Datasheet

# GHX-1017cc2W

## 915MHz ISM Outdoor Fiberglass Baton Antenna

The Joymax GHX-1017cc2W antenna is an outdoor, baton-style, high gain, fiberglass dipole antenna designed for use in sub-1 GHz 915 MHz bands supporting low-power, wide-area (LPWA) applications including LoRaWAN®, Sigfox®, Weightless-P™, Wi-Fi HaLow™ and other unlicensed ISM bands in the 902 MHz to 930 MHz range.

The antenna features UV stabilized fiberglass housing, IP67 rated waterproof design, and omnidirectional radiation attaches with an N-Type plug (male pin) or N-Type Jack (female socket) connector.

### Features

- Bandwidth 902 MHz to 930 MHz
- Performance at 915 MHz
  - VSWR: ≤ 1.3
  - Peak Gain: 4.5 dBi
  - Efficiency: 76%
- UV Stabilized Fiberglass radome for outdoor use
- High Gain, Omnidirectional radiation
- N-Type Plug (male pin) or N-Type Jack (female socket) connector

### Applications

- Low-power, wide-area (LPWA) applications:
  - LoRaWAN®
  - Sigfox®
  - Weightless-P™
  - Wi-Fi HaLow™ (802.11ah)
- ISM applications
- Small Base Station
- Gateways

### Ordering Information

| Part Number | Description |
|---|---|
| **GHX-1017NX2W** | 915MHz ISM Outdoor Fiberglass Baton Antenna w. N plug (male pin) Connector |
| **GHX-1017NF2W** | 915MHz ISM Outdoor Fiberglass Baton Antenna w. N Jack (female socket) |

Available from Joymax Electronics and select distributors and representatives.

## Table 1: Electrical Specifications

| GHX-1017cc2W | Sub-1 GHz LPWA & ISM (MHz) | | |
|---|---|---|---|
| Frequency Range | 902 MHz | 915 MHz | 930 MHz |
| VSWR (Max) | 1.2 | 1.3 | 1.7 |
| Peak Gain (dBi) | 4.3 | 4.5 | 4.8 |
| Average Gain (dBi) | -1.4 | -1.2 | -1.2 |
| Efficiency (%) | 72 | 76 | 75 |
| Polarization | Linear | | |
| Radiation | Omni directional | | |
| Max Power | 10 W | | |
| Wavelength | ½-λ | | |
| Electrical Type | Dipole | | |
| Impedance | 50 Ω | | |

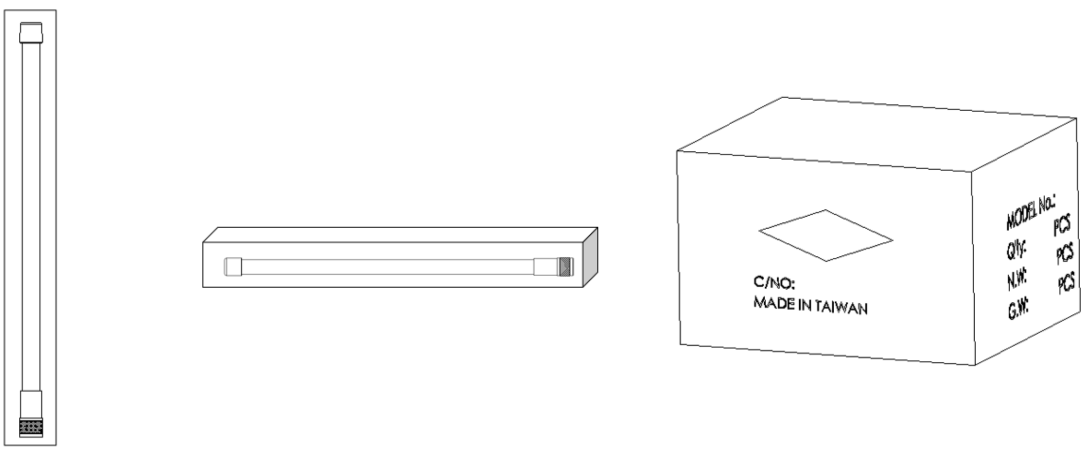
Electrical specifications and plots measured with the antenna hanging free in the space without ground plane.

## Table 2: Mechanical Specifications

| Parameter | Value | |
|---|---|---|
| Connection | N-Type Jack (female socket) | N-Type Plug (male pin) |
| Dimension | 538 mm x ⌀ 20 mm | 528 mm x ⌀ 20 mm |
| Weight | 145 g (5.12 oz) | 111 g (3.92 oz) |
| Operating Temp. | -40˚C to +85˚C | |
| Antenna Color | White | |
| Ingress Protection | IP67 | |

## Packaging Information

The GHX-1017cc2W antennas are individually sealed in a clear plastic bag and packed into a small paper box as shown in **Figure 1**. 100 pcs per carton, 570 mm x 370 mm x 400 mm (22.44 in x 14.56 in x 15.74 in), total weight 16 kgs (35.27 lb). Distribution channels may offer alternative packaging options.




1 pce / 1 PE bag    1 pce / 1 paper box    100 pcs / 1 carton

**Figure 1. Antenna Packaging**

## Product Dimensions

**Figure 2** provides dimensions of the GHX-1017cc2W in mm measurement unit. The baton/stick antenna with N-type Plug (male pin) connector can be directly mounted on enclosure-mounted connector. The antenna with N-type Jack (female socket) can be mounted on L bracket (not included) or end-products' enclosure through screws (included).

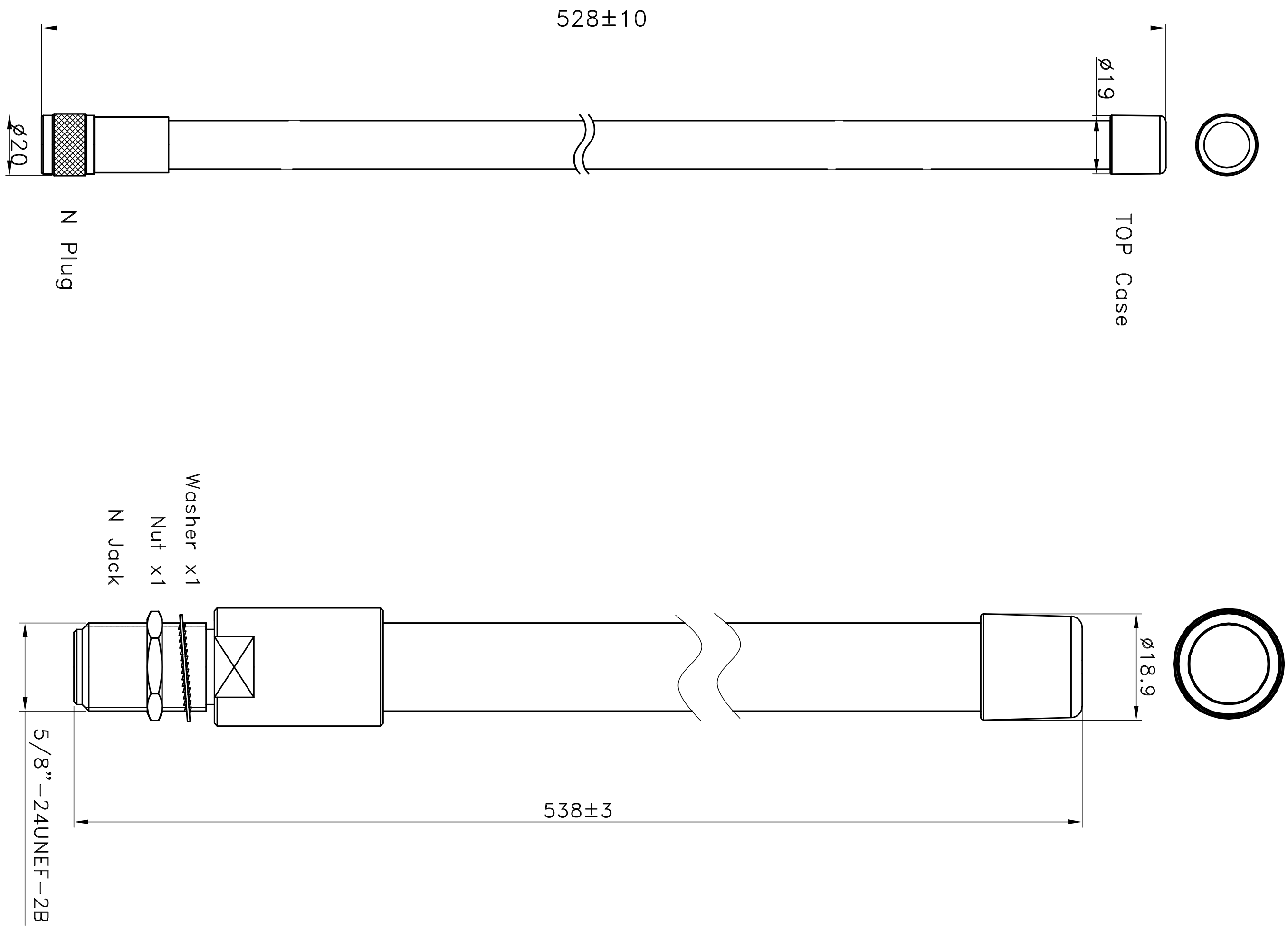



**Figure 2. Antenna Dimensions**

## Antenna Test Setup

The GHX-1017cc2W antenna is characterized in straight antenna orientations as shown in **Figure 3**. The charts on the following pages represent data taken with the antenna hanging free in the space without ground plane.

**Figure 3. Antenna Test Setup, Straight without ground plane**

## 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.

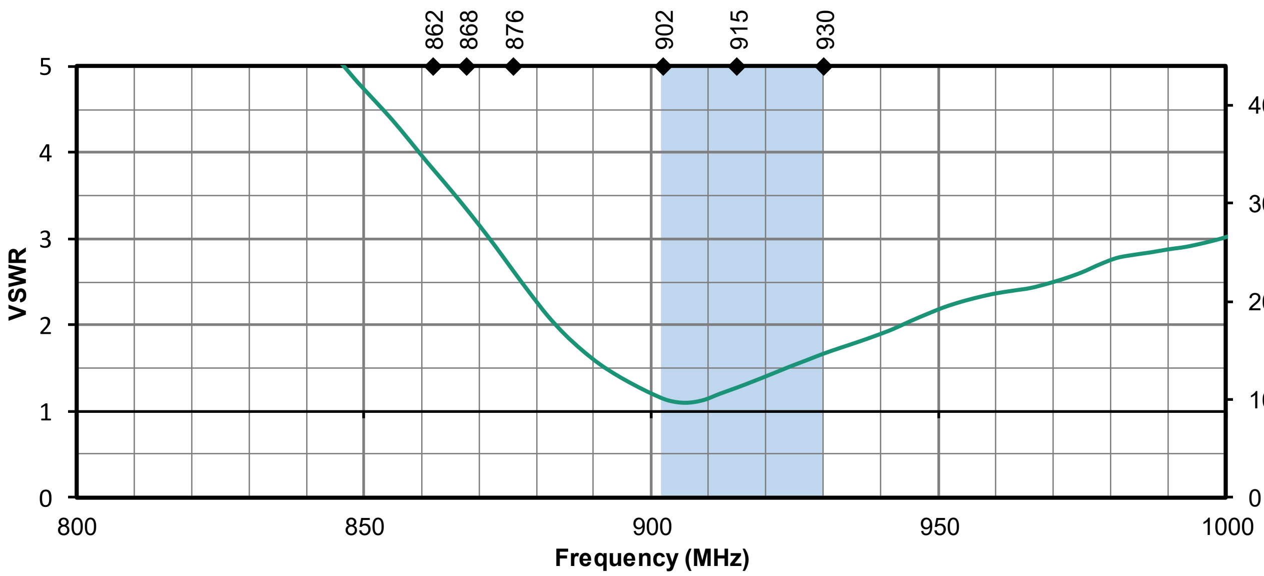



**Figure 4. Antenna VSWR, Straight without ground plane**

## 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.

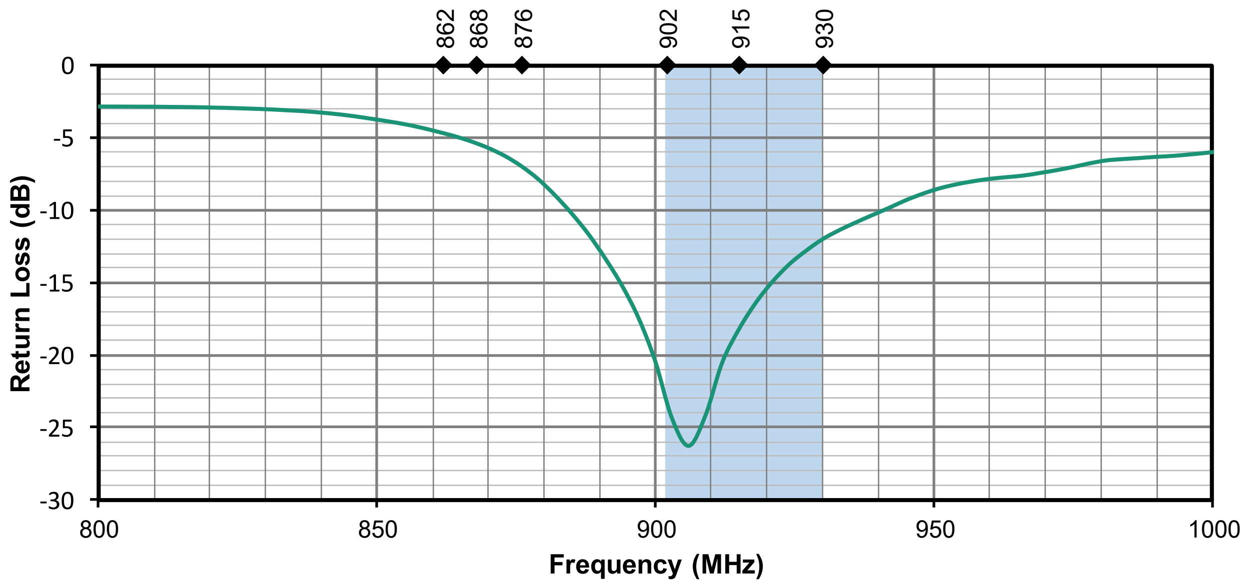



**Figure 5. Antenna Return Loss, Straight without ground plane**

## 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.

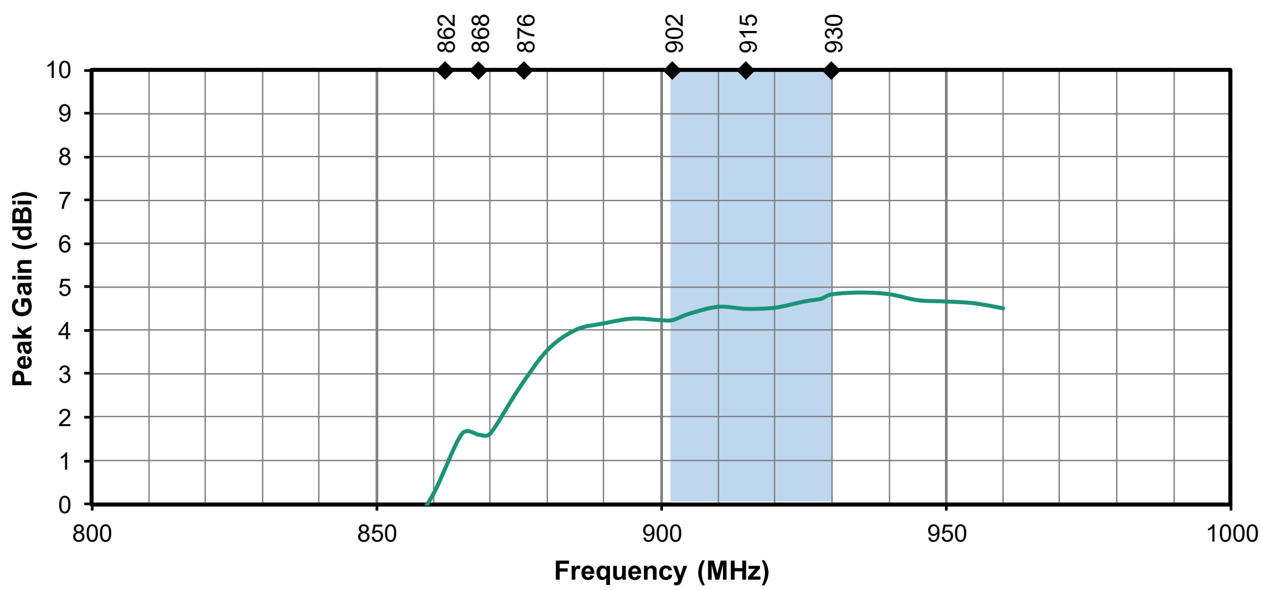



**Figure 6. Antenna Peak Gain, Straight without ground plane**

## 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.

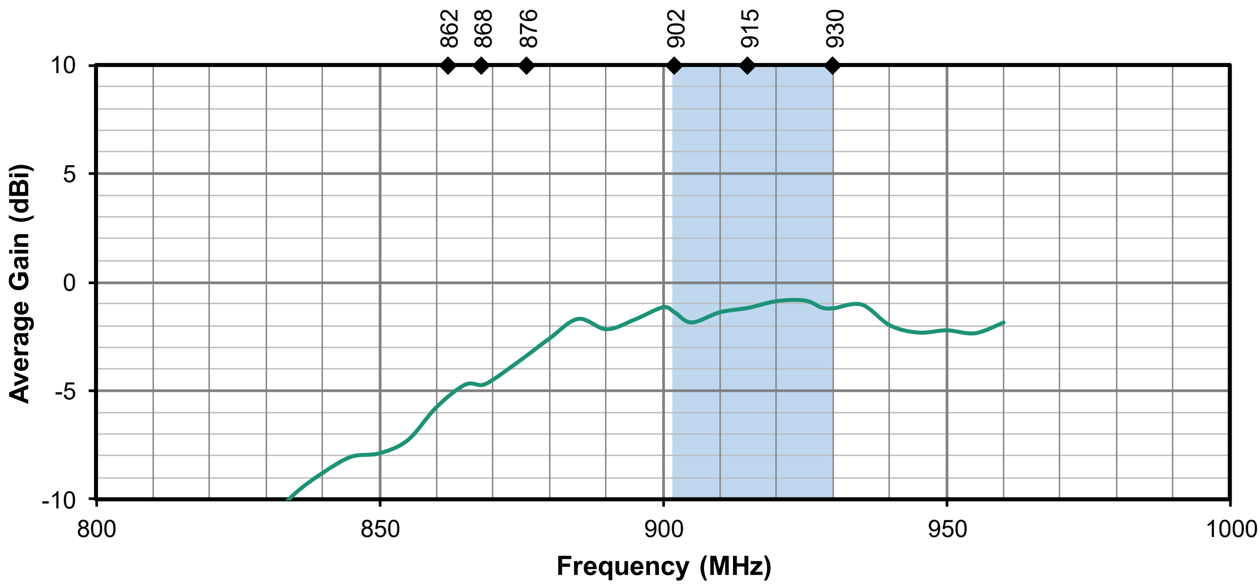



**Figure 7. Antenna Average Gain, Straight without ground plane**

## 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.

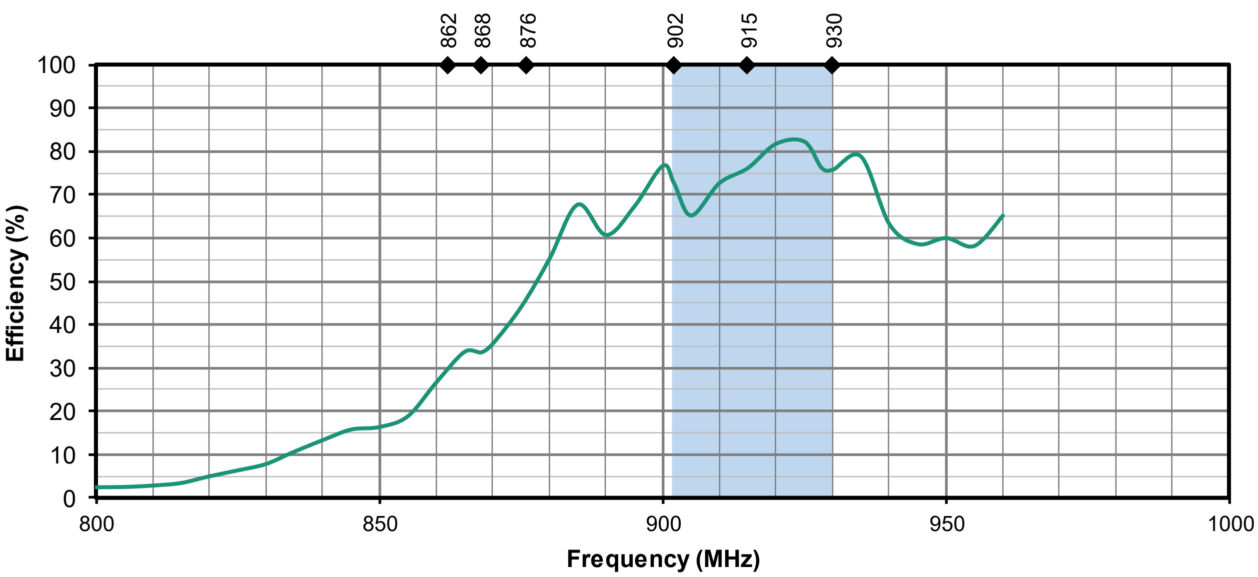
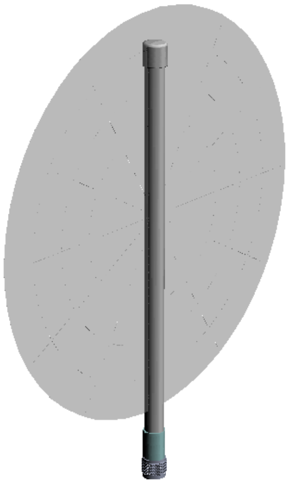


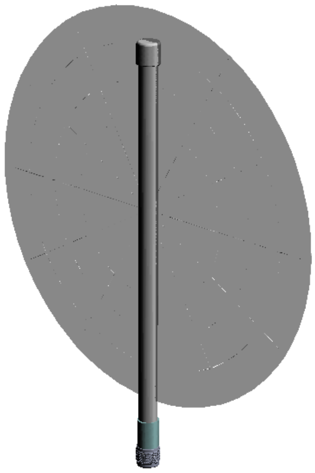

**Figure 8. Antenna Efficiency, Straight without ground plane**

## Radiation Patterns

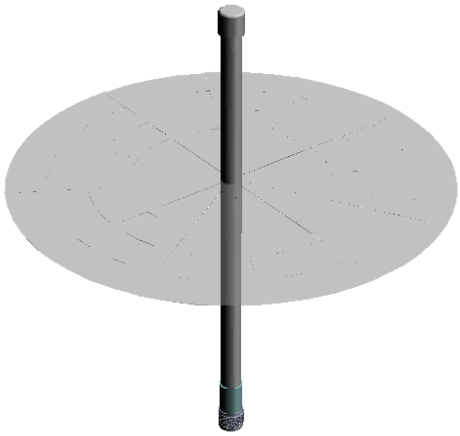
Radiation patterns provide information about the directionality and 3-dimensional gain performance of the antenna by plotting gain at specific frequencies in three orthogonal planes. Antenna radiation patterns for a straight orientation are shown in **Figure 9** using polar plots covering 360 degrees.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



XZ-Plane Gain

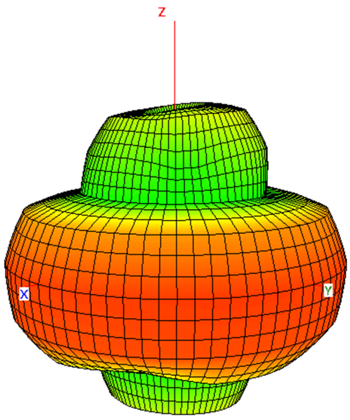


YZ-Plane Gain

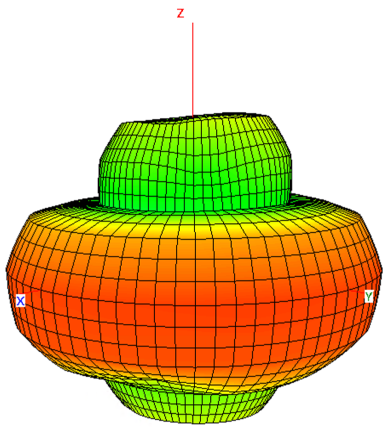


XY-Plane Gain

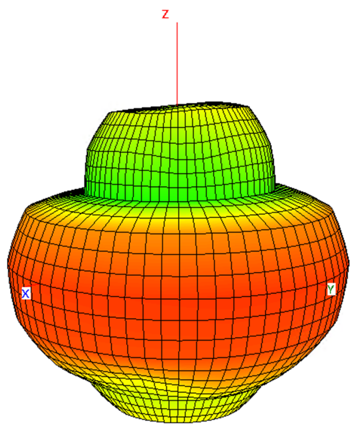
### 902 MHz to 928 MHz (915 MHz)



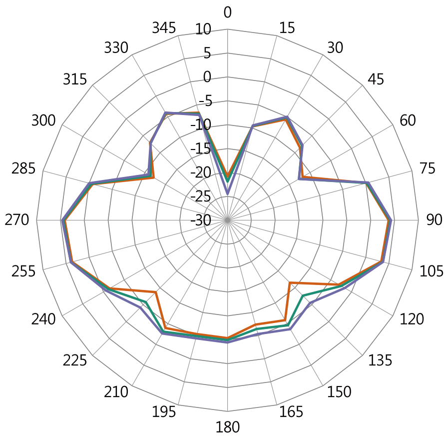
902 MHz



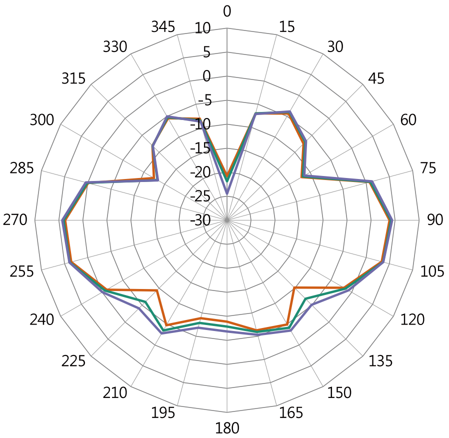
915 MHz



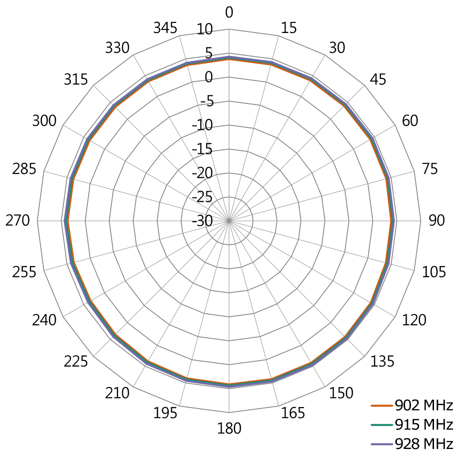
928 MHz



XZ-Plane Gain



YZ-Plane Gain




XY-Plane Gain

**Figure 9. Antenna Radiation Patterns, Straight without ground 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.

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