

THF-3802cc3B

WiFi 7/6E Panel-Mount Antenna

The Joymax THF-3802cc3B is a panel-mount, dipole antenna designed for use in 2.4 GHz, 5 GHz, and 6 GHz frequency bands supporting WiFi 7, WiFi 6E, and WiFi 6 applications.

The antenna features IP67-rated waterproof design, can be directly mounted on end-users’ product enclosure/ panel/roof or a L bracket. Connection is made to the radio via a coaxial cable terminated in an SMA plug (male pin) or RP-SMA Plug (female socket) connector.



Features

- Broad bandwidth 2.4 GHz to 7.125 GHz
- Performance at 2400 MHz to 2500 MHz
 - VSWR: ≤ 1.6
 - Peak Gain: 2.4 dBi
 - Efficiency: 55%
- Performance at 5150 MHz to 5850 MHz
 - VSWR: ≤ 2.1
 - Peak Gain: 5.6 dBi
 - Efficiency: 54%
- IP67 rated, waterproof design
- Ground independence dipole design
- Omnidirectional radiation
- RP-SMA (female socket) or SMA connector

Applications

- WiFi/WLAN applications:
 - WiFi 7 (802.11be)
 - WiFi 6E (802.11ax)
 - WiFi 6 (802.11ax)
 - WiFi 5 (802.11ac)
 - WiFi 4 (802.11n)
- 2.4 GHz ISM applications:
 - Bluetooth®
 - ZigBee®
 - Thread®
 - IEEE 802.15.4
 - IEEE 802.11b/g
- Internet of Things (IoT) gateways

Ordering Information

Part Number	Description
THF-3802SA3B-Q200	WiFi 7/6E Panel-Mount Antenna with RG58 coax cable, L=2000 mm & SMA plug
THF-3802RS3B-Q200	WiFi 7/6E Panel-Mount Antenna with RG58 coax cable, L=2000 mm & RP-SMA plug

Available from Joymax Inc. and select distributors and representatives.

Table 1: Electrical Specifications

THF-3802cc3B	WiFi / WLAN Band (MHz)		
Frequency Range	2400~2500	5150~5850	5925~7125
VSWR (Max)	1.6	2.1	2.4
Peak Gain (dBi)	2.4	5.6	4.0
Average Gain (dBi)	-2.6	-2.7	-4.5
Efficiency (%)	55	54	36
Polarization	Linear		
Radiation	Omni directional		
Max Power	5 W		
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 and 300 mm RG58 cable.

ATTENUATION FIGURES - RG58 (5 MM or 0.195 INCH DIAMETER) CABLES

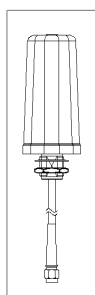
Frequency Range (MHz)	698	960	1710	2650	3300	4400	5000	5850	7125
Cable Attenuation (dB/M)	< 0.4	< 0.5	< 0.6	< 0.8	< 0.9	< 1.1	< 1.2	< 1.3	< 1.7

Table 2: Mechanical Specifications

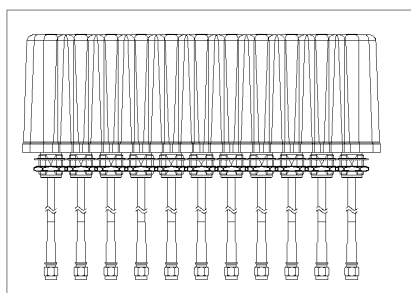
Parameter	Value
Connection	SMA Plug (male pin) or RP-SMA (female socket) Connector
Operating Temp.	-40°C to +85°C
Weight	2000 mm RG58 cable—238g
Dimension	77.7 mm x $\varnothing$ 38 mm
Antenna Color	Black
Ingress Protection	IP67

Packaging Information

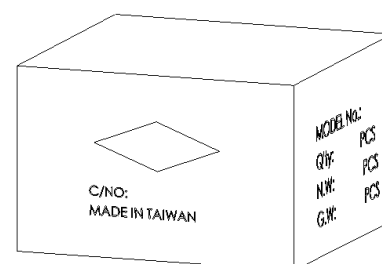
The THF-3802cc3B antennas are individually sealed in a clear plastic bag as shown in **Figure 1**. 50 pcs per carton, 390 mm x 260 mm x 330 mm (15.4 in x 10.2 in x 13.0 in), total weight 11.2kgs (26.2 lb). Distribution channels may offer alternative packaging options.



1 pce antenna/ 1 PE bag



10 pcs antenna/1 Bigger PE bag



50 pcs antenna/1 Carton

Figure 1. Antenna Packaging

Product Dimensions

Figure 2 provides dimensions of the THF-3802cc3B in mm measurement unit. The antenna is designed to mount on device enclosure/panel/roof or a L bracket for outdoor use with ingress protection IP67 rating. Standard antenna pack excludes L bracket.

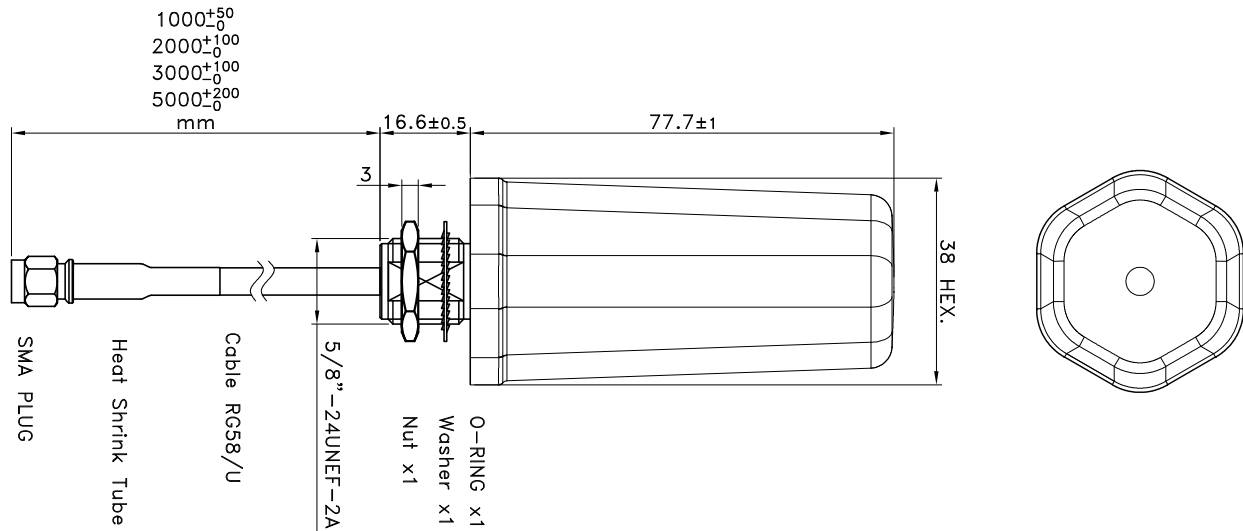


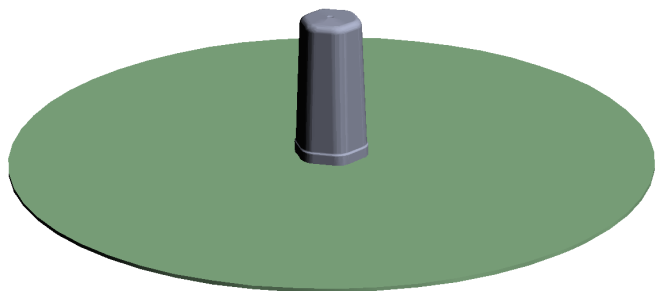
Figure 2. Antenna Dimensions

Antenna Test Setup

The THF-3802cc3B antenna is tested in 2 setups as shown in **Figure 3**. The antenna is a dipole, doesn't require ground plane for better performance. However test with a 350 mm (13.8 in.) diameter metal plate provides insight into antenna performance when installed on roof in really case application. The 2 setups represent the most common use cases.



Hanging free without ground plane



Mount on a 350 mm ground plane

Figure 3. Antenna Test Setup

HANGING FREE WITHOUT GROUND PLANE

The charts on the following pages represent data taken with the antenna hanging free in the space without ground plane as shown in **Figure 4**.



Figure 4. Hanging free without ground plane

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.

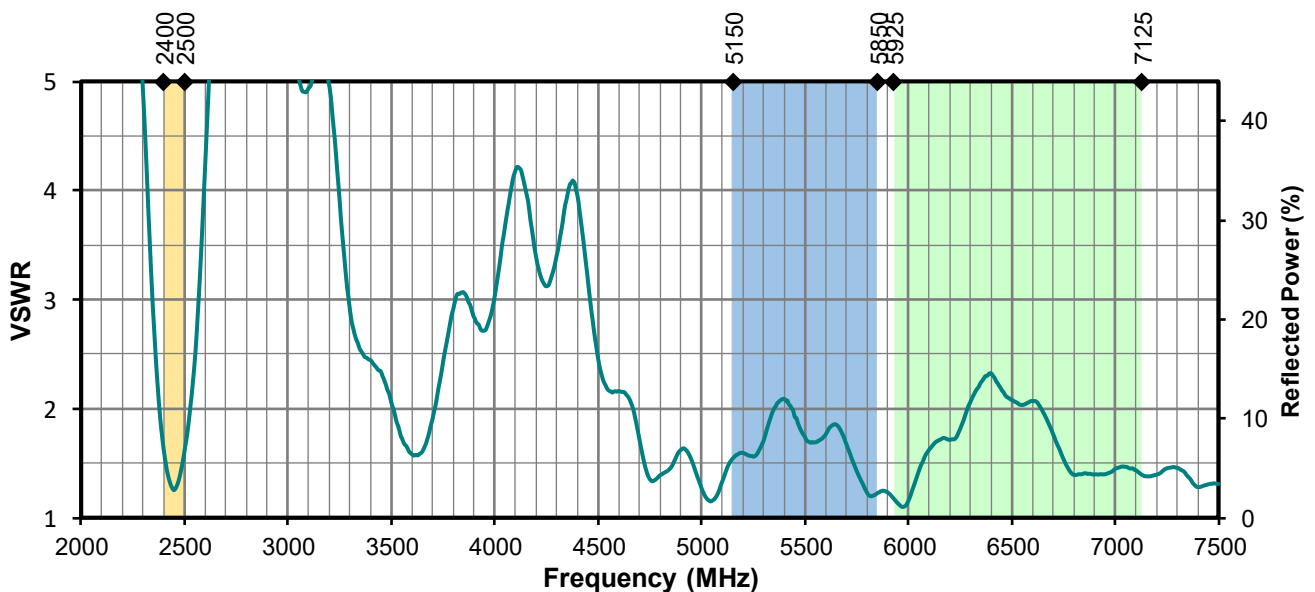


Figure 5. Antenna VSWR

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.

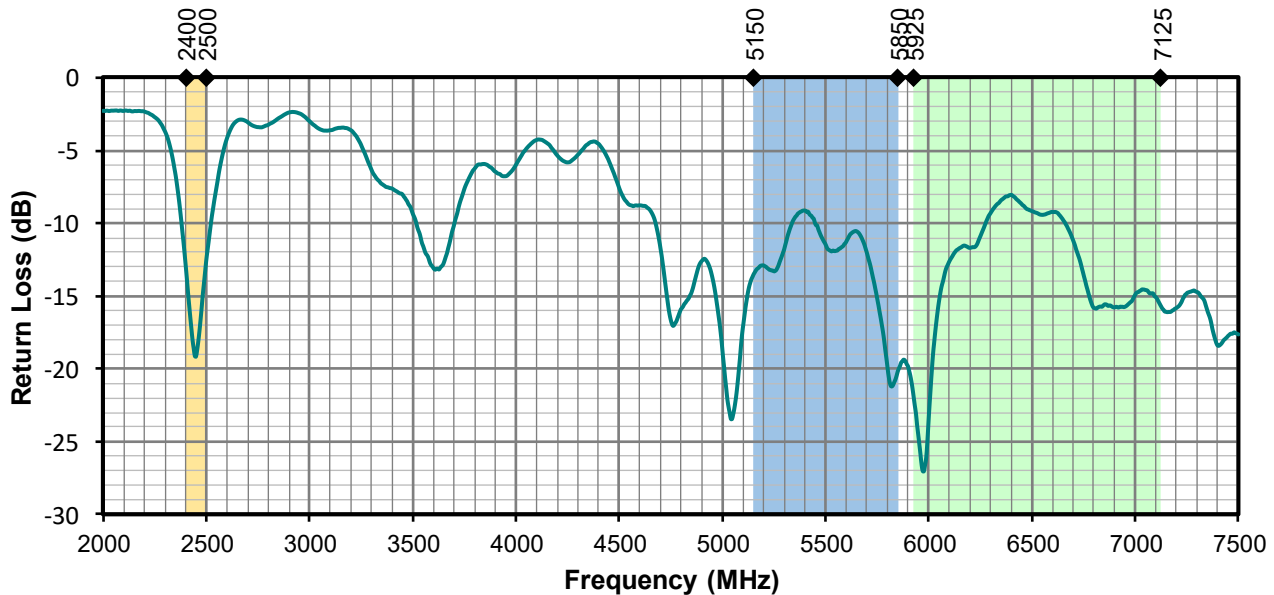


Figure 6. Antenna Return Loss

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.

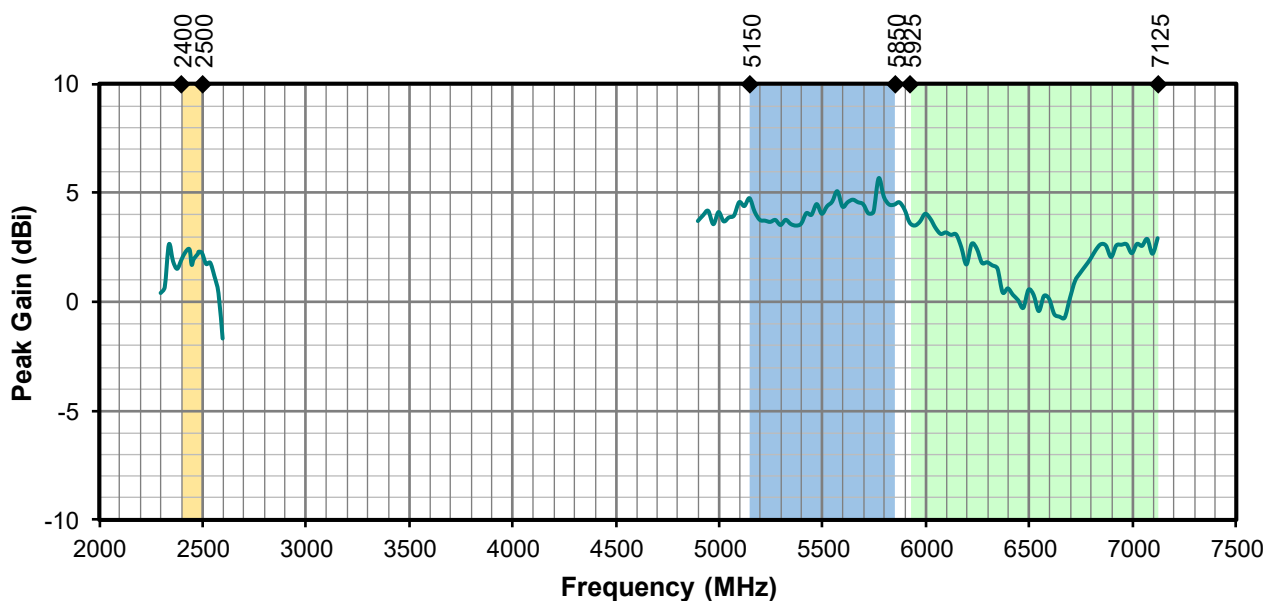


Figure 7. Antenna Peak Gain, Straight

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.

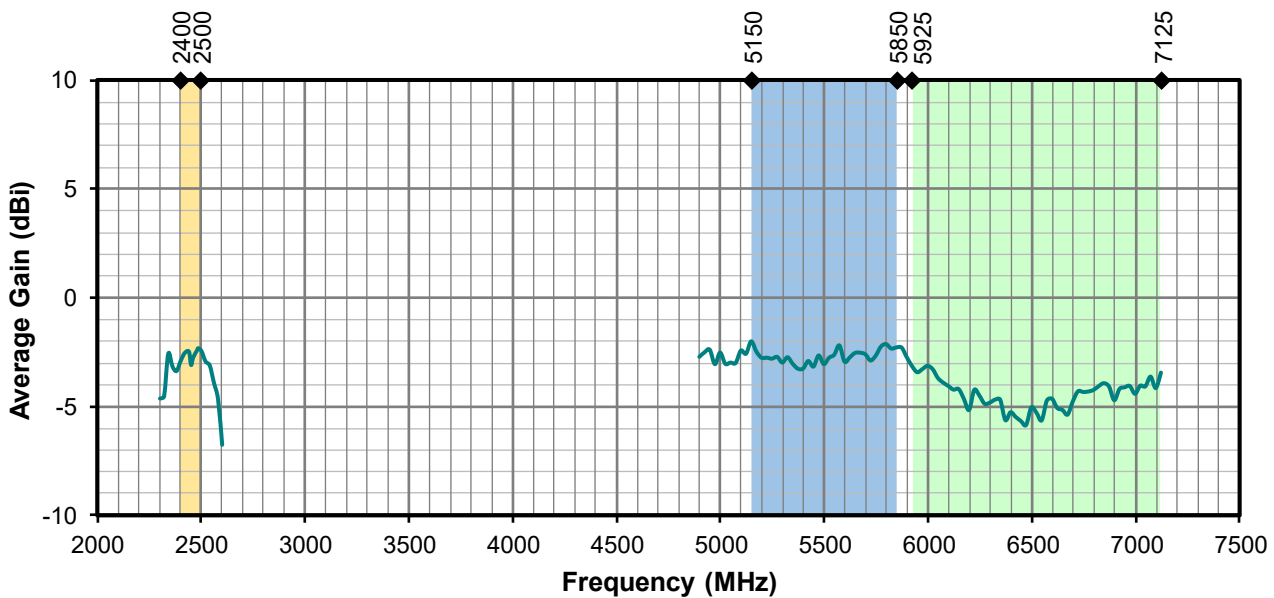


Figure 8. Antenna Average Gain

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.

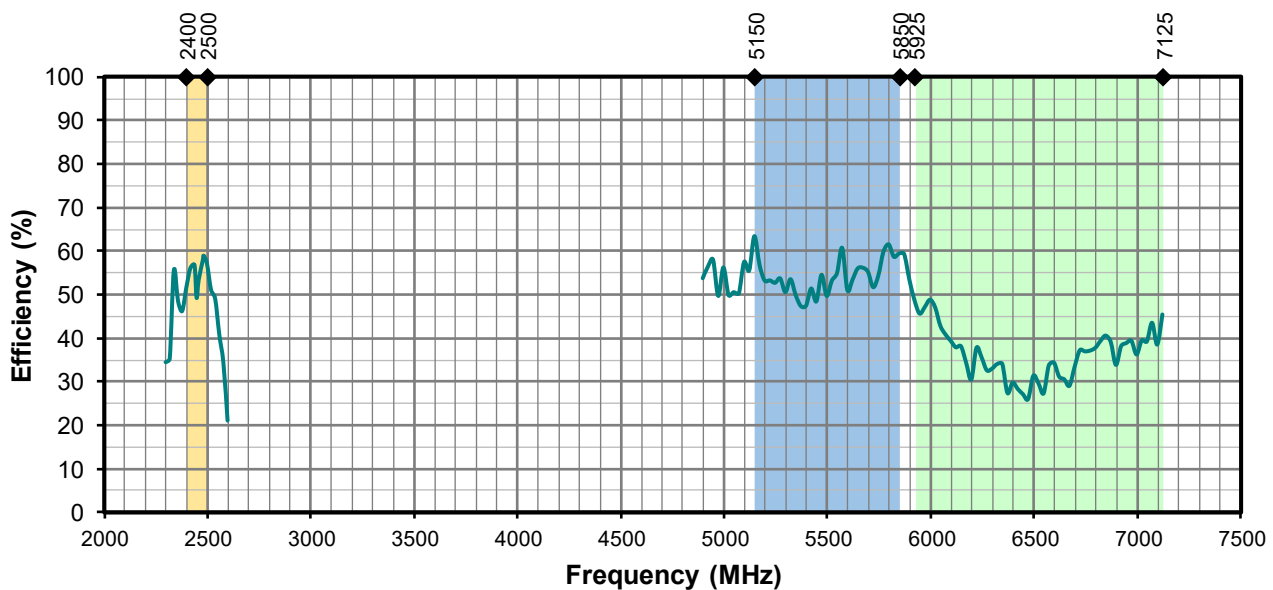


Figure 9. Antenna Efficiency

Radiation Patterns

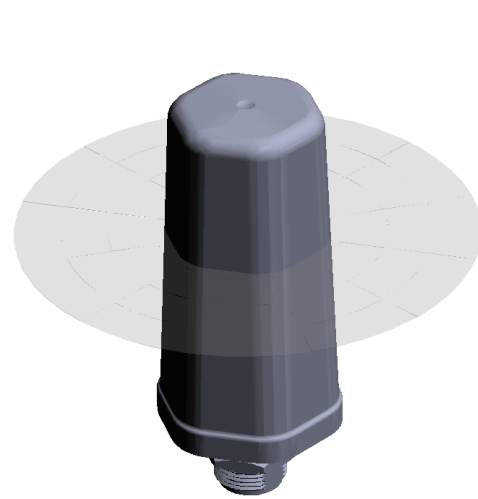
Radiation patterns provide information about the directionality and 3-dimensional gain performance of the antenna by plotting gain at specific frequencies in three orthogonal planes. Antenna radiation patterns without ground plane are shown in **Figure 10** using polar plots covering 360 degrees. The antenna graphic at the top of the page provides reference to the plane of the column of plots below it.



XZ-Plane

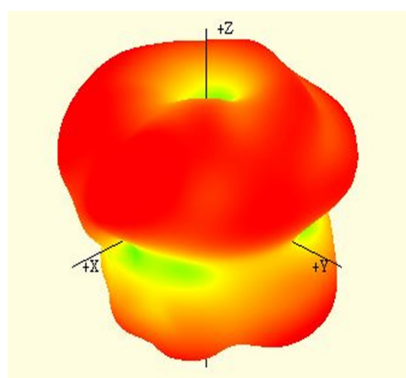


YZ-Plane

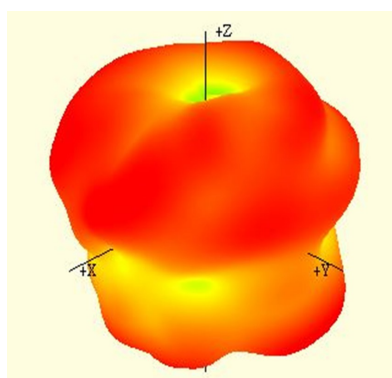


XY-Plane

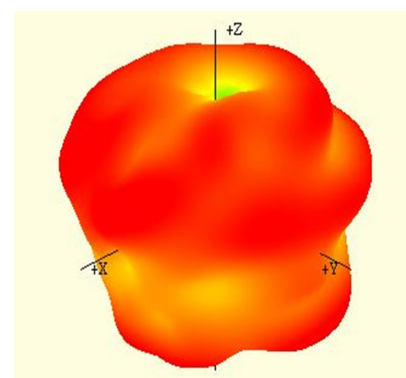
2400 MHz to 2500 MHz (2450 MHz)



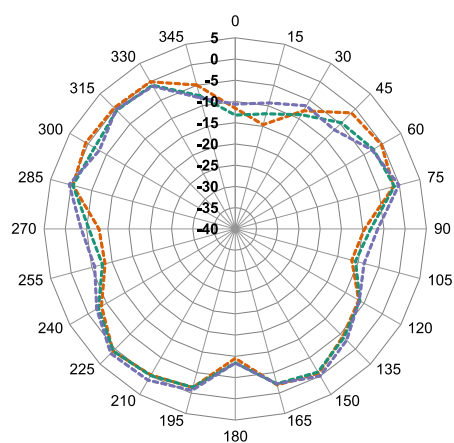
2400 MHz



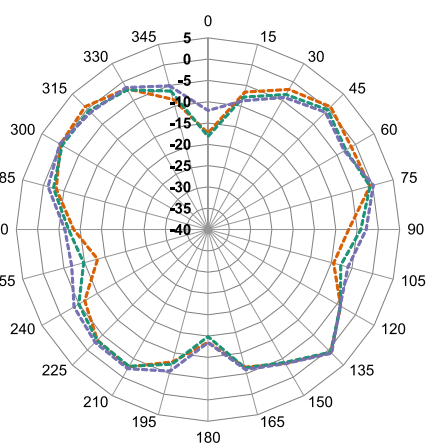
2450 MHz



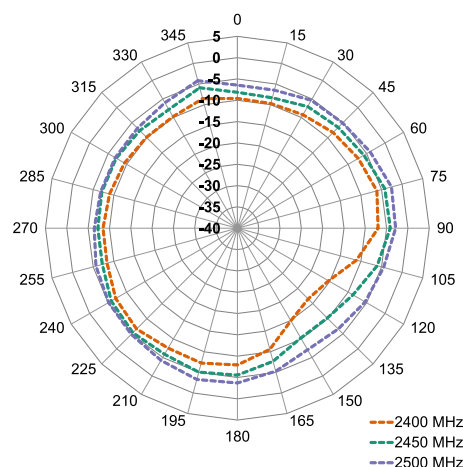
2500 MHz



XZ-Plane Gain



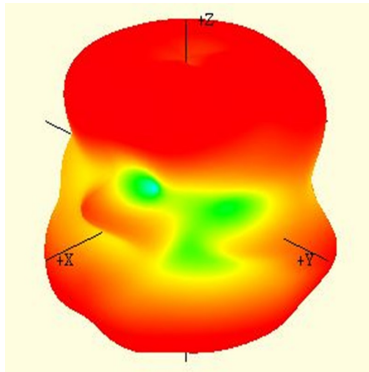
YZ-Plane Gain



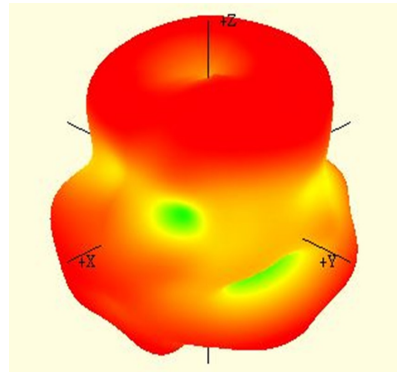
XY-Plane Gain

Figure 10. Antenna Radiation Patterns

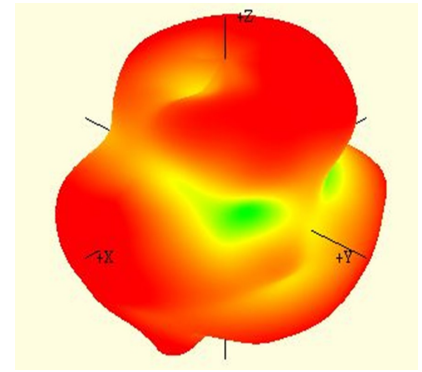
5150 MHz to 5850 MHz (5500MHz)



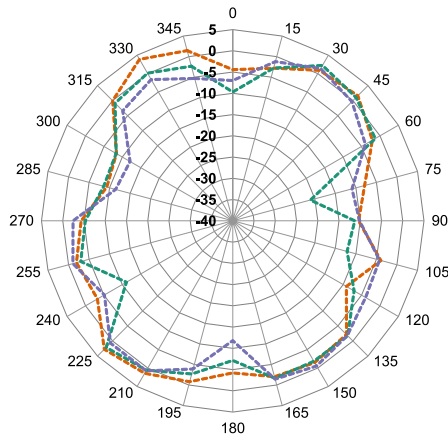
5150 MHz



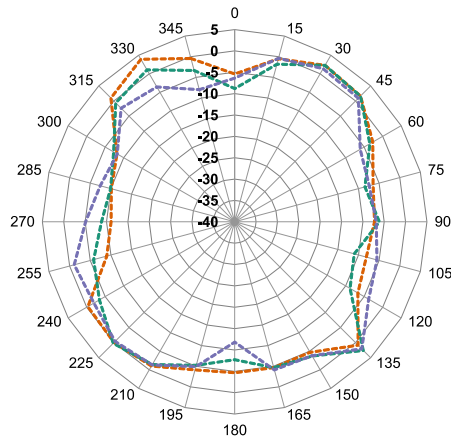
5500 MHz



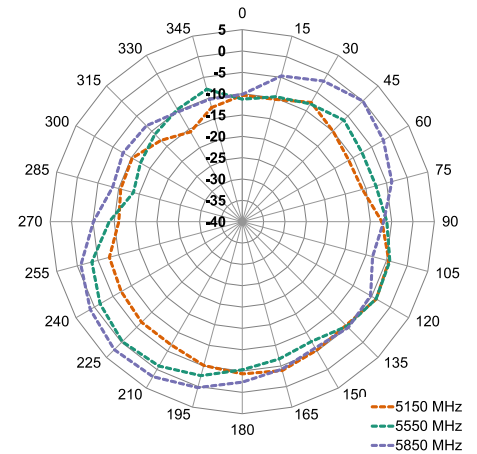
5850 MHz



XZ-Plane Gain

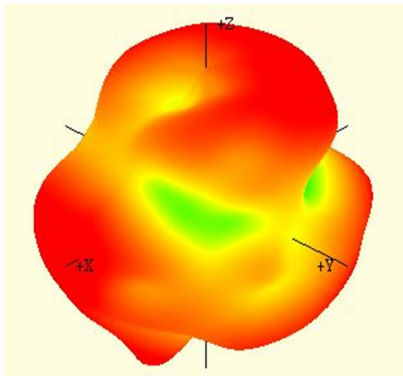


YZ-Plane Gain

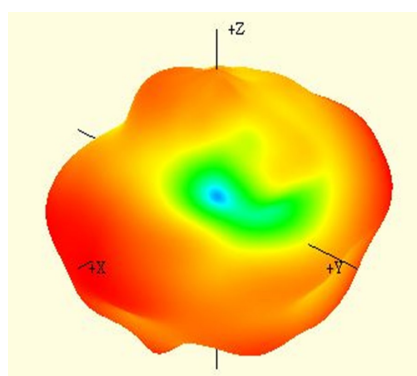


XY-Plane Gain

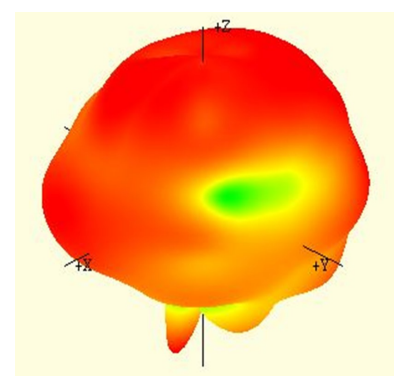
5925 MHz to 7125 MHz (6525 MHz)



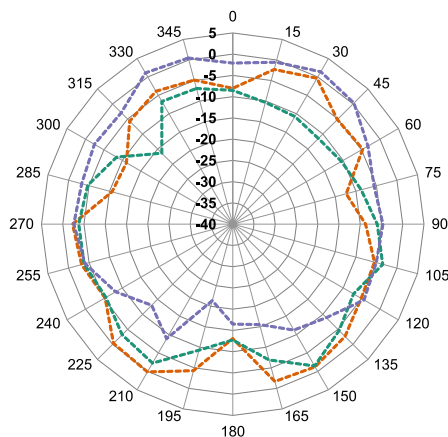
5925 MHz



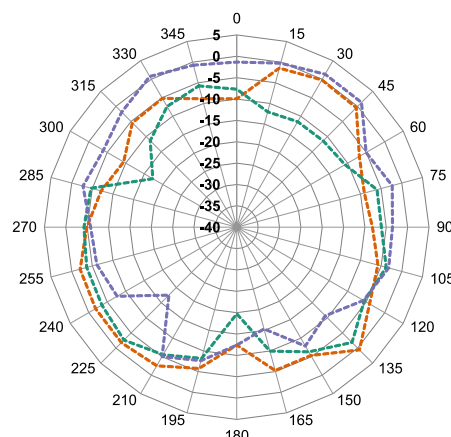
6525 MHz



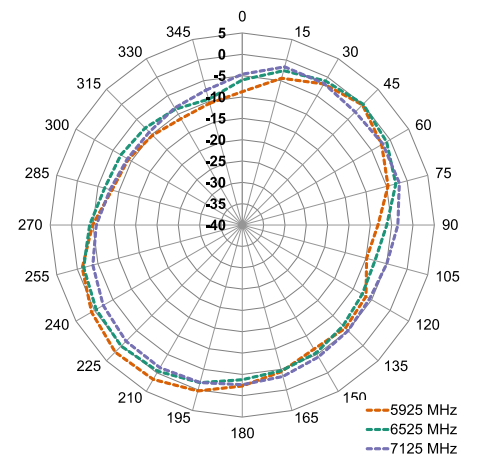
7125 MHz



XZ-Plane Gain



YZ-Plane Gain



XY-Plane Gain

WITH GROUND PLANE

The charts on the following pages represent data taken with the antenna mount on a 350 mm (13.8 in.) diameter metal plate as shown in **Figure 11**.

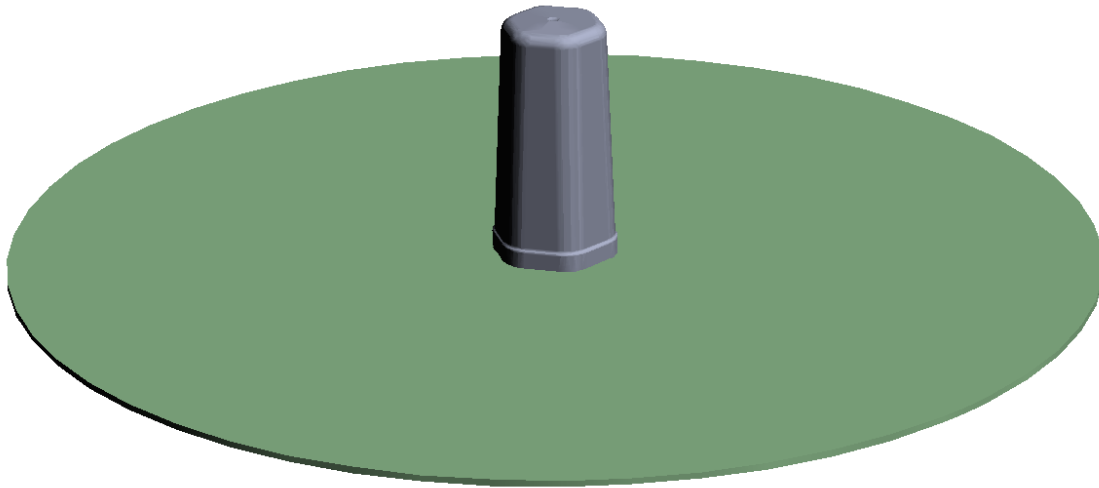


Figure 11. Mount on a 350 mm ground plane

VSWR

Figure 12 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.

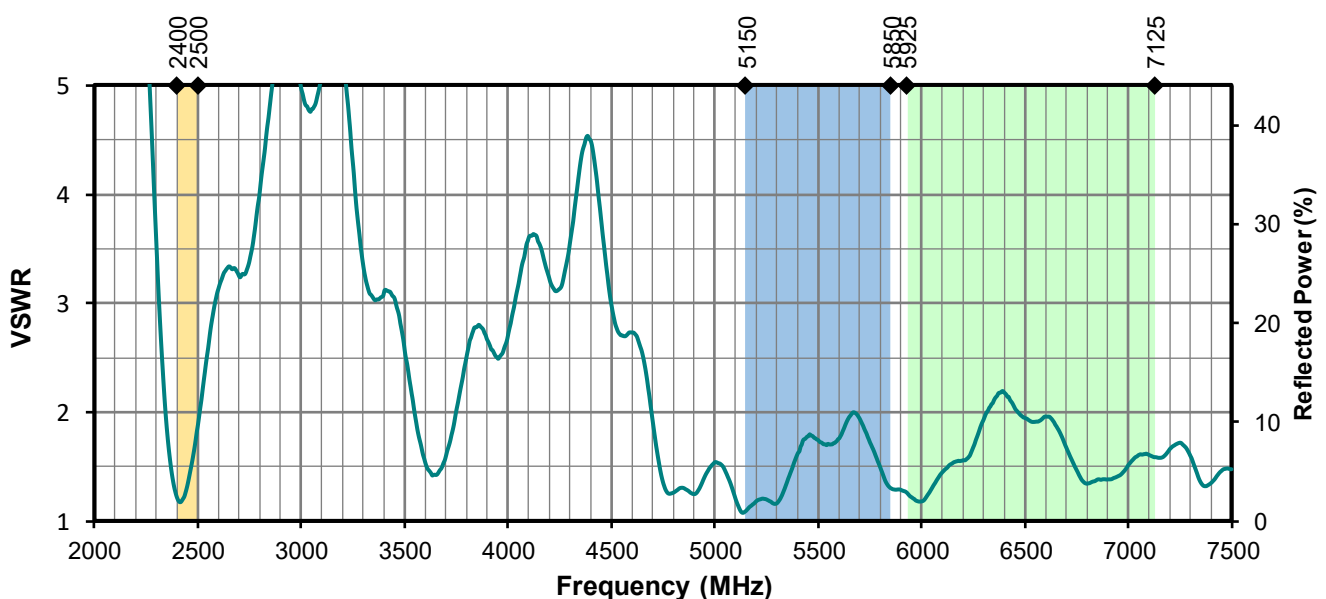


Figure 12. Antenna VSWR

Return Loss

Return loss (**Figure 13**), 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.

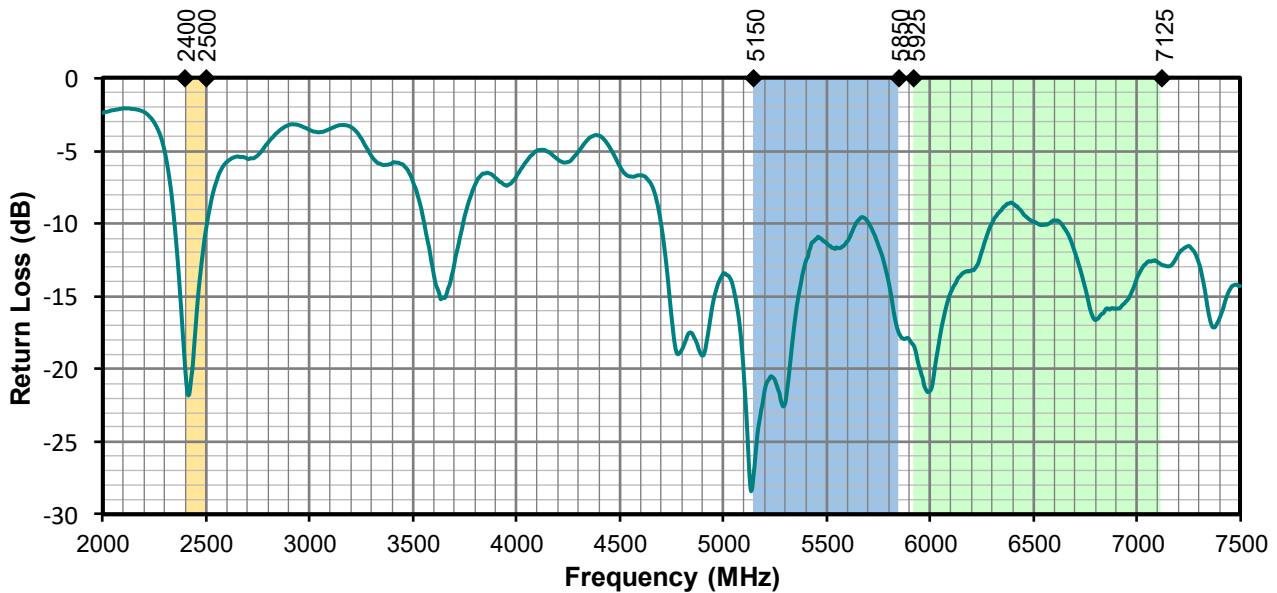


Figure 13. Antenna Return Loss

Peak Gain

The peak gain across the antenna bandwidth is shown in **Figure 14**. 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.

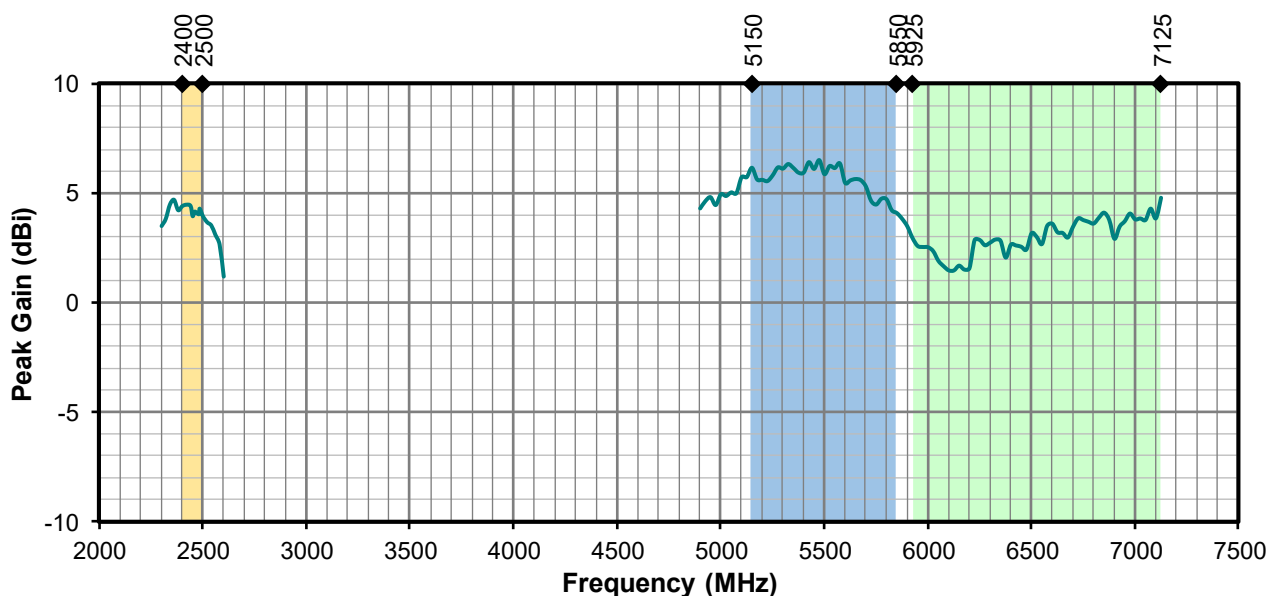


Figure 14. Antenna Peak Gain, Straight

Average Gain

Average gain (**Figure 15**), is the average of all antenna gain in 3-dimensional space at each frequency, providing an indication of overall performance without expressing antenna directionality.

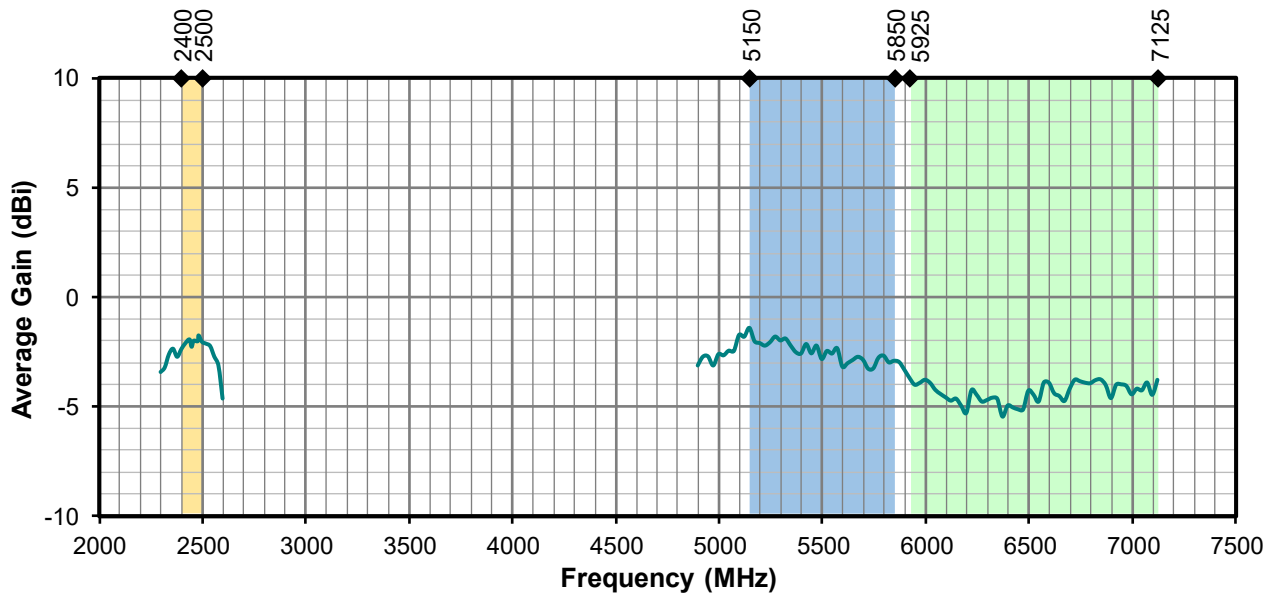


Figure 15. Antenna Average Gain

Radiation Efficiency

Radiation efficiency (**Figure 16**), 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.

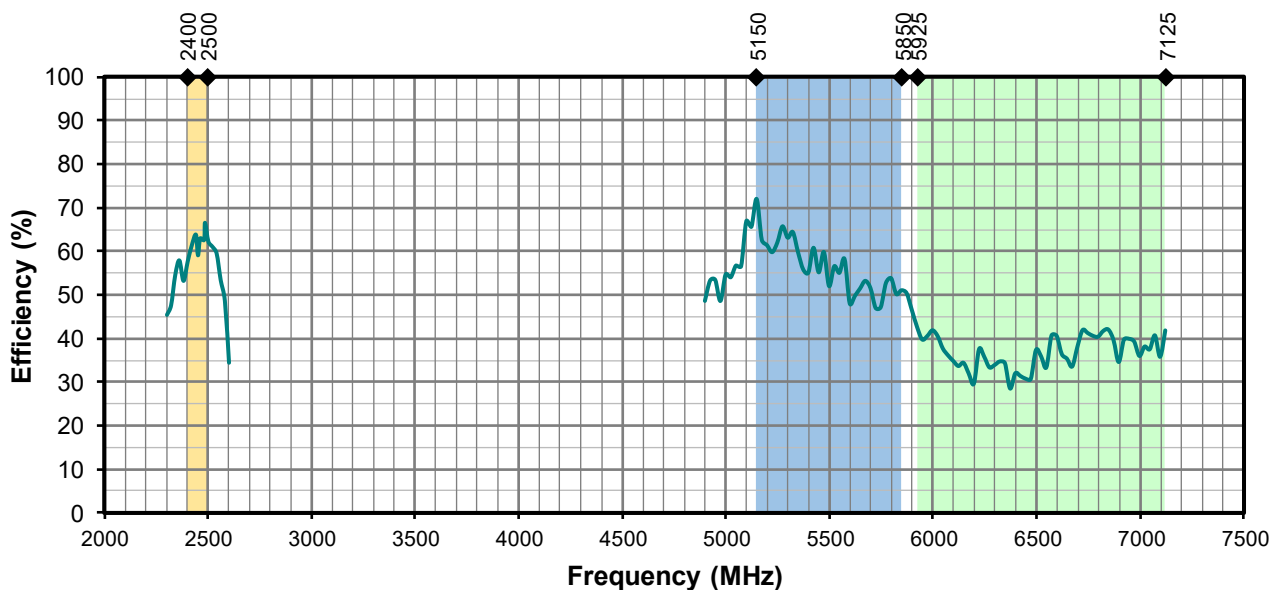
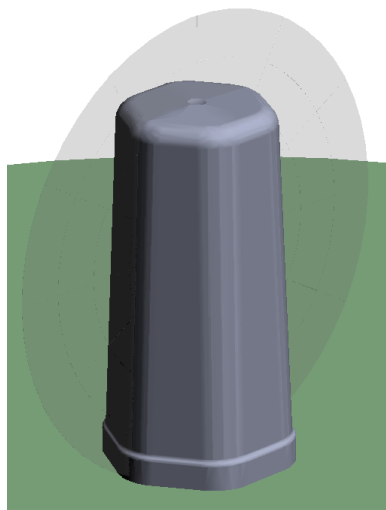


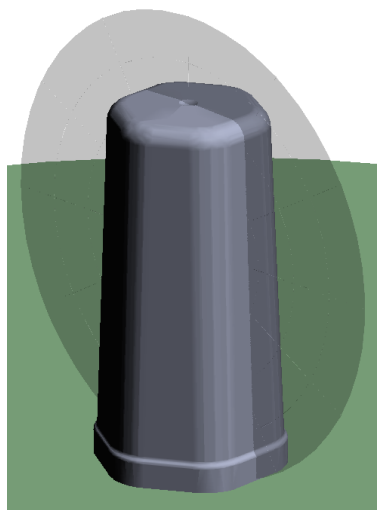
Figure 16. Antenna Efficiency

Radiation Patterns

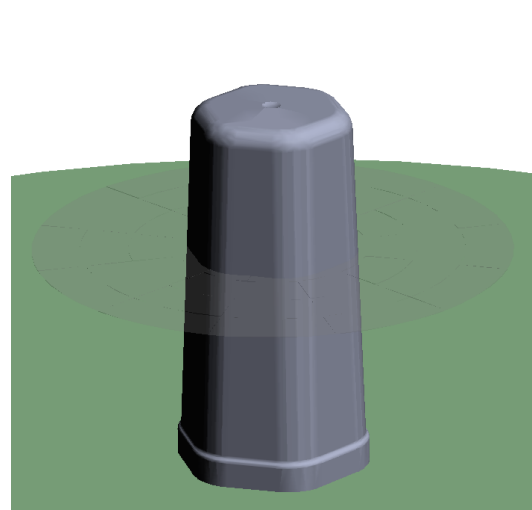
Radiation patterns provide information about the directionality and 3-dimensional gain performance of the antenna by plotting gain at specific frequencies in three orthogonal planes. Antenna radiation patterns with ground plane are shown in **Figure 17** using polar plots covering 360 degrees. The antenna graphic at the top of the page provides reference to the plane of the column of plots below it.



XZ-Plane

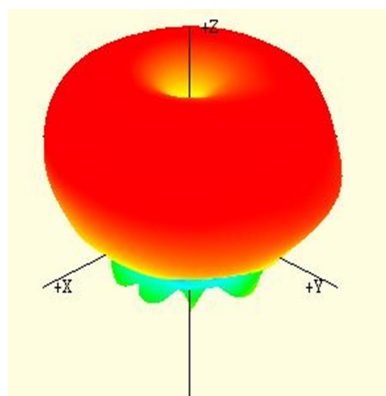


YZ-Plane

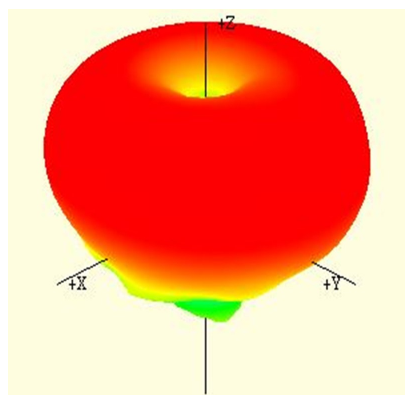


XY-Plane

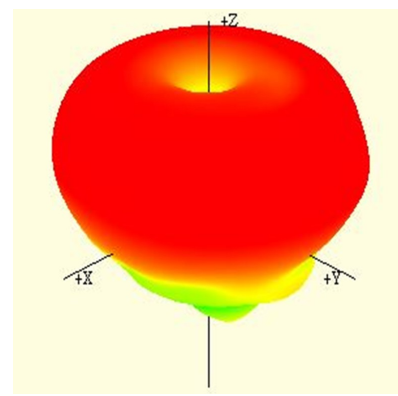
2400 MHz to 2500 MHz (2450 MHz)



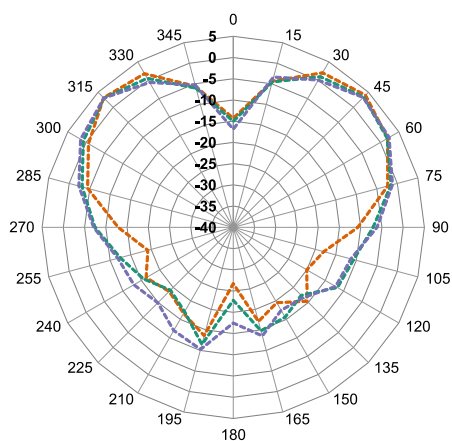
2400 MHz



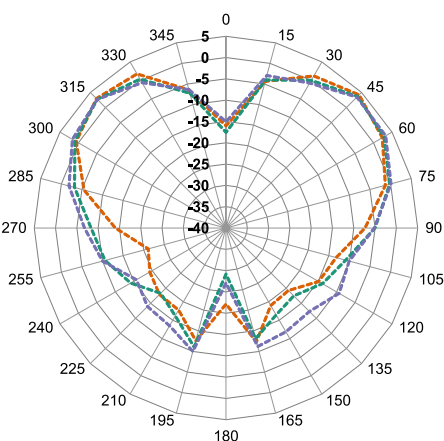
2450 MHz



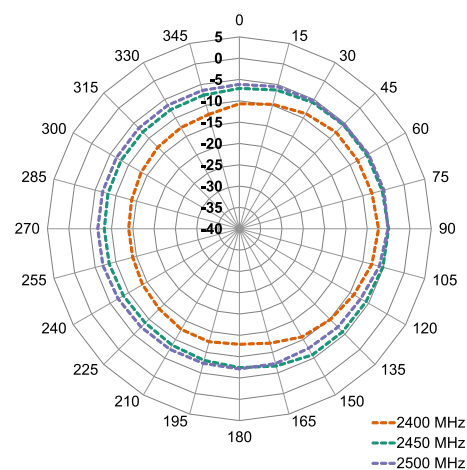
2500 MHz



XZ-Plane Gain



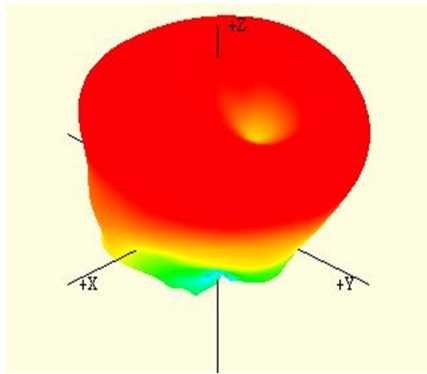
YZ-Plane Gain



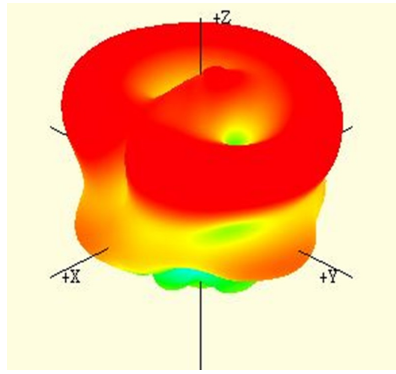
XY-Plane Gain

Figure 17. Antenna Radiation Patterns

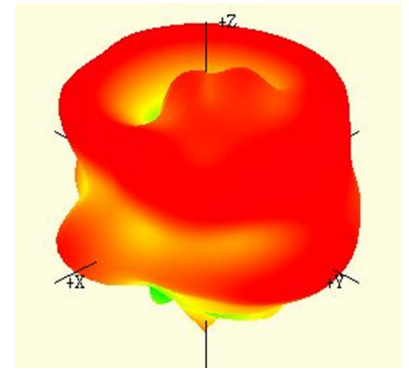
5150 MHz to 5850 MHz (5500MHz)



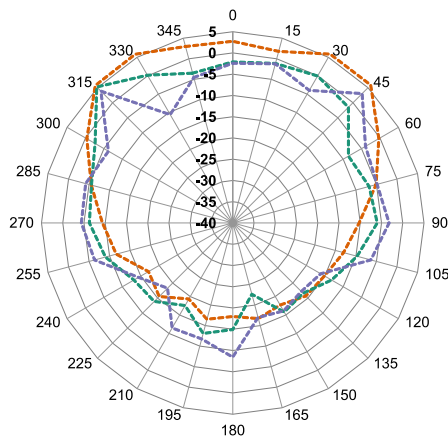
5150 MHz



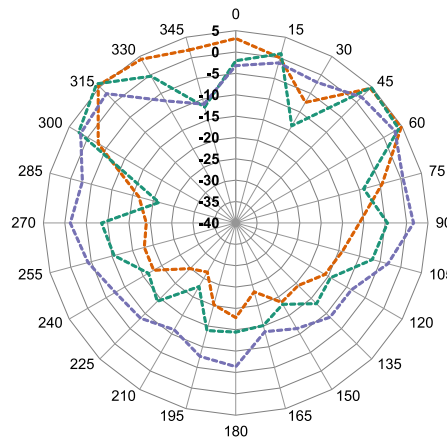
5500 MHz



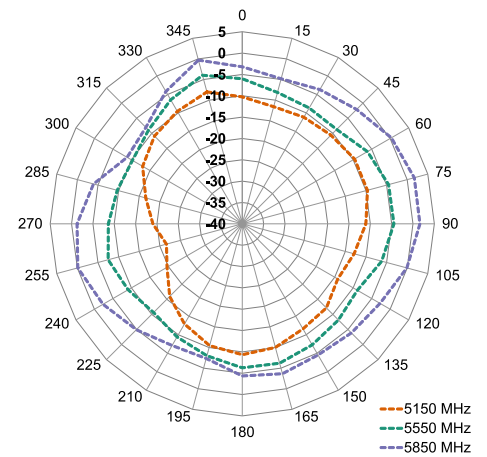
5850 MHz



XZ-Plane Gain

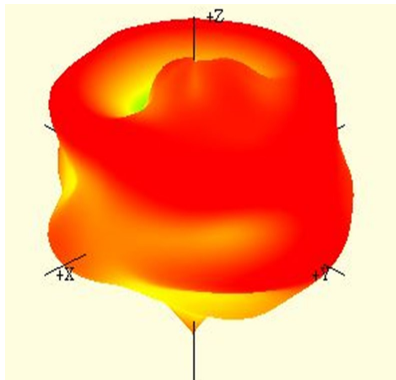


YZ-Plane Gain

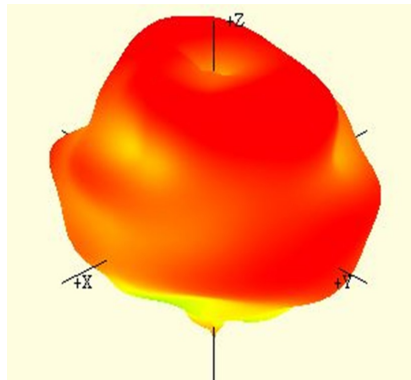


XY-Plane Gain

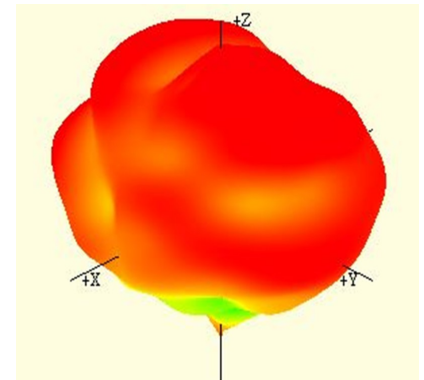
5925 MHz to 7125 MHz (6525 MHz)



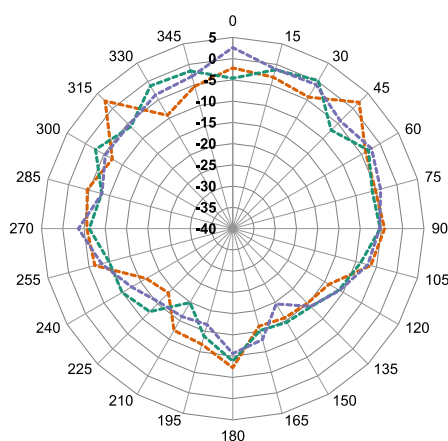
5925 MHz



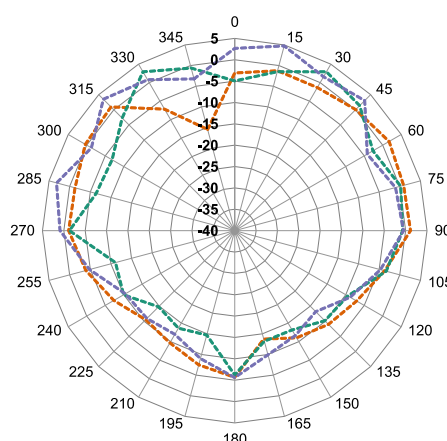
6525 MHz



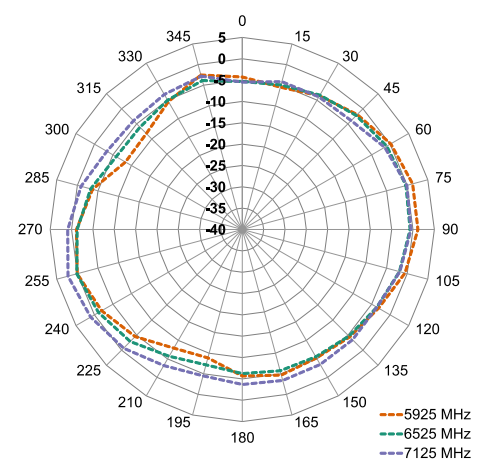
7125 MHz



XZ-Plane Gain



YZ-Plane Gain



XY-Plane Gain

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-SACOMPA1W0020		RP-SMA Jack Male Pin Straight	MHF1	200	7.87	1.13
CX-SAT0MFA1W0030		RP-SMA Jack Male Pin Straight	MHF4	300	11.81	1.13
CT-SAD12X-006M		RP-SMA Jack Male Pin Straight	N/A	N/A	N/A	N/A
CT-SAD11X-006M		RP-SMA Jack Male Pin Right Angle	N/A	N/A	N/A	N/A
CT-SAD010XM		RP-SMA Jack Male Pin Straight	N/A	N/A	N/A	N/A

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