PPC-1000-E(Q)XX-FO INSTALLATION AND SERVICE MANUAL

PPC-1000 Gigabit Ethernet Link

71-76/81-86 GHz
40.5-43.5 GHz

ELVA-1
Millimeter Wave Division

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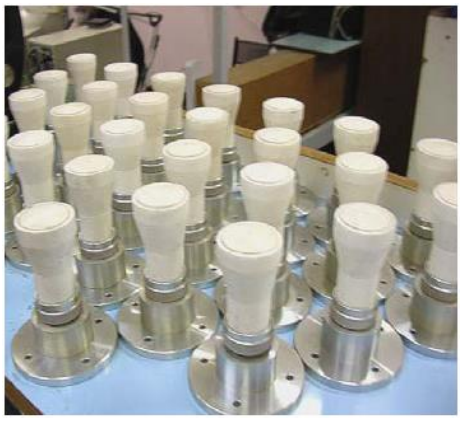
1 Introduction to PPC-1000 Family



In response to market demand for ultra-wide broadband communication equipment, Elva-1 offers PPC-1000 series of designed for a wide range of applications such as Wi-Fi, WiMAX, LTE or mobile network extension and backhaul links, business WAN or IP telephony gateway connections, FSO backup, metropolitan area networks and rapid-deployment emergency communications. The operating frequencies cover bands 40.5-43.5 GHz and 71-76 / 81-86 GHz. These are FCC/ETSI licensed bands allocated in many countries for commercial use in wireless point-to-point communications.

PPC-1000 is a full-duplex Gigabit point-to-point link especially designed according to FCC requirements. It provides interconnection between remote LAN segments at ultra high speed and utilizes Gigabit Ethernet protocol, which is the evolving standard for switches and routers available from a variety of telecommunication equipment manufacturers.

The PPC-1000 product has 1000 Base-LX (1000 Base-SX) connections at each end of the wireless link and transparently establishes the link outputs. The resulting connection can replace a fiber-optics cable physically connected end-to-end. The wireless mm-wave Gigabit link provides fiber equivalent performance, reliability and security but with no high deployment cost associated with outdoor fiber installations.

PPC-1000 links have remote management as well as parameter monitoring capabilities. A twisted pair patch cable connected to any RJ-45 socket within the LAN will allow remote SNMP management and parameter control of a set of PPC-1000 links from a central location.

The Gigabit Ethernet links have been designed with compact parabolic Cassegrain antennas of 1 ft / 2 ft (30/60 cm) diameters. The 60 cm antenna has a 0.35° beam width and 51 dB antenna gain parameters, which are fully compliant with FCC specification requirements for E-band communication.

PPC-1000 equipment has been offered as a comprehensive link kit with antennas (30/60 cm diameters), mounting units and accessories to allow a turnkey installation into the customer's communication system. The advantage of millimeter waves is a permit on more densely packed communications links, thus providing very efficient spectrum utilization, and they can increase security of communication transmissions.

2 PPC-1000 Features

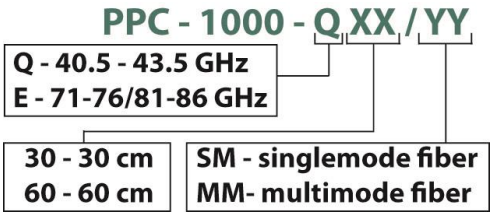
Wireless broadband is the leading sector of the wireless communications market. Millimeter wave links provide large bandwidths of interference-free-operation accommodating ever increasing speed rates for connecting data systems.

Wireless backhaul for the last mile is more cost effective than with fiber for Enterprise, WiFi, SAN, LAN/WAN and a host of other applications. With a choice of models for licensed bands and flexible deployment options the PPC-1000 series of Millimeter Wave products is designed for transparent high bit rate communications applications.

- Frequency band: 71-76/81-86 GHz, 40.5-43.5GHz
- 1250Mbps Gigabit Ethernet Interface
- SNMP enabled
- True Full Duplex Operation
- Solid reliability with Fiber-like Performance
- Distance ranges of up to 5 mile (8 km) at 10mm/h rain for 71-76/81-86 GHz frequency band
- Secure communication due inability to intercept the laser-like beam transmission at free air
- Distance ranges of up to 6.7 mile (10.8 km) at 10mm/h rain for 40.5-43.5 GHZ frequency band
- Easily Installed, Zero Maintenance
- Compact Cassegrain type antennas
- Quasi-optical (laser-like) propagation of mm-wave emission
- EMI Interference free

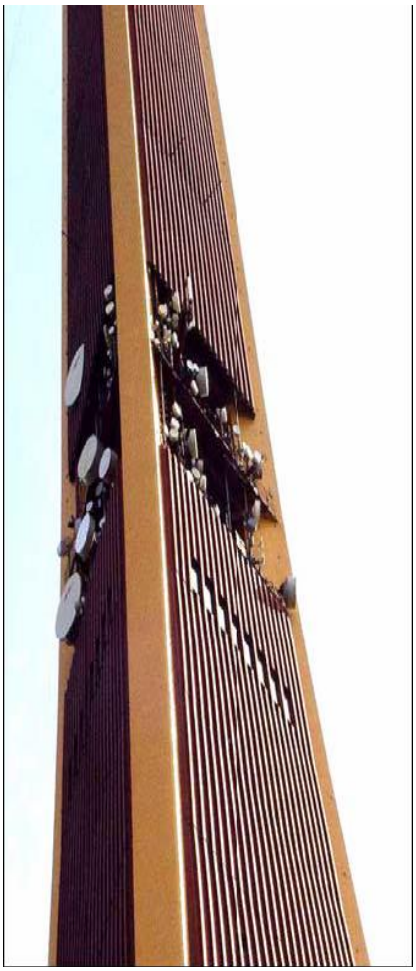
2.1 PPC-1000 Product Code

To choose the right model by its product code please use the following encoding schema:



For example, PPC-1000 link with 60 cm antenna diameter and singlemode fiber optic cable for 40.5 – 43.5 GHz frequency band has product code PPC-1000-Q60/SM.

3 PPC-1000 Typical Applications



According to publicly available marketing data from Cisco Systems, in US the fiber connects only 5 percent of roughly 750,000 commercial buildings that will need fiber-speed access. The company further says that 75 percent are within a mile of a fiber access point.

The newly either FCC and ETSI approved 71-76 GHz, 81-86 GHz, and FCC-only approved 92-95 GHz frequency bands (12,900MHz in total) are the ultimate part of spectrum that provide carrier-class gigabit- and multi-gigabit per second communications for the entire last mile.

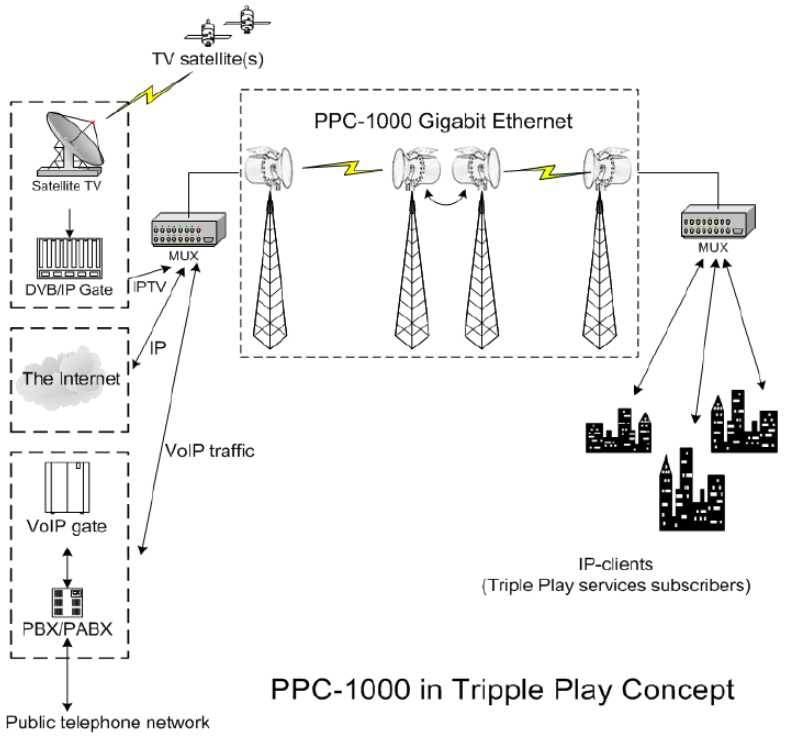
The new millimeter wave bands are open to all types of users including commercial carriers, utility providers, government agencies, public safety agencies, and other mission-critical applications. Possible uses for these bands include a fiber substitute for last-mile connectivity, local loop access, central office bypass, high-capacity backhaul, and local, metro, and wide-area network access.

- Point-to-point Wireless Bridge for Gigabit Ethernet interfaces
- Wireless backhaul for Triple Play services
- Enterprise LAN and PBX extension
- WAN connection redundancy
- ISP remote POP
- ISP direct customer connections using point-to-point
- Extension of an existing fiber network

4 PPC-1000 in Triple Play

Triple Play is the latest technology that combines Video, Voice and Data services delivered through a single IP-based solution.

This technology will help a network provider to deliver On-demand Video lectures, do Live Voice / Video Communication and provide ability to distribute centralized bandwidth to IP services subscribers.



PPC-1000 in Tripple Play Concept

Gigabit-capacity wireless Ethernet bridges provide the industry's most reliable, secure and easily-deployed solutions for either Triple Play services and interconnecting corporate and telecommunications networks.

PPC-1000 point-to-point wireless Gigabit Ethernet bridge provides transparent, carrier-class connectivity with performance options of 1250 Mbps full duplex to integrate VPN, real-time video and IPTV, voice-over-IP, and digital PBX connections over a single broadband wireless network.

5 Statement of Warranty

Elva-1 Millimeter Wave Division warrants each standard Elva-1 Millimeter Wave Division 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 Millimeter Wave Division's option, replacement of defective parts shall be the sole and exclusive remedy under this limited warranty; provided that Elva-1 Millimeter Wave Division may, as an alternative, elect to refund the purchase price amortized on a straight line basis over a period of three (3) years from the date of shipment. All warranty replacement or repair of parts shall be limited to equipment malfunctions, which, in the sole opinion of Elva-1 Millimeter Wave Division, 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 Millimeter Wave Division. If Elva-1 Millimeter Wave Division determines in its sole opinion that such Product does conform to the limited warranty, then Elva-1 Millimeter Wave Division shall pay for the shipping and insurance of repaired or replacement Product back to the Buyer. However, in the event that Elva-1 Millimeter Wave Division 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.

All obligations of Elva-1 Millimeter Wave Division under this limited warranty shall cease in the event of abuse, accident, alteration, misuse or neglect of the Product. In-warranty repaired or replaced parts are warranted only for the remaining unexpired portion of the original warranty period applicable to the repaired or replaced parts.

REASONABLE CARE MUST BE USED TO AVOID HAZARDS. ELVA-1 MILLIMETER WAVE DIVISION EXPRESSLY DISCLAIMS RESPONSIBILITY FOR LOSS OR DAMAGE CAUSED BY USE OF ITS PRODUCTS OTHER THAN IN ACCORDANCE WITH PROPER OPERATING PROCEDURES.

THE FROEGOING LIMITED WARRANTY FOR ELVA-1 MILLIMETER WAVE DIVISION PRODUCTS IS EXPRESSLY IN LIEU OF, AND EXCLUDES ALL OTHER EXPRESS OR IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY AND OF FITNESS FOR PARTICULAR PURPOSE, USE OR APPLICATION, AND ALL OTHER OBLIGATIONS OR LIABILITIES ON THE PART OF ELVA-1 MILLIMETER WAVE DIVISION, UNLESS SUCH OTHER WARRANTIES, OBLIGATIONS OR LIABILITIES ARE EXPRESSLY AGREED TO IN WRITING BY ELVA-1 MILLIMETER WAVE DIVISION. Statements made by any person, including the representatives of Elva-1 Millimeter Wave Division, which are inconsistent or in conflict with the terms of these warranties shall not be binding upon Elva-1 Millimeter Wave Division unless expressly reduced to writing and approved by an officer of Elva-1 Millimeter Wave Division.

6 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 Millimeter Wave Division 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 environment in which it will be used.

7 Safety, Usability and Recommendations signs

ATTENTION, CAUTION, DANGER statements have been placed in the text to catch attention of the personnel to important information and alert them of possible hazards. These statements must be closely observed.

NOTE indicates the recommendations or additional information for technicians.

ATTENTION

Indicates important information to be considered when operating PPC-100 link and its modification.

DANGER

Indicates that personal injury can result if the user does not comply with the given instruction. A DANGER statement will describe the potential hazard, its possible consequences, and the steps to perform to avoid personal injury.

Indicates that equipment damage, process failure, and/or loss instruction.

CAUTION statement will describe the potential hazard, its possible consequences, and the steps to perform to avoid equipment damage, process failure, and/or loss of data.

8 Installation and Operation Precautions

The following general safety precautions must be observed during all phases of operation and service of the products willfully violates standards of design, manufacture, and intended use of the product. Elva-1 Millimeter Wave Division 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 therisk 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 Millimeter Wave Division void the Elva-1 Millimeter Wave Division 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 unit or in manual.

9 Introduction

9.1 Purpose of Manual

The information in this manual is directed to persons who must perform or coordinate the tasks associated with the process of installing wireless communication devices, and planning communication network applications.

9.2 Prior Knowledge

This manual assumes the operator has at least basic experience with and understanding of the concepts underlying telecommunications systems, as well as some familiarity with configuring and operating networking equipment. Preferably, the installer/operator fully understands the information covered in this manual prior to attempting these procedures.

While this manual summarizes the considerations and tasks involved in path analysis and site planning for radio systems, it does not provide an in-depth treatment of such issues. A professional agency specializing in this area should be consulted for additional information and services of this type.

9.3 Contact information

Elva-1 Millimeter Wave Division distributors are authorized local service providers and are responsible for immediate customer support. If problems are not resolved, contact Elva-1 Millimeter Wave Division Customer Service for assistance:

ELVA-1 Millimeter Wave Division

c/o Hörnlund,
Kungsgatan 54
244 62, Furulund
Sweden
Tel: +46 46 56 00 346

E-mail: support@elva-1.com
Facebook: https://www.facebook.com/elva1mmw

In case of purchase from a local dealer, for support assistance please contact them first.

10 Product Description

Wireless Bridge PPC-1000 is intended for full duplex 1.25Gbps Gigabit communication between two remote points. It is composed of two subscriber transceivers which are operated within line-of-sight conditions at working frequencies within mm-wave range.

Two different central frequencies are used for the duplex operation. One Radio (High) transmits data at a frequency of upper part of the frequency range and the second one (Low) uses a frequency from the lower part.

Thus, PPC-1000 provides 1.25Gbps capacity in each way.

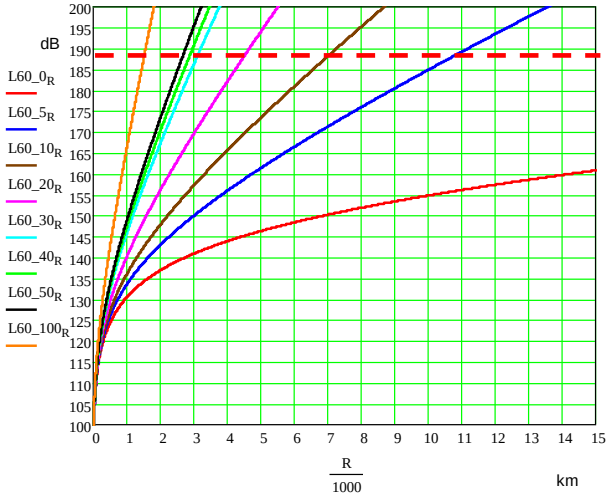
Each Radio is “all outdoor” unit. The only things operator to do for installation are to mount both radios on vertical pipes, connect them to data cables and power, ground them, and point one radio to another one.

As both Radios operates in a full duplex mode, they should be connected to an equipment, operating in a full duplex mode.

11 Site Planning

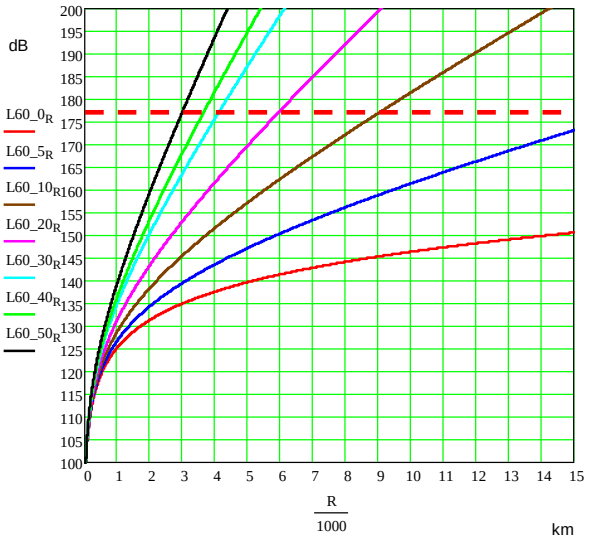
11.1 General info

The max operational distance of the link depends on rain intensity because rain drops size is about link wave-length. The diagrams below shows max distance for rain of various the radio systems.



intensity from 0 mm/hour (fair weather) to 50 mm/hour (tropical rain). Use ordinate value 189 dB when checking distance for PPC-1000-E60.

For example, for 25 mm/hour rain (strong summer rain in Europe) the max operating distance will be 4.2 km (2.6 mile).
Therefore, installing link on distance longer than 4.2 km could lead to link outage during a strong rain, but the connection will restore automatically when the rain will be smaller in intensity.



intensity from 0 mm/hour (fair weather) to 50 mm/hour (tropical rain). Use ordinate value 177 dB when checking distance for PPC-1000-Q60 (red dotted line).
For example, for 25 mm/hour rain (strong summer rain in Europe) the max operating distance will be 5.2 km (3.2 mile).

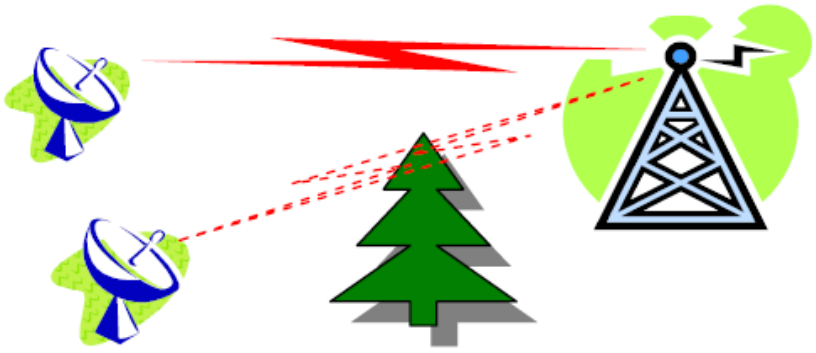
11.2 Equipment Checklist

The survey team may need the following equipment:

- Binoculars or spyglass
- Range-finder or GPS Navigation Device (to determine the exact link path length)
- Mobile phones or walkie-talkie radios

11.3 Line of Sight (LOS)

The mm-wave wireless link requires Line-of-Sight for proper operation. It implies that no obstacles like trees, buildings, chimneys have to be between the station sites. Moreover, no obstacles should be situated in the vicinity of the signal propagation line (inside the first Fresnel region).



Because the link distances are usually within 10 km so obstructions in the path can easily be identified using binoculars.

The planning should include an investigation into future building plans that could block the LOS path, and other longterm incremental obstructions such as growing trees.
Intermittent but regular obstructions such as flying aircrafts at a nearby airport should also be considered.

11.4 Minimum Clearance

It is required to have absolutely no obstructions in front of the antenna in so called first Fresnel zone. The minimum required clearance from obstacles is 60% of the first Fresnel zone.

Fresnel zones are series of concentric ellipsoid areas surrounding the straight-line path between two antennas. The first Fresnel zone is the area containing every point of which the distance from the transmitter to any reflection point on the area and on to the receiver is half a wavelength longer than the path of the direct signal. The radius of the Fresnel zone is greatest at midpoint in the signal path.

Minimum Clearance (aka first Fresnel zone) for various bands is listed below (in meters):

Path Length (km)	Minimum Clearance (meters)	
	Q-band 40.5-43.5 GHz	E-band 71-76/ 81-86 GHz
1 km	1,4 m	1,0 m
2 km	2,0 m	1,4 m
5 km	3,2 m	2,3 m
10 km	4,5 m	3,1 m

12 Installation

12.1 General Info

It is recommended that installation personnel read this section in its entirety prior to installing the radios. During a particular phase of installation, the user may refer directly to the applicable subsection.

12.2 Equipment Unpacking

The radio system equipment will arrive in boxes of sizes depending on antenna diameter. It is recommended that the shipping boxes and packing materials be retained in the event that it is necessary to return equipment for repair reason.

• Open the top cover of the box, and check what's inside. The box contains radio case with fiber-optics patch cable, alignment mechanics (mount) and paper boxes with accessories.

12.3 Antennas Unpacking

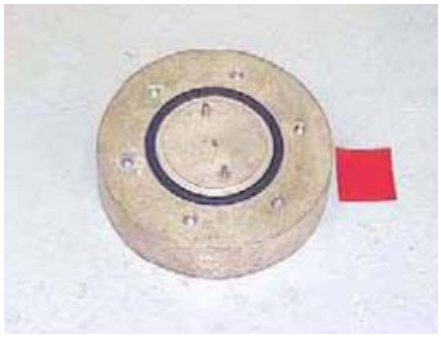
Two antennas for the link come in separate box. The customer required to unpack antennas and fasten them to radio cases by M4 bolts enclosed to accessories.

• Open the top cover of the antenna box, and pull out the antennas. The box usually contains two antennas.

CAUTION

Please be extremely careful with antenna dish mirror. Any damage (dent, distortion) of the antenna or its radome will distort the antenna directional pattern. This will lead to link malfunction.

Place the radiocase on a table and fasten the antenna to the radiocase flange-to-flange. Remove protective tape from waveguide channel hole on antenna and radiocase before. Be sure waveguide channel orientation on antenna flange and radio case flange are the same (like **||** but not like +).
Rotating antenna flange on any 180 degrees relative to radiocase flange orientation doesn't matter, ↑↓ or ↑↑ is the same.



ATTENTION
Waveguide channel hole size depends on link frequency. The higher is the frequency, the smaller is waveguide channel hole. Please prevent this hole from ingress of moisture or dust when fastening antenna to radiocase.

• Use six M4 bolts with washers (enclosed to the accessories box) to fasten antenna to radiocase. When draw up of M4 bolts, do it cross-wise. The wrench 7mm for M4 bolts is enclosed.

Avoid of excessive torque [torsional] force for M4 bolts to prevent screw thread on radiocase flange from damage (strip thread). Max torque force for M4 bolts is 2.5 NM.

As the result of your work to fasten antenna to the radio case, the radio has to look like shown below.

12.4 Equipment Inventory

Following is the inventory list for a typical radio.

Description	Qty
1 Radio case	1
2 Antenna with the radome	1
3 Outdoor cross-box	1
4 Grounding wire	1
5 Power cord to power supply unit	1
6 Tuning panel	1
7 Power supply unit	1
8 Ethernet connector boxes for SNMP twisted pair cable (one box to be installed into Outdoor cross-box, second one – somewhere Indoor to connect SNMP cable to office Ethernet LAN)	2
9 Complete set of grounding bolt, nuts, washers, contact strips and tightening washer to replace shipping bolt	1
10 Wrench 7 mm, 17 mm	1
11 Mount (Alignment bracket)	1
12 Three-ponged clamp	1

12.5 Alignment Tools

The following tools should be on hand when running the alignment of the radio system:

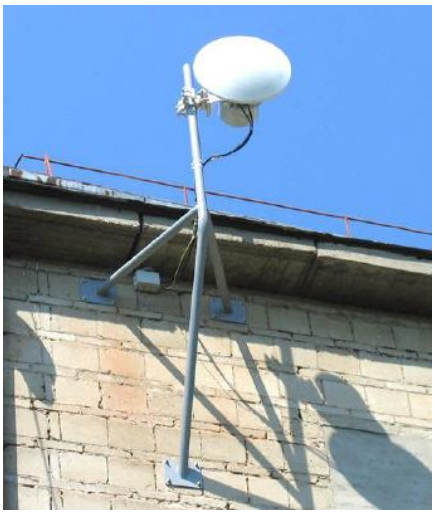
- Wrench 17 mm (enclosed to inventory)

12.6 Ground bolt Assembling

Assemble ground wing bolt (wing nut) for connecting ground wire before installing radio case on the place of installation.

12.7 Radio Mounting General Info

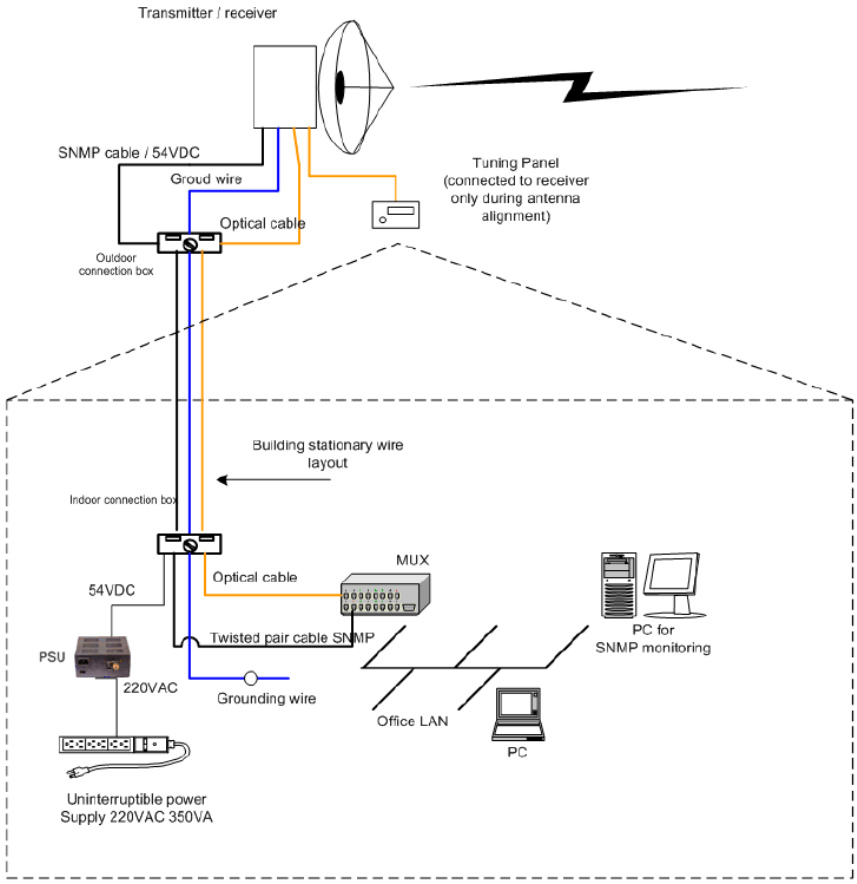
The radio should be fastened on a support leg of vertical tube 80..130 mm diameter and not less than 500 mm height. The design of the support leg is not specified, but bending and torsion rigidity of the support leg has to be enough to prevent angular swing of the antenna in both the azimuth and elevation. An example of the support leg design is given on photo.



Please be extremely careful with antenna dish mirror when carrying radio to the installation position. Hold radio on your hands by radiocase, not by antenna dish. Any damage (dent, distortion) of the antenna or its radome will distort the antenna directional pattern. This will lead to link malfunction.

13 Connections

Total communication schema looks like this. Detailed instructions are given below.



To avoid EMI noise, when installing the radios, the power supply and data transmission cables have to be laid away of building power cables.

13.1 Stationary Cabling of the Building

• Fix Outdoor cross-box nearby the Radio (for example, on the base of same supporting leg)

• Select indoor location, with easy cable routing to the radio, for the Indoor Cross box. Normally it is convenient to place it near the network termination equipment and the main. Fix Indoor cross-box.

• Install the stationary DC power cable from the Outdoor Cross-box to Indoor one.

CAUTION!
The normal PSU output voltage is 54 VDC. The voltage in DC cable at the point of Outdoor Cross-box end because of voltdrop should be not less than 48 VDC .

• Install a 4-pair Twisted Pair cat.5 cable from the Outdoor to Indoor Cross-box

CAUTION!
Be sure that the UTP cable length is less than 100 m

• Install fiber optics cable from indoor host equipment directly to the outdoor connection box nearby the radio. The radio is shipped with fiber optics cable (patch cable) of 2.0 m length.

ATTENTION!
Use 3-wire double-isolated DC cable for stationary cabling from indoor connection box to outdoor one. The wires have to be not less that 1.5 sq.mm. See an example of DC cable in the photo.

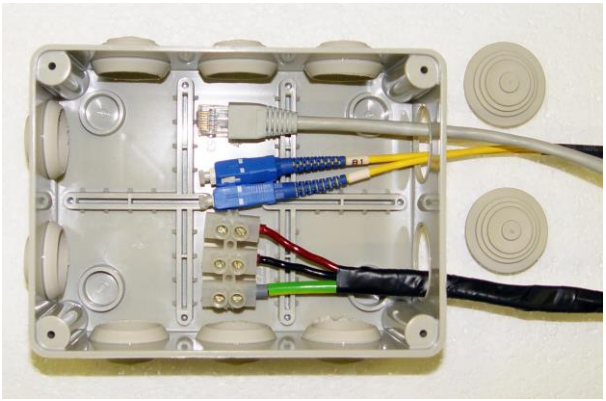
13.2 Connection to Network Equipment Indoor for SNMP Administration

• Connect Ethernet connection to the stationary TP cable in much the same way as for outdoor TP Connection

• Plug-in UTP cable from office LAN equipment to indoor Ethernet connection. With the link power switched on, and installed SNMP software you can use link SNMP administration from one of the office PC.

13.3 Outdoor Cross-end CAT5 Connections and Grounding

- Connect the stationary TP cable to Outdoor cross-box with Ethernet connector (to 110 type connector), special push tool may required (not included to the shipment, it's very common tool and can be obtained at your network administration department).
- Connect stationary DC cable to outdoor cross-box with terminal block.
- Connect TP/Power cable to Outdoor cross-box RJ-45 and power connectors.
- Connect grounding cable to outdoor cross-box with terminal block. Instead of connection to the outdoor box, it's allowed to connect grounding cable to a nearest grounding point at the roof, if such connection available.
- The grounding cable at radio side has to be connected to arth connector, marked with the earth symbol.



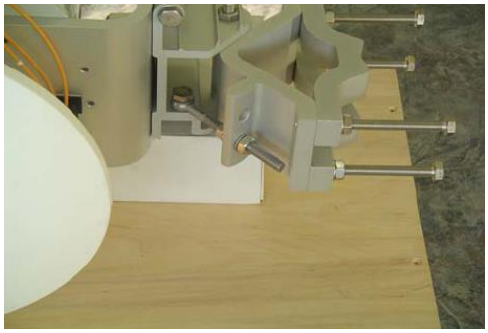
WARNING!
Grounding of both Radios is a mandatory requirement.

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

14 Radio Alignment

Before the alignment procedure:

• Make yourself familiar with the mount (alignment bracket). It consists of two parts – the mount itself and the bracket which is already factory-fastened on the radio case. The bracket and the mount should be screwed by 2xM10 bolts.

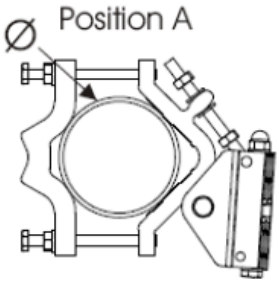


• Installation of the radio on supporting leg has to be done in two steps:

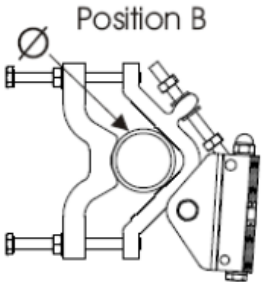
- Installation of mount only (with no radio) and making of preliminary alignment by mount sight Screw on the radio to the already installed mount and precise alignment by Tuning Panel

- Choose the right position of the mount staple according to the diameter of support leg you have.

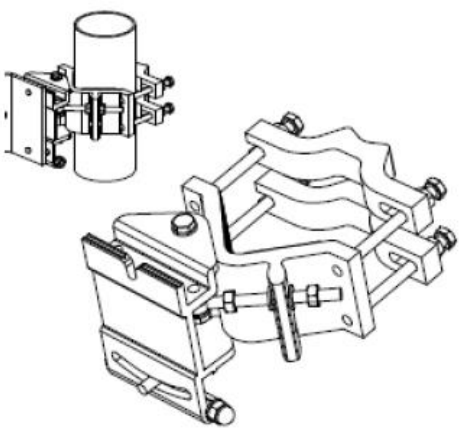
The Mast Mount and different poles



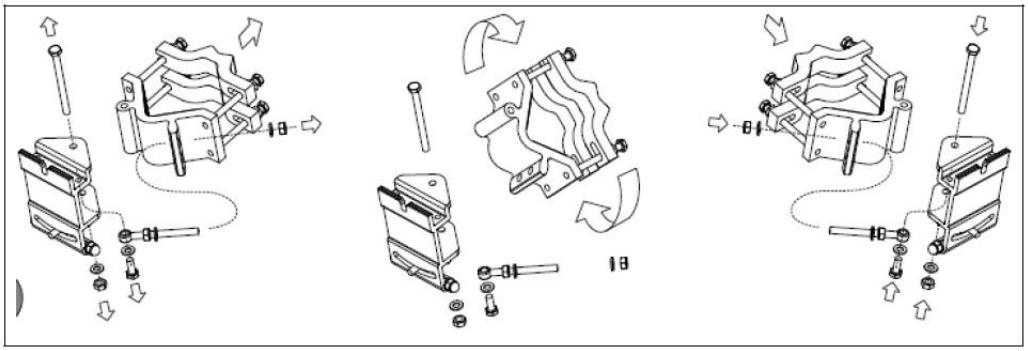
Ø	Pos.
40-75	B
76-95	A / B
96-130	A



• Standard position of the mount on the supporting leg is left-hand as shown below.

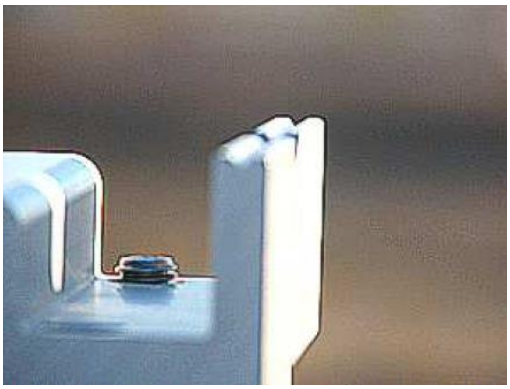


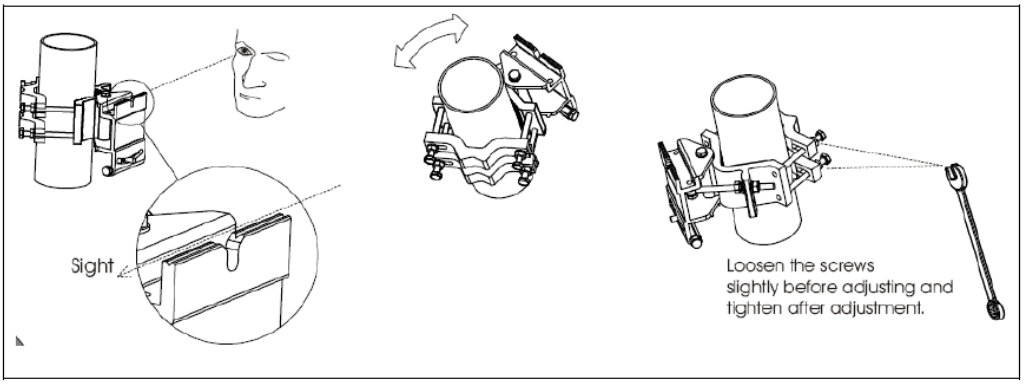
• If you need to use right-hand position of the mount, please re-assemble the mount according the drawing below.



14.1 Preliminary Alignment

• Using the sight of the mount, rotate the mount on supporting leg to direct the mount to the other end of the link in horizontal plane.

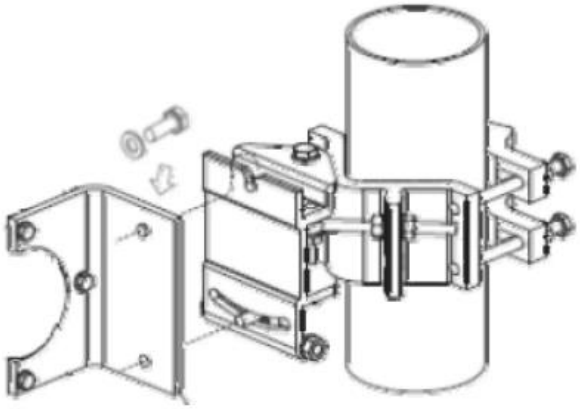




• Using the bolt “Vertical”, direct the mount to the other end of the link in vertical plane. Use mount sight for preliminary alignment in vertical position (elevation).

• Screw on M8 bolt from accessories to the bracket on radiocase.

• Put on the radio to the mount, using top M8 bolt as a hook.



• Slightly fasten two M8 bolts from bracket to mount. The torque is 5Nm. This is to allow further precise alignment in elevation.

14.2 Precise Alignment general information

Precise alignment should be performed at fair weather and good visibility (no rain, no fog or smog, no snow, no sandwind).

For precise alignment it's mandatory to have people at each point of the link. The two-way communication like mobile phones or walkie-talkie radios also required to coordinate their efforts.

The precise alignment is carried out after each radio on both sides of the link have been installed, connected to the power supply source and tuning panel.
Precise aligning is carrying out according to attenuation level.

To measure attenuation do the following:

- Have all cables connected and power supply switched on, with Tuning panel inserted to the each receiver (see photo below).

- Connect Tuning panel with radio case

The Tuning panel in your shipment could looks different from the one on the inventory photo with no changes in its functionality.

Knowing the exact distance between two radios (measure it by GPS or rangefinder), check the displayed attenuation level on the Tuning panel. Compare the displayed attenuation level with the value in diagram for your exact distance.

Diagram for 71-76 & 81-86 GHz frequency bands

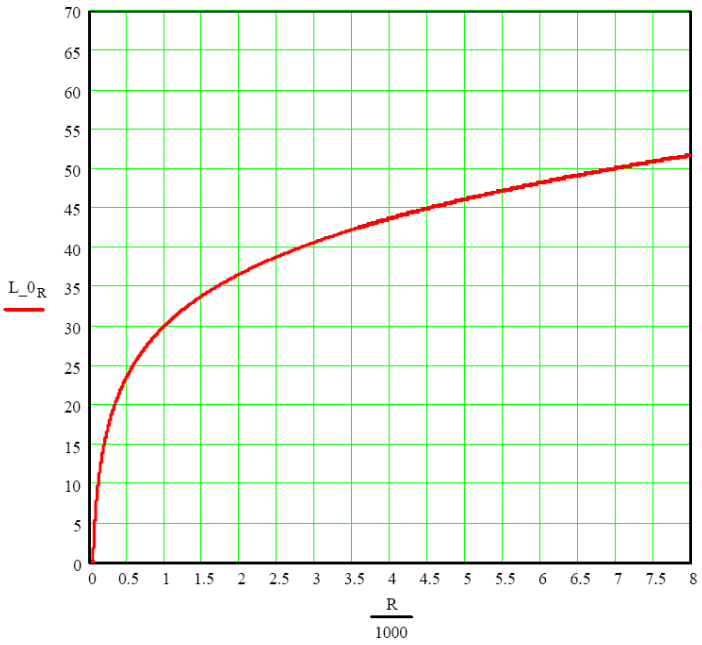
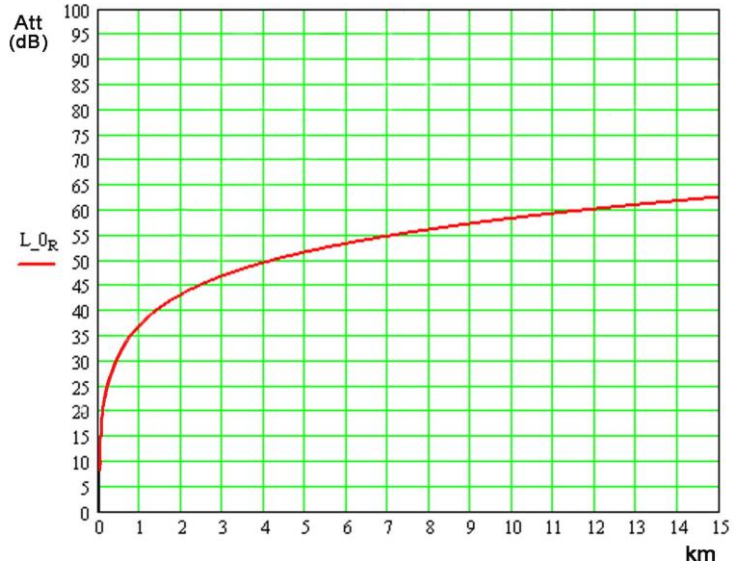


Diagram for 41.5 – 43.5 GHz frequency bands.



• The result of the precise alignment is to achieve such antenna alignment of both transceivers when the displayed attenuation level on receiver will be equal to the value on diagram for the distance between two radios. The max error has be not more than **± 3 dB**.

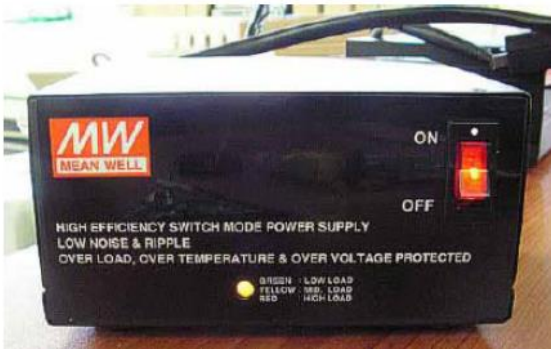
NOTE
An antenna pattern has mainlobe and at least two sidelobes (first harmonic sidelobes). The large antennas (60 cm) could have more sidelobes (second and third harmonics), but their intensity are very small.

In 3D projection the mainlobe and sidelobes are like two cones, one inserted to another. Your goal is to align antennas at both sides of the link to mainlobes.

How to be sure you get to mainlobe, not to sidelobes? First check the attenuation dB value at Tuning panel and compare with value, provided at diagram of the radio for your distance. These attenuation voltage values in diagram are provided for mainlobe. Always use GPS navigator, or largescale digital map or laser range-finder to determine the exact distance of the link path.

Second, as result of the successful alignment you have three minimums of attenuation dB value when scan the line of sight horizontally (see schemas below). If you have only two minimums, it means you missed the mainlobe.

ATTENTION!
Check the color of Power supply LED when using the link in transmitting/receiving mode. The normal LED color has to be YELLOW. Green LED – no load, Red LED – overload.

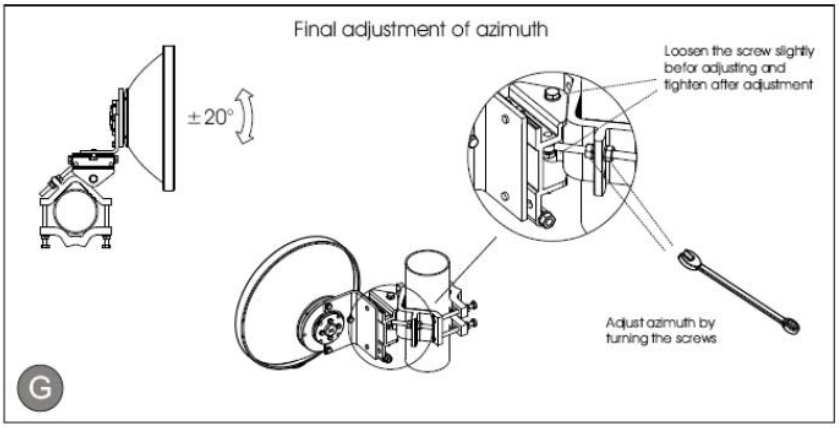


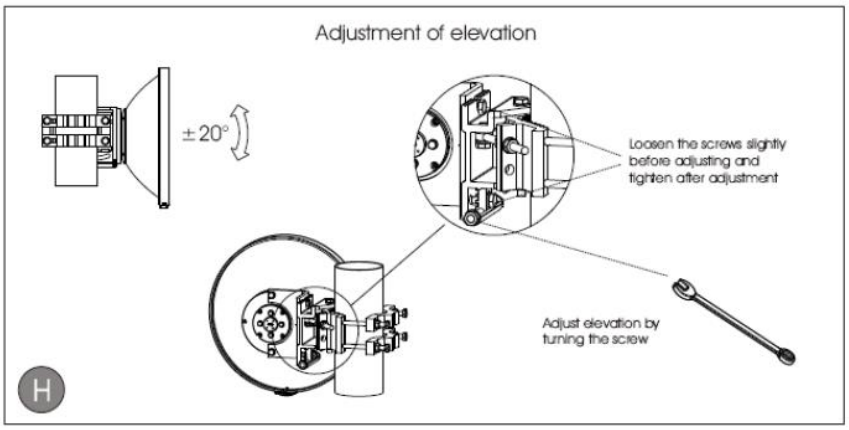
14.3 Precise Alignment

The alignment procedure is as following:

• Be sure Tuning Panel is connected into its socket on the radio. Pay attention to attenuation level at Tuning panel, and wait for a drop.

• Have two-way comminication for technicians on both side of the link (for example by mobile phones). Start slowly moving radios at both sides within a line of sight, trying to get a first contact of at least sidelobes. For moving radios at elevation and azimuth directions use alignment bolts as shown below.



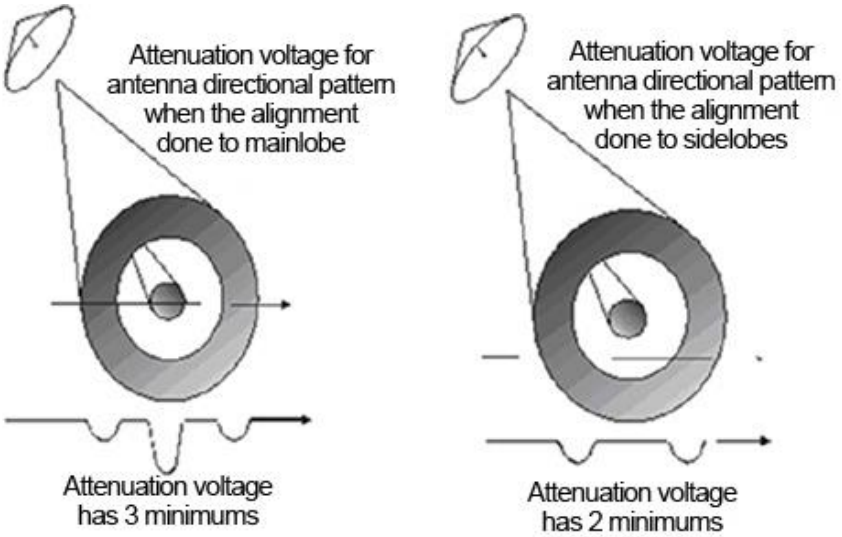


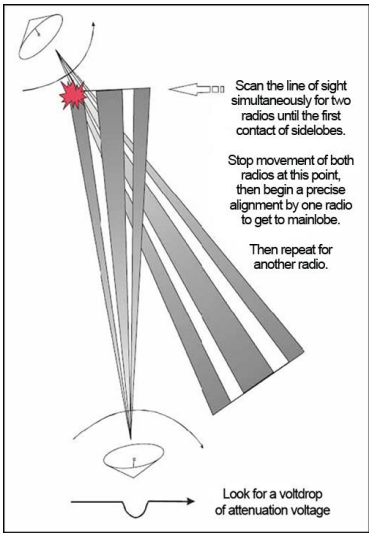
• Connect Tuning Panel into its socket on the radio. Pay attention to attenuation level at Tuning panel, and wait for a drop.

• When got a drop of attenuation level, immediately stop moving of both radios (say “STOP” to your partner, working at another radio).

• Have another radio static; very slowly scan your radio horizontally closely to the point of first contact.

• Check how many drops you will get when do scanning horizontally. If this will be 3 minimums, the central one is mainlobe. If you got only two minimums, it means you missed the mainlobe. Try to stop the antenna horizontally at the center of the virtual arc between two attenuation minimums, than slowly scan the antenna vertically to find the mainlobe.





• Do the same procedures (vertical and horizontal alignment) for another radio.
• Having the alignment completed, tighten bolts of the adjusting plate. Max torgue for M10 is 44Nm. Remove the Tuning panel, close the hatch tightly to prevent moisture and dust getting inside radiocase.

NOTE
The alignment can be considered as completed if the attenuation values on both the receivers agree with values for the given distance, with error 3 dB the maximum.

CAUTION!
Attenuation level instability or/and no expressed minimum of the received signal indicate substantial reflections within the directional diagrams of the transceivers. In turn, this implies existence of obstacles in the vicinity of the signal propagation line. In such a case you advised to change the location of the radios.

• Test the quality of the data transmission via the radio-channel.

15 Installing and Using SNMP software

Each of the PPC-1000 links is shipped as SNMP enabled and could be monitored online. The SNMP feature is independent from data channel, it does not directly affect the link ability to transmit and receive data through main data channel. Without SNMP feature enabled, the link still works, but likely as unmonitored piece of cable.

To use SNMP monitoring, you have to install two software applications

1. Moxa NE SDK Manager
2. ELVA PPC Monitor

Each radio contains built-in MOXA switch IC. To manage switch IP address, you need to use Moxa software. The ***Moxa NE SDK Manager*** is third-party software which you can use in accordance with End User License. You are provided with your copy of this software because of partnership between ELVA-1 and Moxa.

ELVA ***PPC Monitor*** is ELVA-developed SNMP monitor apps.

Please do not distribute these software applications outside your organization without written permission of ELVA-1.

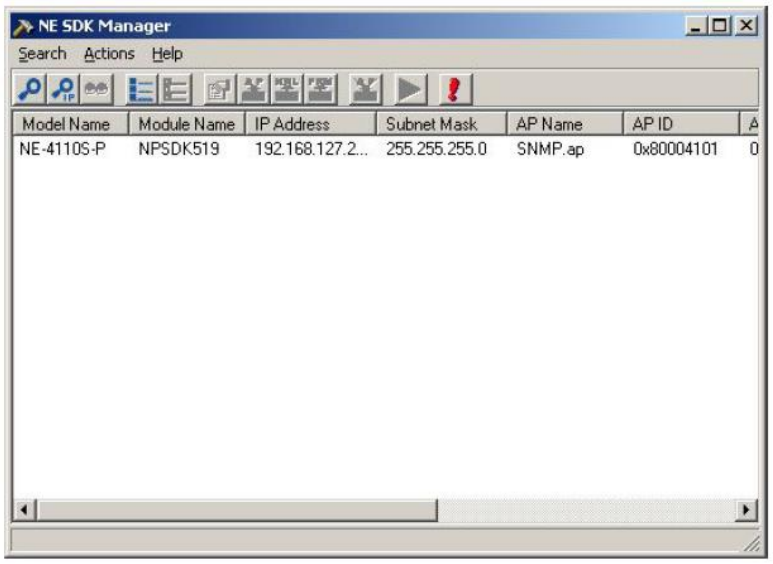
15.1 Installing and running NE SDK Manager. Changing IP-address of the transceivers

1. Install ***Moxa NE SDK Manager*** on the computer which you intended for PPC-1000 SNMP administration (run Setup.exe). While NE SDK Manager is quite complicated software you will use the only one its feature – how to change IP address of each radio of the link from default IP address to an address which is provided to you by your network administrator.

2. Run Moxa NE SDK Manager. Use '***Network Enabler SDK 2 Programmer Guide1.pdf*** ' as your reference how to work with NE SDK Manager.

3. Scroll down the reference file to page 3-5 to understand how to find a switch inside radio case in this manager.

4. Click to ***Search*** button in main window of NE SDK Manager (most left button at toolbar). The NE SDK Manager will find MOXA switch, which is build-in to transceiver.



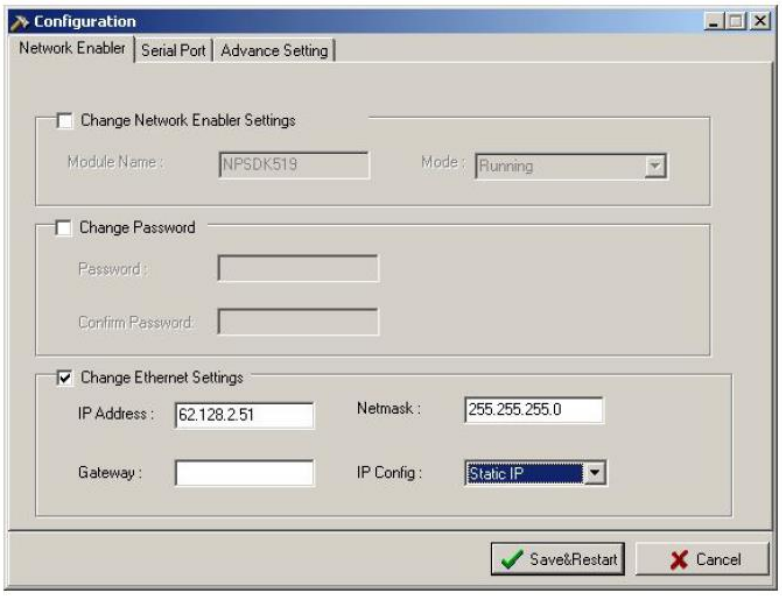
5. Choose NE module found and click ***Actions- Configuration***. The Configuration window will be open.

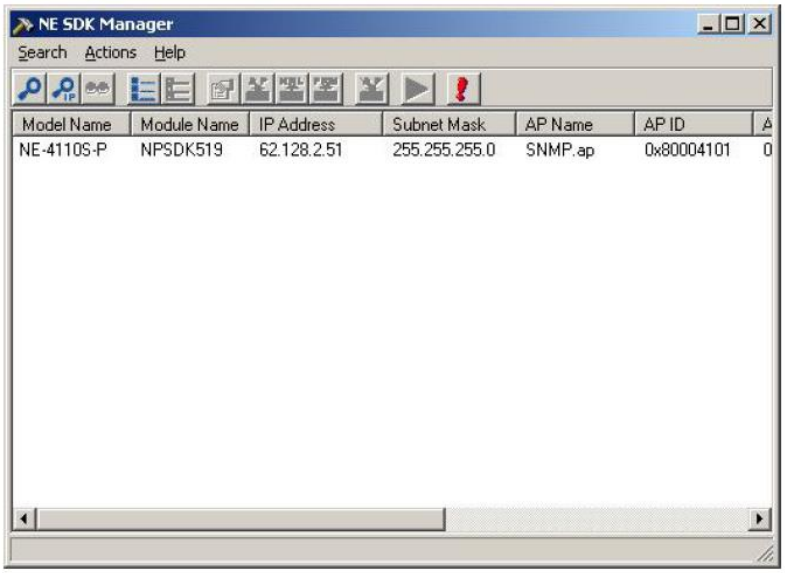
6. Enable "***Change Ethernet Settings***" checkbox and enter IP-address which was provided to you by your Network administrator instead of link default IP-address (see screenshot below, the address 62.128.2.51 has been used in the example).

7. Click ***Save&Restart*** button to save new IP-address and close this window.

8. Click again to ***Search*** button in main window of NE SDK Manager. When MOXA switch will be found, be sure that it has new IP-address you just entered.

9. Repeat steps 4-8 for changing IP-address to second transceiver (for 4-radio modification of PPC-1000 this has to be repeated to all of four radios).





10. Close NE SDK Manager.

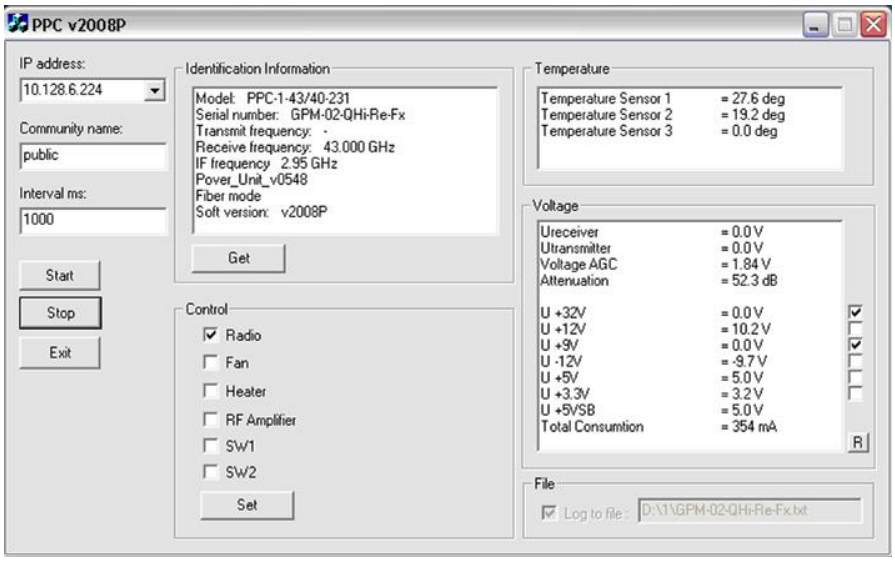
15.2 Running PPC Monitor. Using this application for transceiver parameter monitoring

1. Run ***PPC.exe*** application from hard disk of the computer, intended for SNMP parameter monitoring. The main window of PPC application will be open.

NOTE
You can run 2 copies of PPC.exe application on your computer simultaneously to see parameter monitoring for all transceivers of the link.

2. Enter the IP-address of the transceiver you would like to check. Next time you start the PPC monitor, this IP address will be saved in drop-down list.

3. Click ***Start*** button. PPC application will interrogate the transmitter and displays identification information and parameter values.



Let yourself familiar with PPC window. It consists of ***Identification Information*** window, ***Control*** window with checkboxes, ***Temperature*** and ***Voltage*** window and a number of buttons and line fields.

The typical tasks you can do with PPC software are parameter monitoring and making manual interruption to the automatic link control to see how the link reacts on these interruptions.

The main mode for the transceiver control is automatic. All manual changing of the transceiver parameters like power on/off, heater and fan on/off which could be made in PPC software application are active for 30 seconds only. After 30 sec the transceiver will return to internal automatic microprocessor control mode. This is to prevent damage of the transceiver equipment.

15.2.1 Identification Information window

This window displays a set of id information. To have id information updated and displayed just once you can click on ***Get*** button.

NOTE
Please mind ***Stop*** and ***Start*** buttons do not start and stop of the transceiver (transmitter, receiver) itself. These buttons start and stop the PPC software application only.

The id information on first line of the window allows you to determine what the transceiver (transmitter, receiver) is under control. “HI” means high-frequency channel, “LO” – high frequency one.

If you have all cables connected, power on and network connection to the radio established, id information should be displayed anyway. If no id information displayed, this is a bad symptom that the relevant transceiver (transmitter, receiver) is broken down. Check cables, power and network connection first, then contact ELVA-1 support service.

15.2.2 Control window

Control window consist of number of checkboxes which allows to control of the link.

The general way to make changes to link control is as following:

- Click ***Stop*** button
- Make changes on checkboxes (mark or clear checkboxes)
- Click ***Set*** button
- Click ***Start*** button

Functionality of checkboxes in Control window is as following:
Radio – power ON for internal power supply adapter of the radio (always ON by default). Please mind each radio has external power supply unit and internal power supply adapter.

When you clear ***Radio*** checkbox, you make dead circuit for radio electronic adapters, but not for external power supply. To switch off the link completely, you need to switch off the external power supply.

ATTENTION
Radio checkbox can be used for link restart. Click ***STOP*** button, clear this checkbox and click ***SET*** button, then ***START*** button. The link will be restarted in 30 seconds automatically.-

Other checkboxes:

FAN – internal fan switch on/off. Built-in fan is optional feature, and would be installed for hot weather regions.

Heater – internal heater on (standard mode).

SW1, SW2 – reserved for future use or for special purposes. This includes installing additional heater for northern regions with winter temperature below -40°C.

15.2.3 Temperature window

Displays temperature values in different points of the link case in Celsius degrees.

Temperature of Crystal – microcontroller chip temperature

Temperature sensor 1 – temperature inside radio case

Temperature sensor 2/3/4 – temperature inside radio case in different points

All information from Temperature window is for service only.

15.2.4 Voltage window

Displays voltage and current values for internal supply adapter.

U receiver – receiver heterodyne voltage (service parameter to be send to service)

U transmitter – transmitter powering voltage (service parameter to be send to service)

AGC voltage – Voltage of AGC parameter

Attenuation – attenuation level of signal.

U +32/27, U +9/12, U +5 – voltages for internal power supply adaptor. Check them to be sure that displayed values are close to ideal one. For doubled numbers like 9/12 check the value to be close to one value of the pair.

Total consumption – the total value of the current consumed from external power supply.

All information from Temperature window is for service only.

15.2.5 Buttons, Line Fields and other Checkboxes

Buttons:

GET button – to get link parameters displayed in PPC Monitor window

SET button – to make changes which have been made for power on/off, heater and fan on/off - active.

START button – starts PPC monitor application.

STOP button - stops PPC monitor application.

EXIT button – close PPC monitor application. You can use standard MS Windows “Close application” box on the application title bar instead.

Line fields:
IP address – line field with drop-down list. You have to enter IP-address of the transceiver (transmitter, receiver) yopu would like to monitor or control. IP addresses entered in last sessions can be restored from drop-down list.

ATTENTION!
To see transceiver parameters by the Internet, you have to use for transceivers real Internet static IP-addresses, obtained from ISP (Internet Service Provider). Please carefully discuss this possibility with your network administrator as the link will be open to hackers in this case.

Community name – “public” by default.

Interval – indicates how often the link parameters will be renewed at PPC monitor in milliseconds. 1000 ms means Identification Information window, Control window,
Temperature window and Voltage window will be updated each 1 second.
Do not enter very short intervals (greatly less than 1000 ms) as the transceiver (transmitter, receiver) will not be able to update the displayed info so fast.

Log to file checkbox – you can write displayed parameters to the log file. Enter file name with .txt extension. This data could be further exported to Microsoft Excel. To enable this checkbox, you need to stop PPC monitor application be clicking ***Stop*** button. Then enable checkbox, enter log file name and click ***Start*** button to continue.

NOTE
It is advised to have log files writing continuously to network admin server. In unlucky case of link crash the last log files have to be emailed to support service to help service technician to determine the cause of the link malfunction. Service technician email is support@elva-1.com or email of your local ELVA-1 represenative.

16 Maintenance and Troubleshooting

PPC-1000 has been designed to require no user reconfiguration during its operation. The PPC-1000 Bridge itself does not require periodic maintenance. However, each radio of the link should be periodically inspected for visible damage or excessive accumulation of dirt.

In a case of communication disturbance, it is necessary:

1. Make visible inspection of the radios to be sure of integrity of the stations and the antenna, and that the cable joints are reliable and no strange, unauthorized objects are on the antennas. Remove dust, snow from antennas if necessary.

2. Check the signal propagation line visually and make sure that no obstacles like buildings, cranes, electric lines, trees have appeared on it or in its vicinity. In a case of necessity remove the obstacle or change the radio position.

3. Make sure of that the radio is properly fed with the powersupply:

   • Measure the voltage on outdoor cross-box terminal block while radio is on.
   • The power supply voltage should be within 48 V to 60 V range. If it is not so, clear the fault of the power supply source or use a cable with a smaller voltdrop.

4. Make sure of that the data arrive properly to radio via the twisted-pair/optics cables.

5. Check the attenuation level. The attenuation should correspond to a value, given in the passport for actual distance. If it is not so, discover and remove the cause.

Possible causes:

• Precipitation along the signal propagation line. Wait until the good 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). Re-align the stations.
• Response transmitter failure.

If nevertheless the radio does not operate properly, measure and write down attenuation level voltage, make PPC monitor screenshots and copy last log files, then contact to Service Center, providing all the listed information.

See subsection 9.3 for contact details of tech support.

17 Specifications

System Parameters

Frequency Band	ECC E-band	ETSI Q-band
Bandwidth	71-76/81-86 GHz	40.5-43.5 GHz
Capacity	1250 Mbps Full duplex	
Modulation Type	QPSK	
Allocated Bandwidth	1250 MHz	
Rx Sensitivity at BER 10^{-6}	-97 dBW (-67dBm)	-97 dBW (-67dBm)
Output Power	-10 dBW (20dBm, 100mW)	-8 dBW (22dBm, 150mW)
Max Distance with 600/900 mm antenna in clear sky	>20 km (12 mile)	>20 km (12 mile)
Max Distance with 600 mm antenna at 10 mm/h rain	7.2 km (4.5 mile)	9.3 km (5.8 mile)
Link budget 300 / 600 mm	177 / 189 dB	165 / 177 dB
Network Management	SNMP v.1; v.2; v.3; MIB-II and DOK Enterprise MIB; WEB	
Ethernet Interface	1000 Base-SX / 1000 Base-LX	
Connector Type	Harting hybrid 2x fiber + 4x power (optional: hermetical cord installed)	
Diagnostics Port	100 Base-Tx (RJ – 45)	
Forward Error Correction	RS (204,188)	
Latency	50 µs	
Polarization	Vertical / horisontal - optional	
MTBF	150 000 hours	

Antenna

Antenna Type	Cassegrain type antenna with radome	
Antenna Gain/Beamwidth		
30 cm	45 dB/0.7°	38 dB/1.5°
60 cm	51 dB/0.35°	44 dB/0.7^0

Power / Environment

Power Supply AC	Input 88-132 / 176-264 Volts, 50/60 Hz (with manual voltage range switch)
Transceiver Power Consuption	35 W (+60 W when heater is switched on)
DC Power	36 to 72 Volts DC
Power Connection Ethernet / Power connector	IP-65 [optional IP-68]
Operational Temperature	-40^{0}C to 50^{0}C / -40^{0}F to 122^{0}F
Humiditu	Any Rate

Physical Dimensions

Outdoor unit size w/o antenna	340 x 230 x 120 mm
Weight (ODU w/o antenna)	6 kg max
Complete set	2 ODU + 2 antennas