Quanta 5 / Quanta 6

Infinet Wireless: Technical Documentation

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Quanta 5 / Quanta 6 is a InfiNet Wireless devices family, is used for deployment of wireless Point-to-Point links in 5 and 6 GHz frequency ranges, with a maximal performance of up to 650 Mbps.

Quanta 5 / Quanta 6 families devices are based on the Octopus SDR technology which allows to extend functionality of the device at the physical, channel and upper levels by updating the system software. Thus, the main subsystems capabilities can be determined by the software without the need to dismount or replace the device.

> **NOTE**
>
> Product technical specifications can be obtained from our web site Infinet Wireless[1]
>
> We recommend the online course[2] for the self-study at the IW Academy portal.

1 http://infinetwireless.com/products
2 https://academy.infinetwireless.com/en/online-education/quanta-5-installation-and-configuration

1 About This Manual

This manual provides detailed technical information for the **Quanta 5 / Quanta 6** families devices, 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 with:

- Outdoor/indoor radio equipment installation
- Outdoor wireless networks
- TCP/IP networking protocols
- Safety procedures and instructions for installing antenna equipment
- Professional manipulation with electrical equipment and accessories
- Safety procedures and instructions for working at height.

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This symbol means that this product is subject to Waste of electrical and electronic equipment (WEEE) regulations. Do not dispose of your product with other regular/household waste. Instead, hand over your waste equipment to a designated collection point for recycling.

3 Introduction

3.1 Document structure

This document consists of the following chapters:

- Introduction(see page 11) - presents the information about this document's purpose and structure.
- Planning considerations(see page 33) - describes the principles of wireless system planning.
- Installation(see page 43) - describes the steps to be taken when installing the equipment at the installation sites and installation site requirements.
- Operation & Administration[3] - presents the functionalities of the web interface, a simple and efficient way to monitor the device status, configure and maintain the equipment.
- Troubleshooting[4] - describes the actions to be taken during occured problems investigation.

3.2 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.

3.3 Key Features

Quanta 5 / Quanta 6 is a wireless point-to-point solution with an impressive maximal performance of up to 650 Mbps, a packet perfomance is up to 1 200 000 pps. **Quanta 5 / Quanta 6** are based on the newest Infinet Wireless proprietary Octopus SDR hardware platform.

Quanta 5 operates in frequency range from 4900 MHz to 6000 MHz, **Quanta 6** - from 6000 MHz to 6425 MHz. The solution supports the wide range of channel width between 3.5 MHz and 56 MHz. SC-FDE radio technology is used for data transmission.

3.3.1 Radio

- Extended set of modulation coding schemes – Quanta 5 / Quanta 6 supports 14 modulation-coding schemes. In periodic interference conditions, the performance will stay on the highest level.
- Automatic Modulation Control (AMC) – modulation control algorithm selects the most appropriate modulation-coding scheme at each polarization and each end of the link in order to maximize the link performance.

3 https://wiki.infinetwireless.com/pages/viewpage.action?pageId=7279212
4 https://wiki.infinetwireless.com/display/DR/Troubleshooting

- Hybrid-FDD (split-frequency mode) – separate allocation of downlink and uplink channels to utilize the least congested frequency channel at each end of the link.
- Automatic Repeat Request (ARQ) – a technology which enables packet re-transmission in case of previous unsuccessful delivery, allows to achieve reliable connectivity even in highly congested spectrum.
- Instant DFS (only for Quanta 5 family) – a set of algorithms operating on top of the mandatory DFS/Radar detection/LBT, providing background spectrum scanning and zero-downtime channel reselection in case of congestion or radar detection. For uplink and downlink traffic, different frequencies can be selected to achieve optimum performance.
- Automatic Transmit Power Control (ATPC) – a technology which allows to limit the overall power system mode, which takes into account the antenna gain and losses in the RF cable.

3.3.2 Networking

- VLAN support is an important tool which is used to isolate and filter traffic flows.
- STP support allows to avoid network loops.
- IEEE 1588v2 support provides synchronization between devices via the wired network segment.
- Stacked VLAN support (Q-in-Q) avoids the limitation in the number of available VLANs (4096), which can be useful for large networks. In addition, Q-in-Q allows you to organize L2 channels within a limited VLAN list, which is widely used in provider networks and on leased communication channels.
- Due to QoS support, traffic prioritization is available in accordance with the 802.1p (8 queues), ensures that the most important data arrives with priority.
- One of the network mechanisms to optimize bandwidth by reducing the share of overhead for service headers are Jumbo frames with size up to 9038 bytes.

3.3.3 Distance

Quanta 5 / Quanta 6 devices have a link budget of up to 178 dB for models with 25 dBi antenna and from 125 dB for models with external antennas that allows to achieve reliable connectivity at a distance more than 200 km in clear line-of-sight conditions, as well as provides sufficient margin for near- and non-LOS deployments at shorter distances. Transmit power at the highest modulations is also one of the key performance metrics, allowing devices to achieve the highest performance over long distances and in noisy spectrum. Quanta 5 / Quanta 6 transmit power at QAM256 is up to 24 dBm.

3.3.4 Environment

- Operating temperature range -40 ... +60 °C.
- Dust and water protection in compliance with IP66/IP67.
- Wind load up to 160 kph - operation, 200 kph - survival.

3.3.5 Power

The device has following electrical parameters:

- Consumption is up to 15 W.
- Power options: 90-240 VAC~ @ 50/60 Hz, ±43..56 VDC.
- 802.3at support or InfiNet Wireless proprietary passive PoE.
- AC/DC injector IDU-CPE-G(24W) is included to the packing list.

3.4 Hardware Platform

3.4.1 Octopus SDR

Infnet's latest SDR platform has been designed based on a Software-Defined Radio technology aimed at increasing link performance several-fold. Quanta 5 / Quanta 6 addressing challenges such as limited spectrum availability, growing interference challenges and demands for yet more capacity. Due to Octopus SDR platform Quanta 5 / Quanta 6 allow to bring new PHY, MAC and upper layer features via a firmware upgrade even for the units operating in the field.

3.4.2 Wireless device

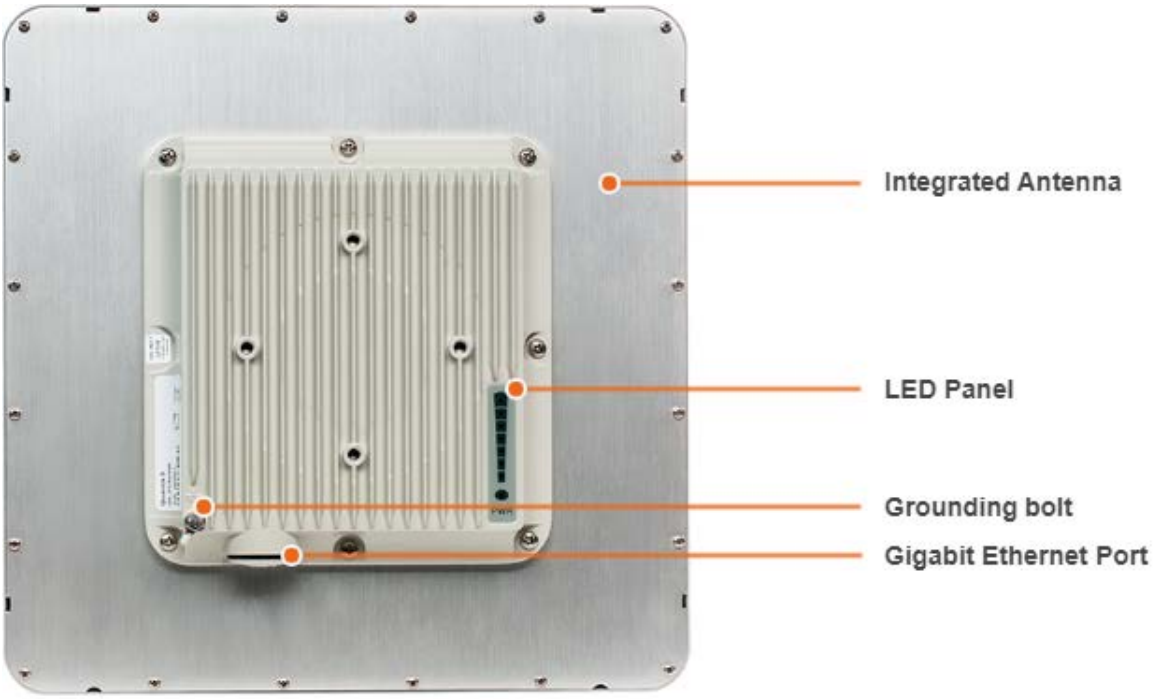
An integrated wireless device contains the radio and networking electronics. Implemented in a robust all-weather metal enclosure, this equipment can be used to create point-to-point wireless links at distances in excess of 150 km (depending on country regulations, antenna types, interference, terrain, climate zones, etc.). There are several possible version of Quanta 5 / Quanta 6 solution enclosures:

3.4.2.1 Quanta 5

- with integrated antenna 25 dBi;
- with integrated antenna 23 dBi;
- with integrated antenna 18 dBi;
- with two N-type ports for an external antenna.

3.4.2.2 Quanta 6

- with integrated antenna 25 dBi;
- with integrated antenna 18 dBi;
- with two N-type ports for an external antenna.



3.4.2.3 Grounding bolt

For grounding the ODU to the supporting structure.

3.4.2.4 Gigabit Ethernet Port

RJ-45 socket for connecting to power supply and network via the PoE power supply. The network connection to the ODU is made via a 1000Base-T (Gigabit) Ethernet connection. Power is provided to the ODU over the 1000Base-T Ethernet connection using a standard IEEE 802.3at passive PoE power supply.

3.4.2.5 LED Panel

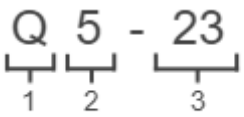
The "POWER" indicator has three possible colors:

- Red light - the device is connected to the electricity mains,
- Yellow light - a wired connection with a speed of 10/100 Mbps
- Green light - a wired connection with a speed of 1000 Mbps.

Other indicators are used to perform coarse antenna alignment. The more indicators are on, the better wireless connection is established. The blinking indicator means an intermediate state.

3.4.3 Part number description

Quanta 5 / **Quanta 6** part number has the following structure



Structure items are described below

Item	Description
1	Product family name: • **Q** - Quanta.

2	Frequency range: • **5** - device in the range of 5 GHz. • **6** - device in the range of 6 GHz.
3	Antenna gain: • **18** - integrated antenna with 18 dBi gain; • **23** - integrated antenna with 23 dBi gain; • **25** - integrated antenna with 25 dBi gain; • **E** - devices for an external antenna connection.

3.5 Power supply

3.5.1 Indoor AC/DC injector IDU-CPE-G(24W)

1 Figure - IDU-CPE-G(24W)

IDU-CPE-G(24W) is an indoor Gigabit PoE injector which supports 100-240 V input range from the AC mains. IDU-CPE-G(24W) feeds 48 VDC power to the device by injecting it to the CAT5 Ethernet cable.

Parameter	Description									
Compatible models	Quanta 5, Quanta 6, Quanta 70, InfiLINK 2x2 LITE, InfiMAN 2x2 STE, InfiMAN Evolution STE, InfiLINK Evolution, AUX-ODU-SYNC									
Size and weight	97*53.5*33.5 mm, 0.133 kg									
Connectors and Interfaces	• "LAN" - Ethernet input (Data only) • "POE" - Ethernet output (Data+VDC), PASSIVE PoE • "PWR" - AC Input									
Supported Ethernet Modes	• 10/100/1000 Mbps									
Standards	• IEEE 802.3 10Base-T • IEEE 802.3U 100Base-TX • IEEE 802.3ab 1000Base-T									
Input Power Requirements	• AC Input Voltage: 100 ... 240 VAC • AC Input Current: 0.75 A • AC Frequency: 50 to 60 Hz									
Consumption	• 28 W									
Operating temperature range	• -10 °C ... +40 °C									
Operating humidity	• Maximum 95 %, Non-condensing									
Storage temperature	• -40 °C ... +70 °C									
Output Power Voltage	• 48 VDC, 0.5 A									
Ethernet Connectors Pin-out	**LAN**	**Pin**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
		Description	A+	A-	B+	C+	C-	B-	D+	D-
	POE	**Pin**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
		Description	A+	A-	B+	+VDC / C+	+VDC / C-	B-	-VDC / D+	-VDC / D-

Parameter	Description
Safety	• UL cUL, CE, GS, CCC, FCC, S-MARK, PSE, C-tick, KC(48V0.5A) BIS （24V1A）

1 Table - IDU-CPE-G(24W) Specification

3.5.2 Indoor AC/DC injector IDU-CPE-G

2 Figure - IDU-CPE-G

Indoor Gigabit PoE Injector with lightning protection IDU-CPE-G.

Parameter	Description
Size	110*40*30 mm (L*W*H)
Weight	0,110 kg

<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>Connectors and Interfaces</td><td>• "ETH IN" - Ethernet input (Data only)
• "ETH OUT" - Ethernet output (Data+VDC), PASSIVE PoE
• "PWR" - AC Input</td></tr>
<tr><td>Supported Ethernet Modes</td><td>• 10/100/1000Mbps</td></tr>
<tr><td>Input Power Requirements</td><td>• AC Input Voltage: 100 ... 240 VAC
• AC Input Current: 0.4A @ 100 VAC
• AC Frequency: 50 to 60 Hz</td></tr>
<tr><td>Consumption</td><td>• 15,4 W (Guaranteed)</td></tr>
<tr><td>Operating temperature range</td><td>• -10 °C ... +50 °C</td></tr>
<tr><td>Operating humidity</td><td>• Maximum 95 %, Non-condensing</td></tr>
<tr><td>Storage temperature</td><td>• -40 °C ... +85 °C</td></tr>
<tr><td>Storage humidity</td><td>• Maximum 95 %, Non-condensing</td></tr>
<tr><td>Output Power Voltage</td><td>• 48 VDC</td></tr>
<tr><td>Ethernet Connectors Pin-out</td><td>
<table>
<tr><th colspan="2">ETH IN</th><th colspan="2">ETH OUT</th></tr>
<tr><th>Pin</th><th>Description</th><th>Pin</th><th>Description</th></tr>
<tr><td>1</td><td>Data pair A+</td><td>1</td><td>Data pair A+</td></tr>
<tr><td>2</td><td>Data pair A-</td><td>2</td><td>Data pair A-</td></tr>
<tr><td>3</td><td>Data pair B+</td><td>3</td><td>Data pair B+</td></tr>
<tr><td>4</td><td>Data pair C+</td><td>4</td><td>+VDC + Data pair C+</td></tr>
<tr><td>5</td><td>Data pair C-</td><td>5</td><td>+VDC + Data pair C-</td></tr>
<tr><td>6</td><td>Data pair B-</td><td>6</td><td>Data pair B-</td></tr>
<tr><td>7</td><td>Data pair D+</td><td>7</td><td>-VDC + Data pair D+</td></tr>
<tr><td>8</td><td>Data pair D-</td><td>8</td><td>-VDC + Data pair D-</td></tr>
</table>
</td></tr>
</table>

Parameter	Description
Electromagnetic Emission & Immunity	• FCC Part 15, Class B • EN 55022 Class B • EN 55024 • VCCI
Regulatory Compliance	• RoHS Compliant, WEEE Compliant, CE Energy Efficiency Level VI
Safety	• UL/IEC/EN 60950-1

2 Table - IDU-CPE-G Specification

3 Figure - IDU-CPE-G Front Panel

4 Figure - IDU-CPE-GRear Panel

3.5.3 Indoor AC/DC injector with integrated lightning protection IDU-BS-G(60W)

5 Figure - IDU-BS-G(60W)

IDU-BS-G(60W) is an indoor AC/DC PoE injector with built-in lightning protection. PoE injector is powered by an AC supply in the 100-240 V range.

Parameter	Description
Compatible models	InfiLINK XG, InfiLINK XG 1000, InfiLINK 2x2 PRO, InfiMAN 2x2 BS, Quanta 70, Quanta 5, Quanta 6, InfiMAN Evolution BS
Size	151*62*38 mm (L*W*H)
Weight	0.32 kg
Connectors and Interfaces	• "ETH IN" - Ethernet input (Data only) • "ETH OUT" - Ethernet output (Data+VDC), PASSIVE PoE • "PWR" - AC Input
Supported Ethernet Modes	• 10/100/1000Mbps (Gigabit Ethernet pass-through)
Input Voltage	• 100 ... 240 V
Output Voltage & Current	• +55 V, 1.5 A
Consumption	• 60 W over 4-pairs (Guaranteed)

Parameter	Description
Operating temperature range	• -10 °C ... +40 °C
Pin Assignment and Polarity	• Data Pairs 1/2 (-) and 3/6 (+) • Spare Pairs 7/8 (-) and 4/5 (+)
EMC	Meet: • FCC Part 15, Class B • EN 55022 Class B (Emissions) • EN 55024 (Immunity), VCCI
Lightning Protection	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)

3 Table - IDU-BS-G(60W) Specification

6 Figure - IDU-BS-G(60W) Front Panel

7 Figure - IDU-BS-G(60W) Rear Panel

3.5.4 Indoor DC/DC injector for all InfiNet Wireless' units with integrated lightning protection IDU-LA-G(V.01)

IDU-LA-G(V.01) is an indoor DC/DC injector. It greatly reduces complexity of the deployment in the cases where DC source is available thus reducing both capital expenditures and total cost of ownership.

IDU-LA-G(V.01) may be used for the following purposes:

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

Technical parameters

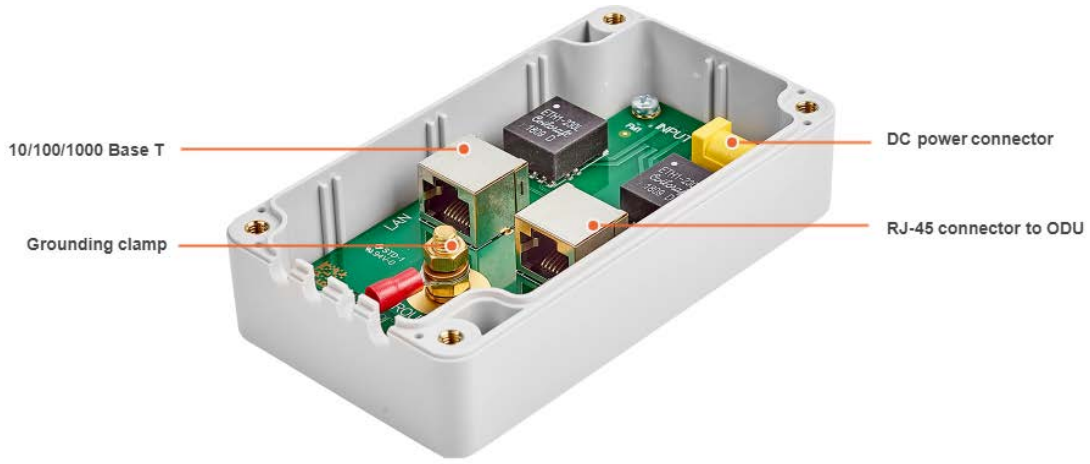
Parameter	Description
Compatible models	InfiLINK XG, InfiLINK XG 1000, InfiLINK 2x2, InfiMAN 2x2, Quanta 5, Quanta 6, Quanta 70, InfiLINK Evolution, InfiMAN Evolution
Output Voltage	The same as input
Supported Ethernet Modes	10/100/1000 Mbps (Gigabit Ethernet pass-through)
Pin assignment and polarity	1/2 (+), 3/6 (-), 4/5 (+), 7/8 (-)
DC Range	Acceptable input DC range depends on the specific ODU model: • InfiLINK XG, InfiLINK XG 1000, InfiLINK 2x2 PRO, InfiMAN 2x2 BS, Quanta 70, Quanta 5, Quanta 6, InfiLINK Evolution, InfiMAN Evolution models: ±43... ±56 VDC • InfiLINK 2x2 Lite, InfiMAN 2x2 STE models: +9... +56 VDC (positive voltage only)
Size and Weight	115×65×40 mm, 0.15 kg

Operating temperature range	from 0°C to +40°C

CAUTION

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

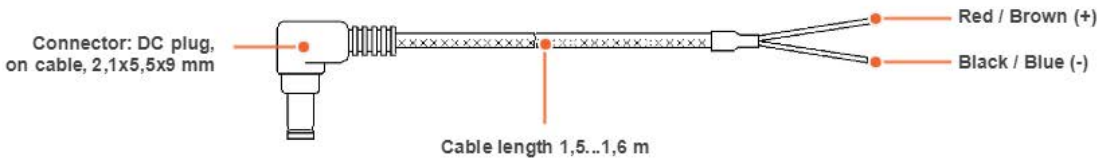
Connectors description



Mounting holes sizes

3.5.4.1 IDU-LA-G(V.01) Packing List

Cable assembly



3.5.5 Lightning Protection Unit with Injector AUX-ODU-INJ-G

8 Figure - 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. AUX-ODU-INJ-G is compatible with all Infinet Wireless devices.

Parameter	Description
Size and Weight	34x94x121 mm, 0.28 kg
Connectors and Interfaces	• ETH IN - Ethernet input • ETH OUT - Ethernet output (data+VDC, protected leg) • PWR - DC Input • GND - Ground clamp
Supported Ethernet Modes	• 10/100/1000 Mbps (Gigabit Ethernet pass-through)
Water and Dust Protection	• IP66 and IP67
Operating temperature range	• -55 °C ... +60 °C
DC Range	• InfiLINK XG, InfiLINK XG 1000, InfiLINK 2x2 PRO, InfiMAN 2x2 BS, Quanta 70, Quanta 5, Quanta 6, InfiLINK Evolution, InfiMAN Evolution: ±43...±56 VDC • InfiLINK 2x2 Lite, InfiMAN 2x2 STE: +9... +56 VDC (positive voltage only)

Parameter	Description									
CAUTION Using inappropriate DC source will damage the ODU, which will be not covered by warranty										
Ethernet Connectors Pin-out	**ETH IN**	**Pin**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
		Description	Data pair A+	Data pair A-	Data pair B+	Data pair C-	Data pair C+	Data pair B-	Data pair D+	Data pair D-
	ETH OUT	**Pin**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
		Description	Data pair A+	Data pair A-	Data pair B+	+VDC + Data pair C-	+VDC + Data pair C+	Data pair B-	-VDC + Data pair D+	-VDC + Data pair D-
Lightning Protection	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									

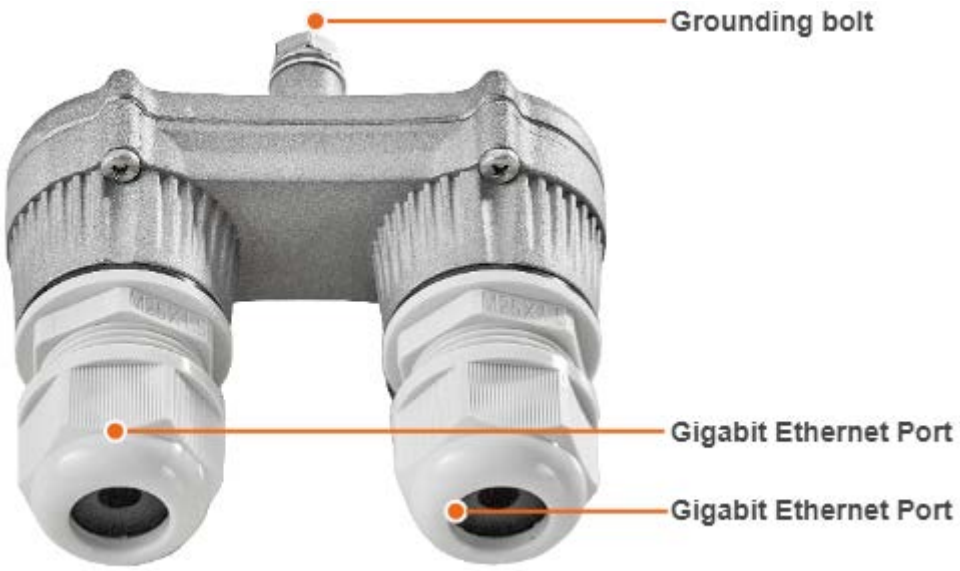
4 Table - AUX-ODU-INJ-G Specifications

3.5.5.1 Packing List

3.6 Lightning protection unit

- AUX-ODU-LPU-L(see page 28)
- AUX-ODU-LPU-G(see page 29)

3.6.1 AUX-ODU-LPU-L



9 Figure - AUX-ODU-LPU-L

AUX-ODU-LPU-L is a bidirectional external outdoor lightning protection unit for Infinet Wireless systems designed to withstand the toughest conditions and protect the outdoor unit or the 3rd party networking equipment installed indoors from sudden power surges induced by lightning strikes. Despite the fact every Infinet wireless device has a built-in lightning protection. AUX-ODU-LPU-L, thanks to its superior GR-1089-grade protection, greatly reduces the risk of damage for the systems operating in harsh environments or difficult-to-reach locations. AUX-ODU-LPU-L is compatible with all Infinet Wireless devices.

> **NOTE**
>
> The device is not supplied by default and must be ordered separately.

Parameter	Description
Size and Weight	• 45x92x55.5 mm, 0.13 kg
Connectors and Interfaces	• 2 x Ethernet ports • Ground clamp
Supported Ethernet Modes	• 10/100/1000 Mbps (Gigabit Ethernet pass-through)
Water and Dust Protection	• IP66 and IP67
Operating temperature range	• -55 °C ... +60 °C

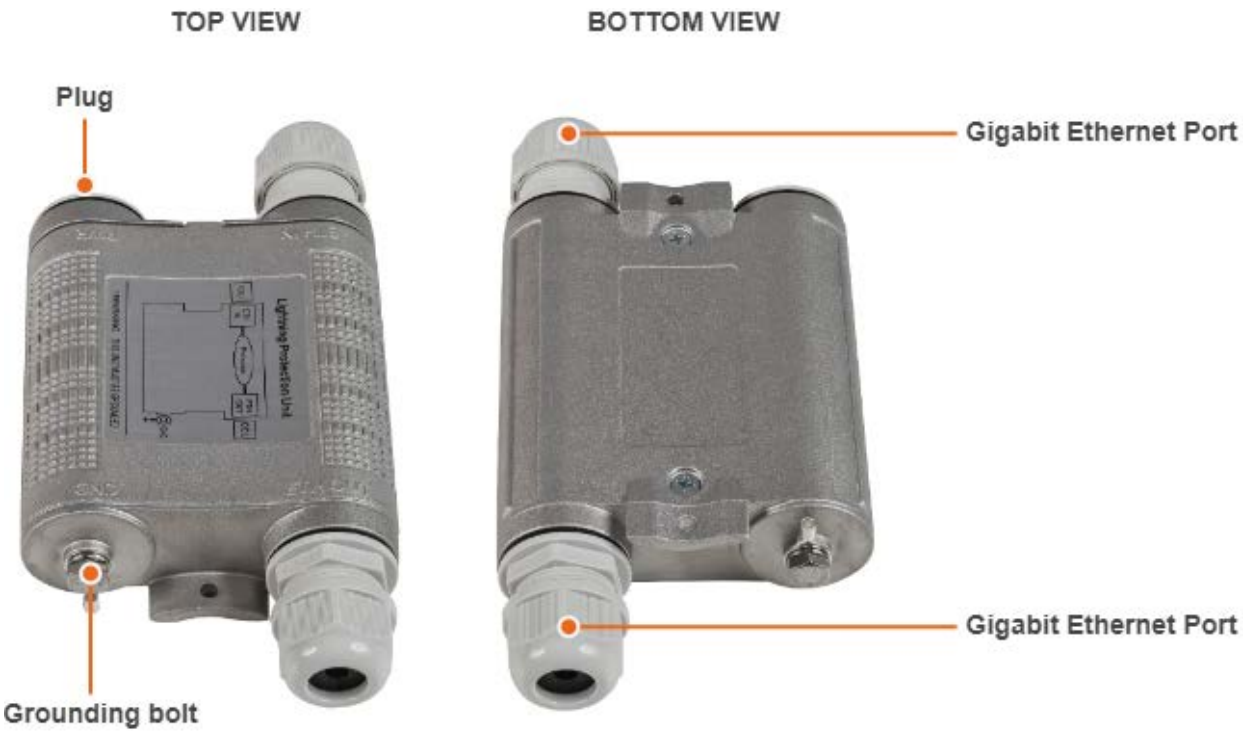
Parameter	Description								
Ethernet pinout	**Pin**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
	Data pair	A+	A-	B+	C-	C+	B-	D+	D-
Lightning Protection	In compliance with: • GR-1089 • IEC 61000-4-2 (ESD) 15kV (air), 8kV (contact) • IEC 61000-4-4 (EFT) 40A (tp = 5/50ns) • IEC 61000-4-5 (Lightning) L5, 95A (tp = 8/20us) • ETSI ETS 300 386								

5 Table - AUX-ODU-LPU-L Specification

3.6.1.1 Packing list

10 Figure - Packing list AUX-ODU-LPU-L

3.6.2 AUX-ODU-LPU-G



11 Figure - AUX-ODU-LPU-G

Optional indoor/outdoor Lightning Protection Unit 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. AUX-ODU-LPU-G is compatible with all Infinet Wireless devices.

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.

> **NOTE**
>
> The device is not supplied by default and must be ordered separately.

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

Parameter	Description								
Operating temperature range	• -55 °C ... +60 °C								
ETH IN and ETH OUT pin-out	**Pin**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
	Data pair	A+	A-	B+	C-	C+	B-	D+	D-
Lightning Protection	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								

6 Table - AUX-ODU-LPU-G Specification

3.6.2.1 Packing list

12 Figure - Packing list AUX-ODU-LPU-G

3.7 Packing List

This section describes the components that are supplied by default with the Quanta 5 model.Before the installation, please make sure you have all necessary parts and accessories.

3.7.1 Q5-25, Q5-23, Q5-E, Q6-25, Q6-E packing list

- Outdoor unit (ODU).
- Power supply.
- Cable gland.
- Shielded RJ-45 connector.
- Unshielded RJ-45 connector.

- Mounting kit - universal assembling kit for mounting the ODU on standard pole, wall or thick pipe (vertical/ horizontal).
- Power cord - the model depends on the region, according to the Purchase Order.

3.7.2 Q5-18, Q6-18 packing list

- Outdoor unit (ODU).
- Power supply.
- Cable gland.
- Shielded RJ-45 connector.
- Unshielded RJ-45 connector.
- Power cord - the model depends on the region, according to the Purchase Order.
- Nut M6 DIN 934 A4 (x2).
- Washer 6 flat (x2).
- Washer 6 spring (x2).
- Threaded rod M6x90 (x2).
- Bracer.

4 Planning considerations

During link planning, such factors as distance, obstacles and the link margin should be taken into account. We strongly recommend to use the InfiPLANNER tool for link planning.

4.1 InfiPLANNER

InfiPLANNER is a link planning tool, which allows to design networks using InfiNet Wireless devices for optimal deployment and cost effectiveness. It accounts for different scenarios based on geography, distance, antenna height, transmit power, device models and other factors. It outputs an installation report that defines the parameters to be used for configuration, alignment and operation. Use the installation report to compare the predicted performance with the actual link performance. InfiPLANNER is available at https://infiplanner.infinetwireless.com[5].

> **NOTE**
>
> You can find more detailed information about InfiPLANNER in the "InfiPLANNER: Link Planning Tool[6]" online course.

4.2 Range and obstacles

Make sure that line of sight is provided when planning the antennas' placement for a point-to-point link in order to achieve maximum range and performance between two antennas. Perform a survey to identify all the obstructions (such as trees or buildings) in the path and to assess the risk of interference.

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

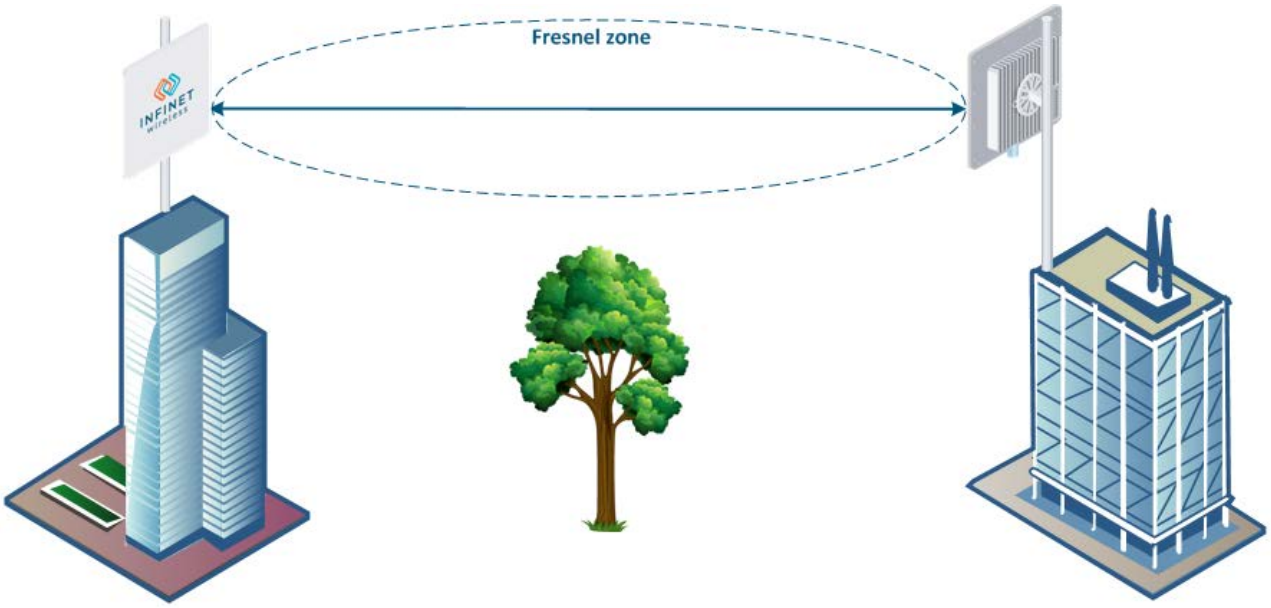
If most of the 1st Fresnel zone is obstructed, a major part of the radio wave's electromagnetic energy is lost, which leads to a severe signal quality degradation and as a result to a decreased coverage range or performance.

Below is an incomplete list of possible obstructions along 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 obstruct the 1st Fresnel zone.

5 https://infiplanner.infinetwireless.com/
6 https://academy.infinetwireless.com/en/online-education/infiplanner-link-planning-tool



NOTE

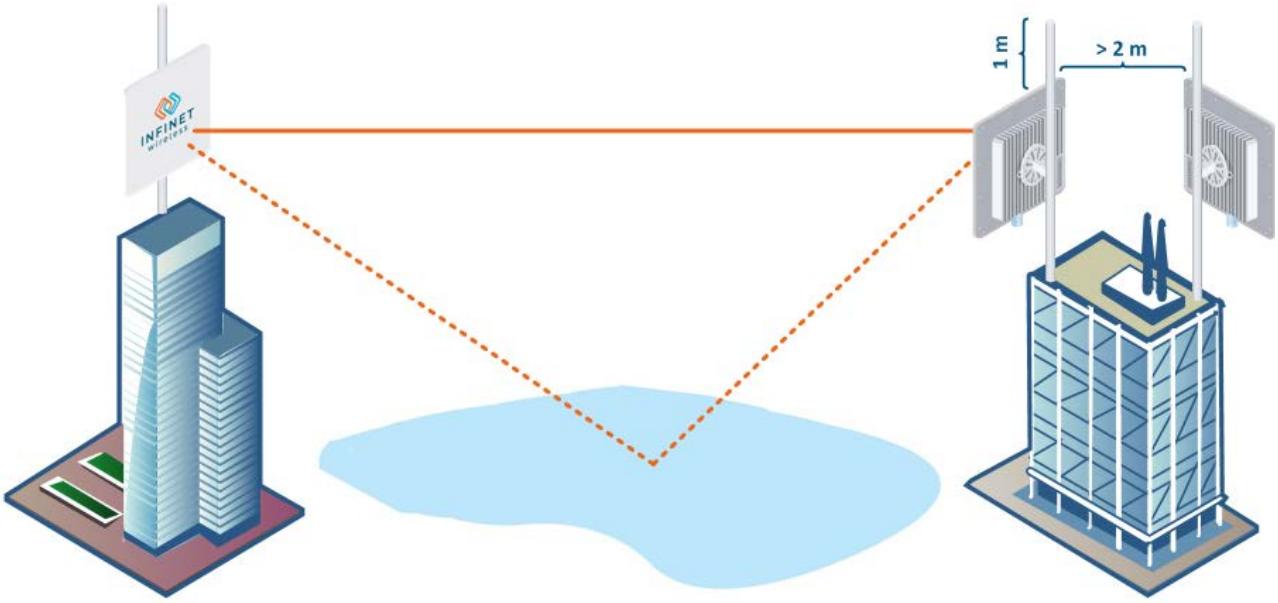
More detailed information about radio signal propagation is available at "Wireless Networking Fundamentals[7]" online course.

4.3 Antenna Installation

General recommendations for antenna installation:

- 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 the season (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.
- Install antennas as far as possible from other antennas (the recommended distance is at least 2 meters).
- Reflecting surfaces should be considered (buildings with reflective windows, water surfaces or wet grounds). These can be useful in NLOS situations, if there is no direct clear path between the 2 antennas, so the radio signal needs to be reflected by a surface. However, reflections can also decrease the signal quality when encountered along a clear LOS link, because of fading caused by multipath propagation.
- When installing antennas over the water, tune the height bracket within a 1-3 meters range variation, because it can yield significant signal level variations due to multipath fading.

7 https://academy.infinetwireless.com/en/online-education/wireless-networking-fundamentals/2



NOTE

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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 or more 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.

Please note that FCC ID for the model Q5-23 with integrated dual-pol antenna, 23 dBi is **FCC ID: X8Q-Q5-23** and is for the frequency range 5.725 – 5.85 GHz UNII-3 operation.

NOTE

On the territory of the European Union, following applies:

- the band 5150–5350 MHz is only for indoor use to reduce the potential for harmful interference to co-channel mobile satellite systems and other services. Further, EU regulations enforce EIRP limit in that band of 200mW (23dBm), output power and antenna gain (in case of devices with detachable antenna) shall be chosen accordingly;
- in the band 5470-5725 MHz, choice of the transmit power and antenna gain (in case of devices with detachable antenna) shall be such that the equipment still complies with the EIRP limit and EIRP density limit. EIRP limit in that band is 1W (30dBm), EIRP density limit is 50mW/MHz (17dBm/MHz);
- in the band 5725-5875 MHz, choice of the transmit power and antenna gain (in case of devices with detachable antenna) shall be such that the equipment still complies with the EIRP density limit. EIRP density limit in that band is 200mW/MHz (23dBm/MHz).

NOTE

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

- This device may not cause interference.
- This device must accept any interference, including interference that may cause undesired operation of the device.

This Class B digital apparatus complies with Canadian ICES-003.

Following also applies to this radio equipment:

- the band 5150–5250 MHz is only for indoor use to reduce the potential for harmful interference to co-channel mobile satellite systems;
- for devices with detachable antenna, the maximum antenna gain permitted for devices in the bands 5250-5350 MHz and 5470-5725 MHz shall be such that the equipment still complies with the e.i.r.p. limit;
- for devices with detachable antenna, the maximum antenna gain permitted for devices in the band 5725-5850 MHz shall be such that the equipment still complies with the e.i.r.p. limits as appropriate; and
- where applicable, antenna type(s), antenna models(s), and worst-case tilt angle(s) necessary to remain compliant with the e.i.r.p. elevation mask requirement set forth in section 6.2.2.3 of the RSS-247 shall be clearly indicated.
  High-power radars are allocated as primary users (i.e. priority users) of the bands 5250-5350 MHz and 5650-5850 MHz and these radars could cause interference and/or damage LE-LAN devices.

REMARQUE

Cet appareil contient des émetteurs / récepteurs exemptés de licence conformes à la (aux) source(s) RSS de Innovation, Sciences et Développement économique Canada. Le fonctionnement est soumis aux deux conditions suivantes:

- Cet appareil ne doit pas causer d'interférences.
- Cet appareil doit accepter toutes les interférences, y compris celles susceptibles de provoquer un fonctionnement indésirable de l'appareil.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

Ce qui suit s'applique également à cet équipement radio:

- la bande 5150–5250 MHz est uniquement destinée à une utilisation en intérieur afin de réduire le risque de brouillage préjudiciable des systèmes de télécommunication par satellite mobiles dans le même canal;
- pour les dispositifs avec une antenna détachable, le gain d'antenne maximal autorisé pour les dispositifs des bandes 5250-5350 MHz et 5470-5725 MHz doit être tel que l'équipement soit toujours conforme à la norme e.i.r.p. limite;
- pour les dispositifs avec une antenna détachable, le gain d'antenne maximal autorisé pour les dispositifs de la bande 5725-5850 MHz doit être tel que l'équipement soit toujours conforme à la norme e.i.r.p. limites, le cas échéant; et
- le cas échéant, type (s) d'antenne, modèle (s) d'antenne et angle (s) d'inclinaison dans le cas le plus défavorable nécessaire pour rester conforme à la norme e.i.r.p. L'exigence de masque d'altitude énoncée à la section 6.2.2.3 du CNR-247 doit être clairement indiquée.
  Les radars à haute puissance sont attribués en tant qu'utilisateurs principaux (utilisateurs prioritaires) des bandes 5250-5350 MHz et 5650-5850 MHz, et ces radars peuvent provoquer des interférences et / ou endommager les dispositifs LE-LAN.

5 Link Pre-configuration in the lab

Usually, before going into the field, it is recommended to pre-configure in the lab the Infinet Wireless units to verify the link establishment. Therefore, let's take the units to be used for this course out of the package and place them on the table.

NOTE

A minimum set of requirements must be met during devices pre-configuration in the lab:

- Make sure the devices are not directed at each other in order to prevent radio modules damage.
- A minimum transmit output power must be set.
- In case of two devices with external antennas, it is recommended to connect them in the link directly, with RF cables and RF attenuators with attenuation of at least 40 dB for each polarization (installation\deinstallation of the RF attenuators and RF cables should only be performed when the devices are switched off).

5.1 Step 1: Connection scheme

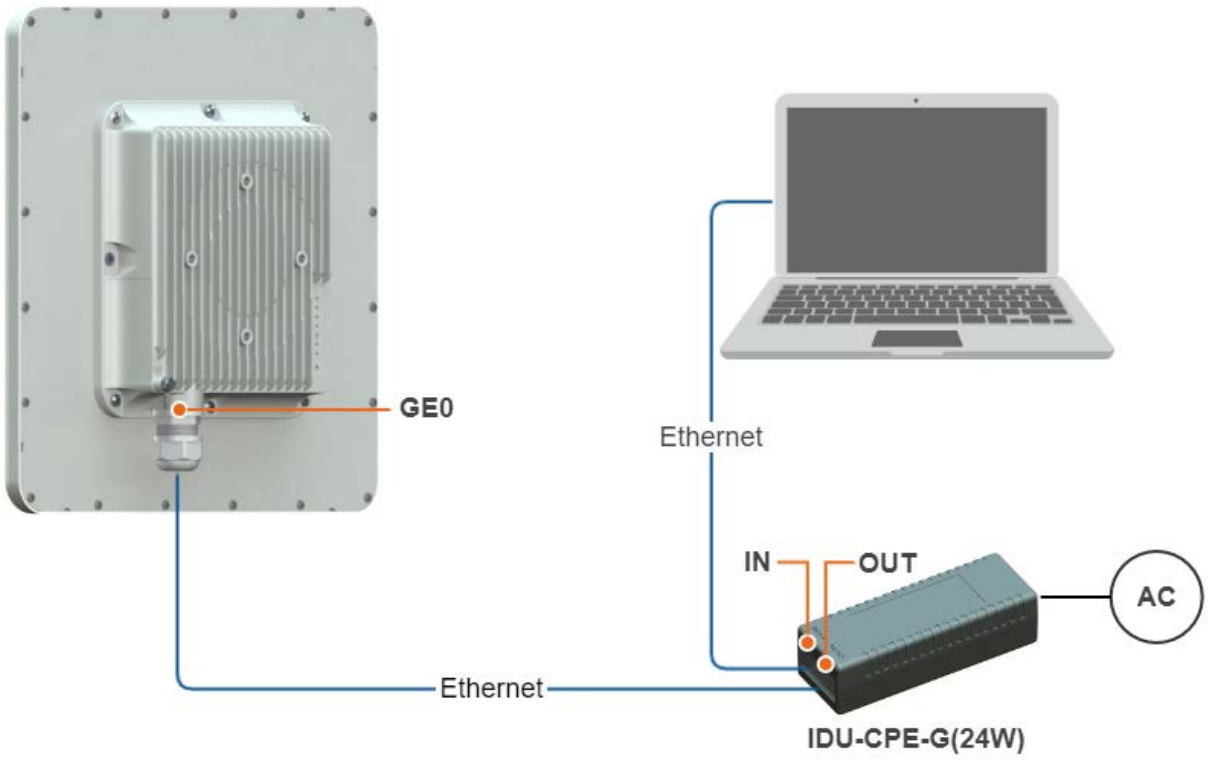
The equipment list required for the lab configuration:

1. Outdoor units - 2 pcs.
2. Power supply - 2 pcs.
3. Power cord - 2 pcs.
4. Ethernet cables - 4 pcs.
5. Laptop with Ethernet port available.

We will perform the settings mentioned below for each unit of the link and check if wireless link was established correctly.

Use the following instruction to assemble a test scheme:

1. Connect Gigabit Ethernet port at the ODU to the power supply port labeled as "OUT".
2. Connect Ethernet port at the laptop to the power supply port labeled as "IN".
3. Connect the power cord to power supply and plug it to AC mains.



5.2 Step 2: Access to the device

Let's access each unit to the default IP address 10.10.10.1 with mask 255.255.255.0 via a web browser. Before, make sure the Ethernet port of the Laptop has an IP address assigned from the same subnetwork as the one for the unit (e.g., set 10.10.10.10 with mask 255.255.255.0).

> **NOTE**
>
> We assume that each unit used in this setup has not been configured before and runs with the factory settings.

Use any letters or numbers for the initial authentication on each unit, for example:

- Login: login.
- Password: password.

> **NOTE**
>
> We strongly recommend to change your login and password after the first login.

After the first login, let's configure a distinctive name for each unit and set a custom login and password. Go to the "Settings" → "General" section and configure:

- Device Name (e.g., Master/Slave).

Go to the "Settings" → "Security" section and configure:

- Login (e.g., admin).
- Password (e.g., admin).

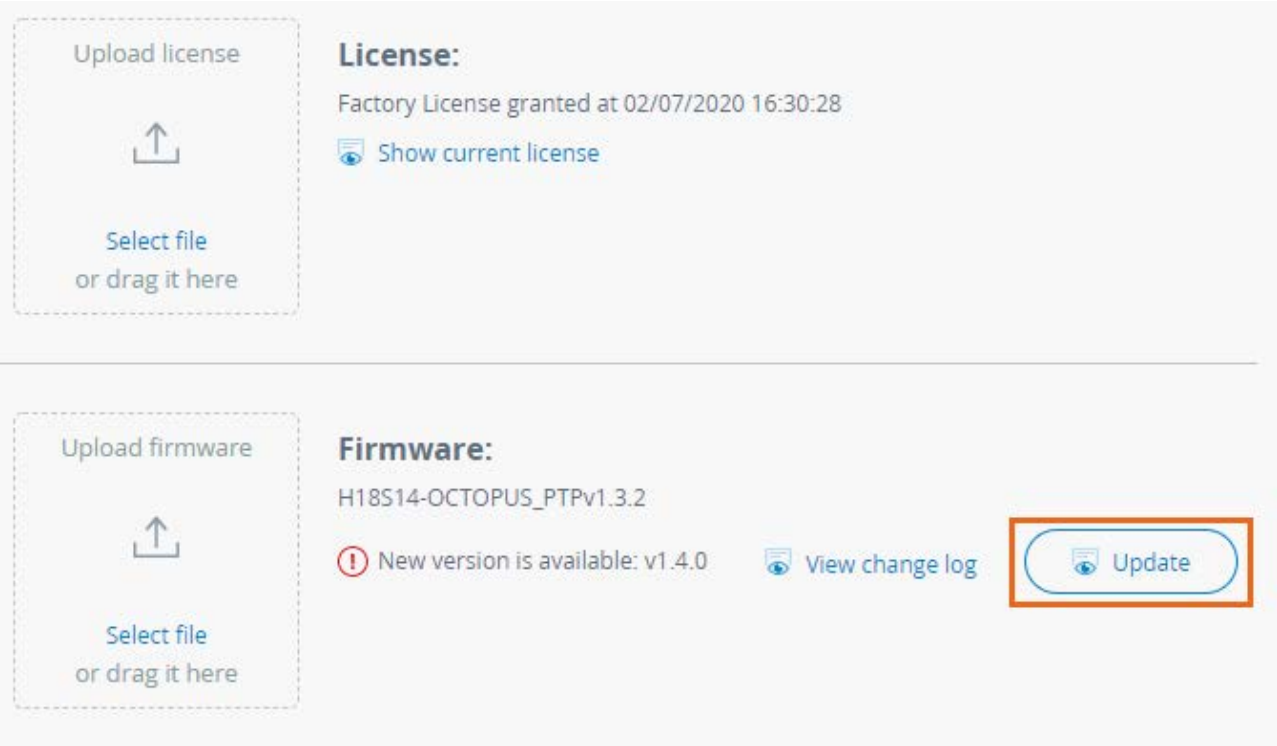
> **NOTE**
>
> At the next login, type "admin" for the Login and Password (if these are the credentials set before) to access the unit in the privileged mode.

5.3 Step 3: Firmware upgrade

Let's upgrade each unit to the latest stable firmware version. In case the laptop has an access to the Internet, a new software version will be detected automatically, update on both devices.

Otherwise, the manual firmware upgrade process should be performed:

- Download latest release from the ftp server ftp://ftp.infinet.ru/pub/Firmware.
- In the "Maintenance" section click the "Select file" button and set the path to the downloaded file, or drug it to the specified area.
- File will be uploaded to the device. Changes will take force after reboot.



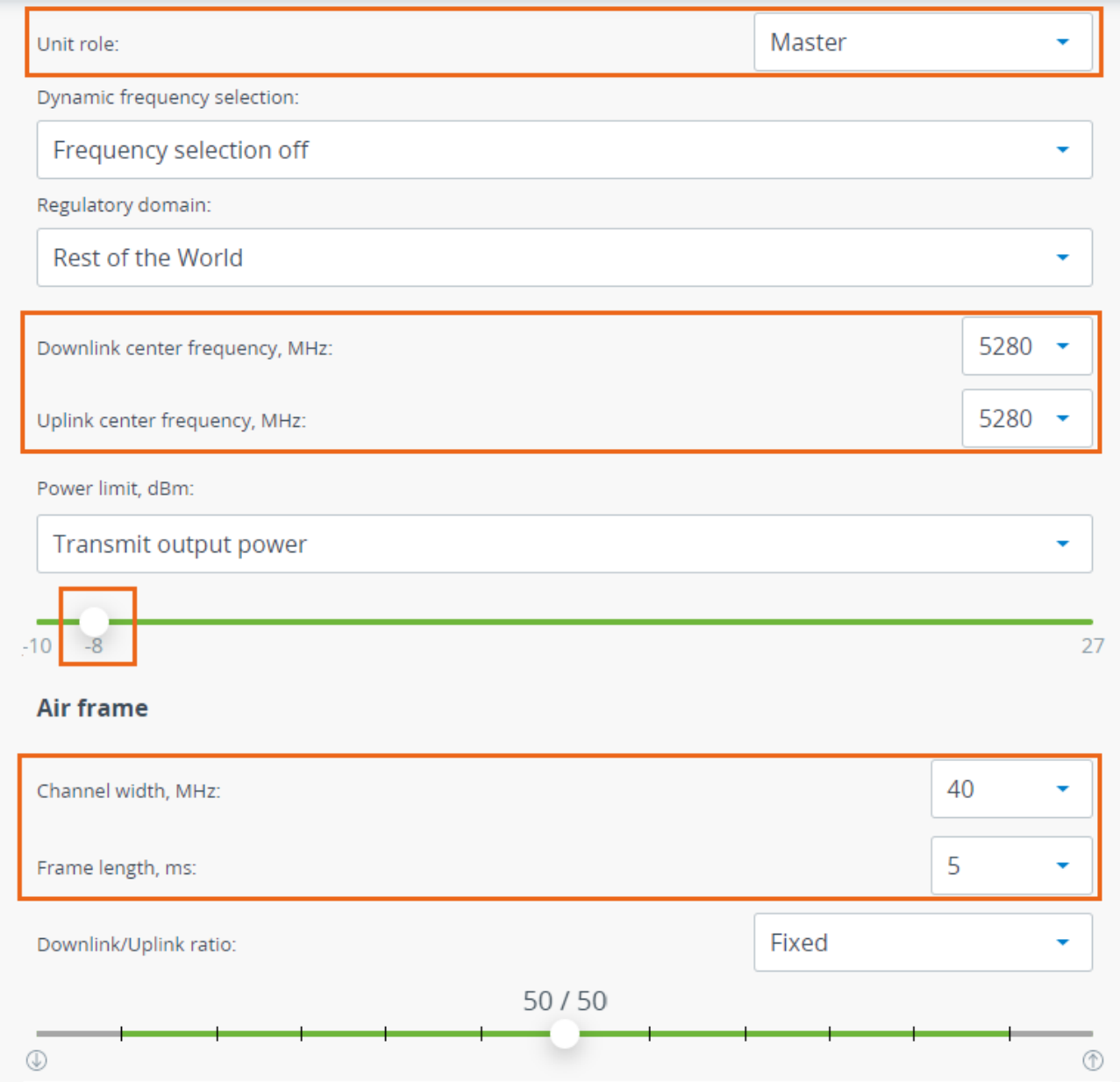
5.4 Step 4: Radio parameters configuration

Let's configure the minimum needed radio parameters to establish the link.

At the unit named Master at step #2 above, go to the "Settings" → "General" section and set the "Link ID" parameter, it must be the same on both sides of the link. Then to "Radio" and set this unit with:

- Unit role: one device should be Master, another one - Slave.
- Downlink center frequency use values selected at the Link Planning[8] stage.
- Uplink center frequency: only for the Slave device.
- Power limit: set the minimum value in the range, as currently, we are in the lab, and we don't need high output power.
- Channel width: use value selected at the Link Planning[9] stage.
- Frame length: same on both devices.

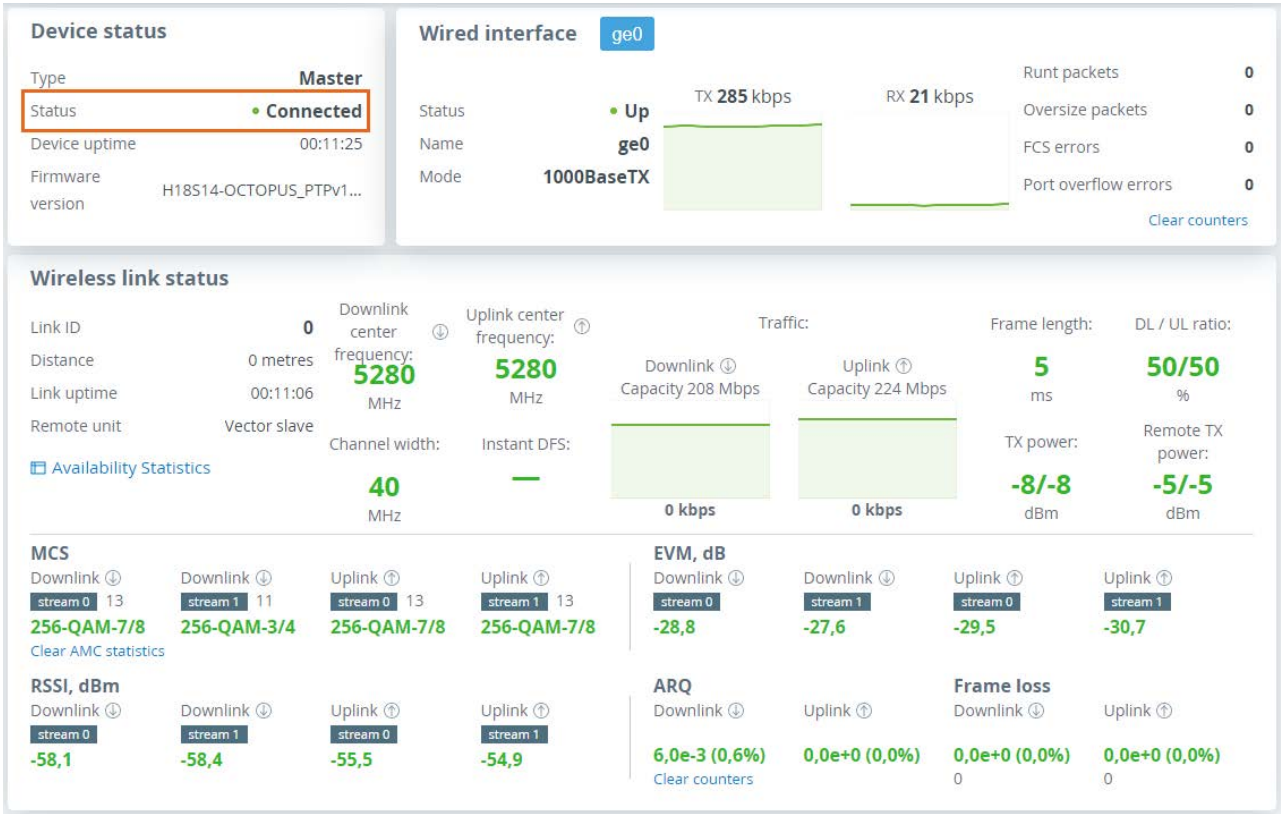
The rest of parameters remain with the default values.



8 https://wiki.infinetwireless.com/display/IA/2.+Link+Planning
9 https://wiki.infinetwireless.com/display/IA/2.+Link+Planning

5.5 Step 5: Check the wireless link status

Let's apply all settings described above for each unit and go to the "Dashboard" section and check if the device status has changed to "Connected".

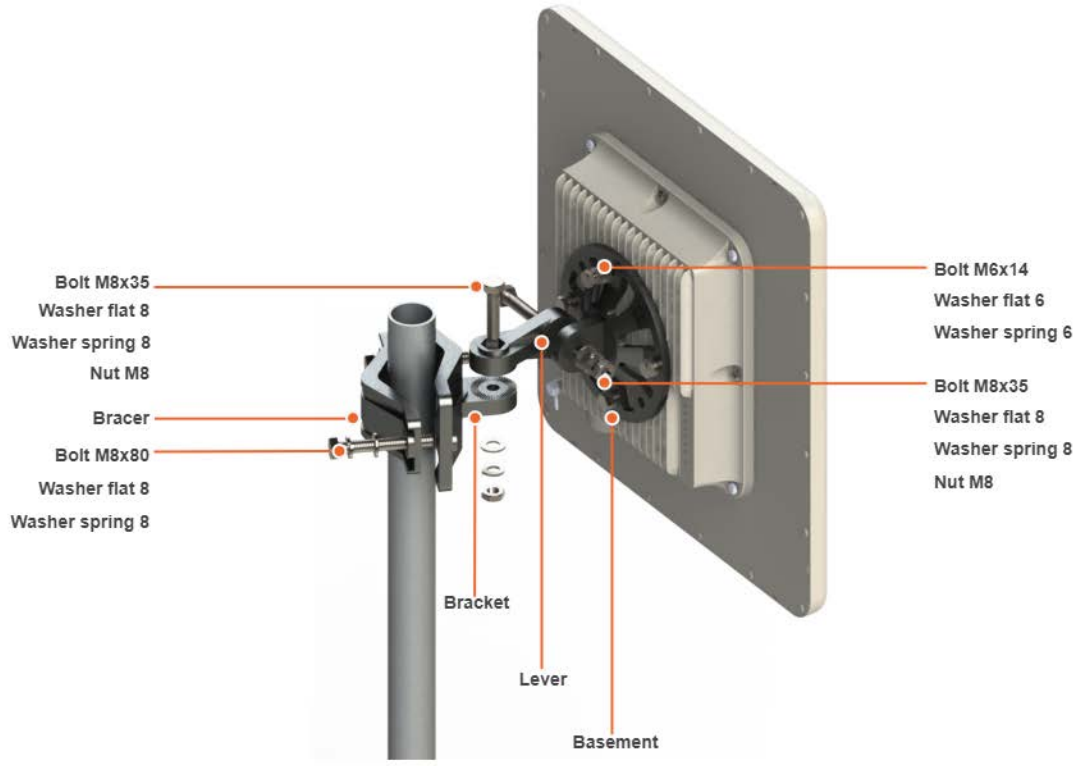


6 Installation

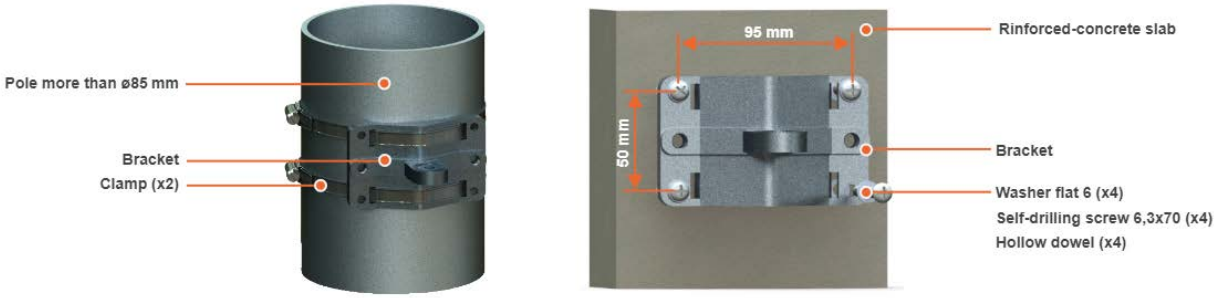
6.1 Mounting kit

6.1.1 MONT-KIT-85 Mounting kit

MONT-KIT-85 is supplied with models Q5-25, Q5-23, Q5-E, Q6-25, Q6-E by default. It allows to make reliable and easy installation of the unit with two-axis adjustment. Assemble the Mounting kit according to the scheme below. The nut must be tightened until the spring washer clicks, without over-tightening.



Mounting is carried out on a pole with a diameter 30-85 mm. There are also possible options for mounting on a wall or pole with a diameter more than 85 mm.



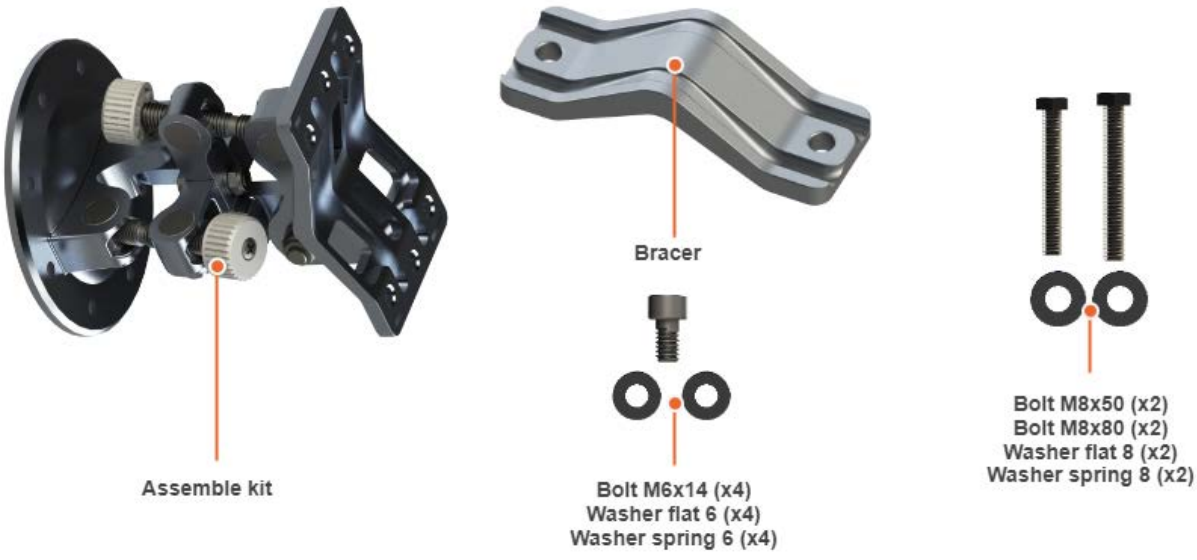
NOTE

Clamps and other optional fasteners are not included in the Mounting kit MONT-KIT-85.

6.1.2 MONT-KIT-85P Mounting kit

High precision mounting kit MONT-KIT-85P allows to make reliable and easy installation and enables extremely accurate adjustment on azimuth and elevation for optimal wireless link performance. Compatible for Quanta 5, Quanta 6, InfiLINK 2x2, InfiMAN 2x2, InfiLINK Evolution, InfiMAN Evolution, InfiLINK XG, InfiLINK XG 1000 families units. Especially suitable for installing high-gain antenna models that have a narrow beam.

6.1.2.1 Packing List



6.1.2.2 Assemble Procedure

Step 1: Insert and tighten the Assembled kit on the back side of the device using bolts M6x14, washers flat 6 and washers spring 6.

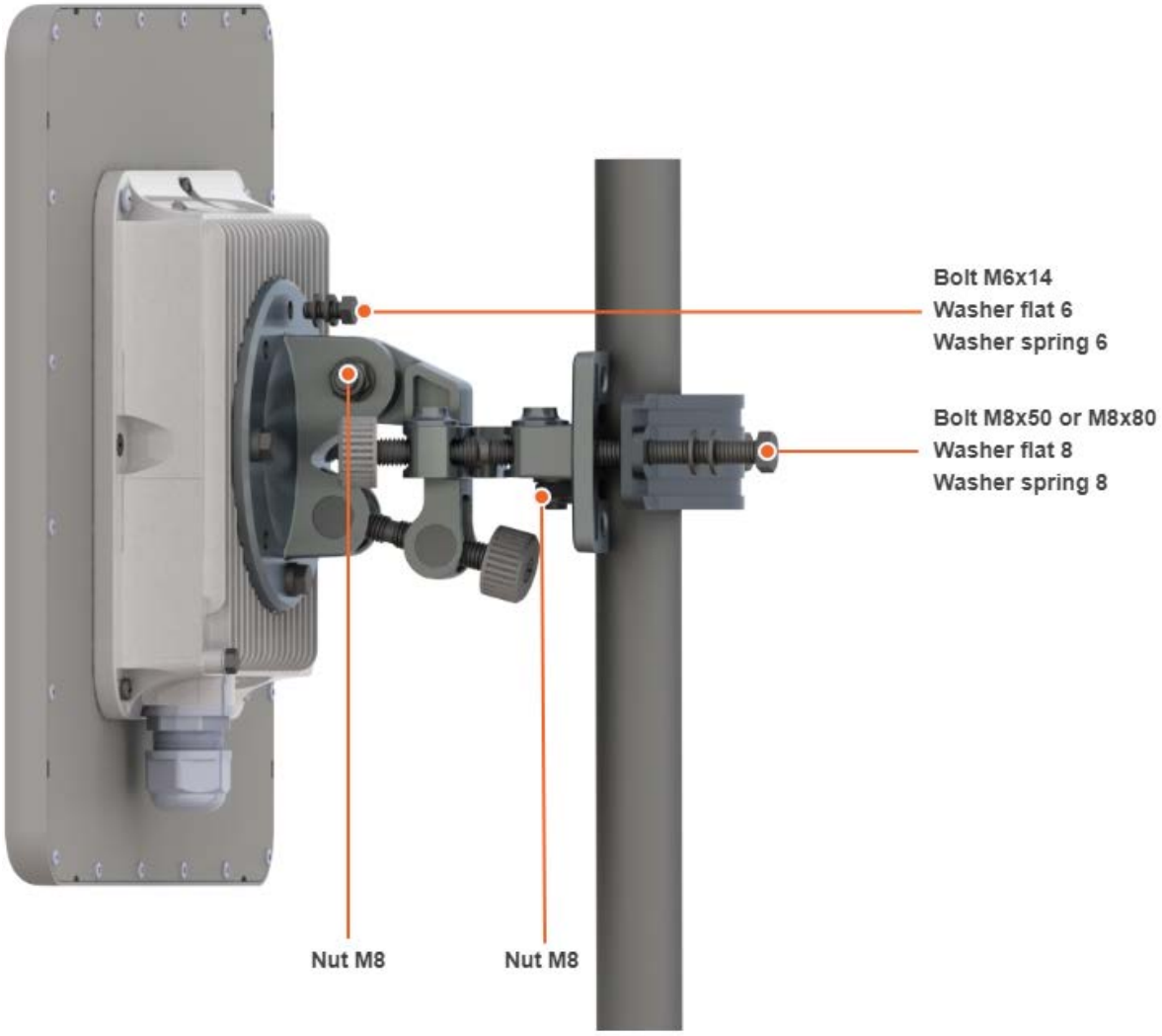
Step 2: Tighten the Assembled kit and Bracer to the pole using bolt M8, washer flat 8 and washer spring 8.

- Bolt M8x50 - used for installation on a pole with Ø 30 ... Ø 55 mm.
- Bolt M8x80 - used for installation on a pole with Ø 55 ... Ø 85 mm.

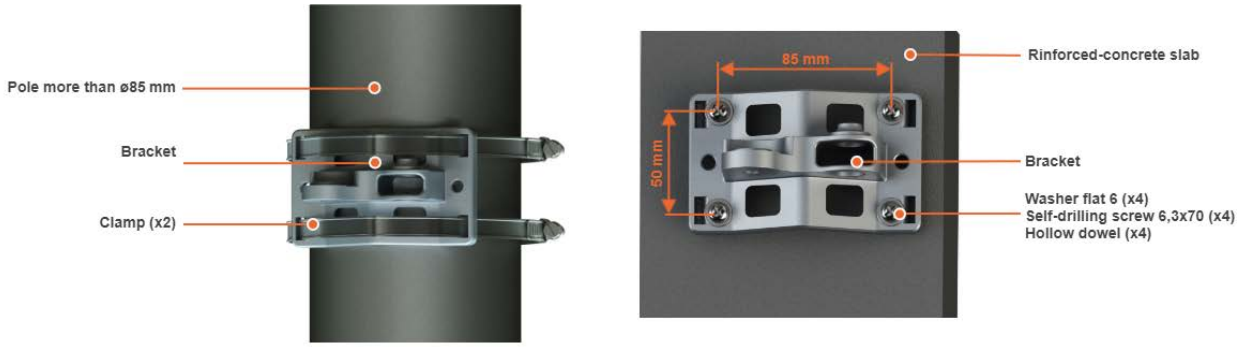
Step 3: Perform required antenna alignment using adjustment knobs and then tighten nuts M8.

> **NOTE**
>
> M8 nuts are pre-tightened at the manufacturing facility in a position that allows the device to be adjusted using the adjustment knobs and ensures that the wireless device does not shift during the final nuts tighten.

> **NOTE**
>
> If further adjustment is required, weaken the nuts M8 on about 15 degrees. Do not adjust the knobs without weaken the nuts first.



Mounting is carried out on a pole with a diameter 30 ... 85 mm. There are also possible options for mounting on a wall or pole with a diameter more than 85 mm.

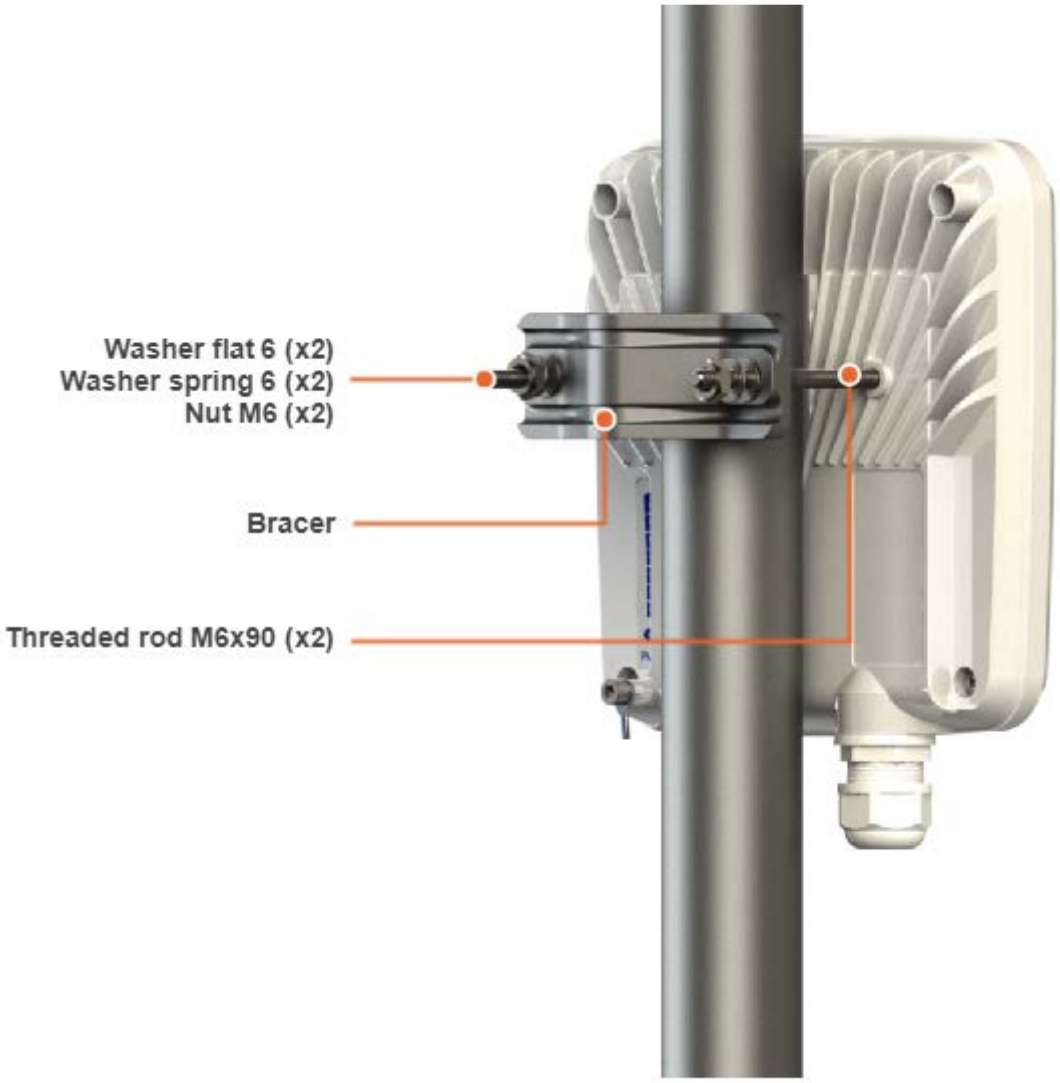


NOTE

Clamps and other optional fasteners are not included in the mounting kit MONT-KIT-85P.

6.1.3 Mounting kit for Q5-18, Q6-18

Q5-18, Q6-18 model installation is performed using bracer and threaded rod M6x90 that s supplied by default. Install the device according to the scheme below. The nut must be tightened until the spring washer clicks, without over-tightening.



6.2 Cable Gland Assembly

Required components are listed below.

1. Unshielded RJ-45 connector.
2. Shielded RJ-45 connector.
3. FTP Cat5e cable.
4. Cable gland:
    - Cable sealing nut.
    - Cable sealing grommet with rubber seal.
    - Cable gland case.
5. Crimping tool for RJ-45 connector.

> **NOTE**
>
> The outside diameter value of the FTP Cat5e cable should not exceed 7 mm.

6.2.1 Assemble procedure

In order to ensure that the device case remains sealed under any environmental conditions follow the assemble procedure:

- **Step 1**: Insert the sealing insert into the clamping claw.
- **Step 2**: Assemble the cable gland by putting the thread-lock sealing nut, clamping claw with sealing insert and body onto the cable as shown on the figure.
- **Step 3**: Insert the clamping claw with sealing insert into the body as shown on the figure.
- **Step 4**: Crimp the standard RJ-45 connector onto the cable using crimping tool. Pin-out scheme: T568B wiring standards

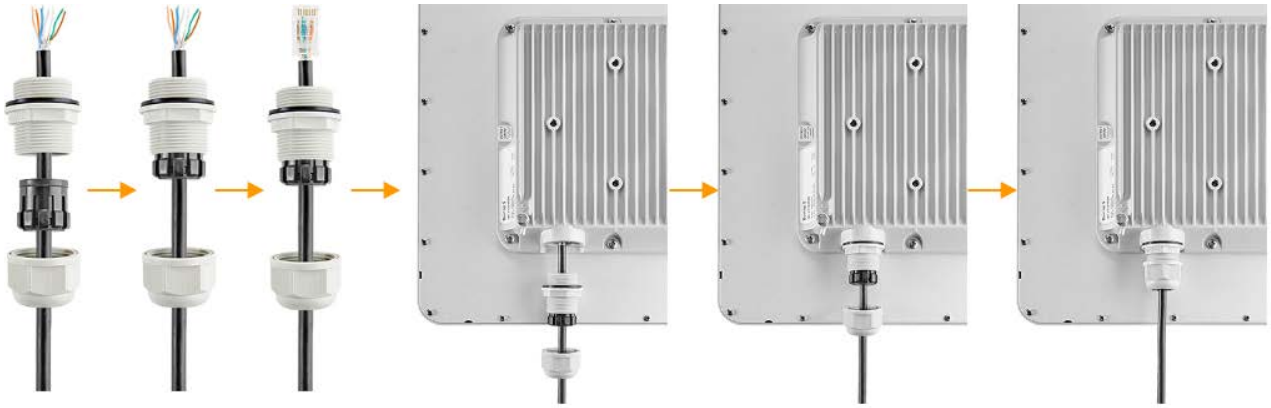
NOTE

Do not use the shielded RJ-45 connector on this end of the cable as it should be attached on the power supply unit end.

CAUTION

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

- **Step 5**: Insert the Rj-45 connector into the device socket until you hear a click.
- **Step 6**: Screw the cable gland body into the port and tighten it. Do not apply excessive force.
- **Step 7**: Tighten the thread-lock sealing nut. Do not apply excessive force.



6.3 Mounting

Pre-installation

Reqiered tools

- Screwdriwer set.
- Pliers / pipe wrench.
- Wrench set.

Additional equipment

- GPS receiver.
- High magnification binoculars.

CAUTION

Before mounting the equipment in an outdoor environment, please make sure that:

- You acknowledge the regulations imposed by the Regulatory Authority for Communications in your country for the radio spectrum to be used.
- You chose known locations for the installation of the links; although InfiNet Wireless devices can also operate in Near-LoS or Non-LoS conditions, to achieve the best performance, it's highly recommended to install the link in locations where Clear-Line-of-Site and clear channels are available.
- You performed link planning using the InfiPLANNER tool (https://infiplanner.infinetwireless.com[10]) to determine the link path profiles, radio equipment placement requirements, etc.
- You met requirements described in the section "Planning considerations" - > "Wireless device placement".

6.3.1 Installation Procedure

1. In case of device with external antenna, mount and connect an external antenna to the device in accordance with the following recommendations:
   a. Mount the antenna according to manufacturer's instructions;
   b. Connect the ODU V and H N-type interfaces to the antenna with RF coaxial cables and with appropriate connectors. Use cables not longer than 1 m (3.3ft). Tighten the N-type connectors to a torque setting of 1.7 Nm (1.3 lb ft);
   c. Form drip loops near the cable ends at the ODU's side so that water doesn't creep towards the ODU connectors;
   d. Weatherproof the N-type connectors (when antenna alignment is complete) using PVC tape and self-amalgamating rubber tape;
   e. Weatherproof the antenna connectors in the same way (unless the antenna manufacturer specifies a different method);
   f. Fix the antenna cables to the supporting structure using site approved methods. Ensure that no undue strain is placed on the ODU or antenna connectors. Ensure that the cables do not flap in the wind, as flapping cables are prone to damage and induce unwanted vibrations in the supporting structure.

10 https://infiplanner.infinetwireless.com/

NOTE

The antenna example:

Directivity	Type	Manufacturer	Reference	Stated Gain
Directional	Flat-panel, dual orthogonal polarization array	MARS Antennas and RF Systems, Ltd.	MA-WA56-DP23IF	23 dBi

Any external antenna of the same type and of gain not greater than the one approved by the FCC can be used with the Quanta 5 Q5-E in the countries abiding by the FCC Rules.
External antenna must be professionally installed pursuant to the section 15.203 of the FCC Rules.

CAUTION

In order to prevent device damage make sure that antenna is connected to both N-type connectors with serviceable RF cables before switching on

2. Install ODU connector facing down using the MONT-KIT-85. Do not tighten the fasteners to the end until the alignment is completed.
3. Connect the Cat5e FTP cable with the cable gland to ODU.
4. Perform ODU grounding.
5. Lay the Cat5e FTP cable from ODU to the power supply.
6. Connect the Cat5e FTP cable with a shielded connector covered by a cap to the "OUT" port of the power supply, having previously touched the power supply connector case with FTP cable connector case.

CAUTION

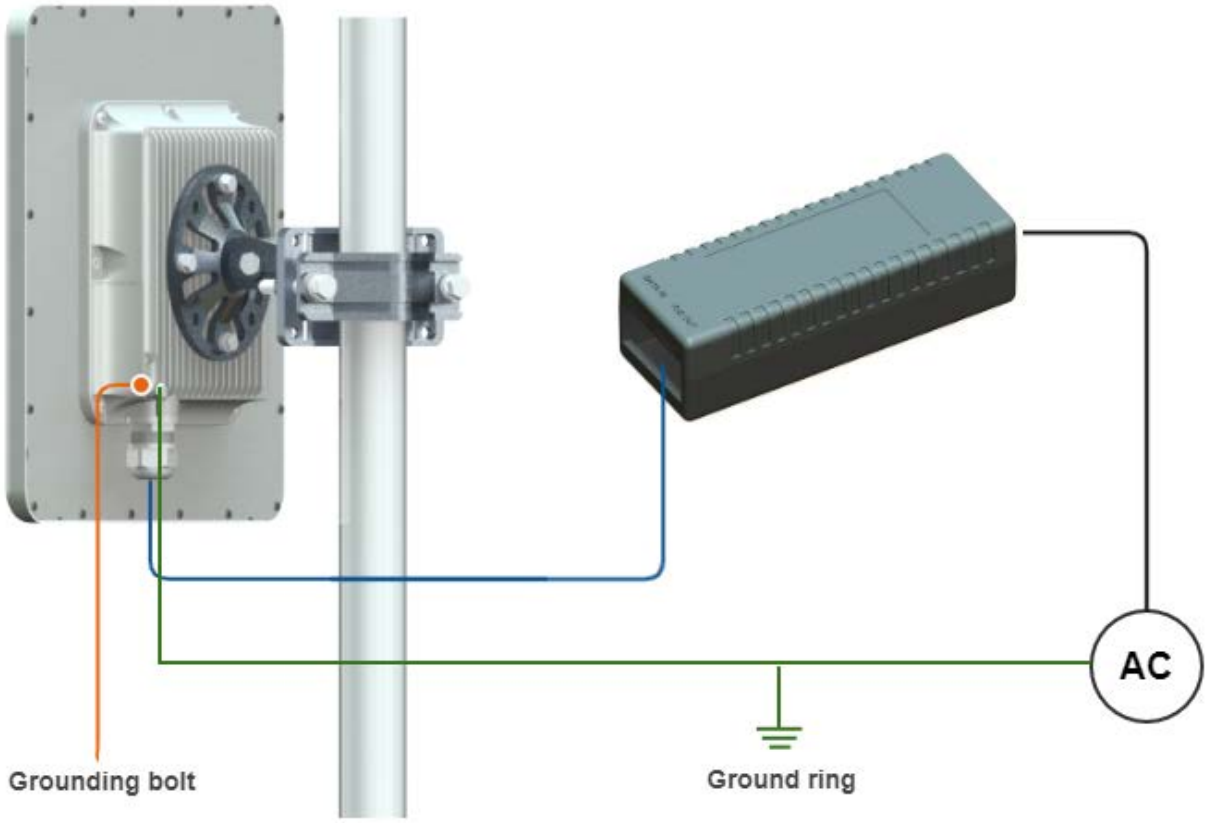
The power supply must not operate near a direct heat source, near water or in an environment with high humidity. The cables must be connected in such a way to prevent water flow to the power supply connectors.

7. Perform the power supply grounding.
8. Connect the laptop using Cat5e FTP cable to the power supply "IN" port.
9. Connect the power cord to the power supply and then to the power circuit.

CAUTION

Use mains supply cords that adhere to safety regulations of the country where the equipment is getting deployed.

Make sure a small loop (at least 10 cable diameters) is provided before the Cat5e FTP cable enter into the building.



CAUTION

This equipment is a source of electromagnetic energy and exposes public and personnel to RF electromagnetic emission. Guaranteed safe distance to human body during operation is 20cm (7.9in) and greater.

CAUTION

Surface of device may become hot during operation, contact may cause burn. Allow to cool before handling.

CAUTION

Please note that the pressure equalization system in Infinet devices is performed via gas exchange through a cable gland and Ethernet cable jacket with a dry room where the power supply is installed. In order to avoid ODU failure due to moisture entering the device, for example, during the pressure drop during the rain, the cable gland assembly requirements should be met and there are should be no cracks in the Ethernet cable jacket.

In addition, you should avoid the Ethernet cable bending near the ODU, that can bring to the pressure equalization system fault between the internal volume of the sealed ODU and the external environment during a sudden air temperature change. This may lead to the device failures.

6.4 Grounding and Lightning Protection

This section describes factors to be considered when planning the proposed link end sites, including grounding, lightning protection and equipment location for the wireless device, power supply, AUX-ODU-LPU-L and AUX-ODU-LPU-G unit (if installed).

CAUTION

Electro-magnetic discharge (lightning) damage is not covered under warranty. The recommendations in this document, when followed correctly, give the user the best protection from the harmful effects of EMD. However 100% protection is neither implied nor possible.

6.4.1 Grounding and lightning protection recommendations

- The wireless device 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 wireless device. The pole should be properly grounded: connected to the building lightning protection circuit according to your local regulations.
- All equipment must be connected at stabilized and surge protected power sources which must be properly grounded.
- The end of the FTP service cable that is connected to the power supply should be assembled with a shielded RJ-45 connector. The other end of the FTP service cable connected to the wireless device should be assembled with unshielded (standard) RJ-45 connector.
- The power supply is grounded via a three-conductor power cord and a grounded socket.
- AUX-ODU-LPU-G and AUX-ODU-LPU-L grounding is performed using grounding bolt.
- Antenna pole and wireless device should be connected to the common ground ring. Grounding cables should be no less than 10AWG thick and must use corrosion-resistant connectors.
- Special attention should be paid if the external antenna used is not DC-shorted. In this case, an additional lightning arrestor should be used between the antenna and ODU.

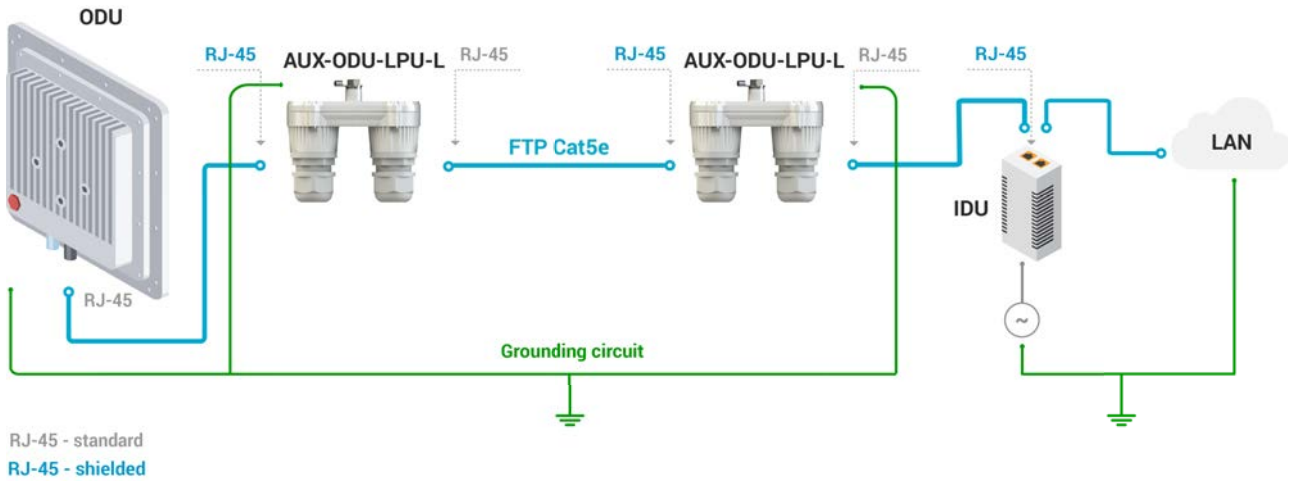
6.4.2 Requirements to the lightning protection unit AUX-ODU-LPU-L location

AUX-ODU-LPU-L 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-L should be properly assembled, mounted and grounded.

General recommendations for installations of lightning protection units:

- Install the lightning protection unit on both ends of the cable to protect both the outdoor and the indoor unit. The purpose of the LPU at the top is to protect the ODU from a surge of lightning strike which can hit the long FTP 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.
- Use the lightning protection unit to protect all circuits for signal transmission and power supply (video, audio, management signals, Ethernet, etc.)
- Regularly (especially before the periods with high thunderstorm activity) check the integrity of lightning protection units, grounding elements and bonding conductors.
- The ports of the AUX-ODU-LPU-L device are symmetrical, i.e. the correspondence of ports position to the external unit and the power supply does not matter.

Make sure to install the two LPU devices as shown in the scheme below.



13 Figure - Connection scheme

CAUTION

Please note grounding cables should not be connected to the mast. All devices must use separate grounding cable that should be connected to the grounding circuit. The best scenario is when grounding cables are lined parallel to the Ethernet cable.

6.4.2.1 AUX-ODU-LPU-L Mounting

AUX-ODU-LPU-L is installed on a mast, using clamp. Attach the grounding cable (min cross-section 2.5 mm^2) to the case, using grounding bolt.

14 Figure - AUX-ODU-LPU-L Mounting

During AUX-ODU-LPU-L mounting it is necessary to provide a small loop of the FTP cable that should be below the cable gland. This ensures that water is not constantly channeled towards the connector. It will also serve as a cable compensation for the cable linear expansion as the temperature difference result.

15 Figure - Cable loop

CAUTION

Missing or bad grounding may leave the unit vulnerable to lightning damage.

6.4.2.2 AUX-ODU-LPU-L Cable Ggland Assembly

In order to ensure that the cable gland remains sealed under any environmental conditions, please, follow the assembly sequence according to the procedure below:

- **Step 1**: Insert the sealing insert into the clamping claw.
- **Step 2**: Assemble the cable gland by putting the thread-lock sealing nut, clamping claw with sealing insert and body onto the cable as shown on the figure.
- **Step 3**: Insert the clamping claw with sealing insert into the body as shown on the figure.
- **Step 4**: Crimp the standard RJ-45 connector onto the cable using crimping tool. Pin-out scheme: T568B wiring standards.

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

- **Step 5**: Insert the RJ-45 connector into the corresponding socket until you hear a click.
- **Step 6**: Screw the cable gland body into the port and tighten it. Do not apply excessive force.
- **Step 7**: Tighten the thread-lock sealing nut. Do not apply excessive force.

16 Figure - Cable gland assembly

6.4.3 Requirements to the lightning protection unit AUX-ODU-LPU-G location

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 assembled, mounted and grounded.

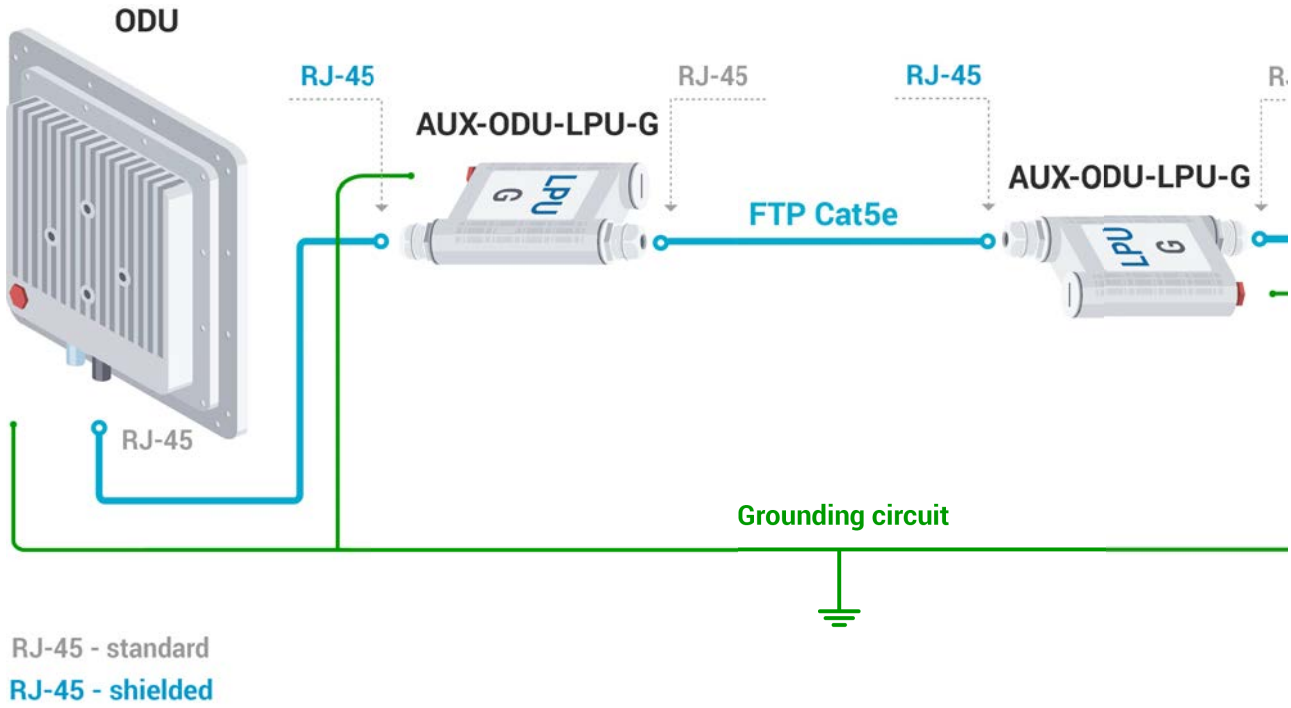
General recommendations for installations of lightning protection units:

- Install the lightning protection unit on both ends of the cable to protect both the outdoor and the indoor unit. The purpose of the LPU at the top is to protect the ODU from a surge of lightning strike which can hit the long FTP 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.
- Use the lightning protection unit to protect all circuits for signal transmission and power supply (video, audio, management signals, Ethernet, etc.)

- Regularly (especially before the periods with high thunderstorm activity) check the integrity of lightning protection units, grounding elements and bonding conductors.

Make sure to install the two LPU devices in the correct polarity, as shown in the diagram:

- Top LPU with "ETH OUT" facing the ODU.
- Bottom LPU with "ETH OUT" facing the IDU.
- LPU units connected to each other via "ETH IN".



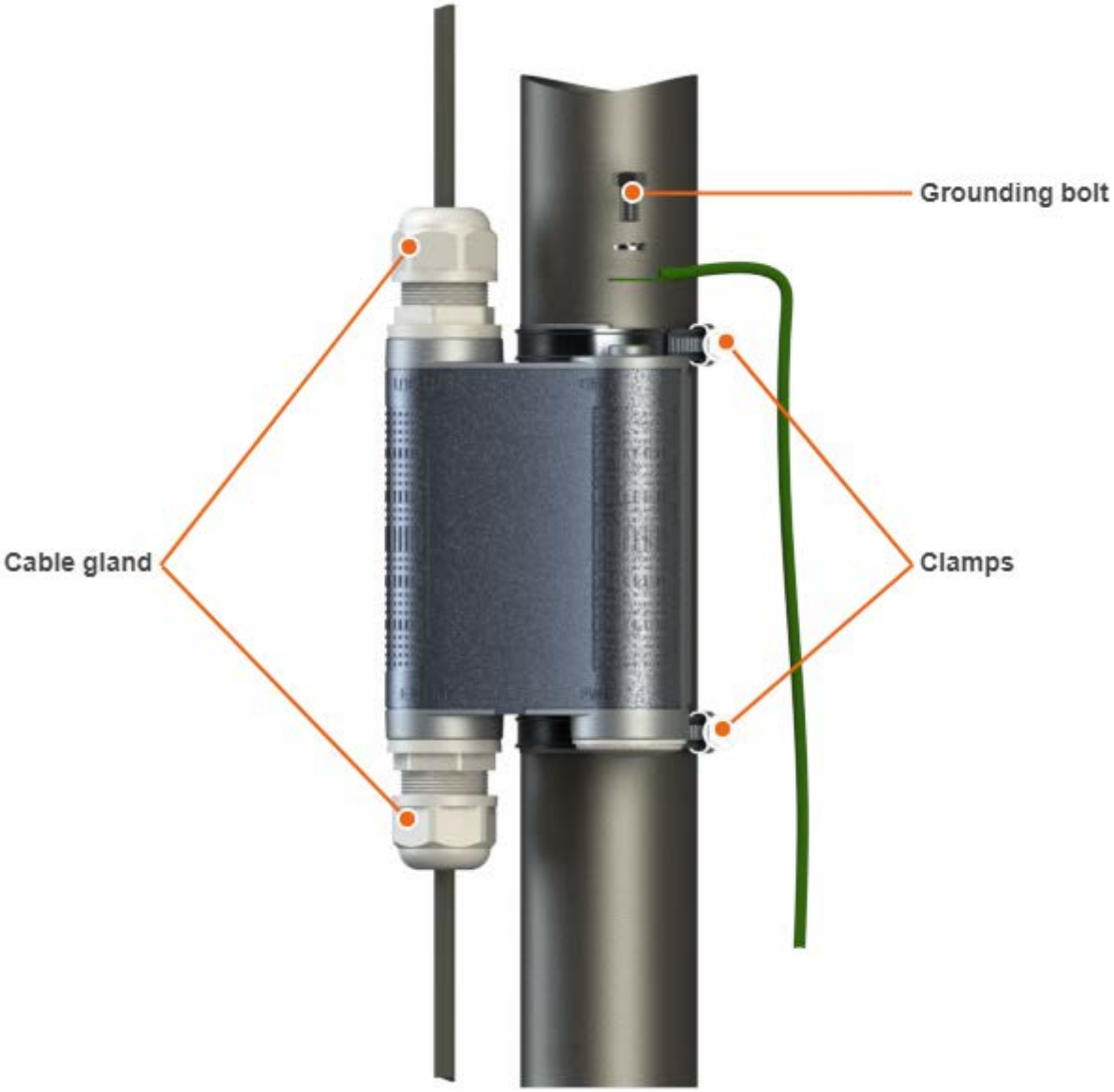
17 Figure - AUX-ODU-LPU-G Assembly Scheme

CAUTION

Please note grounding cables should not be connected to the mast. All devices must use separate grounding cable that should be connected to the grounding circuit. The best scenario is when grounding cables are lined parallel to the Ethernet cable.

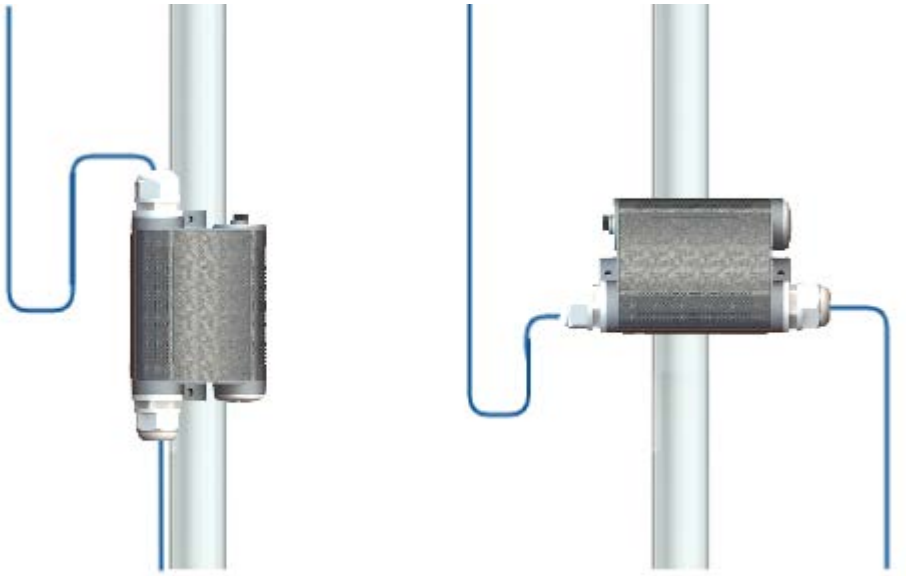
6.4.3.1 AUX-ODU-LPU-G Mounting

AUX-ODU-LPU-G can be installed on a pole, using hose clamps. Attach the grounding cable (min cross-section 2.5 mm^2) to the case, using grounding bolt.



18 Figure - AUX-ODU-LPU-G Mounting

During AUX-ODU-LPU-G mounting it is necessary to provide a small loop of the FTP Cat5e cable that should be below the cable gland. These ensure that water is not constantly channeled towards the connectors. It will also serve as a cable compensator for the cable linear expansion as the temperature difference result.



19 Figure - Cable loop

> **CAUTION**
>
> Missing or bad grounding may leave the unit vulnerable to lightning damage.

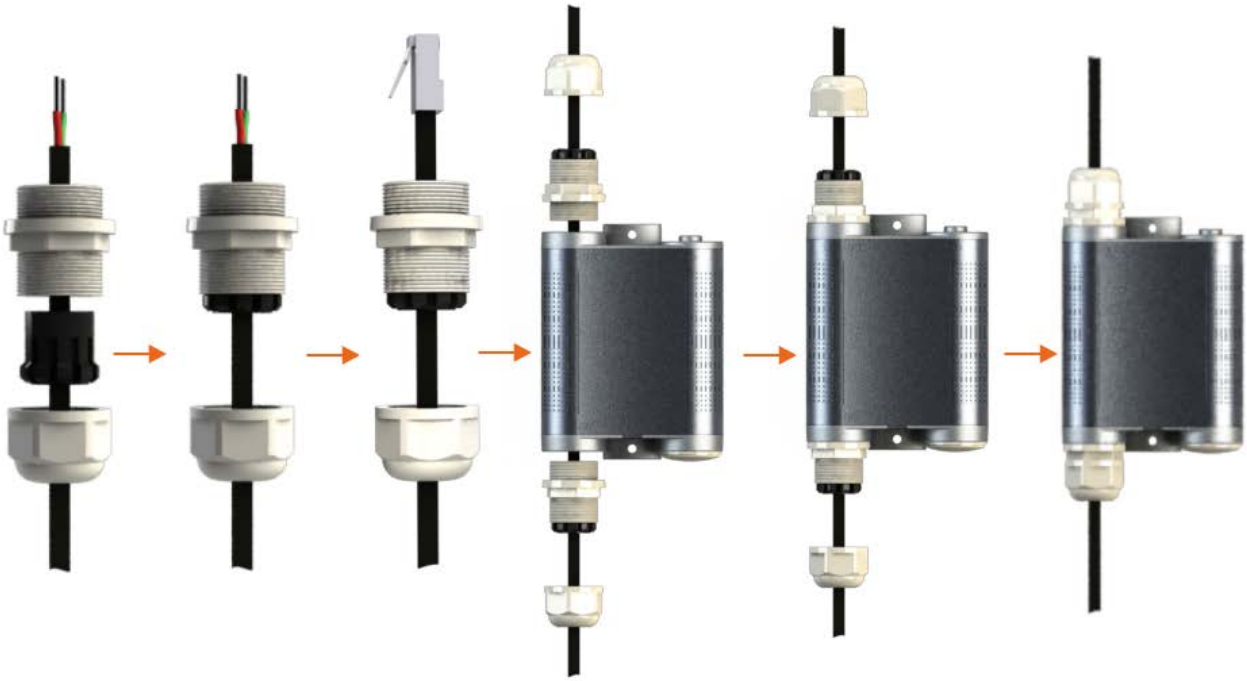
6.4.3.2 AUX-ODU-LPU-G Cable Gland Assembly

In order to ensure that the cable gland remains sealed under any environmental conditions, please, follow the assembly sequence according to the procedure below:

- **Step 1**: Insert the sealing insert into the clamping claw.
- **Step 2**: Assemble the cable gland by putting the thread-lock sealing nut, clamping claw with sealing insert and body onto the cable as shown on the figure.
- **Step 3**: Insert the clamping claw with sealing insert into the body as shown on the figure.
- **Step 4**: Crimp the standard RJ-45 connector onto the cable using crimping tool. Pin-out scheme: T568B wiring standards.

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

- **Step 5**: Insert the Rj-45 connector into the corresponding socket until you hear a click.
- **Step 6**: Screw the cable gland body into the port and tighten it. Do not apply excessive force.
- **Step 7**: Tighten the thread-lock sealing nut. Do not apply excessive force.



20 Figure - AUX-ODU-LPU-G Cable Gland Assembly Scheme

6.5 Antenna Alignment

6.5.1 General recommendations

- It is recommended to have two teams prepared for alignment procedure, each team with at least two members: one should take the signal readings and communicate with the remote end, the other should manipulate the antenna.
- For rough alignment use the azimuth, elevation angle and suspension height from InfiPLANNER report.

> **NOTE**
>
> For devices with an integrated antenna 18 dBi, the mounting kit allows alignment only in the horizontal plane.

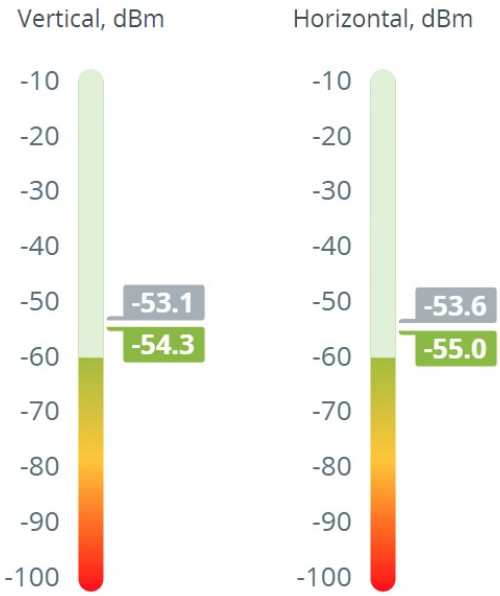
- On the device case there is a scale indicating the received signal level. The more often indicator flashes, the better quality of the connection. Blinking indicator shows an intermediate state, the more often indicator is blinking, the higher the connection level.
- For more accurate alignment, use the alignment tool built into the device web interface.
- After the initial alignment, the device at the remote side must be fixed. Firstly, the alignment is performed for one device, then for another.

6.5.2 Alignment tool

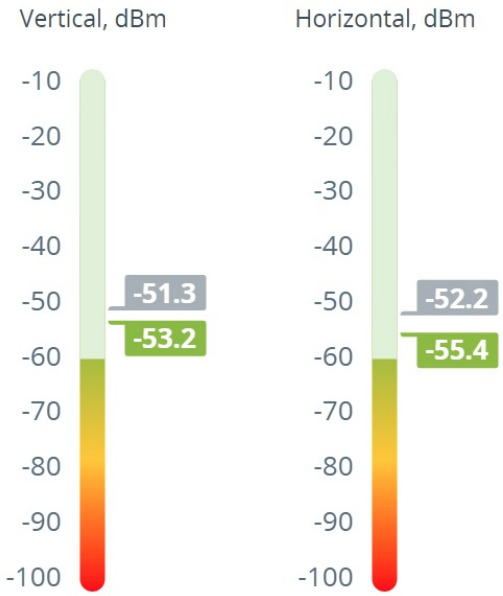
Use the Alignment tool to point and optimize the antenna in the direction of maximum link signal. The built-in graphical antenna alignment tool displays the signal levels for both devices and both polarizations, this makes an alignment process fast and accurate.

A green marker indicates the current signal level. To achieve the best performance, this marker should be as close as possible to the pale green area values, which displays the maximum calculated value possible for this link. A gray marker indicates the maximum value that was reached on this channel.

Local unit

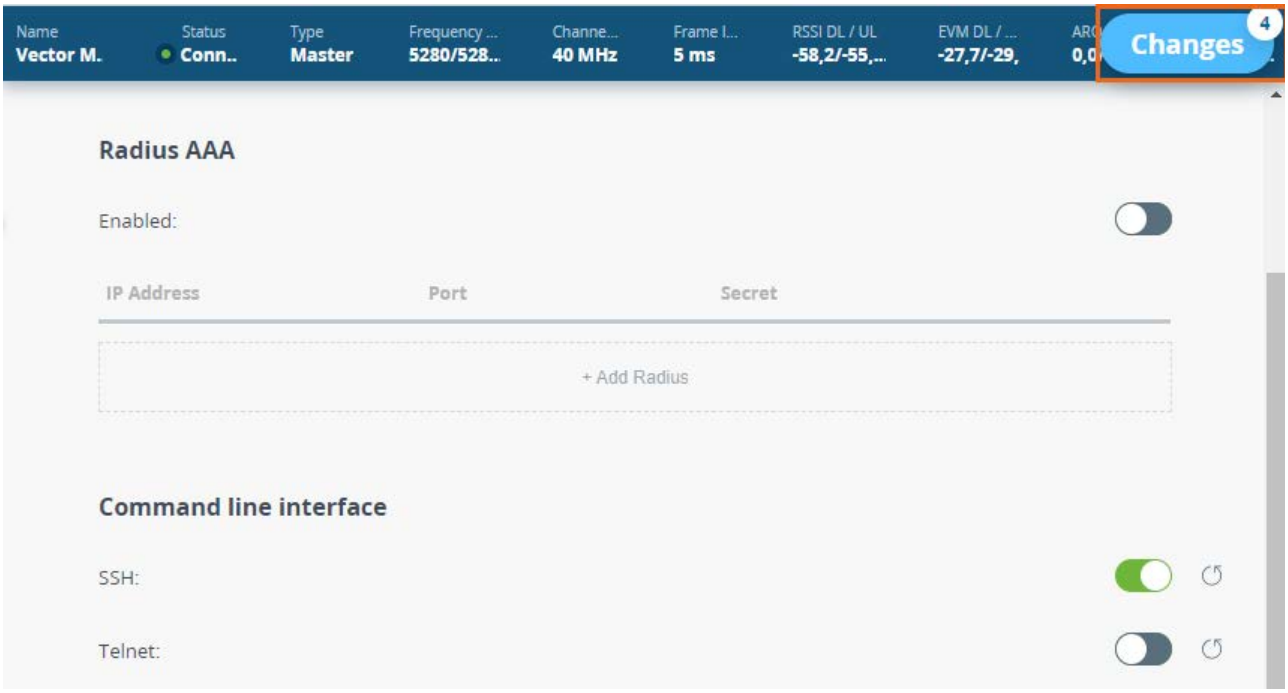


Remote unit



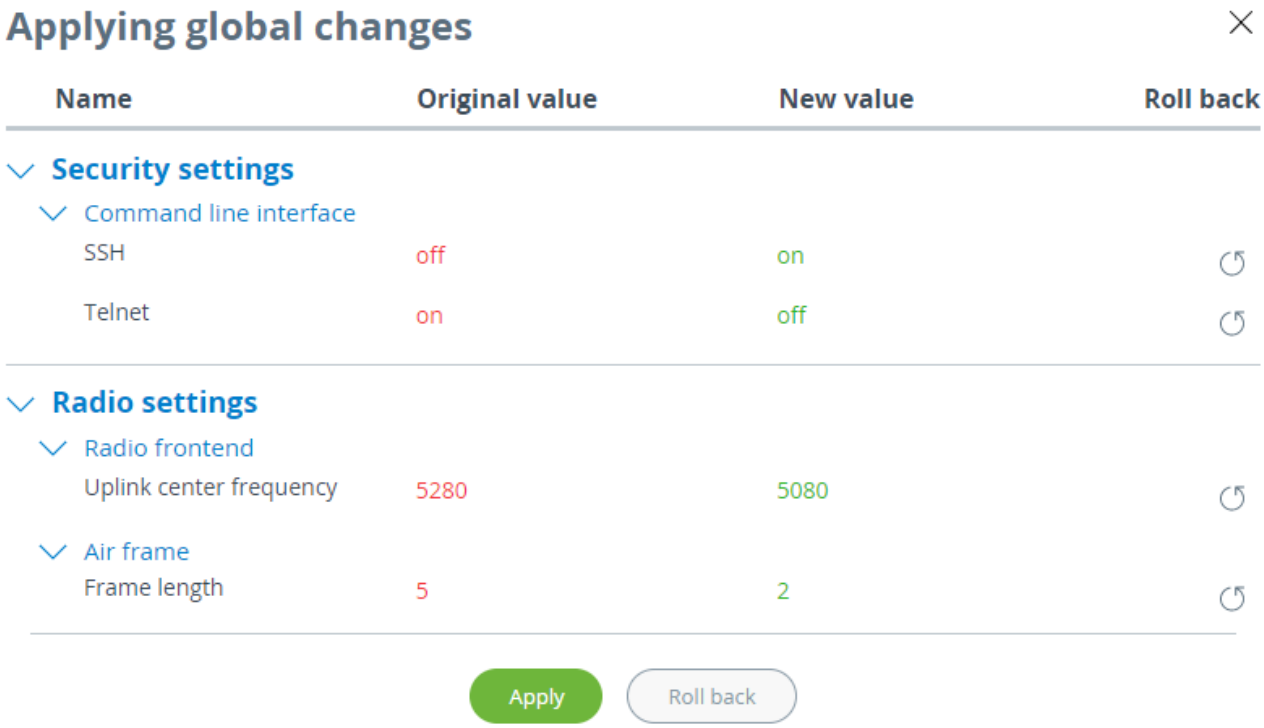
7 Operation & Administration

To make changes in the device configuration click the "Changes" button in the upper right corner of the web interface.



21 Figure - Applying changes

The "Applying global changes" window contains a table of parameters whose values have been changed by the user. If you want to undo one change, click the "Roll back" button near the entry. If you need to undo all changes, use the "Roll back" button at the bottom of the window. Changes will be saved to the device configuration by clicking the "Apply" button.



22 Figure - Applying changes

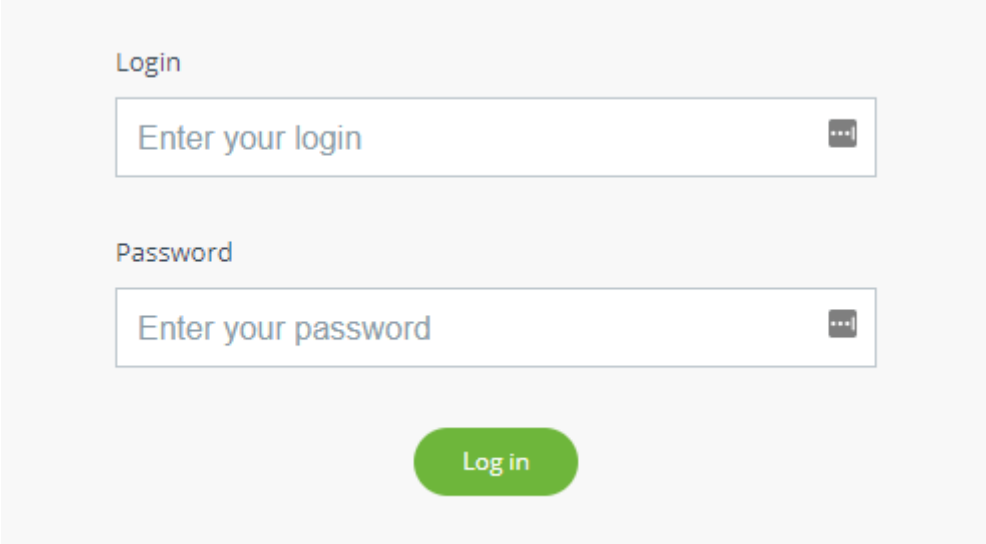
7.1 Web GUI Access

> **NOTE**
>
> Connecting third-party equipment via Ethernet (switches, PCs), make sure the PoE, Energy Efficient Ethernet and Green Ethernet functions are disabled on the network interfaces connected to Infinet devices.

Web User Graphical Interface (**Web GUI**) - is the basic way to configure and operate a wireless unit.

WANFleX OS starts automatically when you power on the unit, Web GUI is enabled by default. In order to access the unit via Web browser, type an IP address in the address bar.

> **NOTE**
>
> By default any username and any password can be used to login Web GUI.
>
> It's strongly recommended to set permanent username and password after the first log in. In order to do this go to the "General settings(see page 68)" section.



23 Figure - Web GUI login

7.2 Dashboard

This section is intended to provide the main information about the wireless unit operation.

The Dashboard displays a read-only summary of the current link status information, local and remote device signal strength, capacity for downlink and uplink, current values of the basic configuration settings and Ethernet network status.

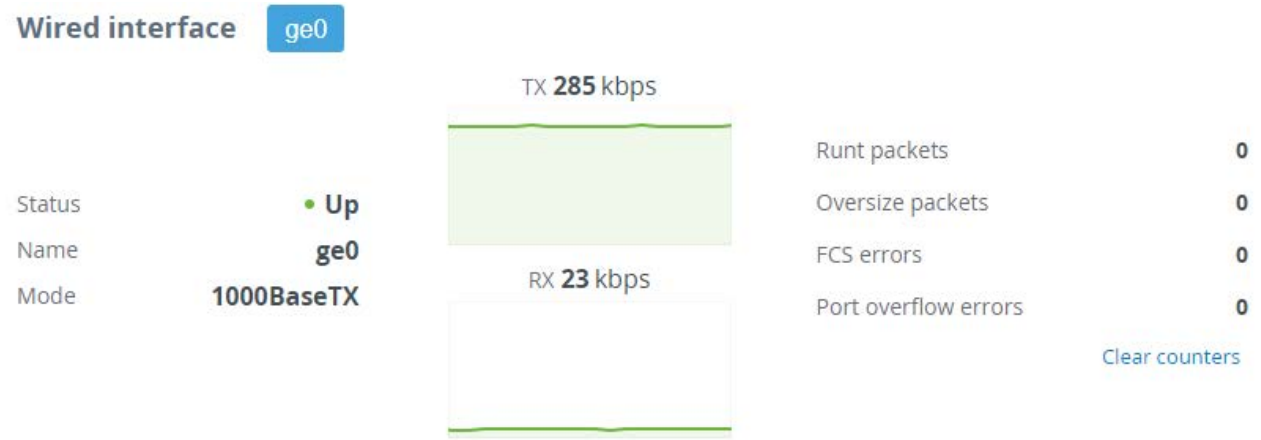
7.2.1 Device status

24 Figure - Device status

Parameter	Description
Type	The device type: Master or Slave.
Status	Wireless connection state.
Device uptime	The device operating time since the last reboot.
Firmware version	The firmware version uploaded to the device.

7.2.2 Wired interface

In the "Wired interface" tab, the Ethernet interface status can be monitored, as well as duplex mode and traffic load for reception and transmission. The wired interface statistic is available on the right side, it can be reset by the "Clear counters" button.

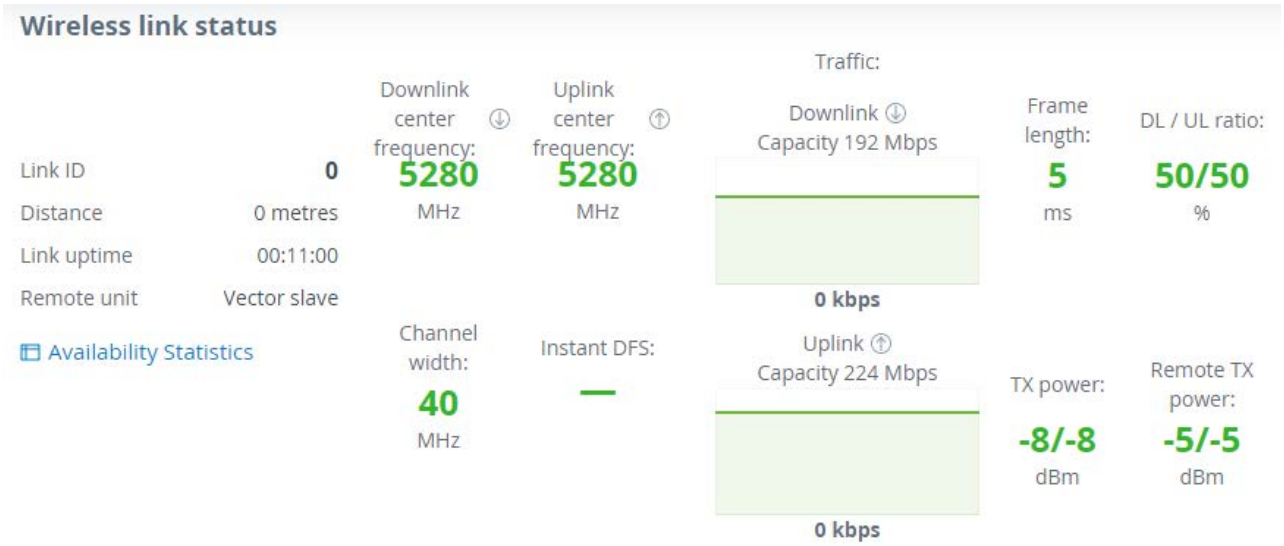


25 Figure - Wired interface paraqmeters

Parameter	Description
Runt packets	Packets less than 64 bytes in size
Oversize packets	Packets larger than 9038 bytes
FCS errors	Packets dropped due to checksum mismatch. The possible reasons for the error counter increasement are described in the "Troubleshooting (see page 97)" article
Port overflow errors	Packets dropped due to port buffer overflow

7.2.3 Wireless link status

The “Radio” tab displays the current settings of the wireless connection, as well as the link load in the uplink and downlink directions.



26 Figure - Wireless link parameters

Parameter	Description
Link ID	Wireless link can be established only with devices which have the same link ID.
Distance	The estimated link length.
Link uptime	The link operating time since the last outage.
Remote unit	The remote device name.
Center frequency	The downlink and uplink center frequency value set in the "Radio" section manually or by the automatic frequency selection mechanism.
Channel width	The channel width value set in the "Radio".
Instant DFS	Instant DFS option state (only for Quanta 5 family devices).
Traffic	The wireless link capacity and utilization in the uplink and downlink directions.
Frame size	The frame size value set in the "Radio".
DL / UL ratio	The ratio of the downlink traffic to uplink, set in the "Radio" section manually or by a mechanism for automatically determining the optimal ratio.
Tx power	The transmitter power value on the local device determined by the automatic power control mechanism for each polarization. If the automatic transmit power control tool is disabled, the value set manually by the user will be displayed.
Remote X power	The transmitter power value on the remote device determined by the automatic power control mechanism for each polarization. If the automatic transmit power control tool is disabled, the value set manually by the user will be displayed.

7.2.3.1 Availability statistics

The link availability statistics window displays the following information:

- The overall wireless link availability since the last device reboot, the number of wireless outages when the connection was unavailable.
- Availability statistics for each modulation, for both polarization for downlink and uplink streams.

Availability Statistics

Link Availability Statistics

Status	Current uptime	Total uptime	Availability	Disconnection	Last outage	Total outage
Connected	00:49:53	02:24:42	97,1%	4	00:01:06	00:04:23

MCS Availability Statistics, %

Modulation	TX, Stream 0	TX, Stream 1	RX, Stream 0	RX, Stream 1
QPSK-1/4	97	97	97	97
QPSK-1/3	97	97	97	97
QPSK-1/2	97	97	97	97
QPSK-5/8	97	97	97	97
QPSK-3/4	97	97	97	97

27 Figure - Availability statistics

7.2.4 Modulation code scheme

7.2.5 Modulation and coding schemes are selected independently for each channel (uplink and downlink) for both polarizations. Current modulation for each channel is displayed in the MCS subsection.

7.2.6 Received signal strength indicator

The RSSI indicator displays the received signal level for each channel (uplink and downlink) and both polarizations. Available values:

- **-90...-80 dBm** - close to the receiver sensitivity level, only the lowest modulations are available.
- **-80...-60 dBm** - average input range.
- **-60...-40 dBm** - the recommended range for achieving best performance.
- **>-40 dBm** - input signal level is too high.

7.2.7 EVM

Error vector magnitude - indicator of the measured input signal quality, telling how far are the received constellation symbols compared to the ideal symbols of the constellation. The parameter value must be as high as possible in absolute value.

The recommended level should be less than -21 dB.

7.2.8 Retries and Frame loss

Retried and lost packets need also to be tracked. Retries should tend to zero, link with the retries value more than 5% should not be allowed to operation.

> **NOTE**
>
> Downlink - the direction from Master to Slave, Uplink - the direction from Slave to Master. These directions are correct for the whole link and do not depend on the roles of the devices.

7.3 General settings

The "General settings" section allows to configure basic system parameters, described in the table below.

This section includes two main csubsections:

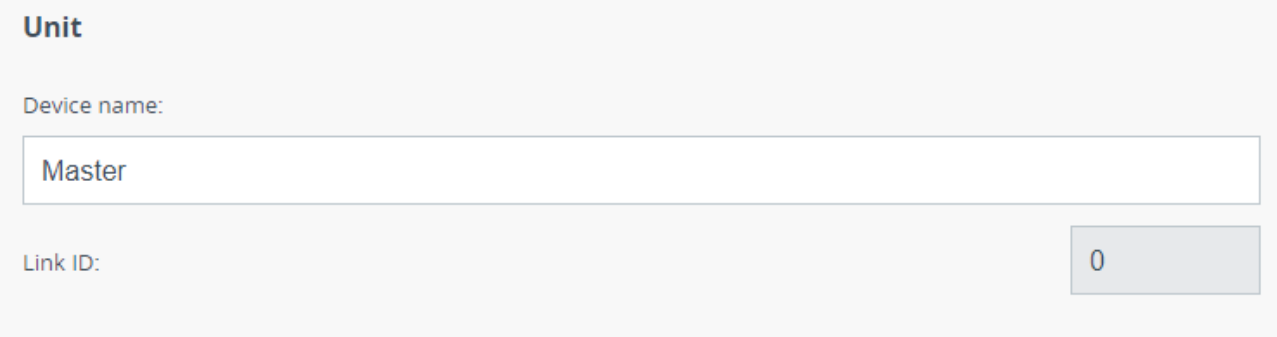
- Unit(see page 68)
- SNTP(see page 69)
- Syslog(see page 69)

7.3.1 Unit

These parameters are used for identification and link authorization.

Parameter	Description
Device Name	The arbitrary wireless unit name which will be used by network administrators for unit identification. It will be shown in Web GUI side panel.
Link ID	Wireless link identificator used 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 links. Both ends of the same link must have the same ID.

7 Unit parameters description



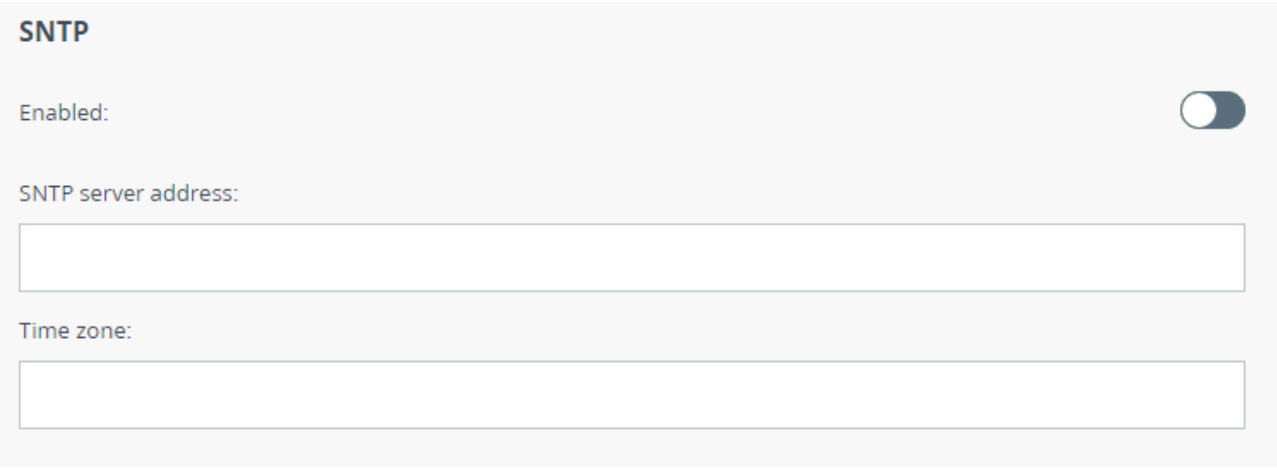
28 Figure - Unit parameters

7.3.2 SNTP

Starts the SNTP time synchronization service. For proper operation, specify the SNTP server time zone and the IP address first. By default, the SNTP service is disabled.

Parameter	Description
SNTP Server Address	The SNTP server IP address, the SNTP service will synchronize the time on the device with. The device must have network access to the SNTP server.
Time Zone	The time zone at the place of device installation. For example: GMT + 5.

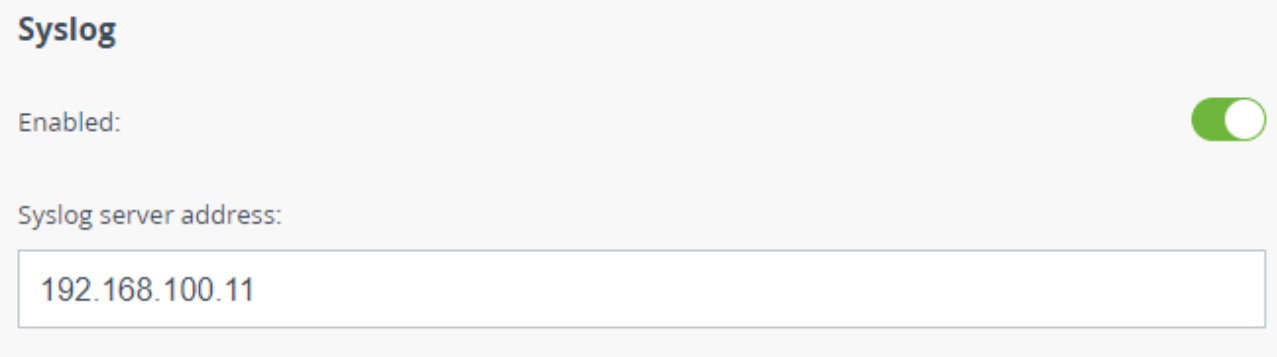
8 SNTP parameters description



29 Figure - SNTP settings

7.3.3 Syslog

Allows to transmit syslog data to the server using the "syslog" protocol. Specify the syslog server address where data should be transmitted.



30 Figure - Syslog configuration

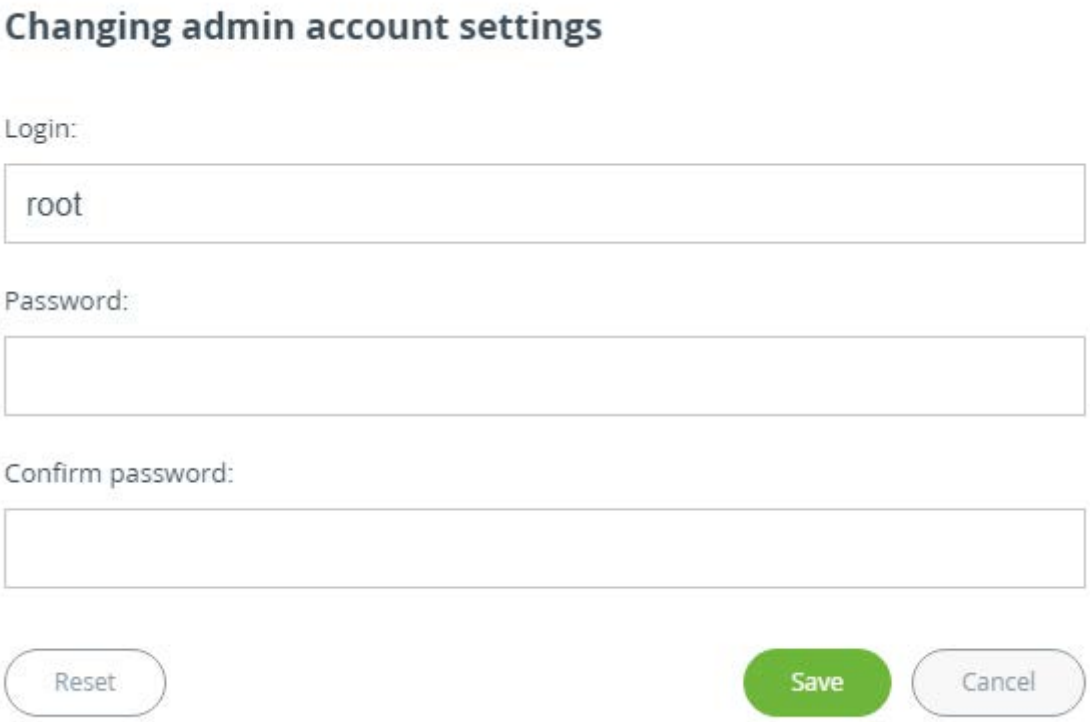
7.4 Security settings

The "Security settings" section allows to configure device access and security settings.

This section includes following subsections:

7.4.1 Administrator access

Here you may change system administrator account login and password, to change the identification data, click the "Change admin password" button. We strongly recommend you to set a login and password after the first login to the device.



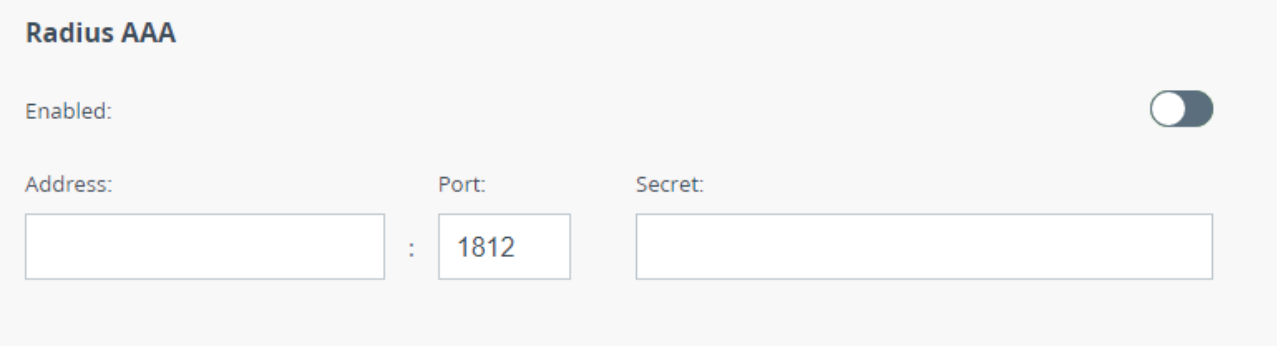
31 Figure - Admin access

7.4.2 Radius AAA

Here you may configure a device access control using a remote RADIUS server.

Parameter	Description
Address	Set the RADIUS server IP address.
Port	Set the RADIUS server port.
Secret	Set the server password.

9 Radius server parameters description



32 Figure - RADIUS parameters

7.4.3 Command line interface

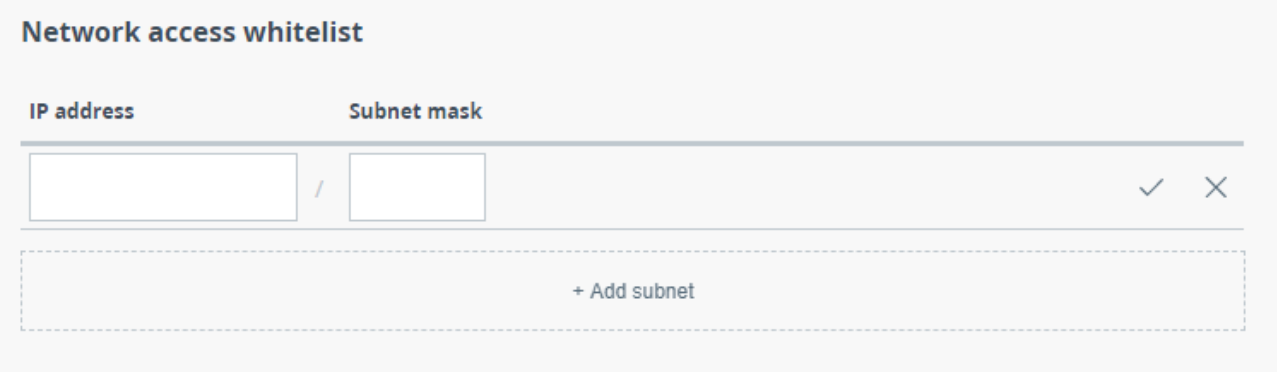
Allows to enable / disable remote device control by the command line using Telnet and SSH protocols.

SSH (Secure Shell) protocol provides secure remote control to network devices. Its functionality is similar to the Telnet protocol, but, unlike Telnet, SSH encodes all protocol messages, including transmitted passwords. By default, only access via Telnet is enabled.

33 Figure - Access protocols

7.4.4 Network access

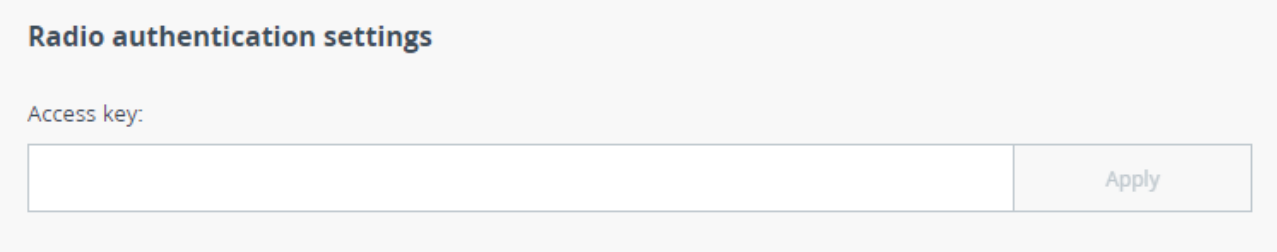
This section is used to create a list of subnets from which access to the device will be allowed.



34 Figure - Network access

7.4.5 Radio authentication settings

Units at both ends of the wireless link should authorize each other before link establishment. Access key must be up to 64 characters long, without spaces and must be the same at both ends of the link.



35 Unit parameters description

7.5 Radio settings

The "Radio settings" section allows to configure radio parameters to establish wireless connection.

Radio settings are divided into the following categories:

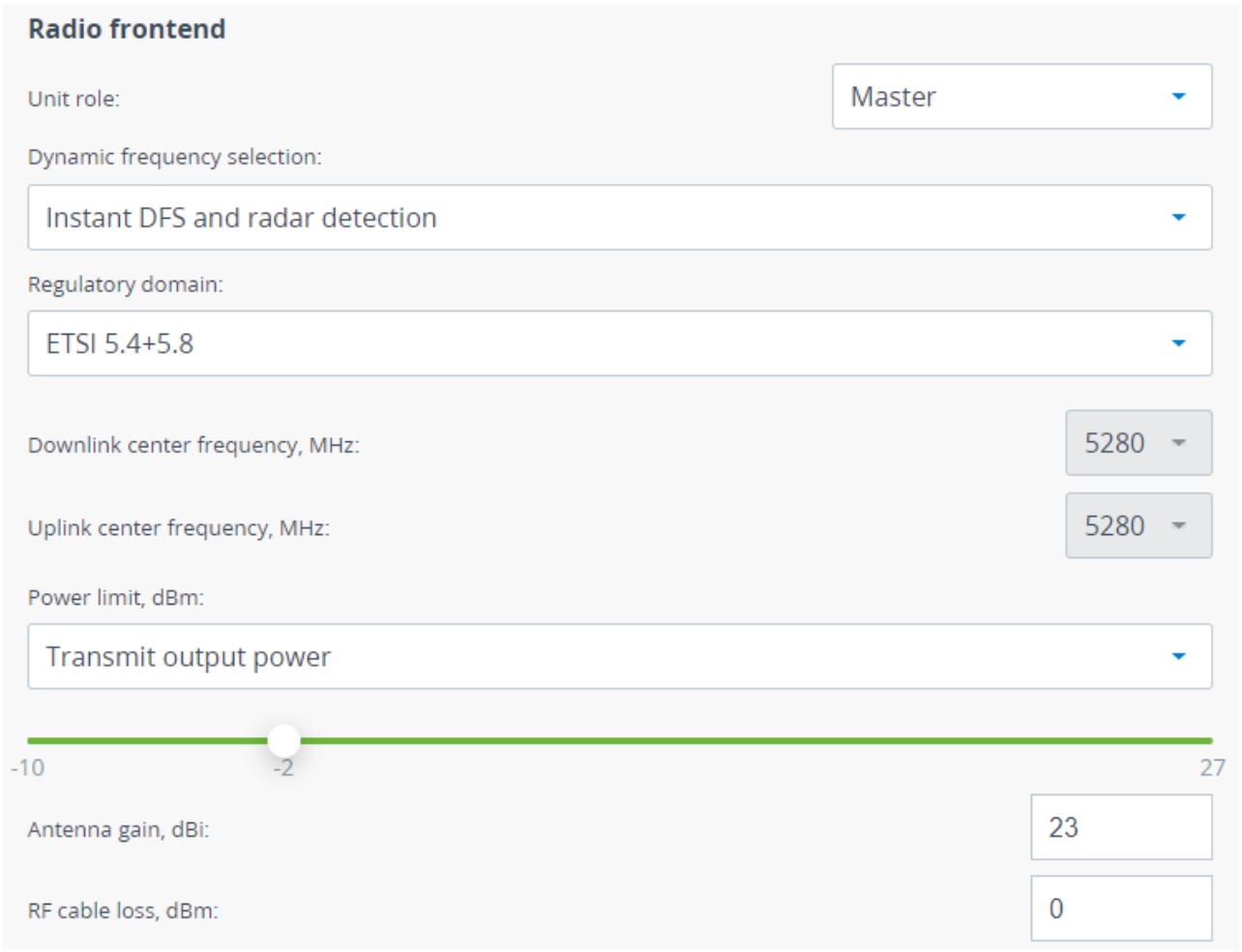
- Radio frontend(see page 73)
- Air frame(see page 75)
- Automatic modulation and transmit power control(see page 77)
- Frequency channel grids(see page 77)

7.5.1 Radio frontend

Parameter	Description
Unit role	One units must be set to Master and the other one to Slave.

Parameter	Description
Dynamic frequency selection	Following modes are possible to operation: • **Frequency selection off** - the center frequency must be selected manually. • **Mandatory DFS and radar detction** - the least noisy frequency will be selected in accordance with the set frequency grid. The device will block the frequency in case it detects a radar. • **Instant DFS** - the least noisy frequency will be selected in accordance with the set frequency grid. The device will change frequency in case the strong interference appears. • **Instant DFS and radar detction** - the least noisy frequency will be selected in accordance with the set frequency grid. The device will change frequency in case the strong interference appears and block the frequency in case it detects a radar. **NOTE** The radar detection mode is only available with "ETSI" regulatory domain. Instant DFS and radar detection are only available for the Quanta 5 family devices.
Regulatory domain	Regulatory domain automatically limits the wireless device operation which is may be needed to meet the local law requirements. Each regulatory domain may limits the following parameters: • Range of available center frequencies • Requirement of use LBT (Listen Before Talk) technique. • Maximum EIRP (Equivalent Isotropically Radiated Power) value. • Requirement of use radar detection technique.
Fixed center frequency	Available only on the Slave unit. • Enabled - center frequency must be set manually on wich the Slave unit will operate. • Disabled - center frequenct will be selected automatically based on frequency channel grids.
Downlink/ Uplink center frequencies	Allows to manually set the center frequency, uplink and downlink directions can use the same frequency or different. The uplink frequency can be configured only on the master. **NOTE** Downlink - the direction from Master to Slave, Uplink - the direction from Slave to Master. These directions are correct for the whole link and do not depend on the roles of the devices.
Power limit	This parameter limits the transmitter power, there are two modes: • Transmitter output power - limits the power of transmitter to the set value. • EIRP - limits the total system power calculated as: Tx Power + Antenna gain + Cable loss (an antenna gain and cable losses should be specified in the fields below).

10 Radio frontend settings description



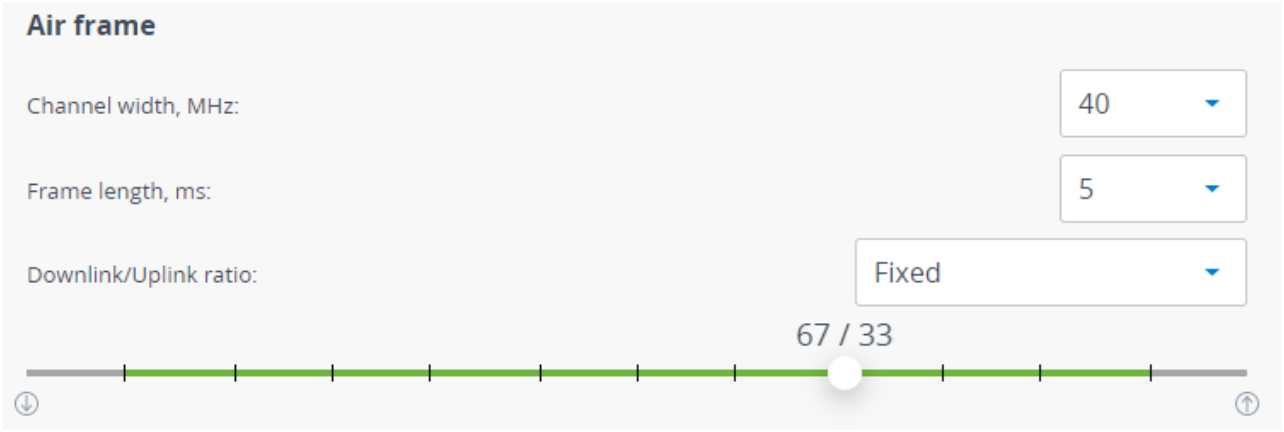
36 Figure - Radio frontend settings

7.5.2 Air frame

Parameter	Description
Channel width	Channel width, shoud be the same on both Master and Slave units. Available values: 3.5, 5, 7, 10, 14, 15, 20, 28, 30, 40, 50, 56 MHz.

Parameter	Description
Frame length	Frame period affects the following wireless link metrics: • The greater frame period the more payload will be transmitted in one frame. Greater values increase latency. • The lower frame period the less payload will be transmitted in one frame. Lower values decrease latency. Please note that frame period value is strongly depends on interference conditions. If larger frames will be dropped the larger payload is lost and system performance is decreased significantly. If smaller frames will be dropped the smaller payload is lost. Available values: 1, 2, 5, 10 ms.
Downlink / Uplink ratio	In automatic mode, the ratio changes dynamically in accordance with the transmitted traffic. Manual mode allows to set a fixed value. Available values depend from: • Channel width. • Frame length.

11 Air frame settings description

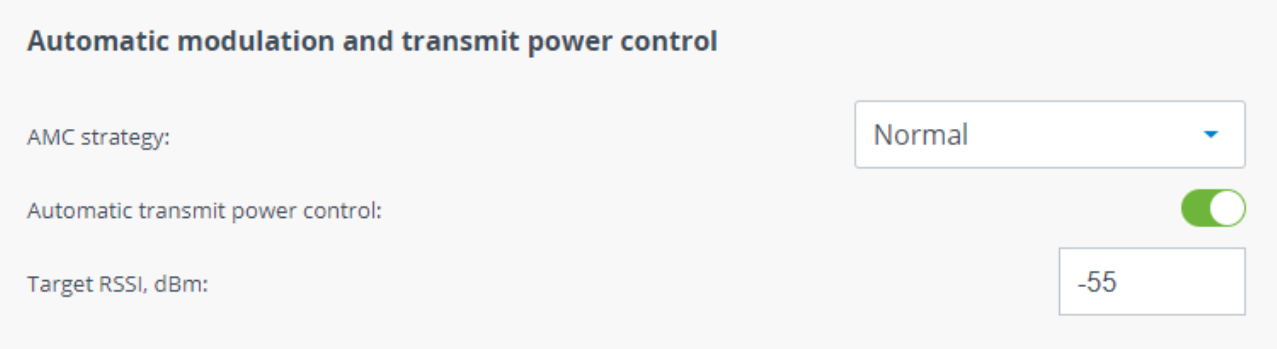


37 Figure - Air frame settings

7.5.3 Automatic modulation and transmit power control

Parameter	Description
AMC strategy	There are following AMC strategies available: • Normal - represents a balance between the error rate and throughput values. • Conservative - assumes using higher CINR thresholds in order to minimize the error rate. • Agressive - lowers the thresholds in order to use higher modulation levels and thus increase the throughput but also increase the error rate. • Extreme - lowers the CINR threshold below the Aggressive strategy values in order to maximize selected modulation and throughput.
Automatic transmit power control	ATPC allows to control transmitter output power automatically based on target RSSI value. If actual RSSI level is lower then unit increases transmitter output power of the remote unit and vice versa. ATPC could not set value that may exceed the "Power limit" value. • The Master unit manages the transmit power of Slave unit. • The Slave unit manages the transmit power of Master unit.
Target RSSI	RSSI value which will be used by ATPC as target.

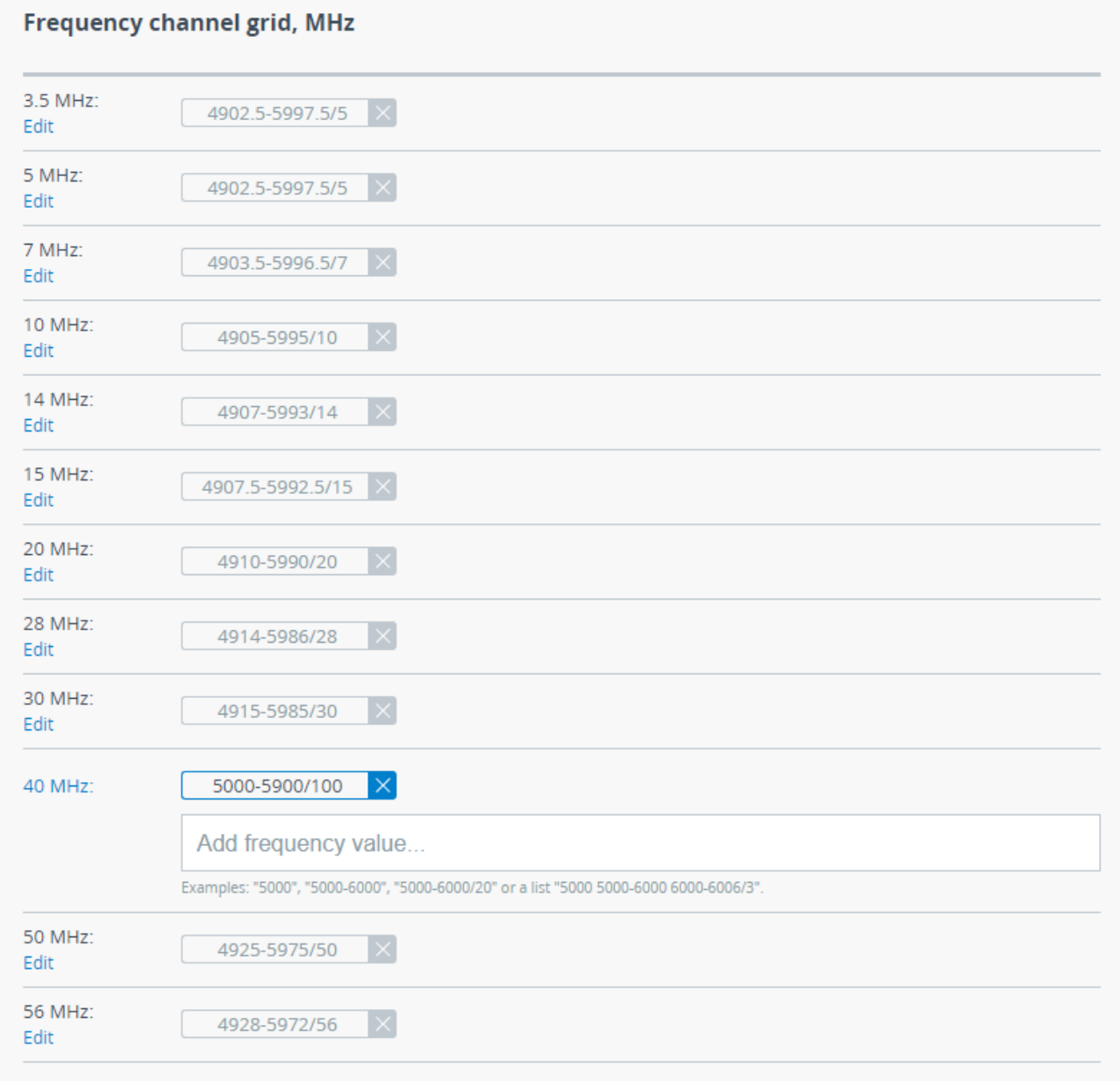
12 AMC and ATPC settings description



38 Figure - AMC and ATPC settings

7.5.4 Frequency channel grids

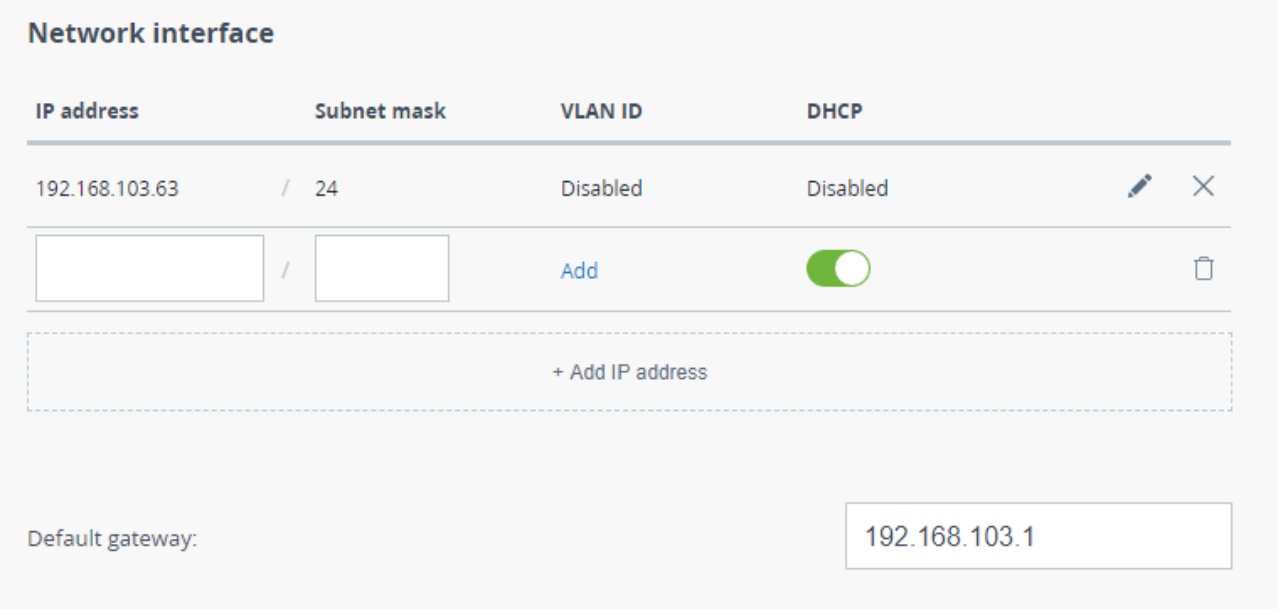
The frequency grid allows to limit the scan range in case the center frequency is automatically selected. Also Instant DFS will use these restrictions when monitoring the noise situation. Narrow grid of available frequencies speeds up scanning and link establishing process. Manual center frequency selection will also be limited to the values indicated in the grid.



39 Figure - Frequency channel grids

7.6 Network settings

This section allows to assign an IP address or several addresses to the wired interface, the default gateway value can also be specified.



Click the "Add IP address" button to add a new address. There are two ways to assign an IP address:

- Automatically - the IP address will be obtained automatically from the DHCP server.
- Manual - the IP address and netmask are specified manually.

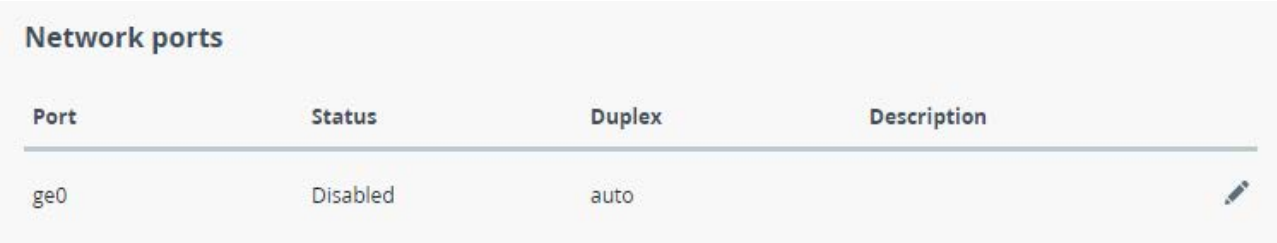
The VLAN tag value can also be set in this section, the VLAN ID value should be in range from 1 to 4096.

7.7 Switch Settings

7.7.1 Network ports

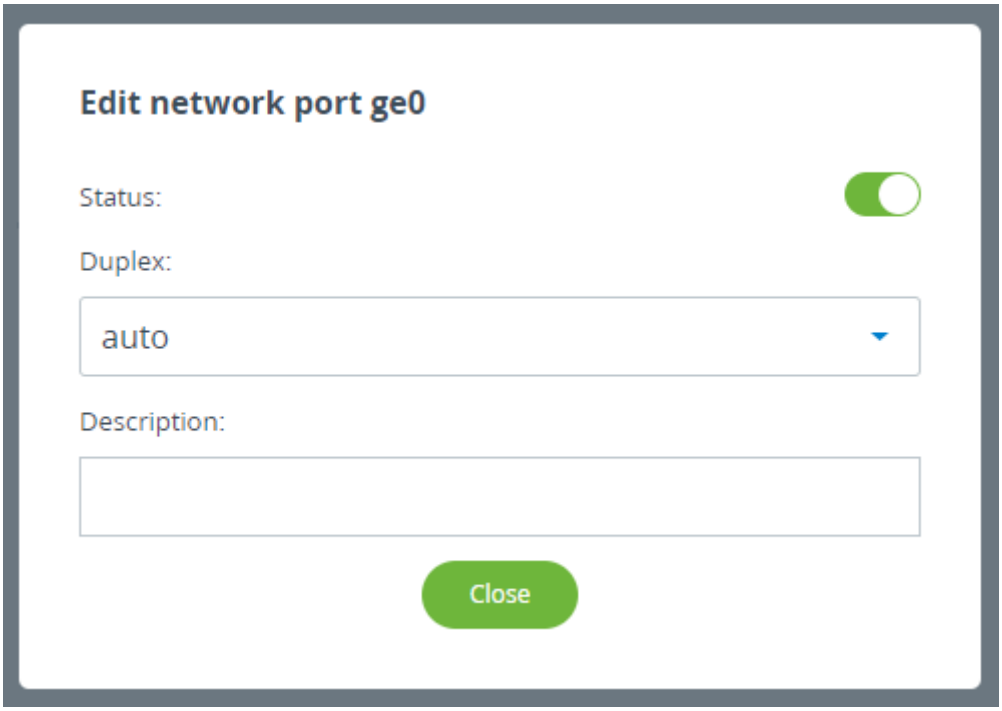
Each family device has 3 ports:

- ge0 - Gigabit Ethernet 1000BASE-T port;
- radio - internal radio interface;
- mgmt - internal interface for device management.



Only ge0 interface is available to configure. The following parameters can be changed:

- **Status:** enabled/disabled.
- **Duplex:** duplex mode, "auto" is by default.
- **Description:** arbitrary text description.

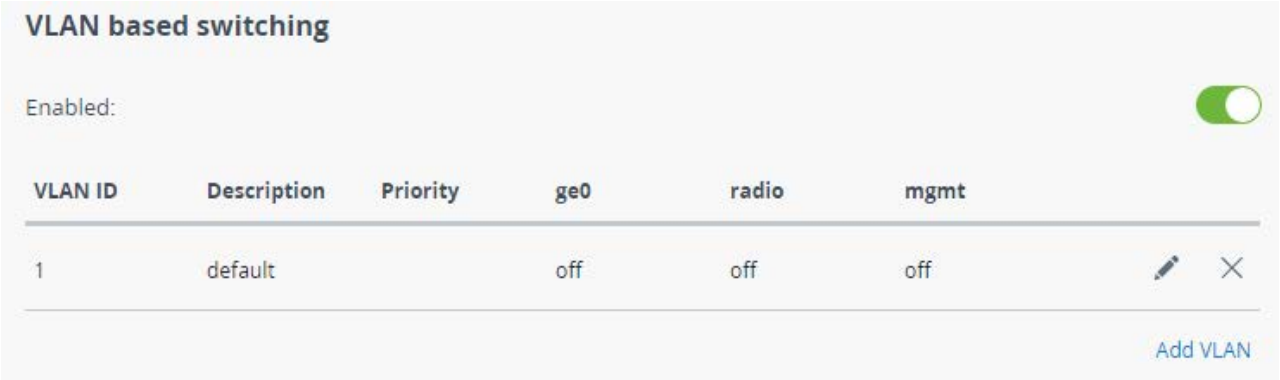


7.7.2 QoS

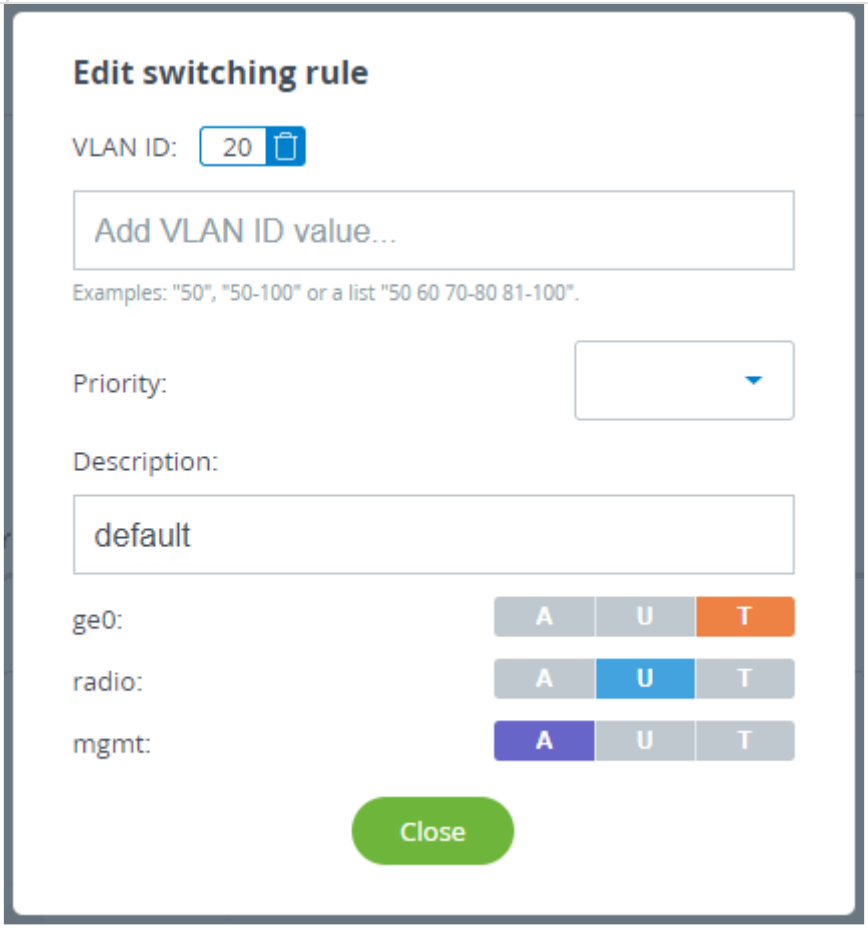
Enable/disable prioritization strategy. Unit will recognize the 802.1p tags in Ethernet frame headers. Based on these tags priorities will be autlomatically assigned to the frames when they are sent over the radio interface. After transmission over radio interface frames with tags are sent to Ethernet. Priorities may be adjusted manually if a VLAN based switching is enabled.

7.7.3 VLAN based switching

VLAN based switching allows to create list of allowed VLANs and their handling on the unit switch plane. If VLAN based switching is enabled but no VLANs are added, device ports will allow untagged traffic only. Each entry of list establishes the relationship between VLAN ID and ports VLAN modes. "VLAN 1" is created by default and could not be deleted, it's enough to set all interfaces to "off" mode to disable it.



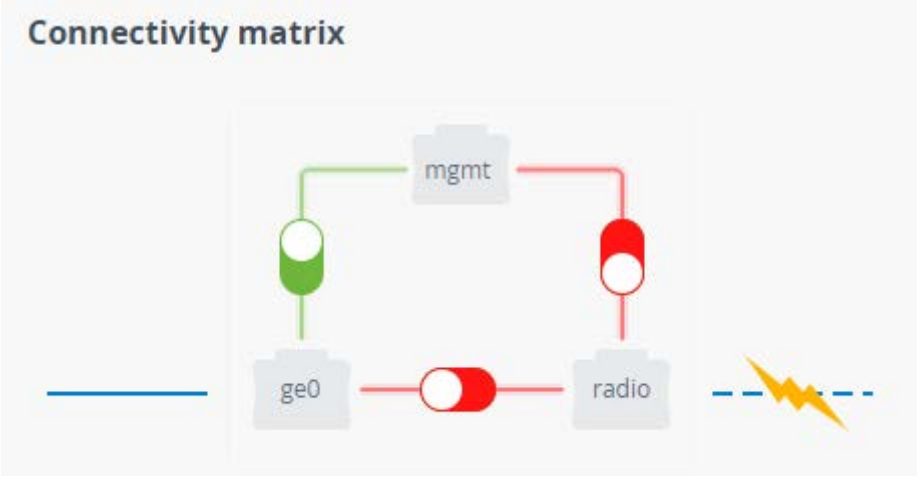
VLAN ID	VLAN tag in range from 1 to 4095. May be set in a few ways, examples: • 12 • 10-20 • 100,200,300 • 23,24,25,50-100
Description	Arbitrary text description.
Priority	Allows to set the priority of a specific VLAN according to 802.1p ranging from 0 to 7, where 0 - the lowest priority level, 7 - the highest, the QoS support function must be enabled.
Port mode	VLAN mode should be set for each of network ports. Mode determines the way which VLAN tagged network packets will be handled by switch. There are three ports modes: • Off - denies all traffic of a specified VLAN. If none of the modes is selected, the port will be marked as "Off". • Access - operates as access port, allows only untagged traffic. • Tagged - operates as trunk port, allows tagged traffic of a specific VLAN to pass through this port • Untagged - operates as trunk port, allows untagged traffic of a specific VLAN to pass through this port.



7.7.3.1 Connectivity matrix

Allows to configure the traffic transfer between the network ports of the device. Configuration is performed visually using switches. The green switch indicates allowed connections, the red one - denied.

Traffic flow between ports is performed in accordance with VLAN modes set, if the VLAN based switching is enabled.



7.8 SNMP settings

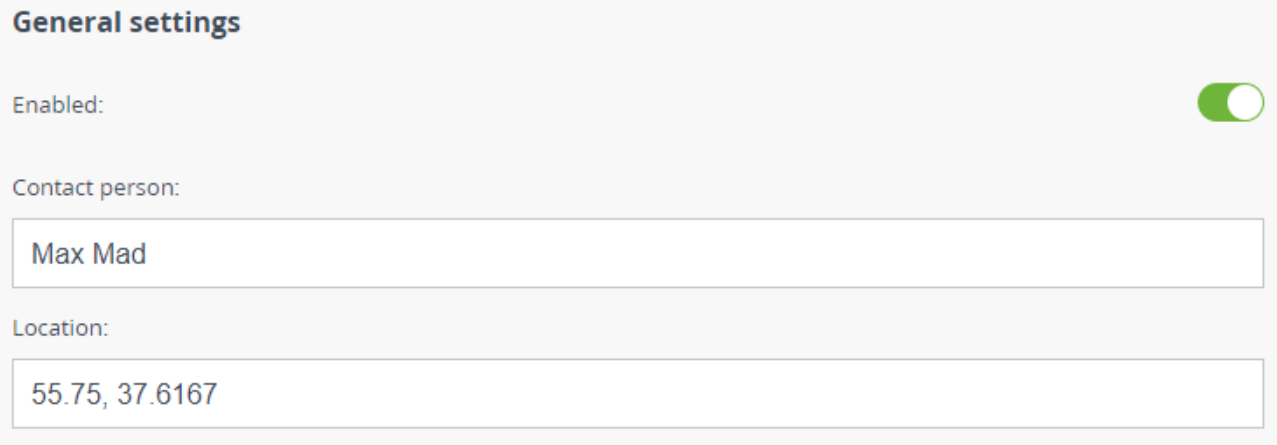
SNMP allows the administrator to gather information about key device parameters and wireless links, including information about changes. The use of any monitoring system helps to timely receive information about the network infrastructure state using Infinet devices. Currently, the devices family supports SNMP protocol versions v1 v2c and v3.

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

- The agent sends data to the management station. Monitoring system - provides data gathering from all agents in the network.
- The monitoring system receives and processes events.
- The information is passed through requests and replies with the use of the MIB.
- The management station or monitoring system is responsible for decoding the SNMP packets and providing an interface to the administrator.

7.8.1 General settings

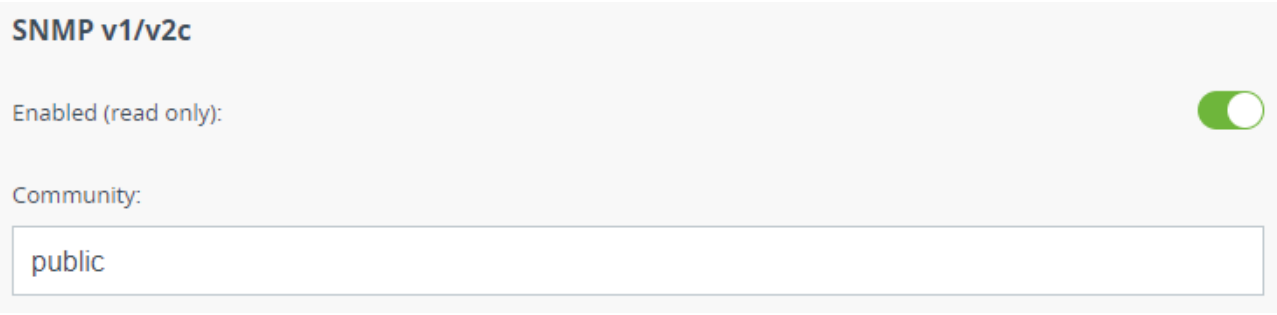
This section allow to enable/disable SNMP protocol support.



40 Figure - General SNMP settings

Parameter	Description
Enabled	Enable/disable the SNMP service in the device.
Contact person	A reference information about the device owner.
Location	The geographical location where the unit is installed, used as a reference information about the physical device's location.

7.8.2 SNMP v1/v2c



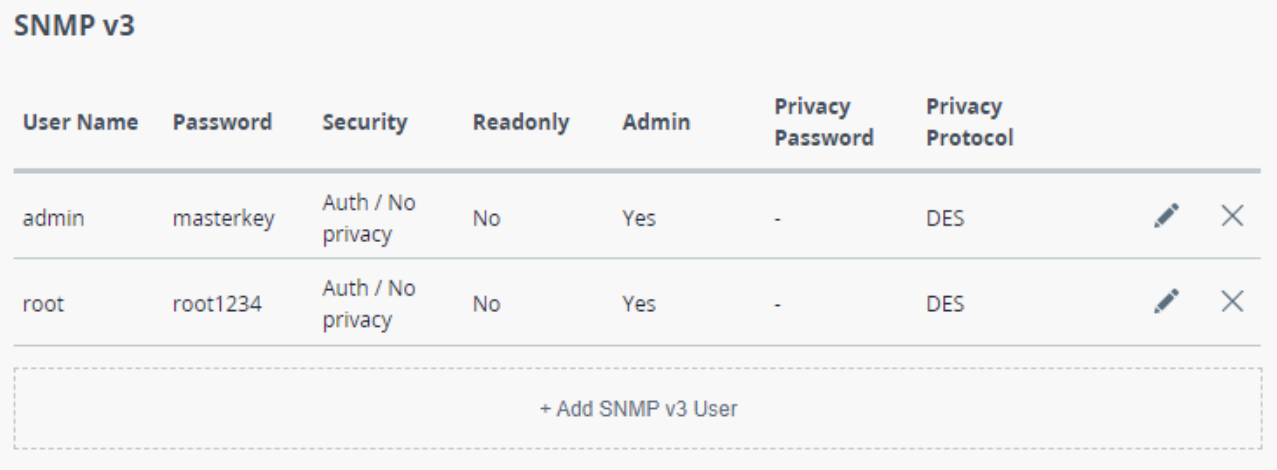
41 Figure - SNMP v1/v2c configuration

Parameter	Description
Enabled	Enable/disable the SNMP v.1 and v.2c support. The first version of the SNMP protocol lacks security, that hinders its use for network management, so SNMP v.1 and v.2c operates in read-only mode. Enabled by default.

Parameter	Description
Community	Set the community name for read-only mode of SNMP v.1 and v.2c, by default: "*public*". The community name passes along with the data packet in clear text.

7.8.3 SNMP v3

Due to the security level of SNMP v.3 is higher than of SNMP v.1 and v.2c, it allows not only the data collection but also to manage devices. Detailed information about the devices management via the monitoring system[11] is available in the corresponding article.



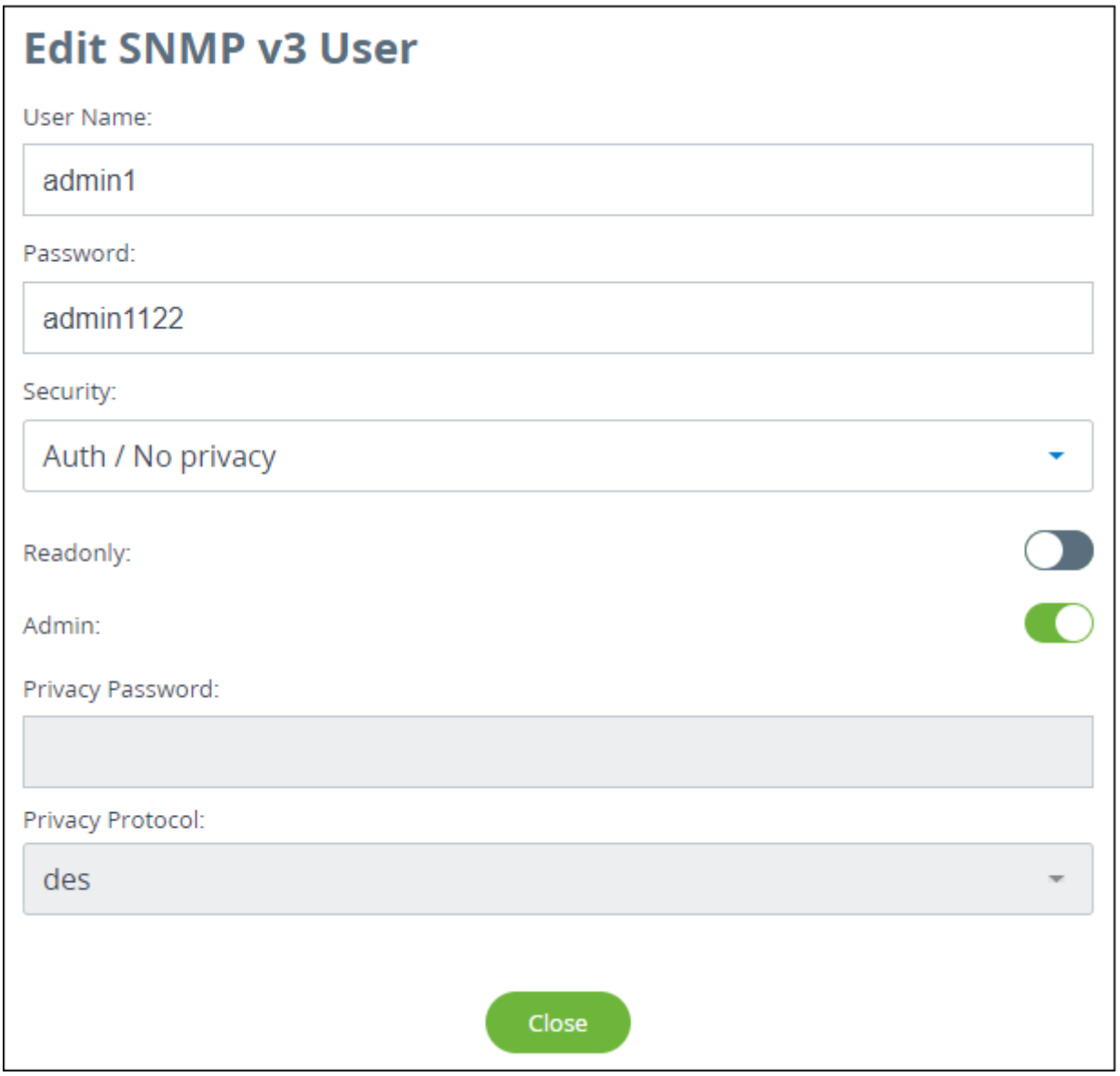
42 Figure SNMP v3 configuration

To add an SNMP v3 user, click the corresponding button and fill in the following fields:

Parameter	Description
User name	SNMP v3 user name.
Password	SNMP v3 password.

11 https://wiki.infinetwireless.com/pages/viewpage.action?pageId=81464037

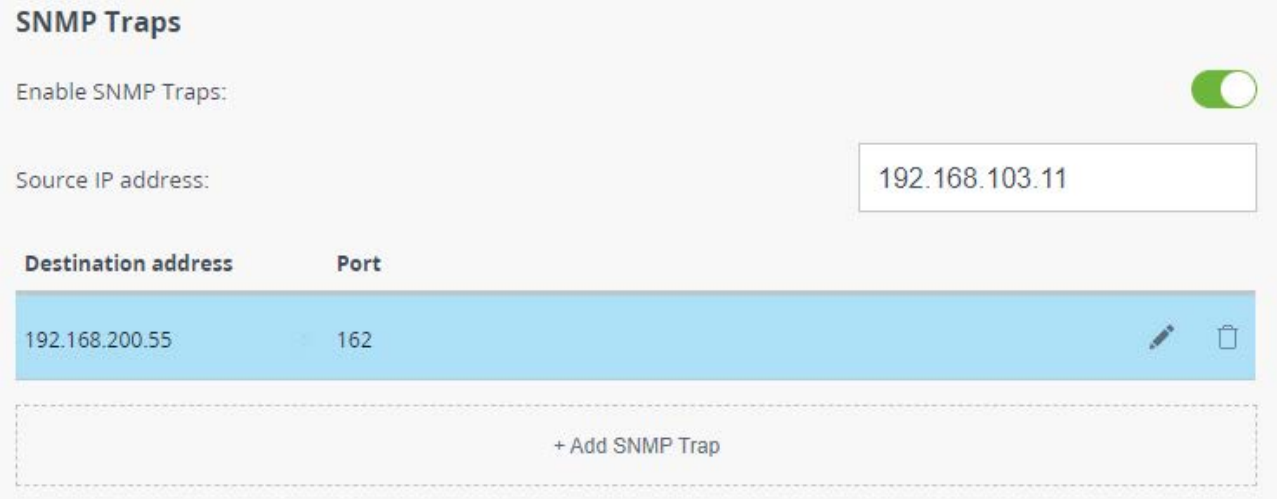
Parameter	Description
Security	Security level: • "**No auth / No privacy**" – the lowest security level without authentication and privacy, only Username needs to be set. This level of protection does not allow management via the monitoring system. • "**Auth / No privacy**" – middle level with authentication but without privacy, Username and Password are required. • "**Auth / Privacy**" – highest level with authentication and privacy, Username, Password, Privacy Password and Privacy Protocol should be set.
Readonly	Enable/disable the read-only mode, readonly is set by defaut.
Admin	Enable/disable the full access to all parameters, for example, the ability to reboot the device. By default an access is limited.
Privacy password	Set the privacy password, it is necessary when privacy is enabled for the required security level.



43 Figure - SNMP v3 user configuration

7.8.4 SNMP traps

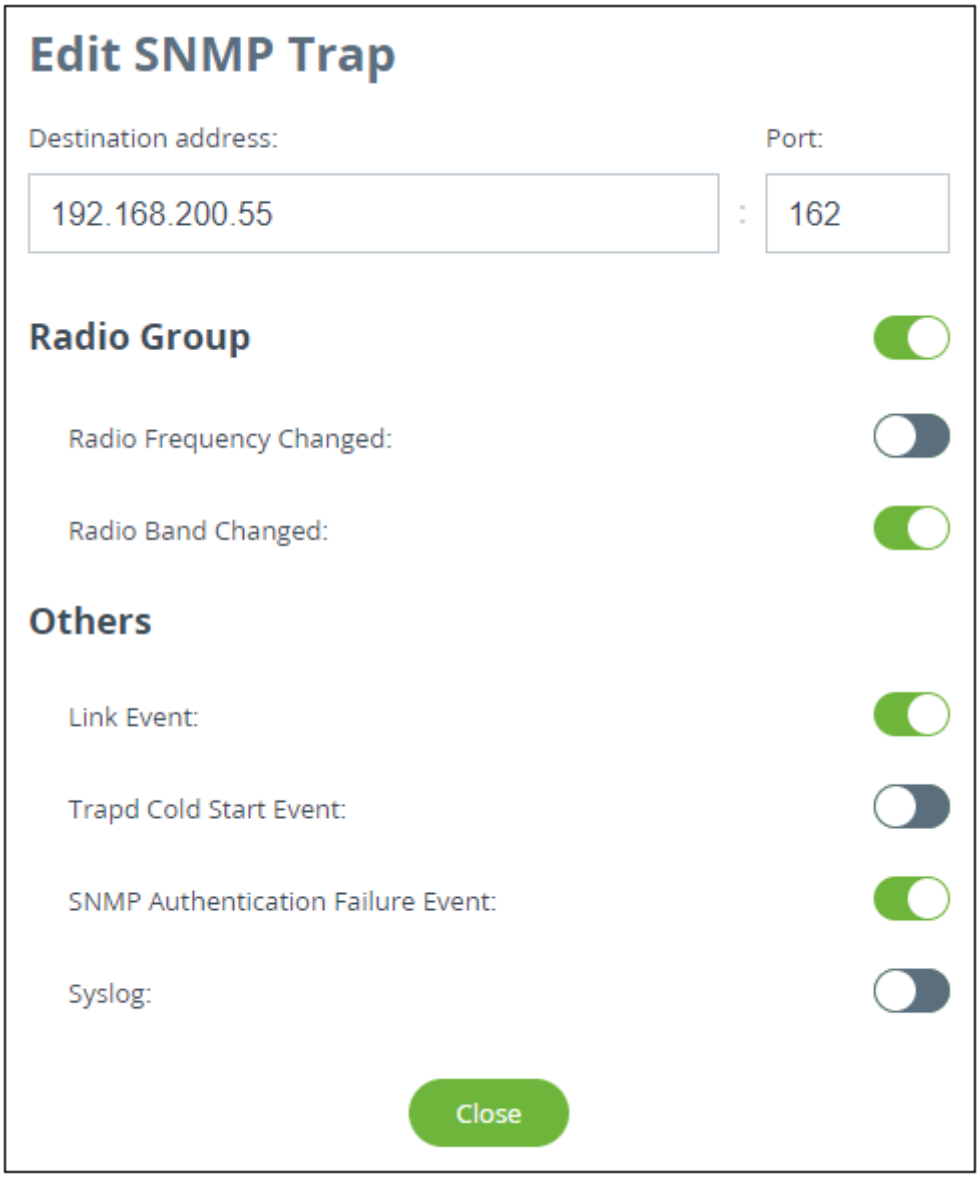
The devices polling cycle of the monitoring system is 5 minutes. To speed up the process of detecting incidents on devices, SNMP traps can be send each time an incident occurs, regardless of the polling process.



44 Figure - SNMP traps configuration

Parameter	Description
Enable SNMP traps	Enable/disable SNMP traps sending.
Source IP address	Set the IP address of the device which sends traps.

To create a new record, click the "**Add SNMP Trap**" button.



45 Figure - Create SNMP trap

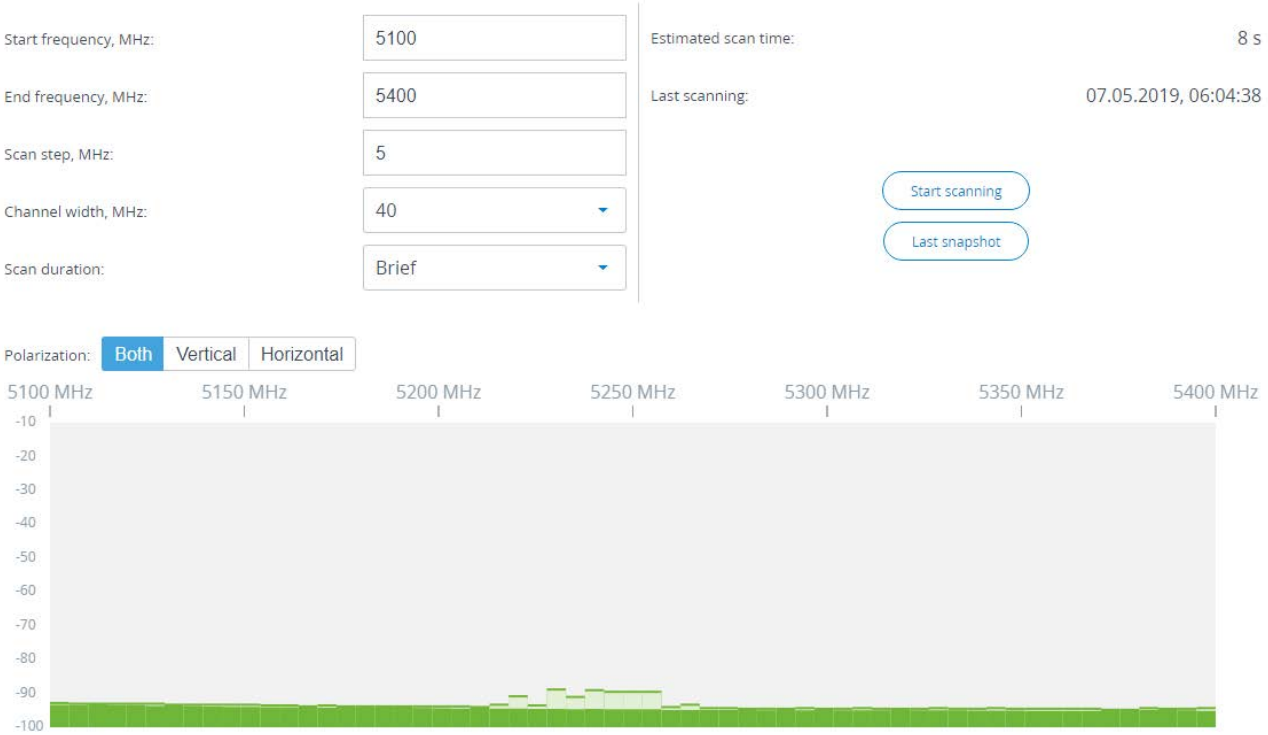
In the new window select the traps type to send and fill in the following parameters:

Parameter	Description
Destination address	Set the monitoring system server IP address.

Parameter	Description
Port	Set the monitoring system UDP port.

7.9 Spectrum Analyzer

In the "Spectrum Analyzer" menu, you can perform a deep analysis of the radio emissions in the environment where the unit is placed. The unit scans the radio spectrum on all available frequencies. In order to obtain the information as accurate as possible, the scanning process may take a while.



46 Figure - Spectrum analyzer result

The following parameters are available in order to operate the Spectrum Analyzer:

Parameter	Description
Start Frequency	• Set the first frequency for scanning (in MHz).
Stop Frequency	• Set the last frequency for scanning (in MHz).

Parameter	Description
Scan step	• Set the scanning frequency step (in MHz). • It is recommended to set 1 MHz "*step*" value to get more precise scanning results.
Channel width	• Set the bandwidth (in MHz).
Scan Duration	• Set the time period for the scanning process (in seconds). • After the end of this time period, scanning is stopped and the radio interface will be back to its normal mode operation.
Estimated scan time	• Estimated scan duration.

13 Table - Spectrum analyzer parameters

Click on "Start scanning" button to start scanning. You may stop scanning by clicking on appropriate button.

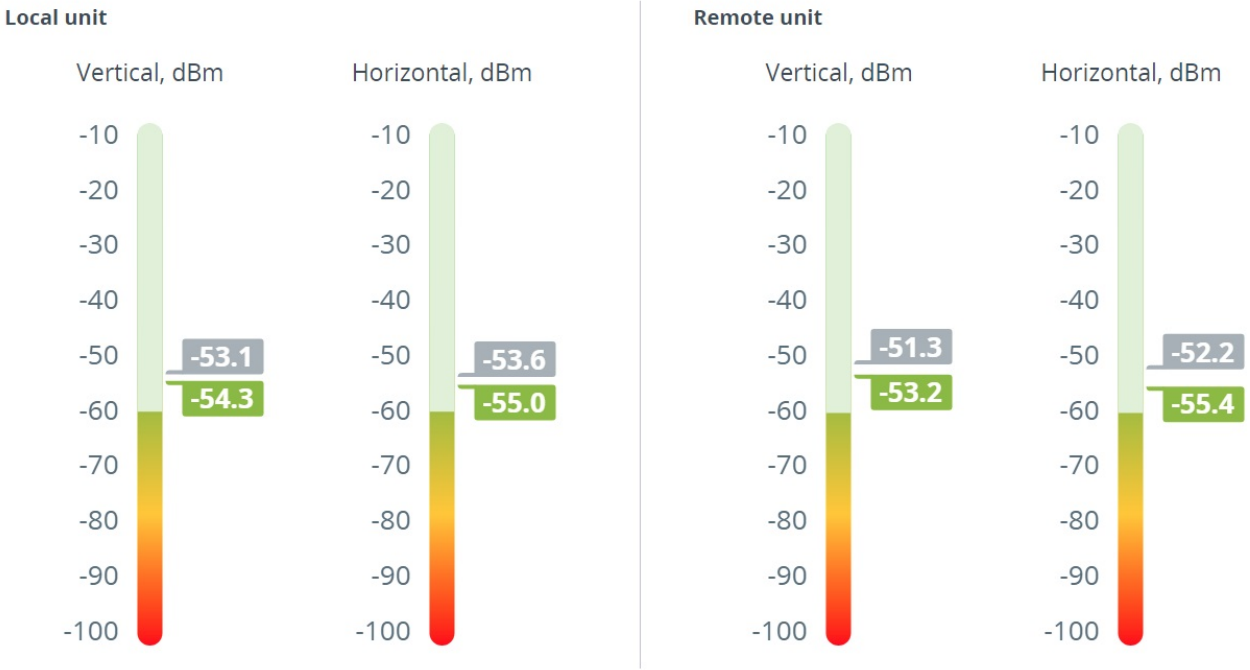
By clicking the "Last Snapshot**"** button, you get the final scanning results. The most common usage of this feature is when you perform a spectrum scan at the remote unit on the other side of the wireless link. When running a spectrum scan at such a unit (accessible via the RF interface), connection to this unit will be lost for a scan time. "*Last Snapshot*" option allows viewing scan results when the connection gets up again.

7.10 Antenna Alignment Tool

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. It helps to find the best antenna position via comparing the actual received signal level with the calculated reference value. The accuracy of the antenna alignment at the neighbor device is very important for the link quality. Antenna alignment tool operates online and does not break the wireless connection.

Each side of the link (local and remote) has two similar test indicator sets, corresponding to each antenna polarization. This allows controlling the alignment process for each antenna polarization for the local and for the remote device simultaneously.

The main idea is to achieve the actual signal level (green square) is closer to the reference value (pale green area). Grey square shows maximal achieved value on each channel.



47 Figure - Antenna alignment tool

7.11 Maintenance

This section is available in the "Service" tab, is used for firmware updates, operations with licenses and configuration. Allows to view extended information about the device, reboot and reset to factory settings.

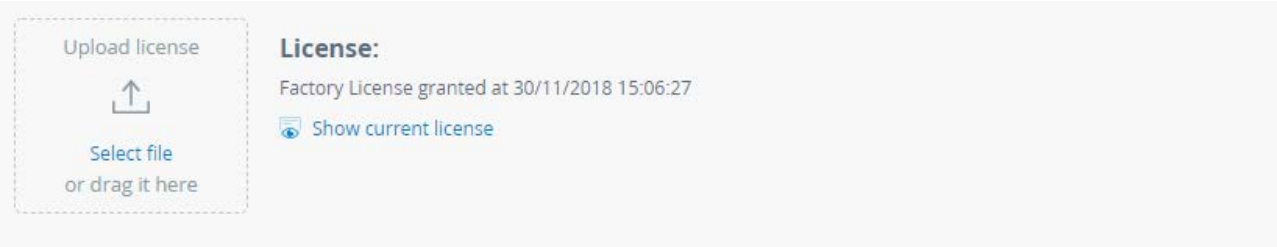
7.11.1 **Device information**

The following information is displayed on information panel:

- Firmware version and build date.
- Device serial number.
- Device part number.
- Hardware platform version.
- Time since last reboot.
- Last reboot reason, following values are possible:
    - Software fault.
    - Unexpected restart.
    - Manual restart.
    - Manual delayed restart.
    - Firmware upgrade.
    - SNMP managed restart.
    - Test firmware loaded.
    - Watchdog.
    - Panic.
- System log.

7.11.2 License

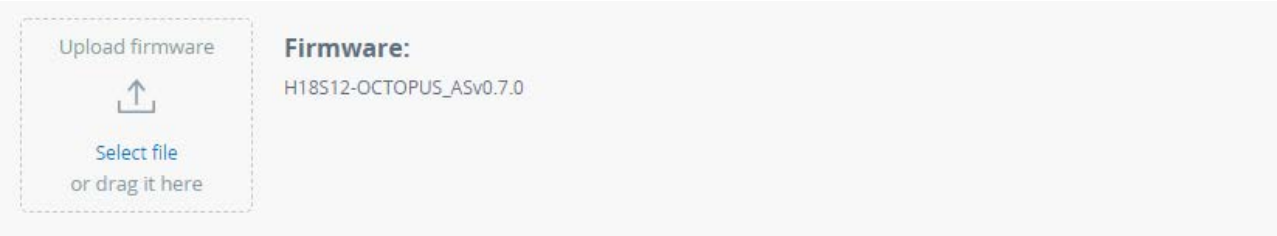
License contains information about allowed frequencies, channel width and power limit. This section allows to view the current license and upload a new one. To upload a license on device, click the "Upload license" button drag and drop a file from your file manager into the dotted area.



7.11.3 Firmware

There are two options to upgrade firmware on the device:

- Manually - new firmware should be downloaded from official Infinet FTP server: ftp://ftp.infinet.ru/pub/Firmware/. Click on "Upload firmware" button and choose a firmware file. Or you can drag and drop a file from your file manager into the dotted area.
- Automatically - if connected to the Internet, the device can automatically detect the new software version. In this case, click the "Update" button, after that your web browser will try to download the latest firmware version and upload it to the unit. Firmware will be applied after unit reboot.



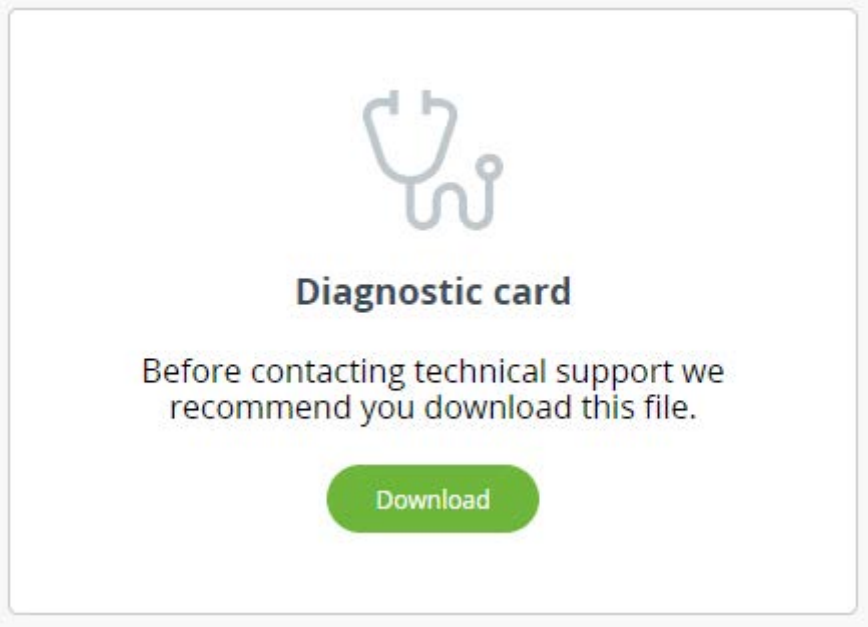
7.11.4 Configuration

The device allows to upload, download and view current configuration in text form. To view the configuration, click the "Show current configuration" button, the file will open in new window. To download the configuration, click the

"Download current configuration" button, the configuration can be loaded by clicking the "Upload configuration" button, or you can drag and drop a file from your file manager into the dotted area.

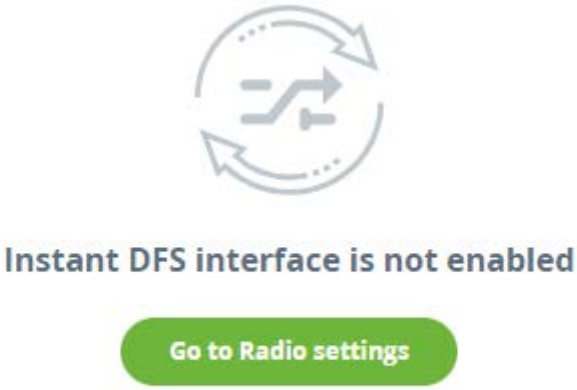
7.11.5 **Diagnostic card**

In situation then helps of Infinet Wireless technical support team is required, the diagnostic card is necessary tool which helps to detect and solve an issue faster and more effective. Click on "Download" button to create diagnostic card.



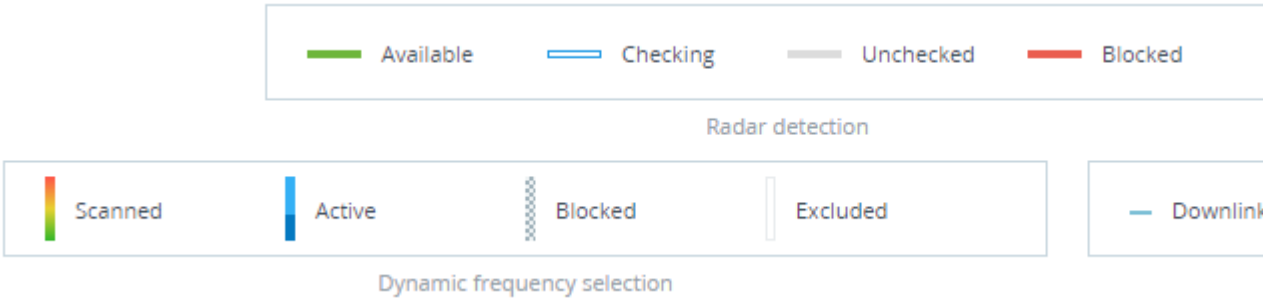
7.12 Inst ant DFS

This section allows to monitor the Instant DFS tool operation in real time. To display the data in this section, the frequency selection must be set to "Instant DFS" or "Instant DFS and radar detection" mode. To enable the required mode, go to the "Radio(see page 73)" section.



48 Figure - Instant DFS configuration

At the top of the section there is information about the status of each band participating in the scan in accordance with the frequency grid. The upper stripe displays the band status discovered by the radar detection tool. The columns show the signal levels detected by the Instant DFS tool. There is the RSSI scale displaying the level of the detected signal in this band at the left side. Band statuses are described in the legend at the bottom of the section.

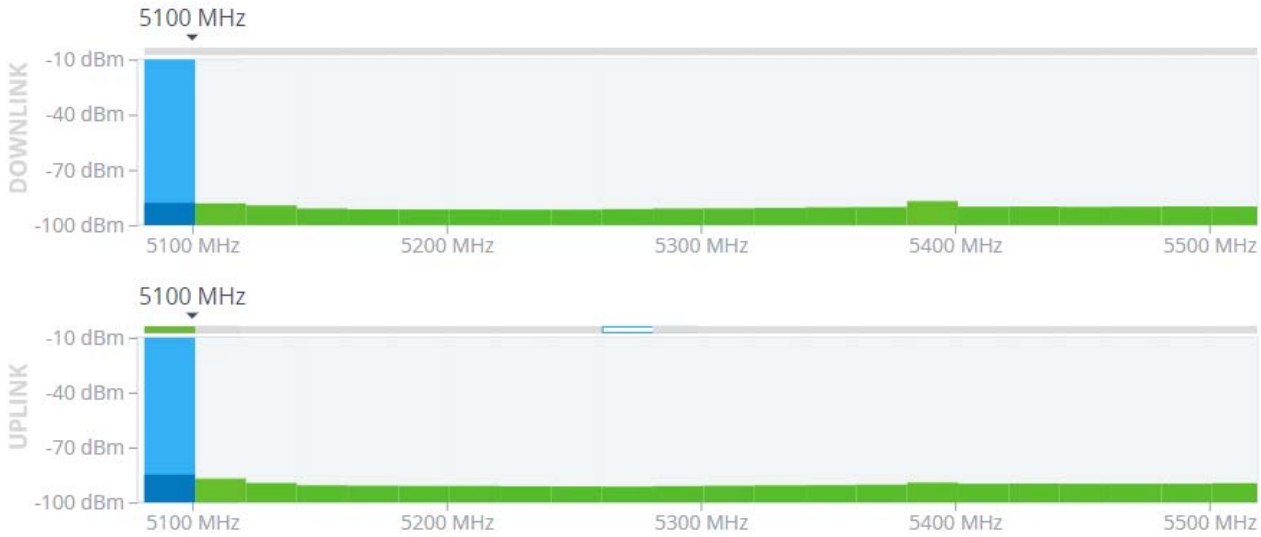


49 Figure - Band state legend

Scanning is performed in two directions:

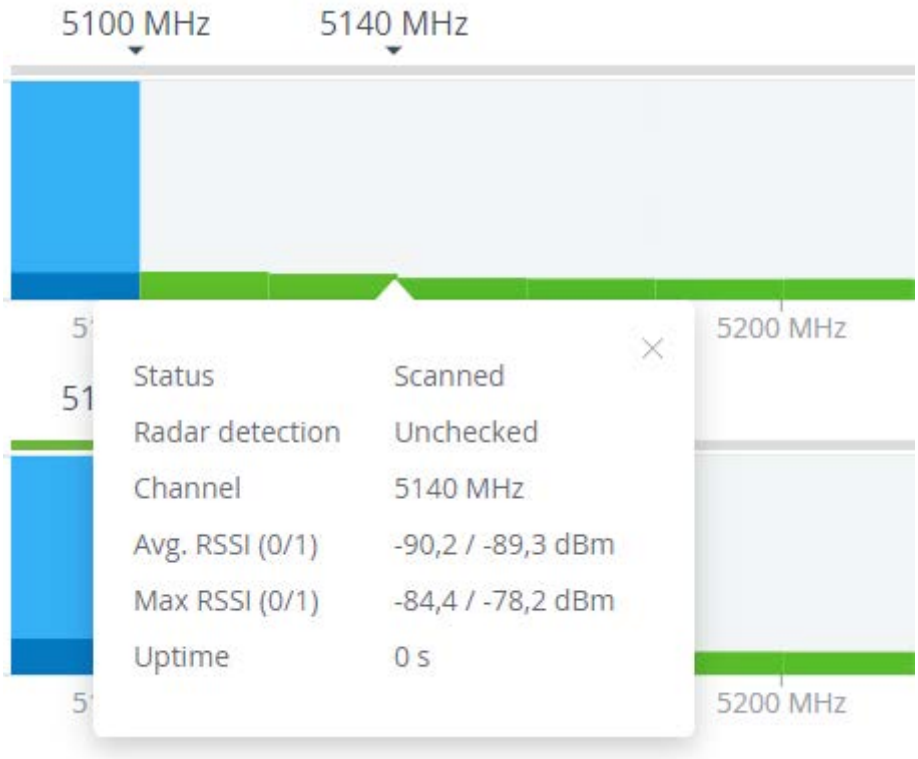
- Uplink - scans the spectrum state on the Master side.
- Downlink - scans the spectrum state on the Slave side.

Enabling the "Instant DFS" mode on one device automatically starts the scanning process at the remote end of the link.



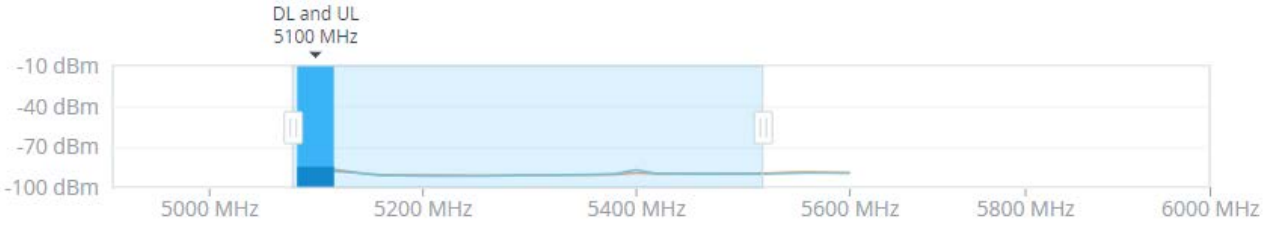
50 Figure - Instant DFS band state

Detailed information about the band status can be obtained by clicking on the corresponding column.



51 Figure - Band information

Use sliders on the scale at the bottom of the section to zoom in or zoom out the layout.



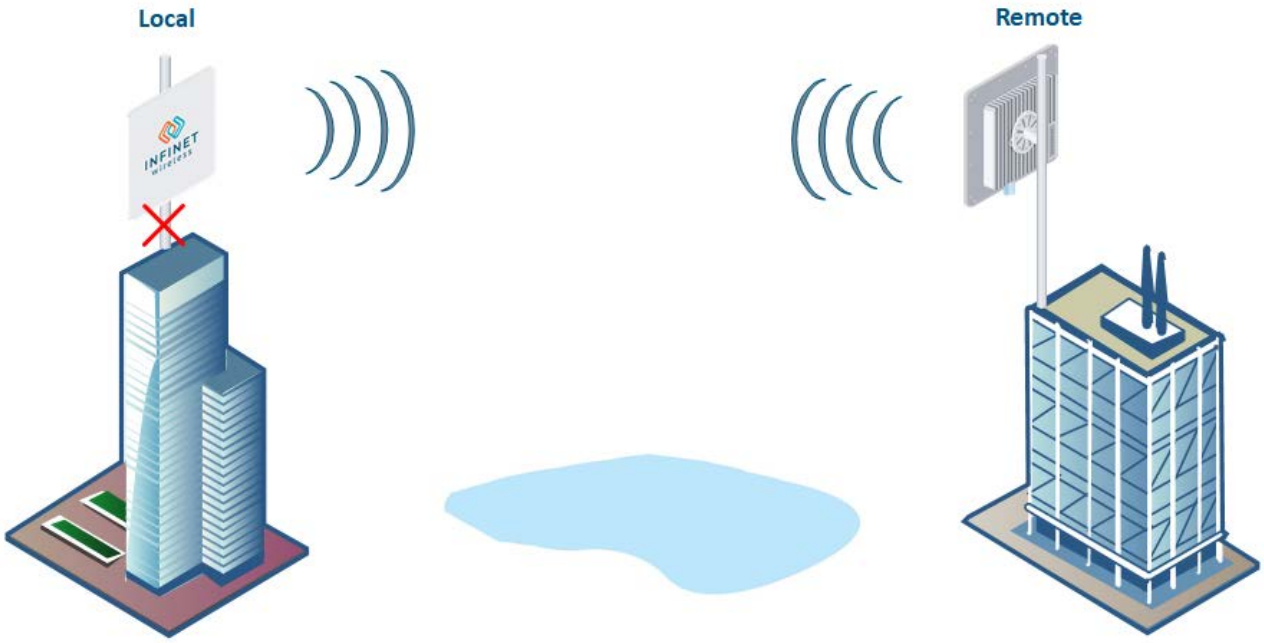
52 Figure - Layout scale

8 Troubleshooting

This lesson describes basic troubleshooting actions to be taken in case a problem occurs to the wireless link.

List of possible problems:

8.1 1.No access to the local unit



8.1.1 **Checking the network infrastructure**

Make sure there is connectivity between the control center and the device installation point. If the access is missing only to the Infinet device, further verification must be performed at the installation site.

8.1.2 **LED indication**

Check the power supply to the device. The "POWER" indicator has three possible colors:

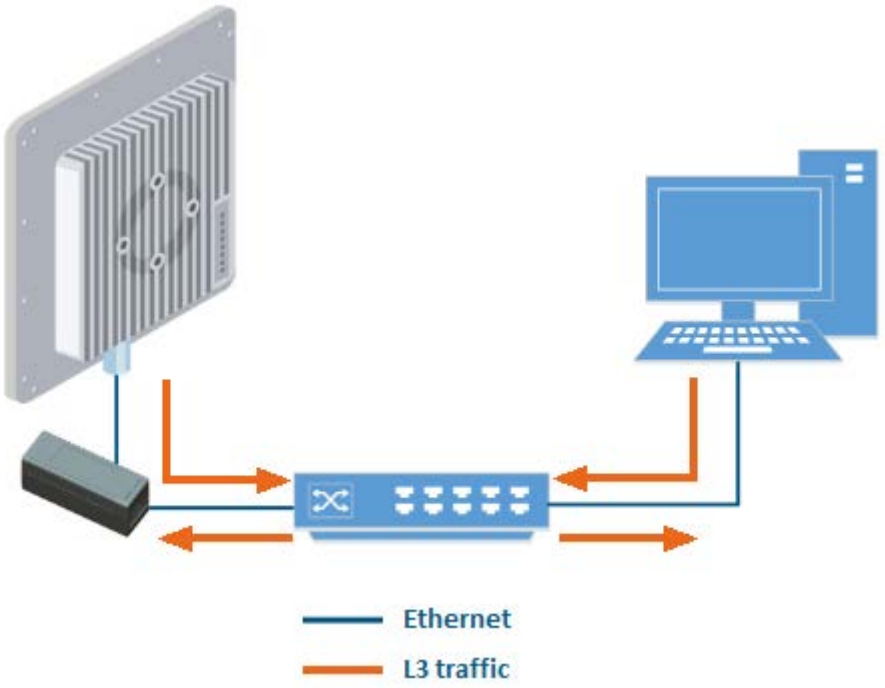
- Red light - the device is connected to the electricity mains,
- Yellow light - a wired connection with a speed of 10/100 Mbps
- Green light - a wired connection with a speed of 1000 Mbps.

Other indicators are used to perform coarse antenna alignment. The more indicators are on, the better wireless connection is established. The blinking indicator means an intermediate state.

If there is no power, it is necessary to check the power supply, connectors, the Ethernet cables integrity.

8.1.3 Access to the unit recovery

If the power indicator is on and there is connection via the Ethernet interface, connect to the device directly as it is shown in the scheme below. Make sure that the IP address of the PC is in the same subnet as the IP address of the device. You can restore the IP address and reset the device to the factory settings using the ERConsole utility.



Before starting the access restoring procedure, it is recommended to install the following software:

- ERConsole: ftp://ftp.infinet.ru/pub/Utils/EmergenceRepairConsole/ERConsole.zip.
- Java Runtime Environment: http://www.java.com/en/download/.

Turn off any anti-virus or firewall running on your computer. If no device can be discovered by ERConsole, turn on the firewall, and add an UDP connection port 10009 as an exception .

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 recovery 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-address or to restore to the default configuration, the Infinet Wireless unit should be rebooted.

Access recovery

Follow the steps below to recovery access to the device:

- Run the ERConsole application.
- Turn off the Infinet Wireless unit by removing ethernet cable from power supply unit and then turn it on in a few seconds.
- Wait for 30 seconds until the ERConsole receive information from the device. The Serial number, number of device reset cycles ("*Sequence*" field), IP-address, network mask and MAC-adress will be displayed on the screen.

If an IP-address is assigned to the device, configure an IP-address belonging to the same network on your laptop and connect to the unit.

IP-address assigning

To assign new IP address make the following steps:

- Click the «**+**» button in the ERConsole application and a new window will appear.
- Set the additional IP-address and network mask, then click "OK".
- Turn off and on the Infinet unit. Wait for about 30 seconds until the "Complete" sign will uppear.
- Add an IP-address from the same network subnet to your PC and access the unit. Note that ERConsole will not show newly assigned IP-address.
- Login to the unit using the new IP-address. Do not reboot the unit now because the IP-address added by ERConsole is temporar and will be removed by saving new configuration.

Factory settings restore

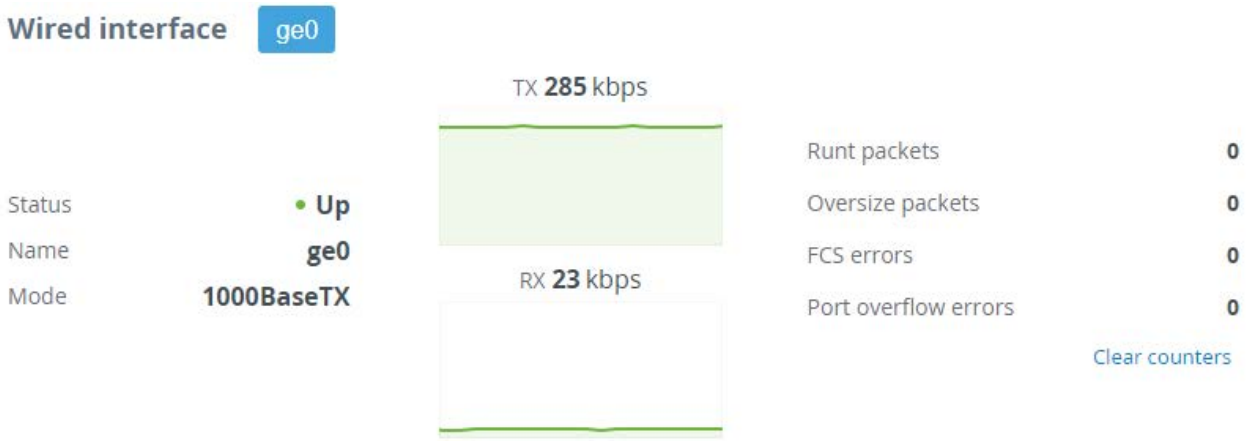
To restore the device to the factory default settings, follow the steps below.

> **NOTE**
>
> If the management of the unit is lost due to unknown user name or password it can be restored using factory password. Put an serial number of device in the "User name" field and factory password in the "Password" field.

- Get the factory password by sending a request to the your distributor or to the Infinet technical support service if the device was purchased directly. In the request, specify the serial number and the "Sequence" parameter value (if the value is not zero).
- Obtain the IP-address of the unit using the ERConsole as described in the section above.
- Click on the «+» button in the ERConsole application and a new window will appear.
- Select “Reset configuration” option and enter the Factory Password obtained at the previous step in the "Factory password" field, then click «OK». The password must be entered the same format as it has been got it from the distributor or IW support (with the gaps)..
- Turn off and on the device and then wait for about 30 seconds until the "Complete" sign will uppear.
- The unit will start in special emergency mode with the IP-address 10.10.10.1 and mask 255.255.255.0.
- Login to the unit and use "Restore Factory Settings" button on the "Maintenance" page to switch off emergency mode.
- Set new login and password, then save the configuration and restart the unit.

8.1.4 Checking the Ethernet interface state

If you were able to access the device by connecting directly, try to determine the possible reason for the unavailability through the network. Pay attention to the wired interface statistics.



In the "Wired interface" section, you can monitor the Ethernet interface status and its traffic load for reception and transmission. The wired interface statistics is on the right side and can be reset by clicking the "Clear counters" button. Pay attention to the FCS errors number which indicate a violation of data integrity during transmission over the wired segment. Also, the problem can be caused by a queue (port) overflow or inappropriate frame size (runt and oversize).

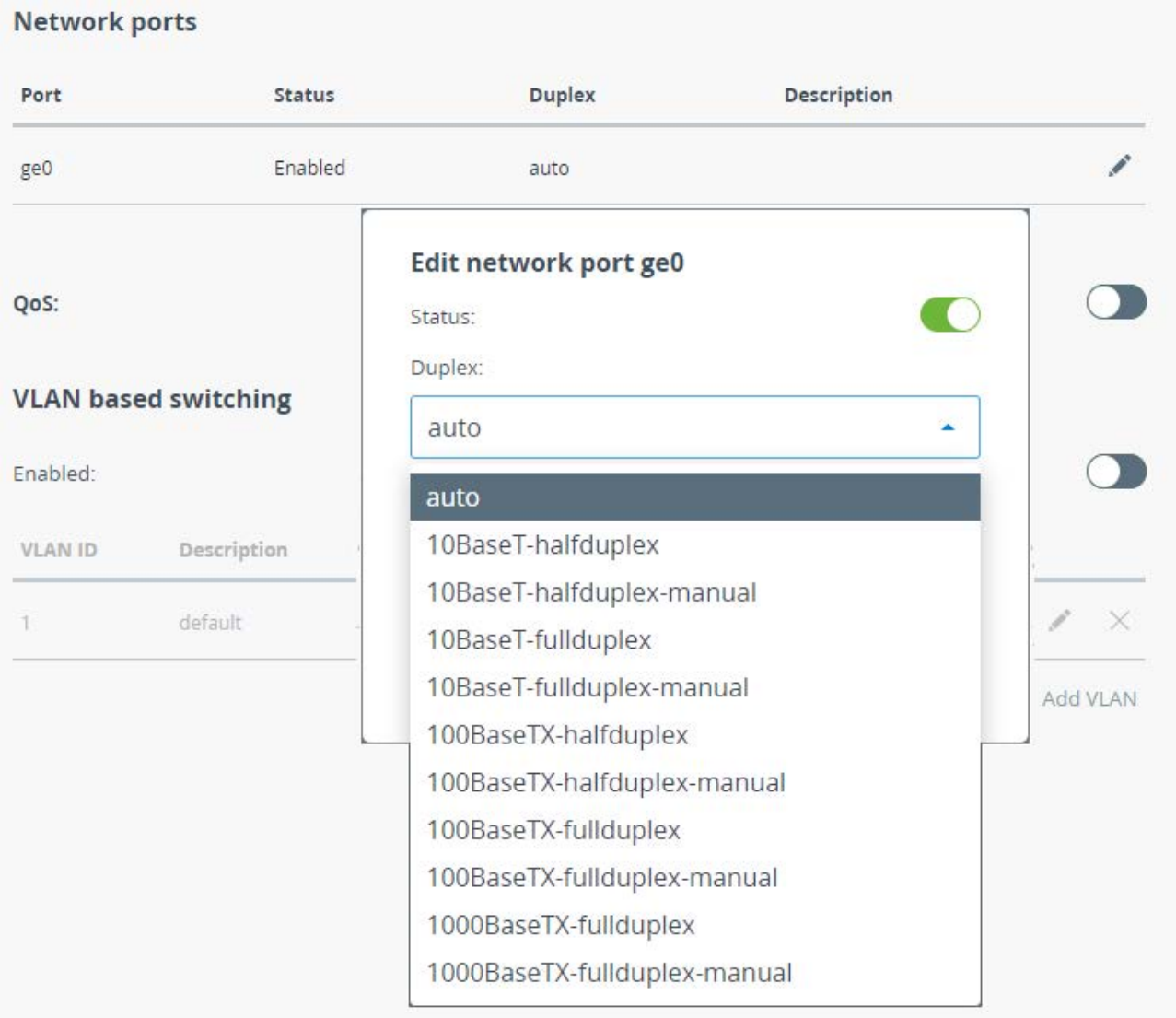
NOTE

The FCS errors counter can increase due to the following reasons:

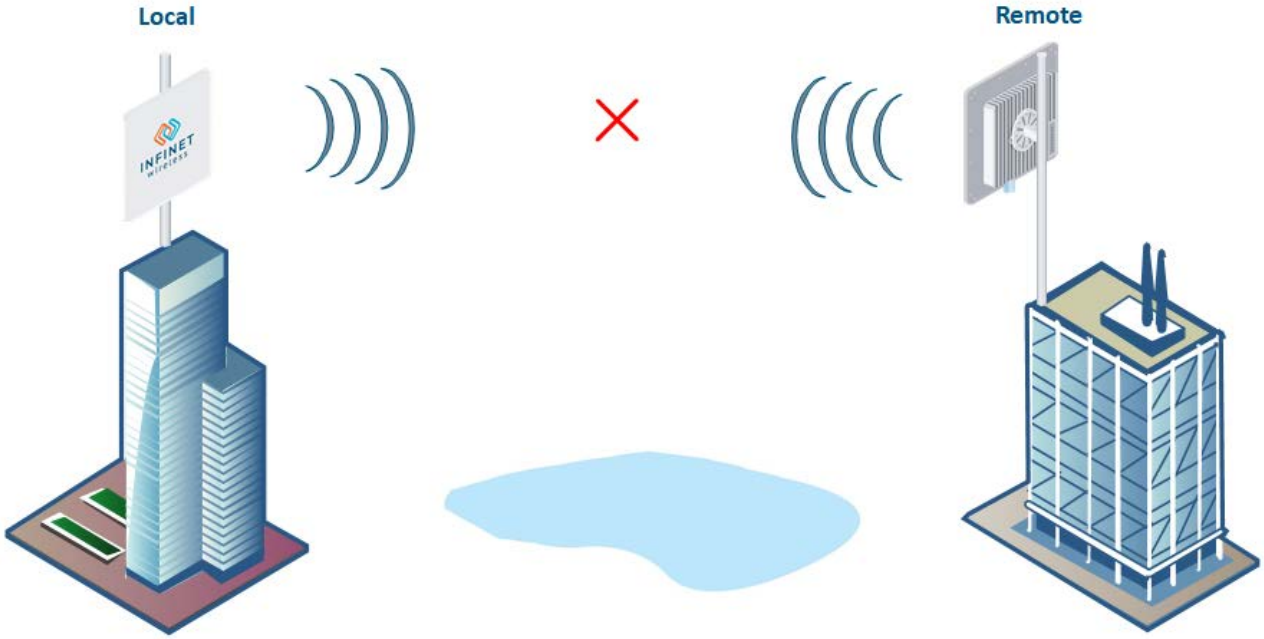
- The device connection is performed using inappropriate cable. We strongly recommend to use FTP Cat5e cable with outside diameter not exceed 7 mm.
- A shielded RJ-45 connector is used from the outdoor unit side. Make sure RJ-45 connectors are installed in the correct order. The shielded connector must be installed on the power supply side, the standard RJ-45 must be installed on the wireless device end.
- The device is grounded incorrectly, make sure the device installation complies with the recommendations specified in the "Grounding and Lightning Protection [12]" article.

Pay attention to the duplex mode on the network devices connected to the wireless bridge. The duplex mode can be changed in the "Switch" - "Network Ports" section. We recommend setting the autonegotiation mode provided by the Ethernet standard. The problem can occur while connecting two devices with different duplex settings. For example, if one device has the autonegotiation mode, and the other - fixed full duplex mode.

12 https://wiki.infinetwireless.com/pages/viewpage.action?pageId=9044431


Network ports
Port
Status
Duplex
Description
ge0
Enabled
auto
QoS:
VLAN based switching
Enabled:
VLAN ID
Description
1
default
Add VLAN
Edit network port ge0
Status:
Duplex:
auto
auto
10BaseT-halfduplex
10BaseT-halfduplex-manual
10BaseT-fullduplex
10BaseT-fullduplex-manual
100BaseTX-halfduplex
100BaseTX-halfduplex-manual
100BaseTX-fullduplex
100BaseTX-fullduplex-manual
1000BaseTX-fullduplex
1000BaseTX-fullduplex-manual

8.2 2. Wireless link is not established



Pre-configuration in the lab

Before installing the devices on site, we recommend to configure the basic parameters in the lab and to make sure that the link is establishing. Step-by-step instructions for a wireless link configuration are given in the Link Pre-configuration in the lab(see page 38) article.

> **NOTE**
>
> During the configuration of the devices in a lab, take into account the following requirements:
>
> - Make sure that the devices are not directed at each other in order to prevent the damage of the radio modules. It is recommended to place the devices at a distance from each other, with the antennas directed to the floor.
> - The minimum transmit output power must be set on the devices.
> - In case of using two devices with "E" index, it is recommended to connect them directly using RF cables and RF attenuators with an attenuation of at least 40 dB for each polarization (the installation\deinstallation of the RF attenuators and of the RF cables should only be performed when the devices are switched off).
> - The failure or damage of the device's radio module in case of disregarding these requirements is not covered by warranty.

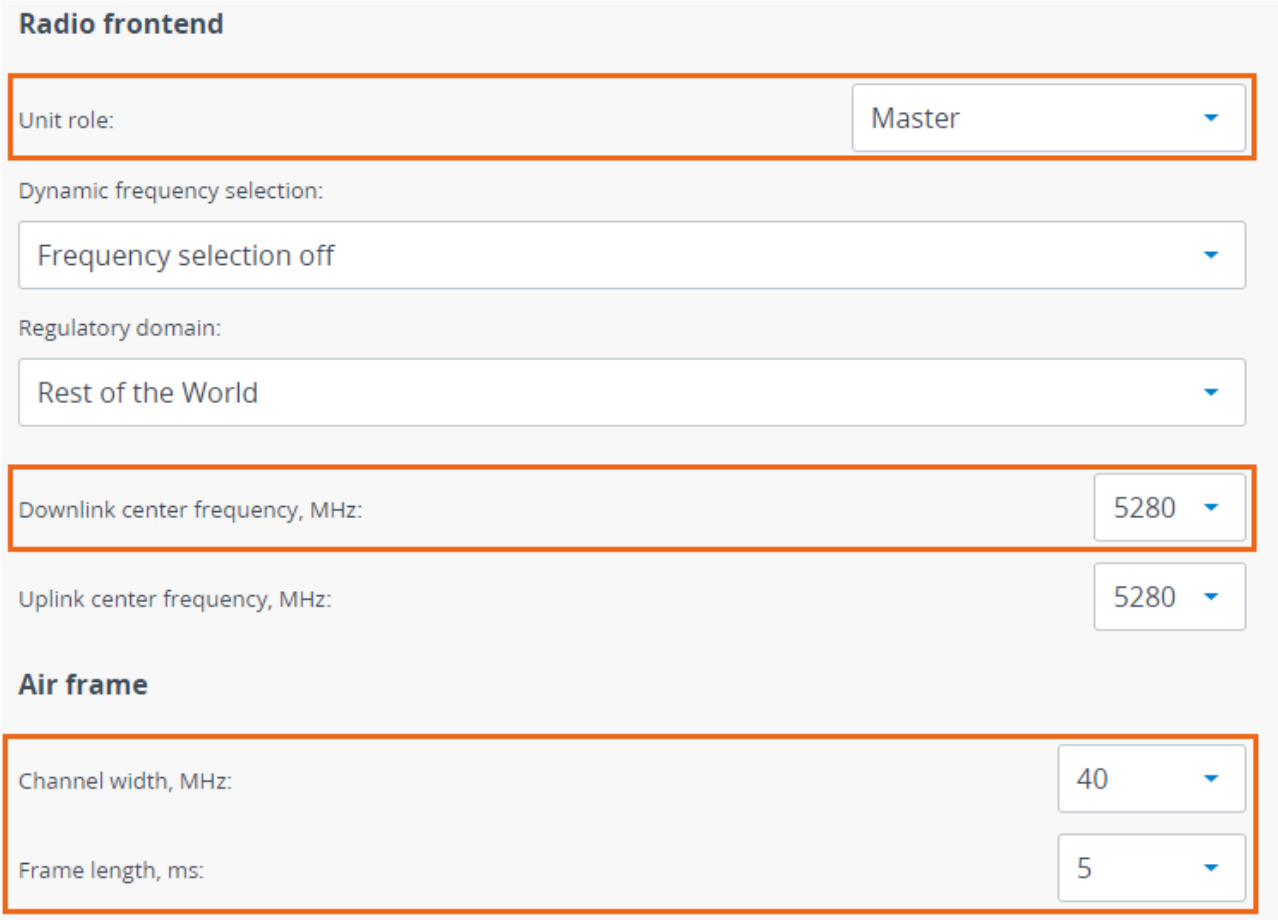
Checking the radio parameters

If the wireless link is not establishing in lab conditions, make sure that the radio parameters are set to the values determined during the planning stage. The correct configuration of the device can be obtained using the Configuration Generator tool found on the IW Academy[13] website. To establish a wireless link, one device must be configured as Master, the second (or all subscribers of the base station in the point-to-multipoint topology) as

13 https://academy.infinetwireless.com/en/configuration_generator

Slave. The following parameters must be identical on both devices:

- Channel Width.
- Frequency.
- Frame length.
- Access key.



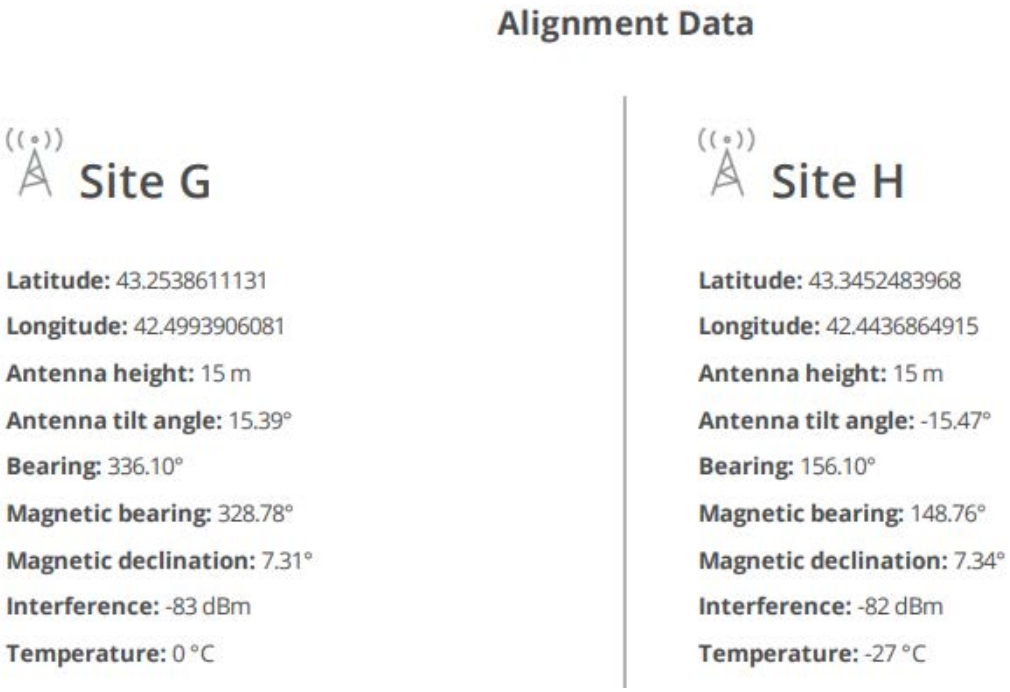
8.2.1 Checking the firmware version

In the "Maintenance" section, make sure that the same firmware version is installed on both devices. The latest software versions can be downloaded from the official Infinet FTP server[14].

14 ftp://ftp.infinetwireless.com/pub/Firmware

8.2.2 Checking the installation requirements

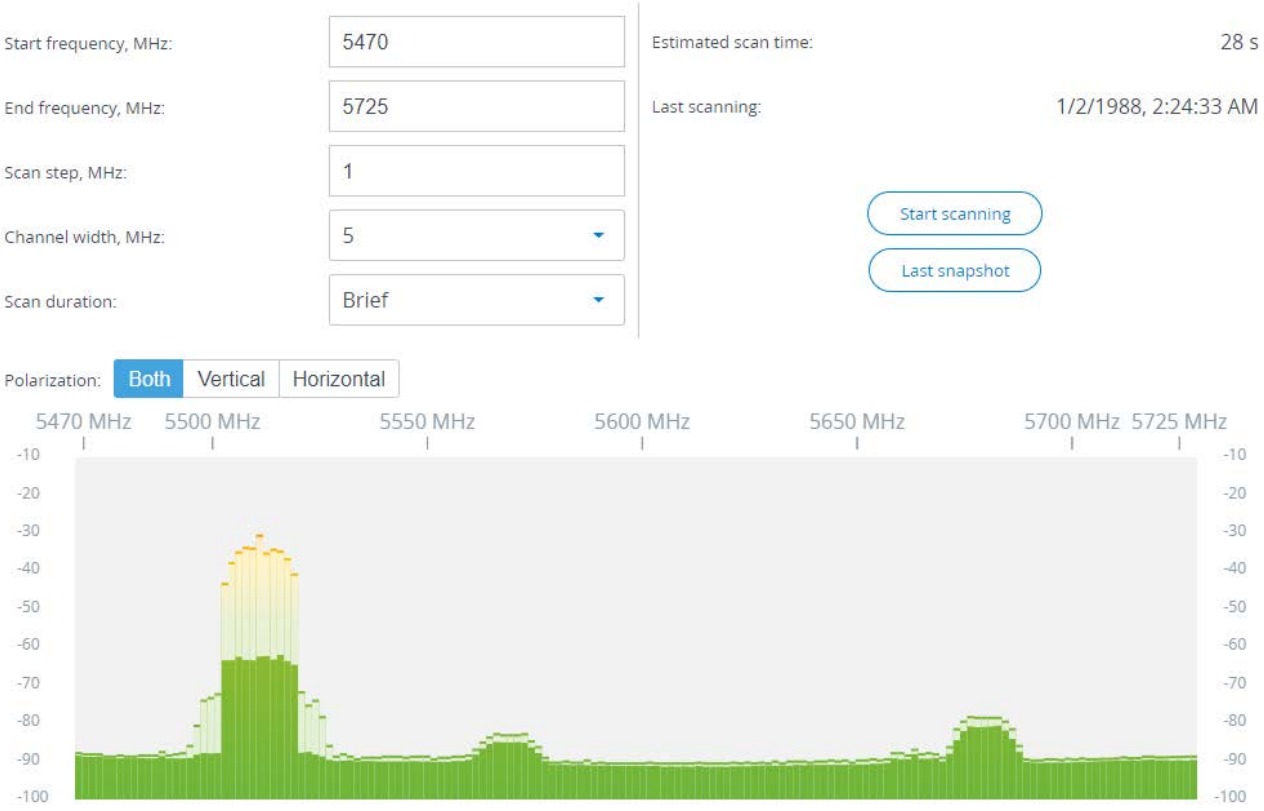
Check if the suspension height, azimuth and elevation of the antenna match with the values obtained from InfiPLANNER[15]. Make sure that the obstacles on the path profile are not higher than those specified during the planning phase.



8.2.3 **Interference detection**

Using the built-in Spectrum Analyzer tool, scan the air on both sides of the link to make sure there is no interference that could corrupt the signal on the device's operating frequency and on the adjacent frequencies. To get accurate information about the frequency, hover the mouse cursor over it. The pop-up window below provides information about frequency, maximum signal level, average signal level. The indicators show the signal level in dBm. For operation at the highest modulations, the RSSI parameter value should be in the range of -60 ...- 40 dBm. To get the spectrum scanning results on the remote device, use the "Last snapshot" button.

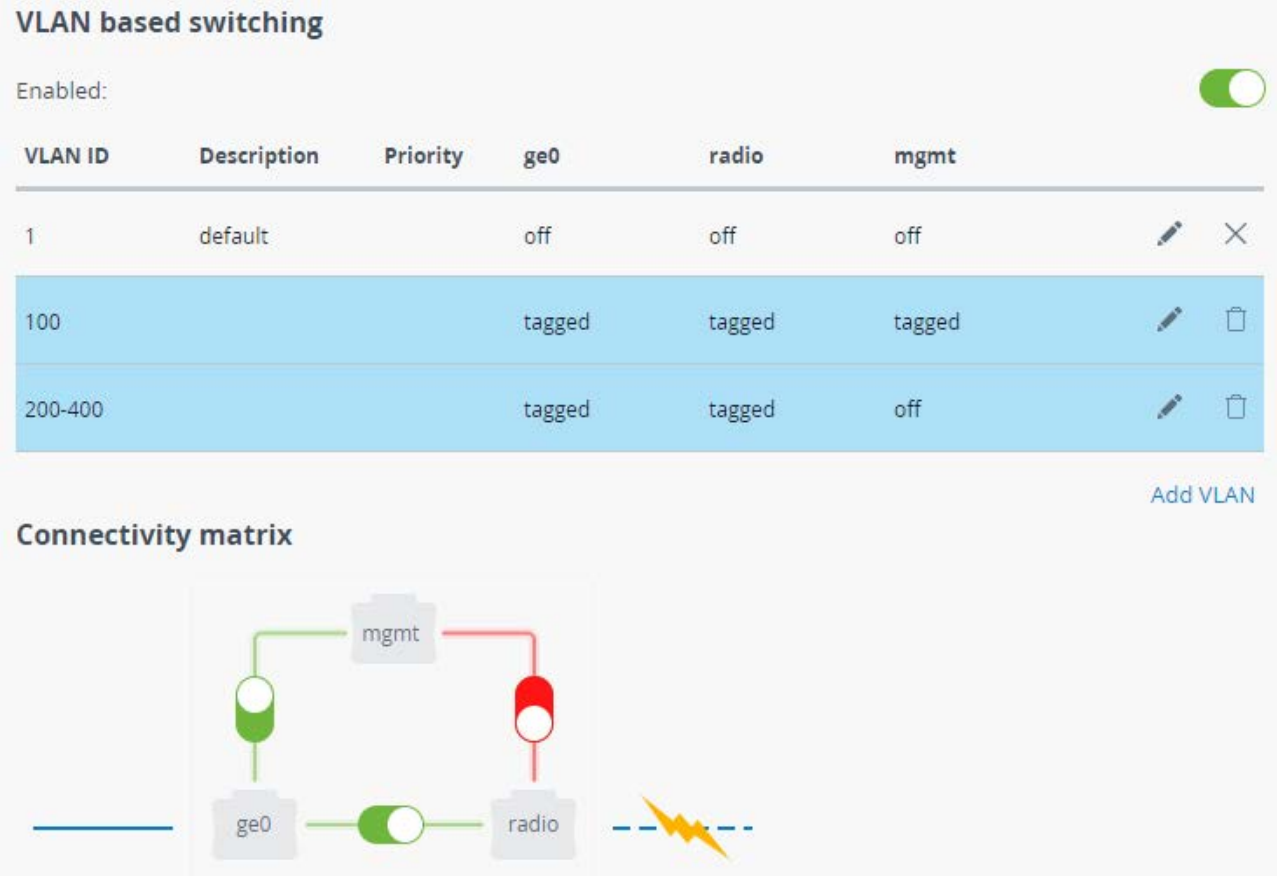
15 https://infiplanner.infinetwireless.com/



8.3 3. The wireless link is established, but there is no access to the remote device

8.3.1 Checking the switch settings on the local device

In the "Switch" section of the web interface, make sure the VLAN-based switching settings are configured in accordance with the network architecture. Make sure the connectivity between the "ge0" and "radio" interfaces is enabled.

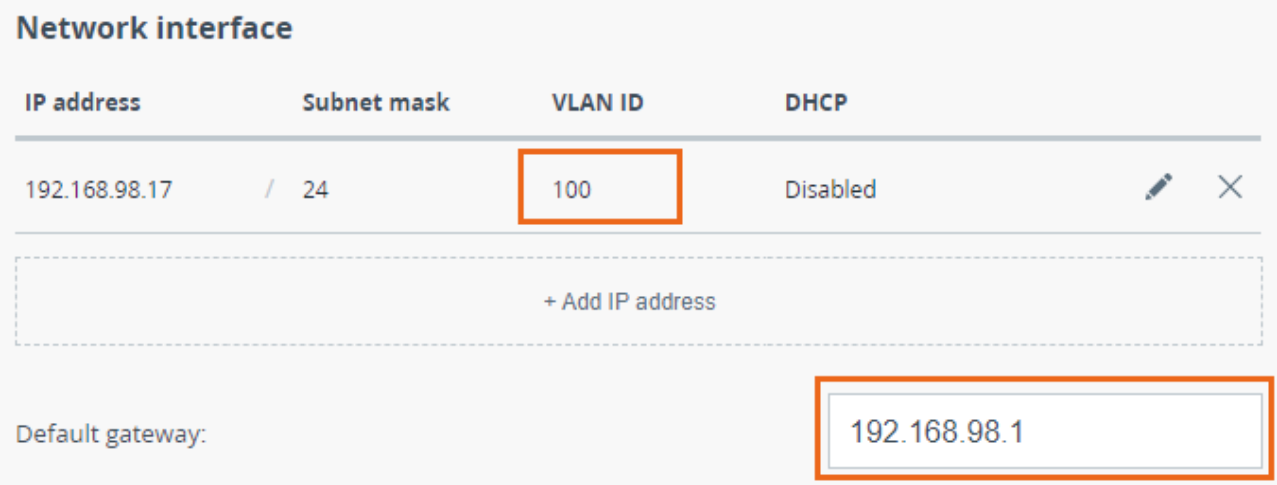


8.3.2 Checking the switch settings on the remote device

Further diagnostics should be performed at the device installation site. Try to access the device directly using the ERConsole utility.

When accessing the web interface, in the "Switch" section, make sure the VLAN-based switching settings are configured in accordance with the network architecture. Make sure the connectivity between the "ge0", "radio" and "mgmt" interfaces is enabled in a connectivity matrix.

In the "Network" section, make sure the correct VLAN ID is assigned to the management IP address and the default gateway is configured in accordance with network architecture.



8.4 4. The wireless link throughput is lower than expected

8.4.1 The wireless link indicators

Go to the web interface of both devices, check the new firmware version availability. Update the firmware if available.

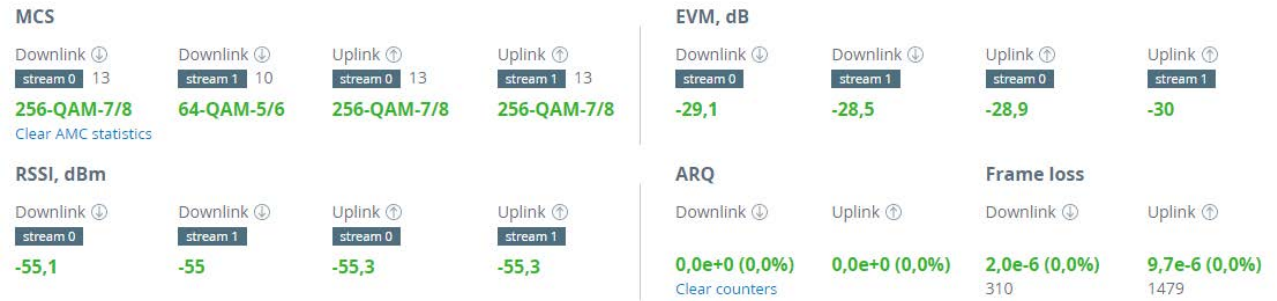
Check the EVM and RSSI parameters values in the dashboard section:

- If the value of the RSSI parameter remains high while the CINR value decreases, it may indicate high interference levels near one of the devices. Use the "Spectrum analyzer" utility built into the web interface to determine the interference level on the current channel and select a new frequency channel.
- The deterioration of both the RSSI and the CINR parameters can indicate a misalignment of the devices. Check the antennas alignment, the RF cables condition and the obstacles in the first Fresnel zone.

Proceed to the "Radio" section and check the following settings:

- The frame length value, if it is too small try to increase it;
- Power limit, increase the value, make sure Automatic Transmit Power Control is enabled, target RSSI value matches expected values.

Perform an antenna alignment using the built-in utility, especially in case the RSSI and EVM values are low.



8.4.2 Availability statistics

To analyze the wireless link availability time, proceed to the corresponding statistics in the "Dashboard" - "Availability statistics" of web interface. The opened window displays the link operation statistics for each modulation.

Link Availability Statistics

Status	Current uptime	Total uptime	Availability	Disconnection	Last outage	Total outage
Connected	4d 11:55:04	5d 22:43:50	100%	6	00:00:07	00:04:16

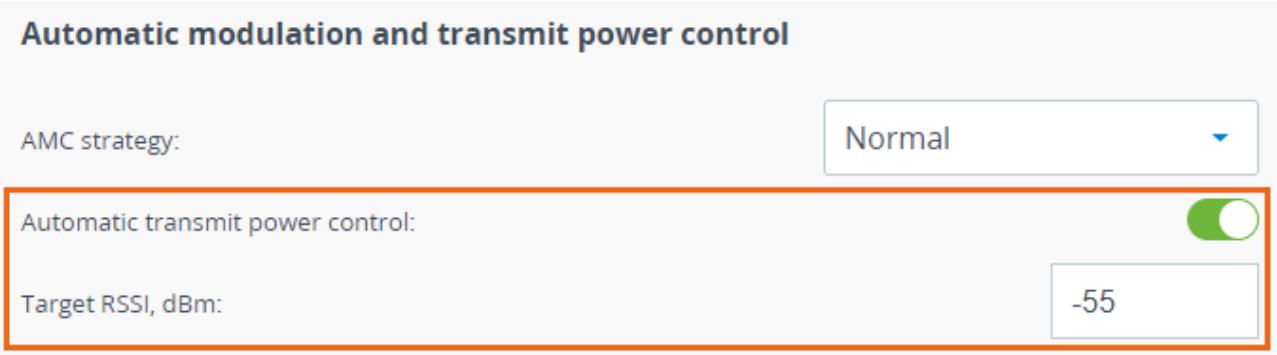
MCS Availability Statistics, %

Modulation	TX, Stream 0	TX, Stream 1	RX, Stream 0	RX, Stream 1
QPSK-1/4	99,9	99,9	99,9	99,9
QPSK-1/3	99,9	99,9	99,9	99,9
QPSK-1/2	99,9	99,9	99,9	99,9
QPSK-5/8	99,9	99,9	99,9	99,9
QPSK-3/4	99,9	99,9	99,9	99,9
16-QAM-1/2	99,9	99,9	99,9	99,9
16-QAM-5/8	99,9	94,8	99,9	99,9
16-QAM-3/4	99,9	94,7	96,5	99,9

8.5 5. Common errors in configuration

8.5.1 Automatic transmit power control

Enable the automatic transmit power control (ATPC) in order to increase the operational life of the devices. Set the "Target RSSI" parameter to values from -40 to -60 dBm.



8.5.2 Frame length

Make sure the selected frame size ensures the best performance for your wireless system. A short frame will transmit less payload than a long one, however it ensures a smaller delay.

9 Glossary

- AC - Alternating Current
- AMC - Automatic Modulation Control
- ARQ - Automatic Repeat reQuest
- ATPC - Automatic Transmit Power Control
- DHCP - Dynamic Host Configuration Protocol
- DC - Direct Current
- DFS - Dynamic Frequency Selection
- ERC - Emergence Repair Console
- ETH - Ethernet
- EVM - Error Vector Magnitude
- FTP - File Transfer Protocol
- H-FDD - Hybrid Frequency Division Duplexing
- IP - Internet Ptotocol
- LBT - Listen Before Talk
- LOS - Line of Sight
- MAC - Media Access Control
- MCS - Modulation and Coding Scheme
- NLOS - Non-Line of Sight
- PHY - Physical layer
- PoE - Power over Ethernet
- QAM - Quadrature Amplitude Modulation
- QoS - Quality of Service
- QPSK - Quadrature Phase Shift Keying
- RF - Radio Frequency
- RSSI - Received Signal Strength Indicator
- SDR - Software-Defined Radio
- SC-FDE - Single-Carrier Frequency Domain Equalization
- STP - Spanning Tree Protocol
- TDD - Time Division Duplexing
- VLAN - Virtual Local Area Network