



## VDP Industrial Series

### Remote Adhesive-Mount Cellular Antenna

The Linx VDP industrial series offers rugged remote-mount dipole antennas having excellent performance for all common 5G and LTE bands and cellular IoT (LTE-M and NB-IoT) applications.

The VDP industrial antennas are durable, low profile, IP67 ratable, and UV protected. They mount permanently to non-conductive surfaces using the integrated adhesive patch and connect using 2 meters of RG-174/U low-loss cable terminated in an SMA plug (male pin) connector.

#### FEATURES

- Performance at 617 MHz to 803 MHz
  - VSWR:  $\leq 2.5$
  - Peak Gain: 4.9 dBi
  - Efficiency: 60%
- Low profile
  - 115.0 mm x 22.0 mm x 6.3 mm
- Durable UV protected enclosure rated at IP67 for heavy-duty outdoor use
- Low-loss RG-174/U coaxial cable for improved performance at higher frequencies
- SMA plug (male pin)

#### APPLICATIONS

- Worldwide 5G, LTE, UMTS and GSM
- Cellular IoT: LTE-M (Cat-M1) and NB-IoT
- Frequency bands
  - T-Mobile: band 71
  - AT&T: bands 12, 14, 17
  - Verizon: band 13
  - Europe: bands 8, 20
  - Latin America: bands 5, 28
  - Asia Pacific: bands 5, 8, 20, 28
- Global Navigation (GNSS)
- Internet of Things (IoT) devices

#### ORDERING INFORMATION

Part Number	Description
ANT-LTE-VDP-2000-SMA	Remote adhesive-mount cellular antenna with 2 m of RG-174/U low-loss coaxial cable terminated in an SMA plug (male pin)

Available from Linx Technologies and select distributors and representatives.

**TABLE 1. ELECTRICAL SPECIFICATIONS**

ANT-LTE-VDP-2000	Frequency Range	VSWR (max.)	Peak Gain (dBi)	Avg. Gain (dBi)	Efficiency (%)
LTE 71	617 MHz to 698 MHz	2.5	4.2	-5.6	56
LTE 12, 13, 14, 17, 26, 28, 29	698 MHz to 803 MHz	1.6	4.9	-2.4	62
LTE 5, 8, 20	791 MHz to 960 MHz	2.2	4.9	-3.6	62
LTE 1, 2, 3, 4, 25, 66	1710 MHz to 2200 MHz	1.5	3.9	-4.1	42
LTE 30, 40	2300 MHz to 2400 MHz	1.5	1.8	-6.0	27
LTE 7, 41	2496 MHz to 2690 MHz	1.5	4.5	-5.6	30
LTE 22, 42, 43, 48, 49, 52	3300 MHz to 3800 MHz	1.4	1.3	-9.7	13
GPS/GNSS	1553 MHz to 1609 MHz	1.7	4.2	-3.1	50
CBRS	3550 MHz to 3700 MHz	1.3	0	-10.0	10
C-Band	3700 MHz to 4200 MHz	1.4	-0.6	-11.7	8
Public Safety	4940 MHz to 4990 MHz	1.5	-3.3	-13.6	5
Polarization	Linear	Radiation		Omnidirectional	
Impedance	50 $\Omega$	Max Power		10 W	
Wavelength	1/2-wave	Electrical Type		Dipole	

**TABLE 2. MECHANICAL SPECIFICATIONS**

ANT-LTE-VDP-2000	Value
Connection	SMA plug (male pin)
Cable	2.0 m (78.74 in) of RG-174/U low-loss coaxial cable
Operating Temp. Range	-40 °C to +85 °C
Weight	47.0 g (1.66 oz)
Dimensions	115.0 mm x 22.0 mm x 6.2 mm (4.53 in x 0.87 in x 0.24 in)
Dimensions	203.0 mm x 13.2 mm x 13.2 mm (7.99 in x 0.52 in x 0.52 in)

## PRODUCT DIMENSIONS

Figure 1 provides dimensions of the ANT-8/9-IPW1-SMA. The antenna whip can be tilted 90 degrees, with a detent at 45 degrees enabling the antenna to be oriented in any direction. The rotating base allows for continuous positioning through 360 degrees even while installed.

## ANTENNA MOUNTING

The remote adhesive-mount VDP industrial series antenna mounts permanently to non-conductive surfaces using the integrated adhesive patch. The mounting surface should be clean, dry and free of oil residue for ideal adhesion.

## PACKAGING INFORMATION

The VDP industrial series antennas are packaged in bags of 50. Distribution channels may offer alternative packaging options.

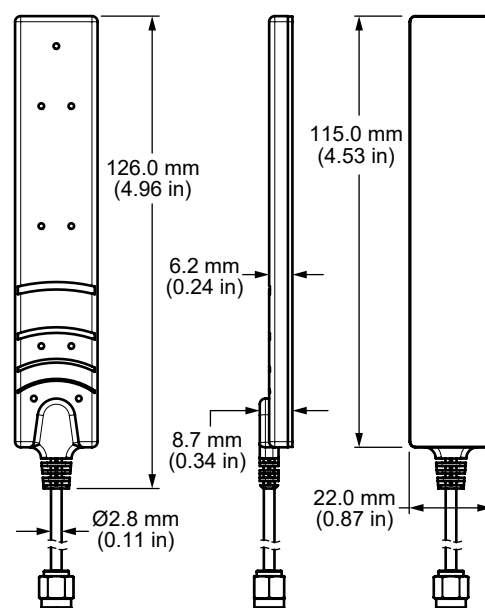


Figure 1. ANT-LTE-VDP-2000 Antenna Dimensions

## VSWR

Figure 2 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.

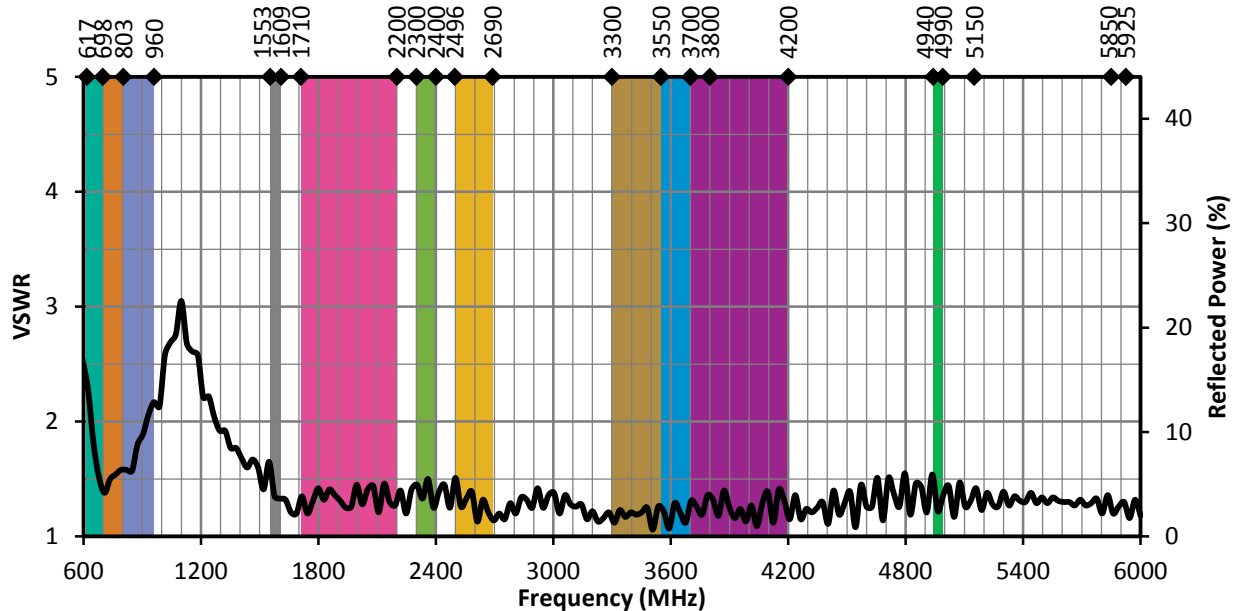


Figure 2. ANT-LTE-VDP-2000-SMA VSWR with Frequency Band Highlights

## RETURN LOSS

Return loss (Figure 3), 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.

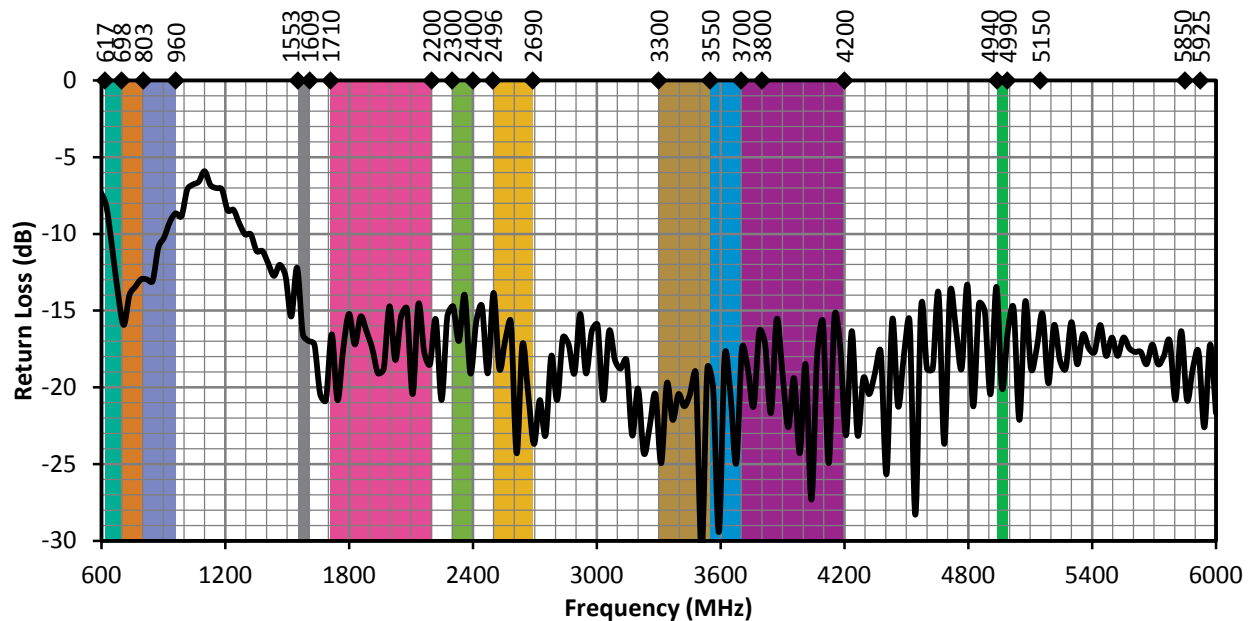


Figure 3. ANT-LTE-VDP-2000-SMA Return Loss with Frequency Band Highlights

## PEAK GAIN

The peak gain across the antenna bandwidth is shown in Figure 4. 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.

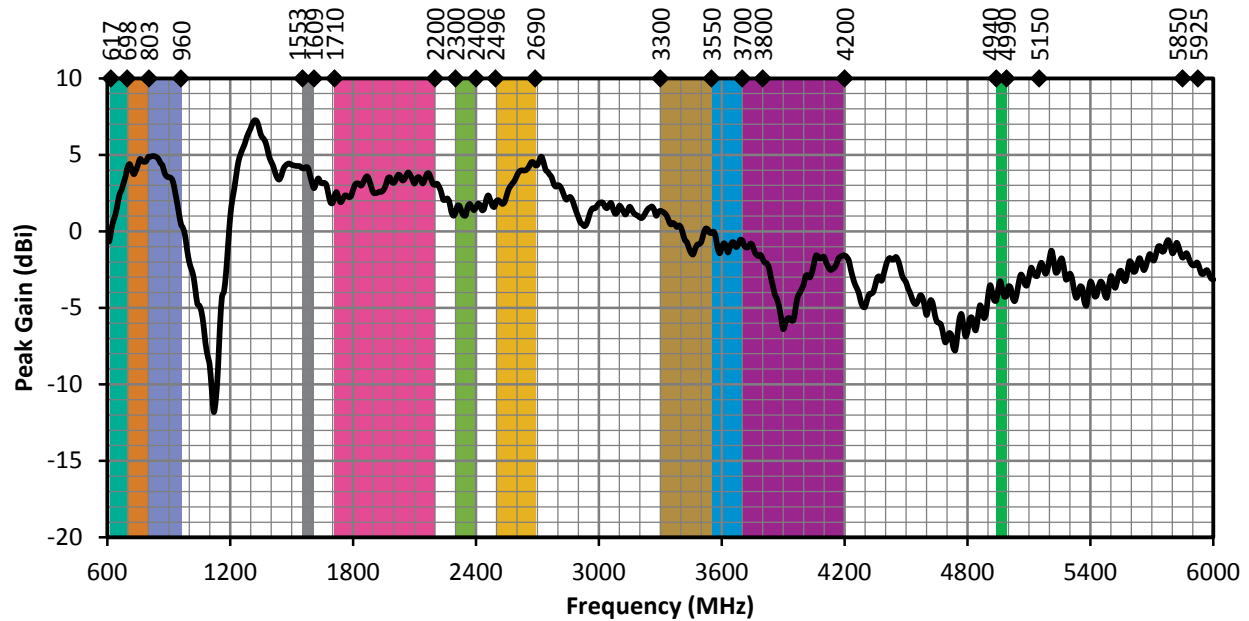


Figure 4. ANT-LTE-VDP-2000-SMA Peak Gain with Frequency Band Highlights

## 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.

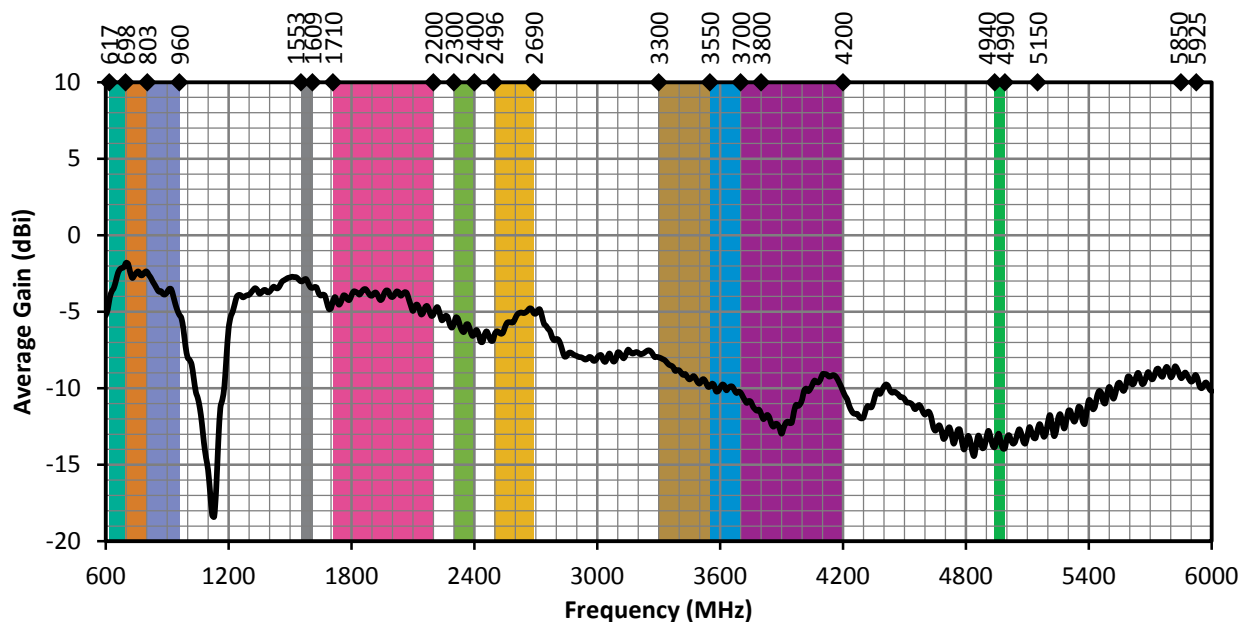


Figure 5. ANT-LTE-VDP-2000-SMA Antenna Average Gain with Frequency Band Highlights

## RADIATION EFFICIENCY

Radiation efficiency (Figure 6), 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.

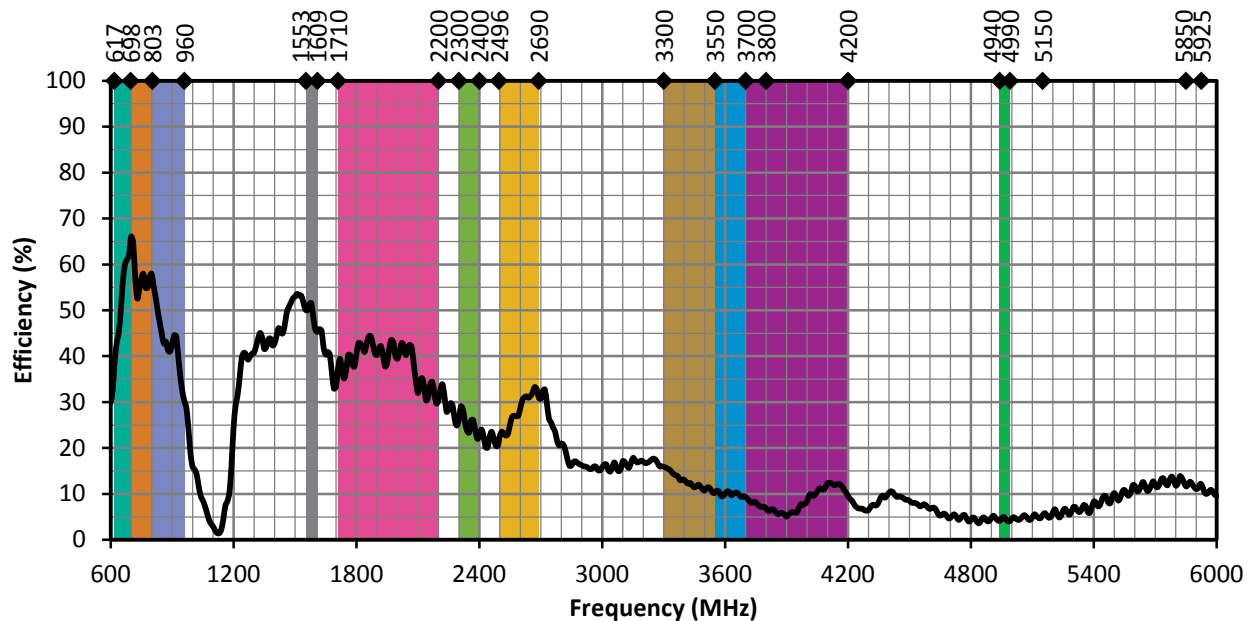


Figure 6. ANT-LTE-VDP-2000-SMA Antenna Radiation Efficiency with Frequency Band Highlights

## 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 are shown in Figure 7 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



XZ-Plane Gain

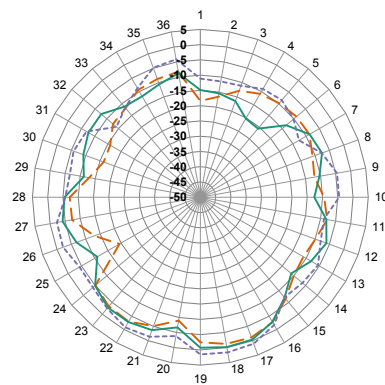


YZ-Plane Gain

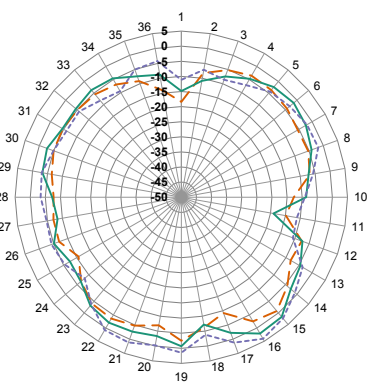


XY-Plane Gain

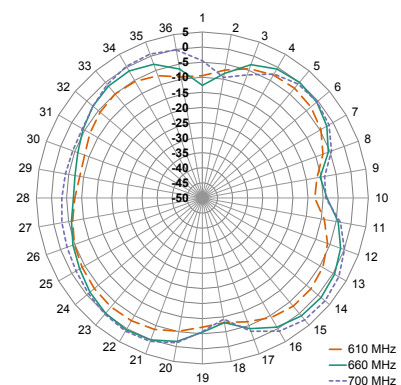
### 617 MHz TO 698 MHz (660 MHz)



XZ-Plane Gain

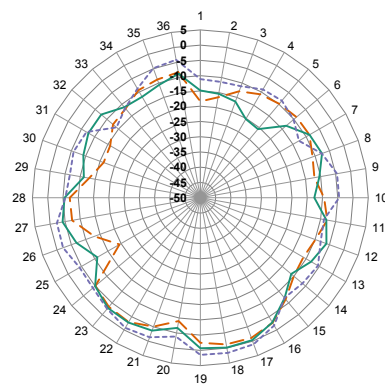


YZ-Plane Gain

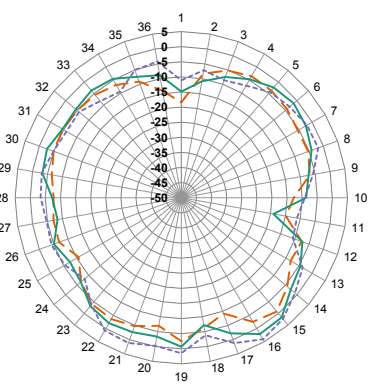


XY-Plane Gain

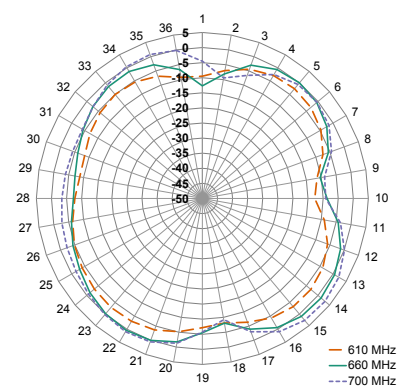
### 698 MHz TO 803 MHz (750 MHz)



XZ-Plane Gain



YZ-Plane Gain



XY-Plane Gain

# RADIATION PATTERNS



XZ-Plane Gain

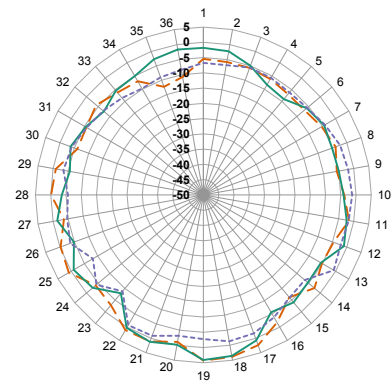


YZ-Plane Gain

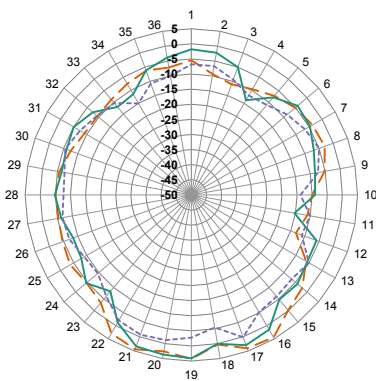


XY-Plane Gain

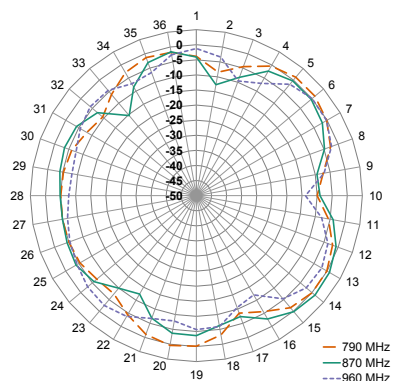
## 791 MHz TO 960 MHz (870 MHz)



XZ-Plane Gain

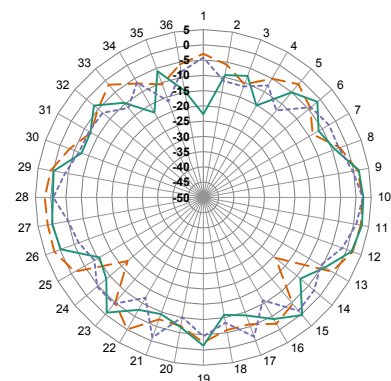


YZ-Plane Gain

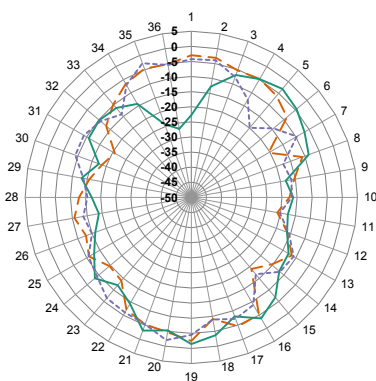


XY-Plane Gain

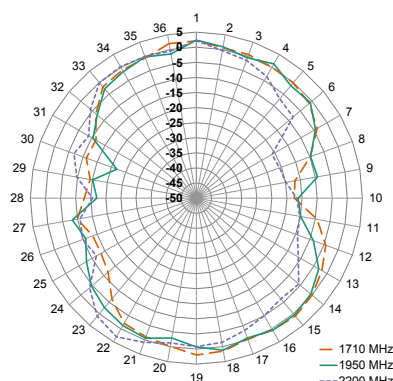
## 1710 MHz TO 2200 MHz (1950 MHz)



XZ-Plane Gain



YZ-Plane Gain



XY-Plane Gain



## RADIATION PATTERNS



XZ-Plane Gain

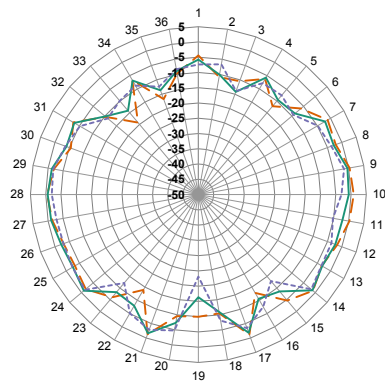


YZ-Plane Gain

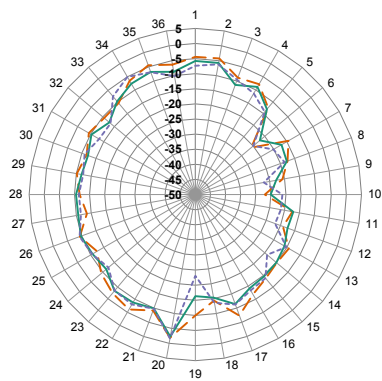


XY-Plane Gain

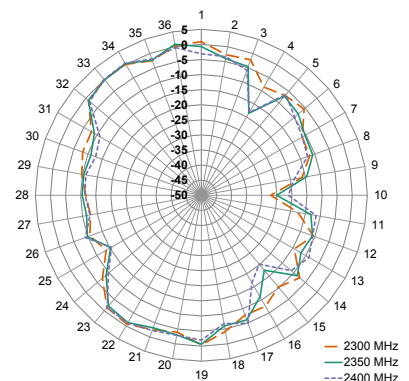
### 2300 MHz TO 2400 MHz (2350) MHz)



XZ-Plane Gain

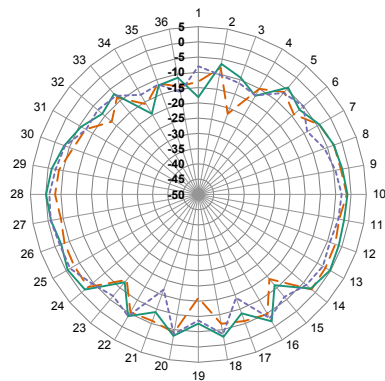


YZ-Plane Gain

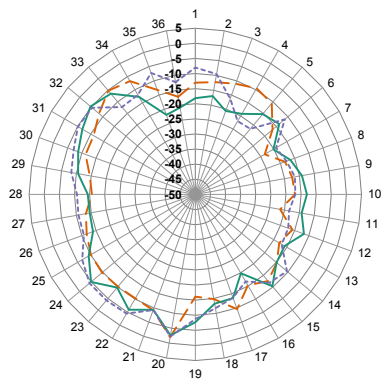


XY-Plane Gain

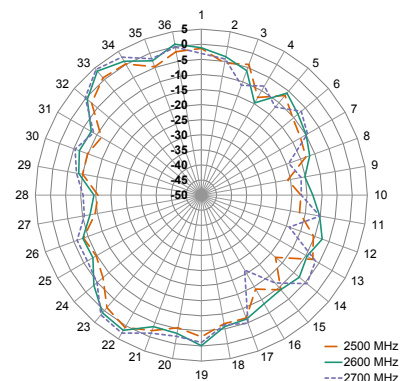
### 2496 MHz TO 2690 MHz (2600 MHz)



XZ-Plane Gain



YZ-Plane Gain



XY-Plane Gain

Figure 7. ANT-LTE-VDP-2000-SMA Radiation Patterns



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## 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 lower 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 ( $\eta$ )** - 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 ratio of an antenna's efficiency in a given direction (G) to the power produced by a theoretical lossless (100% efficient) isotropic antenna. The gain of an antenna is almost always expressed in decibels.

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

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

**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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