TITLE

868/915MHZ DIPOLE FLEXIBLE ANTENNA

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868-915MHZ DIPOLE FLEXIBLE 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.

Although this document AS-2067640100 is for U.FL compatible connector and 100mm cable, it is applicable to all products under 206764 series. All measurements in this document are done with the part no.2067640100 with a cable length of 100mm, it is used to illustrate the product application. 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: 868/915MHz Dipole Flexible Antenna

Series Number: 206764

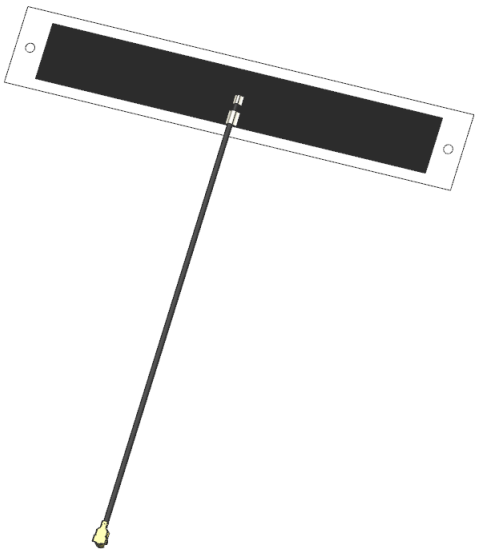
2.2 DESCRIPTION

Series 206764 is similar to series 105262, both series are flexible antenna with cable enable direct connection to host PCB, both cover a typical dual band ISM from 863 – 928MHz.

The difference is 206764 is standard dipole type, the antenna size is a little larger but performance is better than 105262.

2.3 PRODUCT STRUCTURE INFORMATION

Please refer to PS-2067640100 for full information.



Molex 206764 Series 868/915MHz Dipole Flexible Antenna 3D View

3.0 APPLICABLE DOCUMENTS

DOCUMENT	NUMBER	DESCRIPTION
Sale Drawing(SD)	SD-2067640100	Mechanical Dimension of the product
Product Specification (PS)	PS-2067640100	Product Specification
Packing Drawing(PK)	PK-2067640100	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 2mm thickness with VNA Agilent 5071C and Over-The-Air (OTA) chamber. All measurements in this document are done with the part no.2067640100 with a cable length of 100mm.

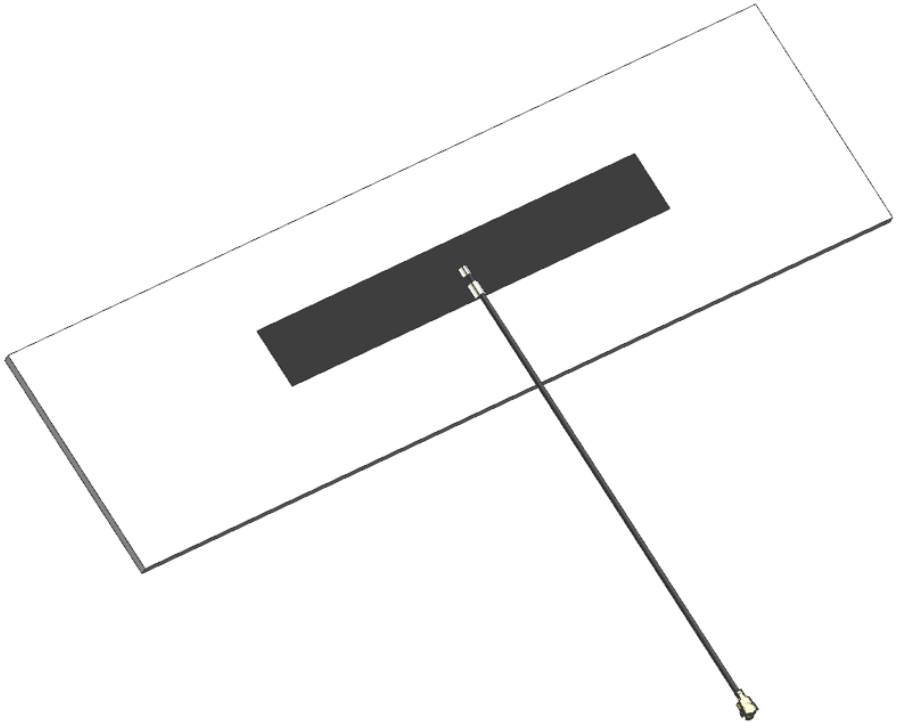


FIGURE4.1.1 ANTENNA LOADED WITH PC/ABS BLOCK OF 2MM THICKNESS

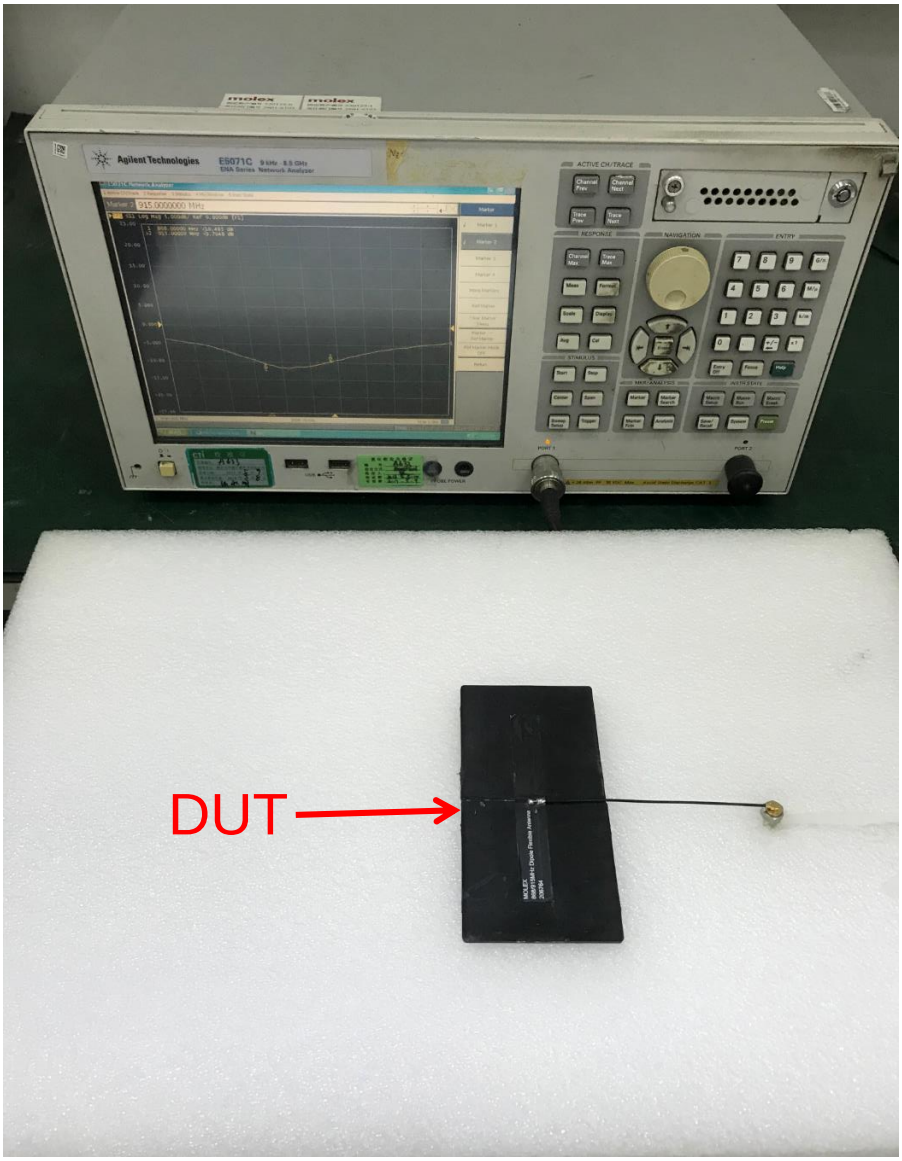


FIGURE4.1.2 ANTENNA LOADED WITH PC/ABS BLOCK OF 2MM THICKNESS WITH VNA

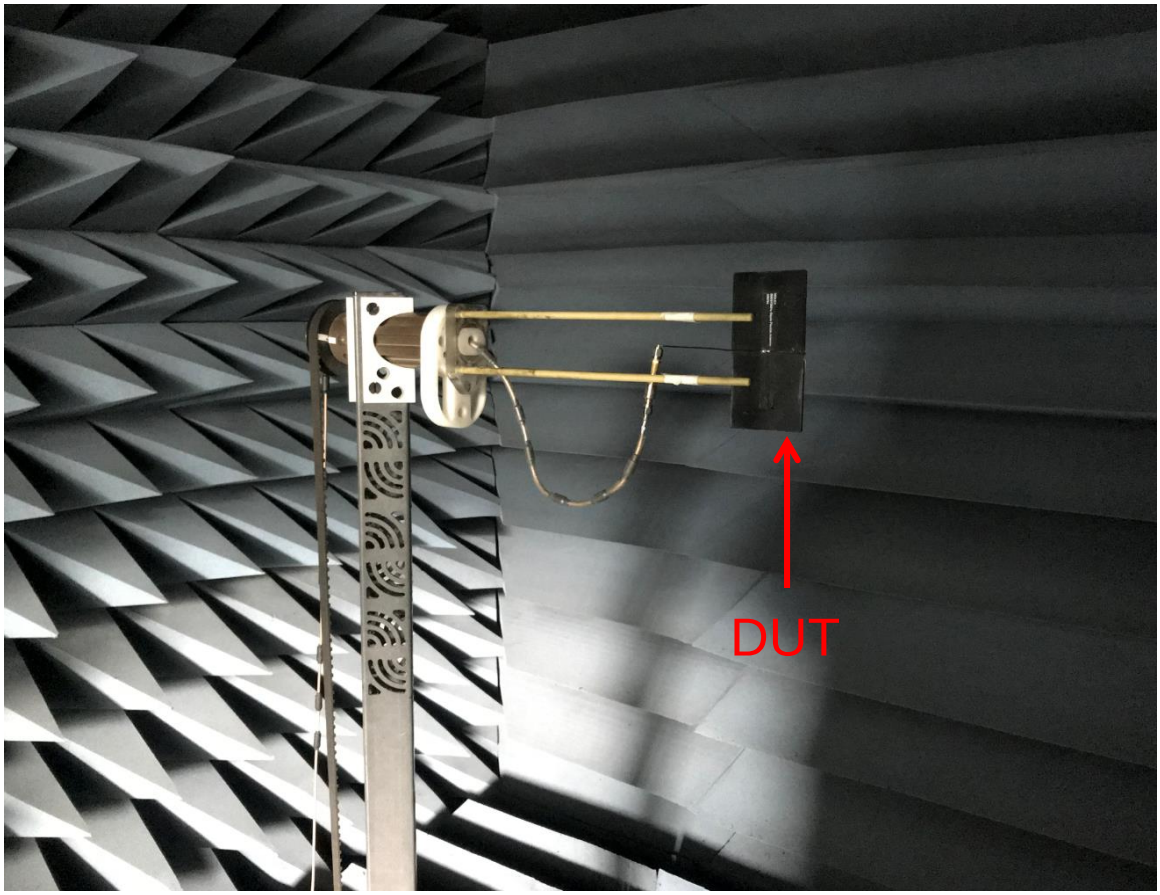


FIGURE4.1.3 ANTENNA LOADED WITH PC/ABS BLOCK OF 2MM THICKNESS WITH OTA CHAMBER

4.2 ANTENNA PERFORMANCE

DESCRIPTION	EQUIPMENT	REQUIREMENT
Frequency Range	VNA E5071C	863-928MHz
Return Loss	VNA E5071C	< -9 dB
Peak Gain (Max)	OTA Chamber	1.2dBi
Average Total Efficiency	OTA Chamber	>70%
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.

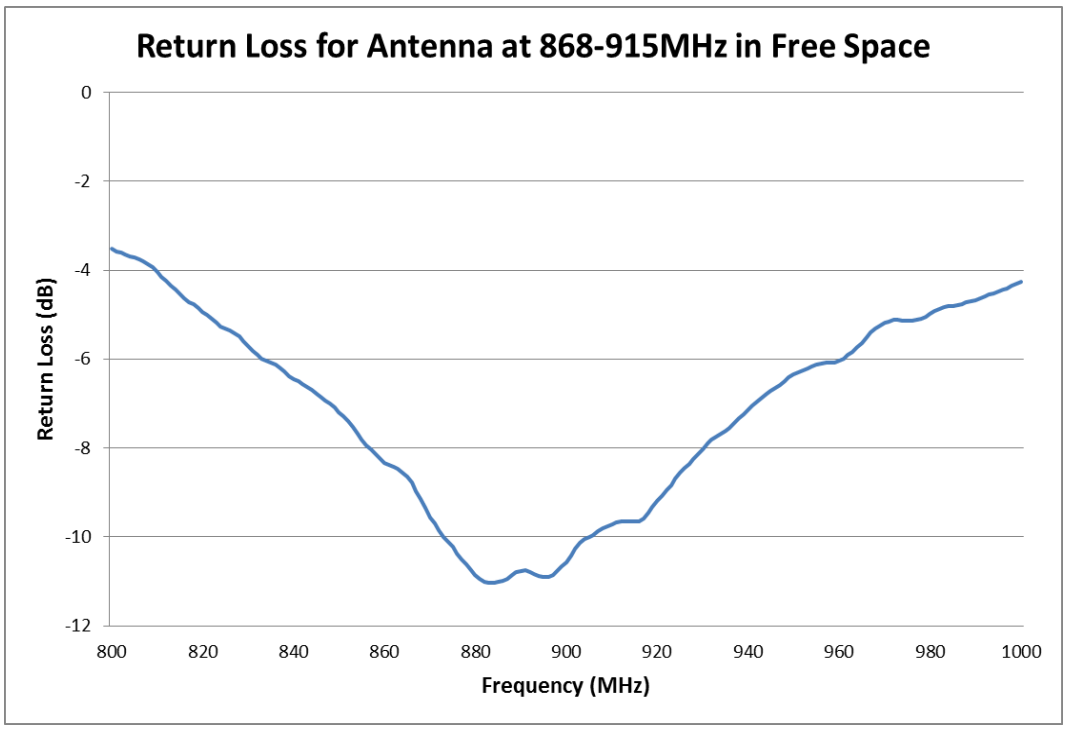


FIGURE 4.3.1 RETURN LOSS OF ANTENNA AT 868/915MHZ IN FREE SPACE

4.4 EFFICIENCY PLOT

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

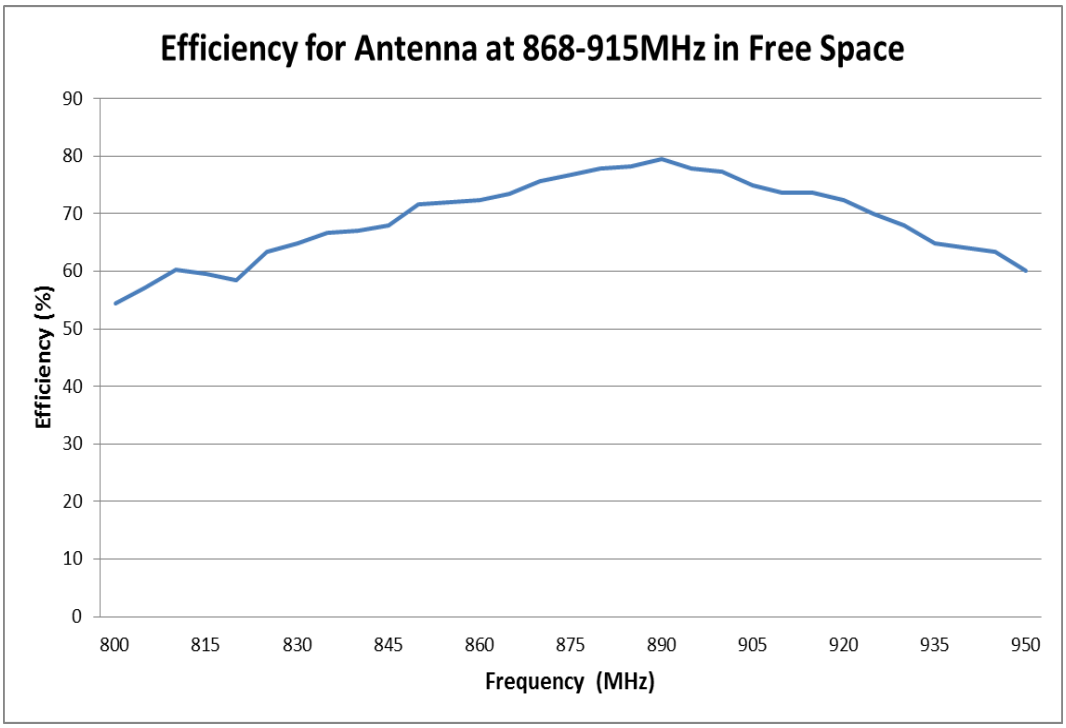
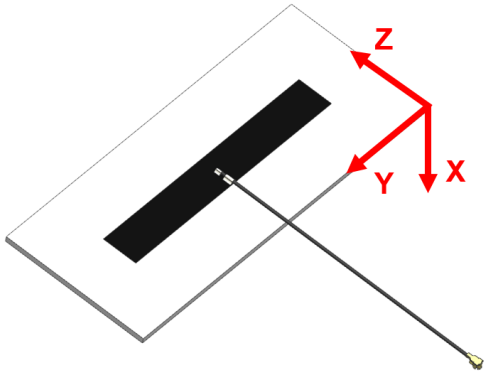
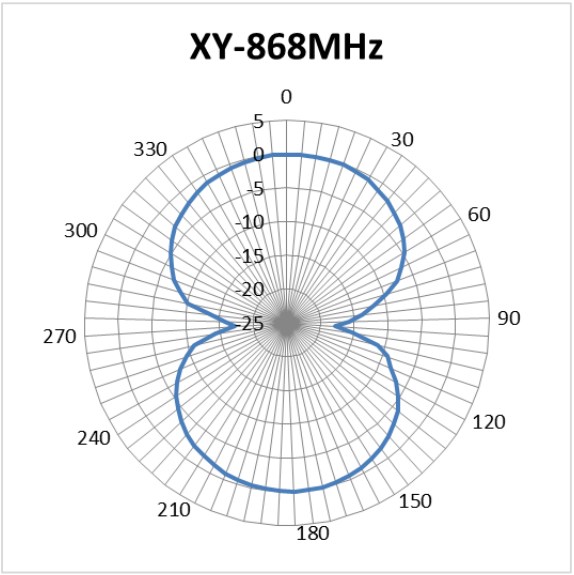


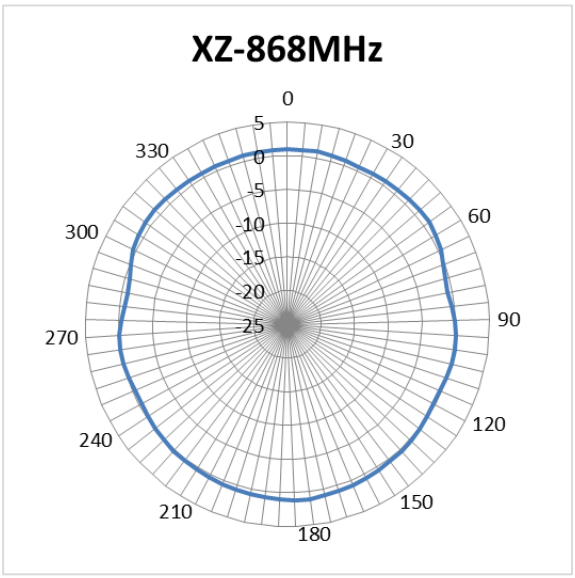
FIGURE 4.4.1 EFFICIENCY OF ANTENNA AT 868/915MHZ IN FREE SPACE

4.5 RADIATION PATTERN

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







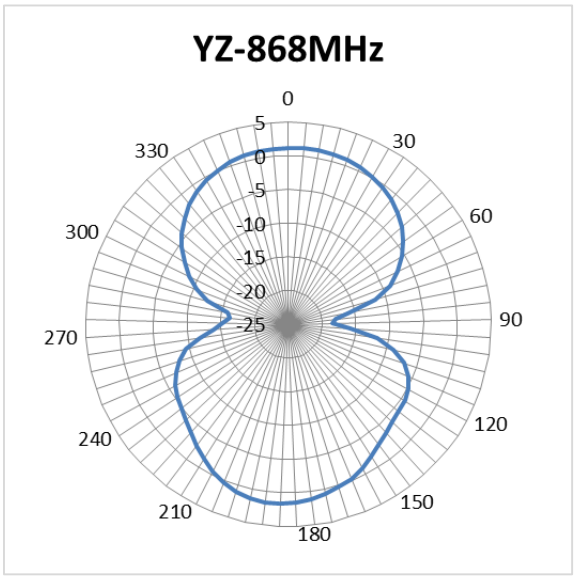
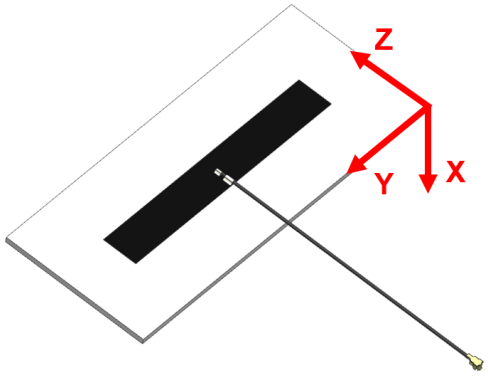
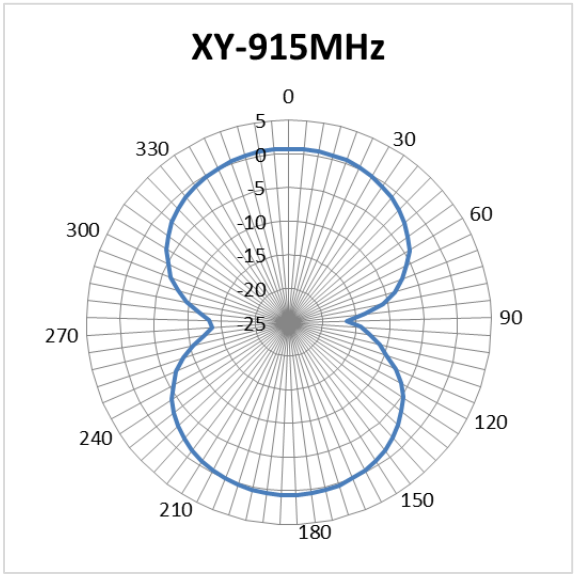
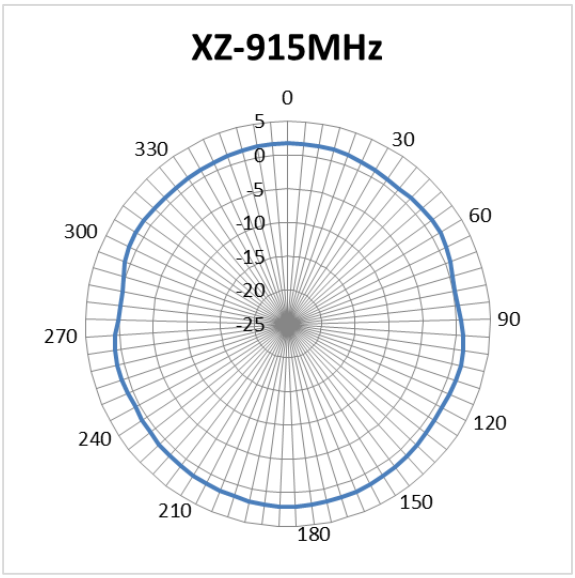


FIGURE 4.5.1 2D RADIATION PATTERN OF ANTENNA AT 868MHZ IN FREE SPACE







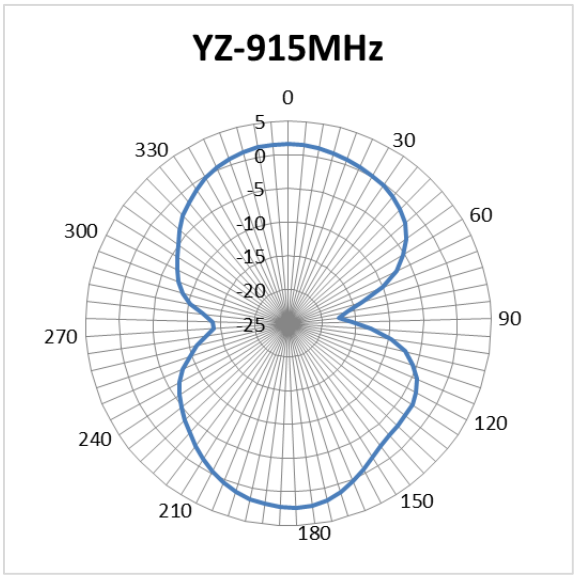


FIGURE 4.5.2 2D RADIATION PATTERN OF ANTENNA AT 915MHZ IN FREE SPACE

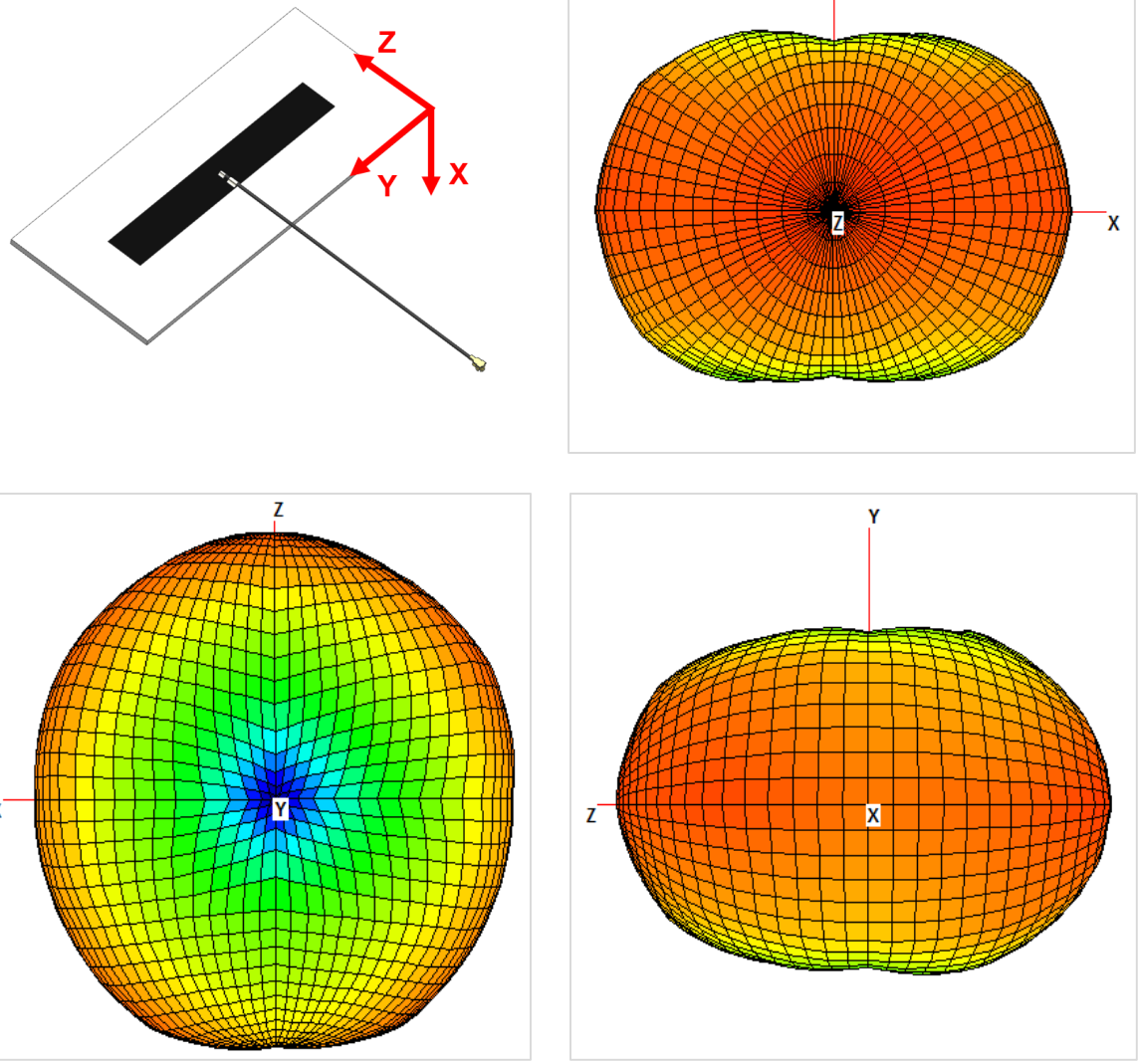


FIGURE 4.5.3 3D RADIATION PATTERN OF ANTENNA AT 868MHZ IN FREE SPACE

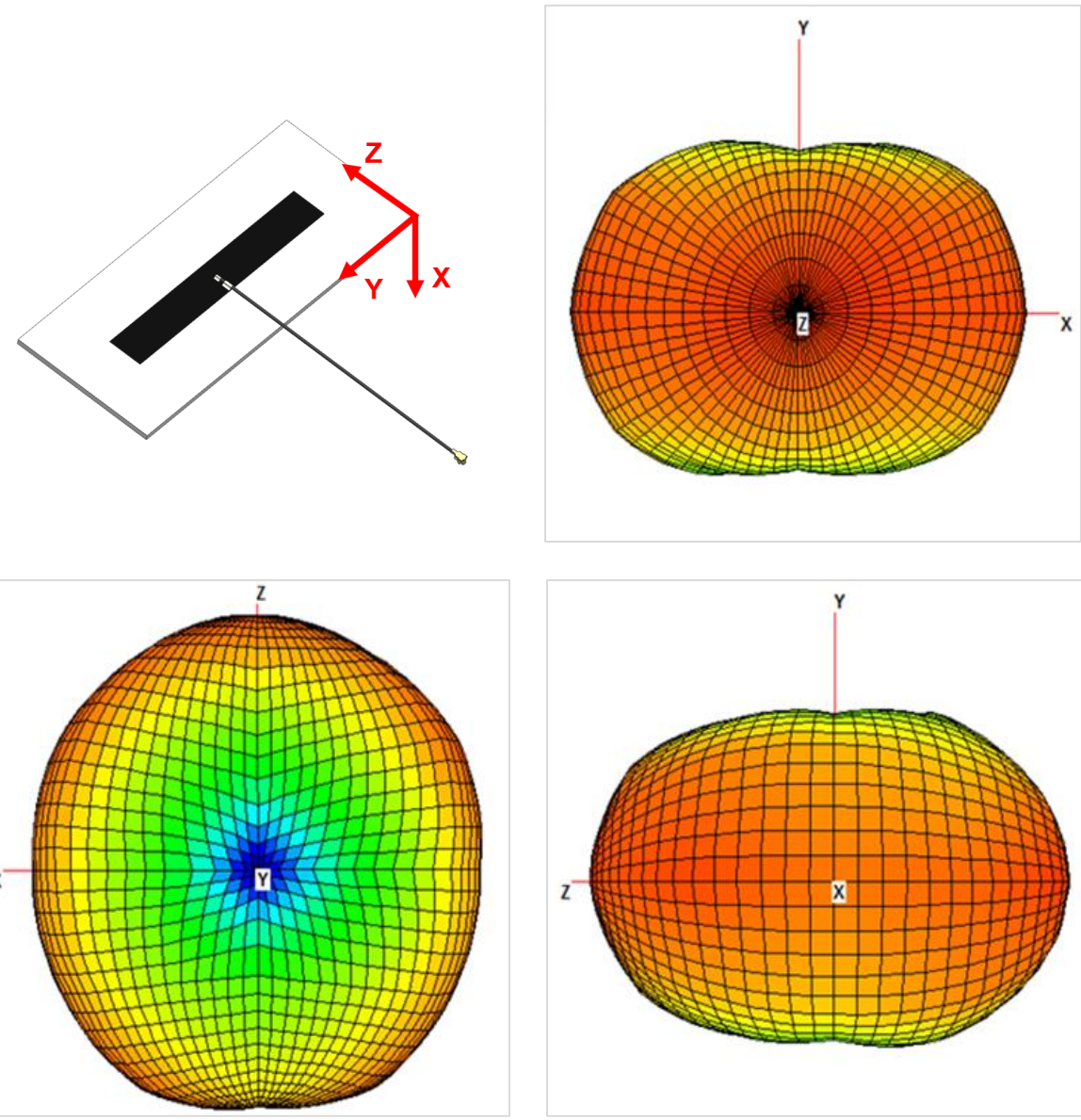


FIGURE 4.5.4 3D RADIATION PATTERN OF ANTENNA AT 915MHZ IN FREE SPACE

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.

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.

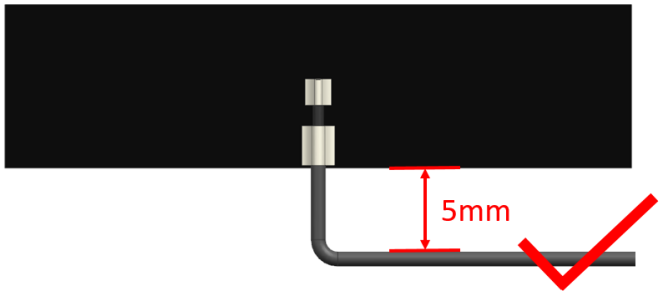


FIGURE 5.2.1 RECOMMENDED CABLE BENDING RANGE

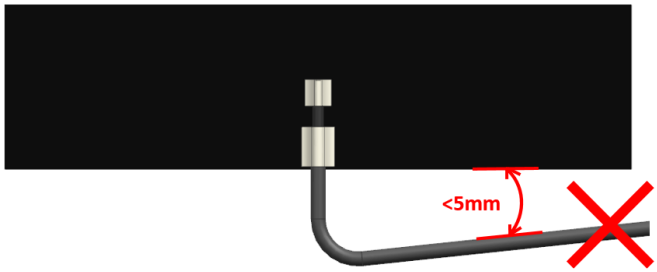


FIGURE 5.2.2 UNRECOMMENDED CABLE BENDING RANGE

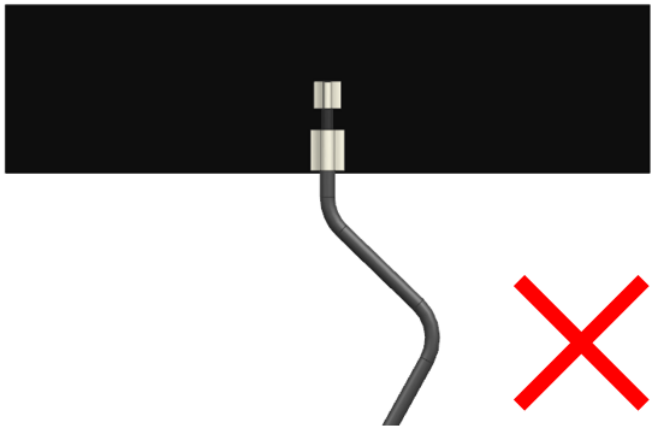


FIGURE 5.2.3 MULTIPLE BENDING OF CABLES IS NOT RECOMMENDED

6.0 THE ANTENNA PERFORMANCE VARIATION WITH CABLE LENGTH

6.1 CABLE LOSS

ITEM	DESCRIPTION	TEST CONDITION	REQUIREMENTS
	Frequency Range	0~1GHz	0~1GHz
6.1.1	Attenuation	1m cable measured by VNA5071C	≤1dB/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 REFERENCE

	100mm cable			300mm cable	
Frequency (MHz)	Efficiency (dB)	Efficiency (%)	Cable Loss	Efficiency (dB)	Efficiency (%)
	X		X-LOSS=Y	Y	
860	-1.41	72.30	0.2m*1dB/m	-1.61	69.04
865	-1.34	73.51		-1.54	70.20
870	-1.22	75.60		-1.42	72.19
875	-1.15	76.75		-1.35	73.29
880	-1.08	77.90		-1.28	74.39
885	-1.07	78.15		-1.27	74.63
890	-1.00	79.52		-1.20	75.94
895	-1.09	77.80		-1.29	74.29
900	-1.12	77.21		-1.32	73.74
905	-1.25	74.98		-1.45	71.60
910	-1.33	73.62		-1.53	70.30
915	-1.33	73.61		-1.53	70.30
920	-1.41	72.35		-1.61	69.09
925	-1.55	70.03		-1.75	66.87
930	-1.53	70.27		-1.73	67.10

- 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

Four locations with parallel plane ground have been evaluated and these locations are shown in figure 7.1.1. The plane ground size is 90mm*90mm and we move the plane ground to four locations for each test. 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 20mm to achieve acceptable RF performance.

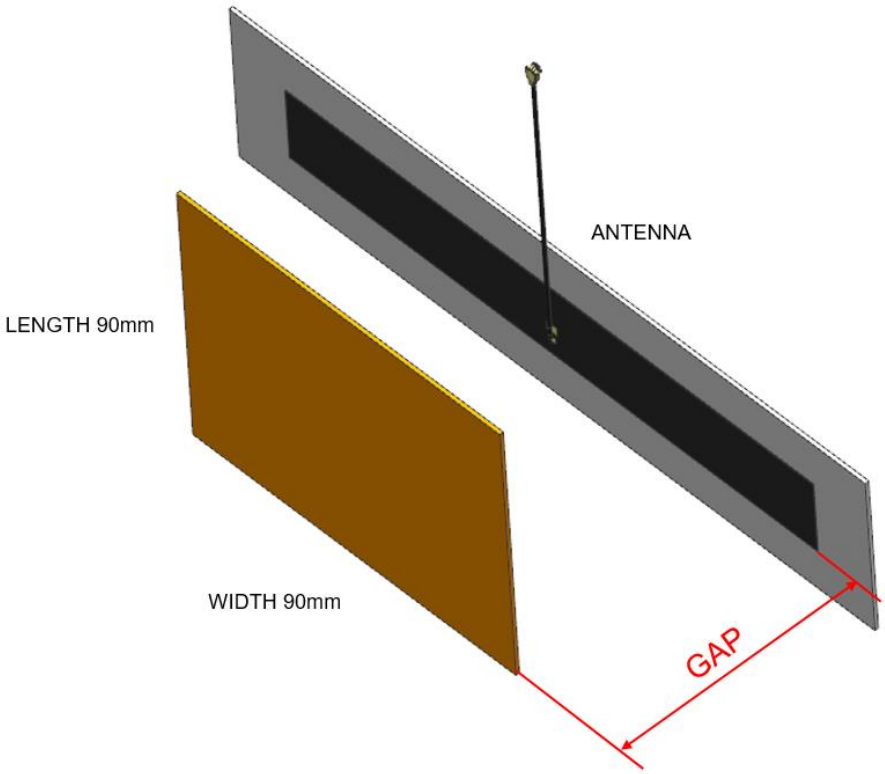


FIGURE 7.1.1 FOUR LOCATIONS WITH PARALLEL PLANE GROUND

Ground Size: 90mm*90mm;
Location 1: Distance between antenna and plane ground (GAP) is about 10mm;
Location 2: Distance between antenna and plane ground (GAP) is about 20mm;
Location 3: Distance between antenna and plane ground (GAP) is about 30mm;
Location 4: Distance between antenna and plane ground (GAP) is about 40mm.

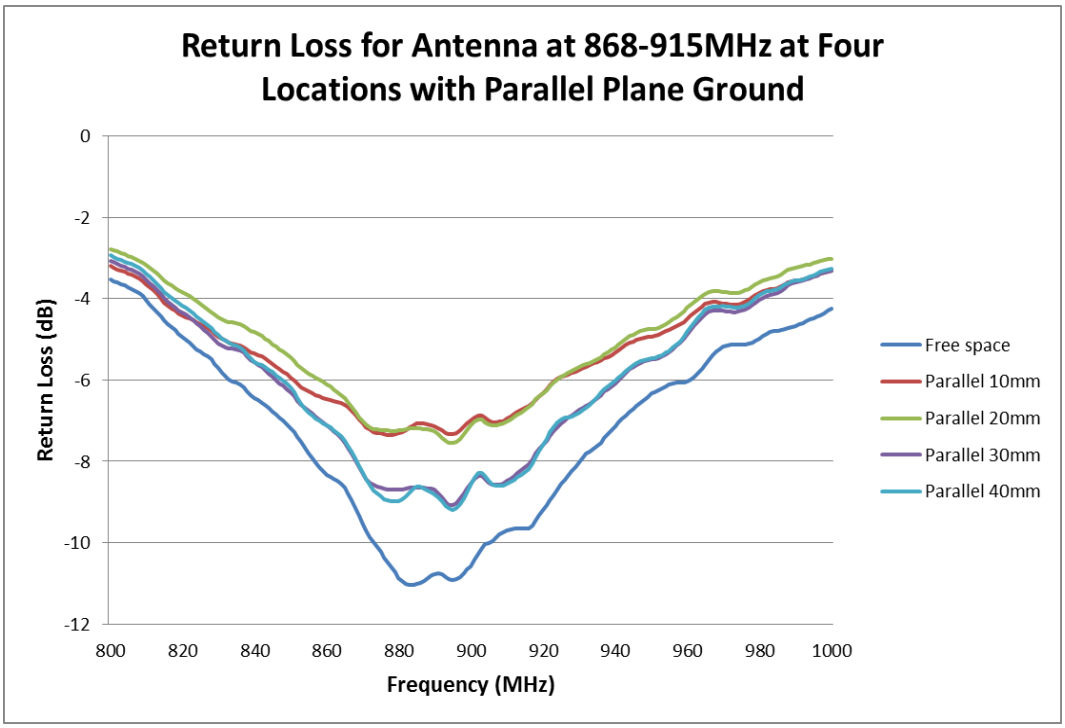


FIGURE 7.1.2 RETURN LOSS OF ANTENNA AT 868/915MHZ AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND

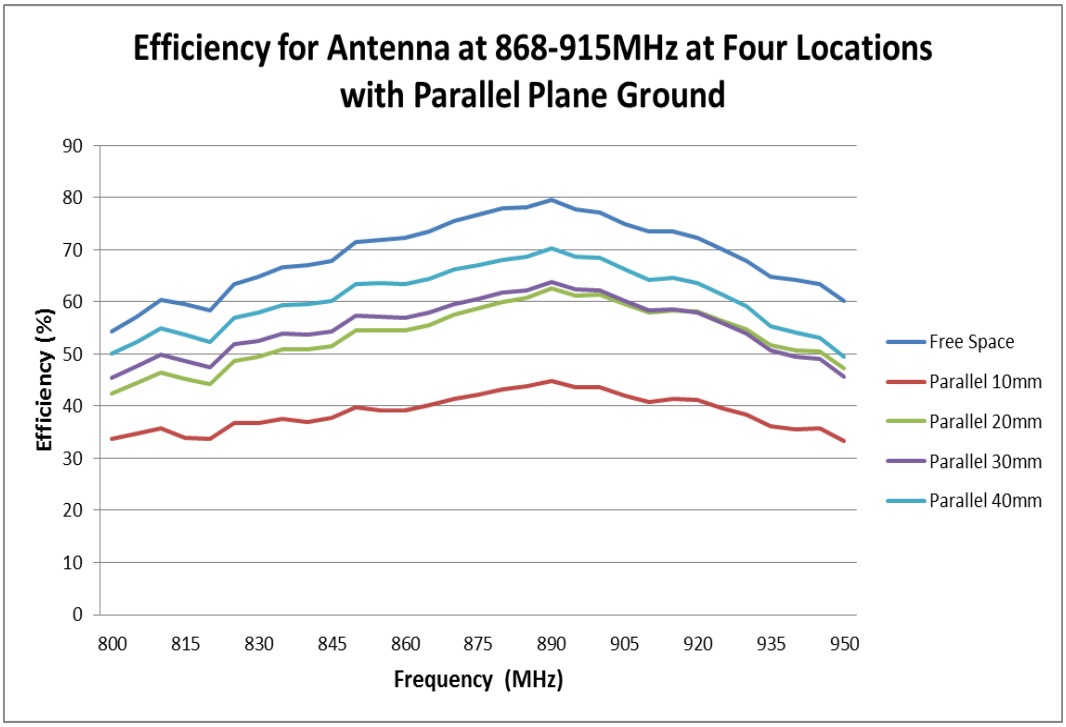


FIGURE 7.1.3 EFFICIENCY OF ANTENNA AT 868/915MHZ AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND

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

Four locations with vertical plane ground have been evaluated and these locations are shown in figure 7.2.1. The plane ground size is 90mm*90mm and we move the plane ground to four locations for each test. 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 20mm to achieve acceptable RF performance.

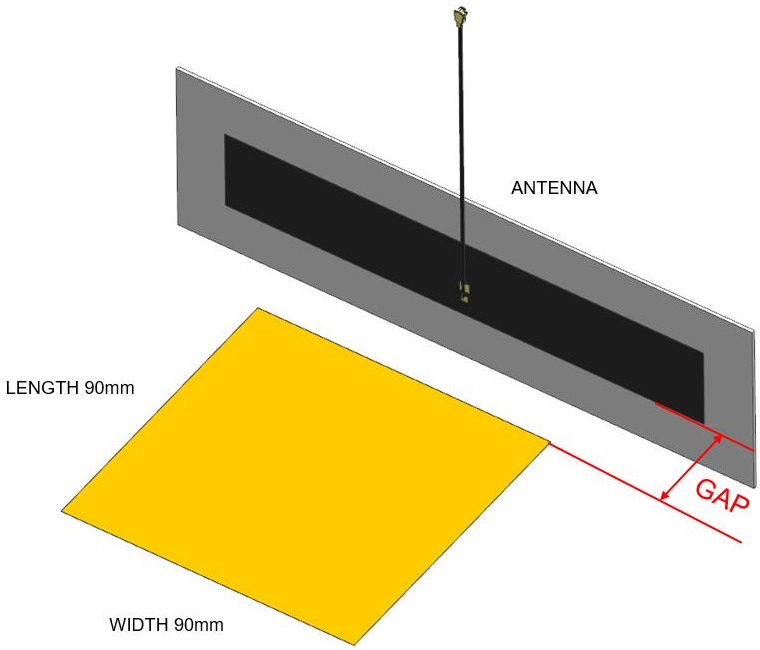


FIGURE 7.2.1 FOUR LOCATIONS WITH VERTICAL PLANE GROUND

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

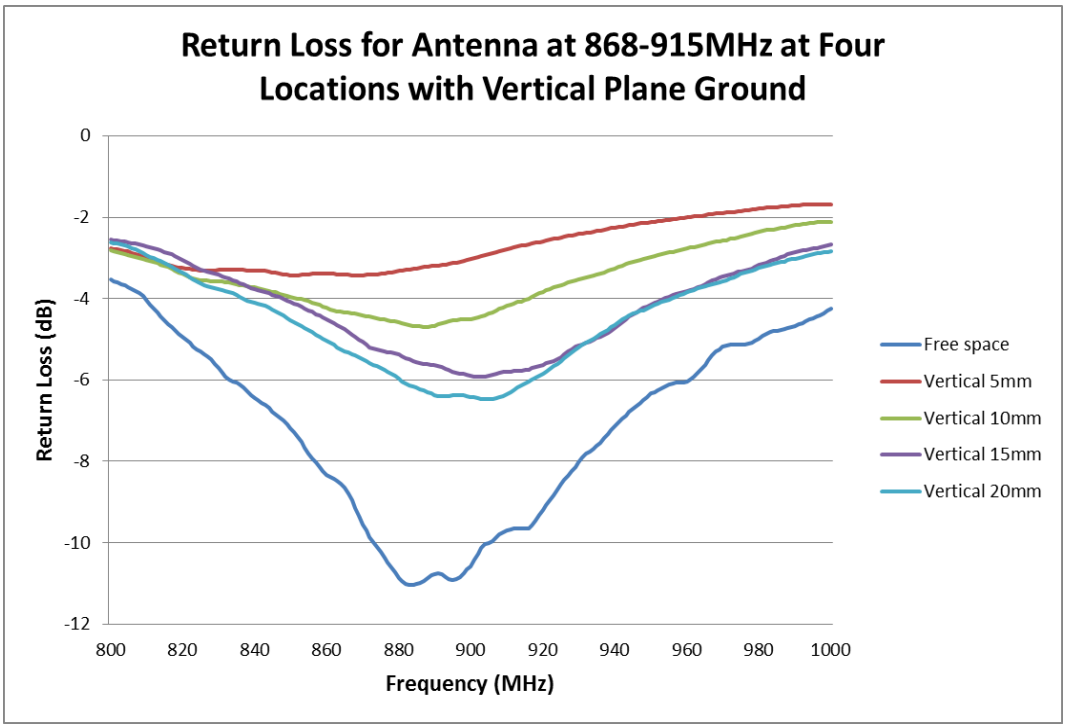


FIGURE 7.2.2 RETURN LOSS OF ANTENNA AT 868/915MHZ AT FOUR LOCATIONS WITH VERTICAL PLANE GROUND

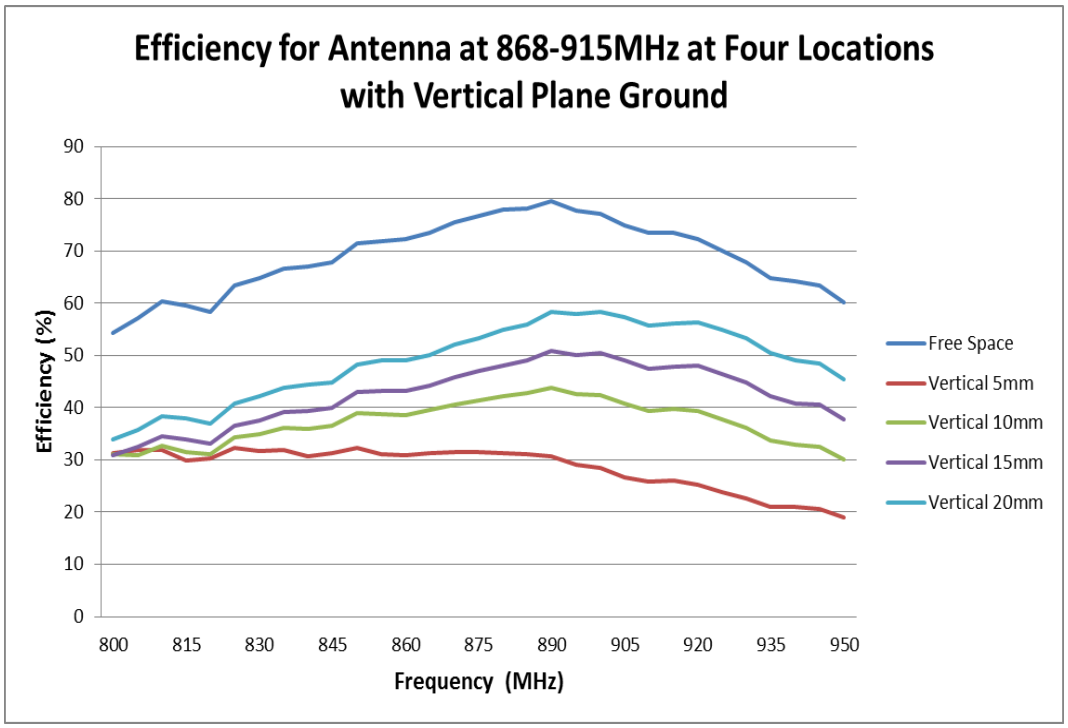


FIGURE 7.2.3 EFFICIENCY OF ANTENNA AT 868/915MHZ AT FOUR LOCATIONS WITH VERTICAL PLANE GROUND

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

Four locations with the parallel plane ground have been evaluated and these locations are shown in figure 7.3.1. The plane ground size is 90mm*90mm and we move the plane ground to four locations for each test. 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 20mm to achieve acceptable RF performance.

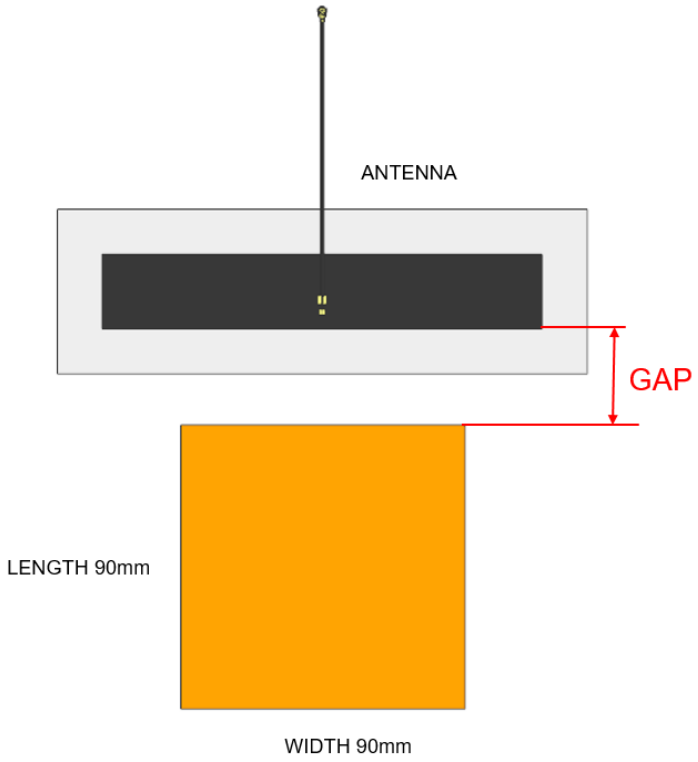


FIGURE 7.3.1 FOUR LOCATIONS WITH PARALLEL PLANE GROUND

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

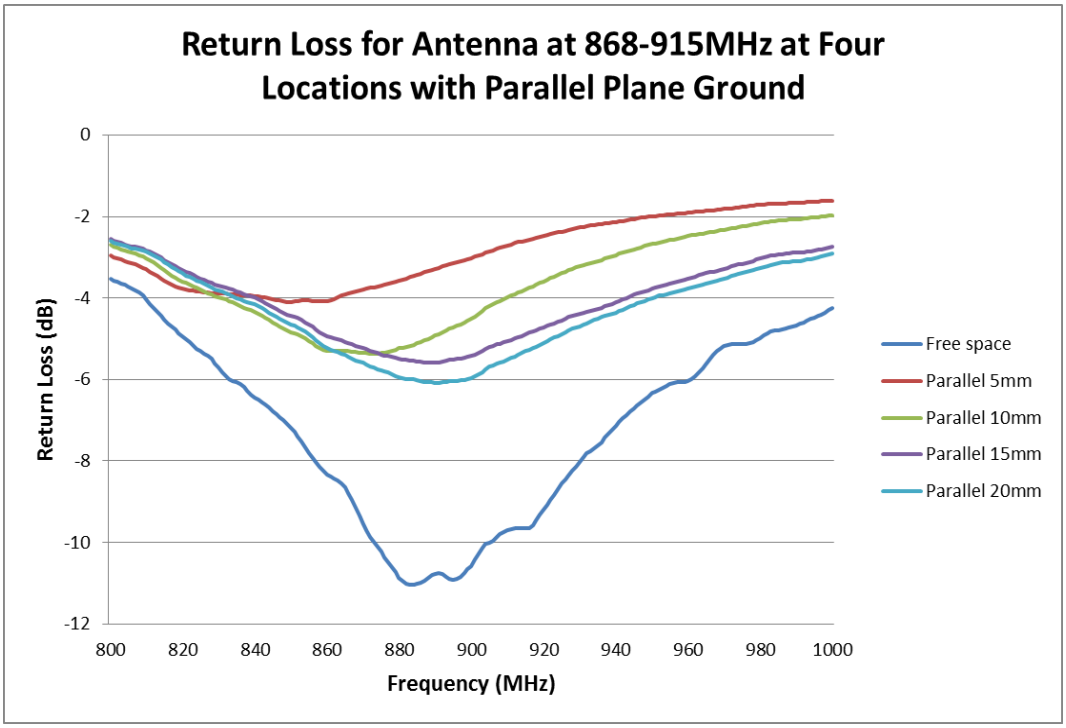


FIGURE 7.3.2 RETURN LOSS OF ANTENNA AT 868/915MHZ AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND

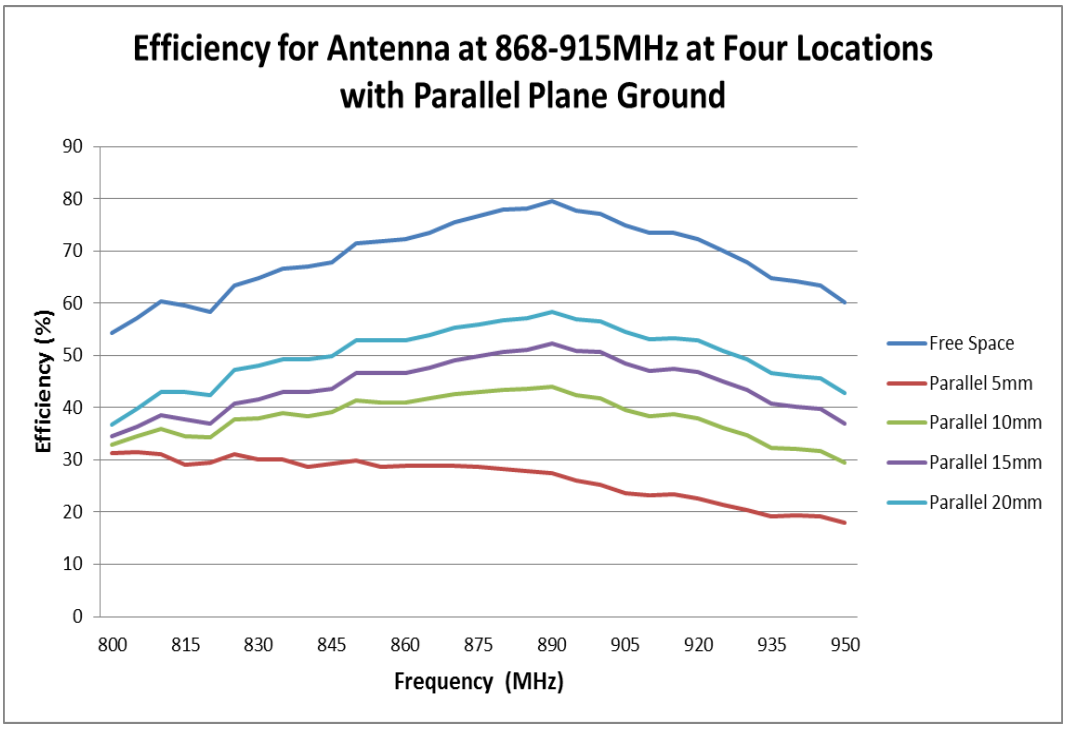


FIGURE 7.3.3 EFFICIENCY OF ANTENNA AT 868/915MHZ AT FOUR LOCATIONS WITH PARALLEL PLANE GROUND