

SPECIFICATION

Part No.	:	MA412.A.BI.003
Product Name	:	MA412 Storm 2in1 Screwmount Antenna LTE MIMO 2in1
Features	:	2* LTE MIMO 698 to 960MHz/1710 to 2170MHz/ 2490 to 2690MHz Antenna Screw-Mount [Permanent Mount] Worldwide 4G Bands including 3G and 2G Aerodynamic, Super Low-profile Vandal Resistant Housing IP67 Enclosure Dims: 216.24*93.25*30.95mm 3M CFD-200 with SMA connectors as standard Custom Cables and Connectors Available Product conforms to the EMC directive 2014/30/EU. RoHS Compliant



1. Introduction

The Storm MA412 LTE MIMO antenna is a low profile, heavy-duty, fully IP67 waterproof external M2M antenna for use in worldwide telematics applications which require best in class LTE performance.

At only 31mm high, the Storm is the world's lowest profile global telematics antenna solution. It delivers powerful worldwide 4G LTE MIMO antenna technology while also covering the 3G and 2G bands.

Typical applications

- HD Video over LTE
- First Responder and Emergency Services
- Intelligent Transport Systems
- Internet of Things (IoT market)
- High Definition Video Broadcast Systems
- Wireless LTE MIMO M2M Devices
- Digital Signage

LTE 4G 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 between the two MIMO antennas to prevent self-interference. The MA412 does not require a ground plane. Low loss cables are used to keep efficiency high over long cable lengths. In contrast, smaller MIMO antennas with poorer quality thinner cables will have much reduced efficiency and isolation, which would lead to a large drop in system throughput or drops, and may indeed not make a system connection at all.

We have a version with Fakra connectors also as standard MA412.A.BI.001. Cable length and connector types are customizable. Conformity is declared under the following standard:

Conformity is declared under the following standard: **EN55022 Class B**

This is to declare that the product listed above conform to the EMC directive 2014/30/EU.

Product conforms to the EMC directive 2014/30/EU. Contact your regional Taoglas sales office for support.

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 (%)									
On the 50*50cm ground plane	30cm	62.06	41.76	49.16	44.93	59.56	59.39	55.42	37.39
	1M	59.27	39.88	46.95	40.98	54.46	54.71	50.55	33.33
	2M	55.31	36.93	42.81	36.86	48.53	48.56	43.53	27.99
	3M	51.62	34.20	39.76	32.65	42.73	42.47	36.84	23.59
	5M	44.25	28.85	33.36	25.50	32.98	32.90	28.22	16.96
In free space	30cm	65.08	48.08	55.44	49.41	57.62	59.92	54.98	38.19
	1M	62.15	45.91	52.95	45.06	52.69	55.18	50.14	34.83
	2M	58.00	42.54	48.29	40.62	46.96	48.99	43.17	29.65
	3M	54.13	39.46	44.80	35.92	41.31	42.84	36.53	24.66
	5M	46.39	33.24	37.60	28.10	31.89	33.19	27.99	19.14
Average Gain(dBi)									
On the 50*50cm ground plane	30cm	-2.22	-3.98	-3.20	-3.55	-2.27	-2.27	-2.57	-4.36
	1M	-2.42	-4.18	-3.40	-3.95	-2.66	-2.63	-2.97	-4.86
	2M	-2.72	-4.51	-3.80	-4.40	-3.16	-3.14	-3.62	-5.61
	3M	-3.02	-4.84	-4.13	-4.94	-3.72	-3.73	-4.35	-6.36
	5M	-3.70	-5.58	-4.88	-6.00	-4.84	-4.84	-5.50	-7.79
In free space	30cm	-2.02	-3.19	-2.60	-3.11	-2.42	-2.23	-2.62	-4.25
	1M	-2.22	-3.39	-2.80	-3.51	-2.81	-2.59	-3.02	-4.65
	2M	-2.52	-3.72	-3.20	-3.97	-3.31	-3.10	-3.67	-5.35
	3M	-2.82	-4.05	-3.52	-4.50	-3.86	-3.69	-4.39	-6.15
	5M	-3.50	-4.79	-4.28	-5.57	-4.98	-4.80	-5.55	-7.25
Peak Gain(dBi)									
On the 50*50cm ground plane	30cm	5.37	3.66	4.35	6.24	7.04	7.11	7.91	6.46
	1M	5.17	3.46	4.15	5.84	6.64	6.81	7.51	5.96
	2M	4.87	3.06	3.75	5.34	6.14	6.31	6.91	5.16
	3M	4.57	2.76	3.45	4.84	5.64	5.71	6.21	4.46
	5M	3.87	2.06	2.65	3.74	4.44	4.61	5.11	4.82
In free space	30cm	3.54	4.07	4.13	4.67	6.57	6.69	8.11	6.27
	1M	3.34	3.87	3.93	4.27	6.17	6.35	7.71	5.87
	2M	3.04	3.47	3.53	3.77	5.67	5.79	7.11	5.17
	3M	2.74	3.17	3.23	3.27	5.07	5.19	6.41	4.37
	5M	2.04	2.37	2.43	2.17	3.97	4.09	5.31	3.27

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 (%)									
On the 50*50cm ground plane	30cm	64.02	46.23	45.95	66.28	61.93	55.94	67.23	32.20
	1M	61.13	44.15	43.91	60.45	56.58	51.48	61.32	28.70
	2M	57.05	40.91	40.05	54.37	50.43	45.69	52.80	24.24
	3M	53.25	37.91	37.20	48.10	44.46	39.97	44.69	20.32
	5M	45.57	31.95	31.19	37.61	34.31	30.95	34.23	14.73
In free space	30cm	55.35	40.93	43.23	62.98	59.12	53.24	67.13	31.79
	1M	52.86	39.09	41.29	57.44	54.01	49.00	61.23	28.99
	2M	49.33	36.19	37.65	51.67	48.14	43.49	52.73	24.68
	3M	46.04	33.55	34.96	45.71	42.45	38.04	44.63	20.53
	5M	39.41	28.29	29.34	35.75	32.75	29.46	34.18	15.93
Average Gain(dBi)									
On the 50*50cm ground plane	30cm	-2.17	-3.38	-3.48	-1.84	-2.17	-2.57	-1.73	-5.25
	1M	-2.37	-3.58	-3.68	-2.24	-2.56	-2.93	-2.13	-5.75
	2M	-2.67	-3.91	-4.08	-2.69	-3.06	-3.44	-2.78	-6.50
	3M	-2.97	-4.23	-4.41	-3.23	-3.62	-4.03	-3.50	-7.25
	5M	-3.64	-4.98	-5.17	-4.29	-4.74	-5.14	-4.66	-8.68
In free space	30cm	-2.87	-3.93	-3.71	-2.04	-2.39	-2.80	-1.73	-5.28
	1M	-3.07	-4.13	-3.91	-2.44	-2.78	-3.16	-2.13	-5.68
	2M	-3.37	-4.46	-4.31	-2.90	-3.28	-3.67	-2.78	-6.38
	3M	-3.67	-4.79	-4.63	-3.43	-3.84	-4.26	-3.51	-7.18
	5M	-4.35	-5.53	-5.39	-4.50	-4.96	-5.37	-4.67	-8.28
Peak Gain(dBi)									
On the 50*50cm ground plane	30cm	6.51	4.09	3.82	7.93	8.06	7.89	8.16	5.48
	1M	6.31	3.89	3.62	7.53	7.66	7.49	7.76	4.98
	2M	6.01	3.59	3.22	7.03	7.16	6.99	7.16	4.28
	3M	5.71	3.19	2.92	6.53	6.66	6.49	6.46	3.48
	5M	5.01	2.49	2.22	5.43	5.46	5.29	5.36	2.18
In free space	30cm	5.21	2.85	3.16	7.48	7.48	7.29	8.13	5.37
	1M	5.01	2.65	2.96	7.08	7.08	6.89	7.73	4.97
	2M	4.71	2.25	2.56	6.58	6.58	6.39	7.13	4.27
	3M	4.41	1.95	2.26	6.08	6.08	5.88	6.43	3.47
	5M	3.71	1.15	1.46	4.98	4.98	4.69	5.33	2.37

Impedance	50Ω
Polarization	Linear
VSWR	< 3.5
Cable	3 meter CFD200 standard, fully customizable
Connector	SMA(M) standard connector , fully customizable

MECHANICAL

Antenna Dimensions	216.24*93.25*30.95mm
Casing	ABS+PC
Base and thread	Nickel Plated Aluminum
Weight	480g
Ingress Protection Rating	IP67
Flame Retardant	UL-94 HB
Maximum Assembly Torque	39.2 N-m

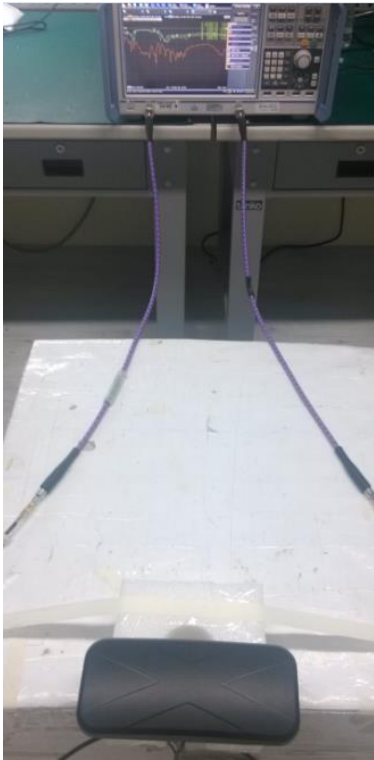
ENVIRONMENTAL

Operation Temperature	-40°C to 85°C
Storage Temperature	-40°C to 90°C
Humidity	Non-condensing 65°C 95% RH

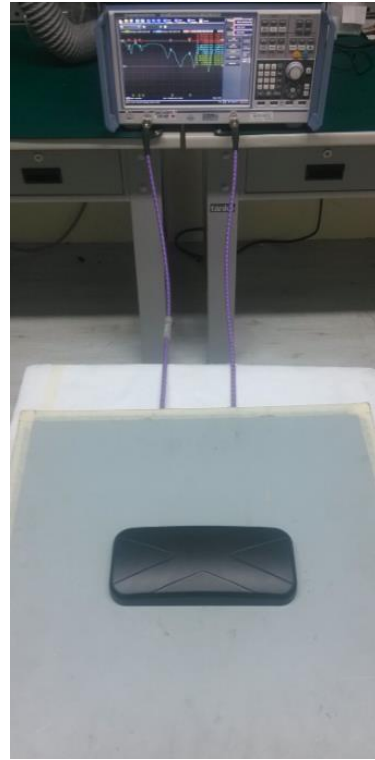
3. Antenna Characteristics

3.1 LTE MIMO Antenna

3.1.1 Test Setup



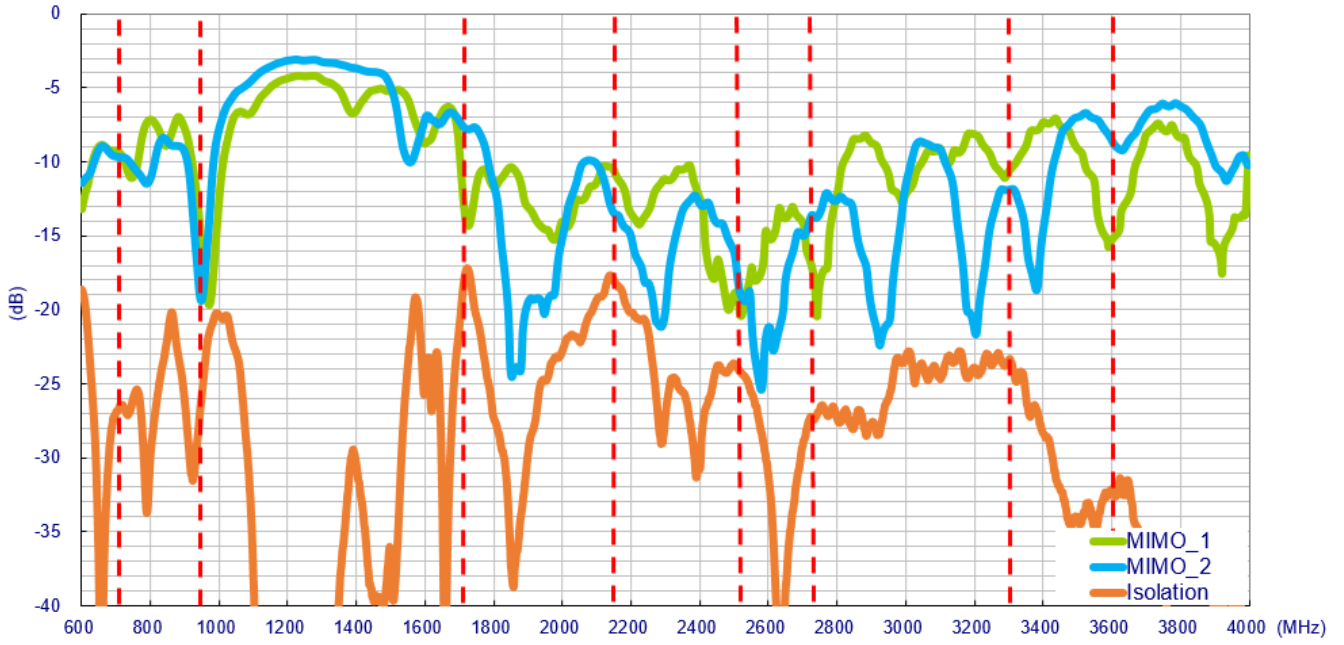
In free space



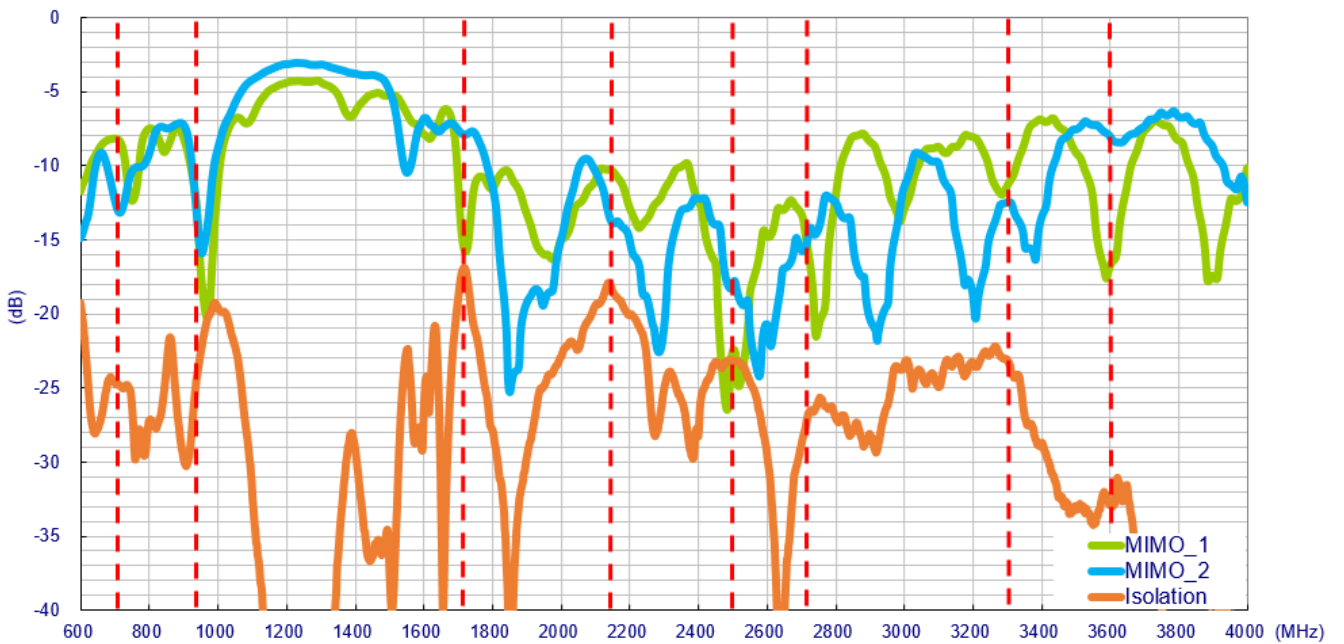
on the 50*50cm ground plane

3.1.2 LTE Antenna Return Loss and Isolation

Setup on the 50*50cm ground plane with 3 meter cable length

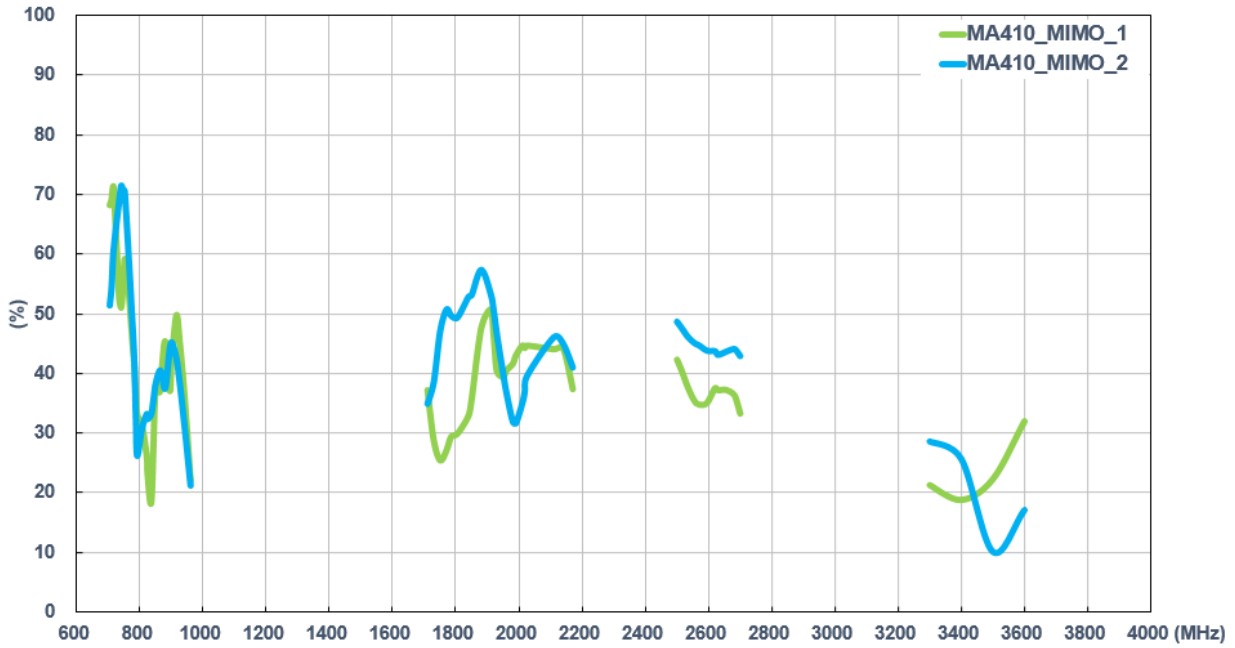


Setup in free space with 3 meter cable length

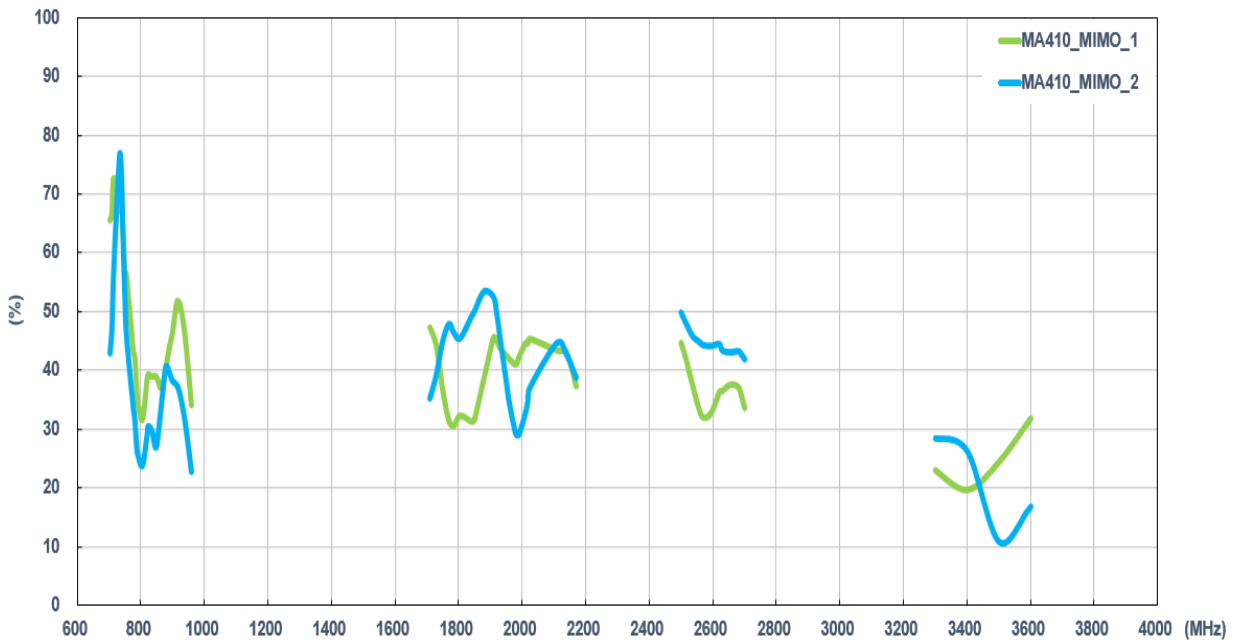


3.1.3 LTE Antenna Efficiency

Setup on the 50*50cm ground plane with 3 meter cable length

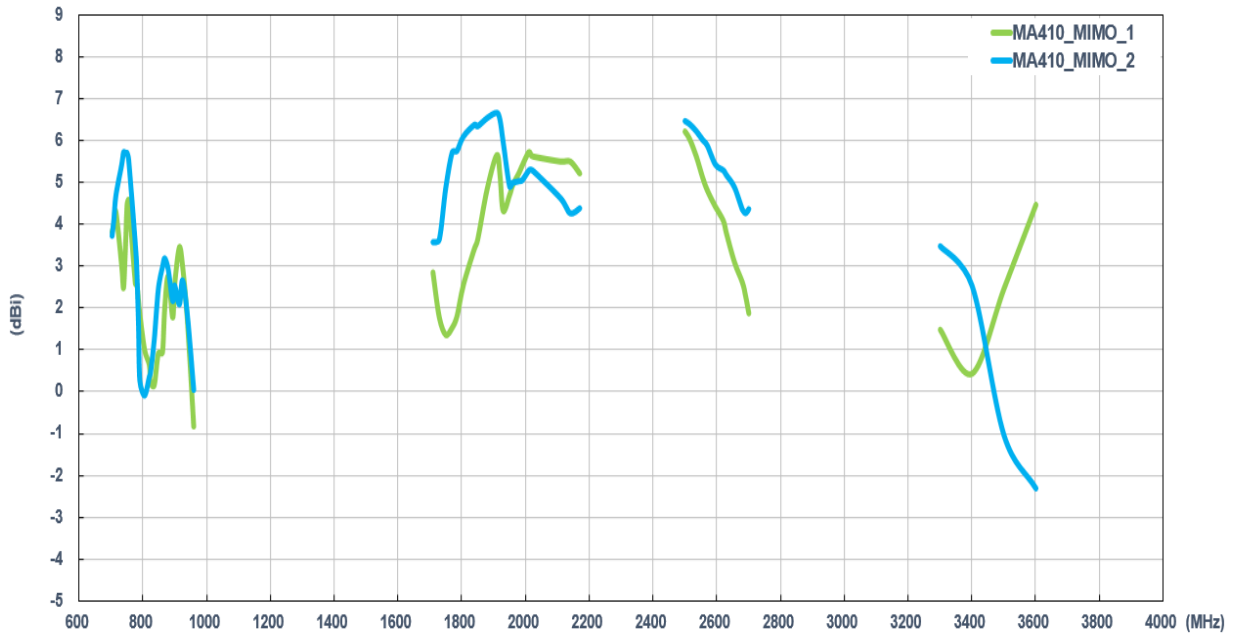


Setup in free space with 3 meter cable length

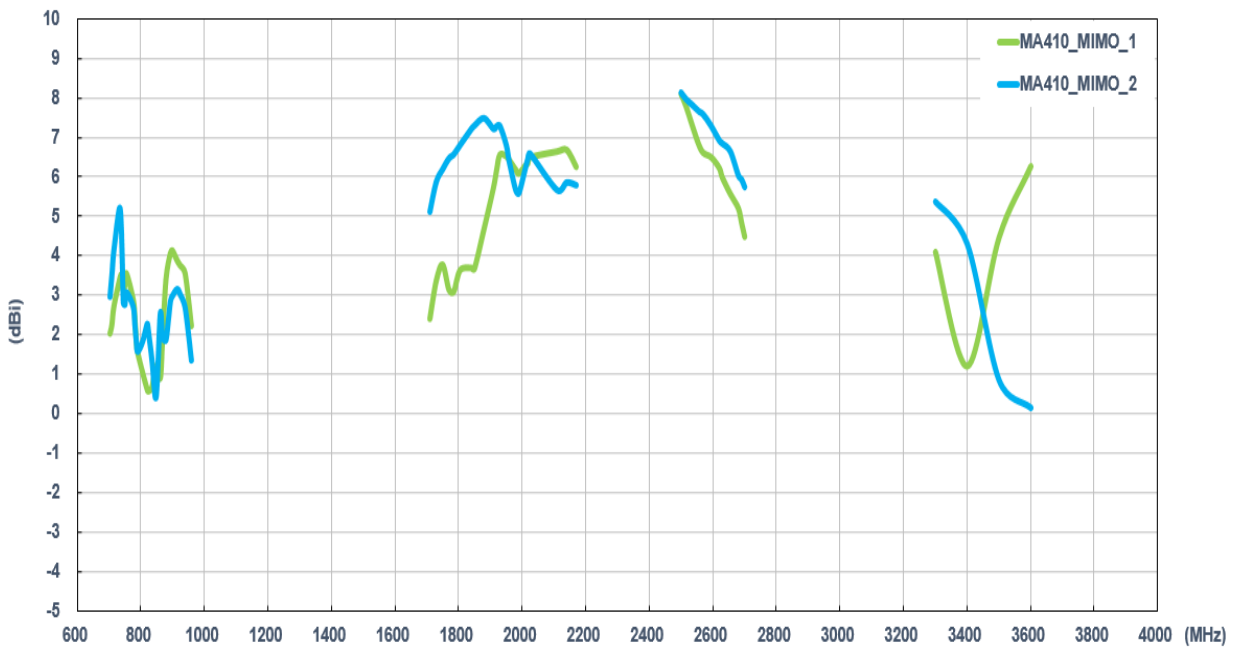


3.1.4 LTE Antenna Peak Gain

Setup on the 50*50cm ground plane with 3 meter cable length

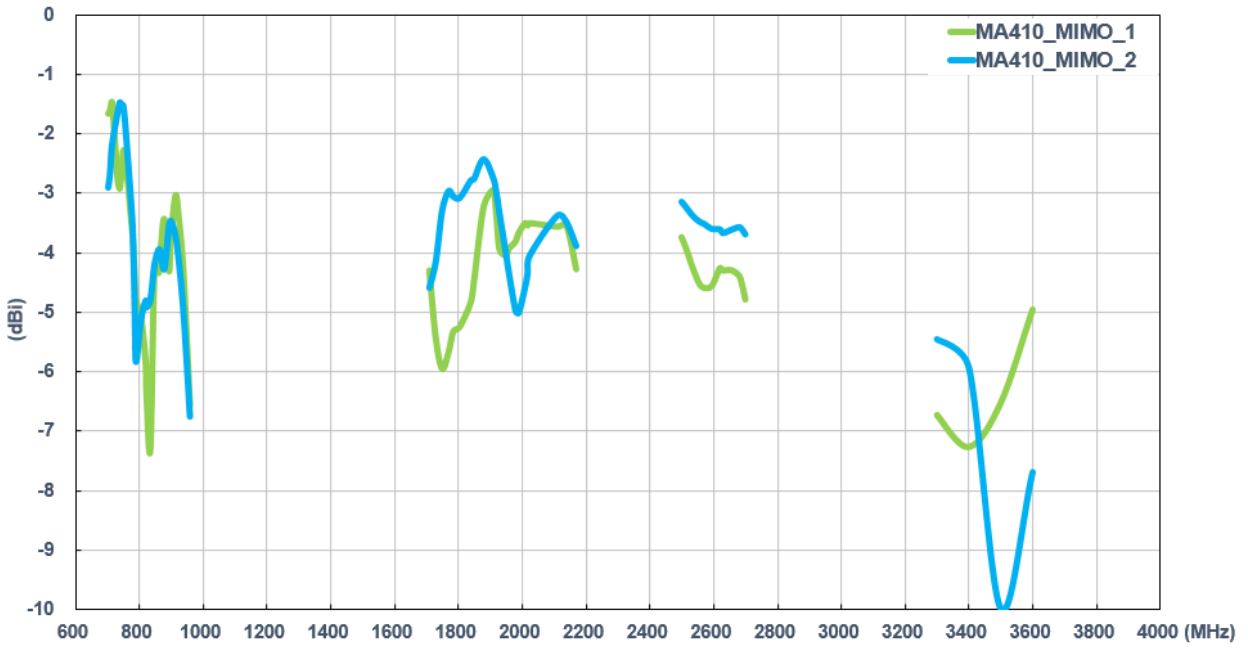


Setup in free space with 3 meter cable length

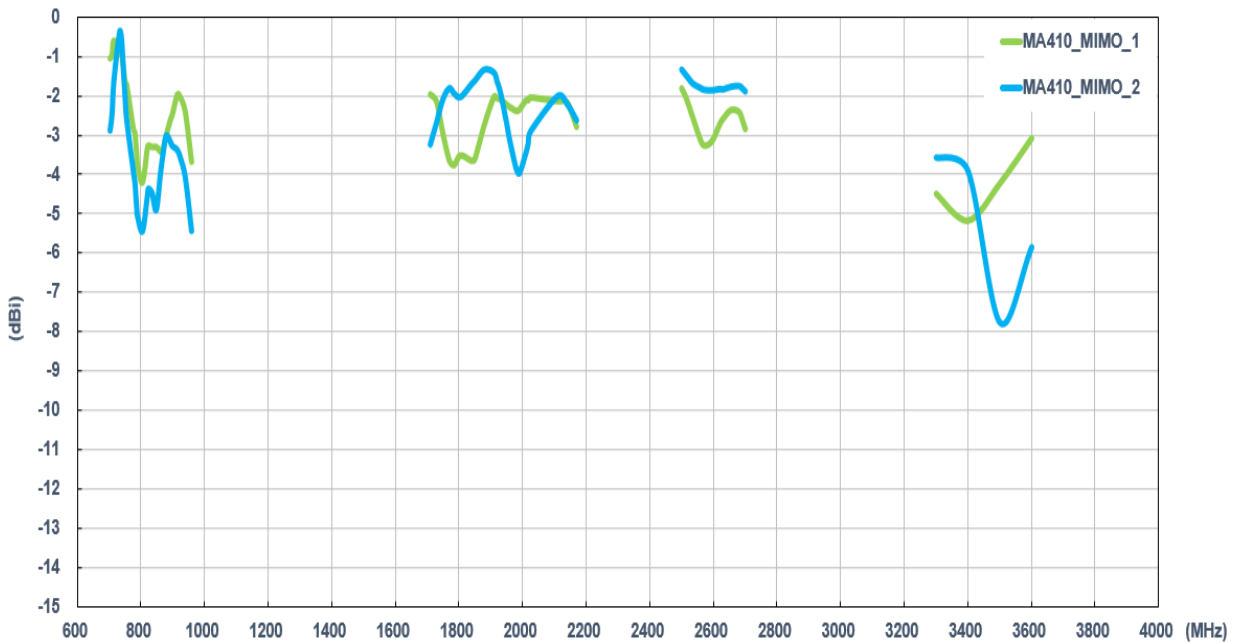


3.1.5 LTE Antenna Average gain

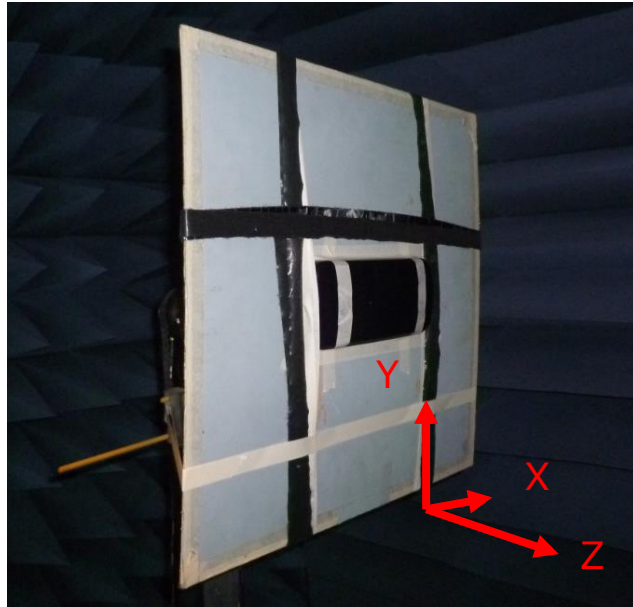
Setup on the 50*50cm ground plane with 3 meter cable length



Setup in free space with 3 meter cable length



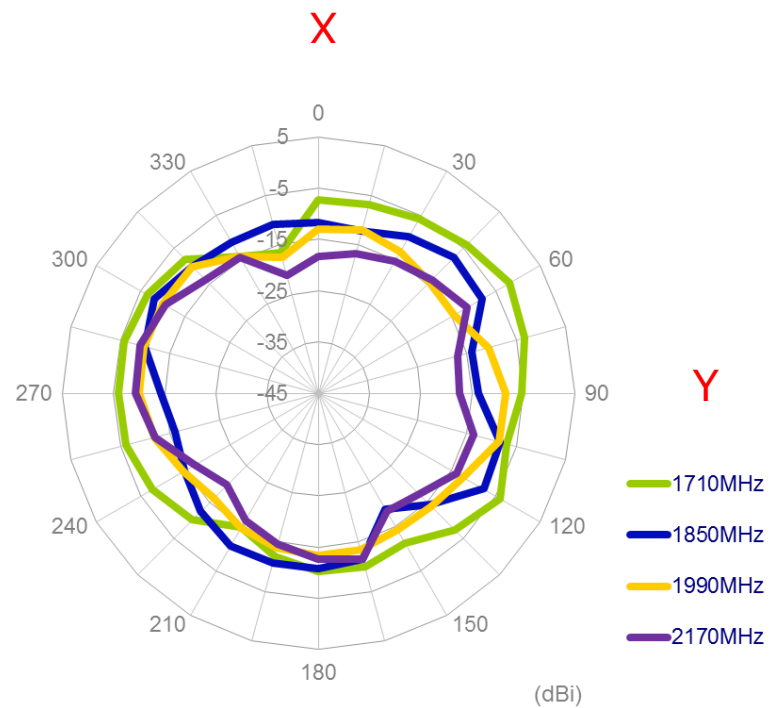
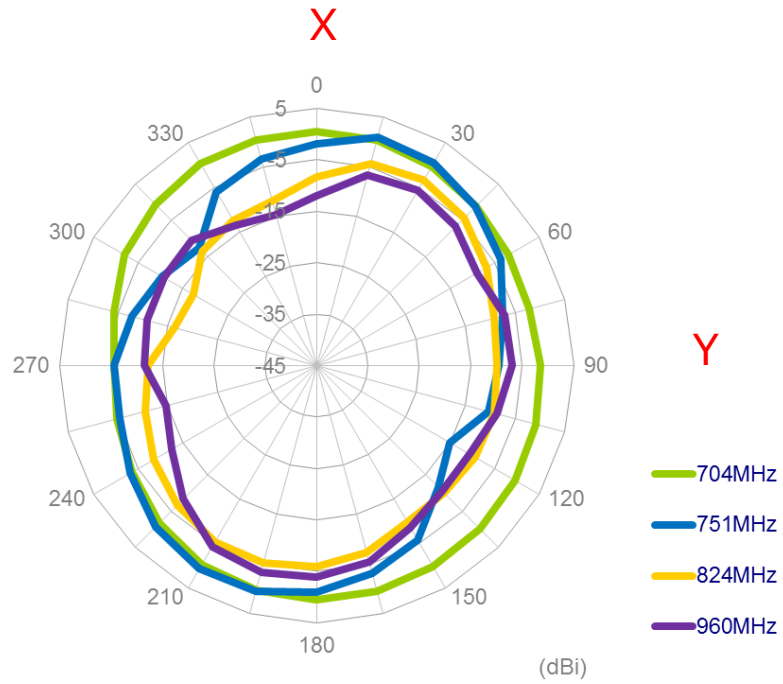
3.1.6 Test Setup For Antenna Radiation Pattern (ETS Anechoic chamber)

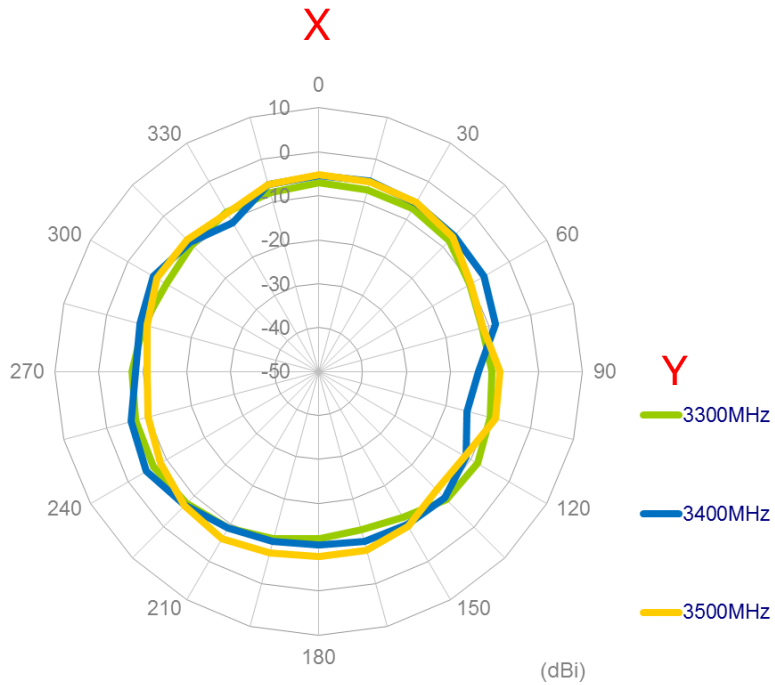
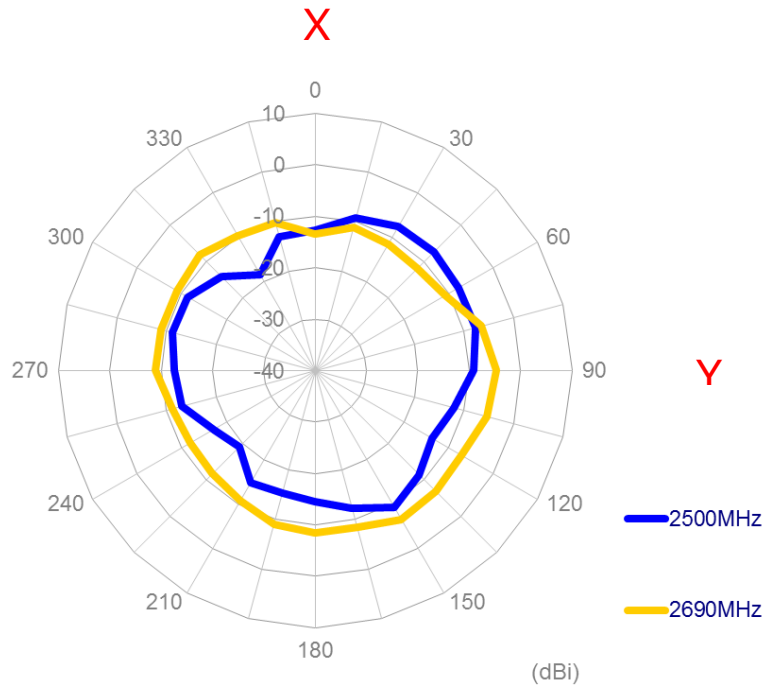


On the 50*50cm ground plane

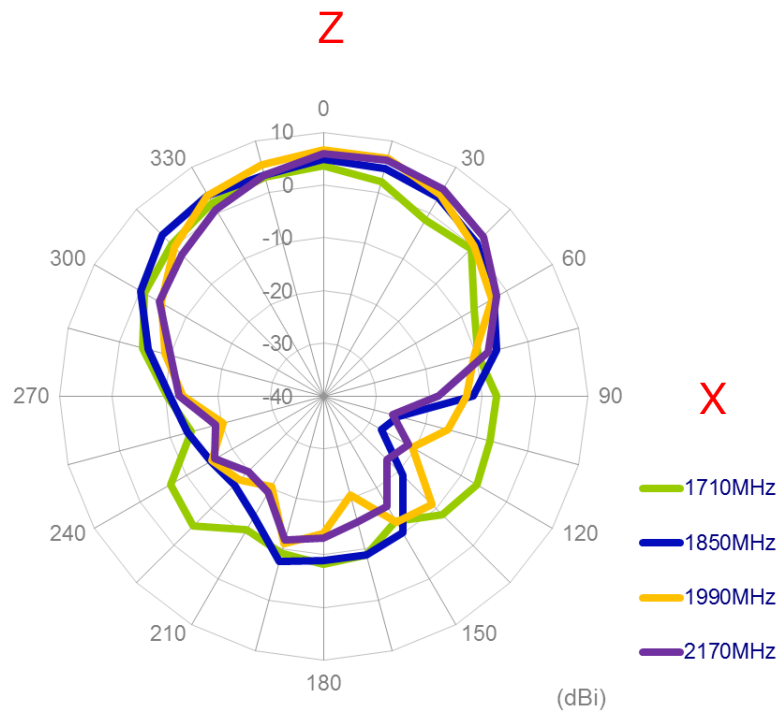
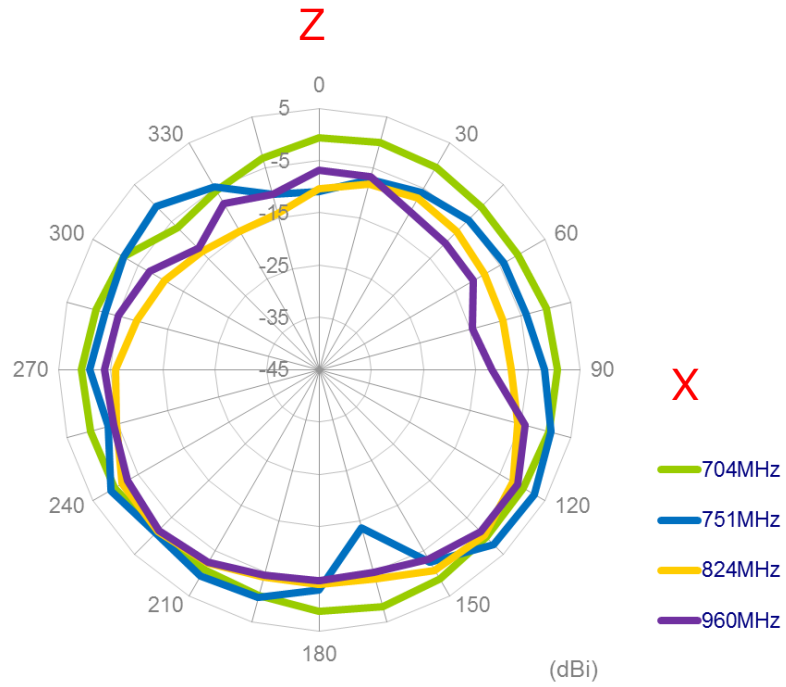
3.1.7 2D Radiation pattern (MIMO1 with 3M cable length on the 50*50 ground plane)

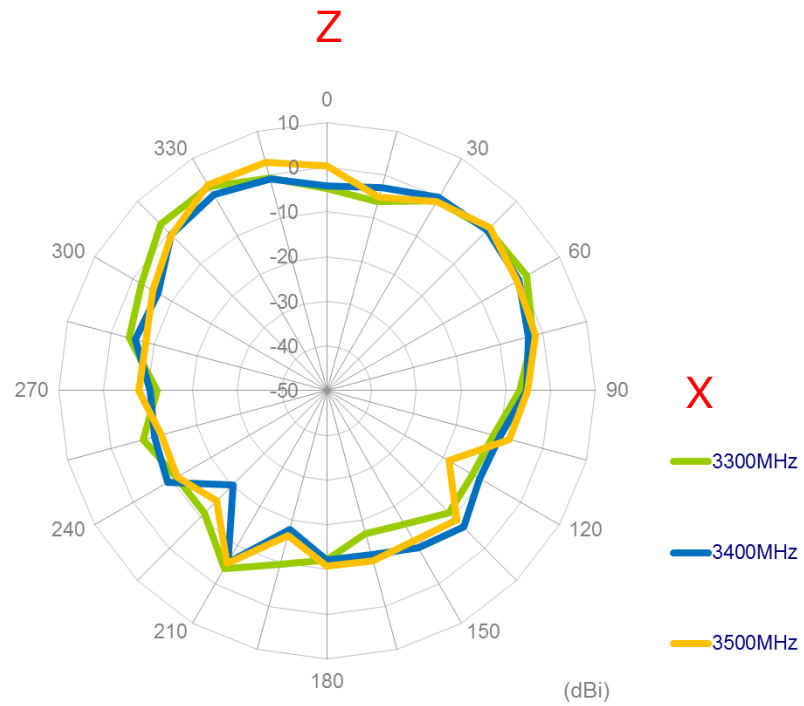
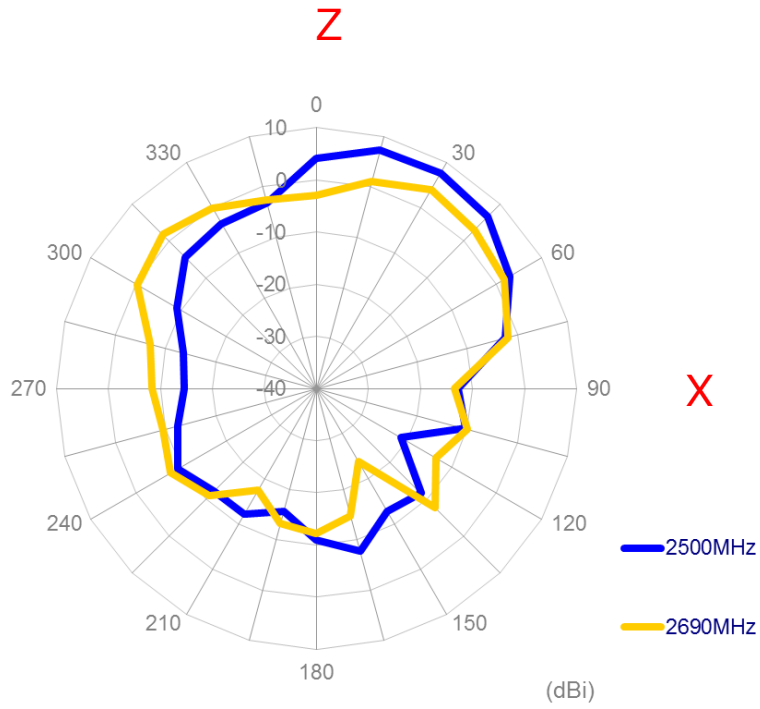
XY Plane



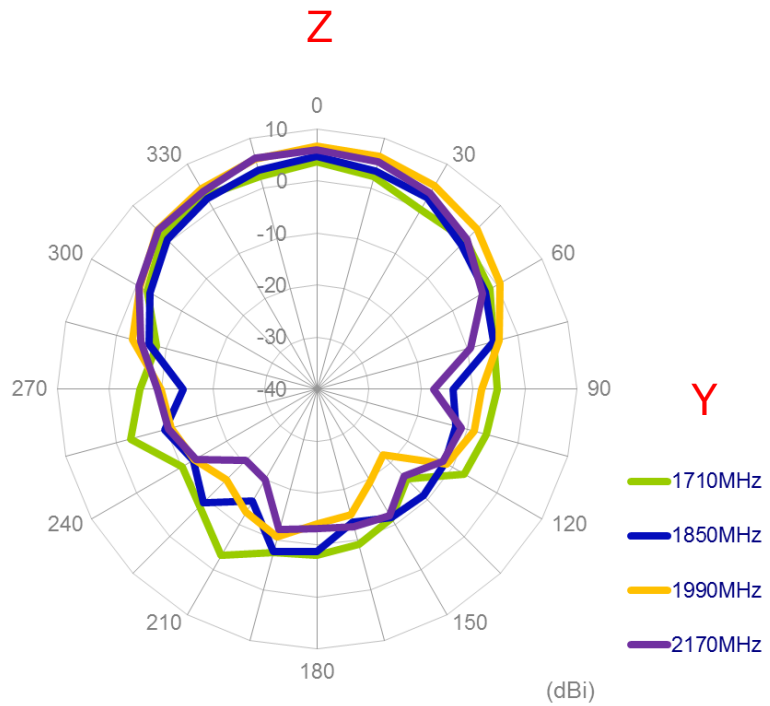
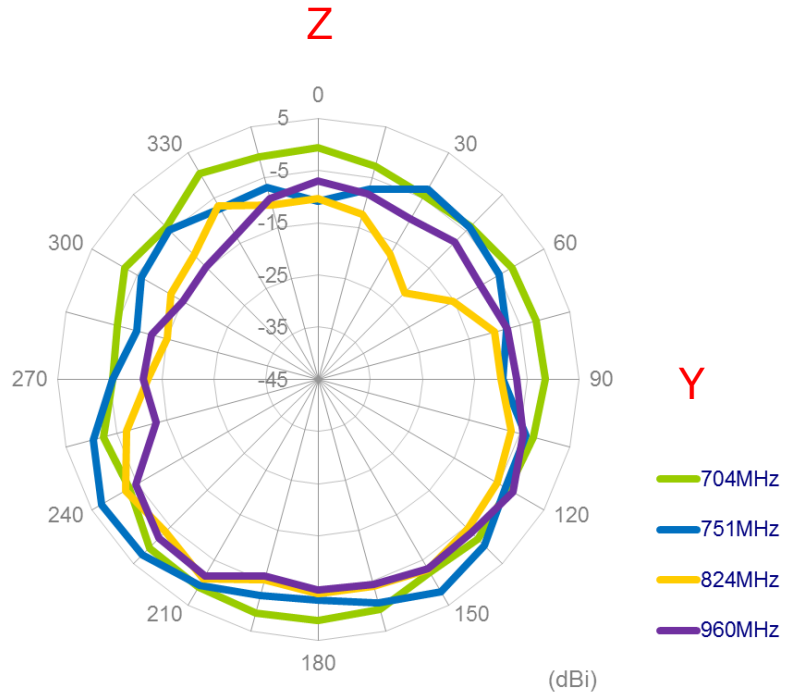


XZ Plane

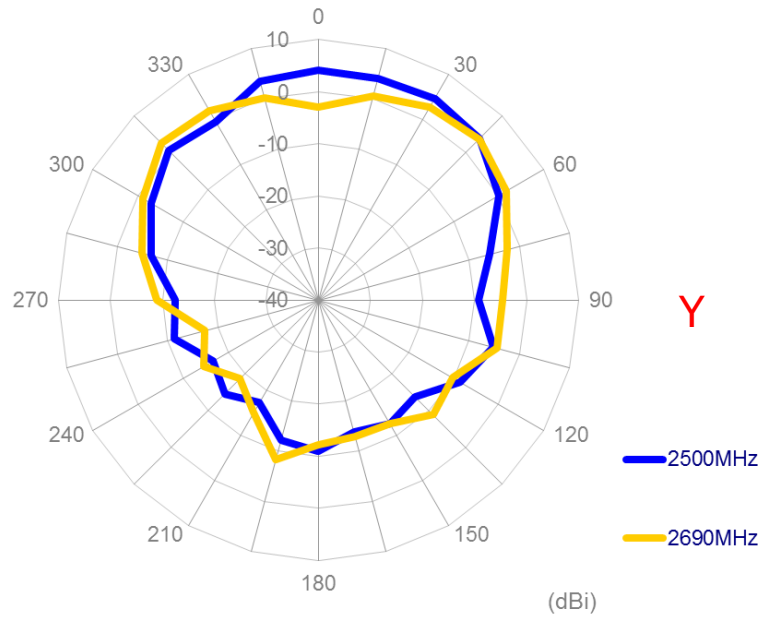




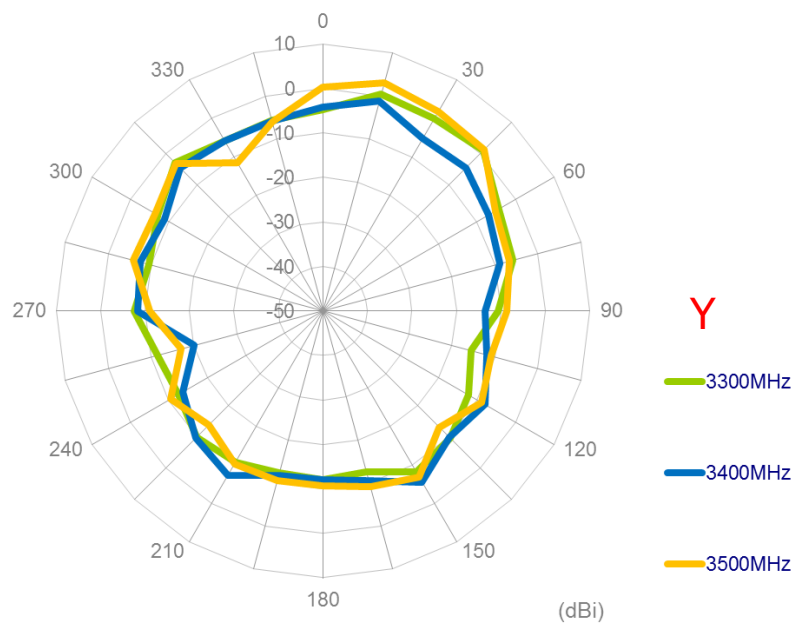
YZ Plane



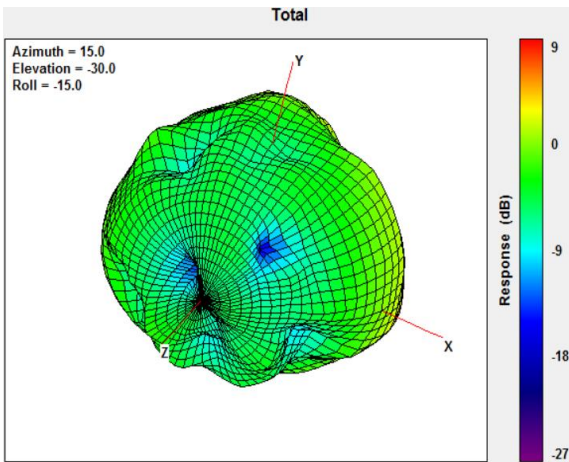
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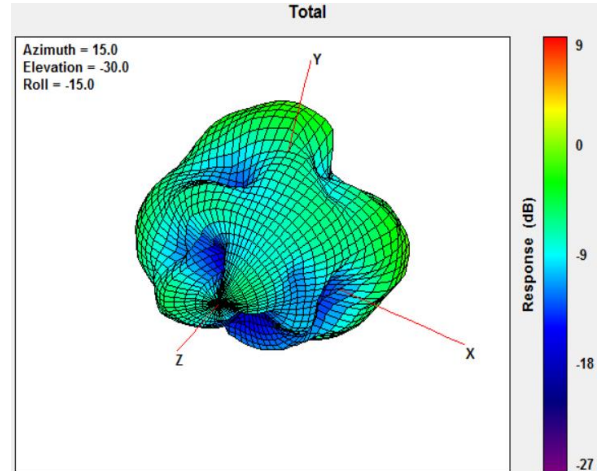
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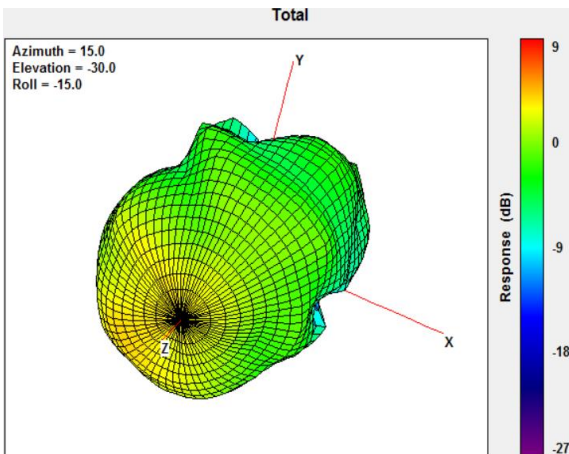
3.1.8 3D Radiation pattern (MIMO1 with 3M cable length on the 50*50 ground plane)



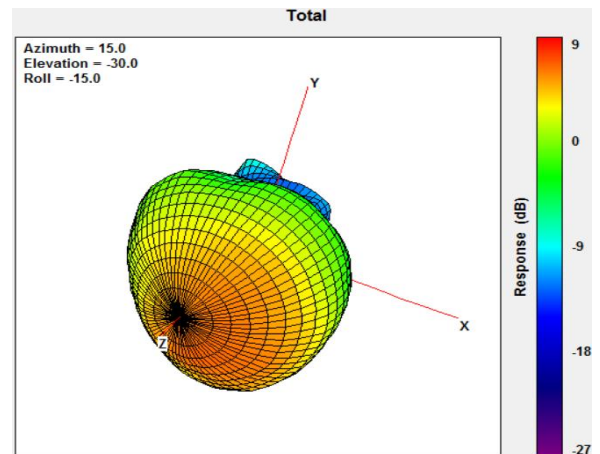
704MHz



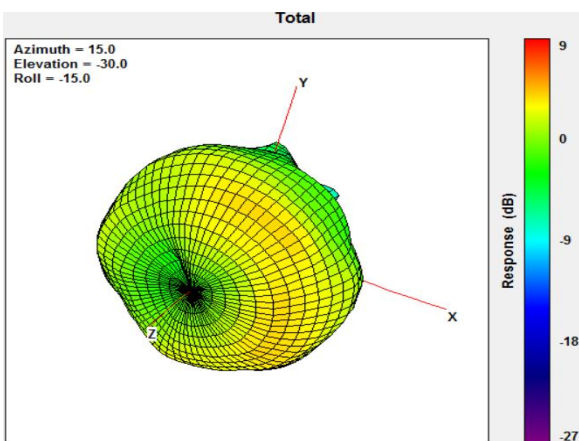
960MHz



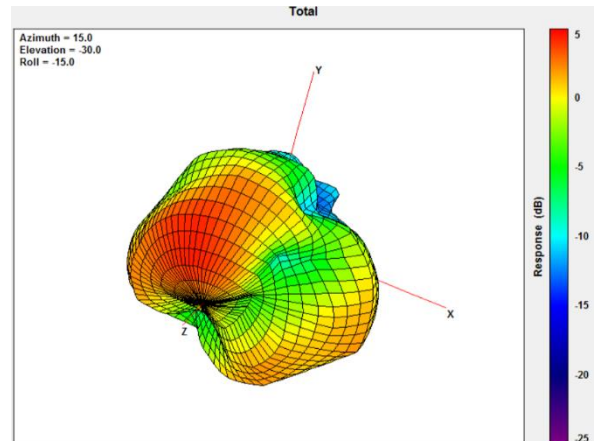
1710MHz



2170MHz



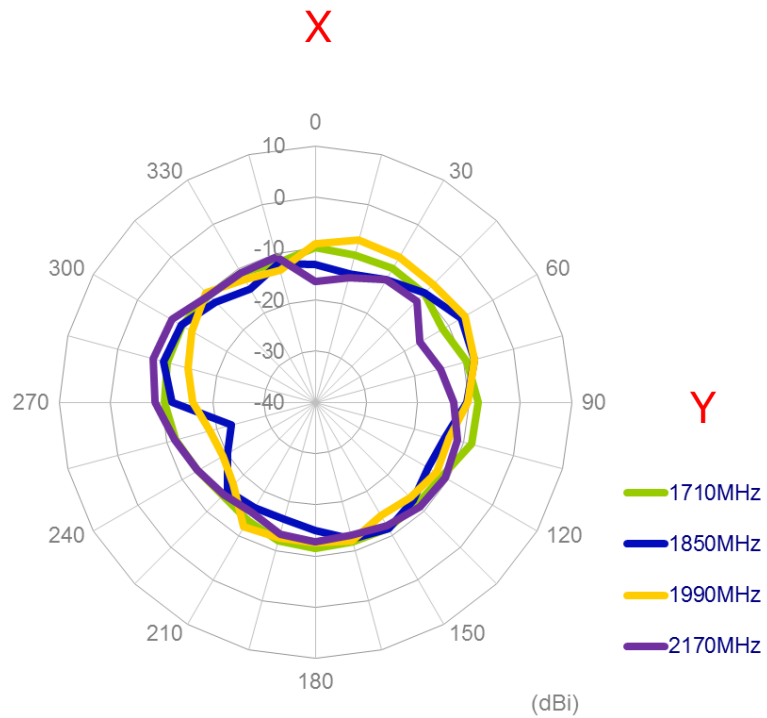
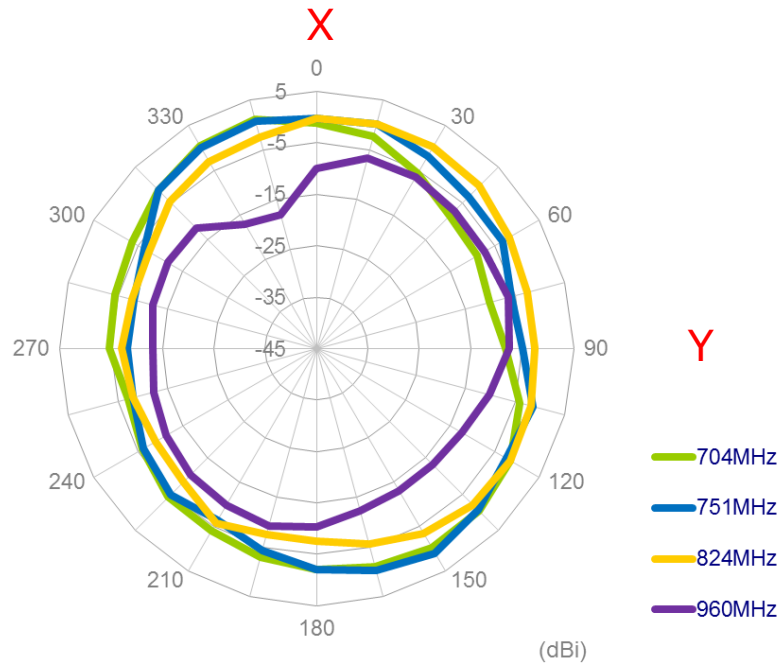
2690MHz

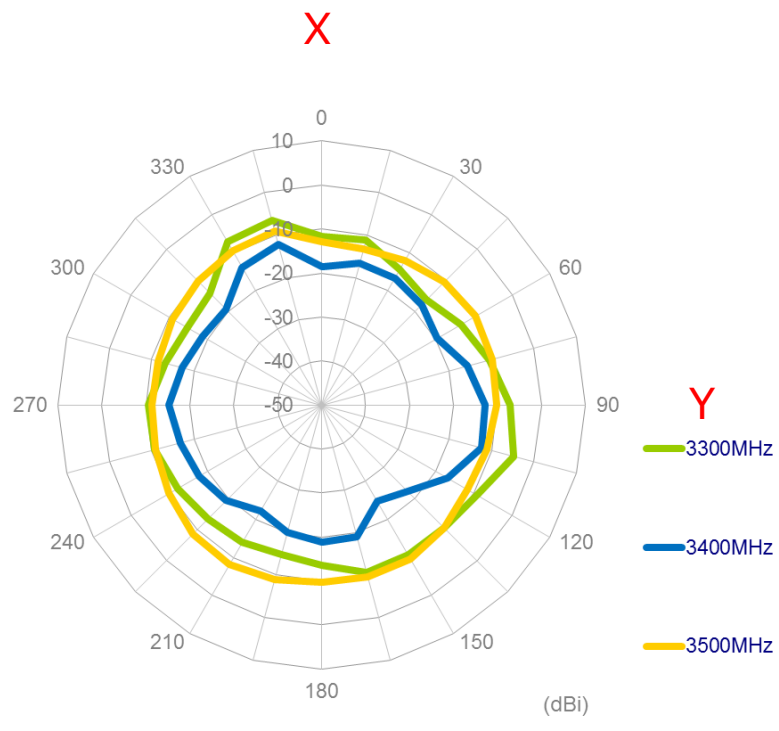
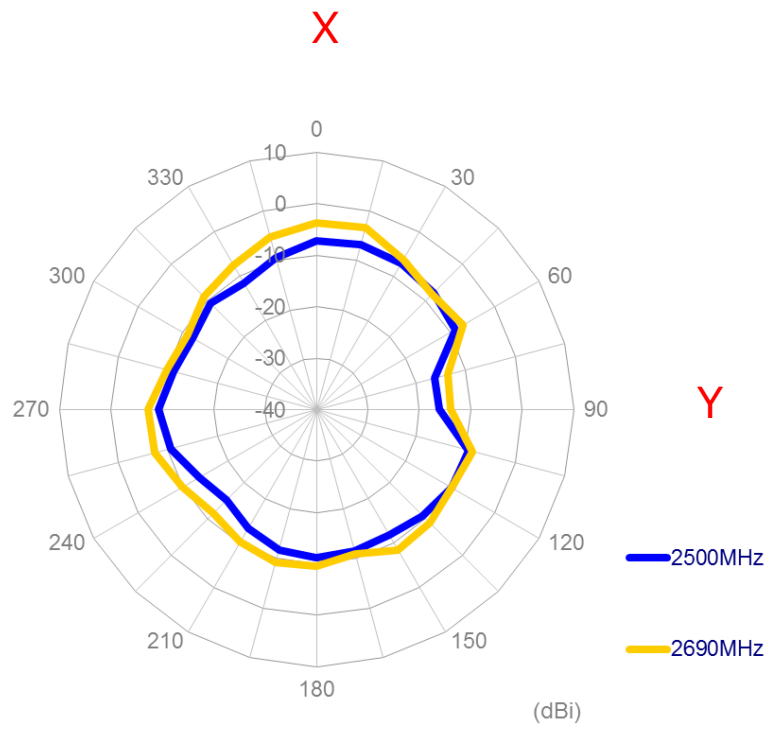


3500MHz

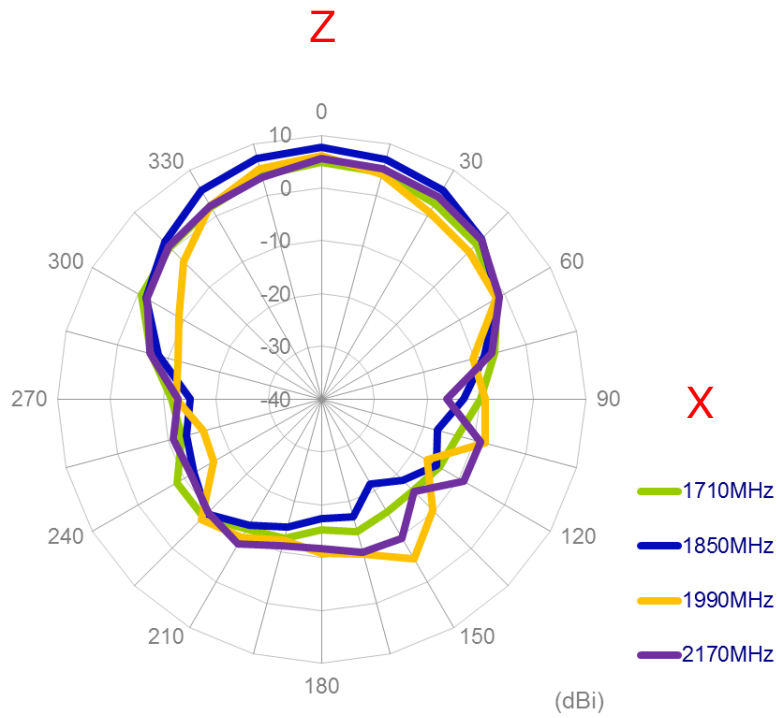
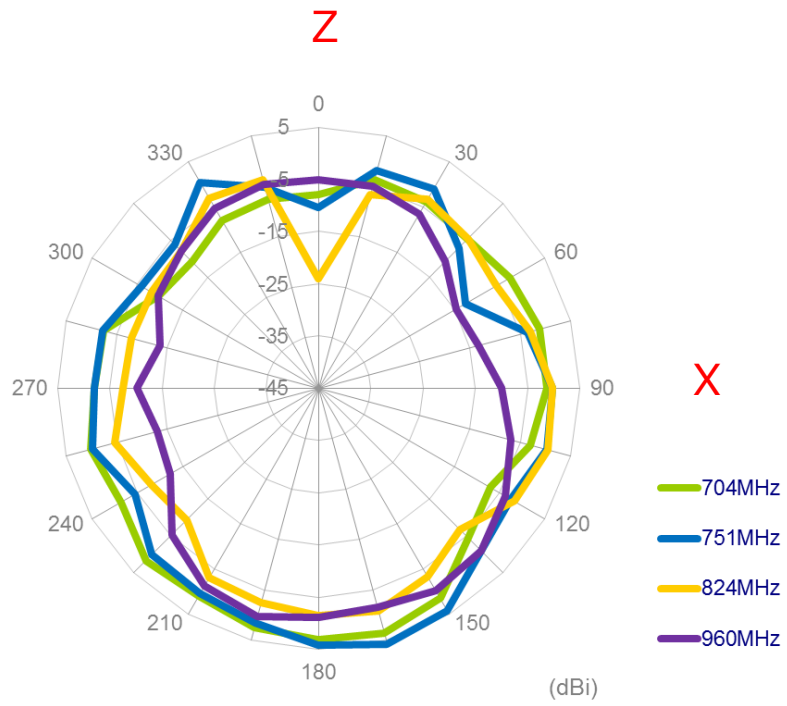
3.1.9 2D Radiation pattern (MIMO2 with 3M cable length on the 50*50 ground plane)

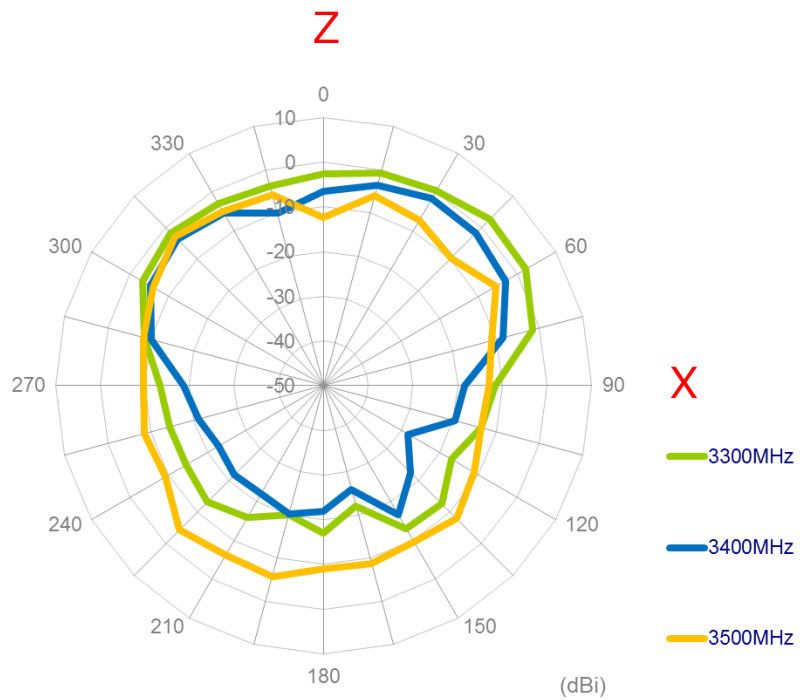
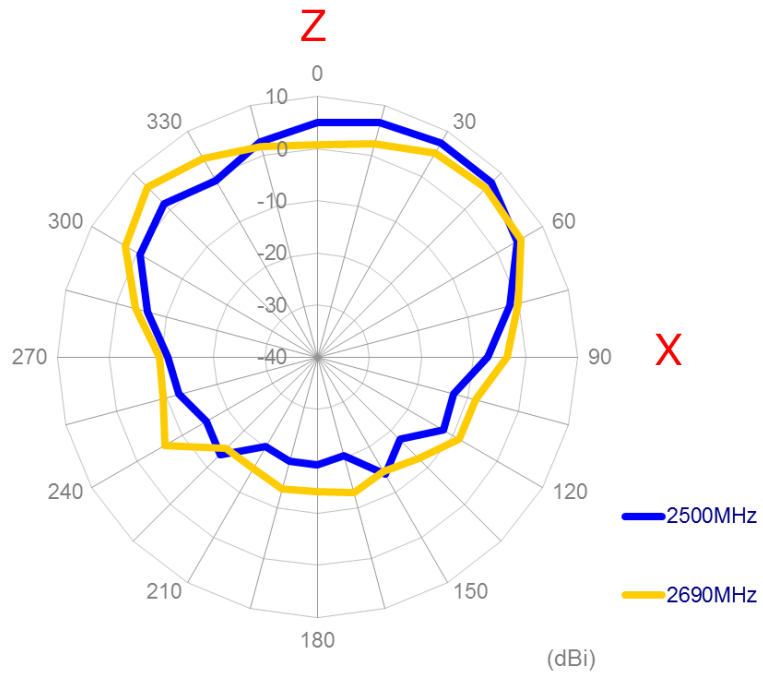
XY Plane



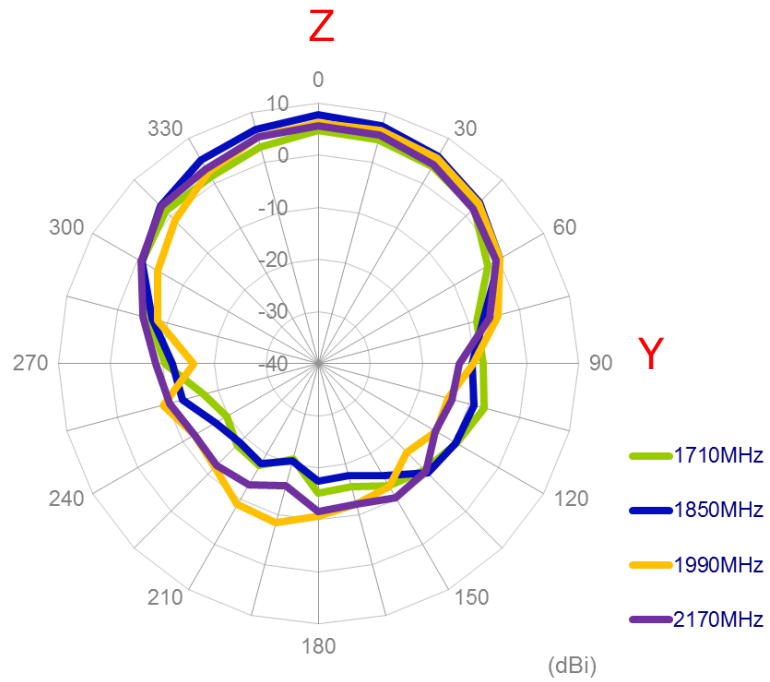
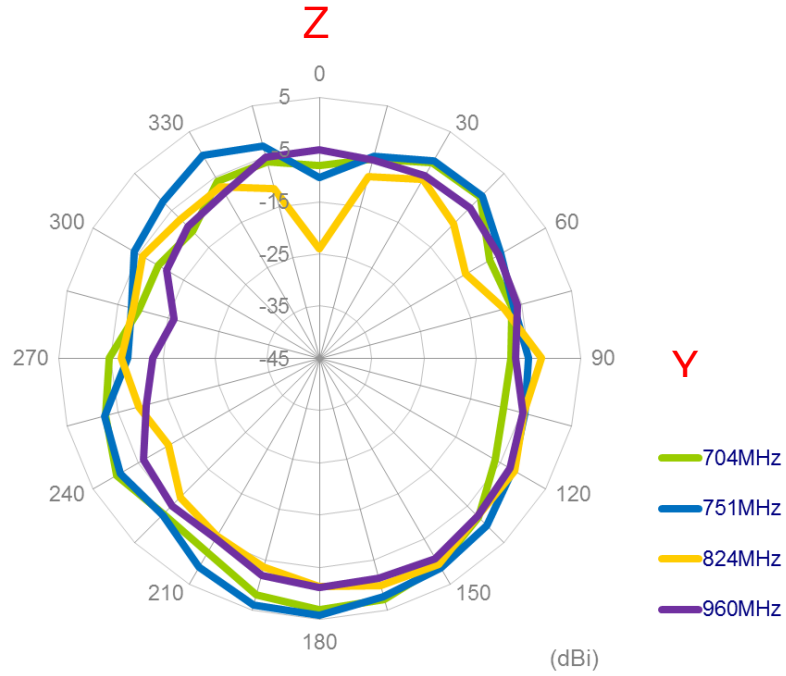


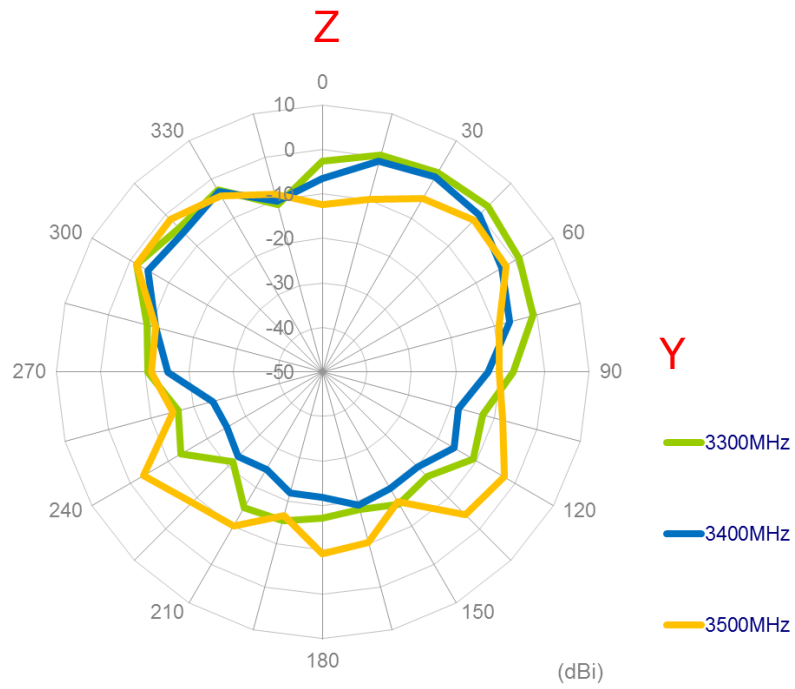
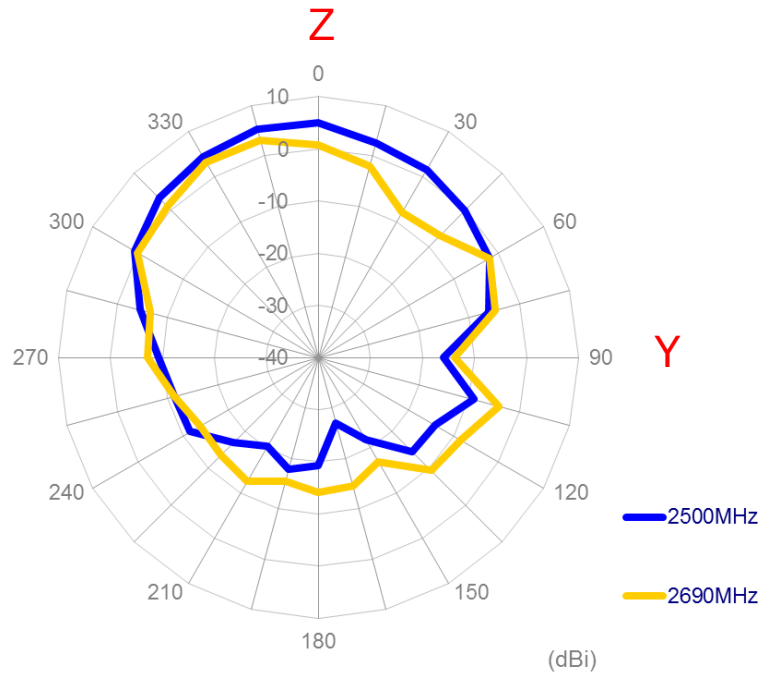
XZ Plane



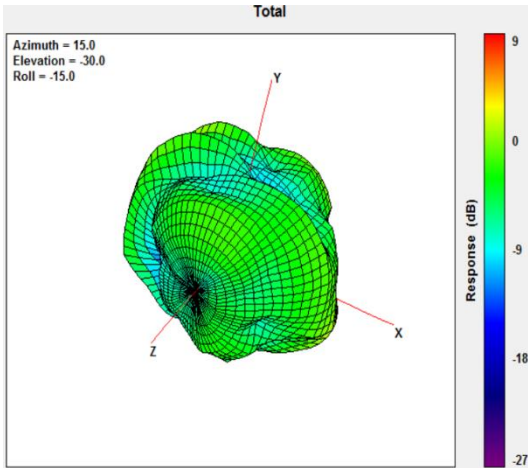


YZ Plane

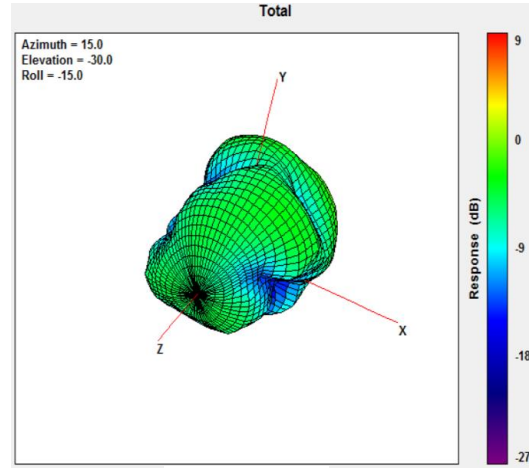




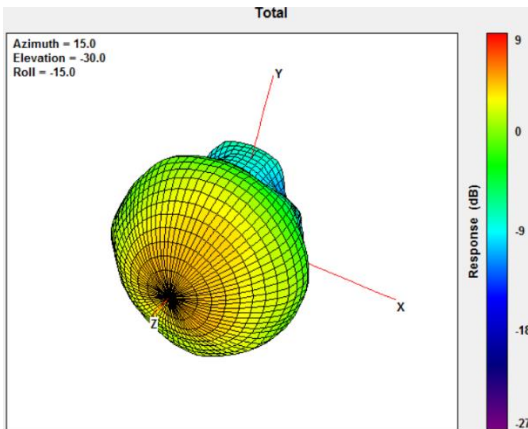
3.1.10 3D Radiation pattern (MIMO2 with 3M cable length on the 50*50 ground plane)



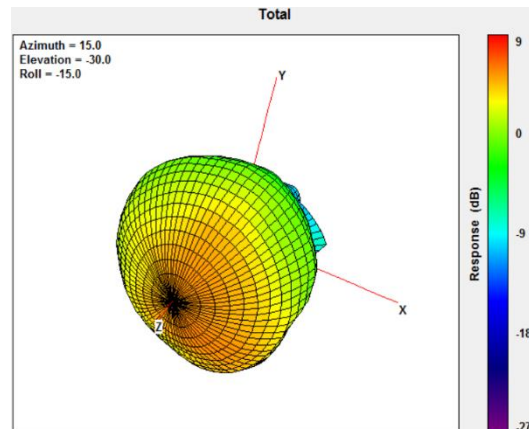
704MHz



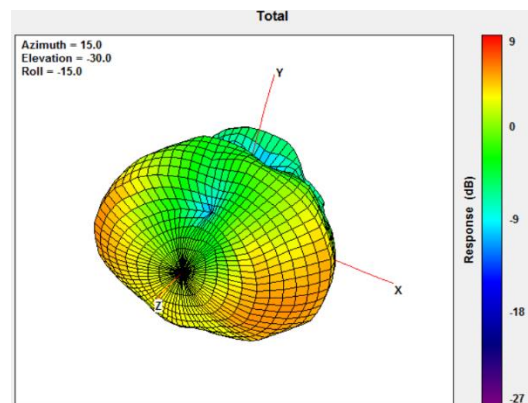
960MHz



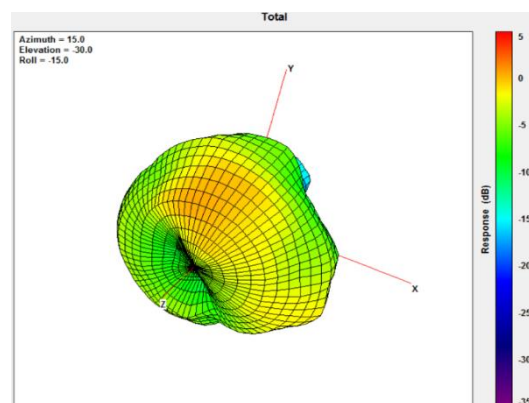
1710MHz



2170MHz

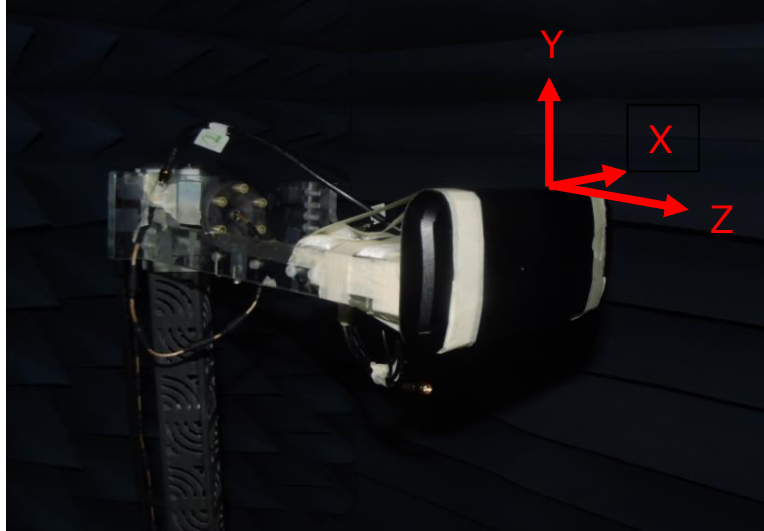


2690MHz



3500MHz

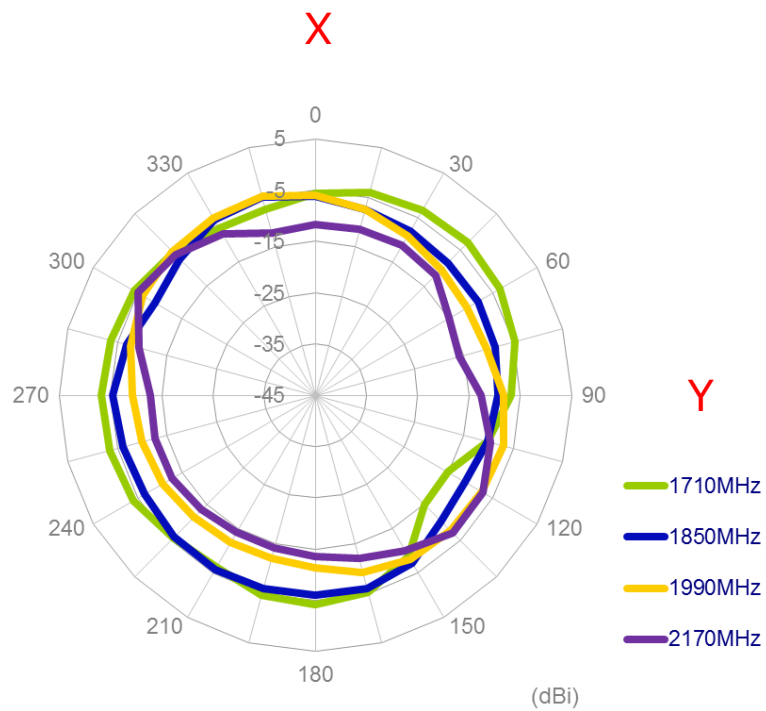
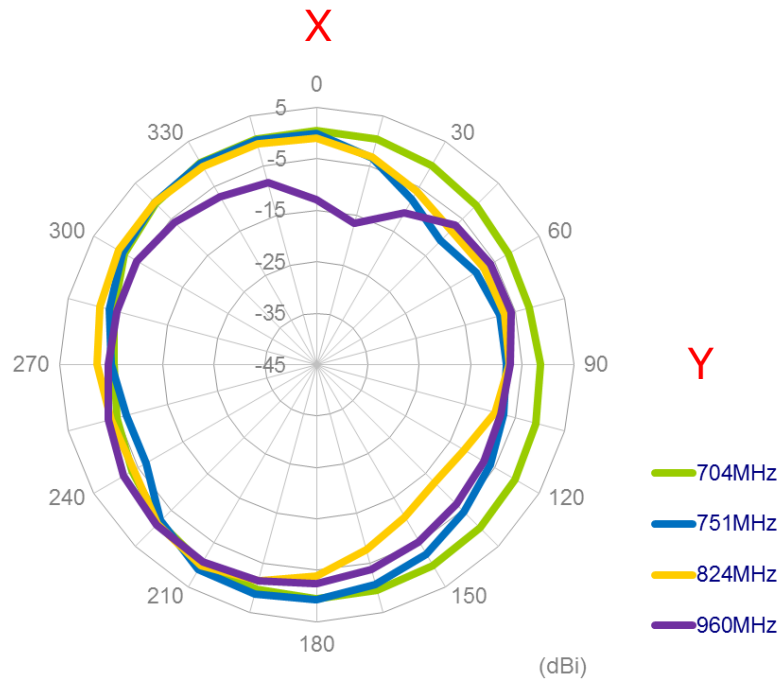
3.1.11 Test Setup For Antenna Radiation Pattern (ETS Anechoic chamber)

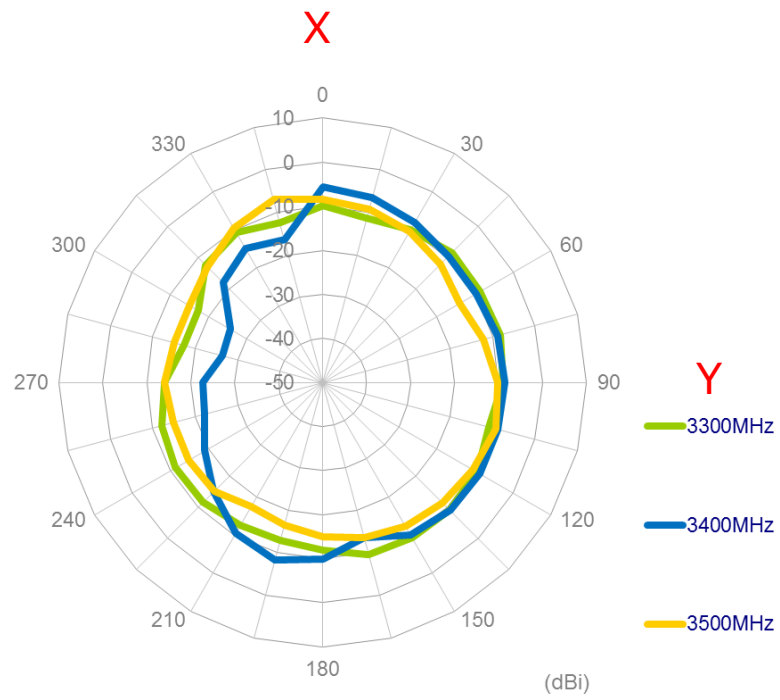
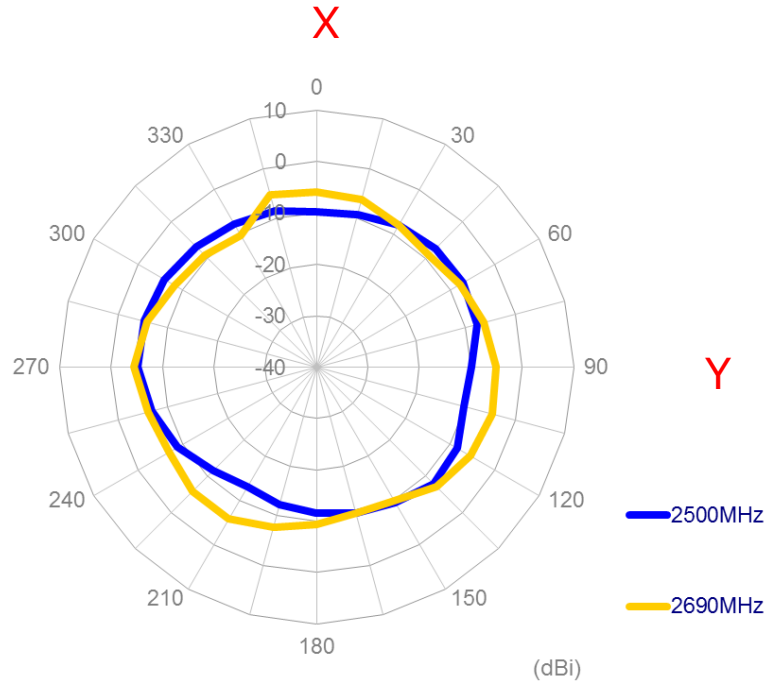


In free space

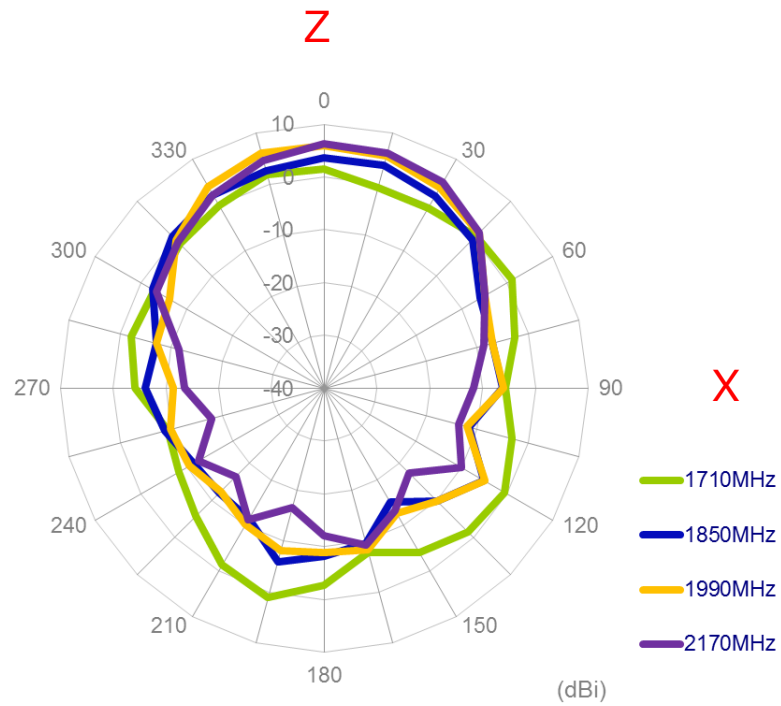
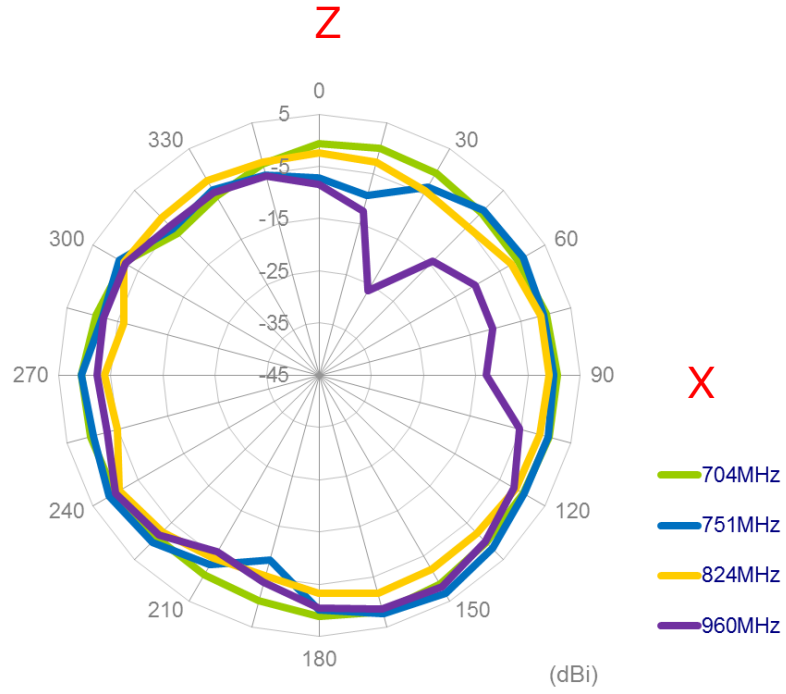
3.1.12 2D Radiation pattern (MIMO1 with 3M cable length in free space)

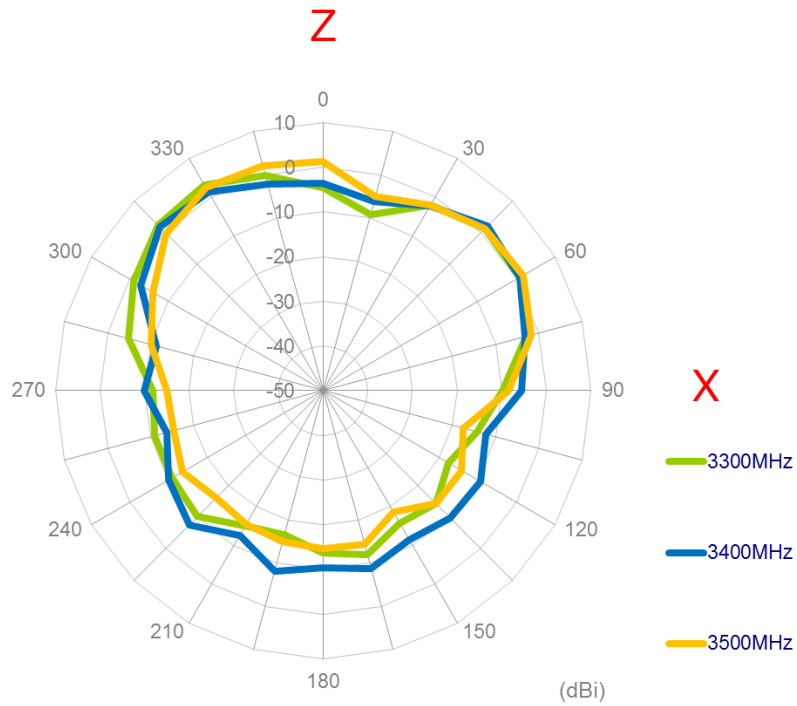
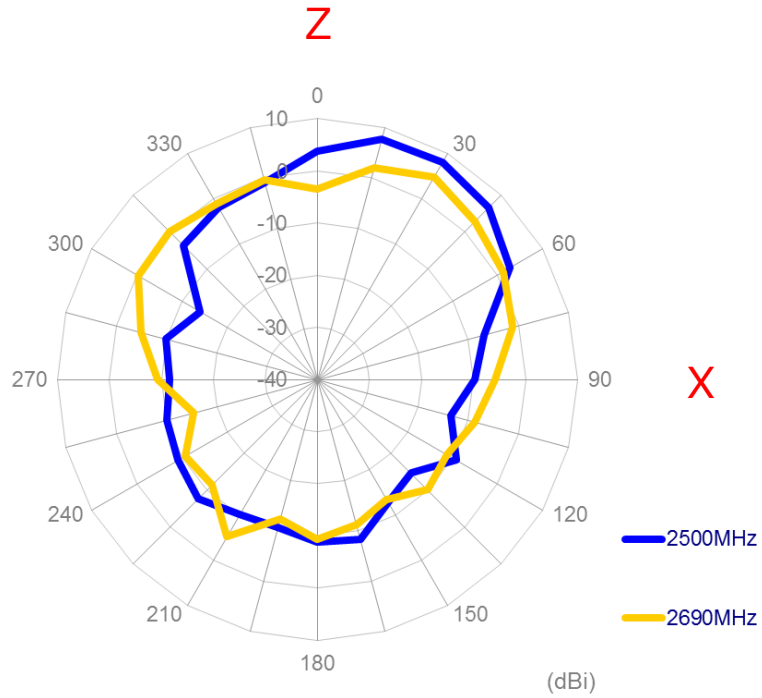
XY Plane



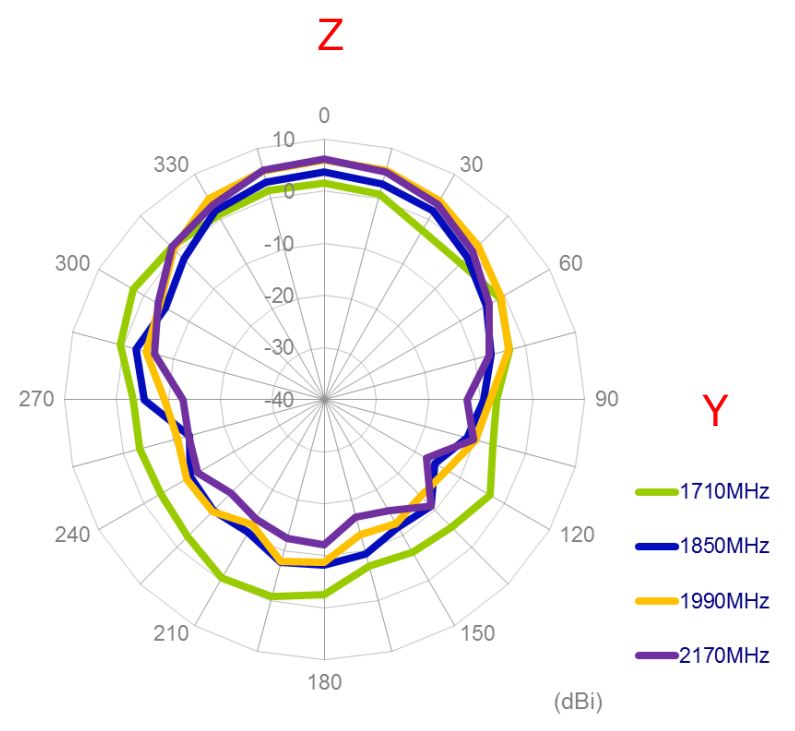
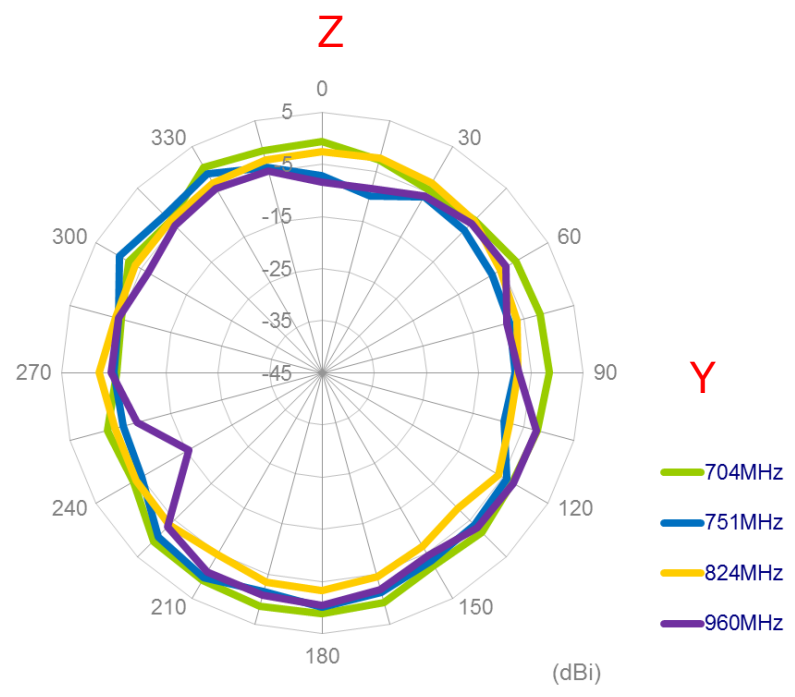


XZ Plane

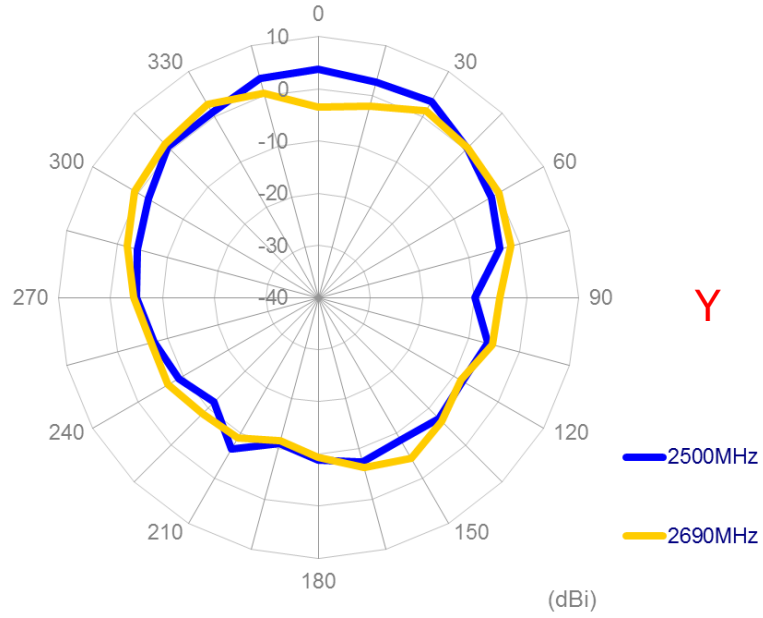




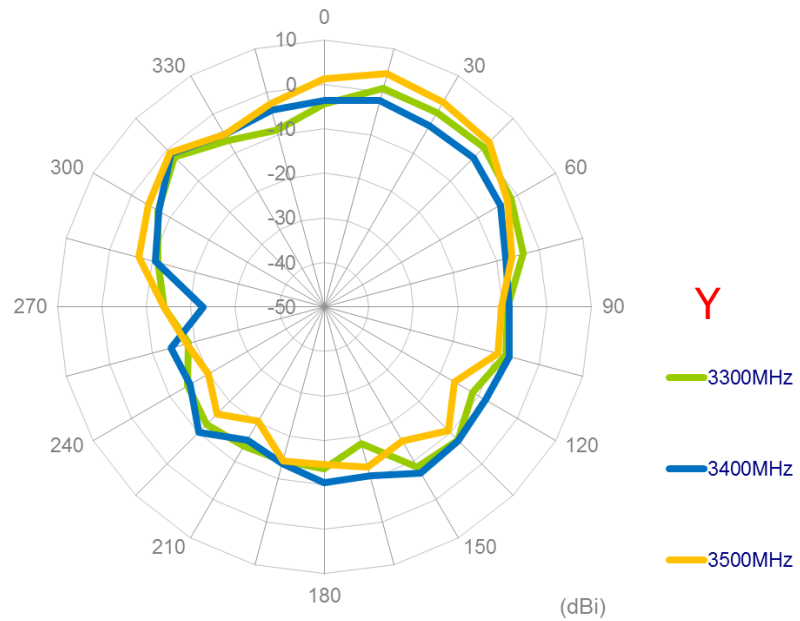
YZ Plane



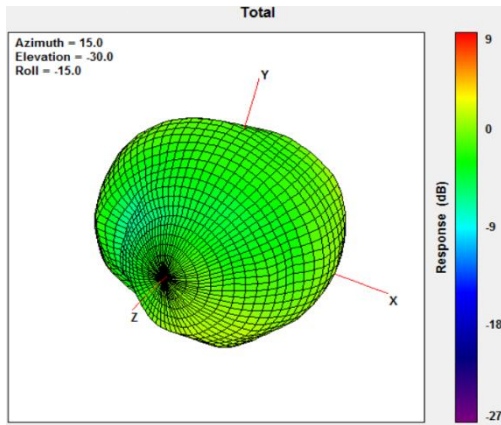
Z



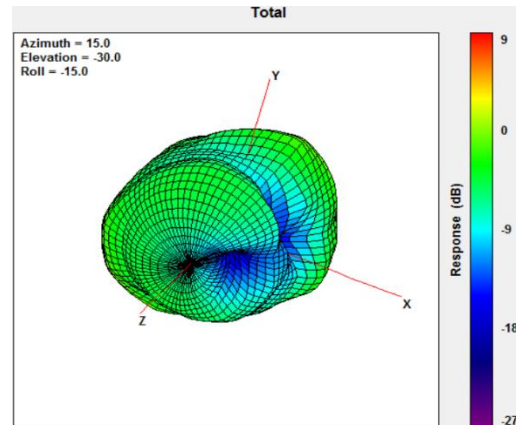
Z



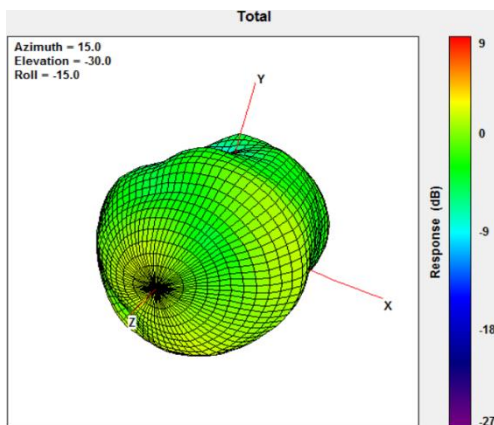
3.1.13 3D Radiation pattern (MIMO1 with 3M cable length in free space)



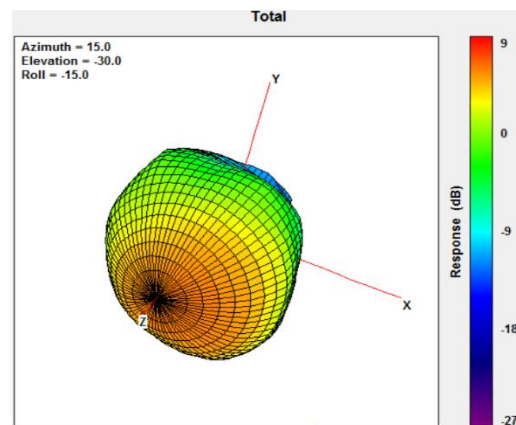
704MHz



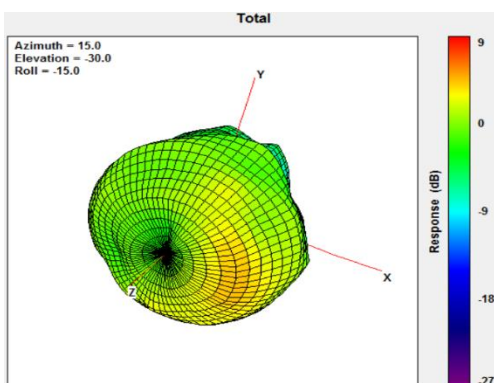
960MHz



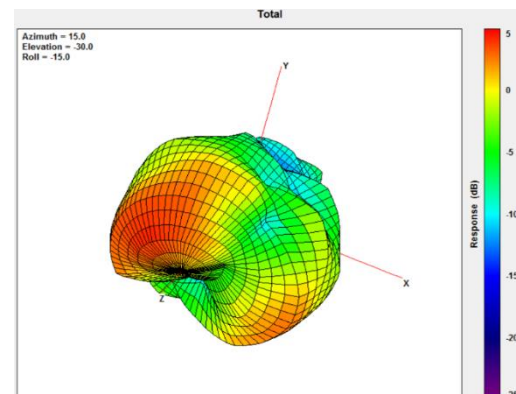
1710MHz



2170MHz



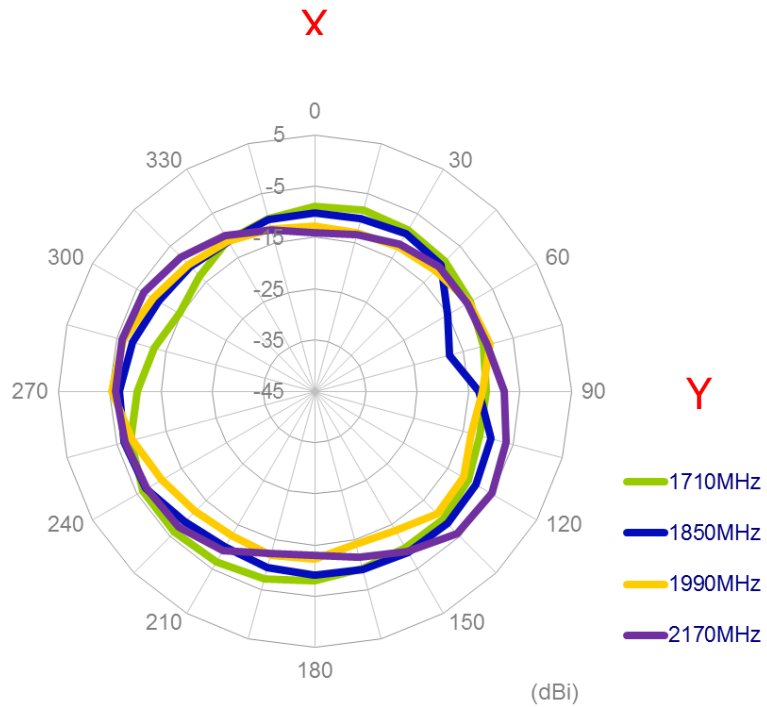
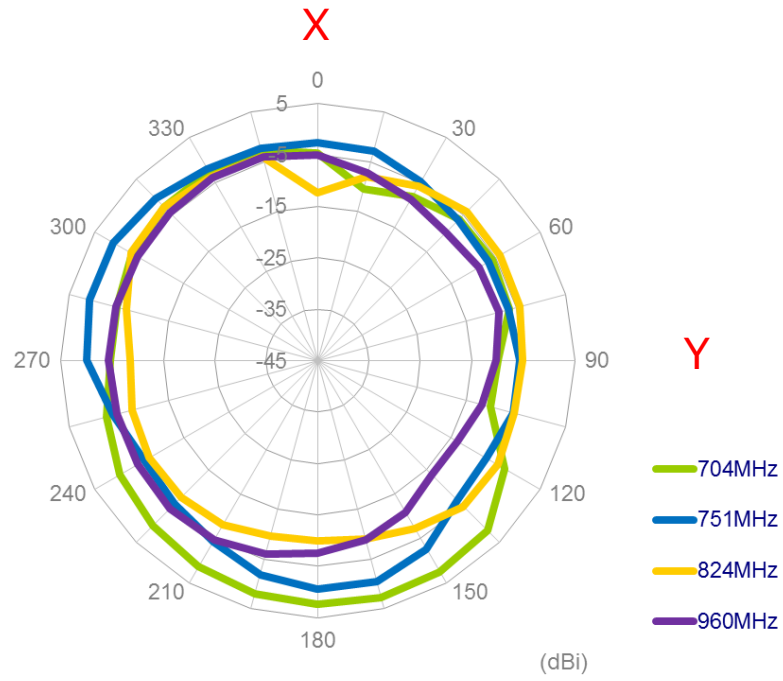
2690MHz

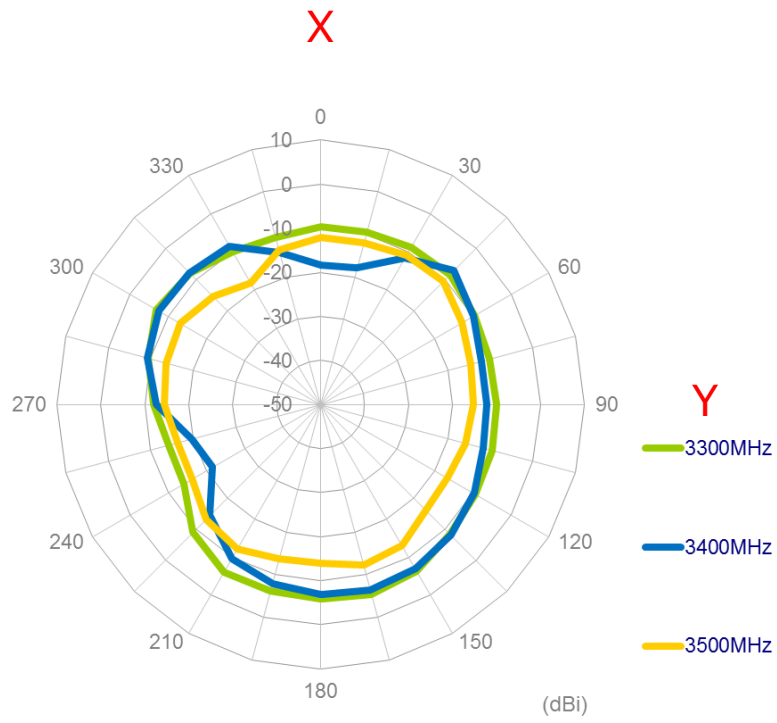
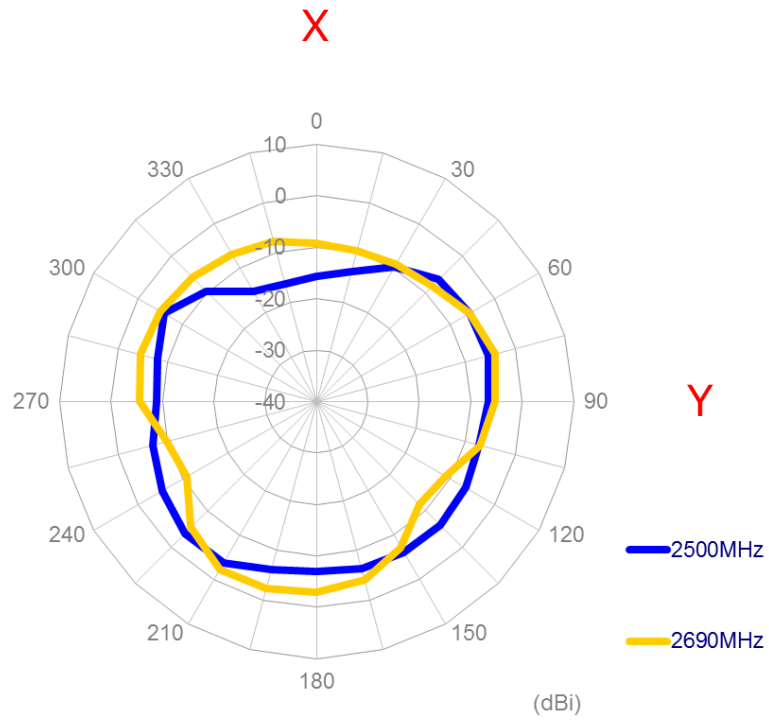


3500MHz

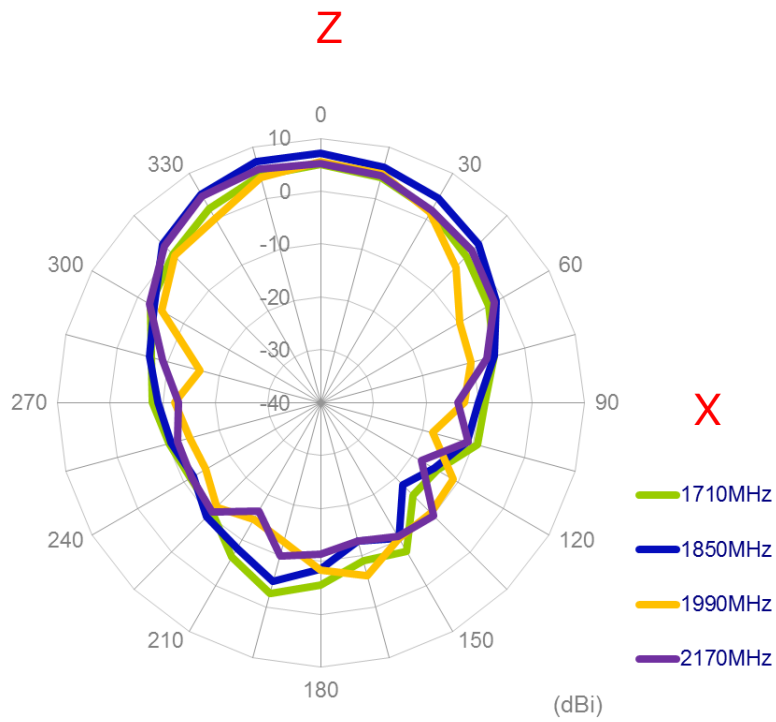
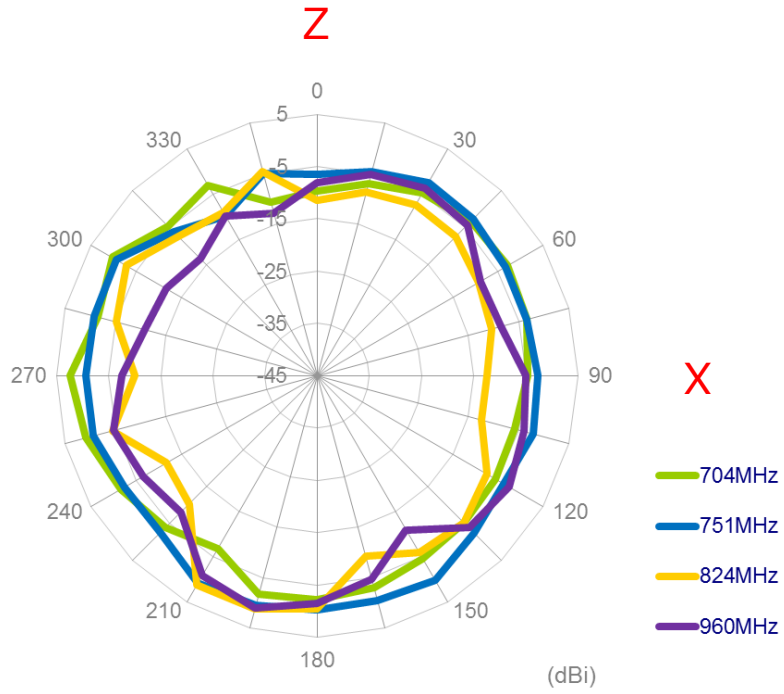
3.1.14 2D Radiation pattern (MIMO2 with 3M cable length in free space)

XY Plane

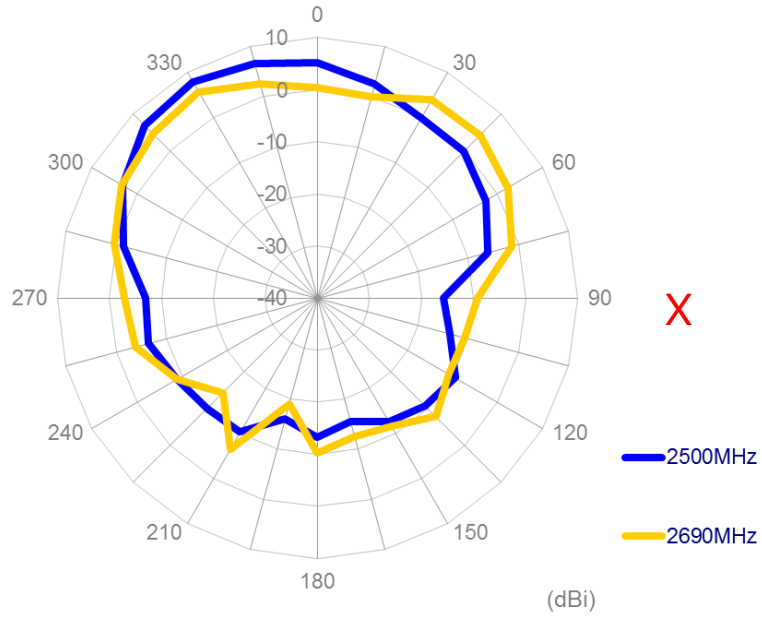




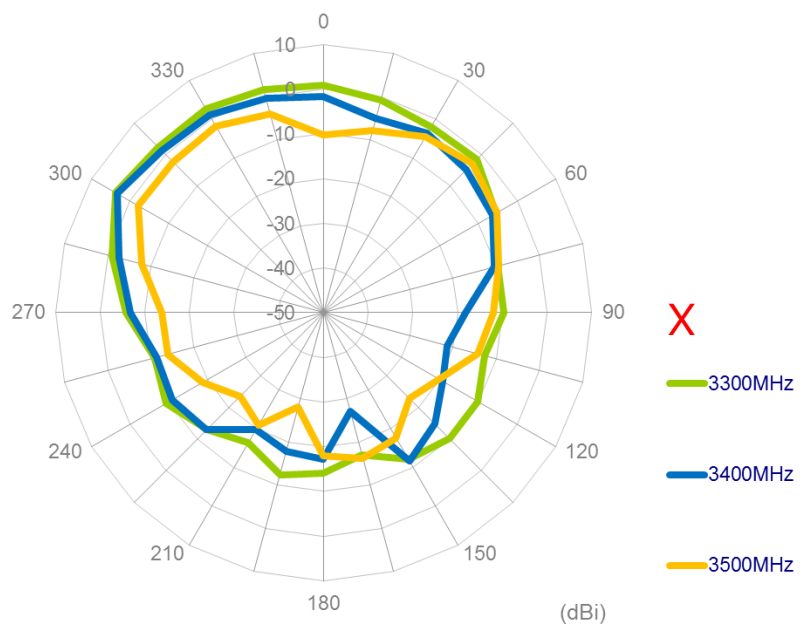
XZ Plane



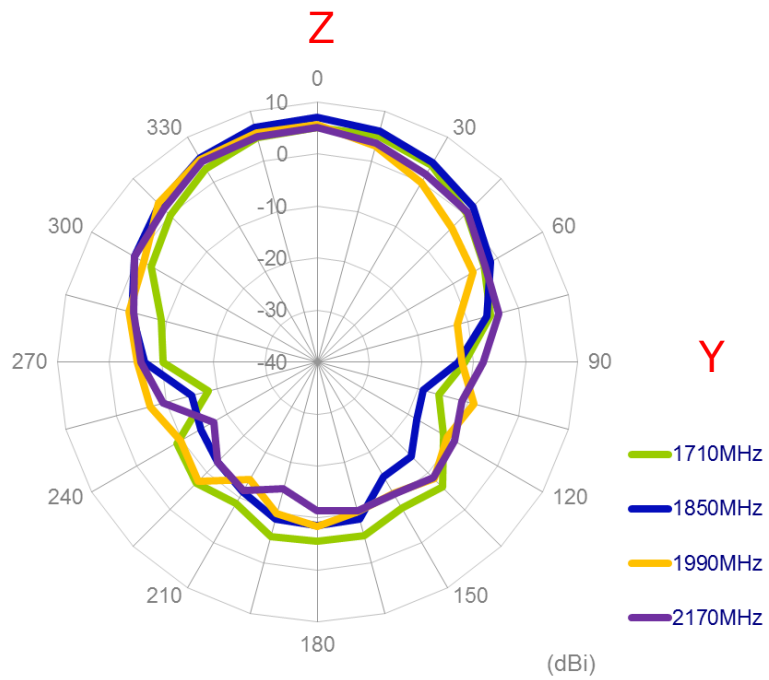
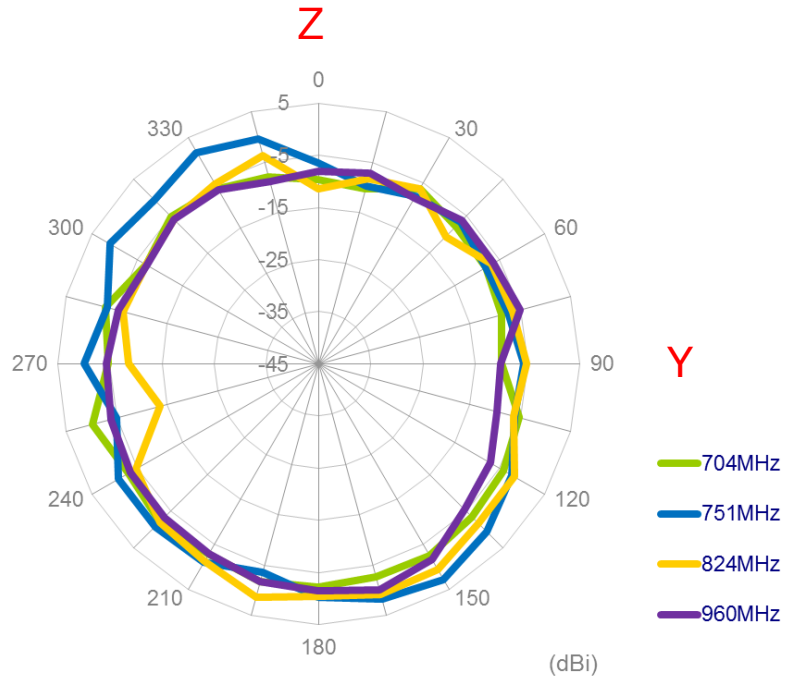
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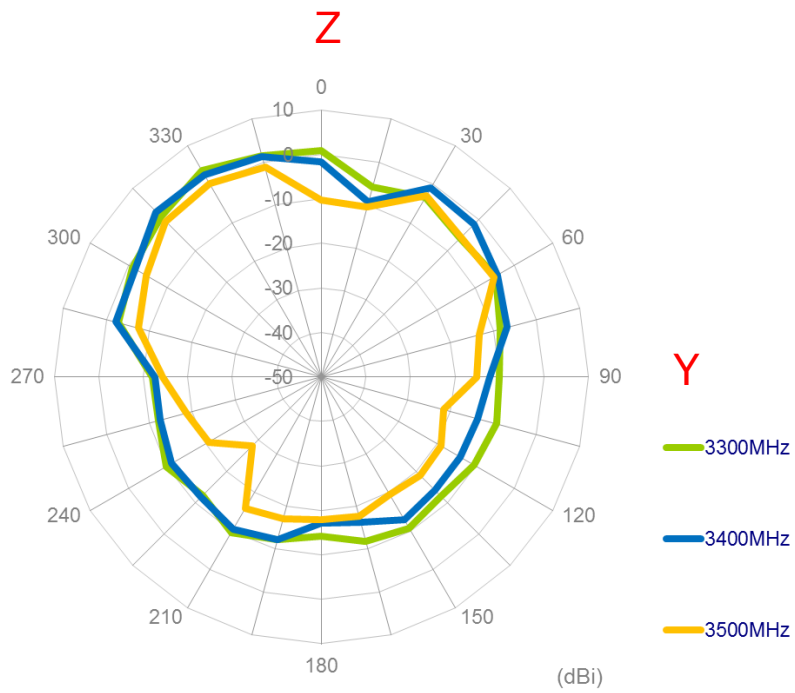
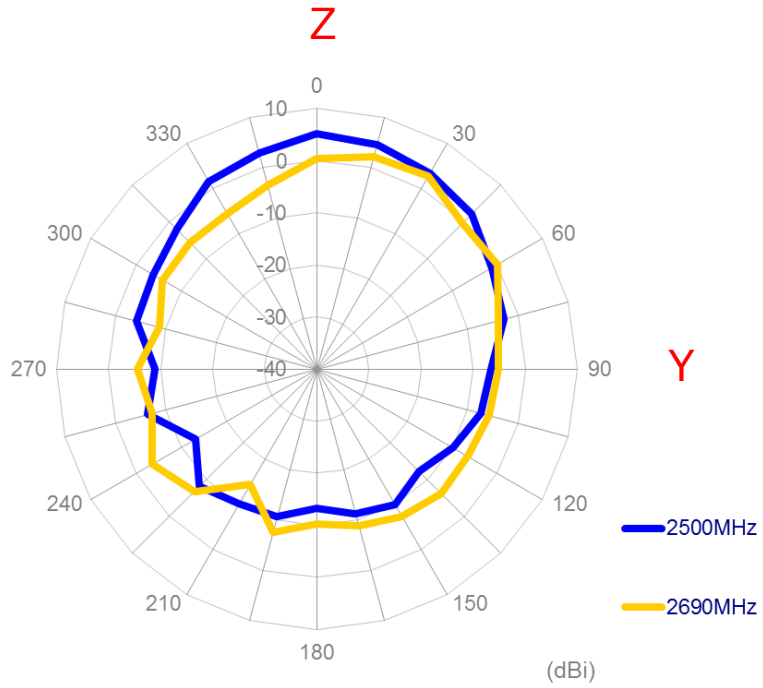


Z

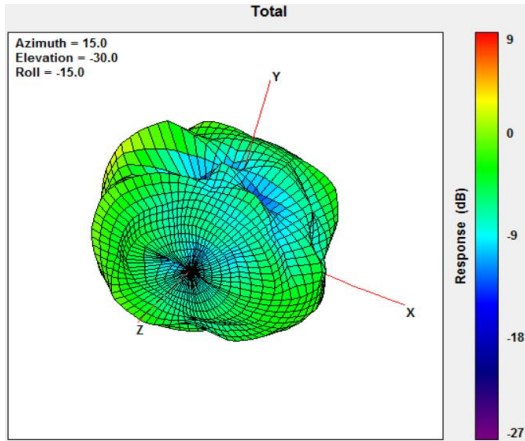


YZ Plane

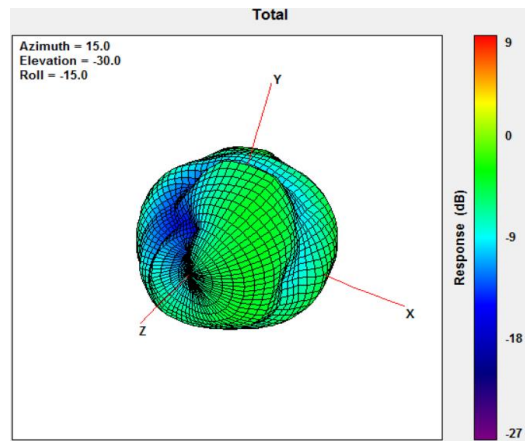




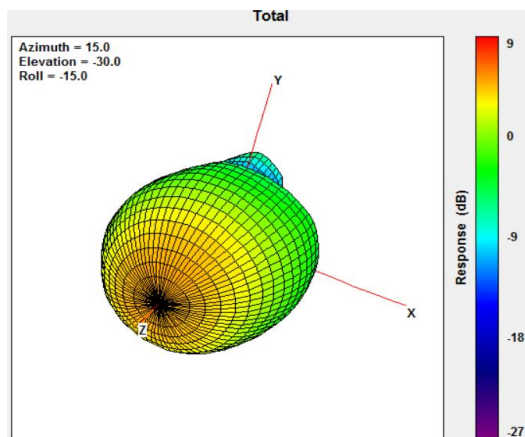
3.1.15 2D Radiation pattern (MIMO2 with 3M cable length in free space)



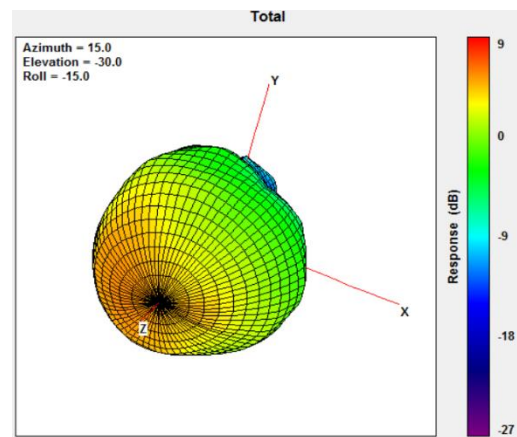
704MHz



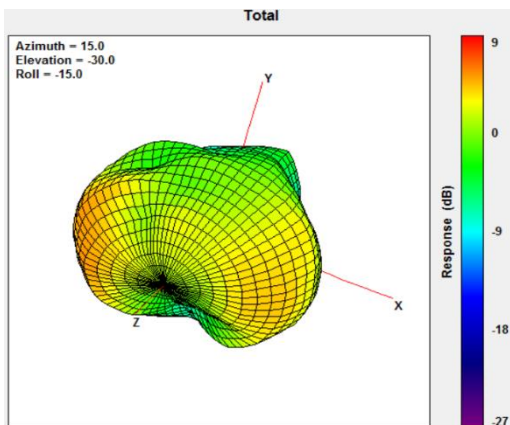
960MHz



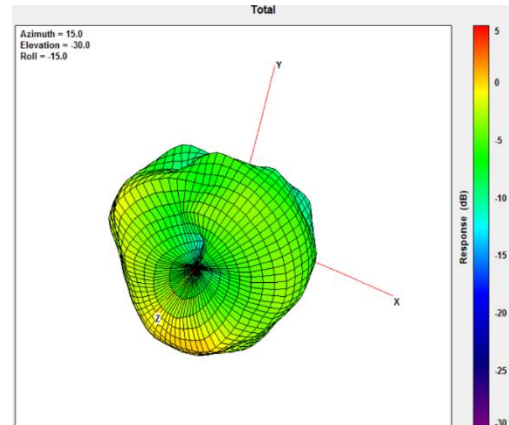
1710MHz



2170MHz

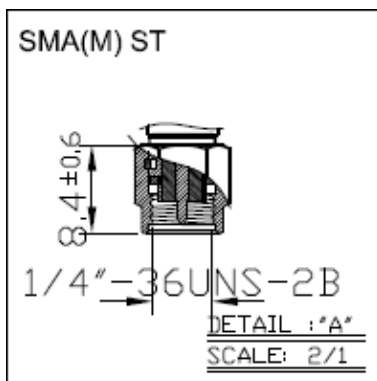
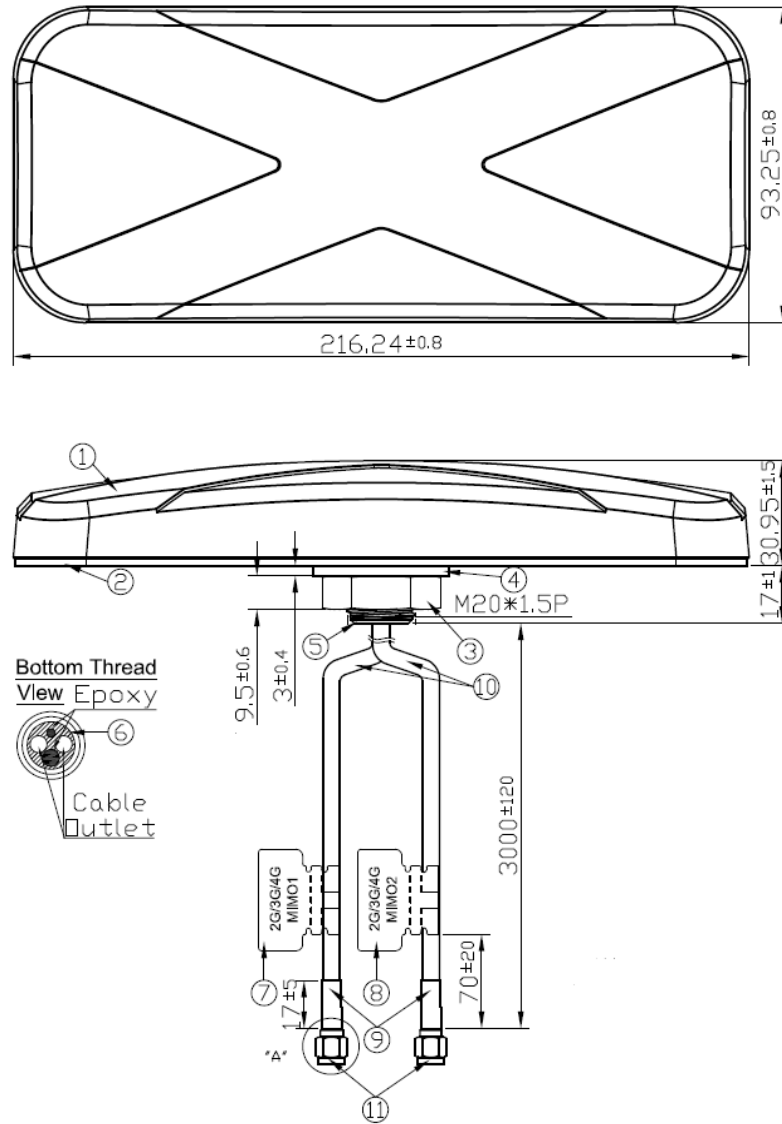


2690MHz



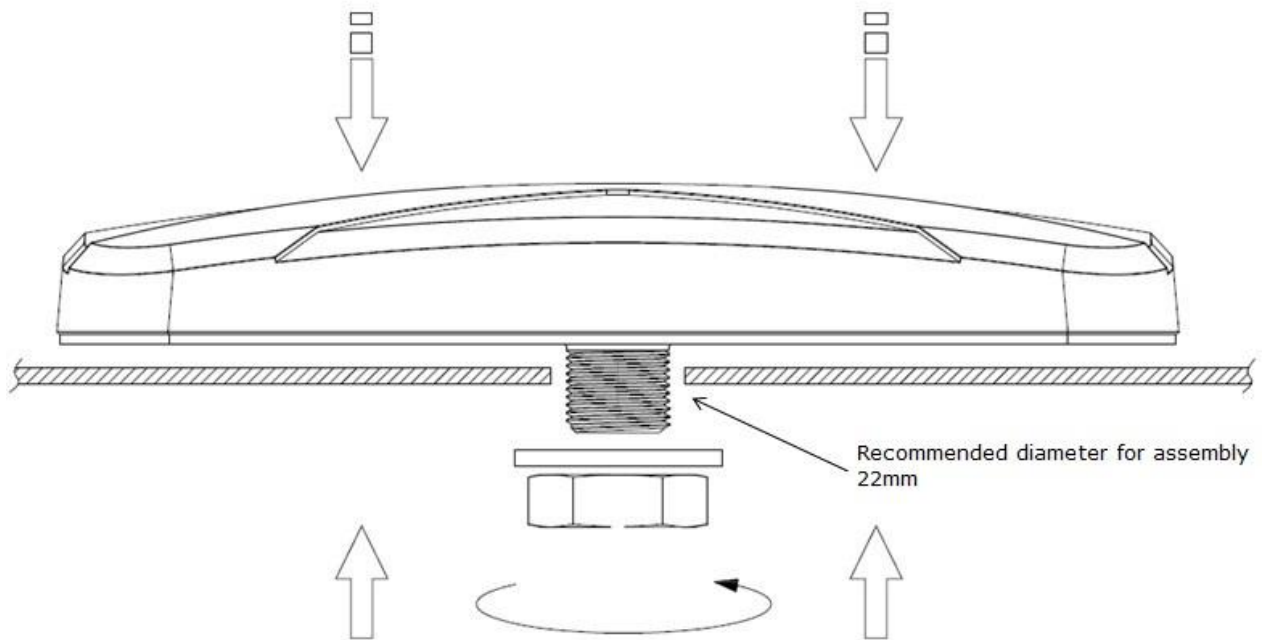
3500MHz

4. Mechanical Drawing



	Name	P/N	Material	Finish	QTY
1	Housing	000113K000066A	ABS+PC	Black	1
2	3M Adhesive Tape & Closed Cell Foam	001013K000039A	3M 9448+CR-4305	Black	1
3	Nut_M20x1.5Px10H Cut	000413E030061A	Steel	Ni Plated	1
4	Washer_Cut	000413E040061A	Steel	NI Plated	1
5	Metal Base	000313K000060A	AL	NI Plated	1
6	Cable Rubber	000713E000063A	Silicone Rubber	Black	1
7	2G/3G/4G MIMO1 Label	001012L080051A	Coated Paper	Gray	1
8	2G/3G/4G MIMO2 Label	001012L090051A	Coated Paper	White	1
9	Heat Shrink Tube	001311F010012A	PE	Black	2
10	CFD200 Coaxial Cable	301412K000012A	PVC	Black	2
11	SMA(M) ST	200213G000012A	Brass	Gold Plated	2

5. Installation



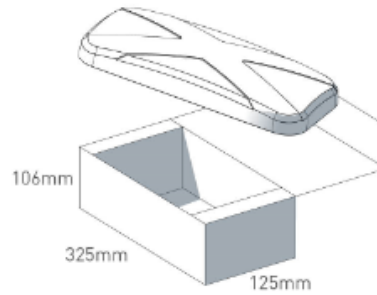
Recommended torque for mounting is 29.4 N.m
Maximum torque for mounting is 39.2 N.m

6. Packaging

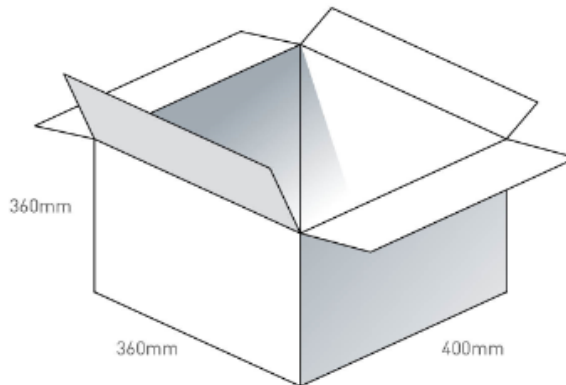
MA412.A.BI.003

Packaging Specifications

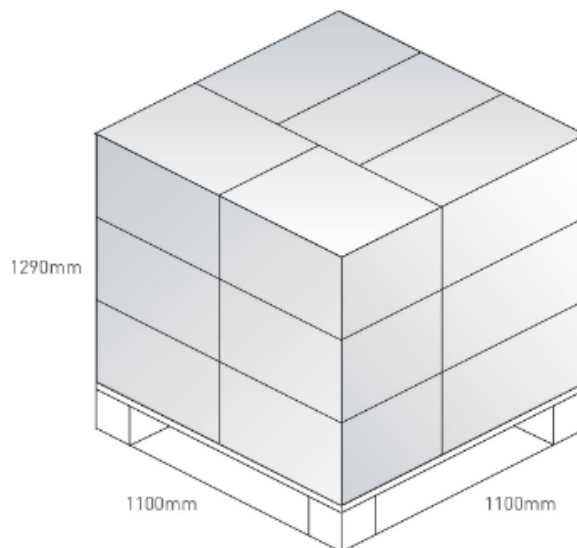
1pc MA412.A.BI.003 per small box
 Box Dimensions - 325x125x106mm
 Weight - 820g



9 small boxes in one carton
 Carton Dimensions - 360x360x400mm
 Weight - 8.28Kg



Pallet Dimensions 1080x720x1350mm
 15 Cartons per Pallet
 5 Cartons per layer
 3 Layers

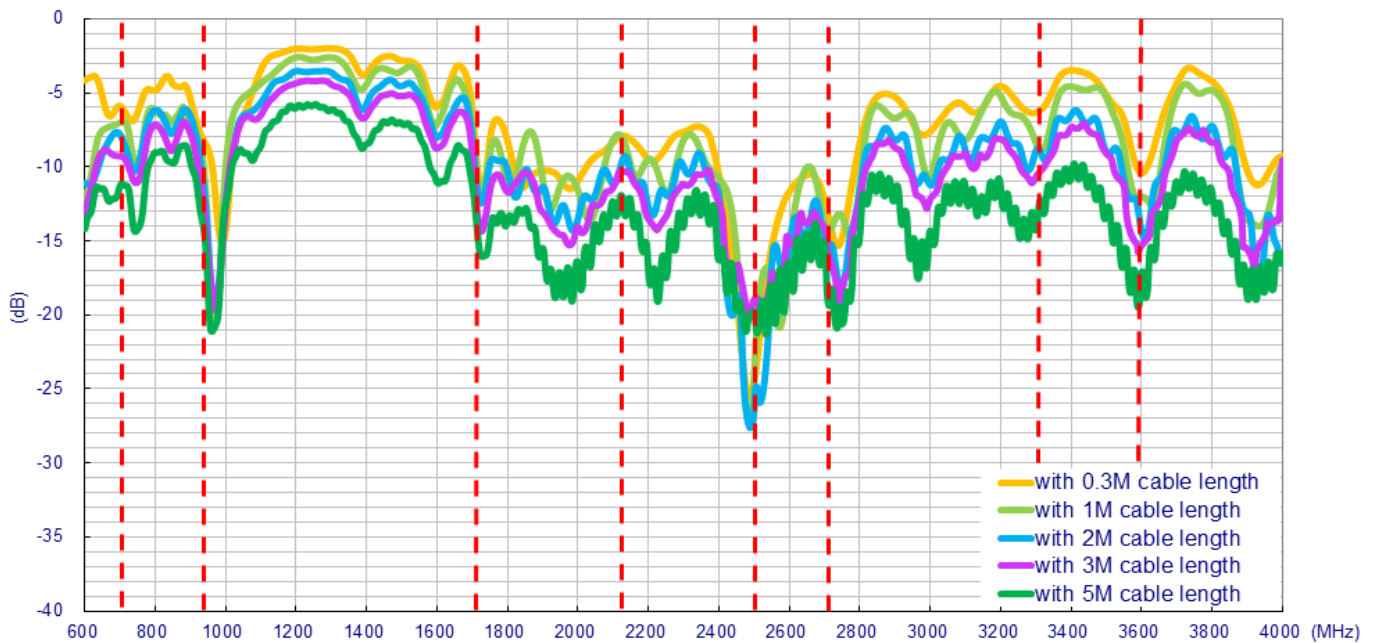


7. Application Note (LTE MIMO Antenna)

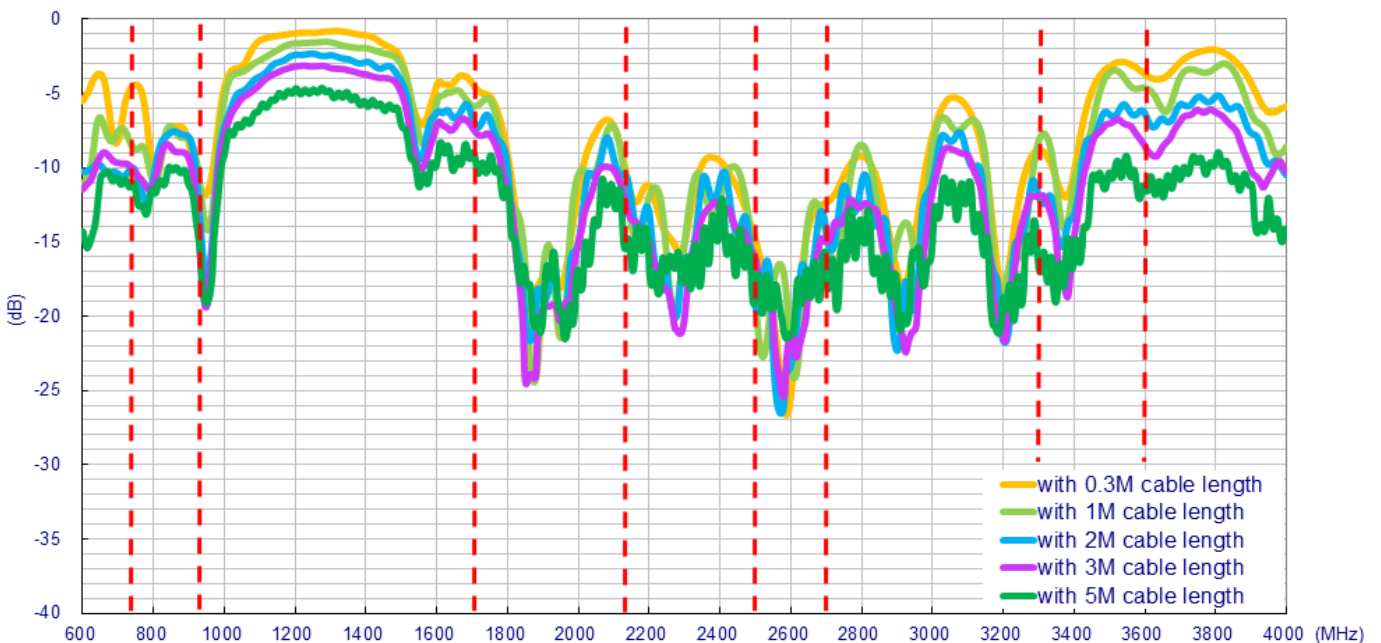
The MA412 antenna performance with different cable lengths and different environments is shown below.

7.1 On the 50*50cm ground plane

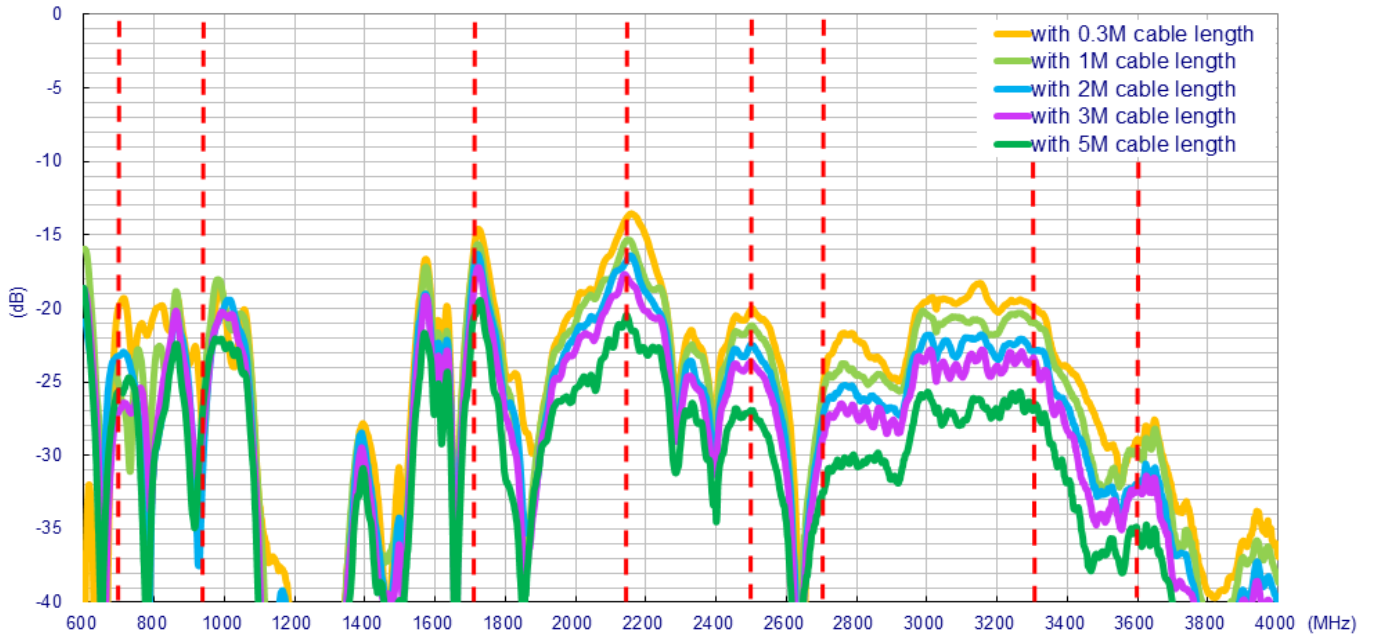
7.1.1 Return Loss (MIMO_1 on the 50*50cm ground plane)



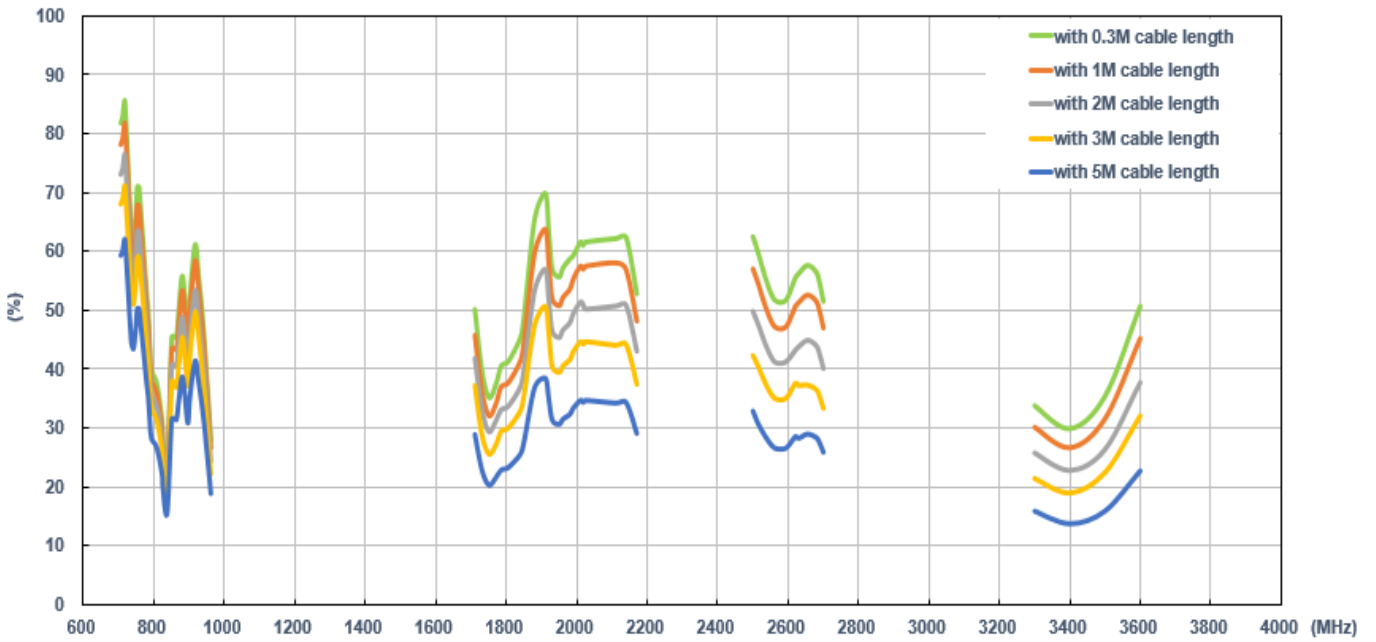
7.1.2 Return Loss (MIMO_2 on the 50*50cm ground plane)



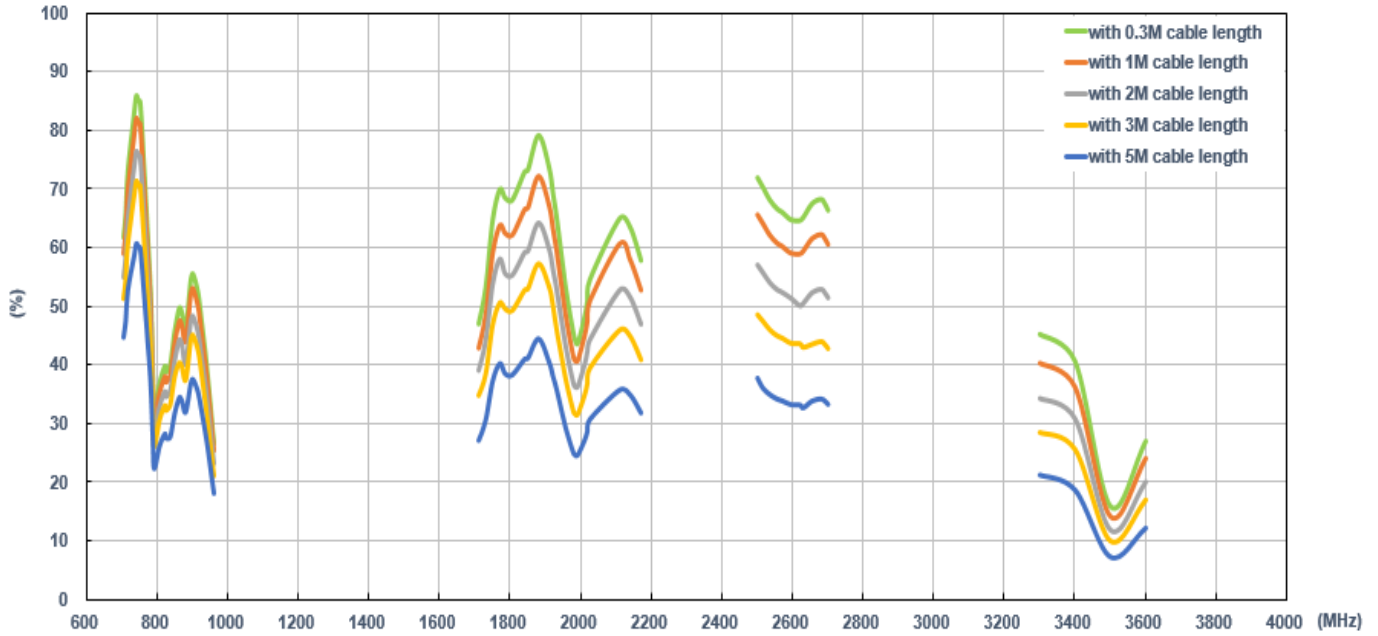
7.1.3 Insertion Loss (on the 50*50cm ground plane)



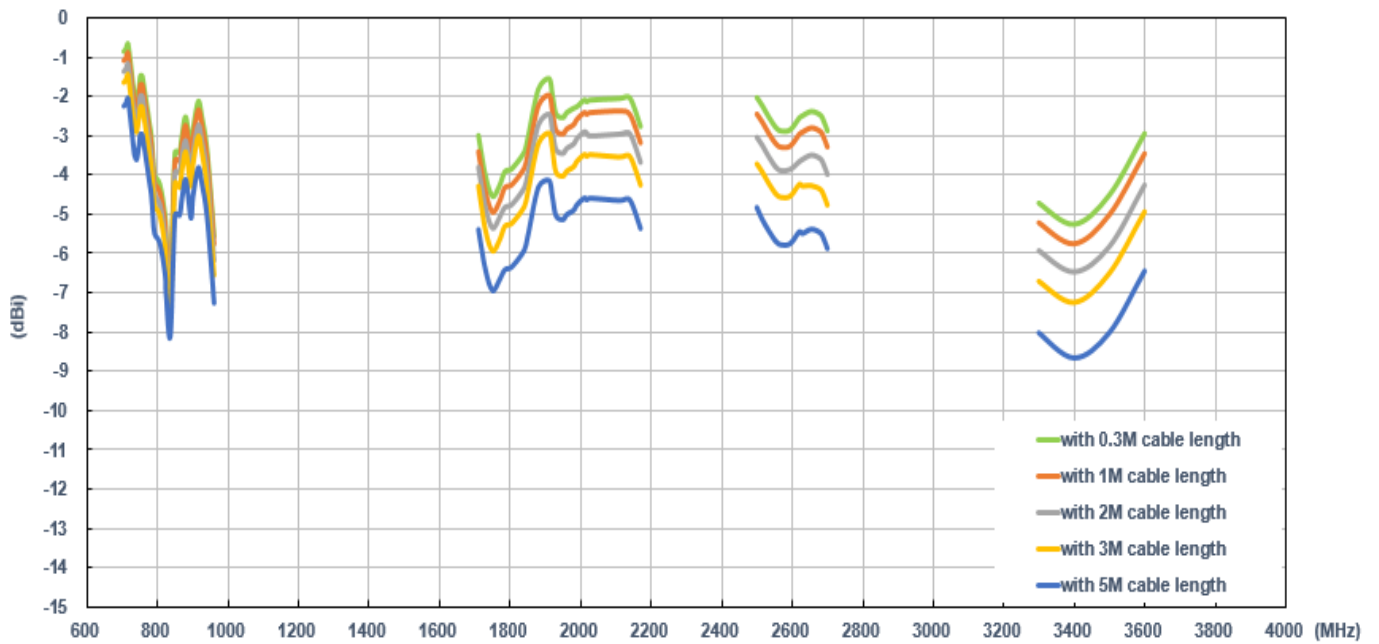
7.1.4 Efficiency (MIMO_1 on the 50*50cm ground plane)



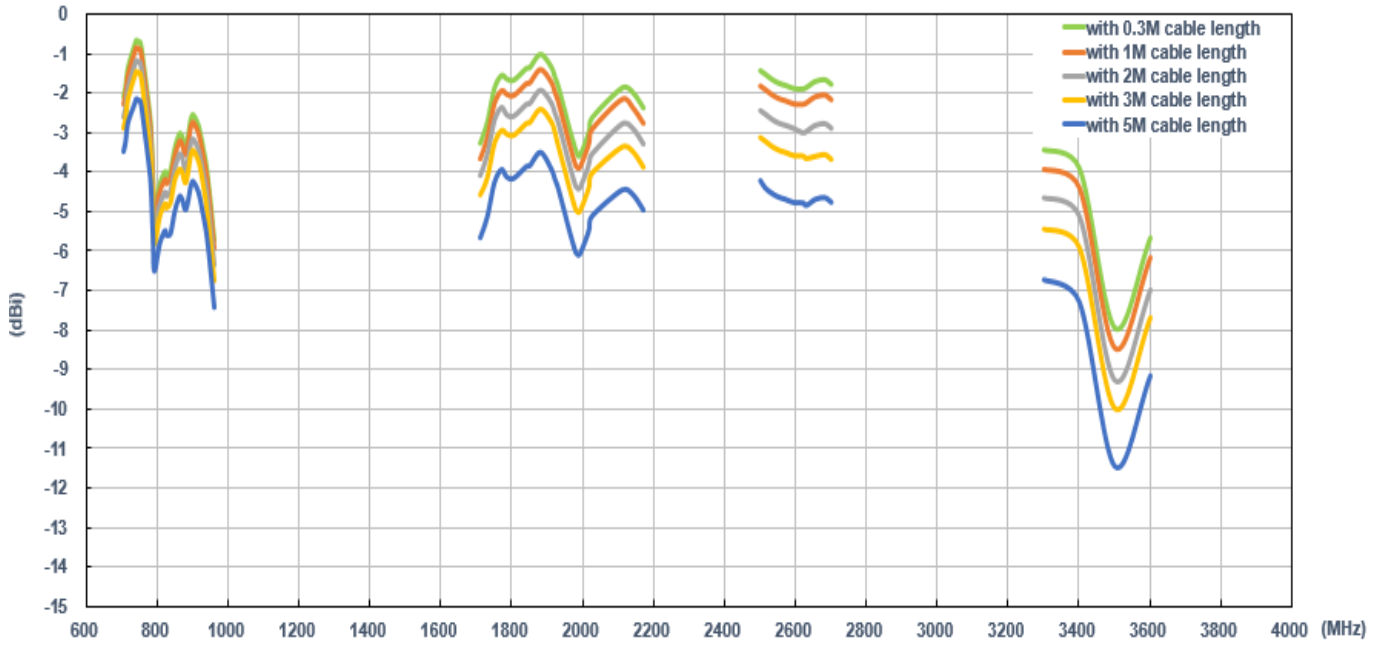
7.1.5 Efficiency (MIMO_2 on the 50*50cm ground plane)



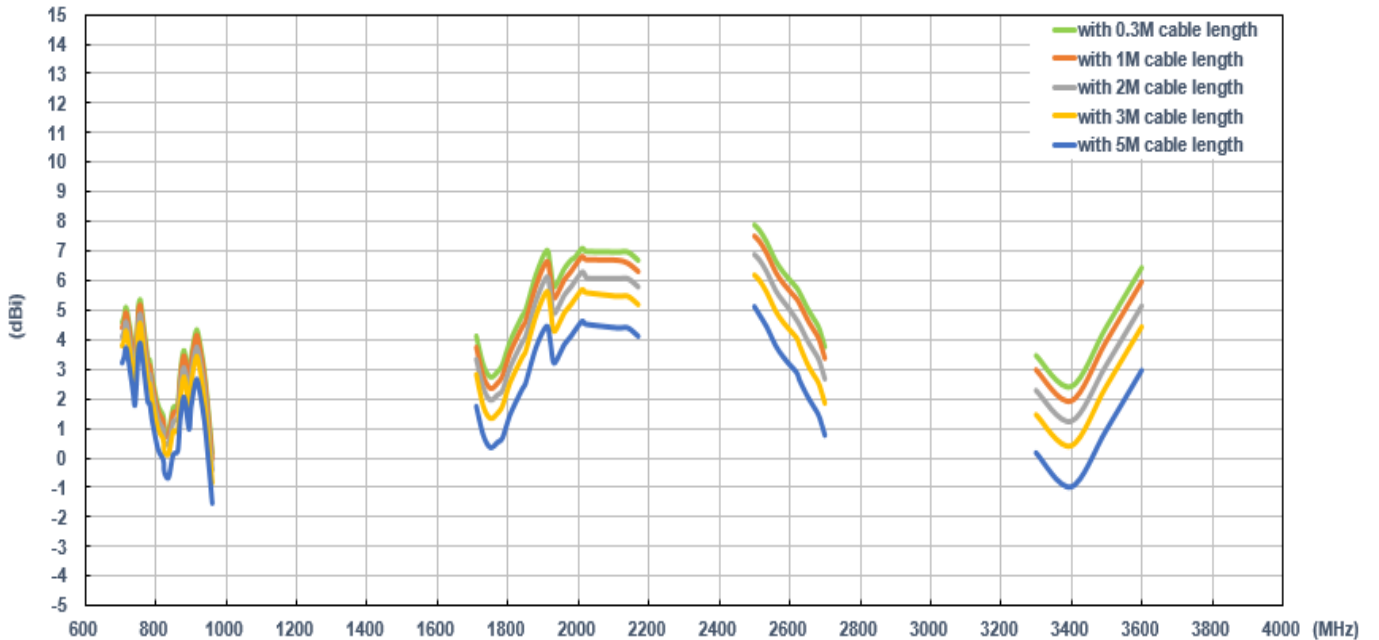
7.1.6 Average Gain (MIMO_1 on the 50*50cm ground plane)



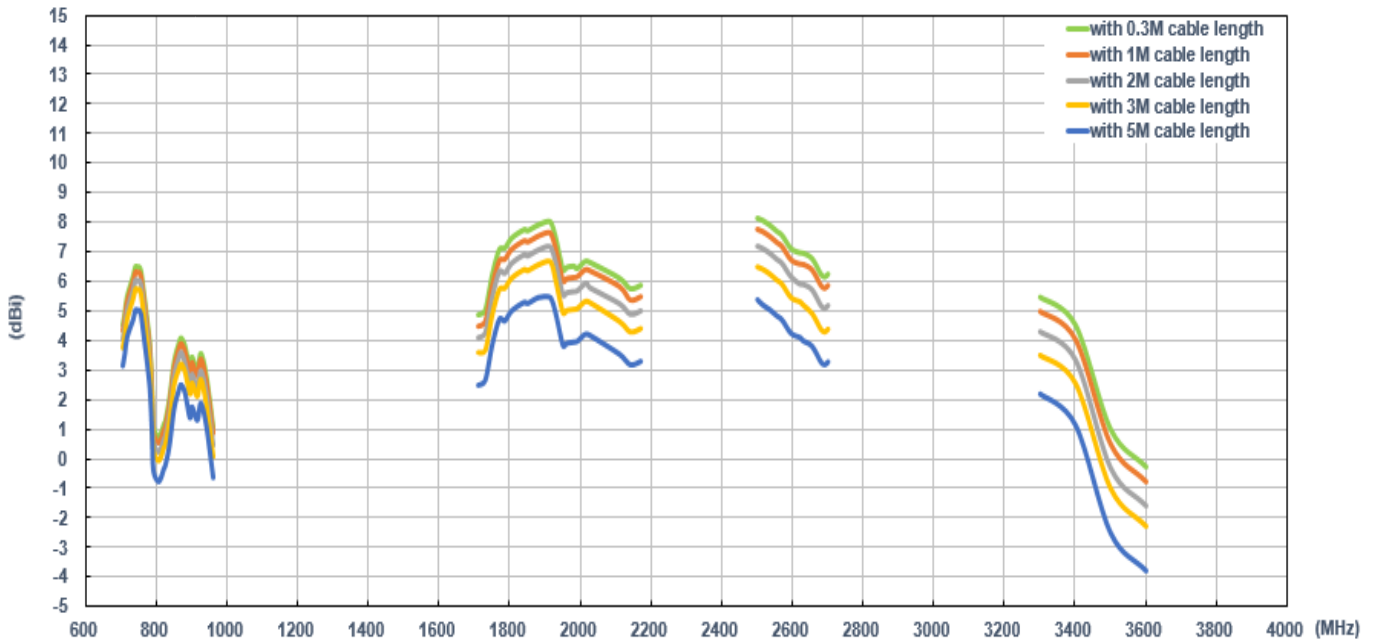
7.1.7 Average Gain (MIMO_2 on the 50*50cm ground plane)



7.1.8 Peak Gain (MIMO_1 on the 50*50cm ground plane)

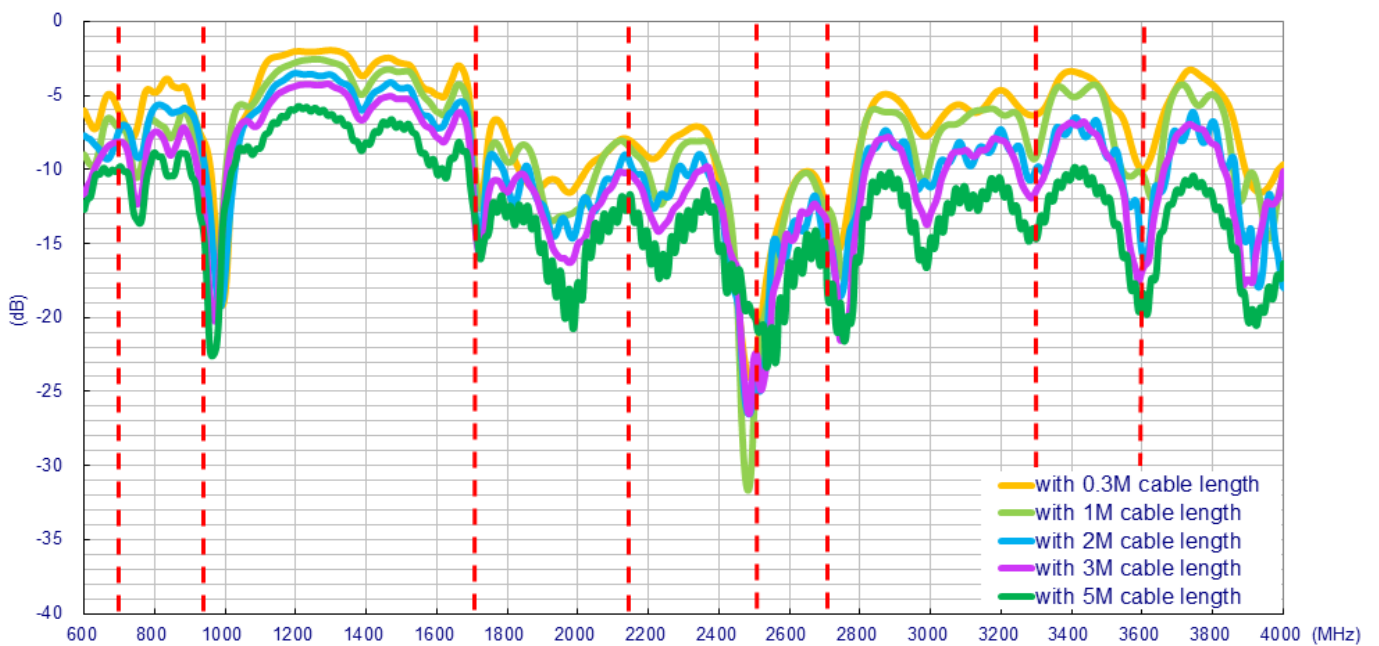


7.1.9 Peak Gain (MIMO_2 on the 50*50cm ground plane)

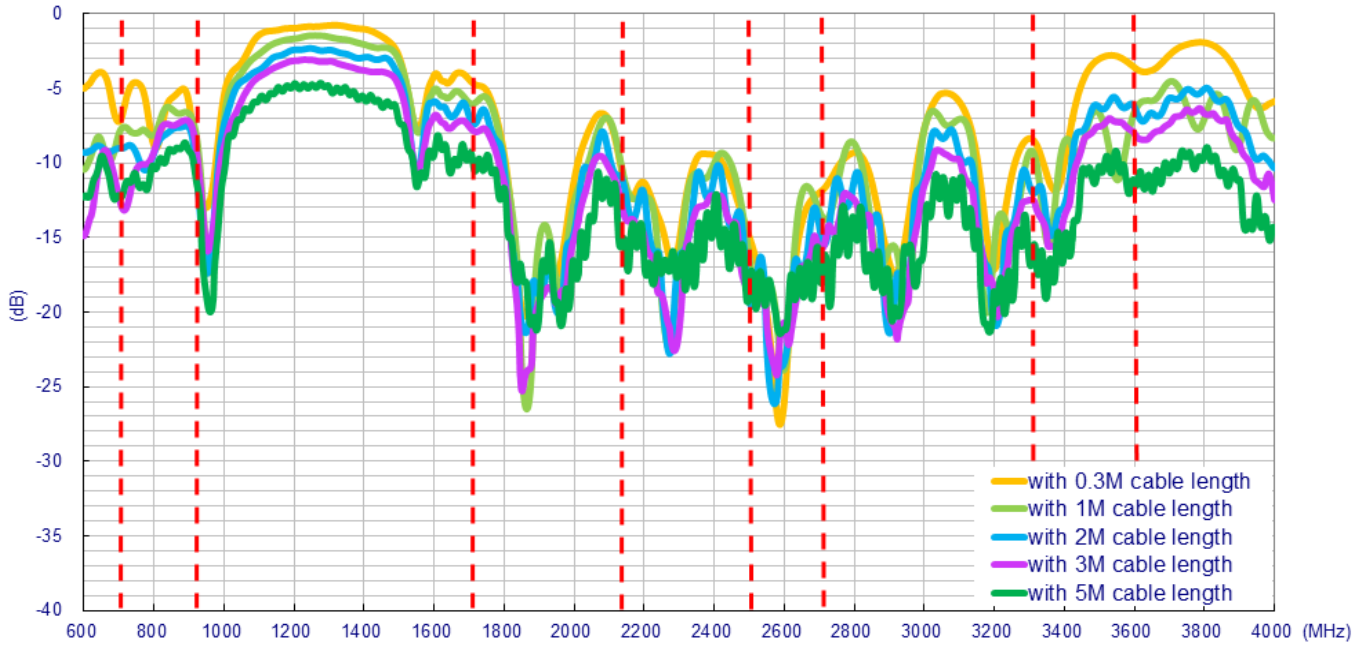


7.2 In free space

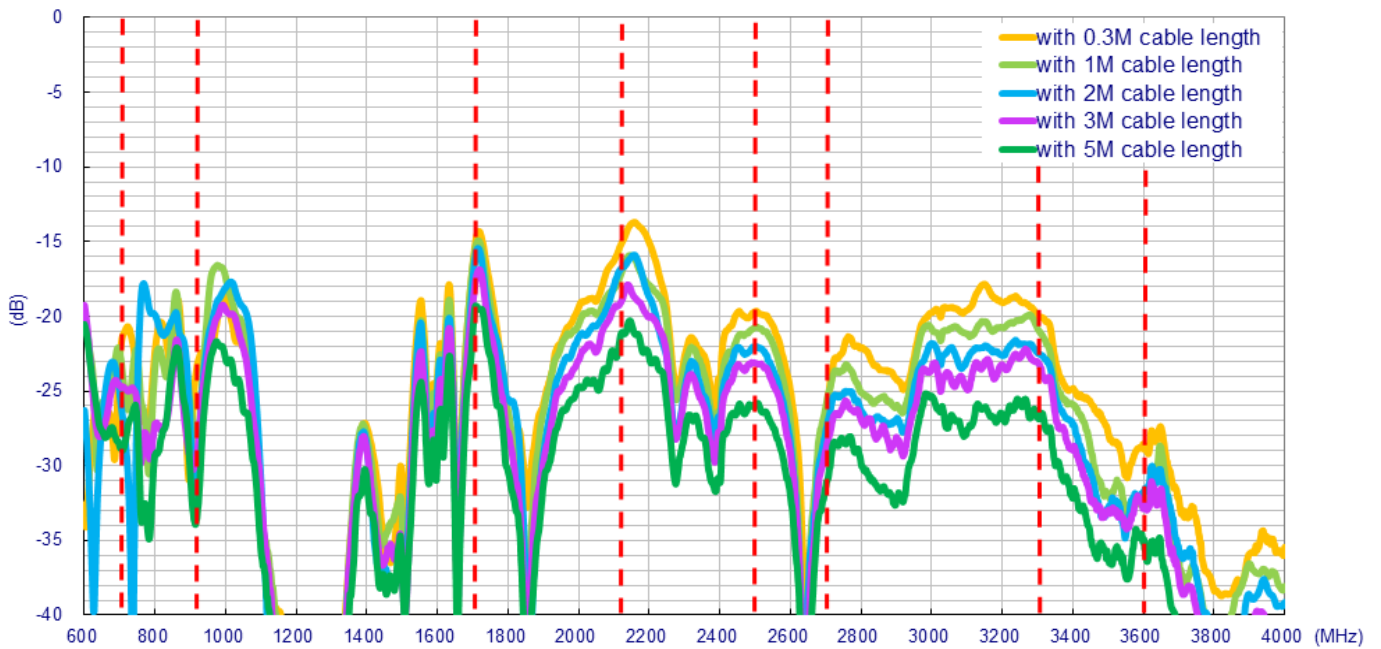
7.2.1 Return Loss (MIMO_1 in free space)



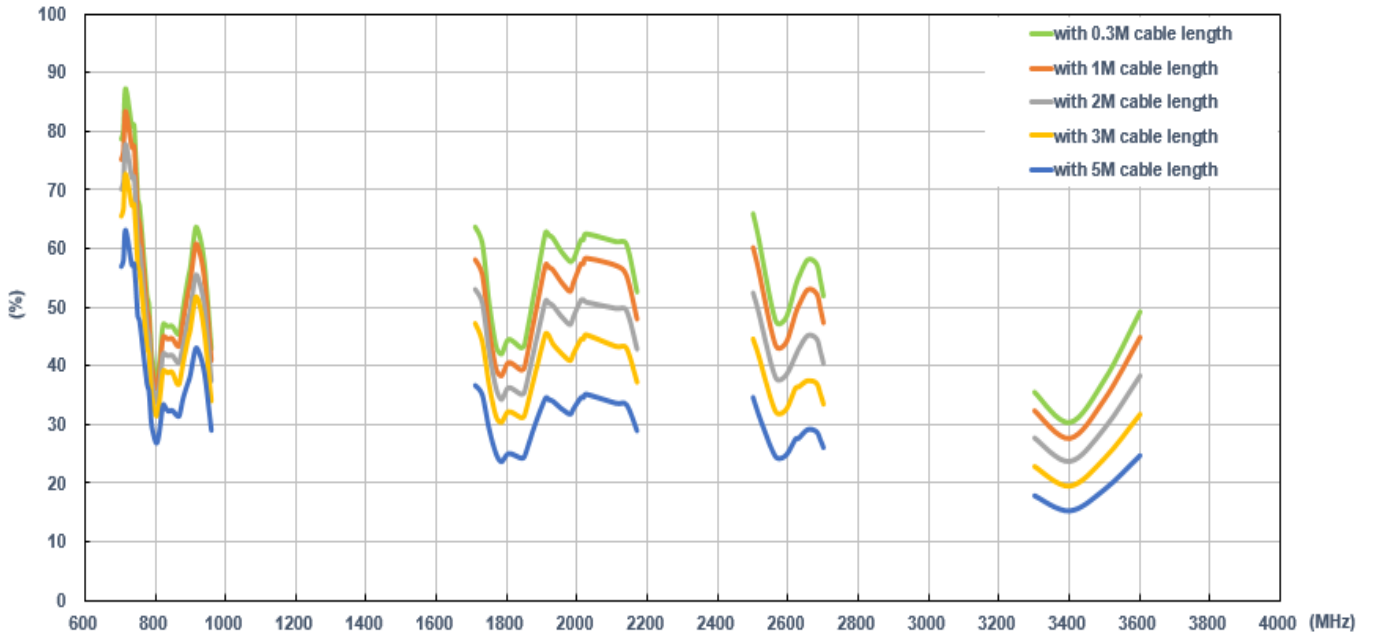
7.2.2 Return Loss (MIMO_2 in free space)



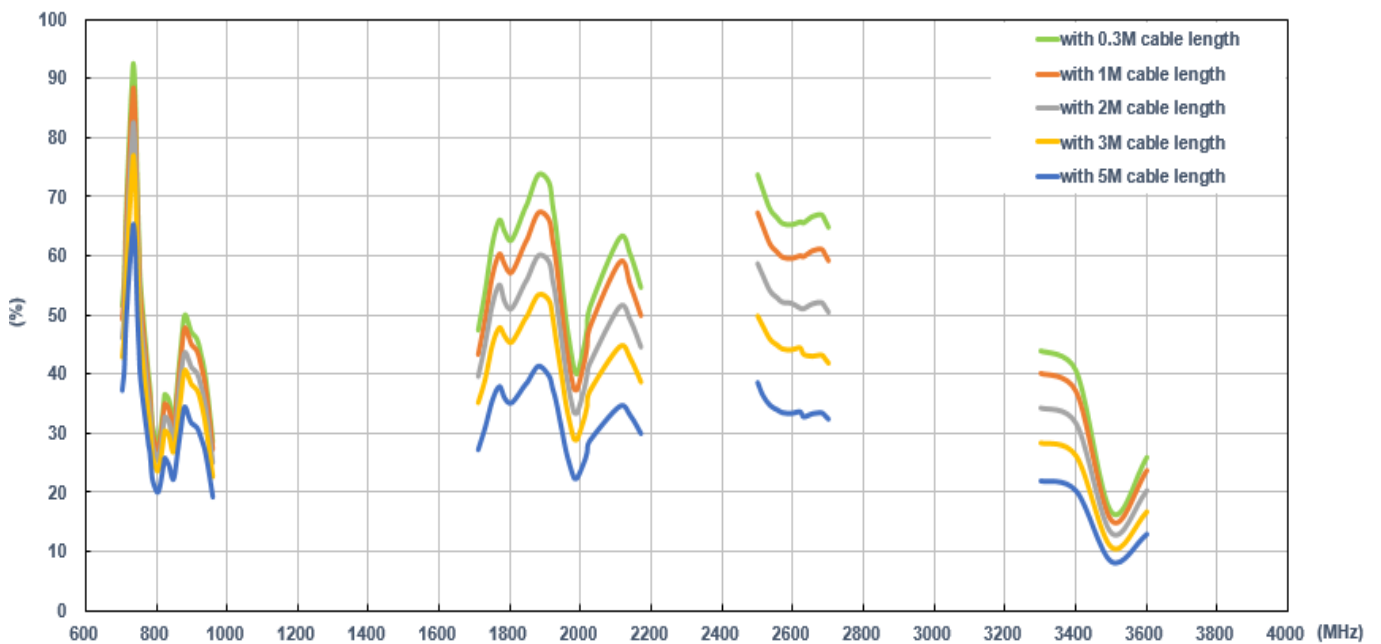
7.2.3 Insertion Loss (in free space)



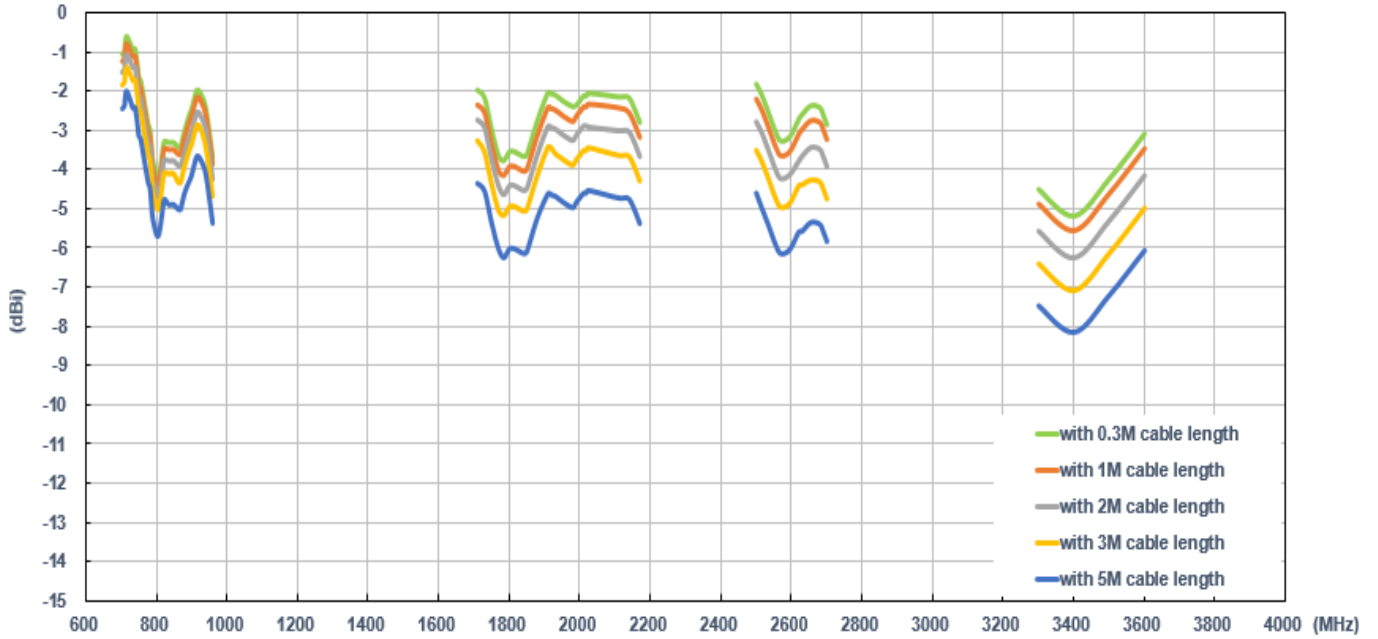
7.2.4 Efficiency (MIMO_1 in free space)



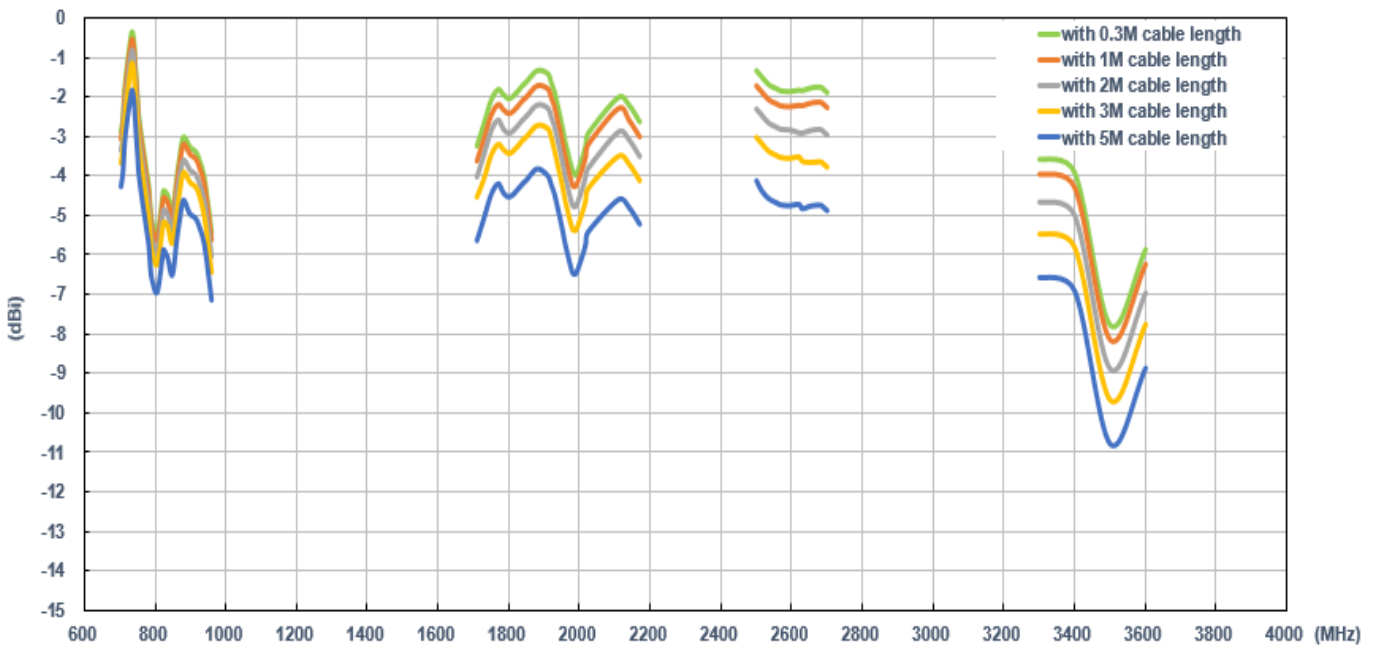
7.2.5 Efficiency (MIMO_2 in free space)



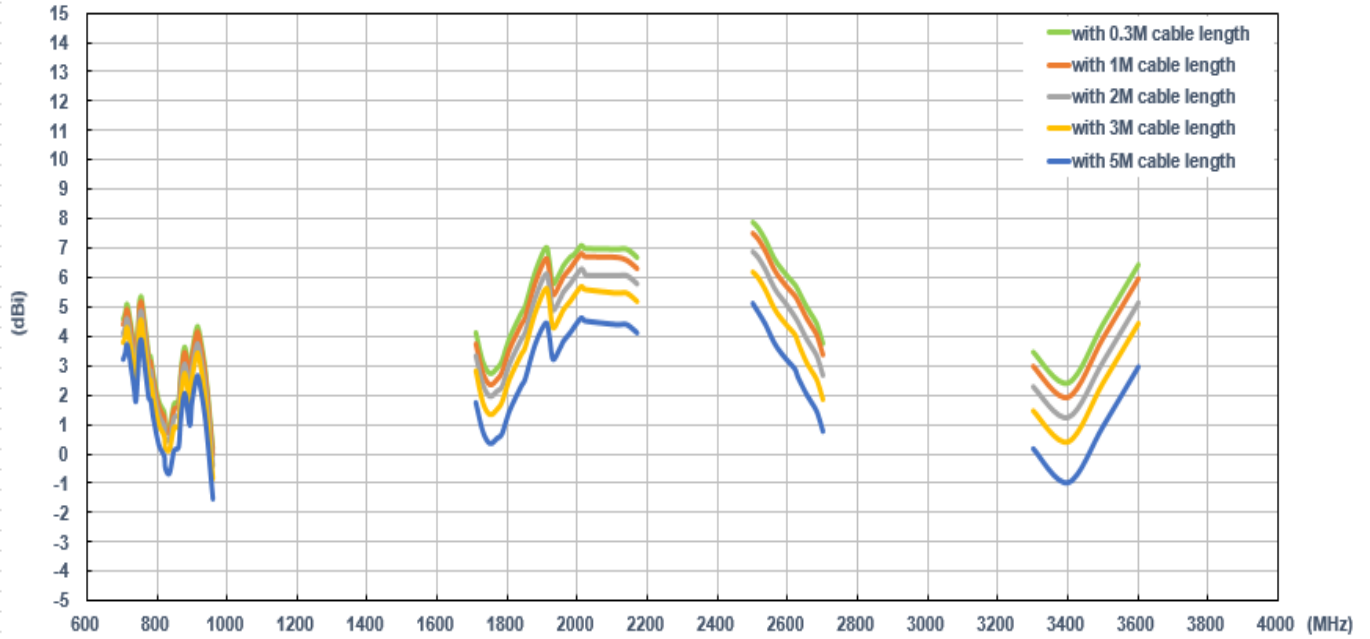
7.2.6 Average Gain (MIMO_1 in free space)



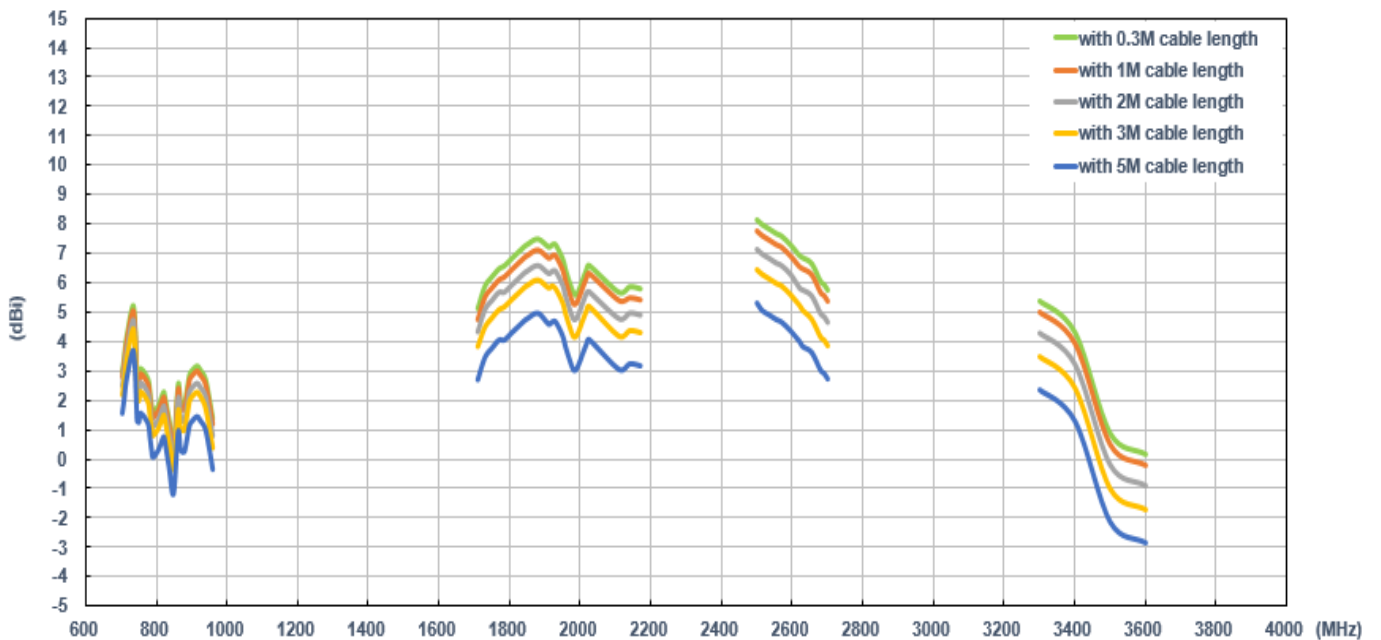
7.2.7 Average Gain (MIMO_2 in free space)



7.2.8 Peak Gain (MIMO_1 in free space)



7.2.9 Peak Gain (MIMO_2 in free space)





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