JOYMAX
EnJOY MAX Wireless®

ZHX-150Xcc3B

5G Cellular Blade antenna

The Joymax ZHX-150Xcc3B antenna is a straight blade-style, 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 applications.

The antenna features waterproof design IP67 rated, omnidirectional radiation, attaches with an N-Type Plug (male pin) or N-Type Jack (female socket) connector.

Features

- Bandwidth 617M Hz to 7.125 GHz
- Performance at 617 MHz to 698 MHz
  - VSWR: ≤ 2.2
  - Peak Gain: 2.2 dBi
  - Efficiency: 51%
- Ground independence dipole design
- IP67 rated, waterproof design
- N Plug (male pin) or N Jack (female socket) connector

Applications

- 5G NR FR1, 4G, 3G, 2G, CBRS
- 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
- Outdoor networking gateways

Ordering Information

Part Number	Description
ZHX-150XNX3B	5G/LTE Cellular Straight-Angle Blade antenna w. N Plug (male pin) connector
ZHX-150XNF3B	5G/LTE Cellular Straight-Angle Blade antenna w. N Jack (female socket) connector

Available from Joymax Electronics and select distributors and representatives.

Table 1: Electrical Specifications

ZHX-150Xcc3B	5G NR / LTE Bands (MHz)					
Frequency Range	617~960	1710~2690	3300~4200	4400~5000	5150~5850	5925-7125
VSWR (Max)	2.2	2.8	2.4	3.1	2.7	3.9
Peak Gain (dBi)	2.2	3.3	2.5	4.3	4.7	4.2
Average Gain (dBi)	-2.9	-2.7	-2.6	-2.3	-2.8	-3.4
Efficiency (%)	51	53	55	59	53	46
Polarization	Linear					
Radiation	Omni directional					
Max Power	1 W					
Wavelength	½-λ					
Electrical Type	Dipole					
Impedance	50 Ω					

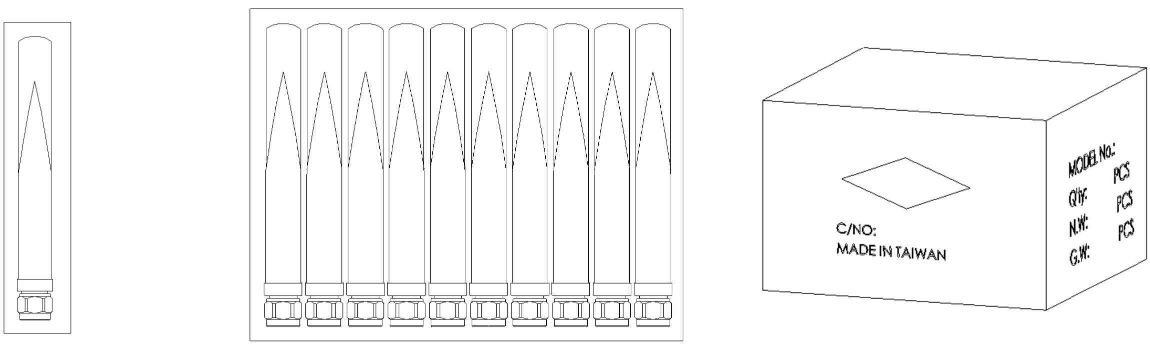
Electrical specifications and plots measured with the antenna hanging free in the space without ground plane.

Table 2: Mechanical Specifications

Parameter	Value	
Connection	N-Type Plug (male pin)	N-Type Jack (female socket)
Dimension	178 mm x ⌀ 21 mm	183 mm x ⌀ 21 mm
Weight	71 g	75g
Connector Torque	0.6 to 1 N.m Recommended	
Operating Temp.	-40˚C to +85˚C	
Radome Material	Thermoplastic Rubber (TPR)	
Antenna Color	Black	
Ingress Protection	IP67	

Packaging Information

The ZHX-150Xcc3B antennas are individually sealed in a clear plastic bag and a small box. **Figure 1**. 100 pcs per carton, 450 mm x 300 mm x 250 mm (18 in x 11.8 in x 9.8 in), total weight 9.2 kgs (20.3 lb) Distribu-tion channels may offer alternative packaging options.



1 pce antenna/ 1 PE bag   10 pcs antenna/ 1 Box   100 pcs antenna/1 Carton

Figure 1. Antenna Packaging

Product Dimensions

Figure 2 provides dimensions of the ZHX-150Xcc3B in mm measurement unit. The antenna can be directly mounted on device enclosure through enclosure-mounted connector (N Plug). The N Jack (female socket) antenna can mount on L bracket through screws. The standard antenna pack excludes L bracket kit.

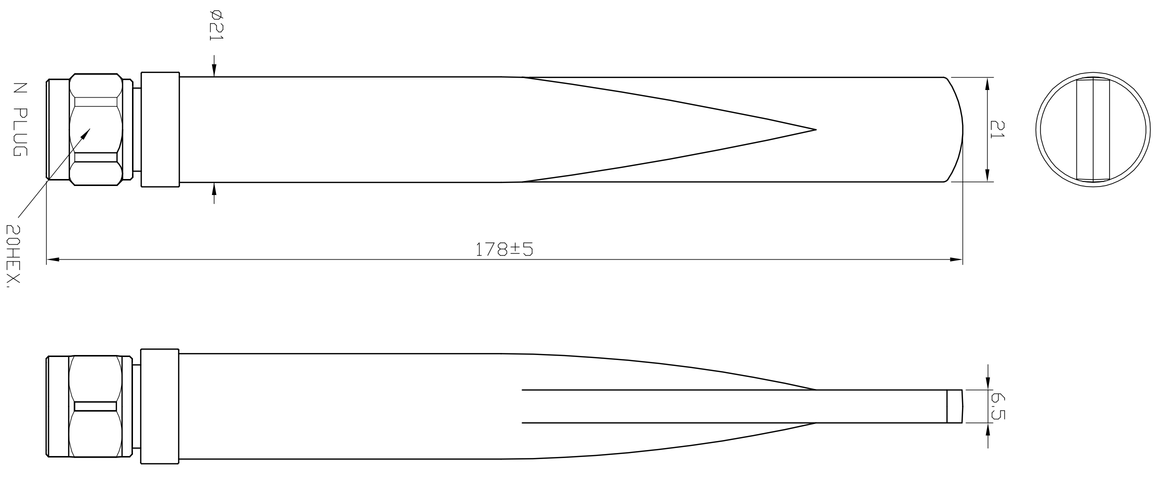


Figure 2-1. Antenna Dimensions, N Plug male

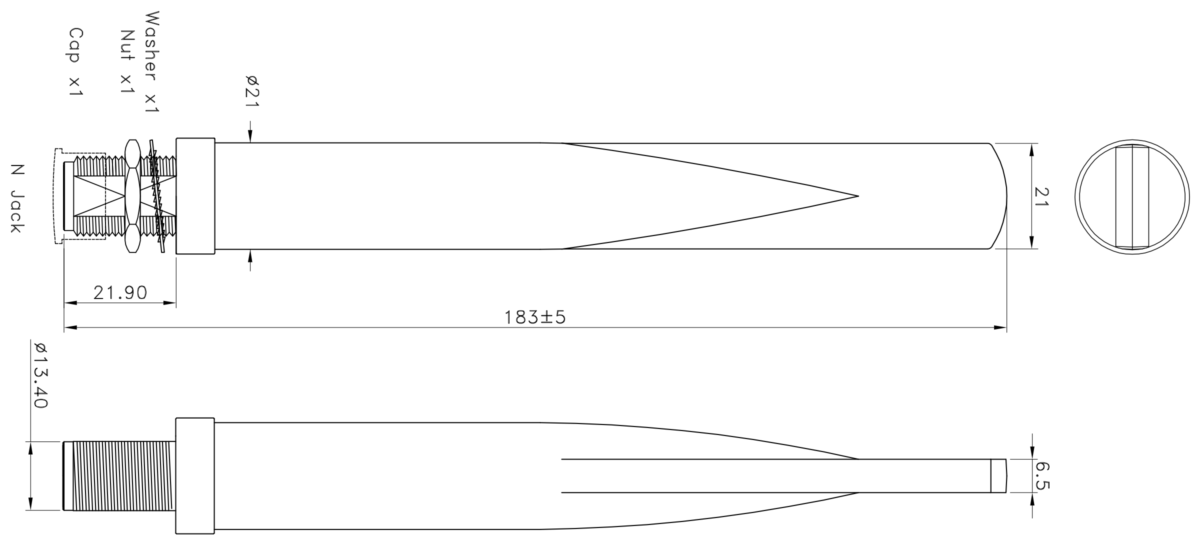


Figure 2-2. Antenna Dimensions, N Jack female

Antenna Test Orientation

The ZHX-150Xcc3B antenna is characterized in straight antenna orientation as shown in **Figure 3**. The antenna orientation characterizes use of antenna attached to enclosure-mounted connector. The charts on the following pages represent data taken with the antenna hanging free without ground plane.

Figure 3. Antenna Test Orientation

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.

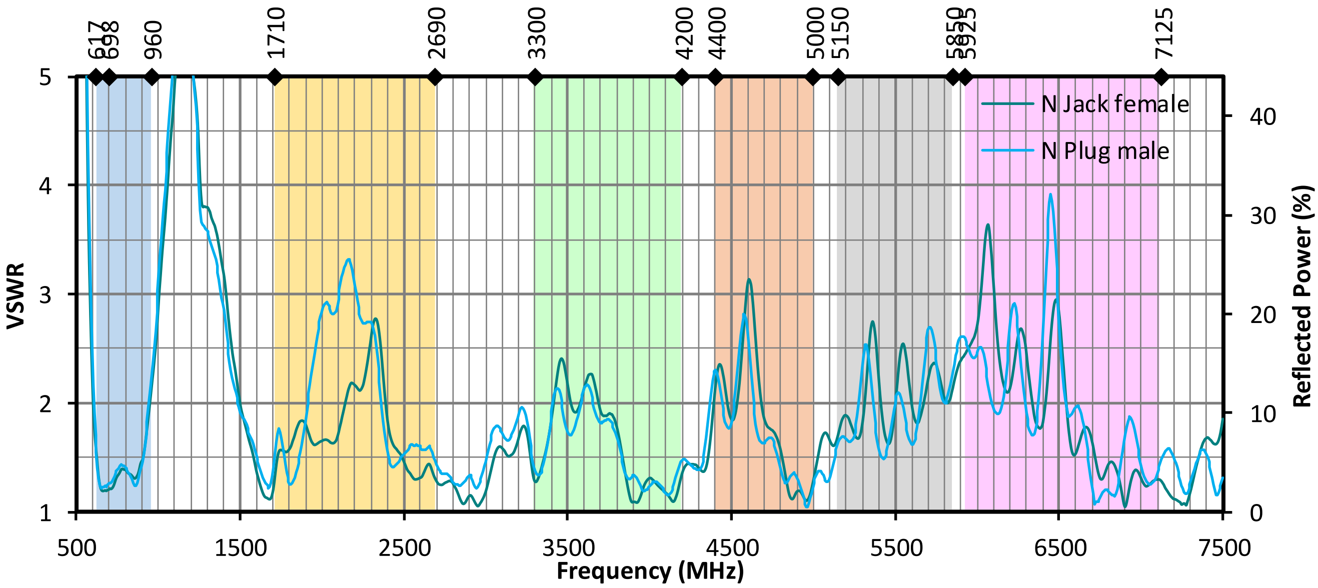


Figure 4. Antenna VSWR, without ground plane

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.

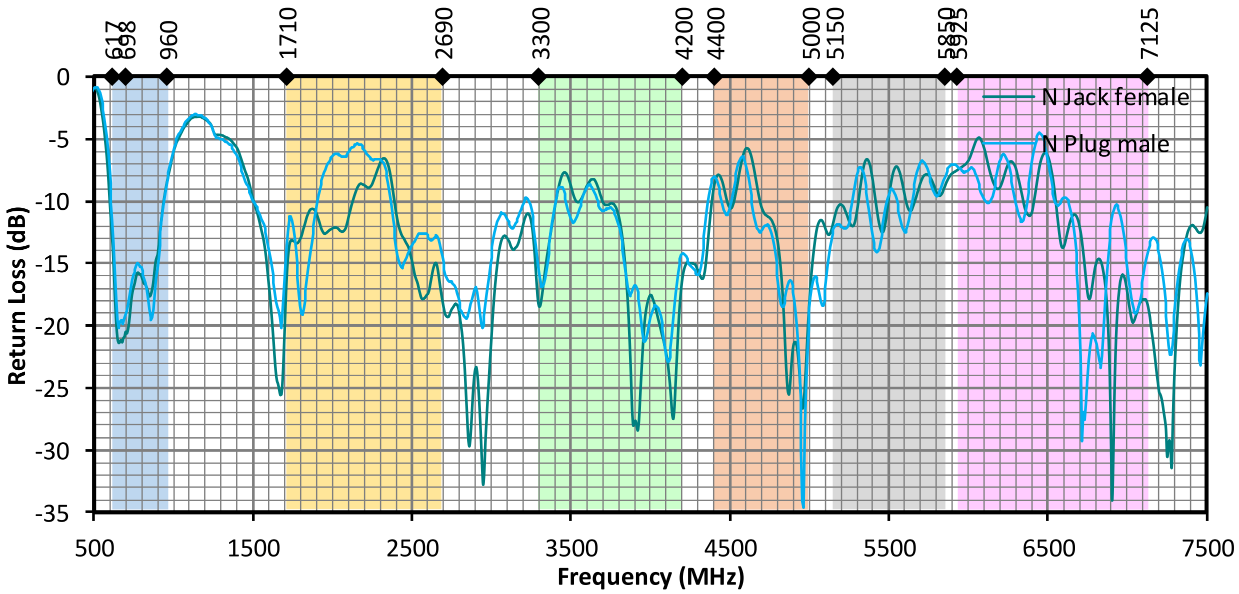


Figure 5. Antenna Return Loss, without ground plane

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.

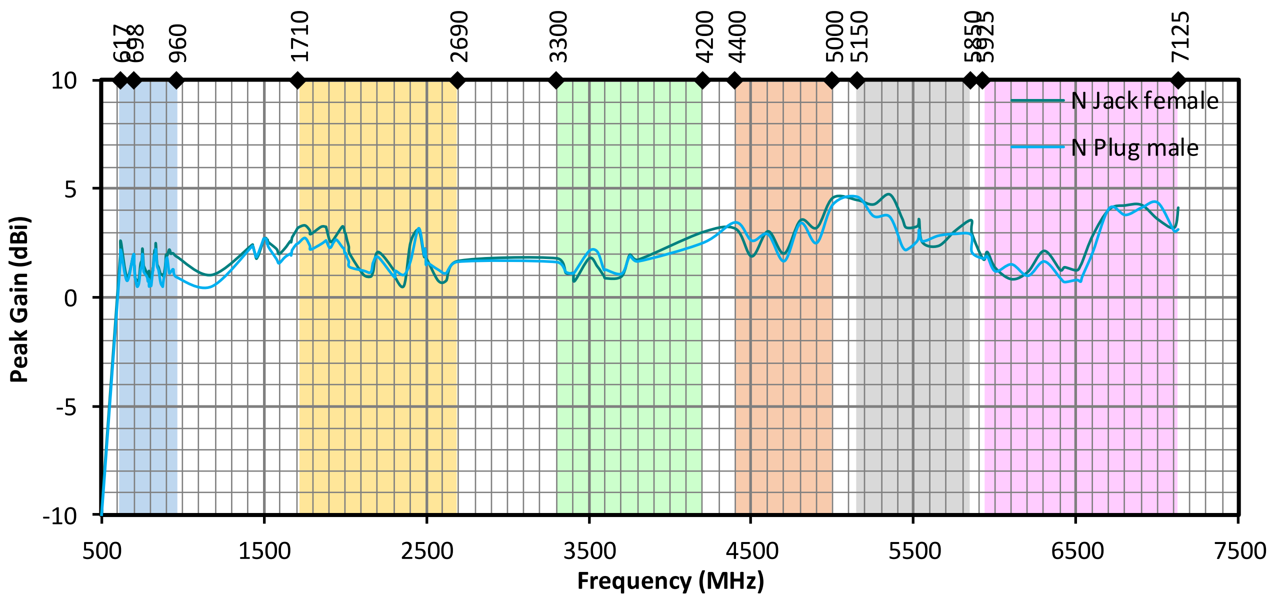


Figure 6. Antenna Peak Gain, without ground plane

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.

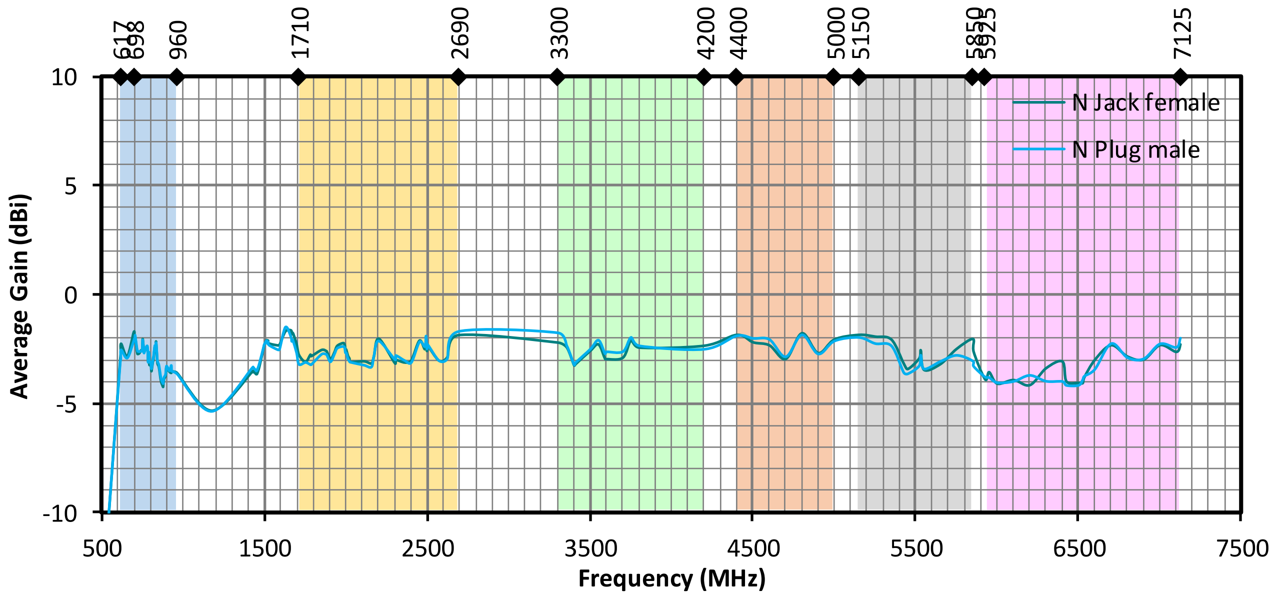


Figure 7. Antenna Average Gain, without ground plane

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.

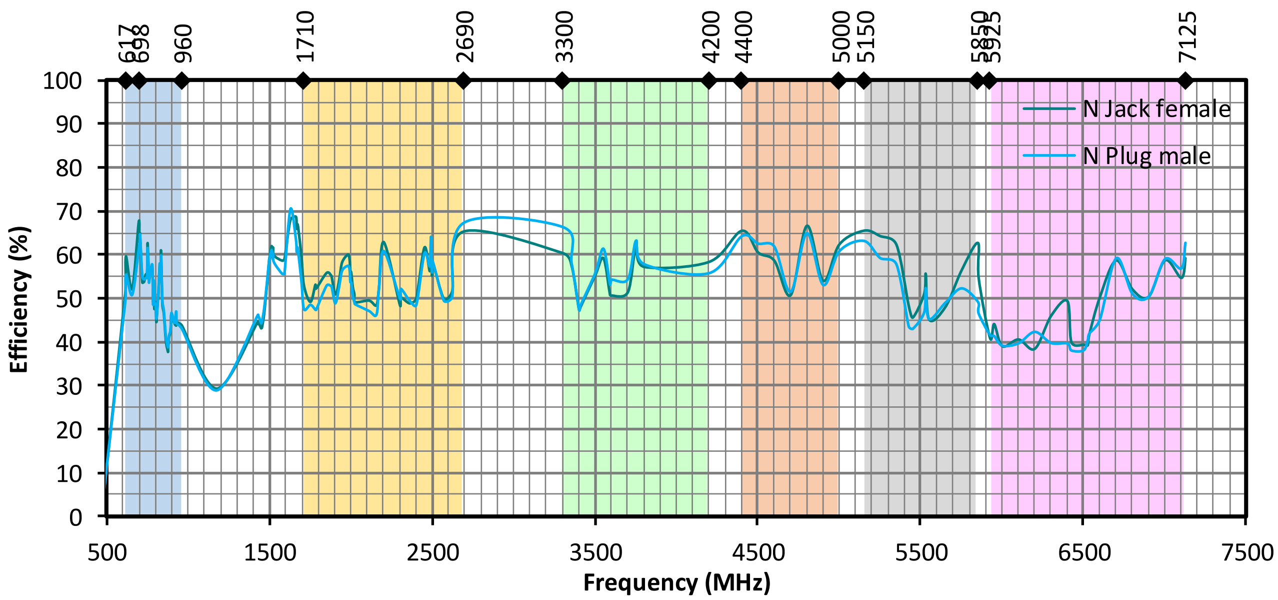


Figure 8. Antenna Efficiency, without ground plane

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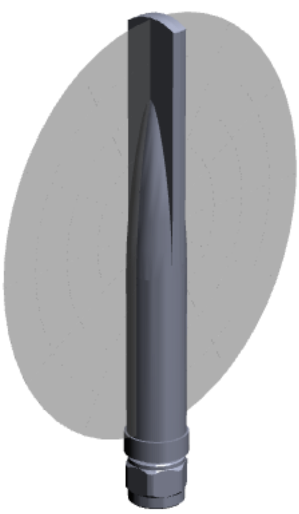
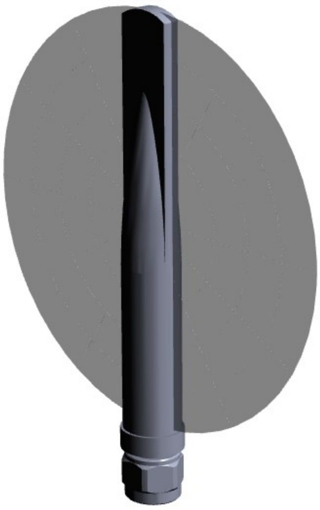
Radiation Patterns (N Plug male)

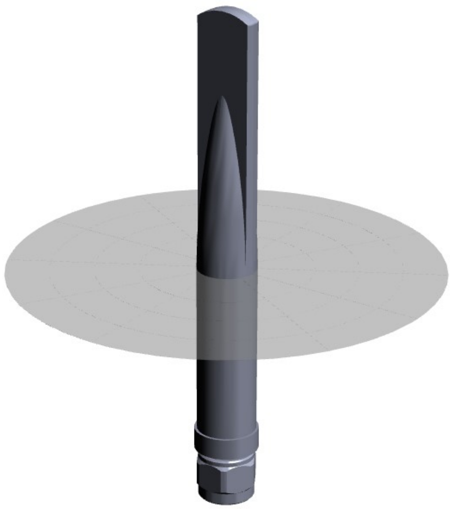
Radiation patterns provide information about the directionality and 3-dimensional gain performance of the antenna by plotting gain at specific frequencies in three orthogonal planes. Antenna radiation patterns are shown in **Figure 9** using polar plots covering 360 degrees. The antenna graphic at the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



XZ-Plane Gain

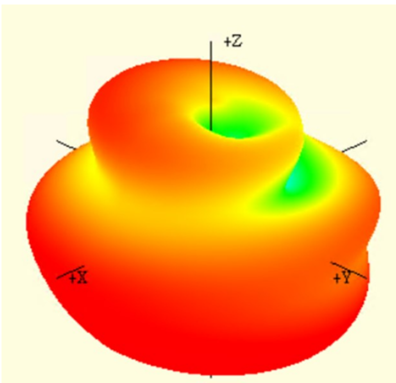


YZ-Plane Gain

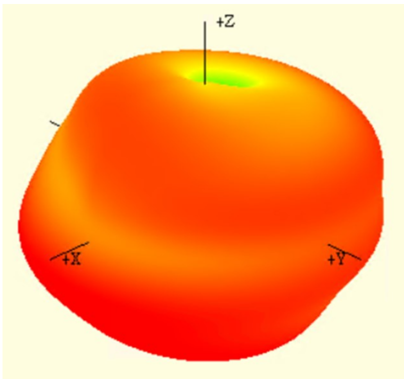


XY-Plane Gain

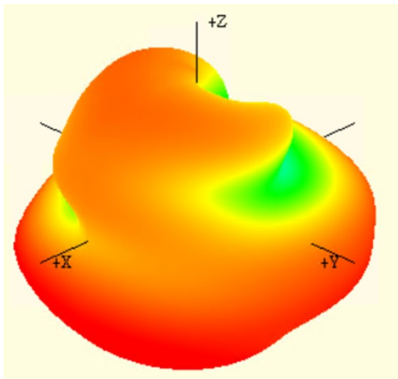
617 MHz to 960 MHz (778 MHz)



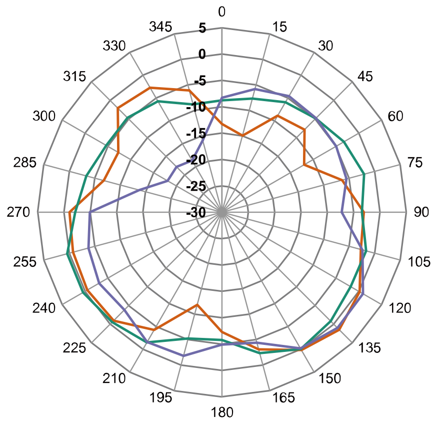
617 MHz



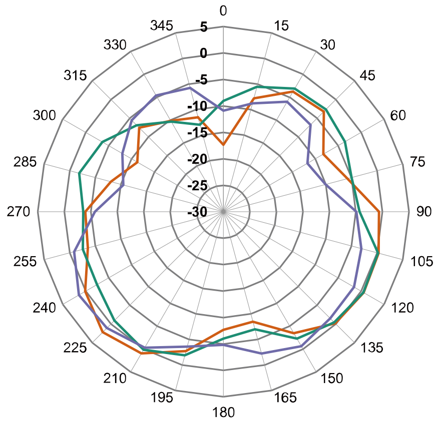
778 MHz



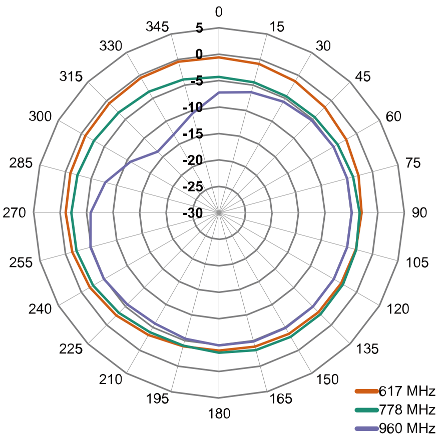
960 MHz



XZ-Plane Gain



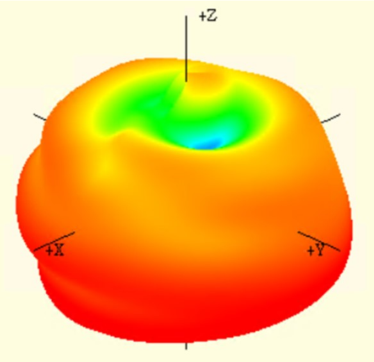
YZ-Plane Gain



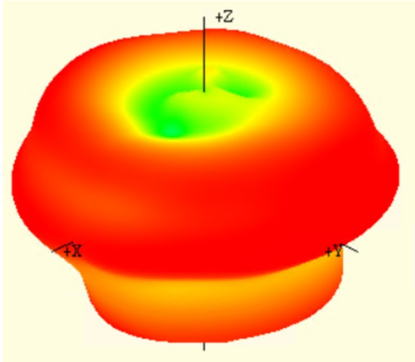
XY-Plane Gain

Figure 9. Antenna Radiation Patterns, N Plug male

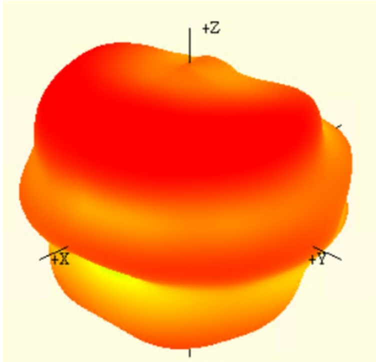
1710 MHz to 5000 MHz (3355 MHz)



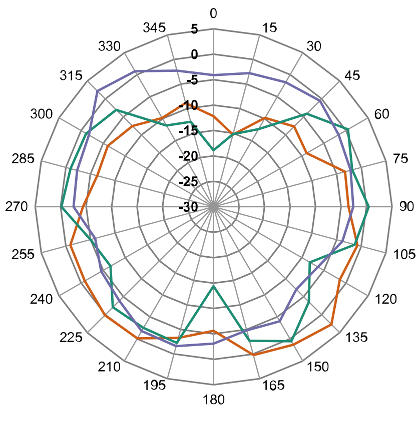
1710 MHz



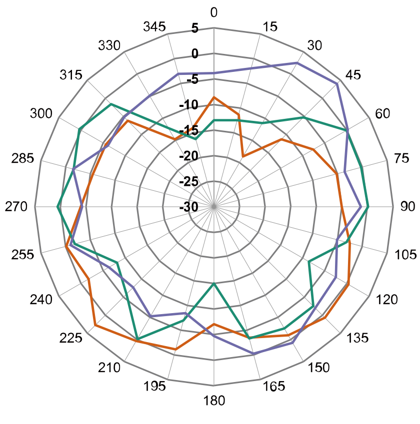
3355 MHz



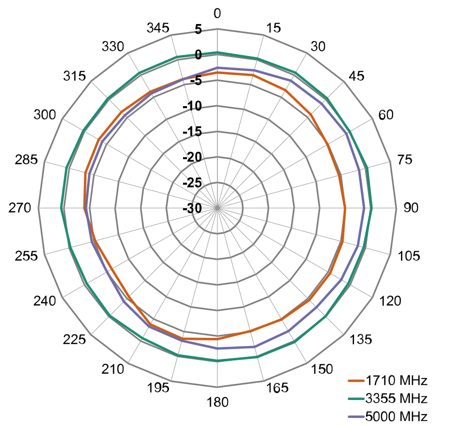
5000 MHz



XZ-Plane Gain

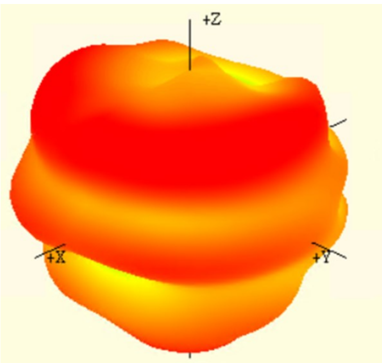


YZ-Plane Gain

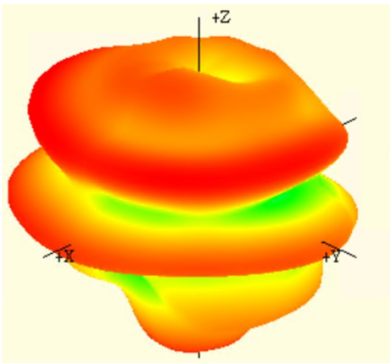


XY-Plane Gain

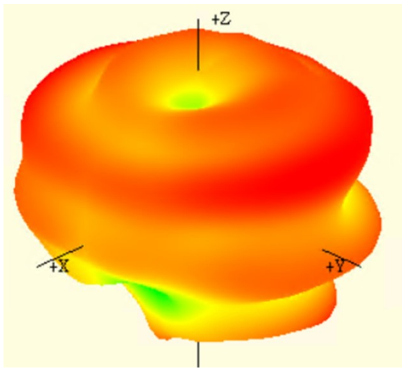
5150 MHz to 5850 MHz (5550 MHz)



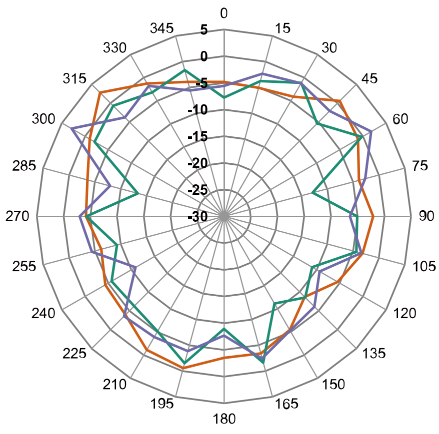
5150MHz



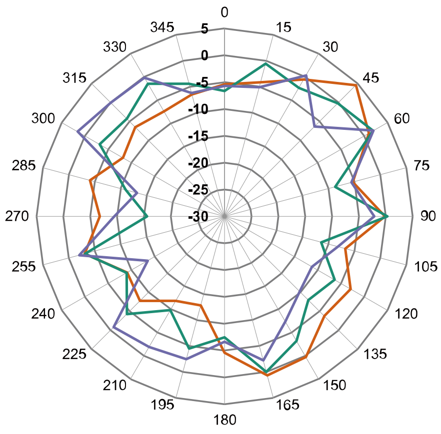
5500 MHz



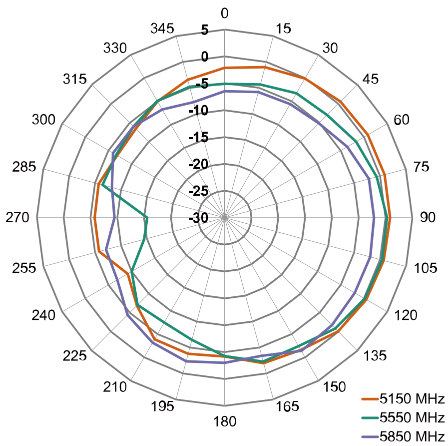
5850 MHz



XZ-Plane Gain



YZ-Plane Gain



XY-Plane Gain

Figure 9-1. Antenna Radiation Patterns, N Plug

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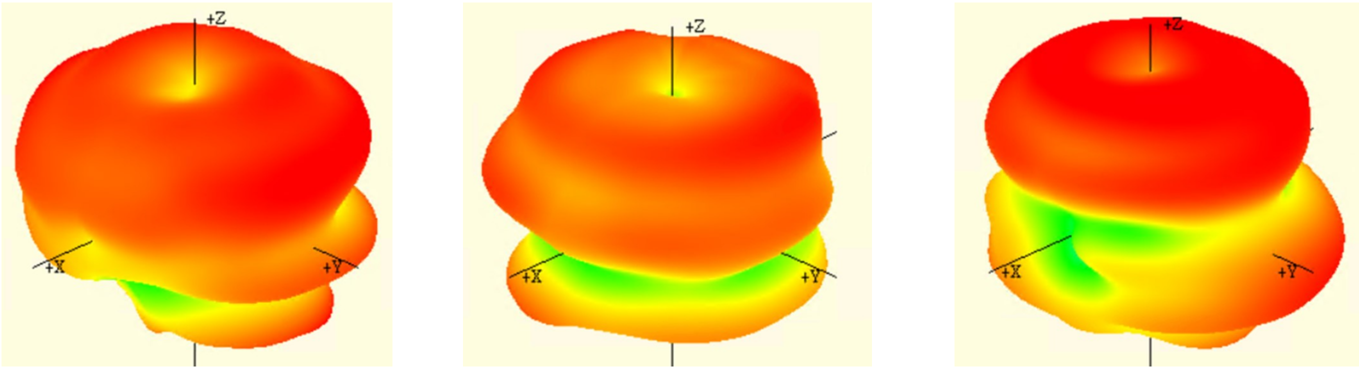
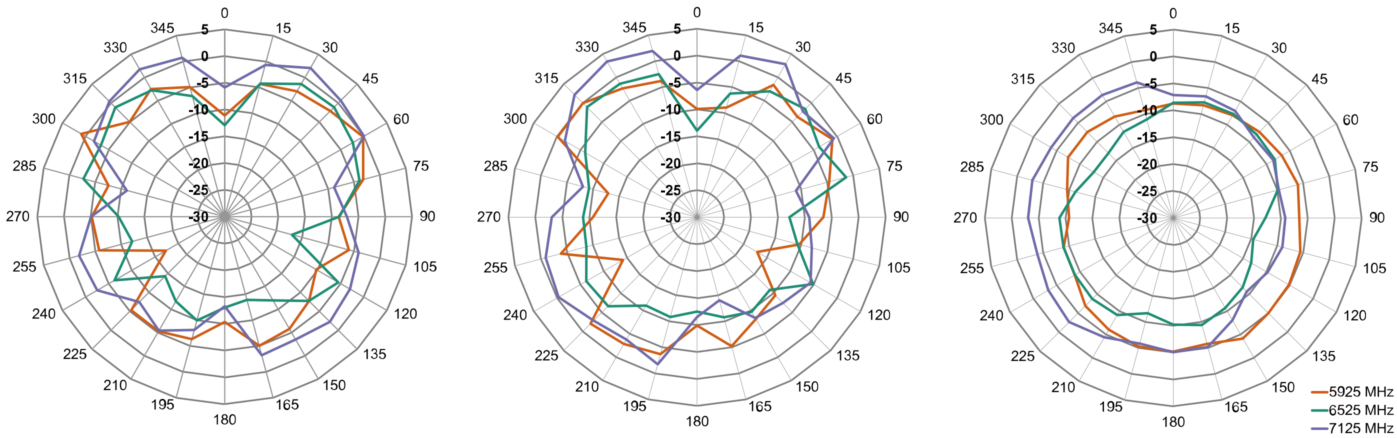
5925 MHz to 7125 MHz (6525 MHz)



5925 MHz | 6525 MHz | 7125 MHz

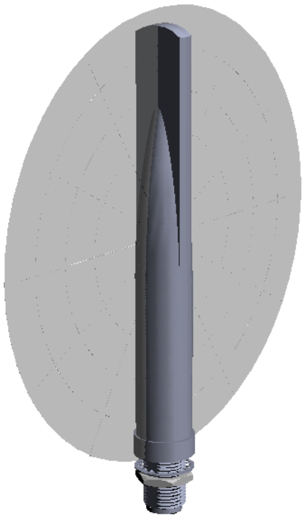


XZ-Plane Gain | YZ-Plane Gain | XY-Plane Gain

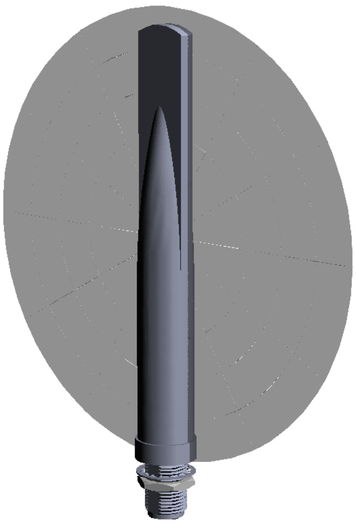
Figure 9-2. Antenna Radiation Patterns, N Plug male

Radiation Patterns (N Jack female)

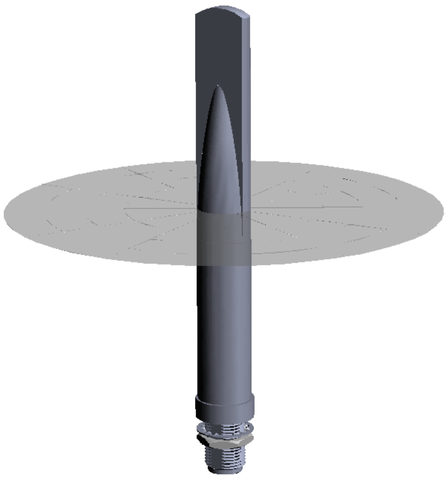
Radiation patterns provide information about the directionality and 3-dimensional gain performance of the antenna by plotting gain at specific frequencies in three orthogonal planes. Antenna radiation patterns are shown in **Figure 10** using polar plots covering 360 degrees. The antenna graphic at the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



XZ-Plane Gain

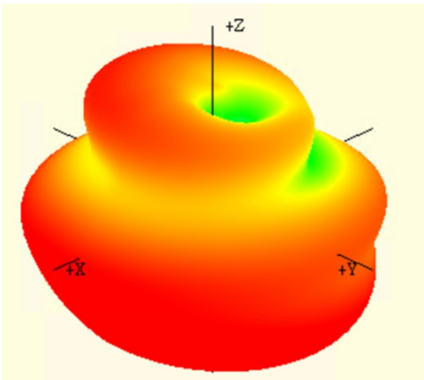


YZ-Plane Gain

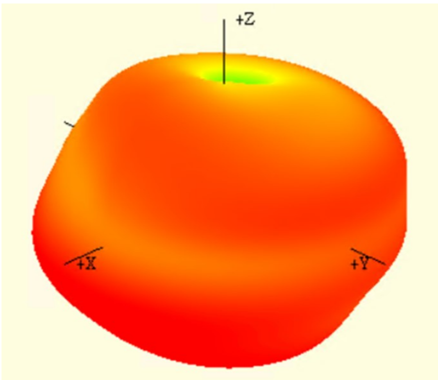


XY-Plane Gain

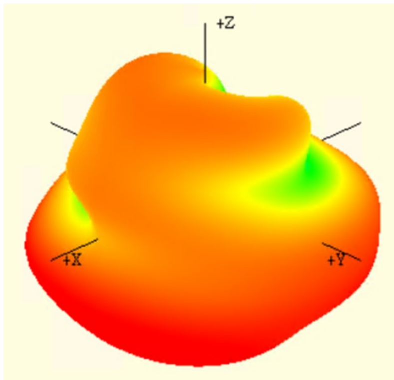
617 MHz to 960 MHz (778 MHz)



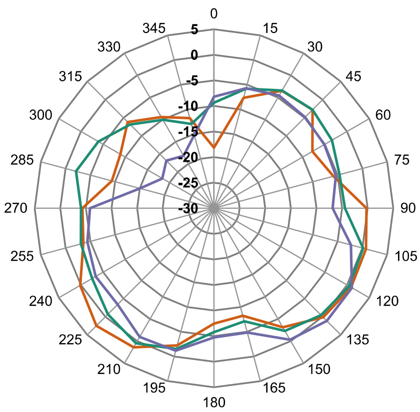
617 MHz



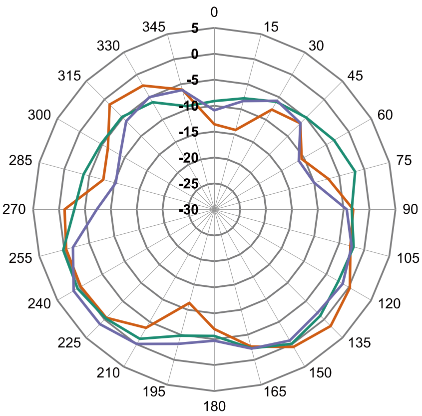
778 MHz



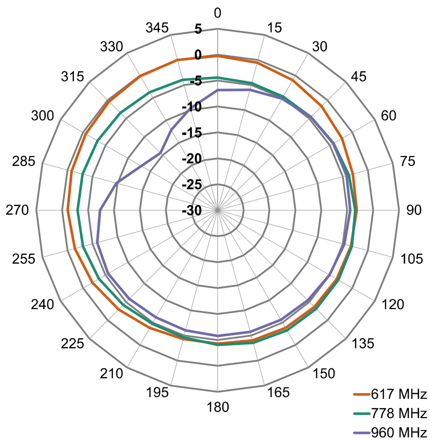
960 MHz



XZ-Plane Gain



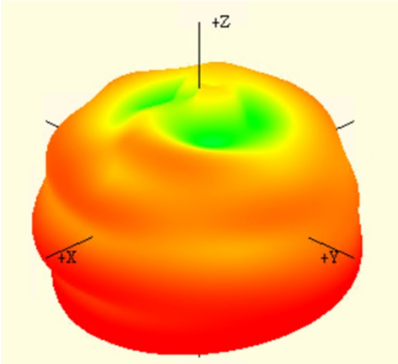
YZ-Plane Gain



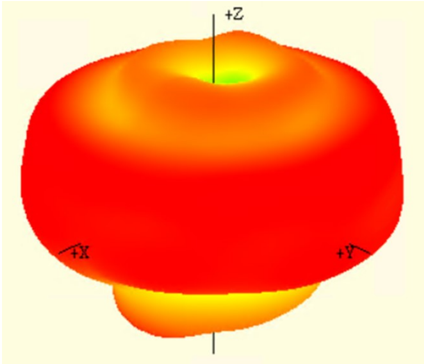
XY-Plane Gain

Figure 10. Antenna Radiation Patterns, N Jack female

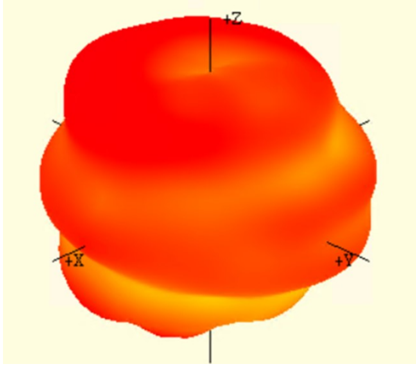
1710 MHz to 5000 MHz (3355 MHz)



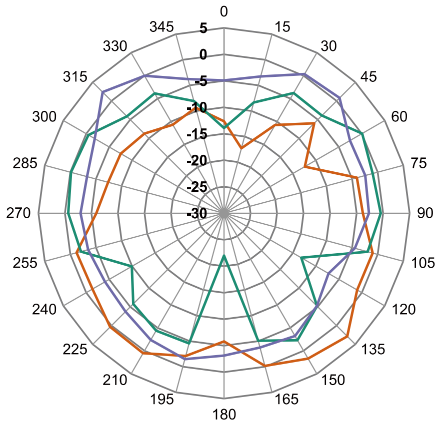
1710 MHz



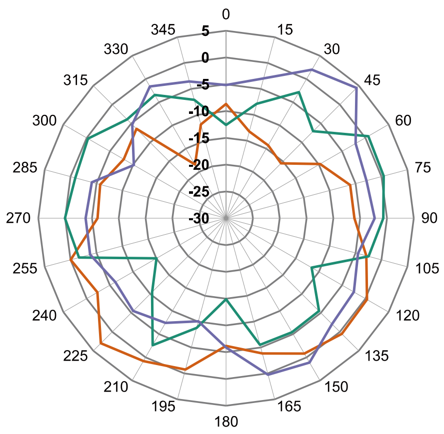
3355 MHz



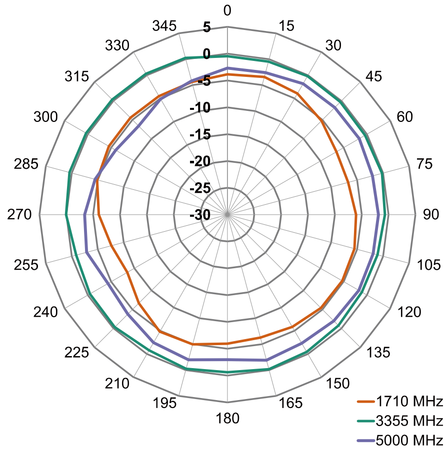
5000 MHz



XZ-Plane Gain

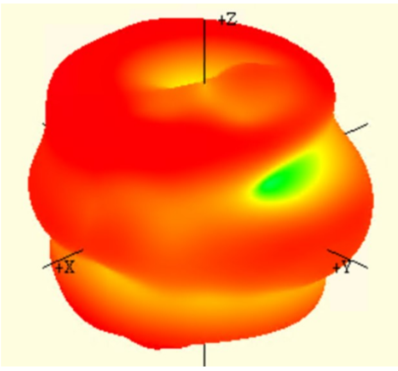


YZ-Plane Gain

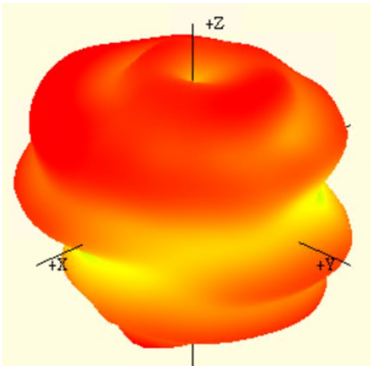


XY-Plane Gain

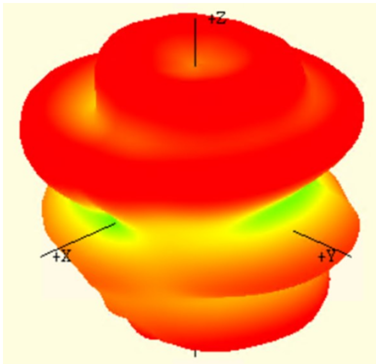
5150 MHz to 5850 MHz (5550 MHz)



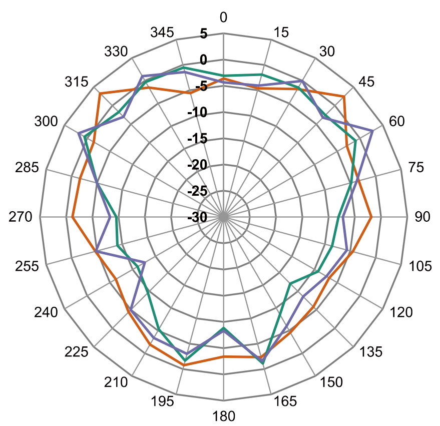
5150MHz



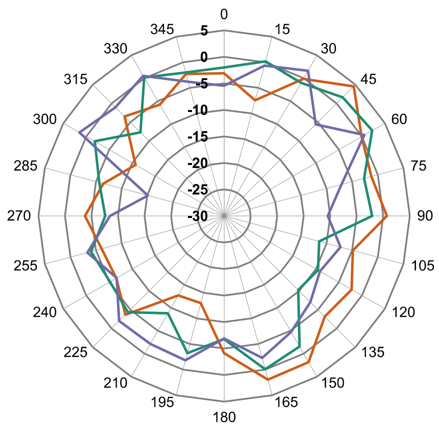
5500 MHz



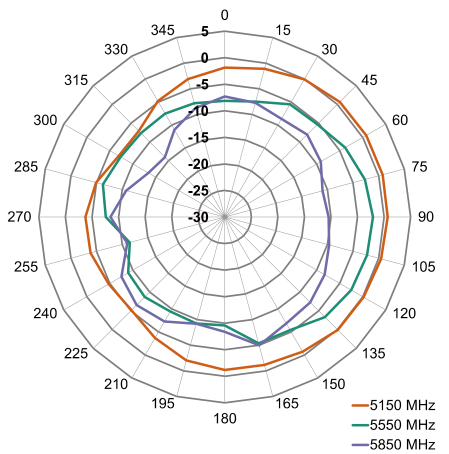
5850 MHz



XZ-Plane Gain



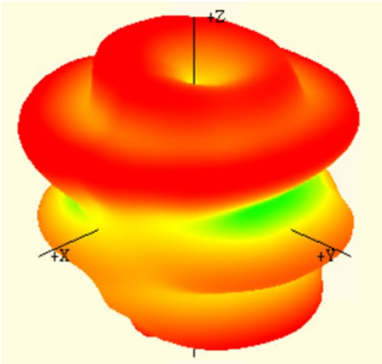
YZ-Plane Gain



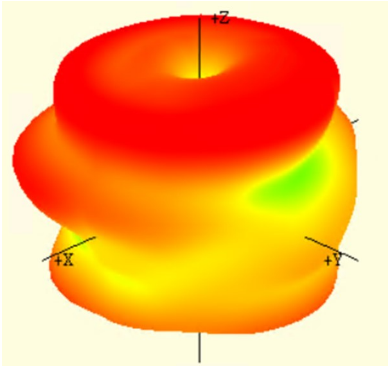
XY-Plane Gain

Figure 10-1. Antenna Radiation Patterns, N Jack

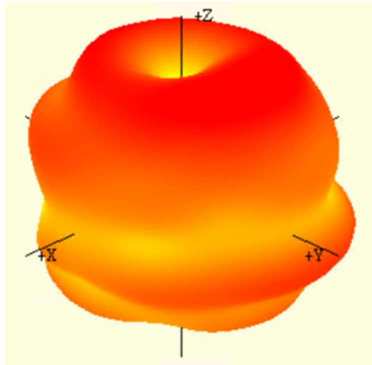
5925 MHz to 7125 MHz (6525 MHz)



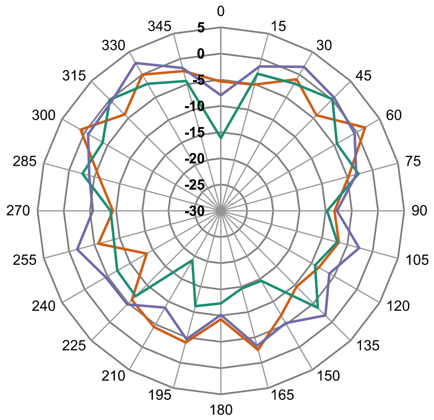
5925 MHz



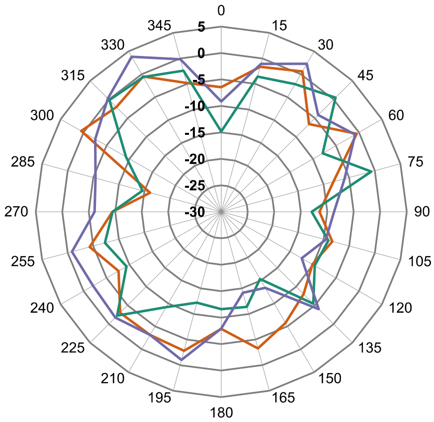
6525 MHz



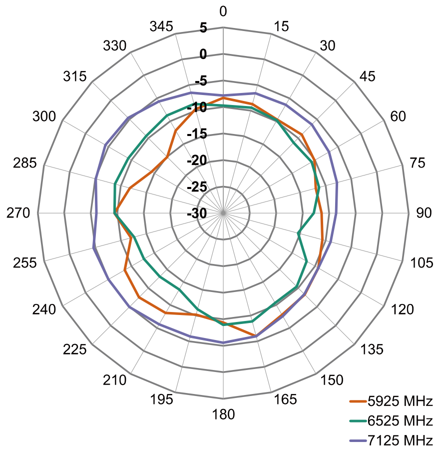
7125 MHz



XZ-Plane Gain



YZ-Plane Gain



XY-Plane Gain

Figure 10-2. Antenna Radiation Patterns, N Jack female

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.

Website:	https://www.joymax.com.tw
Offices:	5, Dong-Yuan 2nd Road, Zhong-Li Dist., Tao-Yuan City 32063 Taiwan (R.O.C.)
Phone:	+886 3 433 5698
E-MAIL:	info@joymax.com.tw

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