Datasheet

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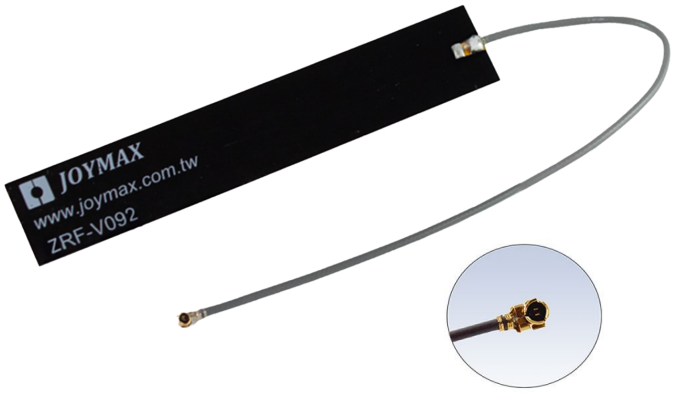
ZRF-V092cc3B

5G Cellular Adhesive PCB antenna

The Joymax ZRF-V092cc3B series antenna is an adhesive mount, rigid print circuit board (PCB) dipole antenna designed for use in 5G New Radio FR1, LTE, and Cellular IoT (LTE-M, NB-IoT) applications with broad bandwidth coverage from 617 MHz to 7125 MHz. The antenna also supports CBRS (3550 MHz to 3700MHz), Public Safety (4940 MHz to 4990 MHz), and a growing number of C-band (3700 to 4200MHz) applications.

The dipole antennas provide a ground plane independent internal/embedded antenna solution to easily mount in RF transparent (e.g. plastic) enclosures, enabling environmental sealing and for protection from antenna damage. Connection is made to the radio via a coaxial cable terminated in an MHF plug connector.



Features

- Bandwidth 617 MHz to 7125 MHz
- Performance at 617 MHz to 698 MHz
  - VSWR: ≤ 2.9
  - Peak Gain: 0.9dBi
  - Efficiency: 33%
- Omnidirectional radiation
- Ground independence dipole design
- Adhesive backing permanently adheres to non-metallic enclosure/chassis using 3M 467MP

Applications

- 5G NR FR1, 4G, 3G, 2G
- Cellular IoT: LTE-M (Cat-M1), NB-IoT
- CBRS Private Network (3550 to 3700MHz)
- C-Band applications (3700 to 4200MHz)
- Public Safety networks (4940 to 4990MHz)
- Internet of Things (IoT) devices
- Gateways

Ordering Information

Part Number	Cable Diameter	Cable Length	Connector
ZRF-V092MP3B-W006	1.13 mm	60 mm	U.FL-Type / MHF1 Plug
ZRF-V092MP3B-W012	1.13 mm	120 mm	U.FL-Type / MHF1 Plug
ZRF-V092MP3B-W018	1.13 mm	180 mm	U.FL-Type / MHF1 Plug
ZRF-V092MF3B-W006	1.13 mm	60 mm	MHF4 Plug
ZRF-V092MF3B-W012	1.13 mm	120 mm	MHF4 Plug
ZRF-V092MF3B-W018	1.13 mm	180 mm	MHF4 Plug

Available from Joymax Inc. and select distributors and representatives.

Table 1: Electrical Specifications

ZRF-V092cc3B	5G NR / LTE Bands (MHz)						
Frequency Range	617~698	698~960	1710~2690	3300~4200	4400~5000	5150~5850	5925-7125
VSWR (Max)	2.9	3.0	2.1	1.9	1.9	1.8	2.9
Peak Gain (dBi)	0.9	3.1	4.0	2.6	4.3	4.0	5.1
Average Gain (dBi)	-4.9	-4.7	-2.6	-3.1	-2.8	-3.0	-4.3
Efficiency (%)	33	36	55	49	53	50	38
Polarization	Linear						
Radiation	Omni directional						
Max Power	1 W						
Wavelength	½-λ						
Electrical Type	Dipole						
Impedance	50 Ω						

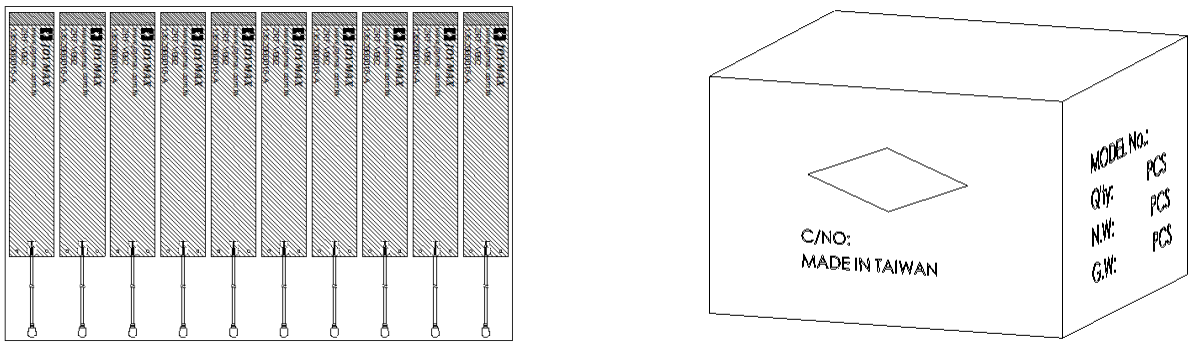
Electrical specifications and plots measured with the antenna adhere to an 150 x 150 mm non-conductive plate with 120 mm coax cable.

Table 2: Mechanical Specifications

Parameter	Value
Connection	U.FL-type / MHF Plug (female socket)
Operating Temp.	-40˚C to +85˚C
Weight	3 g
Dimension	92 mm x 18 mm x 1.1 mm
Antenna Color	Black
Ingress Protection	N/A
Adhesive Backing	3M 467MP™

Packaging Information

The ZRF-V092cc3B are bulk packaged into a clear plastic bag of 50 pcs. **Figure 1**. 1000 pcs per carton, 330 mm x 180 mm x 180 mm (13.0 in x 7.9 in x 7.9 in), total weight 4.38 kgs (9.7 lb) Distribution channels may offer alternative packaging options.



50 pcs antenna/1 PE Bag 1000 pcs antenna/1 Carton

Figure 1. Antenna Packaging

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Product Dimensions

Figure 2 provides dimensions of the ZRF-V092cc3B in mm measurement unit. The adhesive backing is 3M 467MP™, which provides outstanding adhesion to high surface energy plastics.

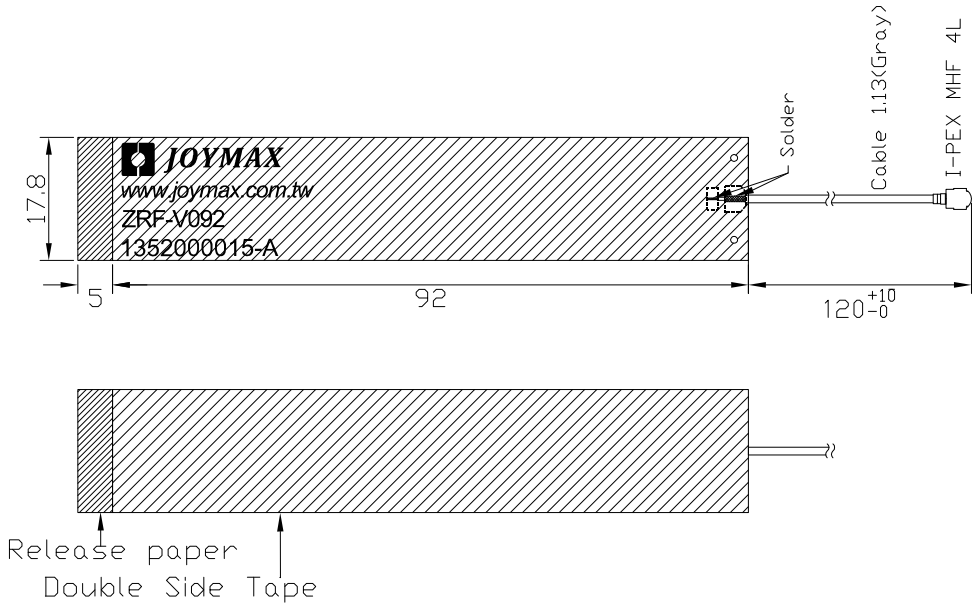

Figure 2. Antenna Dimensions

Antenna Installation

The ZRF-V092cc3B antenna is designed for chassis-mount installation as shown in **Figure 3**. The integration of inner mount allows the antenna to be less affected from external pressure and intensive wavering, guaranteeing the state-of-art performance through inner side enclosure installation. The antenna should never be bent to the point of creating a crease or allowing the angle of the bend to fall below 90 degrees (i.e. become acute) as this will impair function and may cause permanent damage.

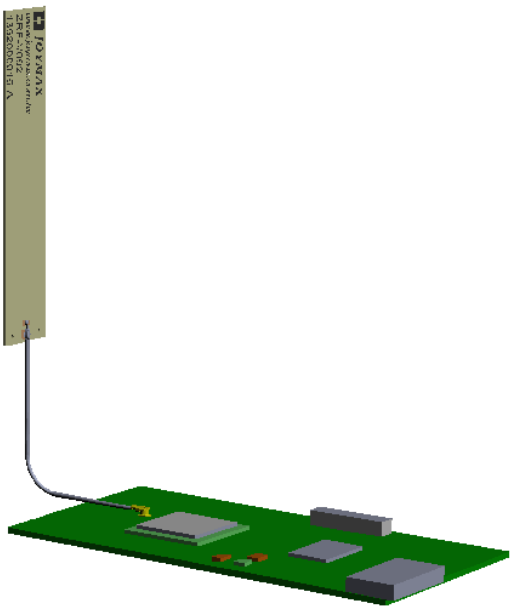

Figure 3. Antenna Installation

Antenna Test Orientation: CHASSIS MOUNT, GROUND PLANE INDEPENDENT

The charts on the following pages represent data taken with the antenna adhere to a 150 mm x 150 mm non-conductive plate as shown in **Figure 4**. Connection is made to the radio via a 120 mm long 1.13 co-axial cable terminated in an U.FL-type / MHF plug (female socket) connector.

Figure 4. Chassis mount, Ground plane independence

VSWR

Figure 5 provides the voltage standing wave ratio (VSWR) across the antenna bandwidth. VSWR is a function of the reflection coefficient, which describes the power reflected from the antenna back to the radio. A lower VSWR value indicates better antenna performance at a given frequency. Reflected power is also shown on the right-side vertical axis as a gauge of the percentage of transmitter power reflected back from the antenna.

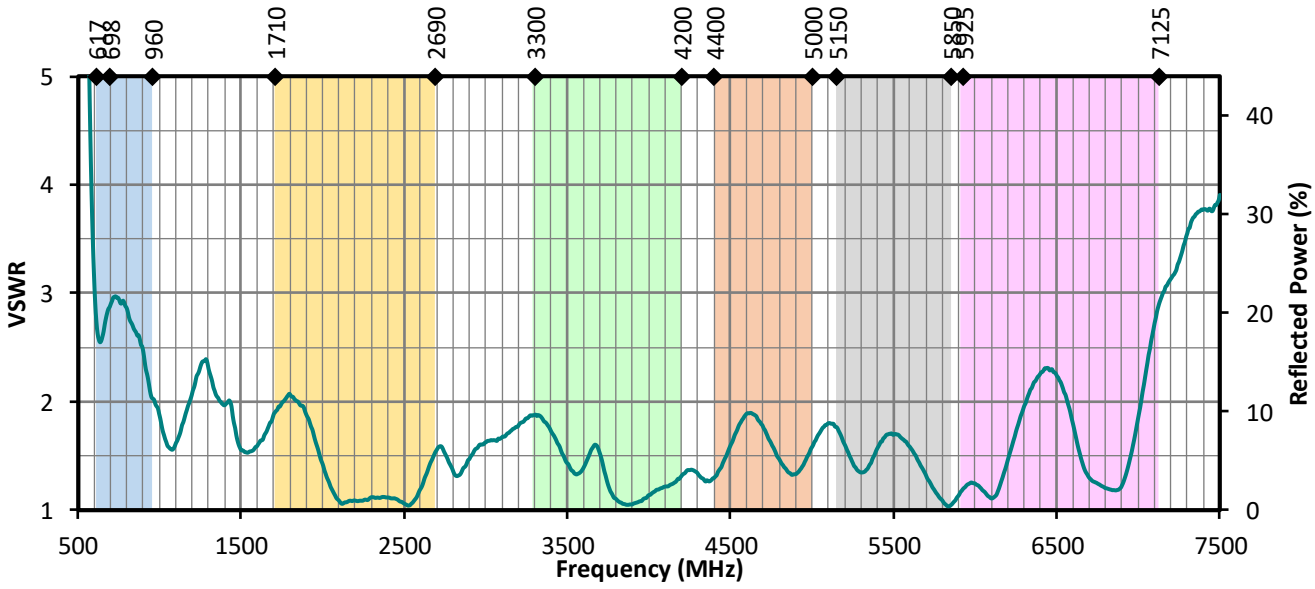

Figure 5. Antenna VSWR

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Return Loss

Return loss (**Figure 6**), represents the loss in power at the antenna due to reflected signals. Like VSWR, a lower return loss value indicates better antenna performance at a given frequency.

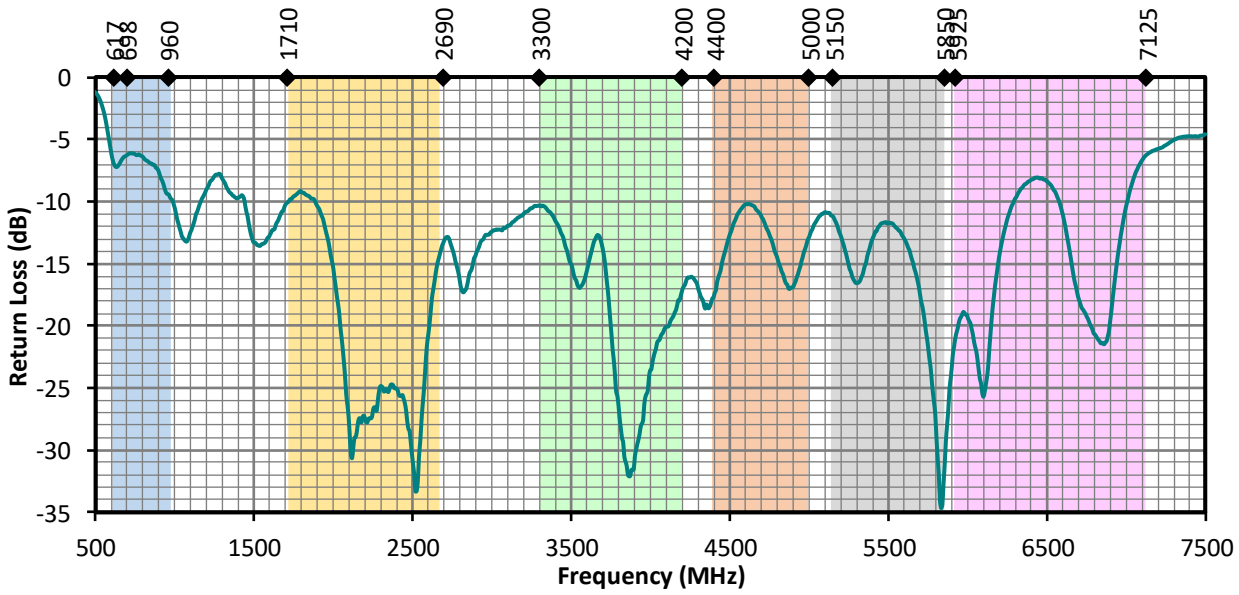


Figure 6. Antenna Return Loss

Peak Gain

The peak gain across the antenna bandwidth is shown in **Figure 7**. Peak gain represents the maximum antenna input power concentration across 3-dimensional space, and therefore peak performance at a given frequency, but does not consider any directionality in the gain pattern.

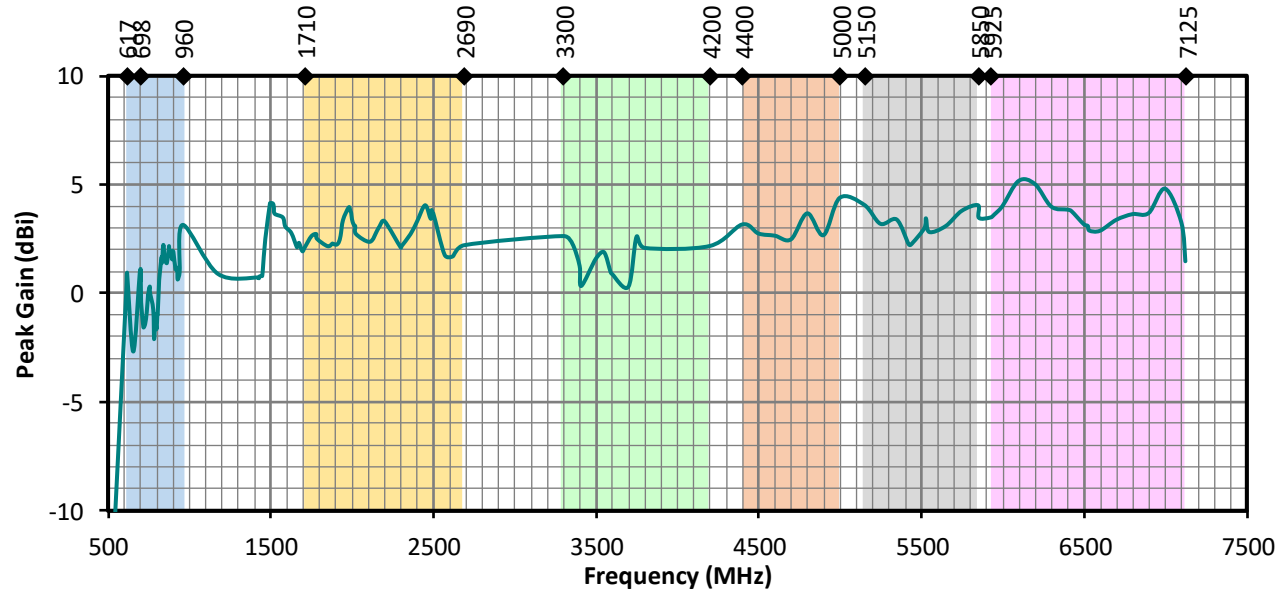


Figure 7. Antenna Peak Gain

Average Gain

Average gain (**Figure 8**), is the average of all antenna gain in 3-dimensional space at each frequency, providing an indication of overall performance without expressing antenna directionality.

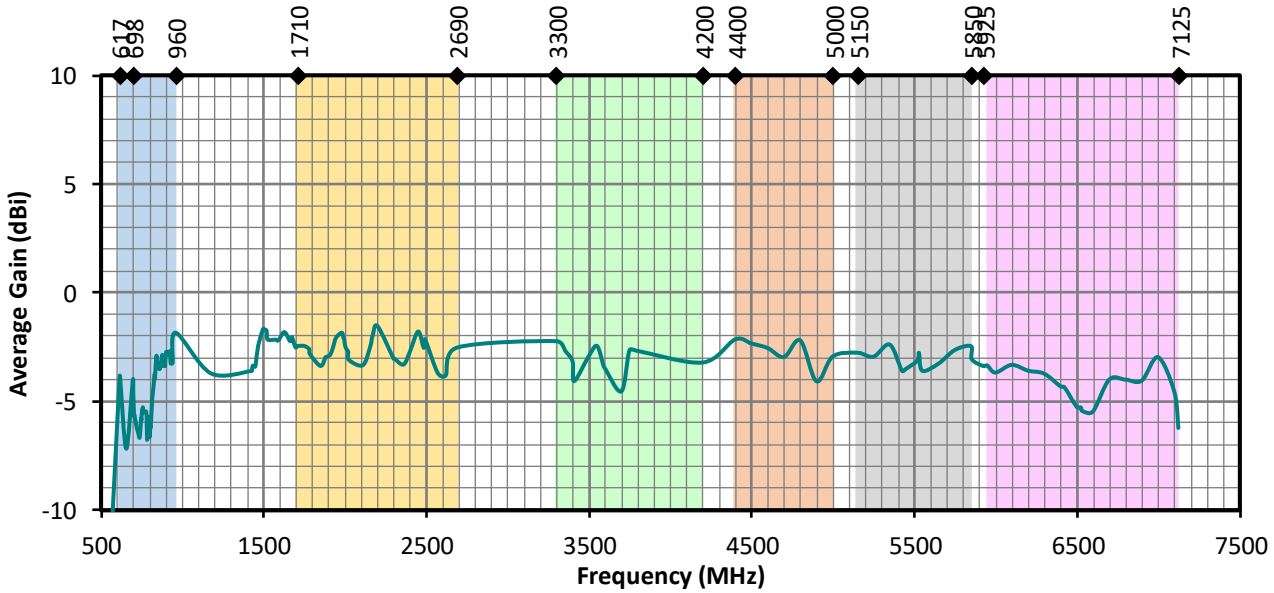


Figure 8. Antenna Average Gain

Radiation Efficiency

Radiation efficiency (**Figure 9**), shows the ratio of power radiated by the antenna relative to the power supplied to the antenna, expressed as a percentage, where a higher percentage indicates better performance at a given frequency. An ideal antenna has 100% efficiency. But in really world, usually an external antenna radiates only 50~60% of power supplied to it.

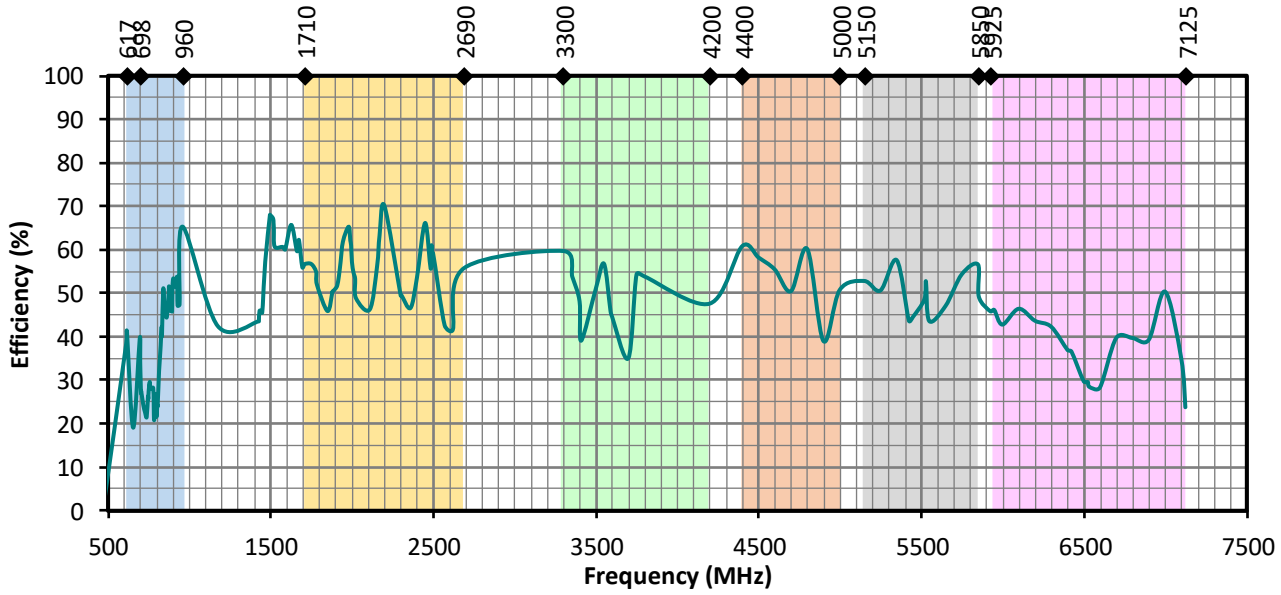
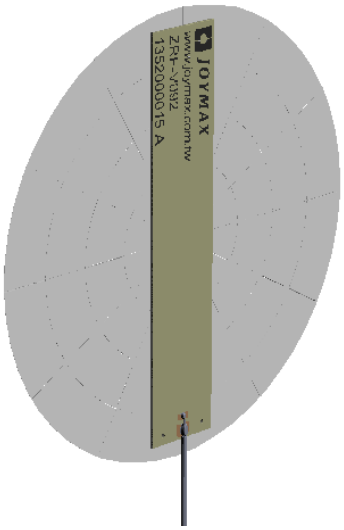


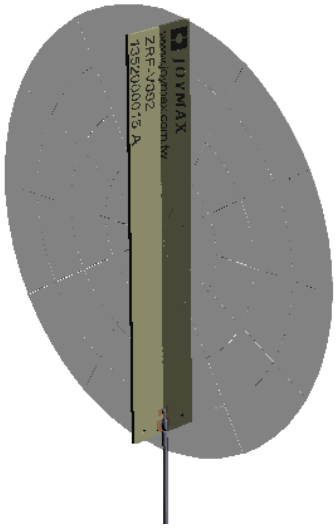
Figure 9. Antenna Efficiency

Radiation Patterns

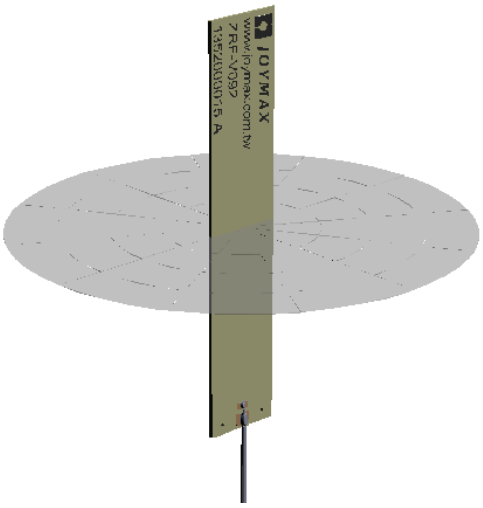
Radiation patterns provide information about the directionality and 3-dimensional gain performance of the antenna by plotting gain at specific frequencies in three orthogonal planes. Antenna radiation patterns are shown in **Figure 10** using polar plots covering 360 degrees. The antenna graphic at the top of the page provides reference to the plane of the column of plots below it.



XZ-Plane Gain

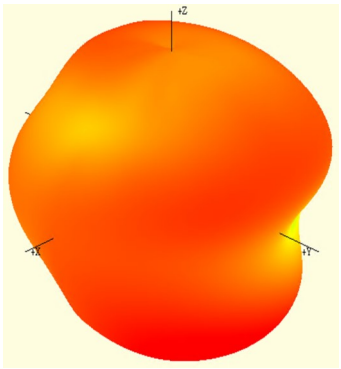


YZ-Plane Gain

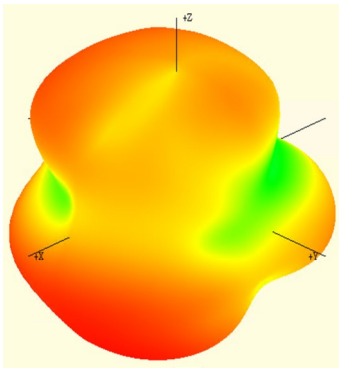


XY-Plane Gain

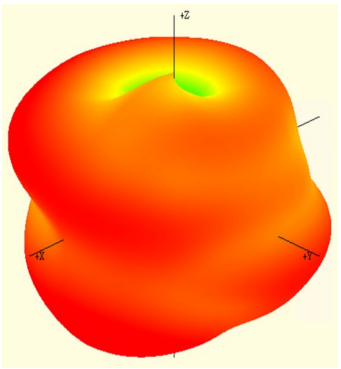
617 MHz to 960 MHz (778 MHz)



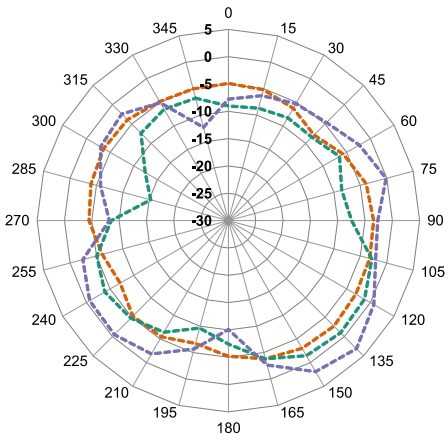
617 MHz



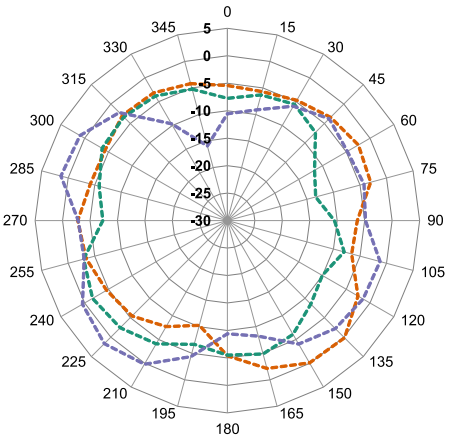
778 MHz



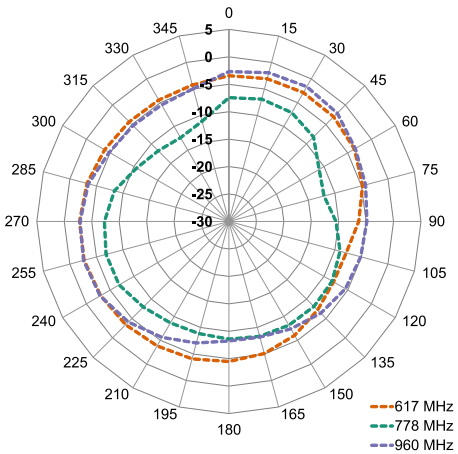
960 MHz



XZ-Plane Gain



YZ-Plane Gain



XY-Plane Gain

Figure 10. Antenna Radiation Patterns

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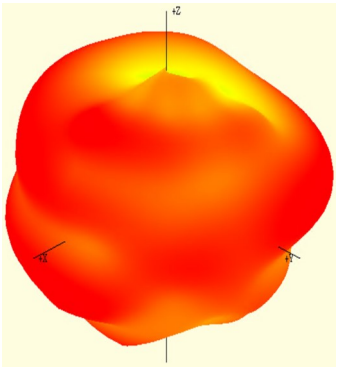
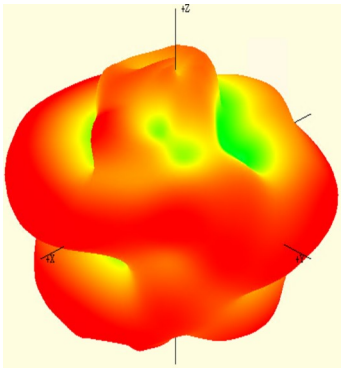
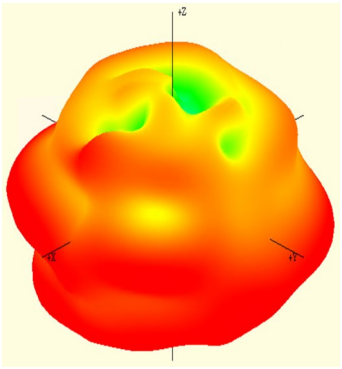
1710 MHz to 2690 MHz (2200 MHz)



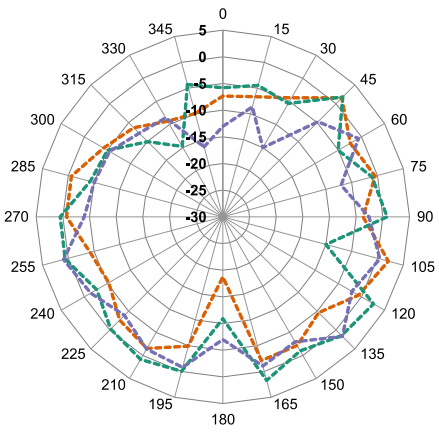
1710 MHz



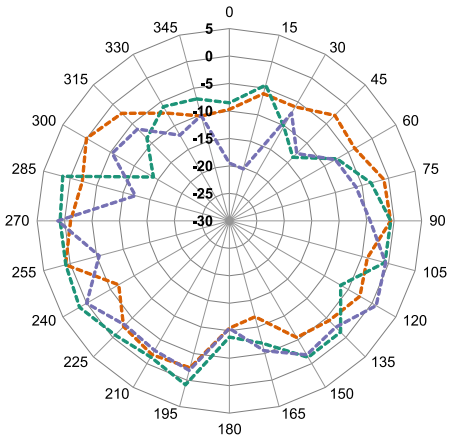
2200 MHz



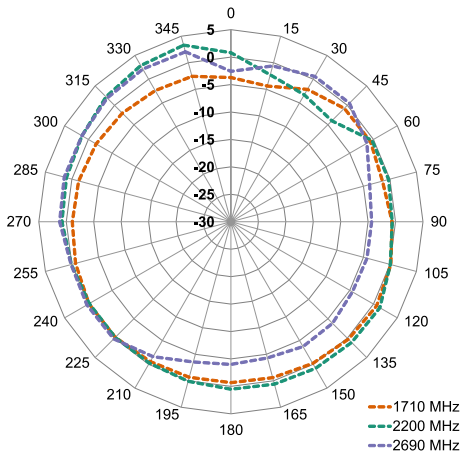
2690 MHz



XZ-Plane Gain

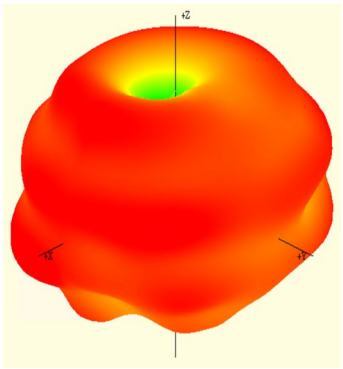


YZ-Plane Gain

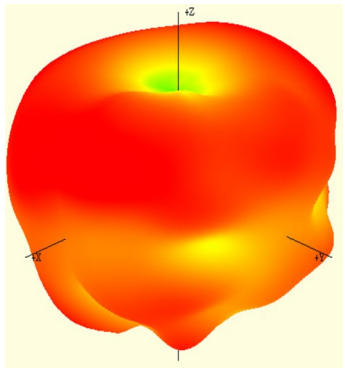


XY-Plane Gain

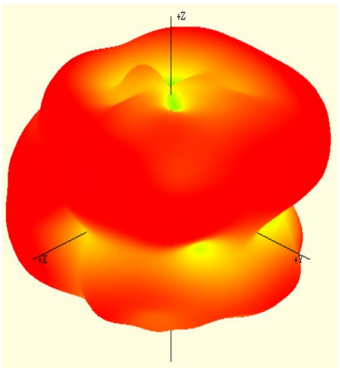
3300 MHz to 5000 MHz (4200 MHz)



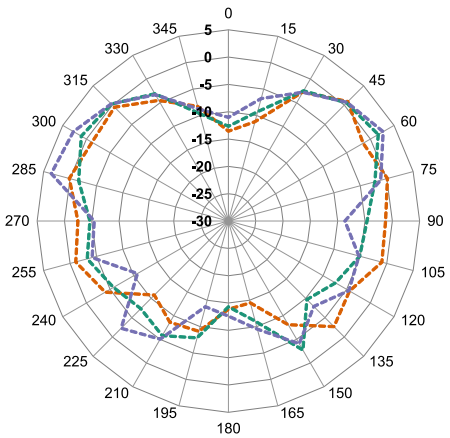
3300 MHz



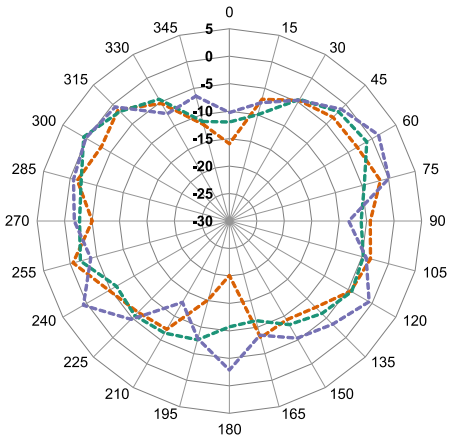
4200 MHz



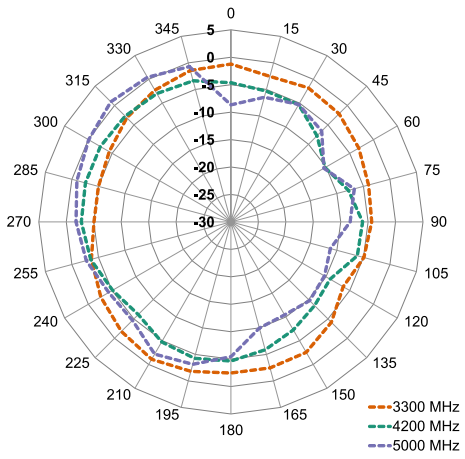
5000 MHz



XZ-Plane Gain



YZ-Plane Gain



XY-Plane Gain

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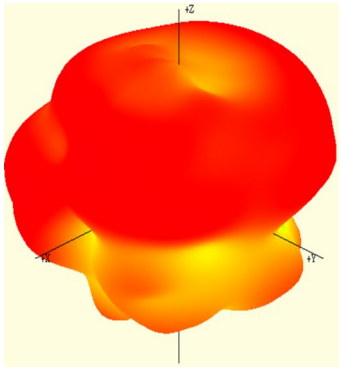
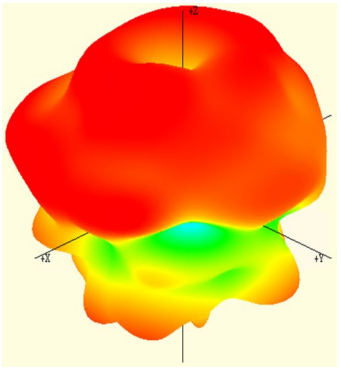
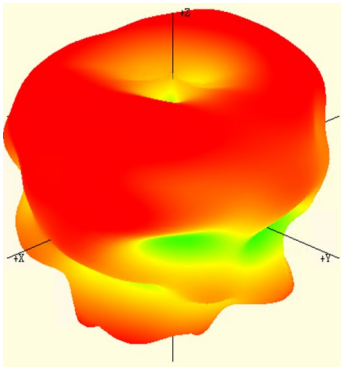
5150 MHz to 5850 MHz (5550 MHz)



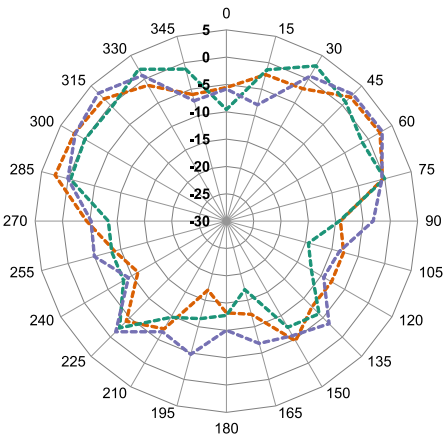
5150 MHz



5550 MHz



5850 MHz



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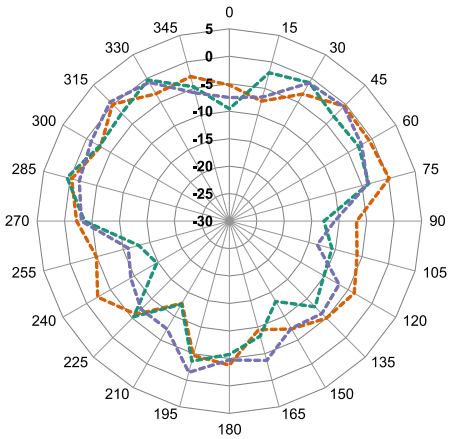
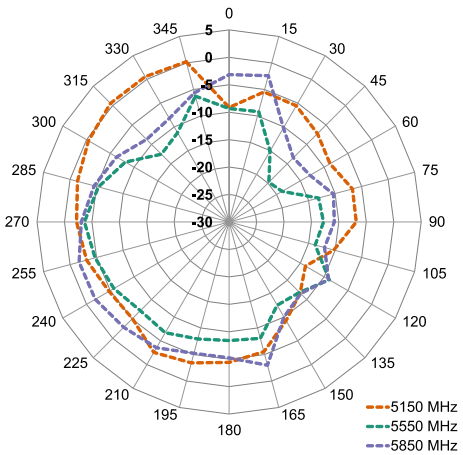
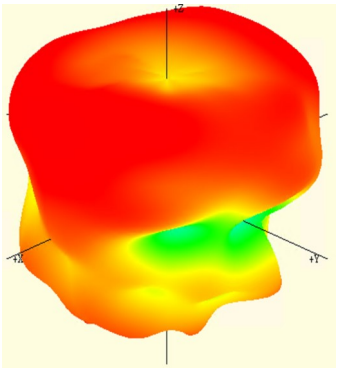


YZ-Plane Gain

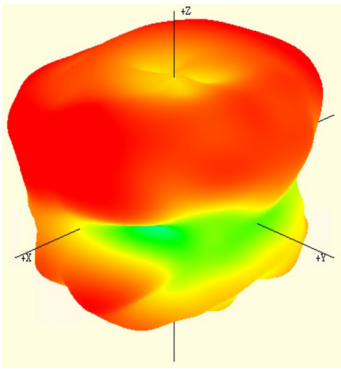


XY-Plane Gain

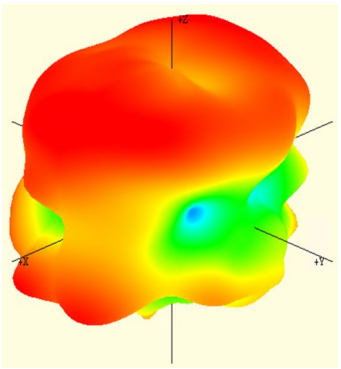
5925 MHz to 7125 MHz (6525 MHz)



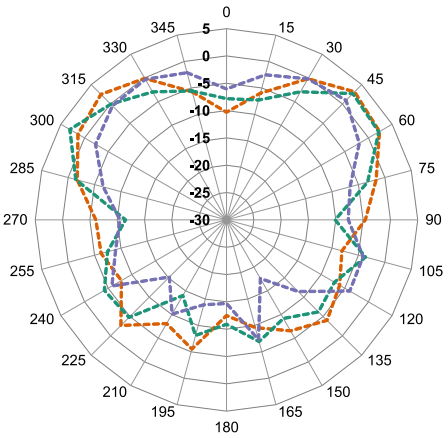
5925 MHz



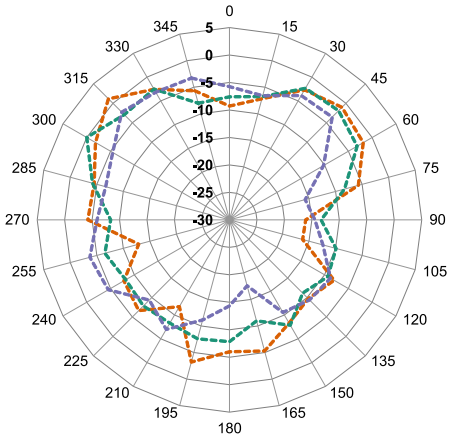
6525 MHz



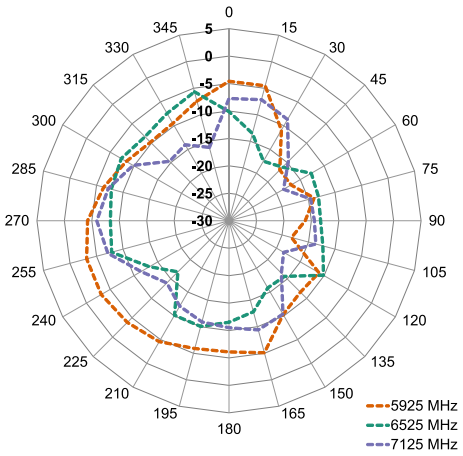
7125 MHz



XZ-Plane Gain



YZ-Plane Gain



XY-Plane Gain

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Antenna FAQs

Q: What is an antenna?

An antenna is used for transmission or reception of radio signals in wireless communication.

Q: How do antennas work?

Electricity flowing into the transmitter antenna makes electrons vibrate up and down it, producing radio waves. The radio waves travel through the air at the speed of light. When the waves arrive at the receiver antenna, they make electrons vibrate inside it.

Q: Does antenna size matter?

A bigger antenna, properly designed, will always have more **gain** than a smaller one. And it will be the best kind of **gain**, much better than using a small antenna and simply over-amplifying it, because a small antenna just won't pull in truly weak signals like this gigantic one will.

Q: What is the advantage of external antennas?

External antennas usually offer **better bandwidth** and **high performance** due to the nature of their larger size. This often results in a higher rated **gain** (dBi) than their internal counterparts. Due to its smaller size, an internal antenna would not function well to support lower frequencies.

Ease of integration – an external antenna requires fewer design resources and shorter time to integrate to allow for a more rapid time-to-market. An internal antenna's performance is influenced by device environment – PCB ground plane, nearby metal part, and enclosure. That would require much more effort such as impedance matching network to complete antenna design.

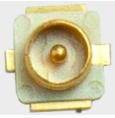
Q: Why is most antenna impedance 50 Ohm?

50 Ohm is an industry standard of coax cables and power amplifiers. It was chosen as a tradeoff between maximum power handling for the transmit coax and the copper losses. The optimum would have been anyway in the range of **30 to 100 ohm** with average at 50 Ohm.

Q: Why does GNSS require RHCP (Right-hand-circularly-polarized) antennas?

Satellite's signal has a low power density, especially after propagating through the **atmosphere** (**ionosphere** affect radio wave). Polarized waves oscillate in more than one direction, which deliver satellite's signal to receiver on Earth surface more effectively.

MATING COMPONENTS: RF COAXIAL CONNECTOR

Part Number	Image	Connector 1 (Receptacle)	Connector 2 (Plug)	Cable Length		Cable Diameter (mm)
				mm	Inch	
CT-MFB01X		MHF4L Jack Male pin Straight	N/A	N/A	N/A	N/A
CT-MPB01X		MHF1 Jack Male pin Straight	N/A	N/A	N/A	N/A

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