Planning considerations

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

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.

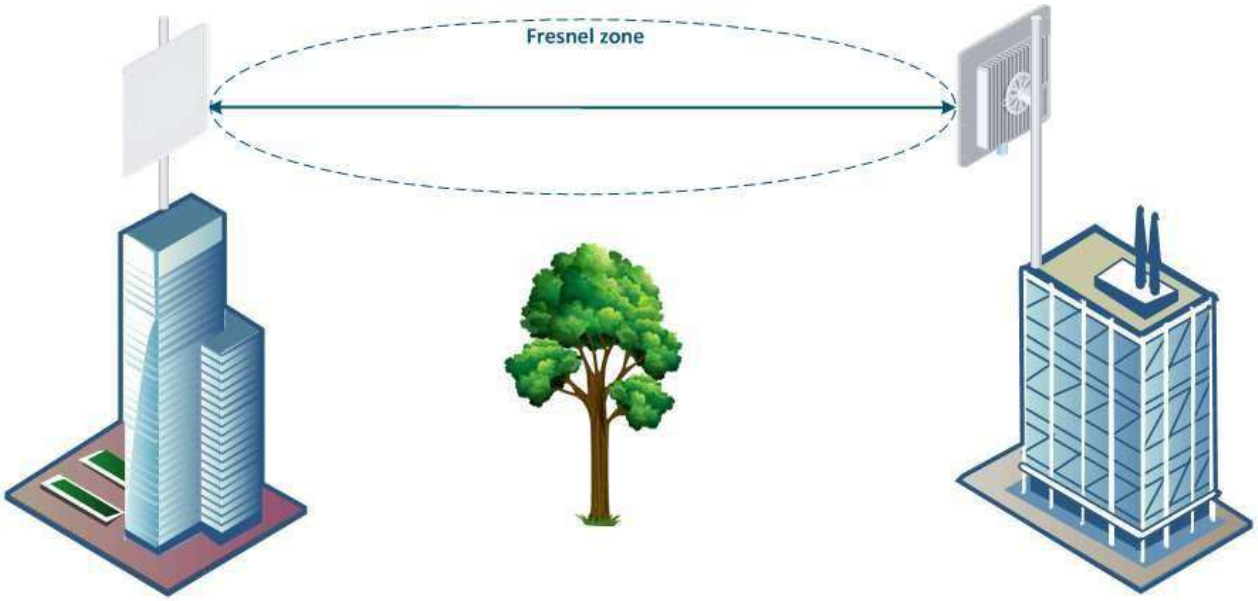
The radio beam is an electromagnetic wave and it is not as thin as a laser beam, for example. The main energy in a radio beam is concentrated along the straight line between the two antennas, inside an area with the shape of an ellipsoid (or a rugby ball). This area is called the 1st Fresnel zone and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

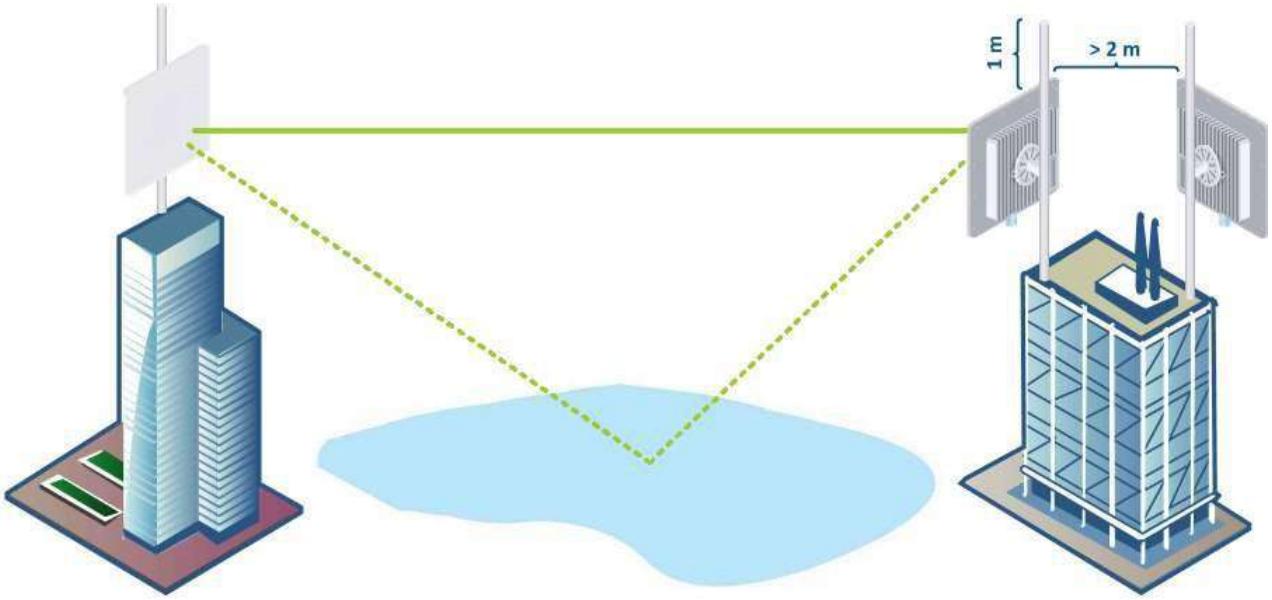
To obtain the best results, it is necessary to perform a precise analysis of the signal propagation path and possible obstructions that may obstruct the 1st Fresnel zone.



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.
- Before installation, make sure the devices are located outside the area of water streams and splashes formation, which can affect the enclosure for a long time.
- Install antennas as far as possible from other antennas (the recommended distance is at least 2 meters between edges of the antennas).
- 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.



Spectral aggregation

Spectral aggregation should be taken into account when planning composite backhauling links, when installing devices in close proximity to each other on the same pole or in order to implement redundancy and link aggregation. For more information, proceed with the "Link aggregation, balancing and redundancy" article. The devices located close to each other can cause mutual interference. Do not ignore the spectral aggregation rules, otherwise it can lead to a degradation of the wireless links.

The document will provide recommendations on distance and frequency separation for scenarios with and without an external synchronization hub. An external clock source allows you to synchronize the time (the beginning of each second) on multiple devices, up to 7 devices, with an accuracy of less than a microsecond so that all connected devices can turn on the transmitters at the same time. This completely eliminates the mutual influence of neighboring sectors, when one transmitting device with its powerful signal prevents the neighboring device from receiving weak signals from its terminals. Wireless devices synchronization using AUX-ODU-SYNC makes it possible to reuse the frequency within the same site, that is, devices mounted back to back can operate on the same frequency channels.

Without synchronization

- Distance separation (vertical or horizontal) must be at least two meters between the edges of the antennas.
- Reduce the transmission power.

With synchronization

In case that the synchronization is enabled, in order to achieve the minimum mutual interference between colocated devices, the distance can be reduced to 1 meter.

Synchronization settings

To perform synchronization using an external hub, each base station sector must be connected to an AUX-ODU-SYNC.

The following conditions should be met:

- Frame size and DL/UL ratio should be equal on all sync-end units.
- The automatic downlink ratio selection is not allowed.

> **NOTE**
>
> The AUX-ODU-SYNC antenna is not included in the standard packing list.

Link Pre-configuration in the lab

Usually, before going into the field, it is recommended to pre-configure in the lab the Astra Wireless units to verify the link establishment. Take the units 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 that devices are positioned in such a way so that they are not directed right at each other to prevent device damage.
> - In case of connectorized model configuration, it is recommended to connect the two devices 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).
> - In case an external antenna or the other unit in the link is connected to only one N-type connector do not switch on the unit.

Step 1: Scheme connection assembling

The equipment list required for the lab configuration:

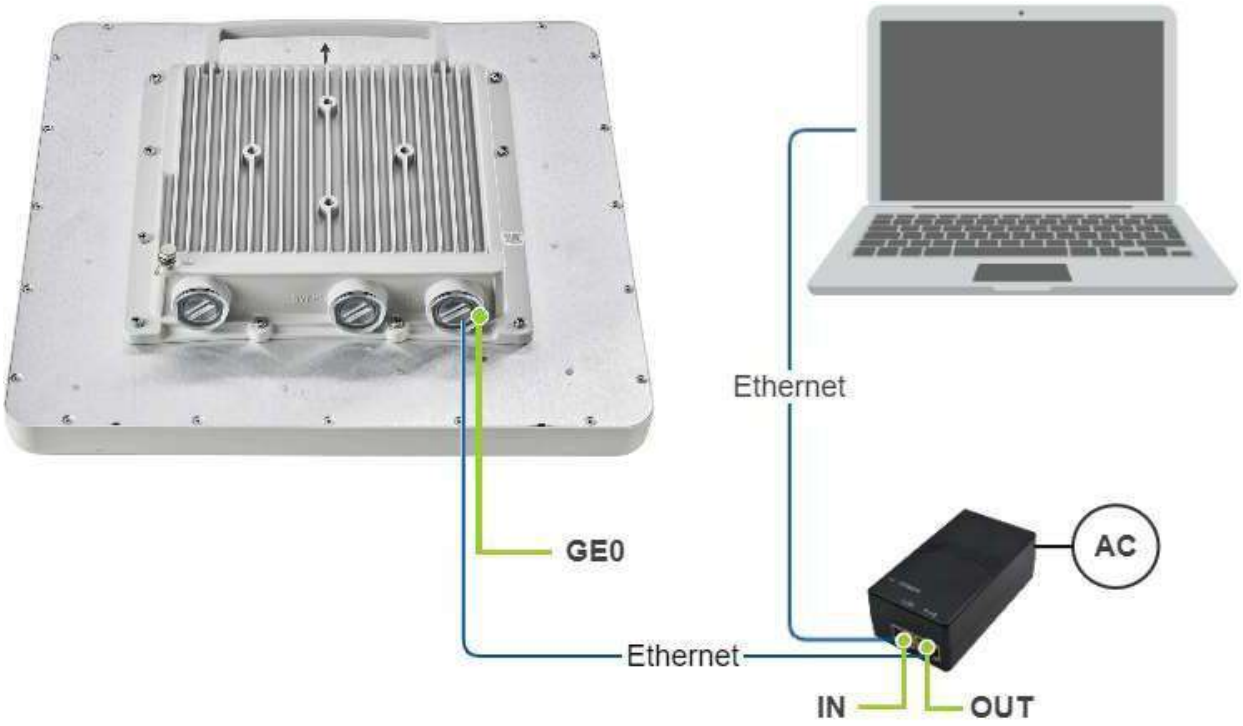
1. Outdoor units - 2 pcs.
2. Power supply - 2 pcs.
3. Power cord - 2 pcs.
4. Ethernet cables - 4 pcs.
5. Laptop with Ethernet port available.

We will perform the settings mentioned below for each unit and check if the 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.

> 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 Astra Wireless devices.



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" → "Change admin password" 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.

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 https://ftp.astrawireless.net/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.

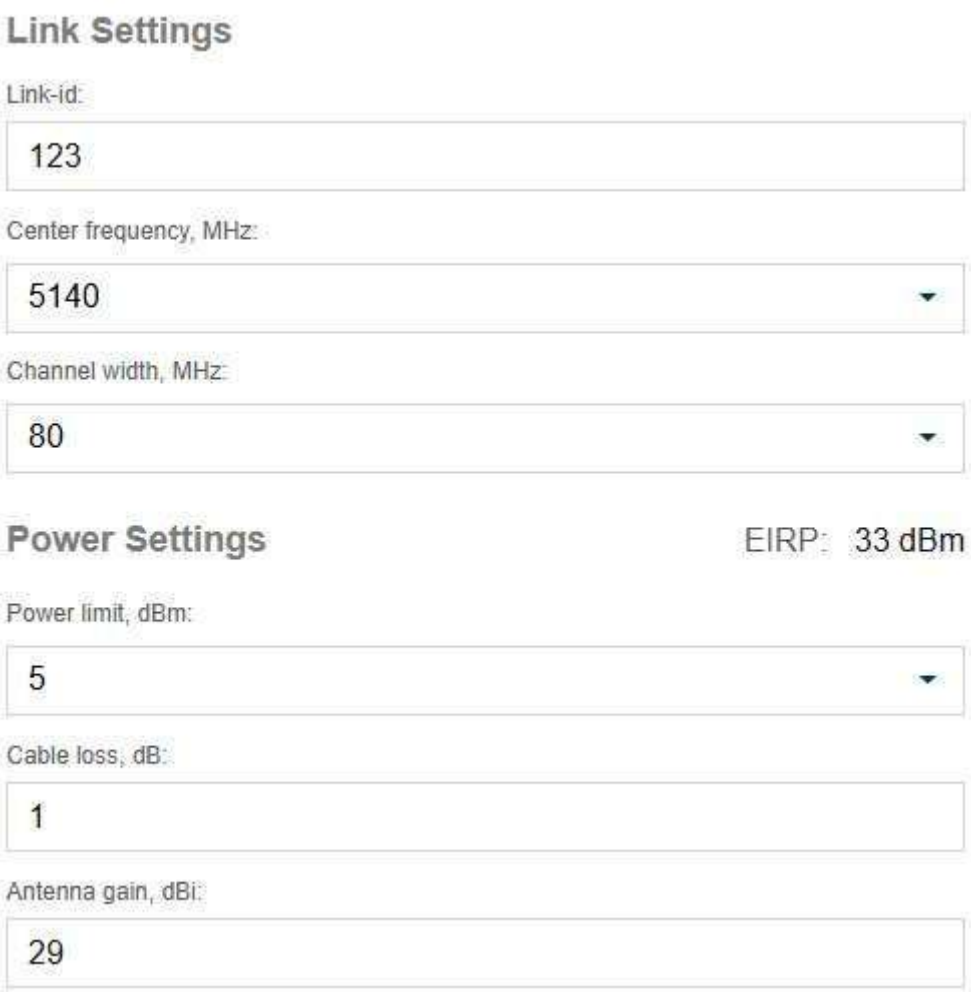
Step 4: Radio parameters configuration

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

At the both units, go to the "Settings" → "Radio" section and set this unit with:

- Link ID parameter, it must be the same on both sides of the link
- Center frequency use values selected at the Link Planning stage.
- Channel width: use value selected at the Link Planning stage.
- Power limit: set the minimum value in the range, as currently, we are in the lab, and we don't need high output power.

The rest of parameters remain with the default values.



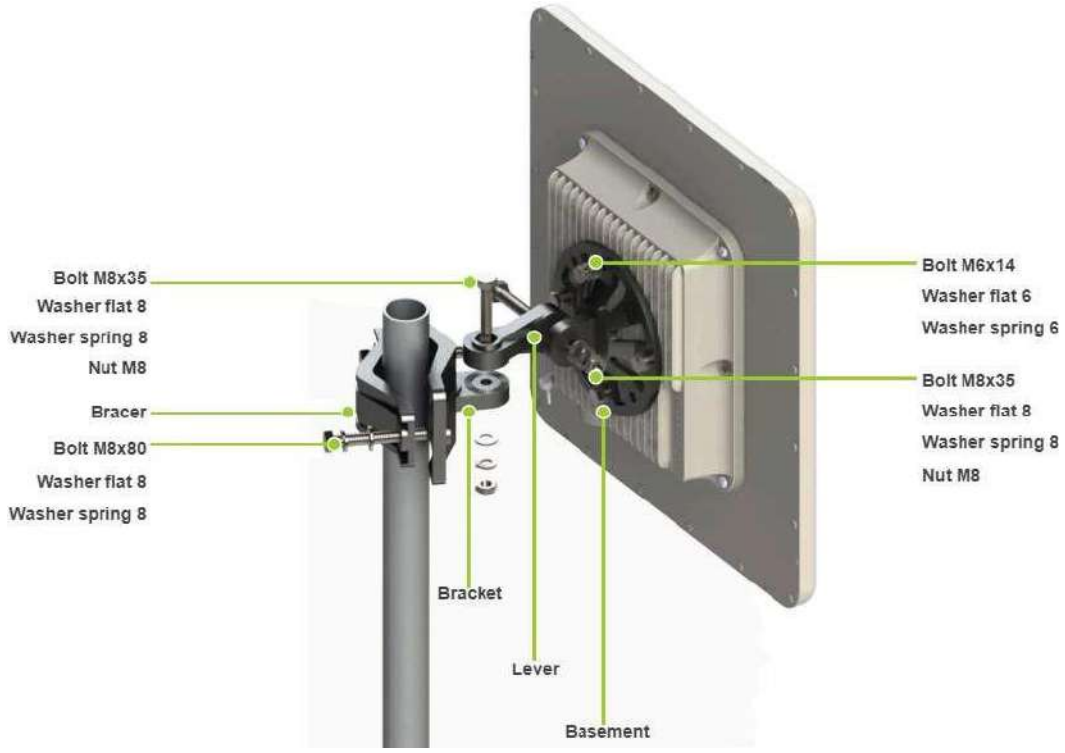
Step 5: Check the wireless link status

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".

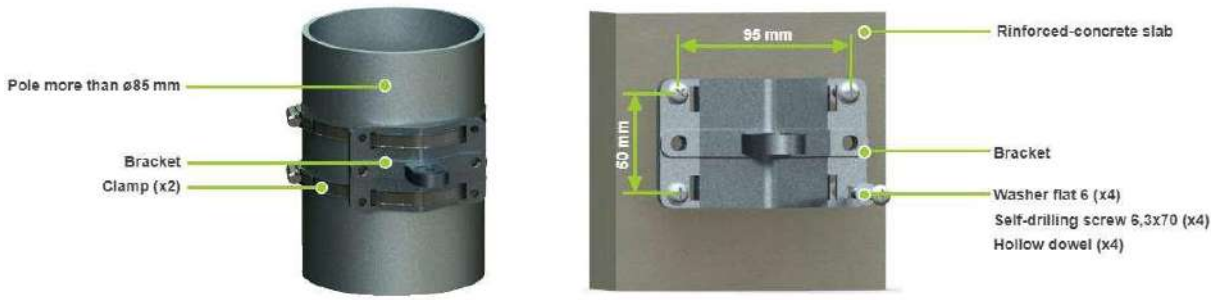
Installation

Mounting kit

MONT-KIT-85 | MONT-KIT-85S is supplied with all models 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.

Cable Gland Assembly

Cable Gland Assembly for RJ-45 connector

Required components are listed below.

1. Unshielded RJ-45 connector.
2. Shielded RJ-45 connector.
3. FTP Cat5e cable.
4. Cable gland:
   - Cable gland nut.
   - Split sealing grommet (with inner diameter 7 mm).
   - Cable gland threaded coupling.
5. Crimping tool for RJ-45 connector.

NOTE

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

Cable gland can be assembled on pre-crimped cable.

Assemble procedure

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

- **Step 1**: Crimp the standard RJ-45 connector onto the cable using crimping tool. Pin-out scheme: T568B wiring standard.

> ⚠ 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.
>
> 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.

- **Step 2**: Assemble cable gland nut, the split sealing grommet and the cable gland threaded coupling onto the pre-terminated cable as shown on the figure below.
- **Step 3**: Insert the split sealing grommet into the cable gland threaded coupling.
- **Step 4**: Insert the RJ-45 connector into the device socket until you hear a click.
- **Step 5**: Screw the cable gland threaded coupling into the port and tighten it. Do not apply excessive force.
- **Step 6**: Tighten the cable gland nut (4). Do not apply excessive force.

Cable Gland Assembly for Optical Cable

Required components are listed below.

1. Optical cable.
2. Optical connector.
3. SFP module.
4. Cable gland:
    - Cable gland nut.
    - Split sealing grommet (with inner diameter 3.2 mm).
    - Cable gland threaded coupling.

Assemble procedure

- **Step 1**: Put the cable gland nut, the split sealing grommet and cable gland threaded coupling onto the optical cable as shown on the figure below.
- **Step 2**: Insert the split sealing grommet into the cable gland threaded coupling.
- **Step 3**: Set the SFP module into the socket until you hear a click.
- **Step 4**: Insert the optical connector into the SFP module.
- **Step 5**: Screw the cable gland threaded coupling into the port and tighten it.
- **Step 6**: Tighten the cable gland nut. Do not apply excessive force.

> NOTE
>
> In order to disassemble SFP, please disconnect the optical cable, pull the clip of the SFP module and withdraw the SFP module from the slot.
>
> SFP module is not included into the packing list. Is possible to use an SFP (Small Form-factor Pluggable) transceiver of any manufacturer that meets the MSA (MultiSource Agreement) standard.

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 Astra 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 planning tool to determine the link path profiles, radio equipment placement requirements, etc.
- You met requirements described in the section "Planning considerations" - > "Wireless device placement".

Installation Procedure

1a. In case of device with removable parabolic antenna, to mount the reflector to Quasar, proceed as follows:

- Match the antenna reflector with the cover of the outdor unit to coincide the cut parts of the antenna and the slots of the enclosure to prevent rotation of the antenna during operation.
- Install the sealing metal ring of the feeder on top of the antenna reflector, screw the feeder into the hole to press the reflector to the device enclosure.
- Tighten the feeder with a 45 mm wrench with a force of 700-800 Nm.

1b. In case of device with external antenna, to mount and connect an external antenna to Quasar, proceed as follows:

- Mount the antenna(s) according to manufacturer's instructions;
- Connect the ODU V and H N-type interfaces to the antenna(s) with RF coaxial cables and with appropriate connectors. Use cables not longer than 3 m (9.8ft). Tighten the N-type connectors to a torque setting of 1.7 Nm (1.3 lb ft);
- Form drip loops near the cable ends at the ODU's side so that water doesn't creep towards the ODU connectors;
- Weatherproof the N-type connectors (when antenna alignment is complete) using PVC tape and self-amalgamating rubber tape;
- Weatherproof the antenna connectors in the same way (unless the antenna manufacturer specifies a different method);
- 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.

> ⚠ 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.

Install ODU connector facing down using the mounting kit. Do not tighten the fasteners to the end until the alignment is completed.

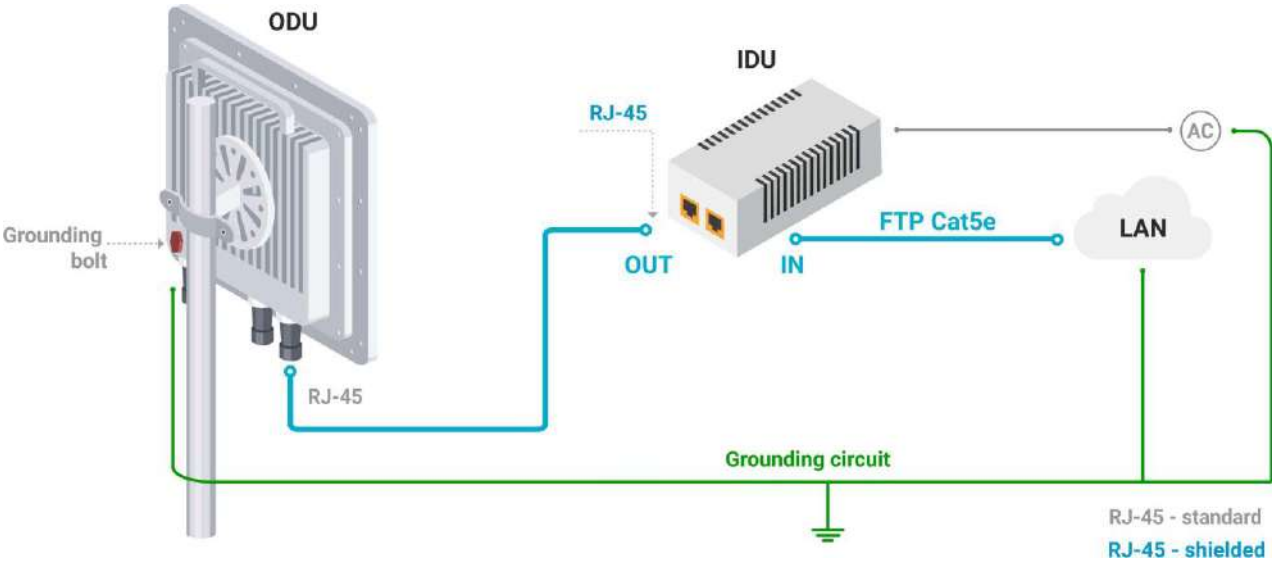
2. Connect the Cat5e FTP cable with the cable gland to ODU.
3. Perform ODU grounding.
4. Lay the Cat5e FTP cable from ODU to the power supply.
5. Connect the Cat5e FTP cable with a shielded connector covered by a cap to the "OUT" port of the power supply, having previously touched the power supply connector case with FTP cable connector case.
6. Perform the power supply grounding.
7. Connect the laptop using Cat5e FTP cable to the power supply "IN" port.
8. Connect the power cord to the power supply and then to the power circuit.

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.

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

Please note that the pressure equalization system in Astra Wireless 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 and pinching with clamps, 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 leakage and device failures.

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 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.

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-L and wireless device 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. Grounding bolt is included in the supply list, M6×10 for BS devices, M5×10 for ST devices.

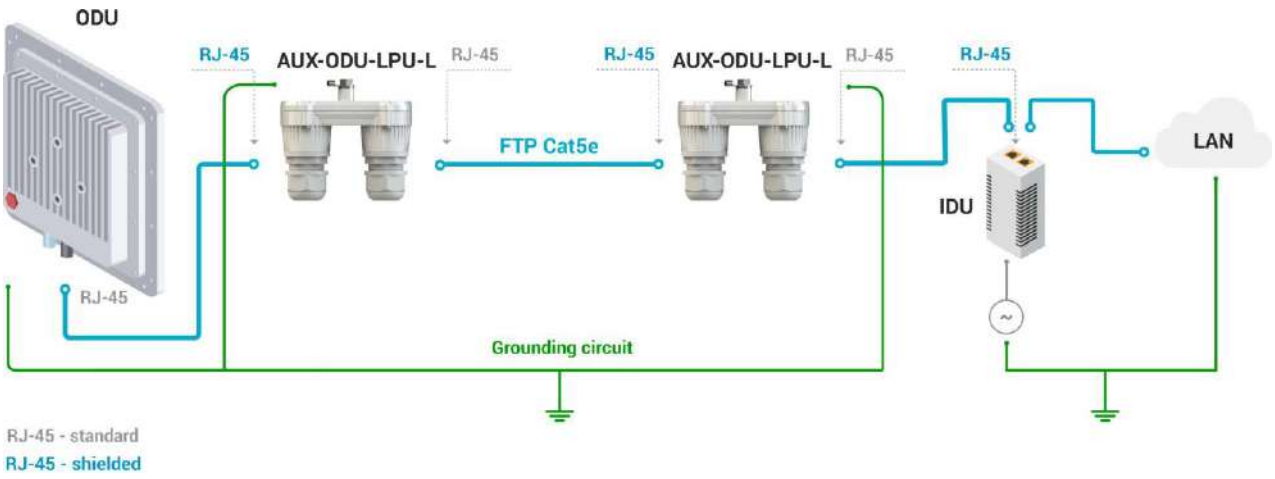
Requirements to the lightning protection unit AUX-ODU-LPU-L location

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.



> ⚠ 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.

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 mm2) to the case, using grounding bolt. An M6×10 grounding bolt is included in the supply list.

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.

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

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.

Antenna Alignment

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 planner tool report.
- 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.

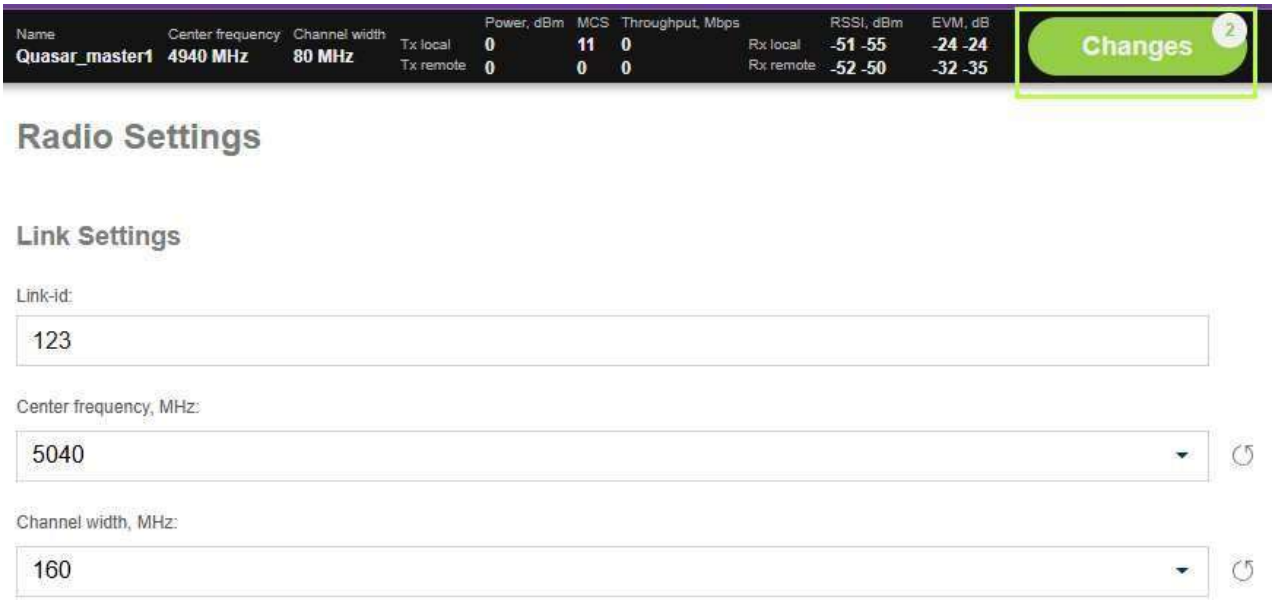
Alignment tool

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.

To achieve the best performance, RSSI level current values should be -60 ... -40 dBm.

Operation & Administration

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



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 all" button at the bottom of the window. Changes will be saved to the device configuration by clicking the "Apply" button.