



# Datasheet

## MA285 Series

**Part No:**  
MA285.LBICG.001

### **Description:**

MA285 Adhesive Mount 5-in-1 Combination  
GNSS, 2\*LTE MIMO & 2\*Wi-Fi MIMO Low Profile Antenna

### **Features:**

GPS/ GLONASS/BeiDou  
4G MIMO with fallback to 3G/2G  
Dual Band Wi-Fi MIMO  
Robust PC/ABS, IP67 Rated Enclosure  
1.8~5.5V/30dB  
Cables: 2m RG-174 & 2m Low Loss TGC-200  
Connectors: SMA(M) & RP-SMA(M)  
Cables & Connectors Fully Customizable  
Dimensions: 151.8 \* 59 \* 13mm  
RoHS & REACH Compliant

1. Introduction	3
2. Specifications	4
3. Antenna Characteristics	8
4. Antenna Radiation Patterns	18
5. Mechanical Drawing	32
6. Packaging	33
7. Application Note	34
8. Drop Test	43
<hr/>	
Changelog	52

Taoglas makes no warranties based on the accuracy or completeness of the contents of this document and reserves the right to make changes to specifications and product descriptions at any time without notice. Taoglas reserves all rights to this document and the information contained herein. Reproduction, use or disclosure to third parties without express permission is strictly prohibited.

Copyright © Taoglas Ltd.



# 1. Introduction



The Taoglas MA285 is one of the smallest 5-in-1 low profile, adhesive mount, combination antennas on the market. Comprising of GNSS, 2\* LTE MIMO and 2\* Wi-Fi MIMO, this unique antenna delivers powerful LTE antenna technology, that includes backward compatibility to work at most worldwide 3G and 2G bands. Coupled with GPS, GLONASS & BeiDou and dual-band 2.4/5.8GHz Wi-Fi MIMO, it is ideal for next generation, multiple wireless technology systems, such as vehicle telematics and applications that require highly sophisticated antennas for real-time streaming demanding high-speed video uplink and downlink into the cabin of the vehicle. These challenges are resolved by the highly efficient, high gain MIMO antennas, with high isolation, all of which is necessary to achieve the required signal to noise ratio and throughput.

The LTE & Wi-Fi antennas have an omnidirectional radiation pattern and the robust PC/ABS enclosure is fully IP67 waterproof and design for use in the harshest of environments. The GNSS antenna has been carefully designed to work equally well on both GPS/GALILEO and GLONASS bands, leading to higher location accuracy and stability of tracking in urban environments.

Typical Applications Include:

- Next Generation OEM Automotive Connectivity
- Multimedia, Navigation and Telematics Systems
- V2V, V2X and Fleet Management Applications
- Real-time HD Video Streaming
- Digital Signage and Remote Monitoring
- First Net Responder Routers

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

## 2. Specifications

### LTE MIMO1 and MIMO2

Band	LTE700	GSM850	GSM900	DCS	PCS	UMTS1	LTE2600	
Frequency (MHz)	698~803	824~894	880~960	1710~1880	1850~1990	1920~2170	2300~2690	
<b>Efficiency (%)</b>								
MIMO1	0.3m	56.88	64.17	68.41	62.92	60.73	62.35	61.23
	1m	53.80	61.28	65.33	57.39	55.39	57.31	55.84
	2m	50.21	56.24	59.59	51.13	48.72	50.18	48.36
	3m	46.49	52.16	55.25	45.48	43.10	44.40	42.01
	5m	43.05	48.38	51.24	40.44	38.14	39.28	36.50
MIMO2	0.3m	65.41	53.23	49.54	74.95	76.59	79.35	75.16
	1m	61.77	50.84	47.31	68.35	69.85	72.93	68.55
	2m	57.64	46.66	43.15	60.88	61.42	63.88	59.35
	3m	53.46	43.27	40.02	54.16	54.35	56.50	51.56
	5m	49.59	40.12	37.12	48.16	48.09	49.98	44.80
<b>Average Gain (dB)</b>								
MIMO1	0.3m	-2.45	-1.93	-1.65	-2.01	-2.17	-2.05	-2.13
	1m	-2.69	-2.13	-1.85	-2.41	-2.57	-2.42	-2.53
	2m	-2.99	-2.50	-2.25	-2.91	-3.12	-2.99	-3.16
	3m	-3.33	-2.83	-2.58	-3.42	-3.66	-3.53	-3.77
	5m	-3.66	-3.15	-2.90	-3.93	-4.19	-4.06	-4.38
MIMO2	0.3m	-1.84	-2.74	-3.05	-1.25	-1.16	-1.00	-1.24
	1m	-2.09	-2.94	-3.25	-1.65	-1.56	-1.37	-1.64
	2m	-2.39	-3.31	-3.65	-2.16	-2.12	-1.95	-2.27
	3m	-2.72	-3.64	-3.98	-2.66	-2.65	-2.48	-2.88
	5m	-3.05	-3.97	-4.30	-3.17	-3.18	-3.01	-3.49
<b>Peak Gain (dBi)</b>								
MIMO1	0.3m	2.49	2.84	2.58	4.05	4.63	5.01	3.85
	1m	2.29	2.64	2.38	3.65	4.23	4.71	3.45
	2m	1.99	2.34	1.98	3.15	3.63	4.11	2.85
	3m	1.61	1.94	1.68	2.55	3.13	3.51	2.25
	5m	1.31	1.54	1.38	1.95	2.63	2.91	1.65
MIMO2	0.3m	2.98	3.35	2.83	4.69	3.58	4.20	4.22
	1m	2.68	3.15	2.63	4.29	3.18	3.90	3.82
	2m	2.38	2.75	2.23	3.79	2.58	3.30	3.22
	3m	2.08	2.45	1.93	3.29	2.08	2.70	2.62
	5m	1.78	2.15	1.63	2.79	1.58	2.10	2.02
Impedance				50 Ω				
Polarization				Linear				

## Wi-Fi Antenna (2.4GHz/5.8GHz)

Frequency (MHz)		2400~2500	4900~5850
<b>Efficiency (%)</b>			
MIMO1	0.3m	56.61	64.55
	1m	51.63	55.53
	2m	47.11	47.78
	3m	41.01	38.77
	5m	31.11	25.47
MIMO2	0.3m	52.46	67.41
	1m	47.84	58.00
	2m	43.63	49.89
	3m	38.00	40.49
	5m	28.83	26.60
<b>Average Gain (dB)</b>			
MIMO1	0.3m	2.12	4.10
	1m	1.72	3.44
	2m	1.12	2.53
	3m	0.52	1.62
	5m	-0.68	-0.21
MIMO2	0.3m	2.16	3.62
	1m	1.76	2.96
	2m	1.16	2.05
	3m	0.56	1.14
	5m	-0.64	-0.69
<b>Peak Gain (dBi)</b>			
MIMO1	0.3m	-2.21	-0.87
	1m	-2.61	-1.47
	2m	-3.01	-2.07
	3m	-3.61	-2.87
	5m	-4.81	-4.67
MIMO2	0.3m	-2.13	-1.10
	1m	-2.53	-1.74
	2m	-2.93	-2.34
	3m	-3.53	-3.14
	5m	-4.73	-4.94
Impedance		50 Ω	
Return loss		< -6 dB	
Polarization		Linear	

## GNSS

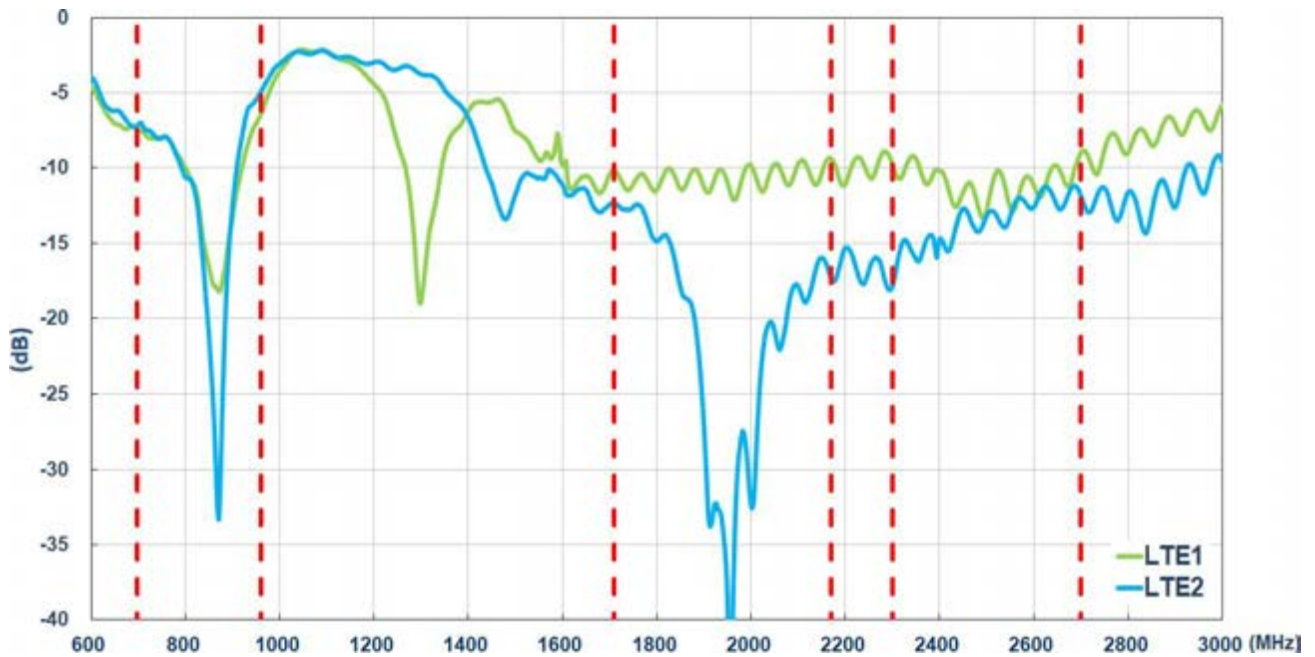
GNSS Electrical			
Frequency	BEIDOU : $1561.098 \pm 2.046\text{MHz}$ . GPS : $1575.42 \pm 1.023\text{MHz}$ GLONASS : $1602 \pm 5\text{MHz}$		
Bandwidth - Return Loss <-10 dB	12.5 MHz min		
Return loss (GPS L1 GLONASS L1)	< -10 dB		
Passive Gain at Zenith (GPS L1 and GLONASS L1)	+2.3 dBi typ.		
Polarization	RHCP		
Impedance	50 $\Omega$		
LNA Out-band Attenuation	$f_o = 1575.42\text{MHz}$ $f_o \pm 50 \text{ MHz } 8\text{dB Min.}$ $f_o \pm 100 \text{ MHz } 22\text{dB Min.}$ $f_o \pm 150 \text{ MHz } 26\text{dB Min.}$		
Input Voltage	Min:1.8V	Typ. 3.0V	Max: 5.5V
Total Gain @ Zenith	25.3dBi	25.5dBi	25.3dBi
Current Consumption	5 mA	10 mA	23 mA
Noise Figure	3.0 dB	2.8 dB	3.0 dB

Mechanical	
Dimensions	151.8*59*13 mm
Cable	LTE MIMO1/ MIMO2: 2000mm TGC200 WI-FI MIMO1/ MIMO2: 2000mm TGC200 GNSS: 2000mm RG174
Connector	LTE: SMA Plug WI-FI: RP SMA Plug GNSS: SMA Plug
Casing	PC+ABS
Adhesive	3M 9448HK + CR4305
Sealant	Rubber Stopper
Weight	180 g (Not Included Cable And Package)
Environmental	
Protection	IP67
Temperature Range	-40°C to +85°C
Thermal Shock	100 cycles -40°C to +85°C
Humidity	Non-condensing 65°C 95% RH
Cable Pull	8 Kgf
Recommended Mounting Torque	RG174 - 4 Kg / TGC200 - 9Kg
Maximum Mounting Torque	SMA 17.28kgf-cm

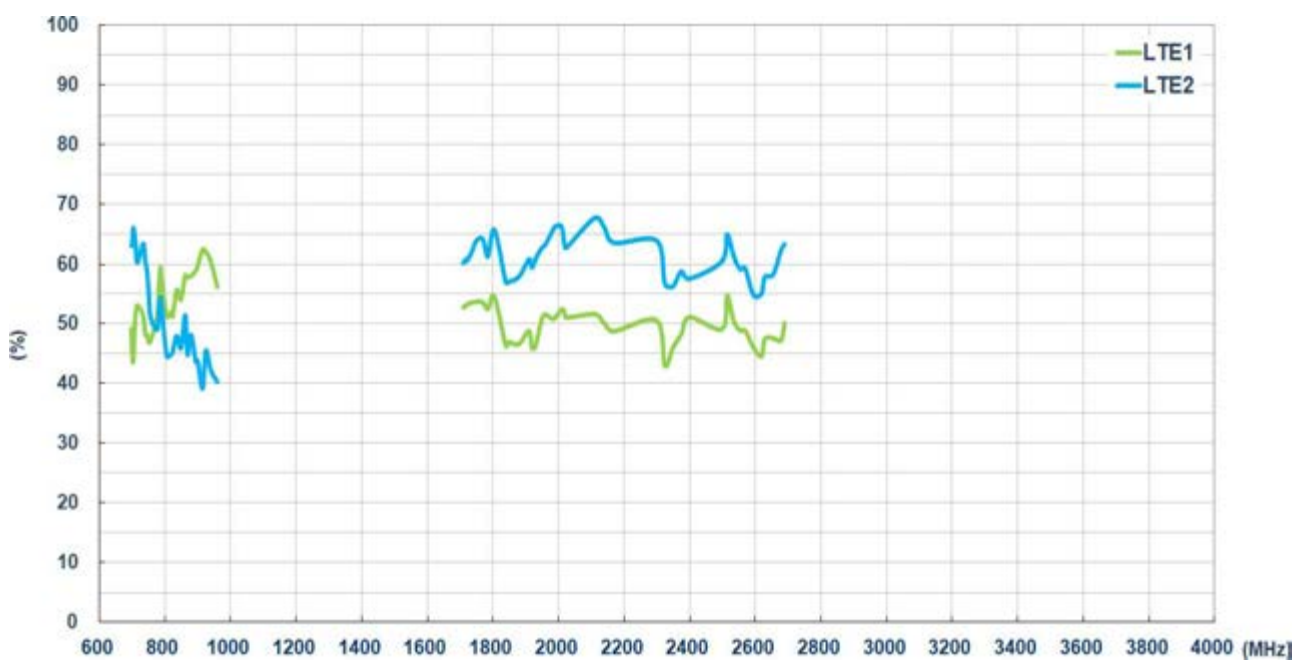
### 3. Antenna Characteristics

#### 3.1 LTE MIMO1 and MIMO2 Antennas

##### 3.1.1. Return Loss – LTE MIMO1 and MIMO2

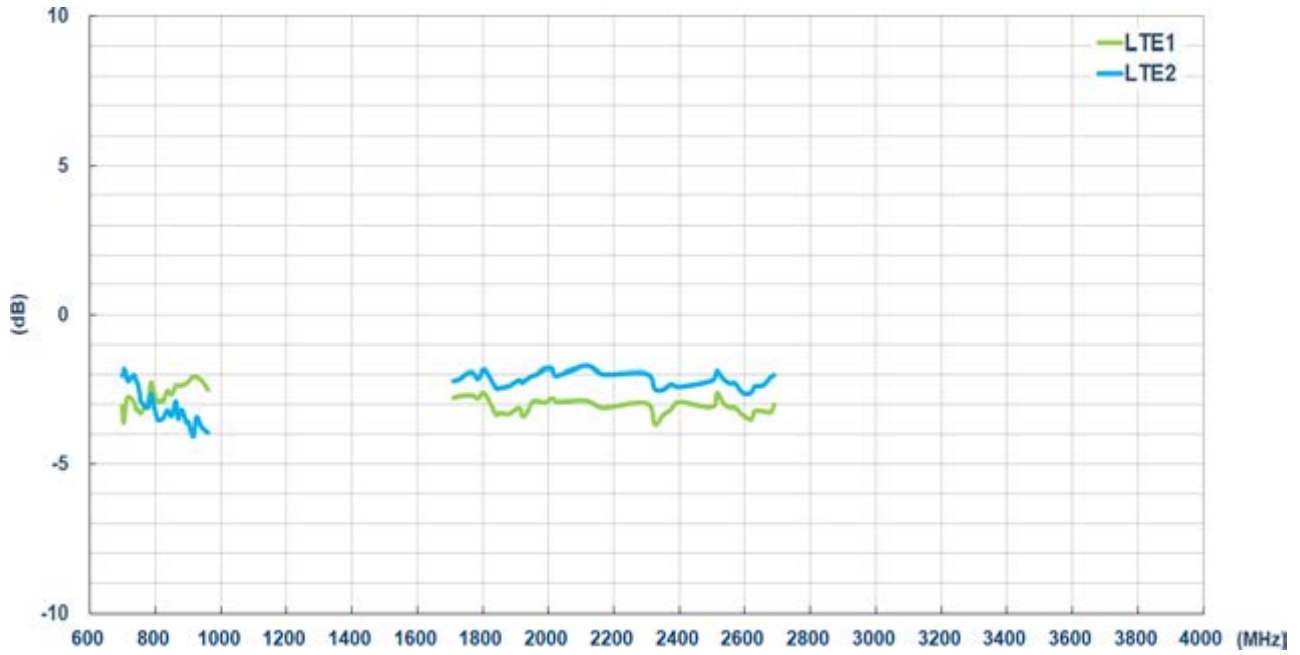


##### 3.1.2. Efficiency – LTE MIMO1 and MIMO2





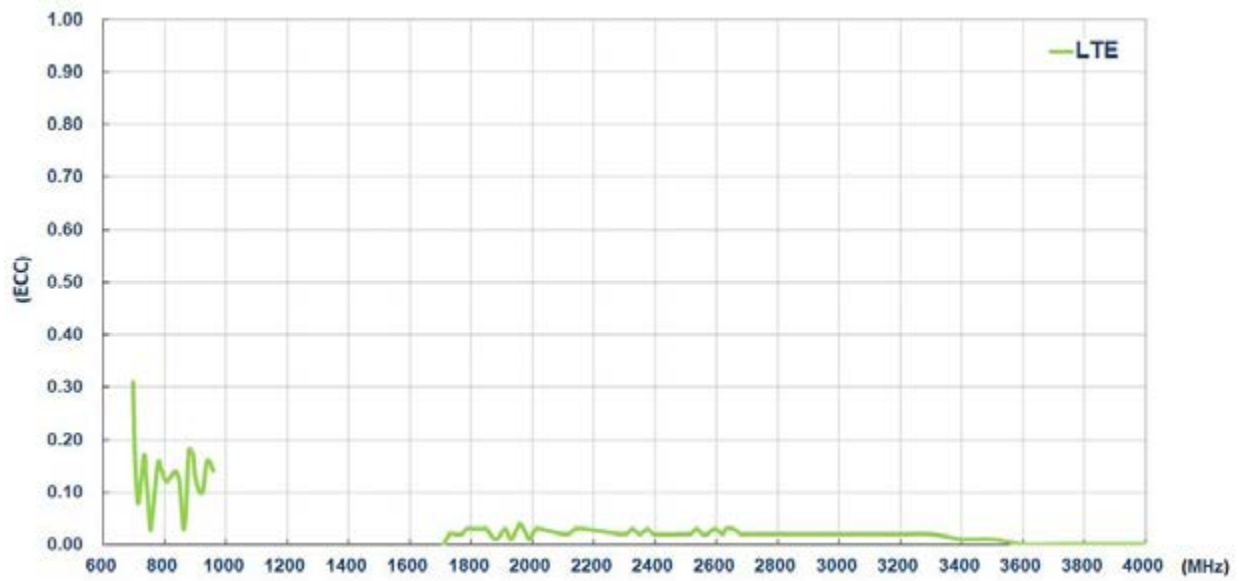
### 3.1.3. Average Gain – LTE MIMO1 and MIMO2



### 3.1.4. Peak Gain – LTE MIMO1 and MIMO2

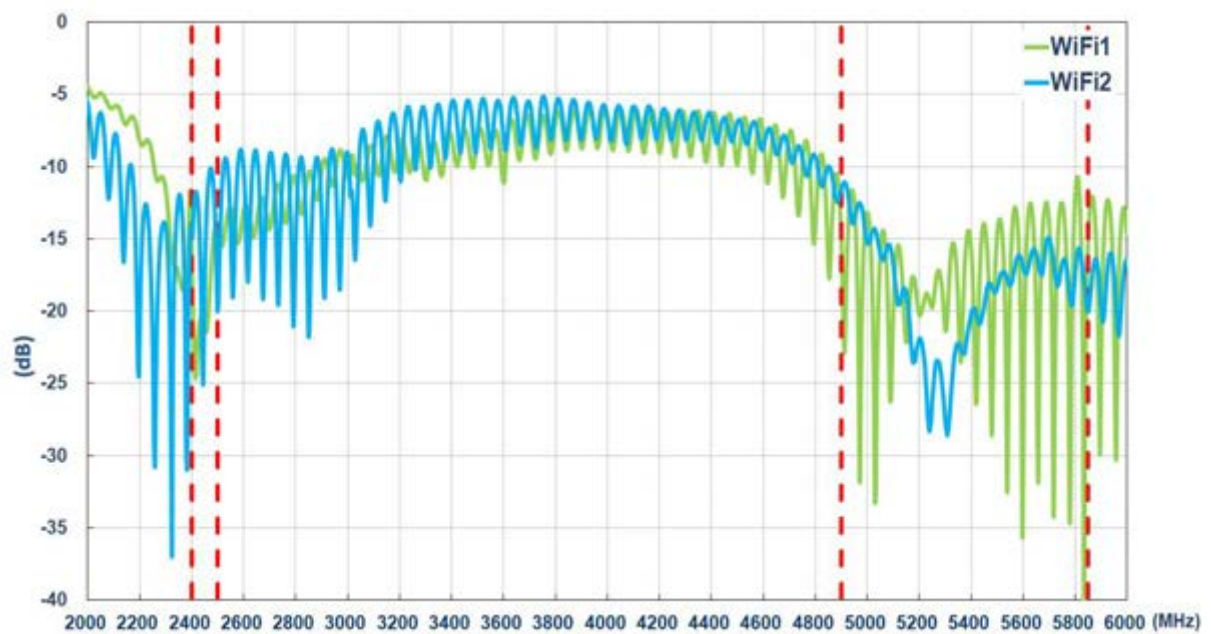


### 3.1.5. ECC – LTE MIMO1 and MIMO2

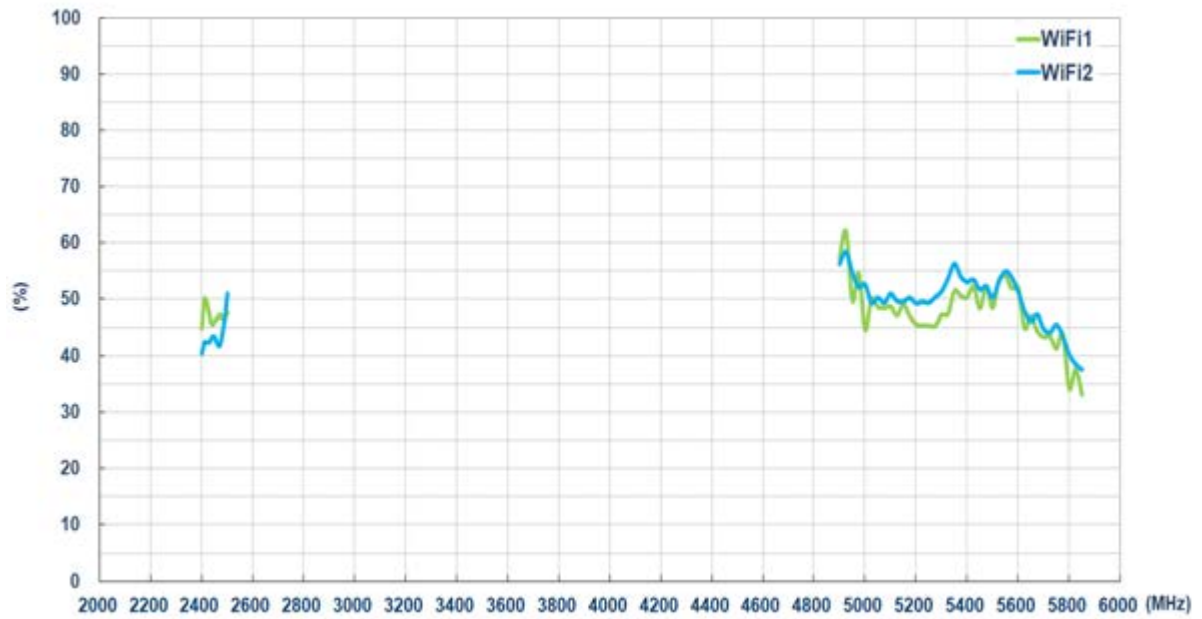


## 3.2 Wi-Fi MIMO1 and MIMO2 Antennas

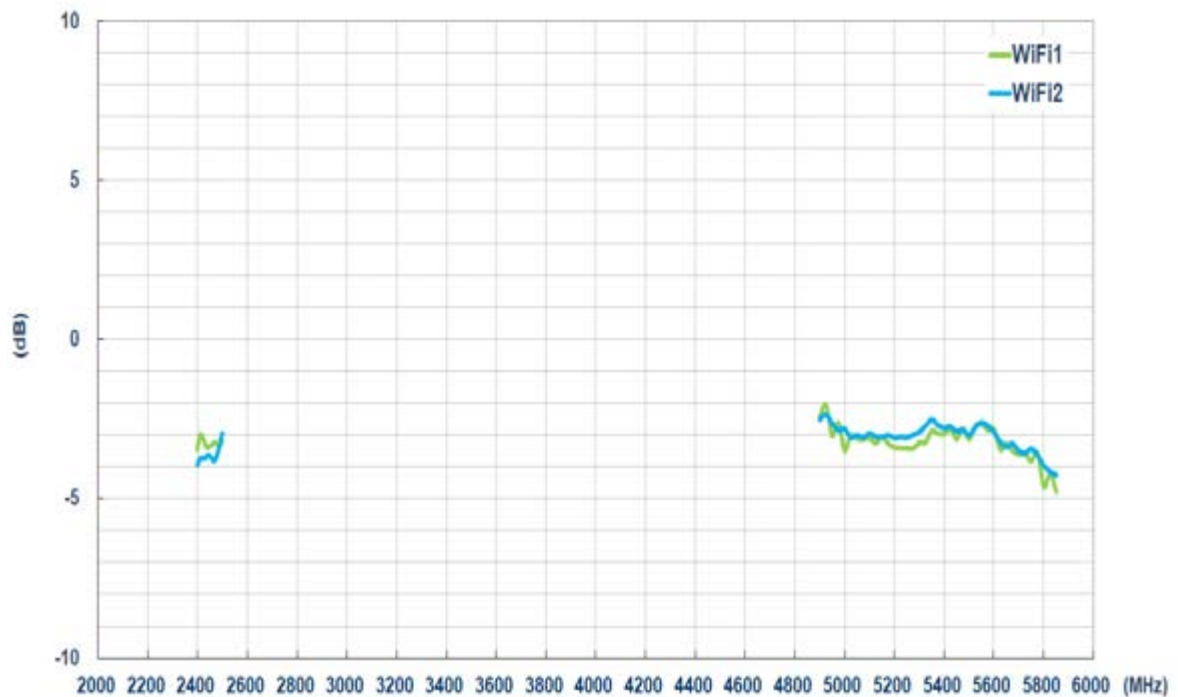
### 3.2.1. Return Loss – Wi-Fi MIMO1 and MIMO2



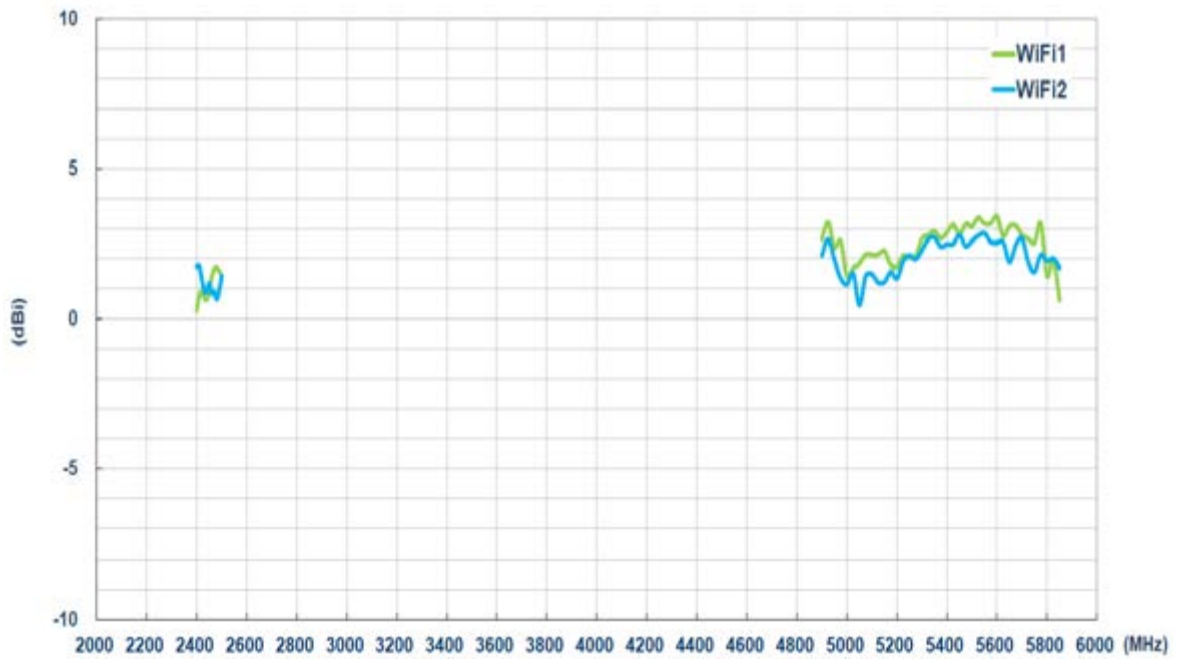
### 3.2.2. Efficiency – Wi-Fi MIMO1 and MIMO2



### 3.2.3. Average Gain – Wi-Fi MIMO1 and MIMO2



### 3.2.4. Peak Gain – Wi-Fi MIMO1 and MIMO2

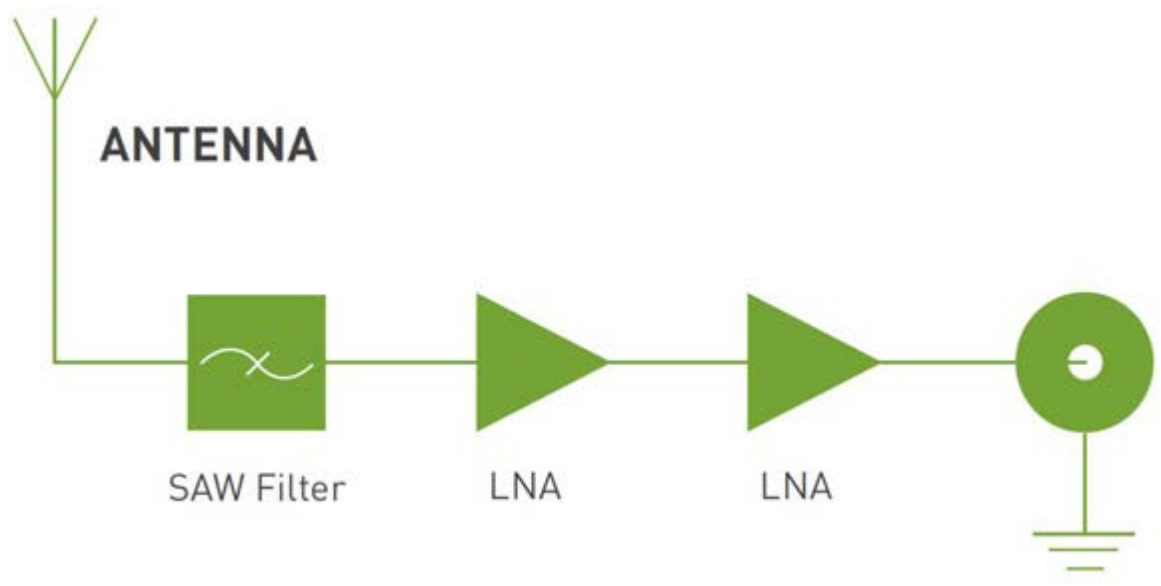


### 3.2.5. Isolation – Wi-Fi MIMO1 and MIMO2

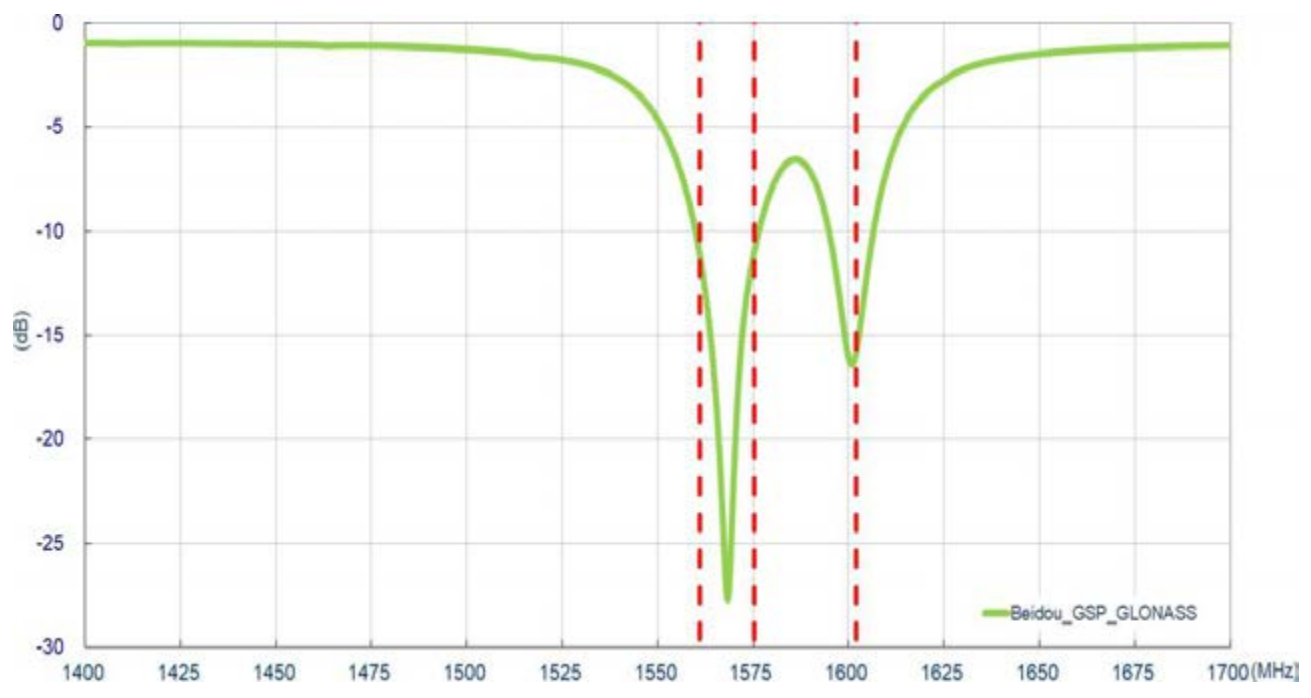


### 3.3 GNSS Antenna

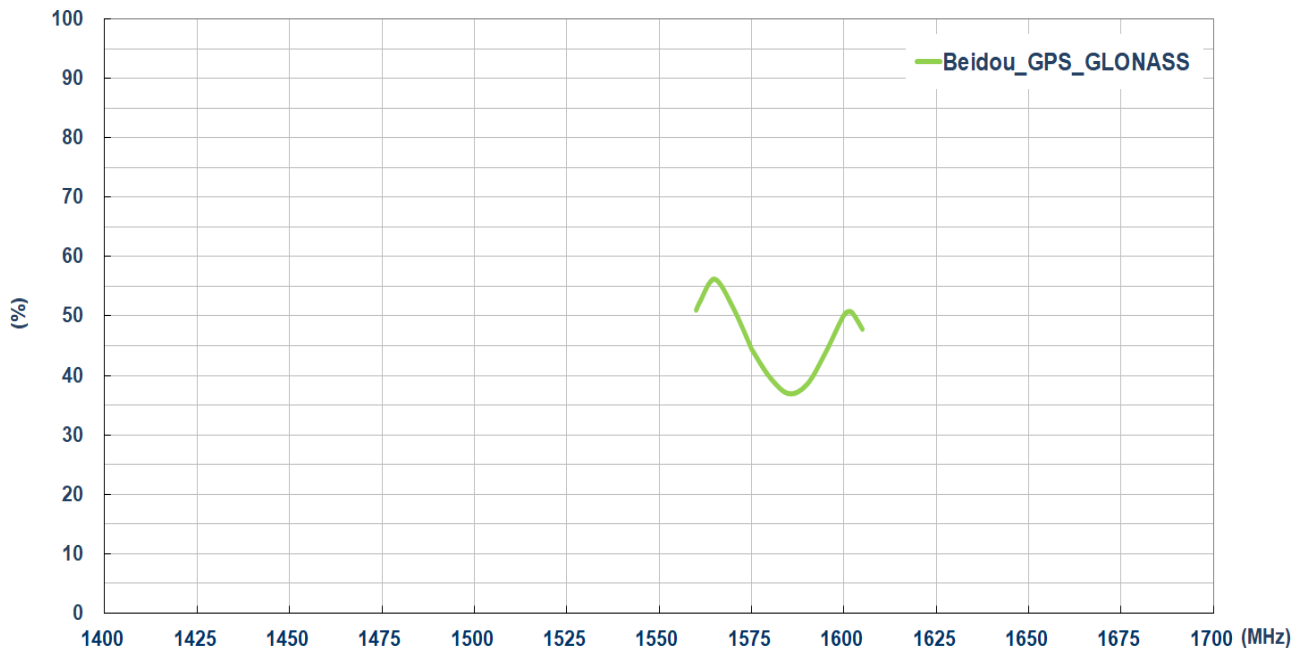
#### 3.3.1. Block Diagram (Active antenna)



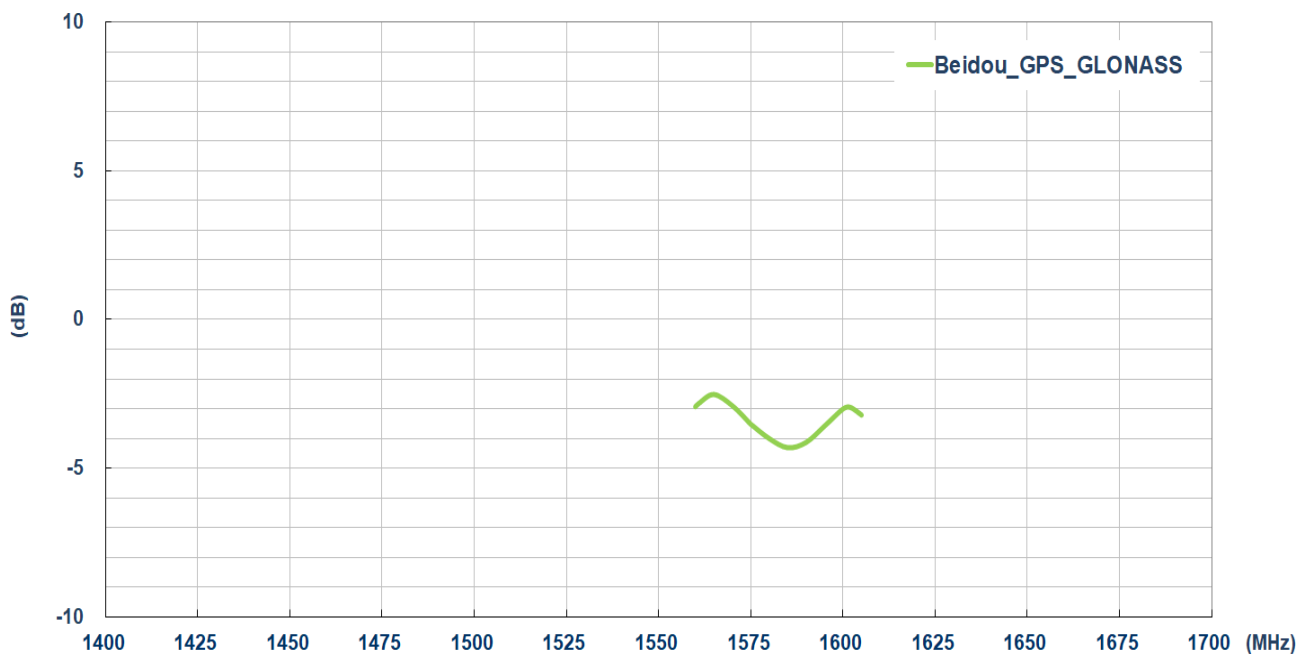
#### 3.3.2. Return Loss – GNSS Antenna



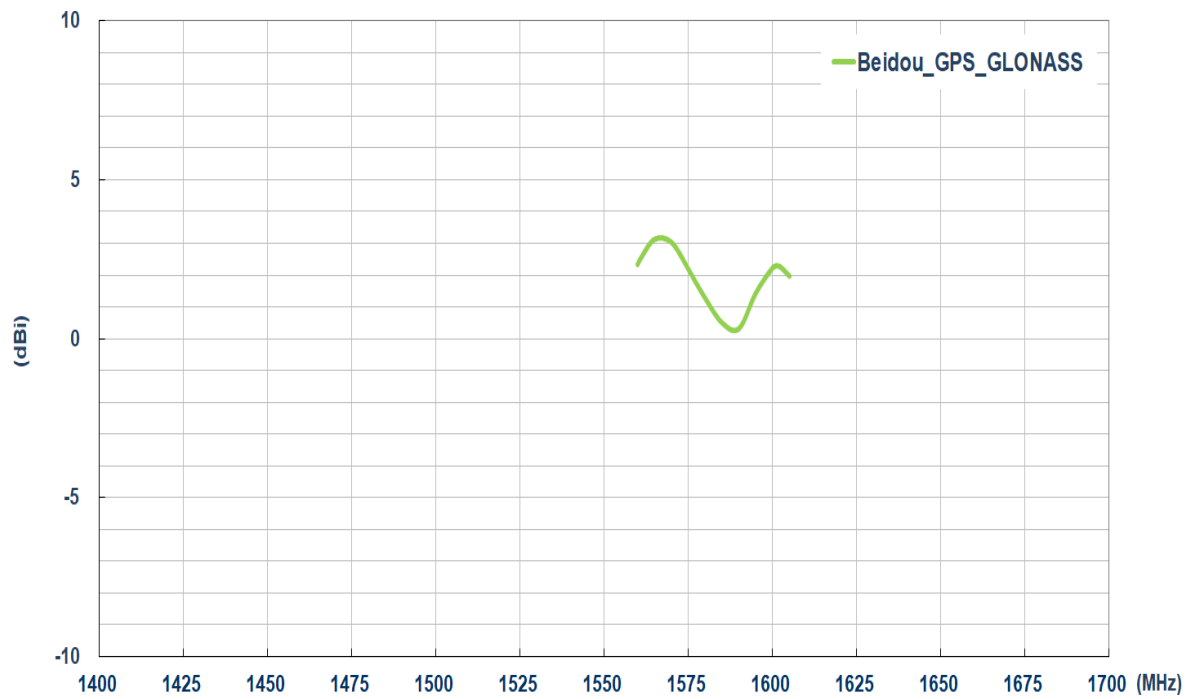
### 3.3.3. Efficiency – GNSS Antenna (passive measurement)



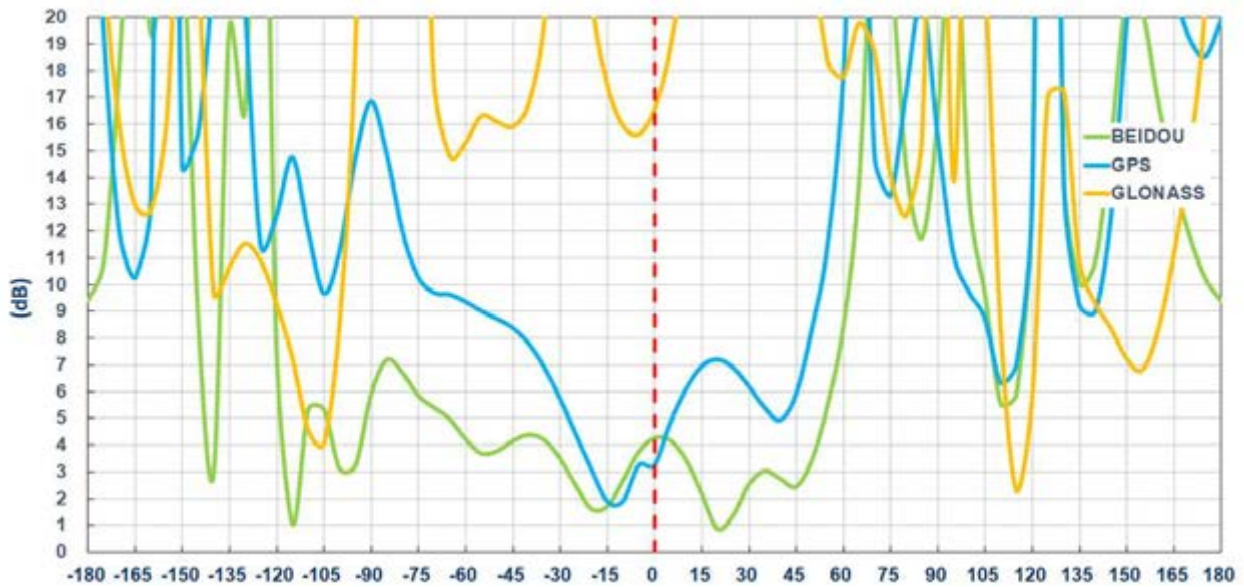
### 3.3.4. Average Gain – GNSS Antenna (passive measurement)



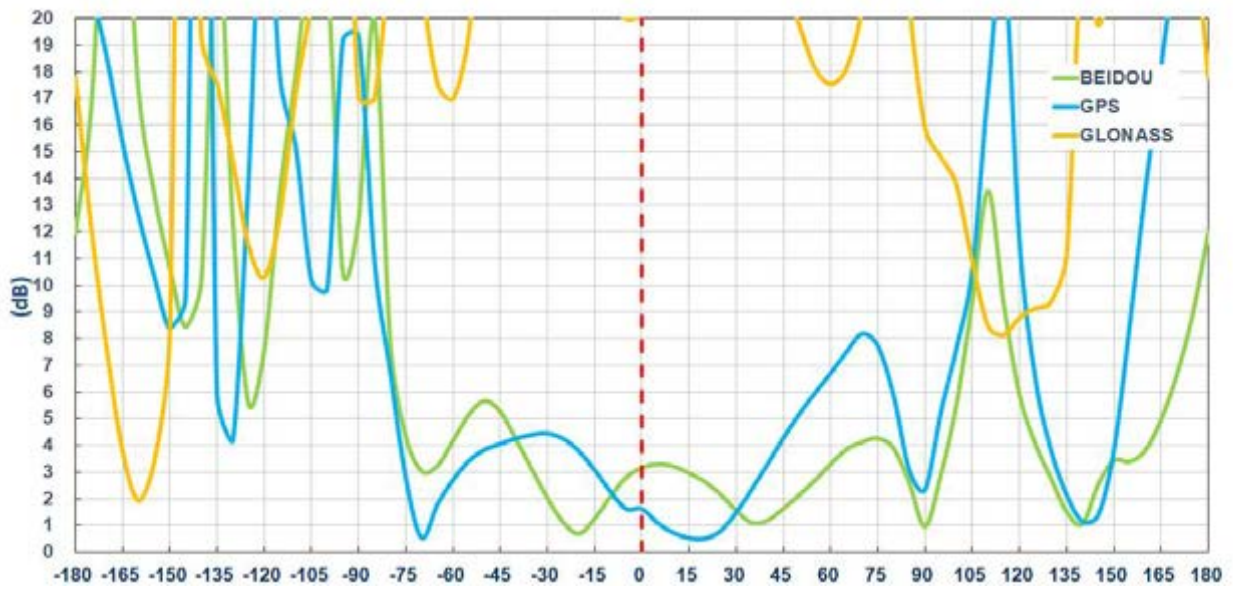
### 3.3.5. Peak Gain – GNSS Antenna (passive measurement)



### 3.3.6. Axial Ratio (XY Plane) – GNSS Antenna (Zenith is at 0°)

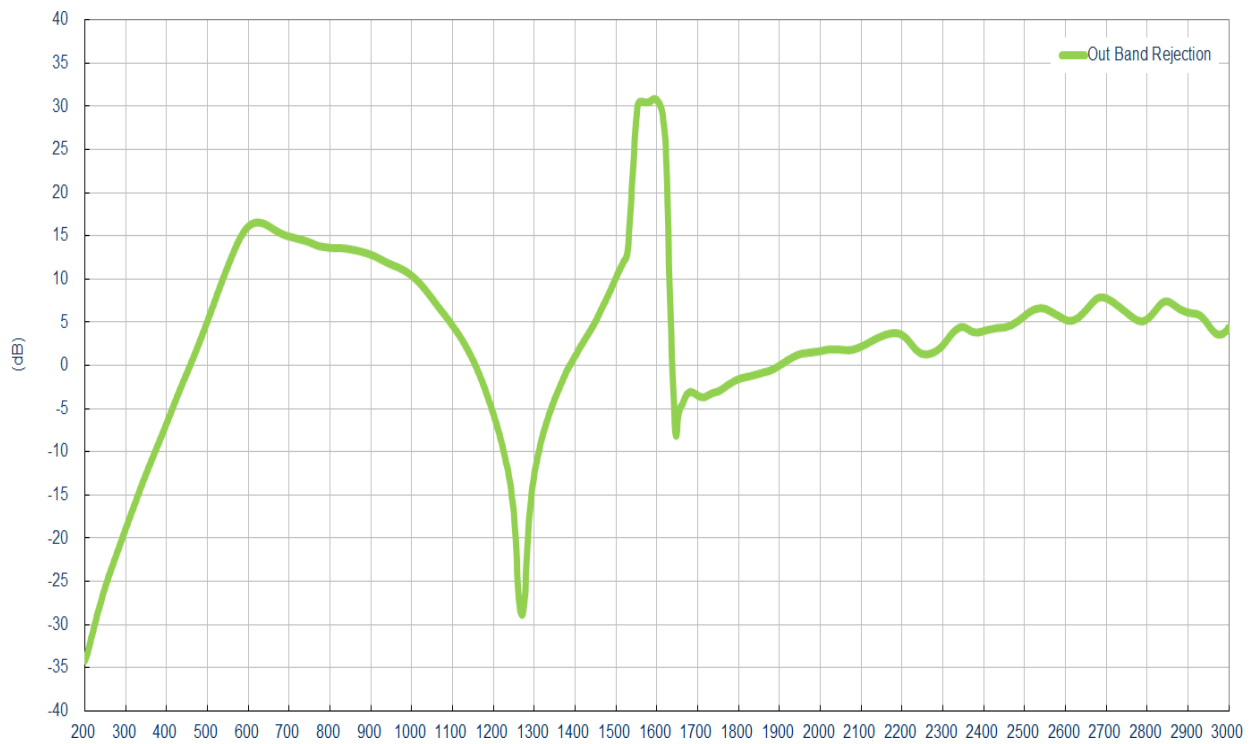


3.3.7. Axial Ratio (XZ Plane) – GNSS Antenna (Zenith is at 0°)

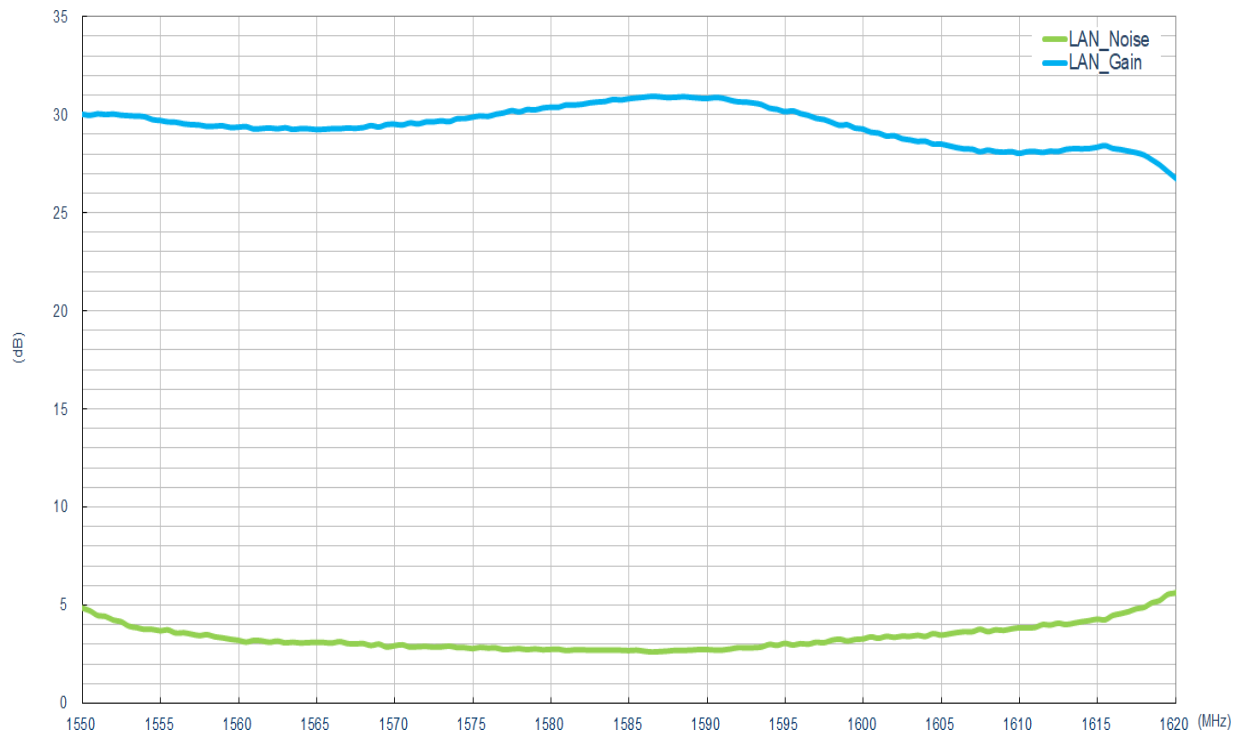




### 3.3.8. GNSS Antenna Active Measurements LNA Gain @ 3.0V



### 3.3.9. LNA Gain and Noise Figure @ 3.0V



## 4. Antenna Radiation Patterns

### 4.1 Test Setup

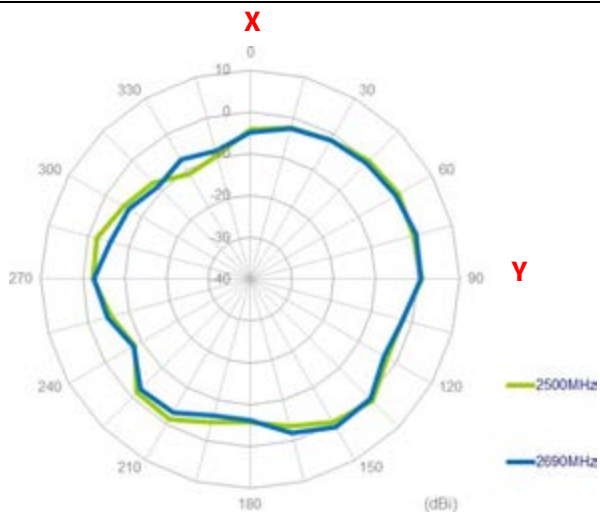
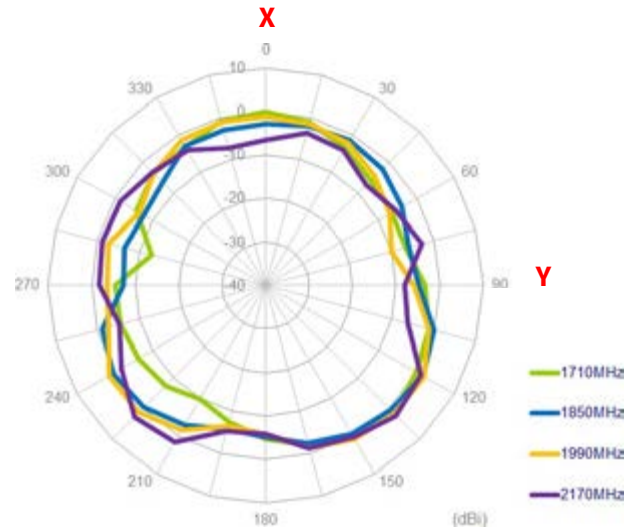
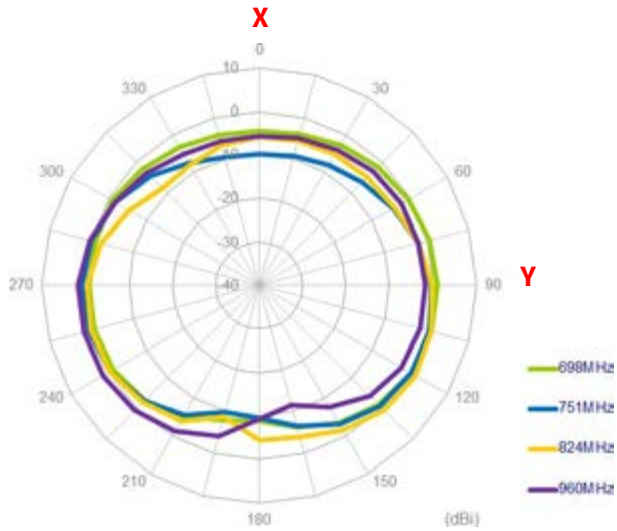


Free space

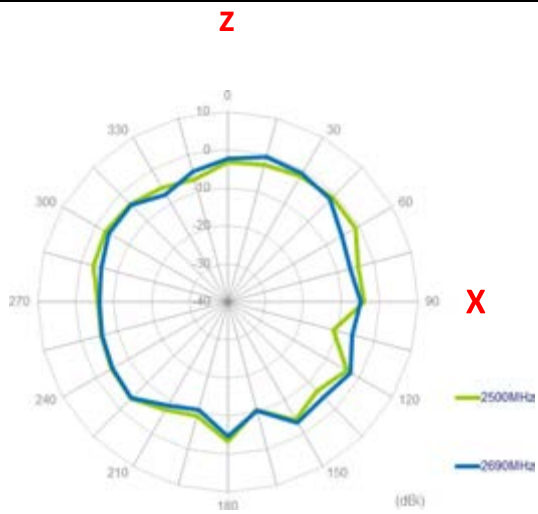
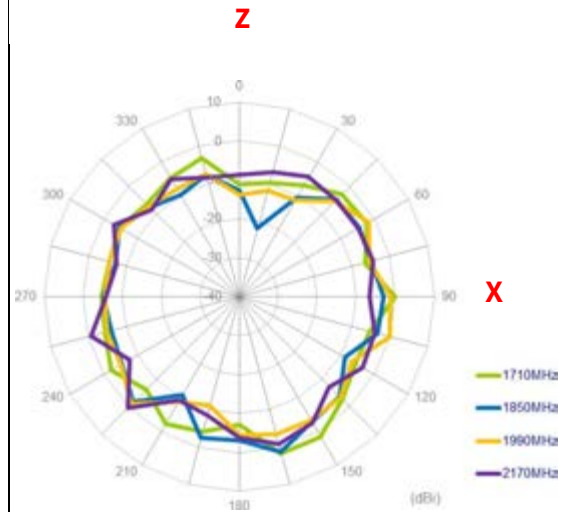
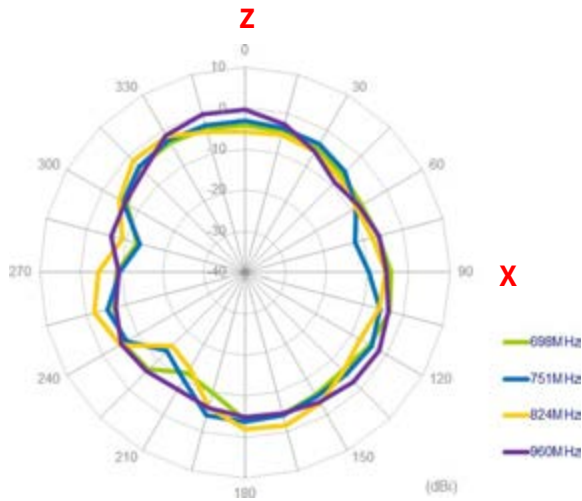
## 4.2 2D Radiation Patterns

### 4.2.1. LTE MIMO1

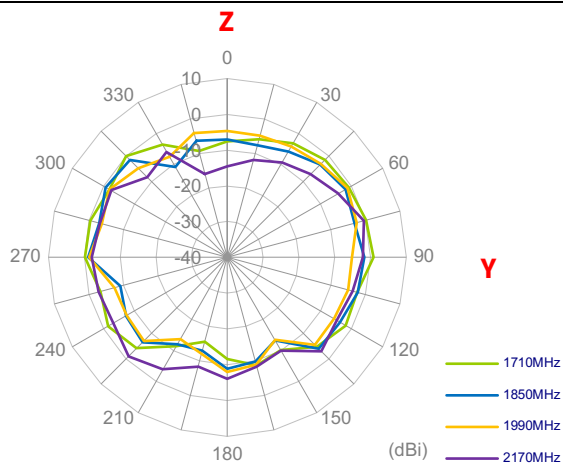
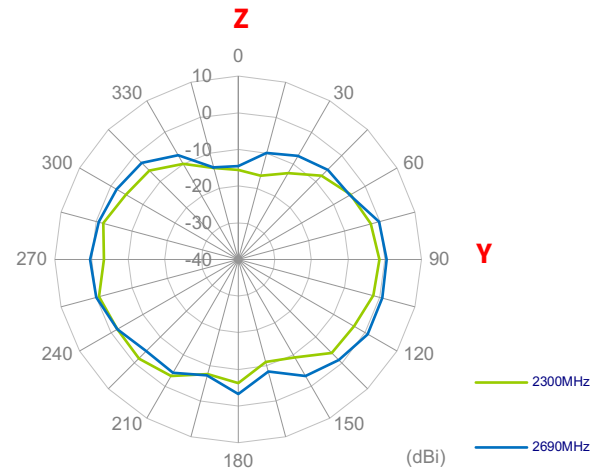
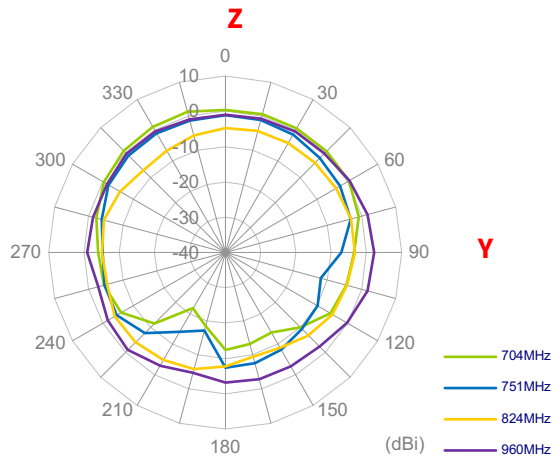
#### XY Plane



XZ Plane

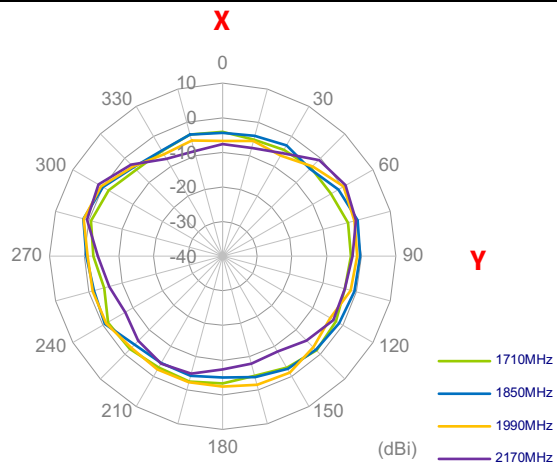
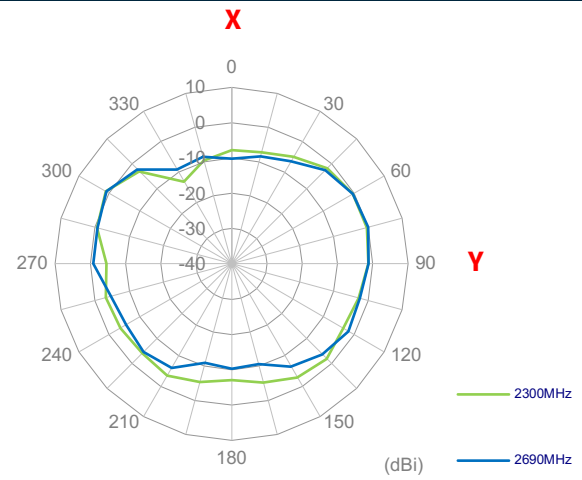
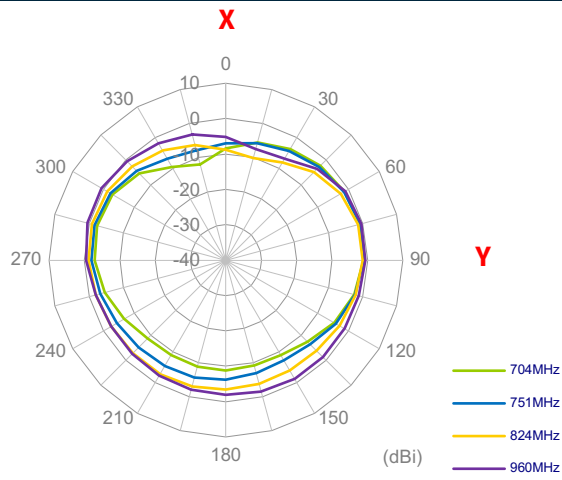


## YZ Plane

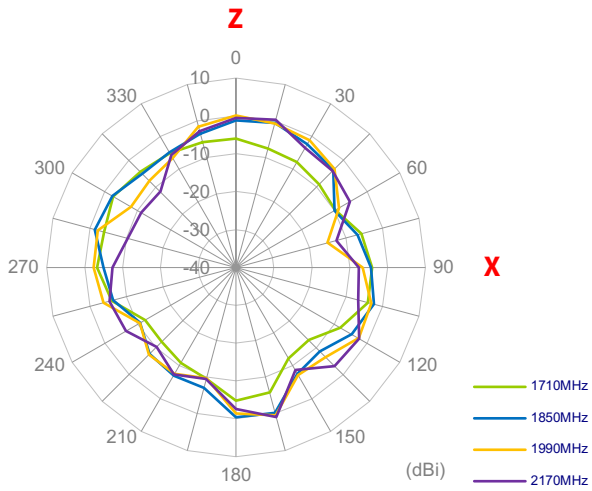
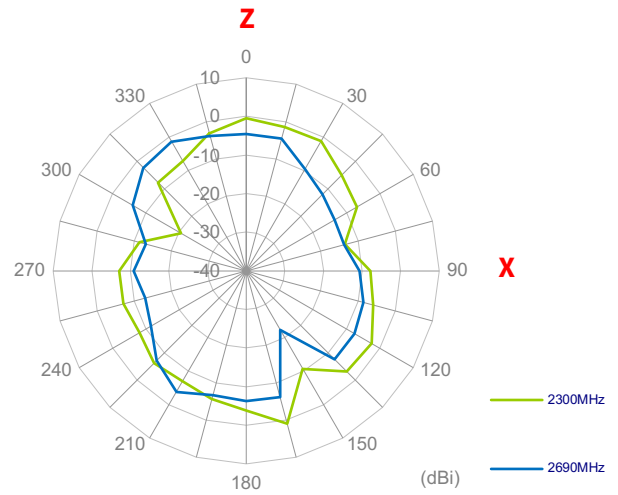
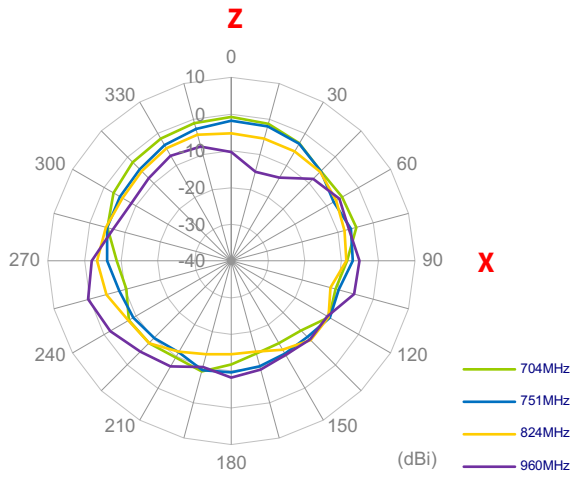


### 4.2.2. LTE MIMO2

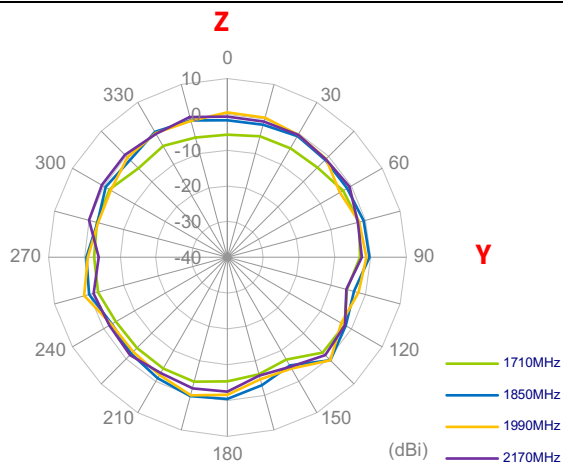
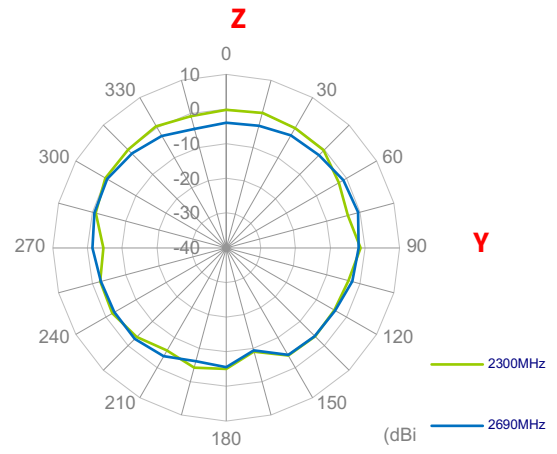
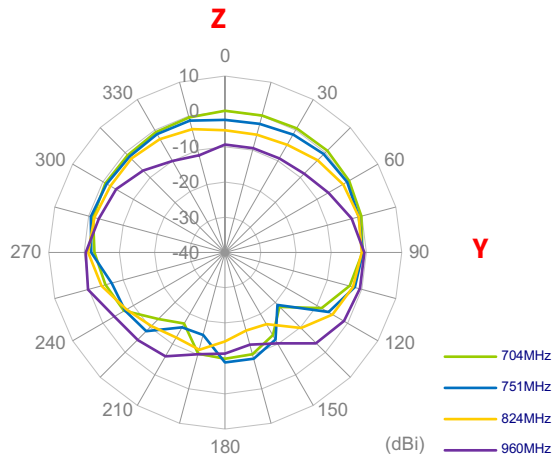
#### XY Plane



## XZ Plane



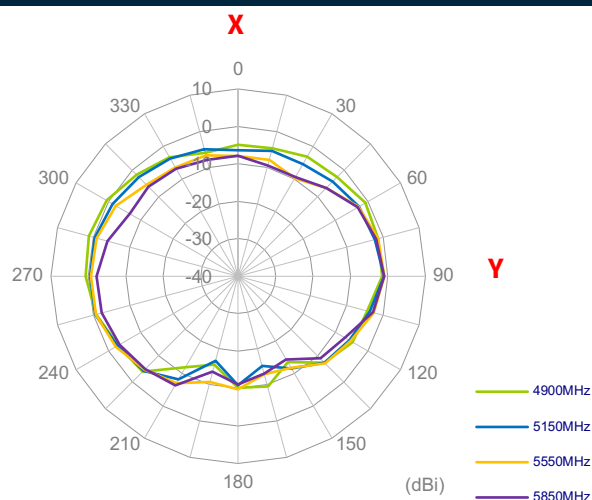
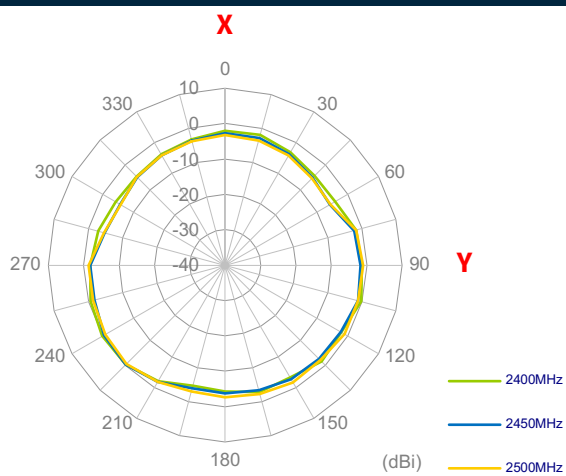
YZ Plane



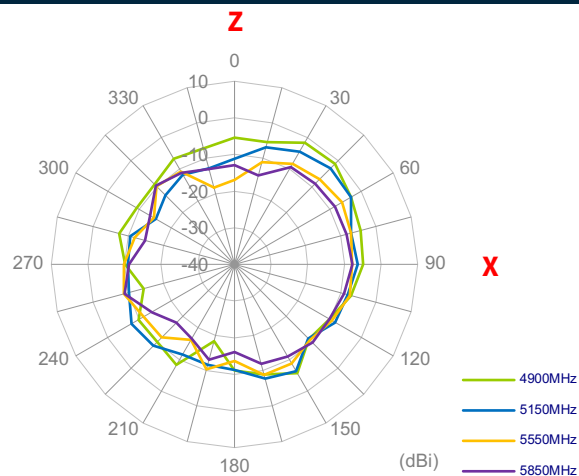
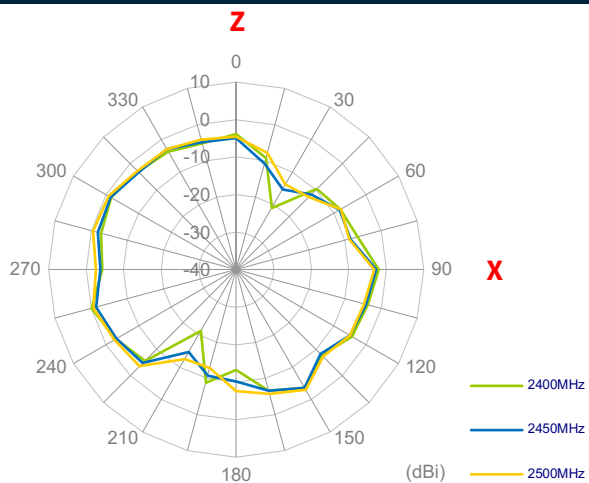


### 4.2.3. Wi-Fi MIMO1

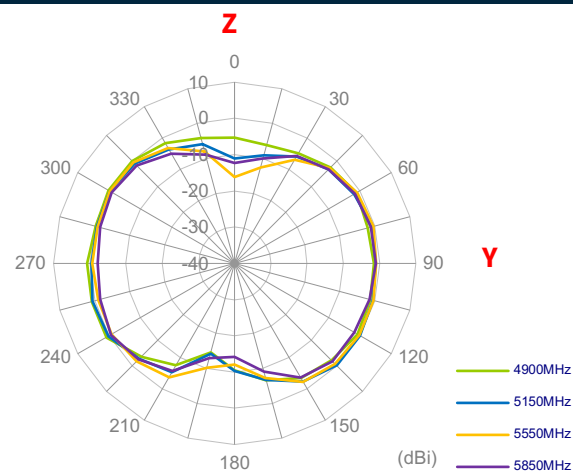
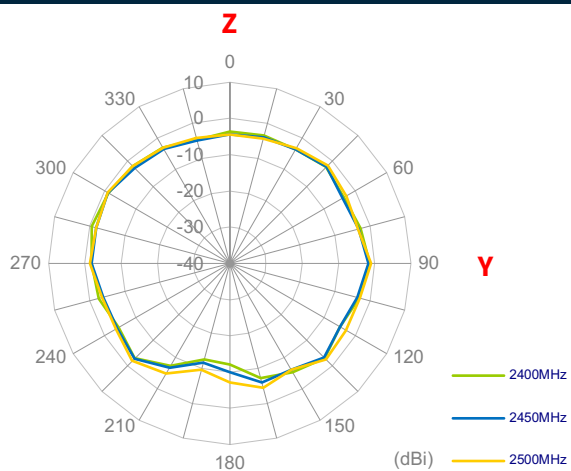
#### XY Plane



#### XZ Plane

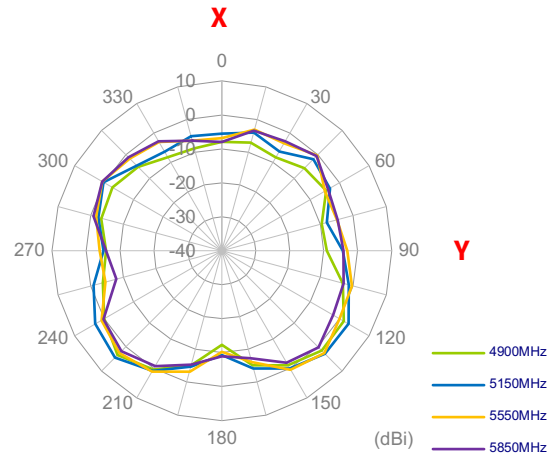
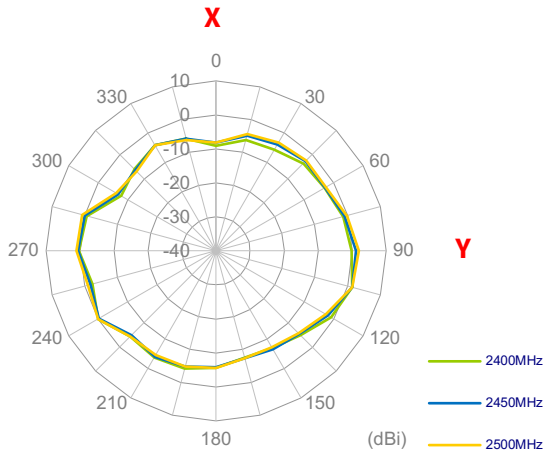


#### YZ Plane

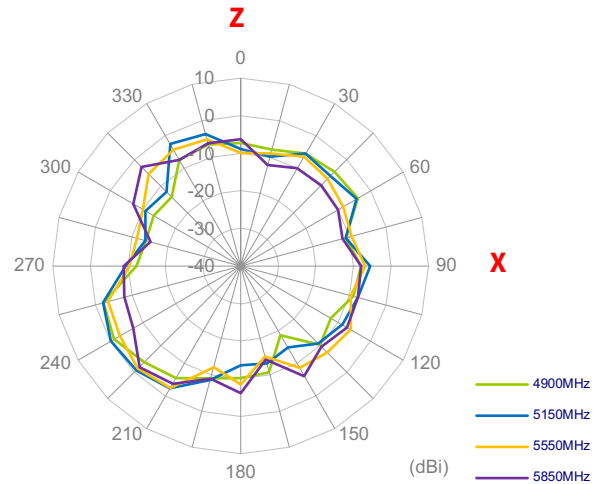
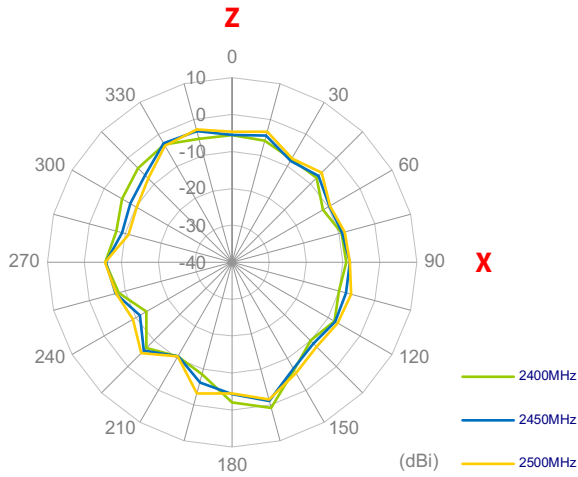


### 4.2.4. Wi-Fi MIMO2

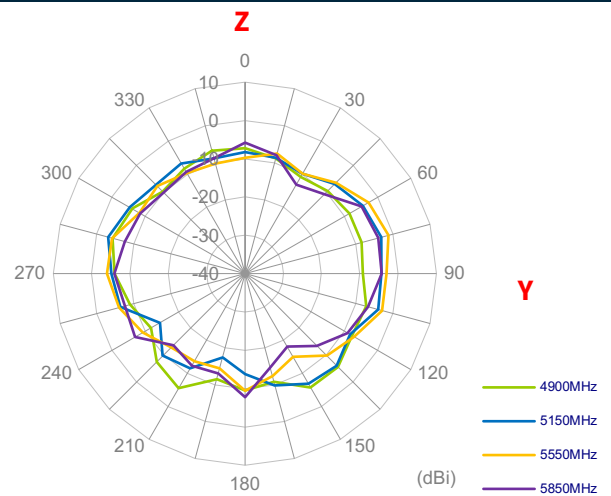
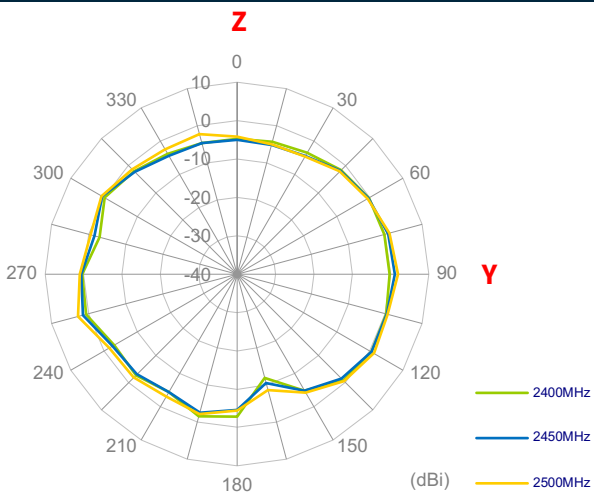
#### XY Plane



#### XZ Plane

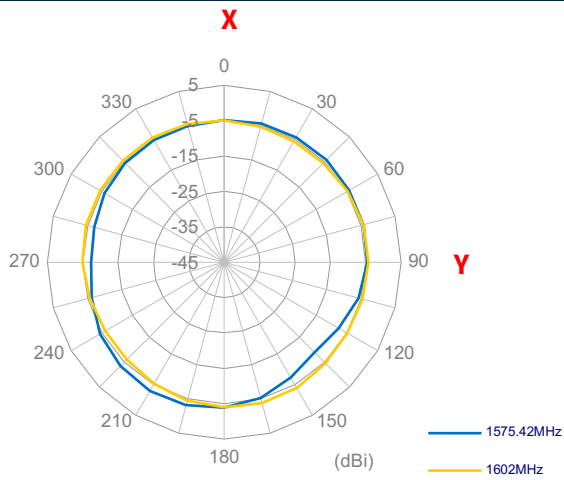


#### YZ Plane

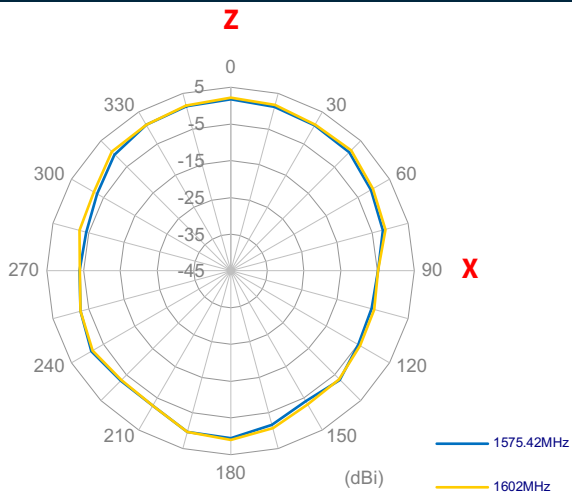


### 4.2.5. GNSS

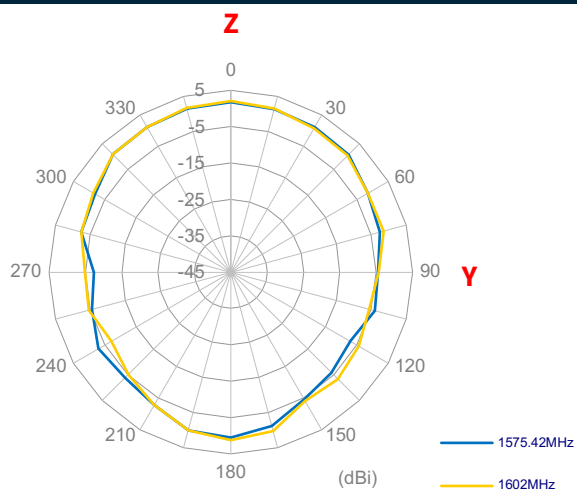
#### XY Plane



#### XZ Plane

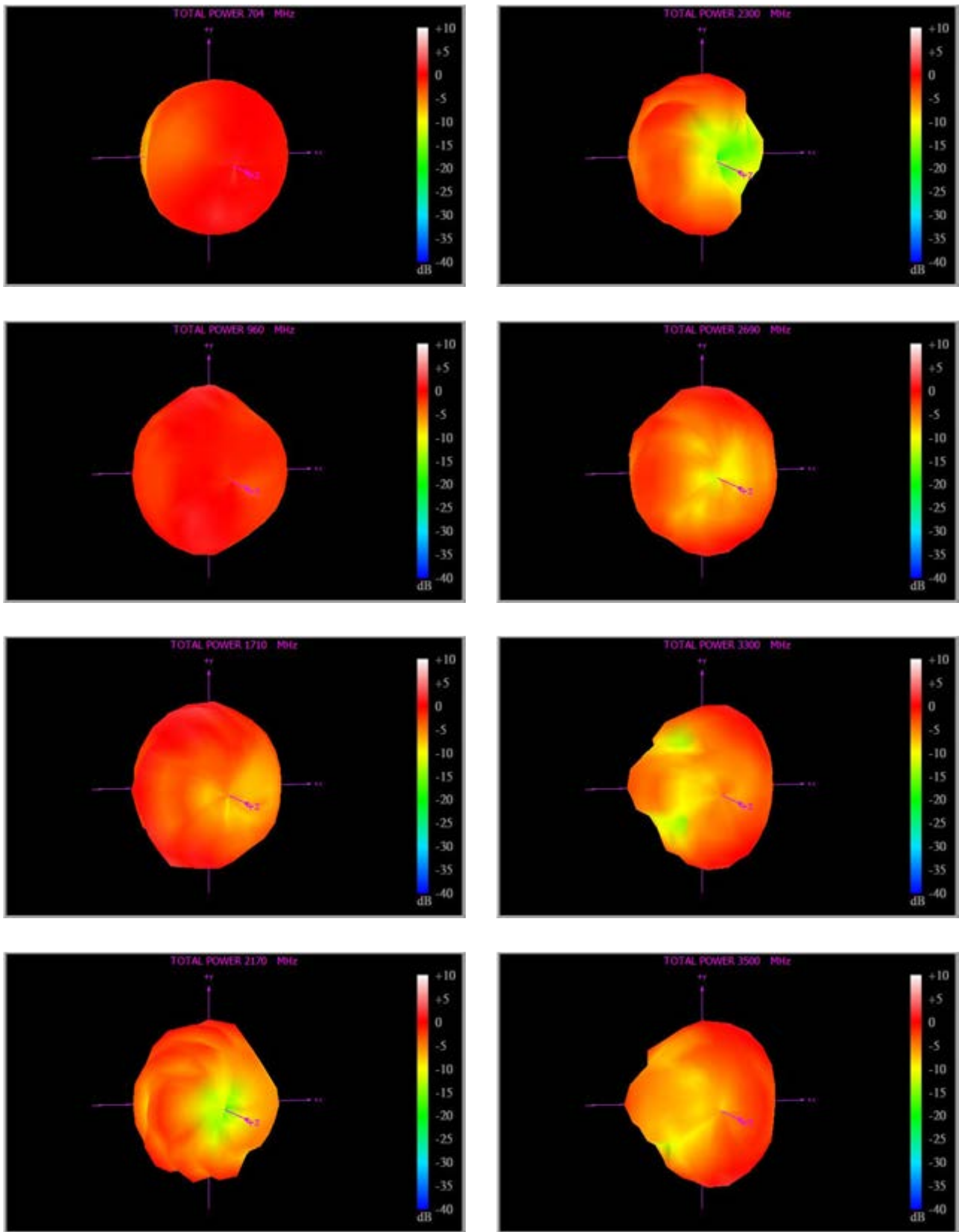


#### YZ Plane

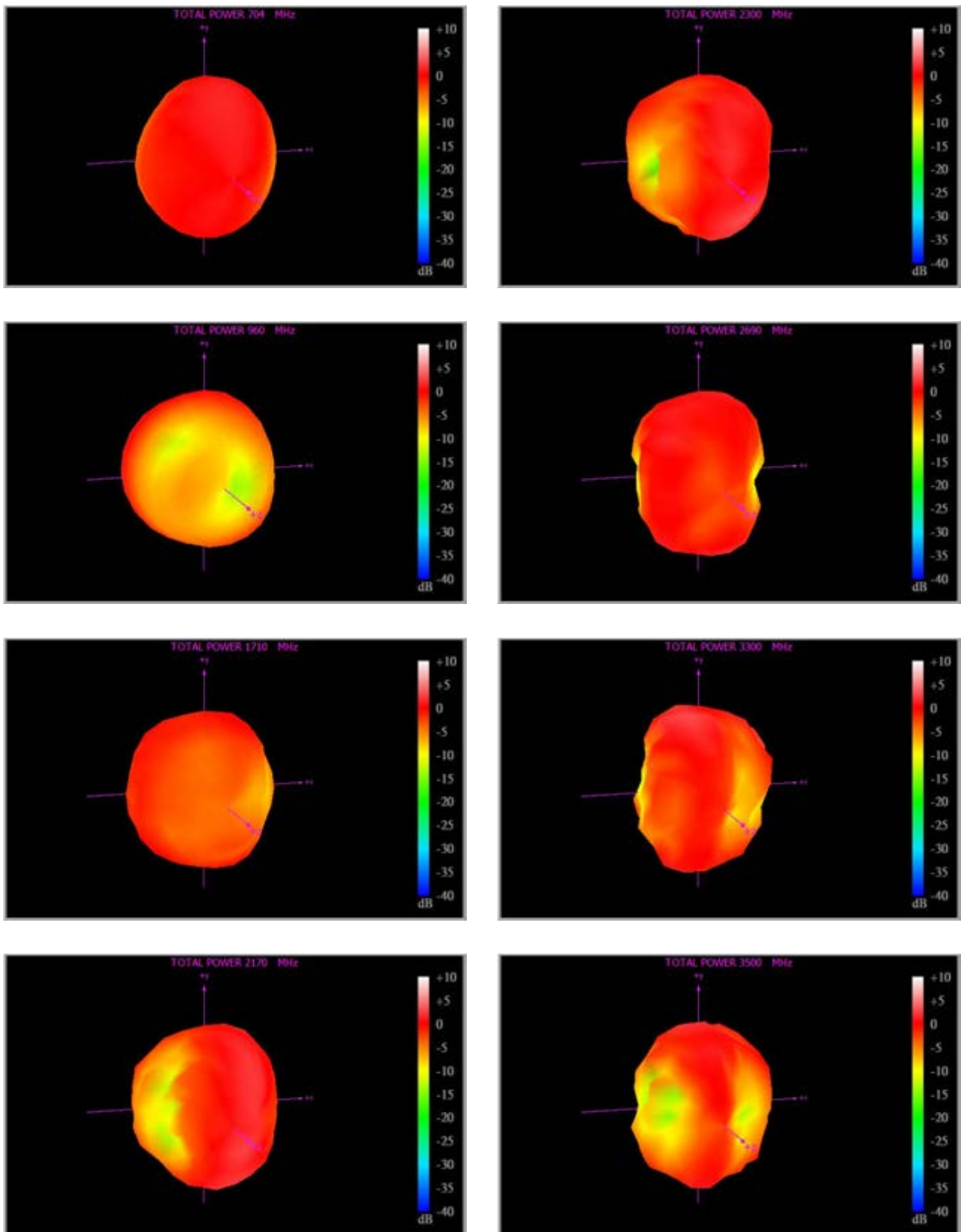


## 4.3 3D Radiation Patterns

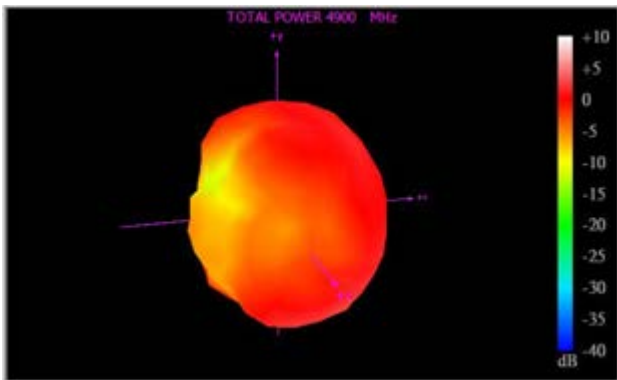
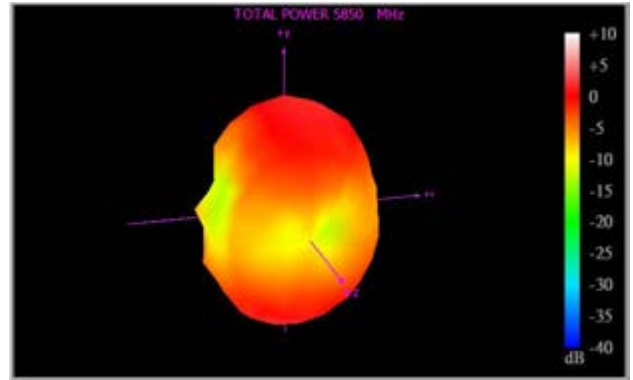
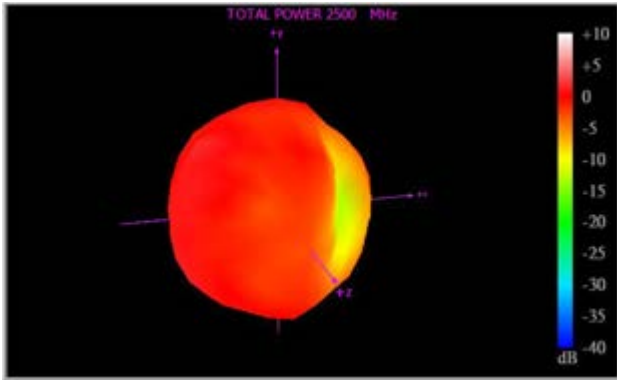
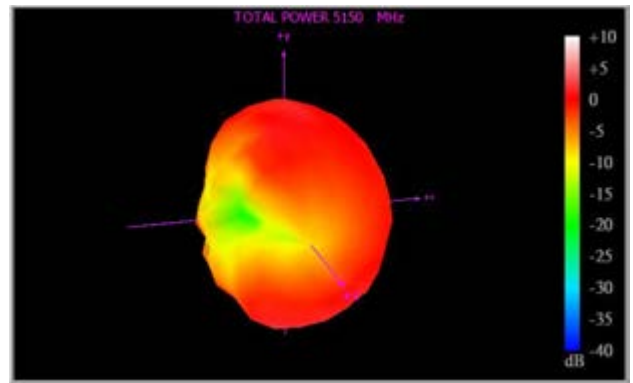
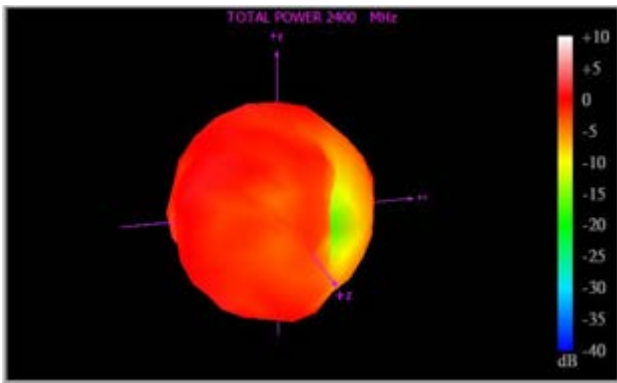
### 4.3.1. LTE MIMO1



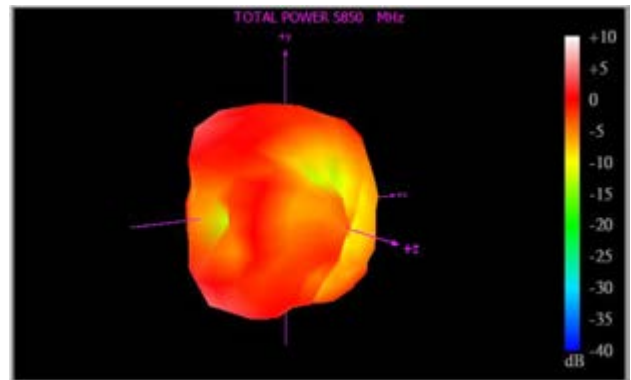
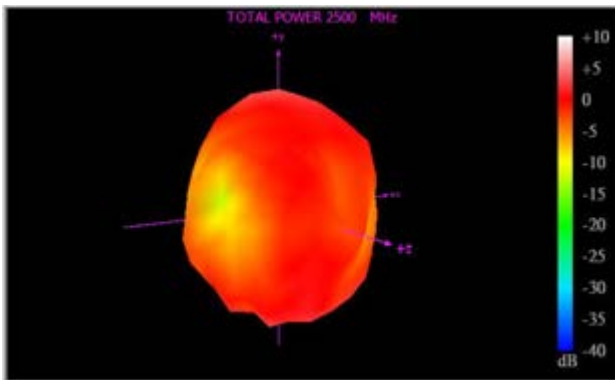
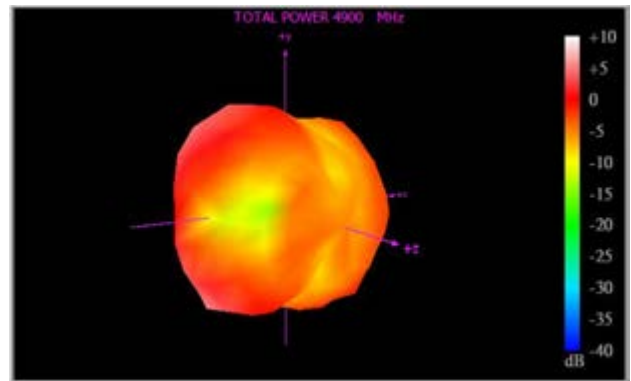
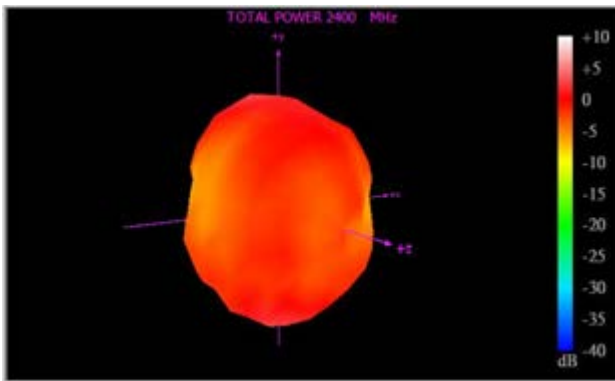
### 4.3.2. LTE MIMO2



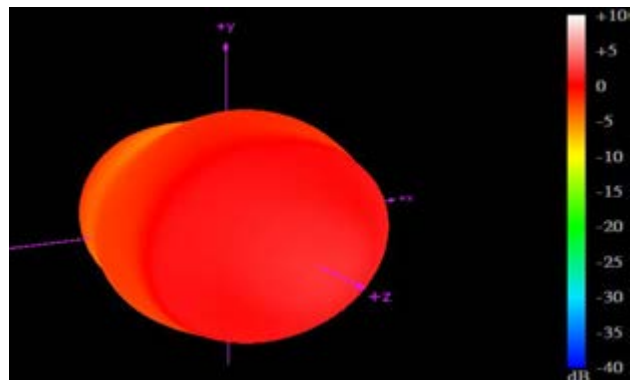
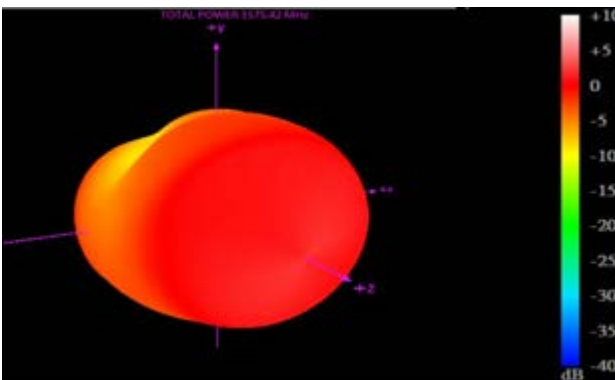
### 4.3.3. Wi-Fi MIMO1



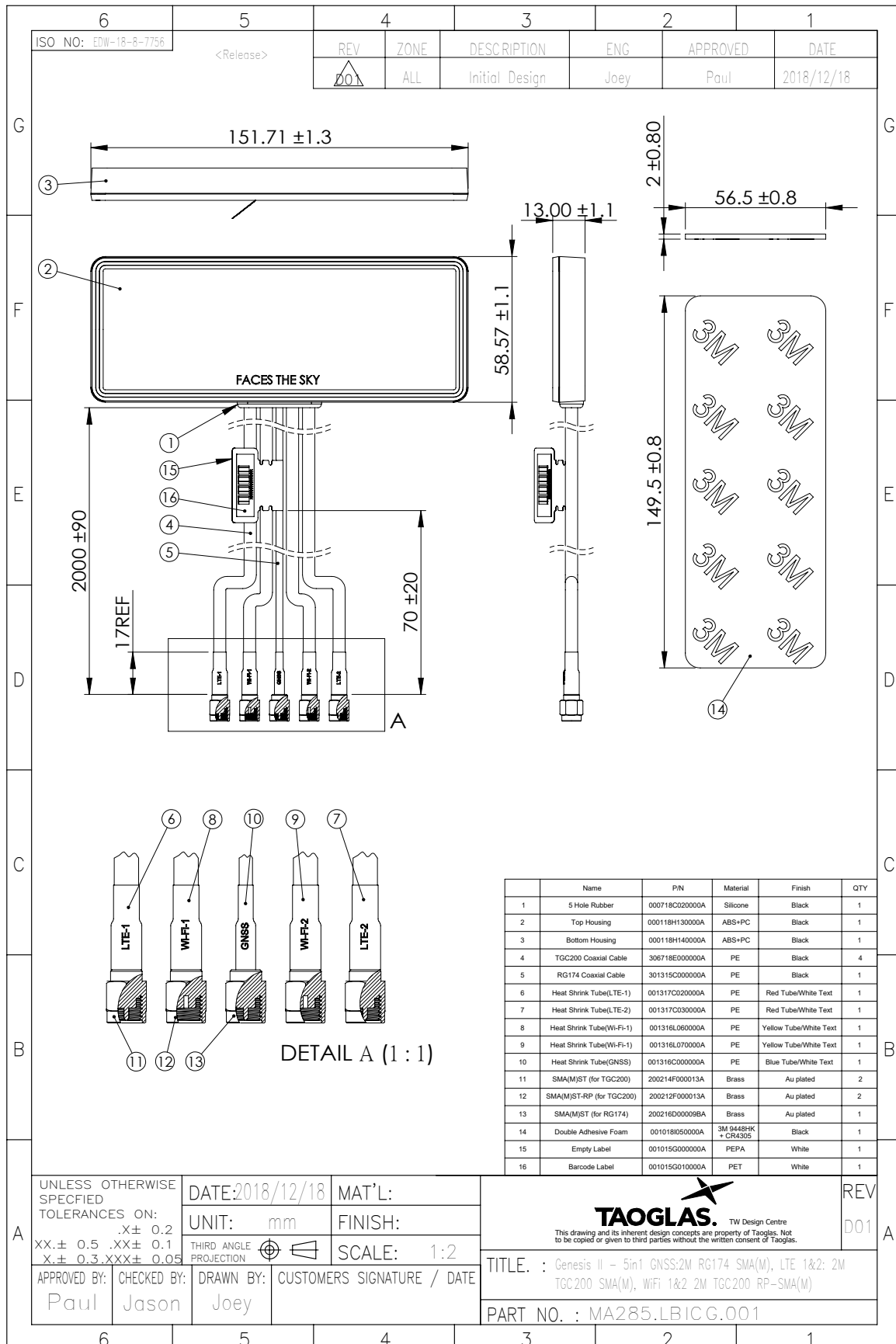
#### 4.3.4. Wi-Fi MIMO2



#### 4.3.5. GNSS



# 5. Mechanical Drawing (Units: mm)

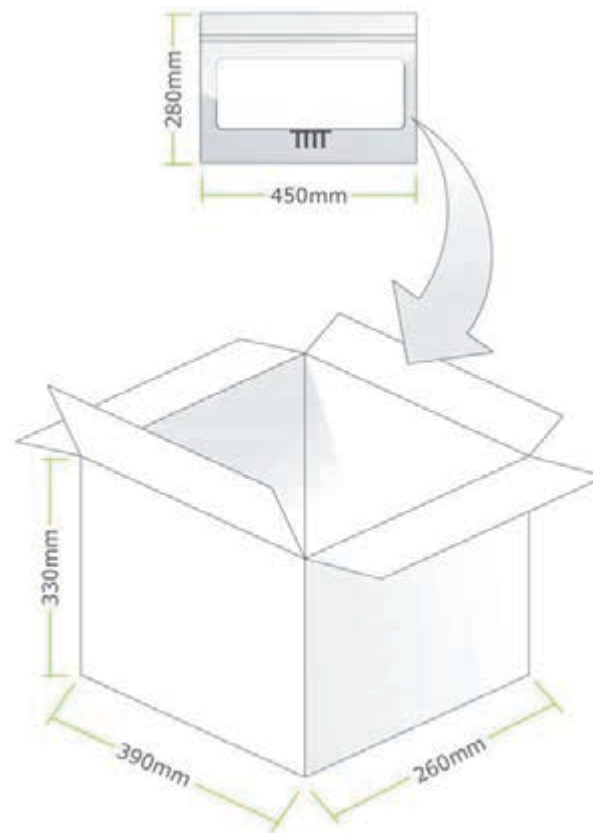




## 6. Packaging

1 pc MA285.LBICG.001 in PE Bag  
 Dimensions - 280\*450mm  
 Weight - 350g

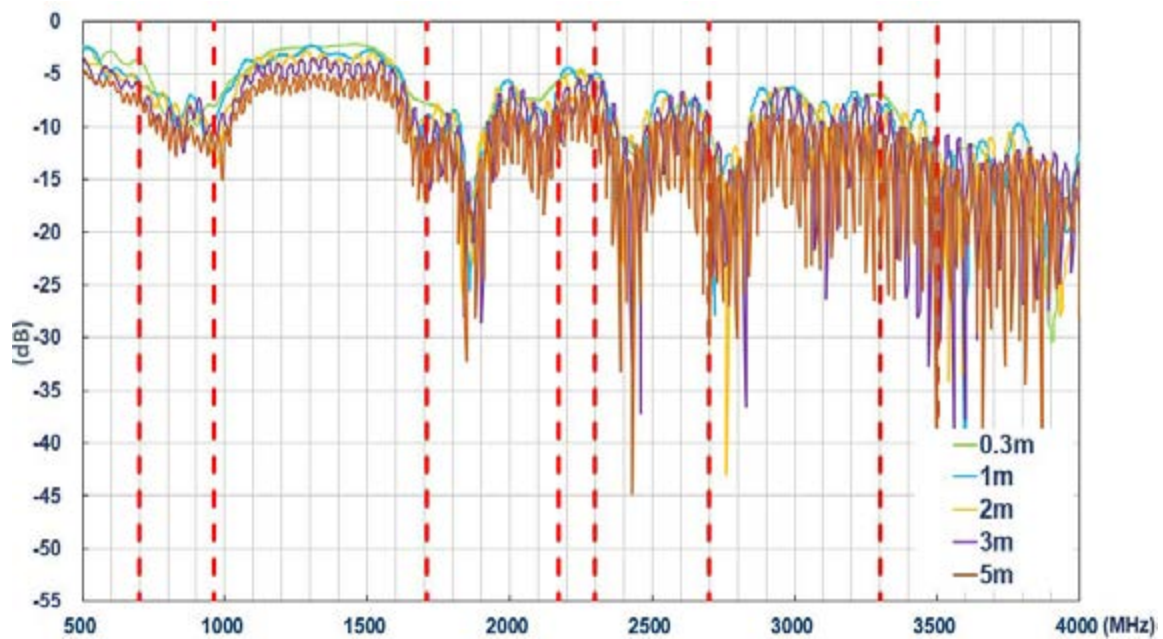
10 PE Bags in one carton  
 Carton Dimensions - 390\*260\*330mm  
 Weight - 3.5Kg



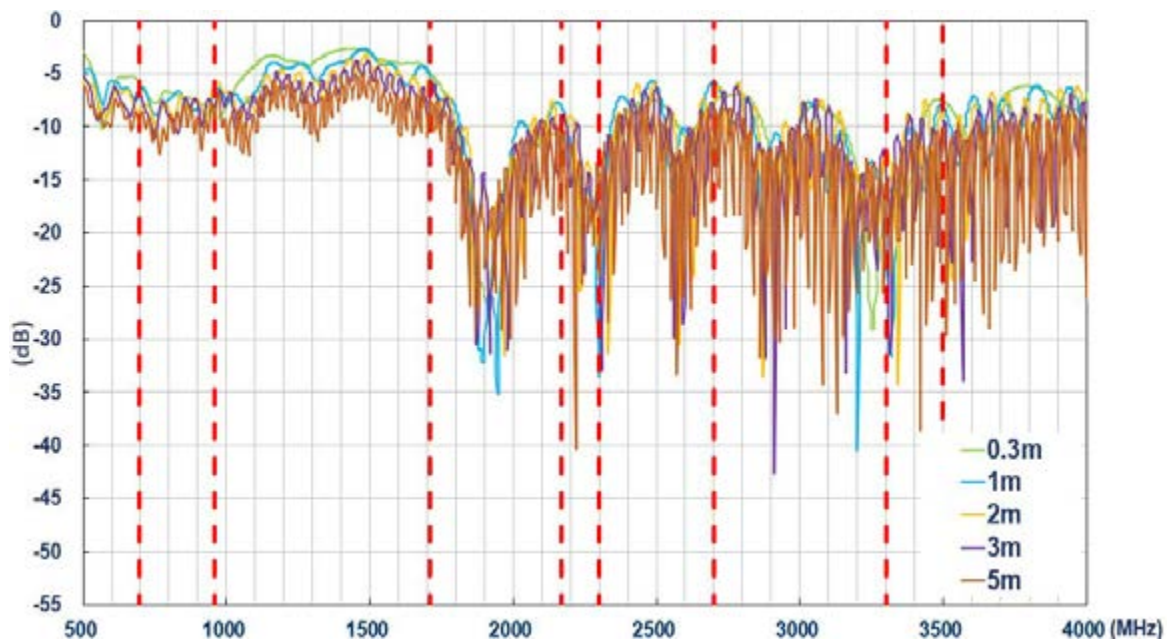
## 7. Application Note

### 7.1 Return Loss

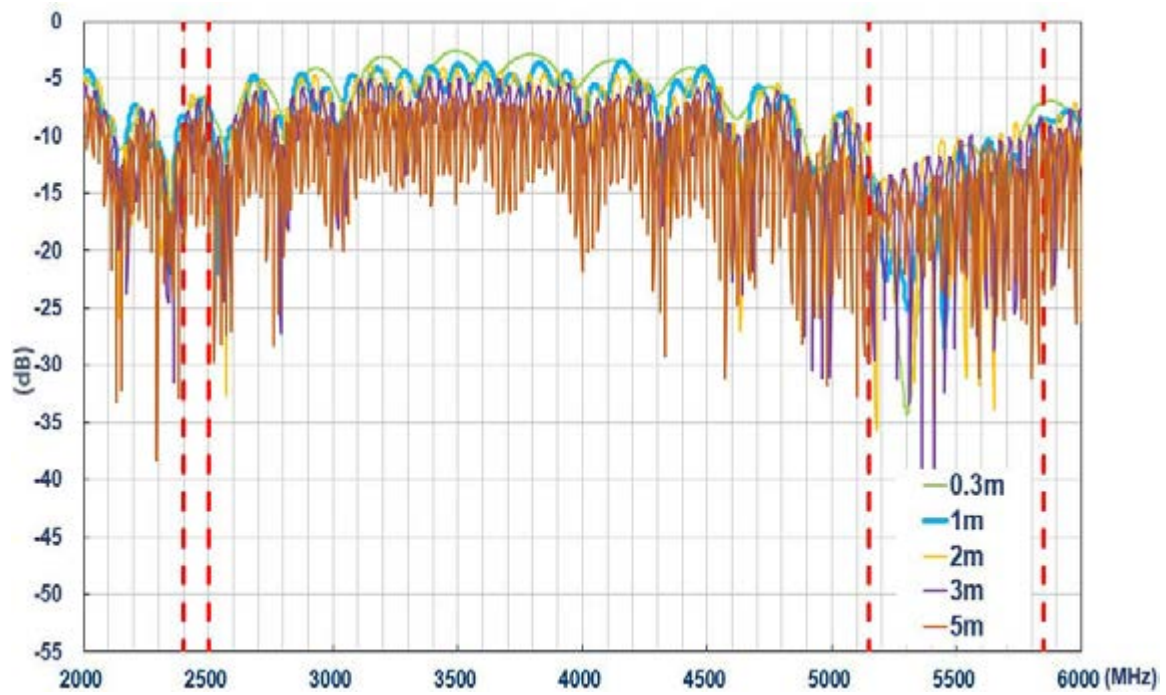
#### 7.1.1. Return Loss – LTE MIMO1 Antenna



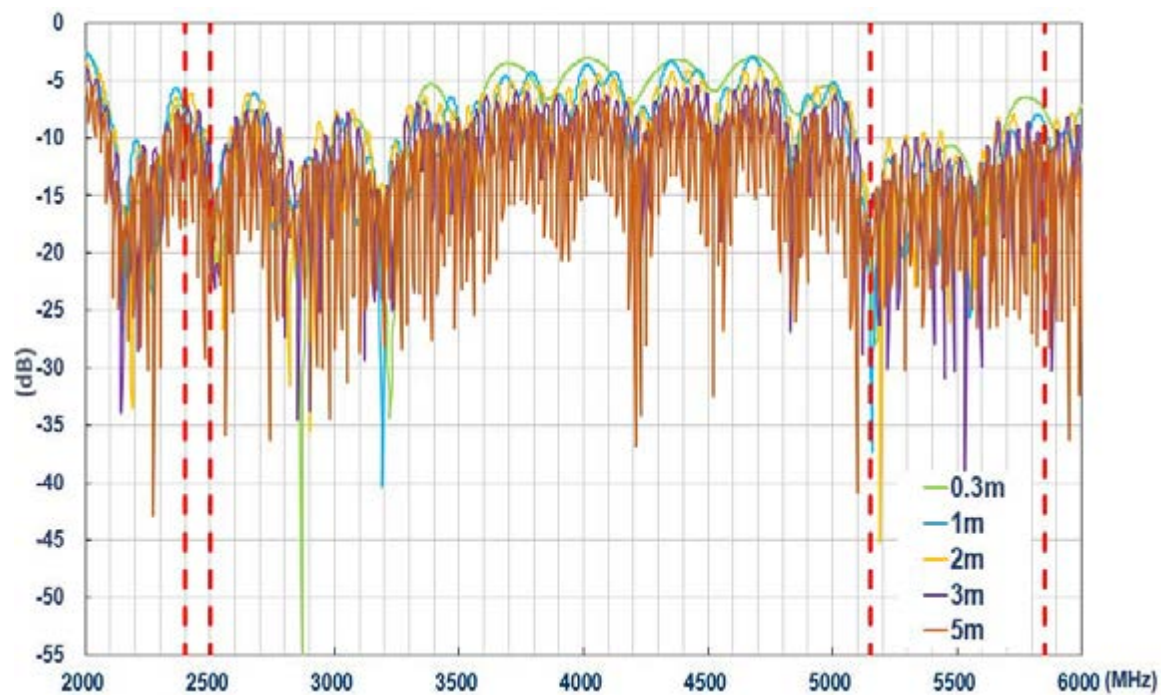
#### 7.1.2. Return Loss – LTE MIMO2 Antenna



### 7.1.3. Return Loss – Wi-Fi MIMO1 Antenna

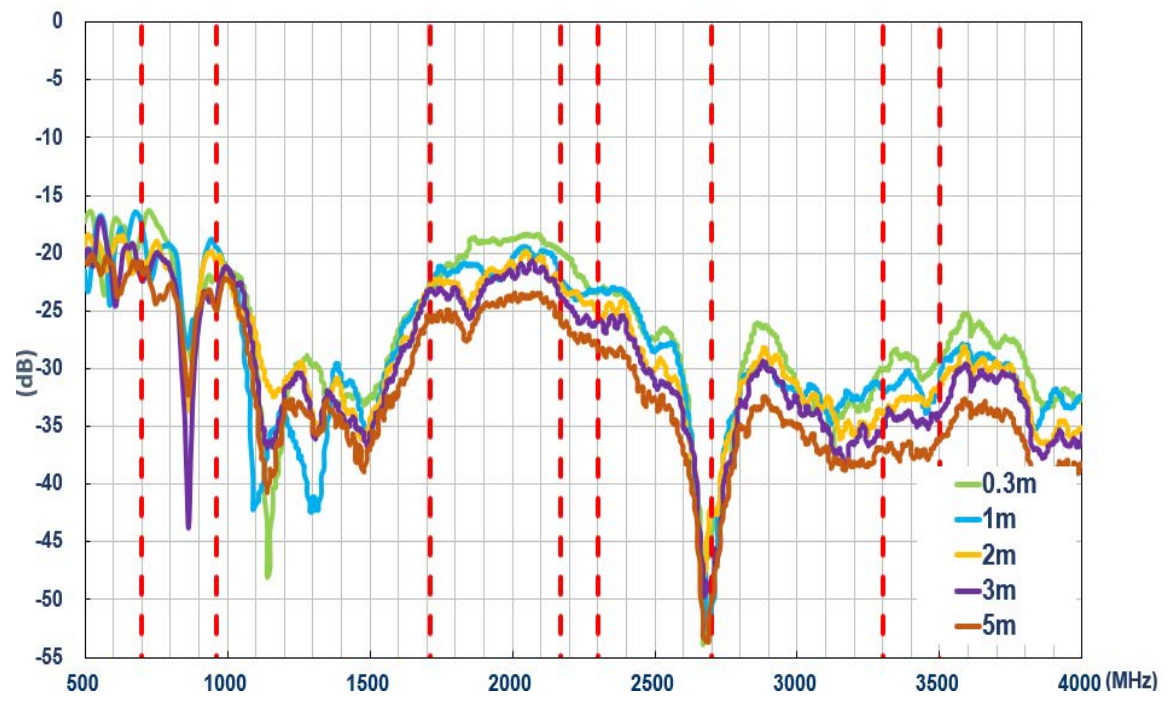


### 7.1.4. Return Loss – Wi-Fi MIMO2 Antenna

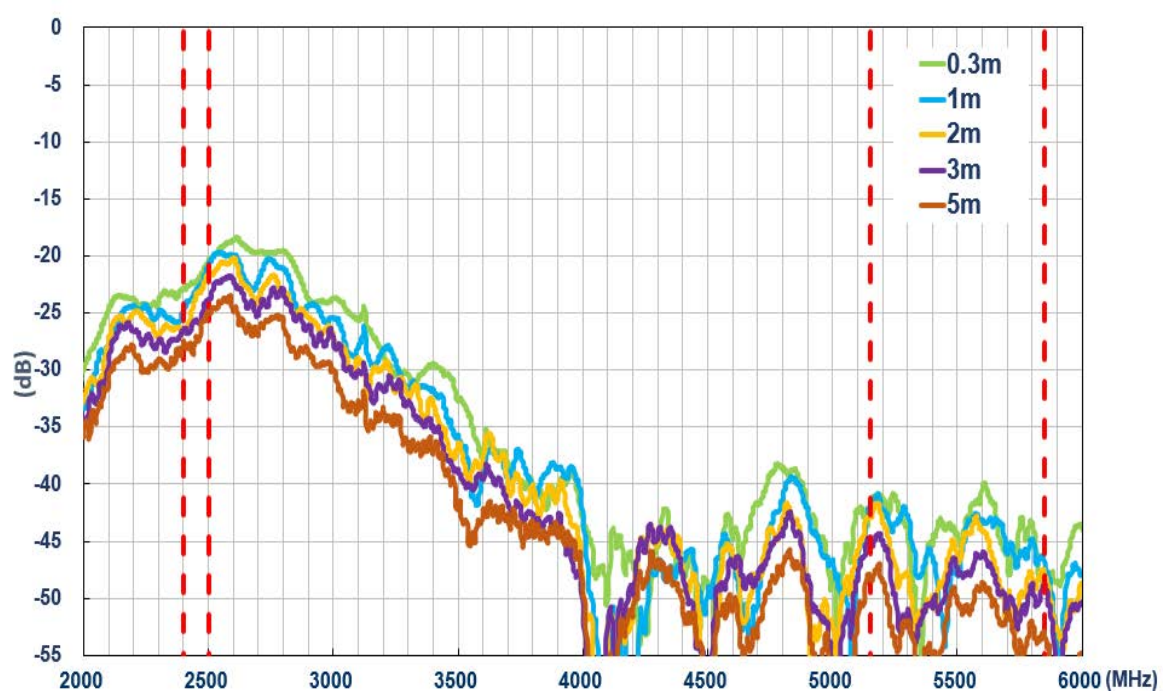


## 7.2 Isolation

### 7.2.1. Isolation – LTE MIMO Antenna

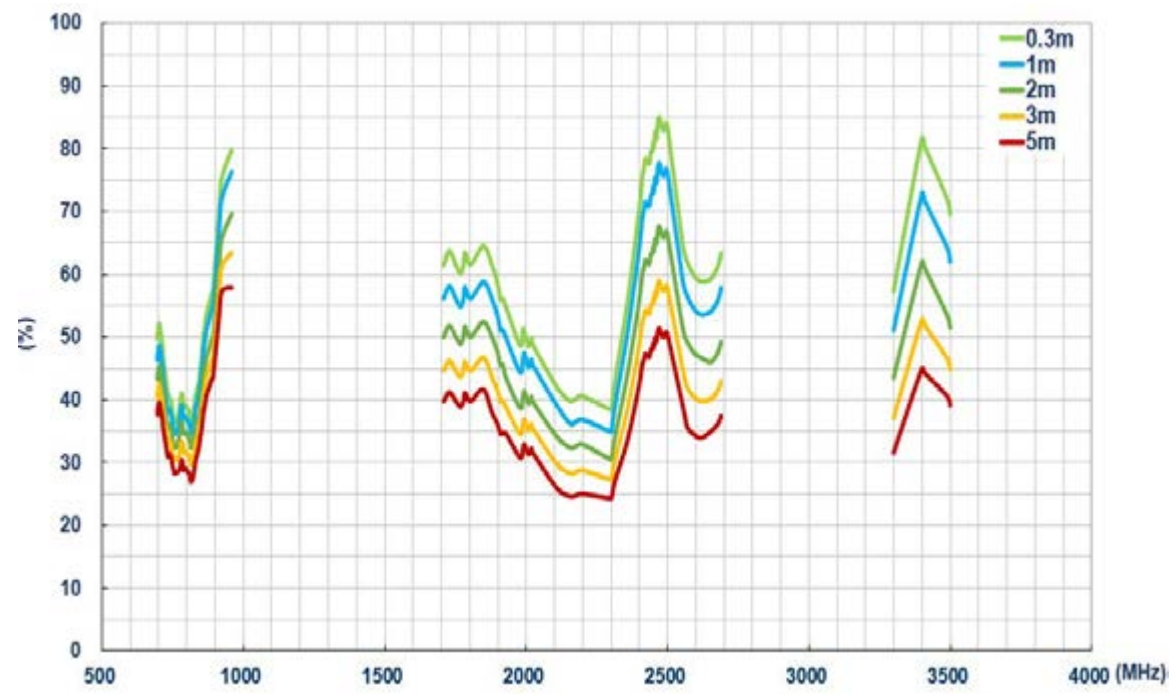


### 7.2.2. Isolation – Wi-Fi MIMO Antenna

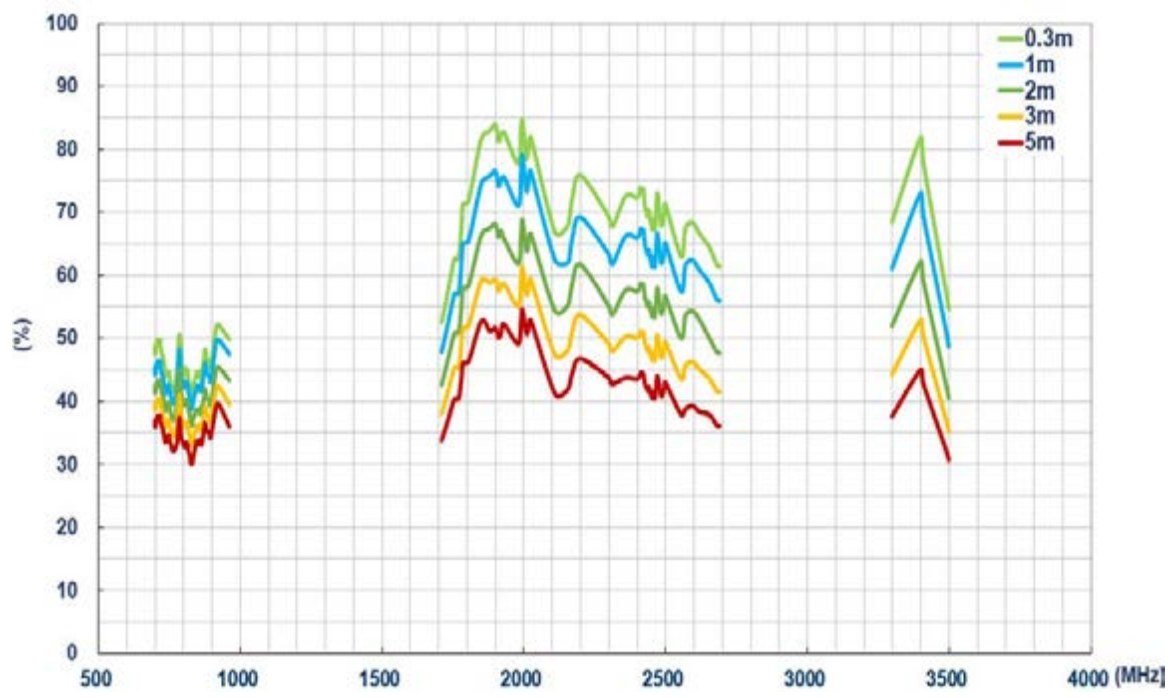


## 7.3 Efficiency

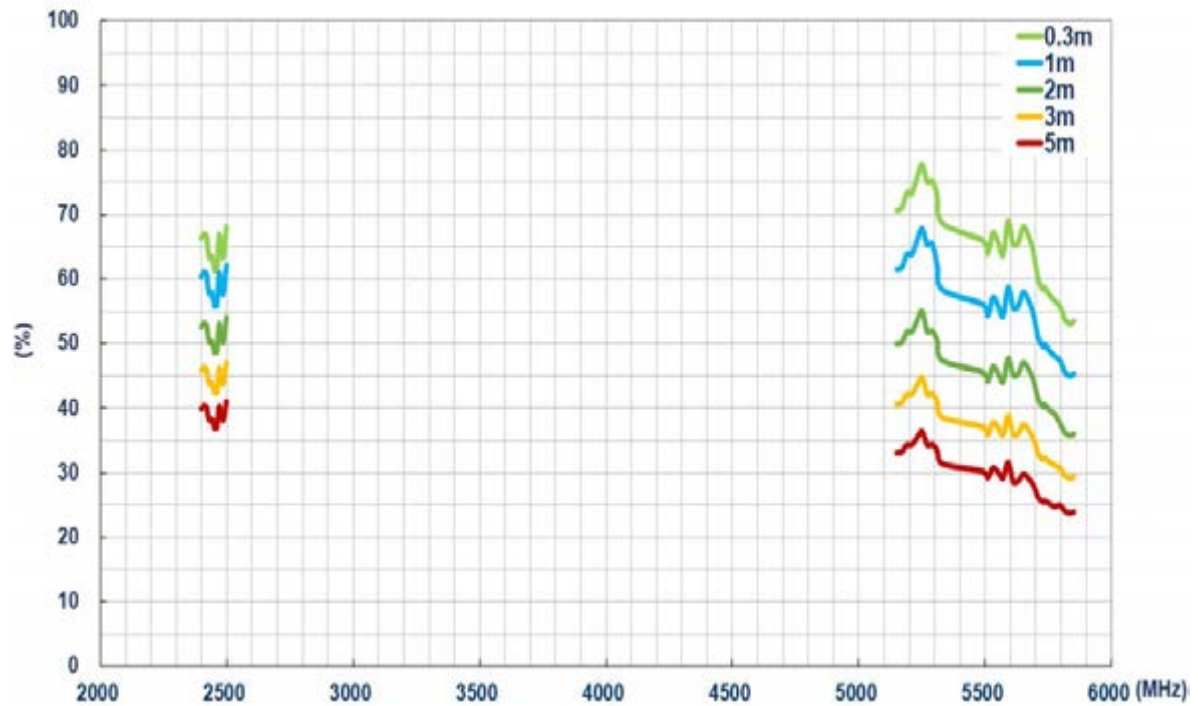
### 7.3.1. Efficiency – LTE MIMO1 Antenna



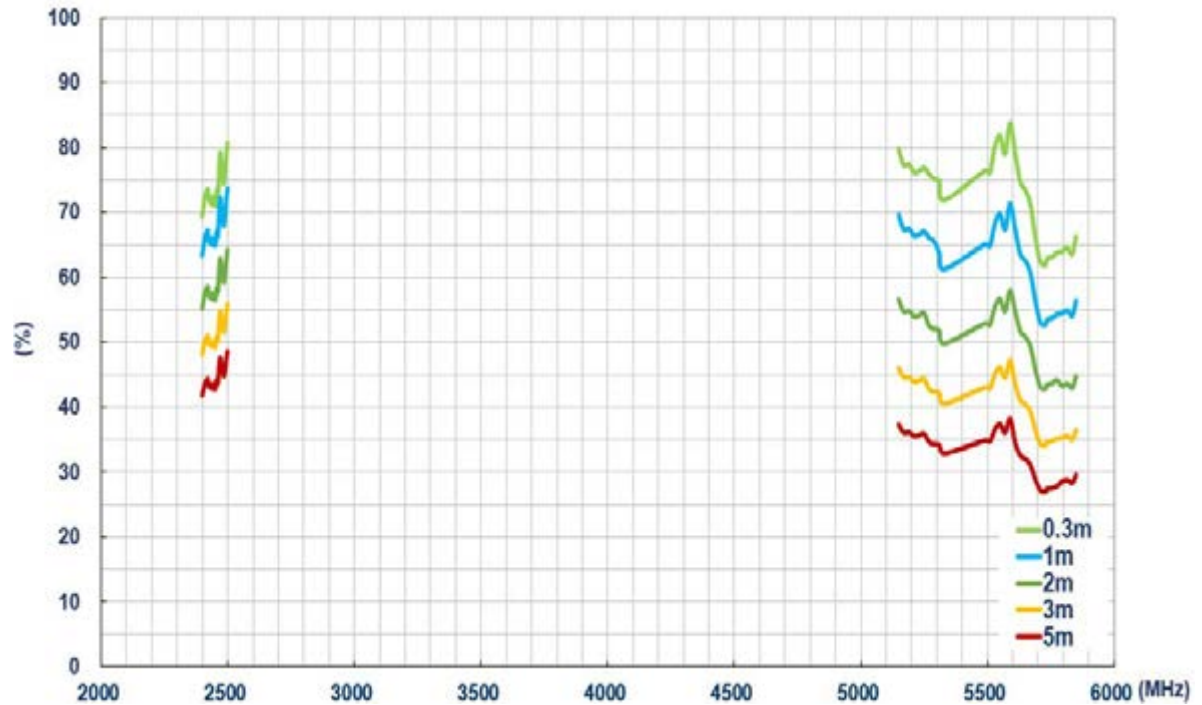
### 7.3.2. Efficiency – LTE MIMO2 Antenna



### 7.3.3. Efficiency – Wi-Fi MIMO1 Antenna

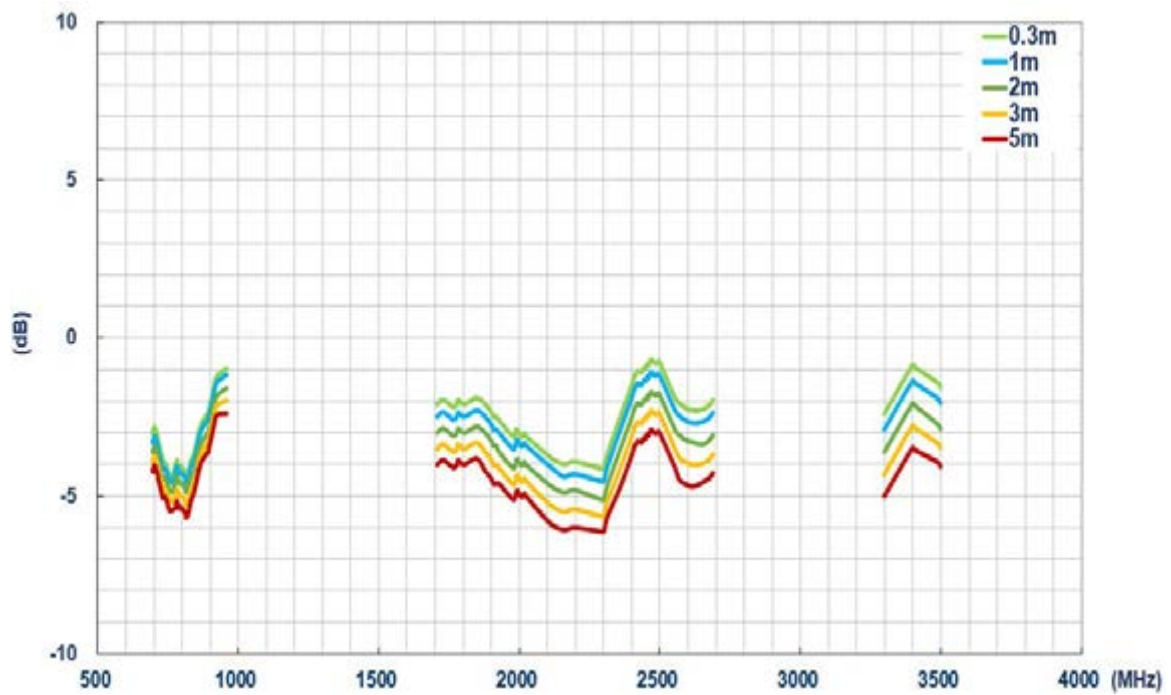


### 7.3.4. Efficiency – Wi-Fi MIMO2 Antenna

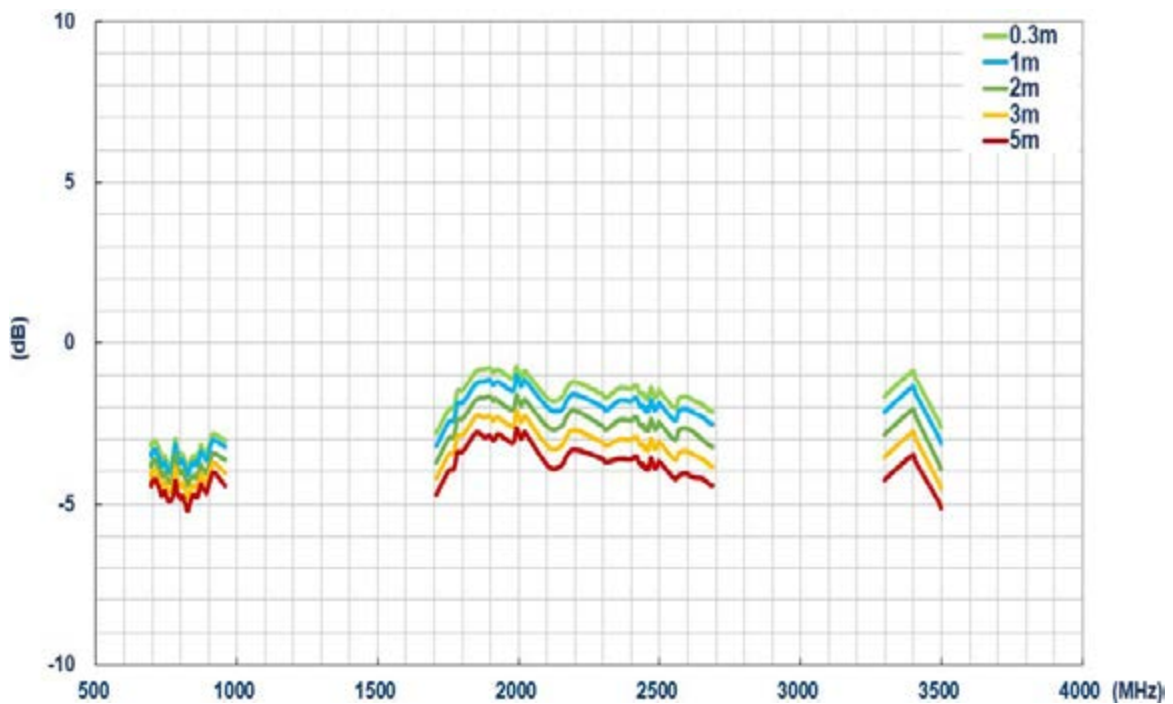


## 7.4 Average Gain

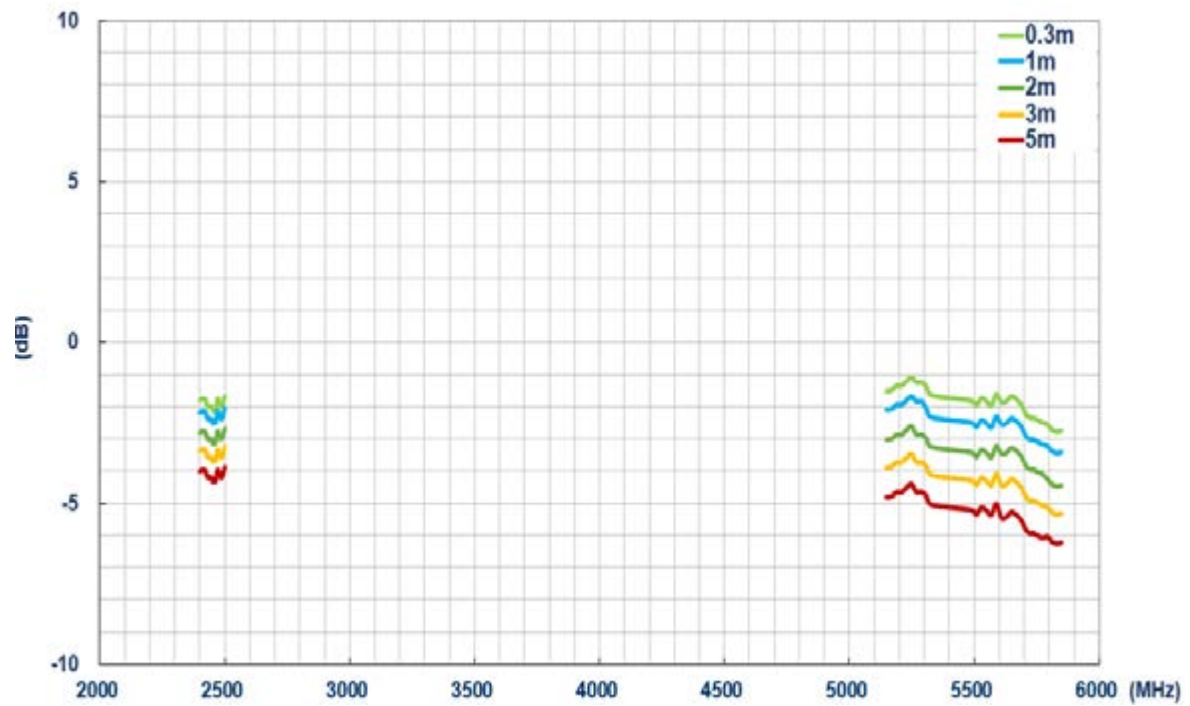
### 7.4.1. Average Gain – LTE MIMO1 Antenna



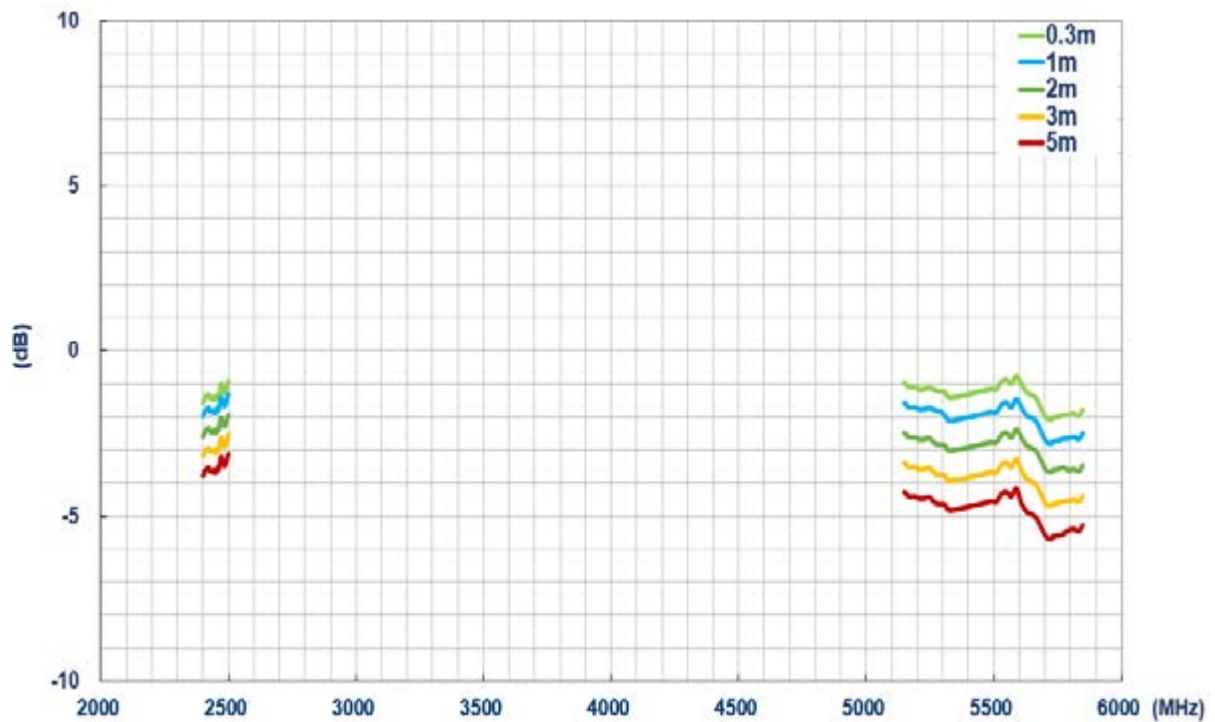
### 7.4.2. Average Gain – LTE MIMO2 Antenna



### 7.4.3. Average Gain – Wi-Fi MIMO1 Antenna



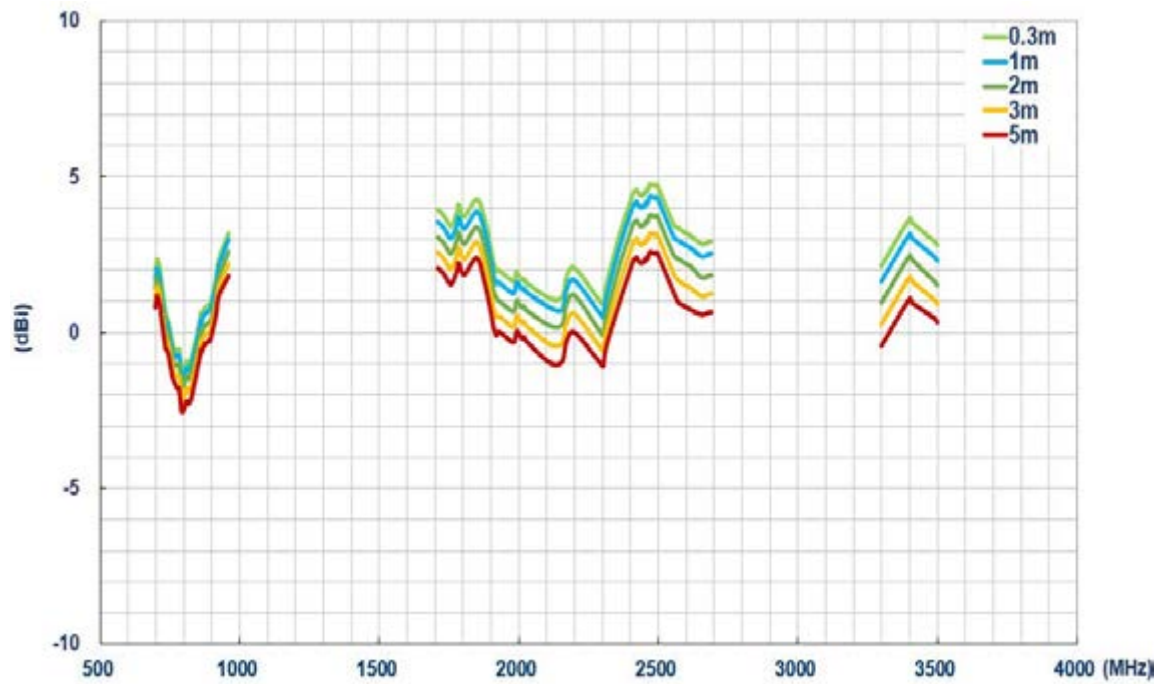
### 7.4.4. Average Gain – Wi-Fi MIMO2 Antenna



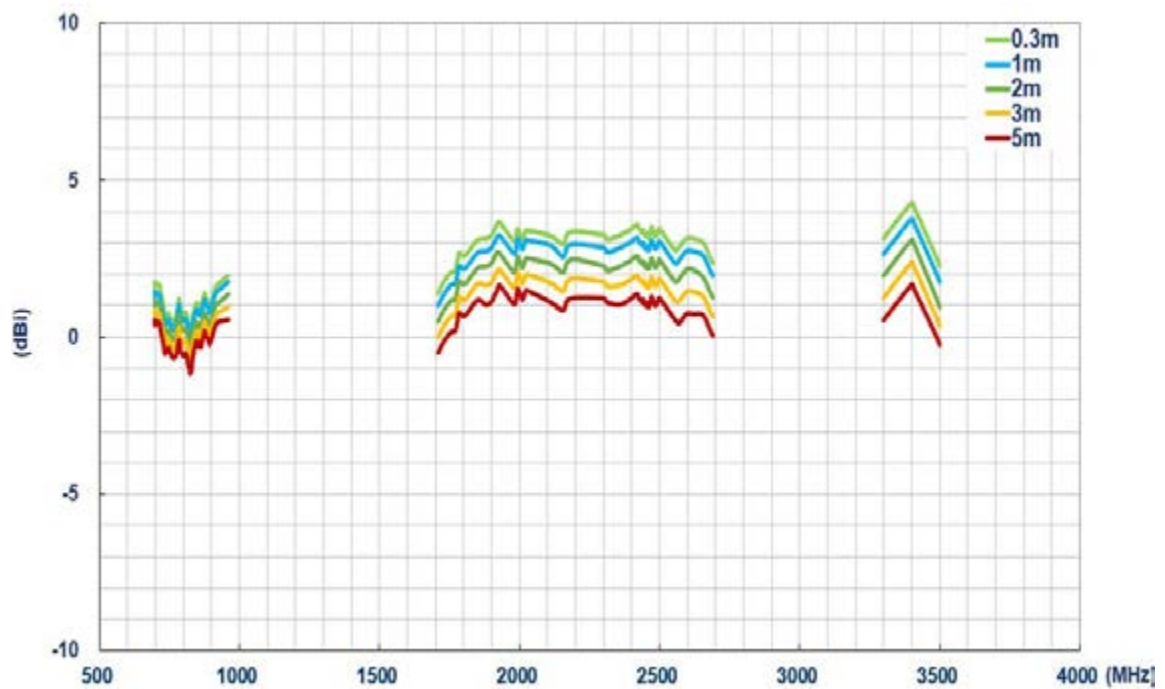


## 7.5 Peak Gain

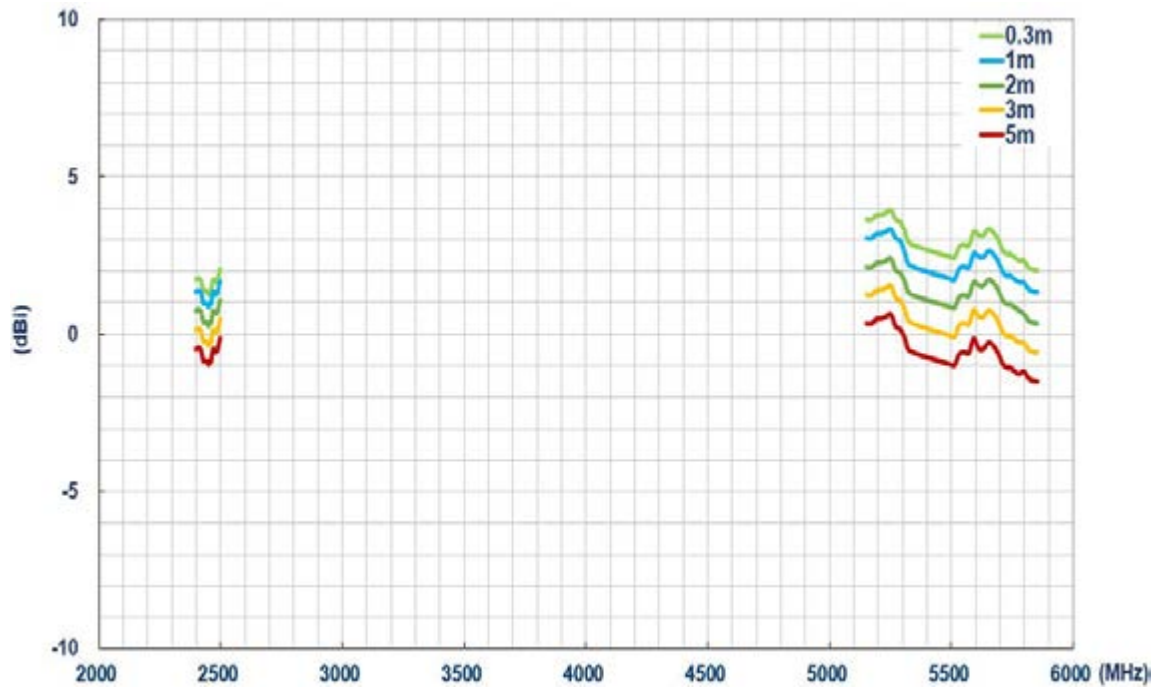
### 7.5.1. Peak Gain– LTE MIMO1 Antenna



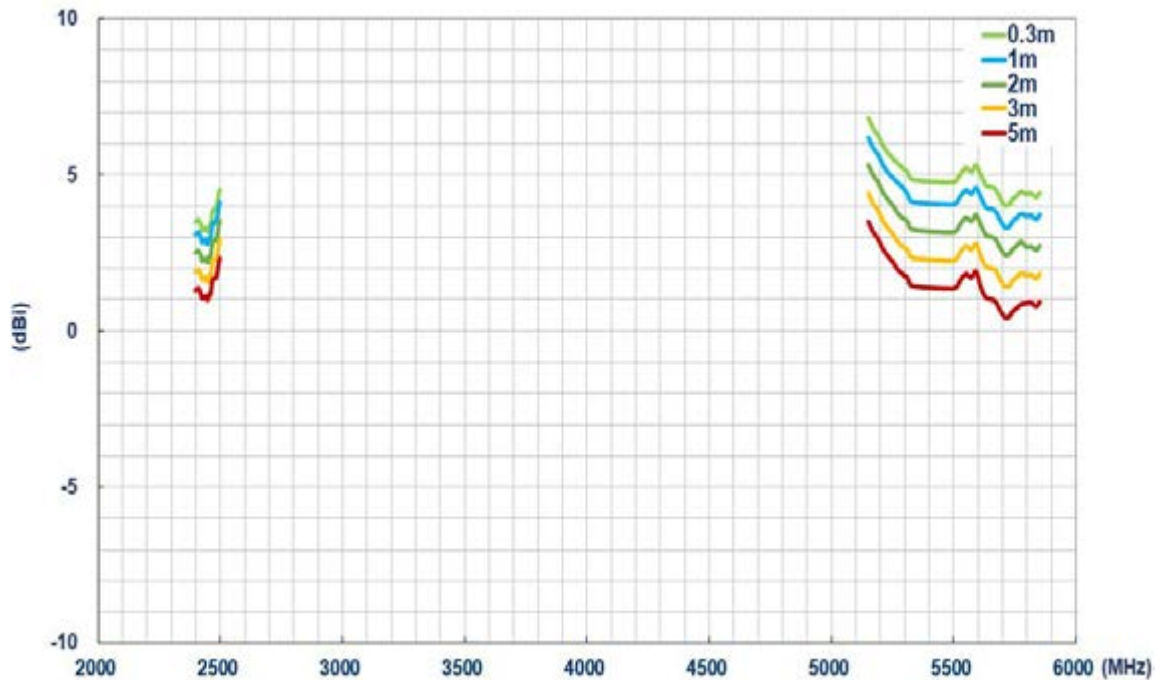
### 7.5.2. Peak Gain– LTE MIMO2 Antenna



### 7.5.3. Peak Gain– Wi-Fi MIMO1 Antenna



### 7.5.4. Peak Gain– Wi-Fi MIMO2 Antenna



## 9. Drop Test

### Test Report Taoglas Taiwan Reliability Test Lab

Product Category:	Antenna
Product Model Part No.:	MA285.LBICG.001
Quantity Tested:	1 pc
Date of Testing:	03/11 /2019
Test Required:	Drop Test
Batch No:	(SWEI001)

Product picture:



### 1. Test Equipment

Name	Brand	Model	Serial No.	Calibration Date
Network Analyzer	KEYSIGHT	E5071C	MY46526857	2018/12/13

## 2. Lab Environmental Conditions:

Ambient temperature:	25±3°C
Relative humidity:	65±20%RH

## 3. Test Method/Specification

Sample condition:	Unpacked
Fall Height:	1 M
Test times	1 time/each test
Test set:	Ground
Test Standard:	Follow Taoglas' Reliability Test Operation Procedure

### Inspection items:

- Visual inspection before and after test
- Functional inspection before and after test

# Test Equipment Set-up

Drop test photo



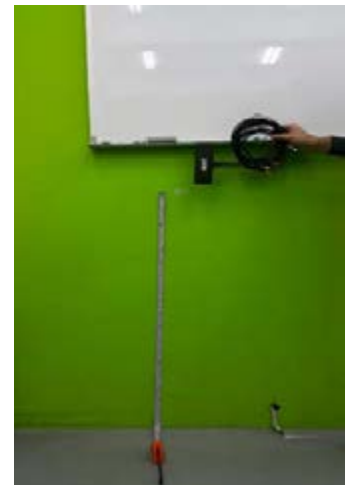
6 faces drop test photo



FACE A



FACE B



FACE C



FACE D



FACE E



FACE F

Angle 1

Angle 1 test photo



Axis 2

3 Axis test photo:



Axis 1



Axis 2



Axis 3

## 4. Test Results

### 4.1. Visual Inspection

Item No./Part No.	Visual Inspection Result	PASS/FAIL
Sample 1	No visible damage or break	PASS

### 4.2. Test Picture

Before Test

After Test

SAMPLE 1



### 4.3. Functional Inspection



LTE1							
Criteria(VSWR)		<2.2	>5	<2.8	<2.8	<2.8	
Part No./ Sample No.		900MHz	1105MHz	1710MHz	2170MHz	2700MHz	PASS/FAIL
Sample 1	Before	1.2210	7.3961	2.1198	1.2980	2.5111	PASS
	After	1.4451	7.9390	1.8249	1.5937	2.6301	

LTE2							
Criteria(VSWR)		<2.4	>3	<2.2	<2.1	<2.4	
Part No./ Sample No.		900MHz	1115MHz	1710MHz	2170MHz	2700MHz	PASS/FAIL
Sample 1	Before	1.7324	7.0355	1.8092	1.6304	1.4320	PASS
	After	1.9199	7.3320	1.7001	1.7662	1.3798	

WIFI1							
Criteria(VSWR)		>5	<2.2	<2.1	<2.4	<2.8	
Part No./ Sample No.		1000MHz	2400MHz	2500MHz	5150MHz	5850MHz	PASS/FAIL
Sample 1	Before	9.0964	1.3290	1.7865	1.3550	1.3672	PASS
	After	8.8443	1.2898	1.6789	1.2678	1.2600	

WIFI2							
Criteria(VSWR)		>5	<2.2	<2.1	<2.4	<2.8	
Part No./ Sample No.		1000MHz	2400MHz	2500MHz	5150MHz	5850MHz	PASS/FAIL
Sample 1	Before	9.9164	1.4077	1.5340	1.5580	1.3856	PASS
	After	9.4661	1.3840	1.5516	1.4238	1.4693	

GPS						
	Criteria(dB)	S11<-10	S11<-10	S11<-10	1-18mA	
Part No./ Sample No.	Before /After	1561MHz	1575.42MHz	1602MHz	Current Unit :mA	PASS/FAIL
Sample 3	Before	-15.8166	-14.2037	-14.4567	11.750	PASS
	After	-20.2241	-26.3585	-23.0684	11.750	PASS
	Criteria(dB)	-8<S12<6	-7<S12<8	-11<S12<4		
Part No./ Sample No.	Before /After	1575.42MHz	1575.42MHz	1602MHz		PASS/ FAIL
Sample 3	Before	-5.2258	0.1317	-5.5774		PASS
	After	-4.9625	-1.7349	-6.4786		PASS

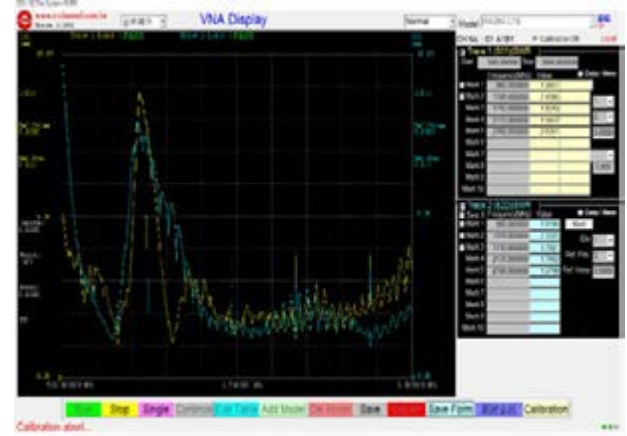
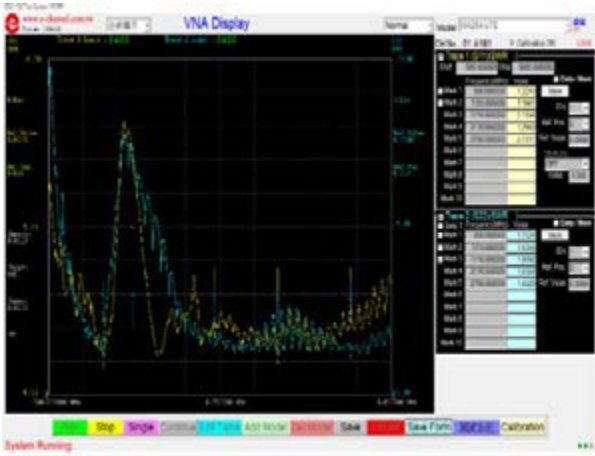
#### 4.4. Function test photo

**LTE1 & 2**

Before Test

After Test

SAMPLE 1

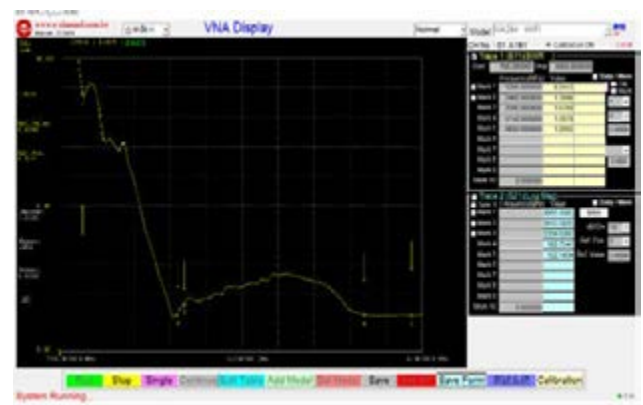
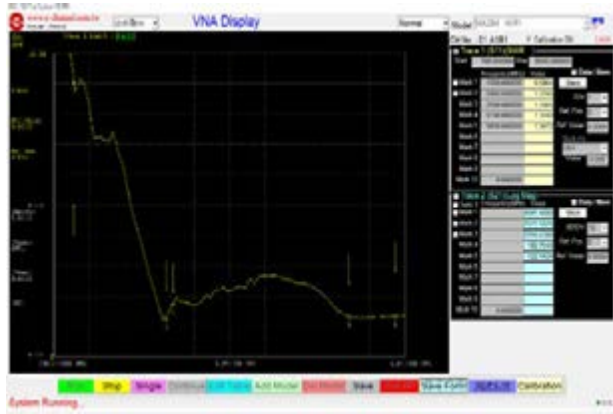


**Wi-Fi 1**

Before Test

After Test

SAMPLE 1

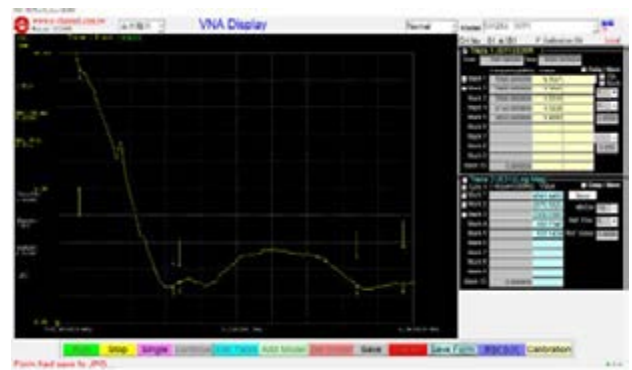
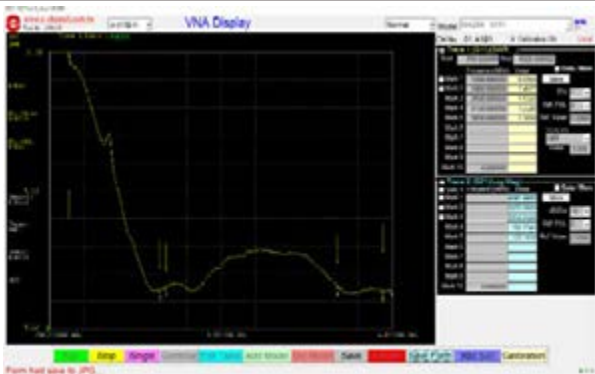


**Wi-Fi 2**

Before Test

After Test

SAMPLE 1

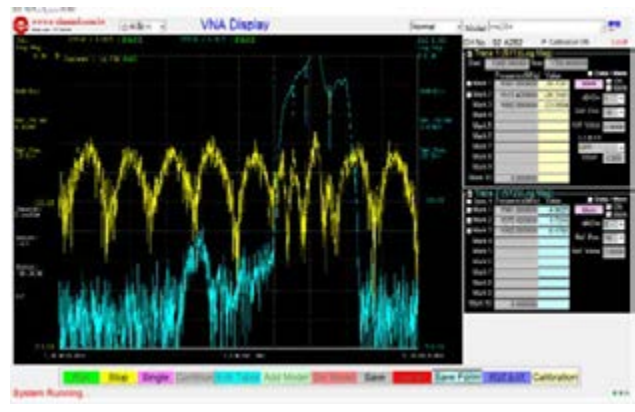
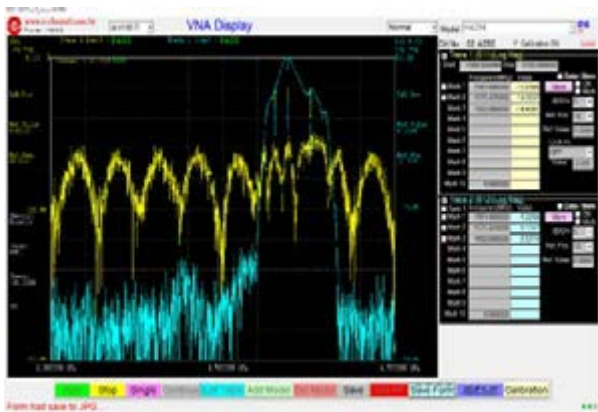


GPS

Before Test

After Test

SAMPLE 1



5. Conclusion

5.1. The drop test result for MA285.LBICG.001 shows PASS

Visual inspection:	PASS
Electrical test:	PASS

5.2. Test method: Follow Taoglas' Reliability Test Operation Procedure

Fall Height:	1 M
Test times:	1 time/each test
Test set:	Ground

Changelog for the datasheet

SPE-19-8-046 - MA285.LBICG.001

Revision: A (Original First Release)	
Date:	05/04/2019
Notes:	Initial Datasheet Release
Author:	Yu Kai Yeung

Previous Revisions




[www.taoglas.com](http://www.taoglas.com)

