

KHF-D03ASA3B-Z012

4000 to 7125 MHz Mushroom Antenna

The Joymax KHF-D03ASA3B-Z012 antenna is a mushroom-style, circularly polarized dipole antenna designed for use in 4000 MHz to 7125 MHz frequency bands supporting wide band applications. Circularly polarized radiation supports both horizontal and vertical polarized signal.

The external antenna features omnidirectional radiation and IP65 rated waterproof design. Connection is made to the radio through a coaxial cable terminated in a SMA Plug (male pin) connector.



Features

- Bandwidth 4000 MHz and 7125 MHz
- Performance at 4000 MHz to 5000 MHz
VSWR: ≤ 2.2
Peak Gain: 2.7 dBi
Efficiency: 57%
- Right Hand Circularly Polarization (RHCP)
- Omni-directional radiation
- Compact size, light weight
- IP65 waterproof design

Applications

- WiFi/WLAN applications:
 - WiFi 7 (802.11be)
 - WiFi 6E (802.11ax)
 - WiFi 6 (802.11ax)
 - WiFi 5 (802.11ac)
- 5G NR Band n79, n96, n102, n104
- Unlicensed application
- UAV (Unmanned Aerial Vehicle)

Ordering Information

Part Number	Description
KHF-D03ASA3B-Z012	4000 to 7125 MHz Mushroom Antenna, with SMA Plug connector

Available from Joymax Inc. and select distributors and representatives.

Table 1: Electrical Specifications

KHF-D03ASA3B-Z012	C Band (MHz)		
Frequency Range	4000–5000	5150–5850	5925–7125
VSWR (Max.)	2.2	1.4	1.3
Peak Gain (dBi)	2.7	3.8	4.3
Average Gain (dBi)	-2.5	-2.3	-1.8
Efficiency (%)	57	59	66
Polarization	RHCP (Right Hand Circularly Polarization)		
Radiation	Omni directional		
Max. Power	1 Watt		
Wavelength	$\frac{1}{2}\lambda$		
Electrical Type	Dipole		
Impedance	50 Ω		

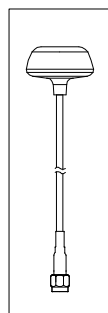
Electrical specifications and plots measured with the antenna hanging free in the space without ground plane.

Table 2: Mechanical Specifications

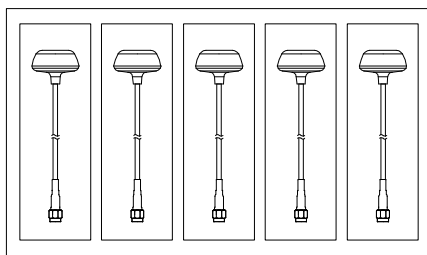
Parameter	Value
Connection	SMA Plug (male pin) Connector
Dimensions	25 mm x $\varnothing$ 34 mm
Weight	13.7 g (0.48 Oz)
Operating Temp.	-30° C to +70°C
Cable Length	125 mm
IP Rating	IP65

Packaging Information

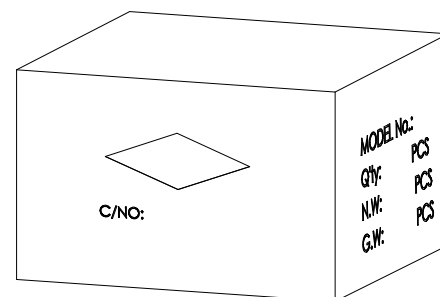
The KHF-D03ASA3B-Z012 are individually packaged in a plastic bubble bag as shown in **Figure 1**. 10 pcs bigger clear plastic bag, 500 pcs packed into a shipping carton box size 390 mm x 260 mm x 330 mm (15.4 in x 10.2 in x 13.0 in) with total weight 12.7 kgs (28 lb). Distribution channels may offer alternative packaging options.



1 pce / Bubble Bag



10 pcs / PE Bag



500 pcs / Carton

Figure 1. Antenna Packaging

Product Dimensions

Figure 2 provides dimensions of the KHF-D03ASA3B-Z012 in mm measurement unit. Connection is made to the radio through a SMA Plug (male pin) connector.

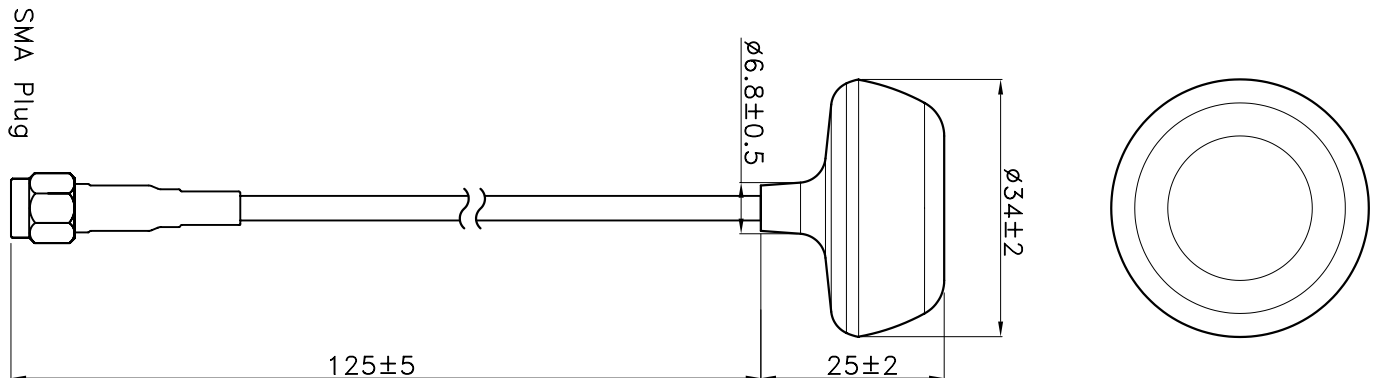


Figure 2. Antenna Dimensions

Antenna Test Setup

The KHF-D03ASA3B-Z012 antenna is a surface-mount antenna designed to attach at the short side of the edge of the main PCB of IoT end-products as shown in **Figure 3**. The charts on the following pages represent data taken with the antenna mount on antenna evaluation board in free space.



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.

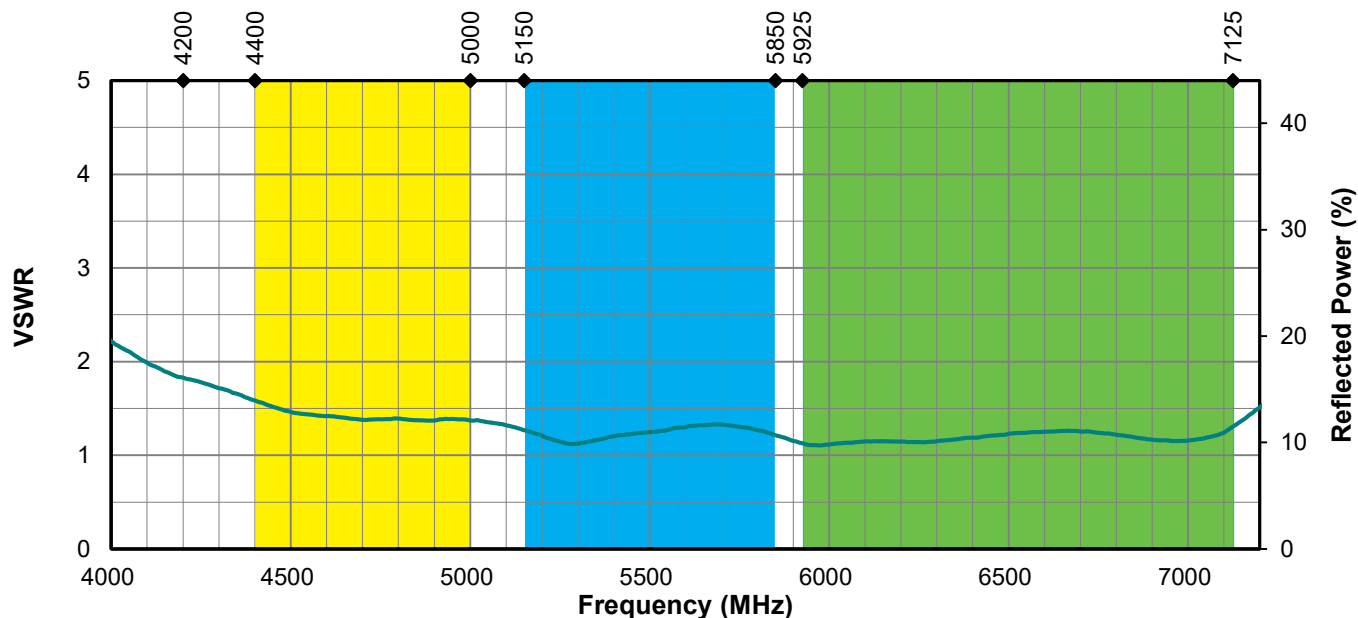


Figure 4. Antenna VSWR

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.

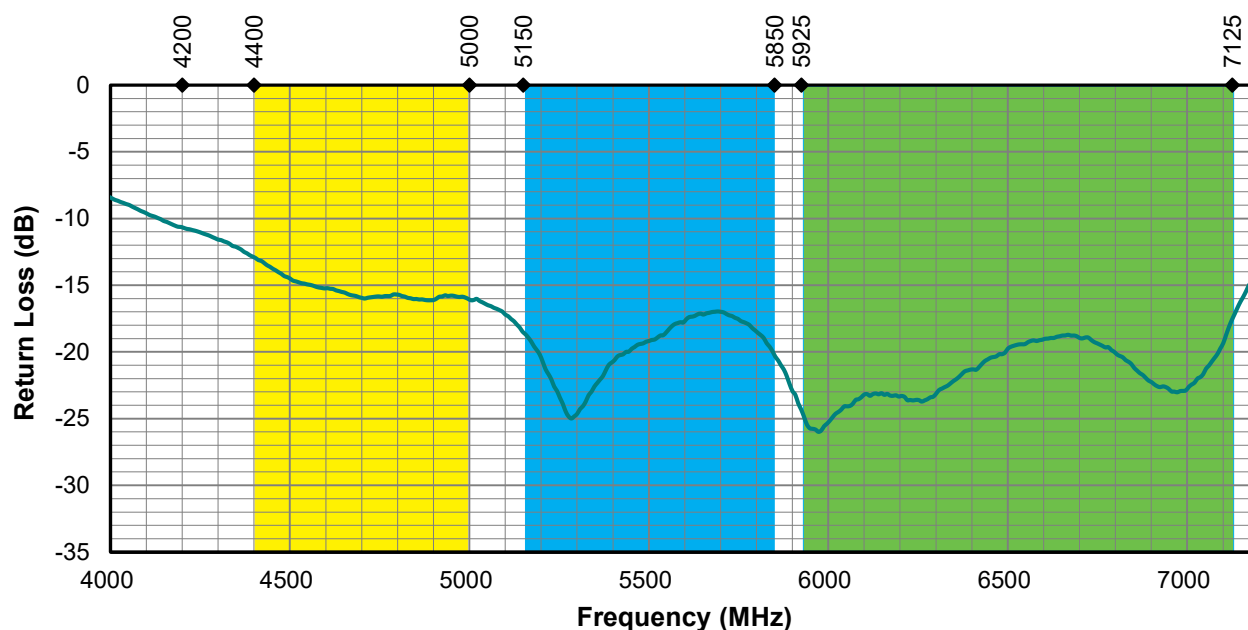


Figure 5. Antenna Return Loss

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.

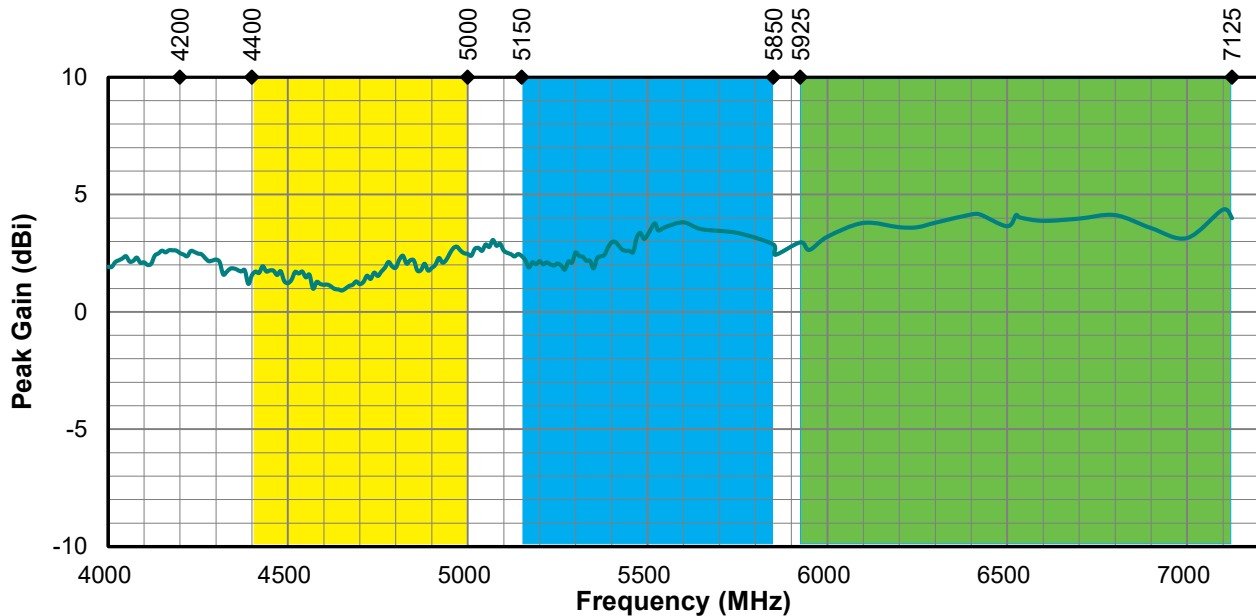


Figure 6. Antenna Peak Gain

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.

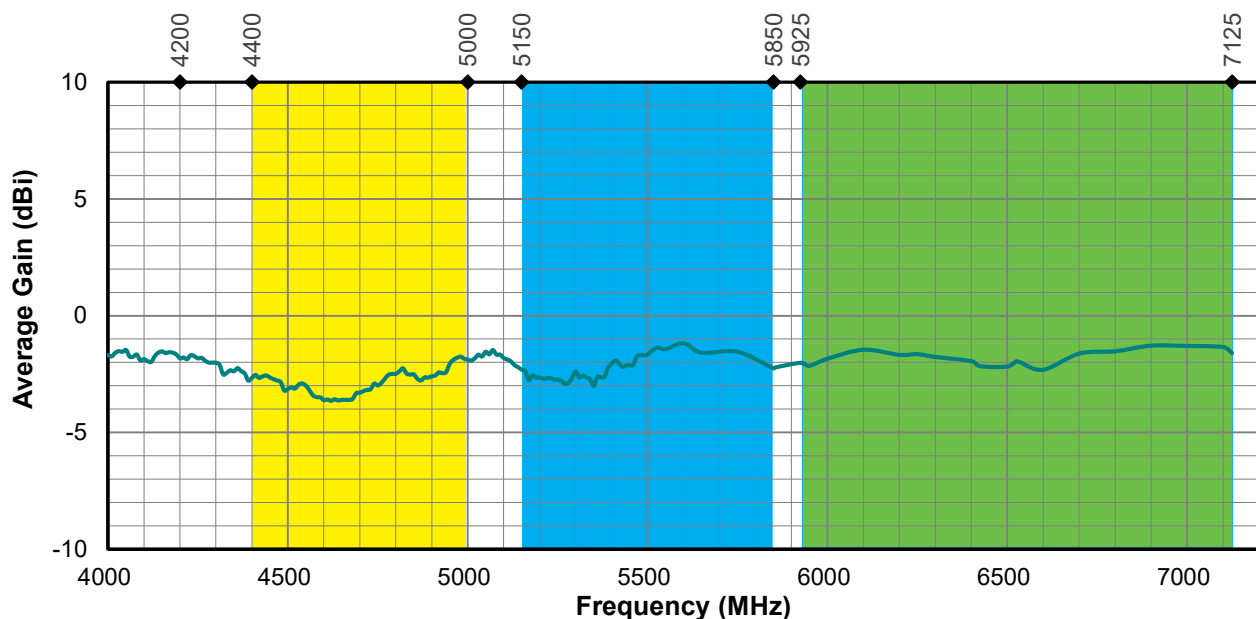


Figure 7. Antenna Average Gain

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.

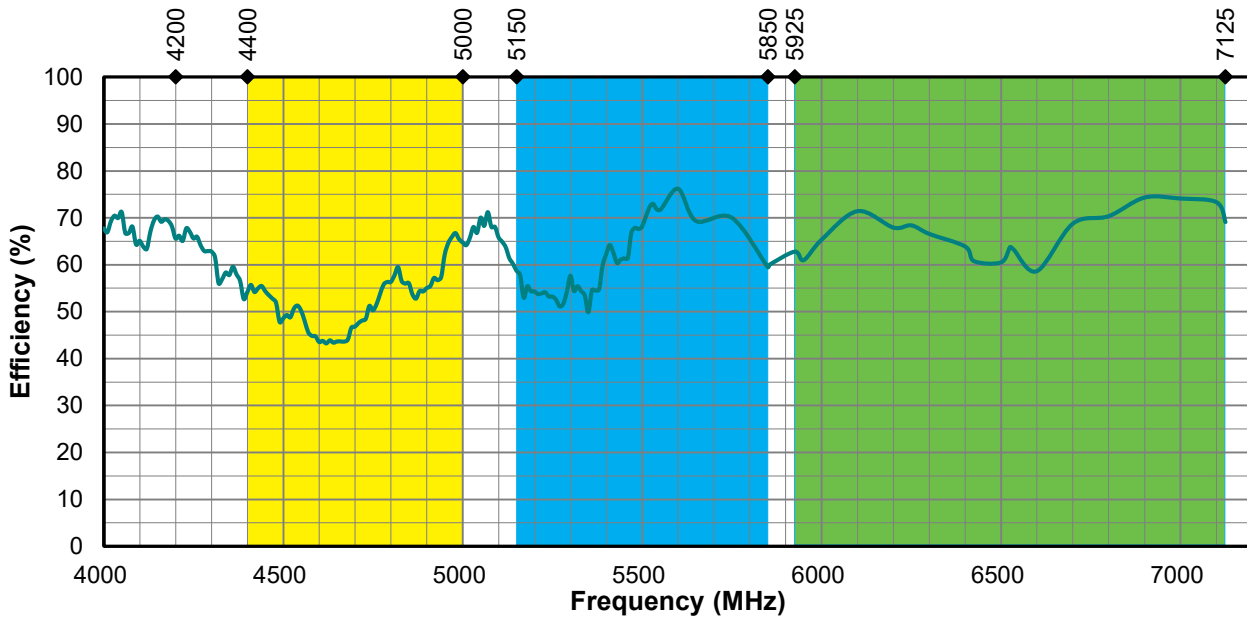
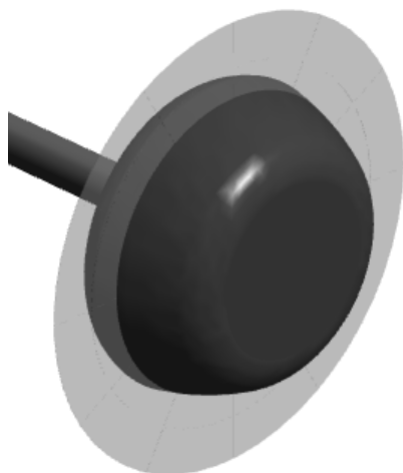


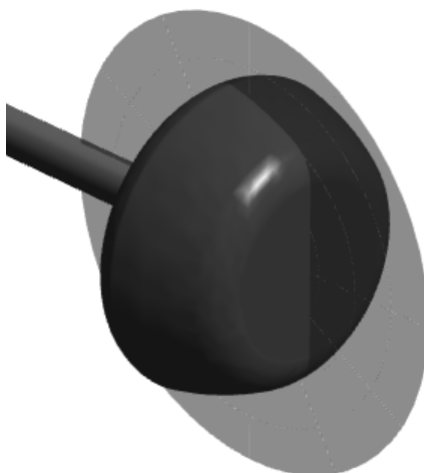
Figure 8. Antenna Efficiency

Radiation Patterns

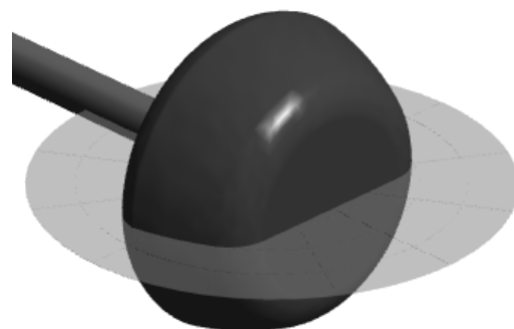
Radiation patterns provide information about the directionality and 3-dimensional gain performance of the antenna by plotting gain at specific frequencies in three orthogonal planes. Antenna radiation patterns are shown in **Figure 9** using polar plots covering 360 degrees. The antenna graphic at the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



XZ-Plane Gain

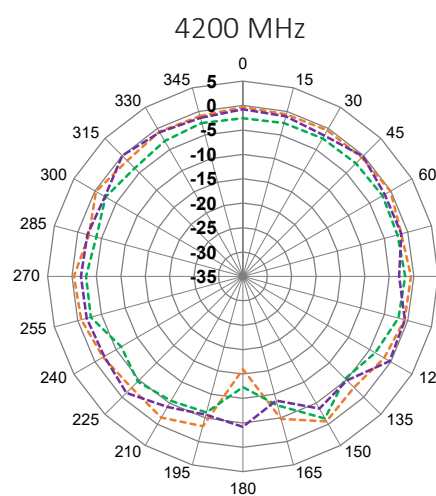
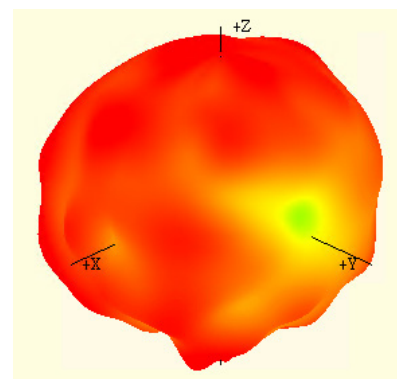
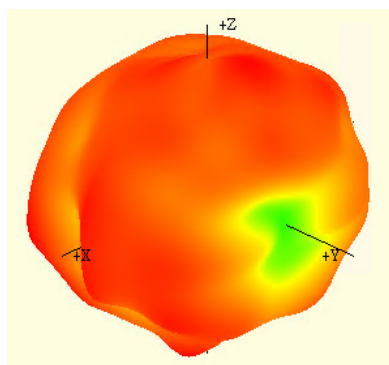
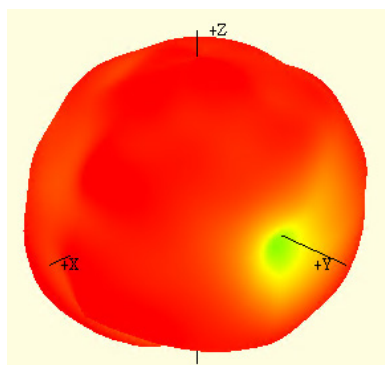


YZ-Plane Gain

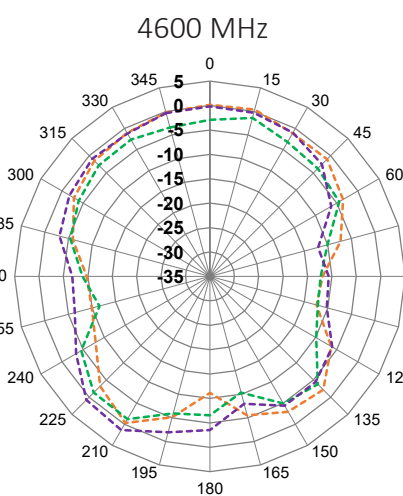


XY-Plane Gain

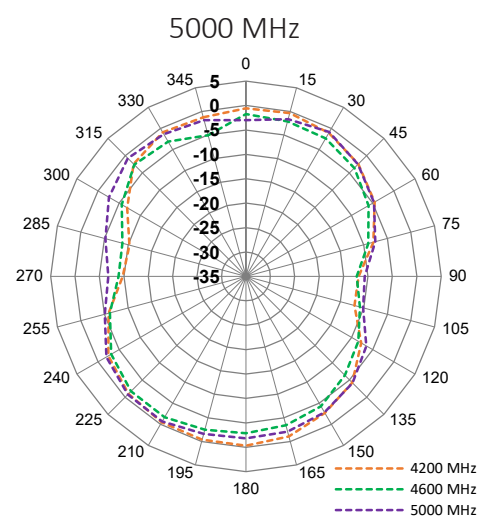
4200 MHz to 5000 MHz (4600 MHz)



XZ-Plane



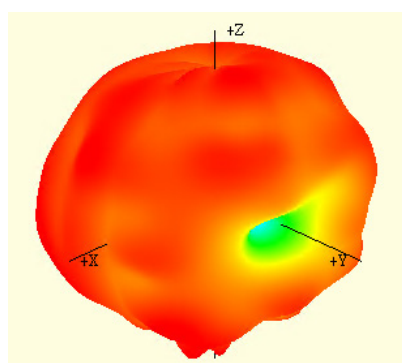
YZ-Plane



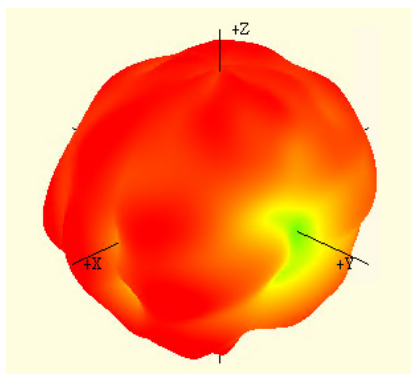
XY-Plane

Figure 9. Antenna Radiation Pattern

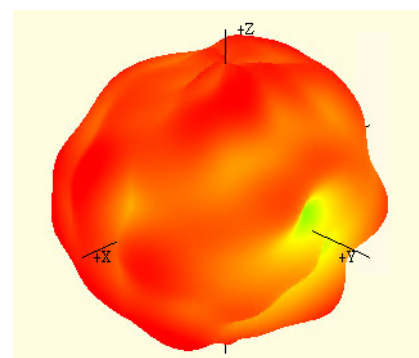
5150 MHz to 5850 MHz (5550 MHz)



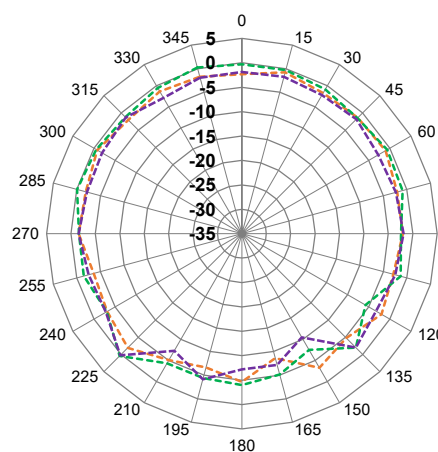
5150 MHz



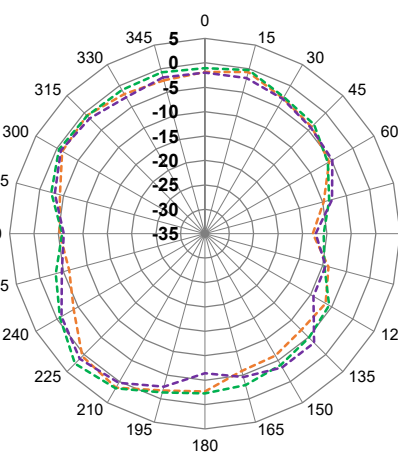
5550 MHz



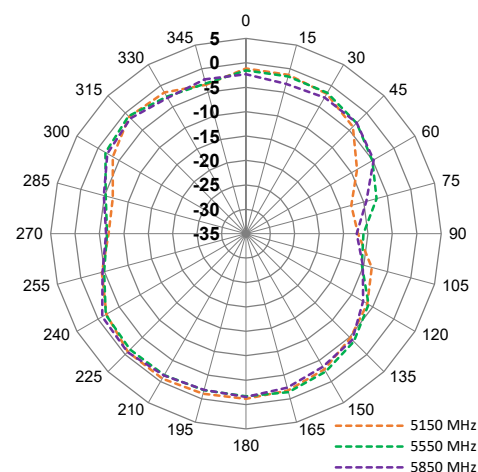
5850 MHz



XZ-Plane

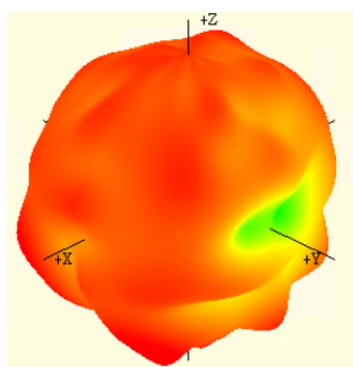


YZ-Plane

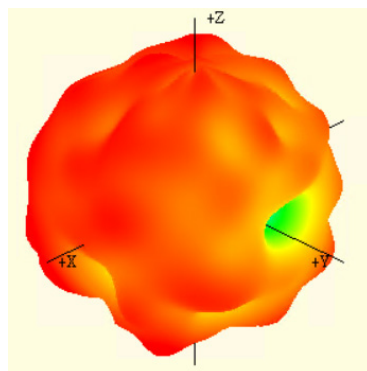


XY-Plane

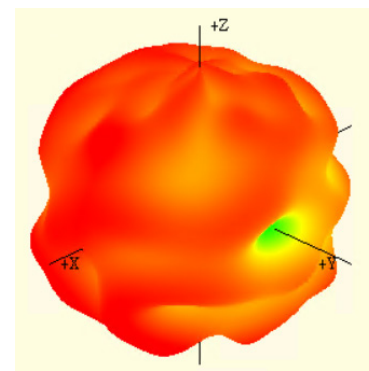
5925 MHz to 7125 MHz (6525 MHz)



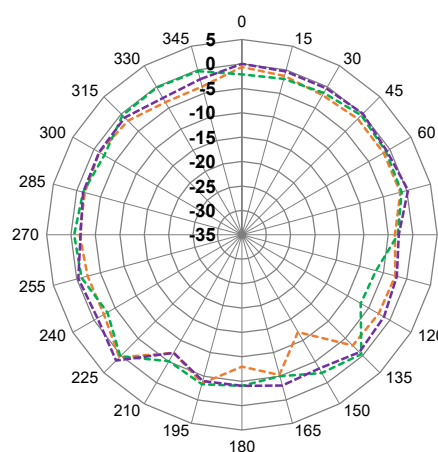
5925 MHz



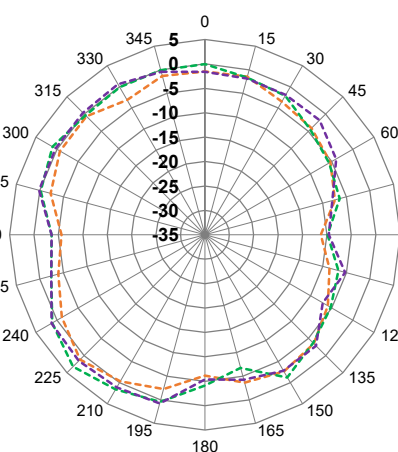
6525 MHz



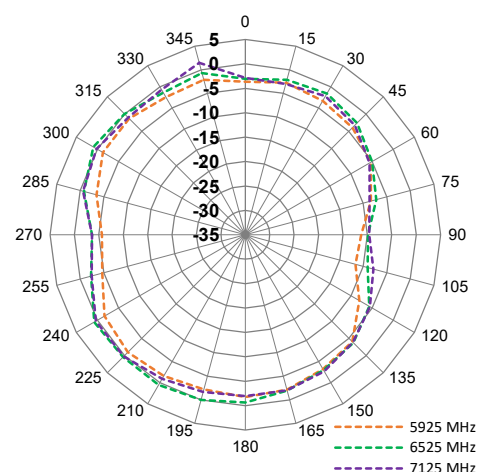
7125 MHz



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 (Receptacle)	Connector 2 (Plug)	Cable Length		Cable Diameter (mm)
				mm	Inch	
CX-SAS0MPA1W0007		SMA Jack Female Socket Straight	MHF1	70	2.76	1.13
CX-SAZ0MPA1W0020		SMA Jack Female Socket Straight	MHF1	200	7.87	1.13
CT-SAB41X		SMA Jack Female Socket Straight	N/A			
CT-SAB010XM		SMA Jack Female Socket Straight	N/A			
CT-SAB11X-006M		SMA Jack Female Socket Right Angle	N/A			
CT-SAB16X-006M		SMA Jack Female Socket Right Angle	N/A			

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