Datasheet

CW-RCL Series
2.4 GHz Right-Angle Whip Antenna

The ANT-2.4-CW-RCL antenna is designed for 2.4 GHz WiFi/WLAN and ISM applications including Bluetooth® and ZigBee®.

The right-angle rotating design of the ANT-2.4-CW-RCL antenna allows for the antenna to be positioned for optimum performance.

The ANT-2.4-CW-RCL antenna is available with an SMA plug (male pin) or RP-SMA plug (female socket) connector for FCC Part 15 compliant applications.

Features

- Performance at 2.4 GHz to 2.485 GHz
  - VSWR: ≤ 1.5
  - Peak Gain: 2.3 dBi
  - Efficiency: 77%
- Compact size
  - 97.7 mm x 18.7 mm x 10.5 mm
- Rotating base allows for optimal positioning
- SMA plug (male pin) or RP-SMA plug (female socket)

Applications

- Single-band WiFi/WLAN
  - 802.11b/g
- ISM applications
  - Bluetooth®
  - ZigBee®
  - IEEE 802.15.4
- Internet of Things (IoT) devices
- Sensing and remote monitoring
- Smart Home networking

Ordering Information

Part Number	Description
ANT-2.4-CW-RCL-SMA	2.4 GHz right-angle whip antenna with SMA plug (male pin)
ANT-2.4-CW-RCL-RPS	2.4 GHz right-angle whip antenna with RP-SMA plug (female socket)

Available from Linx Technologies and select distributors and representatives.

Electrical Specifications

ANT-2.4-CW-RCL	2.4 GHz
Frequency Range	2.4 GHz to 2.485 GHz
VSWR (max)	1.5
Peak Gain (dBi)	2.3
Average Gain (dBi)	-1.2
Efficiency (%)	77
Polarization	Linear
Radiation	Omnidirectional
Max Power	5 W
Wavelength	1/2-wave
Electrical Type	Dipole
Impedance	50 Ω
Connection	SMA plug (male pin) or RP-SMA plug (female socket)
Operating Temperature Range	-20 °C to +85 °C
Weight	13.0 g (0.46 oz)
Dimensions	97.7 mm x 18.7 mm x 10.5 (3.80 in x 0.74 in x 0.41 in)

Packaging Information

The CW-RCL series antennas are packaged, 50 pcs in a clear plastic bag, 500 pcs per inner box, and 2000 pcs per export box. Distribution channels may offer alternative packaging options.

Product Dimensions

Figure 1 provides dimensions of the ANT-2.4-CW-RCL. The rotating base allows for continuous positioning through 360 degrees even while installed.

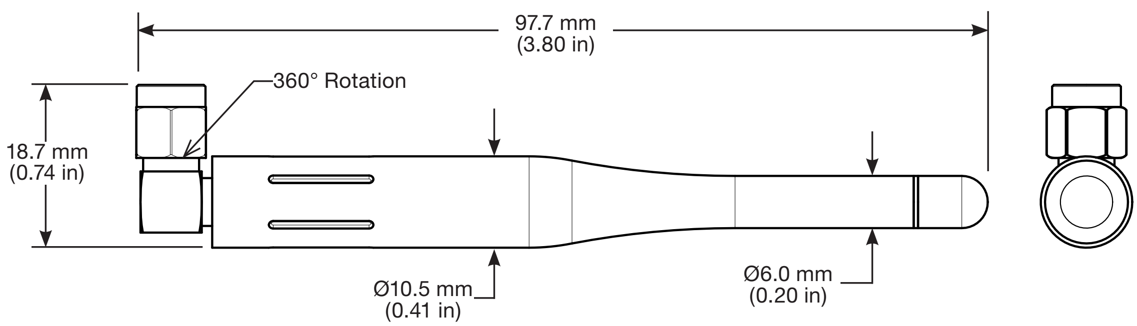

Figure 1. ANT-2.4-CW-RCL Antenna Dimensions

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.

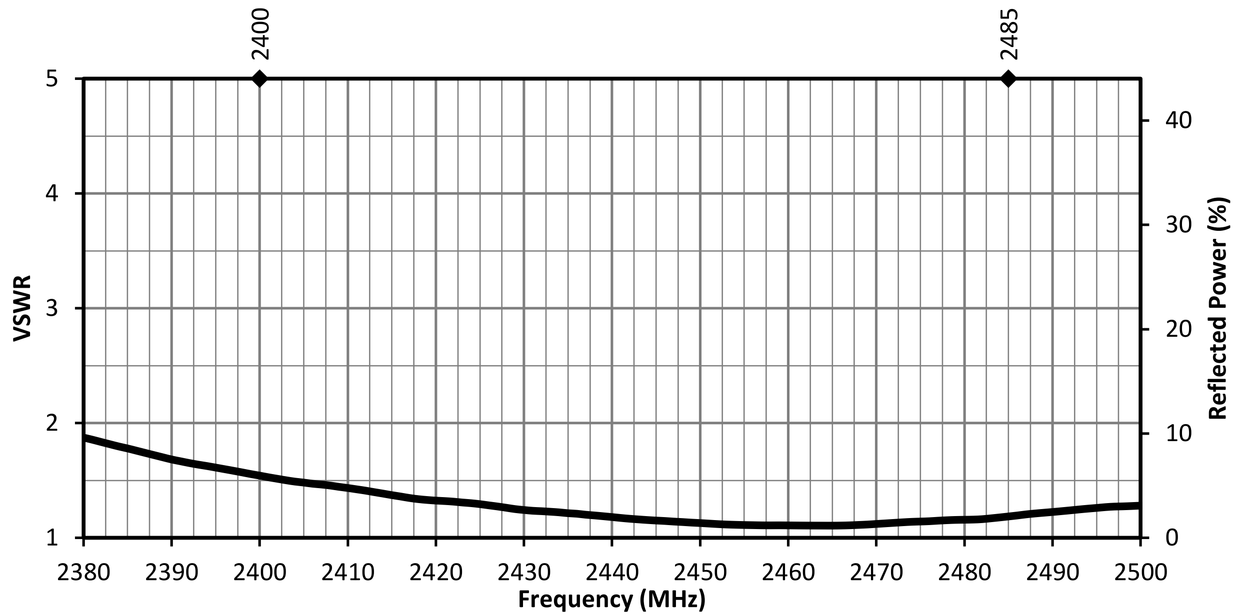

Figure 2. ANT-2.4-CW-RCL VSWR

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.

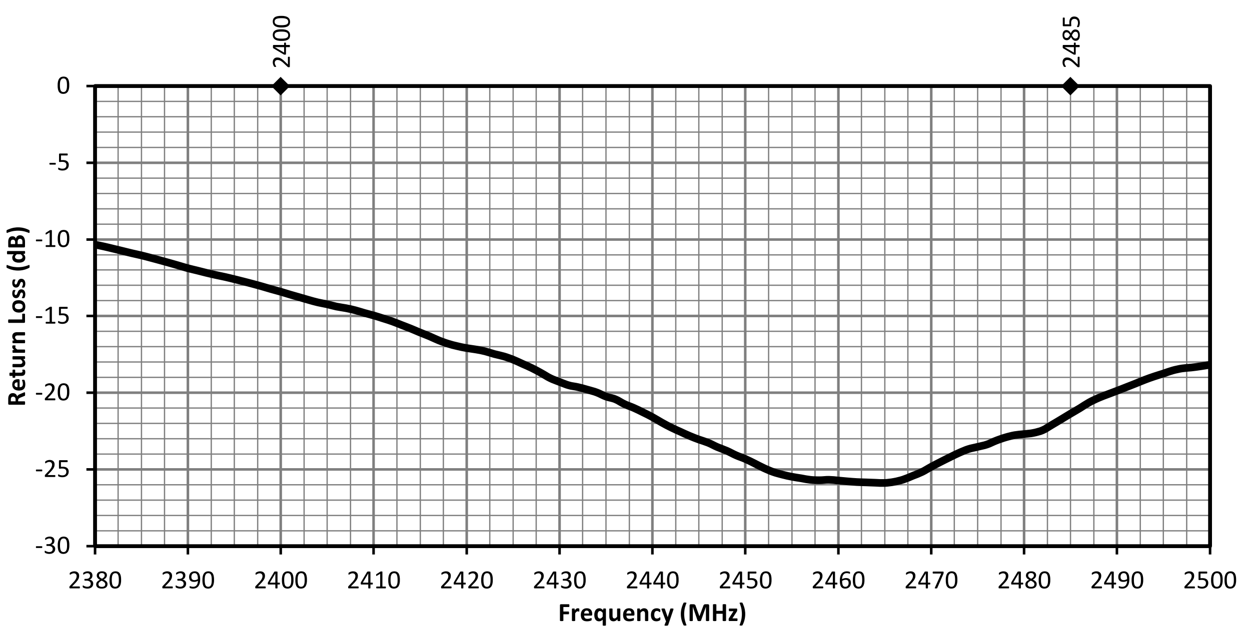

Figure 3. ANT-2.4-CW-RCL Return Loss

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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.

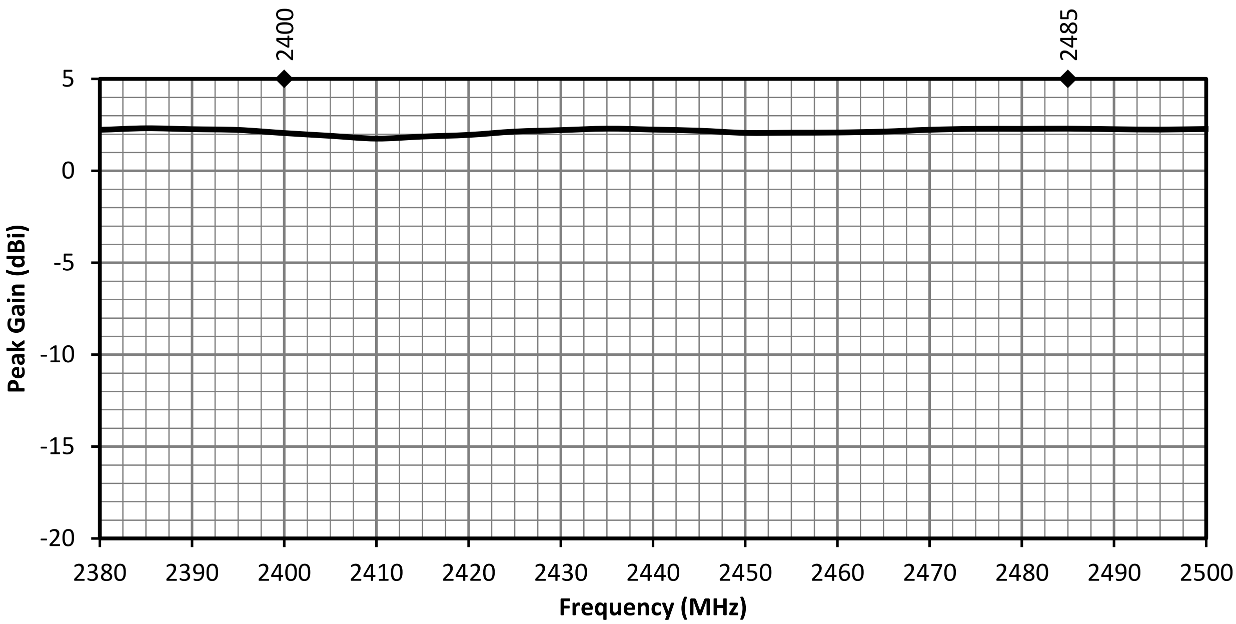


Figure 4. ANT-2.4-CW-RCL Peak Gain

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.

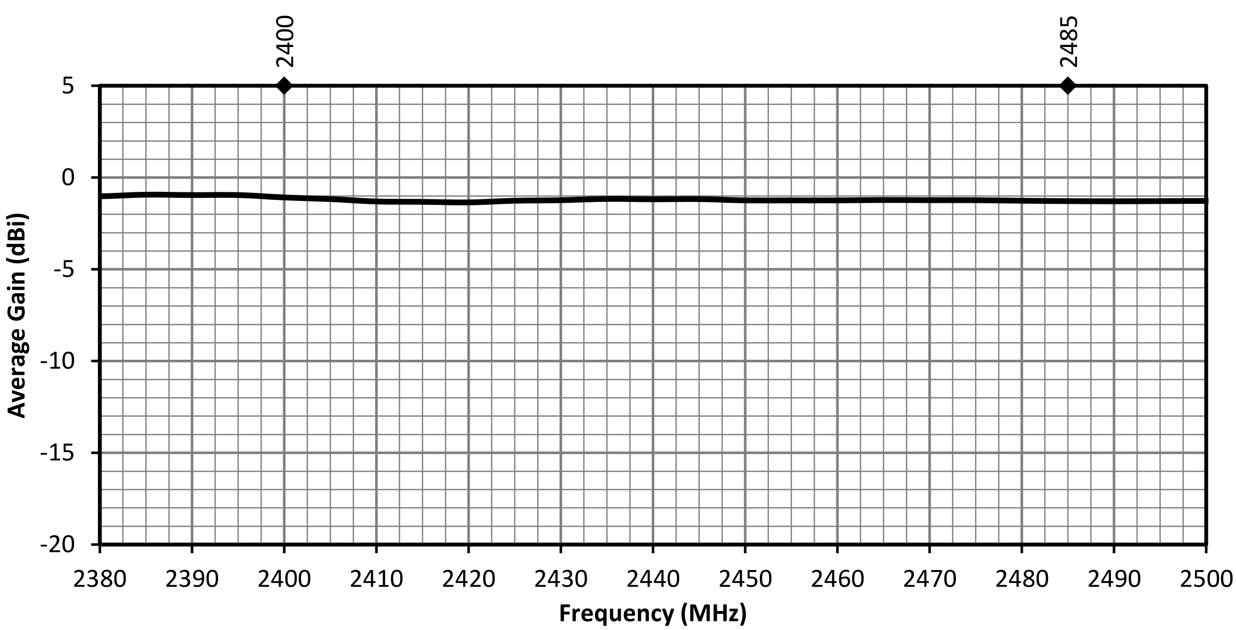


Figure 5. ANT-2.4-CW-RCL Antenna Average Gain

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.

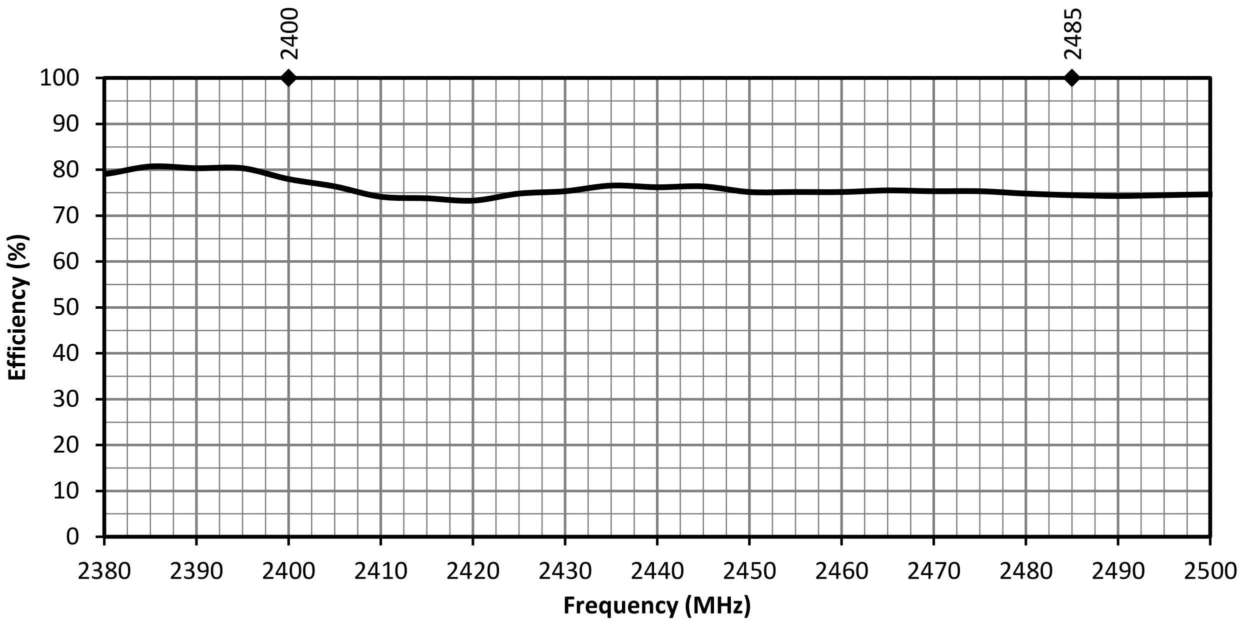
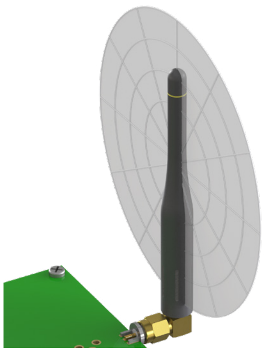


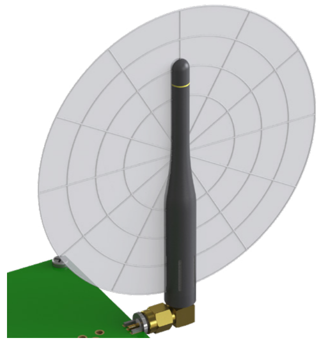
Figure 6. ANT-2.4-CW-RCL Antenna Radiation Efficiency

Radiation Patterns

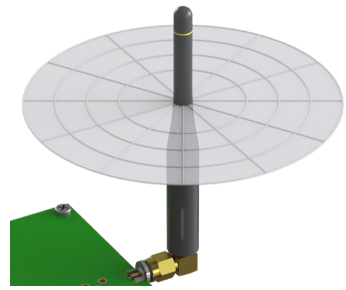
Radiation patterns provide information about the directionality and 3-dimensional gain performance of the antenna by plotting gain at specific frequencies in three orthogonal planes. Antenna radiation patterns are shown in Figure 7 using polar plots covering 360 degrees. The antenna graphic at the top 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.



XZ-Plane Gain

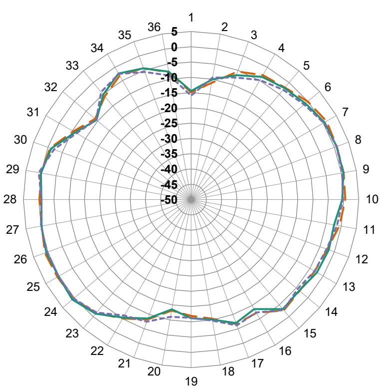


YZ-Plane Gain

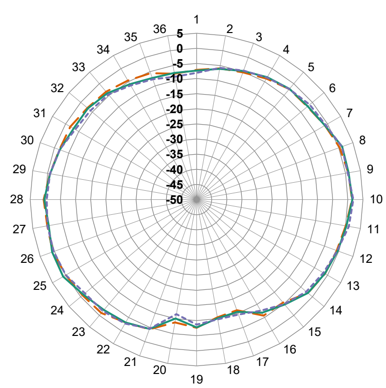


XY-Plane Gain

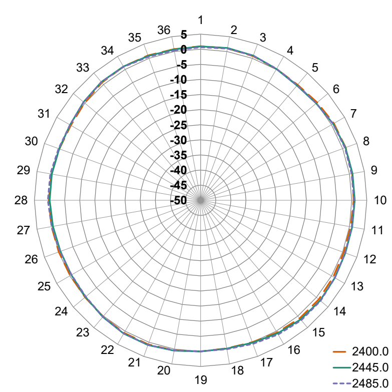
2400 MHz to 2485 MHz (2445 MHz)



XZ-Plane Gain



YZ-Plane Gain



XY-Plane Gain

Figure 7. ANT-2.4-CW-RCL 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.

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

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.

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

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.

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

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.

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

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

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.

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

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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