some problems with its connection to the grounding contour.



Antenna pole, tower, ODU and lightning arrester must be connected to the first common grounding contour. Cable thickness must be not less than 10AWG using corrosion-steady connectors. Grounding contour development must be done by the skilled personnel.

A special attention should be paid if antenna used is not DC-short. In this case additional lightning arrester should be used between the antenna and ODU. Suggested grounding diagram is shown on the picture below.



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 InfiNet Wireless Device features. These features allow evaluating current channel/signal quality and perform precise antenna alignment

Omni-directional and sector antennas have a wide radiation diagram width, thus usually they either do not require a very precise alignment or it is just not necessary due to radio link requirements.

Antenna polarization must be taken into consideration while installation. In most cases omni-directional and sector antennas have a vertical polarization. Directional antennas can be installed either with vertical or horizontal polarization. Please check a corresponding labeling on the antenna and address to the antenna technical documentation.

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 must 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:

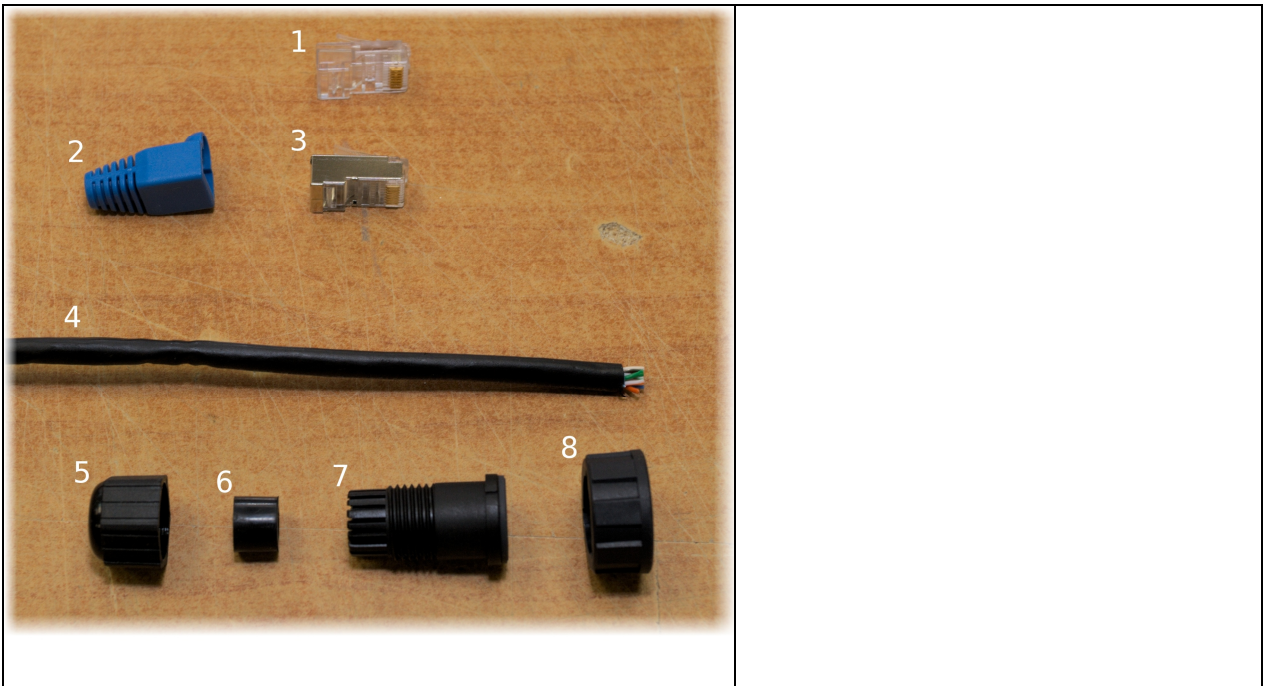
- Do not stay on the roof top in windy or rainy weather, during the thunderstorm or when the working zone is covered with snow or ice
- Do not touch the antennas, antenna poles, cables and lightning arrestors during the thunderstorm
- Antenna placement should not be close to electric or telephone lines. Safe distance is a distance that is a sum of the two antenna poles heights and antenna height
- Antenna cable must be grounded at all times (not relevant for 5000-M modifications)

In case of failure any manipulations with the equipment are allowed to skilled personnel only.



"RJ-45" connector

The following instruction describes the "RJ-45" connector crimping procedure for R5000-Mmx/Mmxb/Omx/Omxb models.

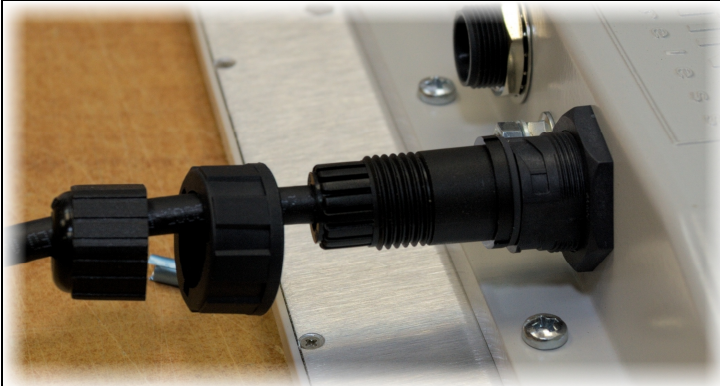


Components required:

1. Standard RJ-45 connector
2. Connector cover
3. Shielded RJ-45 connector
4. STP 5e cable
5. Cable sealing nut
6. Cable sealing bush
7. Cable gland case
8. Cable gland nut



Step 1. Insert the sealing bush (6) into the cable gland case (7) as shown on the picture.



Step 2. Assemble the cable gland as shown on the picture by placing the cable gland nut (8) on the cable gland case (7). Put the cable sealing nut (5) and the cable gland assembly (7,8) onto the cable as shown on the picture. Crimp the regular RJ-45 connector (1) onto the cable using the crimping tool. **Do not** use the shielded RJ-45 connector (3) on this end of the cable as it should be attached on the IDU end.

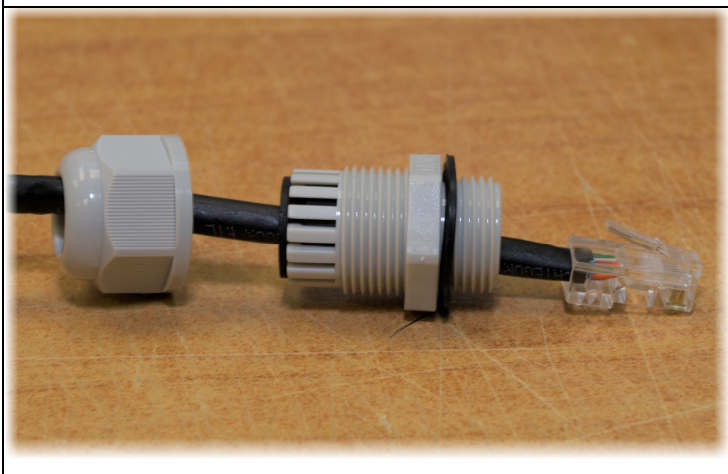
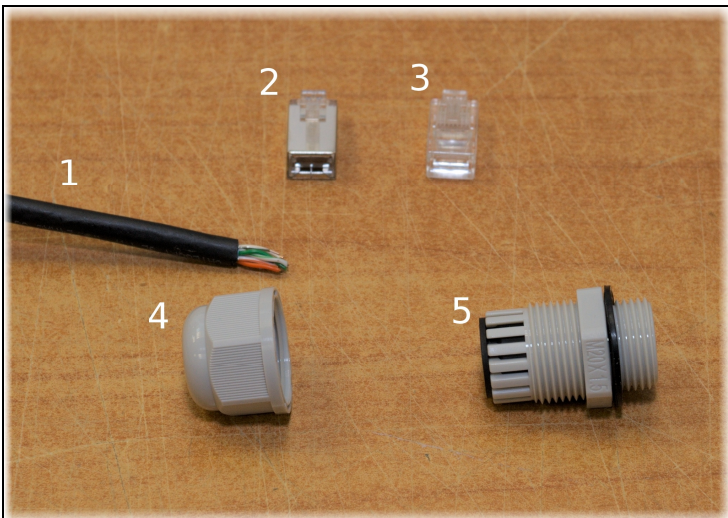
Make sure that the RJ-45 connector is well-crimped. A loose connector can damage the device. Please note that such damage is not covered by the warranty.

Step 3. Attach the cable gland assembly to the device socket.



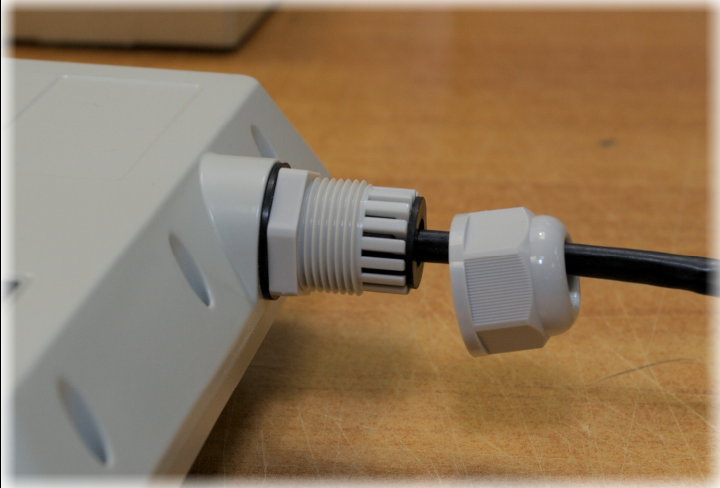
Step 4. Tighten the cable gland nut (8) until you hear a click by rotating it clockwise. Tighten the cable sealing nut (5). Do not apply excessive force.

To assemble the R5000-Smn/Lmn/Smnc cable gland follow the instructions below



Required components:

1. STP-5e cable
2. Shielded RJ-45 connector
3. Standard RJ-45 connector
4. Cable sealing nut
5. Cable gland case

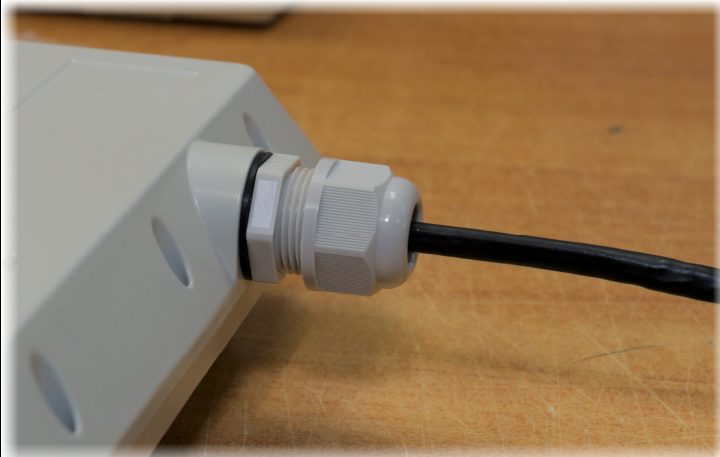


Step 1. Put the cable sealing nut (4) and the cable gland case (5) onto the cable as shown on the picture. Crimp the regular RJ-45 connector (3) onto the cable using the crimping tool. **Do not** use the shielded RJ-45 connector (2) on this end of the cable as it should be attached on the IDU end.

Make sure that the RJ-45 connector is well-crimped. A loose connector can damage the device. Please note that such damage is not covered by the warranty.



Step 2. Insert the connector into the socket until you hear a click. Screw the cable gland case into the port and tighten it. Do not apply excessive force.



Step 3. Tighten the sealing nut (4). Do not apply excessive force.

Tools to be available at the installation site

1. Screwdrivers set
2. Pliers
3. Spanners set
4. Connectors isolating set
 - Raw rubber
 - Thermal shrinkage tube
 - Scissors
 - Fan
 - Mantling gun
5. Additional equipment
 - GPS receiver or area map (with compass and alidade)
 - Big zoom binoculars

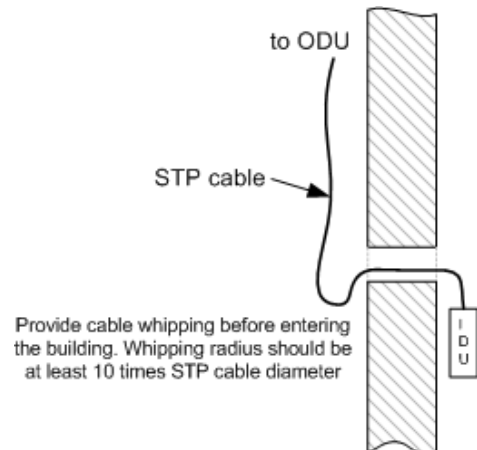
2. InfiNet Wireless R5000-Omx/Omxb

Installation guidelines

1. Unpack the equipment
2. Check items integrity
3. Prepare RF-cables of the required length. For 5GHz devices the recommended maximal RF cable length is 1 meter.

4. Install and isolate the connectors on the RF cable

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

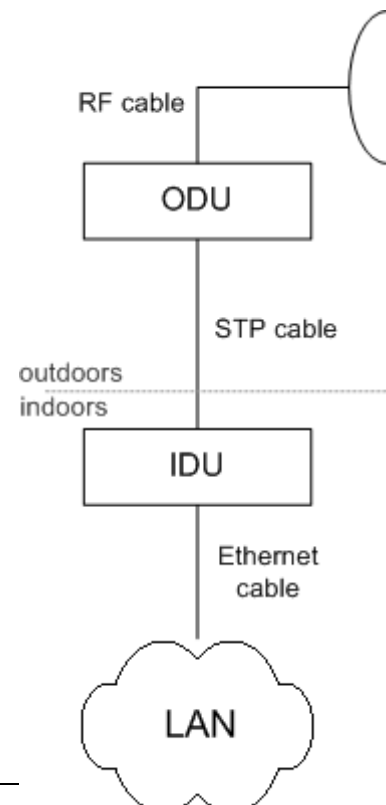
11. Connect the ODU-IDU cable to the ODU

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 arrester must be used which is placed between ODU and antenna and is grounded to the antenna pole grounding contour.

14. Connect RF cable to the antenna. Twist the connector tightly

15. Connect RF cable to the ODU previously having touched RF cable connector 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 Router using Telnet protocol

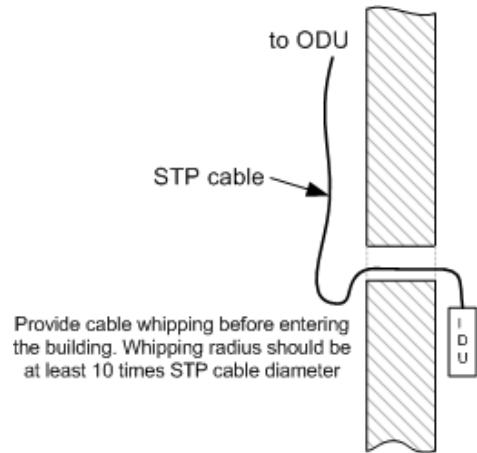


It is extremely important to install ODU connectors down!

3. InfiNet Wireless R5000-Lmn

Installation guidelines

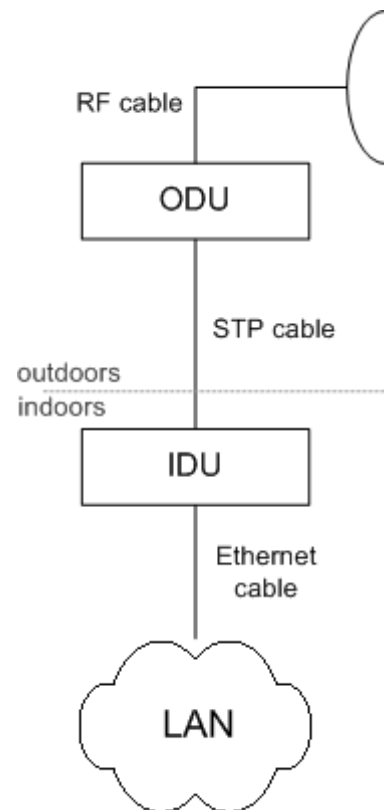
1. Unpack the equipment
2. Check items integrity
3. Prepare RF-cables of the required length. For 5GHz devices the recommended maximal RF cable length is 1 meter.
4. Install and isolate the connectors on the RF cable
5. Determine the STP cable length that is used to connect IDU and ODU. The total cable 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 side on the STP cable and isolate it
7. Lay the STP cable "from top to bottom" – from ODU to IDU
8. After the STP cable has been laid, use distribution box to switch from STP cable to UTP cable with RJ-45 connectors.
9. Install ODU on the mounting bracket connectors down and tighten it
10. Connect the ODU-IDU cable to the ODU
11. Isolate the ODU connector joint place

12. 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-shortened (see antenna technical documentation), the additional lightning arrester must be used which is placed between ODU and antenna and is grounded to the antenna pole grounding contour.

13. Connect RF cable to the antenna. Twist the connector tightly
14. Connect RF cable to the ODU previously having touched RF cable connector case with ODU connector case
15. Isolate RF connectors from both sides (ODU and antenna)
16. Connect the UTP cable to IDU
17. Provide grounding for IDU



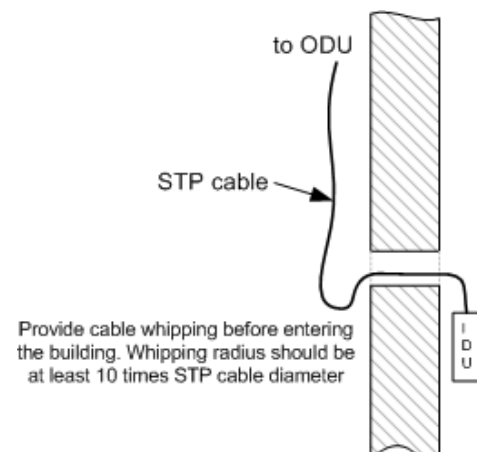
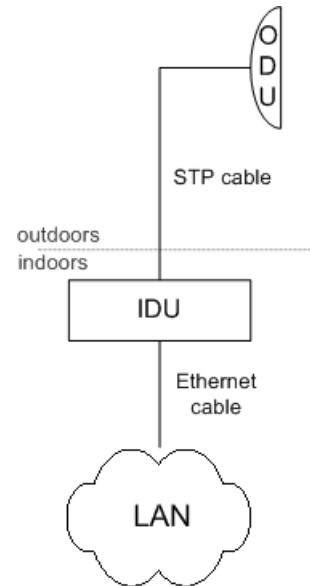
18. Connect Ethernet cable to IDU
19. Provide power supply for IDU
20. Connect to the Device using Telnet protocol



It is extremely important to install ODU connectors down!

4. InfiNet Wireless R5000-M/Mm and R5000-Smn/Smnb/Smnc

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.
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
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



It is extremely important to install ODU connectors down!

5. Mounting kit (MOUNT-KIT-85)

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

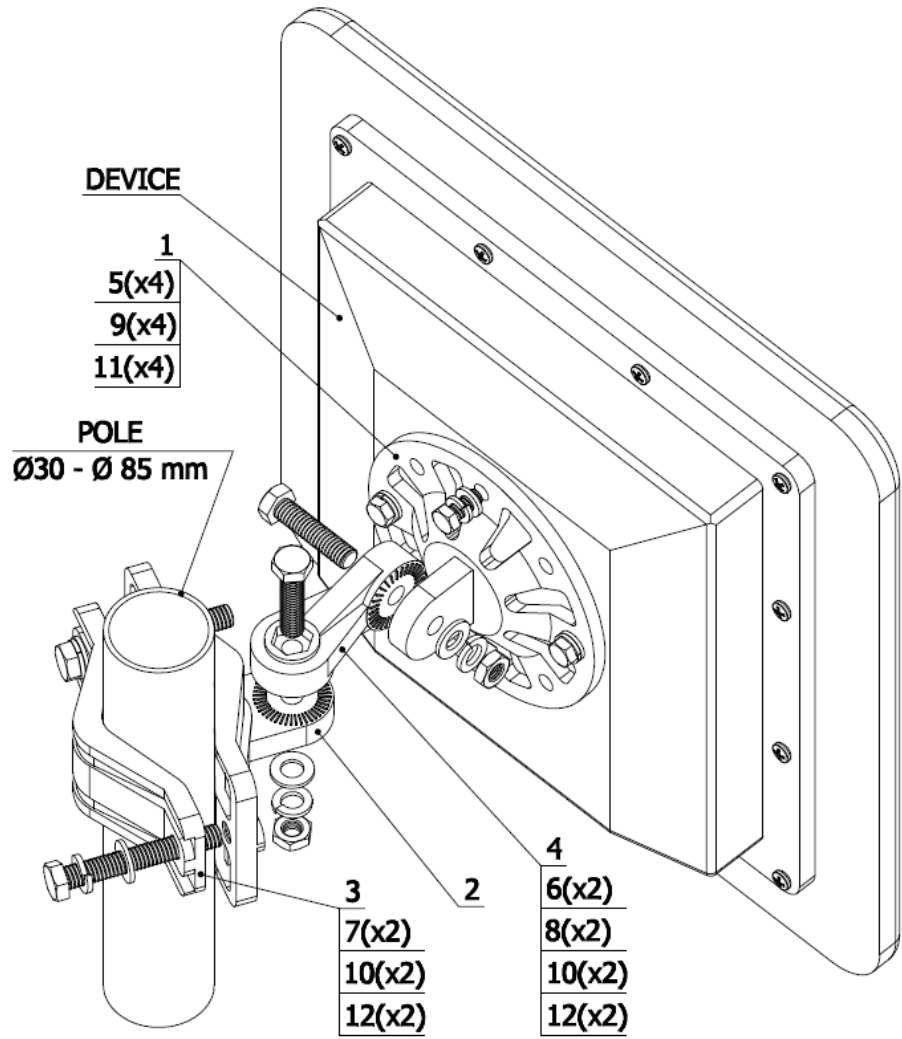
MOUNT-KIT-85 features:

- 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)
- Compatible with all outdoor units produced by InfiNet
- RoHS compliant

General view







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!

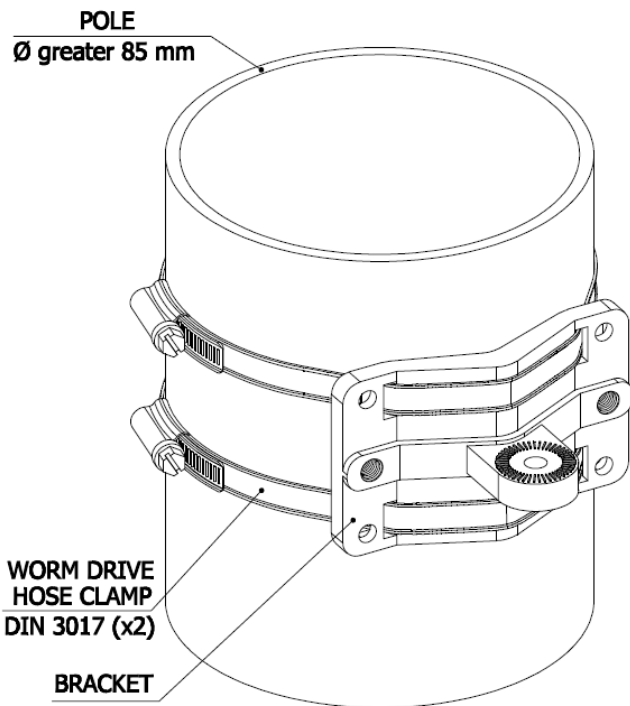
STEP 4:

Adjust the required tilt and fasten all nuts at the required position.

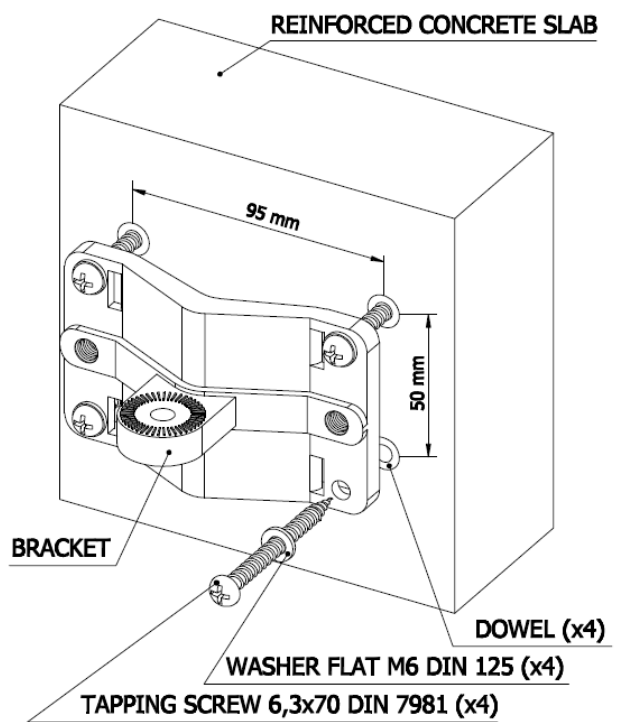
CONFIGURATION KIT

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

INSTALLATION ON A POLE OF BIG DIAMETER



INSTALLATION ON A WALL

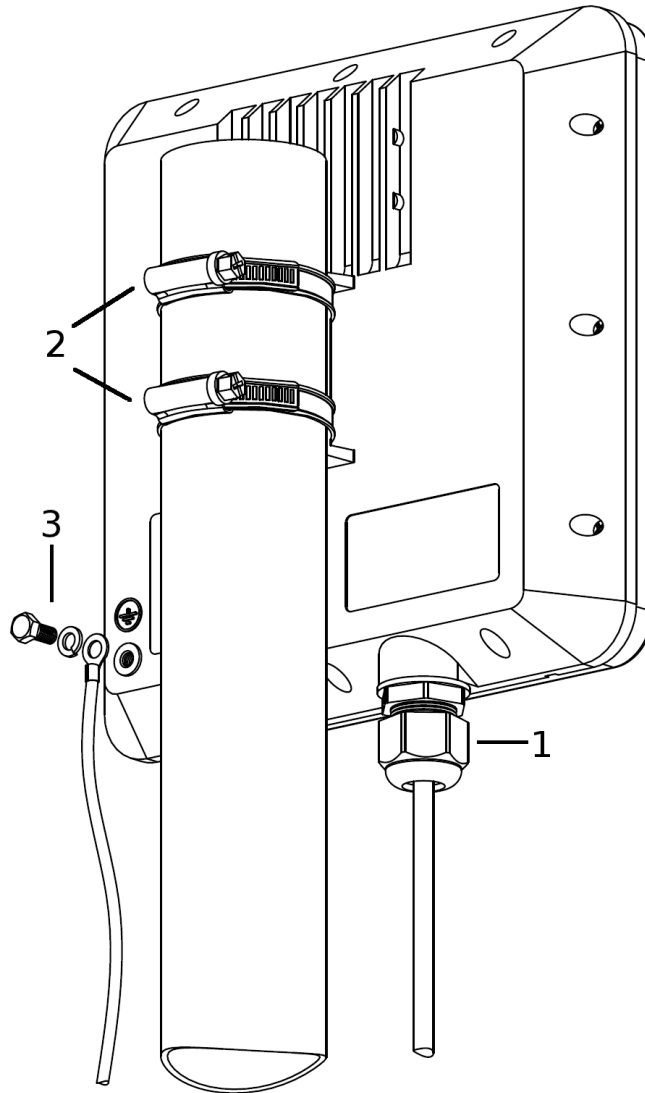


Attention! MOUNT-KIT-85 does NOT contain worm drive hose clamps or other additional fixtures used in possible variants of installation.

8. InfiNet Wireless R5000-Smnc

R5000-Smnc supports several installation options such as pole mounting using the supplied clamps and pipe/wall/pole mounting using the optional mount kit MOUNT-KIT-85C.

The clamps supplied with each device allow it to be mounted on a 32-60 mm pole.



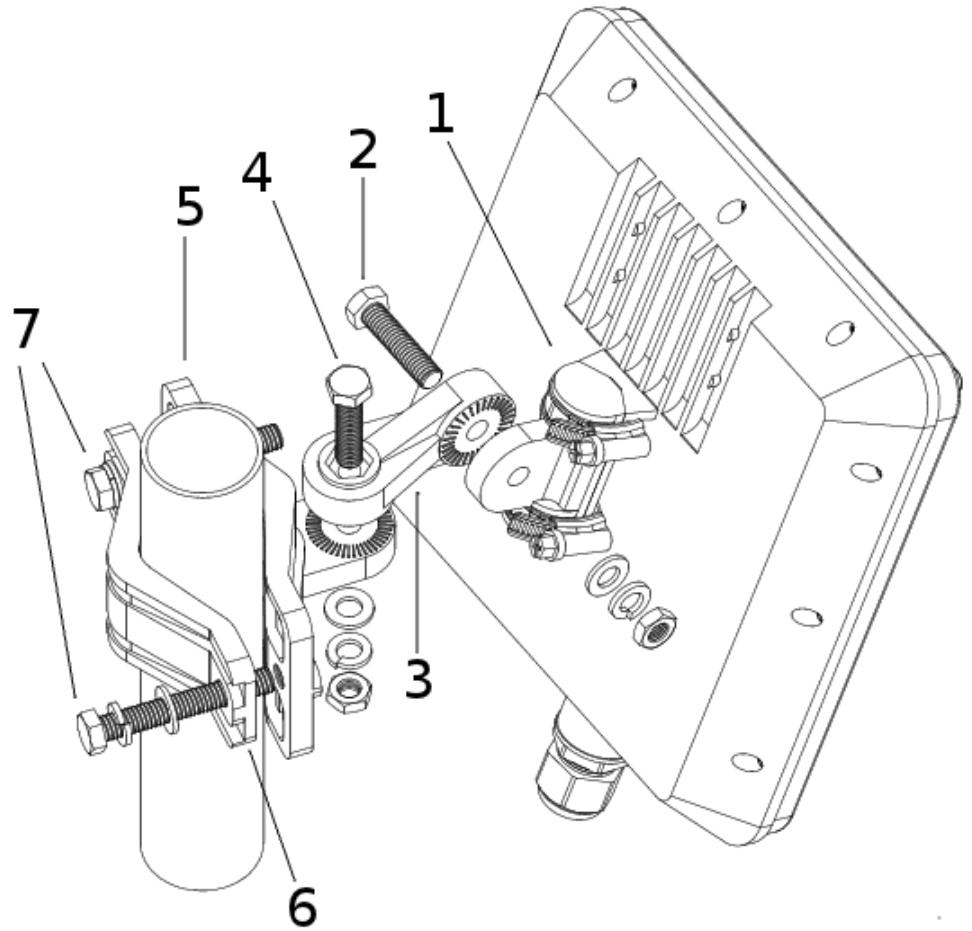
In order to mount the device on a pole follow the guidelines below:

- Ensure that the cable gland (1) is assembled properly.
- Attach the clamps to the pole and to the unit mounting point.

- Hold the unit at the designated position and tighten the clamps by rotating the bolts (2) with a screwdriver or a 7mm wrench. Do not overtighten the clamps.
- Attach the ground cable (3).

If there is a need for further alignment loosen the clamps, adjust the azimuth and tighten them again.

Use the MOUNT-KIT-85C kit for a secure and reliable installation to a pipe/wall/pole. This kit allows 2-axis precise alignment under any mounting conditions.



In order to mount using MOUNT-KIT-85C follow the guidelines below:

- Attach the small mounting bracket (1) to the device using the supplied clamps. Ensure that the bracket fits correctly.
- Attach the mount arm (3) to the bracket and tighten the bolt (2).
- If mounting to a wall or other flat surface, attach the metal plate (5) to the surface, assemble the binding and tighten bolts (2) and (4) until the unit is fixed in position.
- If mounting to a pole (30 to 85 mm diameter), assemble the pole mounting bracket (5, 6) on the designated position. Using the 13mm wrench tighten the bolts (7) until the bracket is fixed in position, attach the unit with the mounting assembly and tighten the bolt (4).
- If there is a need for further alignment adjustments loosen the bolts (2) and (4), adjust the unit's position and tighten the bolts again.

II. Configuration (Web-interface)

1. Overall functionality overview

Web-interface is used for easy device management and monitoring via graphical web-based interface. Web-interface allows:

- Monitoring device interfaces statistics
- Monitoring radio link statistics
- Viewing and changing device configuration
- Access to graphical antenna alignment tool
- Running wireless link throughput tests
- Device maintenance and support
- Access to Spectrum Analyzer tool
- Viewing the system log
- DFS operation monitoring.

2. Prerequisites

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

- Web-browser
- Latest WANFlex OS version installed on the device
- Web-interface support activated on the device («webcfg start» command)
- enabled by default

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

For a secure SSL-protected connection use `https://<device IP-address>` (by default: `https://10.10.10.1`) address.

3. Localization

Web-interface supports multiple locale sets, such as: English (default), Russian, Italian, French and Chinese.

Use the Language drop-down menu in the upper-right corner of the web-interface window to set up a locale for the current session (the default locale will remain unchanged).

To make permanent locale changes follow the instructions given in the System Settings paragraph of the Basic Settings section.

4. Basic settings

The screenshot displays the InfiNet wireless management interface. At the top left is the InfiNet wireless logo. To the right, there is a language dropdown menu set to 'English' and a world map. Below the logo is a navigation bar with tabs for 'Device Status', 'Basic Settings' (which is highlighted), 'Maintenance', 'Spectrum Analyzer', 'DFS', and 'Command Line'. On the far right of the navigation bar is a 'logout' link. The main content area shows a list of settings sections, each with a right-pointing arrow and a horizontal line below it: 'System Settings', 'Network Settings', 'Link Settings', 'Static Links', 'MAC Switch', 'IP Firewall', 'SNMP', 'QoS Options', and 'Extra Commands'. At the bottom of this list are three buttons: 'Apply', 'Test', and 'Preview Configuration'. Below the buttons is a warning message: 'Warning! After pressing "Apply" button all the settings made via command-line interface from the sections present in this configuration page will be replaced. After pressing "Test" button the new configuration will be temporarily activated for about 3 minutes.' At the bottom right of the page, there is a footer with the text 'Infinet Wireless Ltd. All rights reserved, 1997-2012'.

The Basic Settings page allows the user to perform overall device configuration. All available parameters and options are divided into several sections, such as System Settings, Radio Settings.

Click the section header to expand/collapse the corresponding section.

This chapter describes all sections on the Basic Settings page.

Click Preview Configuration to view the configuration results in CLI-style format.

Click Apply to apply all configuration changes.

WANFleX OS allows temporal configuration changes to be applied by clicking Test. Previous config is automatically restored after a grace period of 180 seconds (3 minutes). The user has options to extend the grace period, or immediately accept/reject the changes.

System Settings

Device Name:	<input type="text"/>	Start SNTP:	<input checked="" type="checkbox"/>
User Name:	<input type="text"/>	SNTP IP Address:	<input type="text" value="10"/> <input type="text" value="1"/> <input type="text" value="30"/> <input type="text" value="1"/> <input type="button" value="X"/>
Password:	<input type="text"/>	Time Zone:	<input type="text" value="YEKT+6"/>
Confirm Password:	<input type="text"/>	Latitude:	<input type="text"/>
Keep current system password:	<input type="checkbox"/>	Longitude:	<input type="text"/>
WEB Interface language:	<input type="text" value="English"/>	<input type="button" value="Open Map"/>	

This section contains general system parameters:

- Device name – general device name
- User Name – user name (Login) used to access the unit management interfaces
- Password – password used with the user name specified above
- Confirm Password – password confirmation
- Keep current system password – saves currently used password in the unit configuration and locks Password and Confirm Password fields. In case these fields are empty, and the check-box is unchecked a possible vulnerability exists, as some browsers may put random data into the Password/Confirm Password fields without user consent, making the unit inaccessible after the configuration has been applied.
- WEB Interface language – permanently defines the web interface locale, this choice would be used for all successive sessions (refer to the Localization section earlier in this chapter for tips on per-session locale changes).

SNTP and Time Zone settings:

- Start SNTP – starts SNTP service
- SNTP IP Address - sets SNTP server IP-address
- Time Zone – sets Time Zone. For more details on time zones please visit: http://en.wikipedia.org/wiki/Time_zone.

▼ Network Settings

eth0:	Up: <input checked="" type="checkbox"/> DHCP: <input type="checkbox"/> Mode: auto	Description
	<input style="width: 20px; height: 20px;" type="text"/> . <input style="width: 20px; height: 20px;" type="text"/> . <input style="width: 20px; height: 20px;" type="text"/> . <input style="width: 20px; height: 20px;" type="text"/> / <input style="width: 20px; height: 20px;" type="text"/> X +	<input style="width: 100%; height: 20px;" type="text"/>
rf5.0:	Up: <input checked="" type="checkbox"/> DHCP: <input type="checkbox"/>	Description
	<input style="width: 20px; height: 20px;" type="text"/> . <input style="width: 20px; height: 20px;" type="text"/> . <input style="width: 20px; height: 20px;" type="text"/> . <input style="width: 20px; height: 20px;" type="text"/> / <input style="width: 20px; height: 20px;" type="text"/> X +	<input style="width: 100%; height: 20px;" type="text"/>
prf3:	Up: <input checked="" type="checkbox"/> DHCP: <input type="checkbox"/> Parent: eth0 Channel: 0	Description
Remove	<input style="width: 20px; height: 20px;" type="text"/> . <input style="width: 20px; height: 20px;" type="text"/> . <input style="width: 20px; height: 20px;" type="text"/> . <input style="width: 20px; height: 20px;" type="text"/> / <input style="width: 20px; height: 20px;" type="text"/> X +	<input style="width: 100%; height: 20px;" type="text"/>
lag3:	Up: <input checked="" type="checkbox"/> DHCP: <input type="checkbox"/> Parent(s): Add parent(s)	Description
Remove	<input style="width: 20px; height: 20px;" type="text"/> . <input style="width: 20px; height: 20px;" type="text"/> . <input style="width: 20px; height: 20px;" type="text"/> . <input style="width: 20px; height: 20px;" type="text"/> / <input style="width: 20px; height: 20px;" type="text"/> X +	<input style="width: 100%; height: 20px;" type="text"/>
vlan25:	Up: <input checked="" type="checkbox"/> DHCP: <input type="checkbox"/> Parent: svi25 Vlan ID: 25 QinQ: <input type="checkbox"/>	Description
Remove	10 . 1 . 25 . 120 / 24 X +	<input style="width: 100%; height: 20px;" type="text"/>
svi30:	Up: <input checked="" type="checkbox"/> DHCP: <input type="checkbox"/> Switch group: 30	Description
Remove	<input style="width: 20px; height: 20px;" type="text"/> . <input style="width: 20px; height: 20px;" type="text"/> . <input style="width: 20px; height: 20px;" type="text"/> . <input style="width: 20px; height: 20px;" type="text"/> / <input style="width: 20px; height: 20px;" type="text"/> X +	<input style="width: 100%; height: 20px;" type="text"/>
Default Gateway: 10 . 1 . 30 . 1 X		
Create Pseudo-RF Create VLAN Create LAG Create SVI		

This section contains parameters related to network operation:

- ethX settings – Ethernet interface settings (e.g. eth0):
 - Up enables/disables the interface
 - DHCP allows DHCP client operation on the current interface
 - Mode enables automatic or manual speed and duplex setup for the Ethernet interface. Recommended setting is Auto.
 - IP-address field allows user to assign an IP-address to the Ethernet interface. Click the button to assign alias addresses or click X button to remove existing aliases.

- Description field can be used to add a text note to the interface config (up to 72 characters).
- rfX Settings - RF interface settings (e.g. rf5.0). Same as the Ethernet settings described above.
- prfX settings – Pseudo-RF interface settings (e.g. prf0):

MINT network nodes can connect via either the wireless medium or a wired network. In order to establish connections via Ethernet PRF (Pseudo-RF) interfaces are used. A PRF interface makes the Ethernet interface that it's assigned to to appear as a regular RF interface in terms of the MINT network. For more information please refer to the WANFlex OS User Manual.

- General settings are the same as the Ethernet interface settings described above.
- Parent settings allow user to assign the PRF interface to the physical Ethernet interface.
- Channel setting can be used to set up several channel groups (0 – 4) inside the MINT network. Both PRF interfaces must have the same channel assigned in order for the link to be established.
- lagX settings – Link Aggregation interface settings (e.g. lag0):
 - Link aggregation interface is a logical interface used to combine multiple physical channels into one logical channel in order to increase link capacity and redundancy.
 - General settings are the same as the Ethernet interface settings described above.
 - Add parent(s) function allows user to add physical interfaces to the aggregated channel.
- vlanX settings – VLAN IEEE 802.1q settings (e.g. vlan0):
 - General settings are the same as the Ethernet interface settings described above.
 - Parent settings allow user to assign the VLAN interface to its parent interface.
 - VLAN ID field allows user to configure the VLAN tag for the current interface (1 – 4094)
 - QinQ checkbox enables dot1q tunneling on the interface.
- sviX settings – Switch Virtual Interface settings:

An SVI interface is an L3-interface used to terminate or generate traffic in a certain switch group. Refer to the WANFlex OS manual for details.

- General settings are the same as the Ethernet interface settings described above.
- Switch group option allows user to bind the SVI interface to a switch group.

Default Gateway field is used to configure the default gateway used by the unit L3-interfaces to reach hosts on subnets different from its own.

Create Pseudo-RF, Create VLAN, Create LAG and Create SVI buttons
create the corresponding interfaces in the unit configuration.

▼ Link Settings

▼ rf5.0

General Settings

Enable link:

Type: Master ▾ Polling: On ▾

DFS: DFS Off ▾

Tx Power (dBm): 11 ▾ Auto: - 0 +

Node Name:

Scrambling:

Trap gateway:

Authentication Mode: public ▾

Current Settings

Channel Width (MHz): 40 ▾

Frequency (MHz): 4800 ▾

Frequency Range List:

Tx Bitrate (Kbps): 300000 ▾ Auto: - 0 +

Channel Type: Dual ▾ Greenfield:

Network SID:

Node ID:

Security Key:

This section describes all settings related to the RF link configuration

The Link Settings section is divided into two subsections: the panel on the left describes global link settings, the panel on the right describes radio channel settings that are currently in use.

The general settings panel contains the following items:

- Enable Link checkbox – enables/disables link operation
- Type – each unit can be either a master or a slave in terms of the polling algorithm operation. Please note that each link requires only one master unit.
- Polling – enables/disables polling algorithm. It is strongly recommended to keep Polling on at all times to maximize link performance.
- DFS – DFS (Dynamic Frequency Selection) system operation mode:
 - DFS off – the DFS system is off. Please note that in some countries switching DFS off is against the regulations and may result in legal action.
 - DFS with radar detection – the DFS system performs radar detection. If a radar signal is detected the frequency is marked occupied and can be used again only after a hold-down interval. The link is switched to another frequency (provided there are available frequencies on the list).
 - DFS only – the DFS system monitors interferences but does not perform radar detection. Please note that in some countries

failing to detect public service radar signals is against the regulations and may result in legal action.

- TX Power – configures transmitter power output. Enabling the ATPC (Automatic Transmitter Power Control) system is strongly recommended. The offset parameter is used to adjust the thresholds.
- Node Name – configures node name. This name will appear on the neighbor lists
- Trap gateway – enables/disables SNMP trap relay
- Authentication mode – configures the authentication mode used by the unit: public or static. Please refer to the WANFlex OS user manual, “Node Authentication” section, for more information.

The Current Settings panel contains the RF channel parameters:

- Channel Width (MHz) – RF link channel width in MHz.
- Frequency (MHz) – central operating frequency in MHz.
- Frequency Range List – available only when the DFS system is enabled, this parameter allows users to list frequencies available for DFS operation.
- TX Bitrate (Kbps) – this setting controls the link bitrate. Enabling automatic bitrate selection is strongly recommended. The offset parameter is used to adjust the Autobitrate system thresholds.
- Channel Type – selects channel mode:
 - Dual – MIMO (recommended)
 - Single – MISO
- The Greenfield checkbox enables/disables Greenfield mode. This feature optimizes the frames, transmitted via the RF link, boosting link performance by 10-15%
- Network SID – Network System Identifier (up to 8-digit HEX figure). All units that belong to the same wireless network segment must have the same SID value.
- Node ID – the sequential number for the node. The parameter is optional.
- Security Key – a key word used to encode protocol messages. This key can be up to 64 characters long and should not contain spaces. All units that belong to the same wireless network segment must have the same Security Key.

▼ Static Links

▼ rf5.0

MAC	Disabled	Key	Note
<input type="text"/> : <input type="text"/> : <input type="text"/> : <input type="text"/> : <input type="text"/> : <input type="text"/> X	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>
			<input type="button" value="Remove"/>
<input type="button" value="Add"/>			

▼ prf0

MAC	Disabled	Key	Note
<input type="text"/> : <input type="text"/> : <input type="text"/> : <input type="text"/> : <input type="text"/> : <input type="text"/> X	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>
			<input type="button" value="Remove"/>
<input type="button" value="Add"/>			

This section allows user to create a local nodes database. Please refer to the *Nodes Authentication and Creating local nodes database* sections of the *Mint* chapter of the WANFleX OS User Manual for more information.

Available settings are:

- MAC – defines the MAC-address of the allowed node.
- Disabled – this checkbox temporarily disables the corresponding record in the database.
- Key – a unique key configured on the neighbor unit, can be up to 64 characters long, must not contain spaces. Refer to the Security Key paragraph in the previous section.
- Note – used to provide a short description.
- Remove – this button permanently removes the corresponding node from the database.

MAC Switch

▼ MAC Switch

Enable Switch:
 Management VLAN:

Enabled	Interfaces	STP	IGMP	Repeater	Admin	Mode	Description
<input checked="" type="checkbox"/>	eth0 <input type="text" value="pass"/> X rf5.0 <input type="text" value="pass"/> X	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Normal	<input type="text"/>
<input type="button" value="Add Interface"/>							
Rules(1)							
Default Action: deny		Default Priority:		<input type="button" value="Remove Group"/>			
<input type="button" value="Create Switch Group"/>							

This section allows users to configure the switch operation including switch group management.

General section:

- Help – displays general help guidelines for MAC switch configuration.
- Enable Switch – this checkbox enables/disables global switch operation.
- Management VLAN – sets the VLAN ID for management traffic. When set, device access and configuration are possible only via the specified Management VLAN.
- Create Switch Group – creates a new switch group.

Switch Group configuration section:

- Group# – assigns the switch group identifier (must be unique within the MINT network segment).
- Enabled – enables/disables the corresponding switching group.
- Add Interface– allows including local network interfaces (ethX, rfX, tunX, etc.) into the switch group.
- The Interfaces section provides the means to control the VLAN tag processing mode, as each local interface supports three different scenarios:
 - Pass – transparent mode, traffic remains unchanged.
 - Strip – all tags are stripped.
 - Tag – all packets are tagged with the specified VLAN tag.
- STP – enables/disables Spanning Tree Protocol for the current switch group.
- IGMP – enables/disables IGMP-Snooping for the current switch group.
- Repeater – enables the repeater mode for the current switch group. When set into Repeater mode the unit acts as a simple switch, relaying packets to all ports except the source port.
- Admin – sets the switch group as the admin group. All packets that have originated at the unit itself (e.g. RIP/OSPF or ICMP ping) leave the MINT network via the admin group.

For all units running software v1.86 and earlier: If no Admin Group is selected, such packets are unable to leave the network. Starting software v1.87 SVI interface was introduced allowing for a simpler and more transparent mgmt traffic processing.

- Mode – selects switch group operation mode:
 - Normal – standard mode. The switch group operation is based on the configured Rules, packets are processed without modification. This is the default option.



- Trunk – when a switch group operates in Trunk mode the inbound traffic is untagged and placed into switch groups in accordance with its VLAN tag. Please refer to the WANFlex OS manual for a detailed description.
 - In-Trunk – the In-Trunk mode allows to filter out the traffic that belongs to a certain switch group that is a member of a trunk Switch Group. Please refer to the WANFlex OS manual for a detailed description.
 - Upstream – this mode is used in video surveillance systems for upstream multicast flows. Please refer to the WANFlex OS manual for a detailed description.
 - Downstream – this mode is used in video surveillance systems for downstream traffic. Please refer to the WANFlex OS manual for a detailed description.
- Description – use this field to provide a brief description for the switch group.
 - Up/Down arrows – allow users to organize the switch group list.
 - Remove Group – permanently removes switch group from the unit configuration.

The Rules subsection contains the Switch Group rules configured for each group.

- Action – defines the action performed whenever a packet matches this rule.
- pcap/vlan selection – defines whether the rule is a PCAP expression or a VLAN list .
- Rule field – a text-field for the rule expression or a VLAN list. Click Help for syntax help.
- Validate – performs the syntax check on the expression in the Rule field.
- Up/Down arrows – allow users to organize rules list. The rules are processed one by one in a top-down order.
- Remove Rule – permanently removes the rule from the configuration.
- Add Rule – creates a new rule for the current switch group.

▼ IP Firewall

Action	Priority	Log	Direction	Interface	Group	Rule	Help
Permit ▼	▼	<input type="checkbox"/>	Input ▼	Any ▼			Validate
							↑ ↓
							Remove Rule

Add Rule

IP Firewall is a rules-based mechanism designed for filtering packets traversing the node. A detailed information on the firewall implementation in the WANFlex OS can be found in WANFlex OS manual.

This section provides the means to configure Firewall rules.

- Help – displays firewall rules configuration guidelines.
- Action – the action applied to the packets that match the rule. There are three possible options:
 - Permit – the packet will be processed by the system (ignoring other firewall rules).
 - Deny – the packet will be dropped.
 - Pass – the packet will be passed to the next rule in the list.
- Priority – sets the priority assigned to all packets that match the rule. Two options are available:
 - Up to – used to increase packet priority. The priority will be increased to the specified value only if the processed packet has lower priority.
 - Set – used to assign new priority regardless of the value already assigned to the packet.
- Log – enables/disables filter actions logging in the system log
- Direction – sets the rule applicability scope:
 - Input – the rule is used to process inbound traffic
 - Output – the rule is used to process outbound traffic. The outbound rules can be used for post-routing packet filtering.
- Interface – specifies the unit logical interface which the rule will be applied to. If “any” option is used the rule will be applied to all available interfaces
- Group – configures the filter to accept packets from the specified switch group only
- Rule – a text field for the rule expression
- Validate – performs the syntax check on the expression in the Rule field

- Up/Down arrows – allow users to organize rules list. The rules are processed one by one in a top-down order.
- Remove Rule – permanently removes the rule from the configuration.
- Add Rule – creates a new rule for the current switch group.

SNMP

All InfiNet Wireless units support SNMP management protocols. This section contains all SNMP-related settings.

Access

▼ Access

Start SNMP
 Version 1 enable
 Community:
 Contact:
 Location:

Use the Access subsection to enable SNMP functionality and configure service parameters.

- Start SNMP – this checkbox enables/disables SNMP functions.
- Version 1 enable – enables/disables SNMP v1 support.

To setup SNMPv1 configure the SNMP community (default community is “public”). The Contact and Location parameters are optional, however it’s strongly recommended to provide accurate information about unit owner and installation location.

Use Help button to display help on configuring SNMP.

Start SNMP
 Version 1 enable
 Community:
 Contact:
 Location:

User Name	Password	Security	Readonly	Admin	Privacy Password	Privacy Protocol	
<input type="text"/>	<input type="text"/>	Authorization No Privacy	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>	DES	<input type="button" value="Remove User"/>

Click Add SNMP v3 User to setup SNMP v3 operation.

- User Name – the username for the new SNMP v3 user.
- Password – new user's password. Must be at least 8 characters long.
- Security – three security levels are available for each SNMP v3 user:

- No Authorization No Privacy – SNMP messages are sent unauthorized and unencoded.
- Authorization No Privacy – SNMP messages are sent authorized and unencoded.
- Authorization and Privacy – SNMP messages are sent authenticated and encoded. The passphrase for the encoding can be set using the Privacy Password field.
- Readonly – this checkbox toggles Write operations restriction for the current user.
- Admin – toggles full access to all variables. By default all users have limited access.
- Remove User – removes the user from the SNMP configuration.

Traps

SNMP protocol operation requires a network agent instance to send asynchronous messages (traps) whenever a specific event occurs on the controlled device (object). InfiNet Wireless units have a built-in SNMP Traps support module (which acts as an agent) that performs a centralized information delivery from unit internal subsystems to the SNMP server. This subsection focuses on SNMP Traps agent configuration.

▼ Traps

Help Enable SNMP Traps: Agent IP: [] [] [] [] [] X Transport: IP Gateway MAC: [] [] [] [] [] [] [] [] X

Destination:

[123] [.] [123] [.] [123] [.] [123] [.] [] [] X +

topoGroup

topoEvent

newNeighborEvent

lostNeighborEvent

others

linkEvent

trapdColdStartEvent

snmpdAuthenticationFailureEvent

syslog

Clone Remove Clear

- Use the Help button to display SNMP system help.
- Agent IP – Source IP address used for sending SNMP trap packets.
- Transport – a transport method for SNMP traps. Two options are available:
 - IP – all SNMP traps are sent to the server specified in the Destination field below.
 - MINT Gateway – this option should be used when the SNMP server is located beyond a gateway that acts as an SNMP agent for the whole MINT network. To specify the gateway fill its MAC address into the Gateway MAC field. If there's no MAC address specified all SNMP traps are sent to the MINT SNMP relay. The relay can be specified by checking the Trap Gateway check-box in the Link Settings section.
- Destination – allows users to configure the IP address and port (default port is 162) for the SNMP server.

- The check-boxes below specify traps or trap groups that are to be sent to the server.
- Clone – allows users to setup multiple SNMP servers. Each server can have an individual set of traps directed toward it.
- Clear – clears all check-boxes for the current server.

▼ **QoS Options**

Auto Prioritization:

RTP Packets: Dot1p Tags: Tunnel Prioritization:

IP ToS: TCP Acknowledgments:

Miscellaneous:

Strict Prioritization: ICMP Prioritization:

This section focuses on managing traffic prioritization. The Auto Prioritization subsection contains AutoQos settings:

- RTP Packets – enables/disables automatic prioritization for all RTP traffic regardless of source or destination IP.
- Dot1p Tags – enables/disables automatic prioritization for packets tagged with IEEE 802.1p priority tags.
- Tunnel Prioritization – enables/disables automatic prioritization for tunnel traffic.
- IP ToS – enables/disables automatic prioritization for packets with a non-zero ToS field.
- TCP Acknowledgements – enables/disables automatic prioritization for TCP ACK packets.

Miscellaneous subsection handles other QoS-related options:

- Strict Prioritization – enables Strict Prioritization traffic control policy. By default Weighted Fair Queue policy is used. Refer to WNAFlEX OS Manual for detailed policy descriptions.
- ICMP Prioritization – enables/disables automatic prioritization for ICMP packets.

Extra commands

▼ **Extra Commands**

Command	Parameters	Disabled		
sys		<input type="checkbox"/>	↑	↓
Remove Command				
Add Command				

The Extra commands section allows users to take advantage of the CLI configuration flexibility while keeping the web-interface as the main device management tool. While the web-interface is simple to use and understand, there are several parameters that can be configured via CLI only. However if any configuration changes are introduced via the web-interface later on, the configuration re-initializes and all CLI-configured parameters are reset to default.

Use this section to add CLI-specific commands to the configuration in order to preserve the fine-tuning settings.

- Command menu – selects the command to add to the device configuration .
- Parameters – use this string to specify command parameters and options .
- Disabled – disables the command temporarily .
- Up/Down arrows – allow users to organize the command list
- Remove Command – deletes the command from the list permanently
- Add command – adds the command to the list.

5. Device Status

InfiNet wireless Language: English

Device Status Basic Settings Maintenance Spectrum Analyzer DFS Command Line →logout

CPU 6% Memory 49275K / 123740K Flash 4550K / 15875K

Interface Statistics H08S01-MINTv1.89.4

Interface	MAC Address	Status	Mode	Packets Rx/Tx	Errors Rx/Tx	Load (Kbps) Rx/Tx	Load (pps) Rx/Tx
eth0	00043500a289	Up	100 Mbps Full Duplex	225445 / 222447	0 / 0	5 / 23	3 / 5
rf5.0	00043510a289	Up	300 Mbps / 5340 MHz / 40 MHz	7958532 / 8366288	91 / 1431	50 / 53	109 / 115
vlan30	02043500a289	Up	svi30 / Vlan ID: 30	225277 / 222297	0 / 0	6 / 15	3 / 3
svi30	02043500a289	Up	Switch Group #30	0 / 222297	0 / 0	0 / 13	0 / 2

Reset All Counters

Wireless Links Statistics for Interface rf5.0 (BaseStation_IDFS ID: 41609) Noise: -81 dBm Links: 1 ATPC:On Autobitrate:Off Polling:Master

Link Quality	MAC Address	Name	Node ID	Distance (Km)	Tx Power (dBm) Rx/Tx	Ref. Level (dB) Rx/Tx	Current Level (dB) Rx/Tx	Bitrate Rx/Tx	Retries (%) Rx/Tx	Errors (%) Rx/Tx	Load (Kbps) Rx/Tx	Load (pps) Rx/Tx
■	00043510e5bb	Unknown node	08811	0	18 / 12	25 / 19	21 / 19	300 / 300	0 / 0	0 / 0	2 / 0	3 / 1

Hint: Click on link data to invoke Extended Link Diagnostics menu

Daily Graphs

Switch Statistics Status: Started

Refresh Auto Refresh: Auto Refresh Time (sec): Show System Log

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The “Device Status” page allows viewing CPU/memory/flash usage and monitoring statistics of the unit’s interfaces and radio wireless connections and using the graphical “Antenna alignment” tool and performing radio link performance tests and viewing the system log.

Graphical indicators display basic platform operation parameters, such as CPU load, RAM and flash usage.

CurrentRunning software version is also displayed on the Device Status page.

The "Interface Statistics" section displays the following parameters of all available interfaces of the device:

- Interface – the name of the interface
- MAC Address – the MAC-address of the interface
- Status – the status of the interface (Up, Down)
- Mode – main working parameters currently used by the interface for its operation
- Packets Rx/Tx – the number of received/transmitted packets via the interface
- Errors Rx/Tx – the number of errors on the interface when receiving/transmitting
- Load (kbps) Rx/Tx – the data load of the interface in kilobits per second
- Load (pps) Rx/Tx – the data load of the interface in packets per second.

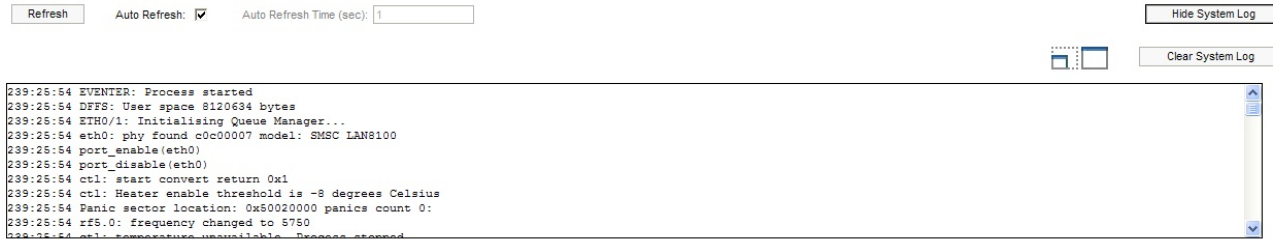
The "Wireless Links Statistics" section displays all neighboring devices which the interface (RF or Pseudo-RF) of the given node is connected to. The following radio link parameters are displayed:


- Link Quality – indicates the quality of the link to a neighboring device: green – the link has acceptable characteristics, yellow – the link has significant problems, red – the link has unsatisfactory characteristics.
- Neighbor – the neighbor's name
- MAC Address – the neighbor's MAC address
- Node ID – the sequential number of the neighboring node
- Distance – the distance of the link
- Transmit Power (dBm) Rx/Tx – transmit power values for remote/local sides of the link in dBm
- Control Level (dB) Rx/Tx – signal levels for receiving/transmitting (in dB) measured relative to the minimum possible bitrate
- Current Level (dB) Rx/Tx - signal levels for receiving/transmitting (in dB) measured relative to the Rx/Tx bitrates that are currently used for the link
- Bitrate Rx/Tx – the bitrates for receiving/transmitting that are currently used for the link
- Retries (%) Rx/Tx – measured percentage of the resent packets on the link for receiving/transmitting
- Errors (%) Rx/Tx – measured percentage of the errors on the link for receiving/transmitting
- Load (kbps) Rx/Tx – the data load of the link in kilobits per second
- Load (pps) Rx/Tx – the data load of the link in packets per second

The "Refresh" button updates the statistics.

The "Auto Refresh" check-box enables automatic statistics update. The update frequency (in seconds) can be set by the "Auto Refresh Time" parameter. The minimal possible value, "0" seconds, makes update process instant.

The "Show System Log" button shows the "System Log" section.



The "System Log" section allows browsing the unit's system log. It is possible to minimize/enlarge the system log window with the following buttons: .

The "Clear System Log" button deletes all the information from the system log.

To hide the "System Log" section press "Hide System Log" button.

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 the data of the wireless link you want to test (see the picture below):

Interface	MAC Address	Status	Mode	Packets Rx/Tx	Errors Rx/Tx	Load (Kbps) Rx/Tx	Load (pps) Rx/Tx
eth0	00043500a289	Up	100 Mbps Full Duplex	225445 / 222447	0 / 0	5 / 23	3 / 5
rf5.0	00043510a289	Up	300 Mbps / 5340 MHz / 40 MHz	7958532 / 8366288	91 / 1431	50 / 53	109 / 115
vlan30	02043500a289	Up	svi30 / Vlan ID: 30	222297	0 / 0	6 / 15	3 / 3
svi30	02043500a289	Up	Switch Group #3	222297	0 / 0	0 / 13	0 / 2

Wireless Links Statistics for Interface rf5.0 (BaseStation_IDFS ID: 41609)

Link Quality	MAC Address	Name	Node ID	Distance (Km)	Signal (dB)	Bitrate Rx/Tx	Retries (%) Rx/Tx	Errors (%) Rx/Tx	Load (Kbps) Rx/Tx	Load (pps) Rx/Tx		
■	00043510e5bb	Unknown node	08811	0	18 / 12	25 / 19	21 / 19	300 / 300	0 / 0	0 / 0	2 / 0	3 / 1

Hint: Click on link data to invoke Extended Link Diagnostics menu

Extended Link Diagnostics

- Performance Tests
- Antenna Alignment Tool
- Stats Graphs

Ok Cancel

Switch Statistics Status: Started

Refresh Auto Refresh: Auto Refresh Time (sec):

Show System Log

Then choose Antenna alignment tool, Performance tests or Graphs from the appeared Extended Link Diagnostics window.

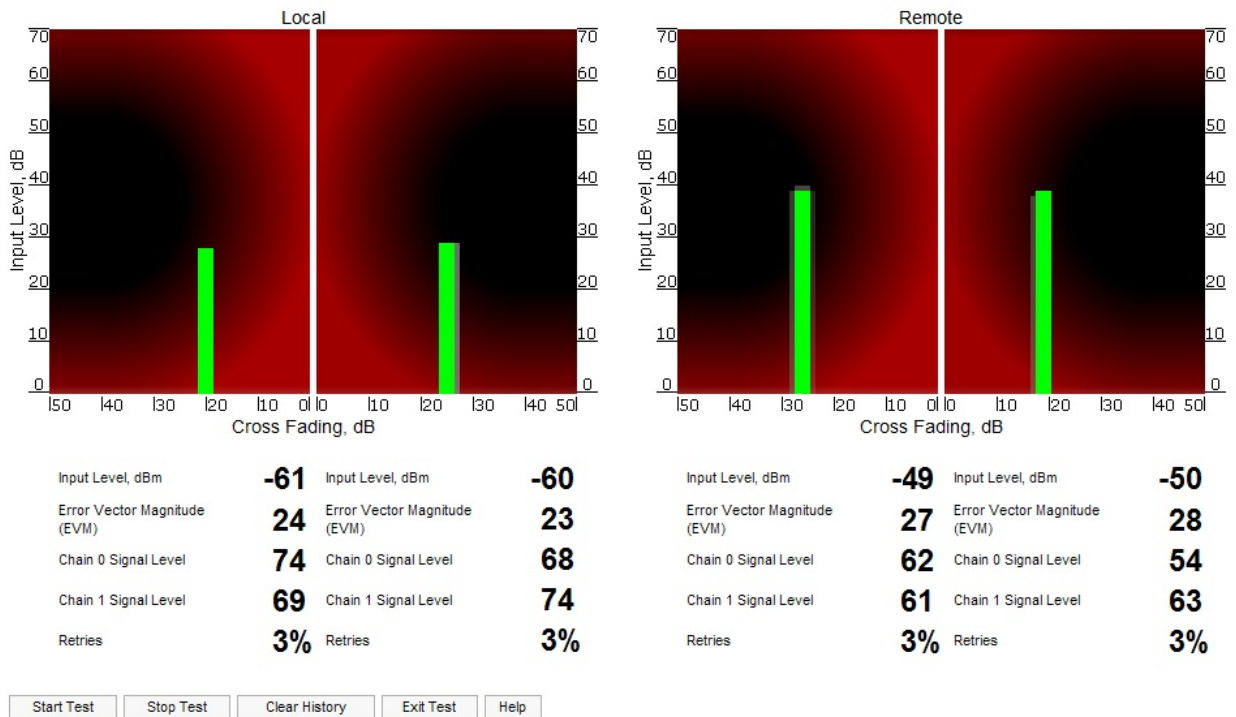
Antenna alignment tool

Graphical antenna alignment tool visualize antenna alignment process making it quicker, easier and comfortable for the user.

“Antenna alignment tool” page view for “R5000-Xm” device models is shown below:



Alignment Test (Interface rf5.0, MAC 000e8e201325, Neighbor Test_node_1)



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

“Exit Test” button returns to the “Device Status” page.

“Help” button displays help guidelines for antenna alignment.

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.

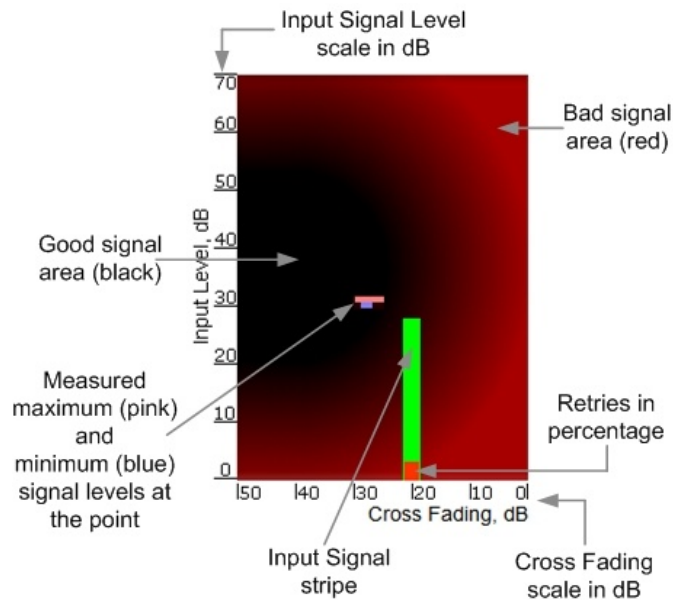
Each side of the link (local and remote) has two similar test indicator sets corresponding to two antenna polarizations (rx chains) of the device (one for Vertical polarization and another for Horizontal). This allows controlling the alignment process for each antenna polarizations for local and remote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

Text indicators are the following:

- Input Level, dBm – RSSI indicator of the input signal. Measured in dBm.

- 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:



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 its 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.

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.

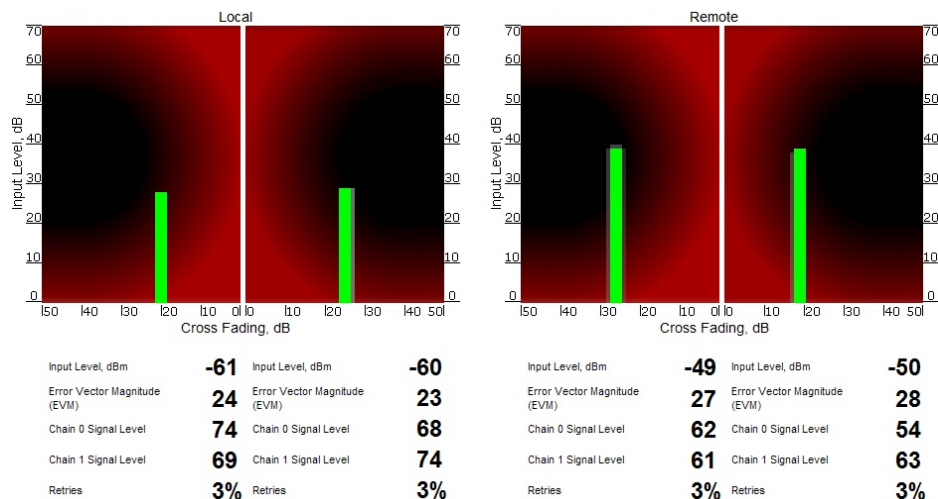
5. The signal quality should be good: EVM value should be more than 21.

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).

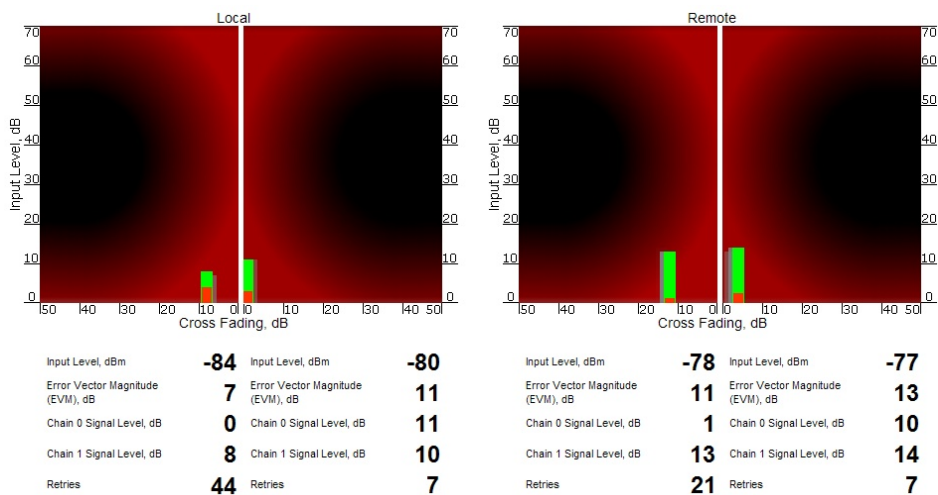
ALL described recommendations are applicable to both (Local and Remote) sections.

Link samples:

- Good link sample



- Bad link sample



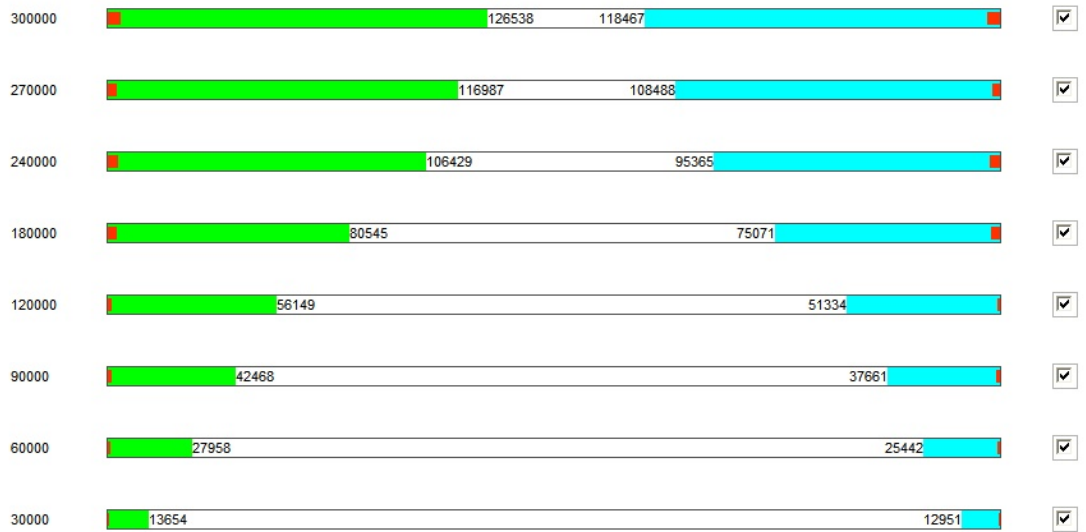
Performance tests

The "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:



Performance Test (Interface rf5.0, MAC 000e8e201325, Neighbor Test_node_1)



Test Time (s): Bi-directional: Use mint: Select all:

Notes:
 - All results are given in kilobits per second.
 - Retries levels are shown by red chart.

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

“Back” button returns to the “Device Status” page.

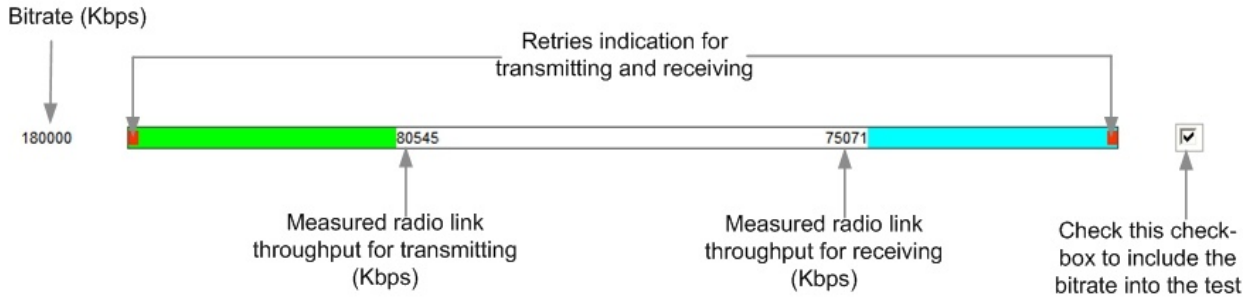
Each row corresponding to a certain bitrate value can be selected or deselected for participating in the performance test by using a check-box on the right of it. By using “Select all” check-box all the bitrates could be selected/deselected at once.

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 MINT-enabled test when all the traffic and link parameters are controlled and managed by MINT functions such as ATPC and autobitrate. 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).

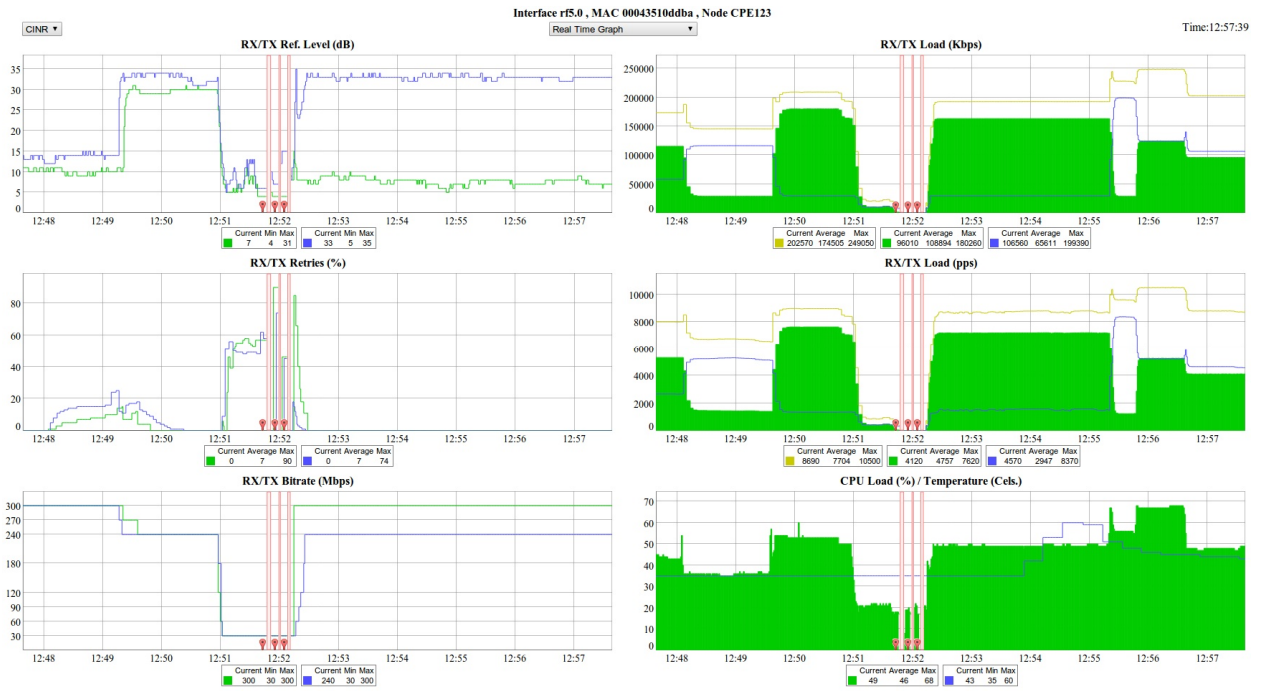
The bitrates list on the "Performance test" page consists of the bitrates that corresponds to the channel bandwidth set on the unit (5/10/20/40MHz). To perform the tests for the bitrates related to the other channel bandwidth you need to reconfigure channel bandwidth ("Channel Width" parameter in the "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):



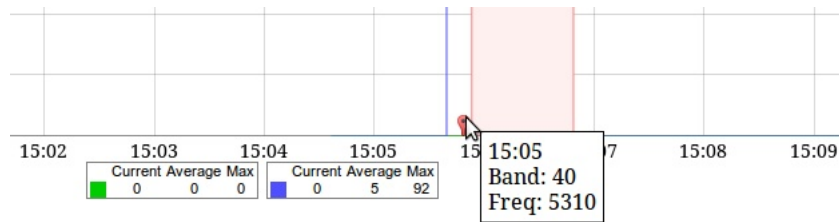
Stats Graphs

This tool allows users to monitor device parameters represented as colorful graphical charts. Supported modes are real-time monitoring and daily data logs display.



By default the system displays daily data logs. All charts support simultaneous zooming to improve usability: once the user zooms into a certain region on any of the charts, all other charts are re-scaled automatically to display the data collected during the same period of time.

Critical events like link outages or frequency swaps are marked by small red balloons on the bottom of each graph. Hover over each balloon for details.

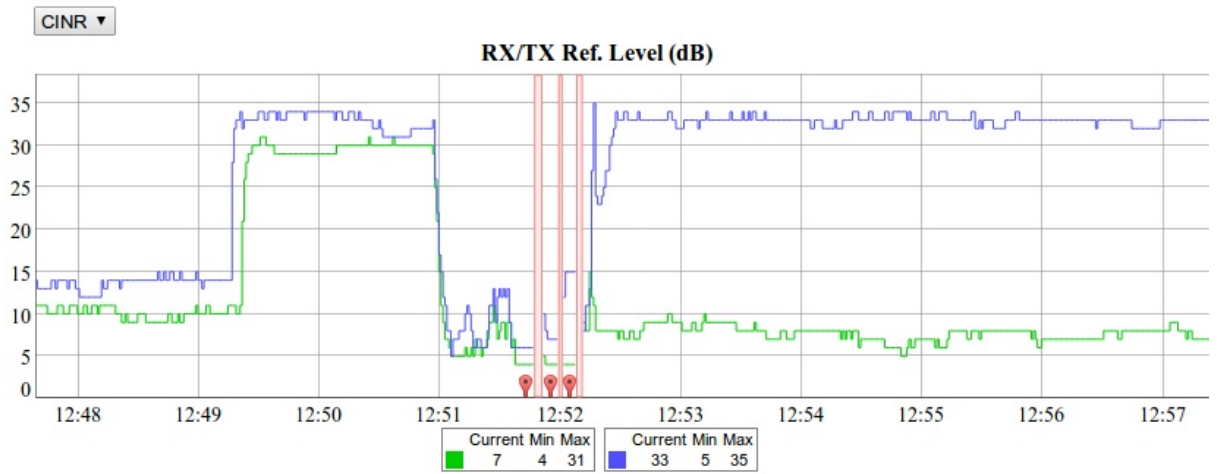


Working with the charts:

- Select chart region to zoom in.
- Hold Shift button and drag the graphs to pan.
- Double-click any chart to reset zoom.

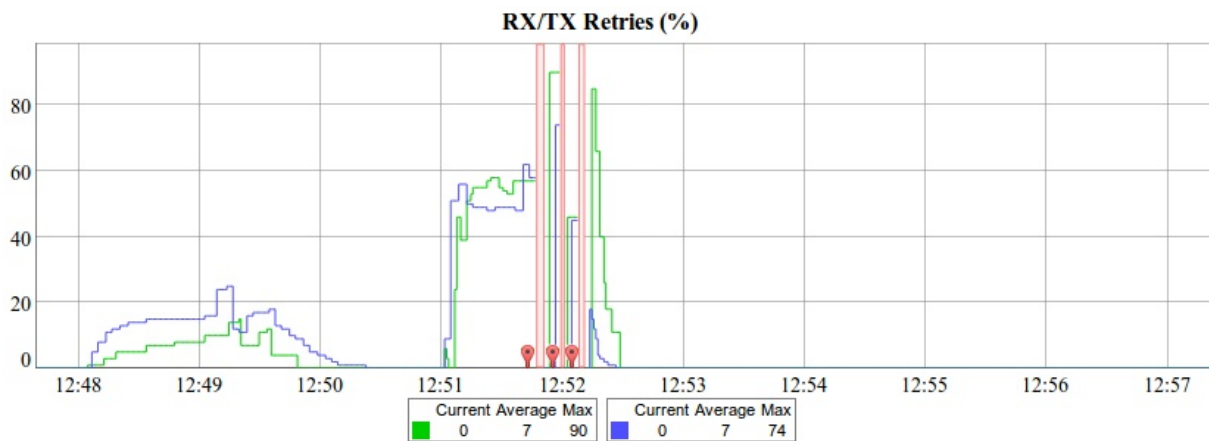
The parameters set includes:

RX/TX Ref. Level (dB)



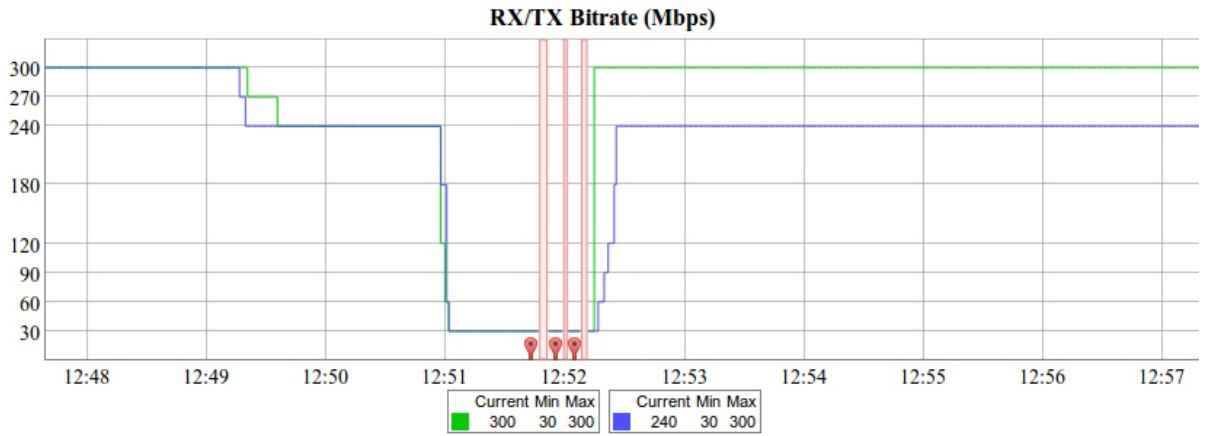
This chart displays measured RX (green) and TX (blue) signal levels. Red regions represent link outages. Default graph uses CINR measurement method, however RSSI method can be selected from the drop-down menu.

RX/TX Retries (%)



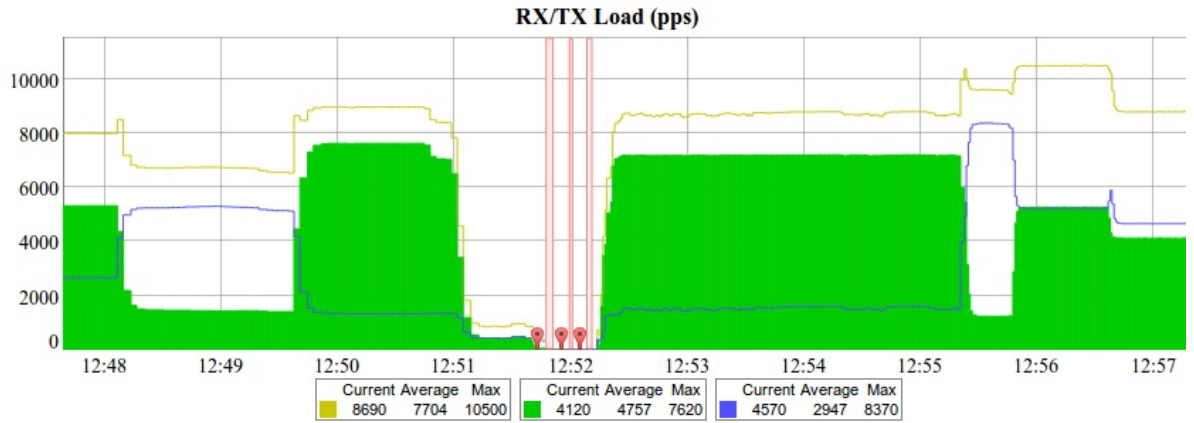
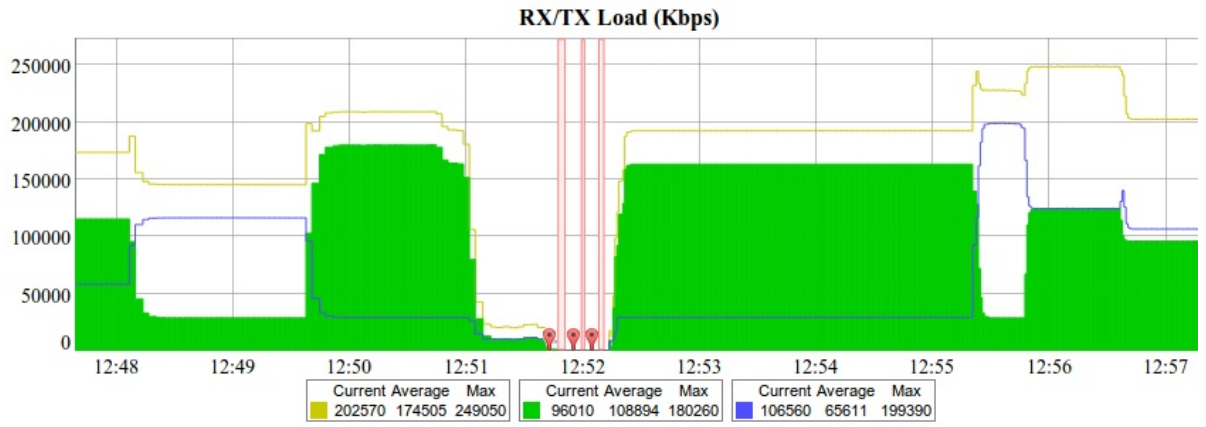
This chart displays retry percentage – an important parameter, that provides a quick estimation of the link quality. Similar to the previous graphs RX retries are represented by the green lines, TX retries – by the blue lines and link outages – by the red lines.

RX/TX Bitrate (Mbps)



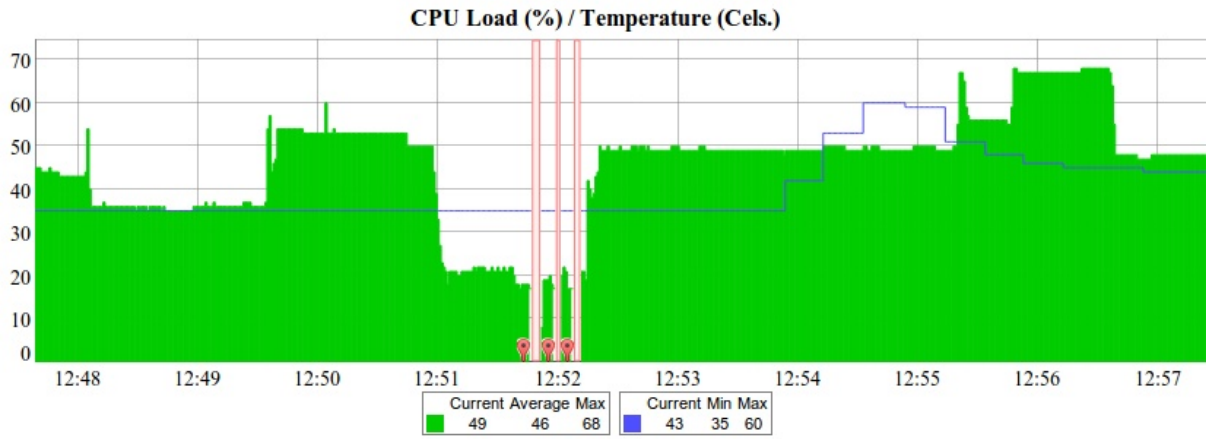
The Bitrate chart displays established link bitrate. Note that the bitrate is not the same as link throughput but rather represents link quality.

Link load charts (pps & Kbps)

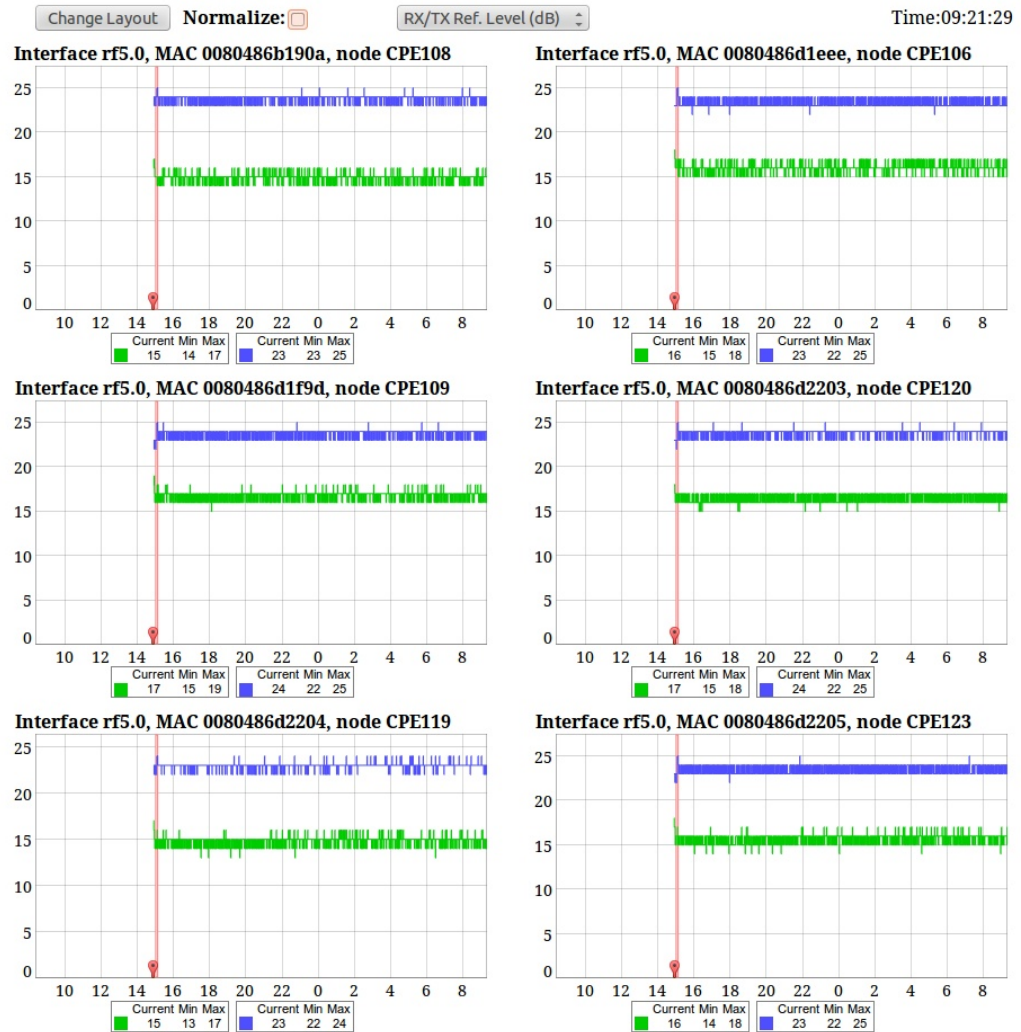


Load charts display actual link load information either in real time or for the given period. Yellow lines represent total link load, green lines – RX load and blue lines – TX load

CPU load / System temperature



The last chart displays current CPU load and unit temperature (for units equipped with temperature sensors).



Daily Graphs page displays statistical information on all active links similar to the Stats Graphs page but collected for the last 24 hours. The drop-down menu on top of the page allows users to select link operation parameter to be displayed. Change Layout button switches page layout between one- and two-column view.

The Normalize checkbox enables/disables graph normalization.

Extended Interface Statistics

Extended Interface Statistics tools allow gathering complete information and enhanced statistics on the unit's interfaces. Each interface type has its own set of available tools applicable to it.

To access the Extended Interface Statistics tools make a mouse-click on the row with the interface on which you want to get statistics in the "Interface Statistics" section (see the picture below):

Then choose the statistic tool you need from the appeared window.

General Statistics

The General Statistics tool shows statistics on the interface such as the interface mode, current status, receive and transmit statistics and so on. The actual statistics details depend on the interface type (i.e. Ethernet, RF and other).

Radio Sources Analysis

The Radio Sources Analysis tool tests the electromagnetic environment and enables to estimate utilization efficiency of the radio links, reveal sources of interference and estimate their power.

QoS statistics

The QoS statistics tool allows viewing the statistics on software priority queues for the interface. The MINT priorities is marked as PXX (e.g. P01, P02, ..., P16). One can see the number of packets that came to each priority queue and the number of dropped ones.

Network Address Table

The Network Address Table tool shows the network address table for the interface.

6. Maintenance

InfiNet
wireless

Language: English

Device Status Basic Settings **Maintenance** Spectrum Analyzer DFS Command Line logout

Firmware

Firmware Version: H08S01-MINTv1.89.5
Build Date: Feb 1 2013 13:41:42
Serial Number: 41609
Part Number: PN:SkyMAN R5000-Mmxs/5.300.2x200.2x23
Platform: Processor: PPC460EX 1000 MHz
Uptime: 00:39:23
Last Reboot Reason: firmware upgrade

Check Latest Release Check Latest Beta

Upload

License: Обзор... X
Firmware: Обзор... X
Configuration: Обзор... X

Upload

Download

Download License
Download Firmware
Download Configuration

Reboot Restore Factory Settings View Current License View Current Configuration Create Diagnostic Card

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The “Maintenance” page allows performing service tasks for the device maintenance.

The «Firmware» section of the page shows current firmware version, firmware build date, serial number and system up time.

“Check Latest Release” and “Check Latest Beta” buttons allow automatic software upgrade. The system checks for updates on the InfiNet Wireless repository and automatically downloads new releases.



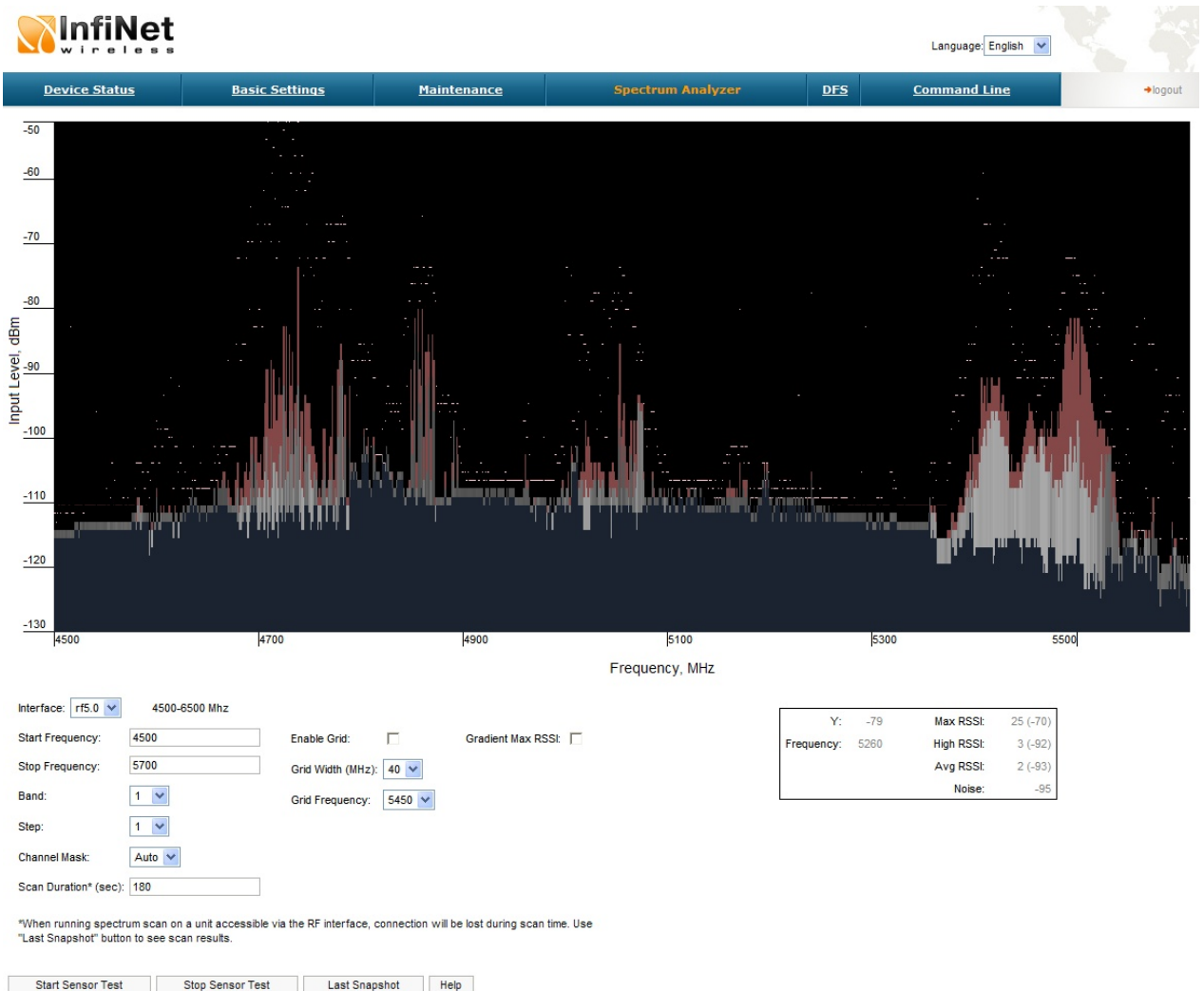
Note that the unit does not have to have access to the Internet for this feature to work. However the PC that is used to initialize the upgrade procedure must have access to IW website (both http and ftp).

The «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 current device configuration in text format in a separate window
- “Create Diagnostic Card” button – Tech Support Reports Generator: 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.

7. Spectrum Analyzer



The «Spectrum Analyzer» page 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
- Step – scanning frequency step in MHz



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

- Channel mask – specifies which antenna will scan the radio environment. "Auto" value set scanning by both antennas. This parameter is applicable only to "R5000-Xm" models
- 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.

"Help" button – displays the help note for the Spectrum Analyzer.

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.

8. DFS



Language: English



Band: 40 MHz Frequency grid: 5450-5930/20

Clear NOL Re-select Channel

5450	5450	5470
5490	5490	5510
5530	5530	5550
5570	5570	5590
5610	5610	5630
5650	5650	5670
5690	5690	5710
5730	5730	5750
5770	5770	5790
5810	5810	5830
5850	5850	5870
5890	5890	5910
5930	5930	

Legend

5000	Available channel. Yellow bar indicates interference level
5005	Channel in use
5010 30s	Channel availability check in progress. Remaining time shown at bottom right
5015	Channel monitoring active
5020 30s	Blocked channel. Remaining time shown at bottom right
5025	Inconsistent configuration
5030	Non-verified channel


The «DFS» page allows monitoring and management of the DFS operation. The DFS status and availability indicators are shown for each frequency for the given band and grid (shown at the top of the page). To understand the indicators please see Legend at the bottom.

“Clear NOL” button clears the non occupation list of the frequencies blocked for using due to the radars detected there and allows the DFS subsystem to rescan those frequencies. If not cleared blocked frequencies will be available for rescan

after the time period shown in the right bottom corner of the frequency indicator.

“Re-select Channel” button restarts the DFS scanning.

9. Command line emulation



The screenshot shows the InfiNet wireless web interface. At the top left is the InfiNet wireless logo. To the right, there is a language dropdown menu set to 'English'. Below the header is a navigation bar with tabs for 'Device Status', 'Basic Settings', 'Maintenance', 'Spectrum Analyzer', 'DFS', and 'Command Line'. A 'logout' link is visible on the right side of the navigation bar. The main content area is a terminal window displaying the following text:

```
mint rf5.0 -authmode public
mint rf5.0 -airupdate passive normal
mint rf5.0 -rcmdserver enabled
mint rf5.0 start

#MAC Switch config
switch group 30 add 1 eth0 rf5.0
switch group 30 vlan 30
  # group 30 attached to 'svi30'
switch group 30 start

switch group 25 add 2 eth0 rf5.0
switch group 25 vlan 25
  # group 25 attached to 'svi25'
switch group 25 start

switch dead-interval 432000
switch start

#Switch Virtual Interface config
svi 25 group 25
svi 30 group 30

#DNS Client configuration
dnsclient -server=10.1.50.2 start

#SNTP configuration
sntp -server='10.1.30.1' -supplier=on start

#WEB configurator
webcfg start
```

Below the terminal window, there is a 'Command:' input field containing the text 'co sh'. To the right of the input field is an 'Execute' button.

The «Command line» page 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 the “Command” field and then press either the “Execute” button on the screen or “Enter” key on your keypad. The commands output are shown in the window above.

III. Configuration (CLI)

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 serial interface, using InfiNet Console cable
- Start any terminal emulation software (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 no initial login and password settings, so you can use any non-zero length login and password to enter the device:

Login: root

Password: 1234

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 Base Station

system user root

system password qwerty



*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.*

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

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 Mbit interface
- **rfX.0** - radio interfaces. See device's labeling or use "ifconfig -a" command to learn your radio interfaces
- **pppX** – point-to-point interfaces
- **tunX** - interfaces used for IPIP tunnels building
- **vlanX** – interfaces supporting VLAN 802.1q tagging

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

```
ifconfig -a
```

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.

4. Configuration manipulations

Printing and saving your configuration

You can easily review your current device's configuration by executing "config show" 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. You can specify several parts of the configuration separating them with a space bar.

Example:

config show rip nat

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).

Import/export

Export/import of the device's configuration is performed using “config export” and “config import” commands correspondingly. “Config export” saves the Device configuration on a remote server and “config import” 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.

Uploading firmware

The latest firmware version can be downloaded from our support site (<http://support.infinetwireless.com>) and from our ftp-server (<ftp://ftp.infinet.ru>).

Command “flashnet” uploads specified firmware version to the Device. Download is performed using FTP and FTP server should be installed somewhere in the network or on a local host from where download being performed.

File name is a full path including IP address of FTP server:

```
flashnet get upgrade@192.168.1.1/conf/infinet/infinet_new.bin
```

Where **192.168.1.1** is IP-address of FTP server and **.../conf/infinet/infinet_new.bin** is a full path to firmware version.

The download process has two phases:

- File uploading into RAM of InfiNet device.
- Programming InfiNet device flash memory from RAM firmware image. This phase is indicated by “O.O.O.O.O...” sequence.



Do not interrupt this process, otherwise device will be brought into invalid state and it recovery will be possible only at manufacturer premises.

During installation process all system events should be observed in the system journal (command “sys log”).

5. 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.

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 that 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.

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.
- Bit-rate (**bitr** parameter). Bit transfer rate in kBits/sec.
- System identifier (**SID** parameter). A hexadecimal number in the range of 1H to FFFFFFFH. All Devices that are supposed to see each other on the same radio link must have the same identifier.



*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.*

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 radio interface name either see the ODU/Device labeling or execute “**ifc -a**” command.

- **txpwr** – transmitting power selection. Available power levels can be obtained using “capabilities” parameter as shown above
- **burst** – enables burst mode. BURST protocol means grouping several short packets with the same destination address on a radio link into larger packets, thus cardinaly decreasing the response time for applications generating streams of short packets. Burst enabling relates to a radio interface as a whole, and means only that you want to use this mode in this device; but the BURST protocol can only work for destinations where it is also enabled at the other end, and only if the MINT protocol is used at both sides.

Burst enabling does not induce any changes in the work of other devices in the network. To disable “burst” mode use “-burst” parameter in “rfconfig” command.

- **distance**: this parameter is used to set the exact distance value between two devices (in kilometers). This parameter changes time values for some delays and time-outs of 802.11a/b/g protocol thus making possible to work on longer distances with smooth adjustment.

There are several ways to manage this parameter:

- if you set an exact value, this value is used no matter what the connection method is used
 - If the CPE has auto value instead of a number (by default), the CPE will configure its parameters using Base Station commands. It is enough to set a numeric value on a Base Station (the distance to the remotest CPE); all other CPEs will automatically adjust their work. While configuration showing, there might be the current distance value after **auto** parameter: **auto (XX)**
 - when knowing exact device's geographical coordinates (e.g. using GPS) you can specify their values in “sys gpsxy” command and distance parameter set as auto on all devices including the Base Station. In this case devices will automatically adjust their settings selecting an optimal value for the **distance** parameter. Base Station will calculate a distance to the remotest subscriber, and subscriber will calculate a distance to the base station. If the CPE has a link coordinates information it will use this information, otherwise it will use the **distance** parameter value got from the base station.
 - If **distance** parameter is set to 0 radio module will use default settings.
- **pwrctl** – automatic transmitting power control mode. In this mode the output power is set up automatically within the values available for the radio module. Used for CPE only.

Example:

```
rfconfig rf5.0 freq 5260 bitr 130000 sid 10203040 burst
rfconfig rf5.0 txpwr 18 distance auto
```

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.

8. Network topology setup

At the core of the system is a MINT (Mesh Interconnection Networking Technology) protocol which acts as a topology defining architecture of InfiNet Wireless system. Please refer to the WANFlex OS User Guide for a detailed description of MINT protocol.

IV. Link setup

1. Preliminary decisions

Bitrate selection

Overall link performance is greatly depends on the right bitrate selection. Wrong bitrate of a radio link in most cases lowers its performance characteristics. In the result subscribers are getting bad services.

IW MINT architecture makes bitrate selection process fully automatic. Using IW proprietary Link Forecasting and Active Testing algorithms MINT chooses the optimal radio transmission rate individually for each connected subscriber device.

- Therefore, main recommendations for bitrate selection are: enable autobitrate mechanism and set the maximal available bitrate on the radio interfaces of all the devices
- To estimate the real bitrate of the device prior to its installation and deployment use the Range Calculator utility (see below).

Frequency planning for multi-sectored Base Stations

Base Stations with six sectors deliver the maximal performance by providing with sector reciprocal reservation and best price/performance parameter value. When having an optimal frequency gap of 40 MHz between adjacent sectors of the BS, the following schemes are recommended to be configured (e.g. having 5 available in configuration frequencies F1, F2 ... F5):

- F1, F3, F5, F1, F3, F5
- F1, F3, F1, F3, F1, F3

Transmitting power selection

High output power correlates with the maximal connection performance. Decreasing the output power is logical when the maximal bitrate is already reached and there are no repeats. In this case excessive output power can decrease the system parameters. When having no built-in or external amplifiers one can try to install the automatic power control for the subscriber.

Range | Bitrate calculation

Range/Bitrate calculator allows estimation of a bitrate and distance for a particular radio link. This calculator can be downloaded from "Repository" of our support web-site (<http://support.infinetwireless.com>).

Bitrate	Site 1 -> 2			Site 2 -> 1		
	Worst	Mean	Optimal	Worst	Mean	Optimal
13.0 Mbps	25.8 km	117.8 km	294.7 km	25.8 km	117.8 km	294.7 km
26.0 Mbps	20.4 km	88.3 km	210.2 km	20.4 km	88.3 km	210.2 km
39.0 Mbps	16.1 km	66.2 km	150.5 km	16.1 km	66.2 km	150.5 km
52.0 Mbps	12.7 km	49.6 km	108.1 km	12.7 km	49.6 km	108.1 km
78.0 Mbps	10.6 km	40.0 km	84.5 km	10.6 km	40.0 km	84.5 km
104.0 Mbps	8.3 km	30.0 km	61.0 km	8.3 km	30.0 km	61.0 km
117.0 Mbps	6.4 km	22.1 km	43.4 km	6.4 km	22.1 km	43.4 km
130.0 Mbps	6.0 km	20.6 km	40.1 km	6.0 km	20.6 km	40.1 km

Range/Bitrate calculator view.

To use the calculator:

1. Set needed frequency range in "Band" field.
2. Set NLOS parameters in "Path type" field.
3. Set radio channel width in "Bandwidth" field.
4. For Site 1 and Site 2 define device model, device's max output, antenna gain and feeder loss.
5. Press "Calculate" button.

The results will be listed in a table below. For each available Bitrate value you will see corresponding distances in kilometers for "worst", "mean" and "optimal" environment conditions.



Earth surface relief is not taken into account in calculations.

2. Link diagnostic tools

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:

It 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:

Current/Maximum incoming signal level

Current/Average number of retries in percent

Current/Average number of undelivered packets in percent

Current/Average number of undelivered acks in percent

Estimated round-trip time

```
Node7#1> lt rf4.0 00179AC2F3E6
Unicast test to 00179AC2F3E6 via rf4.0
packet size 1024, reply size 1024, bitrate 18000, reply bitrate 18000
rt - retries, up - undelivered packets, ua - undelivered acks
```

local				remote				est.
amp/max	rt%/avg	up%/avg	ua%/avg	amp/max	rt%/avg	up%/avg	ua%/avg	rtt
13/13	7/7	0/0	3/3	11/11	7/7	0/0	0/0	5.0
13/13	7/7	0/0	3/3	11/11	10/8	0/0	0/0	5.0
13/13	3/5	0/0	10/5	11/11	13/10	0/0	0/0	5.1
13/13	16/8	0/0	10/6	11/11	7/9	0/0	7/1	5.2
13/13	16/9	0/0	0/5	11/11	13/10	0/0	0/1	5.1
12/13	13/10	0/0	7/5	10/11	16/11	0/0	0/1	5.3
12/13	16/11	0/0	3/5	11/11	19/12	0/0	0/1	5.5
12/13	19/12	0/0	10/5	11/11	13/12	0/0	3/1	5.3
12/13	10/11	0/0	0/5	11/11	10/12	0/0	0/1	5.1
12/13	16/12	0/0	0/4	11/11	13/12	0/0	0/1	5.3
12/13	10/12	0/0	0/4	11/11	3/11	0/0	0/0	5.9
12/13	16/12	0/0	0/3	12/12	13/11	0/0	0/0	5.5
12/13	13/12	0/0	7/4	11/12	13/11	0/0	3/1	5.2
12/13	10/12	0/0	0/3	12/12	7/11	0/0	0/0	5.1
12/13	21/12	0/0	0/3	12/12	16/11	0/0	0/0	5.3
12/13	19/13	0/0	7/3	12/12	13/11	0/0	3/1	5.6
12/13	10/13	0/0	0/3	12/12	7/11	0/0	0/0	5.1

Local device statistics

Remote device statistics

For success 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 than 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 exploited.
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. If this value is constantly not less then 50 then most probably «distance» parameter is set with a wrong value. If radio link distance is more than 20 km then «long» mode must be enabled.

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

Alignment mode (for Xm-series only):

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:

```
lt rf5.0 <Mac-adress> -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

Bandwidth mode (Bandwidth meter):

Bandwidth meter is used to test the following radio link characteristics: throughput in kilobits per second, 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:

lt rf5.0 <Mac-adress> -tb

“Ltest” command output in Bandwidth meter mode:

Direction	Kbit/s	Pkt/s	Retries	Errors	Minimal, average and maximal delay values min/avg/max/stddev (usec)
Transmit	56056	4671	0.00%	0.00%	40/213/5979/751
Receive	54378	4531	0.00%	0.00%	22/220/11682/845
Total	110434	9202			

Annotations:
 - Radio link bandwidth for transmitting: points to the Transmit row.
 - Radio link bandwidth for receiving: points to the Receive row.
 - Total radio link bandwidth: points to the Total row.
 - Minimal, average and maximal delay values: points to the delay column header.

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

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.

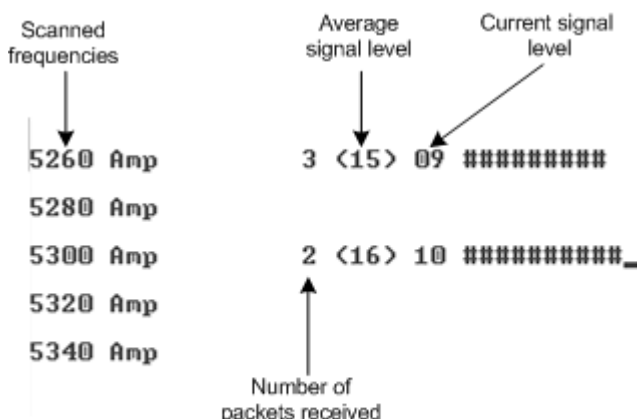


Normal operation of the radio is not possible in this mode.

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.



The scan is performed only for the packets corresponding with the standard of the radio module (802.11a for 5GHz devices and 802.11b for 2.4 GHz devices). Other sources of signals on the scanned frequencies stay unseen.



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.

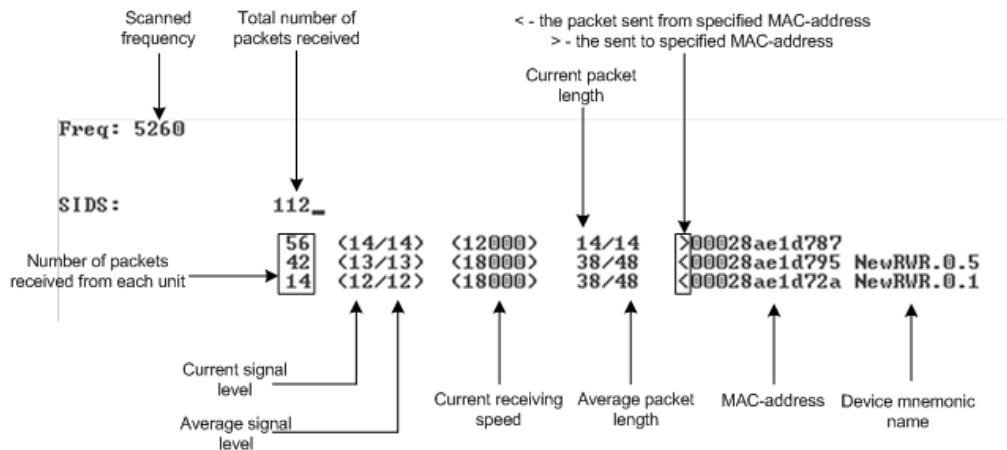
MAC2 mode

This regime performs MAC-addresses analysis to estimate the number of clients with different MAC addresses and the efficiency of their utilization of the air link. The analysis is carried out for all MAC addresses 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.



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

The picture below shows the output `mac2` regime.



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

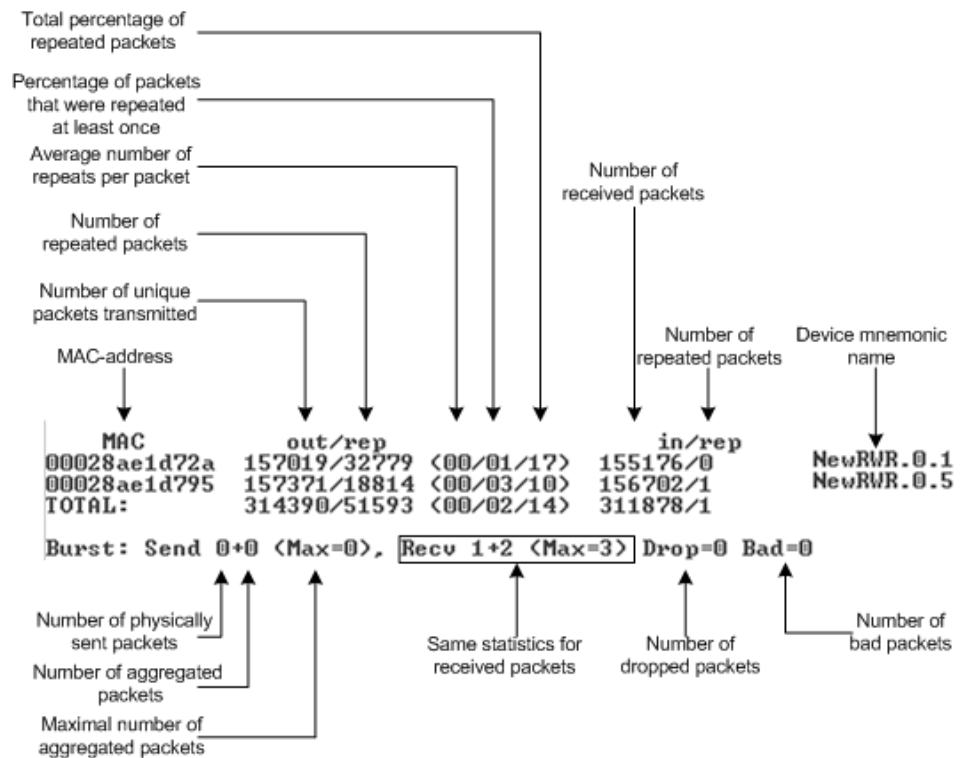
To run the `review` mode please type the following command:

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

Statistics

The statistics gathering is used for estimating link load intensity and per client. 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.



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
```

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
- **mynet** mode performs the radio testing without disturbing radio module's normal operation, but taking into account only packets from within the given network
- **sid** mode. The **sid** regime allows estimating the number of currently operating subscriber groups having different identifiers (SID), and the efficiency of air links utilization. The analysis is carried out for all network identifiers at the frequency previously specified for the radio module by **rfconfig** command.

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.

Load Meter						All results in Kbits per second					
CPU	Name	cur	avg	max	packets	cur	avg	max	packets	SUM	PACKETS
4	rf4.0	865	864	865	226	865	864	865	226	1730	452
4	rf4.0	876	870	876	226	876	870	876	226	1752	452
5	rf4.0	866	869	876	229	866	869	876	229	1732	458
4	rf4.0	865	868	876	226	865	868	876	226	1730	452
4	rf4.0	867	867	876	228	866	867	876	228	1733	456
4	rf4.0	865	867	876	225	865	867	876	225	1730	450
4	rf4.0	142	763	876	48	157	766	876	48	299	96

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

```
loadm -I <IF-NAME>
```

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.

Interface name	Maximum transfer unit size			Number of errors on receiving		Number of errors on transmitting	
Name	Mtu	Network	Address	Ipkts	Ierrs	Opkts	Oerrs
lo0	1500	Link:		46	0	46	0
lo0	1500	127.0.0.0/8	127.0.0.1	46	0	46	0
eth0	1500	Link:		80649	0	18390	0
eth0	1500	195.38.45.64/26	195.38.45.80	80649	0	18390	0
eth0	1500	192.168.3.0/24	192.168.3.2	80649	0	18390	0
eth0	1500	192.168.111.0/24	192.168.111.1	80649	0	18390	0
rf4.0	1500	Link:		323340	6194	328657	3073
rf4.0	1500	9.9.0.4/30	9.9.0.5	323340	6194	328657	3073
rf4.0	1500	9.9.0.0/30	9.9.0.1	323340	6194	328657	3073
null0	1500	Link:		0	0	0	0
tun0*	1500	Link:		398	0	359	0

↑ Network
↑ Address
↑ Number of received packets through interface
↑ Number of transmitted packets through interface



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.

InfiNet Wireless RapidView-1

InfiNet Wireless RapidView-1 – is a special diagnostic device that is used for InfiNet Wireless equipment comfort installation, antenna alignment and configuration.

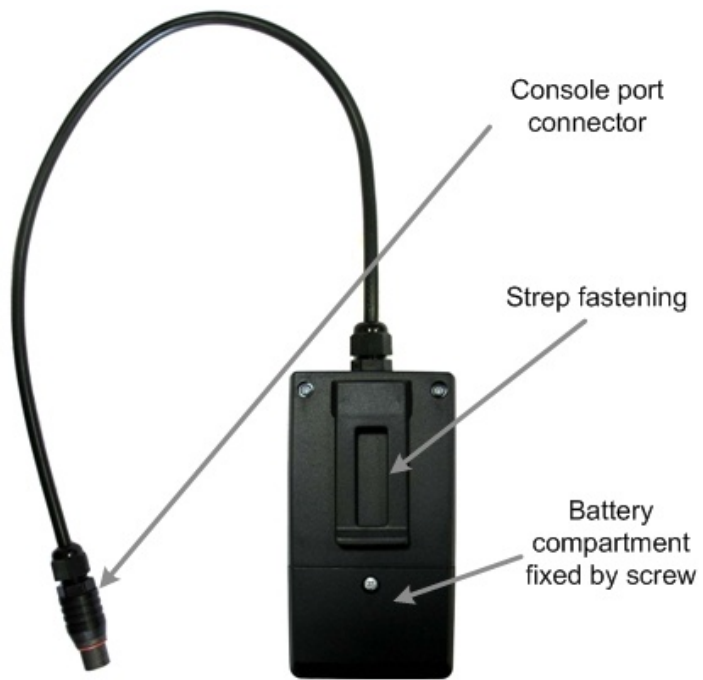
Device allows getting the following information:

- Radio link establishment indication
- Visual monitoring of radio signal levels
- Receiving retries information
- Diagnostic of RF and Ethernet interfaces

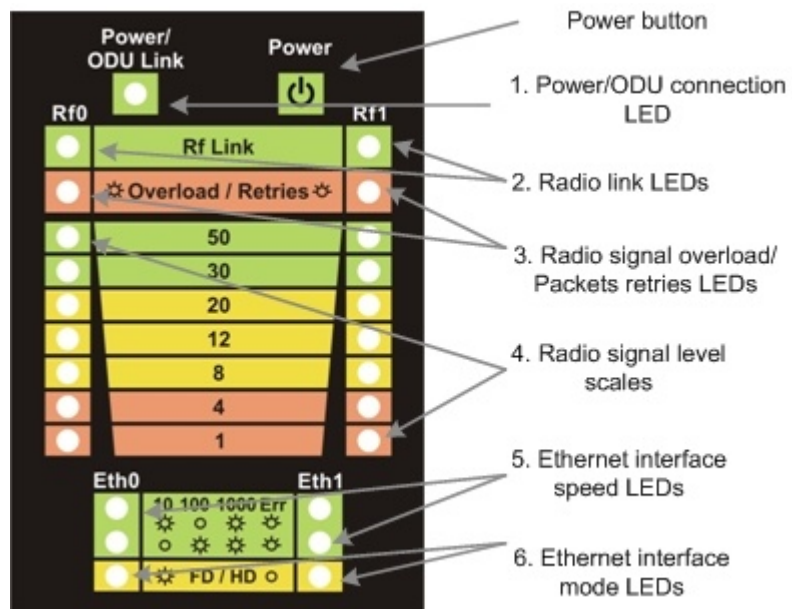
Top view:



Back view:



Indicator panel:



How to use:

Turning on:

1. For turning InfiNet Wireless RapidView-1 on simply push «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:

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, rf5.1. 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 \geq 50%

Blinking 2 times per second - number of retries \geq 28 %

Blinking 1 time per second - number of retries \geq 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.

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 data rate LEDs

Show data rate of the corresponding Ethernet interface.

There are 2 LEDs for each Ethernet interface (Eth0 and Eth1).

	10 Mbps	100 Mbps	1000 Mbps	Error
Upper LED	Lighting	Not lighting	Lighting	Blinking
Lower LED	Not lighting	Lighting	Lighting	Blinking

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.

V. Lost password recovery

The system password can be recovered remotely. The procedure is the following:

1. Locate your device's serial number (SN)
2. Send this SN to the InfiNet Wireless Technical Support
3. You will be given a special key
4. Enter the device and use SN as a login and received key as a password
5. Reconfigure the username and password

Lost password recovery using Emergency Repair Console:

Recovery procedure can be done with the help of "erp" command or graphical "ERConsole" utility.

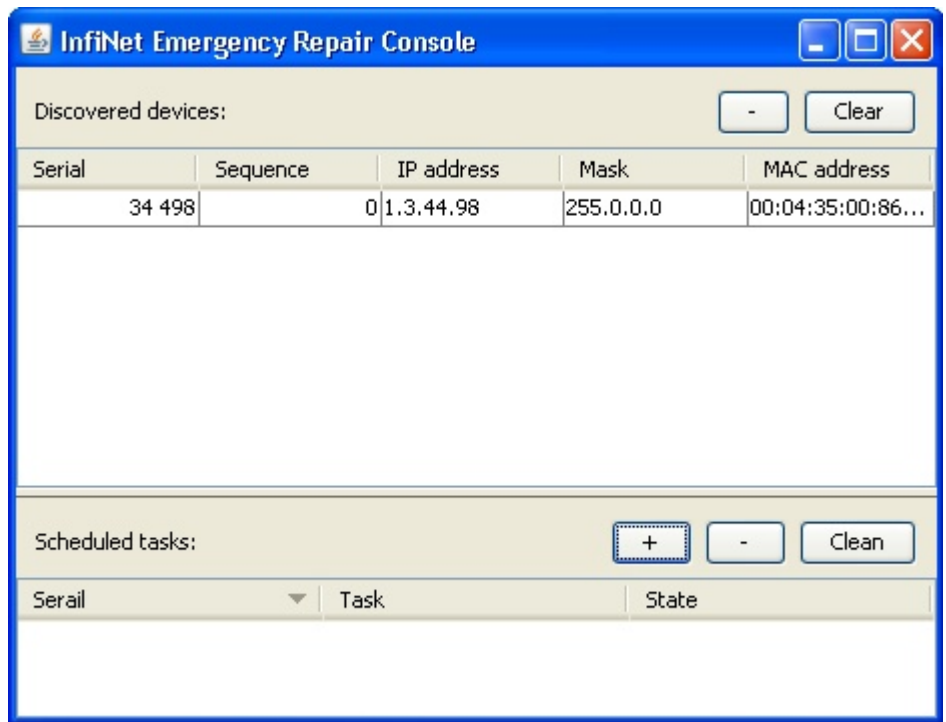
Below is a description of "ERConsole" utility recovery procedure ("erp" command recovery procedure is described in "OS WANFleX User Manual"):

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



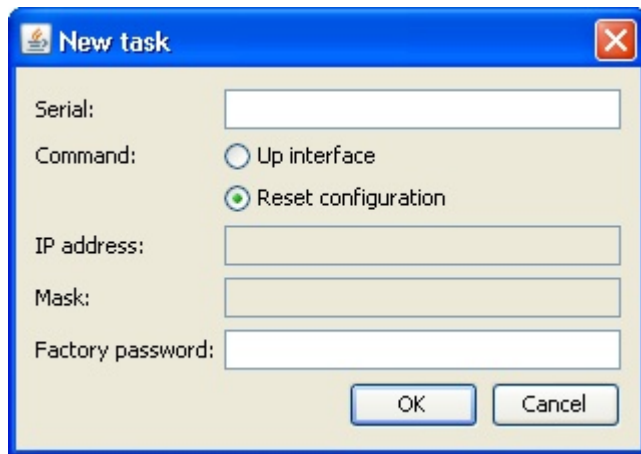
It is recommended to put a switch between the unit and the PC from which ERConsole is executed.

2. Start «ERConsole» utility on the computer by running "ERConsole.jar" file.
Utility will be running in a waiting mode.
3. Restart the device. During its restart «ERConsole» utility will determine the device and will show necessary information about it in the "Discovered devices" section of the main window.



«ERConsole» utility main window.

4. Send "Serial" and "Sequence" field values to the InfiNet Wireless Technical Support.
5. You will be given a factory password for the device.
6. Press «+» 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. Press «Ok».



«New task» window.

8. Restart the device.

After device restart “ERConsole” utility will reset device configuration to the default.

9. Now login the device with any non-zero length login and password.
10. Reconfigure device username and password.

The “ERConsole” utility’s “New task” window also allows setting the units’ IP-address on its Ethernet interface (eth0) without login to the unit. To perform this procedure please follow the below steps:

1. Firstly, do steps 1-3 as described above.
2. Press «+» 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 required IP-address and network mask in the corresponding fields of the window and press “Ok” button.
4. Restart the device.

After the restart the “ERConsole” utility will add the IP-address into its Ethernet interface configuration and will up the interface (in case it was configured “down”).

VI. Recommendations

1. Using InfiNet devices for High Bitrates

Using InfiNet devices on bitrates 48 and 54 Mbps (standard series), 104...130 Mbps (Xm-series, 20 MHz) and 240...300 Mbps (Xm-series, 40 MHz) has specific requirements because of low noise immunity of high-order modulation techniques (64 QAM).

One should take all possible precautions to prevent exceeding of parasite signals over receiver sensitivity threshold. The problem is aggravated by the presence of this parasite signal in entire spectrum.

Nevertheless, when using MINT architecture in most cases it is recommended to set the maximal bitrate on the radio interface and switch on autobitrate function. This will allow the system automatically and dynamically determine the most appropriate bitrate for the current environment conditions.

2. Design of Multi-sectored Base Stations

Using of multiple Base Station sectors with high output power with limited frequency and special gap between them increases noise level on the neighboring sectors. This can lead to the decrease of its performance. So we have ultimate choice: either optimizing base station for more bitrate/less range (without amplifiers) or optimize base station for more range/less bitrate (with amplifiers).

To deal with this problem most effectively it is recommended:

1. To increase number of sectors (commonly, up to 4-6)
2. Switch to the narrower bandwidth (5 or 10 MHz)
3. Use amplifiers and directional antennas at remote subscriber CPEs.

Remote subscribers can be configured for significantly lower than average bitrates providing more stable operating modes but those subscribers can decrease overall cell performance; so try to avoid mix solutions when the BS-CPE has a big difference for different subscribers.

4. Use Xm-series devices that have much higher performance, NLOS and robust characteristics than standard-series ones.

3. Asymmetrical System Design

Following conclusions regarding using base station can be made:

- Downstream bitrate (base to CPE) is usually higher than upstream;
- Beam width of base station sectored antenna is 10 times wider than beam width of subscriber antenna;
- Trying to deploy base stations on area heights leads to raising overall noise level and reducing noise immunity;
- Subscriber SNR measured at a base station is significantly worse than that of subscriber side.
- Increasing transmit bitrate does not influence the overall working conditions and network performance;
- Increasing receive bitrate does worsen noise immunity and network performance.

Every step in bitrate increasing requires 3 dB step improvements SNR. Asymmetry in 8 times corresponds to 9 dB. It means that without link quality losses we can have 2 times bitrate difference between upstream and downstream. In order to maintain energetic parameters, we have to increase base station output power by 9 dB by means of built-in amplifier (for example to use 300-500mW devices).

4. «Bad subscriber» problem

While working in Point-to-Multipoint topology wireless network could face a problem when one of the subscriber devices has much poorer connection characteristics to Base Station than the other ones. Such subscriber device is using a considerable part of Base Station's resources. While Base Station is trying to send him a packet on a low bitrate other subscribers are waiting for this transaction to finish. Therefore, all the networks' performance will be reduced.

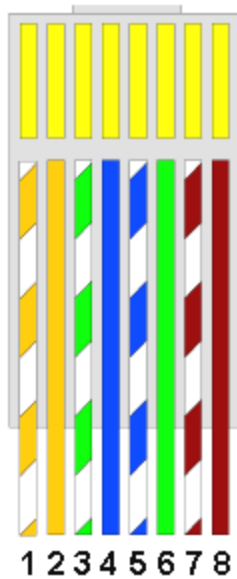
To lower the influence of such "bad subscriber" on the overall wireless network's performance it is recommended to decrease a priority of this subscriber (using "qm" command). In this case all the packets to "bad subscriber" will be sent after other subscriber stations already get their portions of data. This will result in wireless network performance optimization as subscriber devices' operation won't depend on the bitrate of "bad subscriber".

VII. Supplementary information

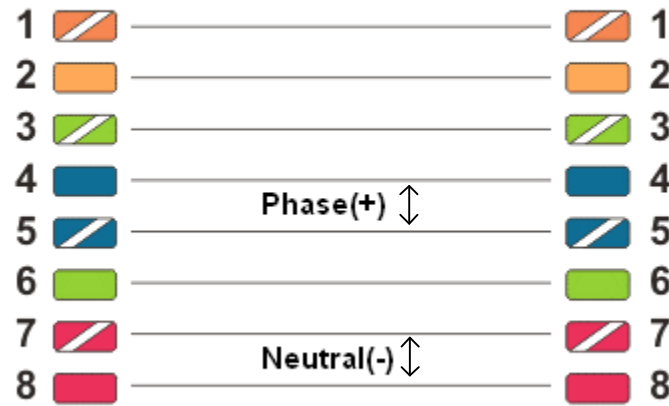
1. Connectors crimping schemes

“RJ-45” service cable connector crimping scheme

RJ-45 Male Ethernet connector



Male connector to ODU



Male connector to IDU

- 1: White-orange**
- 2: Orange**
- 3: White-green**
- 4: Blue**
- 5: White-blue**
- 6: Green**
- 7: White-brown**
- 8: Brown**

Console cable connector soldering scheme

