ANT-GNCP-C25L125100

L1/L2/L5 Active Ceramic Patch GNSS Antenna

The GNCP-C25L125100 is a global navigation satellite system (GNSS) ceramic patch antenna with integrated low noise amplifier (LNA), supporting GPS, Galileo, GLONASS, Beidou, NavIC and QZSS systems in the L1/E1/B1, L2/E5/B2B and L5/E5/B2A bands. The LNA provides high gain with a low noise figure. The antenna has a 100 mm cable terminated in an MHF1/U.FL-type plug (female socket) connector.

FEATURES

- Performance at 1575.42 MHz
  - VSWR: ≤ 1.7
  - Peak Gain: 31.6 dBi
  - Axial Ratio: 12.29 dB
- Performance at 1176.45 MHz
  - VSWR: ≤ 2.2
  - Peak Gain: 30.8 dBi
  - Axial Ratio: 7.8 dB
- 29 dB (Typ.) LNA
- Ground plane independent
- Directional radiation pattern orthogonal to antenna surface
- Right-hand circularly polarized (RHCP)
- U.FL-type plug (female socket) compatible with MHF1, AMC, UMCC

APPLICATIONS

- Global navigation
  - GPS L1C, L1C/A, L2, L5
  - Galileo E1, E5A, E5B
  - GLONASS L1, L2, L3
  - Beidou B1I, B1C, B2A, B2B
  - NavIC
  - QZSS L1, L2C, L5
- Timing solutions

ORDERING INFORMATION

Part Number	Description
ANT-GNCP-C25L125100	GNSS L1/L2/L5 band ceramic patch antenna with MHF1/U.FL-type plug (female socket) on 100 mm of 1.13 mm coaxial cable

Available from Linx Technologies and select distributors and representatives.

TABLE 1. ELECTRICAL SPECIFICATIONS, ANTENNA PLUS LNA

Frequency	GPS Bands	VSWR (max.)	Return Loss (dB)	Peak Gain (dBi)	Axial Ratio (dB)
1176 MHz	GPS L5, Galileo E5A, Beidou B2A, NavIC L5, QZSS L5	2.2	-8.4	30.8	7.8
1202/1207 MHz	Galileo E5B, Beidou B2B, GLONASS L3	1.4	-15.6	18.2	21.1
1228 MHz	GPS L2, QZSS L2	1.6	-13.2	25.0	24.1
1246/1248 MHz	GLONASS L2	1.3	-17.0	10.2	6.9
1561 MHz	Beidou B1I	1.4	-15.4	31.5	14.5
1575 MHz	GPS L1C, GPS L1C/A, Galileo E1, Beidou B1C, QZSS L1	1.7	-11.6	31.6	12.3
1601/1602 MHz	GLONASS L1	1.4	-16.1	28.4	14.6

Output Impedance	50 Ω
Polarization	RHCP
Radiation	Directional radiation pattern orthogonal to antenna surface
Electrical Type	Radiating Patch plus LNA
Input Voltage	Min. 3.0 V, Typ. 3.3 V, Max. 5.0 V
Current Consumption @3.3V	Typ. 10.0 mA, Max. 15.0 mA
Noise Figure (dB)	1.0 (1575.42 MHz), 0.9 (1227.6 MHz), 1.3 (1176.45 MHz)
ESD Sensitivity	ESD sensitive device. As a best practice, Linx uses ESD packaging.

TABLE 2. MECHANICAL SPECIFICATIONS, ANTENNA PLUS LNA

Parameter	Value
Operating Temp. Range	-40 °C to +85 °C
Connection	MHF1/U.FL-type plug (female socket) on 100 mm (3.94 in) of 1.13 mm coaxial cable
Weight	18.7 g (0.66 oz)
Dimensions	25.0 mm x 25.0 mm x 12.0 mm (0.98 in x 0.98 in x 0.47 in)

GROUND PLANE INDEPENDENT OPERATION

Because of the significant signal gain provided by the antenna's LNA, the ground plane typically required for passive GNSS antenna gain performance is not required for active GNSS antennas.

MOUNTING

The GNCP-C25L125100 may be mounted by mechanical means (e.g. bracket, not included) or using an adhesive patch (not included). Alternatively, the antenna may be mounted by soldering the LNA base to a printed circuit board (PCB) - see application note, AN-00504 on the Linx website for more information.

PACKAGING INFORMATION

The ANT-GNCP-C25L125100 antenna is packaged in a protective plastic tray in quantities of 30. Antenna trays are bundled and packaged in a carton of 120 antennas. Distribution channels may offer alternative packaging options.

PRODUCT DIMENSIONS

Figure 1 provides dimensions of the ANT-GNCP-C25L125100.

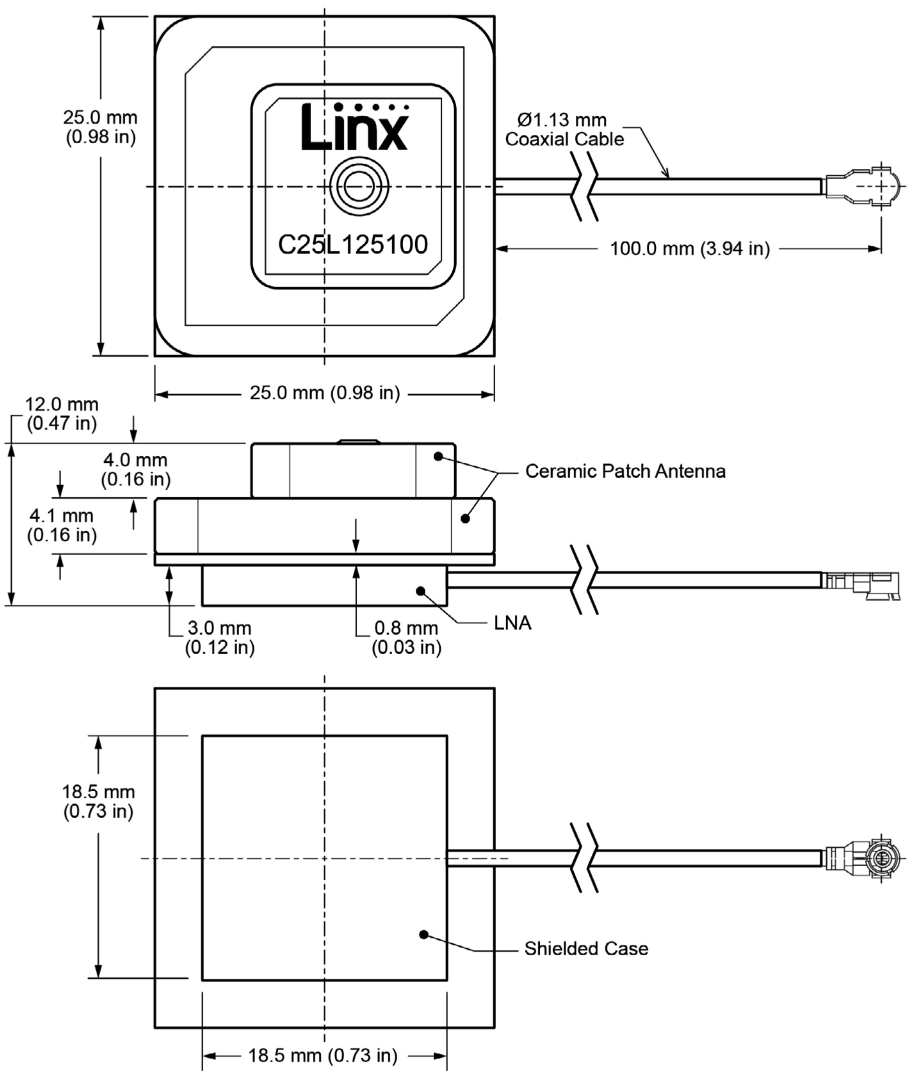


Figure 1. ANT-GNCP-C25L125100 Antenna Dimensions

VSWR

Figure 2 provides the voltage standing wave ratio (VSWR) across the L1 band, and Figure 3 provides VSWR across the L2 and L5 bands.

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.

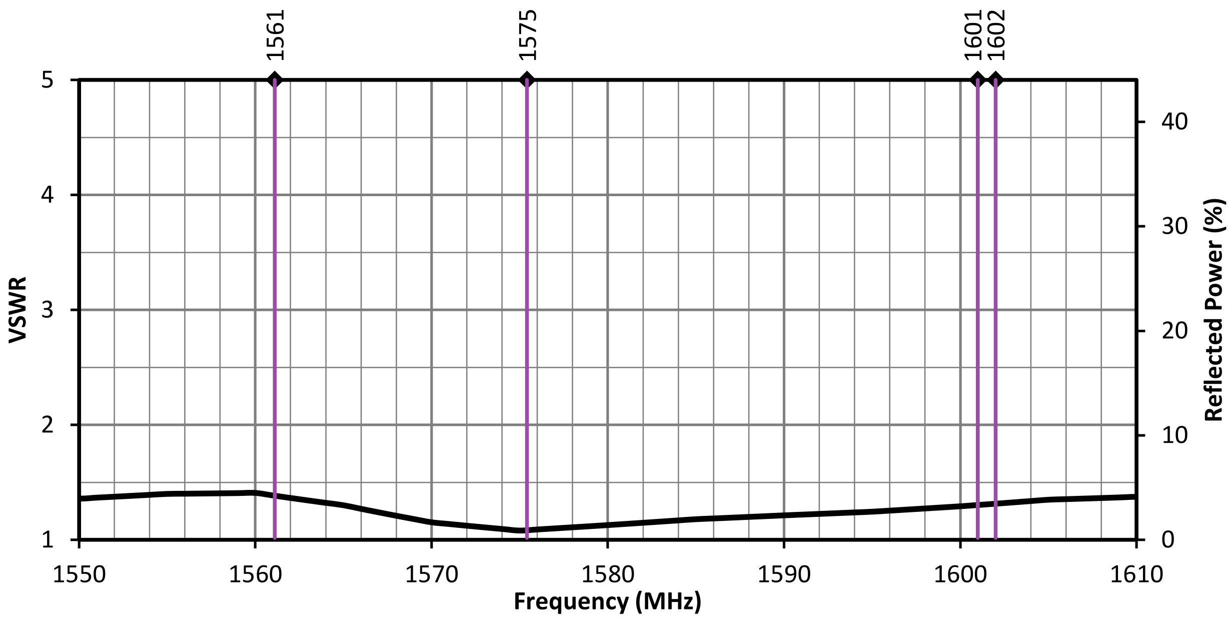


Figure 2. ANT-GNCP-C25L125100 VSWR, L1 Bands

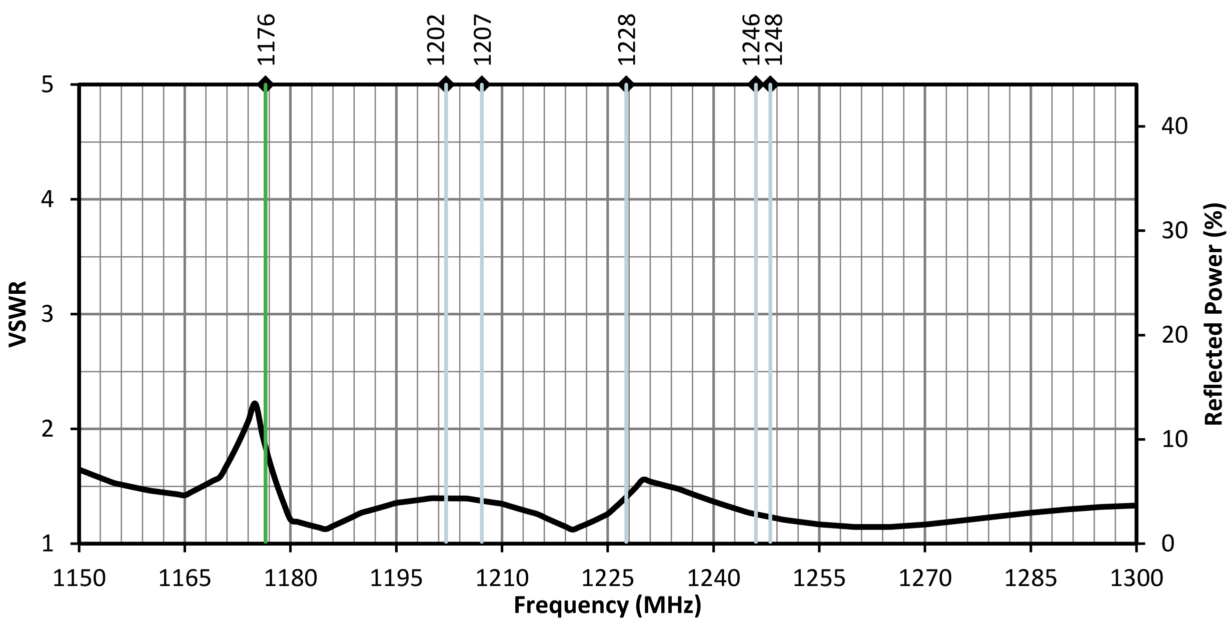


Figure 3. ANT-GNCP-C25L125100 VSWR, L2 and L5 Bands

RETURN LOSS

Return loss, shown in Figure 4, (L1 band) and Figure 5 (L2 andL5 band) 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.

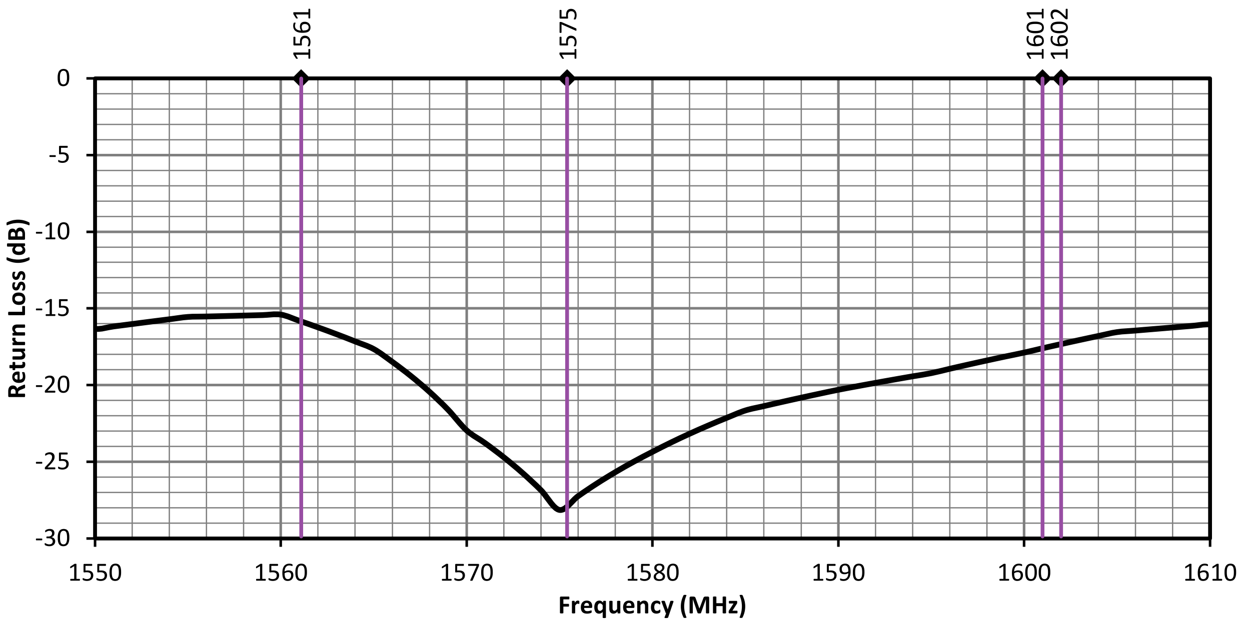


Figure 4. ANT-GNCP-C25L125100 Return Loss, L1 Bands

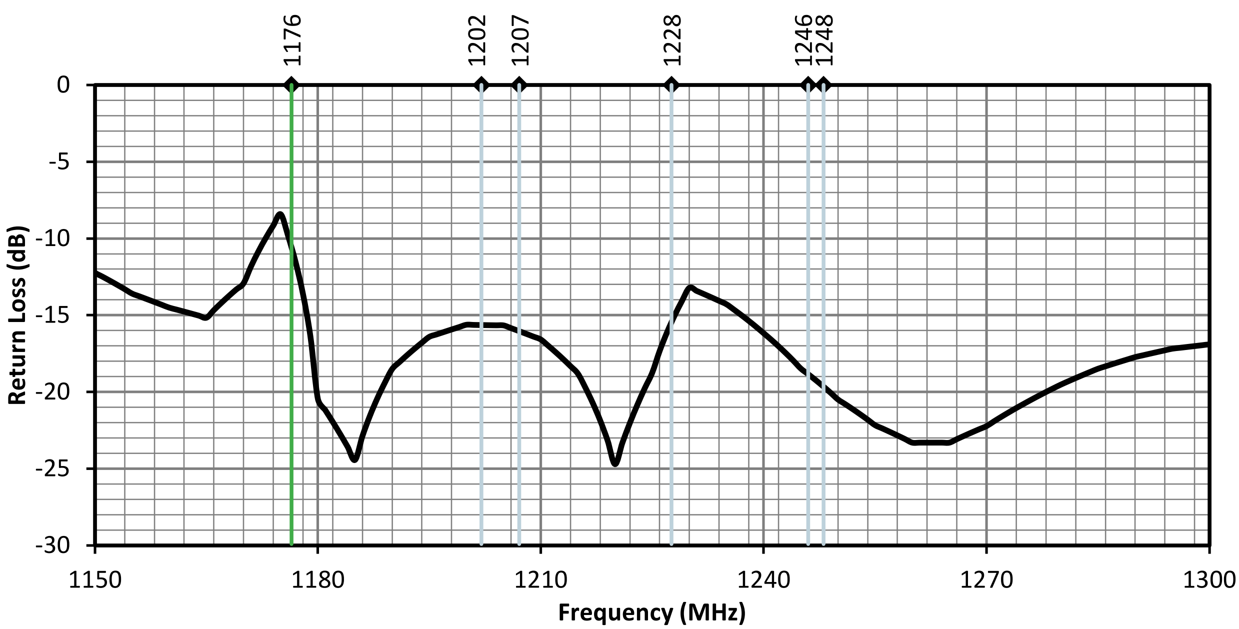


Figure 5. ANT-GNCP-C25L125100 Return Loss, L2 and L5 Bands

PEAK GAIN

The peak gain across the antenna bandwidth is shown in Figure 6 (L1 band) and Figure 7 (L2 and L5 bands). 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.

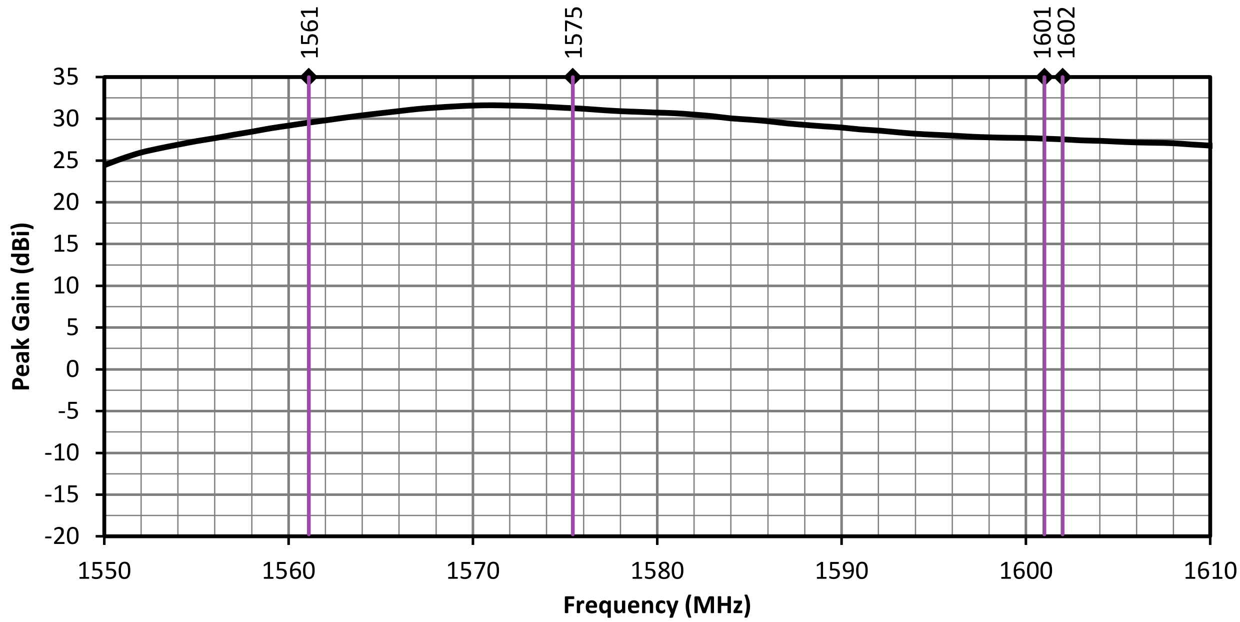


Figure 6. ANT-GNCP-C25L125100 Peak Gain, L1 Bands

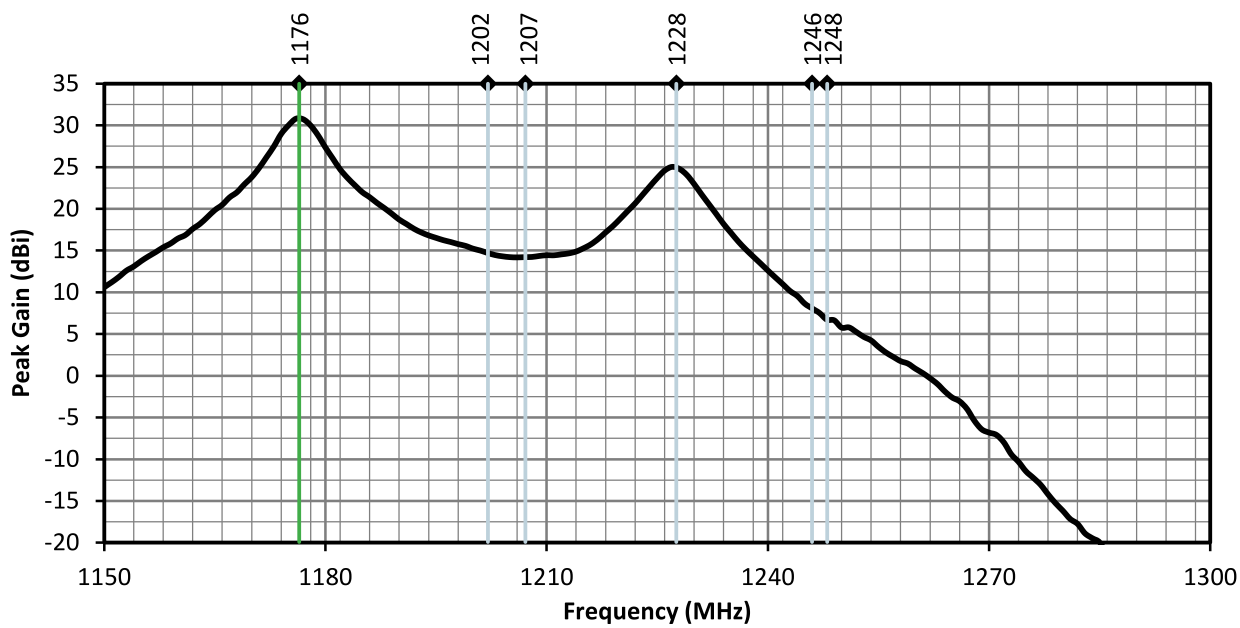


Figure 7. ANT-GNCP-C25L125100 Peak Gain, L2 and L5 Bands

AXIAL RATIO

Axial ratio provides a measure of the quality of circular polarization of an antenna, the lower the value (in dB), the better the circular polarization. A circularly polarized antenna field comprises two orthogonal E-field components. These fields are ideally of equal amplitude, resulting in an axial ratio equal to unity (0 dB). In practice, no antenna is perfectly circular in polarization, the polarization is elliptical as one field has larger magnitude. As the axial ratio increases the antenna gain degrades away from the main beam orthogonal to the antenna surface. The axial ratio for the ANT-GNCP-C25L125100 antenna is shown in Figure 8 (L1 band) and Figure 9 (L2 and L5 bands).

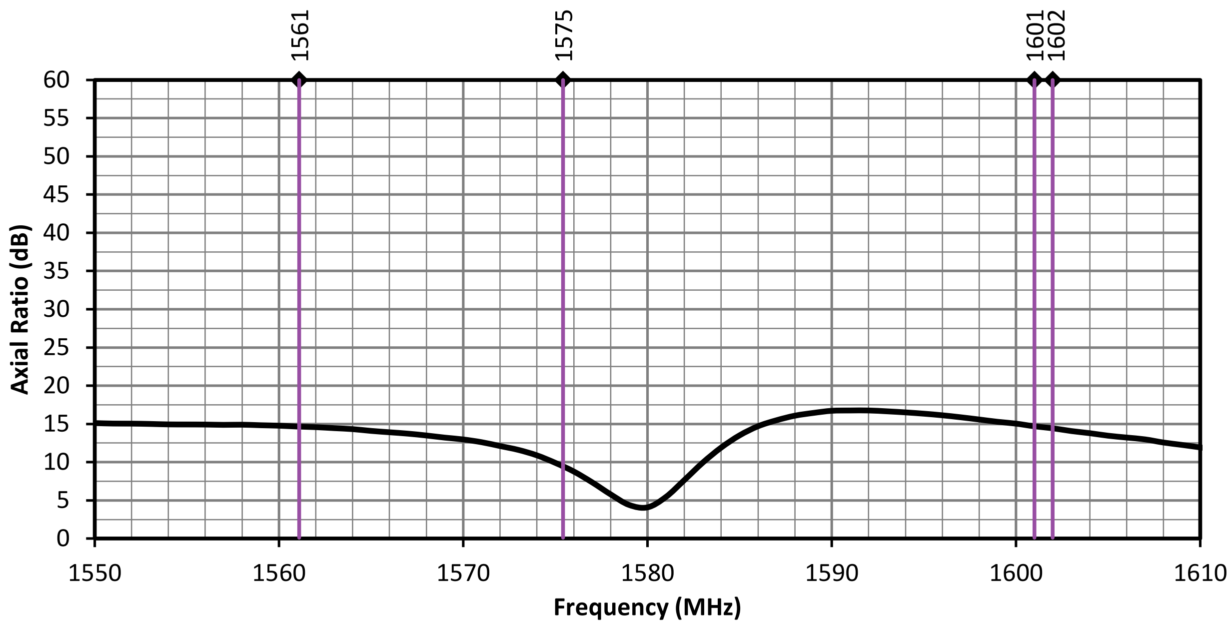


Figure 8. ANT-GNCP-C25L125100 Antenna Axial Ratio, L1 Bands

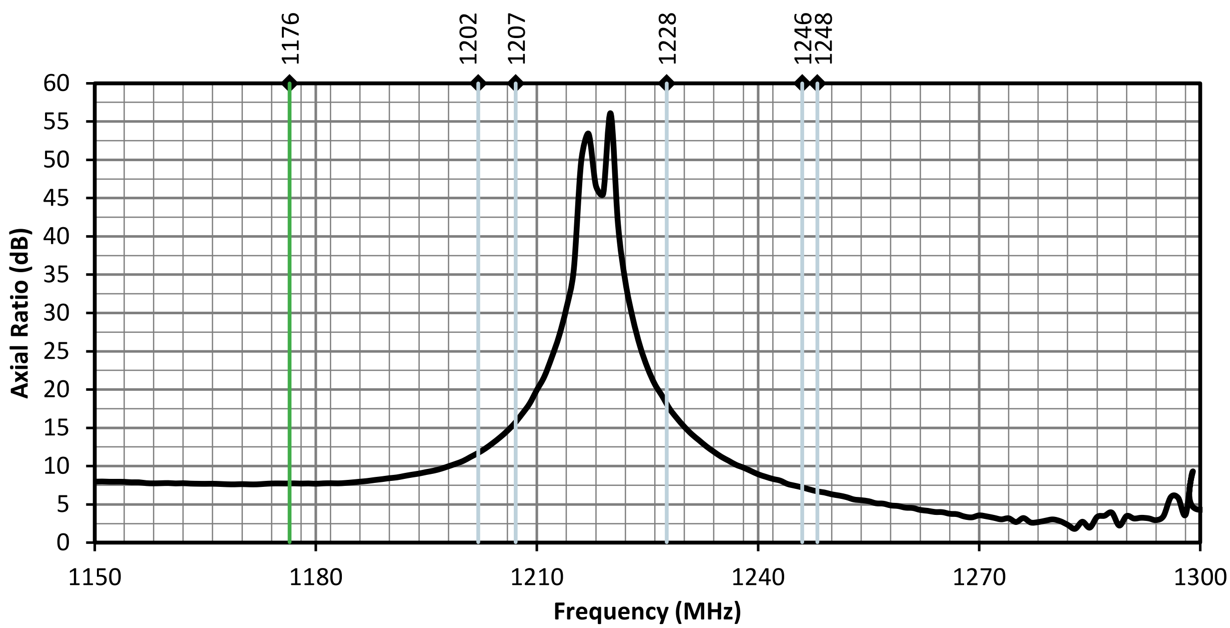
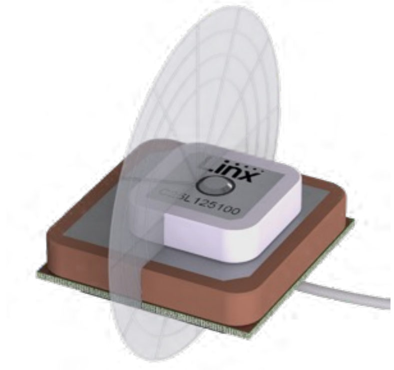


Figure 9. ANT-GNCP-C25L125100 Antenna Axial Ratio, L2 and L5 Bands

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 10 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.

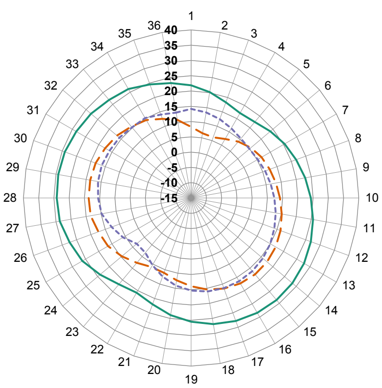
XZ-Plane Gain



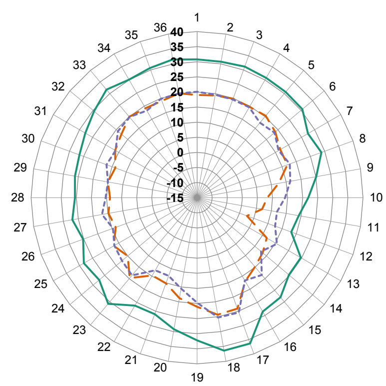
YZ-Plane Gain

XY-Plane Gain

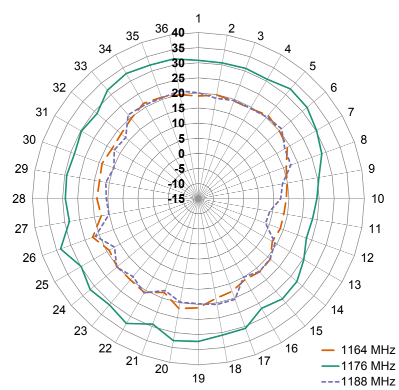
1164 MHz to 1189 MHz (1176 MHz)



XZ-Plane Gain

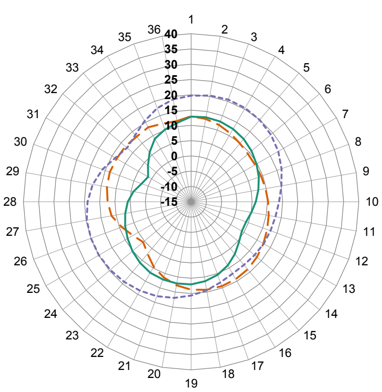


YZ-Plane Gain

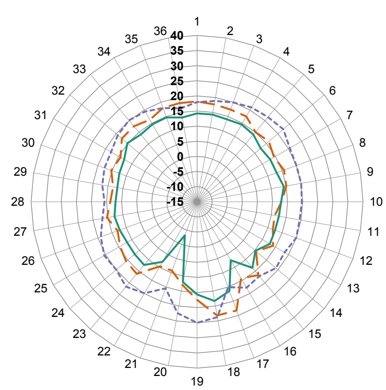


XY-Plane Gain

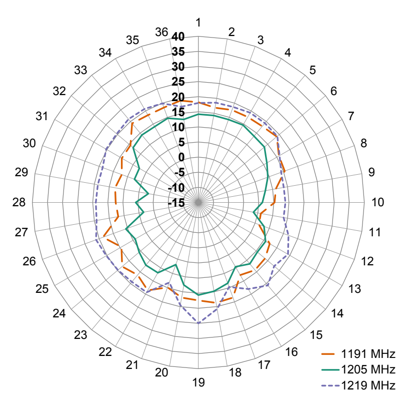
1197 MHz to 1218 MHz (1202 MHz)



XZ-Plane Gain



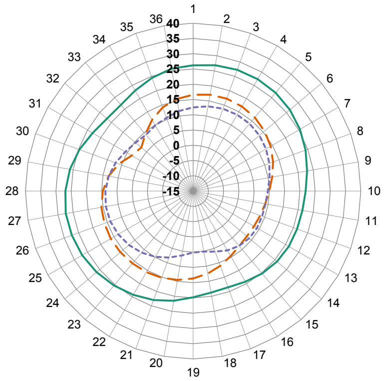
YZ-Plane Gain



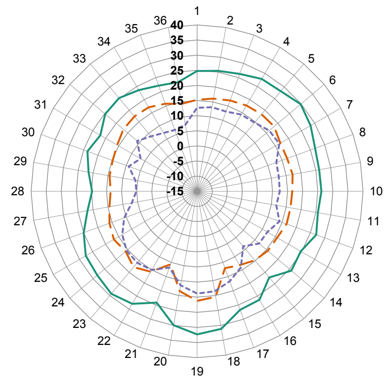
XY-Plane Gain

RADIATION PATTERNS

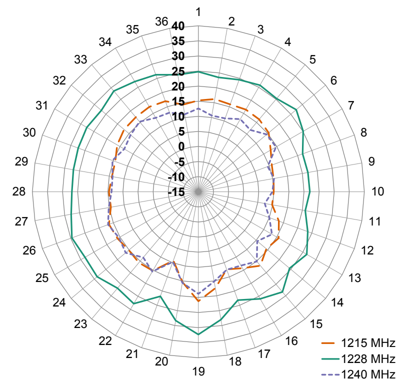
1215 MHz TO 1240 MHz (1228 MHz)



XZ-Plane Gain

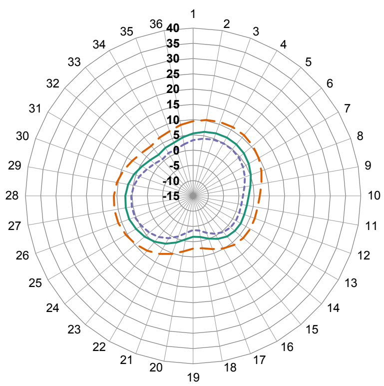


YZ-Plane Gain

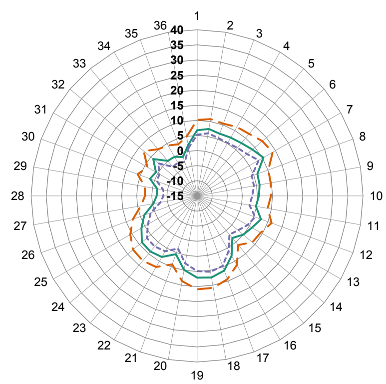


XY-Plane Gain

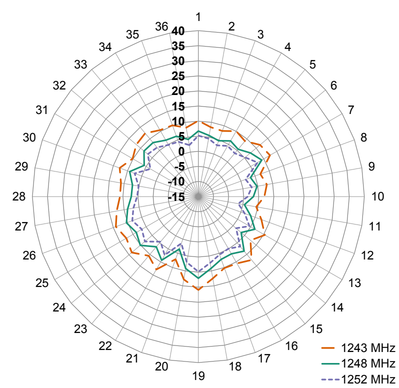
1243 MHz to 1250 MHz (1248 MHz)



XZ-Plane Gain

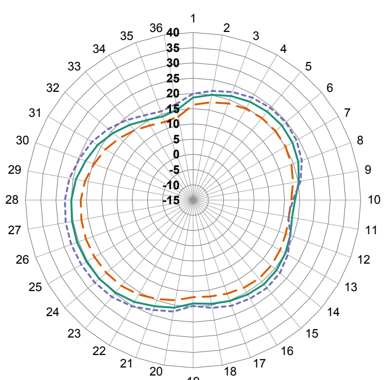


YZ-Plane Gain

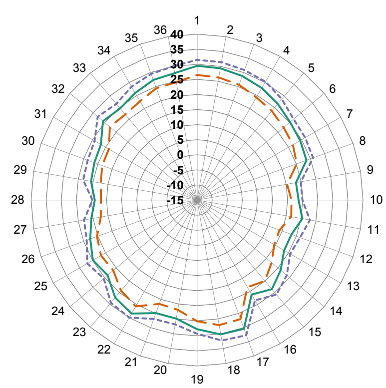


XY-Plane Gain

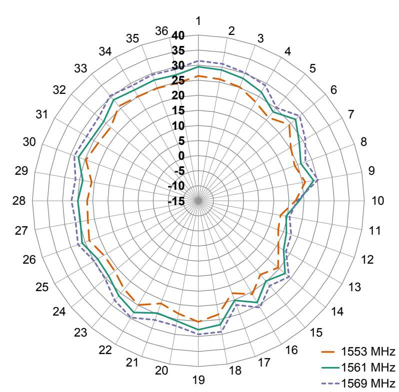
1559 MHz to 1563 MHz (1561 MHz)



XZ-Plane Gain



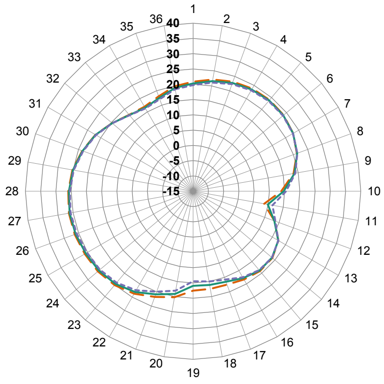
YZ-Plane Gain



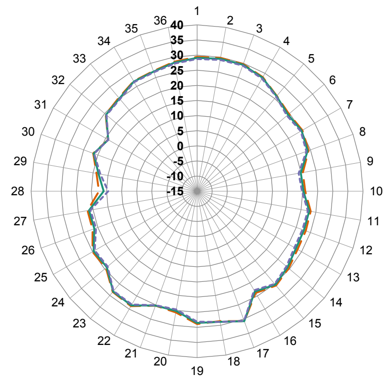
XY-Plane Gain

RADIATION PATTERNS

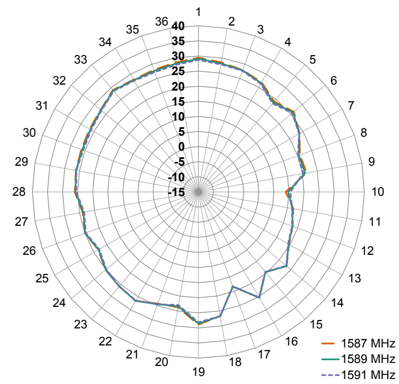
1559 MHz to 1592 MHz (1575 MHz)



XZ-Plane Gain

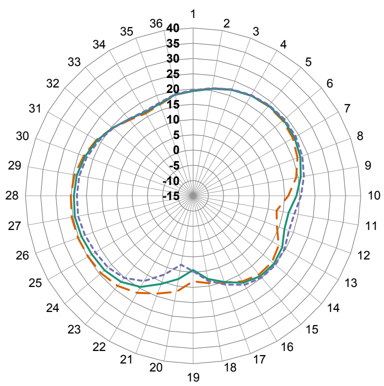


YZ-Plane Gain

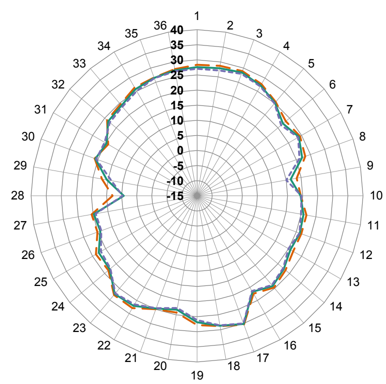


XY-Plane Gain

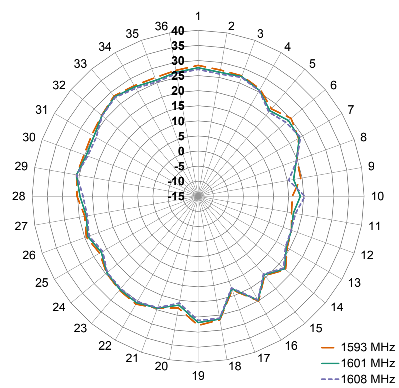
1598 MHz to 1606 MHz (1601 MHz)



XZ-Plane Gain



YZ-Plane Gain



XY-Plane Gain

Figure 10. ANT-GNCP-C25L125100 Radiation Patterns

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.

$$\text{VSWR} = \frac{10^{\left[\frac{\text{Return Loss}}{20}\right]} + 1}{10^{\left[\frac{\text{Return Loss}}{20}\right]} - 1}$$

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.

$$\text{Return Loss} = -20\log_{10}\left[\frac{\text{VSWR} - 1}{\text{VSWR} + 1}\right]$$

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.

$$\text{TRE} = \eta \cdot \left(1 - \left(\frac{\text{VSWR} - 1}{\text{VSWR} + 1}\right)^2\right)$$

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.

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

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

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.

$$\left(\frac{\text{VSWR} - 1}{\text{VSWR} + 1}\right)^2$$

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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