Implementation Guidelines for the MON Series Antenna

Application Note AN-00511

Introduction

The Linx MON Series LTE antenna is a high-end design that provides excellent performance in a tiny package. It is a monopole antenna, so it is only half the antenna structure. The other half is a ground plane on a PCB or a conductive enclosure. This means that the the PCB implementation and packaging are critical to the overall antenna performance.

The MON Series antenna is tested on a 100mm x 100mm ground plane. Many applications need to use a different size ground plane due to product size limits or other constraints. This application note shows the change in antenna performance with a 90mm x 150mm ground plane in different orientations.

This data gives a reference point for how the antenna performance changes with the ground plane size. Each product design is unique and the board shape, other components and enclosure will impact the overall antenna performance. Including a matching network on the design will enable the antenna to be tuned for the individual board, giving optimum performance in that design. A brief discussion of matching networks is included at the end of this note, but contact Linx technical support for more details.

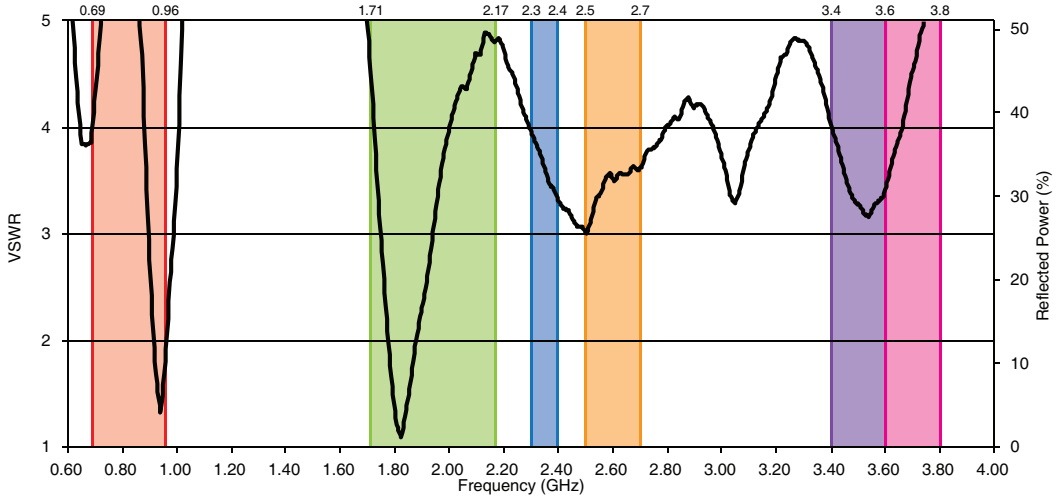
Electrical Specifications

Parameter						
Recommended Frequency Range	LTE/ GSM850/ GSM900	DCS/ PCS/ UMTS1	LTE 2300	LTE 2600	LTE3500	LTE3700
	698 – 960	1710 – 2170	2300 – 2400	2500 – 2700	3400 – 3600	3600 – 3800
VSWR (typical at center)	<2.5:1	<3.5:1	<4.6:1	<3.7:1	<2.2:1	<2.8:1
Peak Gain (max in the band)	5.8dBi	3.7dBi	2.0dBi	1.4dBi	5.2dBi	6.1dBi
Average Gain (typical)	–0.50dBi	–1.75dBi	–2.90dBi	–3.05dBi	–1.95dBi	–2.20dBi
Efficiency (typical)	82%	70%	52%	60%	65%	60%
Polarization	Linear					
Radiation	Omni-Directional					
Max Power	15W					
Wavelength	¼-wave					
Impedance	50-ohms					
Connection	SMA Plug (Male)					
Weight	8g (0.3oz.)					
Operating Temperature Range	–40°C to +70°C					

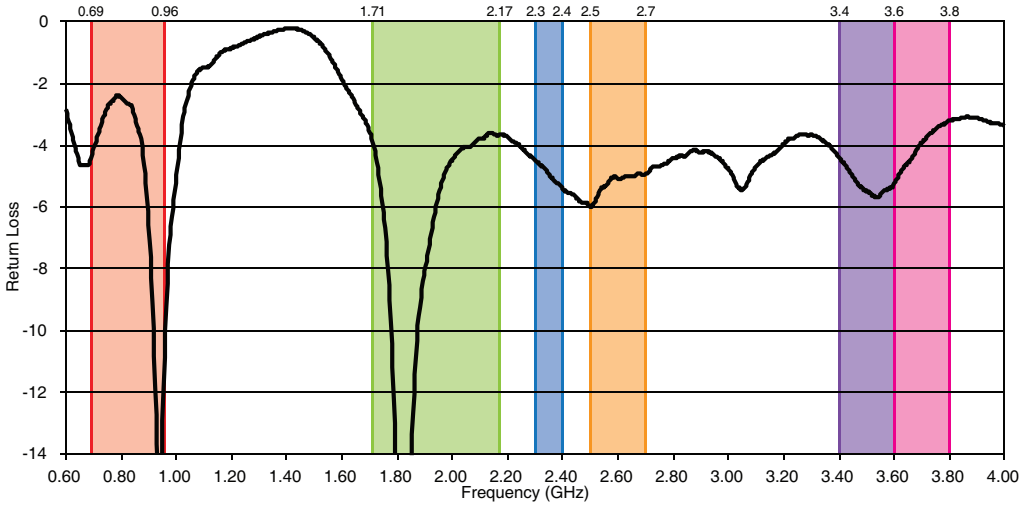
Measurements taken on a 100 x 100mm (4 x 4in) ground plane, mounted on the edge, straight

Edge of the Ground Plane, Straight

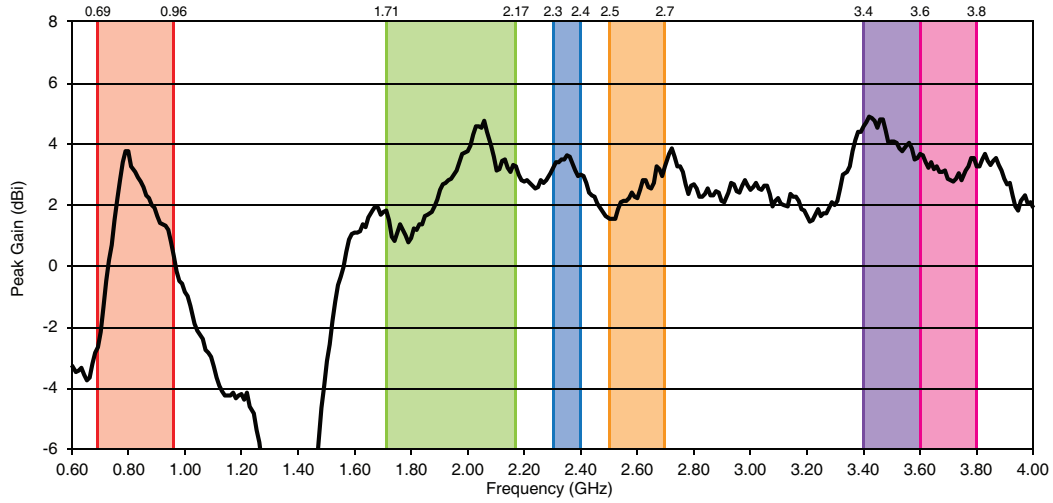
VSWR



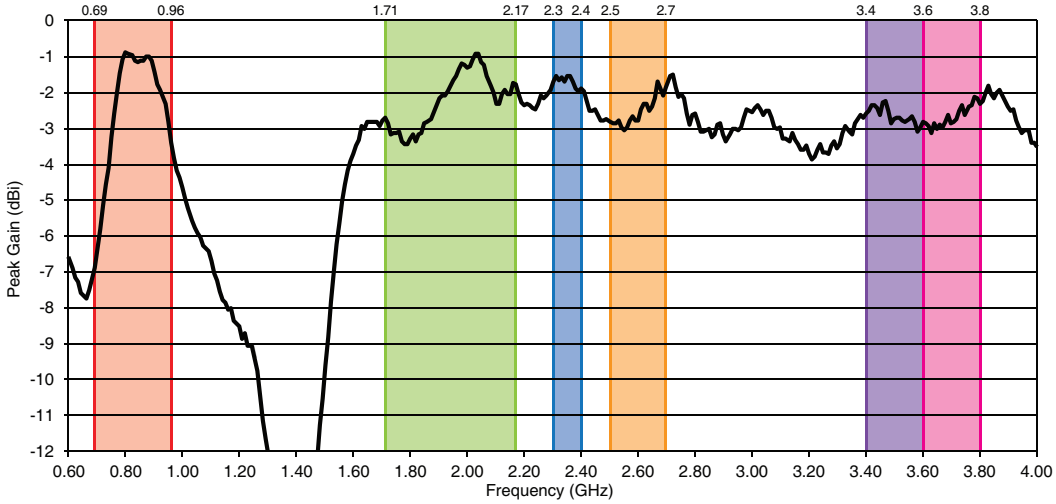
Return Loss



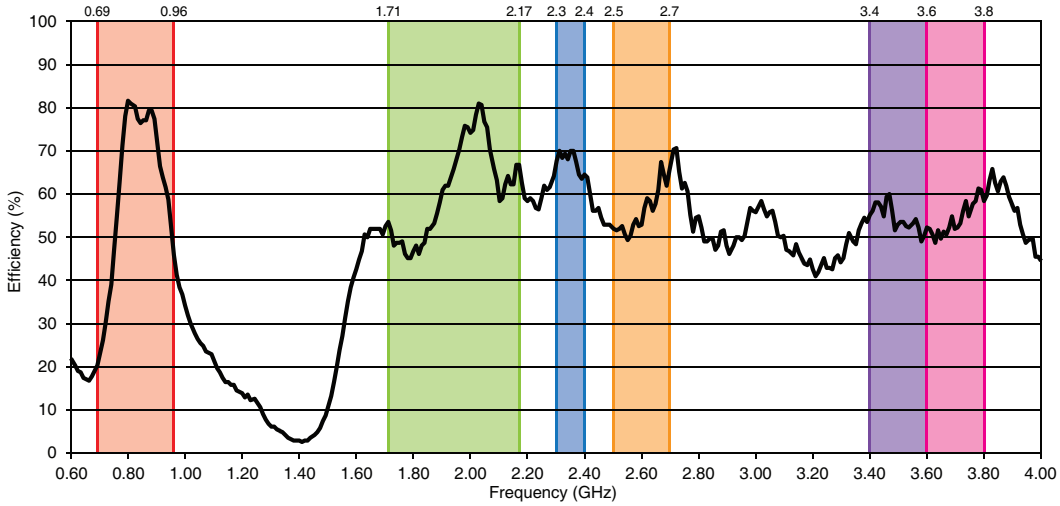
Peak Gain



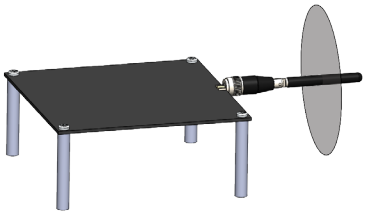
Average Gain



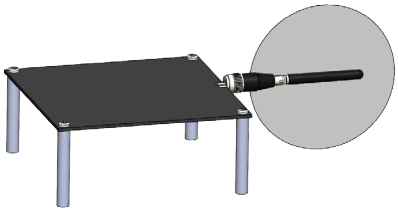
Radiation Efficiency



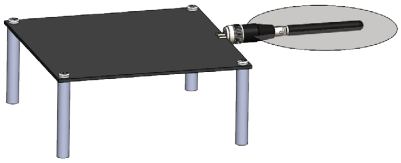
Gain Plots - Edge of Plane, Straight



XZ-Plane Gain

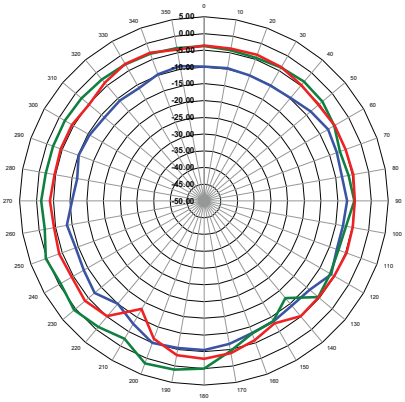


YZ-Plane Gain

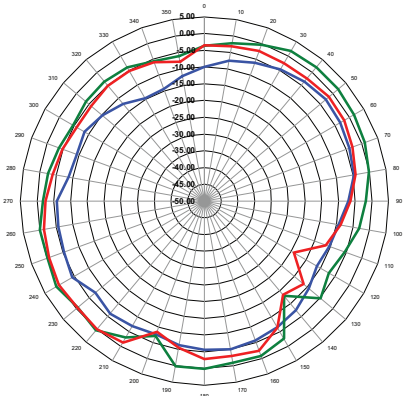


XY-Plane Gain

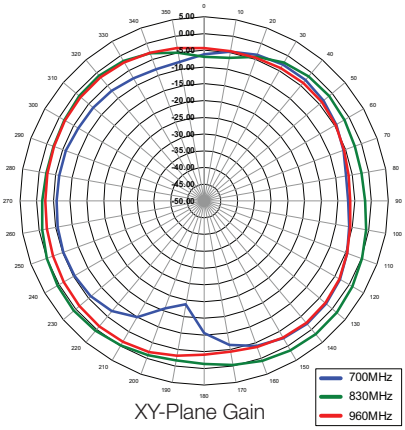
700 - 960MHz



XZ-Plane Gain

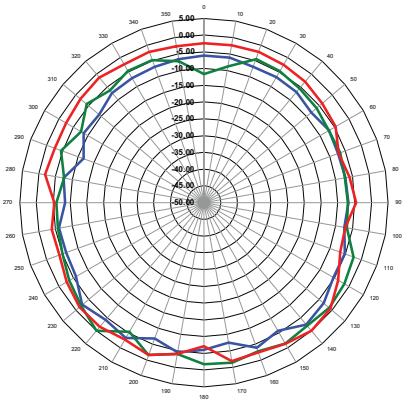


YZ-Plane Gain

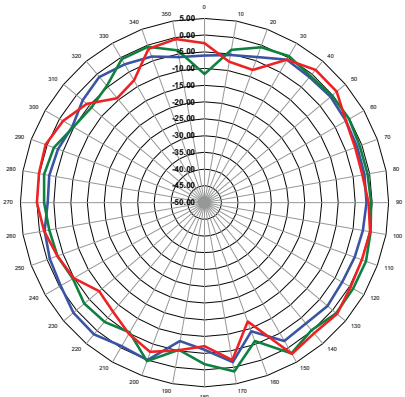


XY-Plane Gain

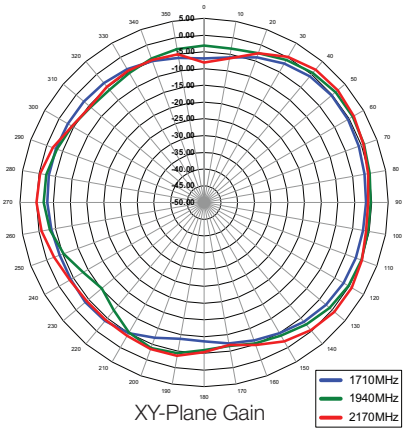
1710 - 2170MHz



XZ-Plane Gain

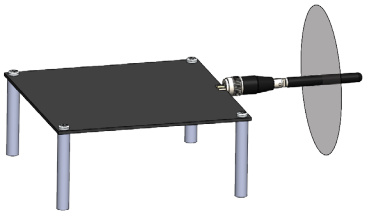


YZ-Plane Gain

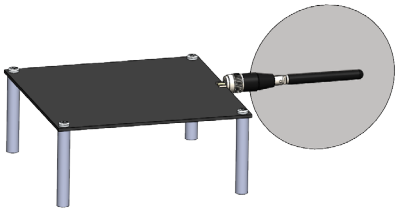


XY-Plane Gain

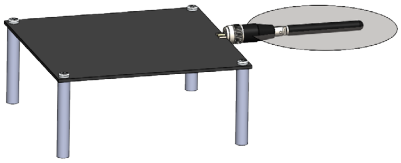
Gain Plots - Edge of Plane, Straight



XZ-Plane Gain

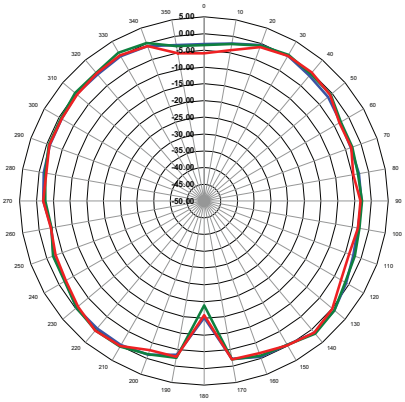


YZ-Plane Gain

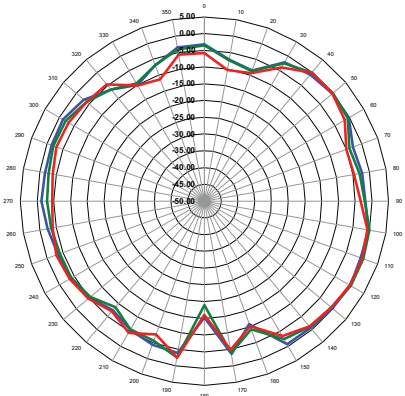


XY-Plane Gain

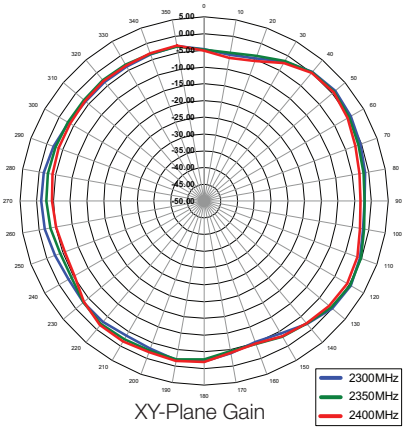
2300 - 2400MHz



XZ-Plane Gain

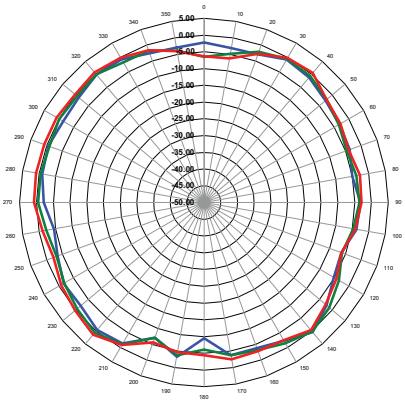


YZ-Plane Gain

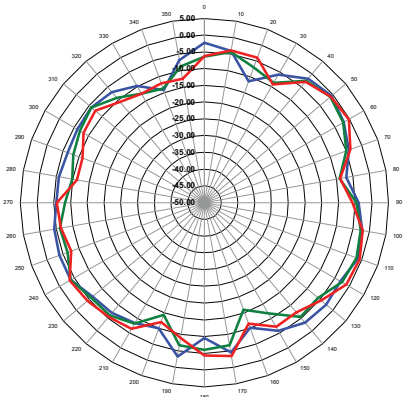


XY-Plane Gain

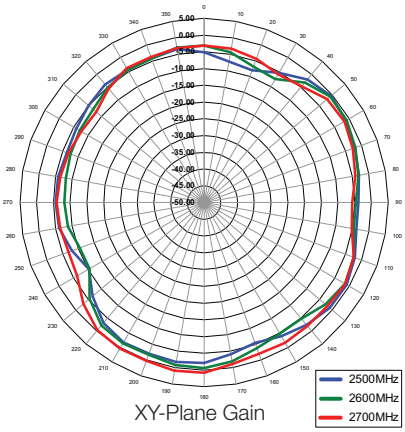
2500 - 2700MHz



XZ-Plane Gain

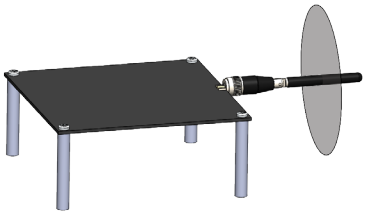


YZ-Plane Gain

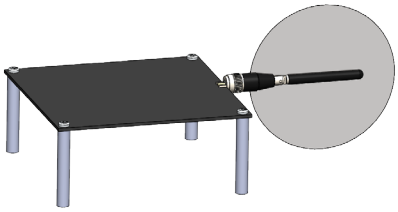


XY-Plane Gain

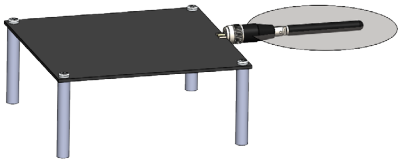
Gain Plots - Edge of Plane, Straight



XZ-Plane Gain

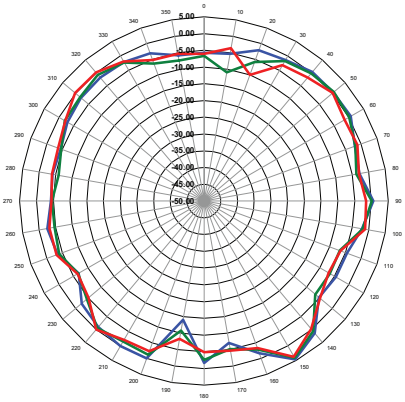


YZ-Plane Gain

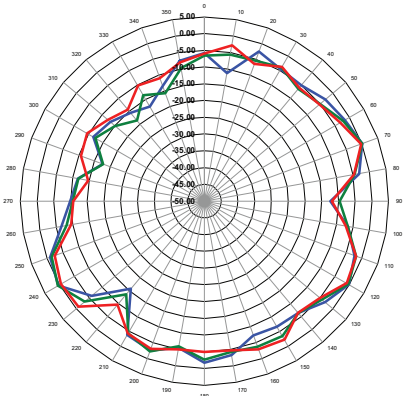


XY-Plane Gain

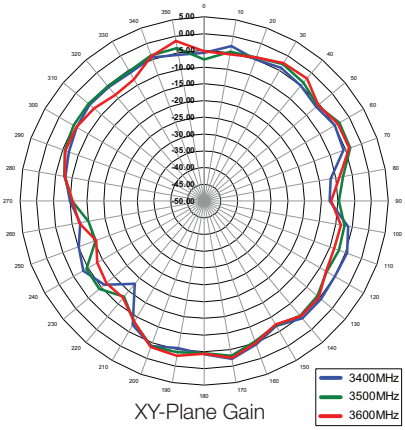
3400 - 3600MHz



XZ-Plane Gain

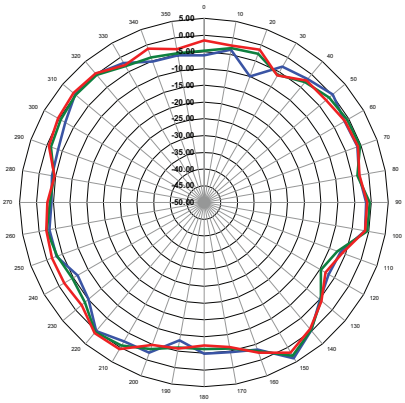


YZ-Plane Gain

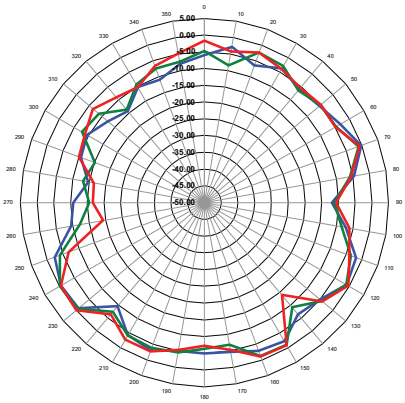


XY-Plane Gain

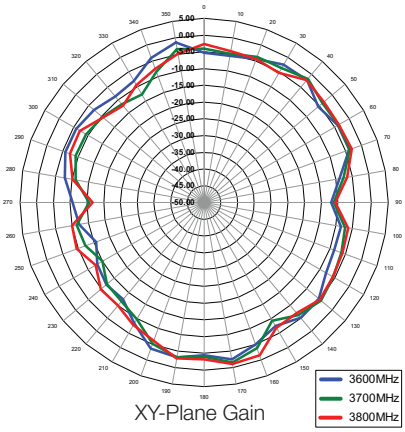
3600 - 3800MHz



XZ-Plane Gain



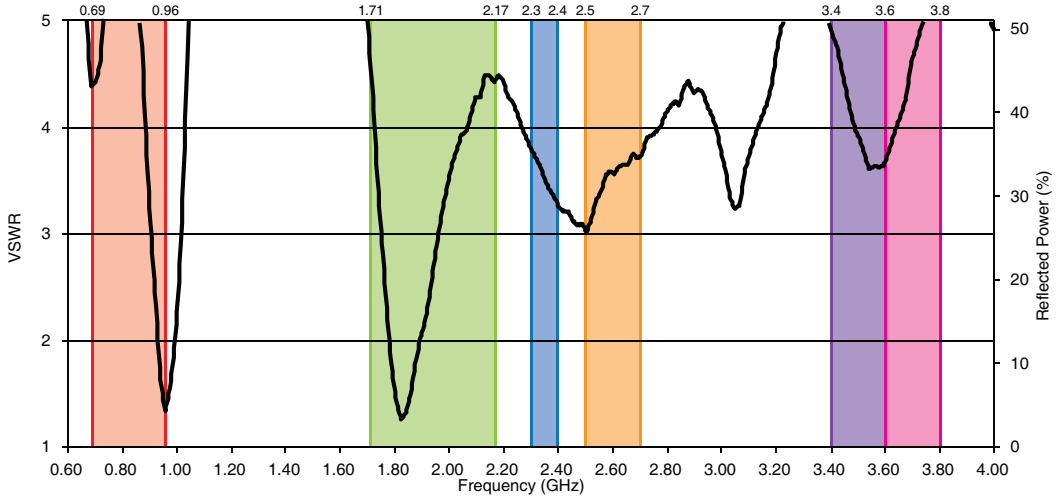
YZ-Plane Gain



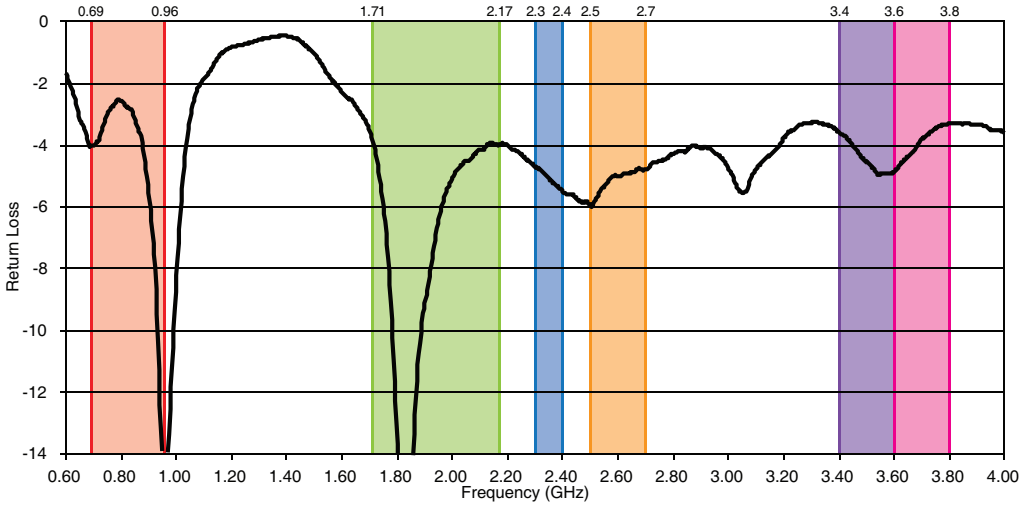
XY-Plane Gain

Edge of the Ground Plane, Bent 90°

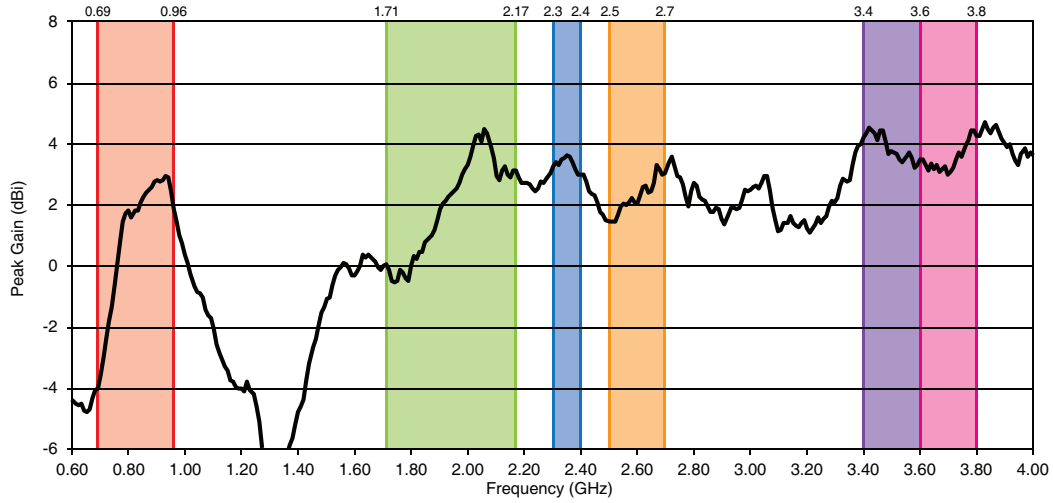
VSWR



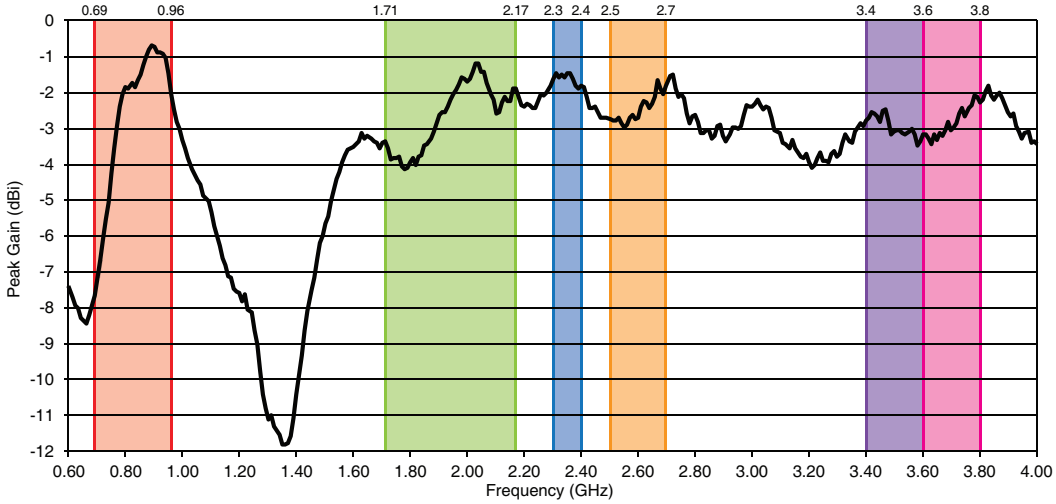
Return Loss



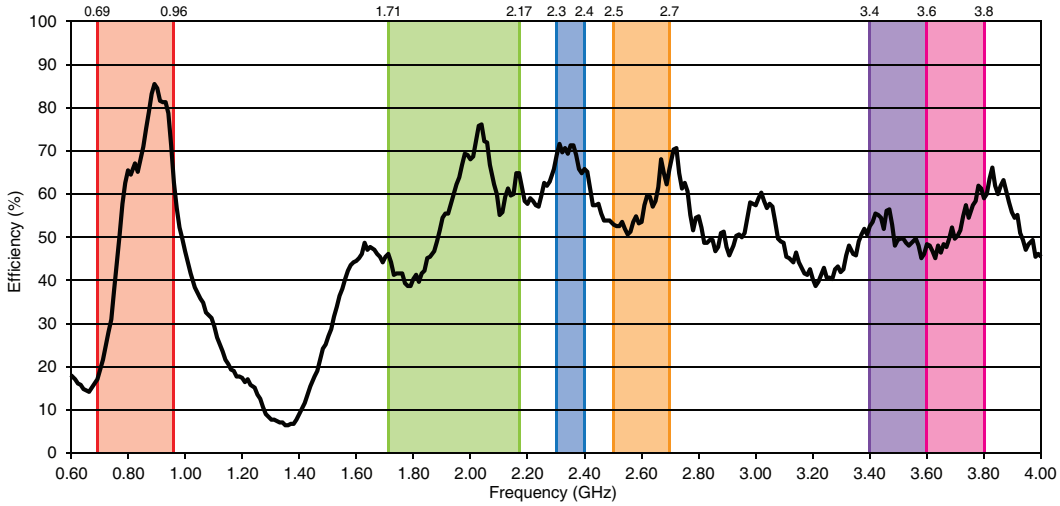
Peak Gain



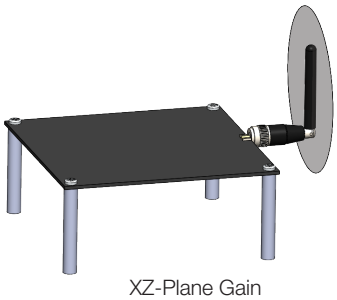
Average Gain



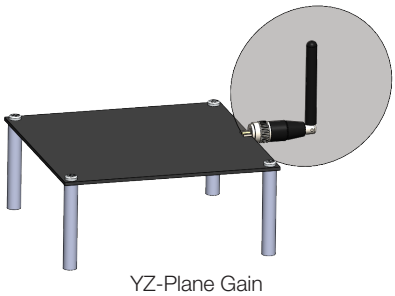
Radiation Efficiency



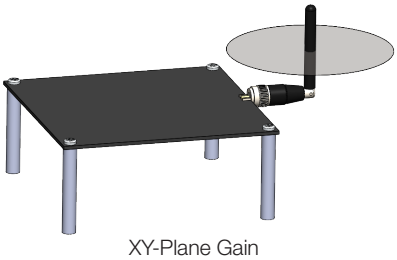
Gain Plots - Edge of Plane, Bent 90°



XZ-Plane Gain

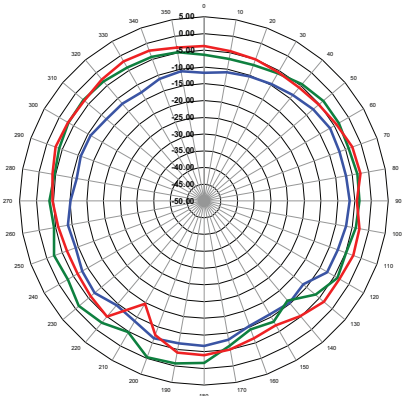


YZ-Plane Gain

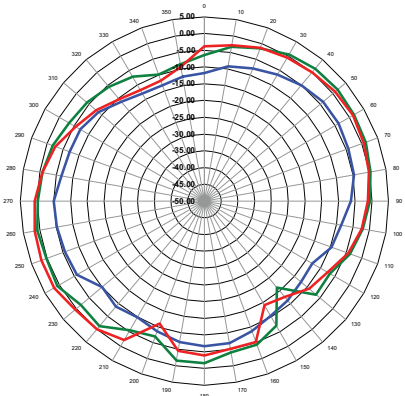


XY-Plane Gain

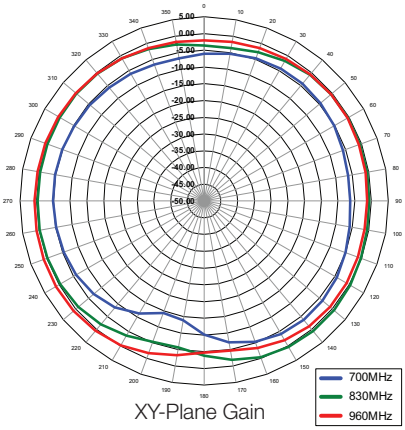
700 - 960MHz



XZ-Plane Gain

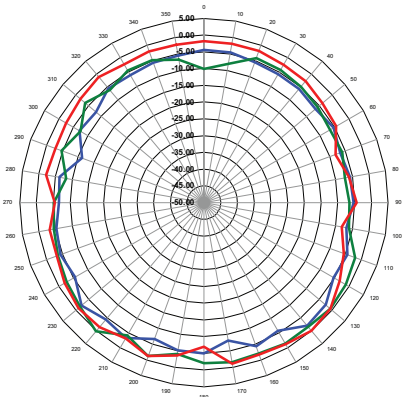


YZ-Plane Gain

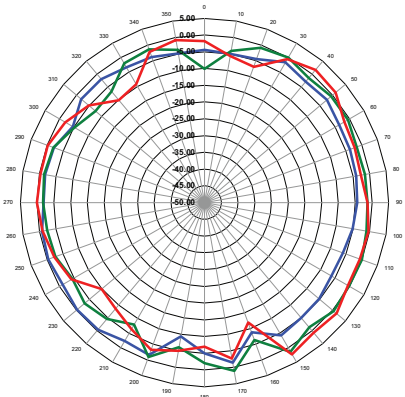


XY-Plane Gain

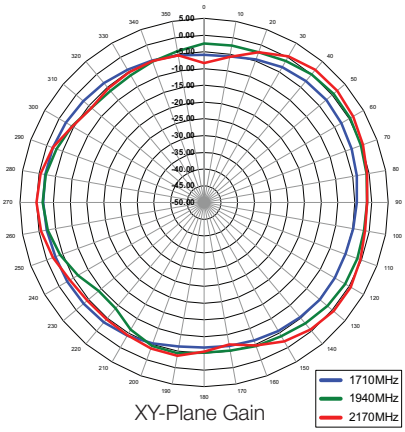
1710 - 2170MHz



XZ-Plane Gain

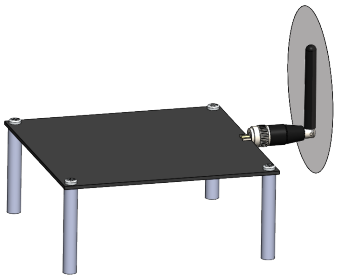


YZ-Plane Gain

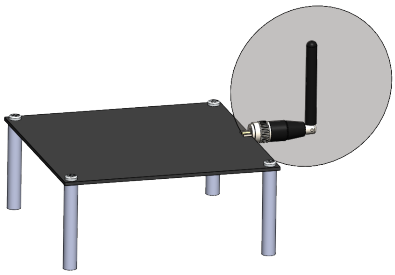


XY-Plane Gain

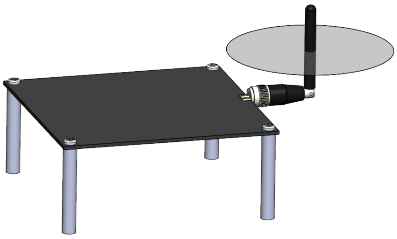
Gain Plots - Edge of Plane, Bent 90°



XZ-Plane Gain

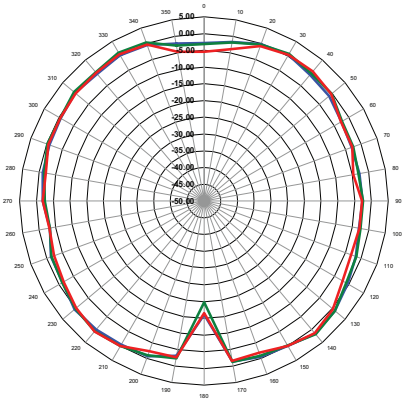


YZ-Plane Gain

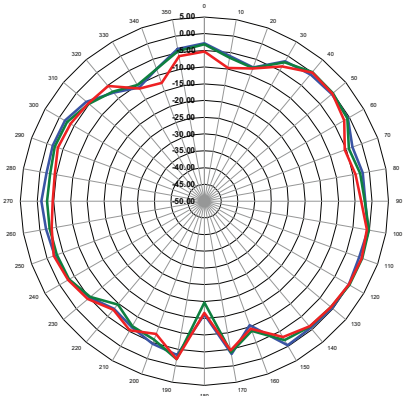


XY-Plane Gain

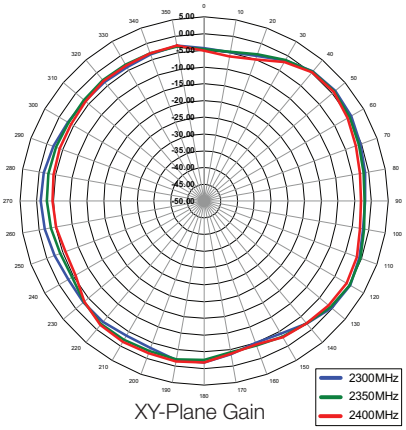
2300 - 2400MHz



XZ-Plane Gain

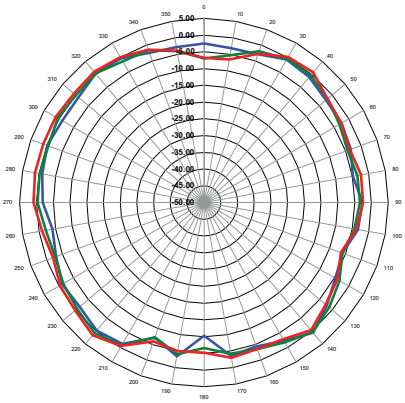


YZ-Plane Gain

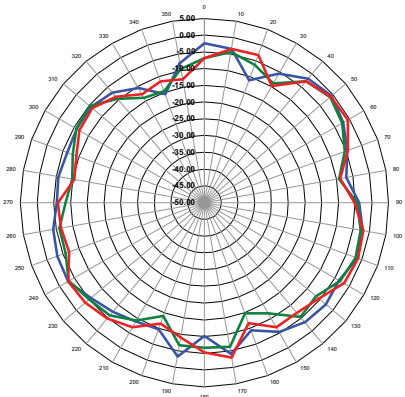


XY-Plane Gain

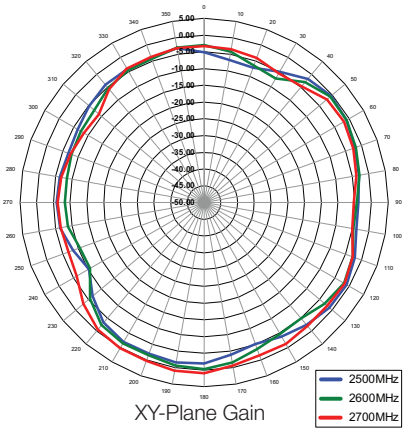
2500 - 2700MHz



XZ-Plane Gain

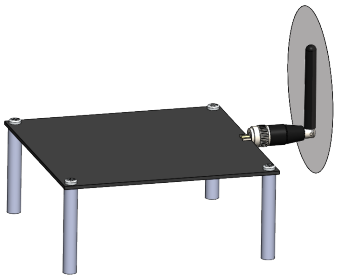


YZ-Plane Gain

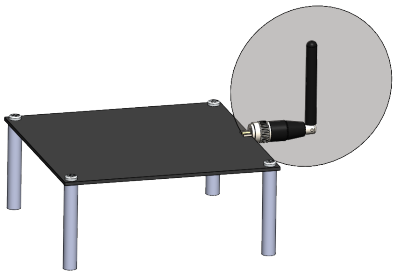


XY-Plane Gain

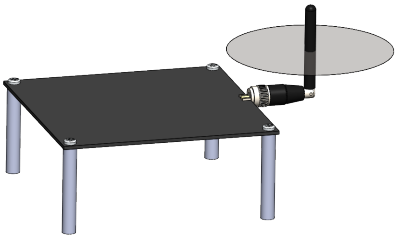
Gain Plots - Edge of Plane, Bent 90°



XZ-Plane Gain

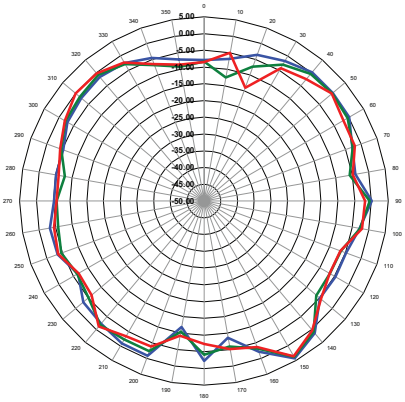


YZ-Plane Gain

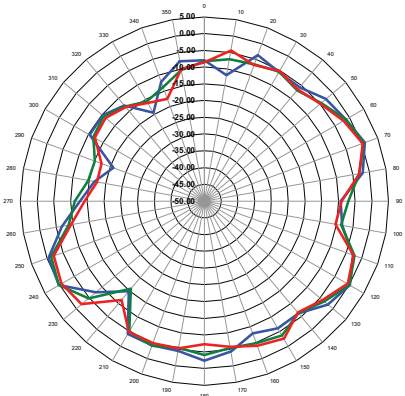


XY-Plane Gain

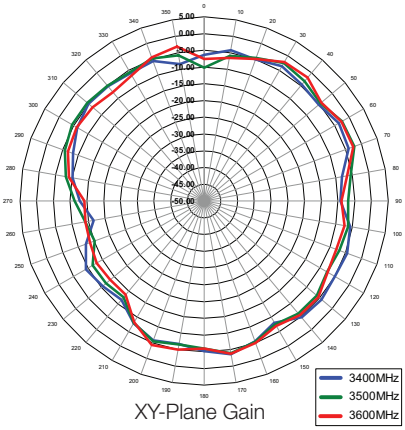
3400 - 3600MHz



XZ-Plane Gain

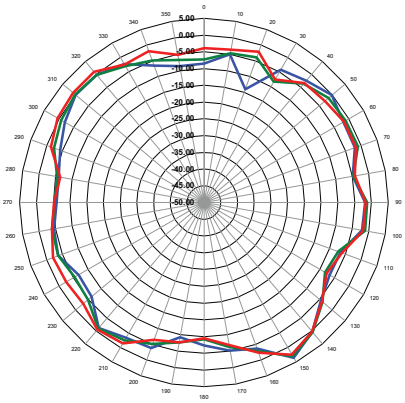


YZ-Plane Gain

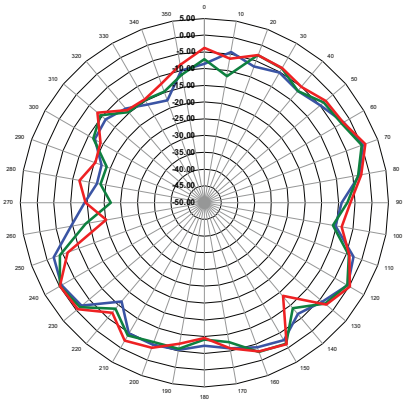


XY-Plane Gain

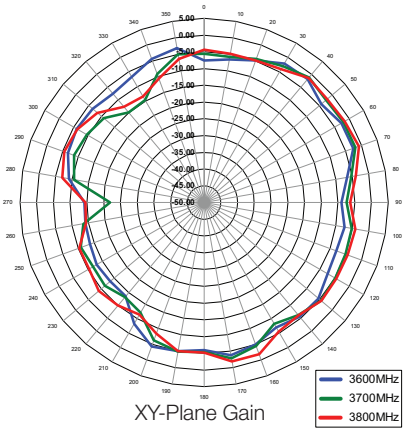
3600 - 3800MHz



XZ-Plane Gain



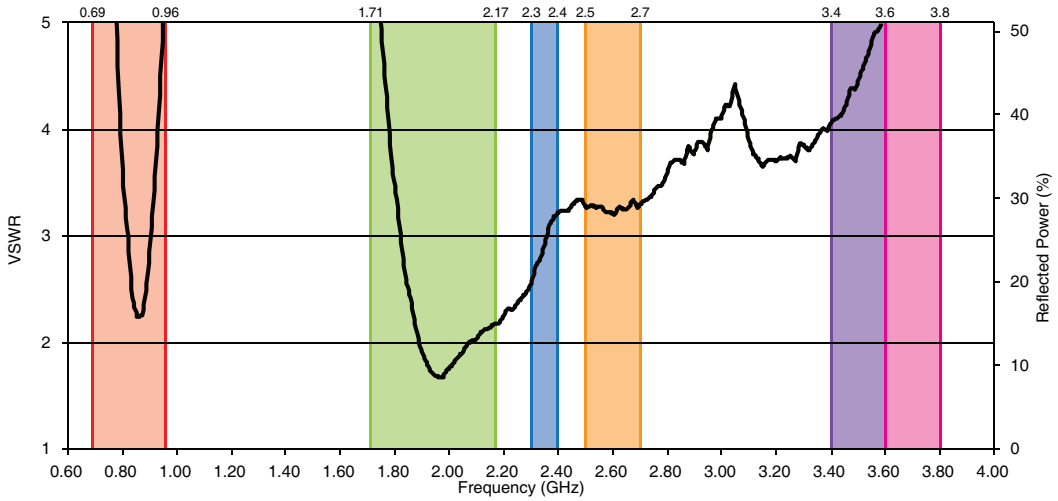
YZ-Plane Gain



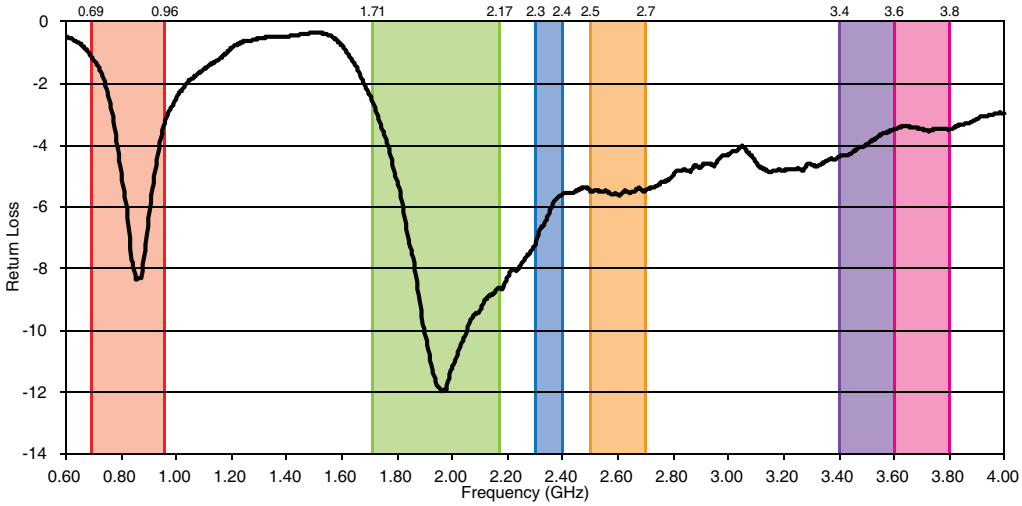
XY-Plane Gain

Center of the Ground Plane, Straight

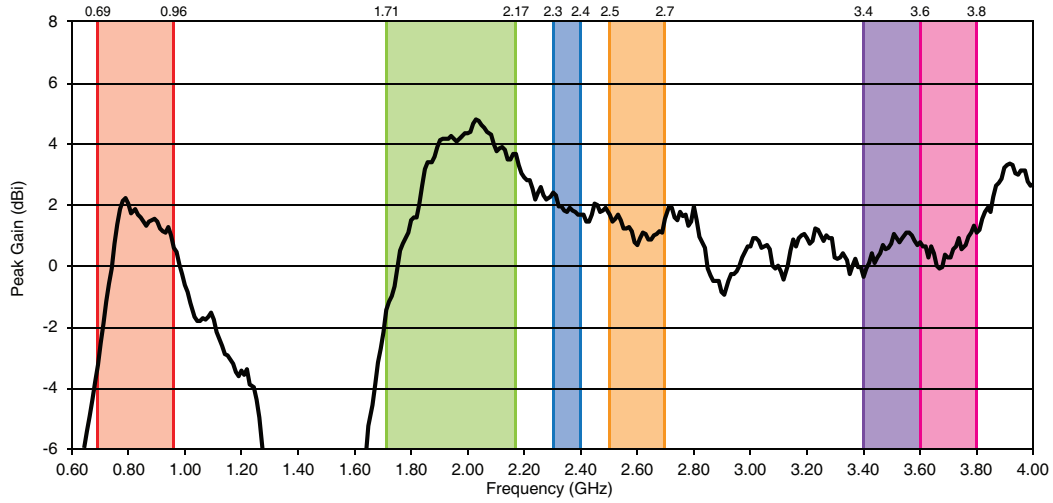
VSWR



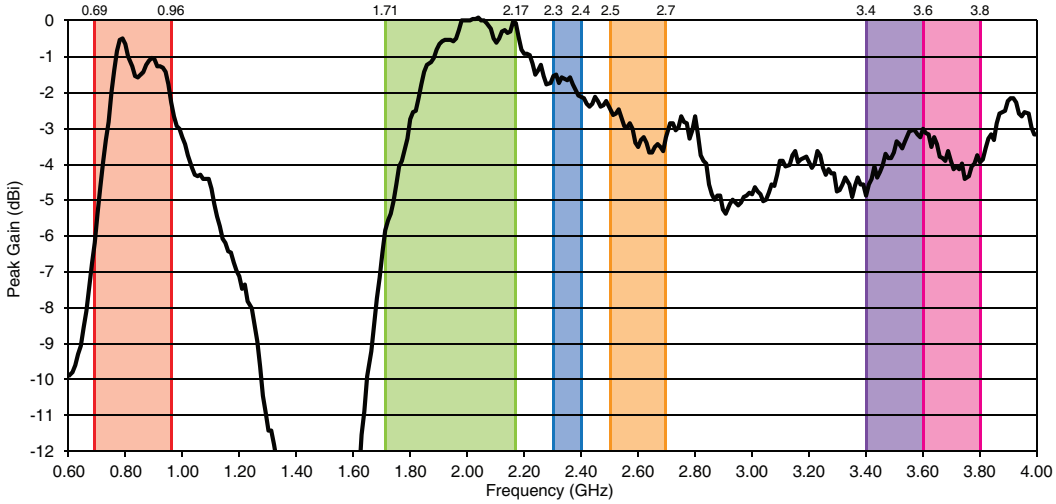
Return Loss



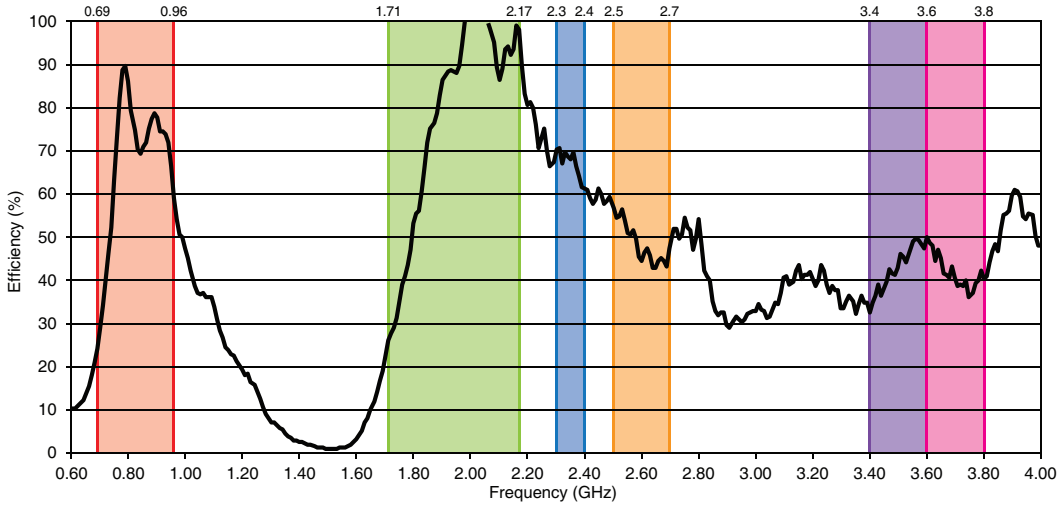
Peak Gain



Average Gain



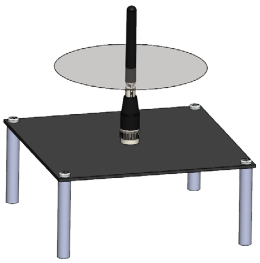
Radiation Efficiency



Gain Plots - Center of the Ground Plane, Straight

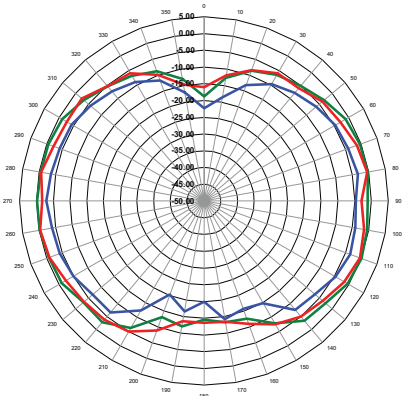
XZ-Plane Gain

YZ-Plane Gain

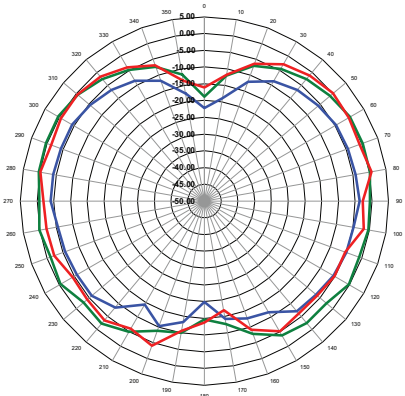


XY-Plane Gain

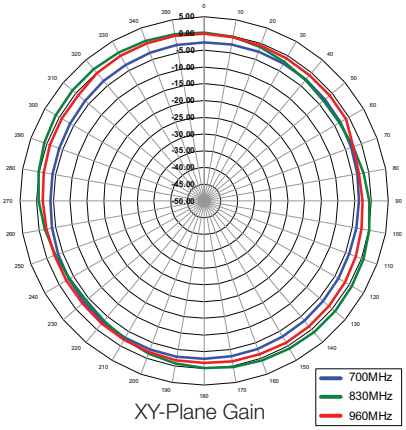
700 - 960MHz



XZ-Plane Gain

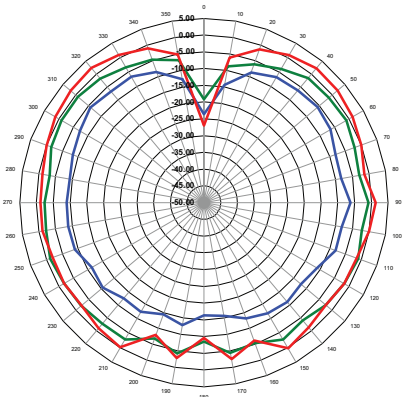


YZ-Plane Gain

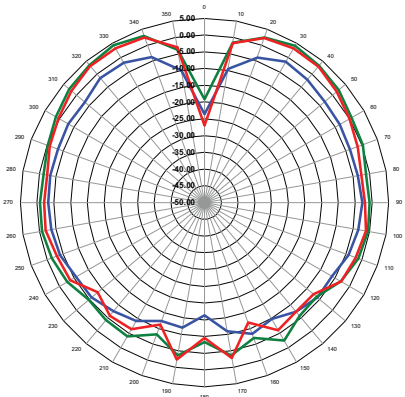


XY-Plane Gain

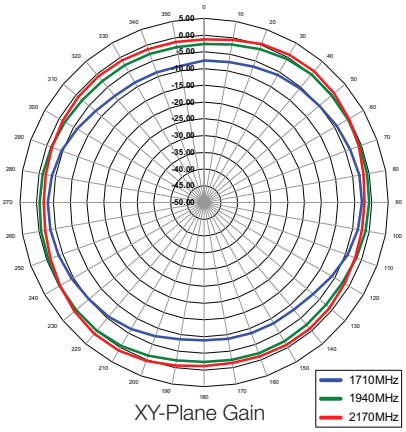
1710 - 2170MHz



XZ-Plane Gain



YZ-Plane Gain

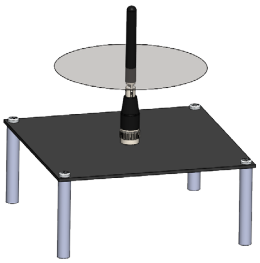


XY-Plane Gain

Gain Plots - Center of the Ground Plane, Straight

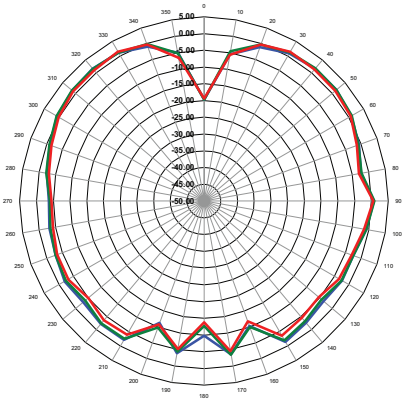
XZ-Plane Gain

YZ-Plane Gain

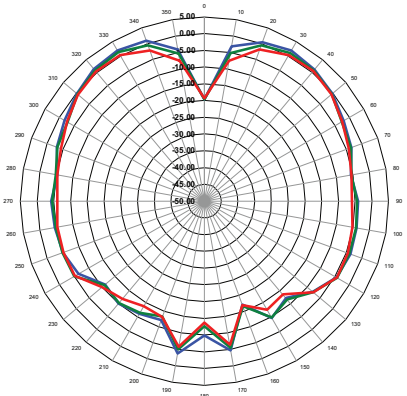


XY-Plane Gain

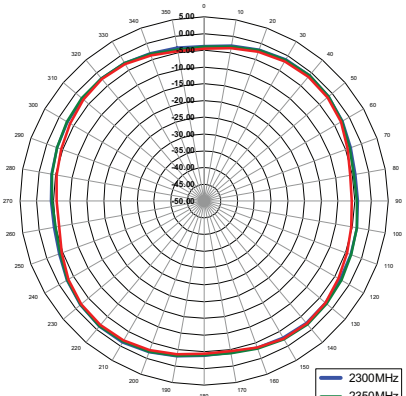
2300 - 2400MHz



XZ-Plane Gain

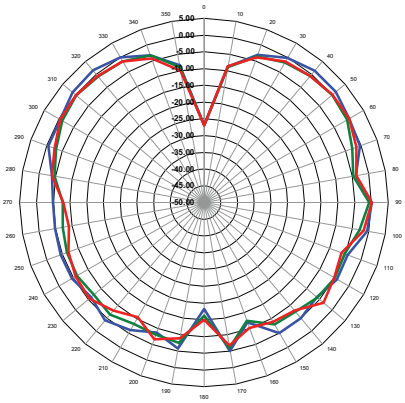


YZ-Plane Gain

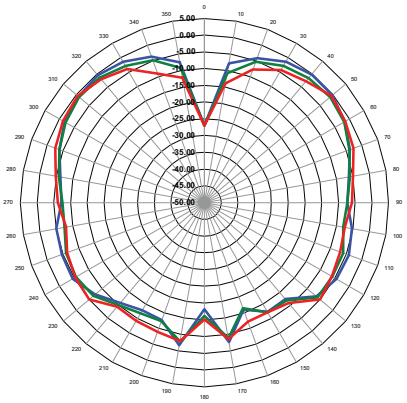


XY-Plane Gain

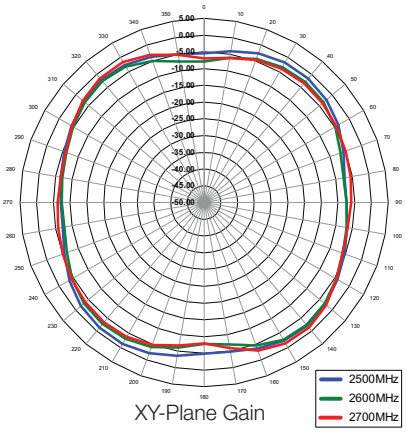
2500 - 2700MHz



XZ-Plane Gain



YZ-Plane Gain

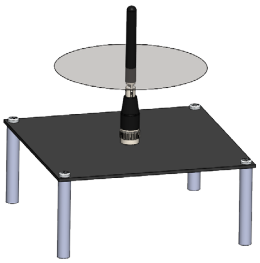


XY-Plane Gain

Gain Plots - Center of the Ground Plane, Straight

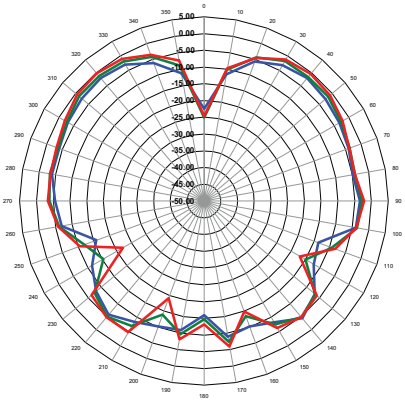
XZ-Plane Gain

YZ-Plane Gain

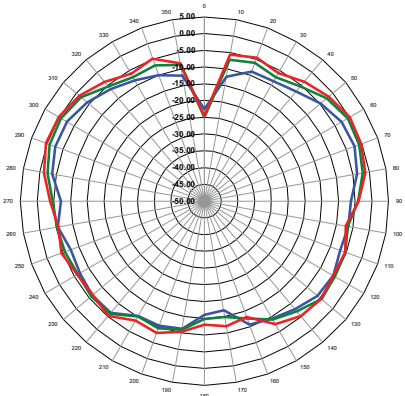


XY-Plane Gain

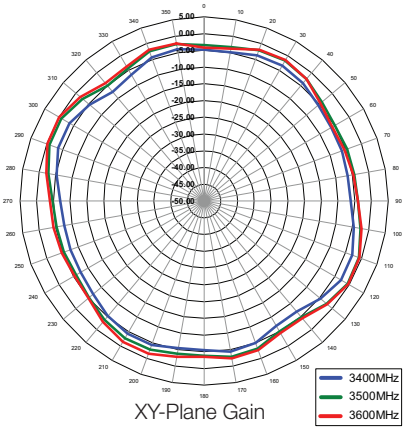
3400 - 3600MHz



XZ-Plane Gain

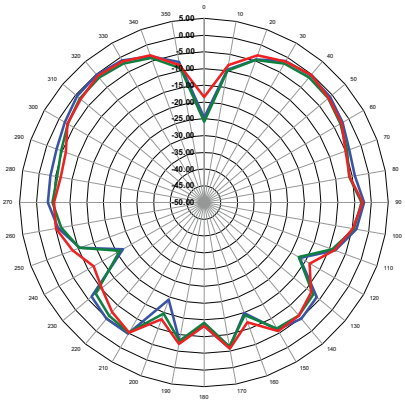


YZ-Plane Gain

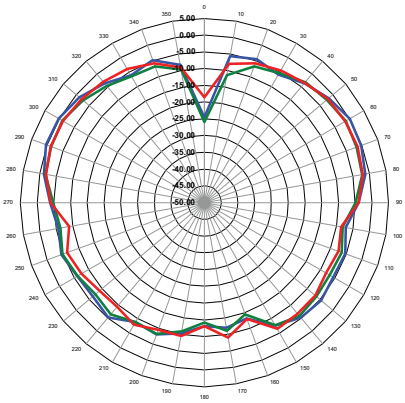


XY-Plane Gain

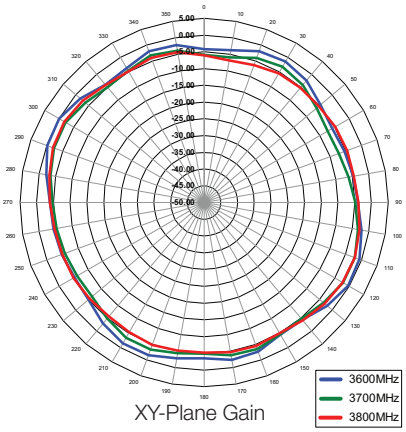
3600 - 3800MHz



XZ-Plane Gain



YZ-Plane Gain

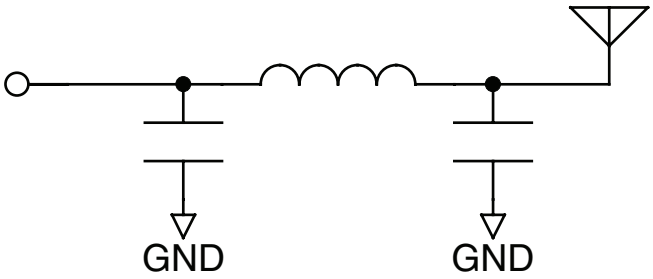


XY-Plane Gain

Matching Network

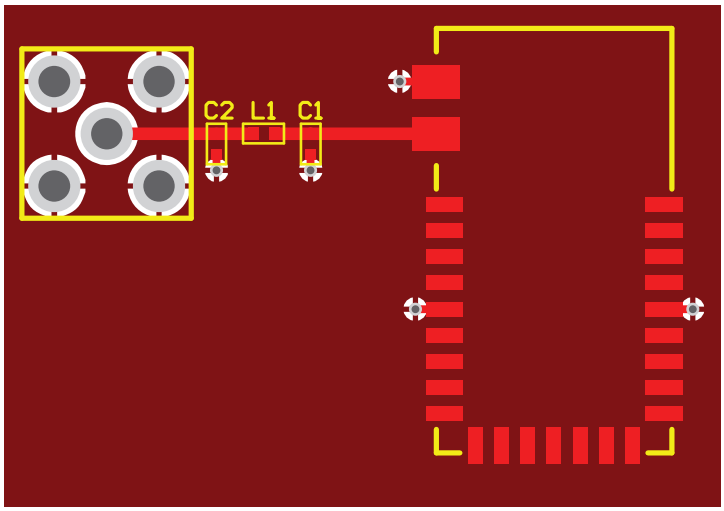
A given design may not be able to incorporate the same size ground plane as was used to design and test the antenna. The antenna's performance can vary widely with the ground plane size, which will affect the product's range and other characteristics. It is possible to adjust the performance using a matching network. This can enable the integrator to be able to optimize performance in a specific band or to level performance across all bands.

The most common matching network is a PI circuit between the antenna and the radio. This is 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.



The values of the matching components are determined experimentally on the product's board. There are many variables that play into the antenna's final performance, so 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.

TE TECHNICAL SUPPORT CENTER

USA:	+1 (800) 522-6752
Canada:	+1 (905) 475-6222
Mexico:	+52 (0) 55-1106-0800
Latin/S. America:	+54 (0) 11-4733-2200
Germany:	+49 (0) 6251-133-1999
UK:	+44 (0) 800-267666
France:	+33 (0) 1-3420-8686
Netherlands:	+31 (0) 73-6246-999
China:	+86 (0) 400-820-6015

te.com

08/23 Original