InfiLINK XG

Technical User Manual

Software Version: v1.5.36

Last updated: 4/11/2016

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Statement of Conditions

InfiNet Wireless Ltd. shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance or use of this manual or equipment supplied with it.

Statement on the safe use

This InfiLINK XG equipment complies with RF exposure limits set forth for an uncontrolled environment, when installed as directed. This equipment should be installed and operated with fix-mounted antenna that are installed with a minimum of 0.5 meters of separation distance between the antenna and all persons' body during normal operation.

FCC and IC Statement

Federal Communication Commission Interference Statement (English)

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules.

These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This device complies with Part 15 of the FCC Rules.

Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and

2. This device must accept any interference received, including interference that may cause undesired operation

FCC et IC Déclaration

Federal Communication Commission Interference Statement

(Français)

Cet équipement a été testé et jugé conforme aux limites d'un dispositif numérique de classe B, conformément à la partie 15 des règles de la FCC.

Ces limites sont conçues pour fournir une protection raisonnable contre les interférences nuisibles dans une installation résidentielle.

Cet équipement génère, utilise et peut émettre de l'énergie radiofréquence et, si non installé et utilisé conformément aux instructions, peut provoquer des interférences dans les communications radio.

Cependant, il n'y a aucune garantie que des interférences ne se produiront pas dans une installation particulière. Si cet équipement provoque des interférences nuisibles à la réception radio ou de télévision, ce qui peut être déterminé en allumant et éteignant l'équipement, l'utilisateur est encouragé à essayer de corriger les interférences par une des mesures suivantes:

• Réorienter ou déplacer l'antenne de réception.

• Augmenter la séparation entre l'équipement et le récepteur.

• Branchez l'appareil dans une prise sur un circuit différent de celui sur lequel est branché le récepteur.

• Consulter le revendeur ou un technicien radio / TV expérimenté.

Avertissement de la FCC: Les changements ou modifications non expressément approuvés par la partie responsable de la conformité pourraient annuler l'autorité de l'utilisateur à utiliser cet équipement.

Cet appareil est conforme à la partie 15 des règles de la FCC.

Son fonctionnement est soumis aux deux conditions suivantes:

1. Ce dispositif ne peut causer des interférences nuisibles, et

2. Cet appareil doit accepter toute interférence reçue, y compris les interférences qui peuvent provoquer un fonctionnement indésirable.

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Indication of the countries

InfiNet Wireless equipment has no geographical limitations for selling and can be supplied to any country of the world.

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About This Manual

This manual provides detailed technical information on the operation of the InfiLINK XG, including system specifications, installation, commissioning, maintenance and troubleshooting.

The document is intended to be used by qualified RF engineers/technicians and IT professionals. Qualified personnel should have skills and experience in the following areas:

- Outdoor/indoor radio equipment installation
- Outdoor wireless networks
- TCP/IP networking protocols
- Safety procedures and instructions for installing antenna equipment
- Professional manage of electrical equipment and accessories
- Safety procedures and instructions for working on towers and heights

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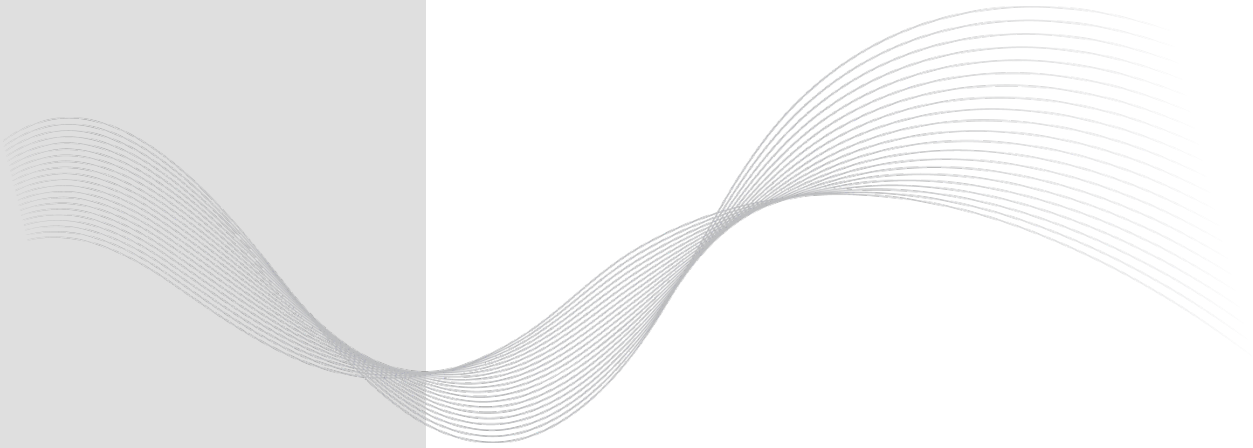
Getting started

Chapter 1



1.1. Document structure

This document consists of the following chapters:

- “Getting started” - This chapter presents the information about this document’s purpose and structure
- “System Description” - This chapter describes the hardware, accessories and technical specifications of the InfiLINK XG unit
- “Installation” - This chapter describes the steps to be taken when installing the equipment at the installation sites and installation site requirements
- “Commissioning” - This chapter presents the actions and operations required for the initial setup of an operational point-to-point link using InfiLINK XG units
- “Operation & Administration” - This chapter presents the functionalities of the web interface, a simple and efficient way to monitor the device status, configure and maintain the equipment
- “Troubleshooting” - This chapter presents the actions to be followed when investigating an occured problem

1.2. Abbreviations

The following abbreviations are used in this document:

- AC - Alternating Current
- AMC - Automatic Modulation Control
- BOM - Bill of Materials
- BS - Base Station
- CPE - Customer Premises Equipment
- DC - Direct Current
- DHCP – Dynamic Host Configuration Protocol
- ETH - Ethernet
- FDD - Frequency Division Duplexing
- GUI – Graphical User Interface
- HTTP - Hyper Text Transfer Protocol
- IDU - Indoor Unit
- IGMP - Internet Group Multicast Protocol
- LAN - Local Area Network

- LED - Light Emitting Diode
- LOS - Line of Sight
- LPU - Lightning Protection Unit
- MIB – Management Information Base
- MIMO - Multiple Input Multiple Output
- NLOS - Non-Line of Sight
- ODU - Outdoor Unit
- PoE - Power over Ethernet
- PCP - Priority Code Point
- PtMP - Point to Multi Point
- PtP - Point to Point
- QoS – Quality of Service
- RF - Radio Frequency
- SFP - Small Form-factor Pluggable
- SNMP - Simple Network Management Protocol
- STP - Shielded Twisted Pair
- TDD - Time Division Duplexing
- VLAN - Virtual Local Area Network
- WRR - Weighted Round Robin

1.3. Document marks

CAUTION

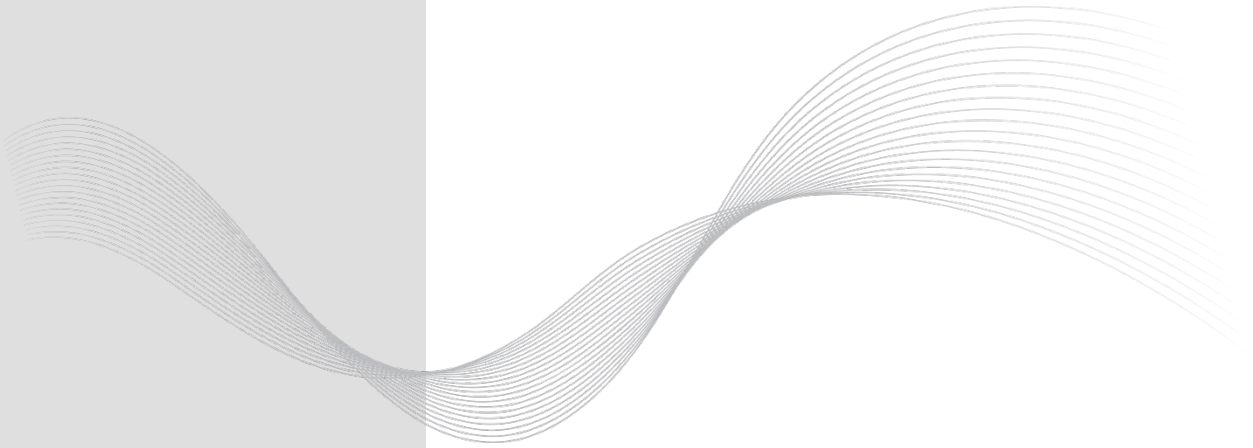
All caution warnings are marked with a special warning sign. One should pay a great deal of attention to what is written in the Caution section.

NOTE

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

System Description

Chapter 2



2.1. Introducing InfiLINK XG

InfiLINK XG is a proprietary system designed to meet the highest performance standards at sub-7 GHz frequency bands (from 4.9 to 6.4 GHz). It is a high capacity Point-to-Point solution, reaching a peak of 480 Mbps of net throughput in 40 MHz of spectrum and more than 100 Mbps in only 10 MHz. It has superior spectral efficiency of up to 13 bps/Hz and it supports high order modulations, such as QAM256 and QAM1024.

InfiLINK XG has full support for internal synchronization either via built-in GLONASS/GPS receiver or via IEEE1588 PTP, making it ideal for applications with tight synchronization constraints like small cell backhauling. Additionaly, a very low constant latency of 0.5 ms is supported for 1 ms air frame period and up to 3 ms for longer air frame period.

NOTE

Product technical specifications can be obtained from our web site at: http://infinetwireless.com/products/infilink-xg

Available with a wide range of integrated antennas, as well as a connectorized version for use with 3rd party external antennas and coupled with improved transmit power and sensitivity, the XG family fits perfectly into a large array of applications such as backhaul in the telecom, ISP or enterprise markets, education, oil and gas, smart cities, video surveillance and public safety.

2.2. Hardware Description

The InfiLINK XG device comprises an Outdoor Unit (ODU) and an Indoor Unit to be used with:

a) an external antenna providing connected to two N-type ports using low-loss RF cables, or
b) an integrated antenna (regular or high-gain integrated antenna options available)

and an Indoor Unit (IDU) to build a high-capacity MIMO point-to-point wireless link over long distances.

Implemented in a robust all-weather metal enclosure and being IP66/67 compliant, InfiLINK XG equipment can be used to create point-to-point wireless links at distances in excess of 100 Km (depending on country regulations, antenna types, interference, terrain, climate zones, etc.).

2.2.1. Outdoor Units

2.2.1.1. Integrated Antenna ODU Models

Part Number	Frequency Band	Integrated Antenna	Mechanics
Xm/5X.500.2x500.2x23	4900-6000 MHz	Flat-panel, 23 dBi, 10°x10°	
Xm/6X.500.2x500.2x24	6000-6425 MHz	Flat-panel, 24 dBi, 8.5°x8.5°	

Table 1 - InfiLINK XG ODU Models with an Integrated Antenna

Part Number	Frequency Band	Integrated Antenna	Mechanics
Xm/5X.500.2x500.2x28	4900-6000 MHz	Flat-panel, 28 dBi, 5°x5°	
Xm/6X.500.2x500.2x27	6000-6425 MHz	Flat-panel, 27 dBi, 5°x5°	

Table 2 - InfiLINK XG ODU Models with a high-gain Integrated Antenna

2.2.2. Power Supply Units (IDU)

2.2.2.1. IDU-BS-G

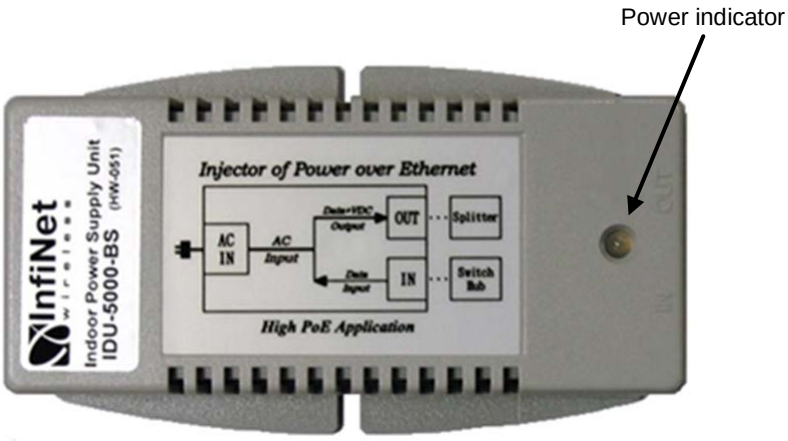


Figure 1 - IDU-BS-G Top View

Indoor Gigabit PoE Injector with lightning protection for InfiLINK XG, InfiLINK 2x2 and InfiMAN 2x2 series ODU.

Parameter	Description
Size	125*72*38 mm (L*W*H)
Connectors and Interfaces	ETH IN - Ethernet input (Data only) ETH OUT - Ethernet output (Data+VDC), PASSIVE PoE PWR - AC Input (100-240 V)
Supported Ethernet Modes	10/100/1000Mbps (Gigabit Ethernet pass-through)
Output Voltage & Current	+56 V, 0.9 A (50.4W Max)

<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>Ethernet Connectors Pin-out</td><td>ETH IN:
<table>
<tr><td>Pin</td><td>Description</td></tr>
<tr><td>1</td><td>Data pair A+</td></tr>
<tr><td>2</td><td>Data pair A-</td></tr>
<tr><td>3</td><td>Data pair B+</td></tr>
<tr><td>4</td><td>Data pair C+</td></tr>
<tr><td>5</td><td>Data pair C-</td></tr>
<tr><td>6</td><td>Data pair B-</td></tr>
<tr><td>7</td><td>Data pair D+</td></tr>
<tr><td>8</td><td>Data pair D-</td></tr>
</table>
ETH OUT:
<table>
<tr><td>Pin</td><td>Description</td></tr>
<tr><td>1</td><td>Data pair A+</td></tr>
<tr><td>2</td><td>Data pair A-</td></tr>
<tr><td>3</td><td>Data pair B+</td></tr>
<tr><td>4</td><td>+VDC + Data pair C+</td></tr>
<tr><td>5</td><td>+VDC + Data pair C-</td></tr>
<tr><td>6</td><td>Data pair B-</td></tr>
<tr><td>7</td><td>-VDC + Data pair D+</td></tr>
<tr><td>8</td><td>-VDC + Data pair D-</td></tr>
</table></td></tr>
<tr><td>EMC</td><td>Meet:
- FCC Class B
- EN55022 Class B</td></tr>
<tr><td>Lightning Protection</td><td>In compliance with:
- IEC 61000-4-2 (ESD) 15kV (air), 8kV (contact)
- IEC 61000-4-4 (EFT) 40A (tp = 5/50ns)
- IEC 61000-4-5 (Lightning) L5, 95A (tp = 8/20us)</td></tr>
</table>

Table 3 - IDU-BS-G Specifications

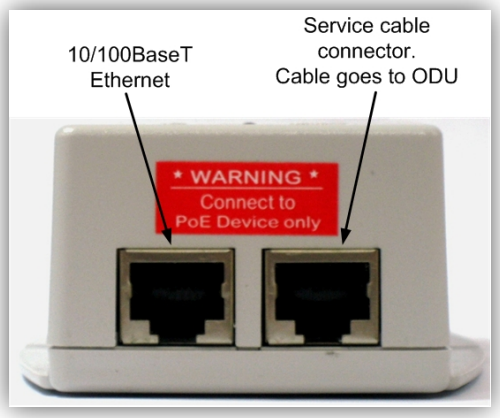


Figure 2 - IDU-BS-G Front Panel

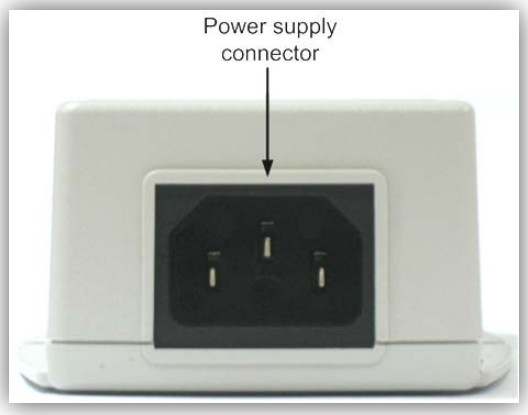


Figure 3 - IDU-BS-G Rear Panel

2.2.3. Auxiliary Units

2.2.3.1. DC Power Injector (AUX-ODU-INJ-G)

Figure 4 - AUX-ODU-INJ-G

Optional indoor/outdoor DC injector with built-in lightning protection. It greatly reduces complexity of the deployment in the cases where DC source is available on the rooftop eliminating the need of weather-sealed cabinets.

Parameter	Description
Size and Weight	34x94x121 mm, 0.28 Kg
Connectors and Interfaces	ETH IN - Ethernet input

<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td></td><td>ETH OUT - Ethernet output (data+VDC, protected leg)
PWR - DC Input
GND - Ground clamp</td></tr>
<tr><td>Supported Ethernet Modes</td><td>10/100/1000 Mbps (Gigabit Ethernet pass-through)</td></tr>
<tr><td>Water and Dust Protection</td><td>IP66 and IP67</td></tr>
<tr><td>DC Range</td><td>±43...±56 VDC</td></tr>
<tr><td>Ethernet Connectors Pin-out</td><td>ETH IN:
<table>
<tr><th>Pin</th><th>Description</th></tr>
<tr><td>1</td><td>Data pair A+</td></tr>
<tr><td>2</td><td>Data pair A-</td></tr>
<tr><td>3</td><td>Data pair B+</td></tr>
<tr><td>4</td><td>Data pair B-</td></tr>
<tr><td>5</td><td>Data pair C+</td></tr>
<tr><td>6</td><td>Data pair C-</td></tr>
<tr><td>7</td><td>Data pair D+</td></tr>
<tr><td>8</td><td>Data pair D-</td></tr>
</table>
ETH OUT:
<table>
<tr><th>Pin</th><th>Description</th></tr>
<tr><td>1</td><td>Data pair A+</td></tr>
<tr><td>2</td><td>Data pair A-</td></tr>
<tr><td>3</td><td>Data pair B+</td></tr>
<tr><td>4</td><td>+VDC + Data pair B-</td></tr>
<tr><td>5</td><td>+VDC + Data pair C+</td></tr>
<tr><td>6</td><td>Data pair C-</td></tr>
<tr><td>7</td><td>-VDC + Data pair D+</td></tr>
<tr><td>8</td><td>-VDC + Data pair D-</td></tr>
</table></td></tr>
<tr><td>Lightning Protection</td><td>In compliance with:
- GR-1089
- IEC 61000-4-2 (ESD) 15kV (air), 8kV (contact)
- IEC 61000-4-4 (EFT) 40A (tp = 5/50ns)
- IEC 61000-4-5 (Lightning) L5, 95A (tp = 8/20us)
- ETSI ETS 300 386</td></tr>
</table>

Table 4 - AUX-ODU-INJ-G Specifications

2.2.3.2. External Lightning Protection (AUX-ODU-LPU-G)

Figure 5 - AUX-ODU-LPU-G Front Panel

Optional indoor/outdoor Lightning Protection Unit (LPU) for InfiNet Wireless systems designed to withstand the toughest conditions and protect the outdoor or the indoor unit from sudden power surges induced by lightning strikes. It provides the same level of protection as AUX-ODU-INJ-G.

Despite the fact every InfiNet Wireless unit has a built-in lightning protection, AUX-ODU-LPU-G, thanks to its superior GR-1089-grade protection, greatly reduces the risk of replacing damaged devices operating in harsh environments or difficult-to-reach locations.

Parameter	Description
Size and Weight	34x94x121 mm, 0.28 Kg
Connectors and Interfaces	ETH IN - Ethernet input ETH OUT - Ethernet output (protected leg) GND - ground clamp
Supported Ethernet Modes	10/100/1000 Mbps (Gigabit Ethernet pass-through)
Water and Dust Protection	IP66 and IP67

<table>
<tr>
<td>Ethernet Connectors Pin-out</td>
<td>ETH IN:
<table>
<tr><th>Pin</th><th>Description</th></tr>
<tr><td>1</td><td>Data pair A+</td></tr>
<tr><td>2</td><td>Data pair A-</td></tr>
<tr><td>3</td><td>Data pair B+</td></tr>
<tr><td>4</td><td>Data pair B-</td></tr>
<tr><td>5</td><td>Data pair C+</td></tr>
<tr><td>6</td><td>Data pair C-</td></tr>
<tr><td>7</td><td>Data pair D+</td></tr>
<tr><td>8</td><td>Data pair D-</td></tr>
</table>
ETH OUT:
<table>
<tr><th>Pin</th><th>Description</th></tr>
<tr><td>1</td><td>Data pair A+</td></tr>
<tr><td>2</td><td>Data pair A-</td></tr>
<tr><td>3</td><td>Data pair B+</td></tr>
<tr><td>4</td><td>Data pair B-</td></tr>
<tr><td>5</td><td>Data pair C+</td></tr>
<tr><td>6</td><td>Data pair C-</td></tr>
<tr><td>7</td><td>Data pair D+</td></tr>
<tr><td>8</td><td>Data pair D-</td></tr>
</table>
</td>
</tr>
<tr>
<td>Lightning Protection</td>
<td>In compliance with:
- GR-1089
- IEC 61000-4-2 (ESD) 15kV (air), 8kV (contact)
- IEC 61000-4-4 (EFT) 40A (tp = 5/50ns)
- IEC 61000-4-5 (Lightning) L5, 95A (tp = 8/20us)
- ETSI ETS 300 386</td>
</tr>
</table>

Table 5 - AUX-ODU-LPU-G Specifications

2.2.4.1. Electrical

Parameter	Description			
Frequency Range	4.9-5.15 GHz	5.15-5.9 GHz	5.9-6.1 GHz	5.7-6.5 GHz
Gain	32 dBi	34 dBi	34 dBi	35 dBi
VSWR, max.	2 : 1	1.7 : 1	2 : 1	1.7 : 1

3 dB Beam-Width, H-Plane	3°	3°	3°	2.5°
3 dB Beam-Width, E-Plane	3°	3°	3°	2.5°
Polarization	Dual Polarized, Vertical & Horizontal			
Cross Polarization, min.	-20 dB			-25 dB
Front to Back Ratio, min.	-40 dB			
Input power, max	100 Watt			
Input Impedance	50 Ohm			
Port to Port Isolation, min.	-36 dB @ 4.9-5.6 GHz -20 dB @ 5.6-6.1 GHz			-35 dB
Side Lobes, typ.	-18 dB			-17 dB

Table 6 - External High-gain Antennas Electrical Specification

2.2.4.2. Mechanical

Parameter	Description
Weight	18 Kg
Connector	2 x N-Type, Female
Diameter (HxDia.)	1200 mm (4ft)

Table 7 - External High-gain Antennas Mechanical Specification

2.2.4.3. Environmental

Parameter	Description
Operating Temperature Range	-40°C to +65°C
Vibration	According to IEC 60721-3-4
Wind Load	200 Km/h (survival)
Flammability	UL94
Dust and Water Proofing	IP-65
Humidity	ETS 300 019-1-4, EN 302 085 (annex A.1.1)
Salt Fog	According to IEC 68-2-11
Ice and Snow	25 mm radial (survival)

Table 8 - External High-gain Antennas Environmental Specification

2.3. InfiLINK XG Specifications

2.3.1. Performance

Parameter	Description
Throughput	Up to 480 Mbps, net aggregate
Packet Performance	More than 1 million packets per second (line rate)
Latency	0.5-3 ms one-way, typical (depending on air frame period)

Table 9 - Data Performance Specification

2.3.2. Radio

Parameter	Description
Modulation	Cyclic Single Carrier
Modulation Schemes	■ QPSK 1/2 ■ QPSK 3/4

	■ QAM16 1/2 ■ QAM16 3/4 ■ QAM64 4/6 ■ QAM64 5/6 ■ QAM256 6/8 ■ QAM256 7/8 ■ QAM256 30/32 ■ QAM1024 8/10
Frequency Bands	■ 4.9-6.0GHz ■ 6.0-6.425GHz
Channel Widths	10, 20 and 40 MHz
Spectral Efficiency	Up to 13 bps/Hz
Output Power	■ Up to 27 dBm (average, per Tx chain) @ QPSK to QAM64 ■ Up to 25 dBm @ QAM256, Up to 18 dBm @ QAM1024
Receiver Sensitivity	-94 dBm @ 10 MHz, QPSK
System Gain	Up to 177 dB (based on a 28 dBi integrated antenna in 10 MHz channel width)
Duplex Scheme	TDD, Hybrid-FDD
Antenna	■ Integrated: dual-polarization flat panel 23, 24, 26, 27 and 28 dBi (selectable at time of ordering and model-dependent) ■ Connectorized: 2 x N-type (Female) connectors for external dual-polarization antenna
Maximal Range	In excess of 100 Km in clear line-of-sight conditions, with use of high gain external antennas

Table 10 - Radio Technology Specification

Parameter	Description
Airframe	Configurable, 1 to 10 ms
Uplink/Downlink Ratio	Configurable, from 50:50 to 90:10 in any direction

Parameter	Description
Automatic Modulation Control	Supported
Automatic Ranging	Supported
TDD Synchronization	Via built-in GLONASS/GPS receiver or IEEE1588 PTP

Table 11 - Air Protocol Specification

2.3.3. Data Communication

Parameter	Description
Ethernet	■ 2x 10/100/1000-BaseT copper ports, RJ-45: - GE0: Data+PoE input - GE1: Data only ■ SFP port: various 3rd party single and multi-mode fiber modules are supported ■ Either of the ports can be configured independently for management, user data or for a hybrid mode
PoE	■ 802.3at or InfiNet-proprietary “passive” PoE
Cable Length	■ Copper Ethernet cable length: up to 100 m between outdoor unit and the primary network connection ■ Fiber cable length: up to 300 m or more depending on the SFP module type

Table 12 - Wired Interfaces Specification

Parameter	Description
QoS	4 queues
Prioritization	Strict and WRR modes
Packet Classification	802.1 p
Network Protocols	VLAN, STP, IGMP

Timing Transport	IEEE 1588 v2, transparent clock

Table 13 - Networking Specification

2.3.4. Configuration Management

Parameter	Description
LED Indication	Power status, wireless and wired link status, RSSI indication, TDD sync status
Management Protocols	HTTP, telnet, SNMP v1/2c/3 (MIB-II and proprietary MIBs)
Installation Tools	Antenna alignment tool

Table 14 - Management Specification

2.3.5. Electrical Characteristics

Parameter	Description
Power Supply	IDU-BS-G: 100-240 VAC, 50/60Hz, 0°C to +40°C, I24x72x38 mm, 0.3 Kg
Input DC range	±43 to ±56 VDC
Consumption	Up to a maximum of 30 W
PoE type	Passive PoE

Table 15 - Electrical Specification

2.3.6. Physical Environmental

Parameter	Description		
	Part Number	**Weight**	**Size**
Weight and Dimensions	Xm/5X.500.2x500.2x23	2.4 Kg	305x305x59 mm
	Xm/6X.500.2x500.2x24		
	Xm/5X.500.2x500.2x26	3.1 Kg	371x371x83 mm
	Xm/5X.500.2x500.2x28	6.2 Kg	600x600x75 mm
	Xm/6X.500.2x500.2x27		
	Um/5X.500.2x500	2.1 Kg	253x240x85 mm
	Um/6X.500.2x500		

Parameter	Description
Operating Temperature Range	-40°C to +60°C
Dust and Water Protection	IP66 and IP67
Wind load	■ 160 Km/h (100mph), operational ■ 200 Km/h (125mph), survival

Table 16 - Physical and Environmental Specification

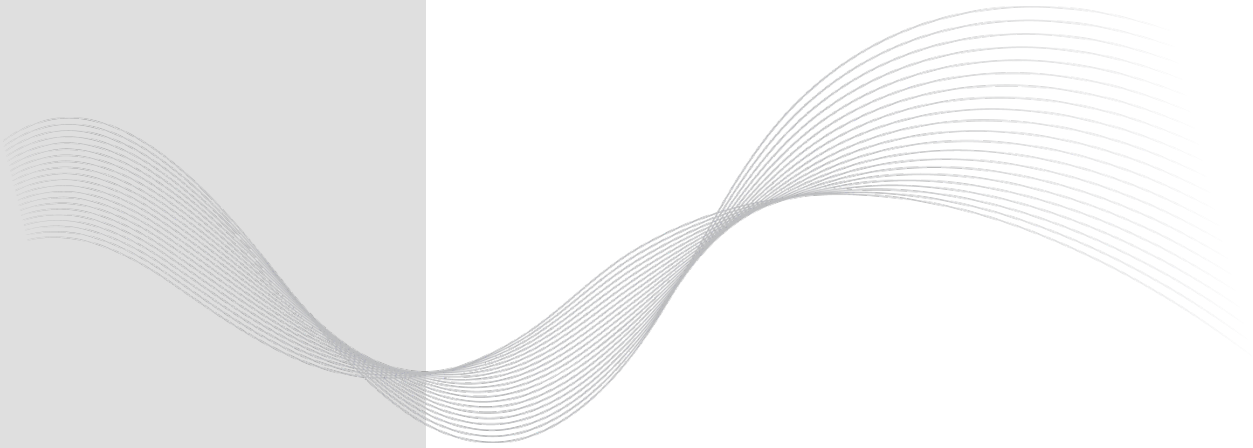
2.3.7. Standards and Regulations

Parameter	Description
Safety	EN 60950-1:2006, UL 60950-1 2nd ed.
Radio	EN 301 893, v.1.8.1 EN 302 502, v.1.2.1 FCC part 15.247
EMC	ETSI EN 301 489-1 ETSI EN 301 489-17 FCC Part 15 Class B
RoHS	Directive 2002/95/EC

Table 17 - Compliance Specification

Installation

Chapter 3



3.1. Installation Requirements

This section describes all the supplies required to install the InfiLINK XG system components and the items included in each installation package.

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

3.1.1. Packing list

Component	Description
	■ **InfiLINK XG unit (ODU)** - Integrated antenna model or connectorized model according to the Purchase Order
	■ **Mounting kit** - Universal assembling kit for mounting the ODU on standard pole, wall or thick pipe (vertical/horizontal)
	■ **Indoor power supply (IDU)** - The model depends on the ODU model
	■ **Power supply cord** - The model depends on the region, according to the Purchase Order

Table 18 - Package list

3.1.2. Additional Items Required

3.1.2.1. Parts and Materials

- External antenna (only for the connectorized ODU models)
- Low-loss RF cables - CAB-RF-1M cable is recommended (only for the connectorized ODU models)
- Antenna pole (if necessary)
- Required grounding circuit, including cables and rods (if these are not already in place at the installation site)

3.1.2.2. Tools

- Screwdrivers set
- Pliers/Wrenches
- Spanners set
- Compass with bearing/azimuth reading

3.1.3. Optional Accessories

- AUX-ODU-INJ-G DC injector with lightning protection
- AUX-ODU-LPU-G line protection unit

NOTE

Accessories are available from InfiNet Wireless.

3.1.4. Precautionary Measures

CAUTION

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 damage 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, during their assembling, disassembling and repairing, they do not have any contact with power lines.

Basic precautionary measures that must be fulfilled during the installation are as follows:

- Do not stay on the roof top in windy or rainy weather, during thunderstorms or when the working zone is covered with snow or ice.
- Do not touch the antennas, antenna poles, cables and lighting arrestors during thunderstorms
- Antenna cable must be grounded at all times.

In case of failure, any manipulation of the equipment is allowed to trained personnel only.

3.2. Equipment Positioning Guidelines

3.2.1. Antenna Placement

When selecting an antenna placement for PTP link, in order to obtain the maximum link range and performance, LOS must be clear for the path between the two antennas.

The radio beam is an invisible form of electromagnetic wave propagation and is not as thin as, for example, a light (or laser) beam. The main energy in a radio beam is concentrated along the straight line between the two antennas, inside an area the shape of an ellipsoid (or a rugby ball). This area is called a 1st Fresnel zone and its exact form and size depends upon the frequency and the signal propagation path length.

If most of the 1st Fresnel zone is obstructed, a major part of the radio wave's electromagnetic energy is lost, which leads to a severe signal quality degradation and, as a result, to decreased coverage range or performance.

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 the signal propagation path and possible obstructions that may cover the 1st Fresnel zone.

NOTE

For radio planning and path profile analysis, both the terrain model and clutter layer of the area are required. These are typically provided by professional mapping vendors. For details, please contact InfiNet Wireless.

Here are some general recommendations for antenna placement:

- Try to keep the LOS clear of obstructions. In case of installations over vegetation and forest, make sure the direct LOS stays above the trees; in urban environments - above the tallest buildings along the radio path;
- The influence of trees can be variable, depending on seasons (ice, dew, leaves). Keep in mind that, during spring and summer, leaves can absorb high levels of radio energy. Therefore, when installing during the cold season, over forests and trees without leaves, try to achieve a higher fade margin;
- Proximity to other antennas should be avoided;
- Reflecting surfaces should be considered (buildings with reflective windows, water surfaces or wet grounds). These can be useful in NLOS situations, where there is no direct clear path between the 2 antennas, so the radio signal needs to be reflected off a surface. However, these can also decrease the signal quality when encountered along a clear LOS link, because of fading caused by multipath;
- When installing antennas over water, tune the height bracket within 1-3 meters range variation, because it can yield significant signal level variations due to multipath fading;
- If seasonal changes influence the signal quality, then the most probable reasons would be either that the connectors are not protected well enough from humidity, or that the cables, connectors or antennas are covered by vegetation during summer or ice during winter.

3.2.2. Mounting Types

3.2.2.1. Pole Mounting

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.

Figure 6 - Pole mounting

3.2.2.2. Poles with Stretching

Usually this kind of poles are used when installing antennas on a flat surface and allow the installer to raise the antenna to a significant height for providing optimal conditions for signal propagation.

3.2.2.3. Wall Mounting

This kind of mounting is used when there is no need to elevate the antenna above the rooftop and there is the possibility of mounting it on a wall. This installation is significantly simpler than the implementation with poles.

3.2.2.4. Pole Requirements

Easy access and sufficient mechanical durability of the pole should provide quick and reliable fastening in conditions of high wind loads. Poles should have a round profile for ease of azimuth adjustment. Typical pole diameter is 30 to 85 mm.

3.3. Installing the Outdoor Units

3.3.1. Preparing the RJ-45 Connectors

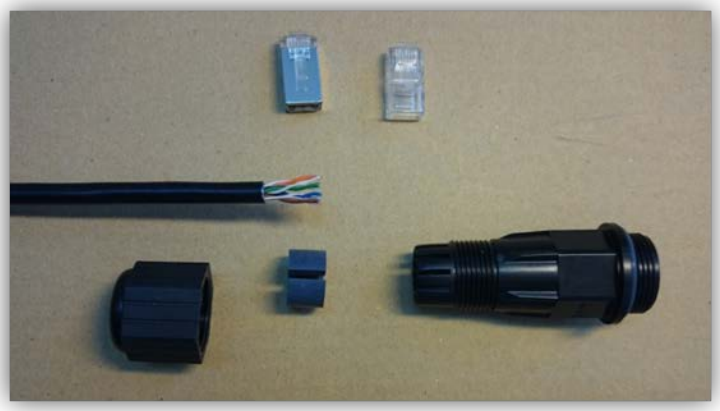


Figure 7 - Ethernet Connector Components

Required components:

1. Cable;
2. Shielded RJ-45 connector;
3. Standard RJ-45 connector;
4. Cable gland nut;
5. Split sealing grommet;
6. Cable gland threaded coupling.

Pin-out scheme: T568B wiring standards

Figure 8 - RJ-45 Connection Step 1

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.

Put the cable gland nut (4), the split sealing grommet (5) and the cable gland threaded coupling (6) onto the pre-terminated cable and insert the split sealing grommet (5) into the cable gland threaded coupling (6).

Figure 9 - RJ-45 Connection Step 2

- Insert the connector into the socket until you hear a click;
- Screw the cable gland threaded coupling (6) into the port and tighten it;
- Tighten the cable gland nut (4);
- Do not apply excessive force.

3.3.2. Preparing the SFP Connectors

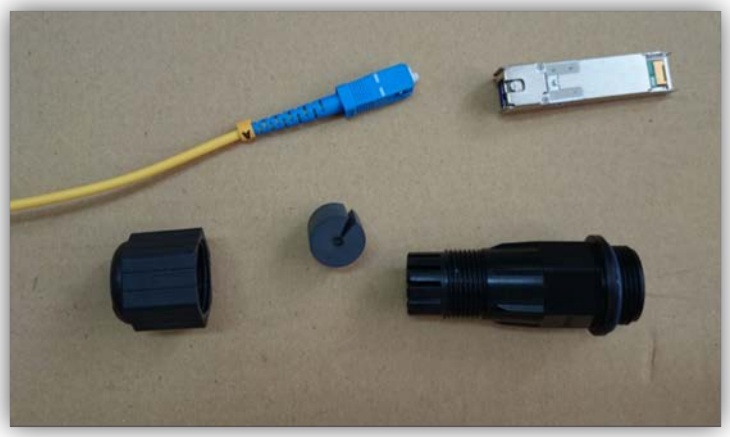


Figure 10 - SFP Connector Components

Required components:

1. Optical cable;
2. Optical connector;
3. SFP-module;
4. Cable gland nut;
5. Split sealing grommet for optical cable;
6. Cable gland threaded coupling.

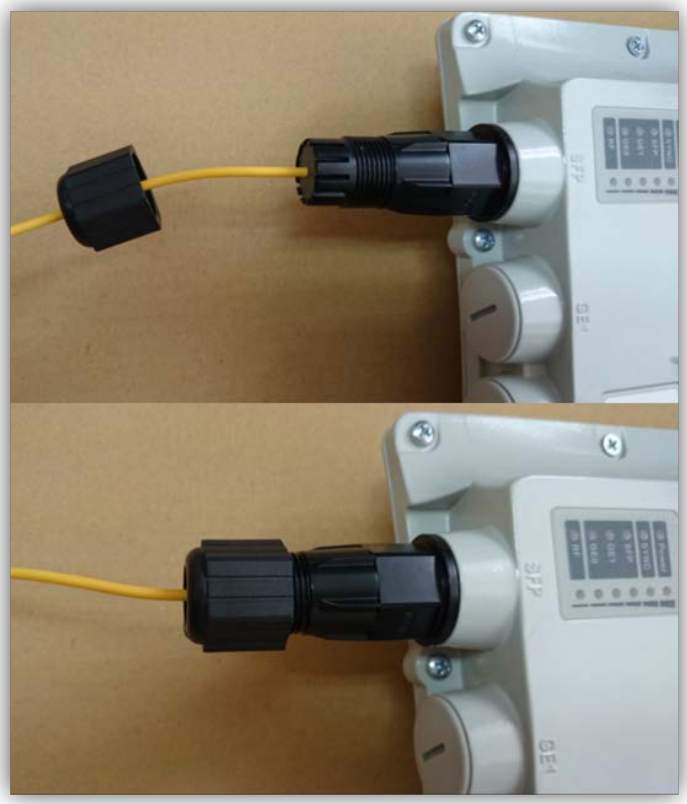
Put the cable gland nut (4), the split sealing grommet for optical cable (5) and the cable gland threaded coupling (6) onto the pre-terminated optical cable (1,2).

Figure 11 - SFP Connection Step 1

Figure 12 - SFP Connection Step 2

Set the SFP-module (3) into the socket until you hear a click;

Insert the connector (2) into the SFP-module (3).



Insert the split sealing grommet (5) into the cable gland threaded coupling (6);

Screw the cable gland threaded coupling (6) into the port and tighten it;

Tighten the cable gland nut (4);

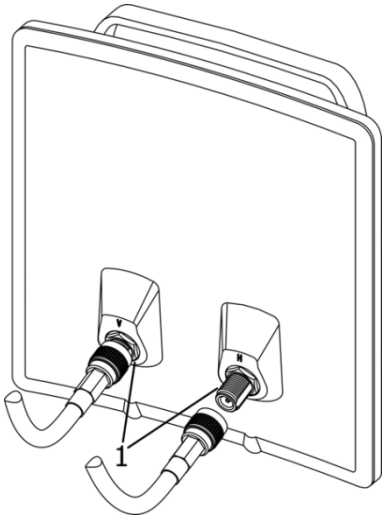
Do not apply excessive force.

Figure 13 - SFP Connection Step 3

In order to disassemble SFP, disconnect the optical cable, pull the clip of the SFP module and withdraw the SFP module from the slot.

3.3.3. InfiLINK XG - Um

1. Unpack the equipment
2. Check items integrity
3. Initial configuration is required for link establishment
4. Prepare RF cables of the required length. For 5GHz devices, the recommended maximum RF cable length is 1meter
5. Install and seal the connectors on the RF cables
6. Important: Horizontal and Vertical polarization should match each other on both sides!



1 - Antenna ports

Figure 14 - InfiLINK XG - UM ODU Front Panel

7. 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

8. If using SFP module, connect it to ODU, plug in the optical cable (the maximum length and type depend on the SFP module type) and seal the connector

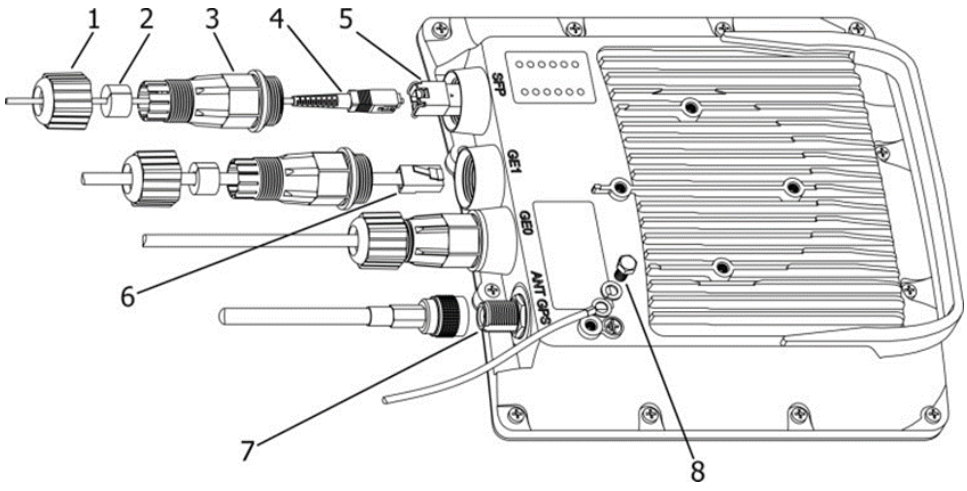


Figure 15 - InfiLINK XG - Um ODU Installation Procedure

1. Cable gland nut
2. Split sealing grommet
3. Cable gland threaded coupling
4. Optical cable (from 2mm to 3mm)
5. SFP-module (not included in the delivery package)
6. Standard RJ-45 connector
7. GPS antenna port (antenna and cable are not included in the delivery package)
8. Grounding bolt

9. Install (crimp) regular RJ-45 connector for ODU on the STP cable and seal it. Do not use the shielded RJ-45 connector on this end of the cable, as it should be attached only on the IDU end
10. Lay the STP cable (and the optical cable, if used) “from top to bottom” – from ODU to IDU
11. Install (crimp and solder) shielded RJ-45 connector for IDU on the STP cable
12. Install ODU on the mounting bracket, connectors facing down, and tighten it

NOTE

It is very important to mount the ODU connectors facing down.

13. Connect the ODU-IDU cable to the ODU
14. Seal the ODU Ethernet connectors
15. Once the antenna and antenna pole are installed they must be properly grounded: connected to the building lightning protection circuit. Antenna’s position must be lower than the highest antenna pole point at least by 1 meter. If antenna is NOT DC-shorted (see antenna technical documentation), additional lightning arrestors must be used which are placed between ODU and antenna and are grounded to the antenna pole grounding circuit
16. Connect the RF cables to the antenna ports, minding the polarization marks. Twist the connectors tightly
17. Connect the RF cables to the ODU ports, after previously having touched the RF cables’ connector case with ODU connector case
18. Seal RF connectors from both sides (ODU and antenna)
19. Connect the STP cable to IDU, after previously having touched IDU connector case with STP cable connector case
20. Provide grounding for IDU
21. Connect Ethernet cable to IDU
22. Connect the IDU to power
23. Connect to the Device using Telnet protocol

3.3.4. InfiLINK XG - Xm

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. Service cable connecting IDU and ODU should be STP Cat 5E cable

4. If using SFP module, connect it to ODU, plug in the optical cable (the maximum length and type depend on the SFP module type) and seal the connector

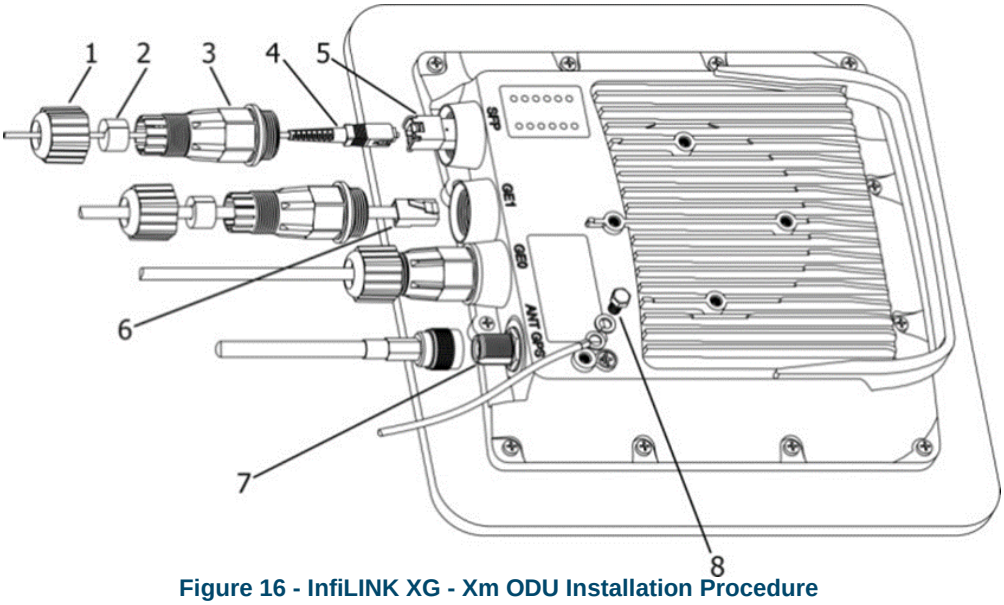


Figure 16 - InfiLINK XG - Xm ODU Installation Procedure

1. Cable gland nut
2. Split sealing grommet
3. Cable gland threaded coupling
4. Optical cable (from 2mm to 3 mm)
5. SFP-module (not included in the delivery package)
6. Standard RJ-45 connector
7. GPS antenna port (antenna and cable are not included in the delivery package)
8. Grounding bolt

5. Install (crimp) regular RJ-45 connector for ODU on the STP cable and seal it. Do not use the shielded RJ-45 connector on this end of the cable, as it should be attached only on the IDU end
6. Lay the STP cable (and the optical cable, if used) “from top to bottom” - from ODU to IDU
7. Install (crimp and solder) shielded RJ-45 connector for IDU on the STP cable
8. Install ODU on the mounting bracket, connectors facing down, and tighten it

NOTE

It is very important to mount the ODU connectors facing down.

9. Connect the ODU-IDU cable to the ODU
10. Seal the ODU Ethernet connectors

11. Once the ODU and pole are installed they must be properly grounded: connected to the building lightning protection circuit. The ODU position must be lower than the highest pole point at least by 2 ODU heights.
12. Connect the STP cable to IDU, after previously having touched IDU connector case with STP cable connector case
13. Provide grounding for IDU
14. Connect Ethernet cable to IDU
15. Connect the IDU to power
16. Connect to the Device using Telnet protocol

3.3.5. Grounding and Lightning Protection

When installing on poles without lightning protection systems, the ODU or external antenna should be placed on the pole at a height that is at least 1 meter below the top of the pole. In this case, there is a significant probability that the lightning strikes the pole and not the ODU or antenna. The pole should be properly grounded: connected to the building lightning protection circuit according to your local regulations. When lightning strikes the external antenna, the current goes through the coaxial cable to the ODU case, which is connected through the ODU clamp to the pole - the pole is grounded. 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.

NOTE

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

NOTE

Antenna pole, tower, ODU and lightning arrestor should be connected to the first common grounding circuit. Grounding cables should be no less than 10AWG thick and must use corrosion-resistant connectors. IDU and the customer LAN should be grounded to the second common grounding circuit.

Special attention should be paid if the antenna used is not DC-shorted. In this case, an additional lightning arrestor should be used between the antenna and ODU. The suggested grounding diagram is shown in the picture below.

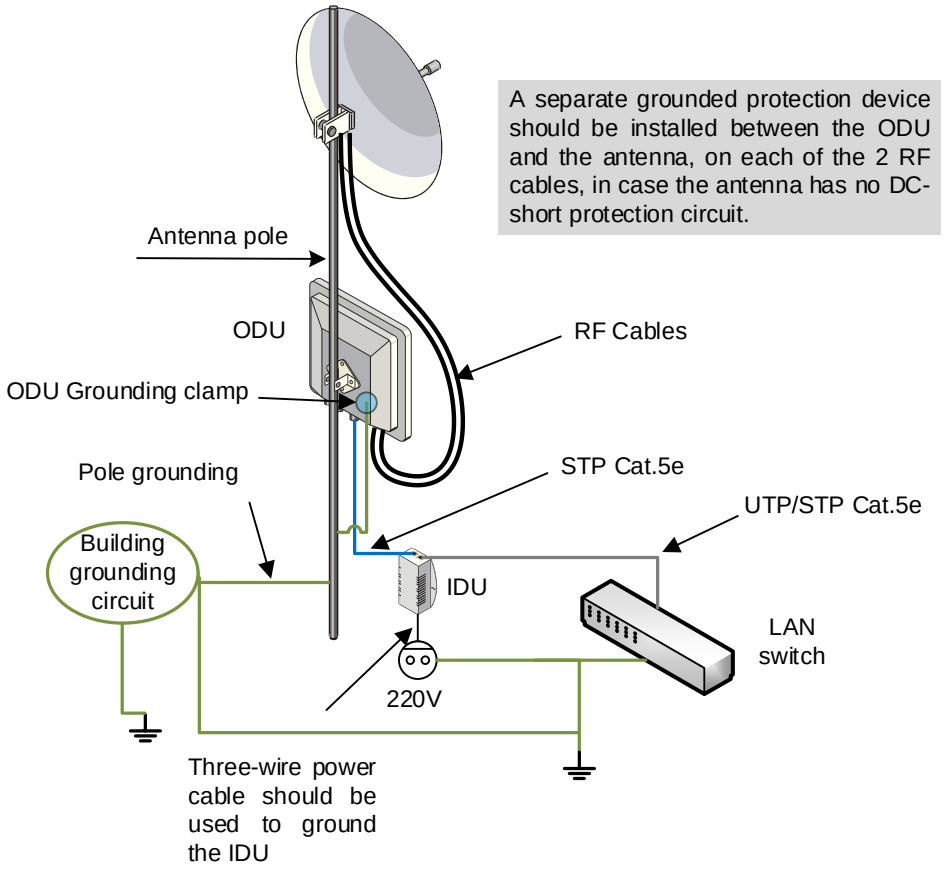
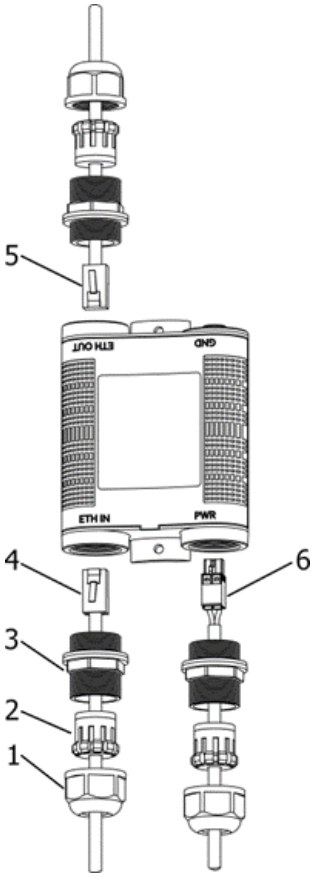


Figure 17 - Grounding Connections Schematics when Using IDU-BS-G

3.3.6. Grounding when Using AUX-ODU-INJ-G

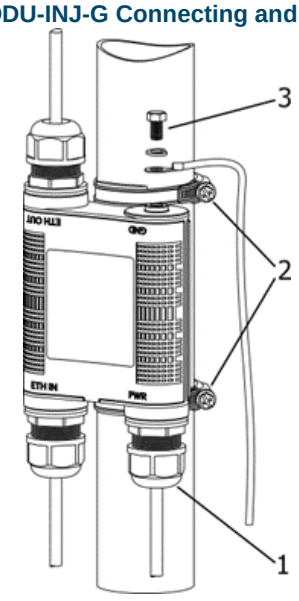
AUX-ODU-INJ-G is an optional accessory which may be used to connect third-party DC power sources to the ODU (for example, to power the unit from solar power or wind power sources).

AUX-ODU-INJ-G should be properly grounded.



1 - Cable gland nut;
2 - Sealing grommet;
3 - Cable gland threaded coupling;
4 - Standard RJ-45 connector;
5 - Shielded RJ-45 connector;
6 - Power connector.

Figure 18 - AUX-ODU-INJ-G Connecting and Sealing Procedure



1 - Cable gland;
2 - Clamps;
3 - Grounding bolt.

Figure 19 - AUX-ODU-INJ-G Mounting and Grounding Procedure

The grounding and lightning protection initial procedures when using AUX-ODU-INJ-G are similar to those when using regular IDU. First, please read the instructions from previous section 3.3.5.

The current section outlines only the differences in grounding connections schematics, when connecting AUX-ODU-INJ-G:

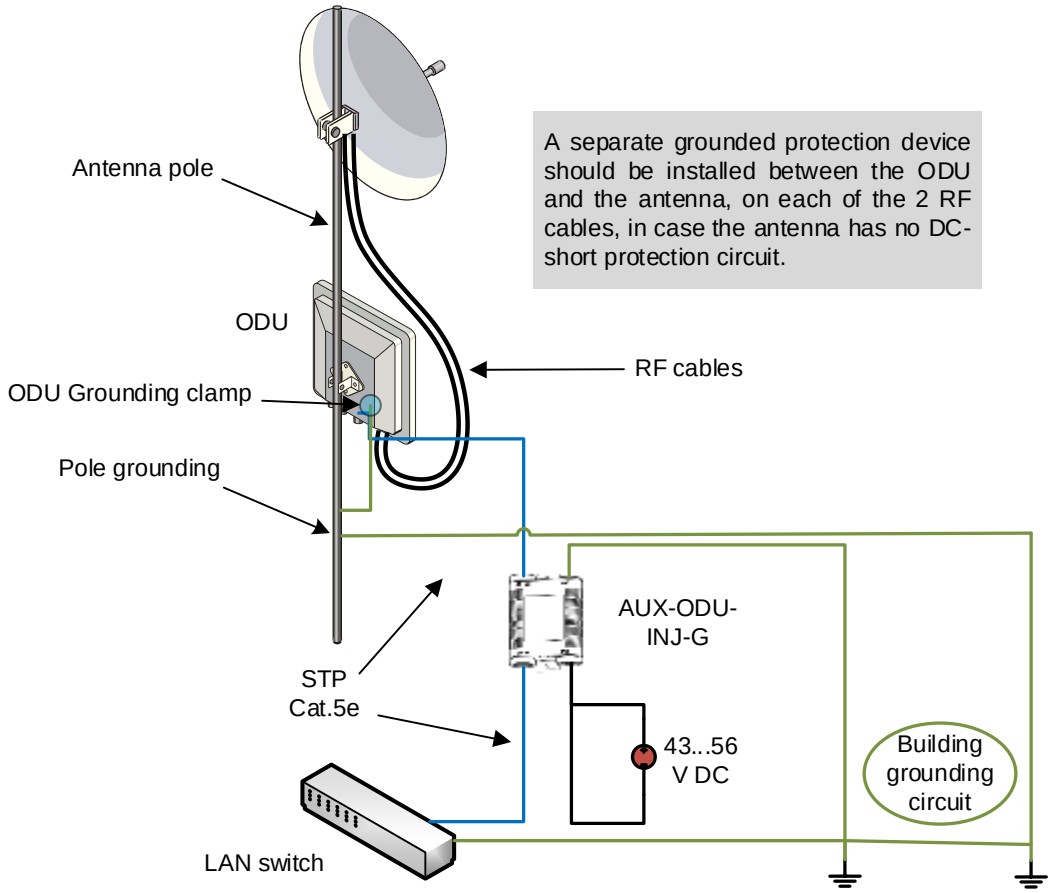
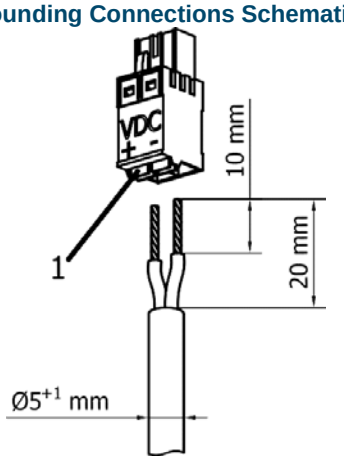


Figure 20 - Grounding Connections Schematics when Using AUX-ODU-INJ-G



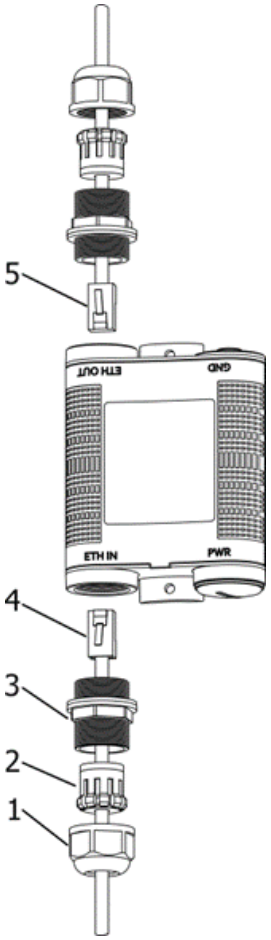
- Press on these catchers (1) when the cable is terminated;
- Use the round cable with diameter from 5mm to 6mm with conductor cross-section from 0.5mm to 2.5mm;
- Cat 5e FTP cable may be used.

Figure 21 - AUX-ODU-INJ-G power connector

3.3.7. Grounding when Using AUX-ODU-LPU-G

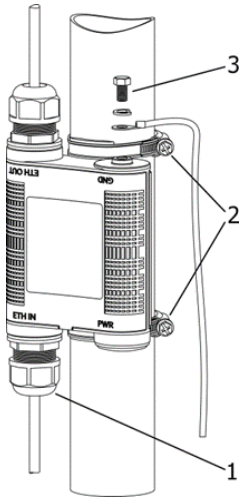
AUX-ODU-LPU-G is an optional accessory which may be used to serve as a line protection unit for the ODU and for the indoor network equipment connected to the Ethernet port of the IDU.

AUX-ODU-LPU-G should be properly grounded.



1 - Cable gland nut;
2 - Sealing grommet;
3 - Cable gland threaded coupling;
4 - Standard RJ-45 connector;
5 - Shielded RJ-45 connector.

Figure 22 - AUX-ODU-LPU-G Connecting and Sealing Procedure



1 - Cable gland;
2 - Clamps;
3 - Grounding bolt.

Figure 23 - AUX-ODU-LPU-G Mounting and Grounding Procedure

The grounding and lightning protection initial procedures when using AUX-ODU-LPU-G are similar to those when using regular IDU. First, please read the instructions from section 3.3.5.

The current section outlines only the differences in grounding connections schematics, when connecting AUX-ODU-LPU-G:

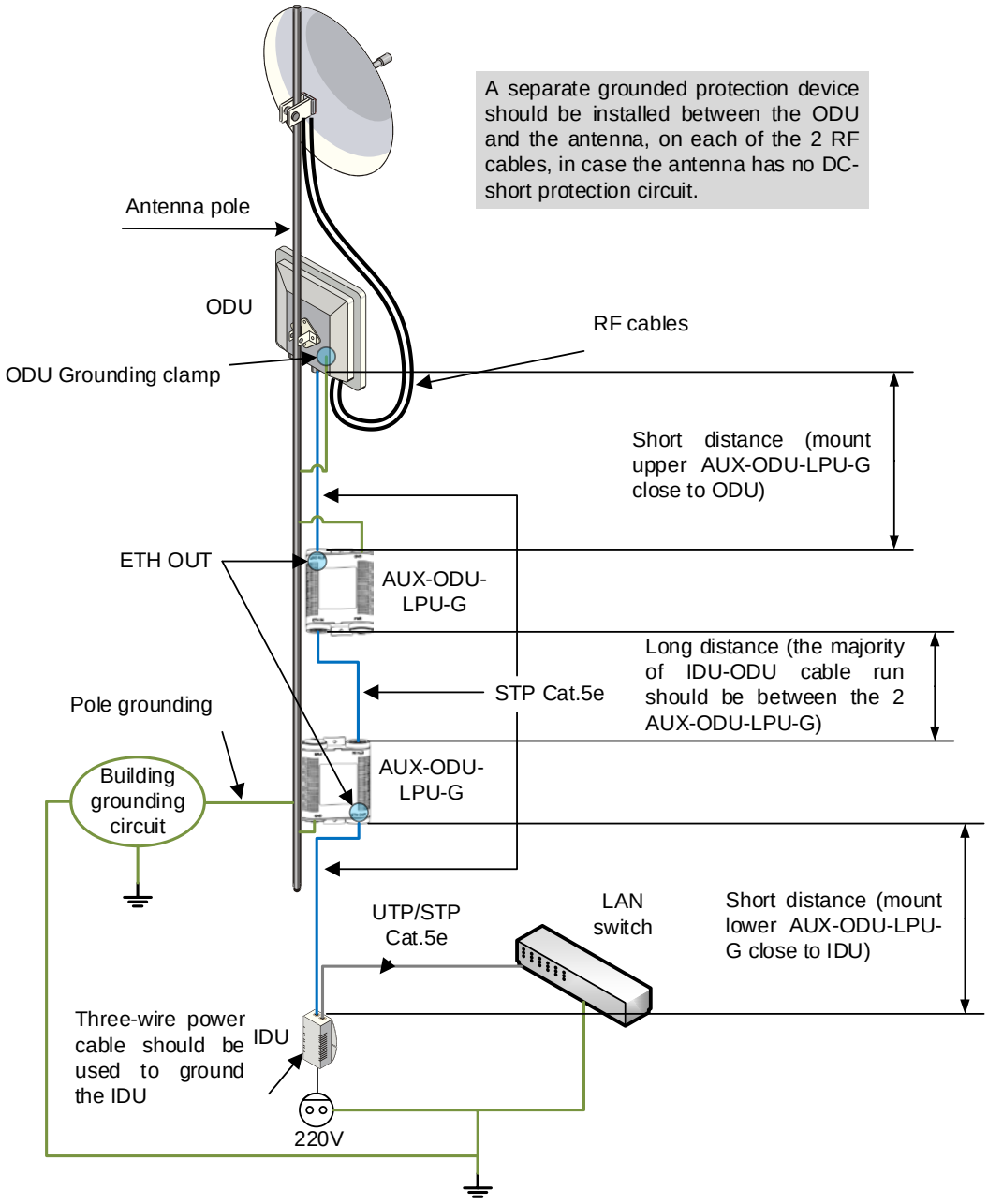


Figure 24 - Grounding Connections Schematics when Using AUX-ODU-LPU-G

For maximum protection of the ODU, IDU and customer LAN devices, use 2 AUX-ODU-LPU-G connected as shown in the diagram. The purpose of the LPU at the top is to protect the ODU from a surge of lightning strike which can hit the long STP cable run along the height of the pole or on the roof of the building. The purpose of the LPU at the bottom is to protect the IDU and customer equipment. Make sure to install the 2 LPU devices in the correct polarity, as shown in the diagram: top LPU with ETH OUT facing the ODU and bottom LPU with ETH OUT facing the IDU, and the 2 LPU units connected to each other via ETH IN.

Install each LPU as close as possible to the device it protects. The cable length between the top LPU and ODU should be minimum, as well as the cable length

between bottom LPU and IDU. Keep most of the IDU-ODU STP cable length between the two LPU devices.

3.3.8. Antenna Alignment

Prior to the antenna alliagnment activity, perform the radio planning activity using either InfiNet Wireless Link Planner tool (http://linkplanner.infinetwireless.com), your own RF planning tool or ordering InfiNet Wireless Professional Services.

To obtain maximum system performance, antennas must be precisely aligned towards one another according to LOS requirements. General recommendations for antenna alignment are as follows:

- Align antennas using optical equipment (binoculars, spyglass) accompanied by mobile phone actions coordination;
- Use GPS receiver, compass and area map;
- Use build-in InfiNet Wireless Device features. These features allow for the evaluation of the current channel and signal quality and are a powerful aid in performing precise antenna alignment.

Antenna polarization must be taken into account while installing. Please check the corresponding labeling on the antenna and refer to the antenna technical documentation.

3.4. Installing the Indoor Unit

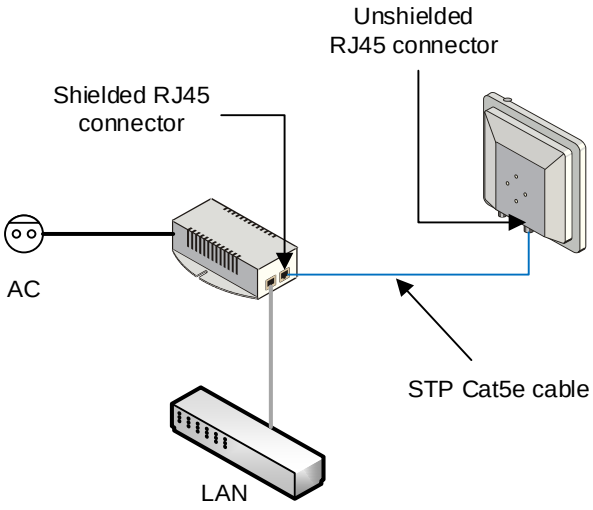
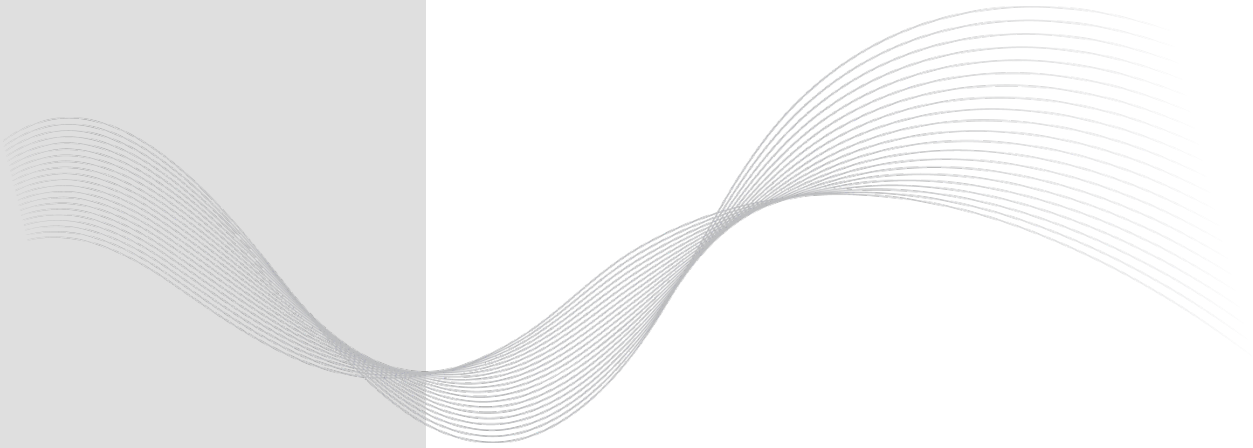


Figure 25 - Connection Scheme for IDU-BS-G

Commissioning

Chapter 4



4.1. Introduction

In order to initially setup an operational point-to-point link using InfiLINK XG units, you must run the procedure described below.

4.2. Step by step procedure

- **Step 1 - Perform site survey**
  - Determine line of sight conditions and obstacles along the path
  - Perform spectrum analysis and figure out spectrum occupation and available channels
  - Use InfiNet Wireless Link Planner tool (http://linkplanner.infinetwireless.com) to estimate link performance and required configuration in terms of antennas, channel width, Tx power, etc.
- **Step 2 - Pre-configure the units in the lab**

  The equipment list required for lab configuration and on site installation is:

Component	Description
	**2 x InfiLINK XG unit (ODU)** - Available in InfiLINK XG BOM
	**2 x mounting kit** - Available in InfiLINK XG BOM
	**2 x indoor power supply (IDU)** - Available in InfiLINK XG BOM

	■ **2 x power supply cord** - Available in InfiLINK XG BOM
	■ **1 x laptop** - **Not** available in InfiLINK XG BOM
	■ **3 x Ethernet patch cords** - **Not** available in InfiLINK XG BOM

Table 19 - The equipment necessary for initial configuration

In the lab and later on site perform the connections as indicated below:

- Connect the power cord between the GE0 port of the XG unit and the splitter port of the PoE injector
- Connect the Ethernet patch cord between the Laptop and the switch port of the PoE injector
- Connect the PoE injector to an AC power supply using the power cord

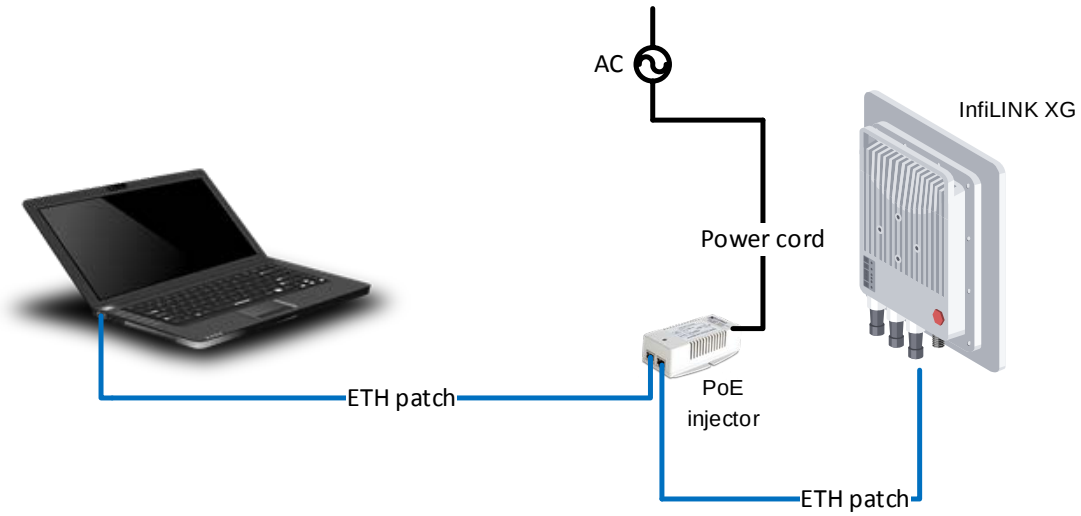


Figure 26 - Connectivity to the unit

NOTE

The PoE port of the IDU must be only connected to the GE0 port of the InfiLINK XG unit

Spectrum analyzer tool would be added to future firmware versions

After the physical connections are completed, access each unit to the default IP address 10.10.10.1 with mask 255.255.255.0 via web browser. Make sure that the Ethernet port of the Laptop has an IP address assigned from the same network class as the one for the InfiLINK XG unit (for example, set 10.10.10.50 with mask 255.255.255.0).

Use any letters or numbers for initial authentication, for example:

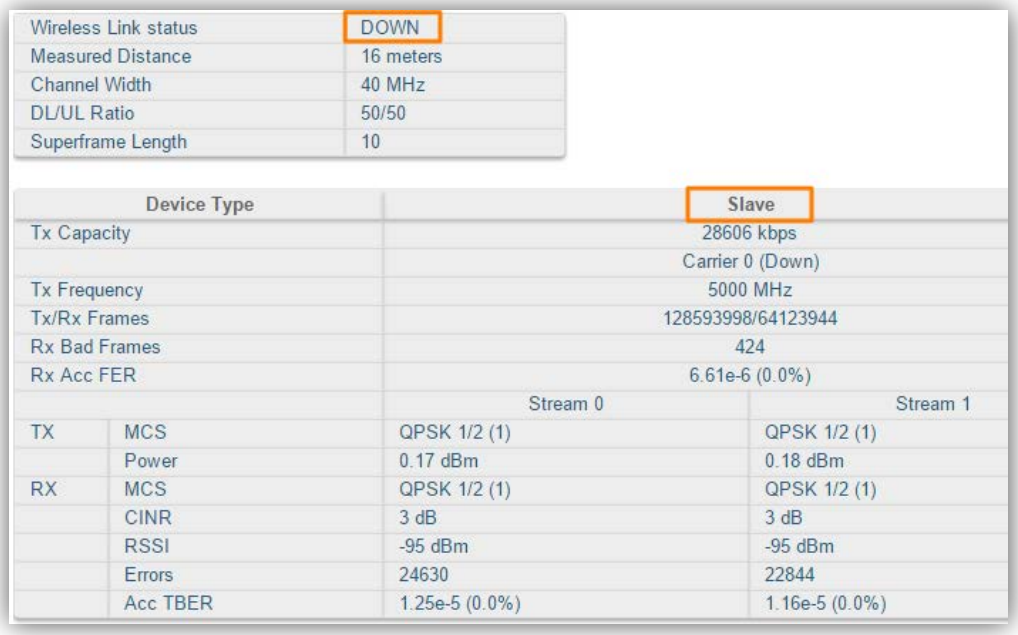
- User name: login
- Password: password

NOTE

After the initial login to the units, it is recommended to change the user and password to more secure permanent values

Upgrade the units to the newest firmware available in order to benefit of the latest features implemented. You can directly upgrade to the latest firmware available as described in section 5.5.1. Another option is to download the firmware from the ftp address ftp://ftp.infinet.ru/pub/Firmware/XG/H12 and then the upgrade can be performed via Web interface as described in section 5.5.2.

The last step is to connect to each unit separately and configure the radio link parameters according to the planning previously performed. Initially the status of the radio link is down like below.



Wireless Link status	DOWN
Measured Distance	16 meters
Channel Width	40 MHz
DL/UL Ratio	50/50
Superframe Length	10

Device Type		Slave	
Tx Capacity		28606 kbps	
		Carrier 0 (Down)	
Tx Frequency		5000 MHz	
Tx/Rx Frames		128593998/64123944	
Rx Bad Frames		424	
Rx Acc FER		6.61e-6 (0.0%)	
		Stream 0	Stream 1
TX	MCS	QPSK 1/2 (1)	QPSK 1/2 (1)
	Power	0.17 dBm	0.18 dBm
RX	MCS	QPSK 1/2 (1)	QPSK 1/2 (1)
	CINR	3 dB	3 dB
	RSSI	-95 dBm	-95 dBm
	Errors	24630	22844
	Acc TBER	1.25e-5 (0.0%)	1.16e-5 (0.0%)

Figure 27 - Initial status of the link

In the Web interface, go to the Radio page and perform the following configuration:

- Set one unit as Master and another one as Slave
- Set the uplink and downlink frequencies which should match on both units
- Set the same channel width on both units from the range: 10, 20 or 40 MHz
- Set the air frame period to match on both units (1, 2, 5 or 10 ms); shorter air frame translates into lower latency and longer air frame means higher throughput
- Set the link ID between 0 and 15 to match at both ends of the links
- Set the maximum distance in meters (initial setting is recommended to exceed more the actual distance for 300…400 meters)
- Set the Tx power for each unit between 0 and 27 dBm

NOTE

The detailed description for each radio setting in the Radio page can be found in section 5.6.3 of this document

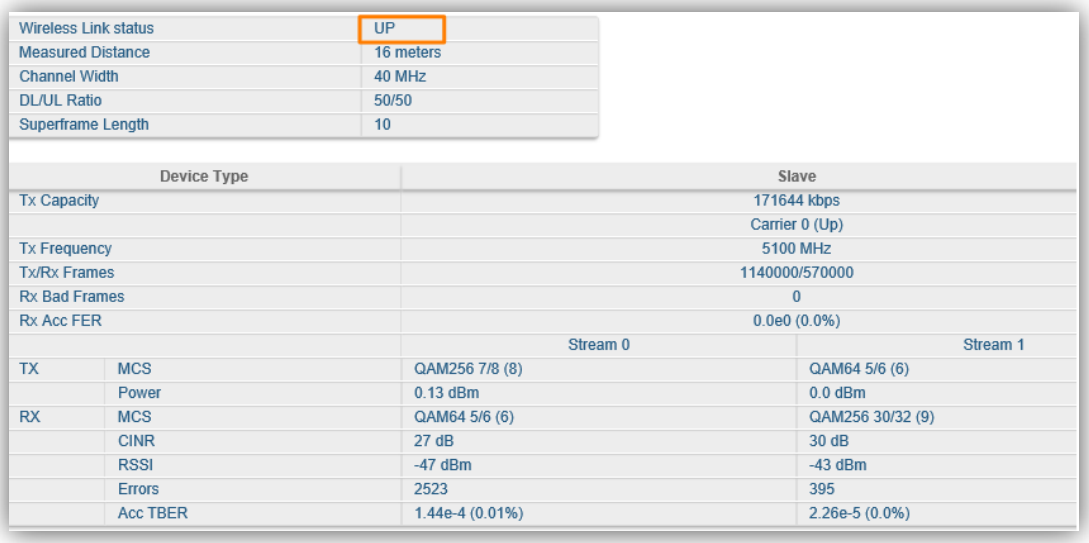
CAUTION

Please note that the following parameters must have the same values at each of the two units in the PtP link; otherwise the wireless link between them won't be established:

- Downlink/uplink frequency channels
- Channel width
- Air frame period
- Downlink/uplink ratio
- Max distance
- Link Id

Save the configuration, reboot both units and check if they link up after reboot.

The link status should be "UP" and the radio statistics should indicate the capabilities and quality of the link.



Wireless Link status	UP
Measured Distance	16 meters
Channel Width	40 MHz
DL/UL Ratio	50/50
Superframe Length	10

Device Type		Slave	
Tx Capacity		171644 kbps	
		Carrier 0 (Up)	
Tx Frequency		5100 MHz	
Tx/Rx Frames		1140000/570000	
Rx Bad Frames		0	
Rx Acc FER		0.0e0 (0.0%)	
		Stream 0	Stream 1
TX	MCS	QAM256 7/8 (8)	QAM64 5/6 (6)
	Power	0.13 dBm	0.0 dBm
RX	MCS	QAM64 5/6 (6)	QAM256 30/32 (9)
	CINR	27 dB	30 dB
	RSSI	-47 dBm	-43 dBm
	Errors	2523	395
	Acc TBER	1.44e-4 (0.01%)	2.26e-5 (0.0%)

Figure 28 - Link UP status

- **Step 3 - Perform initial alignment on site**

  - Install both units on the masts and roughly direct them at each other (the detailed installation steps can be checked at section 3.3 of this document)
  - Turn them on and check that the wireless link will be established using RF link led indicator
  - Perform coarse alignment using built-in signal strength indicators
  - Perform fine alignment using the Alignment tool available in the Web interface. Try to maximize CINR and RSSI readings. Please follow the detailed indications from section 5.4 for a proper antenna alignment

NOTE

If "**Absolute RSSI**" value goes above **-40 dBm**, decrease **Tx power** at the opposite side in order to keep it within **-40...-50 dBm** for the best performance.

- **Step 4 - Optimize the link performance**

  - Adjust Maximal link distance parameter based on the measured distance.

NOTE

Check measured link distance from the Status page and adjust the Max distance setting by adding **200-300 m** to the measured value.

  - Monitor air block error rate by checking the Acc TBER parameter in the Status page and adjust the AMC strategy if necessary.

NOTE

Acceptable error rate depends on the application. See some examples in the table below.

Application	Acceptable error rate
TCP-based applications (web, FTP, etc.)	10^{-4}
Voice-over-IP	10^{-5}
UDP video (CCTV, IPTV, etc)	10^{-6}
TDM-over-IP	$10^{-7}..10^{-9}$

Table 20 - Acceptable error rates for different applications

Automatic Modulation Control (AMC) can be adjusted due to customers requirements.

"Normal" AMC strategy is enabled by default.

"**Aggressive**" AMC strategy has been designed to maximize the throughput by utilizing higher-order modulation schemes and reducing SNR margins.

"**Conservative**" AMC strategy increases SNR margins, so that lower order MCSs are used in order to keep error rates to the minimum.

It is recommended to use "**Normal**" strategy initially and adjust it based on target and actual **TBER** values.

- Fine tune the Tx power in order to optimize the CINR and RSSI values; these parameters can be monitored in real time from the Status page and the recommendation is to keep the RSSI between -40…-60 dBm and the CINR higher than 30 dB
- Select the most appropriate air frame period

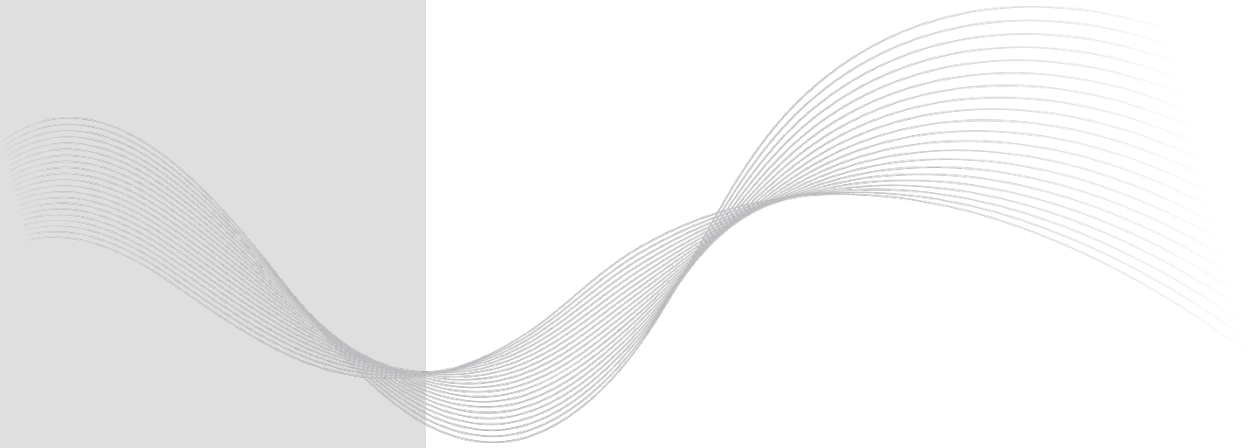
NOTE

The system supports a number of different frame periods **between 1 and 10 ms**.

1 ms frame period gives the lowest latency (from 500 µs one-way), while 10 ms frame period has lowest overheads and thus maximum throughput will be by approximately 12% better for the same MCS. Due to overheads, 1 ms frame period has significantly higher distance penalty compared to 10 ms: at 100 Km maximum throughput decreases by 7% at 10 ms and by 75% at 1 ms. So air frames higher than 2 ms allow using the link at higher distances.

Operation & Administration

Chapter 5



5.1. Introduction

Web interface is a friendly management tool of the InfiLINK XG unit. Using Web interface, you can easily:

- Monitor device interfaces statistics
- Monitor radio link statistics
- View and change device configuration
- Perform device maintenance
- Perform antenna alignment

5.2. InfiLINK XG unit access

Web management is enabled by default so, in order to access the unit via Web browser (start the graphical user interface), type in the address bar:

http://<unit IP address>.

NOTE

The default management IP address is 10.10.10.1/24 and it can be used for initial login. Make sure you have network connectivity to the unit.

NOTE

The system allows concurrent login sessions via Web interface.

On the login page, you can type any username and any password and click Login. For example, “User name: user” and “Password: pass” like below.

Figure 29 - Web GUI login

NOTE

Please change the credentials you have just inserted with a permanent username and password for it after the first log in.

The default language is English. After the authentication step, the language can be changed into Russian, French, Italian or Chinese.

You can access the unit via HTTPS (HTTP with SSL only) using InfiNet Wireless self-signed certificate (from the Maintenance menu of Web interface). The «HTTPS Connection» link is available in the right side of the «Login» button like in the picture above.

5.3. Status

The Status page is displayed by default after the authentication step. It displays the main parameters of the unit in real-time.

Figure 30 - Status page

You can set the "Auto Refresh" option to refresh the statistics automatically. The “Auto refresh” is available in the bottom-left side of the Status page, along with the «Show GNSS Statistics» button. If GNSS is in use and GNSS monitoring is enabled, its statistics can be queried by clicking on «Show GNSS Statistics».

On the bottom-right side of the Status page the «Clear All Counters» button is present with the scope of resetting the counter values to 0 when clicked on.

CAUTION

Clearing these counters by clicking on the «Clear All Counters» button means losing the history data about the functionality of your unit. Avoid this operation unless you are completely sure you don't need this data in the future.

The Status page has the following sections:

- Interface Statistics - displays the main parameters of all configured interfaces (physical and logical)
- Wireless Link Statistics - displays the main parameters of the radio link

5.3.1. Interface Statistics

Parameter	Description
Port	■ Displays all physical and logical set interfaces
Status	■ Displays for each interface whether it is "up and running" or not
Mode	■ Displays the operation mode for the GE ports: - 10,100 or 1000 Mbps and half or full duplex
Packets **Rx/Tx**	■ Displays the number of received and transmitted packets for each interface since the unit is operational or since the counters were last reset
Errors **Rx/Tx**	■ Displays the number of received and transmitted error packets for each interface since the unit is operational or since the counters were last reset
Load (Kbps) **Rx/Tx**	■ Displays the packet flow through each interface in real-time (for the system and the data traffic) expressed in Kbps
Load (pps) **Rx/Tx**	■ Displays the packet flow through each interface in real-time (for the system and the data traffic) expressed in packets per second (pps)

Table 21 - Interface Statistics

Additional statistics about the network packet types and error types for reception/transmission are displayed by clicking on any of the interfaces:

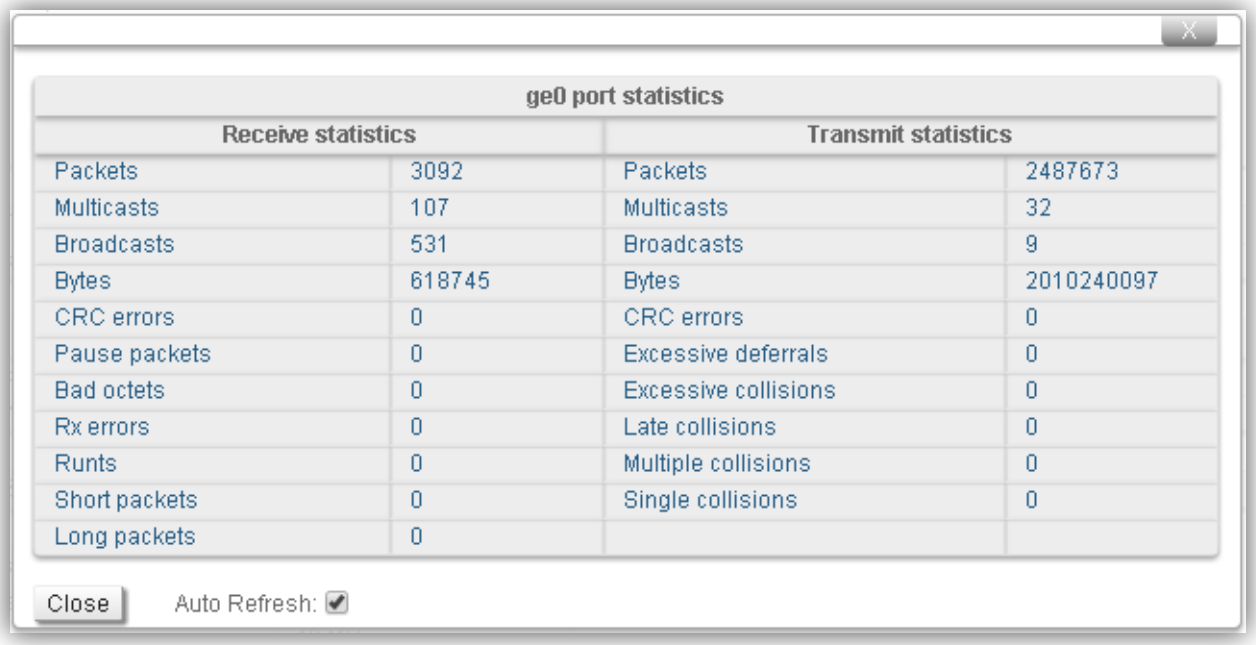


Figure 31 - Additional interface statistics

5.3.2. Wireless Link Statistics

This section is divided in the following two areas:

- General radio link parameters - displays the following information:

Parameter	Description
Wireless Link Status	■ Displays the status of the radio link which can be “Up” or “Down”
Measured Distance	■ Displays the measured distance of the radio link in meters ■ If the remote end stats is disabled, the measured distance is only shown at the slave unit
Channel Width	■ Displays the channel bandwidth that is in use
DL/UL Ratio	■ Displays actual downlink/uplin ratio

Table 22 - General radio link parameters

NOTE

The actual DL/UL ratio might different to the specified in the configuration because of air protocol limitations. The system automatically chooses the closest possible value to the requested one

- Real time radio link status - displays the following parameters of the radio link in real time for both the local and remote unit:

Parameter	Description
Tx capacity	▪ Displays the maximum transmission capacity expressed in Kbps for the current modulation and coding scheme; if the MCS changes, the Tx capacity will also change accordingly
Tx Frequency	▪ Displays the center Tx frequency expressed in MHz
Tx/Rx Frames	▪ Displays the number of transmitted and received air frames
Rx Bad frames	▪ Displays the number of air frames received with errors for which the Control Block cannot be correctly decoded
Rx Acc FER	▪ Displays the Frame Error Ratio, meaning the percentage of frame loss (air frames that cannot be decoded divided by the total number of air frames received)
Tx parameters	
MCS	▪ Displays the modulation and coding scheme that is in use at Tx side. There are 10 MCS schemes available and if the AMC is set to auto, the MCS will dynamically change its value based on the link quality (at both units - local and remote) ▪ For example, for QAM256 7/8 (8), “QAM256” is the modulation in use, “7/8” is the coding scheme in use (for every 7 data bits encoder produces 8 bits to be sent over the air) and “(8)” represents the index of the MCS in use
Power	▪ Displays the current power level of the Tx signal for each radio chain in dBm
Rx parameters	
MCS	▪ Displays the modulation and coding scheme that is in use at Rx side. The representation is similar to that for Tx part
CINR	▪ Displays Carrier to Interference and Noise Ratio measured in downlink and expressed in dB ▪ CINR can be limited either due to too low signal level or because of the interference from other radios ▪ AMC algorithm makes its decisions based on the CINR

Parameter	Description
	value ■ Higher CINR is better
RSSI	■ Displays the Received Signal Strength Indicator measured in downlink and expressed in dBm ■ Represents the power of the received signal as a whole (useful signal plus noise and interferences) and if it goes below the level of the sensitivity, the link will go down
Acc TBER	■ Displays the Transport Block Error Ratio, showing the percentage of errored transport blocks ■ Each application has an acceptable air block error rate defined as a minimum requirement ■ The values are presented in the table below

Table 23 - Wireless Links Statistics

CINR and RSSI are very important in analyzing the link performance. Below there are the guidelines for CINR and RSSI levels:

CINR (dB)	Comment
5…12	Very low quality signal suitable for low-order modulations only. It is highly recommended to improve signal quality by selecting less congested channel or increasing signal level
13…19	Low signal quality, average modulations are available
20…27	Average signal quality
>=28	Very good quality signal suitable for highest-order modulations

Table 24- CINR value ranges

RSSI (dBm)	Comment
-90…-80	Close to the receiver sensitivity level, suitable only for the lowest modulation levels; it is highly recommended to improve signal level or switch to narrower available channel width in order to avoid the loss of connectivity
-80…-60	Average input range
-60…-40	The recommended range for achieving best performance
>-40	Input signal level is too high, it is recommended to decrease the Tx power in order to avoid possible damage of the radio module of the remote unit

Table 25 - RSSI value ranges

The maximum Tx capacity varies based on the MCS in use. The table below specifies the relation between the MCS and the maximum capacity:

Channel width	**10 MHz**		**20 MHz**		**40 MHz**	
Air frame period	**1 ms**	**10 ms**	**1 ms**	**10 ms**	**1 ms**	**10 ms**
Modulation, coding rate	**Throughput, Mbps**					
QAM256 30/32	98	119	200	241	435	477
QAM256 7/8	92	110	186	225	401	440
QAM256 3/4	78	94	159	192	343	377
QAM64 5/6	65	77	132	159	284	312
QAM64 2/3	51	61	105	126	226	249
QAM16 3/4	38	45	77	94	168	185
QAM16 1/2	24	29	51	61	110	121
QPSK 3/4	17	21	37	45	81	89
QPSK 1/2	11	12	24	29	52	57

Table 26 - InfiLINK XG throughput capabilities (laboratory figures)

The minimum TBER requirement for specific applications:

Application	**Acceptable error rate**
TCP-based applications (web, FTP, etc.)	10^{-4}
Voice-over-IP	10^{-5}
UDP video (CCTV, IPTV, etc)	10^{-6}
TDM-over-IP	$10^{-7}...10^{-9}$

Table 27 - Acceptable error rates for different applications

5.4. Antenna alignment

The graphical antenna alignment tool allows to visualize the signal characteristics on both sides of the link in order to make the antenna alignment process more accurate and easier.

The accuracy of the antenna alignment at the neighbor device is very important for the link quality.

By clicking the «Start Test»/«Stop Test» buttons at the bottom of the page, you can start/stop the alignment test.

By clicking the «Clear History» button, you delete all data stored from the moment you clicked the «Start Test» button.

Once the test is started, the antenna alignment can be monitored using the graphic and text indicators. The indicators for both local and remote devices are displayed together in the same page which 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 each antenna polarization (one for Vertical polarization and another for Horizontal). This allows controlling the alignment process for each antenna polarization for the local and for the remote device simultaneously.

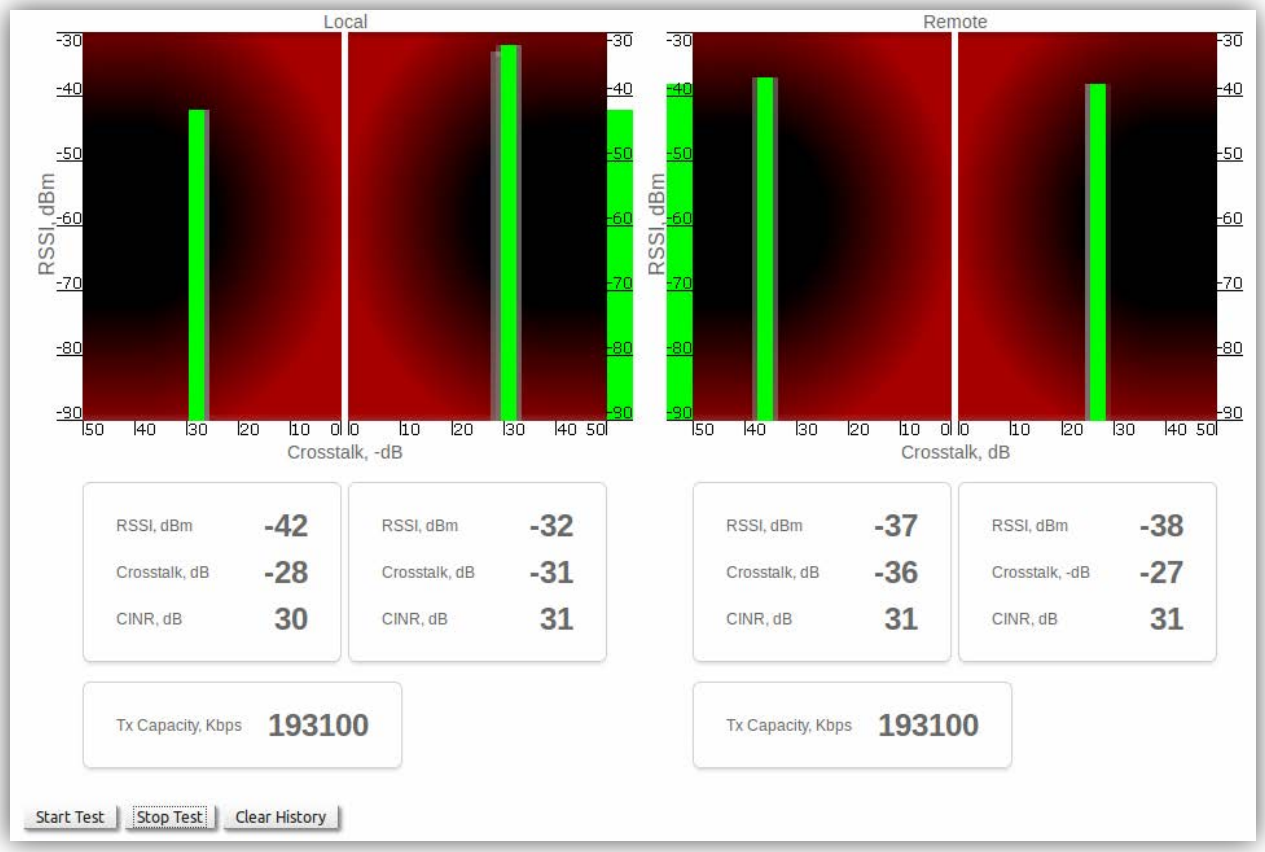


Figure 32 - Antenna alignment tool

The **text indicators** are:

- RSSI - indicates absolute level of the received radio signal (measured in dBm)
- Crosstalk - indicates how much the vertically and horizontally polarized signals interfere each other (measured in dB)
- CINR - indicates the signal quality (for example, how strong is the carrier signal compared to the noise plus interference level, measured in dB)

Graphical indicator:

The main indicator is the Input Signal stripe.

The height of the Input Signal stripe is measured in dBm by the RSSI scale. The higher the stripe is, the stronger the signal is.

The stripe may change its position along the Crosstalk scale, showing how much influence the corresponding device antenna has (for example, how much vertically and horizontally polarized signals influence each other). The higher the value of the stripe according to the Crosstalk scale (the farther stripe is from the 0 dB value), the less influence the antennas have on each other.

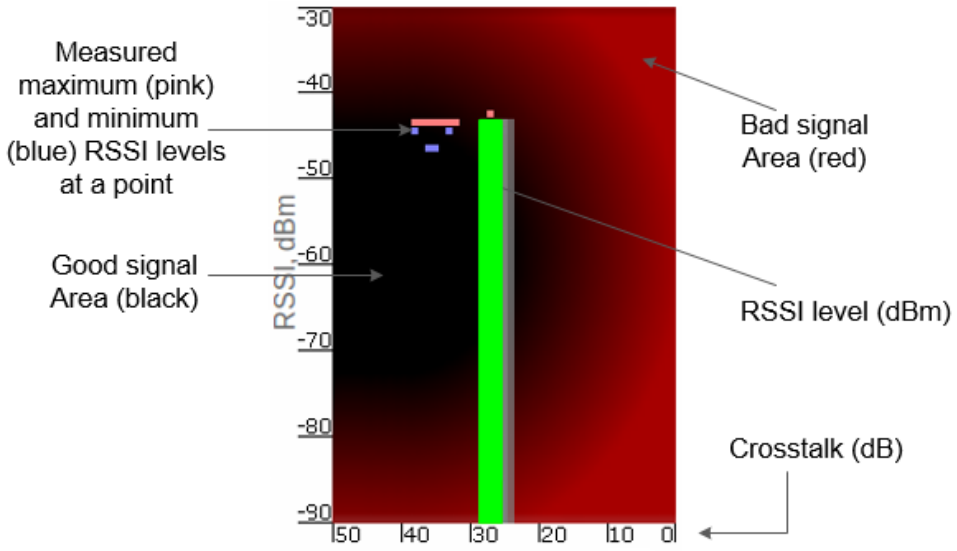


Figure 33 - Alignment test - graphical indicator

The top of the Input Signal stripe can be located in black (Good signal) or red (Bad signal) background areas or somewhere in between them. This means the signal is good, bad or average correspondingly. When aligning the antenna, it is recommended to try achieving 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 the packet retries and the percentage of the total number of transmitted packets.

During the alignment test, the Input Signal stripe may change its position along the Cross Fading scale and increase or decrease in height, indicating the changes in the received signal. When the top of the stripe changes its location, moving from one point on the background area to another, it leaves pink and blue marks behind, indicating the maximum and minimum measured levels of the signal at a particular point. Thus, it makes possible to observe the “history” of the signal changes.

You can clear the marks by clicking the «Clear History» button at the bottom of the page.

Main recommendations when using the “Antenna Alignment Tool”:

- RSSI level should be between -40 dBm and -60 dBm
- If RSSI level is more than -40 dBm, it is recommended to decrease Tx power
- CINR should be maximized during alignment
- Crosstalk should be as far as possible from 0 dB
- The top of an Input Signal stripe should be located in the black area
- Input signals of the two antennas of the device should have similar Cross fading values (Input Signal stripes should be symmetrically to the value of 0 dB)

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

5.5. Maintenance

The Maintenance menu allows you to perform service tasks for the device and to check the hardware and software version, reason for the last reboot, system uptime, current configuration, license, diagnostic card, etc.

Maintenance page has the following sections:

- Firmware
- Upload
- Download
- Bottom section of the page with the «Reboot», «Restore Factory Settings», «View Current License», «View Current Configuration» and «Create Diagnostic Card» buttons available

5.5.1. Firmware

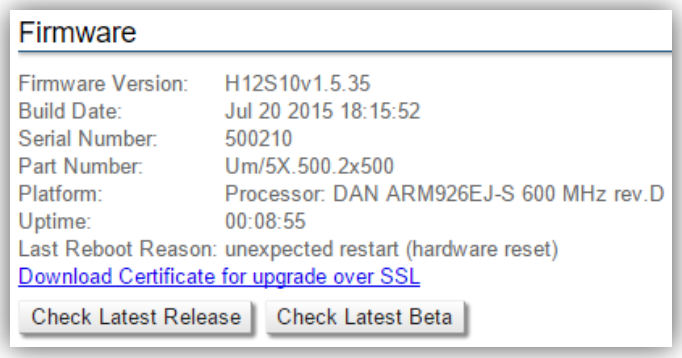


Figure 34 - Firmware

Parameter	Description
Firmware Version	■ Displays the current firmware version ■ The firmware string contains also the hardware platform type
Build Date	■ Displays the firmware build date
Serial Number	■ Displays the serial number of the unit
Part Number	■ Displays the part number of the unit ■ It contains information about the unit type
Platform	■ Displays the processor model
Uptime	■ Displays the system up time since the last reboot
Last Reboot Reason	■ Displays the reason for the last reboot of the unit ■ The options are: - Software fault - Unexpected restart - Manual restart - Manual delayed restart - Firmware upgrade - SNMP managed restart - Test firmware loaded - Watchdog - Panic (in case of critical errors in the software)

Table 28 - Firmware parameters

By clicking on the “Download Certificate for upgrade over SSL” link, you can download InfiNet Wireless self-signed certificate. This allows you to upgrade the unit software version when you are connected to the Web interface via HTTPS.

If Internet connectivity is available for the management PC, the InfiLINK XG unit checks automatically for the firmware updates at the InfiNet Wireless repository and displays a warning message for 10 s each time you go to the Maintenance page if a new software version is available:

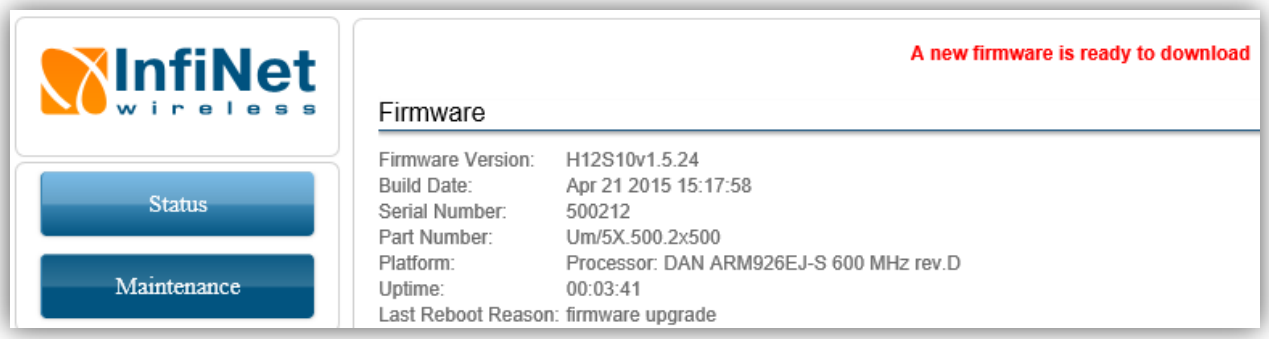


Figure 35 - New firmware warning message

NOTE

It is not mandatory that the unit 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 InfiNet Wireless website (both http and ftp).

Two action buttons are available in the Firmware section:

- **«Check Latest Release»:** if you click this button, a text box will appear with brief information about each firmware release, displaying the latest firmware available. You can perform directly upgrade to the latest release available by clicking the «Upgrade Firmware» button or you can save the newest firmware by clicking the «Save New Firmware» button. In order to hide the information just displayed, you can click the «Hide Update» button.

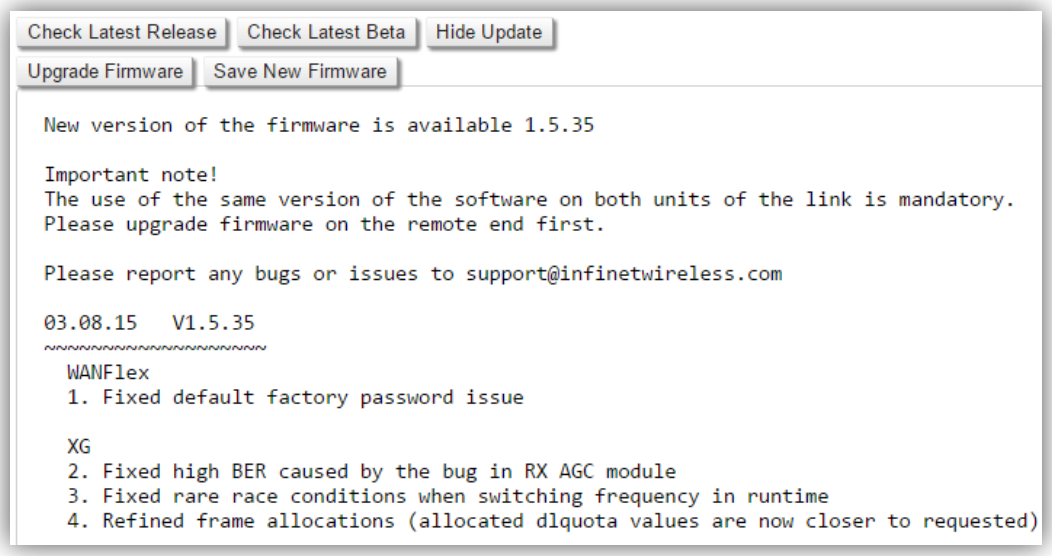


Figure 36 - Check latest release options

- «Check Latest Beta»: if you click this button, the latest beta firmware version available will be displayed. The options are the same like for the «Check Latest Release» button, you can either upgrade or save the latest beta firmware by clicking the corresponding button.

5.5.2. Upload

The Upload section allows you to upload different license, firmware and configuration files to the unit.

For each of the three options, click on the «Browse» button, followed by the «Upload» button after the file has been picked up.

After clicking on the «Upload» button, the system performs three operations: uploading, saving and validating the new file uploaded and indicates if each of the operation succeeded or failed. In case that the process succeeded, you have to reboot the unit in order to apply the new changes.

5.5.3. Download

The Download section allows you to open or download locally, to the management PC, the current license, firmware and configuration files, by clicking on the corresponding buttons: «Download License», «Download Firmware» and «Download Configuration».

5.5.4. Bottom section of the page

The following buttons are available:

- «Reboot» button - reboots the device. A warning message pops up asking for confirmation before the operation can start. During the restart process, you are redirected to the login page and the timeout period of 45 seconds counts down before the new login:

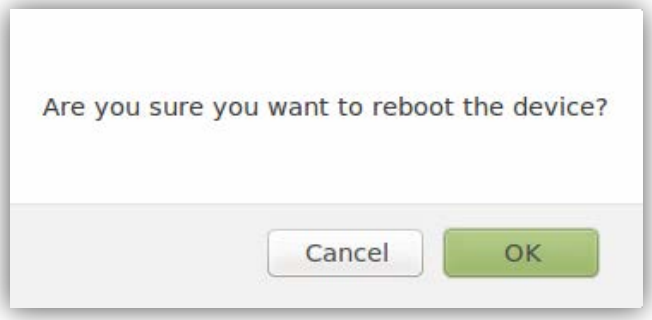


Figure 37 - Unit reboot

- «Restore Factory Settings» button - restores the factory default configuration. A warning message pops up, asking for the permission before the operation to start. During the reset to factory process, you are redirected to the login page and the timeout period of 30 seconds counts down before the new login
- «View Current License» button - shows the currents device license parameters in a new window
- «View Current Configuration» button - shows the currents device configuration in text format in a new window
- «Create Diagnostic Card» button - Tech Support Reports Generator. By clicking on this button, the system downloads to the local PC a text file that contains the complete information (for the technical support specialists) set from the device such as: full device configuration listing, system log output, license information, interfaces statistics, etc.

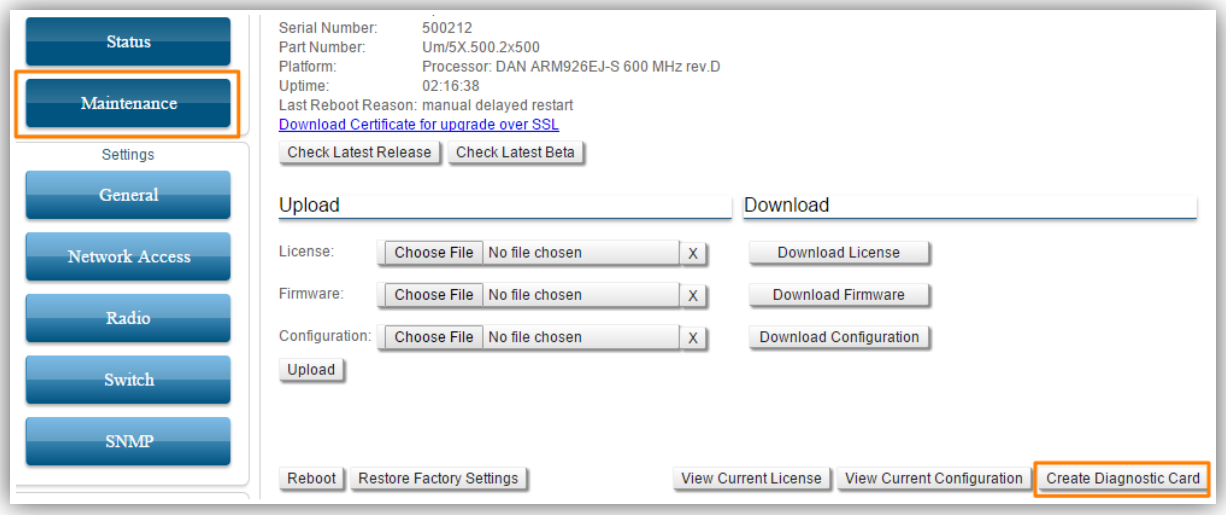


Figure 38 - How to create a diagnostic card

5.6. Settings

In the Settings section you can set and edit the parameters related to the functionality of the unit. The following configuration pages are available:

- General
- Network Access
- Radio
- Switch
- SNMP

5.6.1. General

In this page, you can view and edit the basic system settings.

NOTE

Read the information at the end of the Settings section in order to find out the output of the «Apply», «Try» and buttons for the new configuration performed.

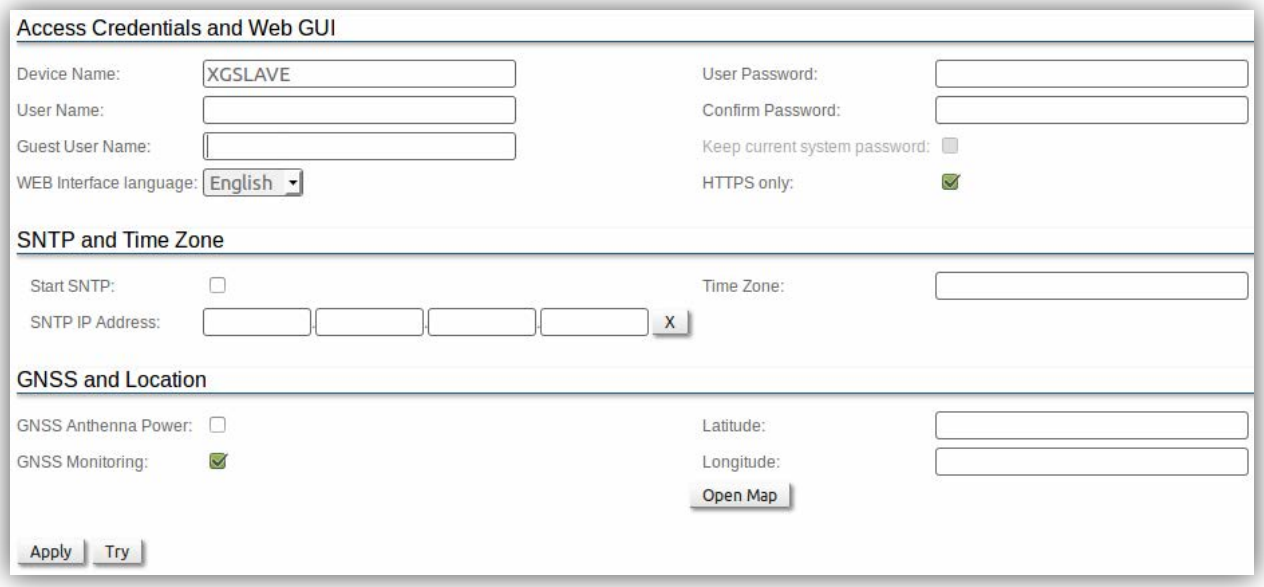


Figure 39 - General page

The general page is divided in the following sections:

- Access Credentials and Web GUI

General System Parameter	Description
Device Name	■ You can set the device name ■ This parameter is displayed in the web-page header
User Name	■ Displays the username (Login) used to access the unit management interfaces ■ You can change the current username
User Password and Confirm Password	■ You can change the password set in the previous configuration only after unmarking the option “keep current system password" in the corresponding checkbox ■ You can return to the default settings for Password and User Name (any values with non-zero length) by unmarking the checkbox “Keep current system password” and leaving the corresponding fields empty and save the configuration at the bottom of the page
Guest User Name	■ You can set the guest user name for accessing the unit in guest mode. ■ The user name and password in the previous fields for normal login should be specified first. If they are not specified, the guest user name will not take effect ■ The guest mode allows access to the unit in a restrictive mode: only the device status can be seen and no configuration modifications are available
WEB Interface language	■ You can change the default system language (English) into Russian, French, Italian or Chinese language
Keep current system password	■ If this checkbox is unselected, you can set new credentials for accessing the unit, if checked, this option will keep the current login password in use
HTTPS only	■ You can set that all HTTP connections to the unit to perform via HTTPS (HTTP with SSL only) by marking the option “HTTPS only” in the corresponding checkbox ■ By default, this option is disabled

Table 29 - Access credentials and Web GUI

- SNTP and Time Zone

General System	Description

Parameter	
Start SNTP	■ You can start SNTP service by marking the option “Start SNTP” in the corresponding checkbox ■ By default, this option is disabled
SNTP IP Address	■ You can set the IP address of a valid SNTP server ■ The unit must have an active connection with the SNTP server in order to receive time services
Time Zone	■ You can set the time zone. For example, GMT+4

Table 30 - SNTP and Time Zone

- GNSS and Location

General System Parameter	Description
GNSS Antenna Power	■ Turn on the power of the antenna amplifier ■ By default, it is disabled
GNSS Monitoring	■ Start/stop the GPS service ■ By default, the GPS service is started
Latitude	■ You can set the latitude of the geographical place where the unit is installed ■ GPS latitude format is [N/S]YY.YYYYYY ■ Use the Google Map feature to automatically fill in this field (follow the indications below)
Longitude	■ You can set the longitude of the geographical place where the unit is installed ■ GPS longitude format is [E/W]XX.XXXXXX ■ Use the Google Map feature to automatically fill in this field (follow the indications below)

Table 31 - GNSS and Location

Click on the «Open Map» button to open the Google map:

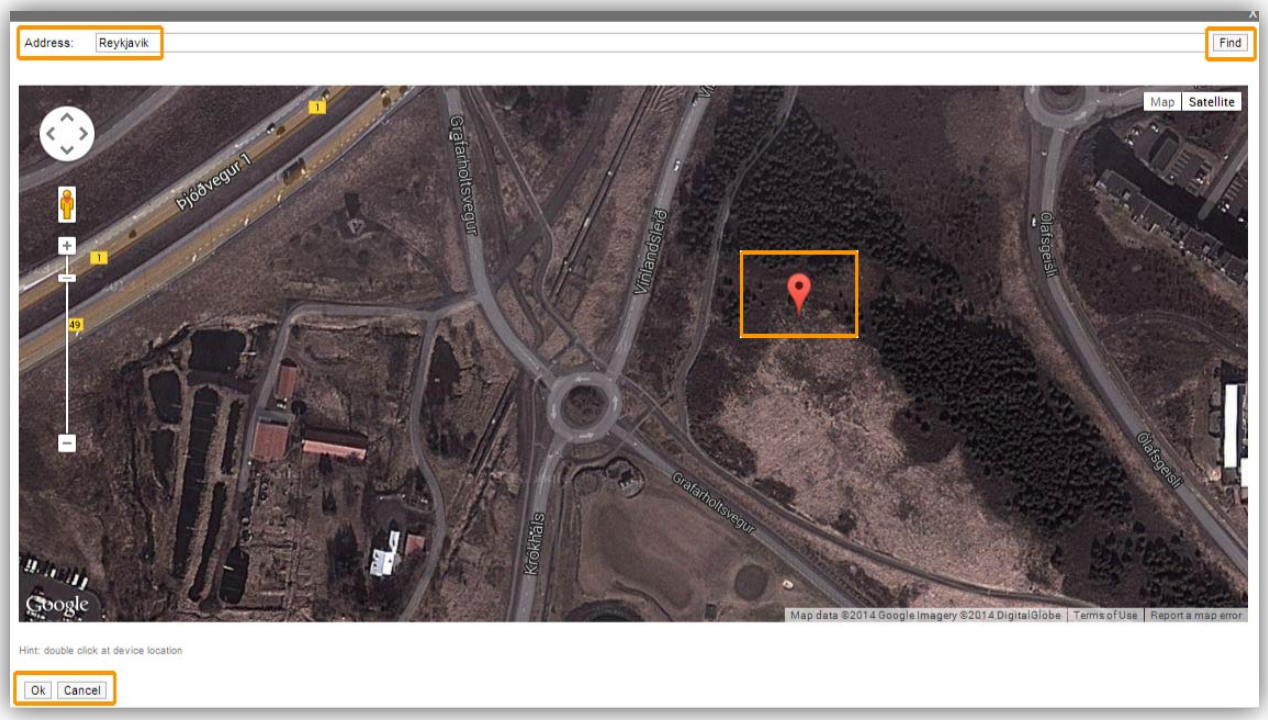


Figure 40 - Google Map

Type the location name in the Address bar, click on the «Find» button to search for it and then move to the exact location where the unit is installed. Double click in that position on the map and the Google pointer (see picture above) will be placed there. After clicking on the «Ok» button, “Latitude” and “Longitude” fields are automatically filled in with the GPS coordinates.

5.6.2. Network Access

The Network Access page allows you to perform general networking configuration settings and it is divided in the following two sections:

- Network settings - allows you to configure the IP address of the unit, to specify a VLAN ID to pass and to enable or disable the DHCP for the IP address allocation. Multiple IP addresses can be added

Figure 41 - Network settings section

- Routing parameters - allows you to configure the routing information for the unit. You can input the default gateway IP address and add a route to a specific destination by specifying the destination network address, the network mask and the gateway for reaching the destination

Figure 42 - Routing parameters

NOTE

Read the information at the end of the Settings section in order to find out the output of the «Apply», «Try» and buttons for the new configuration performed.

5.6.3. Radio

The radio page is divided in two sections:

- Radio settings - allows you to configure general radio parameters and features:
  - General parameters
  - Radio Front End
  - Modulation
  - Radio frame
- Frequency Grid and Limitations - specifies the default and custom frequency domains for each bandwidth (10 MHz, 20 MHz, 40 MHz).

5.6.3.1. Radio settings

The following radio parameters can be configured under the Radio settings section:

Radio parameter	Description
Node Type	■ Set the node type to Master or Slave ■ In the point-to-point link, one unit must be set to Master and the other one to Slave
QoS Strategy	■ You can use this parameter to select the traffic prioritization strategy. The following options are

Radio parameter	Description
	available: - "normal" provides a balance between packet loss and throughput. It is used by default. - "aggressive" gives maximum throughput with a minor priority packet loss allowed - "conservative" assures no priority packet loss, but with small decline in the peak throughput - "off" disables prioritization
Link ID	■ Use this parameter to avoid connecting a unit to a wrong peer if there are several co-located units using the same center frequency ■ Specify different ID values for different link. Both ends of the same link must have the same ID. The value range is 0…15 in increments of 1
Downlink Frequency	■ Allows you to configure the downlink center frequency in MHz (can be different from the UL frequency for the models which support H-FDD) ■ Downlink Frequency refers to the set frequency for communication in downlink direction - from the Master unit to the Slave unit
Uplink Frequency	■ Allows you to configure the uplink center frequency in MHz (can be different from the DL frequency for the models which support H-FDD) ■ Uplink Frequency refers to the set frequency for communication in uplink direction - from the Slave unit to the Master unit
Channel Width	■ Allows you to configure the channel width (in MHz). The possible values are: 10, 20 or 40 MHz
Transmit Power	■ Allows you to configure the transmit power level (in dBm). The value range is 0…27 dBm in increments of 1 dBm
Maximal MCS	■ Allows you to configure the maximum MCS that can be used
AMC Strategy	■ Allows you to select the AMC algorithm strategy: - "conservative" assumes using higher CINR thresholds in order to minimize the error rate

Radio parameter	Description
	- "aggressive" lowers the thresholds in order to use higher modulation levels and thus increase the throughput - "normal" represents a balance between the error rate and throughput values
TDD Synchronization	■ Allows you to configure the TDD synchronization source: - "freerun" unsynchronized frame start - "gnss" synchronization from built-in GPS/GLONASS receiver
Frame period (ms)	■ Allows you to set the air frame period duration (in ms). The value range is 1, 2, 5 or 10 ms - A shorter frame period gives lower latency, but also has higher overheads - Using longer frame periods cuts down overheads, but increases the latency - Also, air frames higher than 2 ms allow using the link at higher distances
Requested Downlink Quota (%)	■ Allows you to set the desired downlink/uplink ratio through specifying the downlink subframe period relative to the whole frame. The value range of the parameter is 10…90 in increments of 1 ■ Actual downlink/uplink ratio might be different due to internal system limitations. The system chooses the closest available ratio automatically which can be checked in the Status page or by checking the output of the "xg capabilities" command
Max Distance (meters)	■ Allows you to specify the maximum link distance (in meters) ■ The specified value must not be lower than the actual link distance, but it is recommended keep it as close as possible to the actual distance to avoid unnecessary overheads ■ The recommended strategy is to set this parameter well above the actual distance and fine-tune it to actual distance plus 200-300 m after the units have been deployed based on the measured distance value taken from "xg stat" output

Table 32 - Radio settings

CAUTION

Setting the source of synchronization takes effect only for the Master unit

CAUTION

Make sure that the built-in GNSS receiver is set up before enabling the “**gnss**” option (use “**gps**” command to check the status - it is recommended to use values of “**HDOP**” parameter up to 1.5 for reliable global timing synchronization)

CAUTION

Please note that the following settings must be equal for the co-located units:

- Channel width
- Maximal distance
- Air frame period
- Downlink/uplink ratio
- All co-located units must be **Master units**

5.6.3.2. Frequency Grid and Limitations

The licensed frequencies range per each bandwidth is displayed in the “Default Frequency Limitation” fields:

- For 10 MHz bandwidth: value range between 4905...5995 MHz in increments of 10 MHz
- For 20 MHz bandwidth: value range between 4910...5990 MHz in increments of 20 MHz
- For 40 MHz bandwidth: value range between 4920...5980 MHz in increments of 20 MHz

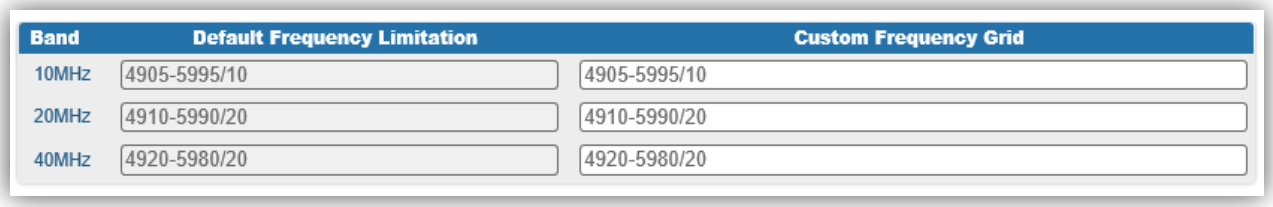


Figure 43 - Default frequency grids

Changes to these default values can be performed in the “Custom Frequency Grid” fields, whre you can:

- Limit the licensed frequencies range per each bandwidth

- Change the center frequency step (for example, 4950-5900/2.5 means that the step between the center frequencies from 4950 GHz and 5900 GHz is 2.5 MHz):

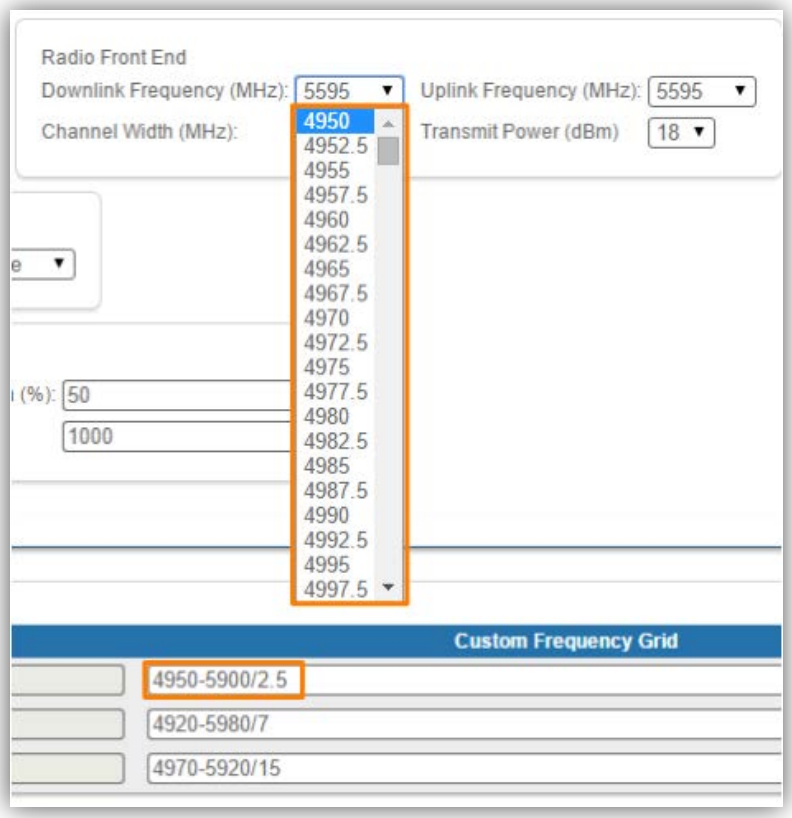


Figure 44 - Custom frequency grids

The step must be >= 1 MHz and the frequencies range (determined by the license) cannot be exceeded.

5.6.4. Switch

The switch page allows you to configure the ports of the unit and the switching related features.

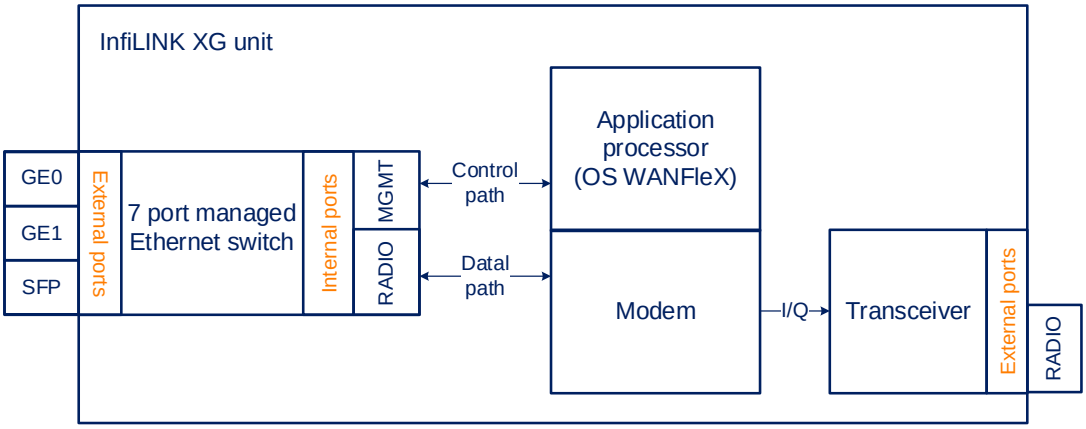


Figure 45 - InfiLINK XG block diagram

NOTE

Please make the distinction between the internal RADIO port of the Ethernet switch used for the data path separation and the external RADIO port of the unit.

The following 5 ports are available at InfiLINK XG:

- **GE0** and **GE1** ports - external copper Gigabit Ethernet ports 1000BASE-T (IEEE 802.1ab)
- **SFP** port - external optical Gigabit port for plugging of the optical SFP transceiver module
- **RADIO** port - internal radio interface of the device
- **MGMT** port - internal interface for the device management.

The switch page has four section:

- Switch port Settings section
- Port Interconnection Schema section
- Connectivity matrix section
- VLAN-based Switching section

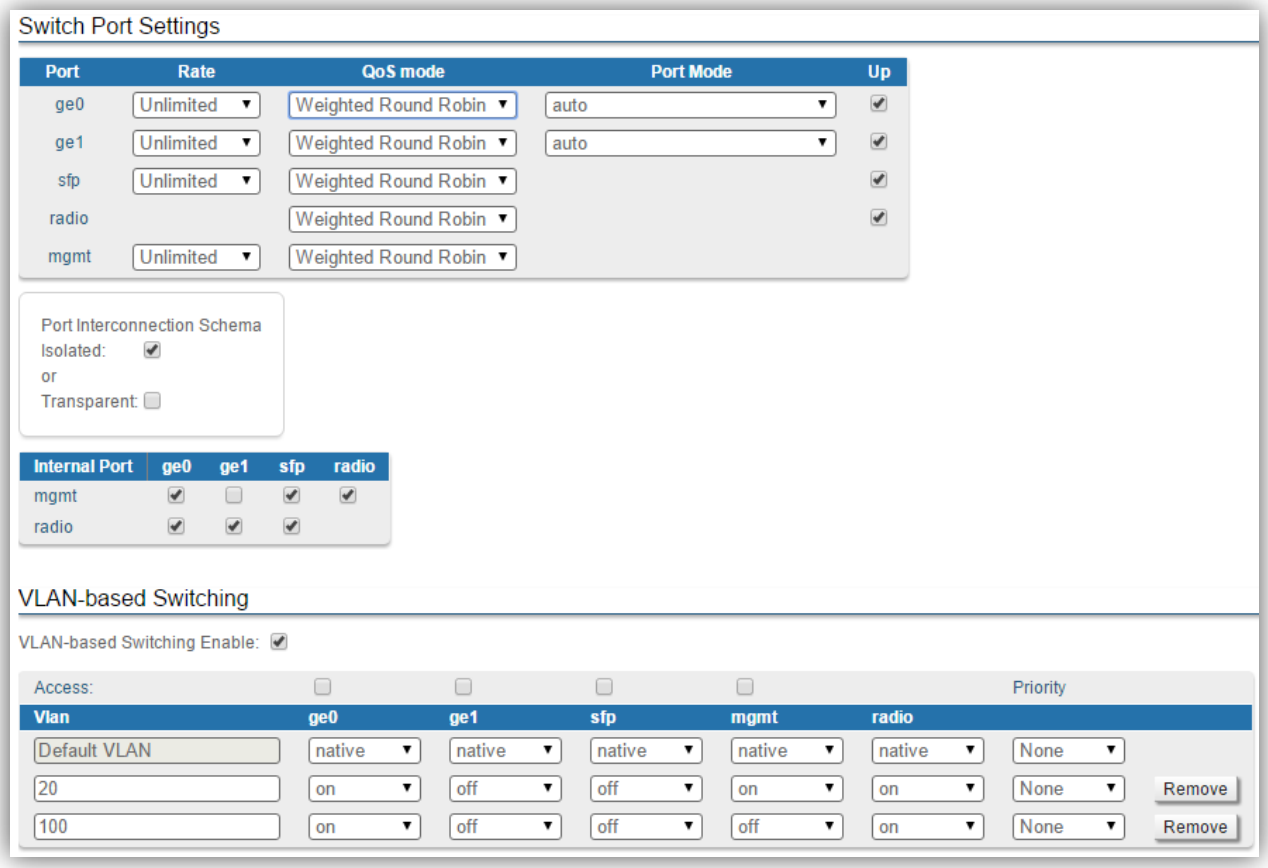


Figure 46 - Switch Port Settings section

- **Switch Port Settings** - allows you to perform general port configuration

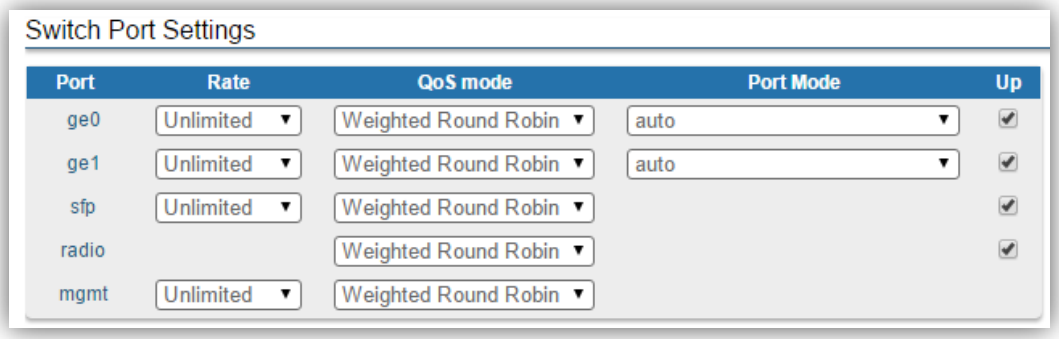


Figure 47 - Switch Port Settings section

The following port parameters can be customized:

Parameter	Description
Rate	■ You can set the limit (traffic shaper) on the selected port, for outgoing traffic, in Mbps, from 1 to 100 in increments of 1, from 100 to 1000 in increments of 10, or to set it unlimited
QoS mode	■ You can select the traffic shaper policy for the port, WRR is selected by default - "weighted round robin" - weights are used for every queue of an interface, which allows different queues to have different service shares depending on the weight value - "strict" - packets within lower priority queue are not processed if the higher priority queue is not empty
Port Mode	■ You can select the physical port operational mode from: - auto: the speed and operational mode of the port will be negotiated between the 2 end points - 10BaseT-halfduplex;10BaseT-halfduplexmanual; 10BaseT-fullduplex;10BaseT-fullduplex-manual - 100BaseTX-halfduplex; 100BaseTX-halfduplex-manual; 100BaseTX-fullduplex; 100BaseTX-fullduplex-manual - 1000BaseTX-fullduplex;1000BaseTX-fullduplex-manual
Up	■ You can enable or disable the port status

Table 33 - Port parameters

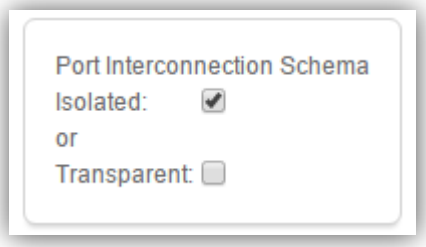
NOTE

Manual settings for the Port Mode will disable the negotiation and detection for speed and duplex. Use them in case that the interconnected 3rd party switches have fixed speed and duplex settings.

■ **Port Interconnection Schema** allows you to select the switch operation mode:

- **Isolate:**All traffic switching is allowed ONLY between external (GE0, GE1, SFP) and internal ports (Mgmt and internal radio). Thus, direct switching between external ports is forbidden (for example, between GE0 and GE1)

- **Transparent:** packet switching is allowed between external and internal



ports

Figure 48 - Port Interconnection Schema section

- **The connectivity matrix** allows you to enable or disable switching between internal and external ports of the switch.

Figure 49 - Connectivity matrix section

For example, it is quite easy to disable management of the unit via wireless link just by disabling check box between “mgmt” and “radio” ports. Example shown below

Figure 50 - Connectivity matrix section

- **VLAN-based Switching** allows to create list of allowed VLANs and their handling on InfiLINK XG switch plane. Without such option active, wireless link works as transparent Layer2 bridge. Thus, the link transport any frames with any VLAN tags set.

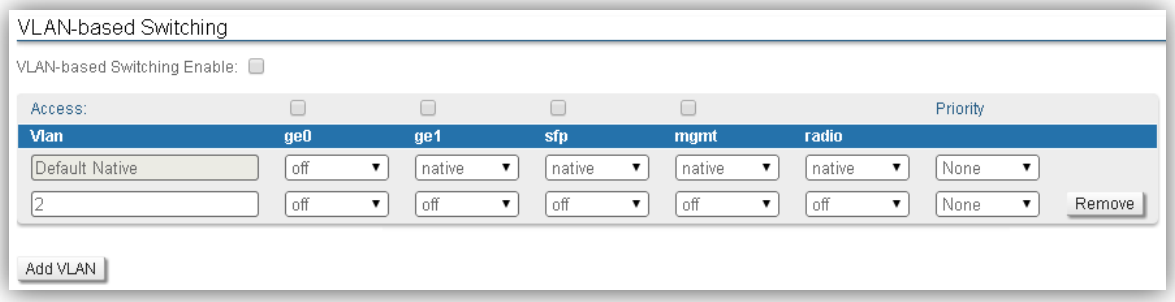


Figure 51 - VLAN-based Switching section

5.6.5. VLAN Switching

The following configuration can be performed in order to customize the VLAN-based switching operation of the InfiLINK XG unit:

- Create management VLAN
- Allow single VLAN and change of operational port mode
- Configure a native VLAN
- Allow multiple VLANs
- Assign per-VLAN 802.1p priorities (also described in the QoS section above)

Switch default configuration works as transparent Layer2 bridge. Therefore, by default any frames with any VLAN tags (and untagged frames too) will flow freely through wireless link.

5.6.5.1. Management VLAN configuration

It is possible to add management VLAN configuration and to keep transparent Layer2 bridging operational. It is the simpliest and sufficient configuration for vast number of cases.

- Go to the Network Access menu page in the Web interface. Add the management IP address and associate it with VLAN 100 (example):

Figure 52- Adding a management IP address and associate it with VLAN 100

- Click on the “Apply” button to save the changes

NOTE

Now, our InfiLINK XG has two management interfaces:

10.10.10.10 for untagged frame

10.10.20.1 for VLAN 100

All frames with any VLAN tags will be transparently switched through link

Security considerations imply to remove management interface for untagged frames, leaving only management VLAN access operational.

Meanwhile, such simple, yet efficient configuration do not allow to restrict any other VLAN transport except management VLAN.

In order to allow switching of selected VLANs only, please proceed to next chapters.

5.6.5.2. Allow single VLAN and change of operational port mode

First: enable VLAN-based Switching.

Once the VLAN-based switching is enabled, the default switching configuration is automatically displayed and it shows the Default VLAN as native VLAN for all ports:

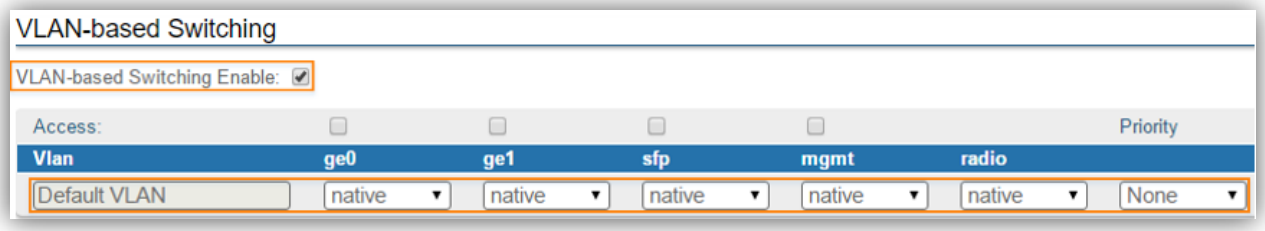


Figure 53 - Default switching configuration

NOTE

The Default VLAN (or VLAN 1) is the only defined VLAN and it cannot be deleted. Multiple VLANs can be afterwards added and configured as desired for each port.

All ports are by default in trunk mode, but the native VLAN allows both tagged and untagged traffic to pass. The operational mode of a port is described in the next section.

Now only traffic allowed in VLAN-based Switching matrix is allowed.

Second: you can allow transport of new VLAN by click to the «Add VLAN» button.

1. Click on the “Add VLAN” button
2. VLAN 2 is added by default. Modify the value for the VLAN tag according to the actual requirements

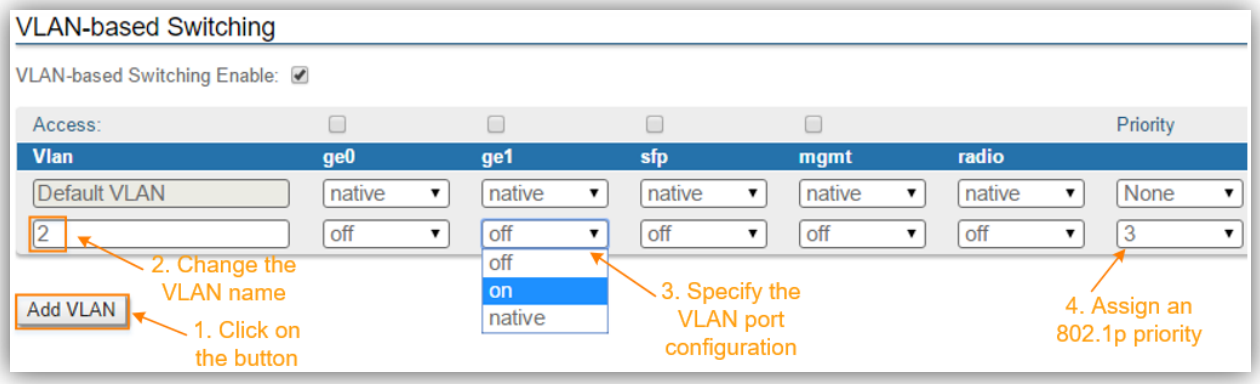


Figure 54 - Adding and configuring a new VLAN

3. The VLAN just added is by default disabled (“off”) on all the ports. The following options are available for the port configuration:

- “on”: allows the VLAN to pass through that port
- “off”: does not allow the VLAN to pass
- “native”: allows the VLAN to pass, but also allows the untagged traffic to pass through that port

4. Assign an 802.1p priority. The packets received at the wired interfaces can be marked with an 802.1p priority. “0” is the lowest priority and “7” the highest.

The following options are available for VLAN configuration:

- **Access mode** (allows untagged traffic from certain VLAN only)
- **Trunk mode** (allows tagged traffic only)

To configure the access mode or trunk mode, you need to enable or disable the “Access” checkbox for each port. In the example below, the ge0 port is in trunk mode and the ge1 port is in access mode.

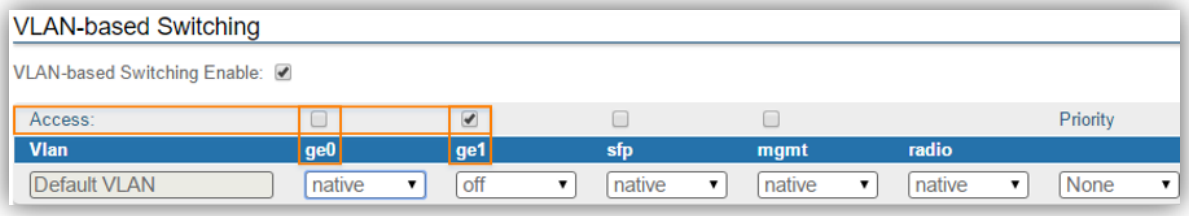


Figure 55 - Configuring the operational mode of a port

To send and receive tagged and untagged traffic the **native** VLAN option should be used. Native VLAN defines the VLAN tag number, which can receive all incoming untagged traffic (for example, by default VLAN1 is configured as a Native VLAN for all the ports).

In order to allow both tagged and untagged traffic to pass in trunk operational mode, a native VLAN can be configured. The details about the native VLAN and specific operation are described in the following section Configuring a native VLAN.

NOTE

Changing the operational mode of a port to the access mode will disable all VLANs on that port automatically. More specifically, the VLANs that are set to “on” or “native” for that port will be changed automatically to “off”. Please check section 7.2.4 for more details about the on/off/native status of a VLAN.

- **Priority**: use this option to set the priority to the certain VLAN in compliance with 802.1p, from 0 to 7 in increments of 1

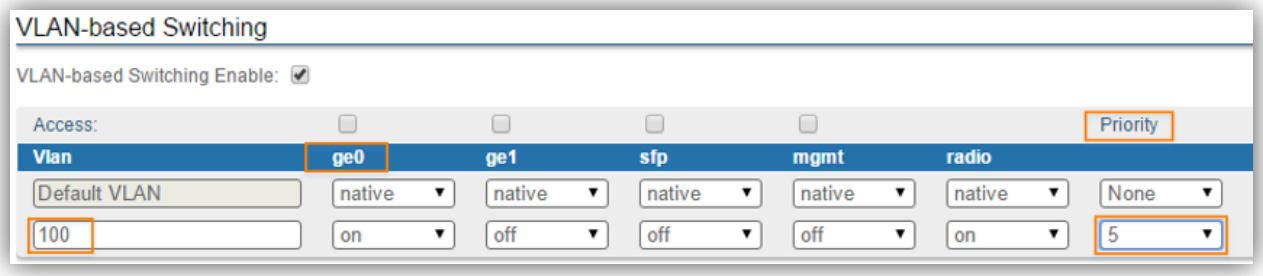


Figure 56 - Configuring per-VLAN 802.1p priorities

- **Port state**: allows you to specify if a VLAN should be allowed to pass by the port ("on" option), denied ("off") or if the VLAN should be a native one for the specific port ("native" option). Only one native VLAN per port.

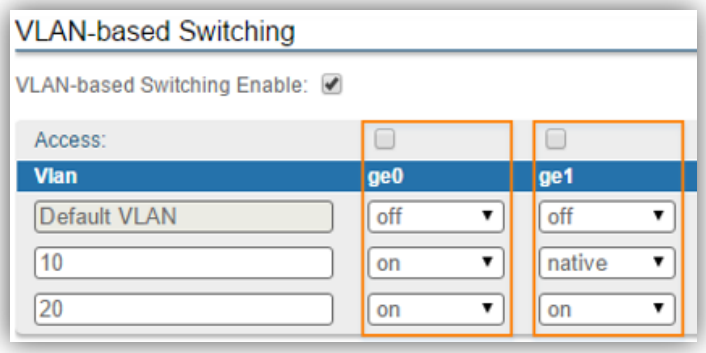


Figure 57 – Different port state values

5.6.5.3. Configuring native VLAN

A port that is set to the trunk operational mode allows only tagged traffic to pass. However, one of the VLANs allowed to pass through that port can be configured as native VLAN and it will be the only VLAN that will allow to pass all the untagged traffic at the reception. Therefore, the native VLAN will pass both tagged and untagged traffic.

To be noted that there can be **maximum one native VLAN for each port!**

The Default VLAN or VLAN 1 is by default configured as native VLAN for all the ports:

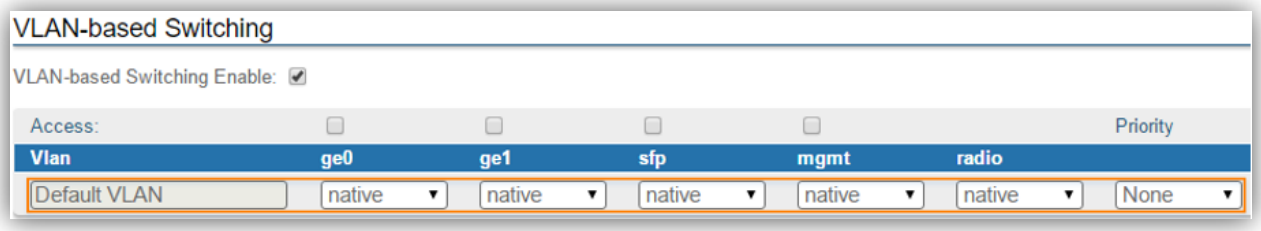


Figure 58 - Default native VLAN configuration

You can customize the native VLAN configuration according to the specific requirements. For example, there can be ports that should allow only tagged traffic to pass and ports that allow both tagged and untagged traffic.

Example - Port ge0 and ge1 should allow only VLANs 10 and 20 to pass. Additionally, port ge1 should also allow the untagged traffic.

In this case, no native VLAN should be configured for the ge0 port and port ge1 should have VLAN 10 or 20 configured as native VLAN. The default VLAN should be set to “off” on both ports, otherwise VLAN 1 will be allowed to pass!

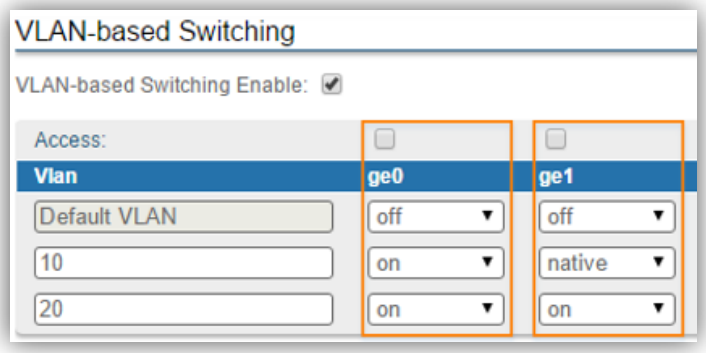


Figure 59 - Native VLAN configuration example

NOTE

Changing the native VLAN, will automatically disable the Default VLAN, by setting it to “off” on the specific port.

NOTE

When a different VLAN besides the Default VLAN is set as native, the “native” option becomes unavailable for all other VLANs. In order to change the native VLAN in this case you have to first remove the current native VLAN by changing the state to “on” or “off”. After this, the “native” option is again available for all other VLANs.

5.6.5.4. Allow multiple VLANs

This section will describe step by step how to configure separate VLANs for management and for the data traffic as follows:

- VLAN 100 is used for the management of the unit
- VLAN 200 is used for the data traffic

NOTE

In order to configure the VLAN based management access, it is necessary to associate the IP address of the management interface with the management VLAN 100. If you begin by enabling the VLAN-based switching and remove the native VLAN, you will lose contact with the unit and ERConsole must be used for recovery.

1. Go to the Network Access menu page in the Web interface. Add the management IP address and associate it with VLAN 100

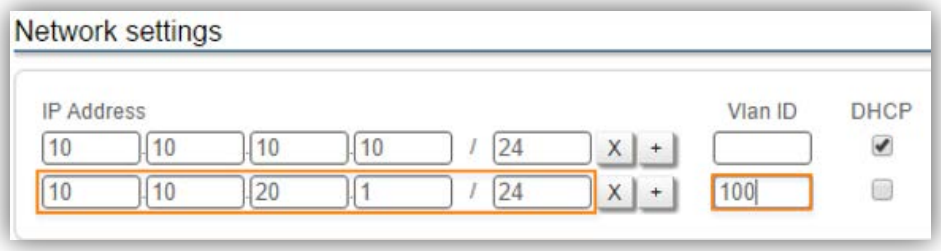


Figure 60 - Adding a management IP address and associate it with VLAN 100

2. Click on the “Apply” button to save the changes

NOTE

The IP address just configured cannot be used at this moment for the management of the unit because VLAN 100 has not been added yet. The unit will be accessed for the moment using the initial management IP address, in this case 10.10.10.10.

3. Go to the Switch menu page and enable VLAN-based switching

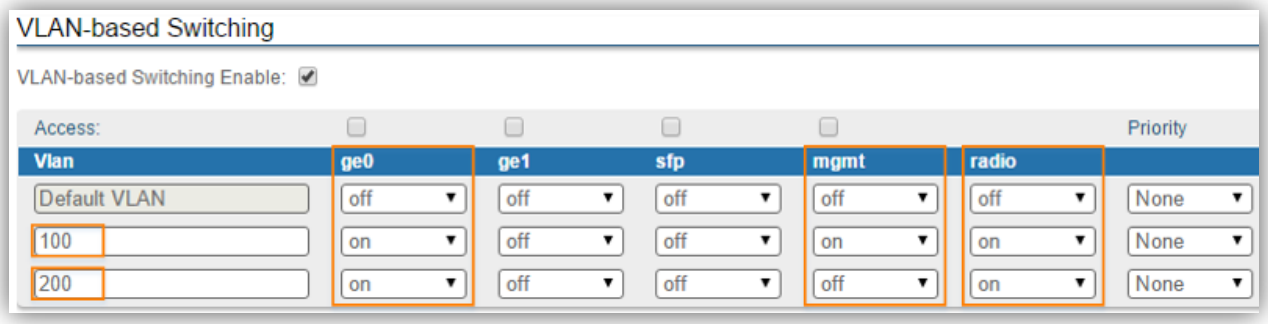


Figure 61 - VLAN-based switching configuration

4. Add VLAN 100 and allow it to pass through the ge0, mgmt and radio ports. This way, the management will be enabled both locally and over the air using VLAN 100

5. The default VLAN cannot be removed, so it is necessary to set it off on all the ports in order to deny access using untagged traffic (“native”) or traffic tagged with VLAN 1

6. Add VLAN 200 for the data traffic and allow it to pass through the ge0 and radio ports. Since management is not allowed on VLAN 200, it should be set to “off” at the mgmt port

7. Click on the “Apply” button to save the changes

At this point, the access to the unit is allowed using only VLAN 100 and the newly assigned IP address. Traffic tagged with VLAN 200 will be switched only between

the ge0 and the rf ports. Untagged traffic or traffic tagged with other VLANs besides 100 or 200 is not allowed!

5.6.5.5. Trunk and Trunk VLAN example

Installation which require VLAN tagged frames to flow in both directions through InfiLINK XG wireless link do not require any specific configuration. Just due to security reasons it is recommended to set up Management VLAN. All the rest configurartion is not needed in most cases, except the issue to deny certain VLANs. Please, use the configuration steps from chapter **5.6.5.1. Management VLAN configuration**

5.6.5.6. Access and Trunk VLAN example

Another example is very common for ISP installation. One InfiLINK XG receive VLAN tagged frames from switch trunk port (port configured to carry frames with different VLAN tags), another InfiLINK XG connects **with end-customer LAN with requirement to egress untagged frames from certain VLAN only. Please see the diagram below.**

Figure 62 – Trunk and Acess VLAN example

Brief actions to configure for XG1 :

- Create management VLAN 100
- Enable VLAN-based switching
- Add VLAN 100, 200

Brief actions to configure for XG2 :

- Create management VLAN 100
- Enable VLAN-based switching
- Add VLAN 100, 200
- Set access port settings for VLAN 200

Configuration of XG1:

1. Go to the Network Access menu page in the Web interface. Add the management IP address and associate it with VLAN 100

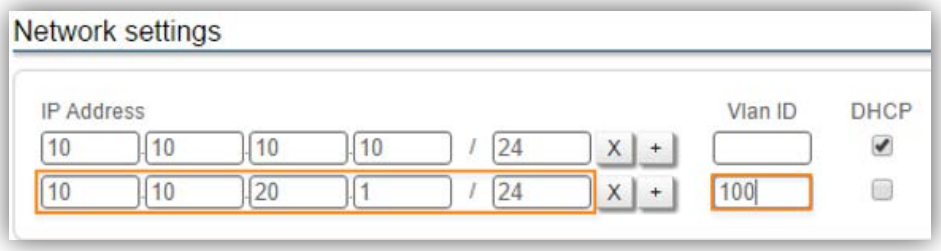


Figure 63 - Adding a management IP address and associate it with VLAN 100

2. Click on the “Apply” button to save the changes

3. Go to the Switch menu page and enable VLAN-based switching

Figure 64 - VLAN-based switching configuration

4. Add VLAN 100 and allow it to pass through the ge0, mgmt and radio ports. This way, the management will be enabled both locally and over the air using VLAN 100

5. The default VLAN cannot be removed, so it is necessary to set it off on all the ports in order to deny access using untagged traffic (“native”) or traffic tagged with VLAN 1

6. Add VLAN 200 for the data traffic and allow it to pass through the ge0 and radio ports. Since management is not allowed on VLAN 200, it should be set to “off” at the mgmt port

7. Click on the “Apply” button to save the changes.

At this point, the access to the unit is allowed using only VLAN 100 and the newly assigned IP address. Traffic tagged with VLAN 200 will be switched only between the ge0 and the rf ports.

Configuration of XG2:

1. Go to the Network Access menu page in the Web interface. Add the management IP address and associate it with VLAN 100:

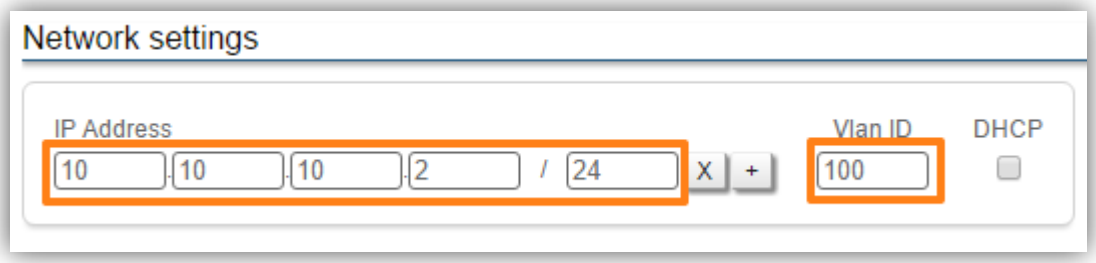


Figure 65 - Adding a management IP address and associate it with VLAN 100

2. Click on the “Apply” button to save the changes
3. Go to the Switch menu page and enable VLAN-based switching:
4. Add VLAN 100 and allow it to pass through the mgmt and radio ports. This way, the management will be enabled over the air using VLAN 100
5. The default VLAN cannot be removed, so it is necessary to set it off on all the ports in order to deny access using untagged traffic (“native”) or traffic tagged with VLAN 1
6. Add VLAN 200 for the data traffic and allow it to pass through the ge0 and radio ports. Since management is not allowed on VLAN 200, it should be set to “off” at the mgmt port
7. Mark **Access** checkbox for ge0 in order to remove all tags for traffic to customer’s LAN

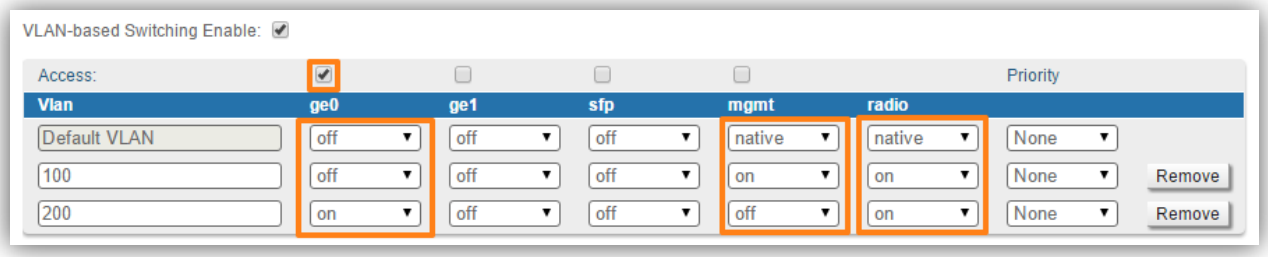


Figure 66 - VLAN-based switching configuration

8. Click on the “Apply” button to save the changes

At this point, the access to the unit is allowed using only VLAN 100 and the newly assigned IP address. Traffic tagged with VLAN 200 will be received by rf port and switched untagged to customer’s LAN through ge0 port.

5.6.6. SNMP

The SNMP protocol support is an important feature of all communication devices because it allows the system administrator to manage the operation of a network as a whole, as well as of each component.

SNMP section contains a set of parameters to exchange data about network activity of the device.

The SNMP Protocol has two sides, the agent and the management stations:

- The agent sends data to the management station
- The management station collects data from all the agents on the network. You can set several destinations of traps with individual set of traps as well as several users with individual access rights
- The agent sends alerts called traps (see Traps zone) and answers requests that were sent by the management station
- The management station captures and decodes the traps. The management station also requests specific information from the agent
- The information is passed through requests and replies with the use of the MIB
- The management station is responsible for decoding the SNMP packets and providing an interface to the administrator. The interface can be a GUI or a command line.

5.6.6.1. SNMP settings

In the SNMP settings section, you can view and edit the current SNMP access settings; you can delete the current SNMP v.3 users by clicking the «Remove SNMP User» button or create new ones by clicking the «Add SNMP v3 User» button:

SNMP access parameter	Description
Start SNMP	■ Enable/disable SNMP daemon in the device
Version 1 enable	■ Enable/disable SNMP v.1 and v.2c support ■ The first version of the SNMP protocol lacks security in the operation of the protocol itself, which hinders its use for network management, so SNMP v.1 and v.2c works only in read-only mode ■ By default, it is enabled
Community	■ Set the community name for read-only mode (SNMP v.1

	and v.2c only) ■ The default SNMP v.1 and v.2c community name is "public" ■ It is a security method for SNMP v.1 and v.2c, as Agents can be set to reply only to queries received by accepted community names ■ In SNMP v.1 and v.2c the community name passes along with the data packet in clear text
Contact	■ Set the contact information ■ Used as a reference information about the device owner
Location	■ Set the geographical location where the unit is installed ■ Used as a reference information about physical device's location
User Name	■ Set the authorization user name of SNMP v.3
Password	■ Set the authorization password of SNMP v.3
Security	■ Set the security level: - the lowest level means no authentication or privacy (No Authorization No Privacy), you have to set the User Name only - the medium level means authorization and no privacy (Authorization No Privacy), you have to set User Name and Password - the highest level means authorization and privacy (Authorization and Privacy), you have to set the User Name, Password and Privacy Password
Read only	■ Enable/disable the read-only permission ■ Read/Write is the default value
Admin	■ Enable/disable the full access to the variables ■ For example, the ability to reboot the device ■ Limited access is the default value
Privacy Password	■ Set the privacy password ■ It is necessary when privacy is enabled for the required security level
Privacy Protocol	■ Set the encryption method for SNMP v.3: DES/AES128

Table 34 - SNMP Access

5.6.6.2. SNMP 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 zone focuses on SNMP Traps agent configuration.

In this section, you can view and edit the current SNMP traps settings. You can clone, remove and clear target and traps by clicking the corresponding buttons:

SNMP traps parameter	Description
Enable SNMP Traps	■ Enable/disable to send SNMP traps
Agent IP	■ Set the IP address of the device which sends traps; it is normally the IP address of the InfiNet Wireless unit
Destination	■ Set the IP address of the server (InfiMonitor, for example) and the UDP port (162 port is commonly used)
V2	■ Enable/disable SNMP v.2

Table 35 - SNMP Traps

The check boxes below specify traps or trap groups that are sent to the server:

SNMP trap types	Description
radioGroup	■ Events which are related to changes of radio link parameters
radioFreqChanged	■ The Frequency has changed
radioBandChanged	■ The Band has changed
others	■ Other changes in network
linkEvent	■ One of the communication links represented in the agent's configuration has come up or come down
trapdColdStartEvent	■ Cold Start event has occurred

snmpdAuthenticationFailureEvent	■ Not properly authenticated SNMP protocol message has been received
syslog	■ Events about messages recorded in a system log

Table 36 - SNMP Trap Types

Clink the «Clone» button if you need to setup multiple SNMP servers. Each server can have an individual set of traps directed toward it.

Click the «Clear» button in order to clear all check-boxes for the current server.

NOTE

Read the information at the end of the Settings section in order to find out the output of the «Apply», «Try» and buttons for the new configuration performed.

5.6.7. Apply and Try buttons for the configuration

After performing the needed configuration in the Settings menu, you must save all the new parameters by clicking on the «Apply» button. If you are not sure about the effect of the new configuration performed, you can apply the new configuration temporarily by clicking on the «Try» button. The previous configuration is automatically restored after a grace period of 180 seconds (3 minutes). You have the options to extend the grace period by choosing «Postpone», or immediately accept/reject the changes by choosing «Commit» or «Undo».

Figure 67 - The options after clicking on the «Try» button

After clicking on the «Apply» button for saving the new configuration, the system will redirect you to the login page. After a 5 seconds timer you can log in back to the unit and check the new configuration.

5.6.8. Configuring QoS

Quality of Services (QoS) techniques aim to ensure a reliable transmission for all type of services, especially for the most demanding ones, in terms of delay, jitter, packet loss and availability. The QoS techniques are applied from inbound to outbound and include: traffic selection and prioritization, queuing, packet scheduling and traffic shaping.

QoS strategies were introduced for the InfiLINK XG units in order to be able to customize the balance between the maximum achievable capacity and the allowed packet loss for the priority packets. The QoS capabilities of the unit fall in two categories:

- QoS wired interface capabilities
- QoS radio interface capabilities

5.6.8.1. QoS wired interface capabilities

The wired interface capabilities of InfiLINK XG unit are the following:

- **Traffic selection and prioritization based on 802.1p**

The IEEE 802.1p standard provides the means to implement QoS techniques at Layer 2 (MAC layer). QoS is implemented using a 3 bit field called Priority Code Point (PCP) part of the Ethernet header when 802.1Q VLAN tagging is in use.

There are eight 802.1p priorities, “0” being the lowest and “7” - the highest. The InfiLINK XG unit is capable to recognize and prioritize packets received on the wired interfaces. Each packt will be further sent to a specific priority queue.

- **Four hardware priority queues on InfiLINK XG**

Each received packet is sent to one of the 4 priority queues based on the PCP field that contains the 802.1p priority.

When the actual traffic load reaches the egress rate, the switch will favor the transmission of the highest priority packets in the detriment of the lower priority ones.

The mapping between the 802.1p priorities and the 4 queues can be found below:

802.1p priority	Traffic type	InfiLINK XG priority queue
0	Background	1
1	Best Effort	
2	Excellent Effort	2
3	Critical Applications	
4	Video	3
5	Voice	
6	Internetwork control	4
7	Network control	

Table 37 - Priority queues mapping

- **Strict or weighted round robin packet scheduling algorithms**

The packet scheduling algorithms available for determining how the packets shall exit the priority queues are the following:

- **Strict priority queuing**: packets from lower priority queues are delayed in case higher priority queues has traffic
- **Weighted round robin**: weights are used for every queue of an interface, which allows different queues to have different service shares depending on the weight value

- **Per-port egress rate limiting**

Traffic shaping can be configured by limiting the egress rate on a selected wired port.

In order to configure per-port egress rate limiting go to the “Switch” menu page in the Web interface and set the **“Rate”** parameter for a specific wired interface. In the example below, the traffic outgoing at the ge0 interface is limited to 100 Mbps. It can be also noticed that the radio interface does not have available the option of configuring a rate limit. Radio throughput depends only on current modulation:

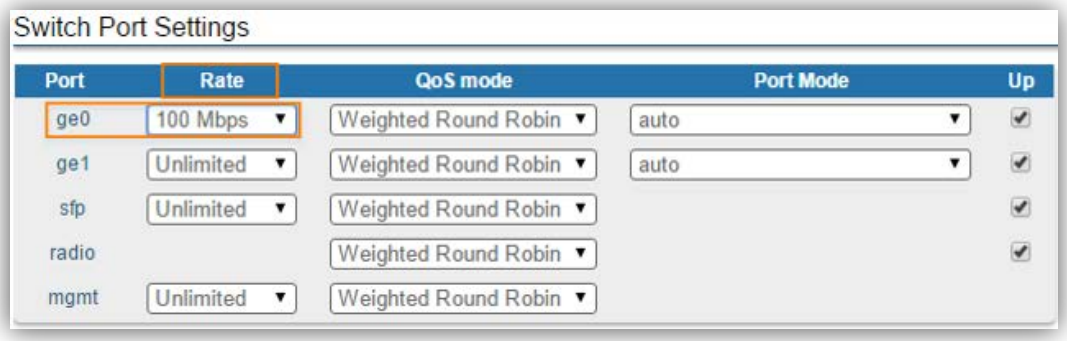


Figure 68 - Configuring per-port egress rate limiting

5.6.8.2. QoS radio interface capabilities

The radio interface QoS capabilities of the InfiLINK XG unit are the following:

- **Traffic selection and prioritization based on 802.1p**

The packets received at the radio interface that are marked with an 802.1p priority will be recognized and sent to a specific priority queue.

- **Four priority queues**

The same considerations mentioned for the wired interface capabilities are valid: each received packet is sent to one of the 4 priority queues based on the PCP field that contains the 802.1p priority.

When the actual traffic load reached the egress rate, the switch will favor the transmission of the highest priority packets in the detriment of the lower priority ones.

Strict or weighted round robin packet scheduling algorithms

The strict priority queuing or weighted round robin scheduling alorithms can be configured for the packets received at the radio interfaces and exiting the priority queues:

- **Strict priority queuing:** packets from lower priority queues are delayed in case higher priority queues has traffic
- **Weighted round robin:** weights are used for every queue of an interface, which allows different queues to have different service shares depending on the weight value.

No matter the interface on which the packets were received, one of the two packet scheduling algorithms can be configured in order to determine the strategy for emptying the priority queues.

Go to the “Switch” menu page in the Web interface and configure the **“QoS mode”** parameter in the “Switch Port Settings” section. In the example below the “Weighted Round Robin” is configured for the ge0 interface and the “Strict” scheduling algorithm is configured for the radio interface:

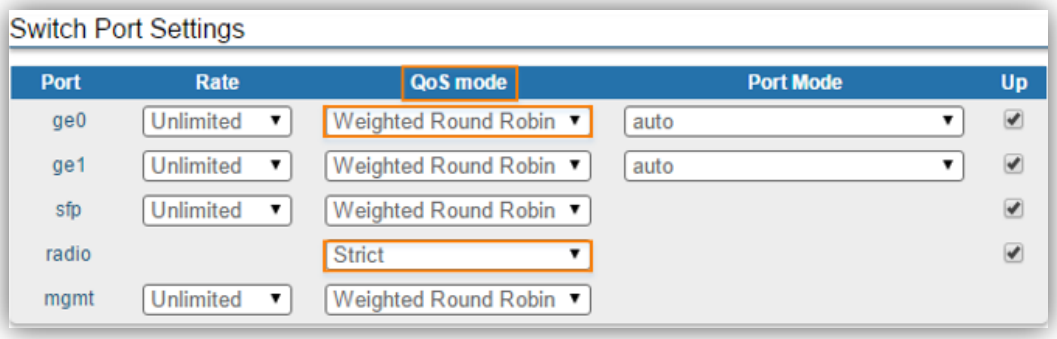


Figure 69 - Configuring the packet scheduling algorithm

Three QoS strategies

Three QoS strategies are available for the radio interface transmission in order to accommodate different packet loss requirements for the high priority packets:

- **Aggressive:** maximal throughput performance, but up to 10% priority packet loss
- **Conservative:** no priority packet loss allowed, but up to 10% peak throughput decrease compared to the aggressive strategy

- **Normal:** minimal priority packet loss allowed, with less than 10% capacity decrease

In order to configure the appropriate QoS strategy, go to the “Radio” menu page in the Web interface and set the **“QoS Strategy”** parameter value:

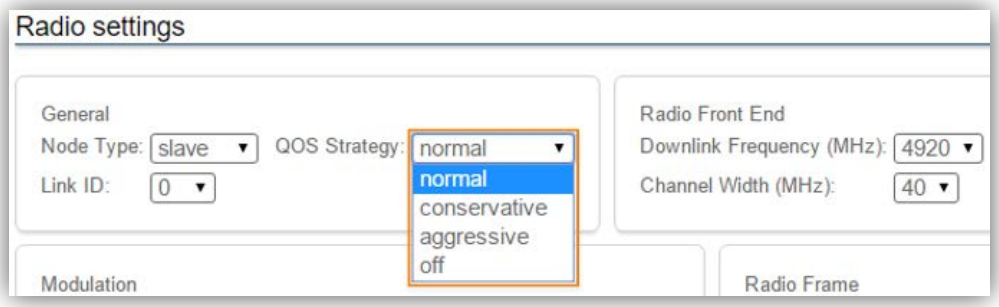


Figure 70 - Configuring the QoS strategy

5.6.9. Configuring per-VLAN 802.1p priority assignment

The packets received on the wired interface can be marked with a specific 802.1p priority.

Example - configuring 802.1p priority 5 for the traffic received on VLAN 100 at ge0

The 802.1p priority assignment takes place only for the incoming packets with 802.1Q tags (VLAN tags) at the wired interfaces. In order to specify the 802.1p priority associated to a VLAN, go to the “Switch” menu page in the Web interface then proceed to add new VLAN:

Click on the “Add VLAN” button

1. VLAN 2 is added by default. Modify the value for the VLAN tag according to the actual requirements:

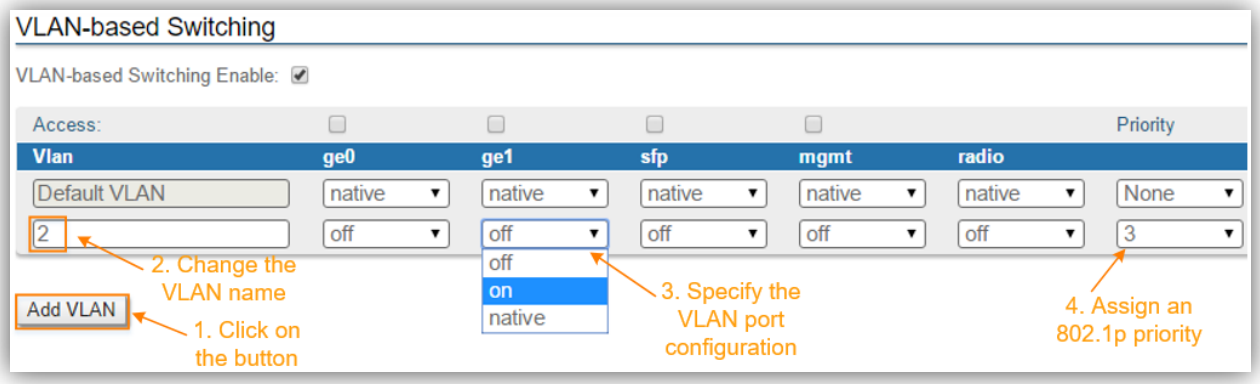


Figure 71 - Adding and configuring a new VLAN

2. The VLAN just added is by default disabled (“off”) on all the ports. The following options are available for the port configuration:

   - **“on”**: allows the VLAN to pass through that port
   - **“off”**: does not allow the VLAN to pass
   - **“native”**: allows the VLAN to pass, but allows also the untagged traffic to pass through that port.

3. Assign an 802.1p priority. The packets received at the wired interfaces can be marked with an 802.1p priority. “0” is the lowest priority and “7” - the highest.

Below, we can see how 802.1p priority 5 was assigned to the traffic received with VLAN 100 at the ge0 interface. Priority 5 will not be assigned to the traffic incoming at the radio interface even if VLAN 100 is allowed to pass through the radio interface in the example below

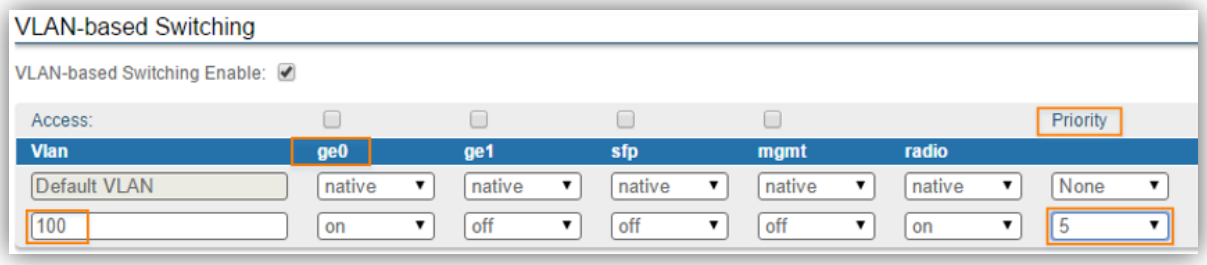
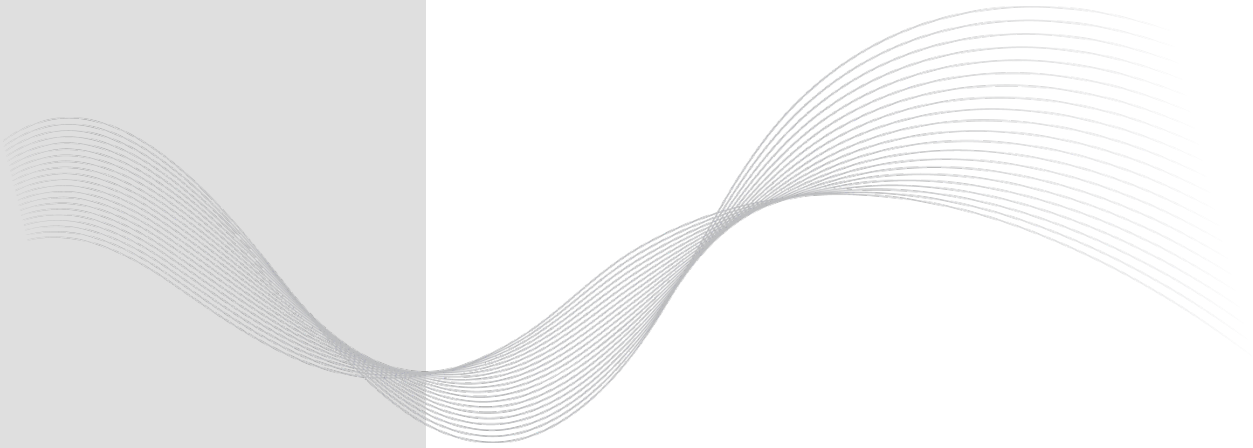


Figure 72 - Configuring per-VLAN 802.1p priorities

Troubleshooting

Chapter 6



6.1. Introduction

In this chapter are presented the basic troubleshooting actions to be taken in case a problem occurs to the InfiLINK XG wireless link. The general fault classification can be checked below and the detailed indications for fault handling are described in the subsequent sections.

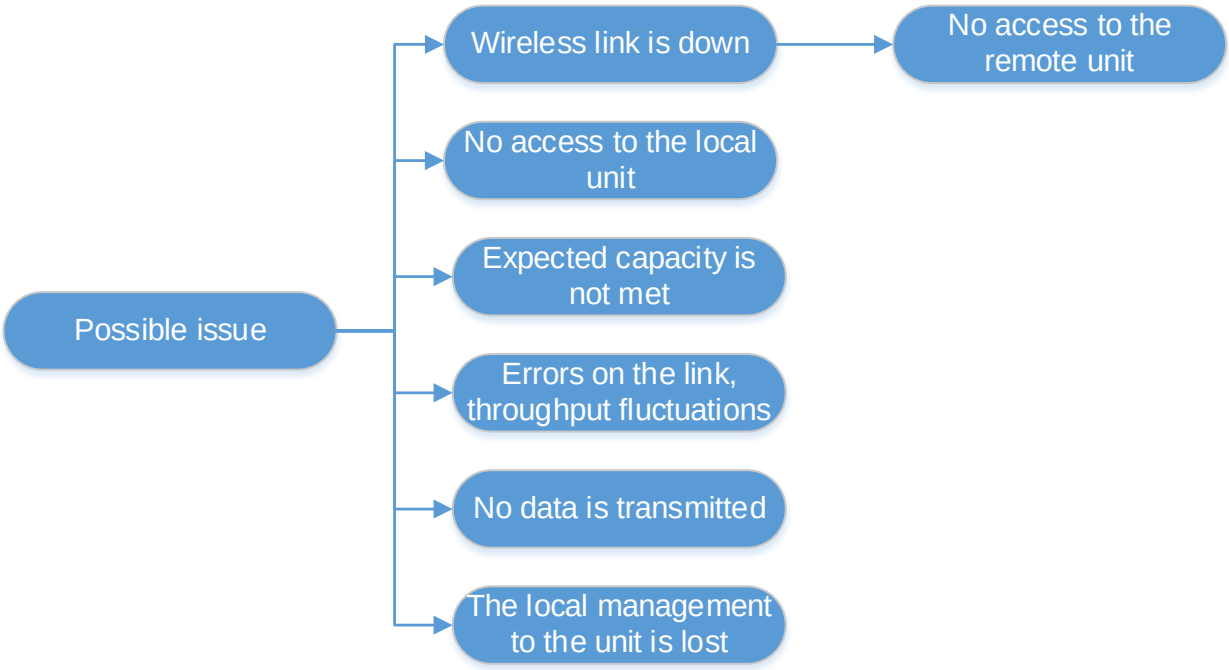


Figure 73 - Basic faults classification

Preliminary definitions:

- For each radio link, the local unit will be considered the one closest to the monitoring center and the remote unit will be its peer end like in the picture below
- If the radio link (between the local unit and the remote unit) or the Ethernet connection (between the monitoring center and the local unit) become unavailable, all units/equipment behind the failure point will be unreachable. The debugging should begin in this case, at- the unit that is closest to the failure point and has management access

Figure 74 - Monitored wireless link

6.2. The wireless link is down (it got lost)

Problem	Debugging steps; possible cause & solution
The wireless link is down and there is no access to the remote unit, but there is access to the local unit	1. Check the values of the radio parameters in the Radio page of the local unit to verify if they correspond to the settings from the radio planning stage: - max distance - uplink/downlink frequenciy - channel width - transmit power - maximal MCS - frame period - node type - link ID - custom frequency grid If some of the parameters have different values, perform the modifications and check the wireless link establishment after unit reboot. In case the wireless link is still down, go on site to the location of the local unit and check the integrity of the RF cables if an external antenna is used. Tighten the connectors and check the antennas, as well. Make sure that the Vertical and Horizontal RF connections are properly performed.
	2. In case the wireless link is still down even if the parameters are according with the settings from the radio planning stage and the RF connectivity verifications are completed for the local unit (cables and connectors), go on site to the location of the remote unit.
	3. If the remote unit is powered on (else, check the AC power supply, the IDU and the Ethernet cables), connect to it using a laptop and check all radio parameters and RF connectivity as described in step 1 and perform all corrections. The values for the following radio parameters must be the same on both units: - uplink/downlink frequenciy - channel width - air frame period - link ID Check the license file in the Maintenance page to see if the configured parameter values are supported by the license (channel width, power level, frequencies, etc.) Perform all needed modifications and check the wireless link establishment after unit reboot.
	4. In case the wireless link is still down, check the antennas alliagnment with two teams working concurrently, one at the

Problem	Debugging steps; possible cause & solution
	remote site and the other one to the local site. Also, redo the radio planning: it can be that the coordinates from the initial radio planning stage to be innapropriate for the current situation (huge interferences on the working set of frequencies, Fresnel zone obstruction as well as the wireless link cannot be established, etc.).
	5. Replace the unit if necessary or report the problem to InfiNet Wireless support team with the Diagnostic card (according to the information presented in Operation & Administration chapter above, in Maintenace section). http://support.infinetwireless.com support@infinetwireless.com +7 343 253-15-33

Table 38 - The wireless link is down

6.3. No access to the local unit

Problem	Debugging steps; possible cause & solution
There is no access to the local unit	1. Check the network connectivity between the monitoring server and the local unit.
	2. If there's still no connectivity to the local unit, go on site to the location of the local unit and check if: - it is powered on (else, check the AC power supply, the IDU, the Ethernet cables/fiber optic and connectors) - the local connection (for example, using a laptop) works (else, follow the ERC console procedure described below) If local connection is allowed, after the authentication step in Web GUI, check the administrative and operational status of the Ethernet/SFP port. Enable the port if found disabled.
	3. If the problem is still not solved, go to the Switch page, check the port interconnection and make sure that traffic is enabled between the corresponding external and internal ports. Check the VLAN configuration if VLANs are used. Reboot the unit.

Table 39 - No access to the local unit

6.4. Expected capacity is not met

Problem	Debugging steps; possible cause & solution

Problem	Debugging steps; possible cause & solution
The wireless link is operational but the expected capacity is not met	1. Go to the Maintenance page and click the «Check Latest Release» button. If a newer firmware version is available, proceed with the firmware upgrade in order to benefit of the latest radio features and improvements.
	2. Go to the Maintenance page, click the «View Current License» button and check if the maximum transmit rate, power levels or channel width are limited to lower values compared to the expected configuration.
	3. Go to the Switch page. Check the Rate limit and the Port mode. In case of GE connection, if one unit has auto negotiation enabled and the other has a manual setting, put both units in auto negotiation. If the rate is lower than the expected one, adjust accordingly or set to unlimited.
	4. Go to the: - Status page and check the radio link status (CINR, RSSI, etc.) - Radio page and check the the radio link configuration: maximum modulation, air frame period, AMC and QoS strategy (take as reference the throughput values available in Operation & Administration chapter, Wireless Link Statistics section to compare the configuration settings with the expected capacity) - Alliagnment page and check the values from the the antenna alliagnment tool - The recorded statistics should be cleared for both units (restart the unit or cli> xg stat -clear) and the wireless link situation must be monitord again Redo the radio planning activities if the values does'n correspond to the values from the initial deployment.
	5. Go on site and: - check the Ethernet or SFP connections, replace the cables if necessary - check the RF connectors if an external antenna is used. Tighten the connectors and check also the integrity of the antenna - perform proper antenna alignment on site. If after the alignment the CINR level is still low, it indicates that external interferences are present. Try to use another frequency if available or perform a spectrum scanning.
	6. Report the problem to InfiNet Wireless support team with the Diagnostic card (according to the information presented in Operation & Administration chapter above, in Maintenace section). http://support.infinetwireless.com

Problem	Debugging steps; possible cause & solution
	support@infinetwireless.com +7 343 253-15-33

Table 40 - Expected capacity is not met

6.5. Errors on the wireless link, throughput fluctuations

Problem	Debugging steps; possible cause & solution
The wireless link is operational but there are errors on the wireless link, throughput fluctuations	1. Go to the Switch page. Check the Rate limit and the Port mode. In case of GE connection, if one unit has auto negotiation enabled and the other has a manual setting, put both units in auto negotiation. If the rate is lower than the expected one, adjust accordingly or set to unlimited.
	2. Go to the Status page and check the CINR and RSSI levels. Try to adjust the Tx power on both ends in order to improve the CINR and RSSI levels. If the CINR value is low, it indicates the presence of external interferences. If both CINR and RSSI are bad, the antenna alignment or hardware faults could be the root cause.
	3. Go on site and: - check the Ethernet or SFP connections, replace the cables if necessary - check the RF connectors if an external antenna is used. Tighten the connectors and check also the integrity of the antenna - perform proper antenna alignment on site. If after the alignment the CINR level is still low, it indicates that external interferences are present. Try to use another frequency if available or perform a spectrum scanning.
	4. Report the problem to InfiNet Wireless support team with the Diagnostic card (according to the information presented in Operation & Administration chapter above, in Maintenace section). http://support.infinetwireless.com support@infinetwireless.com +7 343 253-15-33

Table 41 - Errors on the wireless link, throughput fluctuations

6.6. No data is being transferred

Problem	Debugging steps; possible cause & solution
The wireless link is operational but no data is being transffered	1. Go to the Maintenance page and check the Maximum transmit rate in the current license.
	2. Go to the Switch page and make sure that the internal port mapping is correct and the traffic flow is enabled between the required ports.
	3. Go to the Switch page and check the administrative state of the GE or SFP port. Enable the port if it was disabled. If the status is up but no packets are received, check the configuration of the equipment which is directly connected.
	4. Go on site and check the Ethernet or SFP connections, check and replace the cables if needed.
	5. If VLANs are used, go to the Switch page and make sure that the VLAN configuration is correct, allowing the specific traffic VLAN ID to pass through the required ports.
	6. Report the problem to InfiNet Wireless support team with the Diagnostic card (according to the information presented in Operation & Administration chapter above, in Maintenace section). http://support.infinetwireless.com support@infinetwireless.com +7 343 253-15-33

Table 42 - No data is being transffered

6.7. The management of the unit is lost

If the management of the unit is completely lost (of the local and/or the remote one), the ERConsole recovery procedure should be used. ERConsole is a software application created to recover or add a new IP address to the InfiNet Wireless units. Additionally, the ERConsole can be used to reset the InfiNet Wireless units to the factory default configuration.

6.7.1. ERConsole recovery procedure

Software requirements:

- Java Runtime Environment should be installed. If you don't have it already, you can download it from http://www.java.com/en/download/
- ERConsole software application - can be obtained from our ftp site: ftp://ftp.infinet.ru/pub/Utils/EmergenceRepairConsole/ERConsole.zip

It is recommended to turn off any anti-virus or firewall running on your computer. We also recommend to use a simple unmanaged switch as intermediary device between your PC and the InfiNet unit. It is essential to reboot the InfiNet unit each time in order to activate the Emergency Repair Protocol on the unit, therefore the switch would prevent your PC Ethernet interface from flapping up and down. Using Cisco Catalyst switches for unit recoverty is not recommended due to a known issue port mode negotiation delay.

NOTE

ERConsole and InfiNet Wireless units exchange information only during the bootup process, therefore each time you need to read the units IP address, to add a new IP or to restore to the default configuration, the InfiNet Wireless unit should be rebooted

If you lost management to your InfiNet Wireless unit, proceed with the following steps:

1. Make sure you have set the correct IP address, network mask and VLAN if used in order to access the unit. If these items are checked, proceed with the next step for the ERConsole recovery
2. Connect a network Ethernet cable between the InfiNet Wireless unit and your PC and then run the ETConsole.jar application downloaded from our ftp
3. Power off the InfiNet Wireless unit and then power it on in a few seconds
4. Wait about 30 seconds and the ERConsole screen should receive update from the unit like below. The Serial number, IP address and network mask will be displayed on the screen:

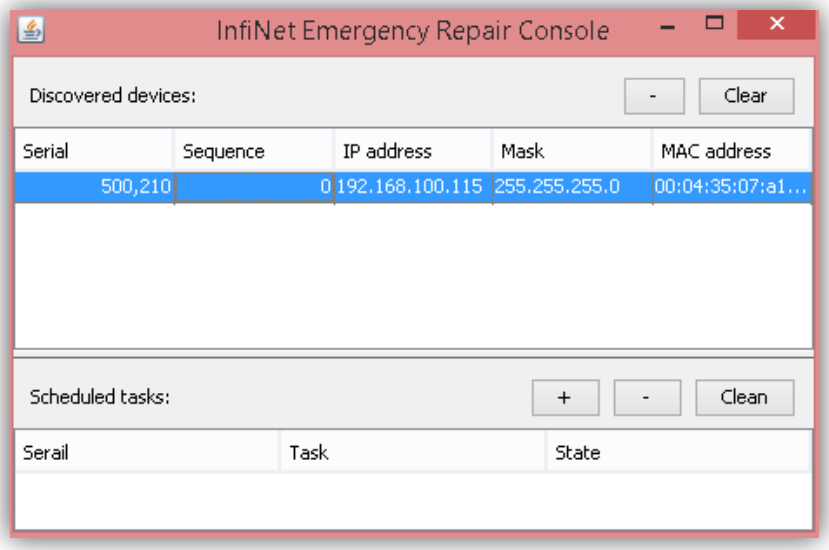


Figure 75 - ERConsole information

5. If an IP address is assigned to the unit, configure on your laptop an IP from the same network class and connect to the unit in order to perform the

modifications and checking required. If there is no IP displayed (0.0.0.0), proceed with the next step

6. Click the «+» button in the ERConsole application and a new window will appear
7. In the New task window, set the additional IP address and network mask, then click «OK» like below:

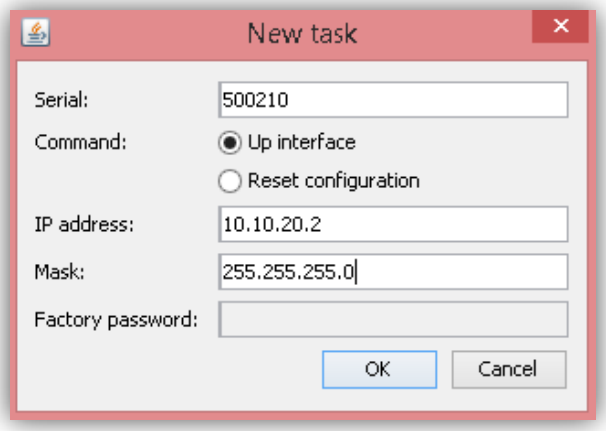


Figure 76 - Adding a new IP address

8. Power off and on the InfiNet unit. Wait about 30 seconds until the IP is assigned
9. Add an IP address from the same network subnet to your PC and access the unit. ERC will not show newly assigned IP address
10. Login to the unit using the new IP. Do not reboot the unit now because the additional IP address is temporar until the next restart or the new configuration is saved

6.7.2. Restore to factory settings using ERConsole

If you need to restore your unit to the factory settings, follow the instructions below:

1. Obtain the IP address of the unit using the ERConsole as described in section above
2. Click on the «+» button in the ERConsole application and a new window will appear
3. Call InfiNet Wireless Technical support at +7 343 253 1533 or open a new case at http://support.infinetwireless.com in order to obtain the Factory Password for the unit. You will need the serial number of the unit for this step
4. Select “Reset configuration” option and input the Factory Password obtained at the previous step in the Factory password field, then click «OK»
5. Power off and on the unit and then wait about 30 seconds

6. The unit will start in special emergency mode with the IP address 10.10.10.1 and mask 255.255.255.0
7. Login to the unit and reset the configuration to the factory defaults from the Maintenance page