

## ZAF-212Xcc3B

### 5G/LTE Magnetic Blade Antenna

The Joymax ZAF-212Xcc3B antenna is a blade-style, magnetic mount dipole antenna designed for use in wide-band applications supporting 5G New Radio FR1, LTE, and Cellular IoT (LTE-M, NB-IoT) with broad band coverage from 617 MHz to 7125 MHz. The antenna also supports CBRS (3550 MHz to 3700 MHz), Public Safety (4940 MHz to 4990 MHz), and a growing number of C band applications.

The antenna has a built-in magnetic base which provides an external remote antenna solution to easily mount on metal surfaces (e.g. vehicle roof, cabinet metal surface) or repositioning as needed. Connection is made to the radio via a RG174 coaxial cable terminated in an RP-SMA plug (female socket) connector.



#### Features

- Bandwidth 2400 MHz and 7125 MHz
- Performance at 2400 MHz to 2500 MHz  
VSWR:  $\leq 2.2$   
Peak Gain: 2.0 dBi  
Efficiency: 40%
- Built-in Magnetic Base
- Omni-directional radiation
- Compact size, light weight

#### Applications

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

### Ordering Information

| Part Number              | Description                                               |
|--------------------------|-----------------------------------------------------------|
| <b>ZAF-212XSA3B-P200</b> | 5G/LTE Magnetic Blade Antenna, with SMA Plug connector    |
| <b>ZAF-212XRS3B-P200</b> | 5G/LTE Magnetic Blade Antenna, with RP-SMA Plug connector |

Available from Joymax Inc. and select distributors and representatives.

**Table 1: Electrical Specifications**

| ZAF-212Xcc3B       | WiFi / WLAN (MHz)    |           |           |           |           |           |
|--------------------|----------------------|-----------|-----------|-----------|-----------|-----------|
| Frequency Range    | 617–960              | 1710–2690 | 3300–4200 | 4400–5000 | 5150–5850 | 5925–7125 |
| VSWR (Max.)        | 3.3                  | 2.5       | 2.0       | 2.2       | 2.7       | 2.8       |
| Peak Gain (dBi)    | 1.5                  | 3.6       | 2.4       | 1.8       | 1.6       | 2.0       |
| Average Gain (dBi) | -3.7                 | -4.0      | -4.3      | -6.5      | -7.2      | -7.2      |
| Efficiency (%)     | 44                   | 40        | 37        | 23        | 19        | 19        |
| Polarization       | Linear               |           |           |           |           |           |
| Radiation          | Omni directional     |           |           |           |           |           |
| Max. Power         | 1 Watt               |           |           |           |           |           |
| Wavelength         | $\frac{1}{2}\lambda$ |           |           |           |           |           |
| Electrical Type    | Dipole               |           |           |           |           |           |
| Impedance          | 50 $\Omega$          |           |           |           |           |           |

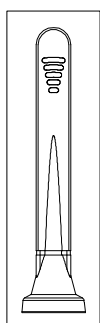
Electrical specifications and plots measured with the antenna mount on 350 x 350 mm ground plane and 1M RG174 cable.

**Table 2: Mechanical Specifications**

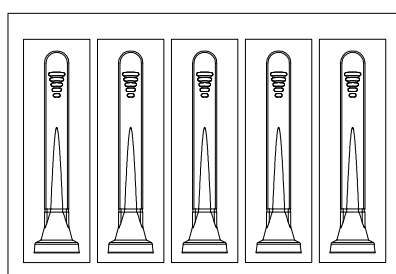
| Parameter       | Value                                                   |
|-----------------|---------------------------------------------------------|
| Connection      | RP-SMA (female socket) or SMA Plug (male pin) Connector |
| Dimension       | 157 mm x $\phi$ 36 mm                                   |
| Weight          | 50 g (1.75 Oz)                                          |
| Operating Temp. | -30° C to +70°C                                         |
| Cable Type      | RG174 ( $\phi$ 2.8 mm)                                  |
| Cable Length    | 2000 mm or Custom                                       |

## Packaging Information

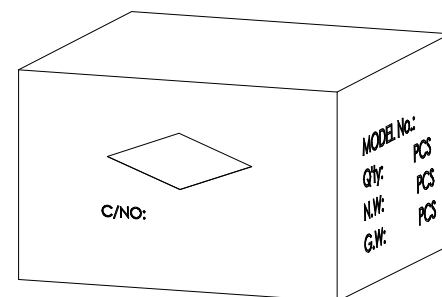
The ZAF-212Xcc3B are individually sealed in a plastic bag as shown in **Figure 1**. 10 pcs in a bigger clear bag, 500 pcs packed into a shipping carton box size 390 mm x 260 mm x 330 mm (15.4 in x 10.2 in x 13.0 in) with total weight 12.7 kgs (28 lb). Distribution channels may offer alternative packaging options.



1 pce / Plastic Bag



10 pcs / PE Bag

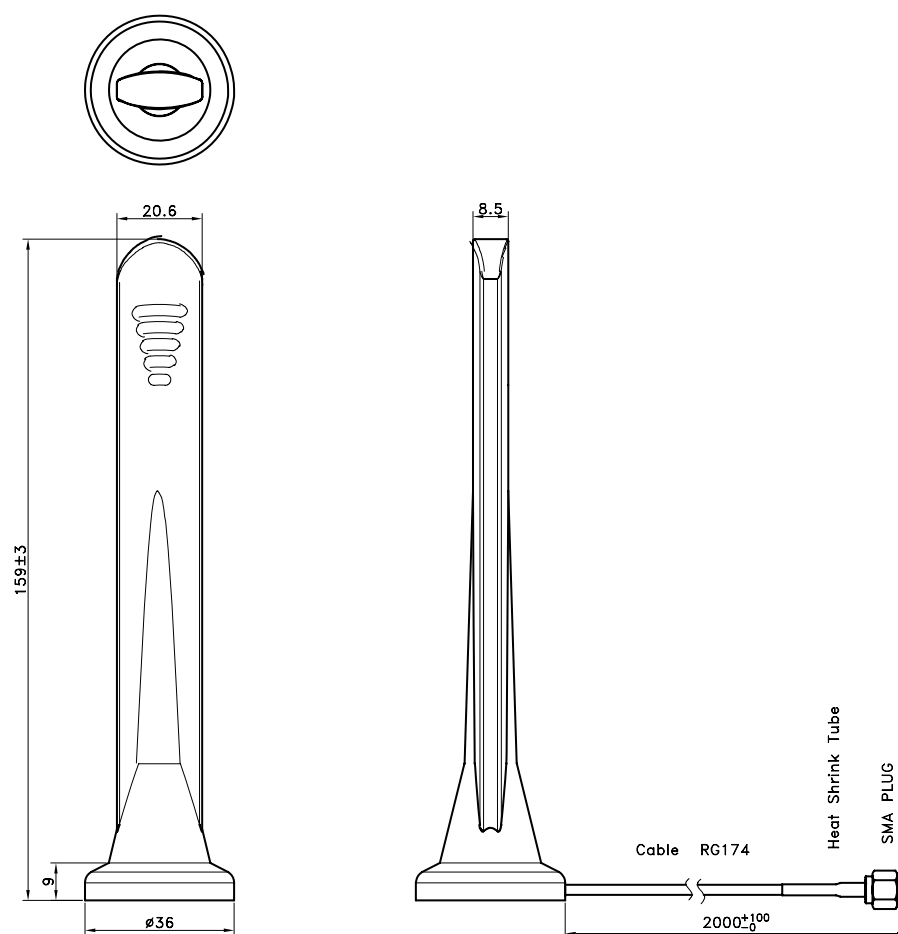


500 pcs / Carton

**Figure 1. Antenna Packaging**

## Product Dimensions

**Figure 2** provides dimensions of the ZAF-212Xcc3B in mm measurement unit. Connection is made to the radio through RG174 cable terminated in a RP-SMA Plug (female socket) or SMA Plug (male pin) connector.



**Figure 2. Antenna Dimensions**

## Antenna Test Setup

The ZAF-212Xcc3B antenna mounts on a 350 x 350 mm reference ground plane and tested with 1M long RG174 cable as shown in **Figure 3**. The charts on the following pages represent data taken with the antenna mount on a metal plate.



**Figure 3. Antenna Test Setup**

## VSWR

**Figure 4** 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.

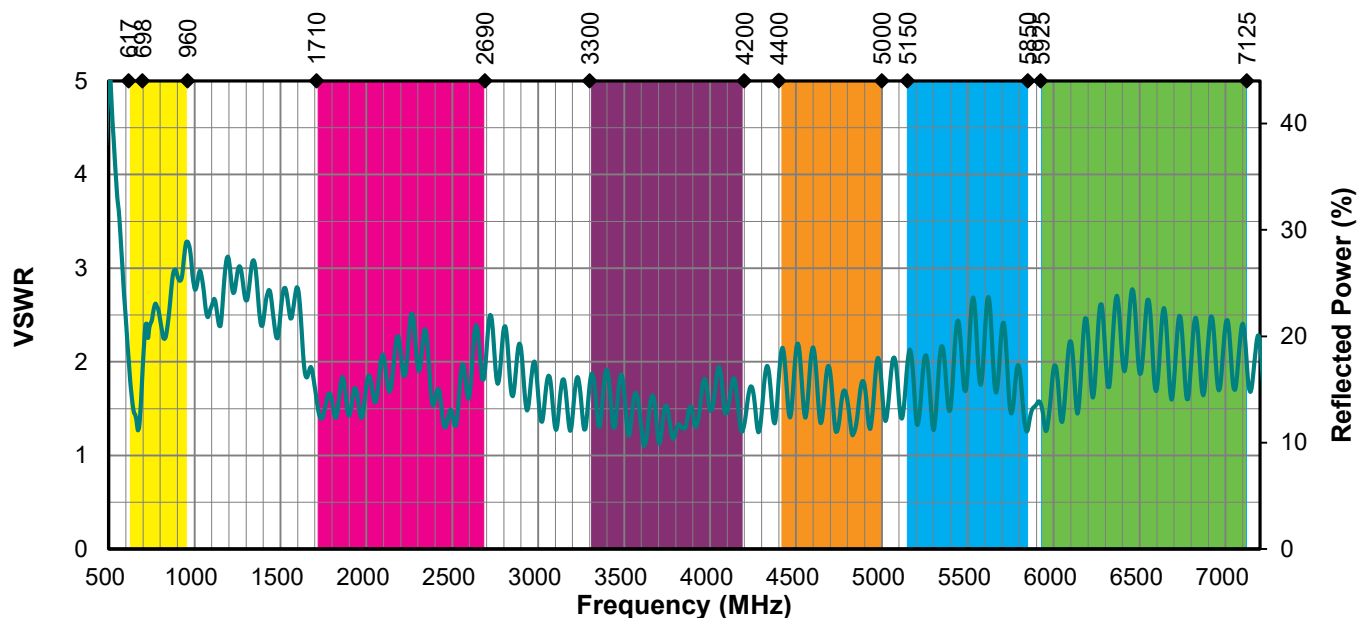


Figure 4. Antenna VSWR

## Return Loss

Return loss (**Figure 5**), 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.

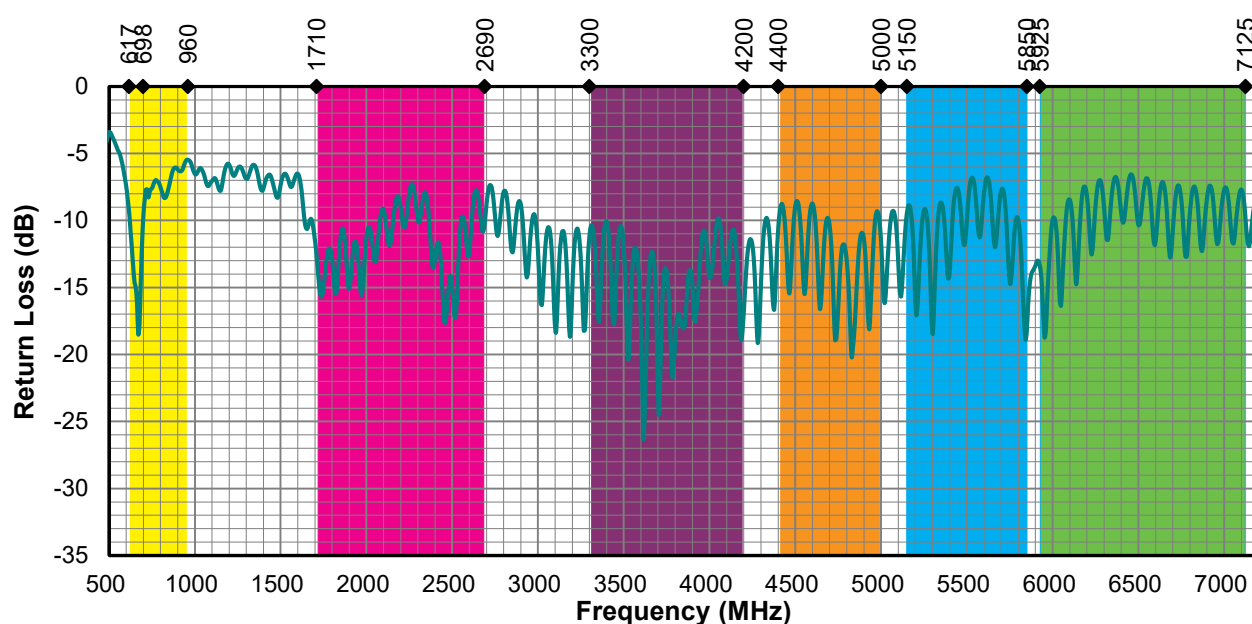


Figure 5. Antenna Return Loss

## Peak Gain

The peak gain across the antenna bandwidth is shown in **Figure 6**. 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.

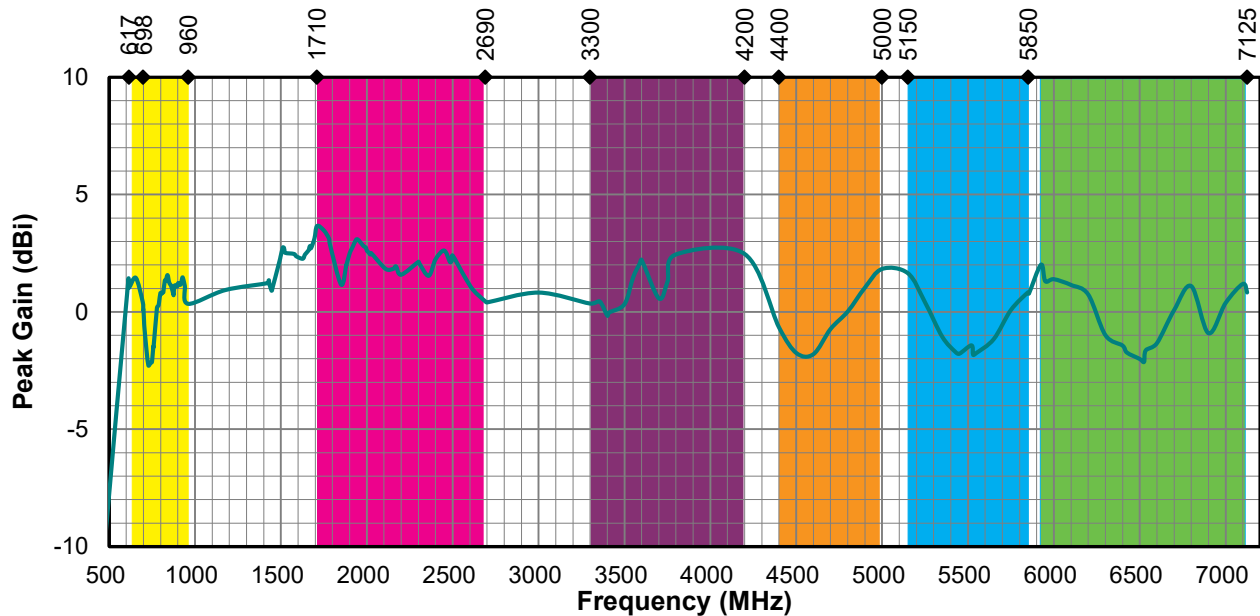


Figure 6. Antenna Peak Gain

## Average Gain

Average gain (**Figure 7**), is the average of all antenna gain in 3-dimensional space at each frequency, providing an indication of overall performance without expressing antenna directionality.

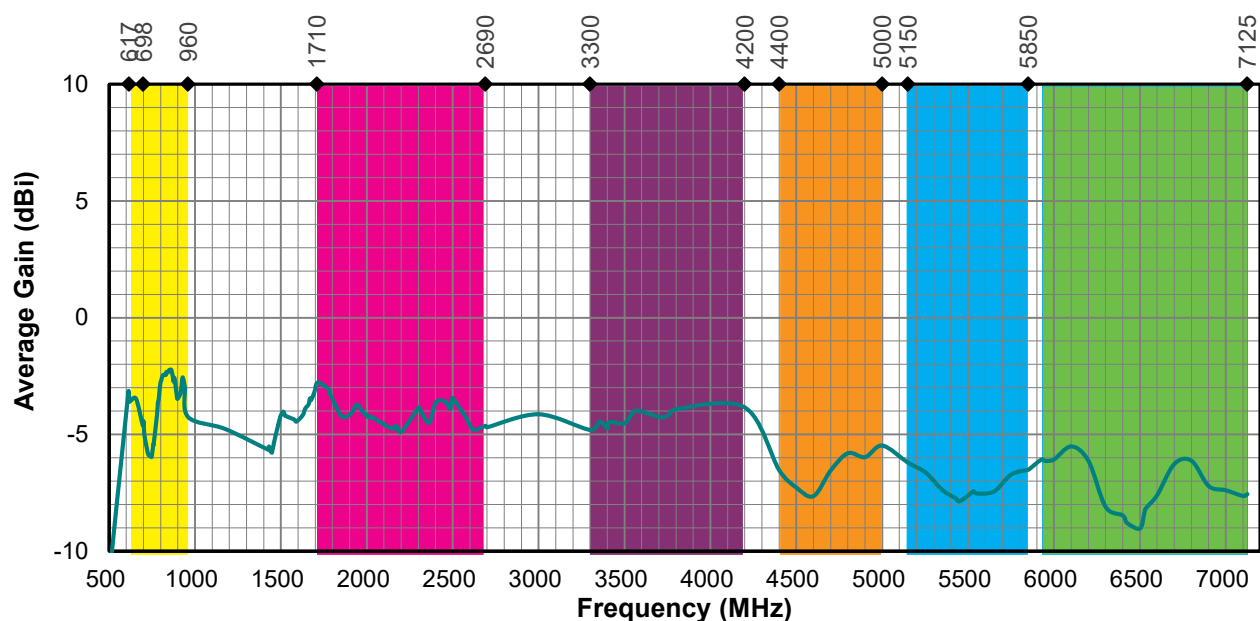


Figure 7. Antenna Average Gain

## Radiation Efficiency

Radiation efficiency (**Figure 8**), 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.

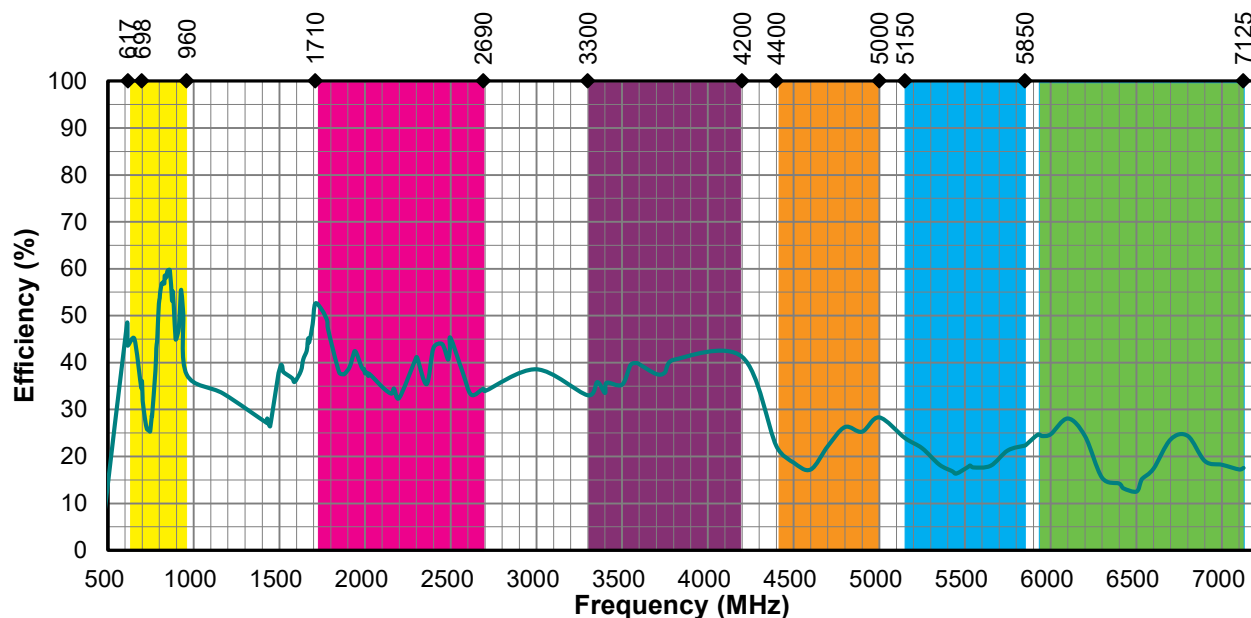
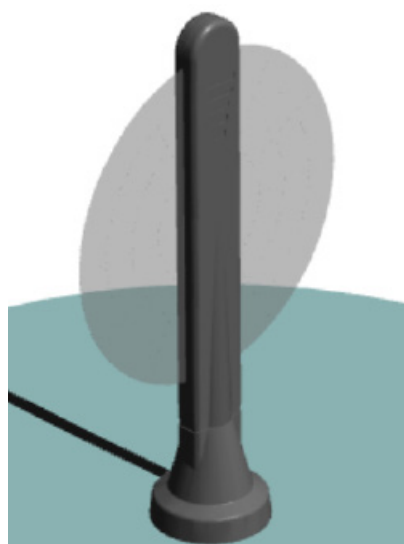


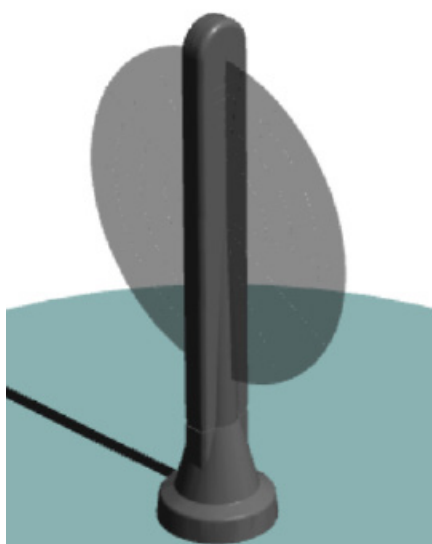
Figure 8. Antenna Efficiency

## Radiation Patterns

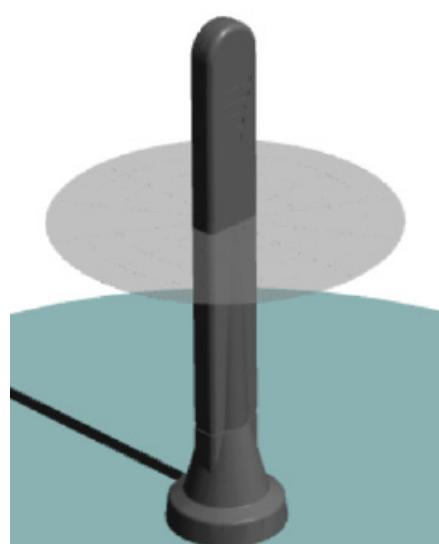
Radiation patterns provide information about the directionality and 3-dimensional gain performance of the antenna by plotting gain at specific frequencies in three orthogonal planes. Antenna radiation patterns are shown in **Figure 9** using polar plots covering 360 degrees. The antenna graphic at the top of the page provides reference to the plane of the column of plots below it.



XZ-Plane Gain

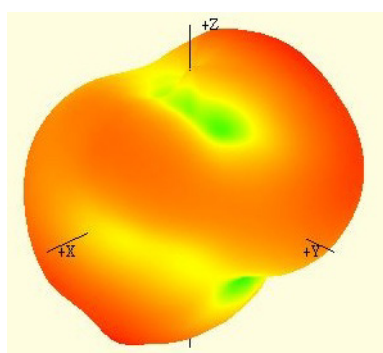


YZ-Plane Gain

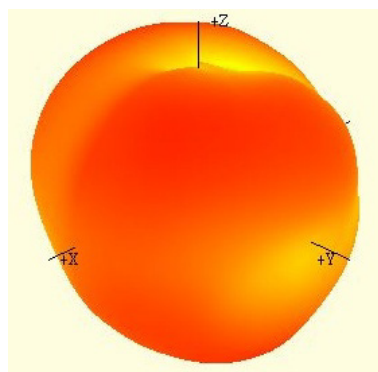


XY-Plane Gain

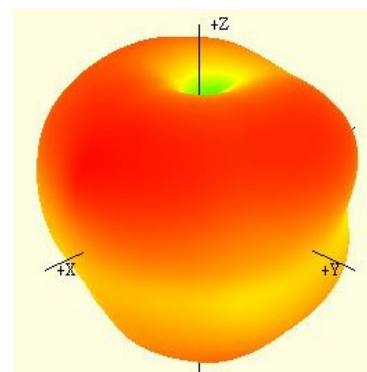
### 617 MHz to 960 MHz (778 MHz)



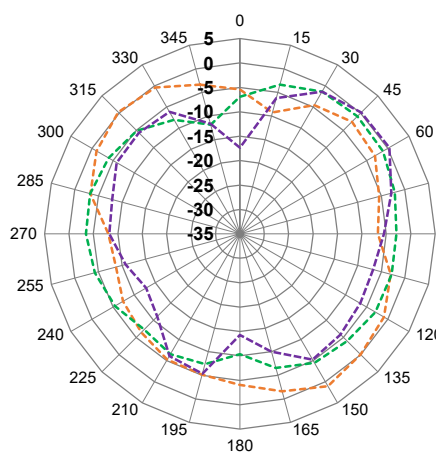
617 MHz



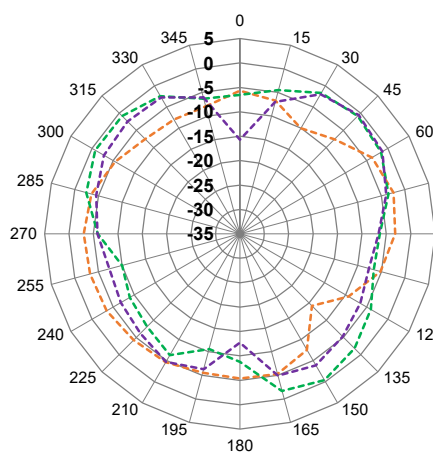
778 MHz



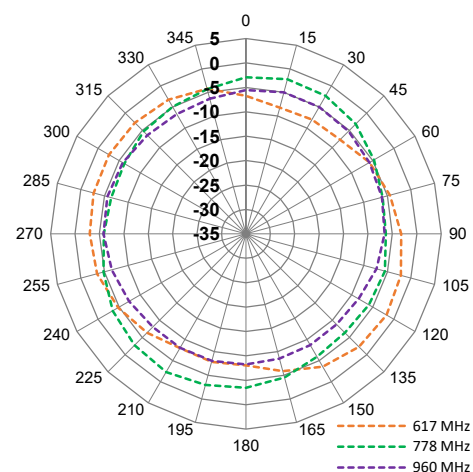
960 MHz



XZ-Plane



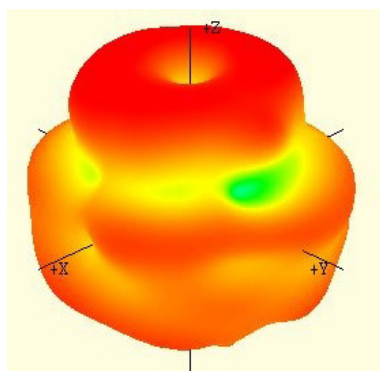
YZ-Plane



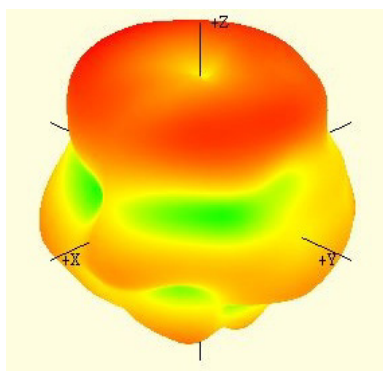
XY-Plane

**Figure 9. Antenna Radiation Pattern**

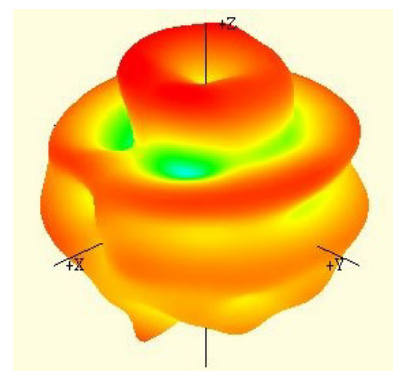
## 1710 MHz to 2690 MHz (2200 MHz)



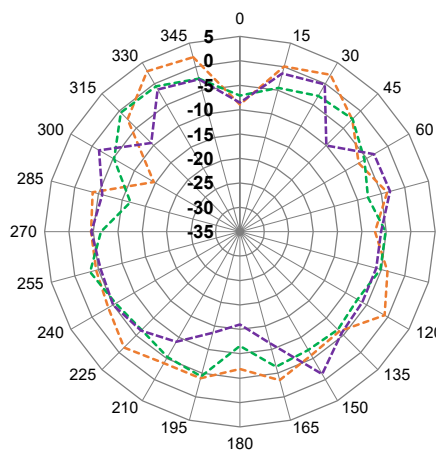
1710 MHz



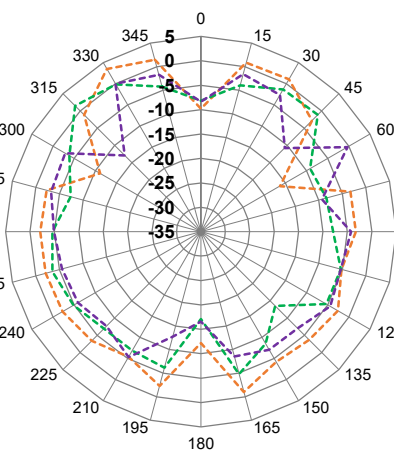
2200 MHz



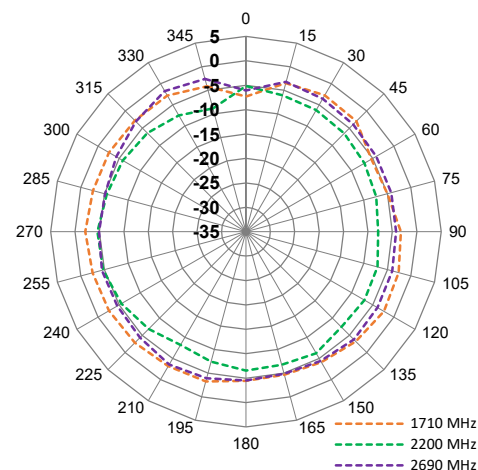
2690 MHz



XZ-Plane

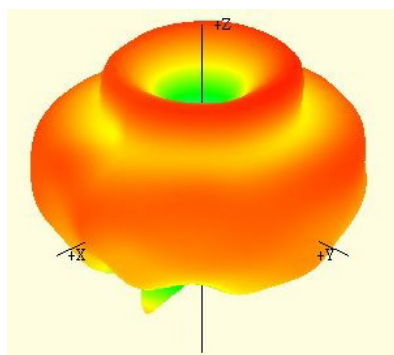


YZ-Plane

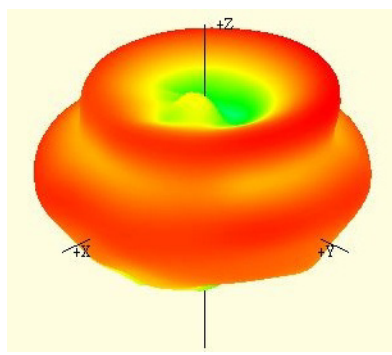


XY-Plane

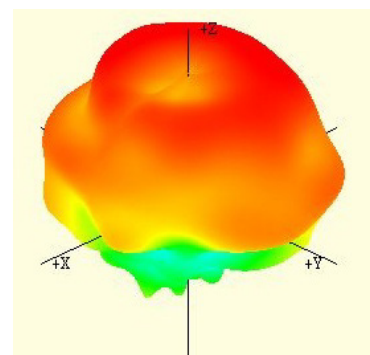
## 3300 MHz to 5000 MHz (4200 MHz)



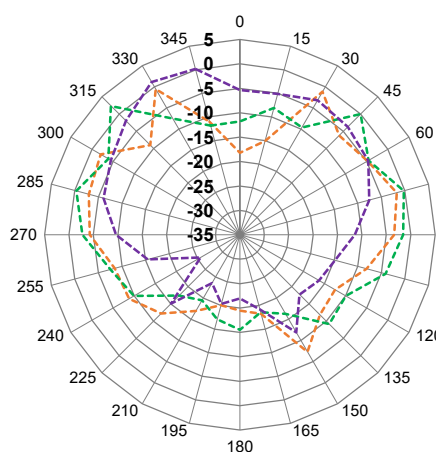
3300 MHz



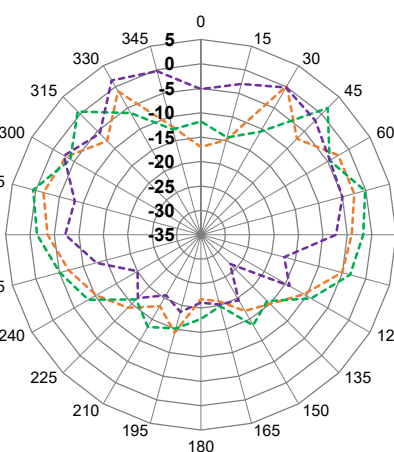
4200 MHz



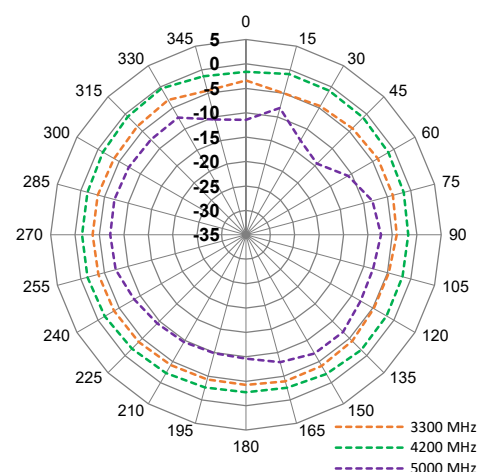
5000 MHz



XZ-Plane

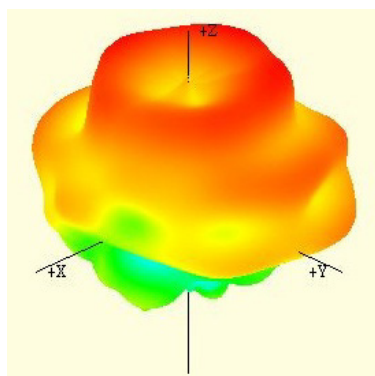


YZ-Plane

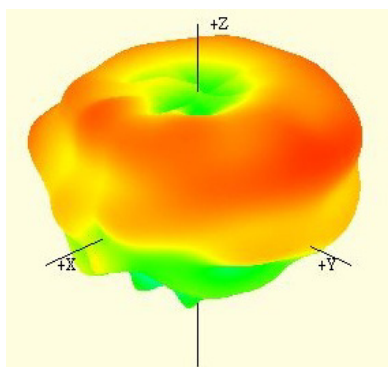


XY-Plane

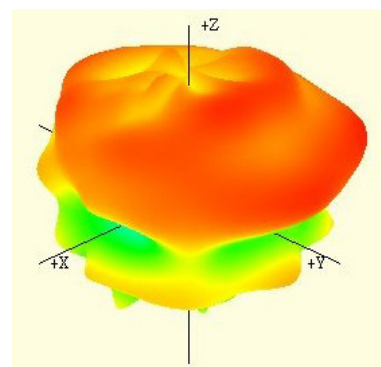
## 5150 MHz to 5850 MHz (5550 MHz)



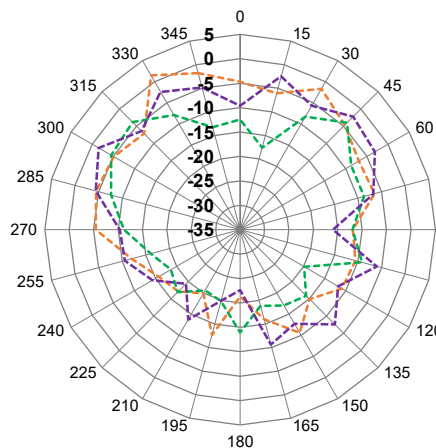
5150 MHz



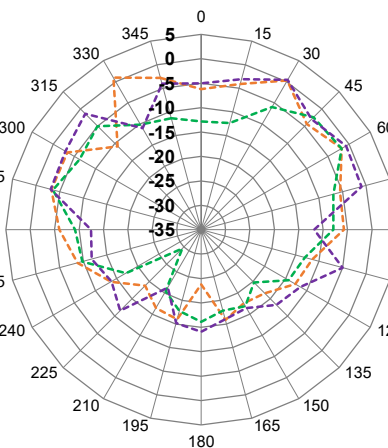
5550 MHz



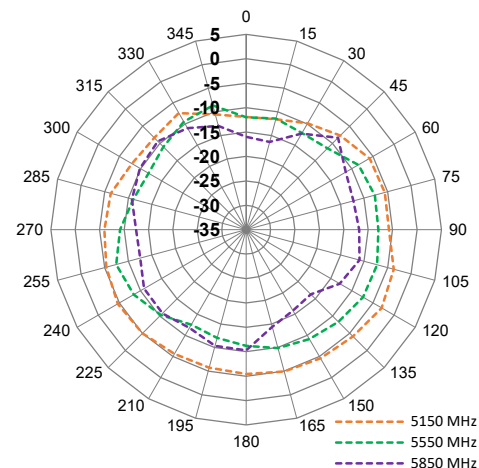
5850 MHz



XZ-Plane

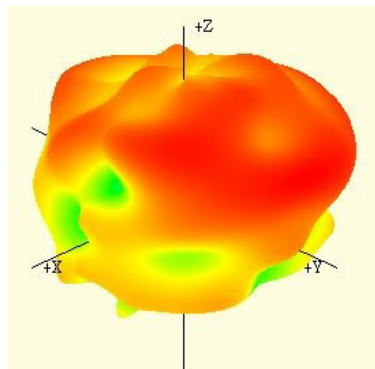


YZ-Plane

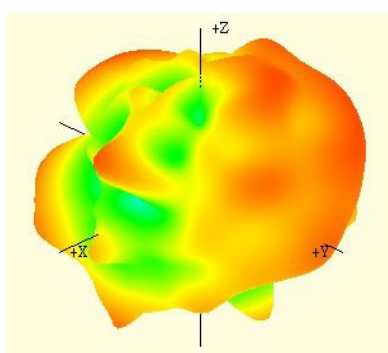


XY-Plane

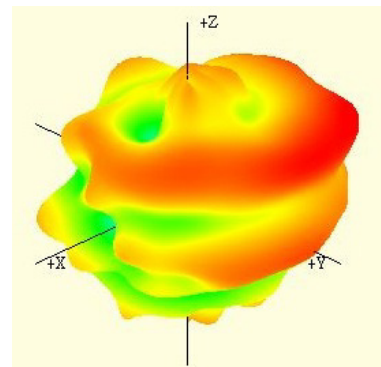
## 5925 MHz to 7125 MHz (6525 MHz)



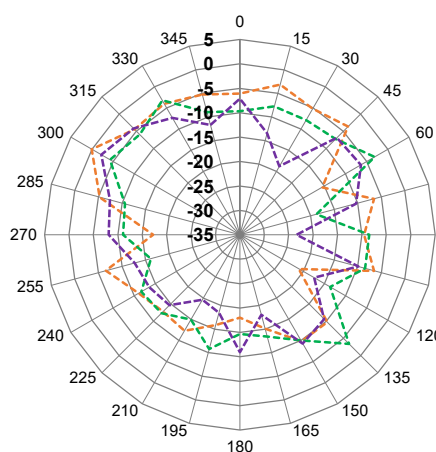
5925 MHz



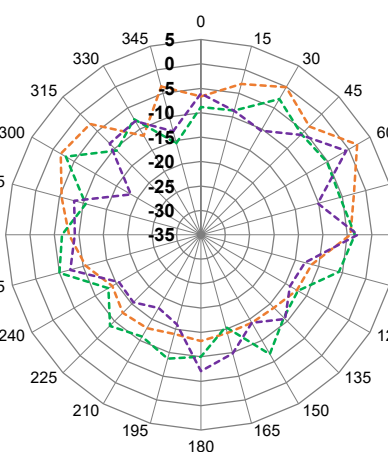
6525 MHz



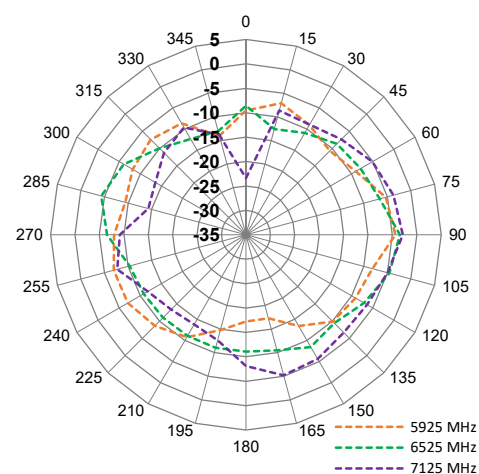
7125 MHz



XZ-Plane



YZ-Plane



XY-Plane

## 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 AND CABLE ASSEMBLY

| Part Number                      | Image                                                                             | Connector 1<br>(Receptacle)              | Connector 2<br>(Plug) | Cable Length |      | Cable Diameter<br>(mm) |
|----------------------------------|-----------------------------------------------------------------------------------|------------------------------------------|-----------------------|--------------|------|------------------------|
|                                  |                                                                                   |                                          |                       | mm           | Inch |                        |
| <a href="#">CX-SAS0MPA1W0007</a> |  | SMA Jack<br>Female Socket<br>Straight    | MHF1                  | 70           | 2.76 | 1.13                   |
| <a href="#">CX-SAZ0MPA1W0020</a> |  | SMA Jack<br>Female Socket<br>Straight    | MHF1                  | 200          | 7.87 | 1.13                   |
| <a href="#">CT-SAB41X</a>        |  | SMA Jack<br>Female Socket<br>Straight    | N/A                   |              |      |                        |
| <a href="#">CT-SAB010XM</a>      |  | SMA Jack<br>Female Socket<br>Straight    | N/A                   |              |      |                        |
| <a href="#">CT-SAB11X-006M</a>   |  | SMA Jack<br>Female Socket<br>Right Angle | N/A                   |              |      |                        |
| <a href="#">CT-SAB16X-006M</a>   |  | SMA Jack<br>Female Socket<br>Right Angle | N/A                   |              |      |                        |

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