Datasheet

JOYMAX
EnJOY MAX Wireless®

CAF-350Xcc1B-*

900/1800 MHz Adhesive Puck antenna

The Joymax CAF-350Xcc1B-* series antennas are adhesive-mount, dipole antennas designed for use in 900 MHz (band 8) and 1800 MHz (band 3) supporting LTE-M (Cat-M1) and GSM applications.

The dipole antenna provides a ground plane independent external antenna solution to easily mount on non-conductive surfaces such as windows, drywall, ceiling tiles, plastic, etc.

Connection is made to the radio via a coaxial cable terminated in an SMA plug (male pin) connector.

Features

- Bandwidth 900 MHz and 1800 MHz
- Performance at 880 MHz to 960 MHz
  - VSWR: ≤ 2.7
  - Peak Gain: 1.6 dBi
  - Efficiency: 34%
- Ground plane independence dipole design
- Compact size, low profile
- Adhesive backing permanently adheres to non-metallic enclosure/chassis using 3M

Applications

- Cellular IoT band 3, band 8 applications
  - LTE-M (Cat-M1)
  - NB-IoT
- Low-power, wide-area (LPWA) applications
  - LoRaWAN®
  - Sigfox®
  - Weightless-P®
  - WiFi HaLow™ (802.11ah)
- GSM
- Internet of Things (IoT) devices

Ordering Information

Part Number	Description
CAF-350XSA1B-P100	900/1800MHz Adhesive Puck Antenna with SMA Plug (male pin), L=1000mm, RG174
CAF-350XSA1B-P200	900/1800MHz Adhesive Puck Antenna with SMA Plug (male pin), L=2000mm, RG174

Available from Joymax Electronics and select distributors and representatives.
Custom cable lengths are available for OEM volume inquiry.

Table 1: Electrical Specifications

CAF-350Xcc1B-*	C-Band (MHz)	
Frequency Range	880~960 MHz	1710~1880 MHz
VSWR (Max)	2.7	2.6
Peak Gain (dBi)	1.6	1.0
Average Gain (dBi)	-4.7	-5.5
Efficiency (%)	34	28
Polarization	Linear	
Radiation	Omni directional	
Max Power	1 W	
Wavelength	½-λ	
Electrical Type	Dipole	
Impedance	50 Ω	

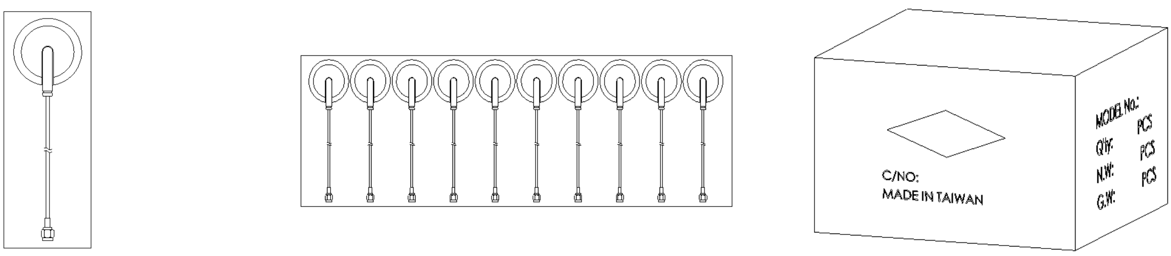
Electrical specifications measured with the antenna adheres to a 150mm x 150mm non-conductive plate, with 1 meter long coax cable.

Table 2: Mechanical Specifications

Parameter	Value
Connection	SMA Plug (male pin)
Operating Temp.	-30˚C to +70˚C
Weight	1000mm cable— 31.5g; 2000mm cable—44.5g
Dimension	⌀50 mm x 9.8 mm
Antenna Color	Black
Ingress Protection	N/A

Packaging Information

The CAF-350Xcc1B-* antennas are individually sealed in a clear plastic bag. **Figure 1**. 200 pcs per carton, 420 mm x 310 mm x 260 mm (16.5 in x 12.2 in x 10.2 in), total weight 10.6 kgs (23.3 lb) Distribution channels may offer alternative packaging options.



1 pc antenna/ 1 PE bag 25 pcs antenna/ 1 Bigger PE bag 200 pcs antenna/ 1 Carton

Figure 1. Antenna Packaging

Product Dimensions

Figure 2 provides dimensions of the CAF-350Xcc1B-*. The antenna mounts permanently with integral adhesive to flat, non-conductive surfaces such as windows, drywall, ceiling tiles, plastic, etc. Connection is made to the radio via a coaxial cable terminated in an SMA plug (male pin).

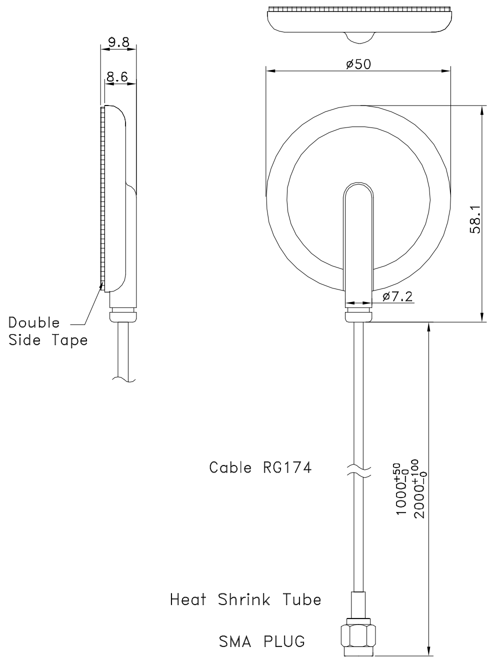


Figure 2. Antenna Dimensions

Antenna Test Setup

The CAF-350Xcc1B-* is tested with antenna adheres to a 150 mm x 150 mm non-conductive plate as shown in **Figure 3.** That provides insights into antenna performance for real case adhesive mount installation. The charts on the following pages represent data taken with the antenna mount on the center of the non-conductive plate with 1 meter and 2 meter long coaxial cable respectively.

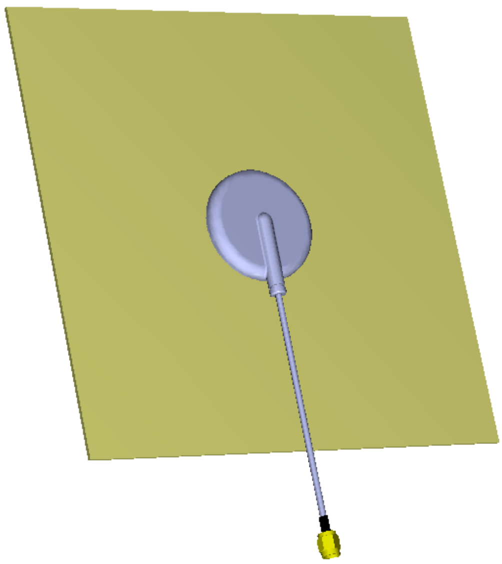


Figure 3. Antenna Test Setup

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.

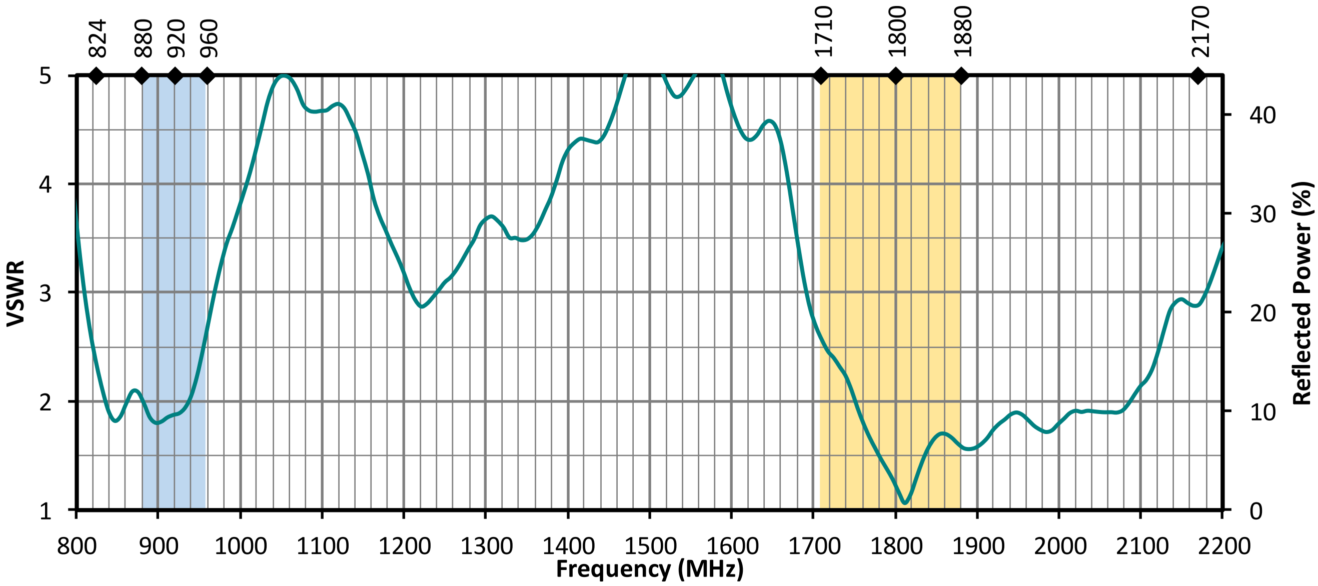


Figure 4-1. Antenna VSWR, with 1 Meter Long Coaxial Cable

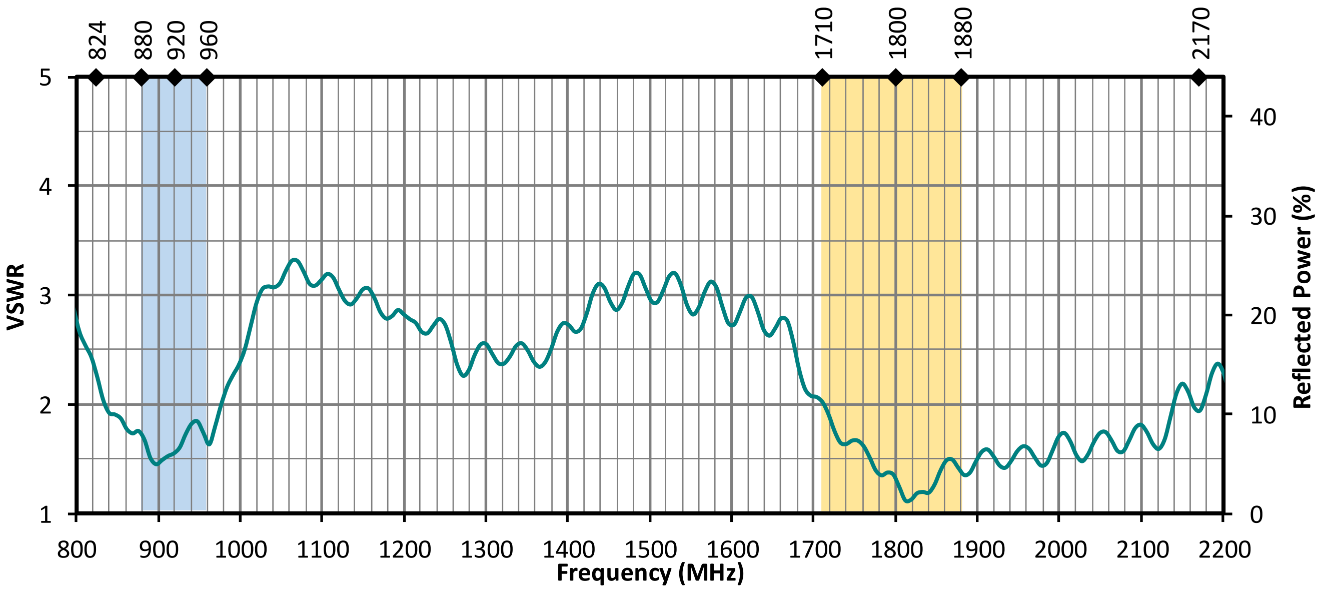


Figure 4-2. Antenna VSWR, with 2 Meter long coaxial cable

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.

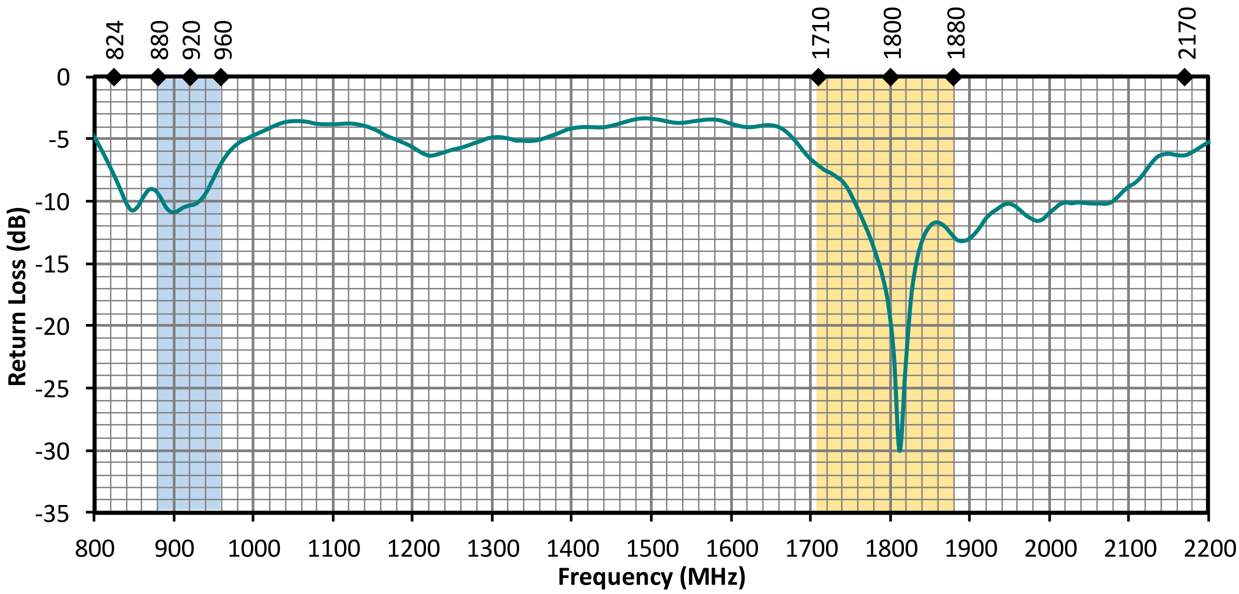


Figure 5-1. Antenna Return Loss, with 1 Meter long coaxial cable

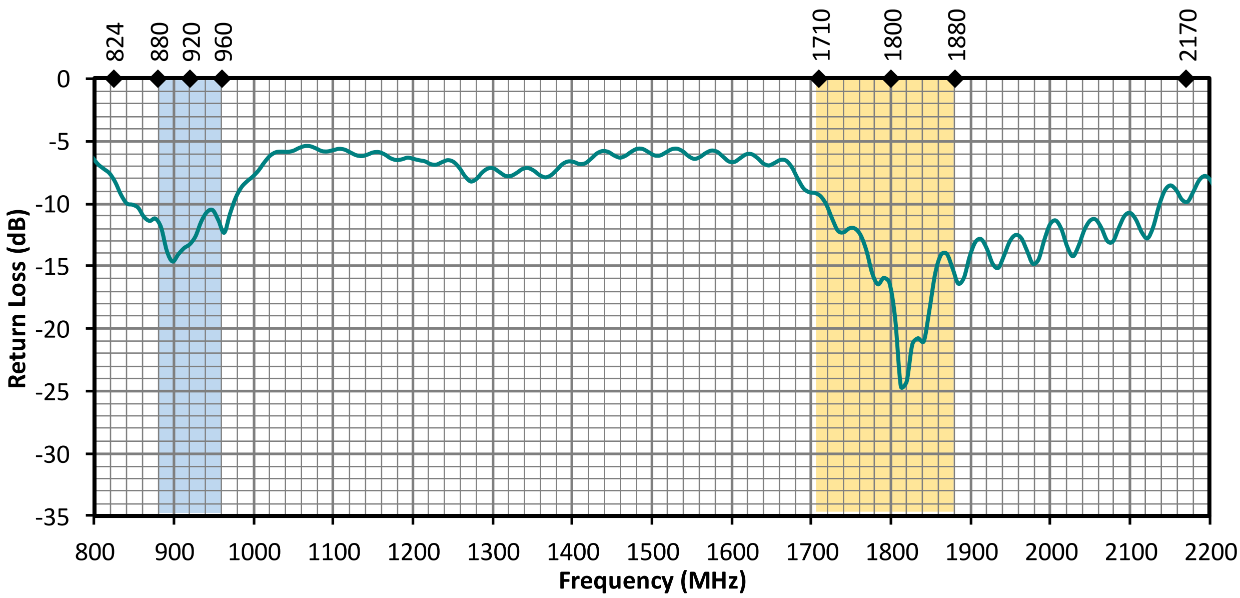


Figure 5-2. Antenna Return Loss, with 2 Meter long coaxial cable

JOYMAX
EnJOY MAX Wireless®

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.

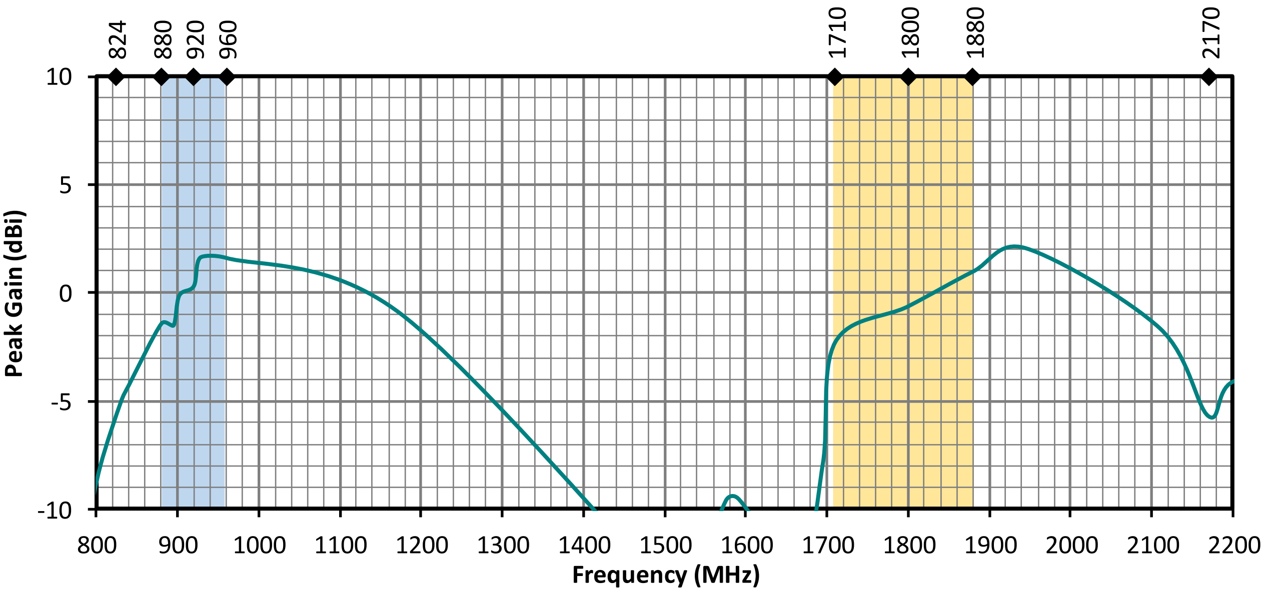


Figure 6-1. Antenna Peak Gain, with 1 Meter long coaxial cable

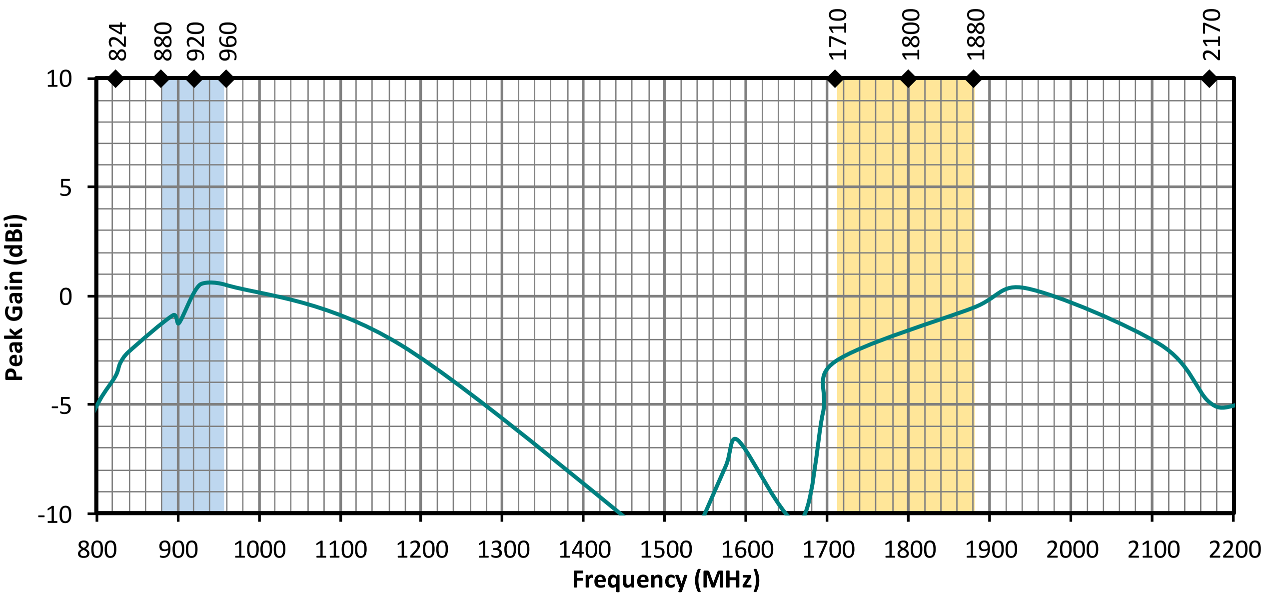


Figure 6-2. Antenna Peak Gain, with 2 Meter long coaxial cable

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.

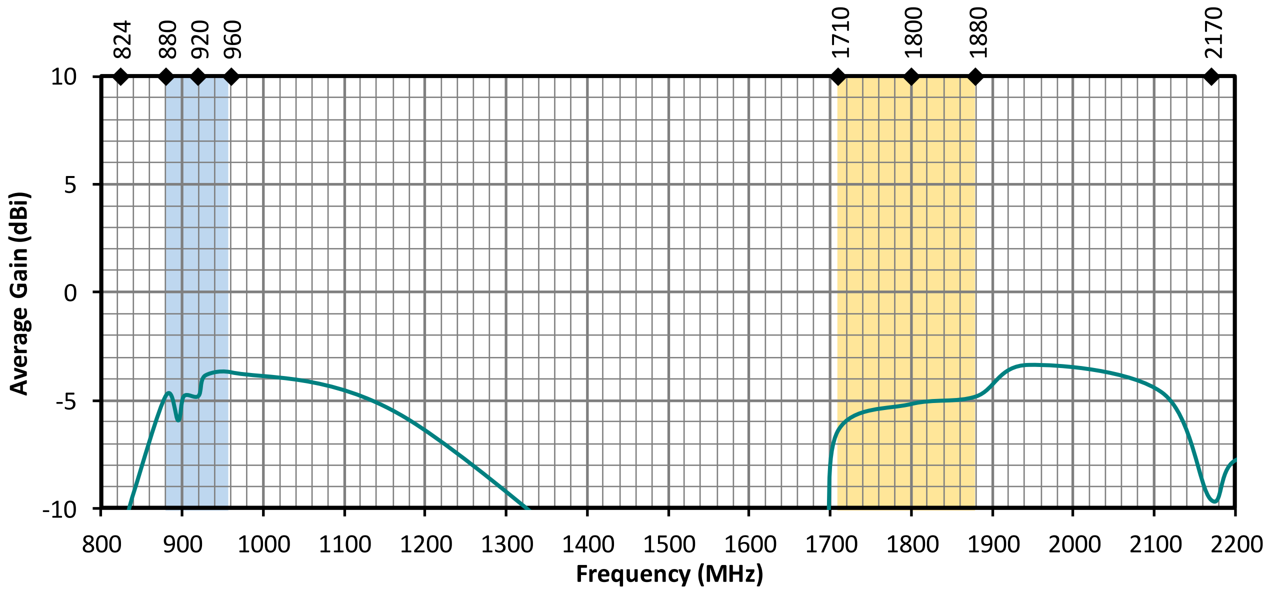


Figure 7-1. Antenna Average Gain, with 1 Meter long coaxial cable

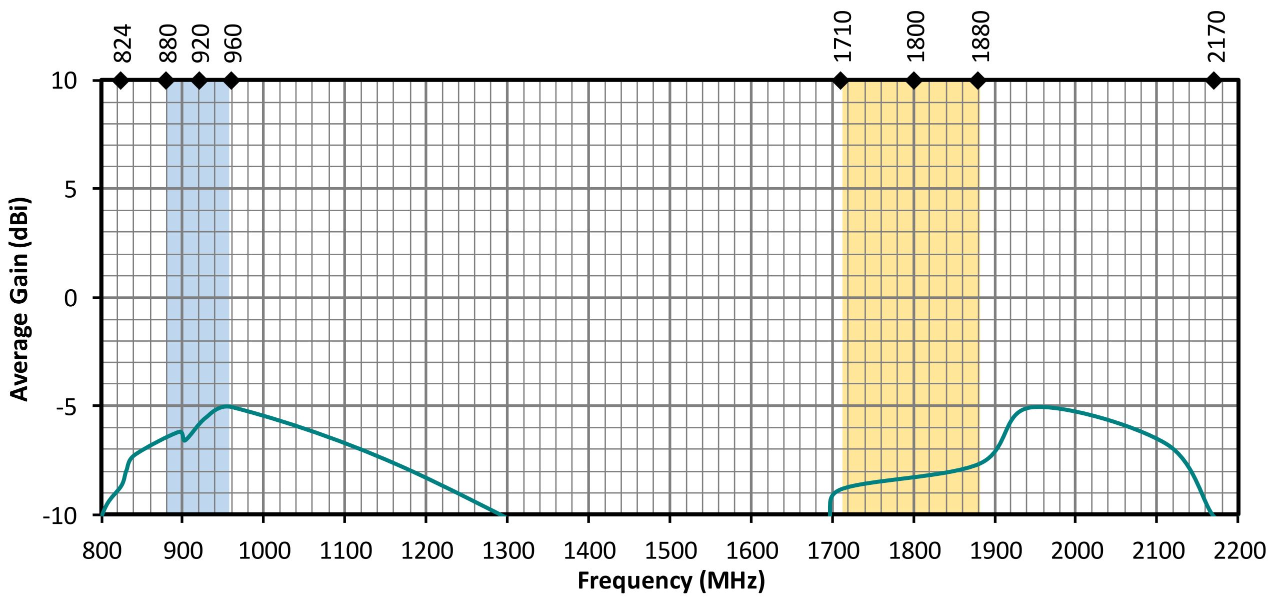


Figure 7. Antenna Average Gain, with 2 Meter long coaxial cable

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.

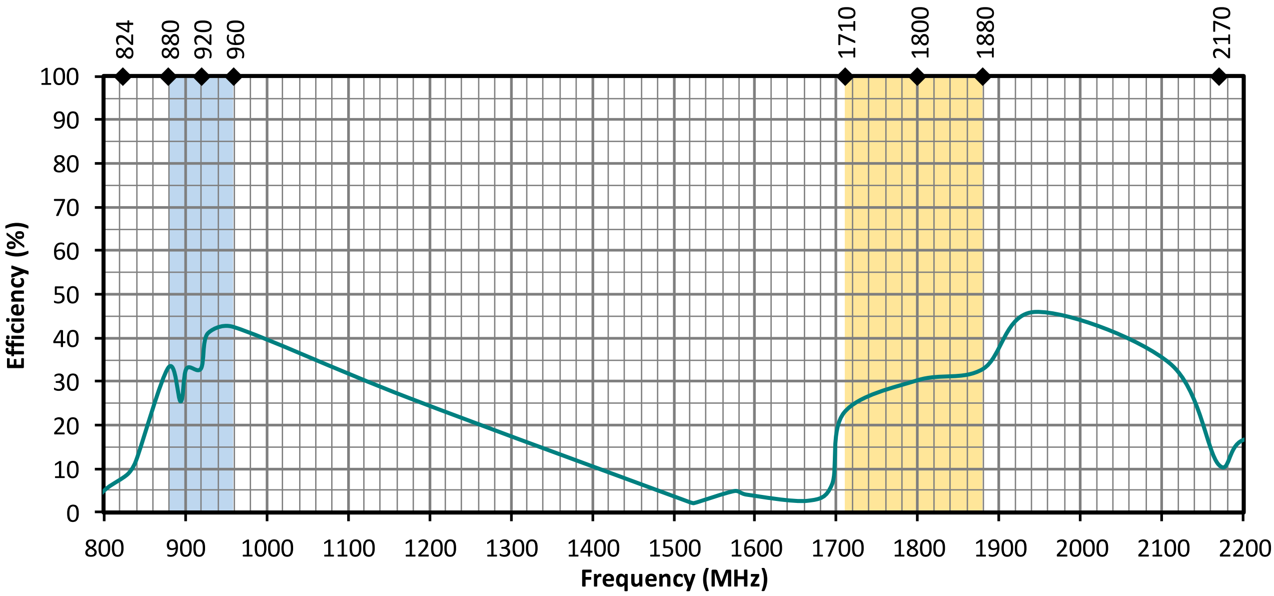


Figure 8-1. Antenna Efficiency, with 1 Meter long coaxial cable

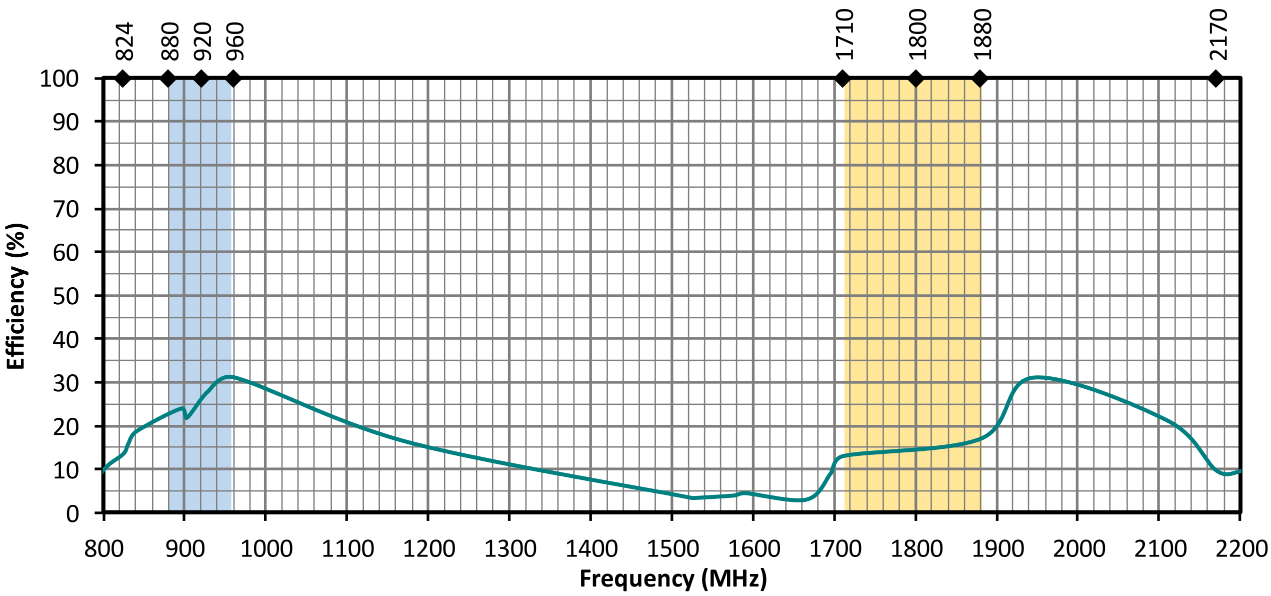
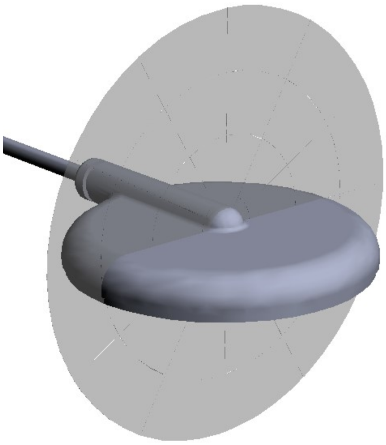


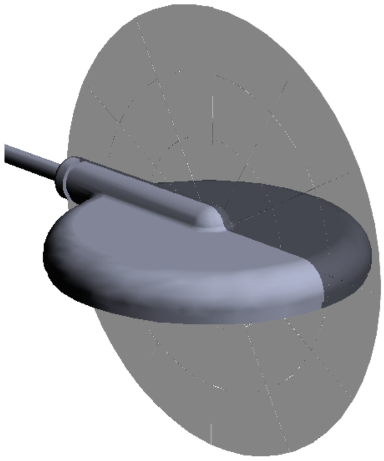
Figure 8-2. Antenna Efficiency, with 2 Meter long coaxial cable

Radiation Patterns

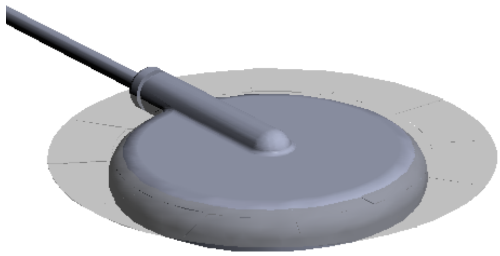
Radiation patterns provide information about the directionality and 3-dimensional gain performance of the antenna by plotting gain at specific frequencies in three orthogonal planes. Antenna radiation patterns for a straight orientation are shown in **Figure 9** using polar plots covering 360 degrees.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



XZ-Plane Gain

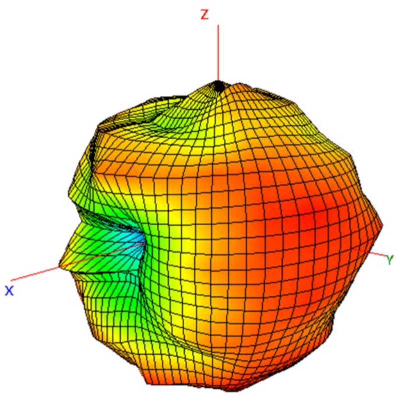


YZ-Plane Gain

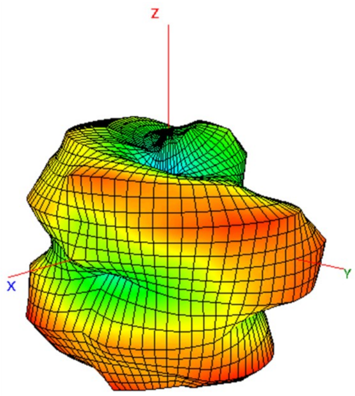


XY-Plane Gain

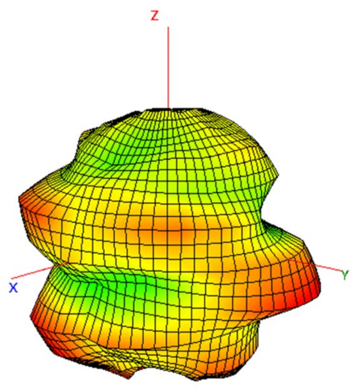
880 MHz to 960 MHz (920 MHz)



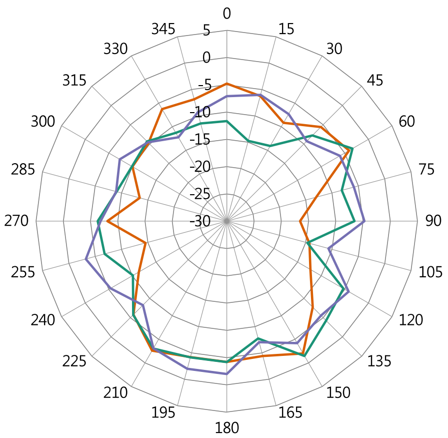
880 MHz



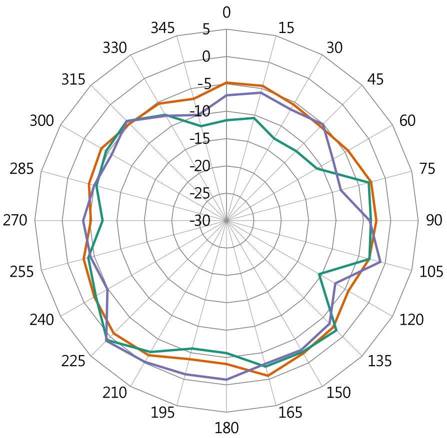
920 MHz



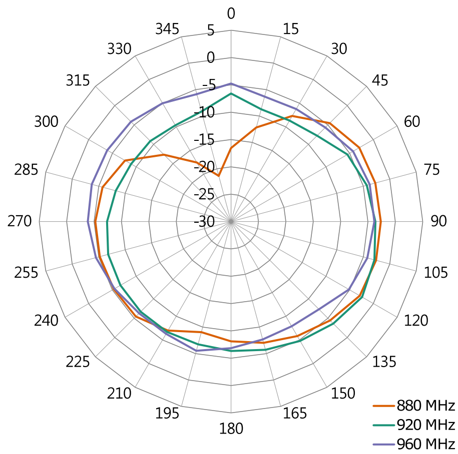
960 MHz



XZ-Plane Gain



YZ-Plane Gain



XY-Plane Gain

Figure 9-1. Antenna Radiation Patterns, with 1 Meter long coaxial cable

JOYMAX
EnJOY MAX Wireless®

1710 MHz to 1880 MHz (1800 MHz)

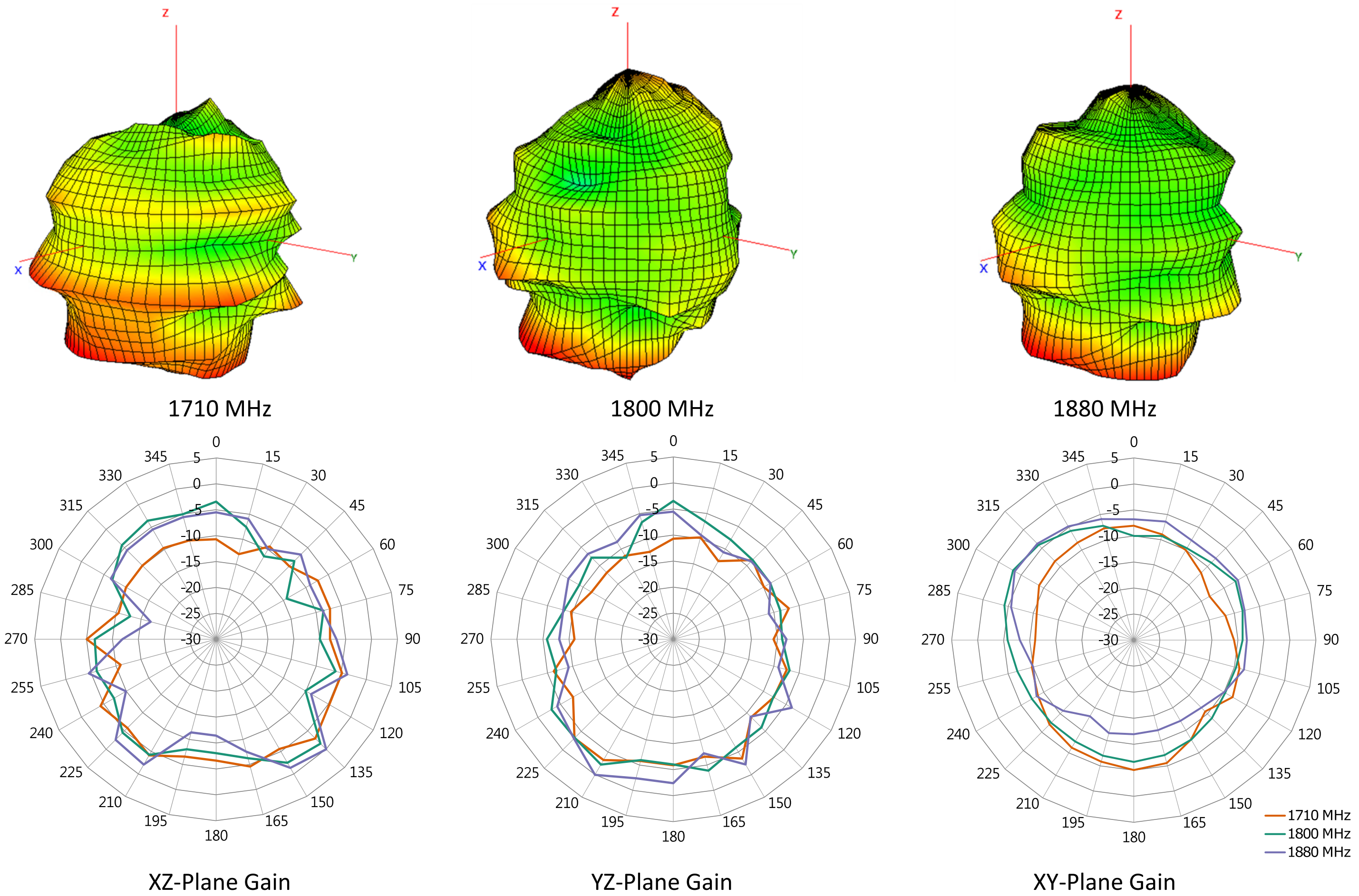
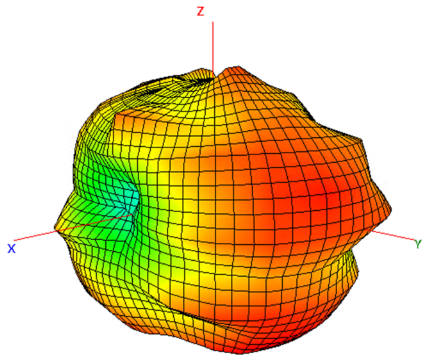
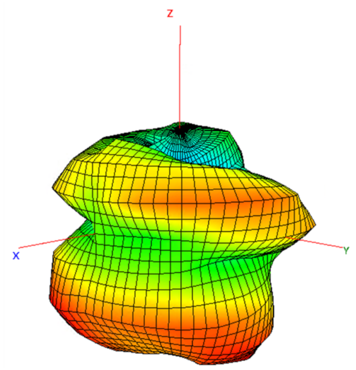


Figure 9-2. Antenna Radiation Patterns, with 1 Meter long coaxial cable

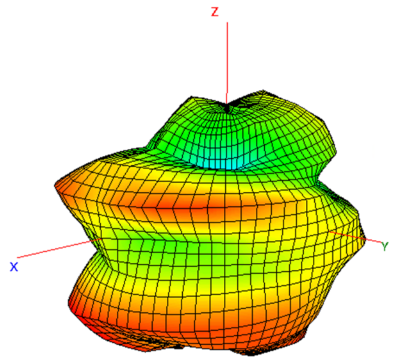
880 MHz to 960 MHz (920 MHz)



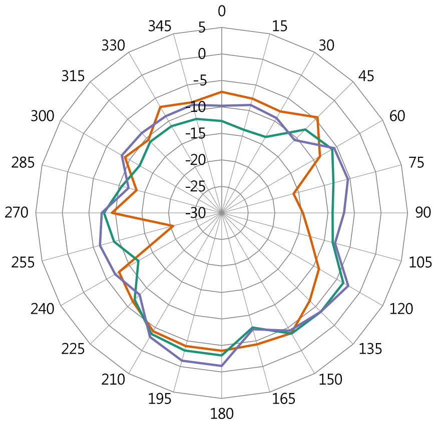
880 MHz



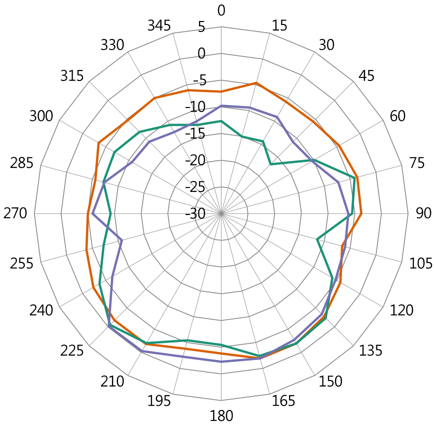
920 MHz



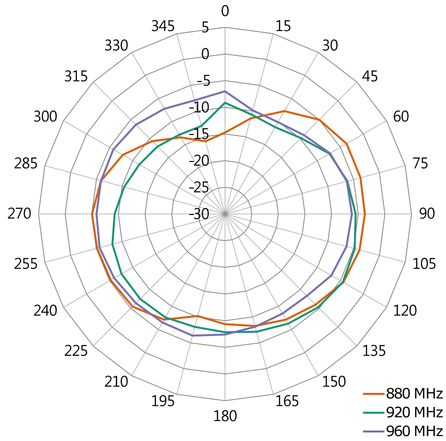
960 MHz



XZ-Plane Gain

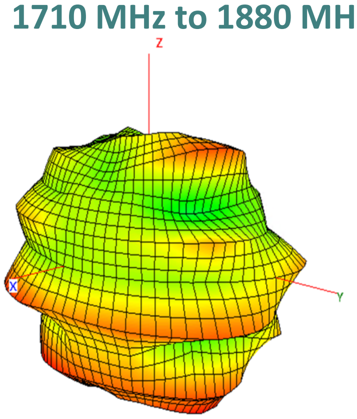


YZ-Plane Gain

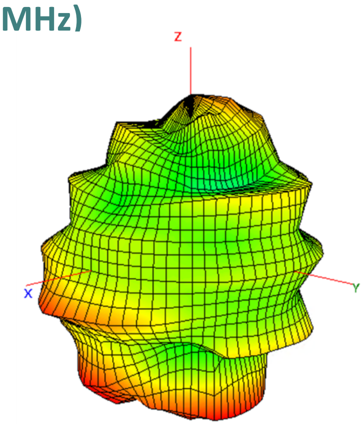


XY-Plane Gain

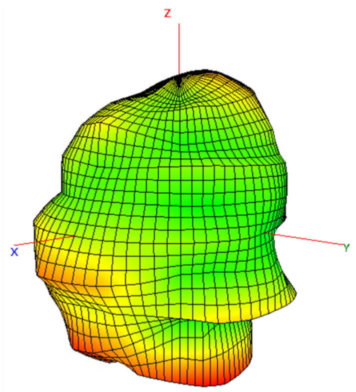
1710 MHz to 1880 MHz (1800 MHz)



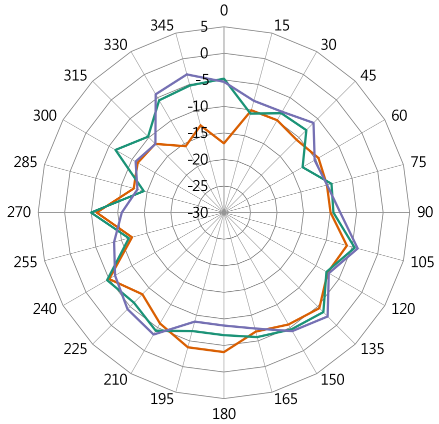
1710 MHz



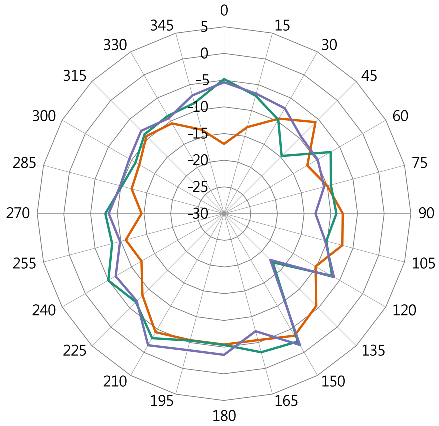
1800 MHz



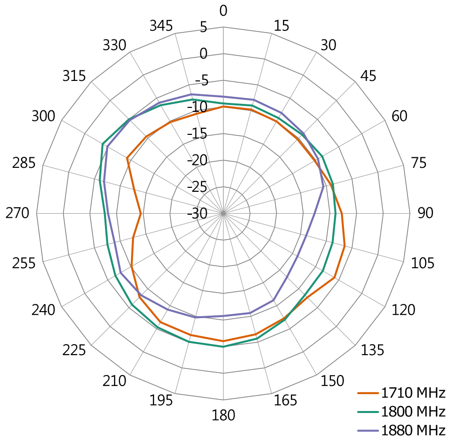
1880 MHz



XZ-Plane Gain



YZ-Plane Gain



XY-Plane Gain

Figure 9-3. Antenna Radiation Patterns, with 2 Meter long coaxial cable

JOYMAX EnJOY MAX Wireless®

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

01/24 RevA

JOYMAX
EnJOY MAX Wireless®