Datasheet

GWX-241Bcc3B

868/915 MHz LPWA Whip antenna

The Joymax GWX-241Bcc3B antenna is a whip-style, monopole antenna designed for use in Sub-1 GHz 868 MHz and 915 MHz frequency bands for low-power, wide-area (LPWA) applications such as LoRaWAN® , Sigfox® , Weightless-P®, and WiFi HaLow™ as well as ISM and remote control applications.

The tilt/swivel design allows the antenna to be positioned for optimum performance and reduces the potential for damage from impact compared to a fixed whip design. The antenna attaches with an SMA plug (male pin) or RP-SMA Plug (female socket) connector.

Features

- Bandwidth 860 MHz to 930 MHz
- Performance at 915 MHz
    - VSWR: ≤ 1.7
    - Peak Gain: 2.3 dBi
    - Efficiency: 78%
- Hinged design with detents for straight, 45 degree and 90 degree positioning
- SMA plug (male pin) or RP-SMA plug (female socket)

Applications

- Low-power, wide-area (LPWA) applications
    - LoRaWAN®
    - Sigfox®
    - Weightless-P®
    - WiFi HaLow™ (802.11ah)
- ISM applications
- Remote control
- Internet of Things (IoT) devices
- Networking routers / gateways

Ordering Information

Part Number	Description
GWX-241BSA3B	868/915 MHz Tilt/Swivel Whip Antenna with SMA plug (male pin) Connector
GWX-241BRS3B	868/915 MHz Tilt/Swivel Whip Antenna with RP-SMA plug (female socket) Connector

Available from Joymax Electronics and select distributors and representatives.

Table 1: Electrical Specifications

GWX-241Bcc3B	Sub-1 GHz LPWA & ISM Bands (MHz)	
Frequency Range	862~876 (868)	902~928 (915)
VSWR (Max)	1.6	1.9
Peak Gain (dBi)	2.3	2.5
Average Gain (dBi)	-1.0	-1.2
Efficiency (%)	78	77
Polarization	Linear	
Radiation	Omni directional	
Max Power	1 W	
Wavelength	¼-λ	
Electrical Type	Monopole	
Impedance	50 Ω	

Electrical specifications and plots measured with a 120 mm x 120 mm (4.72 in. x 4.72 in.) reference ground plane.

Table 2: Mechanical Specifications

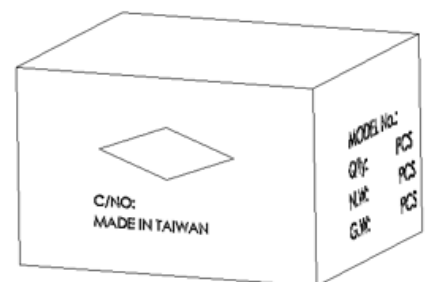| Parameter	Value
Connection	SMA Plug (male pin) or RP-SMA Plug (female socket)
Operating Temp.	-30℃ to +70℃
Weight	8 g
Dimension	108 mm (Straight) x ⌀10 mm
Antenna Color	Black
Ingress Protection	N/A

Packaging Information

The GWX-241Bcc3B antennas are individually sealed in a clear plastic bag. **Figure 1**. 1000 pcs per carton, 320 mm x 250 mm x 290 mm (12.5 in x 9.8 in x 11.4 in), total weight 7.6 kgs (16.8 lb) Distribution channels may offer alternative packaging options.
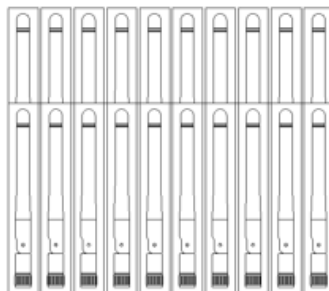
1 pc antenna/ 1 PE bag   50 pcs antenna/1 Bigger PE bag   1000 pcs antenna/1 Carton

Figure 1. Antenna Packaging

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Product Dimensions

Figure 2 provides dimensions of the GWX-241Bcc3B. The antenna blade can be tilted 90 degrees, and has a detent at 45 degrees enabling the antenna to be oriented in any direction. The rotating base allows for continuous positioning through 360 degrees even while installed.
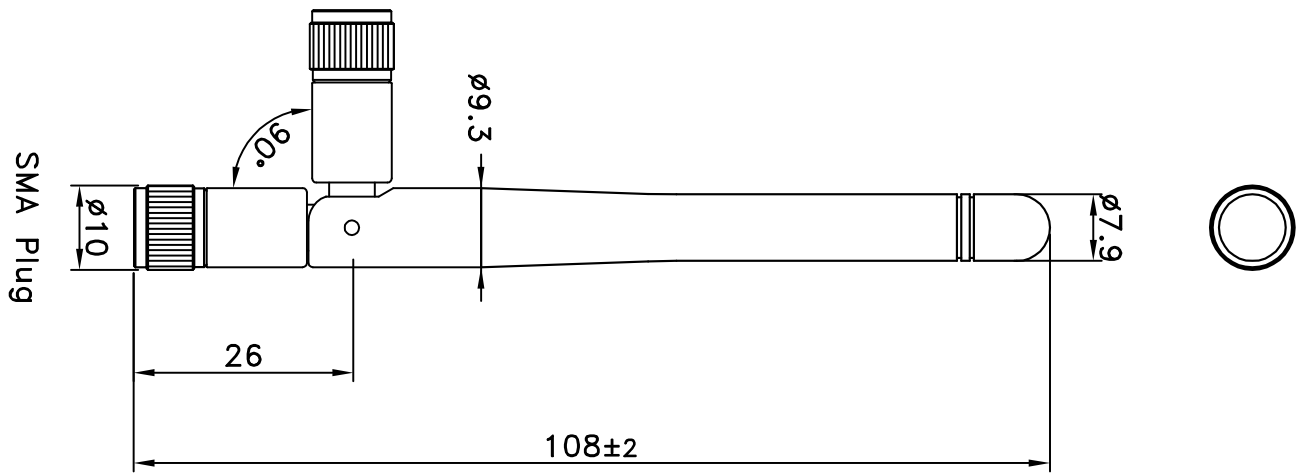
Figure 2. Antenna Dimensions

Antenna Orientation

The GWX-241Bcc3B antenna is characterized in 90 degrees bent antenna orientations with an adjacent ground plane (120 mm x 120 mm) as shown in **Figure 3**. That provides reference insight into antenna performance when attached directly to a printed circuit board mounted connector. The 90 degree edge bent orientation represents the most common end-product use cases.
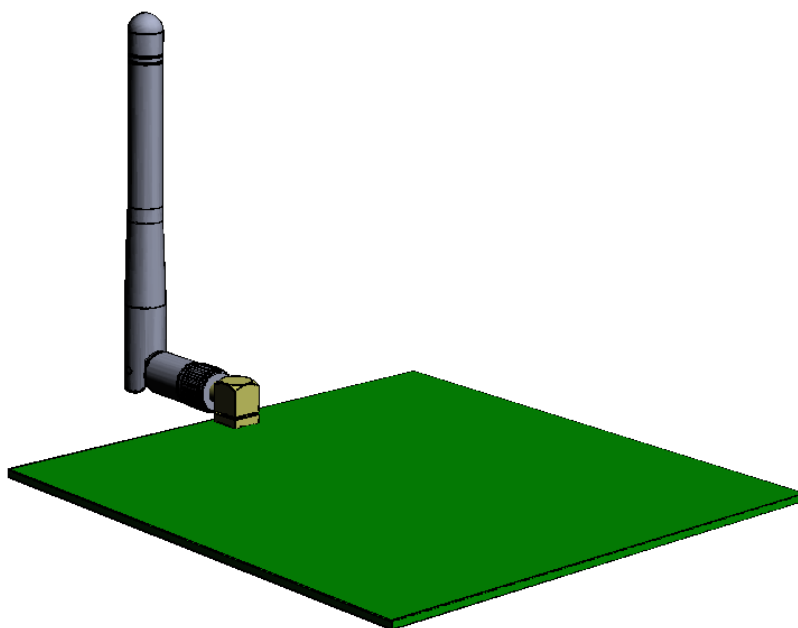
Figure 3. Antenna Test Orientation

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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.
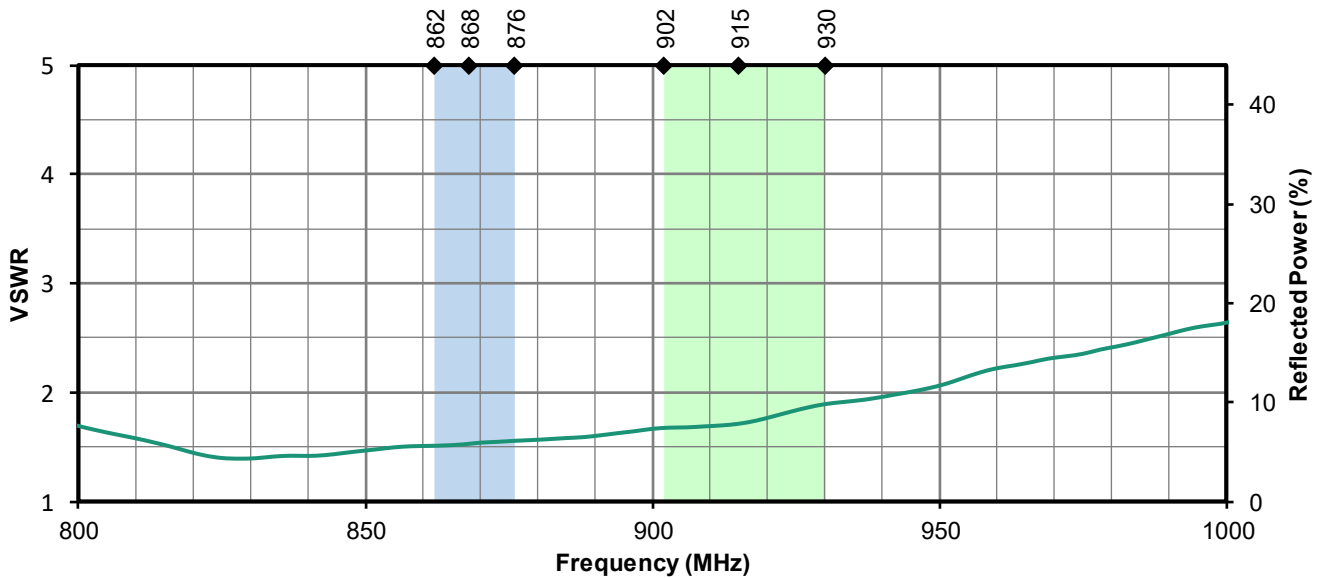
Figure 4. Antenna VSWR, Edge Bent 90 Degrees

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.
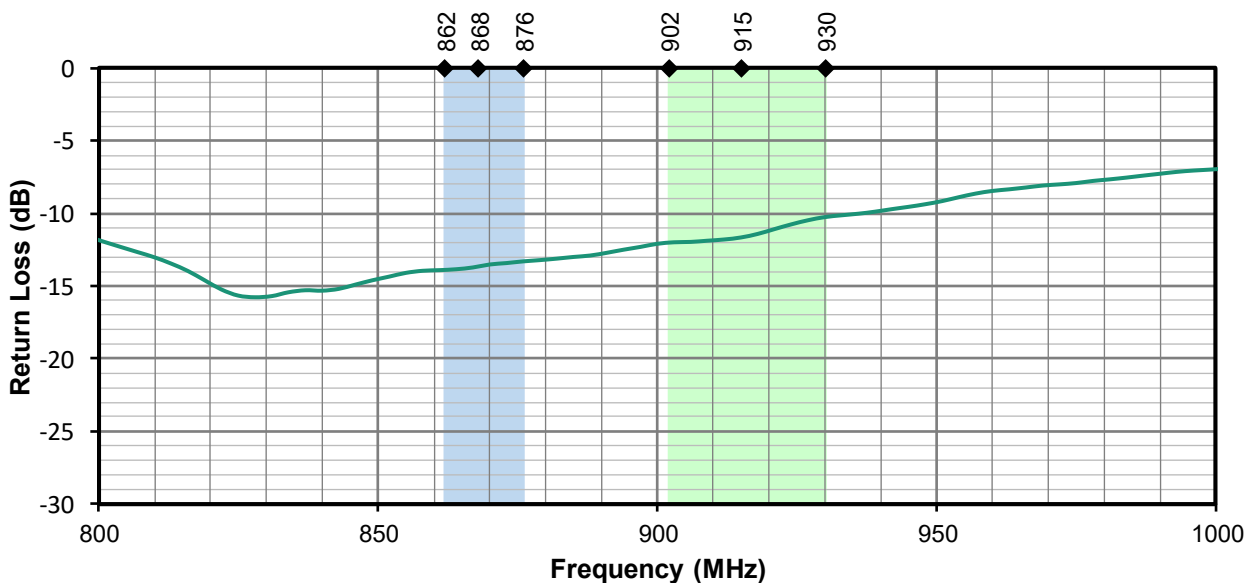
Figure 5. Antenna Return Loss, Edge Bent 90 Degrees

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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.
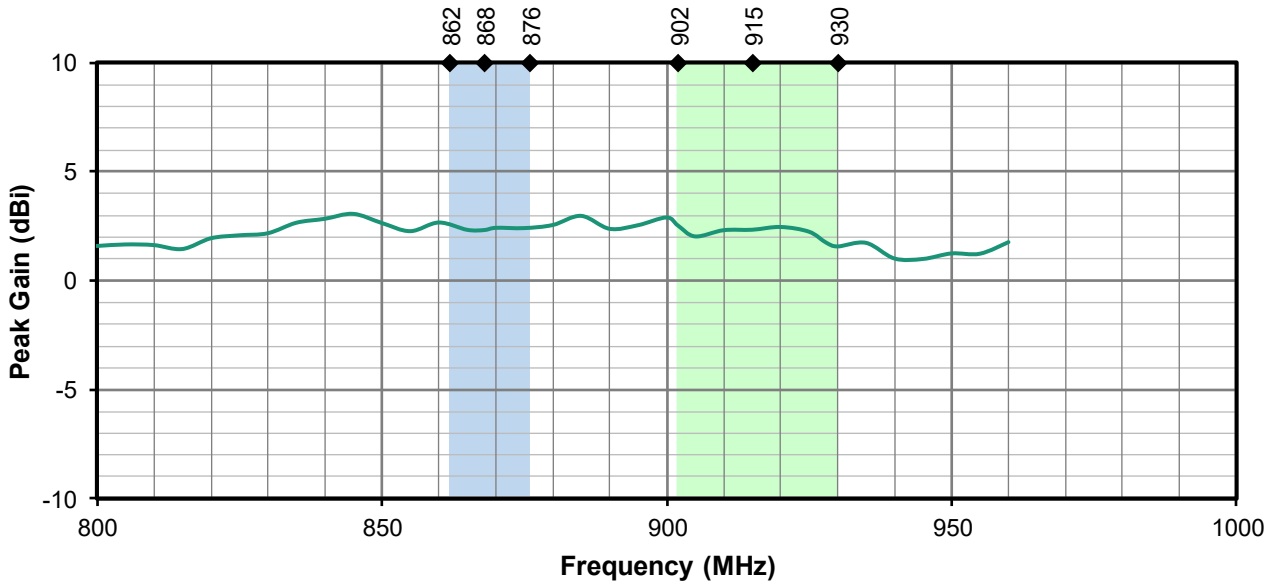
Figure 6. Antenna Peak Gain, Edge Bent 90 Degrees

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.
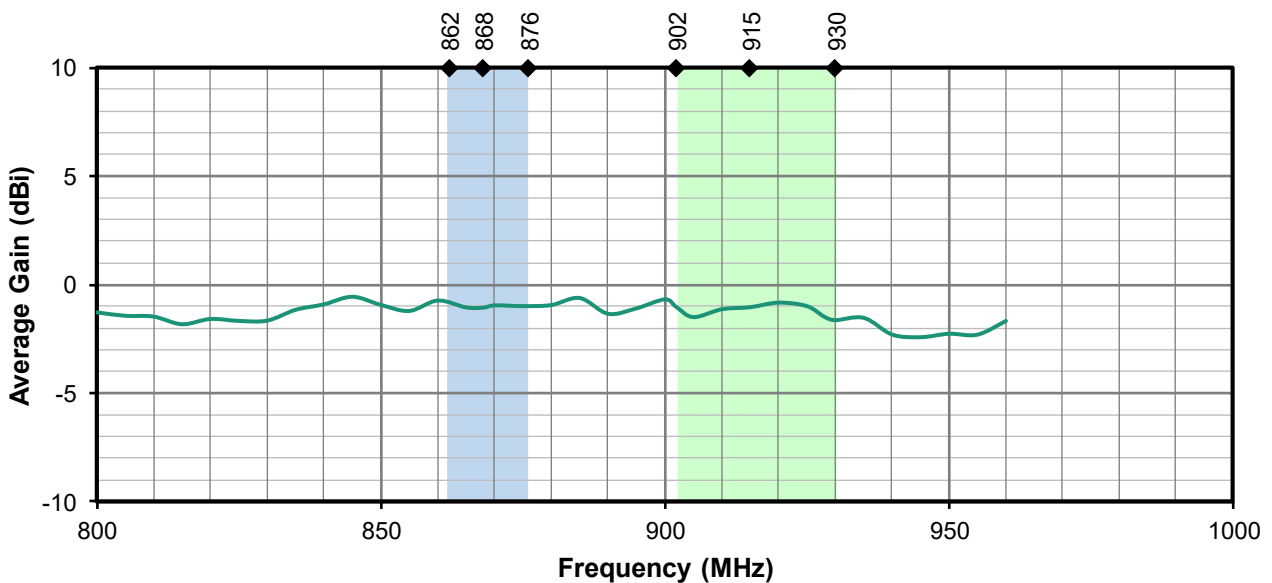
Figure 7. Antenna Average Gain, Edge Bent 90 Degrees

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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.
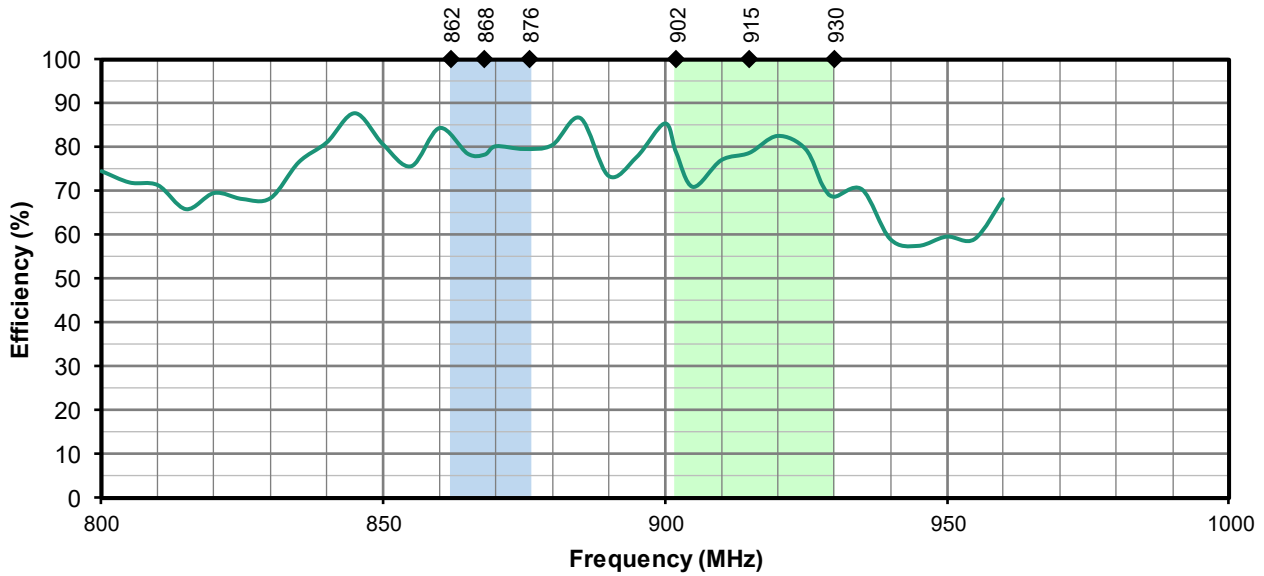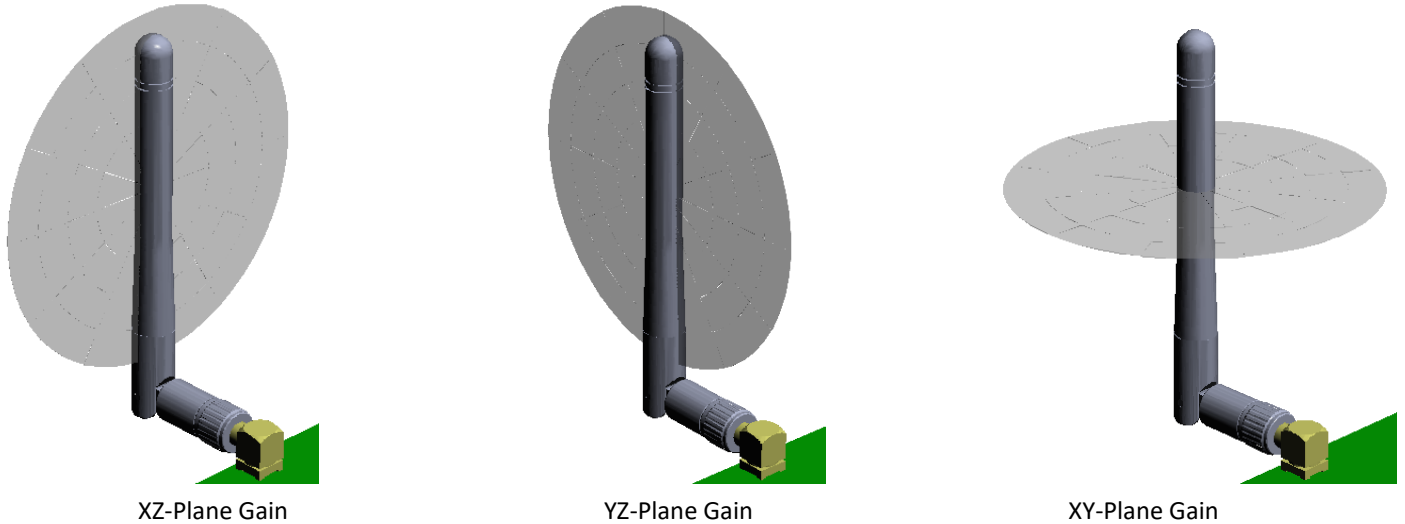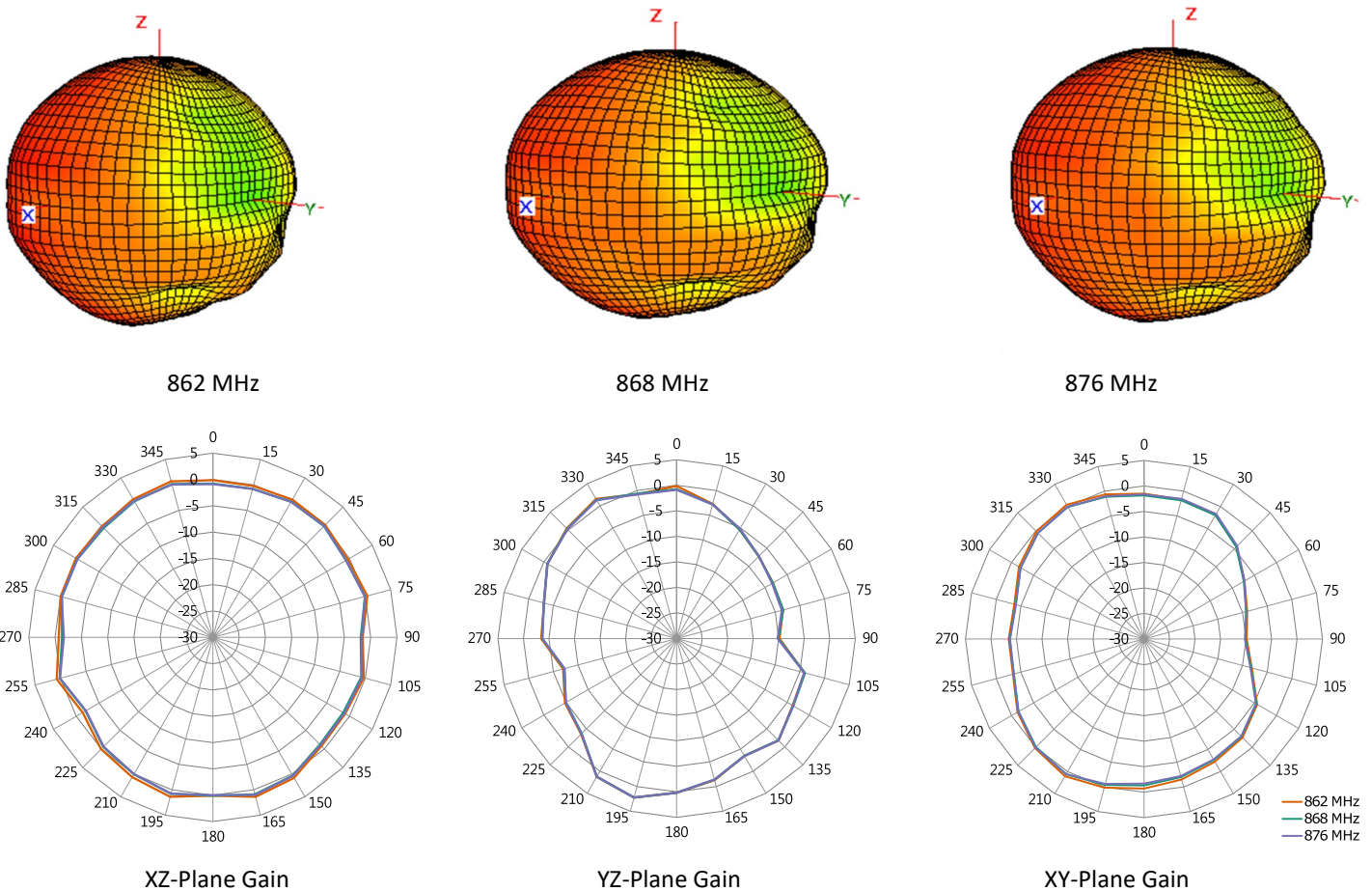

Figure 8. Antenna Efficiency, Edge Bent 90 Degrees

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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 90 bent 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.
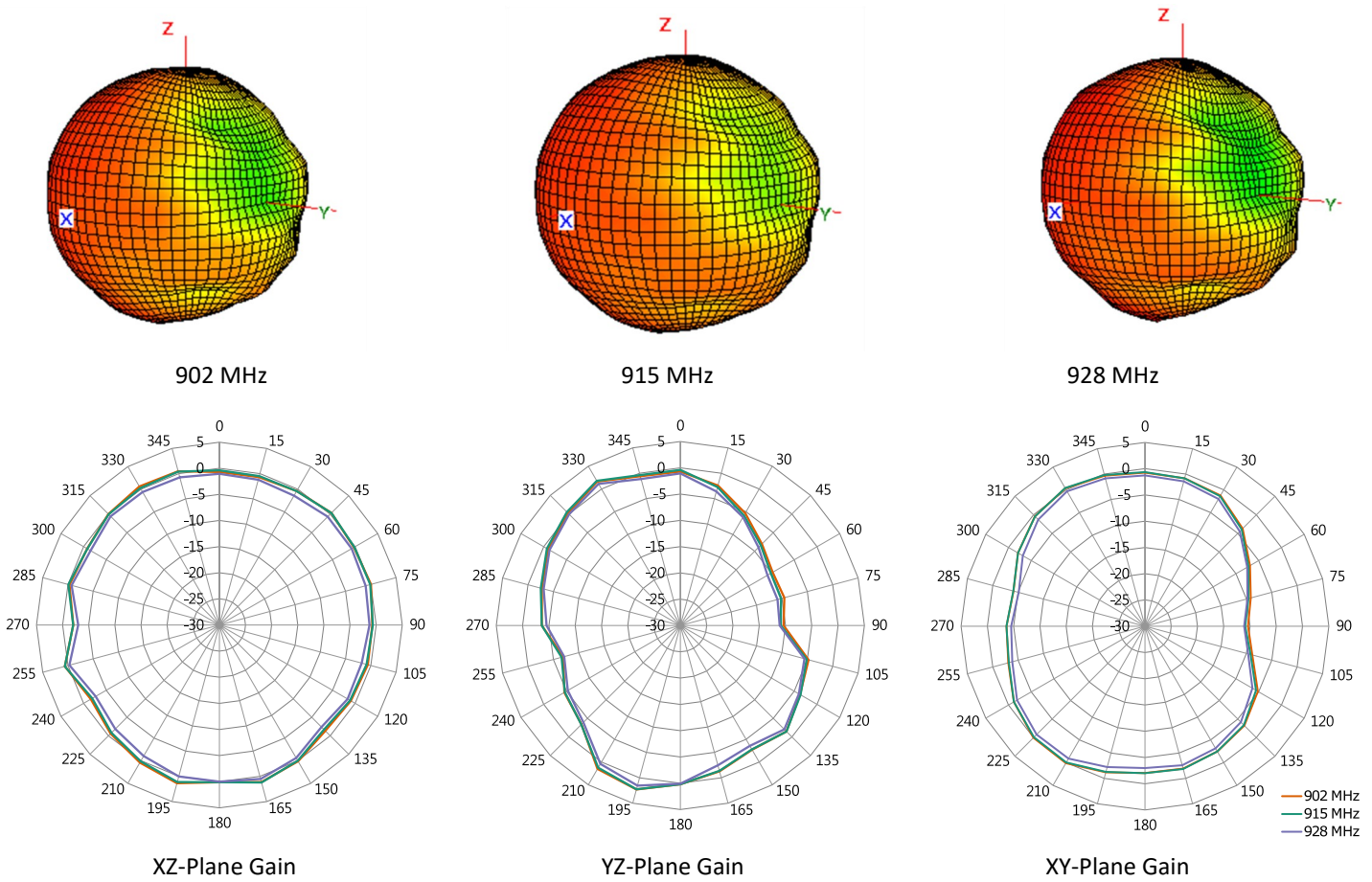

XZ-Plane Gain

YZ-Plane Gain

XY-Plane Gain

862 MHz to 876 MHz (868 MHz)

862 MHz

868 MHz

876 MHz

XZ-Plane Gain

YZ-Plane Gain

XY-Plane Gain

Figure 9. Antenna Radiation Patterns, Edge Bent 90 Degrees

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902 MHz to 928 MHz (915 MHz)

902 MHz　　　　　　　　　　915 MHz　　　　　　　　　928 MHz

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

Figure 9-1. Antenna Radiation Patterns, Edge Bent 90 Degrees

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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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