POYNTING
BEYOND A CONNECTED LIFE

RIPPLE System Integrator Installation Manual

THIS MANUAL DESCRIBES THE INSTALLATION PROCEDURE FOR THE POYNTING GROUP (PTY) LTD.

RIPPLE ANTENNA SYSTEM

This system has been purpose designed as a high-performance LTE, 4G, and 5G antenna system aimed at router manufacturers requiring an antenna system platform; to facilitate high-speed internet and highly reliable connections in a 'near-shore' telecommunications tower.

VERSION CONTROL

Version	Date	Description of Changes	Responsible
Rev AA	09/12/2022	First Draft	Shane Mundy
Rev AB	05/01/2023	Second Draft	Savannah Taitz
Rev AG	06/06/2023	Final Draft for review	Pieter Prinsloo Savannah Taitz
Rev 1.0	06/06/2023	First Revision for Publication	Pieter Prinsloo Beth Komu
Rev 1.1	08/06/2023	Second Revision for Publication	Ernst Coetzee Savannah Taitz

Prepared by: R&D – Technical Support Engineer, Poynting Antenna.

Head Office
Johannesburg
A: Unit 4, N1 Industrial Park, Landmarks Ave, Samrand, 0157, South Africa
P: PO Box 76579, Wendywood, 2144, South Africa
T: +27 12 657 0050 | **E:** info@poynting.tech

Poynting Group (Pty) Ltd
Registration Number: 2014/239013/07

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RIPPLE SYSTEM INTEGRATION

1. BEFORE THE INSTALLATION

1.1. SELECTING THE ANTENNA INSTALLATION SITE

The RIPPLE consists of a cluster of ultra-wideband, omni-directional antennas, which provides a near-perfect 360° radiation pattern. A 'Radiation Pattern' defines an antenna's ability to effectively transmit or receive radio signals within the three-dimensional area. The measured radiation patterns of the RIPPLE are provided in the technical document.

An ideal vertical polarised, omni-directional antenna will have a 360° radiation pattern on the horizon. While an ideal horizontal polarised, omni-directional antenna will have a 360° radiation pattern perpendicular to the horizon. The RIPPLE antenna system offers a combination of vertically and horizontally polarised antennas. This implies that the installation site of the antenna should have limited obstacles in the line-of-sight of the antenna system.

Any substantial structure between the shore-based towers and the RIPPLE will cause degradation of the signal. Therefore, the installation site of the RIPPLE should be chosen accordingly to minimize blockage caused by the structures on the vessel.

It is advised that the RIPPLE antenna system be mounted high enough to minimize the effects of surrounding structures. Large, solid, structures will cause significant signal loss while wire rope stays, lifelines, small-diameter handrails, and other accessories may cause little to no noticeable loss.

Horizontal Radiation Pattern (or Azimuth) - The RIPPLE has an excellent horizontal, also known as 'Azimuth' radiation pattern that will ensure near-perfect reception from 360° around the vessel, provided that the area 'around' the Antenna System is clear of obstacles.

Vertical Radiation Pattern (or Elevation) – The RIPPLE also has an excellent vertical radiation pattern, also known as the 'Elevation' radiation pattern. The RIPPLE has an approximate vertical beamwidth of 60° at the lower frequencies, which means 30° below the 'horizon' and 30° above the 'horizon'. Where the 'horizon' is the 0° 'line-of-sight' of the antenna pointing on the horizon. The antenna elevation should be unobstructed as far as possible.

This 'vertical aperture' is important to counteract any 'Pitch-and Roll' of the vessel that would result in loss of transmission- or reception of the signal.

Obstacles - Most metal structures potentially attenuate (degrade) the radio signal that is being transmitted from or received by the RIPPLE. Examples of solid objects are masts, exhaust funnels, other antennas, etc.

Close proximity to RADAR - Do not install the antenna near the Vessel's RADAR, especially on the same horizontal plane. The electromagnetic energy from the RADAR may negatively affect the Signal-to-Noise Ratio (SNR) of the routers installed in the RIPPLE.

It is recommended to position the antenna at least 4 feet (1.2 m) above or below the level of the RADAR Antenna and a minimum of 15 feet (4.6 m) away from the high-power short-wave radars.

The S-Band RADAR operates at frequencies between 2.9 to 3.1 GHz. Since the RIPPLE is designed to be an ultrawide bandwidth antenna, it can receive signals in the frequency range from 617 to 6000 MHz. SNR protection for the above S-Band frequencies can only be offered by the filters in the router's transceiver. It is therefore prudent to provide as much physical separation as possible between the radiation envelope of the RADAR and that of the RIPPLE.

Rigid Mounting Position - The mounting platform should be rigid enough and not be subjected to excessive vibration. The movement of the antenna can be minimized by installing it at the centre of the vessel. If these conditions can only be partially satisfied, it is preferred to find the best-compromised installation site between the various considerations.

Ideal Height of Installation - Since the Router/s installed in the RIPPLE will be communicating with shore-based telecommunication towers, it would be advantageous to install the RIPPLE as high as possible on the Vessel relative to the waterline. Typical positions will be on a spreader, +4 feet (1.2m) above the RADAR dome.

If both X-Band and S-Band RADAR systems are installed it would typically be worthwhile to install them above the X-Band RADAR. In most cases, it will be mounted higher as it is the smaller Radome of S-Band and X-Band RADAR antennas.

1.2. SAFE ACCESS FROM RADIATION HAZARD

Passive System – The RIPPLE antenna system consists of passive radiating elements, which are designed to radiate in specific frequency bands. Therefore, the system does not produce radiation that can be dangerous to any lifeform.

Effective Isotropic Radiated Power (EIRP) – This is a term used to describe the amount of power that is radiated by an antenna in a specific direction. Antennas are designed to radiate their output power in a specific direction, that is either omni-directional or uni-directional radiation. Therefore, antennas increase the concentration of electromagnetic waves that the human cells would be exposed to.

Although this is taken into consideration when the maximum RF Power output of a router is specified in the FCC (Federal Communications Commission) specifications. It is recommended that 'Radiation Warning Signs' be placed in strategic locations when there is a possibility that personnel or passengers on a vessel could come into close contact with the RIPPLE Antenna System.

Router Transmitter Radio Frequency Output Power – Cellular (LTE/4G, 5G) router specifications are governed by regulations stated by a variety of standards in various countries like FCC in the USA and ETSI in Europe. The standards ensure that the radiated power from the router is limited to prevent exposure to electromagnetic waves.

In this instance, we are concerned with the RF power output of the router/s transmitter/s installed in the RIPPLE. Radio Frequencies in the range from 3 kHz to 300 GHz are regarded as the 'Radio Frequency Spectrum'. The main safety concern as far as RF radiated Power is concerned, is to protect people from being exposed to too high levels of Electromagnetic

(Radio) Waves that could cause damage to cells in their bodies and lead to illness due to this radiation.

All Routers installed in the RIPPLE should conform to international standards limiting the RF radiation presented by the RIPPLE antenna. The majority of cellular (LTE/4G, 5G) routers are class 3 devices that are limited to a maximum output power of 23dBm (200mW), while some class 3 routers are allowed to transmit 26dBm (400mW) at higher frequencies. The integrator/ installer need not be concerned by the maximum output power of the routers, as the main concern is to only install routers that are certified by the various standard bodies, i.e., FCC, ETSI, etc.

Mounting position promotes safety – Apart from the router transmission power being restricted by the above-mentioned regulations. Mounting the RIPPLE as high as possible and away from structures will also provide additional safety to any personnel or passengers on the vessel. As they will not be in close proximity to the RIPPLE antenna system, therefore, reducing the possibility of exposure to electromagnetic waves.

The following Website from the FCC provides more information:
https://www.fcc.gov/engineering-technology/electromagnetic-compatibility-division/radio-frequency-safety/faq/rf-safety#Q2

High-Performance System – Whilst the above recommendations are set out to ensure optimal performance and a safe environment. Care should be taken with the installation and positioning of the RIPPLE. The RIPPLE consists of vertically and horizontally polarised omni-directional antennas to provide the best possible MIMO performance for the routers installed. It has been tested to give exceptional performance and outperforms any standard omni-directional antenna that has been tested.

The RIPPLE has been tested and evaluated in field trials, off the coast of Cape Town in South Africa, which delivered excellent performance in challenging circumstances and environments.

Thank you for your purchase. We would love to get feedback on your installation; we are eager to hear your comments and we are ready to provide you with support during and after your installation.

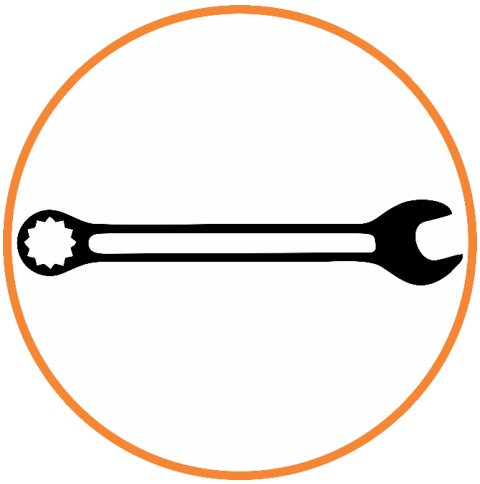
2. TOOLS INCLUDED IN KIT

ALLEN KEY: 4mm & 5mm

NOTE: HEX SOCKET KIT PROVIDED

2.1. REQUIRED TOOLS

SIDE CUTTER; UTILITY KNIFE; SCISSORS.



SPANNER: 10mm & 13mm

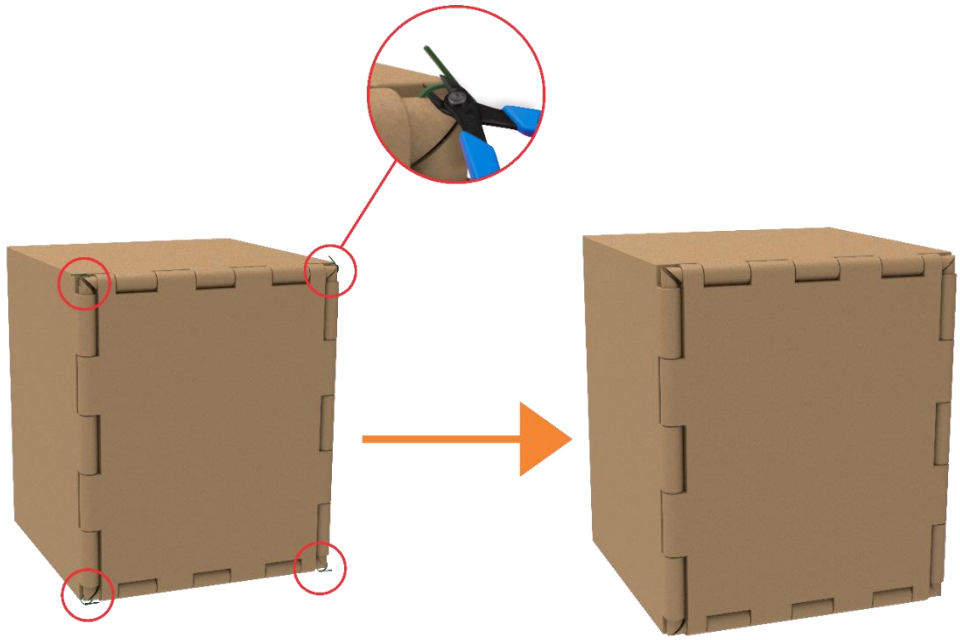
3. ANTENNA INSTALLATION

The method of installation and mounting of the antenna may vary with vessel design but the following procedures are applicable in most situations and will result in a secure and effective installation.

3.1. UNPACKING THE BOX STEP-BY-STEP

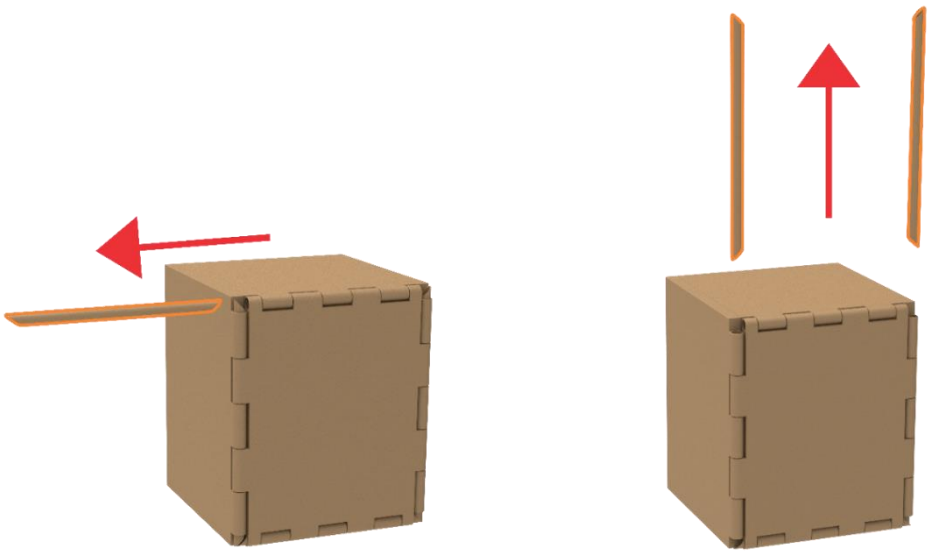
Step 1.

Remove all four cable ties by cutting them off the rods.



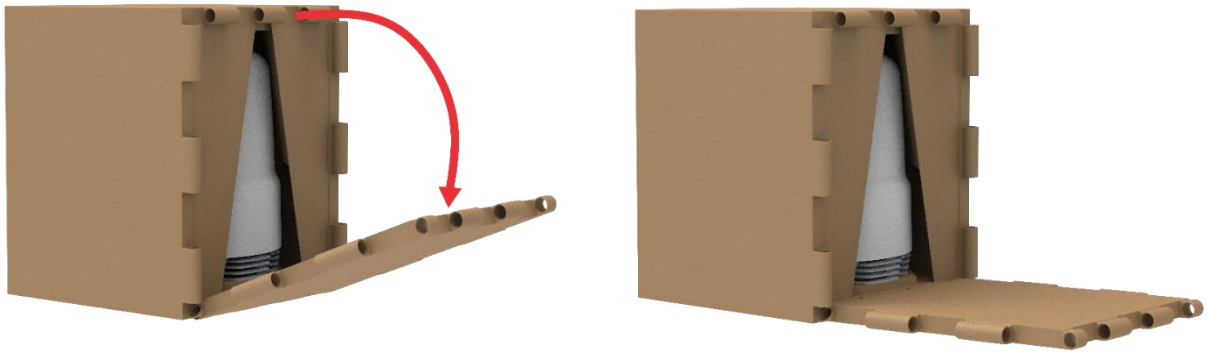
Step 2.

Remove the top rod; then proceed to remove the left and right-side rods as shown below.
NOTE: Do not remove the base rod.



Step 3.

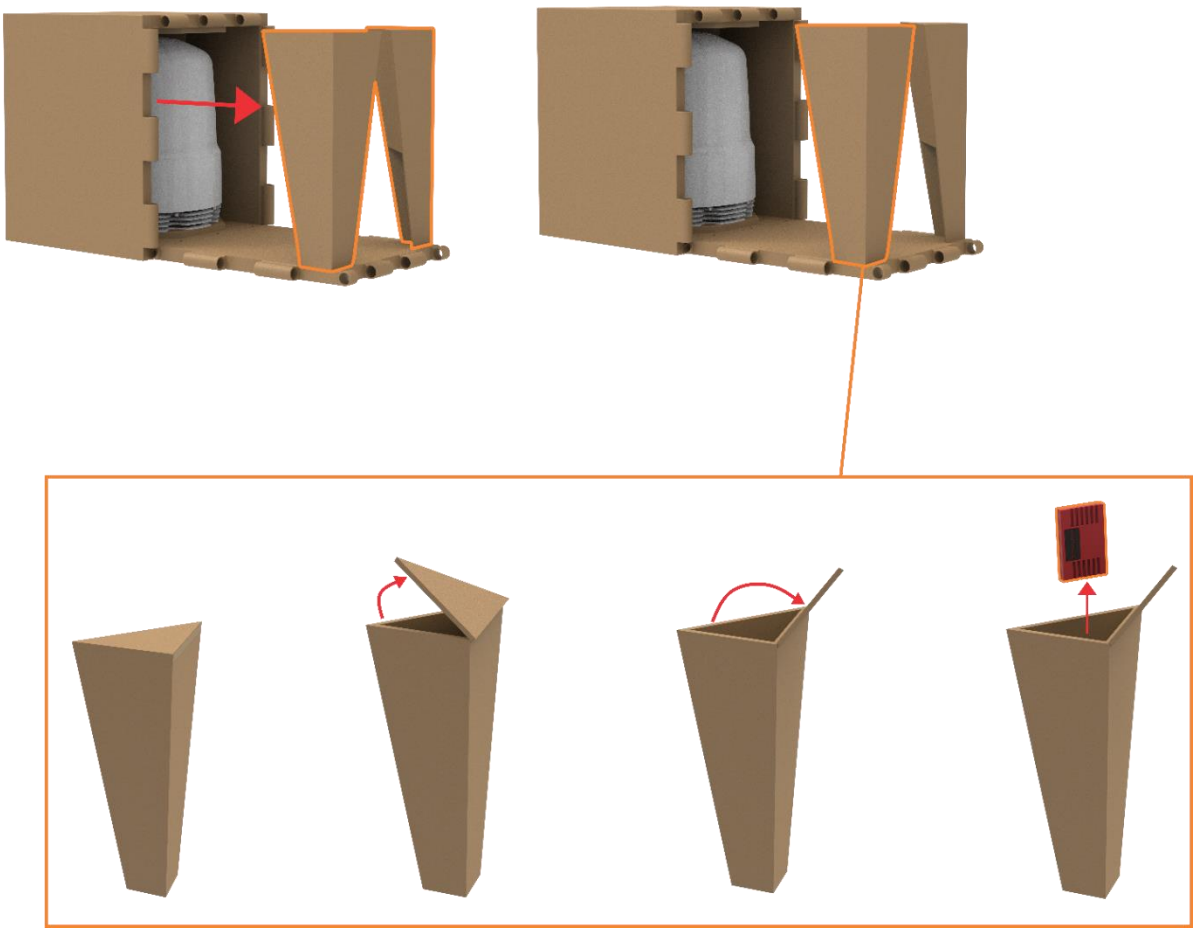
Open the front flap of the box by gently pulling it down from the top; as shown below:



Step 4.

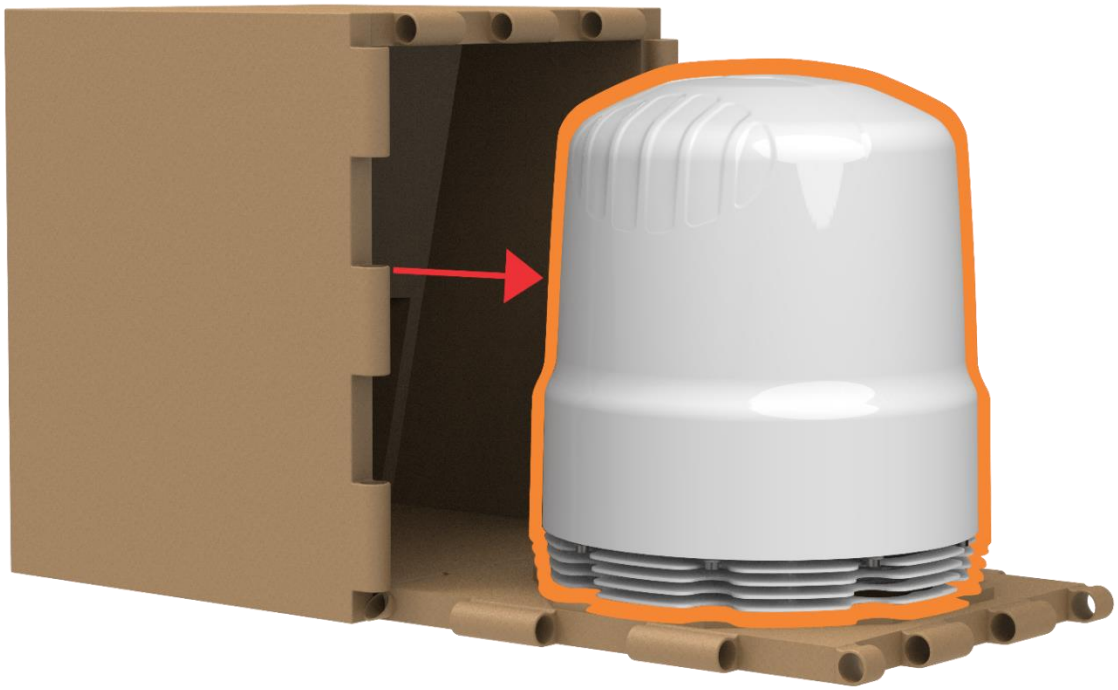
4.1. Pull the side supports towards you, pulling them out of the packaging.

4.2. The Left side support will have a sticker saying, "Open here". Pull the lid of the side support up to open it; then proceed to take out your hex socket tool gift box; as shown below:



Step 5.

Slide the RIPL Antenna out of the box as shown below:

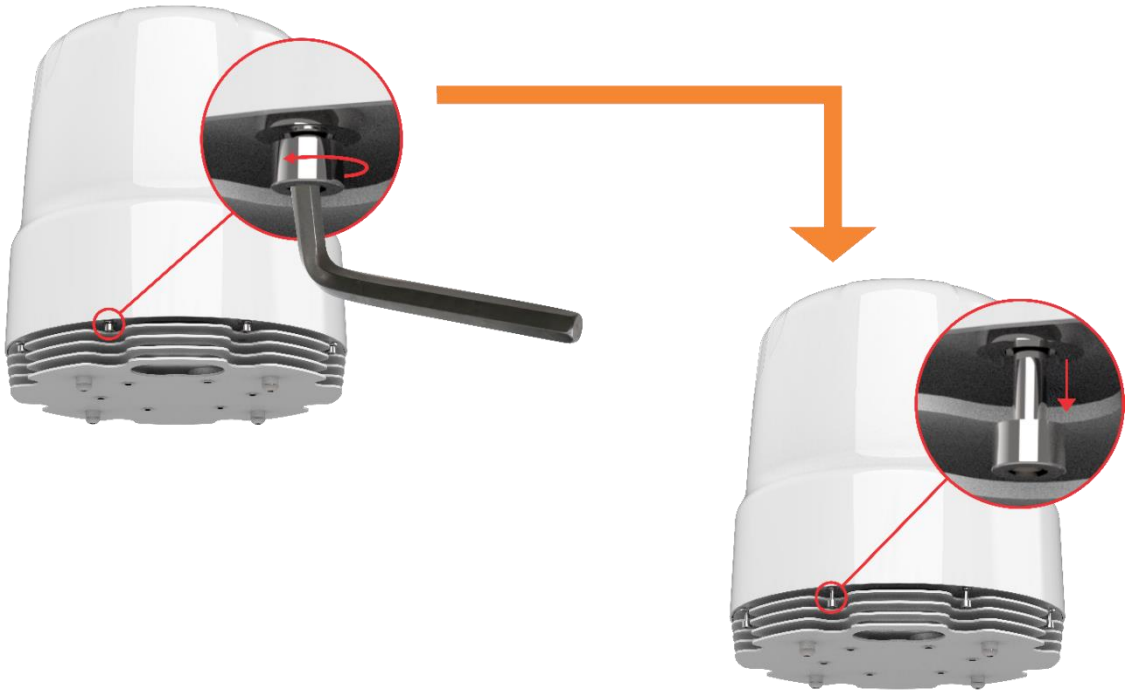


4. OPENING THE ANTENNA AND REMOVING THE RADOME

Step 1.

Orientate the antenna so that the alignment notches are facing in your direction. Then inspect the fastening holes from the angle below. See the next image.

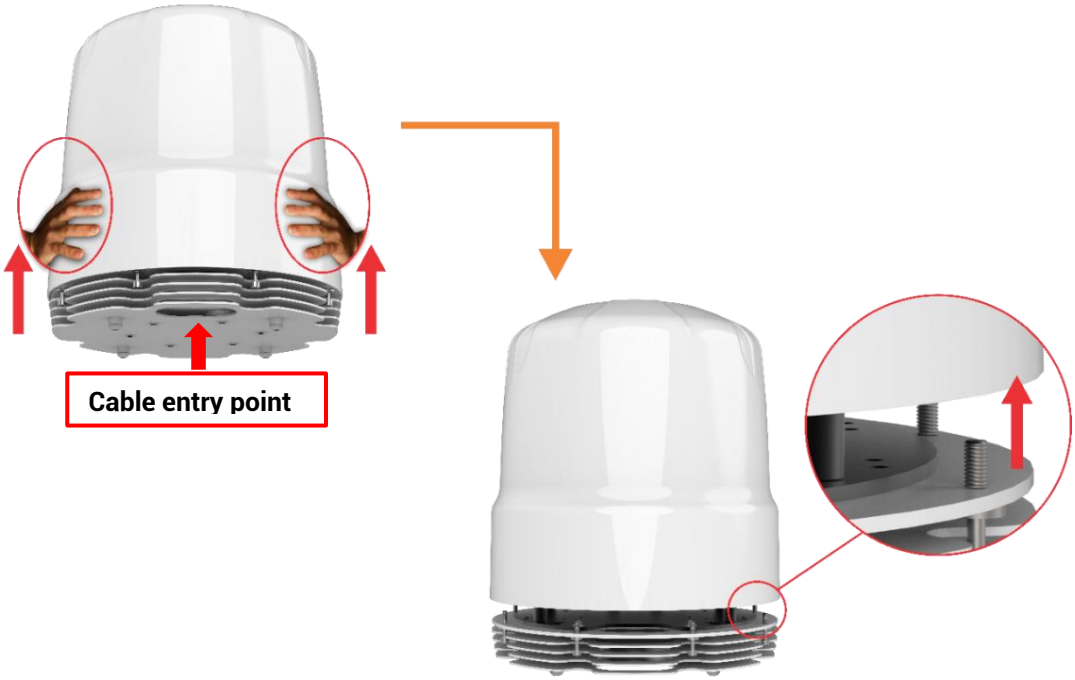
Step 2.



Using the 5mm Allen/hex key in the provided tool kit and unscrew the M8 cap screws. The Cap screws are captive screws and only need to be unscrewed till it drops loose into the cavity below. Continue to the next step.

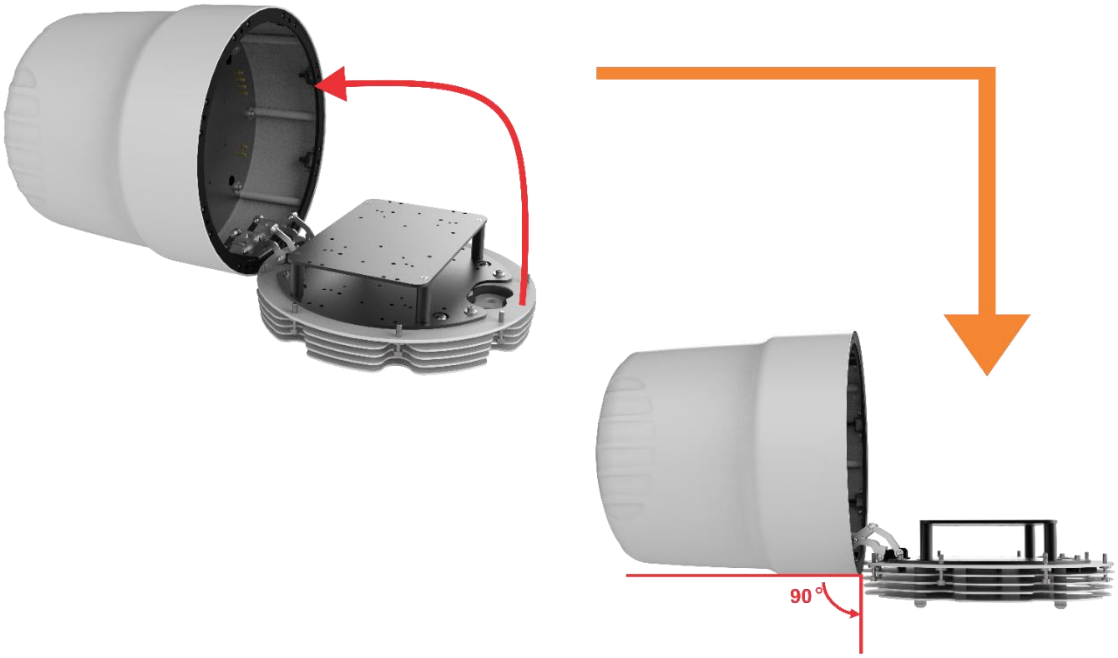
Step 3.

Locate the cable entry point in the base; the Radome hinge is on the opposite side; the Radome rotates in the opposite direction from where the cable entry point is located.
Placing both hands on either side of the Radome, pull it upwards until it releases.
Please look at the image below and continue to the next step.



Step 4.

While lifting Radome upwards push it backwards until it reaches a 90° angle. Please look at the image below and continue to the next step.



5. FITTING THE ROUTERS INSIDE THE RIPPLE

Step 1.

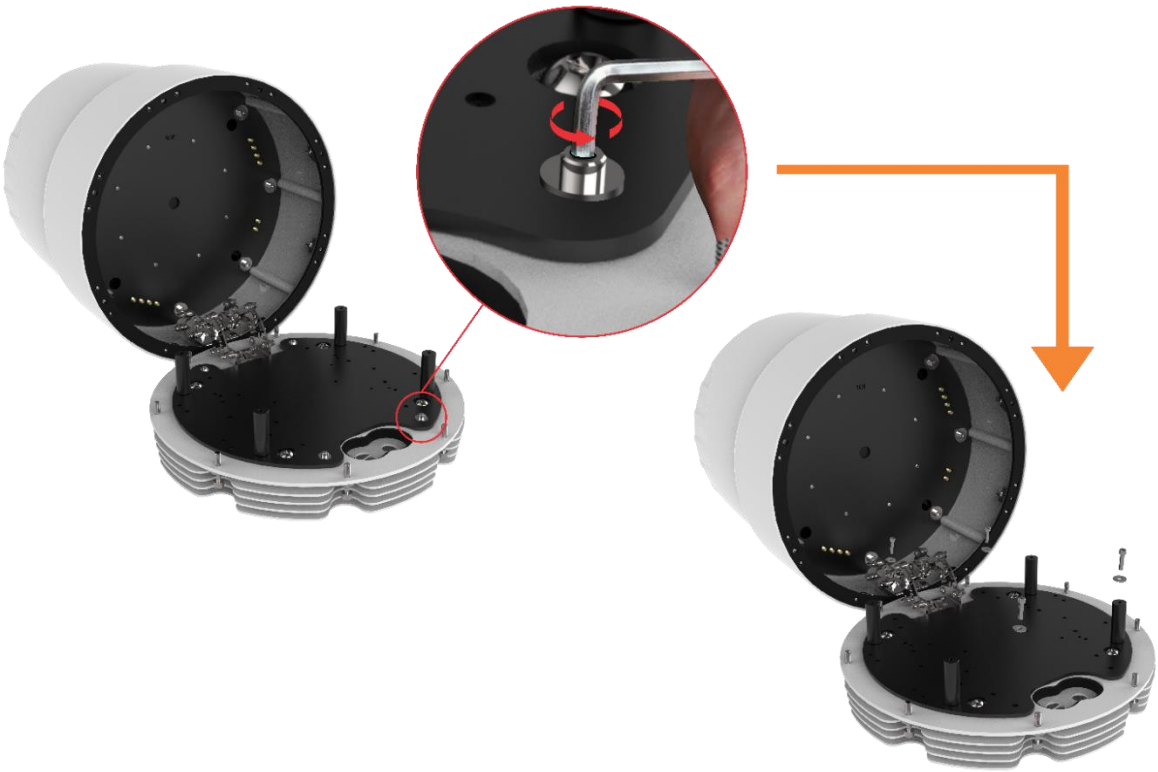
Use the 4mm Allen key to loosen the M6 countersunk screws in the mounting plate as shown below:

Step 2.

Remove the loosened M6 countersunk screws; then proceed to remove the mounting plate as shown below:

Step 3.

Loosen the M6 cap screws using a 4mm Allen key from the main router plate; proceed to remove the loosened M6 cap screws and M6 flat washers as shown below:



Step 4.

Remove the main router plate with the pillars from the heatsink as shown below:

Note: main router plate is now ready for routers to be mounted onto it.

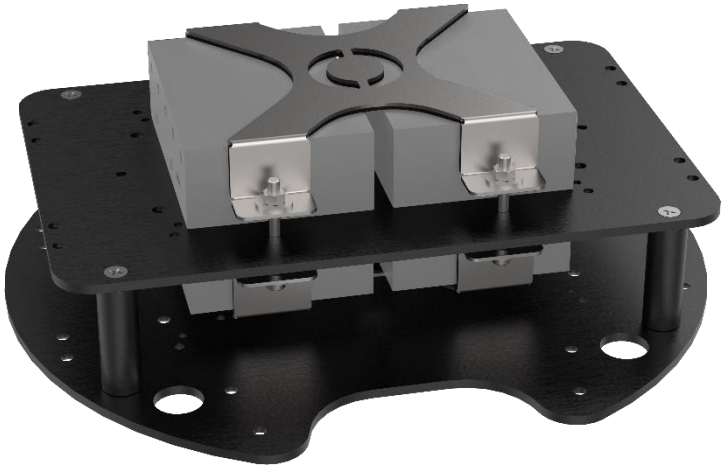
6. RECOMMENDED ROUTER BRACKET MOUNTS FOR RIPPLE

Dimensions [w x h x d]

6.1. A-BRKT-071-V1-01

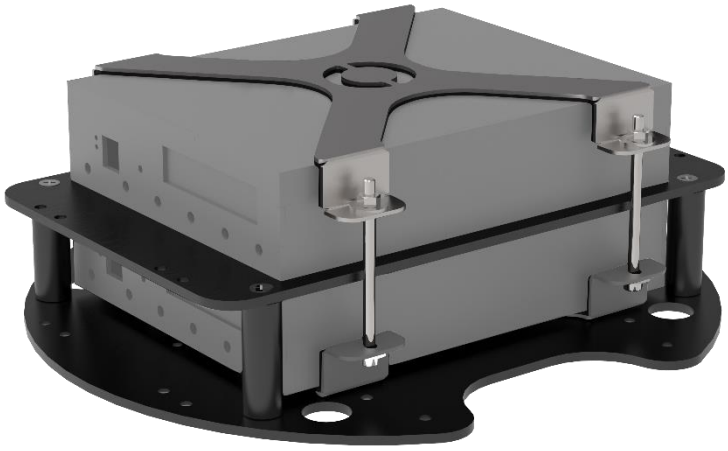
FITS 4 x ROUTERS WITH DIMENSIONS OF: 95.1mm x 44.2mm x 132mm

FITS 2 x ROUTERS WITH DIMENSIONS OF: 190.2mm x 44.2mm x 132mm



6.2. A-BRKT-072-V1-01

FITS 2 x ROUTERS WITH DIMENSIONS OF: 200mm x 55mm x 280mm



6.3. A-BRKT-073-V1-01

FITS 1 x ROUTERS WITH DIMENSIONS OF: 177mm x 43mm x 292mm

7. CONNECTOR LAYOUT INSIDE THE ANTENNA

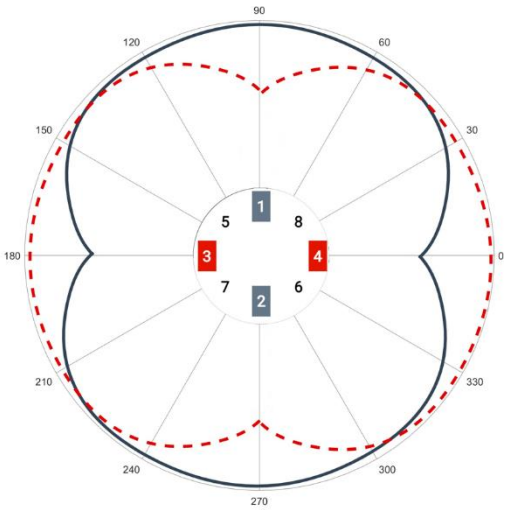
7.1. ANTENNA CONFIGURATION

The verticals (V) are the medium to high gain OMNI antennas. The horizontals (H) are the low-gain OMNI antennas.

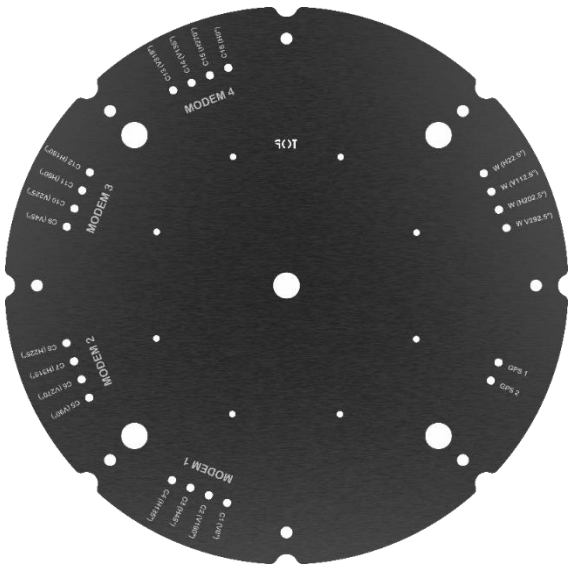
Step 1.

Please study the following pictures to decide how to do cable management for routers installed.

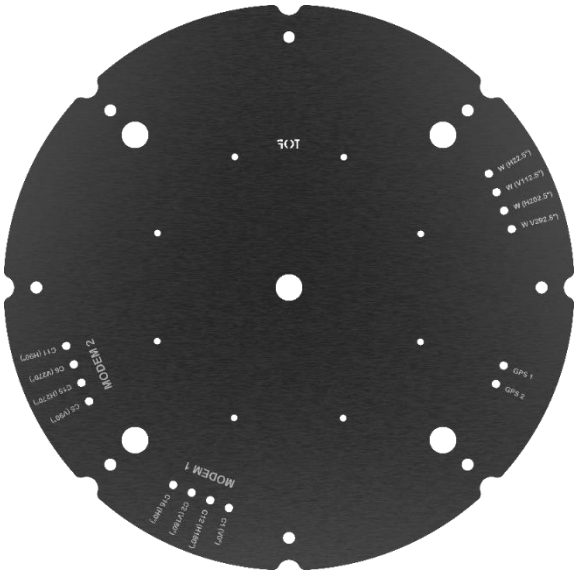
1. RIPPLE-0016 Configuration: This configuration connects: 4 x (4x4) Routers (see Page 16) to
   - 8x Vertical Dipoles
   - 8x Horizontal Dipoles.
2. RIPPLE-0008 Configuration: This configuration connects 2x (4x4) Routers (see Page 17) to
   - 4x Vertical Dipoles
   - 4x Horizontal Dipoles.
3. Attach Wi-Fi and GPS Antennas as per Diagram (see Page 18)



RIPPLE-0016

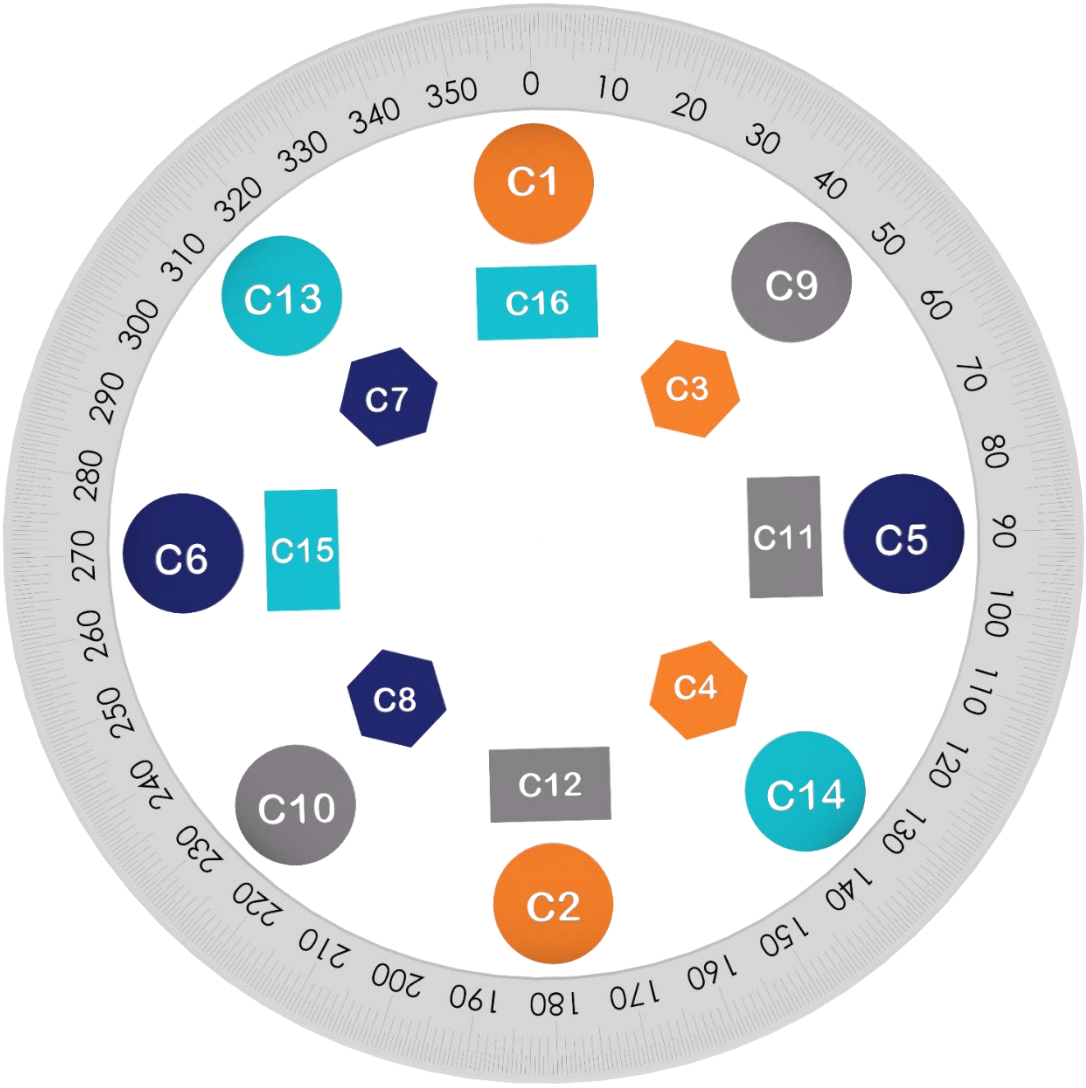


RIPPLE-0008



See Pages 20 and 21 for detail.

7.2. A-RIPL-0016-V1-01 LTE/5G ANTENNA STRUCTURE

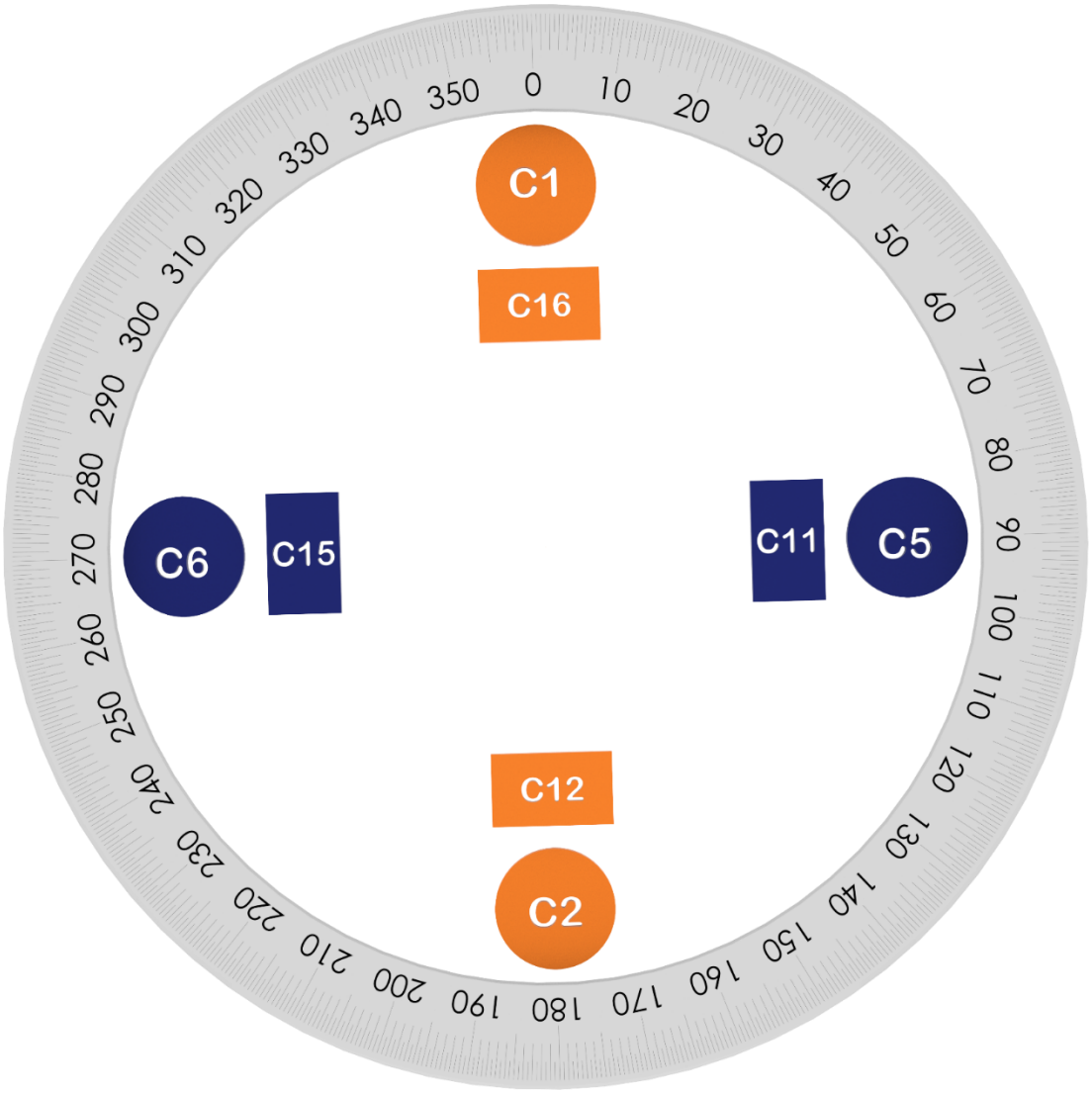


Connecting 4x (4x4) Routers to RIPPLE-0016 (A-RIPL-0016-V1-01)

MODEM 1			MODEM 2			MODEM 3			MODEM 4		
C1	VERTICAL	0°	C5	VERTICAL	90°	C9	VERTICAL	45°	C13	VERTICAL	315°
C2	VERTICAL	180°	C6	VERTICAL	270°	C10	VERTICAL	225°	C14	VERTICAL	135°
C3	HORIZONTAL	45°	C7	HORIZONTAL	315°	C11	HORIZONTAL	90°	C15	HORIZONTAL	270°
C4	HORIZONTAL	135°	C8	HORIZONTAL	225°	C12	HORIZONTAL	180°	C16	HORIZONTAL	0°

Please refer to page 20 which details the Router connections to the RIPPLE-0016 base plate.

7.3. A-RIPL-0008-V1-01 LTE/5G ANTENNA STRUCTURE

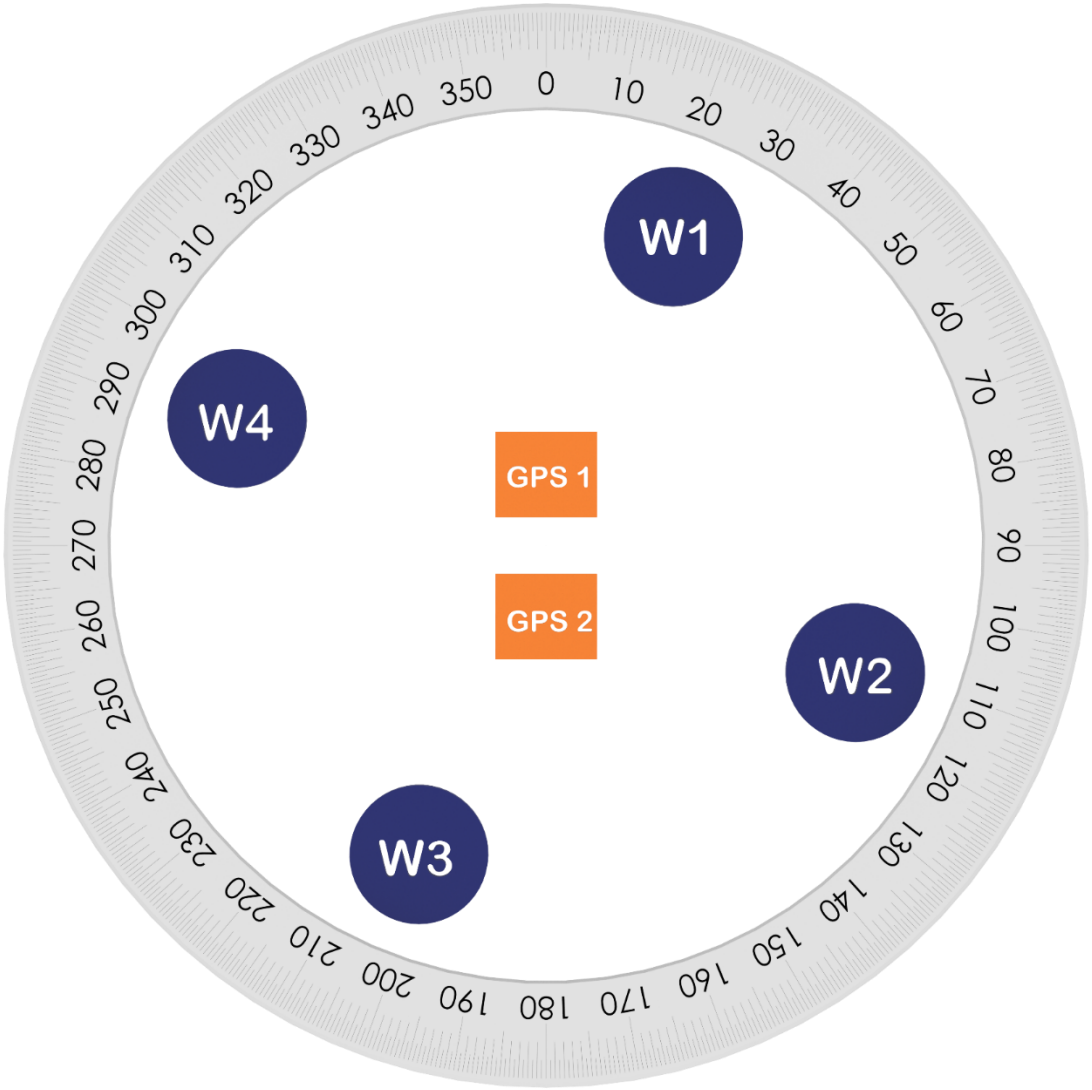


Connecting 2x (4x4) Routers to RIPPLE (A-RIPL-0008-V1-01)

MODEM 1			MODEM 2		
C1	VERTICAL	0°	C5	VERTICAL	90°
C2	VERTICAL	180°	C6	VERTICAL	270°
C12	HORIZONTAL	180°	C11	HORIZONTAL	90°
C16	HORIZONTAL	0°	C15	HORIZONTAL	270°

Please refer to page 21 which details the router connections to the RIPPLE-0008 base plate.

7.4. A-RIPL-0008/0016-V1-01 GPS/WIFI ANTENNA STRUCTURE



Connecting 4x Wi-Fi Antennas and 2x GPS Antennas
RIPPLE (A-RIPL-0008-V1-01) and (A-RIPL-0016-V1-01)

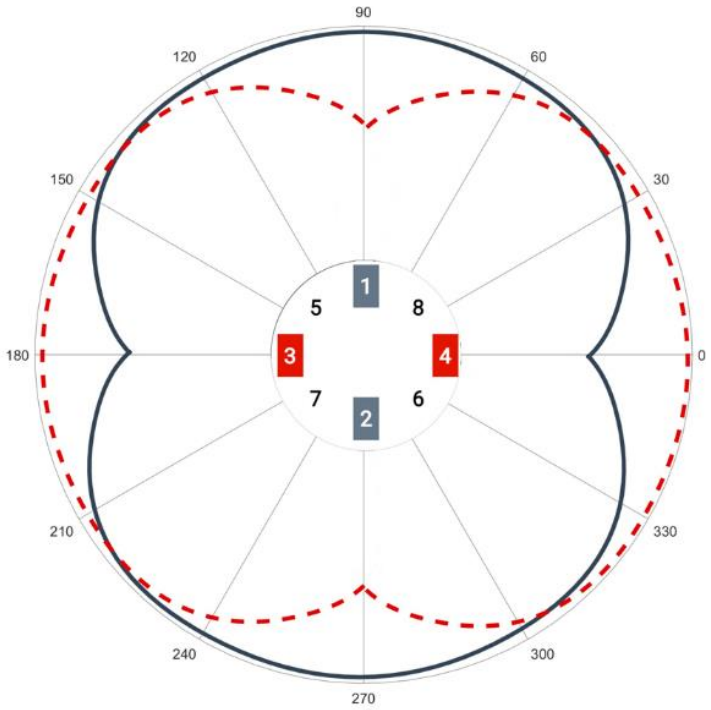
GPS			WIFI		
GPS 1	VERTICAL	0°	W1	HORIZONTAL	22,5°
GPS 2	HORIZONTAL	180°	W2	VERTICAL	112,5°
			W3	HORIZONTAL	202,5°
			W4	VERTICAL	292,5°

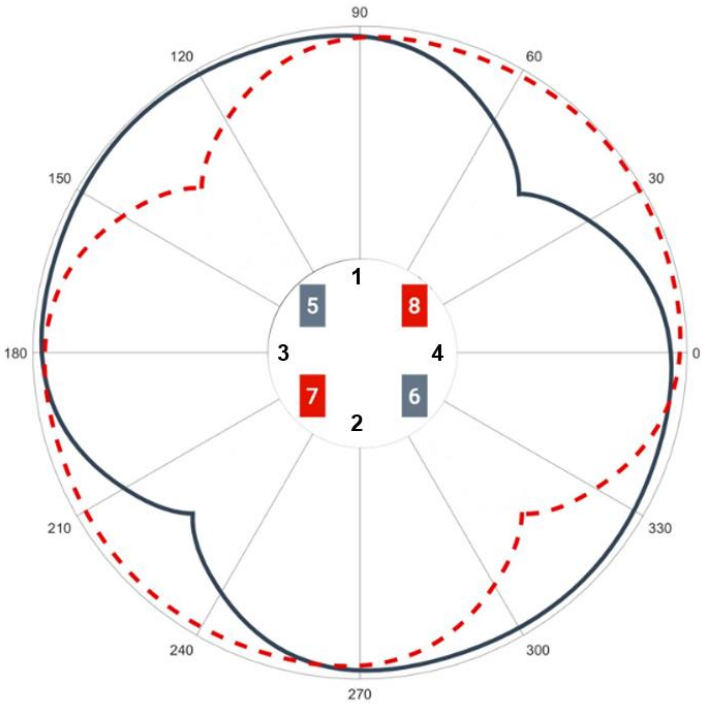
Please refer to page 20 or 21 which details the router connections to the RIPPLE-0008 or RIPPLE-0016 base plate, depending on the Model being deployed.

8. RF CABLE CONNECTION

Radio Frequency Bulkhead Connections: Pages 20 and 21 detail the layout of the RF connections to the different Antenna elements. Following the recommendation to mount the RIPPLE as high as possible above the waterline, possibly on one of the Mast telecommunication equipment extensions.

The diagram directly below details the composite radiation pattern direction (not the actual pattern).

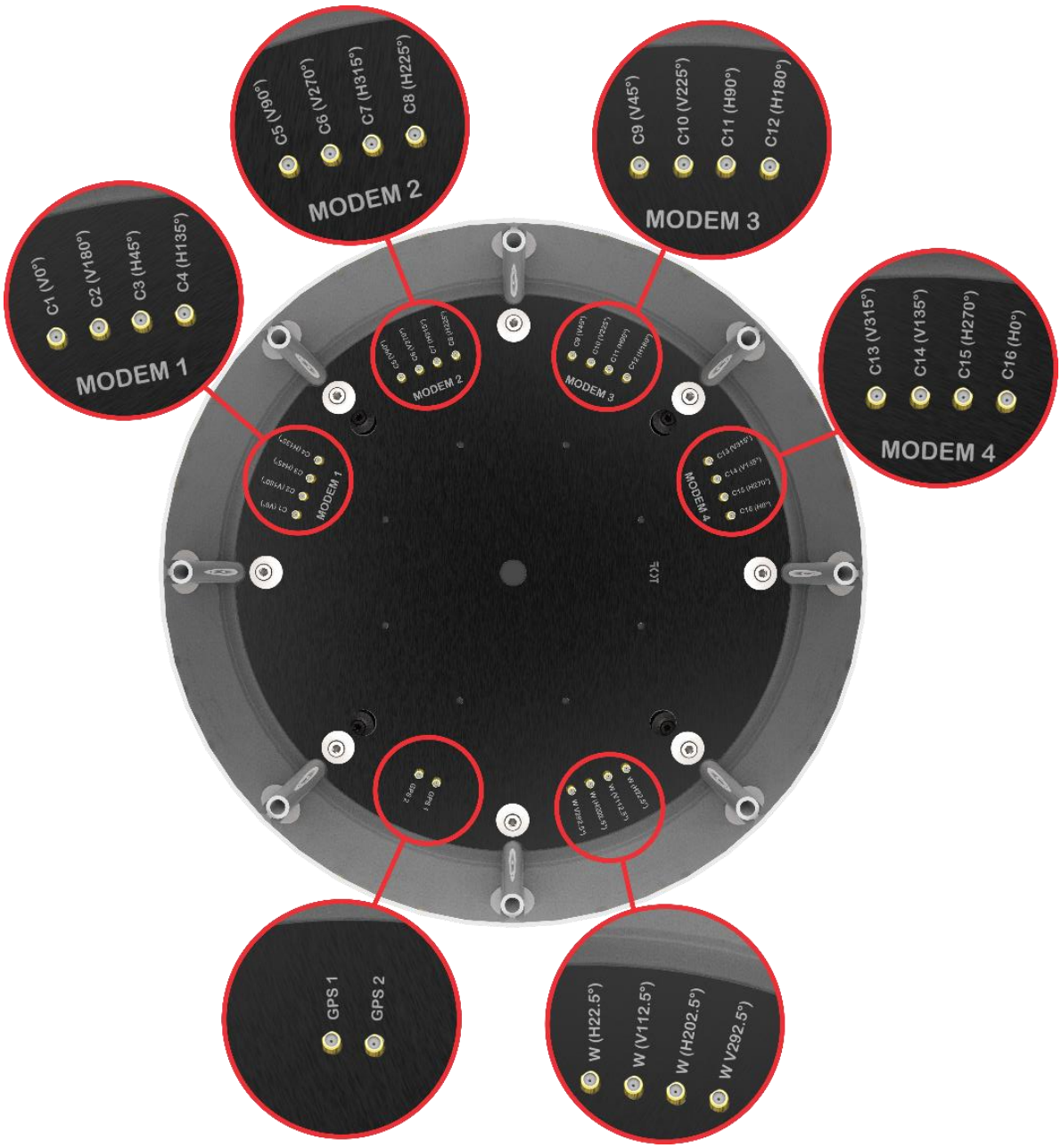




The overlay below details the connector positions and their connected Antenna radiation direction.

8.1. A-RIPL-0016-V1-01

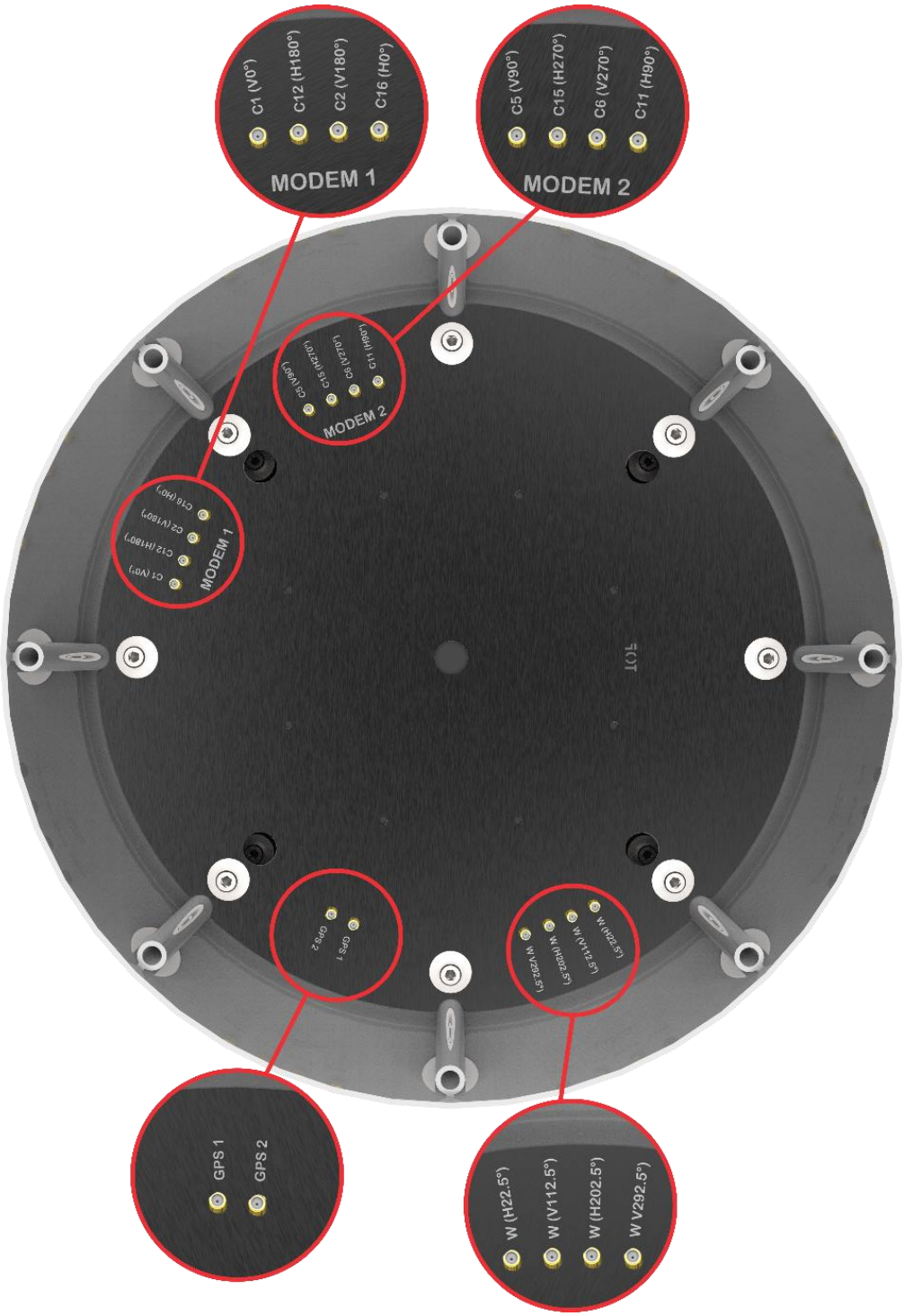
NOTE: TURN THE PAGE HORIZONTALLY TO VIEW



The overlay below details the connector positions and their connected Antenna radiation direction.

8.2. A-RIPL-0008-V1-01

NOTE: TURN THE PAGE HORIZONTALLY TO VIEW

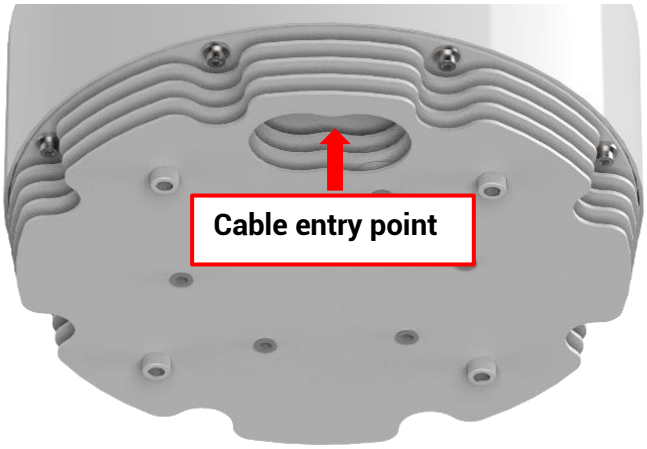


9. ETHERNET AND POWER CABLES

Tilt the base upwards and locate the cable entry point as shown below.

Carefully route the Ethernet- and Power Cable through the compression glands provided.

Route the cables with adequate slack to reach the different points where they should connect.



10. REPLACING THE ASSEMBLED ROUTER ASSEMBLY

Replace and fasten the M6 cap screws holding the router assembly in place.

11. CONNECTING THE RF, ETHERNET AND POWER CABLES

Before closing the Radome connect the RF Cables as per the Diagram on Pages 20 and 21.

Connect the Ethernet Cable to the appropriate Router Ports.

Connect the Power Cable as required.

12. CLOSING THE RIPPLE

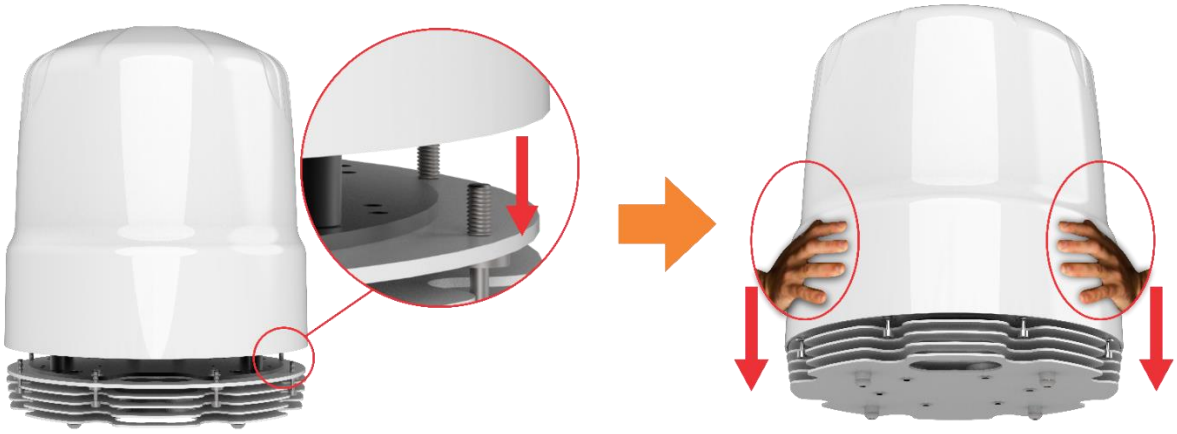
Assembled router(s) in RIPPLE.

Step 1.

Pull the Radome forward as shown below:

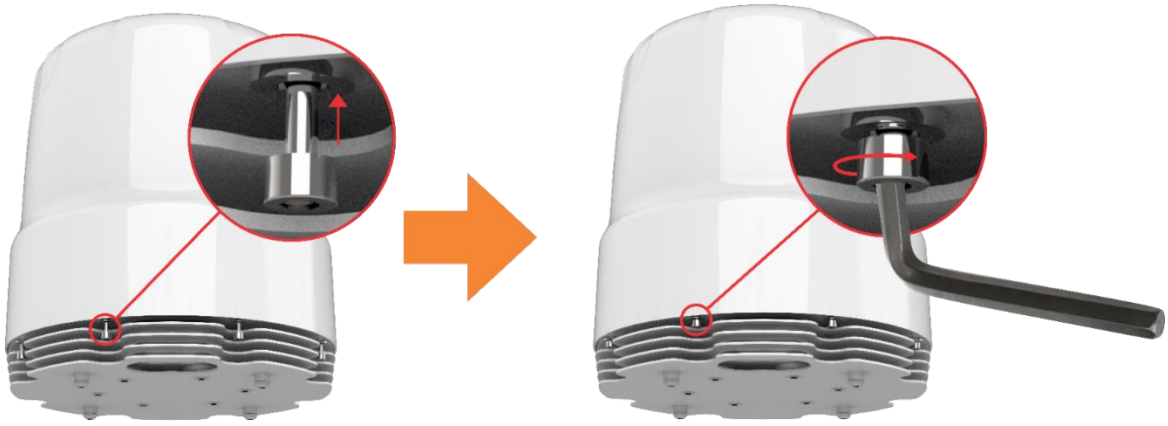
Step 2.

Ensure the Radome aligns with the heatsink base; proceed to push the Radome downwards as shown below:



Step 3.

Push the M8 captive screws upwards and fasten them using the 5mm Allen key as shown below:

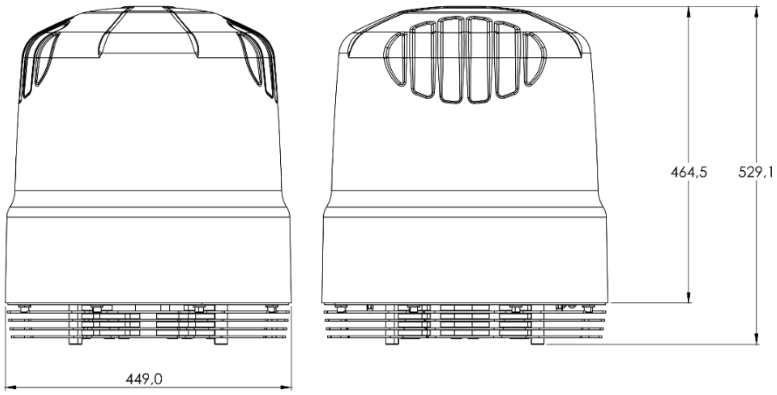


Step 4.

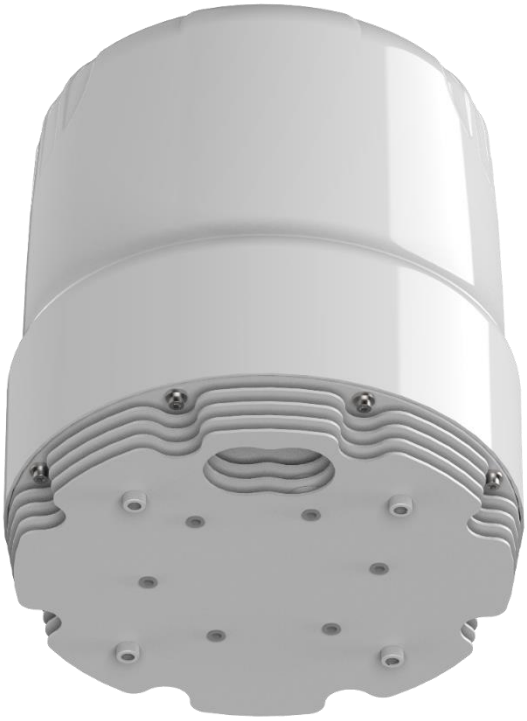
The closing process is now complete.

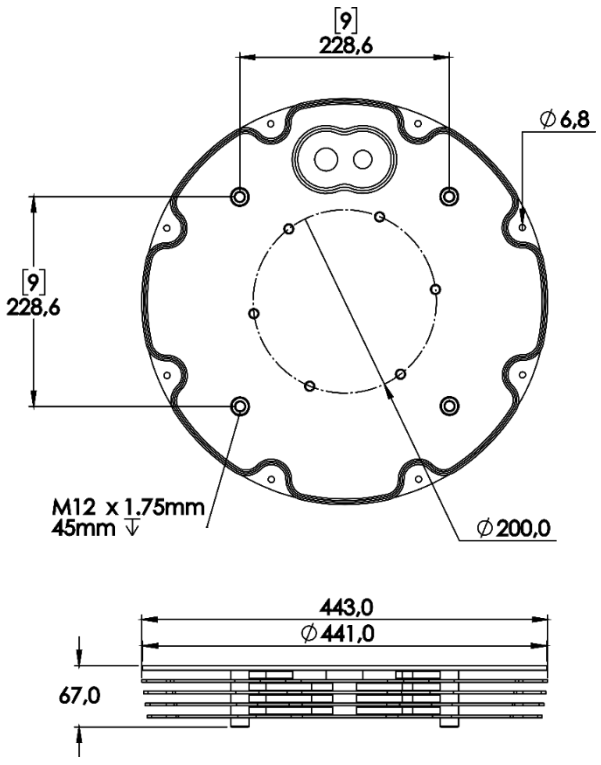
13. ANTENNA MOUNTING TEMPLATES

OVERVIEW



MOUNTING HOLES





*** 9" (228.6mm) apart**

14. MOUNTING THE ANTENNA

Mounting RIPPLE: Following the recommendation to mount the RIPPLE as high as possible above the waterline, possibly on one of the Mast telecommunication equipment extensions. Page 24 details the mounting hole positions for this option.

15. EXTERNAL CABLES TO THE RIPPLE

During the site survey, walk the path where the cables will be installed. Pay particular attention to how cables will be installed, such as what obstacles they will be routed around, difficulties that will be encountered and the overall length of the cables.

The RIPPLE should be installed using good electrical practice. Poynting recommends referring to IEC 60092-352 for specific guidance in choosing cables and installing cables onboard a Vessel.

Within these guidelines, Poynting will provide some very general information regarding the electrical installation.

In general, all cables shall be protected from chaffing and secured to a cableway. The cables which run on an open deck or down a mast should be in a metal conduit suitable for marine use. The conduit shall be blown through with dry air prior to passing the cable to ensure all debris has been cleared out of the conduit and again after passing the cable to ensure no trapped moisture exists.

The ends of the conduit shall be sealed with cable glands (preferred), mastic or low VOC silicon sealant after the cables have been passed through. Cables passing through bulkheads or decks shall be routed through approved weather-tight glands.

16. GROUNDING AND RF PROTECTION

All metal parts of the RIPPLE should be grounded to bare metal that is common to the hull of the vessel. This is commonly accomplished by attaching a ground wire/cable from the upper base plate ground point to a ground stud on the mounting mast near the base of the radome.

Preservation of the bare metal contact point should be done to prevent loss of ground due to rust and/or corrosion.

Grounding by exposing bare metal under all mounting bolts of the underside of the radome base prior to final tightening does NOT provide adequate grounding to the RIPPLE.

Grounding should be ensured throughout the entire mounting to the hull. While it is presumed the installation surface is permanently bonded and grounded to the hull, in cases where the installation point and hull are of different materials a check of an independent ground bonding strap should be made.

Masts should be confirmed to be grounded to the deckhouse and/or hull.

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17. INSTALLATION CHECK

The RIPPLE antenna system provides excellent radio frequency reception capabilities to enhance the near-shore communication capabilities of marine routers.
Installing the router/s in the cavity provided therefore is left to the Integrator to decide how to best integrate the routers and ancillary network communication equipment.

18. AFTER-SALE

This way we are securing the system integrator's future business a bit and we can almost be certain that the system integrator will be a trained partner for RIPPLE.

- Warranty Policy
- Maintenance and Service
- Troubleshooting
- Spare Parts

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