PPC-1000-LL
LOW LATENCY RADIO

FOR FREQUENCY BANDS

71–76/81–86 GHz

40.5–43.5 GHz

37.0–40.0 GHz

INSTALLATION AND USER MANUAL
1 Gigabit Ethernet Wireless Link

For any request regarding this Manual, ccontact us by E-mail: sales@elva-1.com

Contents

DOCUMENT HISTORY

2017 – Initial manual

2019 – Q-band / Ka-band section added

2023 – Update of specifications because of further product development

List of Illustrations

1. COPYRIGHT AND STATEMENTS

1.1 COPYRIGHT INFORMATION

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Elva-1 OU warrants each standard Elva-1 OU product sold by it to be free of defects in material and workmanship under conditions of normal use for twelve (12) months from date of shipment thereof to Buyer. Repair or, at Elva-1 OU's option, replacement of defective parts shall be the sole and exclusive remedy under this limited warranty. All warranty replacement or repair of parts shall be limited to equipment malfunctions, which, in the sole opinion of Elva-1 OU, are due or traceable to defects in original materials or workmanship.

In the event the Buyer believes that the Product is covered by the limited warranty of this Section, the Buyer shall pay for the shipping and insurance of such Product to Elva-1 OU. If Elva-1 OU determines in its sole opinion that such Product does conform to the limited warranty, then Elva-1 OU shall pay for the shipping and insurance of repaired or replacement Product back to the Buyer. However, in the event that Elva-1 OU determines in its sole opinion that such Product is not covered by the limited warranty, Buyer shall pay for shipping and insurance of such Product back to the Buyer.

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1.3 Other Vendor Product Compatibility

While every effort has been made to verify operation of this product with many different communications products and networks, ELVA-1 makes no claim of compatibility between its products and other vendors' equipment. It is assumed that users have thoroughly evaluated this product's performance in the communications and other engineering environment in which it will be used.

1.4 Installation and Operation Precautions

The following general safety precautions must be observed during all phases of operation and service of the products will fully violates standards of design, manufacture, and intended use of the product. Elva-1 OU assumes no liability for the customer's failure to comply with these requirements.

• Do not operate wireless equipment without an appropriate termination.

• Do not work directly in front of energized antenna.

Prior to working on the antenna or RF assembly, ensure that the RF assembly is not radiating energy. When power is applied to the RF assembly and antenna, power precautions must be taken to avoid placing any part of the human body in front of the antenna.

• The outdoor equipment must be properly grounded to provide protection against voltage surges and built-up static charges. In the event of a short circuit, grounding reduces the risk of electrical shock.

For installations in the USA, refer to Articles 810830 of the National Electrical Code, ANSI/NFPA, for information with respect to proper grounding and applicable lightning protection for DC cables.

For installations in all other countries, implement protection in accordance with the safety standards and regulatory requirements of the country where the equipment is to be installed.

• Do not install or operate this equipment in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

• Do not install substitute parts or perform any unauthorized modification to the equipment. Changes or modifications not expressly approved by Elva-1 OU void the Warranty on the equipment.

• This product is designed to withstand moisture conditions typically encountered when installed outdoors. This is not designed for operation under water.

• This product is not designed to withstand direct thunderbolt. It should be operated only under protection of external lightning rod.

• This product should be operated only from the type of power source indicated on the equipment or in this manual.

2. INTRODUCTION

2.1 PPC-1000-LL LINK APPLICATIONS

The PPC-1000-LL wireless link is intended for ultra-low-latency full duplex 1Gigabit Ethernet radio communication between two locations. It is comprised of two subscriber transceivers, each operating under line-of-sight conditions at working frequencies within the 71/86 GHz or 37.0–40.0 GHz radio bands.

This link is intended for point-to-point digital communications applications such as Wireless Backhaul for HFT Trading, Corporate Campus Networks, and other Wireless backbones. In HFT trading environment, fiber optic connections can be too slow to win a bid on stock exchange. A series of PPC-1000-LL radio links can be used to relay the signal. By using mm-wave radios instead of fiber optic cables, an HFT firm can establish a much shorter path to the marketplace, reducing latency and so it can execute trades faster.

Fig. 1 PPC-1000-LL link at the point of installation

PPC-1000-LL is available in either lightly licensed 71-76/81-86 GHz (E-band) or licensed 40.5-43.5 GHz (Q-band), 37.0–40.0 GHz (Ka-band) frequency spectrum. The radios are equipped with 60 cm (2 ft.) antennas by default; however, smaller antenna sizes are also available for all these bands. Also, for Q-band and Ka-band the 90 cm (3 ft.) antennas are available. The PPC-1000-LL is normally mounted in a rooftop or tower location, and contains slot for SFP module to connect to a LAN/WAN network.

The ELVA-1 PPC-1000-LL is a fully-outdoor radio link, designed for temperature variations between -50°C (-58°F) and +60°C (148°F), and humidity up to 100%.

Practical distances for conditions of ITU rain zone "E", and 99.95% availability:

- E-band radio max distance is 7.1 km (4.3 miles) with 60 cm antenna.
- Q-band radio max distance is 14.4 km (8.7 miles) with 90 cm antenna.
- Ka-band operating distance is more than 25 km (11 mi) for links equipped with 90 cm Note. The long-range operation requires installation on high towers to have the line-of-sight.

2.2 PPC-1000-LL FEATURES

- Frequency bands: 71-76/81-86 GHz, 40.5-43.5 GHz, 37.0–40.0 GHz
- 45ns latency from SFP socket to antenna port (one ODU)
- Signal propagation is in about 1.5 time faster than over fiber glass cable
- SNMP v.2; MIB-II and Enterprise MIB; WEB; CLI; Telnet
- True 1000 Mbps Full Duplex Operation
- Easily installed, zero-footprint
- Parabolic Cassegrain type antennas
- Quasi-optical (laser-like) millimetre wave propagation
- EMI interference free

2.3 PRODUCT CODE FORMAT

Wide choice of modification of the radio are available, including

1. PPC-1000-LL link in E-band, Q-band or Ka-band.
2. Choice of antennas includes 2ft (60 cm) as basic one, also 1ft (30 cm) or 3ft (90 cm).
3. To order the right model by its product code, please use the following encoding schema:

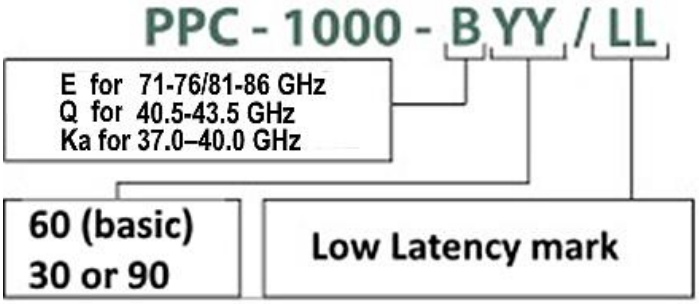


Fig. 2 PPC-1000-LL product code legend

For example, basic PPC-1000-LL link with 2ft antennas for 71-76/81-86 GHz band has the following product code: PPC-1000-E60/LL.

ELVA-1's FCC ID grantee code for PPC-1000-E radios: https://fccid.io/T3S-PPC-1000-E.

2.4 LINK MANAGEMENT

An operator could manage PPC-1000-LL link of any modification using built-in web-based interface. Basic information on web-based interface to start the link at first time is available in this manual in Chapter 6.

3. DELIVERY KIT

3.1 DELIVERY KIT OVERVIEW

The PPC-1000-LL for E-band equipment will arrive in 3 or more boxes, the sizes of which will depend on antenna diameter. For Q-band / Ka-band PPC-1000-LL package, see Chapter 7.

For all modifications of E-/Q-band radios, two of the boxes will contain the antennas and mounting/alignment brackets, and the other box will contain two transceivers and accessories (cables, connectors, tools, etc.), see Fig. 3.

Each antenna box will contain one antenna, an antenna cover and a mounting/alignment bracket. Depending on the antenna configuration, the alignment bracket could already be mounted to the antenna as a complete unit (Fig.4, left photo) or be enclosed in the box as separate accessory package (Fig.4, right photo).

Fig. 3. Delivery package (typical)

Fig. 4. Antenna package

If the alignment bracket is enclosed in a separate accessory package, it must be assembled and mounted to antenna in accordance with the printed manual that is enclosed in the box.

The box with transceivers contains 3 smaller boxes inside. Two of them contain transceivers (Fig.5, left photo) and one with doubled kit of power units, cables, sockets, tools, RSL meter (Fig.5, right photo).

Fig. 5. Transceivers and accessories boxes

The factory recommends that the shipping boxes and packing materials be retained by the customer at least for the length of the warranty (12 months), or longer.

Table 1. Packing list for radios

Description	Quantity
Transceiver module	2 or 4*
600* mm antenna with radio-transparent radome and mount	2
Power Supply unit	2
Diplexer with 6x hex. bolts (for Q-band / Ka-band modification only)	2
Mounting kit (tools, accessories)	2

* Q-band / Ka-band link consists of four ODUs.

** Antenna size is shipped according to the customer order, 600 mm antenna is basic, while there are other sizes of 300 mm (for E-bamd) or 900 mm (for Q-band / Ka-band) in diameter.

3.2 Tools and Accessories in Mounting Kit

There are connectors, tools and cables within Mounting kit to easily install PPC-1000-LL link.

Table 2. ACCESSORIES list

Description	Quantity
RSL meter unit	2
SFP -LR.LC.10 module	2 or 4*
Cable to 110-240 VAC main for ESP-240-54 Power Supply unit	2 or 4*
106059-7700 Fibre Optic Connector LC SM	2 or 4*
130057-0003 Sealed Ethernet, RJ-45, Cable Connector	2 or 4*
120071-0036 Micro-Change (M12) 4 Contacts Connector for power in	2 or 4*
Hexagon Socket Bolt DIN 912 M8	8
Lock Washer DIN6798J A2 M8	8
6mm Metric Allen Wrench Key (hex key)	2 or 4*
17 Ring & Open Ended Wrench	2 or 4*

* Q-band / Ka-band link consists of doubled amount of parts marked with asterick.

4. Preparing the Site of Installation

ELVA-1 assumes that customer personnel has an understanding of mm-wave wireless technology and sufficient familiarity with configuring and operating LAN/WAN networking equipment. Preferably, the personnel installing PPC-1000-LL fully read and understood the information covered in this manual before performing any actions with the PPC-1000-LL.

Before starting installation procedure, it is recommended to get familiar with its general sequence:

- Unpacking the PPC-1000-LL and examining Delivery Kit
- Preparing both sites of installation (at both ends of wireless link)
- Mounting the PPC-1000-LL
- Connecting the cables
- Aligning the antenna (for both transceivers)
- Performing initial link setup by web-interface.

4.1 Unpacking the PPC-1000-LL and Examining Delivery Kit

It is recommended to unpack PPC-1000-LL at a clean indoor place and examine all parts of delivery for any mechanical damage during transportation. Report any damages to ELVA-1 or your dealer.

Please mind that DC power cable, twisted pair cable and optical cable are not included to delivery kit and have to be purchased from local supplier accordingly to required length.

4.2 Examining the Site of Installation

The PPC-1000-LL mm-wave wireless link requires a clear Line-of-Sight (LOS) for proper operation. That means that no obstacles, such as trees, buildings, chimneys, etc. can obstruct the LOS path between the transceivers. Moreover, no obstacles should be located in the vicinity of the signal propagation line (inside the first Fresnel zone).

Fig. 6. Examining LoS

Site planning should include an investigation into future construction that would block the LOS path, and other long term incremental obstructions such as growing trees.

However, it should be understood that due to the physics of the ray divergence process, the antenna radiation pattern is not an ideal thin straight line, but an elongated cone (with side lobes). Leaving practically from a point source (from the center of the antenna), the beam cone reaches a quite significant diameter to the opposite antenna about 30 m at a distance of 3 km, 60 m at

5 km and up to 100 m in diameter at a distance of 8 km and more. Accordingly, such a cone of the radiation pattern should also not touch any obstacles along the way by its edges.

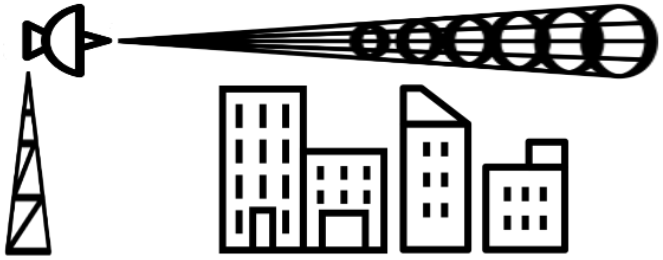


Fig. 7. Antenna radiation pattern is an elongated cone with side lobes in reality

To ensure PPC-1000-LL equipment is protected from vandalism and theft it must be mounted in a position that is accessible to only authorized personnel.

4.3 Path Planning

Use Google Maps or another geographical locating tool to obtain the distance between the proposed transceiver installation points.

Measurement of the link distance is important in calculating of the link availability and Receive Signal Level (RSL). The link distance measurement can be performed using Global Positioning System (GPS) device at proposed locations of the transceiver installation. Additionally GPS reading will be required in order to comply with the FCC registration process.

For estimated link availability and RSL value for your distance please contact to ELVA-1 for RSL value for distance between the transceiver. This value will be your "passport" reference value on the RSL meter device when conducting the final antenna alignment.

4.4 Minimal Clearance for Fresnel zone

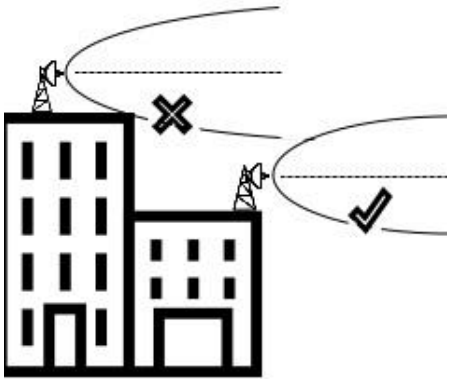


Fig. 8. Clearance in Fresnel zone

There must be no obstructions between the antenna and any on-site structure in the so-called first Fresnel zone. Any obstruction in the first Fresnel zone will corrupt the antenna pattern. In practice, the antenna should be mounted on the edge of a roof or on a mast, so it propagates the signal directly into free space.

Fresnel zones are series of concentric ellipsoids surrounding the straight-line path between two antennas. The radius of the Fresnel zone is greatest at midpoint in the signal path. Minimum Clearance (i.e., radius of the first Fresnel zone) for various bands is listed in the table.

Table 3. Fresnel zone min clearance

Path Length, miles/km	**Minimum Clearance for Fresnel zone**, ft/meters		
	Ka-band 37-40 GHz	**Q-band** 40.5-43.5 GHz	**E-band** 71-76/81-86 GHz
0,6 mi / 1 km	*4,9 ft / 1,5 m*	*4,6 ft / 1.4 m*	*3,3 ft / 1 m*
1,2 mi / 2 km	*6,8 ft / 2,1 m*	*6,5 ft / 2.0 m*	*4,6 ft / 1,4 m*
3,1 mi / 5 km	*10,8 ft / 3,3 m*	*10,5 ft / 3,2 m*	*7,5 ft / 2,3 m*
6,2 mi / 10 km	*15,4 ft / 4,7 m*	*14,7 ft / 4,5 m*	*10,2 ft / 3,1 m*

4.5 Supporting Structure for Transceiver

The radio should be fastened to a vertical support pole that is 51 to 114 mm in diameter and not less than 500 mm (20”) in vertical length. The design of the support structure is not specified, but its resistance to bending and torsion must be strong enough to prevent antenna movement in either azimuth or elevation by wind, snow cap or other natural force.

It is allowed to mount the radio to a horizontal pipe of 51 to 1114 mm diameter.

It is necessary to carefully monitor the polarization marks of the antenna, so that both transceivers are either in the vertical polarization or horizontal position.

For 90 cm antenna an additional locking rod is required to neutralize the wind load.

Fig. 9. Radio could be installed on vertical or horizontal pipe

4.6 Stationary Cabling on Installation Site

Before the transceivers with antennas can be installed, connecting cables must be run from the indoor network equipment (switch, for example) to the outdoor installation point at each site. Please mind the number of cables has to be doubled for Q-band / Ka-band radio, see Chapter 7.

A sample diagram of one transceiver installation layout is shown below. To avoid EMI noise, the low-voltage power supply and UTP data cables must be kept away from stationary 110-240 V AC power cables.

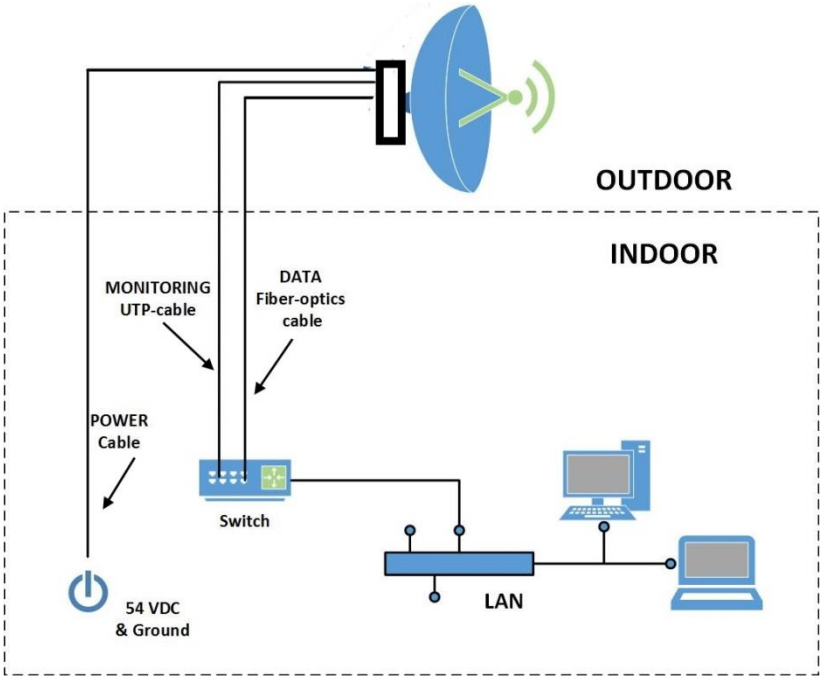


Fig. 10. Stationary cable layout diagram

The installation site should be inspected to determine the run paths for the fiber cable, twisted pair cable, DC power cable and grounding wire from the proposed radio location to the termination point. Locations for roof penetration should be identified. The routing and securing of all cables should conform to all applicable codes and requirements.

Cabling conduit may be required depending on the likelihood of damage due possible reasons. The maximum cable run length must not be exceeded as specified for type of the cable.

Unpack the Mounting Kit and get familiar yourself with connectors for each radio. They include the following:

Fig. 11. Connectors in Mounting Kit for each radio (included to delivery)

1. RJ-45 Connector "MONITORING" for cable of WEB-monitoring

2. Power connector "POWER" for 36-60 V DC power cable

3. SFP "DATA" connector for data transmission cable

When installing cables outdoor, allow power and data cables with service loop for strain relief and proper fiber bend radius when determine the length of each cable.

TIP. It is possible to install a cross-connection box nearby of support pipe, and install all stationary cables from indoor to this box, and then install short-length cables for power, UTP and fiber cables from this box to the transceiver. Please mind, the cross-connection box is not included to delivery and can be purchased locally.

Fig. 12. Cross-connection box with power, UTP and fiber cables to transceiver

- Install the power supply (PSU) in your chosen indoor location. Install 2-wire DC power cable from PSU directly to the radio or to cross-connection box (Fig.12).

- Connect the stationary DC power cable to the PSU

- Install the supplied DC connector on the side of the radio for both radio positions. Use pin #1 or #2 for "+" red wire and pin #3 or #4 for "-" black wire. DC cable wire cross-section must

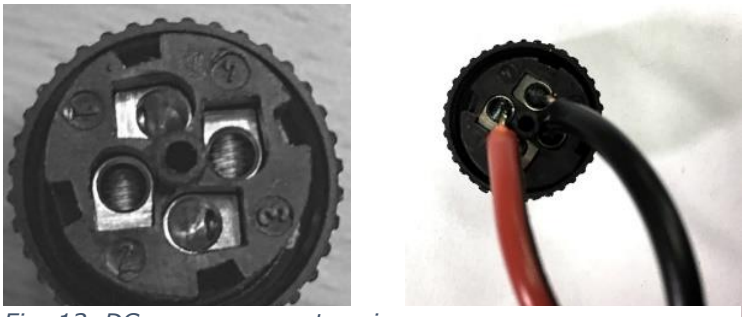


Fig. 13. DC power connector pins

be at least 1.5 mm2 (14 AWG). The normal PSU output voltage is 54 VDC. The voltage in DC cable at the port on the radio because of volt drop should be not less than level of 36 VDC.

- Install a 4-pair Twisted Pair cable from Indoor network equipment directly to the radio or to cross-connection box. Use water-proof connector from Mounting kit for last end of cable like on Fig. 12. Be sure that the UTP cable length from last active port to radio is less than 100 m.

- Install fibre optics cable from indoor network equipment directly to the radio or to cross-connection box. The radio is shipped with SFP module. Use water-proof connector from Mounting Kit like on Fig. 12.

- Install ground wire to the position of radio installation.

- Keep end of cables with installed connectors in a plastic bag or similar cover to prevent from dust and water before connecting them to radio transceiver sockets (see Fig.12, right photo).

Get familiar yourself with sockets on radio case.

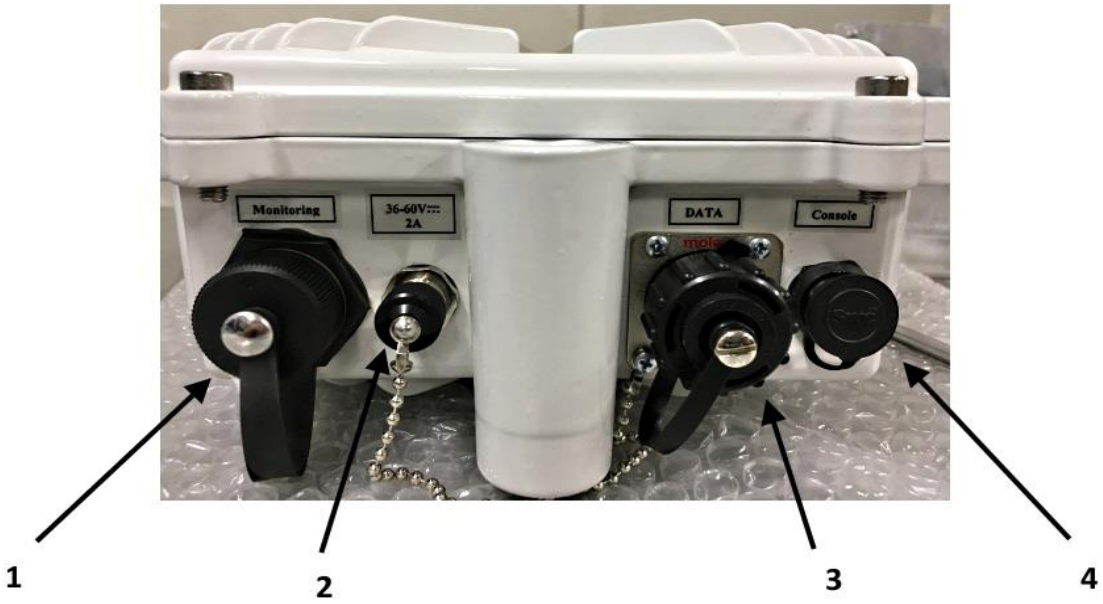


Fig. 14. Transceiver sockets (#1, #2, #3, #4)

1. RJ-45 socket "MONITORING" for UTP cable of WEB-monitoring

2. Socket for 36-60 V DC power cable

3. SFP "DATA" socket for data transmission cable

4. “CONSOLE” socket for RSL meter unit (used for installation procedure only).

5. INSTALLATION OF TRANSCEIVER

- It is recommended to have 2 technicians at each site of transceiver installation with walkie-talkie radios or mobile phones.

- Binocular also is recommended for performing easy preliminary alignment of antennas.

- Windows-based laptop with RJ-45 port is recommended at each side for easy change of IP address during installation procedure (see section 5.3 and Chapter 6 for details).

- For installation of Q-band / Ka-band radio please also read Chapter 7.

5.1 RADIO ASSEMBLING AND INSTALLATION SEQUENCE

- Bring the transceiver, antenna with alignment bracket, 4 mounting screws, allen wrench (hex key), metric open-end wrench and RSL meter to the outdoor points of installation at both sites of the link (see photo).

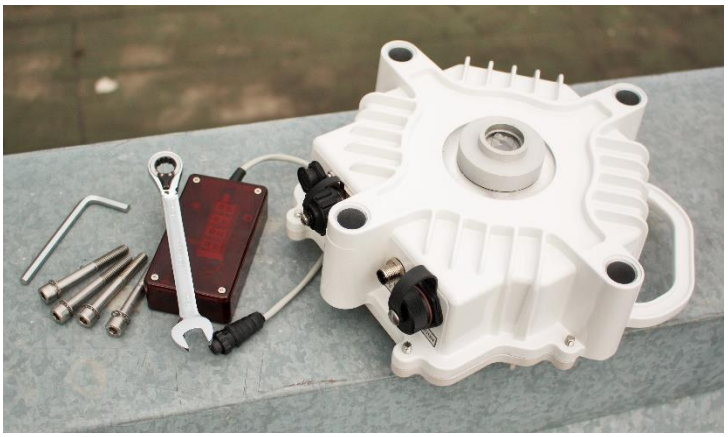


Fig. 15. Transceiver and tools at site of installation.

For quick radio installation, the following sequence of steps is recommended:

Fig. 16. It is easier to put the antenna on top of vertical pipe than reassemble the mount to "hug" the pipe

- Make yourself familiar with the antenna alignment bracket (mount). It allows one to change the antenna's azimuth (horizontal) and elevation (vertical) angles. Use the printed manual from delivery box to assemble the alignment bracket enclosed to the package onto the antenna, if necessary.

It is recommended that the threads of all bolts be lubricated upon assembly to protect them from corrosion and ease removal later.

- Install antenna with alignment bracket on the support pole, and point it to the approximate location of the opposite antenna. Use binoculars for performing more precise preliminary alignment of antennas.

It is possible to slide the alignment bracket over the top of the support pole (in case of vertical pipe), then tighten it in the appropriate position.

TIP. To prevent the mount with antenna from accidentally slipping down the vertical pipe and not getting antenna damaged, it is recommended to use a plastic tie strip, strongly tightening it on the pipe stand at the desired height below projected position of the mount. This tie strip will serve as an obstacle to move the mount down and will not allow it to slip below.

Fig. 17. A plastic tie strip tightening on the pipe stand will not allow the mount to slip down during installation procedure and thus prevents antenna from possible damage

- Remove protective tape from each transceiver and antenna waveguide slots. See photos below with red arrow pointing out to waveguide slots.

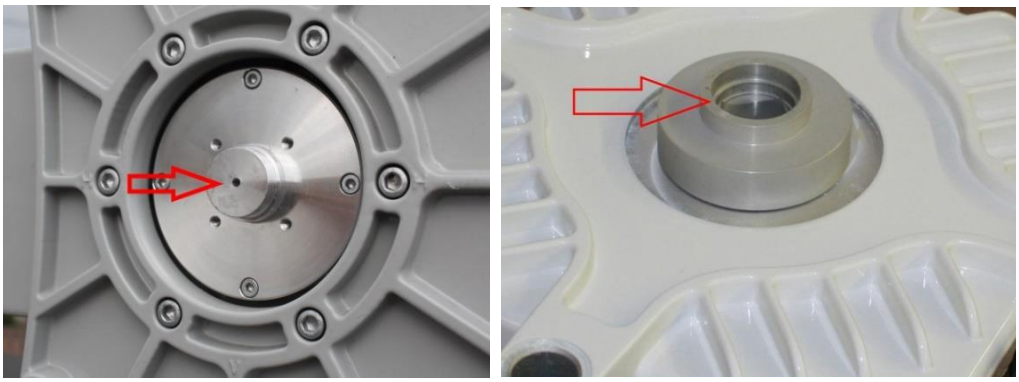


Fig. 18.. Remove protective tape waveguide hole on antenna and transceiver

- Check "H" and "V" polarization labels on antenna. "H" means horizontal polarization and "V" means vertical polarization. Check red label on the handle of the transceiver. This red label used

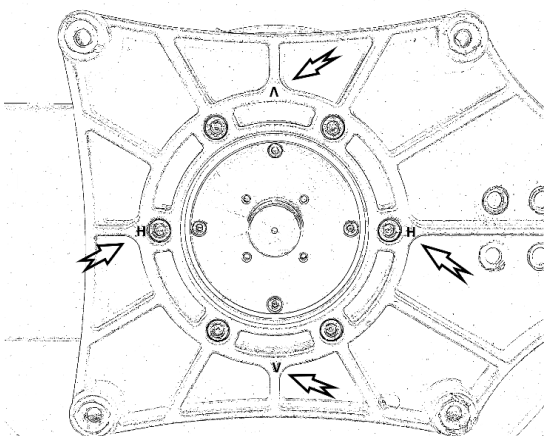


Fig. 19. Check for "H" and "V" polarization labels on antenna

to comply with chosen polarization. Red label has to be on top of mounted transceiver for vertical polarization and left or right side for horizontal polarization.

- When mounting transceiver to the antenna, choose "V" vertical polarization by default on both radios. In case of installing two parallel PPC-1000-LL links from the same position, use vertical polarization on first link, and horizontal polarization on other link.

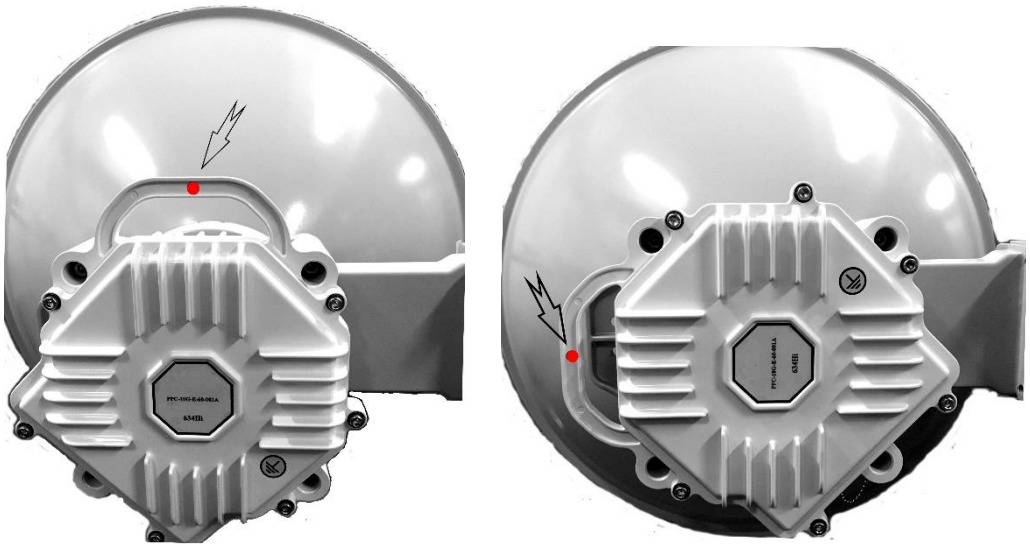


Fig. 20. Photo of V-polarization (left) and H-polarization (right) red label

- Mount each transceiver to its antenna with 4 mounting screws. Be sure that sockets of radio are directed down, and not up. This is to get rain drops fall down from radio sockets easily.

TIP. Always be sure that socket of radio are directed down, and not up.

Fig. 21. Position of sockets to be directed down, not up

- Install grounding wire to the bolt nearby of the GROUND label as on photo.

Fig. 22. Grounding wire position

- Insert all connectors of power cable, UTP and Fiber optics cables into relevant sockets on transceiver marked as DC, MONITORING, DATA respectively. Insert RSL meter (aka attenuation meter) connector into CONSOLE socket on transceiver.

- Ask personnel at the indoor location to switch the 54 VDC power ON.

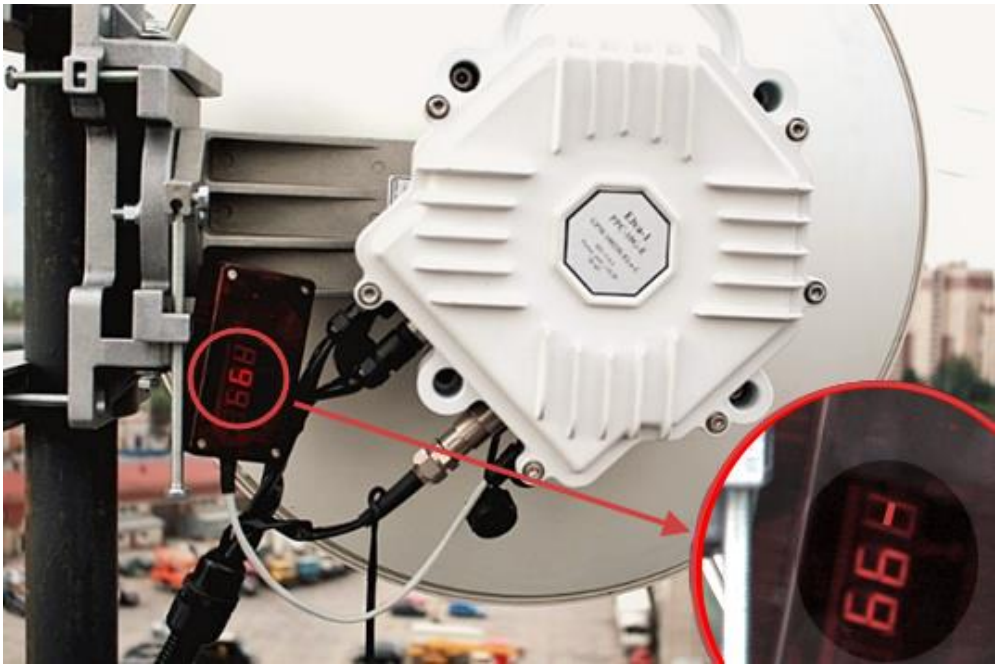


Fig. 23. RSL meter indicates -99.9 if the antenna is not aligned to opposite one

- Check if RSL meter is on. By default, it indicates "-99.9".

5.2 Final Antenna Alignment

For maximum throughput, the antennas must be aligned directly on the LOS. Please consider that antenna radiation pattern has main beam (central beam) and side lobes. The task is to aligned both antennas onto main beam, not side lobes (as throughput and operation distance at side lobes are low and unstable).

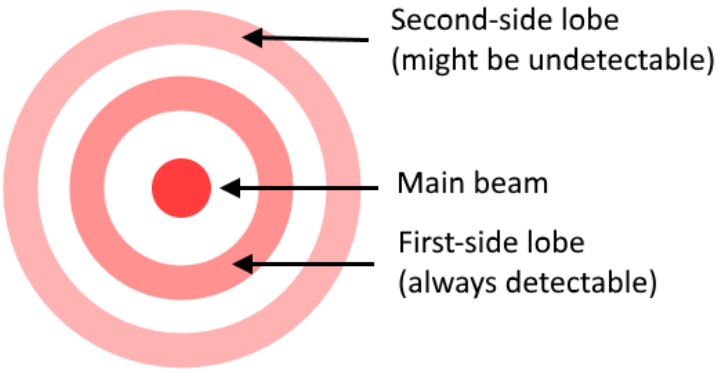


Fig. 24. Antenna radiation pattern has central beam and side lobes

Use the following procedures to accomplish this final alignment:

a. Place a technician with instructions on how to adjust antenna horizontal and vertical movement at each radio location, and designate the antenna at one location as A and the one at the other location as B. The technicians should have cell phone or other mobile communication availability to coordinate their antenna adjustments. Ideally, one person should also be in place at each radio's indoor power supply, with a means of communication to receive instructions to turn the power supply ON or OFF.

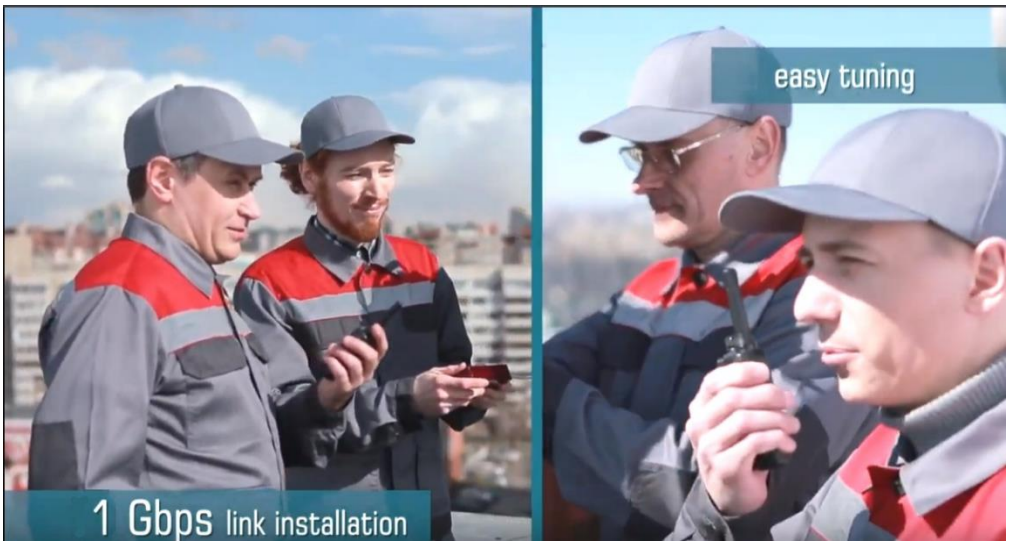


Fig. 25. The technicians should coordinate their antenna adjustments on both sides of the link

b. Using the vertical adjustment bolt on the radio mount, adjust Antenna A to an alignment that is noticeably below the LOS.

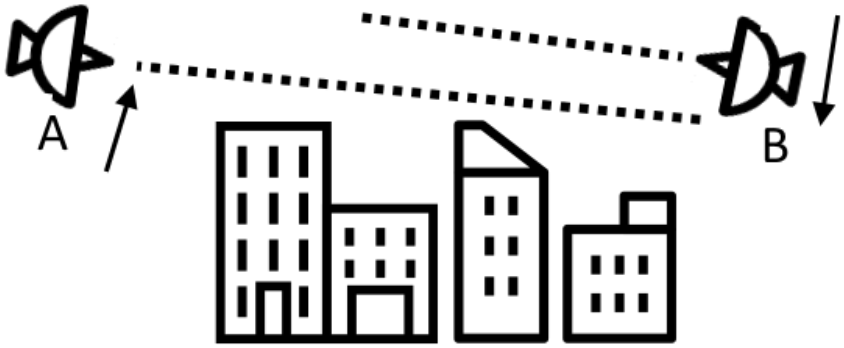


Fig. 26. Antennas A and B to an alignment that is above (B) and below (A) the LOS.

c. Using the same adjustment, adjust Antenna B to an alignment that is noticeably above the LOS.

Fig. 27. Check RSL meter indication when running alignment procedure

d. Turn power ON for both radios by turning on their indoor power supplies, and confirm that an RSL meter is connected to the CONSOLE socket of each radio and turned ON (initial meter reading should be -99.9),

Fig. 28. During antenna alignment, RSL indication should change from -99 to actual "RSL value" for your distance

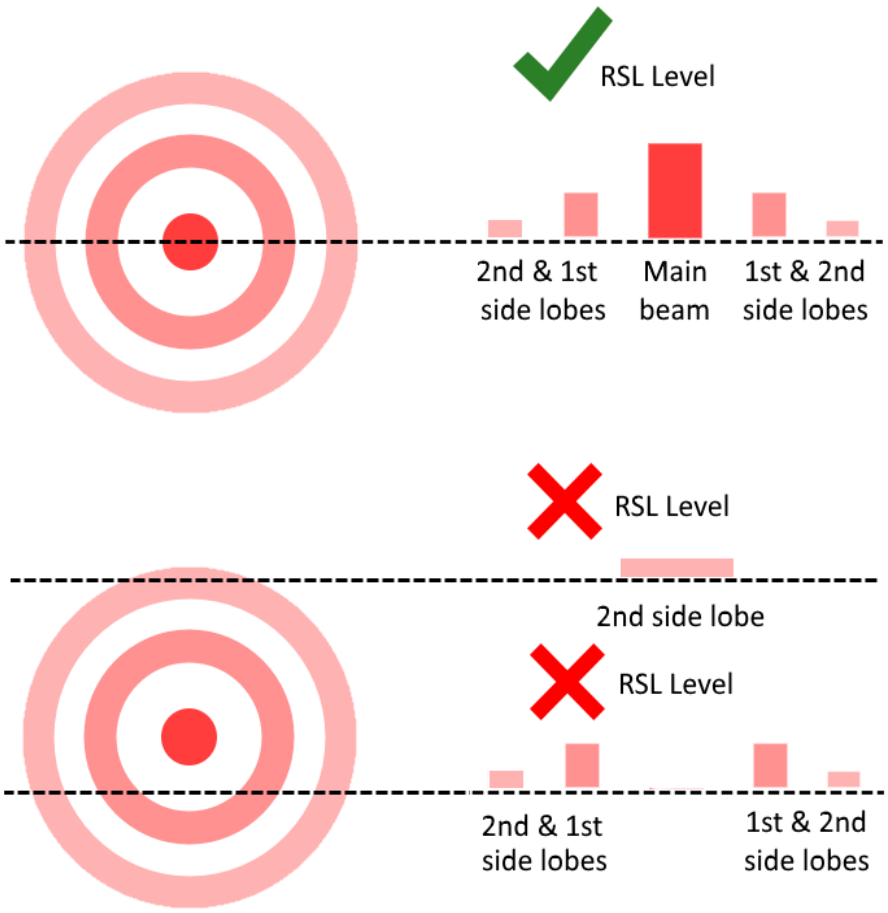


Fig. 29. Diagram for relevance of RSL meter indication to antenna side lobes

TIP. When make final antenna alignment, consider antenna radiation pattern has main beam (central beam) and side lobes as illustrated on Fig. 24, 29.

e. Using the vertical adjustment bolts, simultaneously move Antenna A up and Antenna B down in steps equivalent to one quarter-turn on their adjustment bolts. After each step, use the horizontal adjustment bolts to sweep Antenna A and Antenna B about 10° right and 10° left of the visual LOS center line. If a signal is noticed (a increase in the number on the RSL meters), stop the adjustment where the RSL meter number is highest. If no signal is detected, repeat Step "e" until the number increases on the RSL meter.

f. Adjust Antenna A horizontally and vertically to obtain the highest RSL meter number. See Fig.29 to understand how many RSL meter peaks could be seen on RSL meter.

g. After the initial signal acquisition, and best horizontal and vertical alignment (highest RSL meter number) on Antenna A, adjust Antenna B horizontally and vertically to obtain the highest RSL meter number for Antenna B.

h. Repeat Steps "f" and "g" to obtain the highest RSL meter numbers on both Antenna A and Antenna B.

i. At this point the expected RSL number should be displayed on both attenuation meters. If it is, lock both antennas in their final positions.

j. It is acceptable for the number displayed on the RSL meter to be as much as two points lower than the expected value. For example, if your expected RSL number is -45.0, but your RSL meter(s) displays -47.0 and you cannot achieve higher number of RSL, this is considered to be within normal tolerance.

k. Disconnect the RSL meters and cover the CONSOLE socket with the attached rubber cap. Confirm that all alignment bracket bolts are strongly secured in place. The outdoor link hardware is now ready for operation and if DC Power is ON - the IP traffic between radios is live.

Fig. 30. Do not forget to remove RSL meter and close its socket on the transceiver with ribbon cap when antenna alignment will be complete

6. USING WEB INTERFACE FOR FIRST-TIME LINK SETUP

6.1 UNDERSTANDING WEB INTERFACE CONNECTION TO RADIOS

When PPC-1000-LL transceivers are installed on both sides of the link, and cables from both radios are connected to LAN switch at each side of the link, PPC-1000-LL radios can be accessed over LAN using the Web Interface by link's IP addresses (radios are GUI-enabled).

Any available web browser may be used, but Google Chrome is recommended. Desktop PCs, notebooks, tablets and smartphones are supported to get admin access to PPC-1000-LL radios for either Windows, macOS/iOS and Android operating systems.

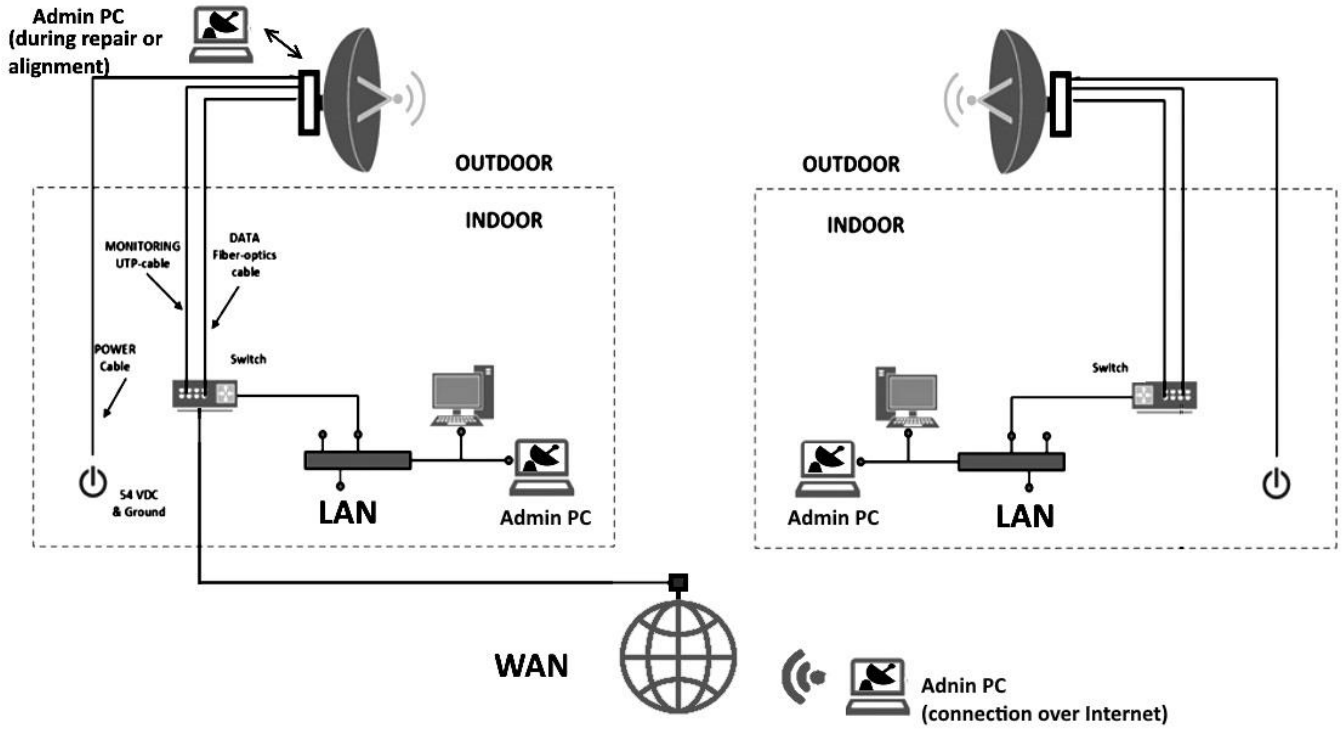
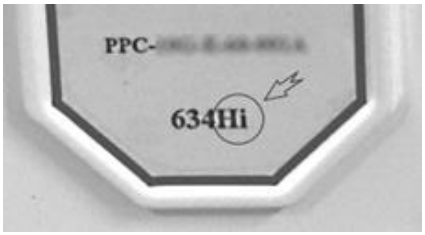


Fig. 31. LAN / WAN web access connectivity diagram

By factory default, each transceiver (each radio unit) has IP address for Web Interface access. These IP addresses are different – the transceiver named Hi has internal IP address 192.168.127.254, while Lo - 192.168.127.253. For Q-band / Ka-band radio default IP addresses see Chapter 7.



What are Hi or Lo symbols mean? One radio of the link works in the higher part of the allocated frequency band and is called **Hi**, while another radio works in lower band and called **Lo**. There is label on the back of radio body with **Hi** or **Lo** symbols in the link abbreviation (see illustration below). To review which radio is Hi and which one is Lo, check label on the radio's body.

Fig. 32. Example of label with Hi symbols on the back of the radio body

The system administrator (aka Admin) could connect to each radio by its IP address in 3 ways:

1. Connect from Admin PC (PC, notebook or mobile device) to the radio while are in the same LAN segment as this radio.

2. Connect from Admin PC (PC, notebook or mobile device) to the radio over WAN (over the Internet). In this case Hi and Lo radios have to have static IP addresses accessed globally. Otherwise, Virtual Desktop technology could also be used for remote connection from Internet to a computer inside LAN, then running web browser on this computer and do all works as within LAN.

3. Directly connect from Admin PC (notebook with Ethernet port) to the radio by UTP cable from indoor (by a stationary UTP cable) or outdoor (by a temporary UTP cable). This way is usually used only in some situations of initial installation of the link or at link repair.

For way #3, can use UTP cable with RJ-45 connector that come from radio to indoor switch, just unplug it from switch and connect it to your notebook. You can also connect notebook to #1 MONITORING socket on the radio directly at place of installation (roof, tower, etc), using temporary twisted pair cable with RJ-45 connectors if needed (be sure radio's external Power Supply is ON to get access). Remember, default IP addresses are 192.168.127.254 for Hi radio, while Lo - 192.168.127.253 (for E-band radios).

Be sure default IP addresses are not occupied in your network by any other devices before first-time connection to radios by web interface. Otherwise, release these IP addresses temporary for the "first time login" to radios. In case if releasing of addresses is not possible, bring Admin notebook equipped with Ethernet RJ-45 port to nearby of LAN switch with MONITORING cable coming from the radio. Disconnect MONITORING cable from the switch and insert this cable RJ-45 jack into notebook's Ethernet port. Start web browser on the notebook and proceed as described below.

6.2 Login to Radios and Initial Setup of their IP

To connect to radio Hi and Lo by its IP address, enter it in browser's address line. Any available web browser may be used, but Google Chrome is recommended.

The factory default PPC-1000-LL IP addresses are (for E-band):
Hi Radio - 192.168.127.254, Lo radio – 192.168.127.253. Mind that setup procedure has to be done for radios on both sides of the link.
For Q-band / Ka-band radio default IP addresses see Chapter 7.

When you arrive at the web page, proceed as follows (Fig.33):

- Choose **Installer** role from drop-down menu as the Access Level
- Enter the default password: **111111**

Installer has an Admin level access, and has rights to change parameters.
User has a reader level access, and has rights to only view parameters, mind the default password for **User** role is: **222222**

Please mind **Auto-Logout** because on Web Interface inactivity after 10 min.

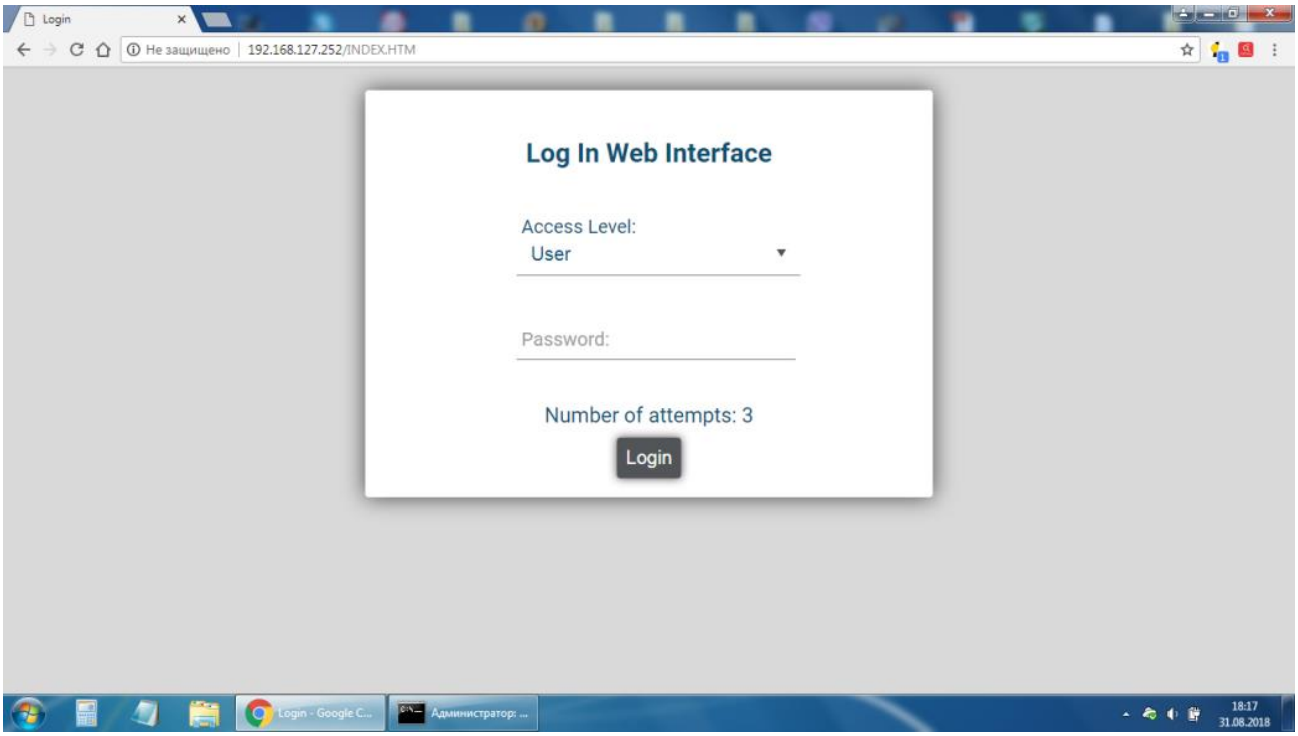


Fig. 33. At Login page, choose Installer option

- Change password for Web Interface access to the radio. For this, choose **Settings** on left menu, then **Password** tab at top. For passwords, use only Latin characters and digits, 6 - 20 symbols long.
Enter new password, retype it, then click **Submit** button. It is possible to change password for both **Installer** and **User** roles here. Please mind, your new password for **Installer** or **User** roles is valid only for this radio. For another radio (the radio on the other side of the link), repeat password setup.

- Save new passwords in a protected local file or cloud storage, otherwise just write down in the paper book. Don't forget to mark which password is valid for Hi or for Lo radio.

In case of forgotten password please contact your supplier's technical support. They will restore factory default password, so you can change it to actual one again. Letter of Authorization may be required from your CEO or CIO to confirm this request for password recovery.

- Change IP address of this radio from default to actual one. For this, choose **Settings** on left menu and **IP Settings** tab at top. Enter the IP parameters of your choice (could use default Mask 255.255.255.0 and default Gateway 0.0.0.0). Click **Submit** button.

After you entered new IP address, current Web Interface session will be finished with "Not found" page. To login to the radio again, use new actual IP address in the browser address bar and new actual password.

- Save new IP address value in the protected file or cloud storage, otherwise just write down on the paper. Don't forget to mark this address valid for Hi or Lo radio.

Fig. 34. Enter actual IP address here

- Check time settings and if needed, set the time for radio to actual local time. You can set time manually or from NTP Server (NTP server requires setting DNS and Gateway at IP Settings tab). By default, "UTC 0" time zone is used. For this, choose **Settings** on left menu, then **Time** tab at top. Adjust hours and minutes to local time, then click **Submit** button.

When password, IP address and time settings done for radios on both sides of the link, the initial PPC-1000-LL setup is complete. Go ahead to familiar with other Web Interface menus and tabs.

- Click **Operational Status** and **Detailed Status** in left menu to check status of link principal parameters. Be sure all marks are green. Orange colour means attention, and red colour indicates error (for Heater red colour indicates switched off).

Fig. 35. Operational Status screen

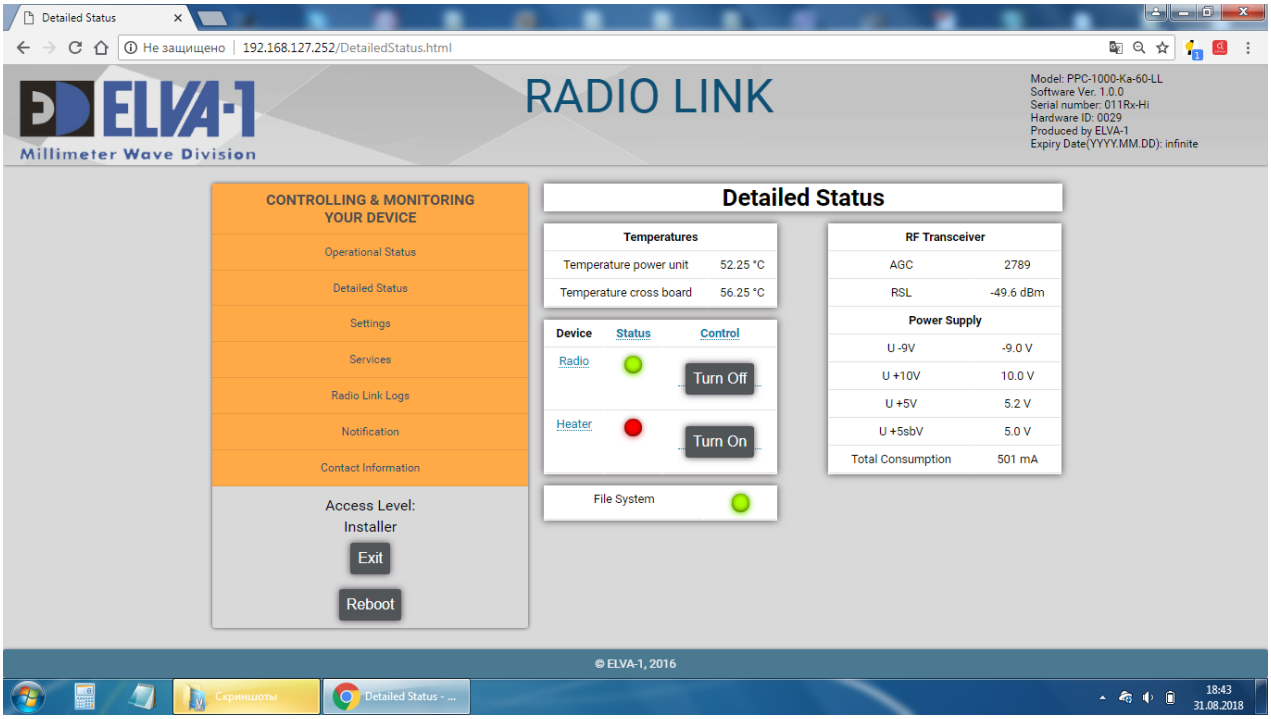


Fig. 36. Detailed Status screen

- Familiarize yourself with other menus and tabs.

Please mind **Change Ke**y tab at **Settings** is intended only for customers who loan the link.

- Use **Reboot** button to restart the link if needed. Please mind all previous settings of the link will be saved after rebooting.

7. Q-band and Ka-band Link Assembling, Installing and Setup

7.1 Q-band / Ka-band PPC-1000-LL Unpacking

Q-band / Ka-band PPC-1000-LL link contains transmitters and receivers at a separate case for an each one. (mind that E-band radio contains transmitter and receiver at the same case). Therefor, Q-band / Ka-band PPC-1000-LL equipment will arrive in 4 boxes. The first two boxes contain transmitters and receivers of the upper and low frequency ranges and accessories (cables, connectors, tools, etc.). The are boxes that contain doubled Mounting Kit of power units, cables, sockets, tools, RSL meter.

Fig. 37. Q-band / Ka-band package with transceivers and accessories

Fig. 38. Q-band / Ka-band package with antenna and diplexer

As for other PPC-1000-LL link modification, it is recommended to store packaging materials for 12 month of link warranty.

For list of components in delivery package see Table 1 and Table 2.

For information on transmitter and receiver sockets and connectors see Fig.11 – Fig.14.

7.2 Assembling and Installation of Q-band / Ka-band Link

It is strongly recommended to read Chapters 5 and 6 of this Manual before starting any works on installation of PPC-1000-LL Q-band / Ka-band link.

Mind Q-band / Ka-band radio as an assembly of transmitter and receiver which share the same antenna.

- Get yourself familiar with all radios in Ka-band delivery. There are 4 radio cases with labels Tx-Hi, Rx-Hi, Tx-Lo, Rx-Lo.

Assemble transmitter and receiver with diplexer (aka dual polarisation adapter, DPA). Use 4 mounting screws and hex key. Attach the blocks so that the sockets on transceivers are pointing down. Look at arrow "UP" label.

- Make two such units. Be careful when assembling, it is necessary to observe polarization.

	Side A		Side B	
Type of port diplexer	V	H	V	H
Labelling of the radio case	Rx-Lo	Tx-Hi	Tx-Lo	Rx-Hi

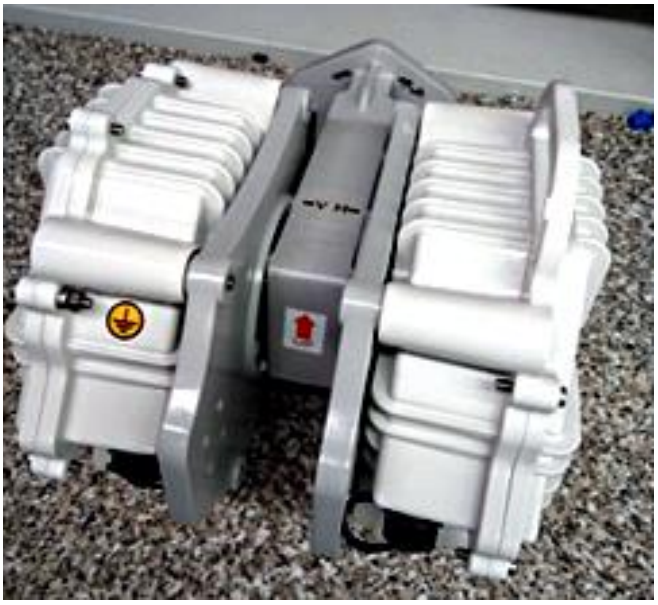


Fig. 39. Transmitter and receiver assembled with diplexer

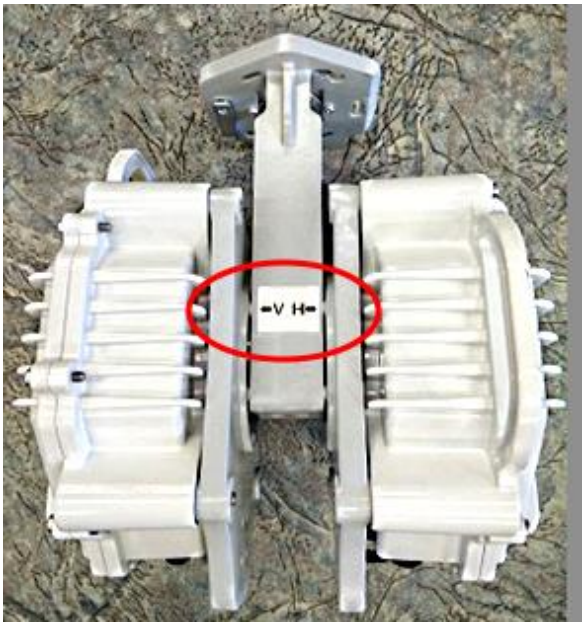


Fig. 40. Mind polarisation label

- Install doubled number of stationary cables (see. Section 4.6) as 2x power cables, 2x UTP and 2x fiber optics cables at each side of the link.

- Install antenna with mount on the supporting pipe as described in Section 5.1 and point it to the approximate location of the opposite antenna. Use binoculars for performing more precise preliminary alignment of antennas.

Fig. 41. Install 3 bolts on positions of "5, 15 and 35 minutes" on the antenna flange

- Install 3 bolts on positions of "5, 15 and 35 minutes" on the antenna flange (Fig. 41). Do not screw them strongly into antenna flange. These bolts will serve like hooks for diplexer.

- Put on the diplexer with pre-screwed transmitter and receiver on 3 bolts like on hooks and rotate to prevent diplexer from fall down.

- Install other 3 bolts with washers on positions "25, 45 and 55 minutes" on the antenna flange. Now there are all 6 bolts with washers on place.

Do not allow the appearance of an uneven gap between the antenna and the diplexer.

Fig. 43. Use 6 bolts to screw diplexer to antenna flange

Fig. 42. Do not allow the appearance of an uneven gap between the antenna and the diplexer

The diplexer must be connected to the antenna without twisting. See the marks in the photo Fig.44 (are indicated with arrows.). If required, adjust the diplexer rotation using the element marked by red oval.

Fig. 44. Adjust the diplexer rotation using the element marked by red oval

Strongly tighten all 6x mounting bolts between antenna and diplexer. Be sure grounding wire is also connected to the bolt nearby of the GROUND label on radio case.

7.3 Antenna alignment for Q-band / Ka-band Link

- Insert all cables to transmitter and receiver at both sides of the link, switch the power ON.
- Insert RSL meter to CONSOLE socket at both sides of the link.
- Proceed antenna alignment like in Section 5.2.
- Disconnect the RSL meter from CONSOLE at both sides of the link and cover the CONSOLE socket with the attached rubber caps.

The installation and alignment procedure is now complete.

7.4 Login to Q-band / Ka-band Radios and Initial Setup

Mind Q-band / Ka-band radio as an assembly of transmitter and receiver which just share the same antenna, so run IP setup for each radio independently.

Use the following default IP addresses:

Hi Tx Radio - 192.168.127.254,

Hi Rx Radio - 192.168.127.252,

Lo Tx Radio – 192.168.127.253,

Lo Rx Radio – 192.168.127.251,

- Release 192.168.127.254, 192.168.127.253, 192.168.127.252, 192.168.127.251 addresses in your LAN to make them not occupied.
- Login to each radio and run initial setup as described in Section 6.2.

8. MAINTENANCE AND TROUBLESHOOTING

PPC-1000-LL has been designed to require practically zero periodic maintenance. However, each radio of the link should be periodically inspected for visible damage or excessive accumulation of dirt. Use a brush or sponge with water to clean antenna and transceiver. When run cleaning procedure, do not stand in front of the energized antenna if transceiver power is ON.

In case of a complete or partial communication failure, please perform the following checklist:

1. Make a visual inspection of the radios for mechanical integrity of and between the transceiver and antenna, and check to be sure that the cable joints are reliable and no unauthorized objects are on the antennas. Remove dust or snow from antennas if necessary.

2. Check the signal propagation line (LOS) to be sure that no obstacles like buildings, cranes, electric lines, trees have appeared in it or its vicinity. If necessary, remove the obstacle or change the radio position.

3. Make sure of that the radio is receiving power from the power supply:

- Measure voltage at radio end of power cable while PSU is on.
- The power supply voltage should be between 36 and 60 VDC. If it is not, clear the fault of the power supply source or use a thicker gauge wire for a smaller voltage drop.

4. Make sure of that the UTP and optical cables are transporting data to/from the radios.

5. Connect RSL meter, and check the value. The RSL should correspond to the value given in the calculation for actual distance. If it does not, find and correct the cause.

Possible causes of low RSL reading:

- Precipitation along the signal propagation line. Wait until the clear weather and repeat the measurements.
- Obstacles on the signal propagation line. Remove them or change the position of the radio.
- Alignment disturbance (could happen occasionally after very strong wind or because of ice build-up during winter). Re-align the antennas.
- Transceiver failure.

If the radio still does not operate properly, measure and write down RSL, make WEB screenshots and copy last log files, then contact your supplier.

ELVA-1 Service Center email:

support@elva-1.com or sales@elva-1.com

9. APPENDIX A

9.1 PPC-1000-LL SPECIFICATIONS

Tx / Rx Specs

Model	PPC-1000-E/LL	PPC-1000-Q/LL	PPC-1000-Ka/LL
Frequency range	71-76/81-86 GHz (E-band) 74-76/84-86 GHz for Czech Republic	40.5-43.5 GHz (Q-band)	37.0-40.0 GHz (Ka-band)
Throughput	1000 Mbps Full duplex	1000 Mbps Full duplex	1000 Mbps Full duplex
Latency	45 ns from SFP socket to antenna port (on one ODU)		
Channel Bandwidth	1250 MHz		
Modulation	QPSK		
MTBF	150 000 hours		
Max Distance *	up to 80.0 km (49.7 miles) with 2ft antennas at clear sky	up to 65.0 km (40.3 miles) with 2ft antennas at clear sky	up to 72.0 km (44.7 miles) with 2ft antennas at clear sky
Max output power	+27 dBm (500 mW)	+27 dBm (500 mW)	+27 dBm (500 mW)
Rx Sensitivity @ 10^{-9} BER	-64 dBm	-65 dBm	-65 dBm
System Gain	91 dB	92 dB	92 dB
Management	SNMP v.2; MIB-II and Enterprise MIB; WEB; CLI; Telnet		
Ethernet Interface	1 × SFP slot (1000Base-X)		
Management Port	100 Base-Tx (RJ – 45)		
Forward Error Correction	n/a		
Polarization	Vertical / Horizontal		

***** The line-of-sight is required, therefore installation on high towers is recommended for such long distances

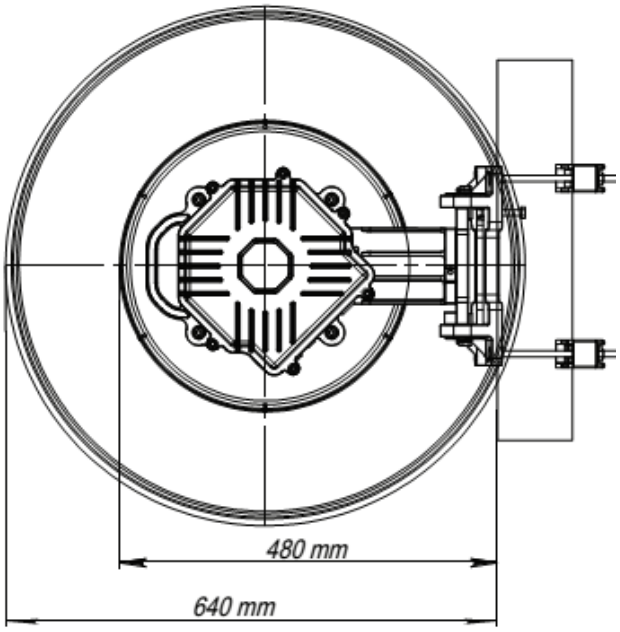
Antenna

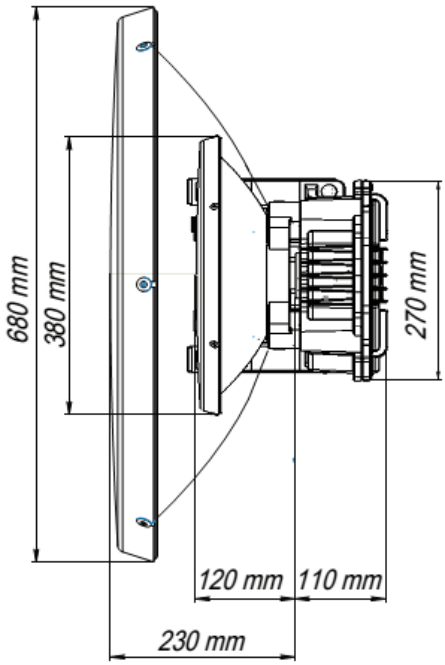
Antenna Type		Cassegrain type antenna with radio-transparent radome	
Antenna Gain/Beamwidth for frequency band:	71-76/81-86 GHz (E-band)	40.5-43.5 GHz (Q-band)	37.0-40.0 GHz (Ka-band)
1ft antenna	45 dB/0.7°	38 dB/1.5°	38 dB/1.5°
2ft antenna	51 dB/0.35°	44 dB/0.7^0	44 dB/0.7^0
3ft antenna	n/a	47 dB/0.5^0	47 dB/0.5^0

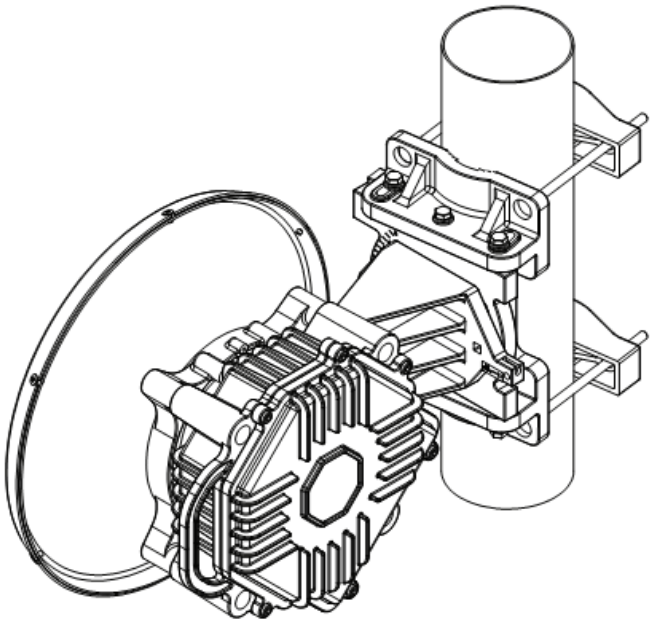
Power / Environment

Power Supply AC	Input 88-132 / 176-264 Volts, 50/60 Hz
Power Consumption (for one radio)	45 W (+60 W when heater is switched on) (E-band) 90 W (+120 W when heater is switched on) (Q-band, Ka-band) *
DC Power	36 to 60 Volts DC
Power Connection	IP-67
Operational Temperature	-50^0C to $+60^0$C / -58^0F to 140^0F
Humidity	Up to 100%

9.2 E-BAND PPC-1000-LL DRAWING







9.3 Q-BAND / KA-BAND PPC-1000-LL DRAWING