



# APPLICATION SPECIFICATION

## 698MHZ-6GHZ WIDE BAND 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.

All measurements are done of the antenna in free space with VNA Agilent 5071C and OTA chamber. All measurements are done with the part no. 1462340100 with a cable length of 100mm.

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

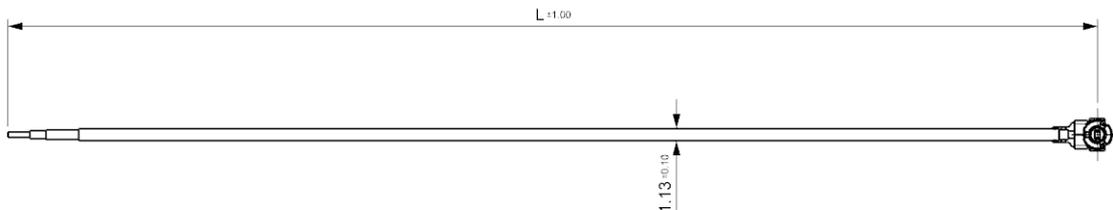
### 2.0 PRODUCT DESCRIPTION

#### A. DEFINITIONS OF TERMS

The overall antenna size is 140mm\*20mm (figure 1).



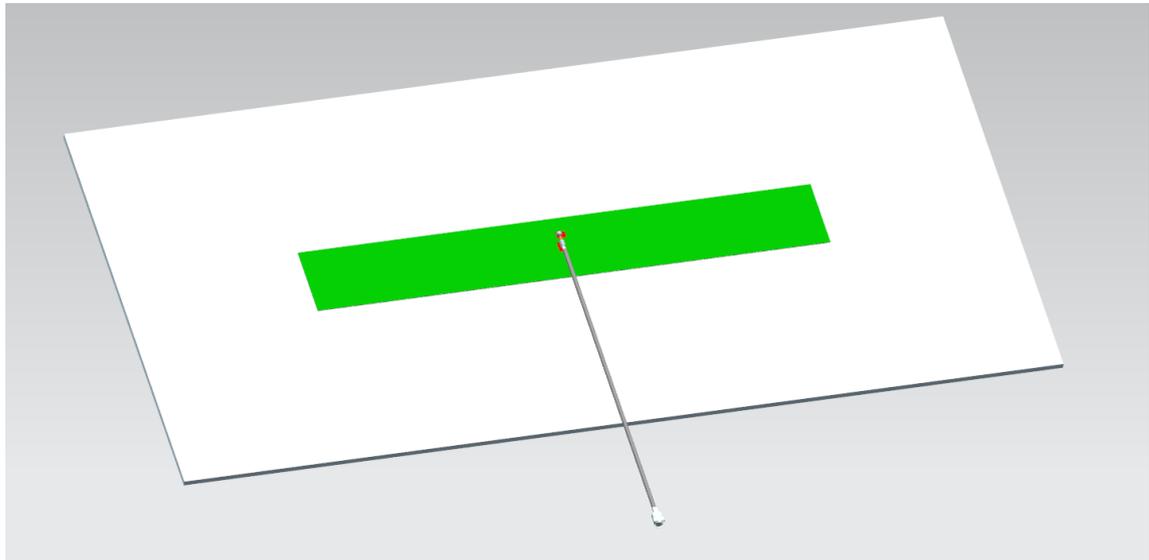
**FIGURE 1. DIMENSION OF THE 698MHZ-6GHZ WIDE BAND ANTENNA**



**FIGURE 2. CABLE LINE VIEW OF 698MHZ-6GHZ WIDE BAND ANTENNA**

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		APPROVED BY: Welson Tan 2017/10/27	

## B. RF PERFORMANCE OF ANTENNA IN FREE SPACE



**FIGURE 2.1. ANTENNA IN FREE SPACE**

DESCRIPTION	TEST CONDITION	REQUIREMENT		
		698~960MHz	1.5~2.7GHz	2.7GHz~6GHz
Frequency Range	698MHz~960MHz / 1.5GHz~6GHz	698~960MHz	1.5~2.7GHz	2.7GHz~6GHz
Return Loss	Antenna with 100mm long, 1.13mm diameter micro coaxial cable in free space Measured by VNA5071C	< -4 dB	< -5 dB	
Peak Gain (Max)	Measure antenna in free space through OTA chamber	1.8dBi	2.8dBi	5.0dBi
Total Efficiency	Measure antenna in free space through OTA chamber	>70%	>70%	>70%
Polarization	Measure antenna in free space through OTA chamber	Linear		
Input Impedance	Measure antenna in free space through VNA E5071C	50 Ohms		

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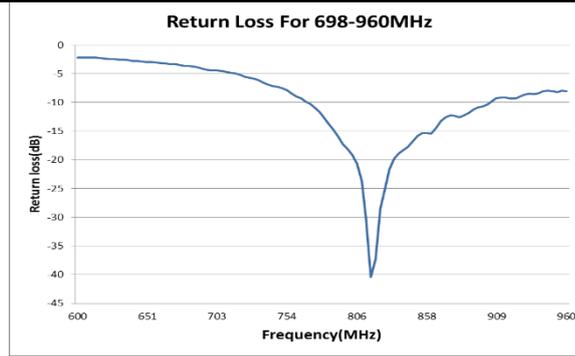


FIGURE 2.2 RETURN LOSS OF ANTENNA AT 698MHZ-960MHZ IN FREE SPACE

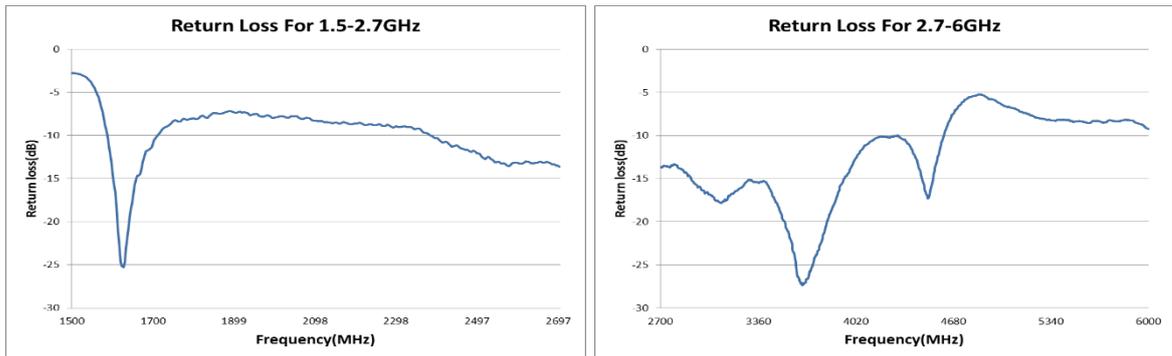


FIGURE 2.3 RETURN LOSS OF ANTENNA AT 1.5GHZ-6GHZ IN FREE SPACE

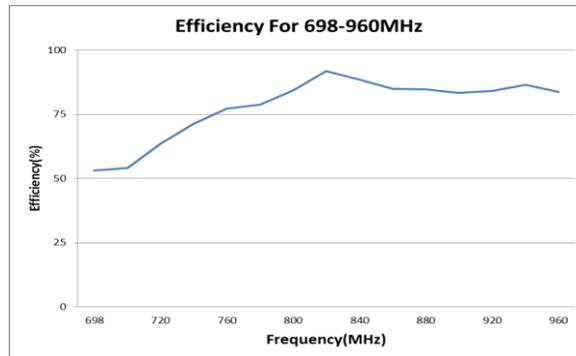


FIGURE 2.4 EFFICIENCY OF ANTENNA AT 698MHZ-960MHZ IN FREE SPACE

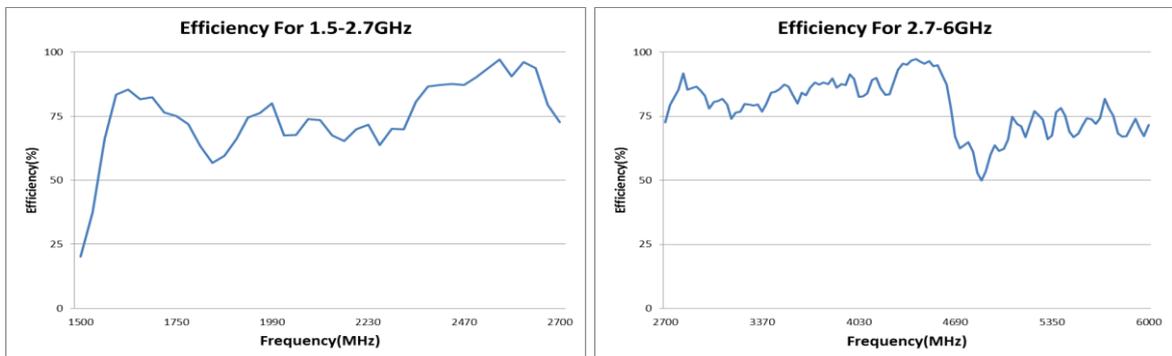


FIGURE 2.5 EFFICIENCY OF ANTENNA AT 1.5-6GHZ IN FREE SPACE

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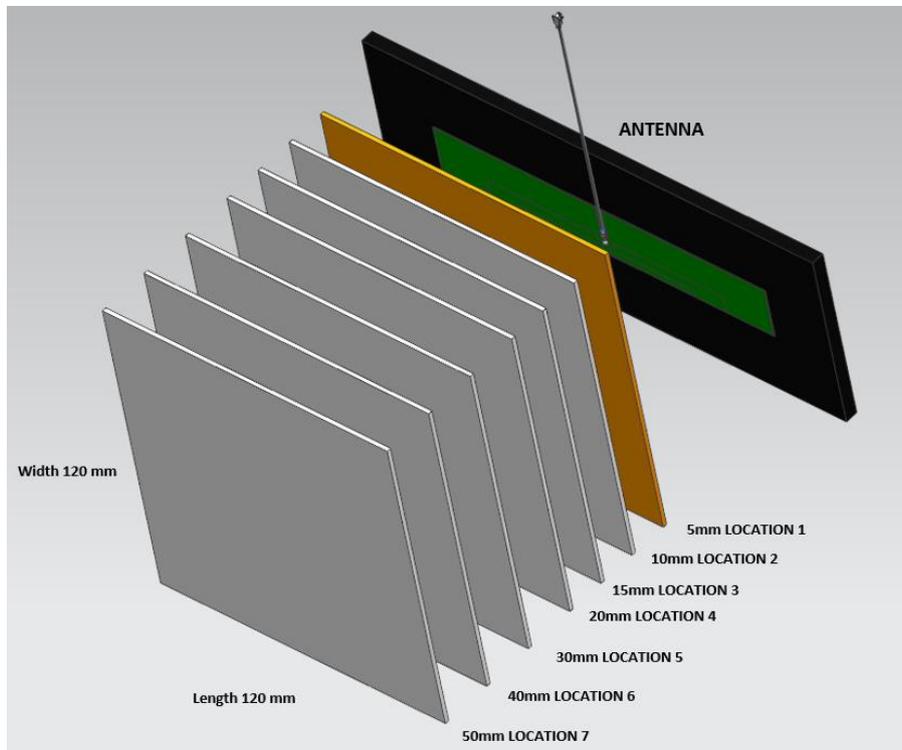
### 3.0 REFERENCE DOCUMENTS

- Sales Drawing: SD-1462340100
- Product Specification: PS-1462340100
- Packaging Information: Refer to the Molex related packaging drawings.

### 4.0 RF PERFORMANCE AS A FUNCTION OF IMPLEMENTATION

#### 4.0.1 ANTENNA RF PERFORMANCE AS A FUNCTION OF DIFFERENT LOCATION WITH PARALLEL GROUND

Seven ground locations with parallel ground have been evaluated, and these locations are show in figure 4.1. The minimum ground distance from the ground is recommended to be 50mm distance from the antenna. When the distance is less than 50mm, the antenna performance will be significantly degraded.



**FIGURE 4.1 SEVEN LOCATIONS WITH PARALLEL GROUND**

Ground Size: 120mm\*120mm

Location 1: Distance between antenna and ground is about 5mm.

Location 2: Distance between antenna and ground is about 10mm

Location 3: Distance between antenna and ground is about 15mm.

Location 4: Distance between antenna and ground is about 20mm.

Location 5: Distance between antenna and ground is about 30mm.

Location 6: Distance between antenna and ground is about 40mm.

Location 7: Distance between antenna and ground is about 50mm.

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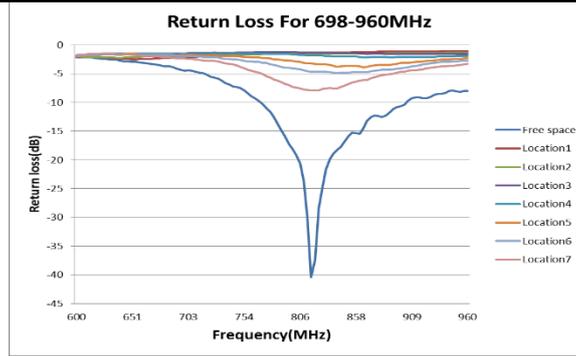


FIGURE 4.1.1 RETURN LOSS OF ANTENNA AT 698MHZ-960MHZ BAND AT SEVEN LOCATIONS WITH PARALLEL GROUND

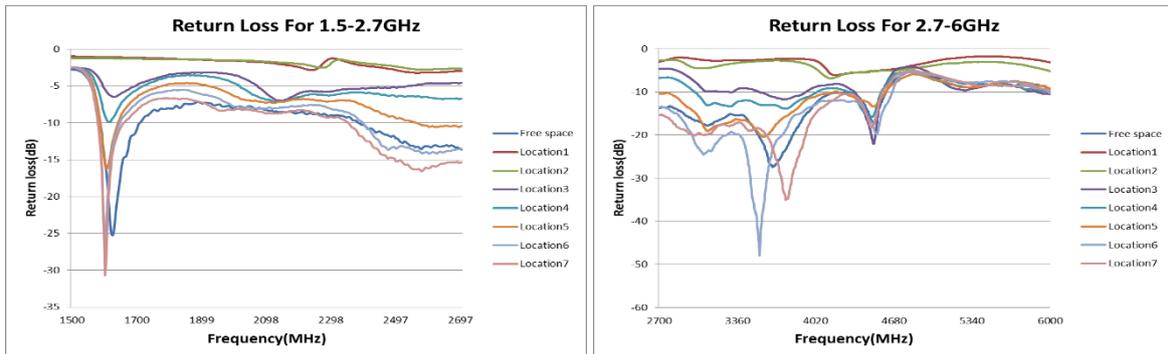


FIGURE 4.1.2 RETURN LOSS OF ANTENNA AT 1.5GHZ-6GHZ BAND AT SEVEN LOCATIONS WITH PARALLEL GROUND

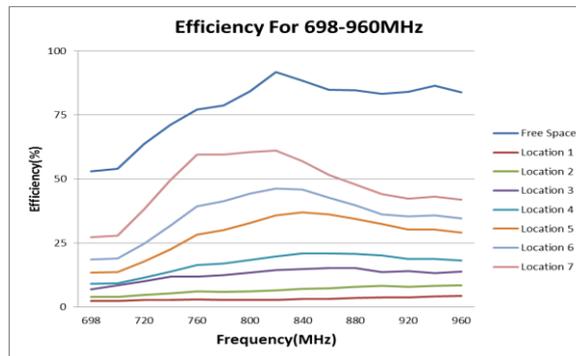


FIGURE 4.1.3 EFFICIENCY OF ANTENNA AT 698-960 MHZ BAND AT SEVEN LOCATIONS WITH PARALLEL GROUND

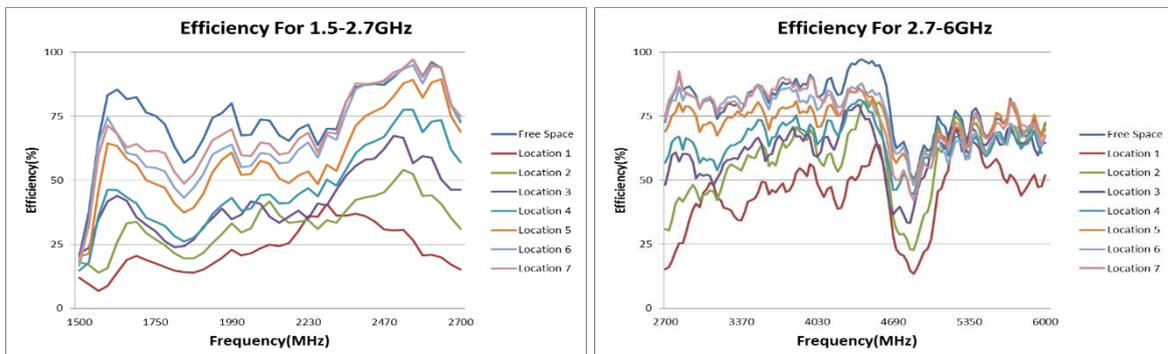
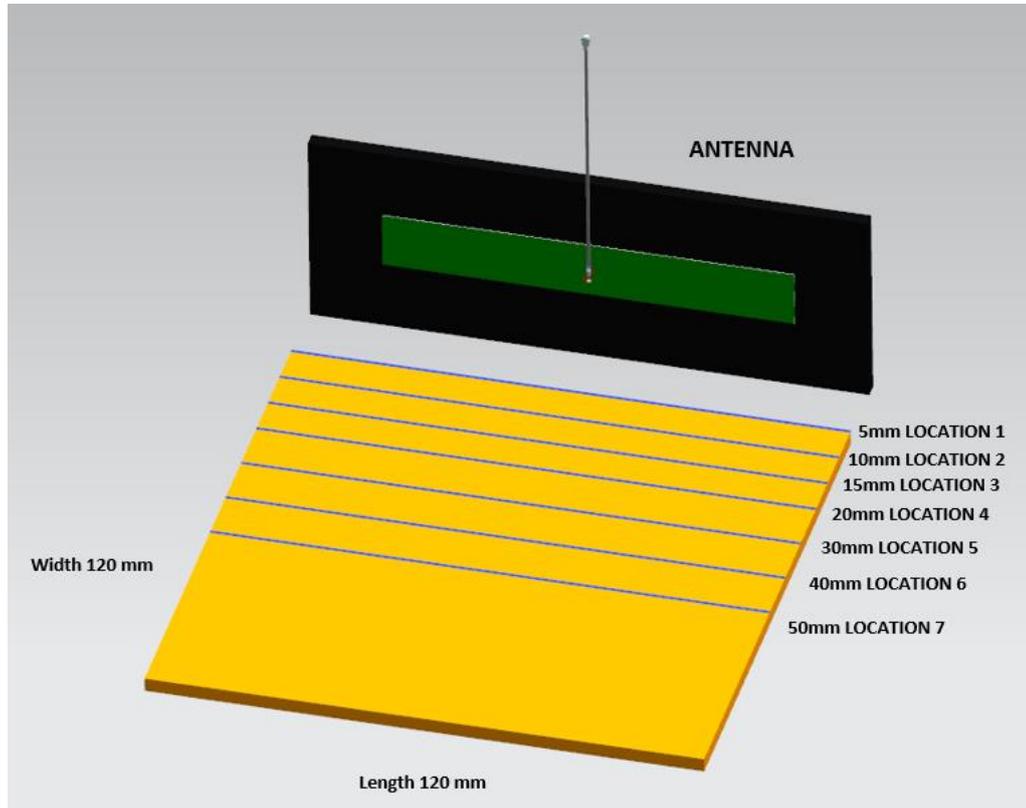


FIGURE 4.1.4 EFFICIENCY OF ANTENNA AT 1.5GHZ-6GHZ BAND AT SEVEN LOCATIONS WITH PARALLEL GROUND

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## 4.0.2 ANTENNA RF PERFORMANCE AS A FUNCTION OF DIFFERENT LOCATION WITH VERTICAL GROUND

Seven ground locations with vertical ground have been evaluated, with different distances from the antenna and these locations are show in figure 4.2. The minimum ground distance from the ground is recommended to be 20mm distance from the antenna. When the distance is less than 20mm, the antenna performance will be significantly degraded.



**FIGURE 4.2 SEVEN LOCATIONS WITH VERTICAL GROUND**

Ground Size: 120mm\*120mm

- Location 1: Distance between antenna and ground is about 5mm
- Location 2: Distance between antenna and ground is about 10mm.
- Location 3: Distance between antenna and ground is about 15mm.
- Location 4: Distance between antenna and ground is about 20mm.
- Location 5: Distance between antenna and ground is about 30mm.
- Location 6: Distance between antenna and ground is about 40mm.
- Location 7: Distance between antenna and ground is about 50mm.

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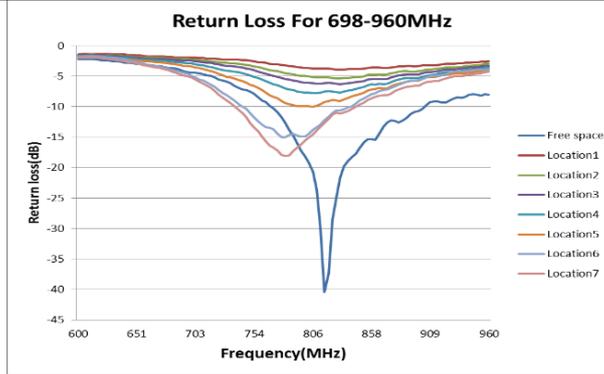


FIGURE 4.2.1 RETURN LOSS OF ANTENNA AT 698MHZ-960MHZ BAND AT SEVEN LOCATIONS WITH VERTICAL GROUND

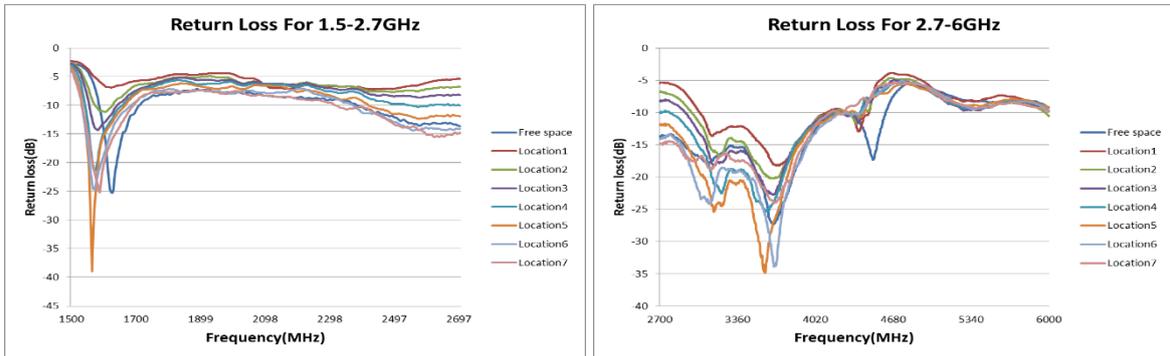


FIGURE 4.2.2 RETURN LOSS OF ANTENNA AT 1.5GHZ-6GHZ BAND AT SEVEN LOCATIONS WITH VERTICAL GROUND

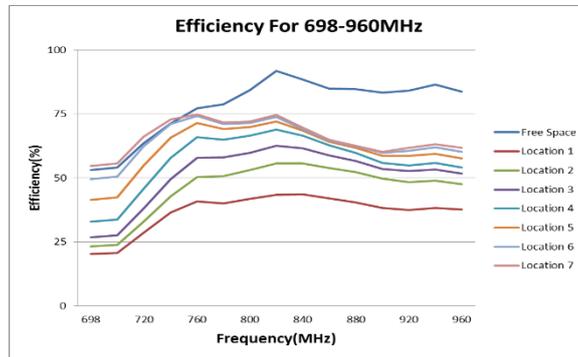


FIGURE 4.2.3 EFFICIENCY OF ANTENNA AT 698MHZ-960MHZ BAND AT SEVEN LOCATIONS WITH VERTICAL GROUND

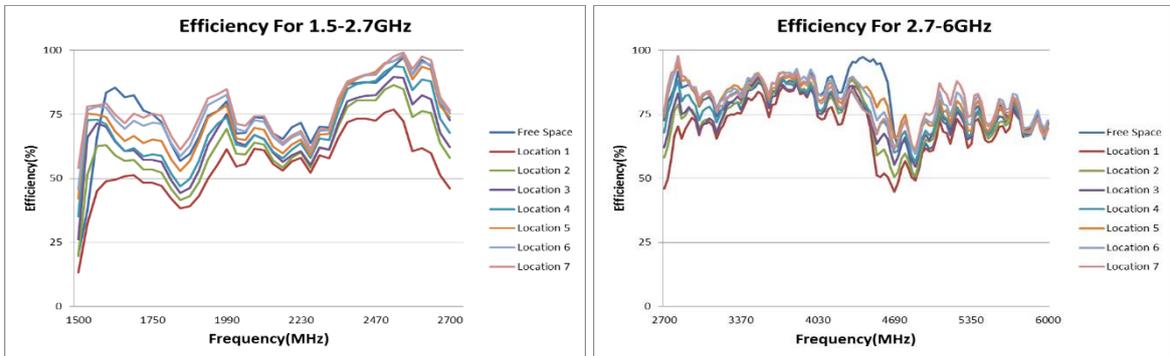
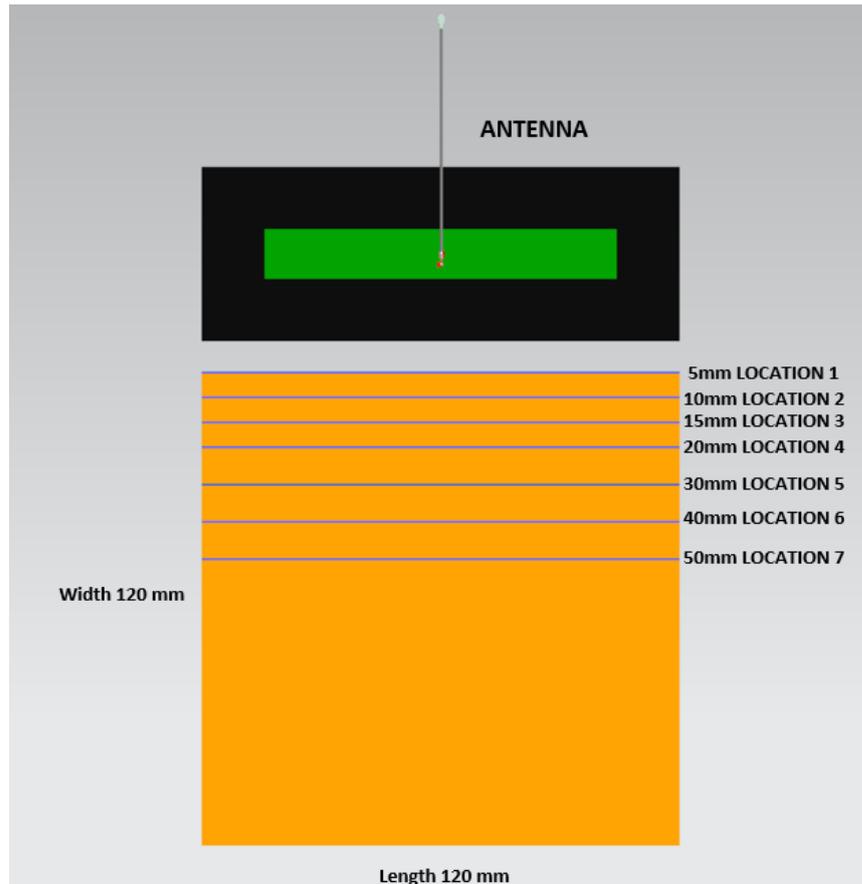


FIGURE 4.2.4 EFFICIENCY OF ANTENNA AT 1.5GHZ-6GHZ BAND AT SEVEN LOCATIONS WITH VERTICAL GROUND

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## 4.0.3 ANTENNA RF PERFORMANCE AS A FUNCTION OF DIFFERENT DISTANCE TO GROUND IN THE SAME PLANE AS THE ANTENNA

Seven ground locations with same plane ground have been evaluated, and these locations are shown in figure 4.3. The minimum ground distance from the antenna is recommended to be 10mm distance from the antenna. When the distance is less than 10mm, the antenna performance will be significantly degraded.



**FIGURE 4.3 SEVEN LOCATIONS WITH SAME PLANE GROUND**

Ground Size: 120mm\*120mm

Location 1: Distance between antenna and ground is about 5mm.

Location 2: Distance between antenna and ground is about 10mm

Location 3: Distance between antenna and ground is about 15mm.

Location 4: Distance between antenna and ground is about 20mm.

Location 5: Distance between antenna and ground is about 30mm.

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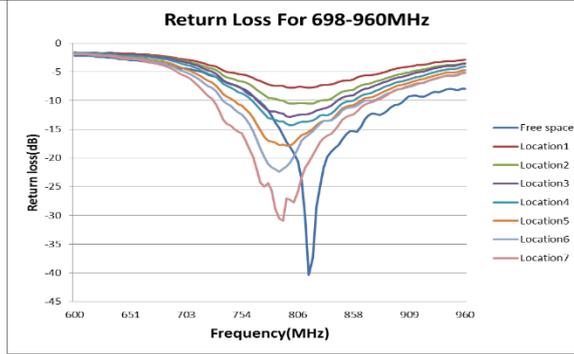


FIGURE 4.3.1 RETURN LOSS OF ANTENNA AT 698MHZ-960MHZ BAND AT SEVEN LOCATIONS WITH SAME PLANE GROUND

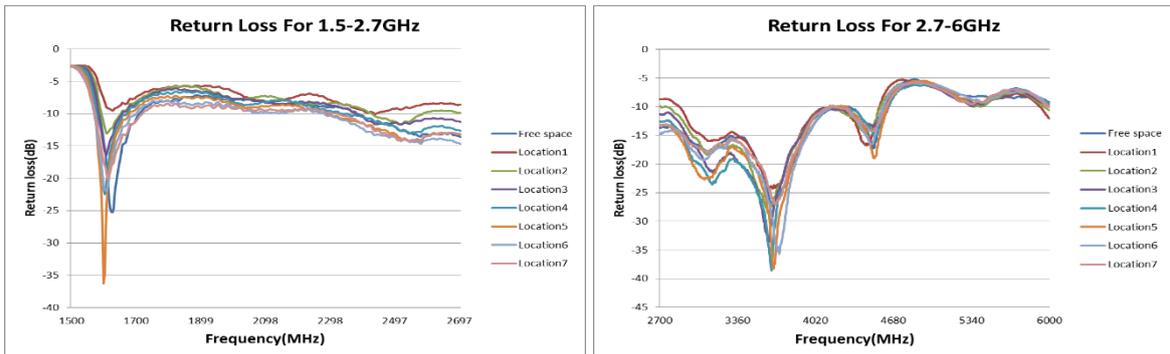


FIGURE 4.3.2 RETURN LOSS OF ANTENNA AT 1.5GHZ-6GHZ BAND AT SEVEN LOCATIONS WITH SAME PLANE GROUND

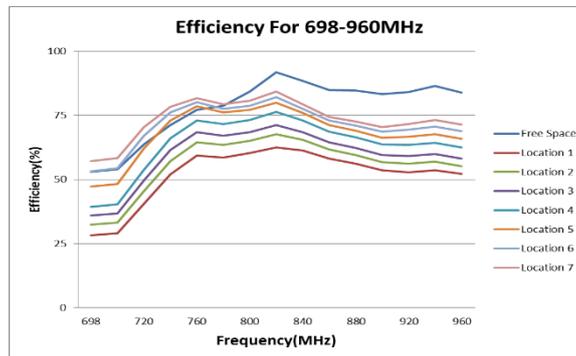


FIGURE 4.3.3 EFFICIENCY OF ANTENNA AT 698MHZ-960MHZ BAND AT SEVEN LOCATIONS WITH SAME PLANE GROUND

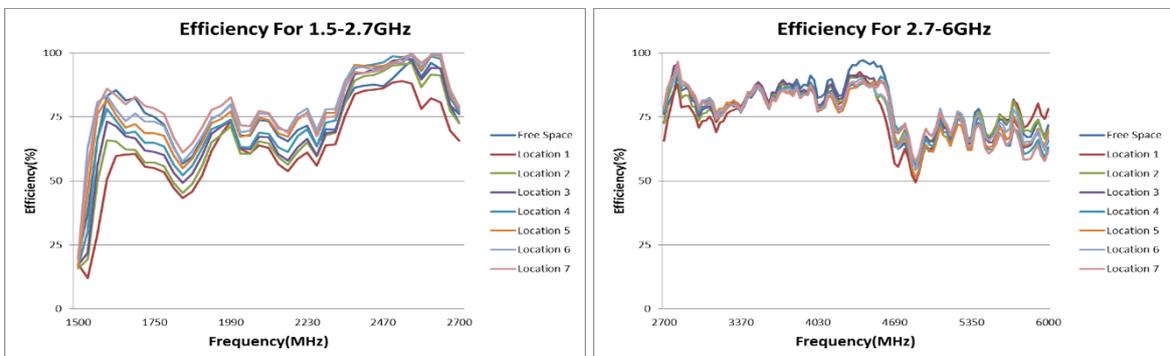


FIGURE 4.3.4 EFFICIENCY OF ANTENNA AT 1.5GHZ-6GHZ BAND AT SEVEN LOCATIONS WITH SAME PLANE GROUND

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## 5.0 RADIATION PATTERN

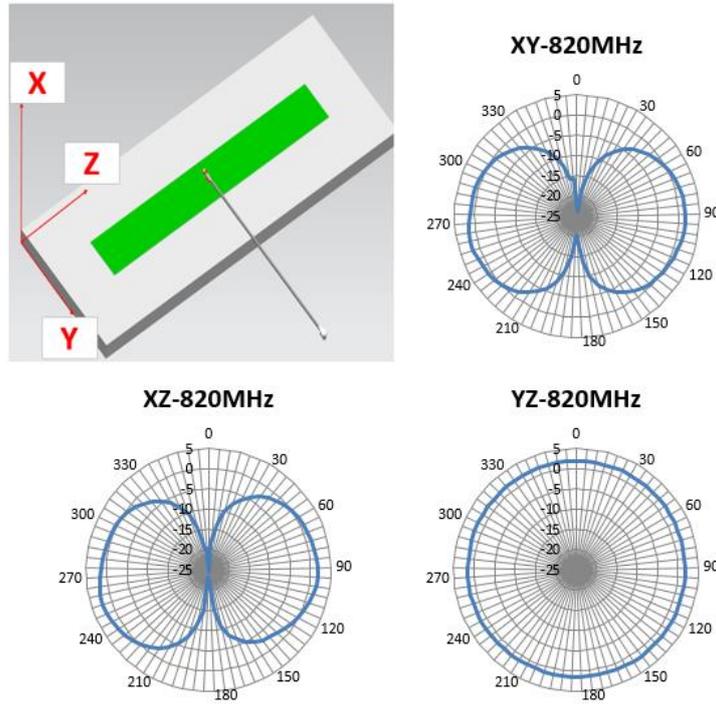


Figure 5.1 Radiation Pattern of antenna at 820MHz in Free space

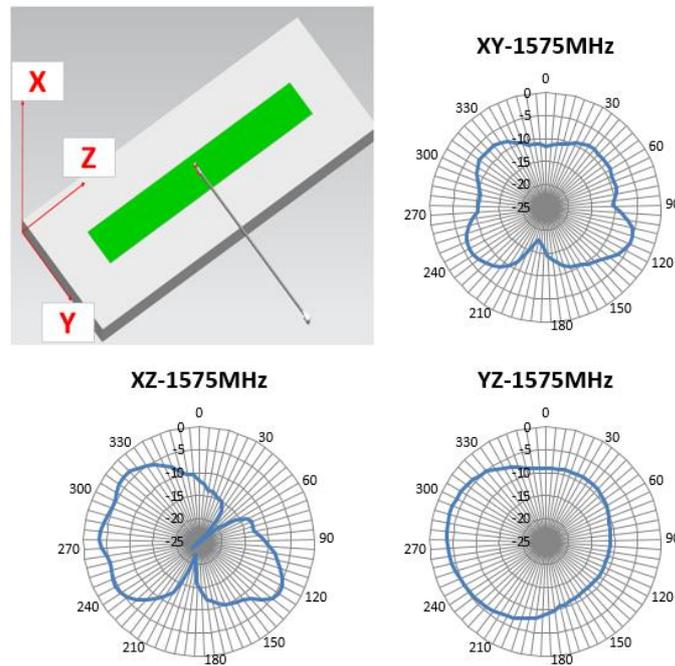


Figure 5.2 Radiation Pattern of antenna at 1.575GHz in Free space

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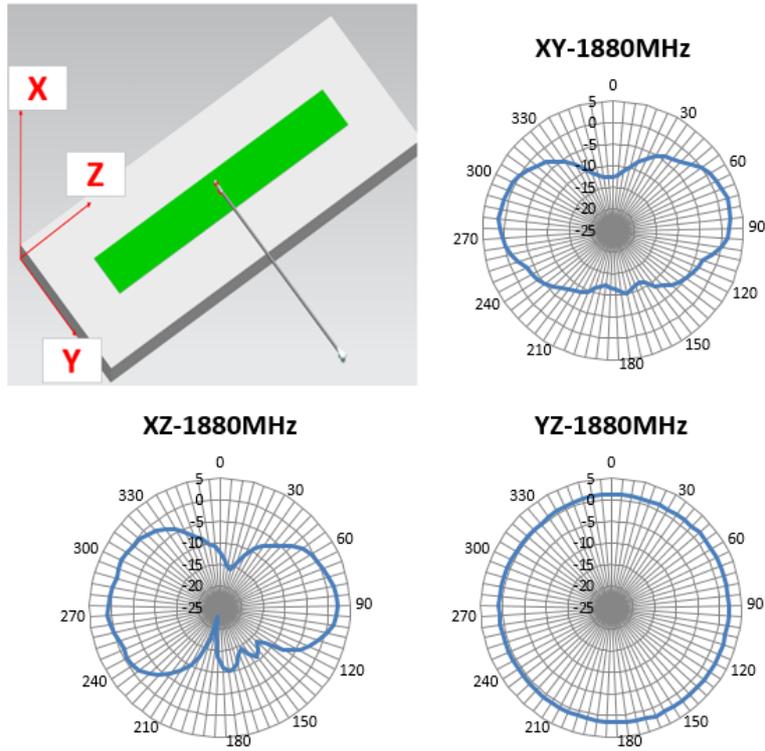


Figure 5.3 Radiation Pattern of antenna at 1.88GHz in Free space

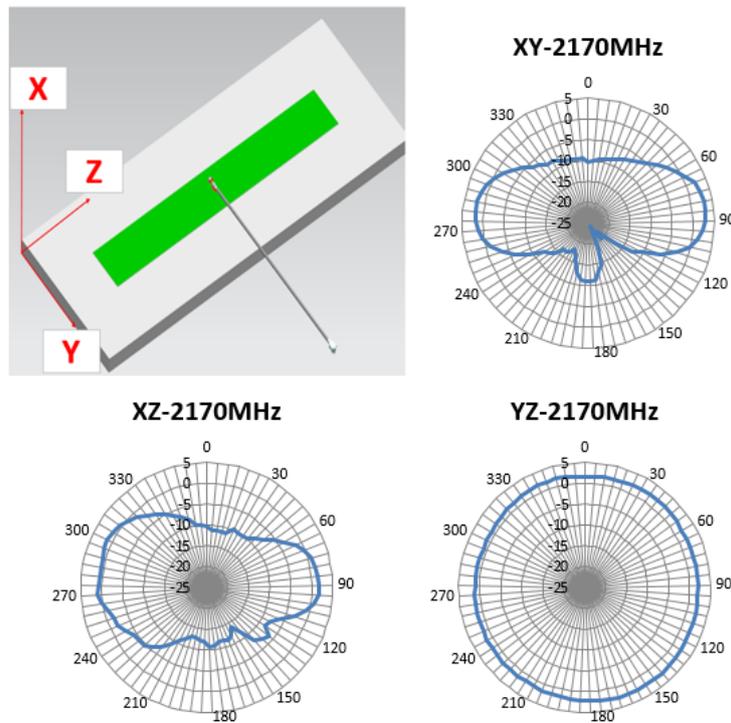
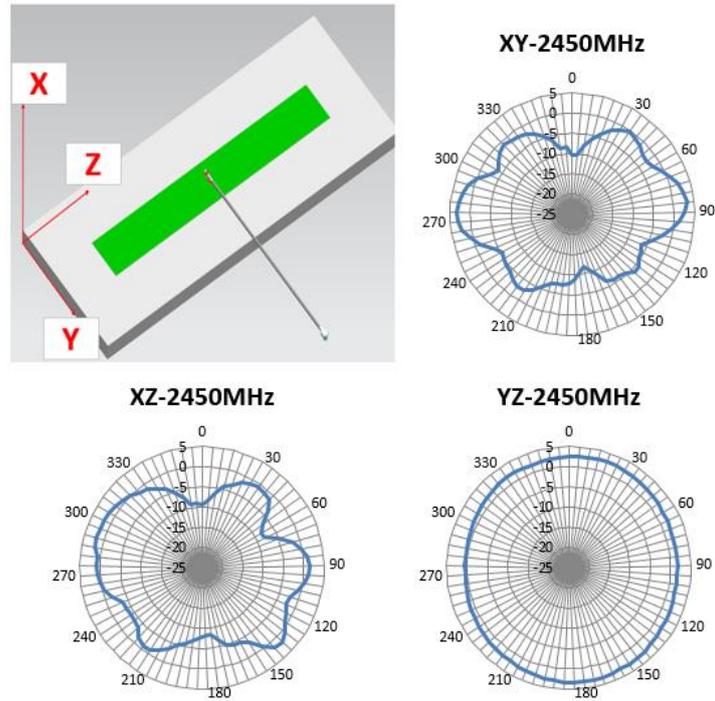
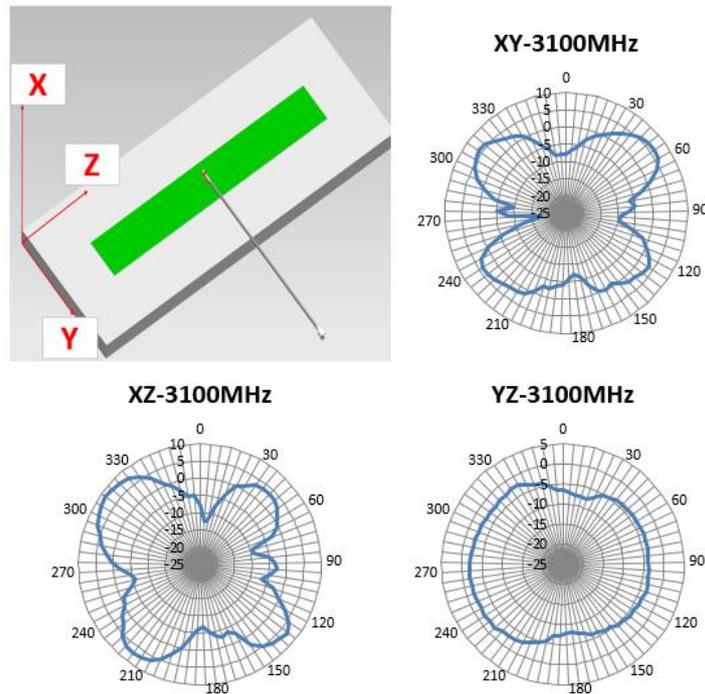


Figure 5.4 Radiation Pattern of antenna at 2.17GHz in Free space

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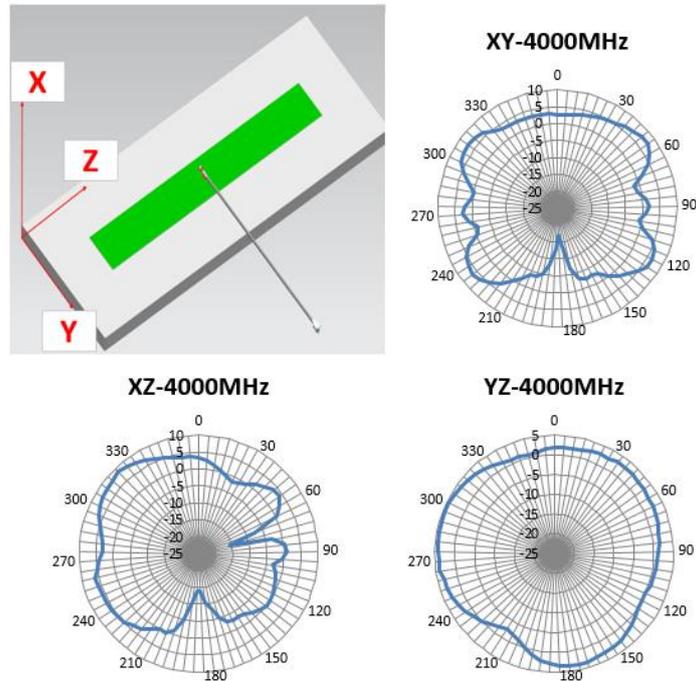


**Figure 5.5 Radiation Pattern of antenna at 2.45GHz in Free space**

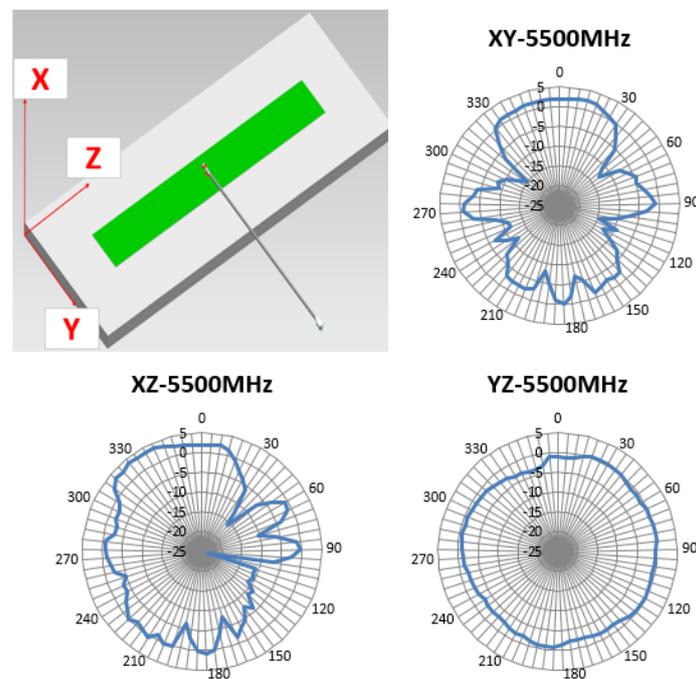


**Figure 5.6 Radiation Pattern of antenna at 3.1GHz in Free space**

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**Figure 5.7 Radiation Pattern of antenna at 4GHz in Free space**



**Figure 5.8 Radiation Pattern of antenna at 5.5GHz in Free space**

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## 6.0 THE ANTENNA PERFORMANCE VARIATION WITH CABLE LENGTH

### 6.0.1 CABLE LOSS

ITEM	DESCRIPTION	TEST CONDITION	REQUIREMENTS			
			698MHz~960MHz	1.5GHz~3GHz	3GHz~5GHz	5GHz~6GHz
6.0.1.1	Attenuation	1m cable. Measured by VNA5071C	≤1.8dB/m	≤3dB/m	≤4dB/m	≤5dB/m

### 6.0.2 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 6.0.1

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## 6.0.3 FOR EXAMPLE

Frequency (MHz)	100mm cable		Cable Loss	300mm cable	
	Efficiency (dB)	Efficiency (%)		Efficiency (dB)	Efficiency (%)
	X		X-LOSS=Y	Y	
698	-2.75	53.08	0.2m*1.8dB/m	-3.15	48.41
700	-2.67	54.02		-3.07	49.27
720	-1.96	63.62		-2.36	58.02
740	-1.48	71.18		-1.88	64.92
760	-1.13	77.16		-1.53	70.37
780	-1.04	78.79		-1.44	71.86
800	-0.74	84.37		-1.14	76.94
820	-0.37	91.87		-0.77	83.78
840	-0.53	88.49		-0.93	80.70
860	-0.71	84.88		-1.11	77.41
880	-0.72	84.69		-1.12	77.24
900	-0.79	83.35		-1.19	76.01
920	-0.75	84.07		-1.15	76.68
940	-0.63	86.40		-1.03	78.80
960	-0.77	83.80		-1.17	76.43
1500	-6.97	20.09	0.2m*3dB/m	-7.57	17.49
1550	-4.26	37.51		-4.86	32.67
1575	-1.80	66.12		-2.40	57.59
1600	-0.79	83.35		-1.39	72.59
1700	-0.84	82.41		-1.44	71.78
1800	-1.43	71.96		-2.03	62.67
1900	-1.80	66.14		-2.40	57.61
2000	-0.97	80.01		-1.57	69.69
2100	-1.32	73.78		-1.92	64.26
2200	-1.55	69.93		-2.15	60.90
2300	-1.54	70.17		-2.14	61.12
2400	-0.60	87.18		-1.20	75.93
2500	-0.45	90.11		-1.05	78.48
2600	-0.43	90.57		-1.03	78.88
2700	-1.39	72.68		-1.99	63.30
2800	-0.69	85.36		-1.29	74.34
2900	-0.65	86.05		-1.25	74.95
3000	-1.08	77.92	0.2m*4dB/m	-1.88	64.81
3100	-0.87	81.89		-1.67	68.11
3200	-1.17	76.33		-1.97	63.49
3300	-1.01	79.21		-1.81	65.89
3400	-0.97	79.90		-1.77	66.46

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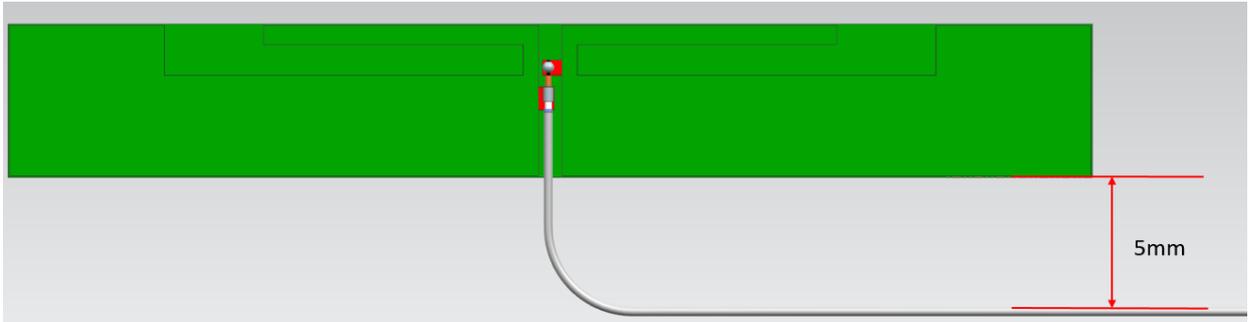
Frequency (MHz)	100mm cable		cable loss	300mm cable	
	Efficiency (dB)	Efficiency (%)		Efficiency (dB)	Efficiency (%)
	X			Y	
3500	-0.68	85.60		-1.48	71.20
3600	-0.97	80.06		-1.77	66.59
3700	-0.65	86.09		-1.45	71.61
3800	-0.55	88.13		-1.35	73.30
3900	-0.57	87.60		-1.37	72.86
4000	-0.48	89.49		-1.28	74.44
4100	-0.75	84.07		-1.55	69.93
4200	-0.79	83.31		-1.59	69.29
4300	-0.31	93.21		-1.11	77.53
4400	-0.14	96.80		-0.94	80.51
4500	-0.15	96.53		-0.95	80.29
4600	-0.39	91.45		-1.19	76.06
4700	-1.73	67.16		-2.53	55.86
4800	-2.13	61.19		-2.93	50.89
4900	-2.71	53.60		-3.51	44.59
5000	-2.11	61.46	0.2m*5dB/m	-3.11	48.82
5100	-1.42	72.09		-2.42	57.26
5200	-1.45	71.62		-2.45	56.89
5300	-1.33	73.58		-2.33	58.44
5400	-1.07	78.18		-2.07	62.10
5500	-1.75	66.85		-2.75	53.10
5600	-1.29	74.25		-2.29	58.98
5700	-0.87	81.90		-1.87	65.05
5800	-1.66	68.21		-2.66	54.18
5900	-1.53	70.38		-2.53	55.91
6000	-1.44	71.74		-2.44	56.99

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

REVISION: <b>A</b>	ECR/ECN INFORMATION: EC No: <b>168342</b> DATE: <b>2017/11/21</b>	TITLE: <b>698MHz-6GHz WIDE BAND ANTENNA</b>	SHEET No. <b>16 of 17</b>
DOCUMENT NUMBER: <b>1462340100</b>	CREATED / REVISED BY: <b>Benson Liu 2017/10/27</b>	CHECKED BY: <b>Chris Zhong 2017/10/27</b>	APPROVED BY: <b>Welson Tan 2017/10/27</b>

## 7.0 ASSEMBLY GUIDELINES

During the assembly of the antenna in a device, the cable needs to be positioned away from the antenna flex. The antenna cable should not go close to the antenna flex. The cable has to be away from the pattern at least 5mm.



**FIGURE 7.1 ASSEMBLY GUIDELINE**

<u>REVISION:</u>  <b>A</b>	<u>ECR/ECN INFORMATION:</u> EC No: 168342 DATE: 2017/11/21	<u>TITLE:</u>  <b>698MHz-6GHz WIDE BAND ANTENNA</b>		<u>SHEET No.</u>  <b>17 of 17</b>
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