Datasheet

# ANT-8/9-IPW1-SMA
# 868/915 MHz LPWA Weatherproof Antenna

The ANT-8/9-IPW1-SMA antenna is a hinged-whip IP67-rated dipole antenna designed for use in 868 MHz and 915 MHz frequency bands for low-power, wide-area (LPWA) applications such as LoRaWAN®, Sigfox® and WiFi HaLow™ as well as ISM and remote control applications.

The ANT-8/9-IPW1-SMA provides a ground plane independent dipole antenna solution and the hinged design allows for 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) connector.

## Features

- Performance at 862 MHz to 876 MHz
  - VSWR: ≤ 1.6
  - Peak Gain: 2.9 dBi
  - Efficiency: 96%
- Performance at 902 MHz to 930 MHz
  - VSWR: ≤ 3.2
  - Peak Gain: 2.5 dBi
  - Efficiency: 84%
- Hinged design with detents for straight, 45 degree and 90 degree positioning
- IP67 rated

## Applications

- Low-power, wide-area (LPWA) applications
  - LoRaWAN®, ITU-T Y.4480
  - Sigfox®
  - WiFi HaLow™ (802.11ah)
- Remote control, monitoring and sensing
- Internet of Things (IoT) devices
- ISM applications

## Ordering Information

| Part Number | Description |
|---|---|
| **ANT-8/9-IPW1-SMA** | Outdoor, hinged-whip LPWA antenna with SMA plug (male pin) connector |

Available from Linx Technologies and select distributors and representatives.

Table 1. Electrical Specifications

| ANT-8/9-IPW1-SMA | 868 MHz | 915 MHz |
|---|---|---|
| Frequency Range | 862 MHz to 876 MHz | 902 MHz to 930 MHz |
| VSWR (max.) | 1.6 | 3.2 |
| Peak Gain (dBi) | 2.9 | 2.5 |
| Average Gain (dBi) | -0.3 | -0.9 |
| Efficiency (%) | 96 | 84 |
| Impedance | 50 Ω | |
| Wavelength | 1/2-wave | |
| Electrical Type | Dipole | |
| Polarization | Linear | |
| Radiation | Omnidirectional | |
| Max Power | 2 W | |

Electrical specifications and plots measured with the antenna at the edge of a 102 mm x 102 mm ground plane, bent 90 degrees.

Table 2. Mechanical Specifications

| Parameter | Value |
|---|---|
| Connection | SMA plug (male pin) |
| Operating Temperature Range | -30 °C to +70 °C |
| Ingress Protection Rating (IP) | IP67 rated |
| Antenna Color | Black |
| Weight | 24.9 g (0.88 oz) |
| Dimensions | 203.0 mm x 13.2 mm x 13.2 mm (7.99 in x 0.52 in x 0.52 in) |

## Product Dimensions

Figure 1 provides dimensions of the ANT-8/9-IPW1-SMA. The antenna whip can be tilted 90 degrees, with 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.

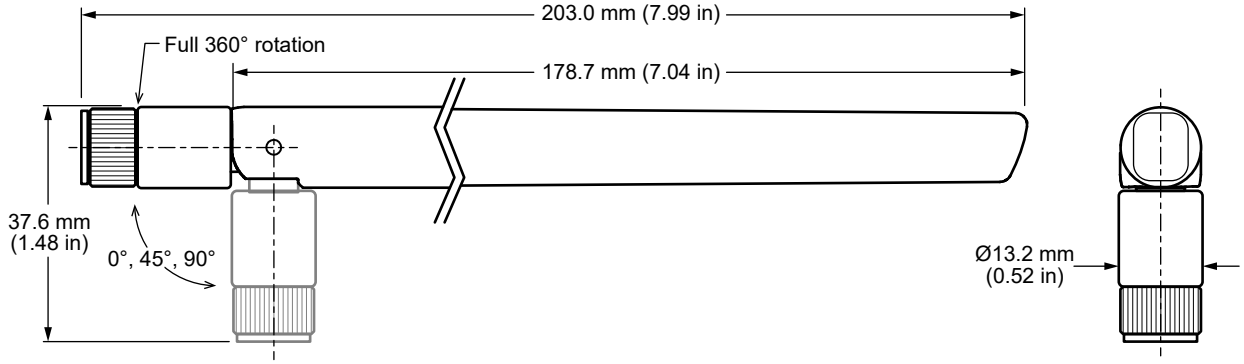



Figure 1. ANT-8/9-IPW1-SMA Antenna Dimensions

## IP (Ingress Protection) Rating

An ingress protection rating (IP rating) refers to the capability of a device to withstand the ingress of dust and/or water under specified conditions. IP rating is typically reserved for marketable product (device) rather than constituent components because design and assembly may affect performance of the device under testing. IP-rated antennas are designed to support the specified level of ingress protection and may be tested in a standalone configuration, however IP testing should be performed on the complete end product to ensure desired performance.

## Packaging Information

The ANT-8/9-IPW1-SMA antenna is packaged in a clear plastic bag. Distribution channels may offer alternative packaging options.

### LPWA: LoRaWAN® ITU-T Y.4480, and Sigfox®

LoRaWAN and Sigfox LPWA technologies operate within several of the frequencies supported by the 8/9-IPW1-SMA antenna. Notably, LoRaWAN operates at the frequency bands shown in Table 3. Sigfox operates at different frequencies determined by country (Table 4).

**Table 3. LoRaWAN® Channel plan**

| Frequency Band | LoRaWAN Channel Plan |
|---|---|
| 779 MHz to 787 MHz | CN779-787 |
| 865 MHz to 867 MHz | IN765-867 |
| 868 MHz to 873 MHz | EU863-870 |
| 902 MHz to 928 MHz | US902-928, AS923 |
| 915 MHz to 928 MHz | AU915-928 |
| 917 MHz to 923.5 MHz | KR920-923 |

**Table 4. Sigfox® Frequencies by Country/Region**

| Center Frequency | Select Countries/Regions |
|---|---|
| 868 MHz | Europe |
| 902 MHz | USA, Mexico, Brazil |
| 920 MHz | Australia |
| 923 MHz | Japan |

## Antenna Orientation

The ANT-8/9-IPW1-SMA antenna is characterized in two antenna orientations as shown in Figure 2. The antenna straight orientation characterizes use of an antenna attached to an enclosure-mounted connector which is connected by cable to a printed circuit board. Although the antenna is a dipole not requiring a ground plane for function, characterization with an adjacent ground plane, (102 mm x 102 mm) provides insight into antenna performance when attached directly to a printed circuit board mounted connector. The two orientations represent the most common end-product use cases.

Edge of ground plane, bent 90 degrees

Straight, without ground plane

**Figure 2. ANT-8/9-IPW1-SMA Antenna on Evaluation PCB**

## Edge of Ground Plane

The charts on the following pages represent data taken with the antenna oriented at the edge of the ground plane, bent 90 degrees as shown in Figure 3.

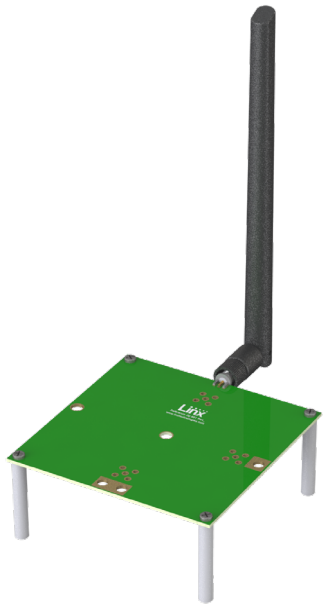


**Figure 3. ANT-8/9-IPW1-SMA at Edge of Ground Plane, Bent 90 Degrees (Edge Bent)**

## VSWR

Figure 4 provides the voltage standing wave ratio (VSWR) across the antenna bandwidth. VSWR 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.

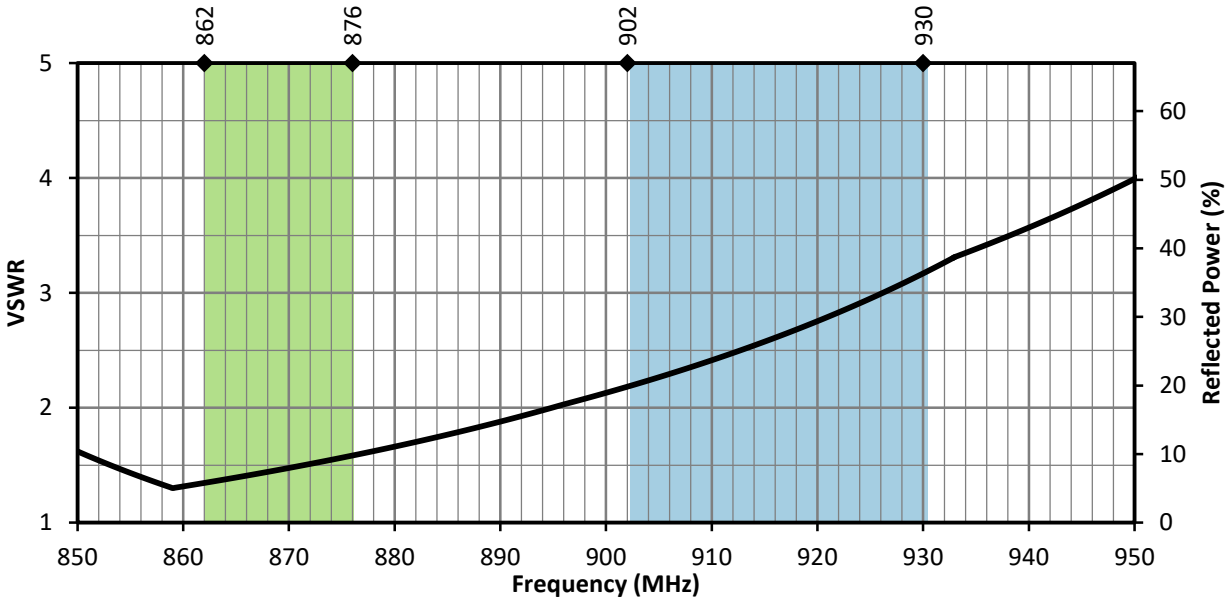



**Figure 4. ANT-8/9-IPW1-SMA Antenna VSWR, Edge Bent**

## 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.

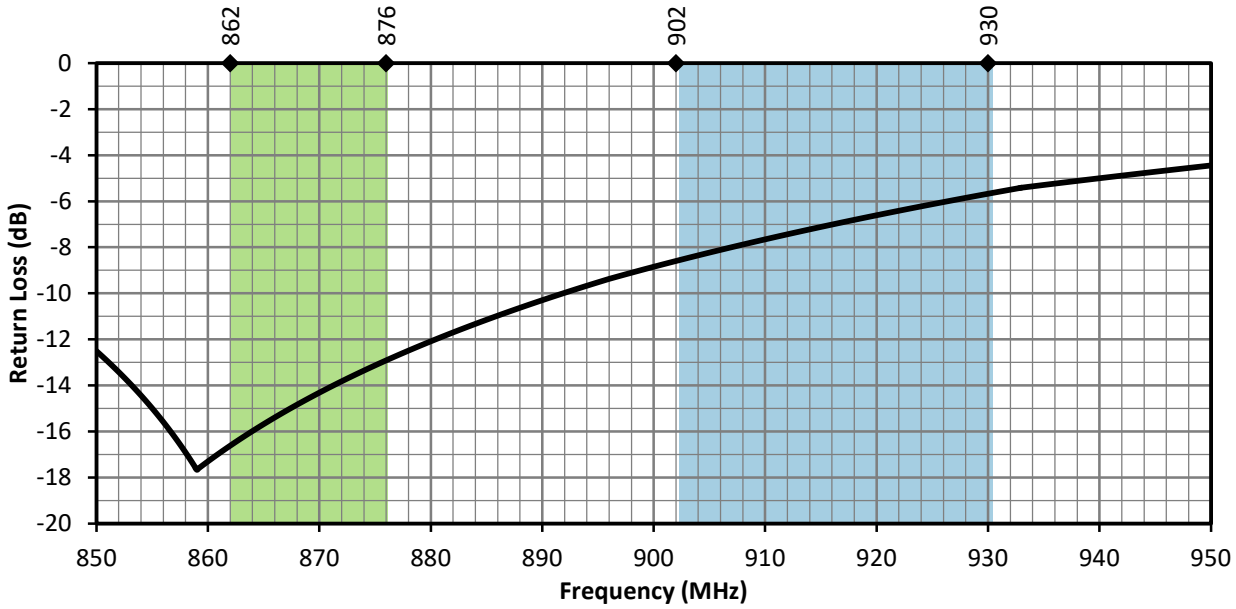



Figure 5. ANT-8/9-IPW1-SMA Antenna Return Loss, Edge Bent

## 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.

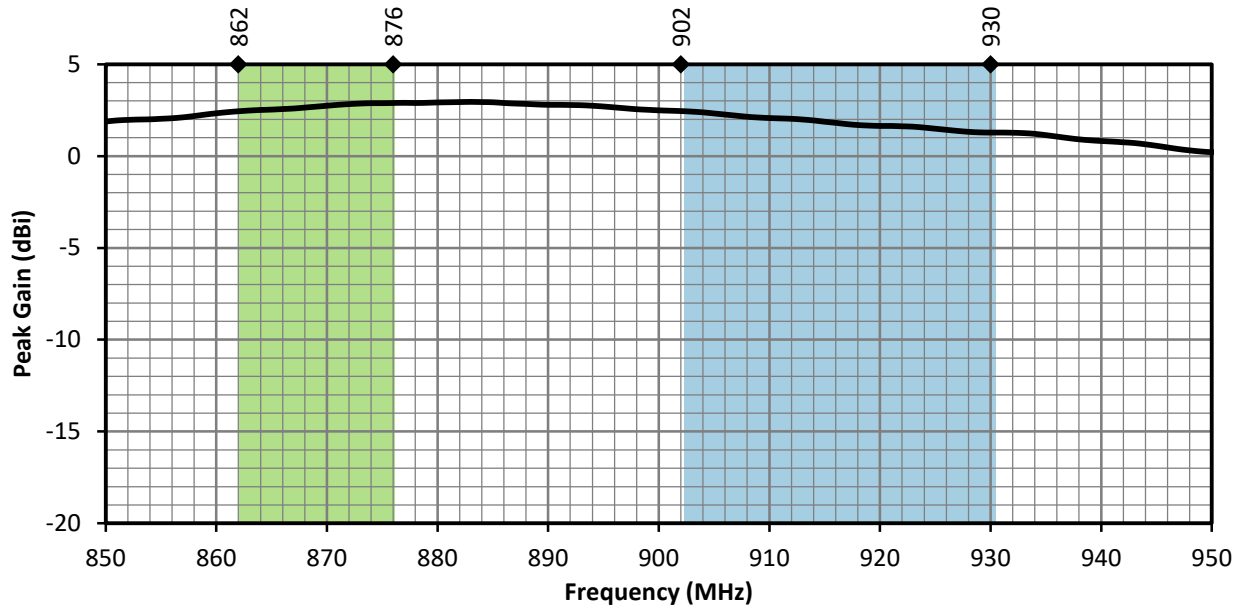



Figure 6. ANT-8/9-IPW1-SMA Antenna Peak Gain, Edge Bent

## 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.

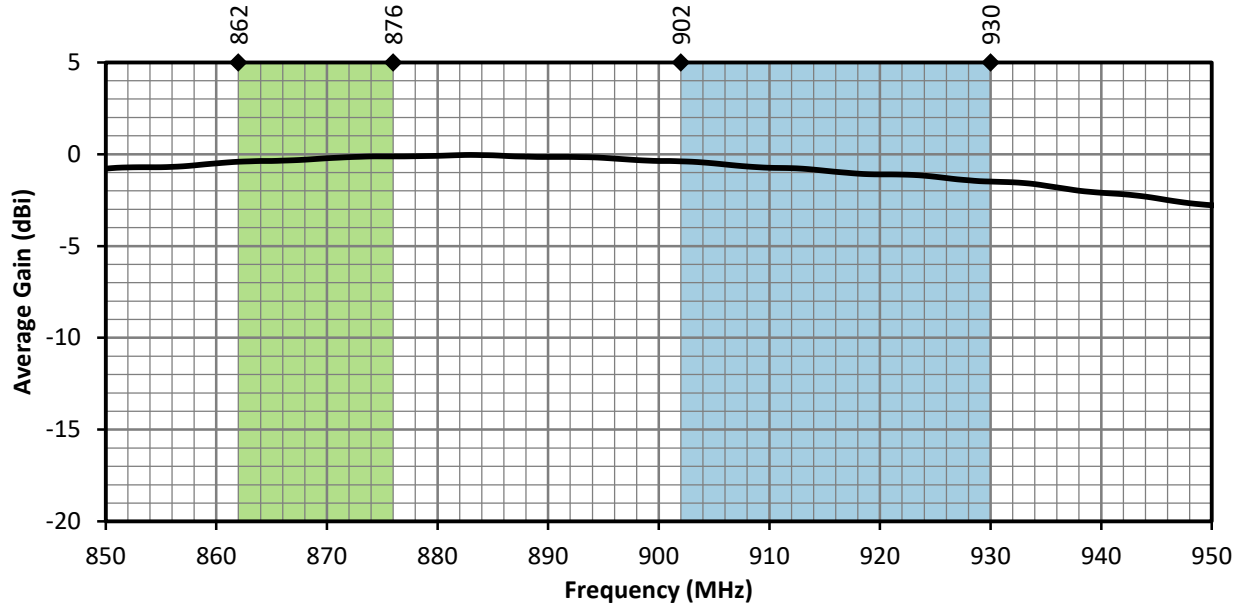



Figure 7. ANT-8/9-IPW1-SMA Antenna Average Gain, Edge Bent

## Radiation Efficiency

Radiation efficiency (Figure 8), shows the ratio of power delivered to the antenna relative to the power radiated at the antenna, expressed as a percentage, where a higher percentage indicates better performance at a given frequency.

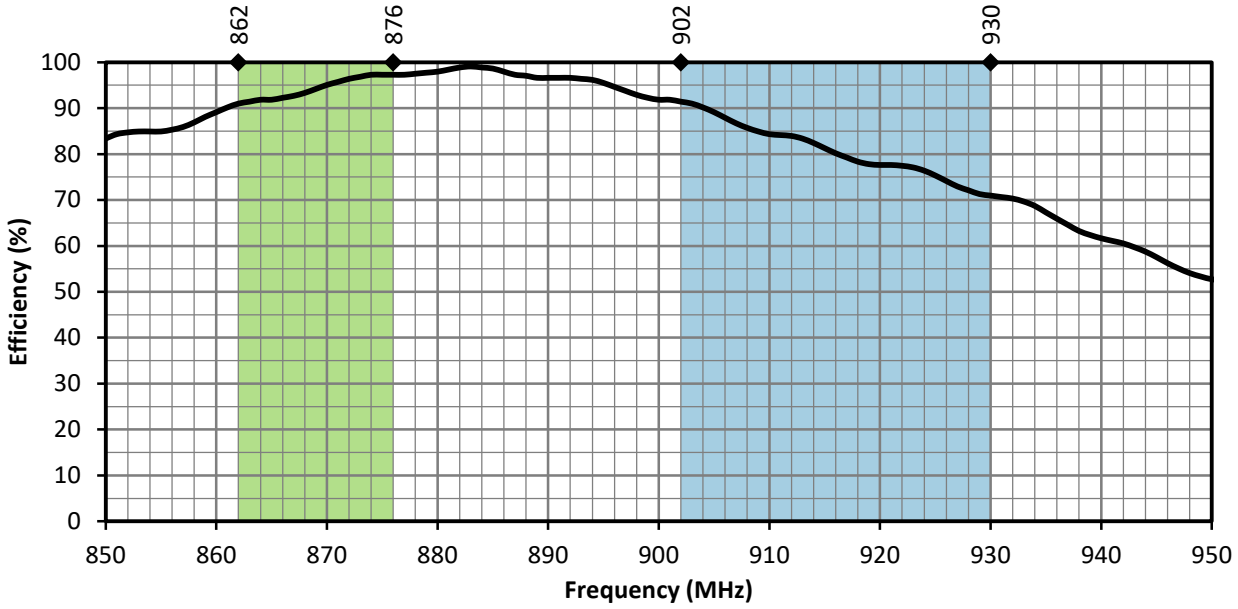
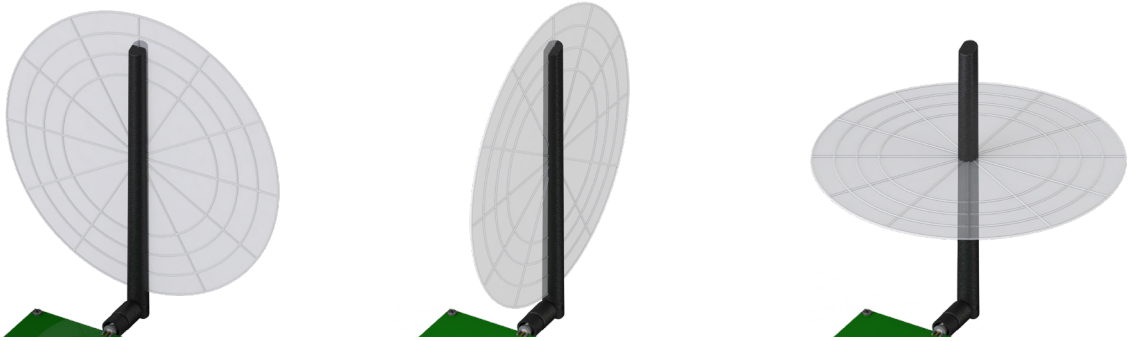



Figure 8. ANT-8/9-IPW1-SMA Antenna Radiation Efficiency, Edge Bent

## Radiation Patterns

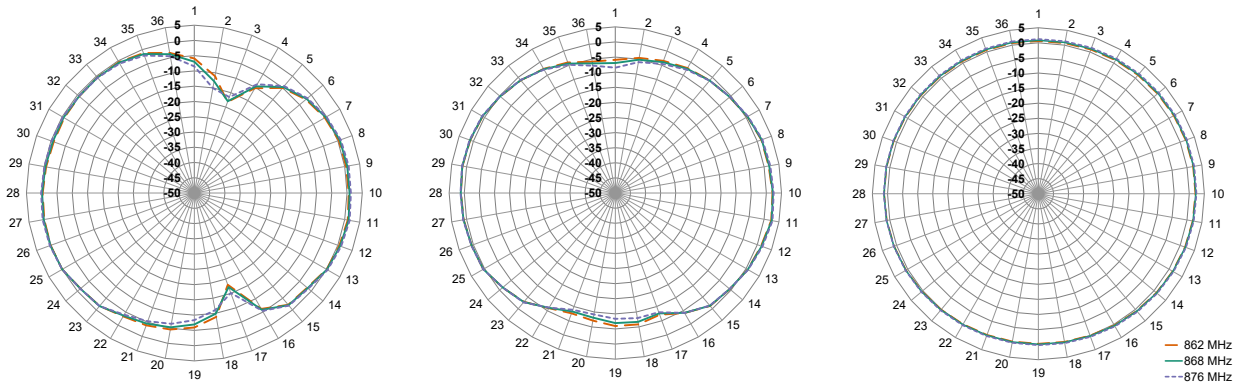
Radiation patterns provide information about the directionality and 3-dimensional gain performance of the antenna by plotting gain at specific frequencies in three orthogonal planes. Antenna radiation patterns for an orientation at the center of the ground plane are shown in Figure 9 using polar plots covering 360 degrees. The antenna graphic at the top of the page provides reference to the plane of the column of plots below it. Note: when viewed with typical PDF viewing software, zooming into radiation patterns is possible to reveal fine detail.

## Radiation Patterns - Edge of Ground Plane



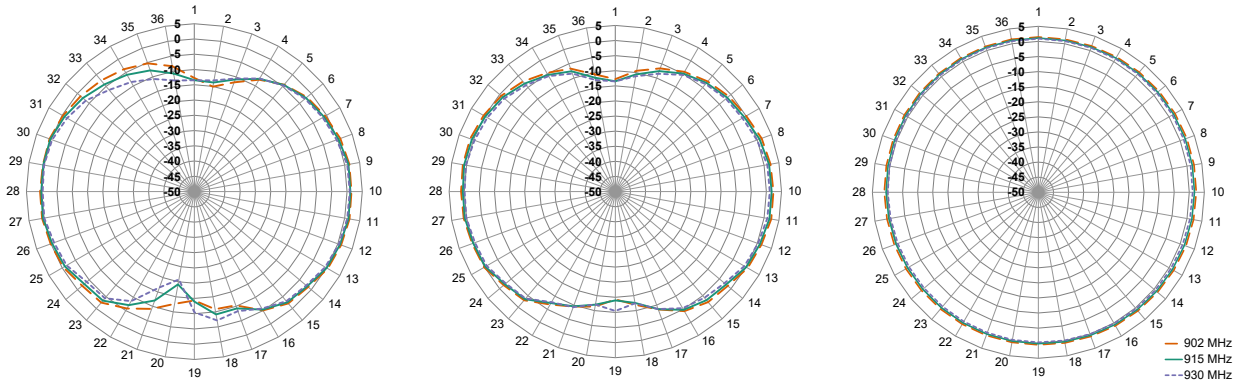
XZ-Plane Gain | YZ-Plane Gain | XY-Plane Gain

## 862 MHz to 876 MHz (868 MHz)




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

## 902 MHz to 930 MHz (915 MHz)




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

**Figure 9. Radiation Patterns for ANT-8/9-IPW1-SMA, Edge Bent**

## Straight, No Ground Plane

The charts on the following pages represent data taken with the antenna oriented straight as shown in Figure 10.

**Figure 10. ANT-8/9-IPW1-SMA Straight, No Ground Plane (Straight)**

## VSWR

Figure 11 provides the voltage standing wave ratio (VSWR) across the antenna bandwidth. VSWR 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.

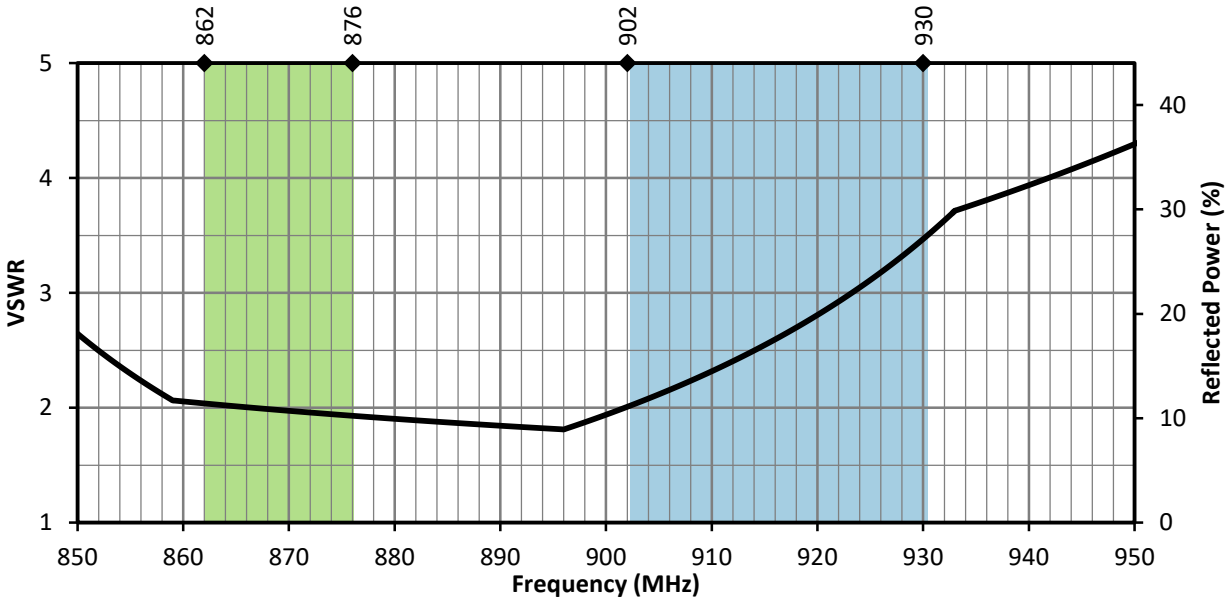



**Figure 11. ANT-8/9-IPW1-SMA Antenna VSWR, Straight**

## Return Loss

Return loss (Figure 12), 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.

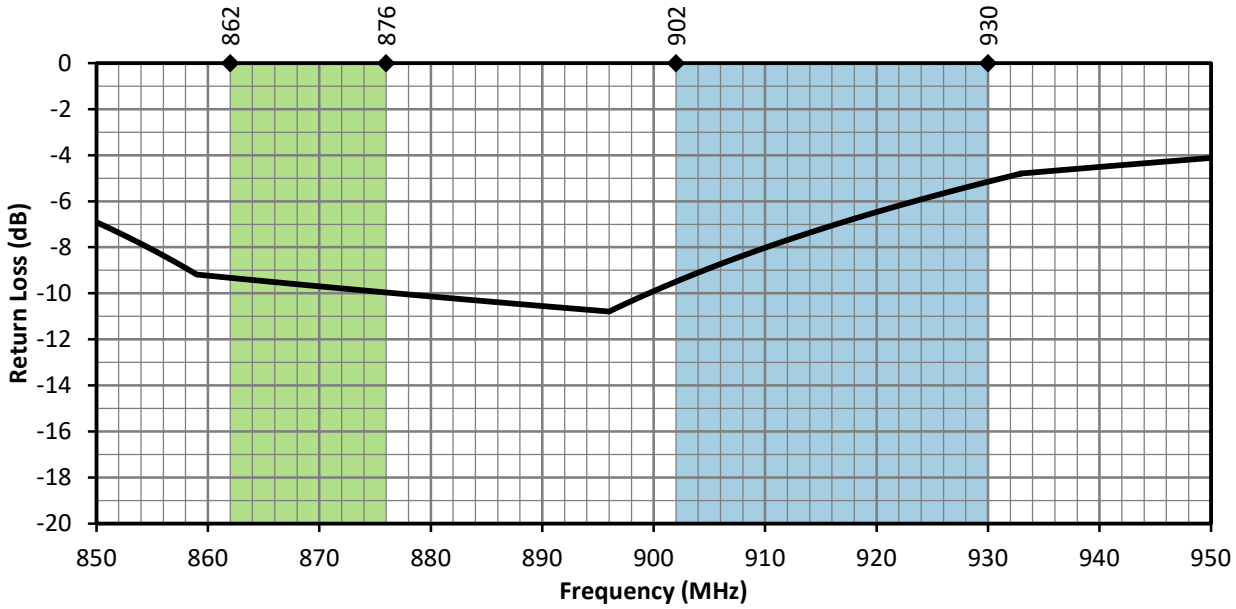



**Figure 12. ANT-8/9-IPW1-SMA Antenna Return Loss, Straight**

## Peak Gain

The peak gain across the antenna bandwidth is shown in Figure 13. 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.

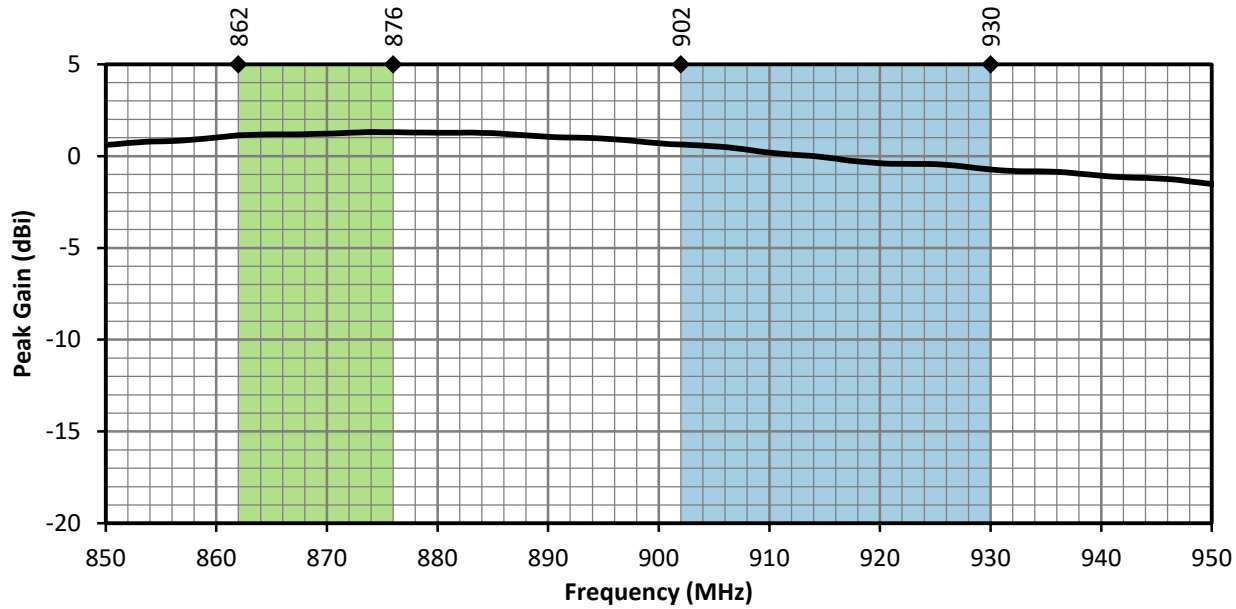



**Figure 13. ANT-8/9-IPW1-SMA Antenna Peak Gain, Straight**

## Average Gain

Average gain (Figure 14), is the average of all antenna gain in 3-dimensional space at each frequency, providing an indication of overall performance without expressing antenna directionality.

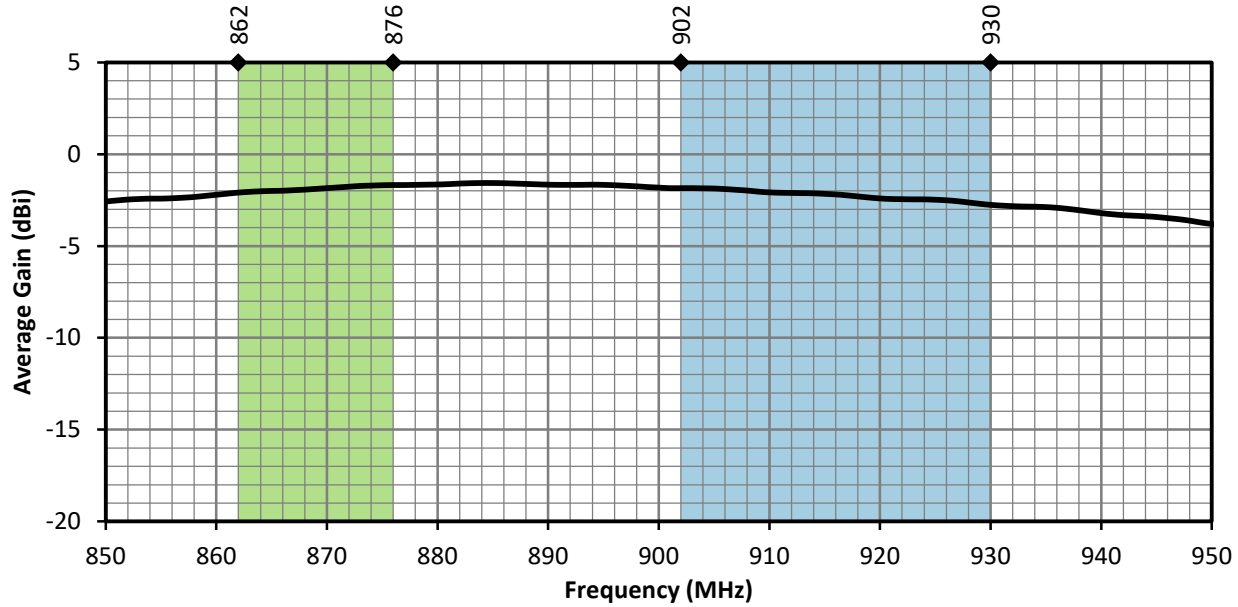



Figure 14. ANT-8/9-IPW1-SMA Antenna Average Gain, Straight

## Radiation Efficiency

Radiation efficiency (Figure 15), shows the ratio of power delivered to the antenna relative to the power radiated at the antenna, expressed as a percentage, where a higher percentage indicates better performance at a given frequency.

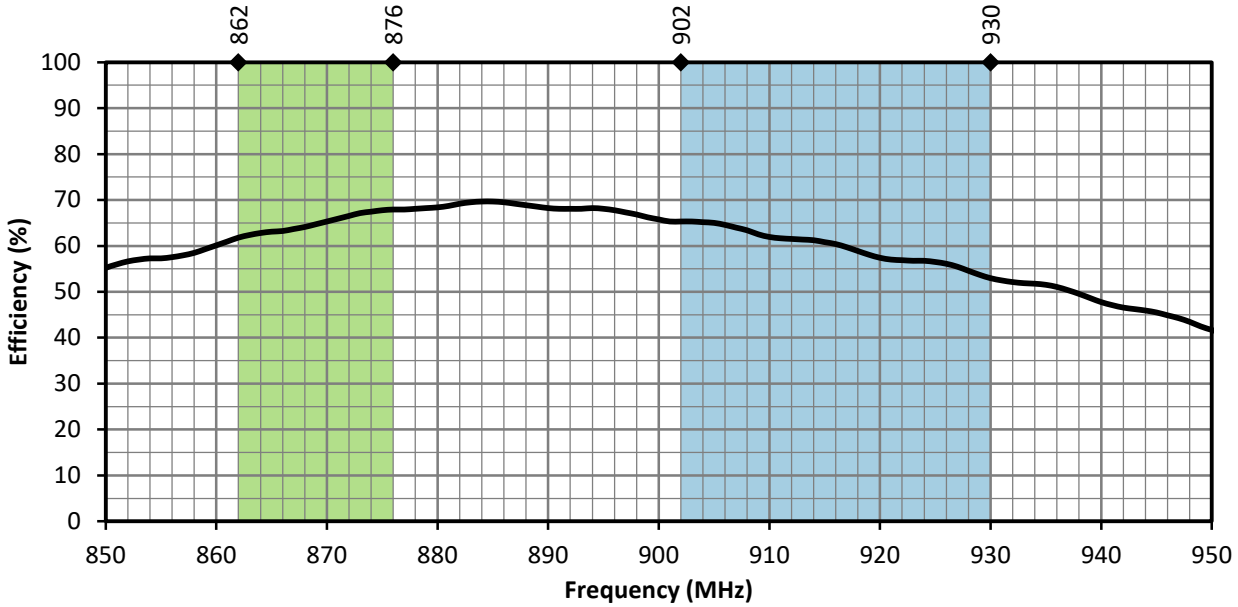



Figure 15. ANT-8/9-IPW1-SMA Antenna Radiation Efficiency, Straight

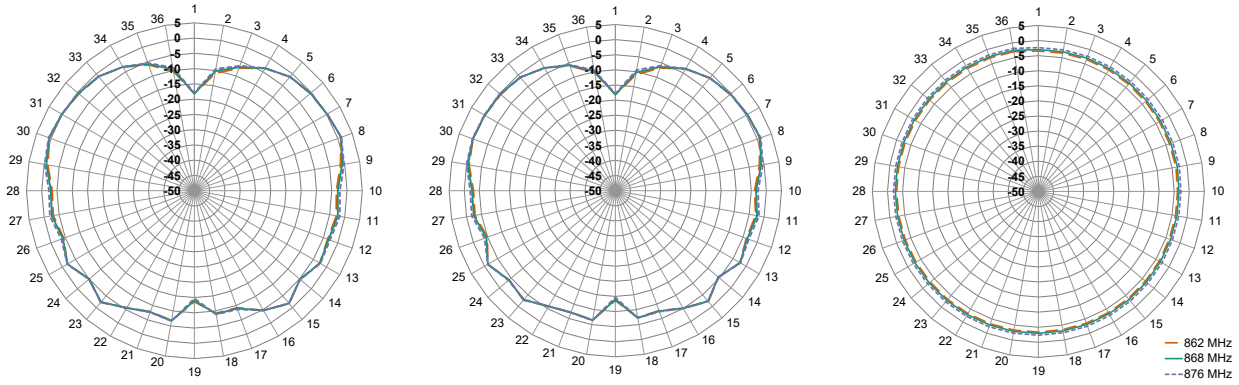
## Radiation Patterns

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 free space orientation are shown in Figure 16 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. Note: when viewed with typical PDF viewing software, zooming into radiation patterns is possible to reveal fine detail.

## Radiation Patterns - Free Space

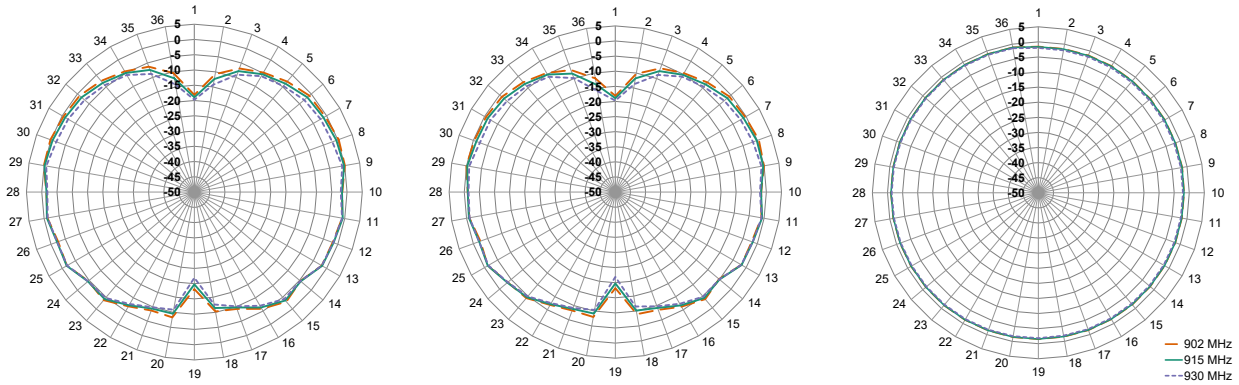
XZ-Plane Gain YZ-Plane Gain XY-Plane Gain

## 862 MHz to 876 MHz (868 MHz)




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

## 902 MHz to 930 MHz (915 MHz)




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

**Figure 16. Radiation Patterns for ANT-8/9-IPW1-SMA, Straight**

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