

## 2.4 / 5.5 GHz FlexPIFA 3 dBi Antenna w/U.FL Cable, 100mm



### ORDERING INFORMATION

Order Number	Description
<b>001-0016</b>	2.4 / 5.5 GHz FlexPIFA Antenna w/U.FL cable, 100mm
<b>001-0021</b>	2.4 / 5.5 GHz FlexPIFA Antenna w/MHF4L cable, 100mm

**Table 1 Orderable Part Numbers**

### KEY FEATURES

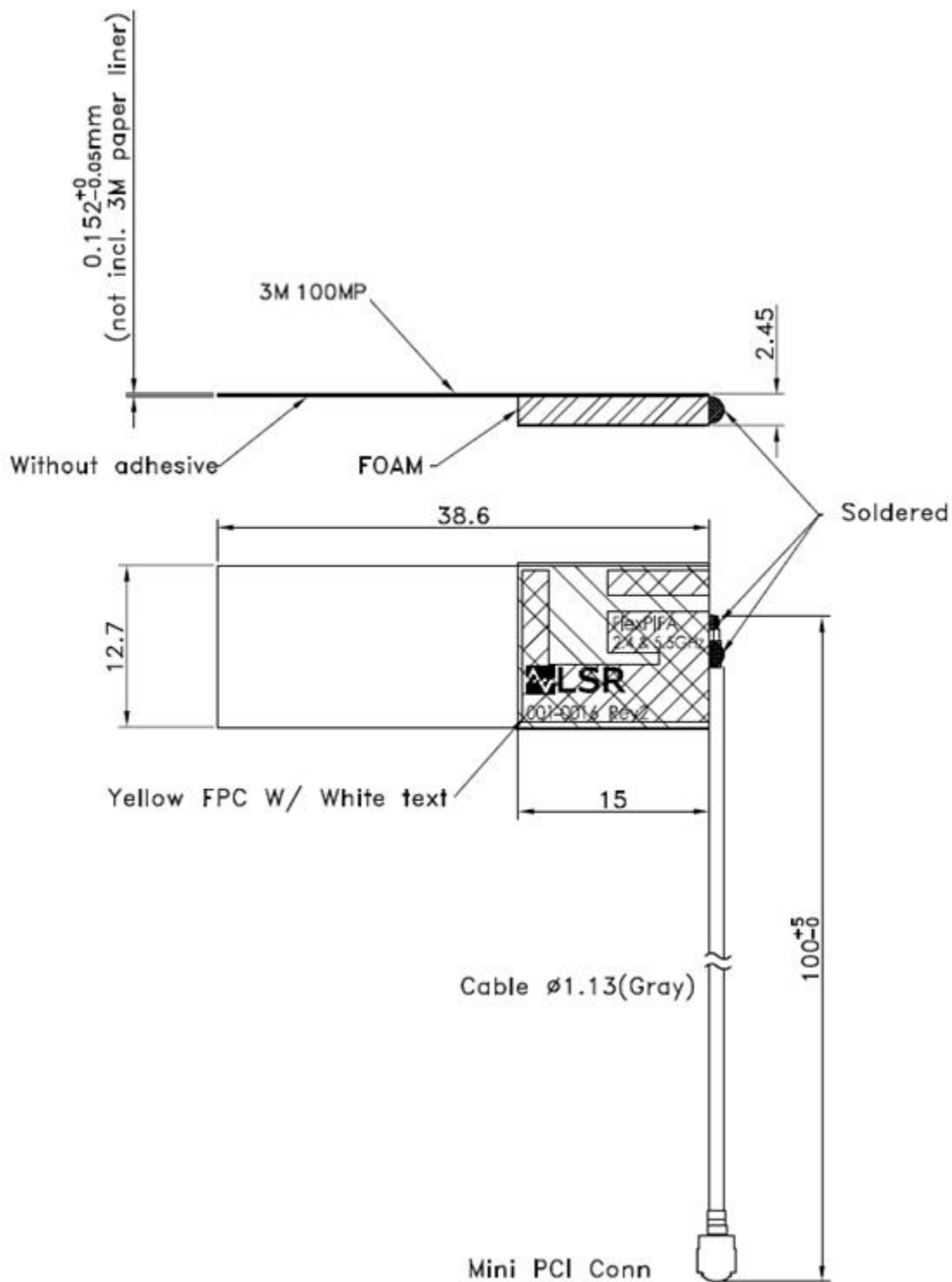
- Can be installed on different non-conductive surfaces and thicknesses.
- Can be installed near metals or the human body.
- Dual Band Antenna: 2.4 GHz and 5 GHz
- Can be installed on flat or curved surfaces.
- Quick and easy Installation
- Adhesive holds to surface during humidity exposure and hot/cold cycles.
- RoHS Compliant

## SPECIFICATIONS

Specification	Value
2.4 GHz Band Peak Gain	+2.5 dBi
5 GHz Band Peak Gain	+3 dBi
2.4 GHz Average Gain	> -1.9 dBi
5 GHz Average Gain	> -4.0 dBi
Impedance	50 ohms
Type	Flexible Planar Inverted F Antenna (FlexPIFA)
Polarization	Linear
VSWR	<3.0:1, 2400 – 2480 MHz
	<3.0:1, 4900 – 5900 MHz
Frequency	2400 - 2480 MHz, 4900 - 5900 MHz
Weight	1.13g
Size	38.6mm × 12.7mm × 2.5mm
Antenna Color	Clear Yellow
Adhesive	3M 100MP
Operating Temp	-40°C to +85°C
Connector Mating Height	U.FL: 2.5mm Max
	MHF4L: 1.4mm Max

**Table 2 Specifications**

## PHYSICAL DIMENSIONS (MM)



**Figure 1 Physical Dimensions**

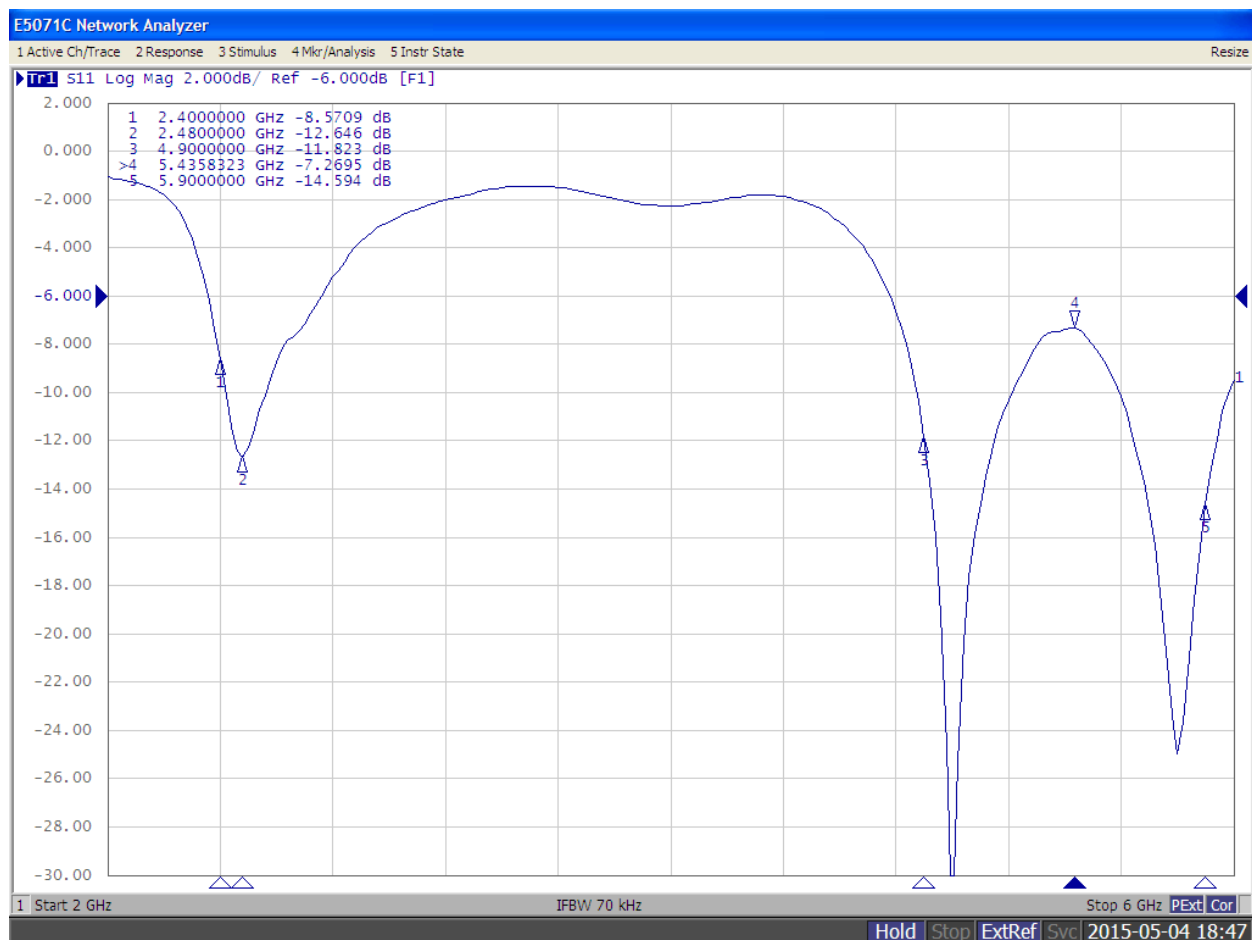
## TEST SETUP

Antenna measurements such as VSWR were measured with an Agilent E5071C Vector Network Analyzer. Radiation patterns were measured with an Agilent 5181A Signal Generator and Agilent E4445A Spectrum Analyzer in a 3 meter Anechoic Chamber.

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.

## FLAT SURFACE ANTENNA MEASUREMENTS

### VSWR



**Figure 2 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:

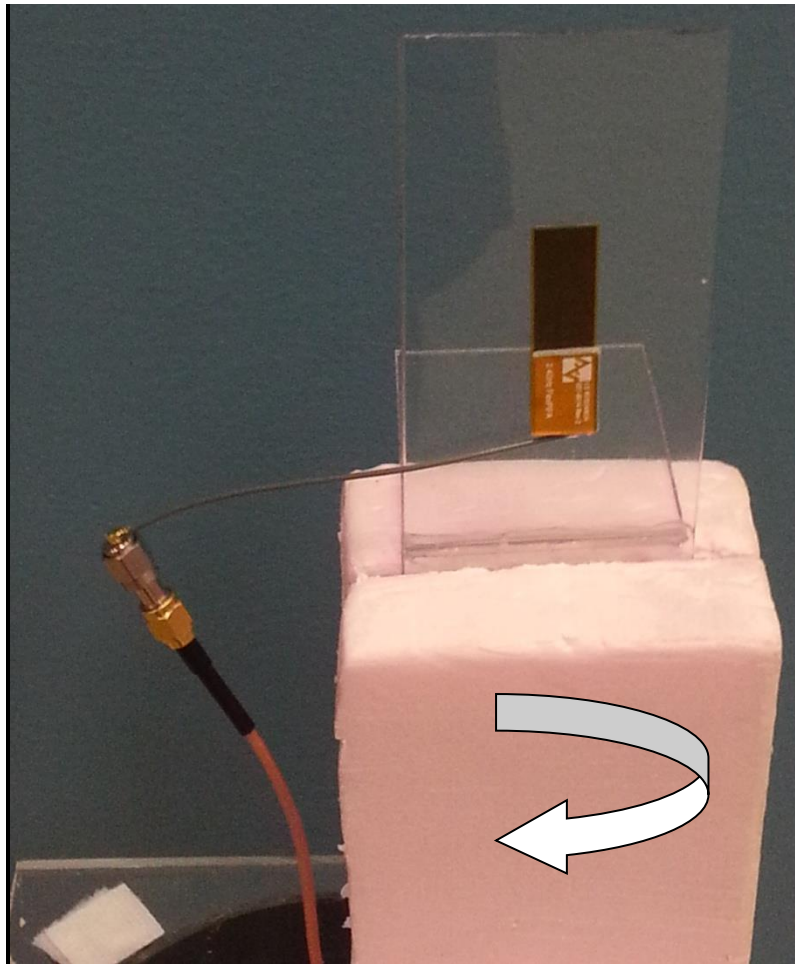
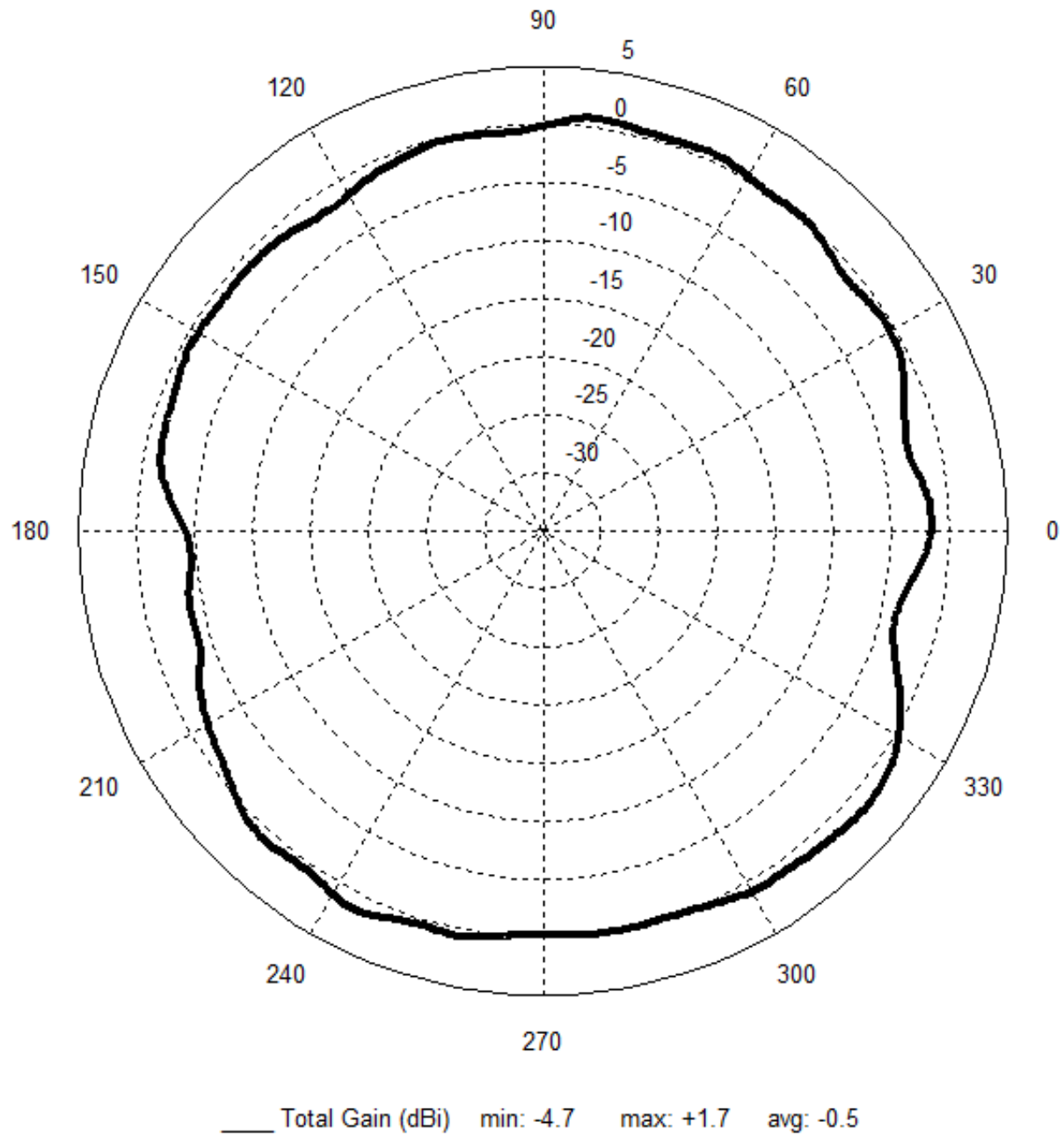


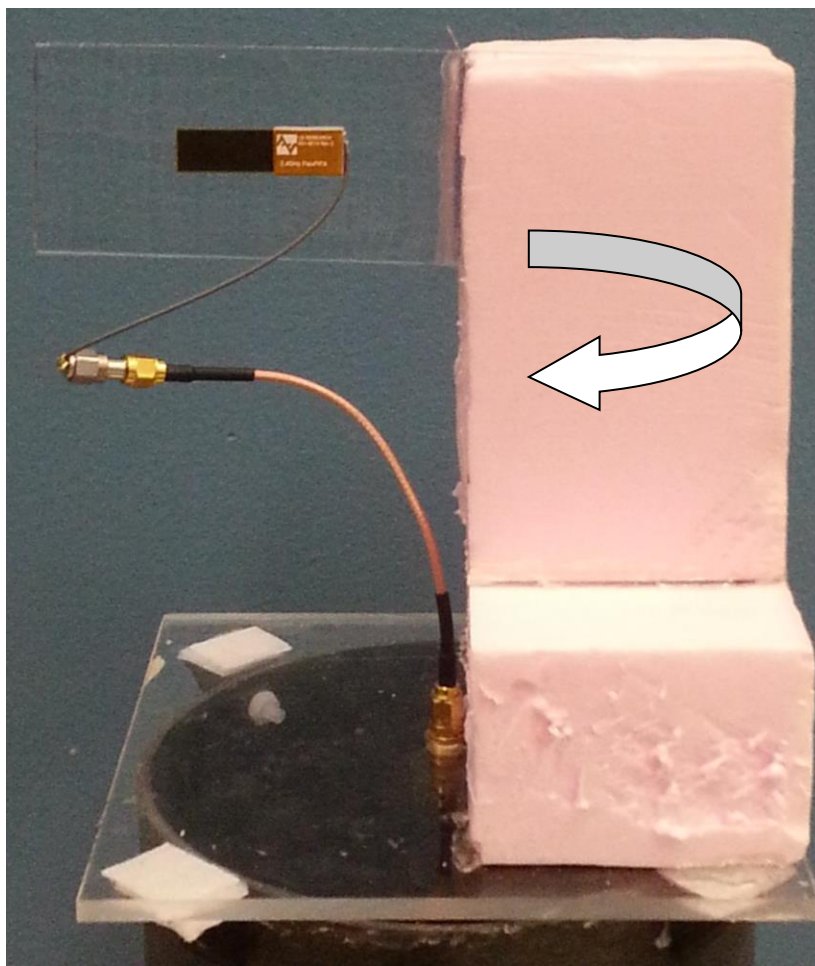
Figure 3 Vertical Orientation Set-Up

**Vertical Orientation at 2440 MHz:**



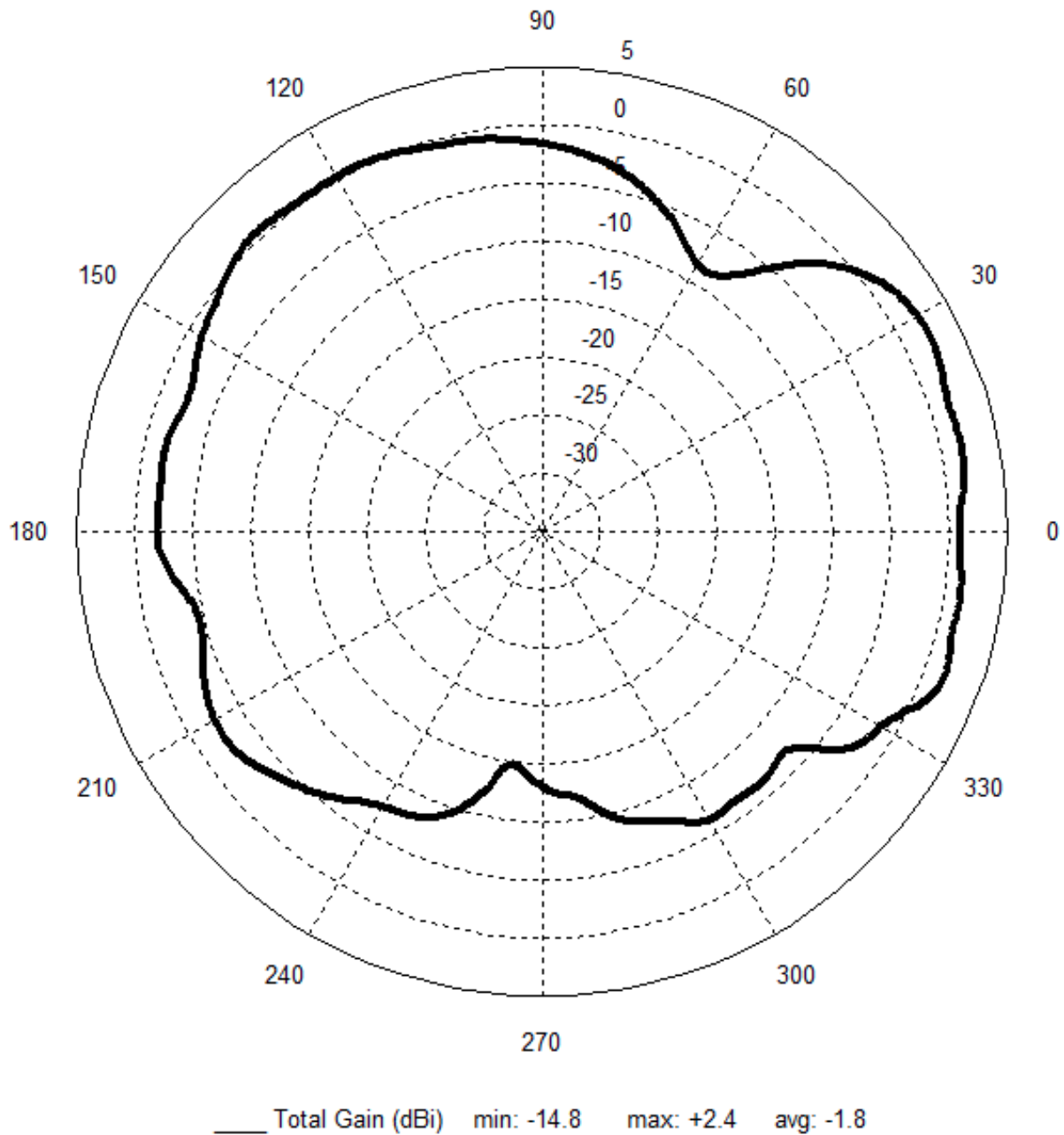
**Figure 4 Vertical Orientation Pattern**

**Antenna Measurement Set-Up:**



**Figure 5 Horizontal Orientation Set-Up**

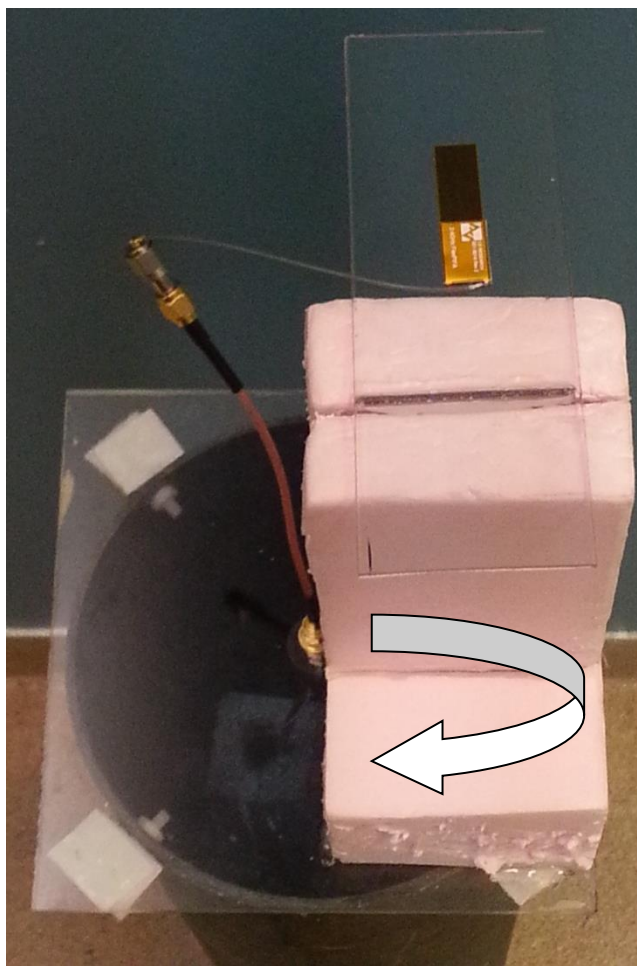
**Horizontal Orientation at 2440 MHz:**



**Figure 6 Horizontal Orientation Pattern**

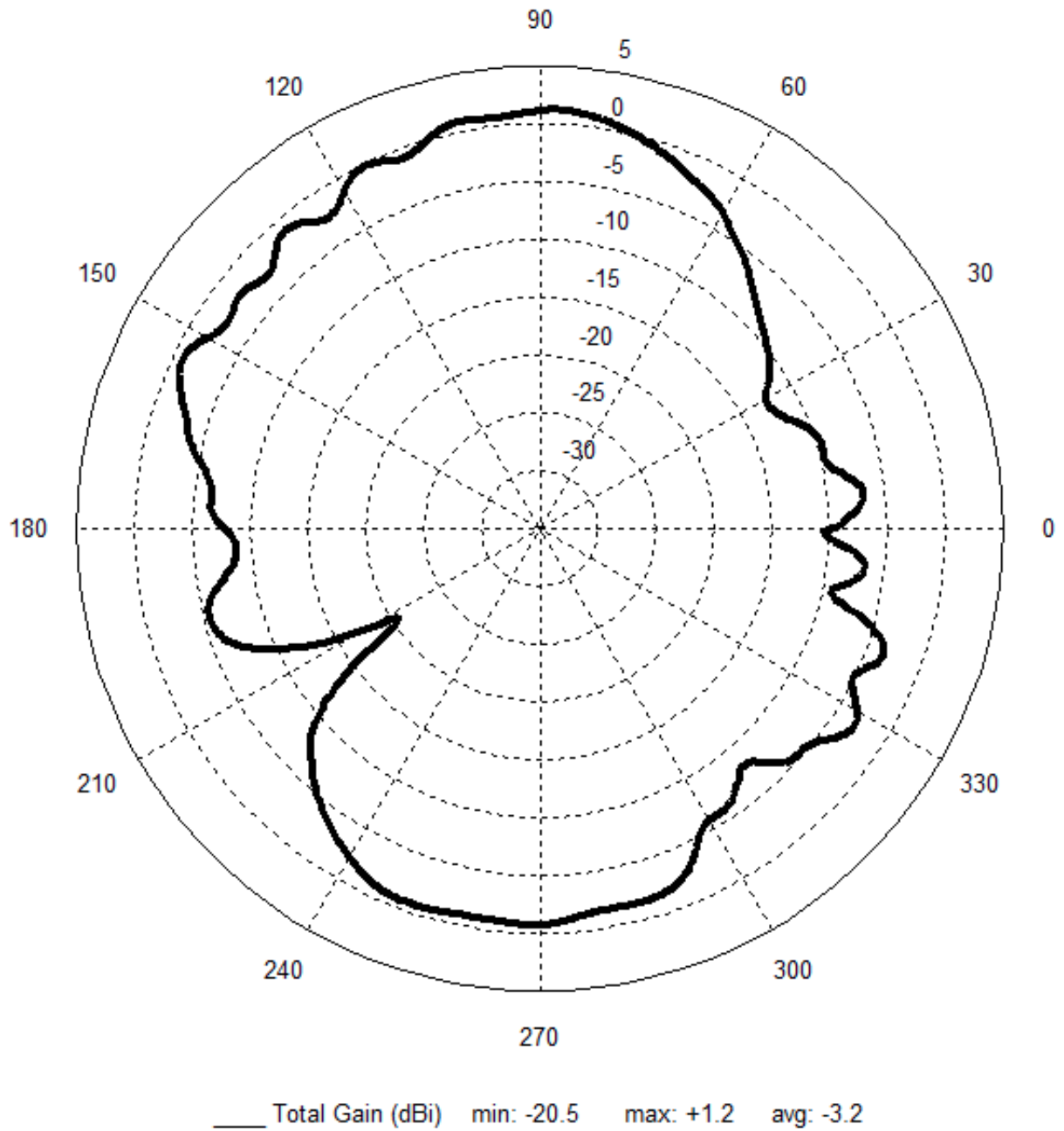


### Antenna Measurement Set-Up:



**Figure 7 Flat Orientation Set-Up**

**Flat Orientation at 2440 MHz:**



**Figure 8 Flat Orientation Pattern**

## 5 GHz Band

FlexPIFA centered on a 1.5 mm thick plate of Polycarbonate

Antenna Measurement Set-Up:

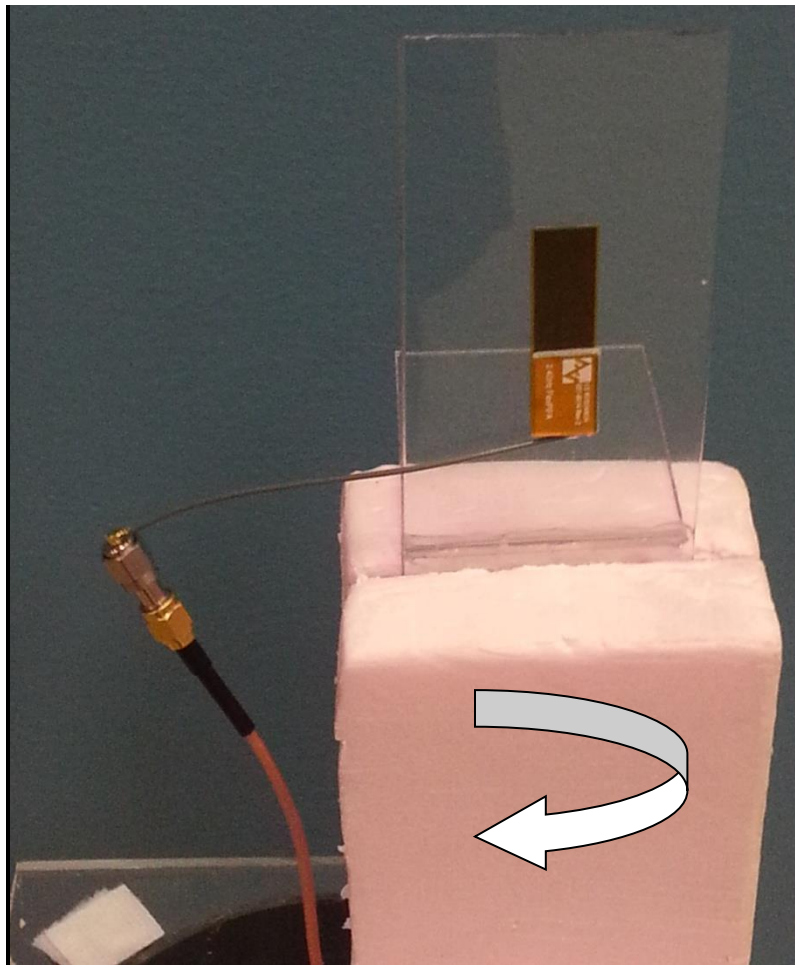
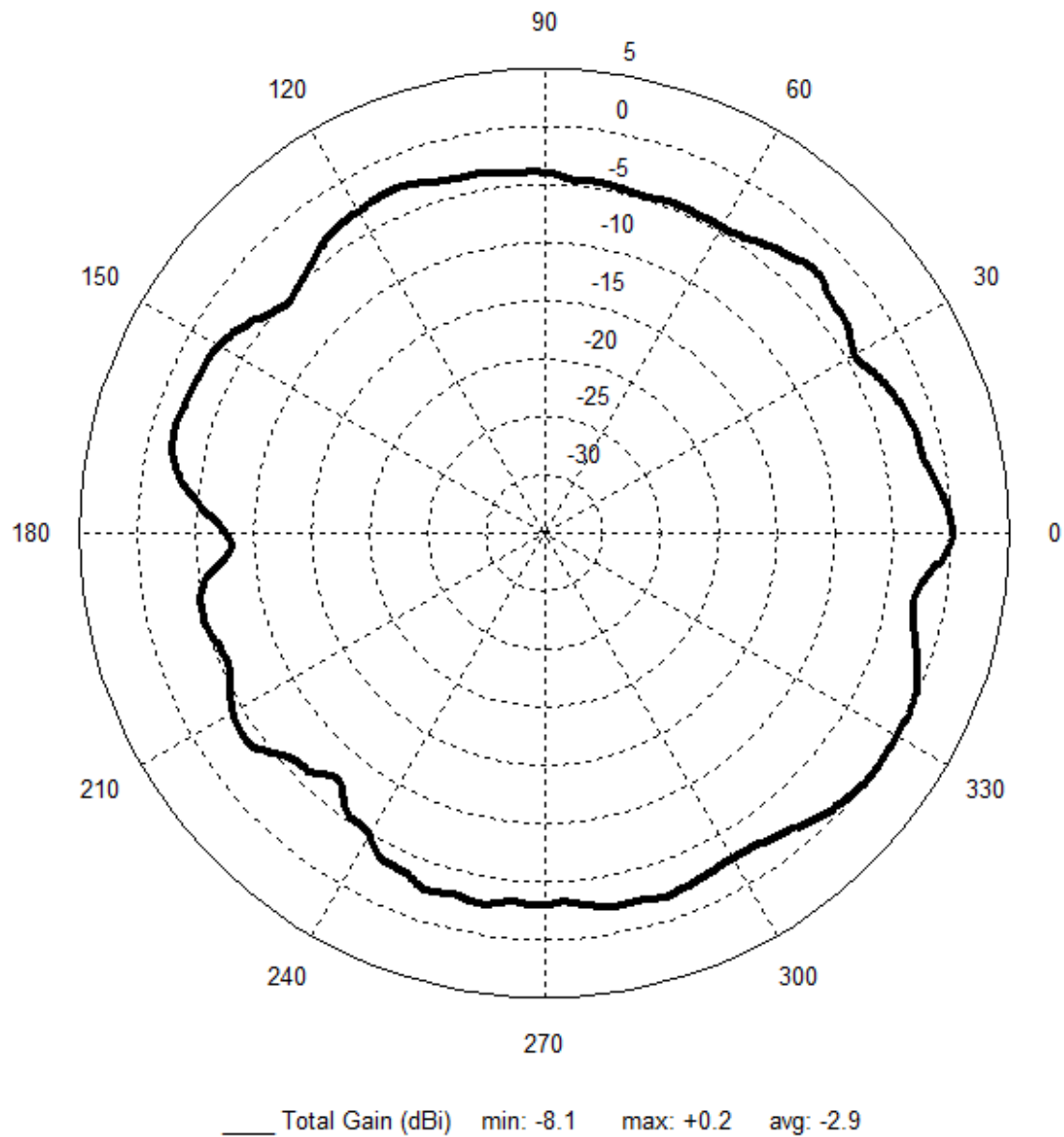


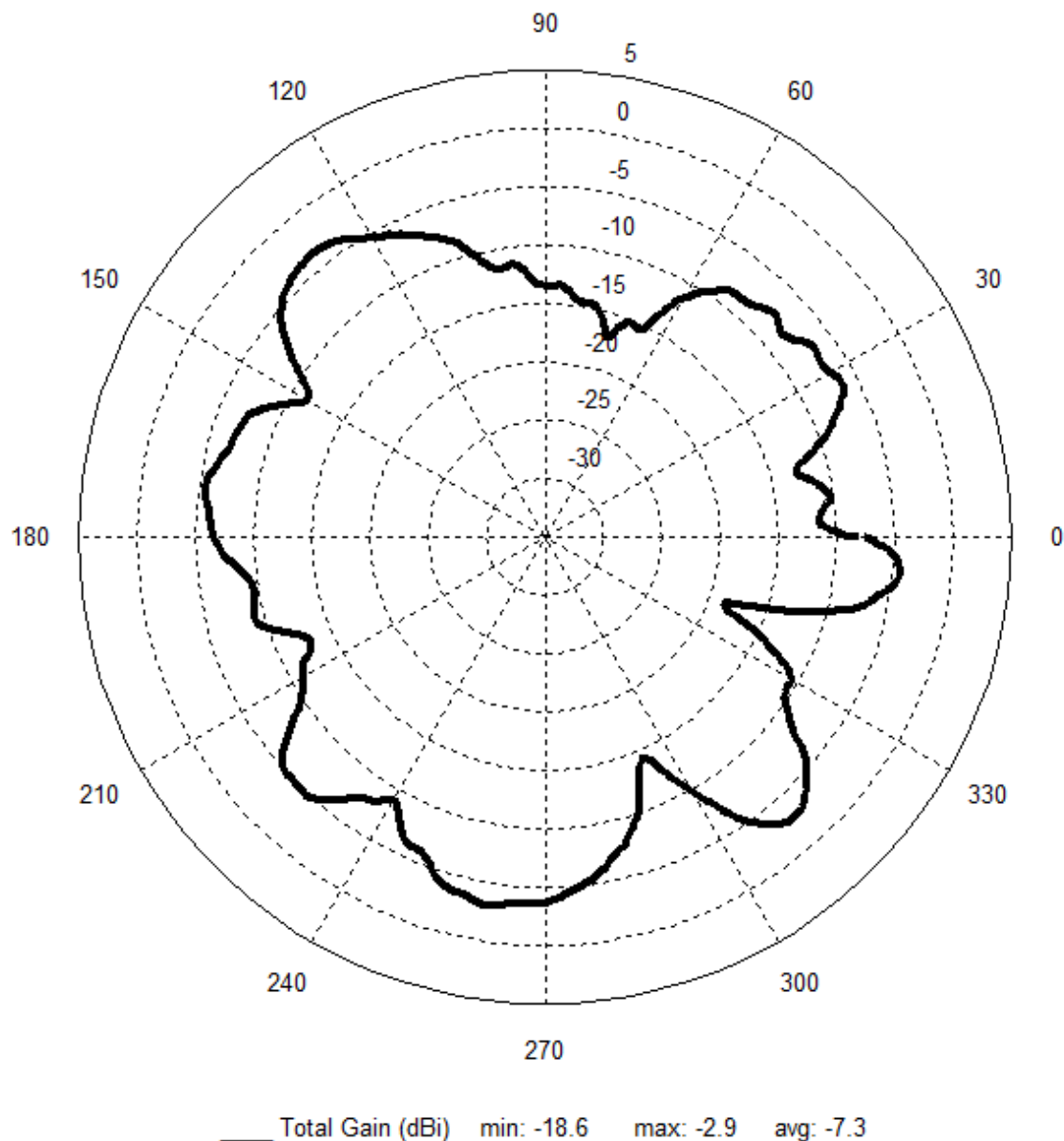
Figure 9 Vertical Orientation Set-Up

**Vertical Orientation at 4900 MHz:**



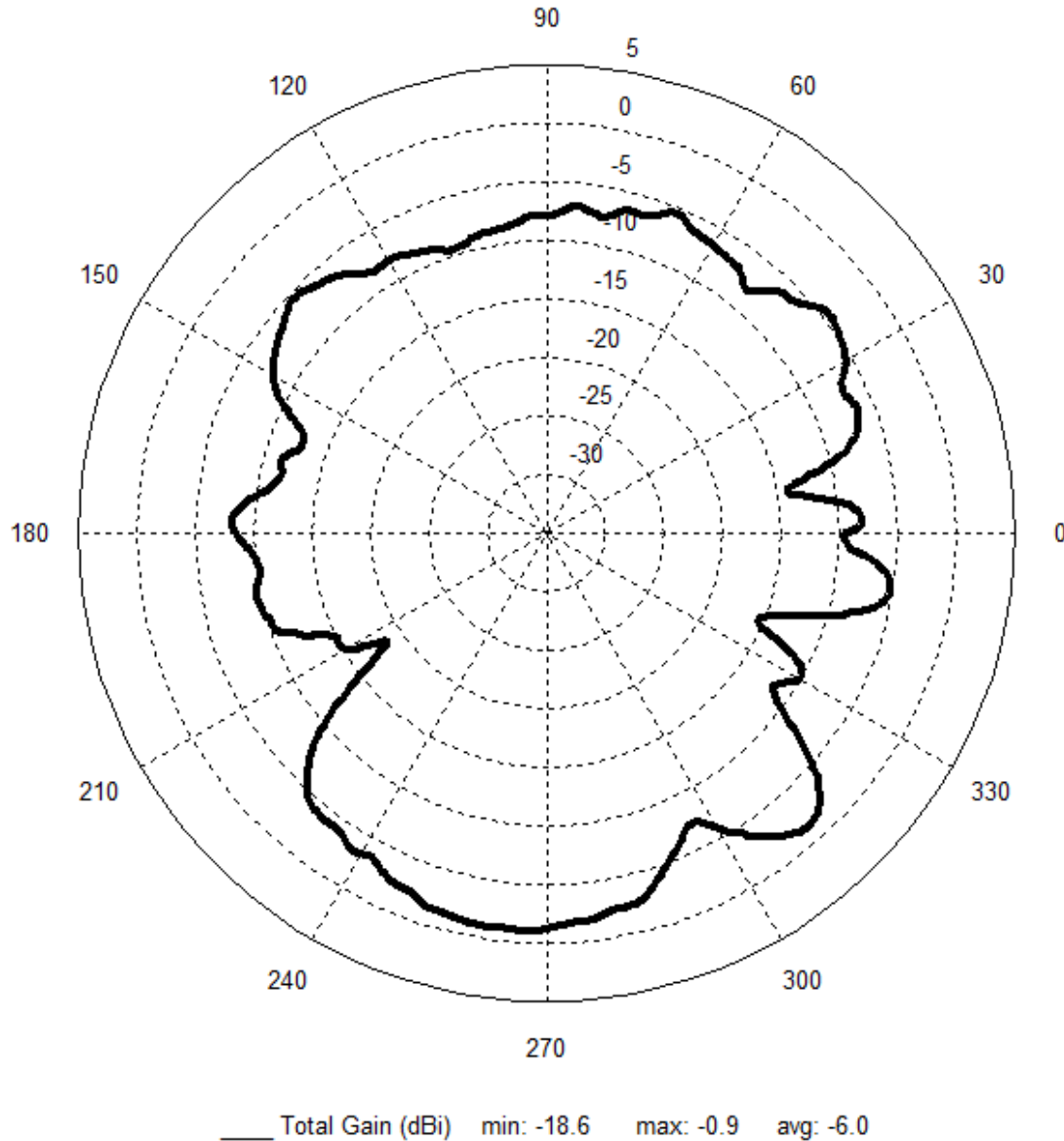
**Figure 10 Vertical Orientation Pattern**

**Vertical Orientation at 5400 MHz:**



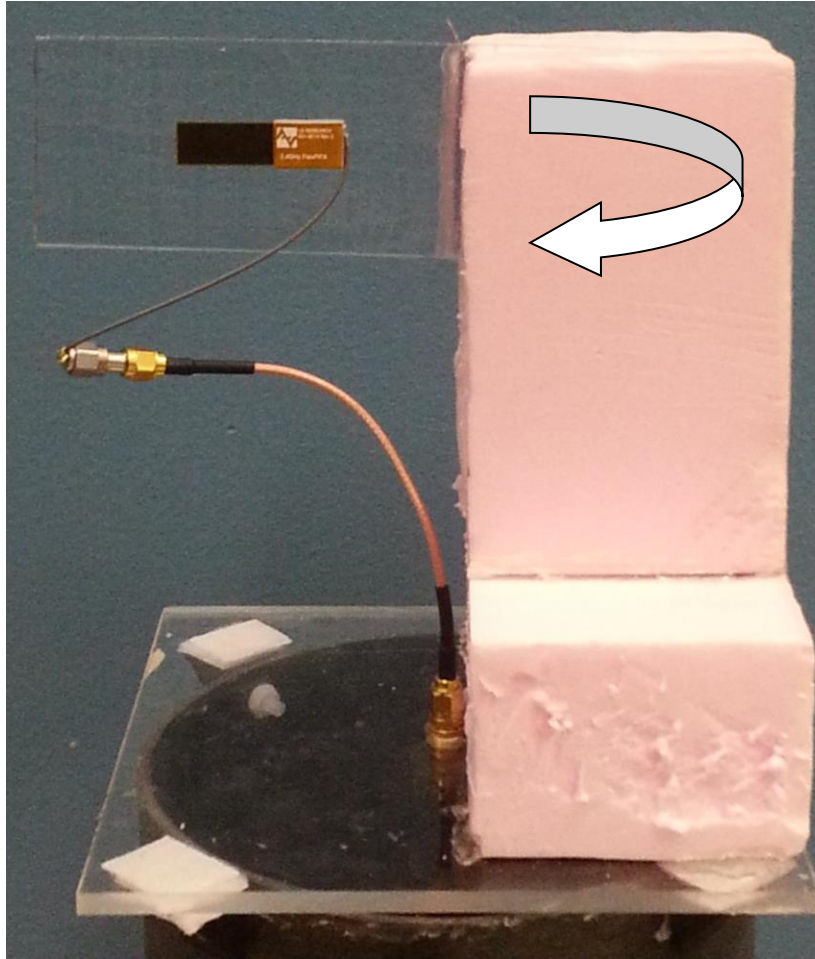
**Figure 11 Vertical Orientation Pattern**

**Vertical Orientation at 5900 MHz:**



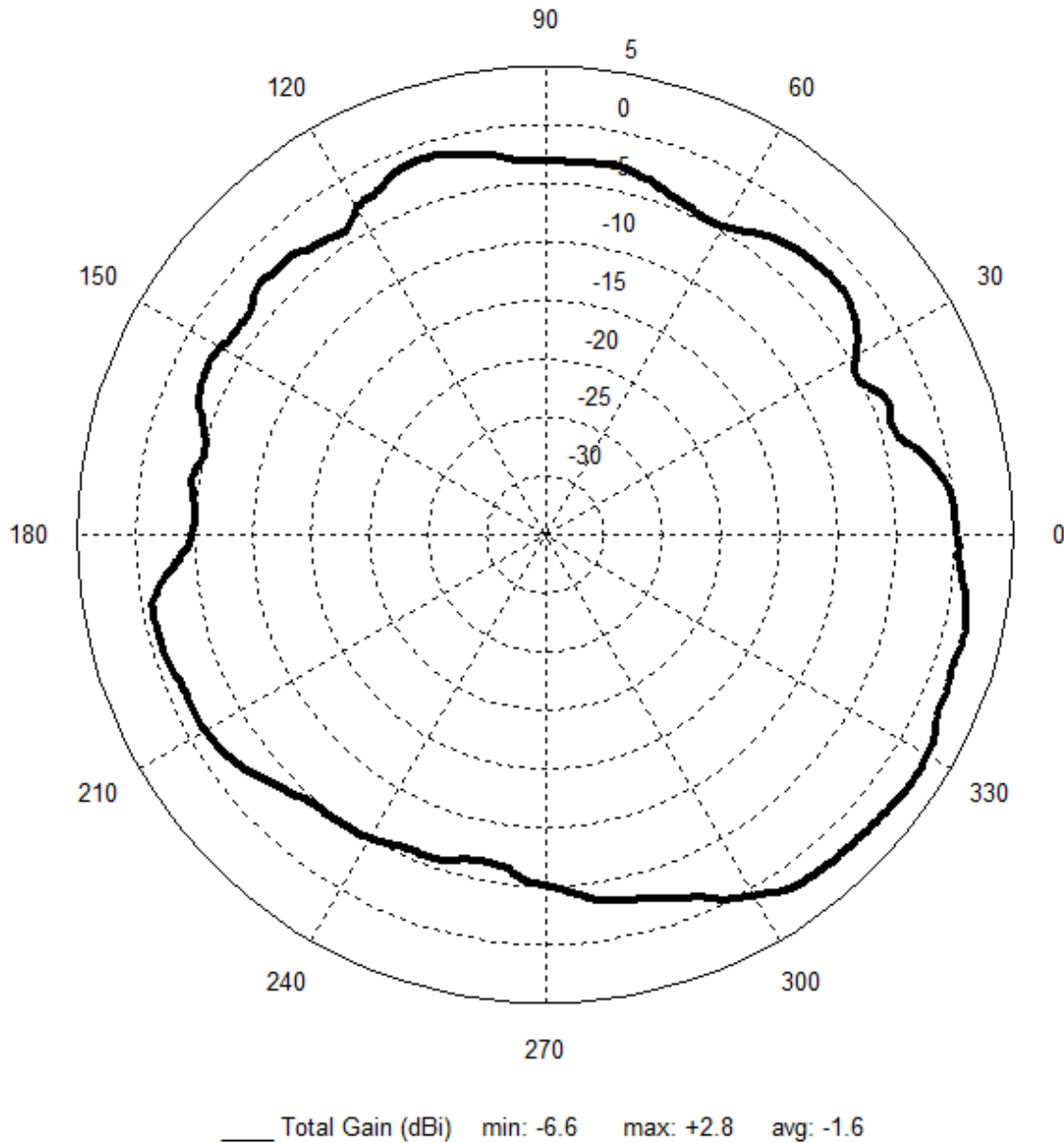
**Figure 12 Vertical Orientation Pattern**

**Antenna Measurement Set-Up:**



**Figure 13 Horizontal Orientation Set-Up**

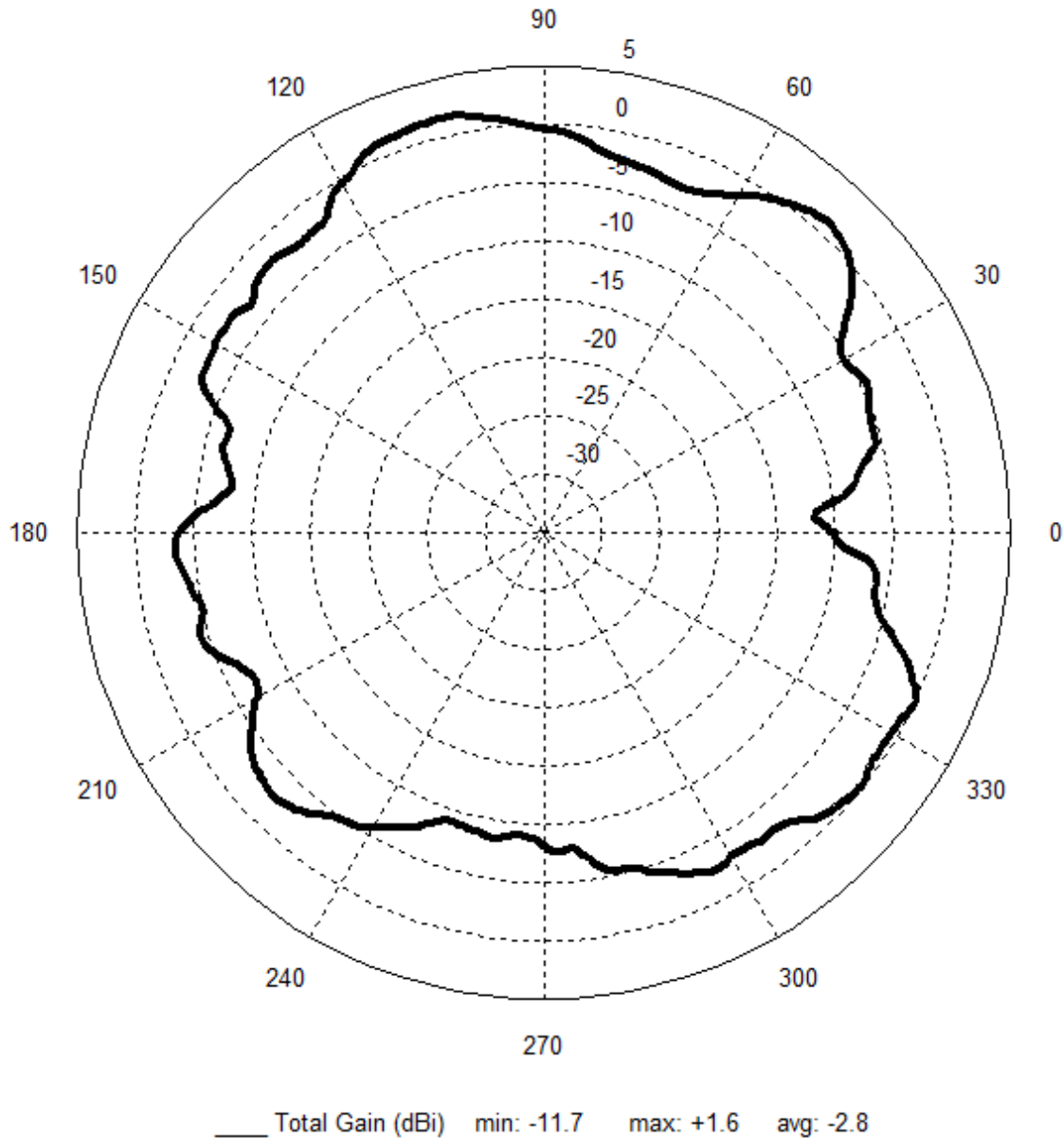
**Horizontal Orientation at 4900 MHz:**



**Figure 14 Horizontal Orientation Pattern**

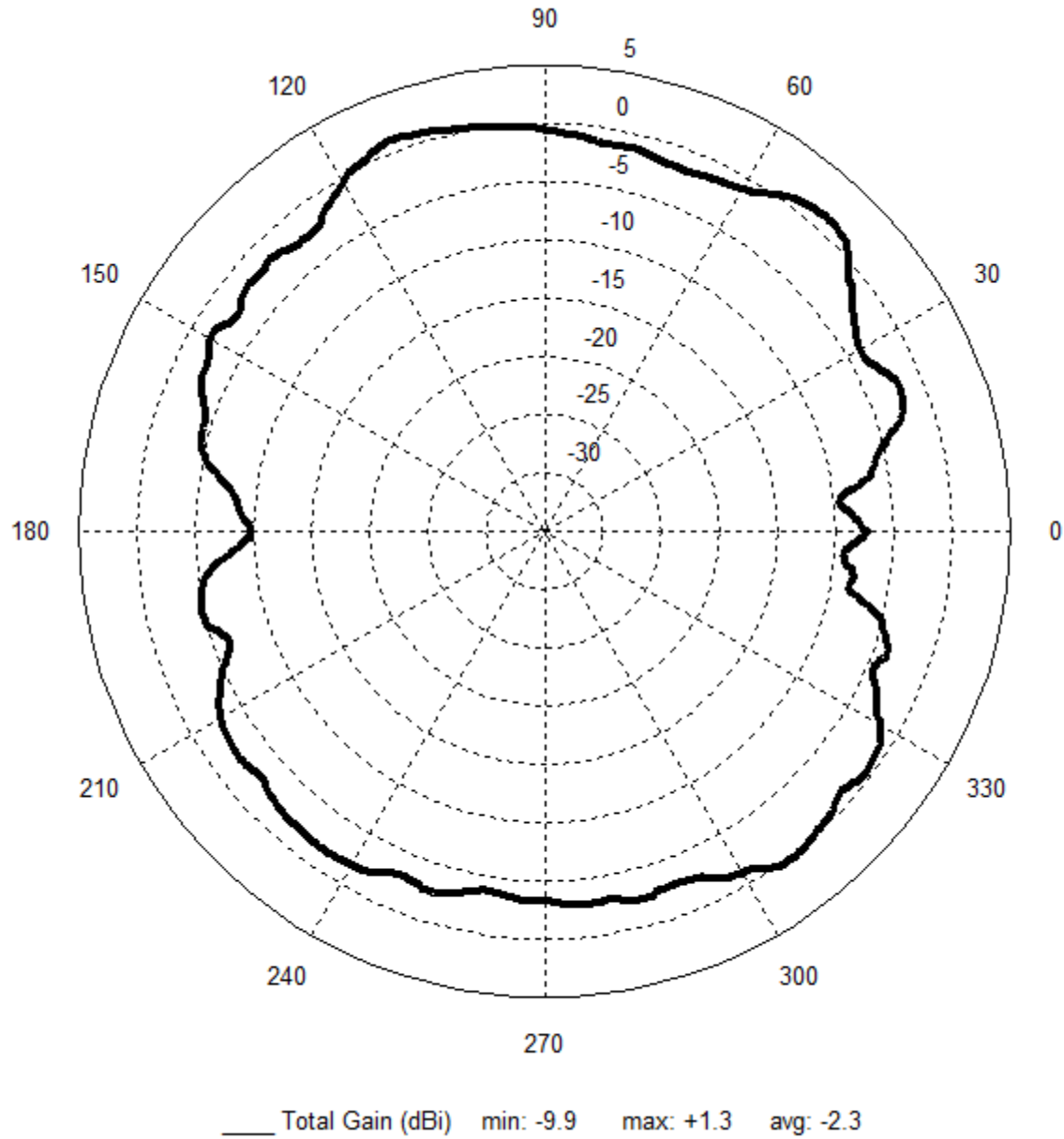


**Horizontal Orientation at 5400 MHz:**



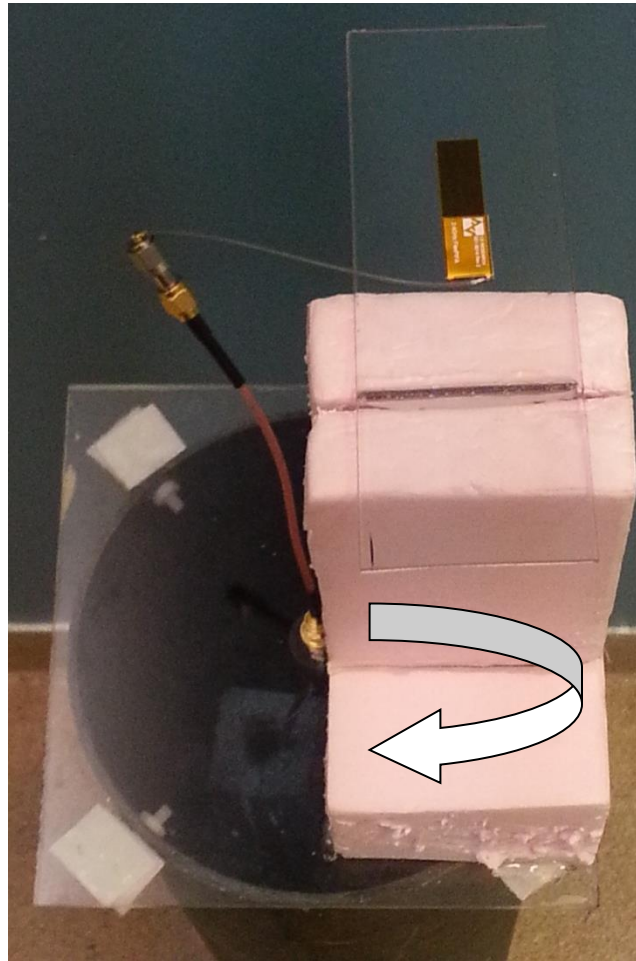
**Figure 15 Horizontal Orientation Pattern**

**Horizontal Orientation at 5900 MHz:**



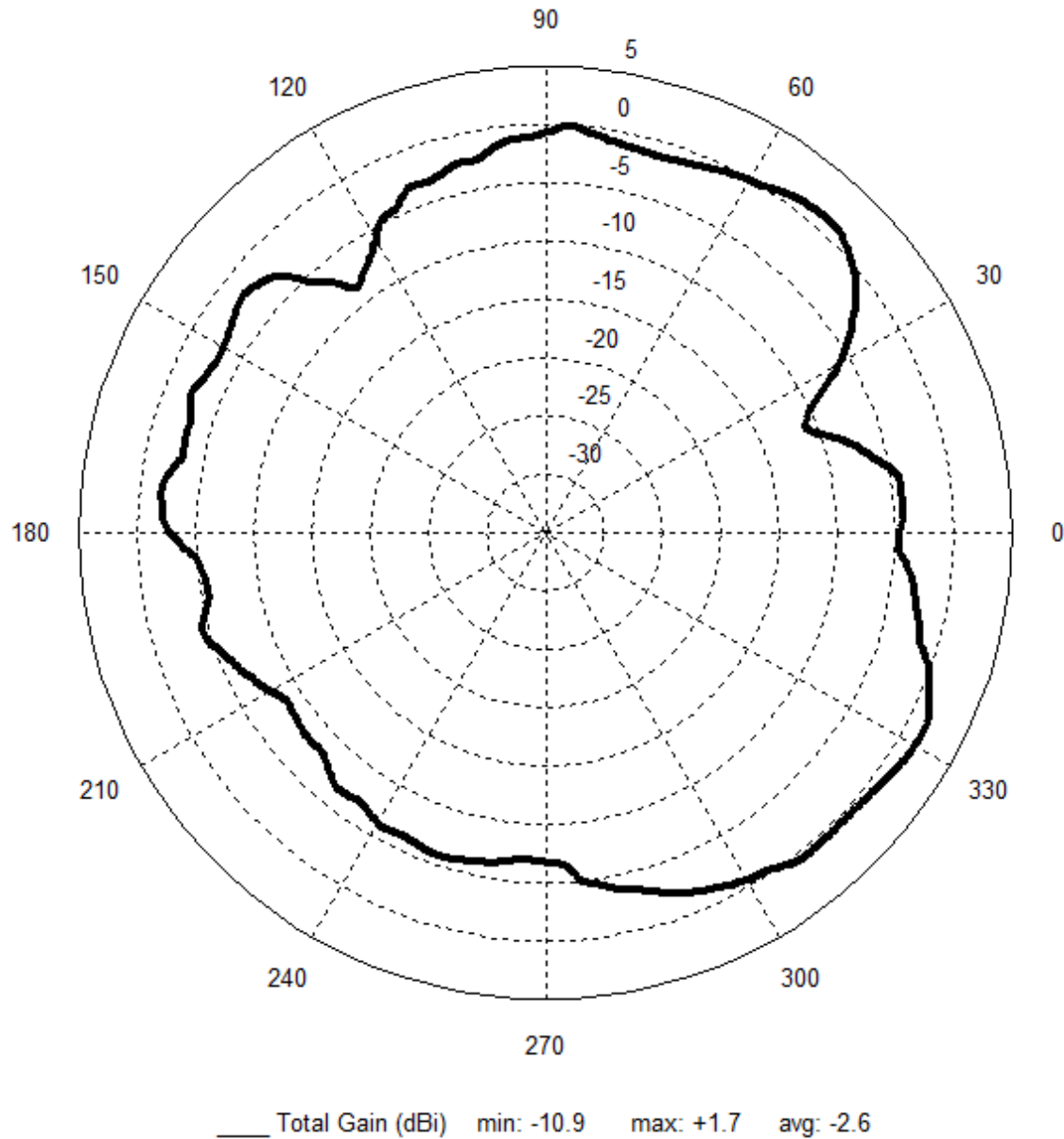
**Figure 16 Horizontal Orientation Pattern**

**Antenna Measurement Set-Up:**



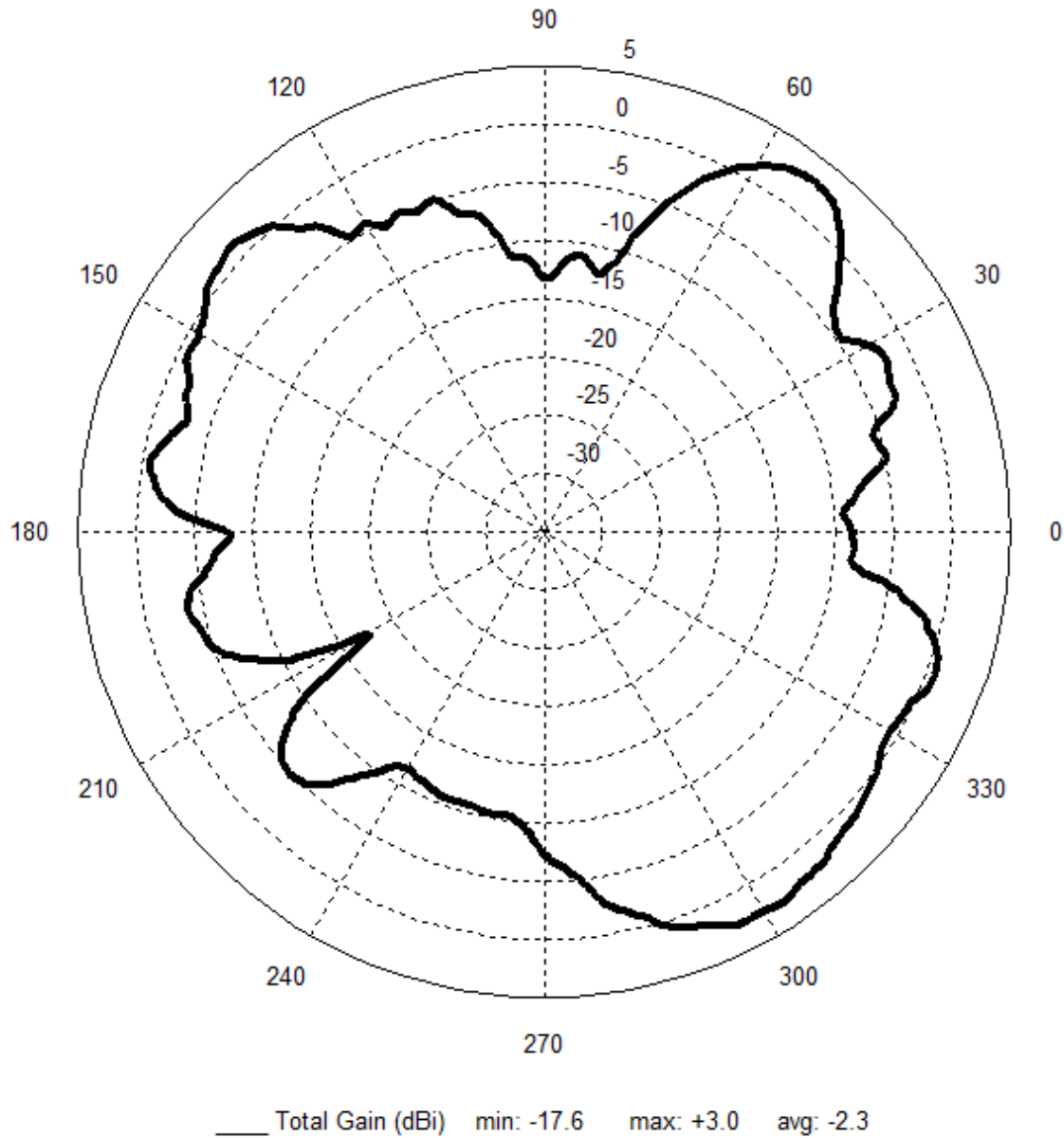
**Figure 17 Flat Orientation Set-Up**

**Flat Orientation at 4900 MHz:**



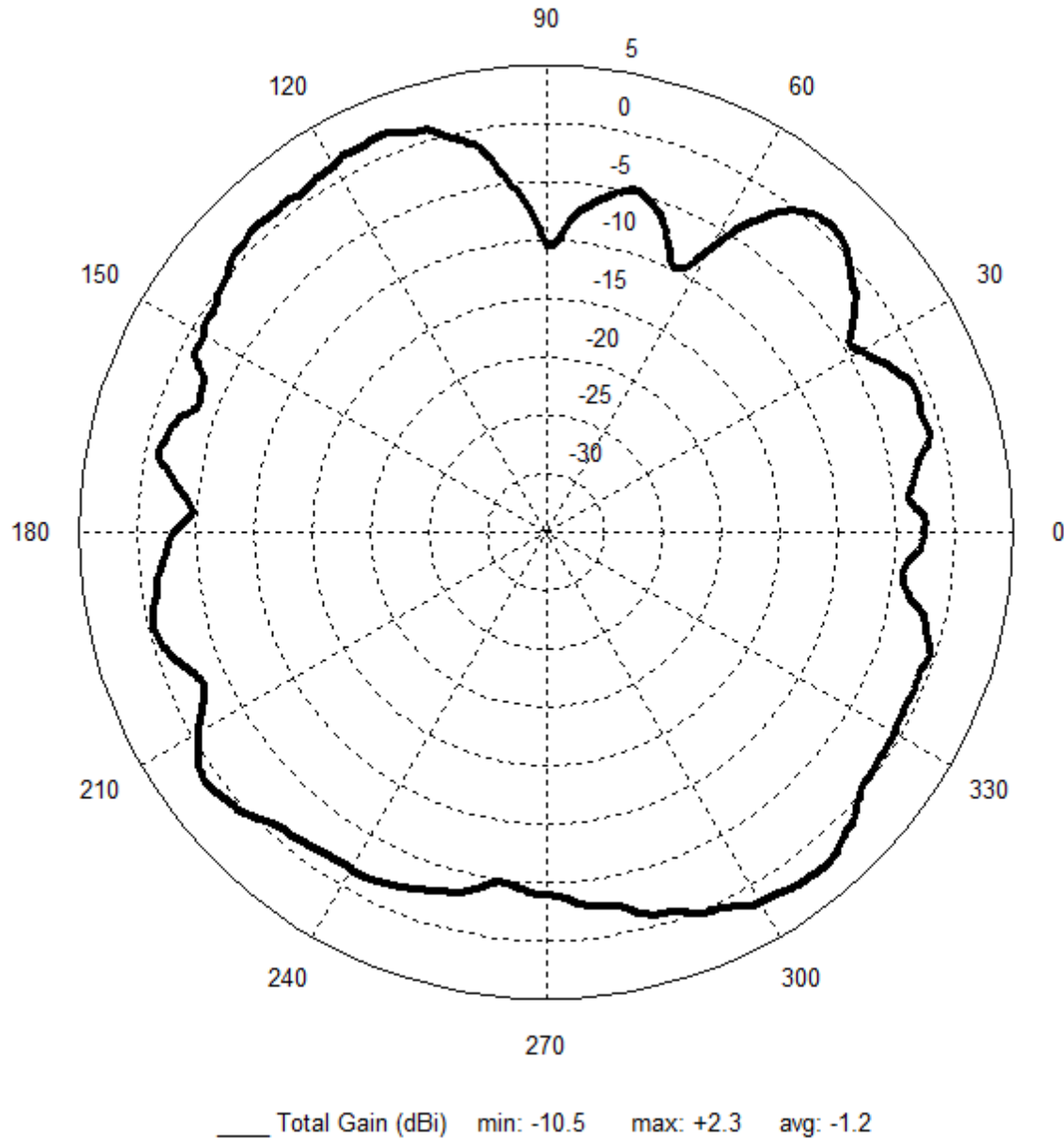
**Figure 18 Flat Orientation Pattern**

**Flat Orientation at 5400 MHz:**



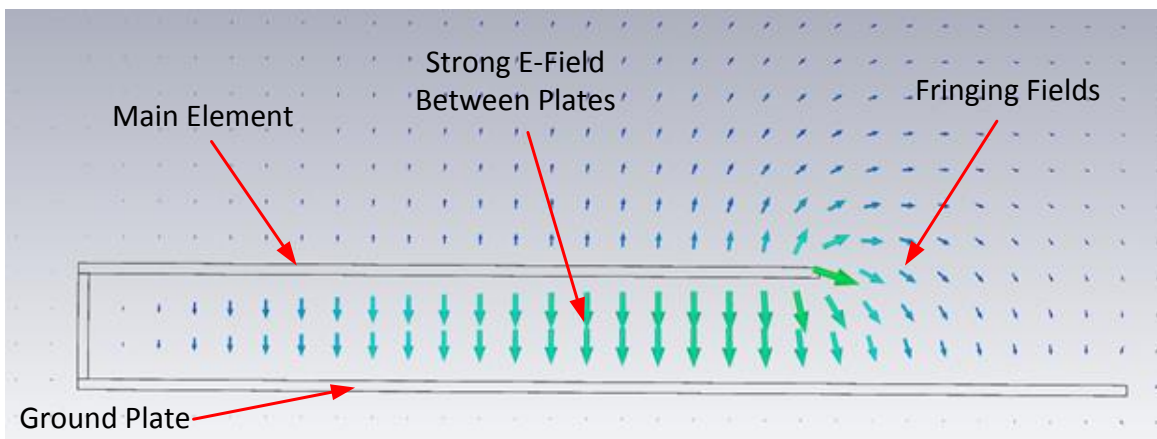
**Figure 19 Flat Orientation Pattern**

**Flat Orientation at 5900 MHz:**



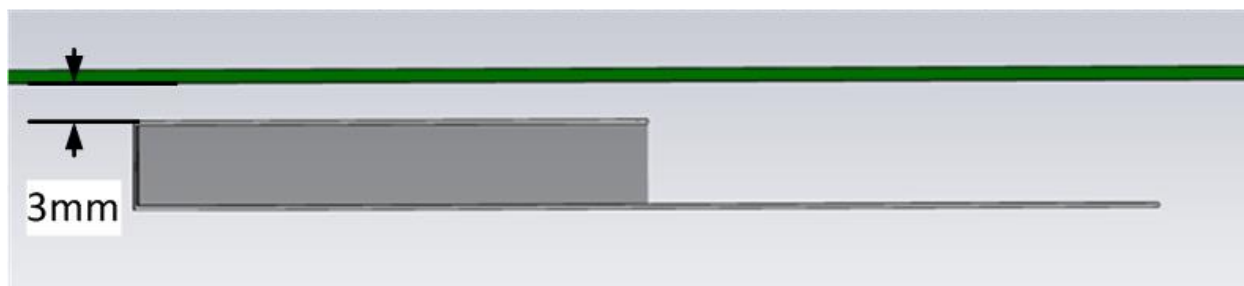
**Figure 20 Secondary Elevation Pattern**

## OPTIMAL INSTALLATION GUIDE

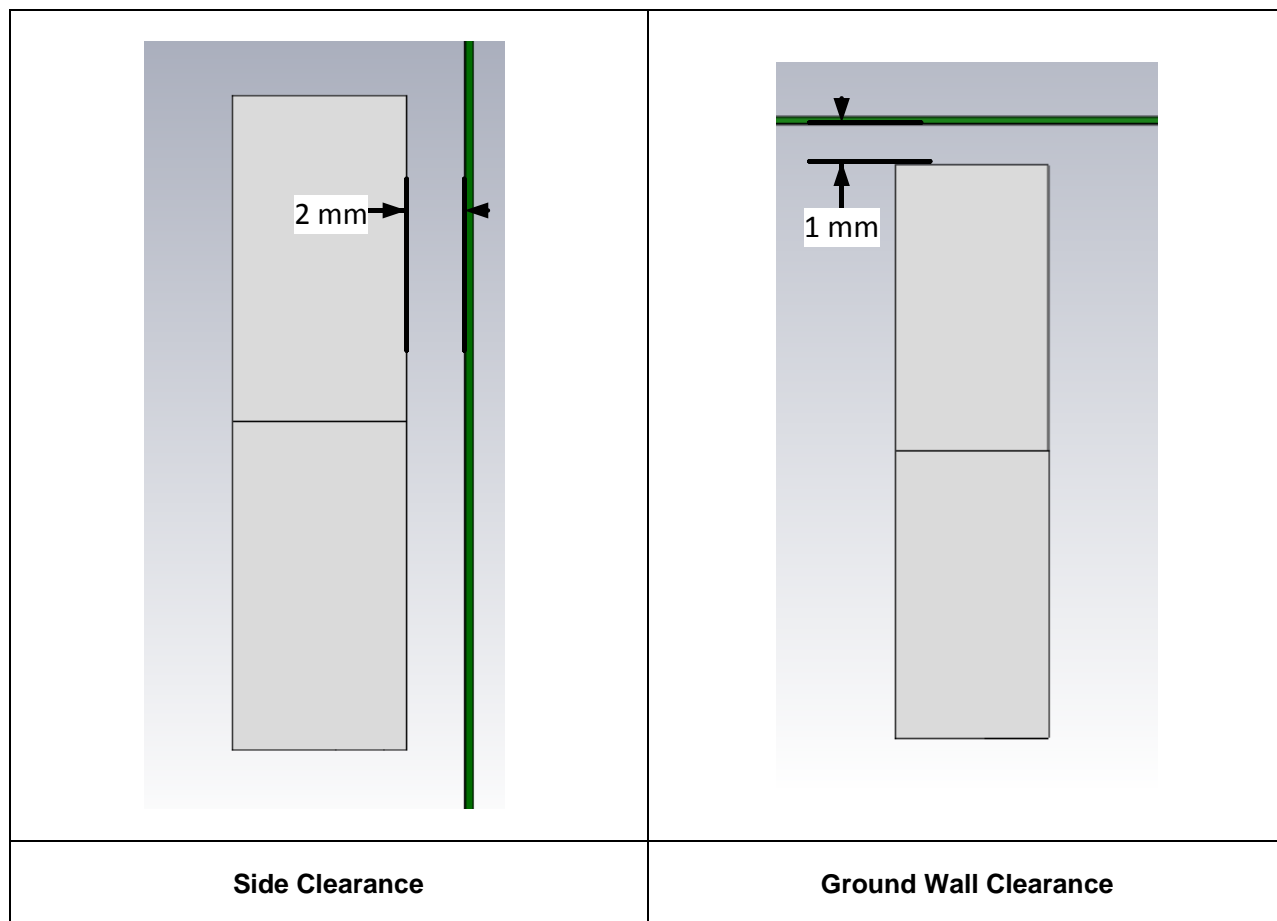


**Figure 21 E-Field Radiation from FlexPIFA, Taken from CST Simulation**

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 22**). Similarly, the two long sides of the FlexPIFA should be kept clear of any non-metal object by at least 2 mm (See **Figure 23**). 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 22 Top Clearance**

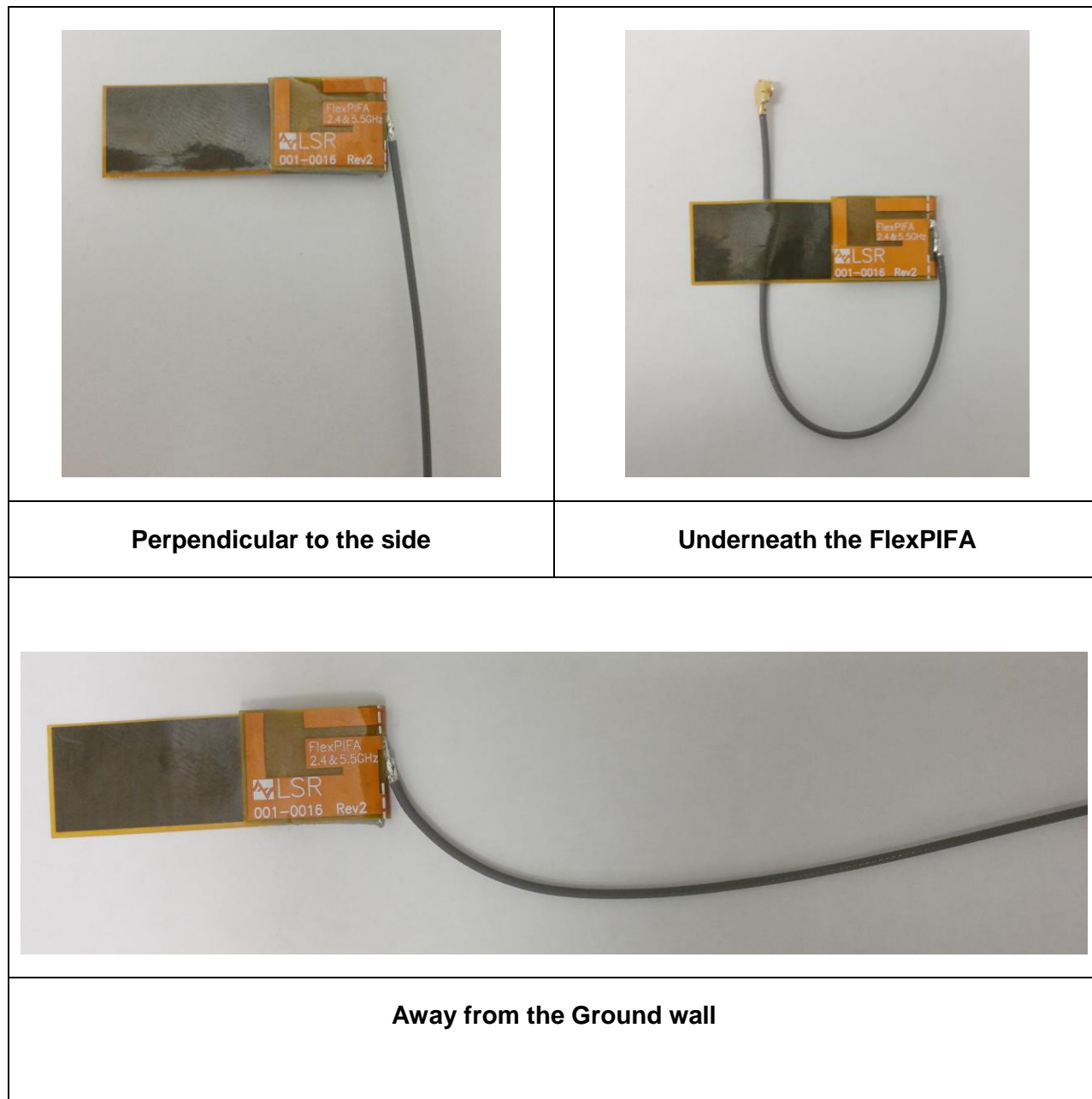


**Figure 23 Side and Ground Wall Clearance**

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 perpendicular to the side of the FlexPIFA (this is the way the cable comes assembled), underneath the ground plate, or away from the ground wall. All three of these options are shown in **Figure 24**.



**Figure 24 Recommended Cable Routing**

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

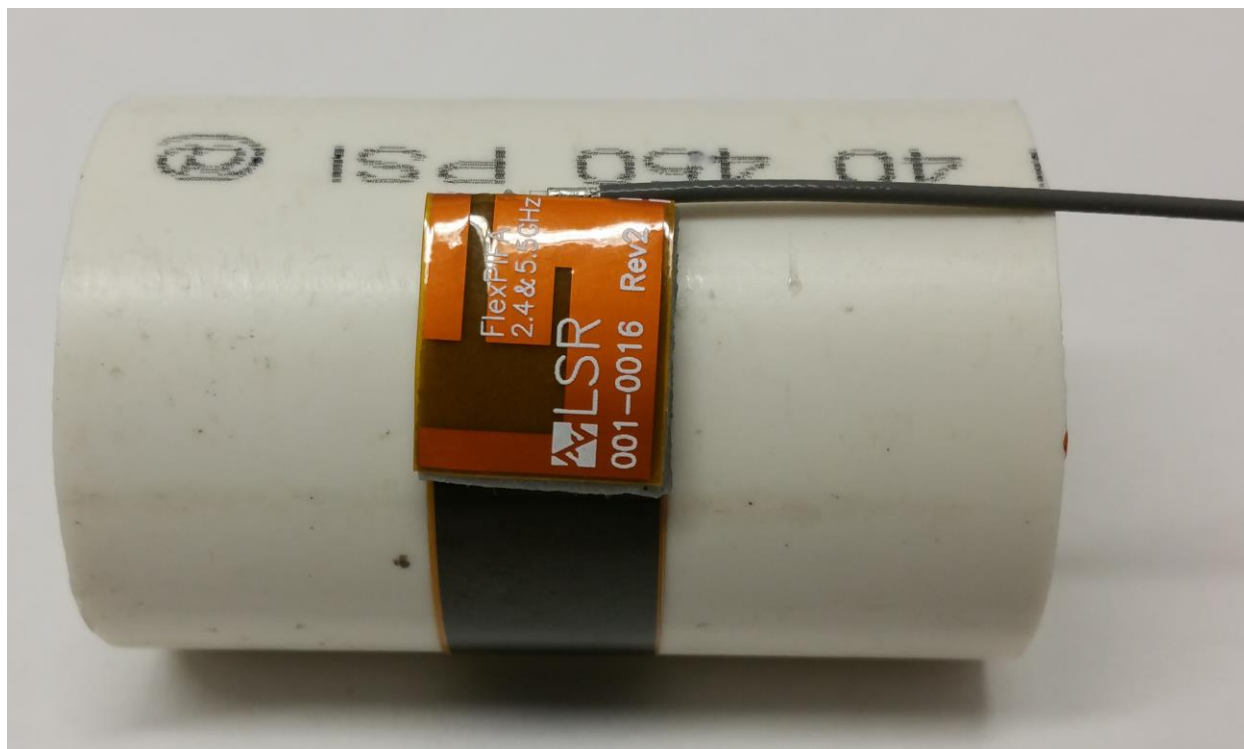
Proximity to Human Body

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 LS Research for assistance.



**Figure 25 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 LS Research for assistance.

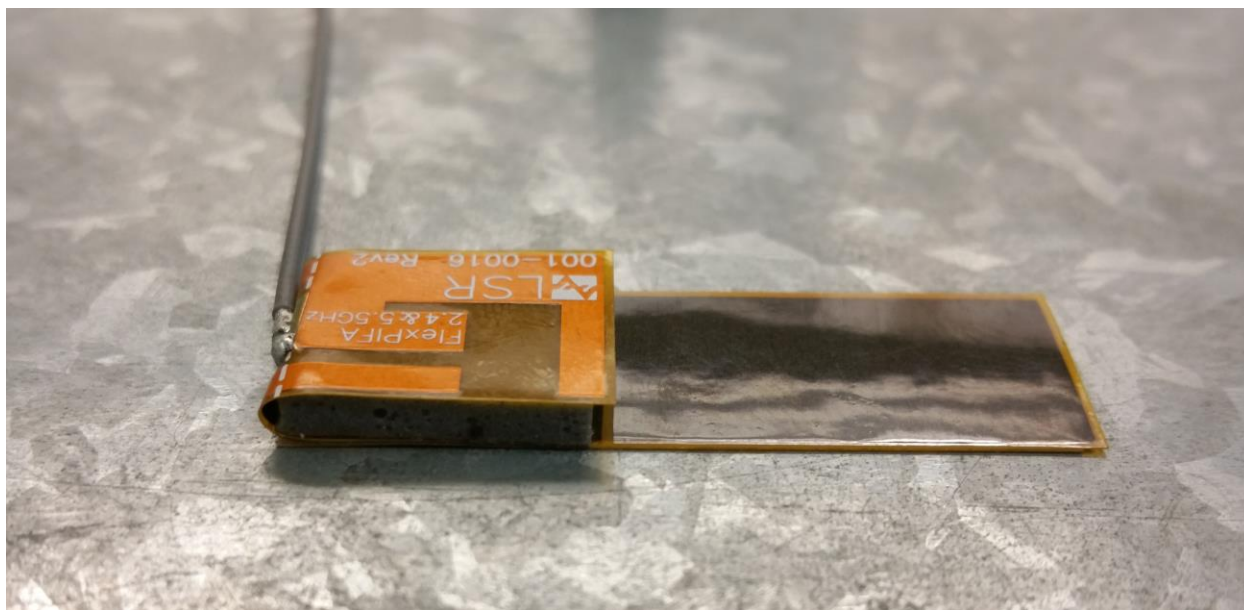


**Figure 26 Concave Mounted**

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

## Mounting on Metal and Body Loaded Applications

The FlexPIFA can tolerate being mounted on conductive surfaces. There will be some detuning of the antenna, which translates into some gain reduction. Even though the FlexPIFA is optimized to work on non-metallic surfaces, it still radiates efficiently due to the fringing fields (Shown in **Figure 21**). The ground plate of the FlexPIFA carries the adhesive backing; placing the antenna onto a metal surface simply enlarges the size of the ground beneath the main element. Previously the fringing fields only interacted with the small ground of the FlexPIFA - however they are now interacting with the much larger ground. The fringing fields still develop and radiate, but the antenna will no longer tune as well to the 2.4 GHz frequency band. Consequently the VSWR increases and there is some loss in radiated power. If the FlexPIFA cannot meet your range requirements after being implemented on a metal surface, contact LS Research for metal tuned samples.



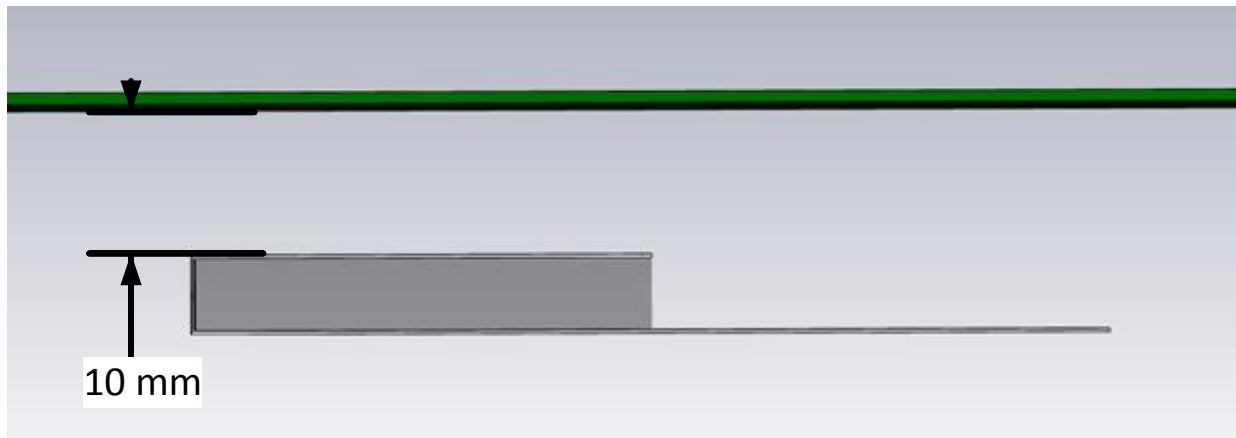
**Figure 27 FlexPIFA Mounted on Metal**

**Do not mount the FlexPIFA where metal is within 10 mm above the main element** (see **Figure 29**). Not only will this severely limit the radiation pattern (mainly due to the re-radiation problem previously described) it will detune the antenna inside of this range. Similarly, the two long sides of the FlexPIFA should be kept clear of any metal object by at least 5 mm. These keep out requirements pertain to **conductive** materials only, and are different from those listed in the previous sections which apply to **non-conductive** materials. In general, it is good practice to always keep metals as far away from the antenna as possible.

For the best performance, a spacer should be placed between the FlexPIFA and the conductive surface (see **Figure 28**). The spacer should be 1.5 mm thick polycarbonate. This will significantly improve performance and tuning of the FlexPIFA on a metal surface. Other non-conductive materials such as ABS plastic can be used; however polycarbonate will provide the best results.



**Figure 28 FlexPIFA Mounted on Metal Surface with 1.5mm Thick Polycarbonate Spacer**



**Figure 29 Metal near Main Element**

For body worn applications, the FlexPIFA can tolerate the presence of the human body. It is not recommended that the antenna be mounted directly on body tissue, this will detune the FlexPIFA. Additionally the human body is an excellent absorber of 2.4GHz RF signals. As a result of this, expect a reduction in range due to the presence of a body. In a body worn application, the ground plate of the FlexPIFA should be closest to the body tissue. The main element should be pointed away from the body. Additionally, for handheld devices the FlexPIFA should be mounted in a location where it will not be covered by the hand. If the antenna is mounted in a location where the main element will be covered or near a human body, ensure that there is at least a 10mm separation distance between the main element and the body as shown in **Figure 29**.



Additionally, when the FlexPIFA is mounted very close to body tissue, use a spacer to create separation distance between the body tissue and ground plate. This will ensure maximum performance and prevent the antenna from detuning. As previously mentioned, the ideal spacer material is 1.5 mm thick polycarbonate.

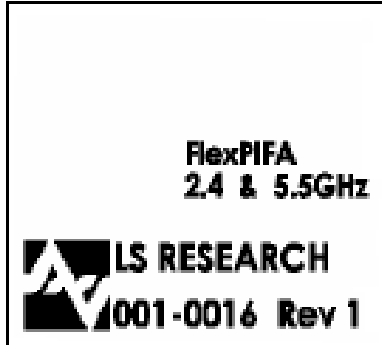
Quite often this separation distance between the body tissue and the FlexPIFA is already provided by the enclosure. **Figure 30** below is an example of a bracelet with the FlexPIFA integrated inside it. The enclosure provides enough spacing between the antenna and body tissue to prevent any major detuning. The enclosure is made of polycarbonate.



**Figure 30 FlexPIFA Integrated into Bracelet**

## PRODUCT REVISION HISTORY

### Rev 1: Initial Production Release



### Rev 2:



### Updated LSR Logo



## CONTACTING LSR

### Headquarters

LS Research, LLC  
W66 N220 Commerce Court  
Cedarburg, WI 53012-2636  
USA  
Tel: 1(262) 375-4400  
Fax: 1(262) 375-4248

### Website

[www.lsr.com](http://www.lsr.com)

### Technical Support

[forum.lsr.com](http://forum.lsr.com)

### Sales Contact

[sales@lsr.com](mailto:sales@lsr.com)

The information in this document is provided in connection with LS Research (hereafter referred to as “LSR”) products. No license, express or implied, by estoppel or otherwise, to any intellectual property right is granted by this document or in connection with the sale of LSR products. EXCEPT AS SET FORTH IN LSR’S TERMS AND CONDITIONS OF SALE LOCATED ON LSR’S WEB SITE, LSR ASSUMES NO LIABILITY WHATSOEVER AND DISCLAIMS ANY EXPRESS, IMPLIED OR STATUTORY WARRANTY RELATING TO ITS PRODUCTS INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT. IN NO EVENT SHALL LSR BE LIABLE FOR ANY DIRECT, INDIRECT, CONSEQUENTIAL, PUNITIVE, SPECIAL OR INCIDENTAL DAMAGES (INCLUDING, WITHOUT LIMITATION, DAMAGES FOR LOSS OF PROFITS, BUSINESS INTERRUPTION, OR LOSS OF INFORMATION) ARISING OUT OF THE USE OR INABILITY TO USE THIS DOCUMENT, EVEN IF LSR HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. LSR makes no representations or warranties with respect to the accuracy or completeness of the contents of this document and reserves the right to make changes to specifications and product descriptions at any time without notice. LSR does not make any commitment to update the information contained herein. Unless specifically provided otherwise, LSR products are not suitable for, and shall not be used in, automotive applications. LSR’s products are not intended, authorized, or warranted for use as components in applications intended to support or sustain life.

---

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



Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

**Телефон:** 8 (812) 309 58 32 (многоканальный)

**Факс:** 8 (812) 320-02-42

**Электронная почта:** [org@eplast1.ru](mailto:org@eplast1.ru)

**Адрес:** 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.