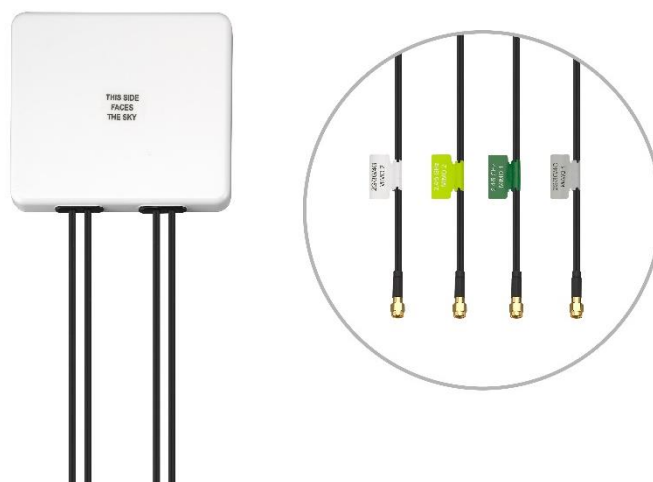


SPECIFICATION

PATENT PENDING

- Part No. : **MA961.W.A.BICG.002**
- Product Name : Guardian 4in1 Adhesive / Wall Mount Antenna
LTE*2+Wi-Fi*2
- Features : Low-profile Housing
Adhesive Mount on Wall or Glass
2* LTE MIMO 698-960MHz / 1710-2170MHz /
2490-2690MHz / 3300-3600MHz
2* Dual Band Wi-Fi MIMO
2400MHz to 2500MHz / 4900MHz to 5850MHz
Worldwide 4G Bands including fallback to 3G and 2G
IP67 Waterproof Enclosure
Dims: 146*134*20mm
3M Low Loss KSR200-P and RG174 Cables
with SMA(M)/RP-SMA(M) connectors
Cables and Connectors Customizable
RoHS Compliant



1. Introduction

The MA961 Guardian is a next generation combination antenna. The first panel antenna worldwide designed for IoT Gateway and Router devices. It is a low profile 4in1 wall and adhesive mount antenna. This unique product delivers powerful worldwide 4G LTE MIMO antenna technology at 700MHz / 800MHz / 1700MHz / 1800MHz / 2600MHz / 3500MHz and dual band Wi-Fi. It is a heavy-duty, fully IP67 waterproof external M2M antenna for use by RF professionals in IoT Gateway and Routers, HD Video Streaming, Transportation and Remote Monitoring Applications.

This antenna delivers powerful MIMO antenna technology for worldwide 4G LTE bands at 698-960MHz / 1710-2170MHz / 2490-2690MHz / 3300-3600MHz bands and dual 2.4/5.8GHz Wi-Fi. It enables designers to cover a wide range of technologies by installing a single antenna.

4G wireless applications demand high speed data uplink and downlink. High efficiency and high gain MIMO antennas are necessary to achieve the required signal to noise ratio and throughput required to solve these challenges. Taoglas also takes care to have high isolation among these antennas to prevent self-interference. Low loss cables used to keep efficiency high over long cable lengths.

The housing is made of durable ASA, is IP67 waterproof and comes with 3M foam adhesive. The antenna can be mounted internally or externally on a vehicle or building. The MA961 comes with 3 meters CFD-200 cable as standard. Customized cables and connector versions are also available.

2. Specification

4G/3G/2G MIMO1 Antenna									
Frequency (MHz)		LTE700	GSM850	GSM900	DCS	PCS	UMTS1	LTE2600	LTE3500
		698~803	824~894	880~960	1710~1880	1850~1990	1920~2170	2490~2690	3300~3600
Efficiency (%)									
In free space	30cm	80.59	64.37	61.48	67.87	72.91	76.16	47.65	55.23
	1M	76.15	61.48	58.71	61.90	66.50	70.02	43.45	49.00
	2M	71.06	56.46	53.55	55.17	58.52	61.35	37.52	41.47
	3M	65.87	52.33	49.65	49.03	51.74	54.25	32.54	35.03
	5M	56.97	44.54	41.98	38.65	40.59	42.27	24.39	25.12
Average Gain (dBi)									
In free space	30cm	-0.95	-1.92	-2.11	-1.69	-1.37	-1.19	-3.42	-2.64
	1M	-1.19	-2.12	-2.31	-2.09	-1.77	-1.55	-3.82	-3.17
	2M	-1.49	-2.49	-2.71	-2.59	-2.33	-2.13	-4.45	-3.89
	3M	-1.82	-2.82	-3.04	-3.10	-2.86	-2.66	-5.08	-4.62
	5M	-2.45	-3.52	-3.77	-4.13	-3.92	-3.75	-6.33	-6.07
Peak Gain (dBi)									
In free space	30cm	3.83	3.32	1.83	4.23	4.23	4.70	4.11	3.36
	1M	3.63	3.12	1.63	3.83	3.83	4.30	3.71	3.36
	2M	3.33	2.82	1.23	3.33	3.33	3.80	3.11	2.66
	3M	3.03	2.42	0.85	2.73	2.73	3.20	2.51	1.86
	5M	2.33	1.72	0.15	1.73	1.73	2.10	1.31	0.46

4G/3G/2G MIMO2 Antenna									
Frequency (MHz)		LTE700	GSM850	GSM900	DCS	PCS	UMTS1	LTE2600	LTE3500
		698~803	824~894	880~960	1710~1880	1850~1990	1920~2170	2490~2690	3300~3600
Efficiency (%)									
In free space	30cm	80.00	63.77	59.51	67.36	72.20	76.03	57.82	64.24
	1M	75.66	60.90	56.84	61.43	65.84	69.92	52.74	56.94
	2M	70.61	55.93	51.83	54.75	57.94	61.24	45.51	48.21
	3M	65.44	51.84	48.09	48.66	51.23	54.16	39.45	40.77
	5M	56.55	44.12	40.66	38.36	40.18	42.20	29.58	29.22
Average Gain (dBi)									
In free space	30cm	-0.99	-1.96	-2.26	-1.72	-1.42	-1.20	-2.47	-1.93
	1M	-1.23	-2.16	-2.46	-2.12	-1.82	-1.56	-2.87	-2.46
	2M	-1.53	-2.53	-2.86	-2.62	-2.37	-2.14	-3.50	-3.18
	3M	-1.86	-2.86	-3.19	-3.13	-2.91	-2.67	-4.13	-3.91
	5M	-2.49	-3.56	-3.92	-4.16	-3.96	-3.76	-5.38	-5.36
Peak Gain (dBi)									
In free space	30cm	4.86	3.06	2.81	4.41	4.67	4.56	3.95	4.15
	1M	4.66	2.86	2.61	4.01	4.27	4.19	3.55	3.55
	2M	4.36	2.56	2.21	3.51	3.77	3.66	2.95	2.85
	3M	4.06	2.16	1.91	2.99	3.17	3.06	2.35	2.15
	5M	3.36	1.46	1.21	1.99	2.17	2.06	1.15	0.65

4G/3G/2G	
Impedance	50Ω
Polarization	Linear
VSWR	< 3
Cable	3 meters CFD-200 standard, fully customizable
Connector	SMA(M) standard, fully customizable

2.4GHz/5GHz Wi-Fi Antenna			
Frequency (MHz)		2400~2500	4900~5850
Efficiency (%)			
MIMO_1	30cm	69.77	59.81
	1M	63.63	51.43
	2M	55.42	41.67
	3M	48.27	33.81
	5M	36.62	22.18
MIMO_2	30cm	70.19	59.69
	1M	64.01	51.32
	2M	55.75	41.57
	3M	48.56	33.71
	5M	36.84	22.12
Average Gain (dBi)			
MIMO_1	30cm	-1.57	-2.27
	1M	-1.97	-2.92
	2M	-2.57	-3.84
	3M	-3.17	-4.75
	5M	-4.37	-6.58
MIMO_2	30cm	-1.54	-2.25
	1M	-1.94	-2.91
	2M	-2.54	-3.82
	3M	-3.14	-4.73
	5M	-4.34	-6.56
Peak Gain (dBi)			
MIMO_1	30cm	4.87	4.95
	1M	4.37	4.26
	2M	3.77	3.36
	3M	3.17	2.46
	5M	1.97	0.66
MIMO_2	30cm	4.93	5.09
	1M	4.43	4.39
	2M	3.83	3.49
	3M	3.23	2.59
	5M	2.03	0.79
Impedance	50Ω		
Polarization	Linear		
VSWR	< 3		
Cable	3 meters CFD-200 standard, fully customizable		
Connector	SMA(M) standard, fully customizable		

MECHANICAL	
Antenna Dimensions	146*134*20mm
Casing	ABS+PC
Base and thread	Nickel Plated Aluminum
Weight	586g
Ingress Protection Rating	IP67
ENVIRONMENTAL	
Operation Temperature	-40°C to 85°C
Storage Temperature	-40°C to 90°C
Humidity	Non-condensing 65°C 95% RH

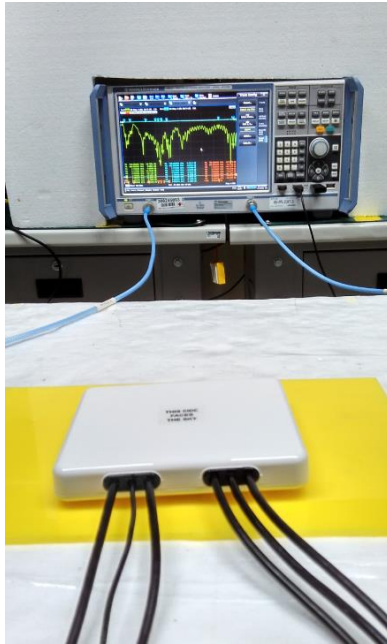
3. Antenna Characteristics

3.1 LTE_MIMO/Wi-Fi_MIMO Antenna

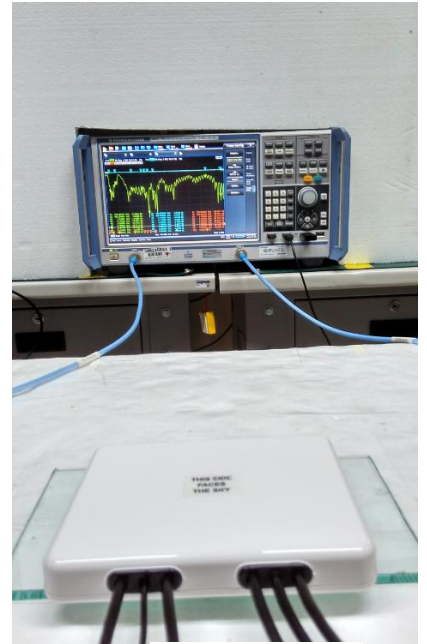
3.1.1 Test Setup



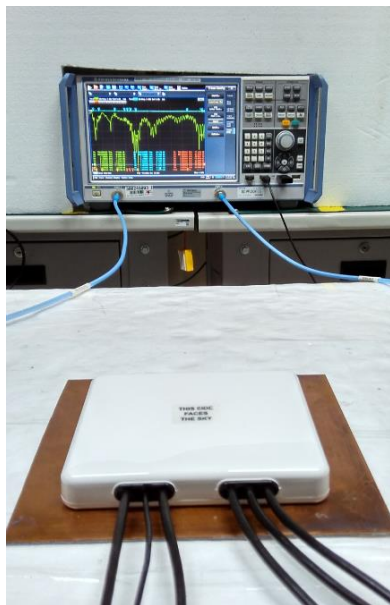
Free space



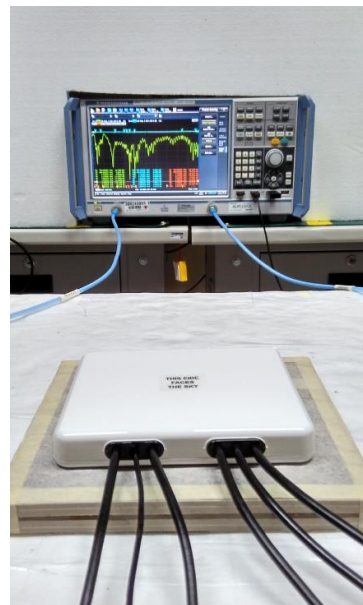
ABS



Glass



Metal



Wall

3.1.2 LTE_1 Antenna Return Loss

Performance in different environments with 1 meter cable length

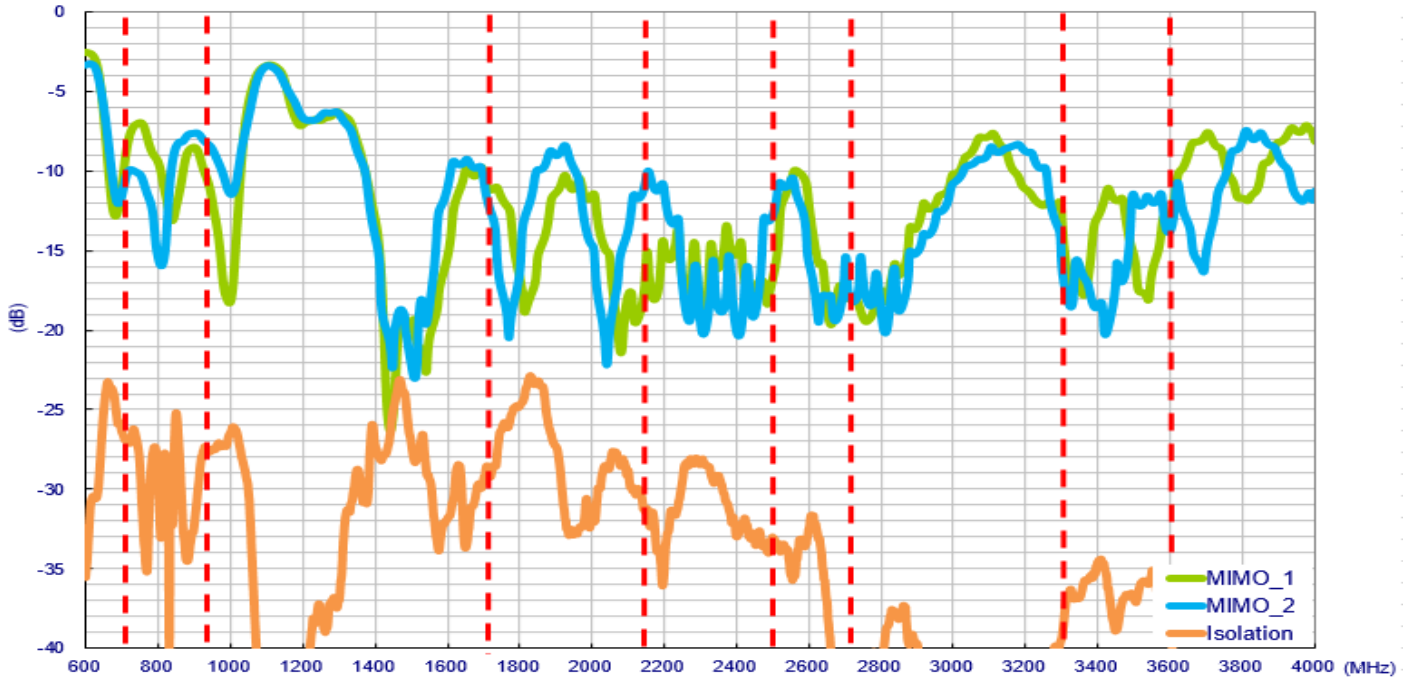


Figure 1. Return loss of MA961 LTE MIMO antenna in free space

3.1.3 LTE Antenna Efficiency

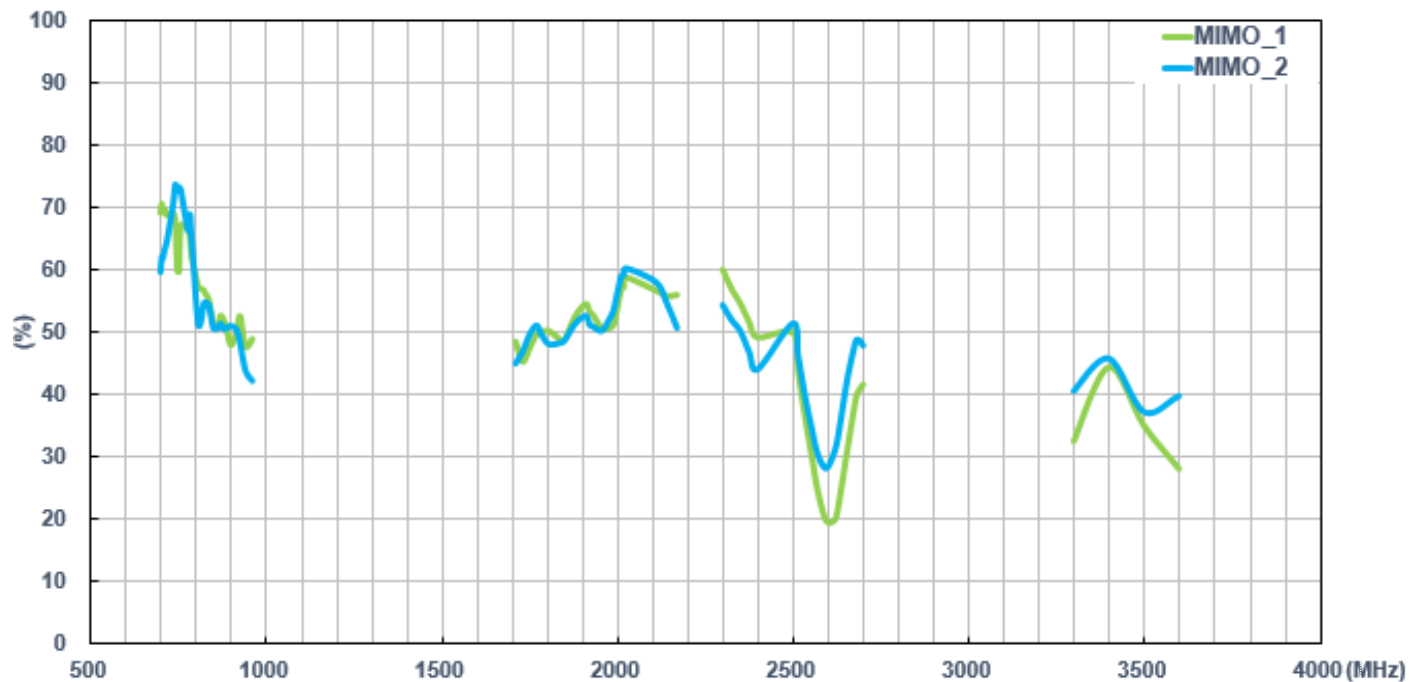


Figure 2. Efficiency of MA961 LTE MIMO antenna in free space

3.1.4 LTE Antenna Average Gain

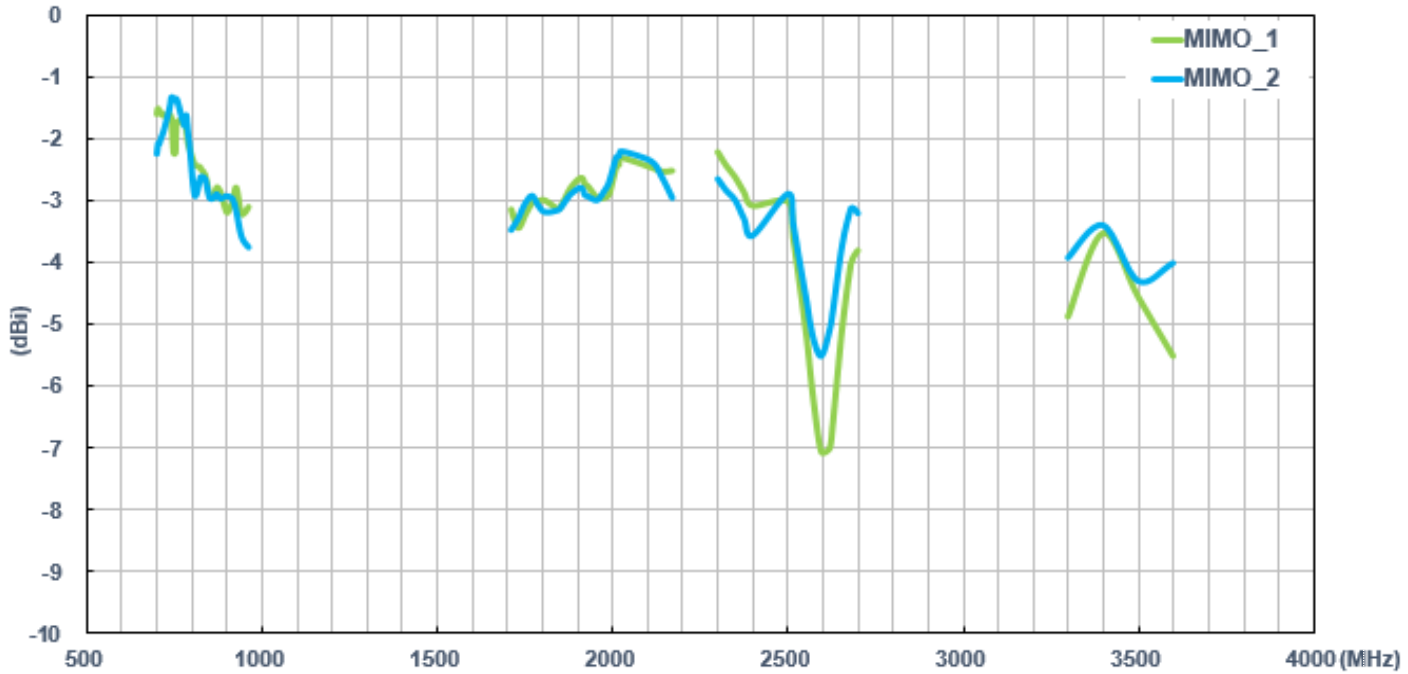


Figure 3. Average gain of MA961 LTE MIMO antenna in free space

3.1.5 LTE Antenna Peak Gain

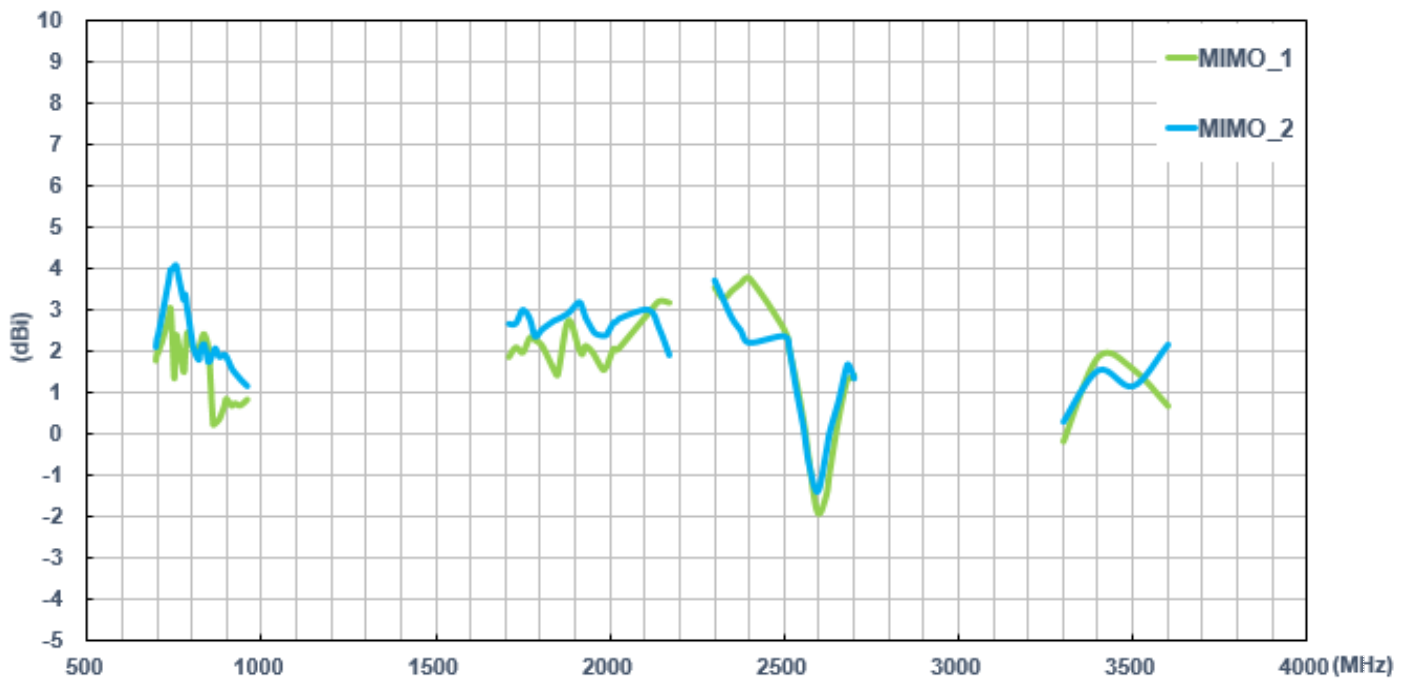


Figure 4. Peak gain of MA961 LTE MIMO antenna in the free space

3.2 Wi-Fi MIMO Antenna

3.2.1 Wi-Fi Antenna Return Loss and Isolation with 3-meter cable length

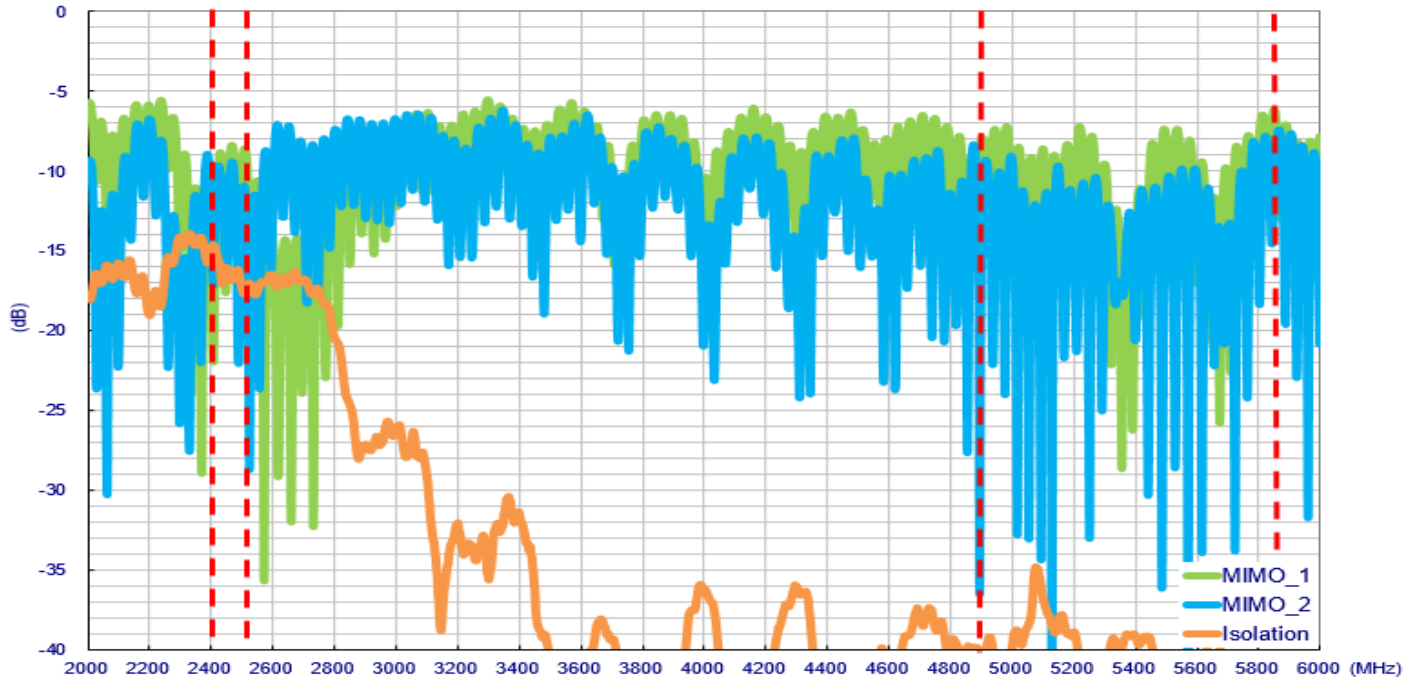


Figure 5. Return loss of MA961 Wi-Fi MIMO antenna in free space

3.2.2 Wi-Fi Antenna Efficiency

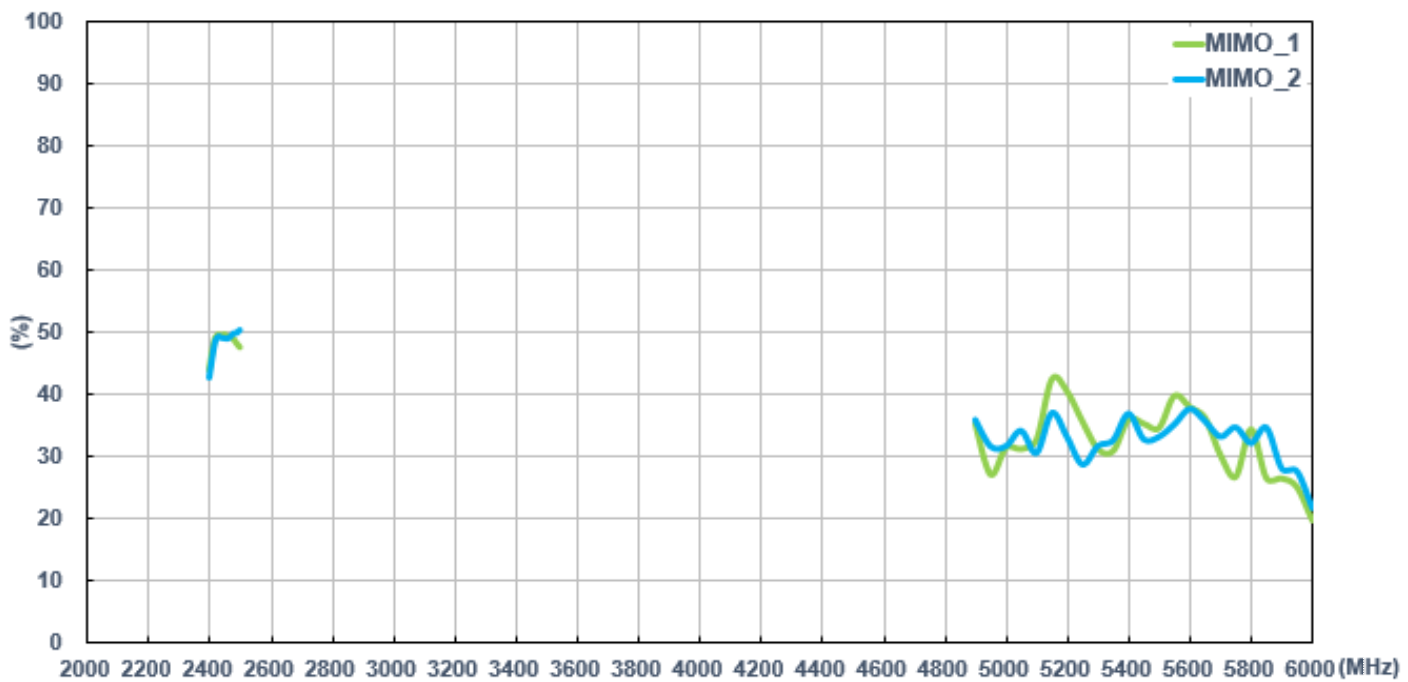


Figure 6. Efficiency of MA961 Wi-Fi MIMO antenna in free space

3.2.3 Wi-Fi Antenna Average Gain

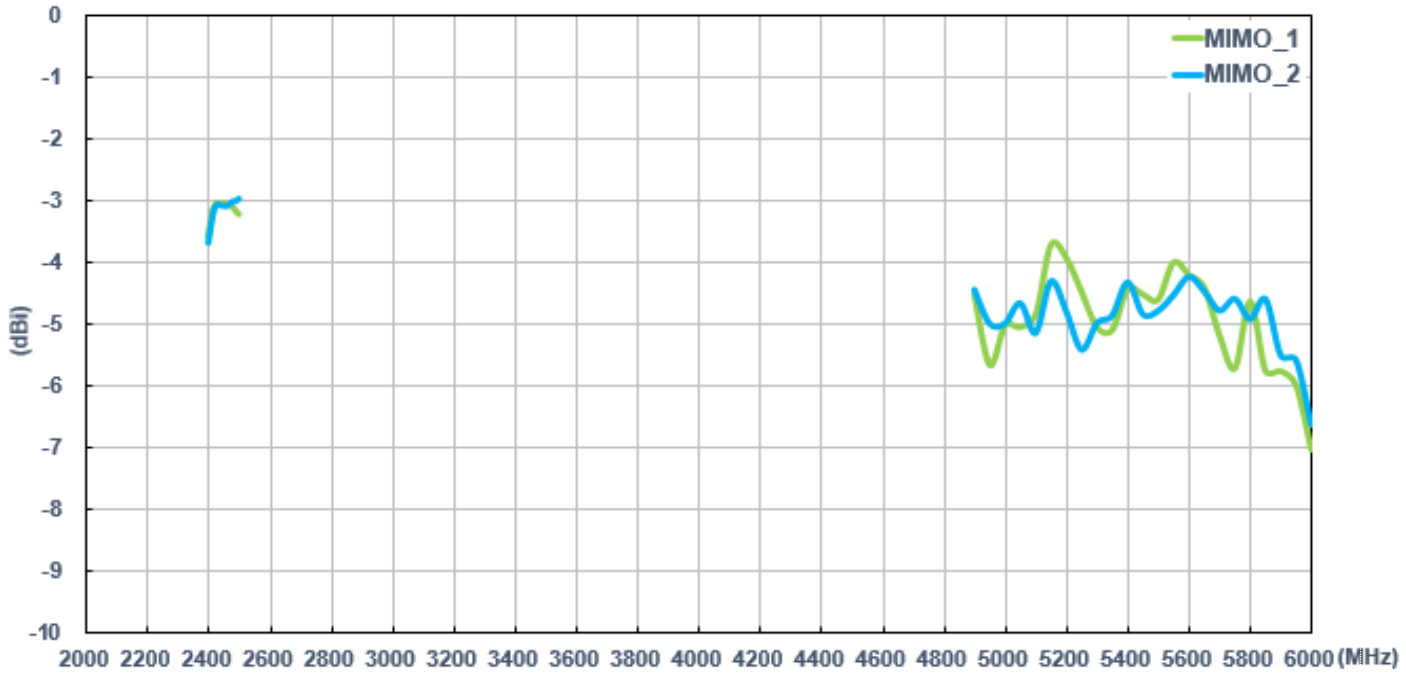


Figure 7. Average gain of MA961 Wi-Fi MIMO antenna in free space

3.2.4 Wi-Fi Antenna Peak Gain

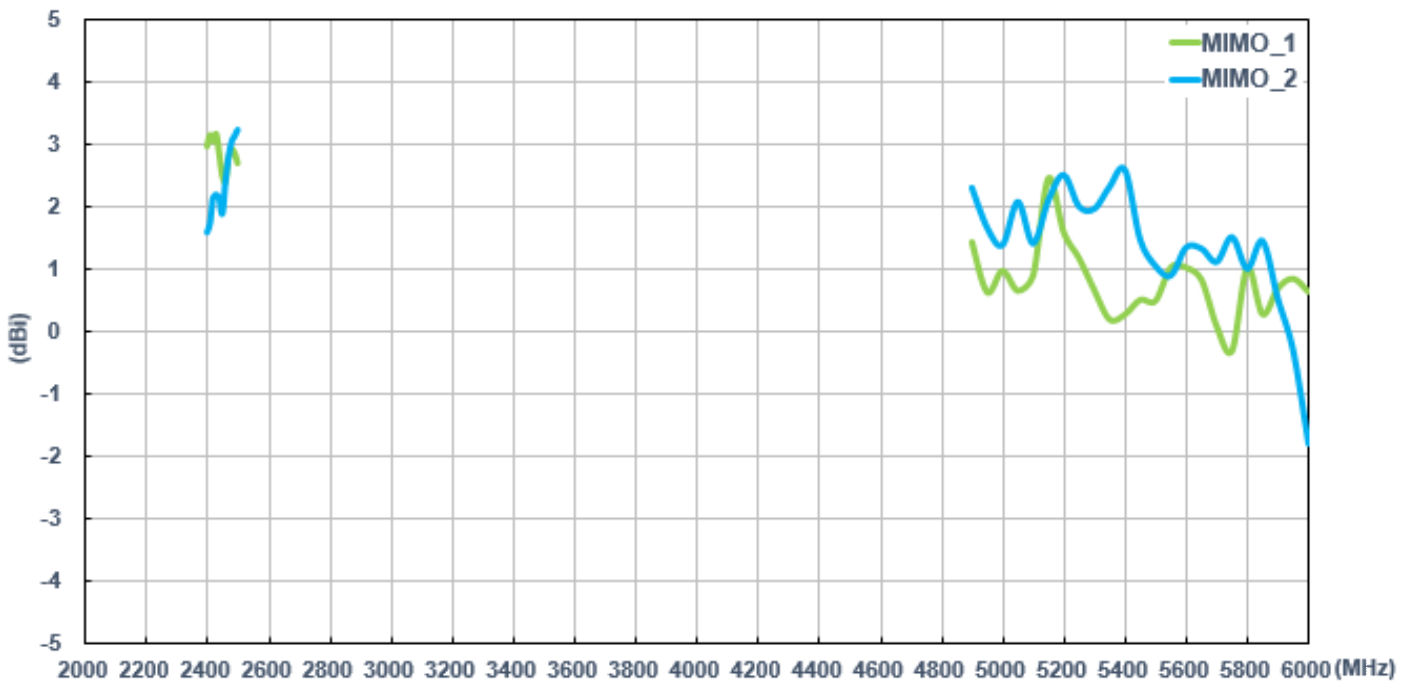


Figure 8. Peak gain of MA961 Wi-Fi MIMO antenna in the free space

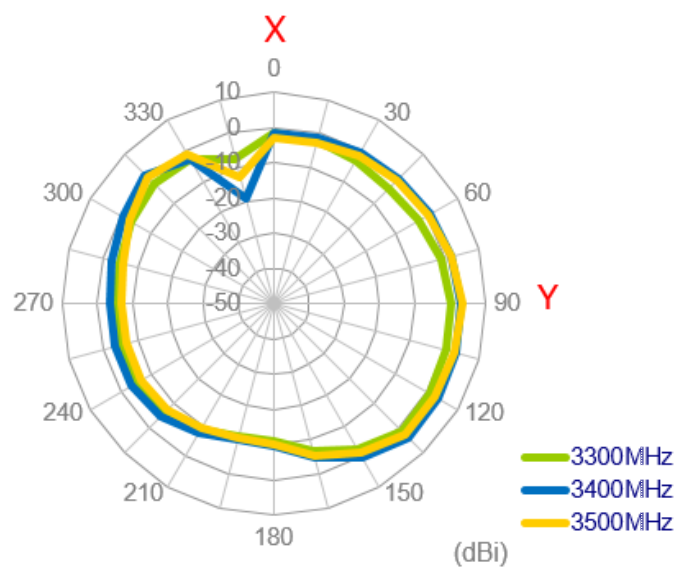
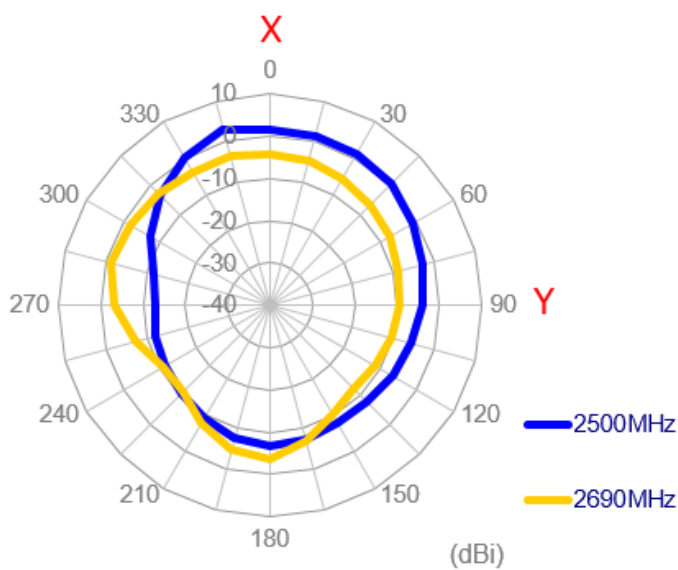
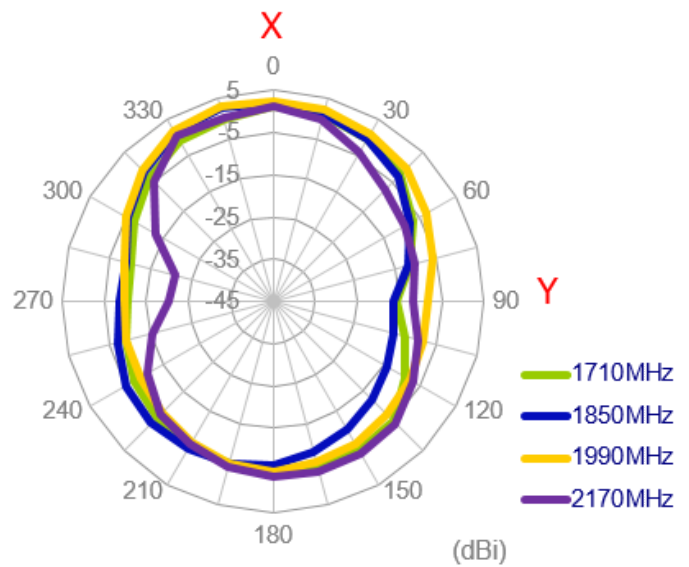
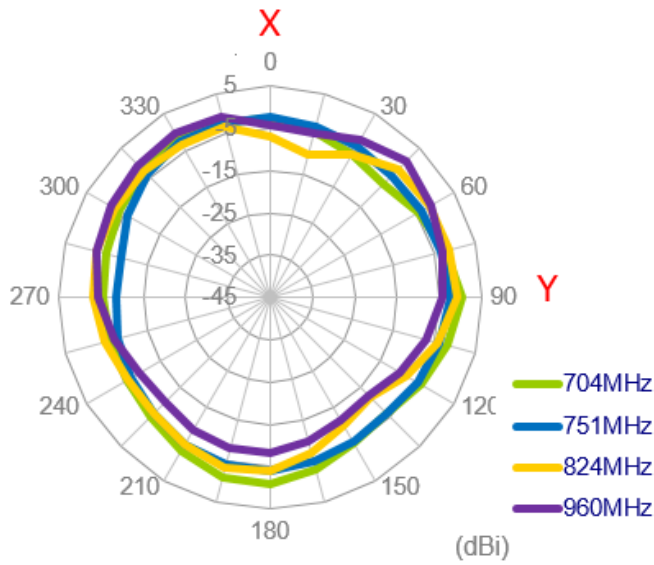
3.3 Test Setup for Antenna Radiation Pattern (ETS Anechoic chamber)



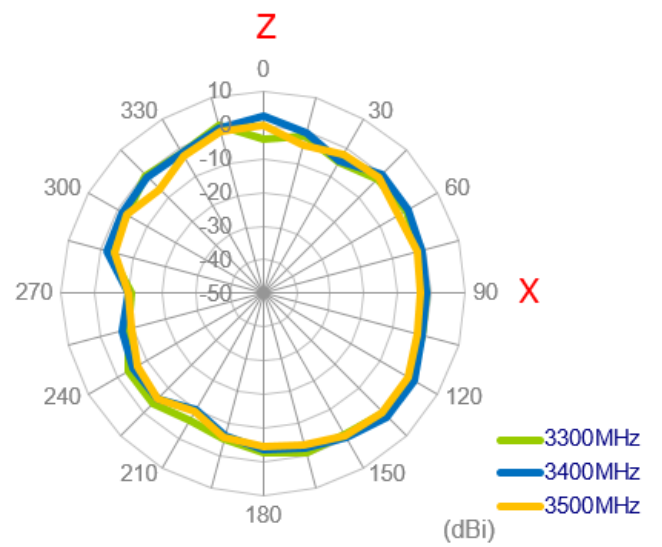
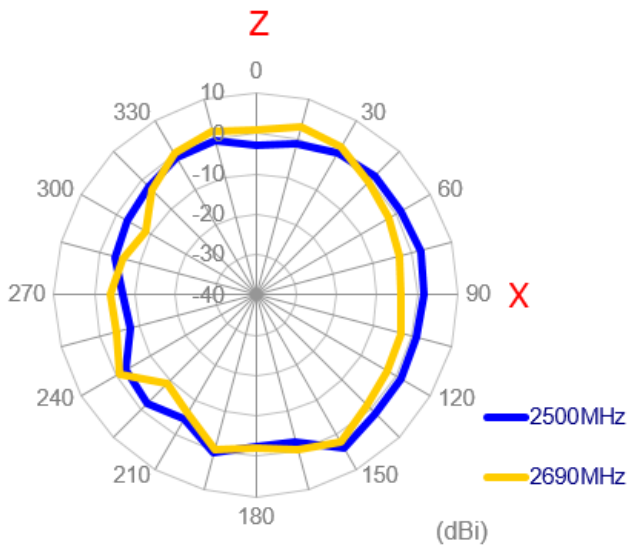
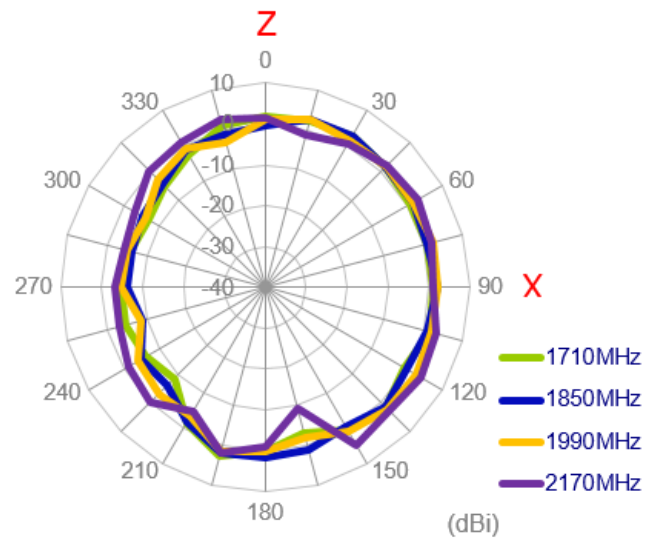
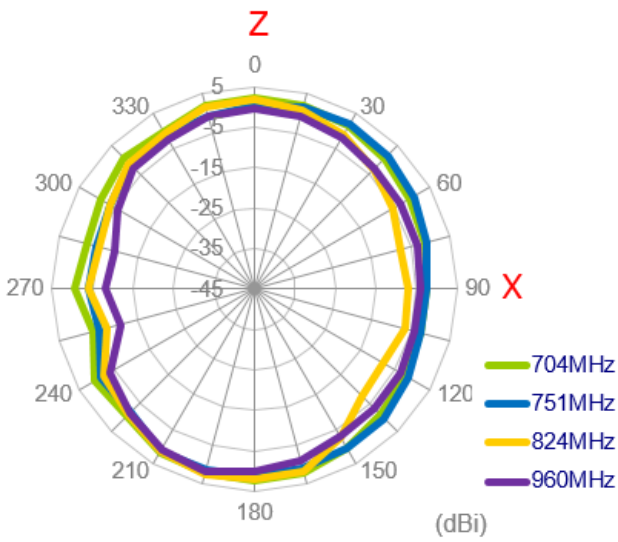
In free space

3.1.21 2D Radiation Pattern (LTE_MIMO1 with 3M cable length in free space)

XY Plane

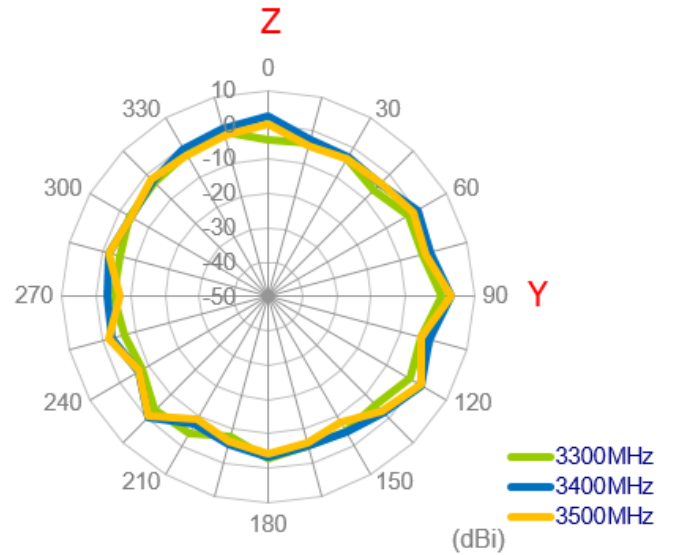
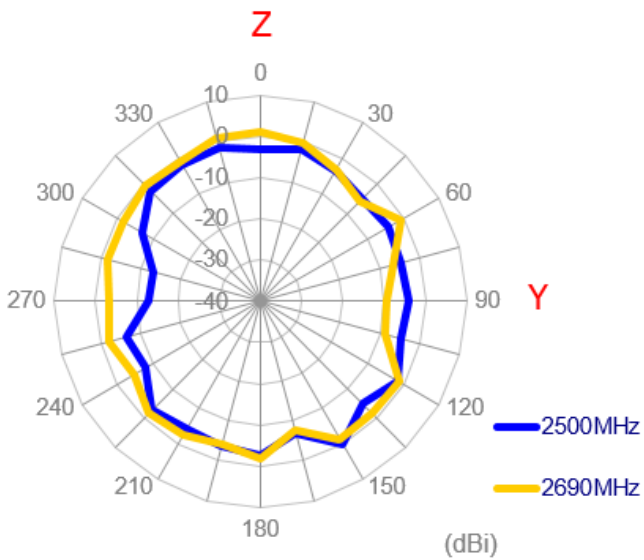
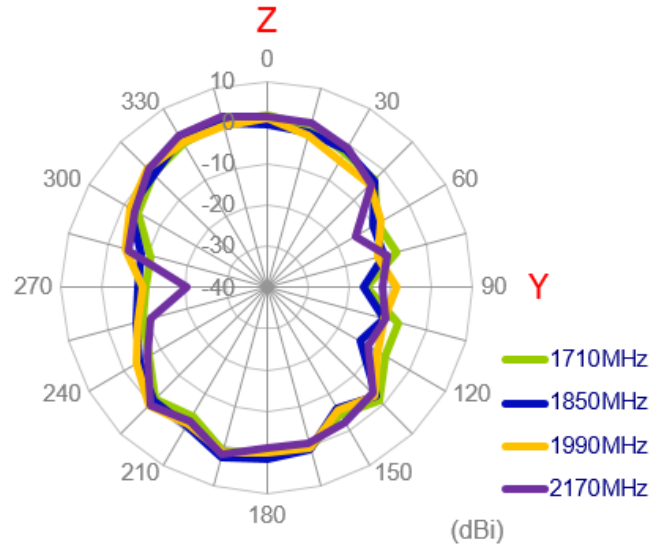
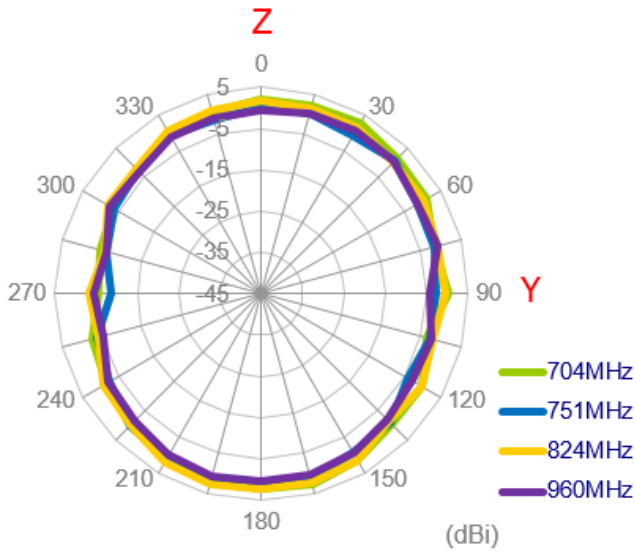


XZ Plane

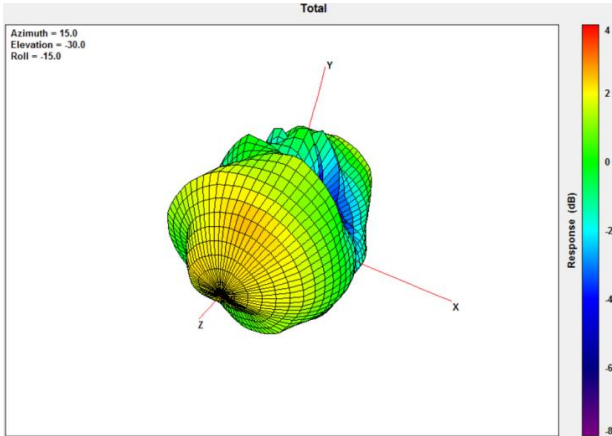




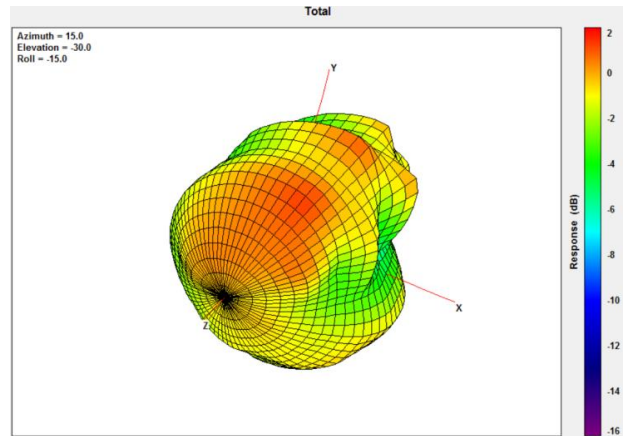
YZ Plane



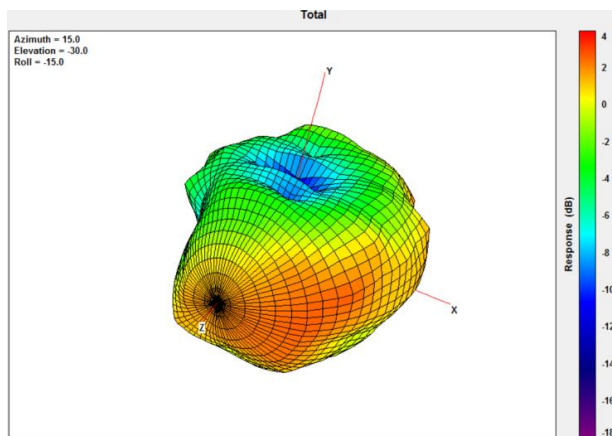
3.3.2 3D Radiation Pattern (LTE_MIMO1 with 3M cable length in free space)



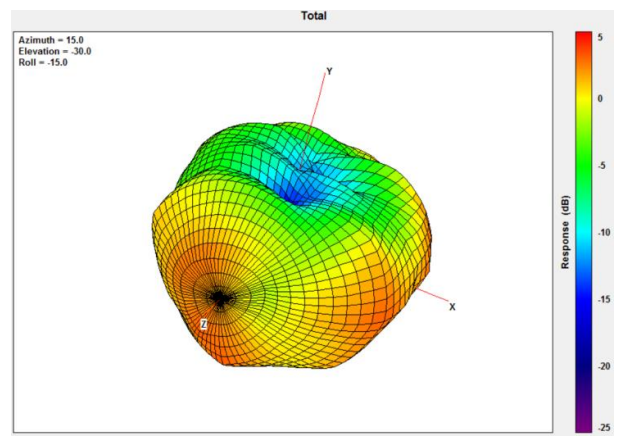
704MHz



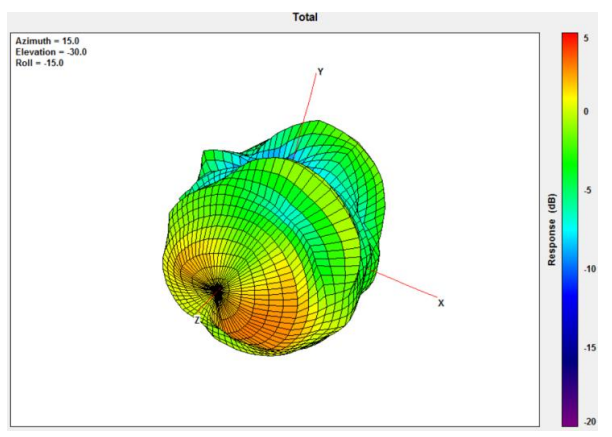
960MHz



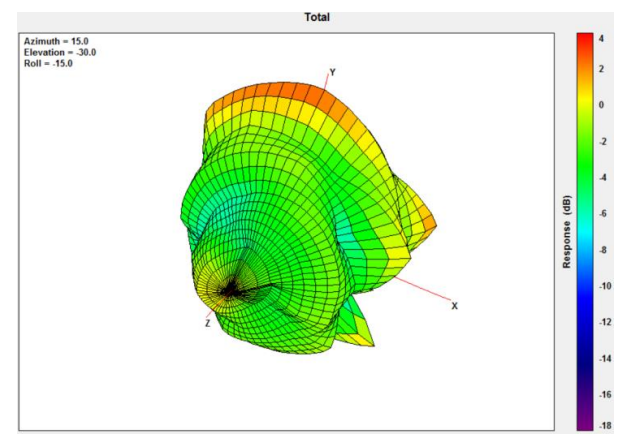
1710MHz



2170MHz



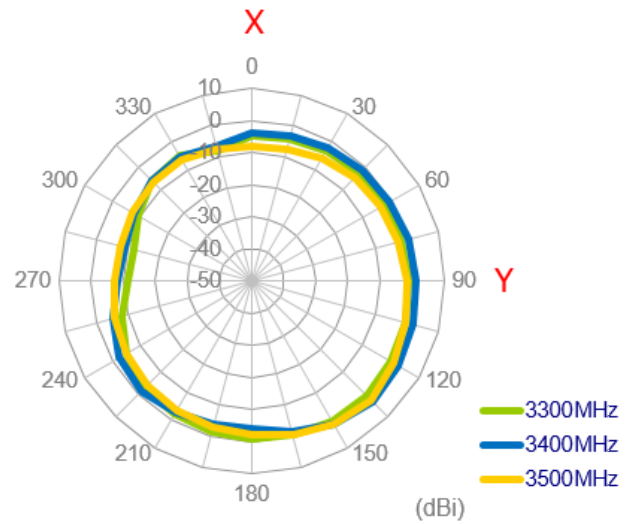
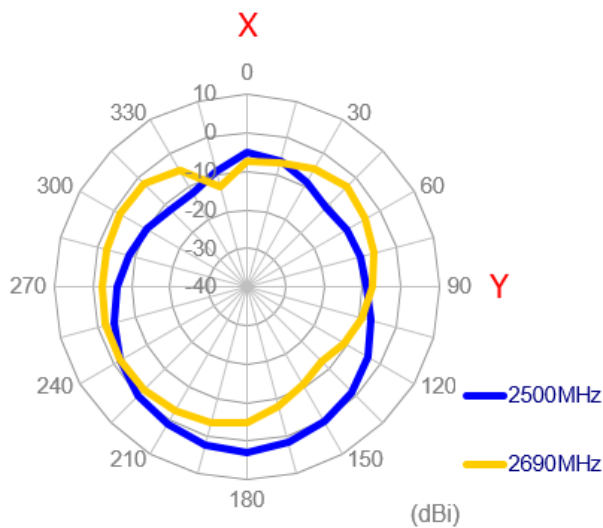
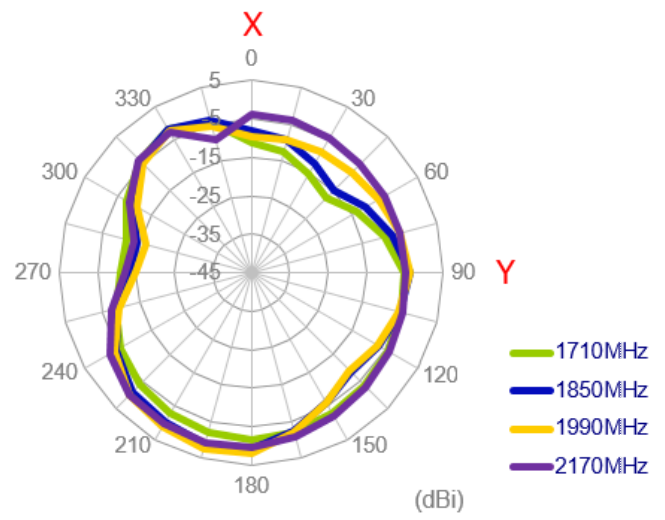
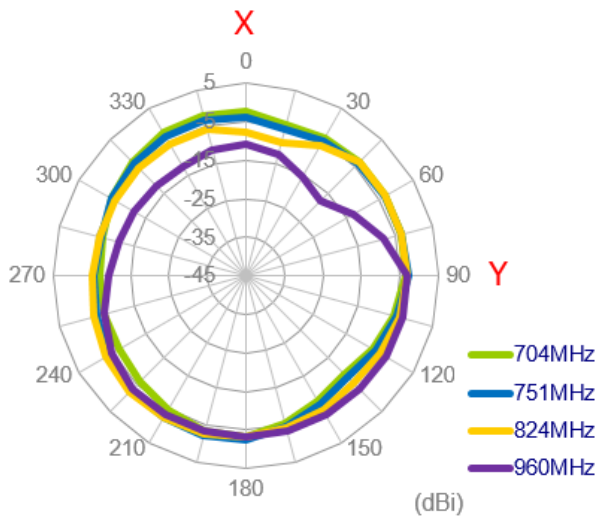
2690MHz



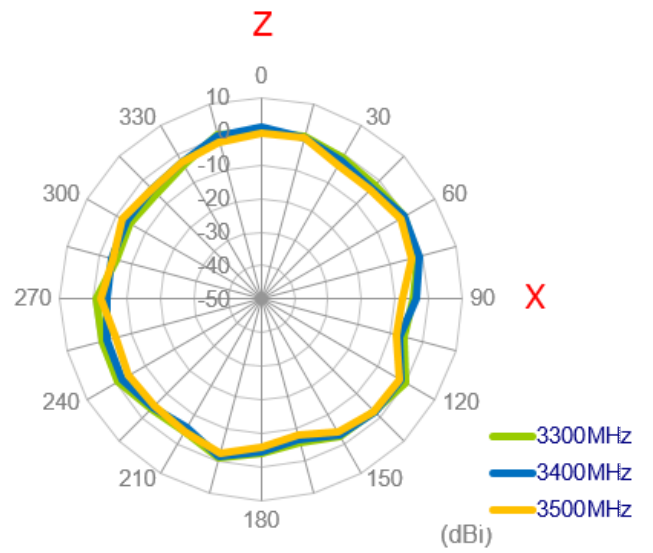
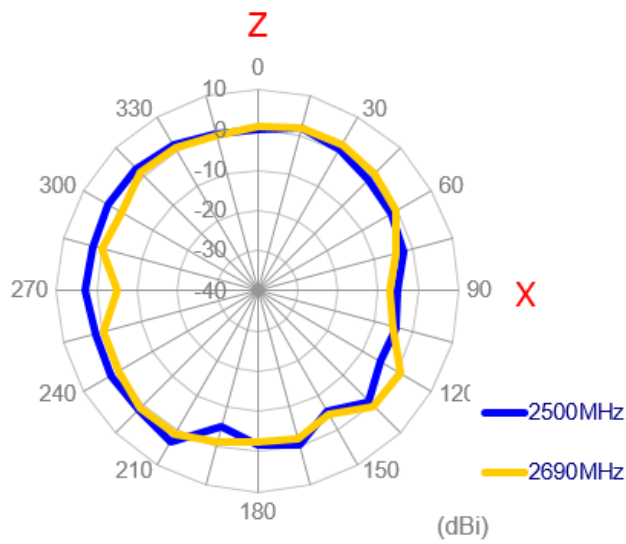
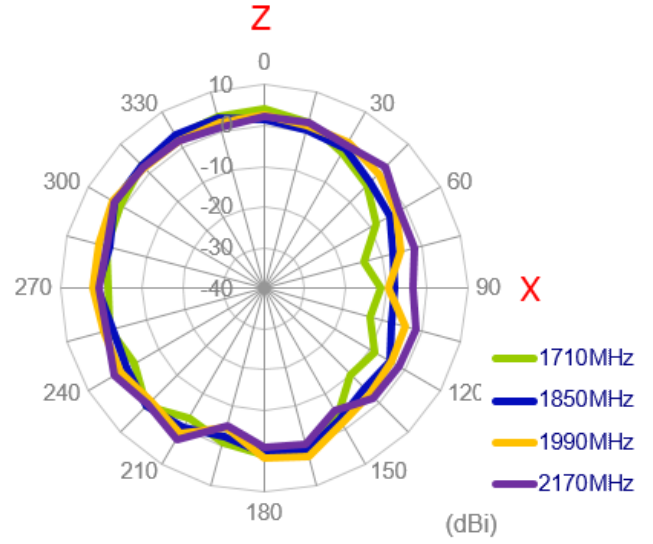
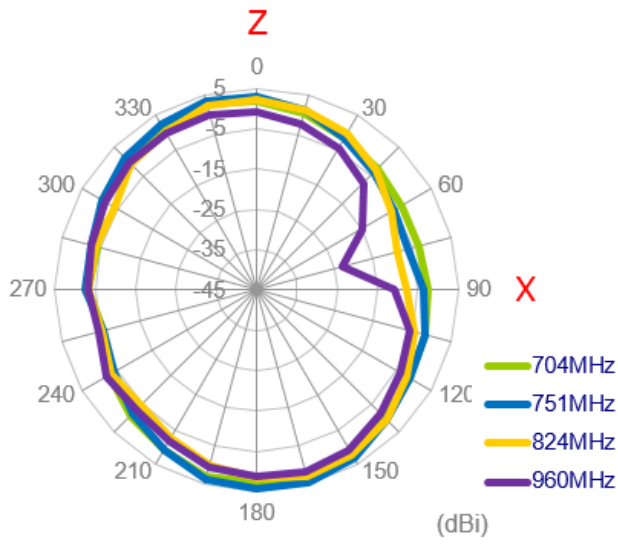
3500MHz

3.3.3 2D Radiation Pattern (LTE_MIMO2 with 3M cable length in free space)

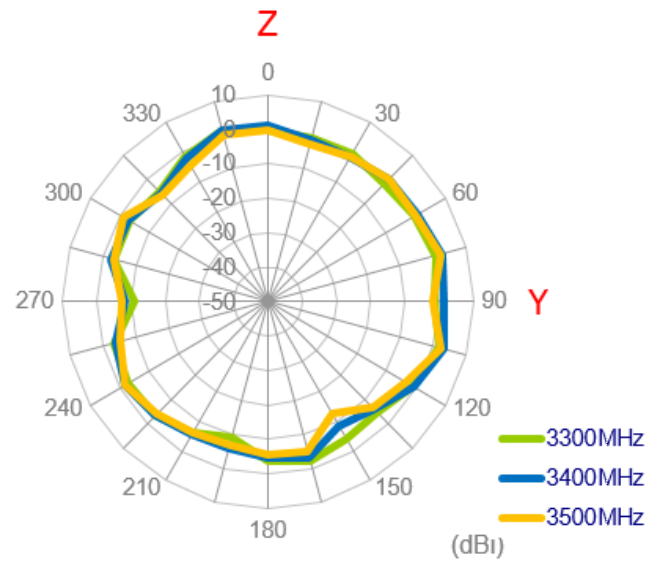
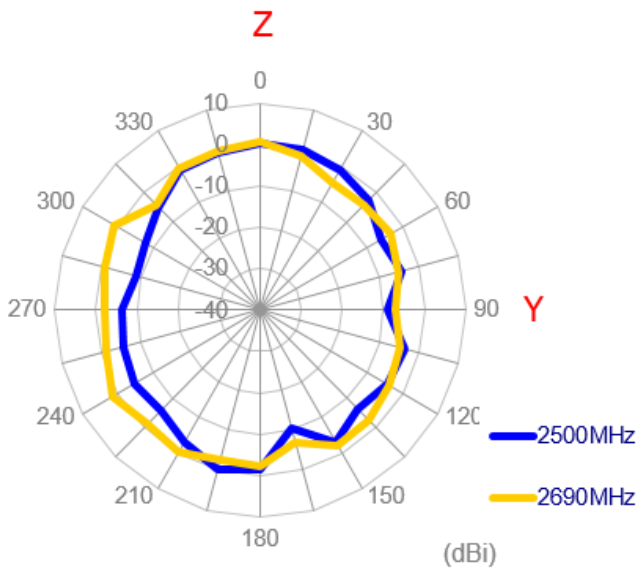
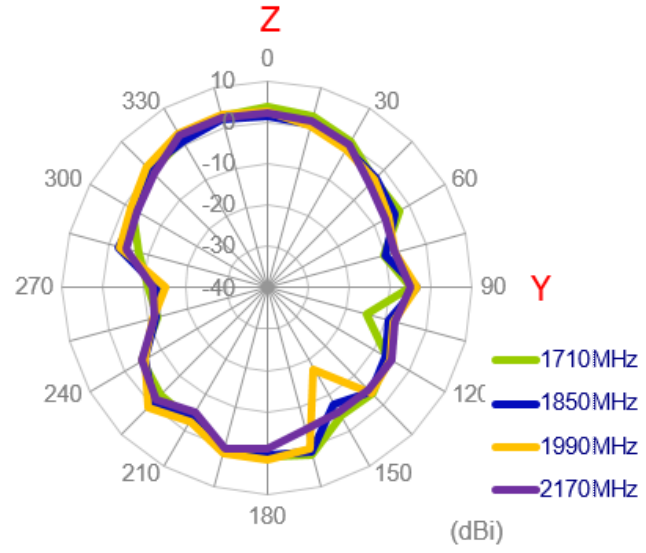
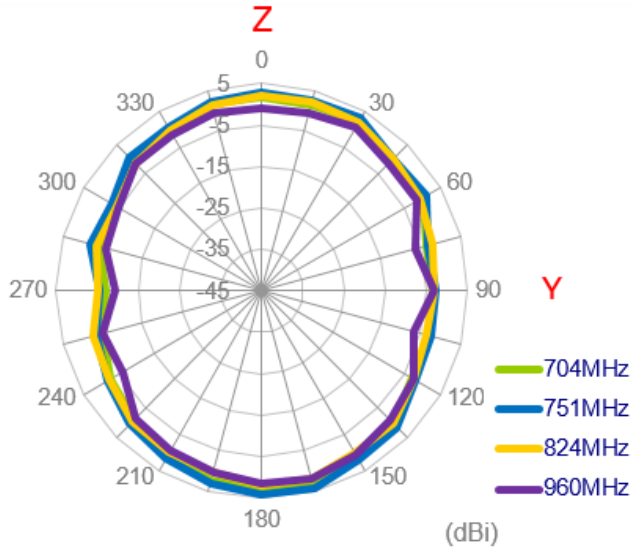
XY Plane



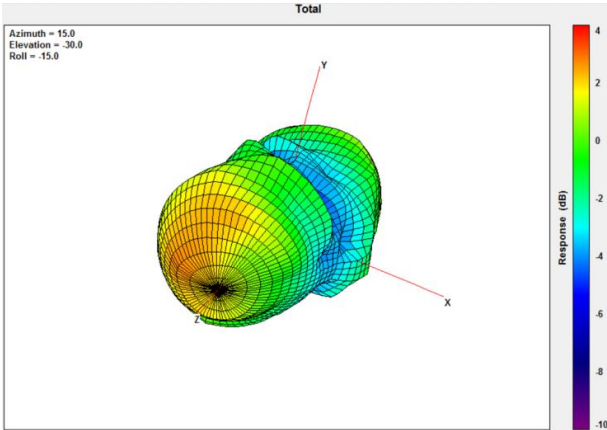
XZ Plane



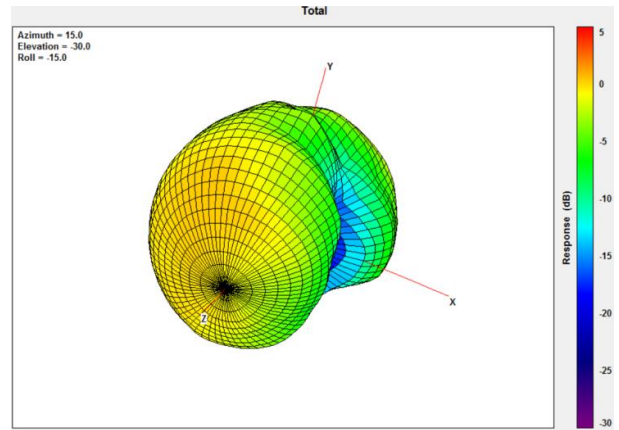
YZ Plane



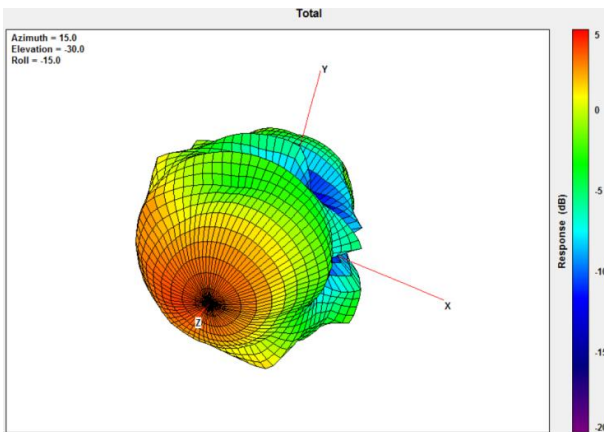
3.1.24 3D Radiation Pattern (LTE_MIMO2 with 1M cable length in free space)



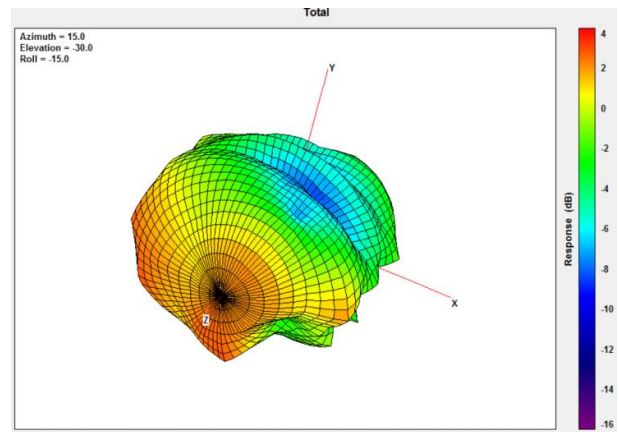
704MHz



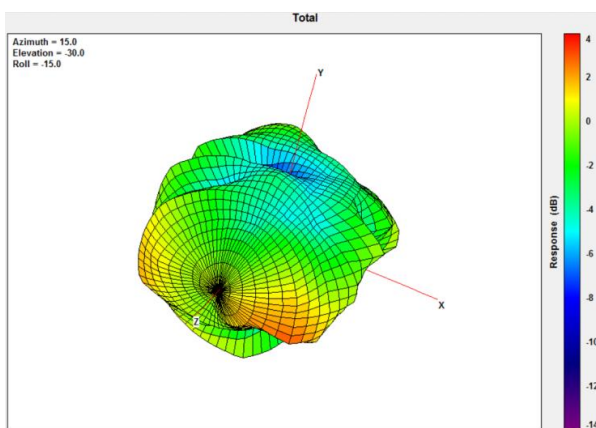
960MHz



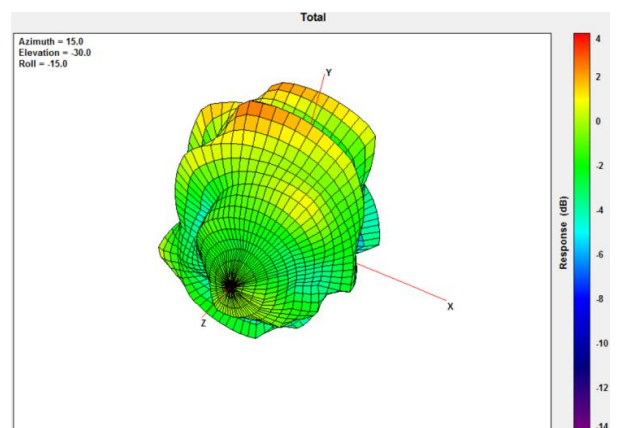
1710MHz



2170MHz



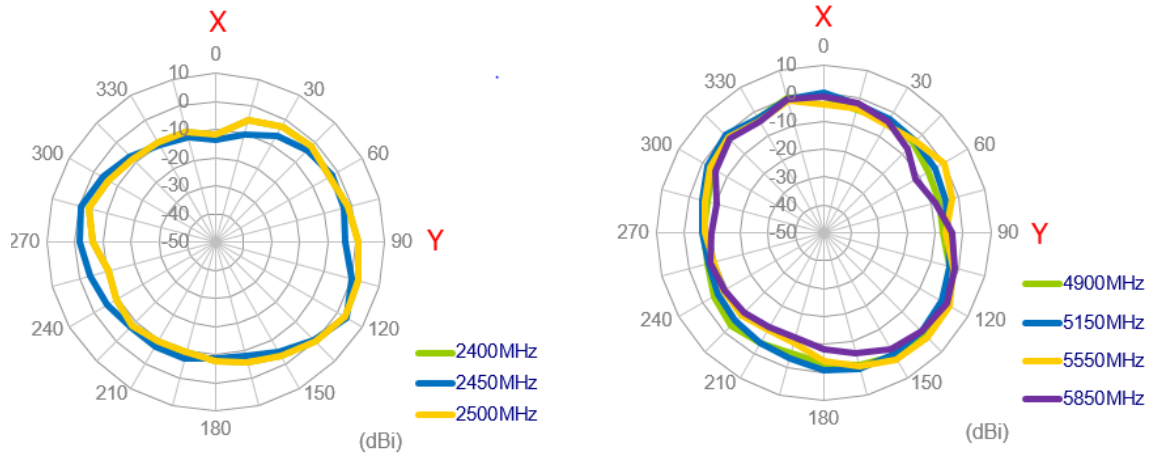
2690MHz



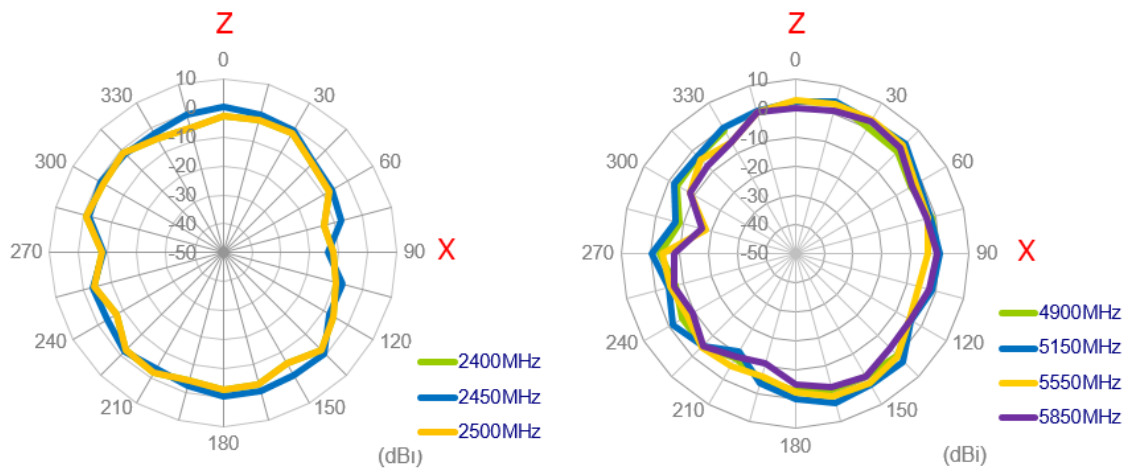
3500MHz

3.3.5 2D Radiation Pattern (Wi-Fi_MIMO1 with 3M cable length in free space)

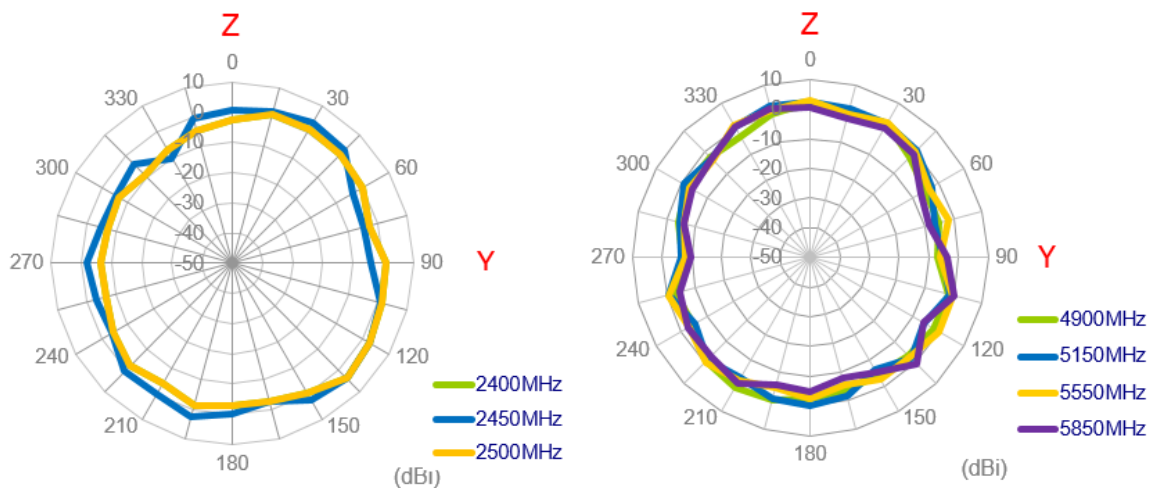
XY Plane



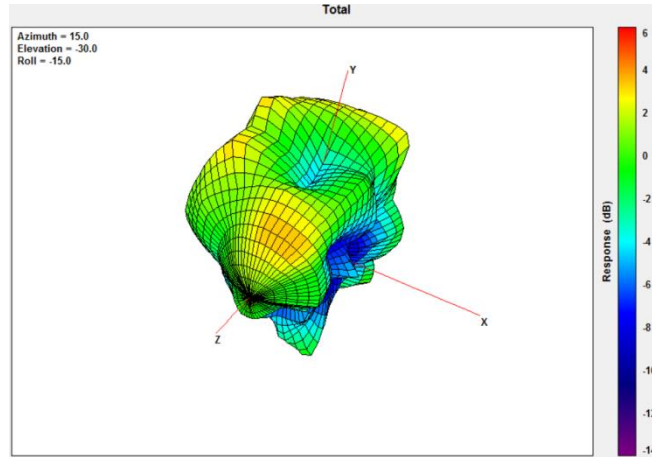
XZ Plane



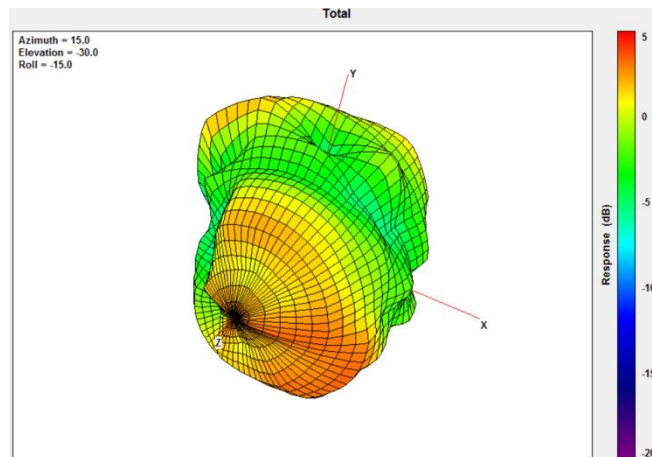
YZ Plane



3.3.6 3D Radiation Pattern (Wi-Fi_MIMO1 with 3M cable length in free space)



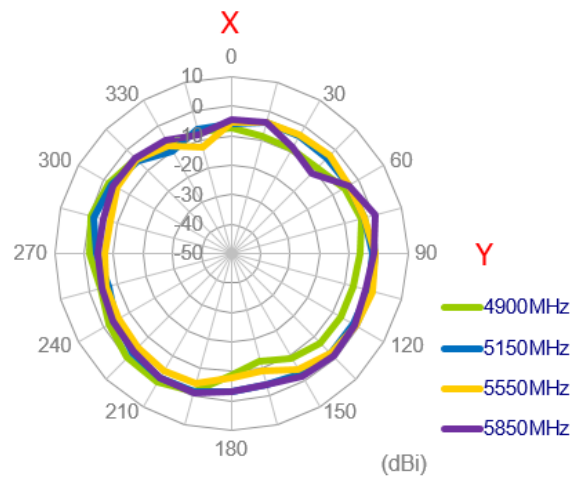
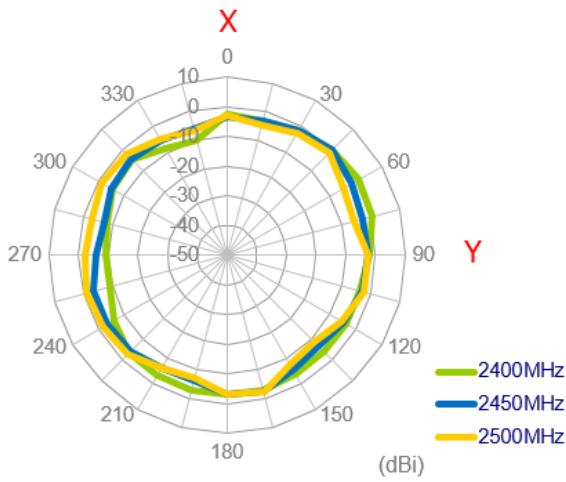
2450MHz



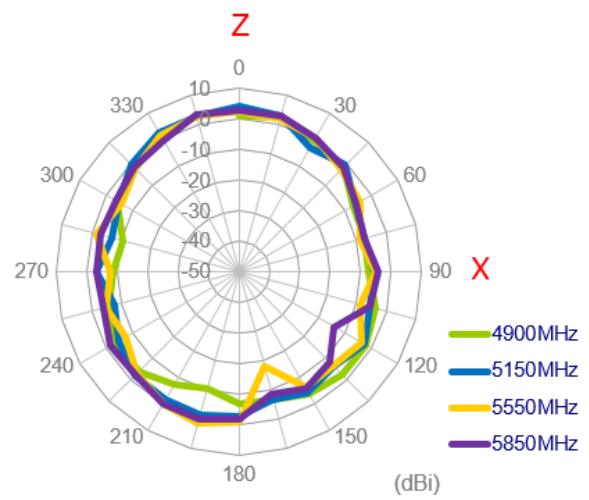
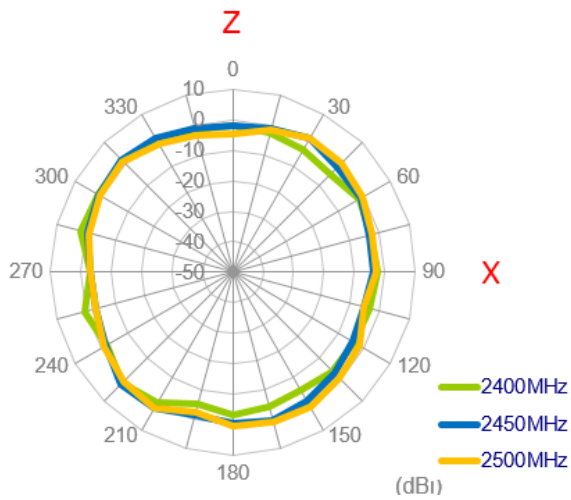
5550MHz

3.3.7 2D Radiation Pattern (Wi-Fi_MIMO2 with 3M cable length in free space)

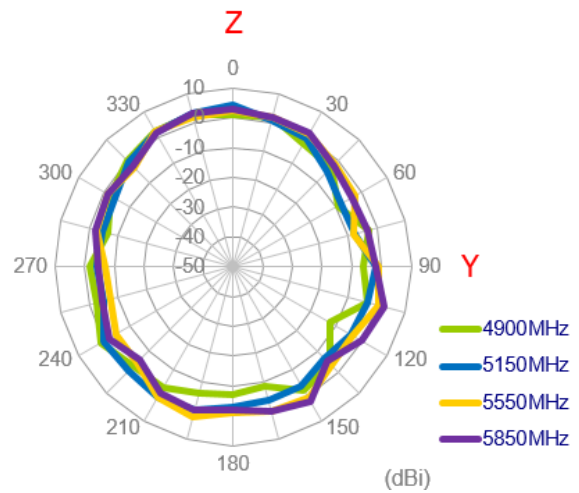
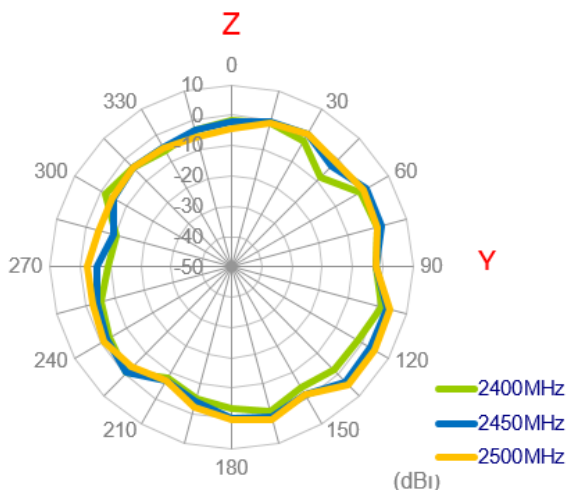
XY Plane



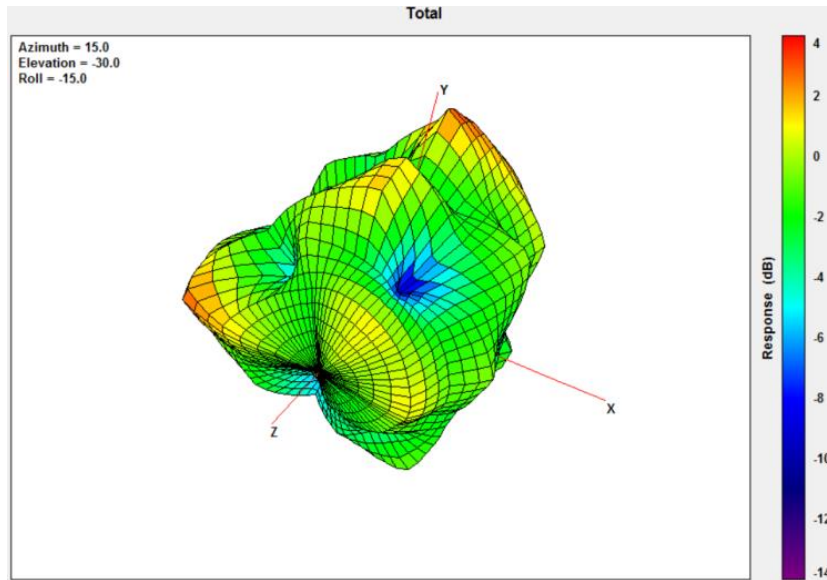
XZ Plane



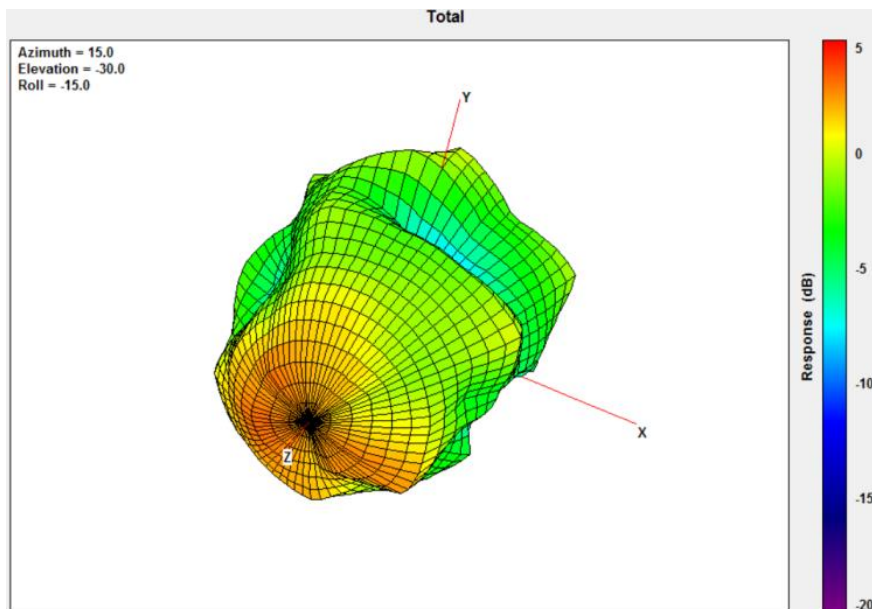
YZ Plane



3.3.8 3D Radiation Pattern (Wi-Fi_MIMO2 with 3M cable length in free space)

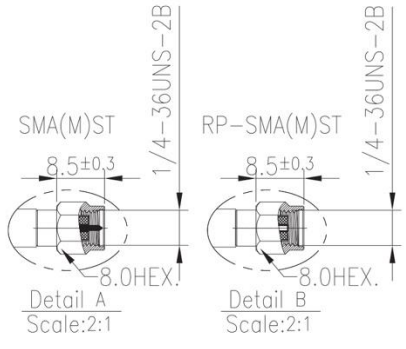
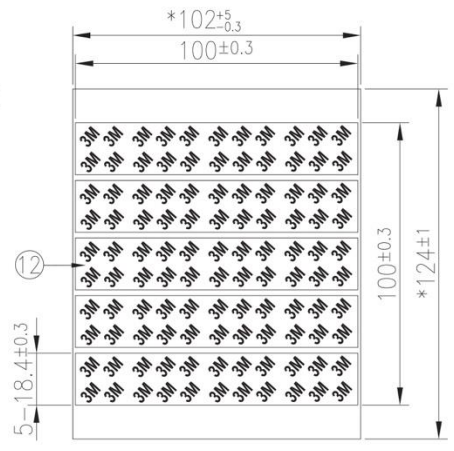
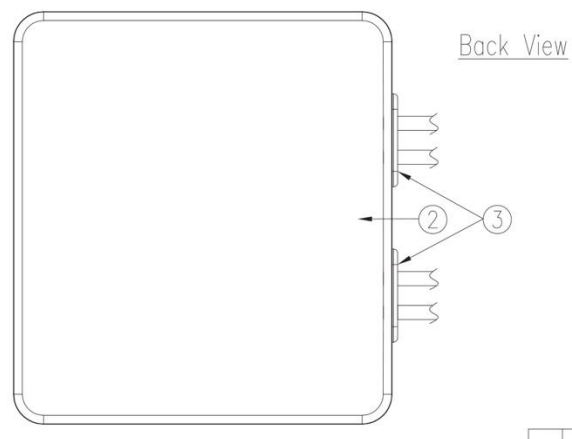
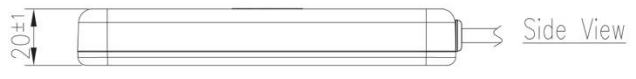
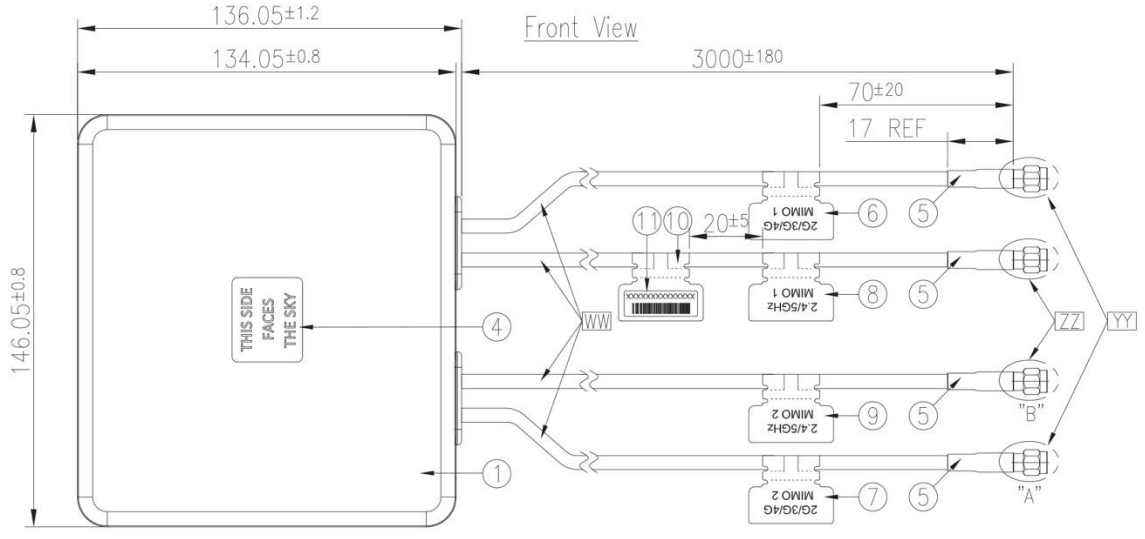


2450MHz



5550MHz

4. Mechanical Drawing (Unit: mm)

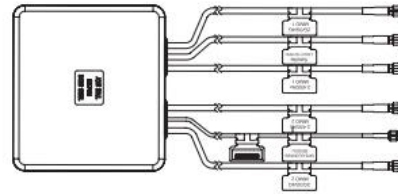


	Name	Material	Finish	QTY
1	Top Housing	ASA	Black	1
2	Bottom Housing	ASA	Black	1
3	Rubber-2 Holes	Silicone Rubber	Black	2
4	Clear Label	PET	Transparent	1
5	Heat Shrink Tube	PE	Black	4
6	2G/3G/4G MIMO1 Label	PEPA	Light Gray	1
7	2G/3G/4G MIMO2 Label	PEPA	White	1
8	2.4/5 GHz MIMO1 Label	PEPA	Dark Green	1
9	2.4/5 GHz MIMO2 Label	PEPA	Green Yellow	1
10	Empty Label(48*30)	PEPA	White	1
11	Barcode Label(25*9)	PET	White	1
12	Double sided Adhesive	3M VHB 4615	White Liner	1

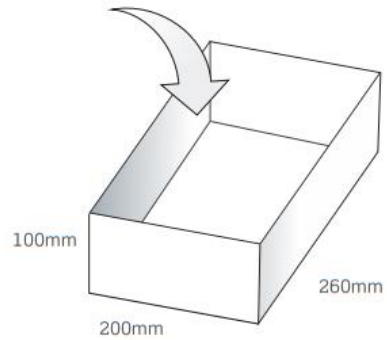
	Name	Material	Finish	QTY
WW	Cable Type	KSR200-P	Black	4
YY	Connector Type(KSR200-P)	SMA(M)ST	Au Plated	2
ZZ	Connector Type(KSR200-P)	RP-SMA(M)ST	Au Plated	2

5. Packaging

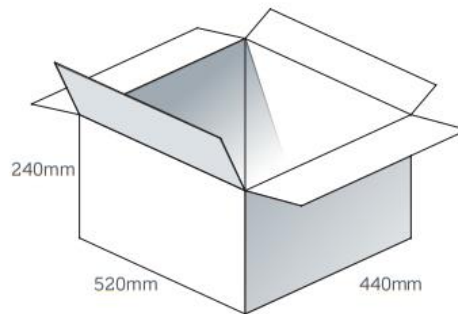
Packaging Specifications



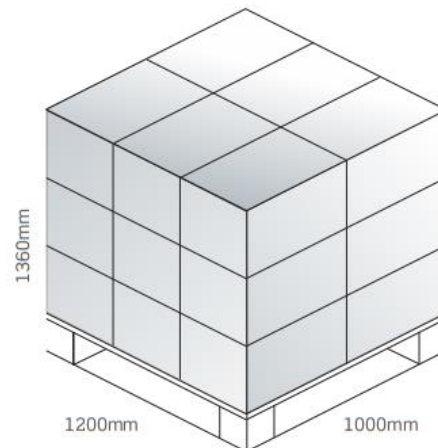
1 No. MA961.W.A.BICG.001 per small box
 Box Dimensions - 260 x 200 x 100mm
 Weight - 891g



1 Outer Carton
 Carton Dimensions - 520 x 440 x 240mm
 8 pcs MA961.W.A.BICG.001 per carton
 Weight - 7.6Kg



Pallet Dimensions 1200*1000*1360mm
 18 Cartons per Pallet
 6 Cartons per layer
 3 Layers

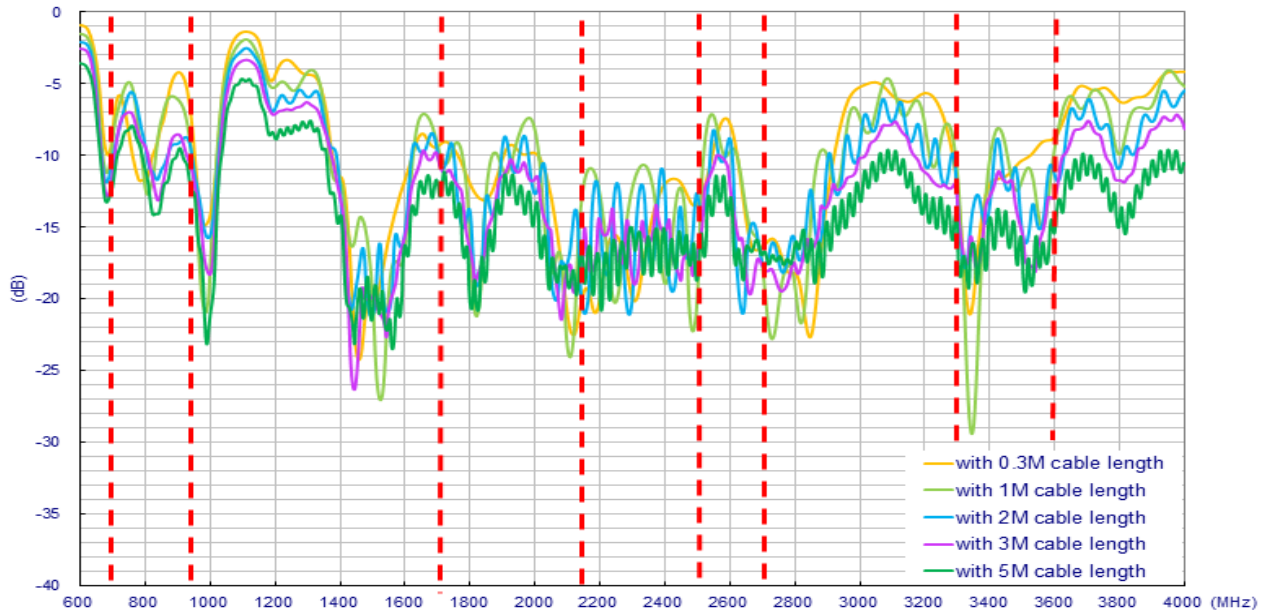


6. Application Note

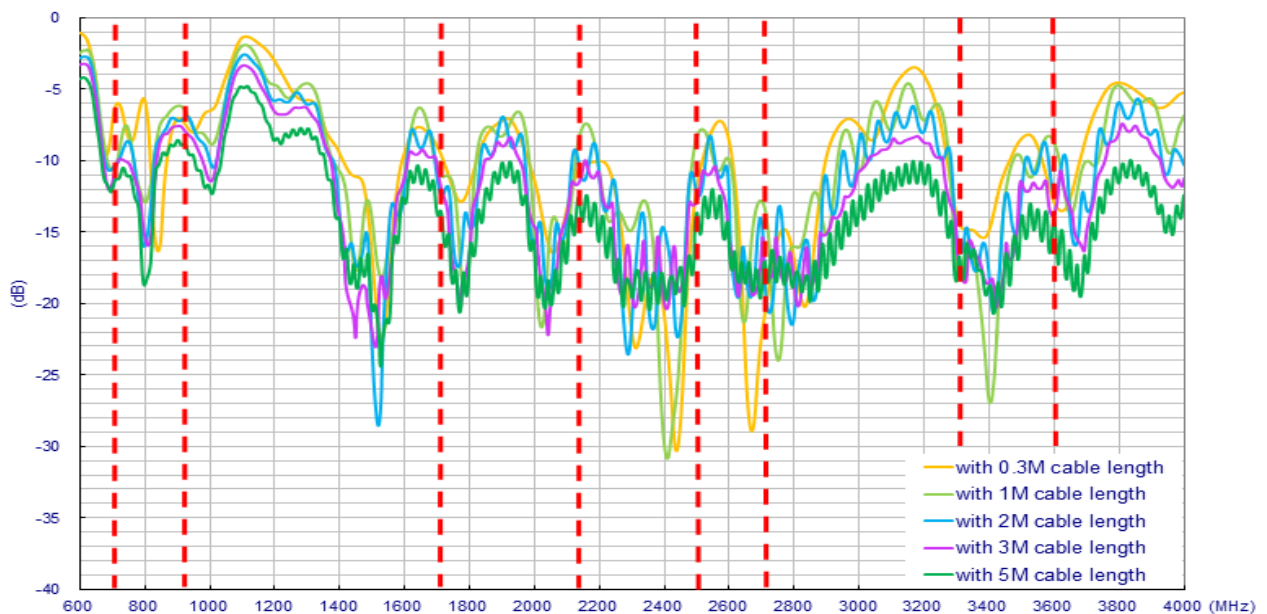
The MA961 antenna performance with different cable lengths is shown below.

6.1 In free space (LTE)

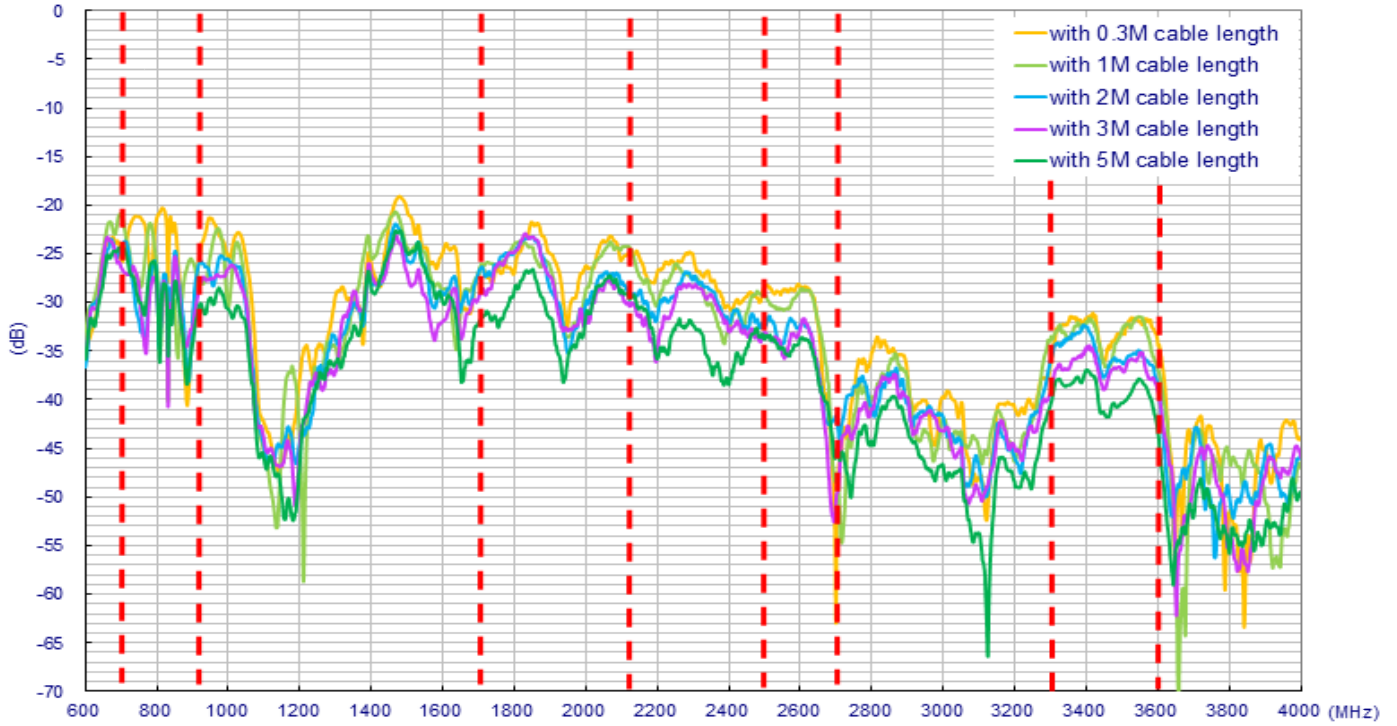
6.1.1 Return Loss (LTE_MIMO_1)



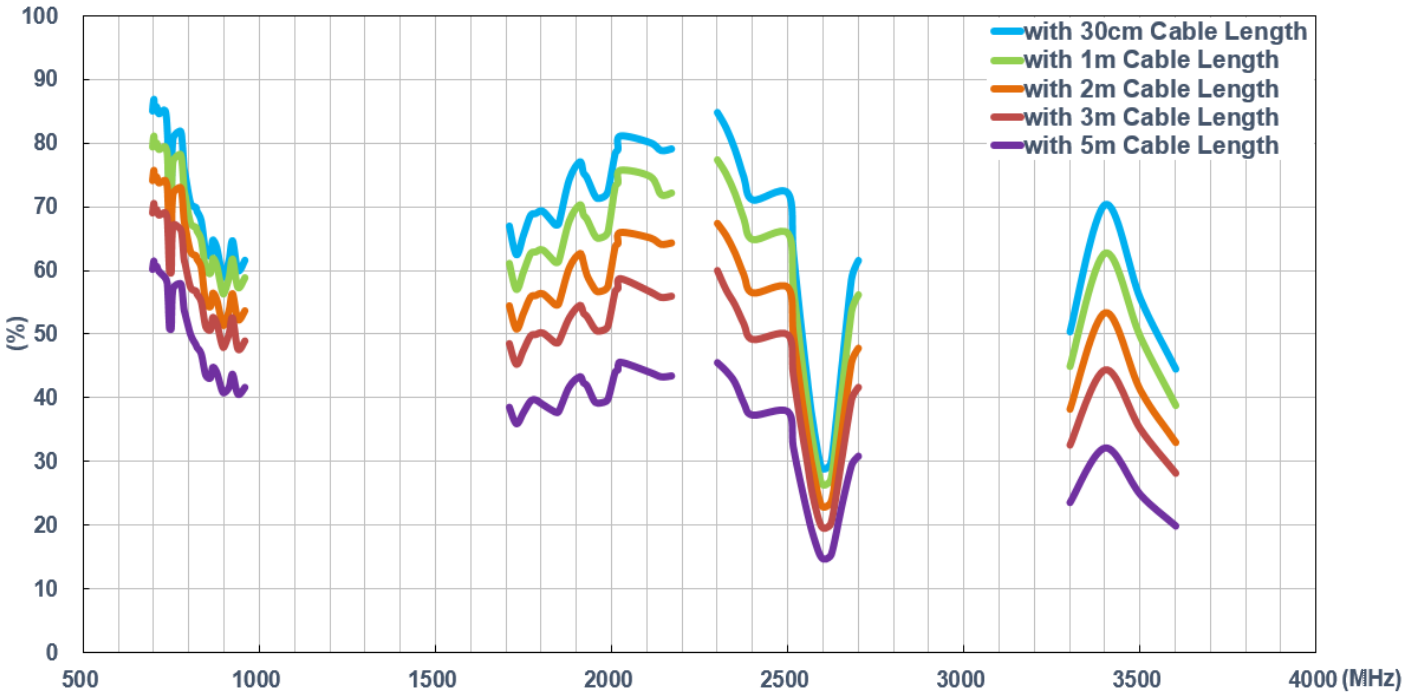
6.1.2 Return Loss (LTE_MIMO_2)



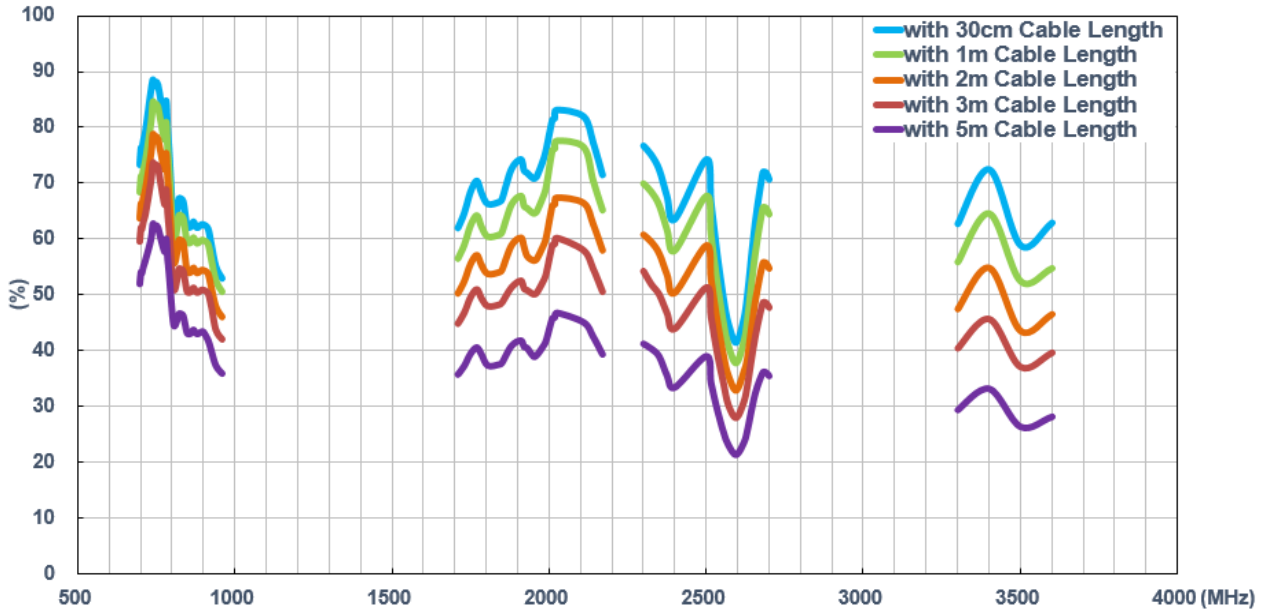
6.1.3 Isolation (LTE antenna)



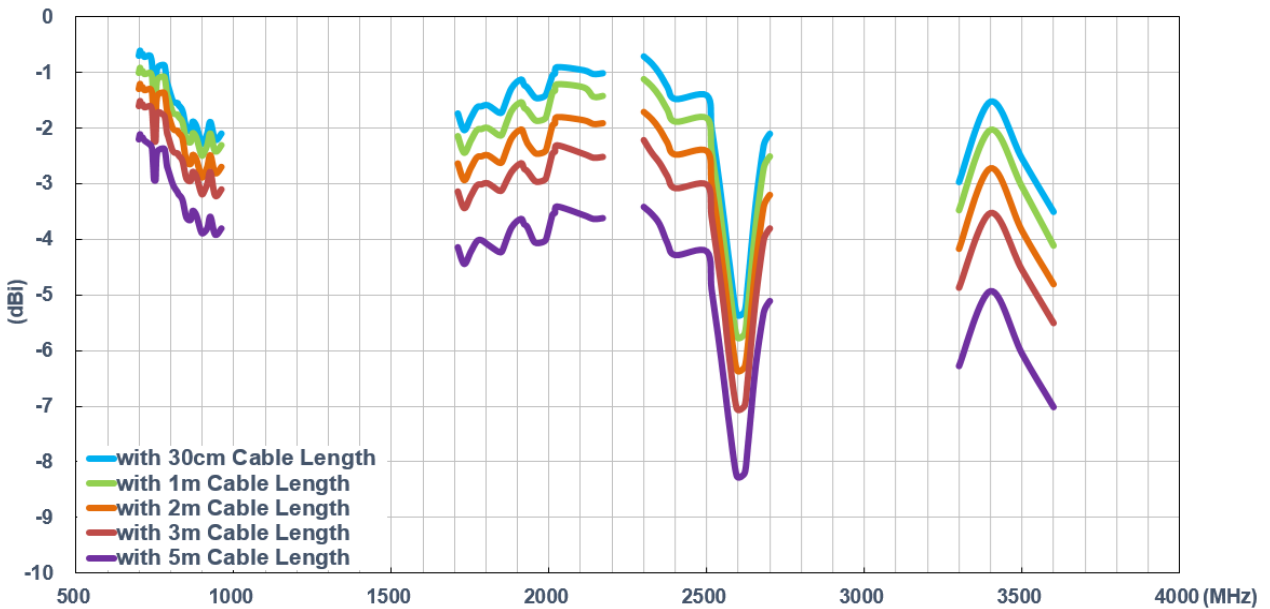
6.1.4 Efficiency (LTE MIMO_1)



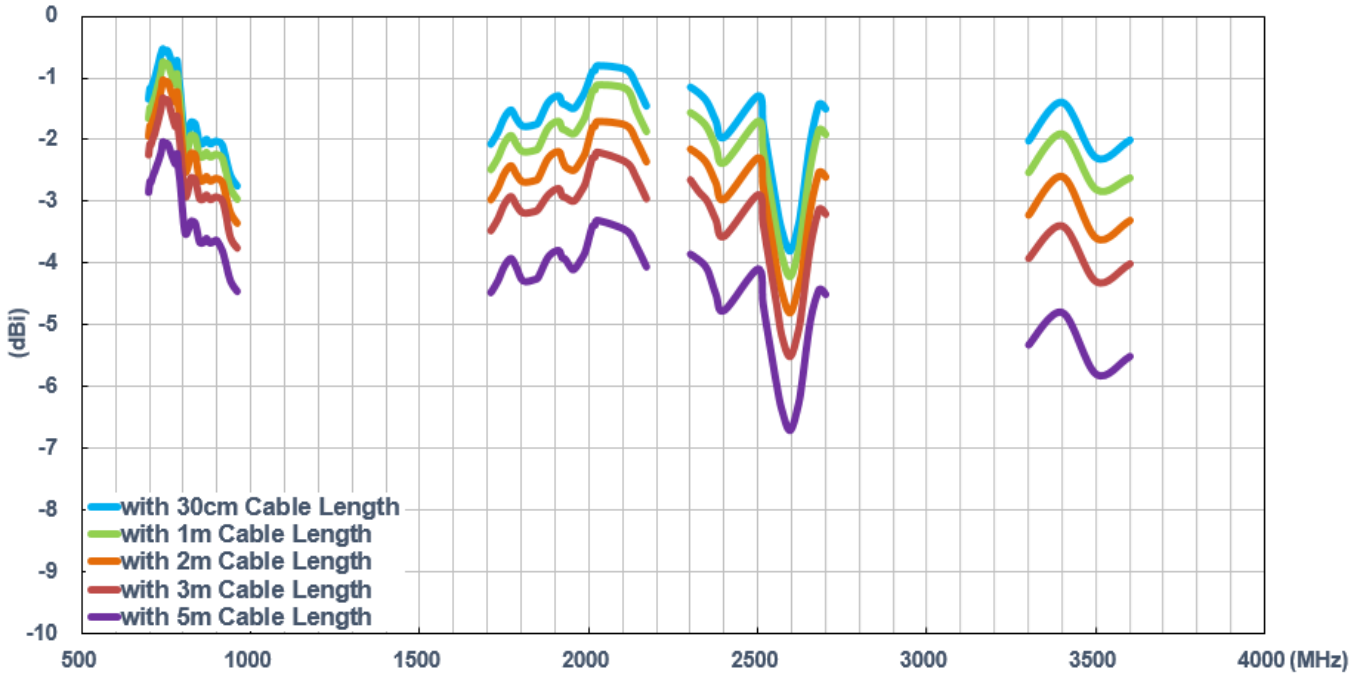
6.1.5 Efficiency (LTE MIMO_2)



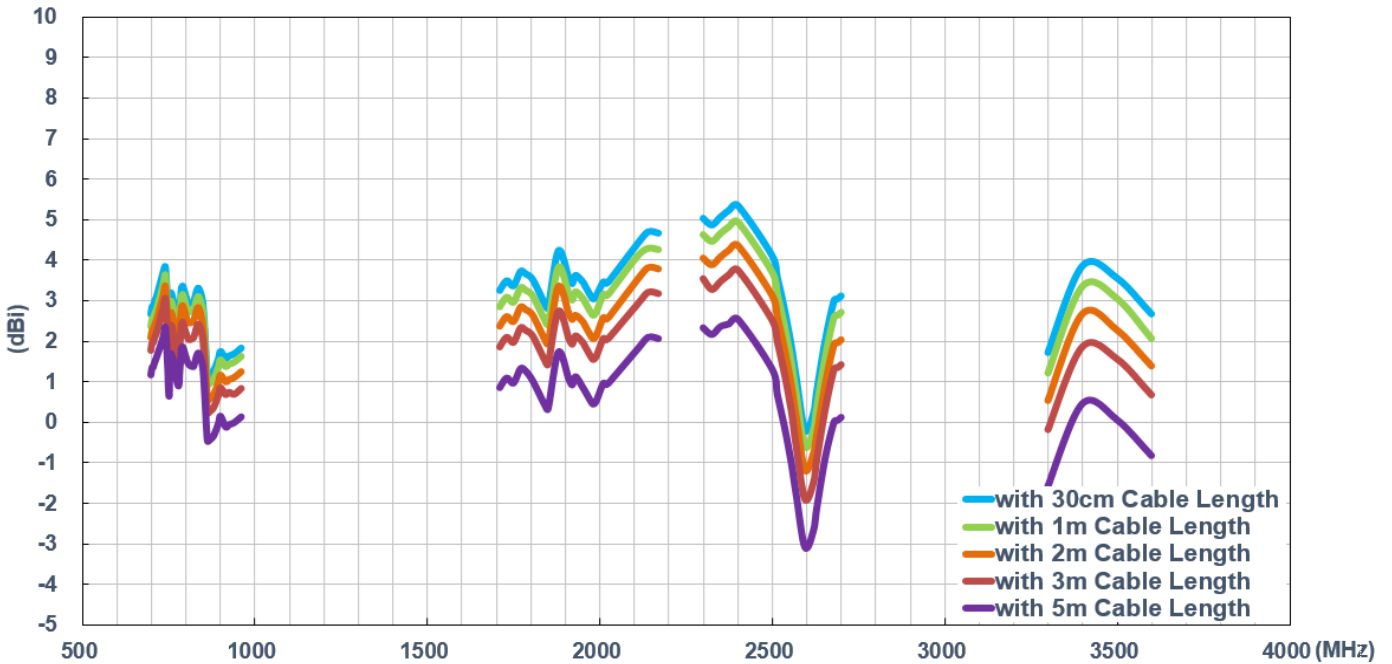
6.1.6 Average Gain (LTE MIMO_1)



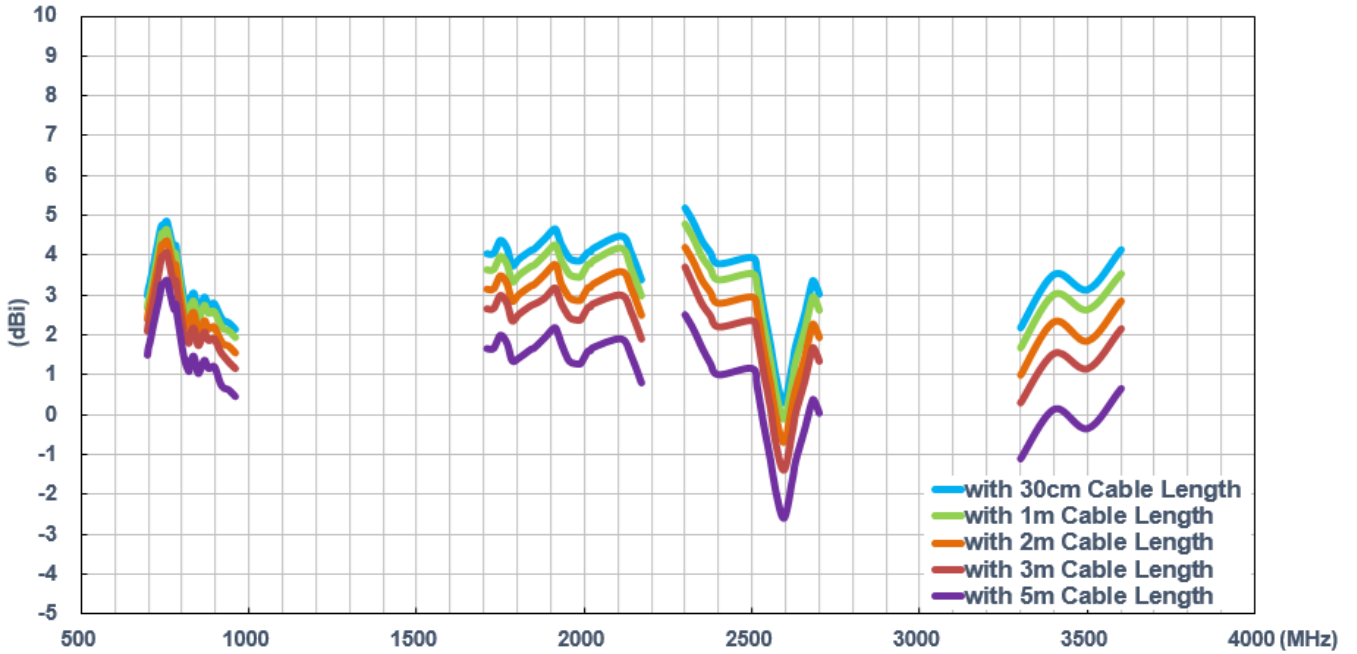
6.1.7 Average Gain (LTE MIMO_2)



6.1.8 Peak Gain (LTE MIMO_1)

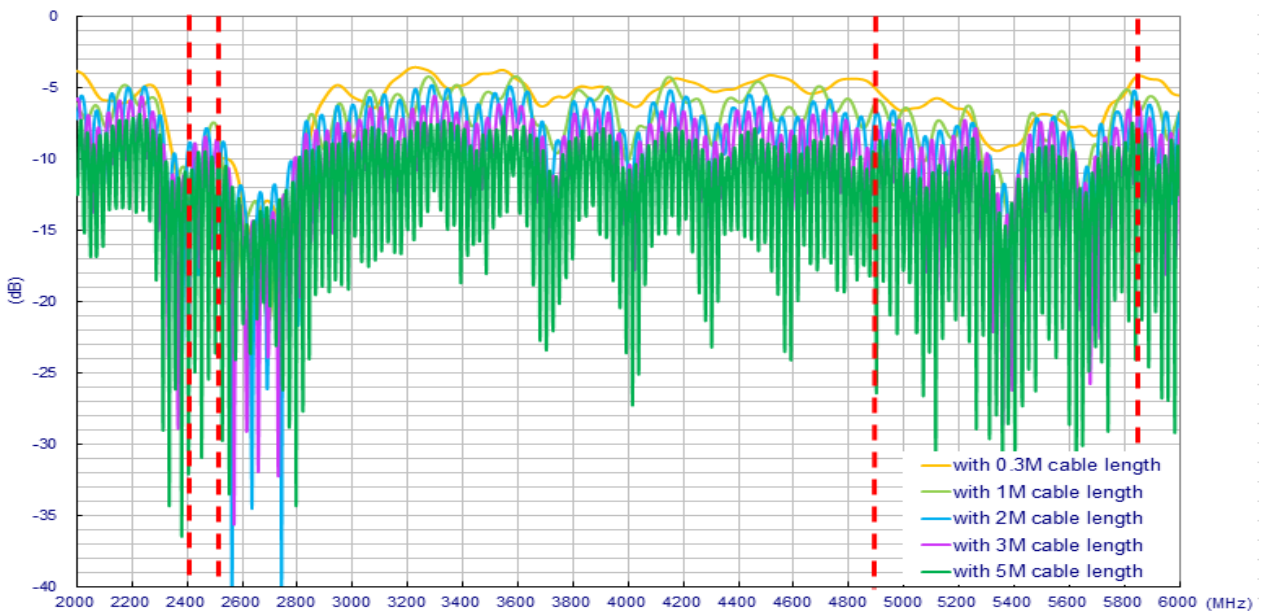


6.1.9 Peak Gain (LTE MIMO_2)

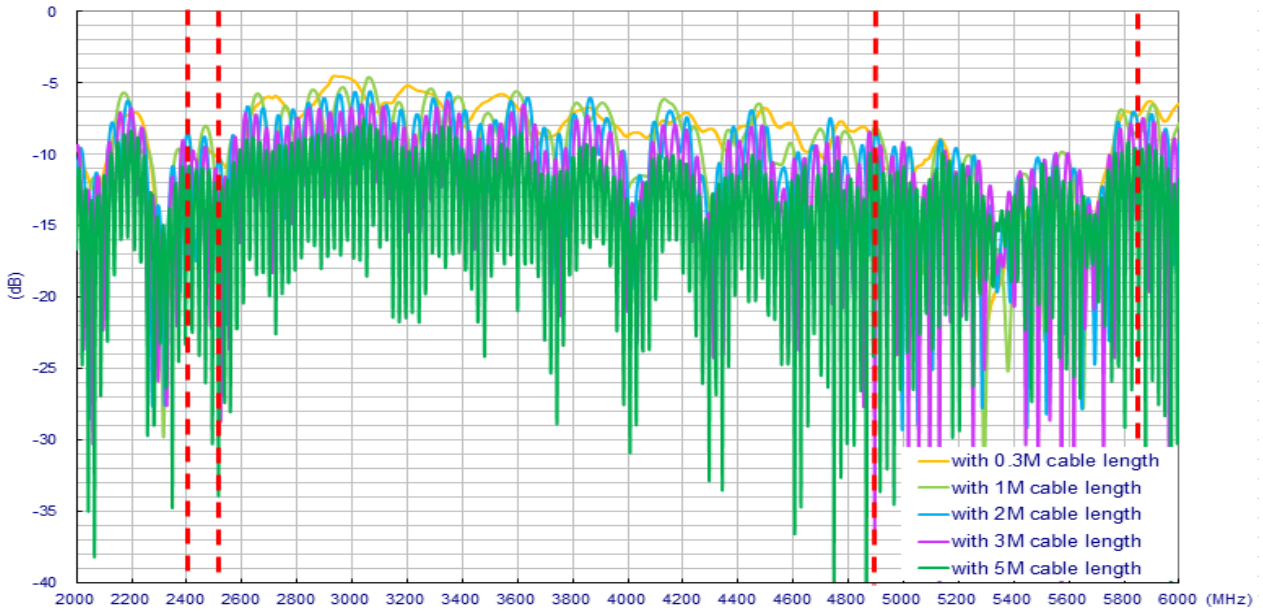


6.2 In free space (Wi-Fi)

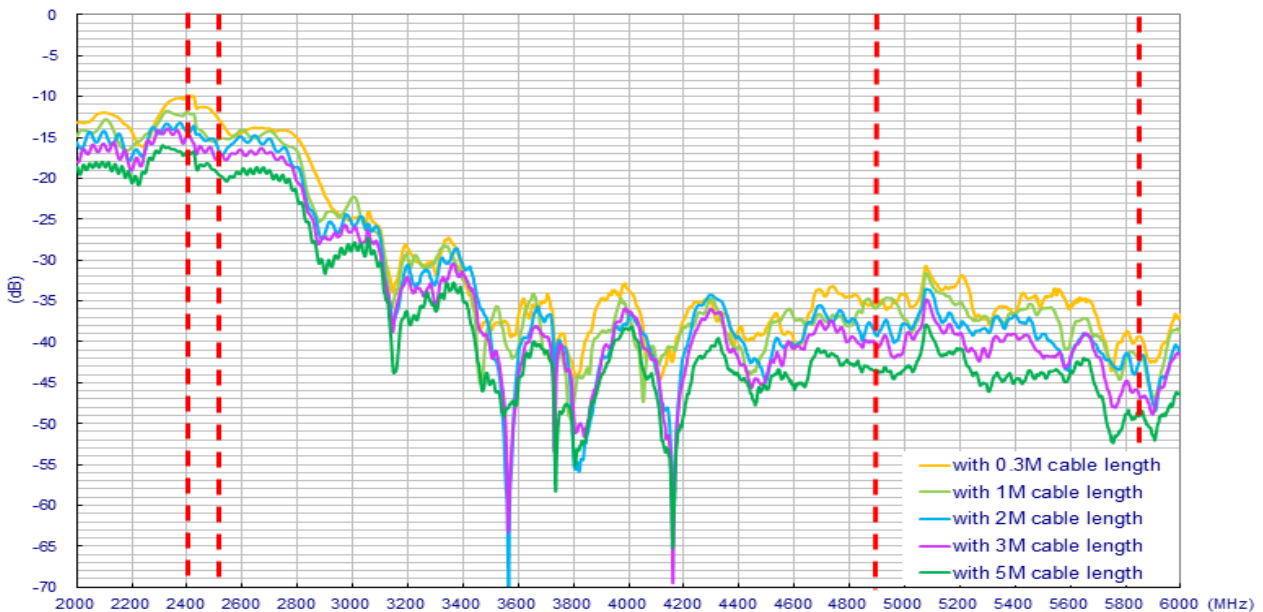
6.2.1 Return Loss (Wi-Fi_MIMO_1)



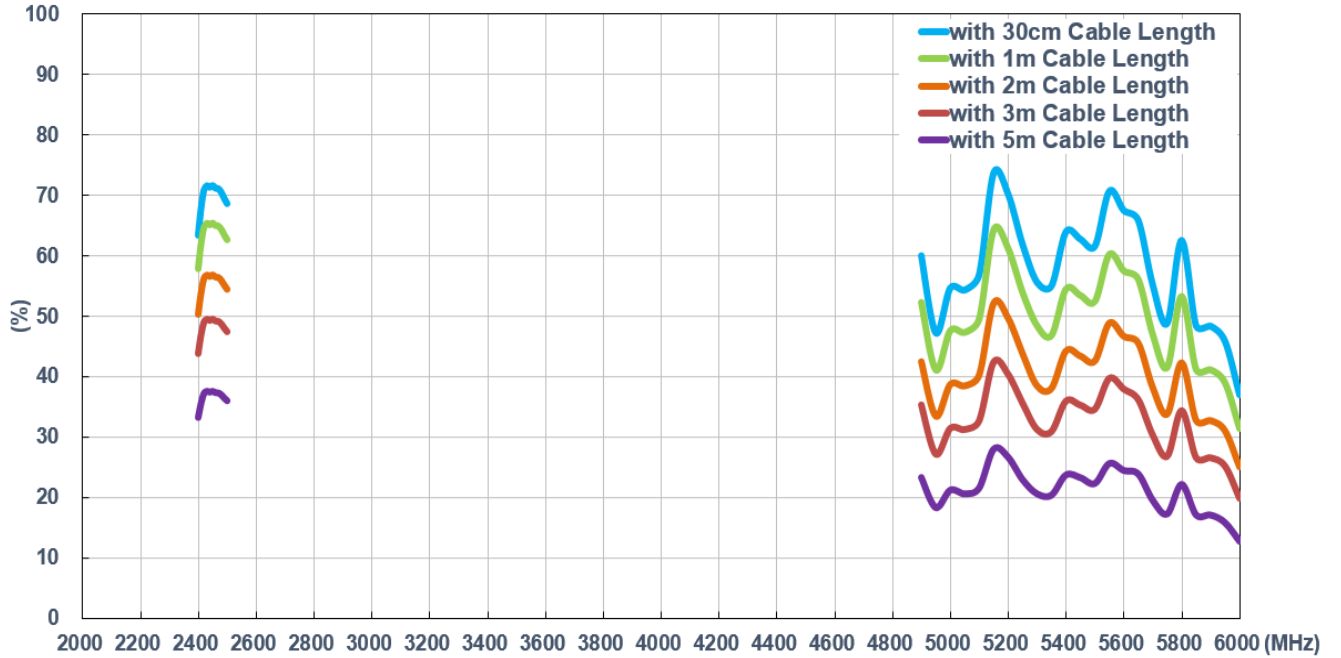
6.2.2 Return Loss (Wi-Fi_MIMO_2)



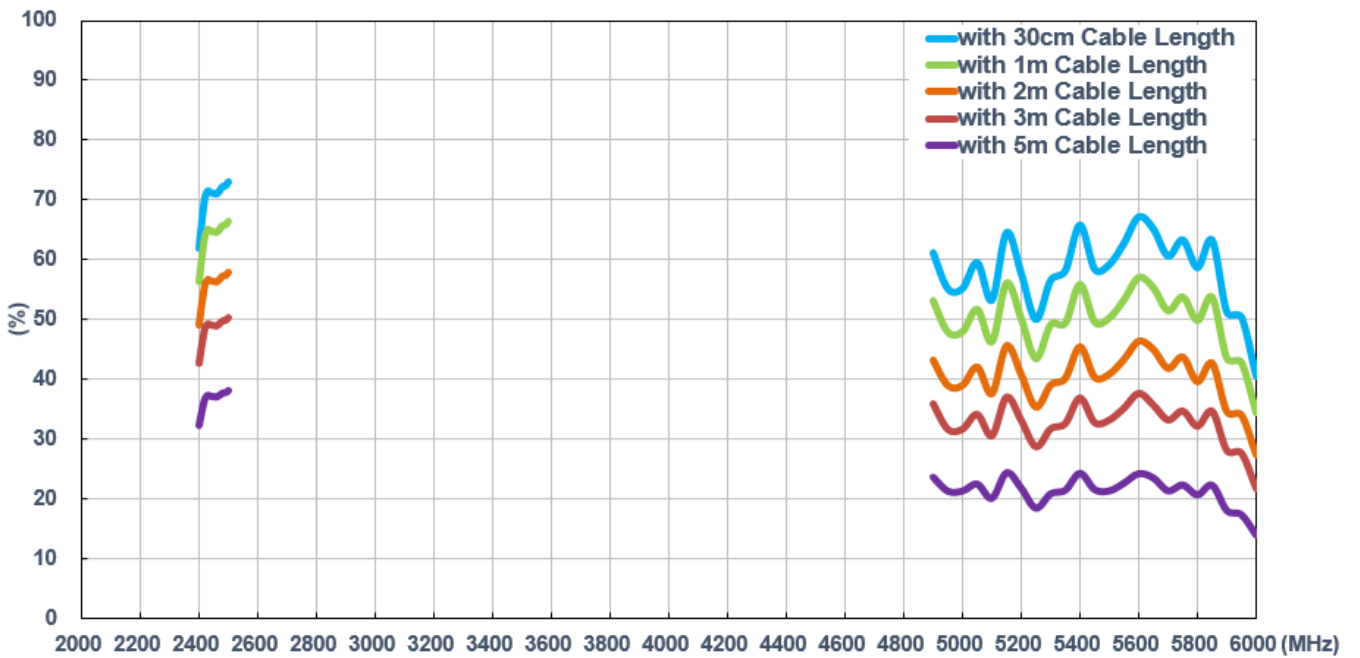
6.2.3 Isolation (Wi-Fi)



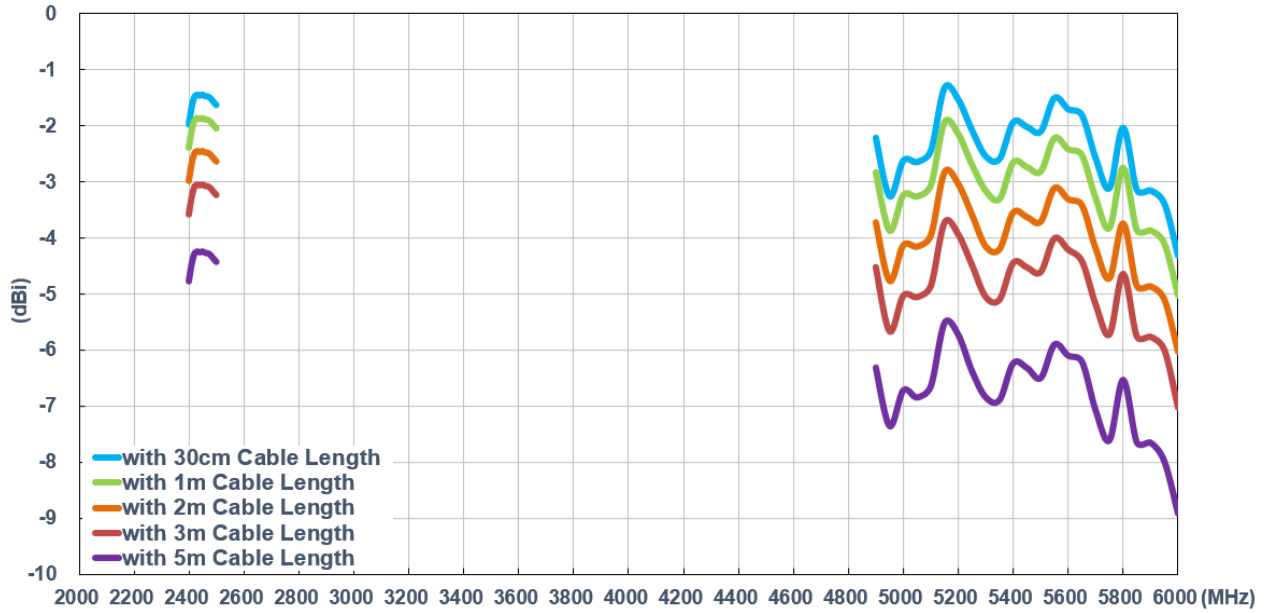
6.2.4 Efficiency (Wi-Fi MIMO_1)



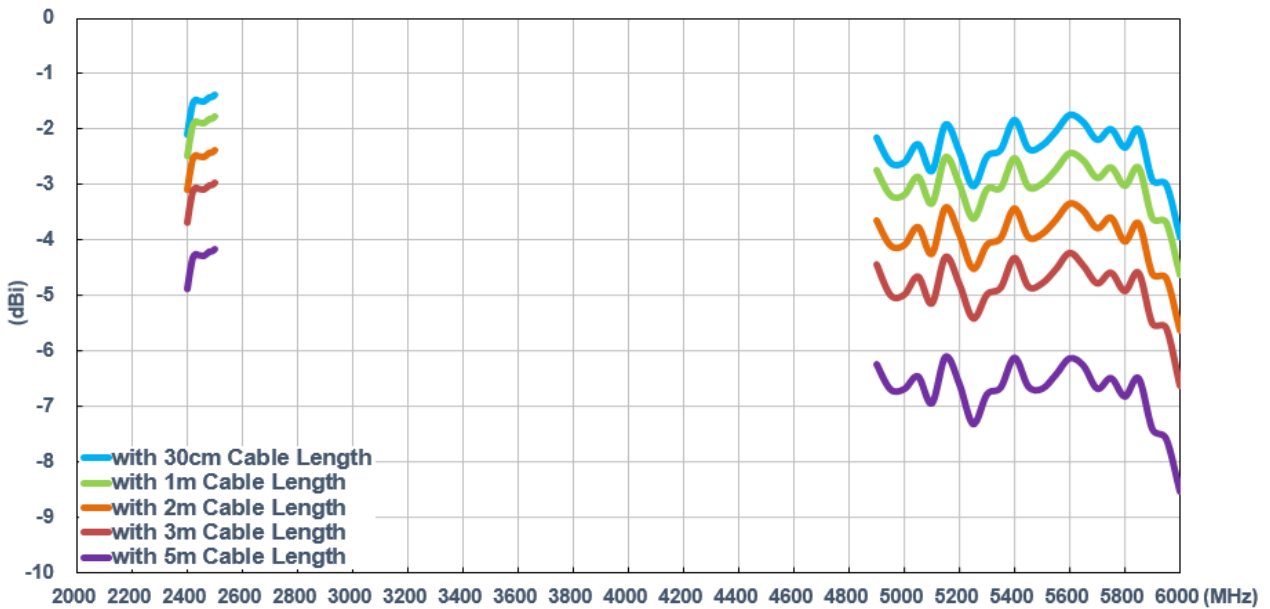
6.2.5 Efficiency (Wi-Fi MIMO_2)



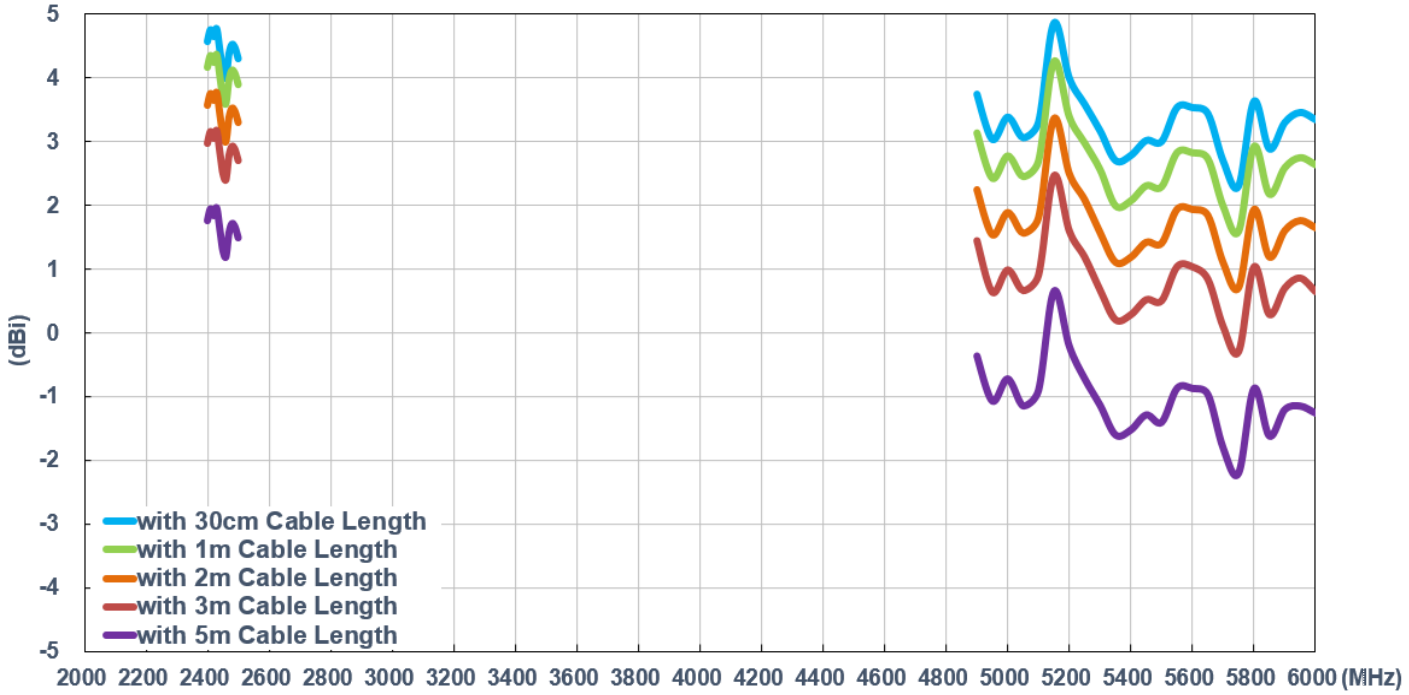
6.2.6 Average Gain (Wi-Fi MIMO_1)



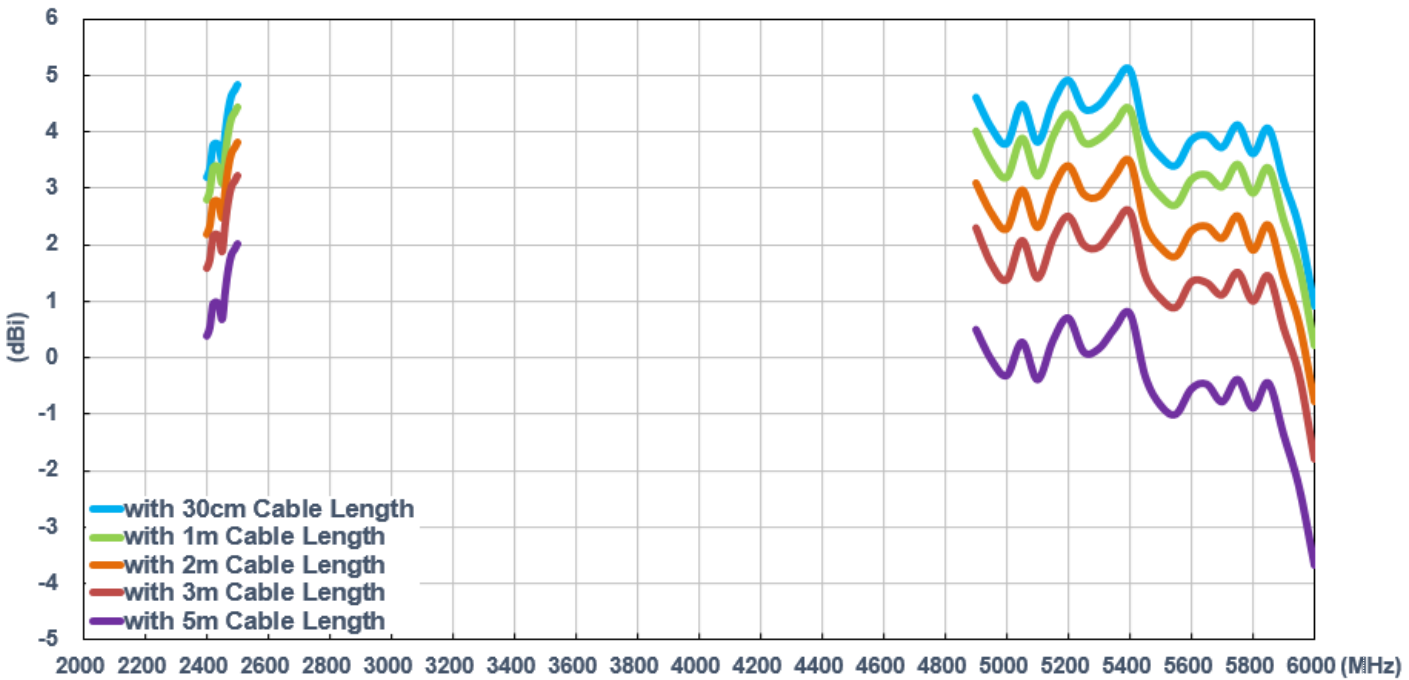
6.2.7 Average Gain (Wi-Fi MIMO_2)



6.2.8 Peak Gain (Wi-Fi MIMO_1)



6.2.9 Peak Gain (Wi-Fi MIMO_2)



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