



AC82100 5G/4G Wideband Cellular Chip Antenna

The Antenna Company AC82100 is a surface-mount monopole antenna for embedded cellular and cellular IoT (LTE-M/ Cat-M1 and NB-IoT) applications.

Covering cellular bands from 617 MHz to 6000 MHz, the AC82100 supports cellular applications in North America, Europe and worldwide.

It is available in tape and reel packaging and is designed for reflow-solder mounting directly to a printed circuit board for high-volume applications.



AC82100
5G/4G Wideband Cellular Chip Antenna

Features

- Full-spectrum cellular performance
 - 617 MHz to 6000 MHz bands
- 617 MHz to 698 MHz (Band 71) performance
 - VSWR: 2.7
 - Peak Gain: 1.7 dBi
 - Efficiency: 52%
- Excellent ground plane size resilience
- Compact package
 - 48.8 mm x 15.8 mm x 3.0 mm
- Reflow- or hand-solder assembly

Applications

- Wideband cellular
 - RedCap devices (industrial IoT, wearables)
 - eRedCap ultra-low-power devices
- Cellular IoT
 - LTE-M (Cat-M1) and NB-IoT
- Long-range smart meters
- Smart utility infrastructure
- Asset management
- Tracking devices
- Vending machines
- Internet of Things (IoT) devices

Ordering Information

Part Number	Description
AC82100	617-6000 MHz Cellular Chip Antenna
AC93100	AC82100 Evaluation Board with SMA Jack connector

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

RF/Electrical Specifications

Frequency Range (MHz)	VSWR (max)	Peak Gain (dBi)	Average Gain (dBi)	Efficiency (%)
615 to 700	3.4	0.3	-3.5	47
695 to 805	4.2	1.2	-2.9	51
790 to 960	3.6	1.7	-1.7	69
1425 to 1675	9.3	2.2	-6.8	31
1695 to 2200	2.5	3.7	-3.8	67
2300 to 2400	2.1	5.1	-3.9	66
2480 to 2690	2.1	6.4	-3.1	76
3400 to 4200	2.8	5.8	-4.1	65
4400 to 5925	4.1	4.9	-4.1	57

Impedance	50 Ω
Polarization	Linear
Radiation Pattern	Omnidirectional
Max Power	5 W

Electrical specifications and plots measured with the antenna mounted on a 49.6 mm x 130 mm ground evaluation board.

Mechanical Specifications

Parameter	Value
Connection	Surface Mount
Operating Temp. Range	-40 °C to +85 °C (-40 °F to 185 °F)
Weight	3 g (0.11 oz)
Dimensions	48.8 mm x 15.8 mm x 3.0 mm (1.92 in x 0.62 in x 0.12 in)

Antenna Dimensions

The dimensions for the AC82100 are shown below in Figure 1.

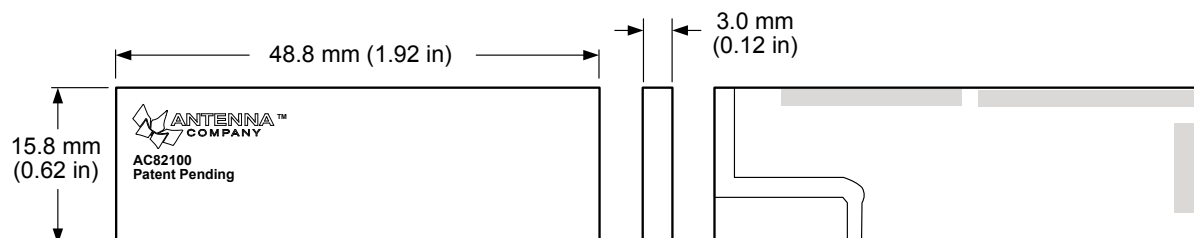


Figure 1. AC82100 Antenna Dimensions

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.

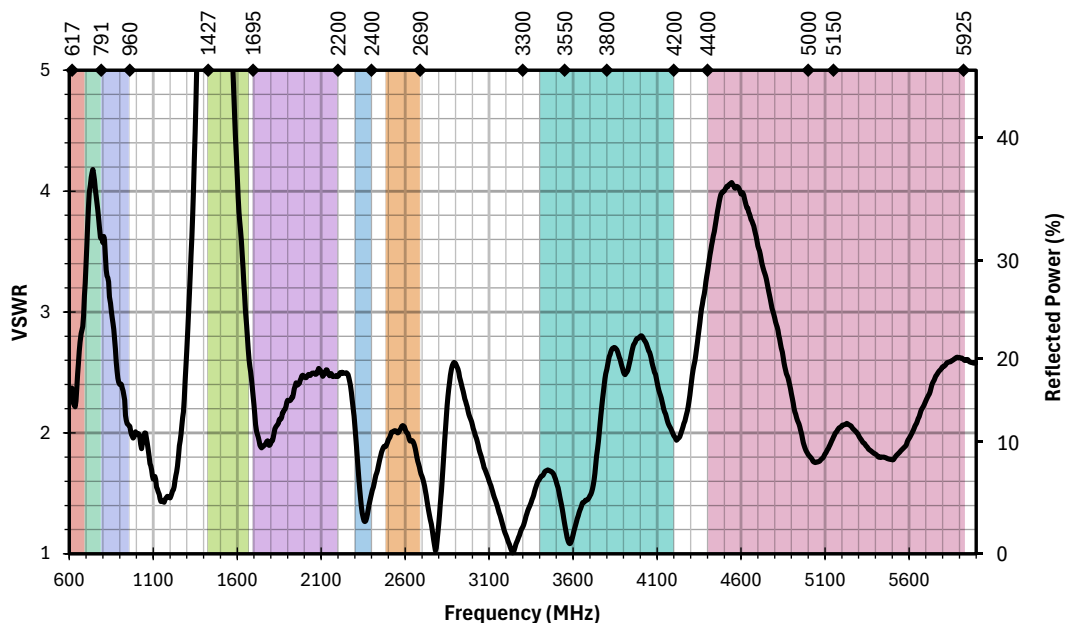


Figure 2. AC82100 Antenna VSWR with Frequency Band Highlights

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.

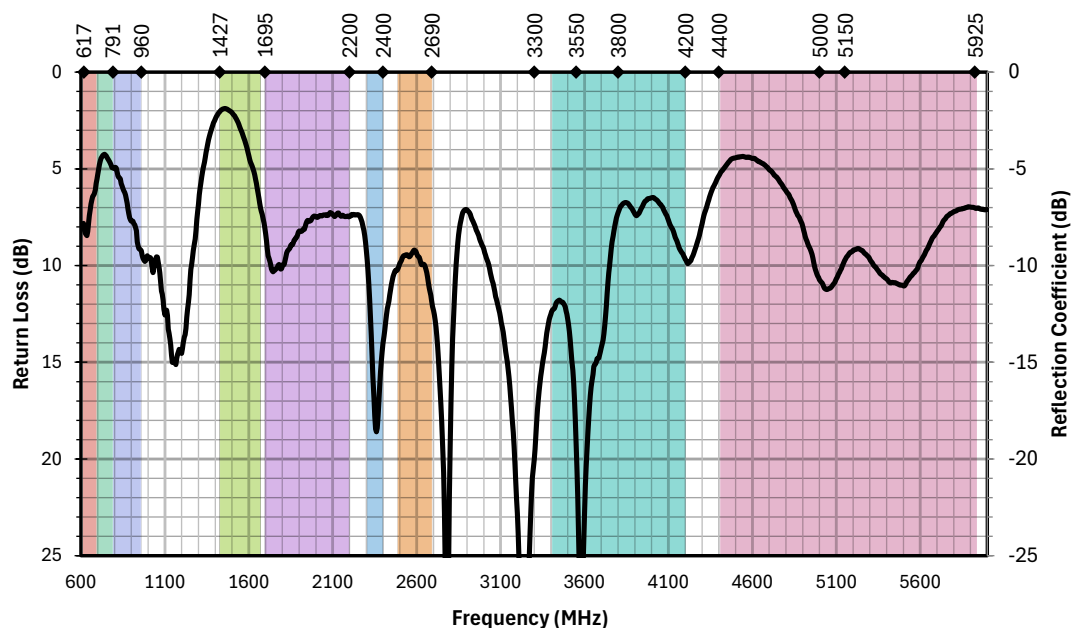


Figure 3. AC82100 Antenna Return Loss with Frequency Band Highlights

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.

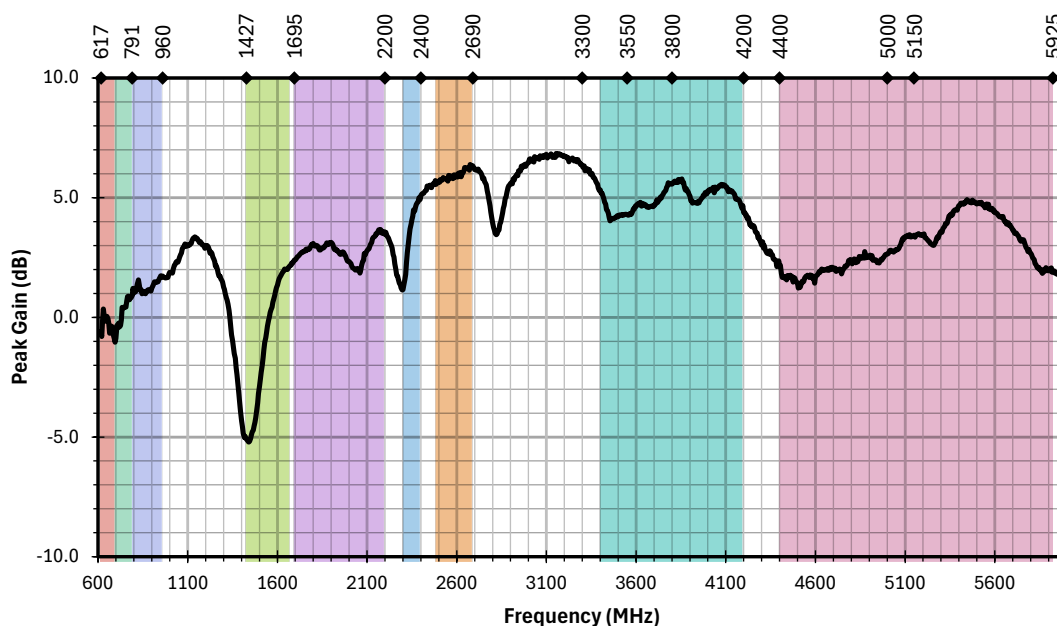


Figure 4. AC82100 Antenna Peak Gain with Frequency Band Highlights

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.

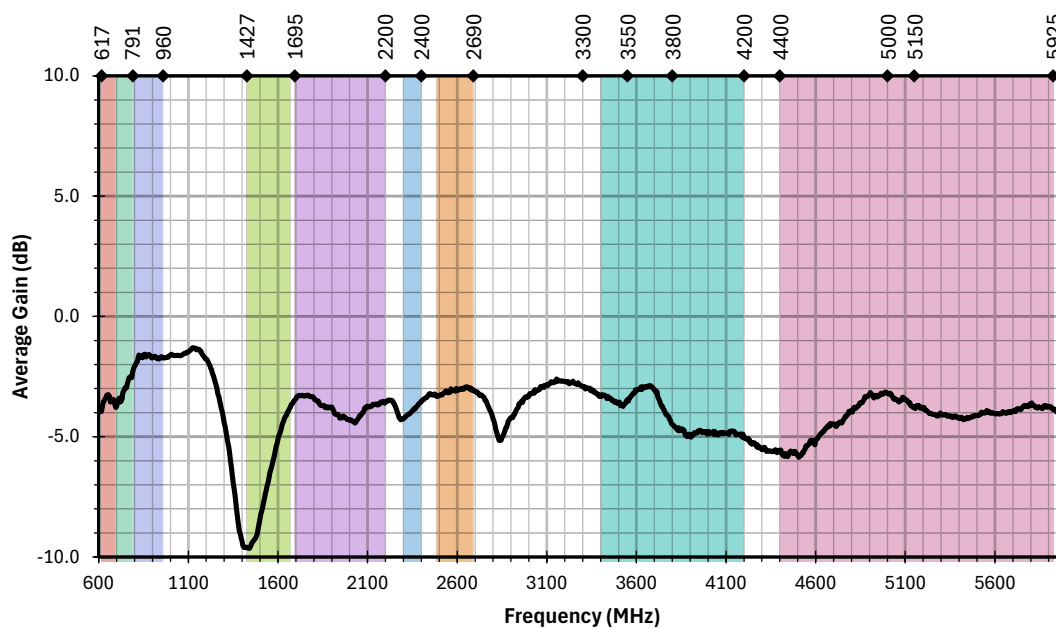


Figure 5. AC82100 Antenna Average Gain with Frequency Band Highlights

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.

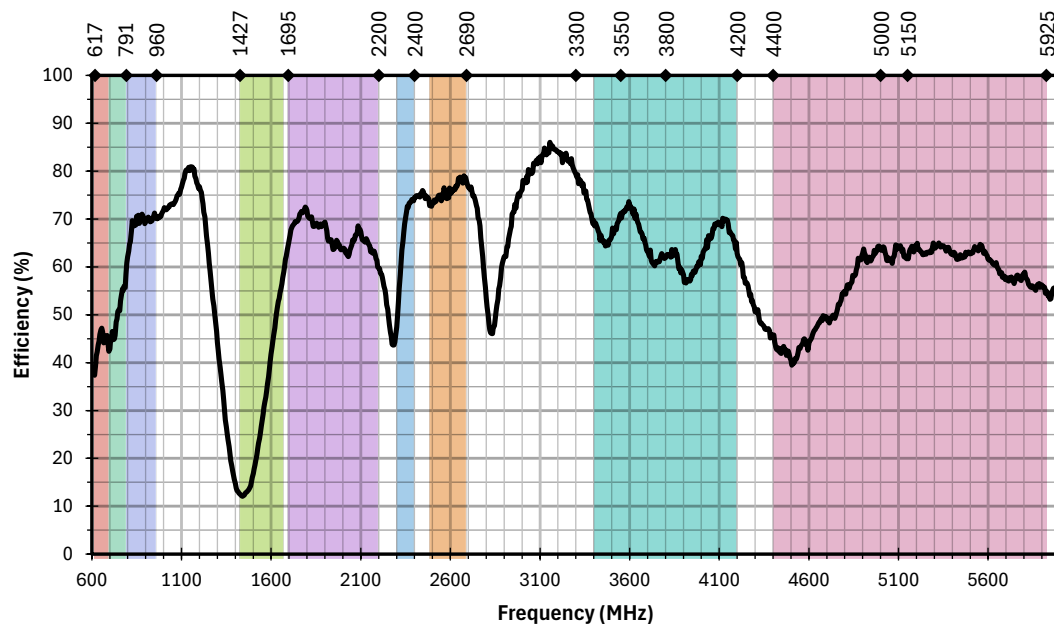
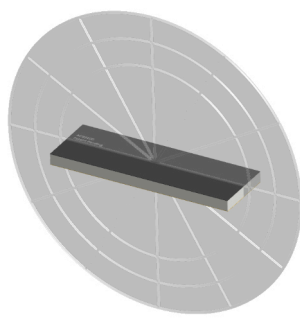


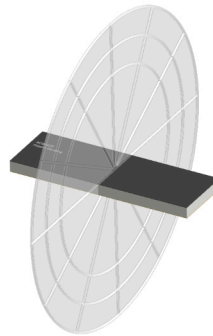
Figure 6. AC82100 Antenna Efficiency with Frequency Band Highlights

Radiation Patterns

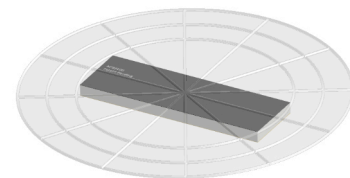
Radiation patterns provide information about the directional performance of the antenna by plotting gain in three orthogonal planes at the high-, low- and center-frequencies of an antenna frequency band. Antenna radiation patterns (Figure 7) are shown using polar plots covering 360 degrees with the plane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

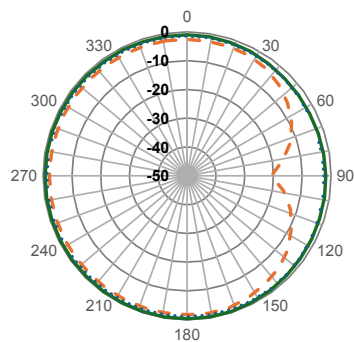


YZ-Plane Gain

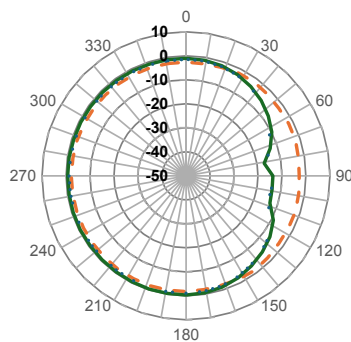


XY-Plane Gain

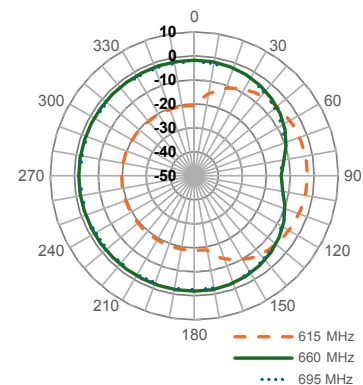
615 MHz to 695 MHz (660 MHz)



XZ-Plane Gain

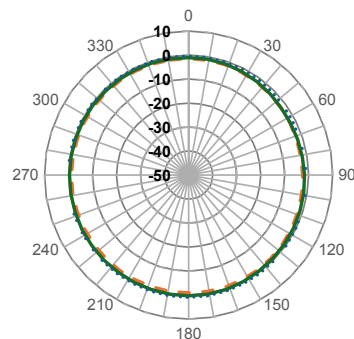


YZ-Plane Gain

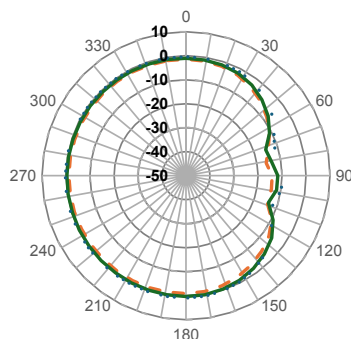


XY-Plane Gain

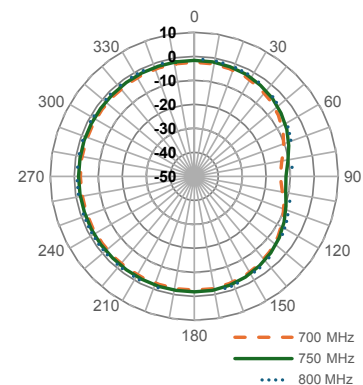
700 MHz to 800 MHz (750 MHz)



XZ-Plane Gain



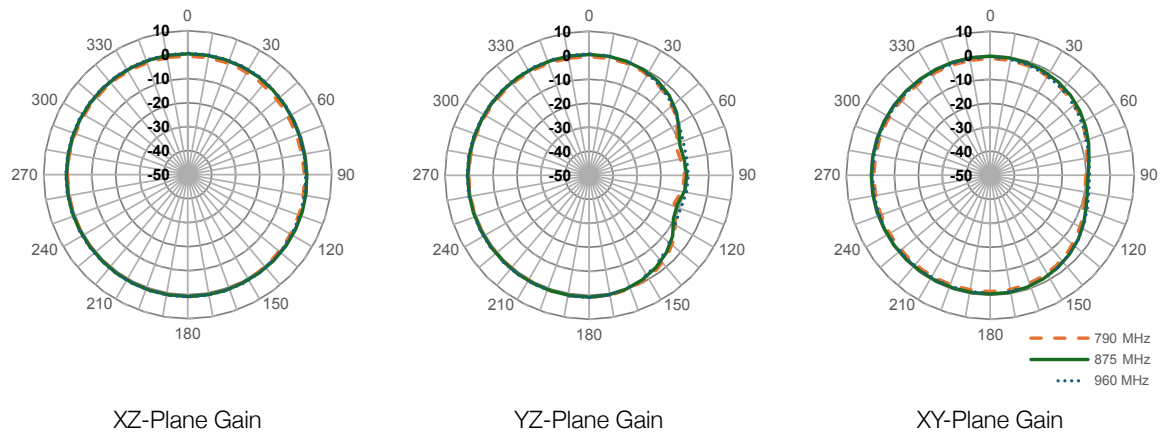
YZ-Plane Gain



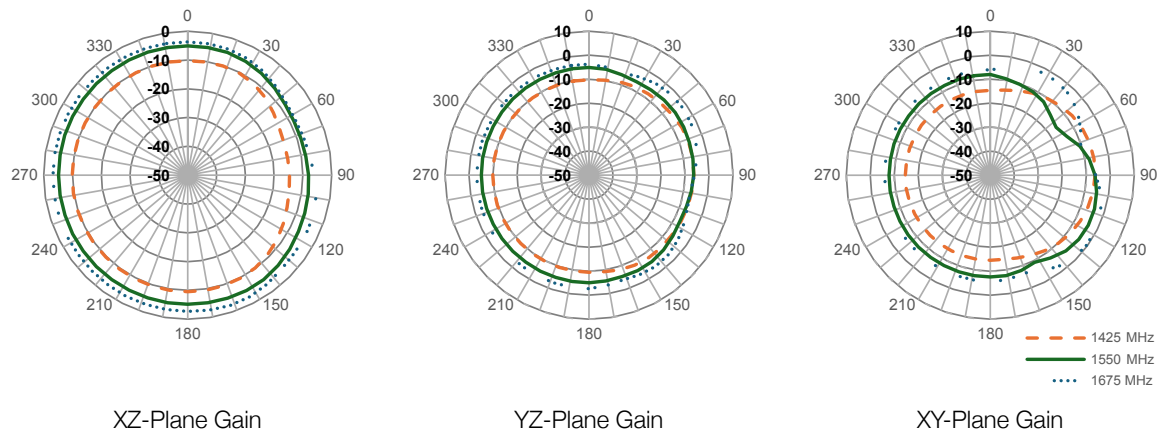
XY-Plane Gain

Radiation Patterns

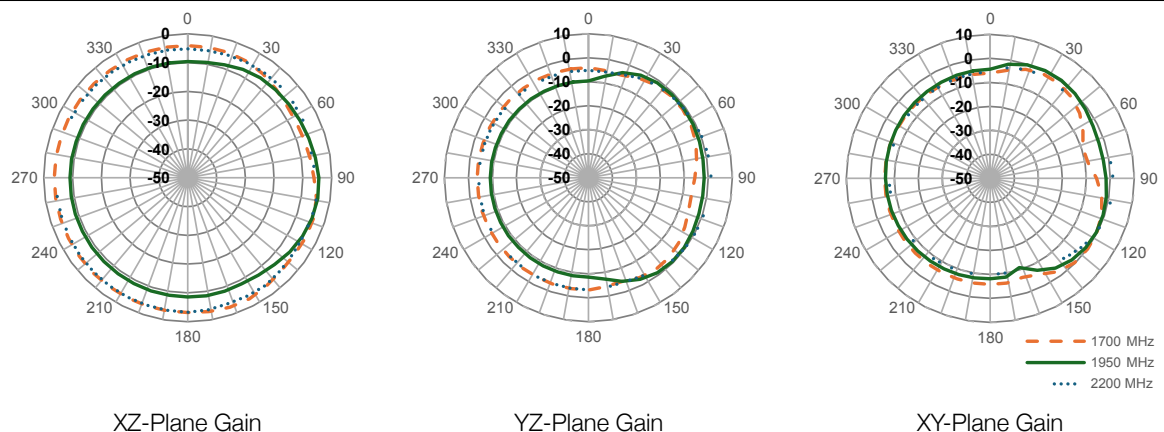
790 MHz to 960 MHz (875 MHz)



1425 MHz to 1675 MHz (1550 MHz)

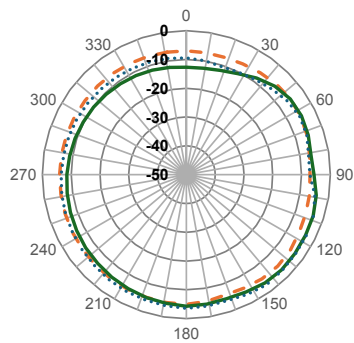


1700 MHz to 2200 MHz (1950 MHz)

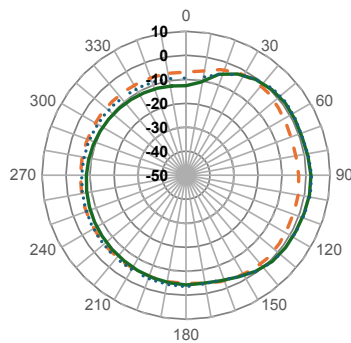


Radiation Patterns

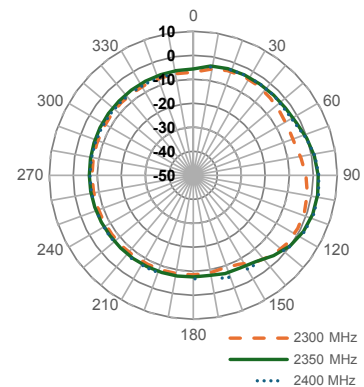
2300 MHz to 2400 MHz (2350 MHz)



XZ-Plane Gain

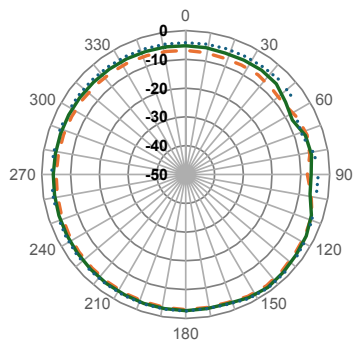


YZ-Plane Gain

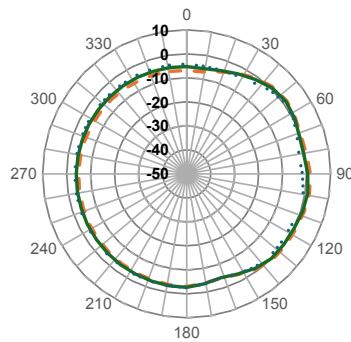


XY-Plane Gain

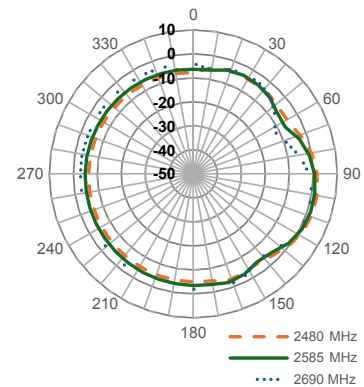
2480 MHz to 2690 MHz (2585 MHz)



XZ-Plane Gain

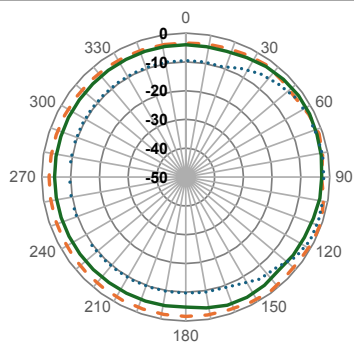


YZ-Plane Gain

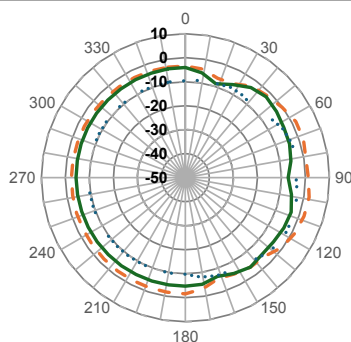


XY-Plane Gain

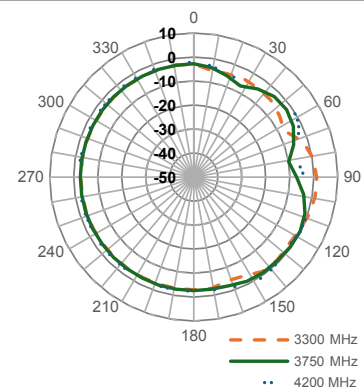
3300 MHz to 4200 MHz (3750 MHz)



XZ-Plane Gain



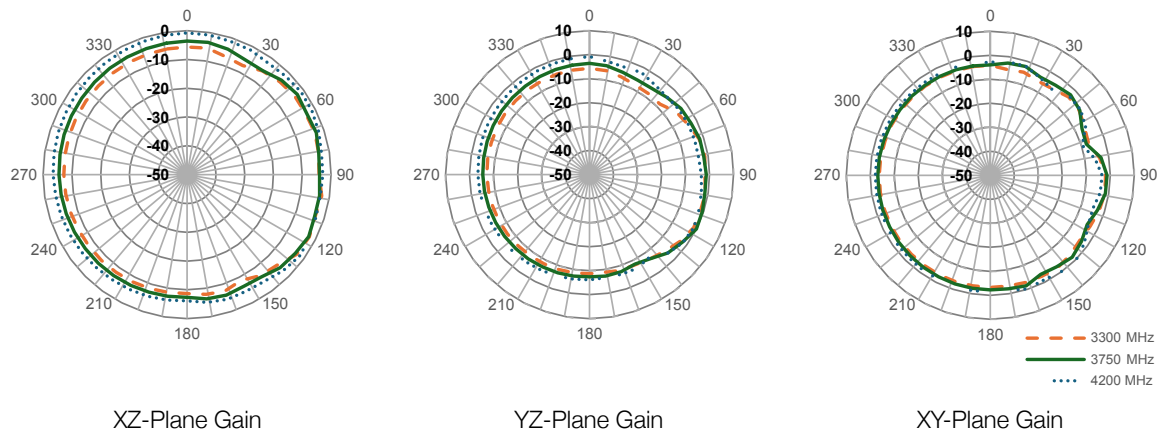
YZ-Plane Gain



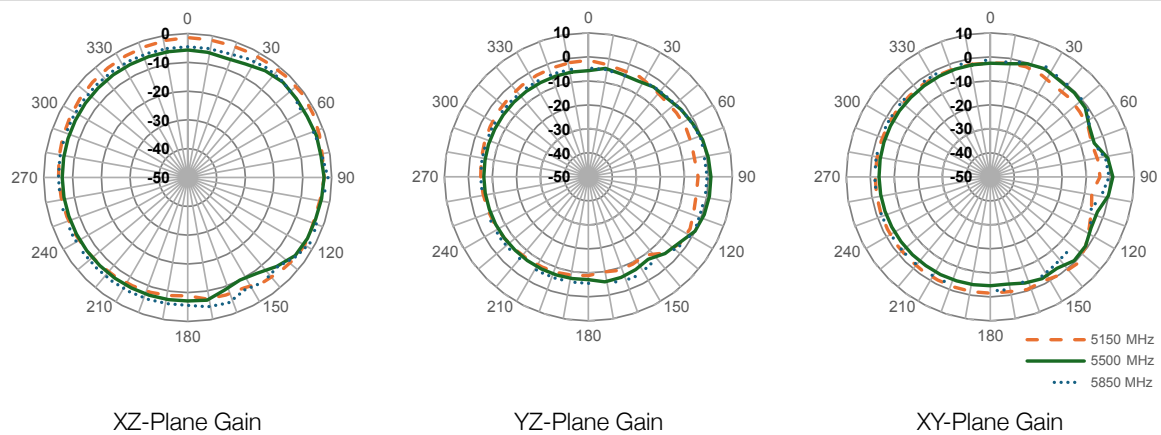
XY-Plane Gain

Radiation Patterns

3300 MHz to 4200 MHz (3750 MHz)



5150 MHz to 5850 MHz (5500 MHz)



5925 MHz to 7125 MHz (6525 MHz)

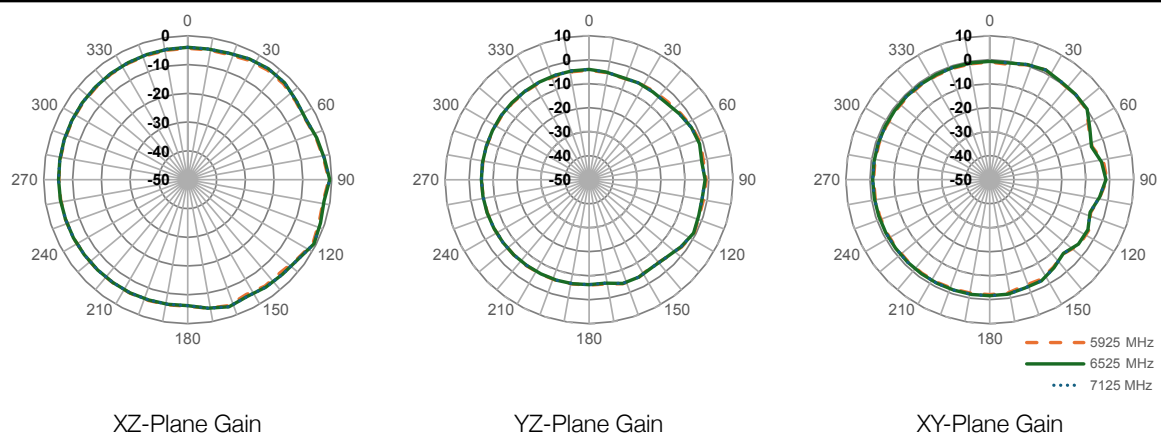


Figure 7. Radiation Patterns for AC82100 Antenna

Recommended Layout

The recommended printed circuit board (PCB) layout for the AC82100 is shown in Figure 8. This layout is used for the AC82100 evaluation board (p/n AC93100) which is available for purchase as listed under Ordering Information. The recommended layout includes a PCB transmission line (Feedline) from the antenna through a Pi-filter matching network (Figure 9) to the RF front end, two mechanical connections, and two RF feeds which are part of the RF element feeding through to the bottom side of the PCB. The layout also requires a ground plane adjacent to the antenna, with a recommended keep out area. The signal definitions for the AC82100 antenna are provided in Table 1.

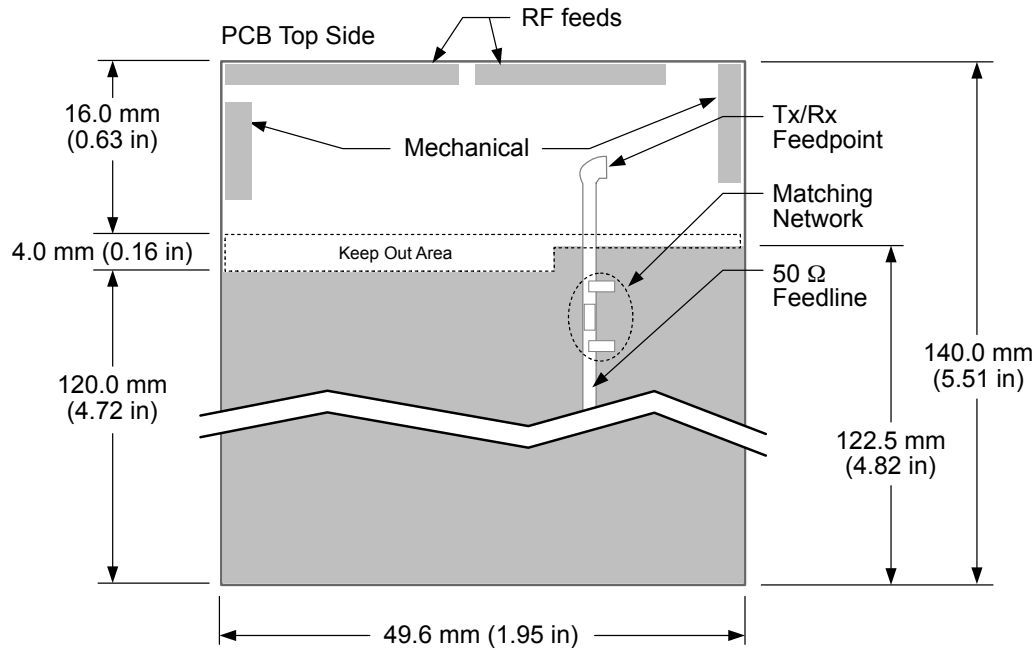


Figure 8. AC82100 Recommended Layout

Table 1. Signal Definitions for the AC82100 Antenna

Connection	Description
Tx/Rx Feedpoint	Signal feedpoint for Rx/Tx to system
RF Feeds	Solder for internal RF connection
Mechanical	Solder for mechanical attachment of the antenna

Note: No solder connection to GND

Pi Filter Matching Network

Pi filter surface mount components should be 0603 size. 0402 size components are also supported. The components in Table 2 are recommended to optimize performance on the recommended layout, but adjusting matching components may improve end-product antenna performance depending on the effects of the enclosure, PCB and other electronic components. If no matching is necessary, the series element (x2) may be populated with a zero-ohm resistor and no components in the other two positions.

Table 2. Recommended Components

Component	Value
x1	n/a
x2	4.0 pF +/- 0.1 pF capacitor
x3	13 nH +/- 2% inductor

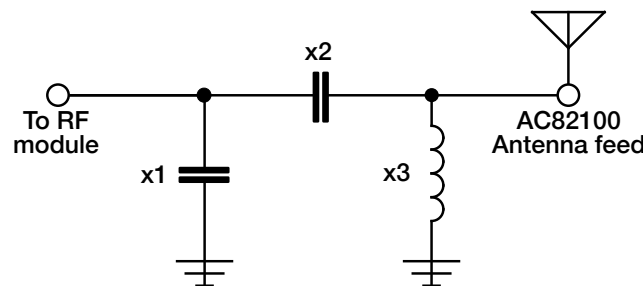


Figure 9. Recommended Pi Matching Network

Ground Plane Recommendations

The AC82100 is a 1/4-wave monopole antenna, and requires a ground plane on the PCB to which it is mounted. The Antenna Company recommends a minimum 49.6 mm x 110 mm or larger ground plane. The AC82100 should be mounted at the top edge of the board with a 4.0 mm keep out area between the antenna and the edge of the ground plane (see Figure 8 see layout drawing), and none of the ground plane should be underneath the antenna. If the ground plane is placed too close to the antenna it may impair antenna function rather than promote it. Other ground plane sizes and antenna mounting locations are possible. The AC93100 evaluation board has a 110 mm ground plane which was used for the performance standard in this datasheet. Expanded performance data for different ground plane sizes is provided later in this datasheet.

Transmission line for Embedded Antennas

For most designs, The Antenna Company recommends a microstrip transmission line for the AC82100. A microstrip transmission line is a controlled PCB trace that runs over the ground plane to maintain the 50 Ohm characteristic impedance for optimal signal transfer between the antenna and RF front end. Important practices to apply when designing a transmission line are:

- Minimize transmission line length for best signal performance.
- Use RF components that maintain a 50 Ω impedance.
- For designs subject to significant electromagnetic interference, a coplanar waveguide transmission line may be used on the PCB.

Reflow Solder Profile

The recommended reflow profile is presented according to information in Figure 10 And Table 3.

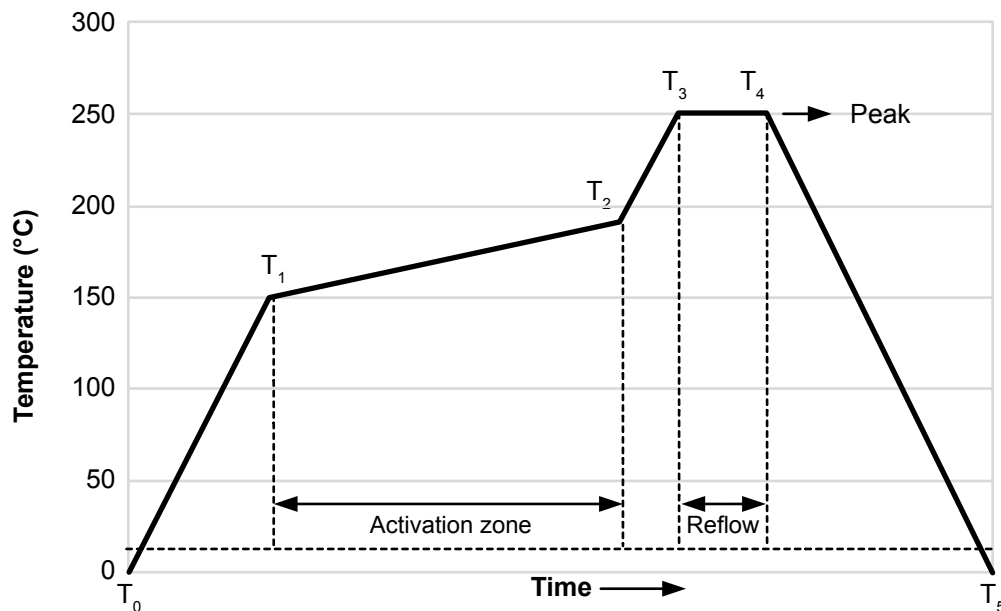


Figure 10. Suggested Solder Reflow Profile

Table 3. Reflow Temperature Table

Time Index	Reflow Phase	Temperature Range	Time
T0 - T1	Heating Zone	0 to 150 °C	Controlled 1 °C~3 °C/sec
T1 - T2	Activation Zone	150 to 190 °C	60 s to 120 s
T3 - T4	Reflow	220 to 250 °C (peak)	Above 45 s
T4 - T5	Cooling Zone	Cool down	Controlled~4 °C/sec

Packaging

The AC82100 is packaged as tape and reel. Figure 11 shows the layout of the tape. Dimensions are provided in Table 4. The specifications for the reel are shown in Figure 12 and Table 5.

Each reel is placed in a vacuum-sealed electro-static (ESD) bag with dessicant packs inside. 3 sealed, bagged reels are placed in a carton 330 mm x 330 mm x 100 mm. (13.0 in x 13.0 in x 3.94 in) for a total of 2,160 antennas per carton.

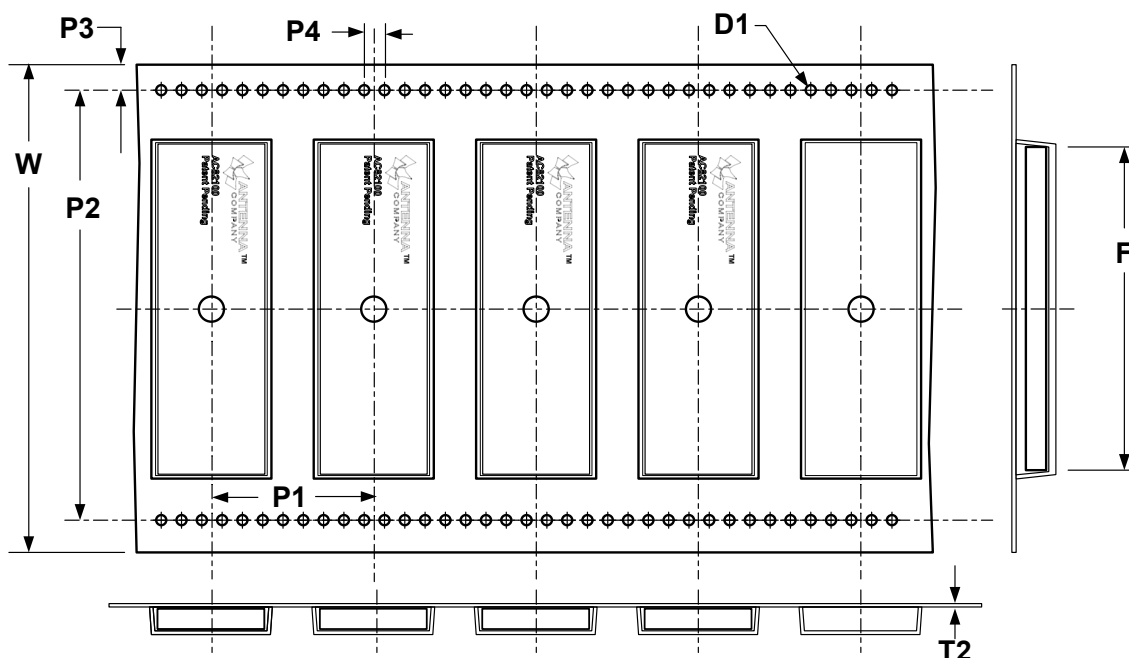


Figure 11. Tape Layout for the AC82100 Packaging

Table 4. Dimension Chart for the AC82100 Tape Packaging

Tape Dimensions		
Symbol	Dimension (mm)	Tolerance
D1	Diameter 1.5	± 0.1
F	49.19	Reference
P1	24.0	± 0.2
P2	68.4	± 0.2
P3	1.75	Reference
P4	4.0	± 0.2
T2	0.4	± 0.1
W	72	± 0.3

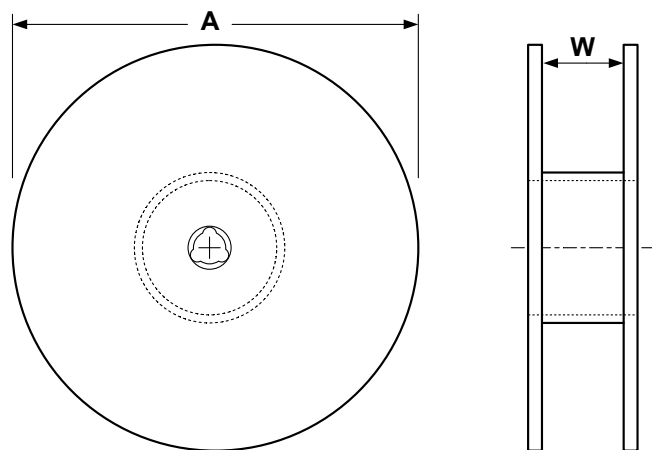


Figure 12. Reel Specifications for the AC82100 Antenna

Table 5. Reel Dimensions for the AC82100 Antenna Packaging

Reel Dimensions		
Symbol	AC82100	Unit
Qty per reel	720	Pcs
Tape width	72	mm
A	330	mm
W	76	mm

Multiple Comparative Ground Plane Length Data

The charts on the following pages represent the performance of the AC82100 antenna when mounted to evaluation boards with various lengths of ground planes ranging in length from 70 mm to 140 mm.

Table 6. Ground Plane Dataset Color Chart

Dataset Colors	Ground Plane Width	Ground Plane Length
Violet	50 mm	140 mm
Indigo	50 mm	130 mm
Blue	50 mm	120 mm
Green	50 mm	110 mm
Yellow	50 mm	100 mm
Orange	50 mm	90 mm
Red	50 mm	80 mm
Pink	50 mm	70 mm

VSWR

Figure 13 shows the voltage standing wave ratio for all of the ground plane lengths shown in Table 6.

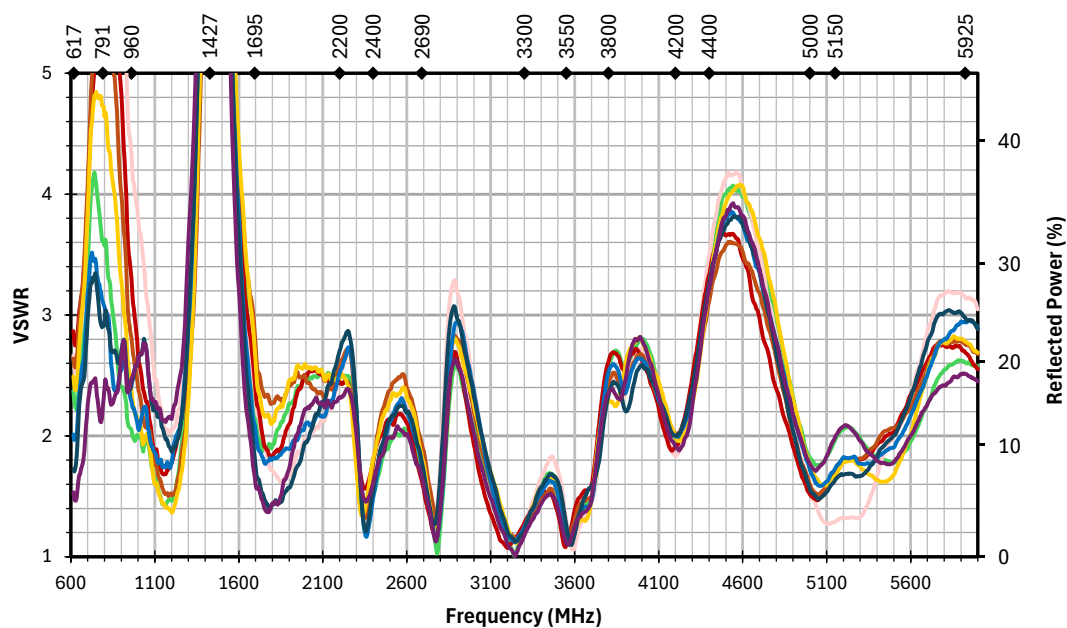


Figure 13. AC82100 Antenna VSWR on Various Ground Plane Sizes

Return Loss

Figure 14 shows the return loss for all of the ground plane lengths shown in Table 6.

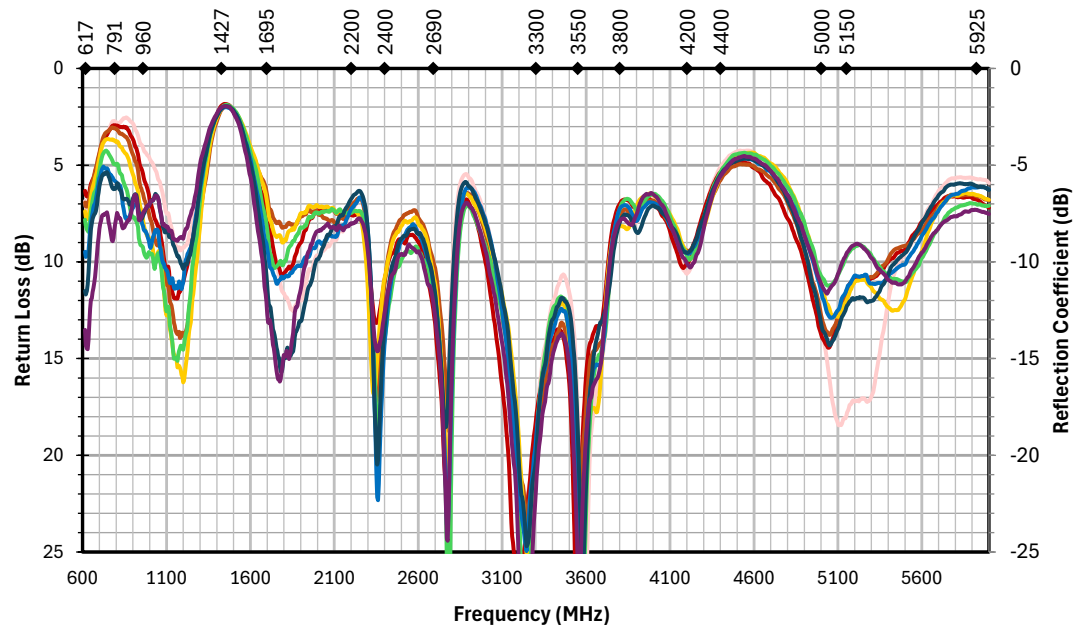


Figure 14. Antenna Return Loss on Various Ground Plane Sizes

Peak Gain

Figure 15 shows the peak gain for all of the ground plane lengths shown in Table 6.

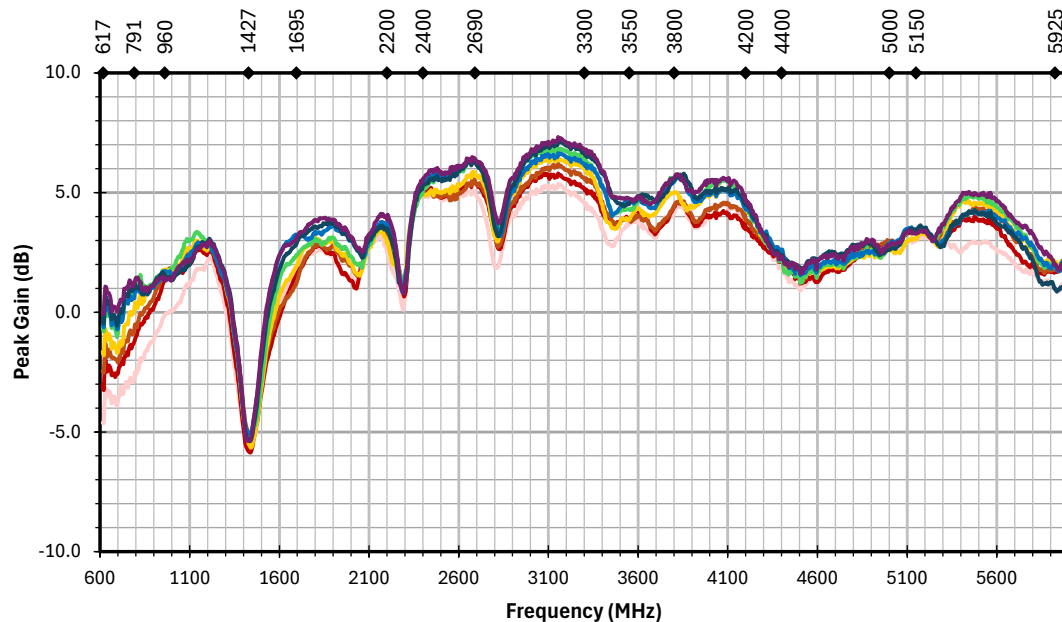


Figure 15. AC82100 Antenna Peak Gain on Various Ground Plane Sizes

Average Gain

Figure 16 shows the average gain for all of the ground plane lengths shown in Table 6.

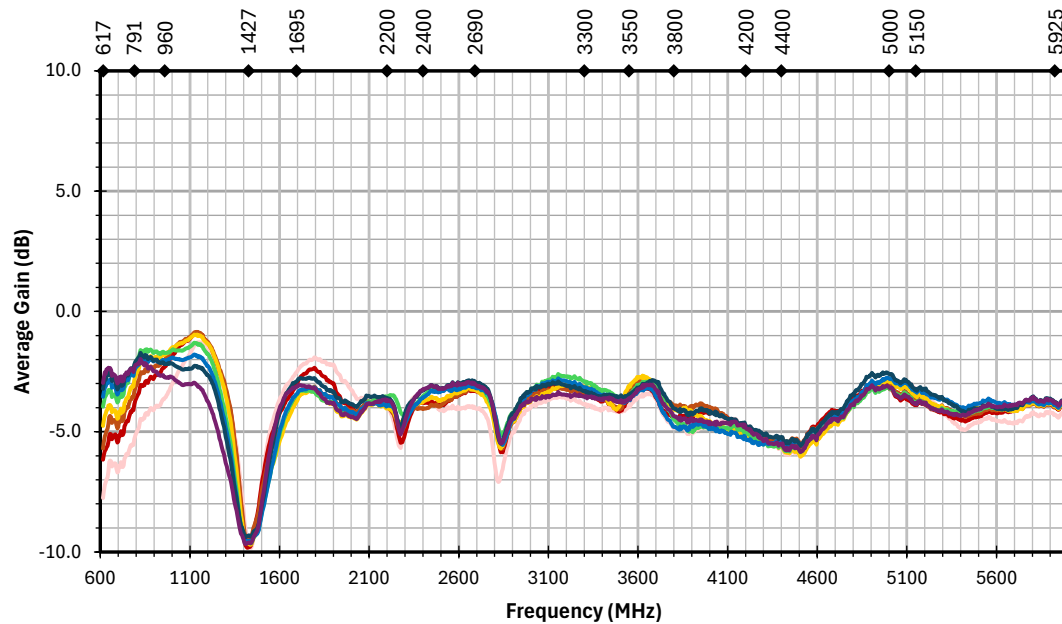


Figure 16. Antenna Average Gain on Various Ground Plane Sizes

Efficiency

Figure 17 shows the antenna efficiency for all of the ground plane lengths shown in Table 6.

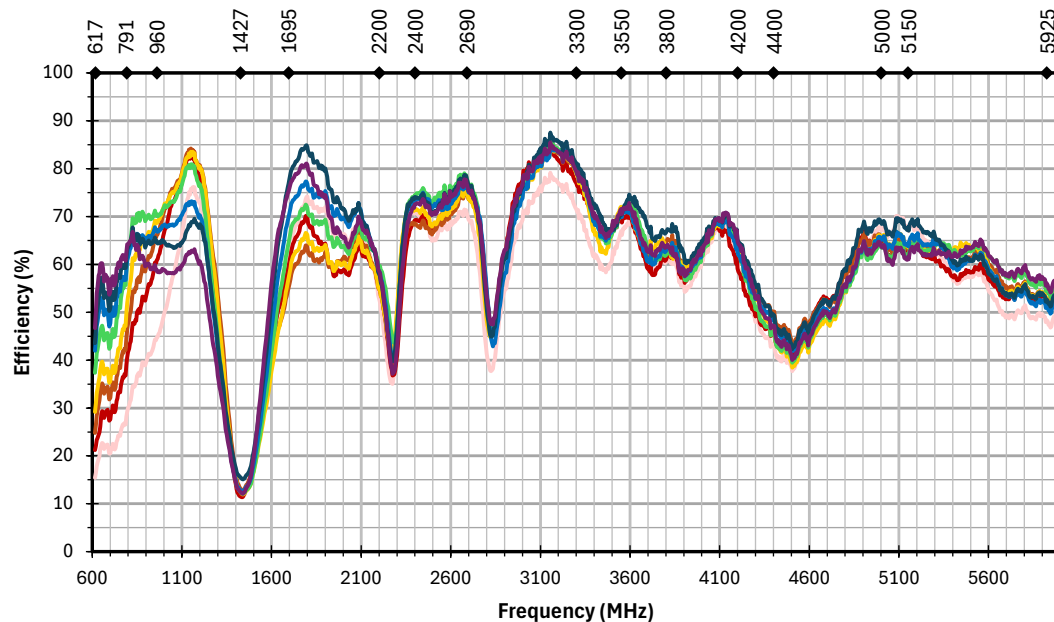


Figure 17. Antenna Efficiency on Various Ground Plane Sizes

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EMAIL: sales@antennacompany.com

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Patent Information. Patent pending.

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