September 2016

Multilayer Antenna (Dual Band type)

For 2400-2484MHz / 5150-5850MHz

ANT162442DT-2001A2

1.6x0.8mm [EIA 0603]*

*** Dimensions Code JIS[EIA]**

Multilayer Antenna

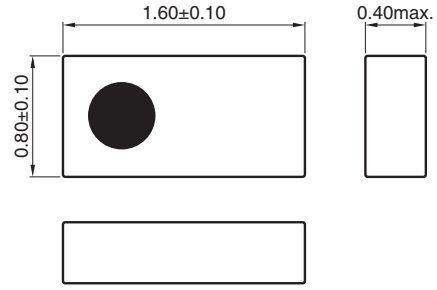
Conformity to RoHS Directive

For 2400-2484MHz / 5150-5850MHz

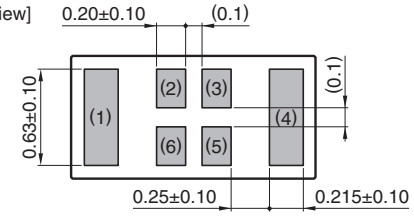
ANT162442DT-2001A2

SHAPES AND DIMENSIONS

[Top view]



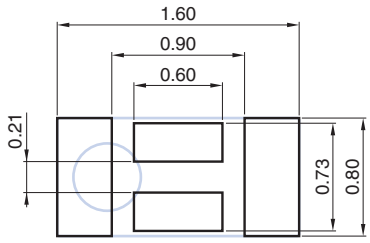
[Bottom view]



Terminal functions	
1	Radiator electrode for 2.4GHz ISM
2	Feed point
3	Feed point
4	Radiator electrode for 5.5GHz
5	Feed point
6	Feed point

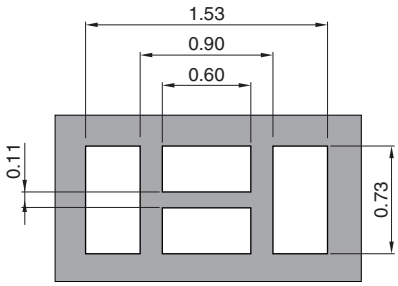
Dimensions in mm

RECOMMENDED LAND PATTERN



Dimensions in mm

SOLDER RESIST PATTERN



Dimensions in mm

○RoHS Directive Compliant Product: See the following for more details.https://product.tdk.com/info/en/environment/rohs/index.html

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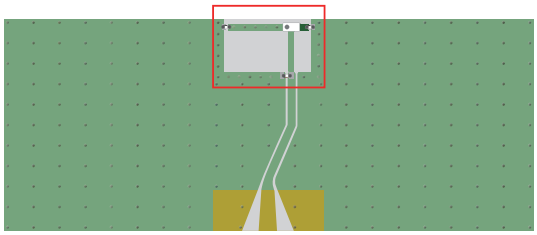
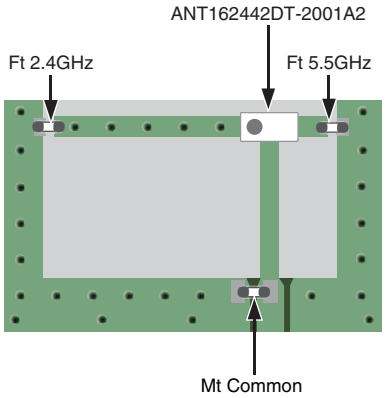
EVALUATION BOARD

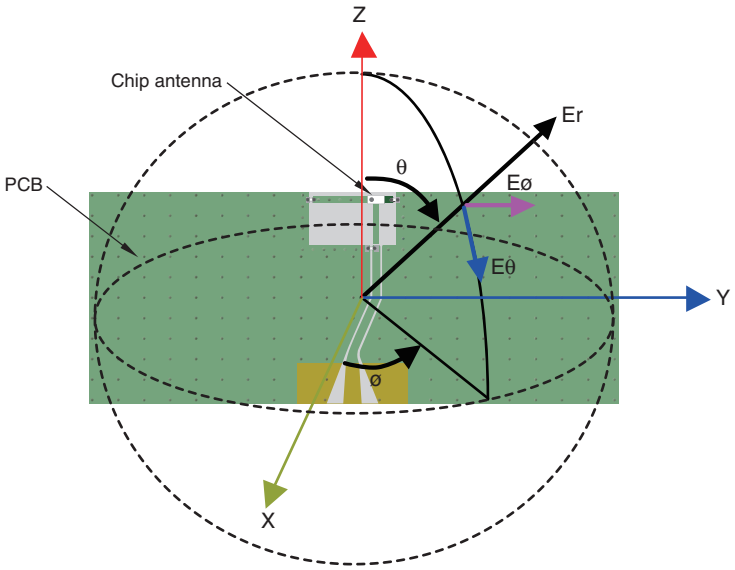


PCB size : 50mm x 20mm x 1mm
Antenna area : 8 x 5 mm



	Component P/N
Ft 2.4GHz	6.2pF
Ft 5.5GHz	0.4pF
Mt Common	1.3nH(MLG1005S1N3C:TDK)

□Measurement condition for Radiation Pattern



ANT162442DT-2001A2

ELECTRICAL CHARACTERISTICS

Item	Frequency Range (MHz)	Min.	Typ.	Max.
VSWR	2400 to 2484	—	1.54	3.0
	5150 to 5850	—	1.58	3.0
Polarization			Linear	
PCB size (mm)			50×20	
Antenna keep-out area (mm)			8×5	
Characteristic Impedance (Ω)			50 (Nominal)	

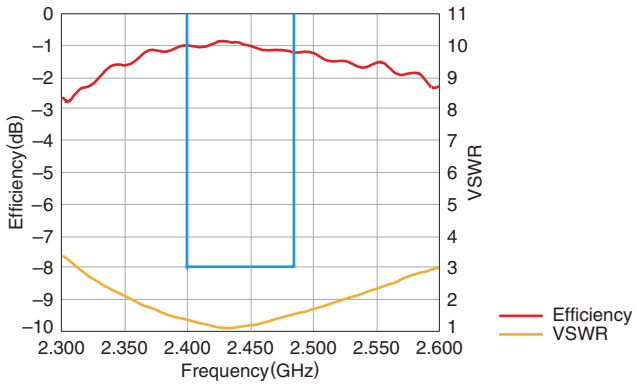
・This is typical antenna performance with the standard PCB.

TEMPERATURE RANGE

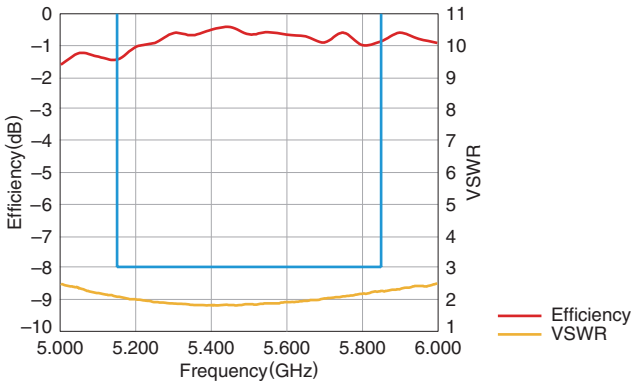
Operating temperature (°C)	Storage temperature (°C)
–40 to +85	–40 to +85

FREQUENCY CHARACTERISTICS

□2.4GHz WLAN BAND



□5.5GHz WLAN BAND

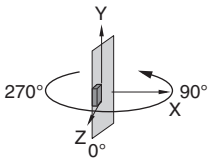


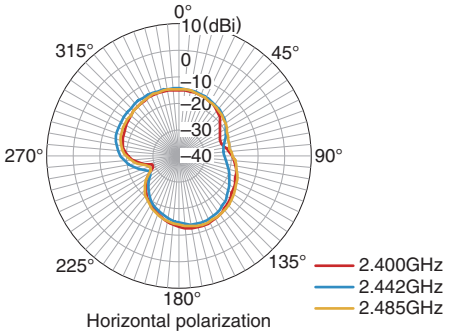
• Tested antenna has been soldered. Evaluation board size is 50x20x1 mm.

ANT162442DT-2001A2

■RADIATION PATTERNS

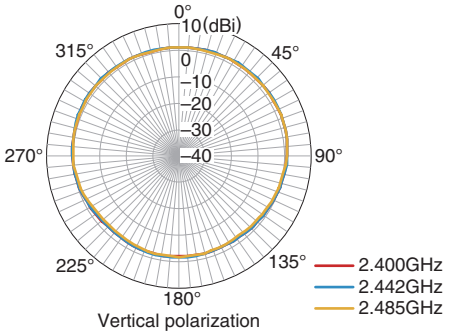
□2.4GHz ISM BAND





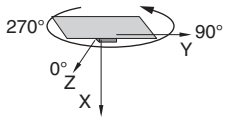
Horizontal polarization

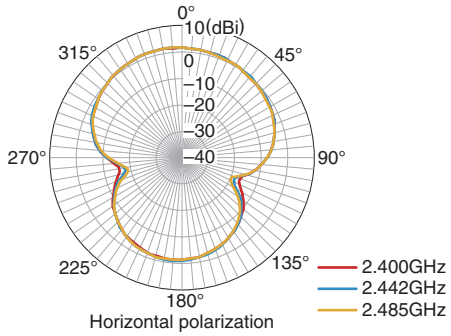
Frequency(GHz)	2.400	2.442	2.485
Average(dBi)	–16.5	–16.6	–16.4
Maximum(dBi)	–12.0	–13.5	–12.7
Minimum(dBi)	–30.1	–27.6	–28.7



Vertical polarization

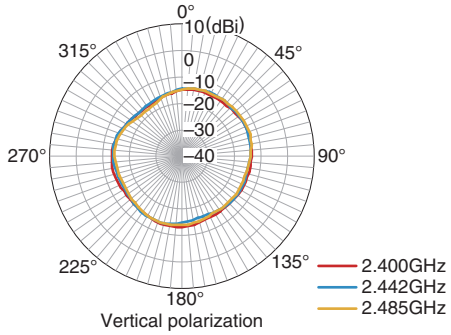
Frequency(GHz)	2.400	2.442	2.485
Average(dBi)	0.6	0.7	0.4
Maximum(dBi)	2.0	2.1	1.9
Minimum(dBi)	–1.4	–1.4	–2.2





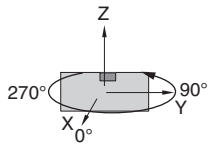
Horizontal polarization

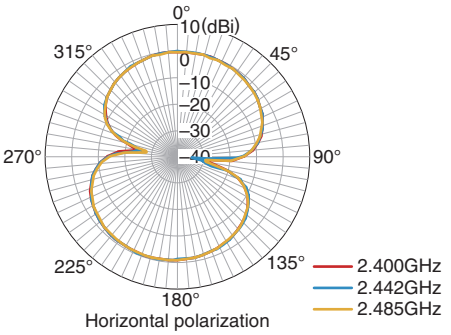
Frequency(GHz)	2.400	2.442	2.485
Average(dBi)	–2.3	–2.1	–2.4
Maximum(dBi)	1.9	2.1	2.0
Minimum(dBi)	–17.1	–19.0	–20.4



Vertical polarization

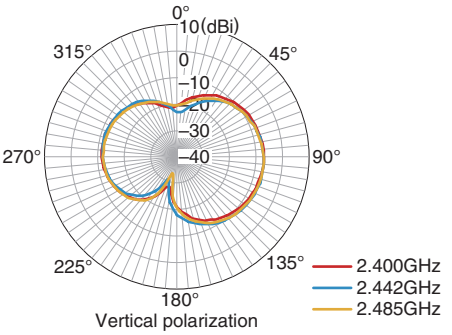
Frequency(GHz)	2.400	2.442	2.485
Average(dBi)	–14.4	–14.7	–14.8
Maximum(dBi)	–12.8	–13.4	–13.4
Minimum(dBi)	–17.1	–16.7	–18.0





Horizontal polarization

Frequency(GHz)	2.400	2.442	2.485
Average(dBi)	–2.3	–2.2	–2.5
Maximum(dBi)	0.7	0.8	0.5
Minimum(dBi)	–30.4	–36.7	–31.2



Vertical polarization

Frequency(GHz)	2.400	2.442	2.485
Average(dBi)	–12.3	–12.3	–12.4
Maximum(dBi)	–8.1	–7.9	–8.0
Minimum(dBi)	–28.7	–31.6	–34.6

• Tested antenna has been soldered. Evaluation board size is 50x20x1 mm.

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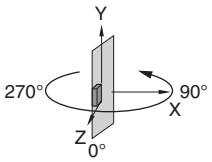
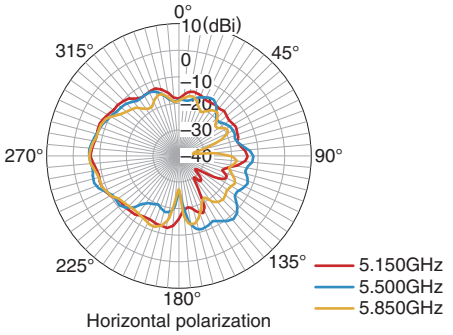
■RADIATION PATTERNS

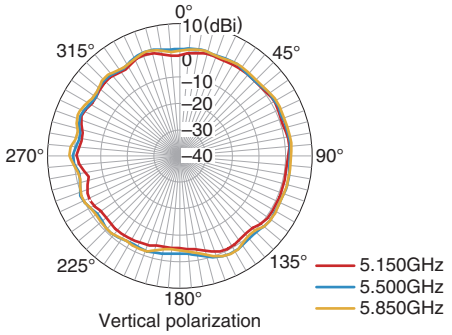
□5.5GHZ BAND





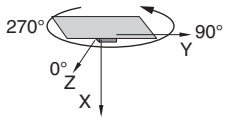
Horizontal polarization

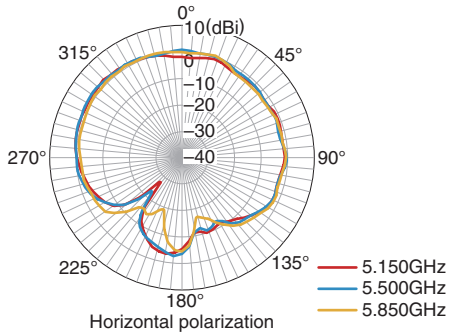
Frequency(GHz)	5.150	5.500	5.850
Average(dBi)	–13.0	–12.2	–13.6
Maximum(dBi)	–7.5	–6.6	–6.7
Minimum(dBi)	–32.5	–26.8	–36.3



Vertical polarization

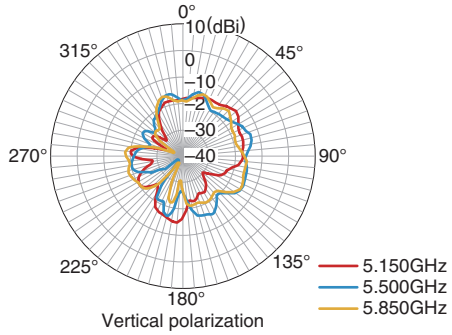
Frequency(GHz)	5.150	5.500	5.850
Average(dBi)	–1.4	–0.2	–0.1
Maximum(dBi)	0.6	1.5	1.7
Minimum(dBi)	–5.5	–3.1	–4.7





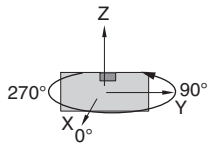
Horizontal polarization

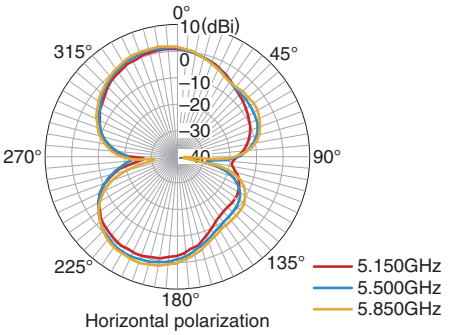
Frequency(GHz)	5.150	5.500	5.850
Average(dBi)	–2.5	–2.1	–2.7
Maximum(dBi)	1.0	1.1	0.4
Minimum(dBi)	–29.0	–23.9	–19.0



Vertical polarization

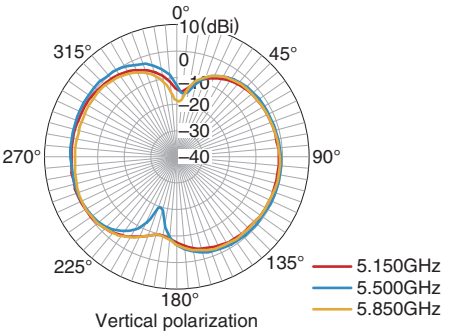
Frequency(GHz)	5.150	5.500	5.850
Average(dBi)	–19.2	–18.2	–19.2
Maximum(dBi)	–13.5	–13.5	–14.9
Minimum(dBi)	–34.6	–42.6	–38.9





Horizontal polarization

Frequency(GHz)	5.150	5.500	5.850
Average(dBi)	–4.5	–3.5	–2.8
Maximum(dBi)	0.4	1.4	2.3
Minimum(dBi)	–29.1	–29.7	–40.7

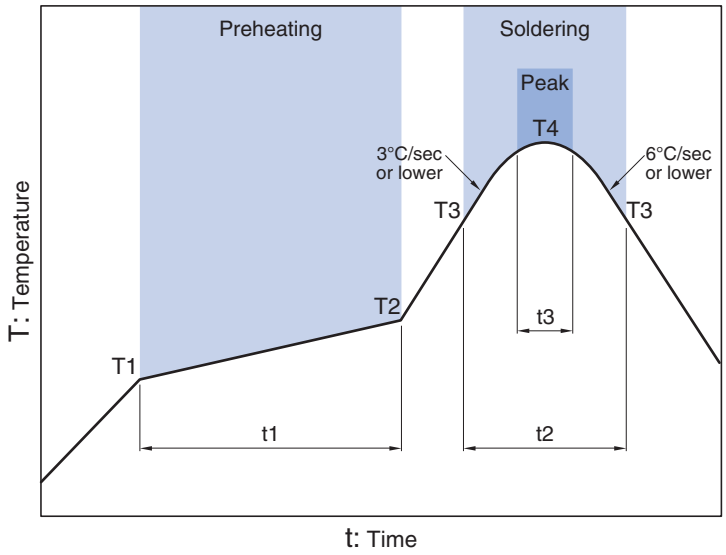


Vertical polarization

Frequency(GHz)	5.150	5.500	5.850
Average(dBi)	–2.9	–2.2	–3.2
Maximum(dBi)	–0.7	0.2	–1.2
Minimum(dBi)	–15.2	–20.3	–19.8

•Tested antenna has been soldered. Evaluation board size is 50x20x1 mm.

RECOMMENDED REFLOW PROFILE



Preheating			Soldering			
			Critical zone (T3 to T4)		Peak	
Temp.		Time	Temp.	Time	Temp.	Time
T1	T2	t1	T3	t2	T4	t3*
150°C	200°C	60 to 120sec	217°C	60 to 120sec	240 to 260°C	30sec max.

* t3 : Time within 5°C of actual peak temperature
The maximum number of reflow is 3.

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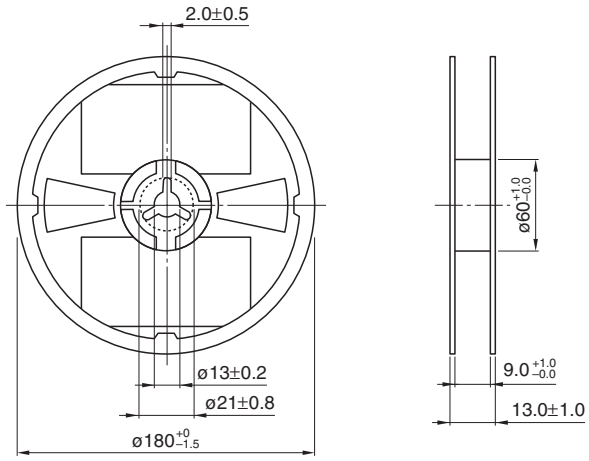
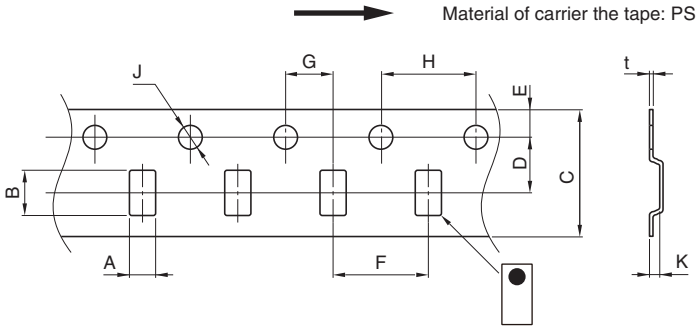
■PACKAGING STYLE

□REEL DIMENSIONS



Dimensions in mm

□TAPE DIMENSIONS



Dimensions in mm

A	B	C	D	E	F	G	H	J	K	t
0.97±0.05	1.8±0.05	8.0±0.2	3.5±0.05	1.75±0.1	4.0±0.1	2.0±0.05	4.0±0.1	1.5+0.1/-0	0.55max.	0.25±0.05

■PACKAGE QUANTITY

Standardpackage quantity (pieces/reel)
4,000

REMINDERS FOR USING THESE PRODUCTS

Before using these products, be sure to request the delivery specifications.

SAFETY REMINDERS

Please pay sufficient attention to the warnings for safe designing when using these products.

⚠ REMINDERS

The products listed on this catalog are intended for use in general electronic equipment (AV equipment, telecommunications equipment, home appliances, amusement equipment, computer equipment, personal equipment, office equipment, measurement equipment, industrial robots) under a normal operation and use condition.
The products are not designed or warranted to meet the requirements of the applications listed below, whose performance and/or quality require a more stringent level of safety or reliability, or whose failure, malfunction or trouble could cause serious damage to society, person or property.
Please understand that we are not responsible for any damage or liability caused by use of the products in any of the applications below or for any other use exceeding the range or conditions set forth in this catalog.

(1) Aerospace/Aviation equipment
(2) Transportation equipment (cars, electric trains, ships, etc.)
(3) Medical equipment
(4) Power-generation control equipment
(5) Atomic energy-related equipment
(6) Seabed equipment
(7) Transportation control equipment
(8) Public information-processing equipment
(9) Military equipment
(10) Electric heating apparatus, burning equipment
(11) Disaster prevention/crime prevention equipment
(12) Safety equipment
(13) Other applications that are not considered general-purpose applications

When using this product in general-purpose applications, you are kindly requested to take into consideration securing protection circuit/equipment or providing backup circuits, etc., to ensure higher safety.

The Ezurio Mini NanoBlade Flex antenna features a flexible printed circuit board that supports WLAN applications. The flexible board can be embedded in space-sensitive applications where a curved housing does not provide a flat surface for antenna mounting. The antennas are specifically designed to be embedded inside devices for aesthetically pleasing integration.

1 Features and Benefits

- Dual-band frequency coverage
- RoHS Compliant (2011/65/EU)
- Flexible PCB for mounting in curved housing

Electrical Specifications		
Operating Frequency (MHz)	2400-2500	4900-5875
Peak Gain - Max (dBi)	2.8	3.4
Efficiency (%)	68	59
VSWR, Max	2:1	
Polarization	Vertical, Omnidirectional	
Nominal Impedance (ohms)	50	

Mechanical Specifications	
Dimensions – mm (in.)	36 x 12 x 0.1 (1.42 x 0.47 x 0.004)
Hazardous Materials Compliance	RoHs Compliant (2011/65/EU)
Operational Temperature, oC (oF)	-35 to +85 (-31 to +185)
Storage Temperature, oC (oF)	-40 to + 85 (-40 to +185)

2 Configuration

Part Number	Cable Length (Length x Diameter)	Connector	Connector Orientation
MAF95310	185 mm (7.28 in.) x 1.13 mm (0.044 in.)	IPEX U.FL	A
EMF2449A1-10UFL	100 mm (3.94 in.) x 1.13 mm (0.044 in.)	IPEX U.FL	A
EMF2449A1-10MH4L	100 mm (3.94 in.) x 1.13 mm (0.044 in.)	IPEX MHF4L	A
EMF2449A2-10MHF1	100 mm (3.94 in.) x 1.13 mm (0.044 in.)	MHF1	B

Note: This antenna is available in many connector and cable configurations. Contact us at 1-847-839-6925 or http://www.ezurio.com/contact for more information.

Americas: +1-800-492-2320
Europe: +44-1628-858-940
Hong Kong: +852-2762-4823

3 Mechanical Drawing – MHF1 Version

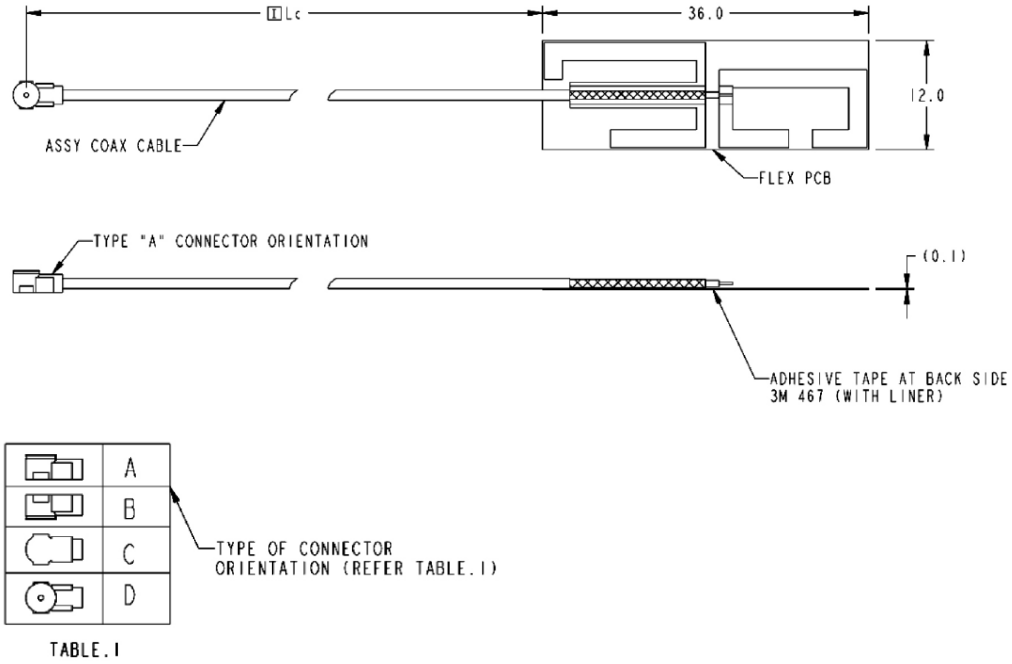
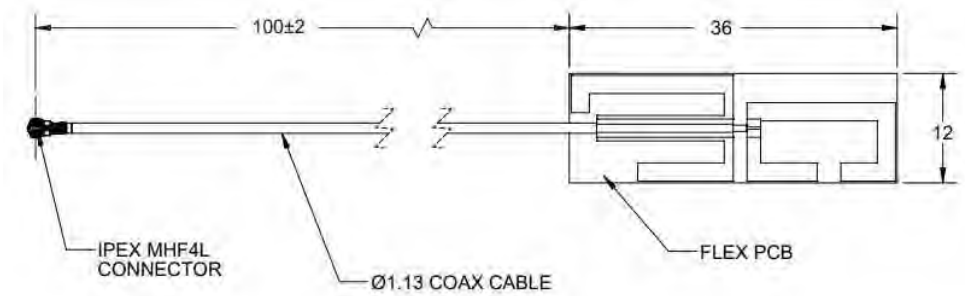
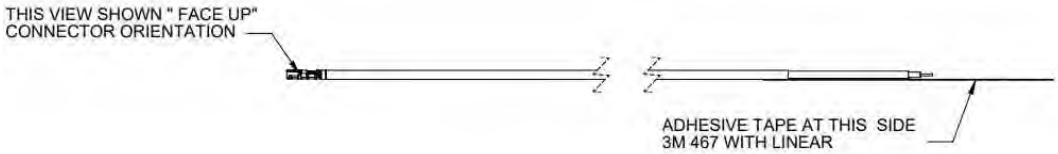


TABLE.1

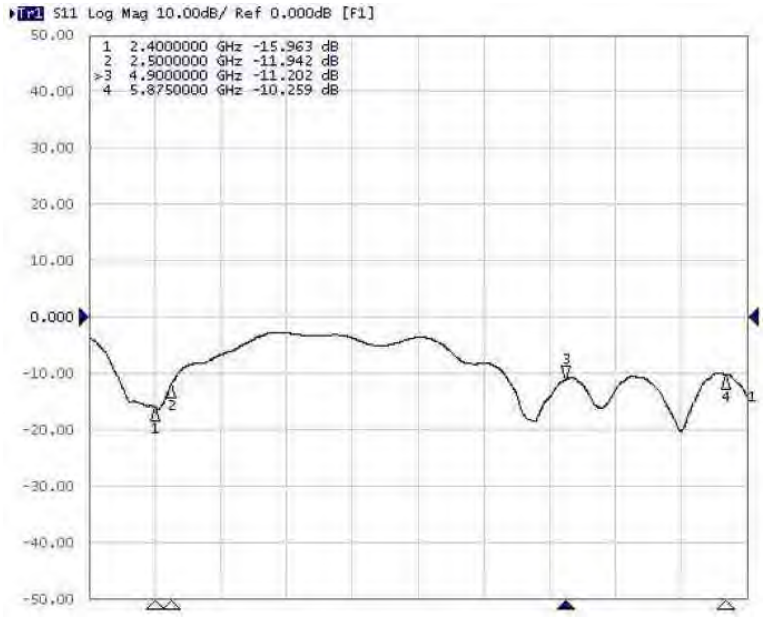
Americas: +1-800-492-2320
Europe: +44-1628-858-940
Hong Kong: +852-2762-4823

4 Mechanical Drawing – MHF4L Version



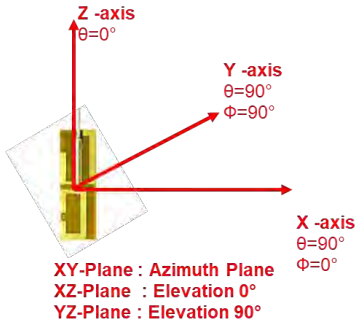


4.1 Return Loss

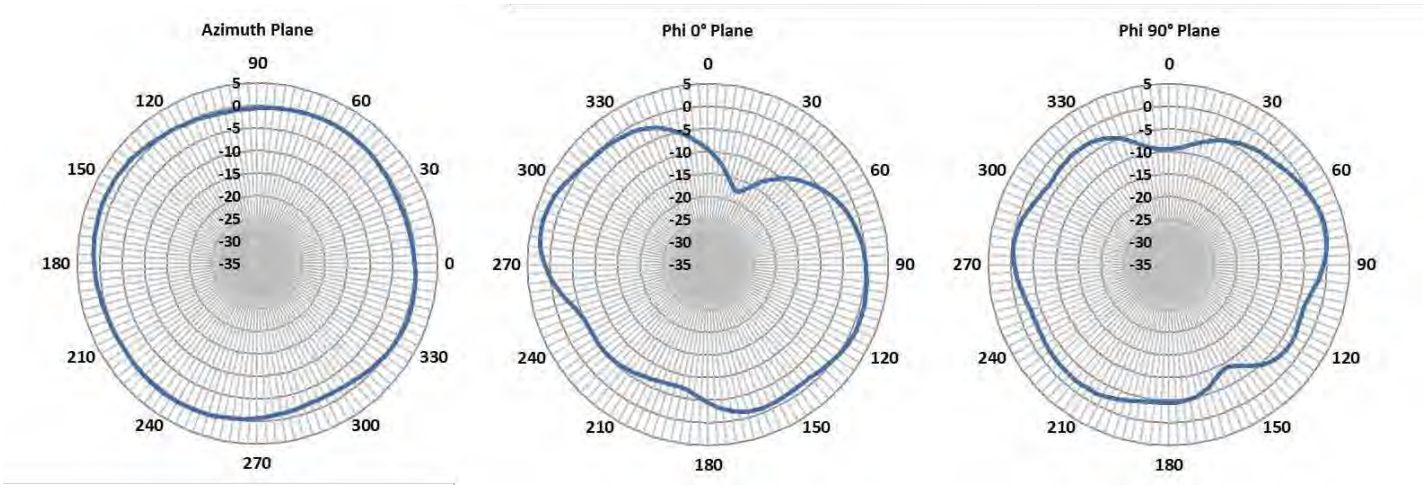


Americas: +1-800-492-2320
Europe: +44-1628-858-940
Hong Kong: +852-2762-4823

4.2 Radiation Patterns

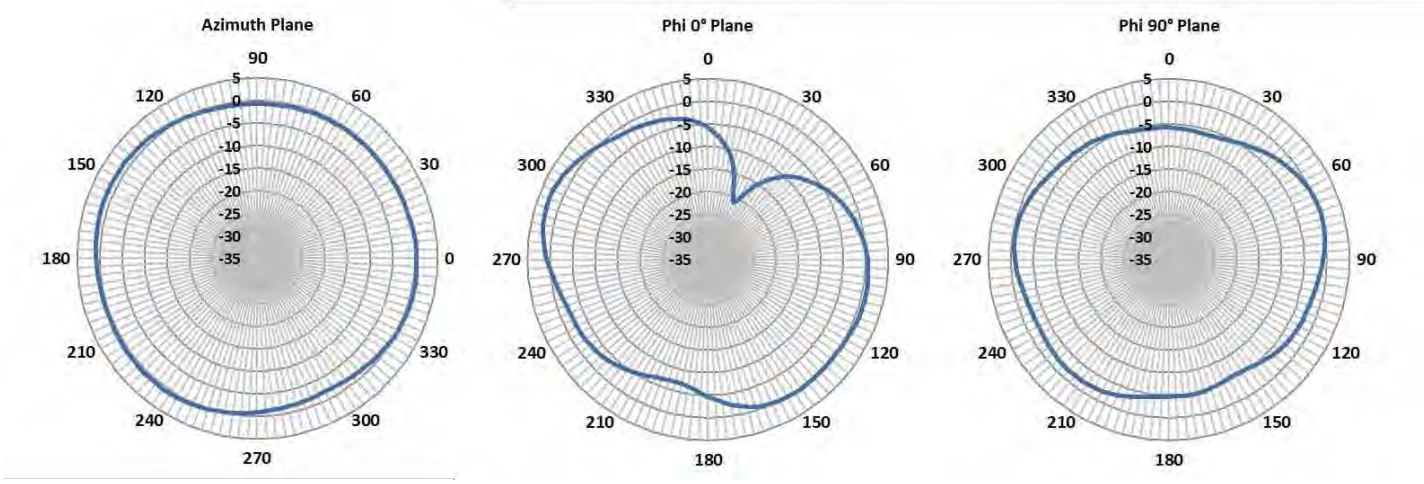


2400 MHz



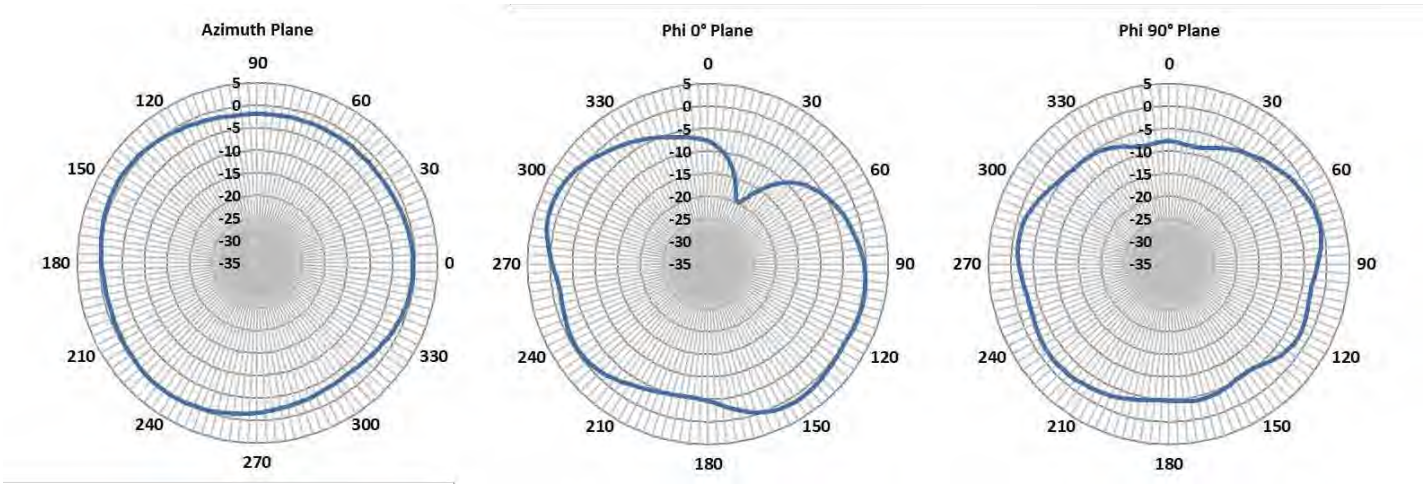
4.3 Radiation Patterns

2450 MHz

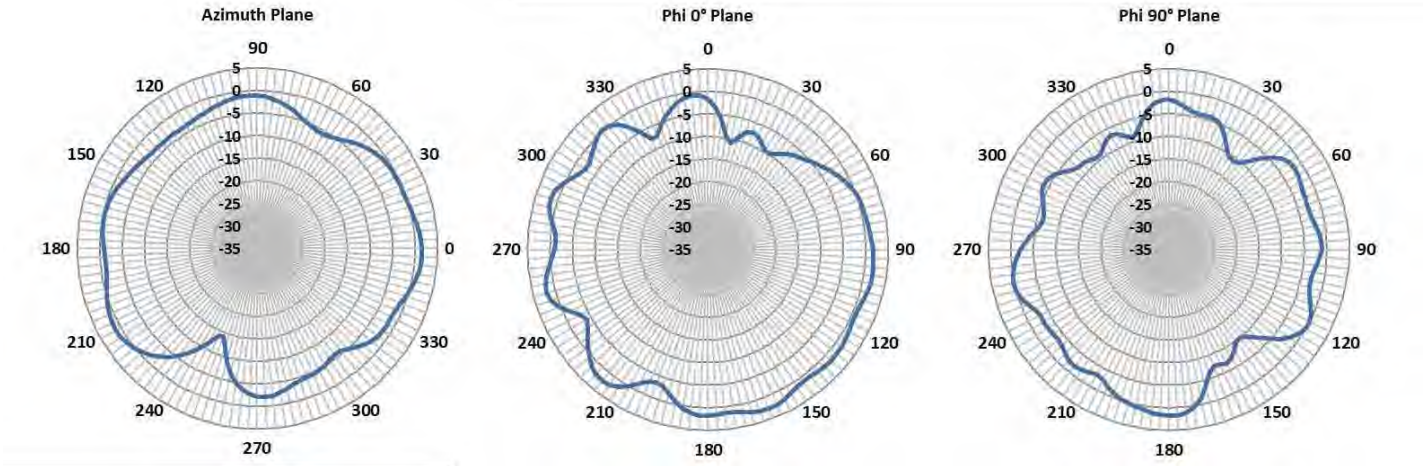


2500 MHz

Americas: +1-800-492-2320
Europe: +44-1628-858-940
Hong Kong: +852-2762-4823



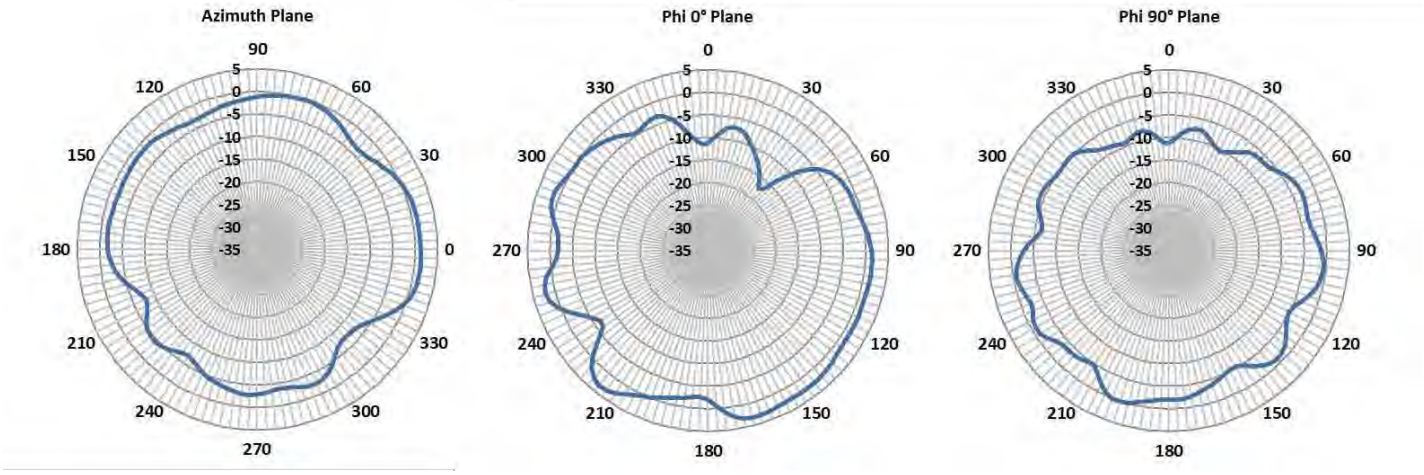
4900 MHz



4.4

4.5 Radiation Patterns

5470 MHz



5875 MHz

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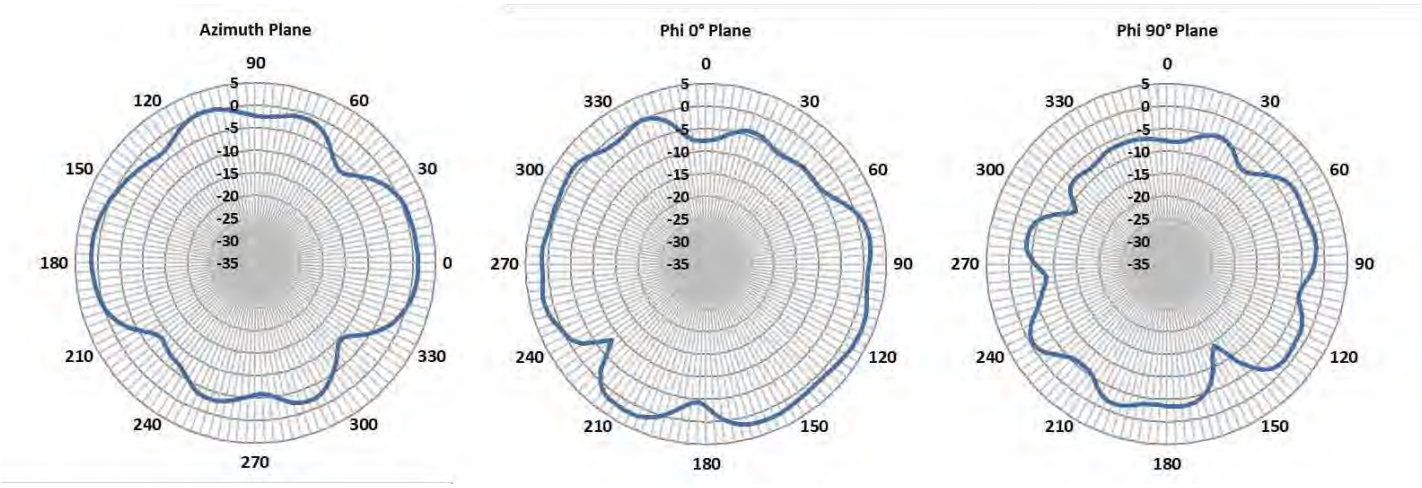

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The Ezurio Wi-Fi 6E Mini NanoBlade Flex 6 GHz is a flexible PCB antenna that supports 3 bands of WLAN applications, including the 6 to 7.125 GHz band enabling Wi-Fi 6E. These small flexible printed circuit antennas can be embedded in space-sensitive applications. They offer excellent efficiency over all 3 Wi-Fi bands. The antennas are specifically designed to be embedded inside various IoT devices for aesthetically pleasing integration.

1 Features and Benefits

- Three-band frequency coverage
- Support for Wi-Fi 6E
- Excellent Omni Gain Patterns
- High Efficiency
- Medical Devices
- Home Automation Equipment
- Smart Grid Applications

Electrical Specifications			
Operating Frequency (MHz)	2400-2500	4900-6000	6000-7125
VSWR – Avg	1.7:1	1.5:1	1.4:1
VSWR – Max		<2.0:1	
Peak Gain – Avg (dBi)	2.0	3.5	4.6
Peak Gain – Max (dBi)	2.4	4.4	5.2
Efficiency – Avg (%)	68%	76%	74%
Efficiency – Avg (dB)	-1.7	-1.2	-1.3
Nominal Impedance (Ohms)		50	
Max Power - Ambient 25°C (W)		5	
Polarization		Linear, Vertical	
Number of Ports		1	
Horizontal Plane 3 dB Beamwidth		360°, Omnidirectional	

Note: Electrical data measured on 1.7mm thick polycarbonate

Mechanical Specifications	
Dimensions – diameter x height – mm (inches)	36 x 12 x 0.3 (1.42 x .47 x .012)
Radome Material	Flexible Printed Circuit Board (FPC)

Environmental Specifications	
Operating Temperature – °C (°F)	-40 to +85°C (-40 to +185°F)
Storage Temperature – °C (°F)	-40 to +85°C (-40 to +185°F)
Material Substance Compliance	RoHS

2 Configuration

Part Number	Cable Length	Connector
EMF2471A3S-10MHF1	100 mm	MHF1
EMF2471A3S-10MH4L	100 mm	MHF4L

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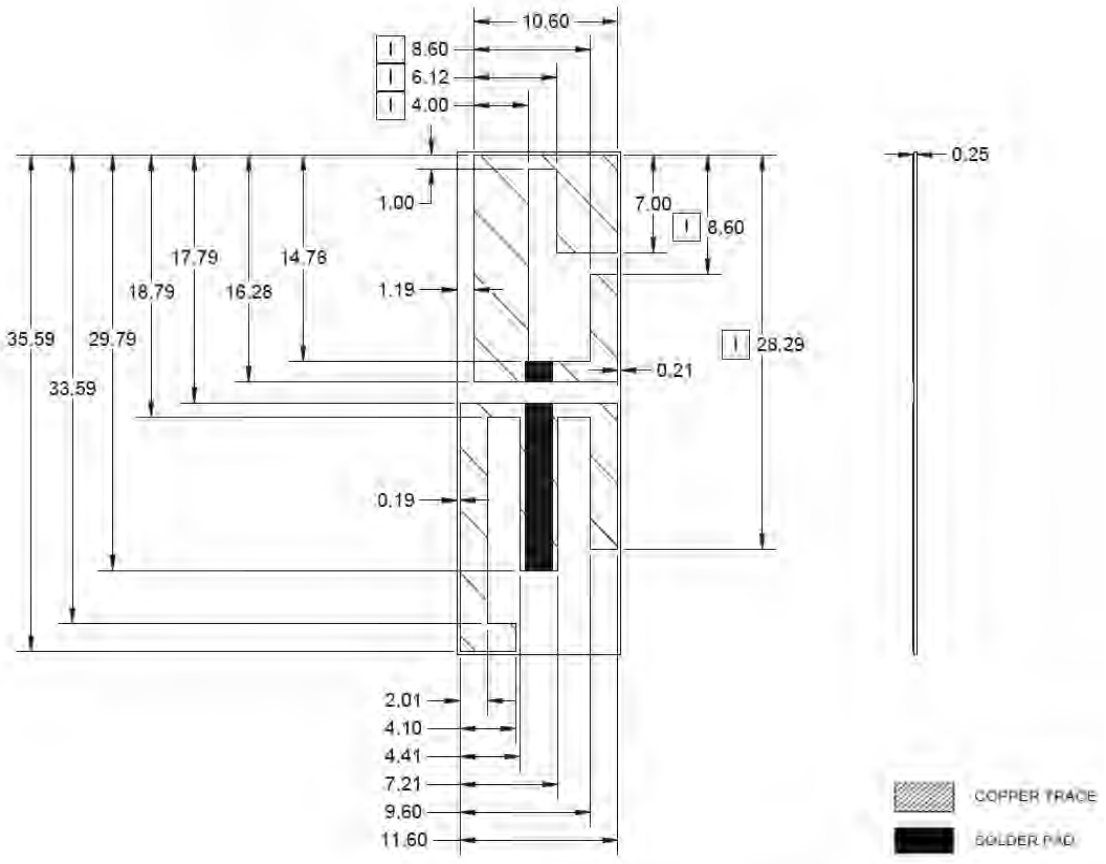
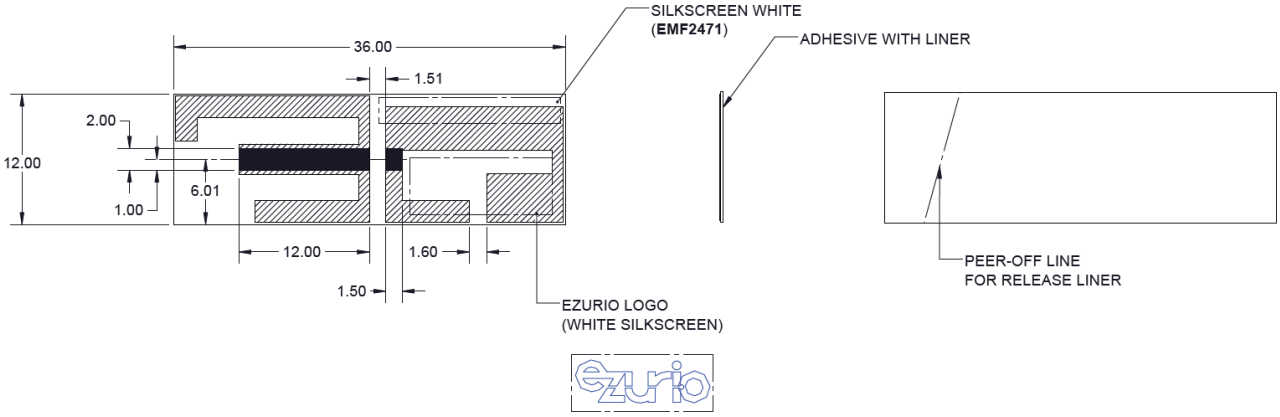
3 Mechanical Drawings





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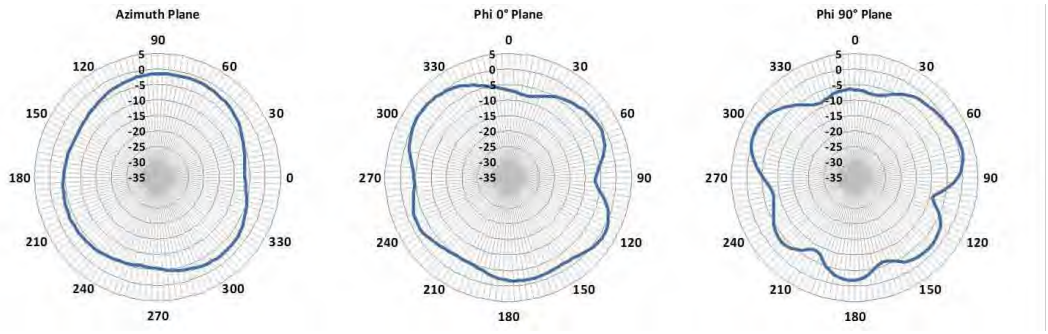
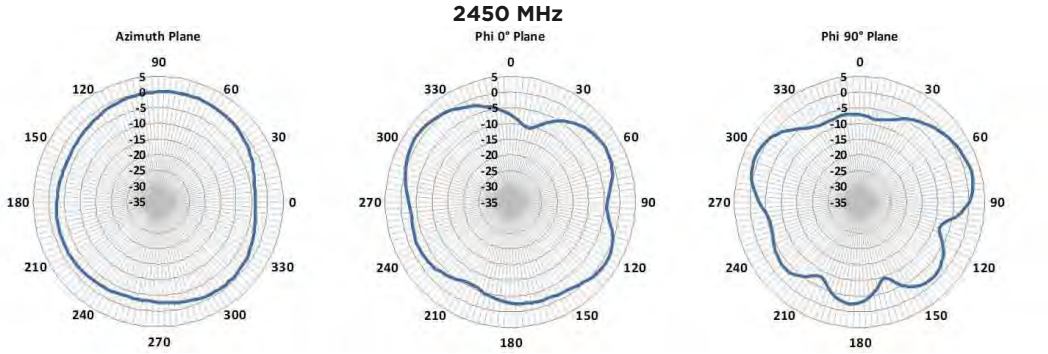
4 Radiation Patterns

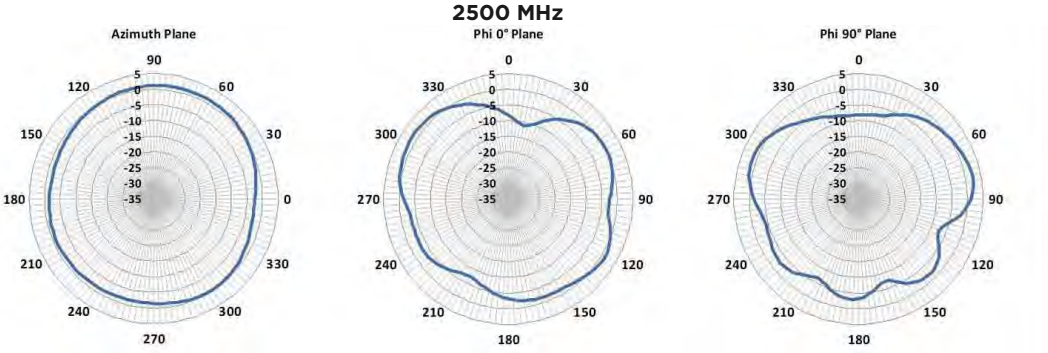
2400 MHz



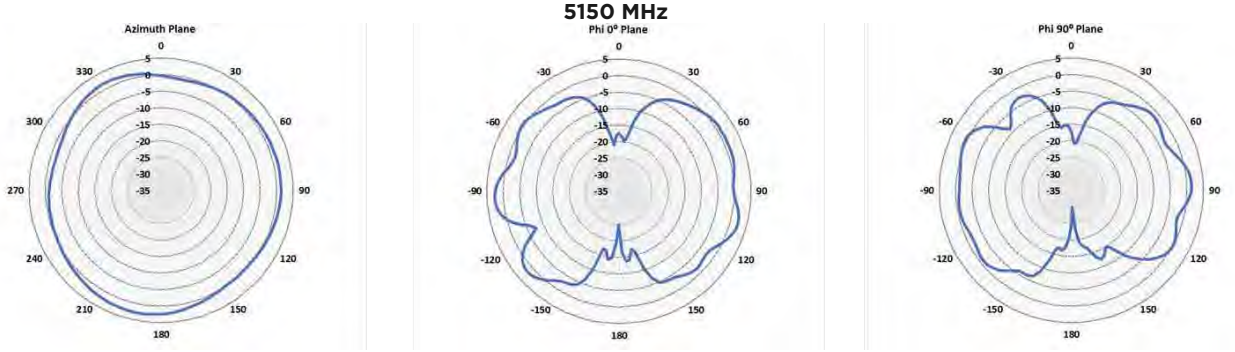
2450 MHz



2500 MHz



5150 MHz



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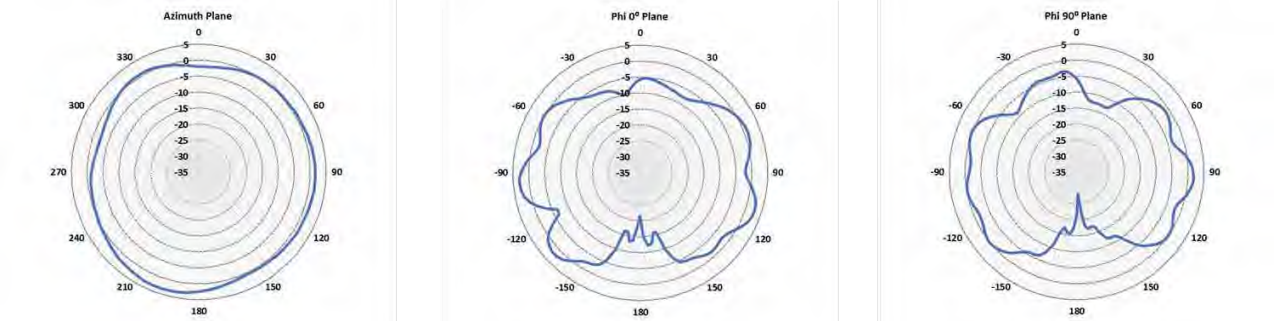
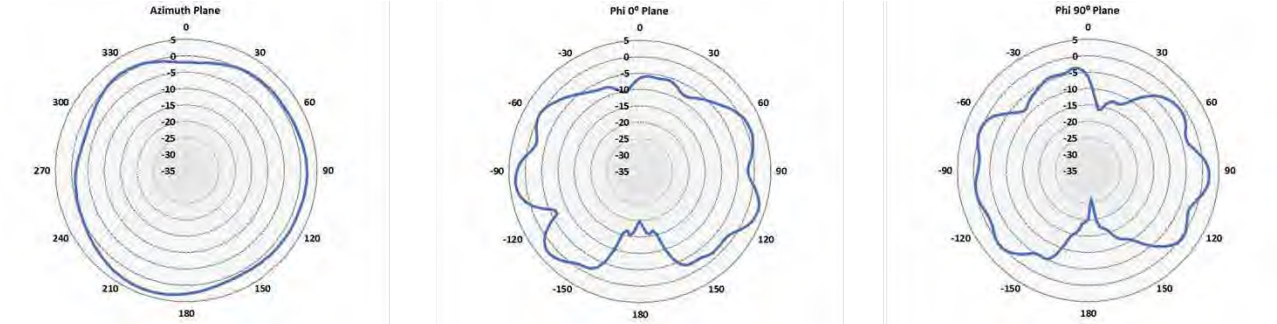
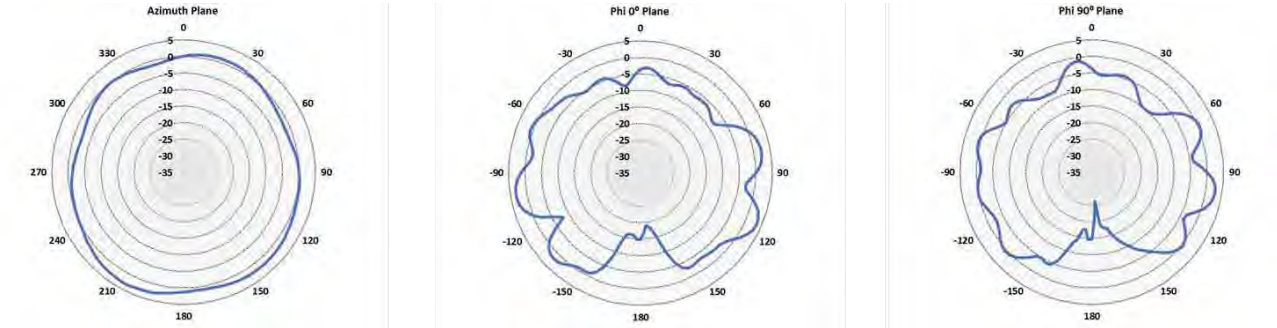
5470 MHz



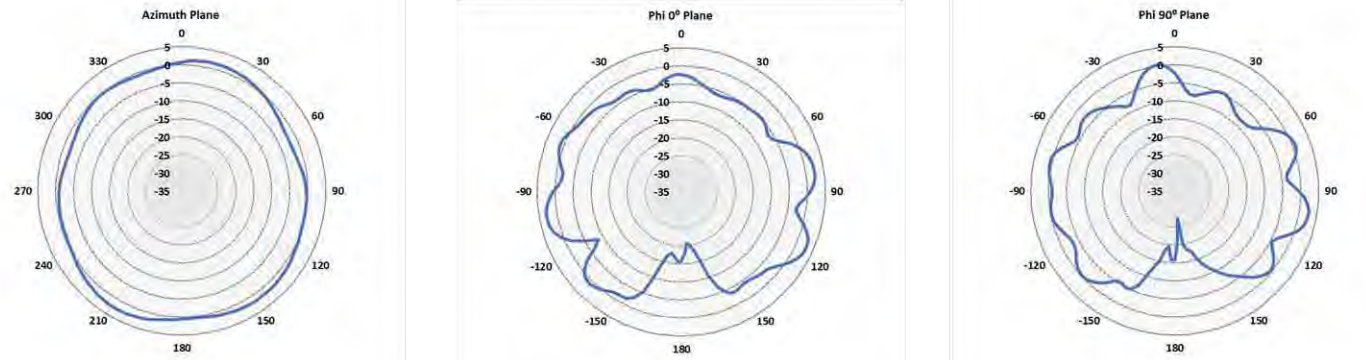
5500 MHz



5850 MHz



5925 MHz



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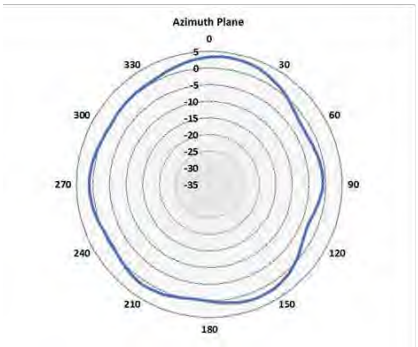
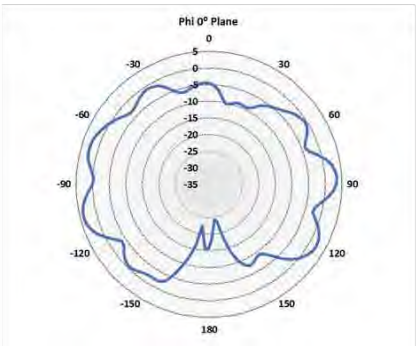
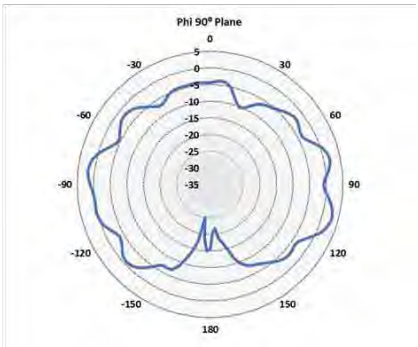
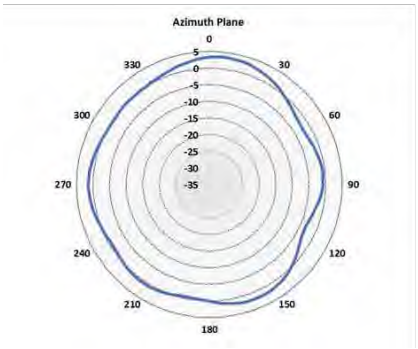
6425 MHz

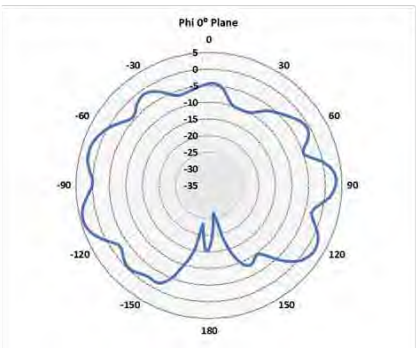


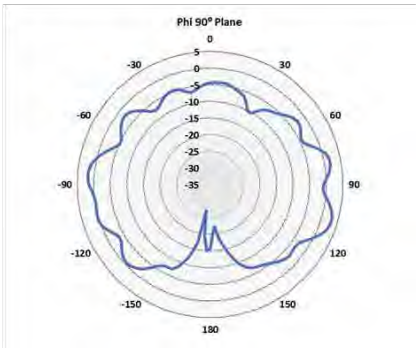




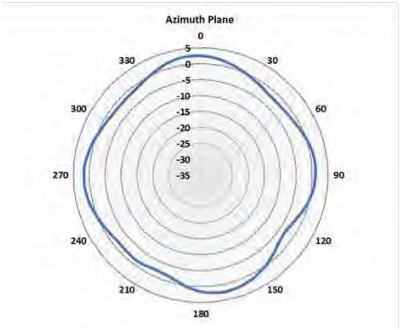
6525 MHz

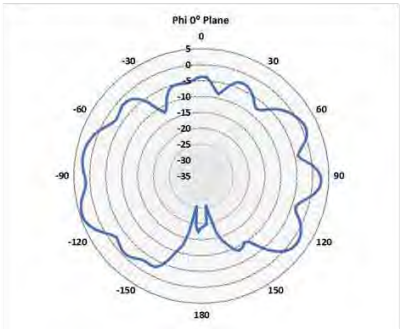


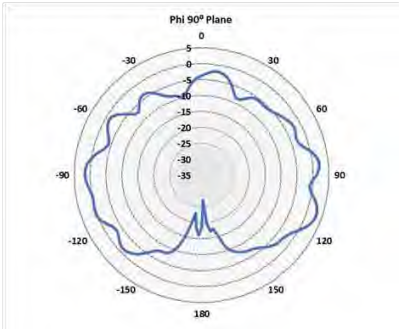




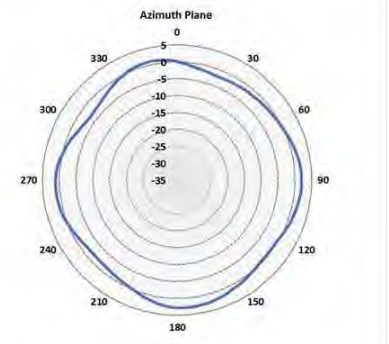
6875 MHz

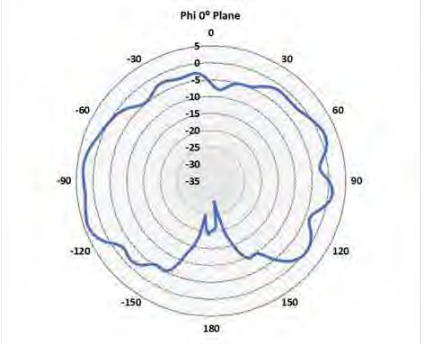


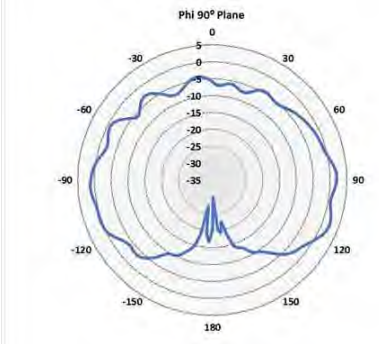




7125 MHz







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The evolution of technology has brought the need to communicate everywhere and at all times without being confined to one space. Our internal wireless device antennas feature wide bandwidth to enhance the performance and application of portable wireless devices based on standards such as 802.11 and Bluetooth®. The antennas are specifically designed to be embedded inside devices for aesthetically pleasing integration with high durability.

1 Features and Benefits

- Covers 2.4 to 2.5 GHz and 4.9 to 6 GHz for all WLAN applications
- Coaxial cable pigtail with various connector choices
- Omnidirectional patterns and all frequencies with increased gain in upper bands for optimal coverage
- Conformance to European RoHS Directive

Specifications						
Part Numbers	CAF94505, MAF95090, MAF94158			ENB2449A1-10MHL4, ENB2449A1-20UFL		
Operating Frequency (MHz)	2400-2500	5150-5350	5600-6000	2400-2500	5150-5350	5600-6000
Peak Gain – Max (dBi)	2	3.9	4	3.19	4.1	4.35
VSWR – Max	2:1					
Nominal Impedance (Ohms)	50					
Polarization	Vertical, Omnidirectional					
Dimensions – cm (in.)	5.08 x 1.65 (2.0 x 0.65)					
Material Substance Compliance	RoHS					
Operating Temperature – °C (°F)	-30 to +70 (-22 to +158)					
Storage Temperature – °C (°F)	-40 to +85 (-40 to +185)					

2 Configuration

Part Number	Cable Length	Connector
CAF94505	100 mm, Ø 1.13 mm	IPEX MHF
MAF95090	175 mm, Ø 1.13 mm	IPEX MHF
MAF94158	279.4 mm, Ø 1.13 mm	IPEX MHF
ENB2449A1-10MH4L	100 mm, Ø 1.13 mm	IPEX MHF4L
ENB2449A1-20UFL	200 mm, Ø 1.13 mm	IPEX MHF

Note: Specifications are based on the 100mm cable length, standard antenna version with MHF1 / U.FL connector. Varying the cable length or type or connector will cause variations in these antenna specifications.

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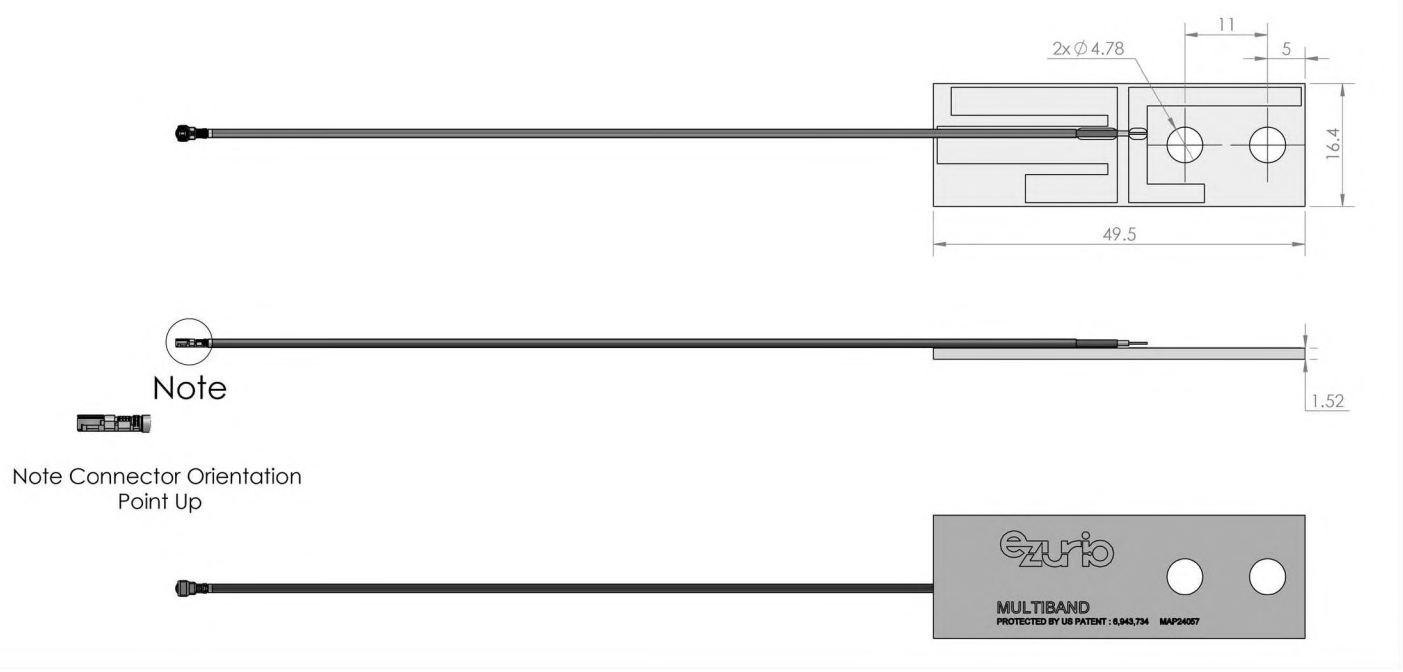

3 Flat Surface Antenna Measurements

Flat surface measurements were performed with the antenna in free space.

3.1 VSWR

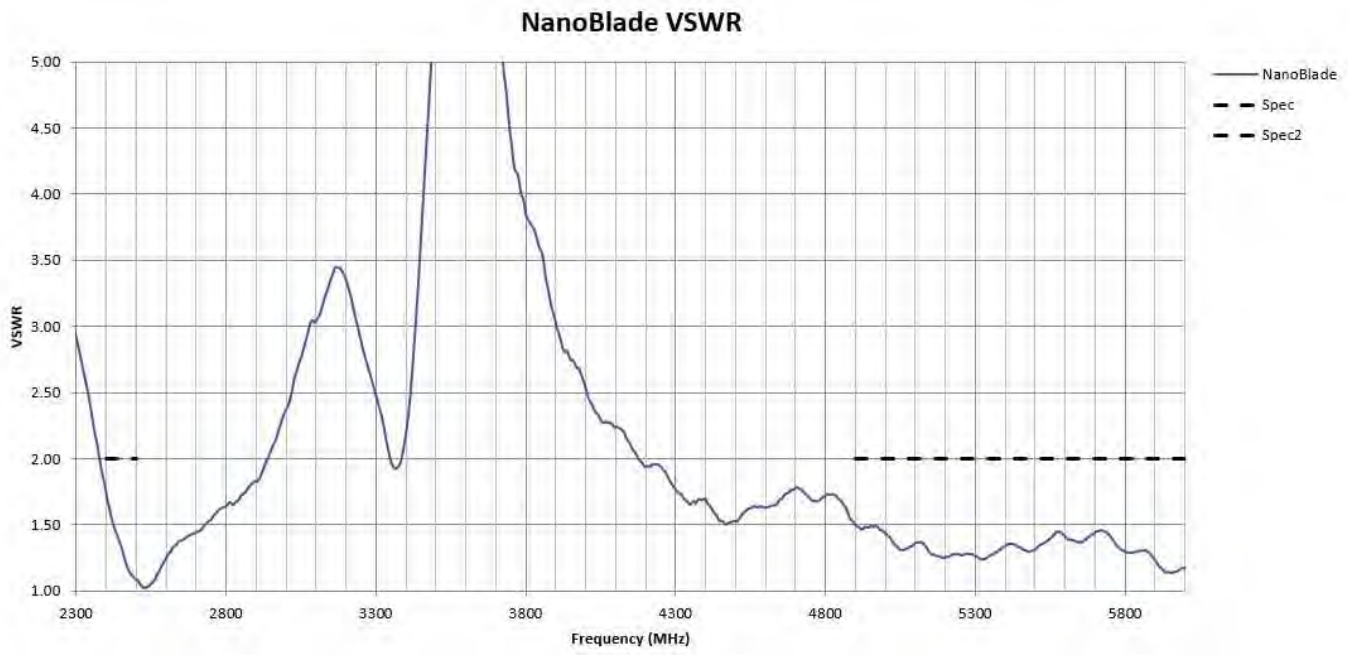

Figure 1: Antenna VSWR measured in free space

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3.2 RETURN LOSS

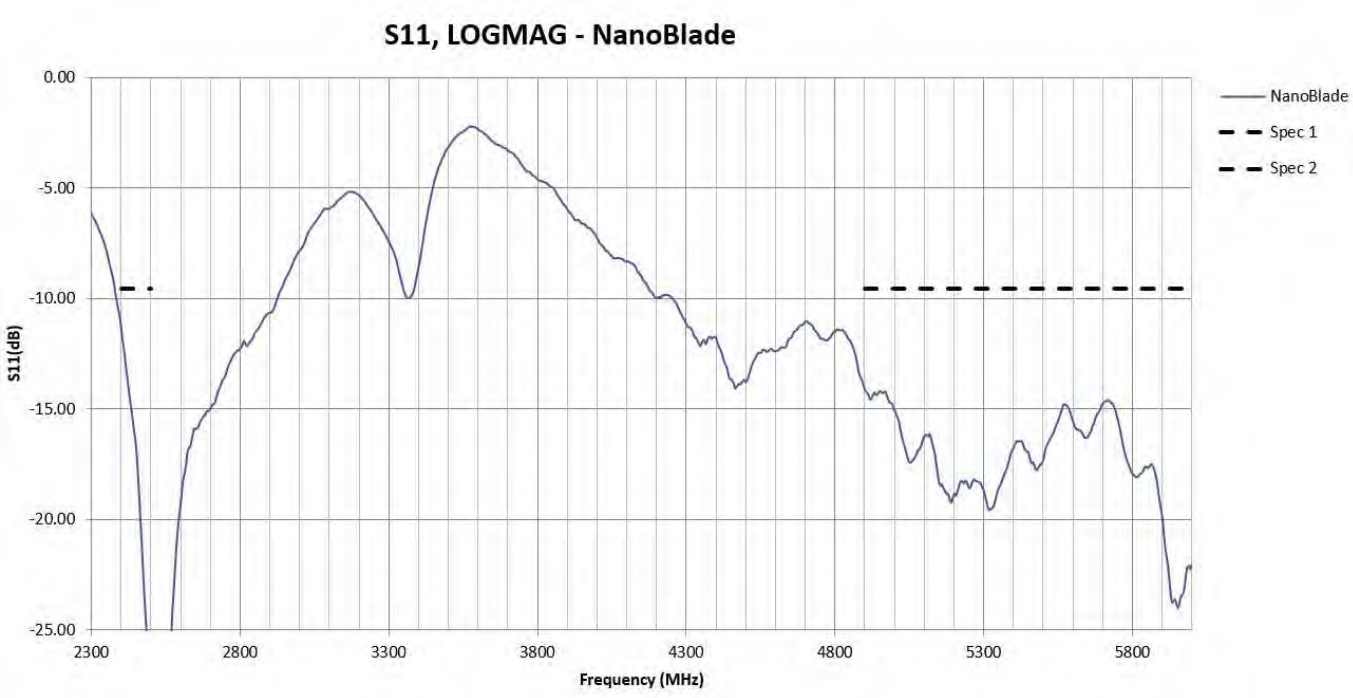

Figure 2: Antenna Return Loss measured in free space

4 Antenna Chamber Test Setup

Antenna measurements such as VSWR and S11 were measured with an Agilent E5071C vector network analyzer. Radiation patterns were measured with a Rohde & Schwarz ZNB8-4PORT vector network analyzer in a Howland Company 3100 chamber equivalent. Phase center is nine inches above the Phi positioner.

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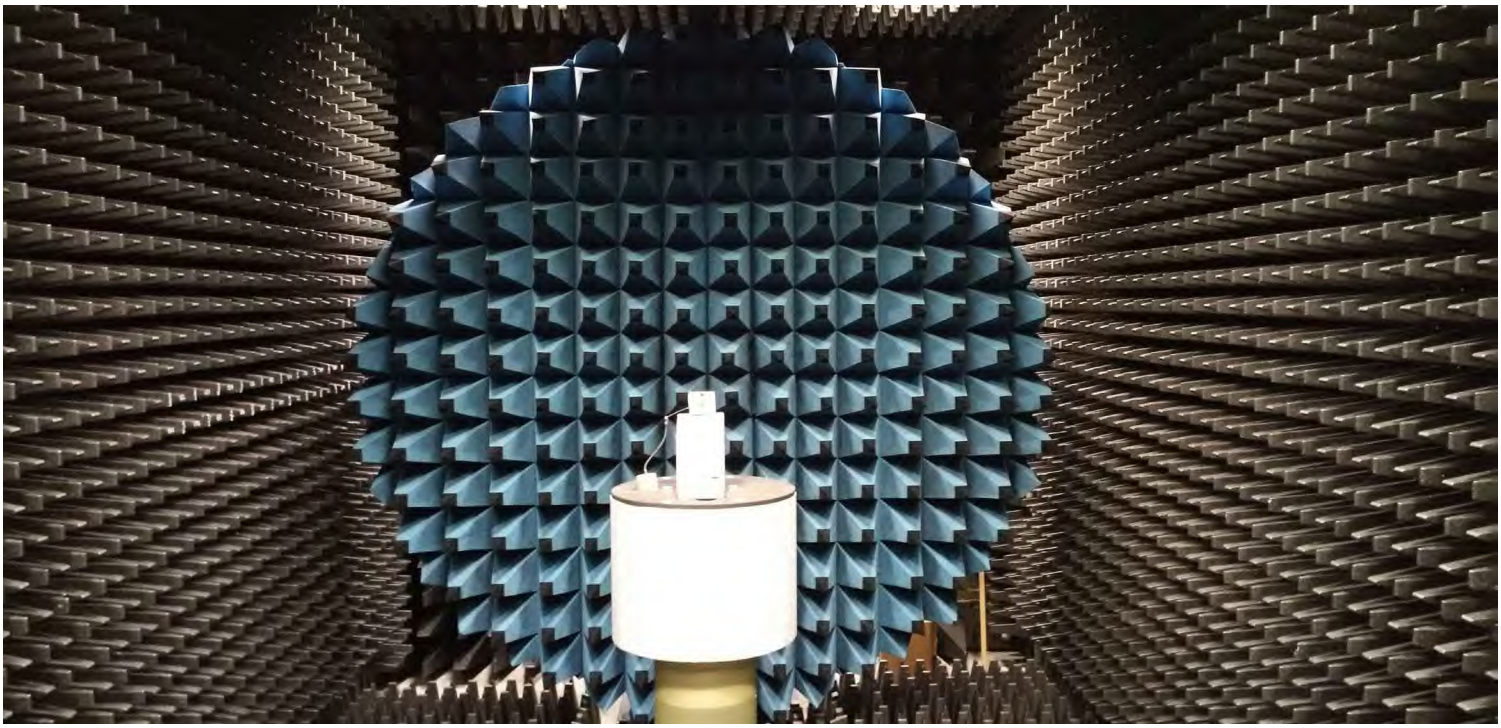

Figure 3: Howland Company 3100 Antenna chamber

5 Antenna Radiation Performance

5.1 Nanoblade centered in free space

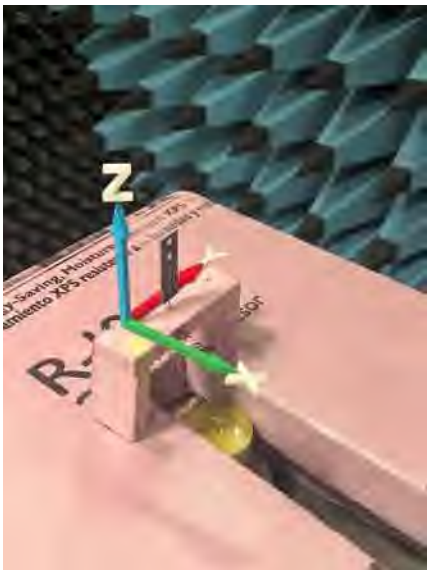

Figure 4: Flat surface setup

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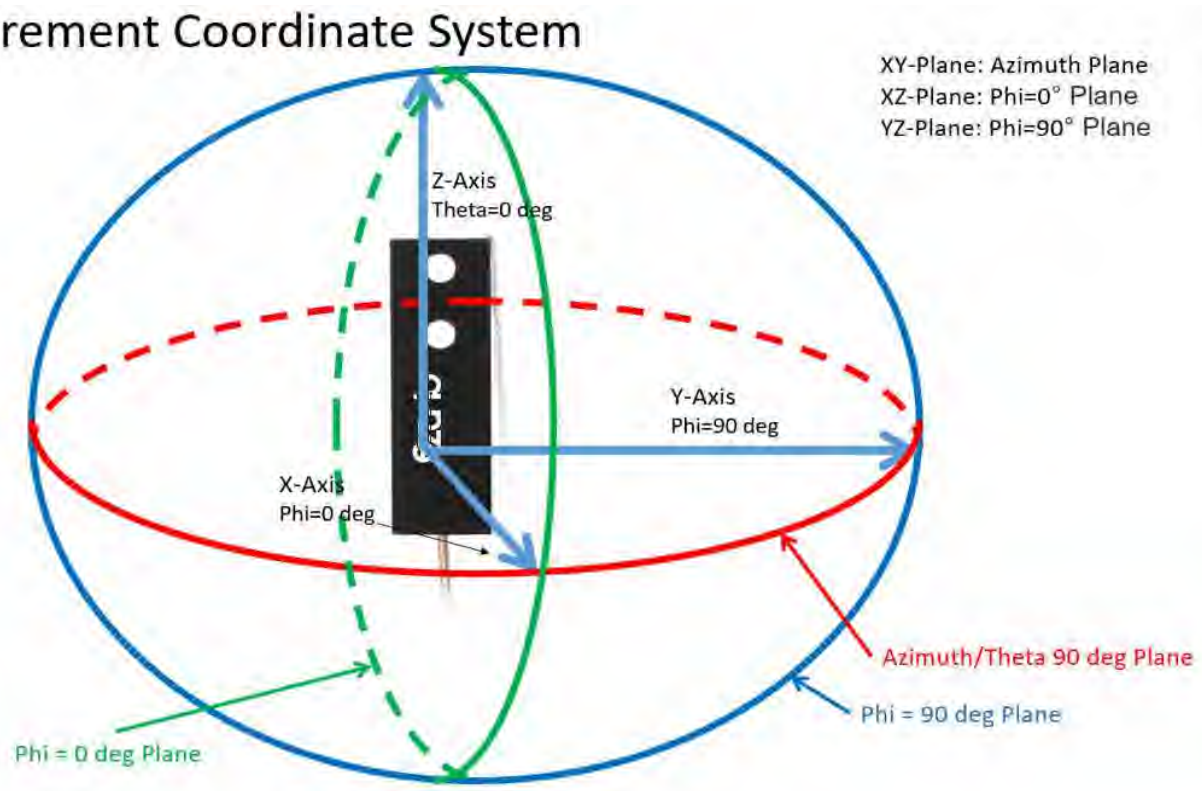
3D Measurement Coordinate System



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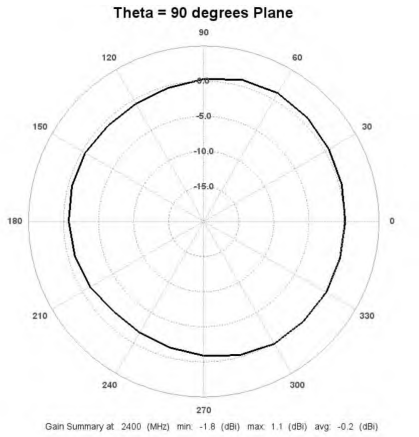
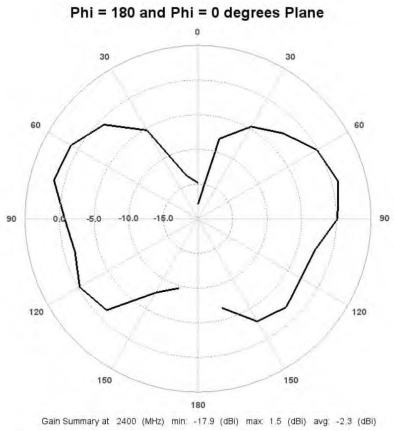
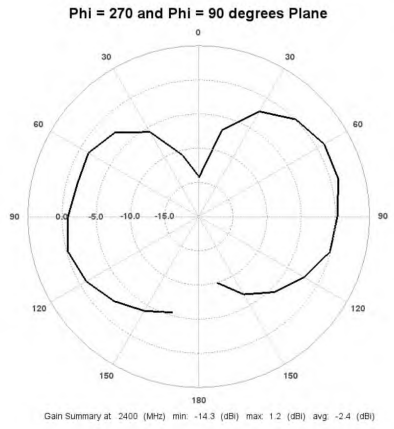
5.2 RADIATION PATTERNS – 2D Plots

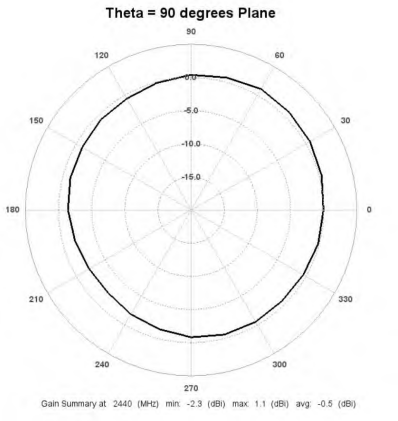
5.2.1 2D Plots at 2400 MHz

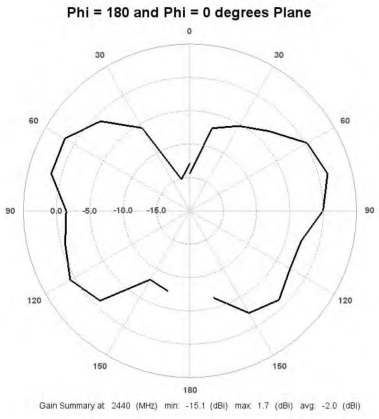


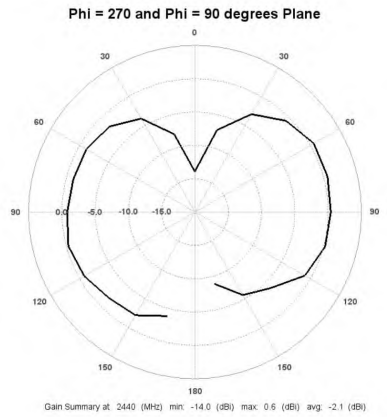




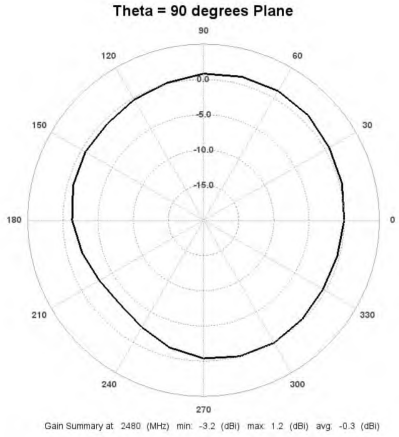
5.2.2 2D Plots at 2440 MHz

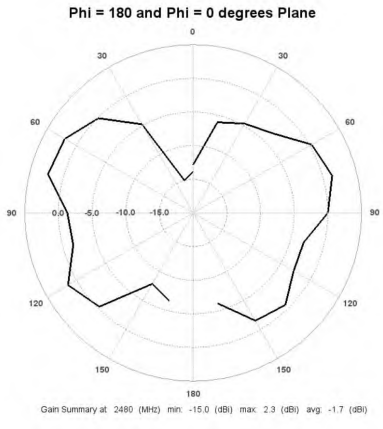


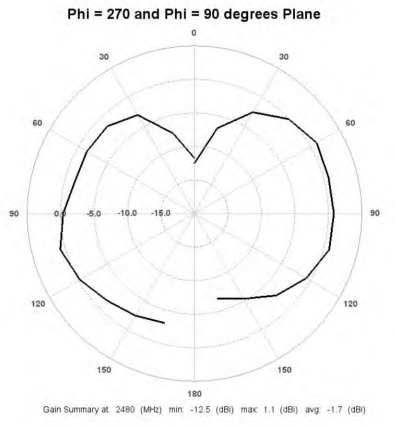




5.2.3 2D Plots at 2480 MHz







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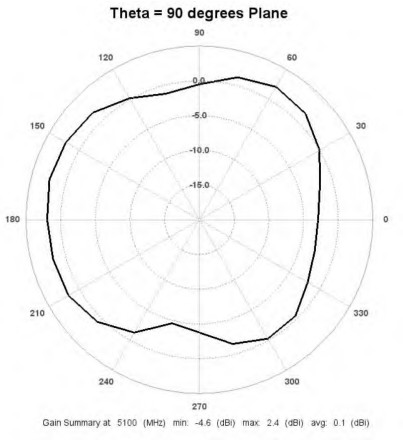
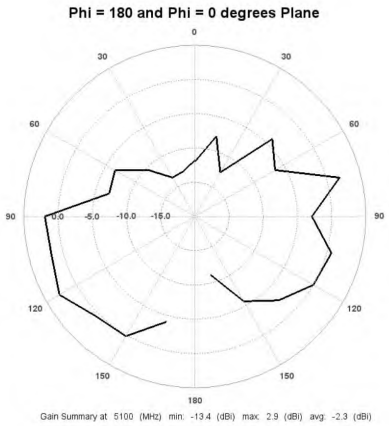
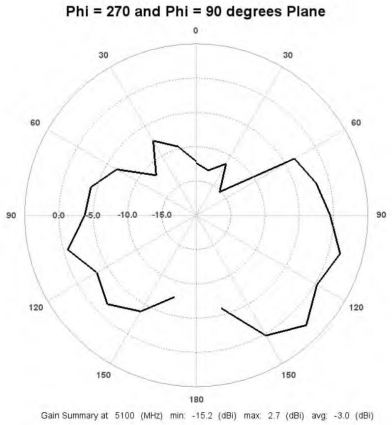
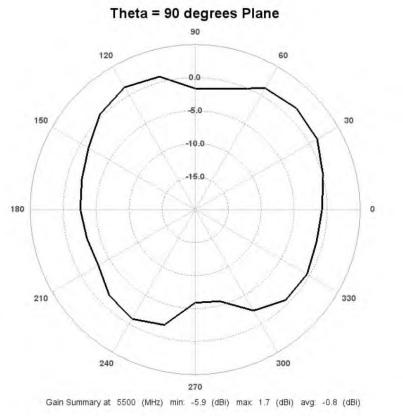
5.2.4 2D Plots at 5100 MHz

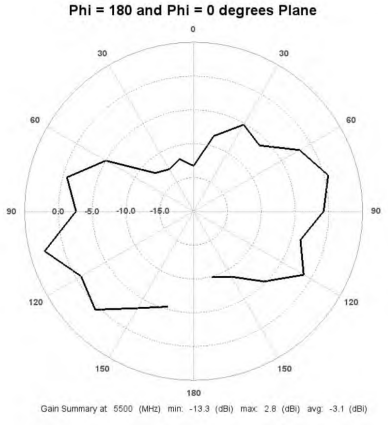


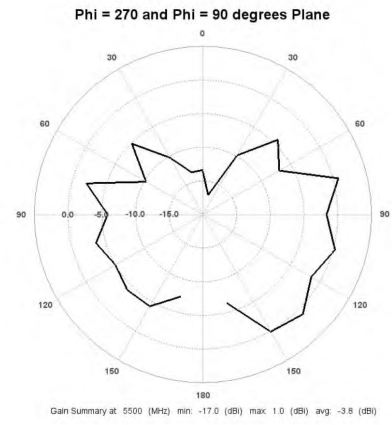




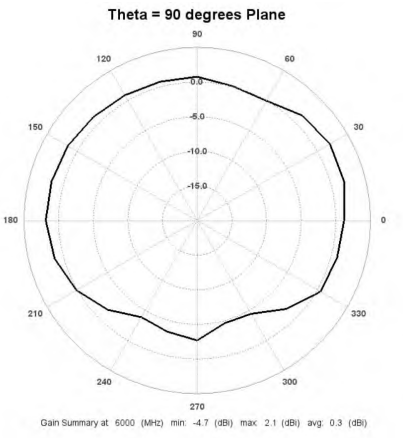
5.2.5 2D Plots at 5500 MHz

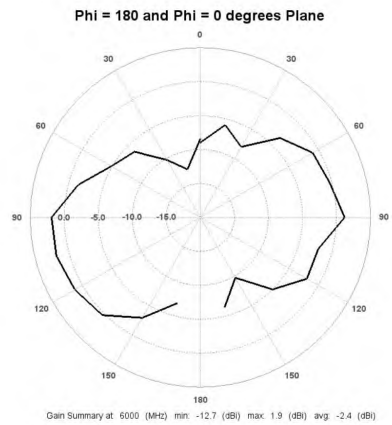


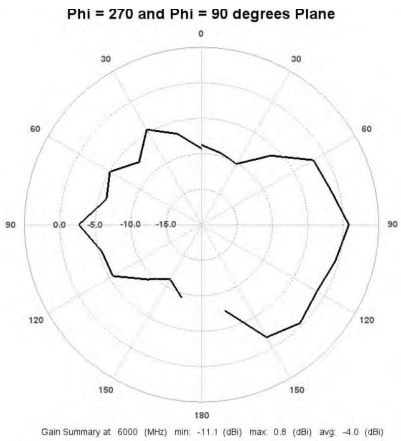




5.2.6 2D Plots at 6000 MHz







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5.3 RADIATION PATTERNS – 3D Plots

5.3.1 3D Plots at 2400 MHz

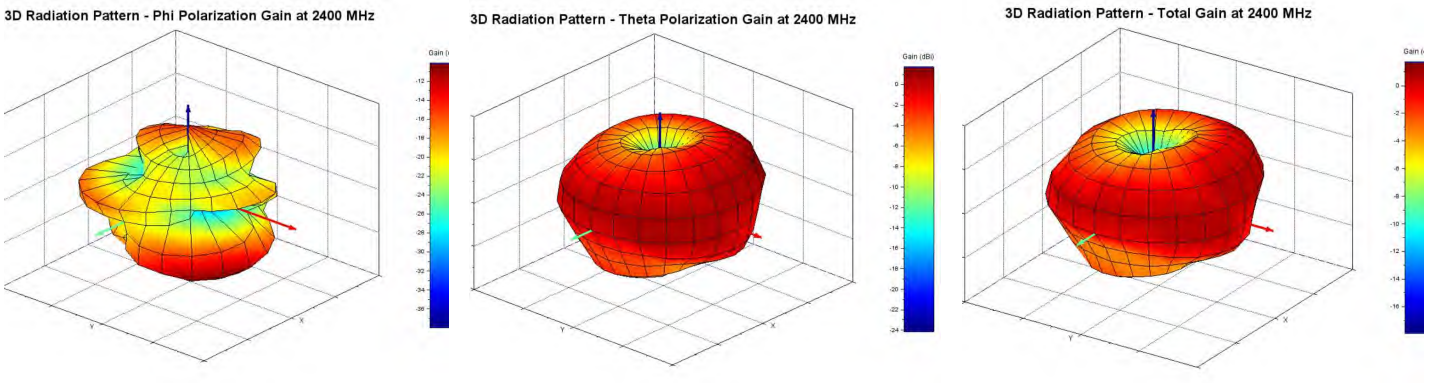

Figure 5: Phi polarization, Theta polarization and, and total gain plots – 2400 MHz

5.3.2 3D Plots at 2440 MHz

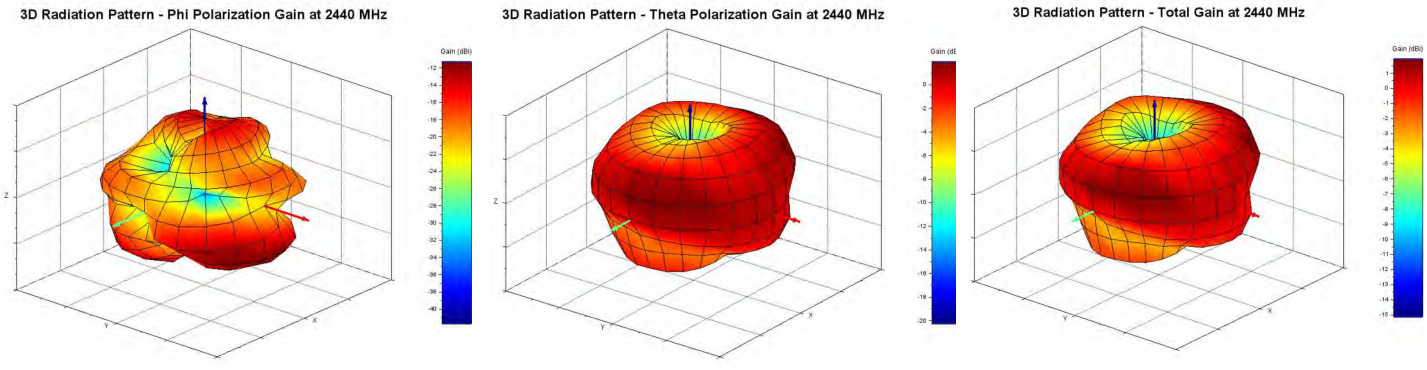

Figure 6: Phi polarization, Theta polarization and, and total gain plots – 2440 MHz

5.3.3 3D Plots at 2480 MHz

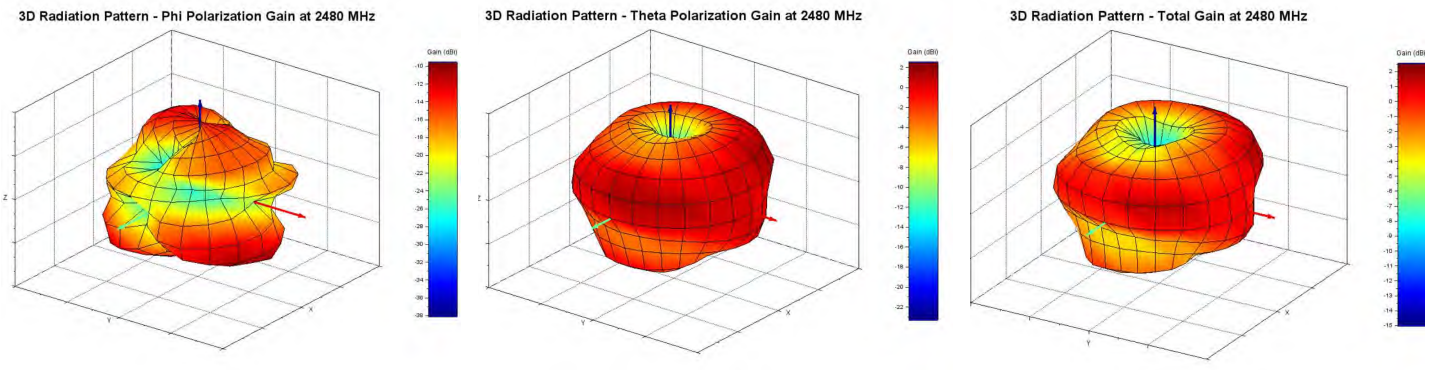

Figure 7: Phi polarization, Theta polarization and, and total gain plots – 2480 MHz

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5.3.4 3D Plots at 5100 MHz

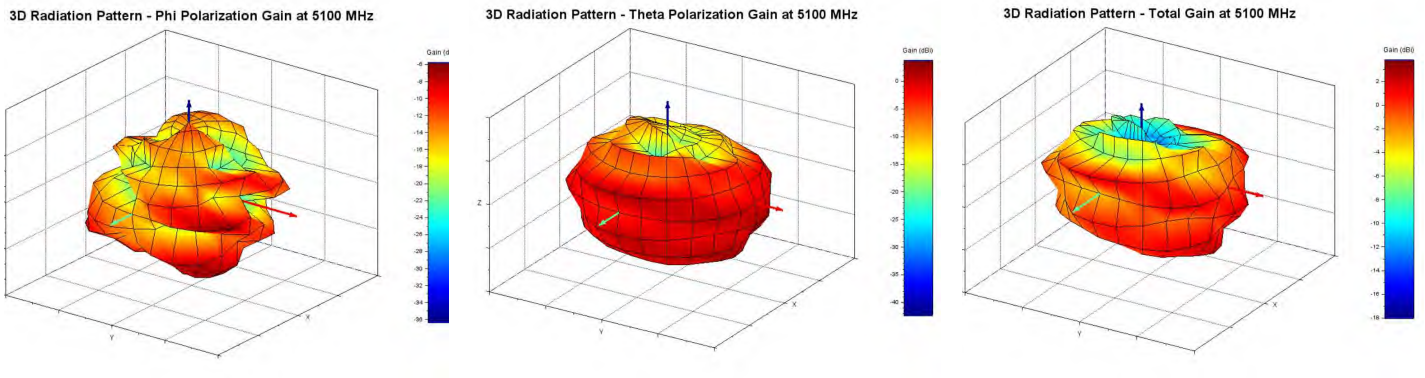

Figure 8: Phi polarization, Theta polarization and, and total gain plots – 5100 MHz

5.3.5 3D Plots at 5500 MHz

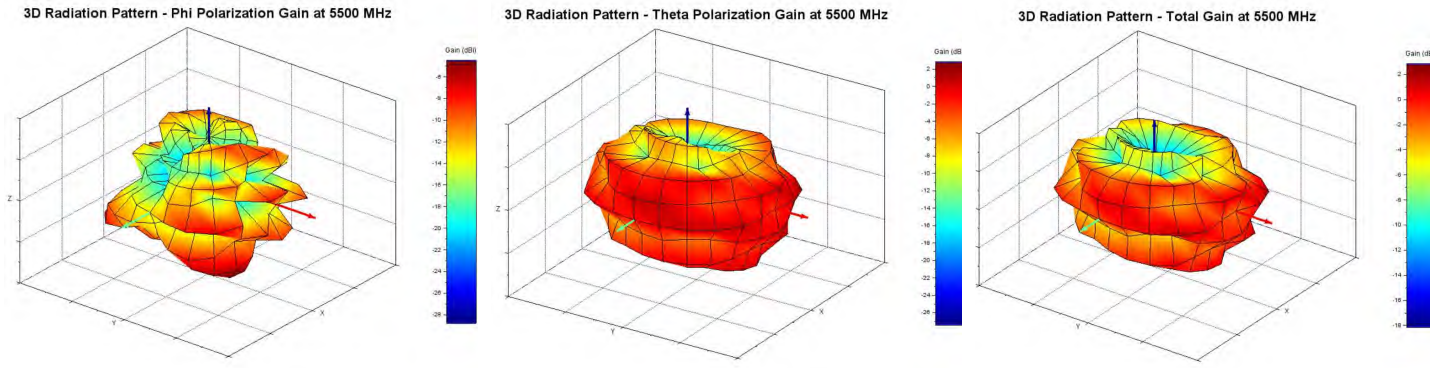

Figure 9: Phi polarization, Theta polarization and, and total gain plots – 5500 MHz

5.3.6 3D Plots at 6000 MHz

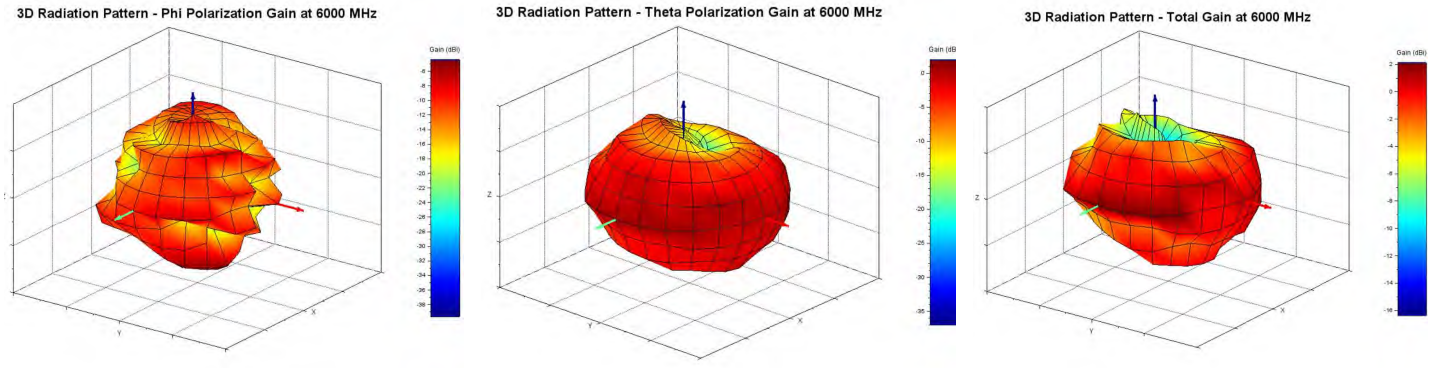

Figure 10: Phi polarization, Theta polarization and, and total gain plots – 6000 MHz

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5.4 EFFICIENCY

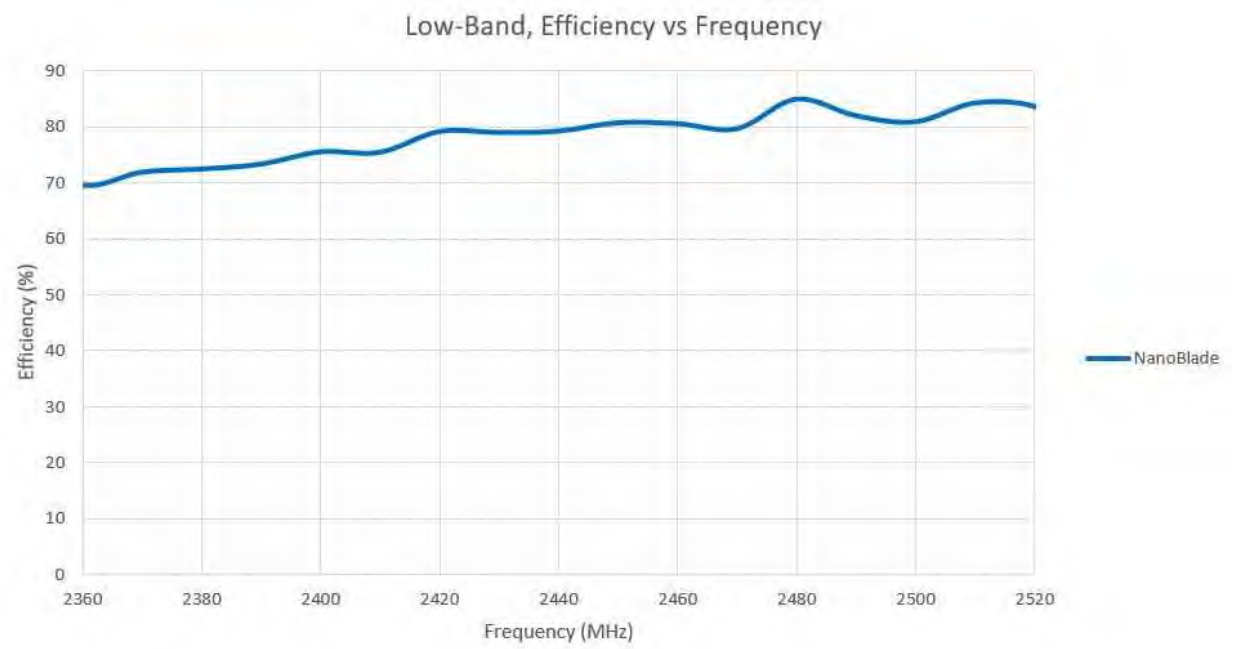

Figure 11: Low-Band antenna efficiency measured in free space with a nominal value of -1.1dB across the operating frequency

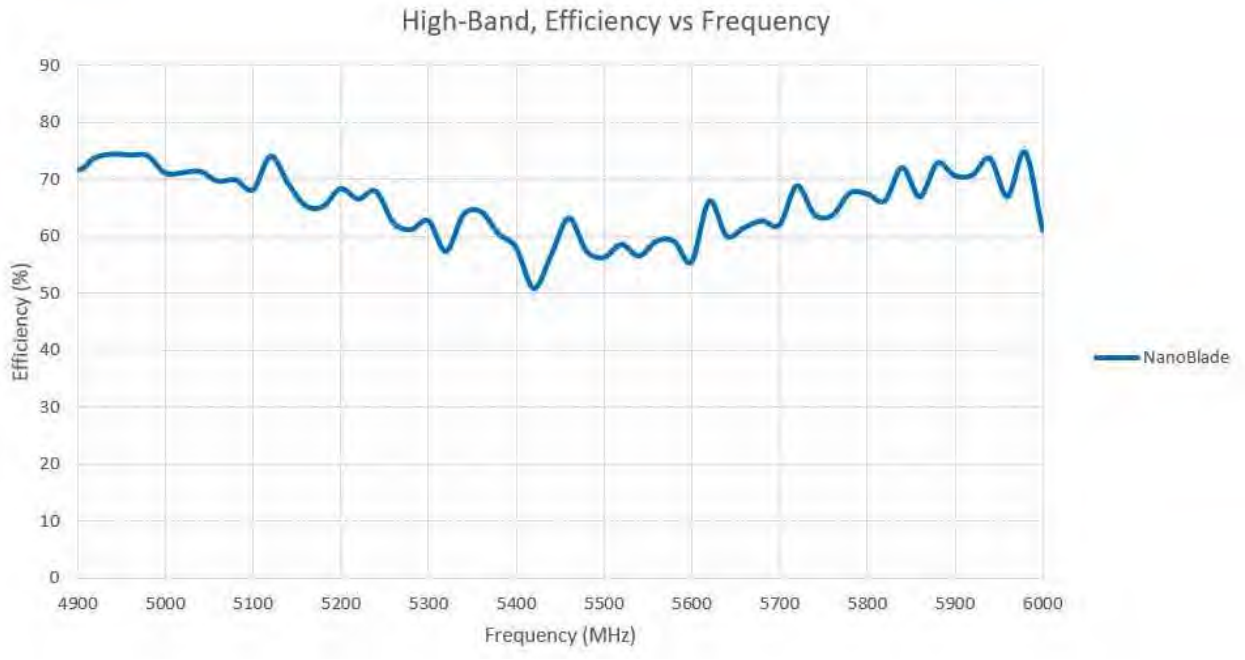

Figure 12: High-Band antenna efficiency measured in free space with a nominal value of -1.91dB across the operating frequency

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5.5 ANTENNA GAIN

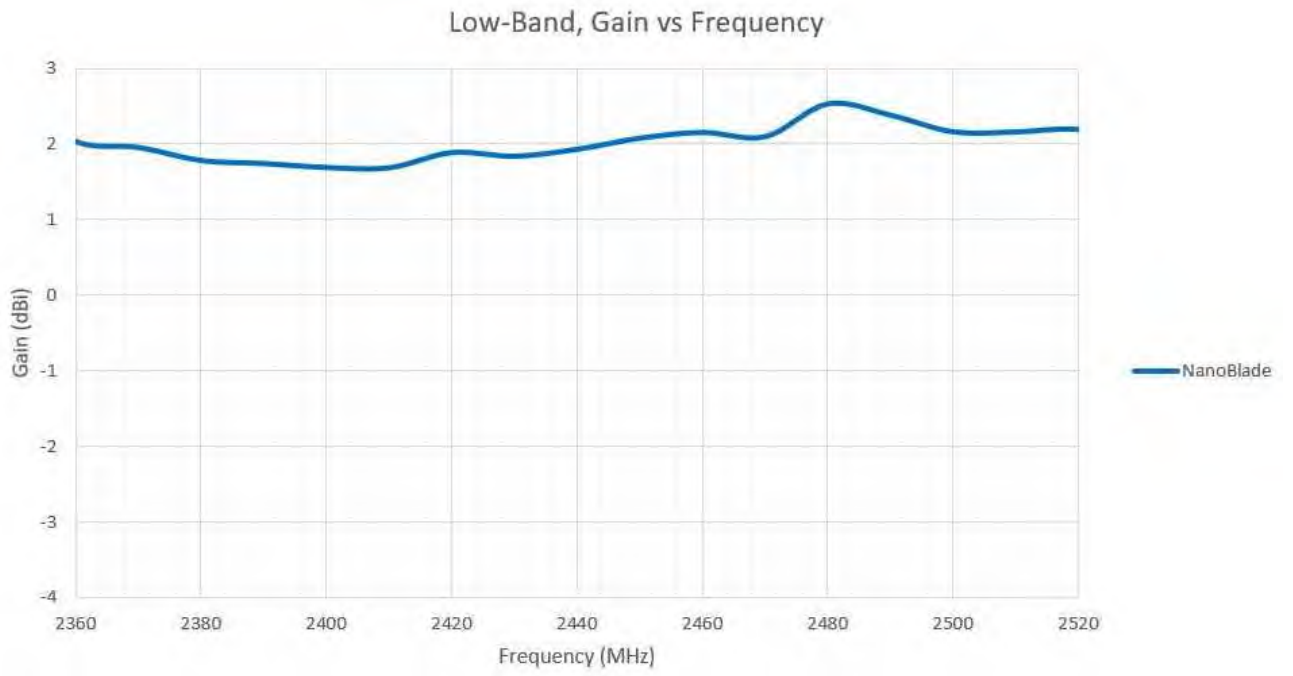

Figure 13: Low-Band Total Gain vs. Frequency, measured in free space

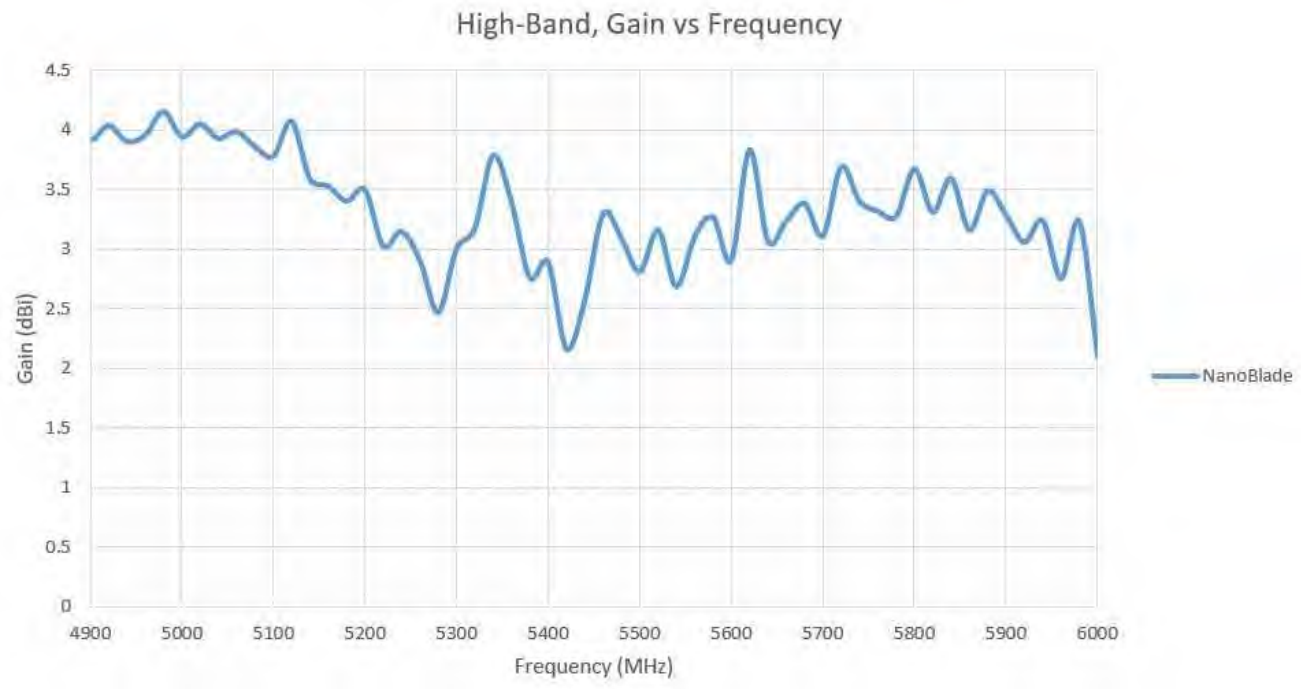

Figure 14: High-Band Total Gain vs. Frequency, measured in free space

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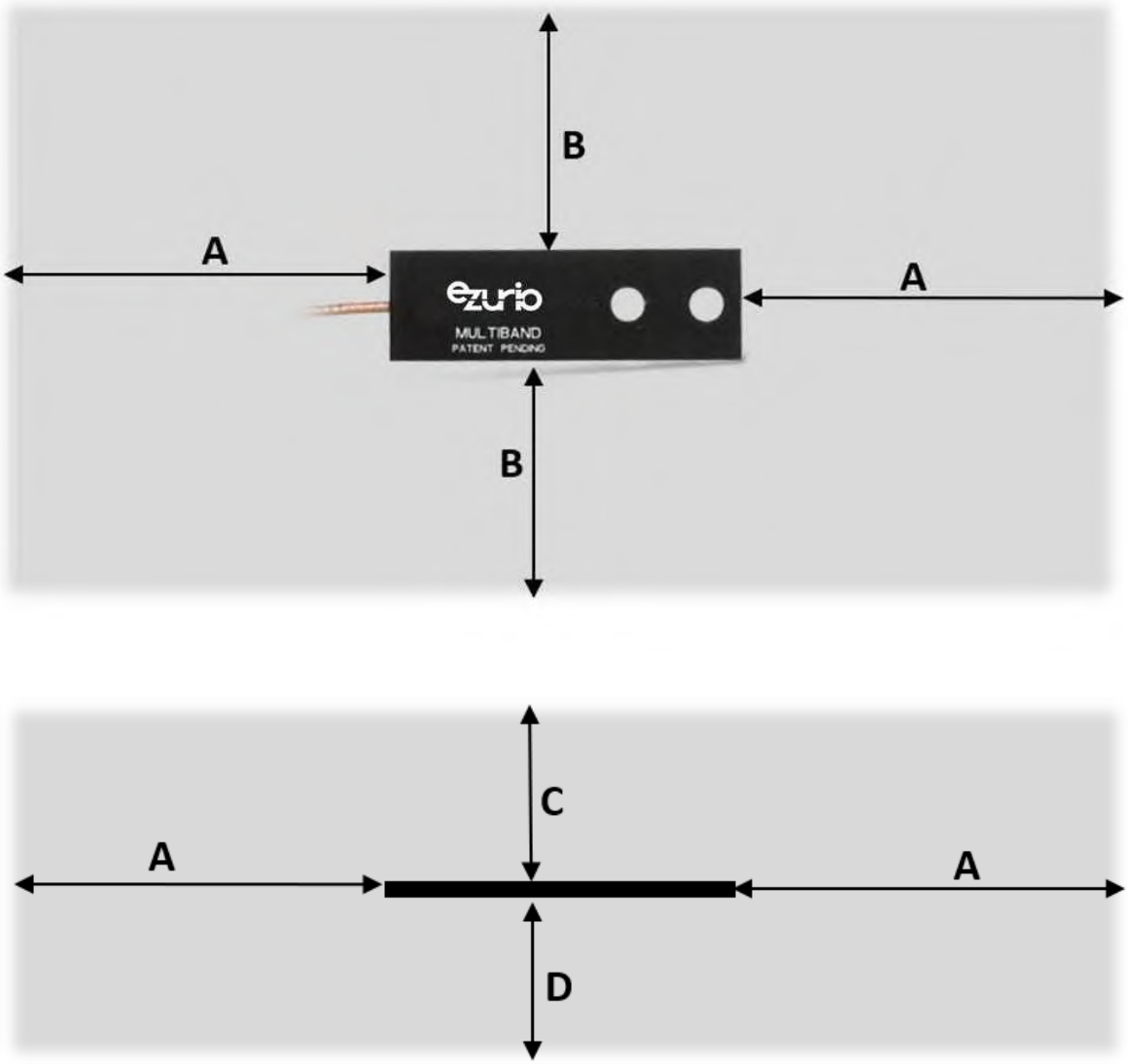
6 Recommended Antenna Conductive Material Keep Out Region



Keep Out Region Distance (mm)			
A	B	C	D
5	5	10	10

Notes:

- Antenna can be mounted on polycarbonate with a nominal thickness of 2.25mm (1.5mm - 3mm), or with plastic screws
- Diagram is not to scale

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7 Additional Information

Please contact your local sales representative or our support team for further assistance:

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Phone	Americas: +1-800-492-2320 Europe: +44-1628-858-940 Hong Kong: +852-2762-4823
Website	http://www.ezurio.com
Technical Support	http://www.ezurio.com/resources/support
Sales Contact	http://www.ezurio.com/contact

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1 Features and Benefits

- Dual band antenna – 2.4 GHz and 5.5 GHz
- Quick and easy installation
- Adhesive holds to surface during humidity exposure and hot/cold cycles
- RoHS-compliant
- Can be installed in the following ways:
  - On different non-conductive surfaces and thicknesses
  - Near metals or the human body
  - On flat or curved surfaces

SPECIFICATIONS		
Frequency (MHz)	2400 - 2480	4900 - 5900
Peak Gain (dBi)	+2.5	+3.0
Average Gain (dBi)	> -2.5	> -3.4
VSWR (MHz)	<2.5:1	<3.0:1
Impedance (Ω)	50	
Antenna Type	Flexible Planar Inverted F (FlexPIFA)	
Polarization	Linear	

MECHANICAL SPECIFICATIONS		
Dimensions – mm (inches)	38.5 x 12.7 x 2.5 (1.52 x 0.5 x 0.098)	
Weight – g (oz.)	1.13 (0.040)	
Color	Clear yellow	
Adhesive	3M 100MP	
Connector Mating Height (max) – mm	MHF1 (U.FL)	2.5
	MHF4L	1.4

ENVIRONMENTAL SPECIFICATIONS	
Operating Temperature – °C (°F)	-40 to +85°C (-40 to +185°F)
Material Substance Compliance	RoHS

2 Configuration

PART NUMBER	CABLE LENGTH	CONNECTOR
001-0016	100 mm	U.FL
001-0021	100 mm	MHF4L
EFB2455A3S-15MH4L	150 mm	MHF4L
EFB2455A3S-16MHF1	160 mm	MHF1
EFB2455A3S-20MHF1	200 mm	MHF1
EFB2455A3S-25MHF1	250 mm	MHF1

Note: Specifications are based on the 100mm cable length, standard antenna version with MHF1 / U.FL connector. Varying the cable length or type or connector will cause variations in these antenna specifications.

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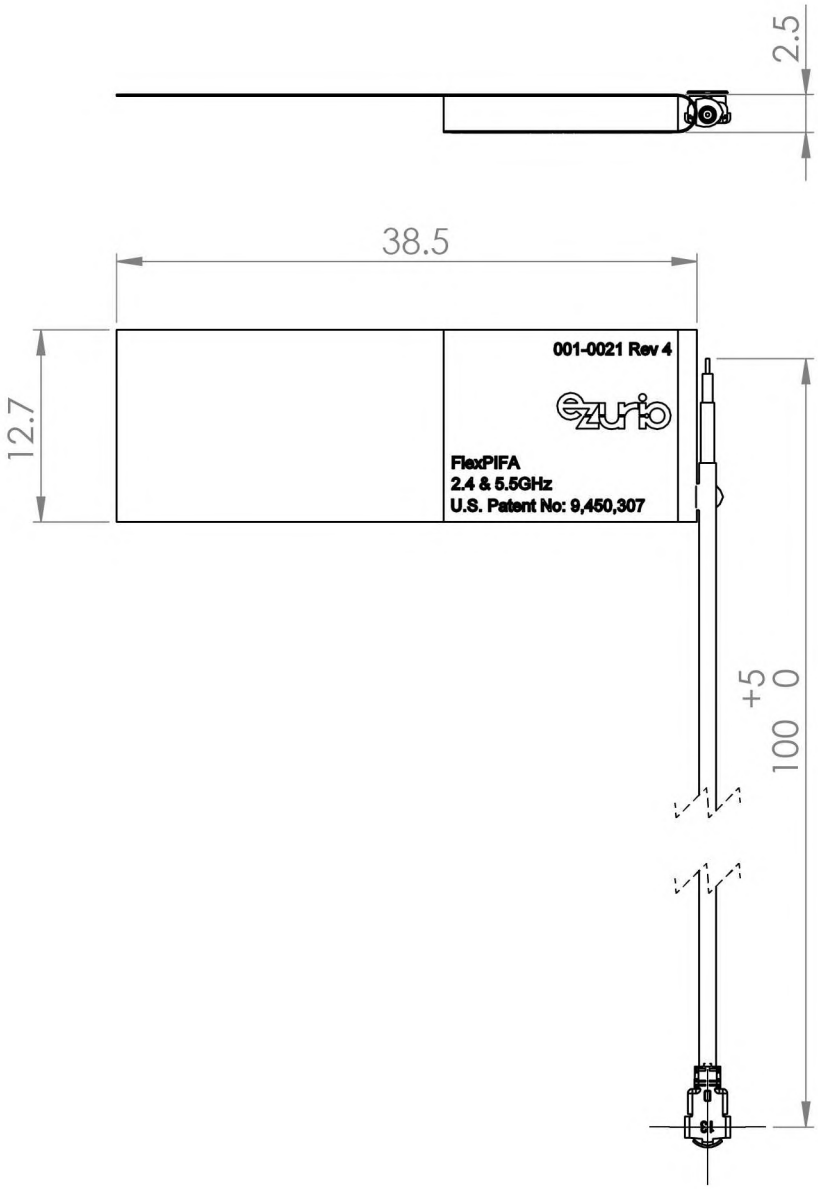
3 Mechanical Drawing



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4 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 nine 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.

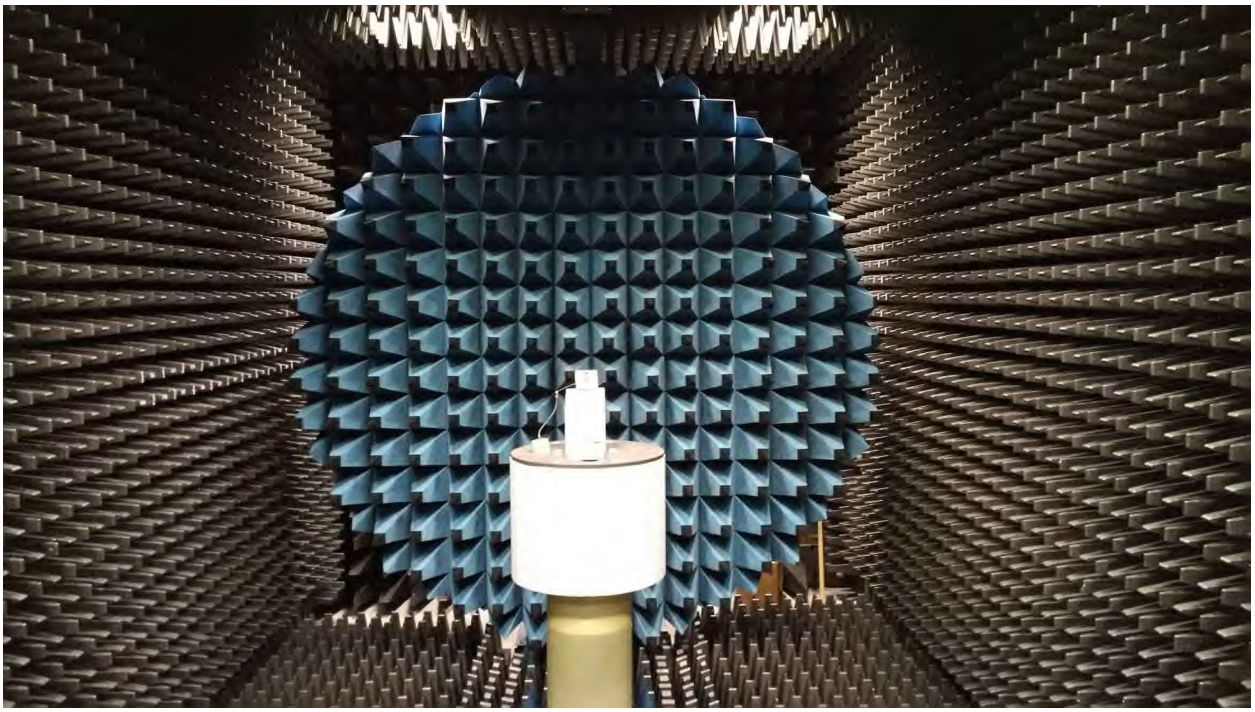

Figure 1: Antenna chamber

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5 Flat Surface Antenna Measurements

5.1 Return Loss

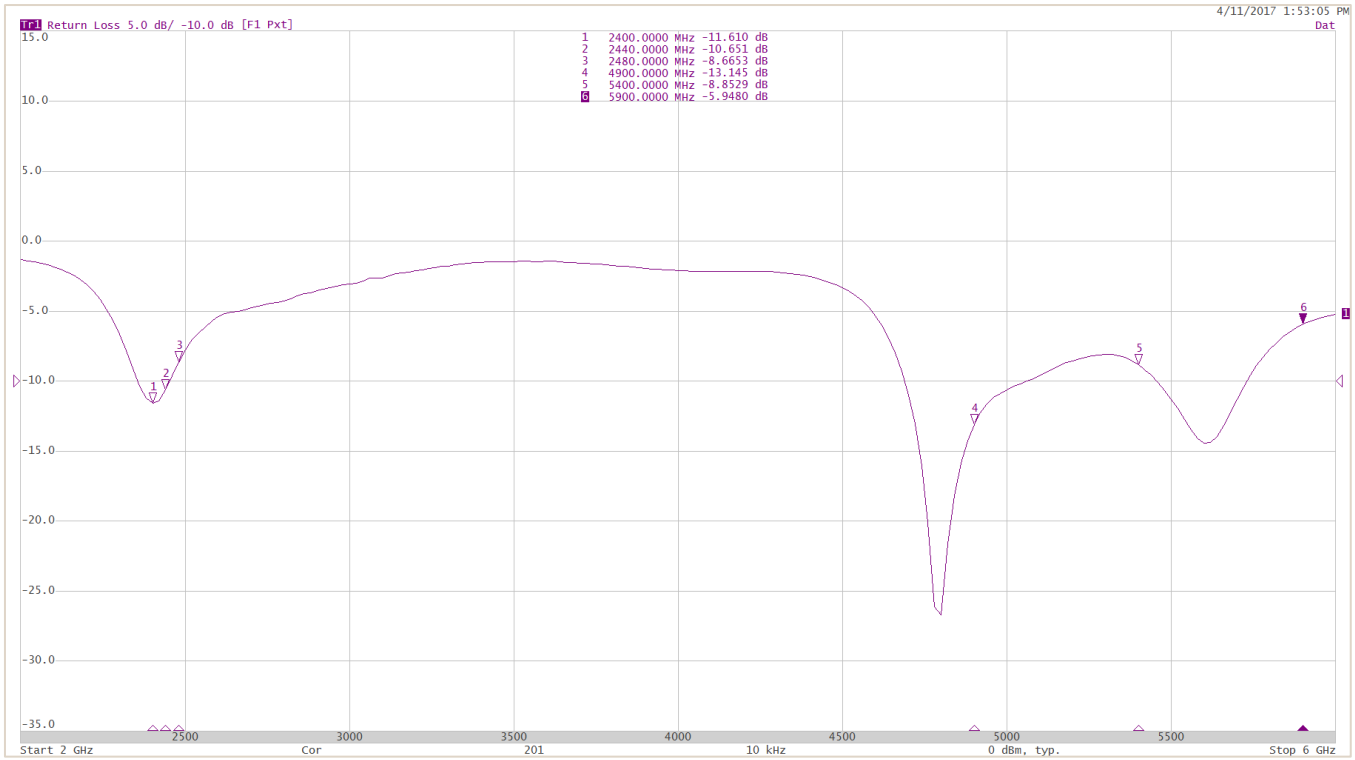

Figure 2: Antenna RL measured on a 1.5 mm-thick plate of polycarbonate

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6 Flat surface Antenna Radiation Performance

6.1 FlexPIFA centered on a 1.5 mm-thick plate of polycarbonate

Antenna Measurement Set-Up

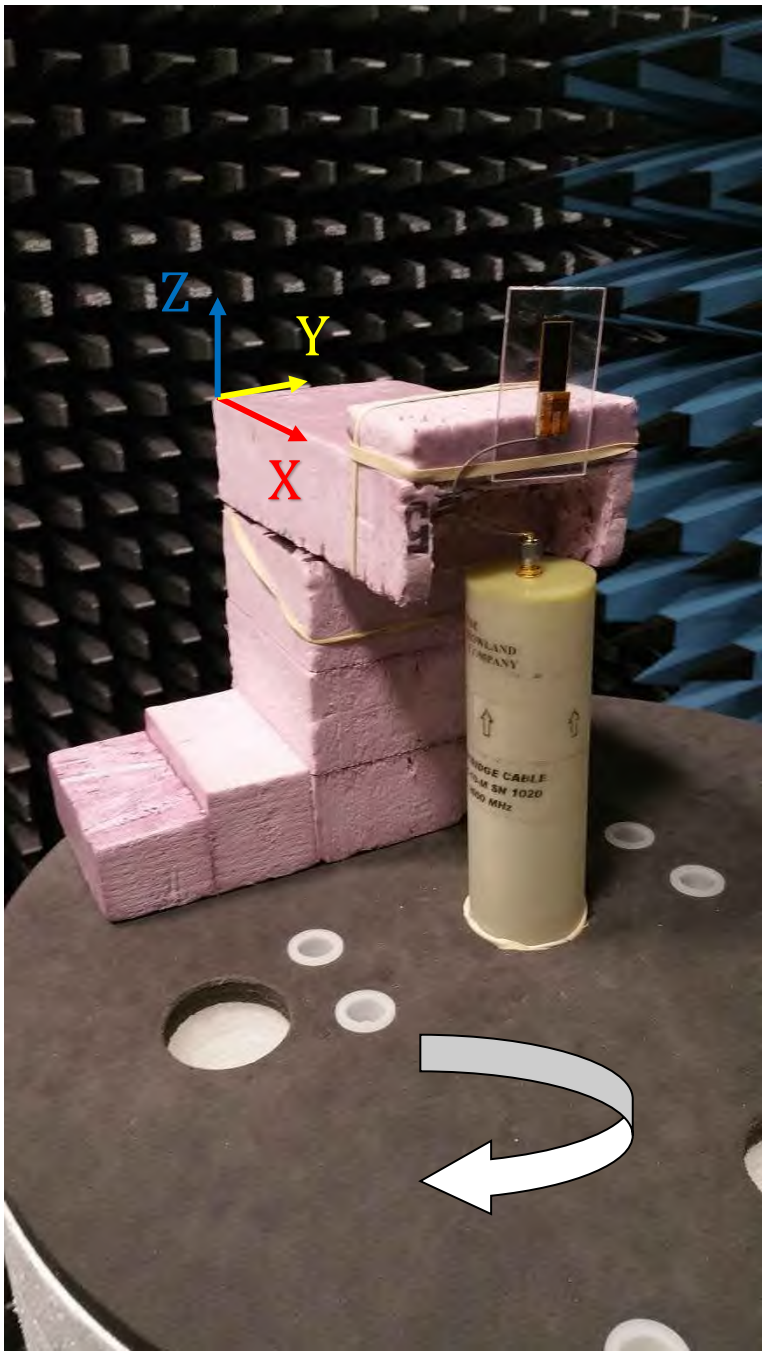

Figure 3: Flat surface setup

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6.2 2.4 GHz Band

6.2.1 Azimuthal Conical Cuts at 2440 MHz

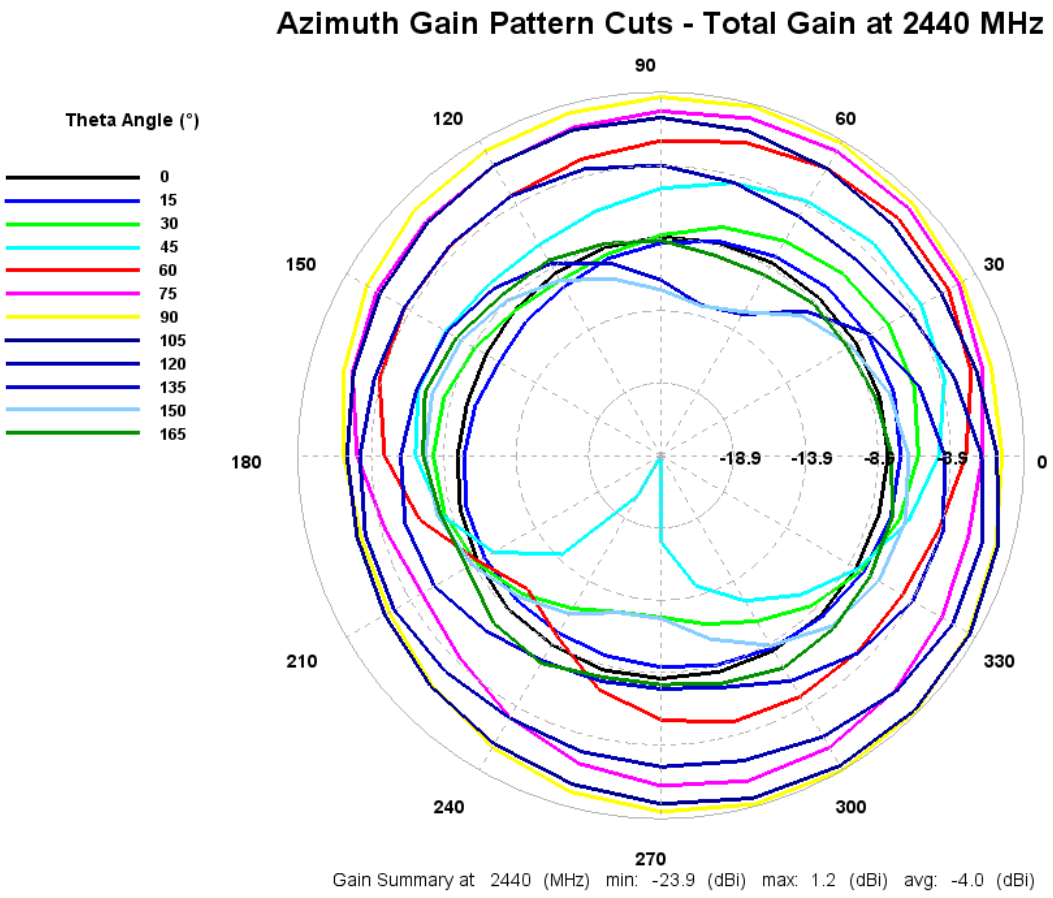

Figure 4: Total gain pattern

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6.2.2 3D Plots at 2440 MHz

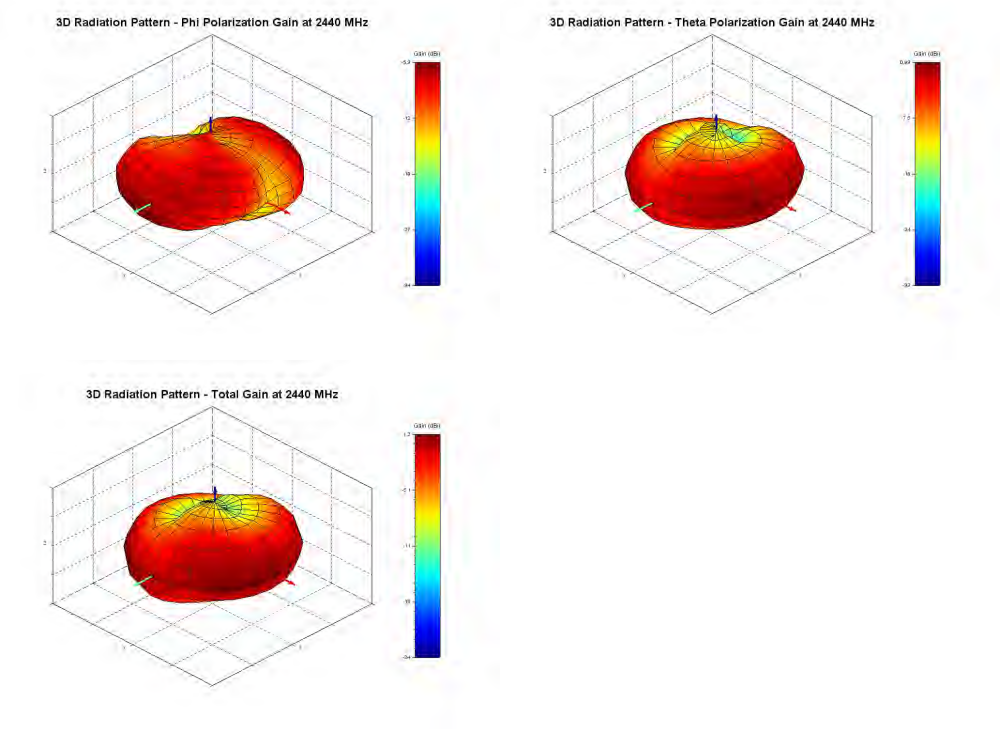

Figure 5: Phi, Theta, and total gain plots

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6.3 5 GHz Band

6.3.1 Azimuthal Conical Cuts at 4900 MHz

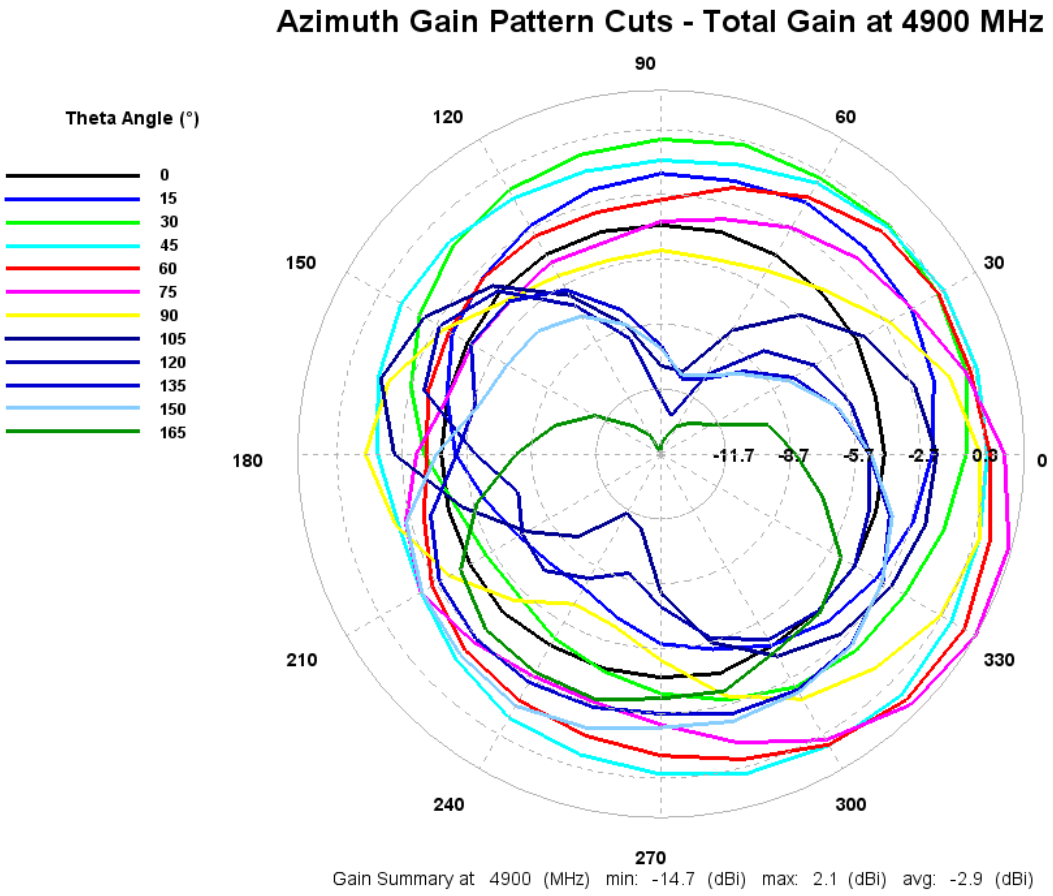

Figure 6: Total gain pattern

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6.3.2 3D Plots at 4900 MHz

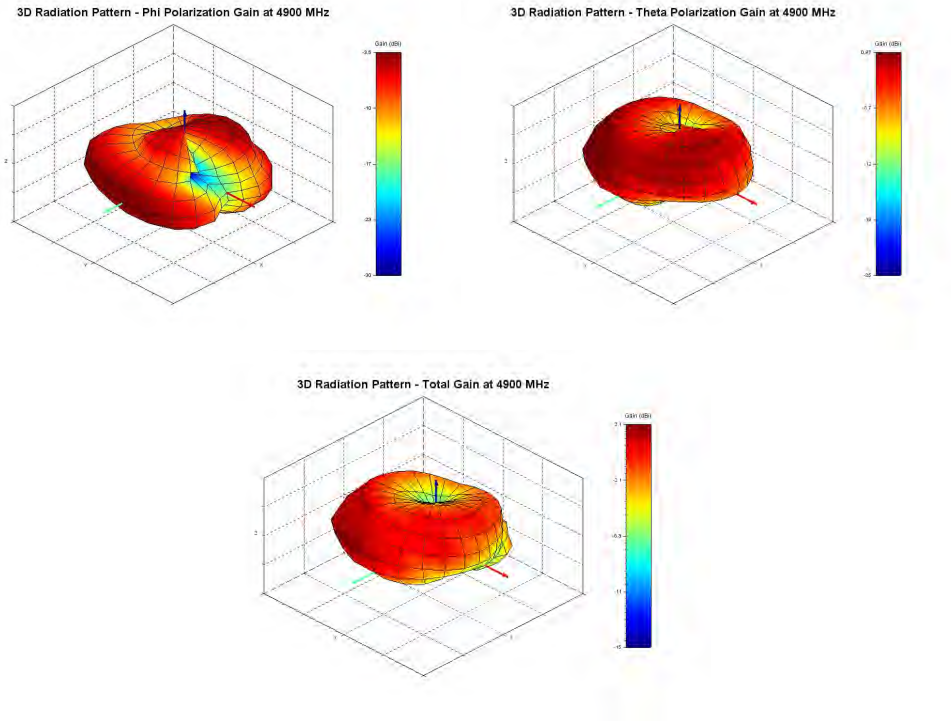

Figure 7: Phi, Theta, and total gain plots

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6.3.3 Azimuthal Conical Cuts at 5400 MHz

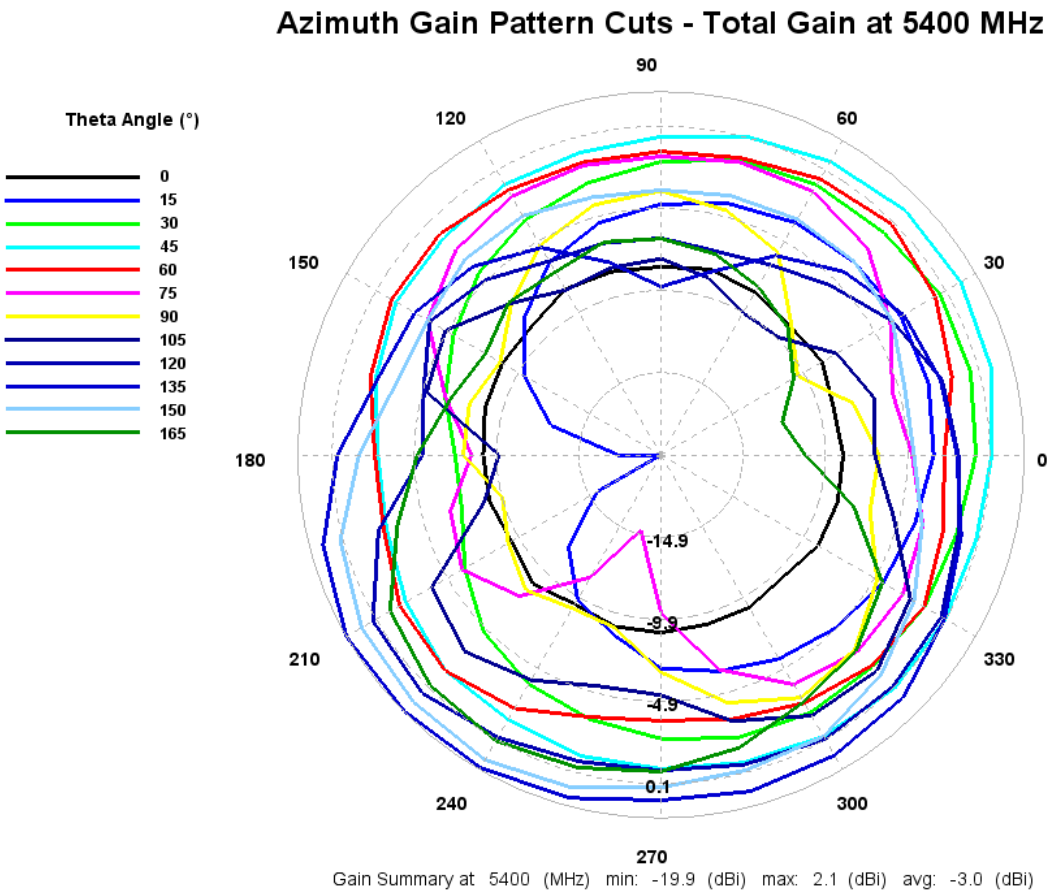

Figure 8: Total gain pattern

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6.3.4 3D Plots at 5400 MHz

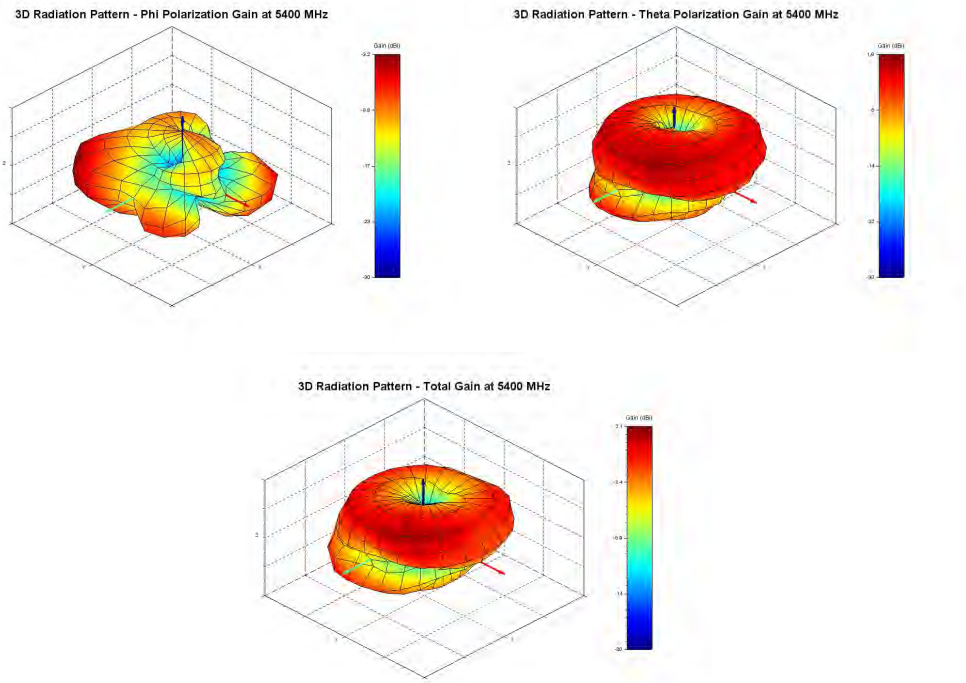

Figure 9: Phi, Theta, and total gain plots

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6.3.5 Azimuthal Conical Cuts at 5900 MHz

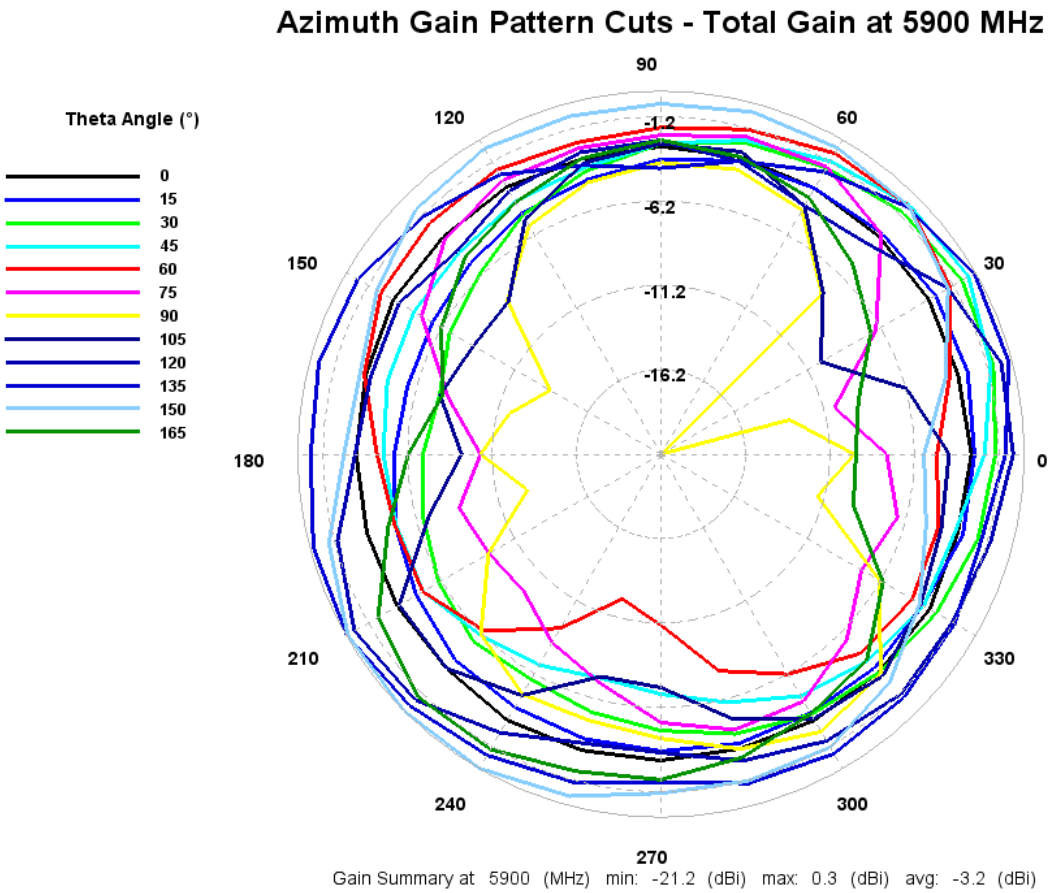

Figure 10: Total gain pattern

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6.3.6 3D Plots at 5900 MHz

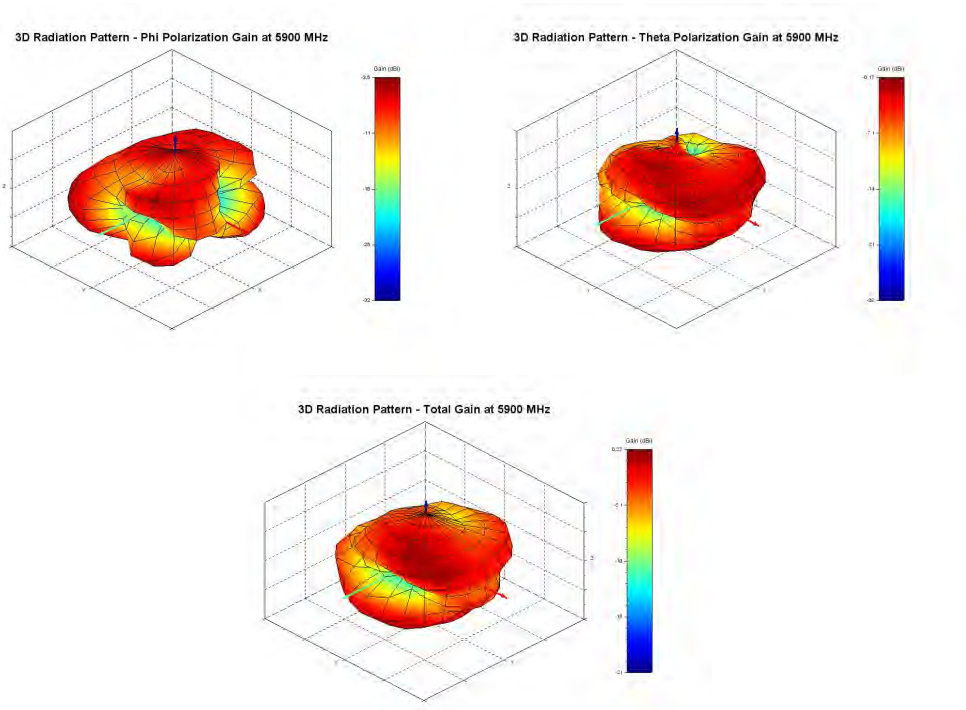

Figure 11: Phi, Theta, and total gain plots

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7 Curved surface Antenna Radiation Performance

7.1 FlexPIFA outside 60 mm outer diameter PVC tube

7.1.1 Antenna Measurement Set-Up

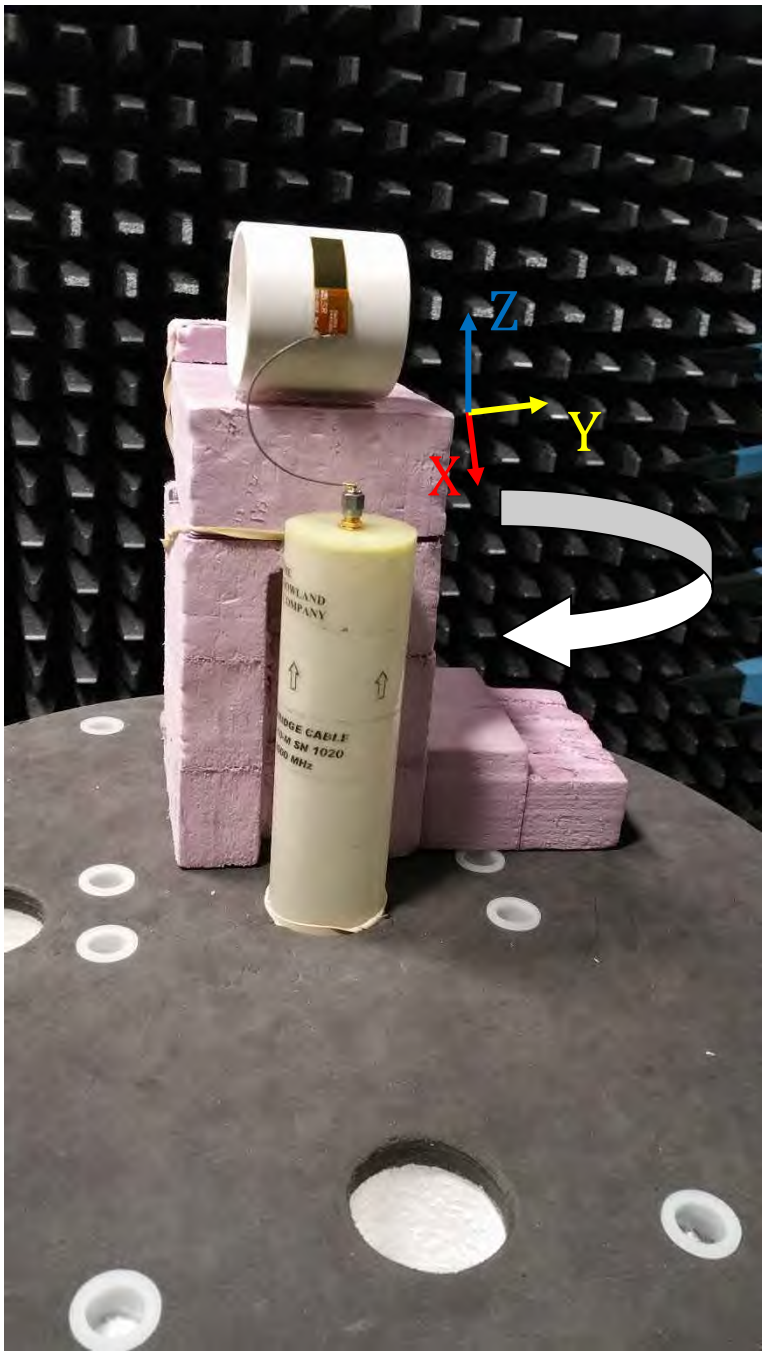

Figure 12: Outer diameter setup

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7.2 2.4 GHz Band

7.2.1 Azimuthal Conical Cuts at 2440 MHz

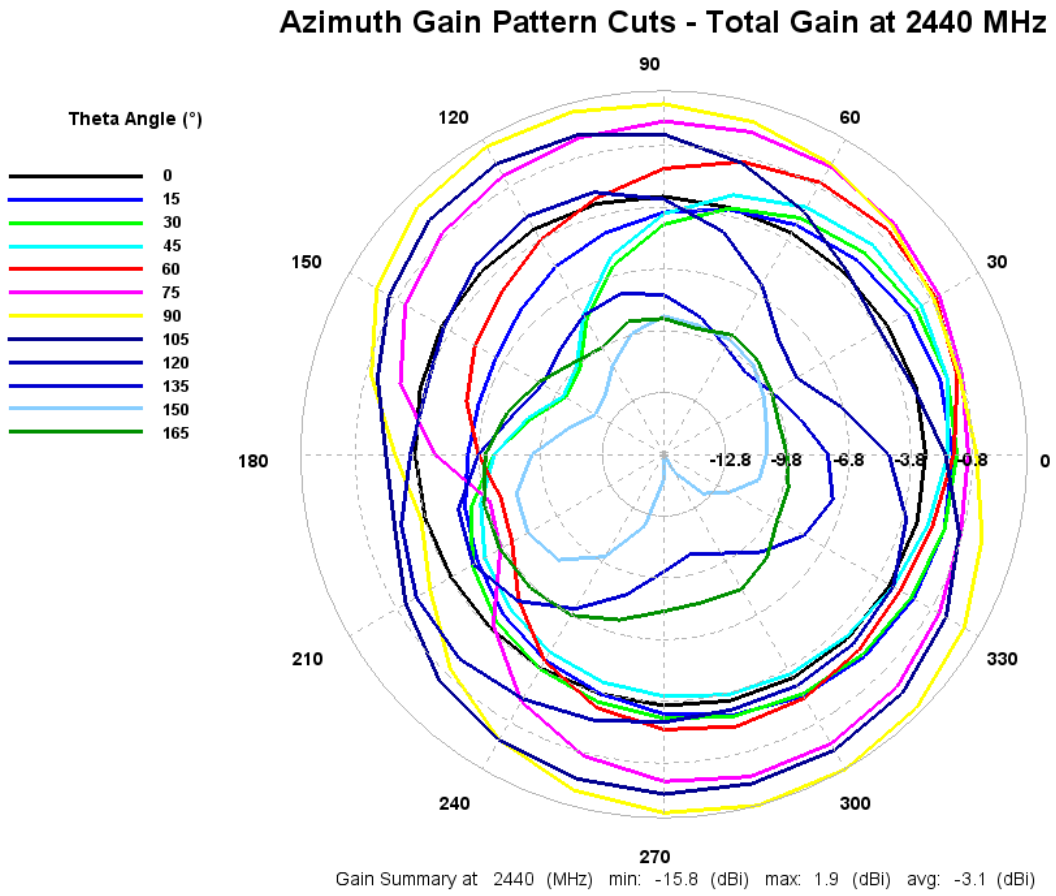

Figure 13: Total gain pattern

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7.2.2 3D Plots at 2440 MHz

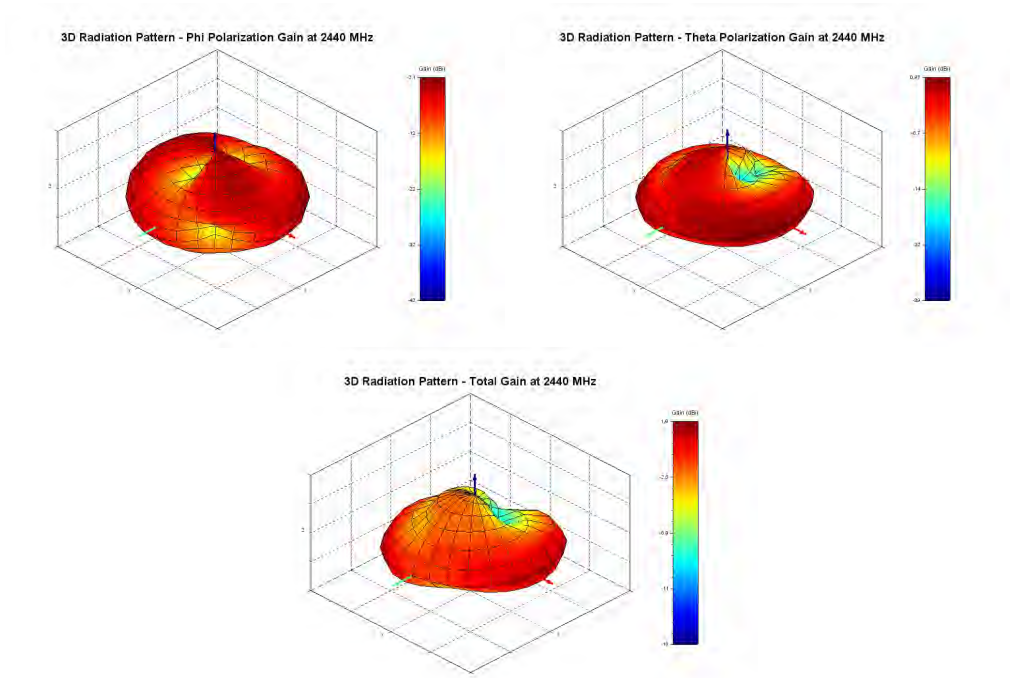

Figure 14: Phi, Theta, and total gain plots

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7.3 5 GHz Band

7.3.1 Azimuthal Conical Cuts at 4900 MHz

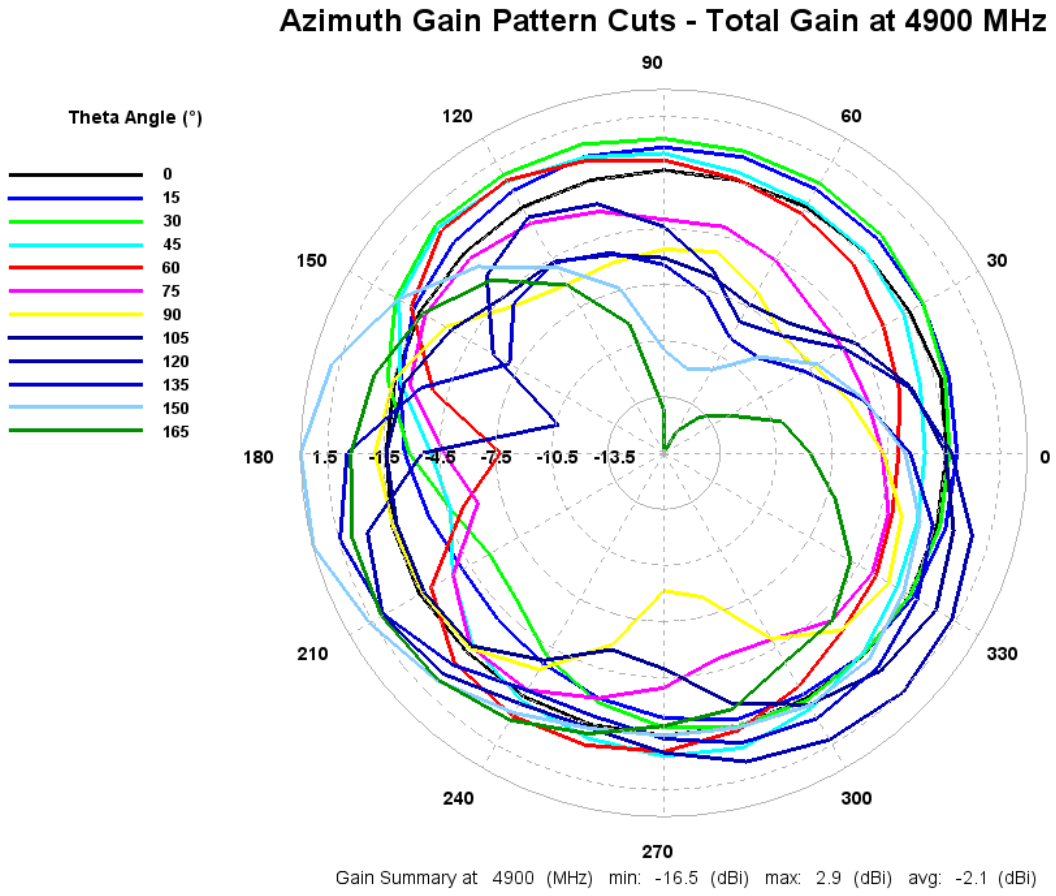

Figure 15: Total gain pattern

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7.3.2 3D Plots at 4900 MHz

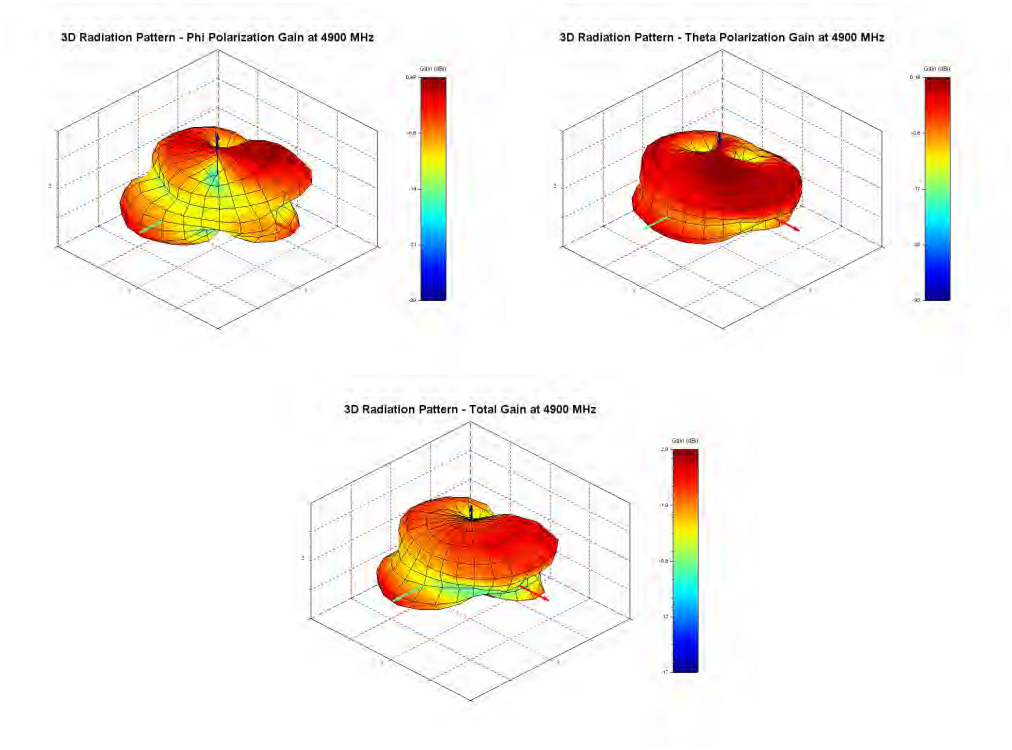

Figure 16: Phi, Theta, and total gain plots

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7.3.3 Azimuthal Conical Cuts at 5400 MHz

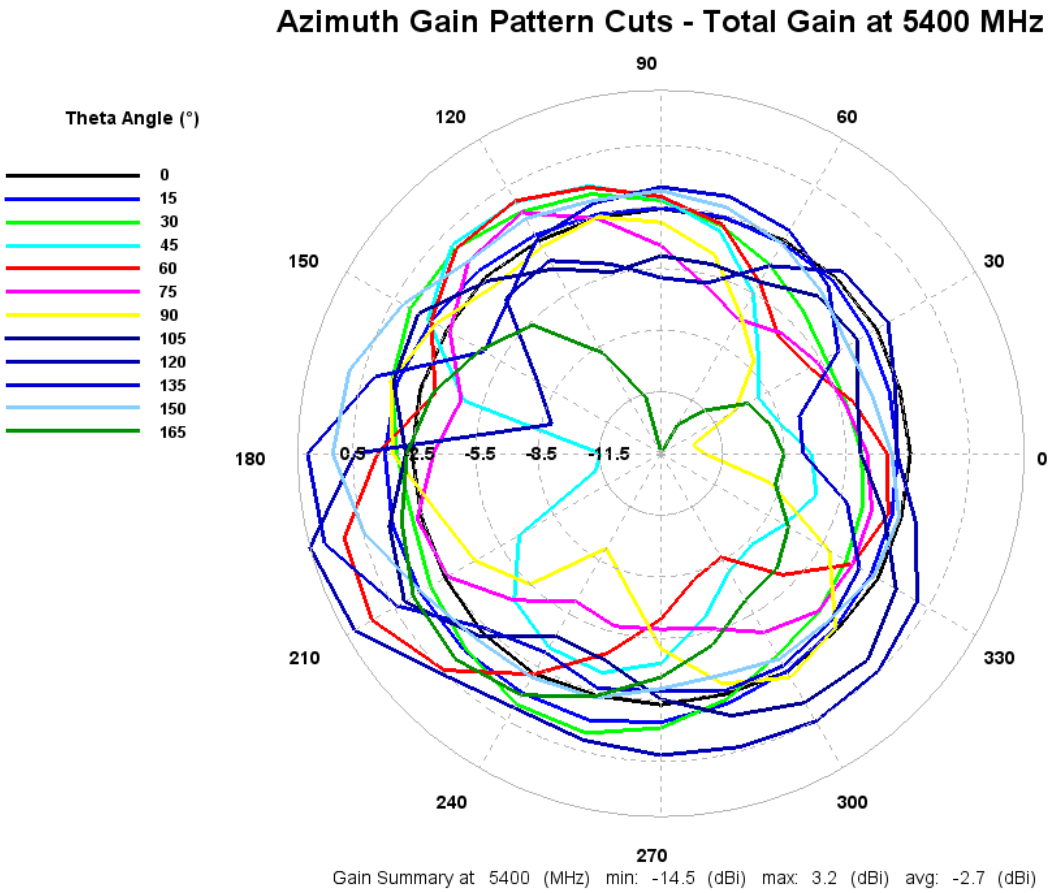

Figure 17: Total gain pattern

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7.3.4 3D Plots at 5400 MHz

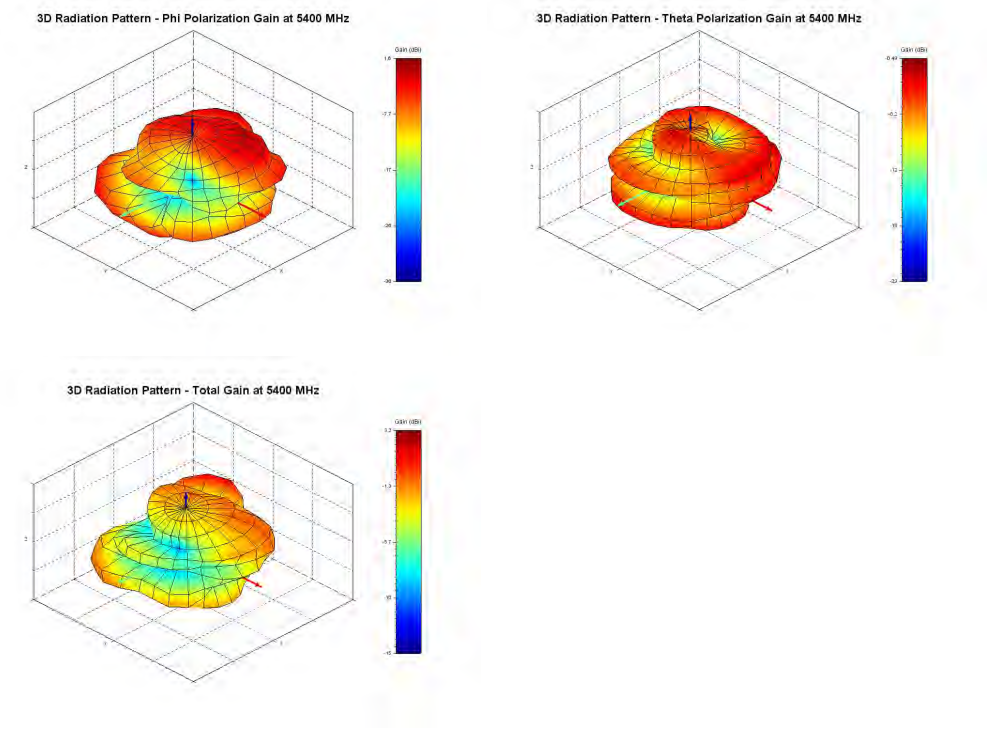

Figure 18: Phi, Theta, and total gain plots

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7.3.5 Azimuthal Conical Cuts at 5900 MHz

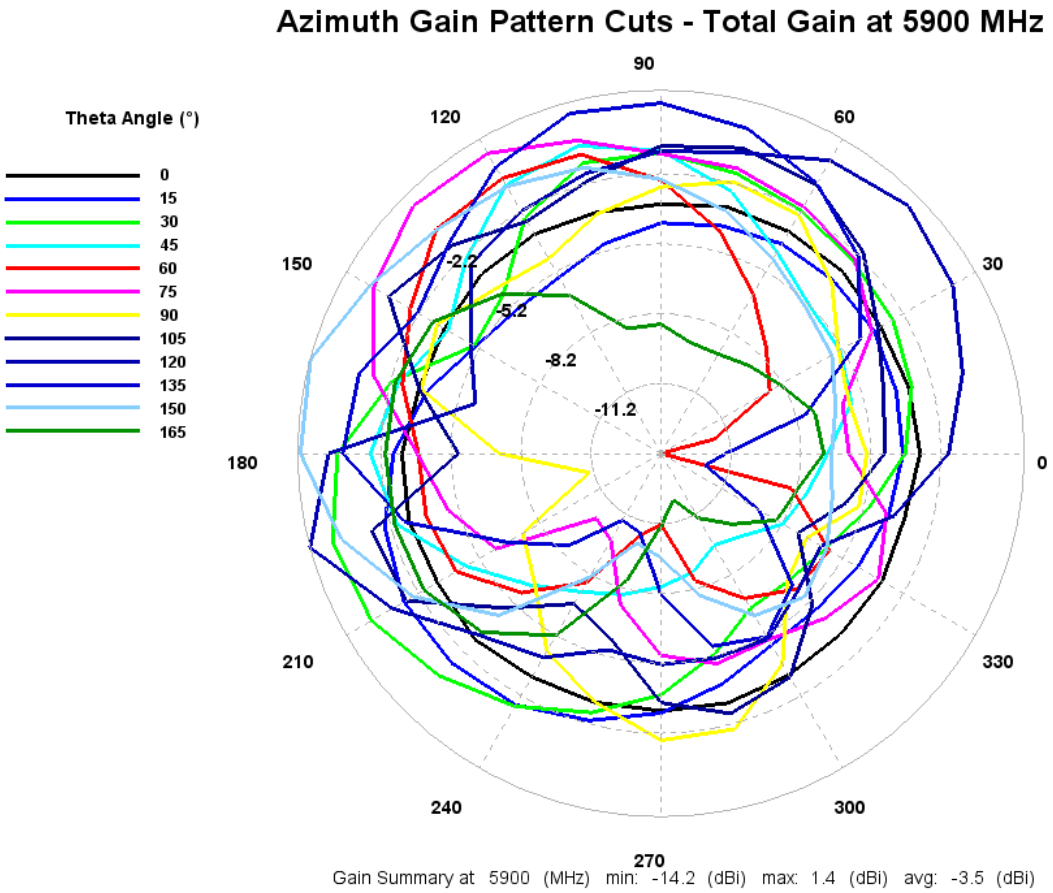

Figure 19: Total gain pattern

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7.3.6 3D Plots at 5900 MHz

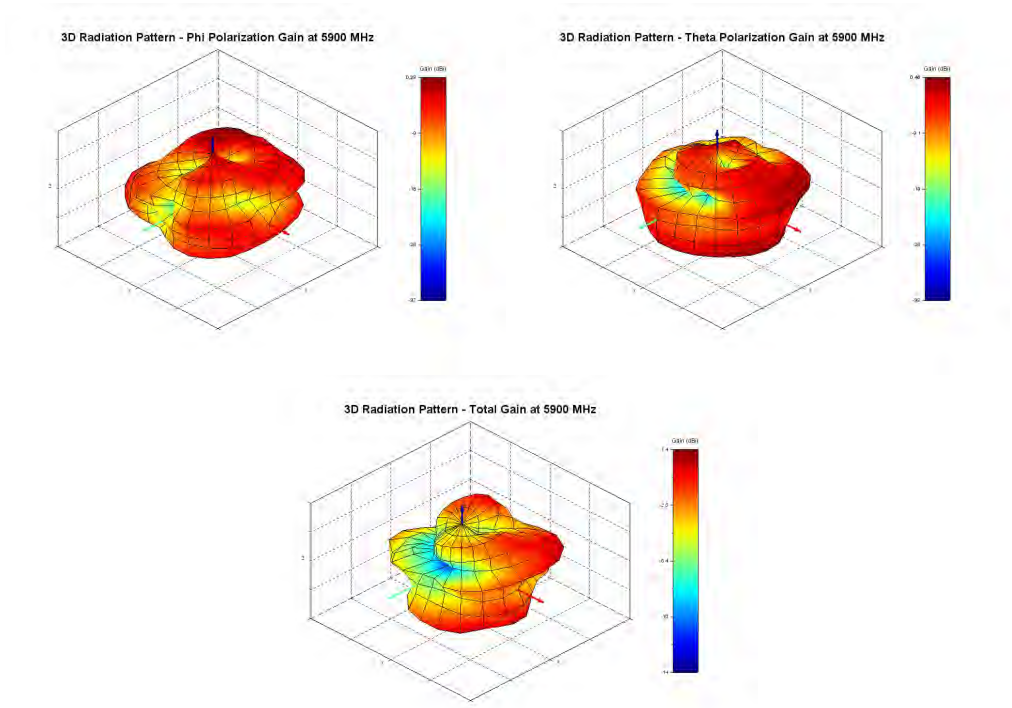

Figure 20: Phi, Theta, and total gain plots

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7.4 FlexPIFA inside 52 mm inner diameter PVC tube

7.4.1 Antenna Measurement Setup

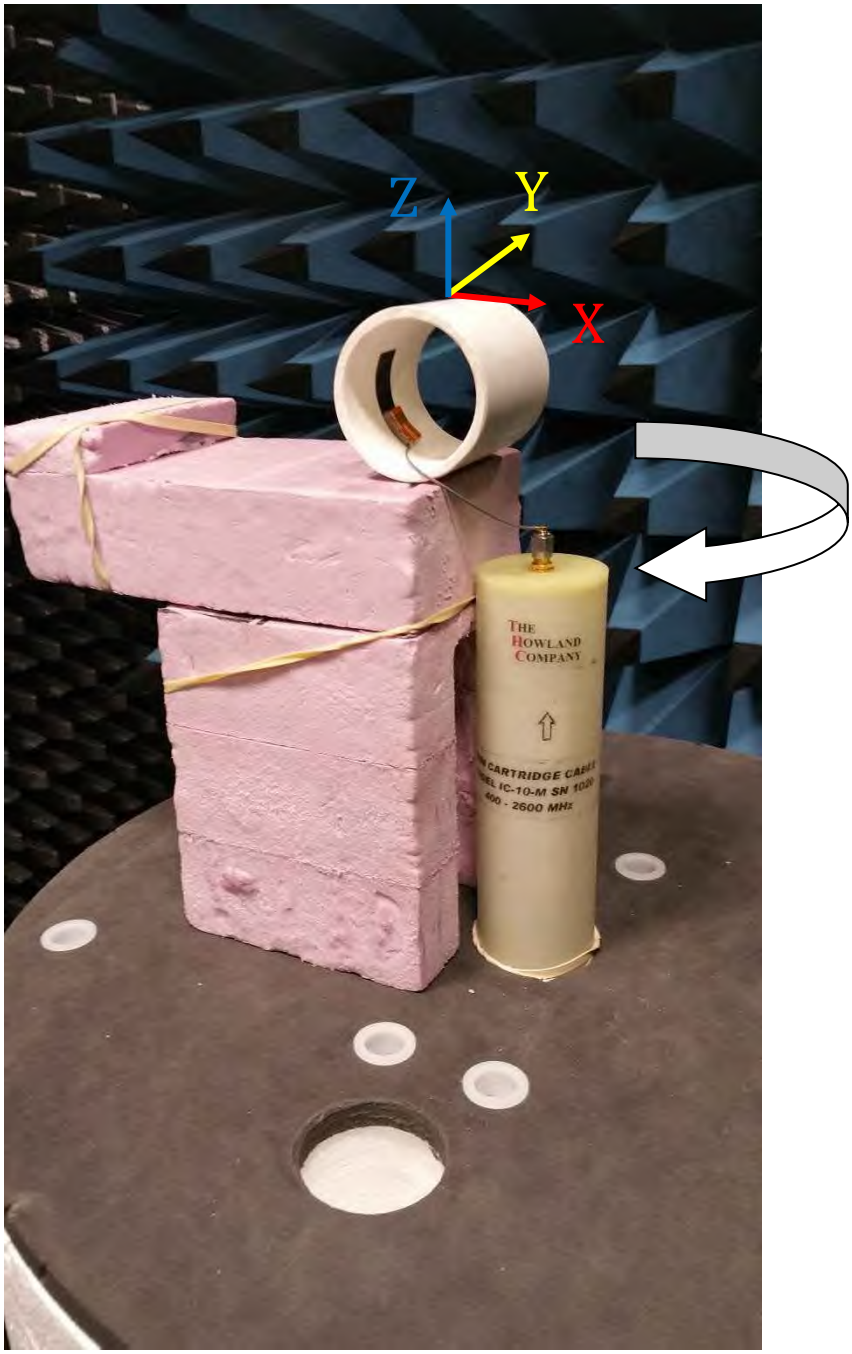

Figure 21: Inner diameter setup

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7.5 2.4 GHz Band

7.5.1 Azimuthal Conical Cuts at 2440 MHz

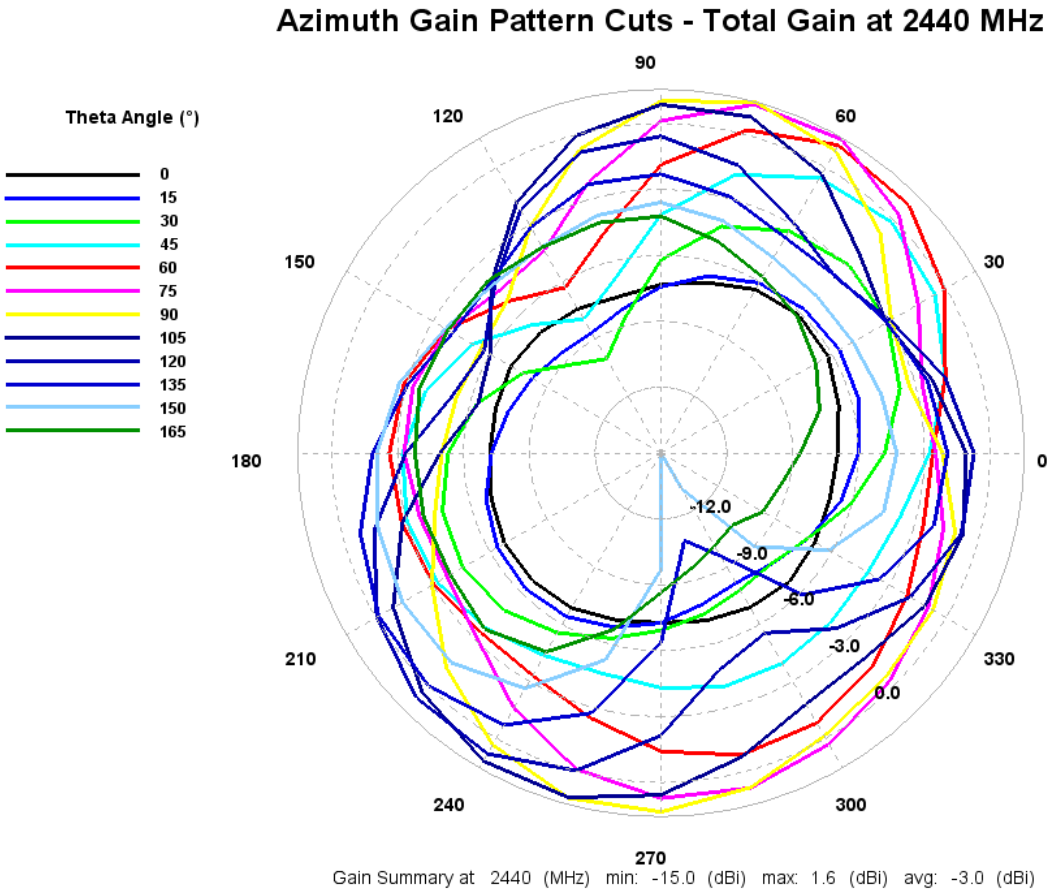

Figure 22: Total gain pattern

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7.5.2 3D Plots at 2440 MHz

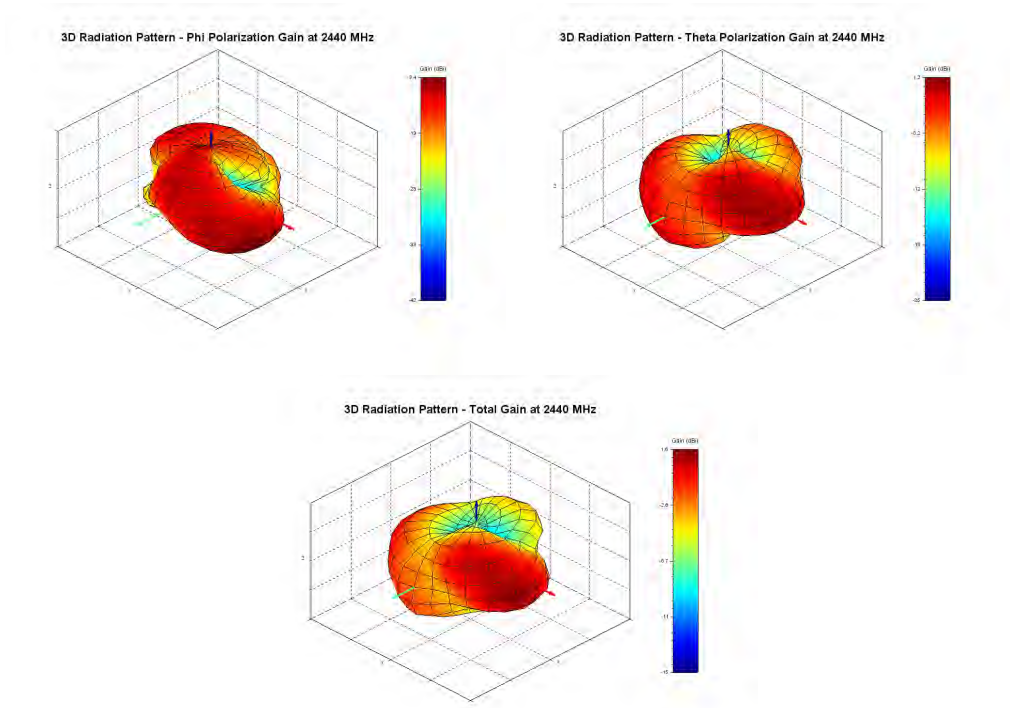

Figure 23: Phi, Theta, and total gain plots

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7.6 5 GHz Band

7.6.1 Azimuthal Conical Cuts at 4900 MHz

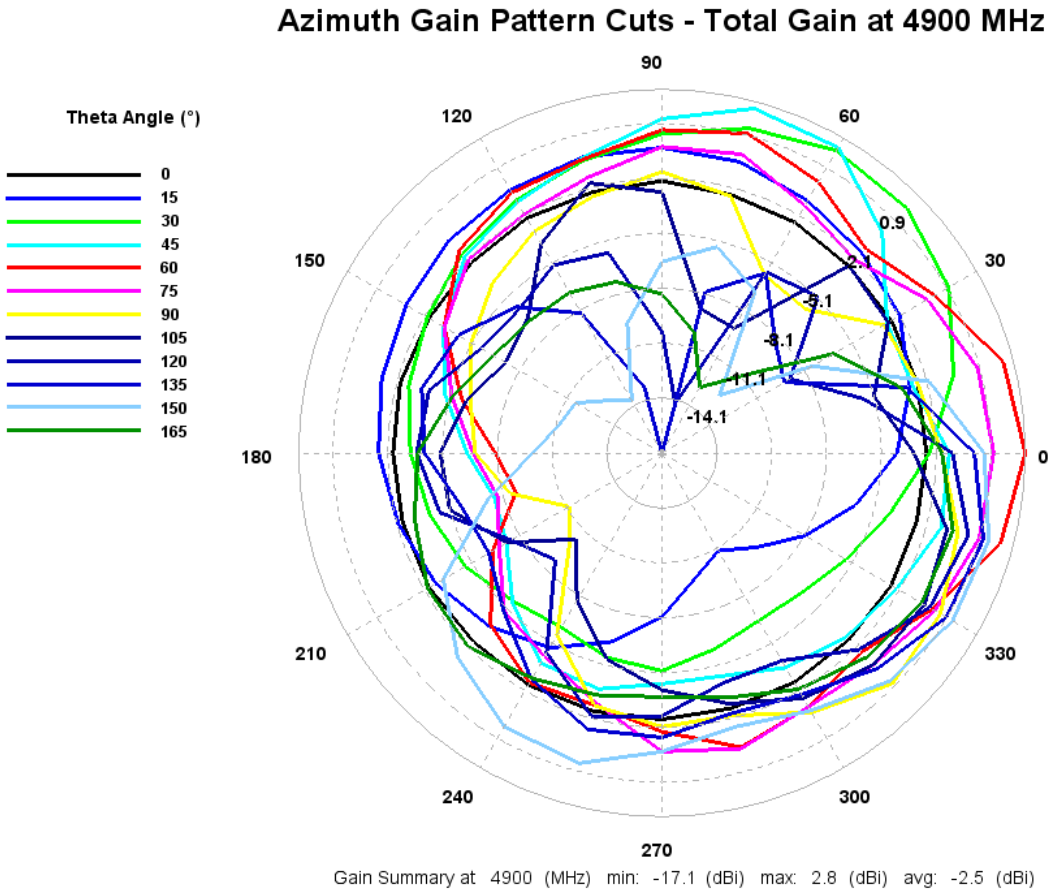

Figure 24: Total gain pattern

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Hong Kong: +852-2762-4823

7.6.2 3D Plots at 4900 MHz

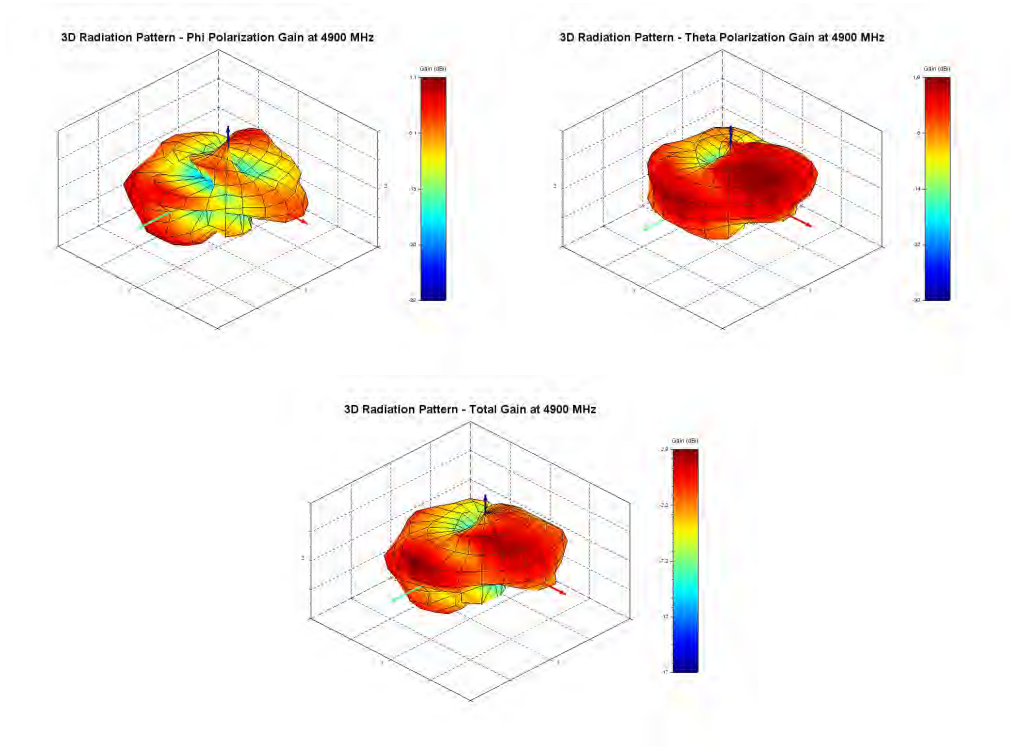

Figure 25: Phi, Theta, and total gain plots

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7.6.3 Azimuthal Conical Cuts at 5400 MHz

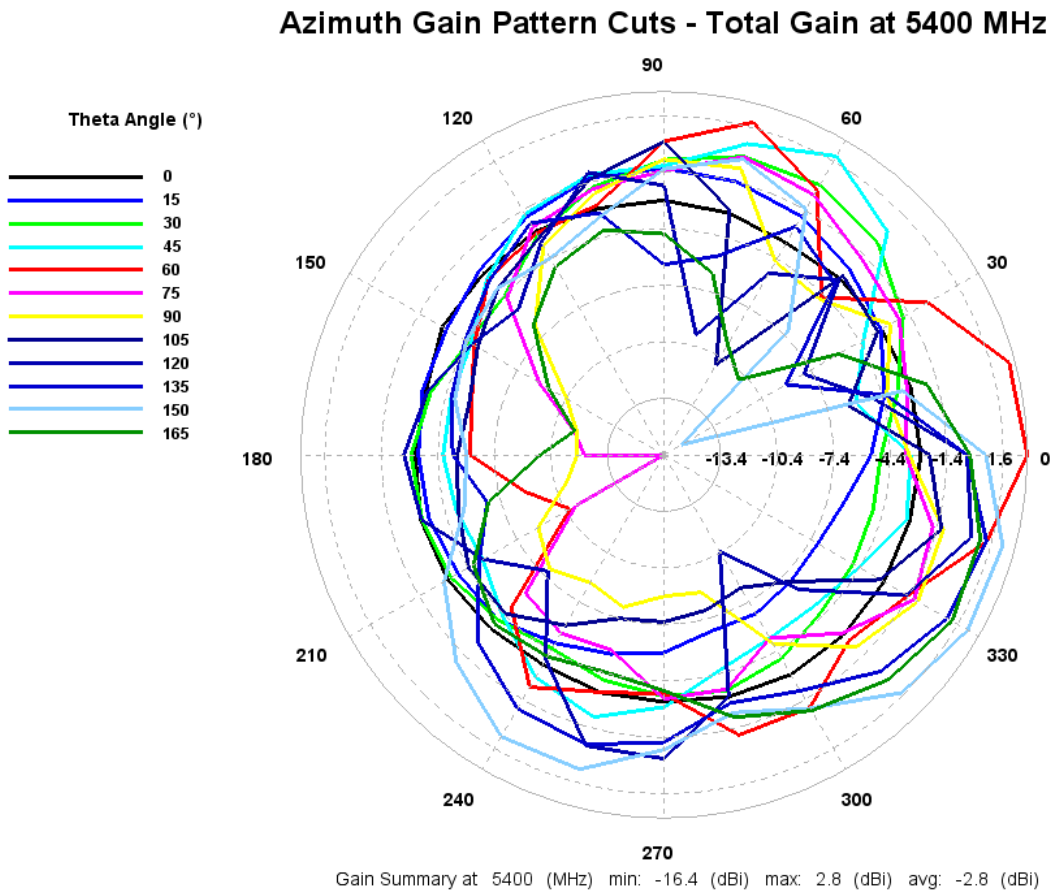

Figure 26: Total gain pattern

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7.6.4 3D Plots at 5400 MHz

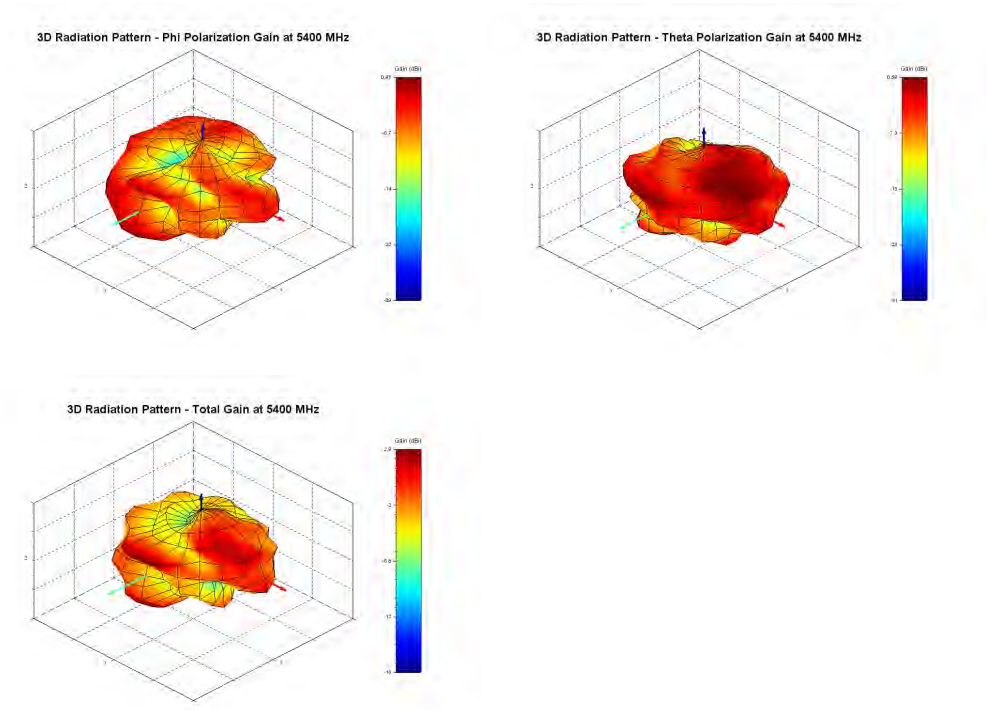

Figure 27: Phi, Theta, and total gain plots

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7.6.5 Azimuthal Conical Cuts at 5900 MHz

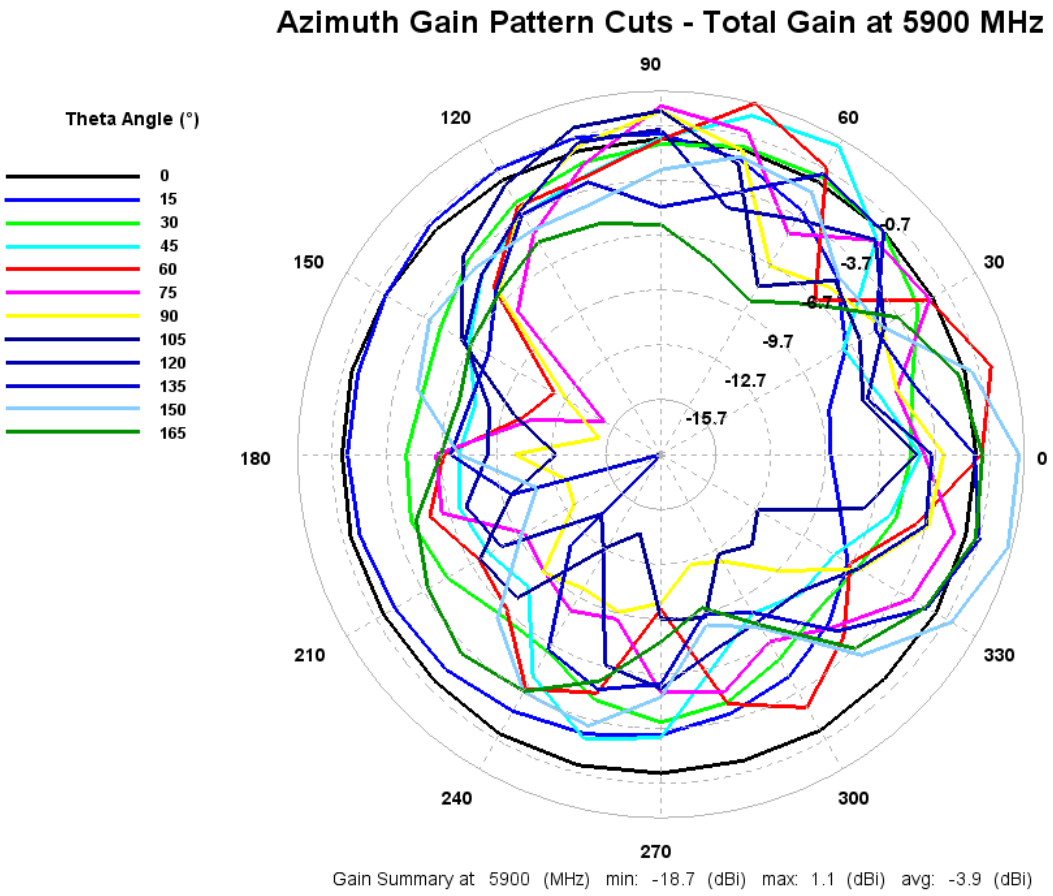

Figure 28: Total gain pattern

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7.6.6 3D Plots at 5900 MHz

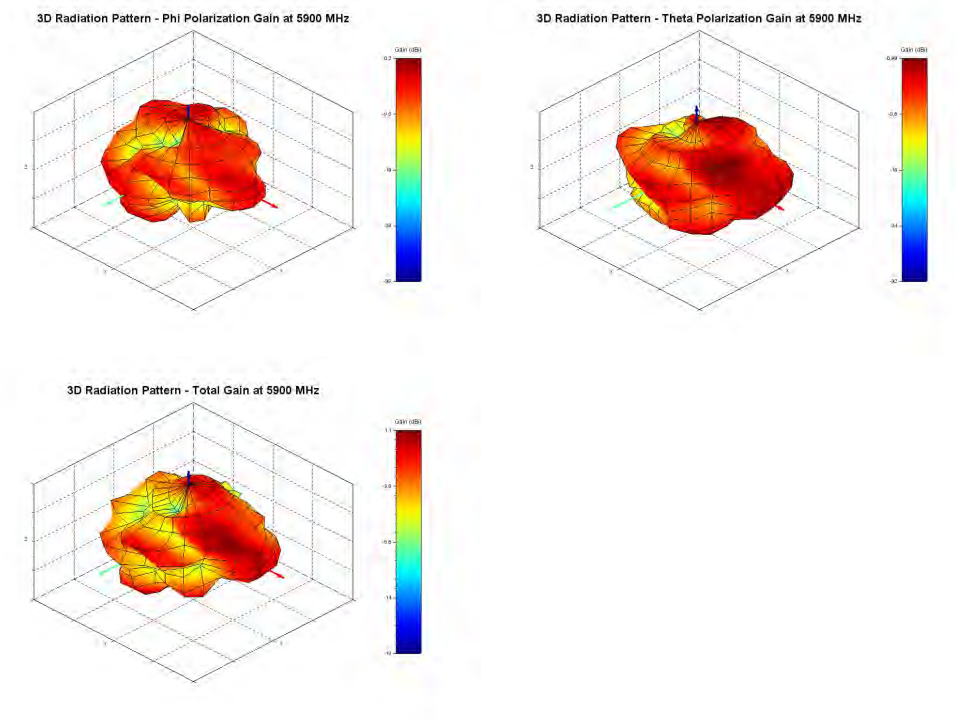

Figure 29: Phi, Theta, and total gain plots

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8 Optimal installation Guide

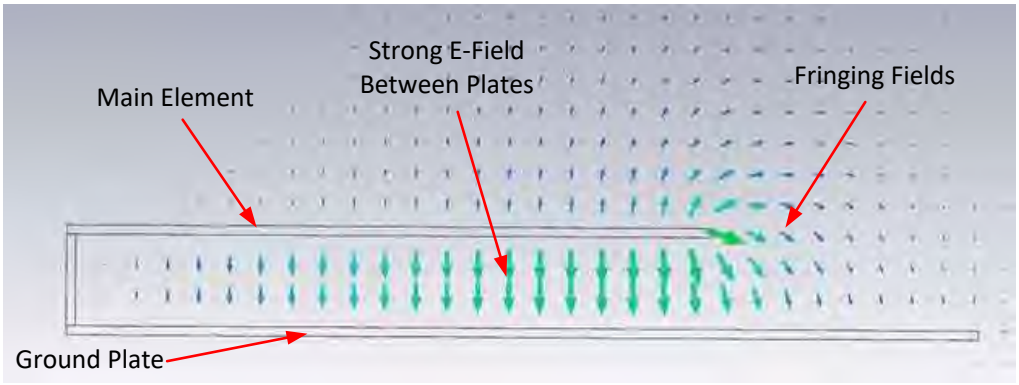
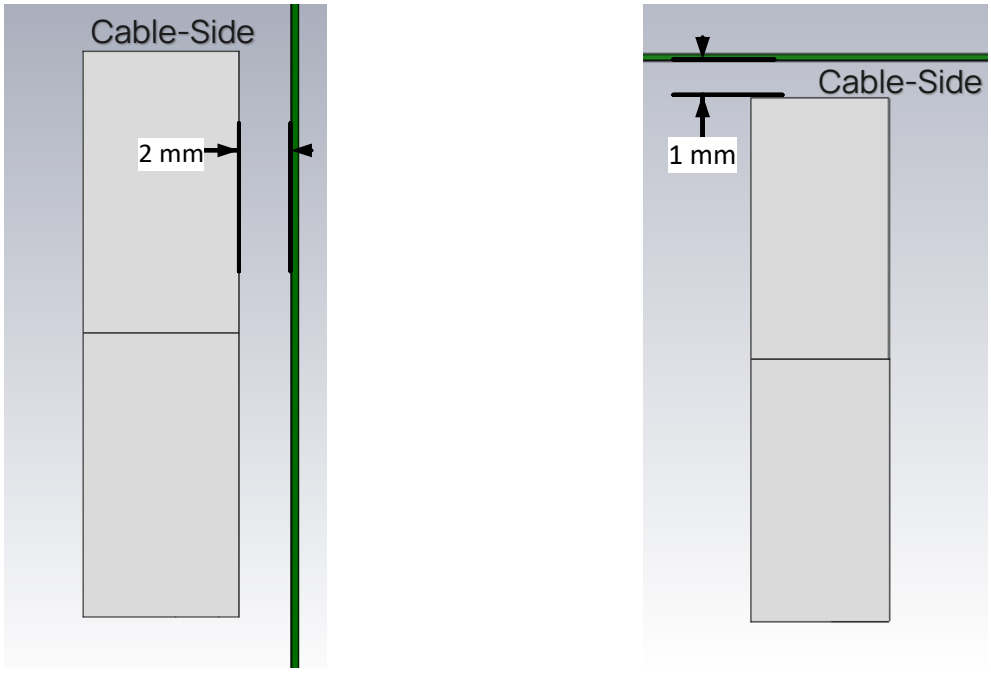


Figure 30: E-field radiation from FlexPIFA – taken from CST simulation

The main element should be kept clear of any non-metal objects (such as plastics) on top of it by at least three millimeters (see Figure 32). Similarly, the two long sides of the FlexPIFA should be kept clear of any non-metal object by at least two millimeters (See Figure 33). A one-millimeter 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 31: Top clearance



Side Clearance *Ground Wall Clearance*

Figure 32: Side and ground wall clearance

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The ideal material on which to mount the FlexPIFA is 1.5-millimeter 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) or away from the ground wall. These options are shown in Figure 34.

Perpendicular to the side

Away from the ground wall

Figure 33: 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 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 interfere with the fields radiating from the FlexPIFA (this is true for any antenna). Other objects, such as an LCD display, placed close 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 absorb radiation
- Paint – Do not use metallic coating or flakes

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8.1.1 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 16 millimeters. Going smaller than this may result in the antenna peeling off the surface over time. Should a tighter radius of curvature be required, contact Ezurio for assistance.

Figure 34: Convex-mounted

The FlexPIFA should not be flexed in a concave position with a radius less than 25 millimeters. 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 datasheet, 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 25 millimeters, the fringing fields are adversely affected, and gain suffers. If a tighter radius of curvature is required, contact Ezurio for assistance.

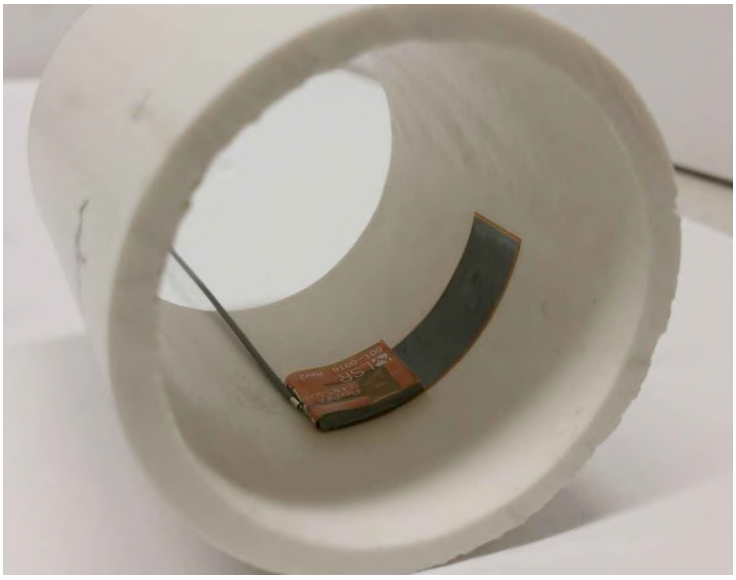

Figure 35: Concave-mounted

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

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8.1.2 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 (see Figure 31). 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 Ezurio for a custom antenna build to help meet your application needs.

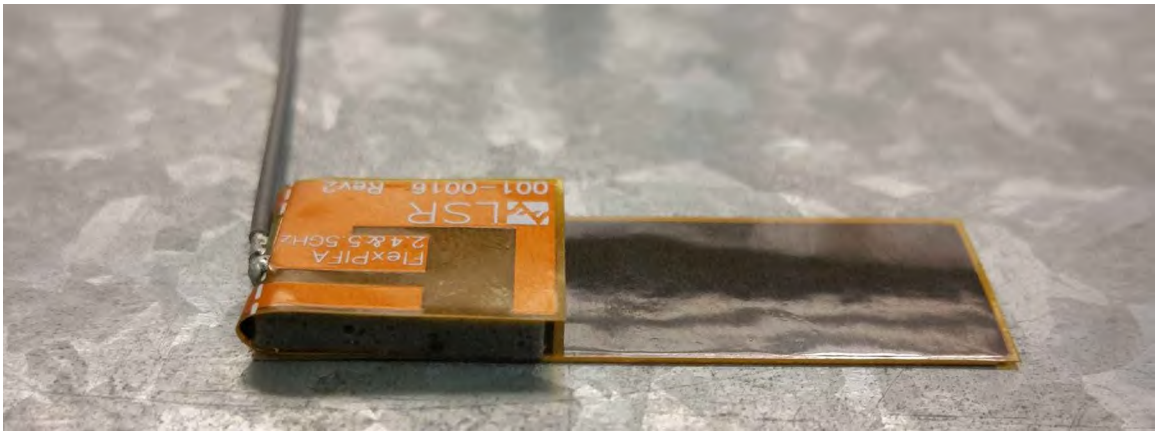

Figure 36: FlexPIFA mounted on metal

Do not mount the FlexPIFA where metal is within ten millimeters above the main element (see Figure 39). Not only does this severely limit the radiation pattern (mainly due to the re-radiation problem previously described) it detunes 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 five millimeters. These keep out requirements pertaining 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 38). The spacer should be 1.5 millimeters 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 provides the best results.

Figure 37: FlexPIFA mounted on metal Surface with 1.5 mm thick polycarbonate spacer

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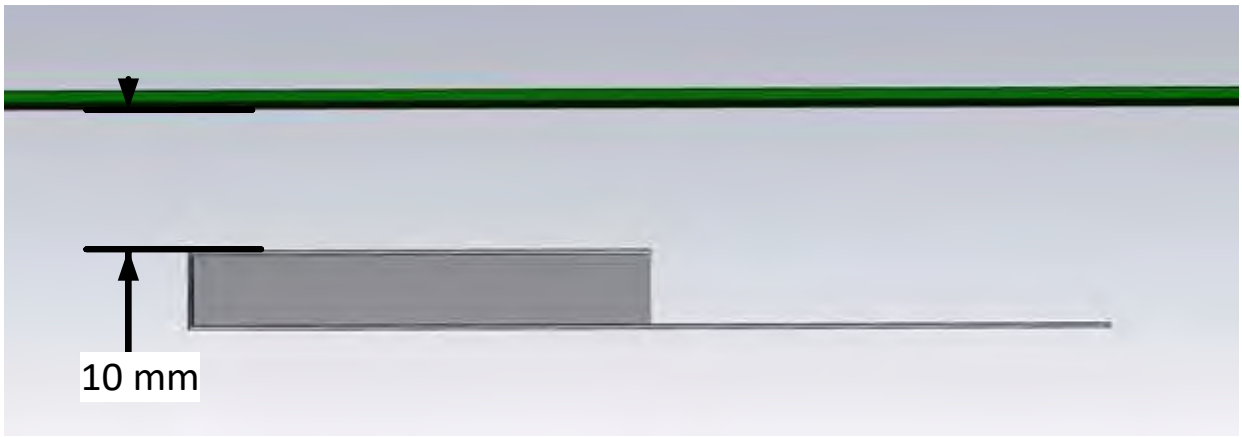

Figure 38: Metal near main element

For body-worn applications, the FlexPIFA can tolerate the presence of the human body. We do not recommend that you mount the antenna directly on body tissue to avoid detuning the FlexPIFA.

Additionally, the human body is an excellent absorber of 2.4 GHz RF signals. As a result, 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 is not covered by the hand. If the antenna is mounted in a location where the main element is covered or near a human body, ensure that there is at least a ten-millimeter separation distance between the main element and the body as shown in Figure 39.

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 ensures maximum performance and prevents 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 40 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 39: FlexPIFA integrated into bracelet

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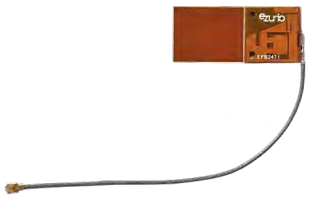
9 Additional Information

Please contact your local sales representative or our support team for further assistance:

Headquarters	Ezurio 50 S. Main St. Suite 1100 Akron, OH 44308 USA
Phone	Americas: +1-800-492-2320 Europe: +44-1628-858-940 Hong Kong: +852-2762-4823
Website	http://www.ezurio.com
Technical Support	http://www.ezurio.com/resources/support
Sales Contact	http://www.ezurio.com/contact

Note: Information contained in this document is subject to change.



In 2020 the FCC announced the allocation of a new frequency spectrum for Wi-Fi applications, extending the frequencies up to 7125 MHz.

FlexPIFA 6E antennas support the full Wi-Fi spectrum of 2400-2500, 4900-5925, and 5925-7125 MHz frequency bands. This makes them an ideal solution for coverage of traditional Wi-Fi frequencies with the addition of futureproofing for newly emerging Wi-Fi 6E applications.

Designed for rapid integration into space-constrained devices and housings, the flexible, adhesive-backed antennas are available with MHF1 or MHF4L connectors, providing multiple installation solutions for IoT device manufacturers.

PIFA antenna technology provides consistent, stable performance across all three Wi-Fi bands, ensuring a solid and reliable connection at all times.

1 Features and Benefits

- **Full Coverage** – Operates over all three Wi-Fi bands
- **Performance** – Exceptional performance across all bands
- **Versatile** – Flexible, peel-and-stick adhesive-backed antenna for a variety of space-constrained IoT devices
- **Future-Proofed** – Coverage for emerging Wi-Fi 6E applications
- **Reliable** – PIFA technology is easy to integrate into IoT devices and less likely to detune in proximity of metal or a human body
- **Quality** – Designed and built to exacting specifications

2 Applications

- Smart metering and utilities
- Industrial IoT
- Agricultural and rural (Farm sense and control)
- Quick service restaurants
- Smart lockers
- Medical devices

ELECTRICAL SPECIFICATIONS			
Number of Ports		1	
Operating Frequency (MHz)	2400-2500	4900-5925	5925-7125
VSWR – Avg	1.4:1	1.9:1	1.6:1
VSWR – Max	<2.5:1	<3.0:1	<3.0:1
Peak Gain – (dBi) *	2.2	3.9	3.8
Efficiency – Avg (%)	59	60	60
Efficiency – Avg (dB)	-2.3	-2.2	-2.2
Nominal Impedance (ohms)		50	
Max Power - Ambient 25°C (W)		5	
Polarization		Linear	
Azimuth Beamwidth		360°, Omnidirectional	

Note: Measured on a 100 mm x 100 mm x 1.7 mm thick polycarbonate sheet.
***** Actual peak gain values can be influenced by measurement variation and other uncertainties.

MECHANICAL SPECIFICATIONS	
Dimensions – length x width x height – mm (inches)	16 x 36 x 2.5 (0.62 x 1.41 x .098)
Weight – g (oz.)	0.6
Adhesive	3M 467MP

ENVIRONMENTAL SPECIFICATIONS	
Operating Temperature – °C (°F)	-40 to +85°C (-40 to +185°F)
Storage Temperature – °C (°F)	-40 to +85°C (-40 to +185°F)
Material Substance Compliance	RoHS

3 Configuration

PART NUMBER	EXPOSED CABLE LENGTH/DIAMETER	CONNECTOR
EFB2471A3S-10MHF1	100 mm/1.13 mm	MHF1
EFB2471A3S-10MH4L	100 mm/1.13 mm	MHF4L

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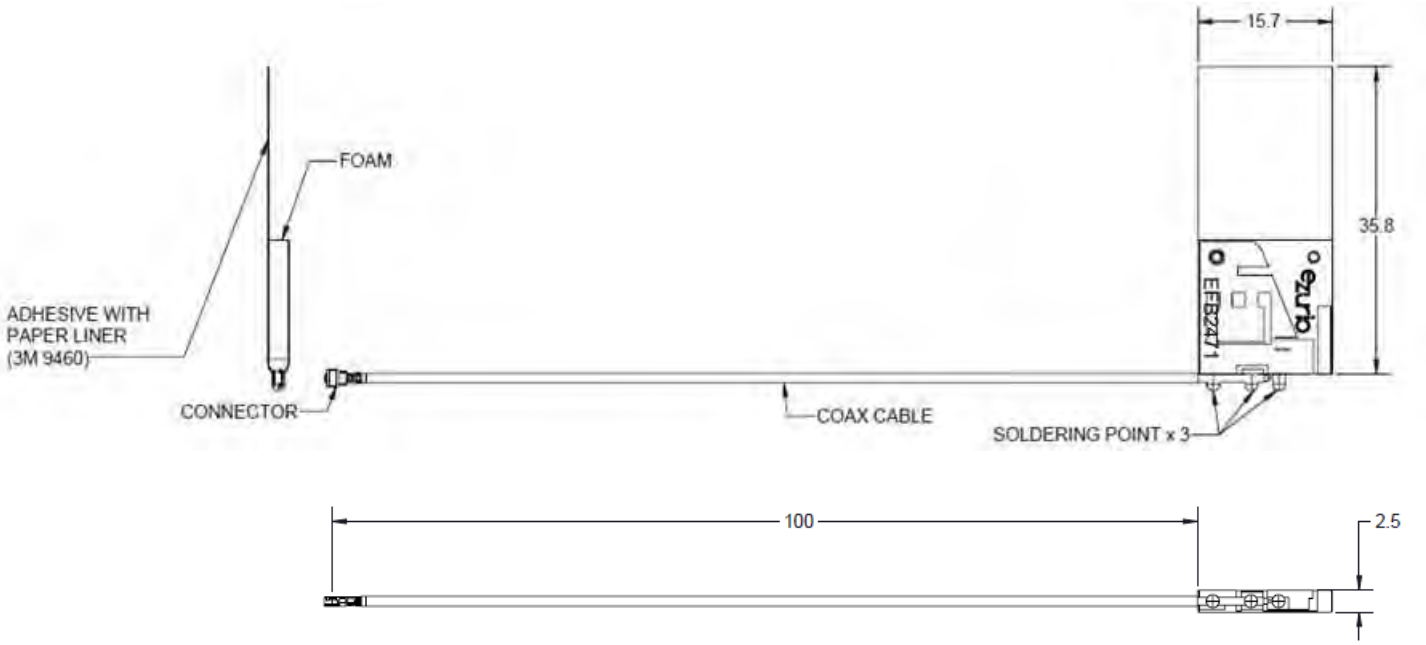
4 Mechanical Drawing



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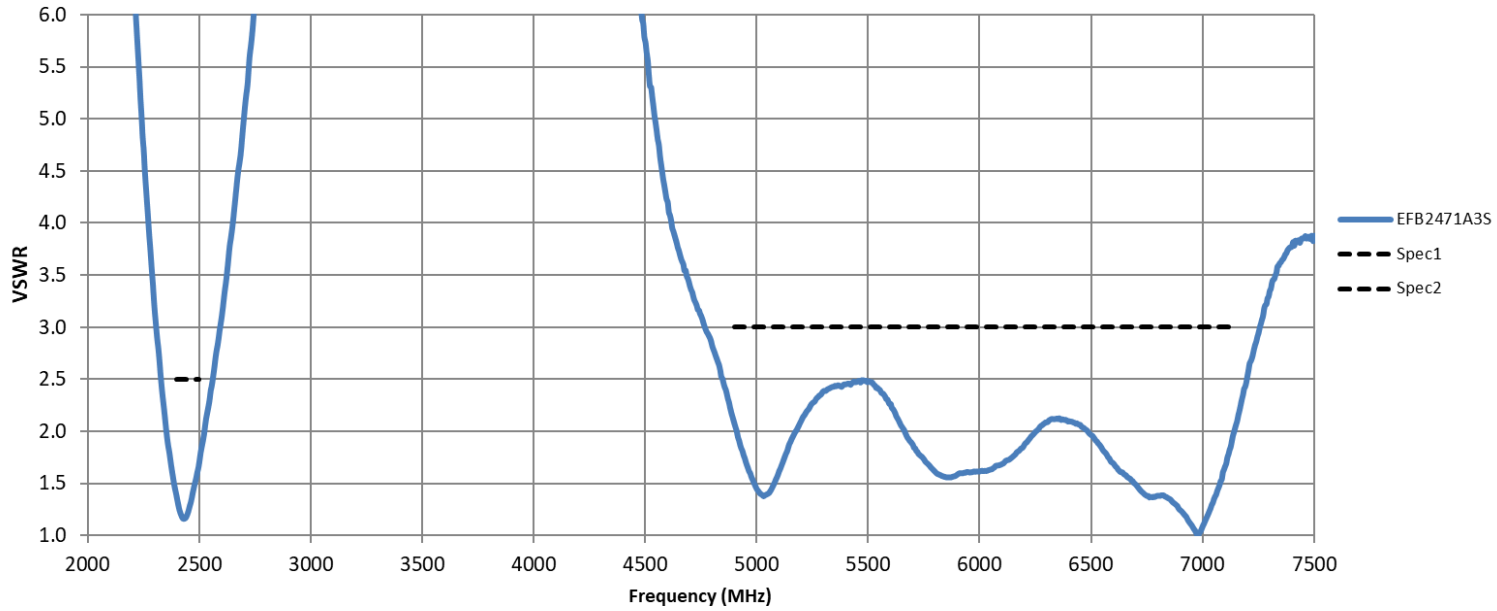
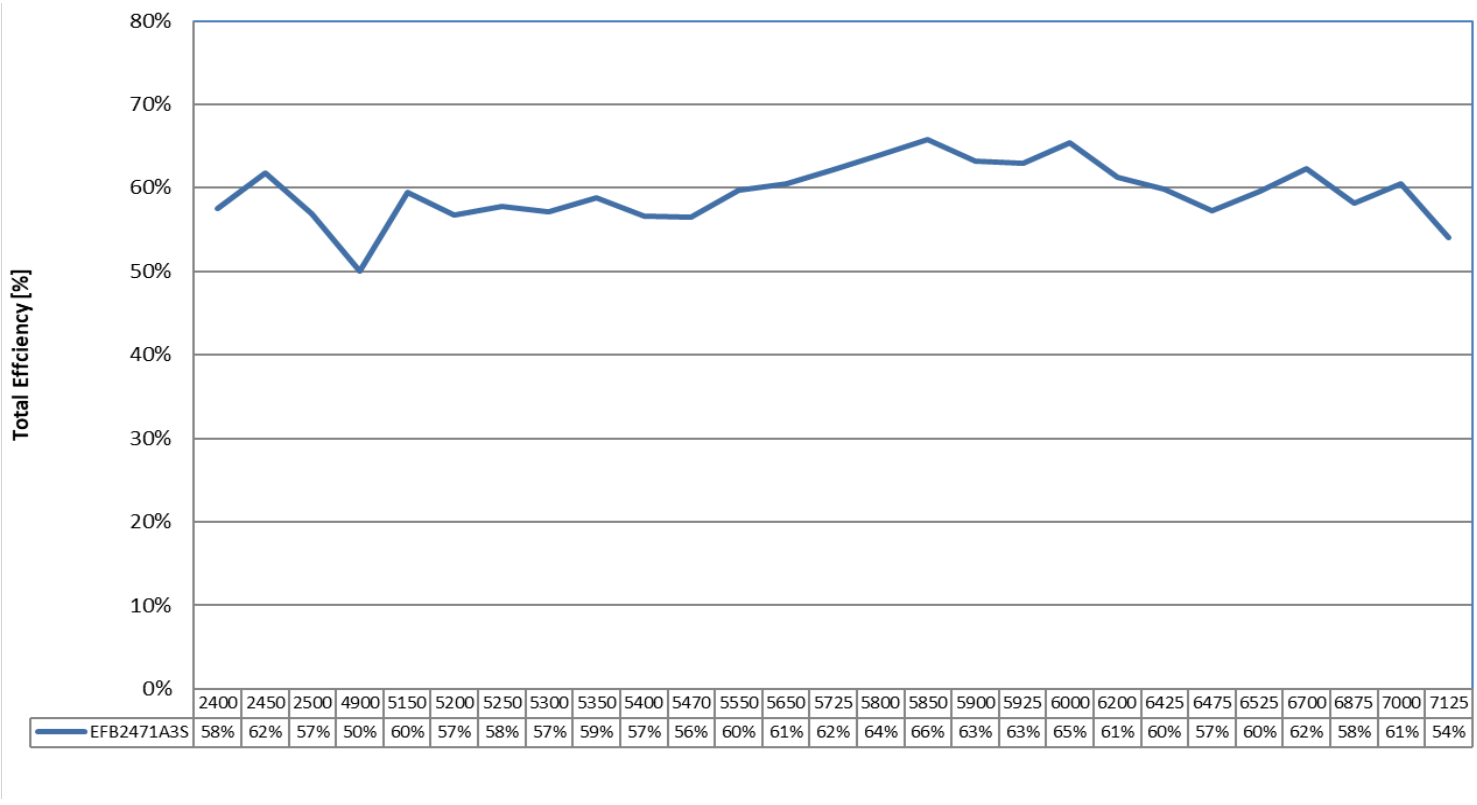
VSWR



TOTAL EFFICIENCY



	2400	2450	2500	4900	5150	5200	5250	5300	5350	5400	5470	5550	5650	5725	5800	5850	5900	5925	6000	6200	6425	6475	6525	6700	6875	7000	7125
EFB2471A3S	58%	62%	57%	50%	60%	57%	58%	57%	59%	57%	56%	60%	61%	62%	64%	66%	63%	63%	65%	61%	60%	57%	60%	62%	58%	61%	54%

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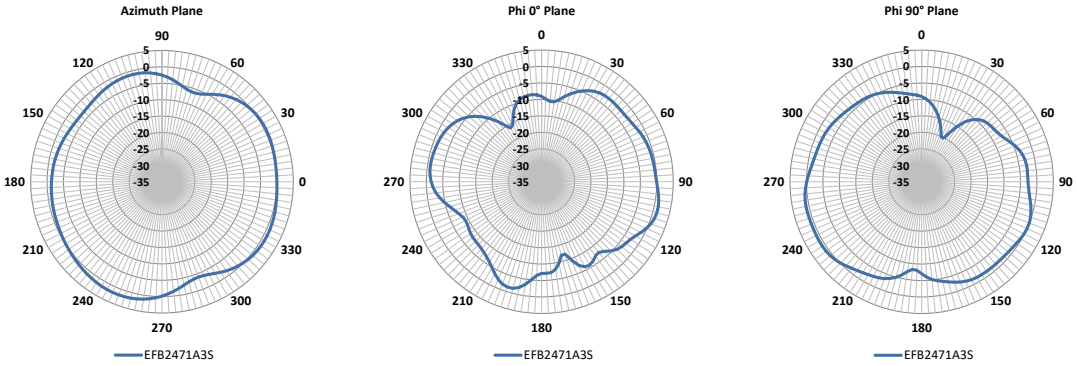
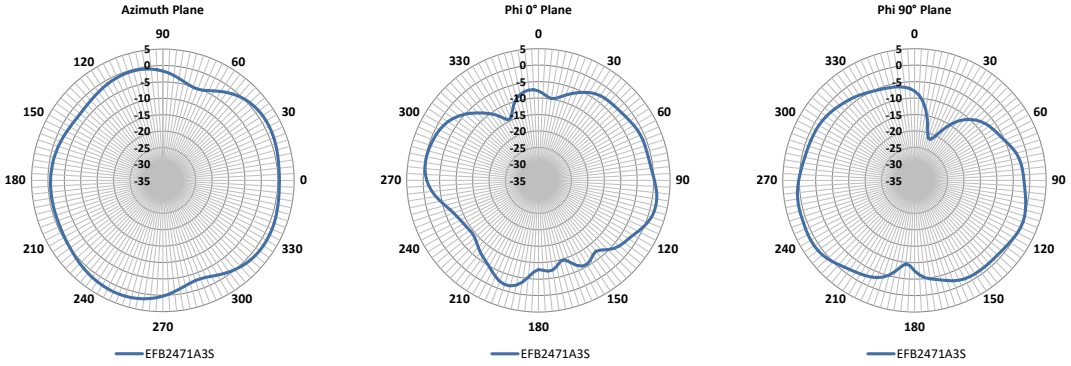
RADIATION PATTERNS

2400 MHz

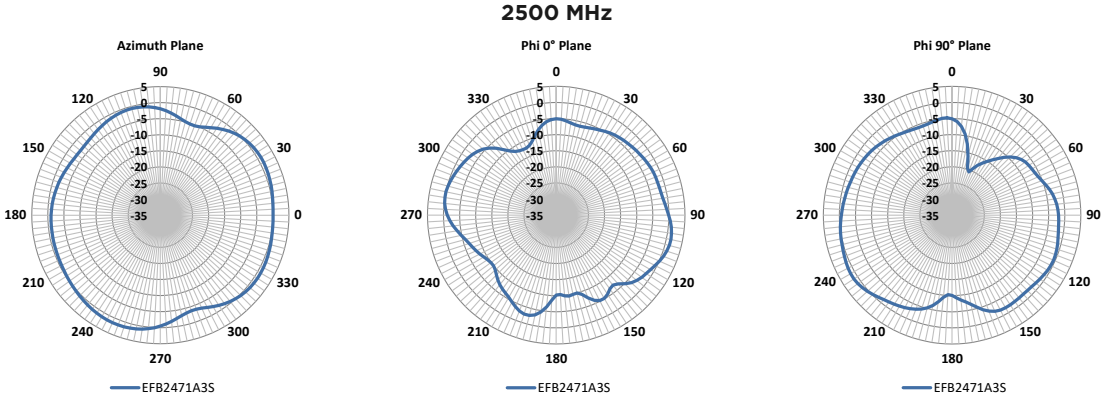


2450 MHz



5 Radiation Patterns

2500 MHz



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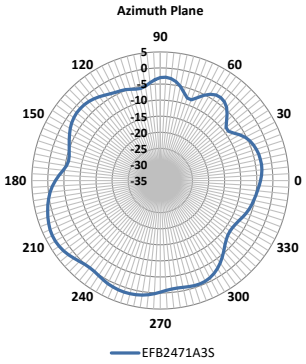
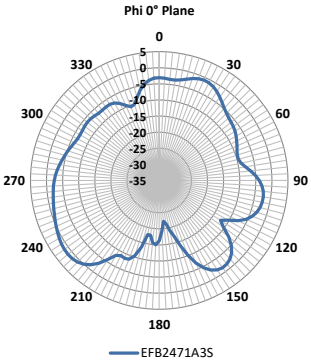
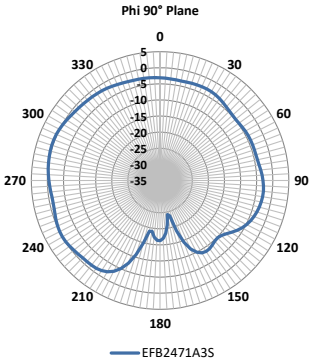
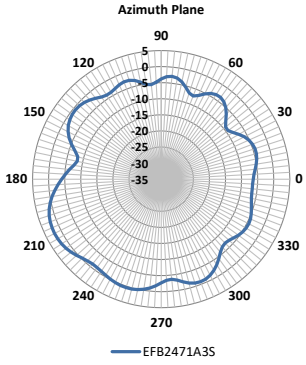
4900 MHz

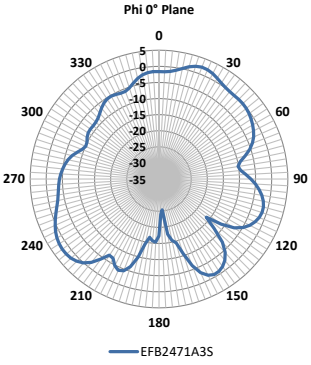


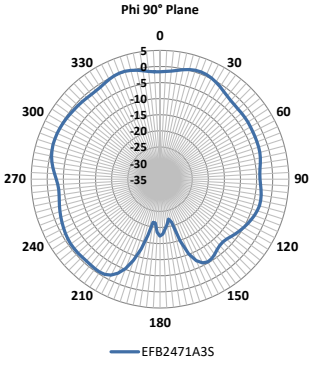




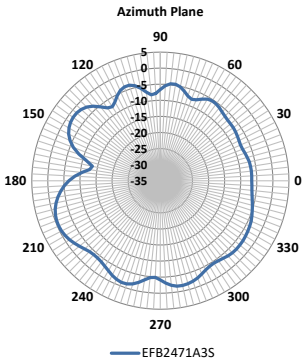
5150 MHz

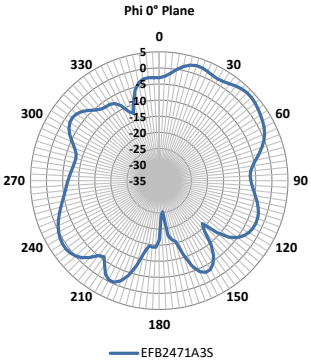


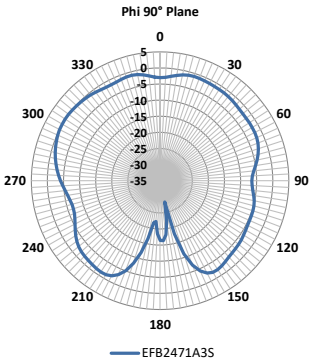




5470 MHz







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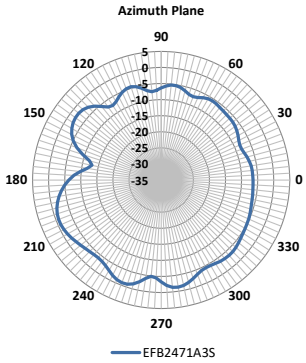
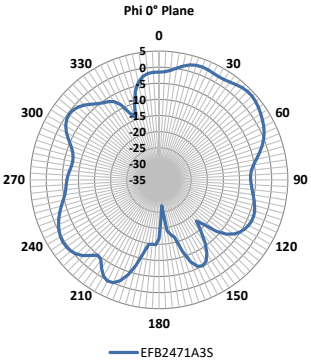
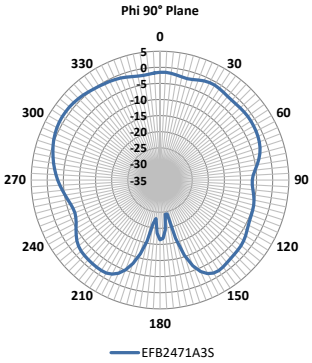
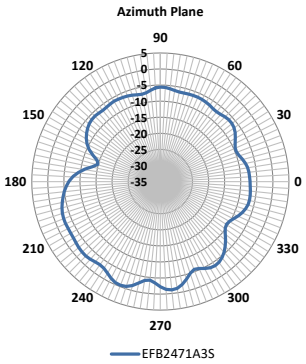
5500 MHz

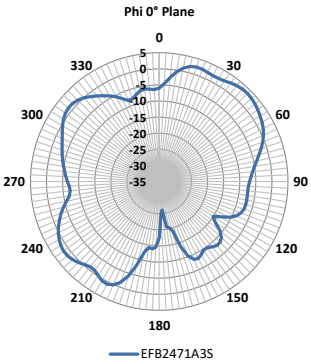


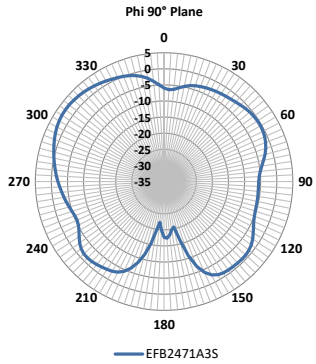




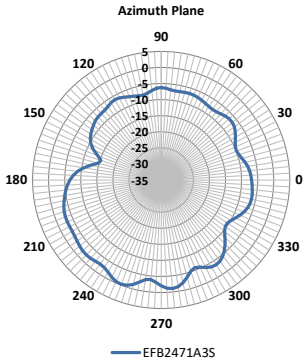
5850 MHz

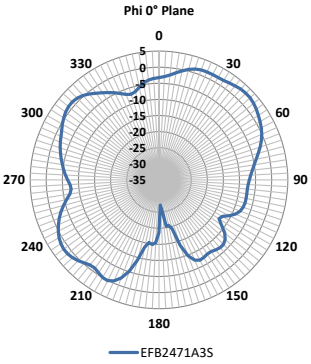


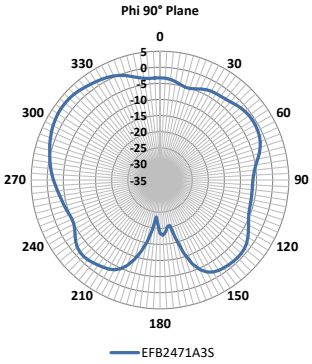




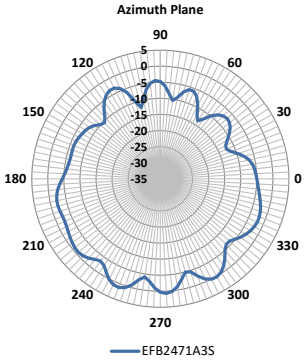
5925 MHz

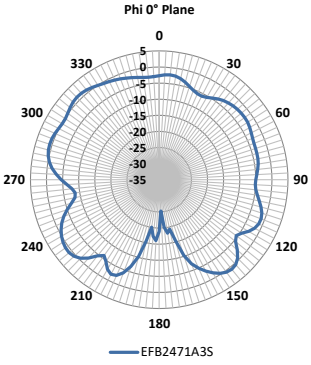


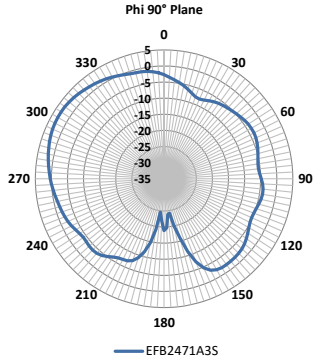




6425 MHz

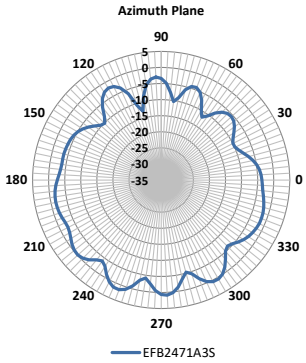


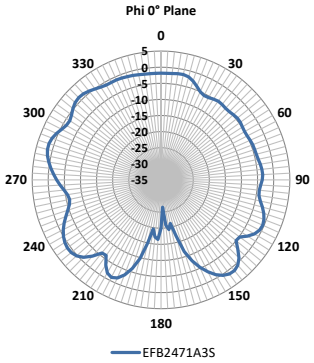


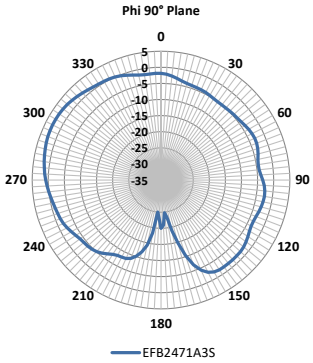


Americas: +1-800-492-2320
Europe: +44-1628-858-940
Hong Kong: +852-2762-4823

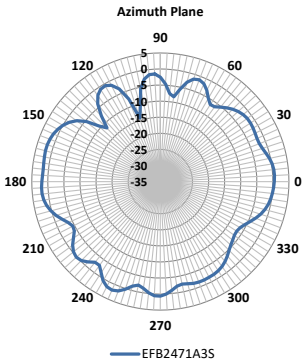
6525 MHz

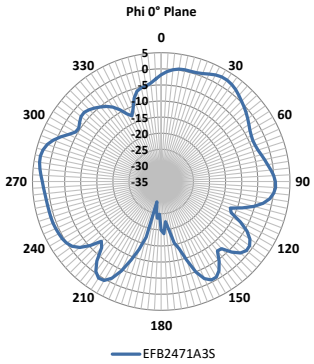


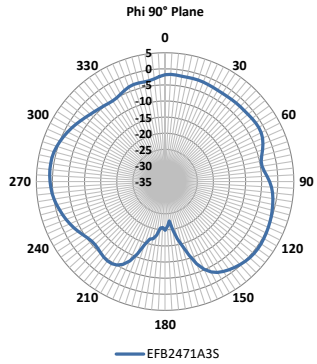




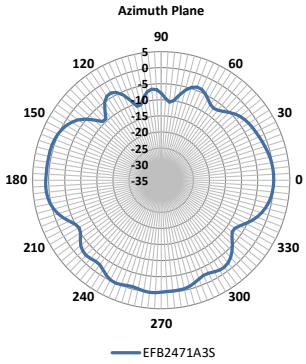
6875 MHz

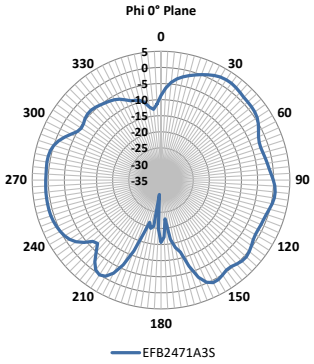


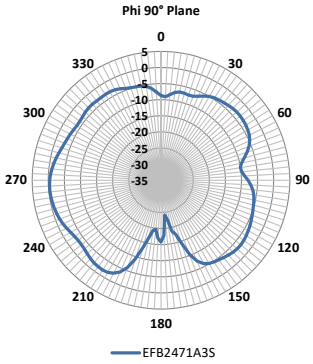




7125 MHz





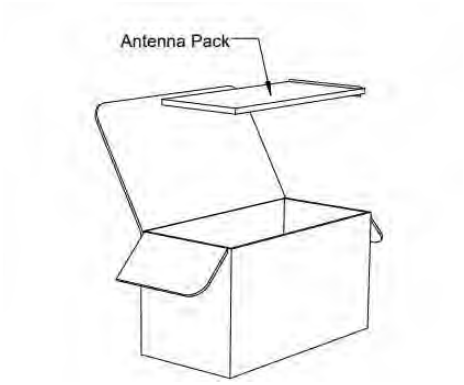


Americas: +1-800-492-2320
Europe: +44-1628-858-940
Hong Kong: +852-2762-4823

6 Packaging Information

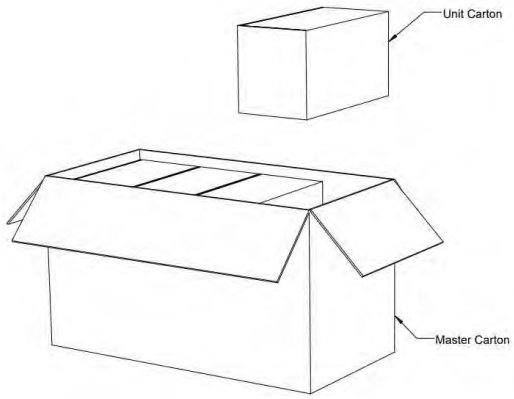
Carton Layout

Unit Carton



- Dimensions: 245 mm x 120 mm x 135 mm
- Weight: 0.22 kg
- Zipper bag 152 mm x 229 mm (10 antennas per bag)
- 20x zipper bags per carton (200 antennas total)

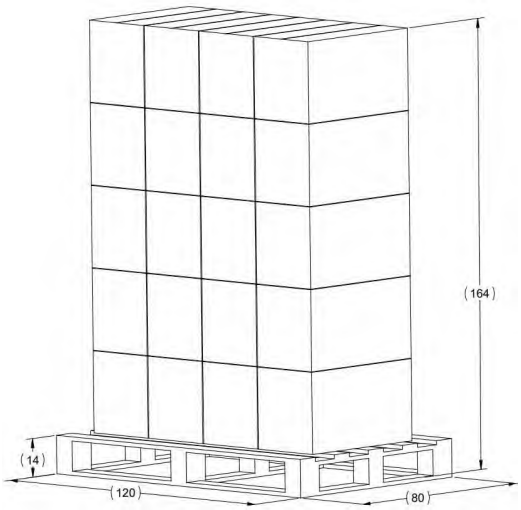
Master Carton



- Dimensions: 520 mm x 260 mm x 295 mm
- Weight: 2.4 kg
- Total of 8-unit cartons per master carton
- Total of 1600 antennas per master carton

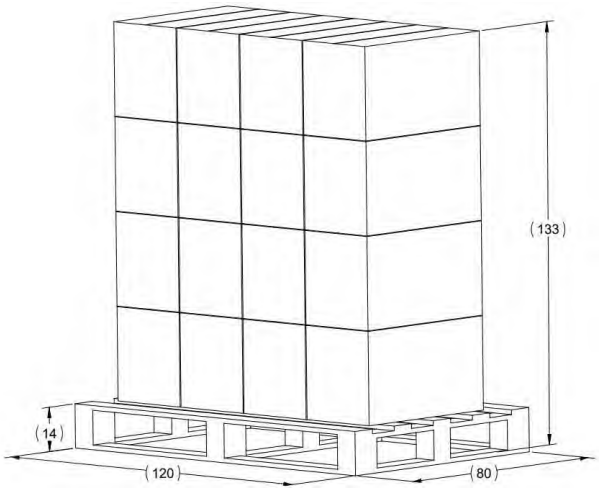
Pallet Layout

Ocean Shipping Pallet



- Pallet base dimensions: 120 cm x 80 cm x 14 cm
- Full loaded dimensions: 120 cm x 80 cm x 164 cm
- 20 master cartons (4 x 5 layout), 60 kg total
- 32000 antennas per pallet

Air Shipping Pallet



- Pallet base dimensions: 120 cm x 80 cm x 14 cm
- Full loaded dimensions: 120 cm x 80 cm x 133 cm
- 16 master cartons (4 x 4 layout), 50.4 kg total
- 25600 antennas per pallet

Americas: +1-800-492-2320
Europe: +44-1628-858-940
Hong Kong: +852-2762-4823

7 Additional Information

Please contact your local sales representative or our support team for further assistance:

Headquarters	Ezurio 50 S. Main St. Suite 1100 Akron, OH 44308 USA
Phone	Americas: +1-800-492-2320 Europe: +44-1628-858-940 Hong Kong: +852-2762-4823
Website	http://www.ezurio.com
Technical Support	http://www.ezurio.com/resources/support
Sales Contact	http://www.ezurio.com/contact

Note: Information contained in this document is subject to change.

承　認　書

A P P R O V A L　S H E E T

CUSTOMER: Laird Connectivity Inc.

CUSTOMER MODEL NO.:

JOYMAX MODEL NO.: TWX-100BRSAX-2001

DESCRIPTION: #100A 2.4~2.4835GHz/5.15~7.125GHz Antenna, Swivel type Black

REV.: A

DATE: 2022/6/20

Customer Approval	Joymax Approval
	士誼科技事業股份有限公司 研發部 發行章

士誼科技事業股份有限公司
JOYMAX ELECTRONICS CO., LTD.
Tel:+886-3-4335698 Fax:+886-3-4337898
E-mail:sevice@joymax.com.tw

桃園市中壢區中壢工業區東園二路5號
No.5 Dong Yuan Rd.2,Jhongli industrial Park,
Jhongli Dist,Tao Yuan,Taiwan,R.O.C.
http://www.joymax.com.tw

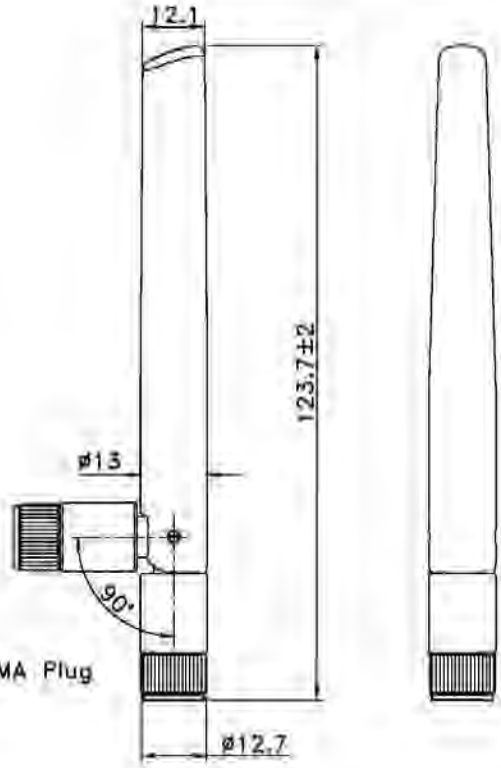
Index

Modification History:

Rev.	Date	Content
A	2022/6/20	

1. Specification & Dimension

REV	ZONE	DESCRIPTION	ECN NO.	ENG	APPROVED	DATE

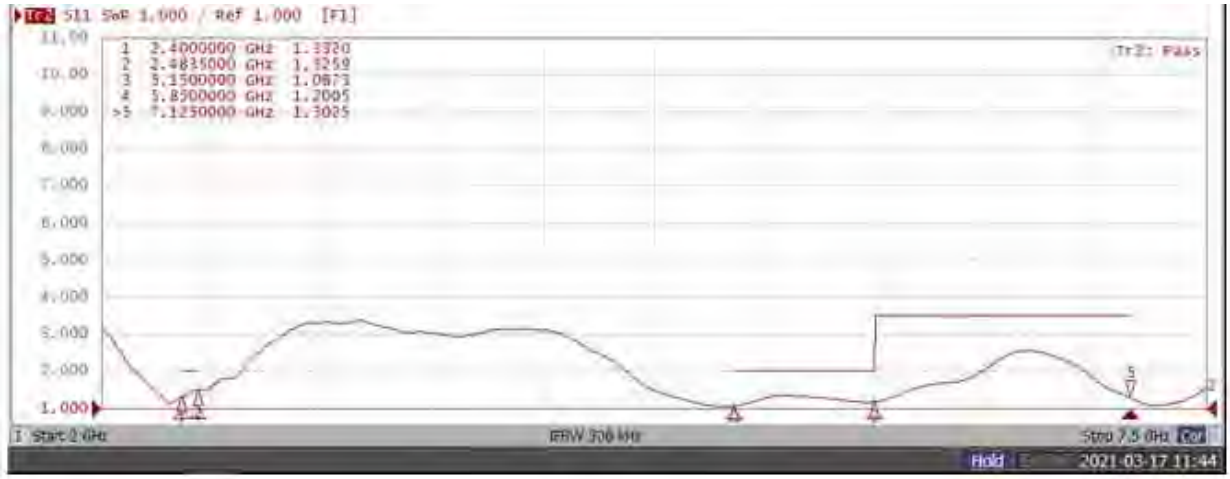


Electrical Properties	
Frequency Range	2.4~2.4835 GHz 5.15~5.85 GHz 5.85~7.125 GHz
Impedance	50Ω
V.S.W.R.	≤2.0@2.4~2.4835 GHz ≤2.0@5.15~5.85 GHz ≤3.5@5.85~7.125 GHz
Radiation	Omni
Gain	2dBi@2.4~2.4835 GHz 4dBi@5.15~5.85 GHz 4dBi@5.85~7.125 GHz
Polarization	Vertical
Mechanical Properties	
Radome Material	PC+PBT
Connector Type	Reverse SMA Plug
Dimension	L=123.7mm
Weight	15 g (est.)
Operating Temp.	-40℃~+85℃
Storage Temp.	-40℃~+85℃

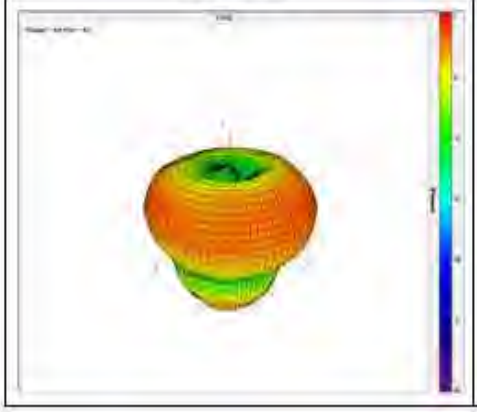
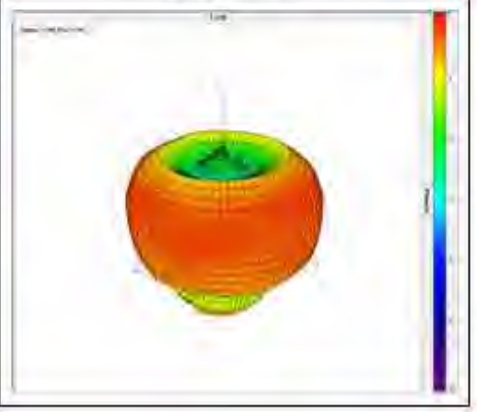
UNLESS OTHERWISE SPECIFIED TOLERANCE'S (in): X ± 1 ; X.X ± 0.5 ; X.XX ± 0.25 ; ANG. ± 2.0°	DRAWN BY: JOAN	MATERIAL:	TITLE : 100A 2.4~2.4835GHz/5.15~7.125GHz Antenna, Swivel type Black
	DESIGNED BY: NICK	FINISH:	DRAW NO. : SSP-220189
	CHECKED BY: SARA/KY	SCALE: 1/1; UNIT: mm	PART NO. : TWX-100BRSAX-2001
THIRD ANGLE PROJECTION	APPOVED BY: MATT	DATE: 2022/6/20	JOYMAX ELECTRONICS CO.,LTD.
THIS DRAWING CONTAINS INFORMATION THAT IS PROPRIETARY TO JOYMAX AND SHOULD NOT BE USED WITHOUT WRITTEN PERMISSION.		REV: A	

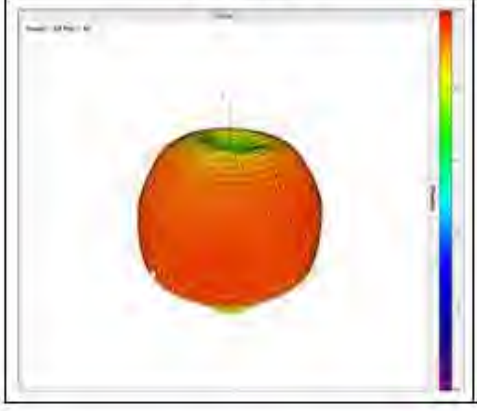
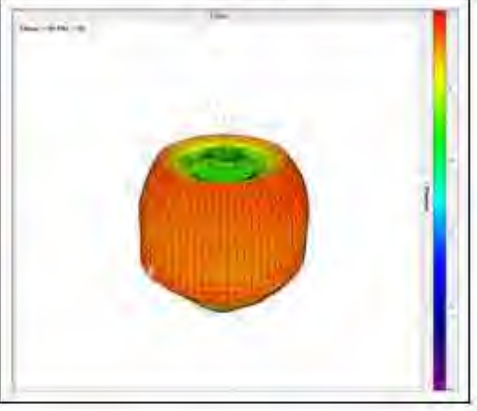
2.Test Condition & Report
2.1 V.S.W.R

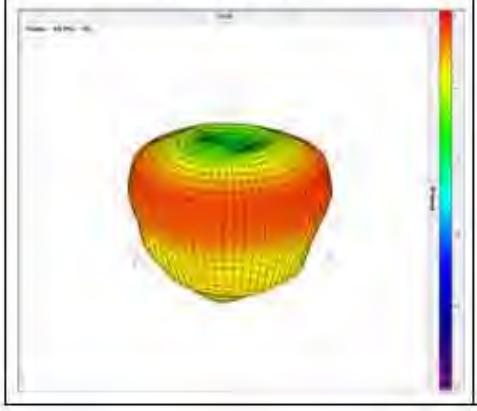
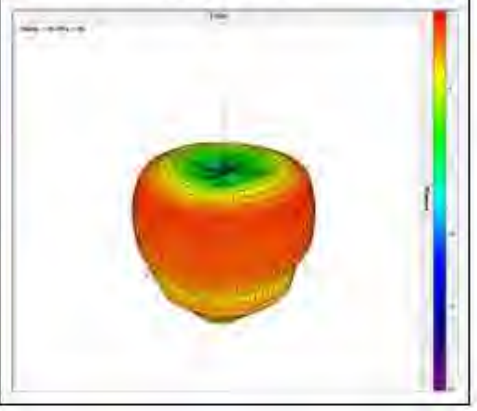
V.S.W.R.



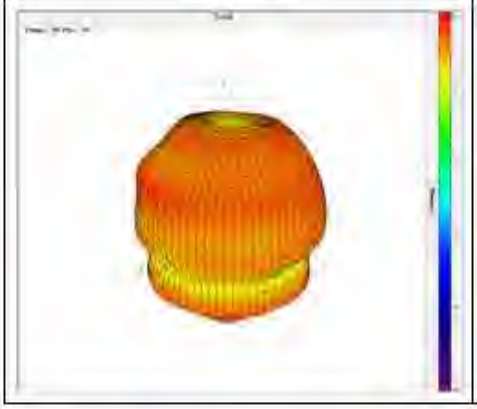
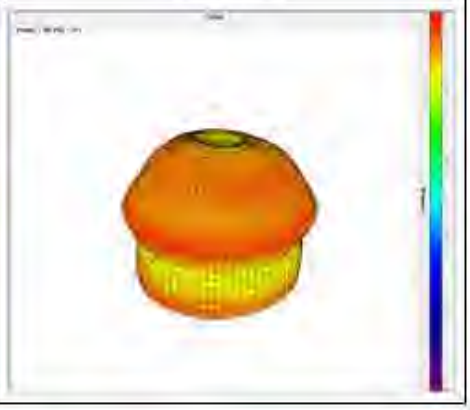
2.2 Pattern

2400MHz	2483.5MHz
	

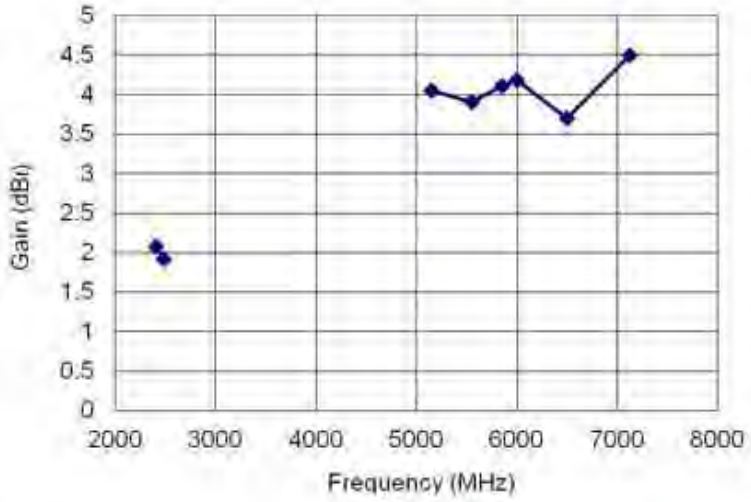
5150MHz	5550MHz
	

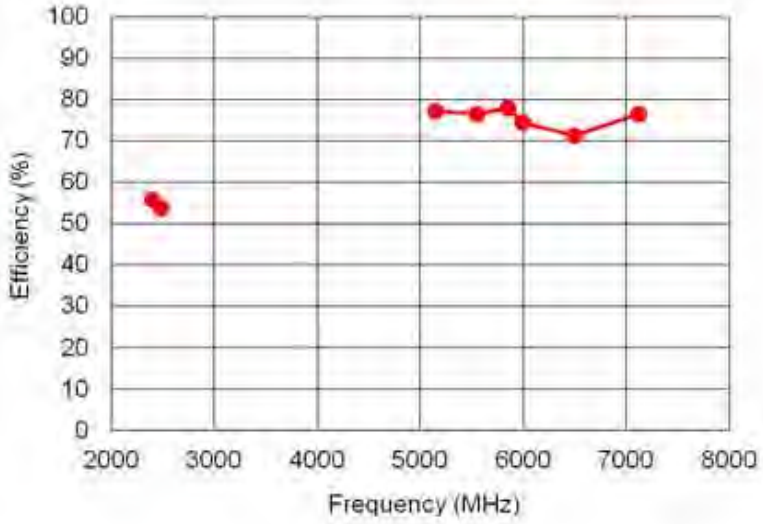
5850MHz	6000MHz
	

2.2 Pattern

6500MHz	7125MHz
	

2.3 Gain and Efficiency

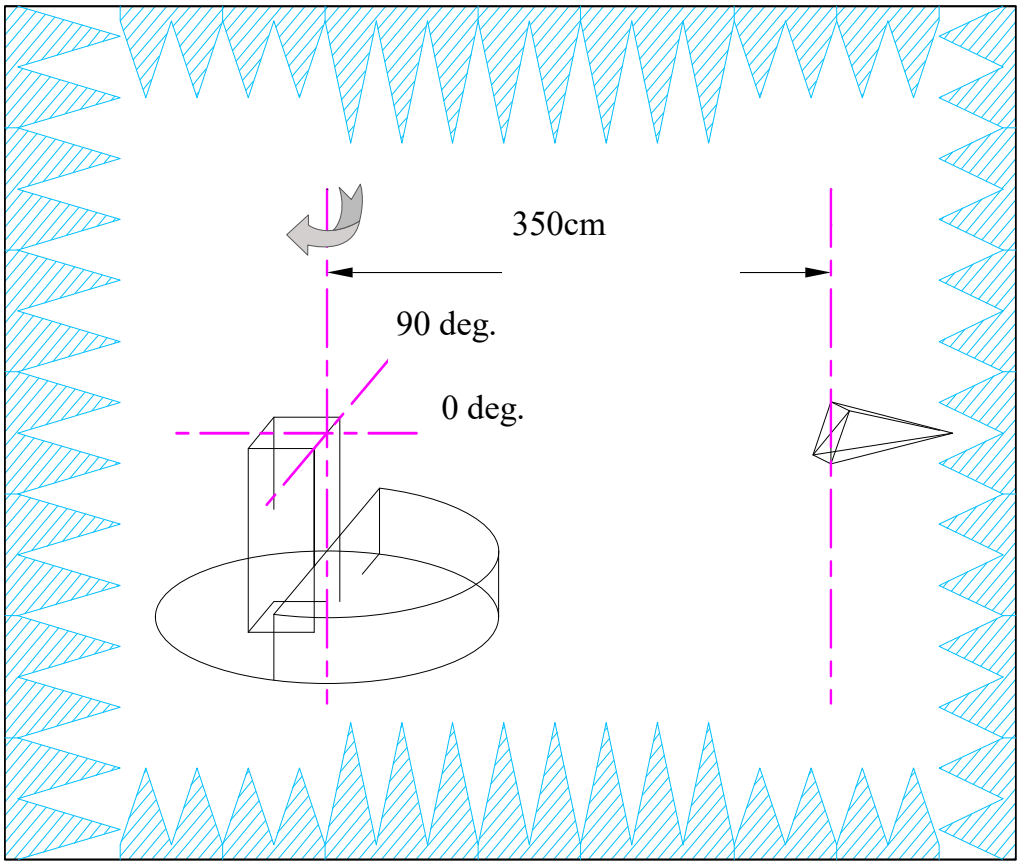




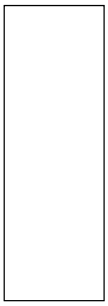
Frequency (MHz)	2400	2483.5	5150	5550	5850	6000	6500	7125
Gain (dBi)-	2.08	1.92	4.05	3.91	4.11	4.18	3.7	4.5
Efficiency (%)	55.71	53.7	77.2	76.6	78	74.33	71.2	76.5

Pattern Test Equipment

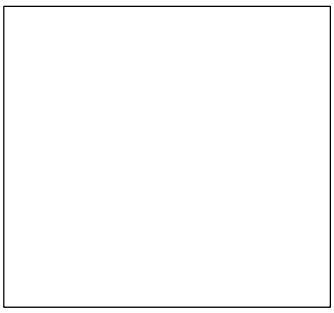
Anechoic chamber: 100MHz~6GHz 8*6*6m (※ 1m Quiet zone at 800MHz)
Source Antenna: ETS-3164 Dual Polarized Horn
Network Analyzer: Agilent E5071B 100kHz~8.5GHz



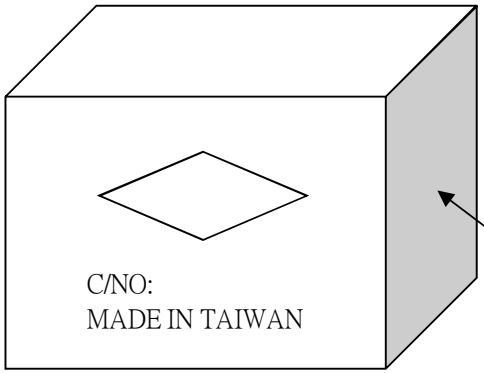
3. Package



1 1pcs antenna / 1 PE bag
PE bag size 50*200mm



2 50pcs antenna / 1 PE bag
PE bag size 280*450mm



3 500pcs antenna / 1 Carton
Carton size 320*250*230mm

MODEL No.:
Q'ty: PCS
N.W: PCS
G.W: PCS

Packing q'ty is for reference only, adjust it based on production packing.