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ANT-2.4-LCW-ccc

Data Sheet

Product Description

The LCW Dipole Antenna is the most cost-effective solution for designers searching for superior performance for 2.4GHz applications including WiFi, Bluetooth™, ZigBee™, Thread™ and proprietary 802.15.4 applications.

The LCW delivers high efficiency and better peak gain than competitive offerings at a fraction of the leading competitors' price.

Dipole design means that no additional ground plane is required.

Features

- Cost effective
- Operates at 2.40-2.50GHz
- Peak Gain at 2.8dBi
- Omni-directional pattern
- Very low VSWR <2:1
- Slim design, less than 6 cm height at 90-degree angle
- Adjustable: articulating base lets you reorient the antenna for performance, storage and shipment
- Standard SMA or Part 15 compliant reverse polarity SMA connector (RP-SMA)

Electrical Specifications

Center Frequency:	2.45GHz
Recom. Freq. Range:	2.40–2.50GHz
Bandwidth:	100MHz
Wavelength:	½-wave
VSWR:	<2:1
Peak Gain:	2.8dBi
Average gain:	-0.6dBi typical
Impedance:	50-ohms
Connection:	RP-SMA or SMA
Weight:	7.4g (0.26oz.)
Oper. Temp. Range:	–40°C to +80°C

Electrical specifications and plot measurements taken on a 100 x 100mm ground plane, mounted on the edge, bent 90°.

Ordering Information

ANT-2.4-LCW-RPS (with RP-SMA connector)
ANT-2.4-LCW-SMA (with SMA connector)

Revised 10/18/2018

Product Dimensions

Dipole antennas, ground planes and additional orientations

Since it is not always possible to provide an adequate ground plane, dipole antennas like the LCW are designed with a built-in ground plane, so an external ground plane is not required for the antenna to radiate properly.

Linx knows how our customers most frequently use our antennas in theirs designs, typically mounted to enclosures, conductive or non-conductive, so we tested our LCW antenna in 2 different configurations: straight, without ground (free space), and edge of a ground plane bent at 90°.

Straight, without ground

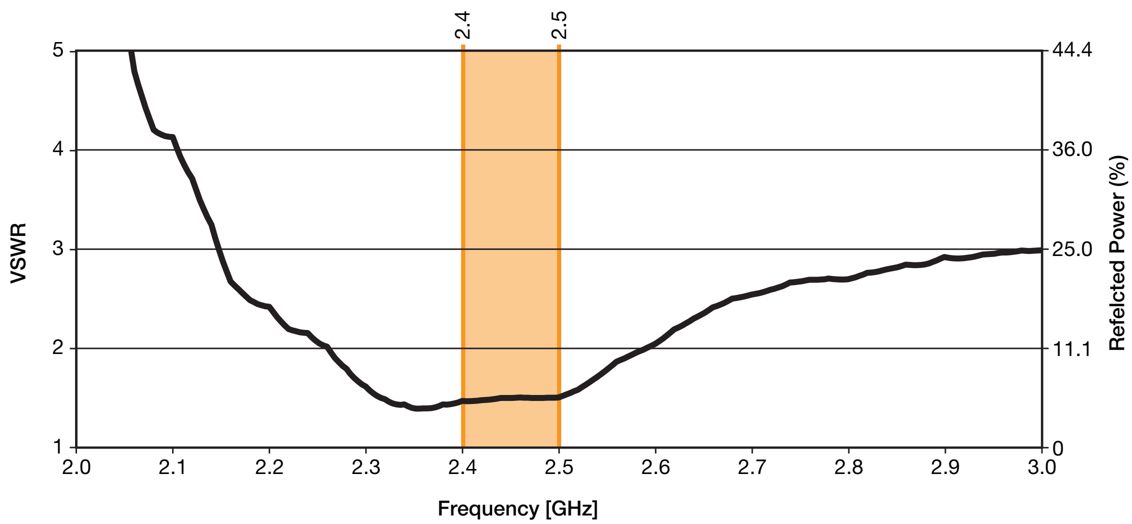
Bent 90°, on edge of ground

Linx tested the LCW dipole antenna to ensure excellent radiation behavior and minimize the risk to the customer when implementing a new design, regardless of complexity.

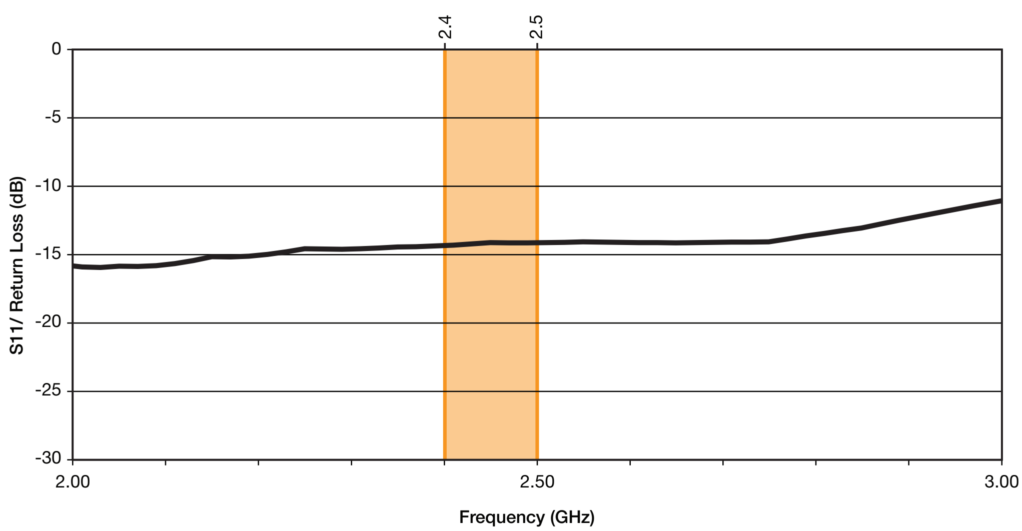
Additionally, there are many other configurations with which our LCW antenna will have similar performance to the Bent 90°, on edge of ground, with minimal difference, as shown below.

Antenna straight on non-conductive surface/ Free space

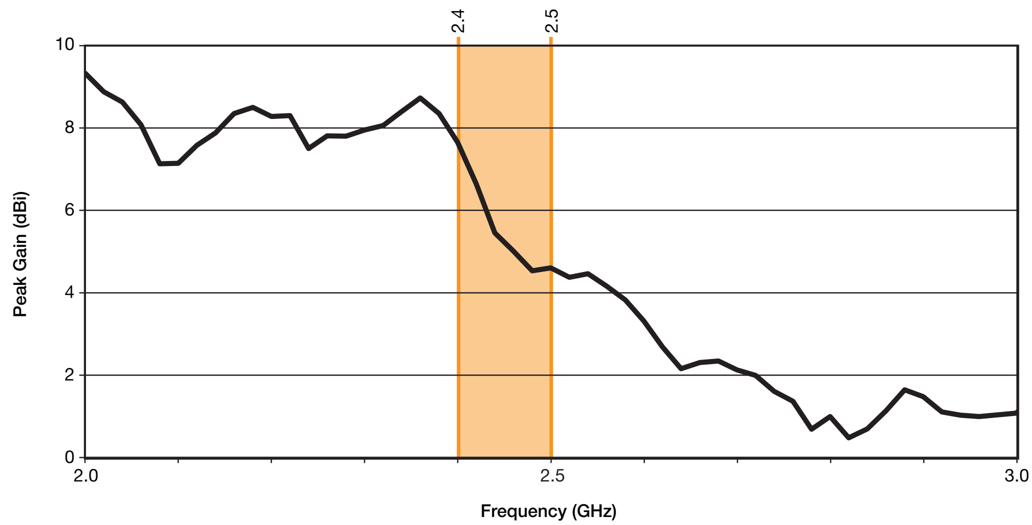
VSWR



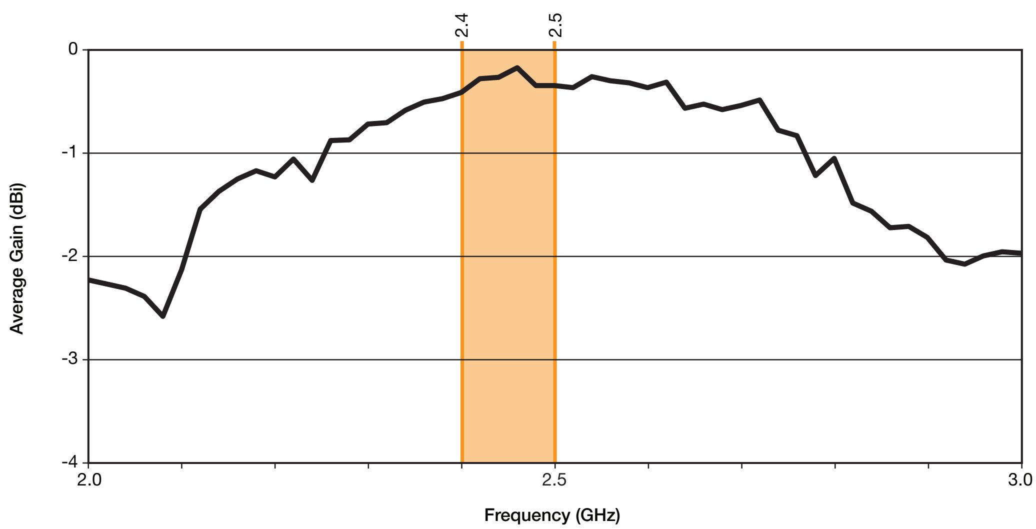
Return Loss



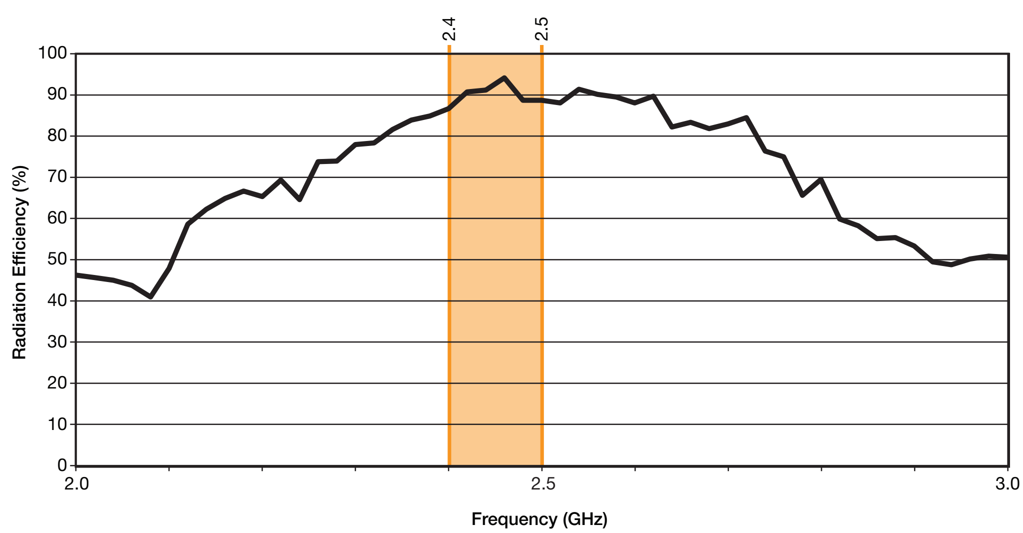
Peak Gain



Average Gain



Radiation Efficiency



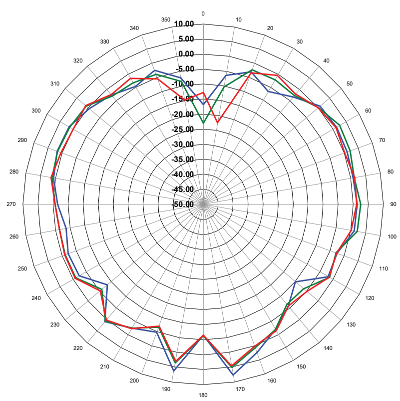
Antenna straight on non-conductive surface/ Free space

XZ-Plane Gain

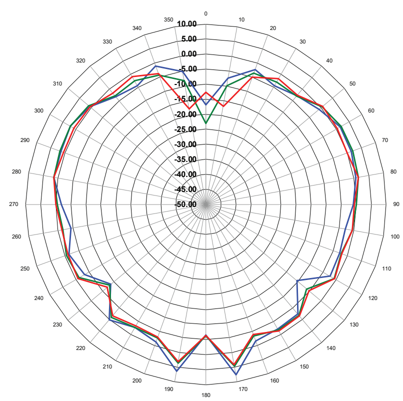
YZ-Plane Gain

XY-Plane Gain

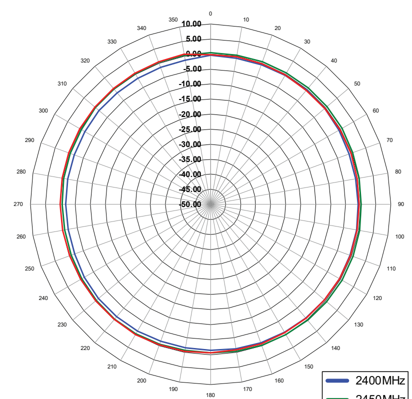
2400 - 2500MHz



XZ-Plane Gain



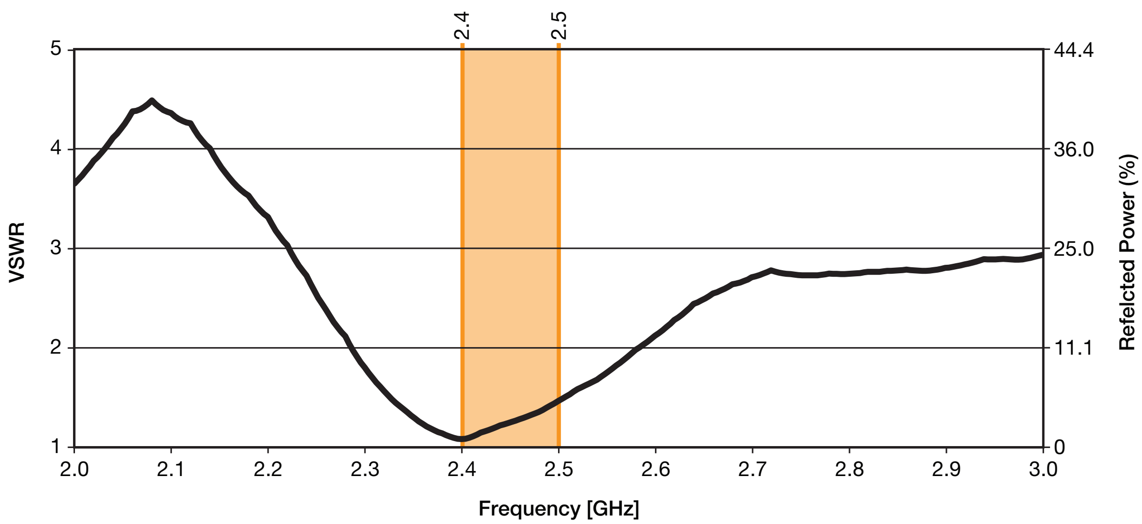
YZ-Plane Gain



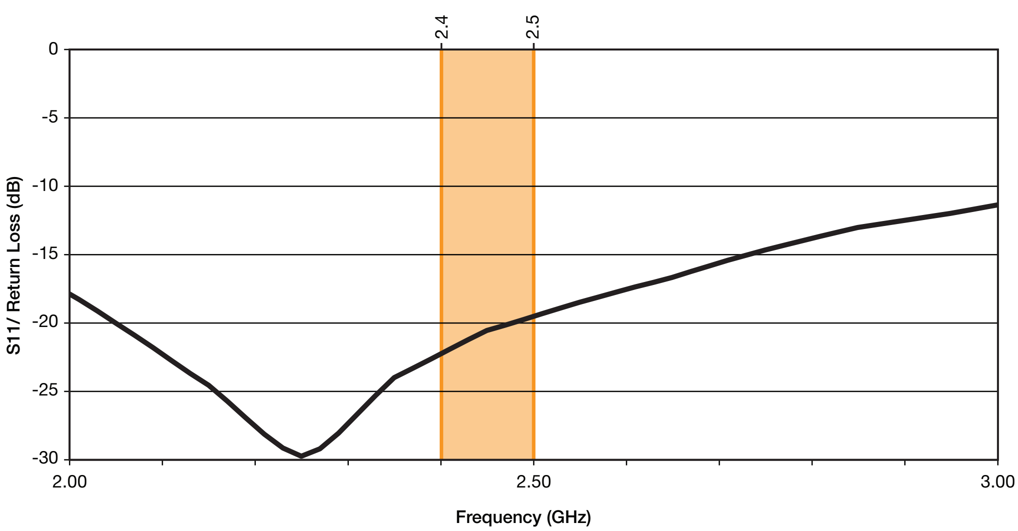
XY-Plane Gain

Edge of the Ground Plane, Bent 90°

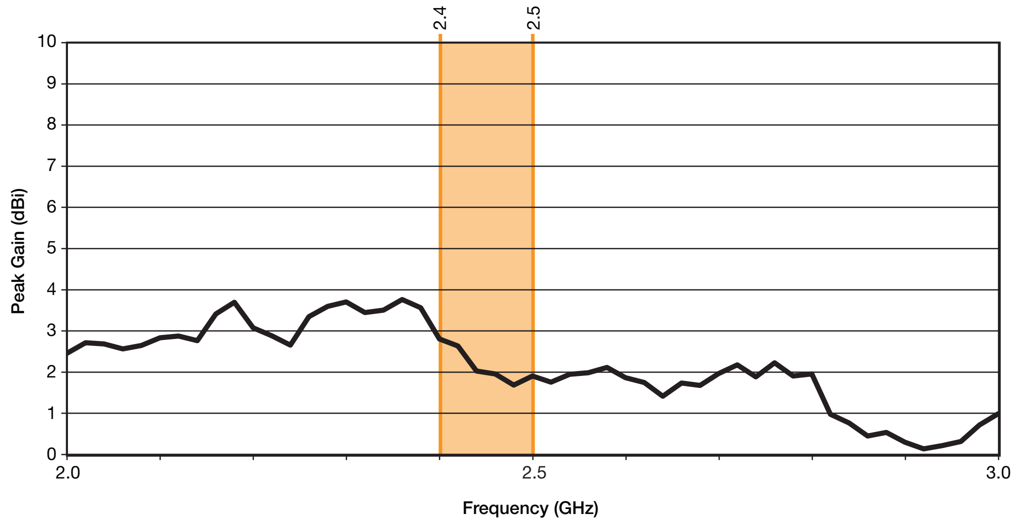
VSWR



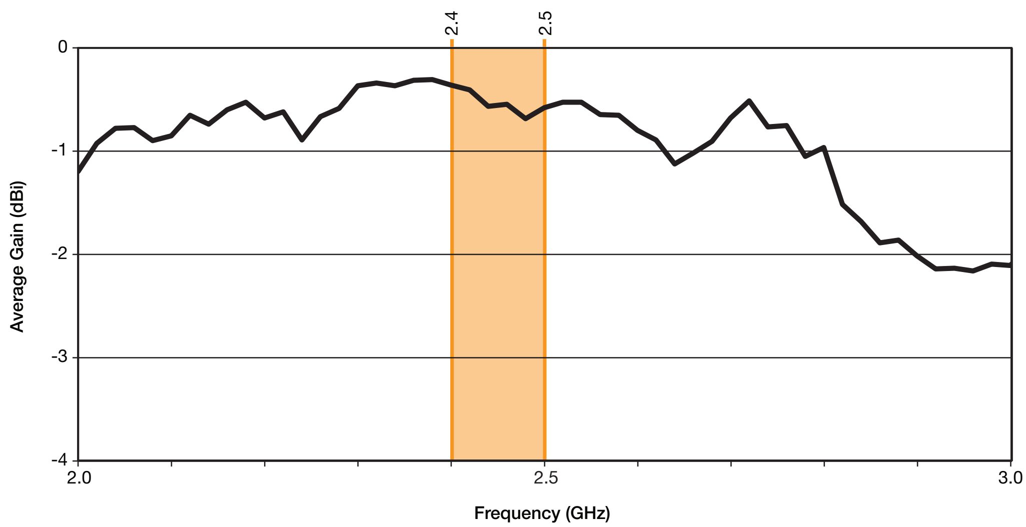
Return Loss



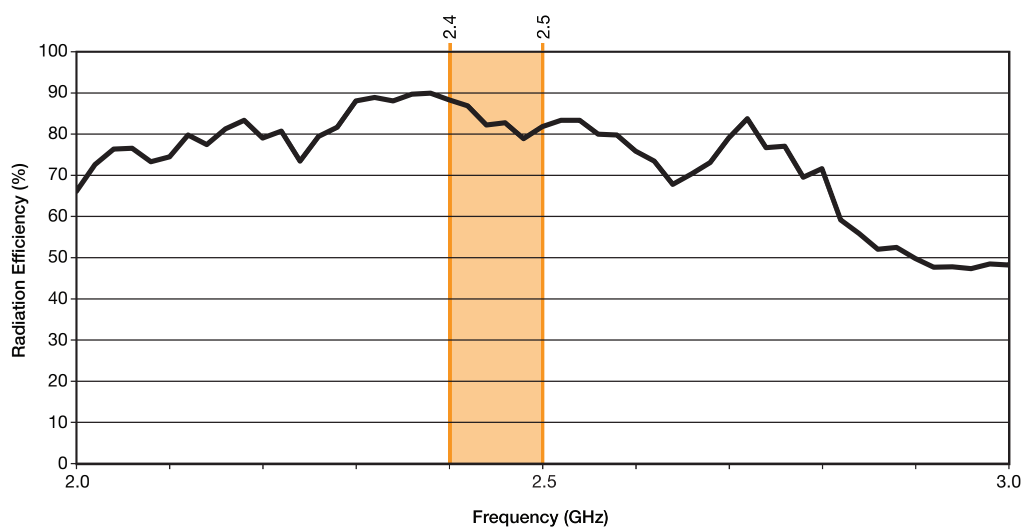
Peak Gain



Average Gain



Radiation Efficiency



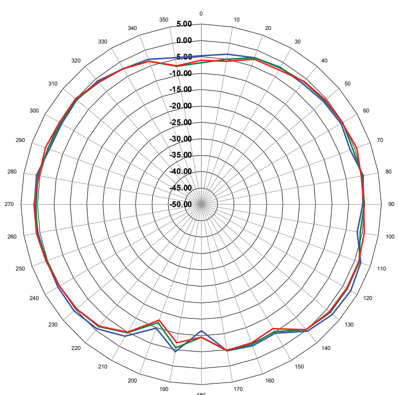
Gain Plots - Edge of Plane, Bent 90°

XZ-Plane Gain

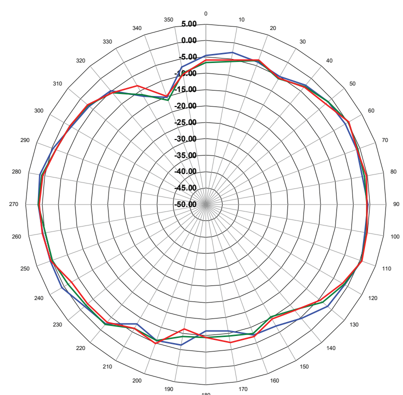
YZ-Plane Gain

XY-Plane Gain

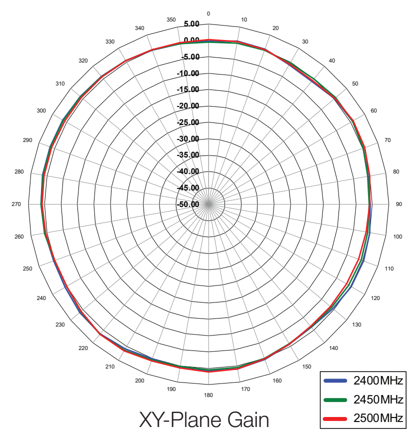
2400 - 2500MHz



XZ-Plane Gain



YZ-Plane Gain



XY-Plane Gain

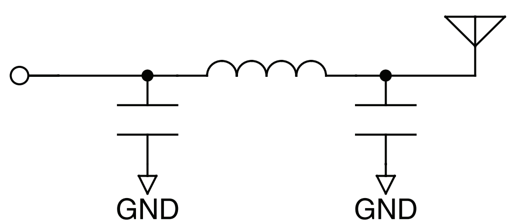
Matching Network

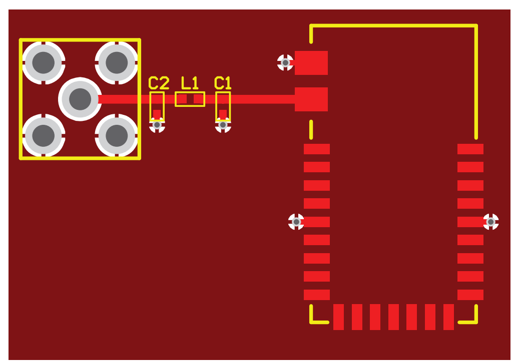
Linx tests all our antennas in ideal scenarios where effects from conductive surfaces, non-conductive surfaces or human proximity issues are eliminated. As a designer, you do not have much control over the environment your product will be used in.

Linx has always worked closely with our customers, and we know what the primary concerns and pitfalls are for designers and how to prepare for them. Whether you are designing for a monopole or a dipole antenna, or an external or even an embedded surface mount antenna, the most common question is, “Why isn’t my design working?”, and frequently it turns out the design needed a matching network.

As your product design progresses, the chances for proximity effect increases as other components are added. Some components can act like ground planes, if they have large conductive surface areas, and can cause interference. This interference is called proximity effect, which can cause a downward shift in the center frequency of the circuit, depending on how strong the effects are. Proximity effect is commonly caused by components like pc boards, batteries, motors, sensors, actuators and even non-conductive enclosures like radomes. Interference can also occur from human proximity, like when using a hand-held mobile device.

Although our dipole antennas have been designed to minimize these effects, we strongly recommend the use of a matching network, so you can ensure that you retain optimum signal levels. A matching network is a circuit that balances the impedance and ensures there is minimum reflected energy coming back from the antenna. This enables the integrator to optimize the performance in a specific band or to level performance across all bands. The most common matching network design is called a Pi circuit, placed between the antenna and the radio; it is a simple circuit of two capacitors to ground on either side of a series inductor.





The values can be selected to electrically tune the antenna. It does take test equipment, such as a network analyzer, to get this right though. Often a design ends up having little or no proximity effect, eliminating the need to retune the matching section. In these cases, the matching section can have a zero ohm resistor in place of the Inductor, leaving the other two shunt components un-populated.

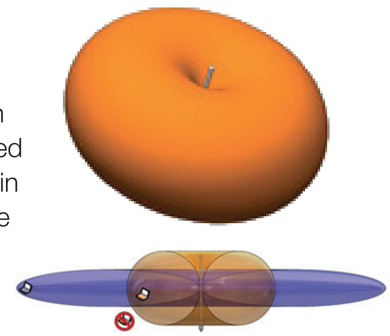
The values of the matching components are determined experimentally on the product’s board. Since there are many variables that play into the antenna’s final performance, it is very difficult to predict what it will do on any specific design. It is best to design in the matching network, see what the antenna does on the prototype and then dial the performance in with the network components. Not all of the components may be needed on a particular design, so they do not need to be populated in production; but it is a good idea to have the component pads on the board in case they are needed. The components should be placed close to the antenna connection. The component pads should be placed on the 50-ohm line between the radio and the antenna.

Linx Technologies offers a service to help customers tune our antennas to their circuit boards. Please contact Linx for more details.

About Gain Plots

The true measure of the effectiveness of an antenna in any given application is determined by the gain and radiation pattern measurement. For antennas gain is typically measured relative to a perfect (isotropic) radiator having the same source power as the antenna under test, the units of gain in this case will be decibels isotropic (dBi). The radiation pattern is a graphical representation of signal strength measured at fixed distance from the antenna.

Gain when applied to antennas is a measure of how the antenna radiates and focuses energy into free space. Much like a flashlight focuses light from a bulb in a specific direction, antennas focus RF energy into specific directions. Gain in this sense refers to an increase in energy in one direction over others.



It should also be understood that gain is not “free”, gain above 0dBi in one direction means that there must be less gain in another direction. Pictorially this can be pictured as shown in the figures to the right. The orange pattern represents the radiation pattern for a perfect dipole antenna, which is shaped like a donut. The pattern for an omnidirectional antenna with gain is shown in blue. The gain antenna is able to work with a device located further from the center along the axis of the pattern, but not with devices closer to the center when they are off the axis – the donut has been squished.

Gain is also related to the overall physical size of the antenna, as well as surrounding materials. As the geometry of the antenna is reduced below the effective wavelength (considered an electrically small antenna) the gain decreases. Also, the relative distance between an electrically small antenna and its associated ground impacts antenna gain.

What is VSWR?

The Voltage Standing Wave Ratio (VSWR) is a measurement of how well an antenna is matched to a source impedance, typically 50-ohms. It is calculated by measuring the voltage wave that is headed toward the load versus the voltage wave that is reflected back from the load. A perfect match has a VSWR of 1:1. The higher the first number, the worse the match, and the more inefficient the system. Since a perfect match cannot ever be obtained, some benchmark for performance needs to be set. In the case of antenna VSWR, this is usually 2:1. At this point, 88.9% of the energy sent to the antenna by the transmitter is radiated into free space and 11.1% is either reflected back into the source or lost as heat on the structure of the antenna. In the other direction, 88.9% of the energy recovered by the antenna is transferred into the receiver. As a side note, since the “:1” is always implied, many data sheets will remove it and just display the first number.

How to Read a VSWR Graph

VSWR is usually displayed graphically versus frequency. The lowest point on the graph is the antenna’s operational center frequency. In most cases, this is different than the designed center frequency due to fabrication tolerances. The VSWR at that point denotes how close to 50-ohms the antenna gets. Linx specifies the recommended bandwidth as the range where the typical antenna VSWR is less than 2:1.

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