SPECIFICATION

Part No.	:	**MA1060.A.LBCT.001**
Product Name	:	Raptor I MA1060 Sharkfin 4in1 Next Generation Permanent Mount External Antenna with LTE, GNSS, Wi-Fi and AM/FM
Features	:	High Efficiency Omnidirectional 4G/3G/2G Antenna 698~960MHz, 1710~2170MHz, 2300~2700MHz GPS/GLONASS/GALILEO/BeiDou L1 Antenna 1561/1575.42/1602MHz Wi-Fi Antenna 2.4GHz/5.8GHz Antenna AM/FM Antenna IP67 Waterproof SMA(M) connector (Fakra optional) RG-316 30cm length Cable Length and Connectors Customizable RoHS Compliant



1. Introduction

The Raptor I MA1060.A Sharkfin antenna is a next generation 4in1, vehicle roof permanent mount solution. Fully IP67 waterproof, it has a distinctive high quality, glossy and robust ABS+PC housing. A hardened polished finish is used according to the strictest OEM automotive standards.

The Raptor I supports GNSS (GPS/GLONASS/GALILEO/BeiDou), Wi-Fi (2.4/5.8GHz), LTE (4G/3G/2G) and a powered AM/FM radio. This sleek antenna is first tier TS16949 automotive approved and is an ideal choice for:

- OEM automotive
- Trucks
- Other vehicles and heavy equipment
- General Telematics

The antenna comes with 30cm RG-316 coaxial pigtail cables as standard, terminating in SMA(M) for GNSS, LTE and AM/FM and with RP SMA(M) for Wi-Fi.

The LTE antenna provides highest efficiency on all common worldwide LTE bands and also works great if the system falls back to 3G and 2G as it also covers these cellular bands.

The AM/FM antenna has an in-built amplifier to increase receive signal sensitivity. The antenna works in conjunction with a 12v DC power source to ensure that improved AM/FM radio signals are delivered to the audio system via an SMA(M) connector.

The antennas inside can be completely customized according to requirements, to work on other applications, such as ISM bands or DSRC. Where more than 4 antennas are needed, we recommend the Raptor II, which can combine 6 antennas in one housing due to its dual-fin design.

Cable length and connector types are customizable. Gain and efficiency depend on cable length. Peak gain will be lower with longer cable lengths. Use of low loss CFD200 cable extensions is recommended but higher loss RG316 can be used up to approximately 1 meter without significant impact on performance.

The Taoglas Raptor antenna series is manufactured in TS16949 automotive approved facilities. Contact your regional Taoglas Sales office for support.

2. Specifications

4G/3G/2G LTE								
In Free Space								
Band		LTE 700	GSM 850	GSM 900	DCS	PCS	UMTS1	LTE 2300/ 2600
Frequency (MHz)		698-824	824-894	880-960	1710-1880	1850-1990	1920-2170	2300-2690
Peak Gain (dBi)	0.3M	3.52	1.45	1.92	3.10	2.88	3.32	4.36
	1M	3.32	1.25	1.72	2.70	2.48	3.02	3.96
	2M	3.02	0.95	1.32	2.20	1.98	2.42	3.26
	3M	2.62	0.55	0.92	1.70	1.48	1.82	2.66
	5M	2.22	0.15	0.52	1.20	0.98	1.22	2.06
Average Gain (dBi)	0.3M	-2.83	-3.25	-3.10	-1.92	-2.11	-2.18	-1.59
	1M	-3.07	-3.45	-3.30	-2.32	-2.51	-2.54	-1.99
	2M	-3.37	-3.83	-3.70	-2.82	-3.07	-3.12	-2.62
	3M	-3.71	-4.15	-4.03	-3.33	-3.60	-3.65	-3.23
	5M	-4.04	-4.48	-4.36	-3.84	-4.14	-4.18	-3.84
Efficiency (%)	0.3M	53.95	47.50	49.20	64.50	61.77	60.96	69.48
	1M	51.15	45.38	47.01	58.80	56.33	56.03	63.38
	2M	47.74	41.70	42.87	52.40	49.61	49.12	54.91
	3M	44.13	38.63	39.73	46.58	43.85	43.40	47.69
	5M	40.80	35.79	36.82	41.41	38.77	38.35	41.43
On 50*50cm Metal Base								
Peak Gain (dBi)	0.3M	2.74	1.98	2.19	5.67	5.67	5.78	6.51
	1M	2.54	1.78	1.99	5.27	5.27	5.48	6.11
	2M	2.24	1.38	1.59	4.77	4.77	4.88	5.41
	3M	1.84	1.08	1.29	4.27	4.27	4.38	4.81
	5M	1.44	0.78	0.99	3.77	3.77	3.88	4.21
Average Gain (dBi)	0.3M	-2.52	-3.76	-4.24	-1.81	-1.50	-1.52	-1.29
	1M	-2.76	-3.96	-4.44	-2.21	-1.90	-1.89	-1.69
	2M	-3.06	-4.33	-4.84	-2.71	-2.46	-2.46	-2.31
	3M	-3.39	-4.66	-5.16	-3.22	-2.99	-3.00	-2.93
	5M	-3.72	-4.98	-5.49	-3.73	-3.53	-3.53	-3.54
Efficiency (%)	0.3M	57.06	42.44	37.81	66.52	71.06	70.79	74.46
	1M	54.03	40.53	36.11	60.66	64.82	65.08	67.90
	2M	50.43	37.25	32.93	54.06	57.08	57.04	58.82
	3M	46.68	34.49	30.55	48.04	50.46	50.41	51.10
	5M	43.21	31.95	28.34	42.69	44.60	44.55	44.39
Return loss (dB) *		<-6	<-6	<-6	<-6	<-6	<-6	<-4
Polarization		Linear						
Impedance		50Ω						
Cable		30cm RG-316 standard, fully customizable on cable length						
Connector		SMA(M) Straight, fully customizable						

GPS/GLONASS/GALILEO/BeiDou			
Center Frequency fc	1561.098 ± 2MHz	1575.42 ± 3MHz	1602 ± 0.5MHz
Average Gain (dBi)	-4.69	-3.16	-3.11
Efficiency (%)	33.98	48.35	48.83
Peak Gain (dBi)	0.45	1.4	2.3
VSWR(@Center Frequency)	< -10 dB		
Polarization	RHCP		
Impedance	50Ω		
Antenna size	25*25*4mm		
Cable	30cm RG-316 standard, fully customizable cable length		
Connector	SMA Male Straight, fully customizable		

LNA ELECTRICAL PROPERTIES			
Frequency	1558~1610MHz		
DC Power Input	1.8V	3V	5V
Gain	24dB	28dB	30dB
Noise Figure	2.7	2.8	2.8
Power Consumption	10mA @ DC 3V		

AM/FM ANTENNA		
Application Bands	AM Radio Bands	FM Radio Bands
Operation Frequency	535~1605KHz	88~108MHz
Integration	Module Integrated	
Power In	DC 12V	

Wi-Fi 2.4GHz/5.8GHz			
Free Space			
Frequency (GHz)		2.4~2.5	5.15~5.85
Peak Gain (dBi)	0.3M	5.62	7.22
	1M	5.22	6.52
	2M	4.62	5.62
	3M	4.02	4.72
	5M	2.82	2.82
Average Gain (dBi)	0.3M	-1.34	-1.93
	1M	-1.74	-2.58
	2M	-2.34	-3.50
	3M	-2.94	-4.41
	5M	-4.14	-6.23
Efficiency (%)	0.3M	73.45	65.19
	1M	67.00	56.10
	2M	58.35	45.50
	3M	50.82	36.90
	5M	38.55	24.26
On 50*50cm Metal Center			
Peak Gain (dBi)	0.3M	6.53	8.85
	1M	6.13	8.25
	2M	5.53	7.35
	3M	4.93	6.45
	5M	3.73	4.75
Average Gain (dBi)	0.3M	-1.66	-2.05
	1M	-2.06	-2.70
	2M	-2.66	-3.61
	3M	-3.26	-4.52
	5M	-4.46	-6.35
Efficiency (%)	0.3M	68.30	63.30
	1M	62.30	54.47
	2M	54.26	44.17
	3M	47.26	35.83
	5M	35.85	23.55
Return Loss	<-8 (When Cable Length 30cm)		
Polarization	Linear		
Impedance	50Ω		
Cable	RG316		
Connector	SMA Male		

MECHANICAL	
Antenna Dimensions	176*85*72mm (L*W*H)
Casing	PC+ABS
Waterproof	IP67
Base and thread	Zinc Alloy
Thread diameter	M20*1.5P
Nut	Nickel Plated Steel
Rubber	Silicone Rubber
Weight	350g
Recommended Torque for Mounting	29.4 N-m
Max Torque for Mounting	39.2 N-m
ENVIRONMENTAL	
Operation Temperature	-40°C to 85°C
Storage Temperature	-40°C to 90°C
Humidity	Non-condensing 65°C 95% RH

* All measurements were conducted with a 30cm cable length. Longer cable lengths will result in lower efficiencies and gain, Taoglas recommend to use CFD-200 Low loss coaxial cable for the cable extension.

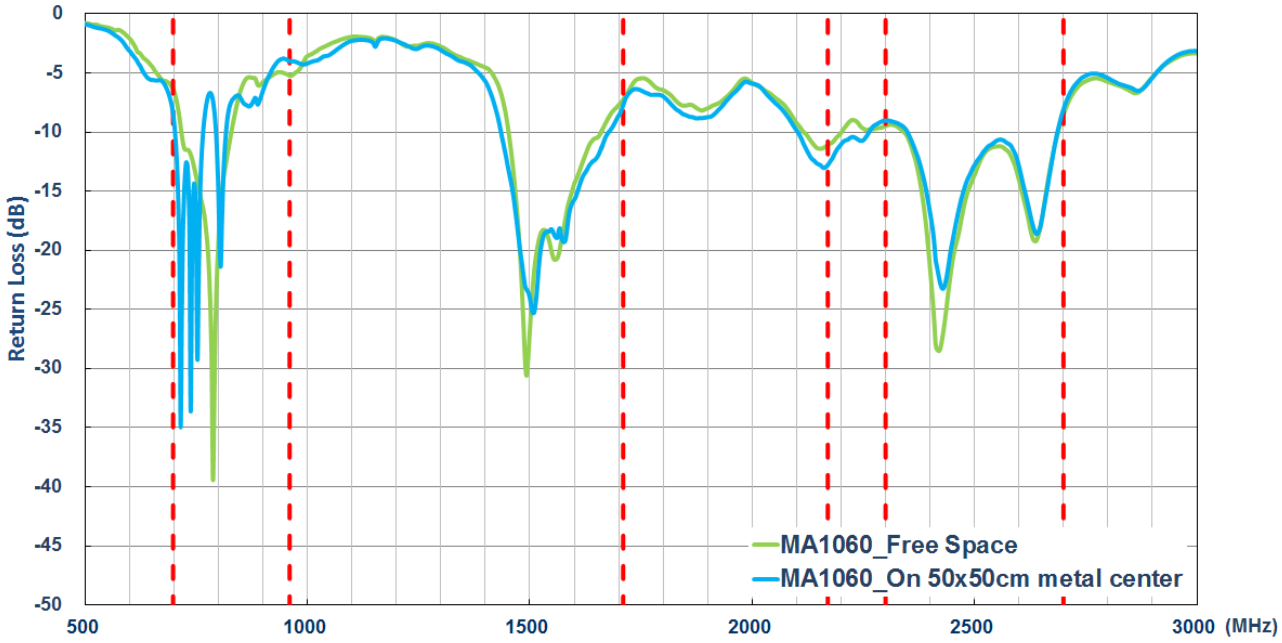
LTE BANDS			
Band Number	LTE / LTE-Advanced / WCDMA / HSPA / HSPA+ / TD-SCDMA		
	Uplink	**Downlink**	**Covered**
1	UL: 1920 to 1980	DL: 2110 to 2170	✓
2	UL: 1850 to 1910	DL: 1930 to 1990	✓
3	UL: 1710 to 1785	DL: 1805 to 1880	✓
4	UL: 1710 to 1755	DL: 2110 to 2155	✓
5	UL: 824 to 849	DL: 869 to 894	✓
7	UL: 2500 to 2570	DL:2620 to 2690	✓
8	UL: 880 to 915	DL: 925 to 960	✓
9	UL: 1749.9 to 1784.9	DL: 1844.9 to 1879.9	✓
11	UL: 1427.9 to 1447.9	DL: 1475.9 to 1495.9	✗
12	UL: 699 to 716	DL: 729 to 746	✓
13	UL: 777 to 787	DL: 746 to 756	✓
14	UL: 788 to 798	DL: 758 to 768	✓
17	UL: 704 to 716	DL: 734 to 746 (LTE only)	✓
18	UL: 815 to 830	DL: 860 to 875 (LET only)	✓
19	UL: 830 to 845	DL: 875 to 890	✓
20	UL: 832 to 862	DL: 791 to 821	✓
21	UL: 1447.9 to 1462.9	DL: 1495.9 to 1510.9	✗
22	UL: 3410 to 3490	DL: 3510 to 3590	✗
23	UL:2000 to 2020	DL: 2180 to 2200 (LTE only)	✓
24	UL:1625.5 to 1660.5	DL: 1525 to 1559 (LTE only)	✓
25	UL: 1850 to 1915	DL: 1930 to 1995	✓
26	UL: 814 to 849	DL: 859 to 894	✓
27	UL: 807 to 824	DL: 852 to 869 (LTE only)	✓
28	UL: 703 to 748	DL: 758 to 803 (LTE only)	✓
29	UL: -	DL: 717 to 728 (LTE only)	✓
30	UL: 2305 to 2315	DL: 2350 to 2360 (LTE only)	✓
31	UL: 452.5 to 457.5	DL: 462.5 to 467.5 (LTE only)	✗
32	UL: -	DL: 1452 - 1496	✗
35	1850 to 1910		✓
38	2570 to 2620		✓
39	1880 to 1920		✓
40	2300 to 2400		✓
41	2496 to 2690		✓
42	3400 to 3600		✗
43	3600 to 3800		✗

*Covered bands represent an efficiency greater than 20%

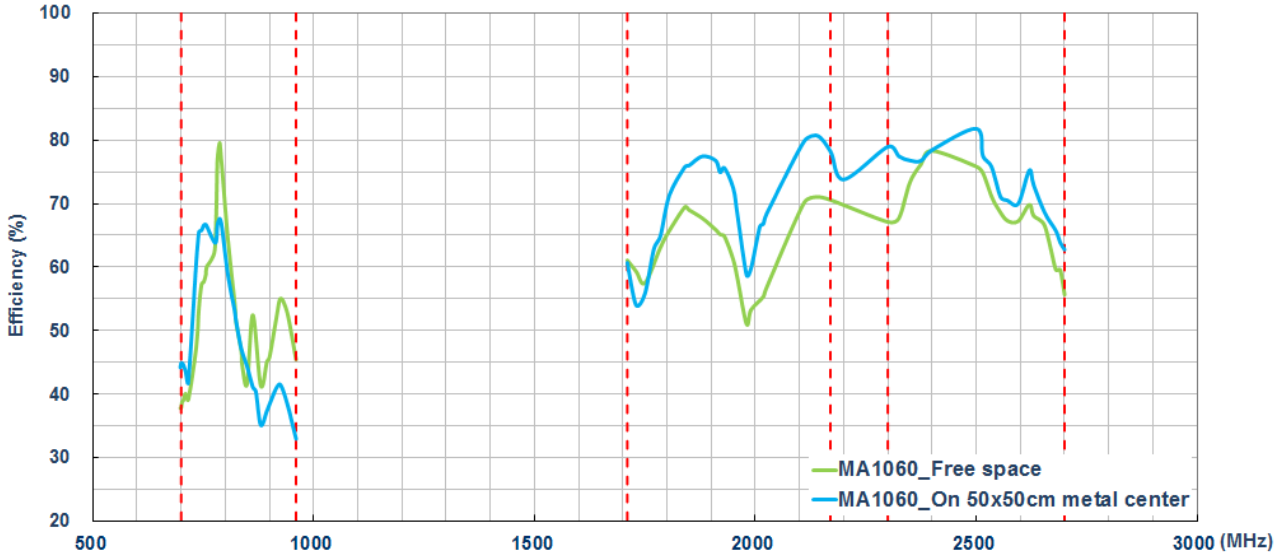
3. 4G/3G/2G LTE Antenna

3.1. LTE Characteristics

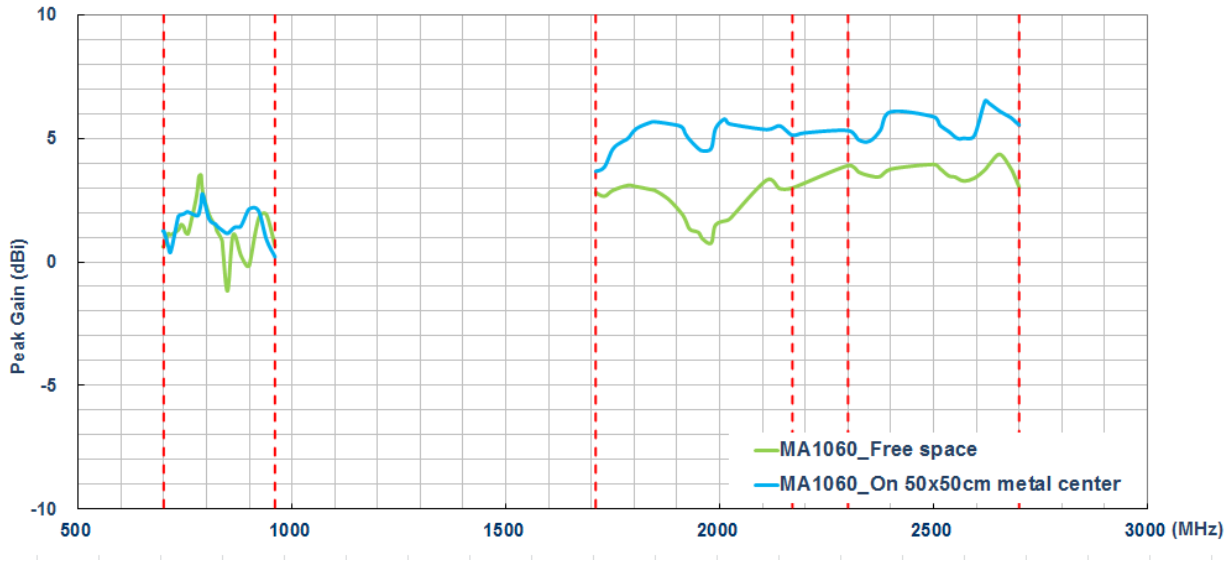
3.1.1. Return Loss



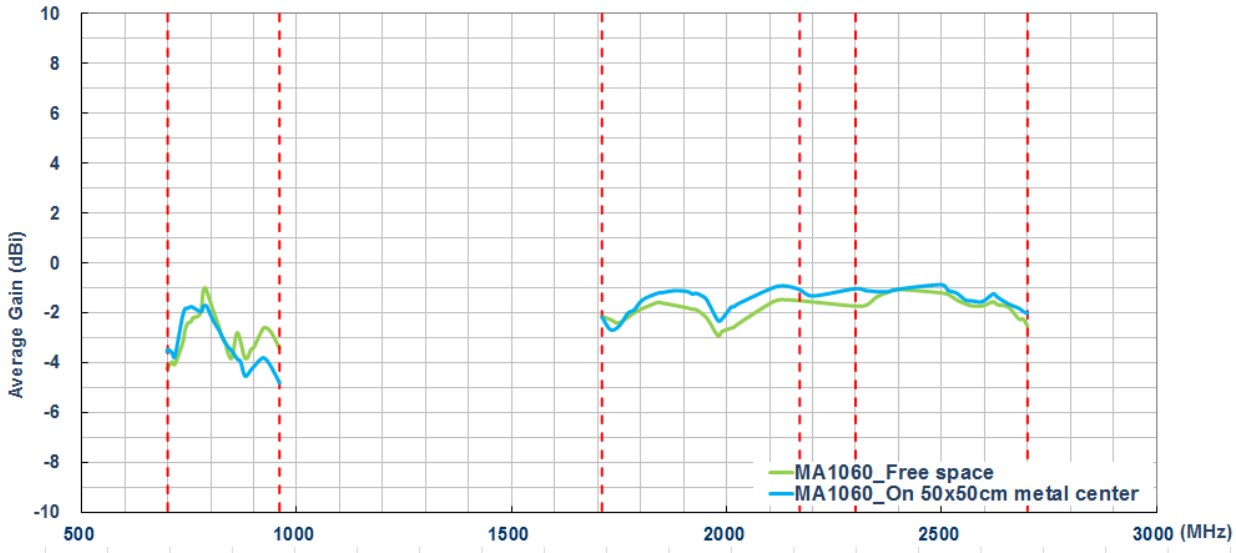
3.1.2. Efficiency



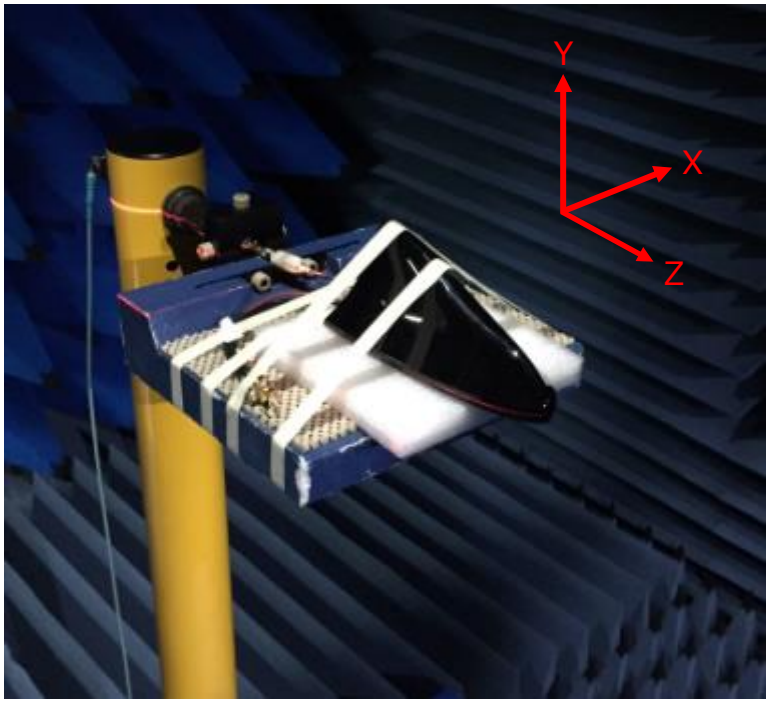
3.1.3. Peak Gain



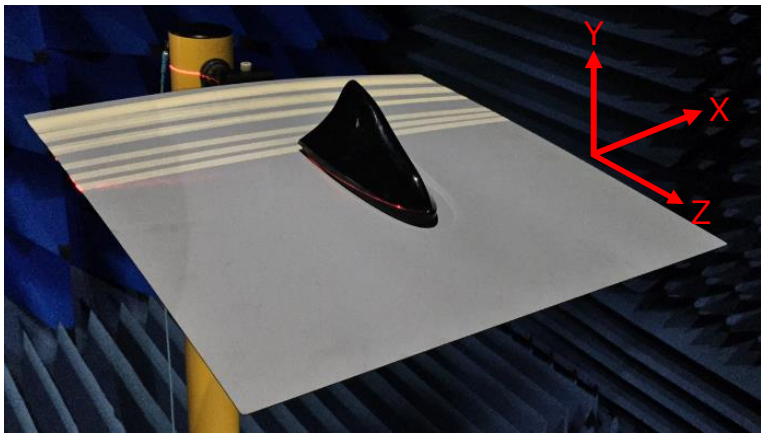
3.1.4. Average Gain



3.2. Radiation Pattern Measurement Setup



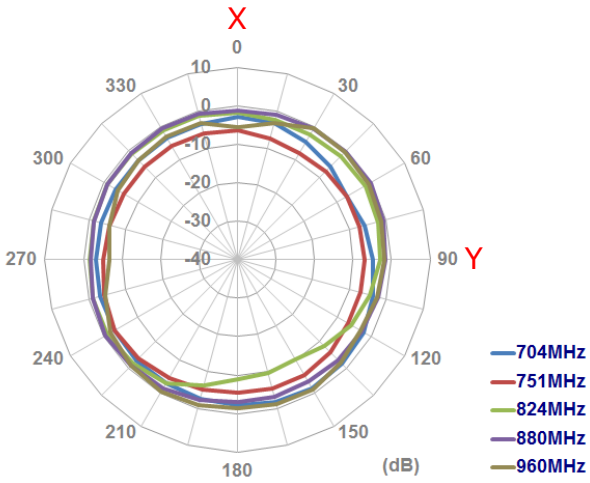
Free Space

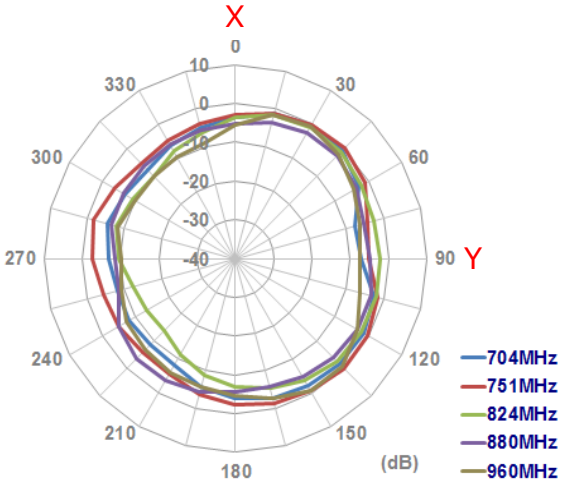


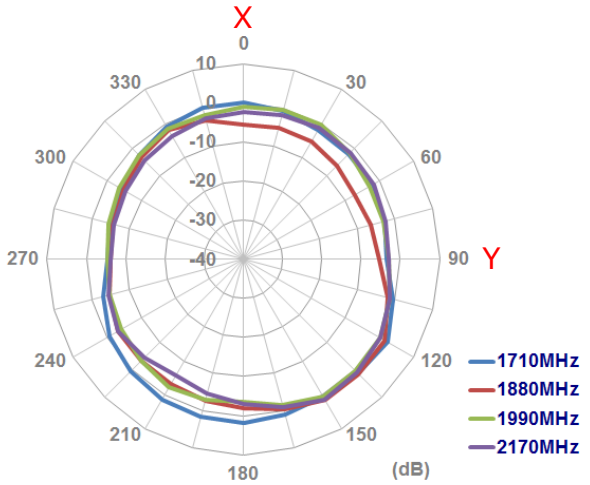
On 50*50cm Metal Base

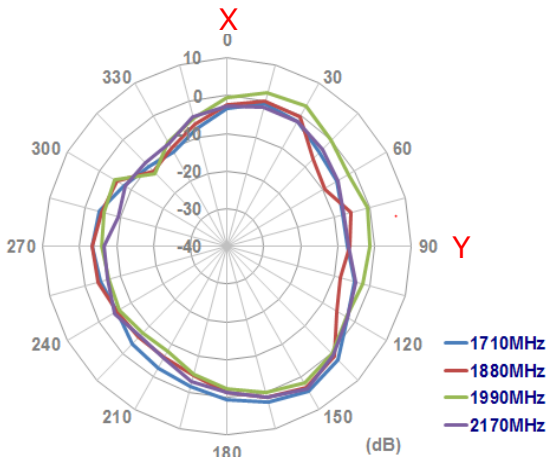
3.2.1. LTE 2D Radiation Pattern

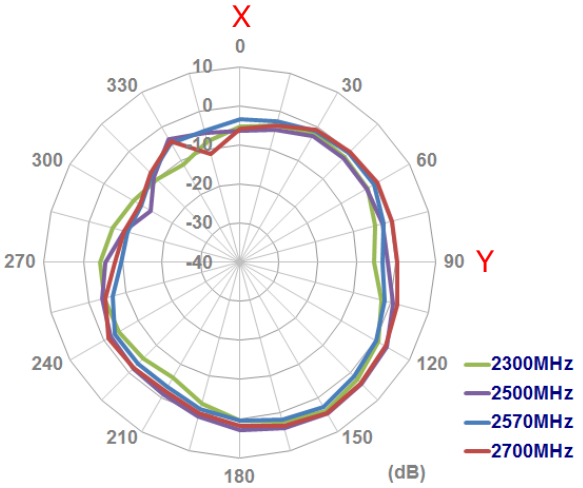
XY Plane

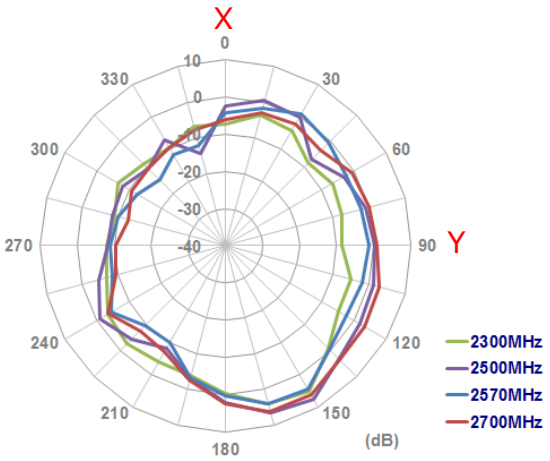








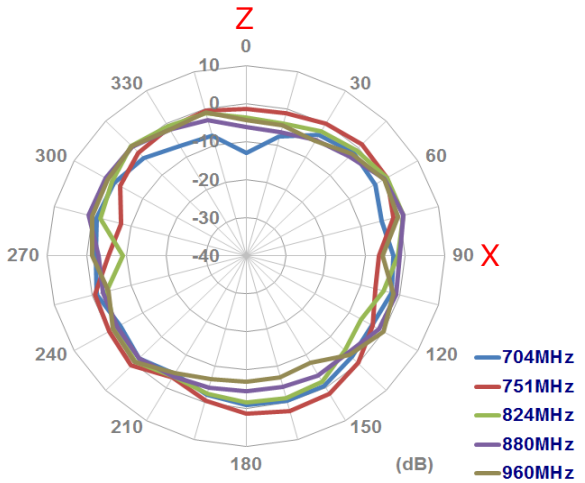


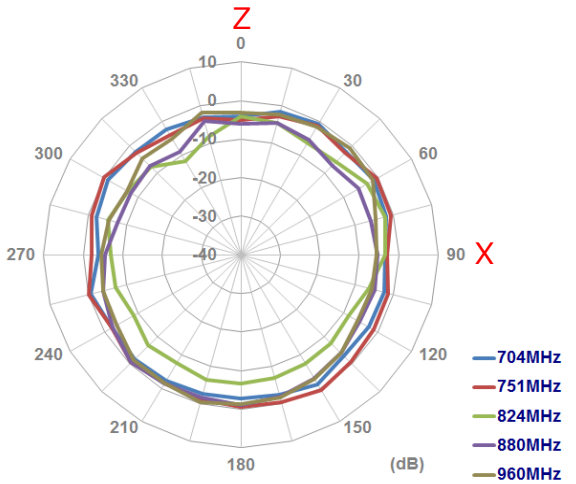


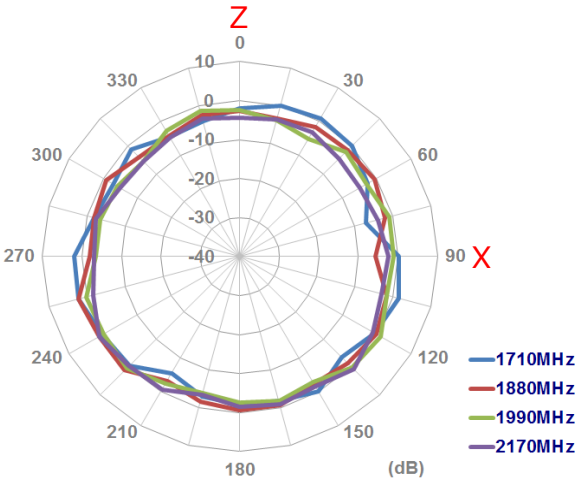
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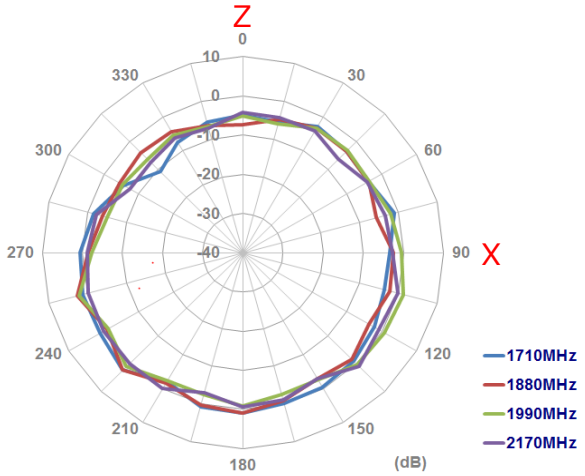
On 50*50cm Metal Base

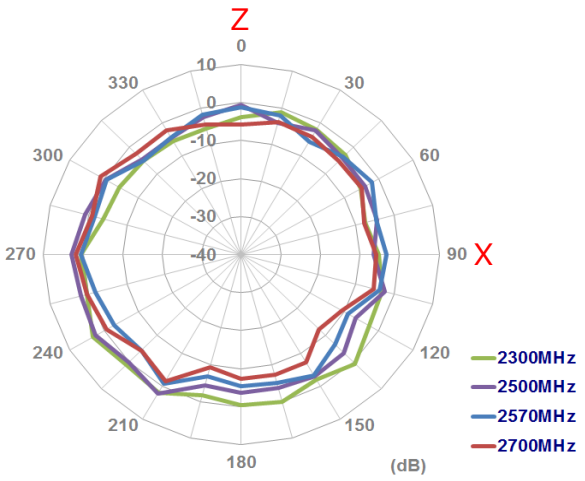
XZ Plane

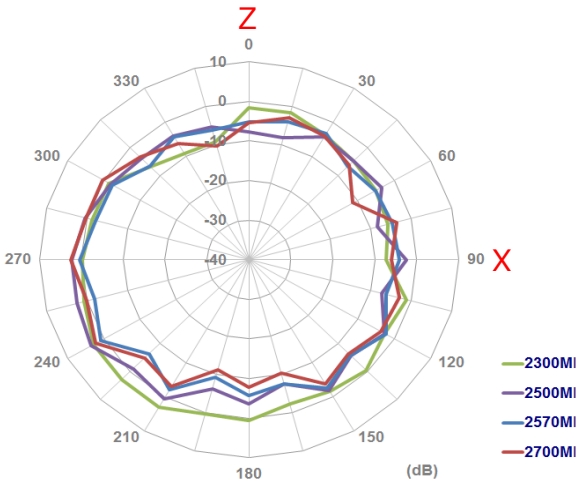








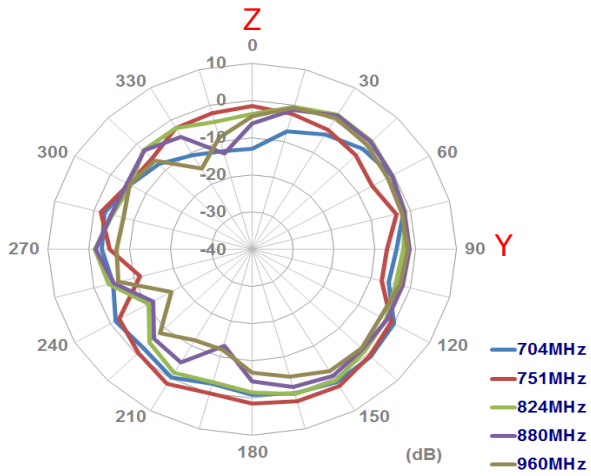


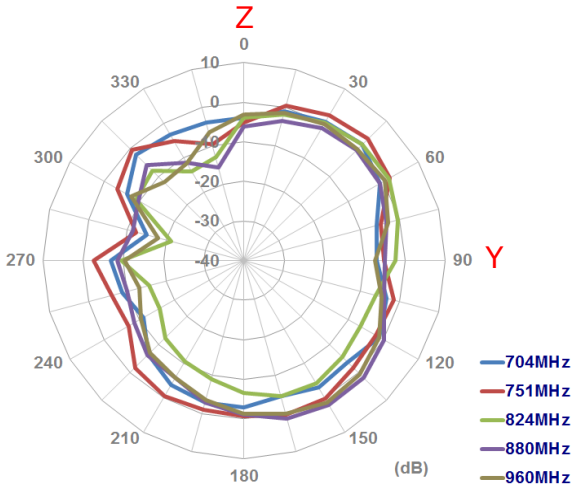


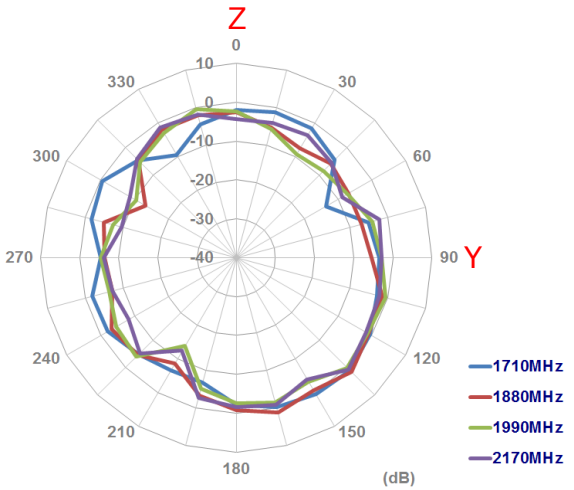
Free Space

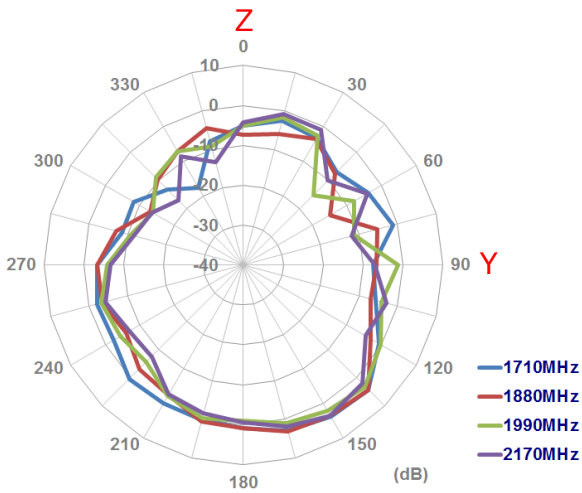
On 50*50cm Metal Base

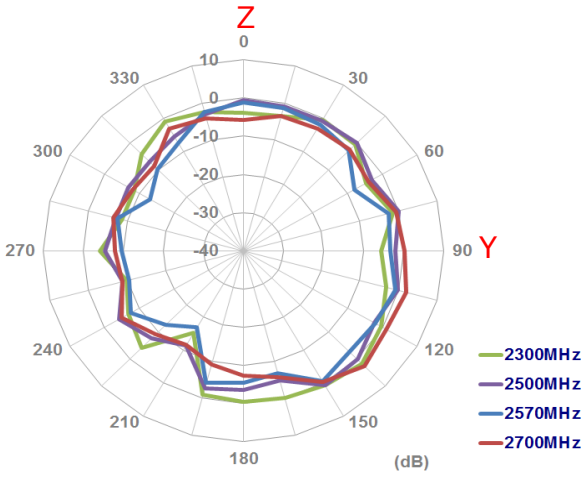
YZ Plane

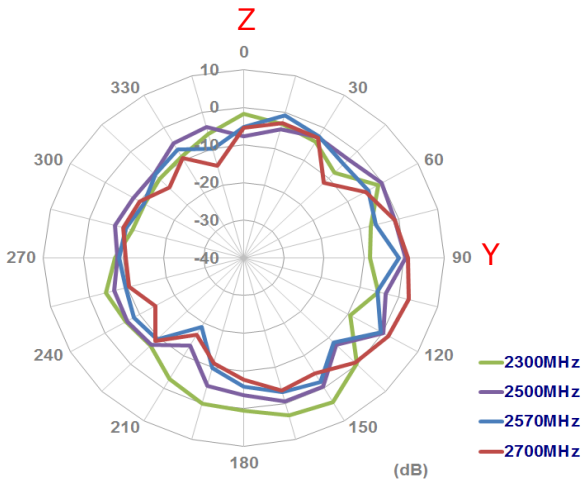










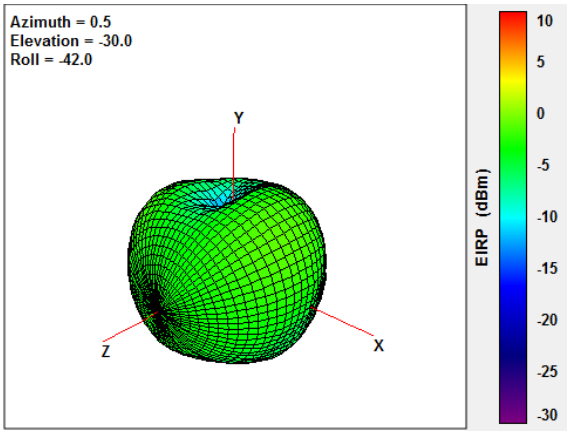


Free Space

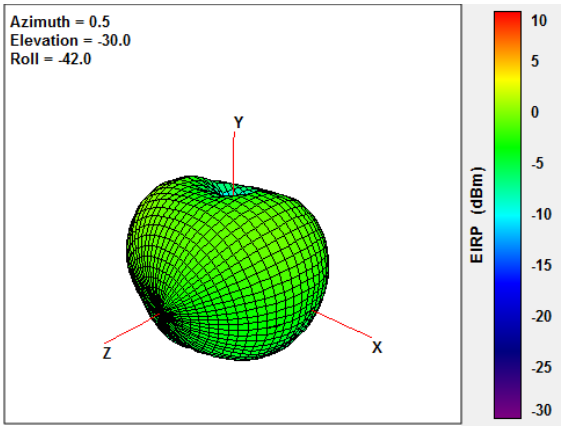
On 50*50cm Metal Base

3.3. 3D Radiation Pattern

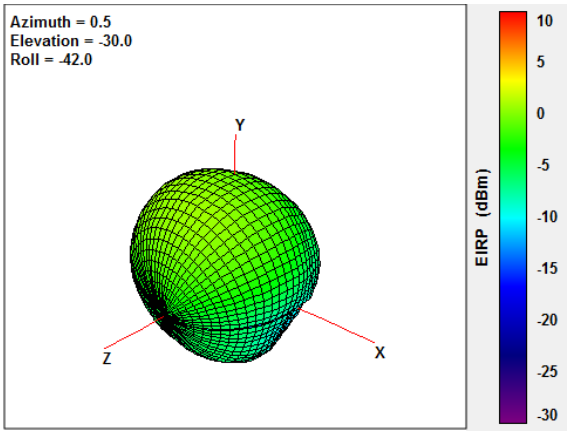
3.3.1 LTE 3D Radiation Pattern



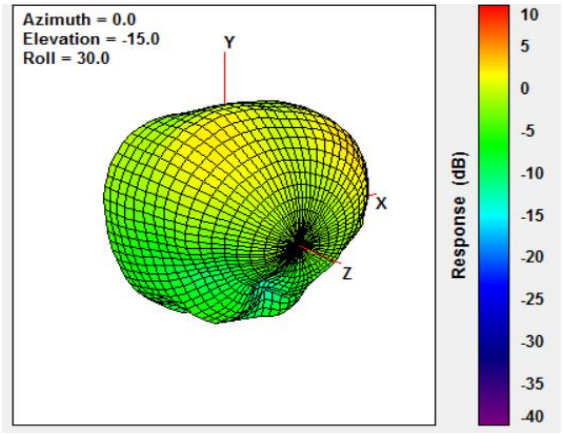
@756MHz



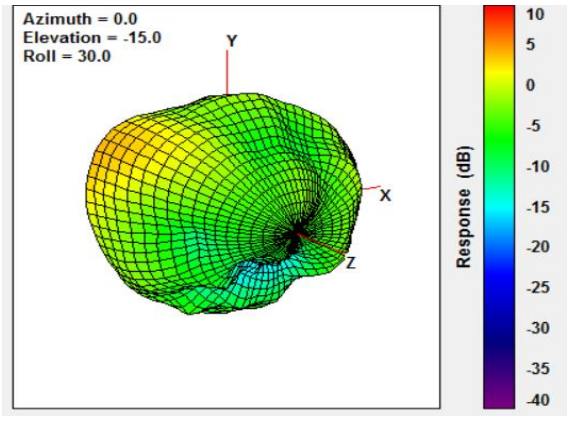
@824MHz



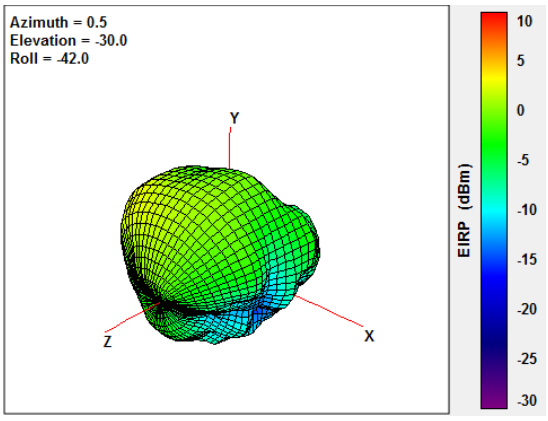
@880MHz



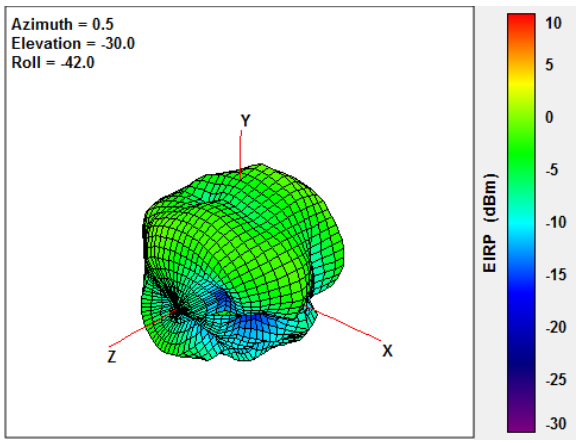
@960MHz



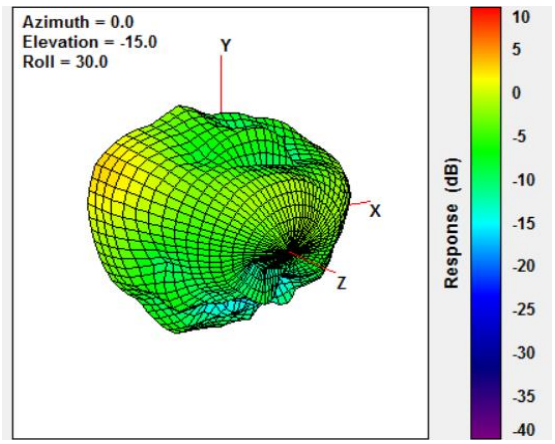
@1710MHz



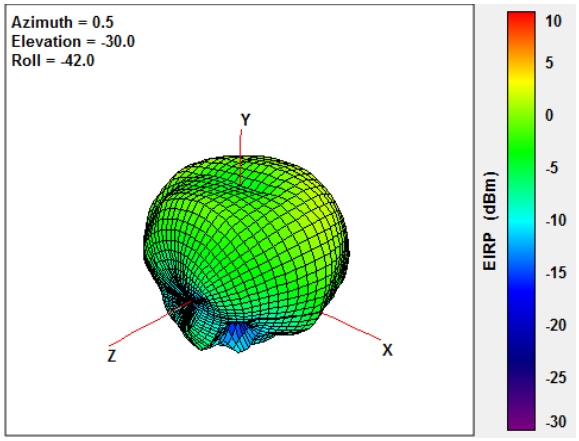
@1880MHz



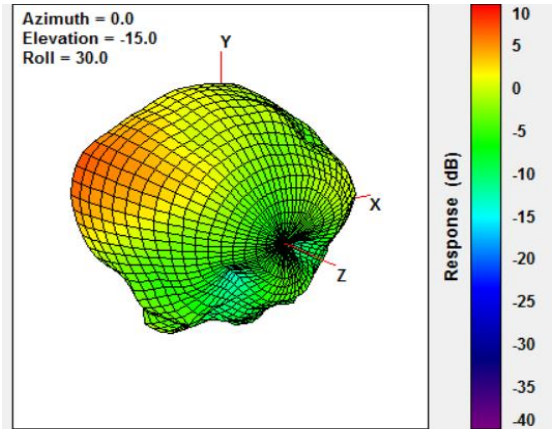
@1990MHz



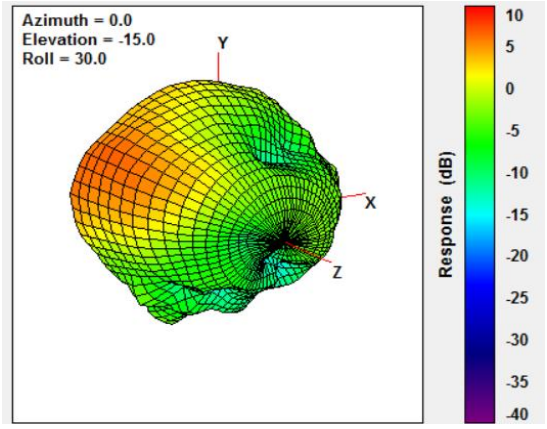
@2170MHz



@2500MHz



@2300MHz

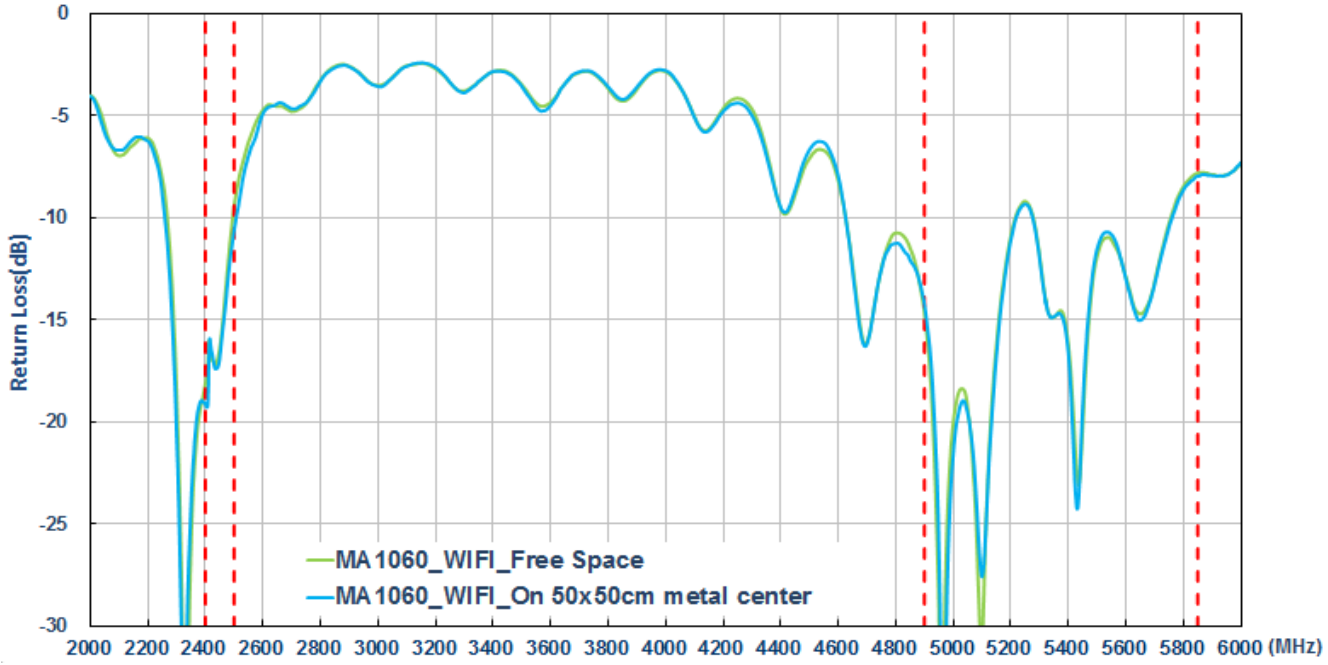


@2690MHz

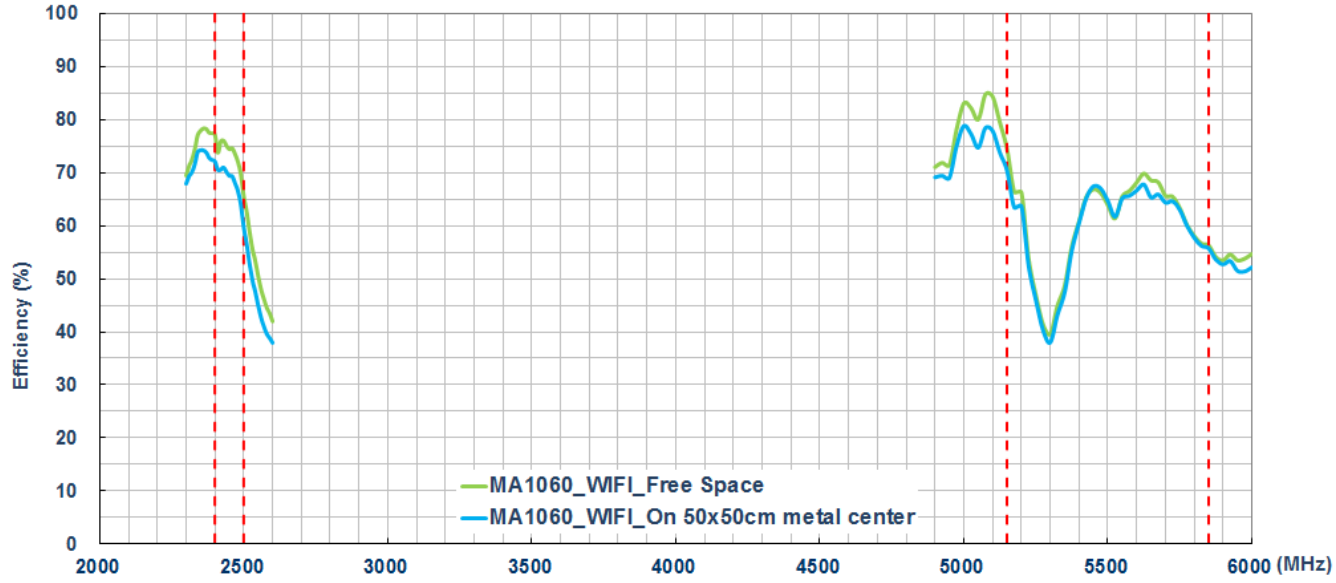
4. Wi-Fi 2.4/5.8GHz

4.1. 2.4/5.8GHz Characteristics

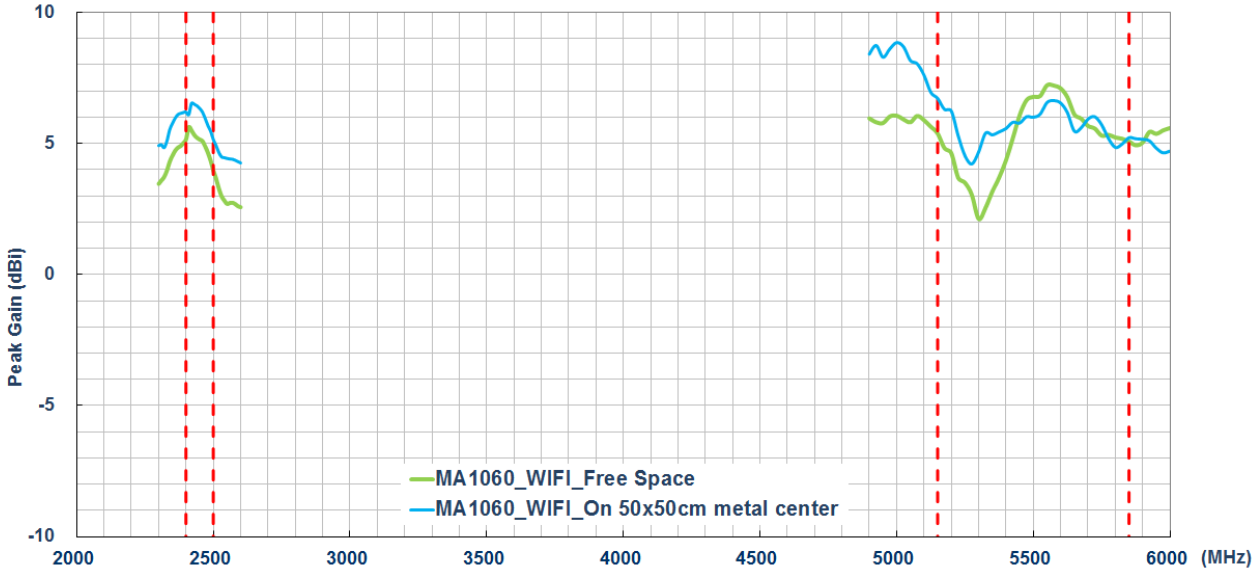
4.1.1. Return Loss



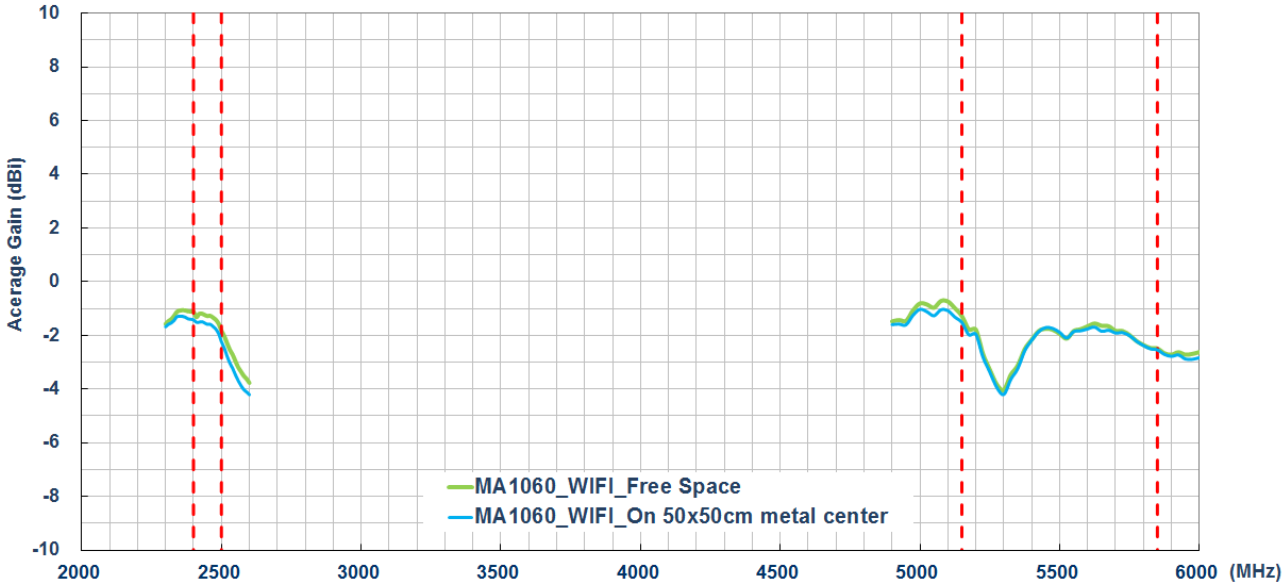
4.1.2. Efficiency



4.1.3. Peak Gain

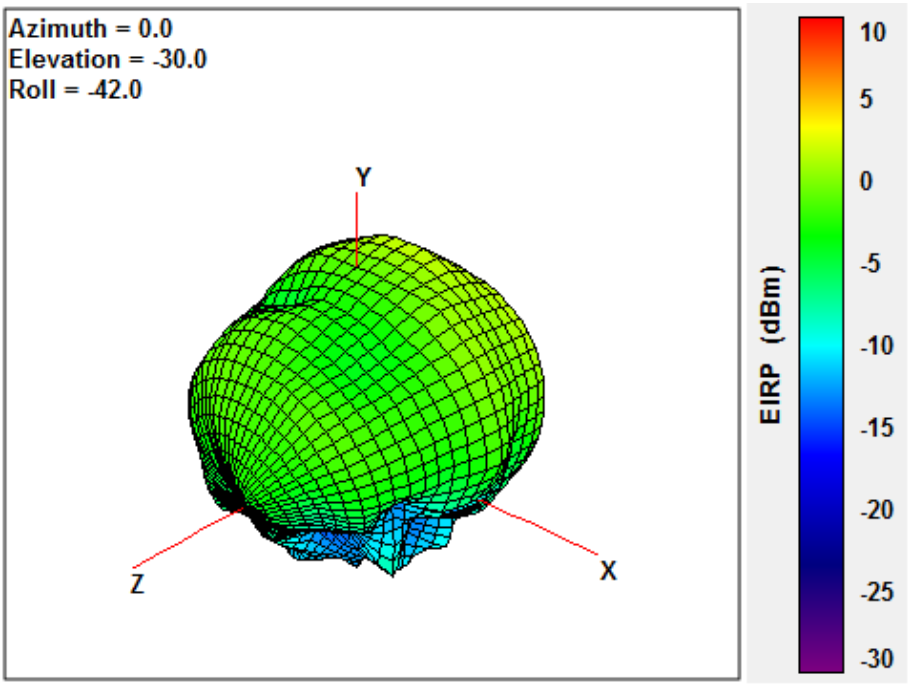


4.1.4. Average Gain

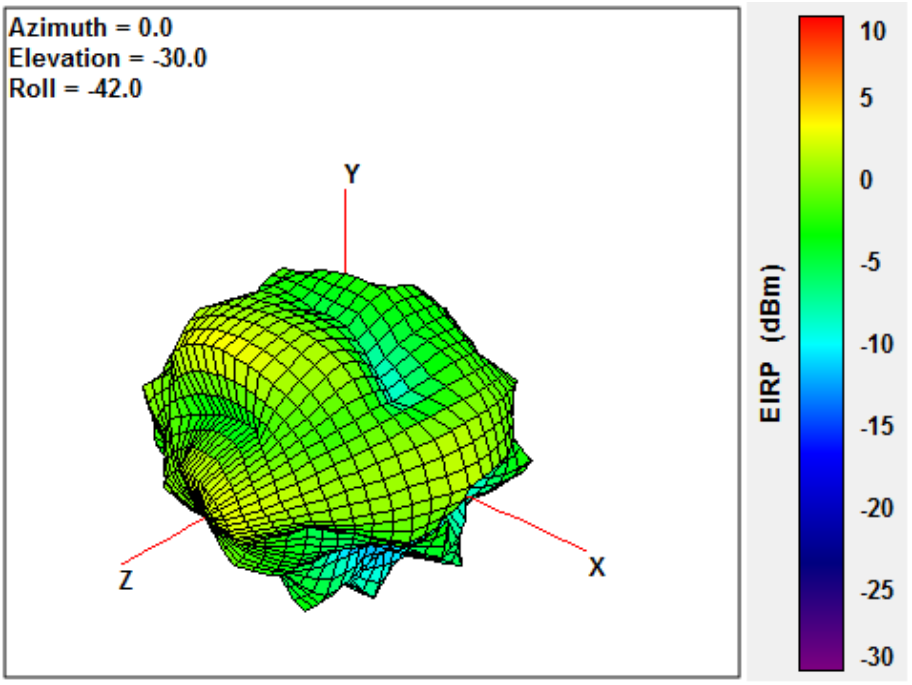


4.2. 3D Radiation Patterns

4.2.1. 2.4/5.8GHz 3D Radiation Pattern



@2450MHz

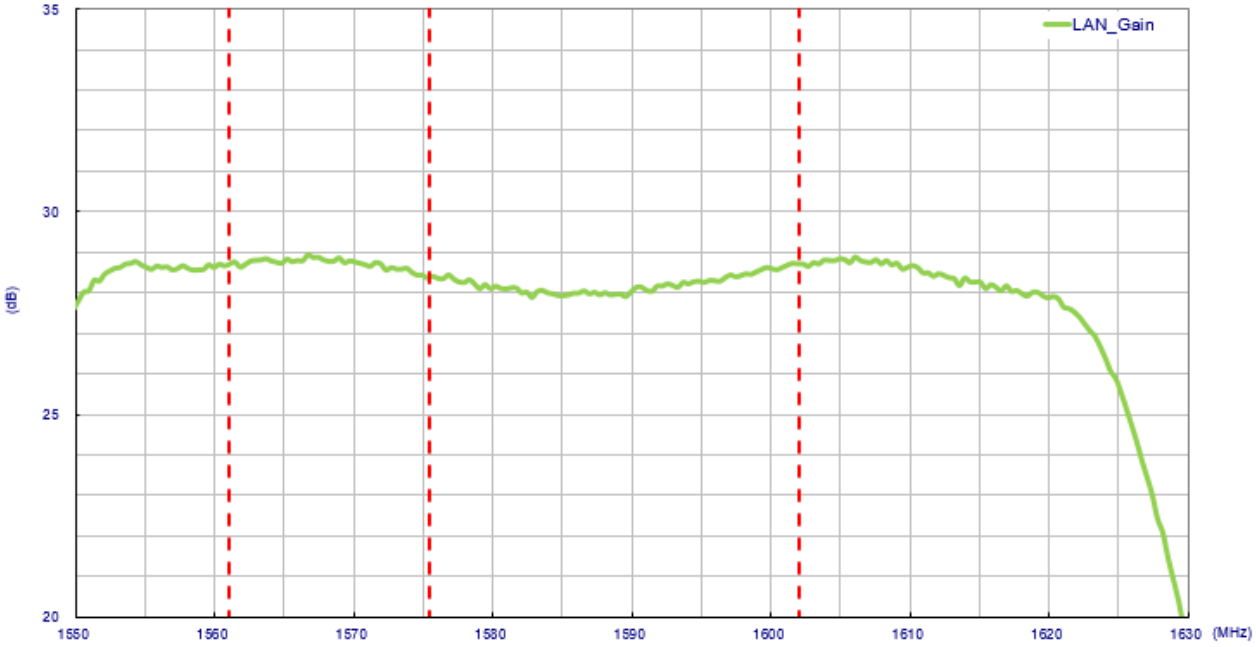


@5550MHz

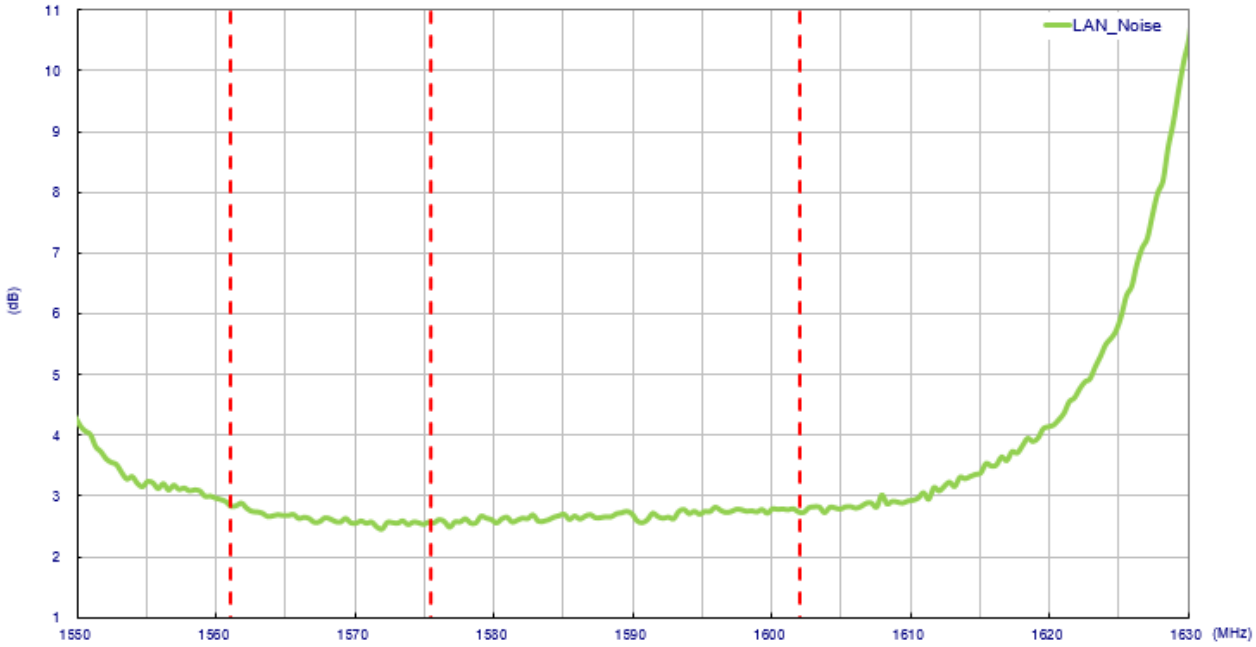
5. GPS/GLONASS/GALILEO/BeiDou

5.1. Characteristics

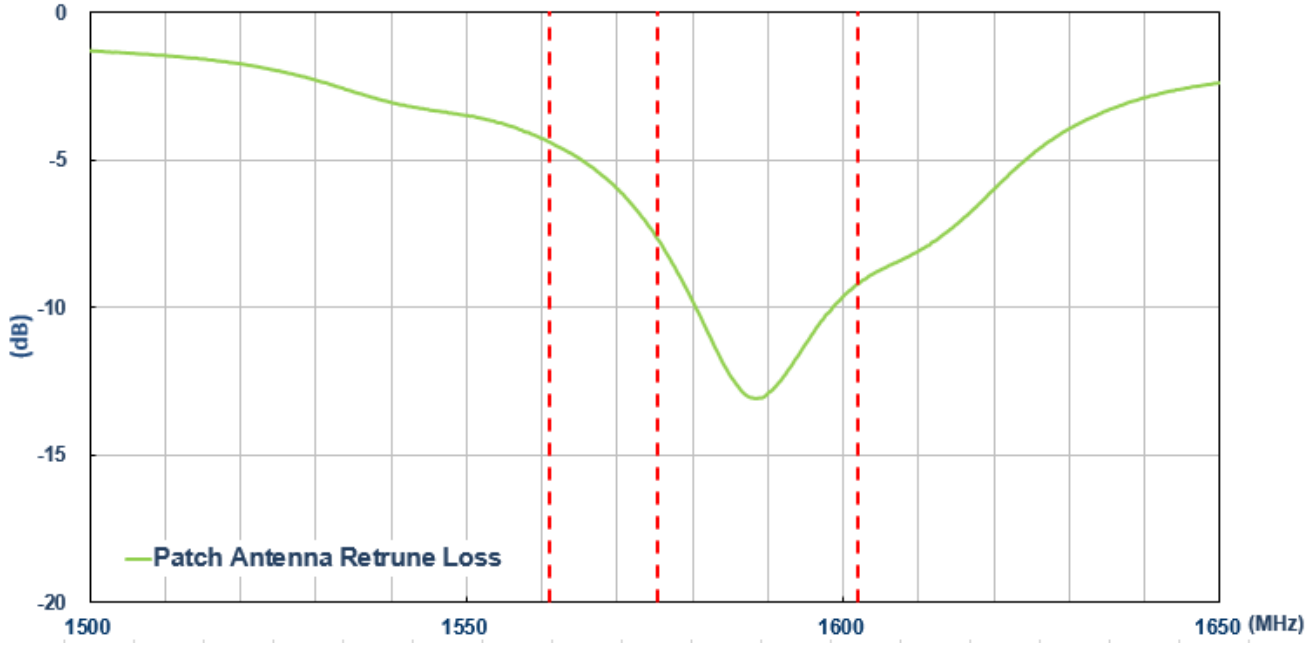
5.1.1. LNA Gain



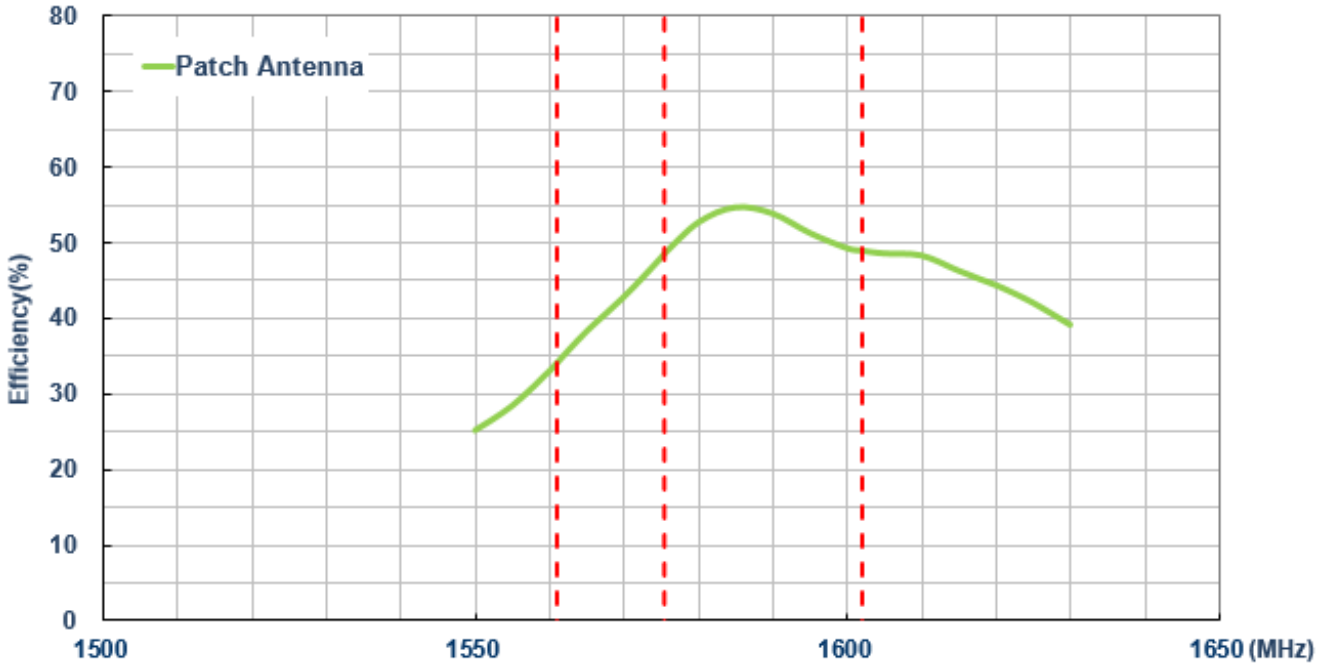
5.1.2. Noise Figure



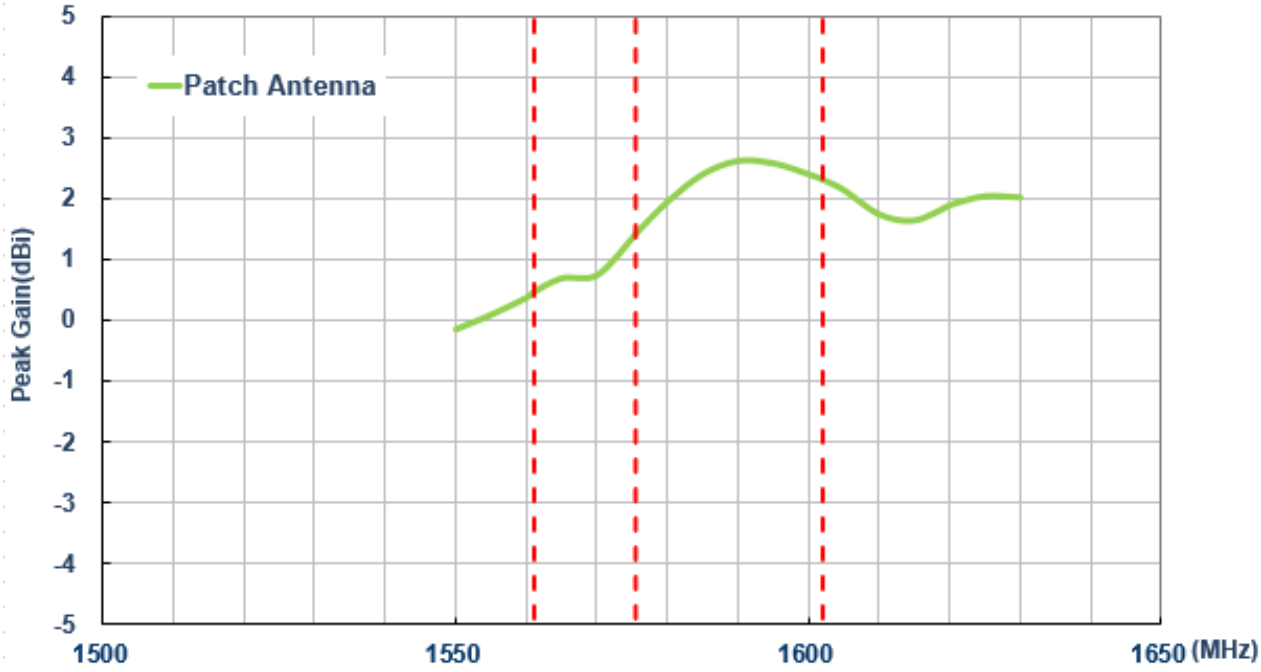
5.1.3. Patch Antenna Passive Return Loss



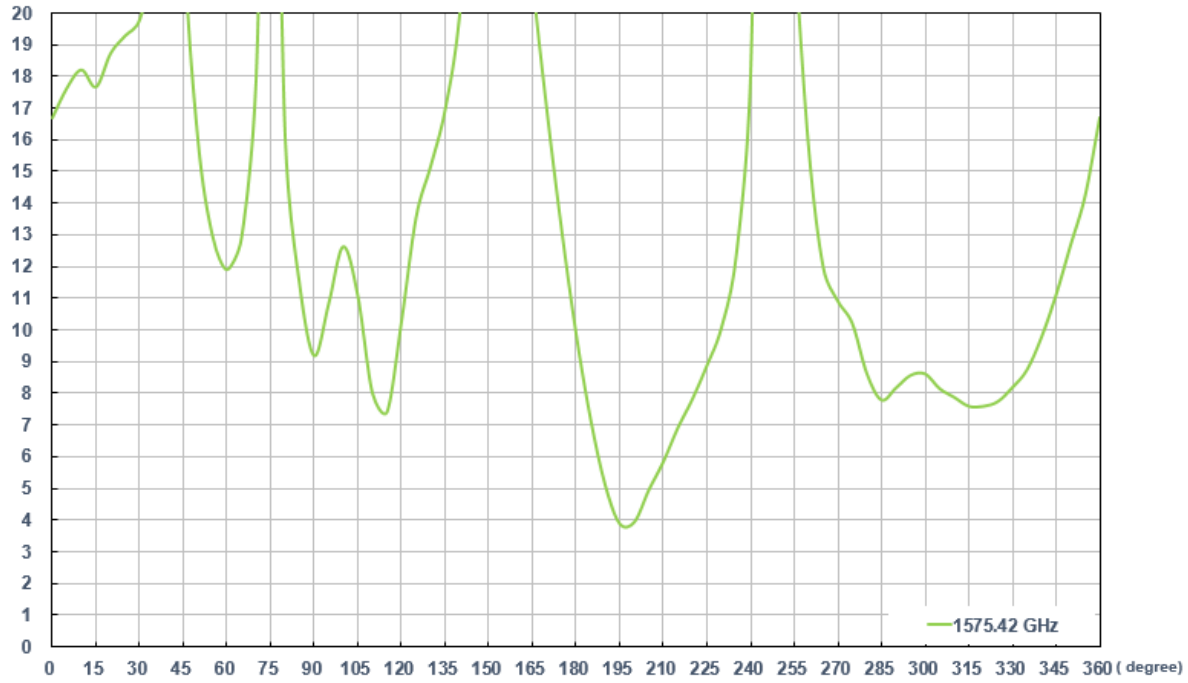
5.1.4. Patch Antenna Passive Efficiency



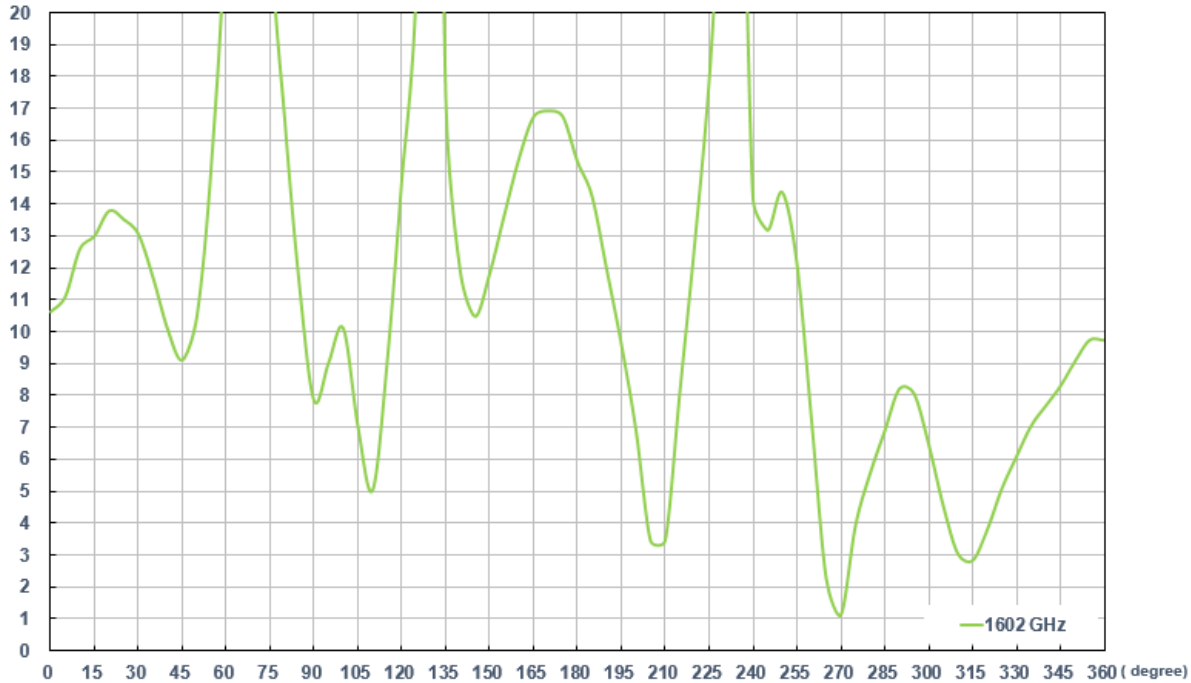
5.1.5. Patch Antenna Passive Peak Gain



5.1.6. Axial Ratio



*At 0 degree (antenna Zenith)

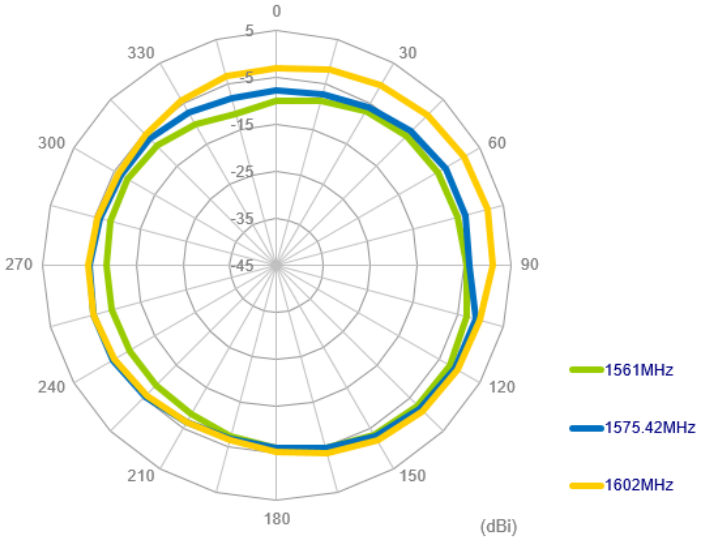


*At 0 degree (antenna Zenith)

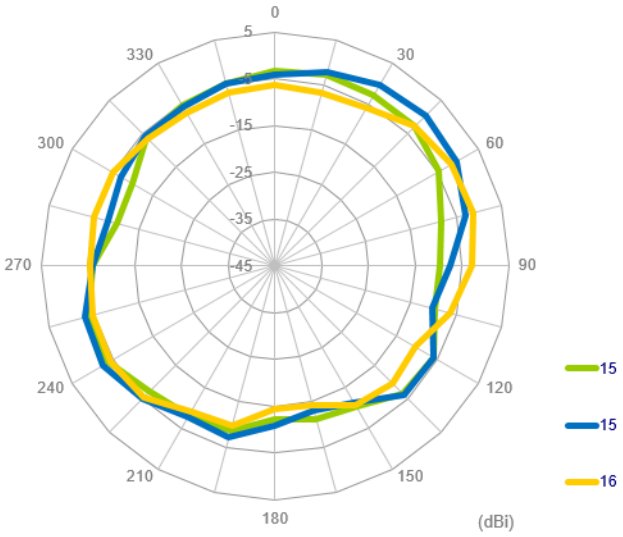
5.2. Radiation Pattern Measurement Setup

5.2.1. GNSS 2D Radiation Pattern

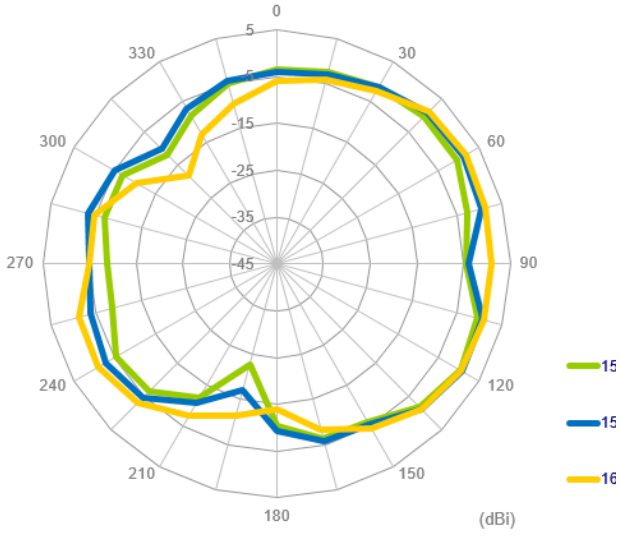
XY Plane



XZ Plane

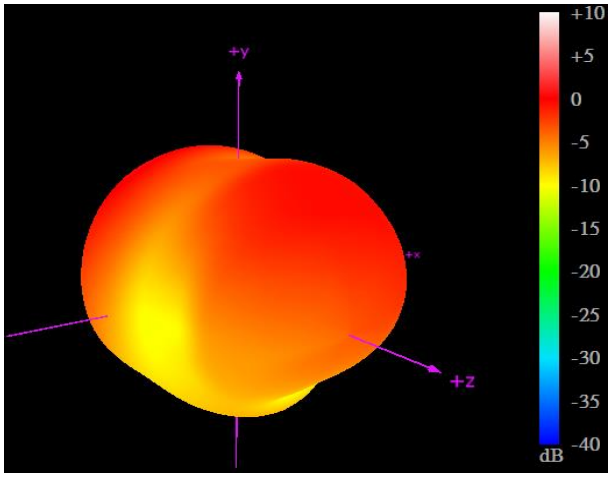


YZ Plane

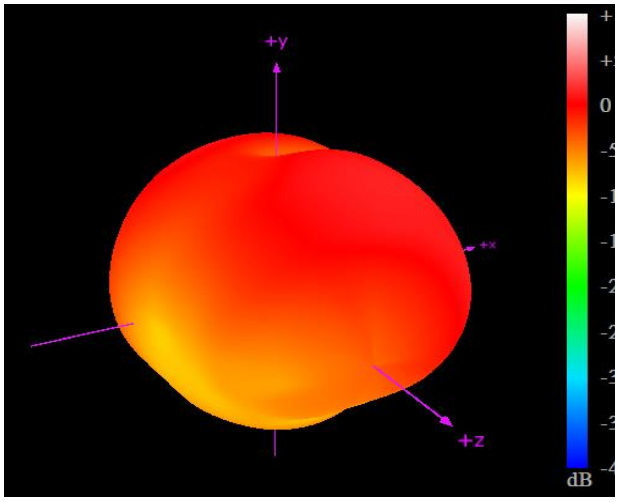


Free Space

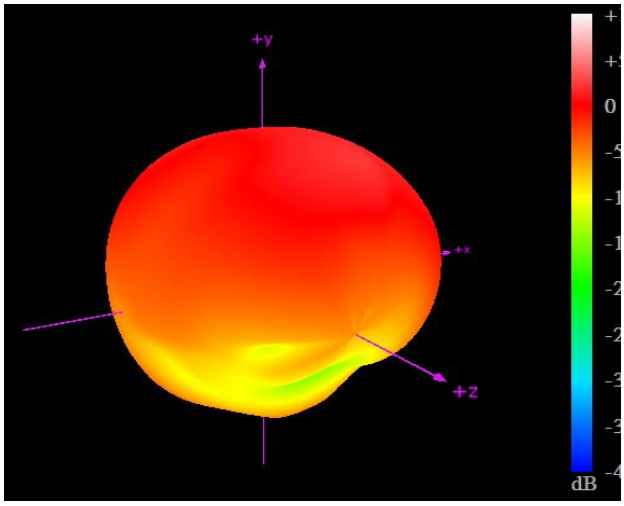
5.2.2. GNSS 3D Radiation Pattern



@ 1561MHz



@1575.42

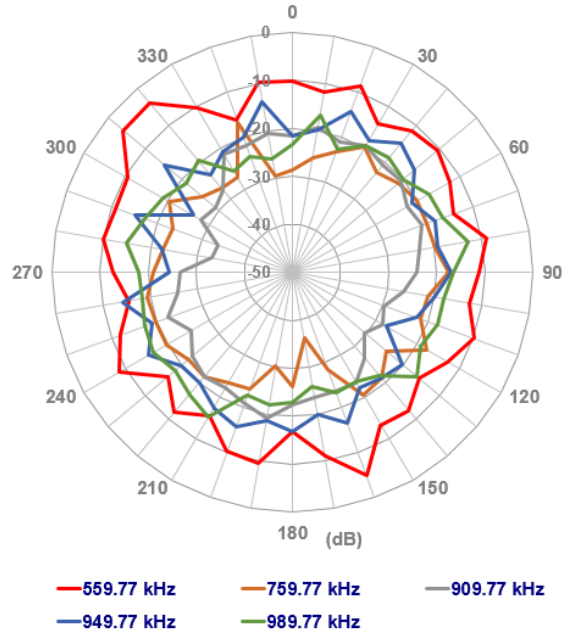


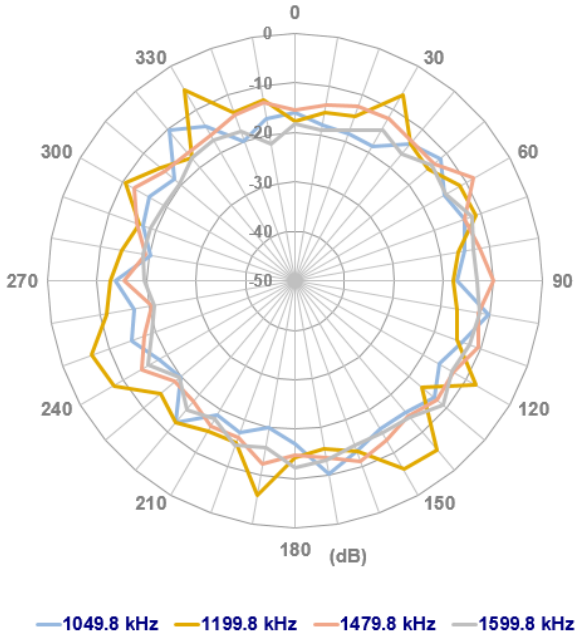
@ 1602MHz

6. AM/FM Antenna

6.1. AM Antenna Radiation Pattern

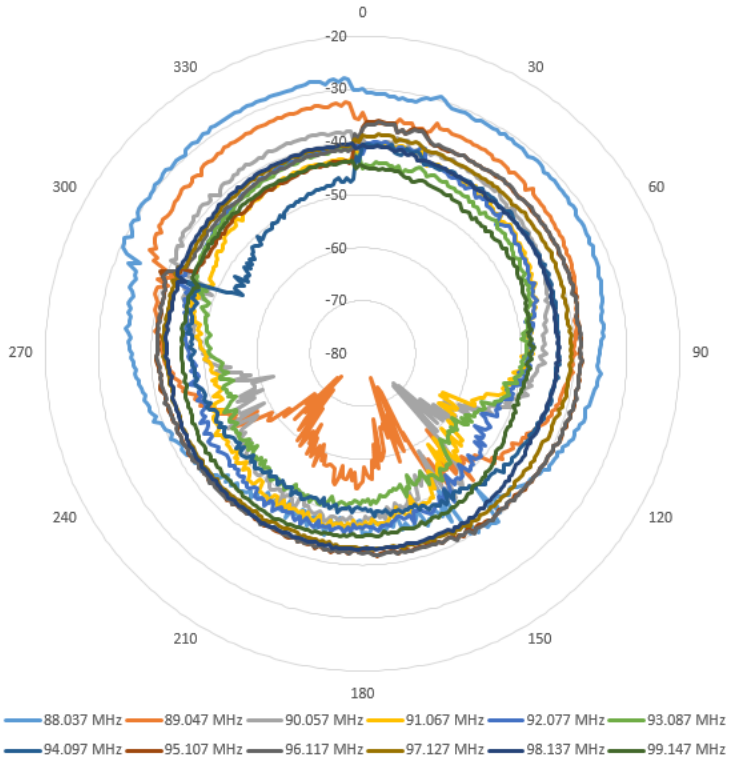
6.1.1. V-Cut

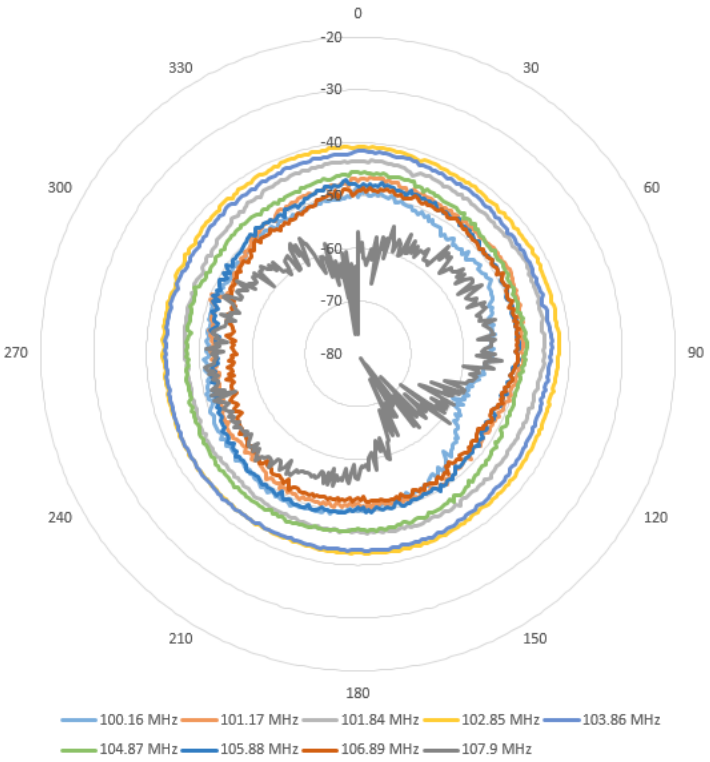




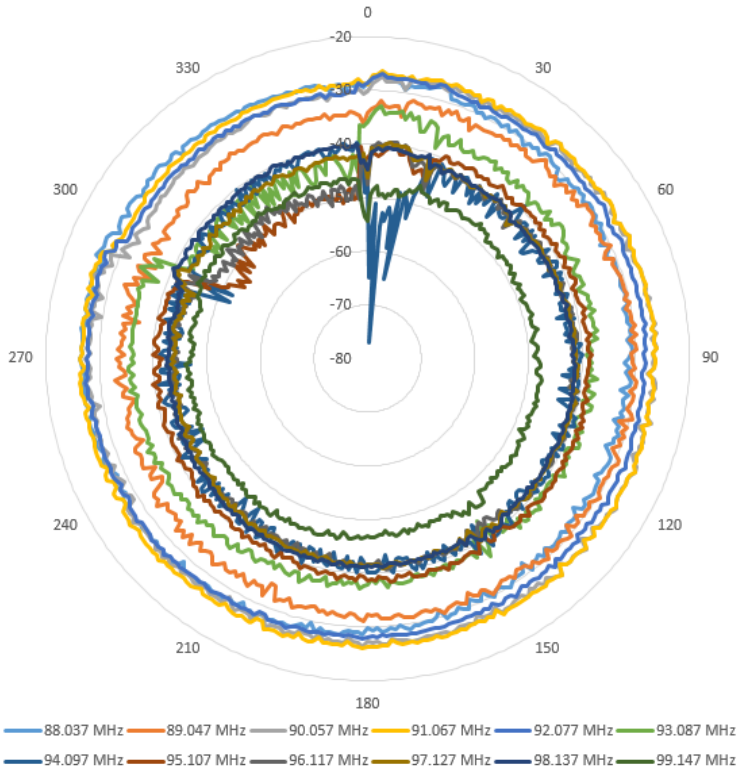
6.2. FM Antenna Radiation Pattern

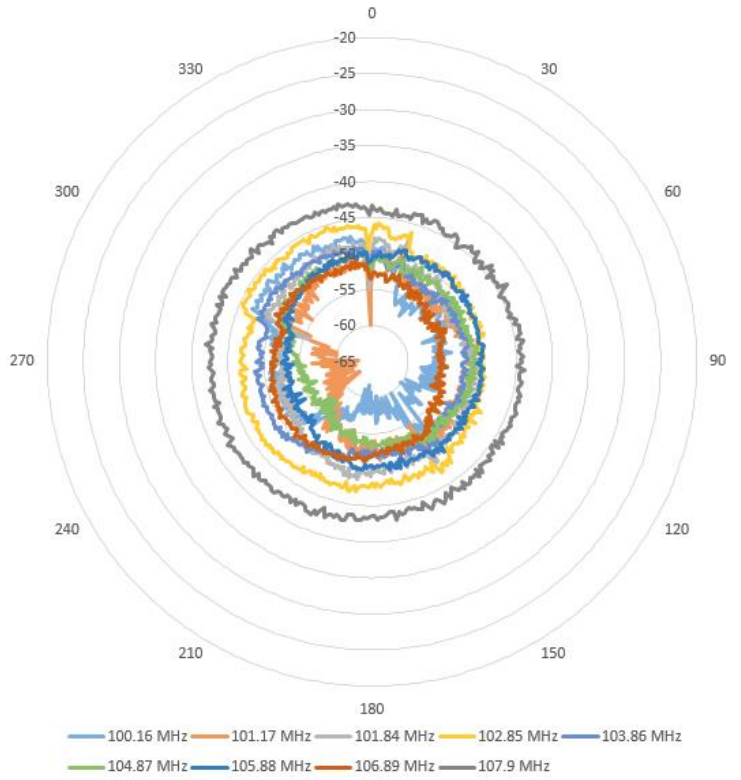
6.2.1. V-Cut



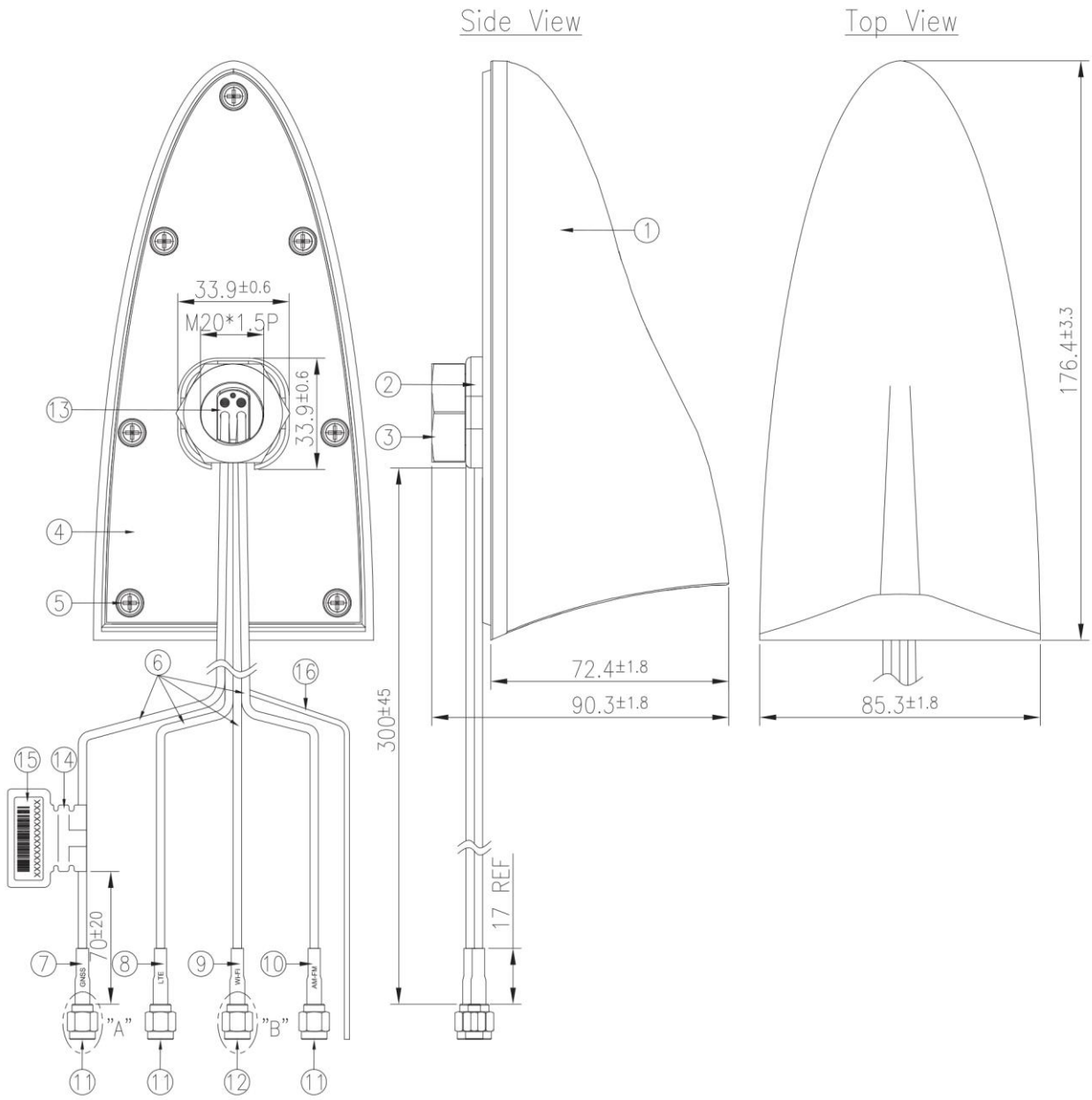


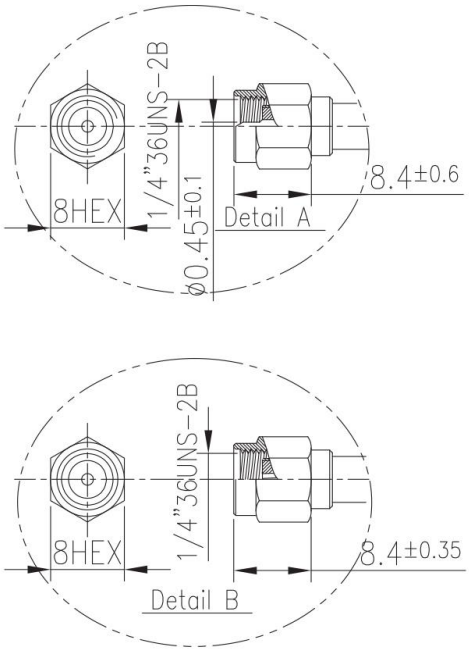
6.2.2. H-Cut


0
-20
-30
-40
-60
-70
-80
30
60
90
120
150
180
210
240
270
300
330
88.037 MHz
89.047 MHz
90.057 MHz
91.067 MHz
92.077 MHz
93.087 MHz
94.097 MHz
95.107 MHz
96.117 MHz
97.127 MHz
98.137 MHz
99.147 MHz


0
-20
-25
-30
-35
-40
-45
-50
-55
-60
-65
30
60
90
120
150
180
210
240
270
300
330
100.16 MHz
101.17 MHz
101.84 MHz
102.85 MHz
103.86 MHz
104.87 MHz
105.88 MHz
106.89 MHz
107.9 MHz

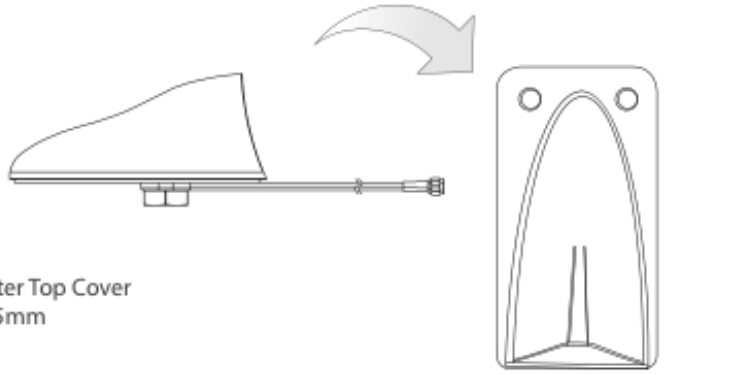
7. Drawing (Unit: mm)





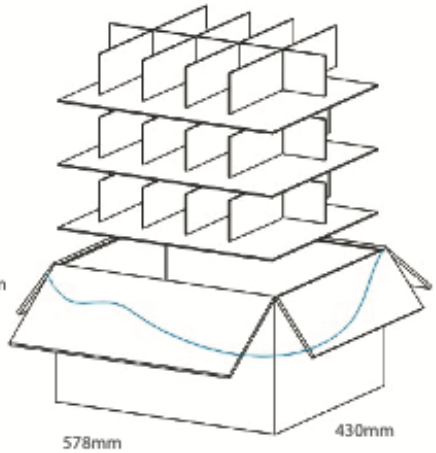
	Name	Material	Finish	QTY
1	Housing(Single Fin)	PC+ABS	Black	1
2	Base Spacer	Zinc Alloy	Ni Plated	1
3	Nut	Steel	Natural	1
4	Rubber Base Plate	Silicone Rubber	Black	1
5	Screw TP-1	Steel	Natural	8
6	RG316 Coaxial Cable	FEP	Black	4
7	Heat Shrink Tube (GNSS)	PE	Blue	1
8	Heat Shrink Tube (LTE)	PE	Red	1
9	Heat Shrink Tube (Wi-Fi)	PE	Yellow	1
10	Heat Shrink Tube (AM-FM)	PE	Green	1
11	SMA(M)ST	Brass	Au Plated	3
12	RP-SMA(M)ST	Brass	Au Plated	1
13	Silicone Cable Seal	Silicone Rubber	Black	1
14	Empty Label(48*30)	PET	White	1
15	BarCode Label(25*9)	PET	White	1
16	Power Cable	PVC	Red	1

8. Packaging

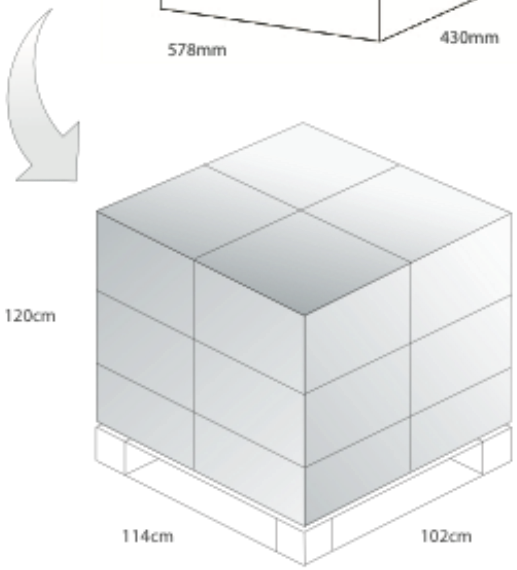


1pc MA1060.A.LBCT.001 per Blister Top Cover
Carton Dimensions - 211*110*85mm
Total Weight - 410g





10 pcs MA1060.A.LBCT.001 per layer
3 layers in a carton
Carton Dimensions - 578 × 430 × 336mm
Total 30pcs per carton.
Total Weight - 10.5kg

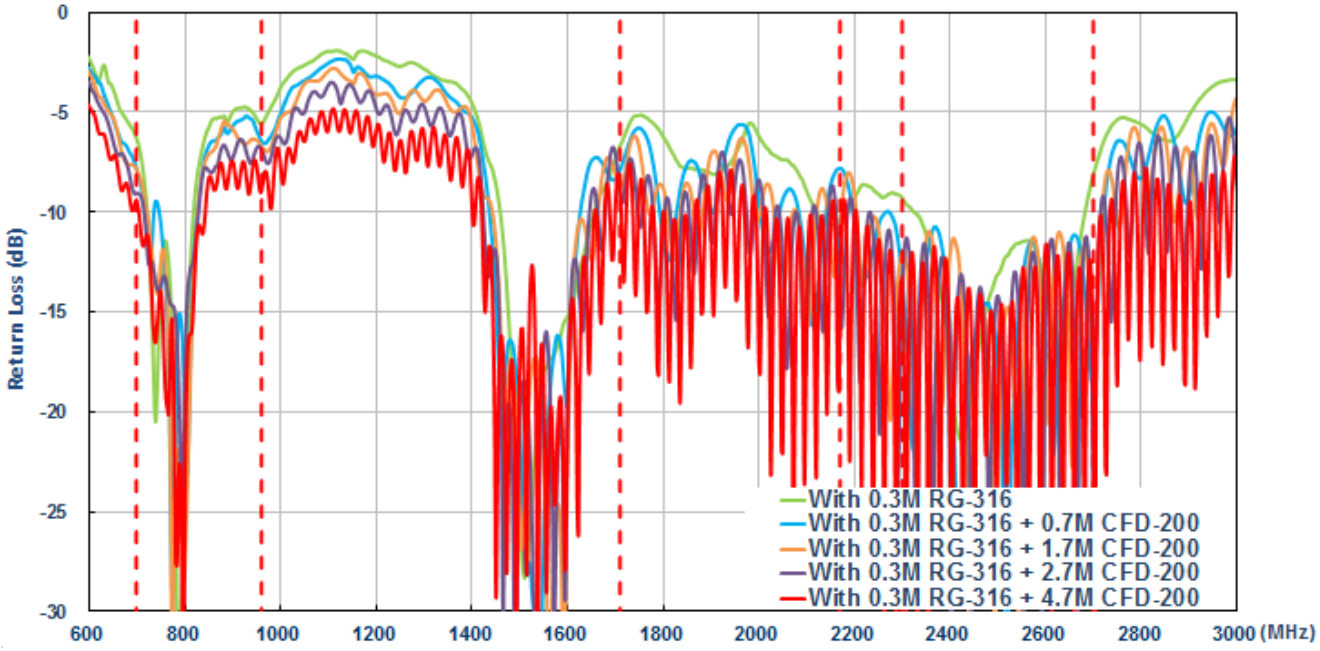


Pallet Dimensions 114cm*102cm*120cm
12 Cartons per pallet
4 Cartons per layer
3 Layers

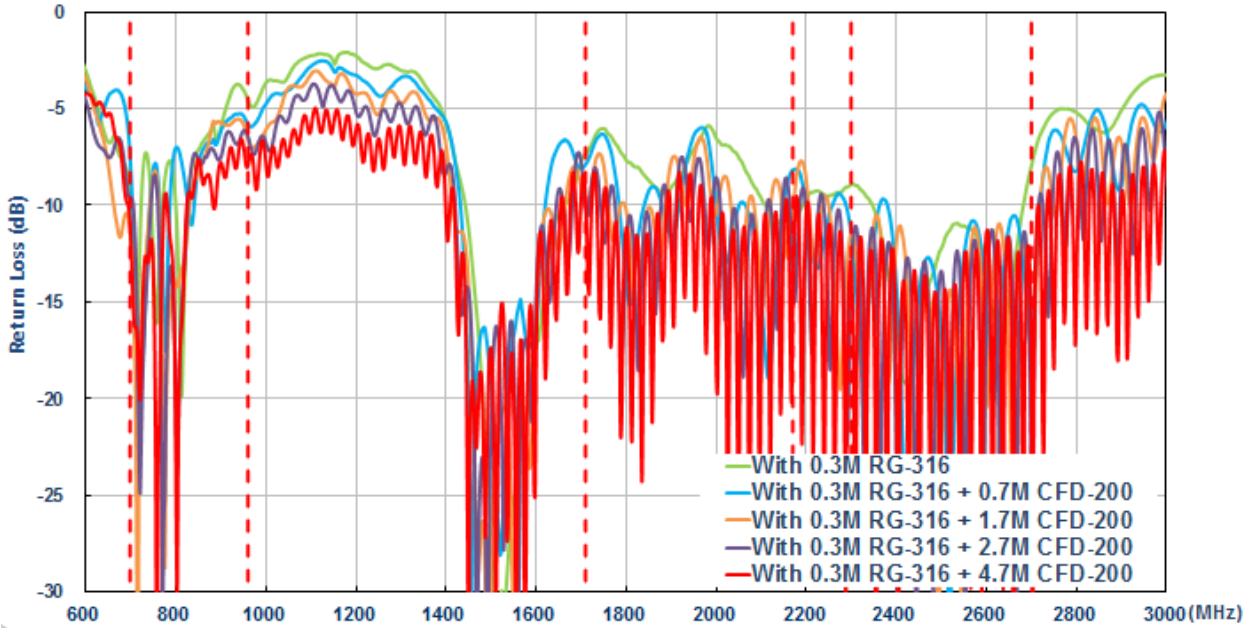
9. Application Note

Taoglas offers customers different cable length antenna performance comparison. The standard part of MA1060 is with 30cm RG316 coaxial cable. If customers need to extend cable length, we would recommend CFD200 low loss coaxial cable to maintain antenna performance for applications. The detailed antenna performance is shown below:

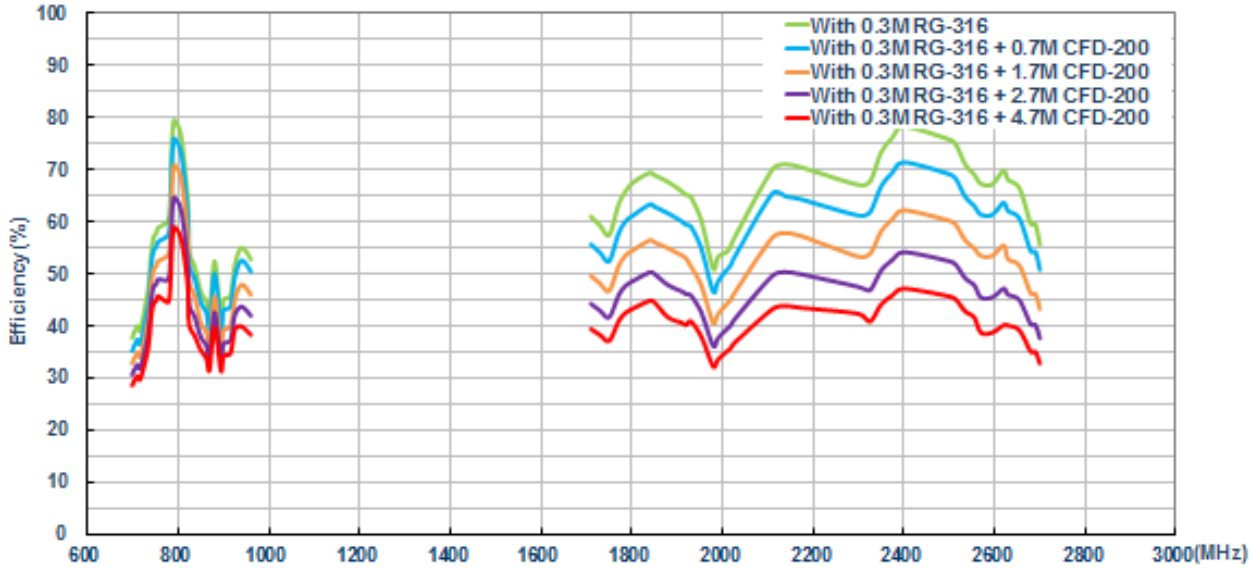
9.1.1. Return Loss in free space



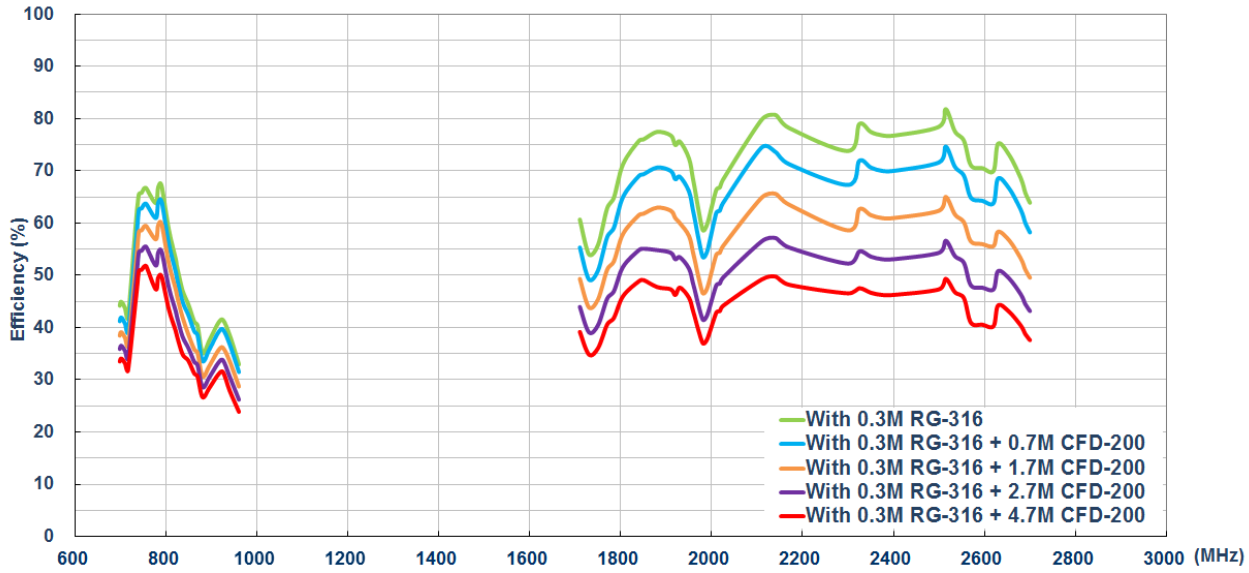
9.1.2. Return Loss on 50*50cm metal base



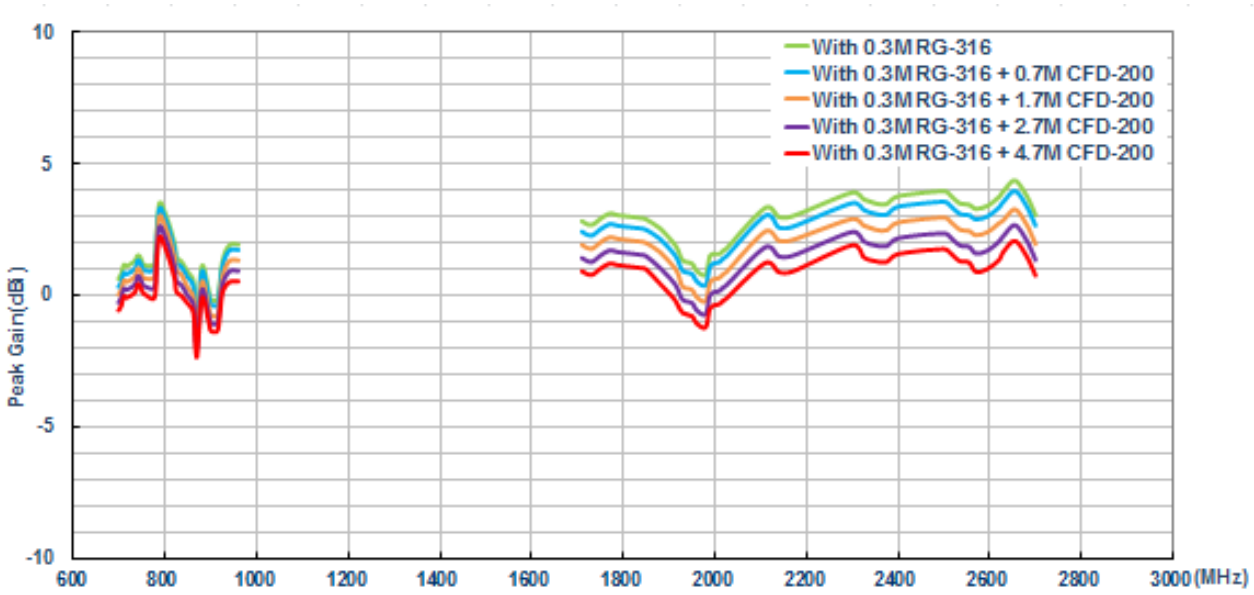
9.1.3. Efficiency in free space



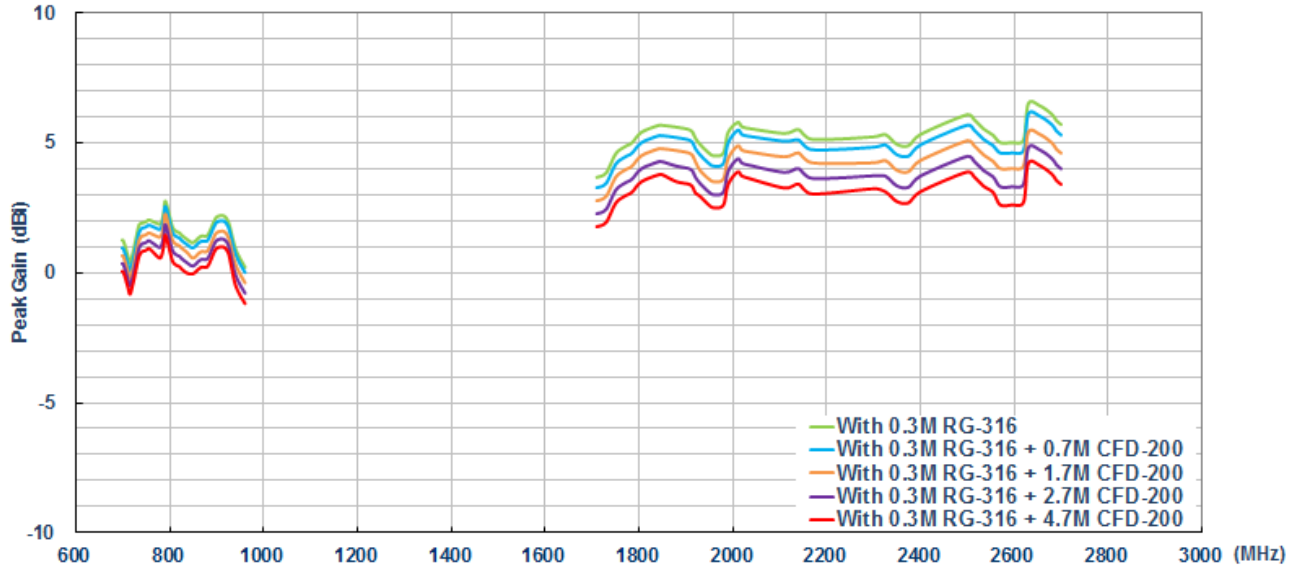
9.1.4. Efficiency on 50*50cm metal base



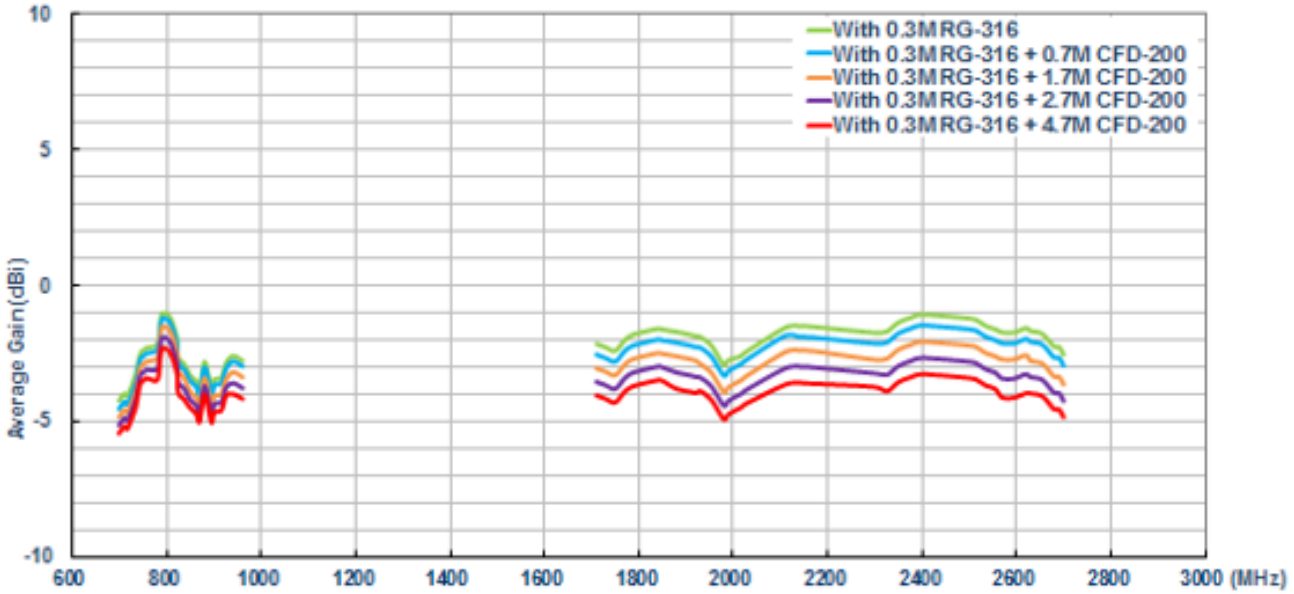
9.1.5. Peak Gain in free space



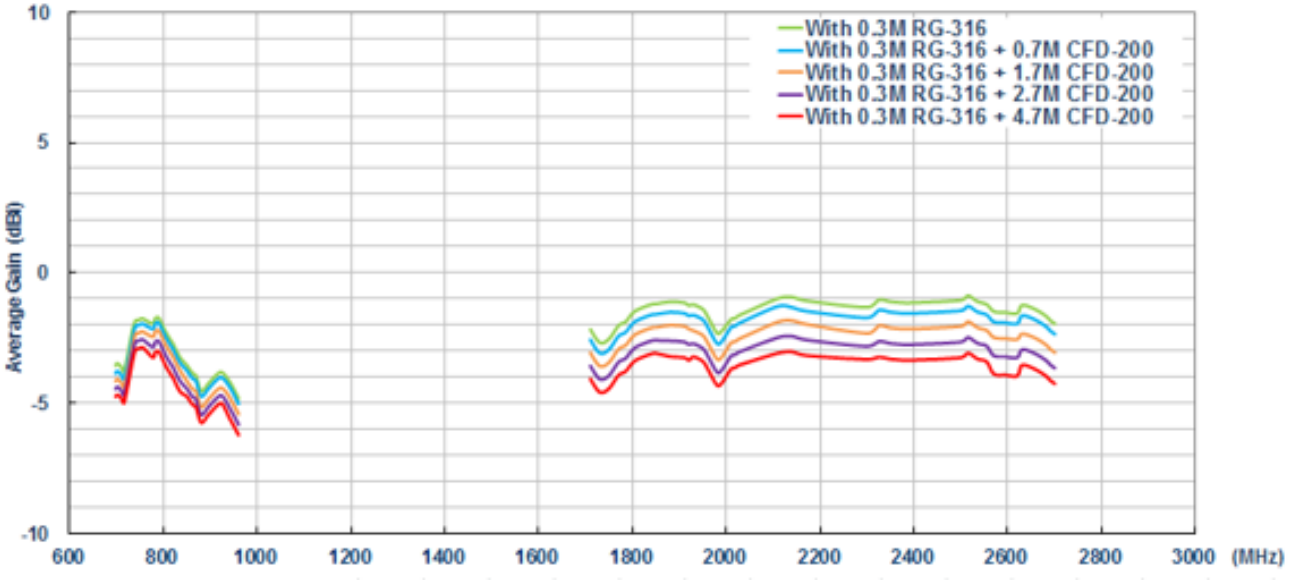
9.1.6. Peak Gain on 50*50cm metal base



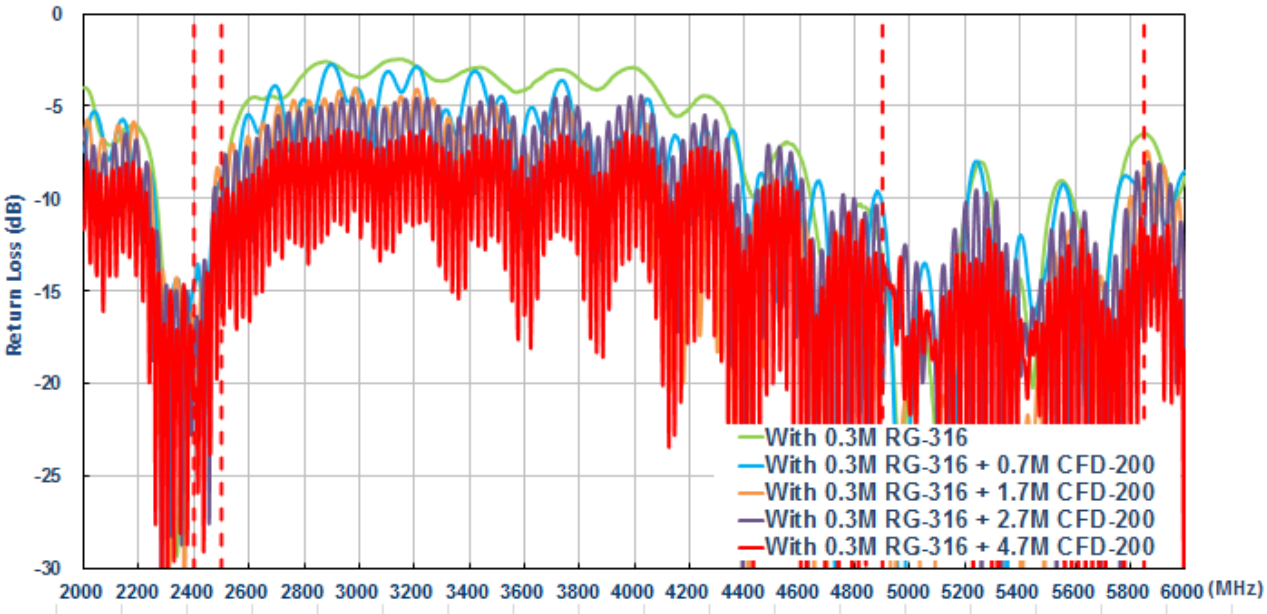
9.1.7. Average Gain in free space



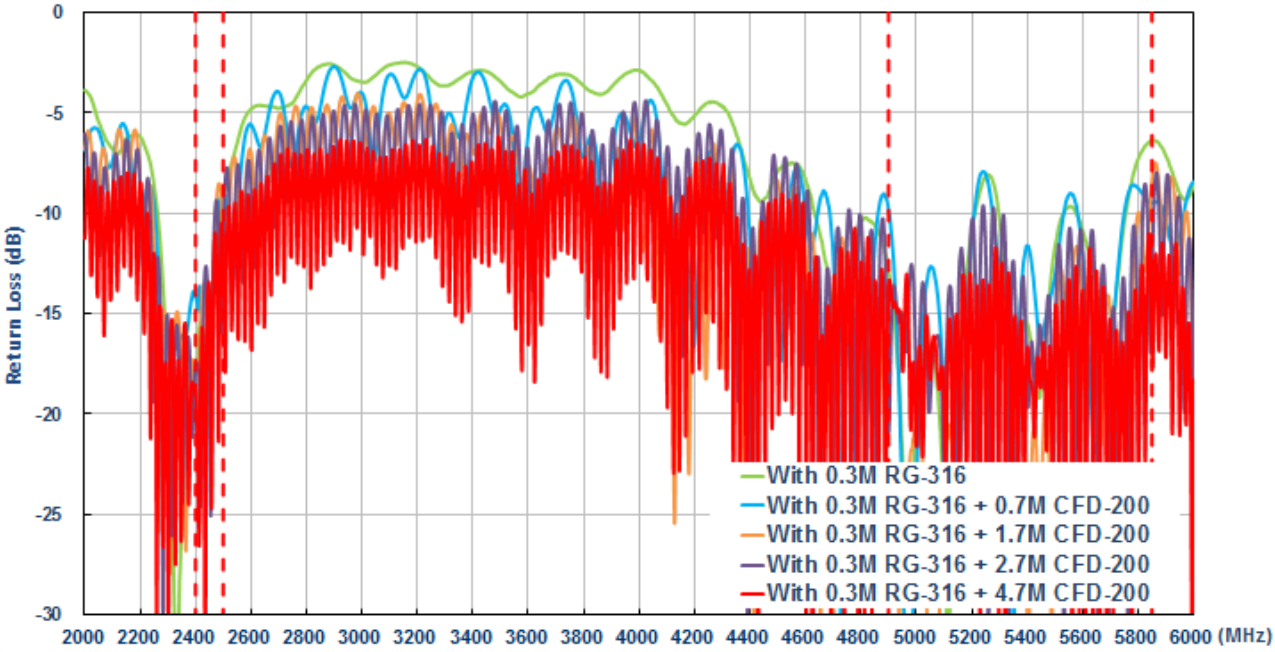
9.1.8. Average Gain on 50*50cm metal base



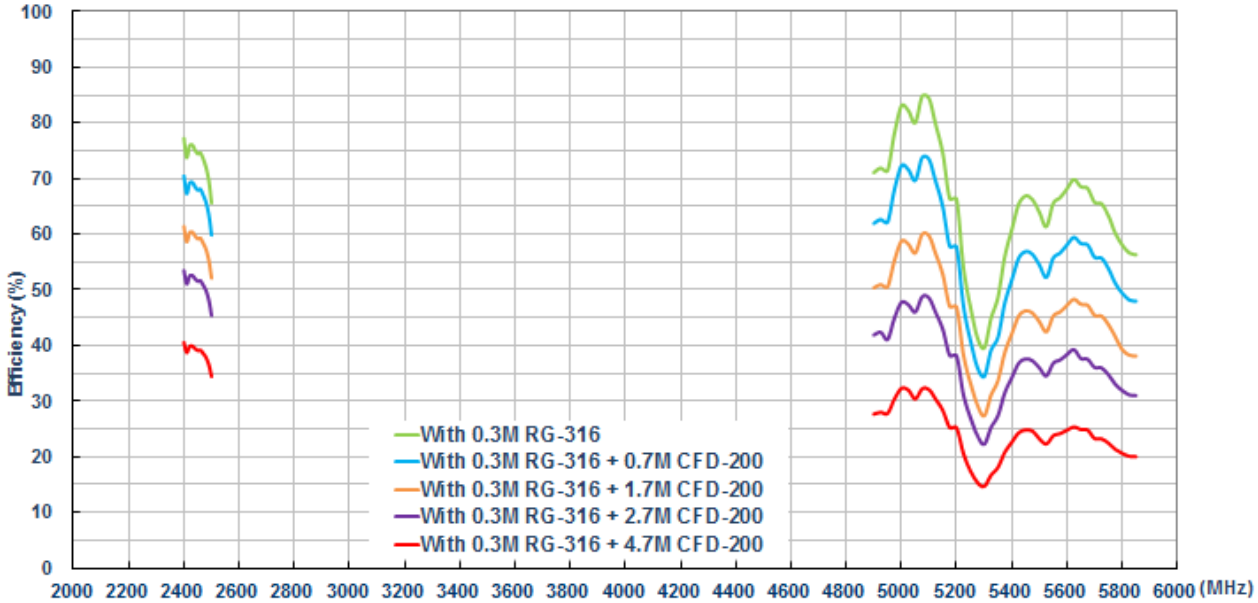
9.1.9. Return Loss in free space



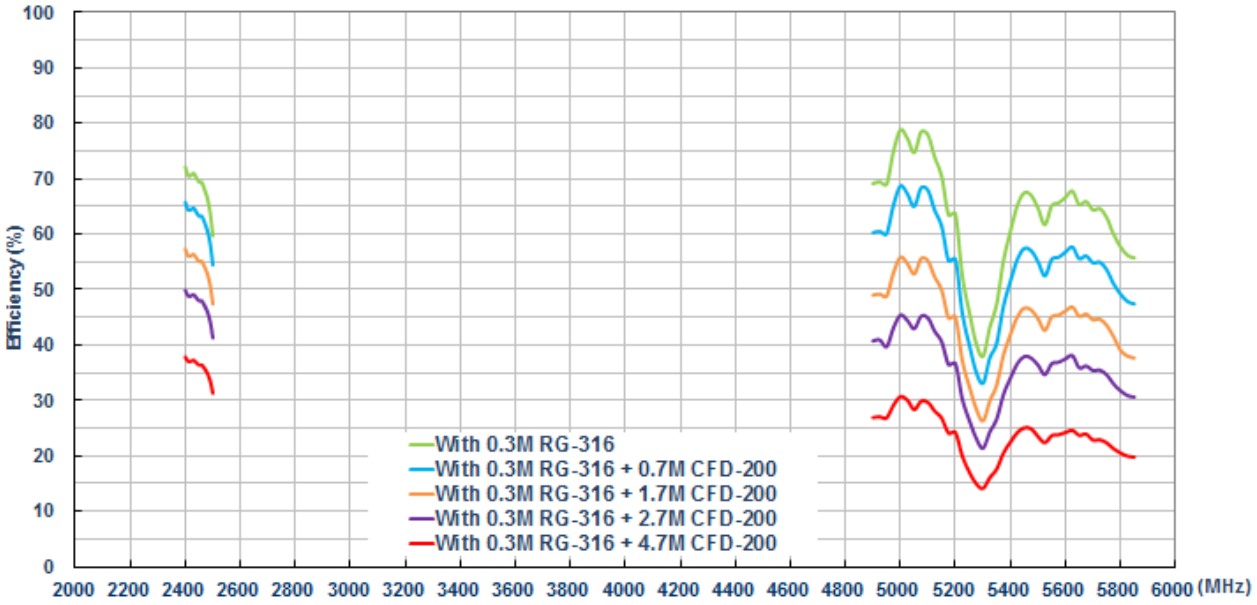
9.1.10. Return Loss on 50*50cm metal base



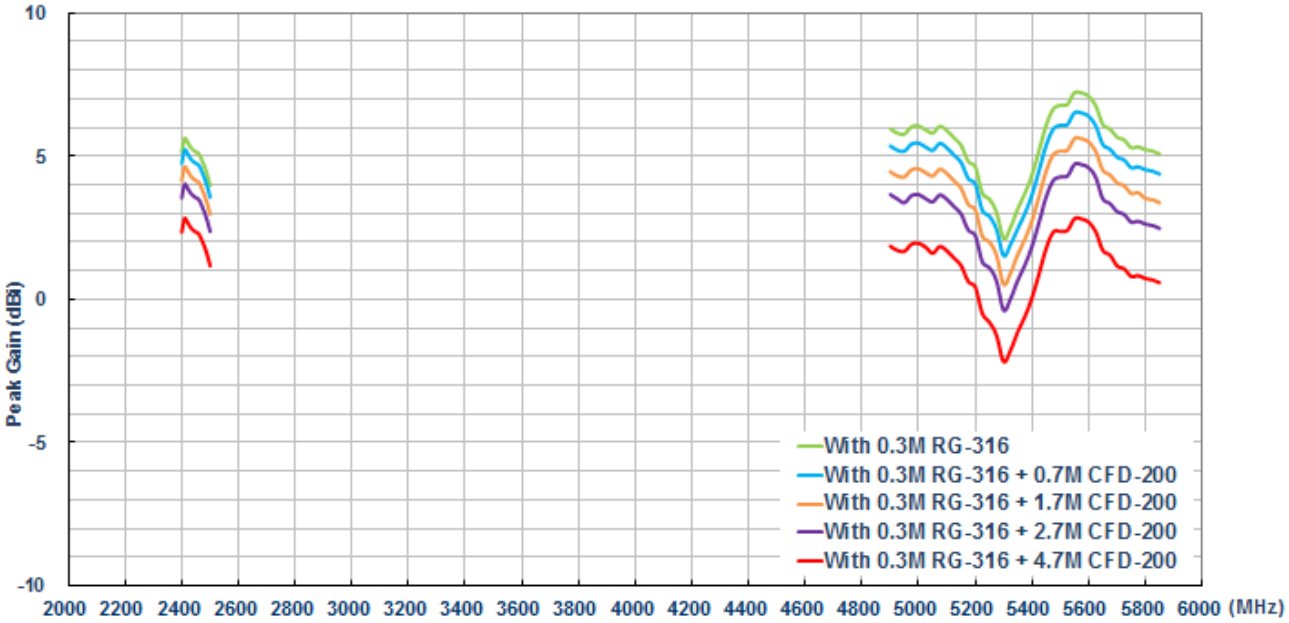
9.1.11. Efficiency in free space



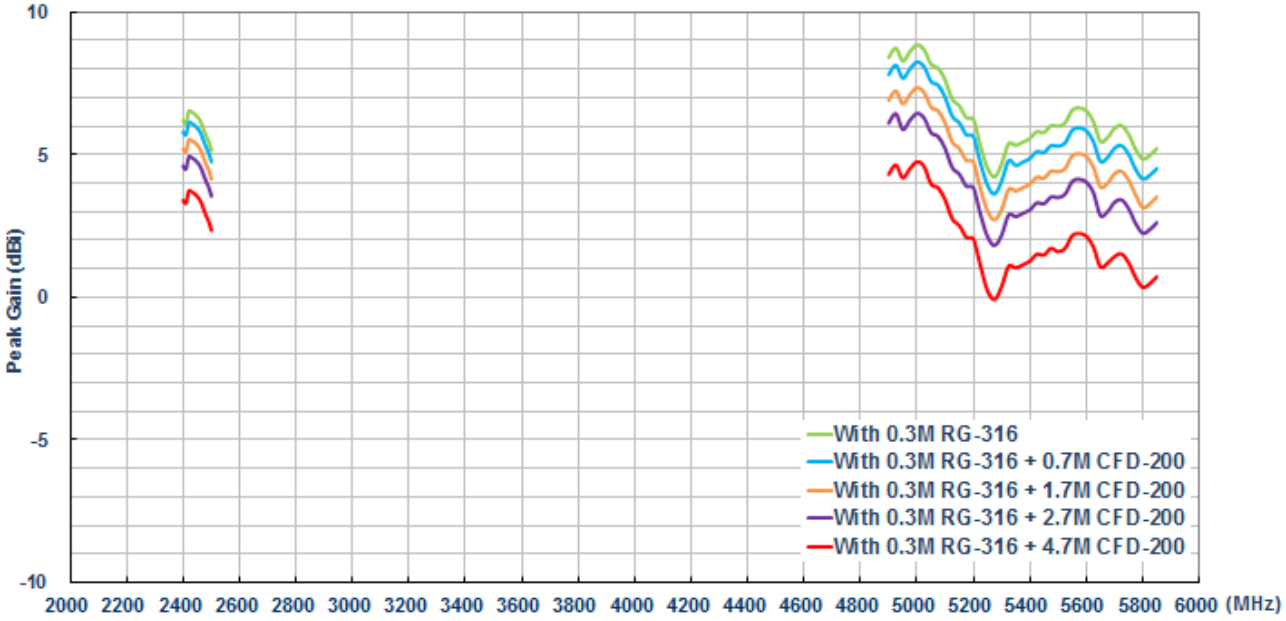
9.1.12. Efficiency on 50*50cm metal base



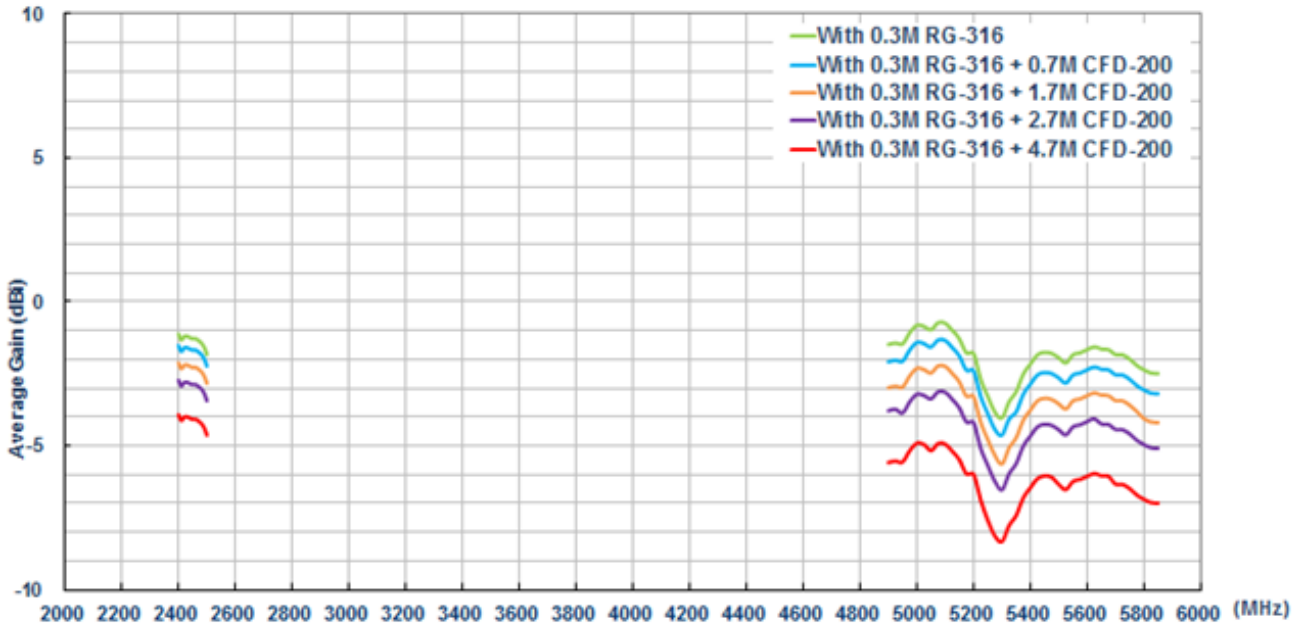
9.1.13. Peak Gain in free space



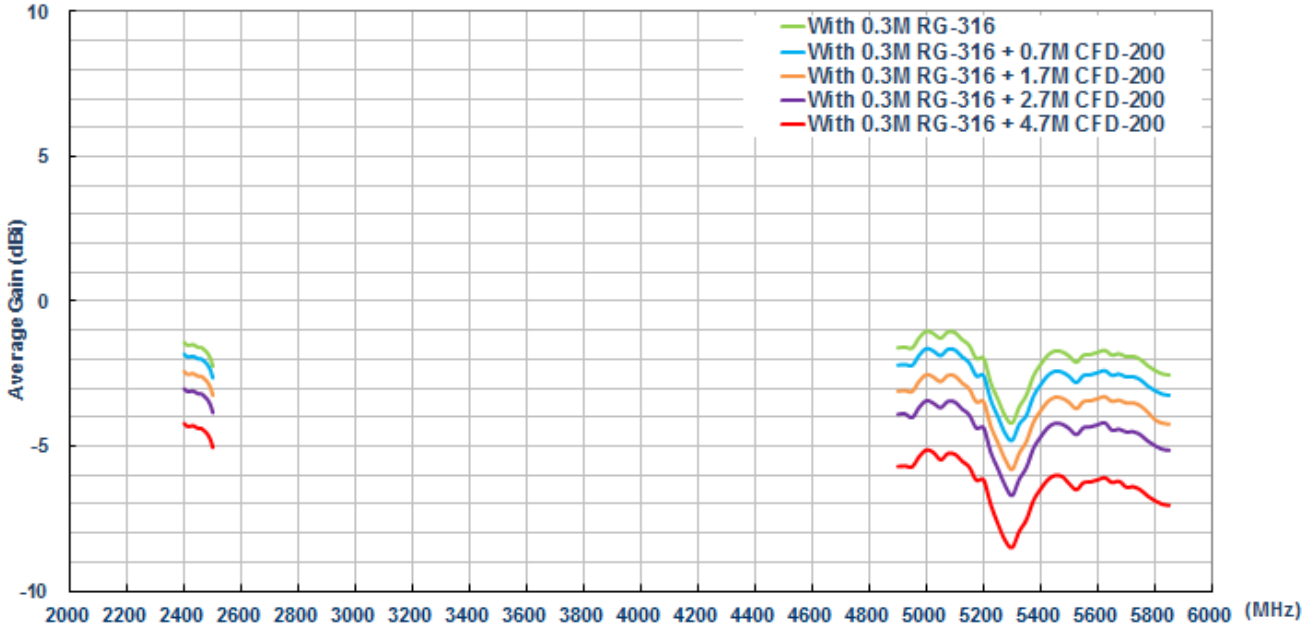
9.1.14. Peak Gain on 50*50cm metal base



9.1.15. Average Gain in free space



9.1.16. Average Gain on 50*50cm metal base



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