TITLE

WIFI 6E FLEX CABLED SIDE-FED ANTENNA

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WIFI 6E FLEX CABLED SIDE-FED ANTENNA

1.0 SCOPE

This specification describes the antenna application and surrounding. The information in this document is for reference and benchmark purposes only. The user is responsible for validating antenna RF performance based on the user's actual implementation.

Antenna illustrations in this document are generic representations. They are not intended to be an image of any antenna listed in the scope.

2.0 PRODUCT DESCRIPTION

2.1 PRODUCT NAME AND SERIES NUMBER (S)

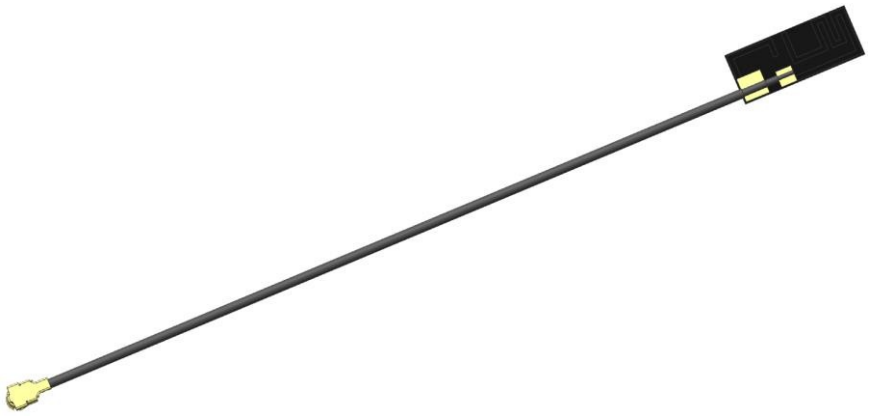
Product name: WiFi 6E Flex Cabled Side-fed Antenna
Series Number: 206994

2.2 DESCRIPTION

Series 206994 is a small monopole flexible antenna for 2.4/5/6GHz dual band. This antenna is made from poly-flexible material with small size 15.4*6.4*0.15mm, and has double-sided adhesive tape for easy "peel and stick" mounting.

2.3 PRODUCT STRUCTURE INFORMATION

Please refer to PS-2069940100 for full information.



Molex Antenna 3D View

3.0 APPLICABLE DOCUMENTS

DOCUMENT	NUMBER	DESCRIPTION
Sale Drawing (SD)	SD-2069940100	Mechanical Dimension of the product
	SD-2069941100	
Product Specification (PS)	PS-2069940100	Product Specification
Packing Drawing (PK)	PK-2069940100	Product packaging specifications
	PK-2069941100	

4.0 ANTENNA PERFORMANCE

4.1 RF TEST CONDITIONS

All measurements are done of the antenna mounted on a PC/ABS material block of 1.5mm thickness with VNA Agilent E5071C and Over-The-Air (OTA) chamber. All measurements in this document are done with the part no.2069940100 with a cable length of 100mm.

FIGURE4.1.1 ANTENNA LOADED WITH PC/ABS BLOCK OF 1.5MM THICKNESS

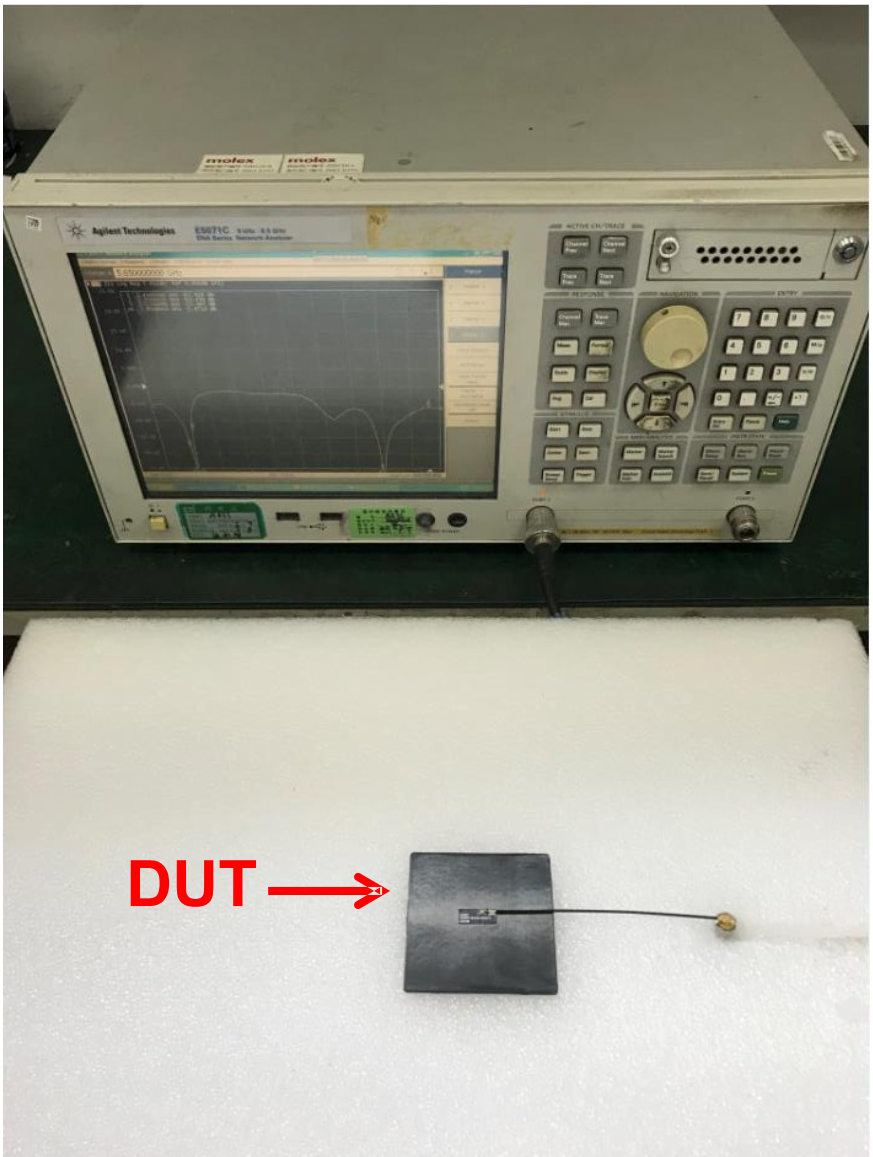


FIGURE4.1.2 ANTENNA LOADED WITH PC/ABS BLOCK OF 1.5MM THICKNESS TESTED WITH VNA E5071C

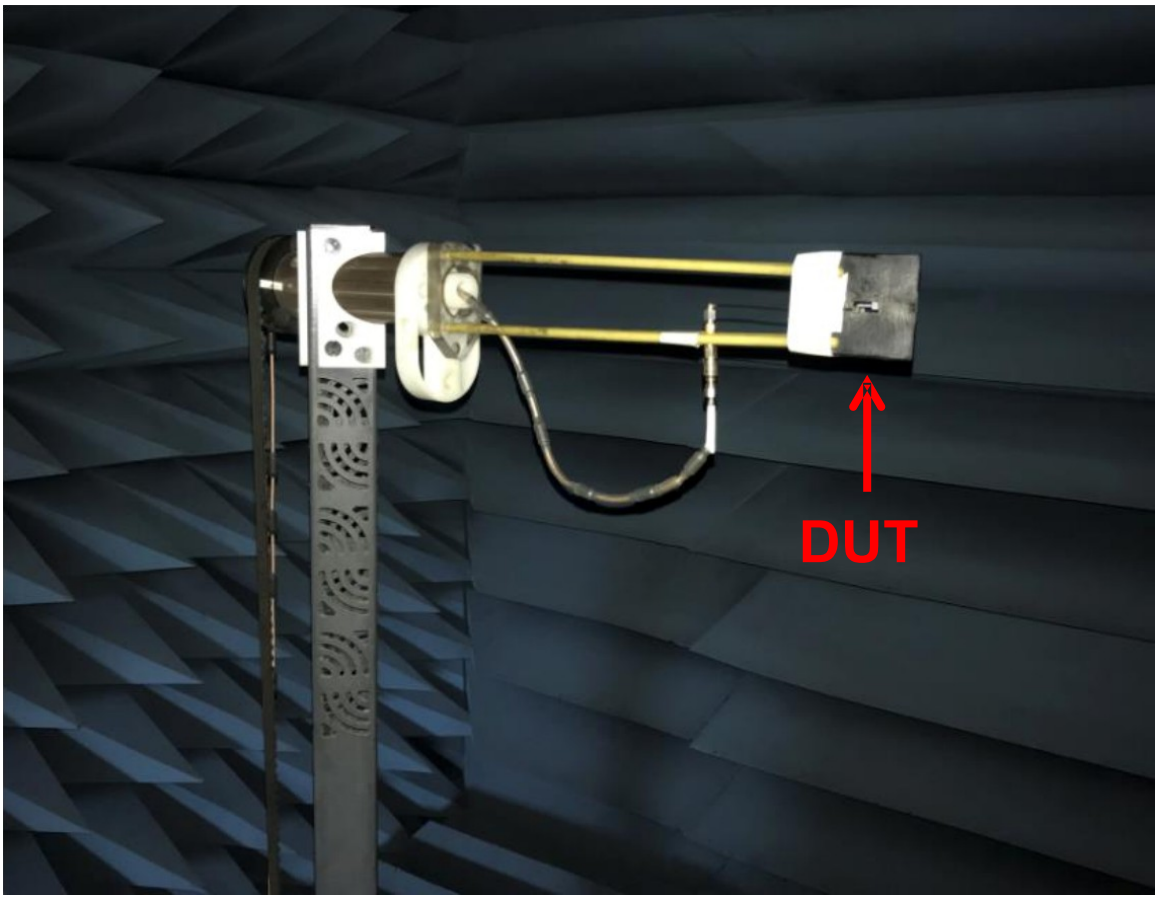


FIGURE4.1.3 ANTENNA LOADED WITH PC/ABS BLOCK OF 1.5MM THICKNESS TESTED IN OTA CHAMBER

4.2 ANTENNA PERFORMANCE

DESCRIPTION	EQUIPMENT	REQUIREMENT		
Frequency Range	VNA E5071C	2.4-2.5GHz	5.15-5.85GHz	5.925-7.125GHz
Return Loss	VNA E5071C	< -10 dB	<-5dB	<-3dB
Peak Gain (Max)	OTA Chamber	3.6dBi	3.6dBi	2.7dBi
Average Total Efficiency	OTA Chamber	>55%	>70%	>40%
Polarization	OTA Chamber	Linear		
Input Impedance	VNA E5071C	50 ohms		

Note that the above antenna performance is measured with just the antenna mounted on a PC/ABS block to similar a free-space condition. When implement into the system, the frequency resonant might be off-tune due to the loading of surrounding components especially metal plane. This off-tune can be compensated through matching. Although module manufacturers specify a peak gain limit, it is based on free-space conditions. The peak gain will be degraded by 1 to 2dBi in the actual implementation as the radiation pattern will change due to the surround components. As such, during selection of antenna, you can select one with high peak gain to compensate for the loss. Molex can offer assistant to choose the best location and best tuning in-order to meet this peak gain requirement.

4.3 RETURN LOSS PLOT

All measurements in this document are done with a cable length of 100mm.

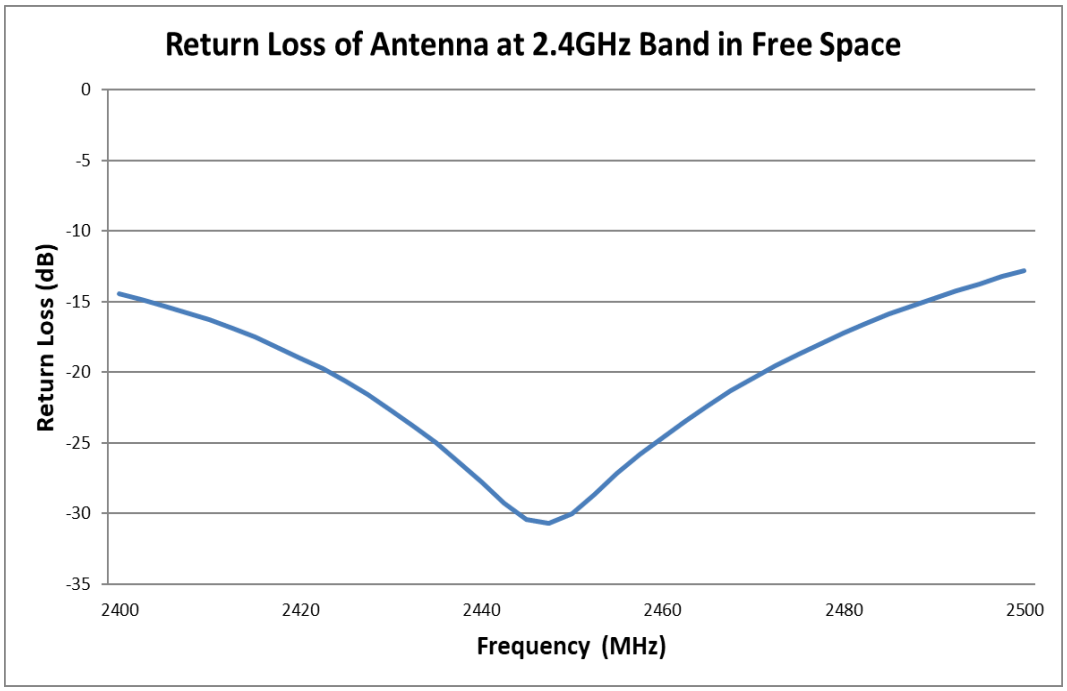


FIGURE 4.3.1 RETURN LOSS OF ANTENNA AT WIFI 2.4GHZ BAND IN FREE SPACE

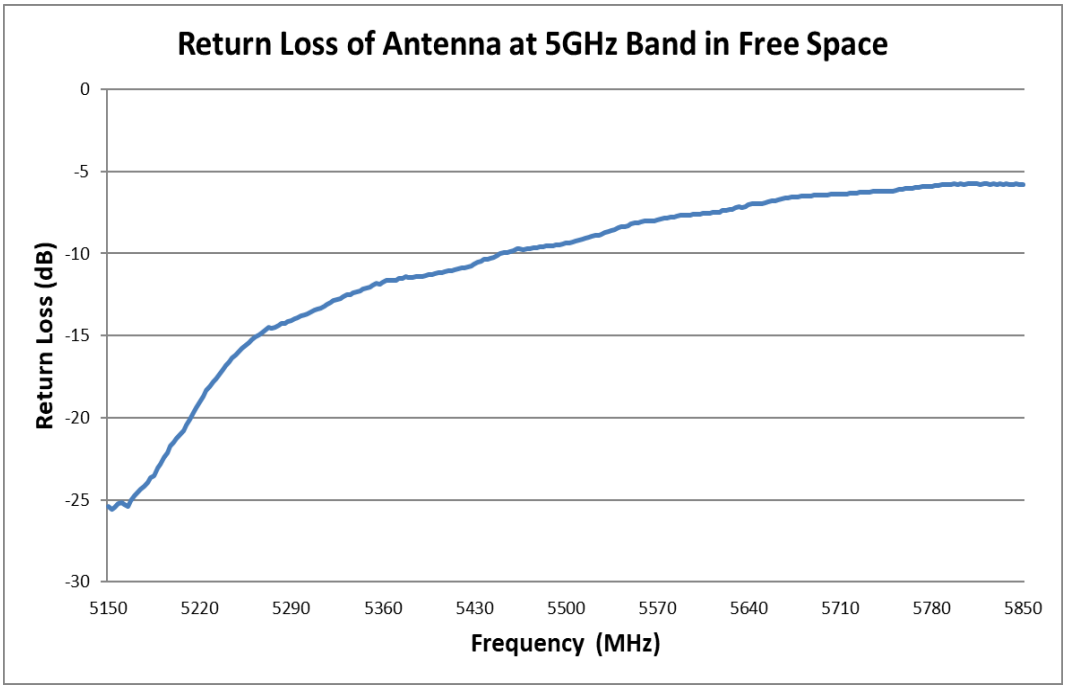


FIGURE 4.3.2 RETURN LOSS OF ANTENNA AT WIFI 5GHZ BAND IN FREE SPACE

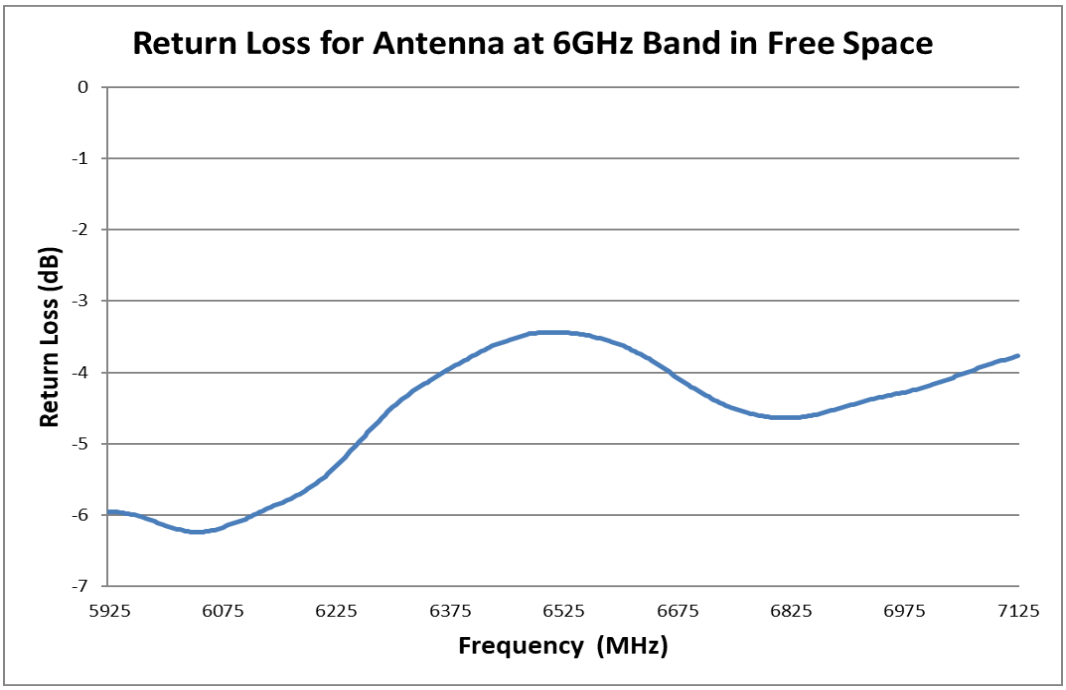


FIGURE 4.3.3 RETURN LOSS OF ANTENNA AT WIFI 6GHZ BAND IN FREE SPACE

4.4 EFFICIENCY PLOT

All measurements in this document are done with a cable length of 100mm.

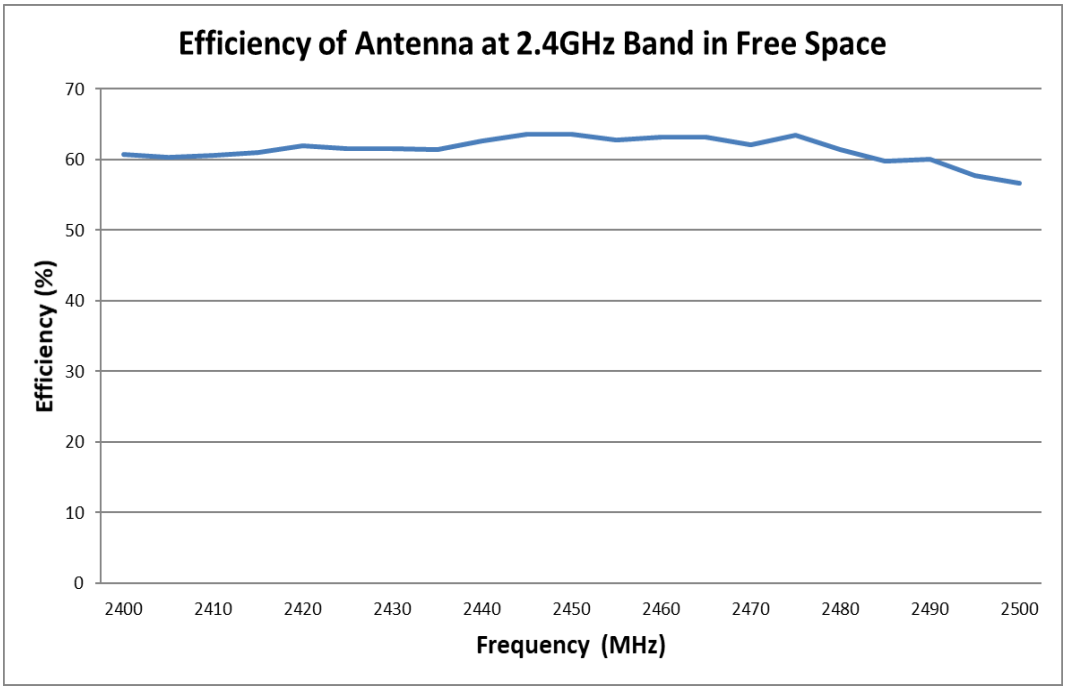


FIGURE 4.4.1 EFFICIENCY OF ANTENNA AT WIFI 2.4GHZ BAND IN FREE SPACE

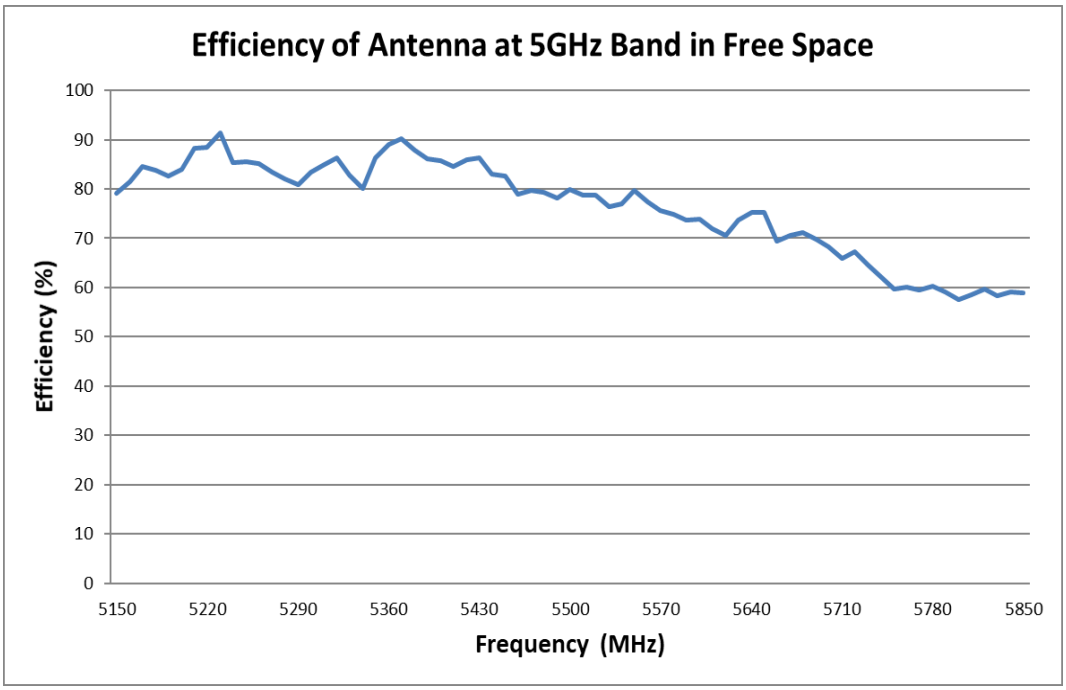


FIGURE 4.4.2 EFFICIENCY OF ANTENNA AT WIFI 5GHZ BAND IN FREE SPACE

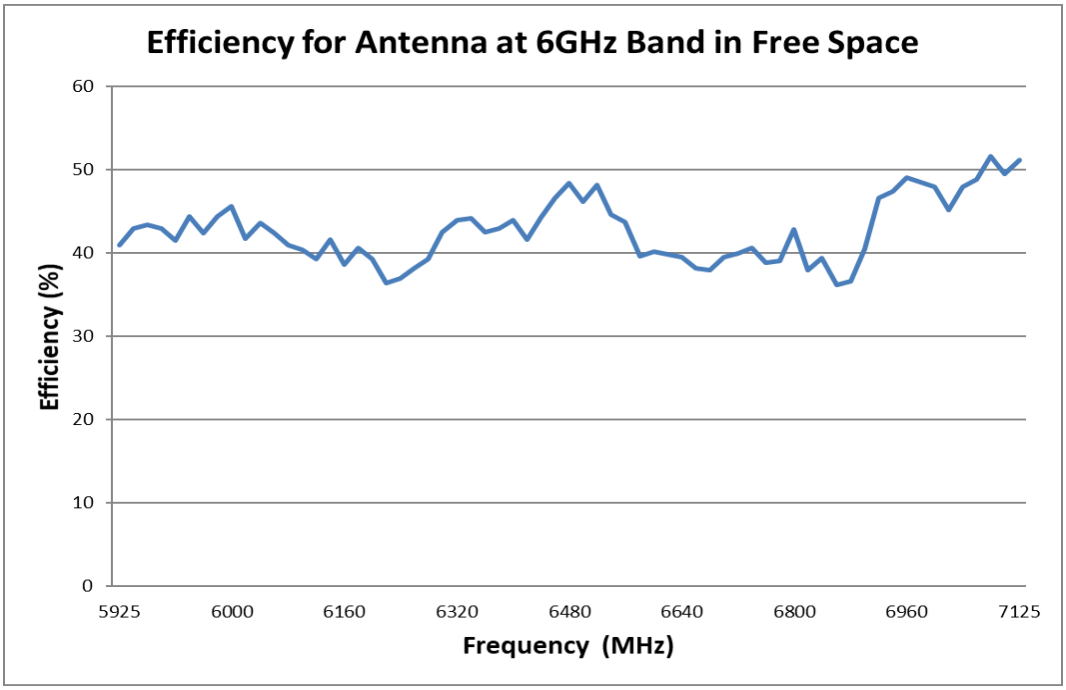


FIGURE 4.4.3 EFFICIENCY OF ANTENNA AT WIFI 6GHZ BAND IN FREE SPACE

4.5 RADIATION PATTERN

All measurements in this document are done with a cable length of 100mm.

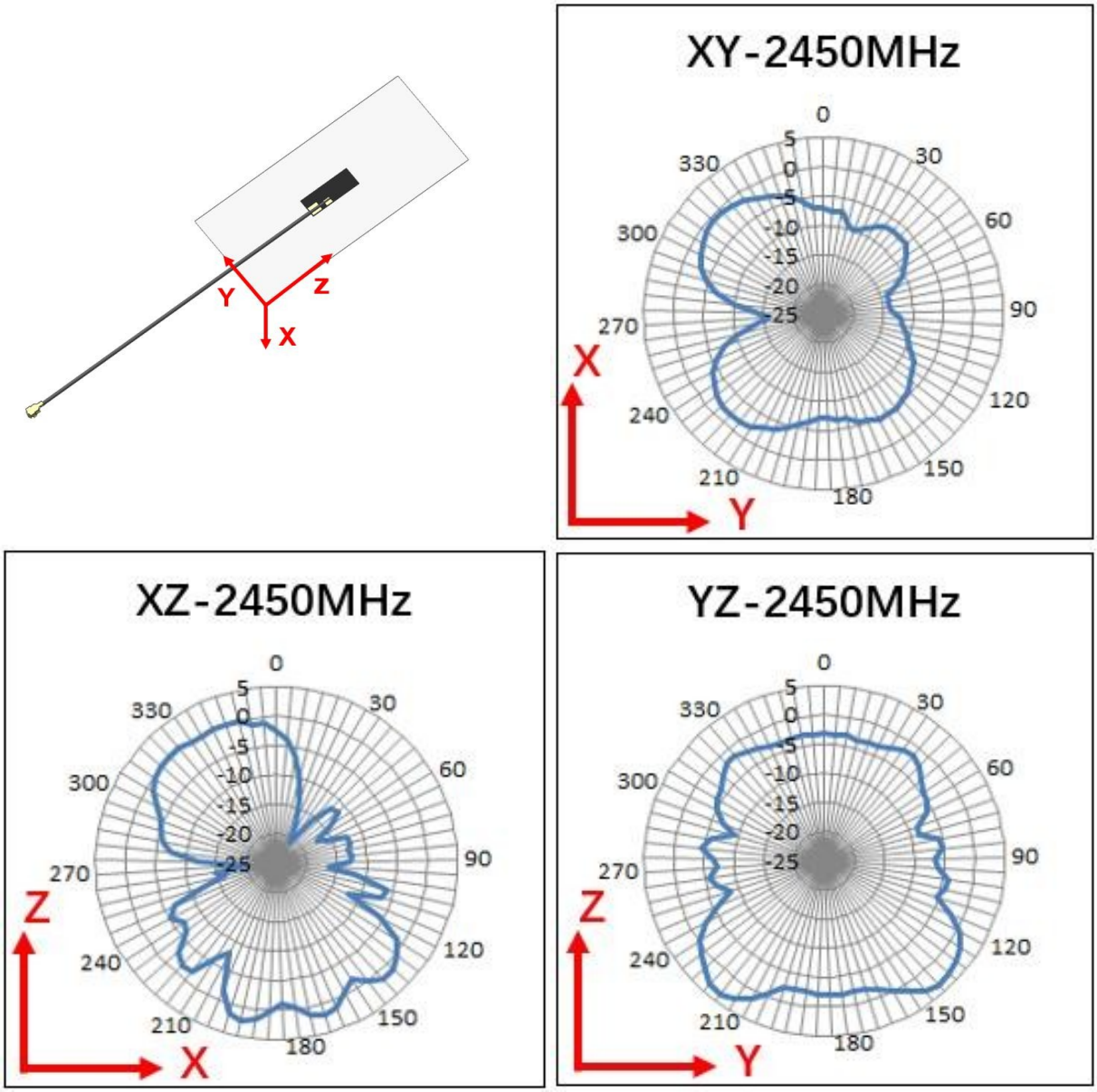


FIGURE 4.5.1 2D RADIATION PATTERN OF ANTENNA AT 2450MHZ IN FREE SPACE

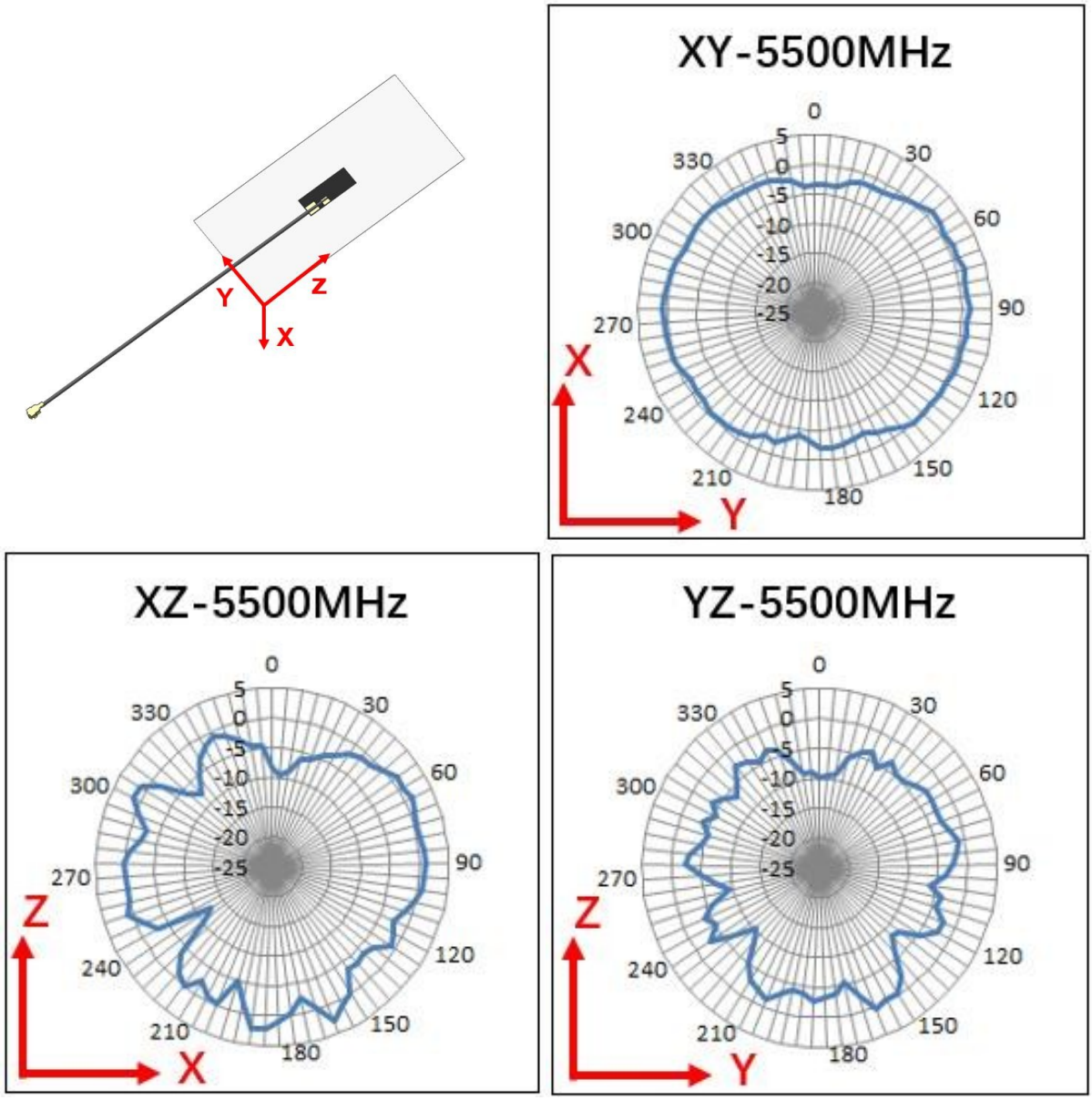
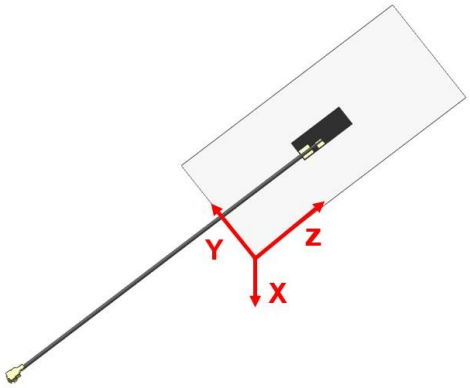
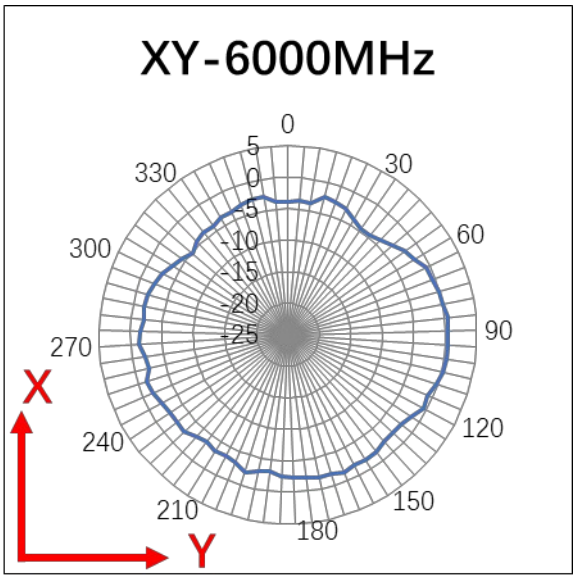
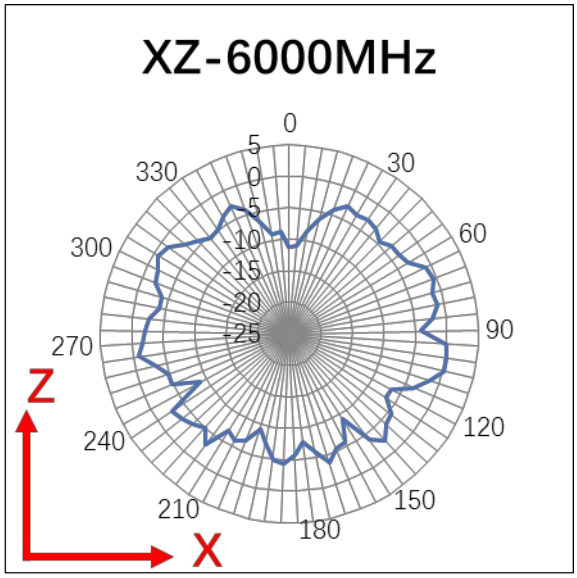


FIGURE 4.5.2 2D RADIATION PATTERN OF ANTENNA AT 5500MHZ IN FREE SPACE







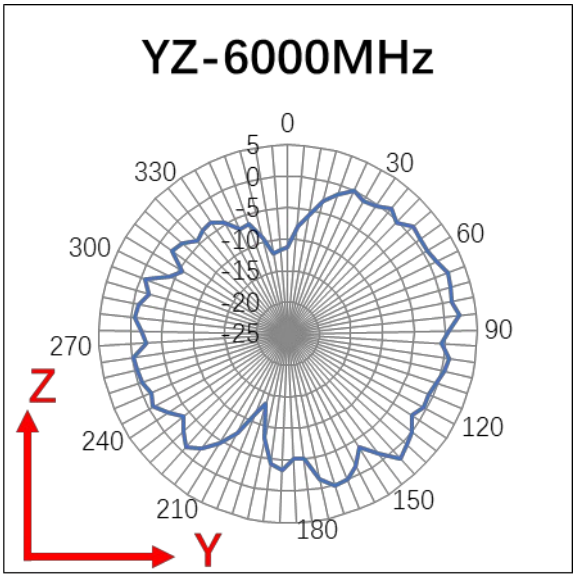
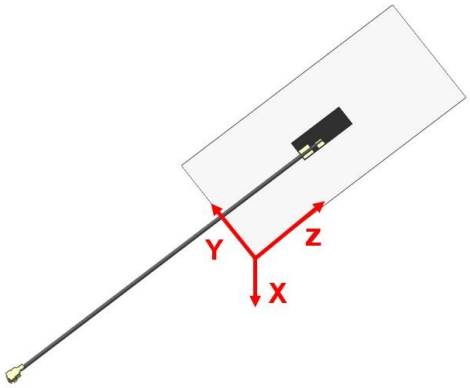
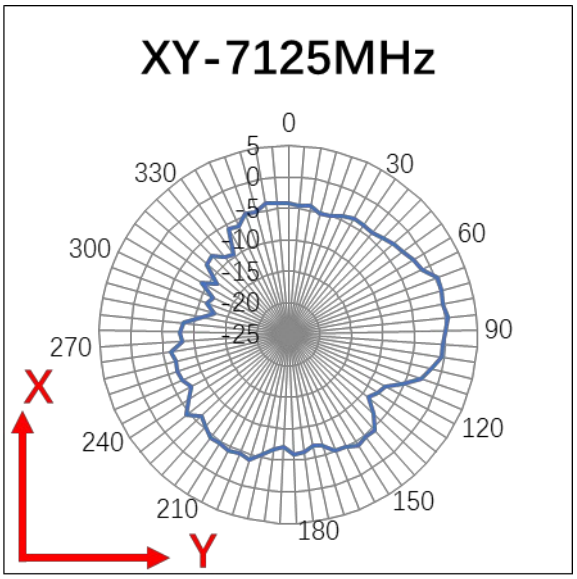
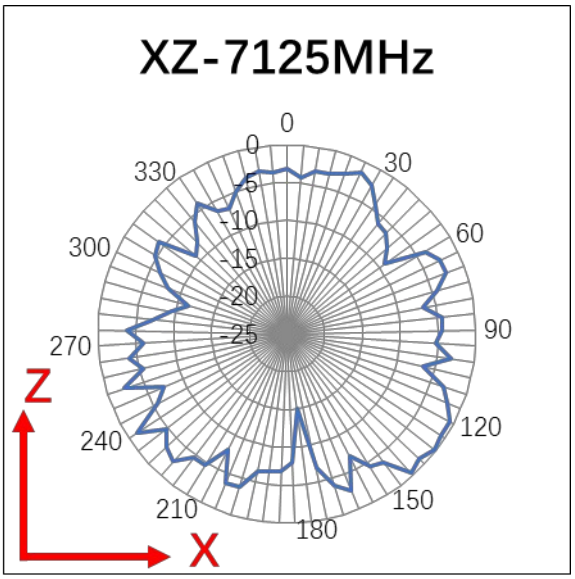


FIGURE 4.5.3 2D RADIATION PATTERN OF ANTENNA AT 6000MHZ IN FREE SPACE







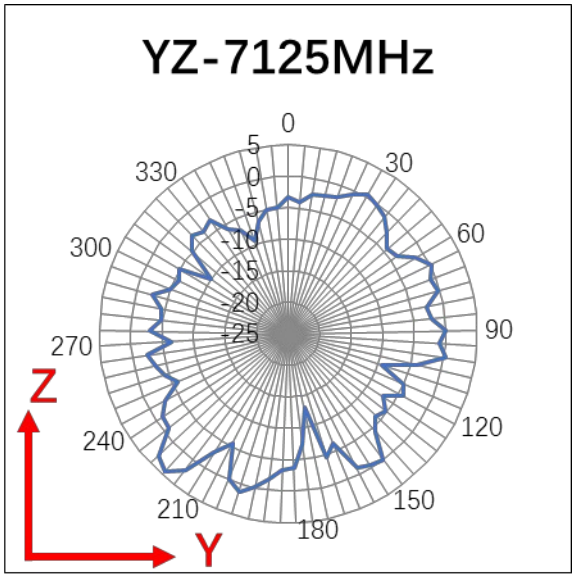


FIGURE 4.5.4 2D RADIATION PATTERN OF ANTENNA AT 7125MHZ IN FREE SPACE

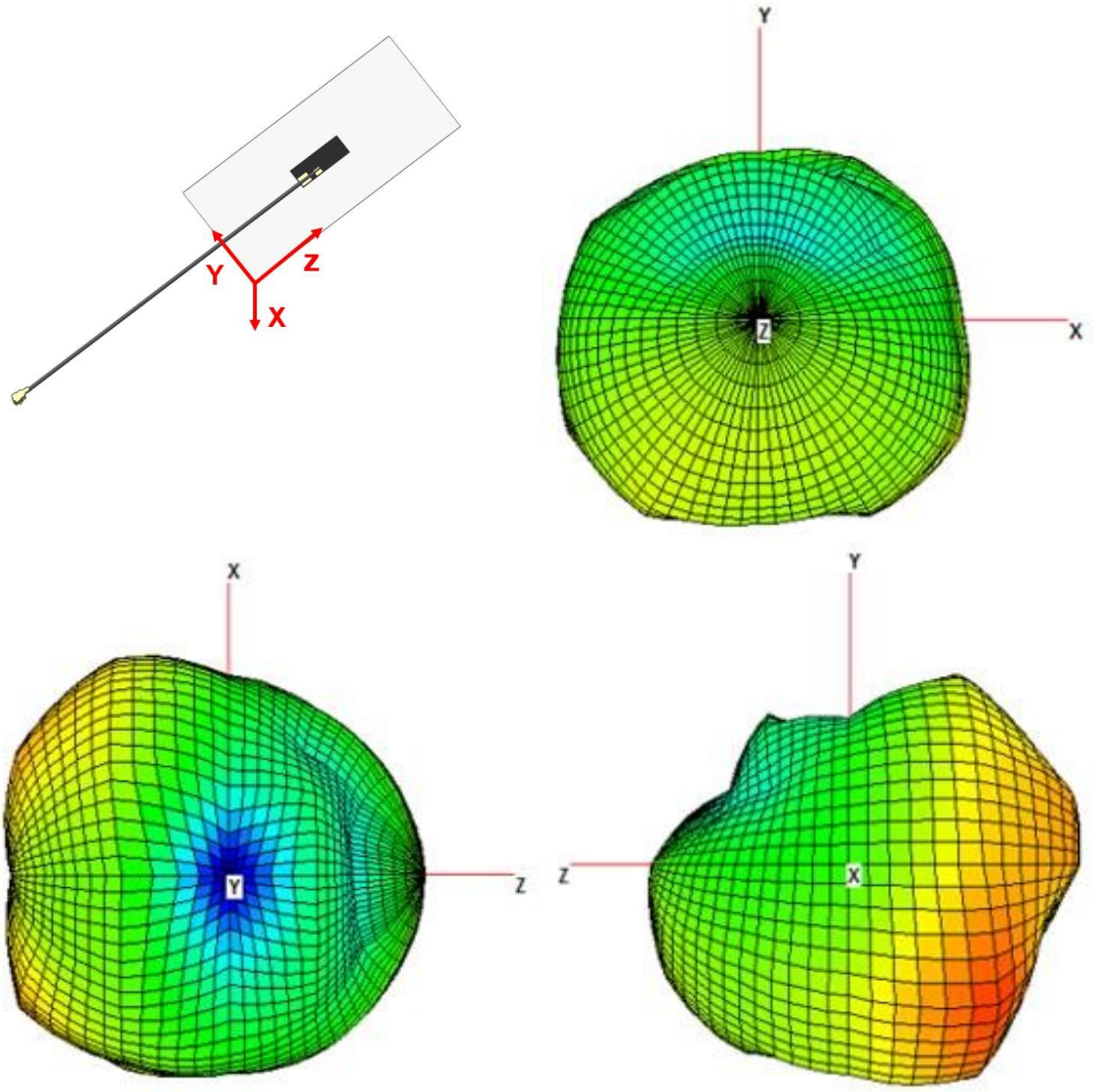


FIGURE 4.5.5 3D RADIATION PATTERN OF ANTENNA AT 2450MHZ IN FREE SPACE

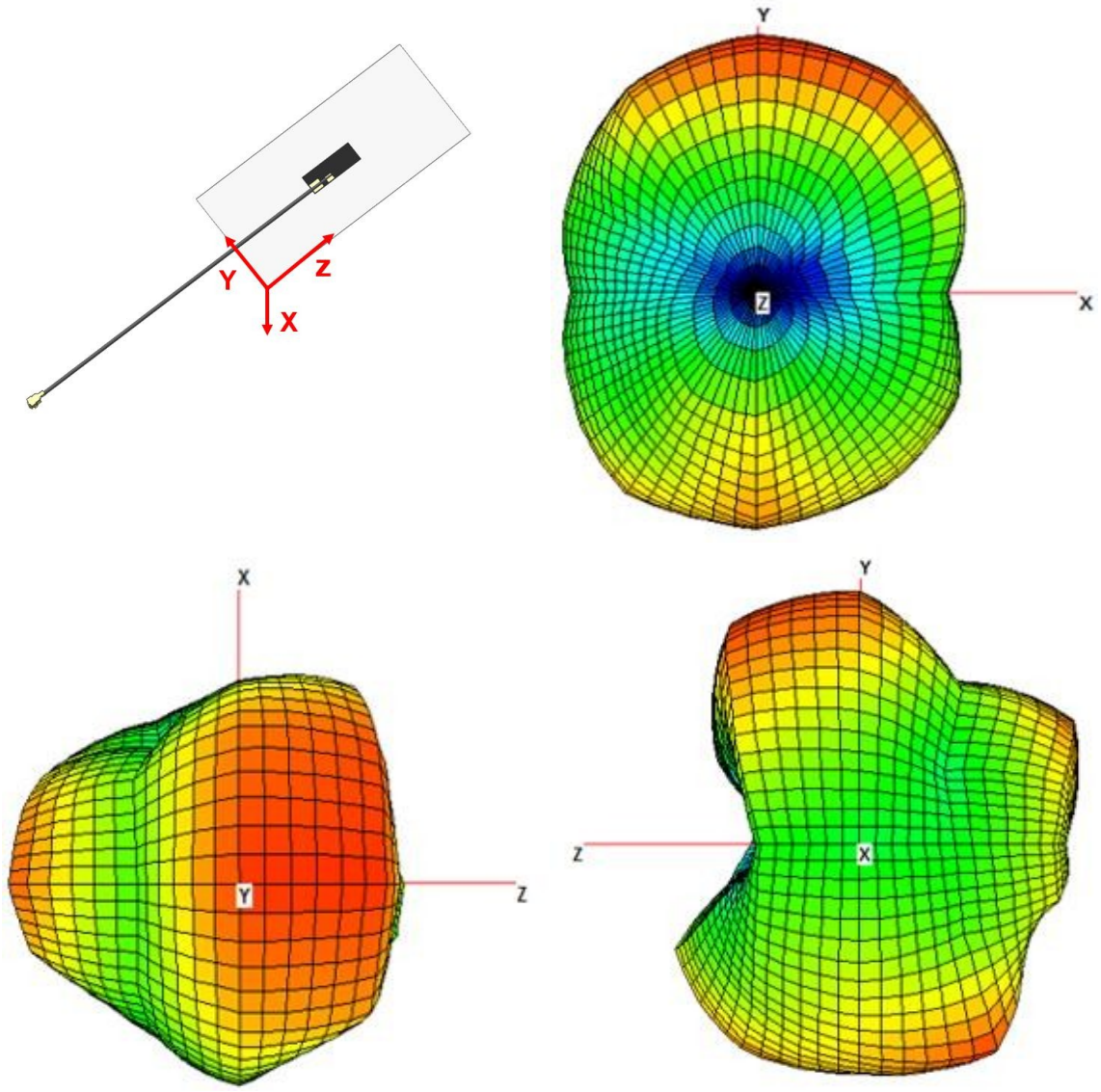


FIGURE 4.5.6 3D RADIATION PATTERN OF ANTENNA AT 5500MHZ IN FREE SPACE

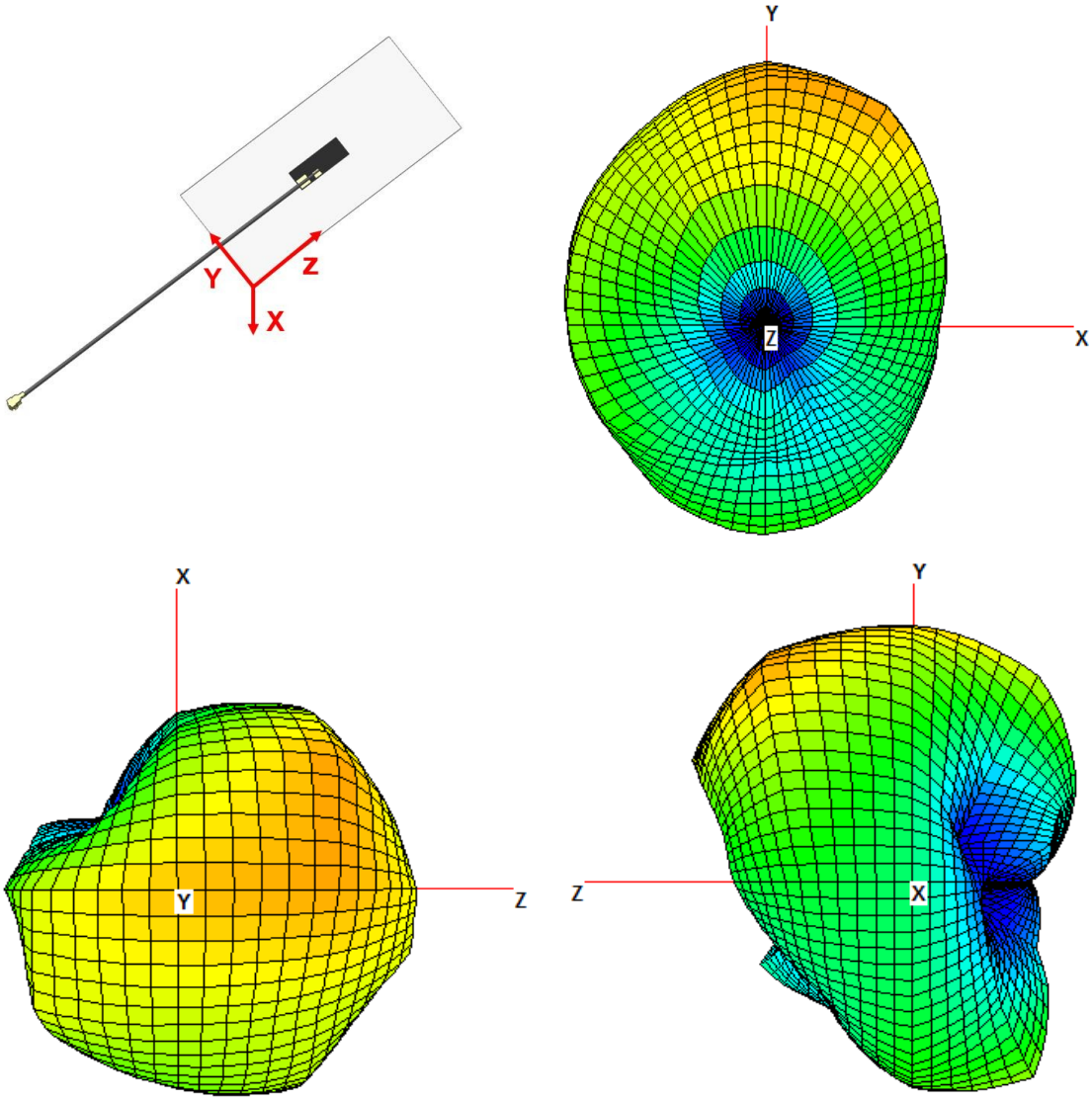


FIGURE 4.5.7 3D RADIATION PATTERN OF ANTENNA AT 6000MHZ IN FREE SPACE

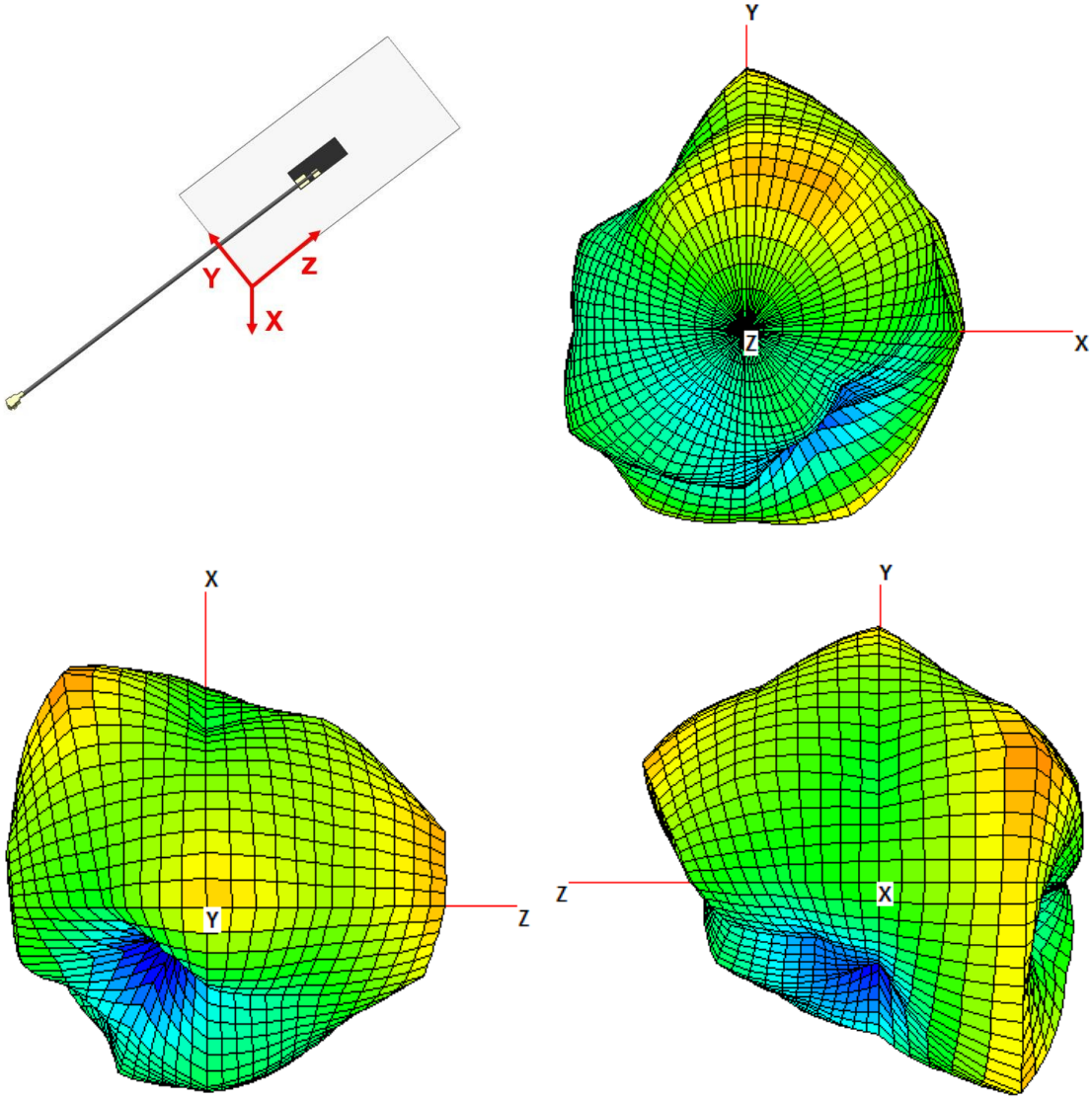


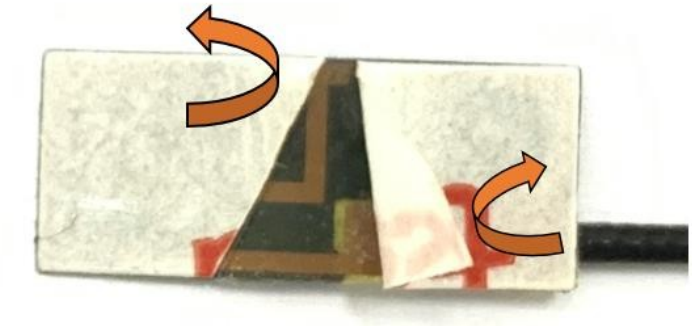
FIGURE 4.5.8 3D RADIATION PATTERN OF ANTENNA AT 7125MHZ IN FREE SPACE

5.0 ASSEMBLY GUIDELINE

The flex antenna comes with an adhesive TESA 68537 for assemble onto the plastic wall of the system. The surface should be smooth with Ra<1.6um and need to clean the surface before sticking this product. The antenna cannot be placed on a metallic surface.

5.1 HOW TO TEAR FLEX RELEASE PAPER

1. Find cut line on flex back side, Bend flex slight along cut line



2. Tear release paper

5.2 CABLE BENDING

During the assembly of the antenna in a device, the cable needs to be positioned away from the antenna flex to achieve best performance. The cable must be away from the pattern at least 5mm as shown in figure 5.2.1. If the cable crosses into the antenna flex, the antenna performance will be degraded.

FIGURE 5.2.1 RECOMMENDED CABLE BENDING RANGE

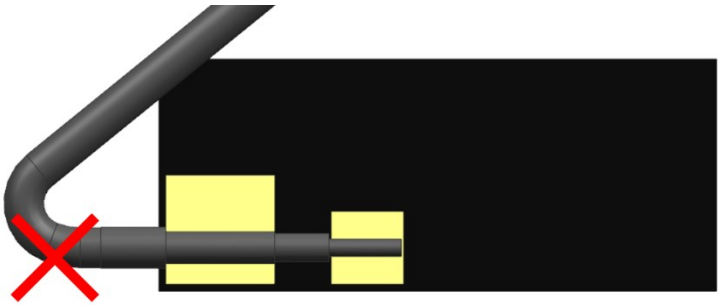


FIGURE 5.2.2 UNRECOMMENDED CABLE BENDING RANGE

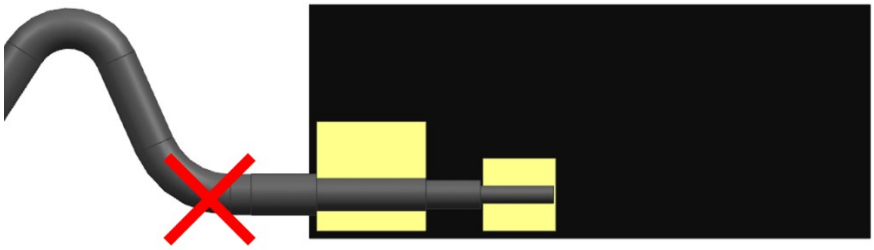


FIGURE 5.2.3 MULTIPLE BENDING OF CABLES IS NOT RECOMMENDED

6.0 RF PERFORMANCE AS A FUNCTION OF IMPLEMENTATION

6.1 ANTENNA RF PERFORMANCE AS A FUNCTION OF DIFFERENT LOCATIONS WITH PARALLEL PLANE GROUND

Antenna performance will be degraded if the antenna is placed too close to a ground plane. Four locations from 5mm, 10mm, 15mm and 20mm with a parallel plane ground have been evaluated. The locations are shown in figure 6.1.1. The plane ground size is 90mm*90mm. The antenna performance is better with larger distance between antenna and parallel plane ground. The minimum distance between antenna and plane ground is recommended to be at least 10mm to achieve acceptable RF performance.

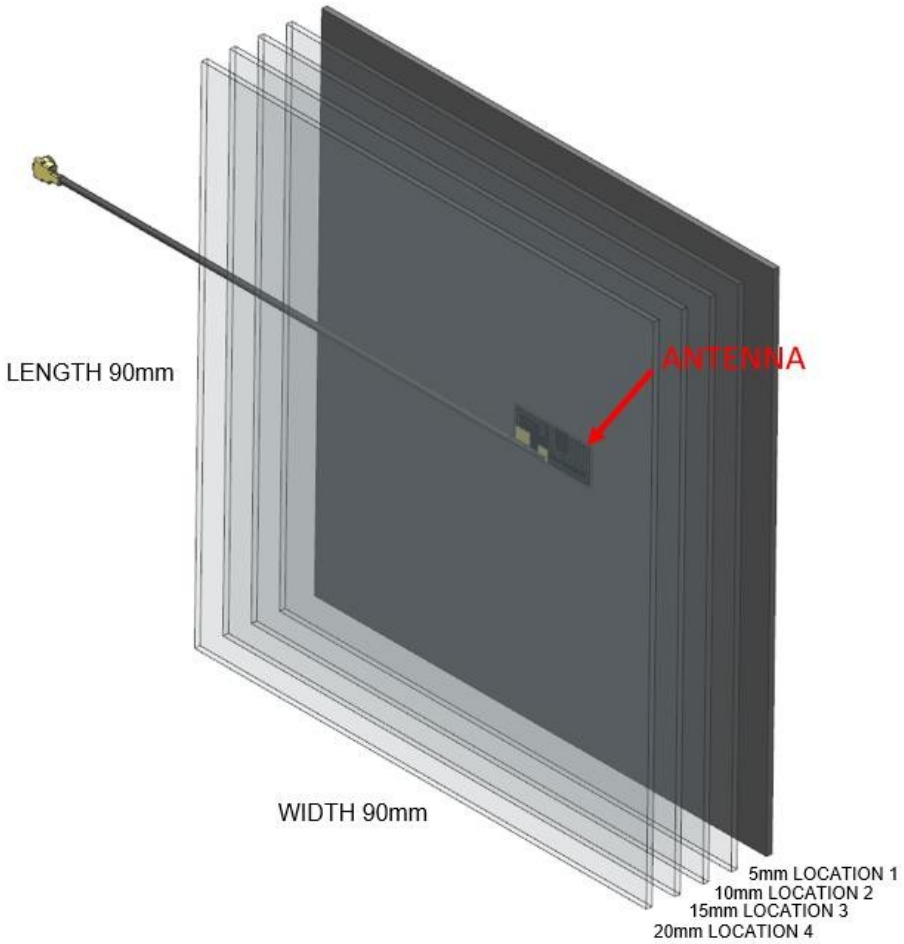


FIGURE 6.1.1 FOUR LOCATIONS WITH PARALLEL PLANE GROUND

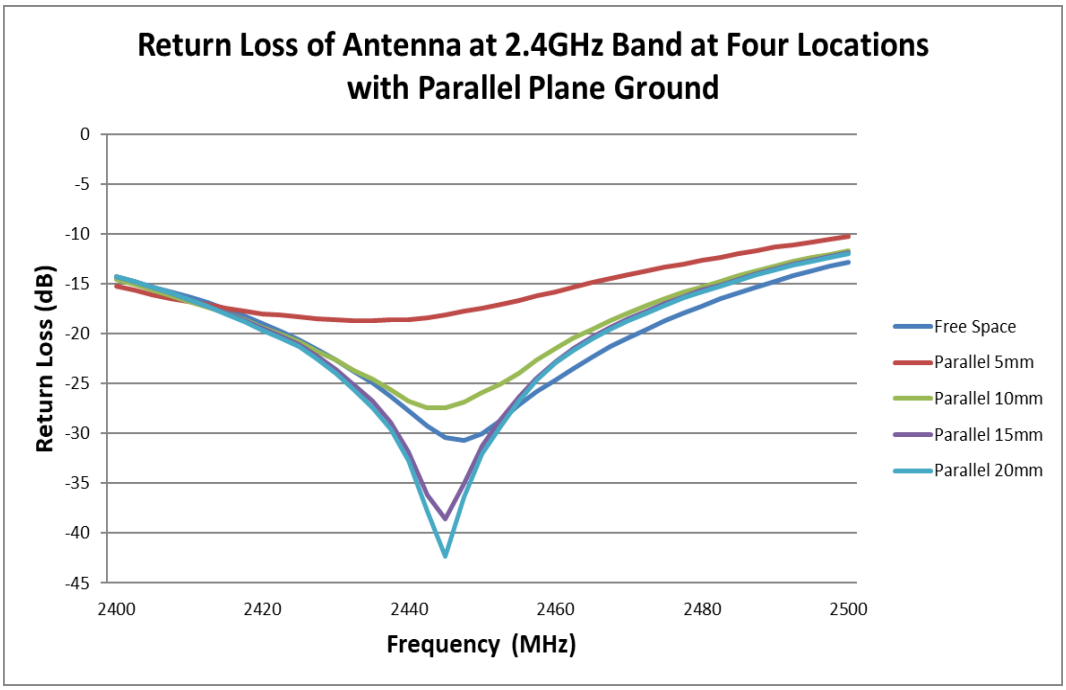


FIGURE 6.1.2 RETURN LOSS OF ANTENNA AT WIFI 2.4GHZ BAND AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND

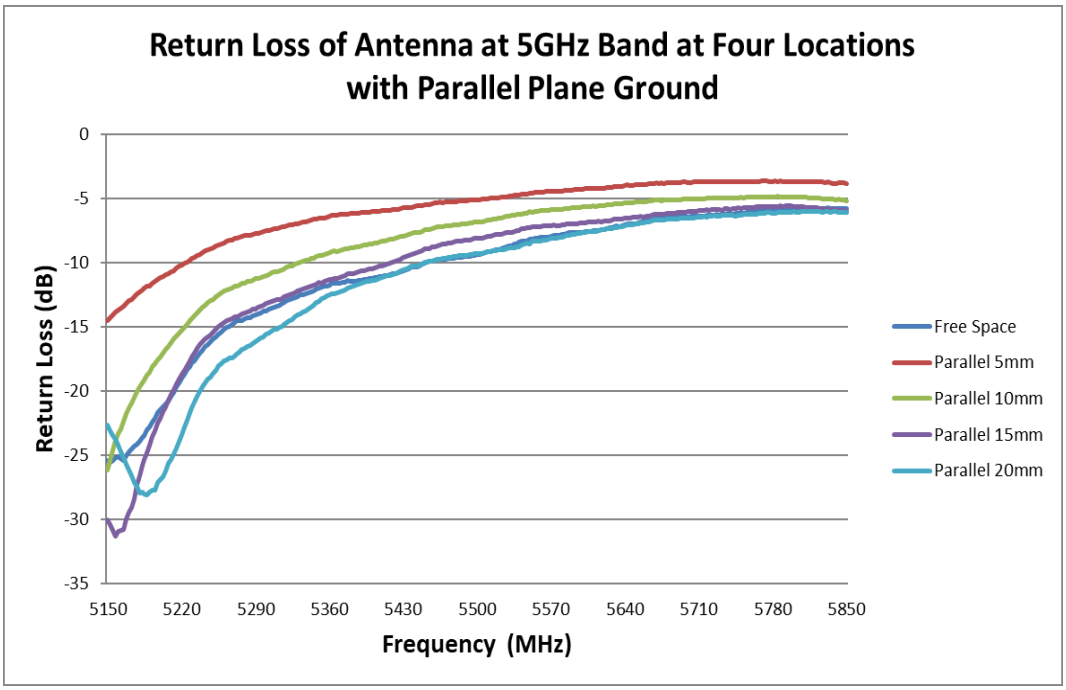


FIGURE 6.1.3 RETURN LOSS OF ANTENNA AT WIFI 5GHZ BAND AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND

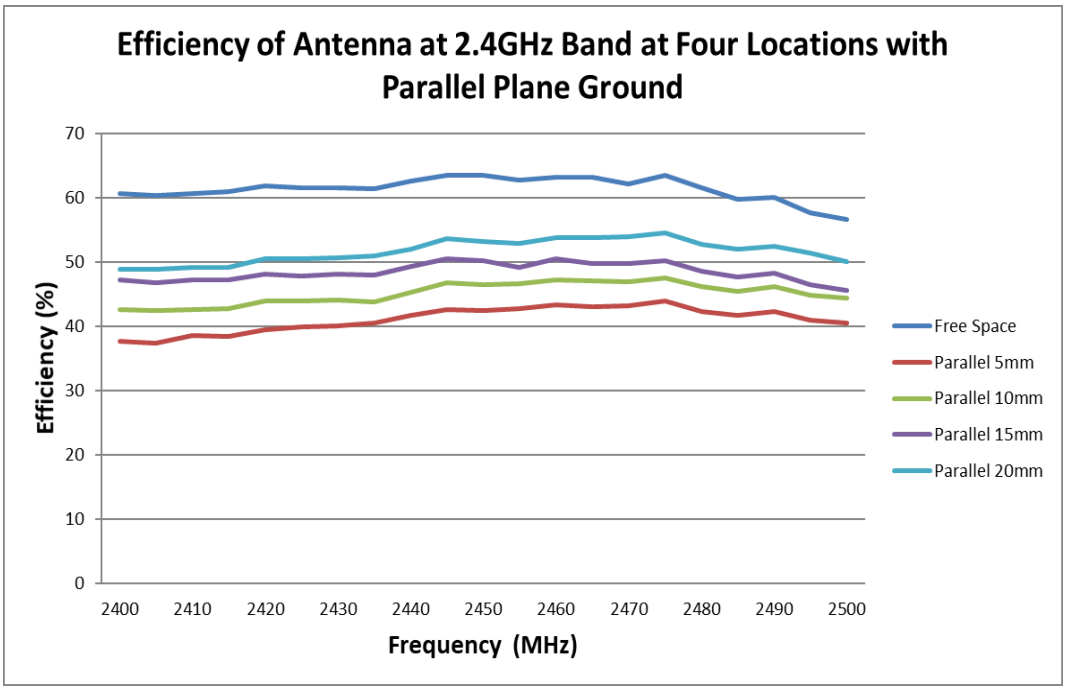


FIGURE 6.1.4 EFFICIENCY OF ANTENNA AT WIFI 2.4GHZ BAND AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND

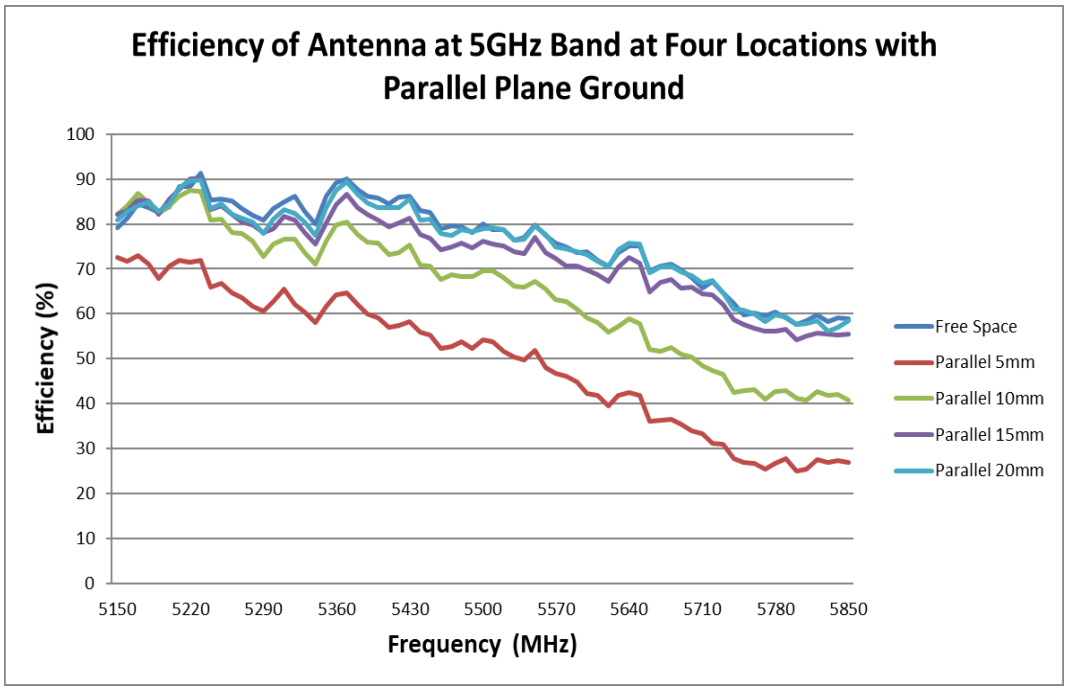


FIGURE 6.1.5 EFFICIENCY OF ANTENNA AT WIFI 5GHZ BAND AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND

6.2 ANTENNA RF PERFORMANCE AS A FUNCTION OF DIFFERENT LOCATIONS WITH VERTICAL PLANE GROUND

Antenna performance will be degraded if the antenna is placed too close to a ground plane. Four locations of 5mm, 10mm, 15mm and 20mm away from the vertical plane ground have been evaluated. These locations are shown in figure 6.2.1. The plane ground size is 90mm*90mm. The antenna performance is better with larger distance between antenna and vertical plane ground. The minimum distance between antenna and plane ground is recommended to be at least 5mm to achieve acceptable RF performance.

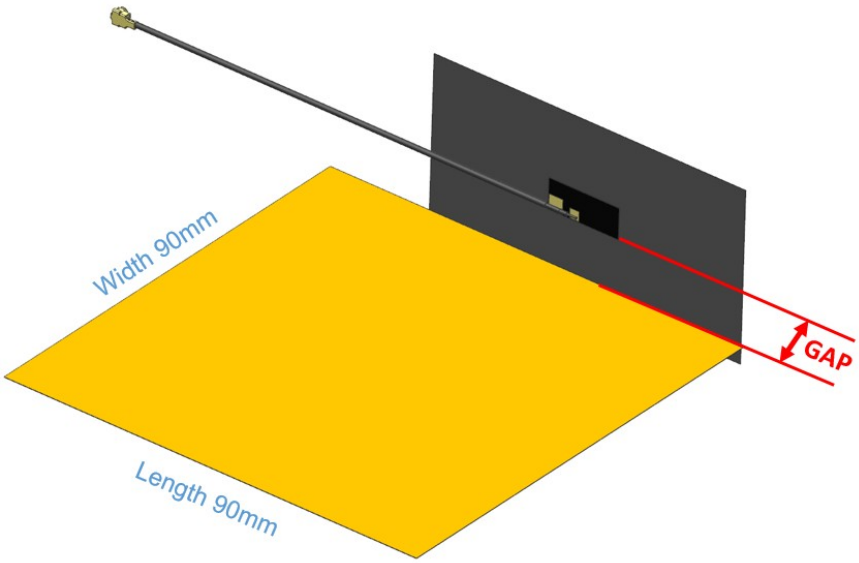


FIGURE 6.2.1 FOUR LOCATIONS WITH VERTICAL PLANE GROUND

Ground size: 90mm*90mm;
Location 1: Distance between antenna and plane (GAP) ground is about 5mm;
Location 2: Distance between antenna and plane (GAP) ground is about 10mm;
Location 3: Distance between antenna and plane (GAP) ground is about 15mm;
Location 4: Distance between antenna and plane (GAP) ground is about 20mm.

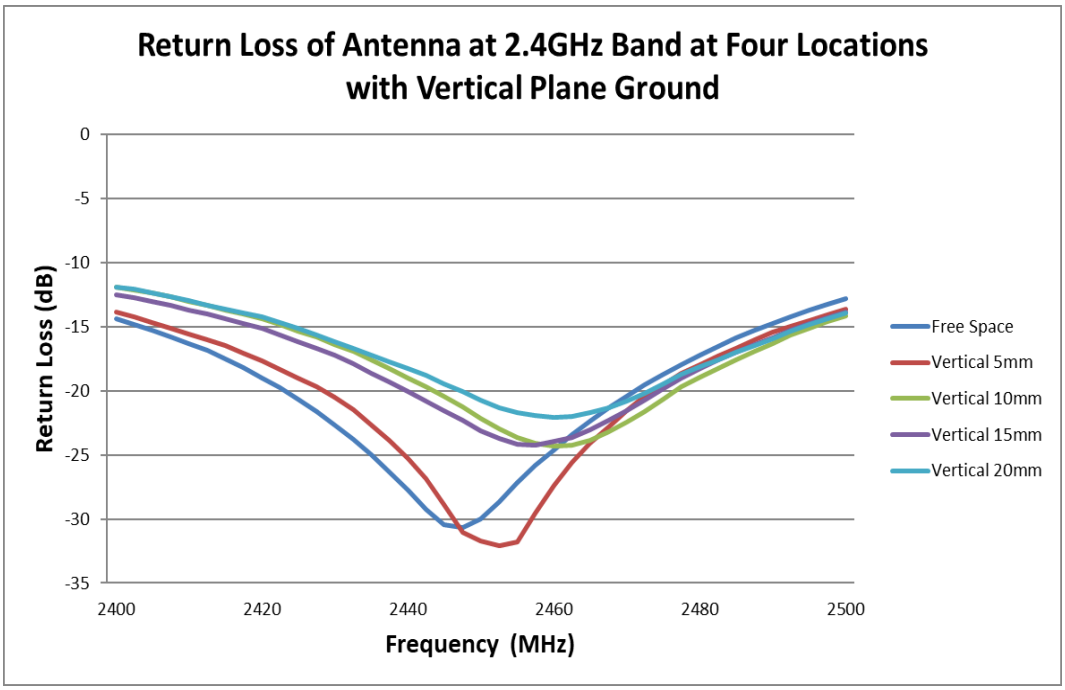


FIGURE 6.2.2 RETURN LOSS OF ANTENNA AT WIFI 2.4GHZ BAND AT FOUR LOCATIONS WITH VERTICAL PLANE GROUND

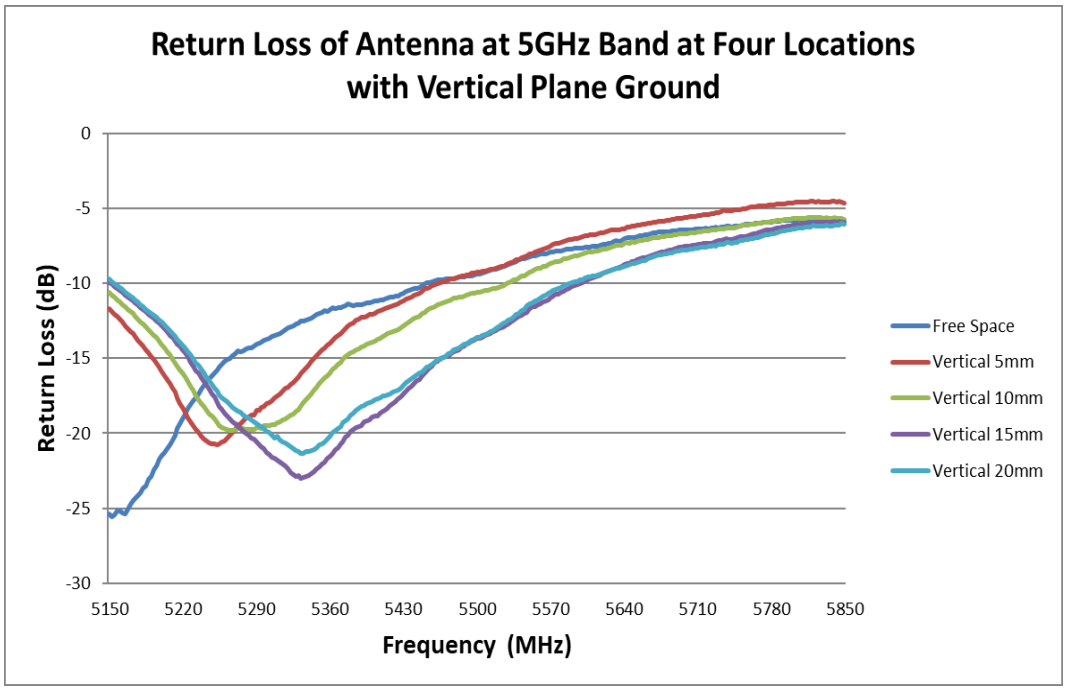


FIGURE 6.2.3 RETURN LOSS OF ANTENNA AT WIFI 5GHZ BAND AT FOUR LOCATIONS WITH VERTICAL PLANE GROUND

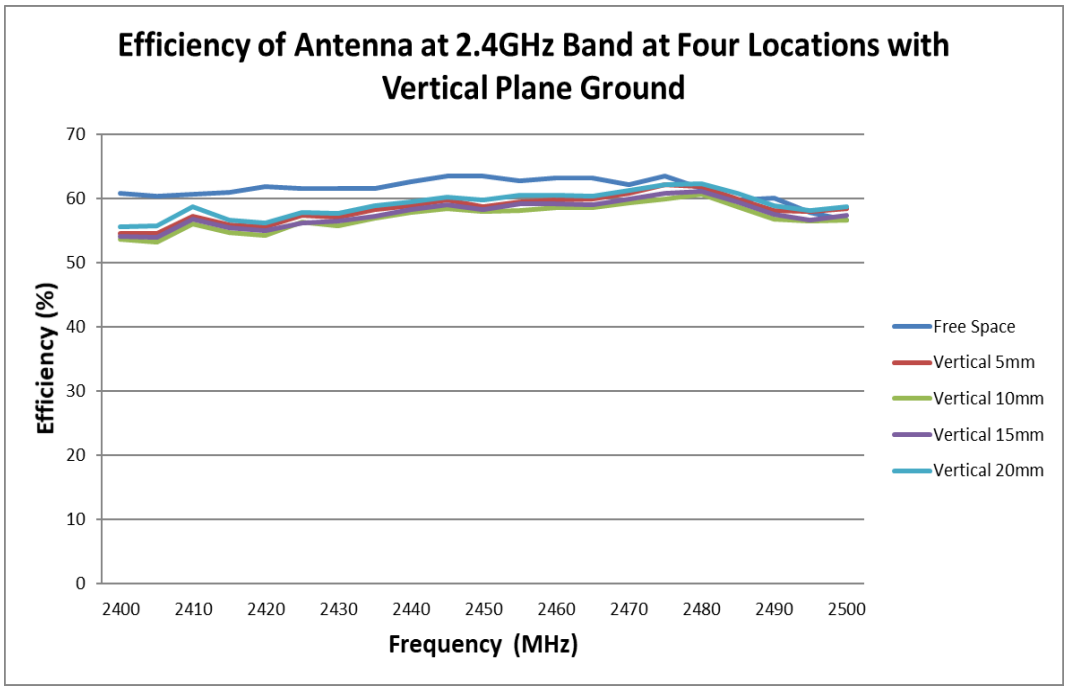


FIGURE 6.2.4 EFFICIENCY OF ANTENNA AT WIFI 2.4GHZ BAND AT FOUR LOCATIONS WITH VERTICAL PLANE GROUND

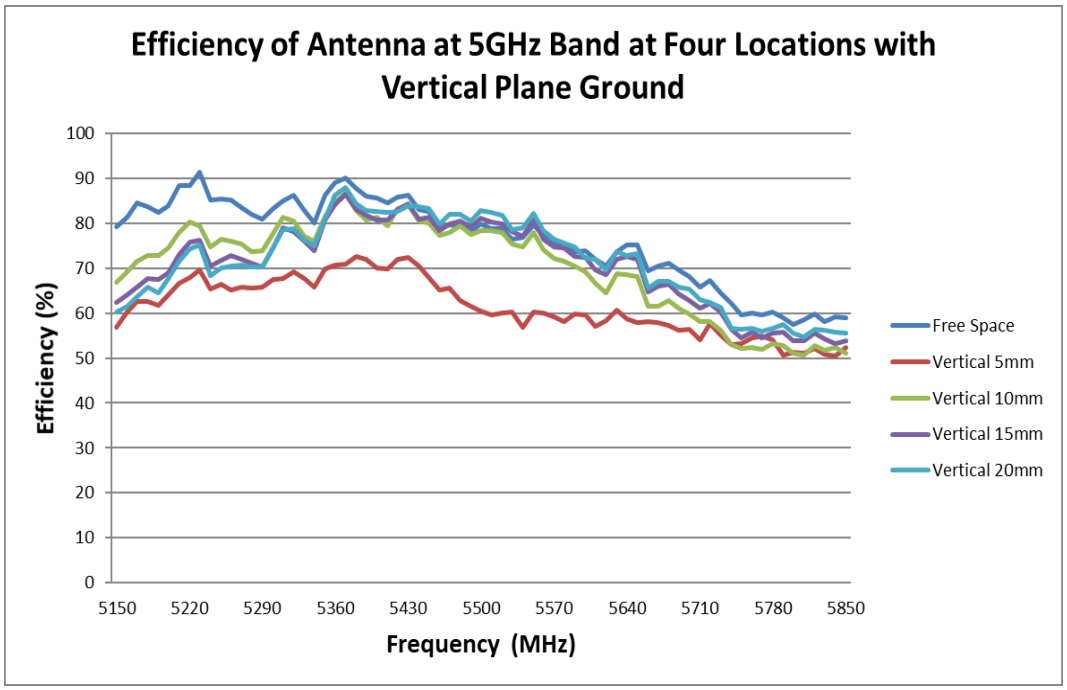


FIGURE 6.2.5 EFFICIENCY OF ANTENNA AT WIFI 5GHZ BAND AT FOUR LOCATIONS WITH VERTICAL PLANE GROUND

6.3 ANTENNA RF PERFORMANCE AS A FUNCTION OF DIFFERENT DISTANCES WITH PARALLEL PLANE GROUND

Antenna performance will be degraded if the antenna is placed too close to a ground plane. Four locations 5mm,10mm,15mm and 20mm from a parallel plane ground have been evaluated. These locations are shown in figure 6.3.1. The plane ground size is 90mm*90mm. The antenna performance is better with larger distance between the antenna and the parallel plane ground. The minimum distance between the antenna and the plane ground is recommended to be at least 5mm to achieve acceptable RF performance.

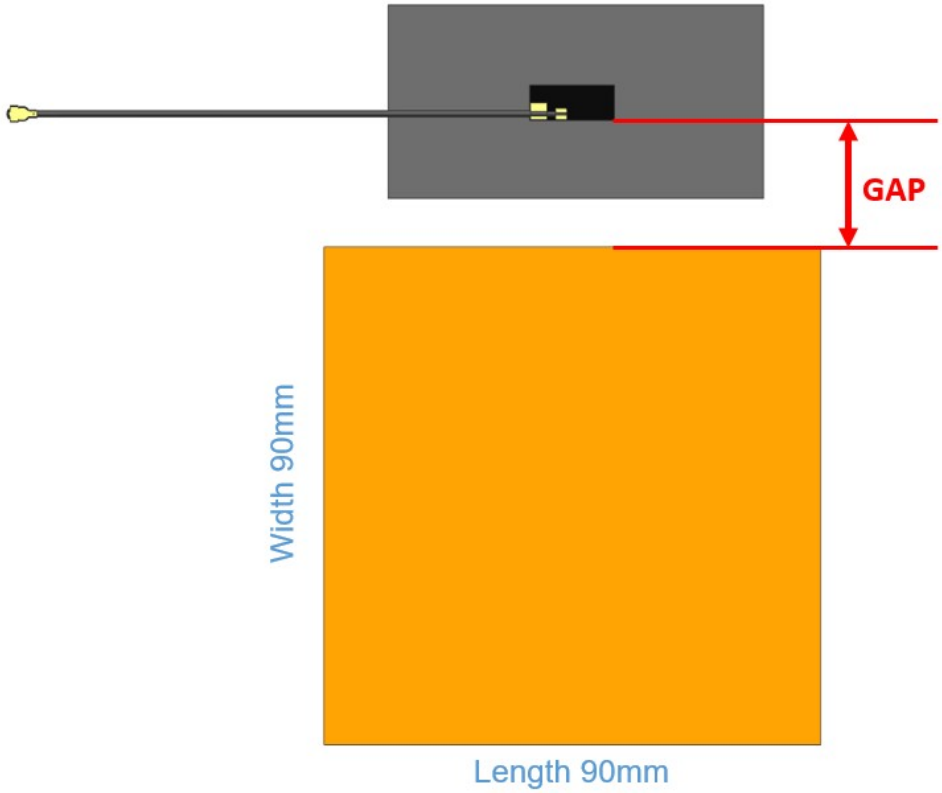


FIGURE 6.3.1 FOUR LOCATIONS WITH PARALLEL PLANE GROUND

Ground Size: 90mm*90mm;
Location 1: Distance between antenna and plane (GAP) ground is about 5mm;
Location 2: Distance between antenna and plane (GAP) ground is about 10mm;
Location 3: Distance between antenna and plane (GAP) ground is about 15mm;
Location 4: Distance between antenna and plane (GAP) ground is about 20mm

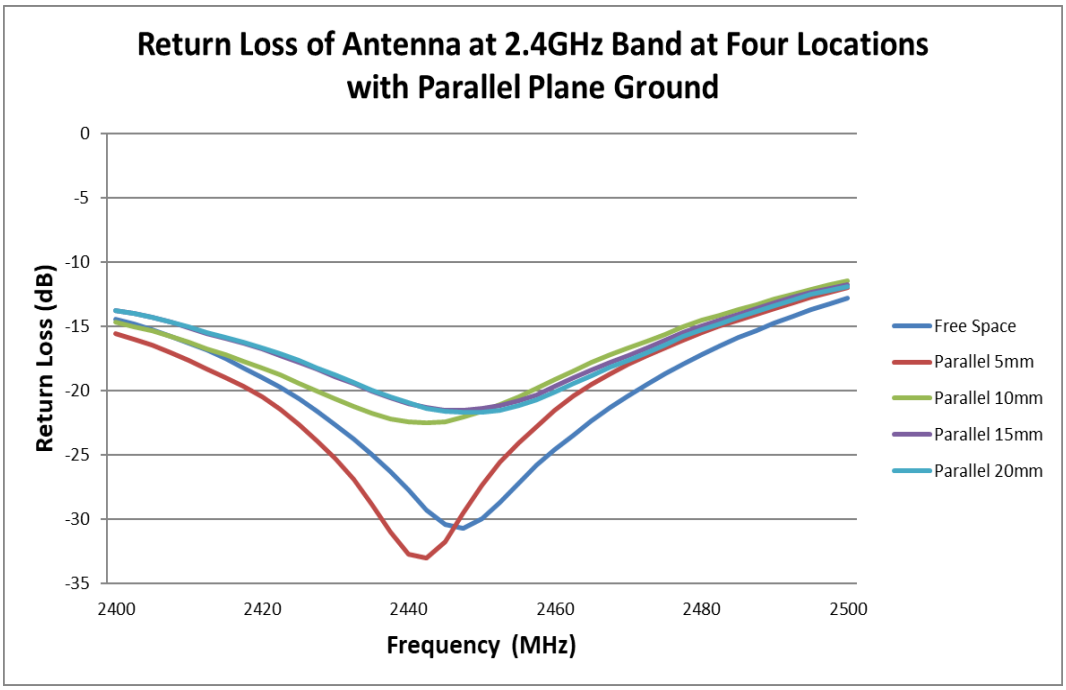


FIGURE 6.3.2 RETURN LOSS OF ANTENNA AT WIFI 2.4GHZ BAND AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND

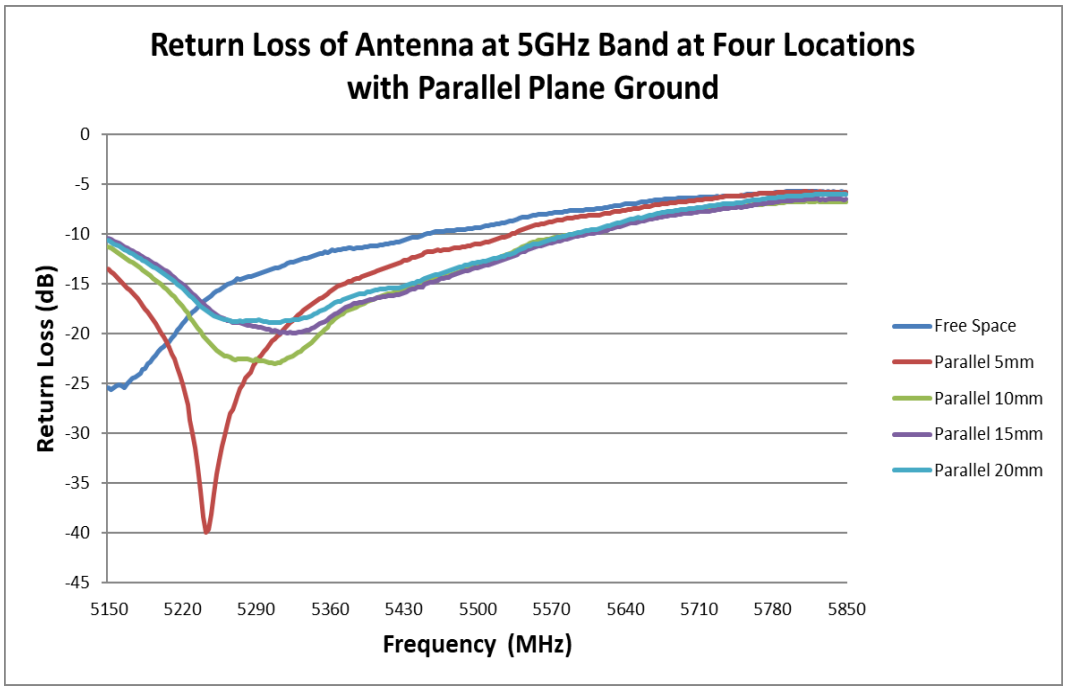


FIGURE 6.3.3 RETURN LOSS OF ANTENNA AT WIFI 5GHZ BAND AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND

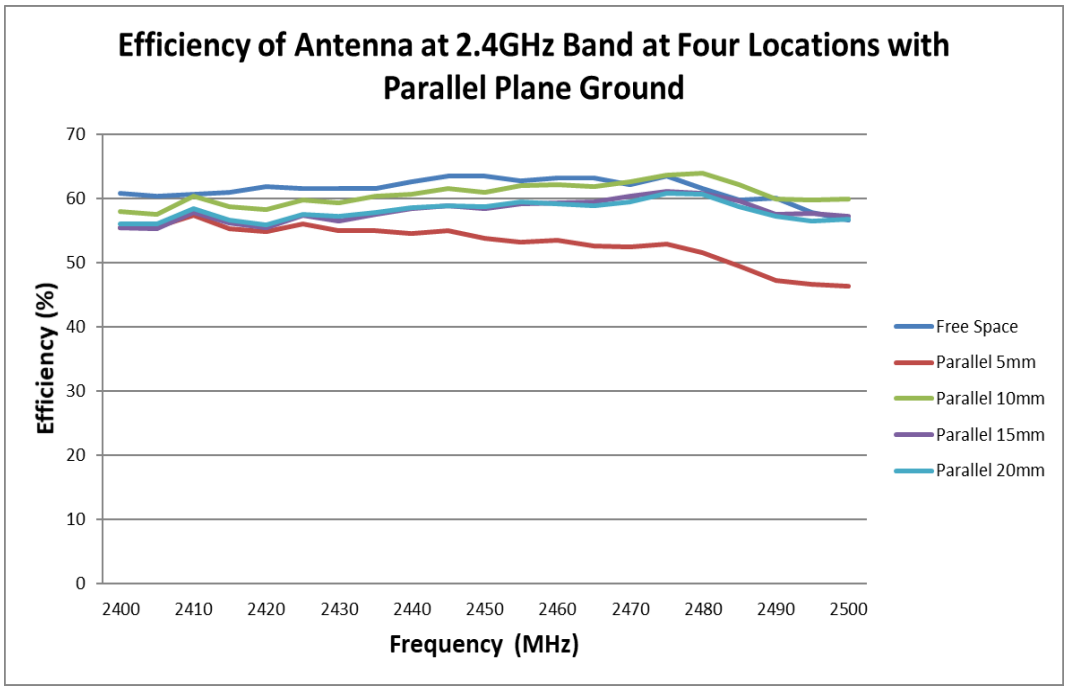


FIGURE 6.3.4 EFFICIENCY OF ANTENNA AT WIFI 2.4GHZ BAND AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND

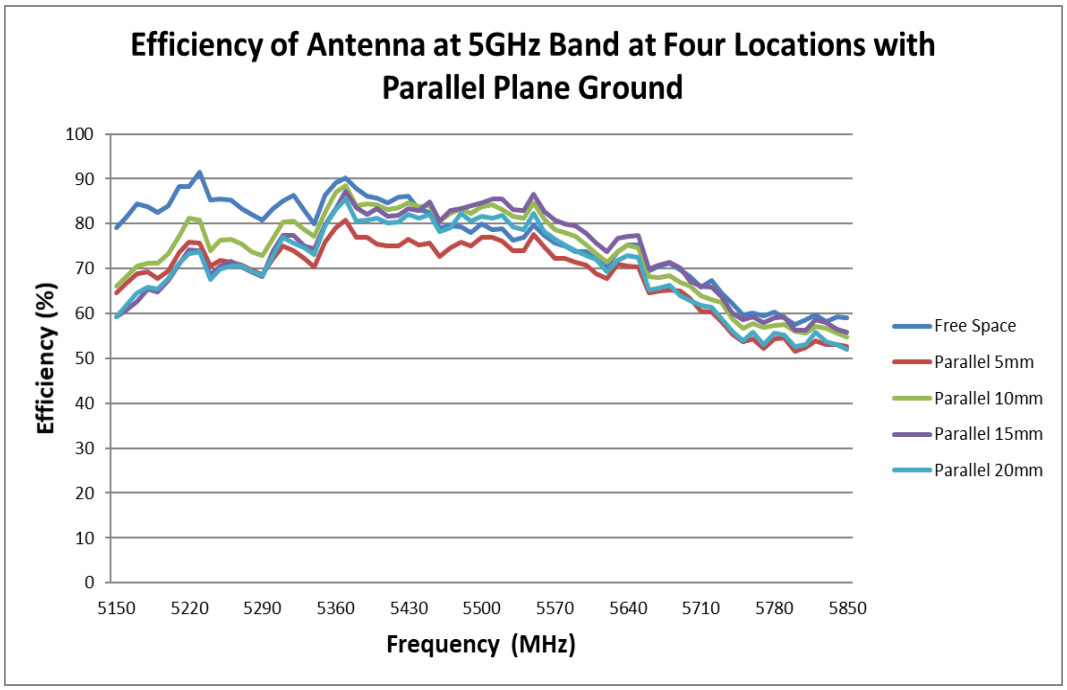


FIGURE 6.3.5 EFFICIENCY OF ANTENNA AT WIFI 5GHZ BAND AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND

6.4 ANTENNA RF PERFORMANCE AS A FUNCTION OF DIFFERENT CABLE LENGTH

Four cable length have been evaluated and these states are shown in figure 6.4.1.
The cable length ”L” is 200mm, 150mm, 100mm(reference length) and 50mm. The cable length should be more than 50mm and less than 200mm. The resonance frequency shift to lower and the antenna performance will decrease obviously when the cable length is less than 50mm and more than 200mm.

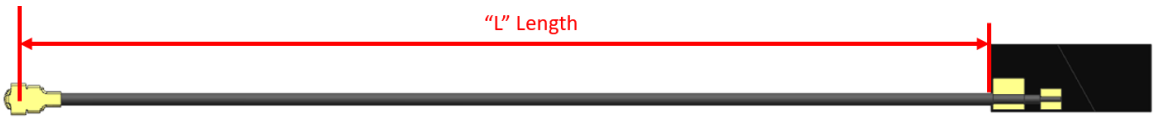


FIGURE 6.3.1 FOUR DIFFERENT CABLE LENGTH

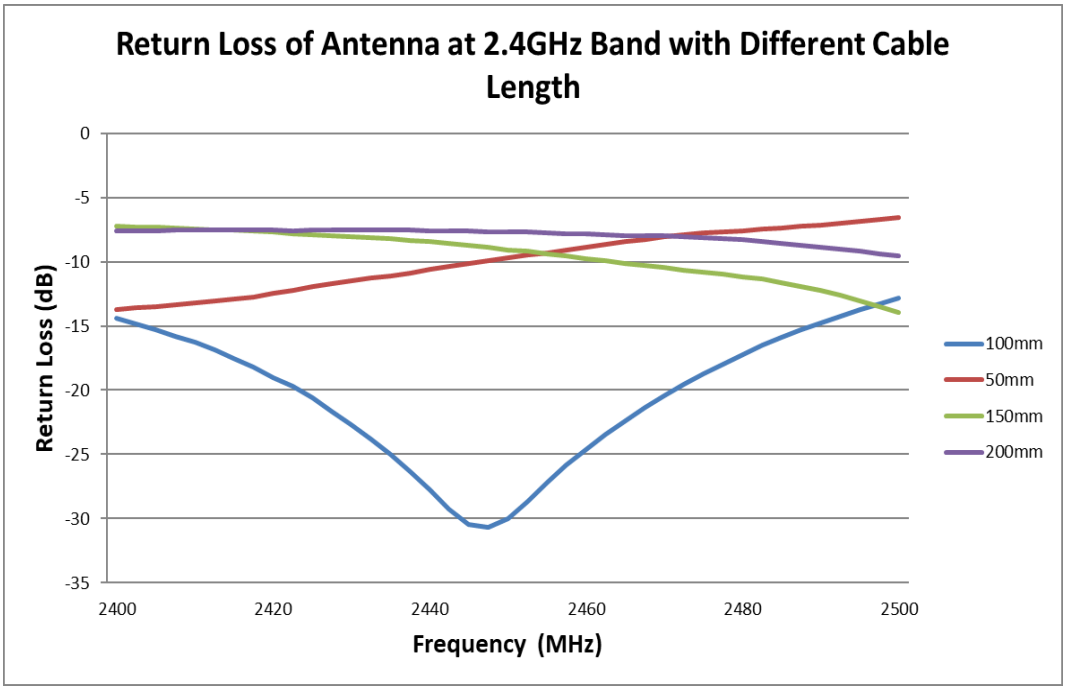


FIGURE 6.4.2 RETURN LOSS OF ANTENNA AT WIFI 2.4GHZ BAND WITH DIFFERENT CABLE LENGTH

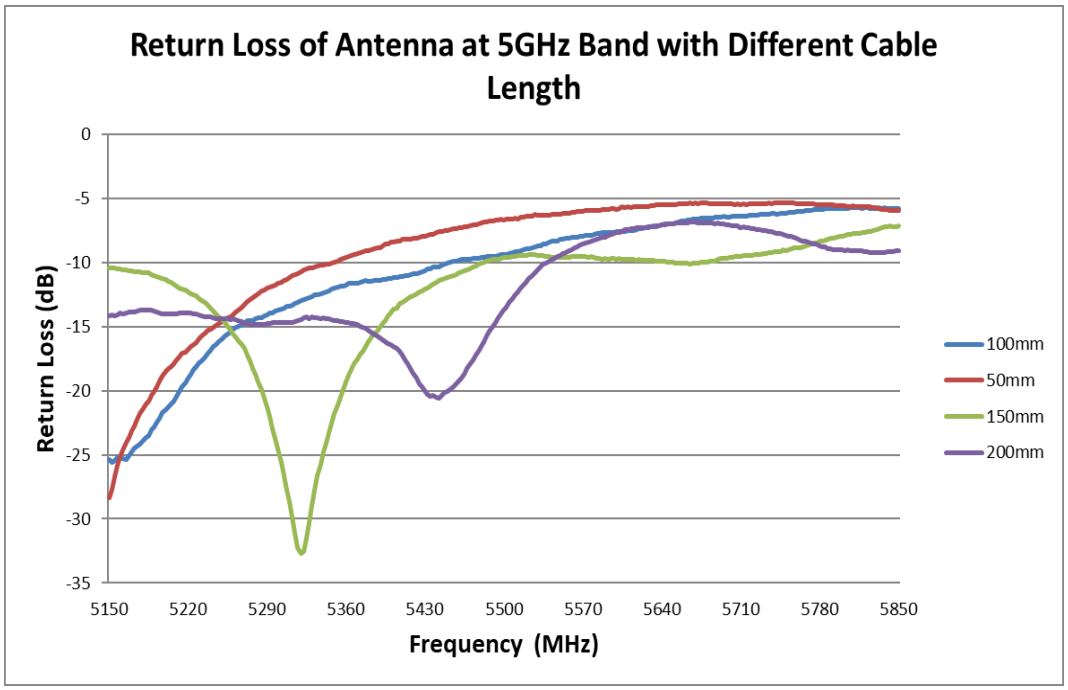


FIGURE 6.4.3 RETURN LOSS OF ANTENNA AT WIFI 5GHZ BAND WITH DIFFERENT CABLE LENGTH

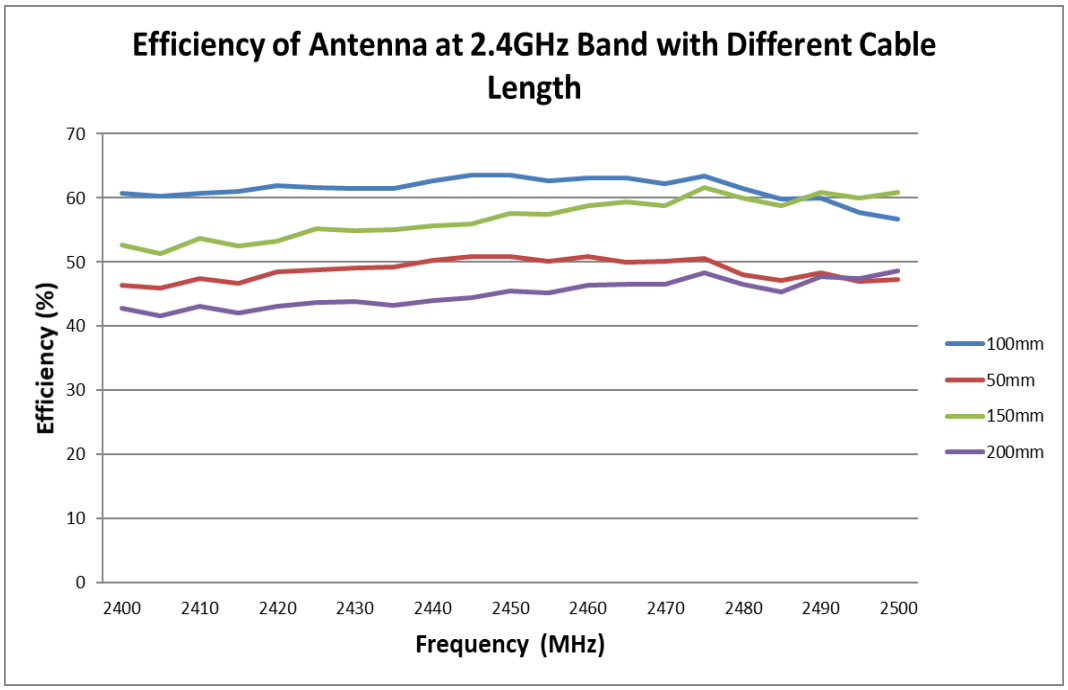


FIGURE 6.4.4 EFFICIENCY OF ANTENNA AT WIFI 2.4GHZ BAND WITH DIFFERENT CABLE LENGTH

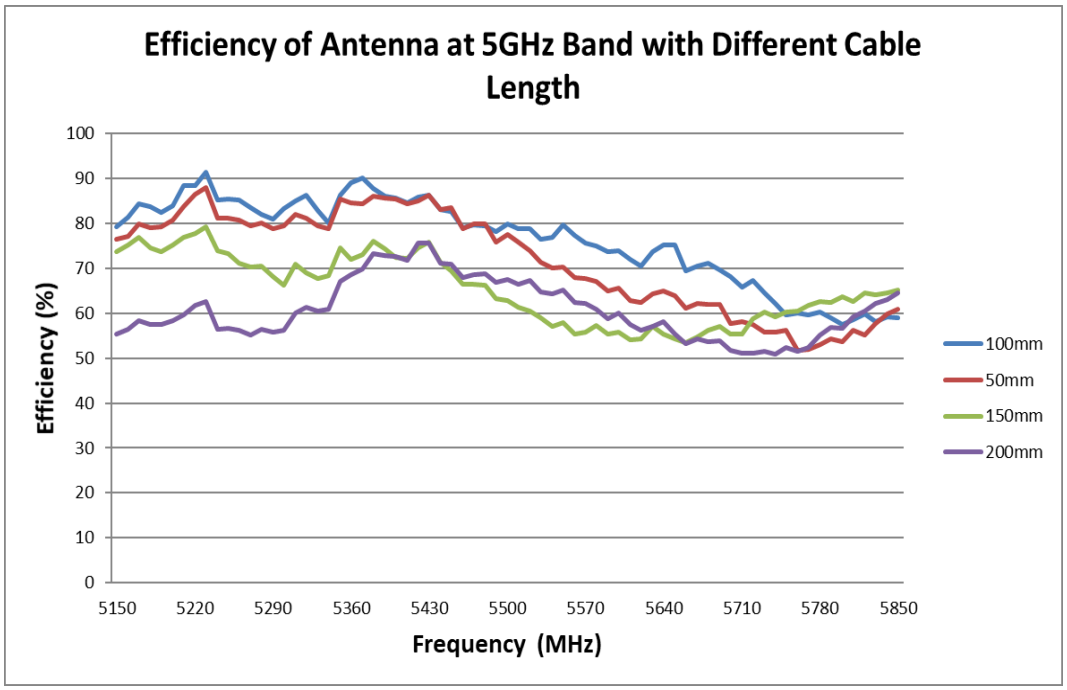


FIGURE 6.4.5 EFFICIENCY OF ANTENNA AT WIFI 5GHZ BAND WITH DIFFERENT CABLE LENGTH

7.0 OTHER MOLEX ANTENNA PRODUCTS

Please refer to the Antenna products in Molex home page to view all the Molex Antenna products.
https://www.molex.com
Molex, LLC
2222 Wellington Court
Lisle, IL 60532
USA

8.0 CHANGE HISTORY

CHANGE HISTORY		
REV	DATA	DESCRIPTION
D	2020/07/03	Update radiation pattern, add different cable length and 6-7.125GHz band
E	2020/08/31	Optimized Part 4.2 Peak Gain & Efficiency
F	2022/12/02	Added section: Other Molex Antenna Products