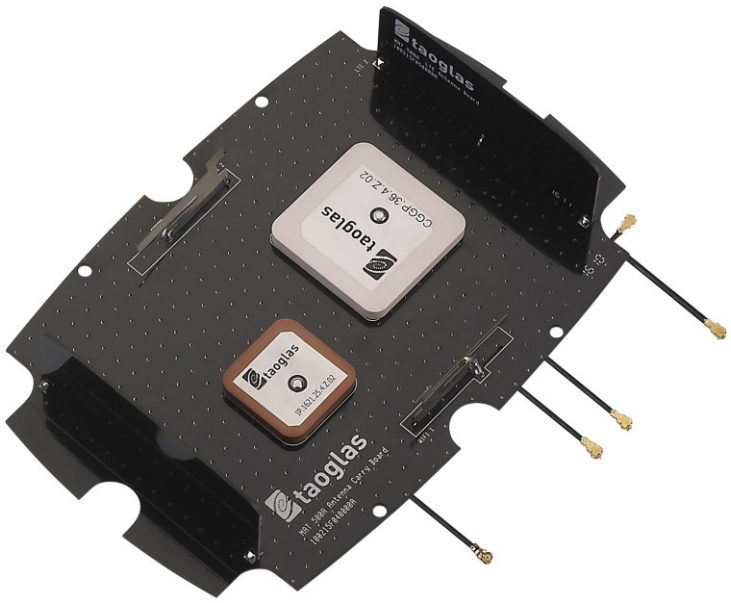
SPECIFICATION

Part No.	:	**MAT.500.A**
Product Name	:	MAT.500 Embedded Antenna Board 6in1 for Telematics Devices LTE MIMO + GPS/GLONASS + Satellite L Band 1621MHz
Features	:	2* LTE MIMO 698-960MHz/1710-2170MHz/ 2490-2690MHz/3300-3600MHz 2* Wi-Fi MIMO 2.4GHz/5.8GHz 1* GPS-GLONASS Antenna 1* Satellite L Band 1621MHz Antenna Worldwide 4G Bands including 3G and 2G Dims: 157.32*103.19*30mm IPEX connectors, 1.37mm cables **RoHS Compliant**



1. Introduction

The MAT.500.A embedded antenna board combines LTE MIMO antennas, Wi-Fi MIMO antennas, plus GPS/GLONASS and Iridium® 1621MHz antennas. It can be used as a reference design or actual embedded antenna for telematics devices in applications such as fleet management, asset tracking, and security/surveillance.

The board comes with six IPEX connectors and 1.37mm coax cables for LTE, Wi-Fi, GPS/GLONASS and Iridium 1621MHz.

Typical applications:
- High speed data links with a need for satellite communication as fallback
- Automotive and Heavy Equipment Vehicle Tracking and Telematics
- Remote Asset and Pipeline Monitoring
- HD Video over LTE
- First Responder and Emergency Services
- Global data communications/IoT

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 GPS-GLONASS passive antenna receives efficiently on all two bands, leading to higher location accuracy and stability of tracking in urban environments.

The unique omnidirectional Wi-Fi antennas provide high efficiency and high isolation between antenna elements in a heavy-duty low profile compact structure, delivering powerful MIMO antenna technology for Wi-Fi 802.11n and emerging 802.11ac.

Finally, a low axial ratio 1621MHz Antenna is also embedded, providing connectivity for the Iridium satellite system, enabling global coverage, and back-up in case of cellular network failure. Cable length and connector types are customizable. Contact your regional Taoglas sales office for support.

2. Specification (in Reference Housing)

GPS-GLONASS	
Center Frequency	GPS:1575.42±1.023 MHz GLONASS:1602±5 MHz
Passive Antenna Efficiency	GPS: 75% GLONASS: 68%
Average gain	GPS: -1.2dBi GLONASS: -1.6dBi
Peak gain	GPS: 5.47dBi GLONASS: 4.9dBi
VSWR	2:1 Max
Impedance	50Ω
Axial Ratio	GPS:< 5.1 GLONASS:< 6.3
Polarization	RHCP
Cable	Ø1.37 Micro Coax. 68mm standard, fully customizable
Connector	IPEX standard, fully customizable

Satellite L-Band 1621MHz	
Center Frequency	Satellite L-Band:1621±5 MHz
Passive Antenna Efficiency	70%
Average gain	-1.52dBi
Peak gain	5.11dBi
VSWR	2:1 Max
Impedance	50Ω
Axial Ratio	<7.3
Polarization	RHCP
Cable	Ø1.37 Micro Coax. 83mm standard, fully customizable
Connector	IPEX standard, fully customizable

4G/3G/2G LTE Antenna							
Frequency (MHz)	LTE700	GSM850	GSM900	DCS	PCS	UMTS1	LTE2600
	698~803	824~894	880~960	1710~1880	1850~1990	1920~2170	2490~2690
Efficiency (%)							
MIMO_1	44.65	50.40	28.06	68.20	67.23	56.83	33.30
MIMO_2	40.43	35.92	25.54	66.06	60.22	56.20	29.30
Average Gain(dBi)							
MIMO_1	-3.58	-3.04	-5.70	-1.67	-1.74	-2.55	-4.78
MIMO_2	-4.00	-4.60	-5.93	-1.83	-2.21	-2.51	-5.34
Peak Gain(dBi)							
MIMO_1	0.28	1.70	1.70	6.79	7.06	6.81	1.35
MIMO_2	0.55	1.07	-1.42	5.23	5.23	4.64	1.38
Envelope Correlation Coefficient (ECC)			< 0.33				
Impedance			50Ω				
Polarization			Linear				
VSWR			< 4				
Cable			Ø1.37 78mm/MIMO_1,133mm/MIMO_2 standard, fully customizable				
Connector			I-PEX standard , fully customizable				

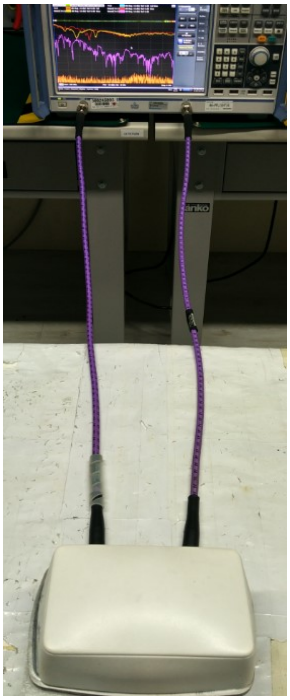
2.4GHz/5.8GHz Wi-Fi Antenna		
Frequency (MHz)	2400~2500	4900~5850
Efficiency (%)		
MIMO_1	50.51	61.87
MIMO_2	65.72	60.18
Average Gain(dBi)		
MIMO_1	-2.97	-2.10
MIMO_2	-1.84	-2.22
Peak Gain(dBi)		
MIMO_1	5.14	4.77
MIMO_2	5.82	4.96
Impedance	50Ω	
Polarization	Linear	
VSWR	< 2.2	
Cable	Ø1.37 Micro Coax. 68mm for MIMO_1, 118mm for MIMO_2 standard, fully customizable	
Connector	I-PEX standard , fully customizable	

MECHANICAL	
Antenna Dimensions	157.32*103.19*30mm
Weight	66g
ENVIRONMENTAL	
Operation Temperature	-40°C to 85°C
Storage Temperature	-40°C to 90°C
Humidity	Non-condensing 65°C 95% RH

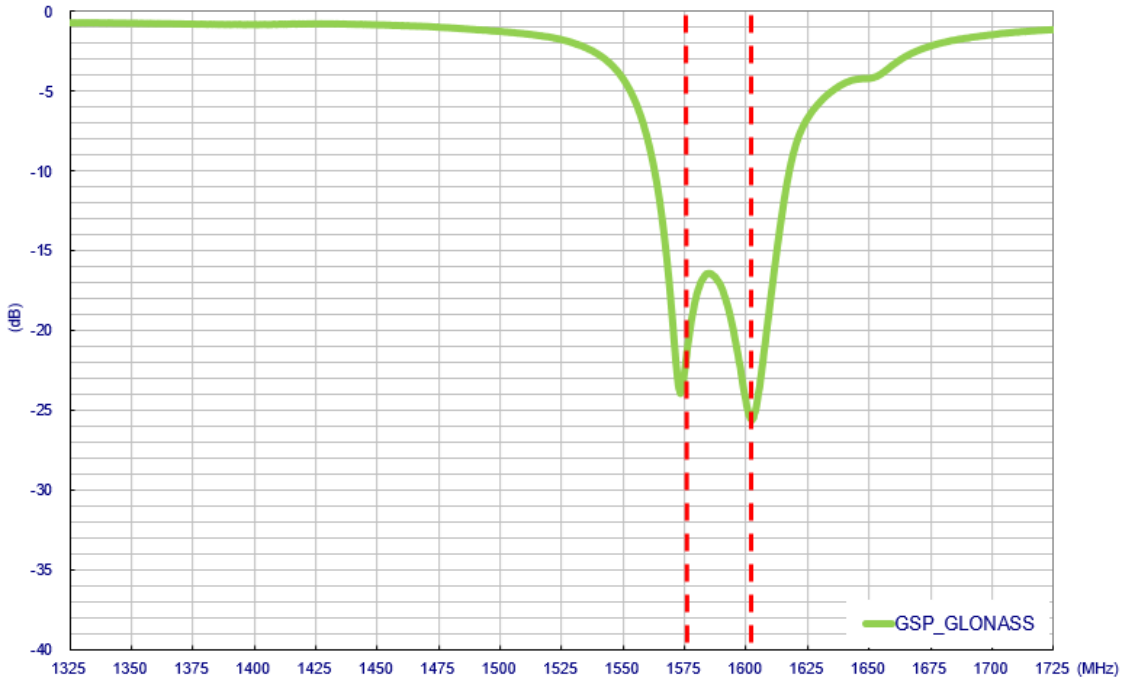
3. Antenna Characteristics (In Reference Housing)

3.1 GPS-GLONASS Antenna

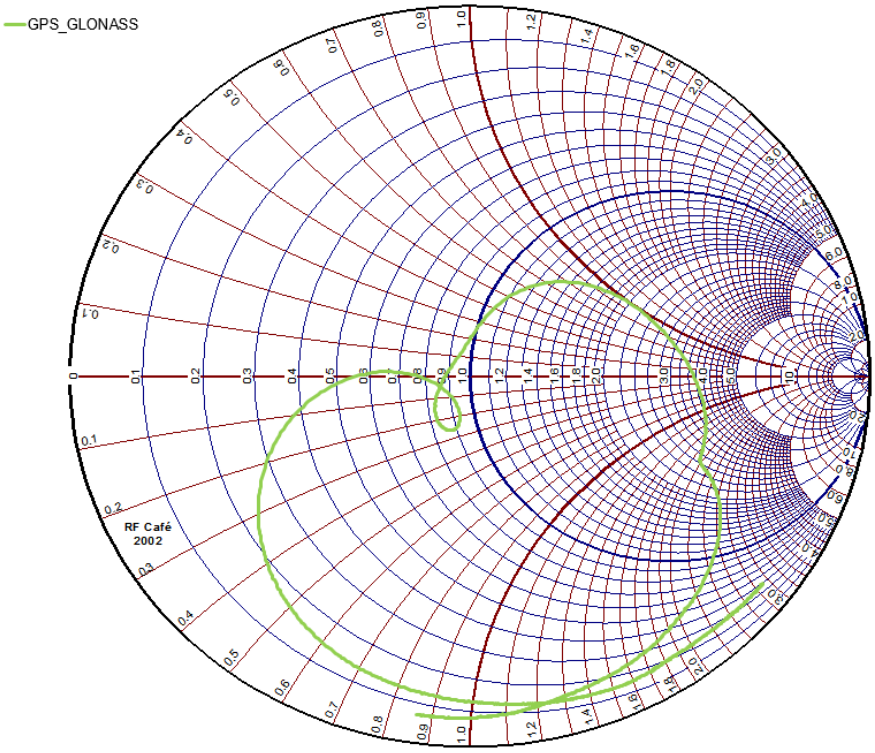
3.1.1 Test Setup



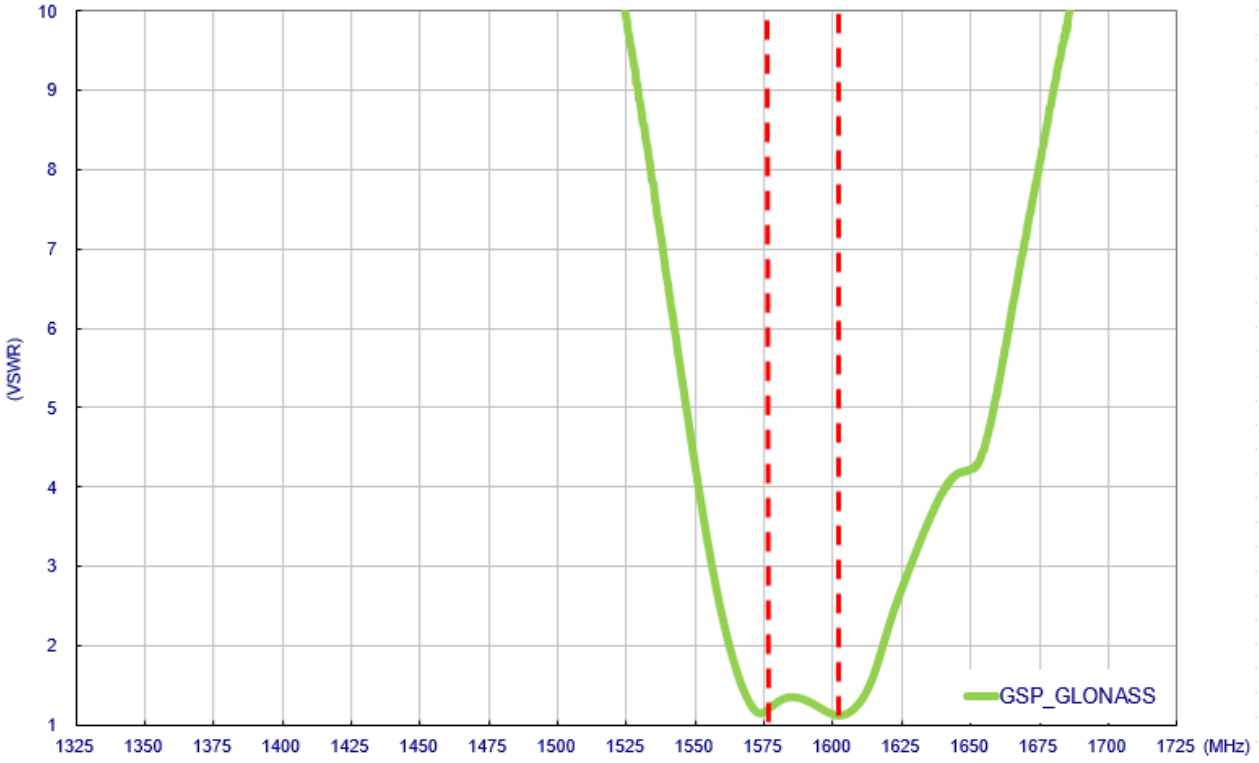
3.1.2 GPS-GLONASS Return Loss



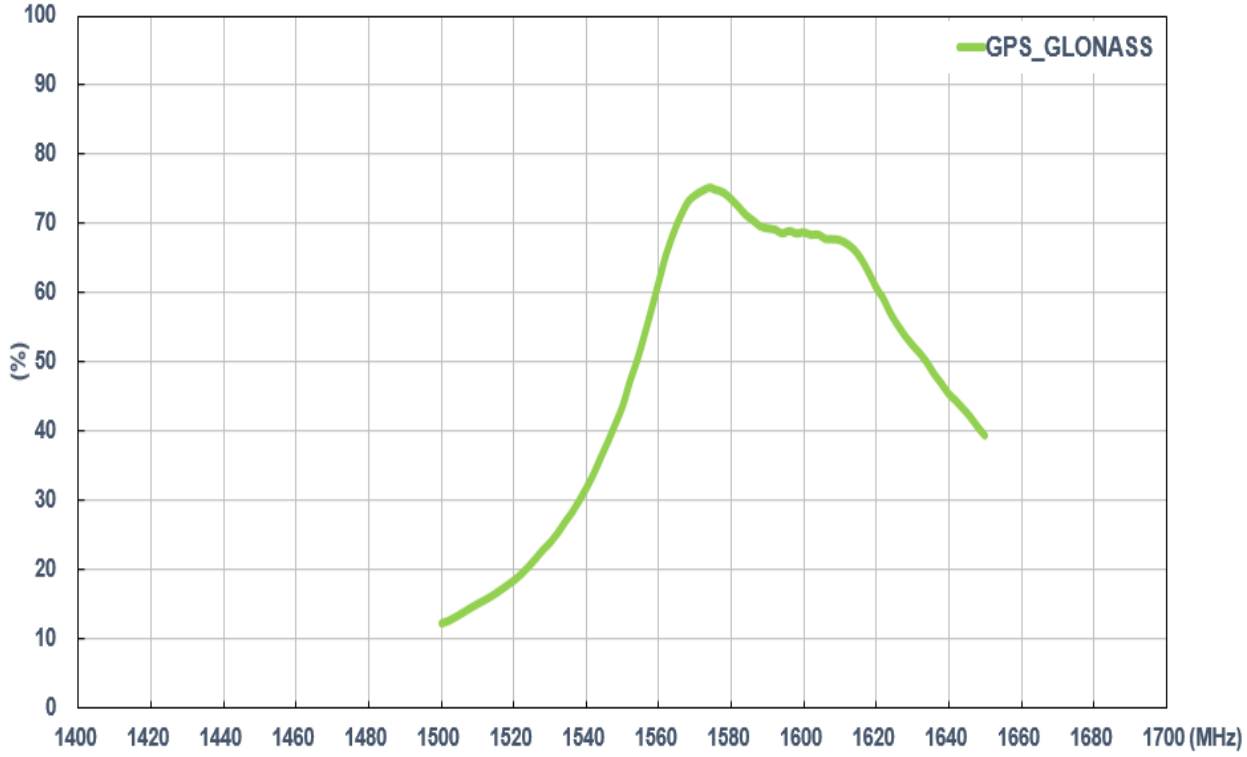
3.1.3 GPS-GLONASS Smith Chart



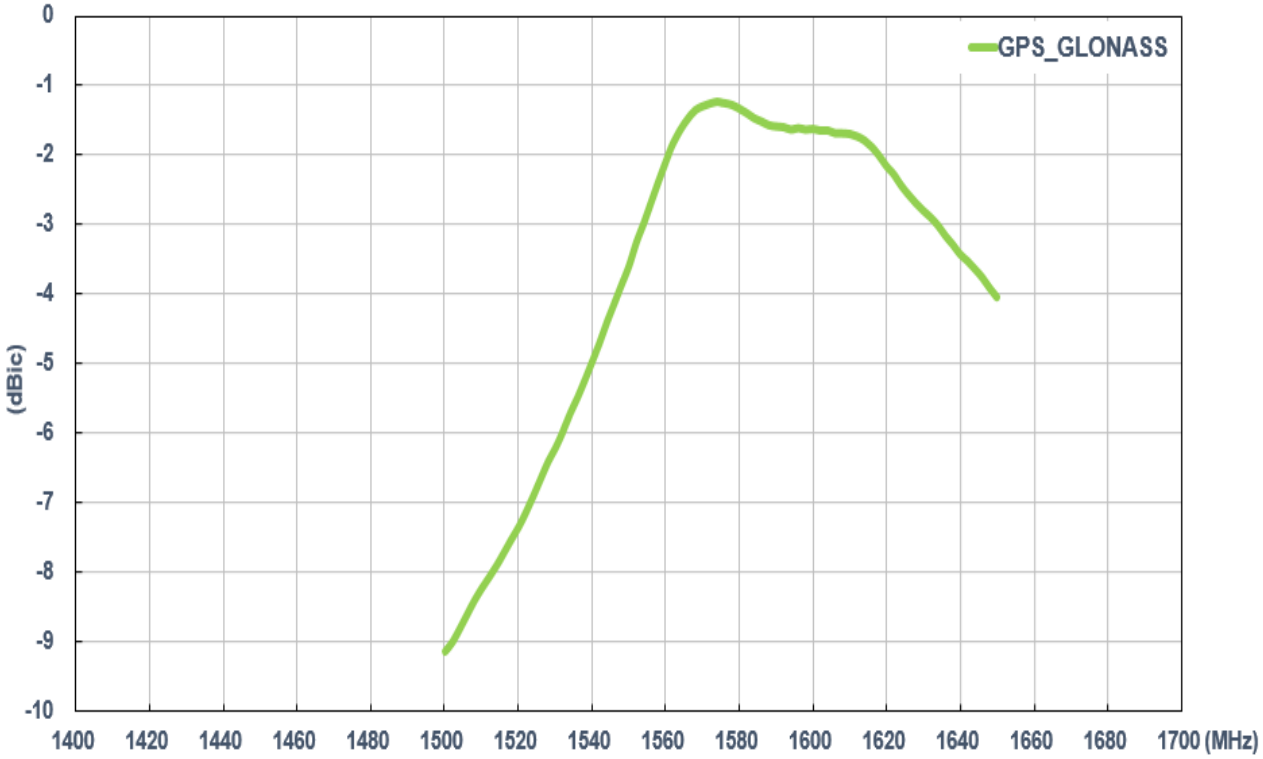
3.1.4 GPS-GLONASS VSWR



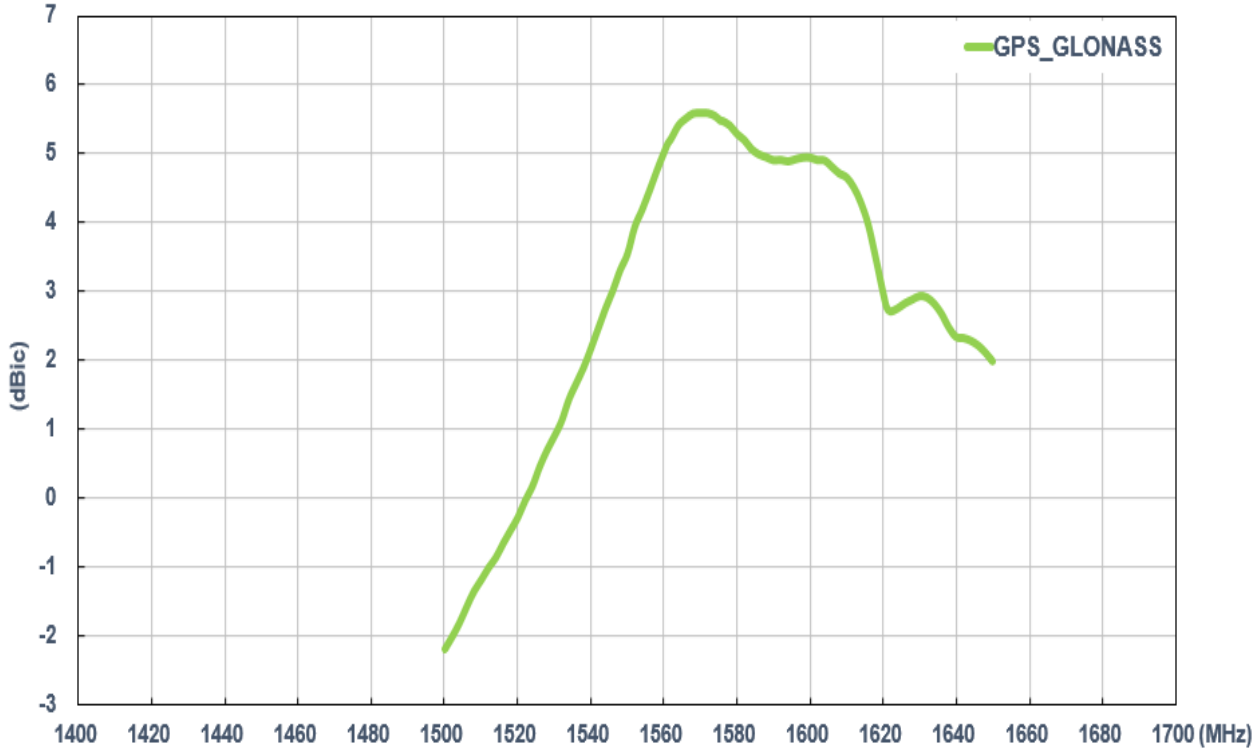
3.1.5 GPS-GLONASS Efficiency



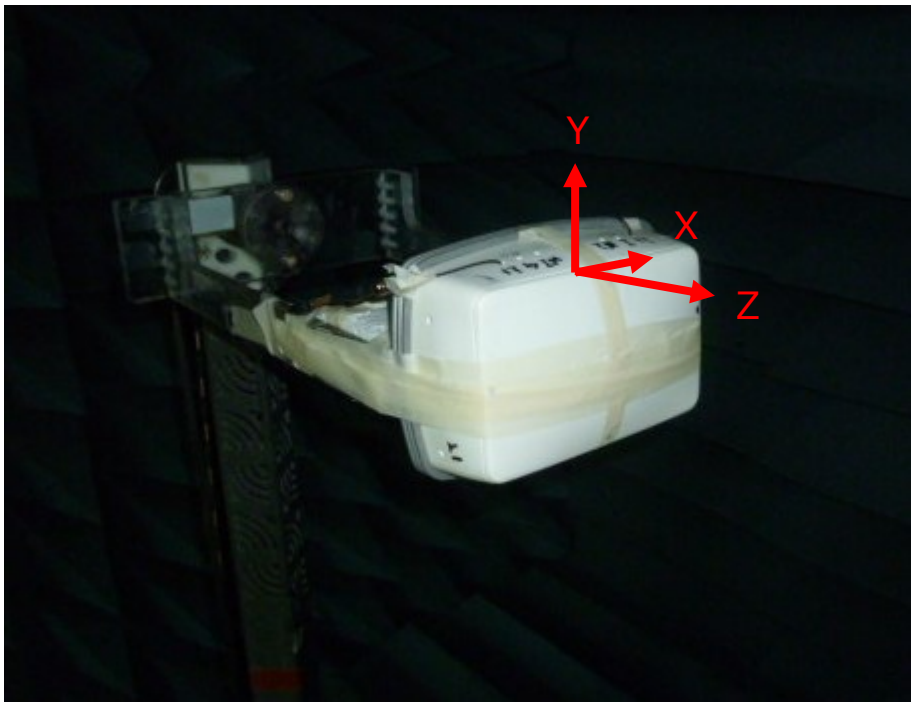
3.1.6 GPS-GLONASS Average gain



3.1.7 GPS-GLONASS Peak gain



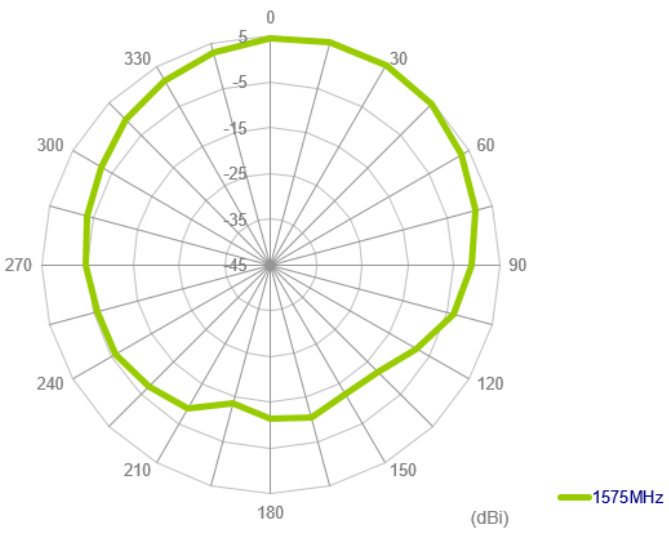
3.1.8 Test Setup For Antenna Radiation Pattern



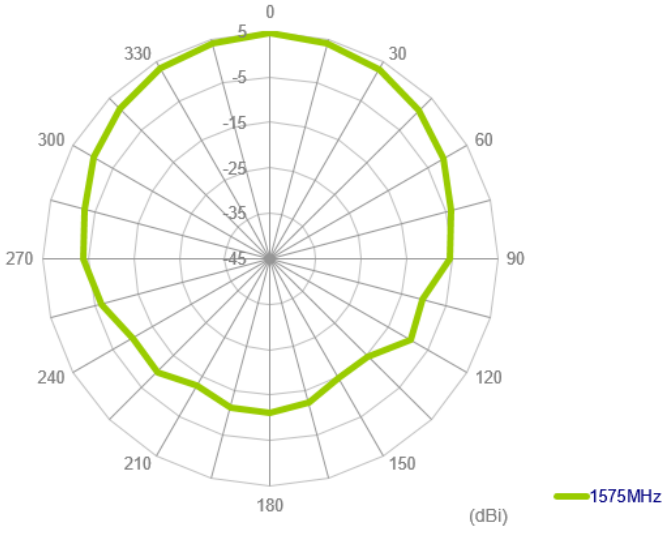
In free space

3.1.9 GPS-GLONASS 2D Radiation Pattern

2D Radiation Pattern @ 1575.42MHz



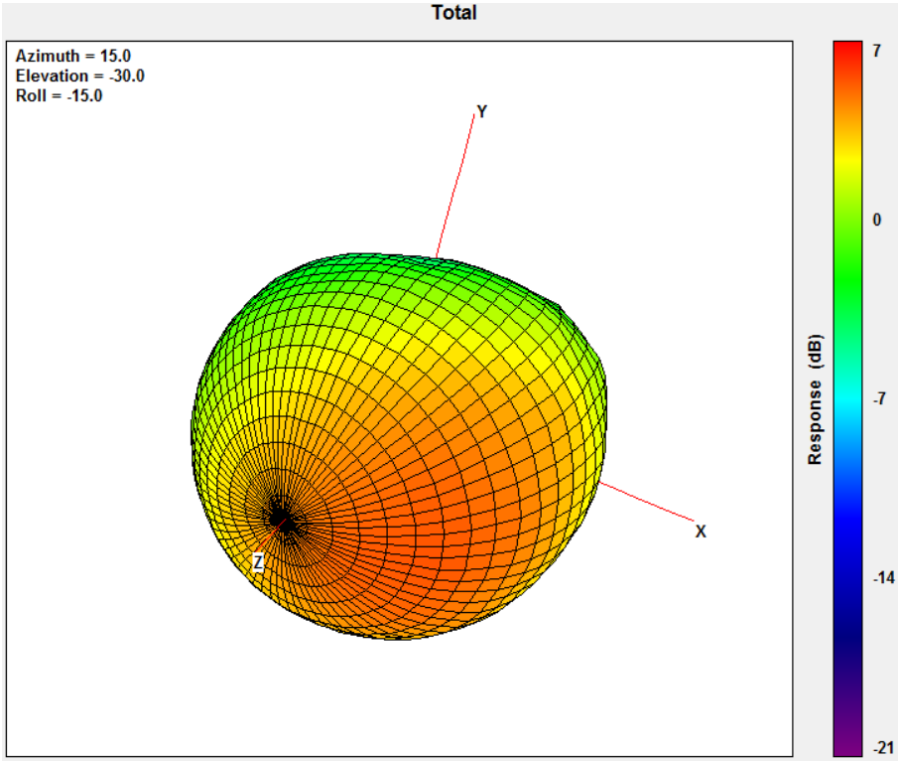
XZ Plane (phi=0◦, Theta=0~360◦)



YZ Plane (phi=90◦, Theta=0~360◦)

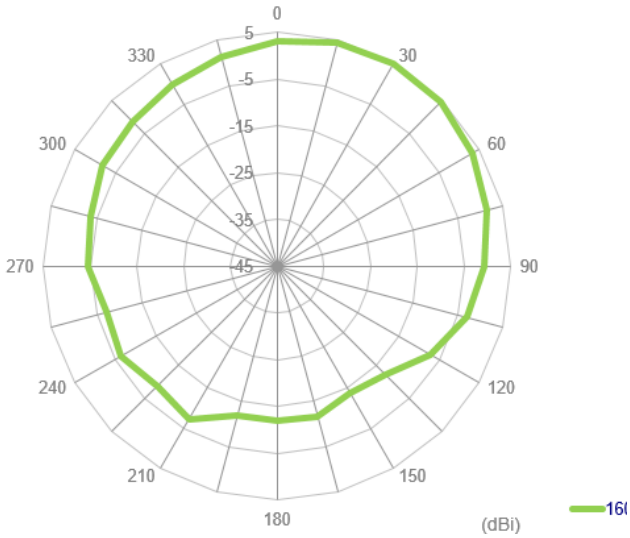
3.1.10 GPS-GLONASS 3D Radiation Pattern

3D Radiation pattern @ 1575.42MHz

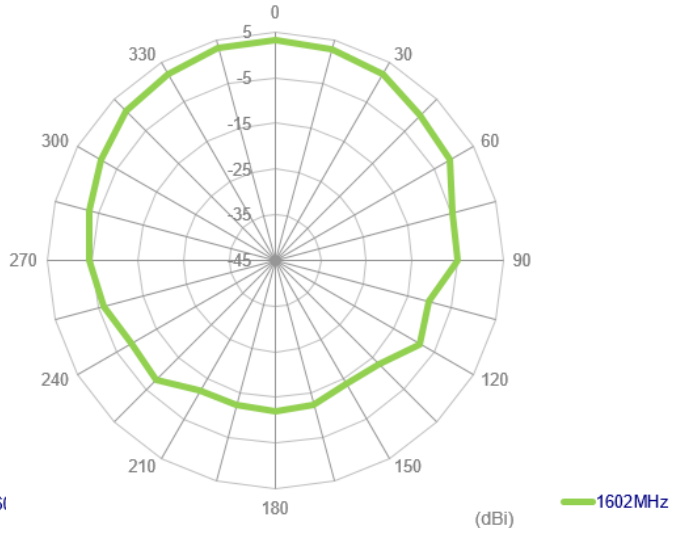


3.1.11 GPS-GLONASS 2D Radiation Pattern

2D Radiation pattern @ 1602MHz



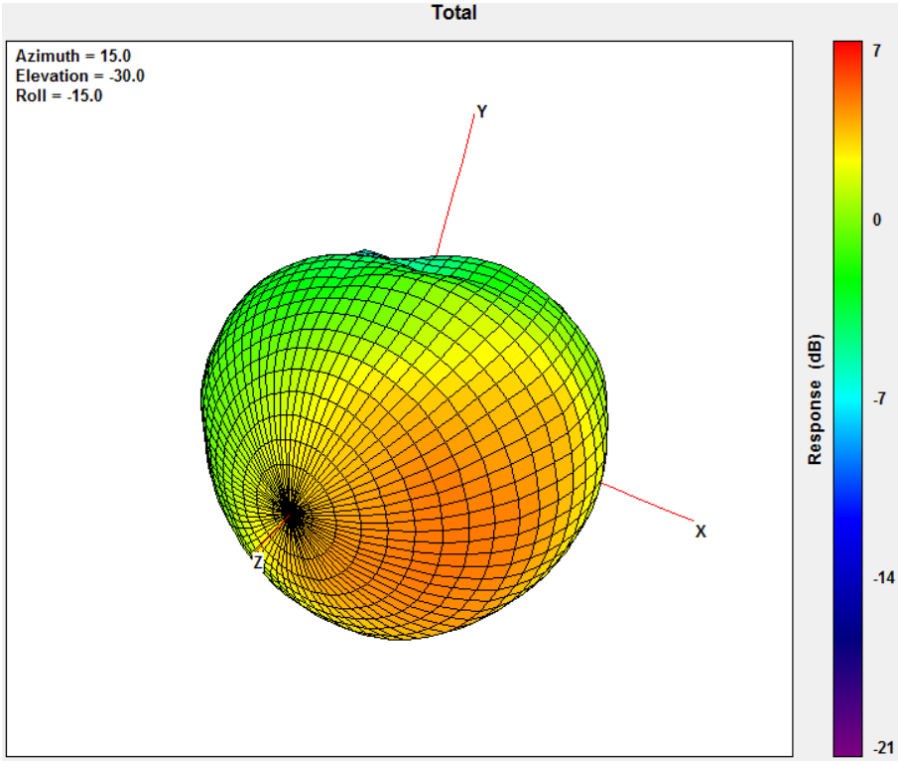
XZ Plane (phi=0° , Theta=0~360°)



YZ Plane (phi=90° , Theta=0~360°)

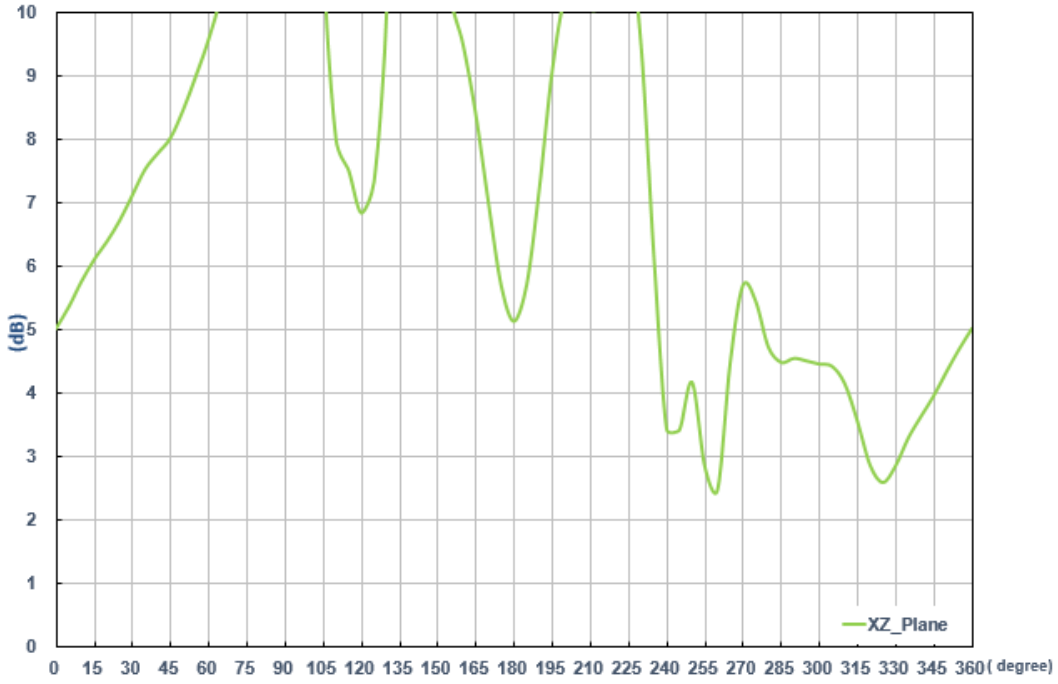
3.1.12 GPS-GLONASS 3D Radiation Pattern

3D Radiation pattern @ 1602MHz



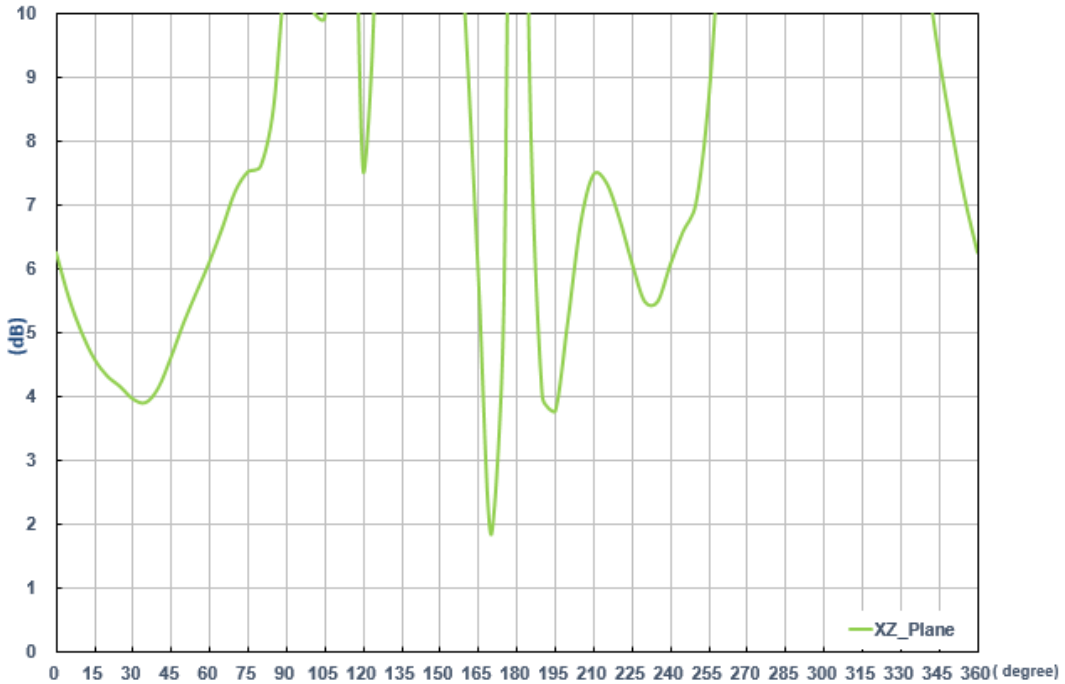
3.1.13 Axial Ratio Pattern

Frequency: 1575.42MHz



XZ Plane (phi=0° , Theta=-180~180°)

Frequency: 1602MHz

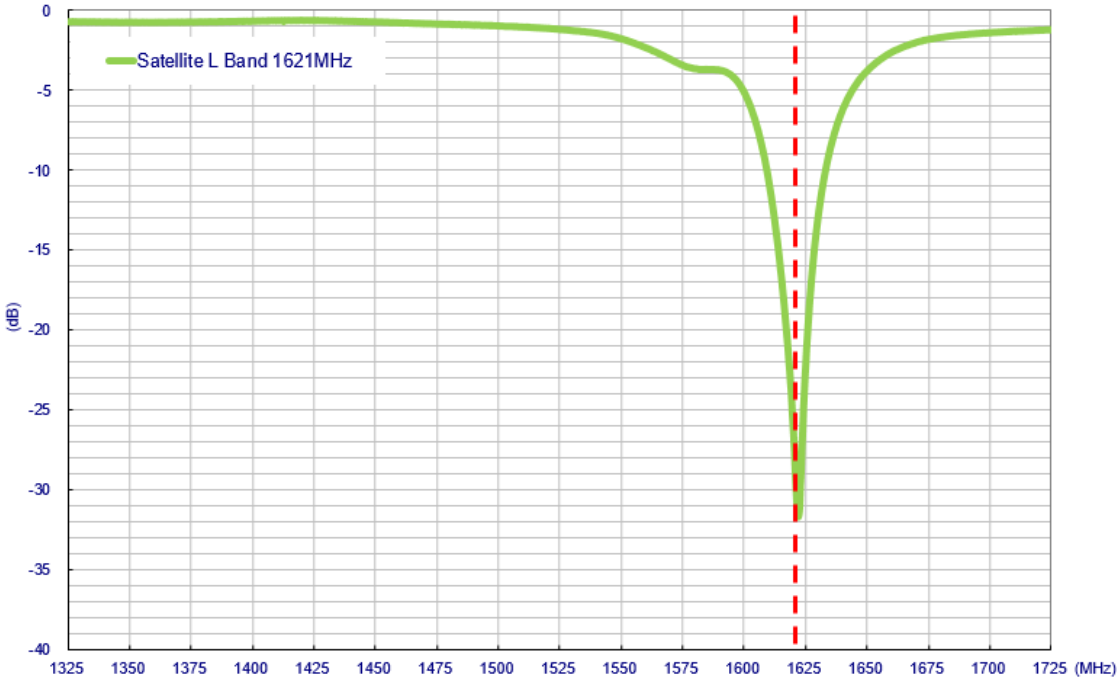


XZ Plane (phi=0° , Theta=-180~180°)

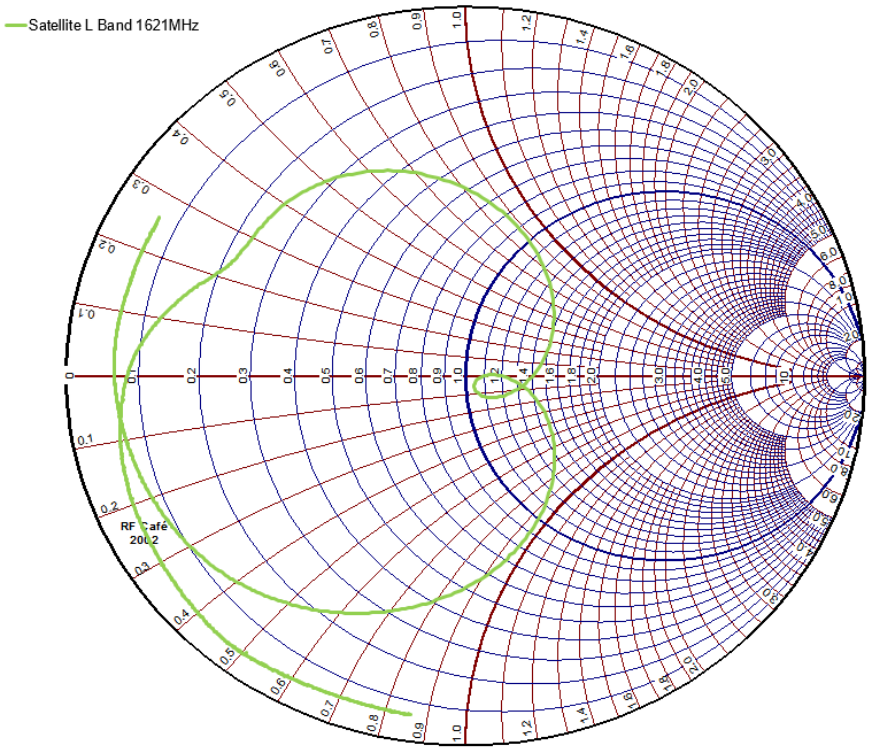
3.2 Satellite L-Band 1621MHz Antenna

3.2.1 Test Setup

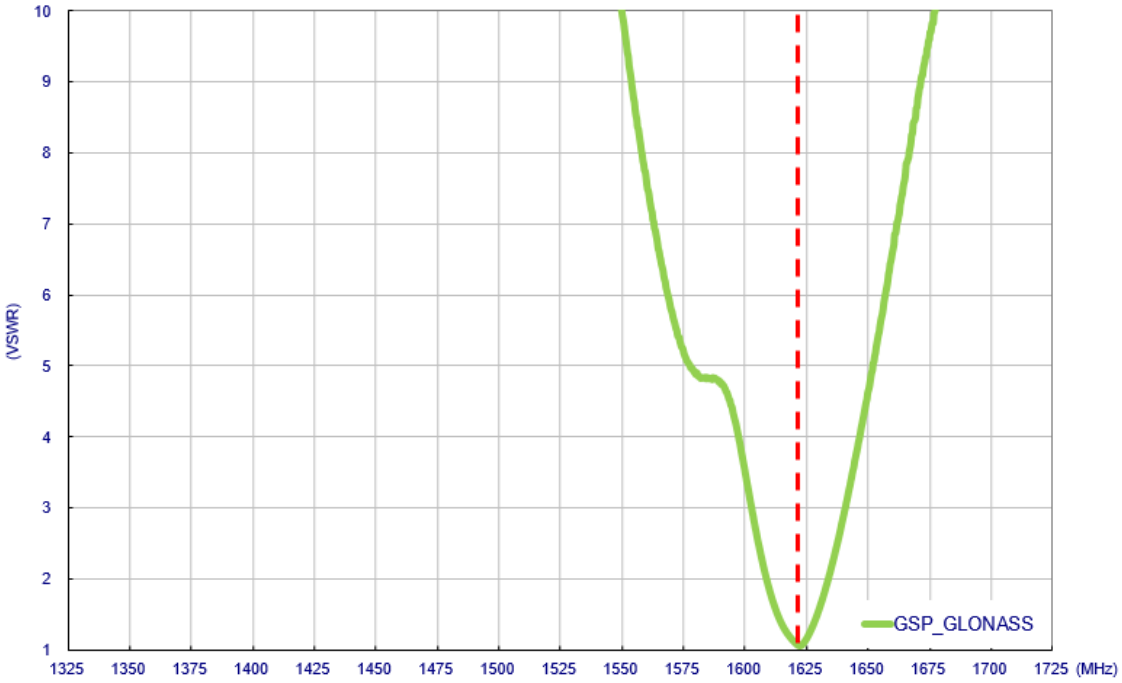
3.2.2 Satellite L-Band 1621MHz Return Loss



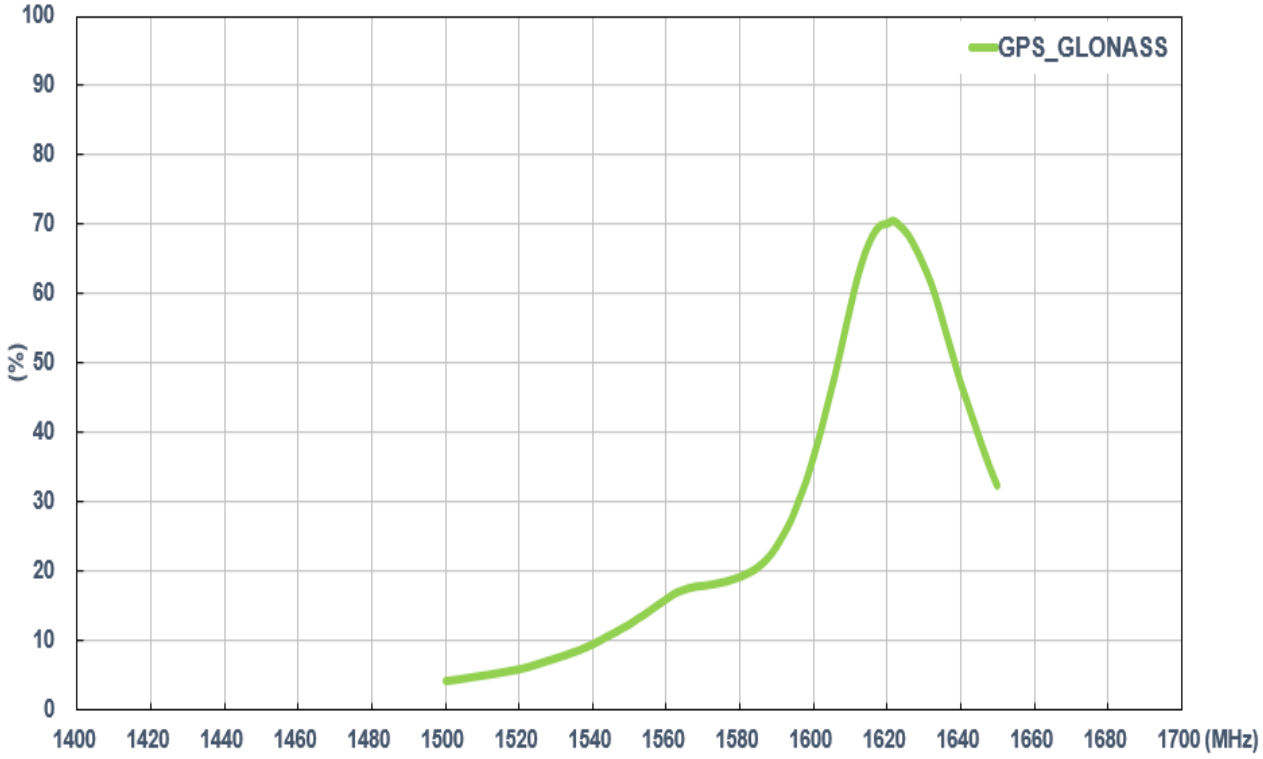
3.2.3 Satellite L-Band 1621MHz Smith Chart



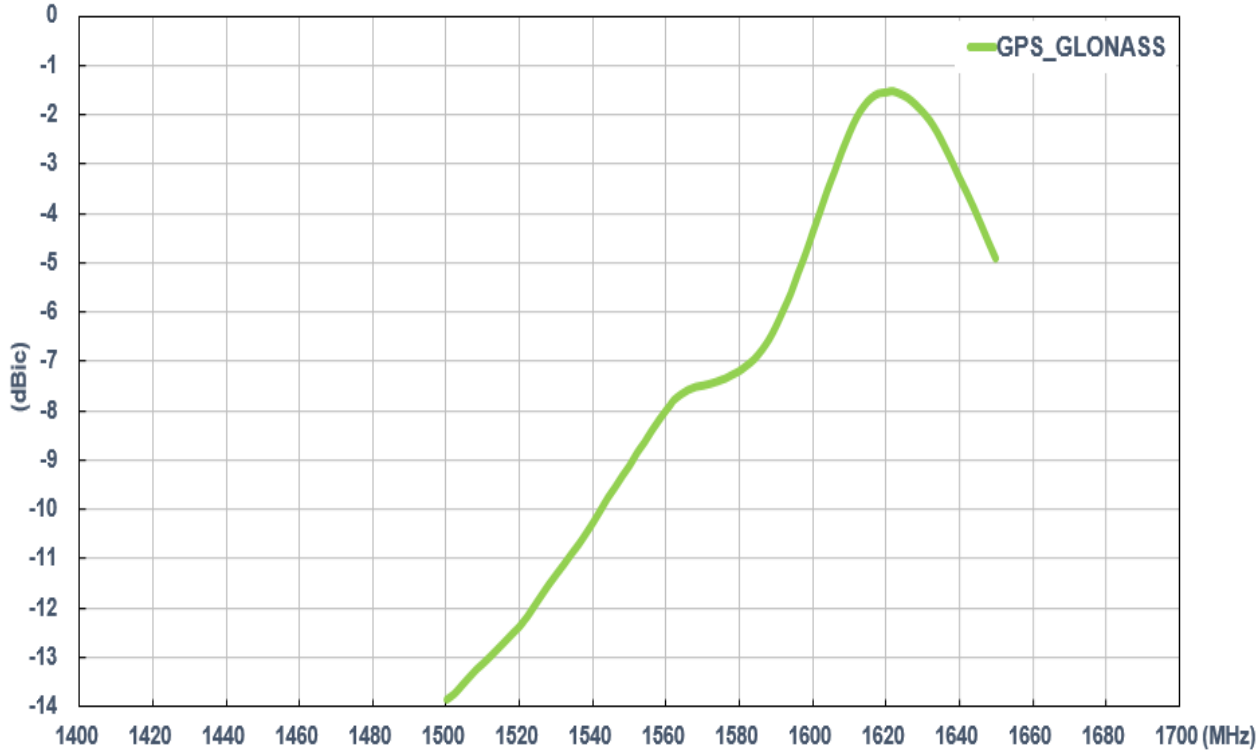
3.2.4 Satellite L-Band 1621MHz VSWR



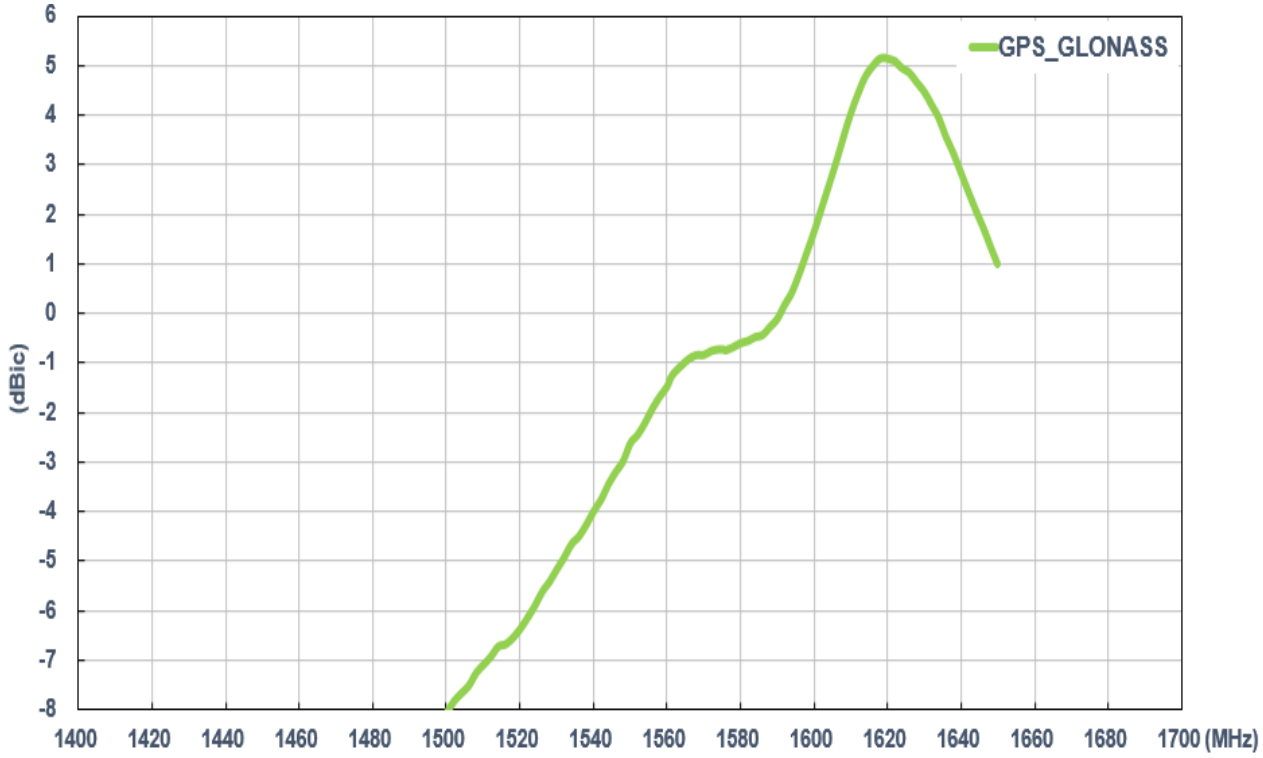
3.2.5 Satellite L-Band 1621MHz Efficiency



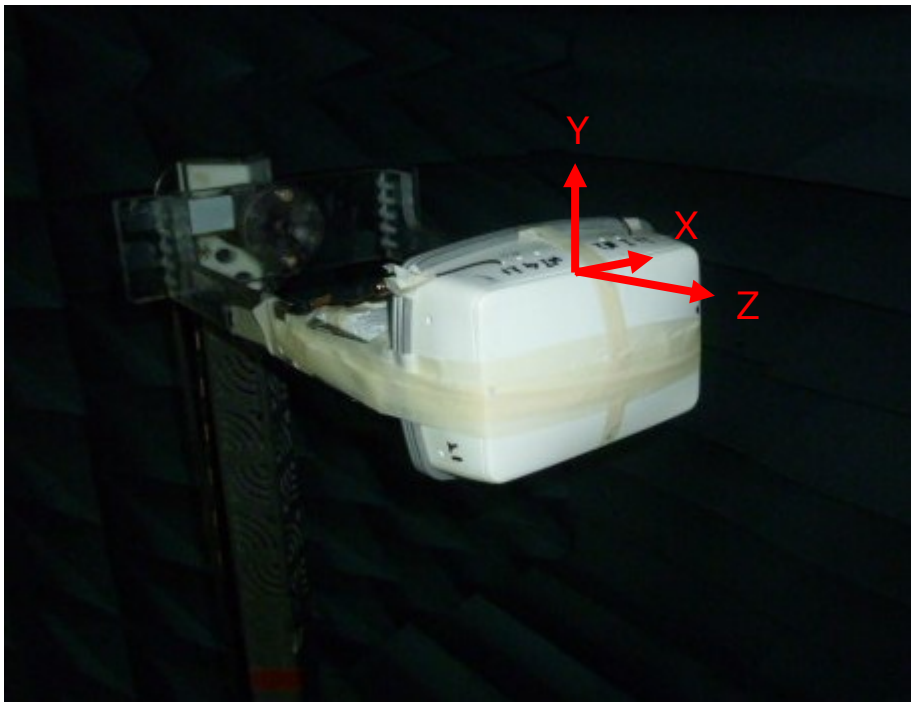
3.2.6 Satellite L-Band 1621MHz Average gain



3.2.7 Satellite L-Band 1621MHz Peak gain



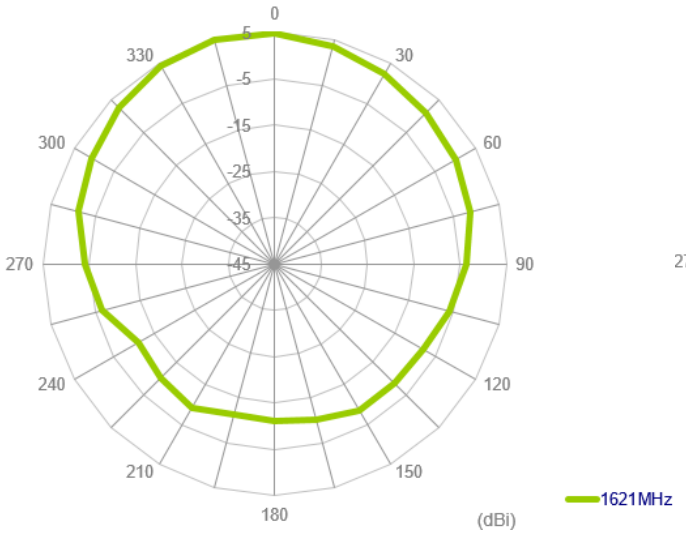
3.2.8 Test Setup For Antenna Radiation Pattern



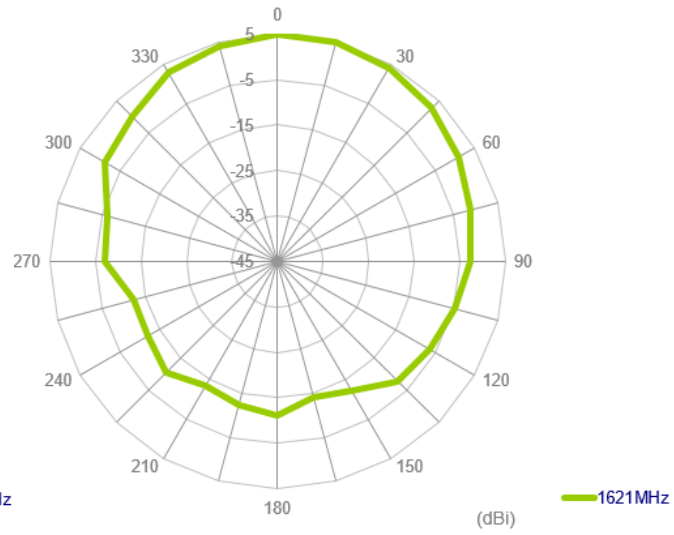
In free space

3.2.9 Satellite L-Band 1621MHz 2D Radiation Pattern

2D Radiation pattern @ 1621MHz



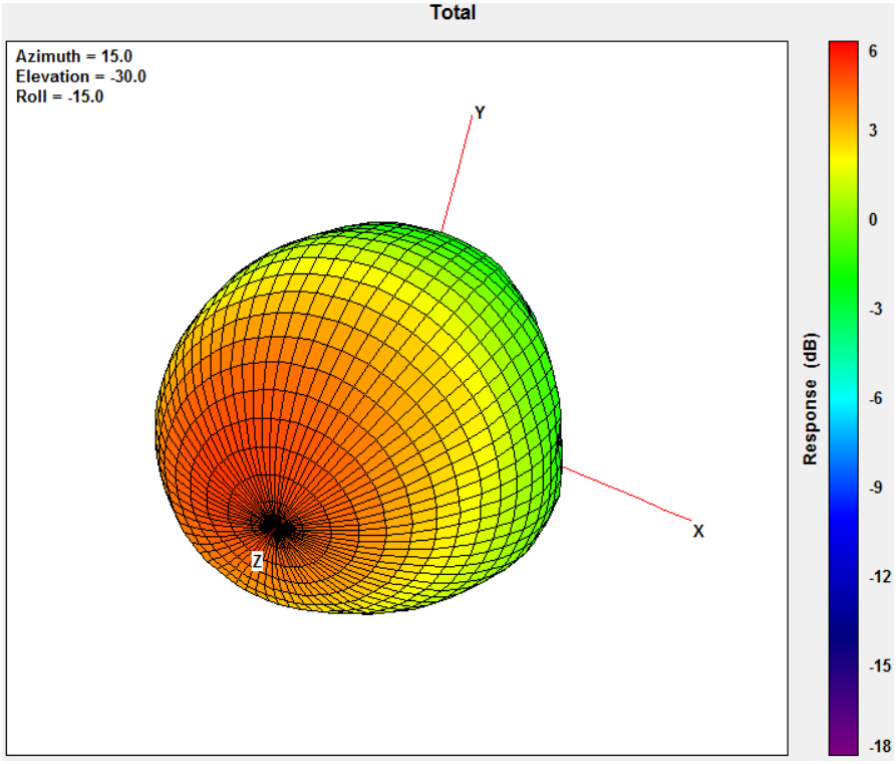
XZ Plane (phi=0◦, Theta=0~360◦)



YZ Plane (phi=90◦, Theta=0~360◦)

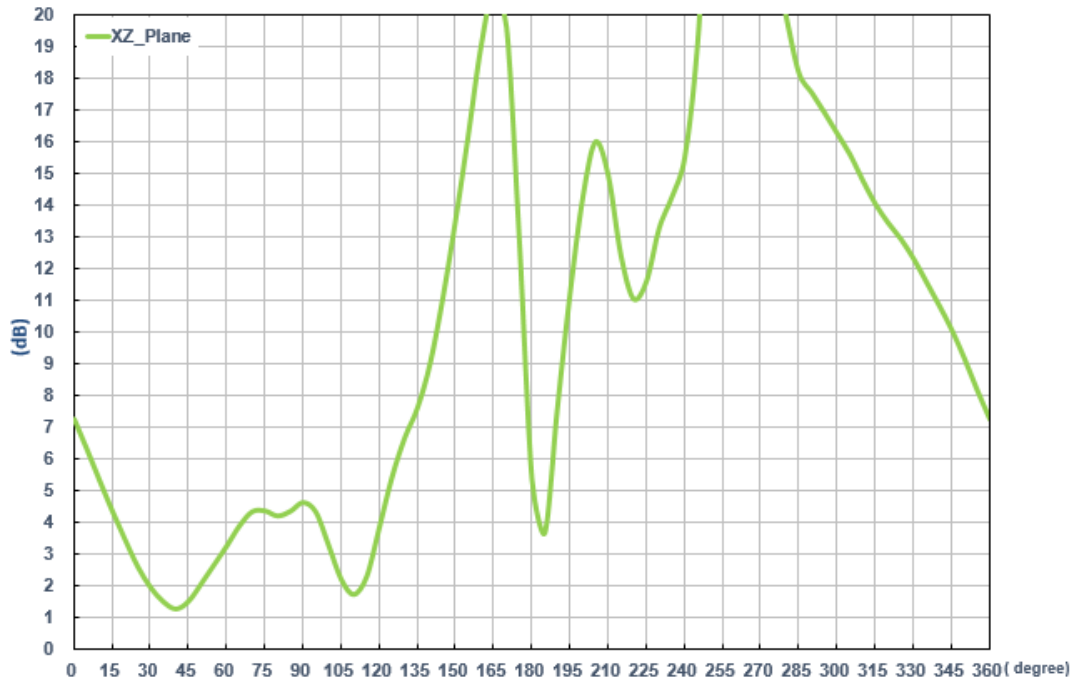
3.2.10 Satellite L-Band 1621MHz 3D Radiation Pattern

3D Radiation pattern @ 1621MHz



3.2.11 Axial Ratio Pattern

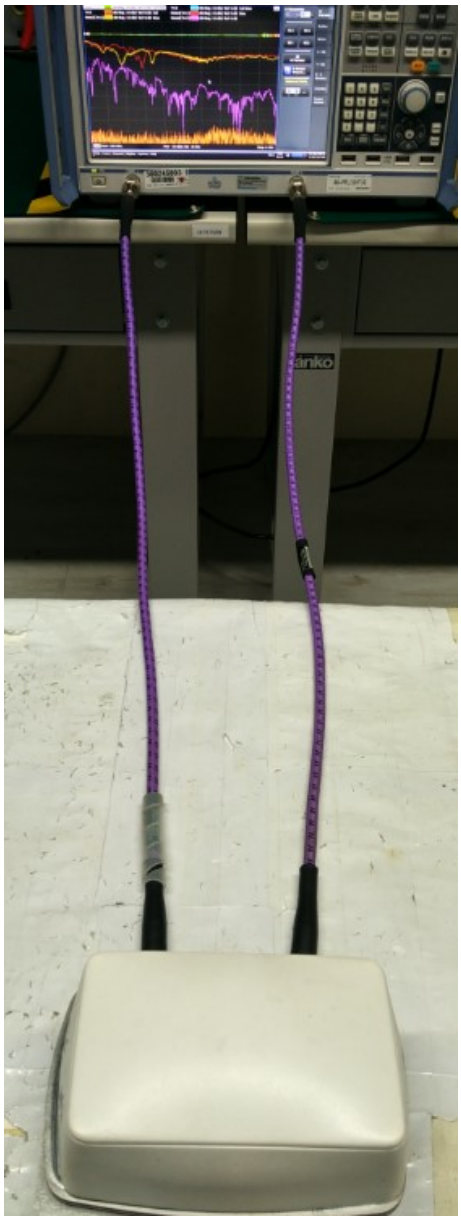
Frequency: 1621MHz



XZ Plane (phi=0°, Theta=-180~180°)

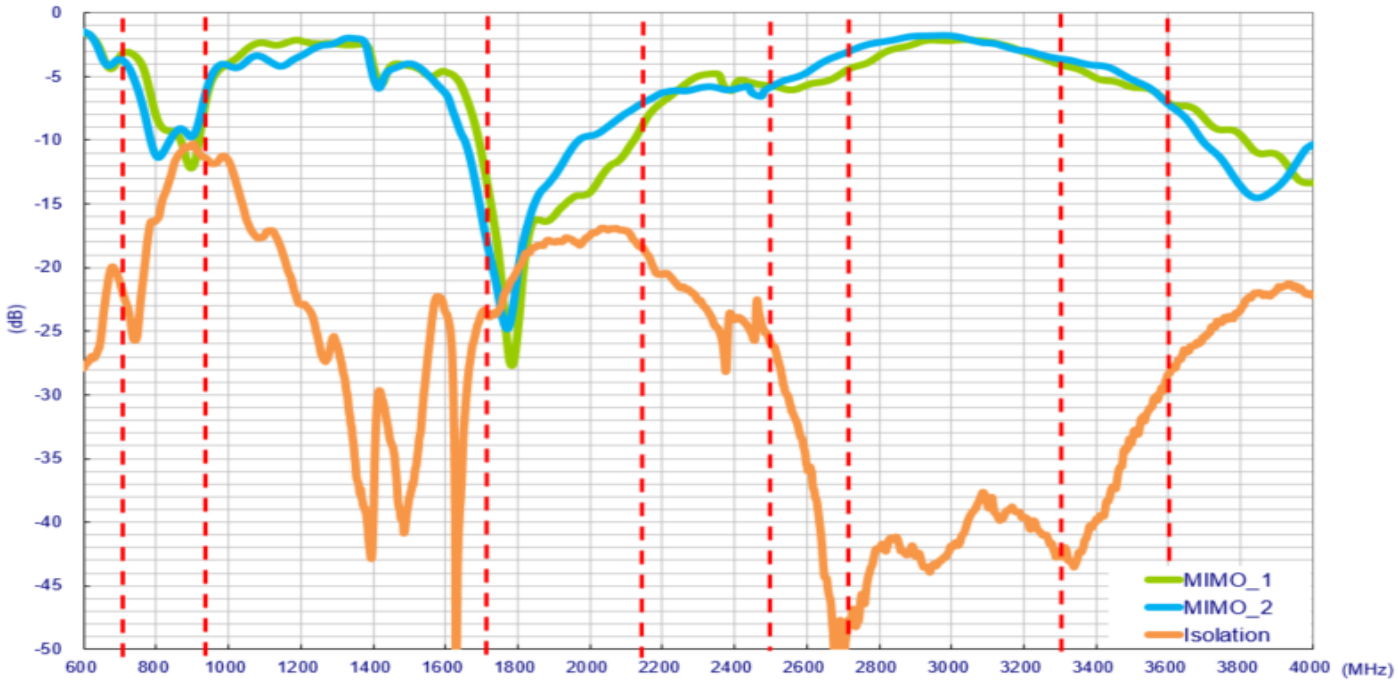
3.3 LTE_MIMO/Wi-Fi_MIMO Antenna

3.3.1 Test Setup

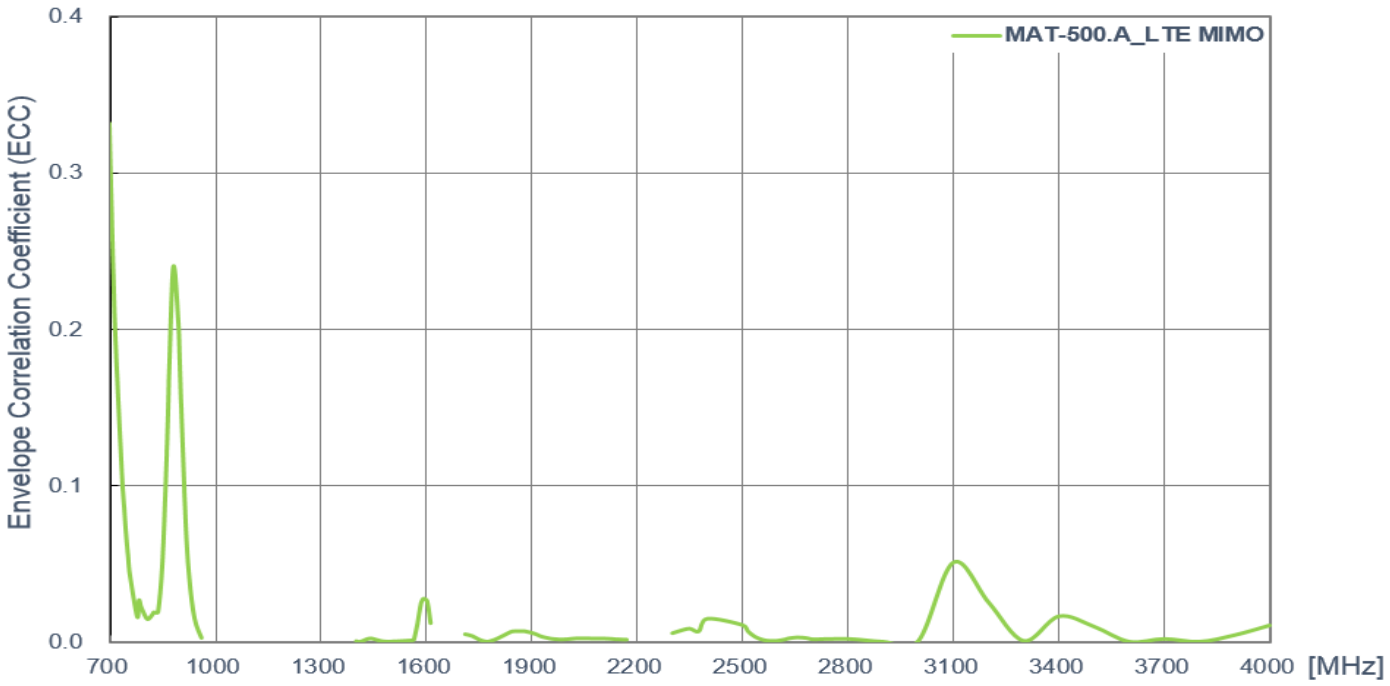


In free space

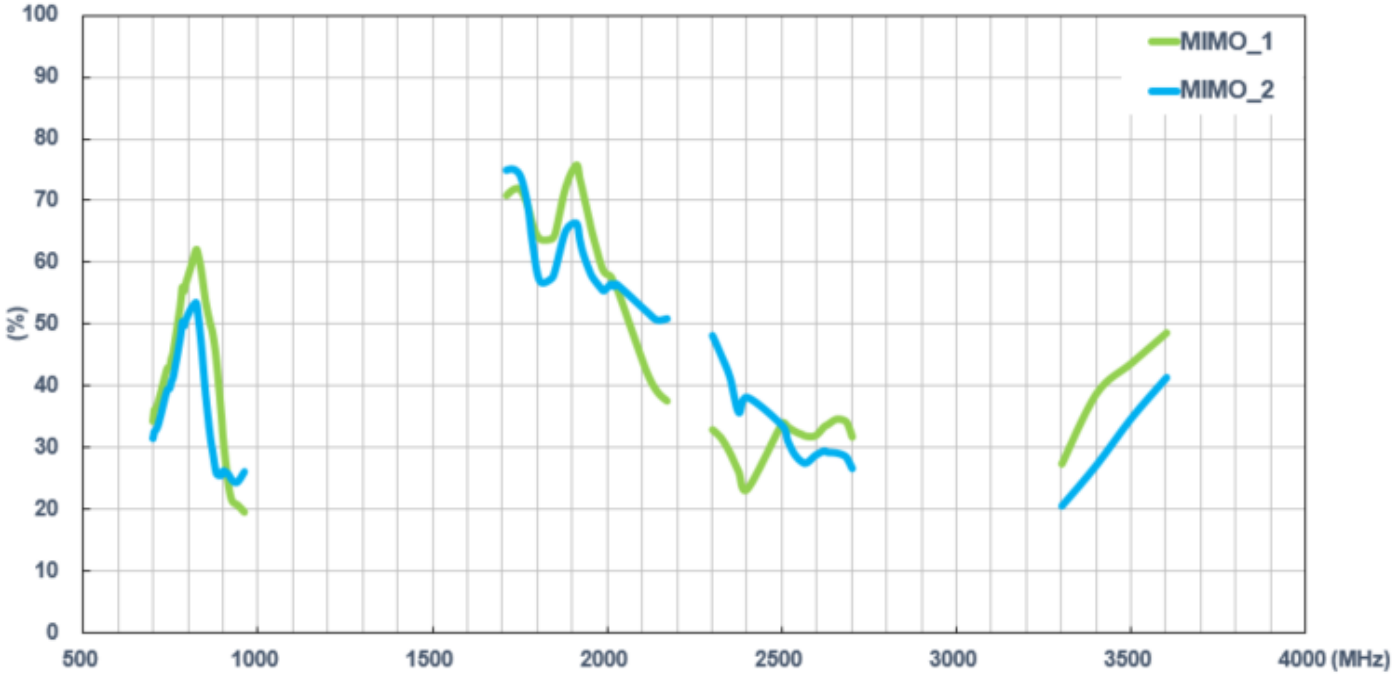
3.3.2 LTE MIMO Antenna S-parameters



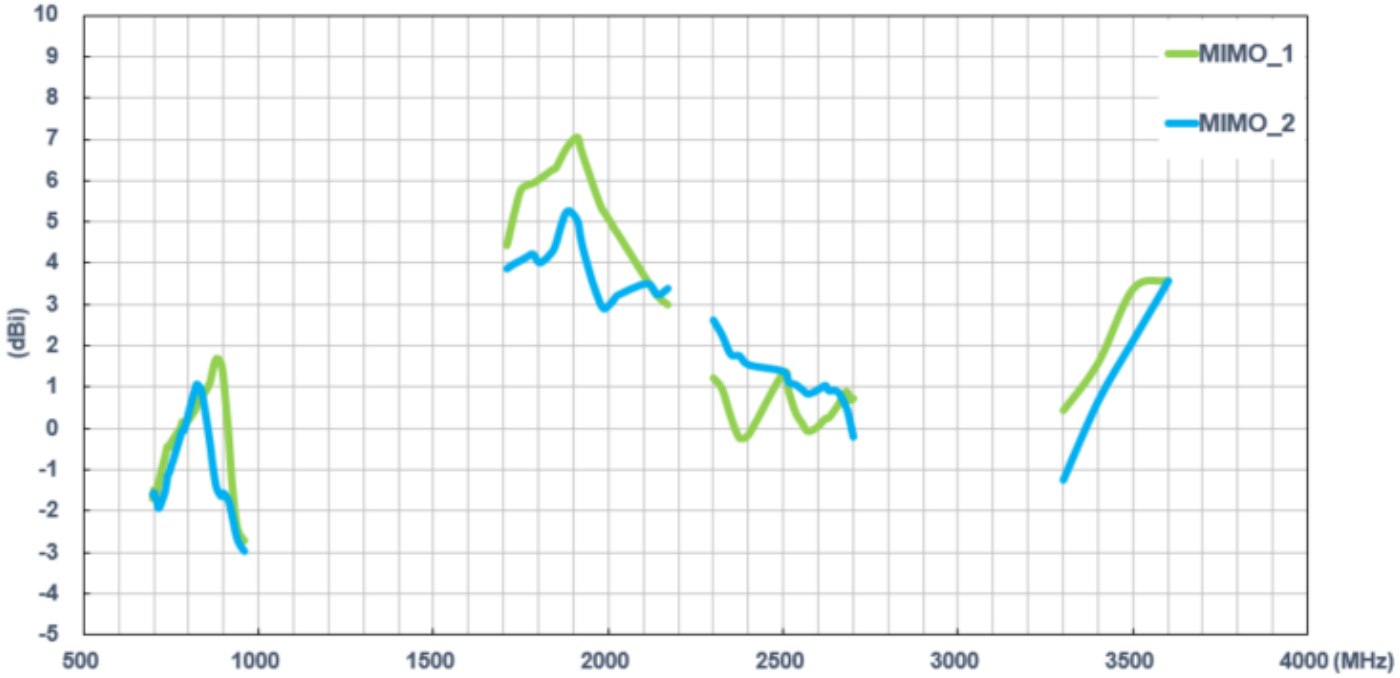
3.3.3 Envelope Correlation Coefficient (LTE)



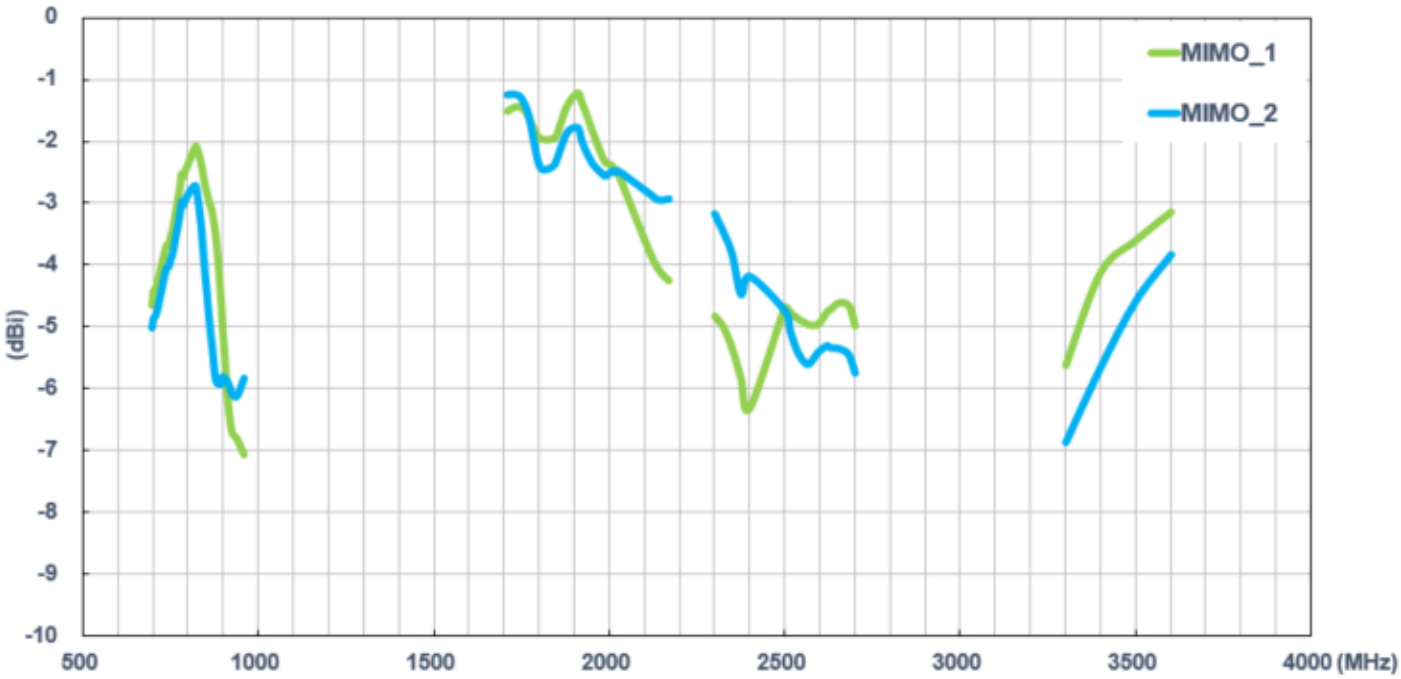
3.3.4 LTE Antenna Efficiency



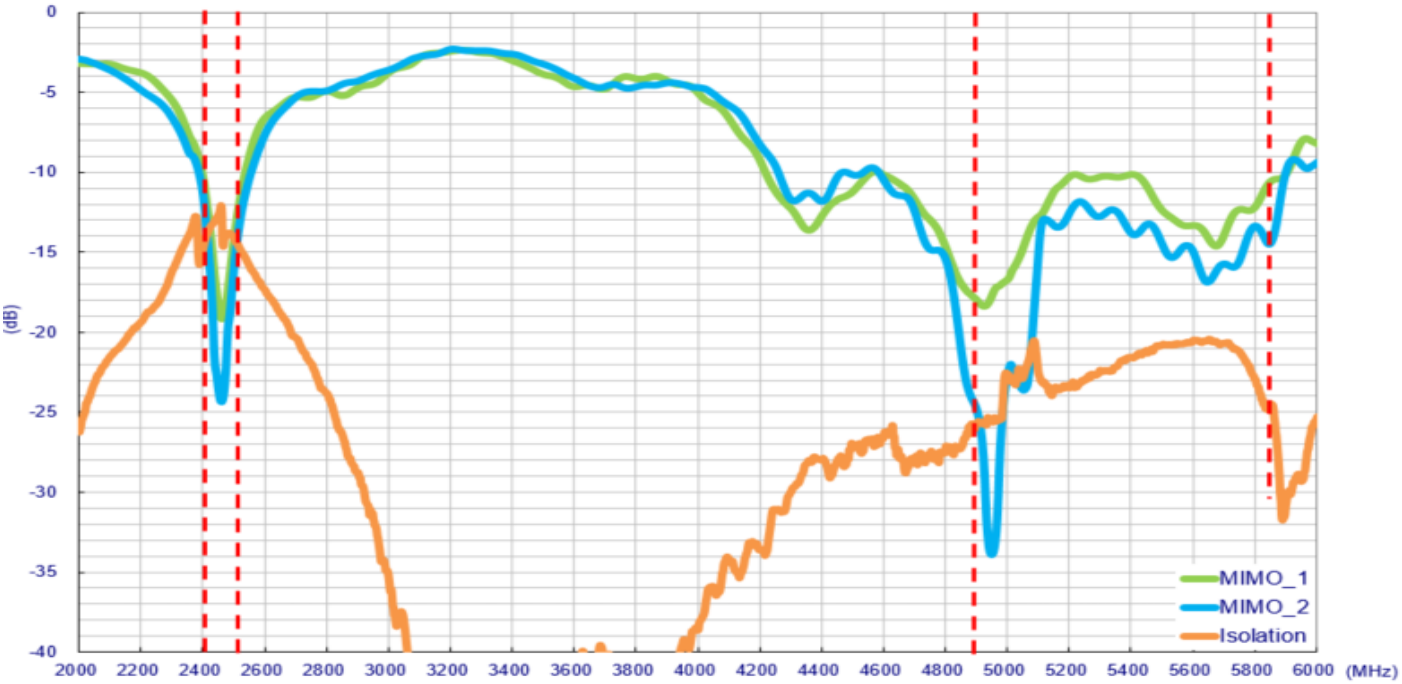
3.3.5 LTE Antenna Peak Gain



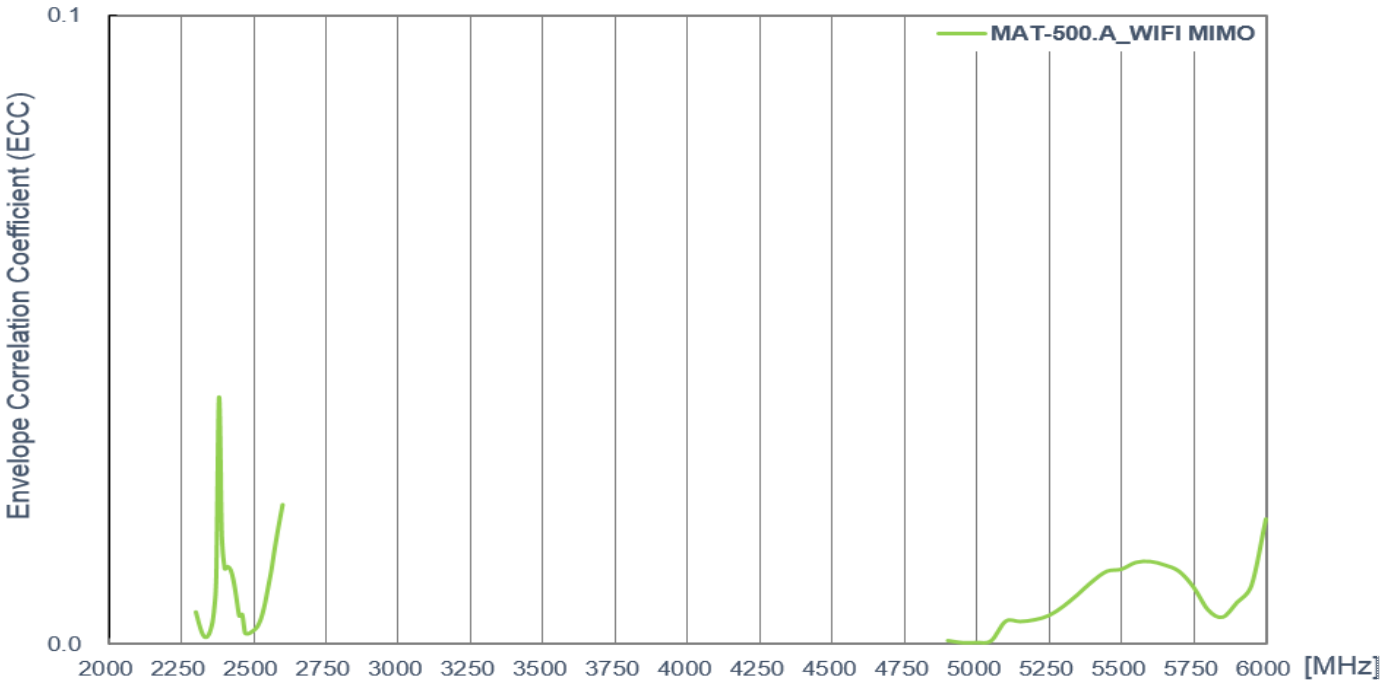
3.3.6 LTE Antenna Peak Gain



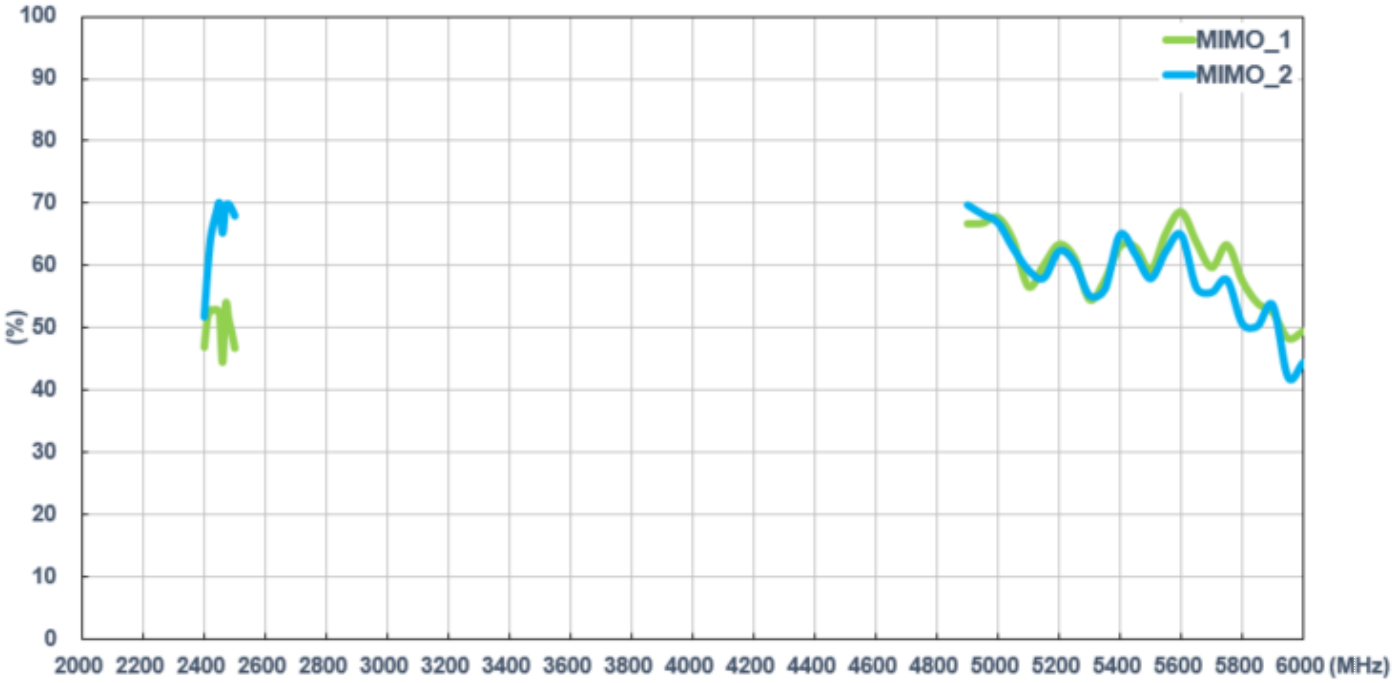
3.3.7 Wi-Fi Antenna Return Loss



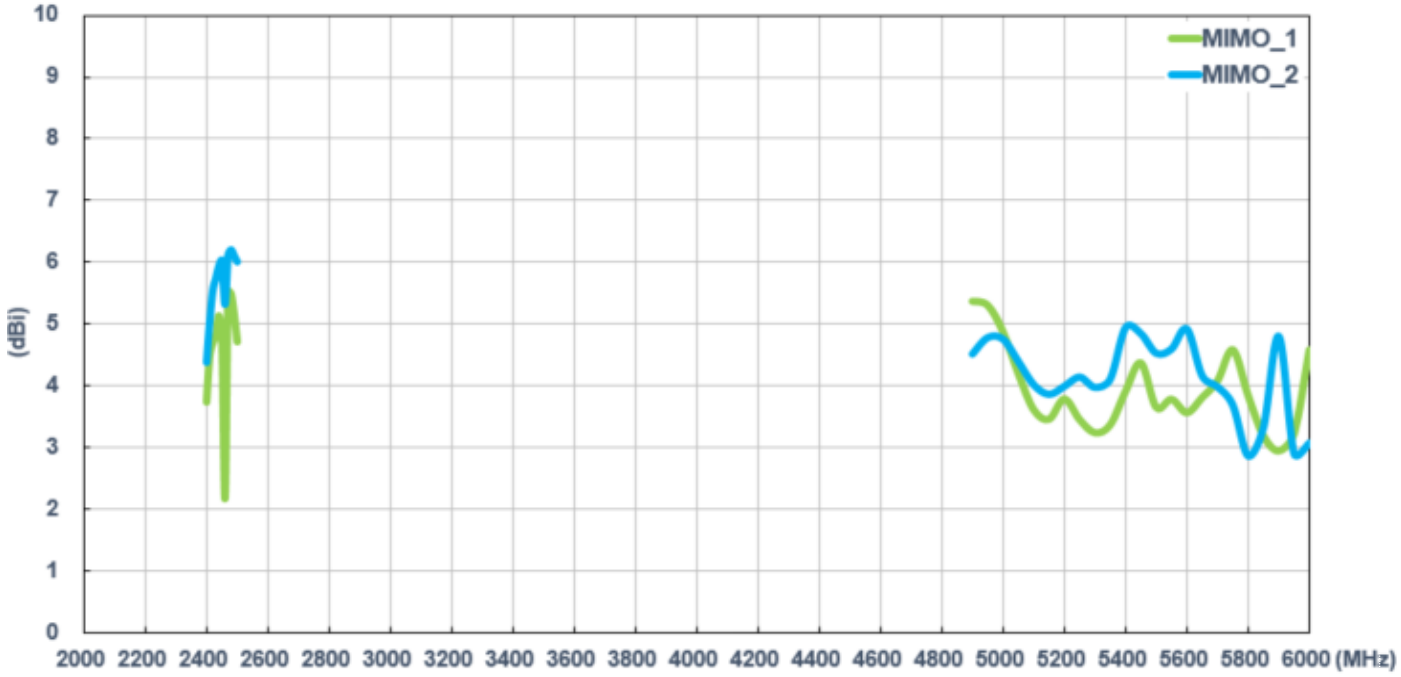
3.3.8 Envelope Correlation Coefficient



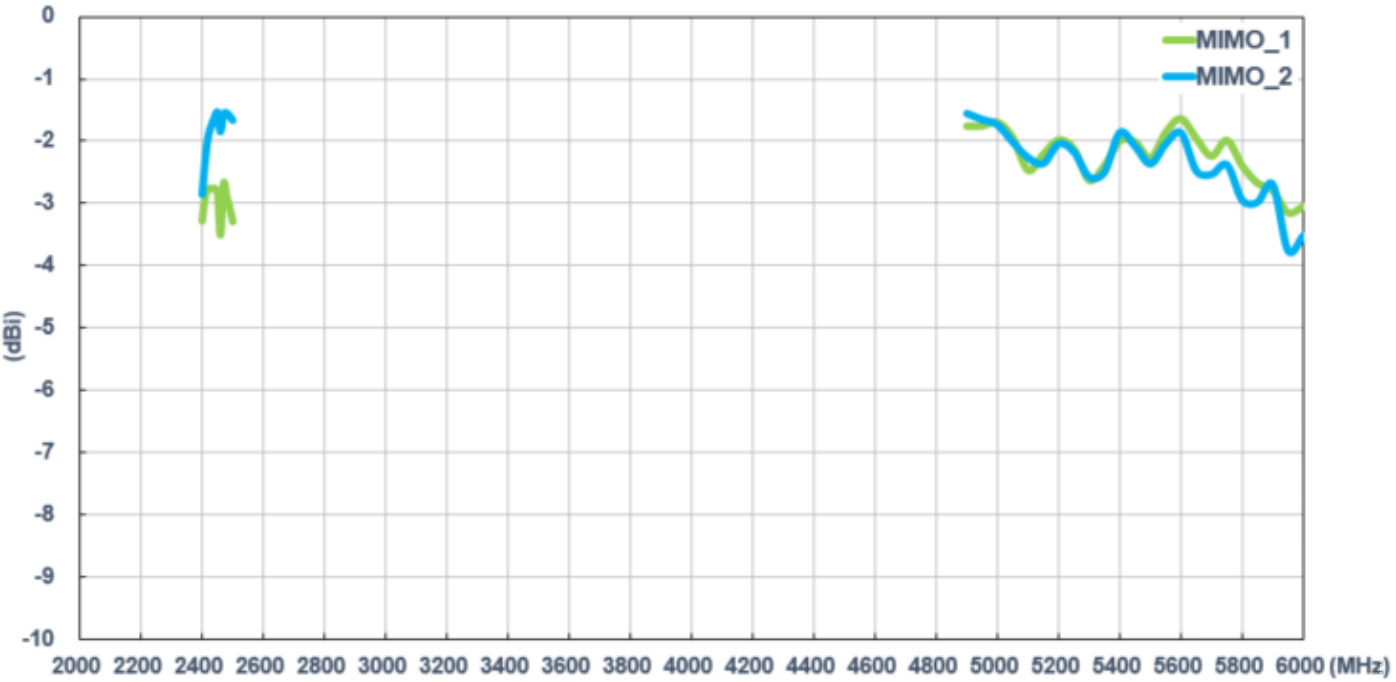
3.3.9 Wi-Fi Antenna Efficiency



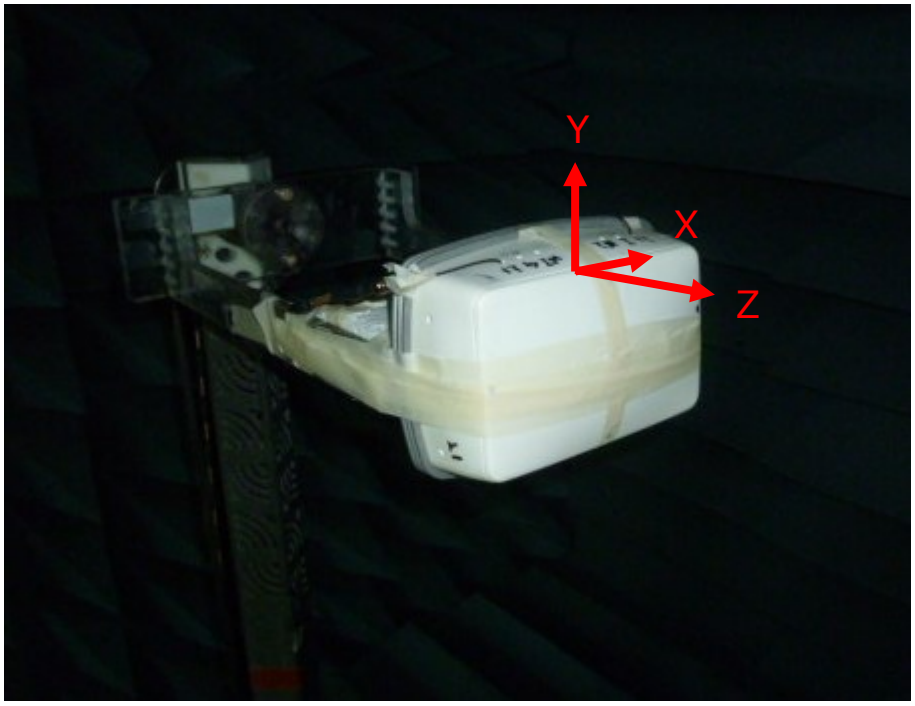
3.3.10 Wi-Fi Antenna Peak Gain



3.3.11 Wi-Fi Antenna Average Gain



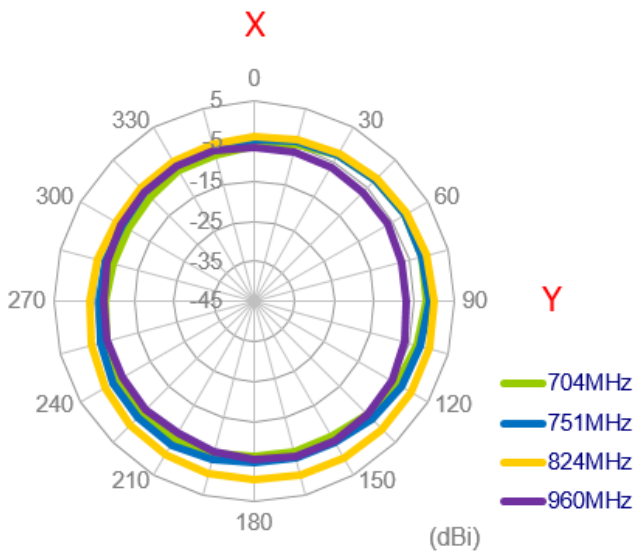
3.3.12 Test Setup For Antenna Radiation Pattern (ETS Anechoic chamber)

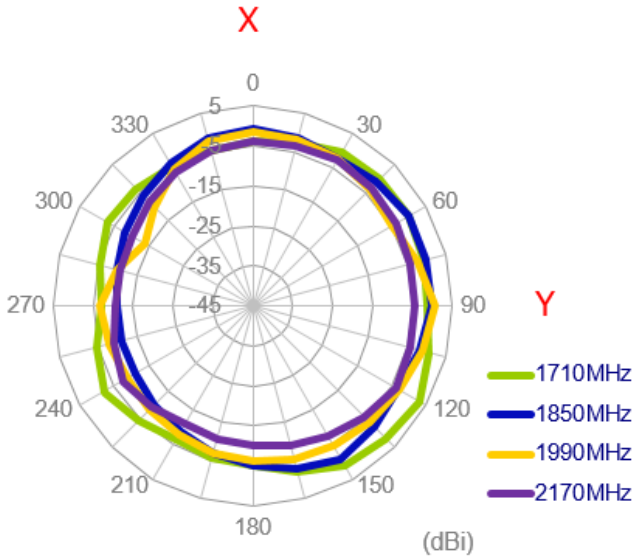


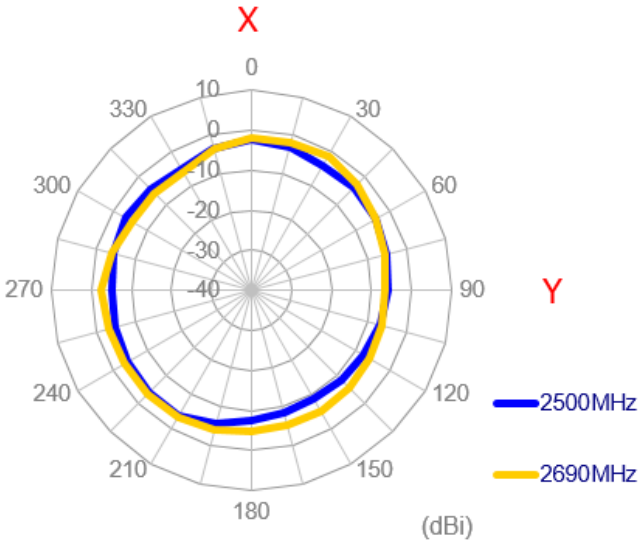
In free space

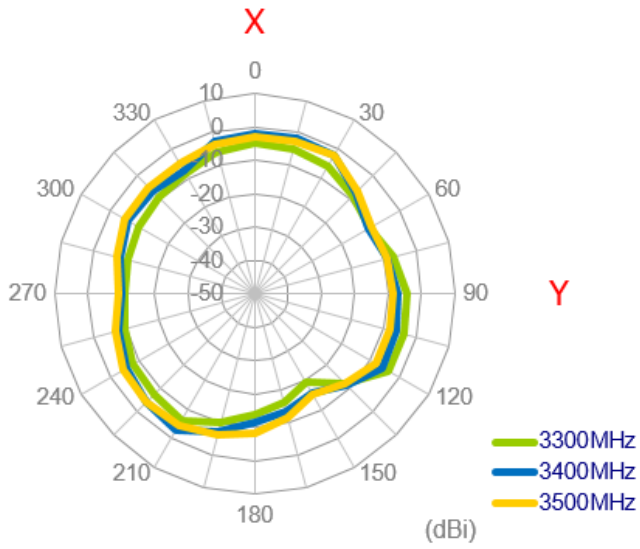
3.3.13 2D Radiation Pattern (LTE_MIMO1)

XY Plane

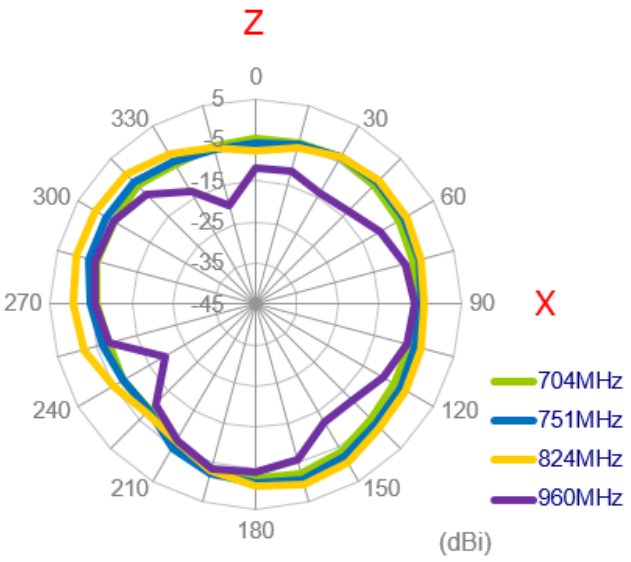


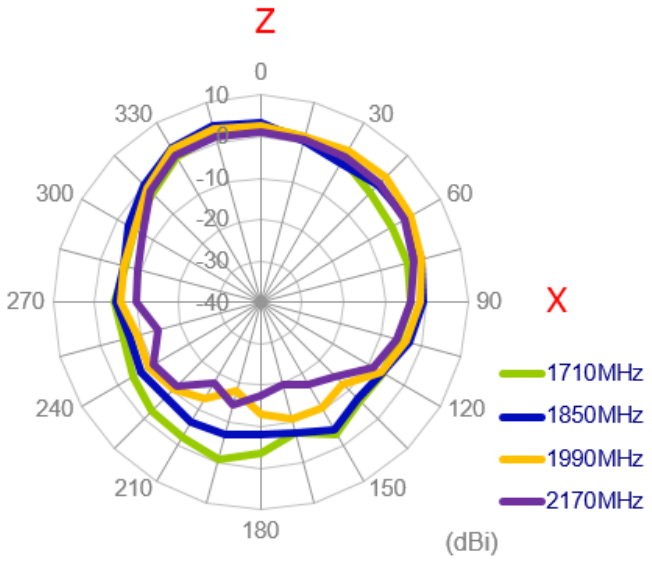


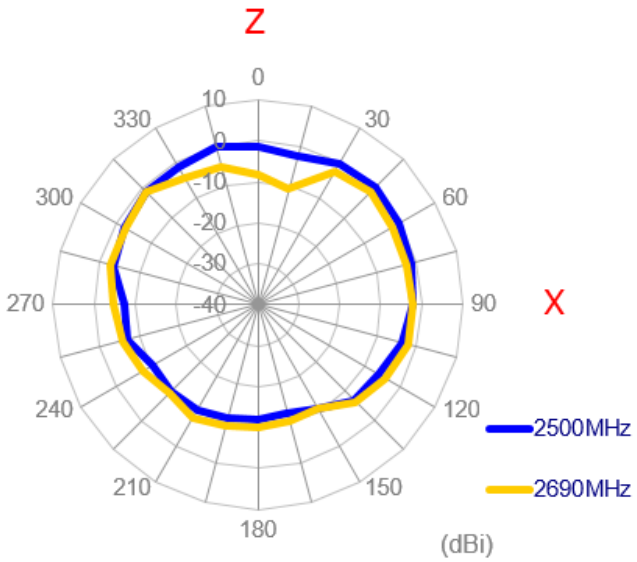


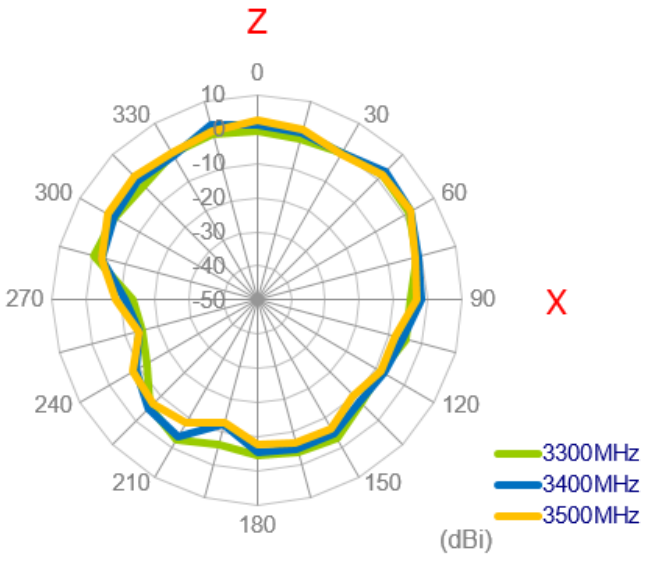


XZ Plane

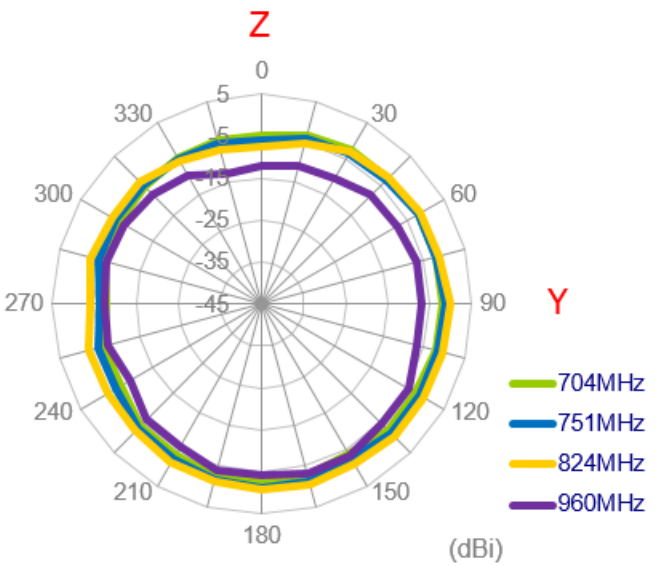

Z
X
0
30
60
90
120
150
180
210
240
270
300
330
5
-5
-15
-25
-35
-45
704MHz
751MHz
824MHz
960MHz
(dBi)

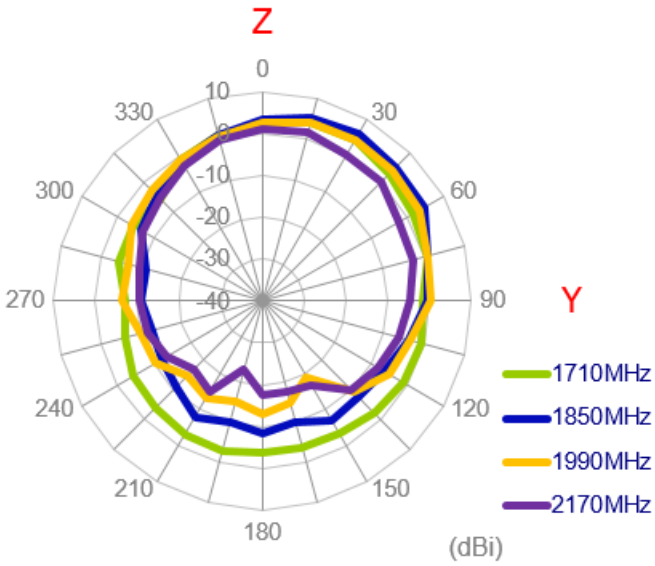

Z
X
0
10
-10
-20
-30
-40
1710MHz
1850MHz
1990MHz
2170MHz
(dBi)

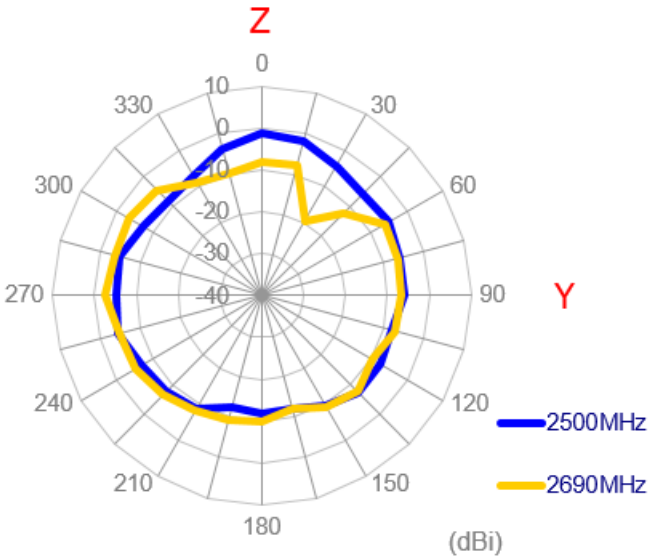

Z
X
0
10
-10
-20
-30
-40
2500MHz
2690MHz
(dBi)

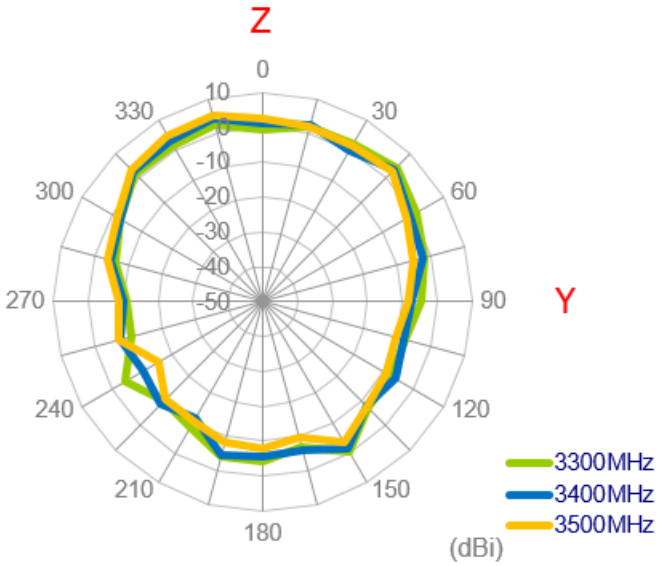

Z
X
0
10
-10
-20
-30
-40
-50
3300MHz
3400MHz
3500MHz
(dBi)

YZ Plane

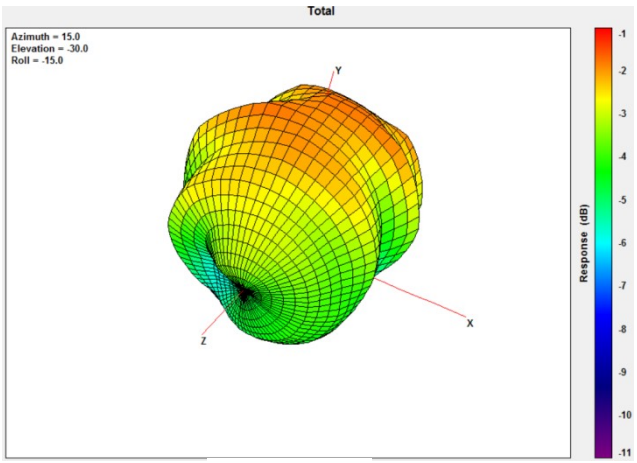

Z
Y
0
30
60
90
120
150
180
210
240
270
300
330
5
-5
-15
-25
-35
-45
704MHz
751MHz
824MHz
960MHz
(dBi)


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

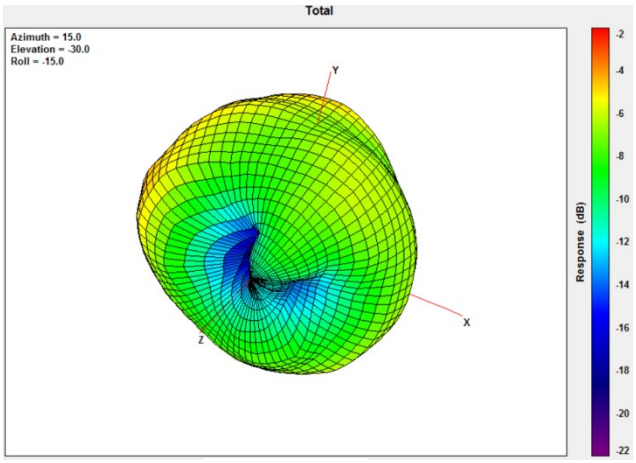

Z
Y
0
30
60
90
120
150
180
210
240
270
300
330
10
-10
-20
-30
-40
2500MHz
2690MHz
(dBi)


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

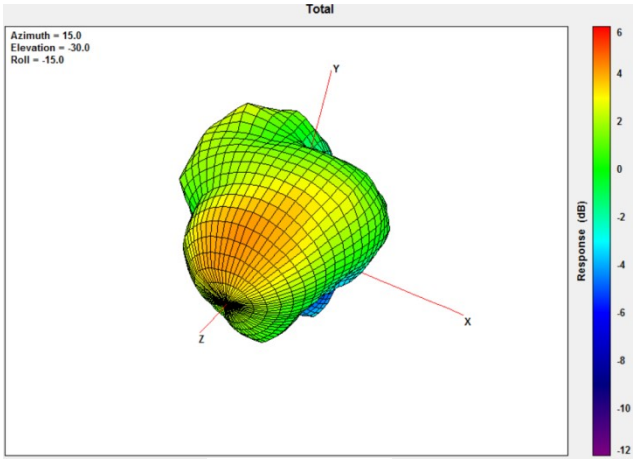
3.3.14 3D Radiation Pattern (LTE_MIMO1)



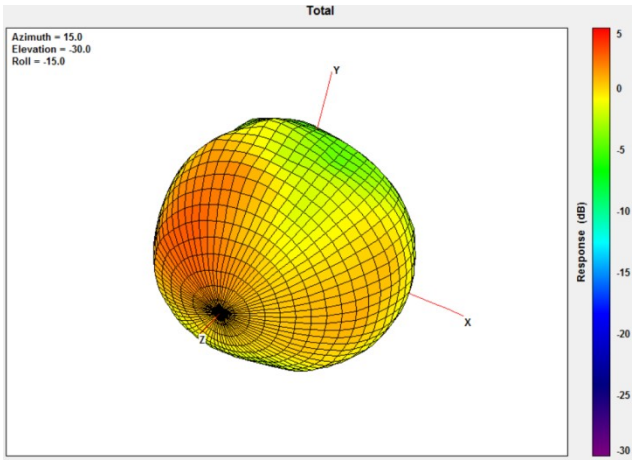
704MHz



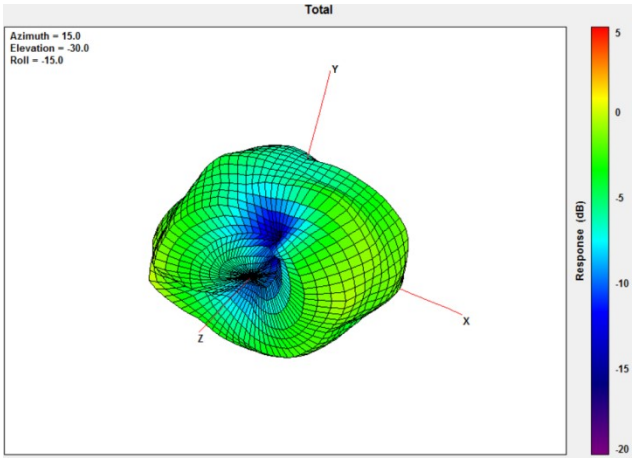
960MHz



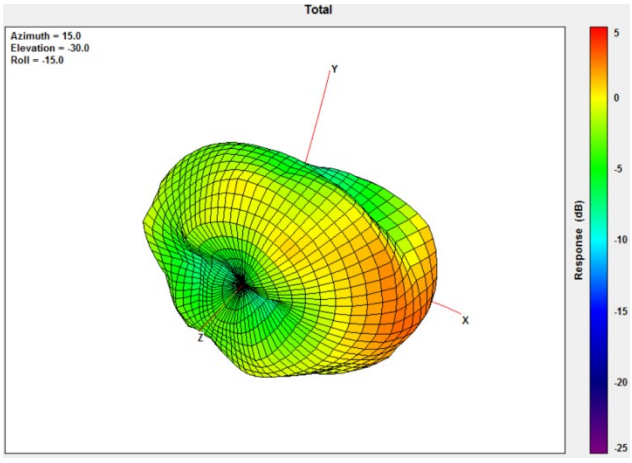
1710MHz



2170MHz



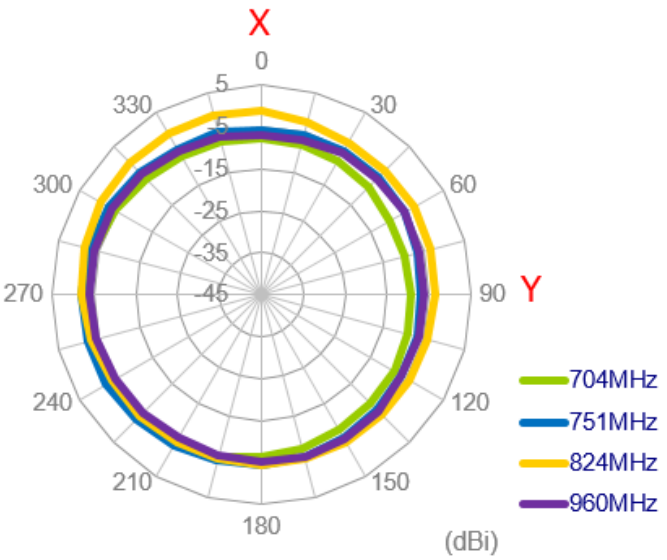
2690MHz

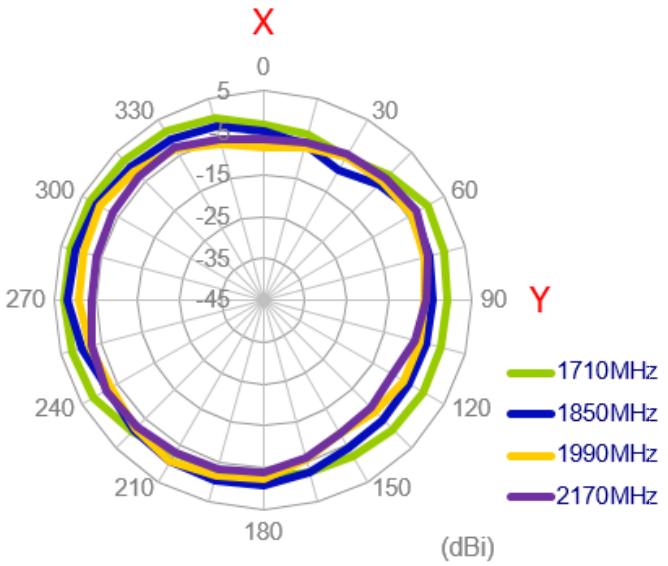


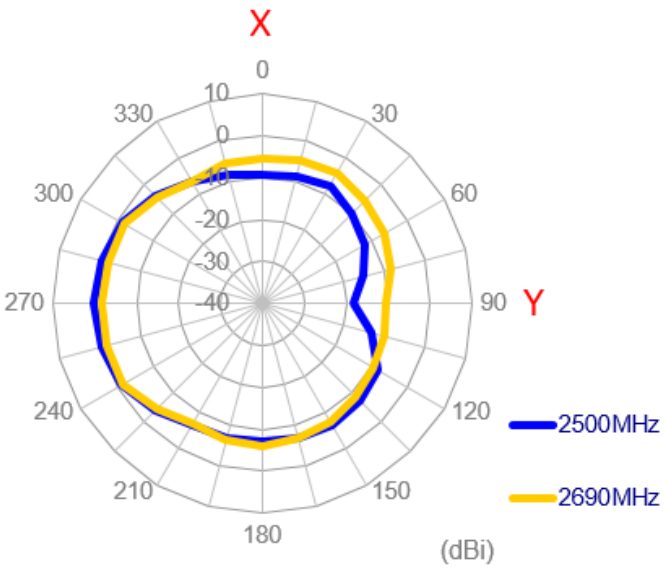
3500MHz

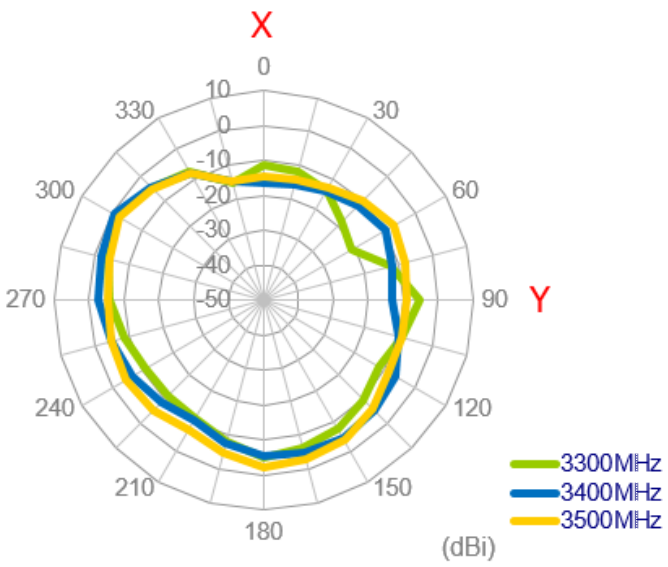
3.3.15 2D Radiation Pattern (LTE_MIMO2)

XY Plane

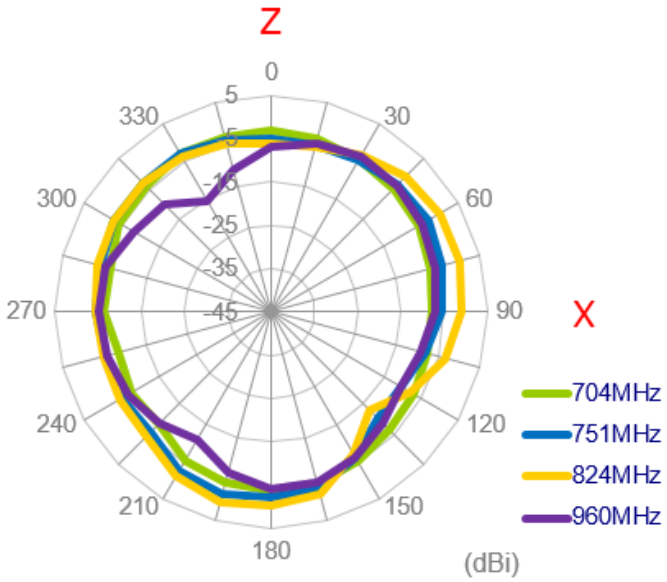


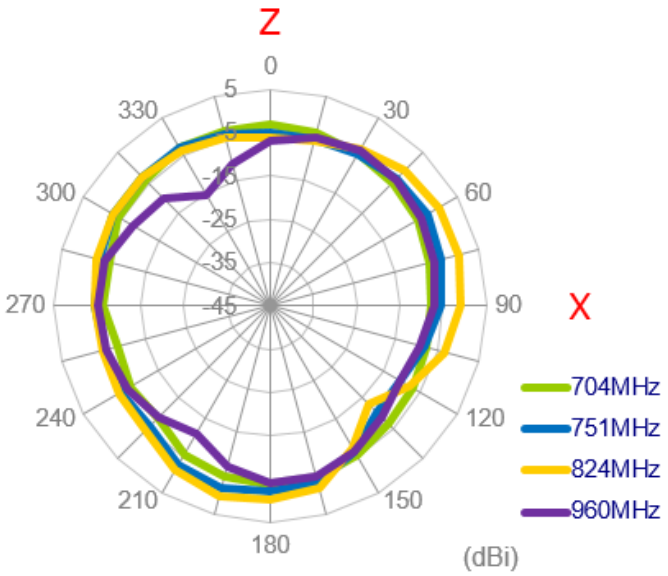


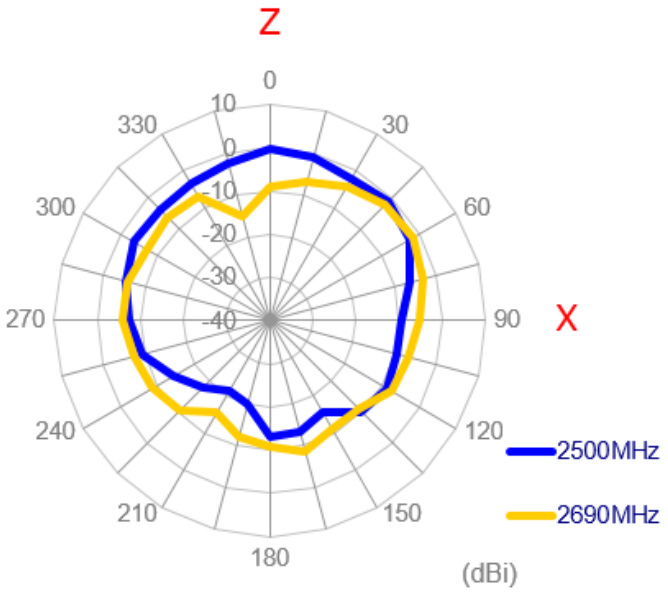


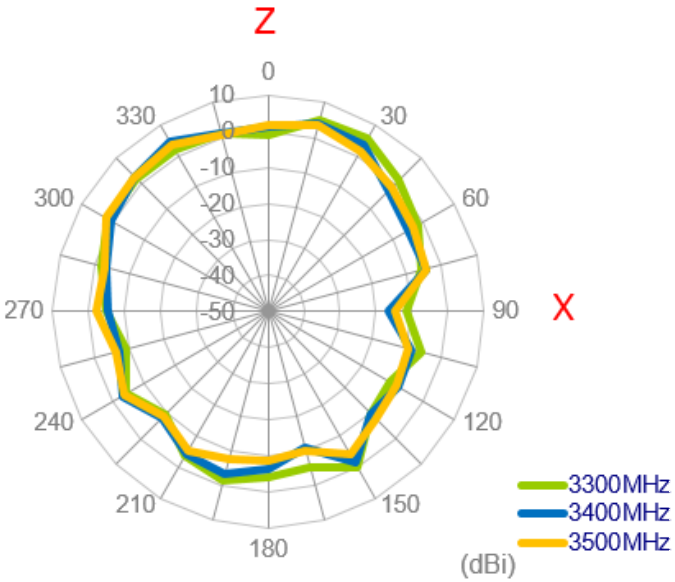


XZ Plane

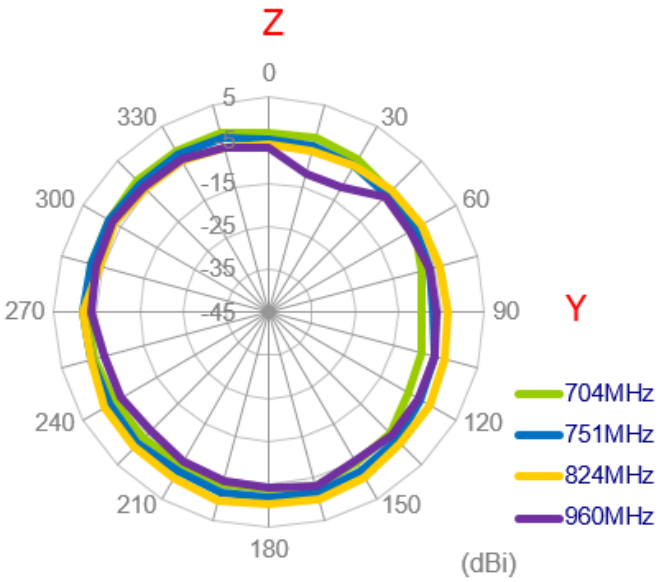

Z
X
0
30
60
90
120
150
180
210
240
270
300
330
5
-5
-15
-25
-35
-45
704MHz
751MHz
824MHz
960MHz
(dBi)

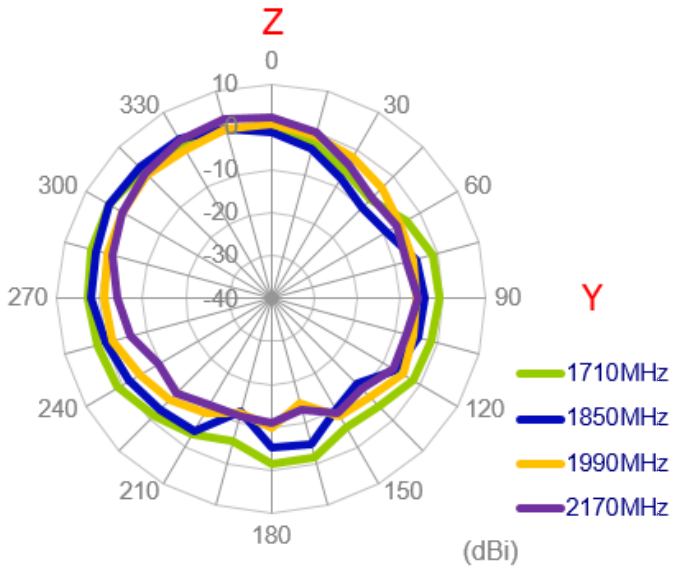

Z
X
0
30
60
90
120
150
180
210
240
270
300
330
5
-5
-15
-25
-35
-45
704MHz
751MHz
824MHz
960MHz
(dBi)

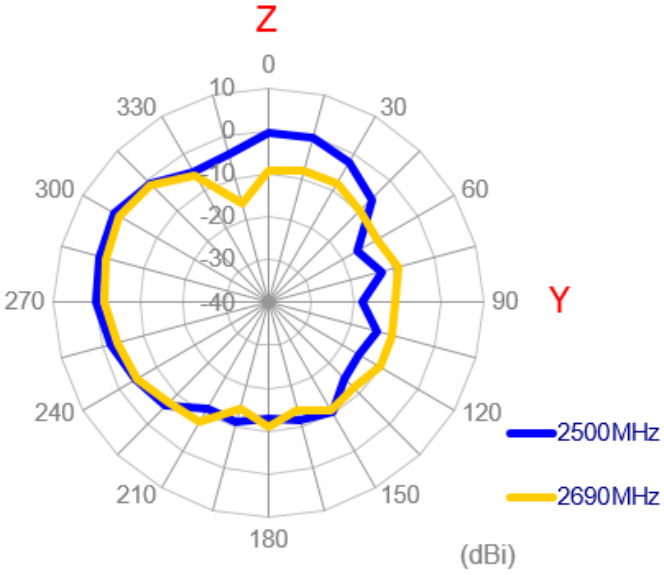

Z
X
0
30
60
90
120
150
180
210
240
270
300
330
10
0
-10
-20
-30
-40
2500MHz
2690MHz
(dBi)

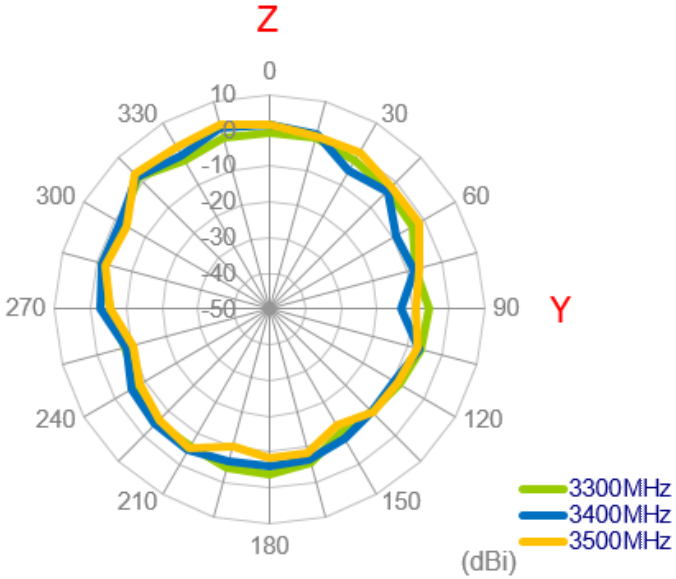

Z
X
0
30
60
90
120
150
180
210
240
270
300
330
10
0
-10
-20
-30
-40
-50
3300MHz
3400MHz
3500MHz
(dBi)

YZ Plane

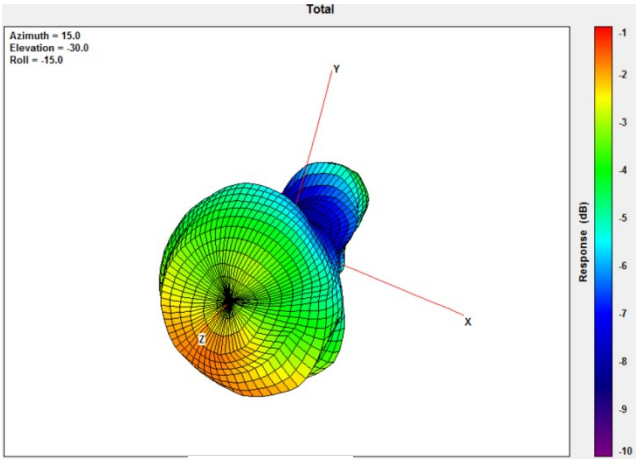

Z
Y
0
30
60
90
120
150
180
210
240
270
300
330
5
-15
-25
-35
-45
704MHz
751MHz
824MHz
960MHz
(dBi)


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

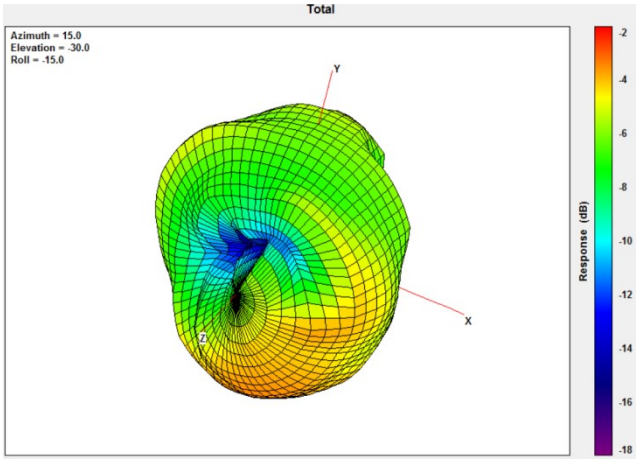

Z
Y
0
10
30
60
90
120
150
180
210
240
270
300
330
-10
-20
-30
-40
2500MHz
2690MHz
(dBi)


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

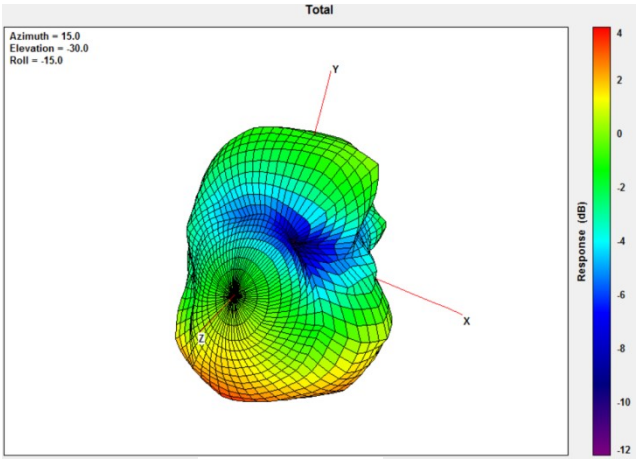
3.3.16 3D Radiation Pattern (LTE_MIMO2)



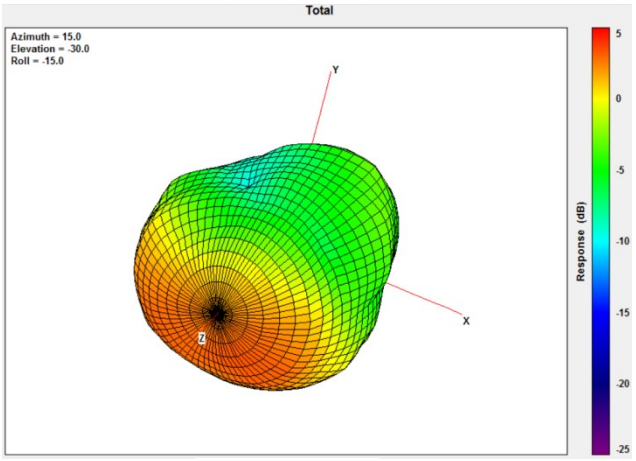
704MHz



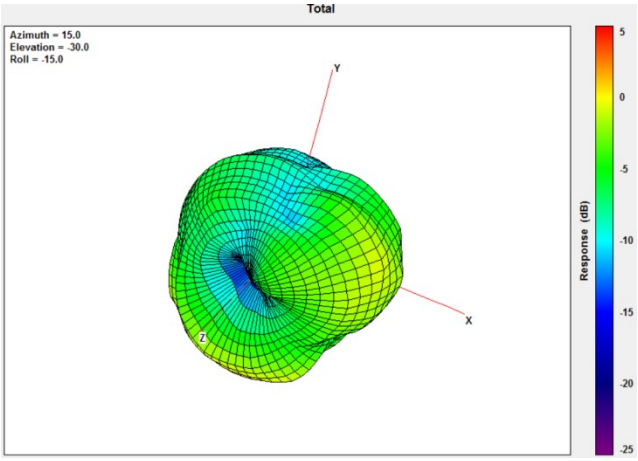
960MHz



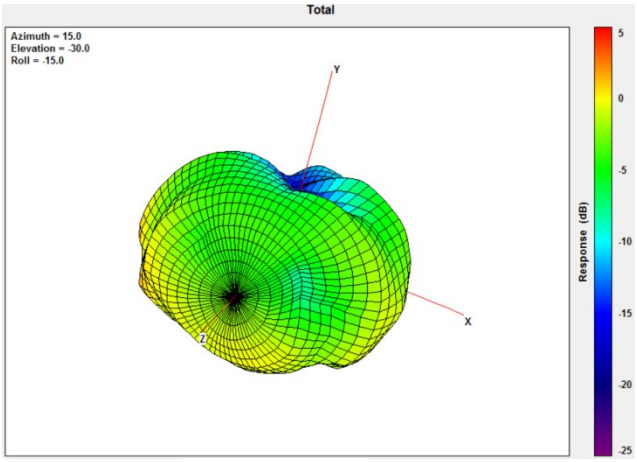
1710MHz



2170MHz



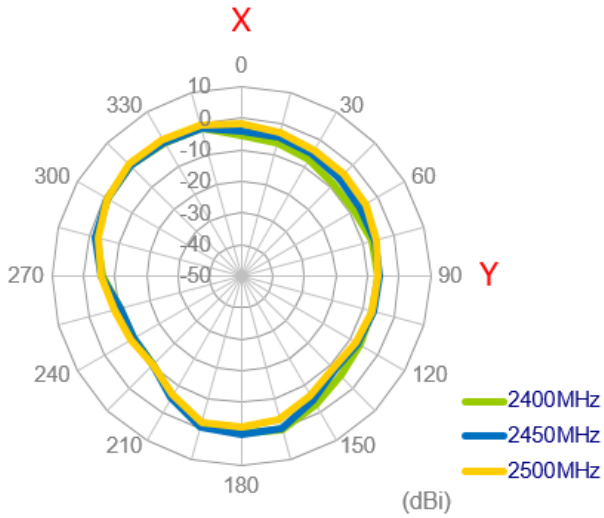
2690MHz

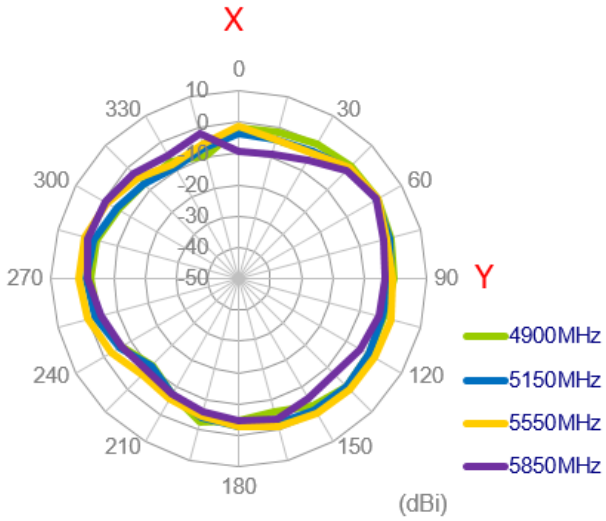


3500MHz

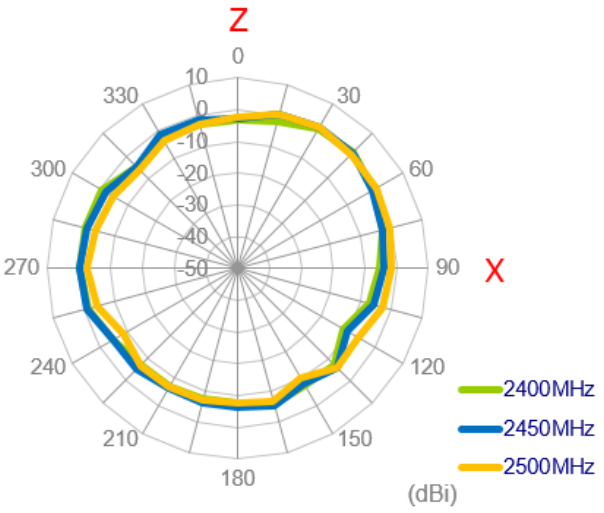
3.3.17 2D Radiation Pattern (Wi-Fi_MIMO1)

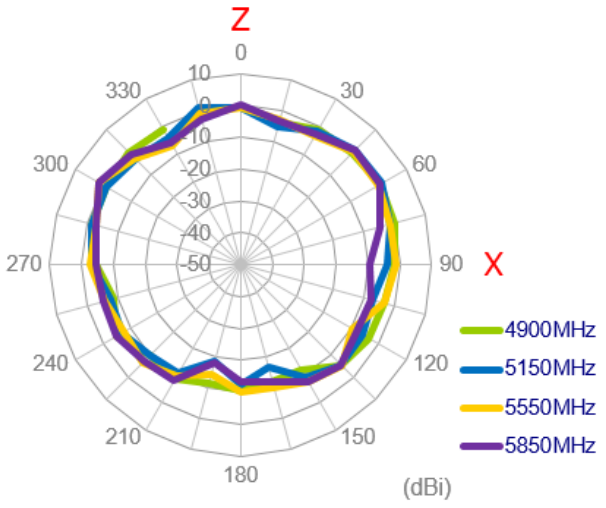
XY Plane



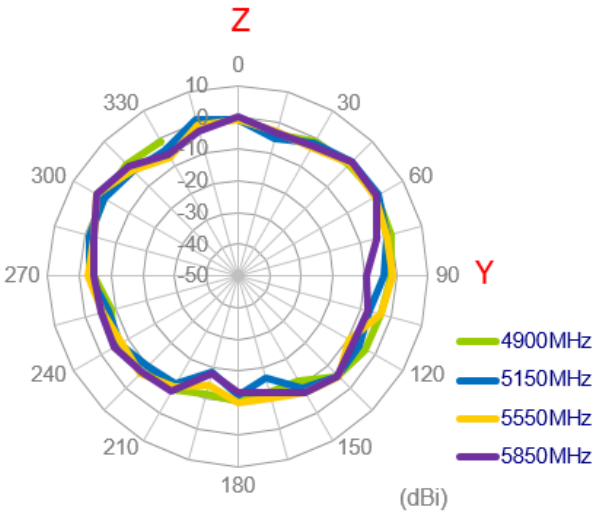


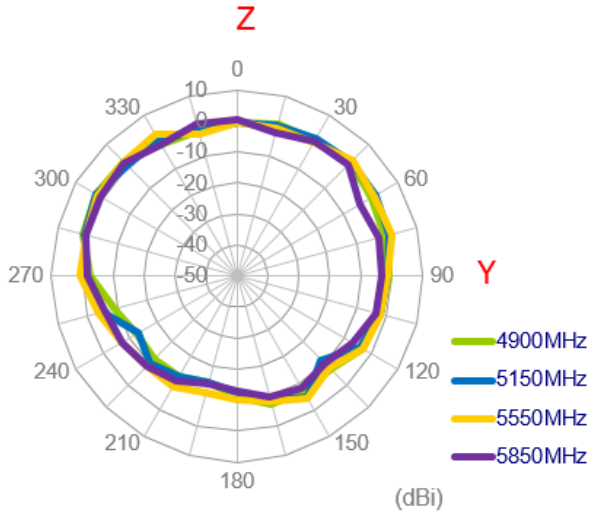
XZ Plane



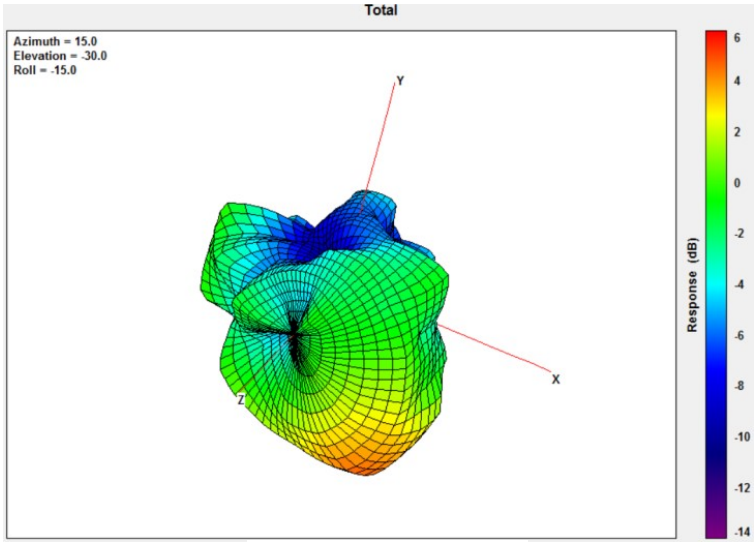


YZ Plane

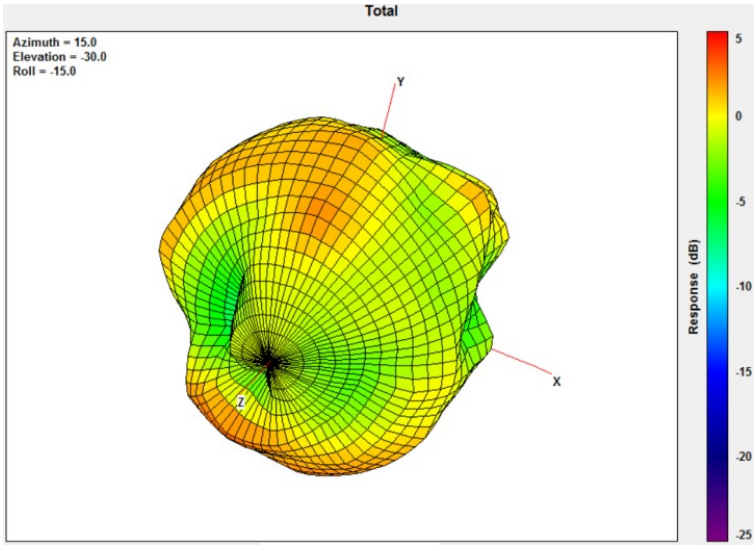




3.3.18 3D Radiation Pattern (Wi-Fi_MIMO1)



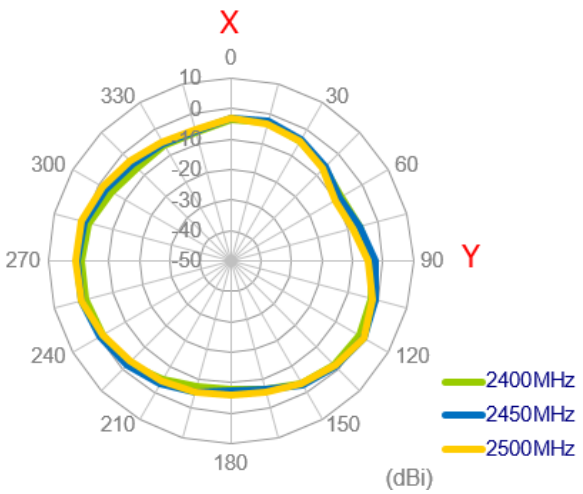
2450MHz

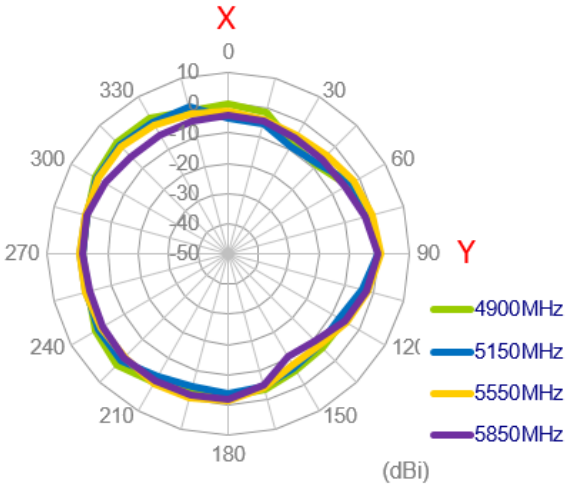


5550MHz

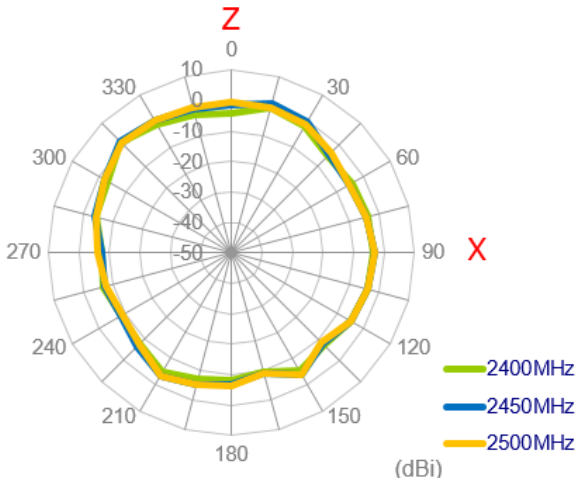
3.3.19 2D Radiation Pattern (Wi-Fi_MIMO2)

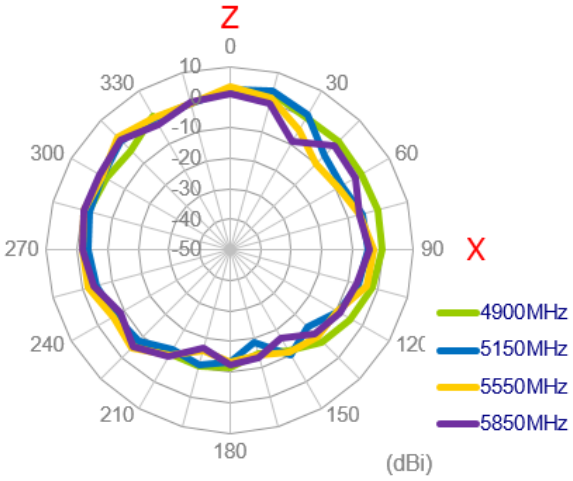
XY Plane



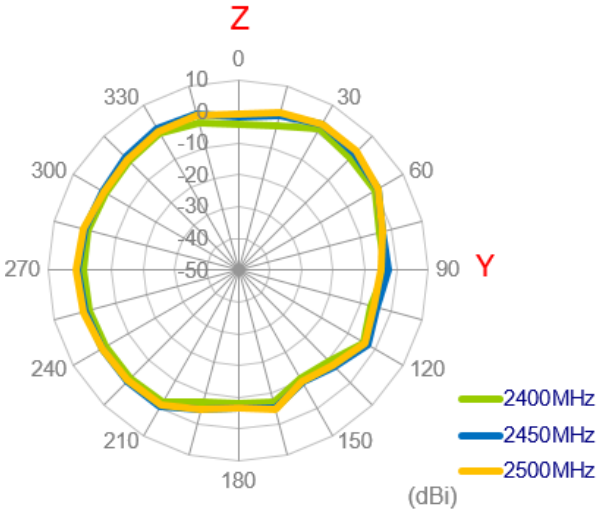


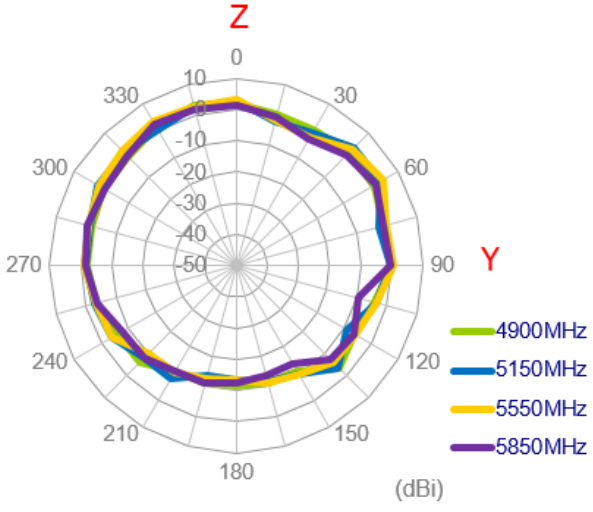
XZ Plane



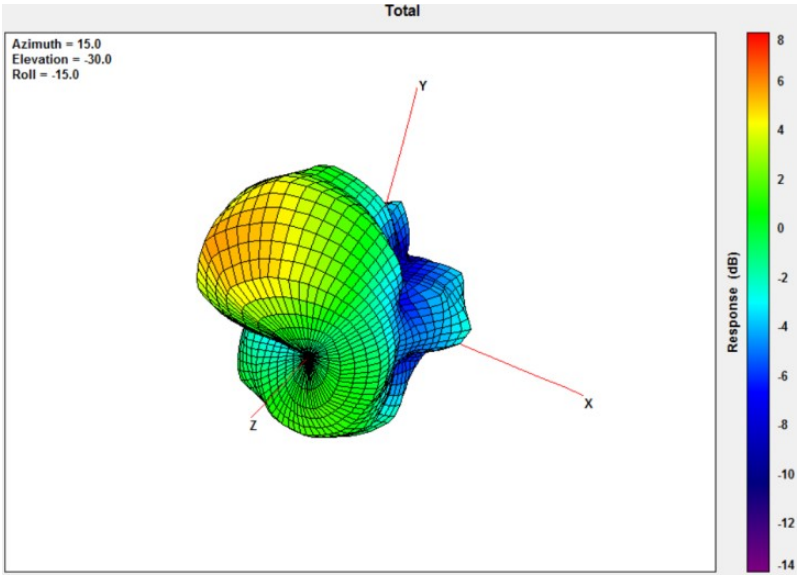


YZ Plane

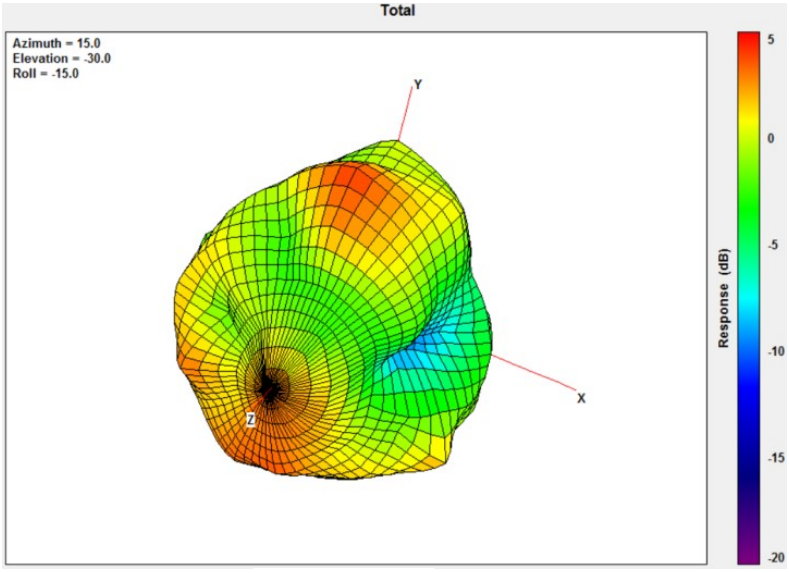




3.3.20 3D Radiation Pattern (Wi-Fi_MIMO2)

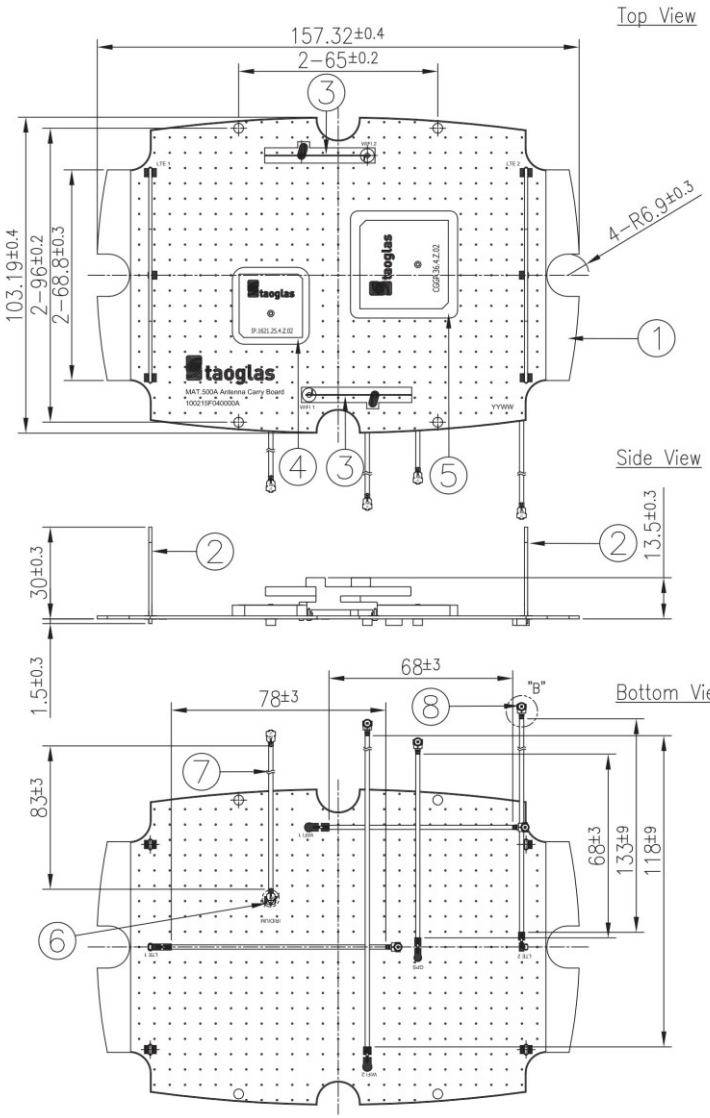


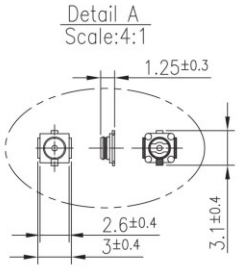
2450MHz

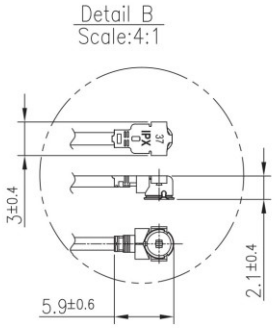


5550MHz

4. Mechanical Drawing (Unit: mm)



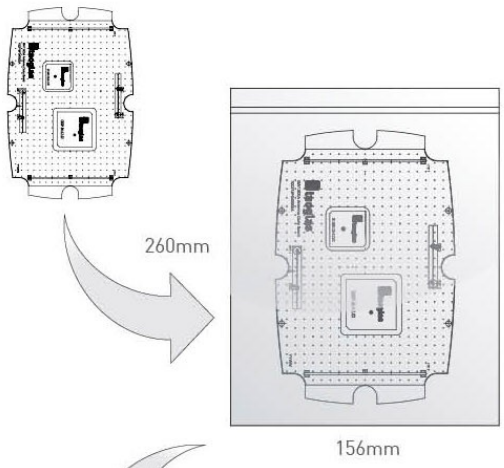




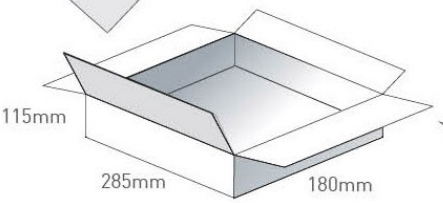
	Name	Material	Finish	QTY
1	MAT.500A Antenna Carry Board	Composite t=1.0	Black	1
2	MAT.500A LTE Antenna Board	Composite t=1.0	Black	2
3	MAT.500 WiFi Antenna	Cu-Ni-Zn Alloy,t=0.25	N/A	2
4	Iridium Antenna (25x25x4)	Ceramic patch	Clear	1
5	GNSS Antenna (36x36x4)	Ceramic patch	Clear	1
6	IPEX MHFI Receptacle	Brass	Au plated	1
7	1.37 Coaxial Cable	FEP	Black	6
8	IPEX.MHFHT	Brass	Au plated	7

5. Packaging

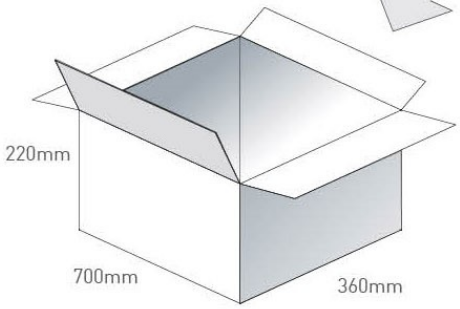
1 pc MAT.500A per PE bag
Tray Dimensions - 156*260mm
Total Weight - 780g



8 pc MAT.500A per inner carton
Dimensions - 285*180*115
Weight - 780g



48 pc MAT.500A per outer carton
Dimensions - 700*360*220
Weight - 6.74Kg



Pallet Dimensions 1060mm*720mm*1470mm
18 Cartons per pallet
6 Cartons per layer
3 Layers