

AC86000 Wideband Cellular Tilt/Swivel Blade Antenna

The Antenna Company AC86000 tilt/swivel blade antennas provide robust indoor/outdoor, omnidirectional antenna capability for all cellular solutions from 617 MHz to 5925 MHz. The hinged base allows for fixed positioning of the antenna at 0 degrees (straight), 45 degrees and 90 degrees (right angle) to support use in many configurations from single-antenna (SISO) and MIMO fixed wireless, to IoT applications. The swivel connector allows for easy installation and firm positioning for optimal performance.



AC86000-SMAB WiFi
Tilt/Swivel Blade Antenna

The 150 mm long (straight) by 25 mm maximum width provides appropriate size for performance on both metal enclosures or in free space including non-metallic enclosures, while not being so large as to interfere with the deployment or dominating equipment aesthetics. Additionally, beyond the capability of most blade antennas, AC86000 blade antennas support IP67 and IP65 ingress protection and UV-resistant materials for outdoor applications.

The AC86000 blade antennas are available in black and white, with fine matte finish, and SMA connection.

Features

- Very high efficiency
- IP67/IP65 ingress protection
- UV resistance
- Dimensions:
 - 151.6 mm x 25.0 mm x 12.9 mm
- Performance in 617-698 MHz band
 - VSWR: 1.7
 - Peak Gain: 3.6
 - Efficiency: 72%
- SMA termination

Applications

- Cellular IoT
 - Cat-M1/LTE-M
 - NB-IoT
- Band 71 cellular
- Indoor/Outdoor CPE
- Fixed wireless access (FWA)
- Gateway/router
- Internet of Things (IoT) devices

Ordering Information

Part Number	Description
AC86000-SMAB	Black SMA-connector hinge/swivel WiFi blade antenna
AC86000-SMAW	White SMA-connector hinge/swivel WiFi blade antenna

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

RF/Electrical Specifications

AC86000	VSWR (max)	Peak Gain (dBi)	Average Gain (dBi)	Average Efficiency (%)
617 MHz to 698 MHz	1.7	3.6	-1.5	71
698 MHz to 803 MHz	1.6	4.3	-1.1	77
791 MHz to 960 MHz	1.6	4.5	-1.3	75
832 MHz to 1517 MHz	3.3	4.5	-2.0	64
1427 MHz to 1675 MHz	1.7	5.2	-1.3	75
1695 MHz to 2200 MHz	1.9	5.6	-1.1	79
2300 MHz to 2400 MHz	1.7	5.6	-1.7	68
2483.5 MHz to 2690 MHz	1.7	5.3	-0.9	81
3300 MHz to 4200 MHz	1.7	7.2	-1.1	78
4400 MHz to 5000 MHz	1.8	4.5	-1.4	72
5150 MHz to 5925 MHz	5.9	5.4	-3.6	47
Impedance	50 Ω			
Polarization	Linear			
Radiation Pattern	Omnidirectional			
Wavelength	$\frac{1}{2}$ -wave			
Max Power	10 W			
Electrical Type	Dipole			

Electrical specifications and plots measured with the antenna in free space.

Mechanical Specifications

Part Number	AC86000-SMAx
Weight	23 g (0.81 oz)
Connection	SMA
Dimensions	151.6 mm x 25.0 mm x 12.9 mm (Straight) (5.97 in x 0.98 in x 0.51 in)
Ingress Protection	IP67, IP65
Operating Temp. Range	-40 °C to +85 °C (-40 °F to 185 °F)

Antenna Dimensions

Figure 1 provides dimensions of the AC86000 antenna. The antenna blade can be installed straight or tilted to 45 or 90 degrees to help optimize system performance. The rotating base allows for continuous positioning through 360 degrees even while installed.

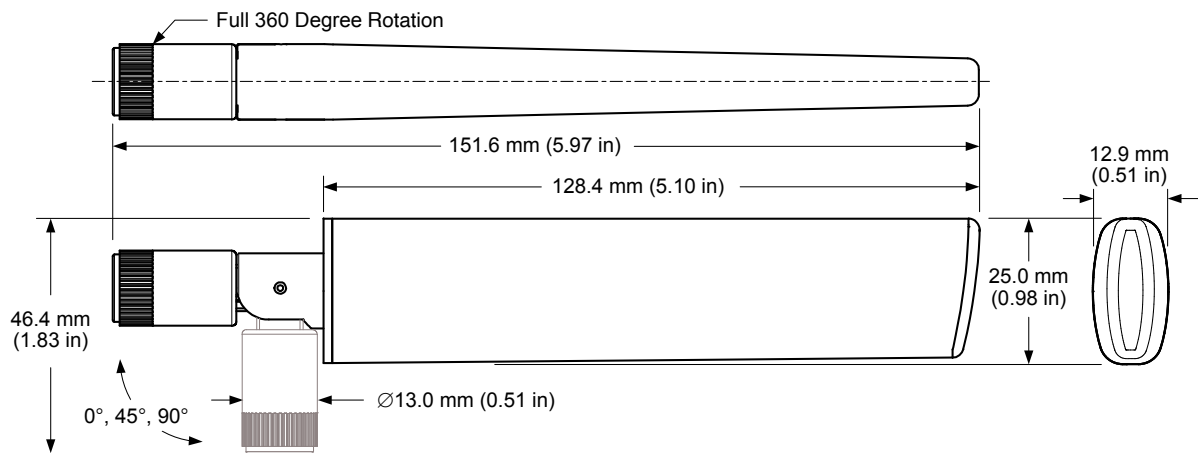
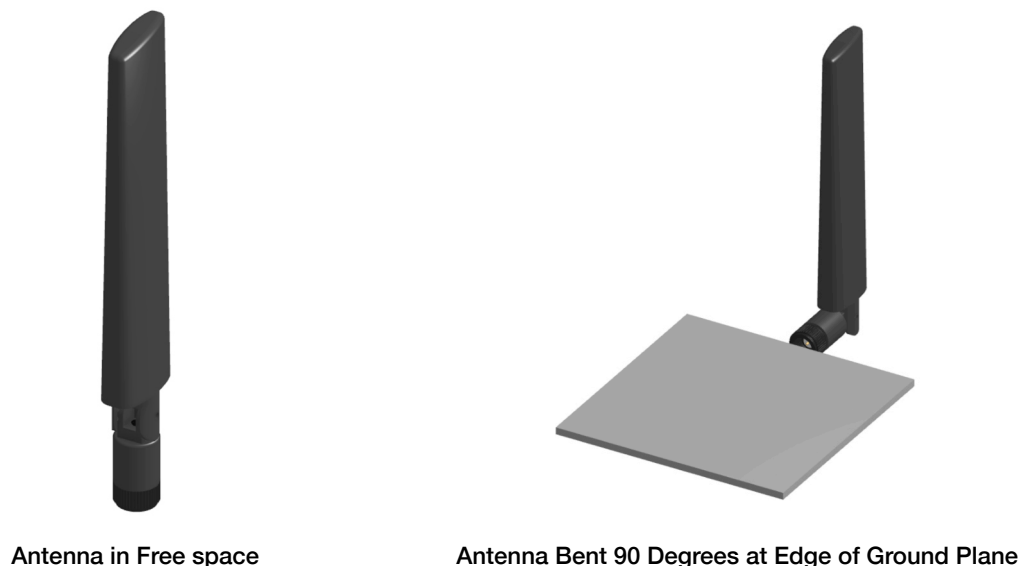


Figure 1. AC86000 Antenna Dimensions

Antenna Test Orientations

The AC86000 antenna is characterized in two antenna orientations as shown in Figure 2. Although the antenna does not require a ground plane to function, characterization on an adjacent ground plane (100 mm x 100 mm) provides insight into antenna performance when attached directly on a metal enclosure. The antenna free space orientation characterizes use of an antenna attached to a non-metallic enclosure. These two orientations represent common end-product use cases.



Antenna in Free space

Antenna Bent 90 Degrees at Edge of Ground Plane

Figure 2. AC86000 Test Orientations

Straight, No Ground Plane

The charts on the following pages represent data taken with the antenna in free space as shown in Figure 3.



Figure 3. AC86000 Antenna in Free Space

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.

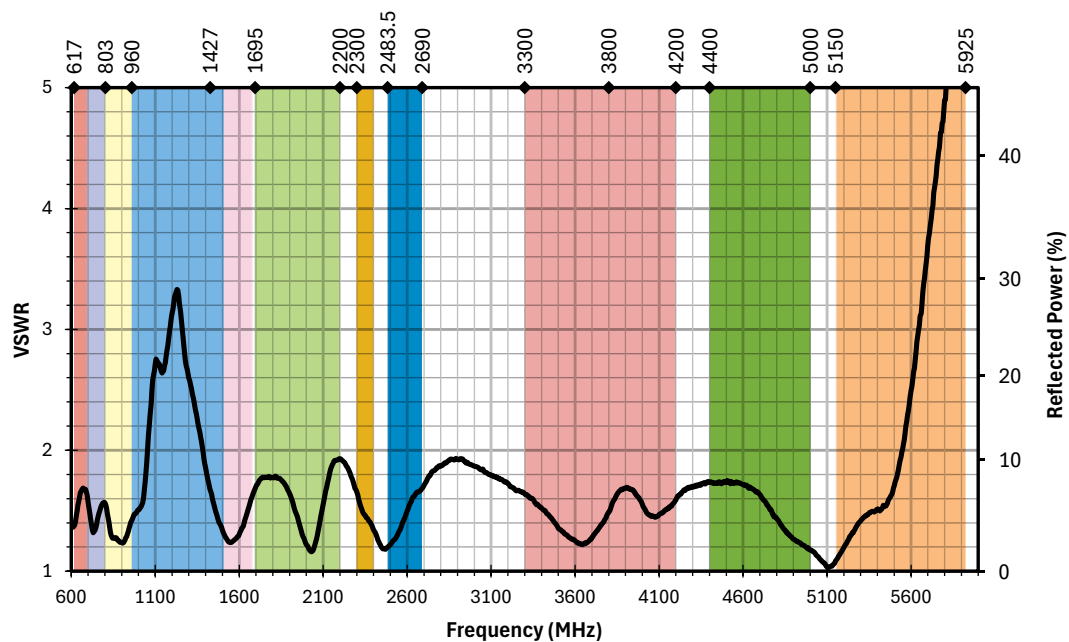


Figure 4. AC86000 Antenna VSWR, Free Space

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.

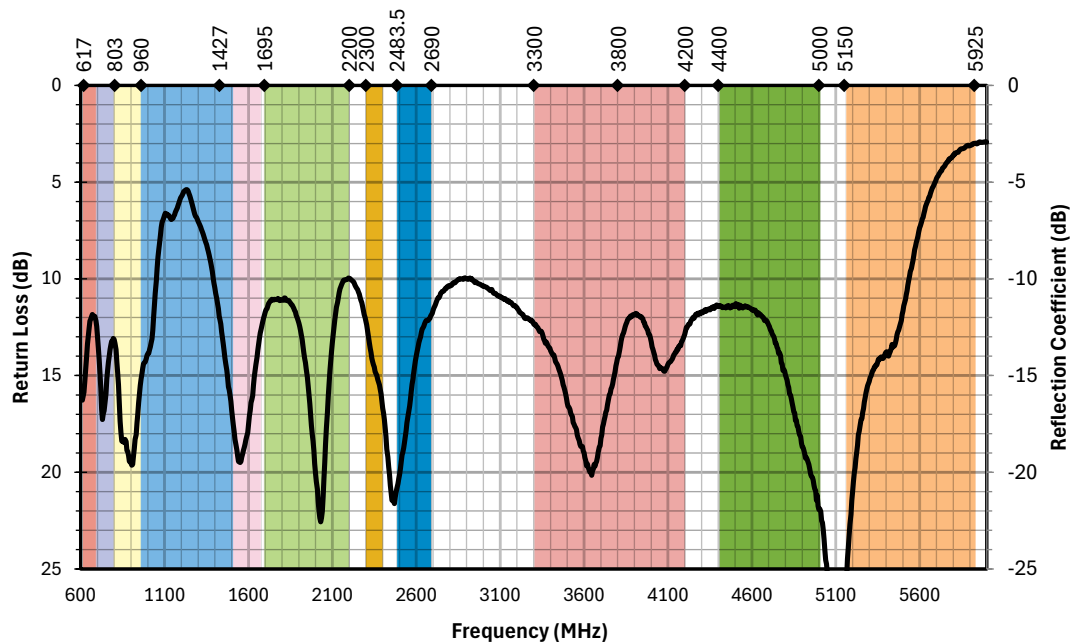


Figure 5. AC86000 Antenna Return Loss, Free Space

Peak Gain

Peak gain (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.

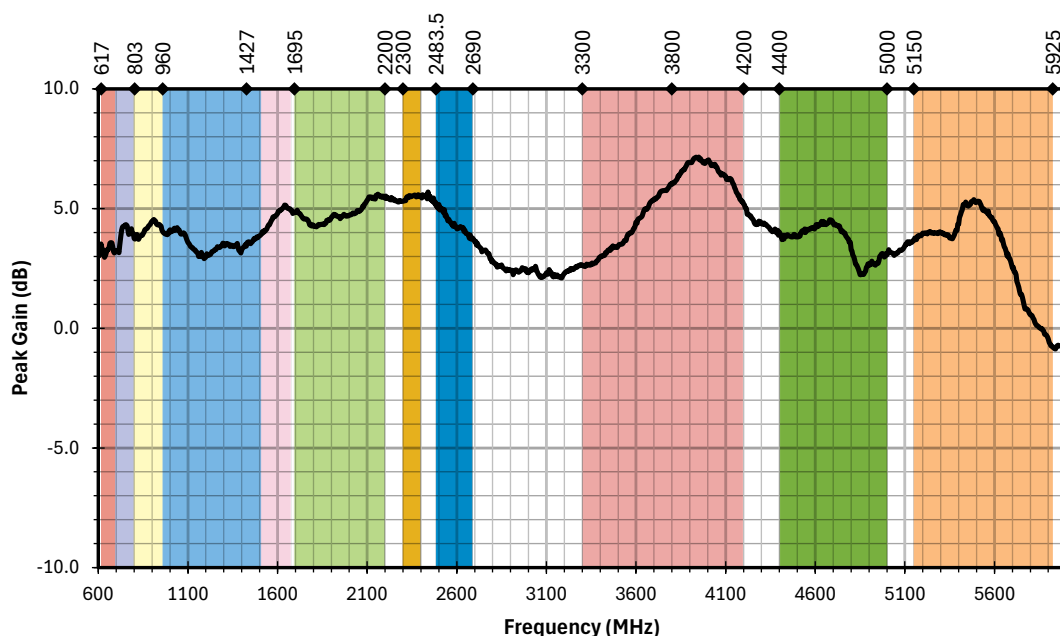


Figure 6. AC86000 Antenna Peak Gain, Free Space

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.

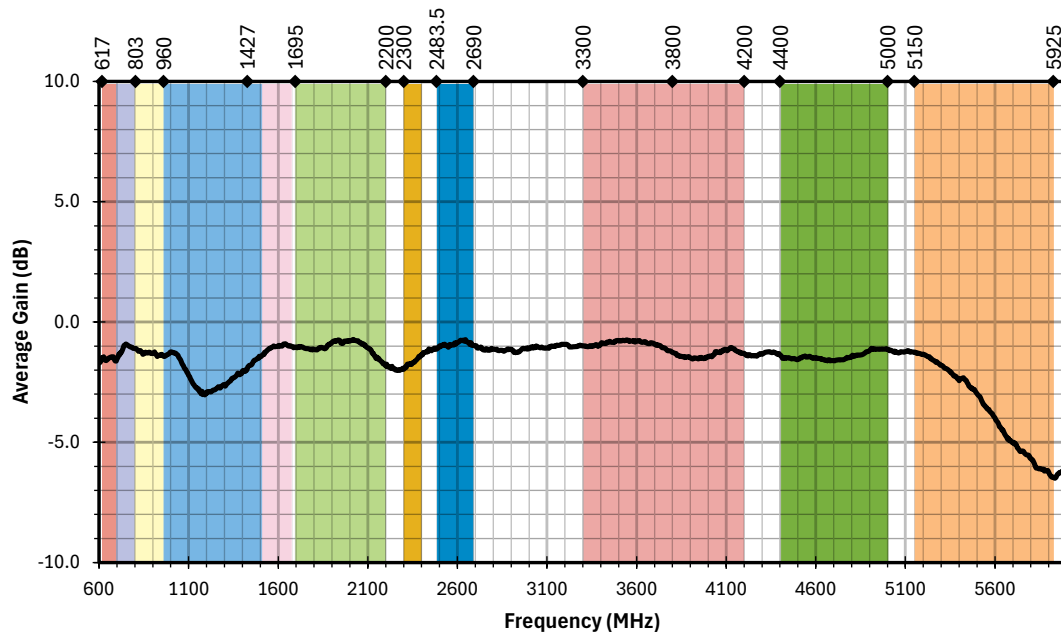


Figure 7. AC86000 Antenna Average Gain, Free Space

Efficiency

Efficiency (Figure 8) is 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.

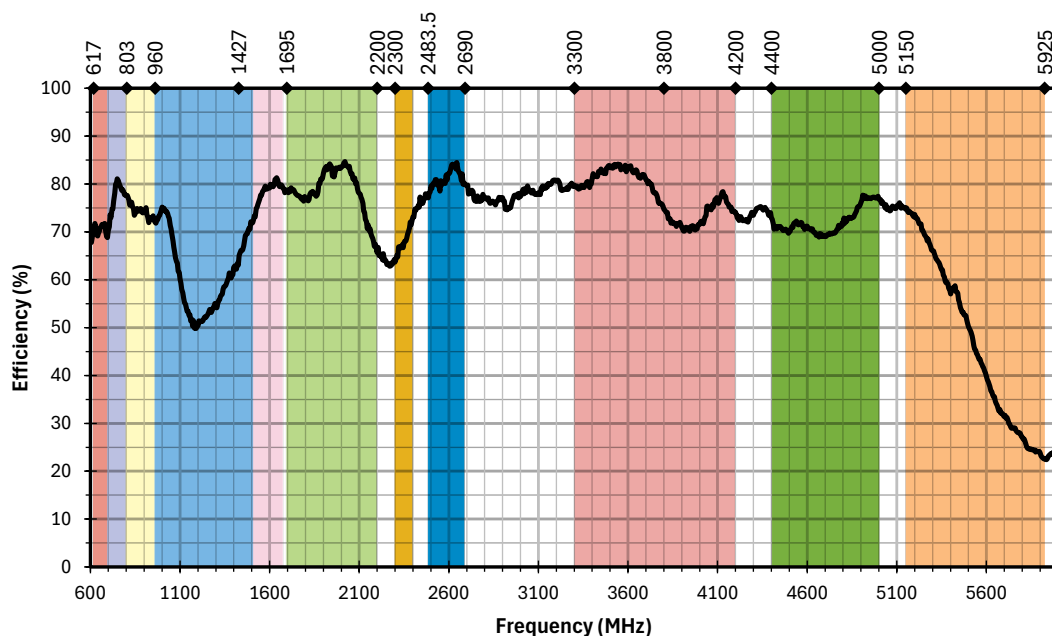


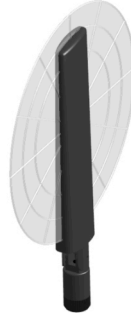
Figure 8. AC86000 Antenna Efficiency, Free Space

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 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

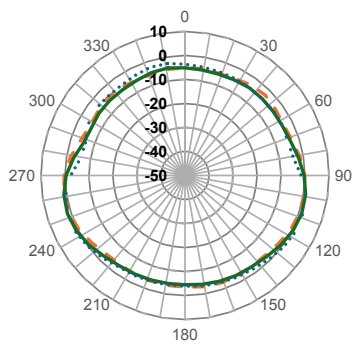


YZ-Plane Gain

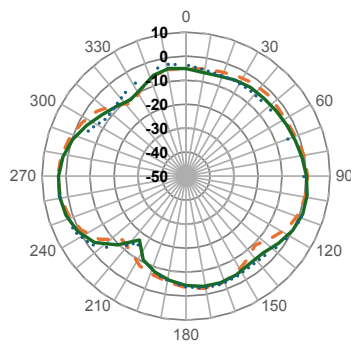


XY-Plane Gain

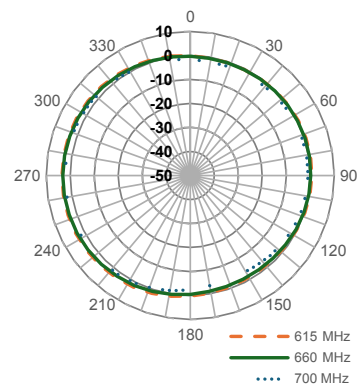
615 MHz to 700 MHz (660 MHz)



XZ-Plane Gain

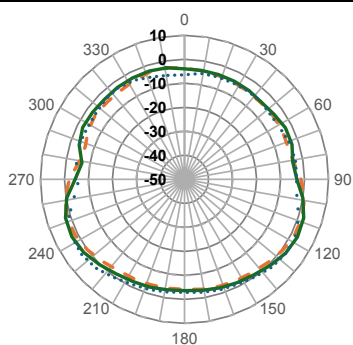


YZ-Plane Gain

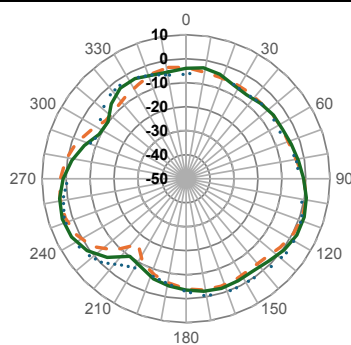


XY-Plane Gain

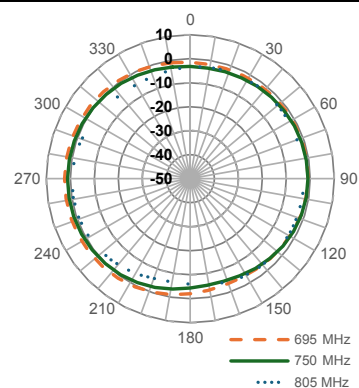
695 MHz to 805 MHz (750 MHz)



XZ-Plane Gain



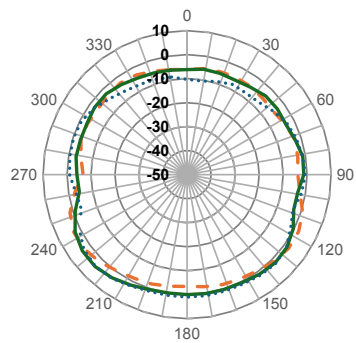
YZ-Plane Gain



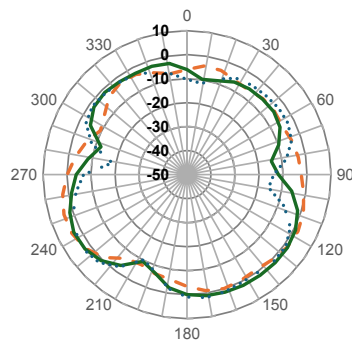
XY-Plane Gain

Radiation Patterns

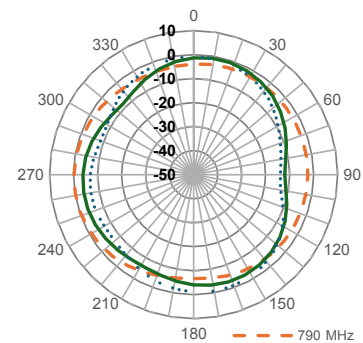
790 MHz to 960 MHz (875 MHz)



XZ-Plane Gain

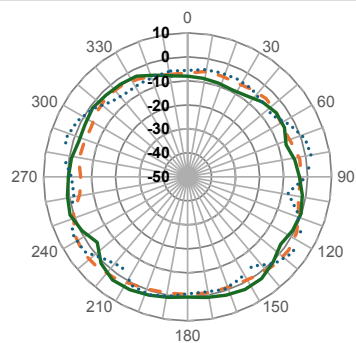


YZ-Plane Gain

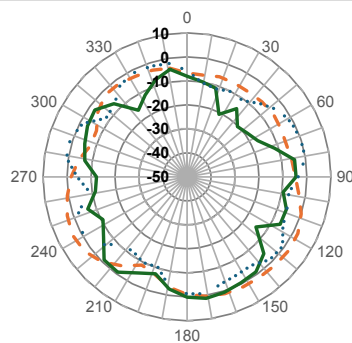


XY-Plane Gain

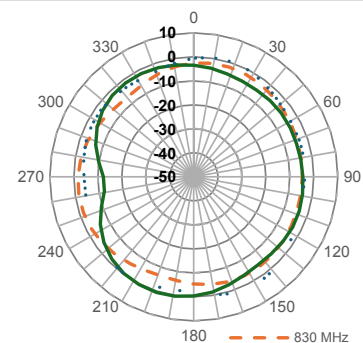
830 MHz to 1520 MHz (1175 MHz)



XZ-Plane Gain

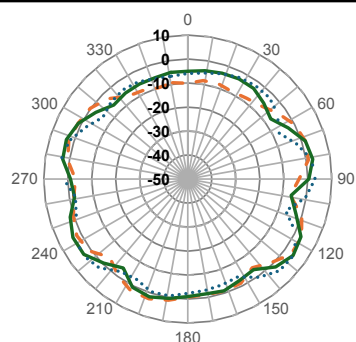


YZ-Plane Gain

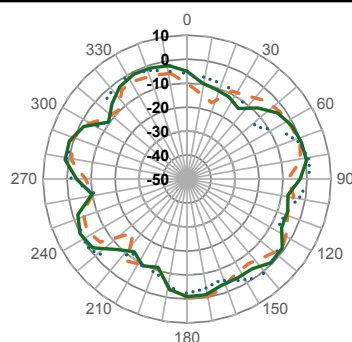


XY-Plane Gain

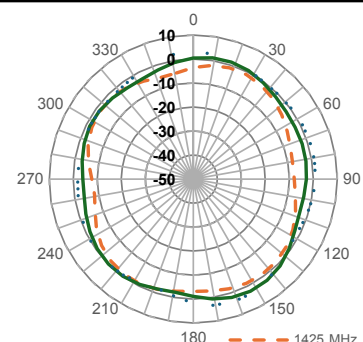
1425 MHz to 1675 MHz (1550 MHz)



XZ-Plane Gain



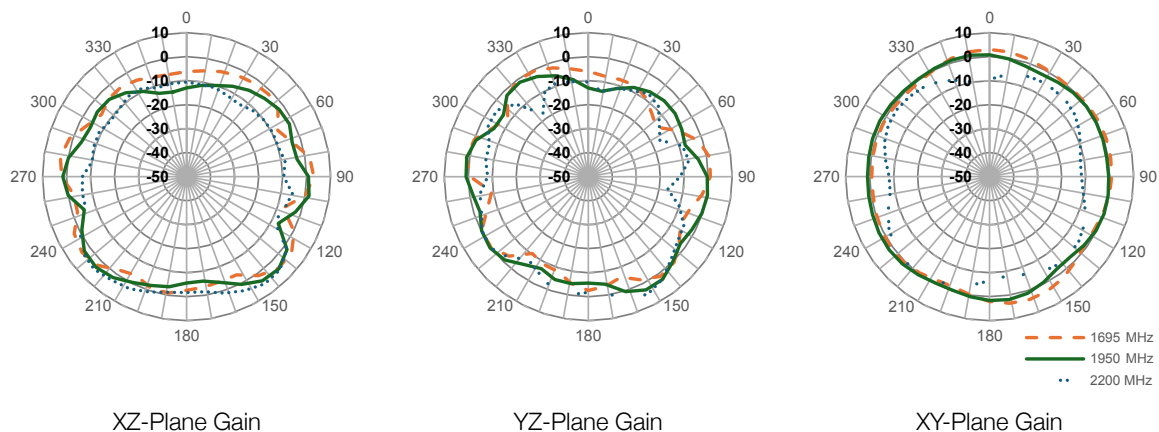
YZ-Plane Gain



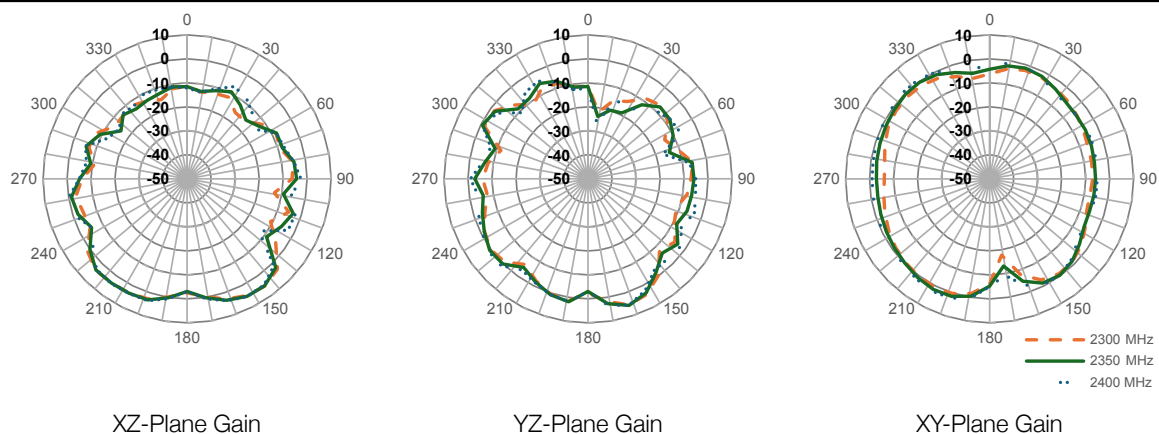
XY-Plane Gain

Radiation Patterns

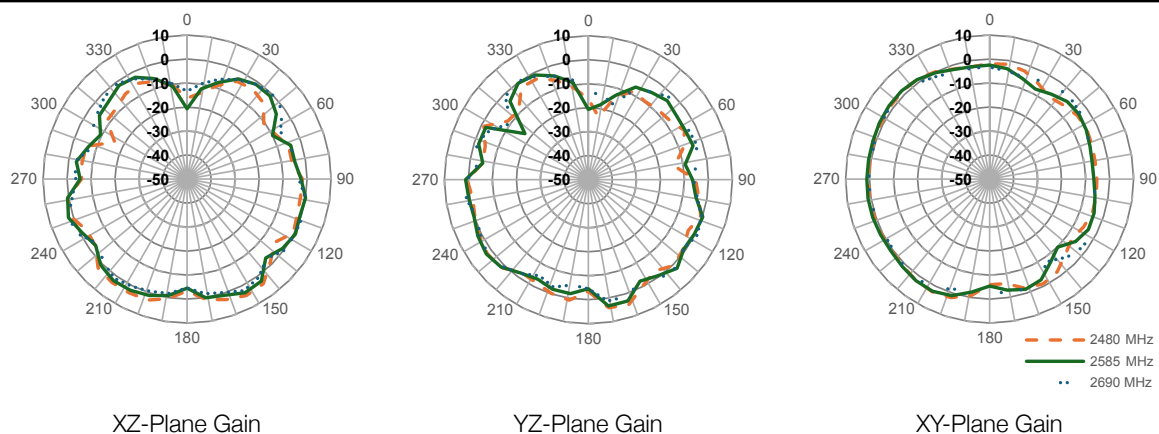
1695 MHz to 2200 MHz (1950 MHz)



2300 MHz to 2400 MHz (2350 MHz)

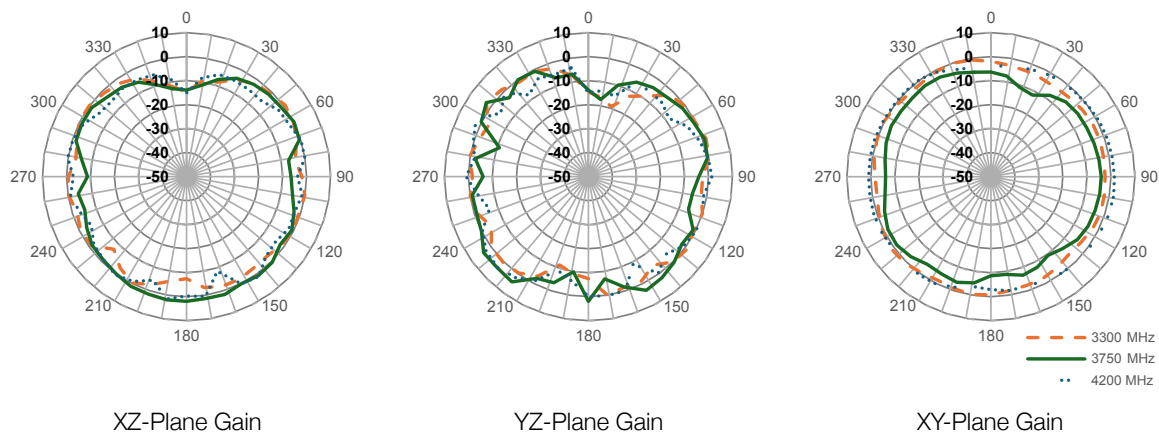


2480 MHz to 2690 MHz (2585 MHz)

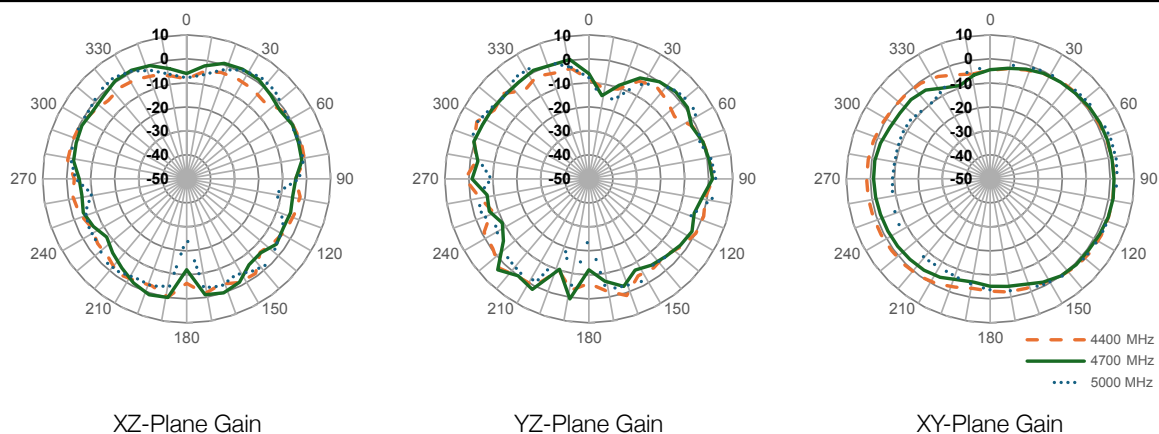


Radiation Patterns

3300 MHz to 4200 MHz (3750 MHz)



4400 MHz to 5000 MHz (4700 MHz)



5150 MHz to 5925 MHz (5540 MHz)

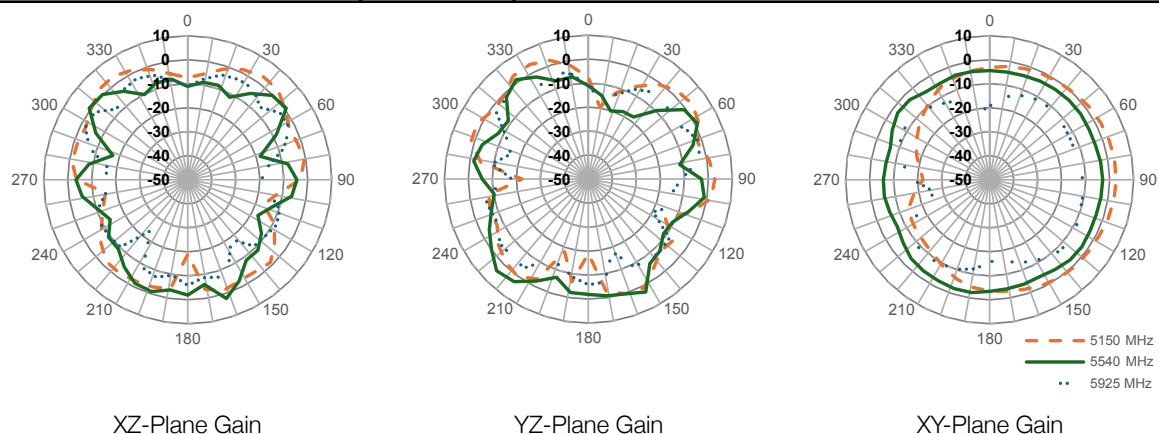


Figure 9. Radiation Patterns for the AC86000 Antenna, in Free Space

Edge of Ground Plane

The charts on the following pages represent data taken with the antenna oriented at the edge of a 100 mm x 100 mm ground plane as shown in Figure 10.

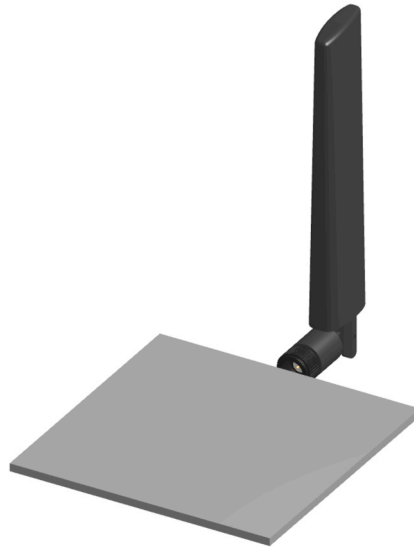


Figure 10. AC86000 Antenna at Edge of Ground Plane, Bent 90 Degrees

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.

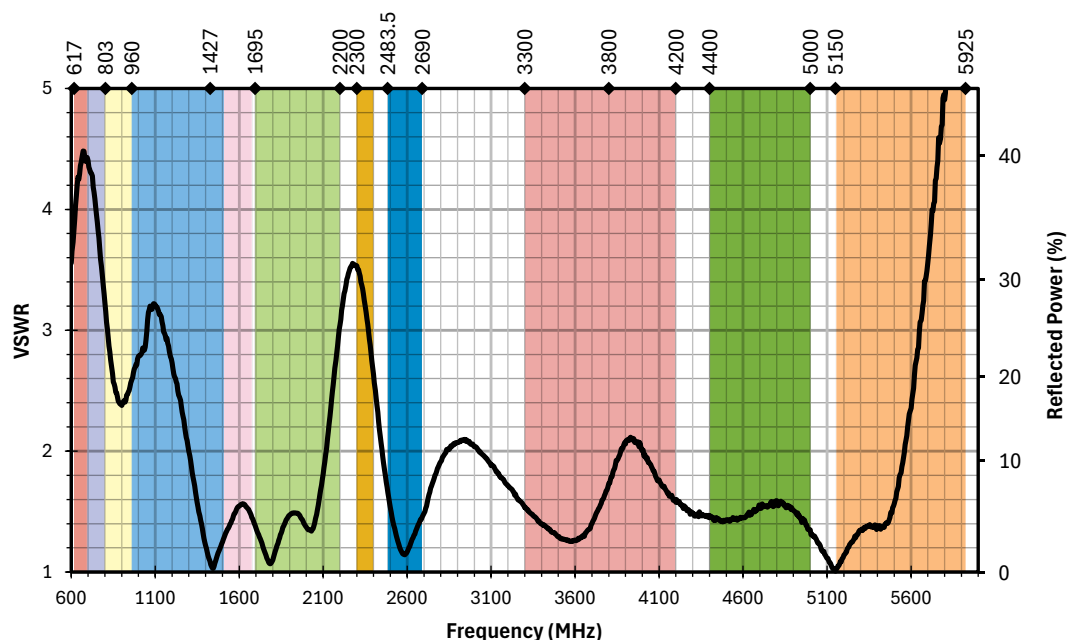


Figure 11. AC86000 Antenna VSWR at Edge of Ground Plane

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.

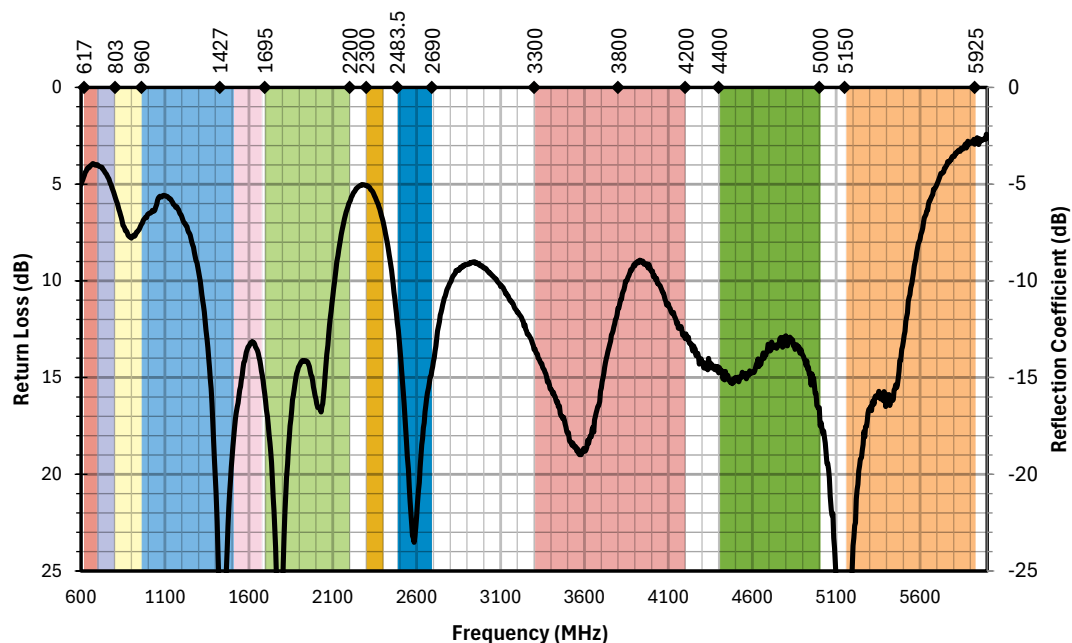


Figure 12. AC86000 Antenna Return Loss at Edge of Ground Plane

Peak Gain

Peak gain (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.

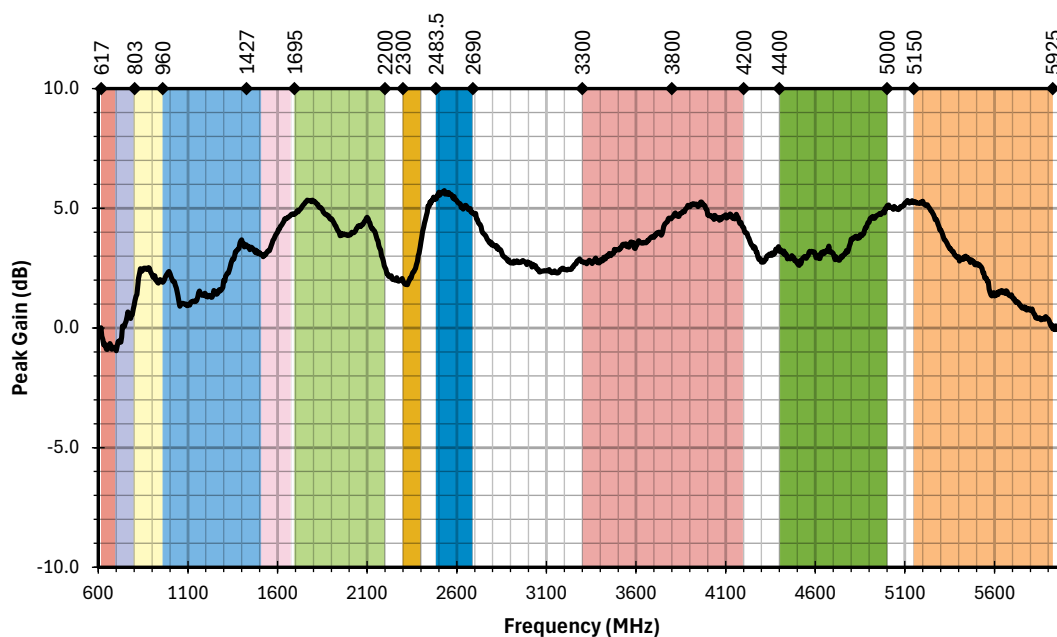


Figure 13. AC86000 Antenna Peak Gain at Edge of Ground Plane

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.

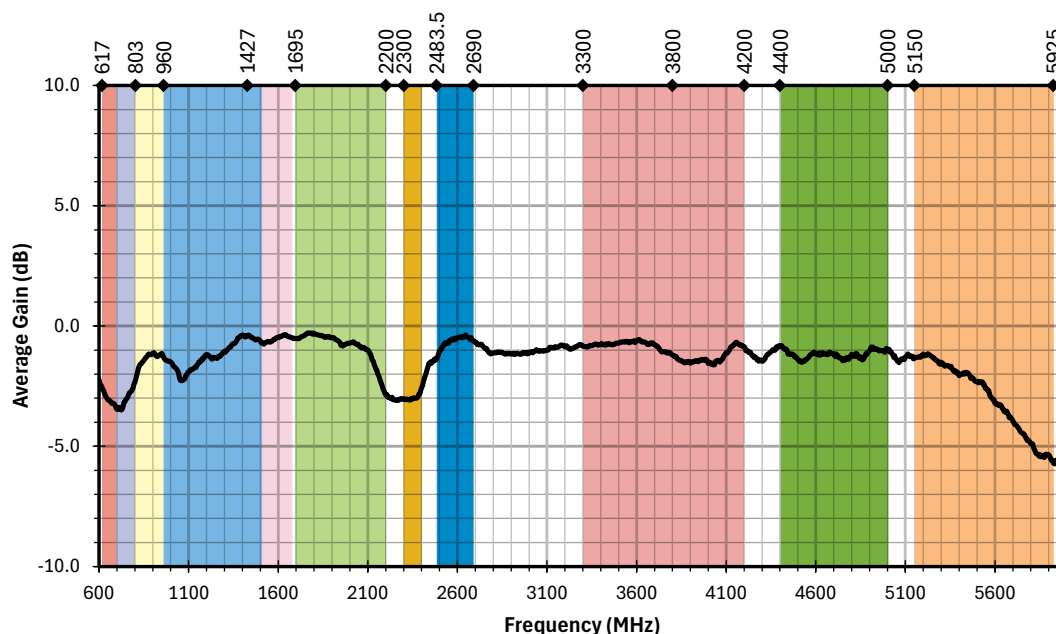


Figure 14. AC86000 Antenna Average Gain at Edge of Ground Plane

Efficiency

Efficiency (Figure 15) is 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.

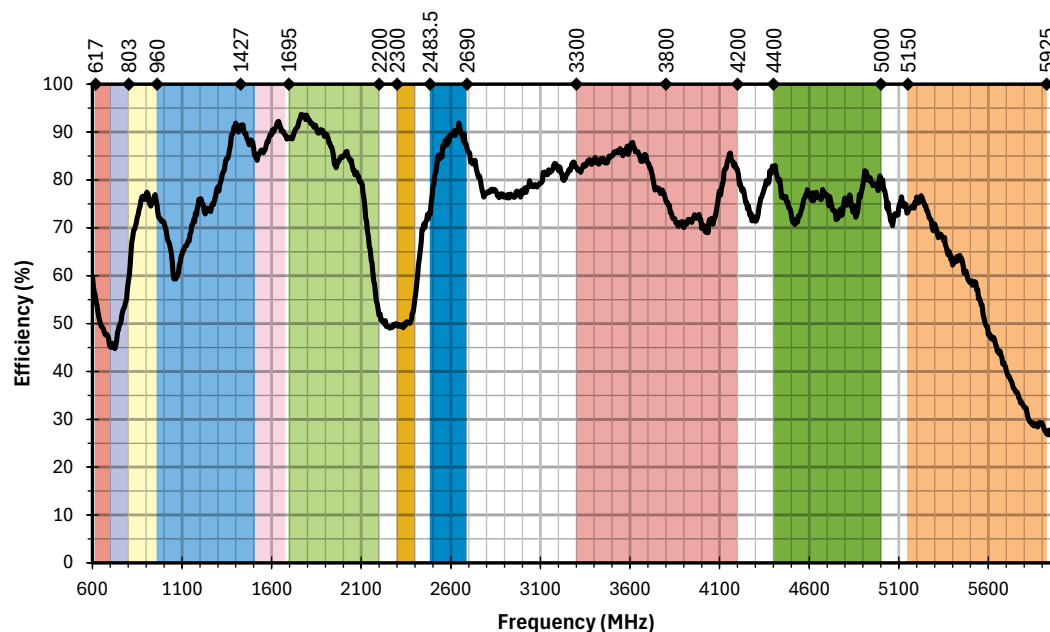
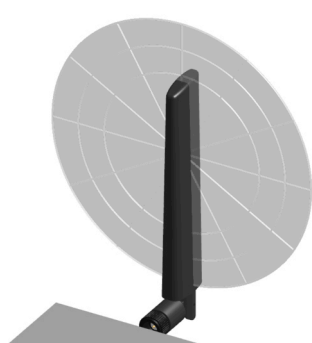


Figure 15. AC86000 Antenna Efficiency at Edge of Ground Plane

Radiation Patterns - Edge of Ground Plane

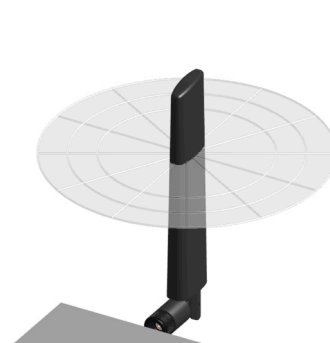
Radiation patterns provide information about the directional performance of the antenna by plotting gain in three orthogonal planes at the high-, low- and center-frequencies of an antenna frequency band. Antenna radiation patterns (Figure 16) are shown using polar plots covering 360 degrees with the 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

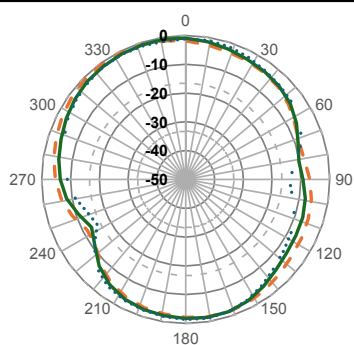


YZ-Plane Gain

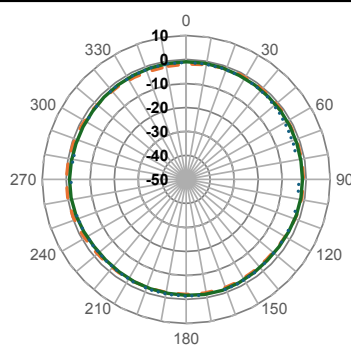


XY-Plane Gain

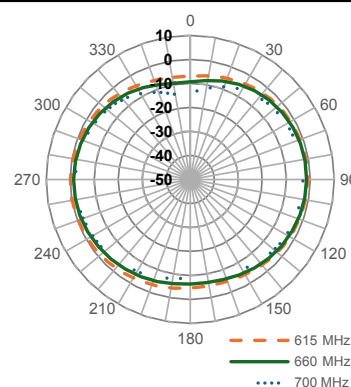
615 MHz to 700 MHz (660 MHz)



XZ-Plane Gain

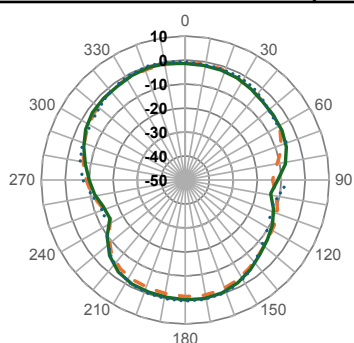


YZ-Plane Gain

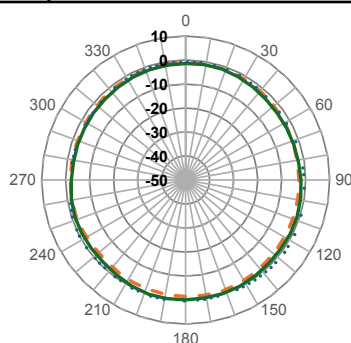


XY-Plane Gain

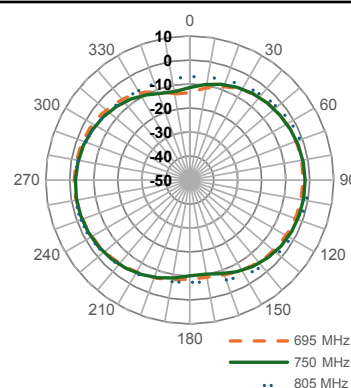
695 MHz to 805 MHz (750 MHz)



XZ-Plane Gain



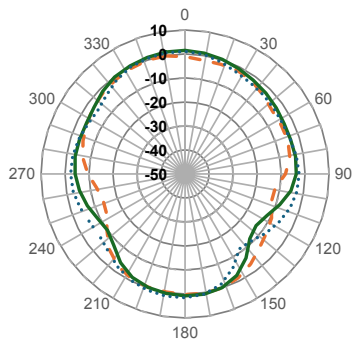
YZ-Plane Gain



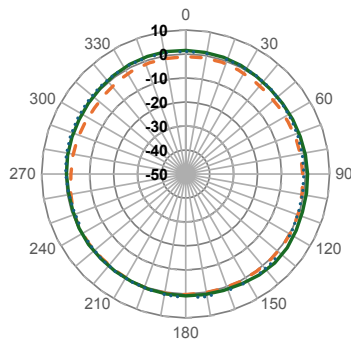
XY-Plane Gain

Radiation Patterns

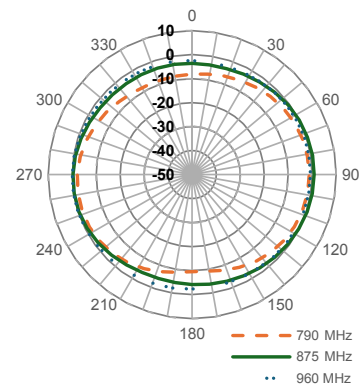
790 MHz to 960 MHz (875 MHz)



XZ-Plane Gain

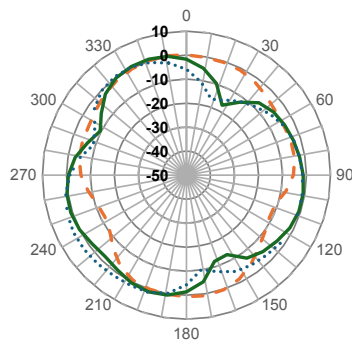


YZ-Plane Gain

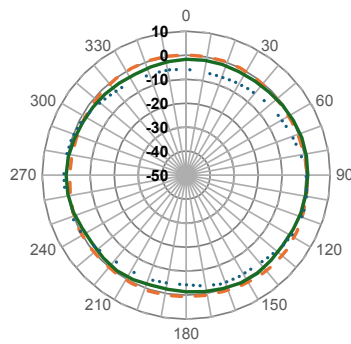


XY-Plane Gain

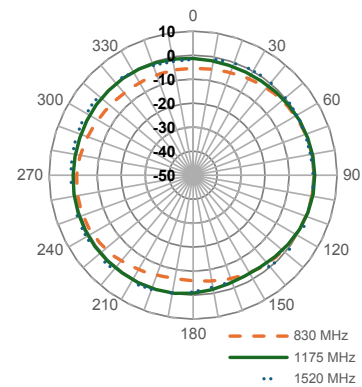
830 MHz to 1520 MHz (1175 MHz)



XZ-Plane Gain

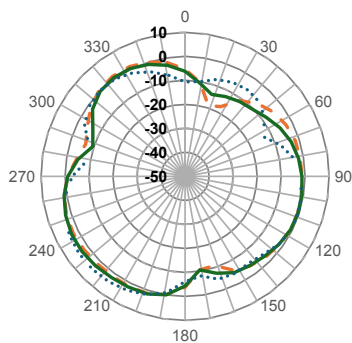


YZ-Plane Gain

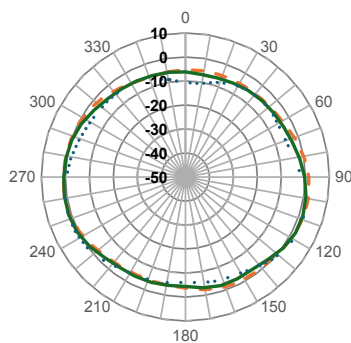


XY-Plane Gain

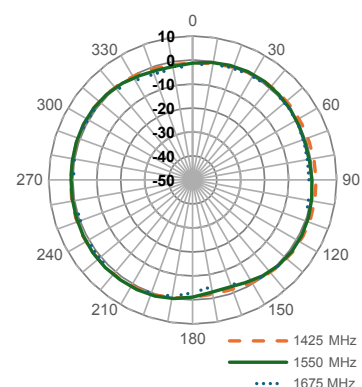
1425 MHz to 1675 MHz (1550 MHz)



XZ-Plane Gain



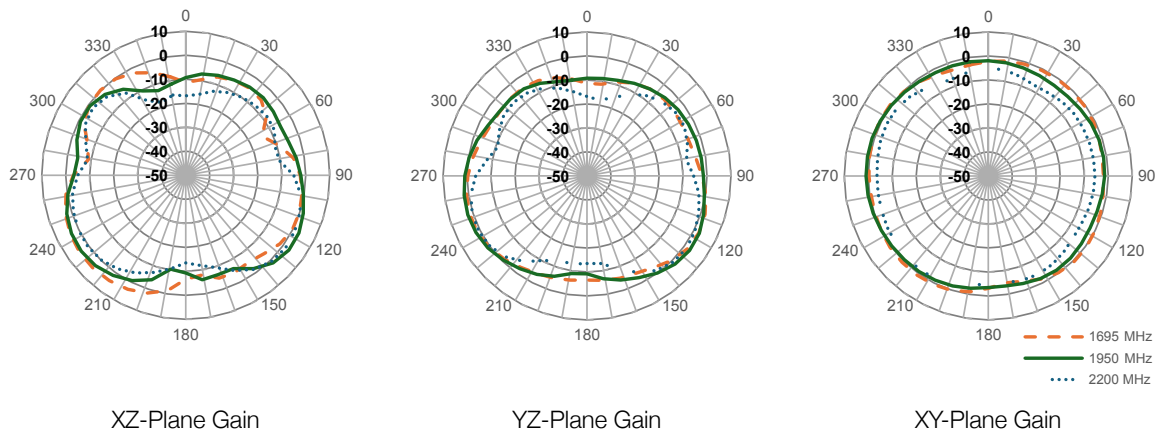
YZ-Plane Gain



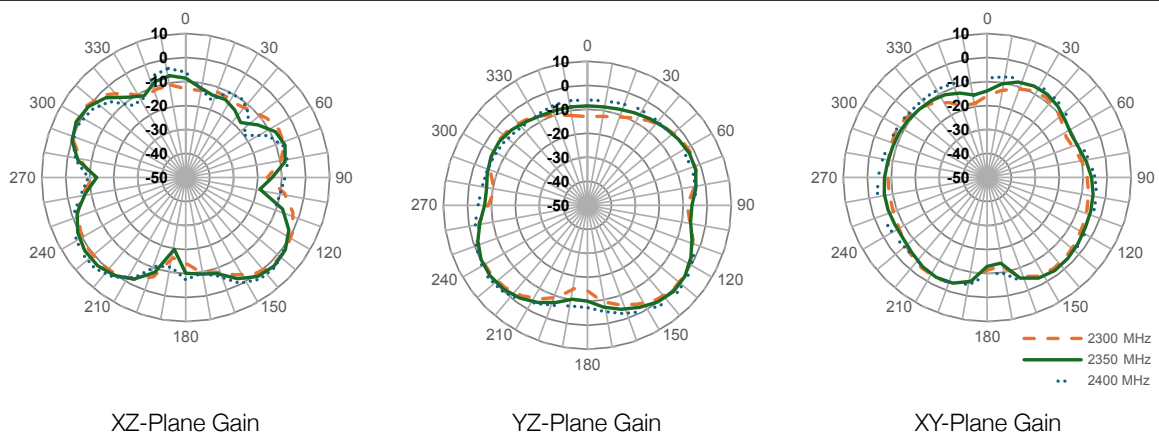
XY-Plane Gain

Radiation Patterns

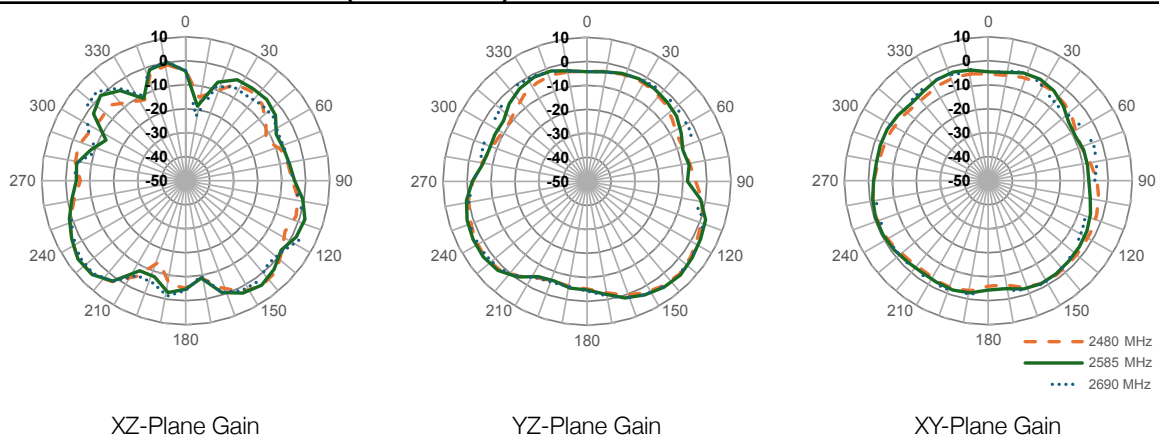
1695 MHz to 2200 MHz (1950 MHz)



2300 MHz to 2400 MHz (2350 MHz)

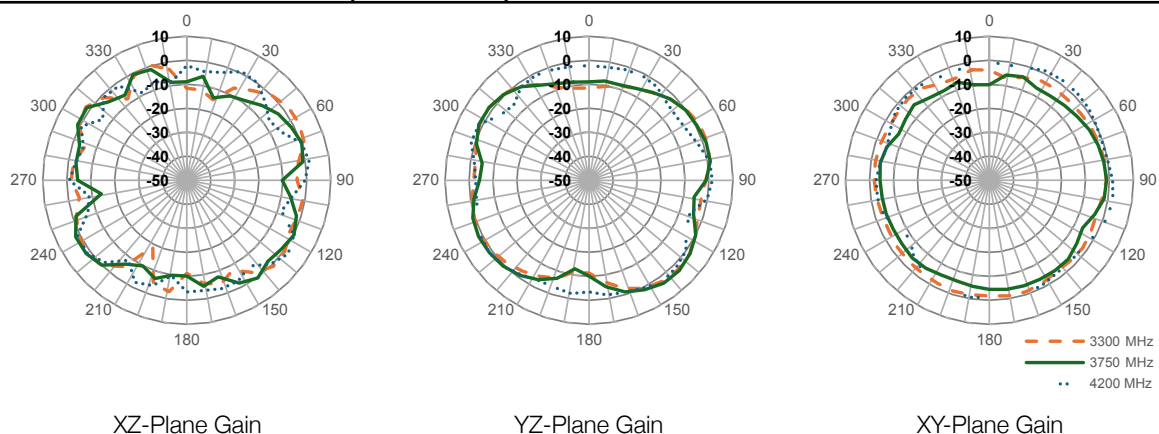


2480 MHz to 2690 MHz (2585 MHz)

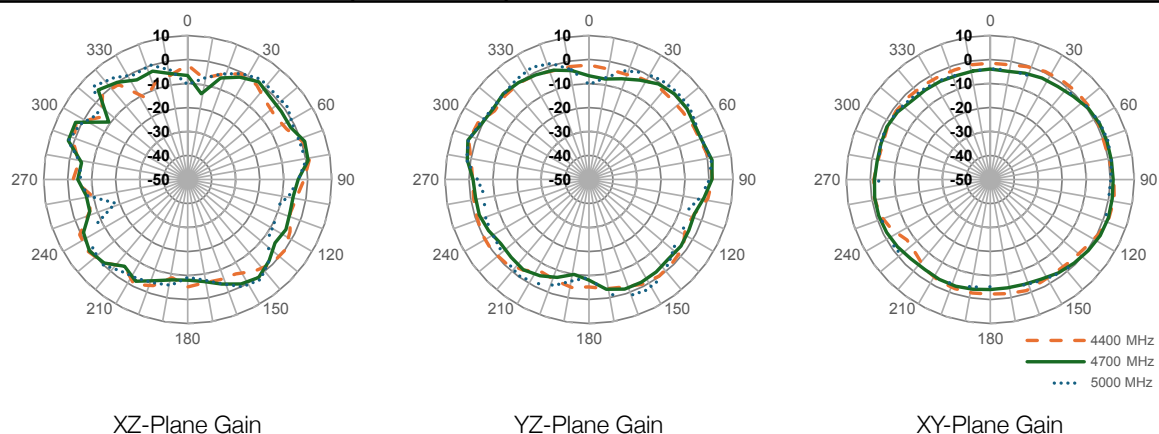


Radiation Patterns

3300 MHz to 4200 MHz (3750 MHz)



4400 MHz to 5000 MHz (4700 MHz)



5150 MHz to 5925 MHz (5540 MHz)

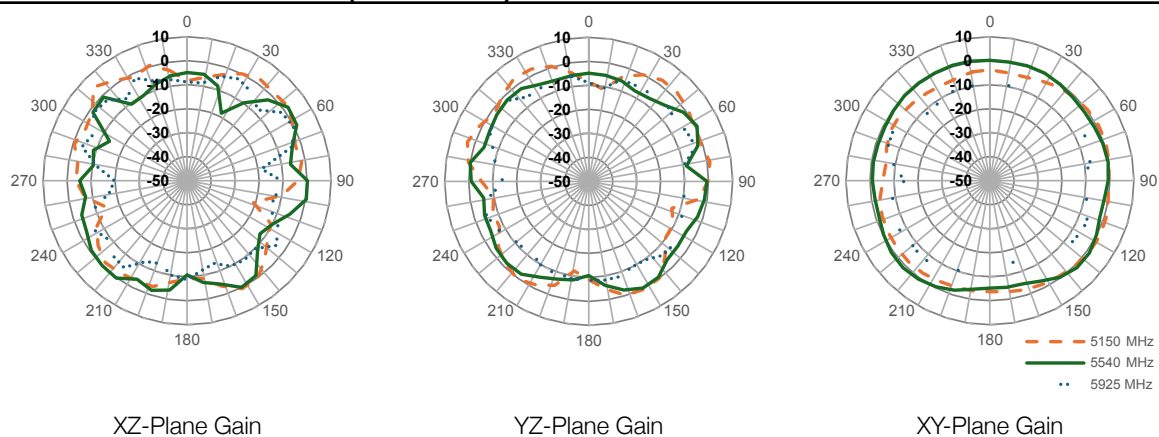


Figure 16. Radiation Patterns for the AC86000 Antenna

Packaging Information

The AC86000 antenna is individually packaged in a polyethylene bag as shown in Figure 17 and then packaged in a larger polyethylene bag in quantities of 5 each. These bags are placed in (honeycomb) pockets in a carton of 2 layers totalling 500 pieces. Carton dimensions are 335 mm x 295 mm x 360 mm (13.2 in x 11.6 in x 14.2 in).

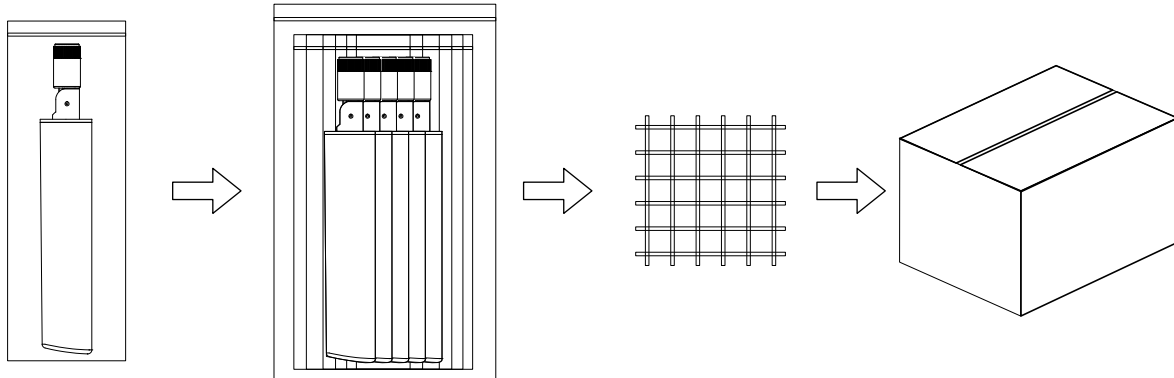


Figure 17. Packaging Details for the AC86000 Antenna

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.

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

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

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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