

AC85003 NM

Wideband Cellular Compact Dome NMO-Mount Antenna

The AC85003 NMO cellular compact dome antennas provide robust, compact, outdoor, omnidirectional antenna solutions for 5G/4G/LTE and cellular IoT applications including Cat-M1/LTE-M and NB-IoT systems from 617 MHz to 5925 MHz.

Each antenna supports IP67 and IP65 ingress protection as well as IK-10 impact resistance, all under an attractive, UV-resistant, dome. The 82 mm x 40 mm mounted size combines excellent antenna performance with a compact low-profile that fits in many applications from mobile/vehicular roof-mount to fixed vending machine use, supports use on both metallic and non-metallic enclosures.

The AC85003 NMO compact dome antenna series is available in two colors, black and white, with fine matte finish. Similar-performing N-connector (AC85003 NJ type) and cabled (AC87002 type) compact dome antennas are also available.



AC85003-NMB Compact Dome
NMO-Mount Antenna

Features

- 617 MHz to 6000 MHz Wideband Cellular
- Very high efficiency
- IP67/IP65 ingress protection
- IK10 impact resistance
- O-ring mounting seal
- UV resistance
- Dimensions: 82 mm x 40 mm
- Ground plane independence
- NMO termination

Applications

- 5G/4G/LTE cellular
- Cellular IoT
 - Cat-M1/LTE-M
 - NB-IoT
- Automotive/vehicular/OHV
- Outdoor CPE
- Fixed wireless
- Smart metering
- Substation monitoring
- Asset management
- Internet of Things (IoT) devices

Ordering Information

Part Number	Description
AC85003-NMB	Black NMO connector, cellular IoT compact dome antenna
AC85003-NMW	White NMO connector, cellular IoT compact dome antenna

See the AC87002 compact dome antennas for cabled options and AC85003-NJ type for N connector termination options. Available from The Antenna Company (sales@antennacompany.com) and select distributors and representatives.

RF/Electrical Specifications

Frequency (MHz)	VSWR (max)	Peak Gain (dBi)	Average Gain (dBi)	Efficiency (%)
615 to 700	2.9	6.2	-2.0	63
700 to 805	3.1	1.3	-1.9	64
790 to 960	2.6	4.0	-0.9	82
830 to 1520	2.3	4.2	-0.9	82
1425 to 1675	2.5	3.3	-1.4	73
1695 to 2200	2.6	3.2	-2.2	61
2300 to 2400	2.5	1.5	-2.5	56
2480 to 2690	2.3	3.7	-1.7	68
3300 to 4200	2.0	7.6	-1.7	68
4400 to 5000	2.5	6.9	-1.9	65
5150 to 5925	4.5	6.4	-2.4	59

Impedance	50 Ω
Polarization	Linear
Radiation Pattern	Omnidirectional
Wavelength	$\frac{1}{2}$ -wave
Maximum Input Power	10W
Electrical Type	Dipole

Electrical specifications and plots measured with the antenna mounted at the center of a 300 mm x 300 mm ground plane using NMO to N-connector test adapter.

Mechanical Specifications

Parameter	Value
Antenna Connection (Termination)	NMO
Mounting Torque	Hand tighten, 2.0 Nm typical
Mating Connector	Commercially available NMO connectors vary widely. An NMO connector designed for high frequency (i.e. > 700 MHz) is recommended
Weight	AC85003-NMx = 56.7 g (2.0 oz)
Dimensions (mounted)	82.0 mm x $\varnothing$ 40.0 mm (3.23 in x $\varnothing$ 1.57 in)

Environmental Specifications

Parameter	Value
Operating Temp. Range	-40 °C to +85 °C (-104 °F to 185 °F)
Operating Relative Humidity	$\leq$ 98%
Ingress Protection	IP67, IP65
Impact Resistance	IK10
Flammability Rating	UL 94-HB
Salt Spray	MIL-STD 810F/STM B117
Wind Resistance (max.)	300 km/hr (186 mi/hr)

Antenna Dimensions

The dimensions for the AC85003 are shown below in Figure 1.

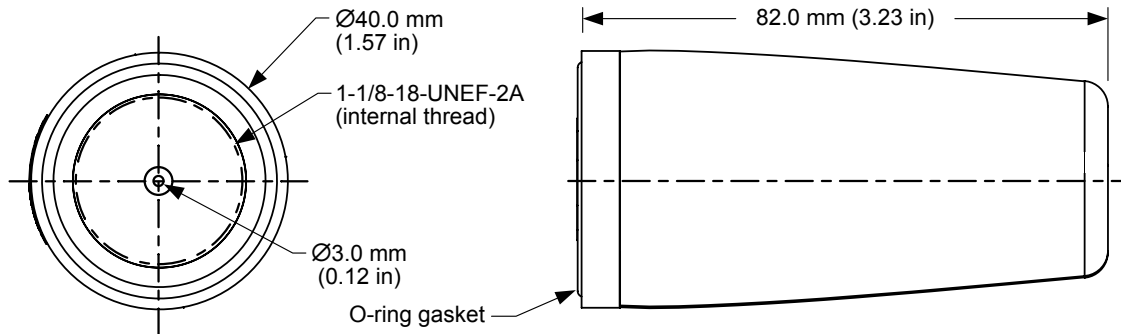
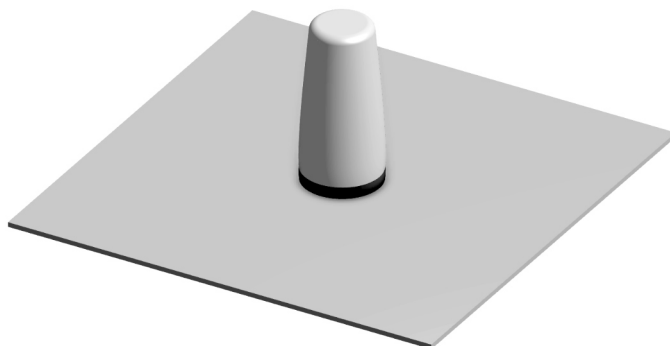


Figure 1. AC85003 Antenna Dimensions

Antenna Test Orientations

The AC85003 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 (300 mm x 300 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 on Ground Plane



Antenna in Free space

Figure 2. AC85003 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.

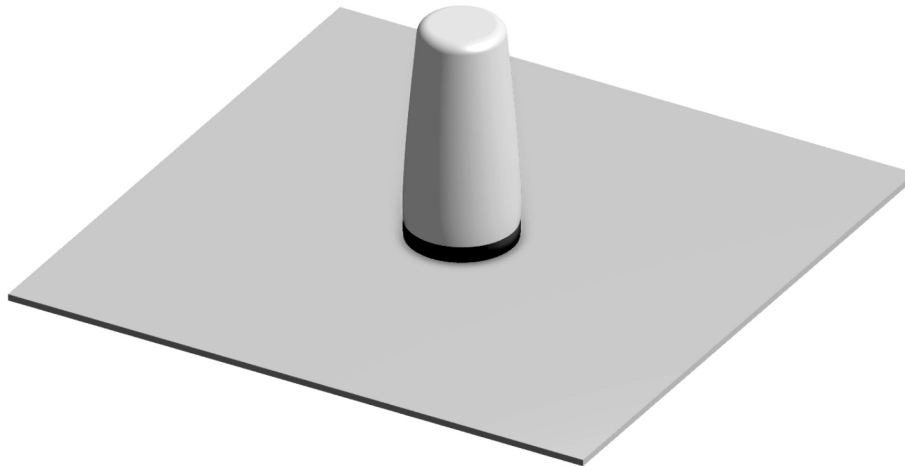


Figure 3. AC85003 Antenna On Ground Plane

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.

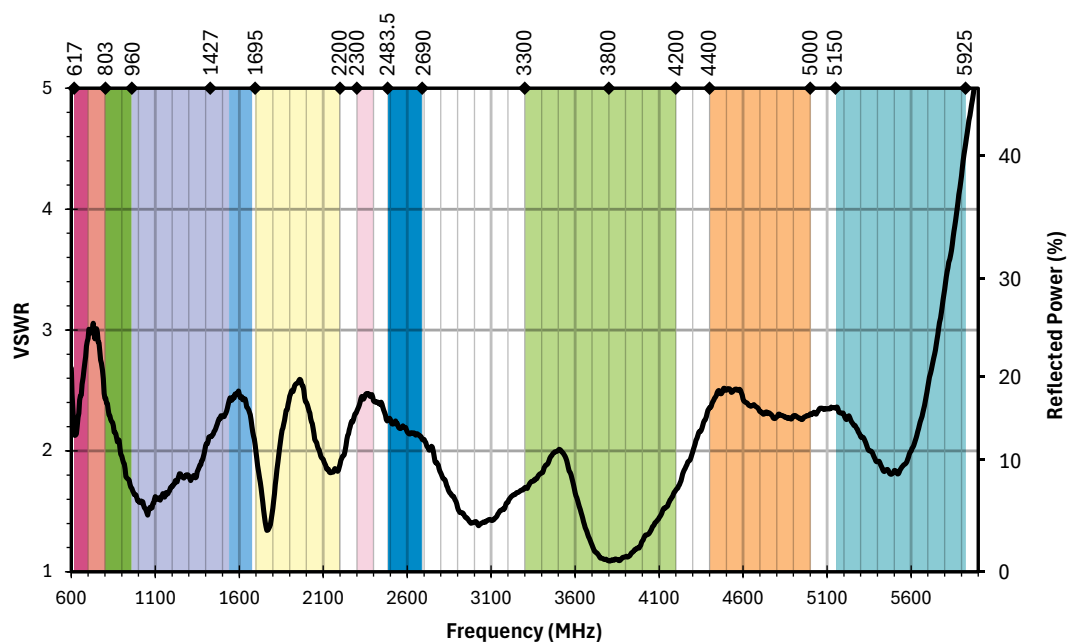


Figure 4. AC85003 Antenna VSWR on Ground Plane

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.

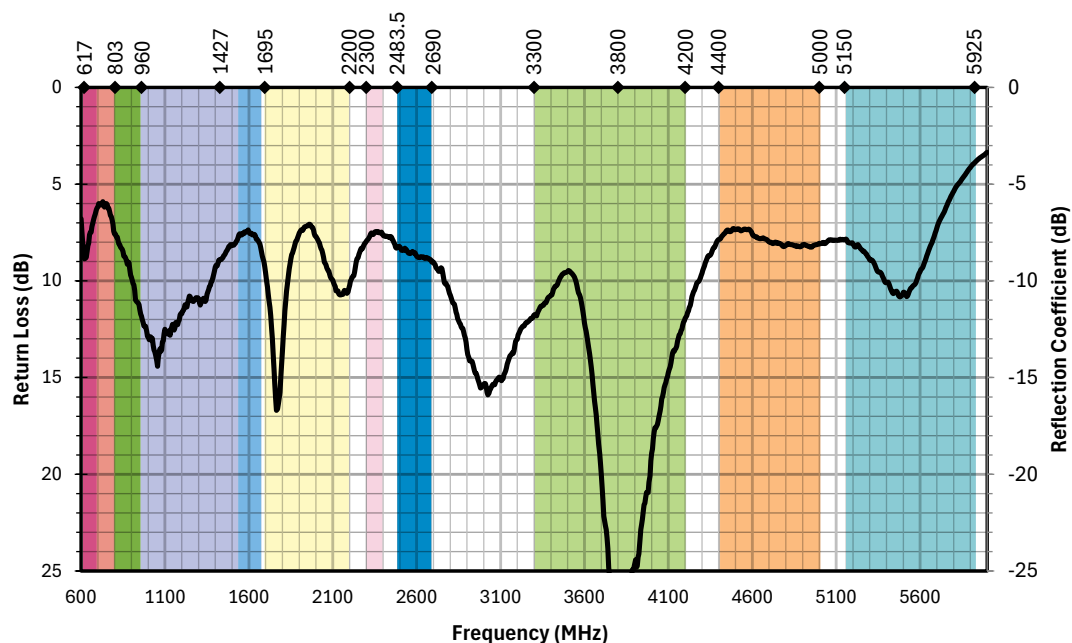


Figure 5. AC85003 Antenna Return Loss on Ground Plane

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.

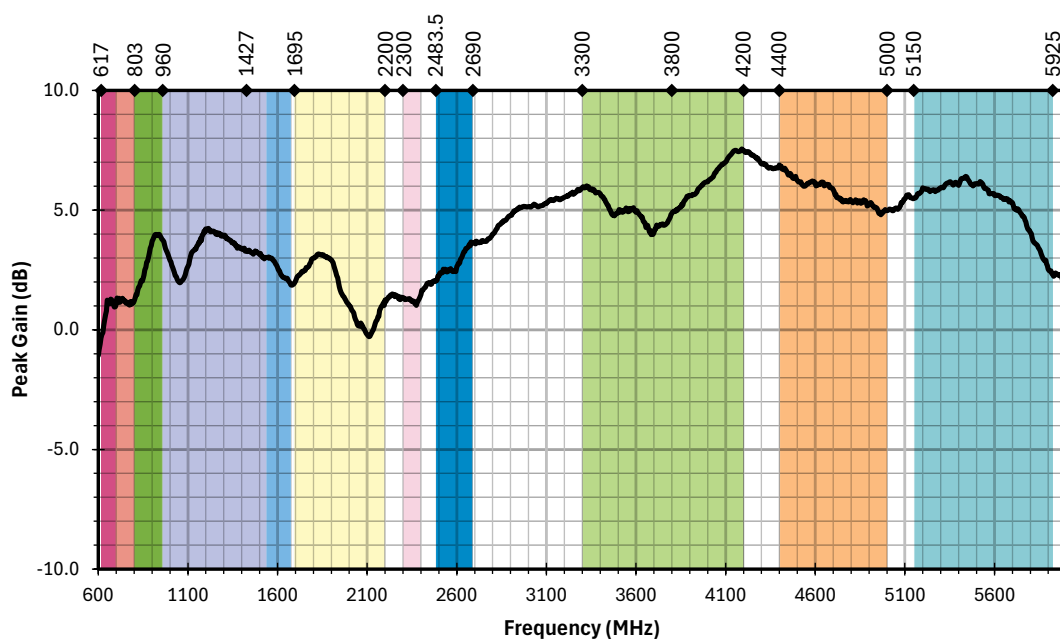


Figure 6. AC85003 Antenna Peak Gain on Ground Plane

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.

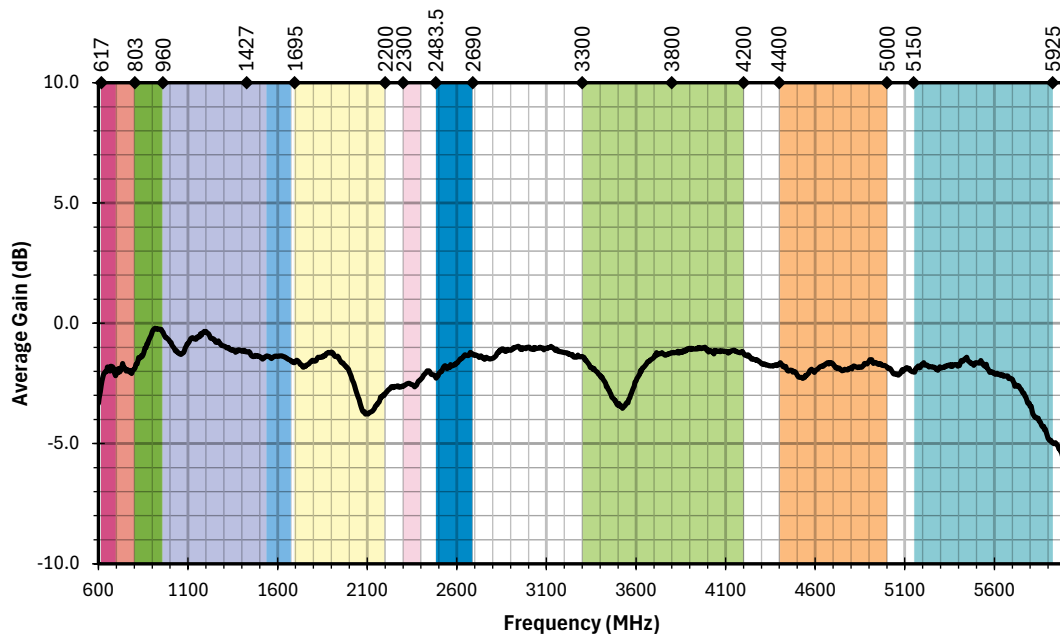


Figure 7. AC85003 Antenna Average Gain on Ground Plane

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.

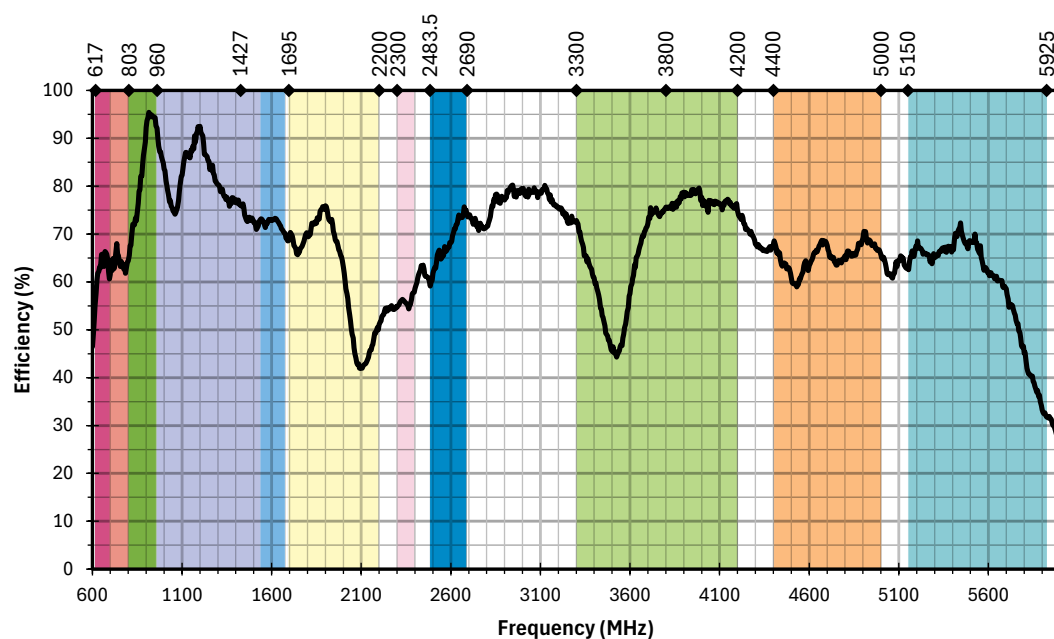
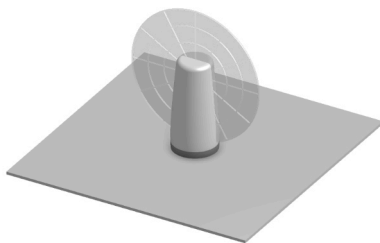


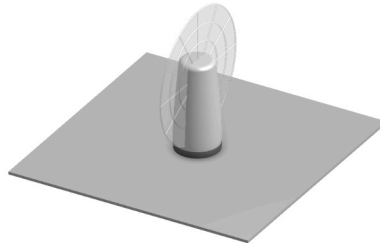
Figure 8. AC85003 Antenna Efficiency on Ground Plane

Radiation Patterns - On Ground Plane

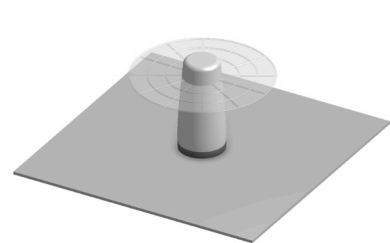
Radiation patterns provide information about the directional performance of the antenna by plotting gain in three orthogonal planes at the high-, low- and center-frequencies of an antenna frequency band. Antenna radiation patterns (Figure 9) are shown using polar plots covering 360 degrees with the plane 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

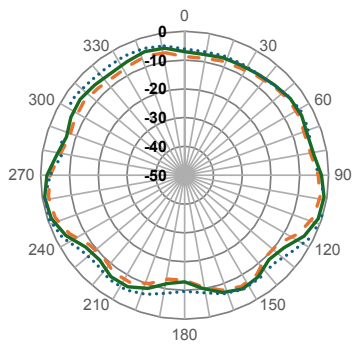


YZ-Plane Gain

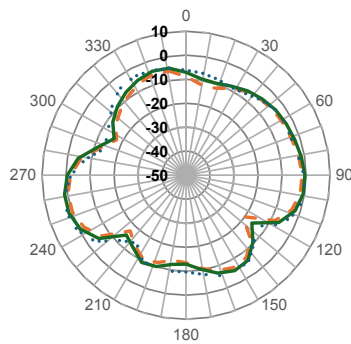


XY-Plane Gain

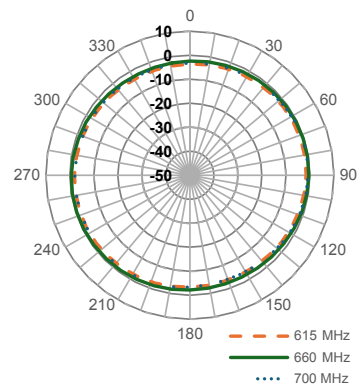
615 MHz to 700 MHz (660 MHz)



XZ-Plane Gain

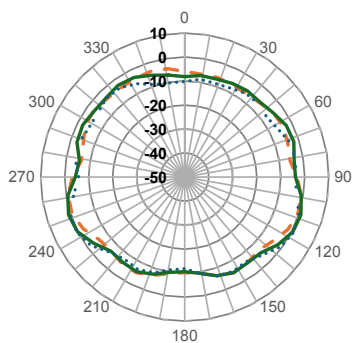


YZ-Plane Gain

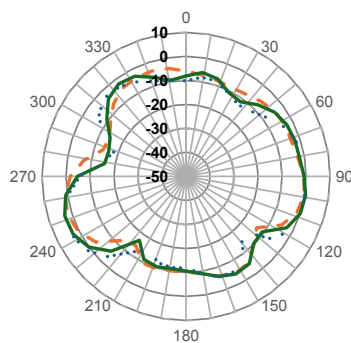


XY-Plane Gain

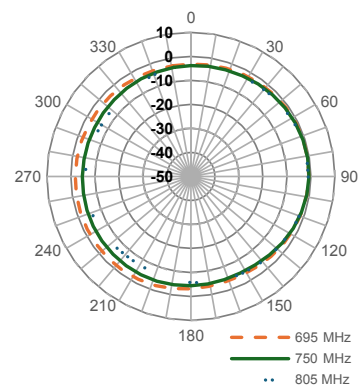
695 MHz to 805 MHz (750 MHz)



XZ-Plane Gain



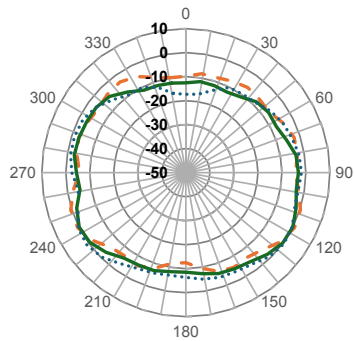
YZ-Plane Gain



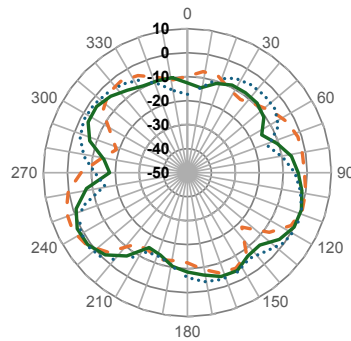
XY-Plane Gain

Radiation Patterns

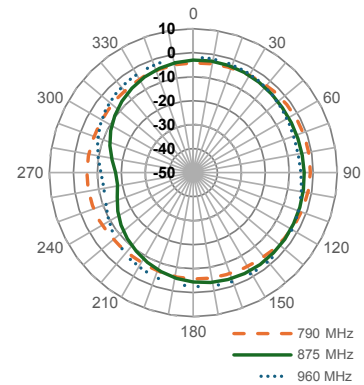
790 MHz to 960 MHz (875 MHz)



XZ-Plane Gain

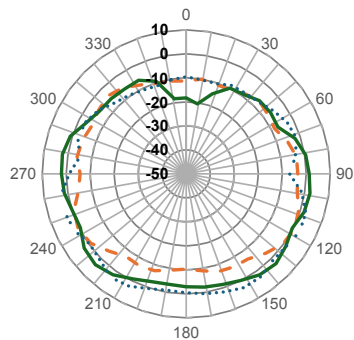


YZ-Plane Gain

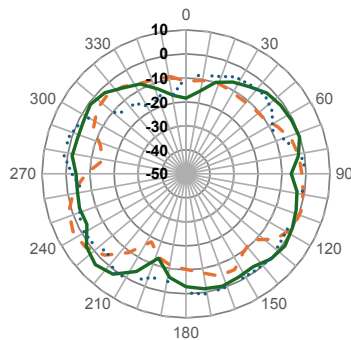


XY-Plane Gain

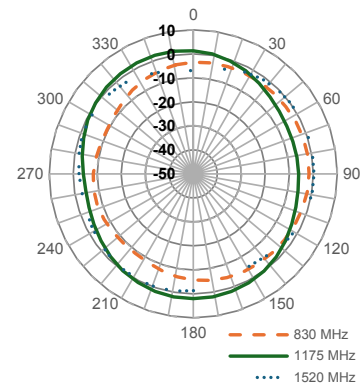
830 MHz to 1520 MHz (1175 MHz)



XZ-Plane Gain

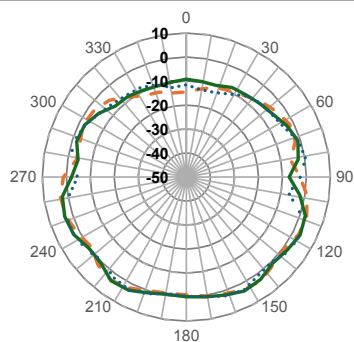


YZ-Plane Gain

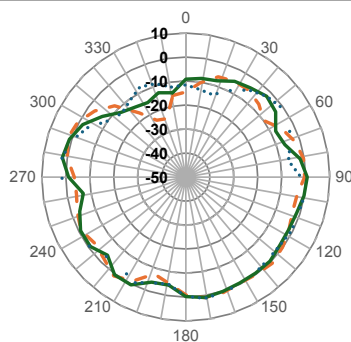


XY-Plane Gain

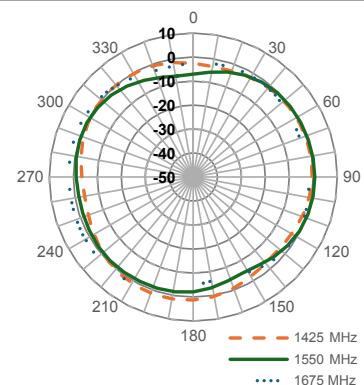
1425 MHz to 1675 MHz (1550 MHz)



XZ-Plane Gain



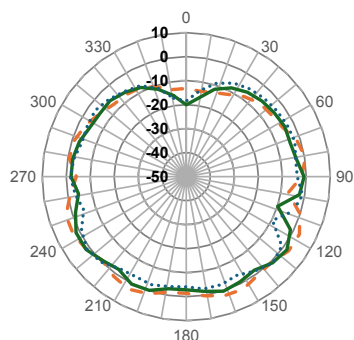
YZ-Plane Gain



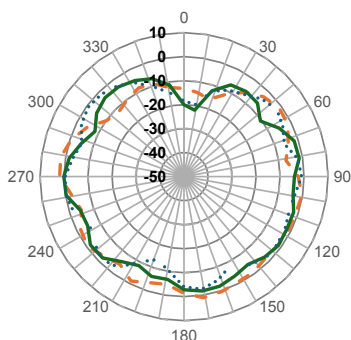
XY-Plane Gain

Radiation Patterns

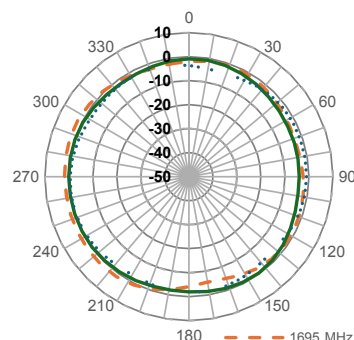
1695 MHz to 2200 MHz (1950 MHz)



XZ-Plane Gain

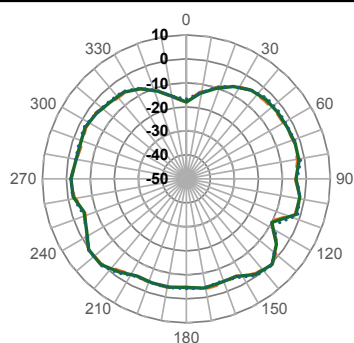


YZ-Plane Gain

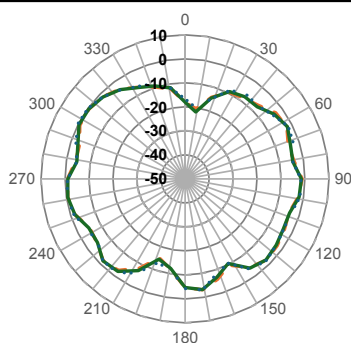


XY-Plane Gain

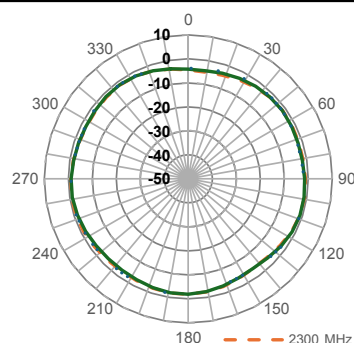
2300 MHz to 2400 MHz (2350 MHz)



XZ-Plane Gain

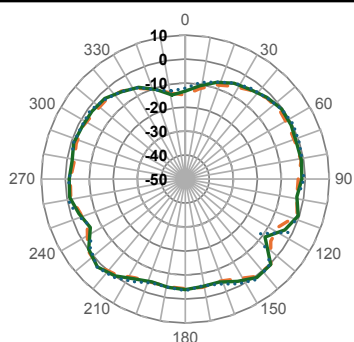


YZ-Plane Gain

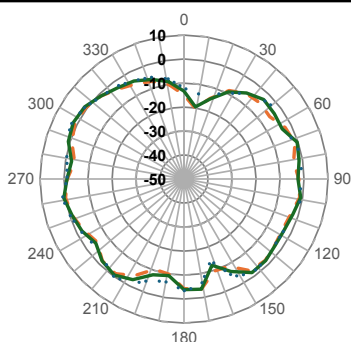


XY-Plane Gain

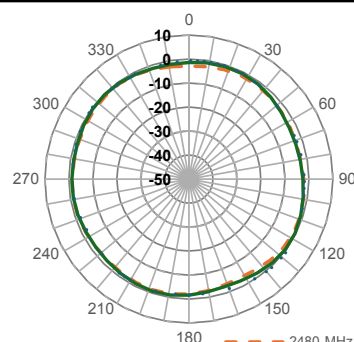
2480 MHz to 2690 MHz (2585 MHz)



XZ-Plane Gain



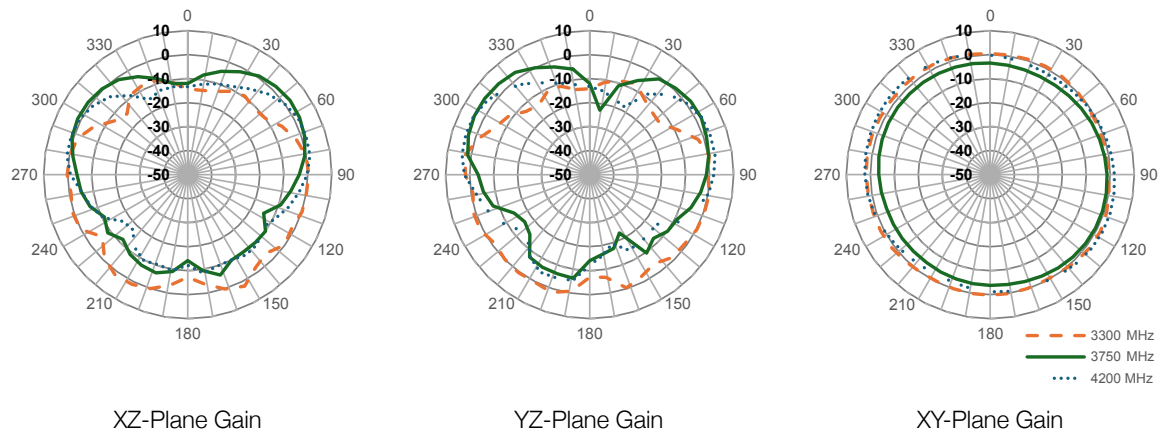
YZ-Plane Gain



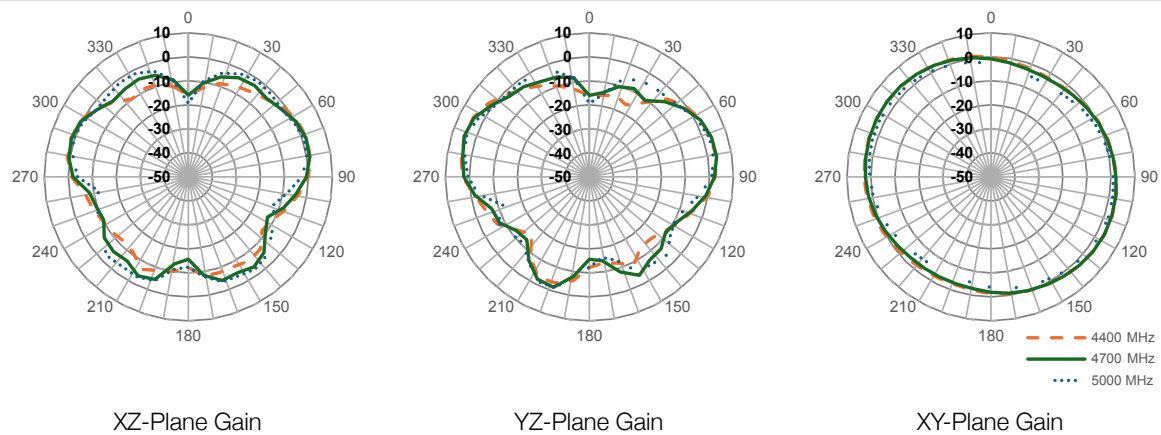
XY-Plane Gain

Radiation Patterns

3300 MHz to 4200 MHz (3750 MHz)



4400 MHz to 5000 MHz (4700 MHz)



5150 MHz to 5925 MHz (5540 MHz)

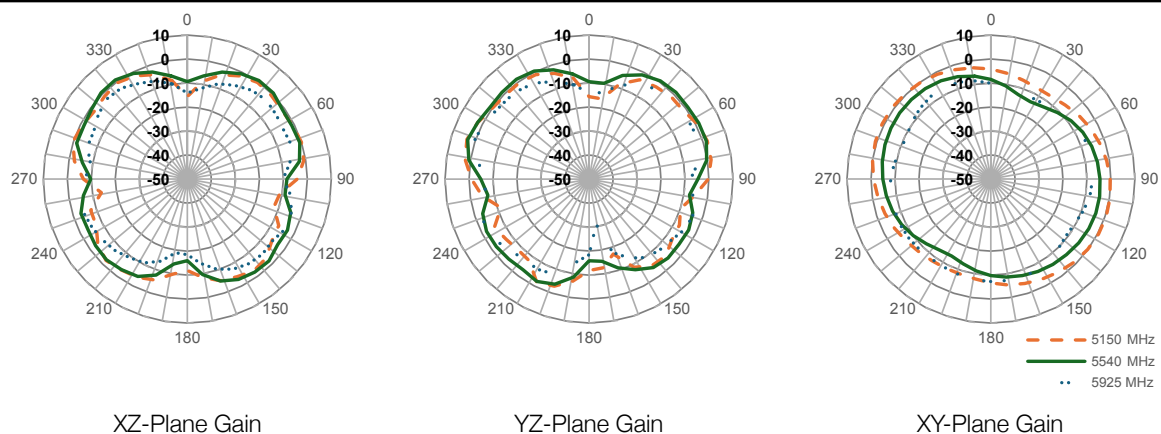


Figure 9. Radiation Patterns for AC85003 Antenna on Ground Plane

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.

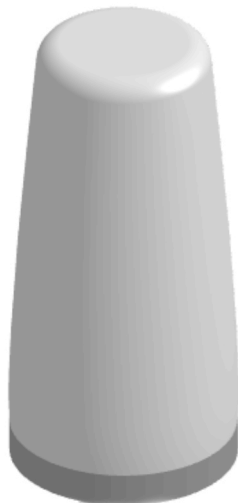


Figure 10. AC85003 Antenna, Free Space, no Ground Plane

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.

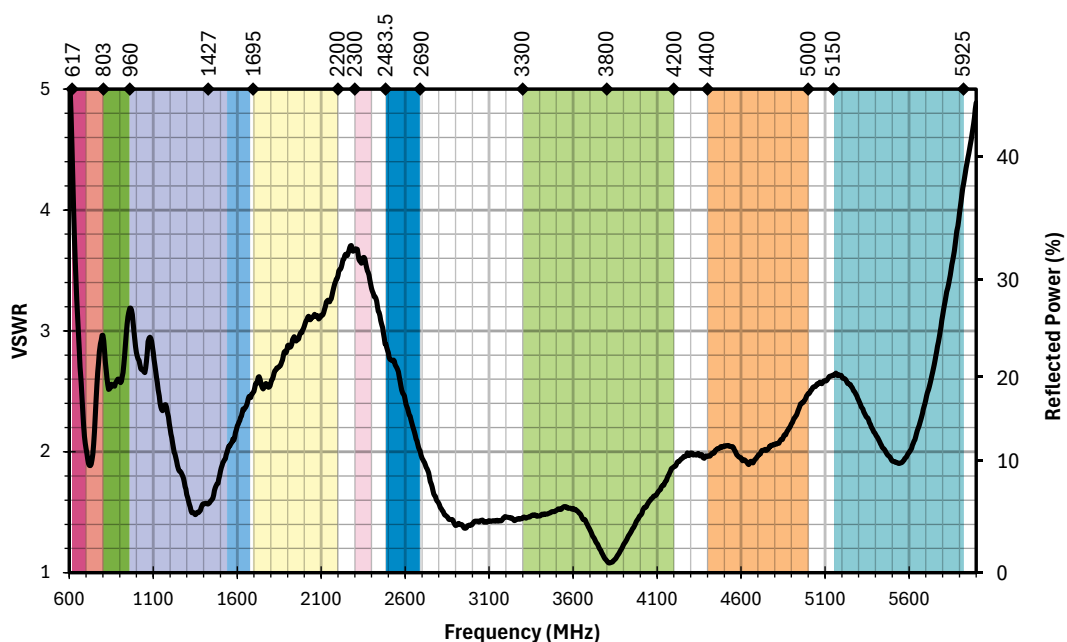


Figure 11. AC85003 Antenna VSWR, Free Space

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.

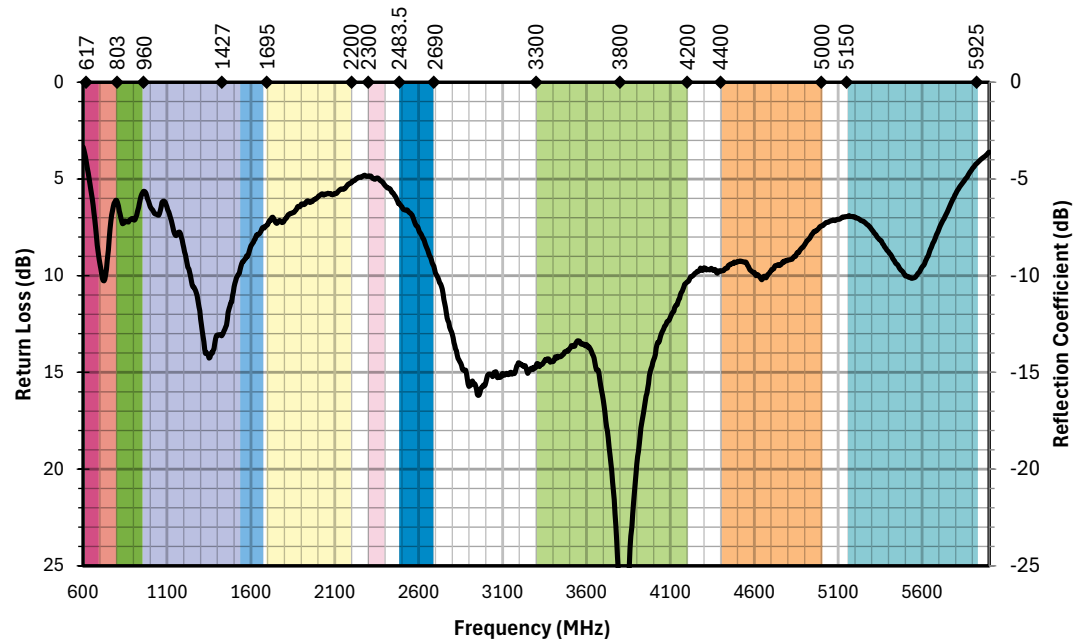


Figure 12. AC85003 Antenna Return Loss, Free Space

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.

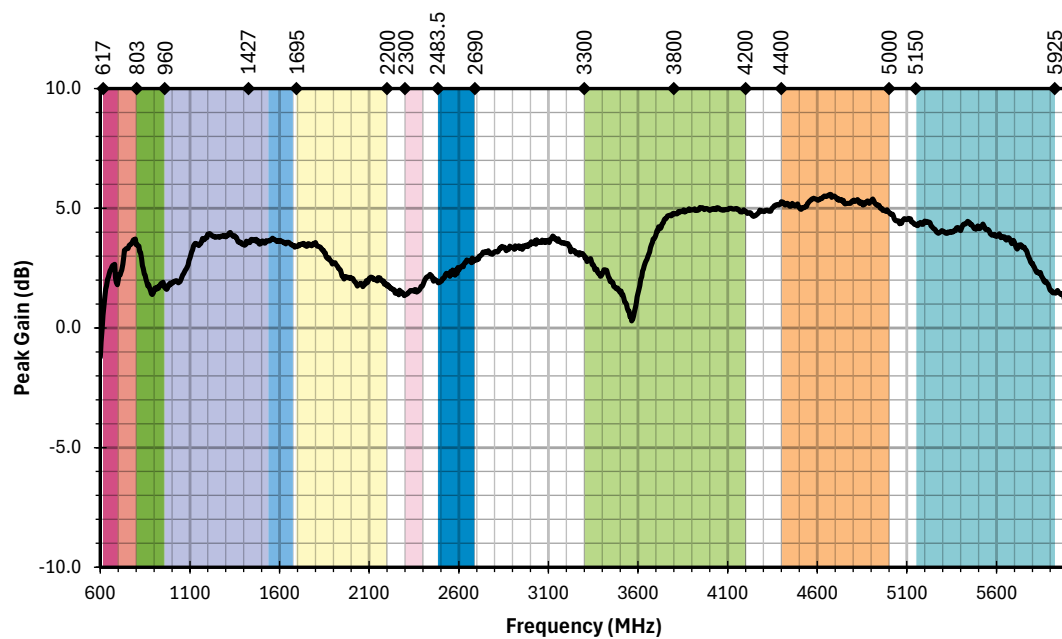


Figure 13. AC85003 Antenna Peak Gain, Free Space

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.

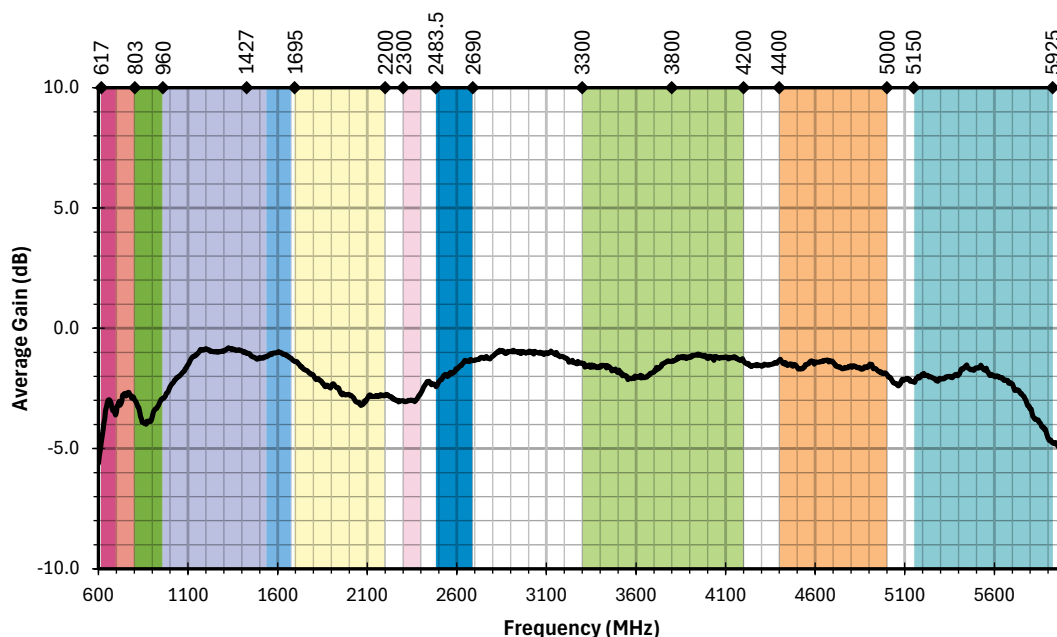


Figure 14. AC85003 Antenna Average Gain, Free Space

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.

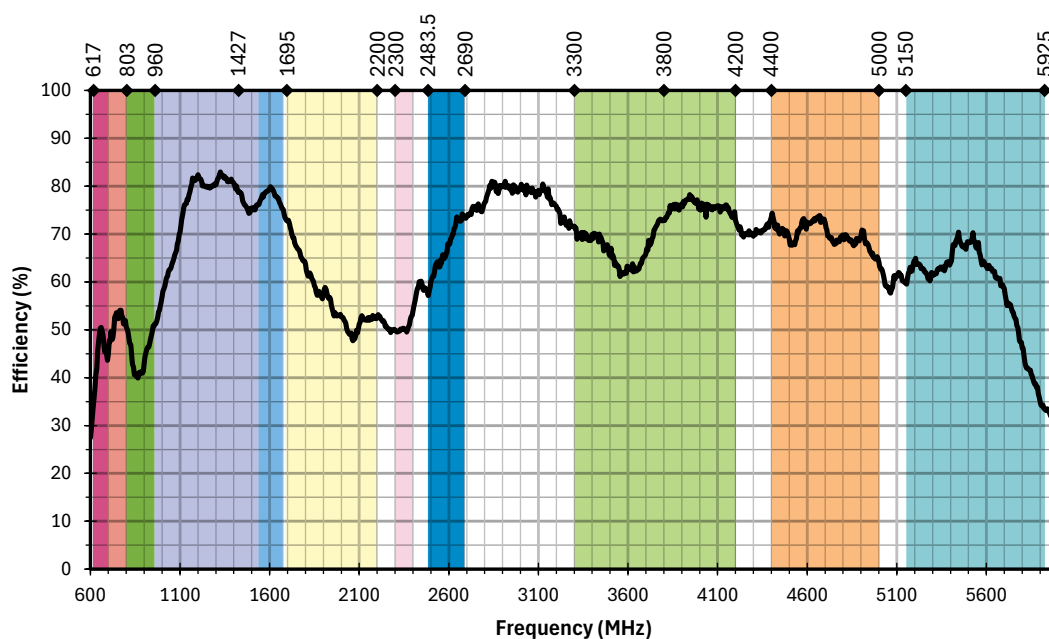
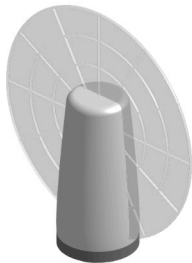


Figure 15. AC85003 Antenna Efficiency, Free Space

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

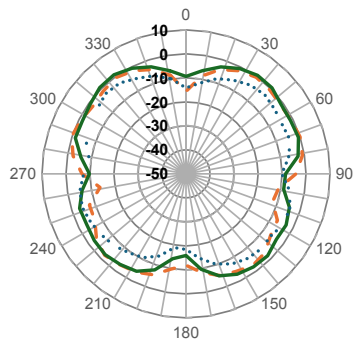


YZ-Plane Gain

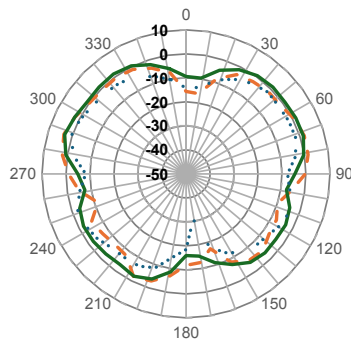


XY-Plane Gain

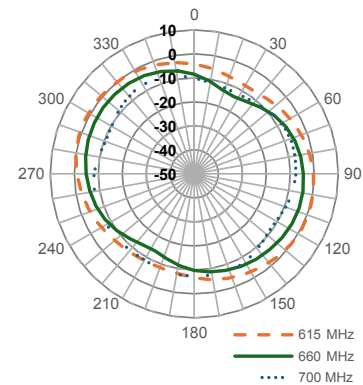
615 MHz to 700 MHz (660 MHz)



XZ-Plane Gain

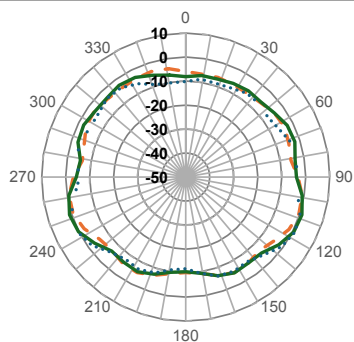


YZ-Plane Gain

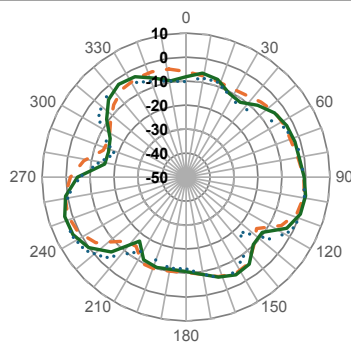


XY-Plane Gain

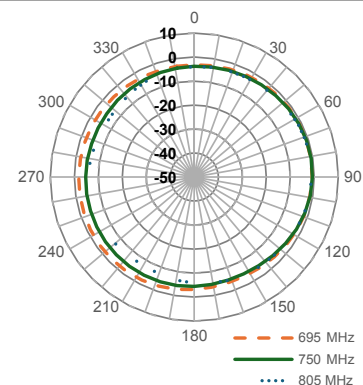
695 MHz to 805 MHz (750 MHz)



XZ-Plane Gain



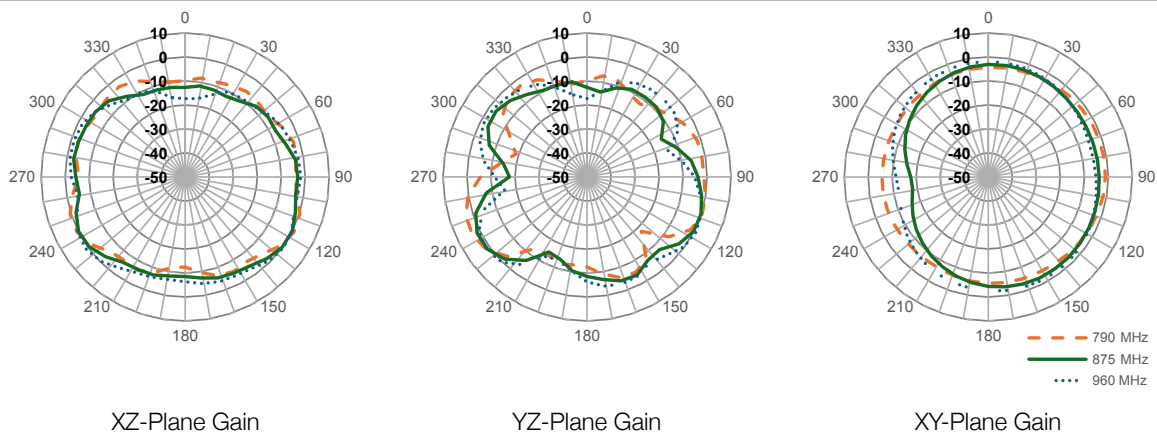
YZ-Plane Gain



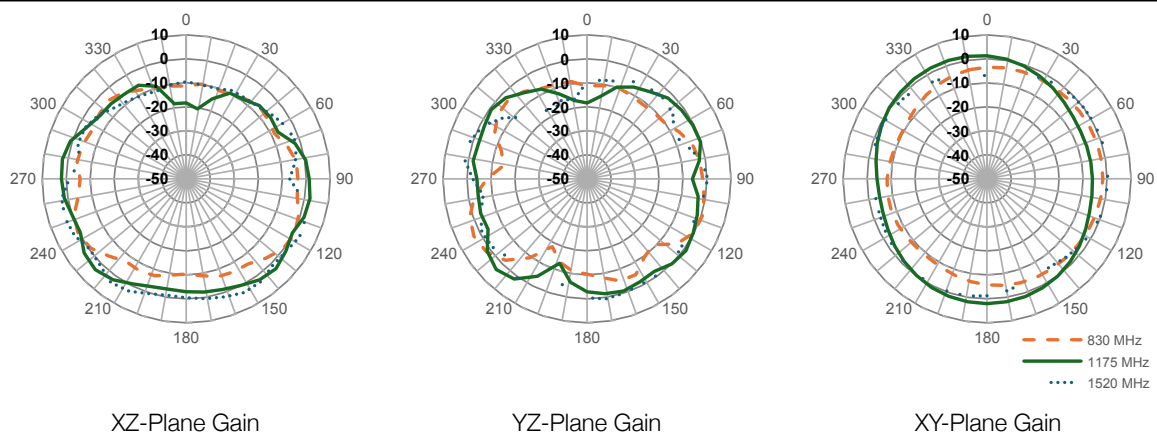
XY-Plane Gain

Radiation Patterns

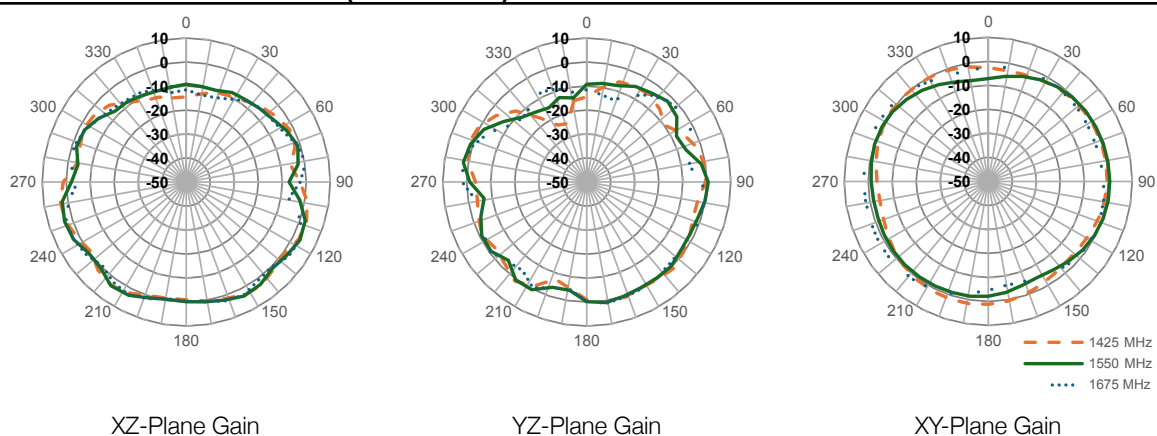
790 MHz to 960 MHz (875 MHz)



830 MHz to 1520 MHz (1175 MHz)

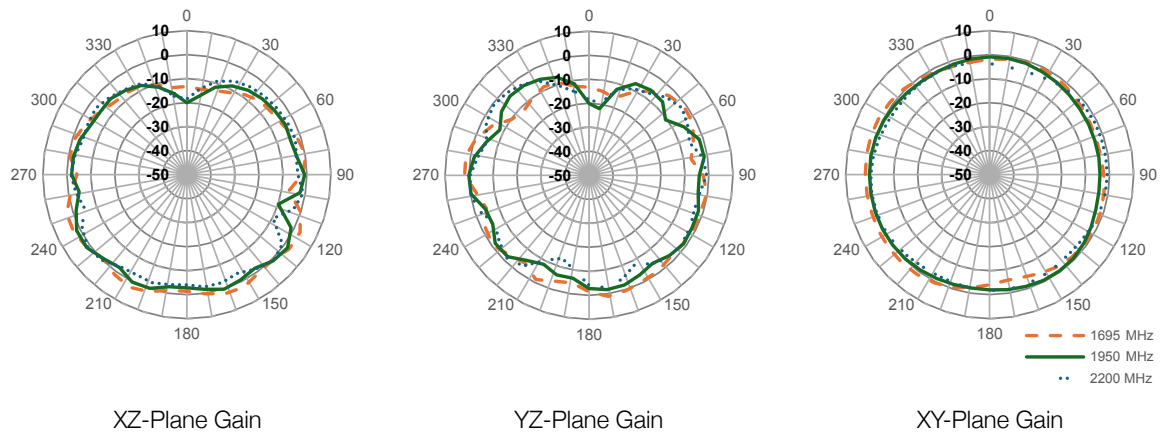


1425 MHz to 1675 MHz (1550 MHz)

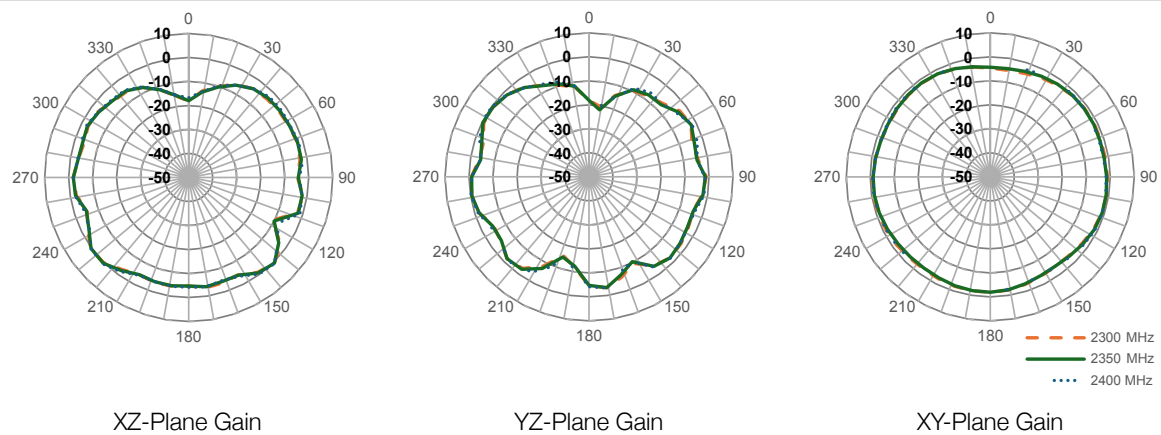


Radiation Patterns

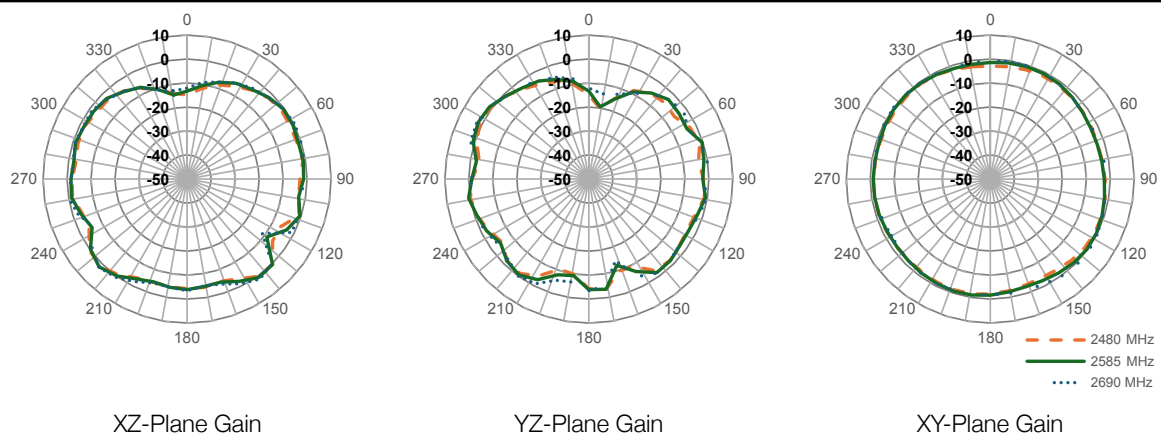
1695 MHz to 2200 MHz (1950 MHz)



2300 MHz to 2400 MHz (2350 MHz)

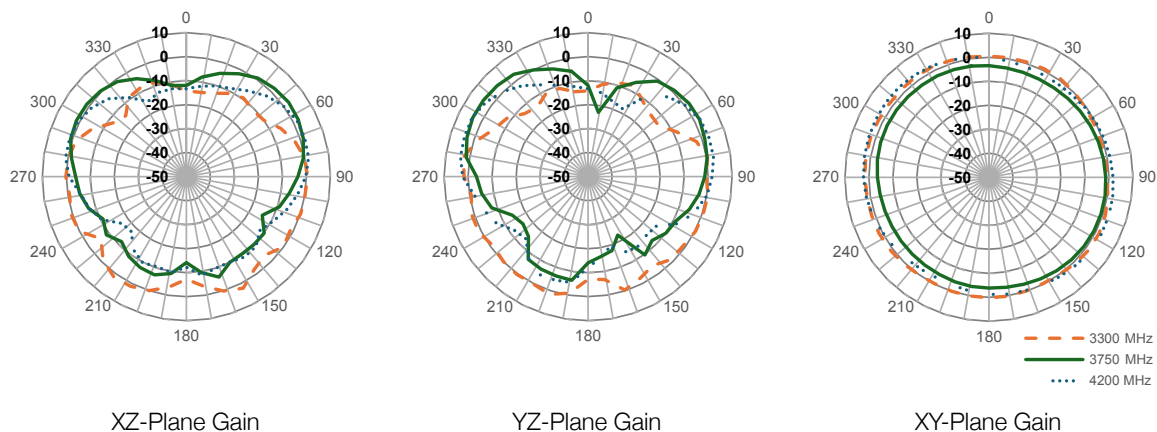


2480 MHz to 2690 MHz (2585 MHz)

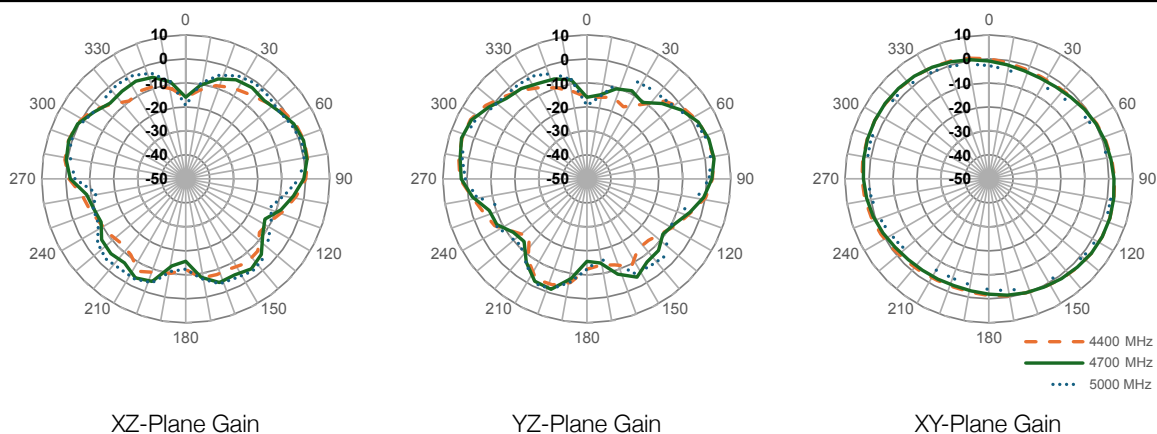


Radiation Patterns

3300 MHz to 4200 MHz (3750 MHz)



4400 MHz to 5000 MHz (4700 MHz)



5150 MHz to 5925 MHz (5540 MHz)

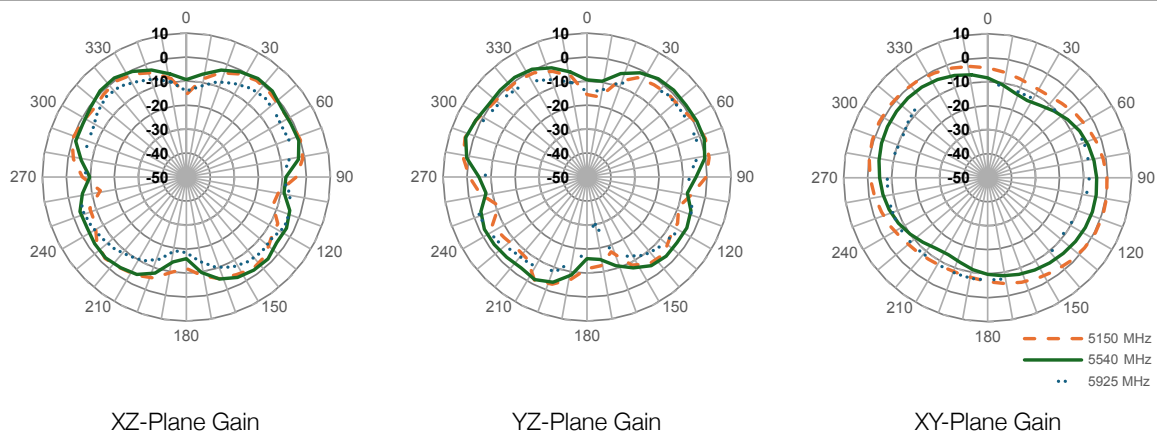
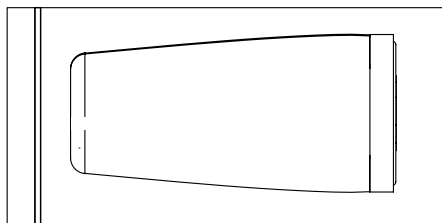


Figure 16. Radiation Patterns for AC85003 Antenna in Free Space

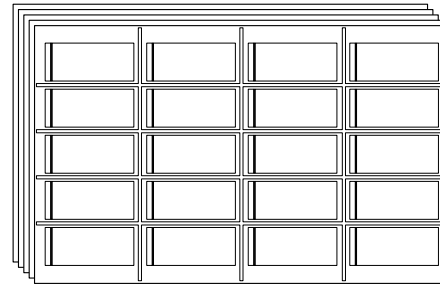
Packaging Information

The AC85003 antennas are individually packaged in a resealable polyethylene bag. Bagged antennas are placed in “honeycomb” divided pockets in a carton at 100 antennas per carton. 5 layers of 20 antennas per layer. Layers are separated by protective sheets. Carton dimensions are 590 mm x 290 mm x 270 mm, 23.2 in x 11.4 in x 10.6 in.

Table 1. Packing Materials and Specifications



Antenna in resealable bag



Antennas arranged in layers

Regional Environmental Regulation Compliance

Region	Regulation	Reference
United States	US EPA Toxic Substances Control Act amended December 2020 Declaration	TSCA Section 6(h)
United States	California Proposition 65 Safe Drinking Water & Toxic Enforcement Act of 1986 Declaration	HSC division 20 chapter 6.6
European Union	RoHS 3	EU 2015/863
European Union	EU REACH	EU 1907/2006
Worldwide	Responsible Minerals Initiatives	Dodd Frank act 1502; EU 2017/821
European Union	Persistent Organic Pollutants	(EU) 2019/1021
European Union	Packaging Directive	94/62/EC
European Union	PFOA Free	2006/122/ECOF

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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Series: Compact Dome Antenna

Patent Pending.

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