

AC81002 Cellular IoT (Cat-M1, NB-IoT) Embedded FPC Antenna

The AC81002 is a linearly polarized, flexible printed circuit (FPC) antenna that delivers robust, omnidirectional performance for cellular IoT applications including NB-IoT, Cat-M1/LTE-M, and 5G NR systems from 695 MHz to 6000 MHz. The flexibility and peel-and-stick adhesive backing make the AC81002 antenna easy to mount in unique and custom enclosures.

Connection is made to the radio via a 1.13 mm coaxial cable terminated in a U.FL-type plug connector. Various cable length options are available (See Ordering Information).



AC81002-100UF
Cellular FPC Antenna

Features

- Broadband (695 MHz to 6000 MHz) coverage
- Very high efficiency
- Ground plane independent
- I-shape form factor
- 115.5 mm x 20.5 mm x 0.25 mm
- Linear polarization for use in varying orientations
- MHF1/U.FL compatible plug termination

Applications

- Worldwide 5G/4G/3G/2G cellular
- Cellular IoT
 - 5G NR/RedCap
 - 4G LTE
 - Cat-M1/LTE-M
 - NB-IoT
- Smart Metering
- M2M and Smart Utility Infrastructure
- Asset Management
- Tracking Devices
- Vending Machines
- Gateways/Routers/CPEs

Ordering Information

Part Number	Description	Cable Length	Connector
AC81002-050UF	Cellular 695 MHz to 6000 MHz 116 mm x 21 mm FPC Antenna	50 mm (1.97 in)	MHF1/U.FL-type plug (male)
AC81002-100UF	Cellular 695 MHz to 6000 MHz 116 mm x 21 mm FPC Antenna	100 mm (3.94 in)	MHF1/U.FL-type plug (male)
AC81002-150UF	Cellular 695 MHz to 6000 MHz 116 mm x 21 mm FPC Antenna	150 mm (5.91 in)	MHF1/U.FL-type plug (male)
AC81002-200UF	Cellular 695 MHz to 6000 MHz 116 mm x 21 mm FPC Antenna	200 mm (7.87 in)	MHF1/U.FL-type plug (male)

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

RF/Electrical Specifications

AC81002	VSWR (max)	Peak Gain (dBi)	Average Gain (dBi)	Average Efficiency (%)
695 MHz to 960 MHz	2.6	4.5	-2.3	60
1425 MHz to 1675 MHz	2.5	6.3	-2.0	64
1695 MHz to 2200 MHz	2.5	5.5	-1.7	68
2300 MHz to 2400 MHz	1.9	5.1	-1.7	68
2480 MHz to 2690 MHz	1.8	4.4	-1.4	73
3300 MHz to 5000 MHz	1.9	6.1	-1.7	68
5150 MHz to 5925 MHz	2.5	4.6	-2.4	57

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

Electrical specifications and plots measured with the antenna mounted on a 2 mm (0.08 in) thick sheet of ABS plastic.

Mechanical Specifications

Part Number	AC81002-050UF	AC81002-100UF	AC81002-150UF	AC81002-200UF
Weight	0.9 g (0.03 oz)	1.0 g (0.04 oz)	1.1 g (0.04 oz)	1.2 g (0.04 oz)
Coaxial cable, minimum inside bend radius	1.13 mm: 5.0 mm (0.20 in)			
Connection	MHF1/U.FL-type plug (male)			
Dimensions	115.5 mm x 20.5 mm x 0.25 mm (4.55 in x 0.81 in x 0.01 in)			
Operating Temp. Range	-40 °C to +85 °C (-40 °F to 185 °F)			
Recommended Storage Conditions	16° C - 27° C and 40% to 60% relative humidity			

Antenna Mounting

The AC81002 antenna is a flexible, adhesive-backed antenna that allows it to be permanently installed onto non-metallic surfaces. The adhesive backing is 3M 467MP™, which provides outstanding adhesion to high surface energy plastics. The adhesive delivers excellent shear strength to resist slippage and edge lifting, but can be repositioned before the adhesive cures, allowing for accurate positioning. This adhesive is highly resistant to solvents, humidity and moisture, as well as heat up to 204 °C (400 °F) for short periods.

The antenna should never be bent to the point of creating a crease or allowing the angle of the bend to fall below 90 degrees (i.e. become acute) as this will impair function and may cause permanent damage.

Antenna Dimensions

The dimensions for the AC81002 are shown below in Figure 1.

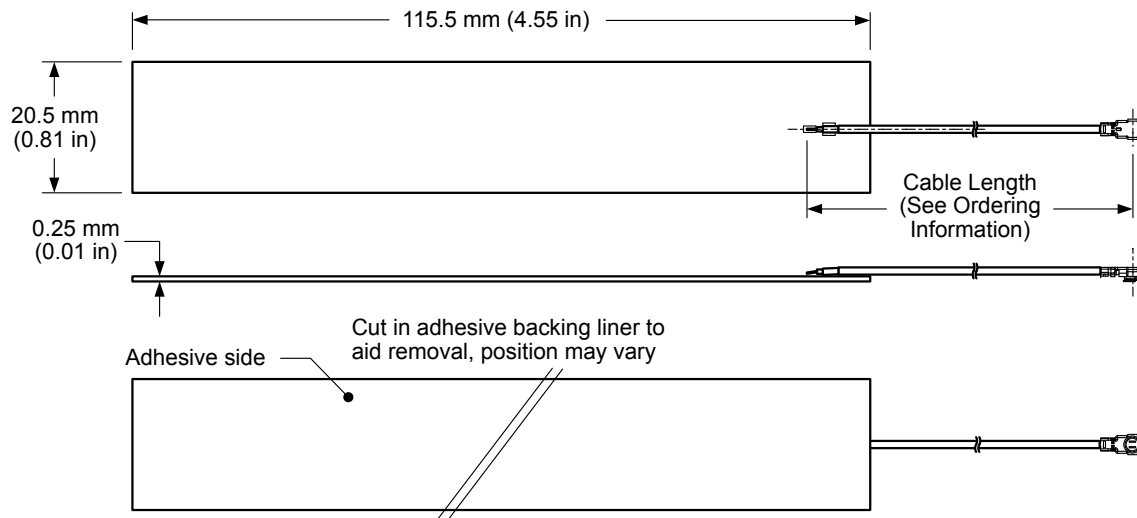


Figure 1. AC81002 Antenna Dimensions

VSWR

Figure 2 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.

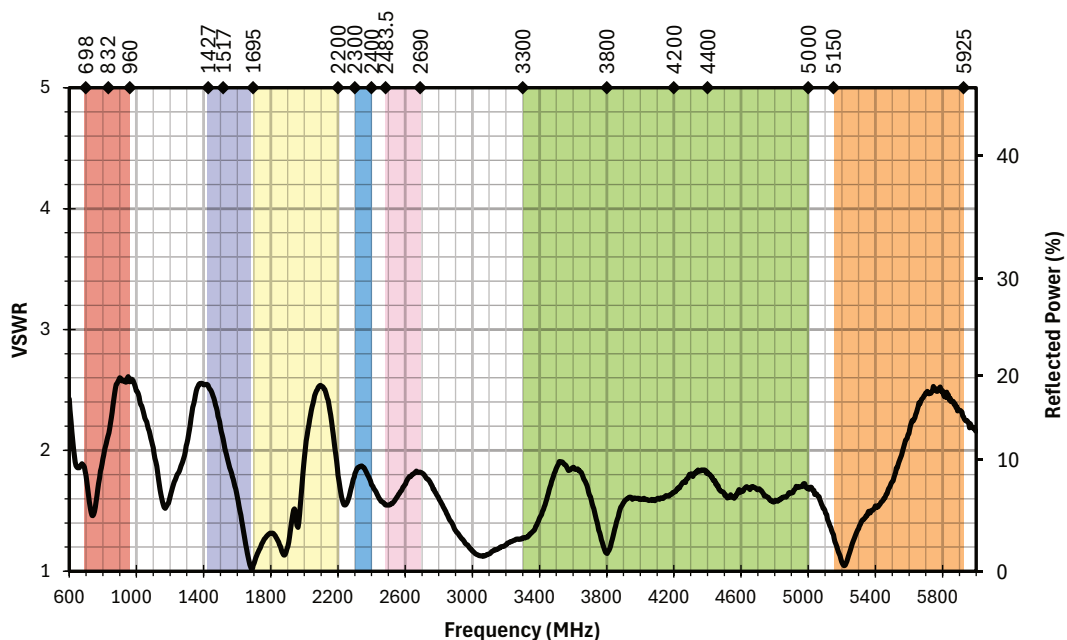


Figure 2. AC81002 Antenna VSWR

Return Loss

Return loss (Figure 3) 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.

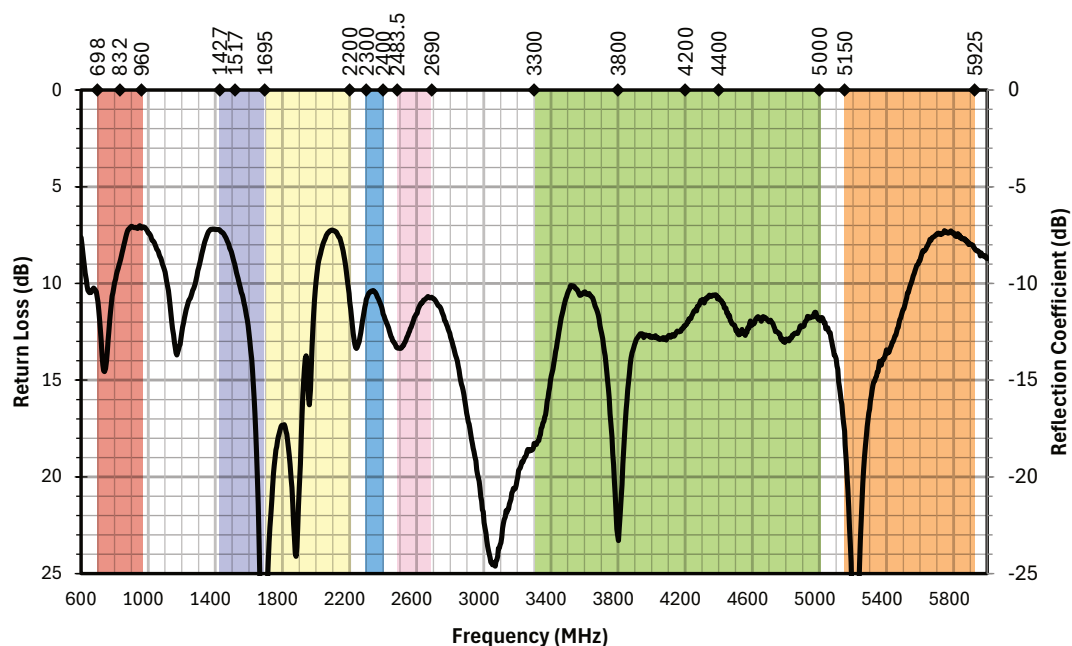


Figure 3. AC81002 Antenna Return Loss

Peak Gain

Peak gain (Figure 4) 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.

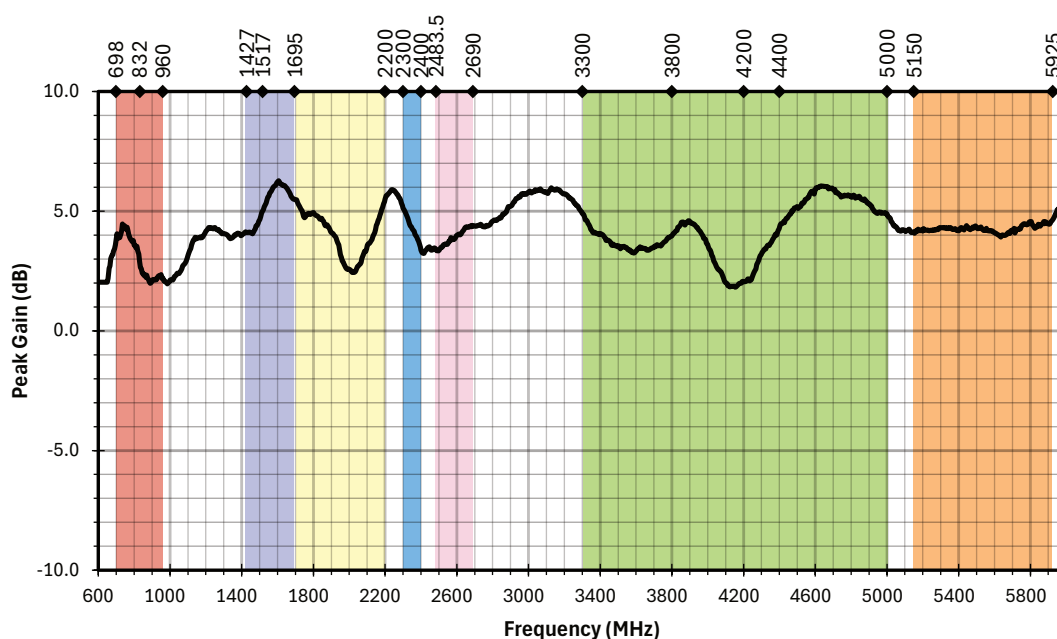


Figure 4. AC81002 Antenna Peak Gain

Average Gain

Average gain (Figure 5) is the average of all antenna gain in 3-dimensional space at each frequency, providing an indication of overall performance without expressing antenna directionality.

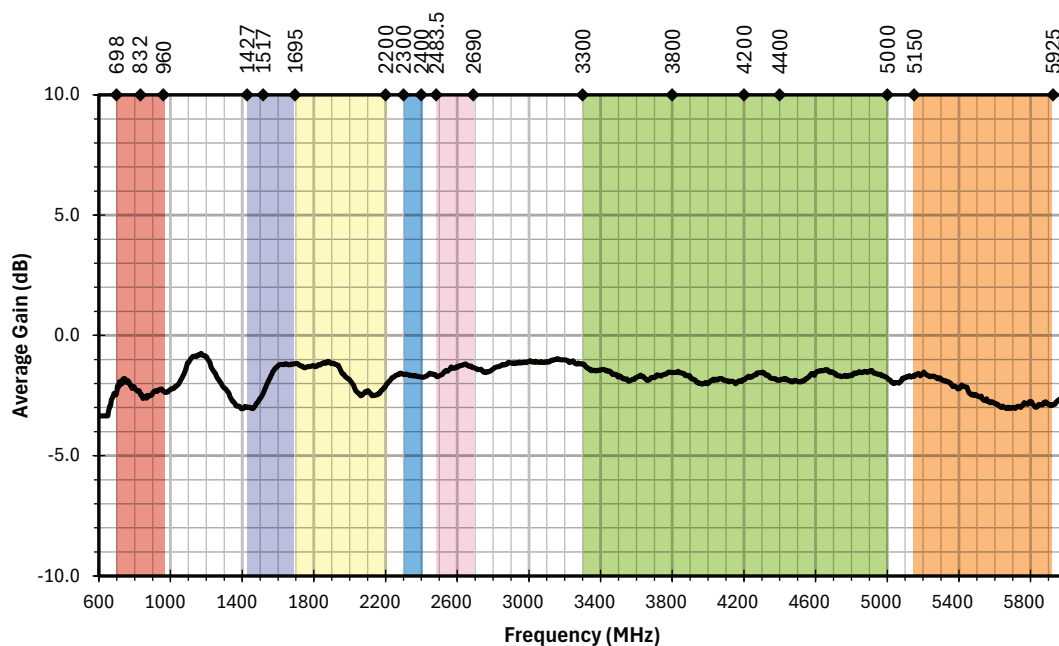


Figure 5. AC81002 Antenna Average Gain

Efficiency

Efficiency (Figure 6) 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.

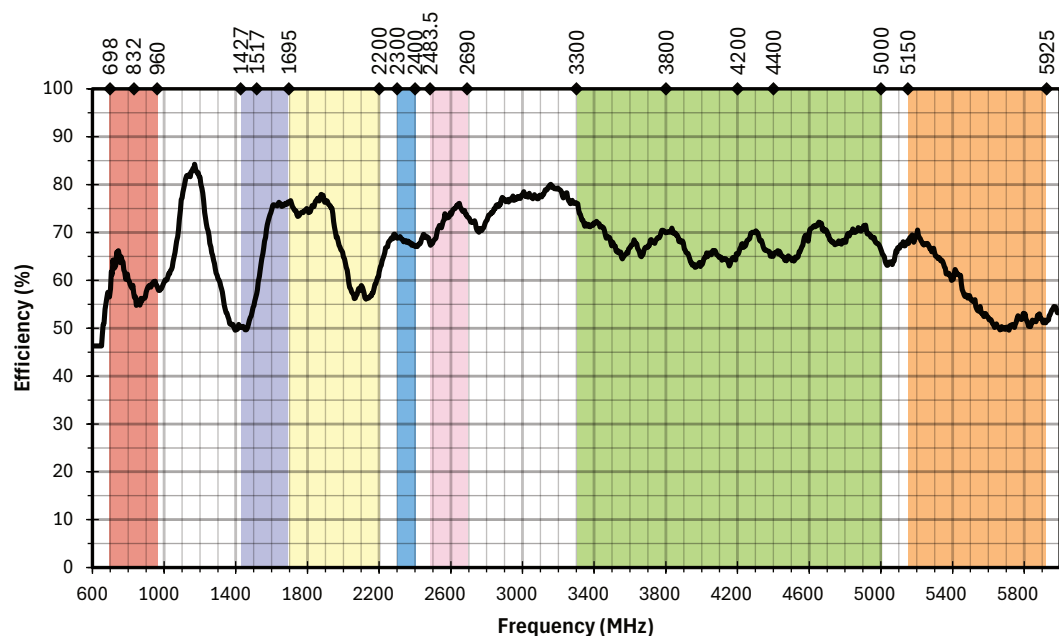
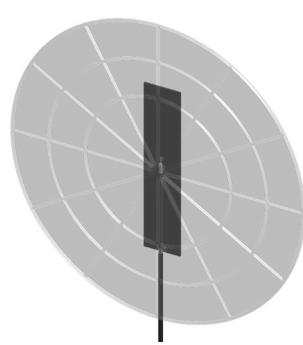


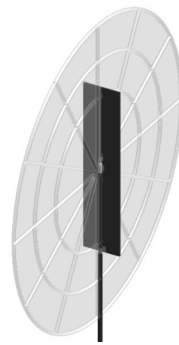
Figure 6. AC81002 Antenna Efficiency

Radiation Patterns

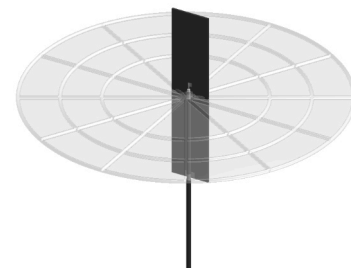
Radiation patterns provide information about the directional performance of the antenna by plotting gain in three orthogonal planes at the high-, low- and center-frequencies of an antenna frequency band. Antenna radiation patterns (Figure 7) are shown using polar plots covering 360 degrees with the plane 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

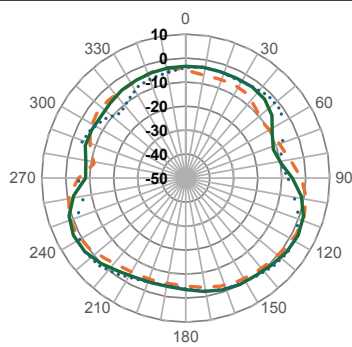


YZ-Plane Gain

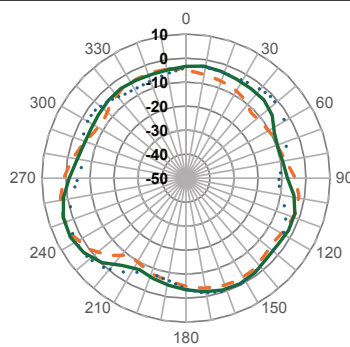


XY-Plane Gain

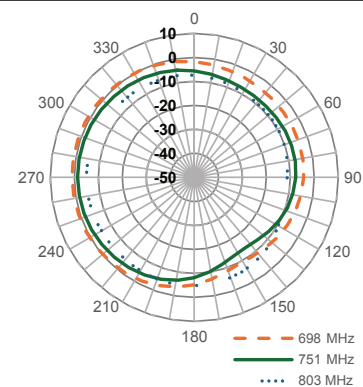
698 MHz to 803 MHz (751 MHz)



XZ-Plane Gain

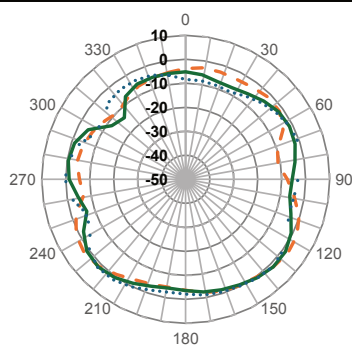


YZ-Plane Gain

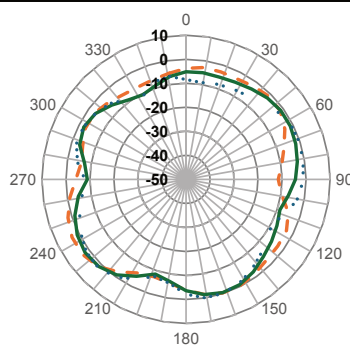


XY-Plane Gain

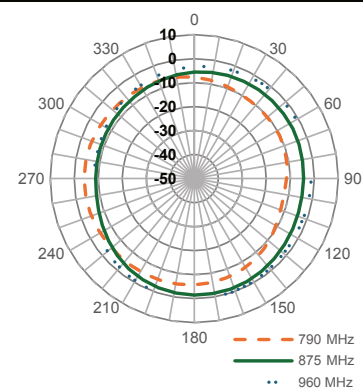
790 MHz to 960 MHz (875 MHz)



XZ-Plane Gain



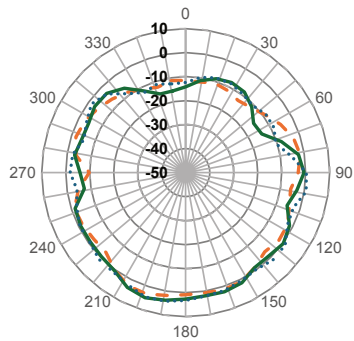
YZ-Plane Gain



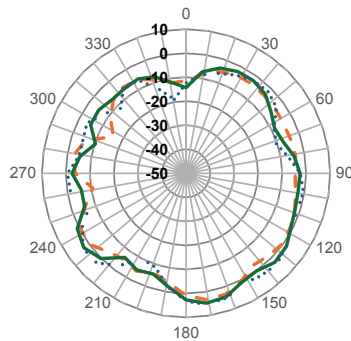
XY-Plane Gain

Radiation Patterns

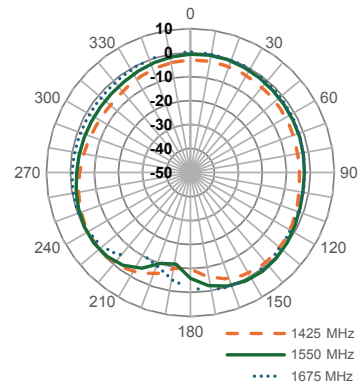
1425 MHz to 1675 MHz (1550 MHz)



XZ-Plane Gain

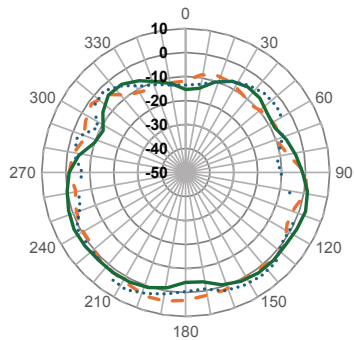


YZ-Plane Gain

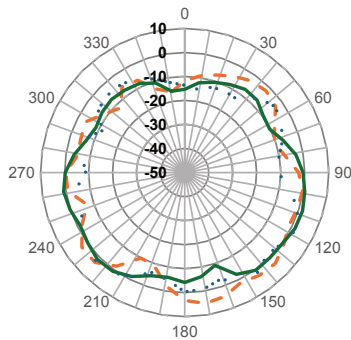


XY-Plane Gain

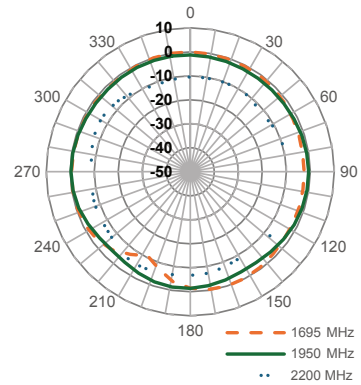
1695 MHz to 2200 MHz (1950 MHz)



XZ-Plane Gain

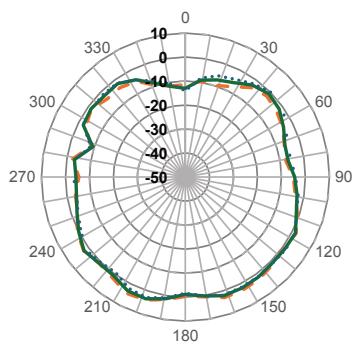


YZ-Plane Gain

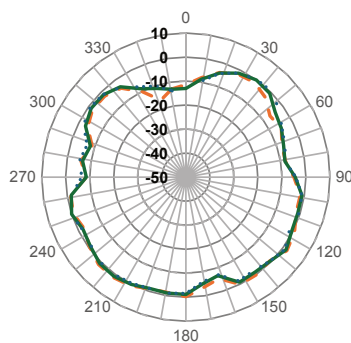


XY-Plane Gain

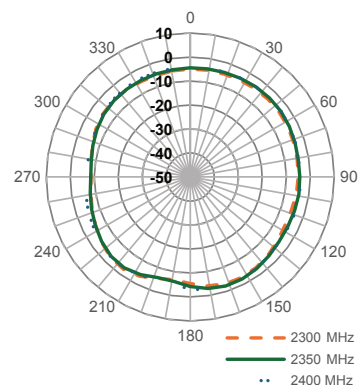
2300 MHz to 2400 MHz (2350 MHz)



XZ-Plane Gain



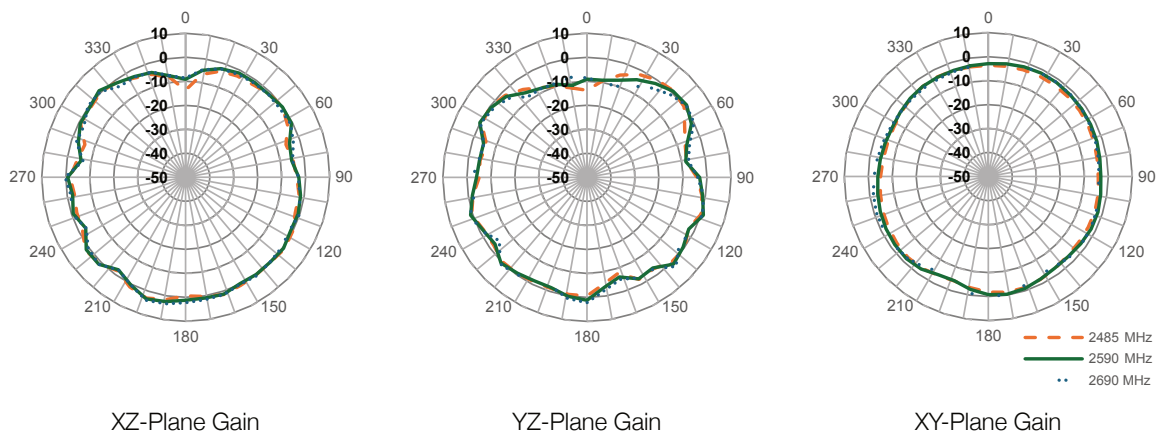
YZ-Plane Gain



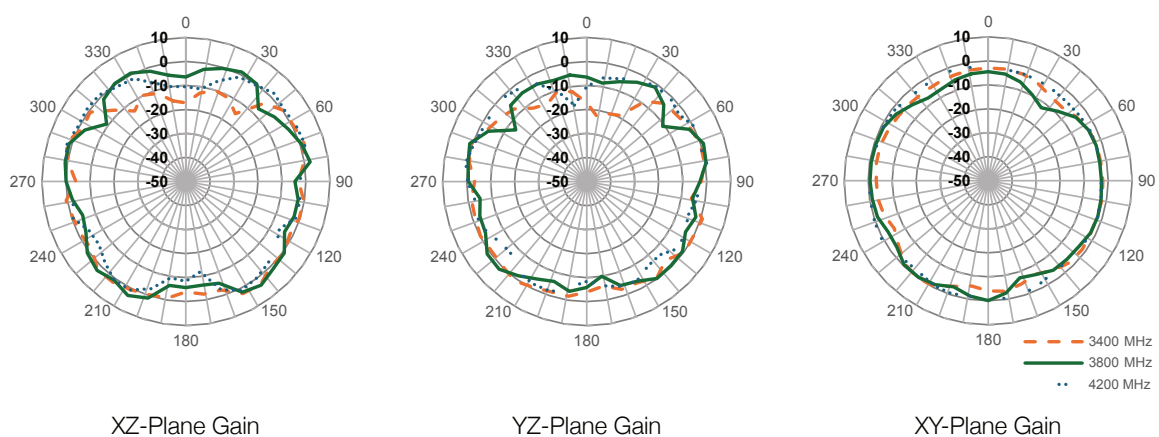
XY-Plane Gain

Radiation Patterns

2485 MHz to 2690 MHz (2590 MHz)



3400 MHz to 4200 MHz (3800 MHz)



4400 MHz to 5925 MHz (5165 MHz)

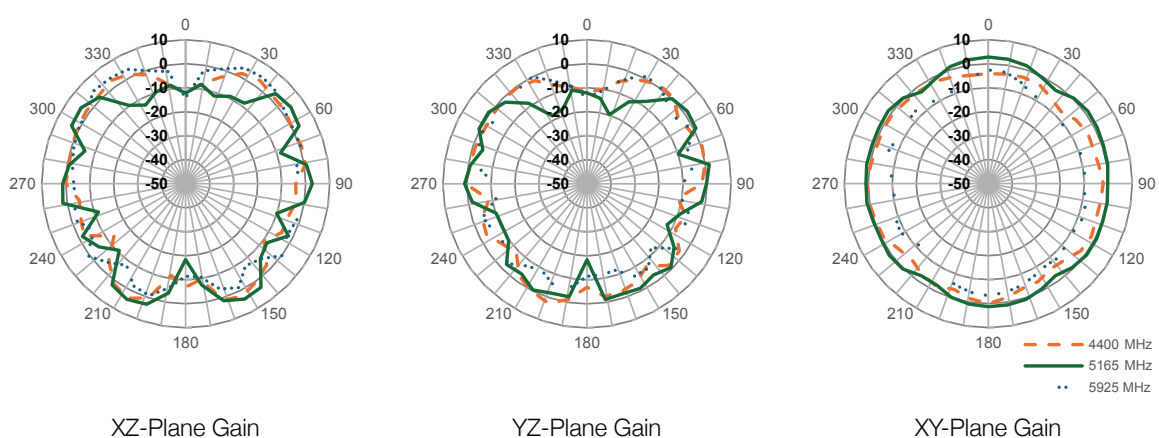


Figure 7. Radiation Patterns for the AC81002 Antenna

Packaging Information

The AC81002 antenna is individually packaged in a labeled polyethylene bag and then bulk packaged in a polyethylene bag in quantities of 50 pcs. Sealed bulk polyethylene bags are packed in cartons in quantities of 160 yielding 8000 pieces per carton. Carton dimensions are 340 mm x 340 mm x 200 mm (13.4 in x 13.4 in x 7.9 in).

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Series: FPC

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