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**2.4 GHz – 2.5 GHz FlexPIFA 2 dBi Antenna w/U.FL Cable, 100mm**



**ORDERING INFORMATION**

Order Number	Description
001-0014	2.4 GHz FlexPIFA Antenna w/U.FL Cable, 100mm
001-0022	2.4 GHz FlexPIFA Antenna w/MHF4L Cable, 100mm
001-0025	2.4 GHz FlexPIFA Antenna w/U.FL Cable, 100mm, LH

**Table 1 Orderable Part Numbers**

**KEY FEATURES**

- Can be installed on different non-conductive surfaces and thicknesses.
- Can be installed near metals or the human body.
- Can be installed on flat or curved surfaces.
- Quick and easy Installation
- Adhesive holds to surface during humidity exposure and hot/cold cycles.
- RoHS Compliant

The information in this document is subject to change without notice.

**SPECIFICATIONS**

Specification	Value
Peak Gain	+2 dBi
Average Gain	>-1.5 dBi
Impedance	50 ohms
Type	Flexible Planar Inverted F Antenna (FlexPIFA)
Polarization	Linear
VSWR	< 2.0:1, 2400 - 2480 MHz
Frequency	2400 – 2480 MHz
Weight	1.13g
Size	40.1mm × 11mm × 2.5mm
Antenna Color	Clear Yellow
Adhesive	3M 100MP
Operating Temp	-40°C to +85°C
Connector Height	U.FL: 2.5mm Max
	MHF4L: 1.4mm Max

**Table 2 Specifications**



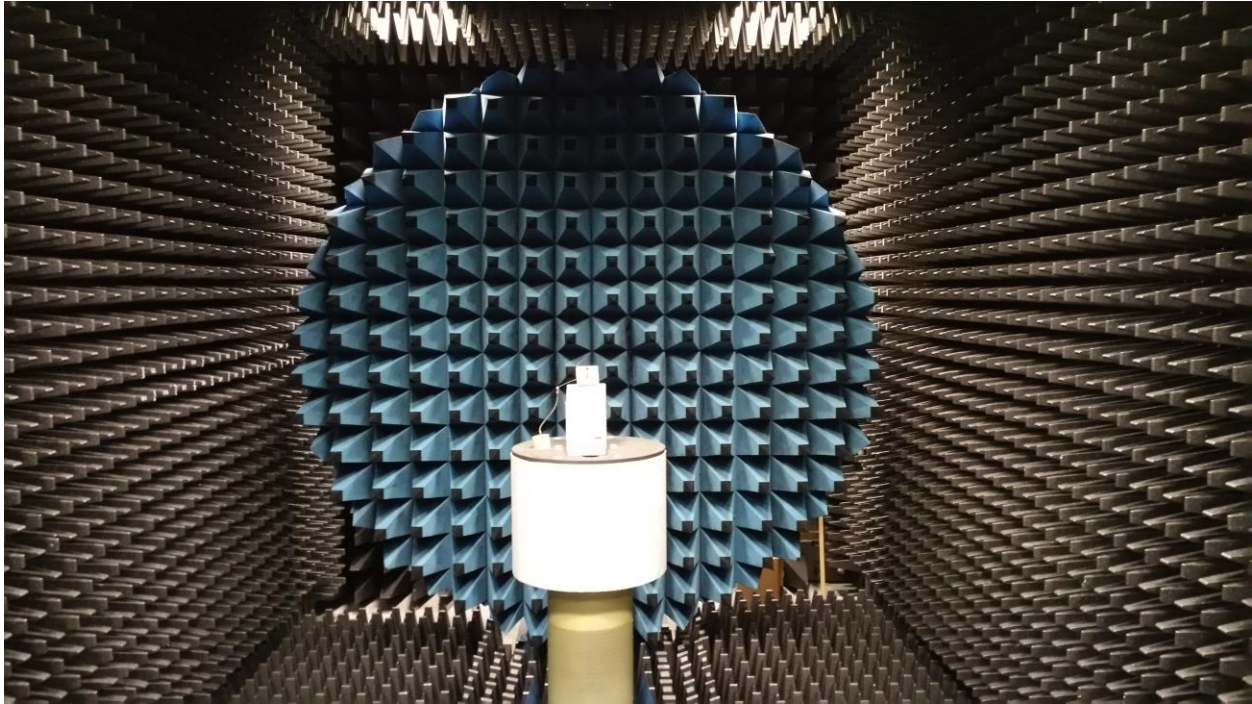


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## TEST SETUP

Antenna measurements such as VSWR were measured with an Agilent E5071C Vector Network Analyzer. Radiation patterns were measured with a CMT Planar 804/1 Vector Network Analyzer in a Howland Company 3100 Chamber equivalent. Phase Center is 9 inches above the Phi positioner.

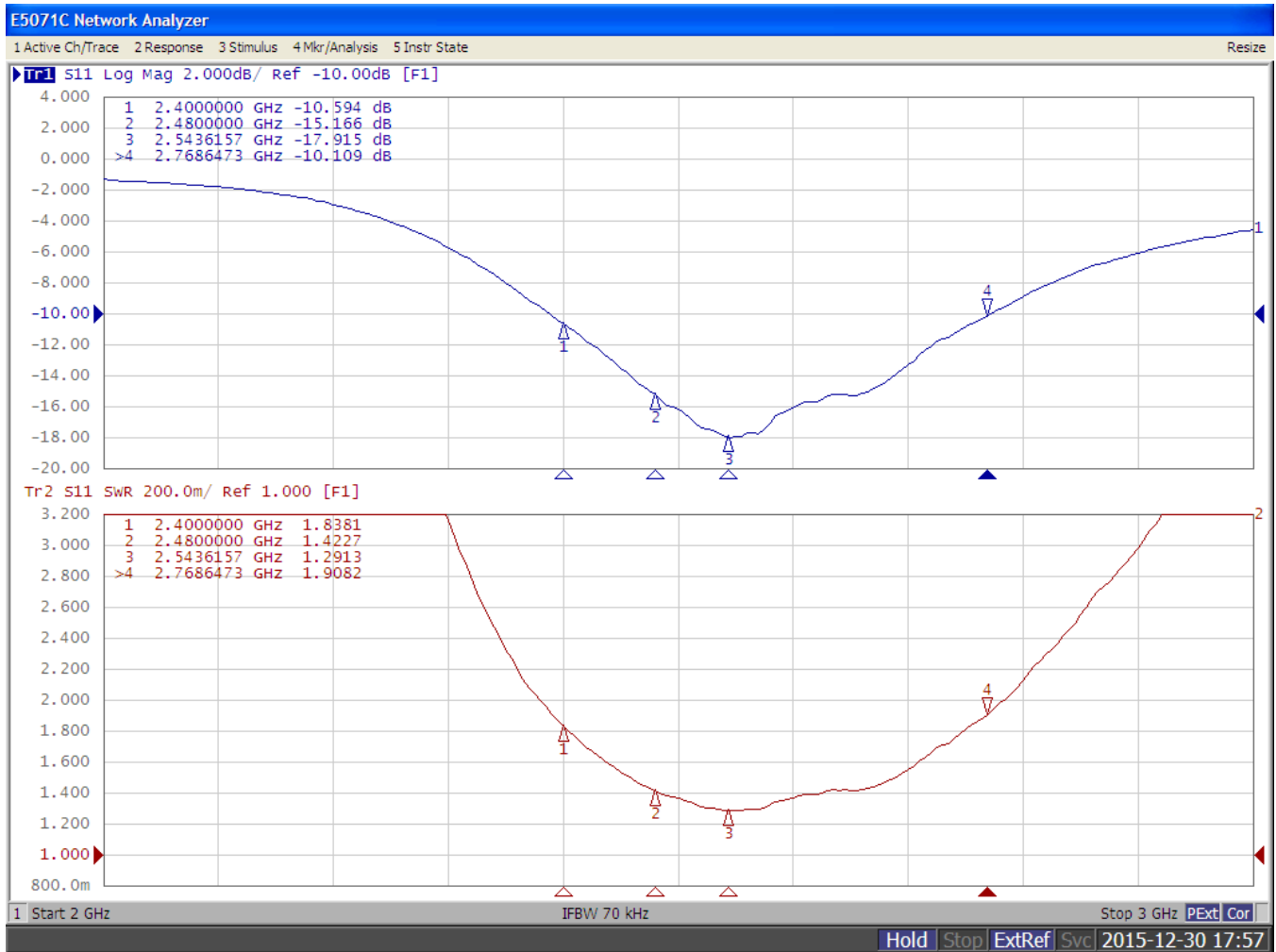
Flat surface measurements were done with the antenna centered on a 1.5 mm thick plate of Polycarbonate. Curved surface measurements were taken by placing the antenna on the inside and outside of different diameter PVC tubing.



**Figure 3 Antenna Chamber**

**FLAT SURFACE ANTENNA MEASUREMENTS**

**VSWR**



**Figure 4 Antenna VSWR measured on a 1.5 mm thick plate of Polycarbonate**

**FLAT SURFACE ANTENNA RADIATION PERFORMANCE**

FlexPIFA centered on a 1.5 mm thick plate of Polycarbonate

Antenna Measurement Set-Up:

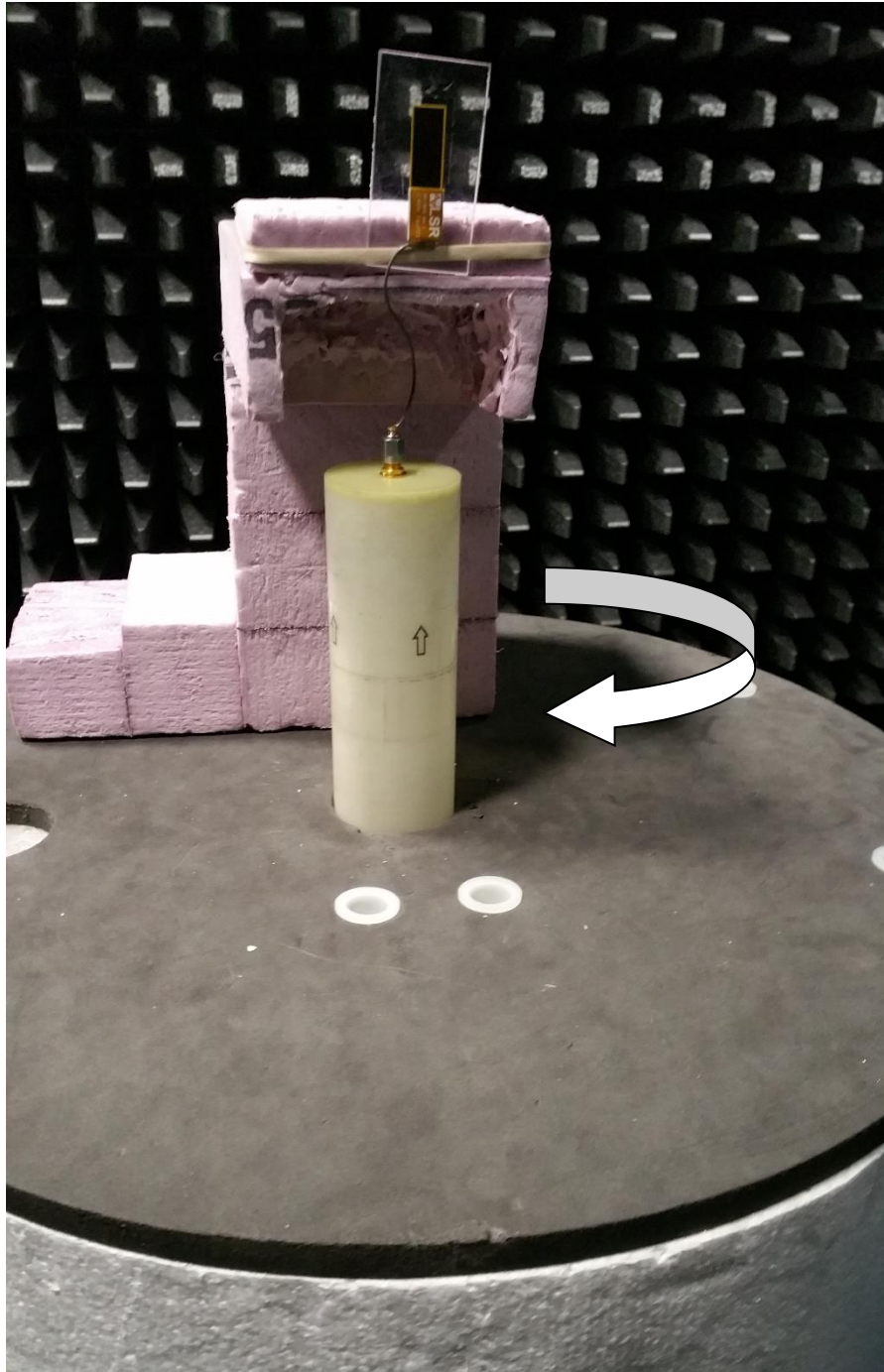
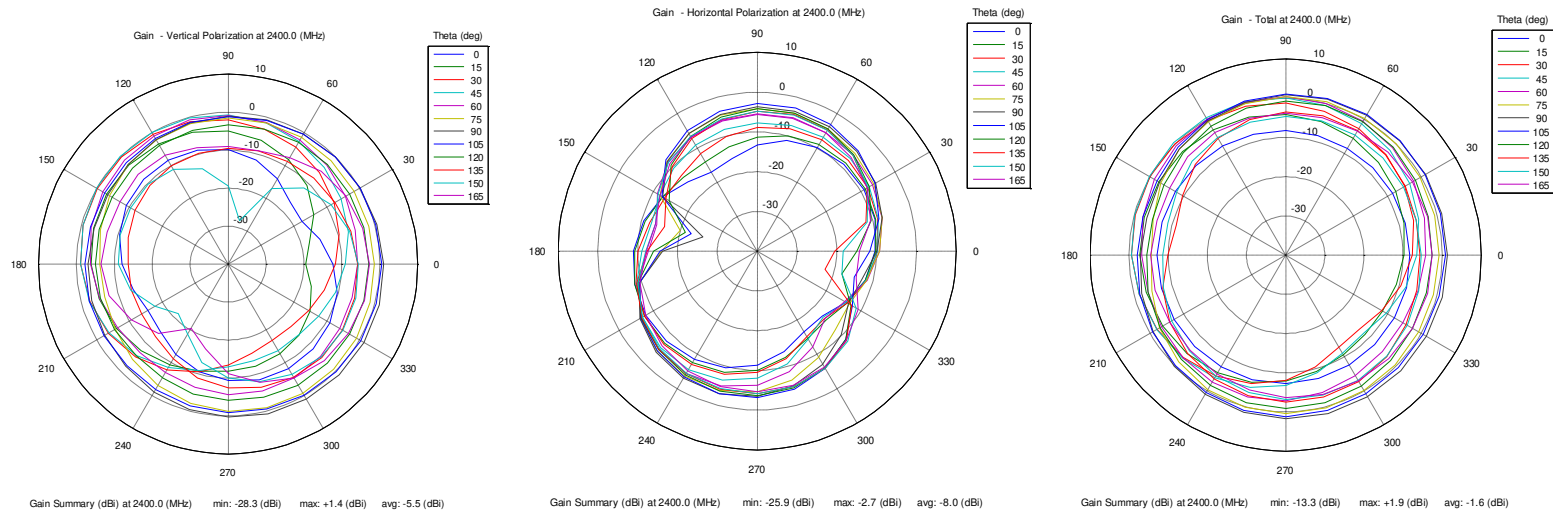


Figure 5 Flat Surface Set-Up

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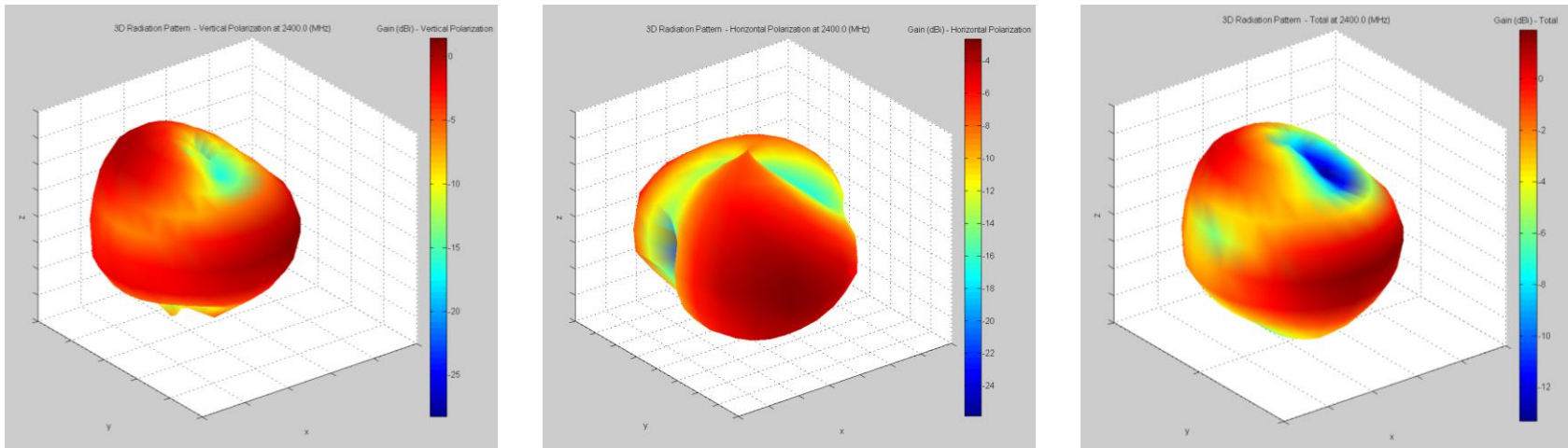
**Azimuthal Conical Cuts at 2400 MHz:**



**Figure 6 Vertical, Horizontal, and Total Gain Patterns**

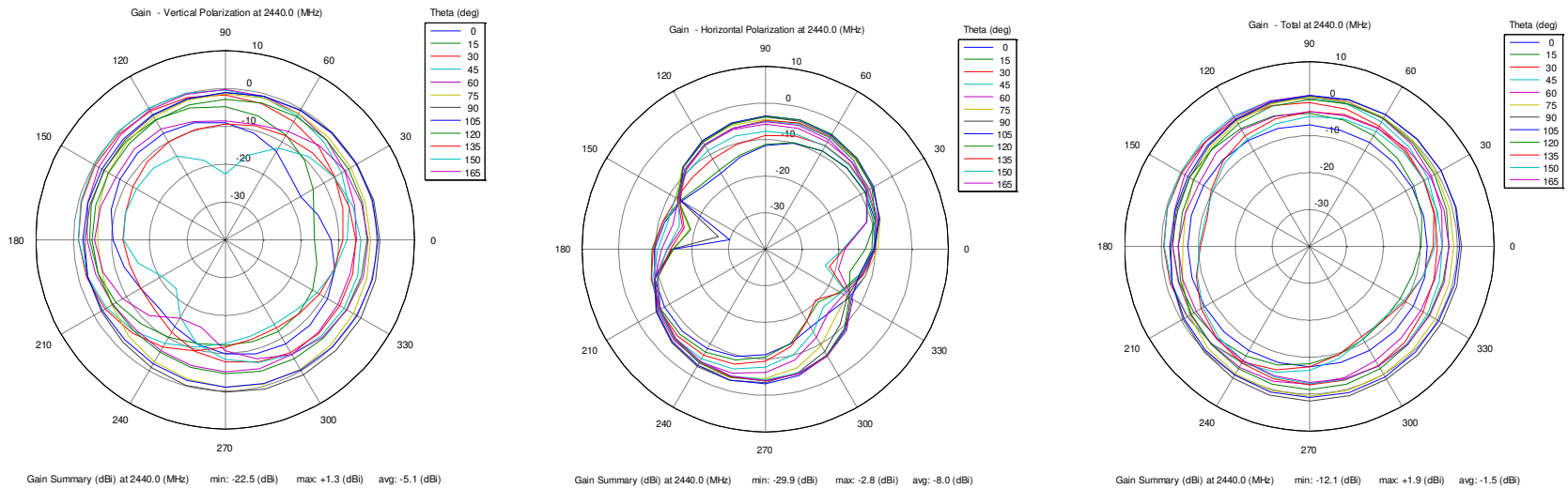
The information in this document is subject to change without notice.

**3D Plots at 2400 MHz:**



**Figure 7 Vertical, Horizontal, and Total Gain Plots**

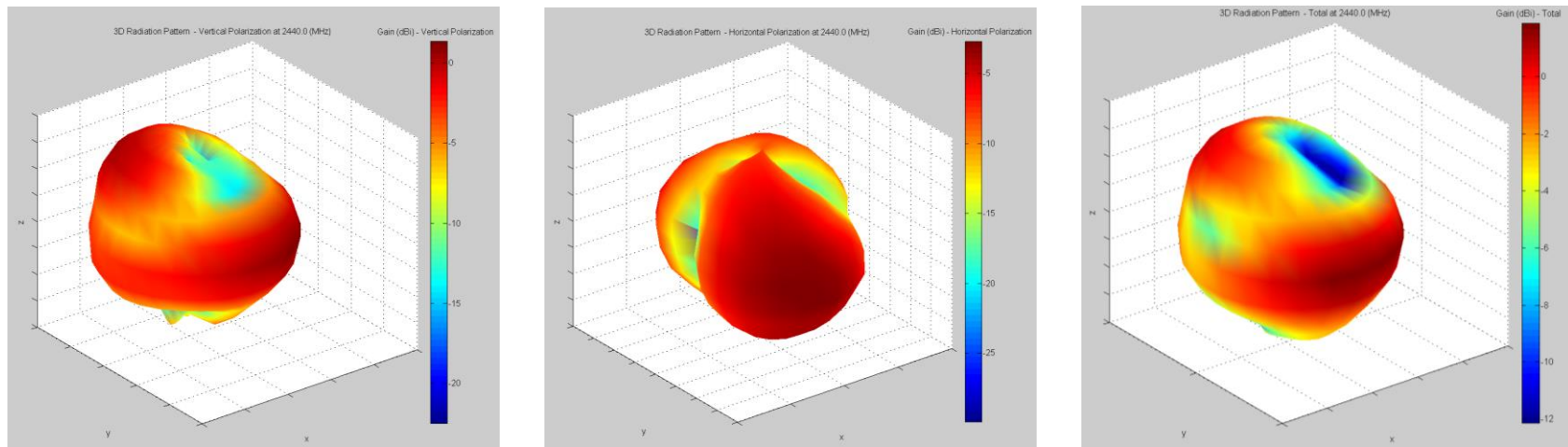
**Azimuthal Conical Cuts at 2440 MHz:**



**Figure 8 Vertical, Horizontal, and Total Gain Patterns**

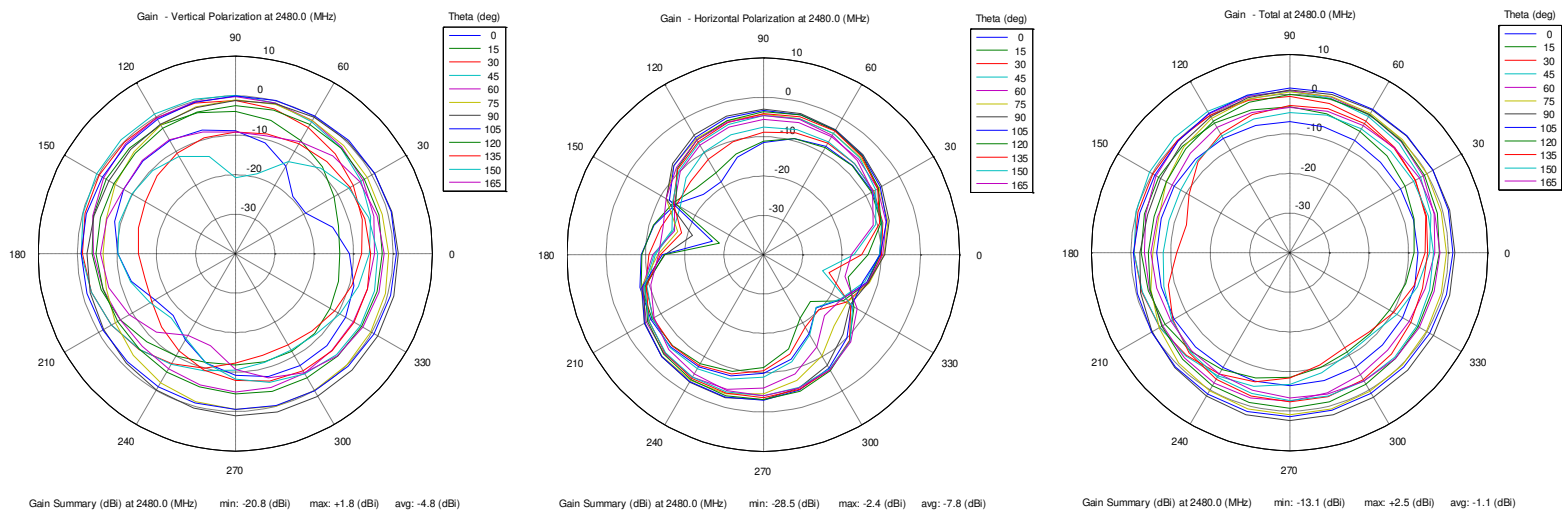
The information in this document is subject to change without notice.

**3D Plots at 2440 MHz:**



**Figure 9 Vertical, Horizontal, and Total Gain Plots**

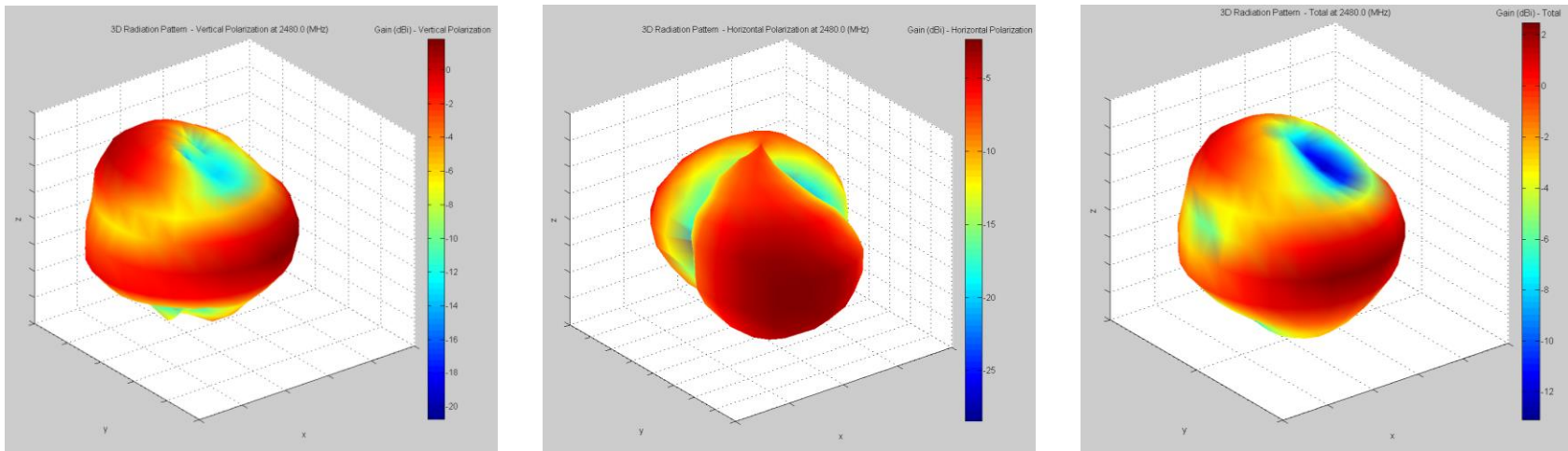
**Azimuthal Conical Cuts at 2480 MHz:**



**Figure 10 Vertical, Horizontal, and Total Gain Patterns**

The information in this document is subject to change without notice.

**3D Plots at 2480 MHz:**

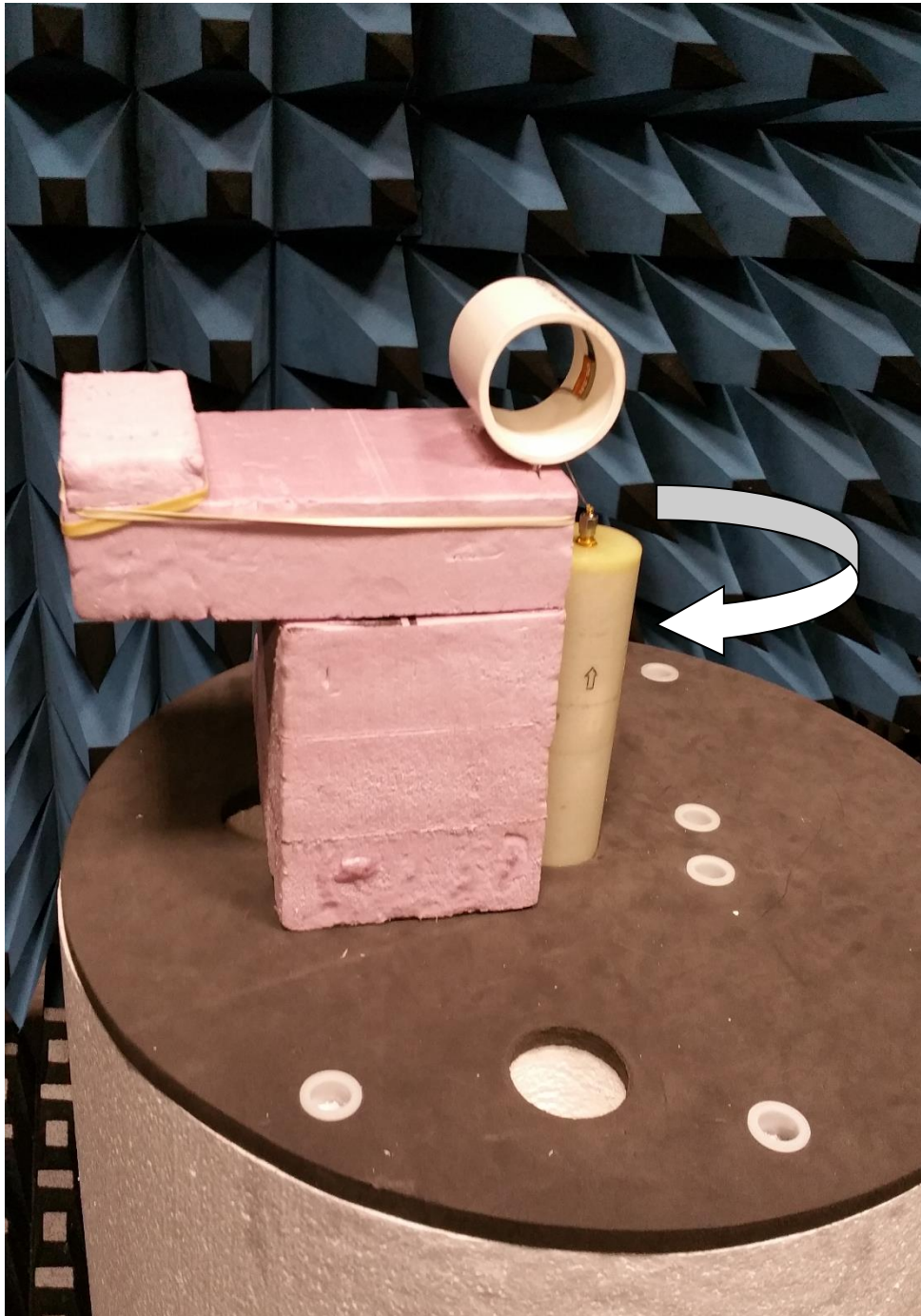


**Figure 11 Vertical, Horizontal, and Total Gain Plots**

**CURVED SURFACE ANTENNA RADIATION PERFORMANCE**

**Flex PIFA inside 51 mm Inner Diameter PVC tube.**

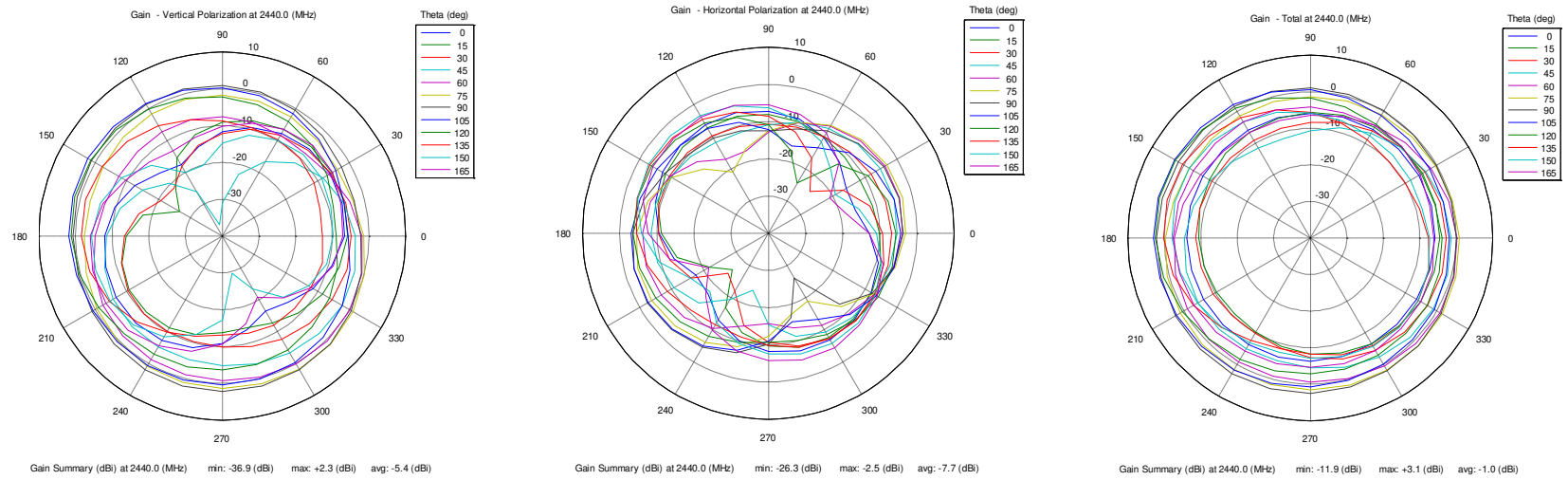
**Antenna Measurement Set-Up:**



**Figure 12 Concave Curve Set-Up**

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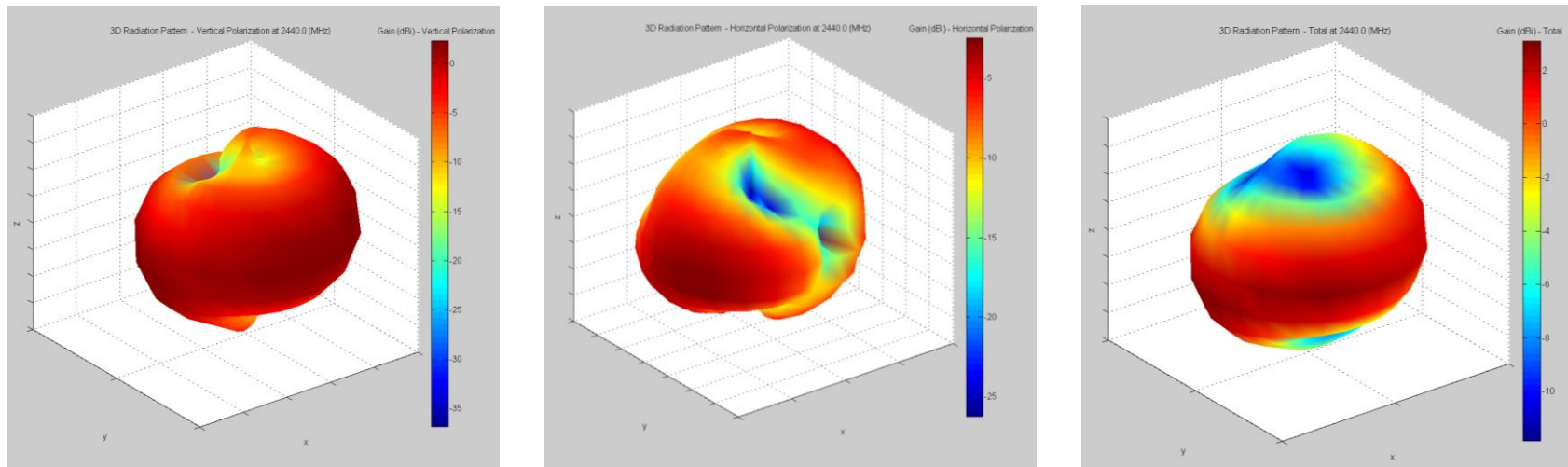
**Azimuthal Conical Cuts at 2440 MHz:**



**Figure 13 Vertical, Horizontal, and Total Gain Patterns**



**3D Plots at 2440 MHz:**



**Figure 14 Vertical, Horizontal, and Total Gain Plots**

Flex PIFA outside 60 mm Outer Diameter PVC tube.

Antenna Measurement Set-Up:

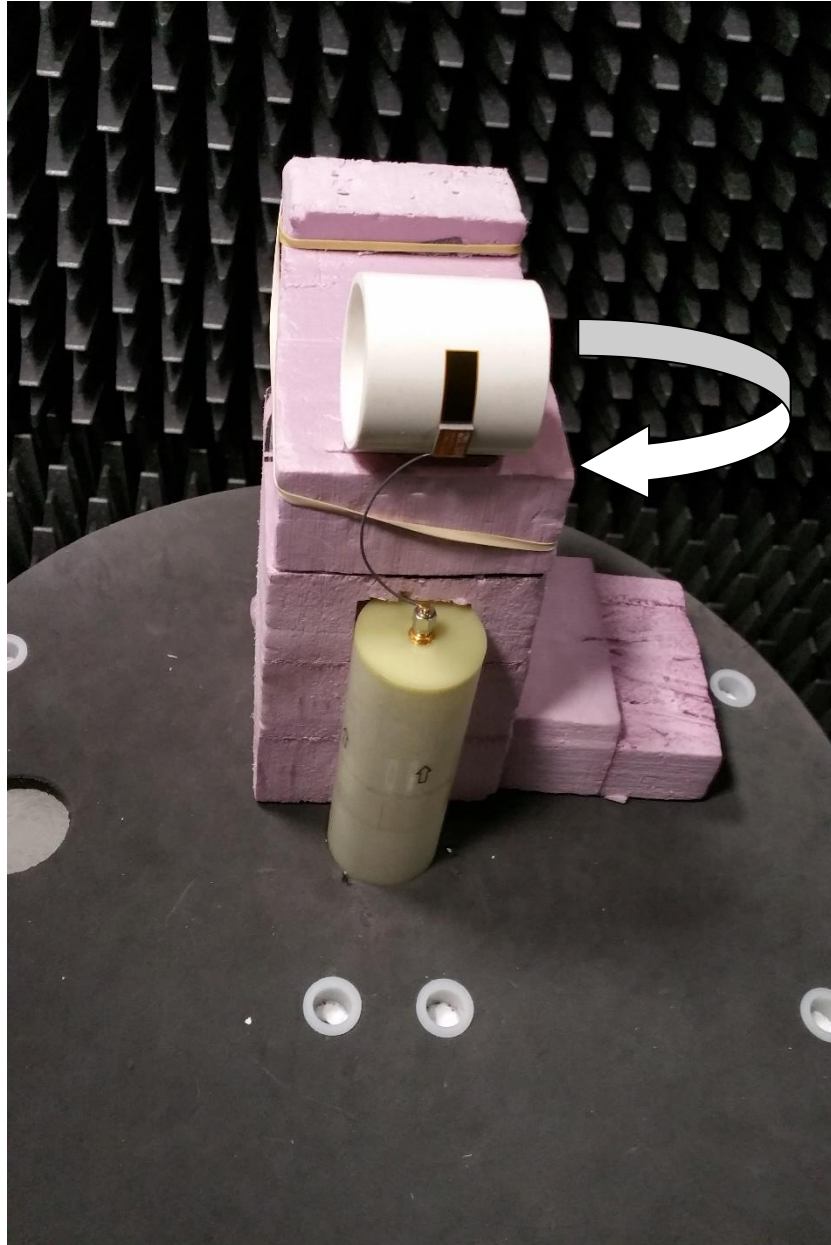
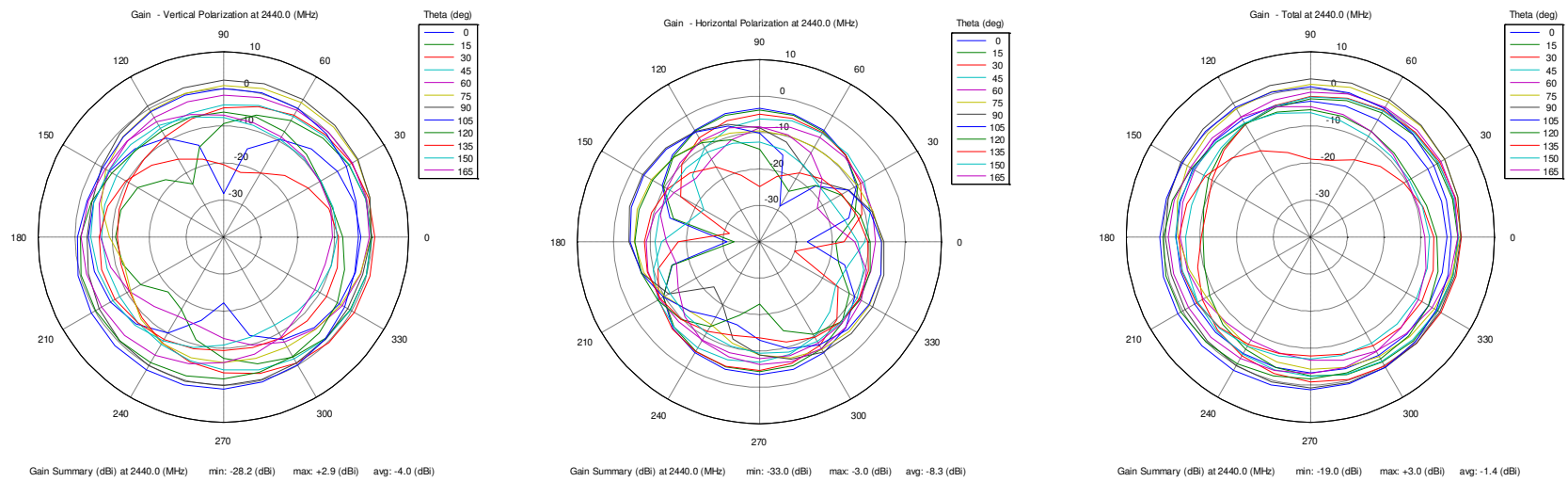


Figure 15 Convex Curve Set-Up

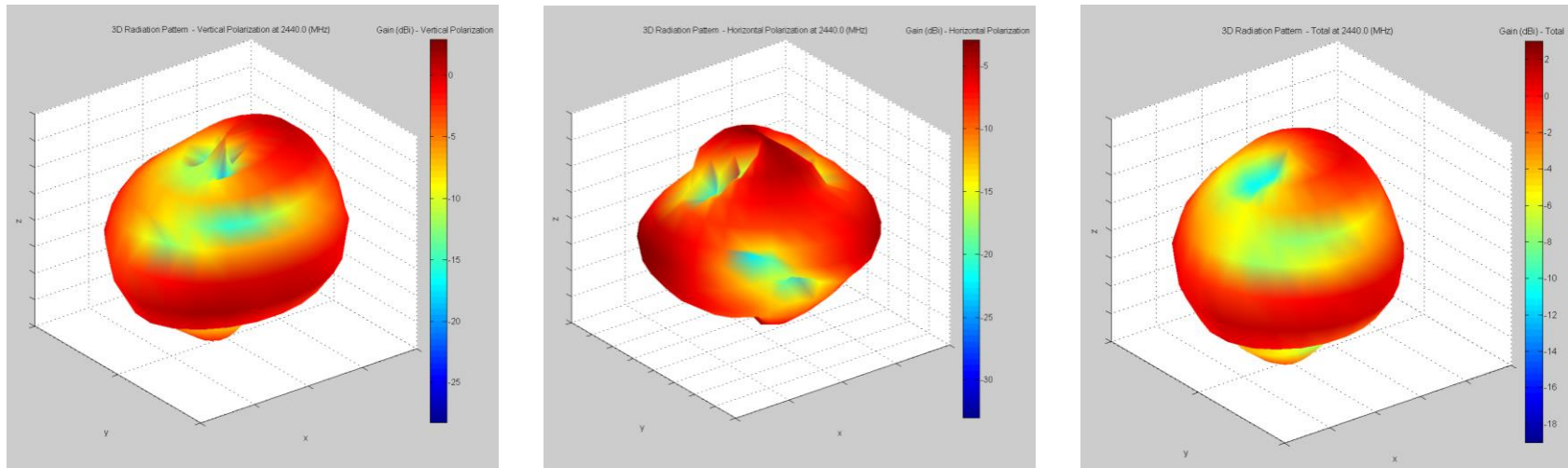
**Azimuthal Conical Cuts at 2440 MHz:**



**Figure 16 Vertical, Horizontal, and Total Gain Patterns**

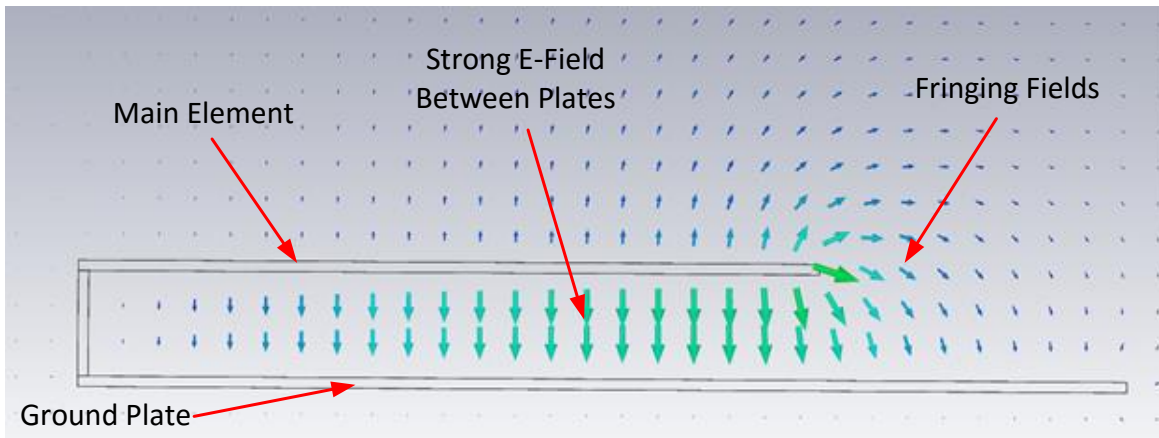
The information in this document is subject to change without notice.

**3D Plots at 2440 MHz:**



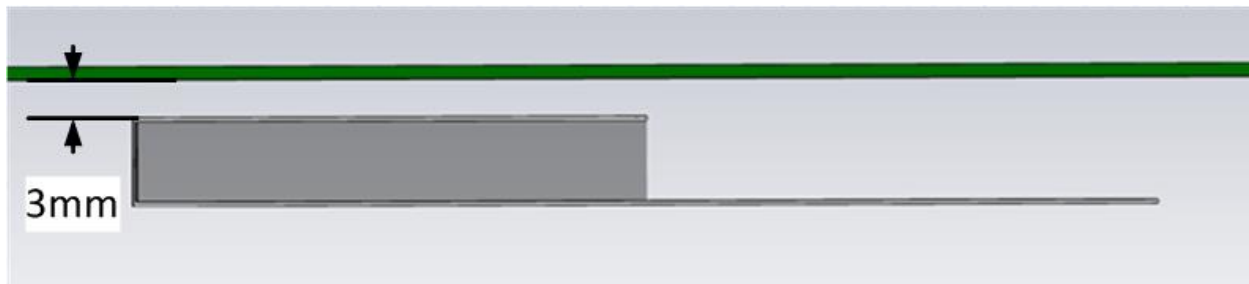
**Figure 17 Vertical, Horizontal, and Total Gain Plots**

**OPTIMAL INSTALLATION GUIDE**

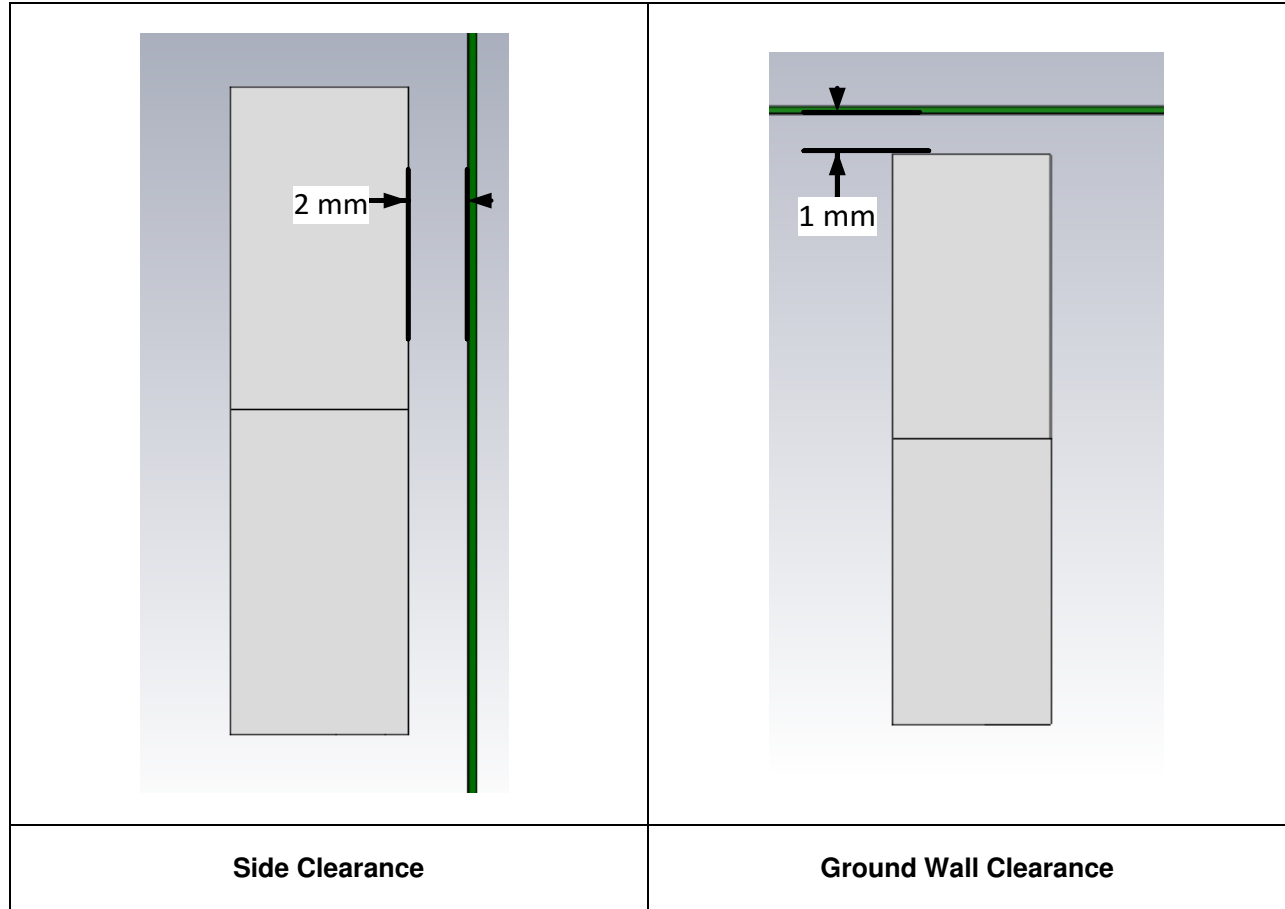


**Figure 18 E-Field Radiation from FlexPIFA, Taken from CST Simulation**

The main element should be kept clear of any non-metal objects (such as plastics) on top of it by at least 3 mm (see **Figure 19**). Similarly, the two long sides of the FlexPIFA should be kept clear of any non-metal object by at least 2 mm (See **Figure 20**). A 1 mm clearance should be observed from the ground wall to any non-metal object. Mounting the FlexPIFA in a situation that does not allow for these clearance recommendations may change the gain characteristics stated in the datasheet, which could impact overall range of the wireless system.



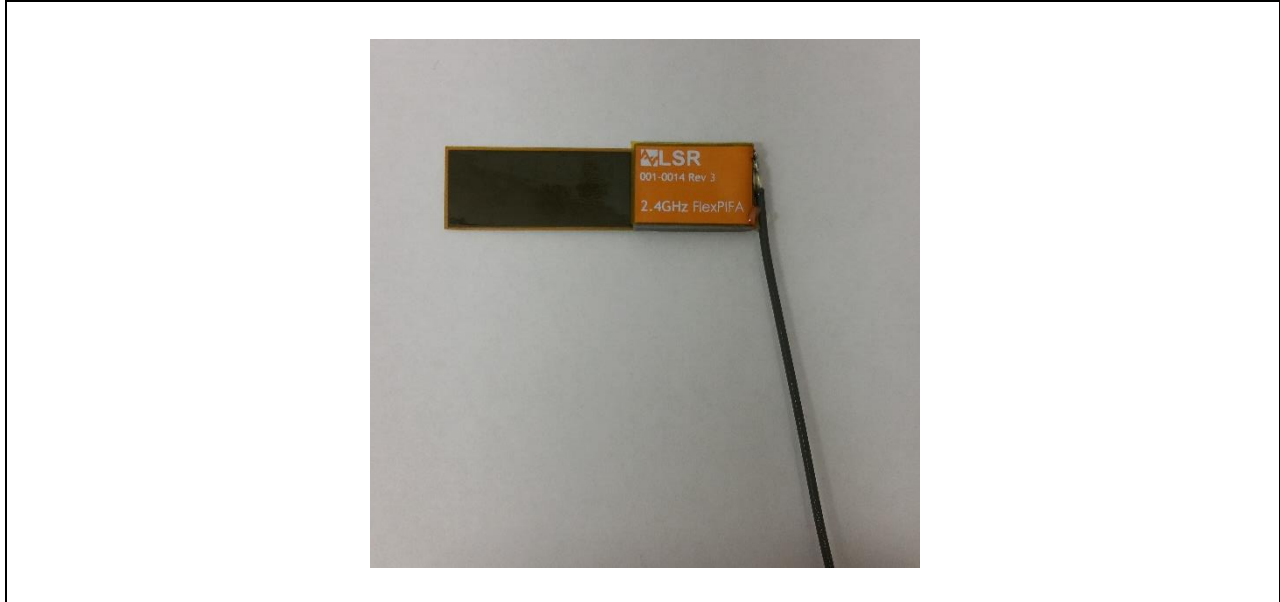
**Figure 19 Top Clearance**



**Figure 20 Side and Ground Wall Clearance**

The ideal material for the FlexPIFA to be mounted on is 1.5 mm thick polycarbonate for maximum performance. However, as previously mentioned, the FlexPIFA can tolerate other non-metallic surfaces and thicknesses and still radiate effectively. Depending on the type of material, the FlexPIFA may be detuned.

The coaxial cable feeding the FlexPIFA should be routed away from the antenna. Do not run the coaxial cable over the top of the FlexPIFA or near the tip of the main element. The cable should be routed as shown in **Figure 21**.



**Figure 21 Recommended Cable Routing**



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As with any antenna, care should be taken not to place conductive materials or objects near the antenna (except as described in the next section). The radiated fields from the antenna will induce currents on the surface of the metal; as a result those currents then produce their own radiation. These re-radiating fields from the metal will interfere with the fields radiating from the FlexPIFA (this is true for any antenna). Other objects, such as an LCD display, placed in close proximity to the antenna may not affect its tuning but it can distort the radiation pattern. Materials that absorb electromagnetic fields should be kept away from the antenna to maximize performance. Common things to keep in mind when placing the antenna:

#### Wire Routing

Speakers – these generate magnetic fields

Metal Chassis and Frames

Battery Location

Proximity to Human Body

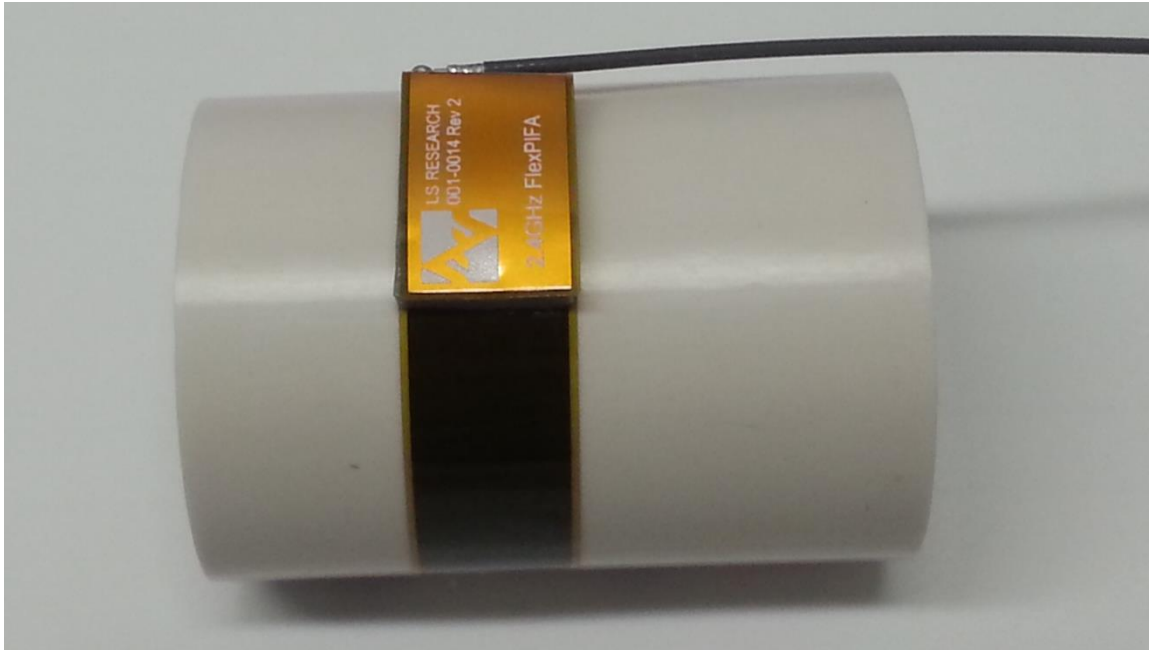
Display Screen – these will absorb radiation

Paint – do not use metallic coating or flakes



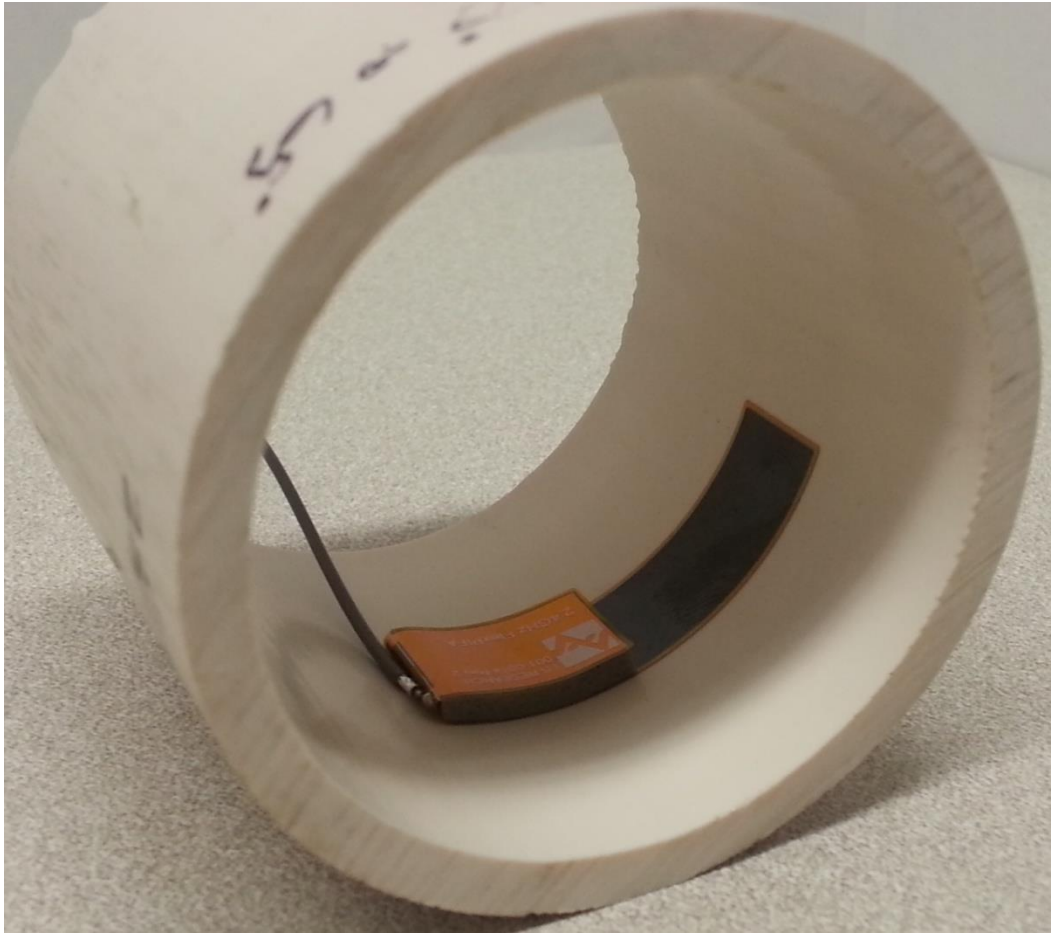
### Flex Limits of the FlexPIFA

One of the unique features of the FlexPIFA is its ability to flex. However, due to the adhesive there are limits as to how much the antenna can be flexed and remain secured to the device. The FlexPIFA should not be flexed in a convex position with a radius less than 16mm. Going smaller than this may result in the antenna peeling off the surface over time. Should a tighter radius of curvature be required, it is recommended you contact LSR for assistance.



**Figure 22 Convex Mounted**

The FlexPIFA should not be flexed in a concave position with a radius less than 25mm. In this scenario, the limiting factor is performance. The ground plate of the antenna is pressed closer to the main element. As previously discussed in the introduction of this application note, the fringing fields developing off the end of the element are responsible for most of the radiation. In a concave position with a radius of curvature less than 25mm, the fringing fields are adversely affected and gain suffers. If a tighter radius of curvature is required, it is recommended you contact LSR for assistance.



**Figure 23 Concave Mounted**

The FlexPIFA is not designed to be twisted or crumpled. The adhesive back should lay flush with the surface it is mounted on.