2.4/5GHZ WIFI DUAL BAND ANTENNA WITH SIDE SOLDER CABLE

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2.4/5GHZ WIFI DUAL BAND ANTENNA WITH SIDE SOLDER CABLE

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.

Although this document AS-2042810200 is for U.FL compatible connector and 200mm cable, it is applicable to all products under 204281 series. All measurements in this document are done with the part no.2042810200 with a cable length of 200mm, it is used to illustrate the product application. There is no different between the performances for 204810100 and 204811100. The document is applicable to all cable length as well.

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)

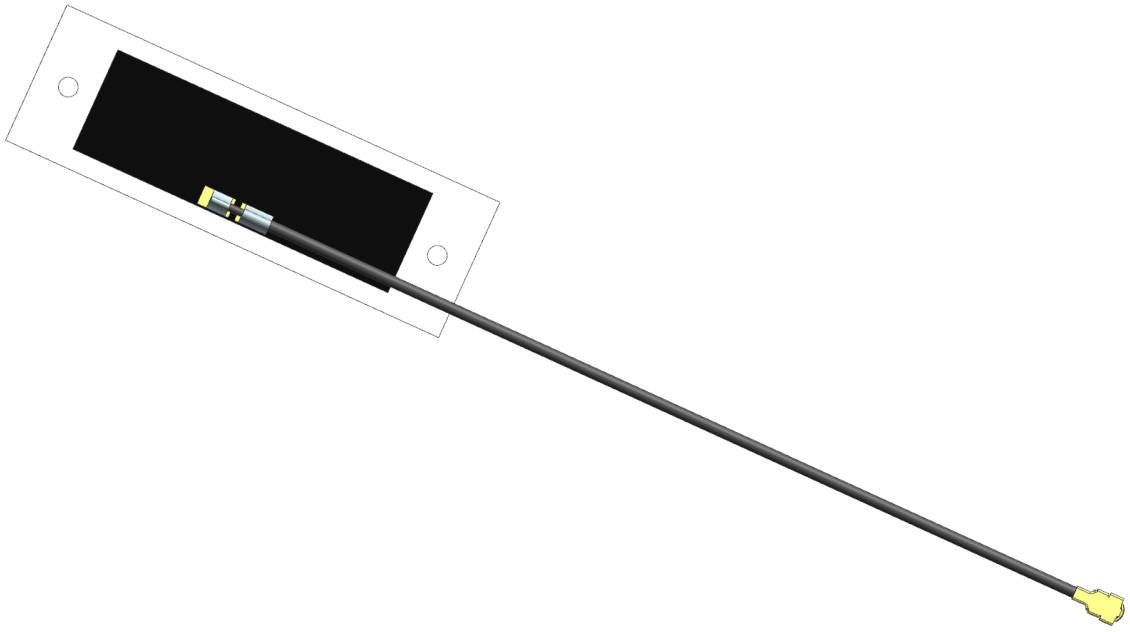
Product name: 2.4/5GHz WIFI Dual Band Antenna with Side Solder Cable
Series Number: 204281

2.2 DESCRIPTION

Series 204281 is a balanced, side-fed, dipole-type, high efficiency antenna for 2.4/5 GHz applications, including WiFi, Bluetooth, Zigbee and others. This antenna is made from poly-flexible material with small size 35*11*0.1mm, and has double-sided adhesive tape for easy "peel and stick" mounting. This balanced antenna with ground plane independent design offers various cable length options for ease of integration into various devices.

2.3 PRODUCT STRUCTURE INFORMATION

Please refer to PS-2042810200 for full information.



Molex 204281XXXX 2.4/5GHz Wide dual band Antenna 3D View

3.0 APPLICABLE DOCUMENTS

Document	Number	Description
Sales Drawing(SD)	SD-2042810200	Mechanical Dimension of the product
	SD-2042811100	
Product Specification (PS)	PS-2042810200	Product Specification
Packing Drawing(PK)	PK-2042810200	Product packaging specifications

4.0 ANTENNA PERFORMANCE

4.1 RF TEST CONDITIONS

All measurements are done of the antenna mounted on a PC/ABS material block of 1mm thickness with VNA Agilent 5071C and Over-The-Air (OTA) chamber. All measurements in this document are done with the part no.2042810200 and 2042811100 with a cable length of 200mm.

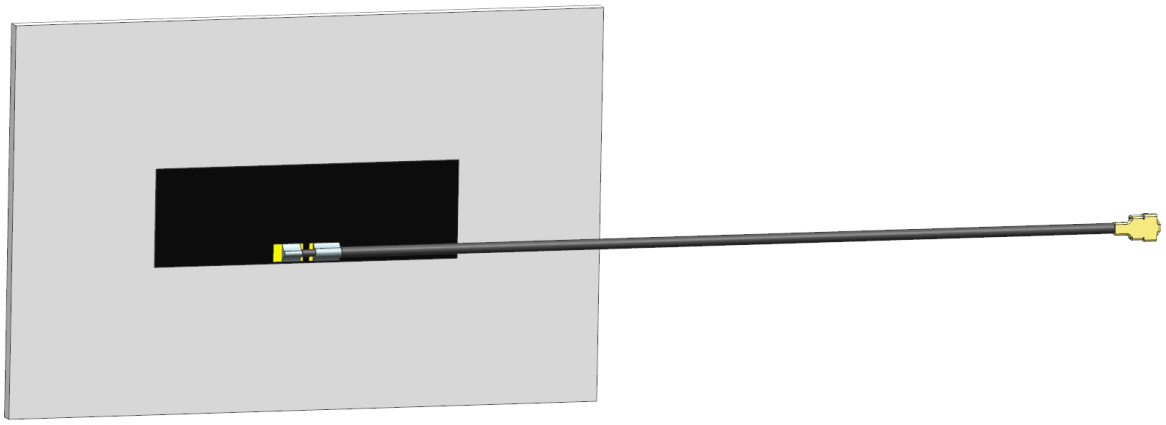


FIGURE4.1.1 ANTENNA LOADED WITH PC/ABS BLOCK OF 1MM THICKNESS

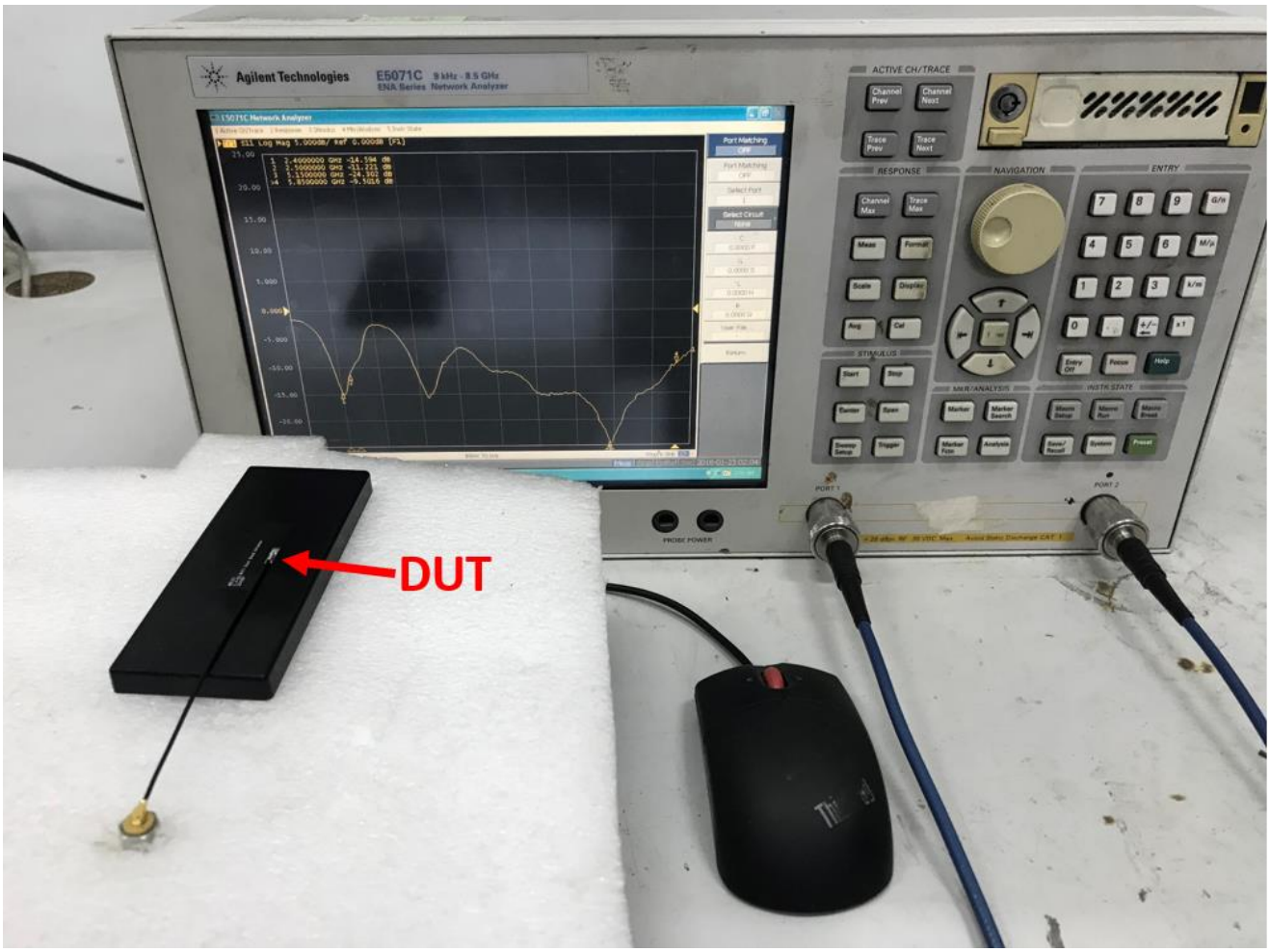


FIGURE4.1.2 ANTENNA LOADED WITH PC/ABS BLOCK OF 1MM THICKNESS TESTED WITH VNA E5071C

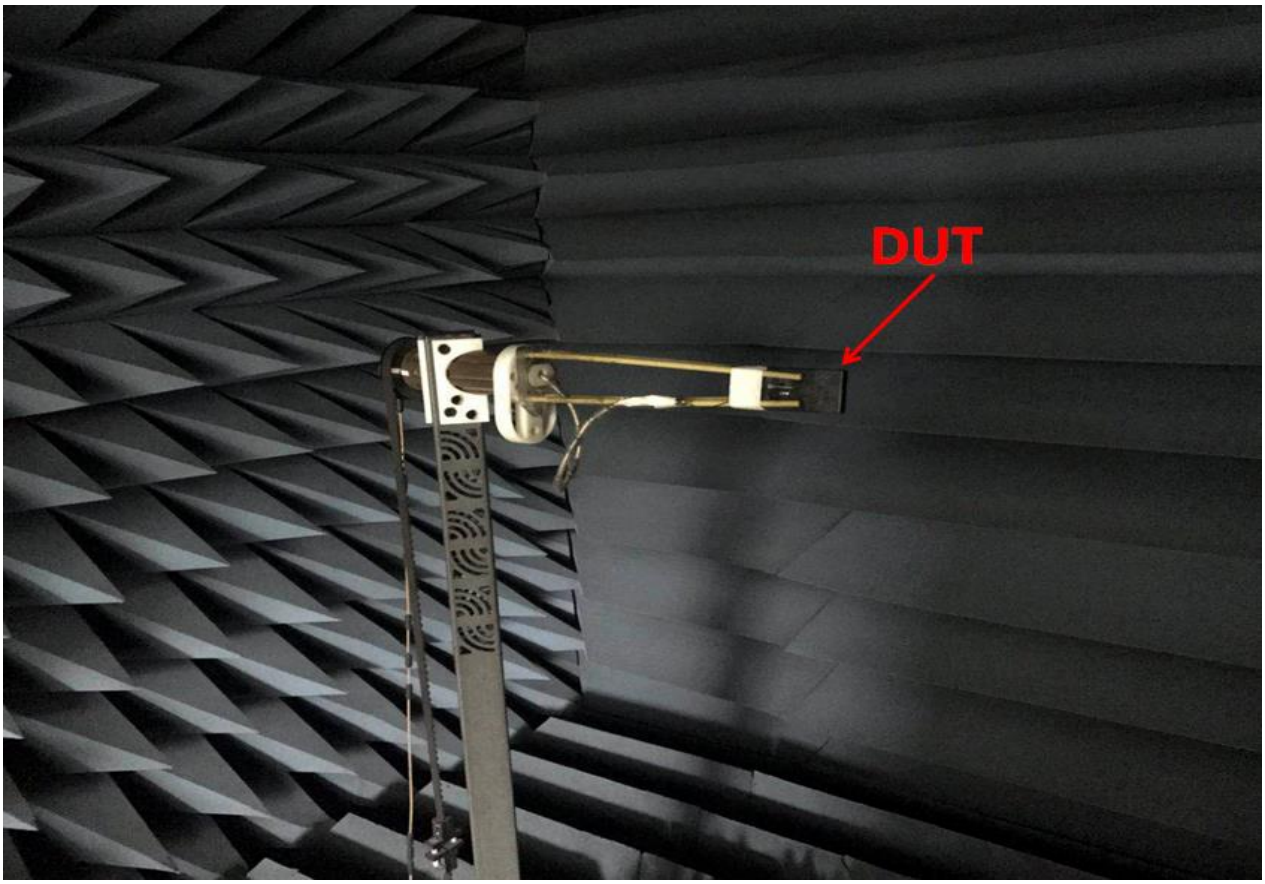


FIGURE4.1.3 ANTENNA LOADED WITH PC/ABS BLOCK OF 1MM THICKNESS TESTED IN OTA CHAMBER

4.2 ANTENNA PERFORMANCE

Description	Equipment	Requirement	
Frequency Range	VNA E5071C	2.4-2.5GHz	5.15-5.85GHz
Return Loss	VNA E5071C	< -10 dB	
Peak Gain (Max)	OTA Chamber	1.6dBi	2.8dBi
Average Total Efficiency	OTA Chamber	>59%	>60%
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 200mm

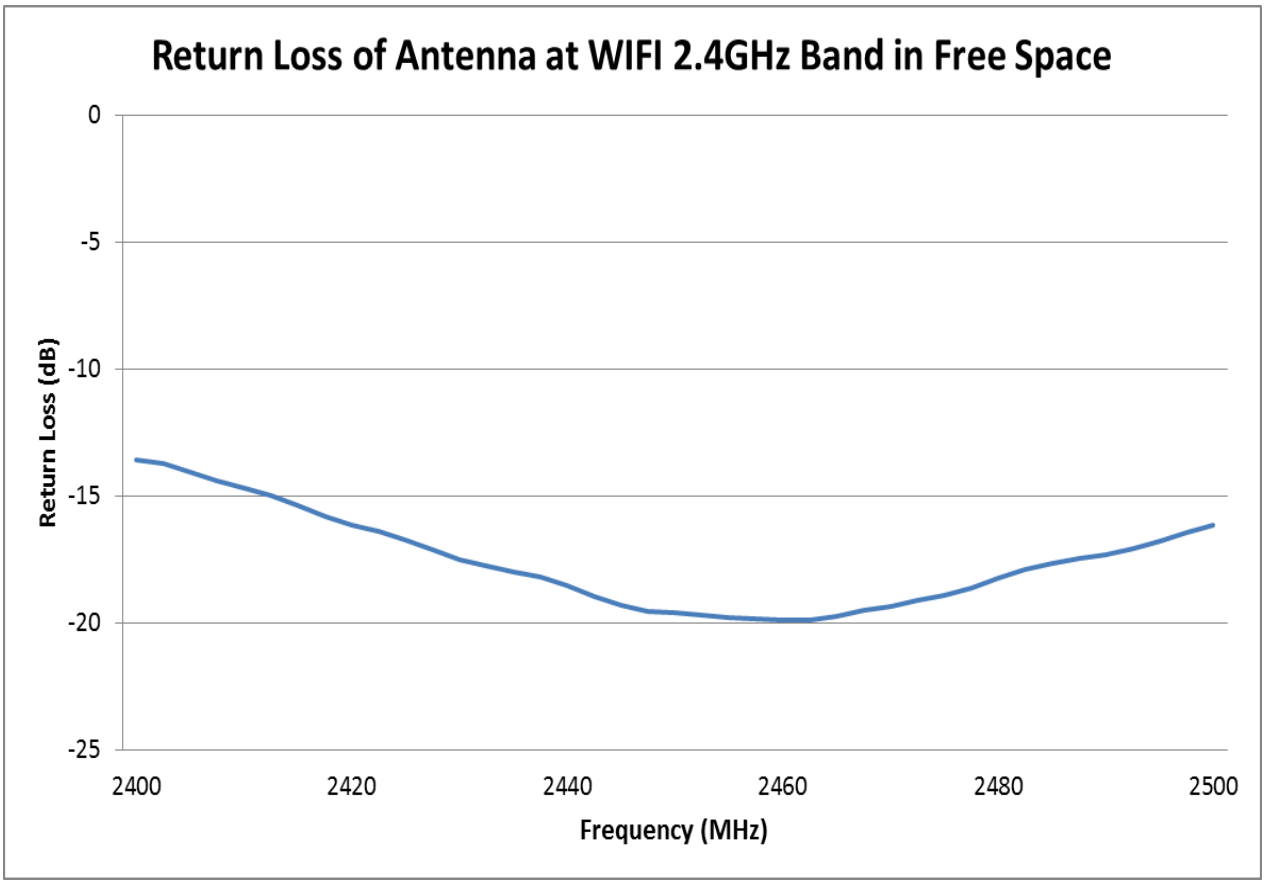


FIGURE 4.3.1 RETURN LOSS OF ANTENNA AT WIFI 2.4GHZ BAND IN FREE SPACE

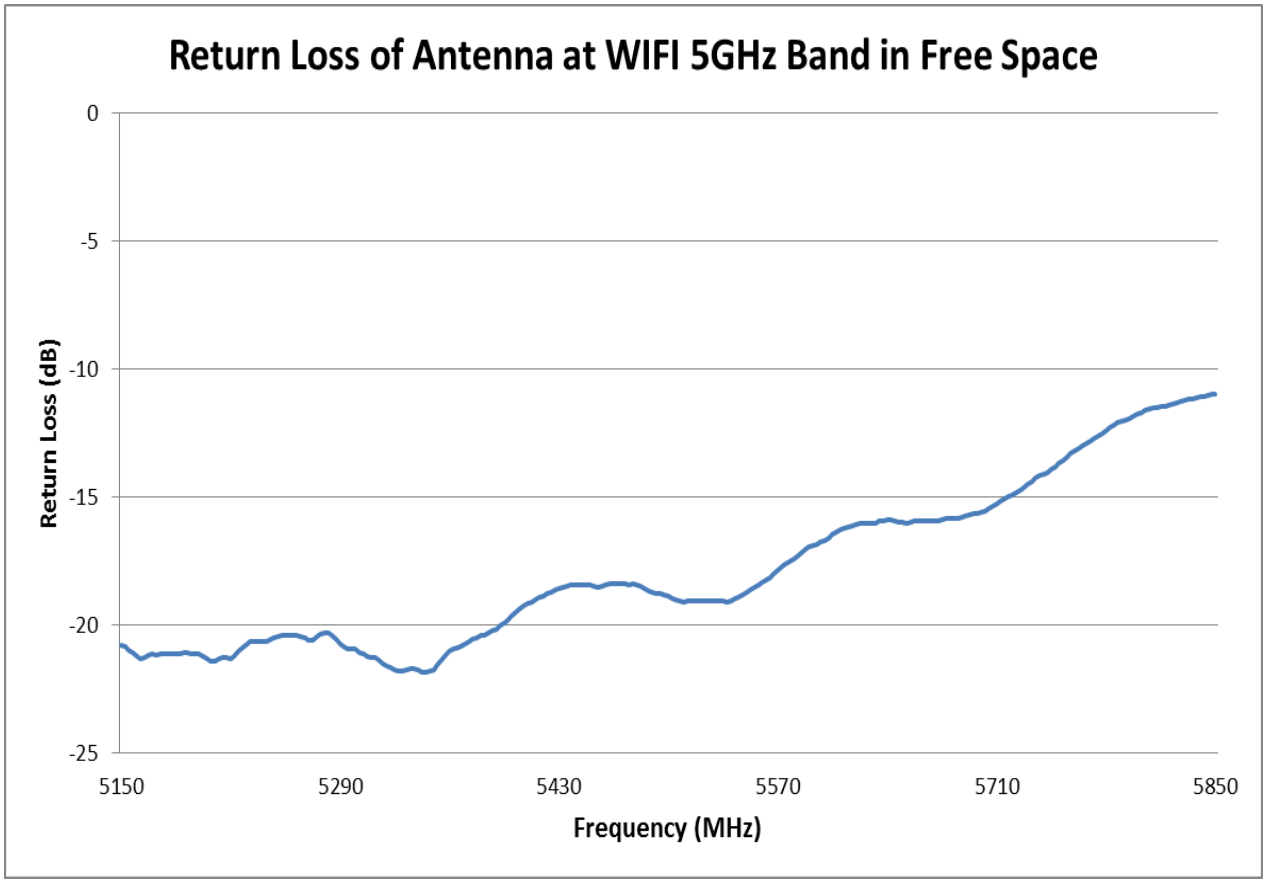


FIGURE 4.3.2 RETURN LOSS OF ANTENNA AT WIFI 5GHZ BAND IN FREE SPACE

4.4 EFFICIENCY PLOT

All measurements in this document are done with a cable length of 200mm

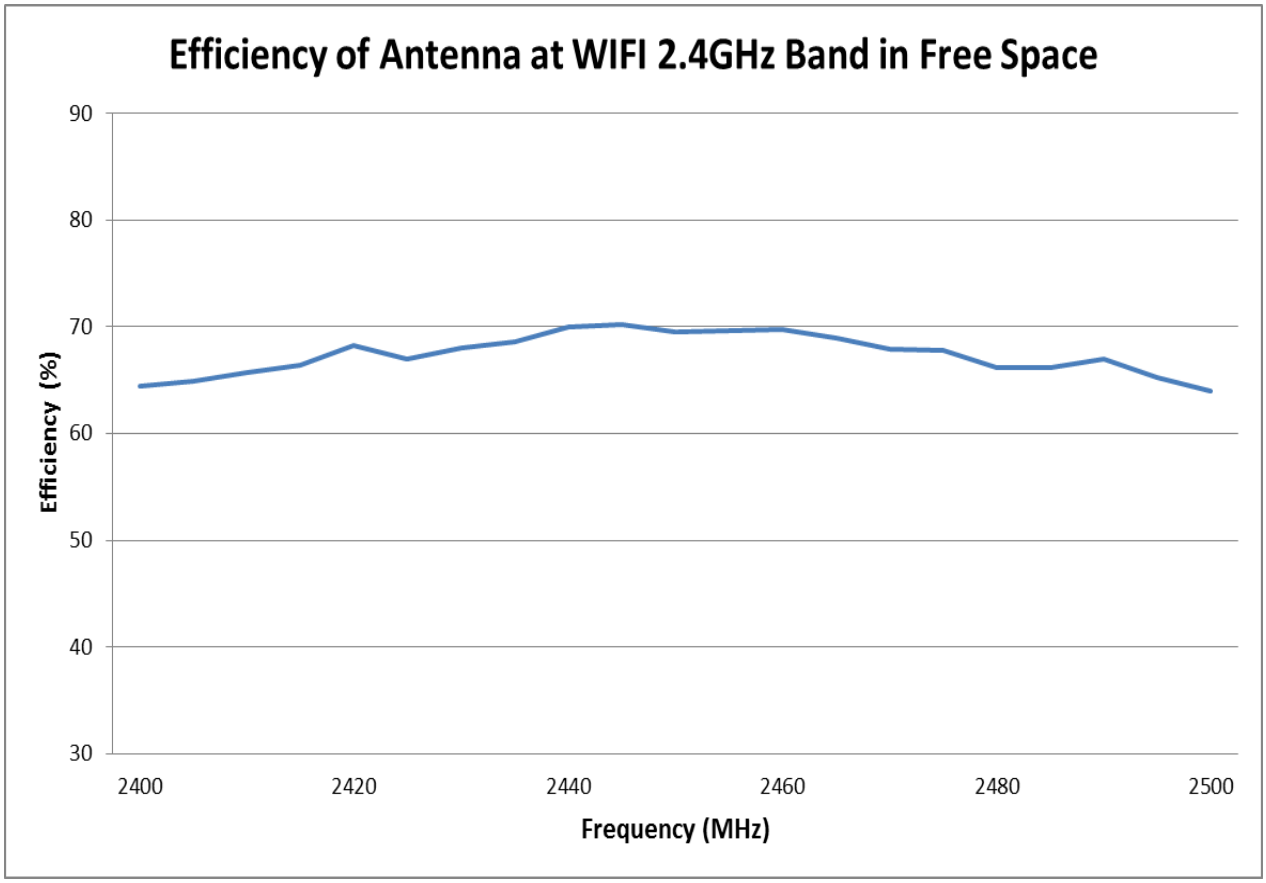


FIGURE 4.4.1 EFFICIENCY OF ANTENNA AT WIFI 2.4GHZ BAND IN FREE SPACE

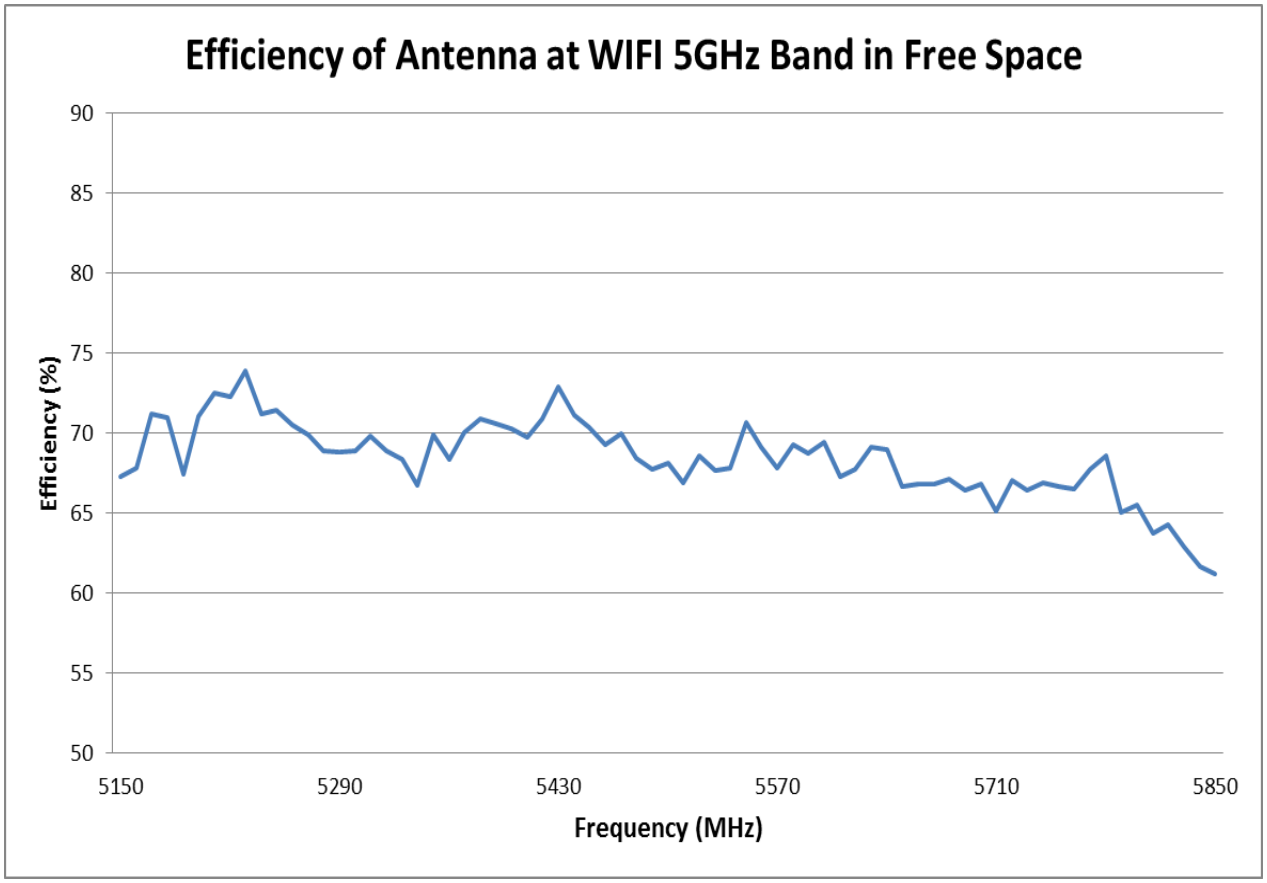
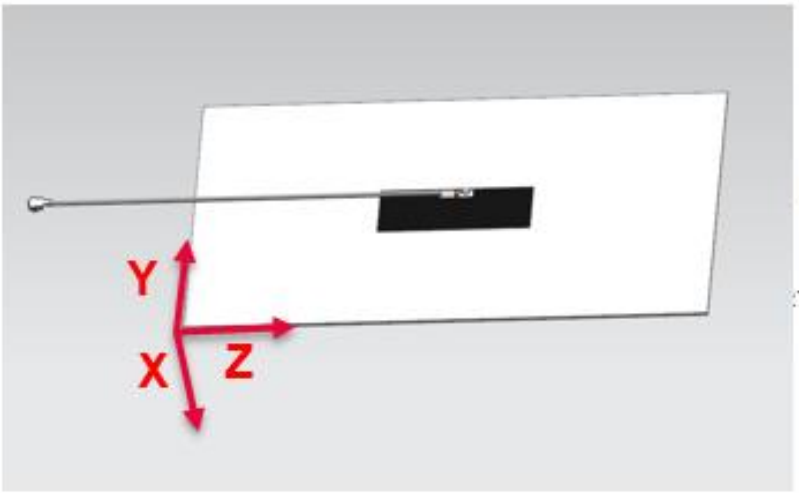
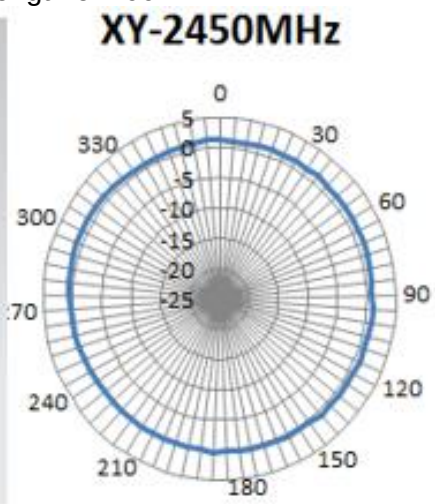


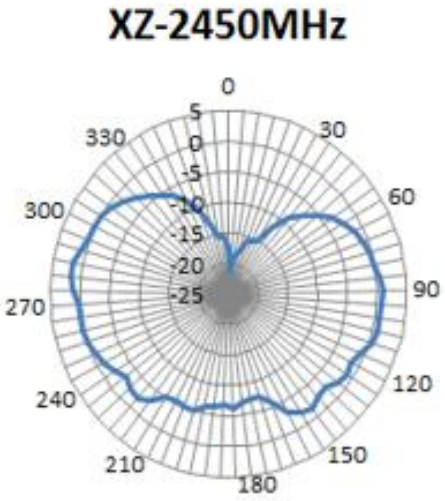
FIGURE 4.4.2 EFFICIENCY OF ANTENNA AT WIFI 5GHZ BAND IN FREE SPACE

4.5 RADIATION PATTERN

All measurements in this document are done with a cable length of 200mm.







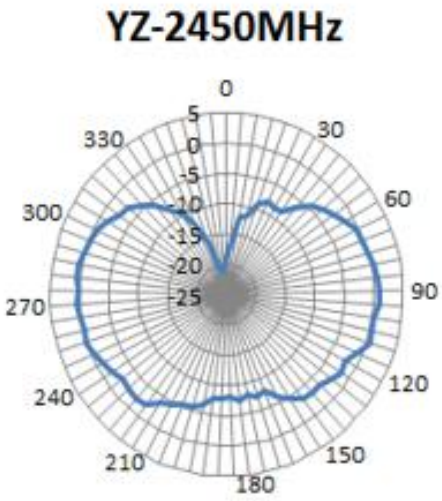
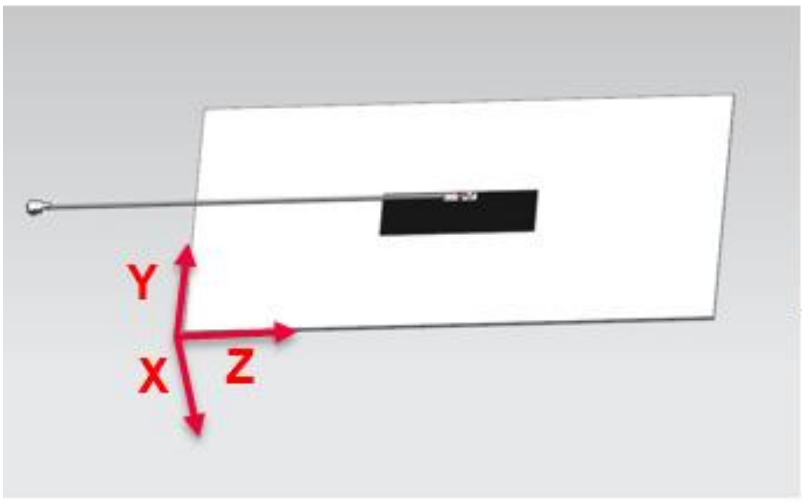
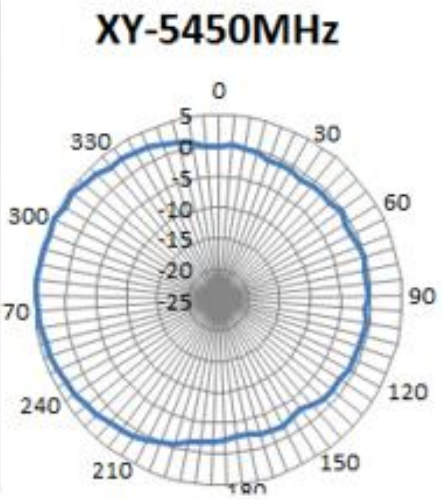
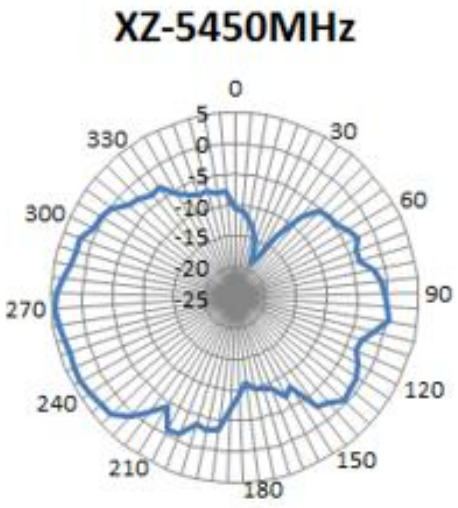


FIGURE 4.5.1 2D RADIATION PATTERN OF ANTENNA AT 2.45GHZ IN FREE SPACE







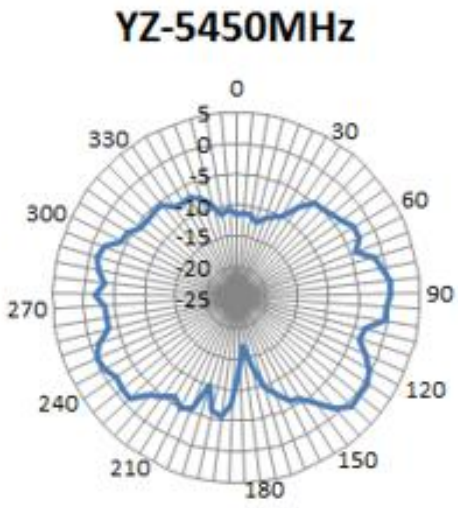


FIGURE 4.5.2 2D RADIATION PATTERN OF ANTENNA AT 5.45GHZ IN FREE SPACE

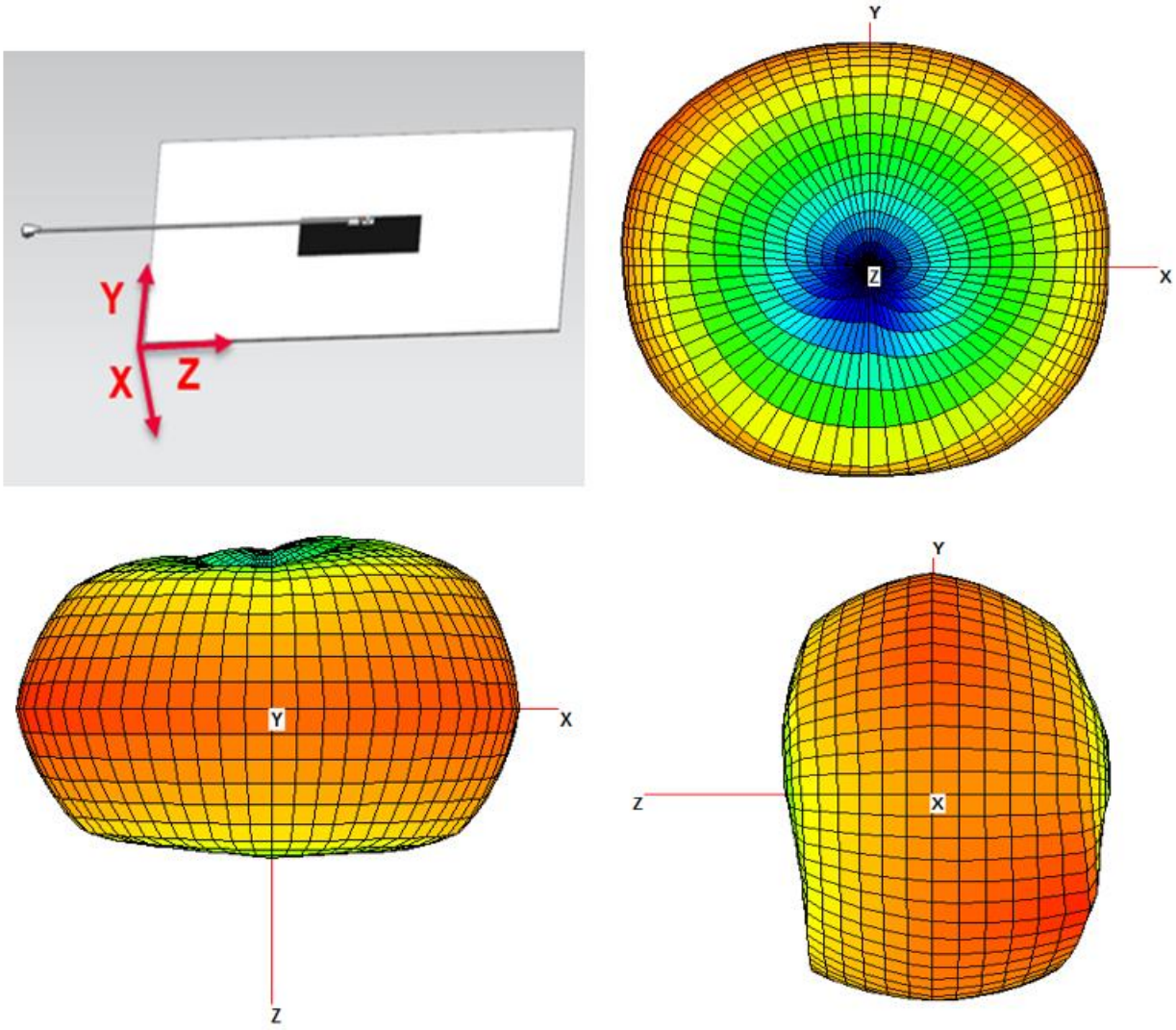


FIGURE 4.5.3 3D RADIATION PATTERN OF ANTENNA AT 2.45GHZ IN FREE SPACE

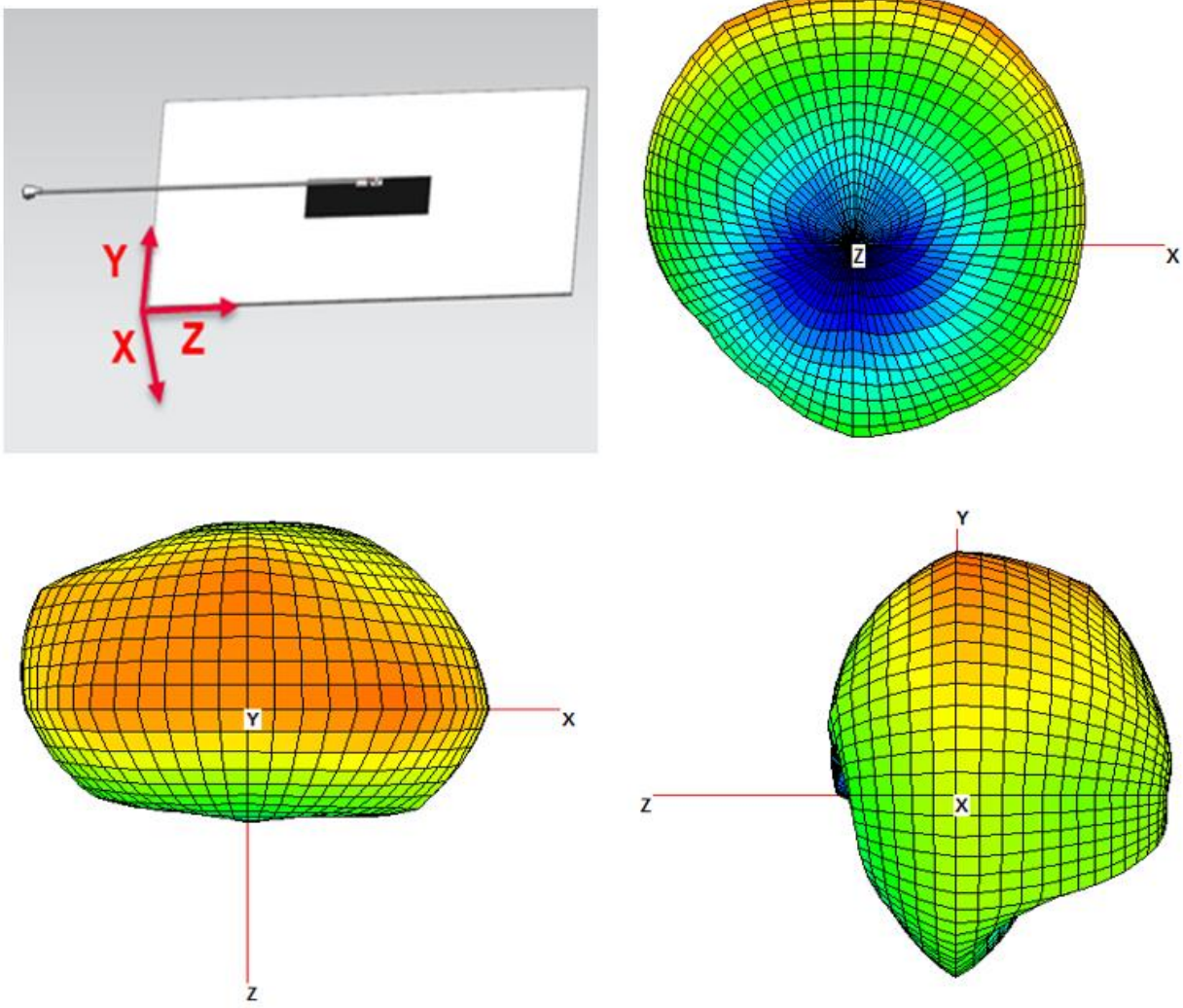


FIGURE 4.5.4 3D RADIATION PATTERN OF ANTENNA AT 5.45GHZ IN FREE SPACE

5.0 ASSEMBLY GUIDELINE

The flex antenna comes with an adhesive 3M9077 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.

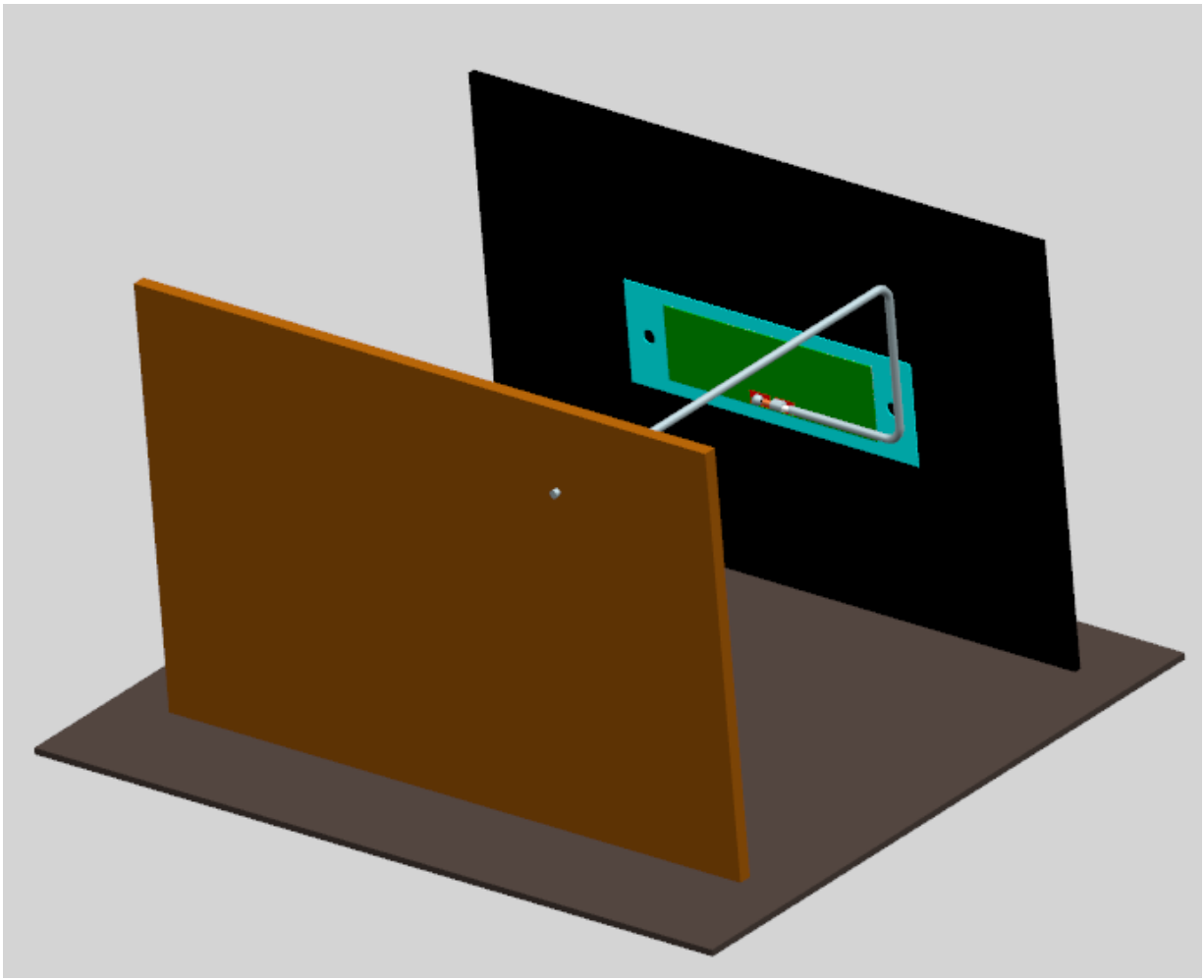


FIGURE 5.1 ASSEMBLY GUIDELINE

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. If the cable crosses into the antenna flex, the antenna performance will be degraded.

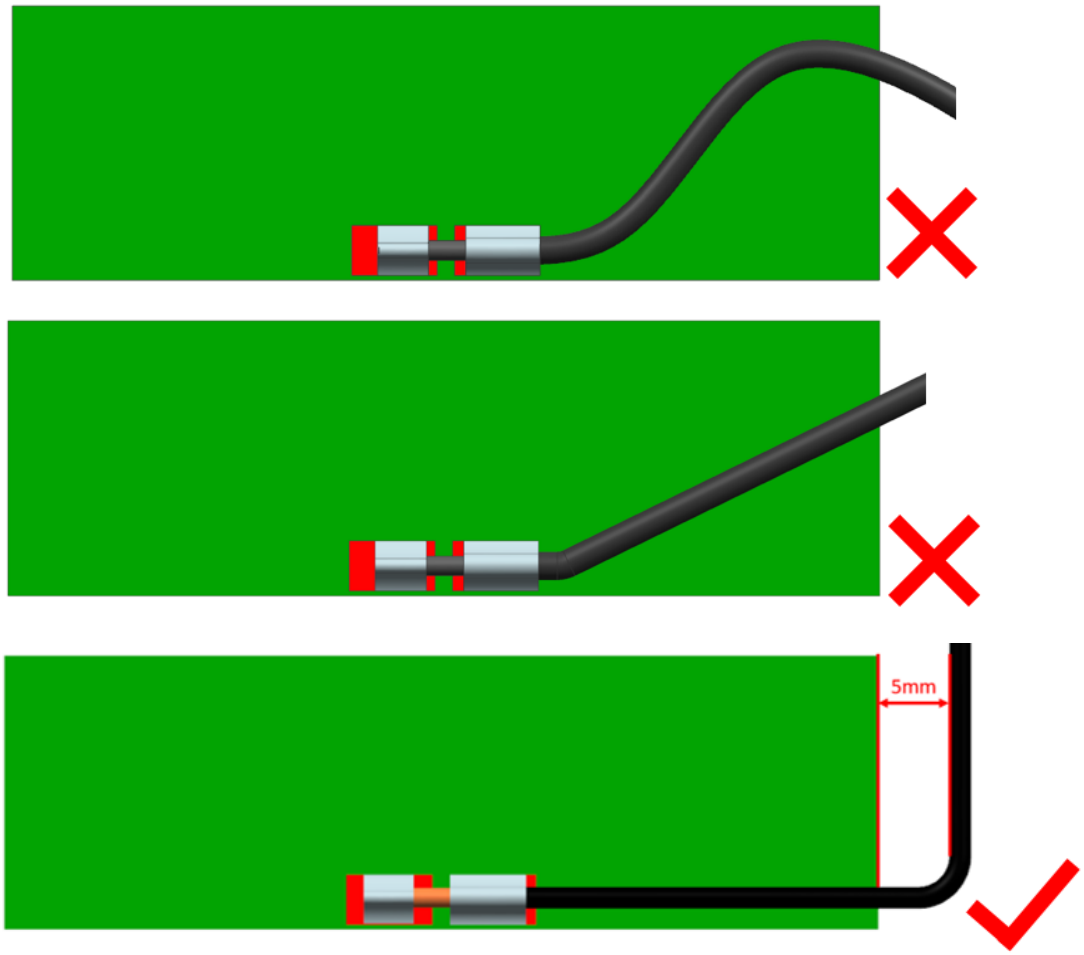


FIGURE 5.2 CABLE BENDING

6.0 THE ANTENNA PERFORMANCE VARIATION WITH CABLE LENGTH

6.1 CABLE LOSS

ITEM	DESCRIPTION	TEST CONDITION	REQUIREMENTS	
	Frequency Range	2.4GHz/5GHz	2GHz~3GHz	5GHz~6.0GHz
6.1.1	Attenuation	1m cable measured by VNA5071C	⩽3.5dB/m	⩽5dB/m

6.2 CABLE LENGTH AFFECT THE ANTENNA PERFORMANCE

Balance antenna resonance is insensitive by cable's length, but the cable's loss will affect the total efficiency. Refer to 6.1.1.

6.3 FOR EXAMPLE

	100mm cable			200mm cable	
Frequency (MHz)	Efficiency (dB)	Efficiency (%)	Cable Loss	Efficiency (dB)	Efficiency (%)
	X		X-LOSS=Y	Y	
2400	-1.91	64.44	0.2m*3.5dB/m	-2.61	54.85
2420	-1.66	68.21		-2.36	58.06
2440	-1.55	69.92		-2.25	59.52
2460	-1.56	69.74		-2.26	59.36
2480	-1.79	66.18		-2.49	56.33
2500	-1.94	64.02		-2.64	54.49
5150	-1.72	67.25	0.2m*5dB/m	-2.72	53.42
5200	-1.49	71.00		-2.49	56.40
5250	-1.46	71.40		-2.46	56.71
5300	-1.62	68.86		-2.62	54.69
5350	-1.56	69.89		-2.56	55.52
5400	-1.53	70.30		-2.53	55.84
5450	-1.53	70.32		-2.53	55.85
5500	-1.67	68.08		-2.67	54.08
5550	-1.51	70.63		-2.51	56.10
5600	-1.59	69.40		-2.59	55.13
5650	-1.76	66.66		-2.76	52.95
5700	-1.75	66.78		-2.75	53.04
5750	-1.76	66.67		-2.76	52.96
5800	-1.84	65.48		-2.84	52.01
5850	-2.13	61.21		-3.13	48.62

- The data is just for your reference, all accurate performance should be according to the test results in the OTA chamber.

7.0 RF PERFORMANCE AS A FUNCTION OF IMPLEMENTATION

7.1 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 7.1.1. 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 15mm to achieve acceptable RF performance.

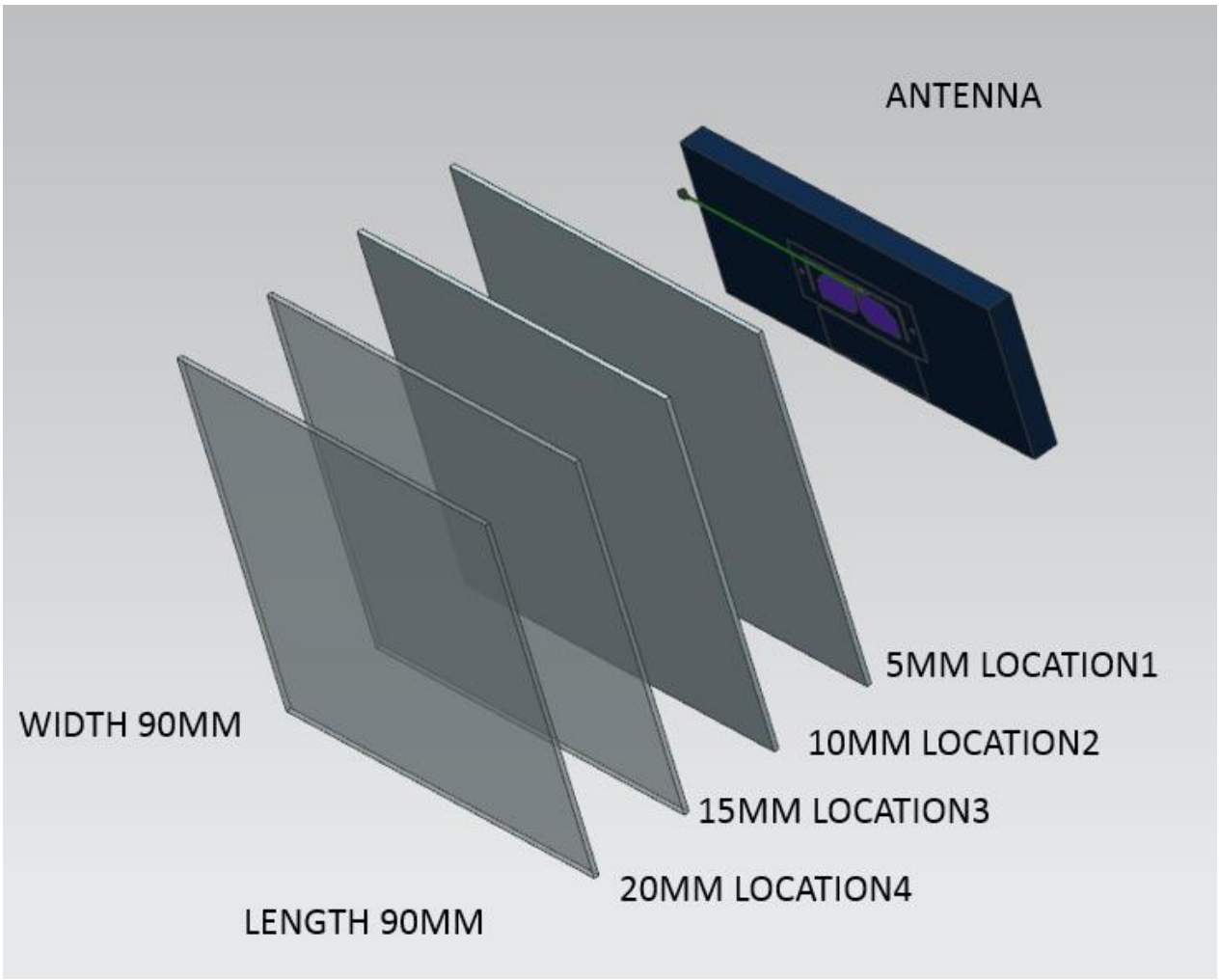


FIGURE 7.1.1 FOUR LOCATIONS WITH PARALLEL PLANE GROUND

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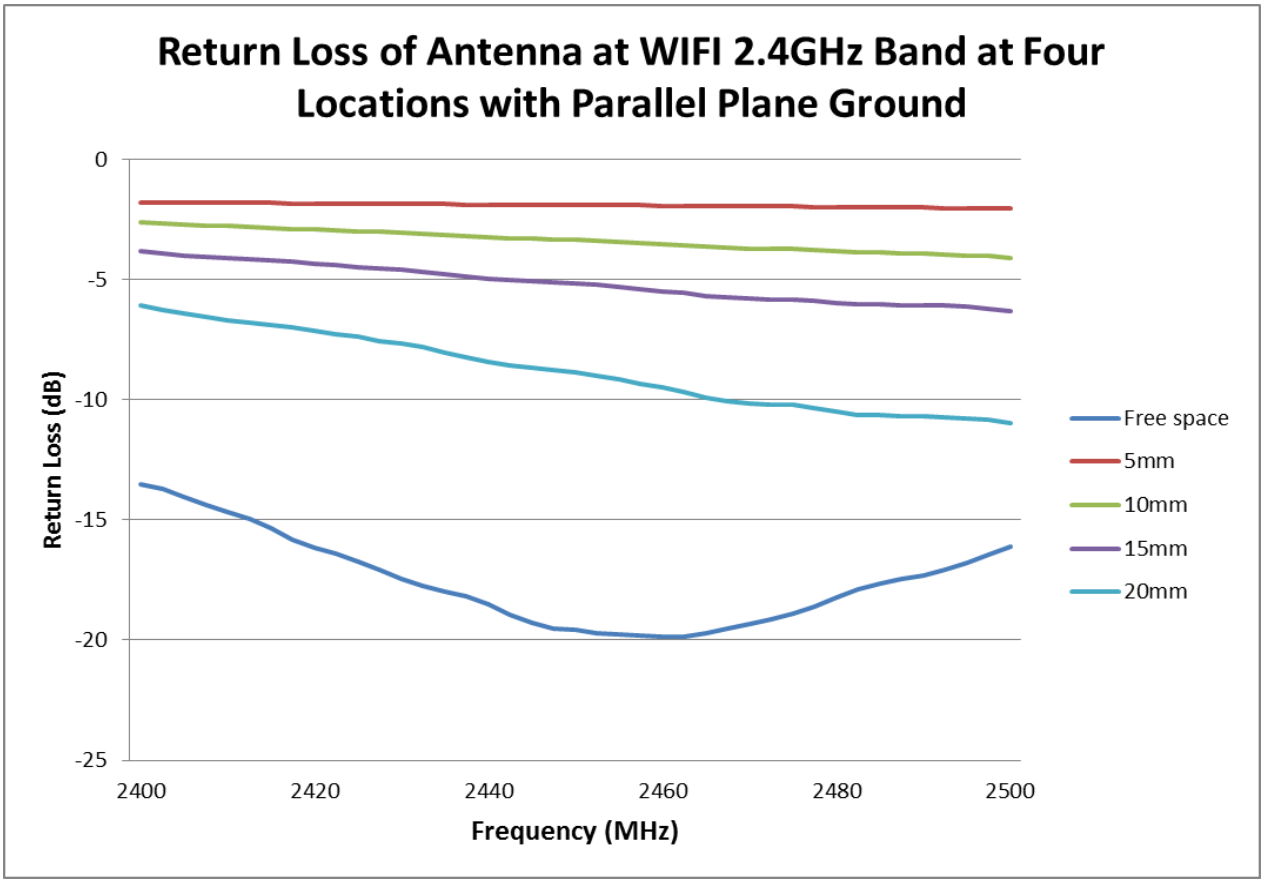

FIGURE 7.1.2 RETURN LOSS OF ANTENNA AT WIFI 2.4GHZ BAND AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND

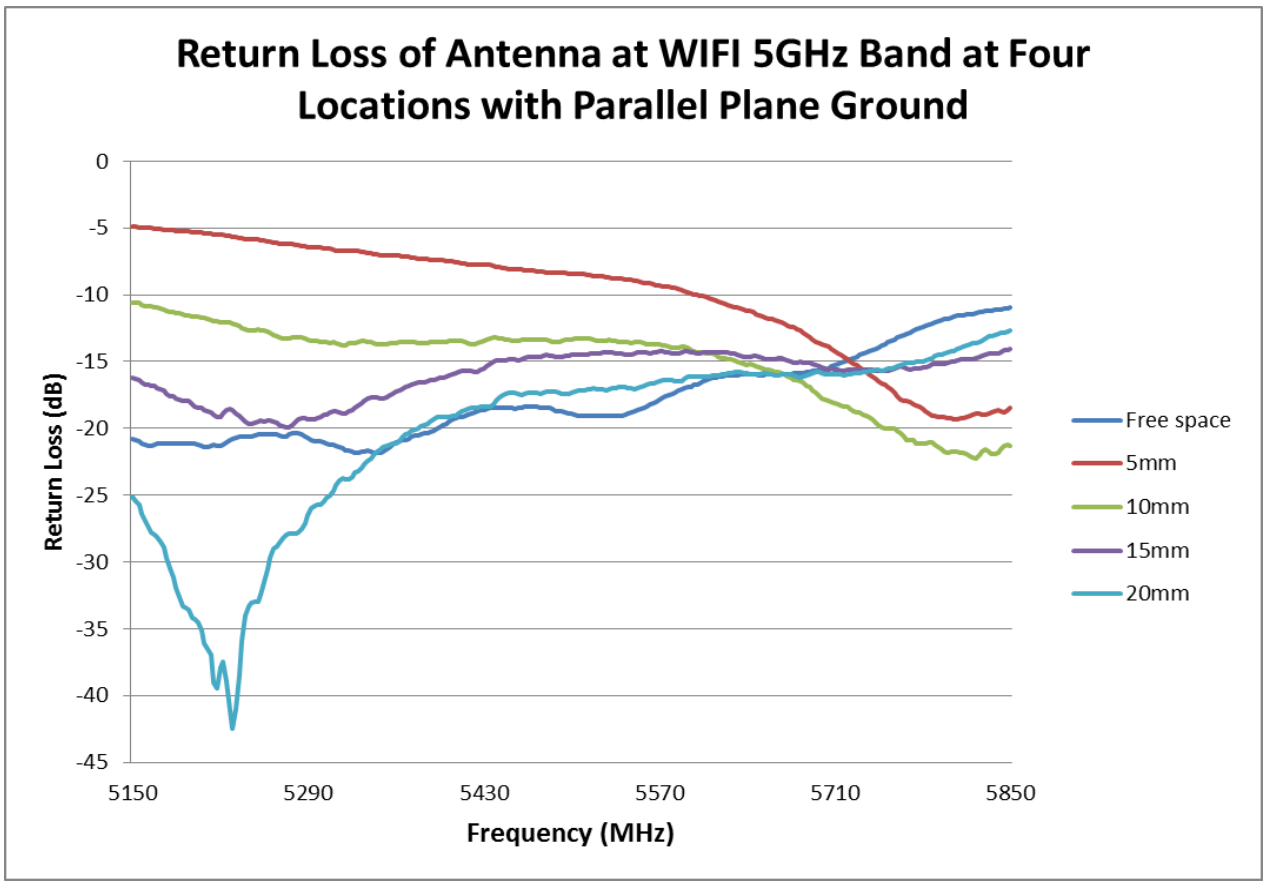

FIGURE 7.1.3 RETURN LOSS OF ANTENNA AT WIFI 5GHZ BAND AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND

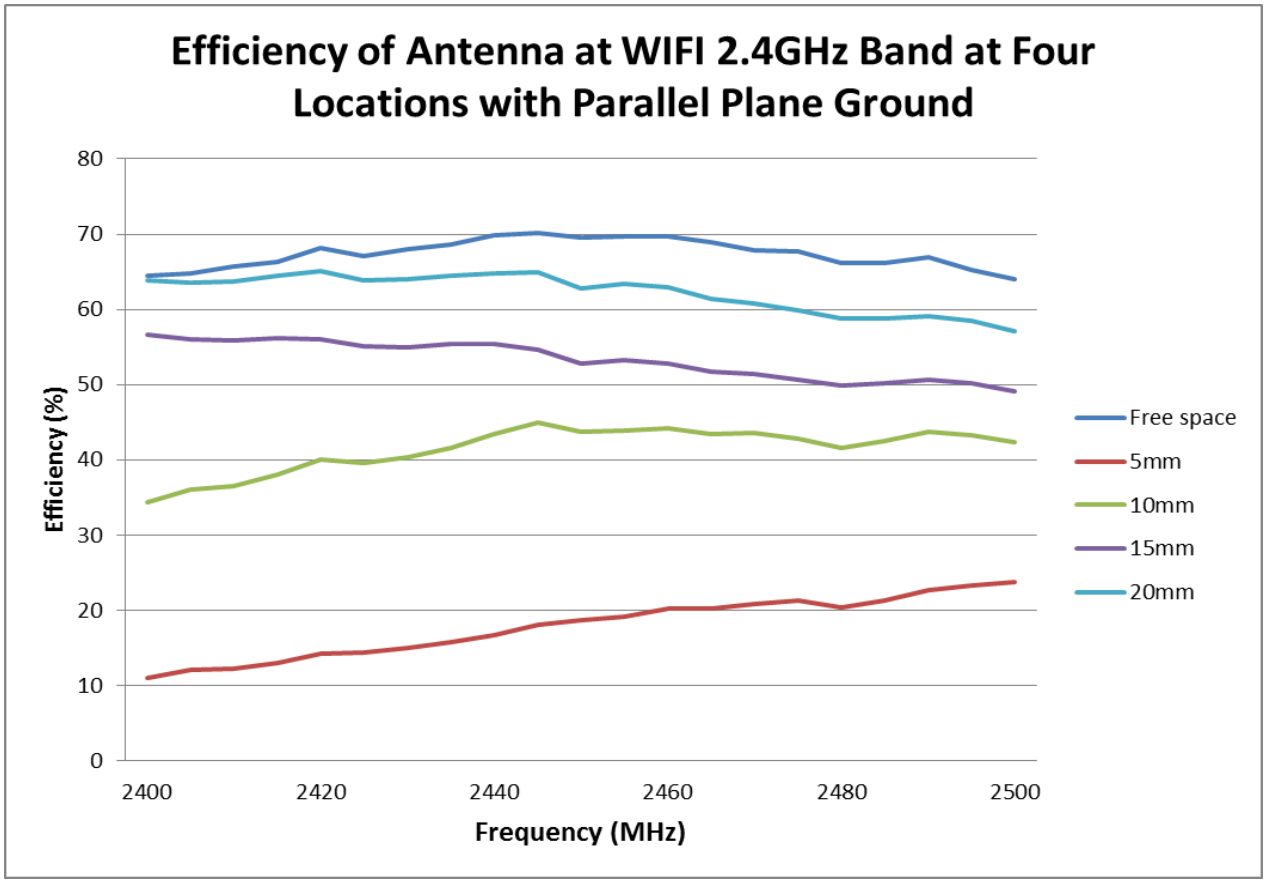

FIGURE 7.1.4 EFFICIENCY OF ANTENNA AT WIFI 2.4GHZ BAND AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND

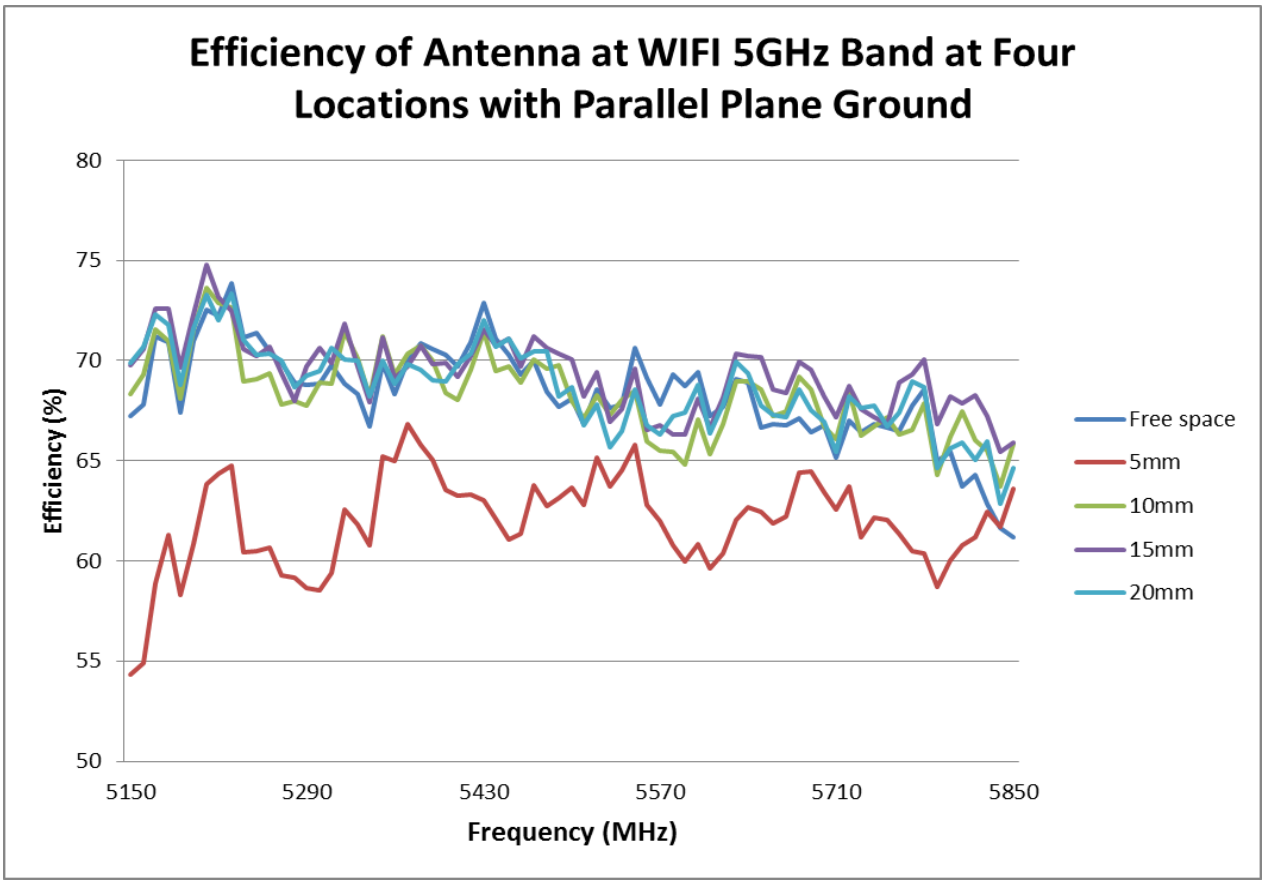

FIGURE 7.1.5 EFFICIENCY OF ANTENNA AT WIFI 5GHZ BAND AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND

7.2 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 7.2.1. 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 10mm to achieve acceptable RF performance.

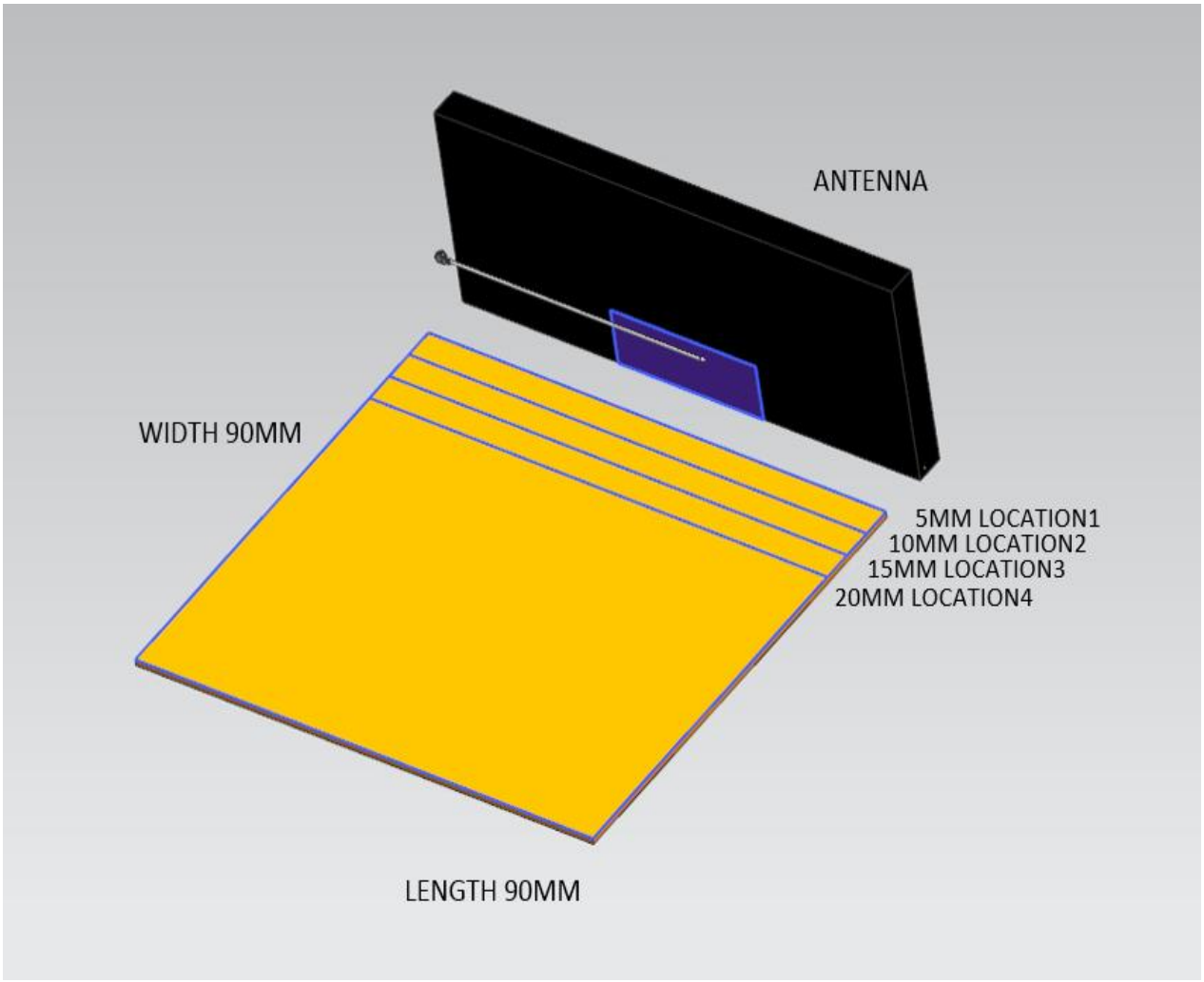

FIGURE 7.2.1 FOUR LOCATIONS WITH VERTICAL PLANE GROUND

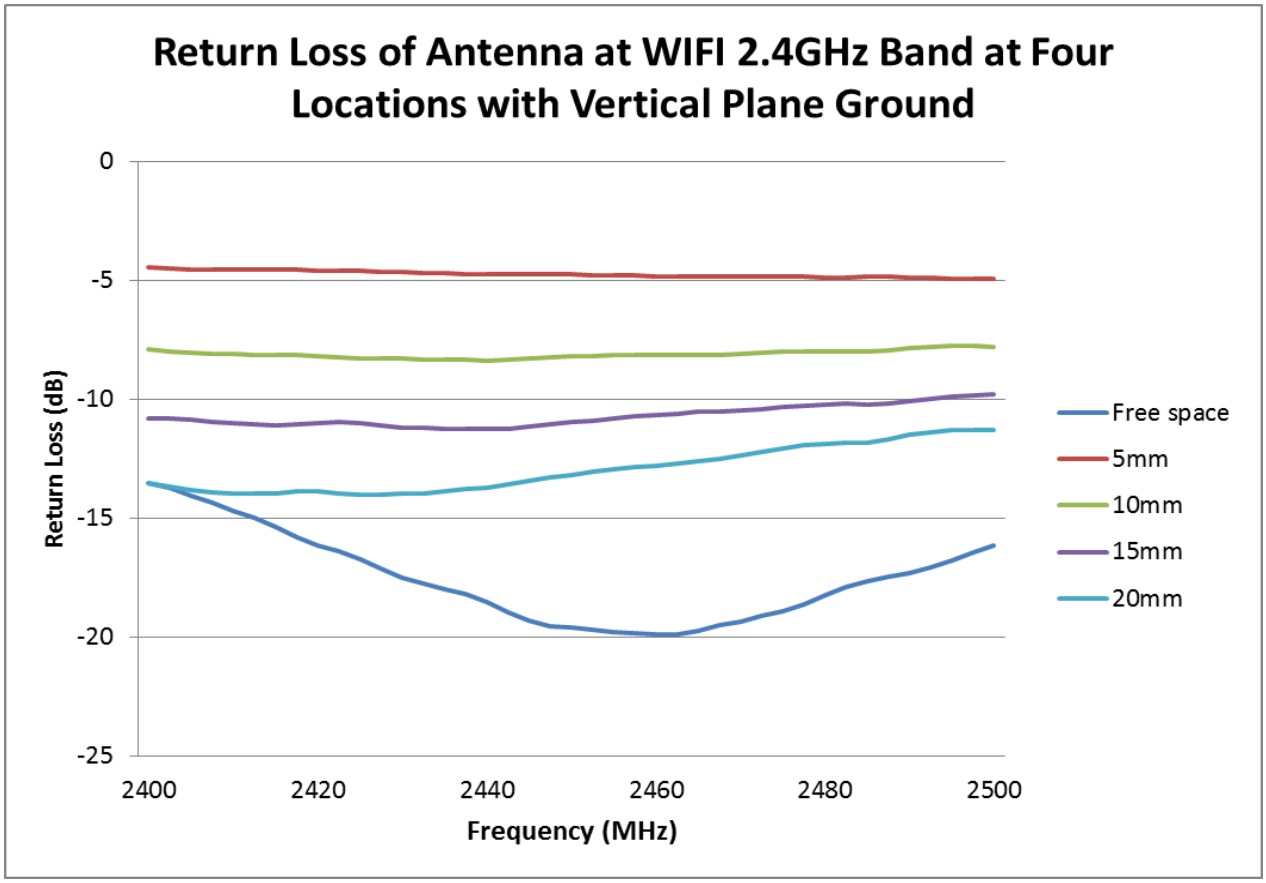

FIGURE 7.2.2 RETURN LOSS OF ANTENNA AT WIFI 2.4GHZ BAND AT FOUR LOCATIONS WITH VERTICAL PLANE GROUND

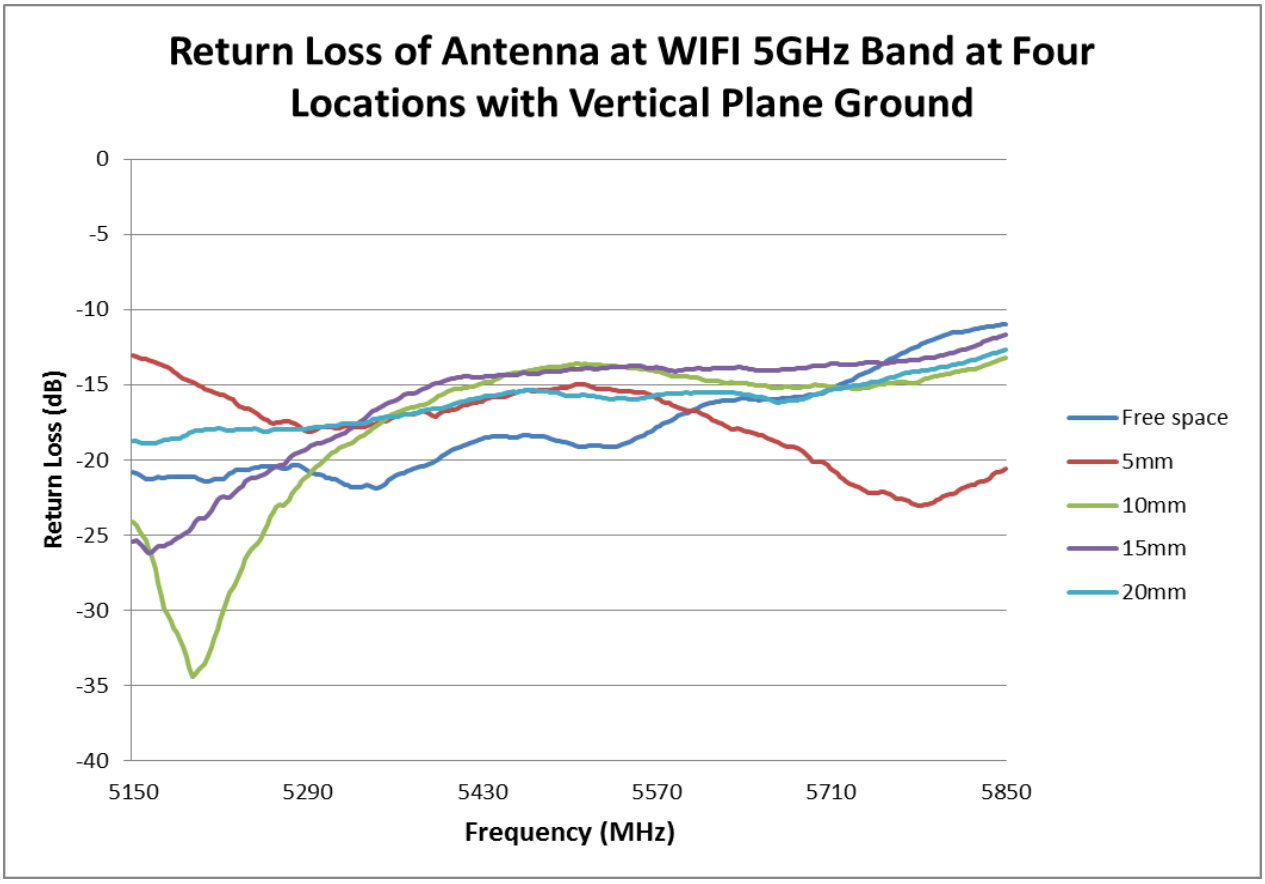

FIGURE 7.2.3 RETURN LOSS OF ANTENNA AT WIFI 5GHZ BAND AT FOUR LOCATIONS WITH VERTICAL PLANE GROUND

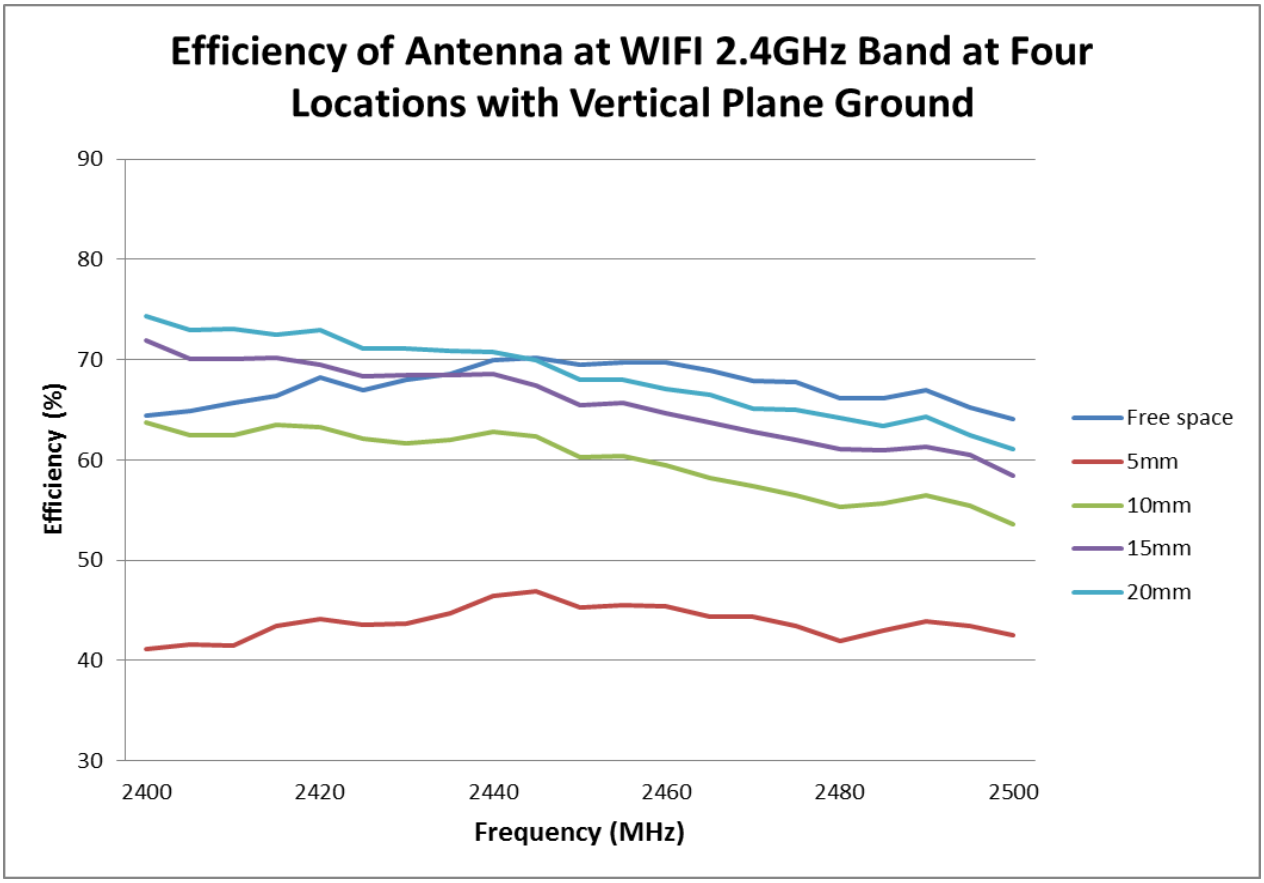

FIGURE 7.2.4 EFFICIENCY OF ANTENNA AT WIFI 2.4GHZ BAND AT FOUR LOCATIONS WITH VERTICAL PLANE GROUND

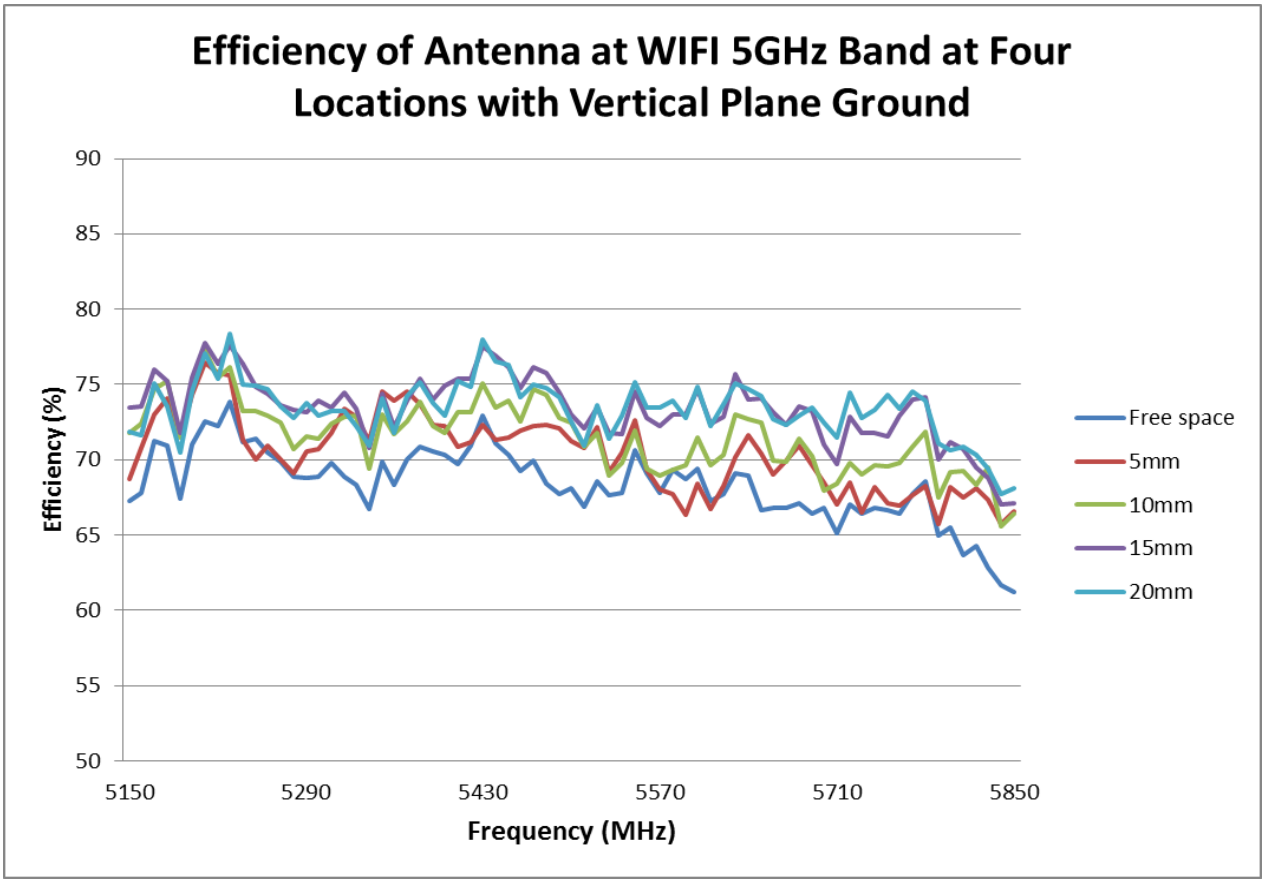

FIGURE 7.2.5 EFFICIENCY OF ANTENNA AT WIFI 5GHZ BAND AT FOUR LOCATIONS WITH VERTICAL PLANE GROUND

7.3 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 7.3.1. 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 10mm to achieve acceptable RF performance.

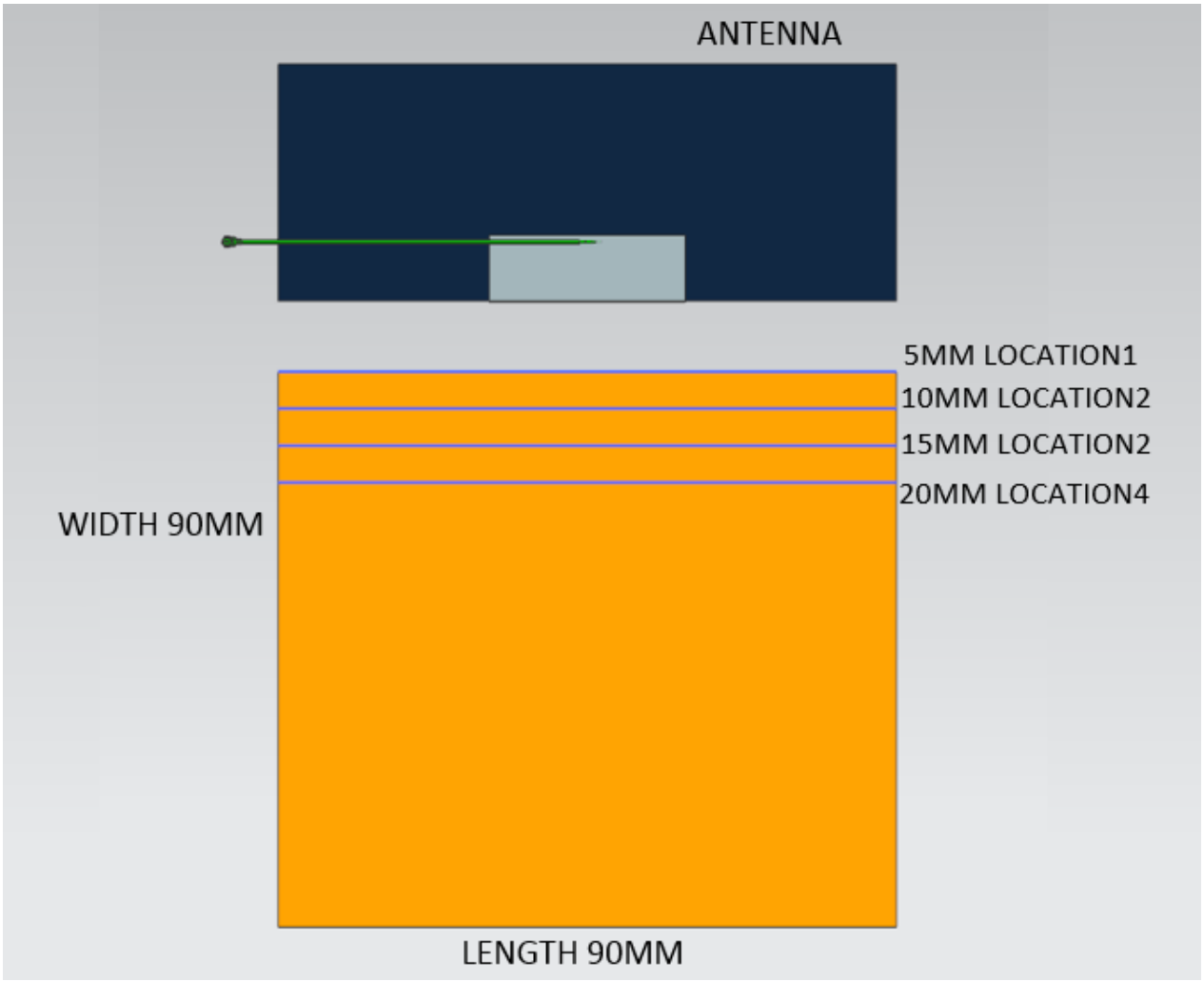

FIGURE 7.3.1 FOUR LOCATIONS WITH PARALLEL PLANE GROUND

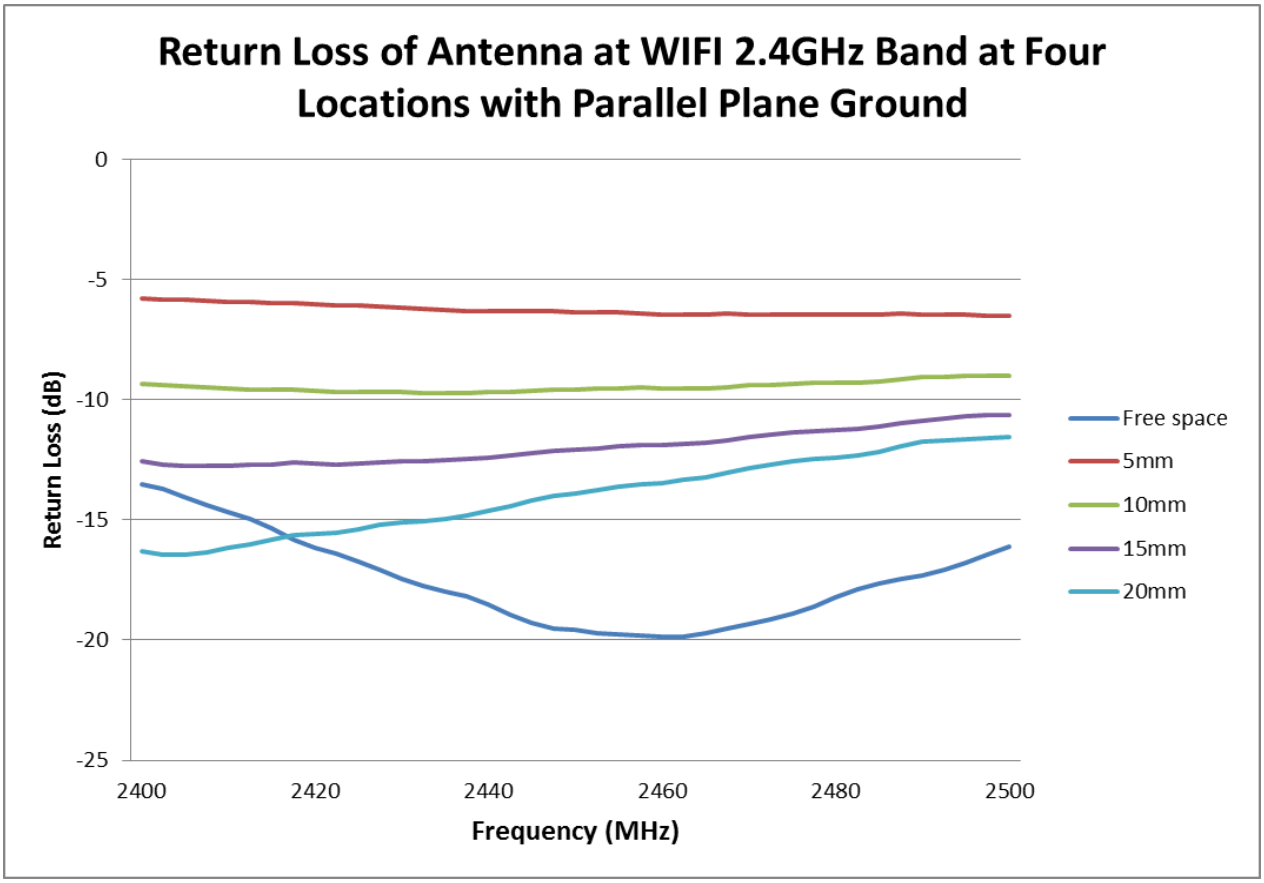

FIGURE 7.3.2 RETURN LOSS OF ANTENNA AT WIFI 2.4GHZ BAND AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND

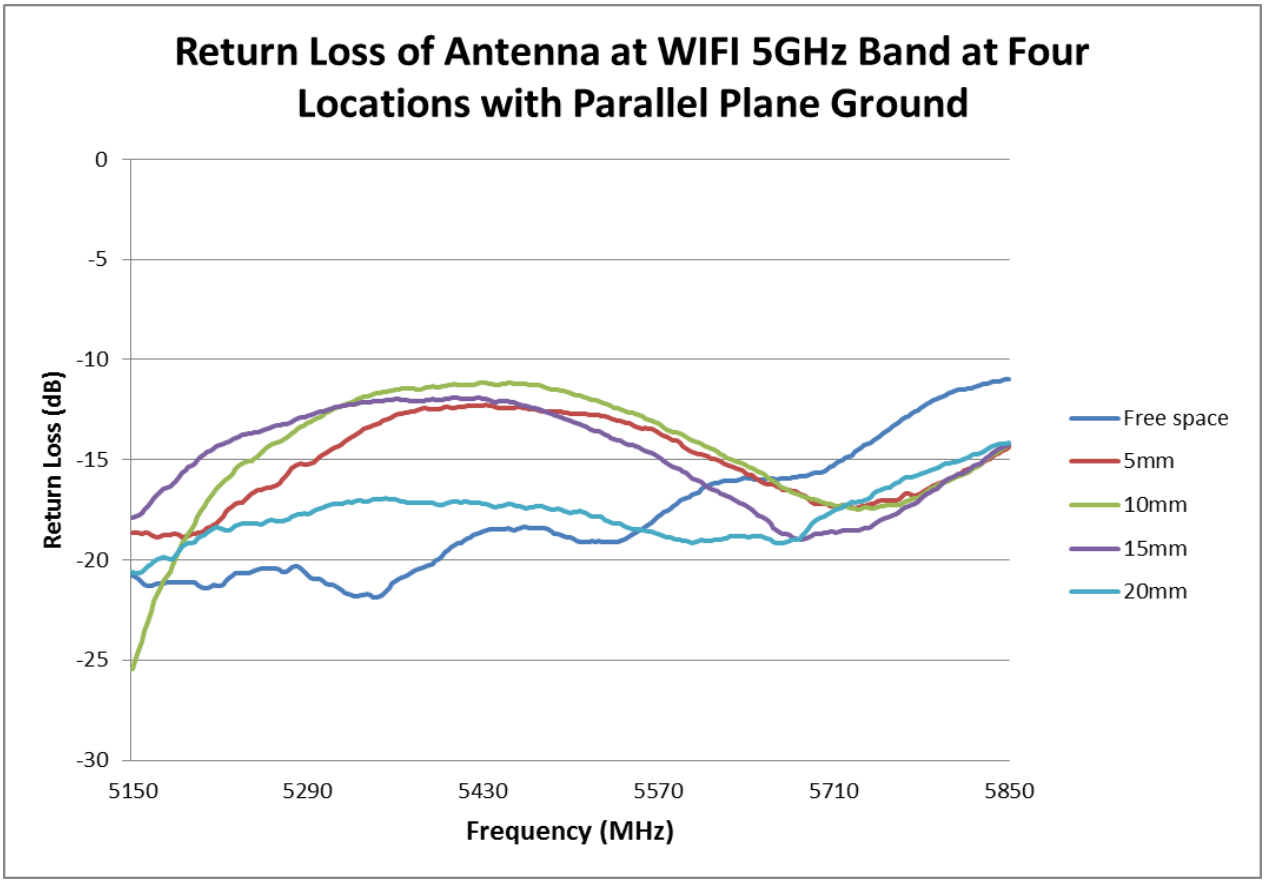

FIGURE 7.3.3 RETURN LOSS OF ANTENNA AT WIFI 5GHZ BAND AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND

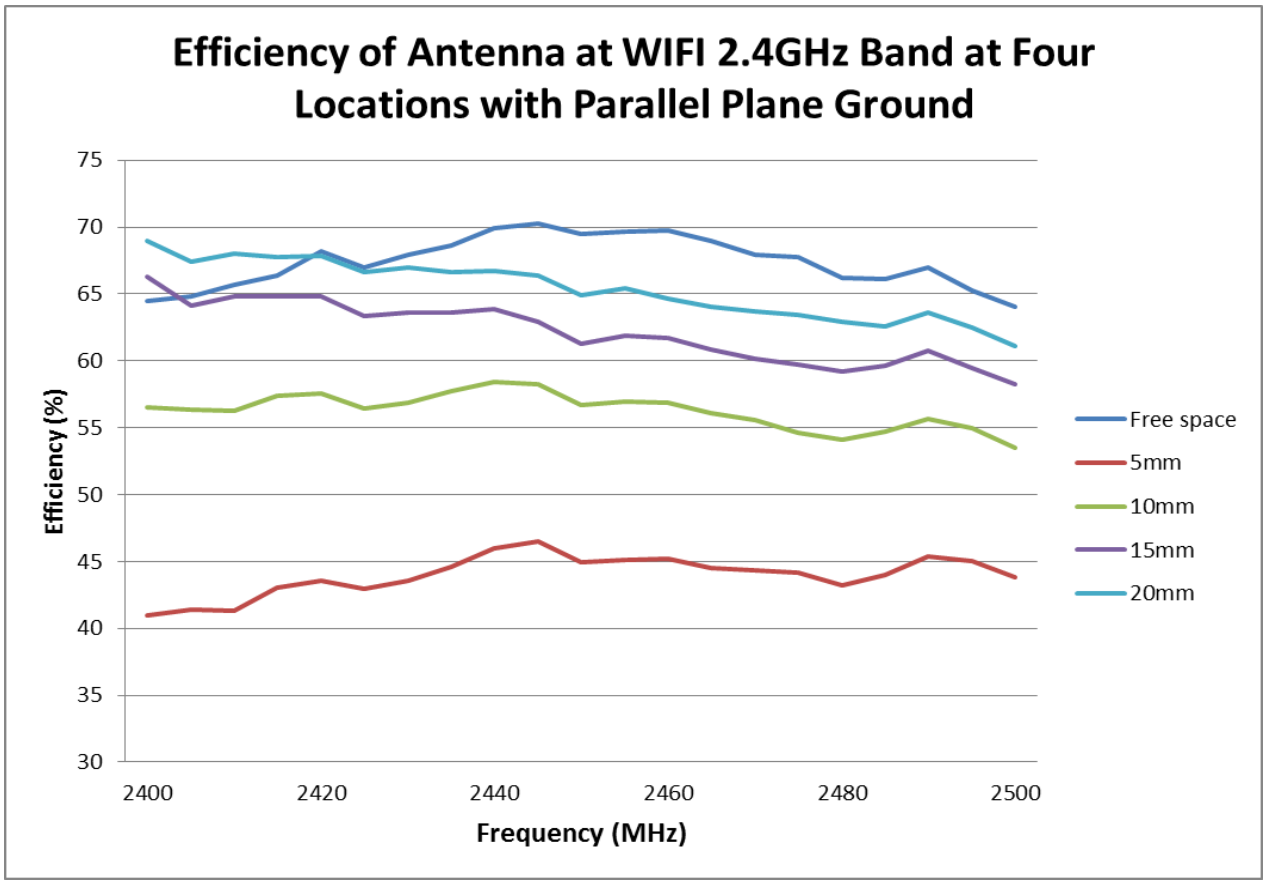

FIGURE 7.3.4 EFFICIENCY OF ANTENNA AT WIFI 2.4GHZ BAND AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND

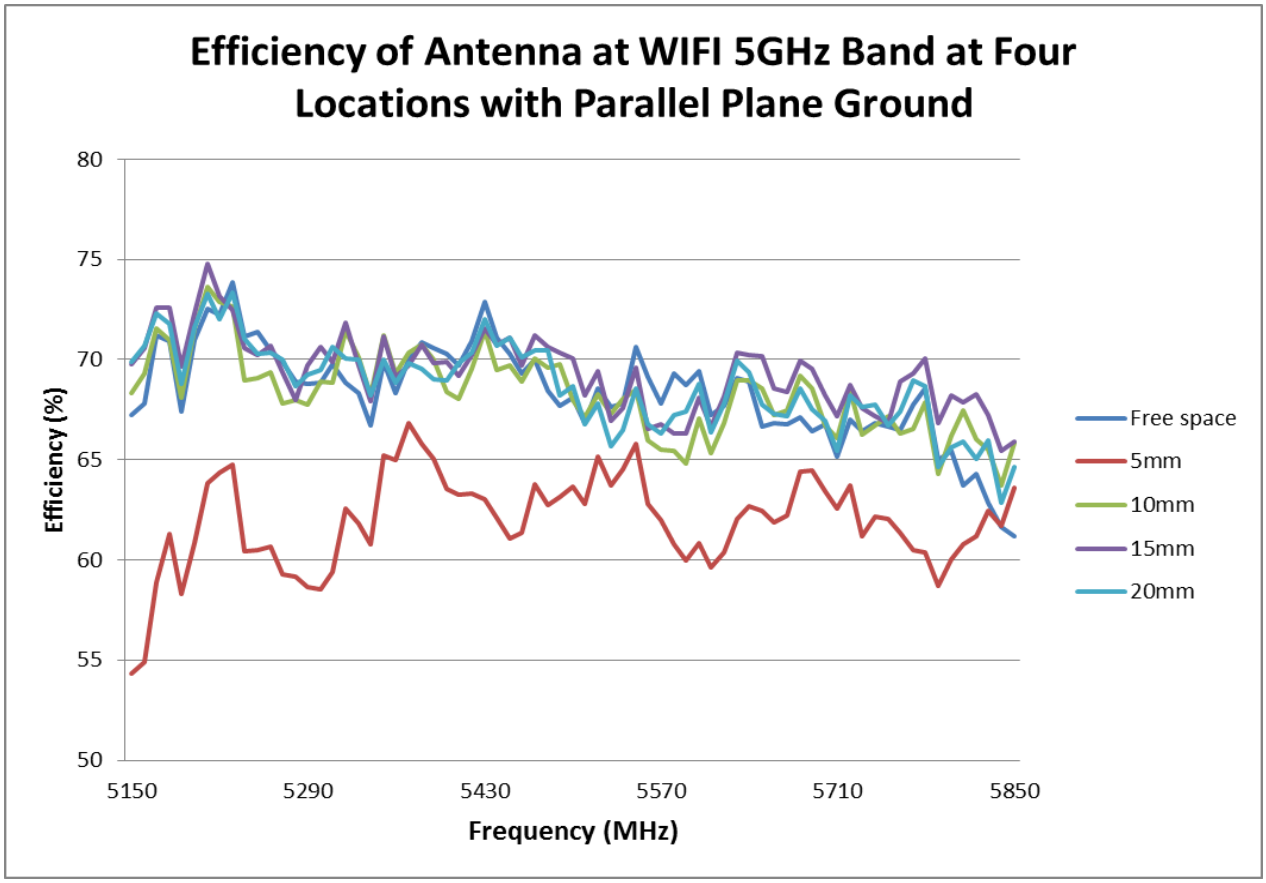

FIGURE 7.3.5 EFFICIENCY OF ANTENNA AT WIFI 5GHZ BAND AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND