SPECIFICATION

Part No. : **MA411.A.LBI.001**

Product Name : MA411 Storm 3in1 Screw mount Antenna
LTE MIMO + GPS/GLONASS/BeiDou

Features

2* LTE MIMO Antennas
698 to 960MHz/1710 to 2170MHz/
2490 to 2690MHz/3300 to 3600 MHz
Worldwide 4G Bands including 3G and 2G
1* GPS-GLONASS-BEIDOU Antenna
Screw-Mount [Permanent Mount]
Aerodynamic, Super Low-profile Vandal Resistant Housing
IP67 Enclosure
Dims: 216.24*93.25*30.95mm
0.3M low loss cable with Fakra connectors as standard
Custom Cables and Connectors Available
Product conforms to the EMC directive 2014/30/EU.
RoHS Compliant

1. Introduction

The Storm MA411 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 and GNSS performance. You will never be out of touch with this extremely robust antenna.

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, plus BeiDou-GPS-GLONASS for next generation location accuracy.

Typical applications
- Automotive and Heavy Equipment Vehicle Tracking and Telematics
- Remote Asset and Pipeline Monitoring
- HD Video over LTE
- First Responder and Emergency Services

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. Low loss cables are used to keep efficiency high over long cable lengths. The MA411 does not require a ground plane. 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.

The BeiDou-GPS-Glonass active antenna has been carefully designed to work well on BeiDou, GPS and Glonass bands, leading to higher location accuracy and stability of tracking in urban environments.

Cable length and connector types are customizable. Contact your regional Taoglas sales office for support. 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.

2. Specification

BeiDou-GPS-GLONASS				
Center Frequency	Beidou:1561.098±2.046MHz GPS:1575.42±1.023MHz GLONASS:1602±5MHz			
Passive Antenna Gain	BeiDou: 1dBi @Zenith GPS: 1dBi Typ. @Zenith GLONASS: 4dBi Typ. @Zenith			
Passive Antenna efficiency	BeiDou: 55% GPS: 55% GLONASS: 58%			
VSWR	2:1 Max			
Impedance	50Ω			
Axial Ratio	BeiDou:<5.5 GPS:<3.2 GLONASS:<10.6			
Polarization	RHCP			
Cable	0.3 meter RG174 standard, fully customizable			
Connector	Fakra (Jack) standard connector, fully customizable			
LNA and Filter Electrical Properties				
Center Frequency	BeiDou: 1561.098±2.046MHz GPS:1575.42±1.023MHz GLONASS:1602±5MHz			
SAW Filter Rejection	1651~1700MHz & 1549~1500MHz 25dB Min			
Pout 1dB gain Compression point	-6dBm Min. -2 dBm Typ.			
Output Impedance	50 Ohm			
VSWR	< 2:1			
Return Loss	10 dB Min.			
LNA Gain ,Power consumption and Noise Figure@GPS	Voltage	LNA Gain(Typ)	Power Consumption(mA) Typ	Noise Figure(Typ)
	Min 1.8V	20dB	5mA	2.7dB
	Typ 3.0V	28dB	10mA	2.4dB
	Max 5.5V	31dB	23mA	2.6dB
Total specification(Through Antenna, LNA)				
Frequency	1561.098±2.046MHz	1575.42±1.023MHz	1602±5MHz	
Gain@3V	1561MHz:29±3dBi	1575.42MHz:29±3dBi	1602MHz:32±3dBi	
Output Impedance	50Ω			

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

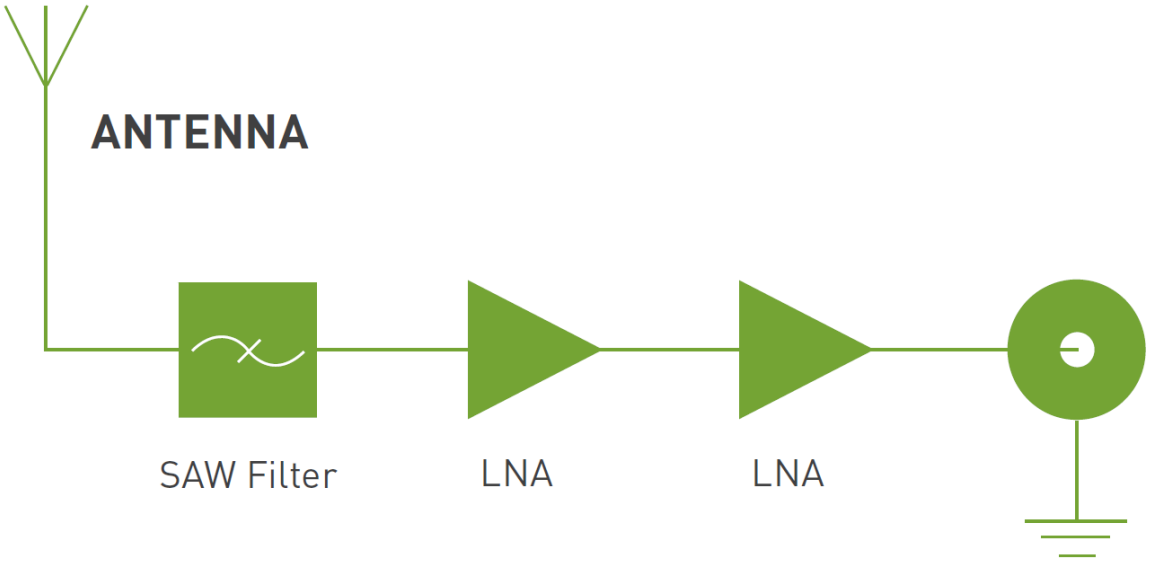
Impedance	50Ω
Polarization	Linear
VSWR	< 3.5
Cable	0.3meter CFD-200 standard, fully customizable
Connector	Fakra(Jack) standard , fully customizable

MECHANICAL	
Antenna Dimensions	216.24*93.25*30.95mm
Casing	ABS+PC
Base and thread	Nickel Plated Aluminum
Weight (antenna)	415g
Ingress Protection Rating	IP67
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

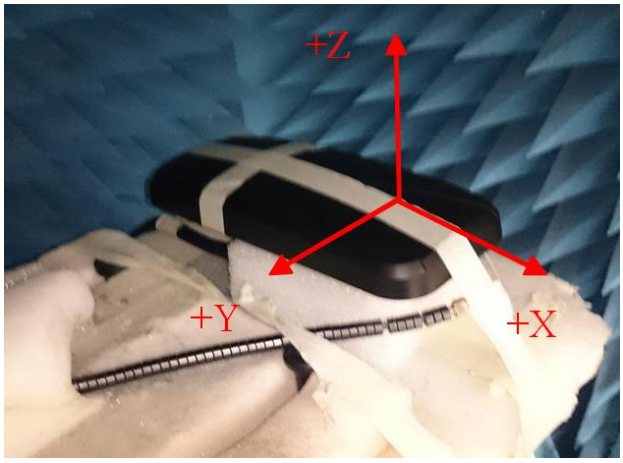
3.1 BeiDou-GPS-GLONASS Antenna

3.1.1 Block Diagram

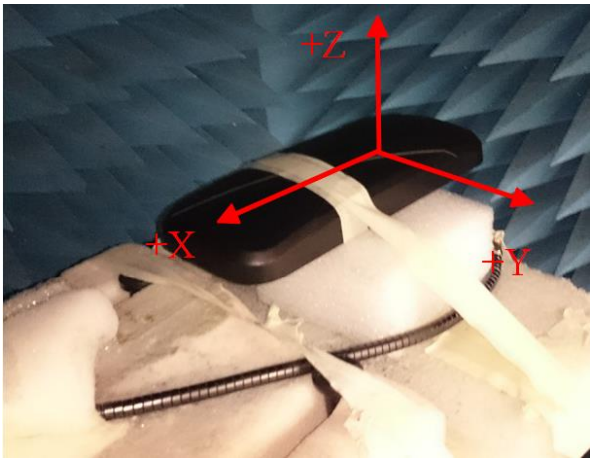


3.1.2 Test Setup

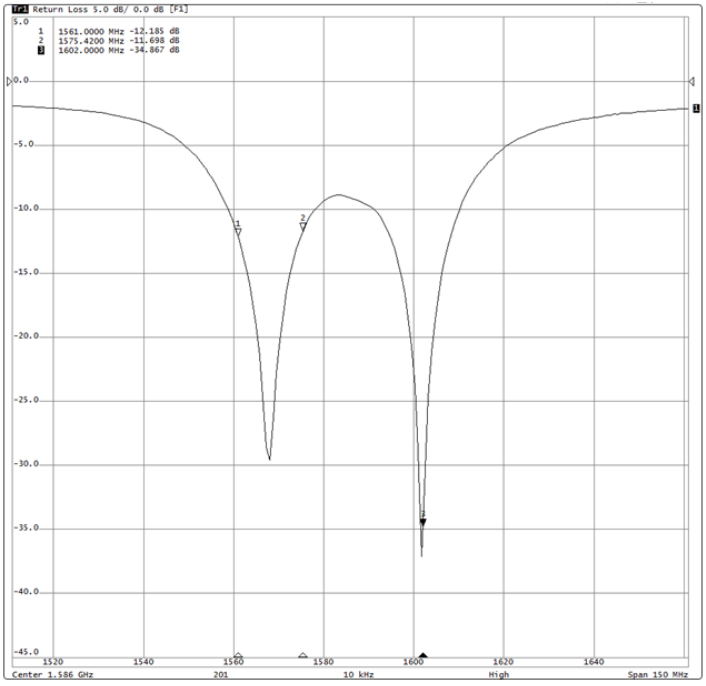
XZ-Plane



YZ-Plane



3.1.3 BeiDou-GPS-GLONASS Return Loss

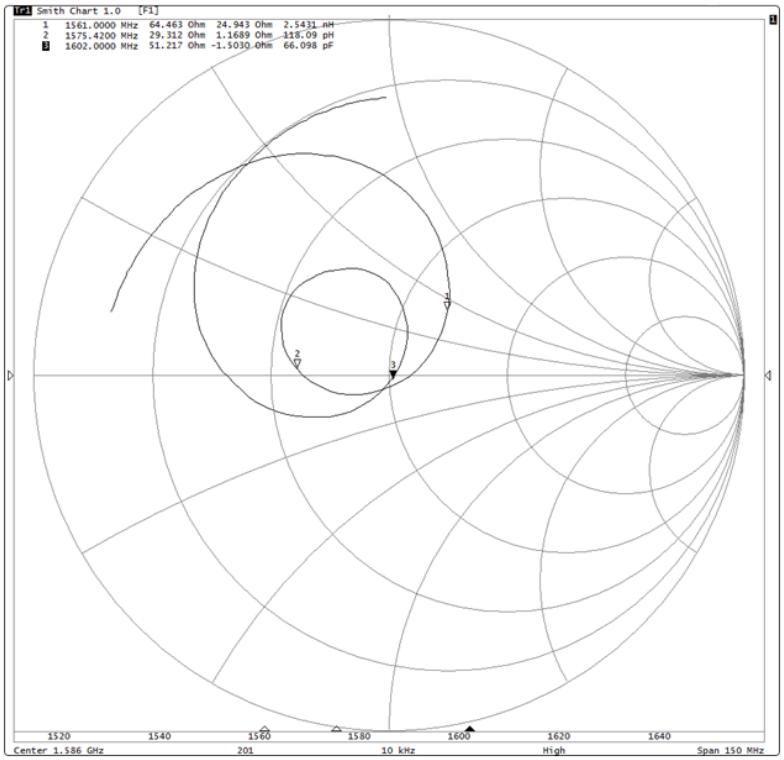


Return Loss : -12.185 dB @ 1561MHz

Return Loss : -11.698 dB @ 1575.42MHz

Return Loss : -34.867 dB @ 1602MHz

3.1.4 BeiDou-GPS-GLONASS Smith Chart



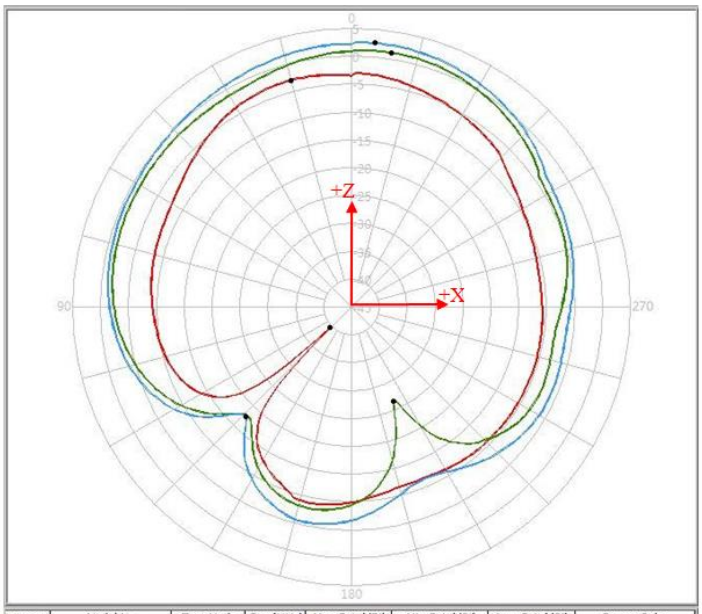
Impedance : 64.46+j24.94 Ohm@ 1561MHz

Impedance : 29.31+j01.16 Ohm@ 1575.42MHz

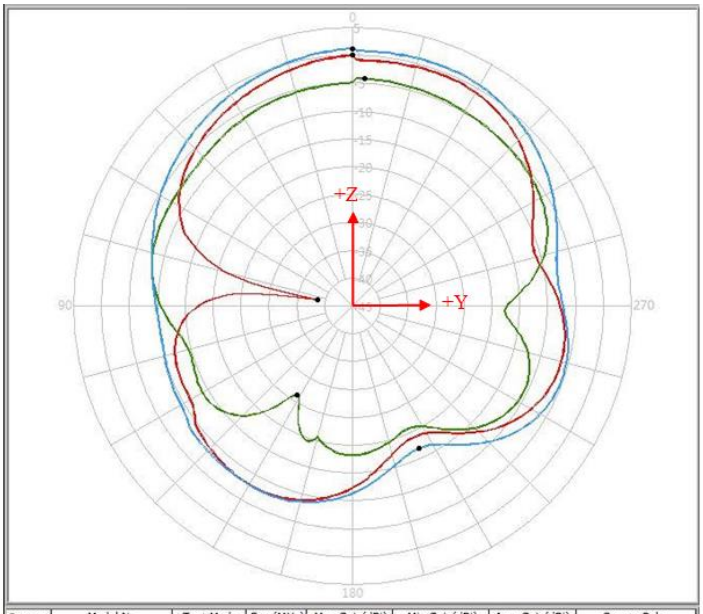
Impedance : 51.24-j01.50 Ohm@ 1602MHz

3.1.5 BeiDou-GPS-GLONASS Radiation Pattern

Radiation pattern @ 1561MHz



Pattern	Model No.	Test Mode	Freq(MHz)	Max Gain(dBi)	Min Gain(dBi)	Avg. Gain(dBi)	Source Polar.
1	Taoglas Starm	XZ	1561.00	-2.91 / 15.00	-39.63 / 134.00	-7.69	Ver.
2	Taoglas Starm	XZ	1561.00	1.20 / 351.00	-26.50 / 204.00	-3.49	Hor.
3	Taoglas Starm	XZ	1561.00	2.54 / 355.00	-17.70 / 136.00	-2.09	V+H

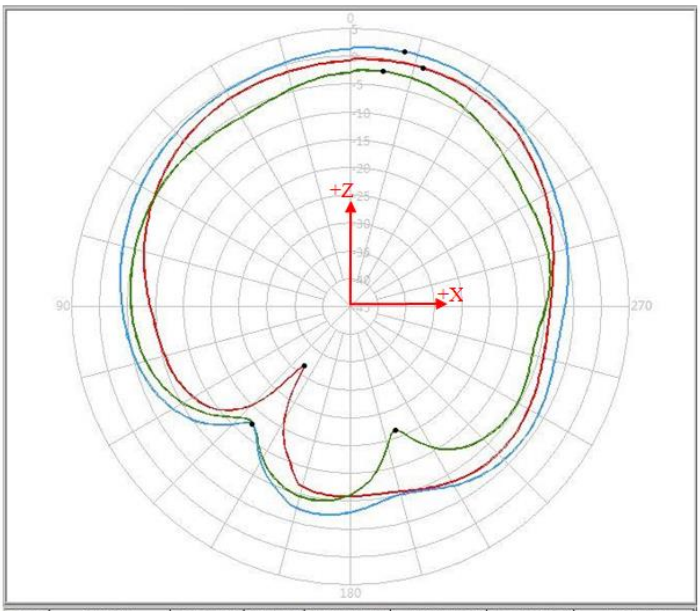


Pattern	Model No.	Test Mode	Freq(MHz)	Max Gain(dBi)	Min Gain(dBi)	Avg. Gain(dBi)	Source Polar.
1	Taoglas Starm	YZ	1561.00	-0.01 / 0.00	-38.65 / 80.00	-5.79	Ver.
2	Taoglas Starm	YZ	1561.00	-4.15 / 357.00	-26.19 / 148.00	-8.73	Hor.
3	Taoglas Starm	YZ	1561.00	1.21 / 0.00	-16.80 / 205.00	-4.01	V+H

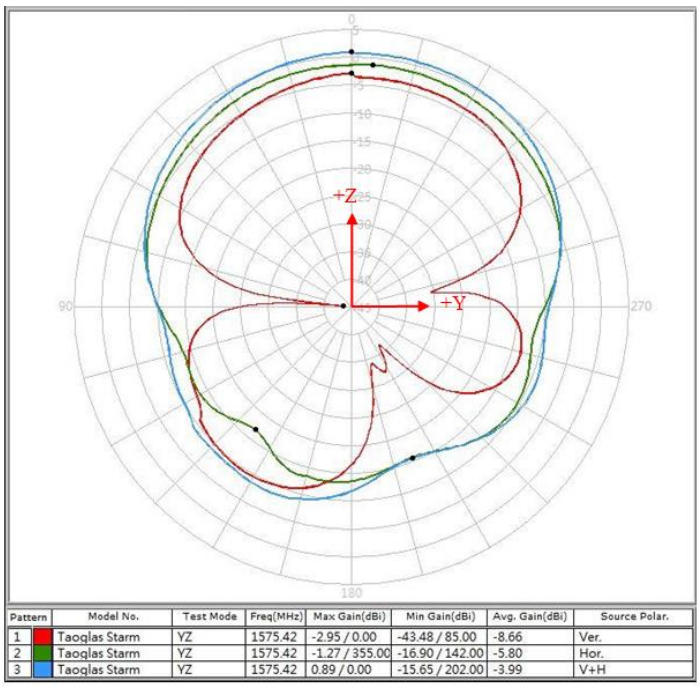
1561MHz		Peak Gain	Zenith Gain
V+H	XZ-Plane	2.54	2.19
	YZ-Plane	1.21	1.16

(dBi)

Radiation pattern @ 1575.42MHz



Pattern	Model No.	Test Mode	Freq(MHz)	Max Gain(dBi)	Min Gain(dBi)	Avg. Gain(dBi)	Source Polar.
1	Taoglas Starm	XZ	1575.42	-0.21 / 343.00	-31.48 / 142.00	-5.03	Ver.
2	Taoglas Starm	XZ	1575.42	-2.36 / 352.00	-21.30 / 200.00	-6.97	Hor.
3	Taoglas Starm	XZ	1575.42	1.81 / 348.00	-17.46 / 140.00	-2.88	V+H

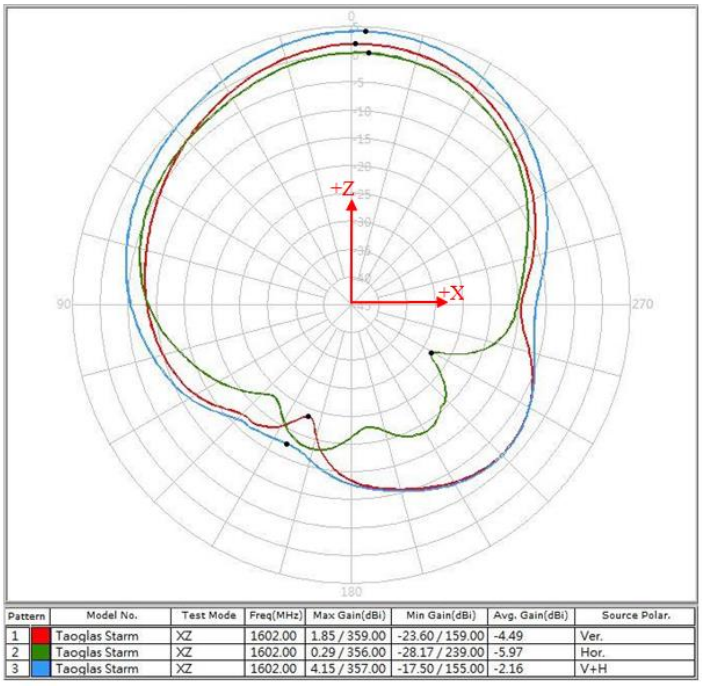


Pattern	Model No.	Test Mode	Freq(MHz)	Max Gain(dBi)	Min Gain(dBi)	Avg. Gain(dBi)	Source Polar.
1	Taoglas Starm	YZ	1575.42	-2.95 / 0.00	-43.48 / 85.00	-8.66	Ver.
2	Taoglas Starm	YZ	1575.42	-1.27 / 355.00	-16.90 / 142.00	-5.80	Hor.
3	Taoglas Starm	YZ	1575.42	0.89 / 0.00	-15.65 / 202.00	-3.99	V+H

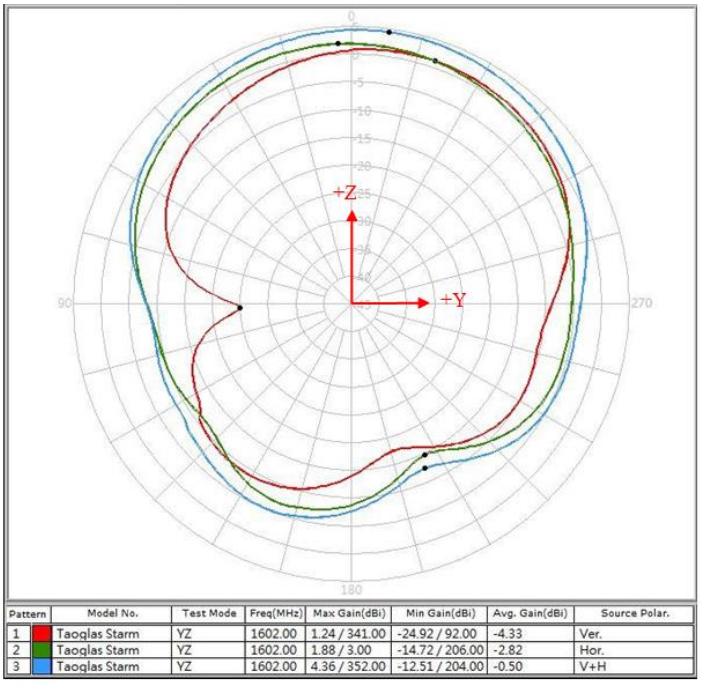
1575.42MHz		Peak Gain	Zenith Gain
V+H	XZ-Plane	1.81	1.25
	YZ-Plane	0.89	0.89

(dBi)

Radiation pattern @ 1602MHz



Pattern	Model No.	Test Mode	Freq(MHz)	Max Gain(dBi)	Min Gain(dBi)	Avg. Gain(dBi)	Source Polar.
1	Taoglas Starm	XZ	1602.00	1.85 / 359.00	-23.60 / 159.00	-4.49	Ver.
2	Taoglas Starm	XZ	1602.00	0.29 / 356.00	-28.17 / 239.00	-5.97	Hor.
3	Taoglas Starm	XZ	1602.00	4.15 / 357.00	-17.50 / 155.00	-2.16	V+H



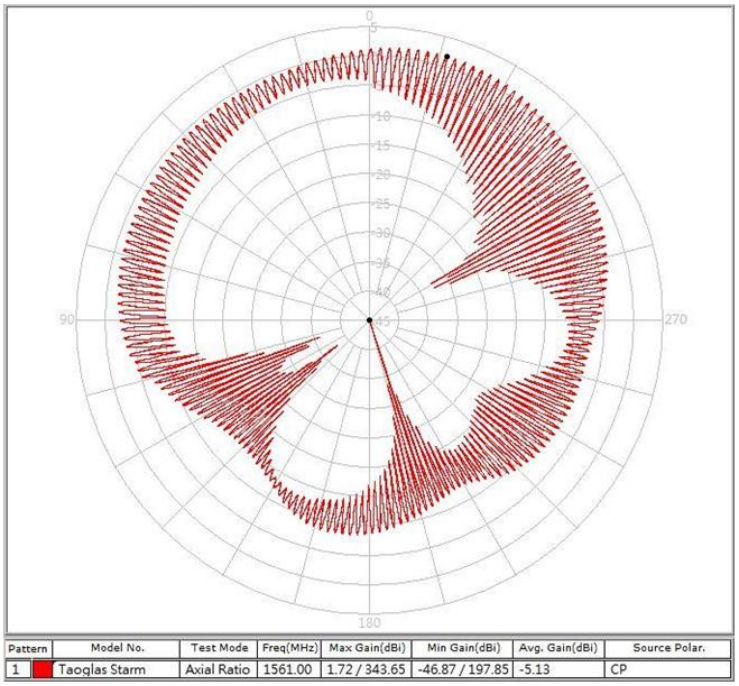
Pattern	Model No.	Test Mode	Freq(MHz)	Max Gain(dBi)	Min Gain(dBi)	Avg. Gain(dBi)	Source Polar.
1	Taoglas Starm	YZ	1602.00	1.24 / 341.00	-24.92 / 92.00	-4.33	Ver.
2	Taoglas Starm	YZ	1602.00	1.88 / 3.00	-14.72 / 206.00	-2.82	Hor.
3	Taoglas Starm	YZ	1602.00	4.36 / 352.00	-12.51 / 204.00	-0.50	V+H

1602MHz		Peak Gain	Zenith Gain
V+H	XZ-Plane	4.15	4.08
	YZ-Plane	4.36	4.31

(dBi)

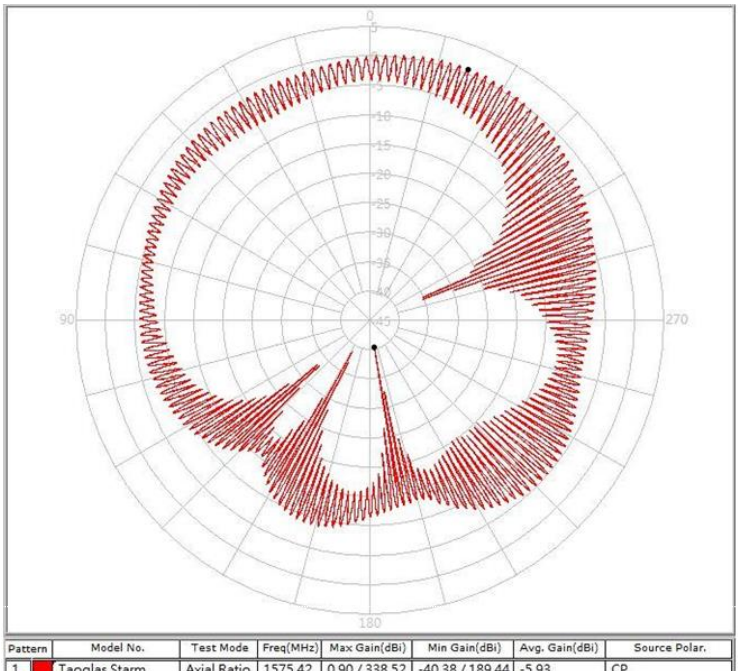
3.1.6 Axial Ratio Pattern

Frequency: 1561MHz



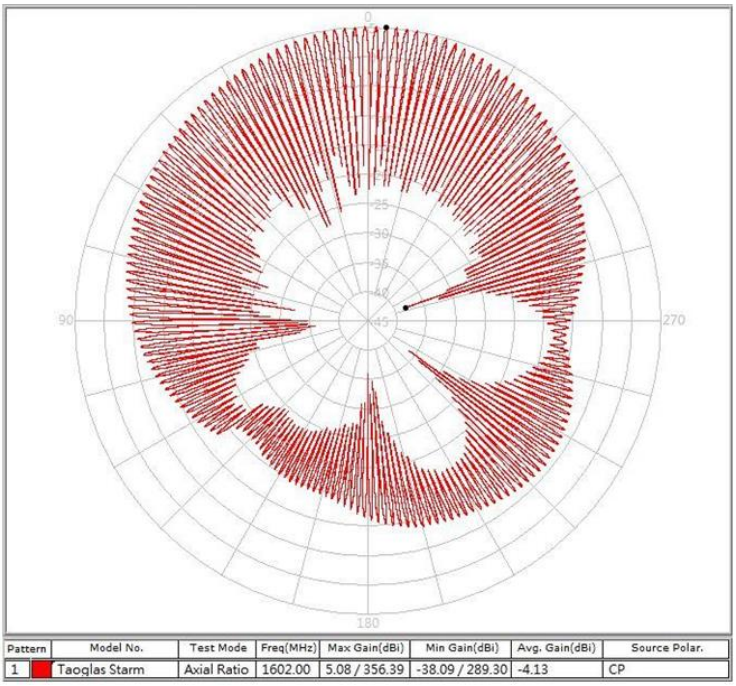
Angle	Axial Ratio
90°	8.03
75°	7.33
60°	6.74
45°	6.16
30°	4.45
15°	3.25
0°	4.93
345°	10.02
330°	14.36
315°	20.04
300°	31.37
285°	15.69
270°	5.79

Frequency: 1575.42MHz



Angle	Axial Ratio
90°	2.89
75°	1.73
60°	2.57
45°	3.89
30°	4.88
15°	4.43
0°	2.77
345°	5.61
330°	8.09
315°	11.46
300°	19.67
285°	19.46
270°	8.11

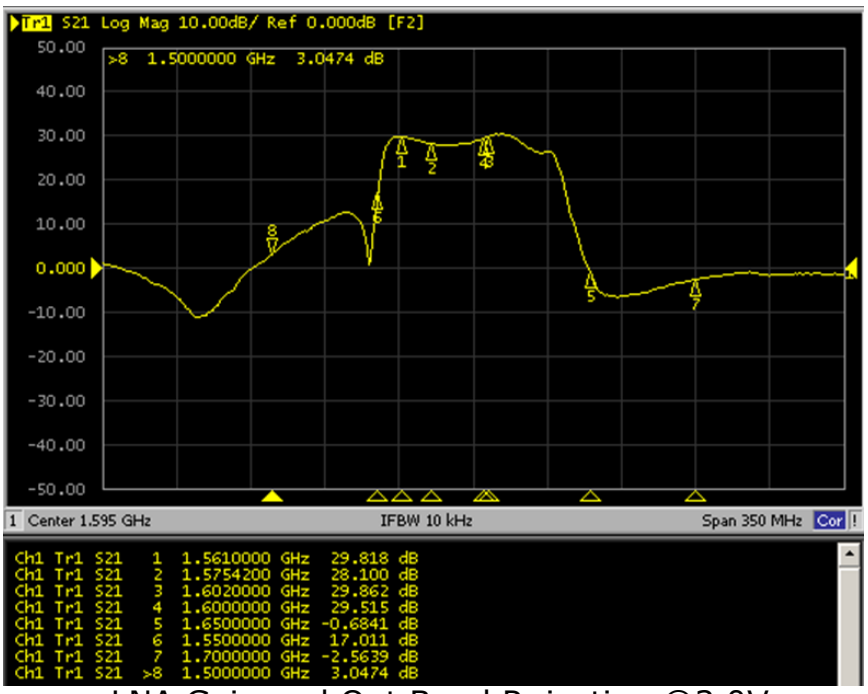
Frequency: 1602MHz



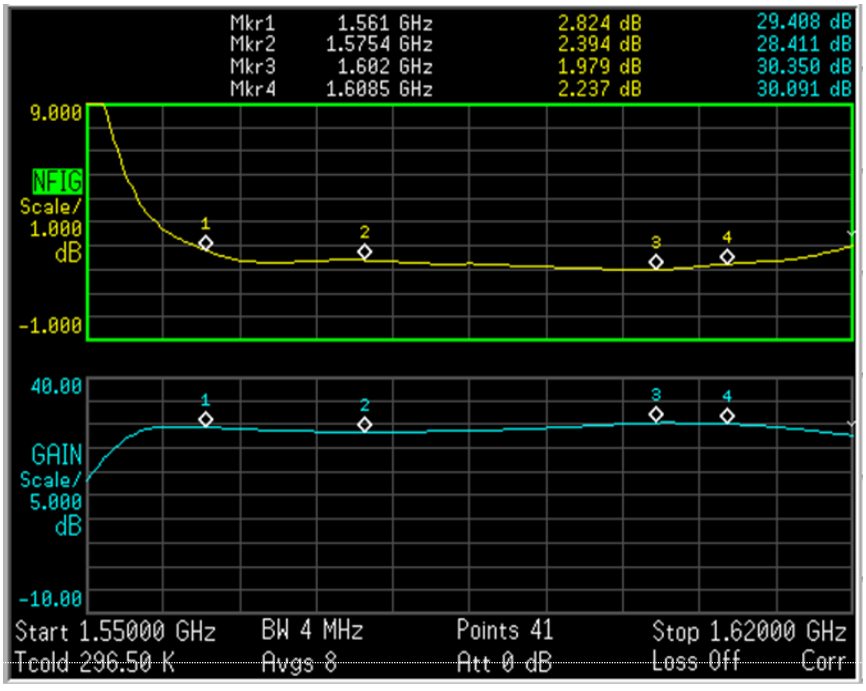
Pattern	Model No.	Test Mode	Freq(MHz)	Max Gain(dBi)	Min Gain(dBi)	Avg. Gain(dBi)	Source Polar.
1	Taoglas Starm	Axial Ratio	1602.00	5.08 / 356.39	-38.09 / 289.30	-4.13	CP

Angle	Axial Ratio
90°	29.65
75°	20.00
60°	22.48
45°	20.99
30°	25.20
15°	24.06
0°	10.14
345°	26.98
330°	24.1
315°	21.9
300°	19.5
285°	20.18
270°	4.5

3.1.7 BeiDou-GPS-GLONASS LNA Noise Figure



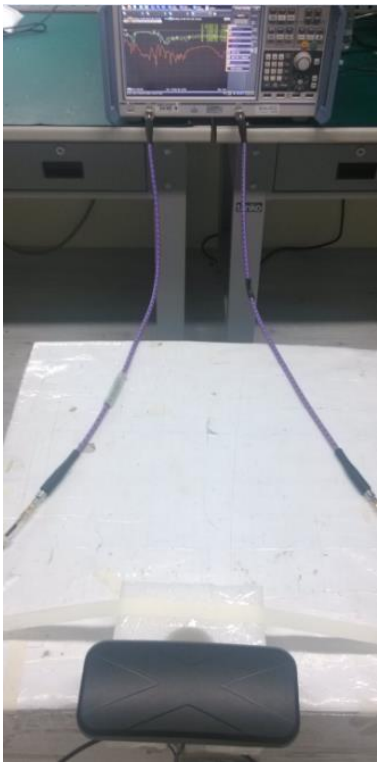
LNA Gain and Out Band Rejection @3.0V



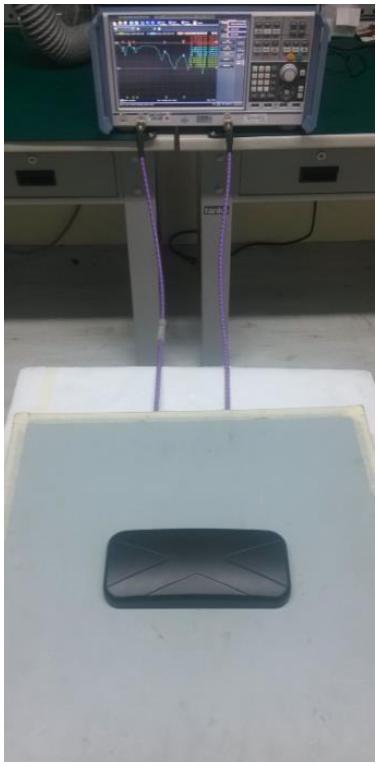
LNA Noise Figure @3.0V

3.2 LTE MIMO Antenna

3.2.1 Test Setup



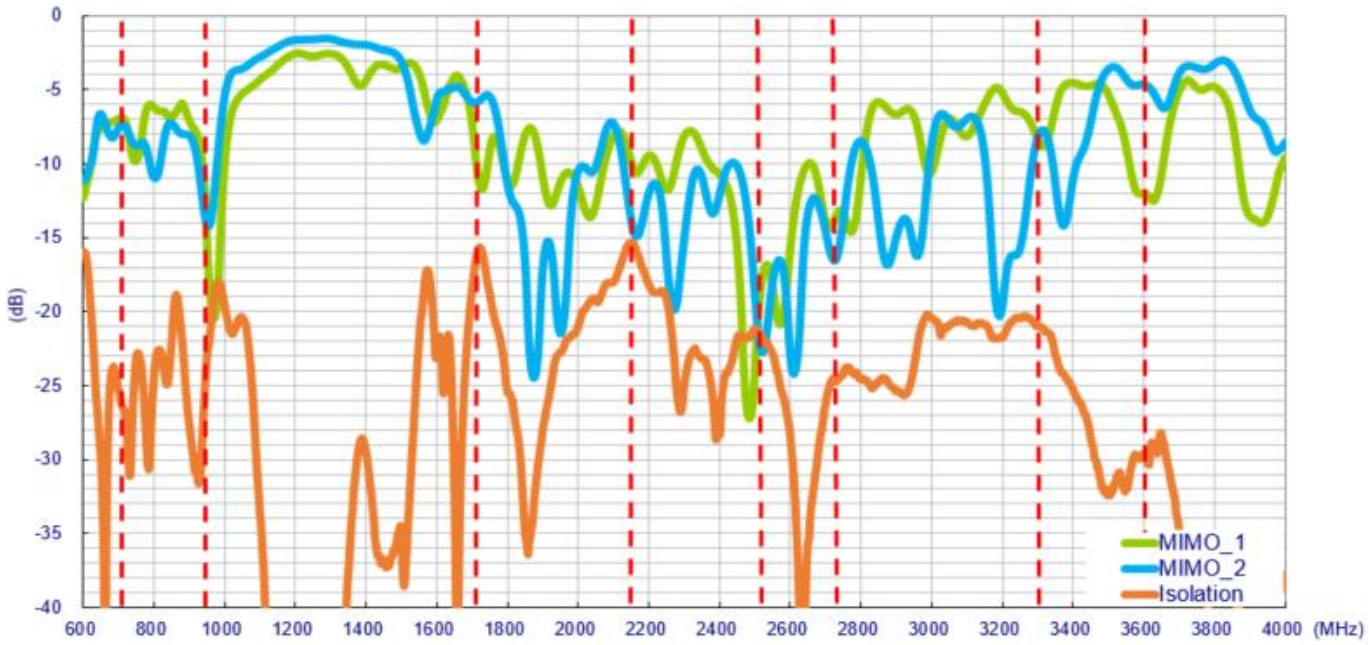
In free space



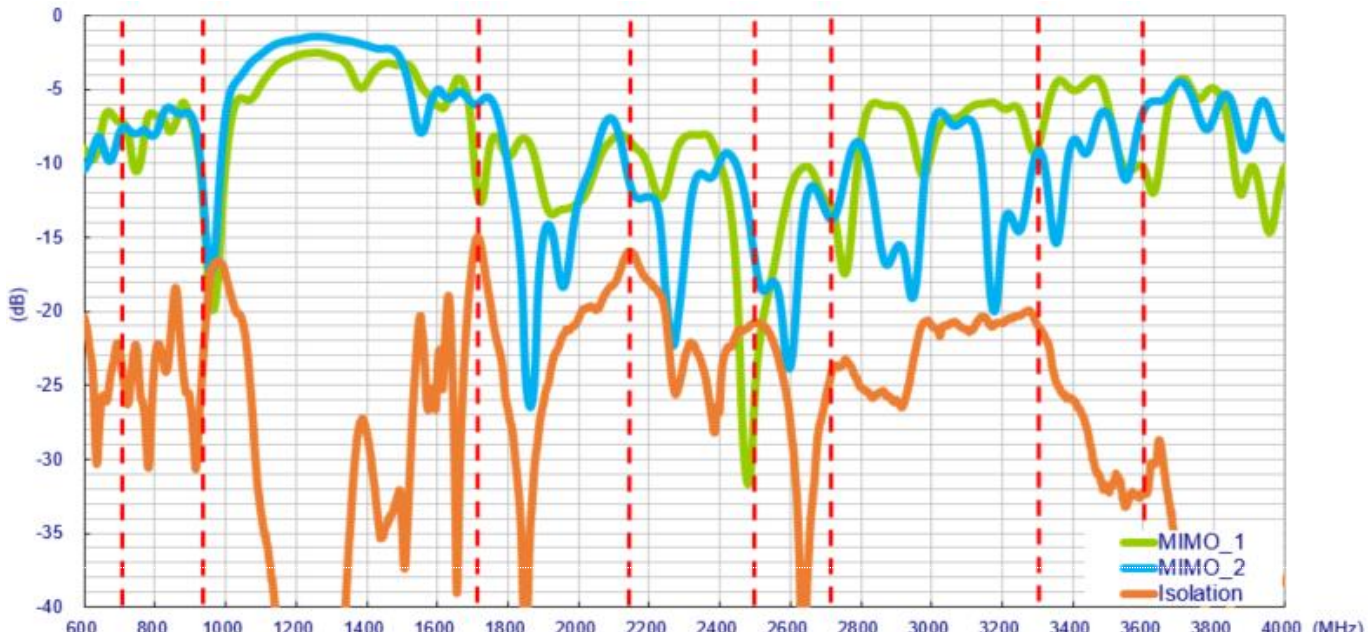
on the 50*50cm ground plane

3.2.2 LTE Antenna Return Loss and Isolation

Setup on the 50*50cm ground plane with 0.3 meter cable length

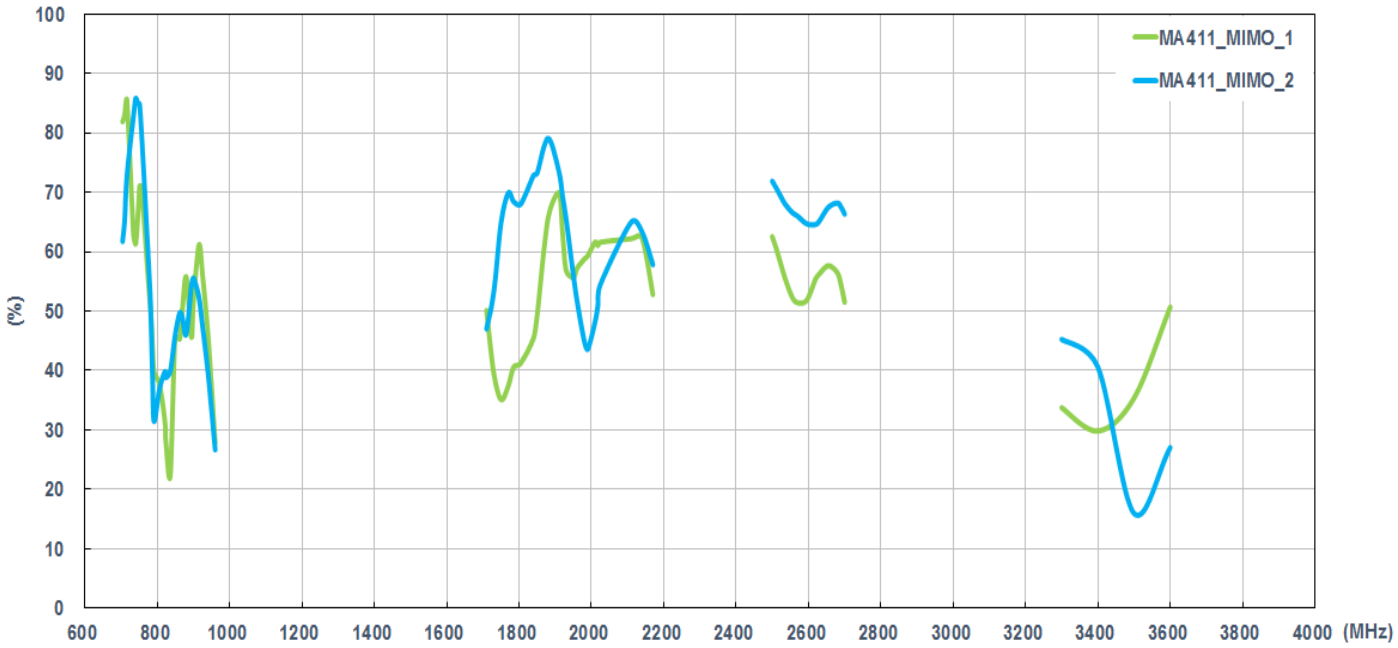


Setup in free space with 0.3 meter cable length

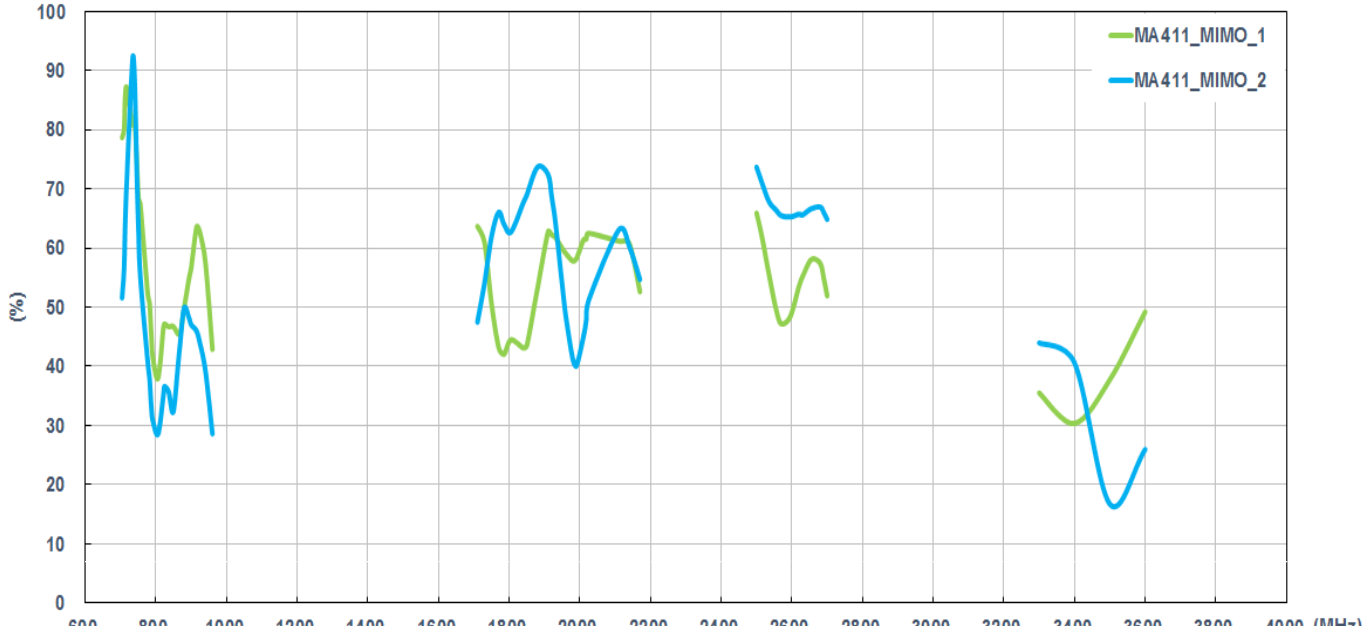


3.2.3 LTE Antenna Efficiency

Setup on the 50*50cm ground plane with 0.3 meter cable length

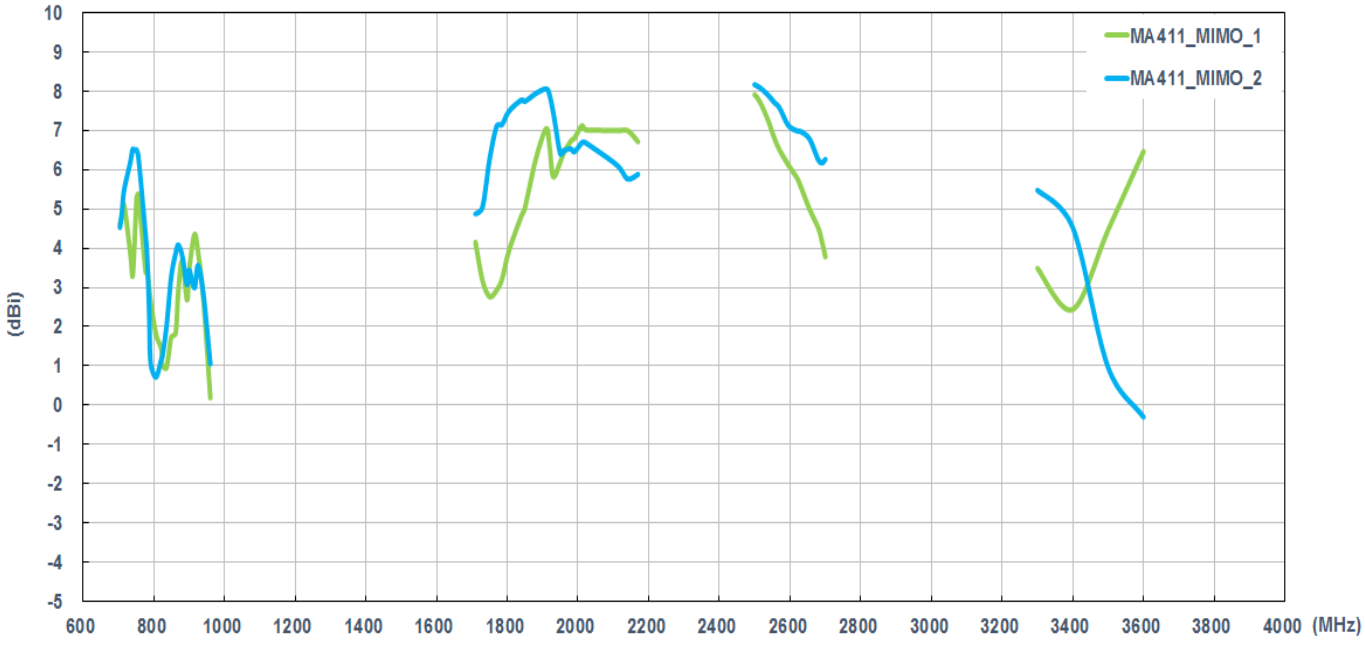


Setup in free space with 0.3 meter cable length

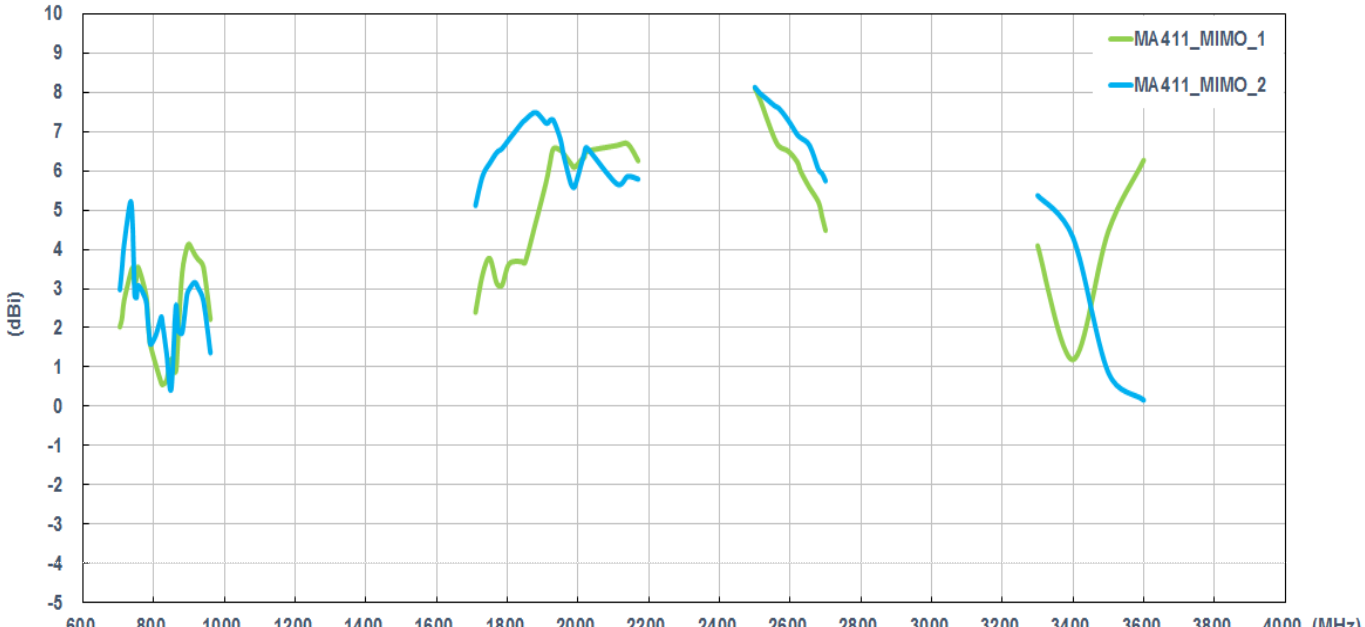


3.2.4 LTE Antenna Peak Gain

Setup on the 50*50cm ground plane with 0.3 meter cable length

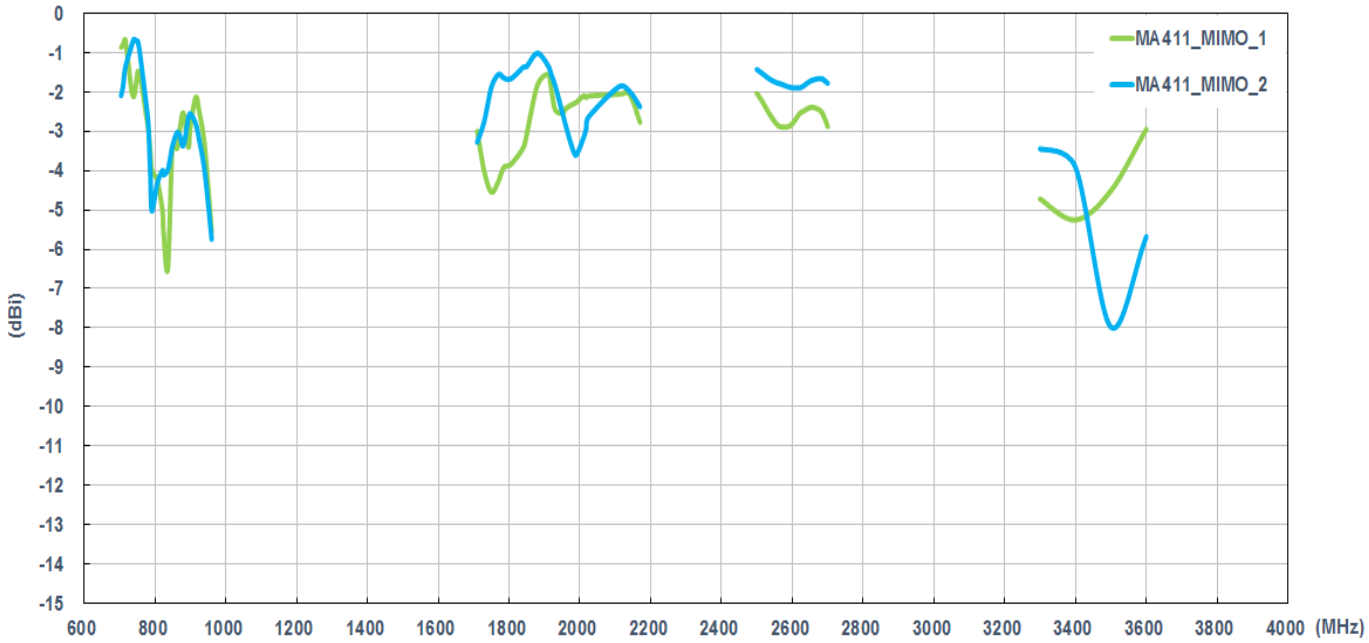


Setup in free space with 0.3 meter cable length

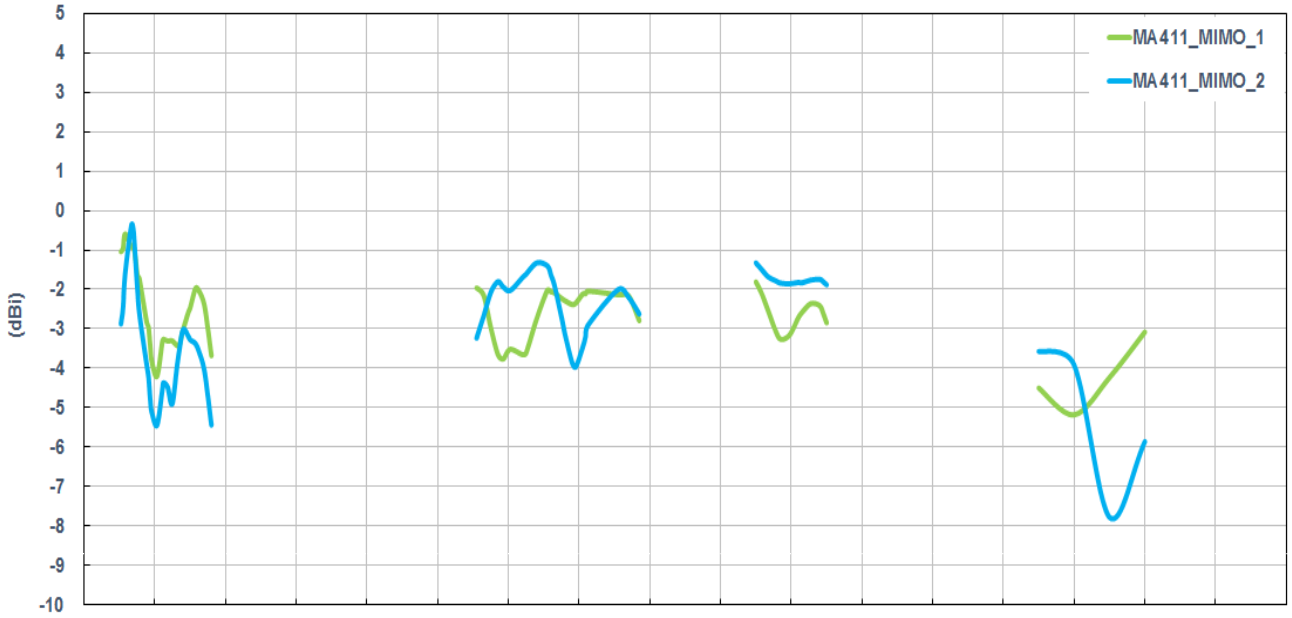


3.2.5 LTE Antenna Average gain

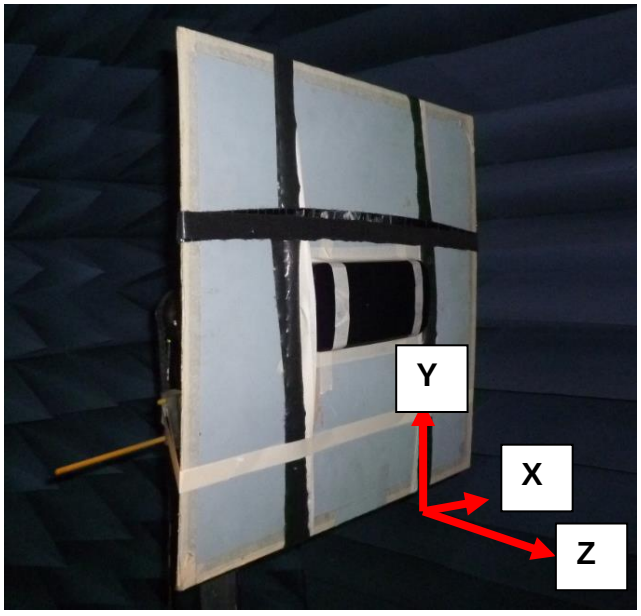
Setup on the 50*50cm ground plane with 0.3 meter cable length



Setup in free space with 0.3 meter cable length



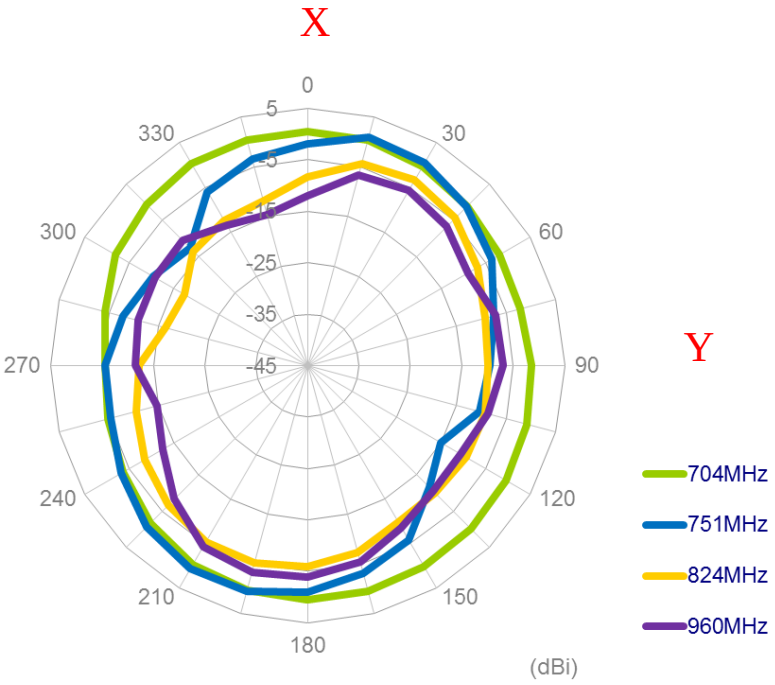
3.2.6 Test Setup For Antenna Radiation Pattern (ETS Anechoic chamber)

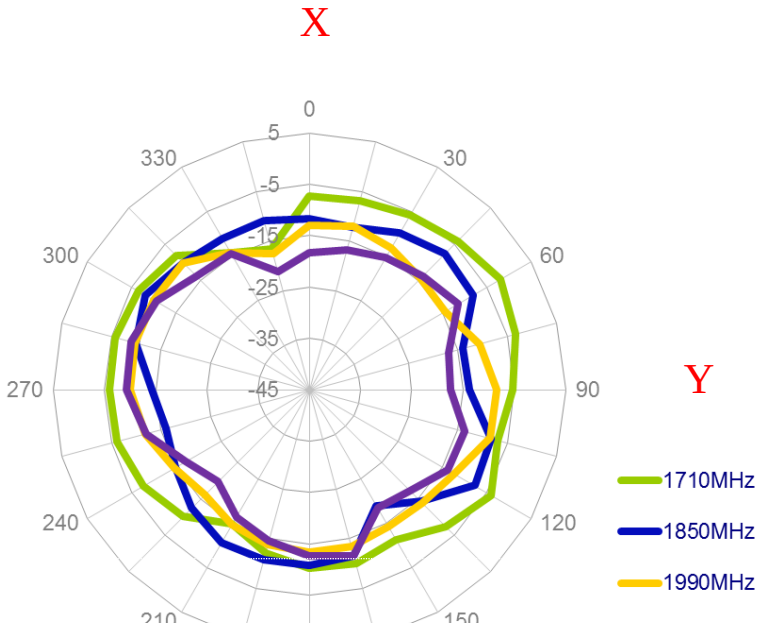


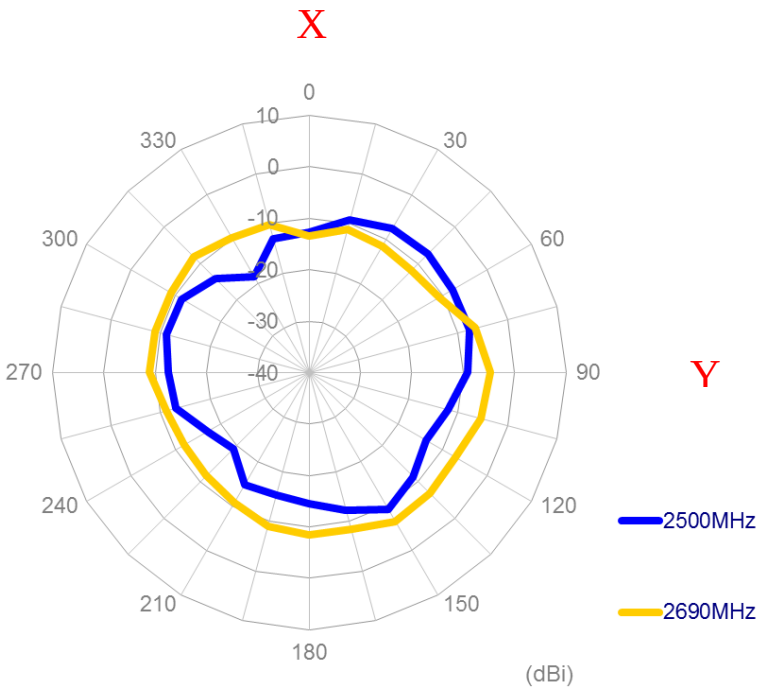
On the 50*50cm ground plane

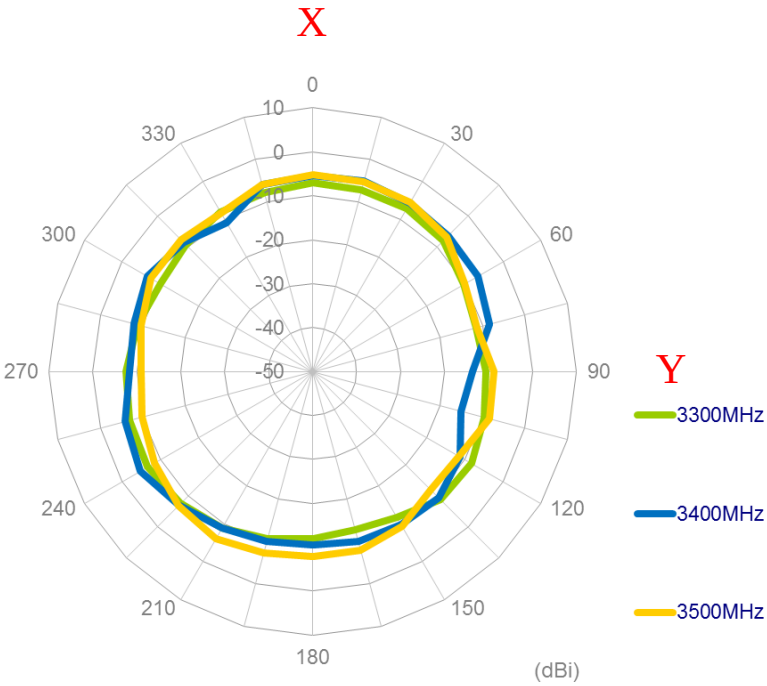
3.2.7 2D Radiation pattern (MIMO1 with 0.3M cable length on the 50*50 ground plane)

XY Plane

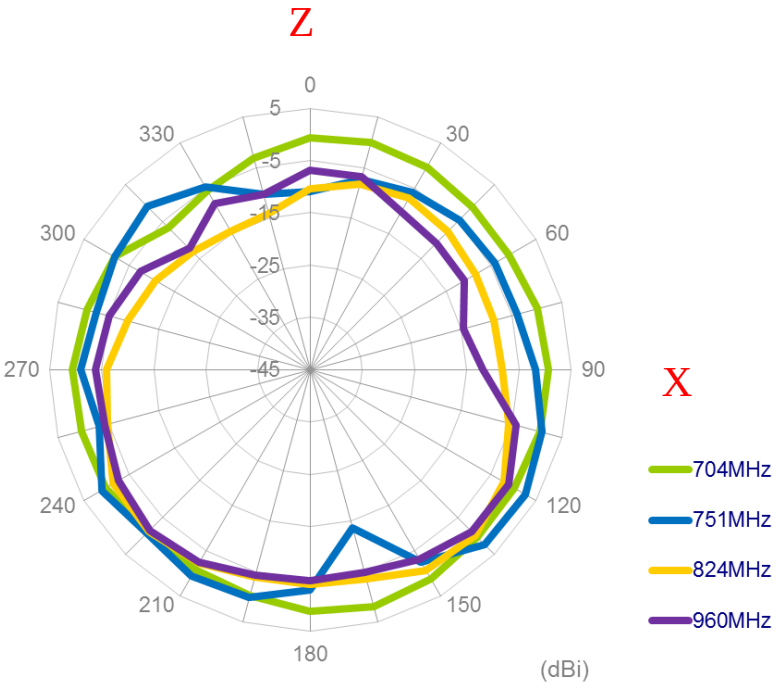


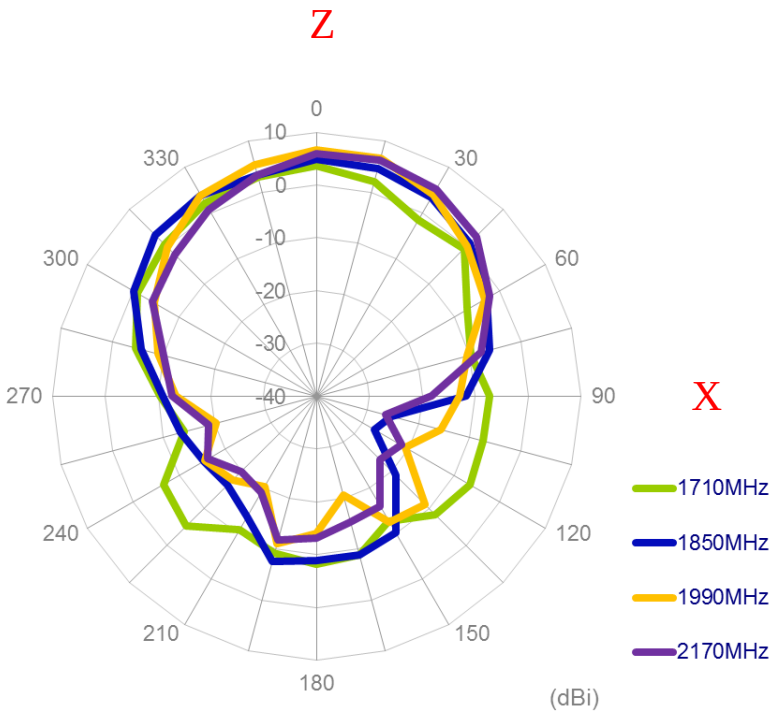


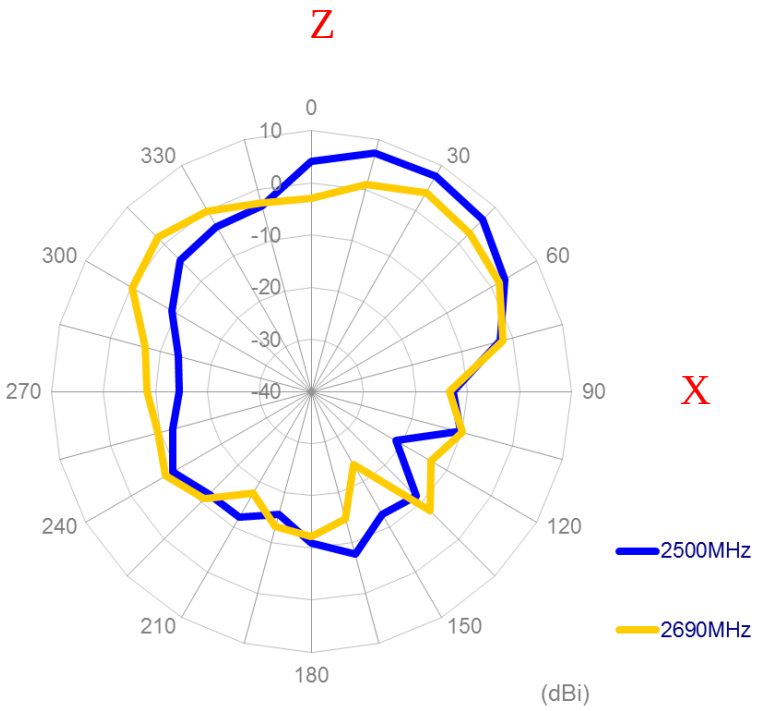

X
0
30
60
90
120
150
180
210
240
270
300
330
10
0
-10
-20
-30
-40
Y
2500MHz
2690MHz
(dBi)

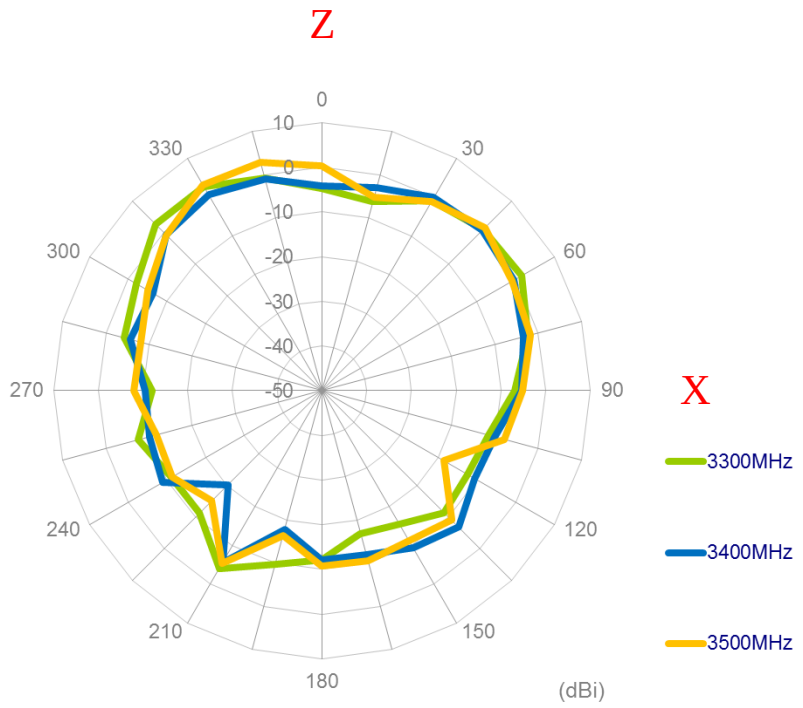

X
0
30
60
90
120
150
180
210
240
270
300
330
10
0
-10
-20
-30
-40
-50
Y
3300MHz
3400MHz
3500MHz
(dBi)

XZ Plane

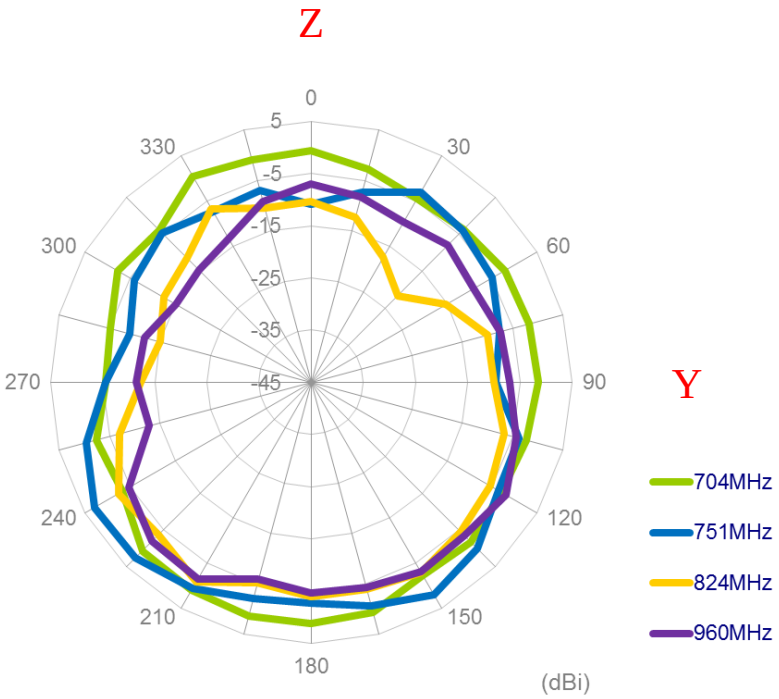

Z
0
30
60
90
120
150
180
210
240
270
300
330
5
-5
-15
-25
-35
-45
X
704MHz
751MHz
824MHz
960MHz
(dBi)

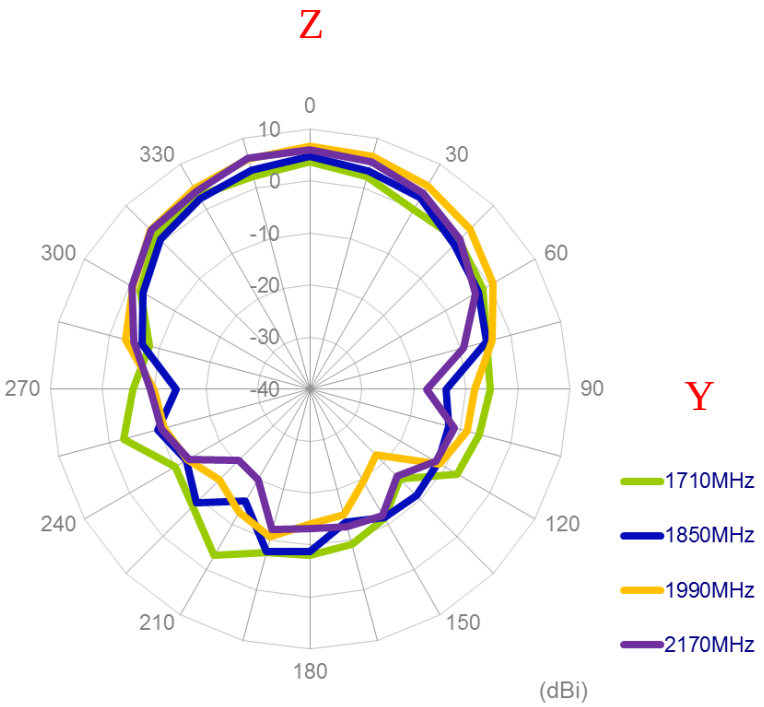

Z
0
30
60
90
120
150
180
210
240
270
300
330
10
0
-10
-20
-30
-40
X
1710MHz
1850MHz
1990MHz
2170MHz
(dBi)


Z
0
10
30
330
0
60
-10
300
-20
-30
270
-40
90
X
240
120
2500MHz
210
150
2690MHz
180
(dBi)


Z
0
10
330
30
0
-10
300
60
-20
-30
-40
270
-50
90
X
240
120
3300MHz
210
150
3400MHz
180
3500MHz
(dBi)

YZ Plane


Z
0
30
60
90
120
150
180
210
240
270
300
330
5
-5
-15
-25
-35
-45
Y
704MHz
751MHz
824MHz
960MHz
(dBi)


Z
0
30
60
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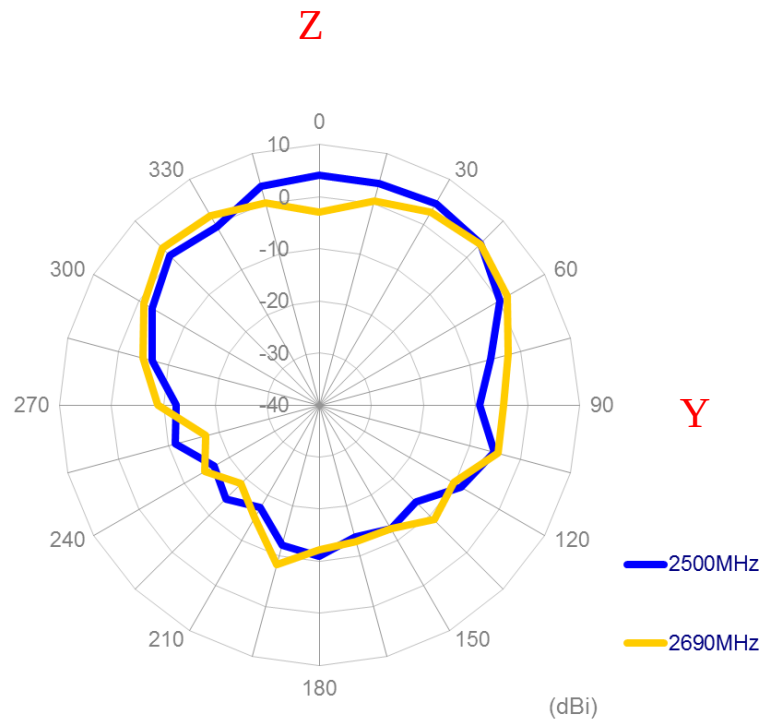
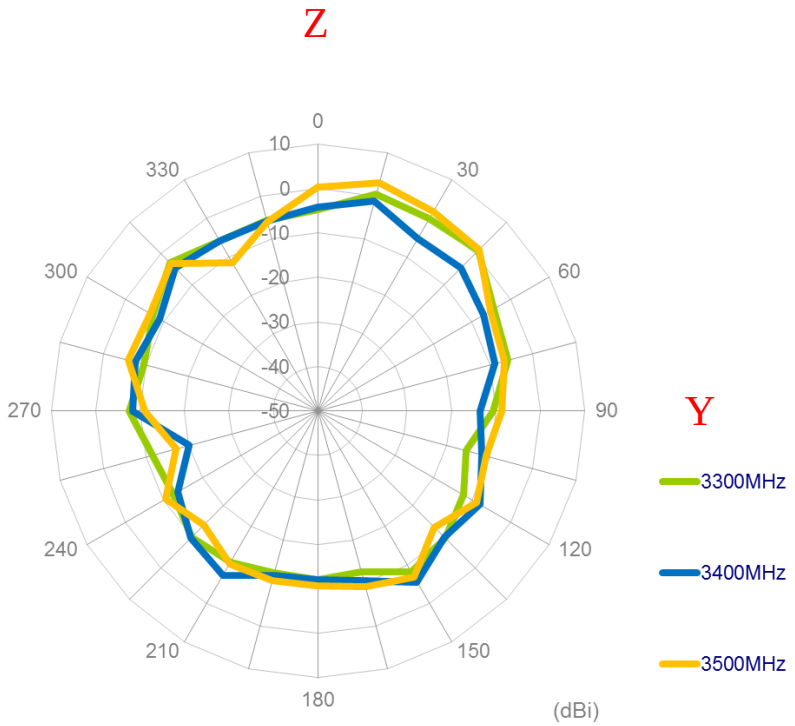
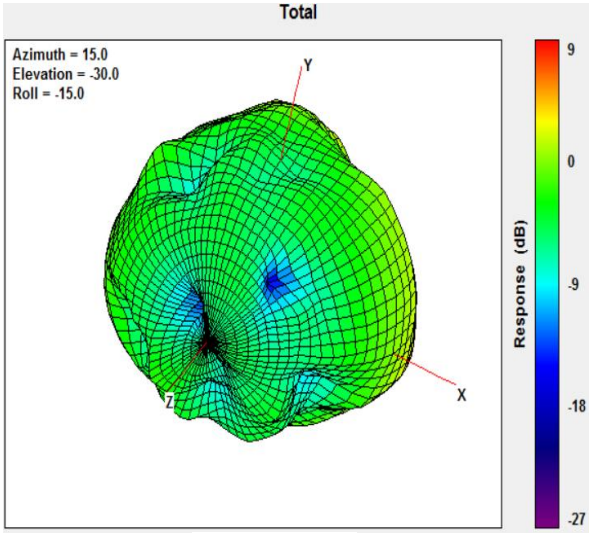
120
150
180
210
240
270
300
330
10
0
-10
-20
-30
-40
Y
1710MHz
1850MHz
1990MHz
2170MHz
(dBi)

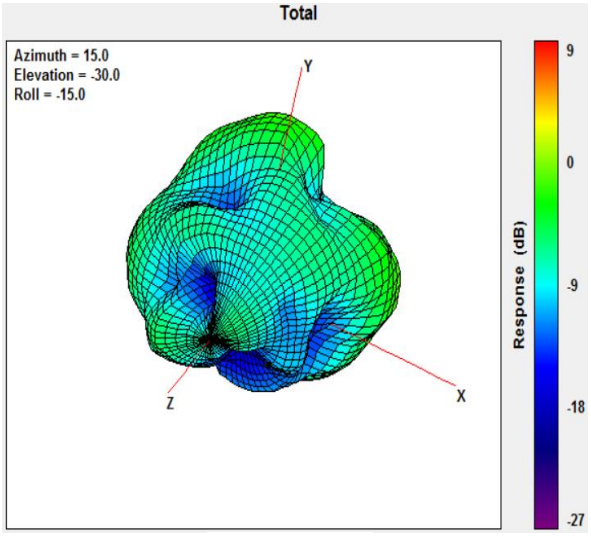

Z
0
10
30
60
90
120
150
180
210
240
270
300
330
0
-10
-20
-30
-40
Y
2500MHz
2690MHz
(dBi)


Z
0
10
30
60
90
120
150
180
210
240
270
300
330
0
-10
-20
-30
-40
-50
Y
3300MHz
3400MHz
3500MHz
(dBi)

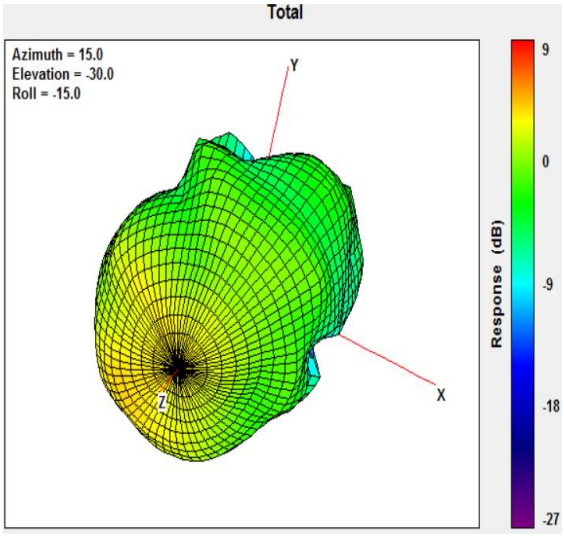
3.2.8 3D Radiation pattern (MIMO1 with 0.3M cable length on the 50*50 ground plane)



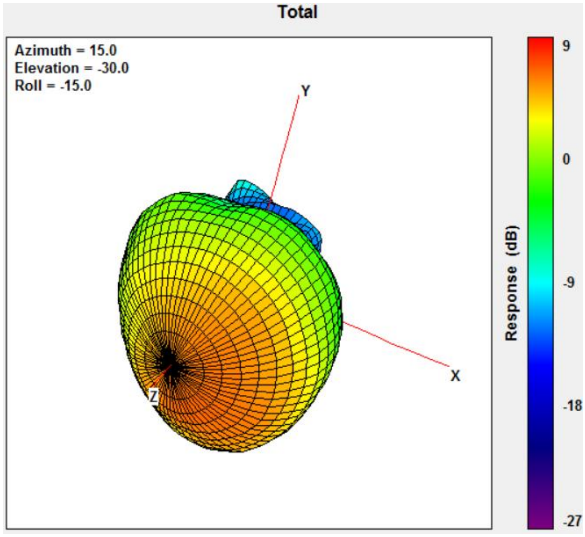
704MHz



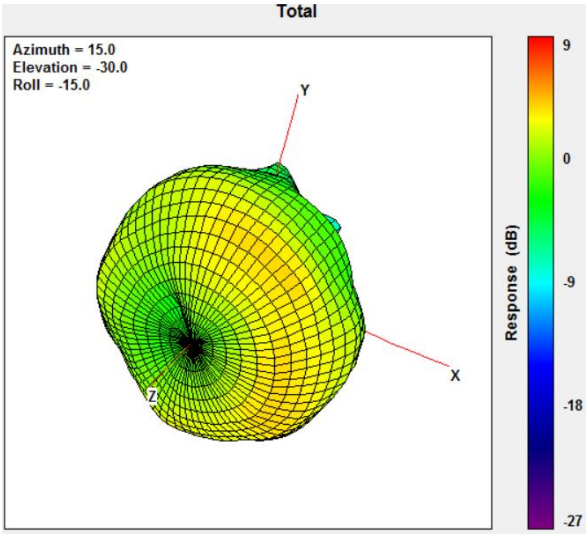
960MHz



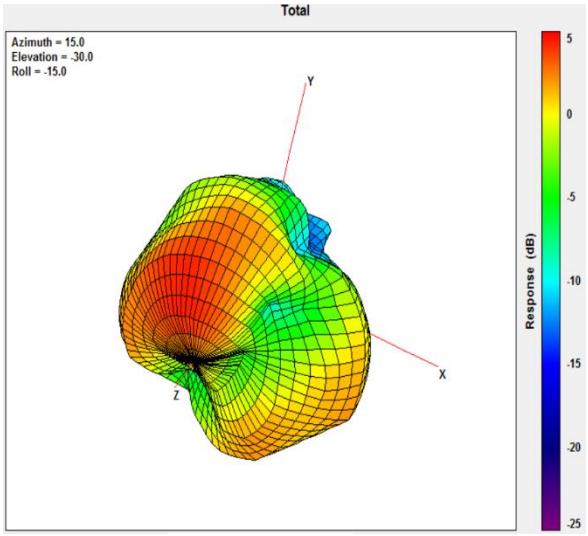
1710MHz



2170MHz



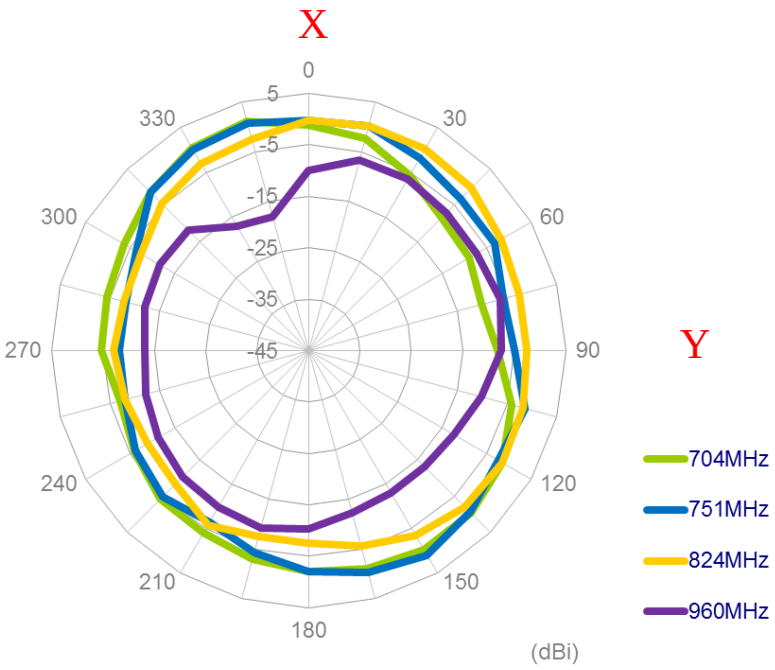
2690MHz

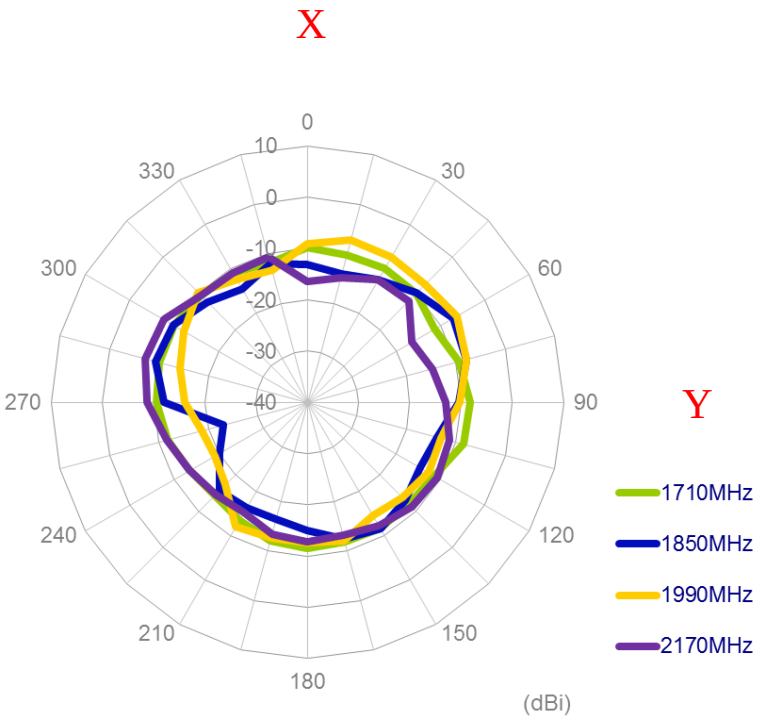


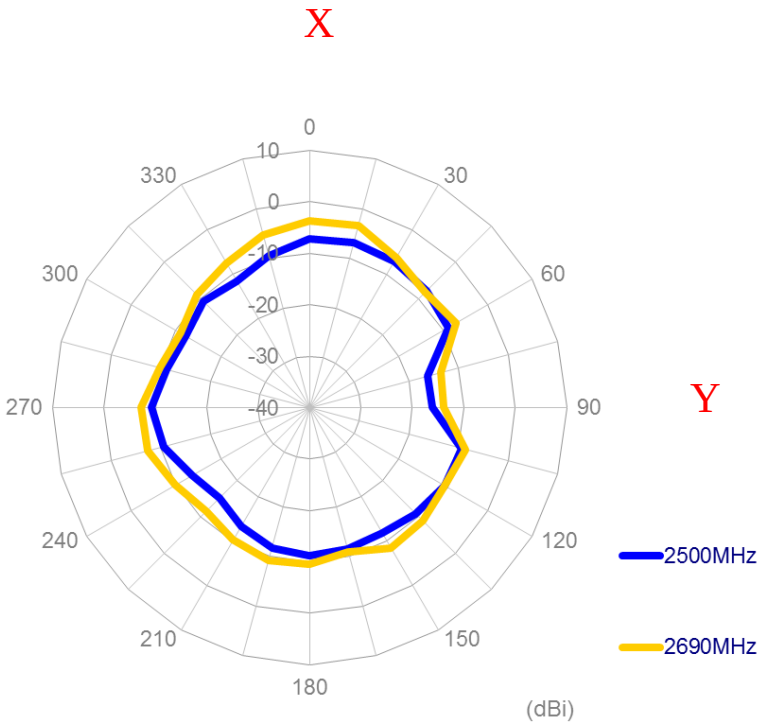
3500MHz

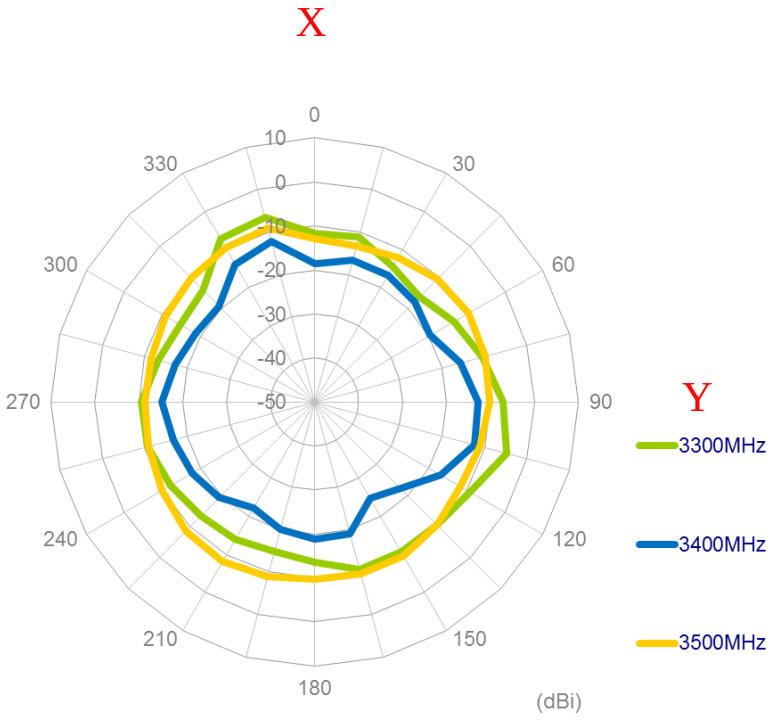
3.2.9 2D Radiation pattern (MIMO2 with 0.3M cable length on the 50*50 ground plane

XY Plane

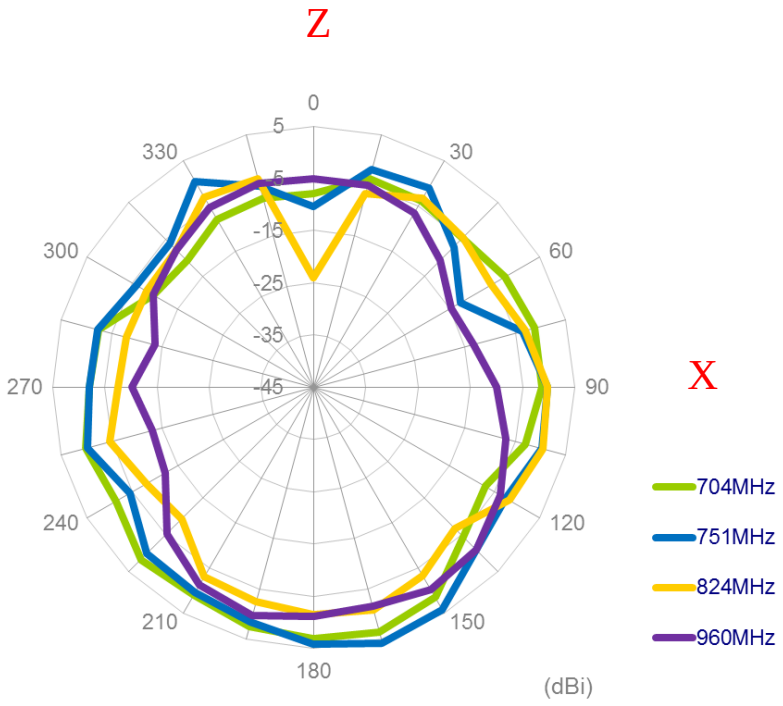


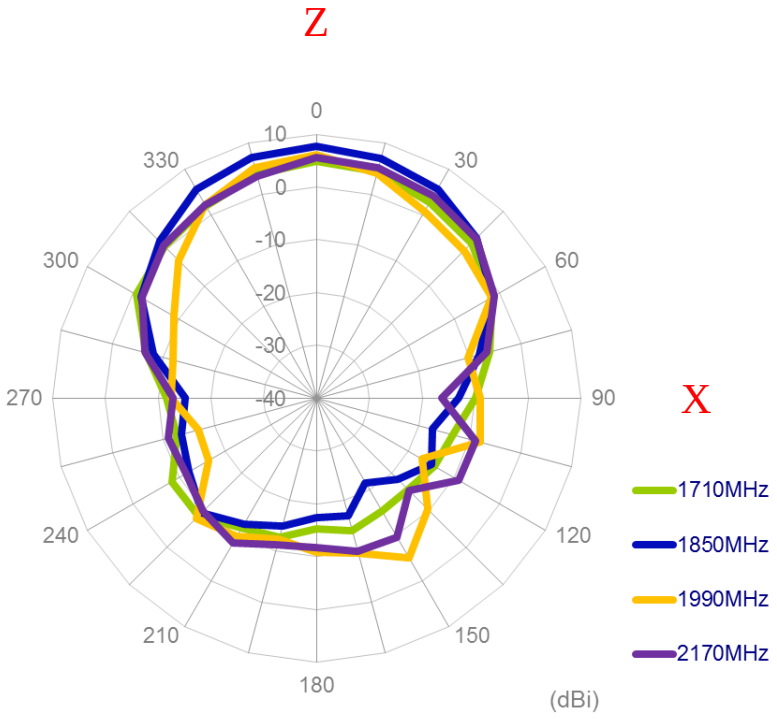


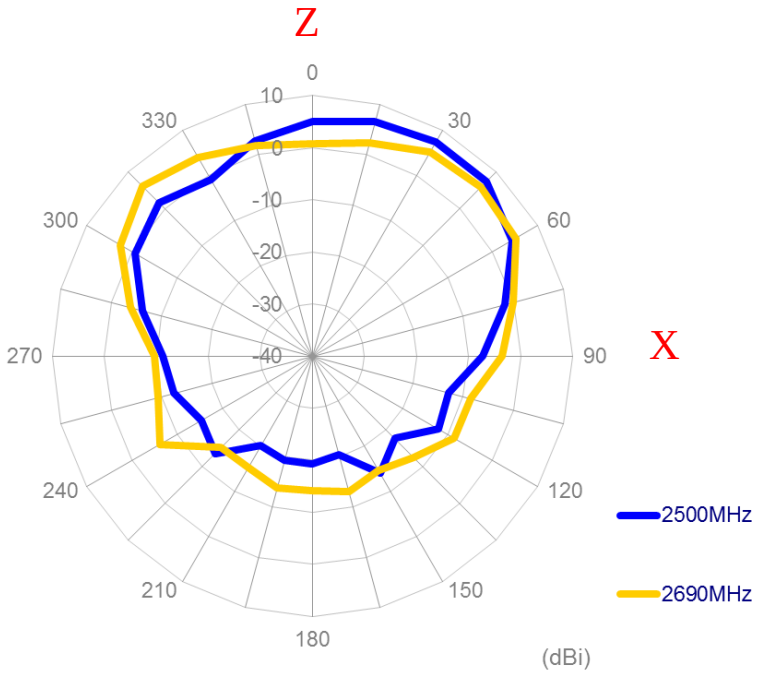

X
0
10
30
330
0
60
300
-10
-20
-30
270
-40
90
Y
240
120
2500MHz
210
150
2690MHz
180
(dBi)

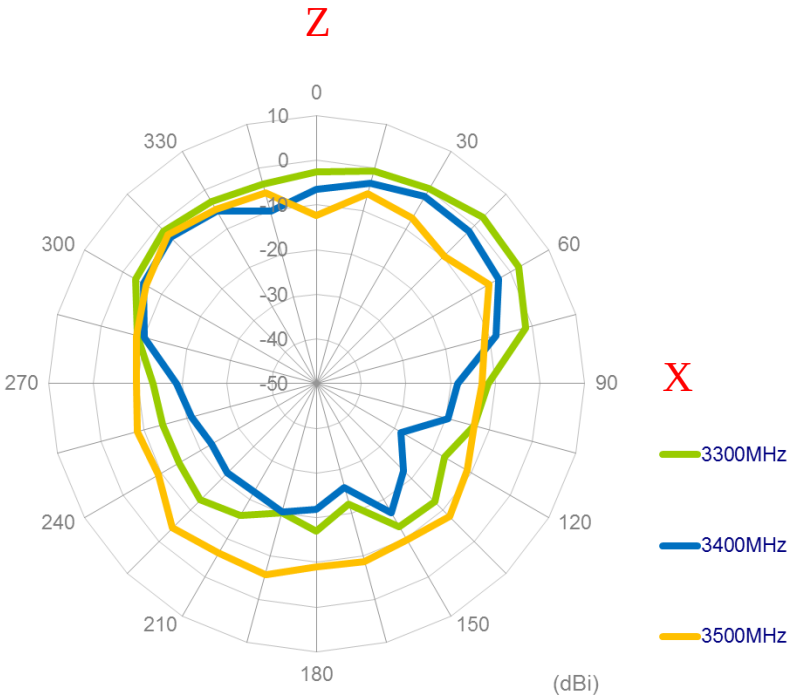

X
0
10
330
30
0
300
60
-10
-20
-30
-40
270
-50
90
Y
240
120
3300MHz
210
150
3400MHz
180
3500MHz
(dBi)

XZ Plane

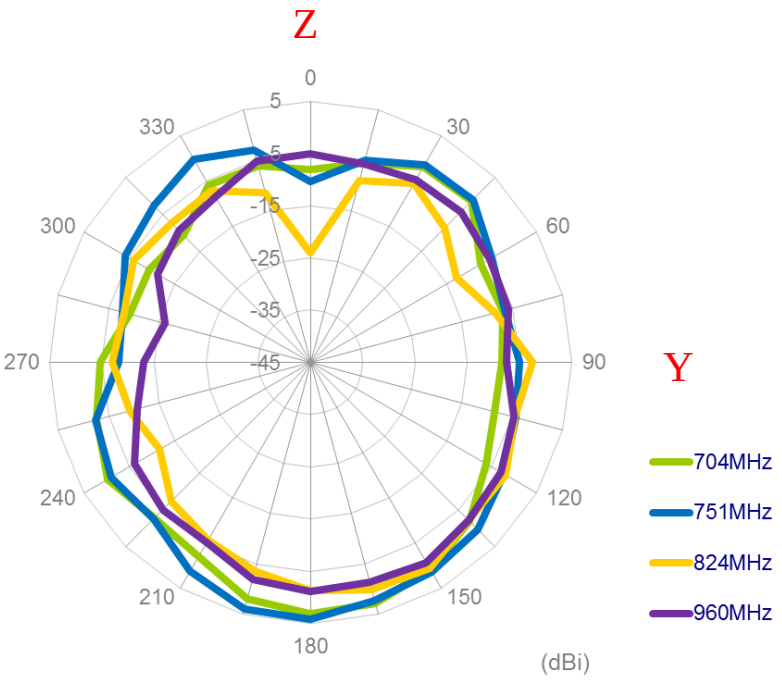

Z
0
30
60
90
120
150
180
210
240
270
300
330
5
-5
-15
-25
-35
-45
X
704MHz
751MHz
824MHz
960MHz
(dBi)

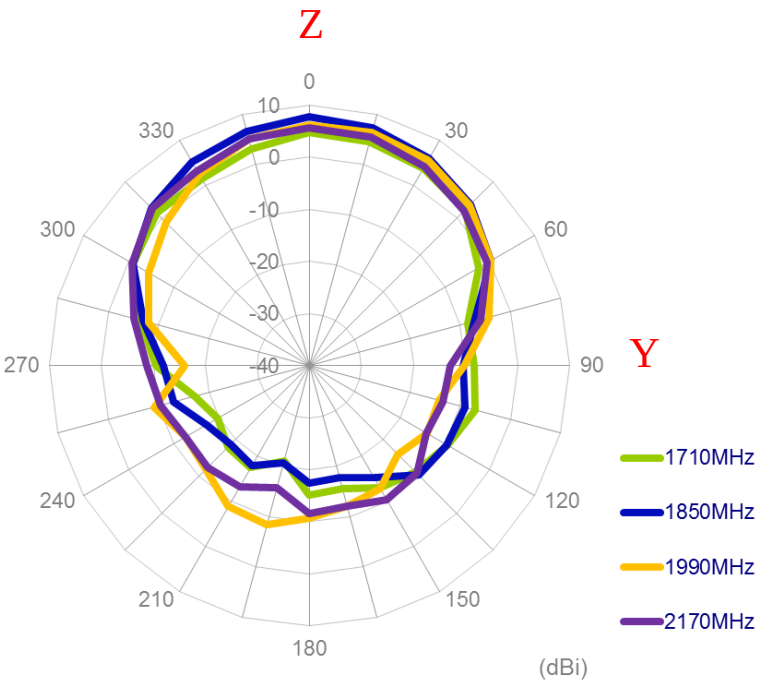

Z
0
30
60
90
120
150
180
210
240
270
300
330
10
0
-10
-20
-30
-40
X
1710MHz
1850MHz
1990MHz
2170MHz
(dBi)

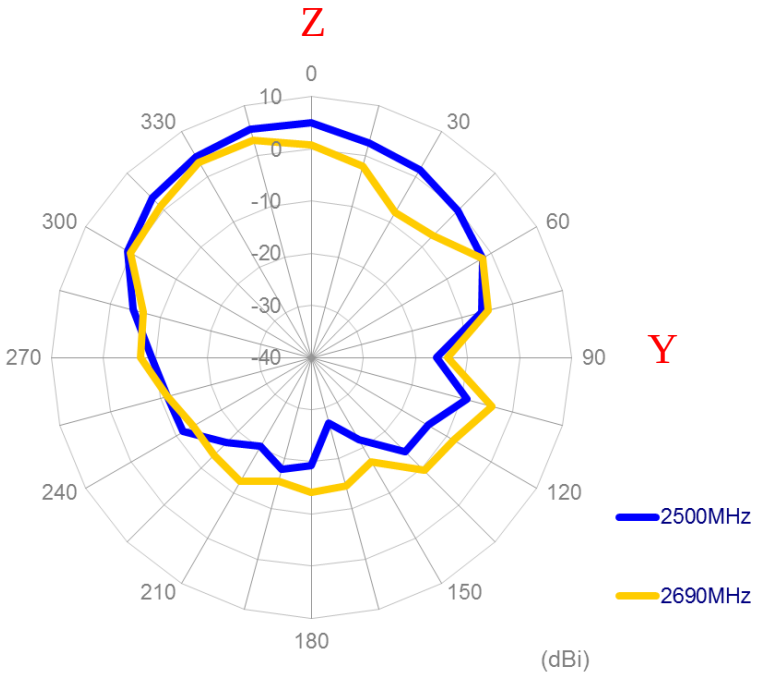

Z
0
10
30
330
0
-10
60
300
-20
-30
270
-40
90
X
240
120
2500MHz
210
150
2690MHz
180
(dBi)

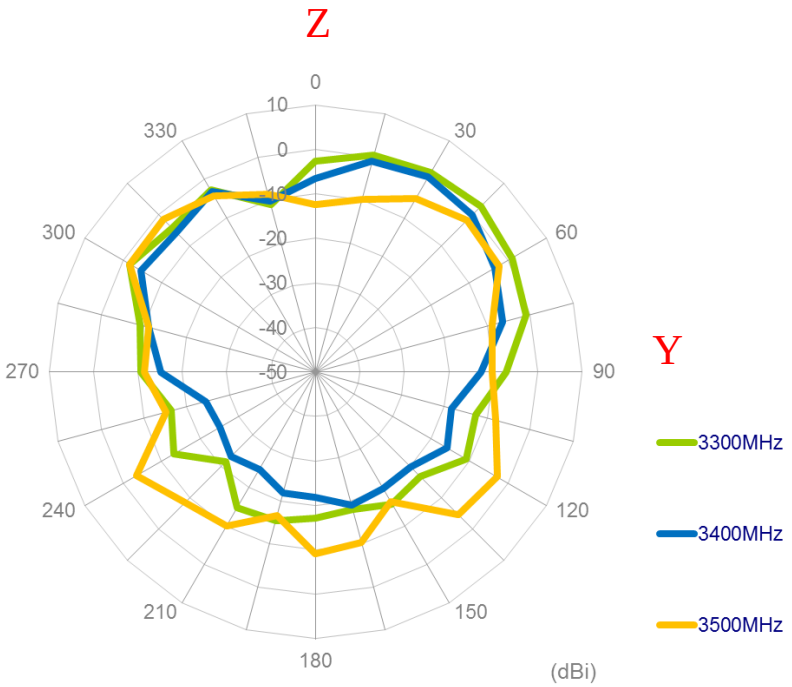

Z
0
10
330
30
0
300
-20
60
-30
-40
270
-50
90
X
240
120
3300MHz
3400MHz
210
150
3500MHz
180
(dBi)

YZ Plane

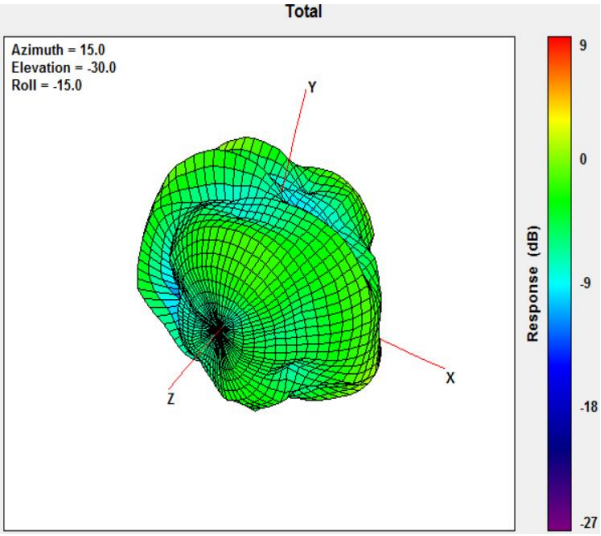

Z
0
30
60
90
120
150
180
210
240
270
300
330
5
-5
-15
-25
-35
-45
Y
704MHz
751MHz
824MHz
960MHz
(dBi)


Z
0
30
60
90
120
150
180
210
240
270
300
330
10
0
-10
-20
-30
-40
Y
1710MHz
1850MHz
1990MHz
2170MHz
(dBi)

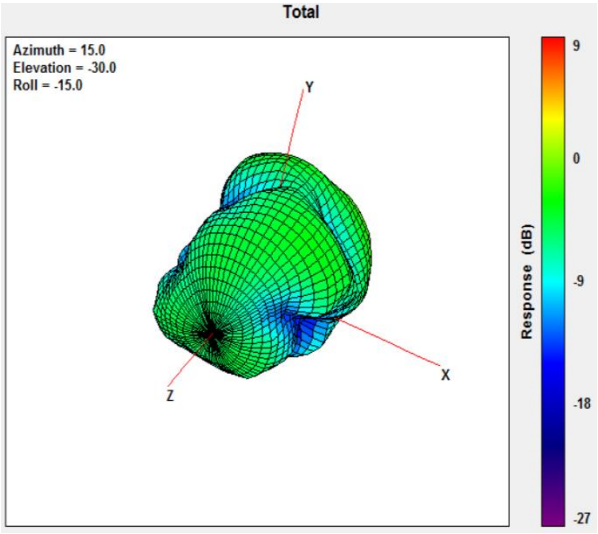

Z
0
10
30
330
0
-10
300
60
-20
-30
270
-40
90
Y
240
120
2500MHz
210
150
2690MHz
180
(dBi)


Z
0
10
330
30
0
300
60
-20
-30
-40
270
-50
90
Y
240
120
3300MHz
210
150
3400MHz
180
3500MHz
(dBi)

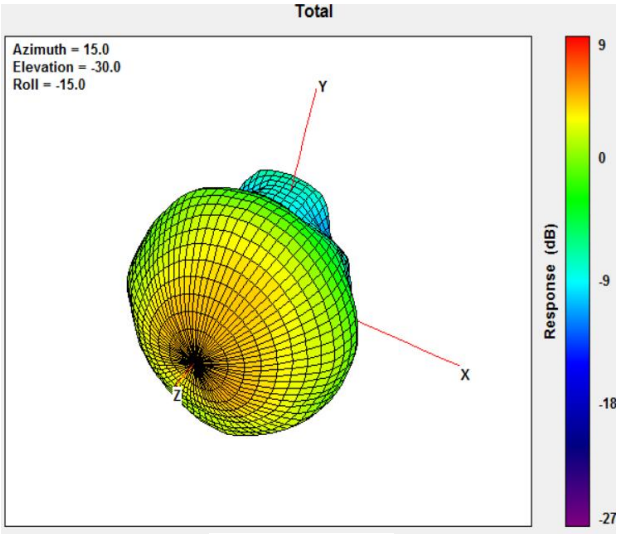
3.2.10 3D Radiation pattern (MIMO2 with 0.3M cable length on the 50*50 ground plane



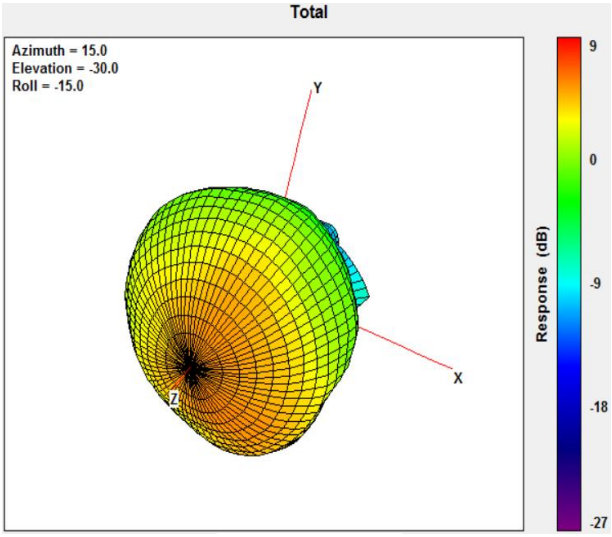
704MHz



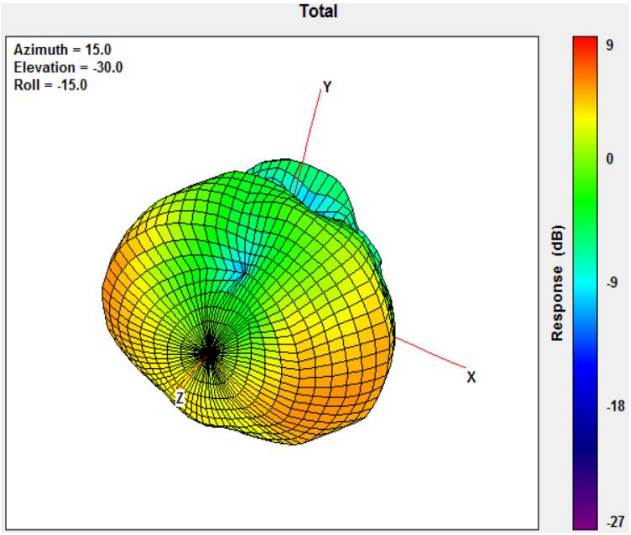
960MHz



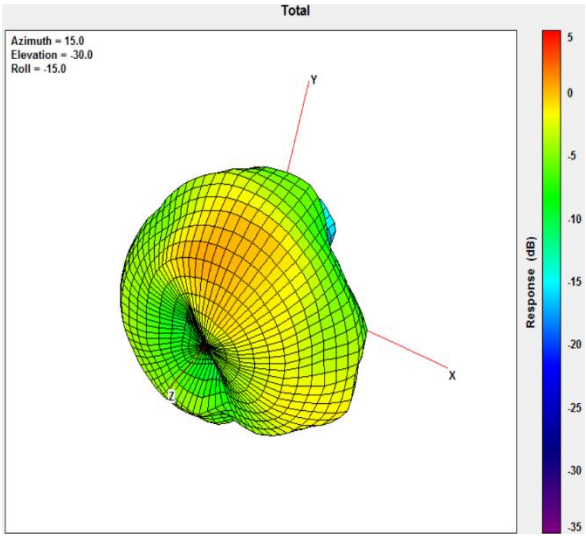
1710MHz



2170MHz

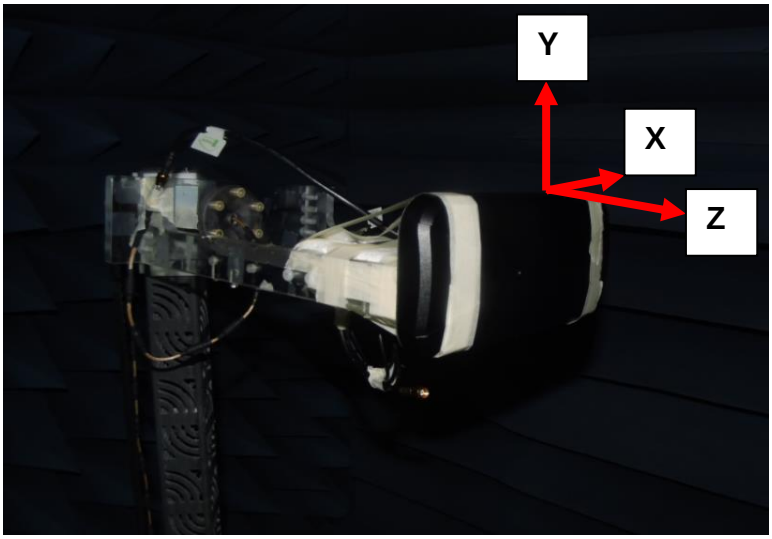


2690MHz



3500MHz

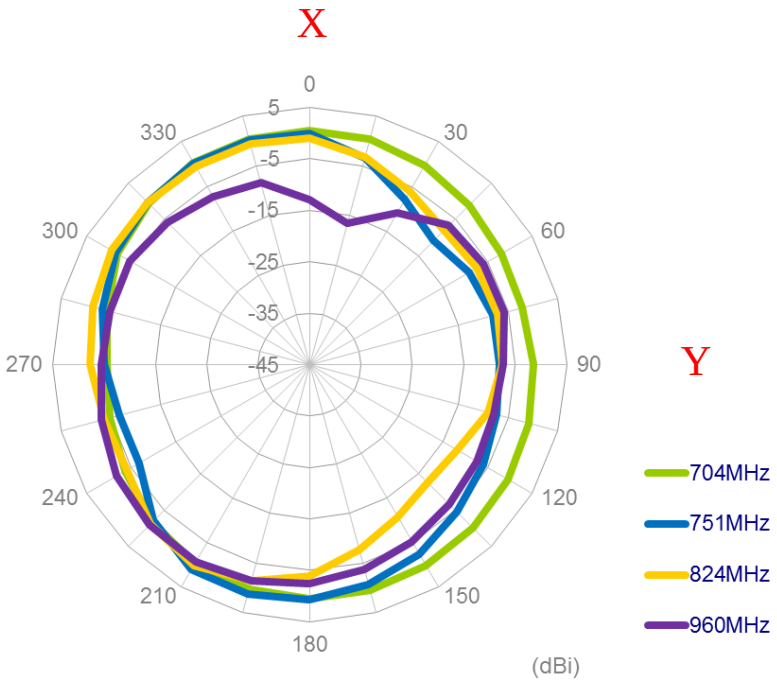
3.2.11 Test Setup For Antenna Radiation Pattern (ETS Anechoic chamber)

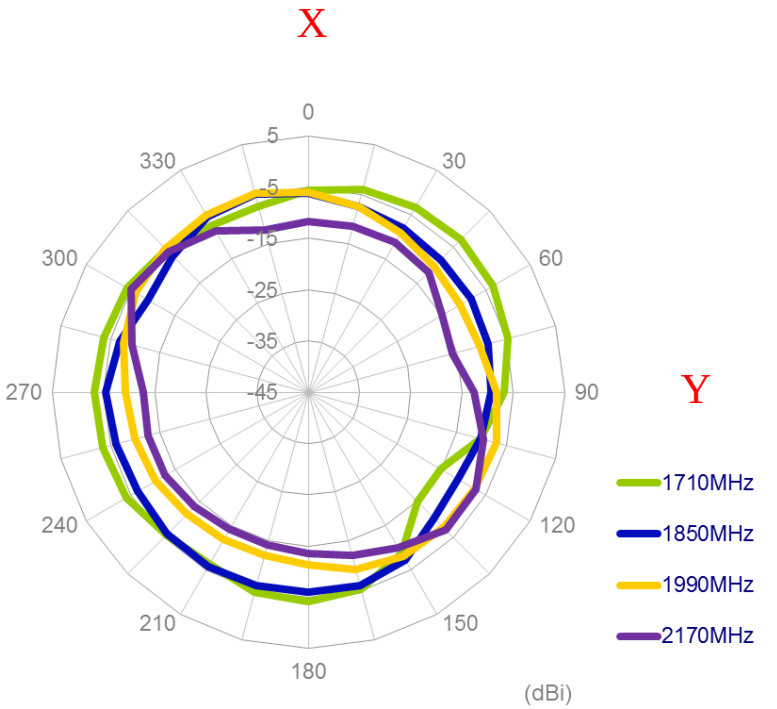


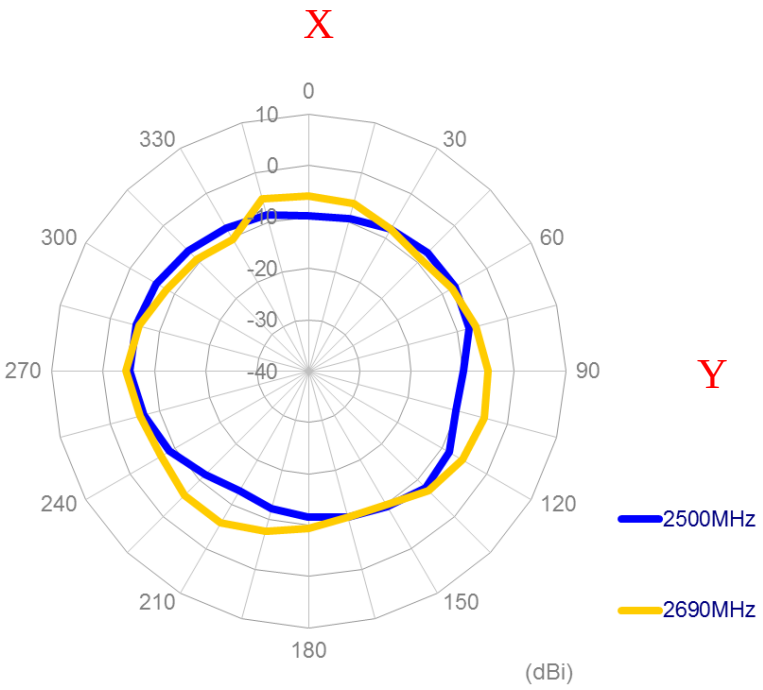
In free space

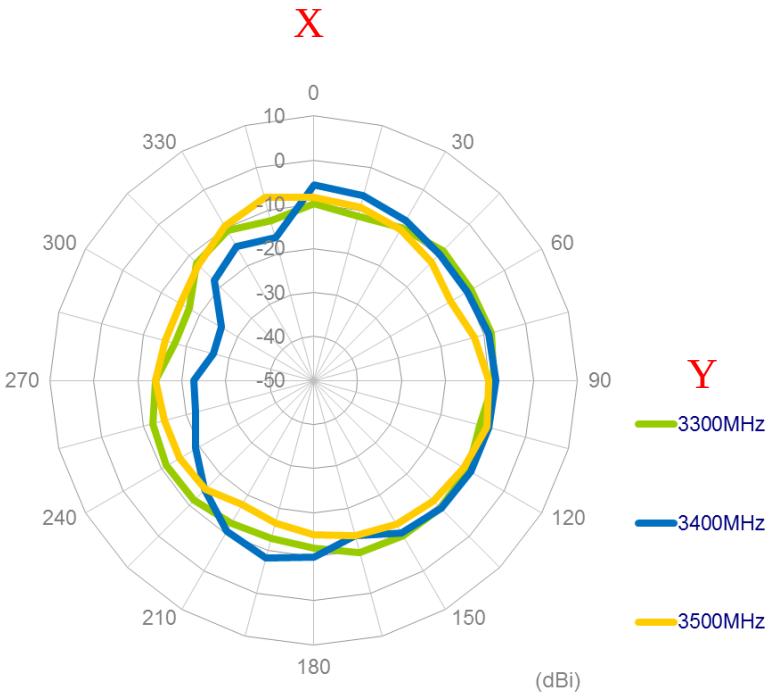
3.2.12 2D Radiation pattern (MIMO1 with 0.3M cable length in free space)

XY Plane

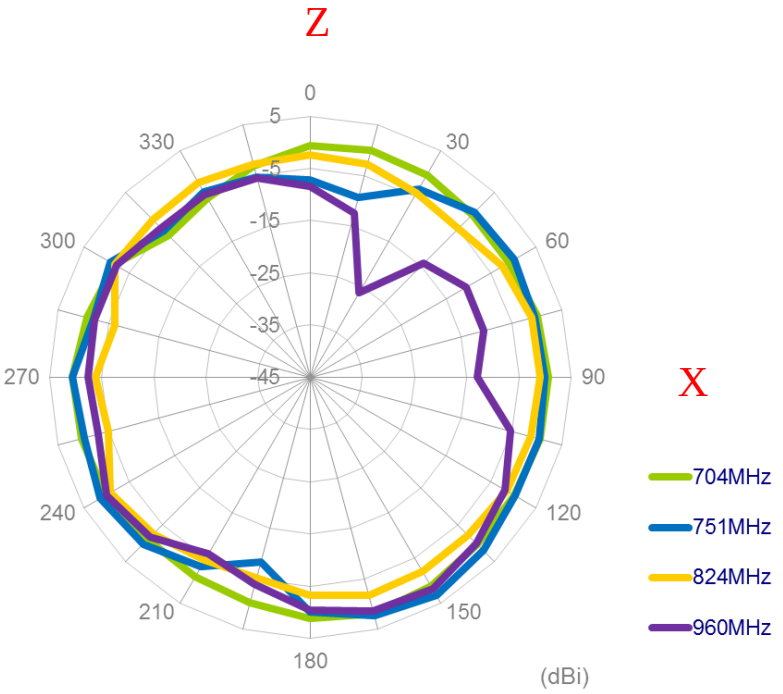


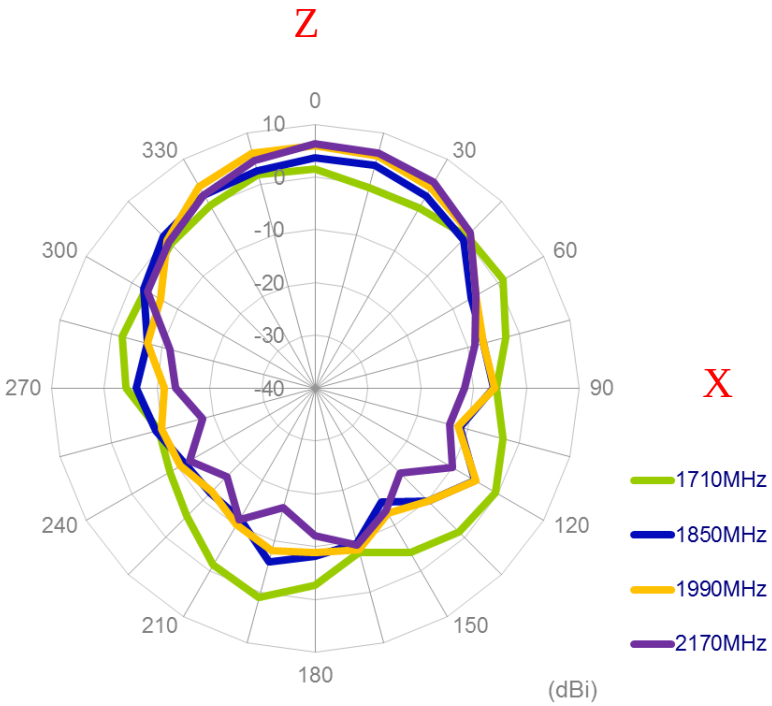


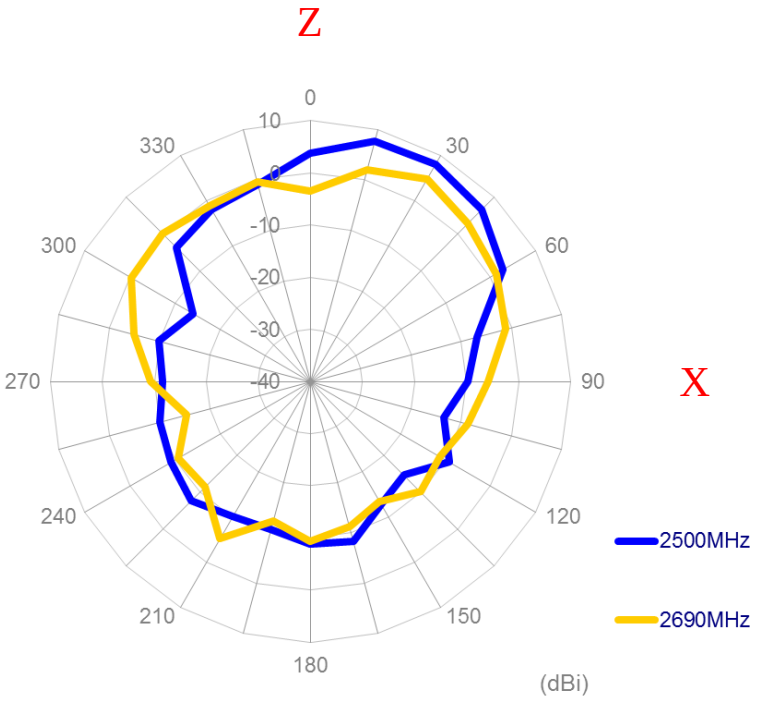

X
0
10
30
330
0
60
300
-20
-30
270
-40
90
Y
240
120
2500MHz
210
150
2690MHz
180
(dBi)

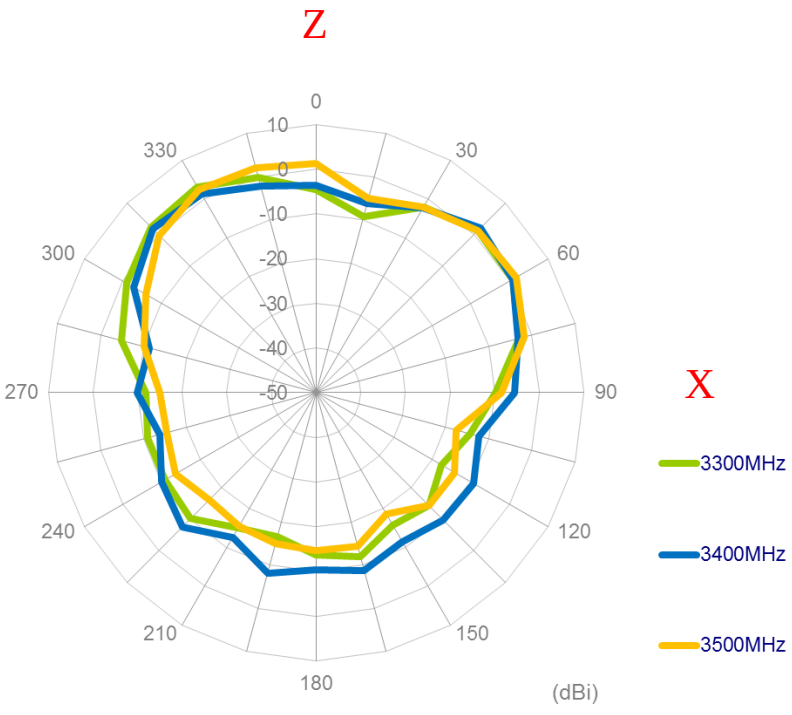

X
0
10
330
30
0
300
60
-10
-20
-30
-40
270
-50
90
Y
240
120
3300MHz
3400MHz
210
150
3500MHz
180
(dBi)

XZ Plane

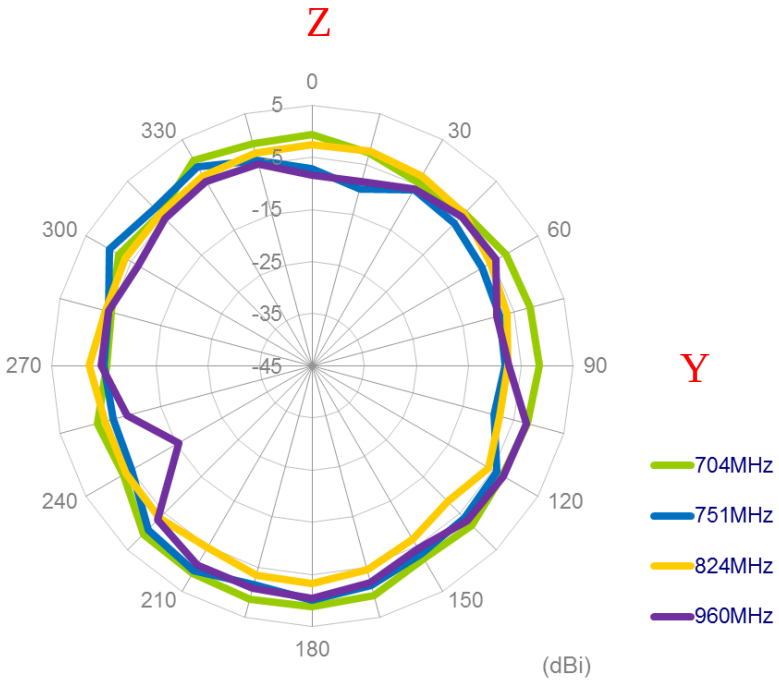

Z
0
5
-5
-15
-25
-35
-45
30
60
90
120
150
180
210
240
270
300
330
X
704MHz
751MHz
824MHz
960MHz
(dBi)

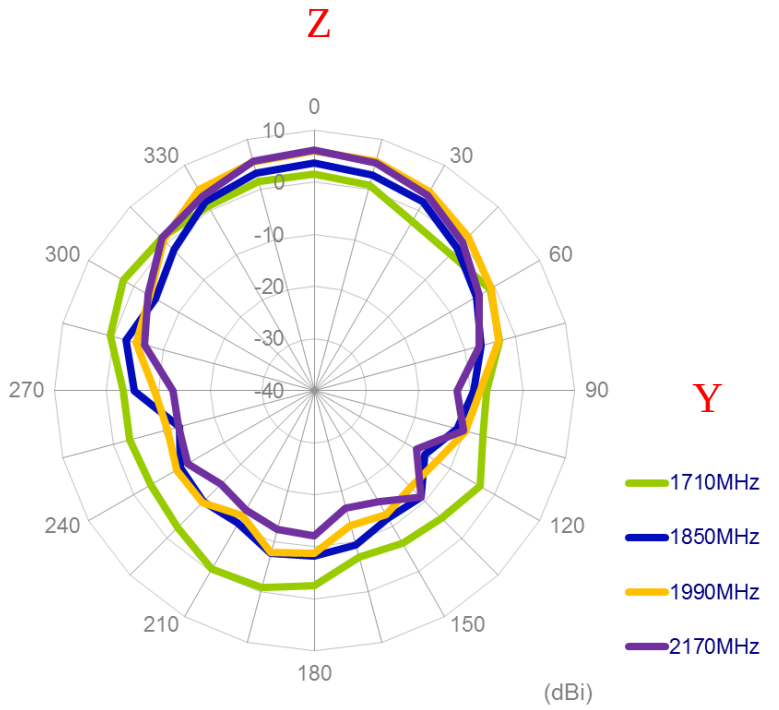

Z
0
10
0
-10
-20
-30
-40
30
60
90
120
150
180
210
240
270
300
330
X
1710MHz
1850MHz
1990MHz
2170MHz
(dBi)

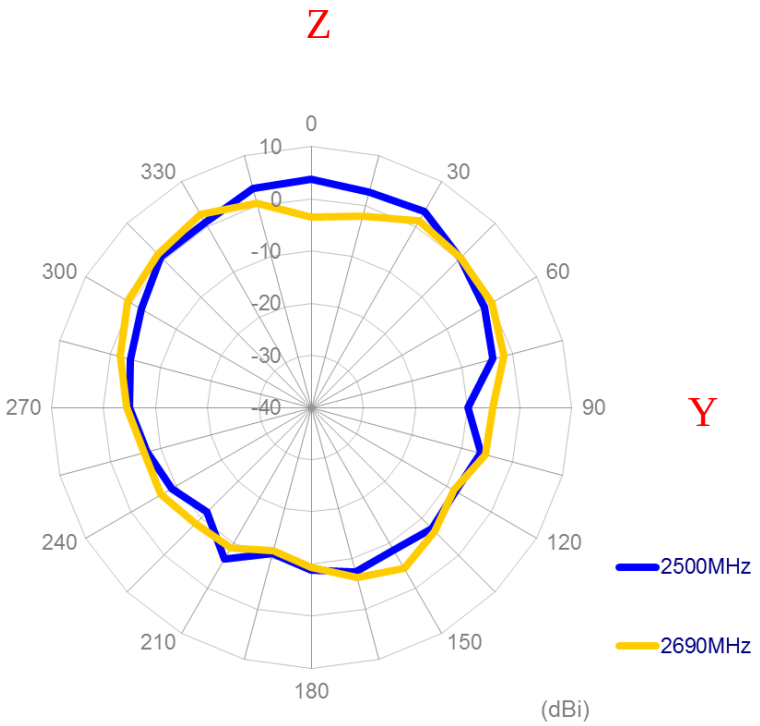

Z
0
10
30
330
0
-10
300
60
-20
-30
270
-40
90
X
240
120
2500MHz
210
150
2690MHz
180
(dBi)

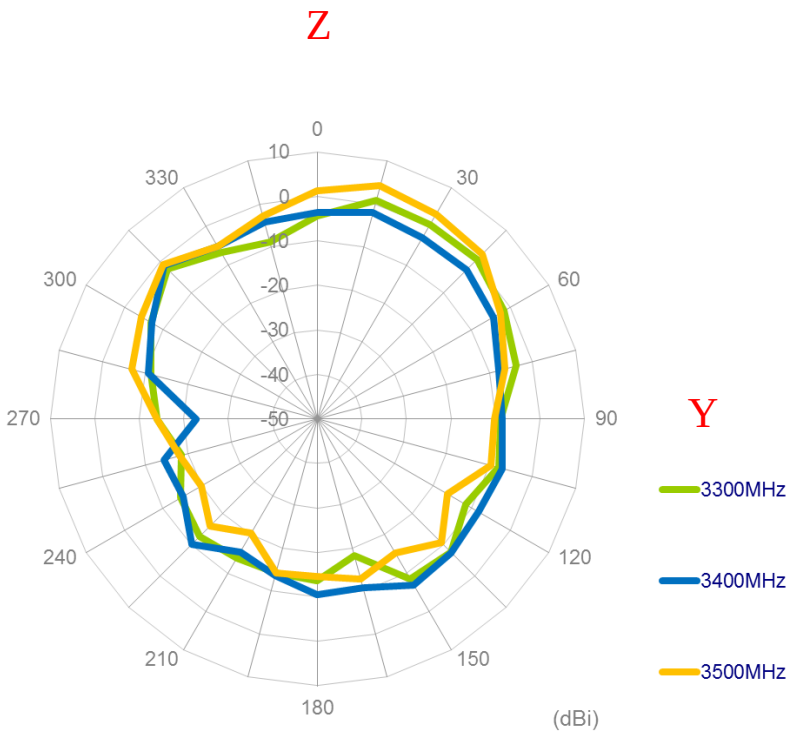

Z
0
10
330
30
0
-10
300
60
-20
-30
-40
270
-50
90
X
240
120
3300MHz
210
150
3400MHz
180
3500MHz
(dBi)

YZ Plane

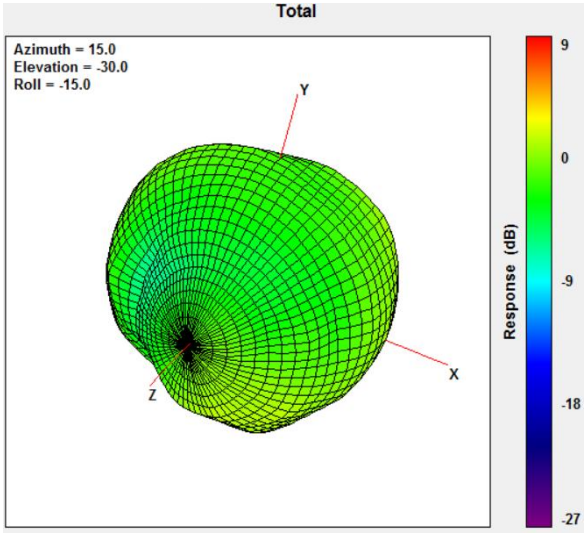

Z
0
30
60
90
120
150
180
210
240
270
300
330
5
-5
-15
-25
-35
-45
Y
704MHz
751MHz
824MHz
960MHz
(dBi)


Z
0
30
60
90
120
150
180
210
240
270
300
330
10
0
-10
-20
-30
-40
Y
1710MHz
1850MHz
1990MHz
2170MHz
(dBi)

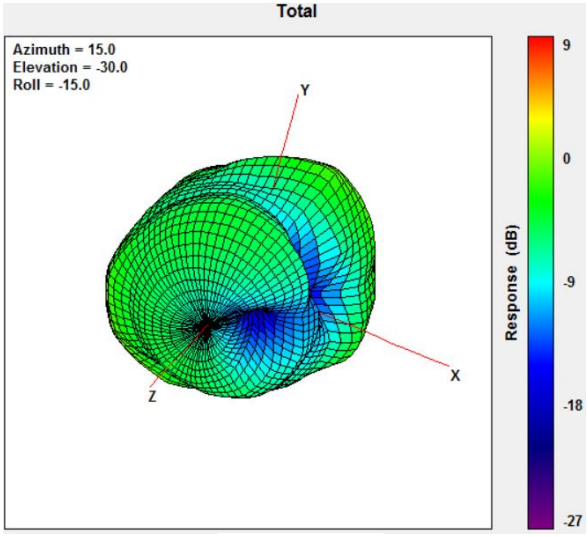

Z
0
10
30
330
0
-10
60
300
-20
-30
270
-40
90
Y
240
120
2500MHz
210
150
2690MHz
180
(dBi)


Z
0
10
330
30
0
-10
300
60
-20
-30
-40
270
-50
90
Y
240
120
3300MHz
210
150
3400MHz
180
3500MHz
(dBi)

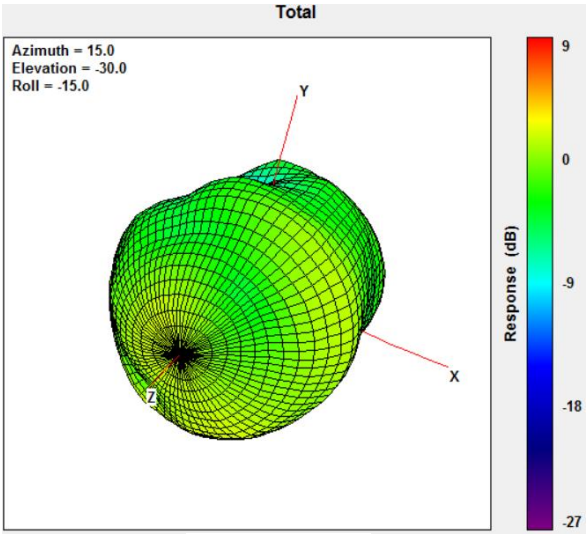
3.2.13 3D Radiation pattern (MIMO1 with 0.3M cable length in free space)



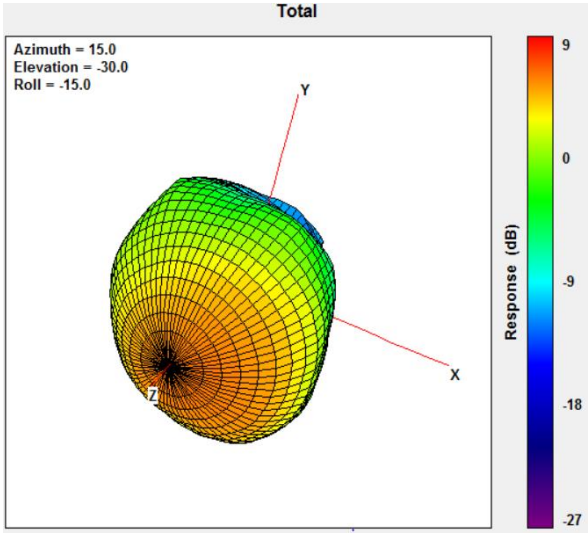
704MHz



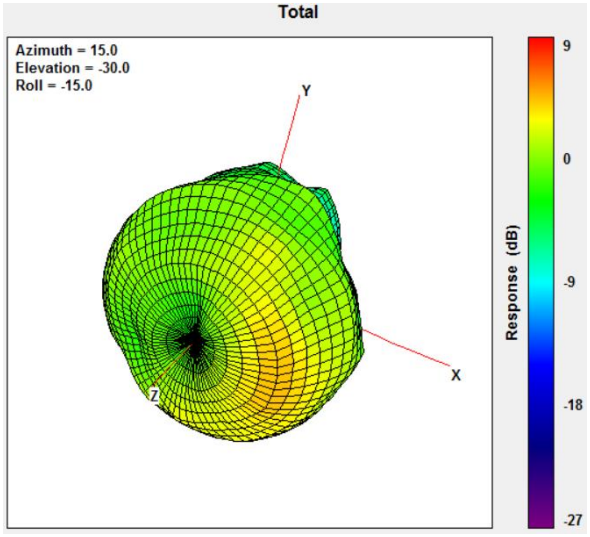
960MHz



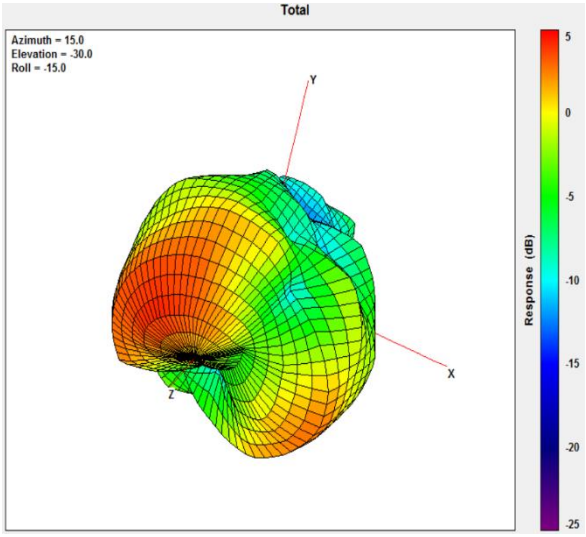
1710MHz



2170MHz



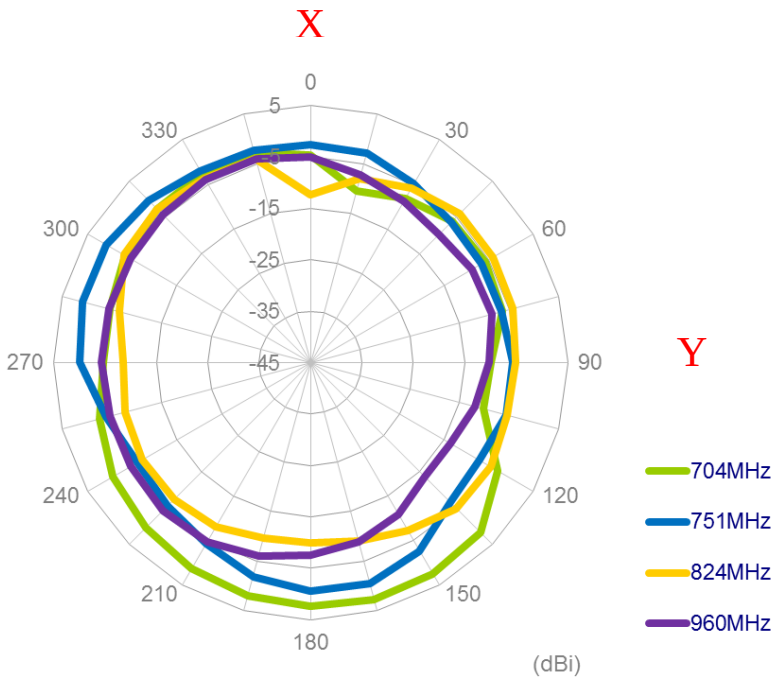
2690MHz

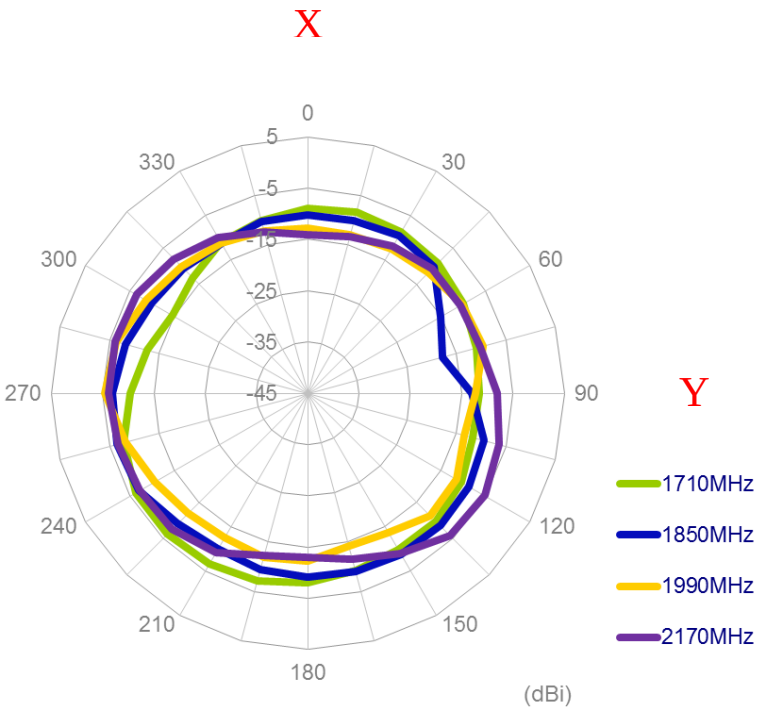


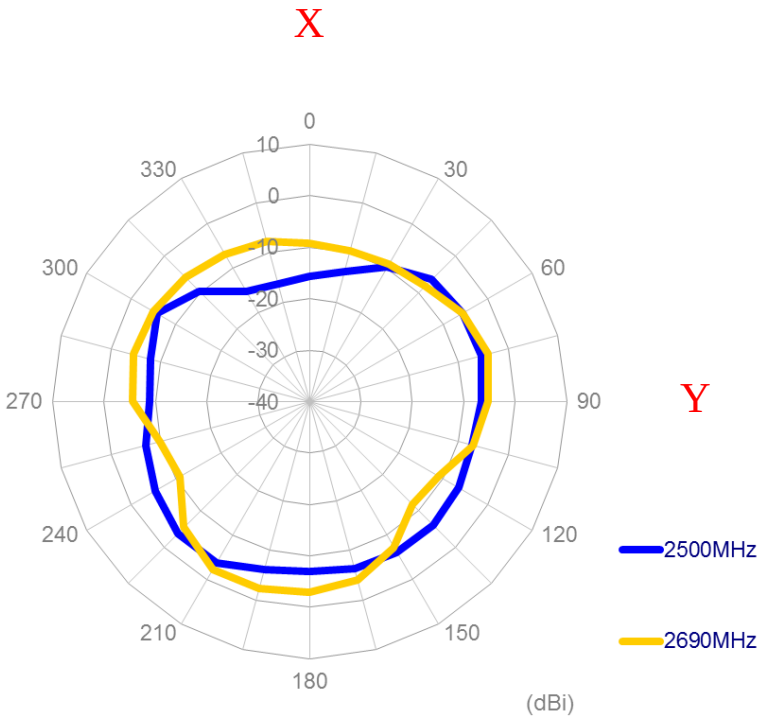
3500MHz

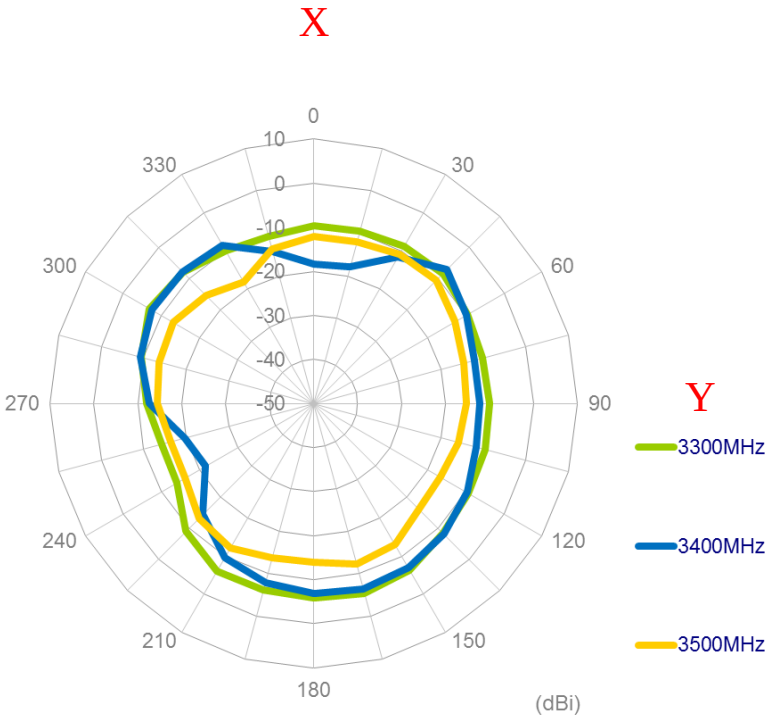
3.2.14 2D Radiation pattern (MIMO2 with 0.3M cable length in free space)

XY Plane

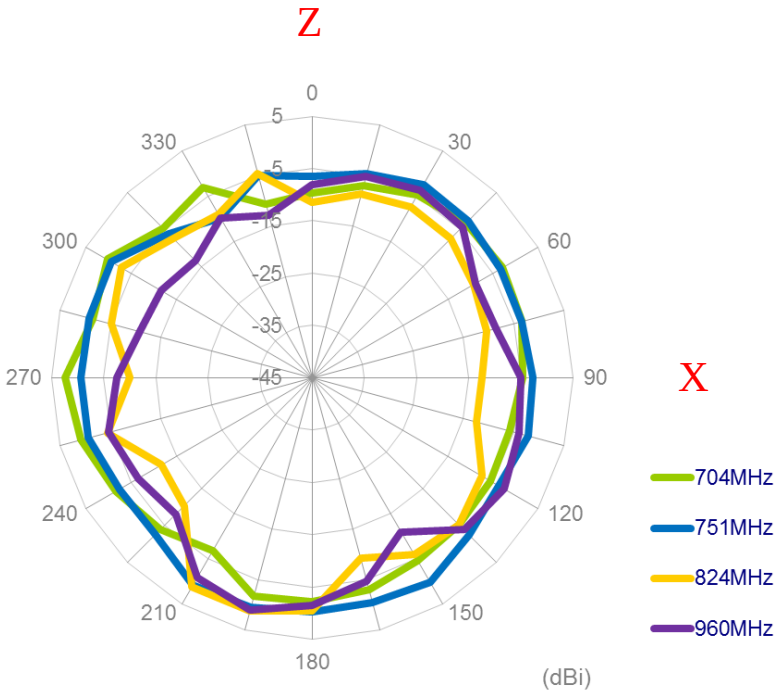


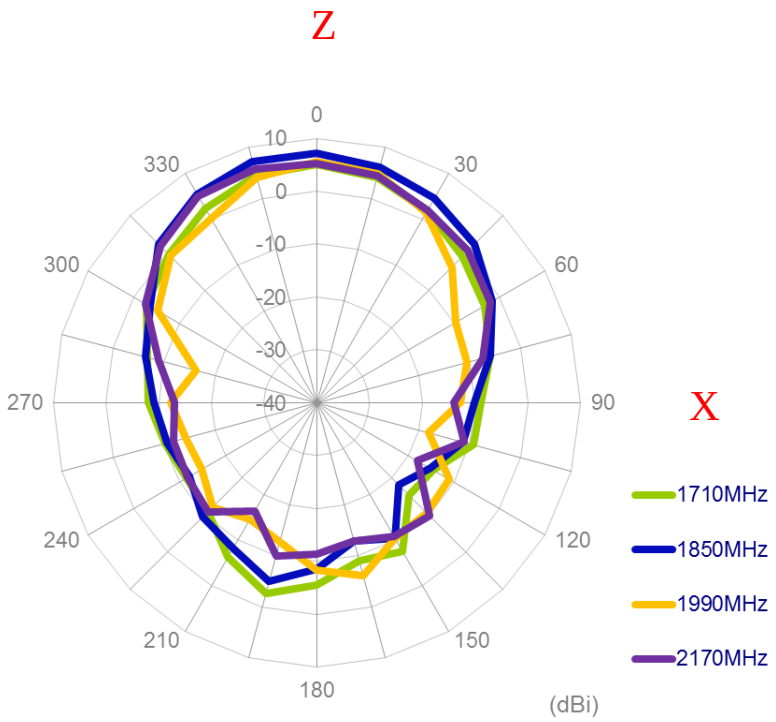


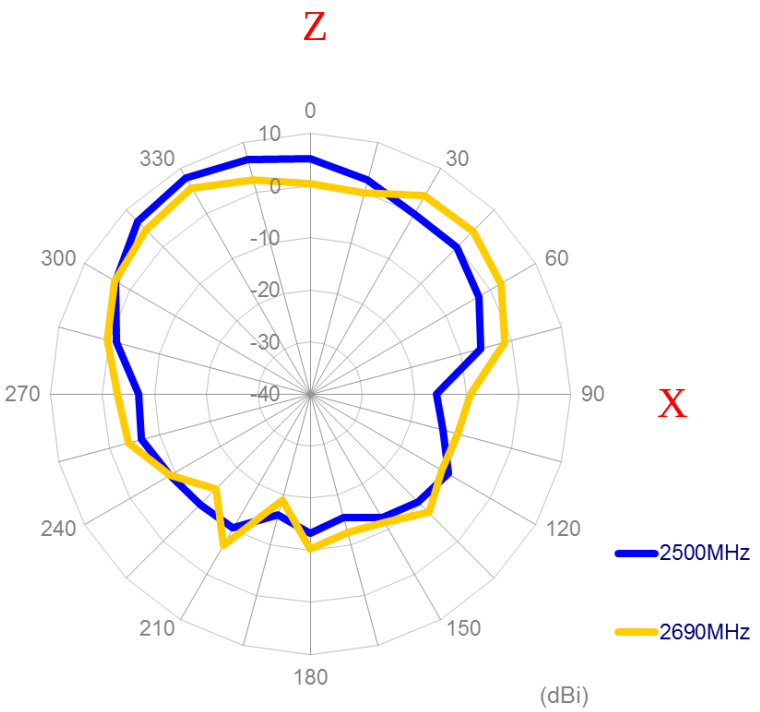

X
0
10
30
330
0
60
-10
300
-20
-30
270
-40
90
Y
240
120
2500MHz
210
150
2690MHz
180
(dBi)

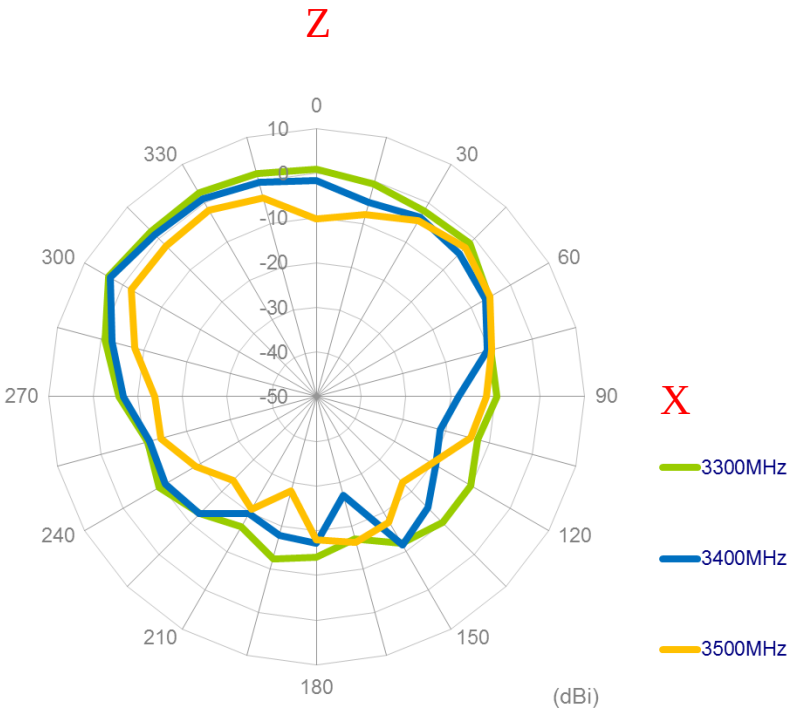

X
0
10
330
30
0
-10
300
60
-20
-30
-40
270
-50
90
Y
240
120
3300MHz
3400MHz
210
150
3500MHz
180
(dBi)

XZ Plane

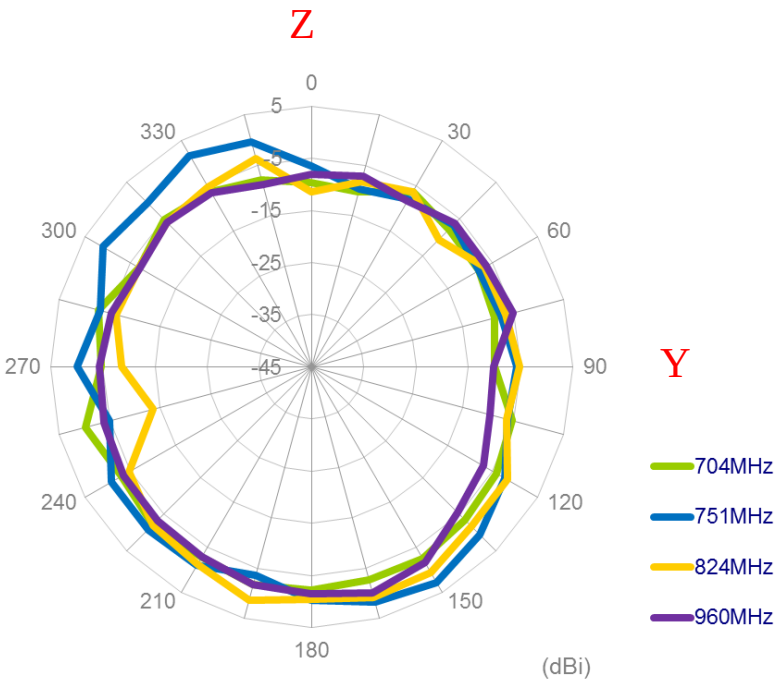

Z
0
30
60
90
120
150
180
210
240
270
300
330
5
-5
-15
-25
-35
-45
X
704MHz
751MHz
824MHz
960MHz
(dBi)

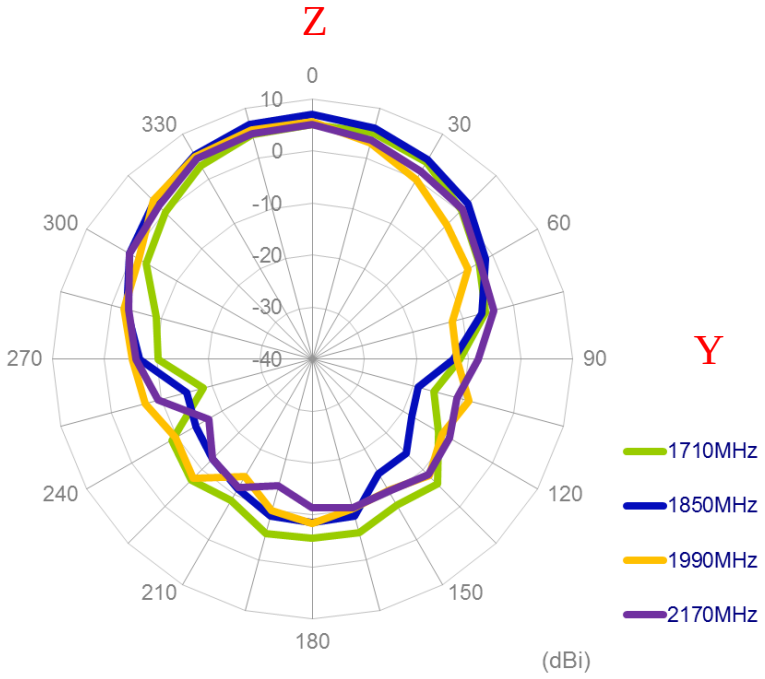

Z
0
30
60
90
120
150
180
210
240
270
300
330
10
0
-10
-20
-30
-40
X
1710MHz
1850MHz
1990MHz
2170MHz
(dBi)

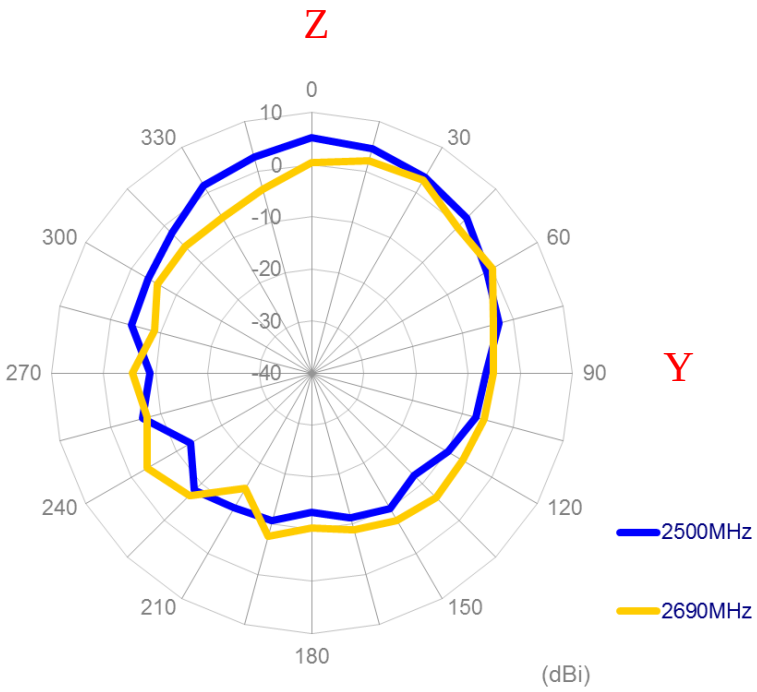

Z
0
10
30
330
0
-10
300
60
-20
-30
270
-40
90
X
240
120
2500MHz
210
150
2690MHz
180
(dBi)

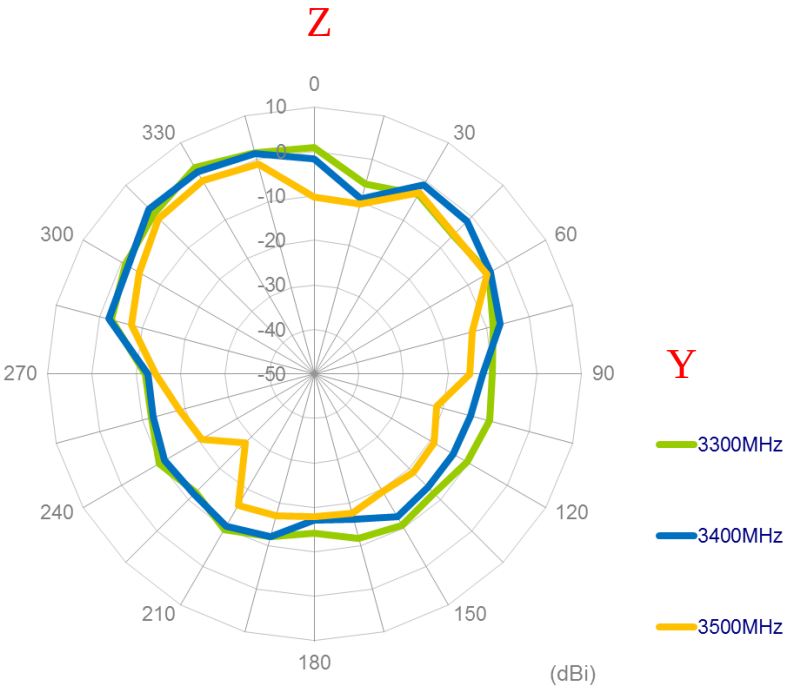

Z
0
10
330
30
0
-10
300
60
-20
-30
-40
270
-50
90
X
240
120
3300MHz
3400MHz
210
150
3500MHz
180
(dBi)

YZ Plane

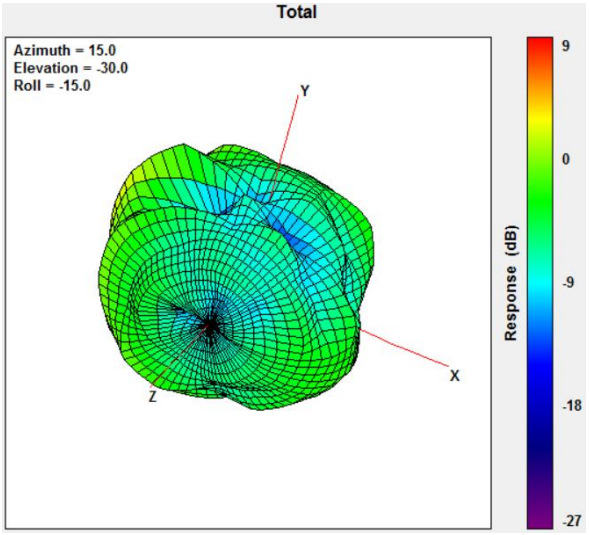

Z
0
30
60
90
120
150
180
210
240
270
300
330
5
-5
-15
-25
-35
-45
Y
704MHz
751MHz
824MHz
960MHz
(dBi)


Z
0
30
60
90
120
150
180
210
240
270
300
330
10
0
-10
-20
-30
-40
Y
1710MHz
1850MHz
1990MHz
2170MHz
(dBi)

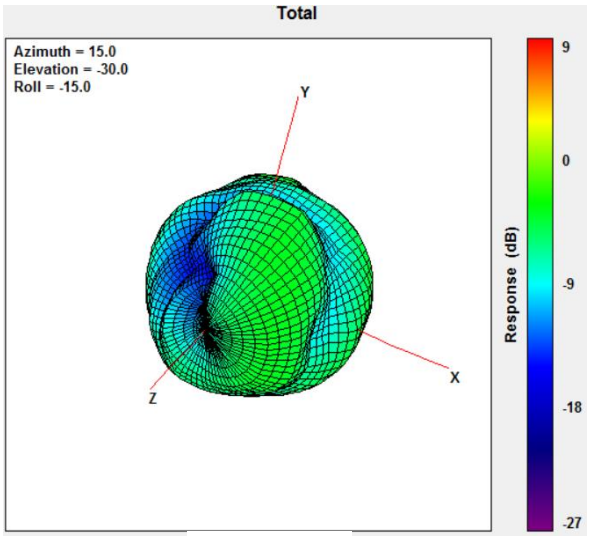

Z
0
10
30
60
90
120
150
180
210
240
270
300
330
0
-10
-20
-30
-40
Y
2500MHz
2690MHz
(dBi)


Z
0
10
30
60
90
120
150
180
210
240
270
300
330
0
-10
-20
-30
-40
-50
Y
3300MHz
3400MHz
3500MHz
(dBi)

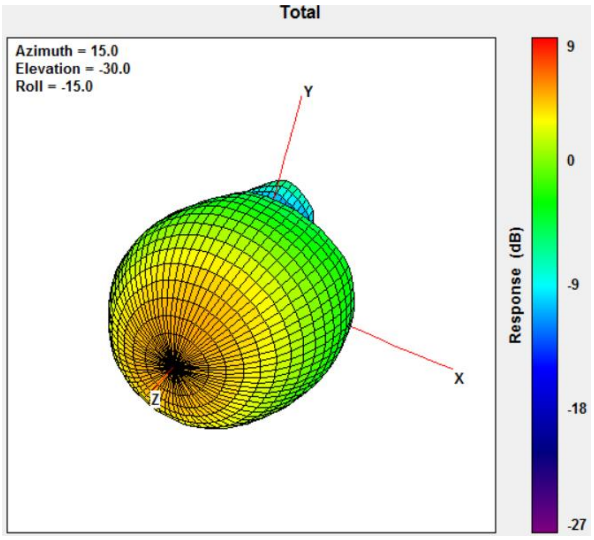
3.2.15 2D Radiation pattern (MIMO2 with 0.3M cable length in free space)



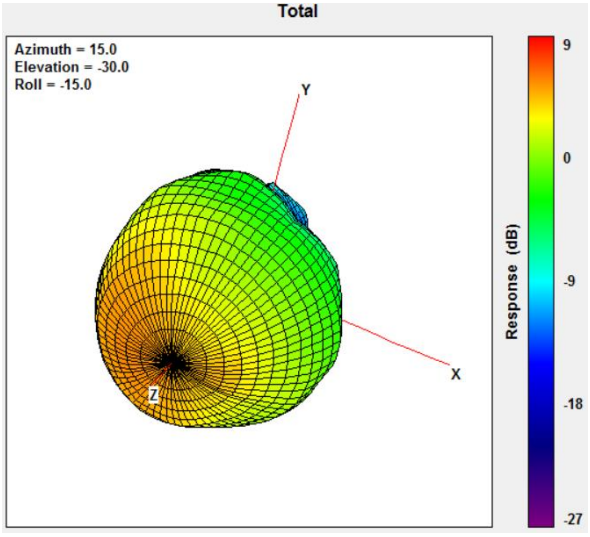
704MHz



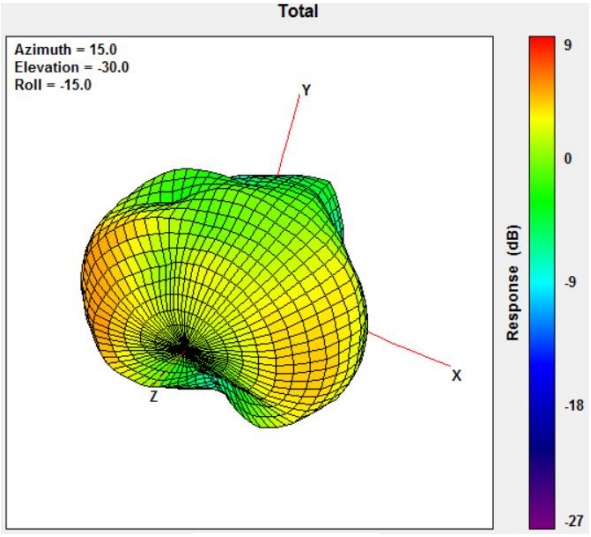
960MHz



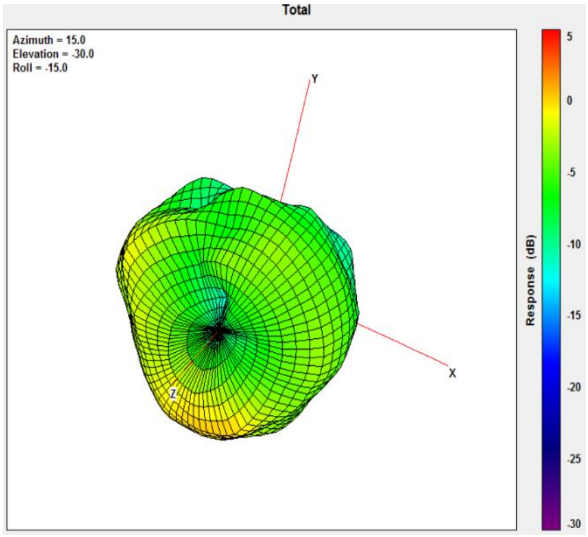
1710MHz



2170MHz

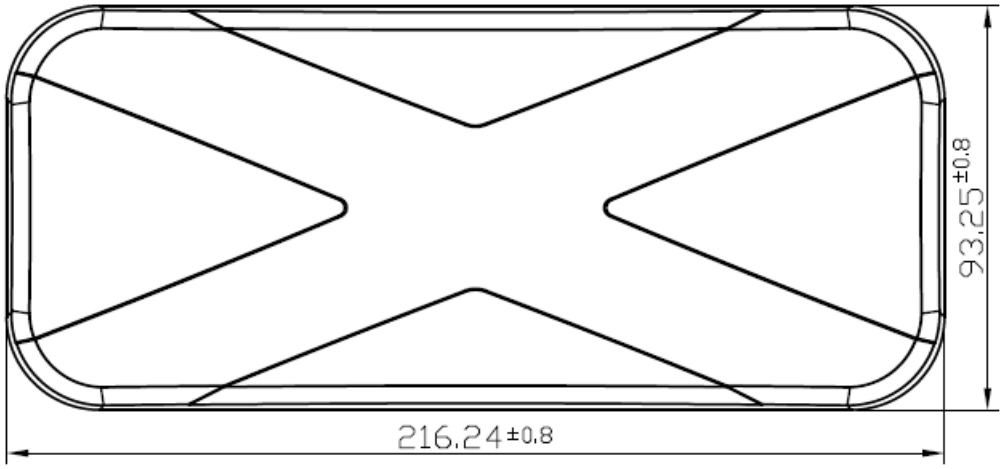


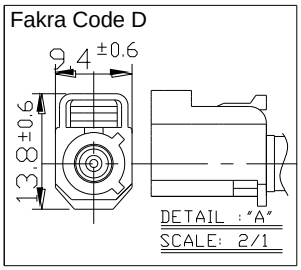
2690MHz

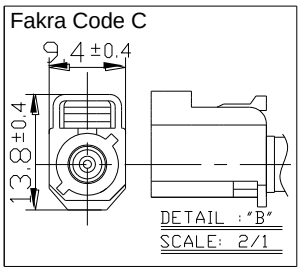


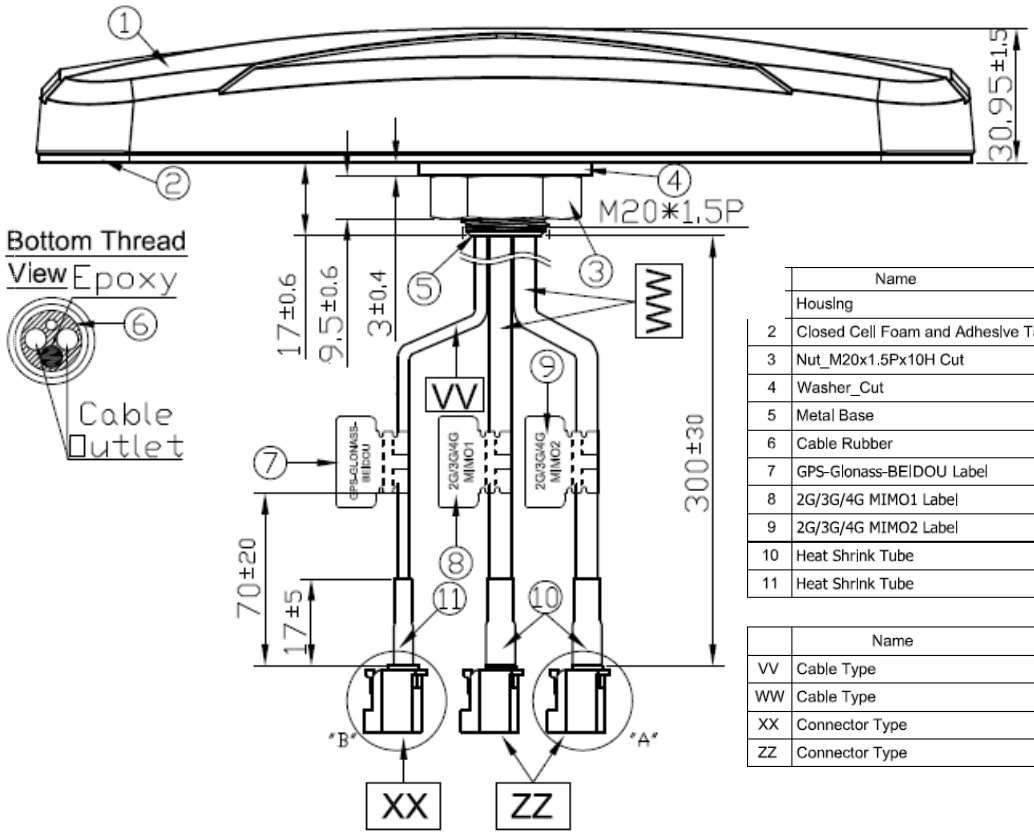
3500MHz

4.Mechanical Drawing(unit mm)





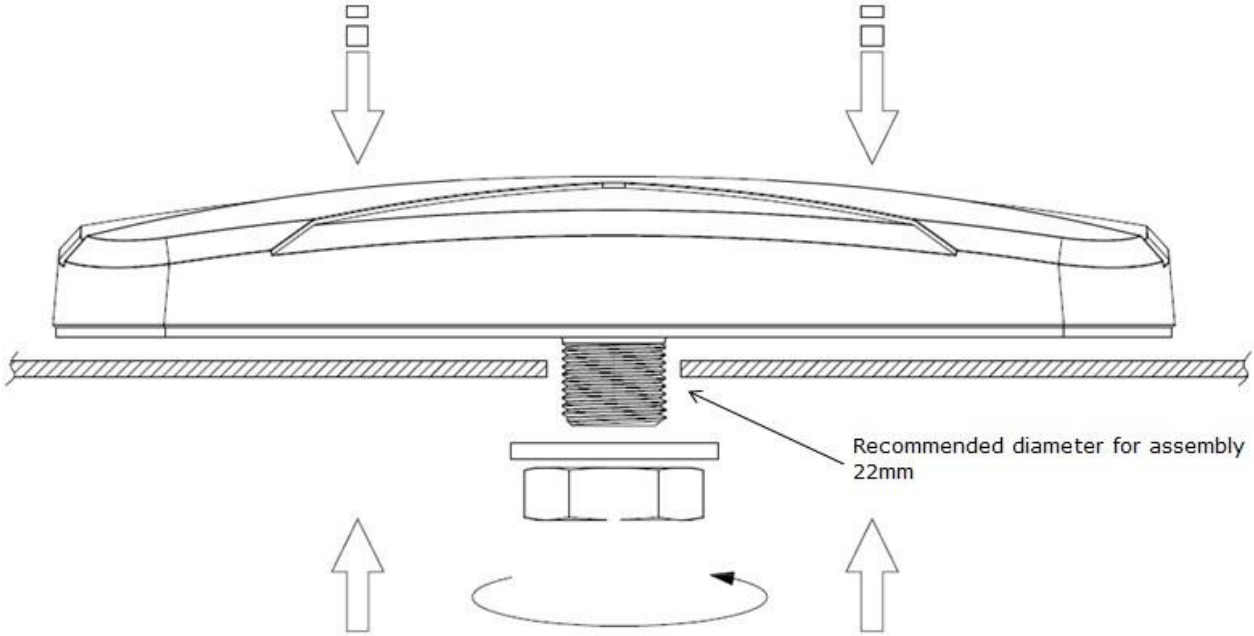




	Name	P/N	Material	Finish	QTY
	Housing	000113K000066A	ABS+PC	Black	1
2	Closed Cell Foam and Adhesive Tape	001013K000039A	3M 9448+CR-4305	Black	1
3	Nut_M20x1.5Px10H Cut	000413E030061A	Steel	Ni Plated	1
4	Washer_Cut	000413E040061A	Steel	Ni Plated	1
5	Metal Base	000313K000060A	AL	Ni Plated	1
6	Cable Rubber	000713E000063A	Silicone Rubber	Black	1
7	GPS-Glonass-BEIDOU Label	001014E030051A	Coated Paper	Orange	1
8	2G/3G/4G MIMO1 Label	001012L080051A	Coated Paper	Gray	1
9	2G/3G/4G MIMO2 Label	001012L090051A	Coated Paper	White	1
10	Heat Shrink Tube	001311F010013A	PE	Black	2
11	Heat Shrink Tube	001311F000013A	PE	Black	1

	Name	P/N	Spec	Finish	QTY
VV	Cable Type	301313A000013A	RG174	Black	1
WW	Cable Type	301412K010013A	CFD200	Black	2
XX	Connector Type	202311G010003A	Fakra Code C	Blue	1
ZZ	Connector Type	202413K010003A	Fakra Code D	Violet	2

5. Installation



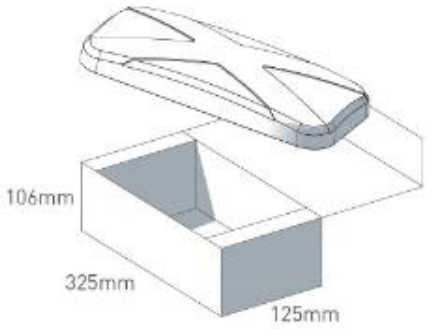
Recommended torque for mounting is 29.4 N.m
Maximum torque for mounting is 39.2 N.m

6.Packaging

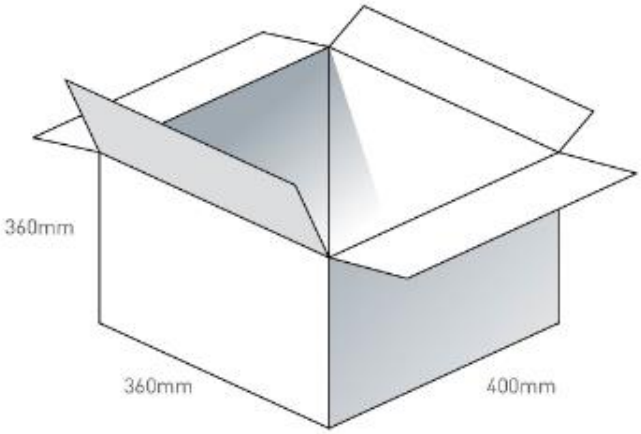
MA411.A.LBI.001

Packaging Specifications

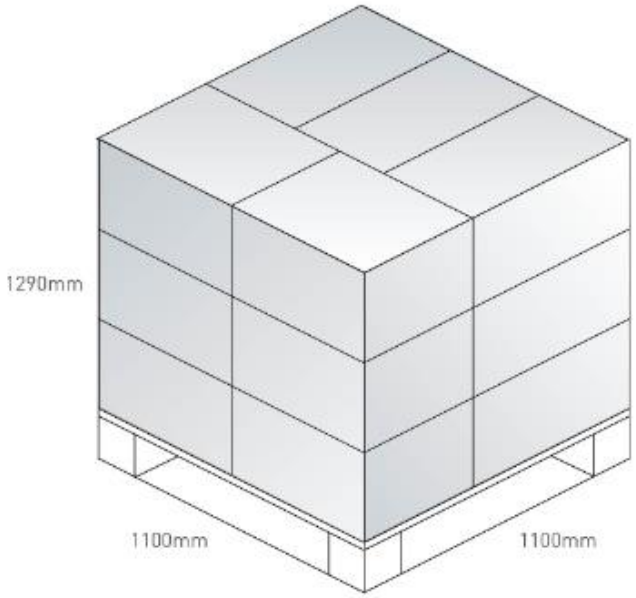
1pc MA411.A.LBI.001 per small box
Box Dimensions - 325x125x106mm
Weight - 645g



9 small boxes in one carton
Carton Dimensions - 360x360x400mm
Weight - 6.57Kg



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

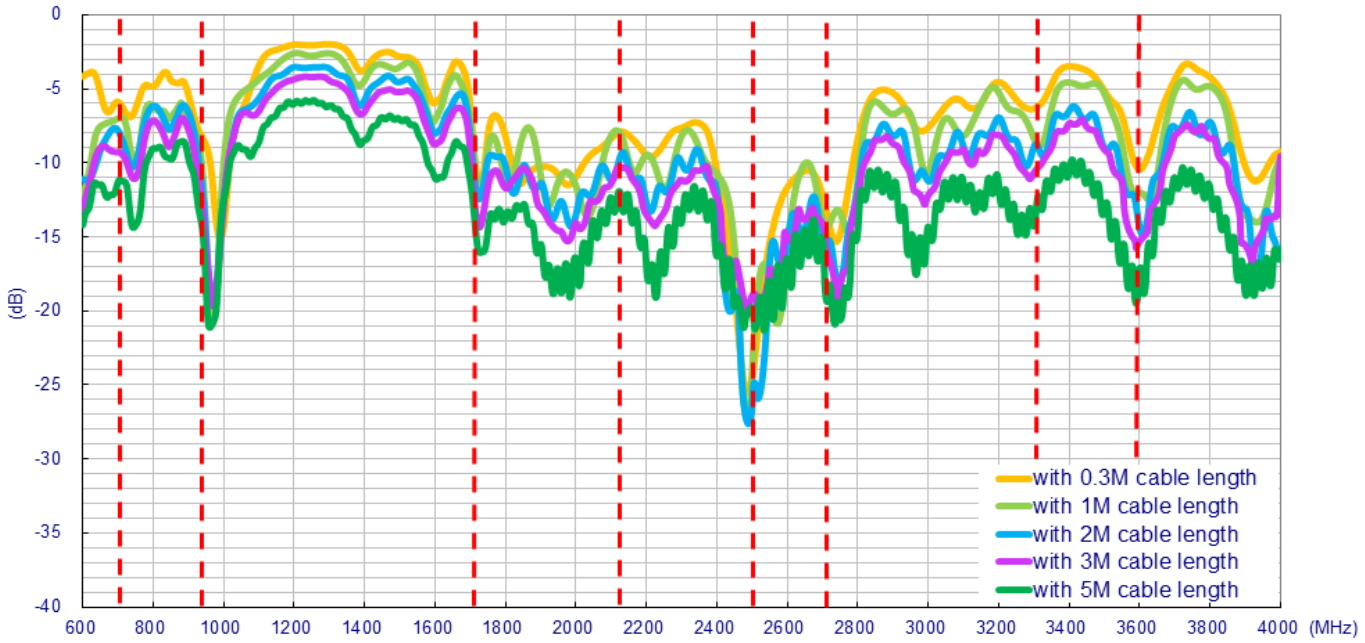


7. Application Note (LTE MIMO Antenna)

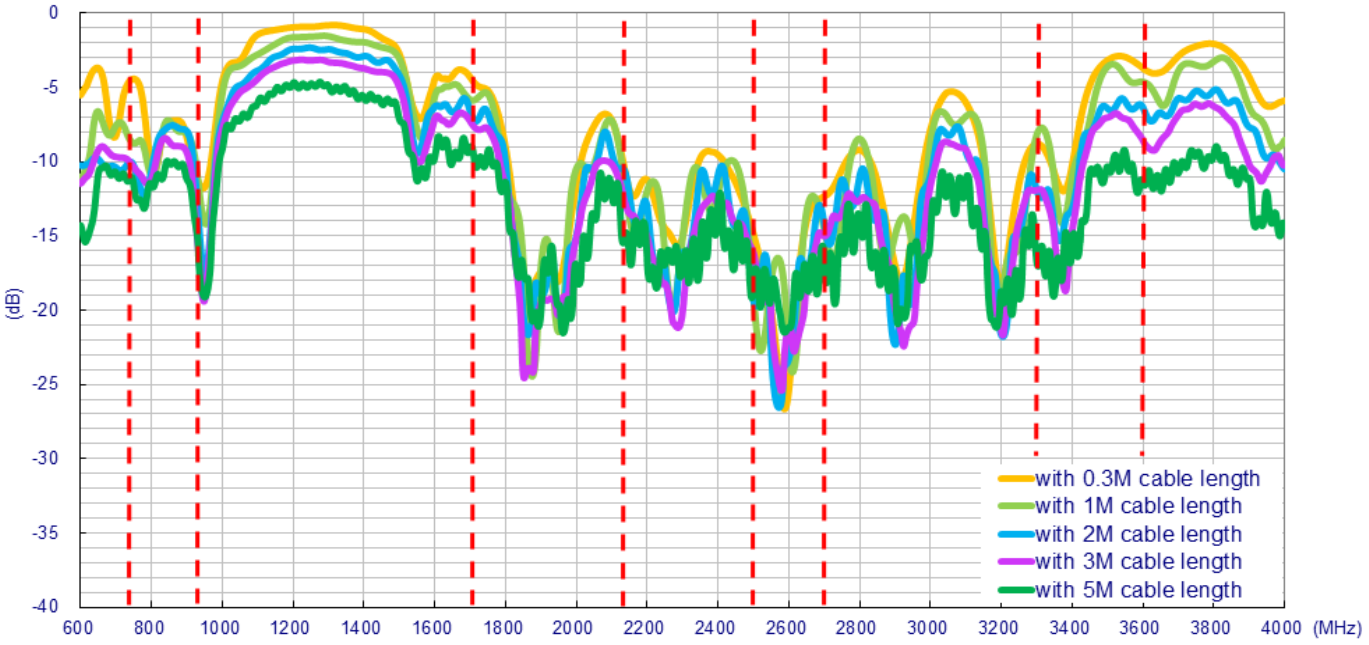
The MA411 antenna performance with different cable lengths and different environments is shown below.

7.1 On the 50*50cm ground plane

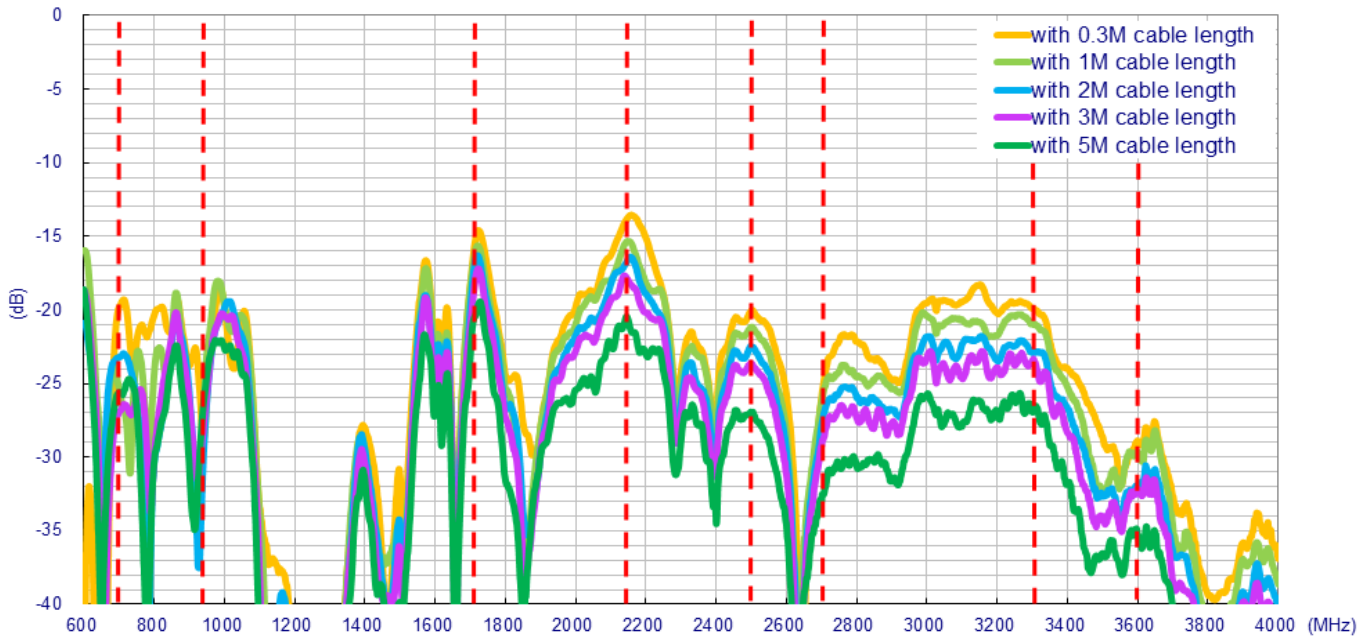
7.1.1 Return Loss (MIMO_1 on the 50*50cm ground plane)



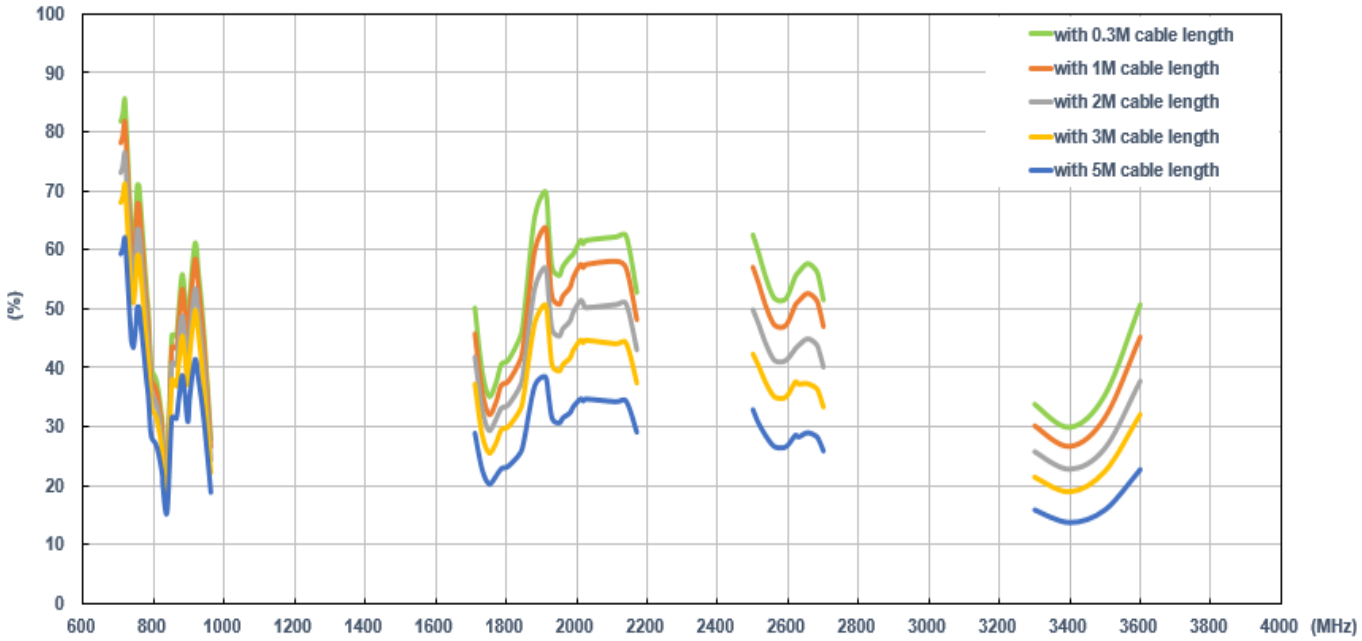
7.1.2 Return Loss (MIMO_2 on the 50*50cm ground plane)



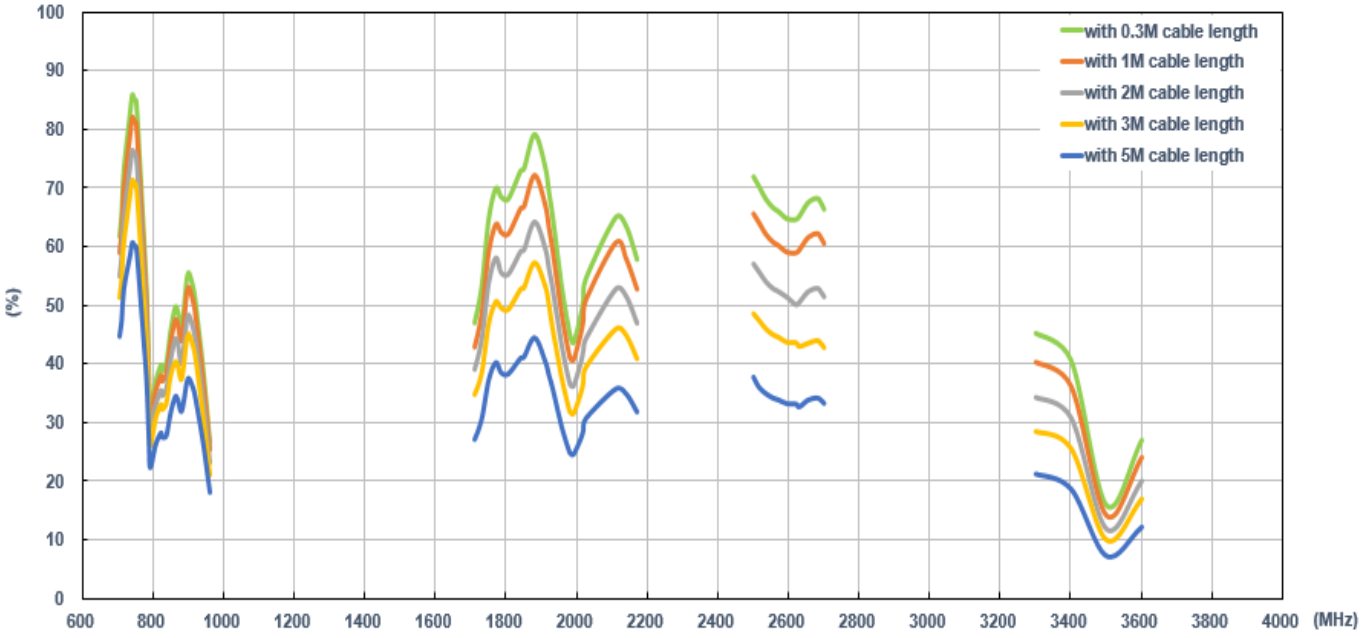
7.1.3 Insertion Loss (on the 50*50cm ground plane)



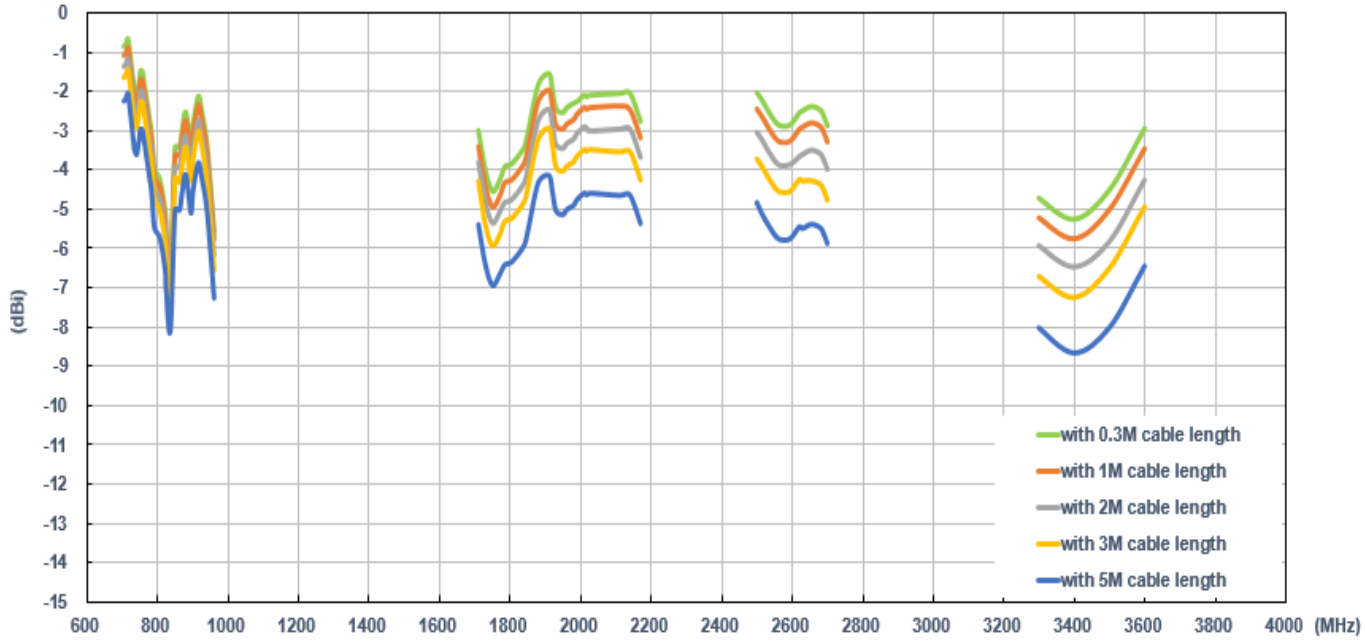
7.1.4 Efficiency (MIMO_1 on the 50*50cm ground plane)



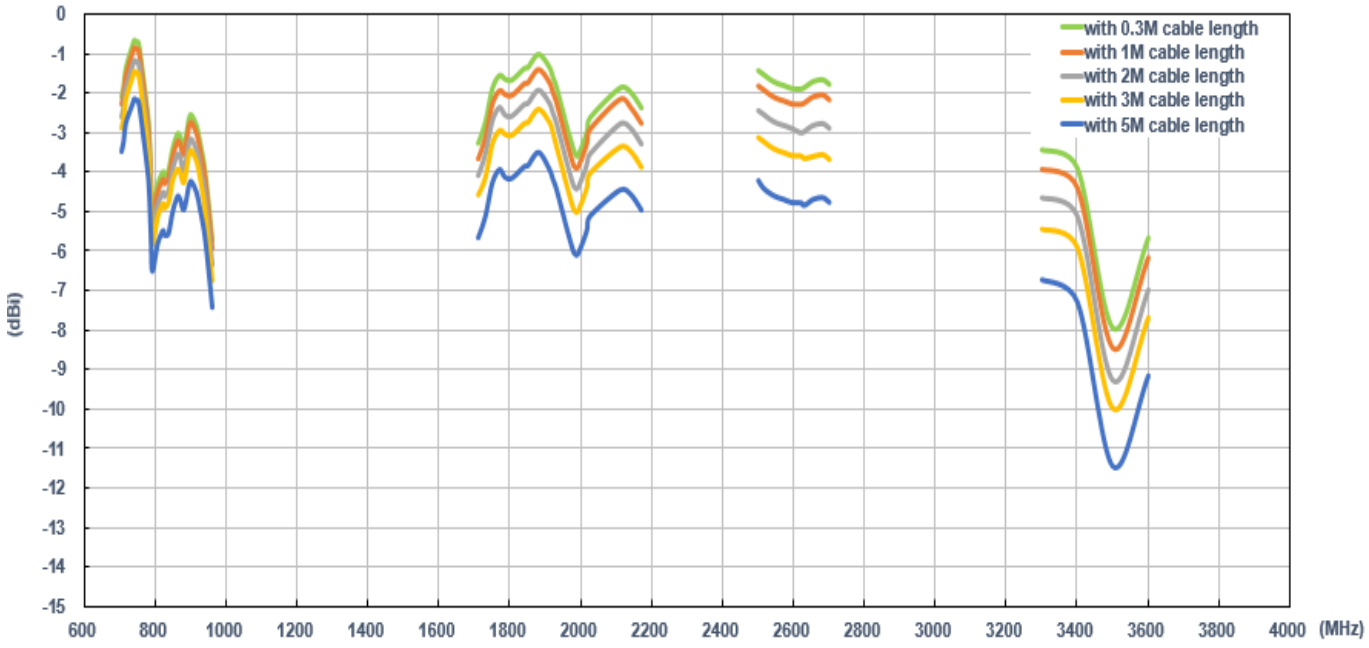
7.1.5 Efficiency (MIMO_2 on the 50*50cm ground plane)



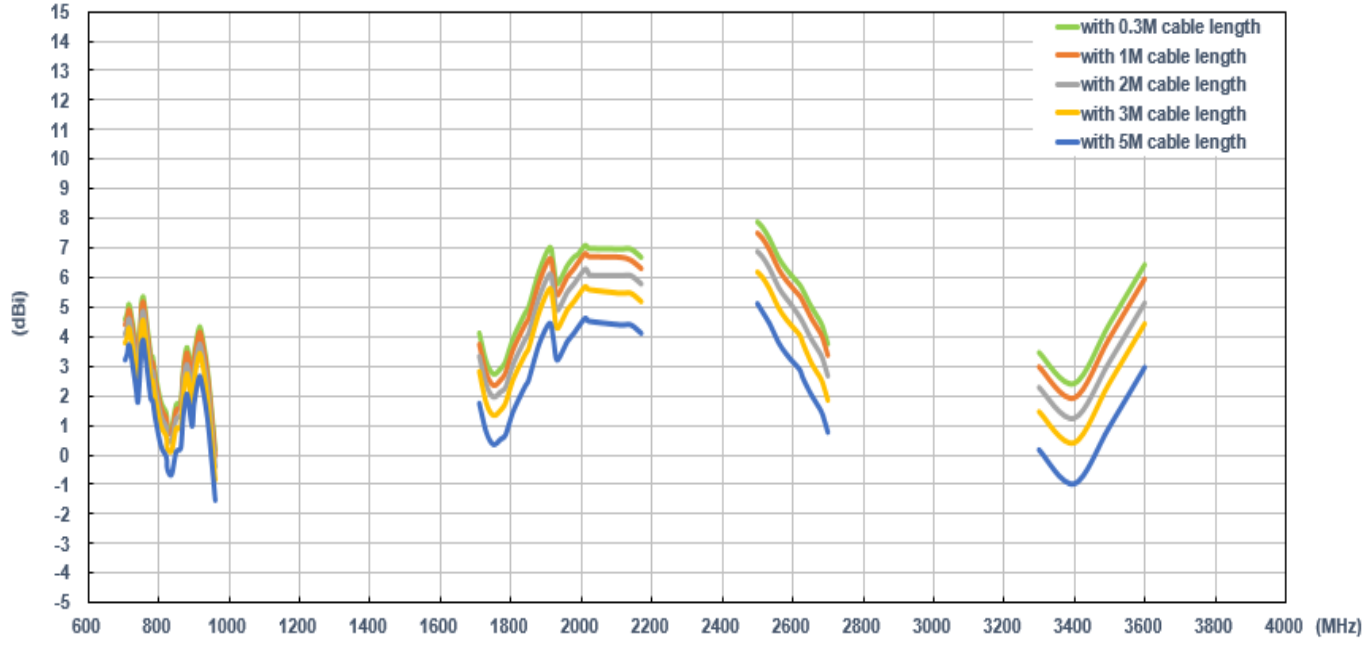
7.1.6 Average Gain (MIMO_1 on the 50*50cm ground plane)



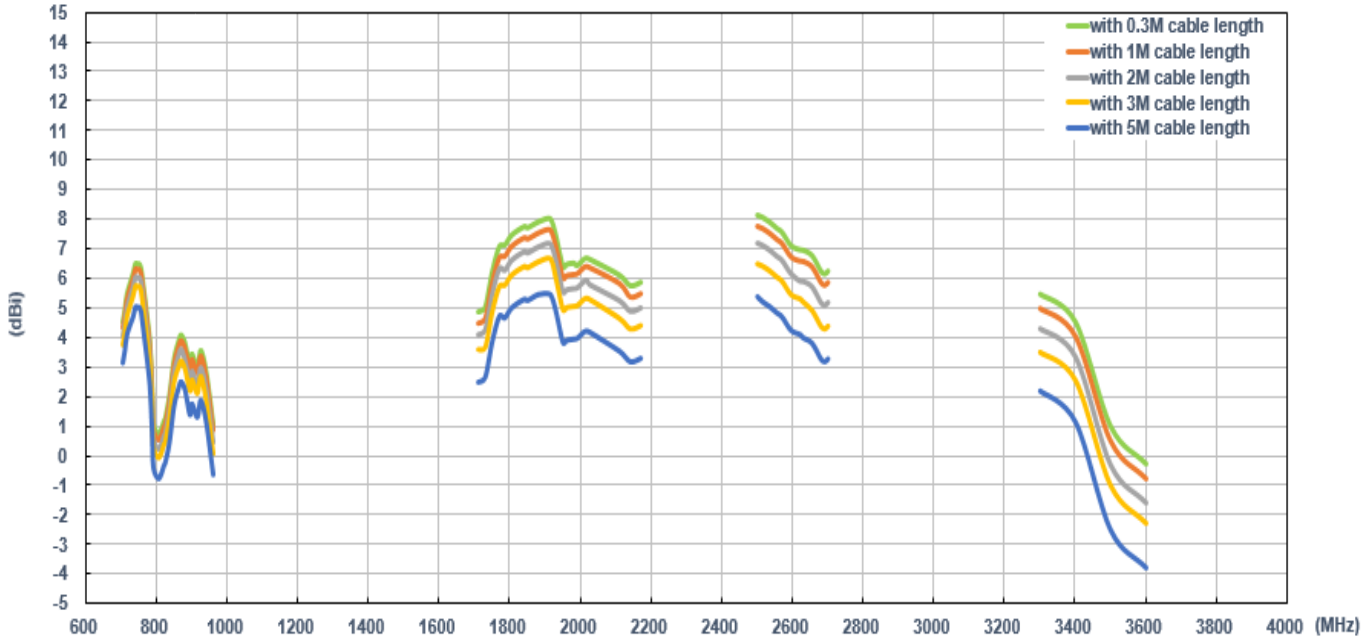
7.1.7 Average Gain (MIMO_2 on the 50*50cm ground plane)



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

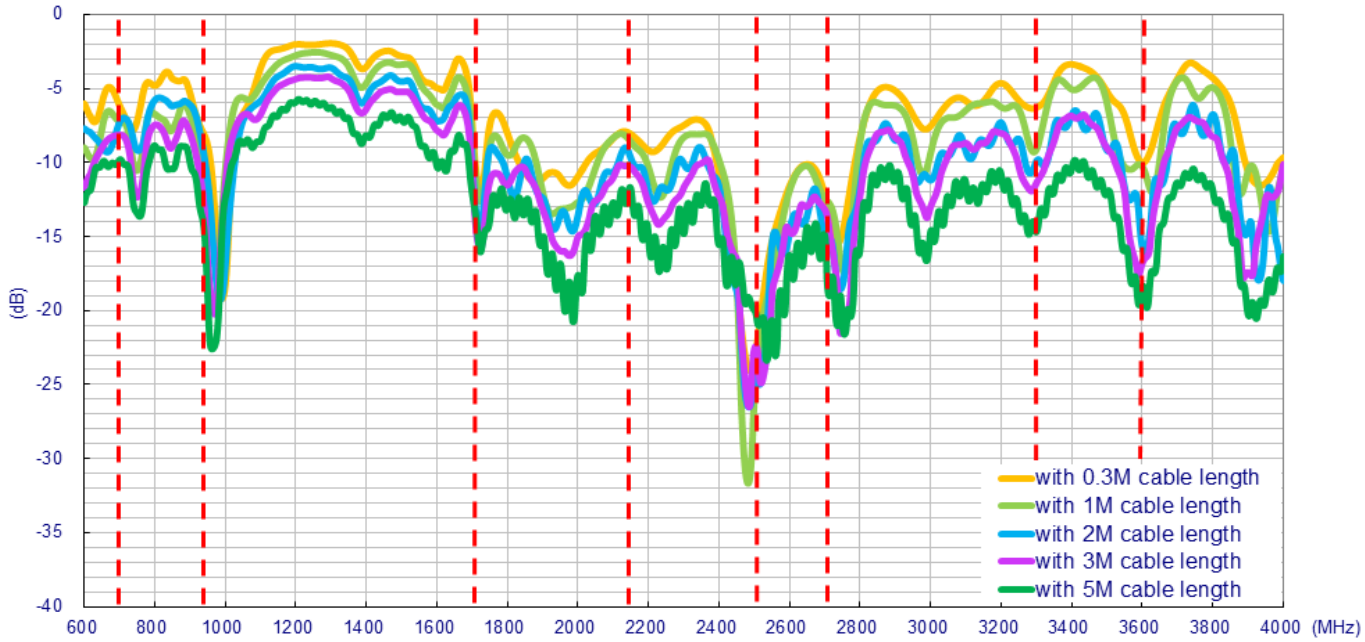


7.1.9 Peak Gain (MIMO_2 on the 50*50cm ground plane)

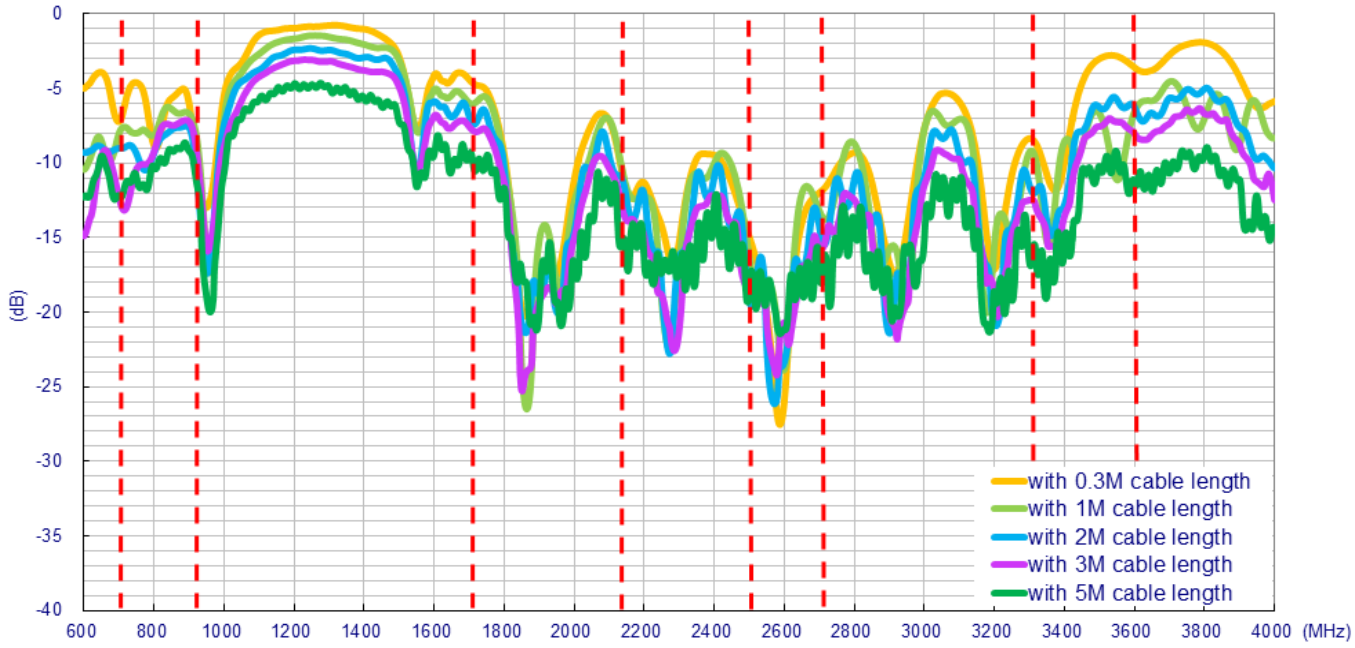


7.2 In free space

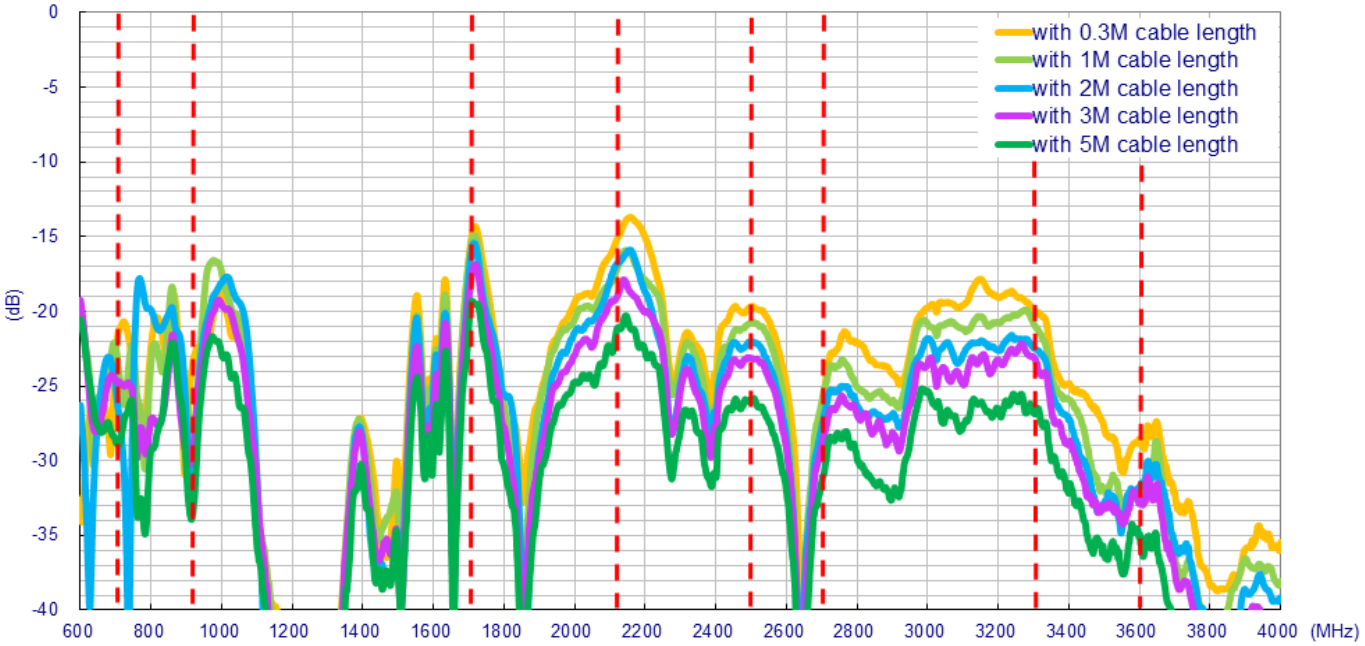
7.2.1 Return Loss (MIMO_1 in free space)



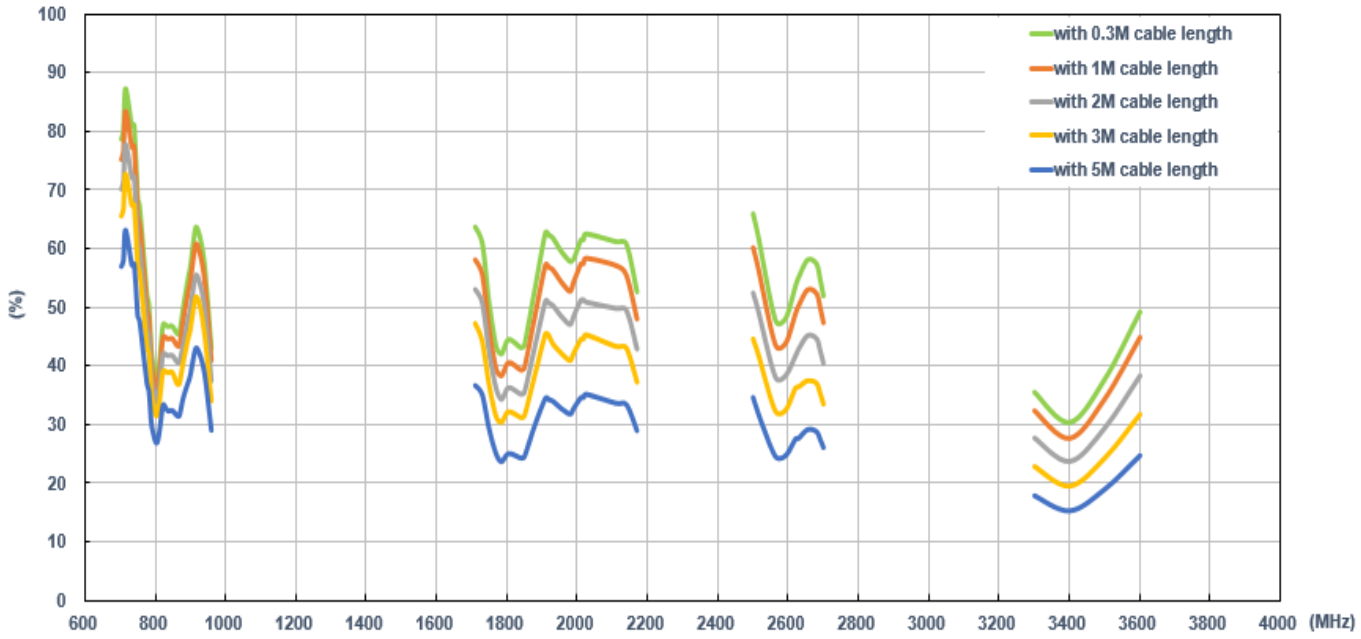
7.2.2 Return Loss (MIMO_2 in free space)



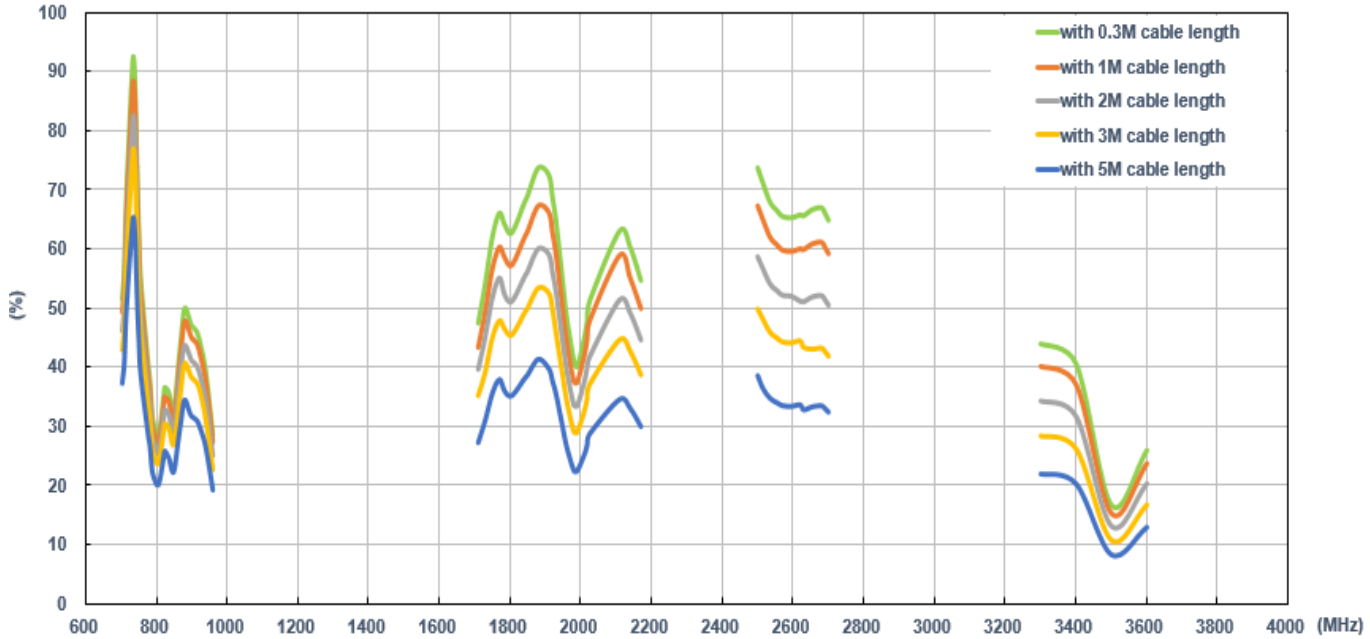
7.2.3 Insertion Loss (in free space)



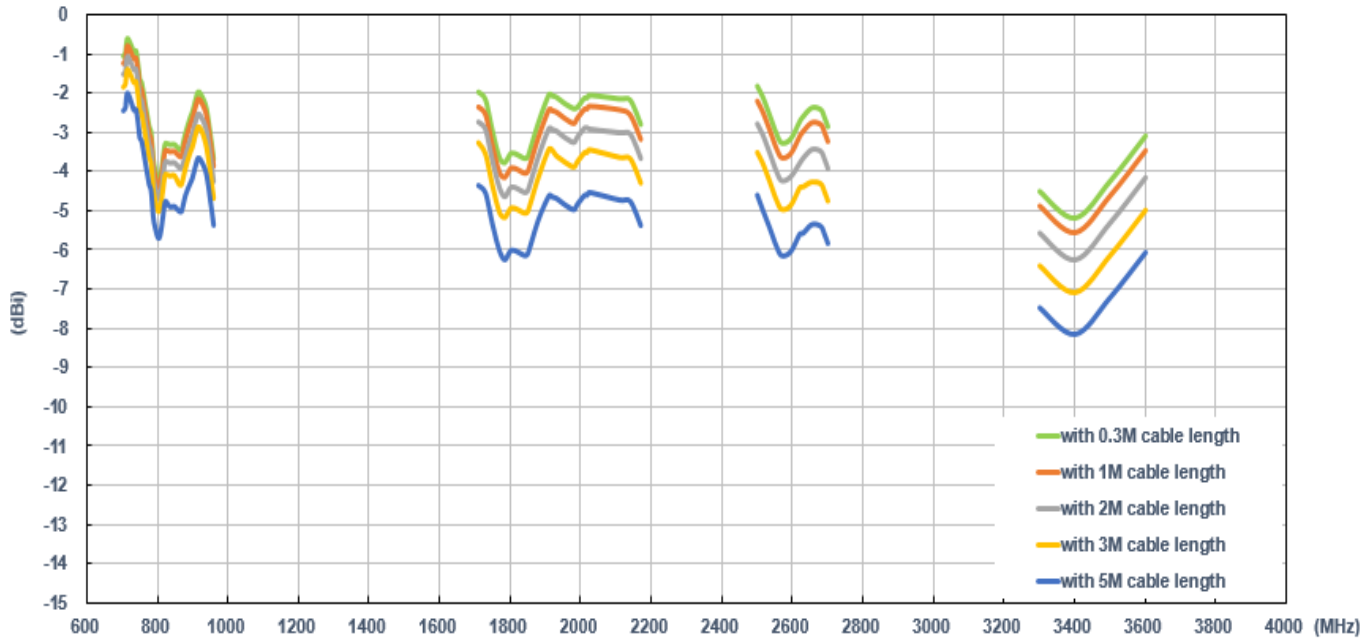
7.2.4 Efficiency (MIMO_1 in free space)



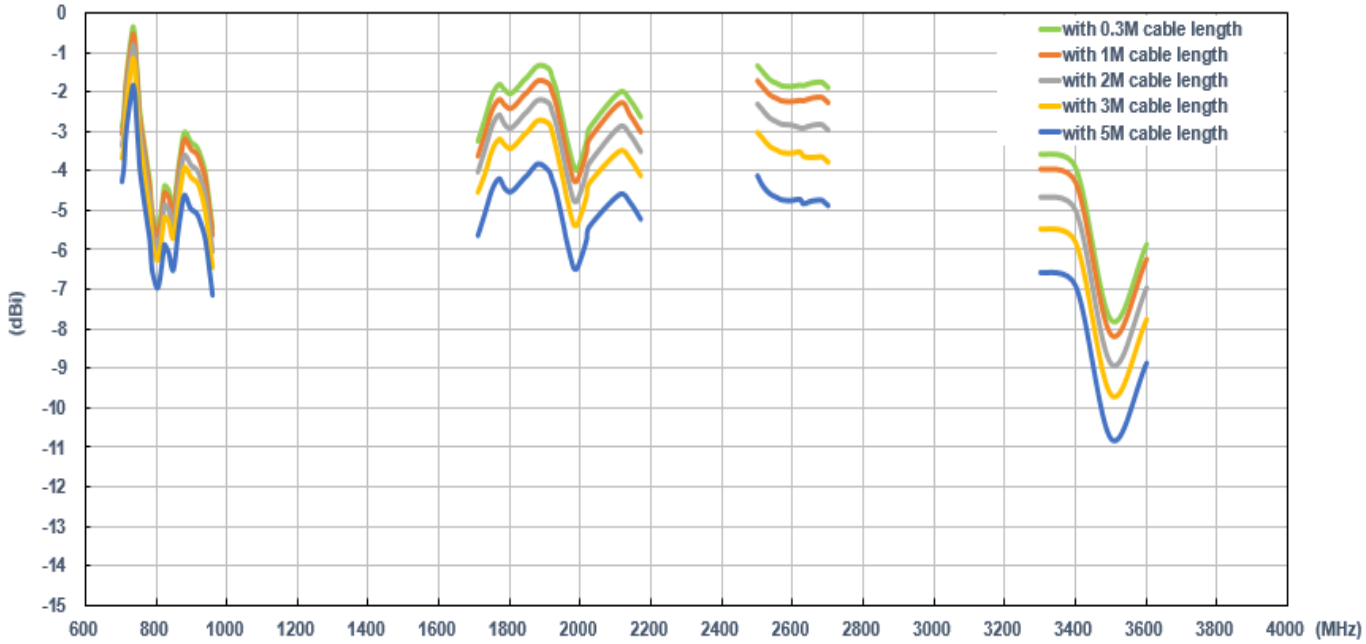
7.2.5 Efficiency (MIMO_2 in free space)



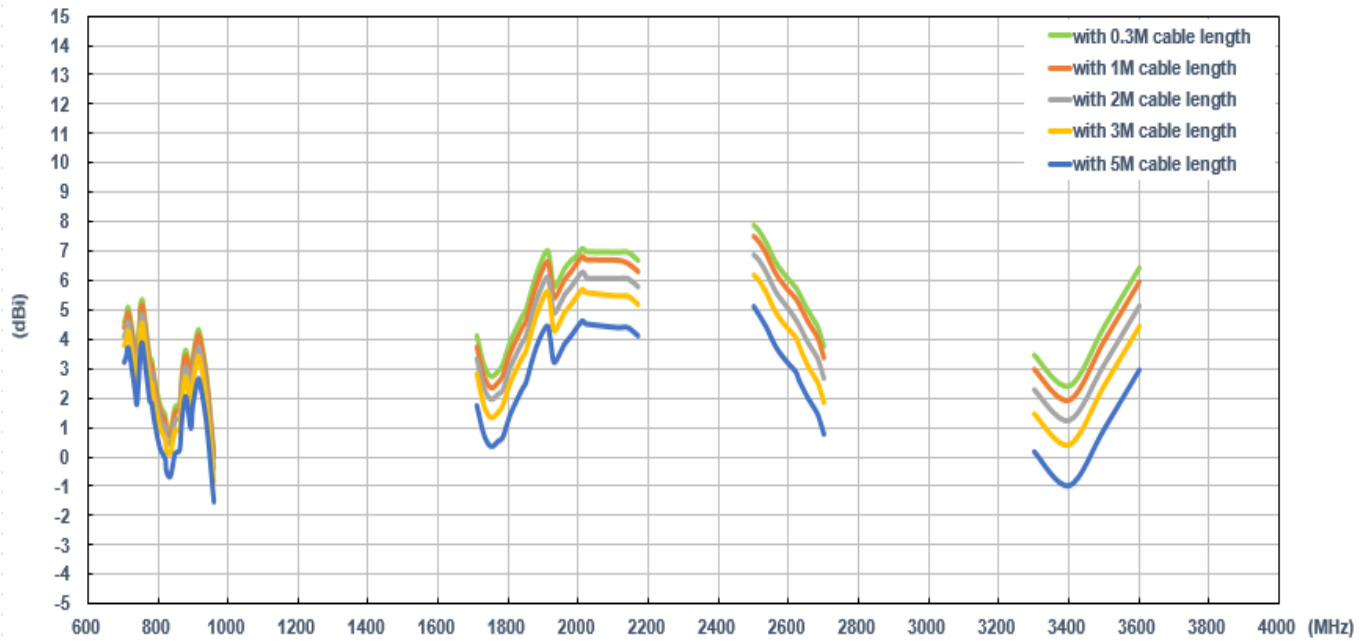
7.2.6 Average Gain (MIMO_1 in free space)



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)