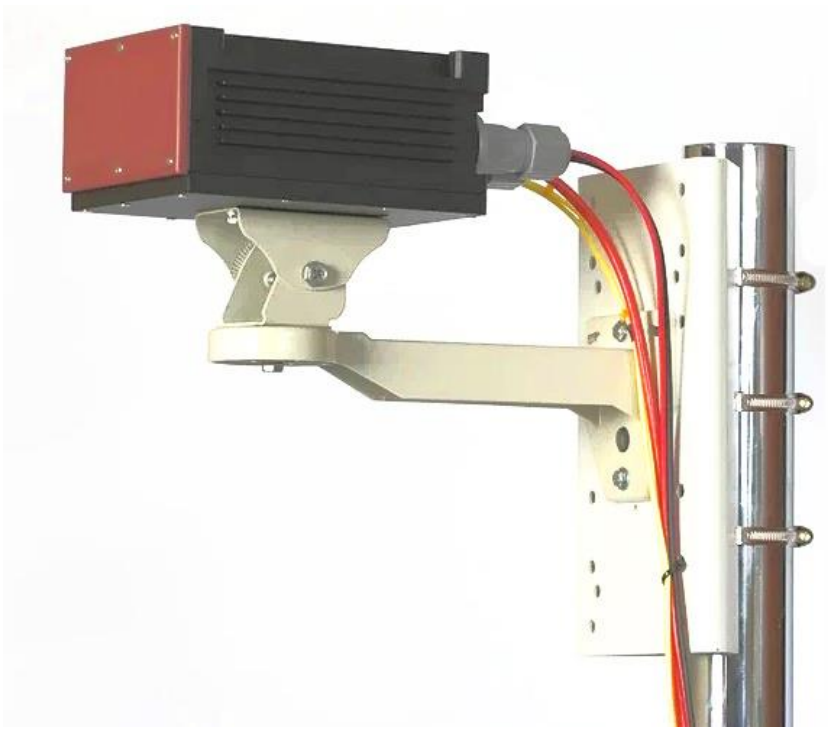
MOBIBRIDGE-10G

57–71 GHZ
V-BAND



INSTALLATION AND USER MANUAL
10 Gigabit Ethernet Wireless Link

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

Contents

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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.

• Use Ethernet Surge Protector device either indoor and outdoor for each MobiBridge-10G radio to protect MobiBridge-10G radio from any energized electric peaks.

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

2. INTRODUCTION

2.1 MOBIBRIDGE-10G LINK APPLICATIONS

The MobiBridge-10G wireless link is intended for full duplex 10 Gigabit Ethernet radio communication between two locations within short distances. It is comprised of two transceivers, each operating under line-of-sight conditions at working frequencies within the 57-71 GHz bands.

This link is intended for point-to-point digital communications applications in transportation industry, including public transport data offload/download, railway and marine communications. The link can also be used for fixed wireless such as Corporate Campus Networks, IPTV, and Wireless ISP connectivity. It is designed to wirelessly interconnect WAN/LAN segments and critical IoT that are located at sites with no fixed line broadband connection.

Fig. 1 MobiBridge-10G link example of installation on the tram

The radios are equipped with integrated phase array antennas. The MobiBridge-10G is normally mounted in a rooftop of a vehicle or tower location, and contains slots for SFP/SFP+ modules to connect to a LAN/WAN network.

The ELVA-1 MobiBridge-10G 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%. The total operating distance is up to 400 m.

2.2 MobiBridge-10G Features

- Frequency band: 57-71 GHz, up to 6 sub-bands within this frequency allocation.
- SNMP v.2; MIB-II; IP-MIB; IF-MIB and Enterprise MIB; WEB
- True Full Duplex Operation
- Hitless adaptive bandwidth, coding and modulation
- IEEE 1588v2 (TC)
- Solid reliability with Fiber-like Performance
- Easily installed, zero-footprint
- Compact integrated phase array antennas
- EMI interference free

2.3 Product Code Format

The choice of modification of the radio power is available, including

1. Basic **MobiBridge-10G/36-60** link, for 36-60 VDC power line (typical for use in rail and maritime transport).
2. Optional **MobiBridge-10G/18-36** link for 18-36 VDC power line, (typical for use in automotive transport, i.e. buses and trucks).

External Power Supply Unit 230 VAC /54 VDC is shipped for each radio by default.

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

Fig. 2 MobiBridge-10G product code legend

2.4 Link Web Management

An operator could manage MobiBridge-10G link of any modification using its web-based interface. Basic information on web-based interface to start the link at first time is available in this manual.

To understand all MobiBridge-10G features and wide range of built-in indicators and diagnostic tools please refer to MobiBridge-10G Web Interface Manual in ELVA-1 website. It is also available any time on request to support@elva-1.com.

3. DELIVERY KIT

3.1 DELIVERY KIT OVERVIEW

The MobiBridge-10G equipment will arrive in 1 box.

The box with transceivers contains 3 smaller boxes inside. Two of them contain transceivers and one box with doubled kit of power units, cables, sockets, metalware .

Fig. 3. 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
Plastic fitting for cable	6
Power Supply	2
Mounting kit (metalware, accessories)	2

This User Manual and Web Interface Manual are usually delivered to customer via the Internet in electronic format.

3.2 Tools and Accessories in Mounting Kit

There are connectors, tools and cables within Mounting kit to easily install MobiBridge-10G link.

Table 2. ACCESSORIES list

Description	Quantity
Bracket system	2
Metal collar	6
Cable to 110-240 VAC main for ESP-240-54 Power Supply unit	2
Bracket plate	2
Screws kit	2
Cable clamps	2

4. Preparing the Site of Installation

ELVA-1 assumes that customer personnel has an understanding of mm-wave wireless communications and sufficient familiarity with configuring and operating LAN/WAN networking equipment. Preferably, the personnel installing MobiBridge-10G fully read and understood the information covered in this manual before performing any actions with the MobiBridge-10G.

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

- Unpacking the MobiBridge-10G and examining Delivery Kit
- Preparing both places in installation sites (at both ends of wireless link)
- Mounting the MobiBridge-10G equipment on the places of installation
- Connecting the cables
- Aligning the antenna (for both transceivers)
- Performing initial link setup by web-interface.

4.1 Unpacking the MobiBridge-10G and Examining Delivery Kit

It is recommended to unpack MobiBridge-10G 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 hanks of DC power cable, twisted pair cable and optical cable are not included to Delivery Kit and have to be purchased from a local supplier accordingly to required length.

4.2 Examining the Line-of-Sight

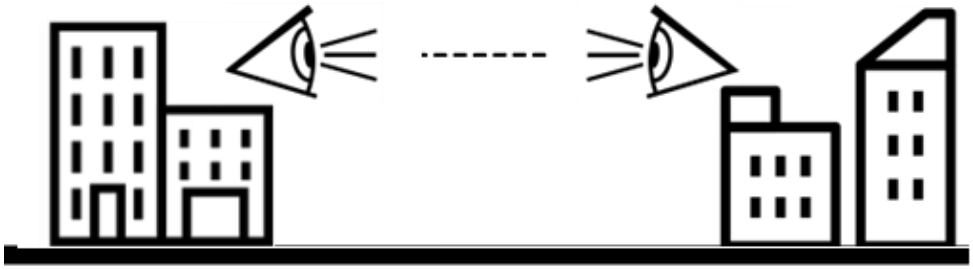

Fig. 4. Examining LoS

The MobiBridge-10G 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.

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

To ensure MobiBridge-10G equipment is protected from vandalism and theft it is recommended to be mounted in a position that is accessible by an authorized personnel only.

4.3 Path Length Planning

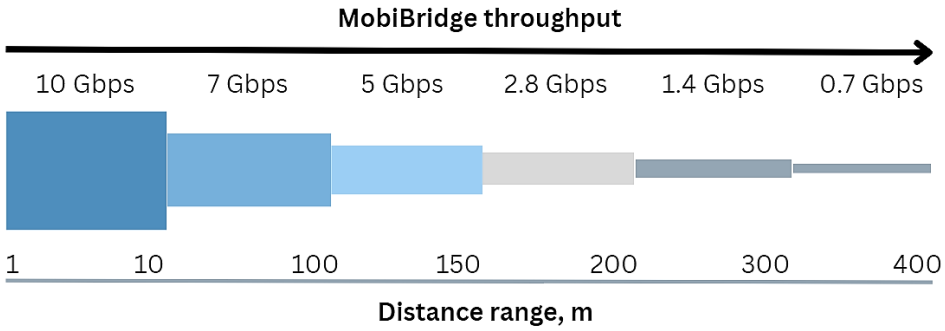

Fig. 5. Throughput versus range for MobiBridge-10G

Measurement of the link distance is important for calculating of the link throughput and Receive Signal Level (RSL). The measurement of the link distance can be performed by laser rangefinder or using Google Map or Global Positioning System (GPS) device at proposed locations of the transceivers installation.

For estimated throughput value for distance from 0.5 to 400 m please refer to Fig.5. In case of doubt, contact ELVA-1 or your local dealer for help and advice.

4.4 Proposed Installation Types

MobiBridge-10G transceiver can be used in various applications where wideband short distance communication is required.

Such applications include the following scenarios although not limited to:

- Data upload and download from/to a vehicle when connecting to stationary network in bus terminal, tram depo, railway station, metro station, etc.
- As a 10 Gbit link connecting on-board LAN between two moving vehicles like between two coupled trains.
- As a wireless link between a cruise ship or ferry and a network access point at a seaport berth to provide passengers with broadband internet access
- As a point-to-point fixed wireless communication between two buildings in the industrial site, in a sea port, etc.

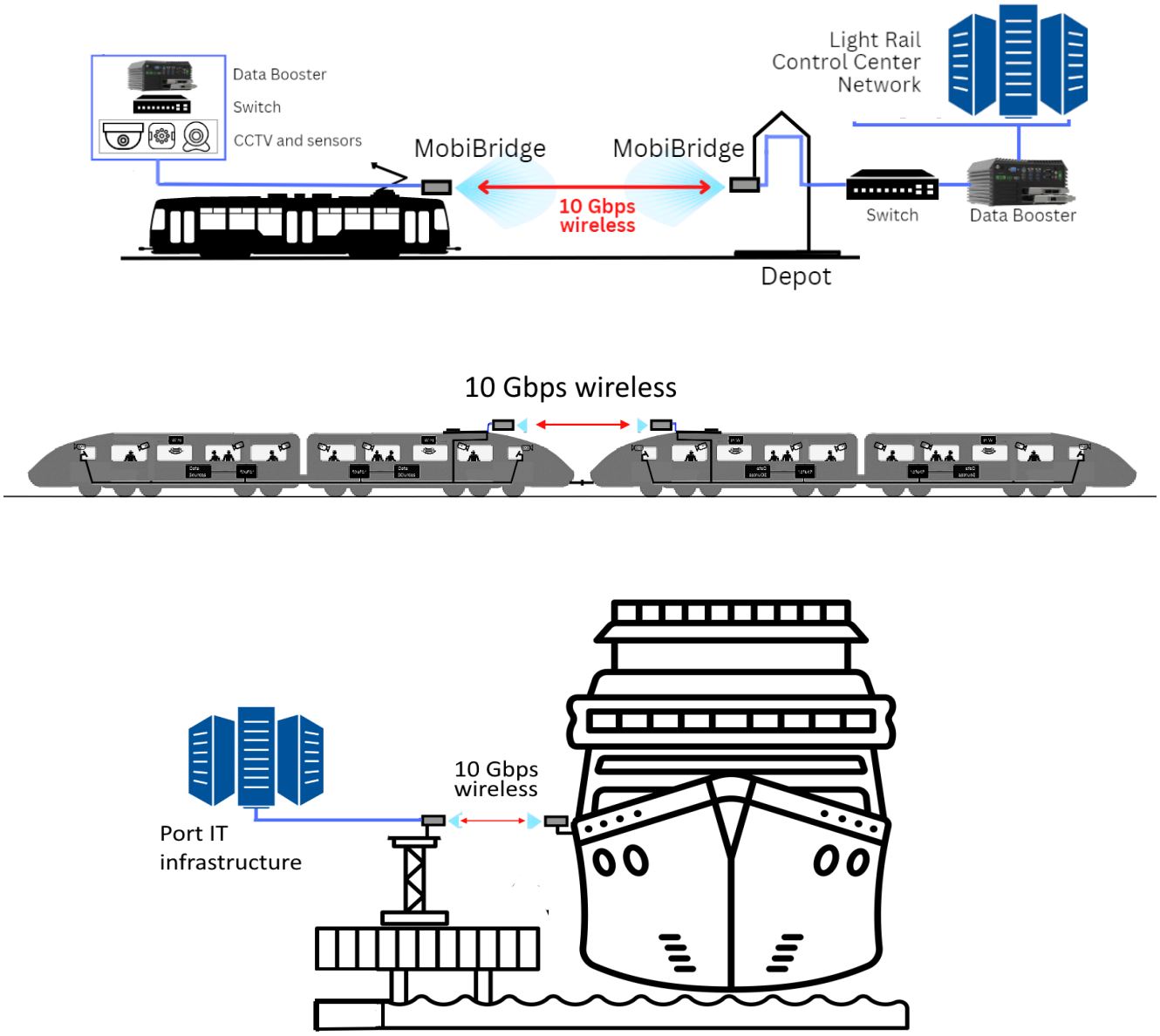

Fig. 6. Scenarios of MobiBridge-10G use

4.5 Aggregation of Radio Links

The MobiBridge-10G radios can be easily aggregated to ultra-wideband wireless channel between two points. Depending on the local frequency spectrum regulation, the total number of aggregated radios can be from 2 to 3 ones, each using two dedicated sub-band.

For example, in the USA, where FCC allows 57-71 GHz frequency allocation, the number of aggregated MobiBridge-10G radios working from the same points could be as many as 3 ones.

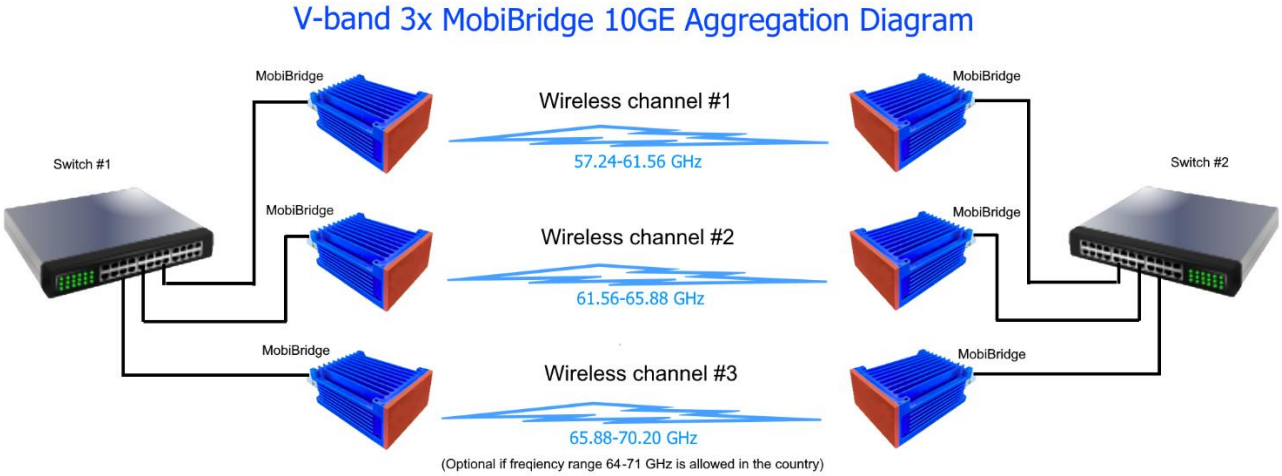

Fig. 7. Aggregation diagram of MobiBridge-10G radios

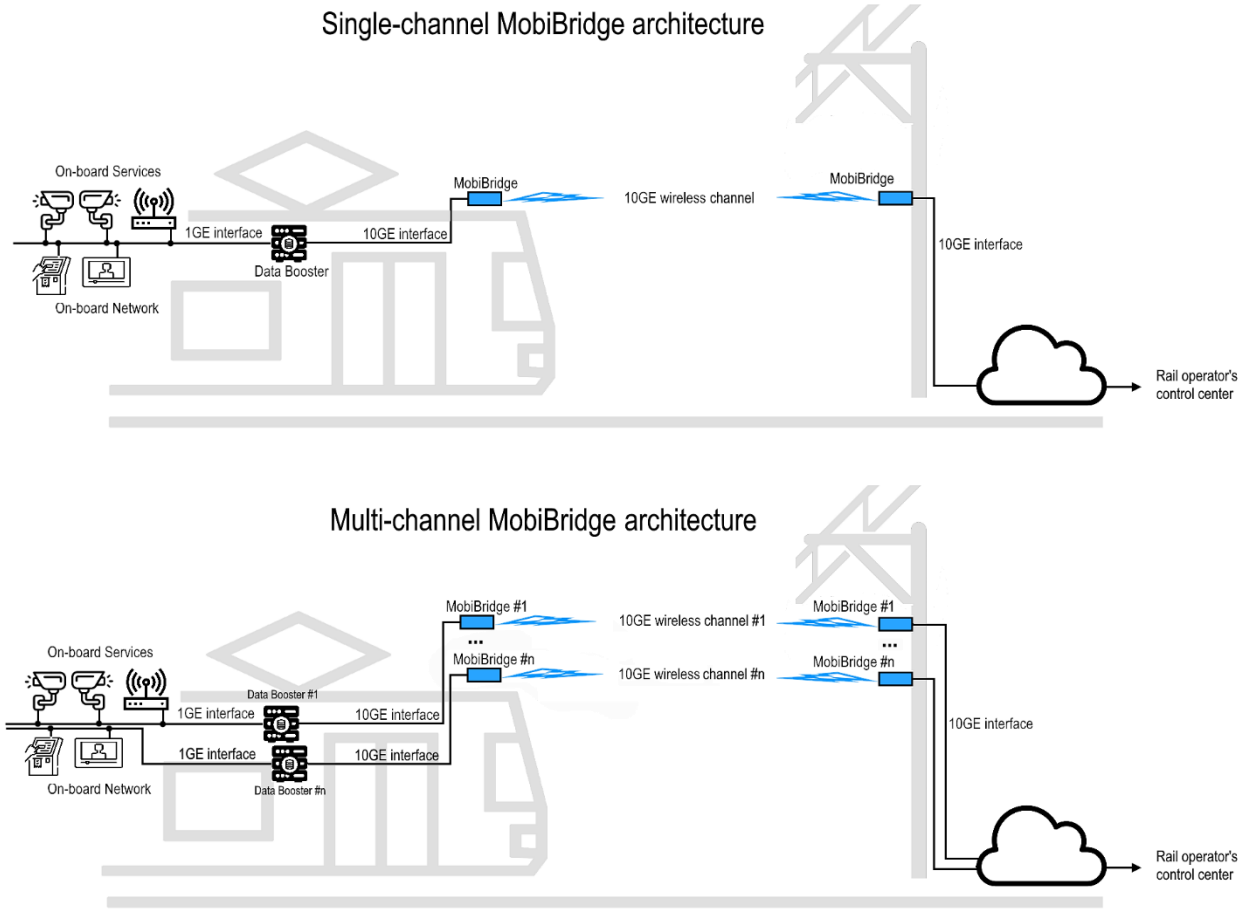

Fig. 8. Example of aggregation of MobiBridge-10G radios for ultra-wideband rail transport interconnect

4.6 Cabling on Installation Site

The MobiBridge-10G radios can be accessed by IP addresses via LAN, WAN or by UTP cable from a laptop directly connected through the RJ-45 port. To do this, the MobiBridge-10G must be installed at the place of use, powered and cables from both radios connected to the LAN on each side of the radio link (or to a PC/laptop with direct UTP cable to radio).

Any available web browser may be used, while Google Chrome is recommended. Desktop PCs, notebooks, tablets and smartphones are supported to get web access to MobiBridge-10G radios for either Windows, macOS/iOS and Android operating systems. Please note that the MobiBridge-10G web interface may not be adapted for the mobile device screen.

By factory default, each MobiBridge-10G radio has IP address for web access. These IP addresses are different – the device with **even serial number** has internal IP address 192.168.127.254, while **odd serial number** - 192.168.127.253. For actual serial number of your device, check the label on the radio enclosure.

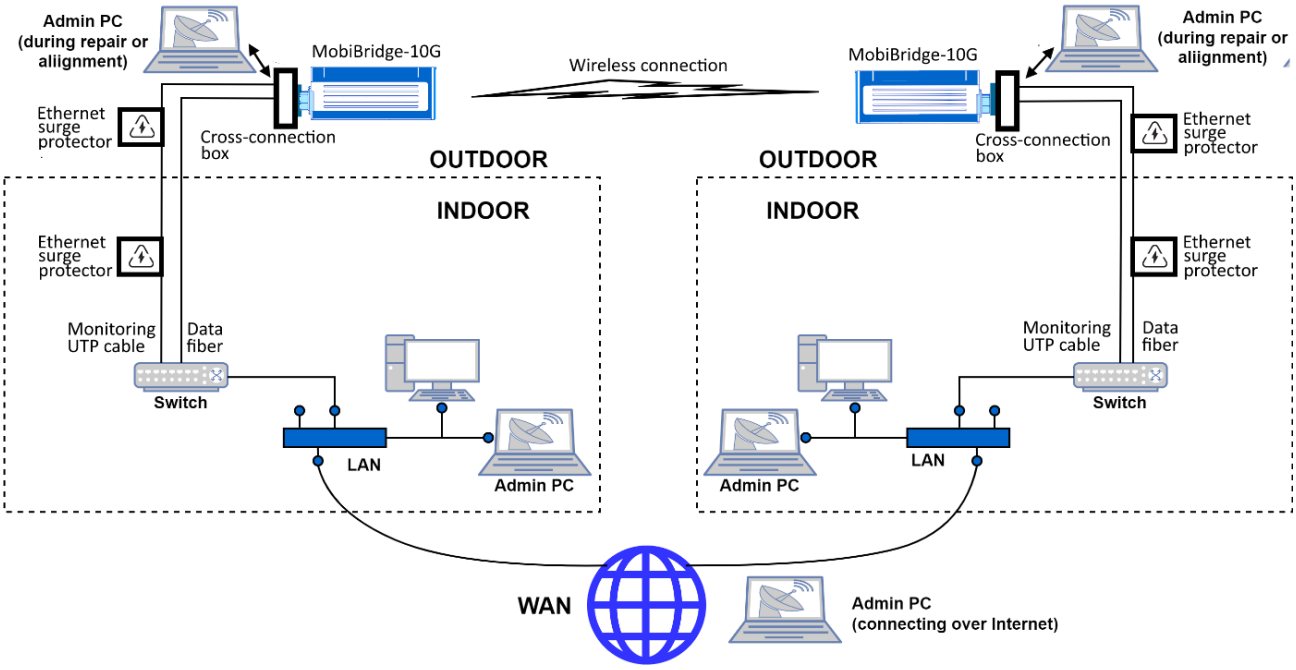

Fig. 9. MobiBridge-10G communication cabling

The diagram shows all possible cases where a system administrator (aka Admin) can connect to each radio by its IP address in three ways:

1. Connect from Admin PC to the radio while are in the same LAN.

2. Connect from Admin PC (desktop, notebook or mobile device) to the radio over WAN (over the Internet). In this case both 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 this LAN.

3. Directly connect from Admin PC (using PC/notebook with Ethernet port) to the radio by UTP cable with RJ-45 connectors. This way usually used only in some situations of initial installation of the link or at link repair works.

Fig. 10. MobiBridge-10G sockets Power (2-wire), Monitoring (UTP), Data (Fiber) – from left to right

- Power connector "POWER" for 36-60 VDC power cable (or optional 18-36 VDC)
- RJ-45 Connector "MONITORING" for cable of web-monitoring
- SFP/SFP + "DATA" connector for 10 Gbps data transmission cable

Power cable wire cross-section must 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 (or below 18 VDC for automotive version of the radio with 18-36 V range).

- Install Twisted Pair cable from network equipment to the radio. Be sure that the UTP cable length from last active port to radio is less than 100 m. Using of Ethernet cable surge protector is recommended to prevent the port from surge damage.

- Install fibre optics cable from network equipment directly to the radio. The radio is shipped with a spare SFP+ module.

5. INSTALLATION OF TRANSCEIVERS

For easy and fast installation of the radio link, please consider the following:

- It is recommended to have technician personnel at both sides of transceiver installation place with walkie-talkie radios or mobile phones.

- Binocular also is recommended for performing LoS check and easy alignment of antennas.

- Windows-based laptop with RJ-45 port is recommended at each side for initial radio setup using web interface.

If the radio is installed on a vehicle, it is recommended to prepare the seating place and lay the power and data cables in advance. The radio can be mounted behind a vehicle's carbon fiber fairing. If there is any doubt about the transparency of the fairing material, please contact your local dealer or ELVA-1 for an advise.

If the radio is installed on a fixed outdoor support, it is recommended to try on the bracket mounting location in advance, buying long clamps if necessary, and to lay the power and data cables.

5.1 Radio with Bracket Assembling and Installation Sequence

Bring the transceiver, mount bracket, mounting screws and other accessories from Delivery Kit to the outdoor points of installation at both sites of the link (see photo, Fig.11).

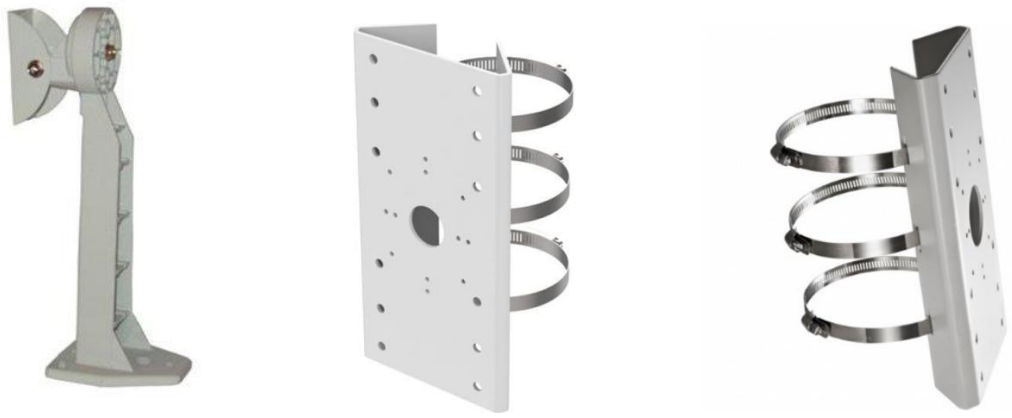

Fig. 11. Transceiver mount bracket

NOTE. The use of the mount bracket from the Delivery Kit is **not mandatory**. The customer can install the radio in place directly by the mounting holes on the radio enclosure or use any other mount bracket which is appropriate.

The general installation sequence is as follows:

1. Assemble the bracket from the supplied parts (see this below in more detail).
2. Fix the bracket to a pole, mast or other support at the place of installation. Repeat this operation for the second radio.
3. Screw the radio to the bracket with two M5 bolts to the M5 threaded holes on the belly of the radio. Repeat this operation for the second radio.
4. Connect the power, twisted pair and optical cables to the radio's sockets. Repeat this operation for the second radio.
5. Connect the cables from the radio to the power supply and LAN network equipment. Repeat this operation for the second radio..
6. Loosen the swivel pad fastener on the bracket and accurately point the radio at the other radio, visually forming a line-of-sight wireless path. Tighten the pivot pad bolts securely. Repeat this operation for the second radio.
7. Get power to both radios, get IP-based access to each radio via the web interface, and setup the wireless connection. Use MobiBridge-10G Web Interface Manual for detailed explanation of the web interface features.

5.2 Bracket Assembling

To assemble the supplied bracket, thread the clamps onto the mounting pad to the outer support pole or mast, etc. If your support is larger than the supplied clamp size, purchase flexible plastic strips or metal clamps of the required size and use them.

Next, bolt the bracket leg to the pivot pad to a pole or other support.

Familiarise yourself with the pivoting mechanism of the mounting bracket. It allows you to change the azimuth (horizontal) and elevation (vertical) angles of the radio.

Once the bracket is installed on a pole or other support, make sure it is securely fastened and only

then screw the radio to the bracket. To do that, attach the radio to the pivot pad on the leg of the bracket. There are two M5 threaded holes on the belly of the radio for this purpose.

See Fig. 12 and Fig. 13 on how the radio has to be fastened to the bracket.

Fig. 12. General view on the bracket installed on a support leg

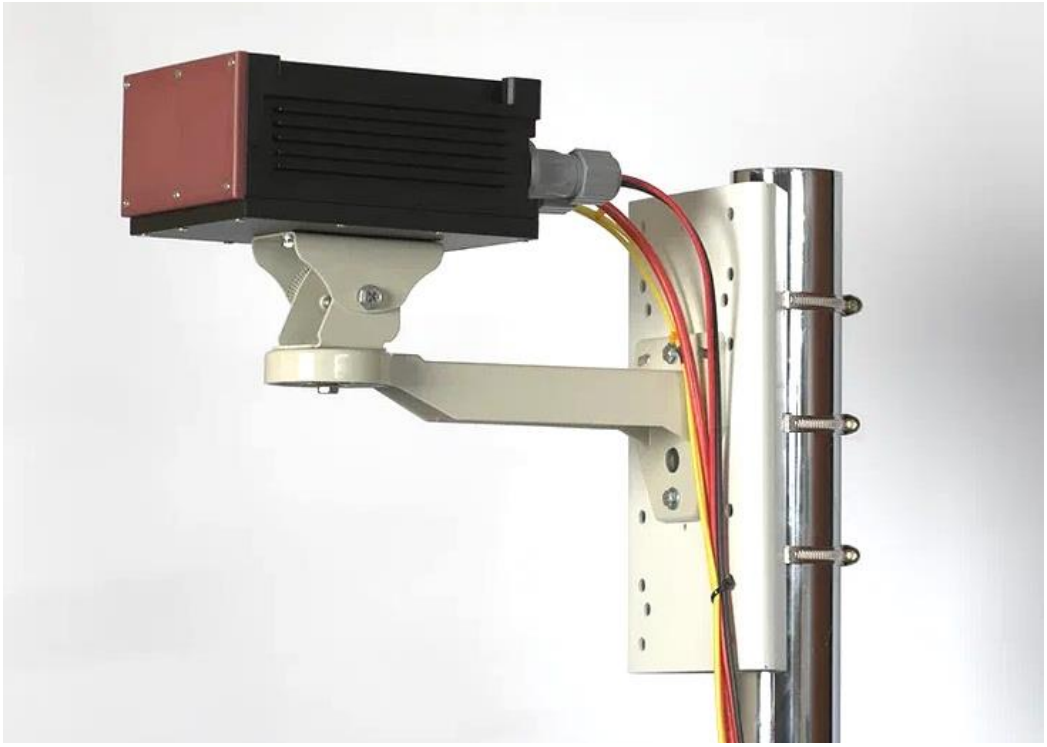

Fig. 13. The view of radio on the mount bracket

After installing both radios, use MobiBridge-10G Web Interface Manual for detailed guide how to tune and operate MobiBridge-10G connection for max data throughput.

6. MAINTENANCE AND TROUBLESHOOTING

MobiBridge-10G 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 the 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. Access both radios via web interface and visit **Operational Status** tab. Check there if **Signal Quality** and **10GbE Link** indicators are green. If not, click **Reboot** in the left menu for both radios.
2. In case the communication failure still exists, visit **Settings** tab. In the **Loopback** box, you can set es either **Line** mode to test the optical cable from the external active network equipment to the MobiBridge-10G or **Terminal** mode.

Loopback mode has different configurations:

- **Line**, where traffic coming over the optical cable to the radio unit is not passed to the wireless, but is looped back. In this way, the admin can check the optical section from the server room to the radio unit at the installation site, taking into account all sockets and connections.
- **Terminal**, where all traffic that came over the wireless channel is not transmitted to the optics, but is wrapped back to the wireless channel.

By selecting these modes, the administrator can check the sections of traffic passing sequentially. For example: first check the optical line on side A, without affecting the radio channel and the optics on side B. Then check the optics on side A and the radio channel, without touching the optics of B. Then do the same thing from side B.

3. Make a visual inspection of the radios for mechanical integrity of the transceiver, and check cable joints. At winter, remove ice or snow from both transceivers if necessary.
4. Check the signal propagation line (LOS) to be sure that no obstacles like cranes, trees, etc., have appeared in it or its vicinity. If necessary, change the radio positions.
5. 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 (18 to 36 VDC for version intended for automotive vehicle). If it is not, clear the fault of the power supply source or use a thicker gauge wire for a smaller voltage drop.
6. Make sure of that the UTP and optical cables are firmly inserted to the radio sockets.

If the radio still does not operate properly, measure and write down RSL, then contact your supplier or ELVA-1 Service Center by email for troubleshooting recommendations:

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

7. APPENDIX A

7.1 MOBIBRIDGE-10G SPECIFICATIONS

Model	MobiBridge-10G						
Frequency range	57-71 GHz (V-band)						
Throughput	Up to 10 Gbps Full duplex						
Channel Bandwidths Available	250/ 500/ 750 / 1000 / 1250 / 1500 / 2000 MHz						
Modulation	QAM-256 to BPSK Adaptive to weather with hitless adaptive bandwidth, coding and modulation						
MTBF	150 000 hours						
Central frequency	Tunable 6 frequency channels 2000 MHz						
Max Distance	up to 400 m						
Max output power	EIRP 40 dBm						
Max throughput	1330Mbps @250MHz	2660Mbps @500MHz	3750Mbps @750MHz	5200Mbps @1000MHz	7200Mbps @1250MHz	7630Mbps @1500MHz	9980Mbps @2000MHz
Management	SNMP v.1; v.2; MIB-II and proprietary MIB; WEB GUI; Telnet; CLI						
Ethernet Interface	1 × SFP/SFP+ slot (1000Base-X, 10GBase-LR/SR)						
Ethernet	Transparent for Ethernet services, Flow Control 802.3x PTP IEEE 1588v2 (TC) support						
Management Port	100 Base-Tx (RJ – 45)						
Forward Error Correction	LDPC						
Polarization	Vertical / Horizontal						

Antenna

Antenna Type	Integrated, phase array
Beamwidth / Beam steering	
Elevation deg.	90 / fixed
Azimuth deg.	12 / 90

Power / Environment

Power Supply AC	Input 88-132 / 176-264 Volts, 50/60 Hz
Transceiver Power Consumption (for one radio)	45 W
DC Power	36 to 60 Volts DC (optional 18 to 36 VDC)
Power Connection	IP-67
Operational Temperature	-50^0C to $+60^0$C / -58^0F to 140^0F
Humidity	Up to 100%

Physical dimensions

Outdoor unit size	125 x 72 x 50 mm
Weight	1.5 kg max

7.2 MOBIBRIDGE-10G DRAWING