

## AC16001-NPW WiFi External N-Connector Baton-Style Antenna

The AC16001-NPW is a robust outdoor antenna for applications including WiFi7, WiFi6/6E and others. 180 mm long with N-plug connector termination, the AC16001-NPW is built to operate in solutions requiring a robust, high-performance antenna.

Supporting IP67 ingress protection and an ASA ultraviolet resistant baton-style radome, the AC16001-NPW does just that for WiFi applications in the 2400 to 2500 MHz and 5150 to 7125 MHz bands.



AC16001-NPW WiFi Baton-style antenna

### Features

- Performance at 2.40 GHz to 2.50 GHz
  - VSWR: 1.6
  - Peak Gain: 3.3 dBi
  - Efficiency: 72%
- Performance at 5.150 GHz to 7.125 GHz
  - VSWR: 1.9
  - Peak Gain: 7.3 dBi
  - Efficiency: 87.3%
- IP67 ingress protection
- UV resistance
- N Plug connector
- Excellent ground plane and free space performance

### Applications

- WiFi/WLAN Coverage
  - WiFi 7 (802.11be)
  - WiFi 6E (802.11ax)
  - WiFi 6 (802.11ax)
  - WiFi 5 (802.11ac)
  - WiFi 4 (802.11n)
  - 802.11b/g
- 2.4 GHz ISM applications
  - Bluetooth®
  - ZigBee®
- U-NII bands 1-8
- Internet of Things (IoT) devices
- WLAN Gateways/Routers
- Fixed Wireless Customer Premise Equipment (CPE)

### Ordering Information

Part Number	Description
<b>AC16001-NPW</b>	WiFi baton-style antenna with N-plug (male) connector, white dome

Available from The Antenna Company (sales@antennacompany.com) and select distributors and representatives.

Table 1. RF/Electrical Specifications

AC16001-NPW	ISM/WiFi	WiFi/U-NII 1-4	WiFi/U-NII 5-8
Parameter	2400 MHz to 2500 MHz	5150 MHz to 5895 MHz	5925 MHz to 7125 MHz
VSWR (max)	1.6	1.9	1.6
Peak Gain (dBi)	3.3	5.9	7.3
Average Gain (dBi)	-1.4	-1.0	-1.0
Average Efficiency (%)	72	79.3	79.7
Impedance	50 Ω		
Polarization	Linear		
Radiation Pattern	Omnidirectional		
Wavelength	½-wave		
Max Power	2 W		
Electrical Type	Dipole		

Electrical specifications and plots measured with the AC16001-NPW on a 300 mm x 300 mm (11.8 in x 11.8 in) metal ground plane.

Table 2. Mechanical Specifications

Parameter	Value
Connection	N plug (Male)
Radome Material	UV resistant ASA plastic, Color = White
Operating Temp. Range	-40 °C to +80 °C (-104 °F to 176 °F)
Ingress Protection	IP67
Weight	78.5 g (2.77 oz)
Dimensions	180.0 mm x Ø25.4 mm (7.10 in x Ø1.0 in)

Antenna Dimensions

The dimensions for the AC16001-NPW are shown below in Figure 1.

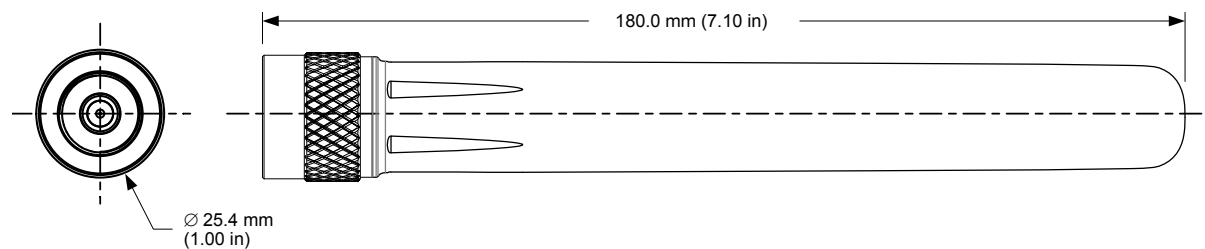


Figure 1. AC16001-NPW Antenna Dimensions

**Antenna Test Orientations**

The AC16001-NPW antenna is characterized in two antenna orientations as shown in Figure 2. The antenna free space orientation characterizes use of an antenna attached to an enclosure-mounted connector which is connected by cable to the radio. Although the antenna is a dipole not requiring a ground plane for function, characterization on an adjacent ground plane (300 mm x 300 mm) provides insight into antenna performance when attached directly to a connector on a metal enclosure. The two orientations represent the most common end-product use cases

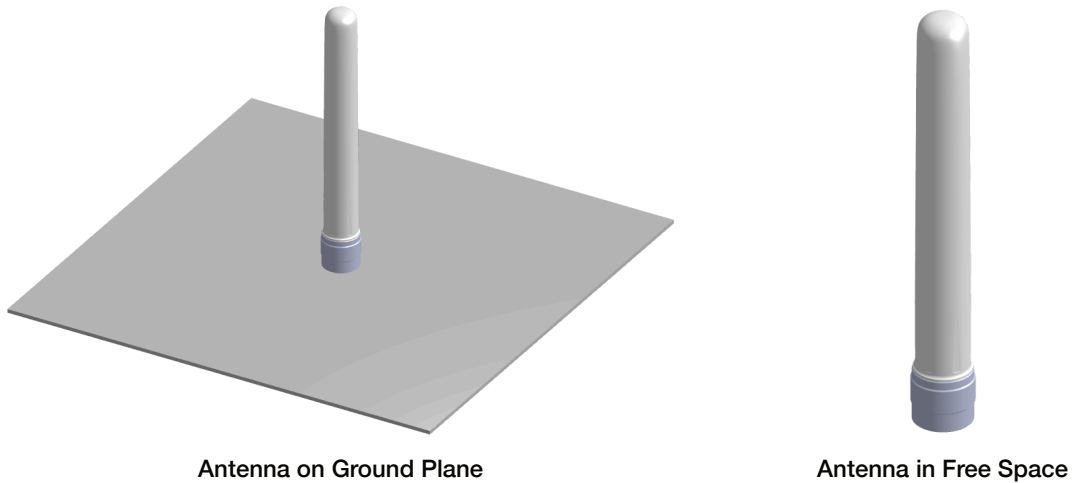


Figure 2. AC16001-NPW Antenna Test Orientations

On Ground Plane

The charts on the following pages represent data taken with the antenna oriented at the center of the 300 mm x 300 mm metal plate as shown in Figure 3.

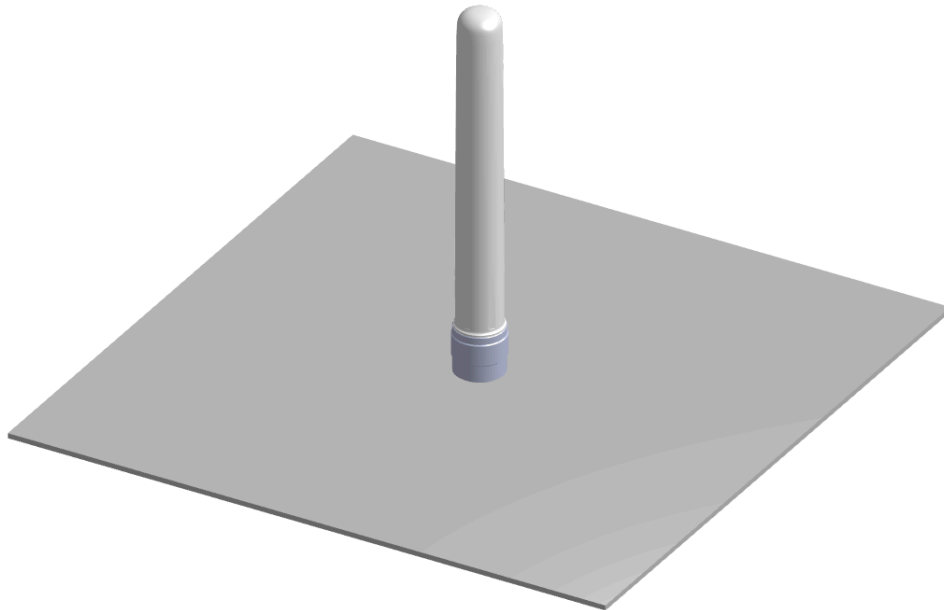


Figure 3. AC16001-NPW Antenna On Ground Plane

VSWR

Figure 4 provides the voltage standing wave ratio (VSWR) across the antenna bandwidth. VSWR characterizes the power reflected from the antenna back to the transmitter. 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 measure of the percentage of transmitter power reflected back from the antenna.

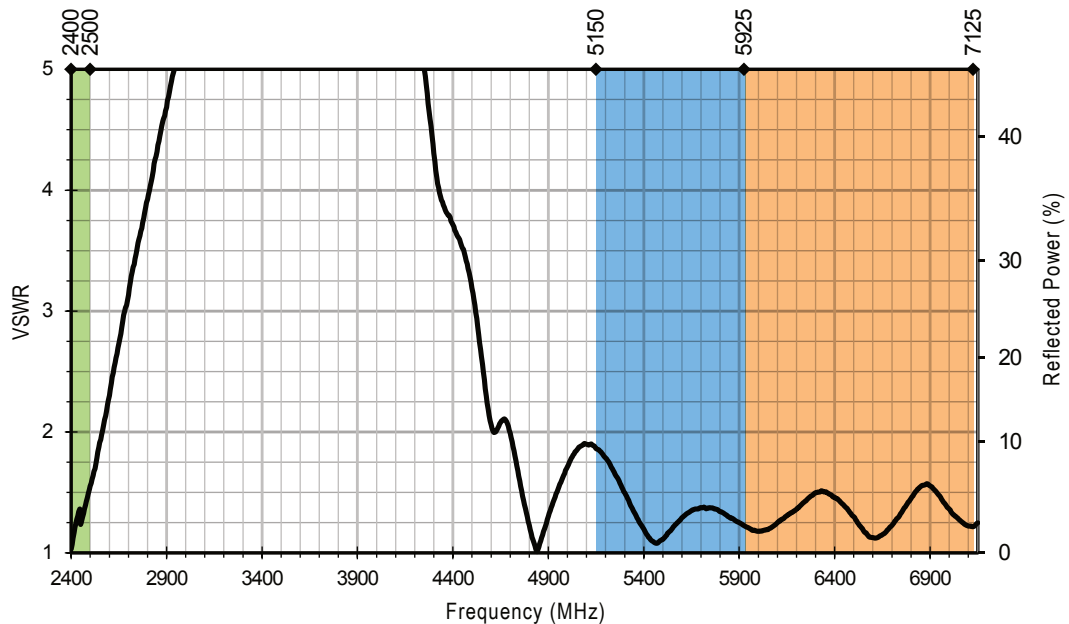


Figure 4. AC16001-NPW Antenna VSWR on Ground Plane

### Return Loss

Return loss (Figure 5), represents the loss in power at the antenna due to reflected signals. A higher magnitude return loss indicates better performance. Return loss is the negative of input reflection coefficient, in decibels (dB), and the two values are often used interchangeably.

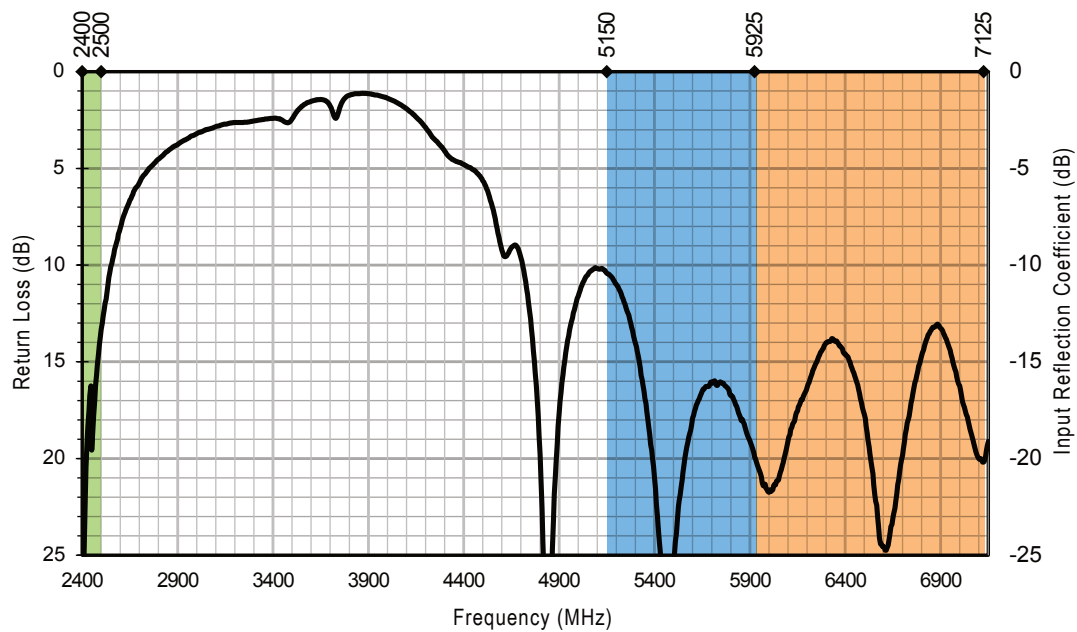


Figure 5. AC16001-NPW Antenna Return Loss on Ground Plane

### Peak Gain

Peak gain, (See Figure 6) provides a measure of the maximum conversion of antenna input power to radio waves at a given frequency. Peak gain does not account for the directionality of gain in 3-dimensional space.

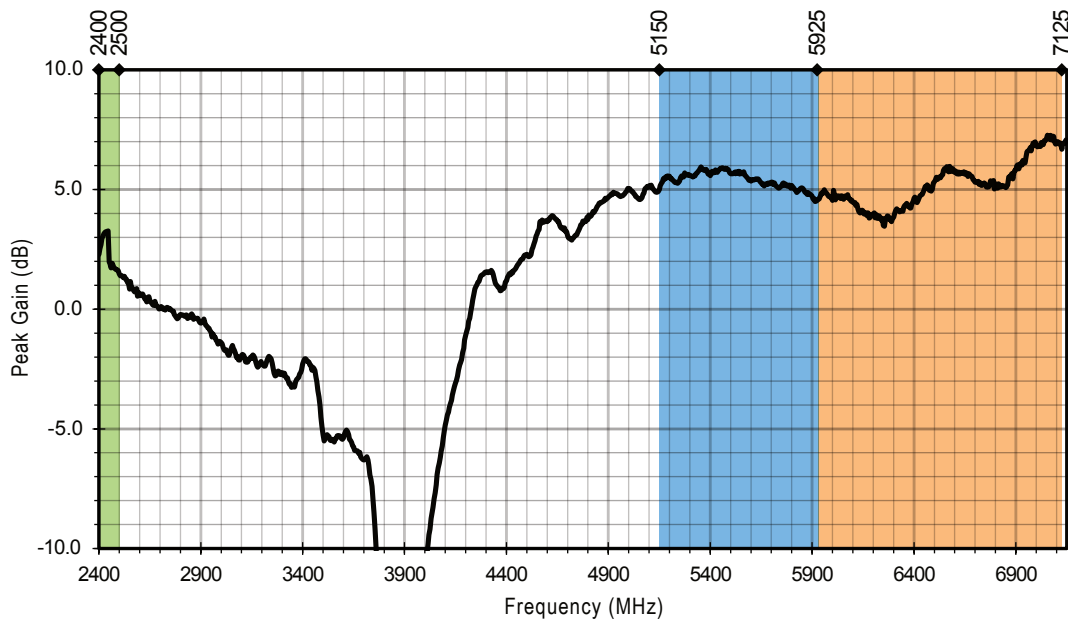


Figure 6. AC16001-NPW Antenna Peak Gain on Ground Plane

**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.

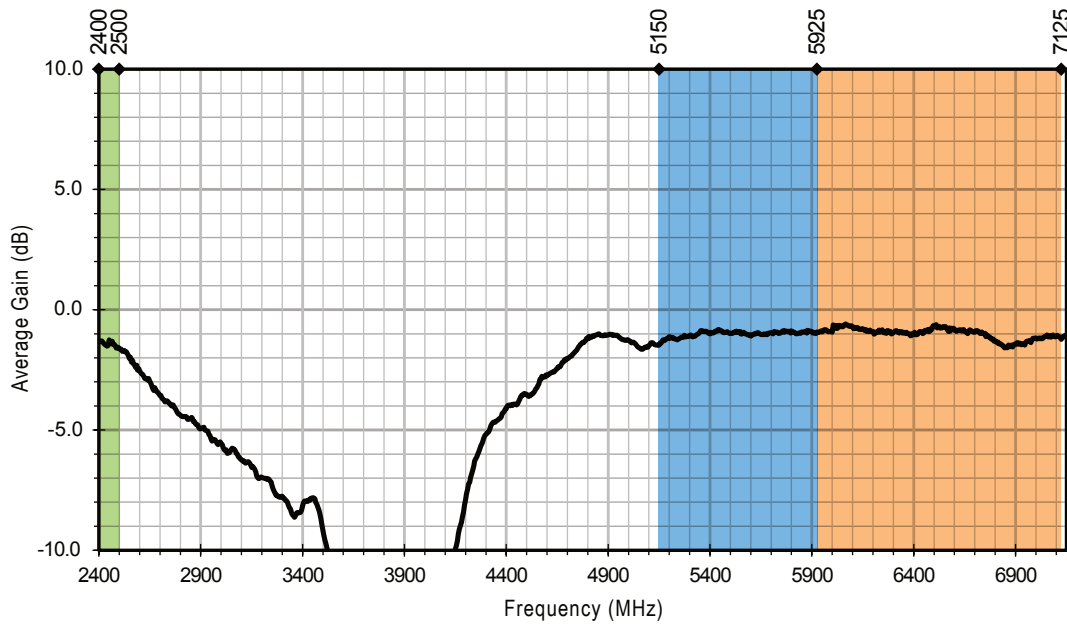


Figure 7. AC16001-NPW Antenna Average Gain on Ground Plane

**Efficiency**

Efficiency (Figure 8) is the ratio of power radiated by the antenna to the power delivered to the antenna terminals, expressed as a percentage, where a higher percentage indicates better performance at a given frequency.

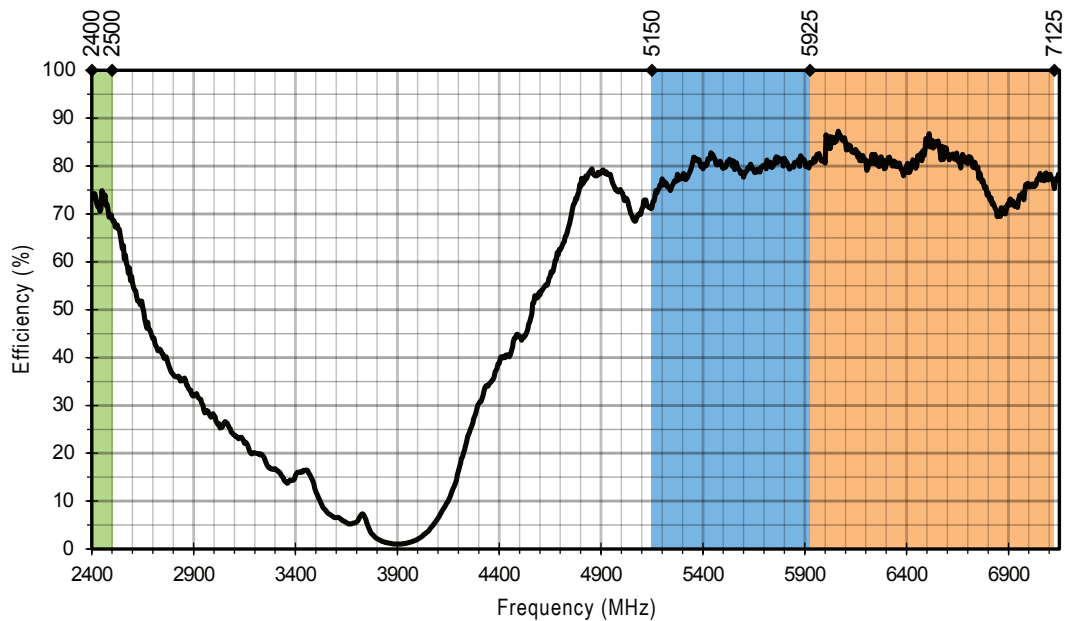
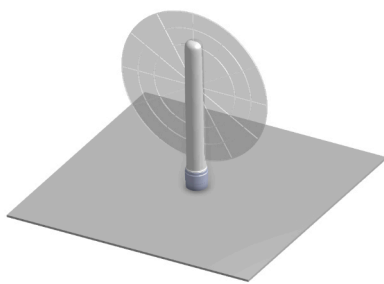


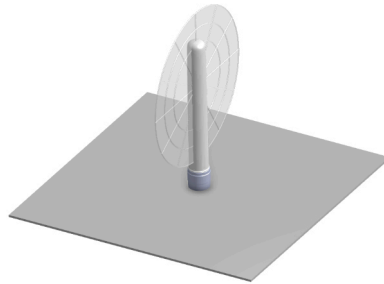
Figure 8. AC16001-NPW Antenna Efficiency on Ground Plane

Radiation Patterns - On Ground Plane

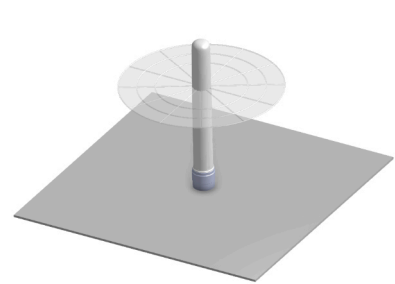
Radiation patterns provide information about the directional performance of the antenna by plotting gain in three orthogonal planes at the high-, low- and center-frequencies of an antenna frequency band. Antenna radiation patterns (Figure 9), are shown using polar plots covering 360 degrees with the plane of reference depicted above the plots. Note: when viewed with typical PDF viewing software, zooming into radiation patterns is possible to reveal fine detail.



XZ-Plane Gain

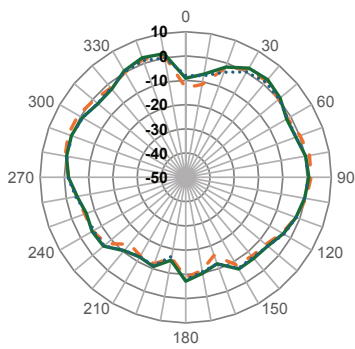


YZ-Plane Gain

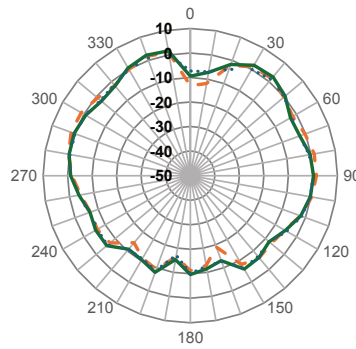


XY-Plane Gain

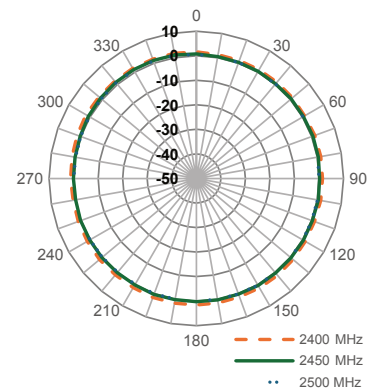
2400 MHz to 2500 MHz (2450 MHz)



XZ-Plane Gain

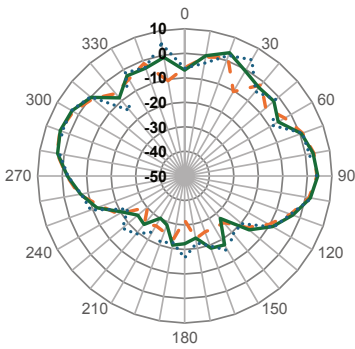


YZ-Plane Gain

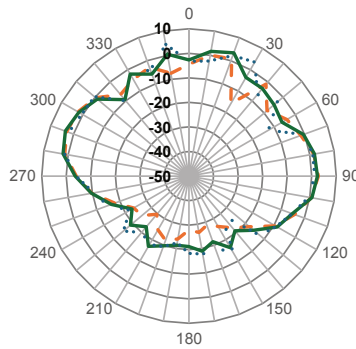


XY-Plane Gain

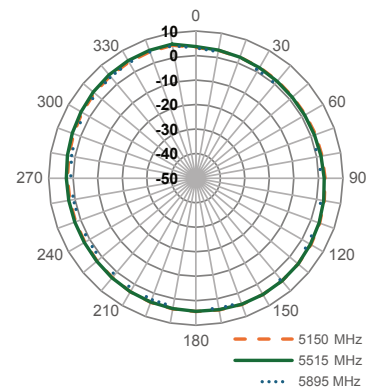
5150 MHz to 5895 MHz (5515 MHz)



XZ-Plane Gain



YZ-Plane Gain



XY-Plane Gain

5925 MHz to 7125 MHz (6525 MHz)

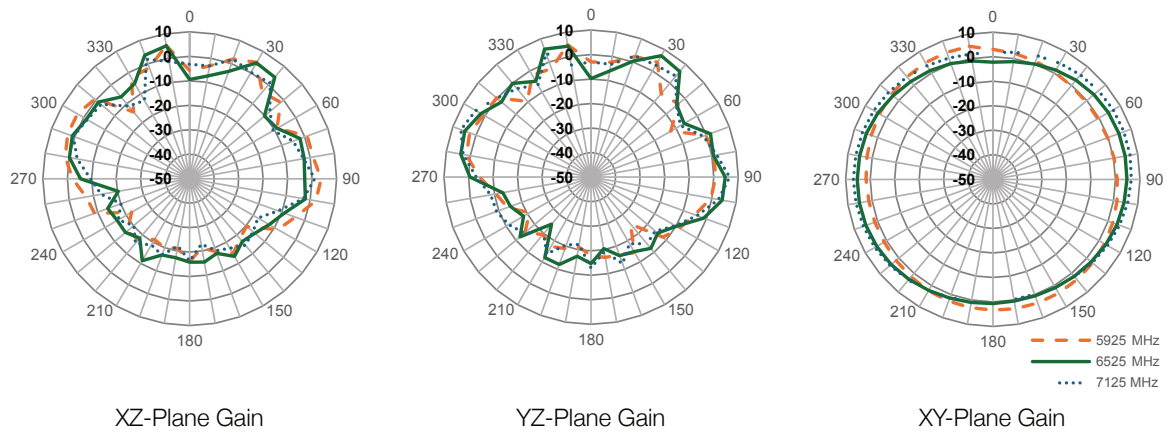


Figure 9. Radiation Patterns for AC16001-NPW Antenna on Ground Plane

Free Space, No Ground Plane

The charts on the following pages represent data taken with the antenna, in free space as shown in Figure 10.



Figure 10. AC16001 Antenna, (Free Space), no Ground Plane

VSWR

Figure 11 provides the voltage standing wave ratio (VSWR) across the antenna bandwidth. VSWR characterizes the power reflected from the antenna back to the transmitter. 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 measure of the percentage of transmitter power reflected back from the antenna.

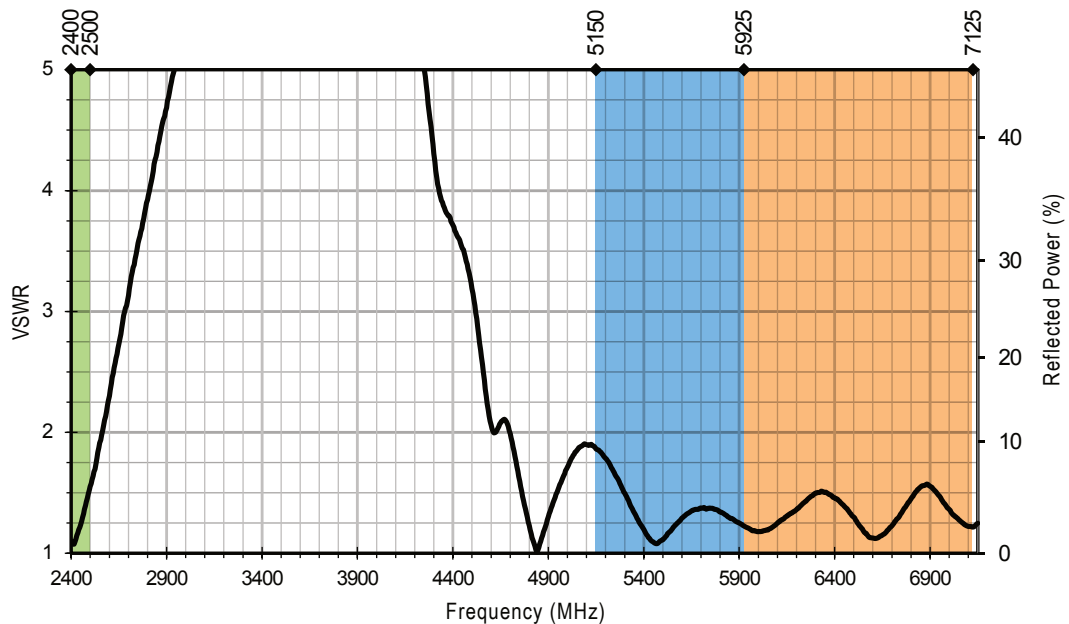


Figure 11. AC16001-NPW Antenna VSWR, Free Space

**Return Loss**

Return loss (Figure 12), represents the loss in power at the antenna due to reflected signals. A higher magnitude return loss indicates better performance. Return loss is the negative of input reflection coefficient, in decibels (dB), and the two values are often used interchangeably.

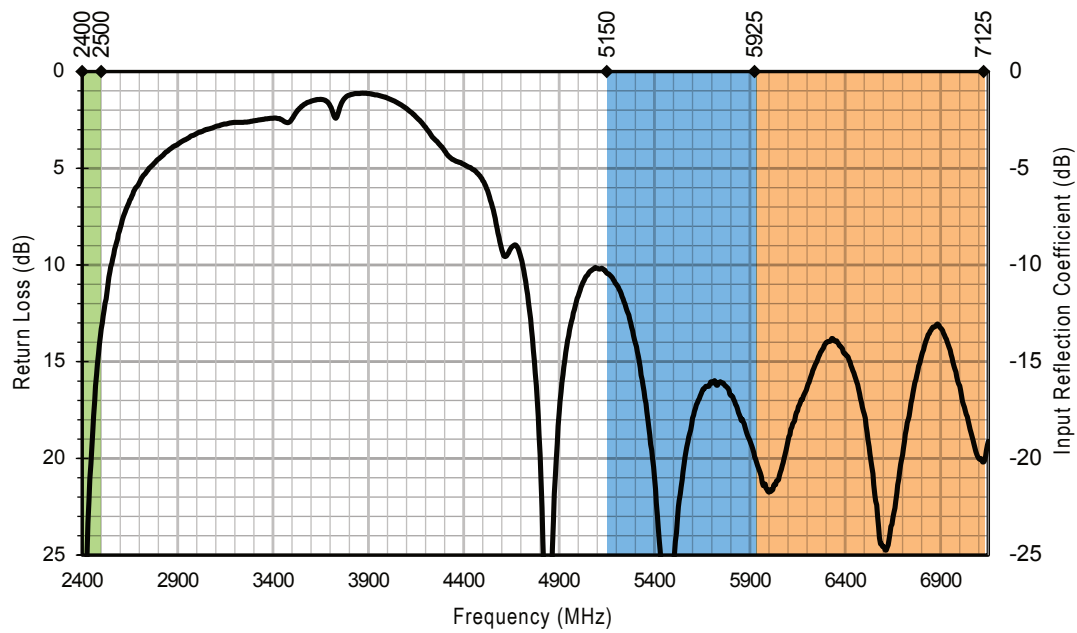


Figure 12. AC16001-NPW Antenna Return Loss, Free Space

**Peak Gain**

Peak gain, (See Figure 13) provides a measure of the maximum conversion of antenna input power to radio waves at a given frequency. Peak gain does not account for the directionality of gain in 3-dimensional space.

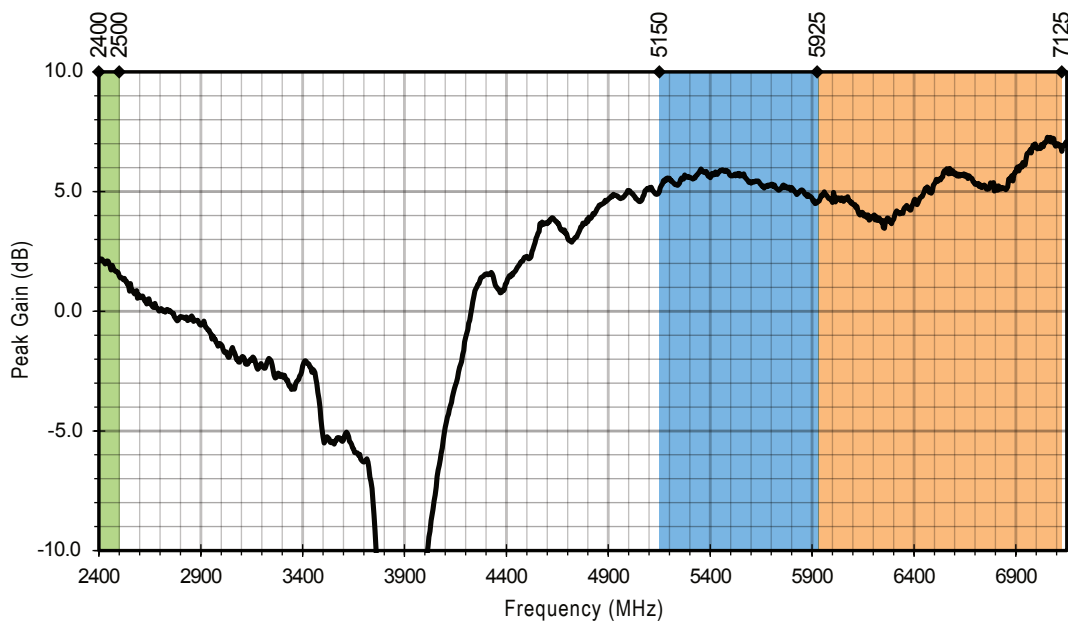


Figure 13. AC16001-NPW Antenna Peak Gain, Free Space

**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.

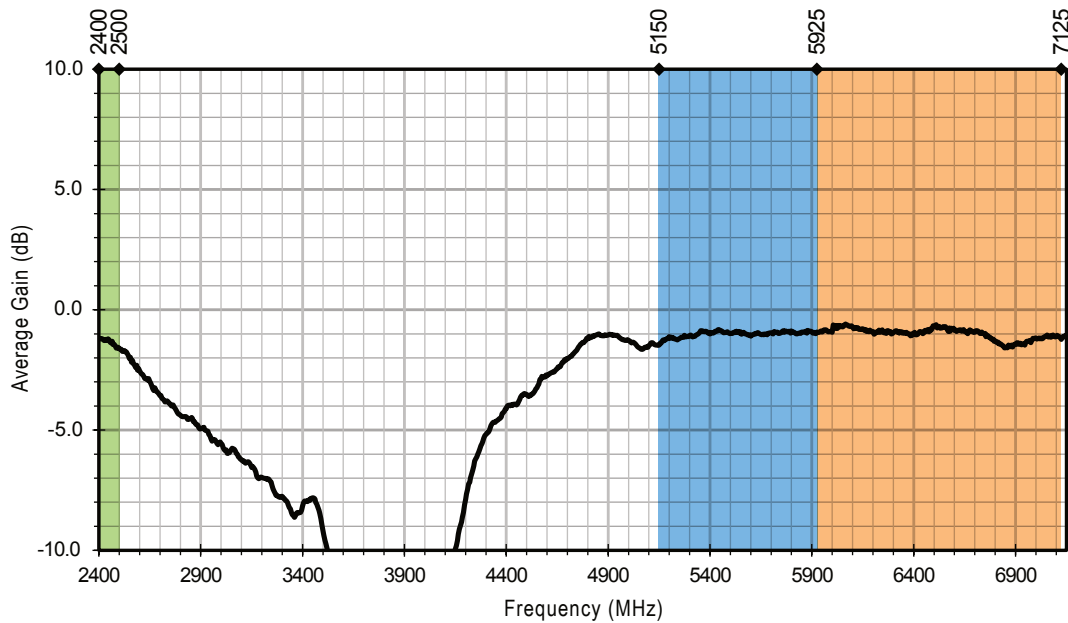


Figure 14. AC16001-NPW Antenna Average Gain, Free Space

**Efficiency**

Efficiency (Figure 15) is the ratio of power radiated by the antenna to the power delivered to the antenna terminals, expressed as a percentage, where a higher percentage indicates better performance at a given frequency.

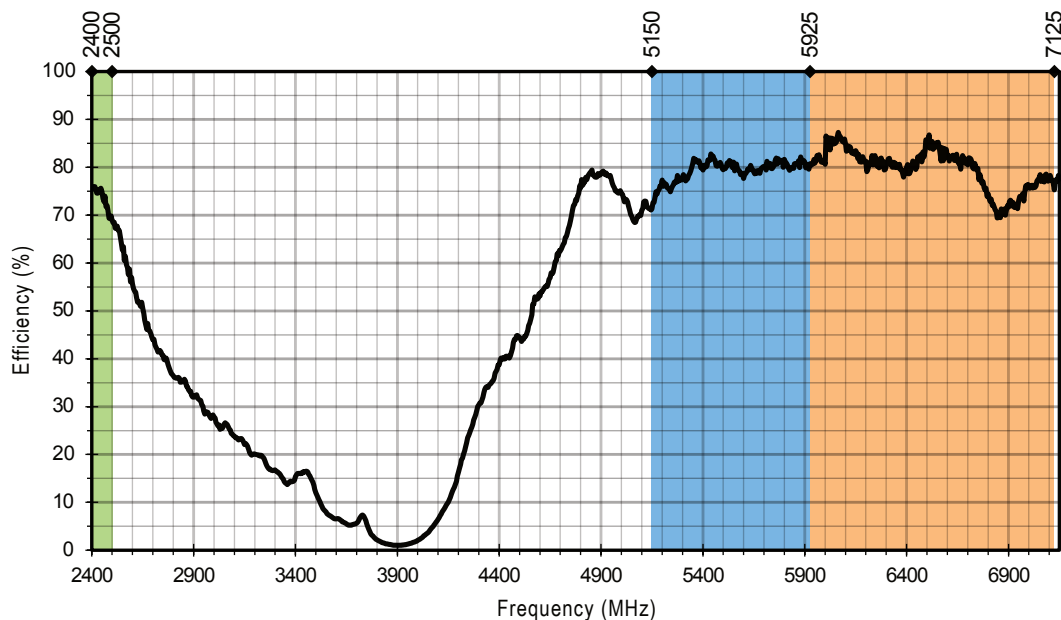
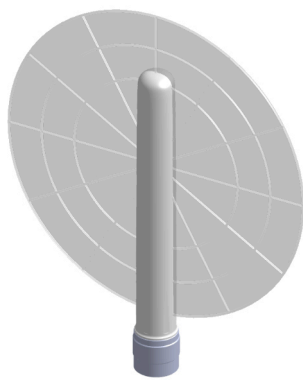


Figure 15. AC16001-NPW Antenna Efficiency, Free Space

Radiation Patterns - Free Space

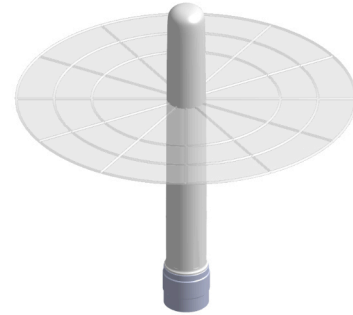
Radiation patterns provide information about the directional performance of the antenna by plotting gain in three orthogonal planes at the high-, low- and center-frequencies of an antenna frequency band. Antenna radiation patterns (Figure 16), are shown using polar plots covering 360 degrees with the plane of reference depicted above the plots. Note: when viewed with typical PDF viewing software, zooming into radiation patterns is possible to reveal fine detail.



XZ-Plane Gain

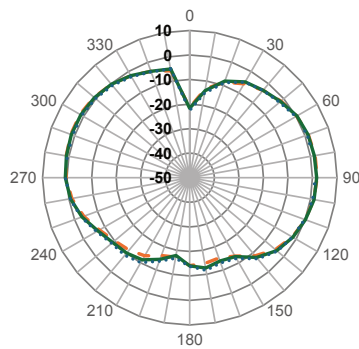


YZ-Plane Gain

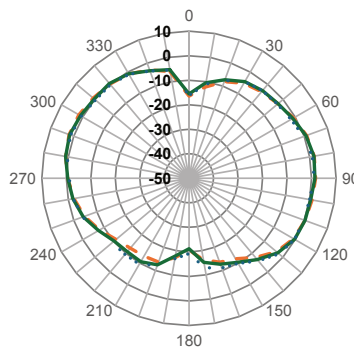


XY-Plane Gain

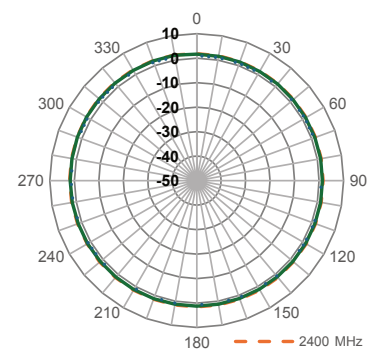
2400 MHz to 2500 MHz (2450 MHz)



XZ-Plane Gain

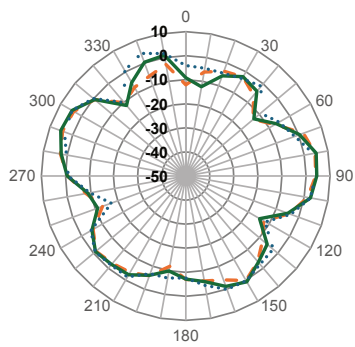


YZ-Plane Gain

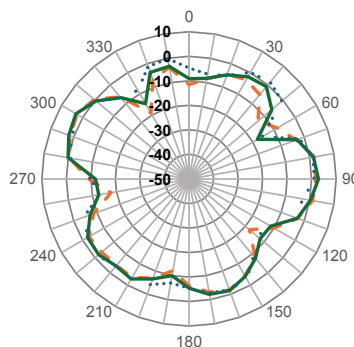


XY-Plane Gain

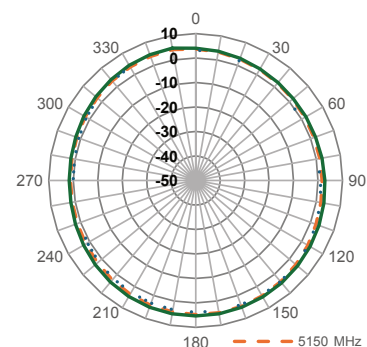
5150 MHz to 5895 MHz (5515 MHz)



XZ-Plane Gain



YZ-Plane Gain



XY-Plane Gain

5925 MHz to 7125 MHz (6525 MHz)

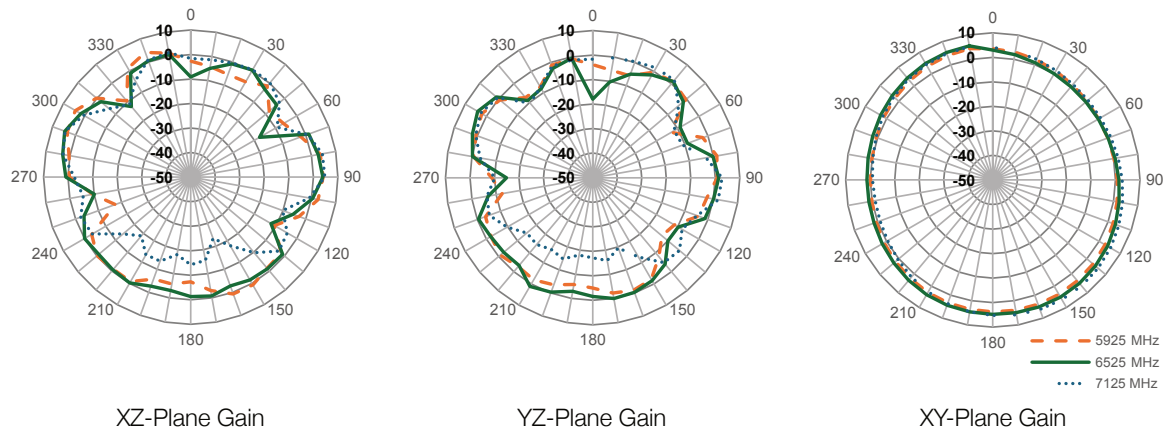


Figure 16. Radiation Patterns for AC16001-NPW Antenna, Free Space

### Packaging Information

The AC16001-NPW antenna is individually packaged in a sealed and labeled polyethylene bag and then bulk packaged in a sealed polyethylene bag in quantities of 50 pcs. See Figure 17.

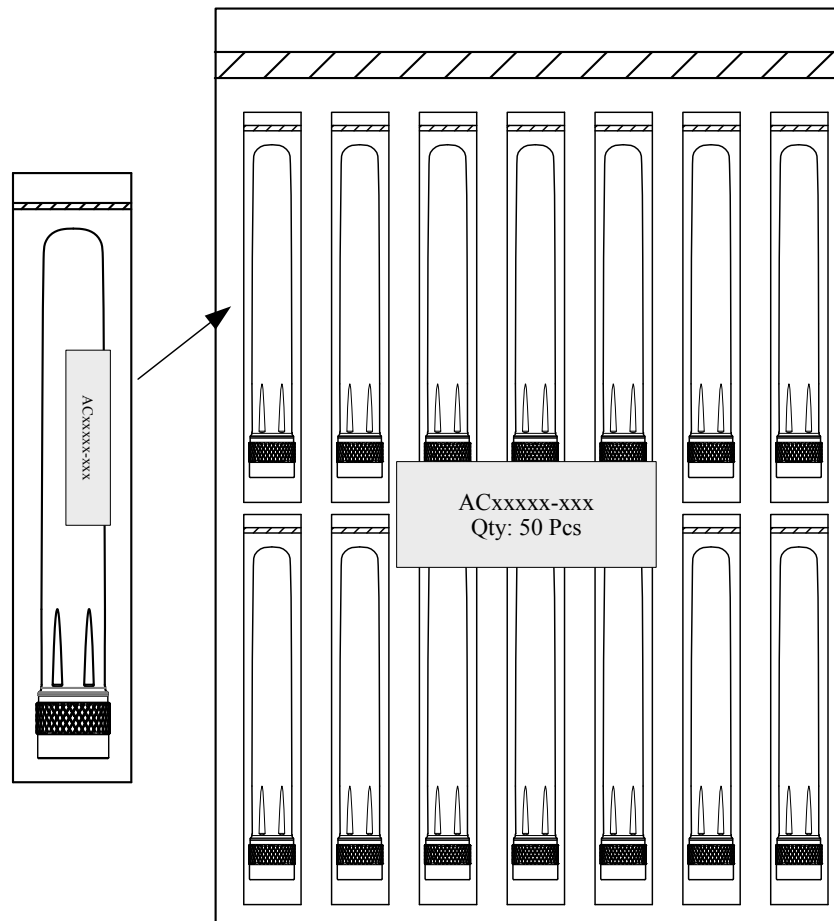


Figure 17. AC16001 Antenna in Sealed Polyethylene Bags

Two sealed bulk polyethylene bags are packed yielding 100 pieces per carton. Carton dimensions are 295 mm x 240 mm x 240 mm (11.6 in x 9.5 in x 9.5 in).

**Antenna Definitions and Useful Formulas**

**VSWR** - Voltage Standing Wave Ratio. VSWR is a unitless ratio that describes the power reflected from the antenna back to the radio. A lower VSWR value indicates better antenna performance at a given frequency. VSWR is easily derived from Return Loss.

$$VSWR = \frac{10^{\left[\frac{\text{Return Loss}}{20}\right]} + 1}{10^{\left[\frac{\text{Return Loss}}{20}\right]} - 1}$$

**Return Loss** - Return loss represents the loss in power at the antenna due to reflected signals, measured in decibels. A larger magnitude return loss value indicates better antenna performance at a given frequency. Return Loss is easily derived from VSWR.

$$\text{Return Loss} = -20 \log_{10} \left[ \frac{VSWR - 1}{VSWR + 1} \right]$$

**Efficiency (η)** - The total power radiated from an antenna divided by the input power at the feed point of the antenna as a percentage.

**Total Radiated Efficiency** - (TRE) The total efficiency of an antenna solution comprising the radiation efficiency of the antenna and the transmitted (forward) efficiency from the transmitter.

$$TRE = \eta \cdot \left( 1 - \left( \frac{VSWR - 1}{VSWR + 1} \right)^2 \right)$$

**Gain** - The gain of an antenna is the ratio of its radiation intensity in a given direction (G) to the radiation intensity that would be obtained if the total power accepted by the antenna were radiated isotropically (identically in all directions). Realized gain is antenna gain accounting for input reflection and mismatch losses. Realized gain is typically labeled simply as “gain” in antenna datasheets.

$$G_{db} = 10 \log_{10}(G)$$

$$G_{dBd} = G_{dBi} - 2.51dB$$

**Peak Gain** - The highest antenna gain across all directions for a given frequency range. A directional antenna will have a very high peak gain compared to average gain.

**Average Gain** - The average gain across all directions for a given frequency range.

**Maximum Power** - The maximum signal power which may be applied to an antenna feed point, typically measured in watts (W).

**Reflected Power** - A portion of the forward power reflected back toward the amplifier due to a mismatch at the antenna port.

$$\left( \frac{VSWR - 1}{VSWR + 1} \right)^2$$

**decibel (dB)** - A logarithmic unit of measure of the power of an electrical signal.

**decibel isotropic (dBi)** - A comparative measure in decibels between an antenna under test and an isotropic radiator.

**decibel relative to a dipole (dBd)** - A comparative measure in decibels between an antenna under test and an ideal half-wave dipole.

**Dipole** - An ideal dipole comprises a straight electrical conductor measuring 1/2 wavelength from end to end connected at the center to a feed point for the radio.

**Isotropic Radiator** - A theoretical antenna which radiates energy equally in all directions as a perfect sphere.

**Omnidirectional** - Term describing an antenna radiation pattern that is uniform in all directions. An isotropic antenna is the theoretical perfect omnidirectional antenna. An ideal dipole antenna has a donut-shaped radiation pattern and other practical antenna implementations will have less perfect but generally omnidirectional radiation patterns which are typically plotted on three axes.

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REACH Article 33 notice: This product contains the SVHC lead (CAS 7439-92-1) above 0.1% w/w. Please handle accordingly.

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