SPECIFICATION

Part No. : **TG.09.0113W**

Product Name : 4G/3G/2G Cellular Hinged SMA (M) Mount Monopole

Feature : 700MHz to 3800MHz
LTE*/GSM/CDMA/HSPA/UMTS
700*/850/900/1700/1800/1900/2100/2300/3500/3700
Rotatable hinge design for optimal reception
*LTE 700MHz Band Compatible only when connected directly on ground plane lengths of 60mm or more
RoHS Compliant





1. Introduction

The TG.09 Penta-band Cellular Hinged Rotatable SMA antenna is a high efficiency monopole antenna. Compared to other much larger antennas on the market, it has superior wide-band high efficiency characteristics. This antenna is used by many of the leading wireless device providers in the world marketplace.

The unique rotatable hinge design enables the user to rotate the antenna to the best angle for an optimal cellular signal reception. As the upper antenna element can move in any direction, it also reduces damage from impact force from any angle to the antenna, compared to traditional hinged right angle or fixed fight angle designs or straight antennas.

The tiny dimensions of this antenna coupled with excellent RF performance and an aesthetic high end design feel make it the ideal cellular antenna for routers, vehicle tracking devices, telematics devices, remote monitoring systems, and POS devices.

The TG.09, as all monopole antennas works best connected directly to the ground-plane of the device main-board. Taoglas offers support services to characterize antenna efficiency on your individual device ground-plane.

The TG.09 antenna also supports LTE 700MHz band applications when it is directly connected to ground-planes with lengths above 60mm.

Please contact Taoglas regional support center first if you wish to do PTCRB or network approvals with this antenna attached to your device, so we can check RF integration is correct and do a pre-test first to ensure optimized passive and active performance and a smooth and quick certification approval process.

This antenna also comes in a black housing version. TG.09.0113

2. Specification

ELECTRICAL										
Communication System	4G/3G/2G Cellular									
	700 LTE	AMPS	GSM	DCS	PCS	UMTS	2300 LTE	2700 LTE	3500 LTE	3700 LTE
Frequency (MHz)	703 ~ 803	824 ~ 896	880 ~ 960	1710 ~ 1880	1850 ~ 1990	1710 ~ 2170	2300 ~ 2400	2490 ~ 2690	3400 ~ 3600	3600 ~ 3800
Efficiency (free space)*	18%	22%	22%	25%	30%	30%	17%	32%	28%	43%
Gain (dBi, free space)*	-3.0	-2.6	-3.0	0.9	0.9	0.9	-1.3	1.1	1.8	3.1
Efficiency (mounted on PCB)*	52%	58%	57%	61%	58%	54%	31%	59%	36%	37%
Gain (dBi, mounted on PCB)*	0.8	1.7	1.8	3.4	3.4	3.4	2.3	3.7	4.3	2.6
Impedance	50Ω									
Polarization	Linear									
Radiation Pattern	Omnidirectional									
Input Power	10W									
MECHANICAL										
Antenna Length	72 ± 1.5 mm									
Antenna Diameter	10 ± 0.3 mm									
Casing	POM									
Connector	SMA Male (Brass)									
Weight	8g									
ENVIRONMENTAL										
Temperature Range	-40°C to 85°C									
Storage Temperature	-40℃ ~ +85℃									
Humidity	Non-condensing 65°C 95% RH									

* Average efficiency and peak gain of antenna sitting 180° in Free Space and on 150*90mm ground plane at the side of the PCB. Please refer to section 3 for testing detail.

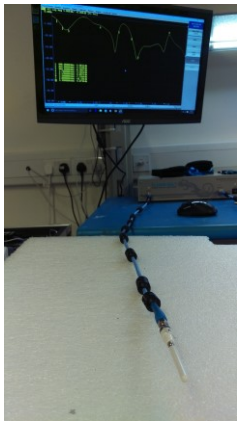
3. Antenna Characteristics

3.1 Test Setup

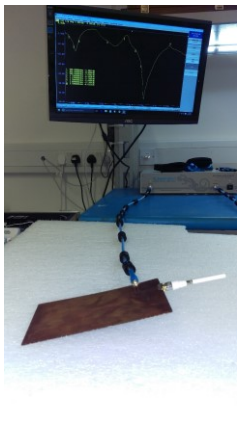
The TG.09 was measured and tested in four different environments

a. Free space
b. On the edge of a 150*90mm ground plane - common size for IoT devices. TG.09 is mounted on the 90mm edge for testing.
c. In the center of a 300*300mm ground plane – simulate the effect of mounting in the center of a big ground plane.
d. On the edge of a 300*300mm ground plane - simulates the effect of mounting TG.09 on top of a large gateway/router.

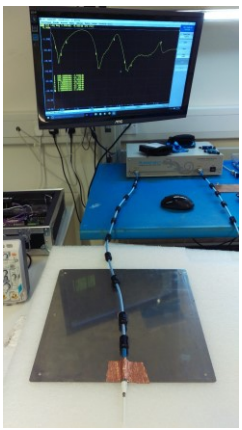
Straight Position



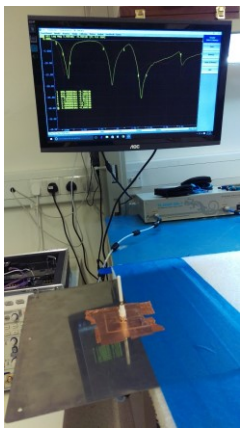
Free Space



150mm x 90mm
Ground Plane

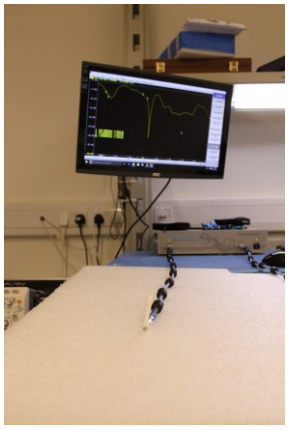


300mm x 300mm
Ground Plane Edge

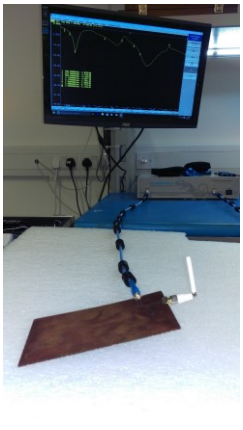


300mm x 300mm
Ground Pane Center

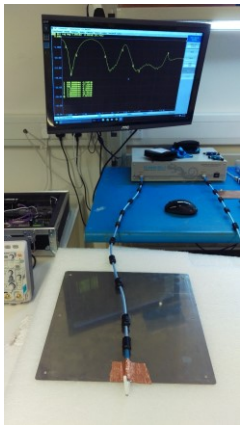
Antenna in 90° Bend Position



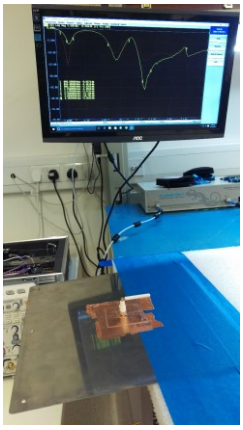
Free Space



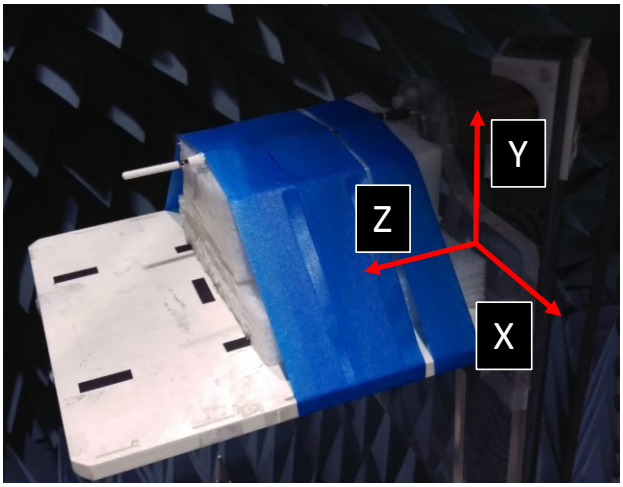
150mm x 90mm
Ground Plane

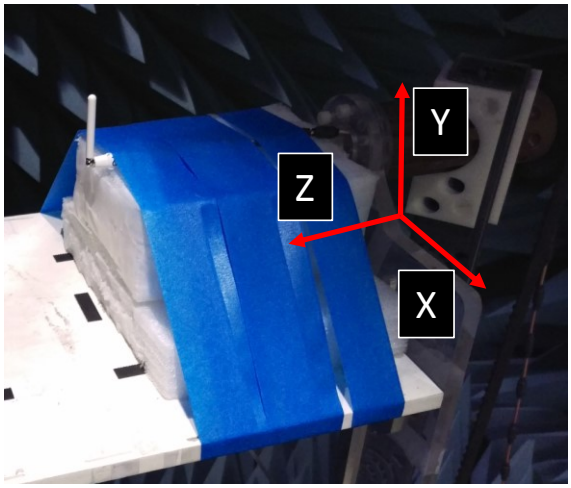


300mm x 300mm
Ground Plane Edge



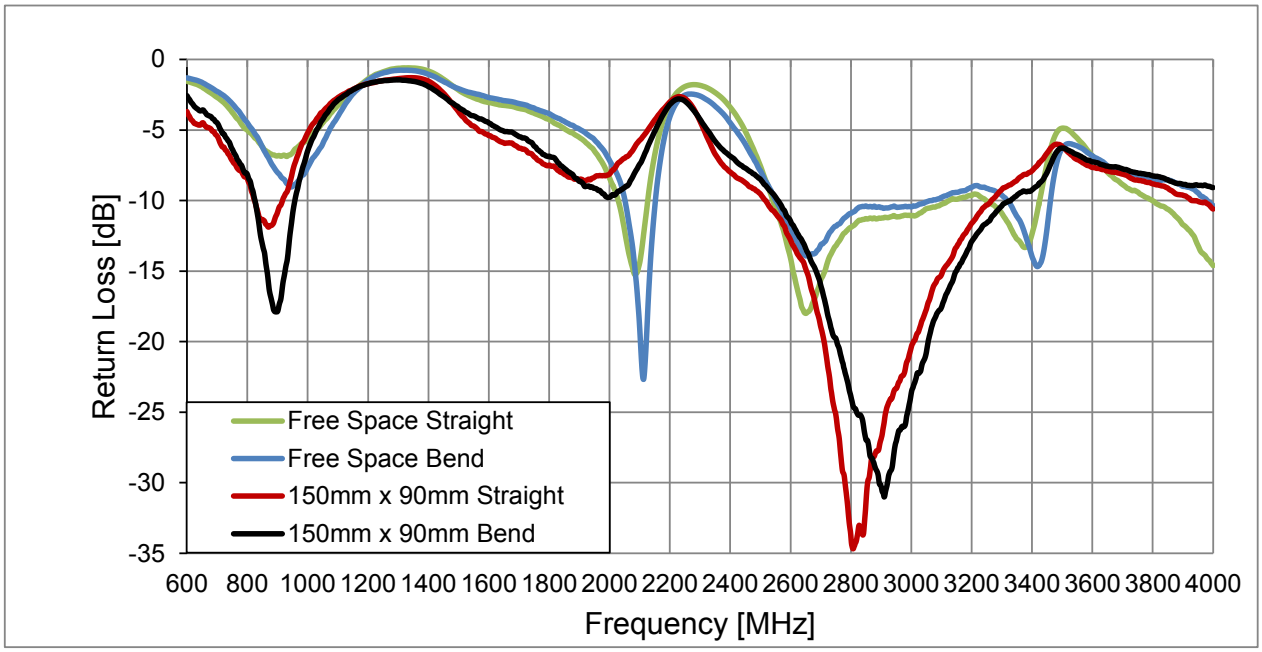
300mm x 300mm
Ground Pane Center

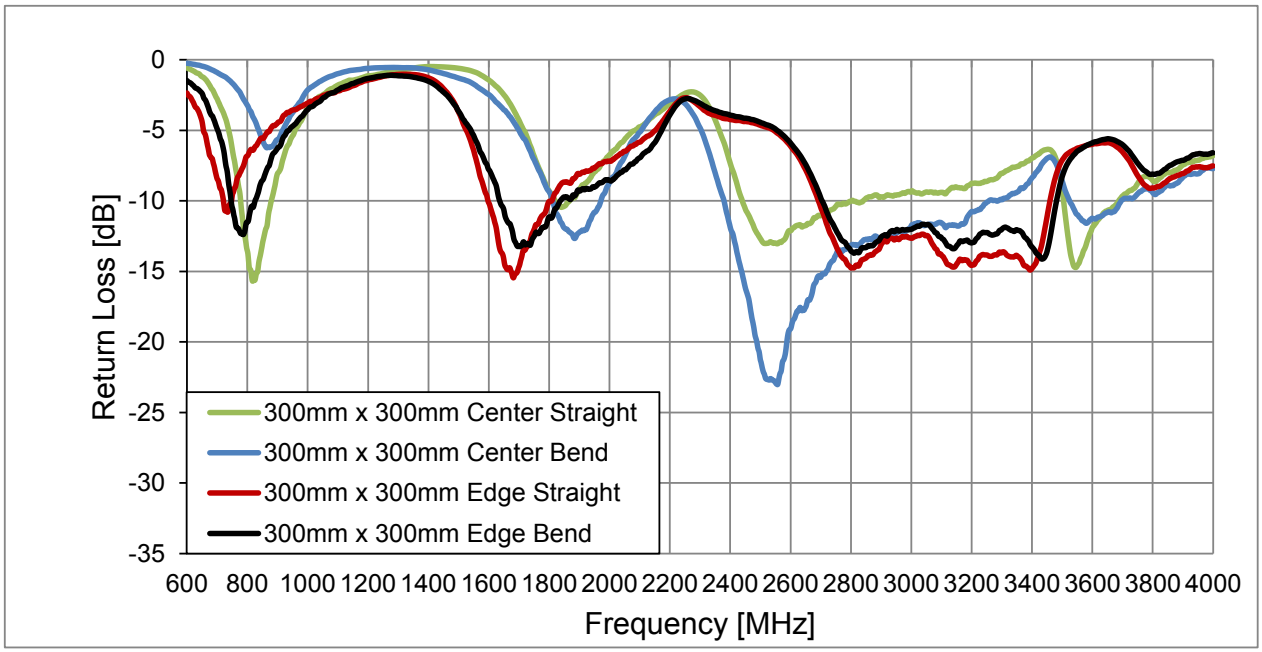




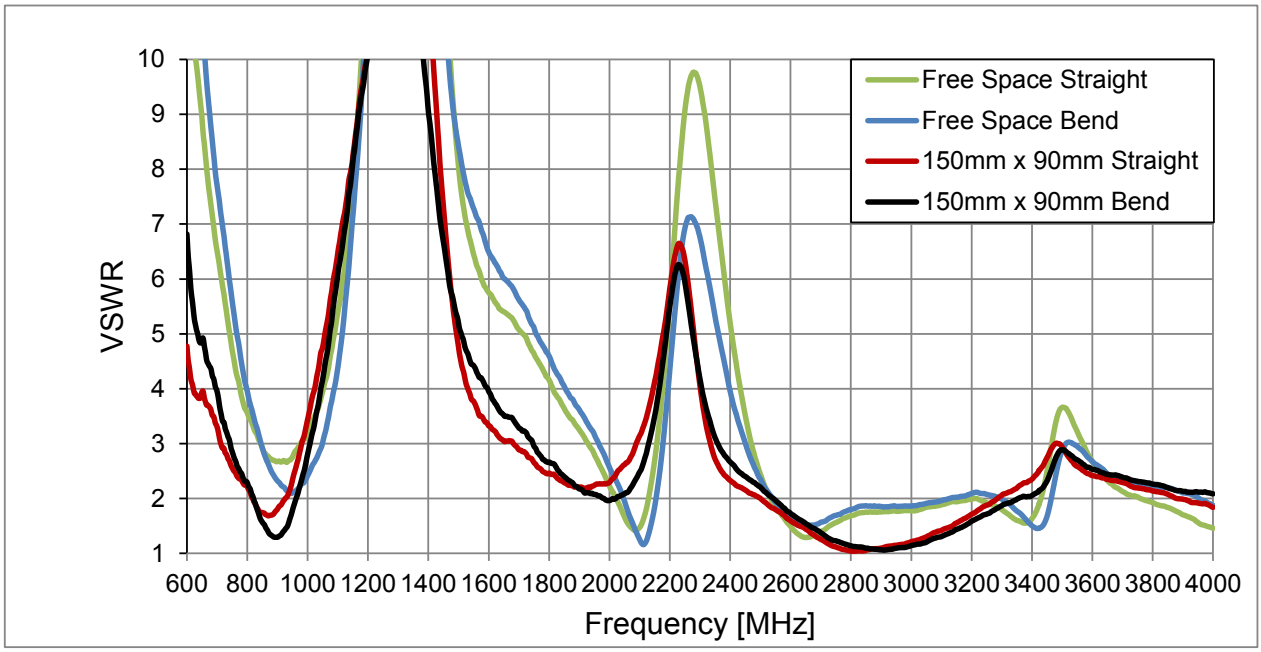
Chamber Setup

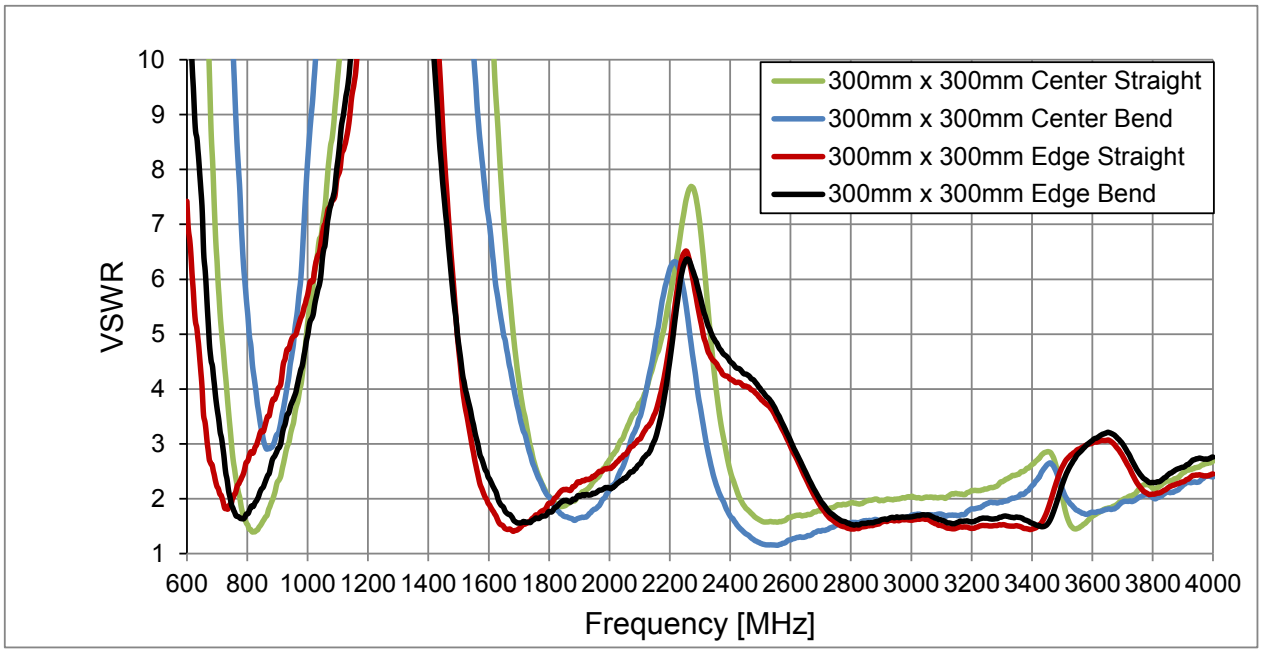
3.2 Return Loss



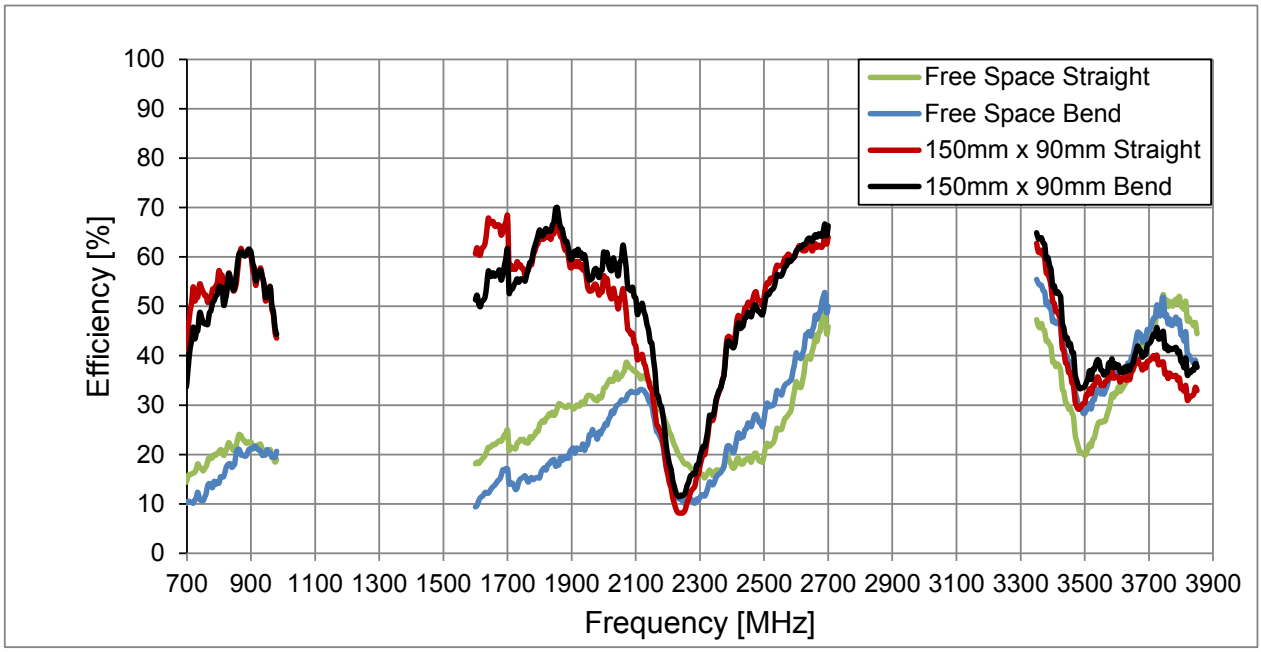


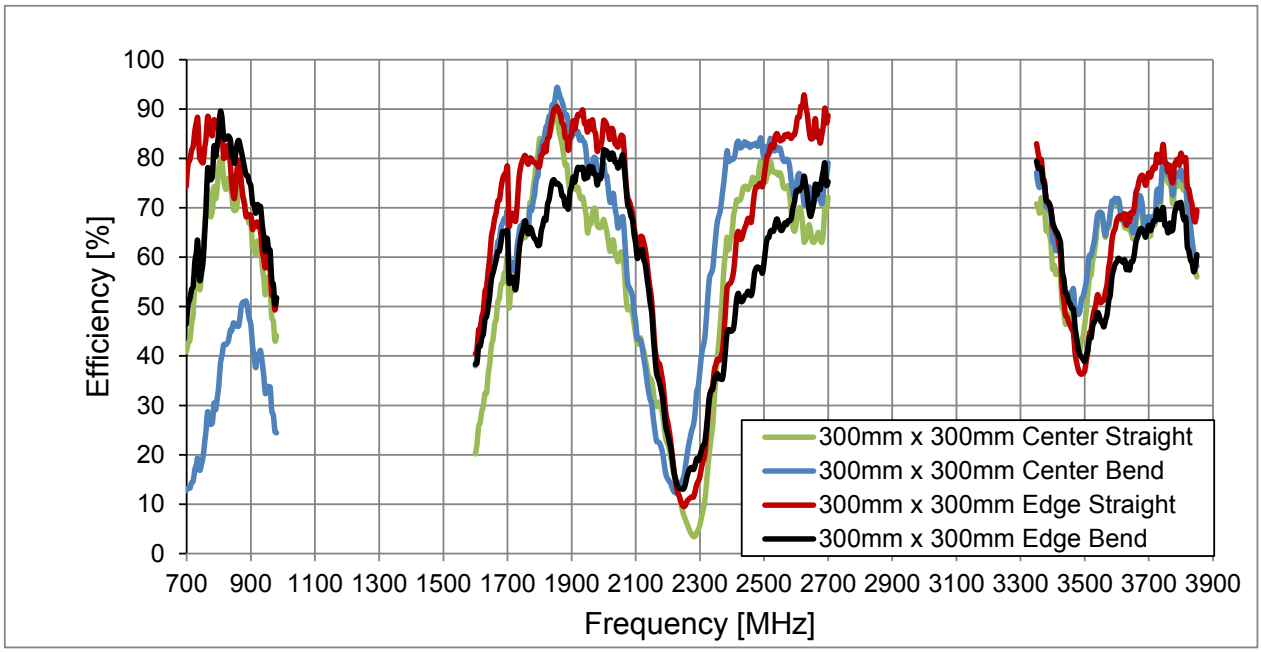
3.3 VSWR


VSWR
Frequency [MHz]
Free Space Straight
Free Space Bend
150mm x 90mm Straight
150mm x 90mm Bend

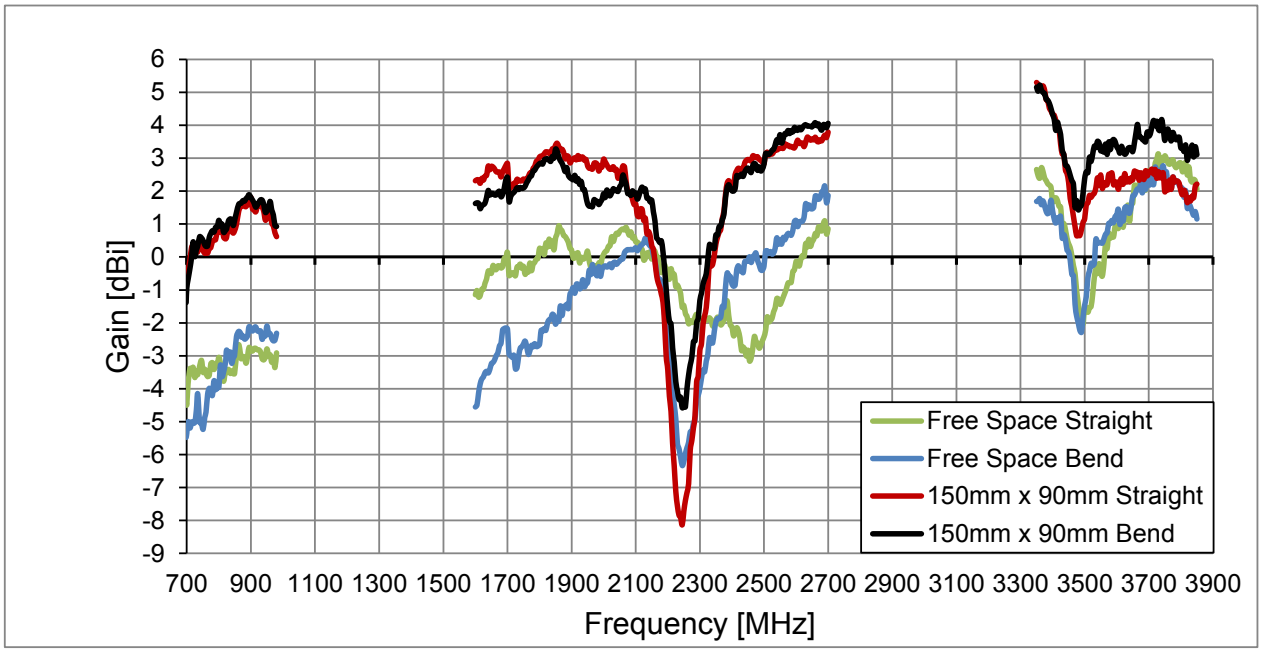

VSWR
Frequency [MHz]
300mm x 300mm Center Straight
300mm x 300mm Center Bend
300mm x 300mm Edge Straight
300mm x 300mm Edge Bend

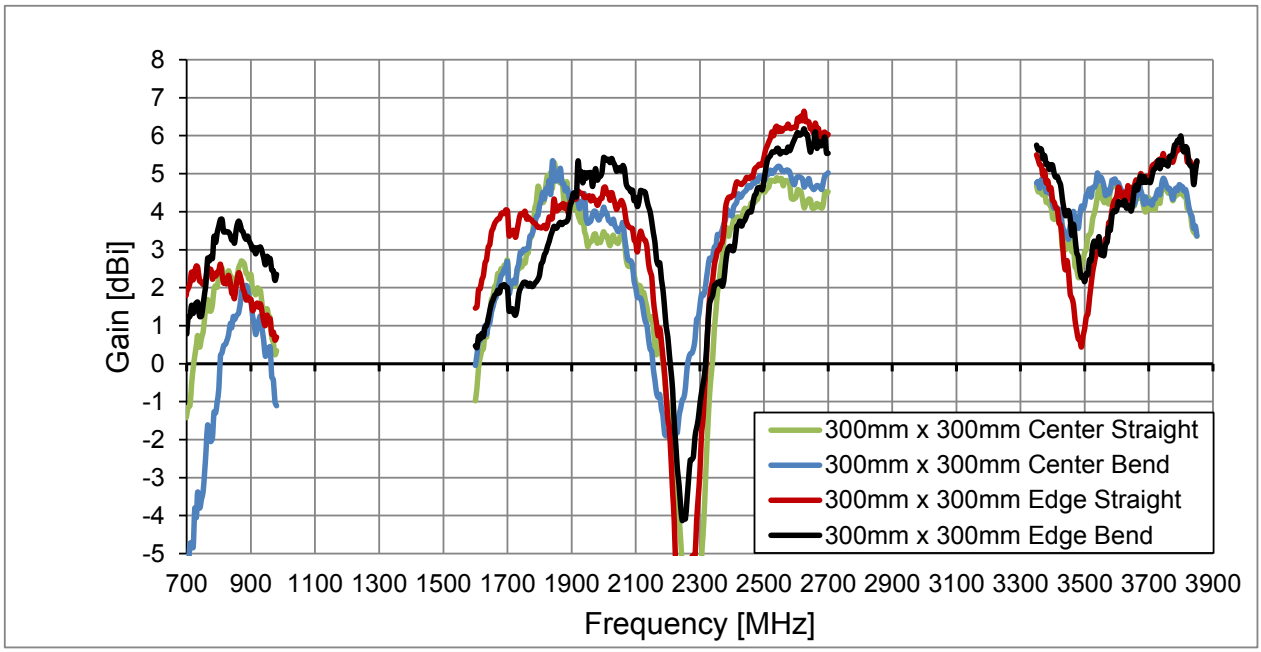
3.4 Efficiency



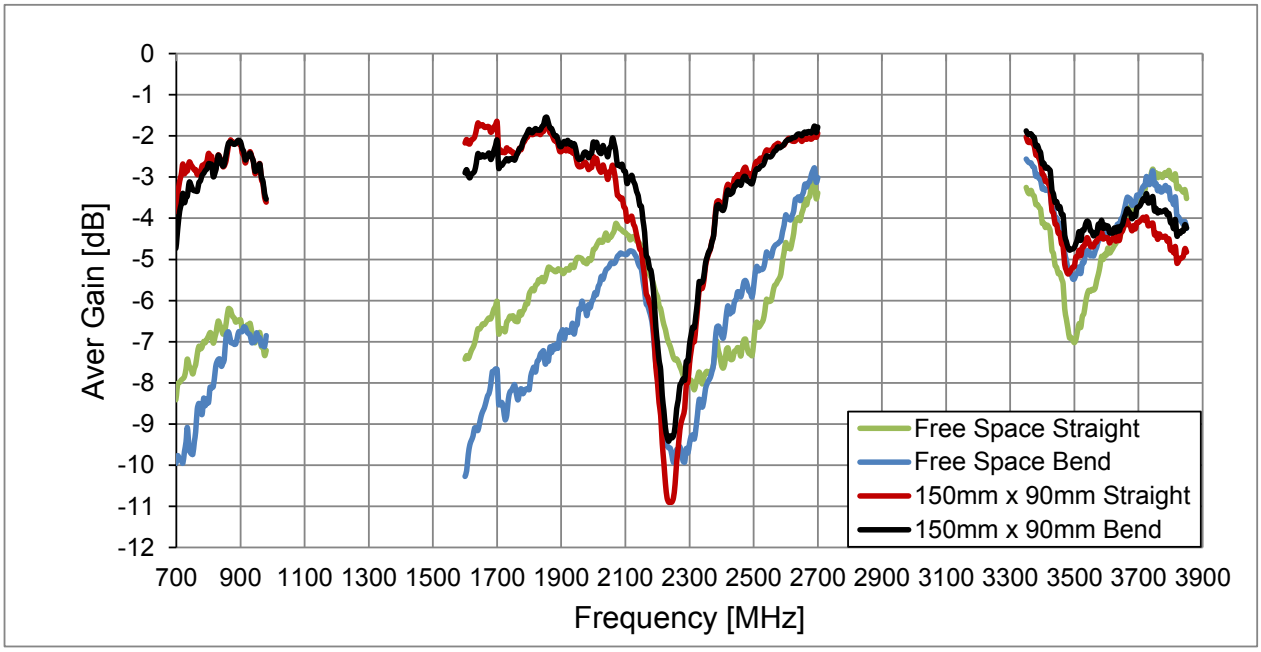


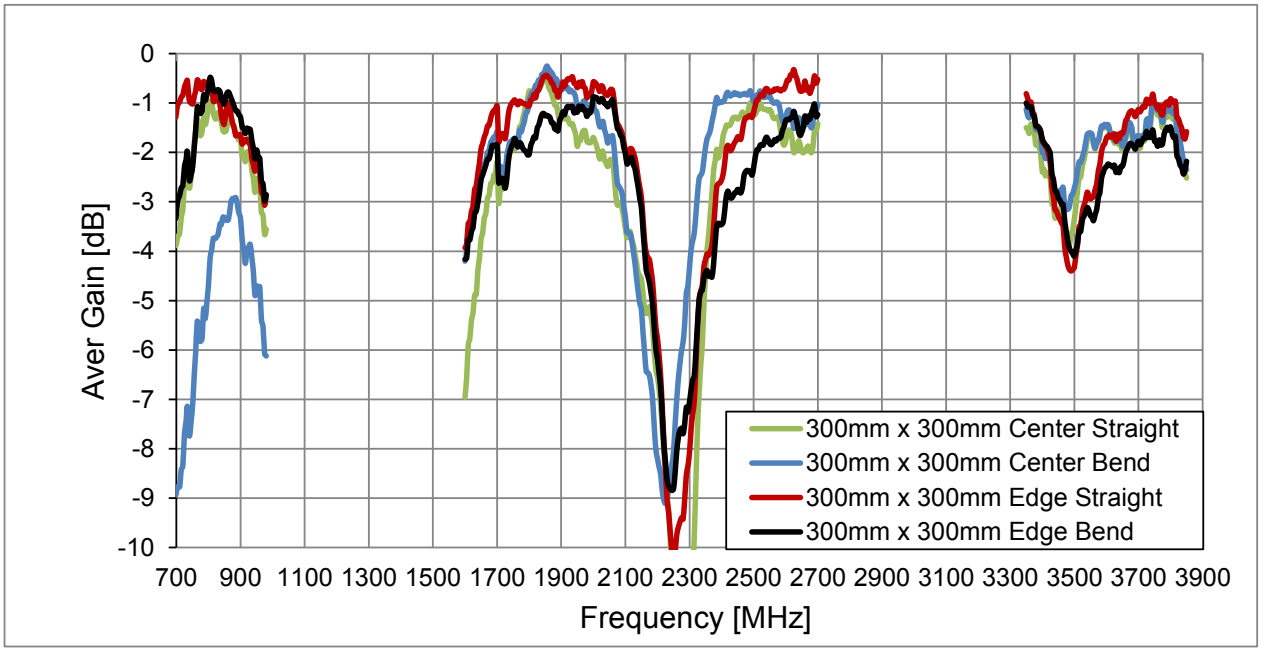
3.5 Peak Gain


Gain [dBi]
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
700 900 1100 1300 1500 1700 1900 2100 2300 2500 2700 2900 3100 3300 3500 3700 3900
Frequency [MHz]
Free Space Straight
Free Space Bend
150mm x 90mm Straight
150mm x 90mm Bend


Gain [dBi]
8
7
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
700 900 1100 1300 1500 1700 1900 2100 2300 2500 2700 2900 3100 3300 3500 3700 3900
Frequency [MHz]
300mm x 300mm Center Straight
300mm x 300mm Center Bend
300mm x 300mm Edge Straight
300mm x 300mm Edge Bend

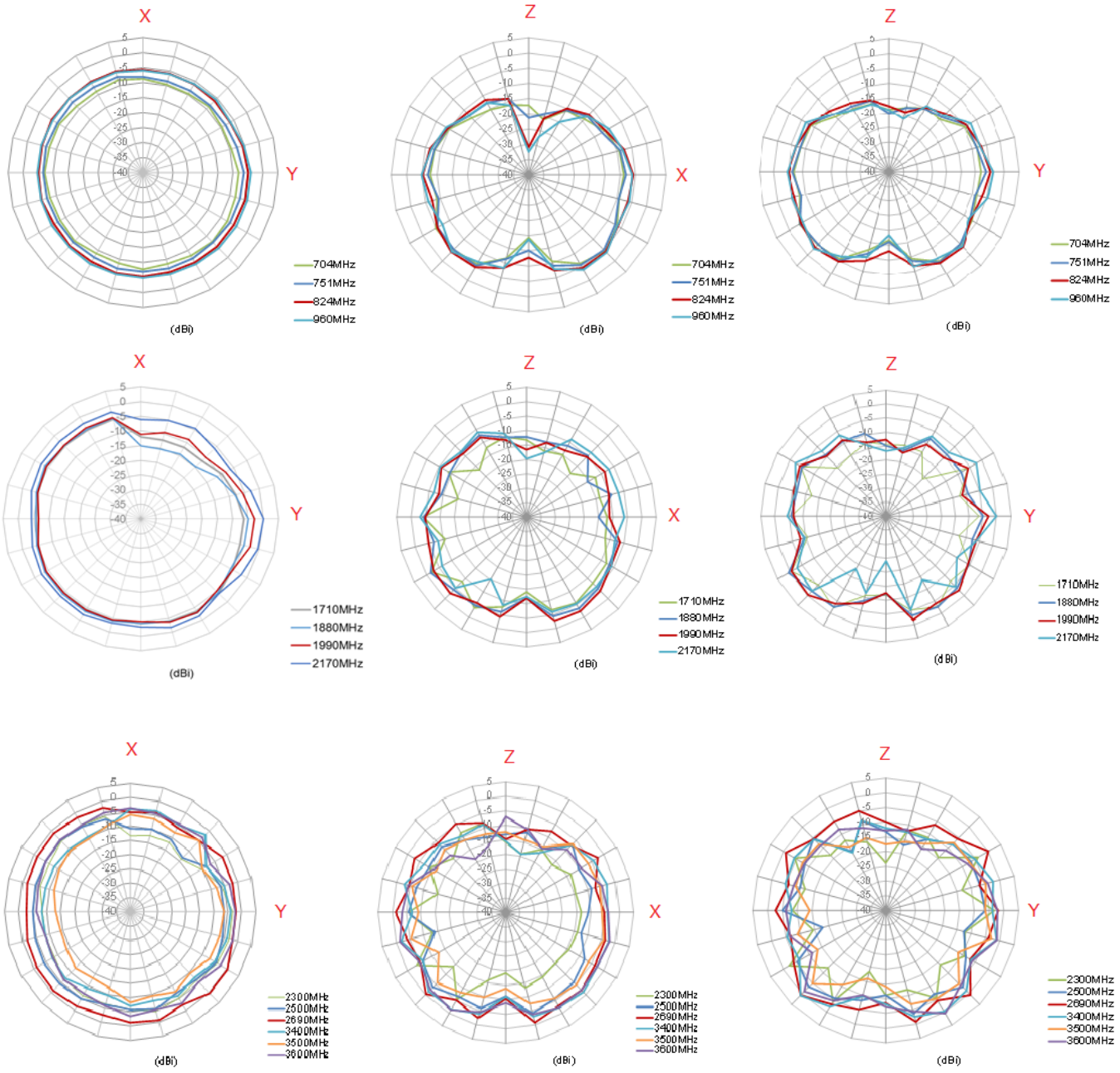
3.6 Average Gain



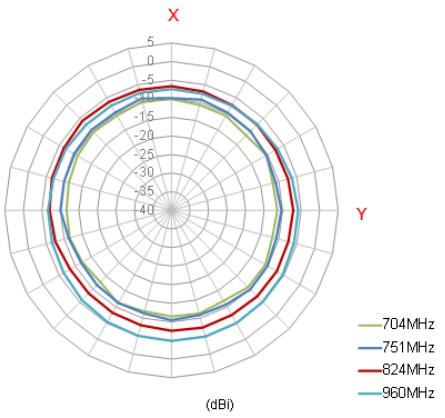


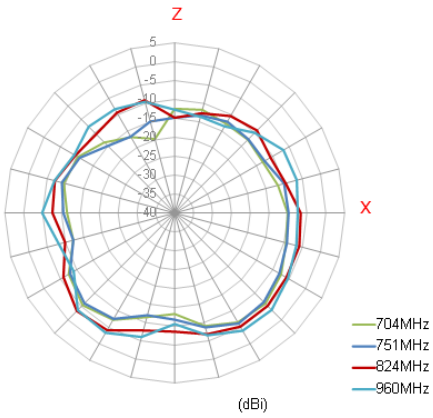
4. Radiation Patterns

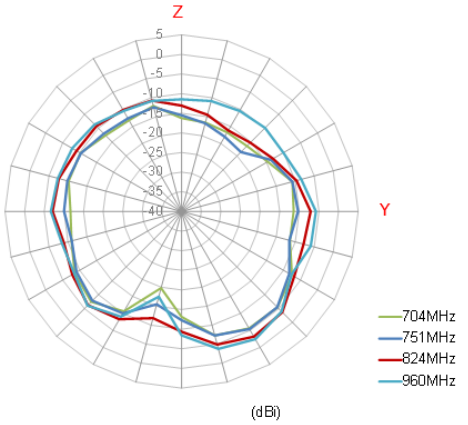
4.1 TG.09 in Free Space – Straight

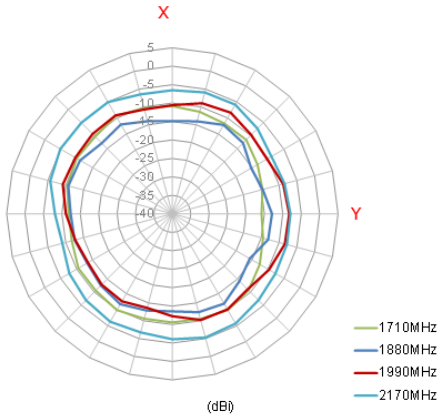


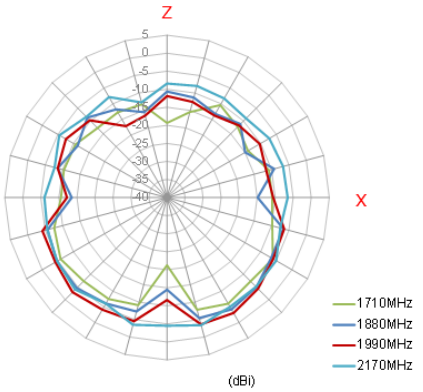
4.2 TG.09 in Free Space – 90°

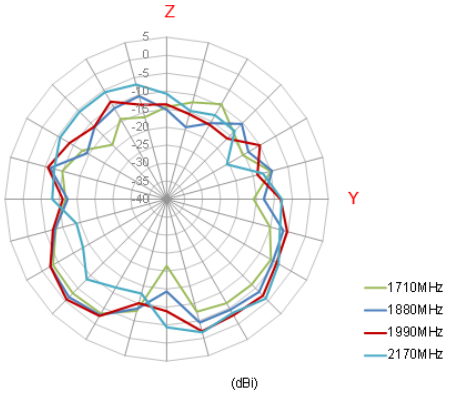


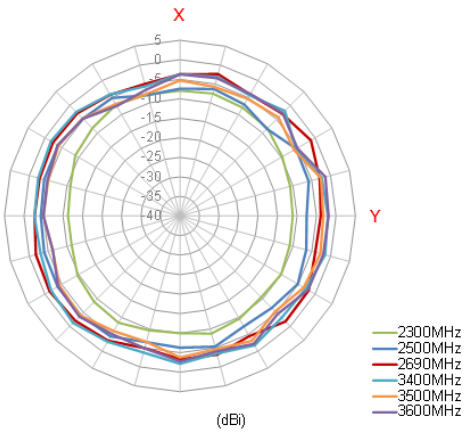


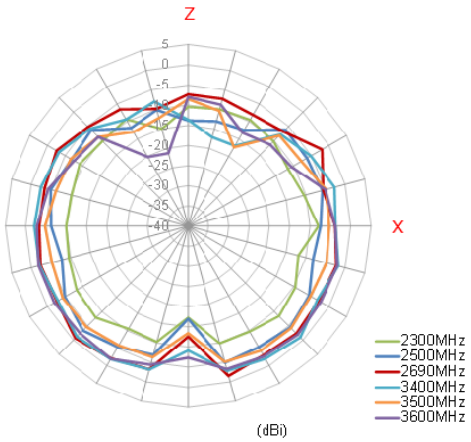


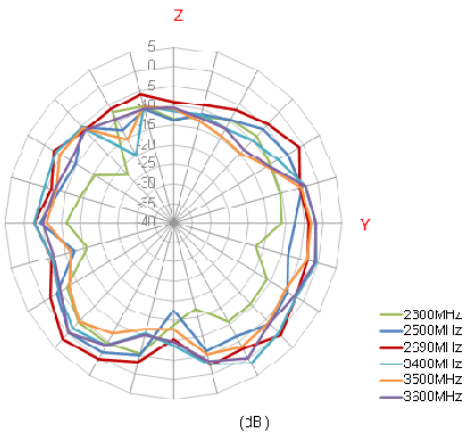




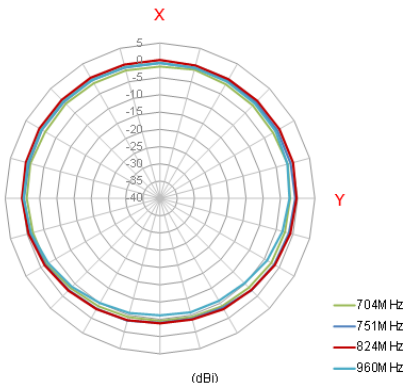


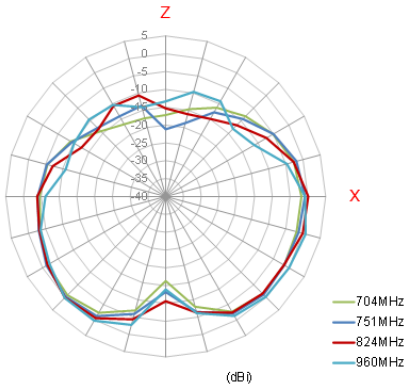


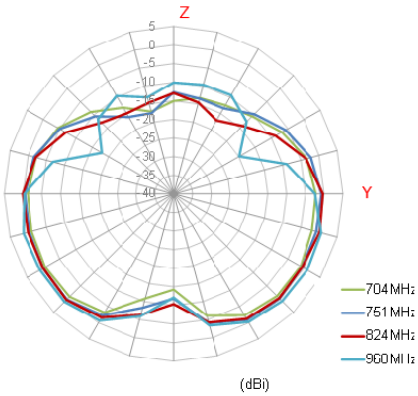


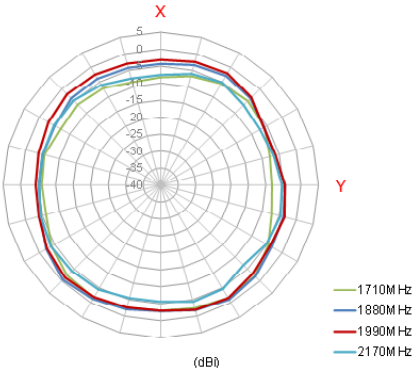


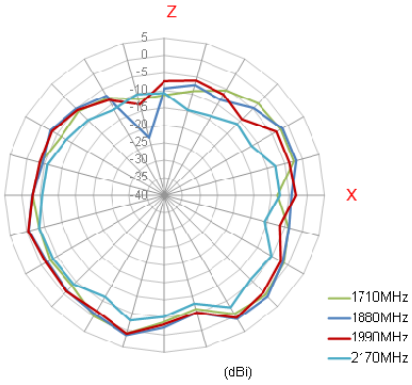
4.3 TG.09 on 150*90mm Ground Plane – Straight

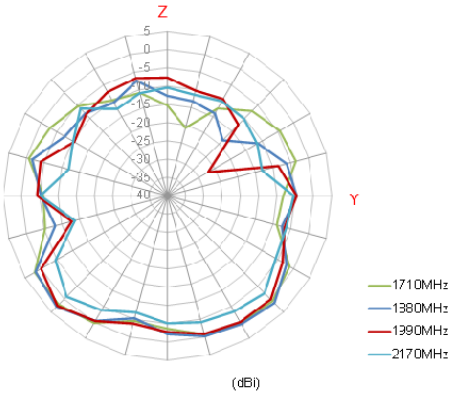


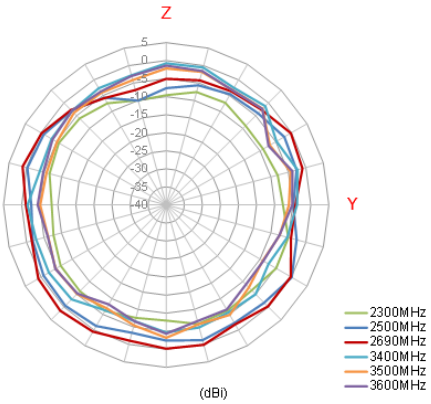


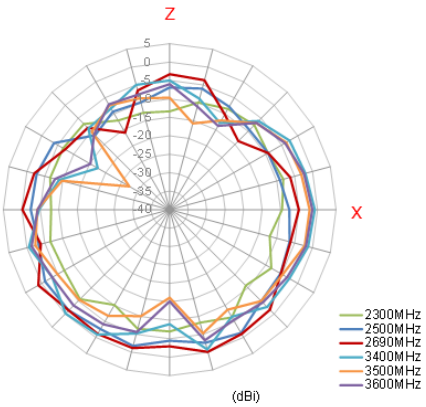


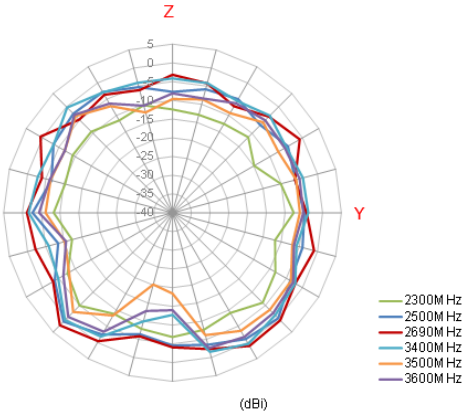




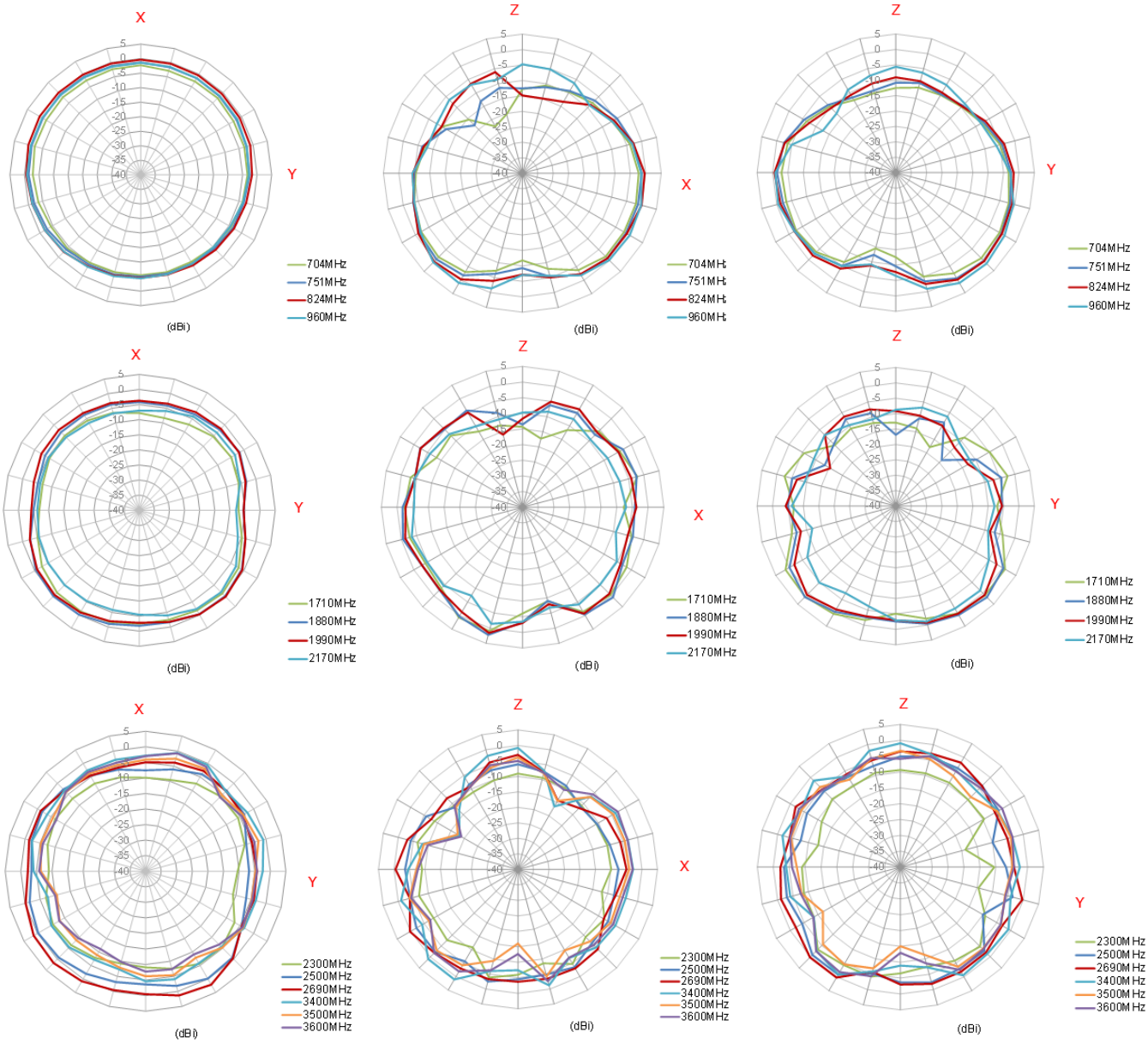




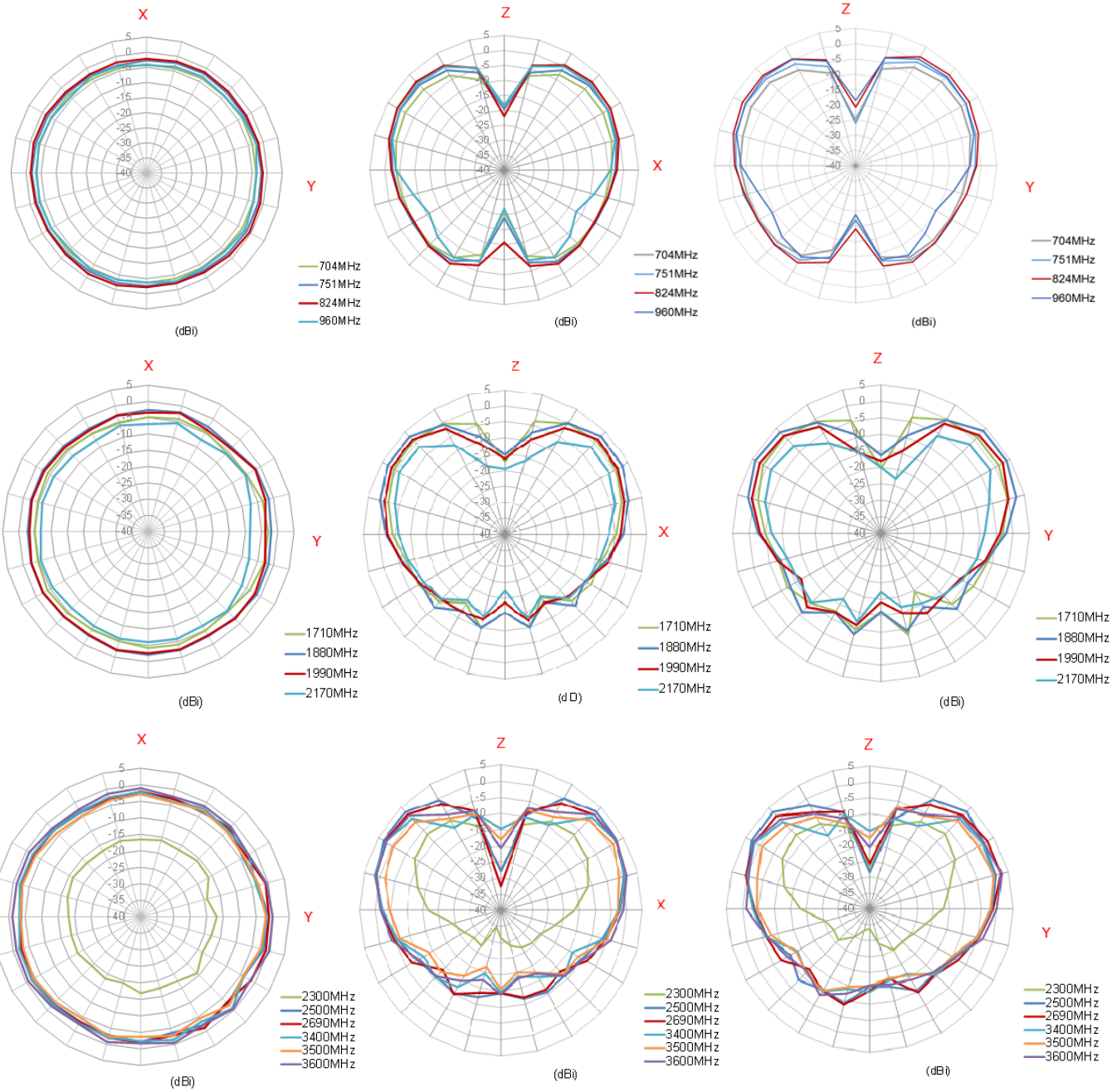




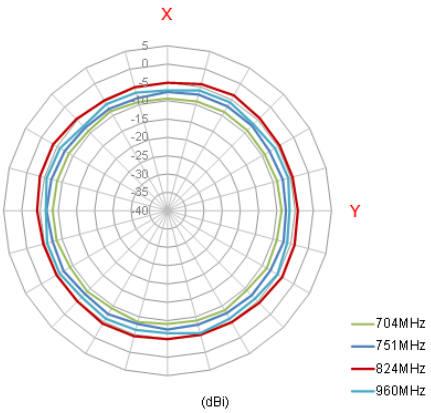
4.4 TG.09 on 150*90mm Ground Plane – 90°

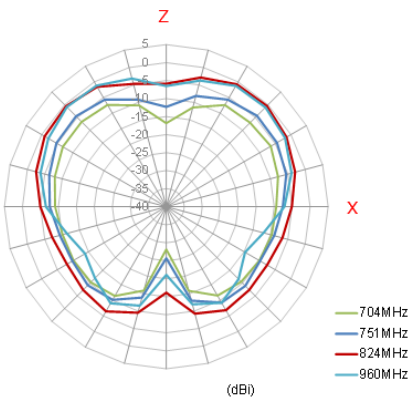


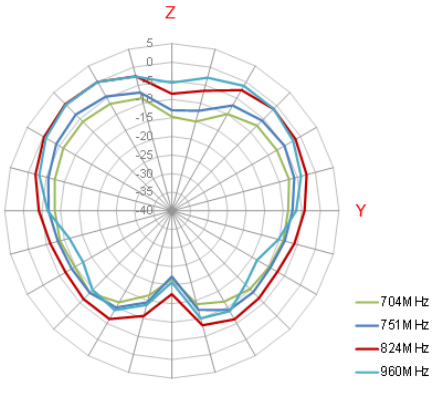
4.5 TG.09 on 300*300mm Ground Plane Centre – Straight

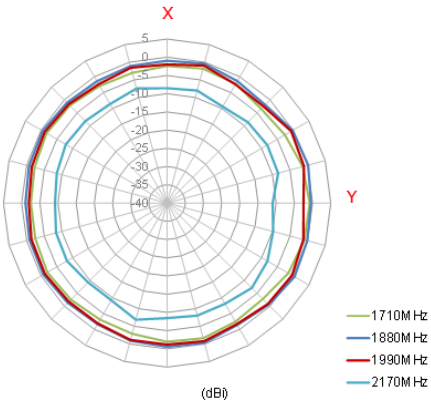


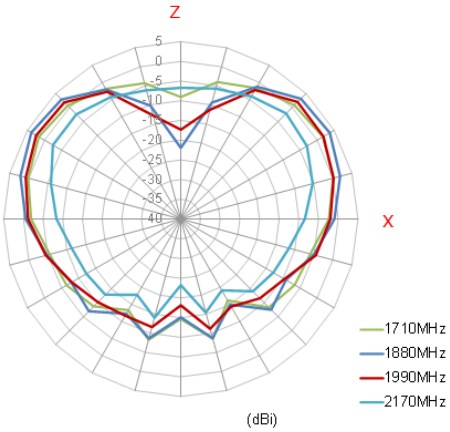
4.6 TG.09 on 300*300mm Ground Plane Centre – 90°

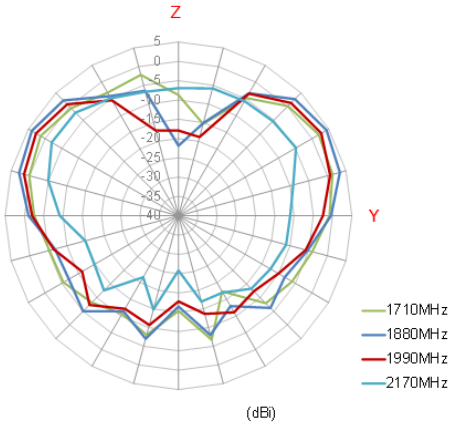


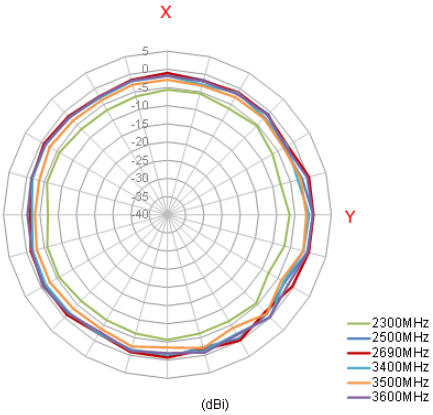


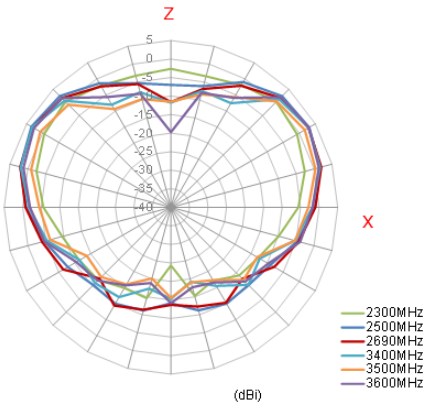


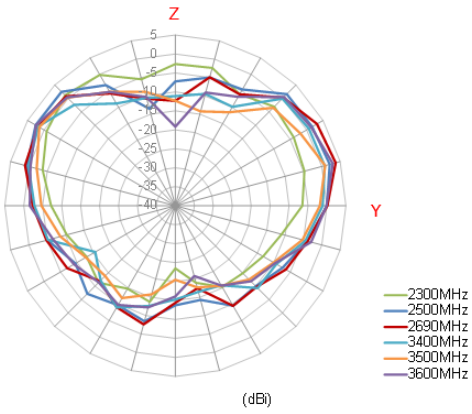




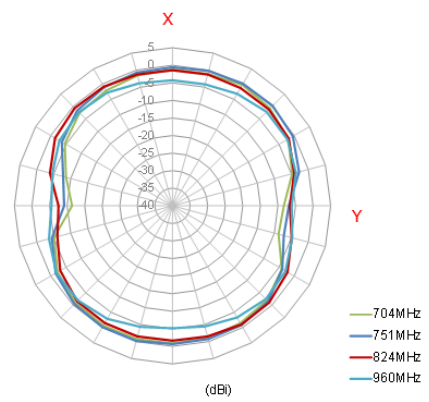


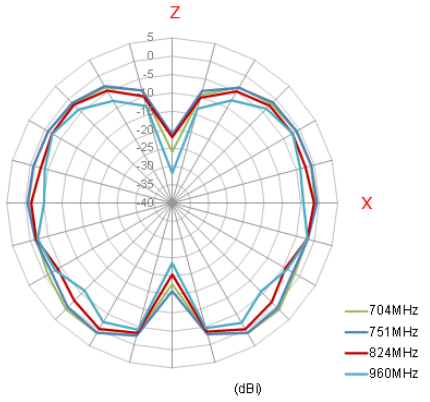


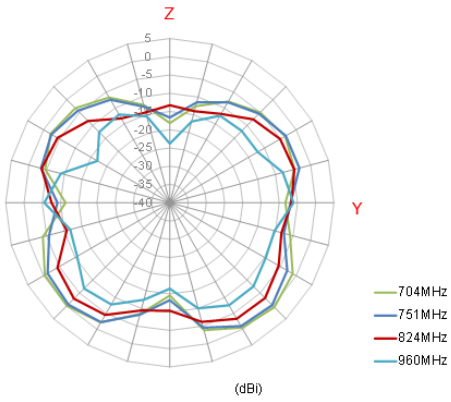


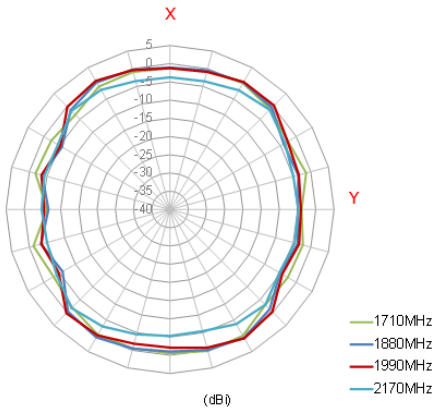


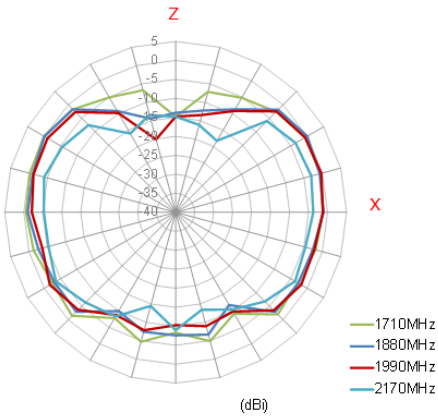
4.7 TG.09 on 300*300mm Ground Plane Edge – Straight

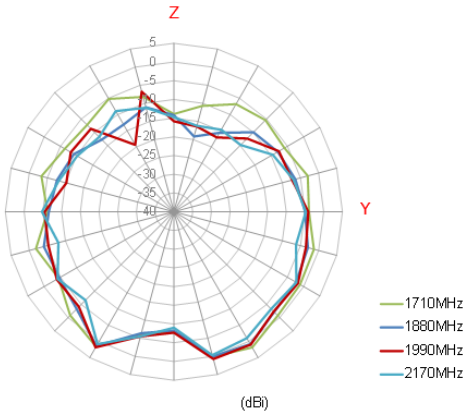


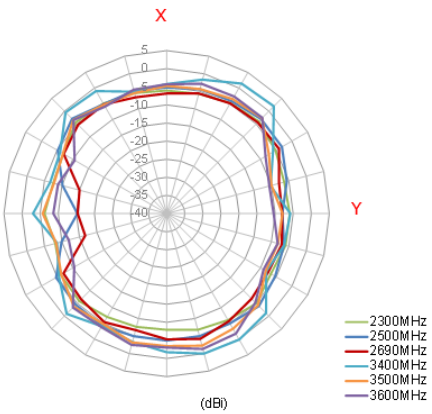


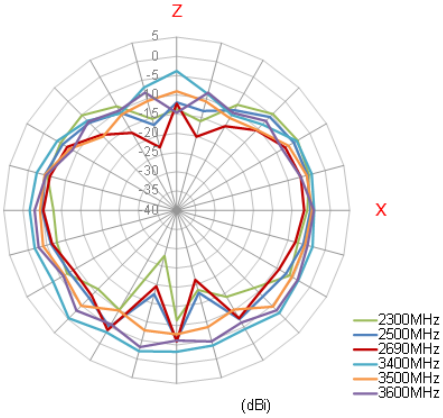


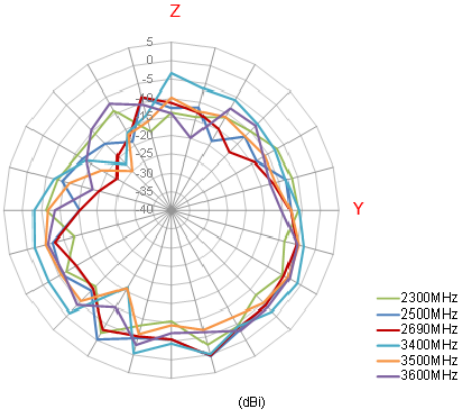




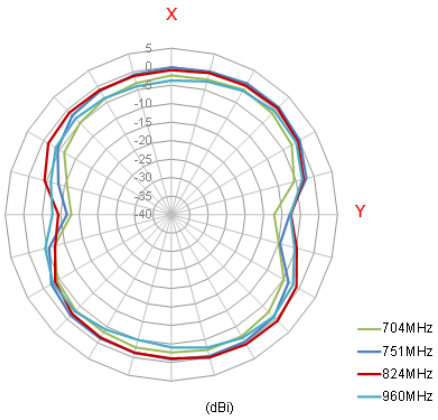


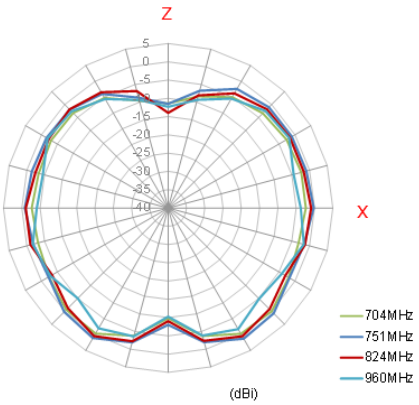


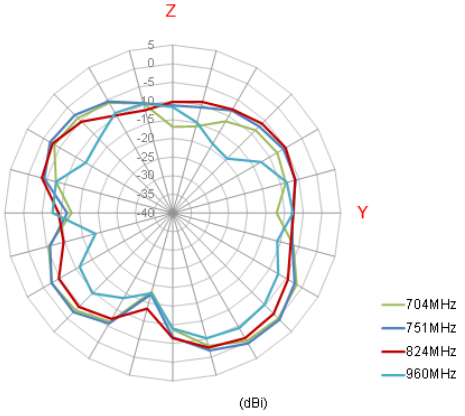


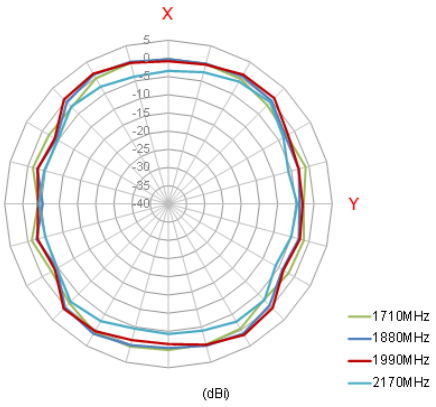


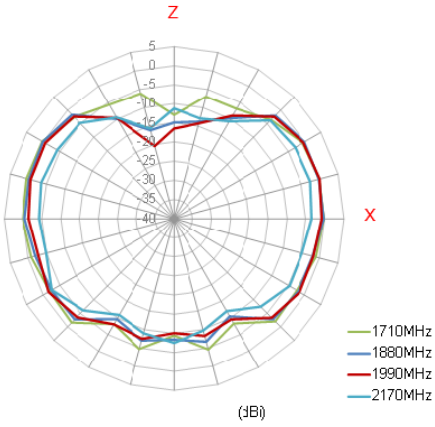
4.8 TG.09 on 300*300mm Ground Plane Edge – 90°

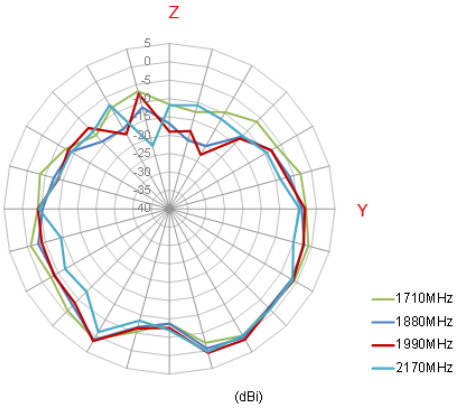


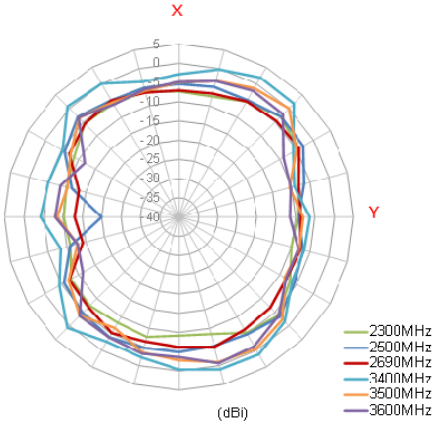


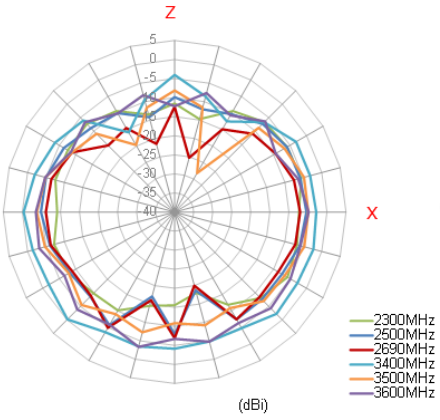


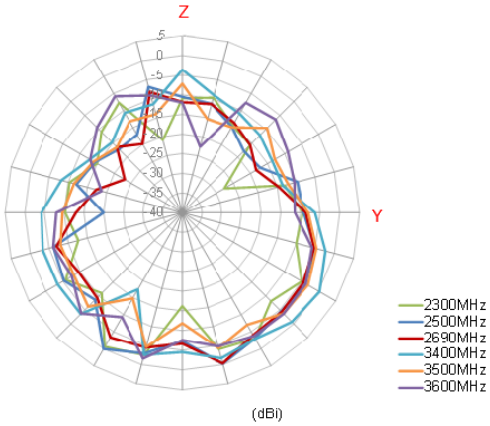






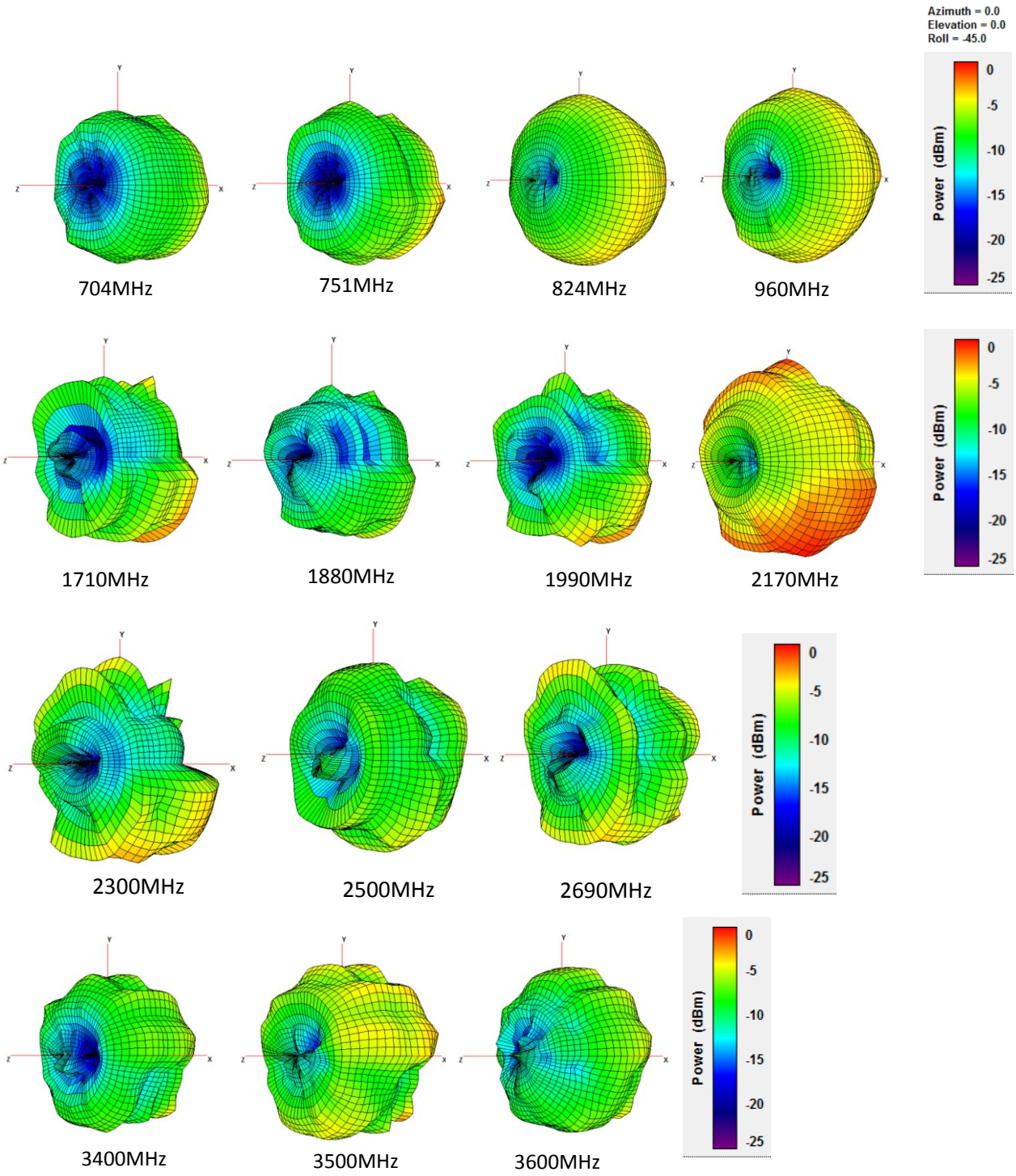




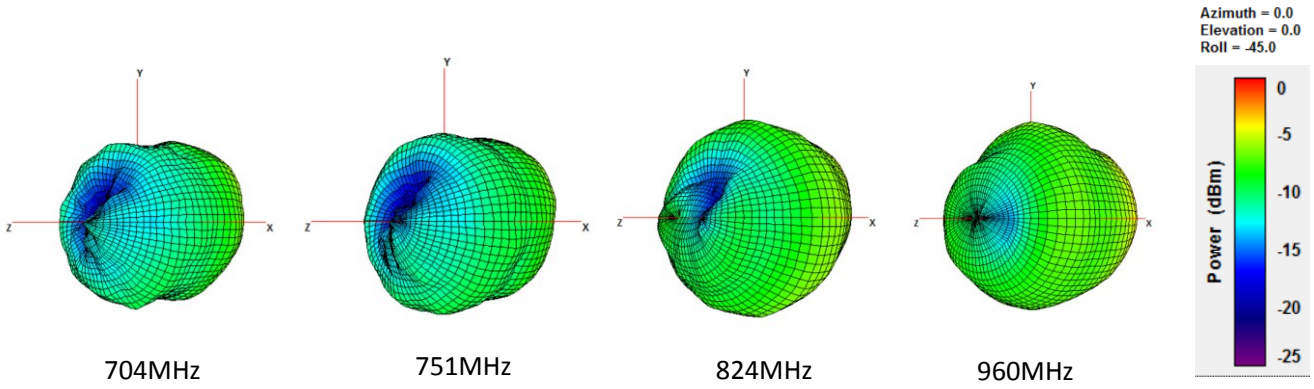


5. 3D Radiated Pattern

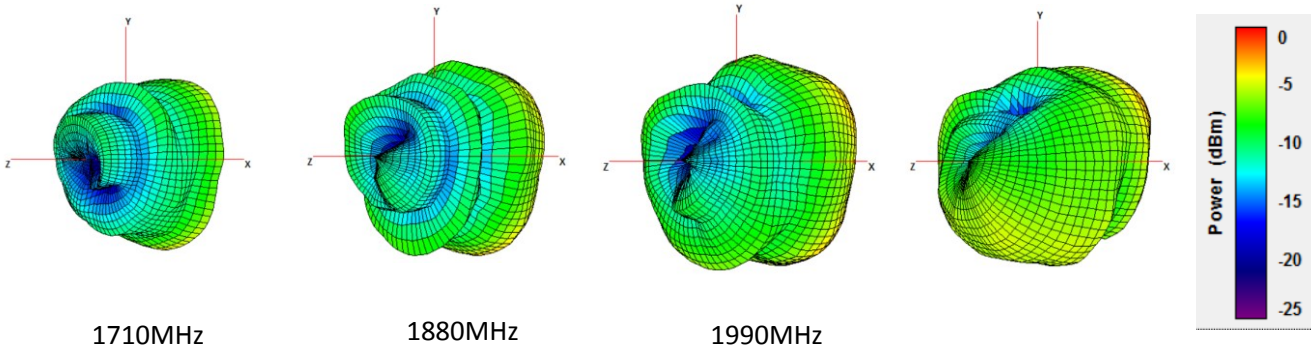
5.1 Free Space – Straight



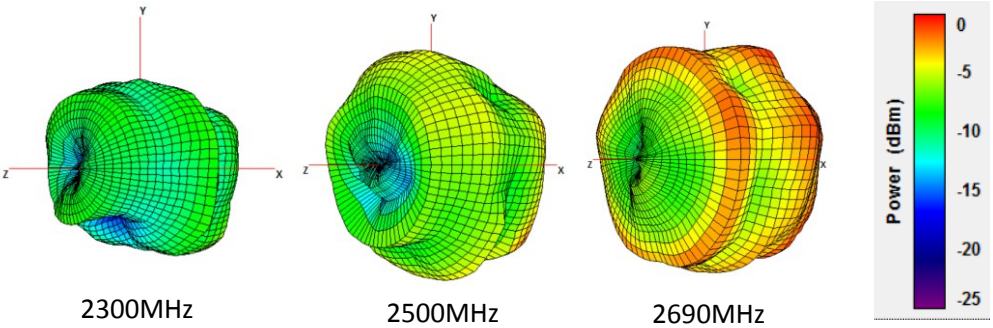
5.2 Free Space – 90°



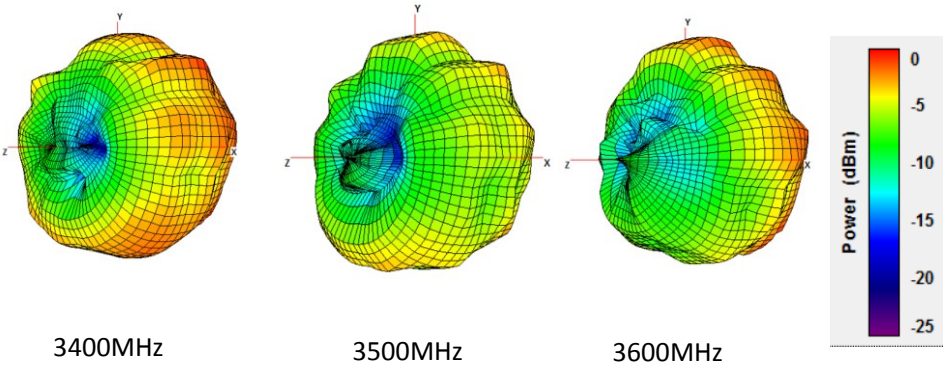
704MHz 751MHz 824MHz 960MHz



1710MHz 1880MHz 1990MHz

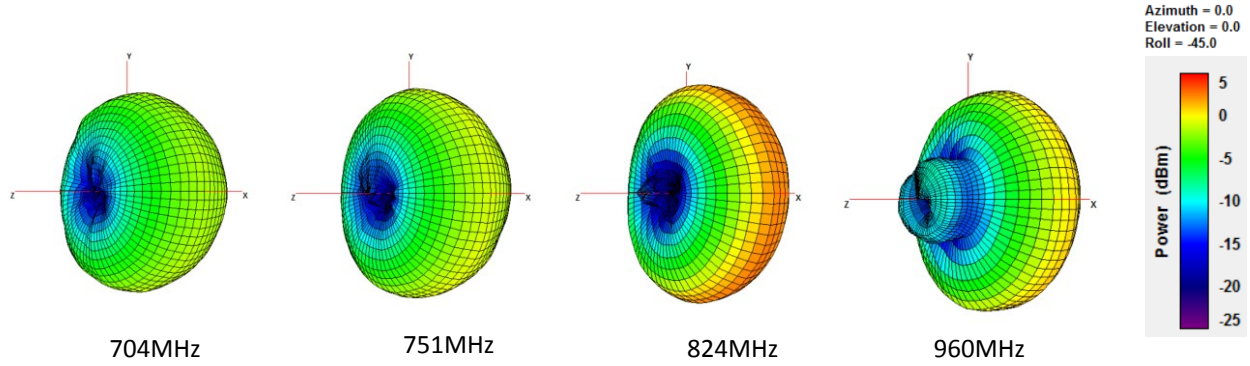


2300MHz 2500MHz 2690MHz

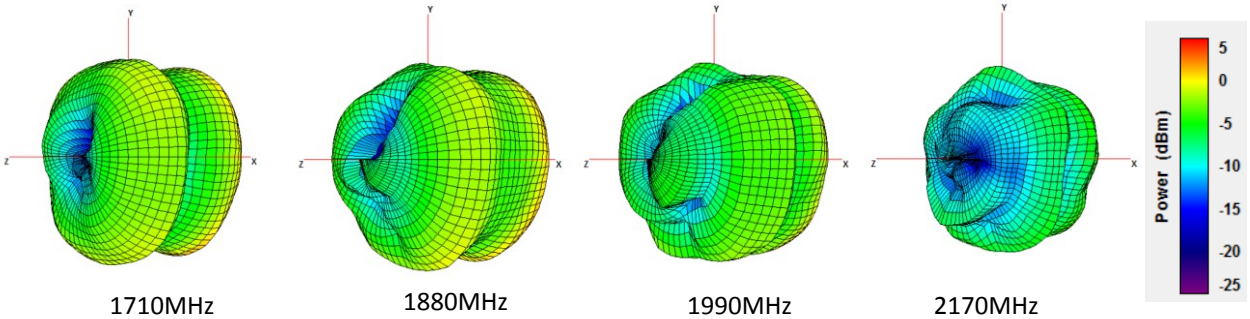


3400MHz 3500MHz 3600MHz

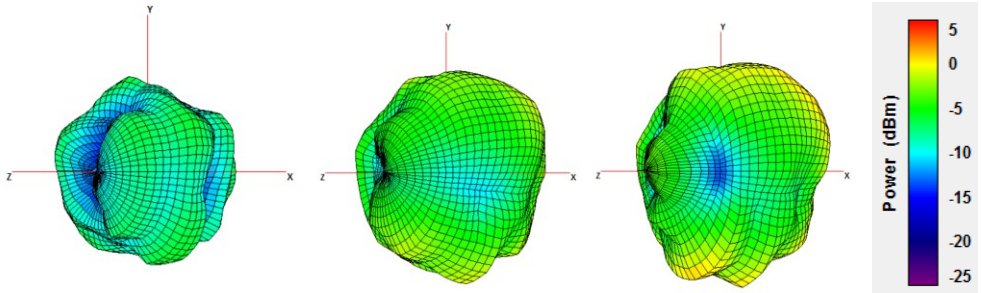
5.3 150*90mm Ground Plane – Straight



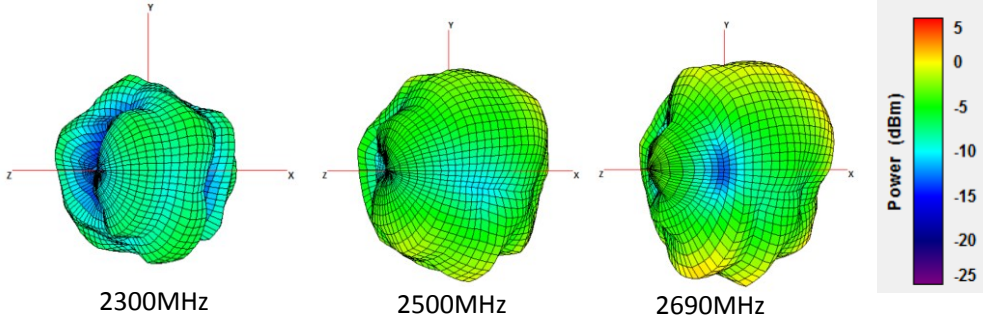
704MHz 751MHz 824MHz 960MHz



1710MHz 1880MHz 1990MHz 2170MHz

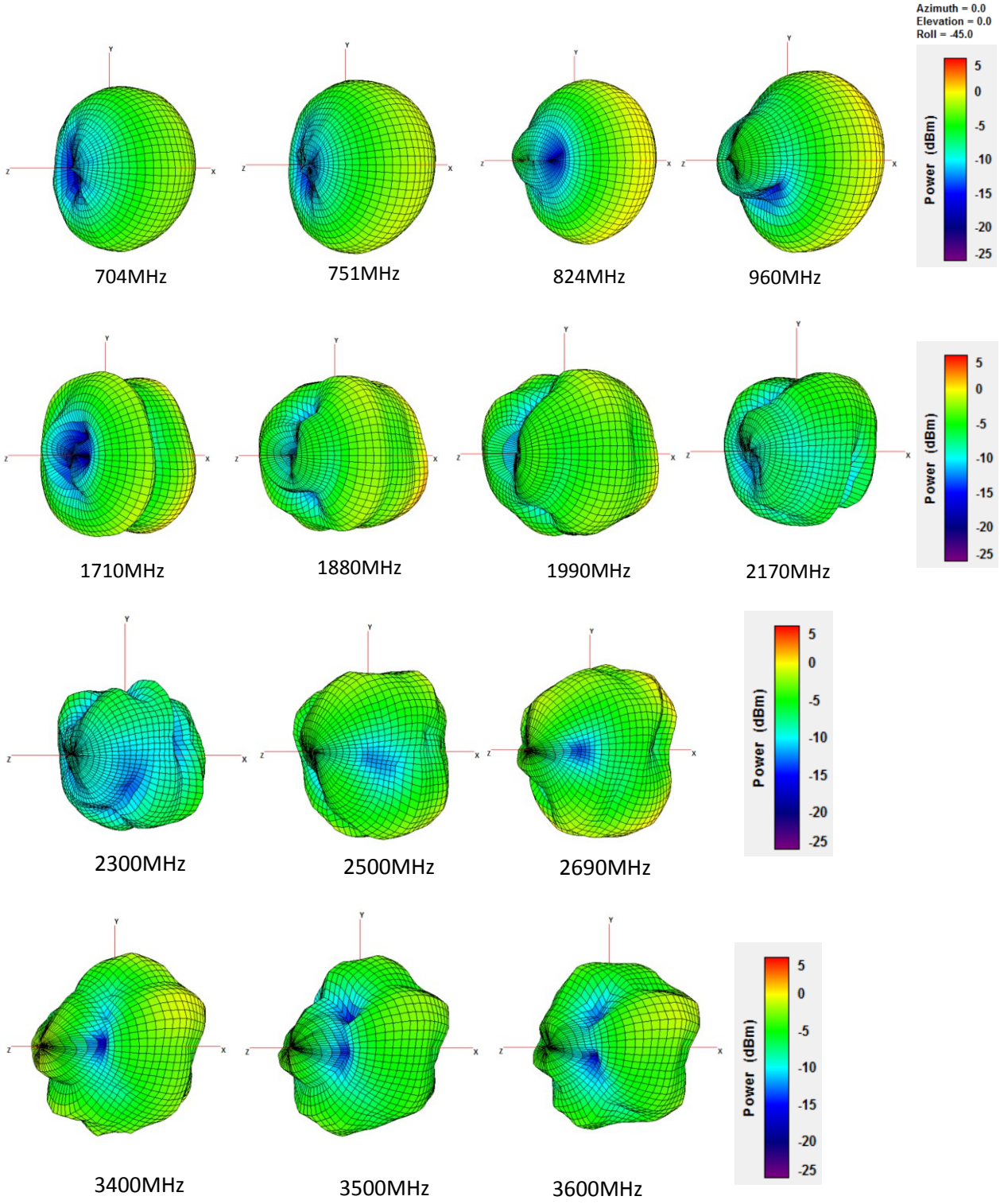


2300MHz 2500MHz 2690MHz

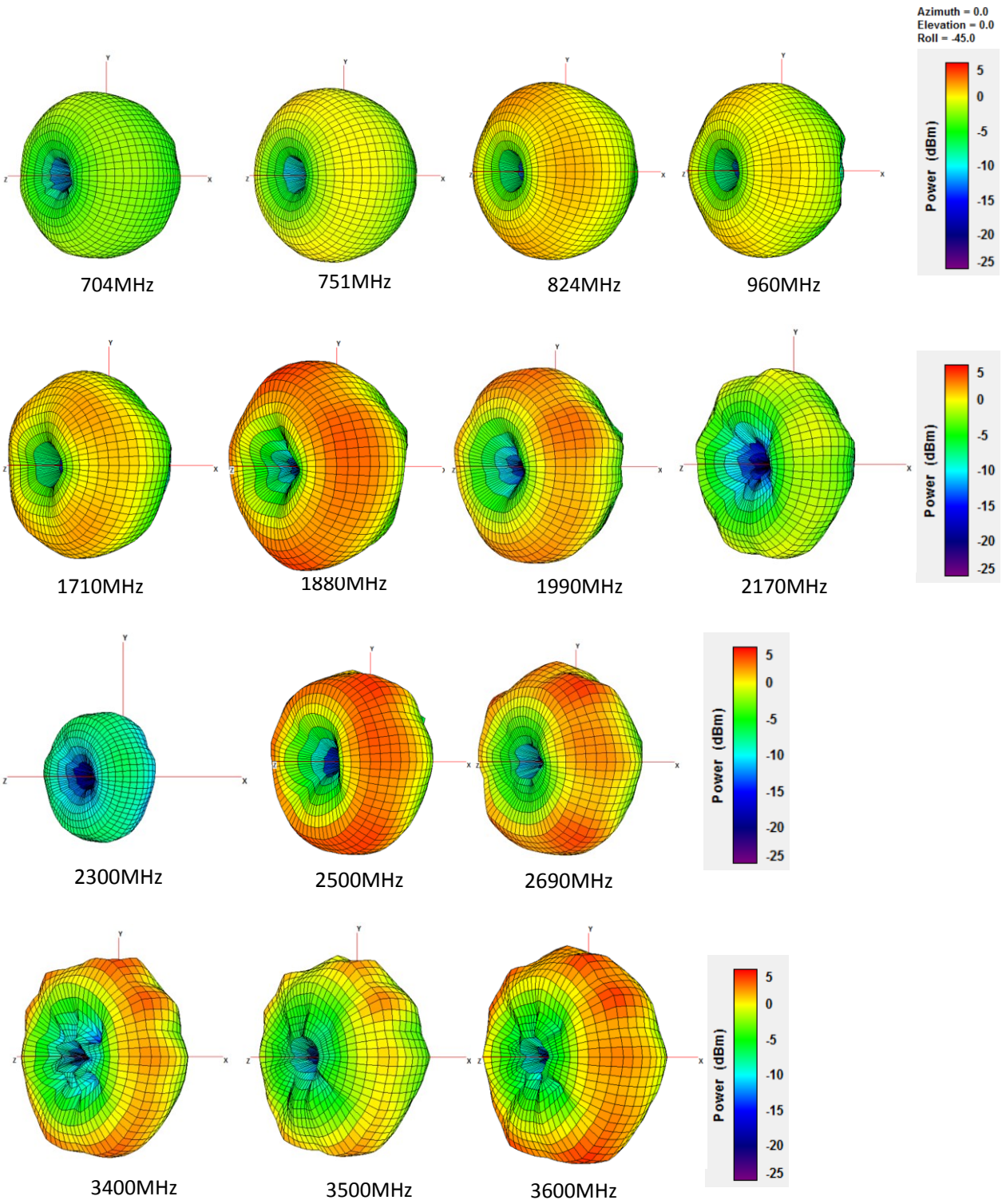


2300MHz 2500MHz 2690MHz

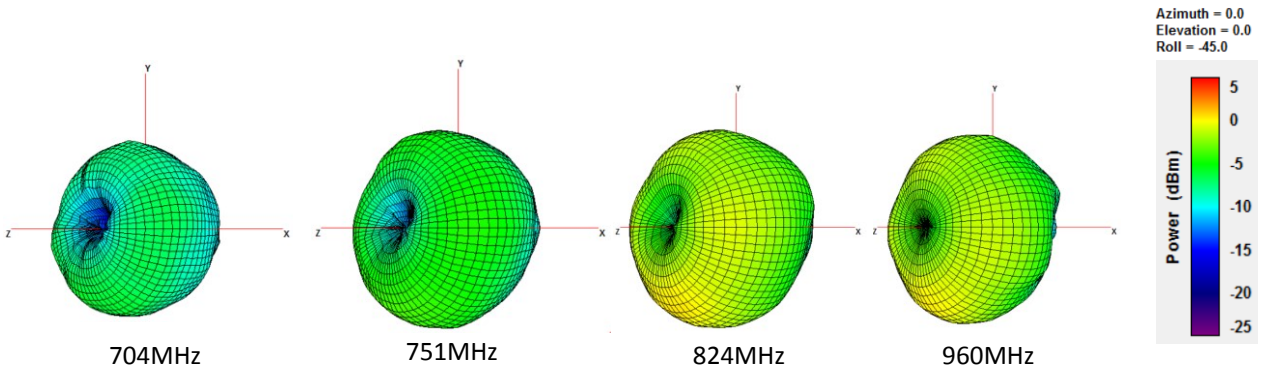
5.4 150*90mm Ground Plane – 90°



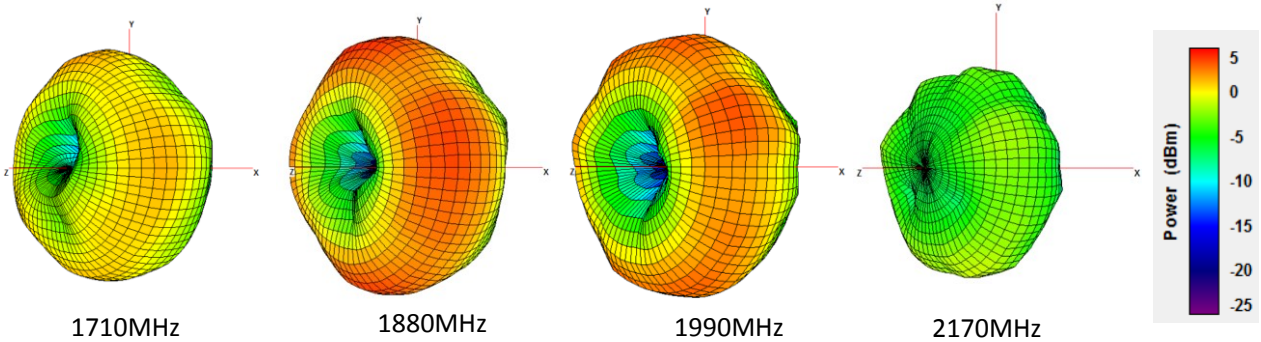
5.5 300*300mm Ground Plane Center – Straight



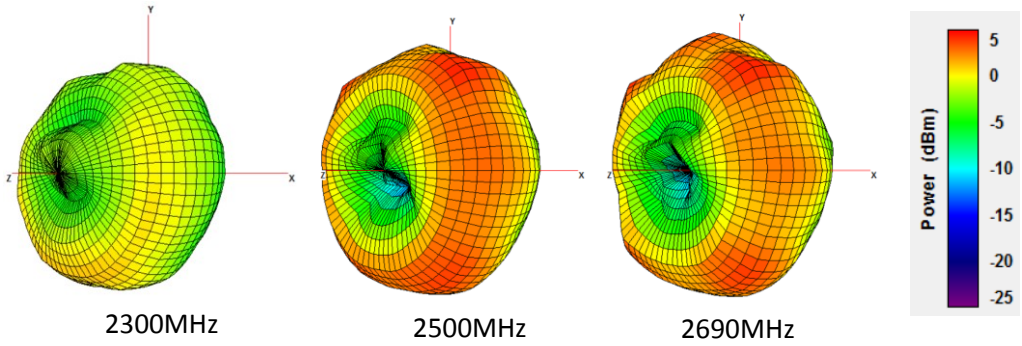
5.6 300*300mm Ground Plane Center – 90°



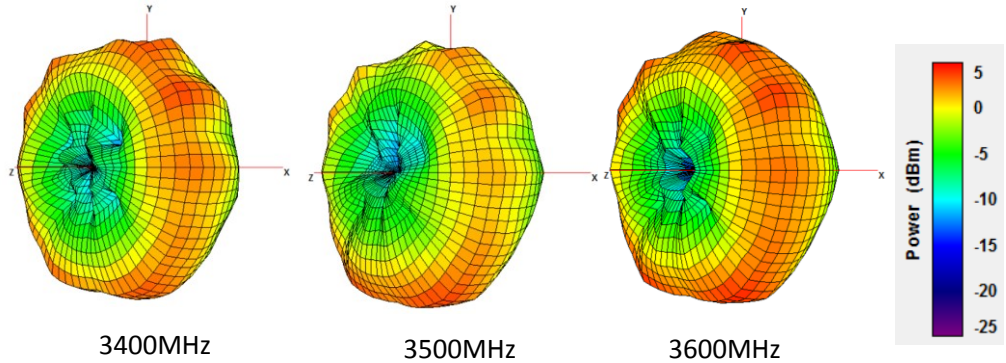
704MHz 751MHz 824MHz 960MHz



1710MHz 1880MHz 1990MHz 2170MHz

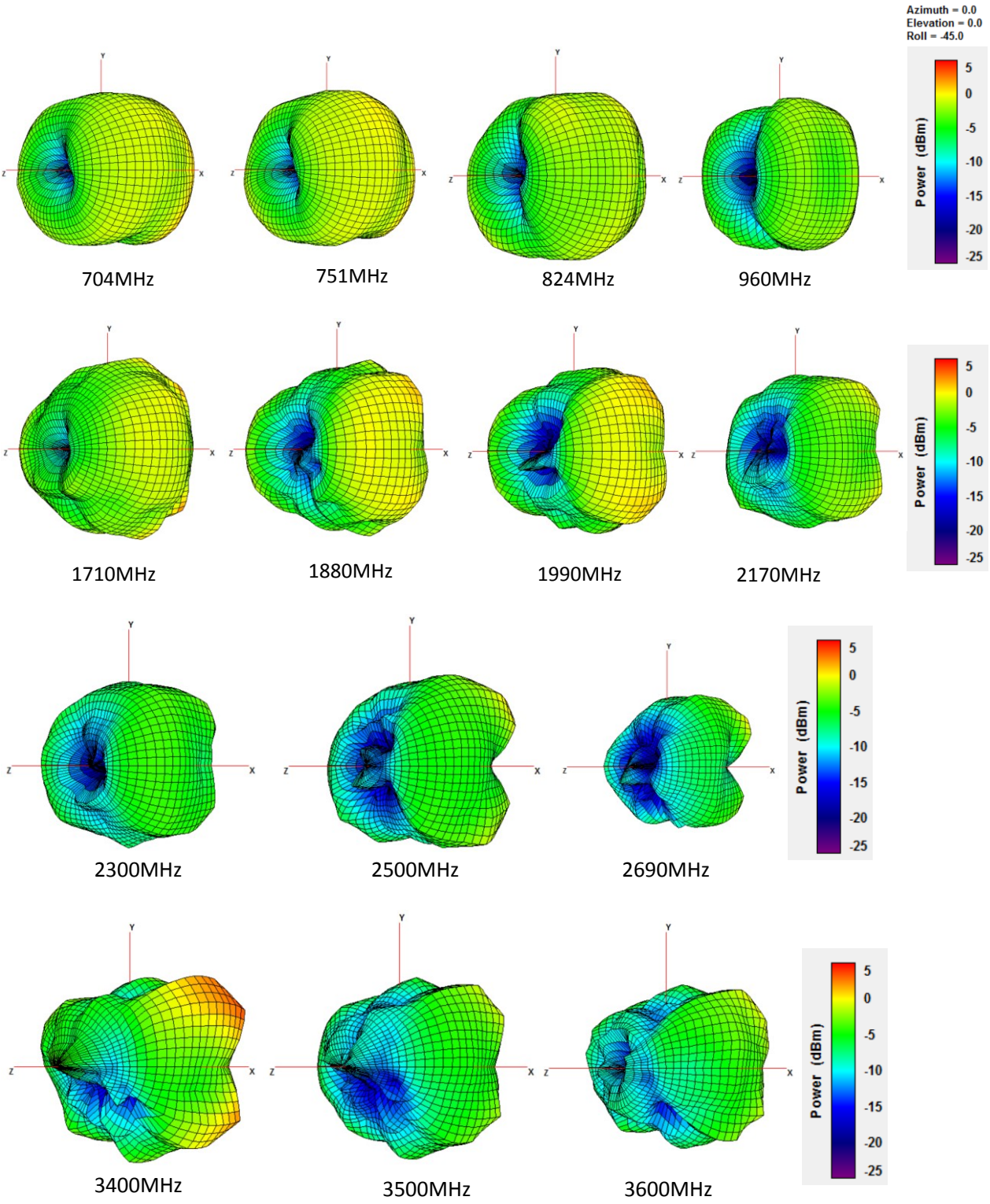


2300MHz 2500MHz 2690MHz

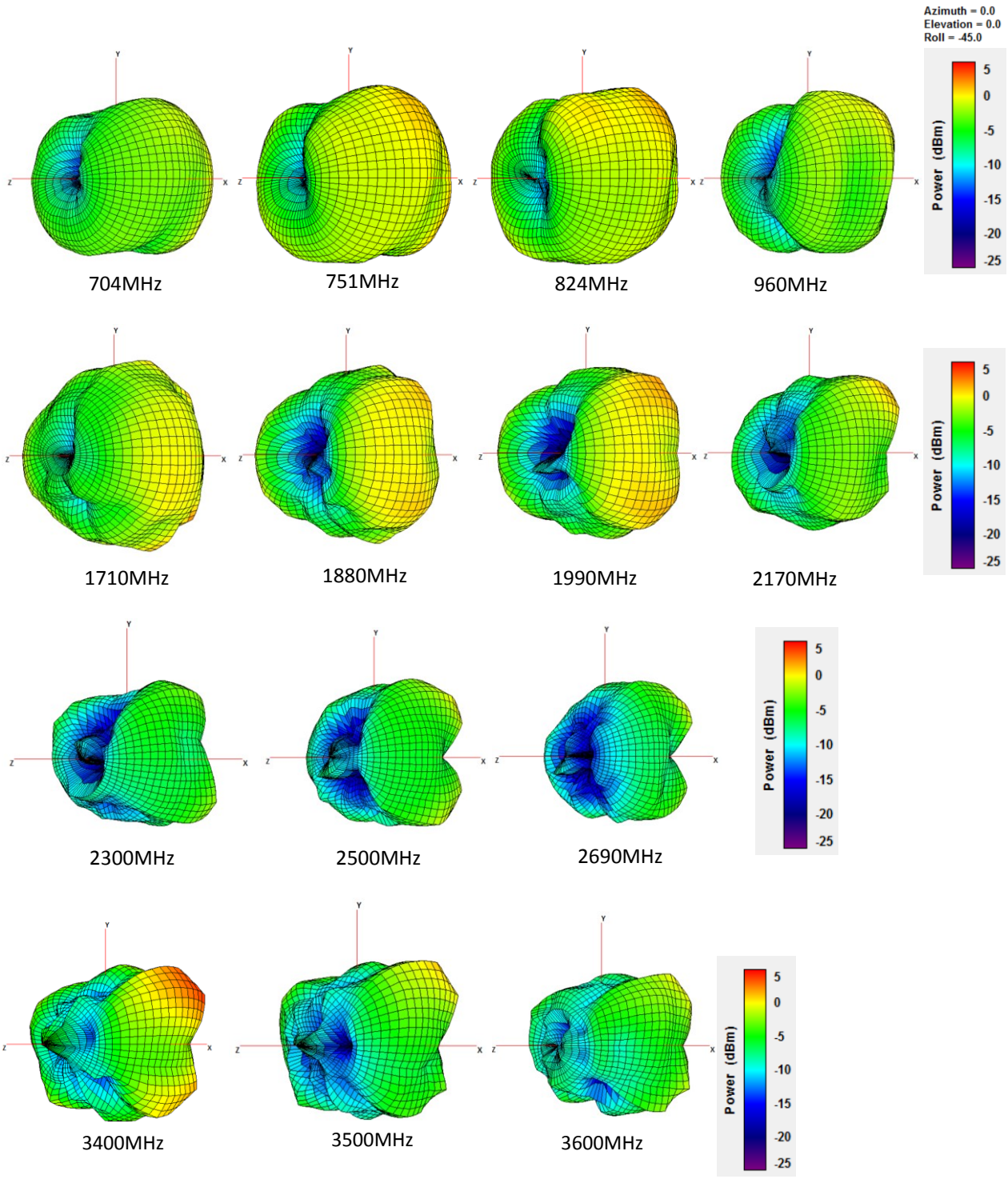


3400MHz 3500MHz 3600MHz

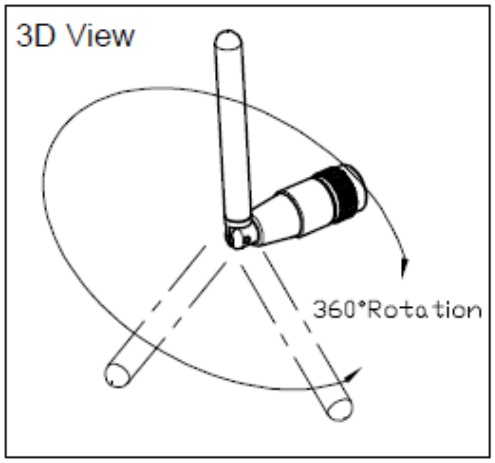
5.7 300*300mm Ground Plane Edge – Straight

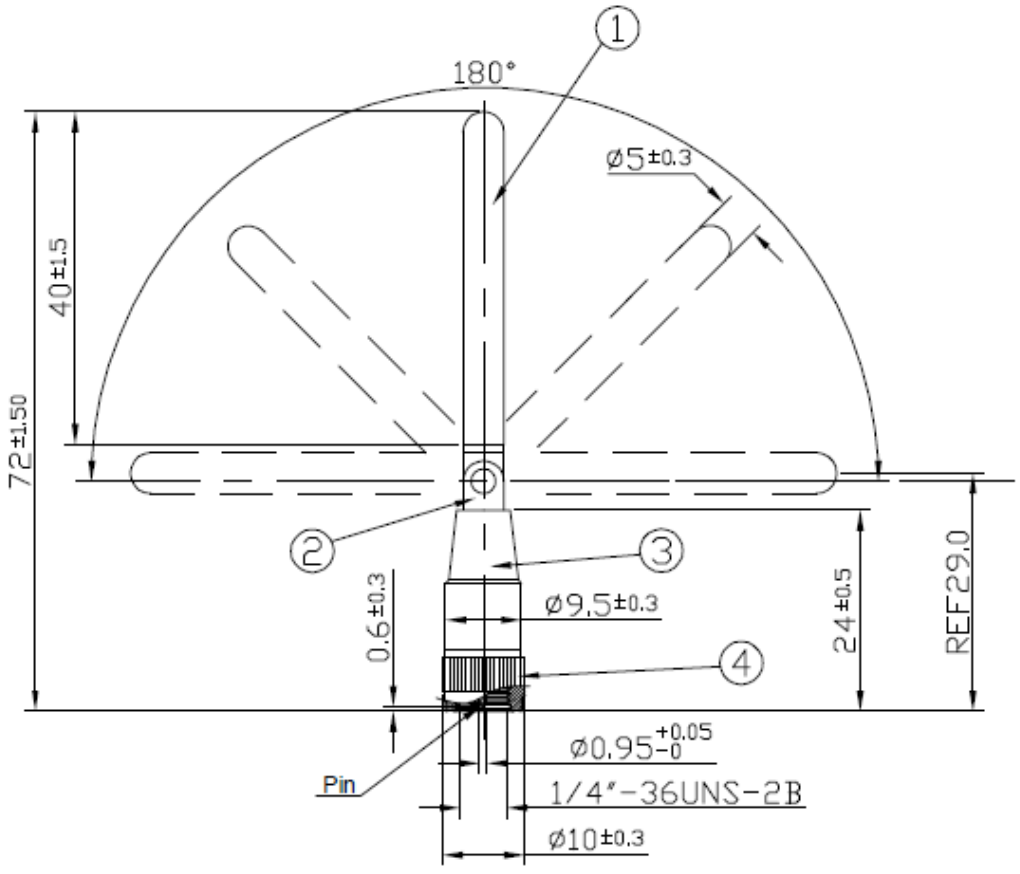


5.8 300*300mm Ground Plane Edge – 90°



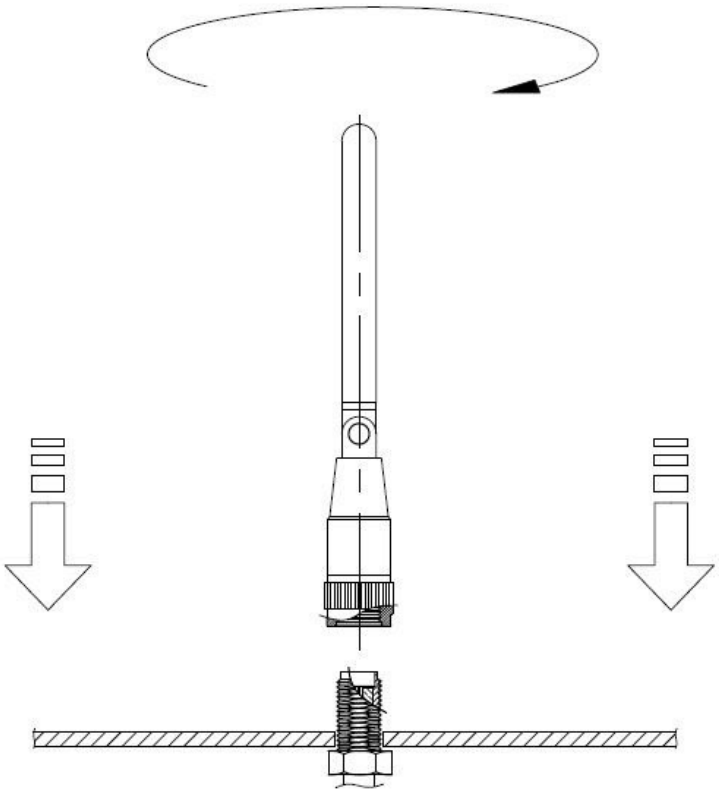
6. Mechanical Drawing (Unit: mm)





1	Housing	POM Black
2	Hinge	Brass Ni Plated
3	Cap	POM Black
4	Connector	SMA Male (Brass)

7. Installation



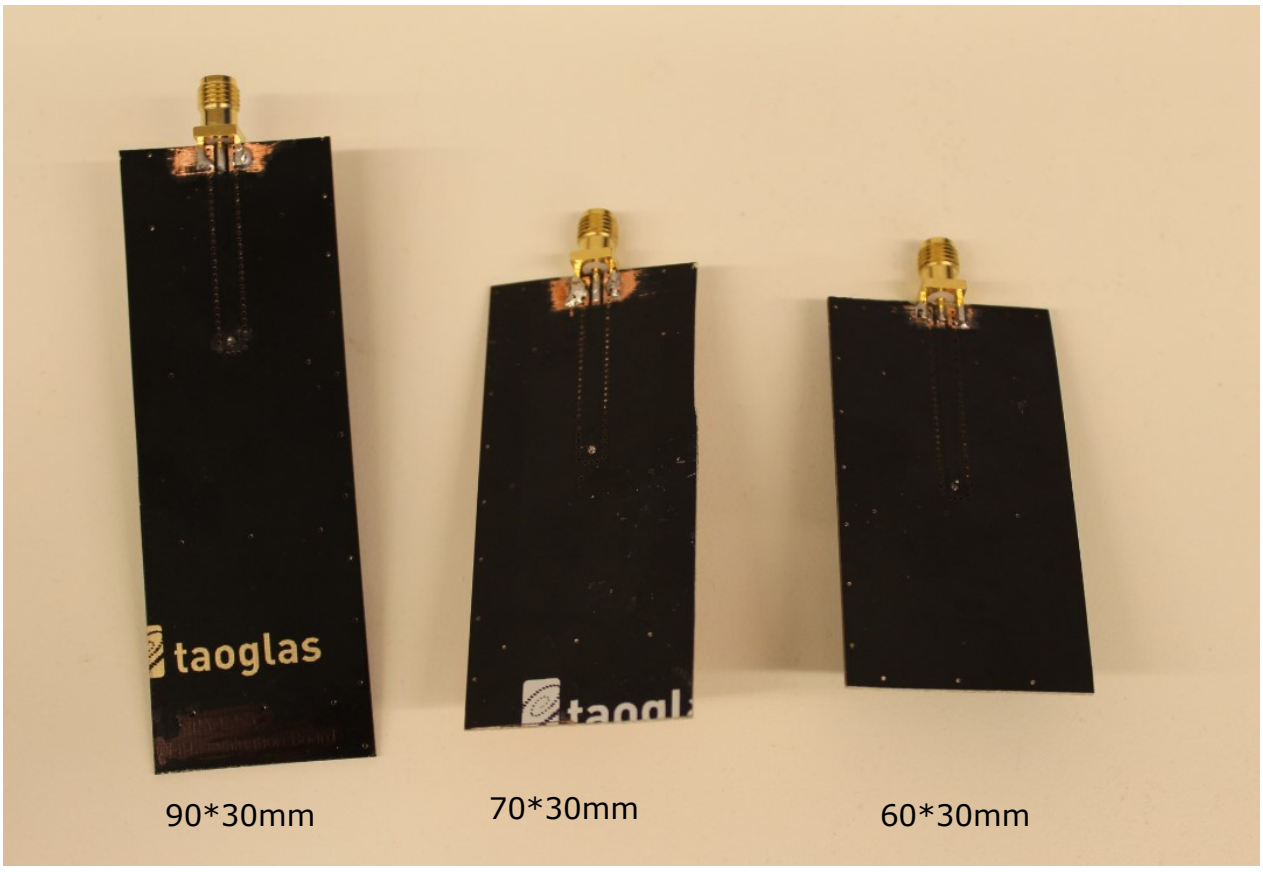
Recommended torque for mounting is 0.9 N·m

Maximum torque for mounting is 1.176 N·m

8. Minimum Ground Plane for LTE Efficiency

Different Ground Plane lengths were considered for acceptable efficiency for LTE bands.

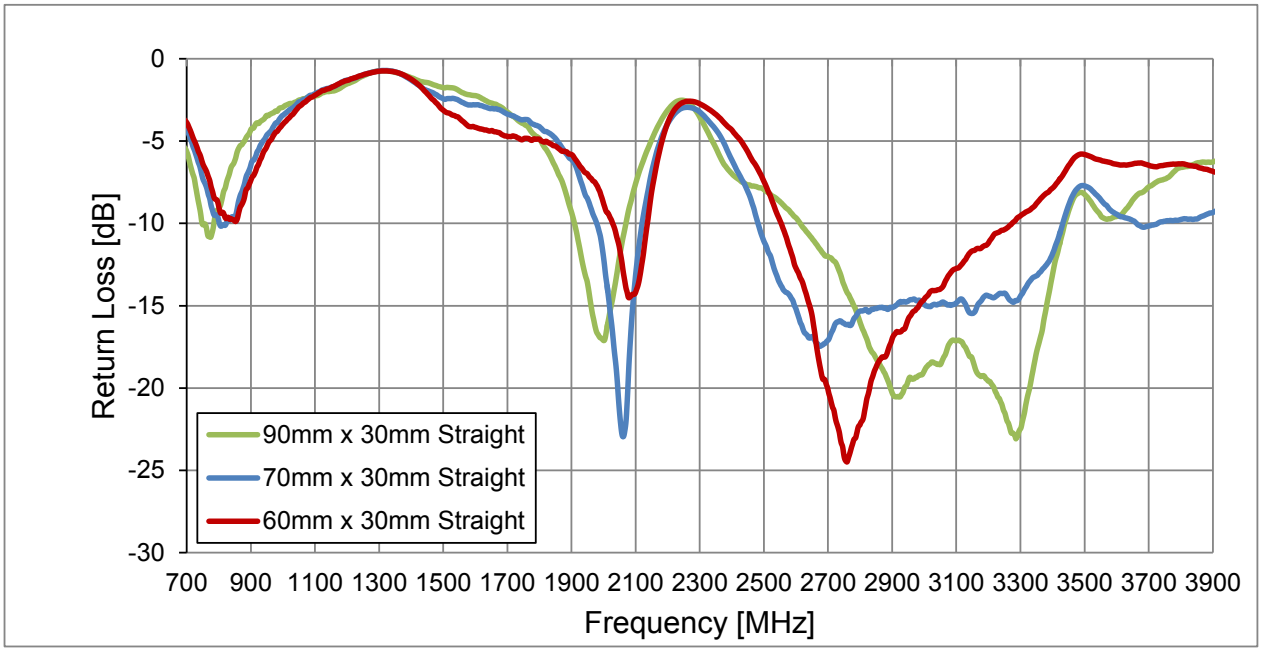
Three different ground planes were chosen. They were all 30mm wide and the lengths were varied beginning at 90mm then 70mm and finally 60mm

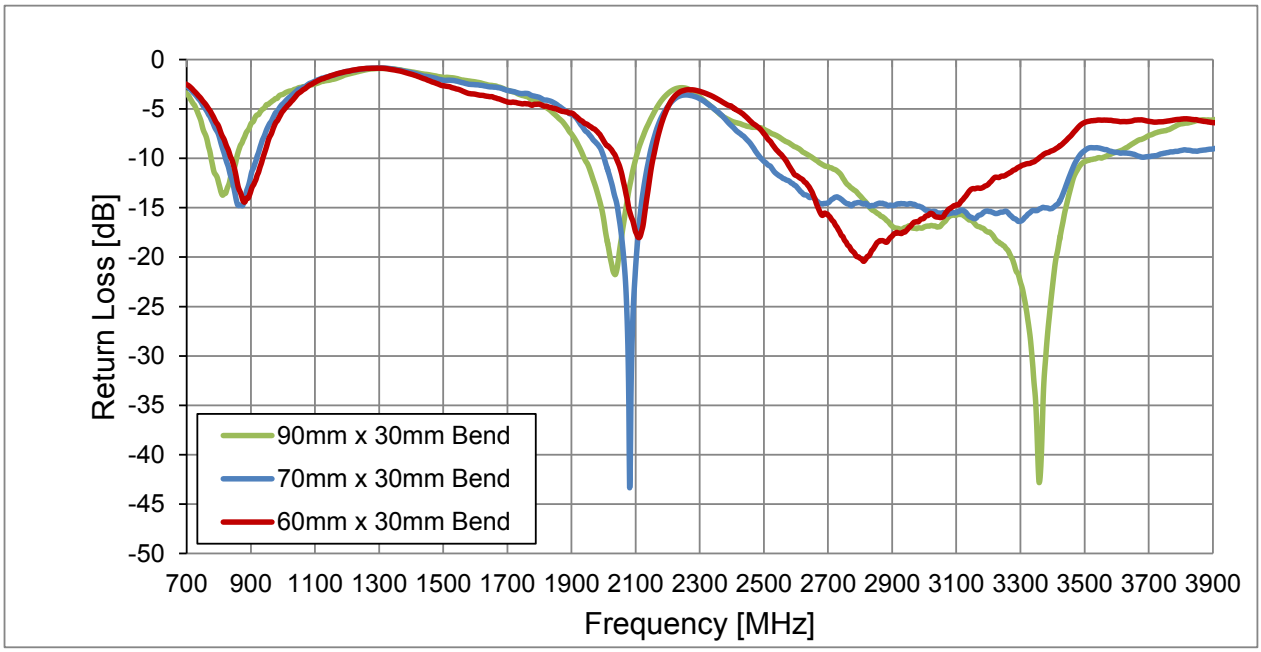


It was also considered whether the TG.09 antenna was positioned straight or at an angle of 90°.
The antenna was positioned on the edge of the Ground Plane for all tests.

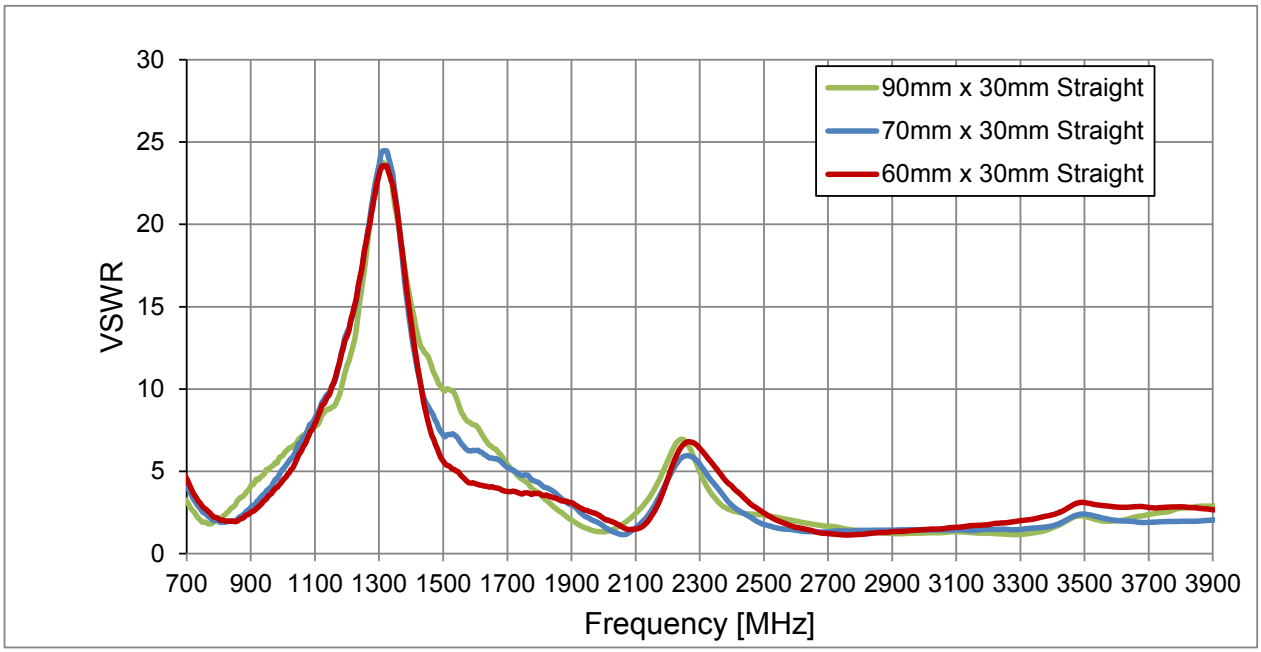
Parameter										
Straight Pose										
Band		700 LTE	GSM	DCS	PCS	UMTS/ HSPA	2300 LTE	2700 LTE	3500 LTE	3700LTE
Frequency (MHz)		703~ 803	824~ 960	1710~ 1880	1850~ 1990	1920~ 2170	2300~ 2400	2490~ 2690	3400~3600	3600~ 3800
Average Gain (dBi)	90*30mm Ground	-1.4	-3.2	-3.2	-1.9	-2.3	-5.1	-2.0	-3.8	-2.9
Efficiency (%)		72%	49%	48%	64%	59%	31%	63%	42%	54%
Peak Gain (dBi)		2.0	1.9	2.7	3.2	3.6	1.3	5.2	2.7	4.2
Return Loss (dB)		9	4.8	5.1	11.4	11.1	5.3	9.6	9.5	7.9
Average Gain (dBi)	70* 30mm Ground	-2.7	-2.7	-3.4	-2.2	-1.8	-5.7	-1.5	-3.9	-2.0
Efficiency (%)		53%	54%	45%	60%	67%	28%	70%	42%	62%
Peak Gain (dBi)		1.8	2.0	1.5	3.5	4.3	1.7	4.3	3.7	5.0
Return Loss (dB)		7.3	7.1	4.2	7.3	12.4	4.4	14.7	8.9	9.9
Average Gain (dBi)	60* 30mm Ground	-3.9	-2.9	-2.9	-2.4	-1.6	-7.3	-1.4	-4.3	-3.0
Efficiency (%)		41%	50%	51%	58%	69%	20%	72%	37%	49%
Peak Gain (dBi)		1.1	1.3	2.1	3.0	4.1	0.4	4.5	3.0	4.5
Return Loss (dB)		6.5	7.7	5.0	6.4	9.9	3.4	12.4	6.3	6.4
90° Bend Pose										
Average Gain (dBi)	90*30mm Ground	-1.7	-2.4	-3.5	-2.1	-2.1	-5.3	-2.1	-3.3	-2.6
Efficiency (%)		68%	58%	45%	61%	61%	30%	61%	47%	54%
Peak Gain (dBi)		2.7	2.5	2.1	3.1	3.5	1.6	5.2	3.4	4.3
Return Loss (dB)		7.5	7.6	4.5	9.1	12.5	5.1	8.7	12.3	7.8
Average Gain (dBi)	70*30mm Ground	-4.2	-2.3	-3.7	-2.5	-1.8	-4.6	-1.5	-3.4	-2.0
Efficiency (%)		39%	59%	42%	56%	67%	35%	70%	46%	62%
Peak Gain (dBi)		1.4	1.7	1.4	3.2	4.3	2.1	4.1	4.1	5.1
Return Loss (dB)		4.9	11.2	3.9	6.4	13.5	5.2	12.6	10.6	9.5
Average Gain (dBi)	60*30mm Ground	-5.6	-3.0	-3.2	-2.6	-1.7	-5.9	-1.4	-3.9	-3.1
Efficiency (%)		28%	50%	47%	54%	68%	26%	73%	41%	49%
Peak Gain (dBi)		0.0	1.0	1.8	3.0	3.8	1.1	4.3	3.3	4.5
Return Loss (dB)		4.4	11.5	4.6	6.0	10.8	3.9	11.2	7.0	6.2

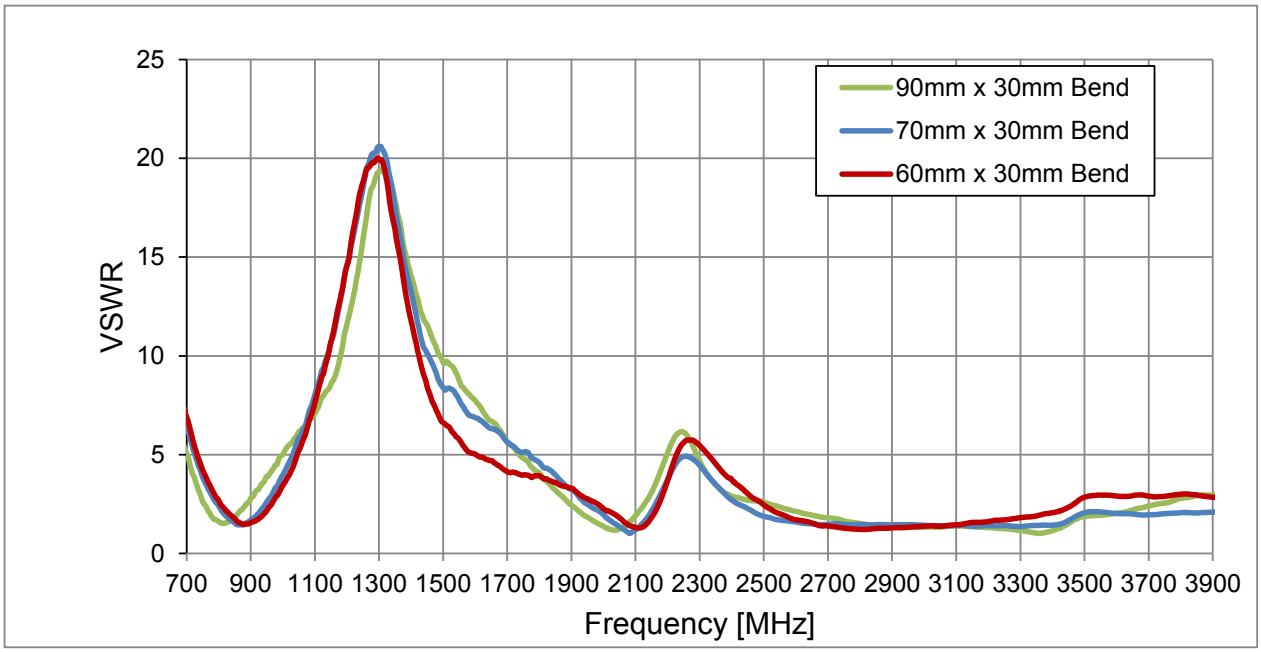
8.1 Return Loss



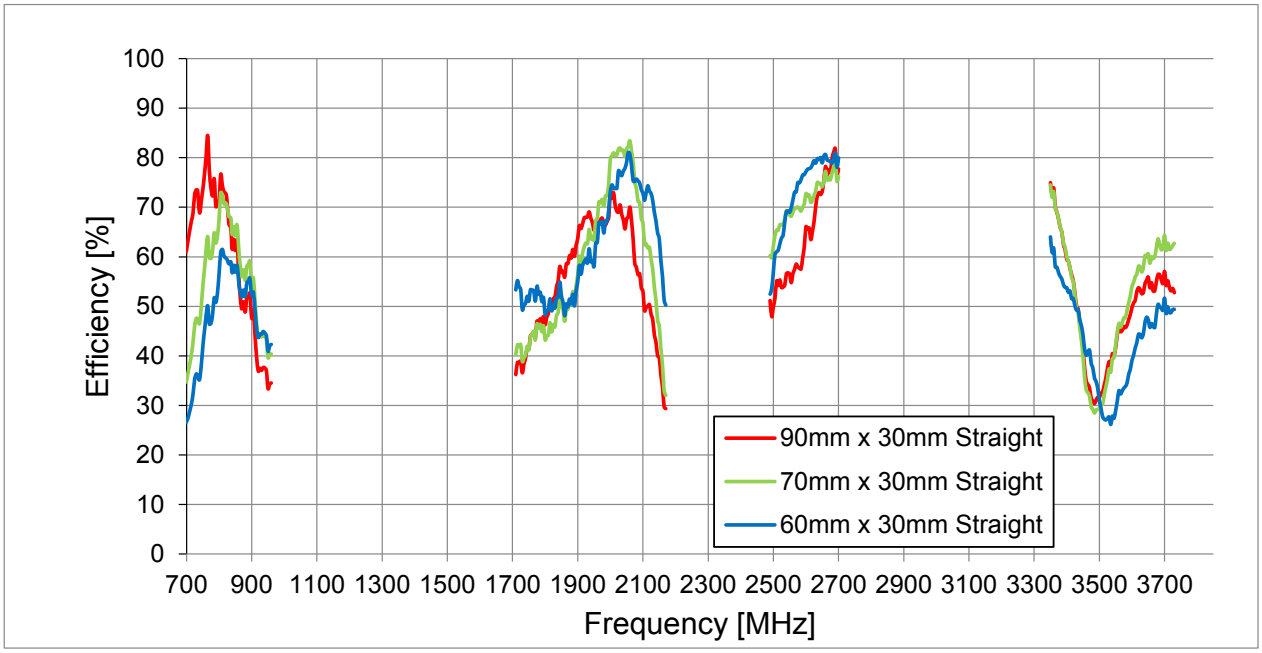


8.2 VSWR

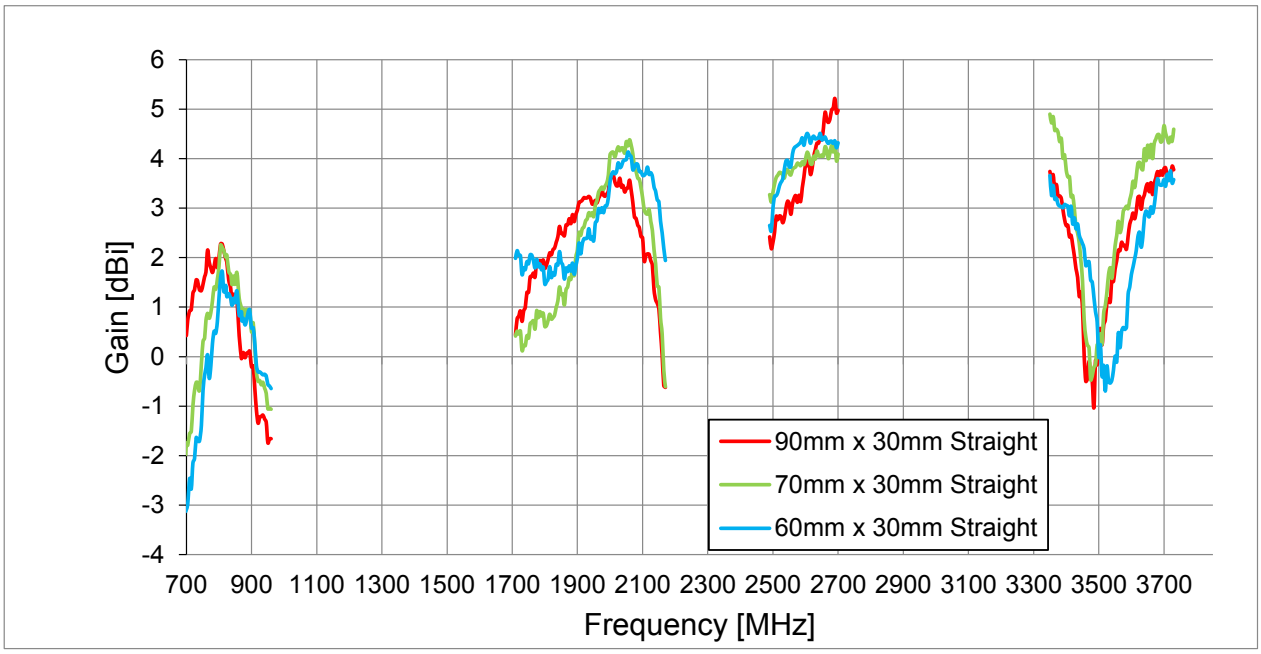

VSWR
30
25
20
15
10
5
0
700 900 1100 1300 1500 1700 1900 2100 2300 2500 2700 2900 3100 3300 3500 3700 3900
Frequency [MHz]
90mm x 30mm Straight
70mm x 30mm Straight
60mm x 30mm Straight


VSWR
25
20
15
10
5
0
700 900 1100 1300 1500 1700 1900 2100 2300 2500 2700 2900 3100 3300 3500 3700 3900
Frequency [MHz]
90mm x 30mm Bend
70mm x 30mm Bend
60mm x 30mm Bend

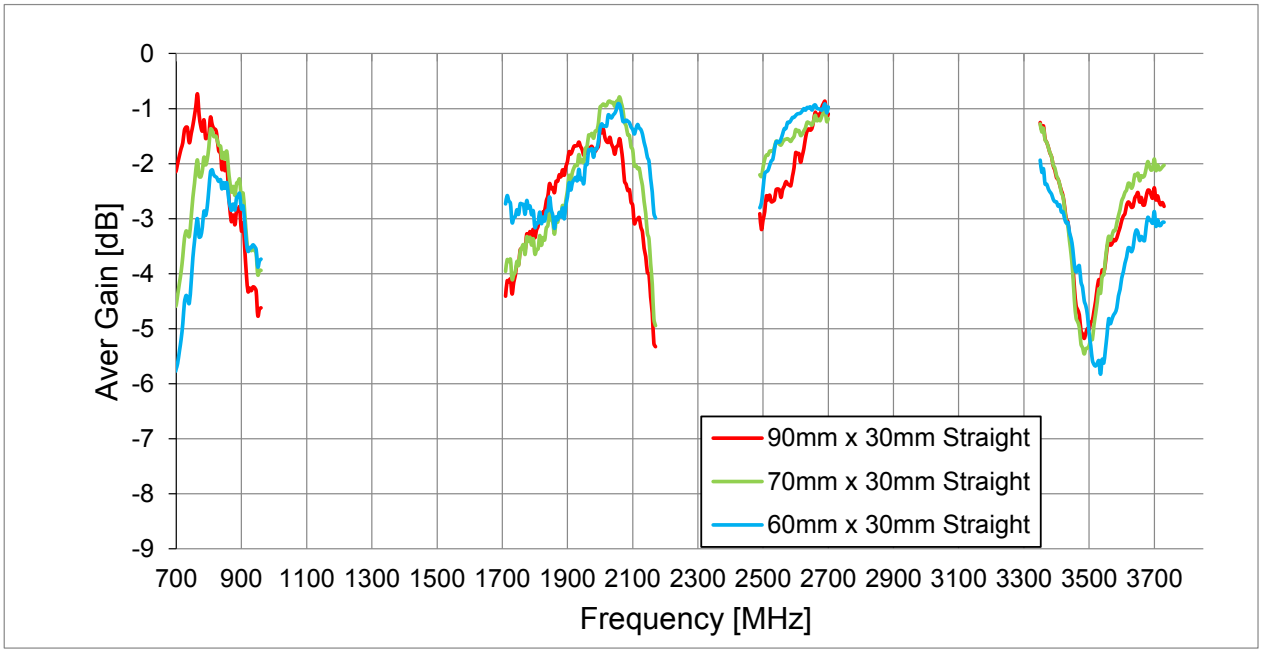
8.3 Efficiency for Straight Antenna



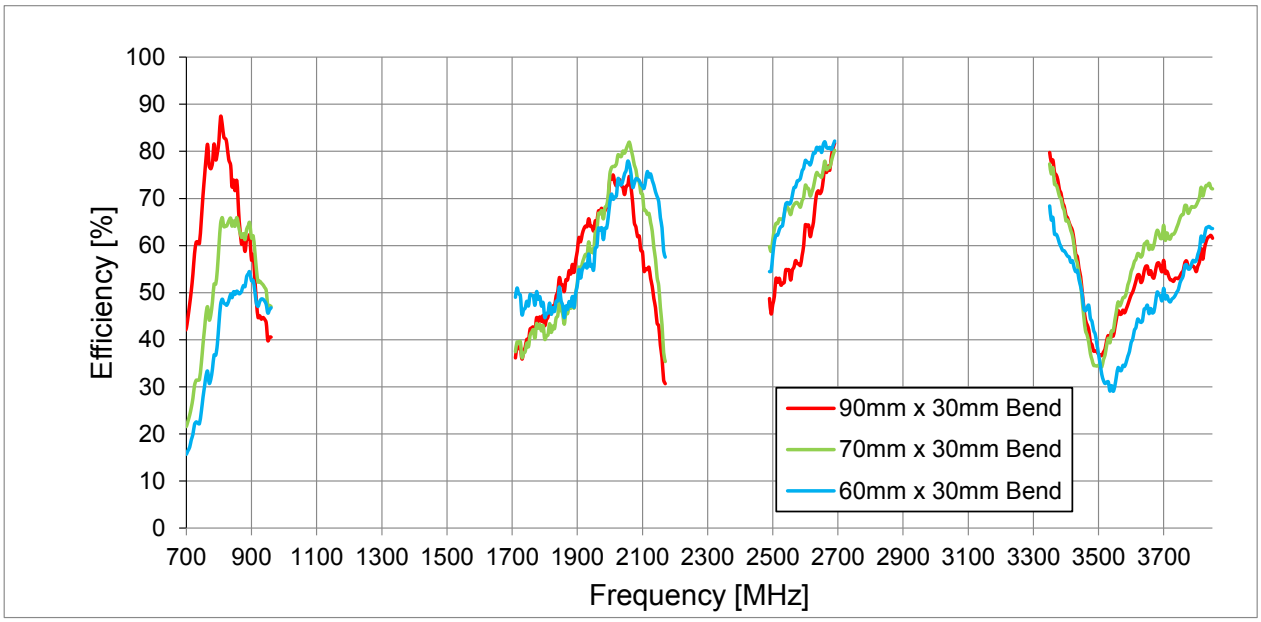
8.4 Peak Gain for Straight Antenna



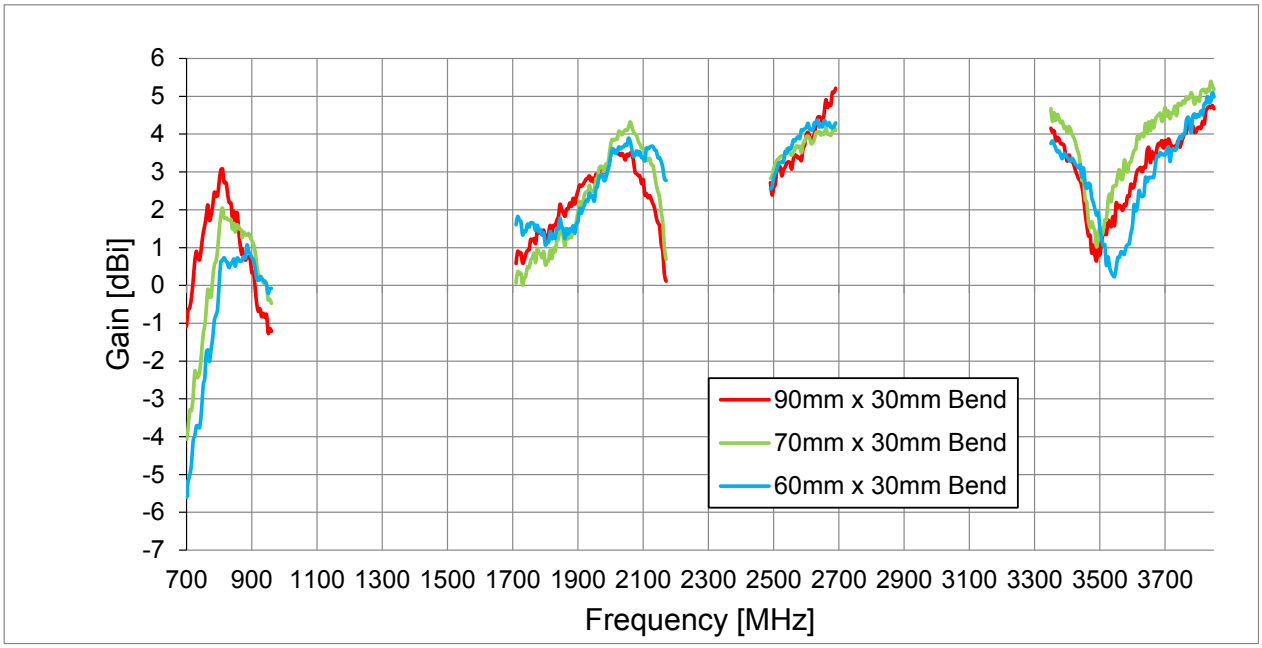
8.5 Average Gain for Straight Antenna



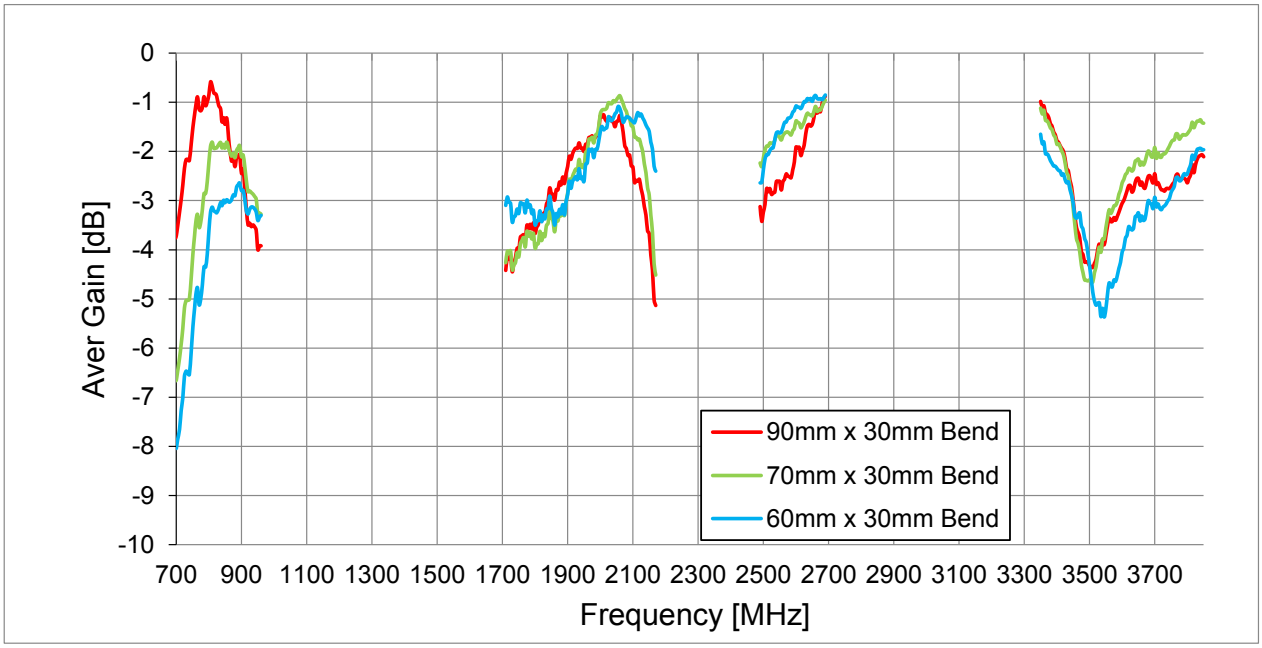
8.6 Efficiency for 90° Bend



8.7 Peak Gain for 90° Bend

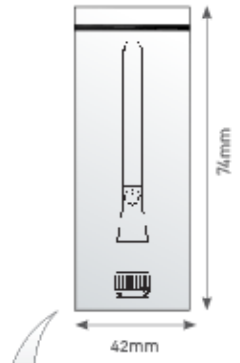


8.8 Average Gain for 90° Bend

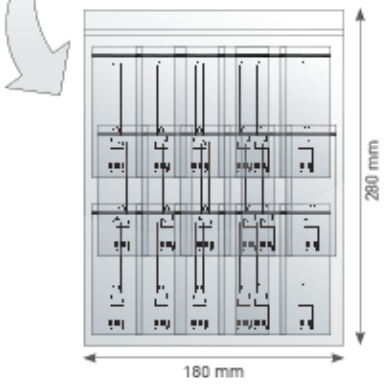


9. Packaging

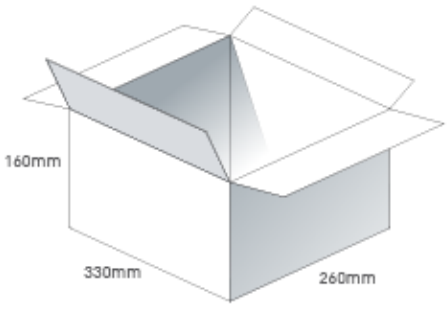
1 pc TG.09.0113 per small zipper bag
PE Bag Dimensions - 74*42mm
Weight - 8.6g



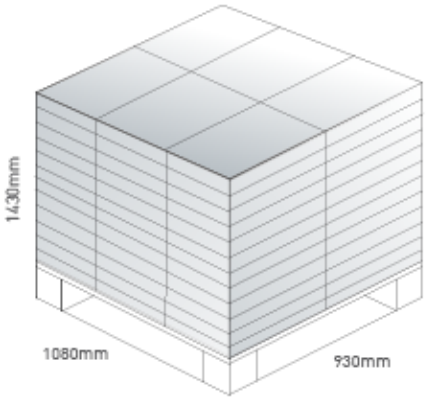
100 PE bags per large PE bags
100 pcs TG.09.0113 per large PE bags
Weight - .86kg



1500 pcs TG.09.0113 per carton
Carton Dimensions - 360*310*160mm
Weight - 13.6kg



Pallet Dimensions 1080*930*1430mm
72 Cartons per Pallet
6 Cartons per layer
12 Layers



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