

TN & NTN Dual-Mode Antenna Satellite IoT Direct to Device Ready

Outdoor Cellular IP67 Rated Antenna

Covering 4G/5G/Satellite Band 25

Satellite IoT D2D Ready

The L001270-01 direct to device (D2D) antenna is an outdoor IP67-rated multiband dipole antenna, covering 617-5000 MHz, for 5G, LTE, and cellular IoT (LTE-M, NB-IoT) applications.

L001270-01 provides a ground plane independent dipole antenna solution which mounts to metallic and non-metallic surfaces. The antenna housing is UV stabilized (ASA) and the antenna connects using an N plug (male pin) connector.

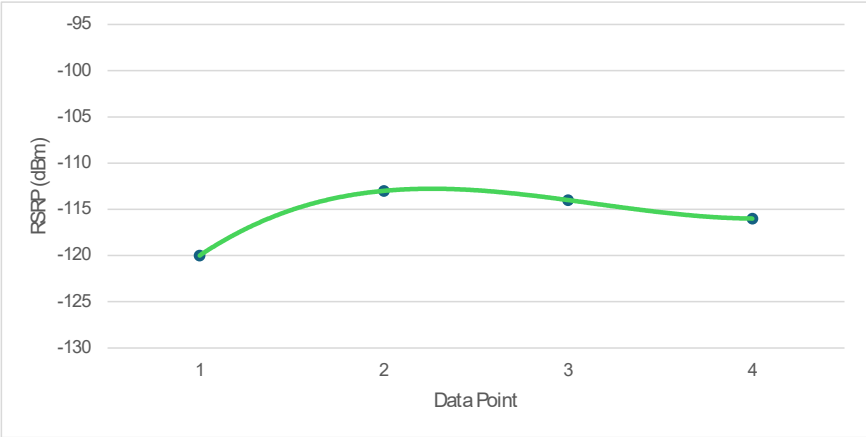
SATELLITE IOT D2D COMMUNICATIONS

Low Earth Orbit (LEO) satellites, positioned a few hundred km's above Earth, orbit rapidly and are ideal for IoT networks. A LEO satellite constellation can now support low data rate communications through specific LTE frequencies.

- Dual-mode capable - Supporting Terrestrial Networks (TN) and Non-Terrestrial Networks (NTN) from a single antenna
  - 617-5000 MHz terrestrial cellular coverage
  - Band 25 (1900 MHz) cellular satellite coverage
    - Testing available for other/future cellular satellite D2D frequency bands used by various network providers
- Enabling dual-mode communications via IoT devices
  - Prioritizing terrestrial networks but capable of automatically switching to satellite when the signal is weak or unavailable

REFERENCE SIGNAL RECEIVED POWER (RSRP) VALUES

The L001270-01 antenna was live-tested for receive signal strength. Data encompasses multiple satellite pass-overs, showing signal strength variation; exceeding the -120 dBm minimum for IoT devices.



An RSRP value of -120 dBm is generally the recognized minimum requirement suitable for the data rates of SMS, CAT-1, CAT-1 Bis connectivity.

RSRP can be susceptible to fluctuations for a variety of reasons. These can include: satellite elevation angle: antenna radiation patterns; solar flares; atmospheric conditions, and more.

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TABLE 1. ELECTRICAL SPECIFICATIONS

Bands	Frequency Range	VSWR (max.)	Peak Gain (dBi)	Avg. Gain (dBi)	Efficiency (%)
71	617 MHz to 698 MHz	1.9	1.8	-1.7	68
12, 13, 14, 17, 26, 28, 29	698 MHz to 803 MHz	1.9	2.8	-1.1	82
5, 8, 20	791 MHz to 960 MHz	3.1	2.3	-2.2	69
1, 2, 3, 4, 25, 66	1710 MHz to 2200 MHz	4.1	3.8	-1.2	81
30, 40	2300 MHz to 2400 MHz	4.8	3.9	-1.2	80
7, 41	2496 MHz to 2690 MHz	3.6	3.0	-2.0	68
22, 42, 43, 48, 49, 52, n77, n78	3300 MHz to 3800 MHz	1.8	5.4	-0.9	88
CBRS	3550 MHz to 3700 MHz	1.1	5.4	-0.3	96
C-Band	3700 MHz to 4200 MHz	1.5	6.2	-1.0	83
n79	4400 MHz to 5000 MHz	1.9	7.6	-1.4	78

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

TABLE 2. MECHANICAL SPECIFICATIONS

Parameter	Value
Polarization	Linear
Radiation	Omnidirectional
Max Power	2 W
Wavelength	1/2-wave
Electrical Type	Dipole
Impedance	50 Ω
Connector Torque Recommended/Maximum	5 Nm/ 15 Nm
Operating Temperature Range	-40 °C to +70 °C
Weight	76.1 g (2.68 oz)
Dimensions	178.0 mm x Ø25.0 mm (7.00 in x Ø0.98 in)
Connection	N plug (male pin)
Ingress Protection Rating (IP)	IP67 rated
Antenna Color	White

*Exceeding maximum torque may cause permanent damage to the connector.

PRODUCT DIMENSIONS

Figure 1 provides dimensions of the L001270-01 antenna.

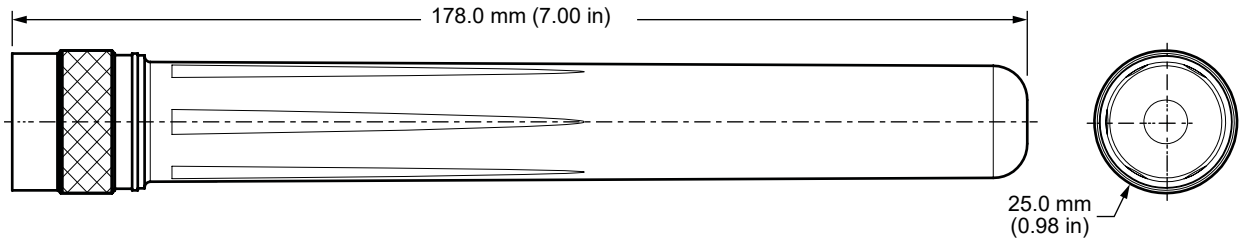


Figure 1: L001270-01 Antenna Dimensions

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PACKAGING INFORMATION

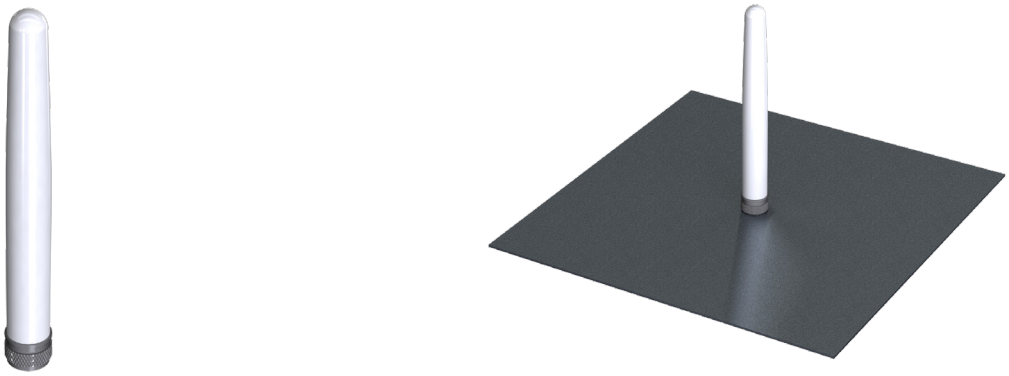
The L001270-01 antenna is packaged in a clear plastic bag. Distribution channels may offer alternative packaging options.

IP (INGRESS PROTECTION) RATING

An ingress protection rating (IP rating) refers to the capability of a device to withstand the ingress of dust and/or water under specified conditions. IP rating is typically reserved for marketable product (device) rather than constituent components because design and assembly may affect performance of the device under testing. IP-rated antennas are designed to support the specified level of ingress protection and may be tested in a standalone configuration, however IP testing should be performed on the complete end product to ensure desired performance.

ANTENNA ORIENTATION

The L001270-01 antenna is characterized in two antenna orientations as shown in Figure 2. The antenna in a free space orientation characterizes use of an antenna attached to an enclosure-mounted connector which is connected by cable to a printed circuit board. Although the antenna is a dipole not requiring a ground plane for function, characterization at the center of the ground plane (300 mm x 300 mm) provides insight into antenna performance when attached to a connector on a metal enclosure. The two orientations represent the most common end-product use cases.



L001270-01 in Free Space

L001270-01 at Center of 300 mm x 300 mm Ground Plane

Figure 2. L001270-01 Test Orientations

FREE SPACE, NO GROUND PLANE

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



Figure 3. L001270-01 No Ground Plane (Free Space)

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VSWR

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

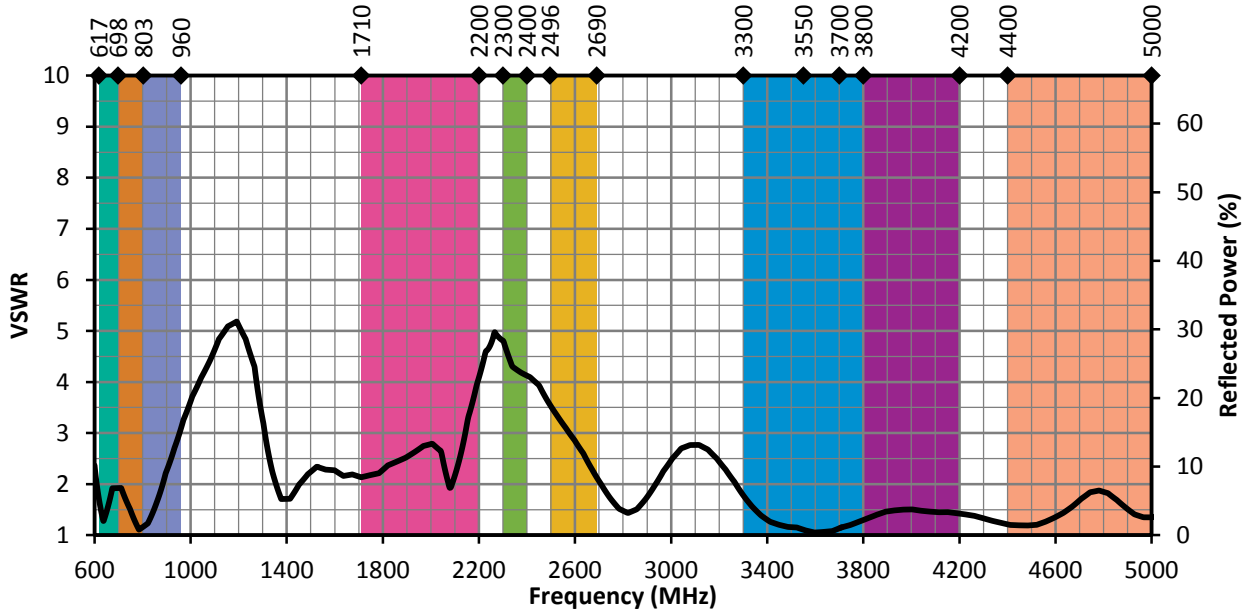


Figure 4. L001270-01 VSWR, Free Space

RETURN LOSS

Return loss (Figure 5), represents the loss in power at the antenna due to reflected signals. Like VSWR, a lower return loss value indicates better antenna performance at a given frequency.

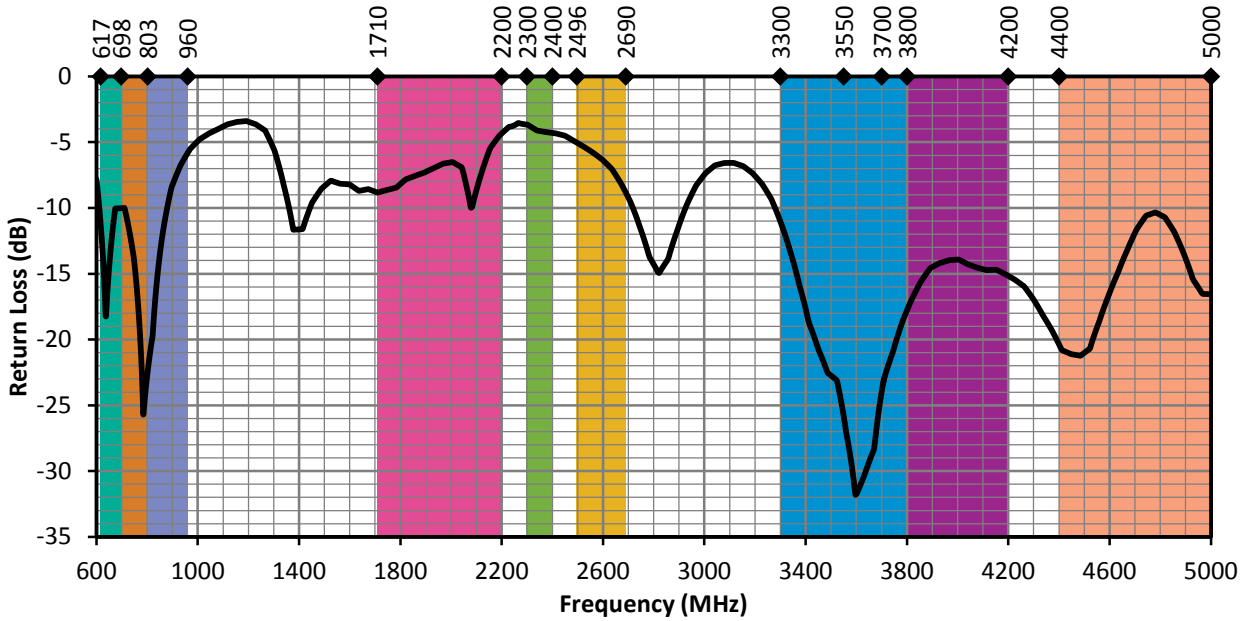


Figure 5. L001270-01 Return Loss, Free Space

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PEAK GAIN

The peak gain across the antenna bandwidth is shown in Figure 6. Peak gain represents the maximum antenna input power concentration across 3-dimensional space, and therefore peak performance at a given frequency, but does not consider any directionality in the gain pattern.

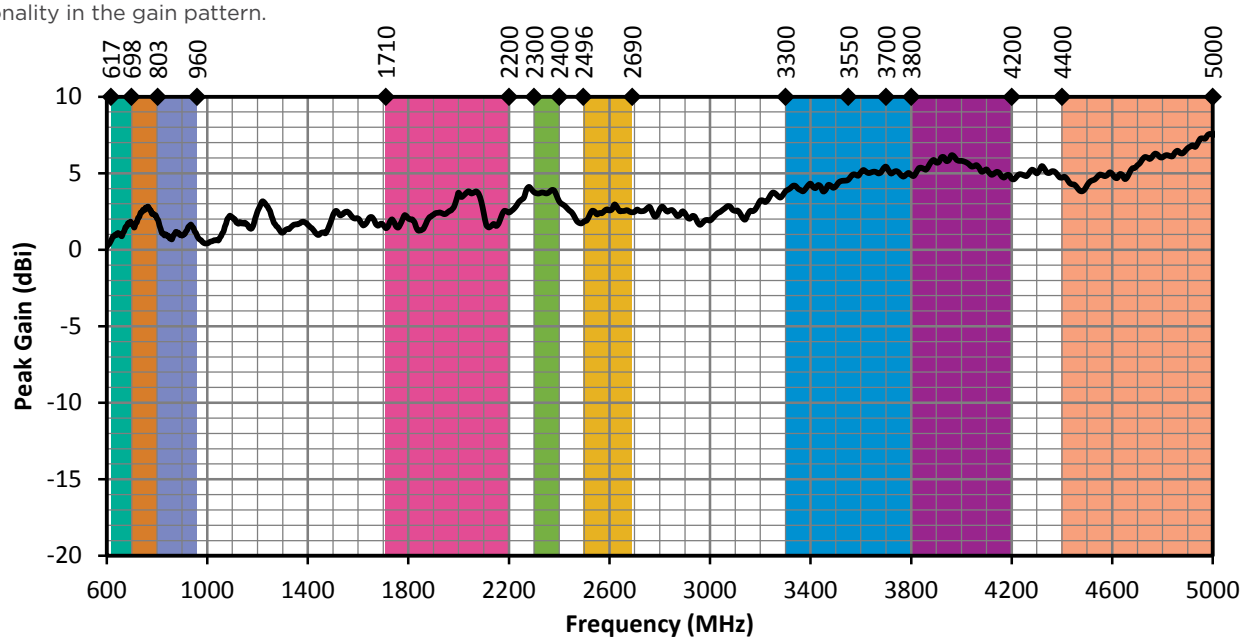


Figure 6. L001270-01 Peak Gain, Free Space

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.

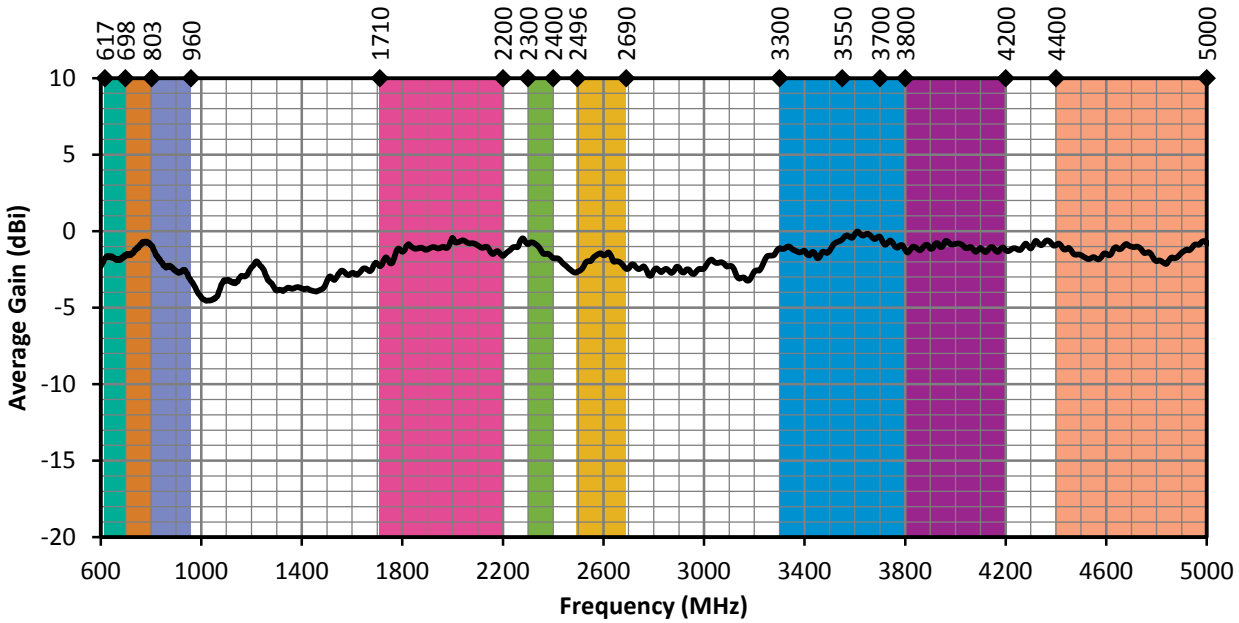


Figure 7. L001270-01 Antenna Average Gain, Free Space

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RADIATION EFFICIENCY

Radiation efficiency (Figure 8), shows 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.

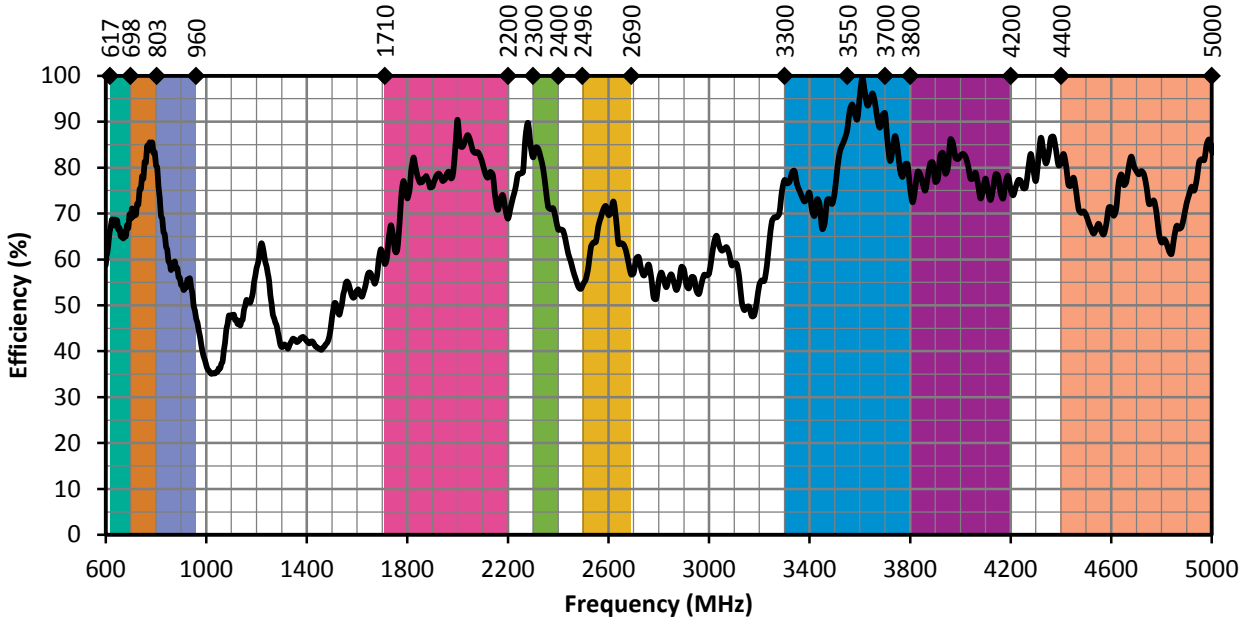
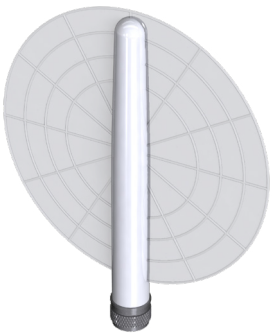


Figure 8. L001270-01 Antenna Efficiency, Free Space

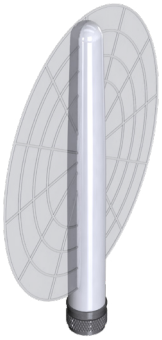
RADIATION PATTERNS

Radiation patterns provide information about the directionality and 3-dimensional gain performance of the antenna by plotting gain at specific frequencies in three orthogonal planes. Antenna radiation patterns for a free space orientation are shown in Figure 9 using polar plots covering 360 degrees. The antenna graphic at the top of the page provides reference to the plane of the column of plots below it. Note: when viewed with typical PDF viewing software, zooming into radiation patterns is possible to reveal fine detail.

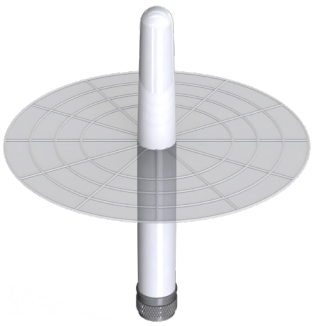
RADIATION PATTERNS - FREE SPACE



XZ-Plane Gain



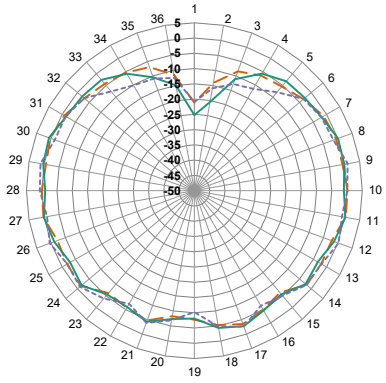
YZ-Plane Gain



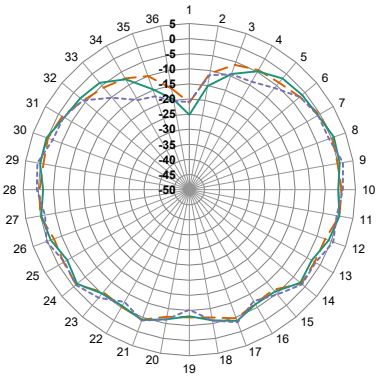
XY-Plane Gain

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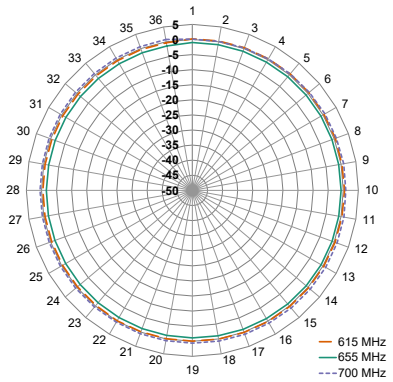
617 MHz TO 698 MHz (660 MHz)



XZ-Plane Gain

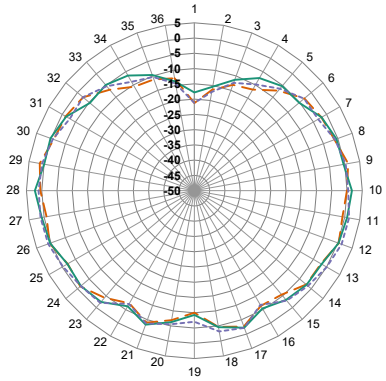


YZ-Plane Gain

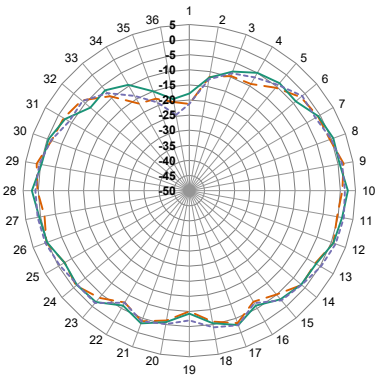


XY-Plane Gain

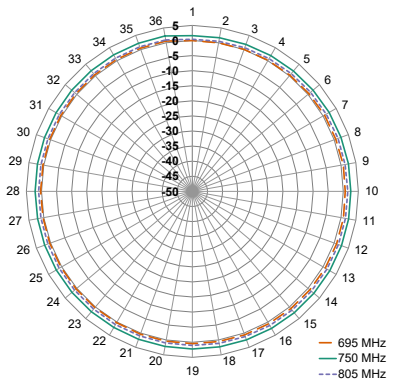
698 MHz TO 803 MHz (750 MHz)



XZ-Plane Gain



YZ-Plane Gain

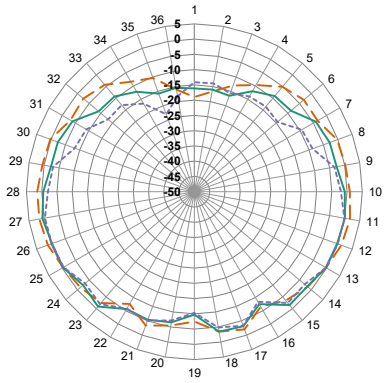


XY-Plane Gain

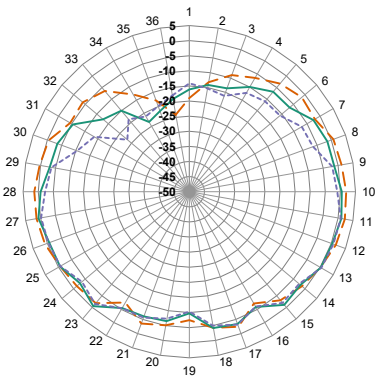
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RADIATION PATTERNS - FREE SPACE

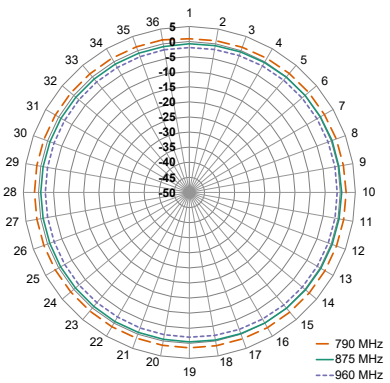
791 MHz TO 960 MHz (870 MHz)



XZ-Plane Gain

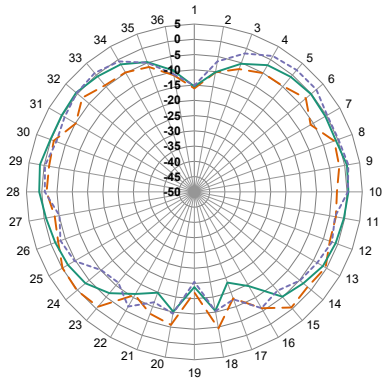


YZ-Plane Gain

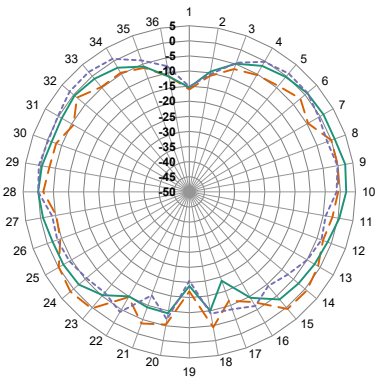


XY-Plane Gain

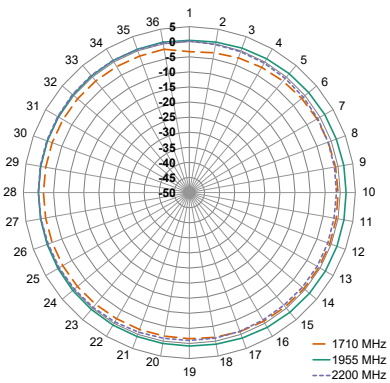
1710 MHz TO 2200 MHz (1950 MHz)



XZ-Plane Gain

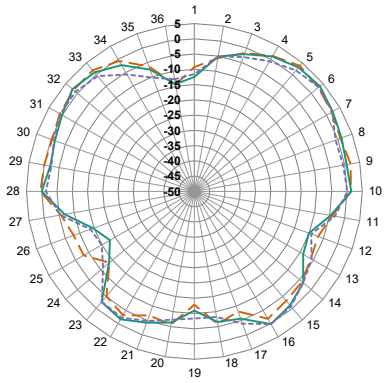


YZ-Plane Gain

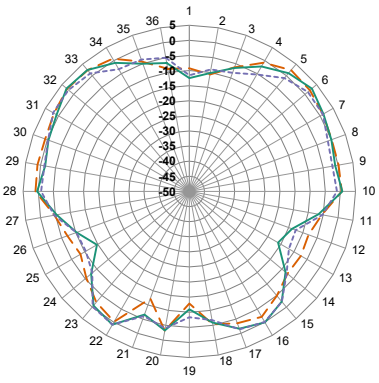


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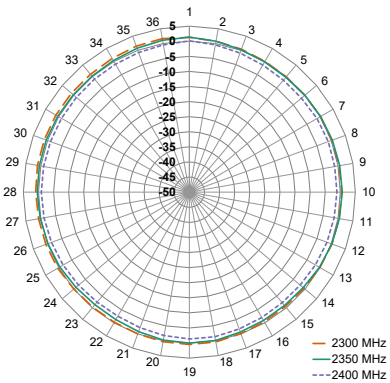
2300 MHz TO 2400 MHz (2350 MHz)



XZ-Plane Gain



YZ-Plane Gain

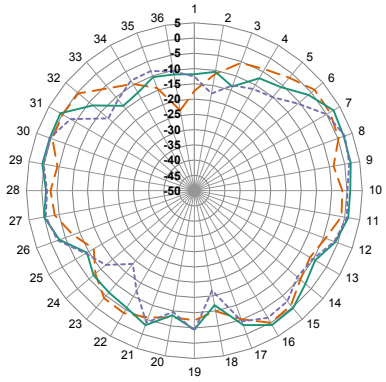


XY-Plane Gain

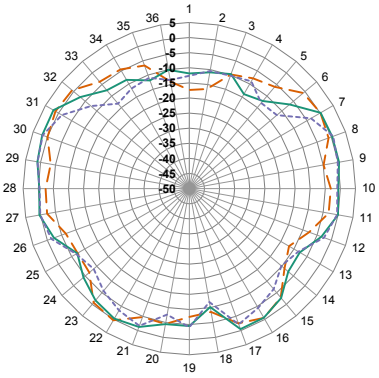
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RADIATION PATTERNS - FREE SPACE

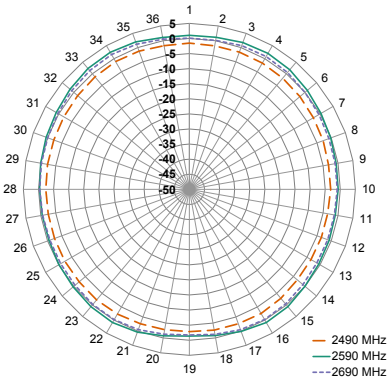
2496 MHz TO 2690 MHz (2600 MHz)



XZ-Plane Gain

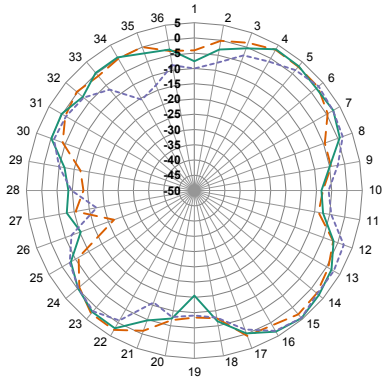


YZ-Plane Gain

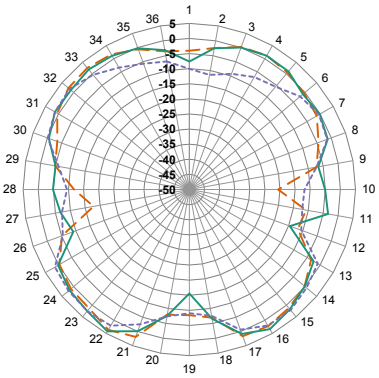


XY-Plane Gain

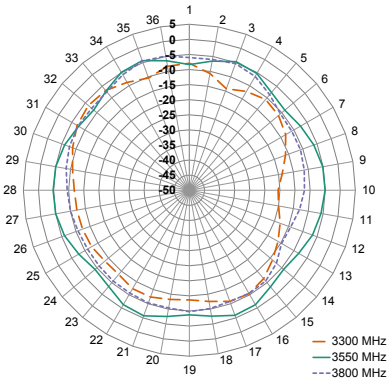
3300 MHz TO 3800 MHz (3550 MHz)



XZ-Plane Gain

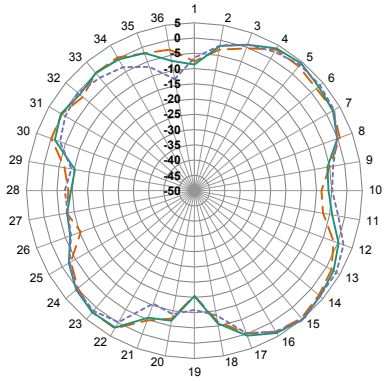


YZ-Plane Gain

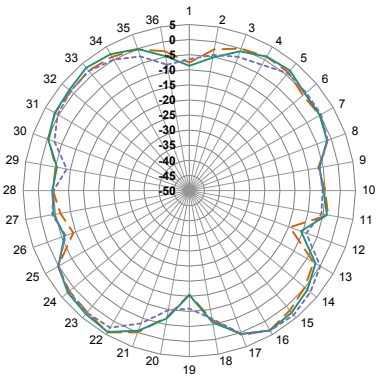


XY-Plane Gain

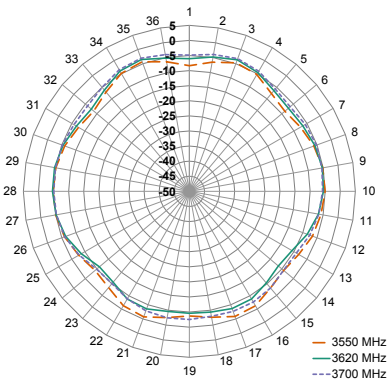
3550 MHz TO 3700 MHz (3620 MHz)



XZ-Plane Gain



YZ-Plane Gain

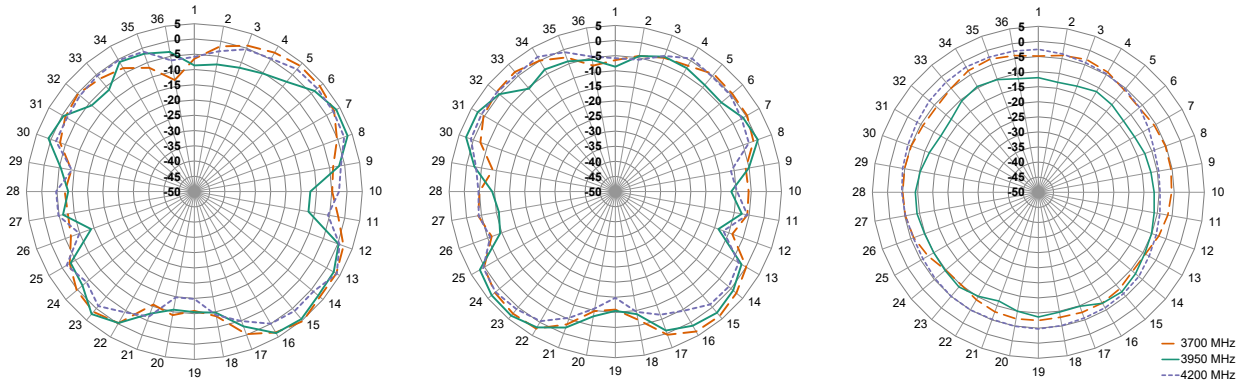


XY-Plane Gain

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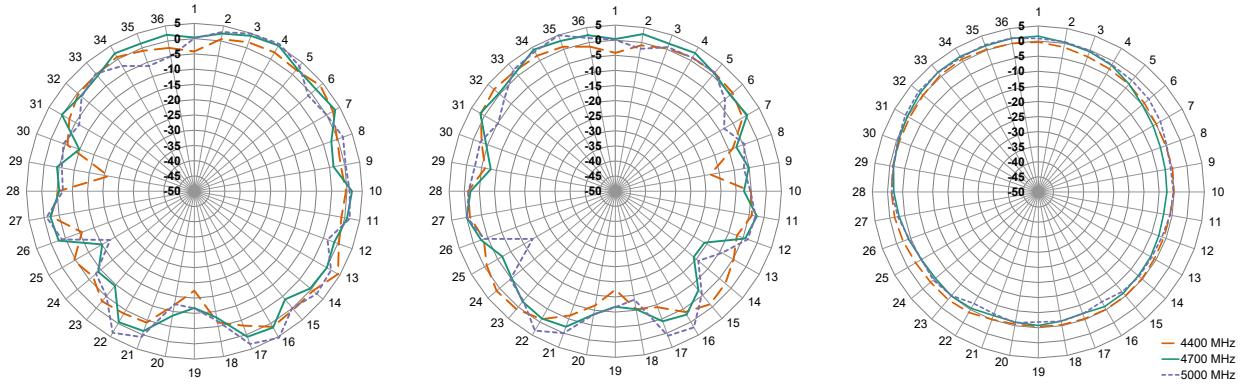
RADIATION PATTERNS - FREE SPACE

3700 MHz TO 4200 MHz (3950 MHz)



XZ-Plane Gain | YZ-Plane Gain | XY-Plane Gain

4400 MHz TO 5000 MHz (4700 MHz)



XZ-Plane Gain | YZ-Plane Gain | XY-Plane Gain

Figure 9. Radiation Patterns for L001270-01, Free Space

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CENTER OF GROUND PLANE

The charts on the following pages represent data taken with the antenna oriented at the center of the ground plane as shown in Figure 10.

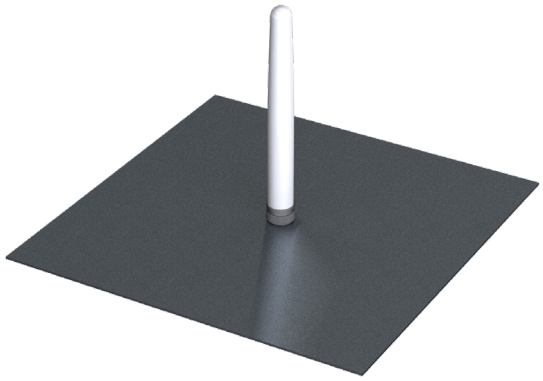


Figure 10. L001270-01 at Center of Ground Plane

VSWR

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

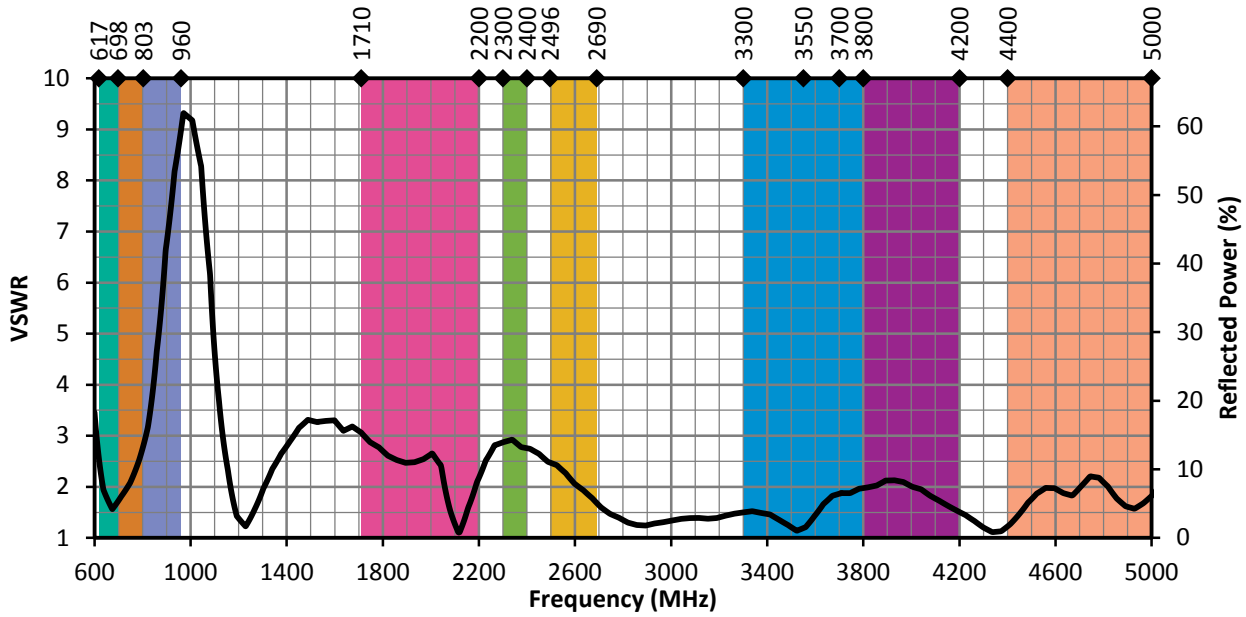


Figure 11. L001270-01 VSWR, Center of Ground Plane

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RETURN LOSS

Return loss (Figure 12), represents the loss in power at the antenna due to reflected signals. Like VSWR, a lower return loss value indicates better antenna performance at a given frequency.

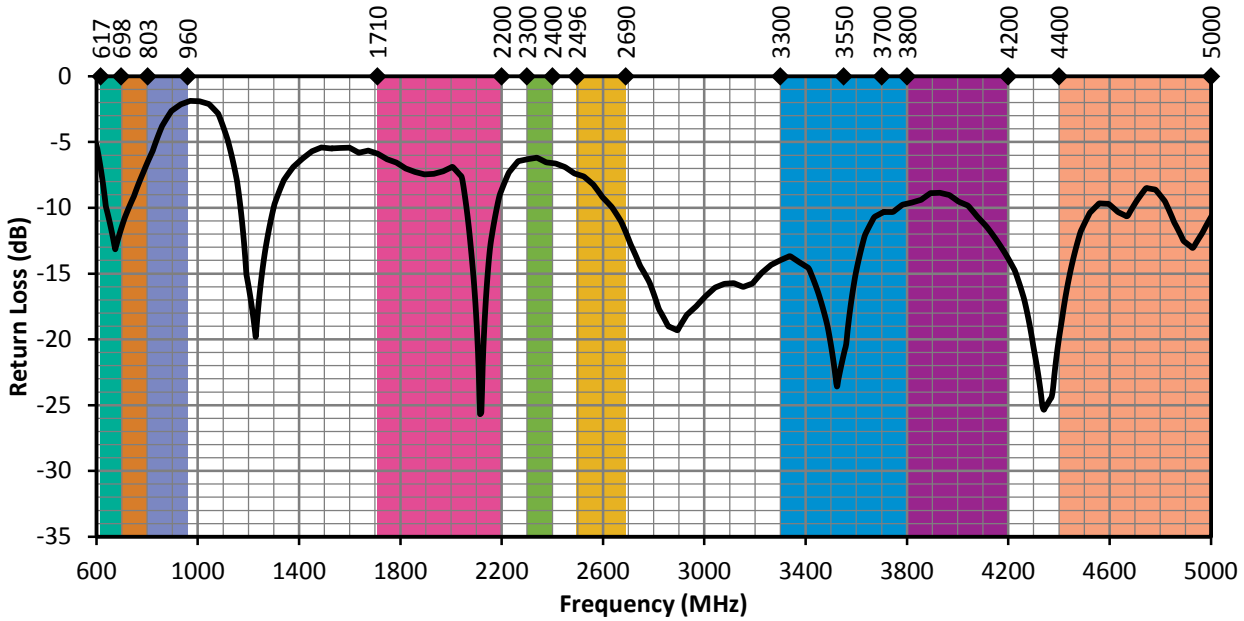


Figure 12. L001270-01 Return Loss, Center of Ground Plane

PEAK GAIN

The peak gain across the antenna bandwidth is shown in Figure 13. Peak gain represents the maximum antenna input power concentration across 3-dimensional space, and therefore peak performance at a given frequency, but does not consider any directionality in the gain pattern.

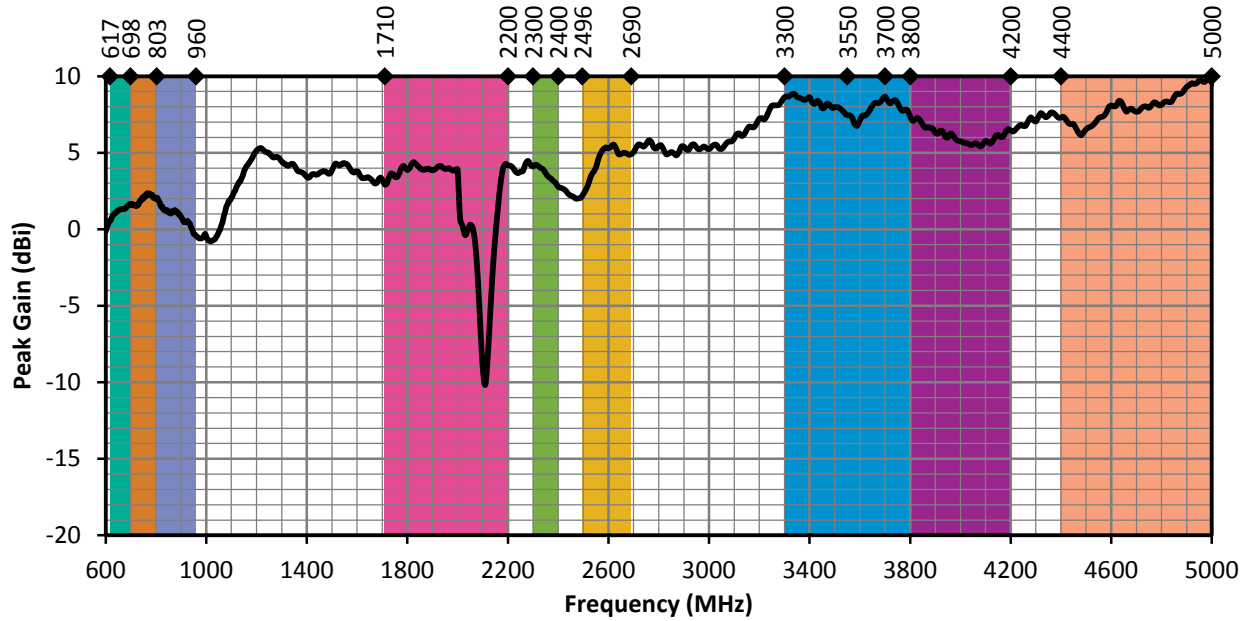


Figure 13. L001270-01 Peak Gain, Center of Ground Plane

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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.

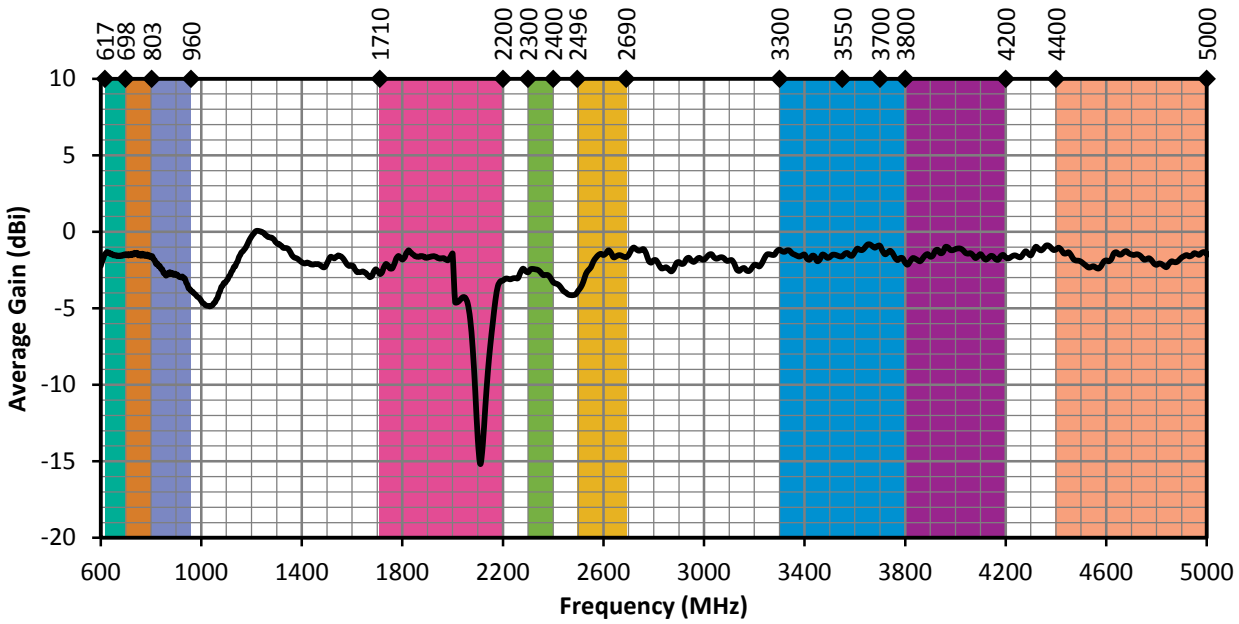


Figure 14. L001270-01 Antenna Average Gain, Center of Ground Plane

RADIATION EFFICIENCY

Radiation efficiency (Figure 15), shows 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.

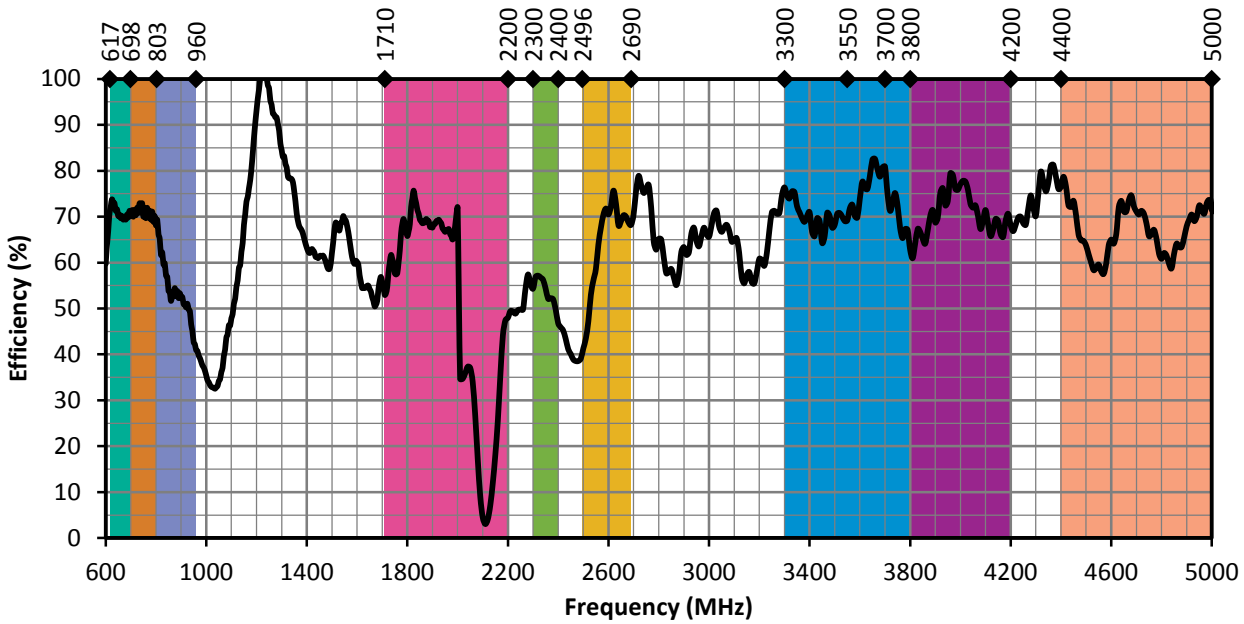


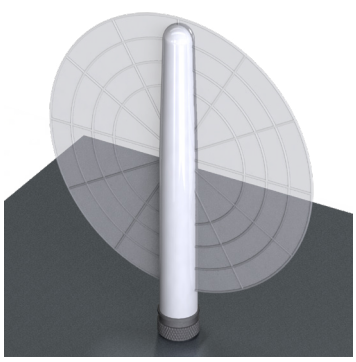
Figure 15. L001270-01 Antenna Efficiency, Center of Ground Plane

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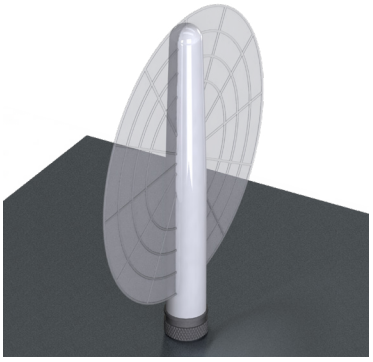
RADIATION PATTERNS

Radiation patterns provide information about the directionality and 3-dimensional gain performance of the antenna by plotting gain at specific frequencies in three orthogonal planes. Antenna radiation patterns for an orientation at the center of the ground plane are shown in Figure 16 using polar plots covering 360 degrees. The antenna graphic at the top of the page provides reference to the plane of the column of plots below it. Note: when viewed with typical PDF viewing software, zooming into radiation patterns is possible to reveal fine detail.

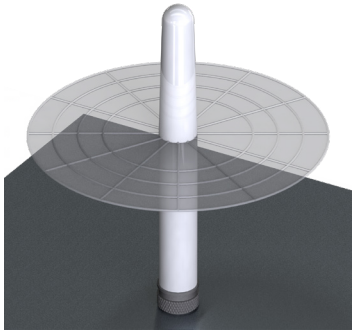
RADIATION PATTERNS - CENTER OF GROUND PLANE



XZ-Plane Gain

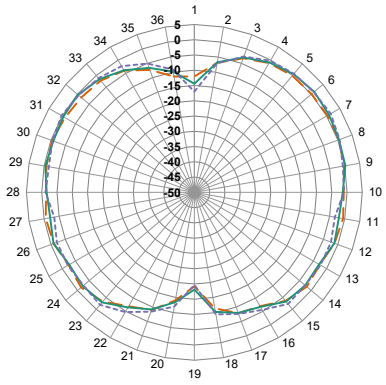


YZ-Plane Gain

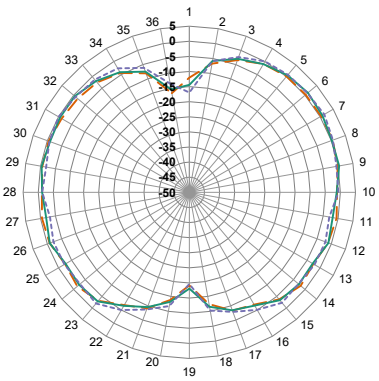


XY-Plane Gain

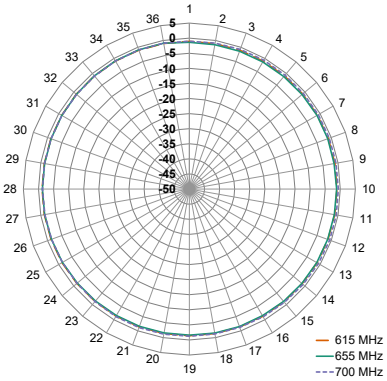
617 MHz TO 698 MHz (660 MHz)



XZ-Plane Gain

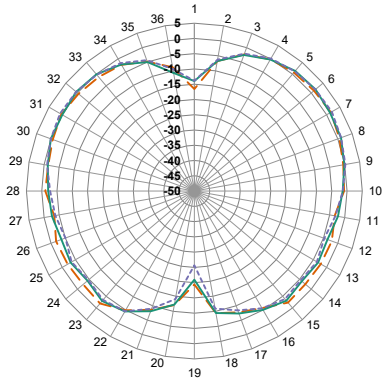


YZ-Plane Gain

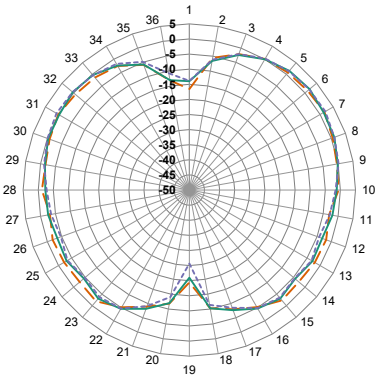


XY-Plane Gain

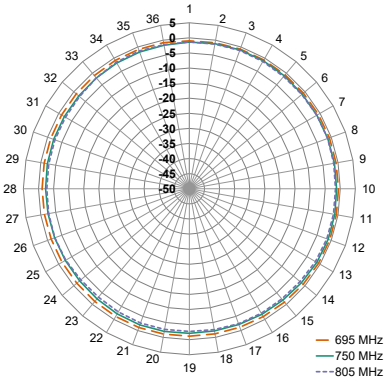
698 MHz TO 803 MHz (750 MHz)



XZ-Plane Gain



YZ-Plane Gain

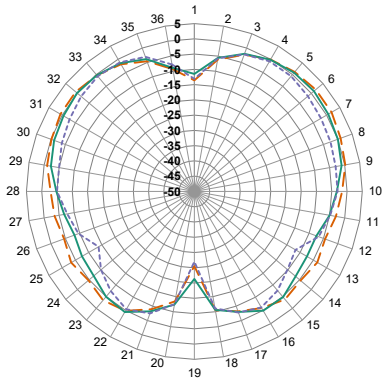


XY-Plane Gain

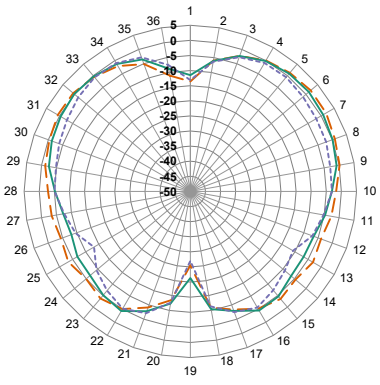
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RADIATION PATTERNS - CENTER OF GROUND PLANE

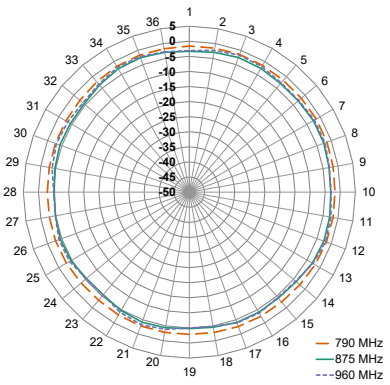
791 MHz TO 960 MHz (870 MHz)



XZ-Plane Gain

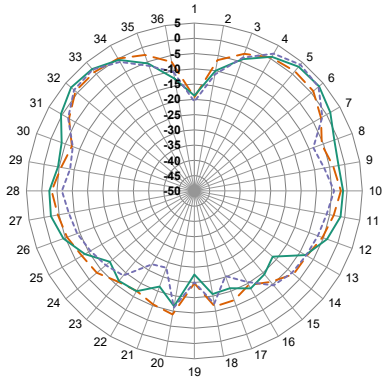


YZ-Plane Gain

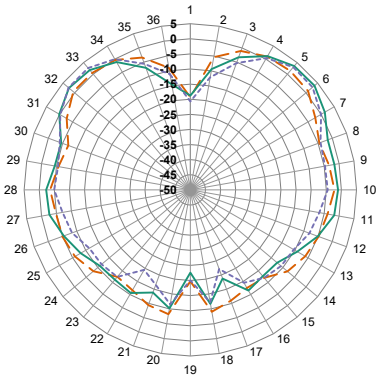


XY-Plane Gain

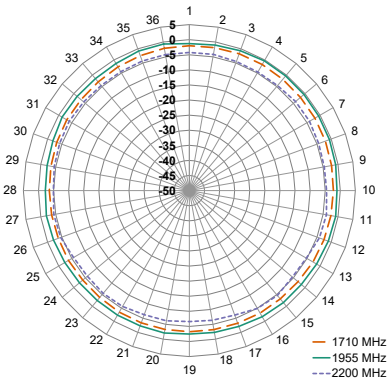
1710 MHz TO 2200 MHz (1950 MHz)



XZ-Plane Gain

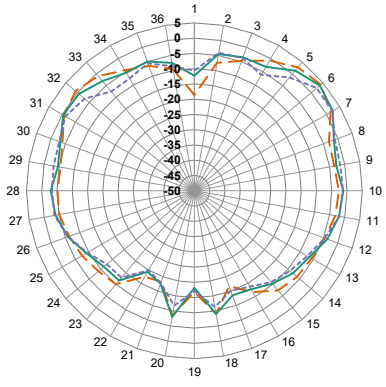


YZ-Plane Gain

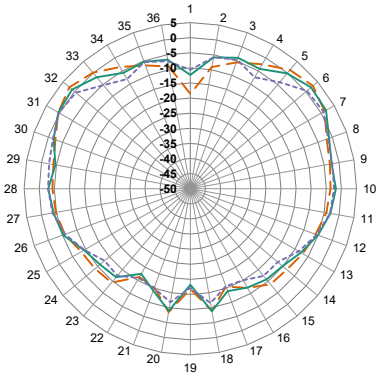


XY-Plane Gain

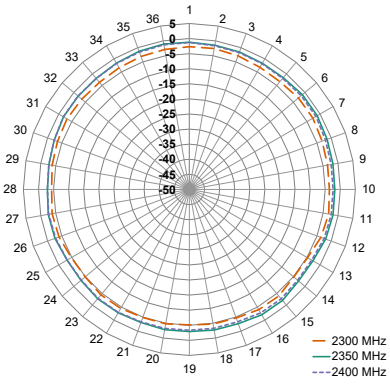
2300 MHz TO 2400 MHz (2350 MHz)



XZ-Plane Gain



YZ-Plane Gain

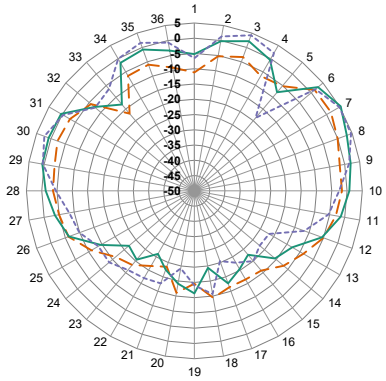


XY-Plane Gain

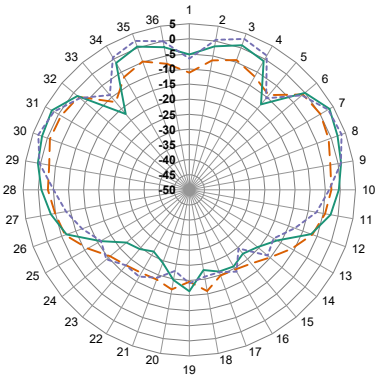
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RADIATION PATTERNS - CENTER OF GROUND PLANE

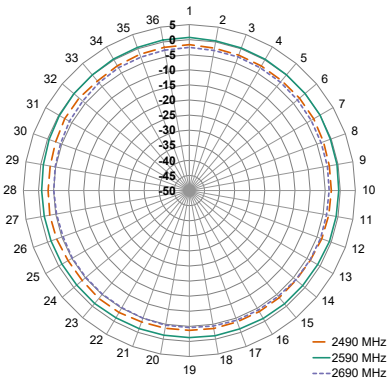
2496 MHz TO 2690 MHz (3620 MHz)



XZ-Plane Gain

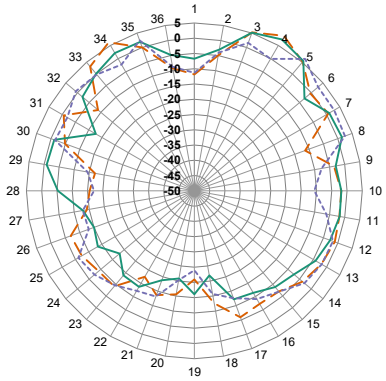


YZ-Plane Gain

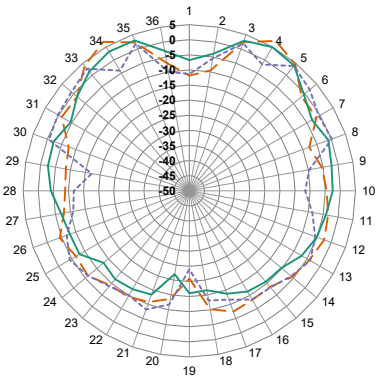


XY-Plane Gain

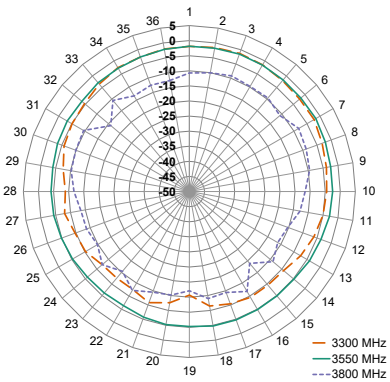
3300 MHz TO 3800 MHz (3550 MHz)



XZ-Plane Gain

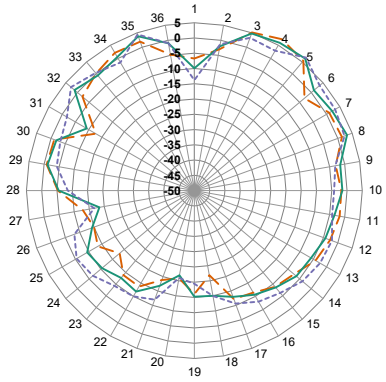


YZ-Plane Gain

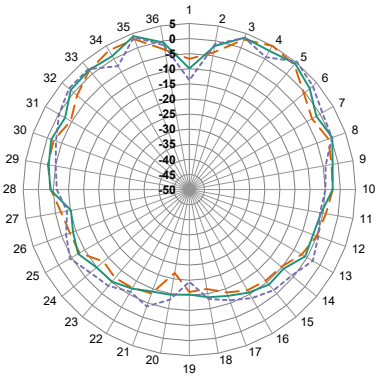


XY-Plane Gain

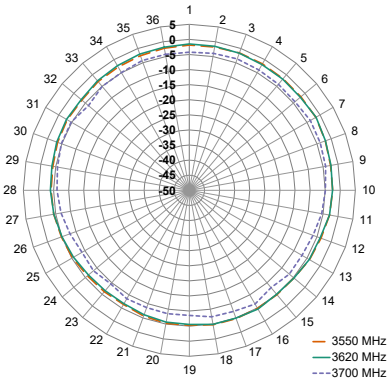
3550 MHz TO 3700 MHz (3620 MHz)



XZ-Plane Gain



YZ-Plane Gain

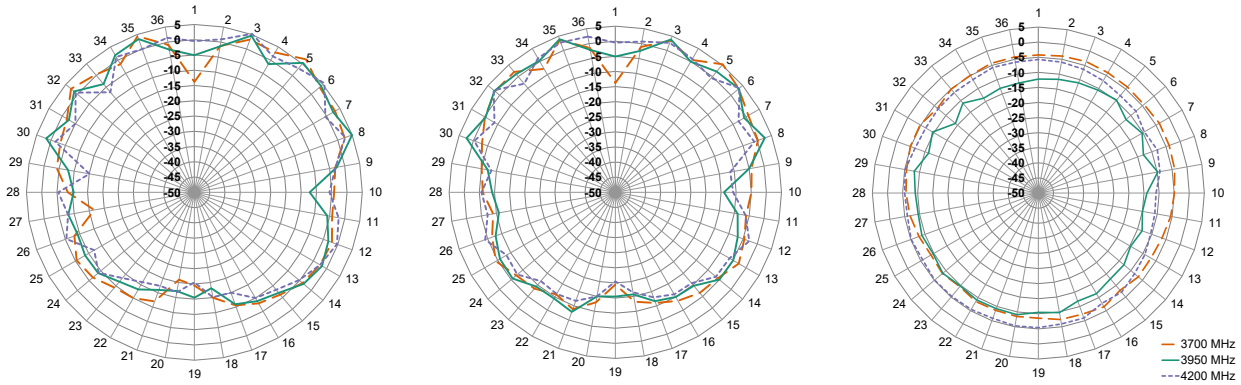


XY-Plane Gain

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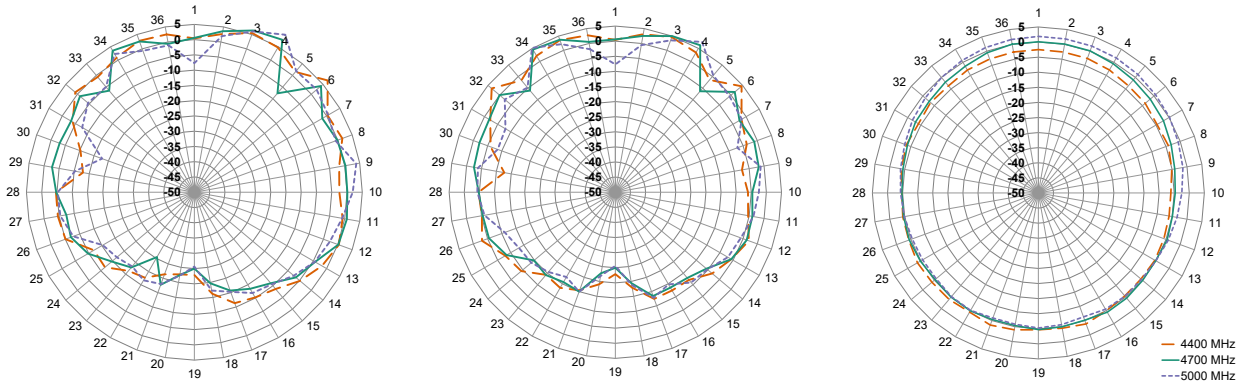
RADIATION PATTERNS - CENTER OF GROUND PLANE

3700 MHz TO 4200 MHz (3950 MHz)



XZ-Plane Gain YZ-Plane Gain XY-Plane Gain

4400 MHz TO 5000 MHz (4700 MHz)



XZ-Plane Gain YZ-Plane Gain XY-Plane Gain

Figure 16. Radiation Patterns for L001270-01, Center of Ground Plane

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