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GLOBTEL GIGARAY 70/80 GHZ

USER MANUAL AND TECHNICAL SPECIFICATIONS



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1. FOREWORD

IMPORTANT!!!!

Before you is a highly technical transmitting device intended to be used on telecommunication towers. Please be aware of following notices and notes.

NOTICE:

This device complies with Part 15 of the FCC Rules.

Operation is subject to the following two conditions:

- (1) this device may not cause harmful interference, and*
- (2) this device must accept any interference received, including interference that may cause undesired operation.*

NOTICE:

Changes or modifications made to this equipment not expressly approved by Globtel holding d.o.o. may void the FCC authorization to operate this equipment.

NOTE: *This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.*

NOTE: *AIR BASE station INSTALLATION MANUAL covers the initial hardware installation, system maintenance. The procedures described in this manual are intended to help service technicians to install and do initial AIR base station start up. Users who perform these tasks should be familiar with AIR hardware and cabling, wiring practices, and safety precautions.*

DANGER:

Do not intend to do unauthorized repairs. "Danger" do not do repairs when the units are on power. Power off the unit and disconnect the power cable. Not following the procedure permits the existence of a hazard that could result in death or serious bodily injury if the safety instruction is not observed. Improper repair of the units may result in safety hazards. Be sure to fasten screws securely with the right screwdriver. If a screw is not fully fastened, it could come loose, creating a danger of a short circuit, which could cause overheating, smoke or fire.

Radiofrequency Radiation Exposure:

This device is used on a fixed location in an area not accessible to the general public and only accessible to highly skilled and trained engineers. The radiated output power of the device is far below the FCC radio frequency exposure limits. Nevertheless, the device should be used in such a manner that the potential for human contact during normal operation is minimized. This equipment should be installed and operated with a minimum distance of 2m between the radiator and your body.

AIR GIGARAY 7080G BS
AIRGMP70803-1



FCC ID: 2AWXTAIRGRMP70803
IC: 27453-AIRGMP70803

This device complies with Part 15 of the FCC Rules and with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est

2. GLOBTEL GIGARAY SOLUTION

2.1. General Description

Globtel GIGARAY system is a unique wireless point to multipoint solution that enables operators to offer their customers full set of triple play services. System is especially suitable for areas with less developed infrastructure as it can be set-up very quickly and can cover wide area at once. It can deliver fiber-like services without the need for construction works, roadblocks and long deployment times. In 360° coverage configuration the system can achieve up to 14 Gbps of total throughput at base station location and up to 2 Gbps per single customer. Globtel Gigaray 70 was specially designed to be used with unlicensed frequency bands in the USA in 70 GHz and 80 GHz range.

The system uses Frequency Division Duplex (FDD) which means that different frequencies are used for upstream and downstream. In this way system can be used to the full potential as downlink and uplink do not share the same frequency which is an advantage over most of other wireless solutions that share the same spectrum for downlink and uplink. The system consists of base station indoor equipment with sector antennas and a transceiver which is installed at the customer premises.

System supports Docsis 3.0 and Docsis 3.1 transmission technologies. The system combines several Docsis/Euro Docsis channels to achieve total supported bandwidth of 500 MHz per each 30° antenna in each direction which enables use of 1500 MHz in total per each direction. Throughput that can be achieved is dependent on Docsis transmission and in line with Docsis standards.

2.1.1. BASE STATION THROUGHPUT

Cumulative throughput of the base station depends on number of sectors used and transmission technology. In the table below you can find total throughput per single sector by using 500 MHz of frequency bandwidth and Docsis 3.1 transmission. To calculate the total throughput of all sectors just multiply single sector capacity with number of sectors.

Modulation	Downlink		Uplink	
	500 MHz Bandwidth	Bits per Hz	500 MHz Bandwidth	Bits per Hz
QAM512	3.516 Gbps	7.03		
QAM256	3.175 Gbps	6.35	3.100 Gbps	6.35
QAM128	2.700 Gbps	5.40	2.700 Gbps	5.40
QAM64	2.400 Gbps	4.80	2.400 Gbps	4.80
QAM32	2.000 Gbps	4.00	2.000 Gbps	4.00
QAM16	1.900 Gbps	3.80	1.600 Gbps	3.20
QPSK	/	/	1.200 Gbps	2.50

Table 1: Sector downlink throughput with 500 MHz bandwidth and Docsis 3.1

2.1.2. SPECTRUM

One sector antenna has 90° coverage. Four sector antennas with 90° coverage are used to achieve 360° coverage. Each sector can utilize up to 500 MHz of frequency spectrum in range from 69 000 MHz to 71 0000 MHz for downstream and 500 MHz of frequency spectrum in range from 81 000 MHz to 83 0000 MHz for upstream. System allows different combination of sectors from a single sector setup to a fully equipped 4 sector base station. Number of sectors can be adjusted depending on geography and customer needs and is part of network planning.

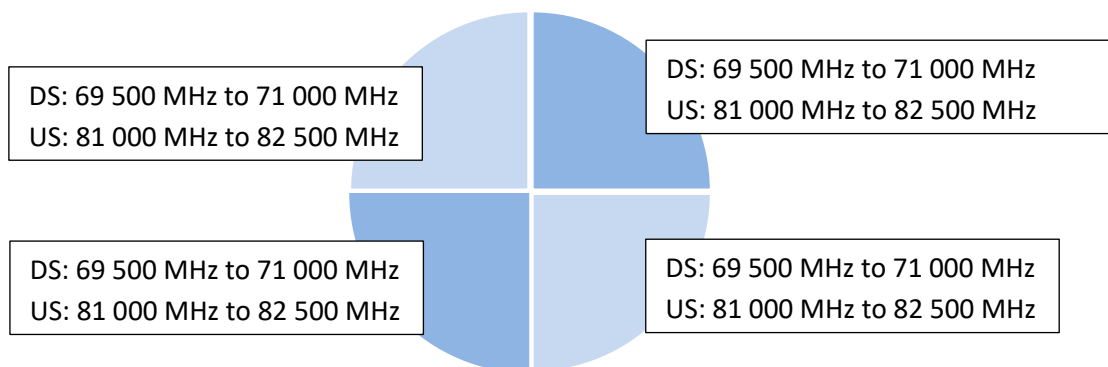


Figure 1: Four sector arrangement with frequency bands

2.1.3. Base station

2.1.3.1 Sector Antenna

Sector antenna is built from aluminium casing with embedded electronics and plastic antenna dome which is housing the sector antennas and optional heaters. All the outdoor parts of the unit are fitted in a robust, climatic non-erosive and frequency independent casing. The sector antenna has a typical horizontal coverage of 90°. In addition to described outdoor equipment there is also a base station indoor equipment which needs to be installed in a collocation space at the base station location.

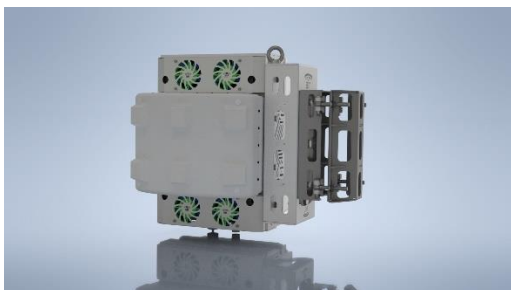


Figure 2: Gloftel Gigaray Sector Antenna

2.1.3.2 General technical specification for base station

Transmitting section

- | | |
|--------------------------------|--------------------------------|
| • RF output frequency | 69500-71000 MHz (1500MHz band) |
| • Gain flatness | ±2 dB (-30°C - +70°C) |
| • Max throughput (DOCSIS 3.1) | Up to 3x 3,5 Gbps |
| • Max output power | 22 dBm/500MHz |
| • Antenna gain | 19 dBi (3x30degrees) |

Receiving section

- | | |
|--------------------------------|----------------------------------|
| • RF input frequency | 81000 - 82500 MHz (1500MHz band) |
| • Gain flatness | ±2 dB (-30°C - +70°C) |
| • Noise figure | 8 dB typ. |
| • Max throughput (DOCSIS 3.1) | Up to 3x 2,4 Gbps |
| • Antenna gain | 19 dBi (3x30 degrees) |

General specifications

- | | |
|-------------------------|-----------------|
| • Power supply | 48 VDC |
| • Operating temperature | -30°C - +70°C |
| • Weatherproof housing | 100% waterproof |

Table 2: General specification

2.1.4. DOCSIS platform

Globtel Gigaray system in its core is a wireless bridge and can be seen as infrastructure layer (physical layer) like cables in the wireline network. To be able to offer services additional transmission technology must be used. Globtel Gigaray system supports Docsis 3.0 and Docsis 3.1 data transmission technology and DVBx for live TV.

These technologies are widely used in cable networks all over the world serving more than 142 million subscribers and representing 33,5% of all internet subscriptions in the world. Both technologies Globtel Gigaray and DOCSIS are already being used in several countries all over the world with frequency bandwidths of 200 MHz to 800 MHz.

Docsis platform can be used as a centralised CMTS solution with remote PHY at each base station location or as a stand-alone solution with CMTS at each base station location.

DOCSIS 3.1 uses OFDM modulation on downstream and upstream. Downstream OFDM carriers are from 24MHz to 192MHz wide. Upstream OFDMA carriers are from 12 to 96 MHz wide. OFDM uses individual narrow sub-carriers. OFDM supports flexible modulation schemes on both sides, downstream and upstream. Modulation schemes are based on cable modem performance. Level of modulation is based on MER on cable modem.

DOCSIS 3.1 specifications:

- OFDM modulation on downstream and upstream
- Downstream OFDM carriers are from 24MHz to 192MHz wide
- Upstream OFDMA carriers are from 20 to 96MHz wide
- OFDM uses individual narrowband sub-carriers
- Flexible modulation schemes: different modulation schemes based on cable modem performance, Level of modulation is based on MER on CPE(customer unit)
- Improved error correction, LPDC, provide higher orders of modulation with the same CNR

2.1.5. LATENCY

Delay in the DOCSIS network is created by transit time in the coax or wireless system. This delay is actually very small adding 0.02 to 0.7 milliseconds to the total latency. The major delay in DOCSIS networks is caused by queueing delay and media acquisition. Queueing delay is caused by TCP acknowledgments in downstream and upstream data transmission. This creates a large round-trip delay for data, which is also dependent on the latency of both the downstream and upstream. Average latency in Globtel Gigaray system with or without traffic is below 10 ms.



3. NETWORK SCHEMATICS

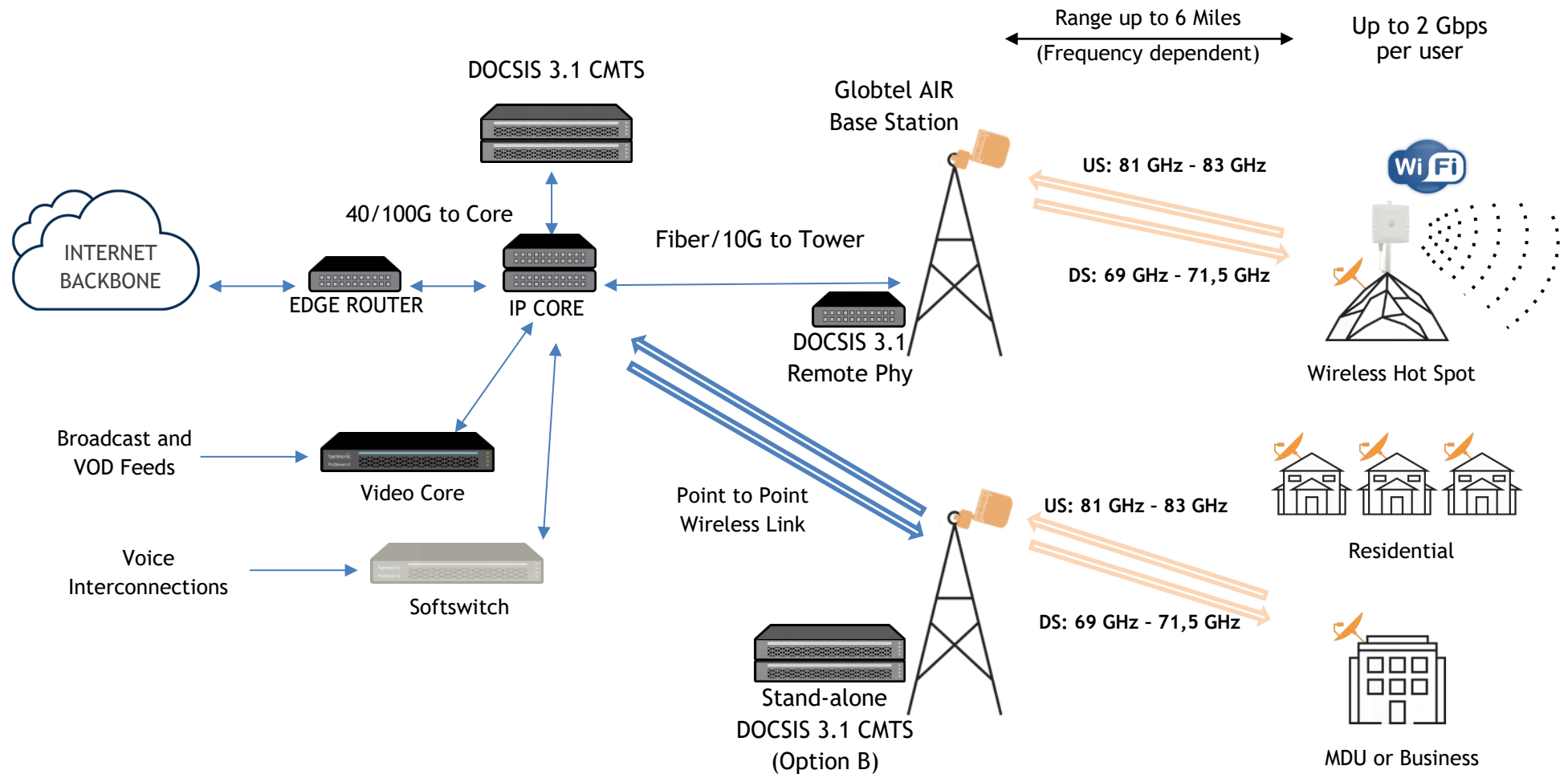


Figure 3: Network schematics

4. PROTOCOLS AND TECHNOLOGY

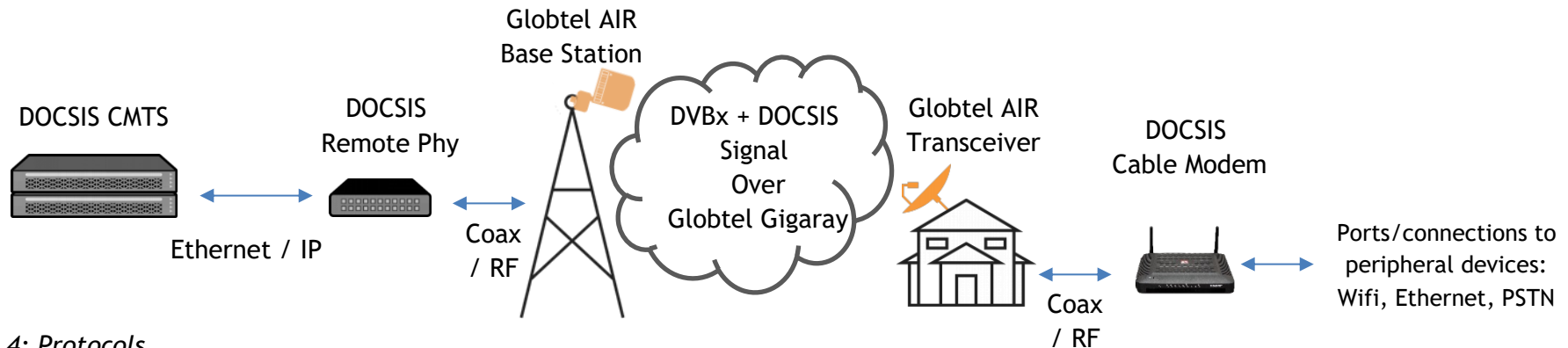


Figure 4: Protocols

Globtel AIR fixed wireless system is basically a cable network without cables. Cables as the physical layer that are responsible for distribution of CATV signal have been replaced by wireless technology which delivers CATV signal to the end user wirelessly. All other TV signal transmission and data transmission equipment remain the same as in wireline cable network. Apart from few Globtel AIR equipment parts the rest of the system components are standard DVBx and Docsis equipment. Depending on network topology a central CMTS with remote phys can be used or an independent CMTS at each base station location.

All users connected via Globtel AIR system are seen by the cable network provisioning and management systems as they would be connected through wireline coaxial cable. All protocols used by Globtel AIR are standard Docsis 3.1 or DVBx and are the same as would be in the cable network. Transmission technology is defined by the use of EdgeQAM, CMTS and other standard cable network components. Globtel AIR equipment does not alter or interfere with any protocols, traffic, content, or any kind of data. Globtel AIR only shifts RF signals from CMTS and EdgeQAM to alternative frequency at the base station location and back to standard cable network frequency at the customer premises. Service portfolio and performance are the same as in the standard cable network. Customers can use standard cable modems and enjoy all services like live CATV, ultra-fast broadband, VoIP, VOD, OTT TV... The latency is comparable to cable network.

5. BASE STATION INSTALLATION MANUAL

AIR GIGARAY 7080G BS
FCC ID: 2AWXTAIRGRMP70801

5.1 Base station sector

Technical data:

- Length: 414 mm
- Width: 566 mm
- Height: 498 mm
- Weight: 35 kg
- Mounting pole suggested diameter: Ø75 - Ø120 mm

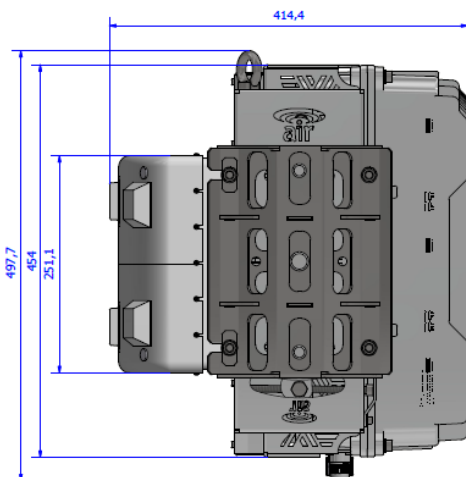


Figure 5: Sector side view

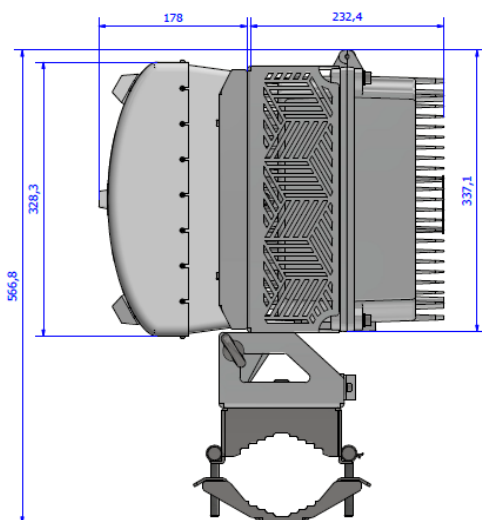


Figure 6: Sector top view

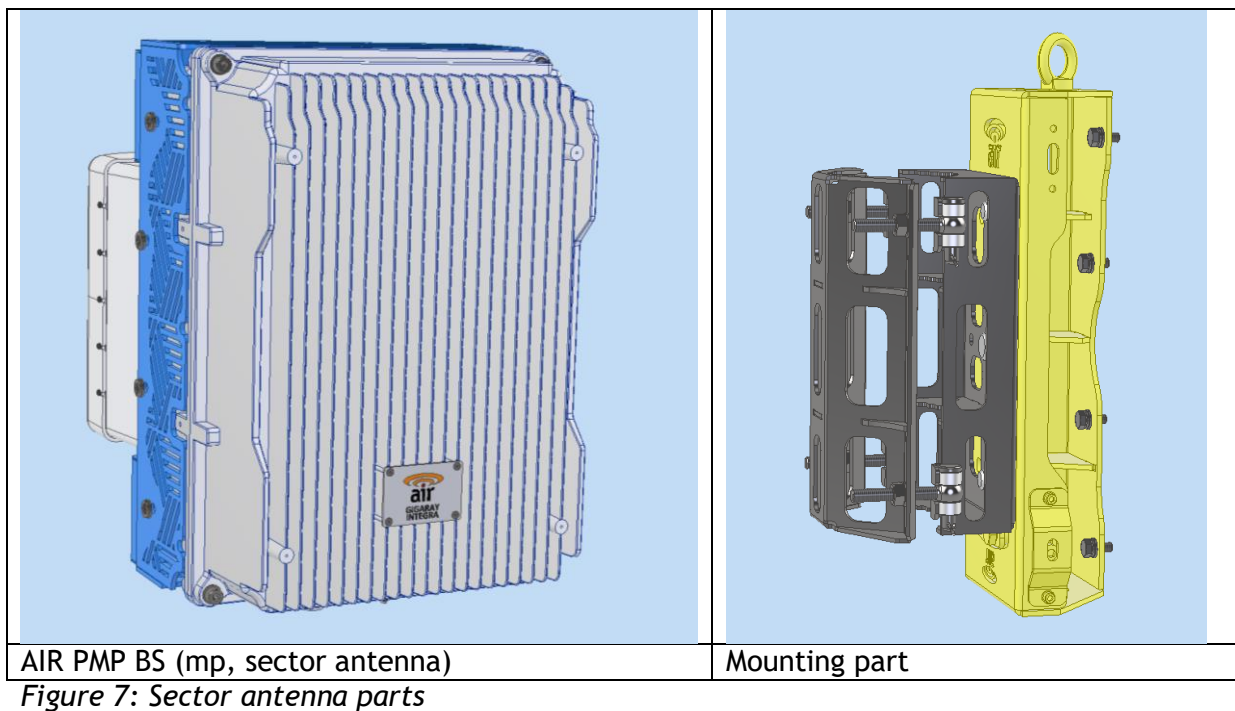
5.1.1. Technical specifications

Table 3: Sector antenna specification

SPECIFICATION for SECTOR ANTENNA:	
Parameter	Description
Receiving Section (upstream)	
RF Input Frequency	81000-82500 MHz (500MHz per antenna)
IF Output Frequency	1000-1500 MHz (500MHz per antenna)
LO Frequency	80000 MHz
LO Frequency Stability	$\pm 60\text{Hz}$ ($-30^{\circ}\text{C} \sim +60^{\circ}\text{C}$)
Gain	42 \pm 5dB typ.
	42 \pm 6dB ($-30^{\circ}\text{C} \sim +60^{\circ}\text{C}$)
Gain Flatness	$\pm 3\text{dB}$ ($-30^{\circ}\text{C} \sim +60^{\circ}\text{C}$)
Noise Figure	8dB typ.
Cross talk between output and input	min 80dB
Transmitting Section (downstream)	
IF Input Frequency	1000-1500 MHz (per 30 degrees antenna)
RF Output Frequency	69500-71000 MHz
LO Frequency	72000, 71500, 71000 MHz
LO Frequency Stability	$\pm 60\text{Hz}$ ($-30^{\circ}\text{C} \sim +60^{\circ}\text{C}$)
Gain	42 \pm 3dB typ.
	42 \pm 4dB ($-30^{\circ}\text{C} \sim +60^{\circ}\text{C}$)
Gain Flatness	$\pm 2\text{dB}$ ($-30^{\circ}\text{C} \sim +60^{\circ}\text{C}$)
General Specifications	
Output return loss	14dB
Input return loss	13dB
DC Power supply	+48 V
Operating Temperature	$-30^{\circ}\text{C} \sim +60^{\circ}\text{C}$
Weather Proof Housing	100% Water proof

5.1.2. Base station sector assembly

The base station sector is assembled from the mounting part and the sector antenna part.
Bellow picture showing both components separated.



Before any assembly all nuts and bolts have to be loosen on the mounting par as shown on bellow picture.

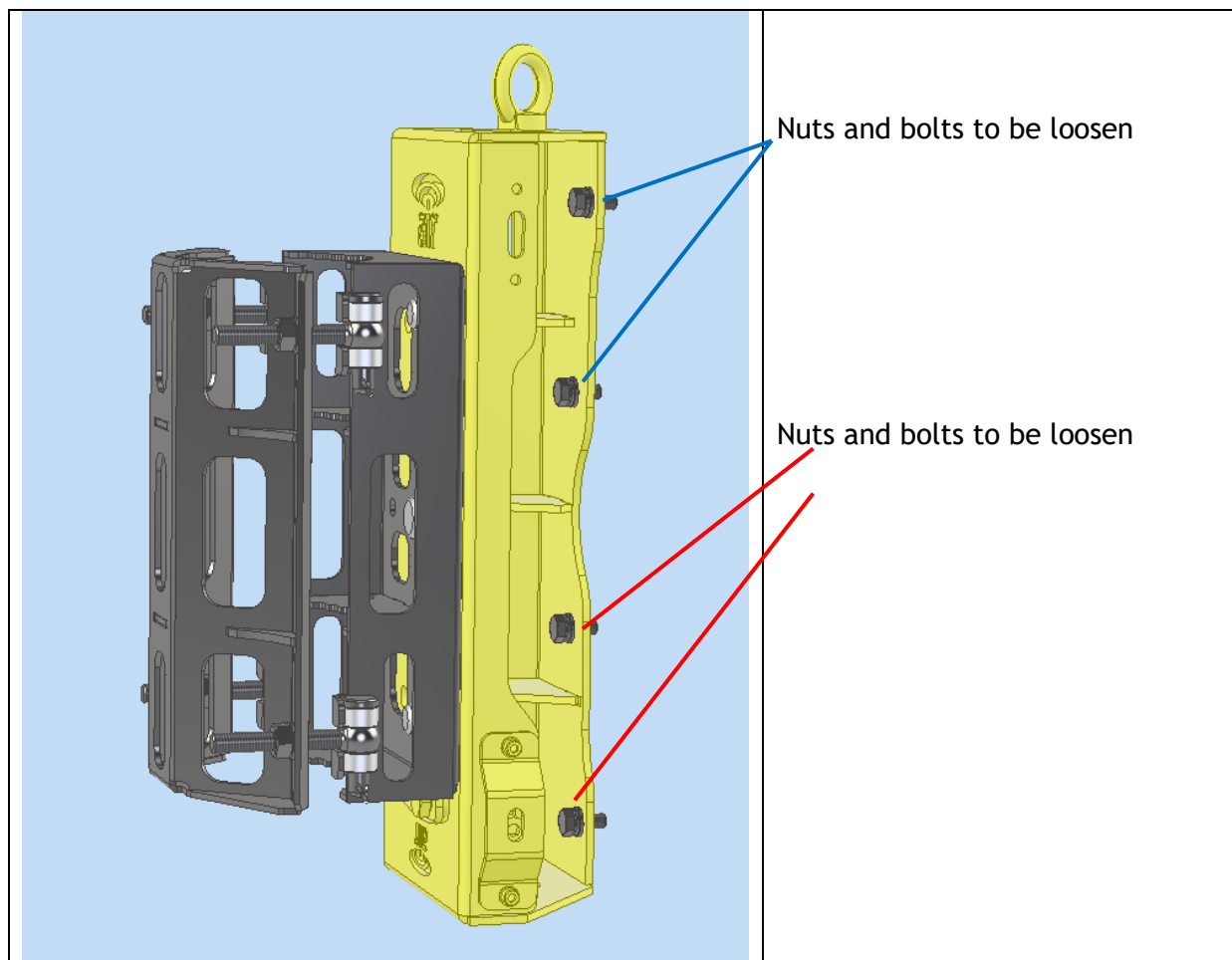


Figure 8: Mounting part in detail

We take the nut, washer and bolt from the far end of the eye cable tensioner and from the mounting part. The mounting part is than assembled to the sector antenna part as shown on bellow picture.

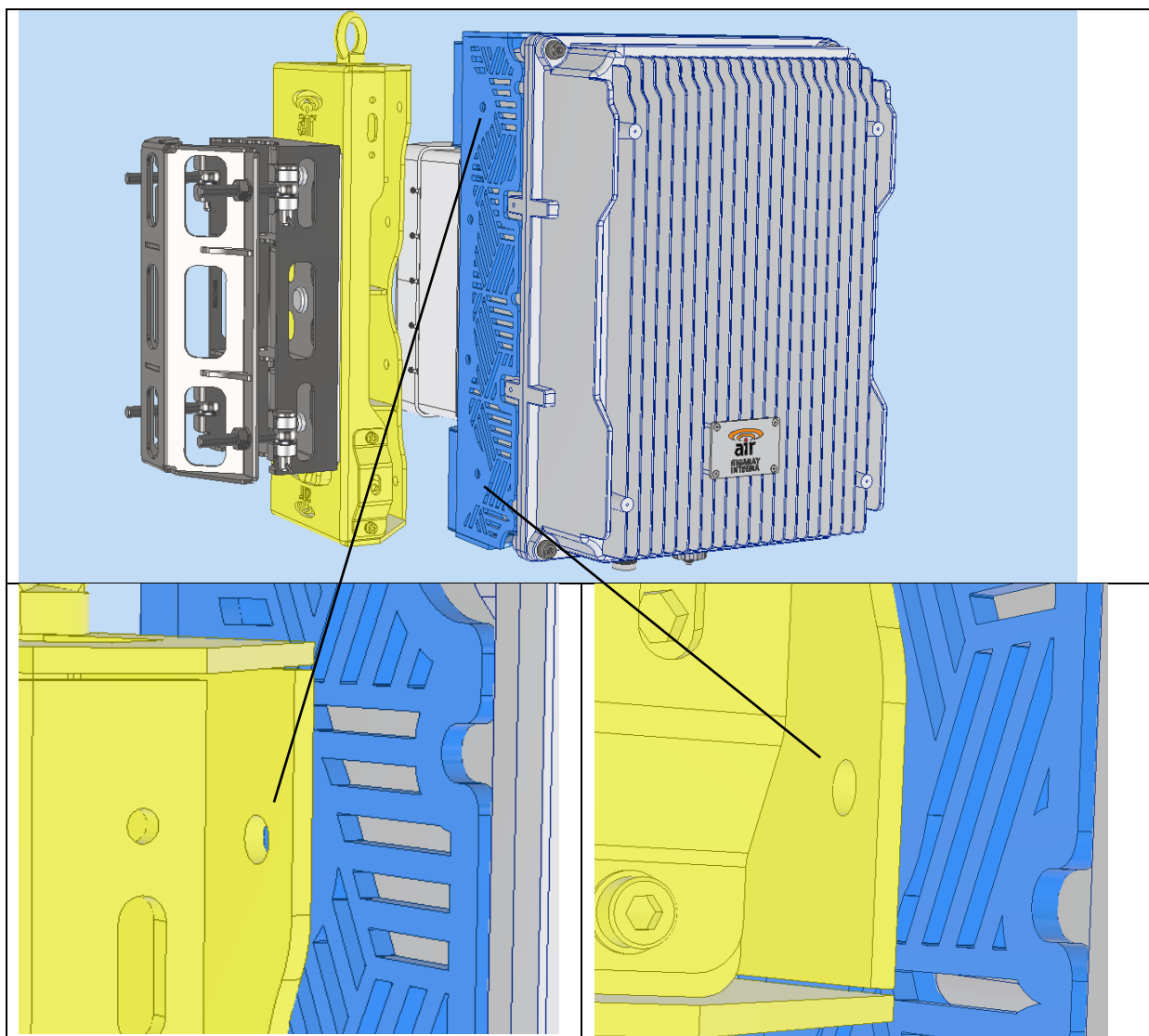


Figure 9: Assembly of sector antenna and mounting part

When the mounting part is fitted to the sector antenna we insert all the bolts, nuts, washers and begin to tighten them. How the bolts are inserted is shown on below picture. The bolt head has to be always on the outside as shown in picture.

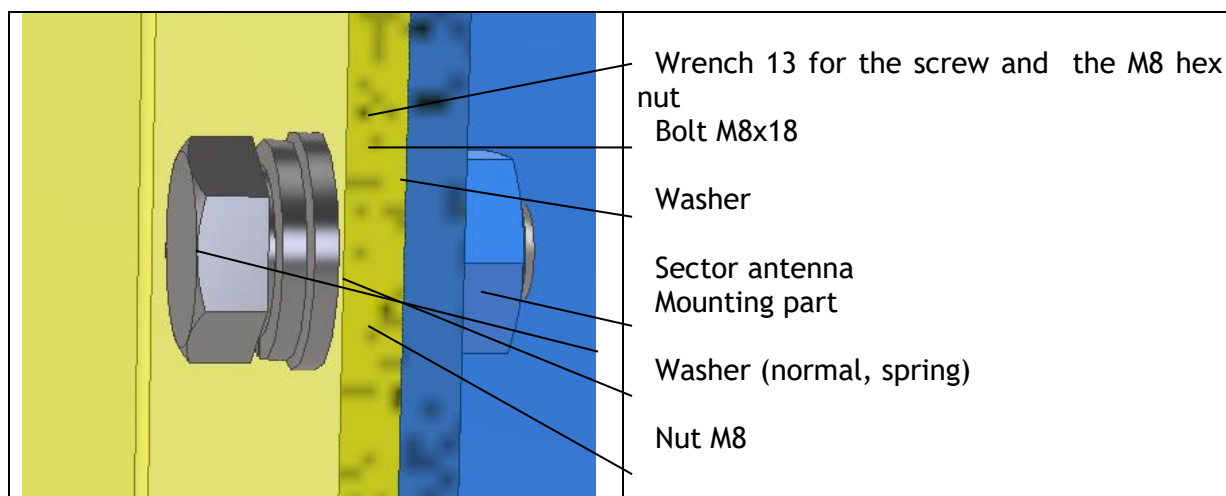


Figure 10: Bolt assembly

The eye cable tensioner is fitted to one of the holes on the sector antenna. The angle between the mounting part and the sector antenna should be app. 95°.

Now the sector antenna and mounting part are prepared to be mounted on the mounting pole. Before the actual mounting is done the metal jaws on the mounting part have to be loosened.

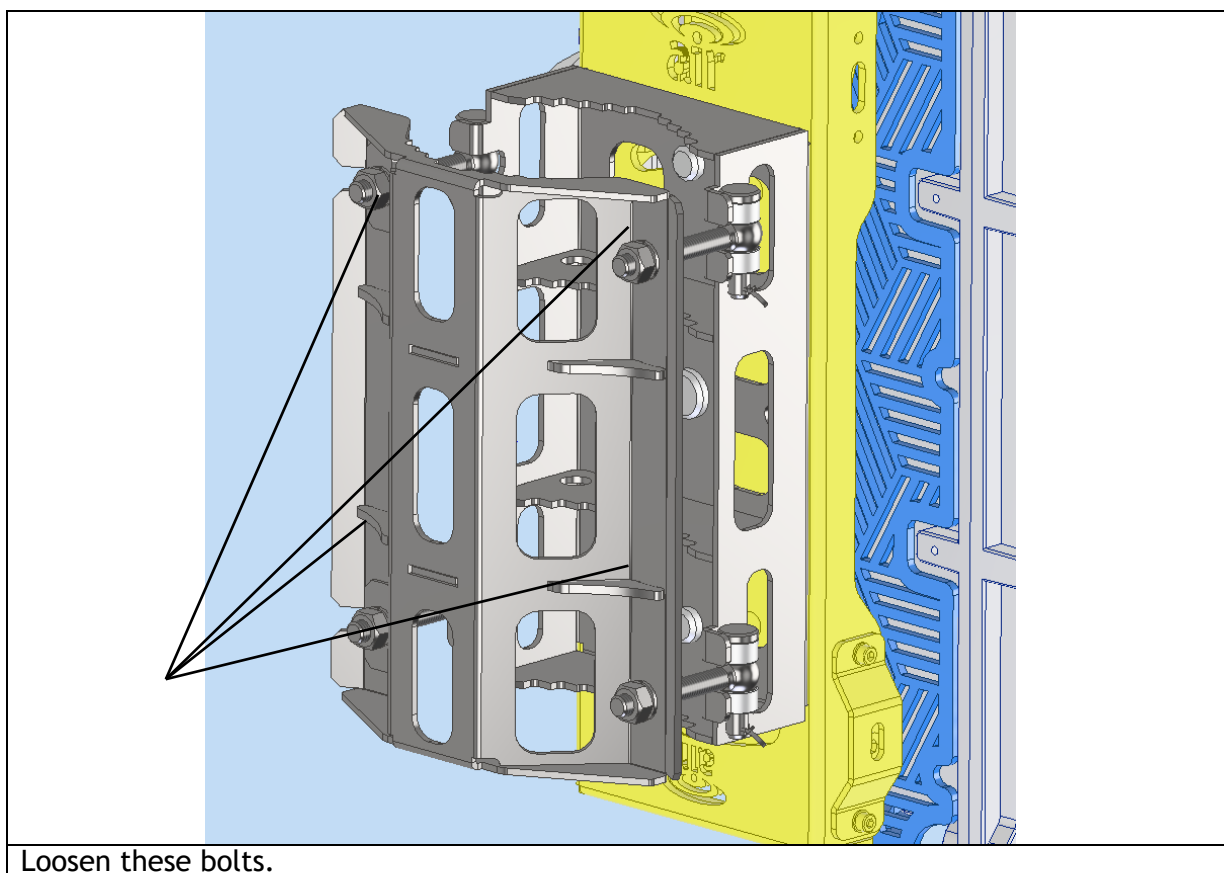


Figure 11: Metal jaws bolts

When the bolts are loosened the jaws for the mounting pole can be opened.

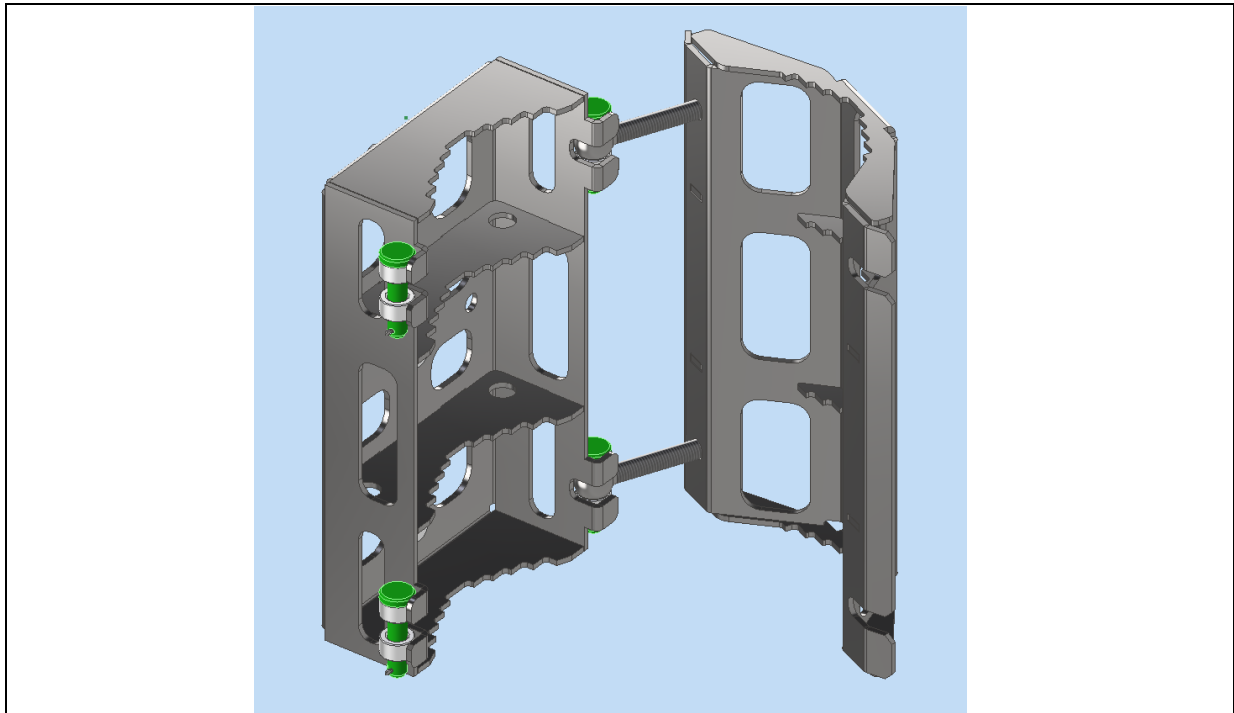


Figure 12: Metal jaws

5.2 Antenna mounting

When the sector antenna is mounted to the desired position on the pole we close the metal jaws and tighten the bolts so much that the antenna stays at the desired height. Now we align the antenna to the desired direction and tighten the bolt with app. 38 Nm strength.



Bolts tightened to allow directional positioning of the antenna.

Figure 13: Metal jaws positioned on pole

WARNING: Bolts on the metal jaws have to be tightened symmetrically the distance on both ends of the jaws has to be symmetrically!

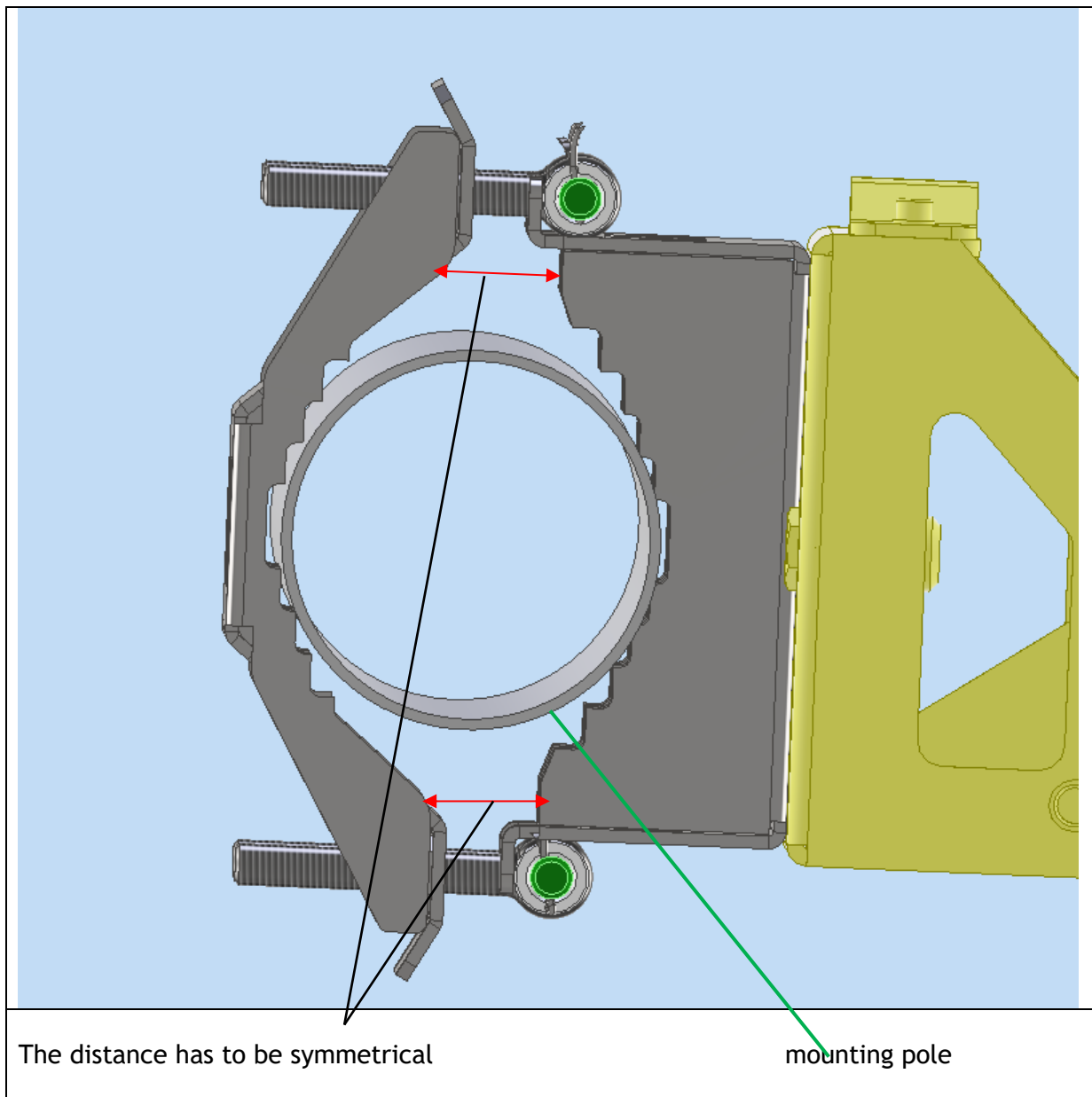


Figure 14: Distance front and back on jaws

5.3 Antenna positioning

5.3.1 Elevation antenna positioning

Step 1: loosen the nuts on the mounting part with wrench nu. 13

Step 2: loosen the nut on the lever with wrench nu. 13

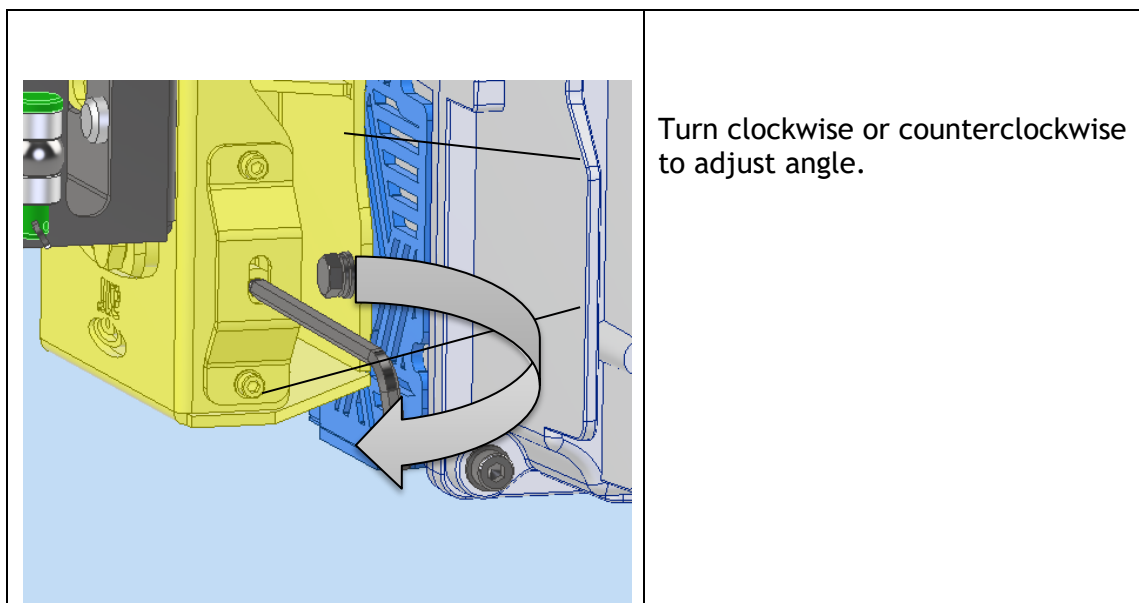


Figure 15: Positioning guide part 3

Step 3: Apply some grease. With the help of an allen wrench adjust the tilt to the desired elevation; the default angle is set to 0°.

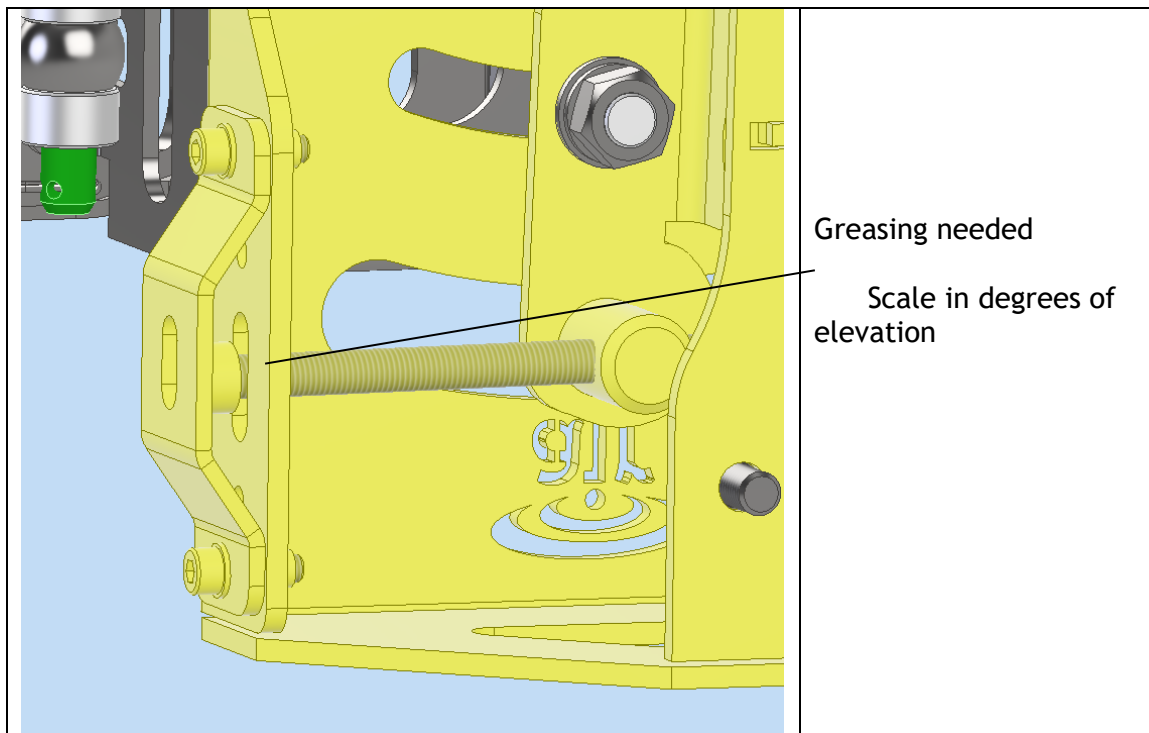


Figure 16: Positioning guide part 4

Step 4: when the tilt is set tighten the nuts marked

5.4 Connections

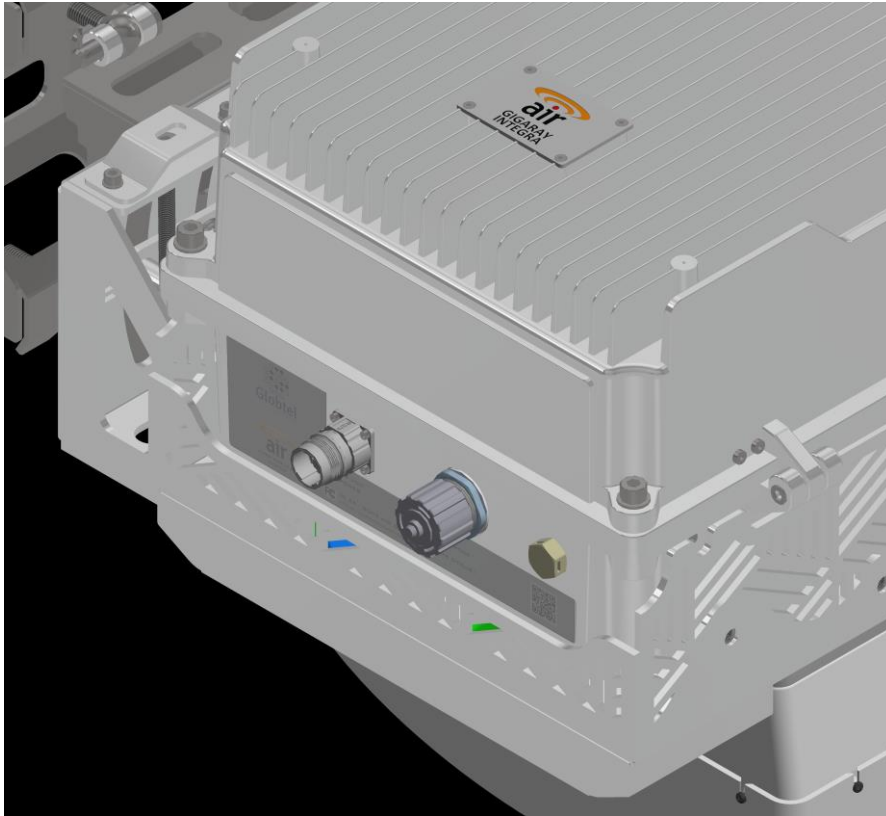


Figure 17: AIR Sector antenna

1. Power 48V DC connector (M23)
2. FO interface

5.4.1 Pre-Installation requirement summary checklist

Table 4: Pre-Installation requirements

Requirement	Verified	Date
Preparation for installation		
Verify the contents of the shipping cartons		
Verify the serial numbers of equipment		
Safety		
Equipment to be positioned in a clear, dry, dust-free area		
Grounding straps provided for ESD protection		
Power		
AC-input supply operates within range of 100-240 VAC and 47 to 63 Hz		
Uninterruptible power supply(UPS) availability		
Availability of backup power supply		
Environment		
Ambient temperature conditions satisfied		
Ambient humidity conditions satisfied		
Mounting		
Adequate access clearance to front and rear side of indoor AIR equipment		
Antenna mast availability for sector antenna		
Required tools and cables available		

5.4.2 Connecting units

Cables

An Outdoor unit is connected with data cable (fiber optic) and power supply cable. Power supply cable length should not exceed 100m.

Recommended cables:

- Power supply cable - Helukabel JZ-600 4G4 (MAX outer diameter is 14,5mm)

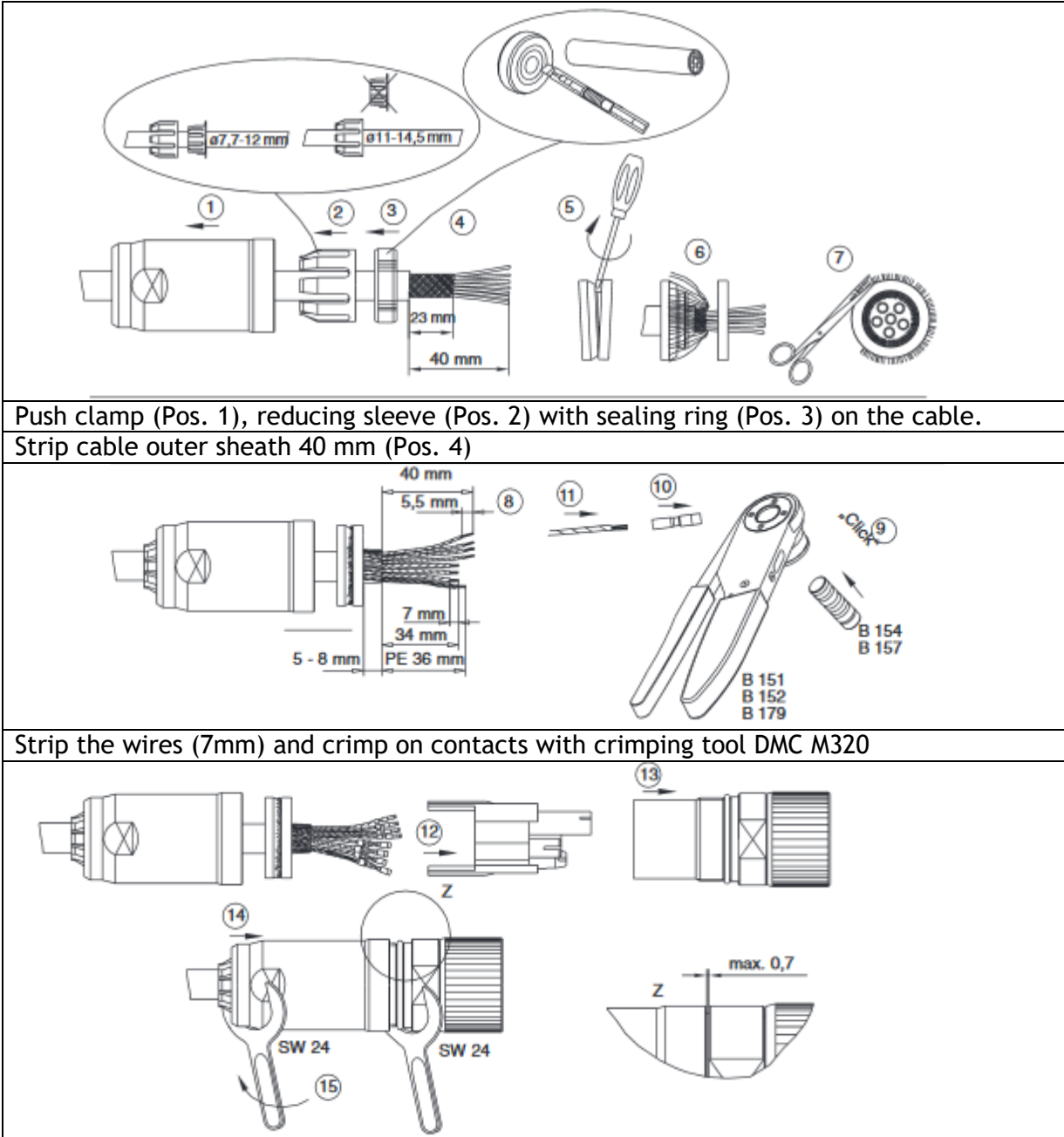
Connectors - Outdoor (Sector antenna) side

- Or fiber optic connector (LC/SC)
- Power connector M23, Male thread, 6 contacts

Tools and Equipment

- 24mm wrench
- Utility knife
- Long nose pliers
- DMC M320 crimp tool
- 19mm wrench
- Small metal saw
- Cutting pliers

5.4.3 M23 Power connector installation manual (outdoor MP side)



Push clamp (Pos. 1), reducing sleeve (Pos. 2) with sealing ring (Pos. 3) on the cable.
Strip cable outer sheath 40 mm (Pos. 4)

Strip the wires (7mm) and crimp on contacts with crimping tool DMC M320

Clip contacts laterally into the contact carrier (Pos. 12).
Insert contact support (Pos. 12) in the insert sleeve (Pos. 13).
Insert sleeve (Pos. 13) and clamp (Pos. 14) tighten until it stops. - wrench size 24mm

Figure 18: M23-connector installation manual MP

5.4.4 Power supply cable wiring scheme

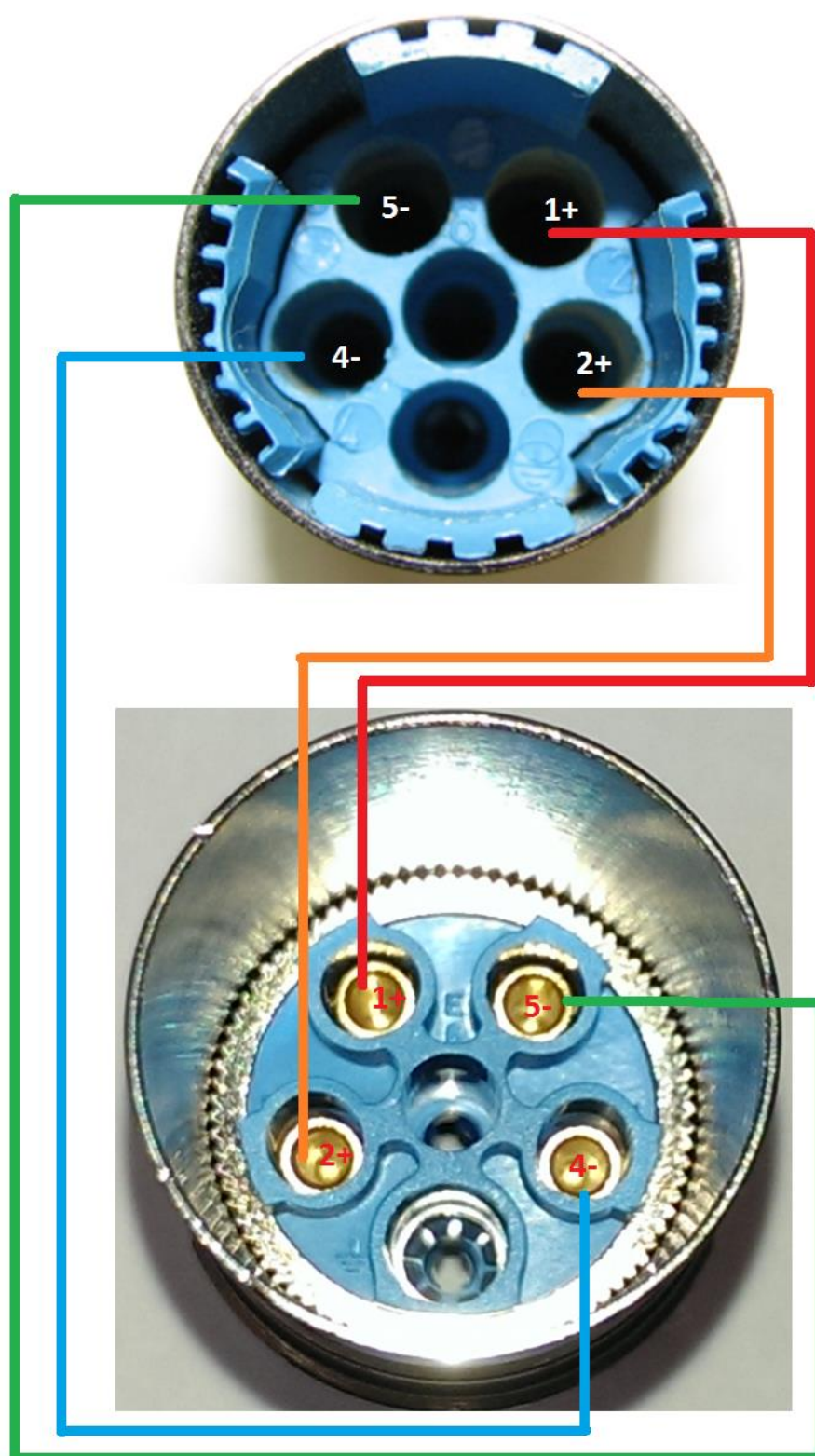


Figure 19: Power supply cable wiring

5.4.5 Recommended installation steps

Below are recommended installation steps. These are suggested steps. In practice the sequence of installation steps can be mixed.

- Mount sector antenna
- Prepare and lay cables between Power Supply unit and outdoor units
- Install connectors on power supply cables
- Power on supply
- Connect outdoor unit with input signal (fiber optic)
- Power ON Sector antenna/s
- Fine tune the RF signals
- CPE unit installation