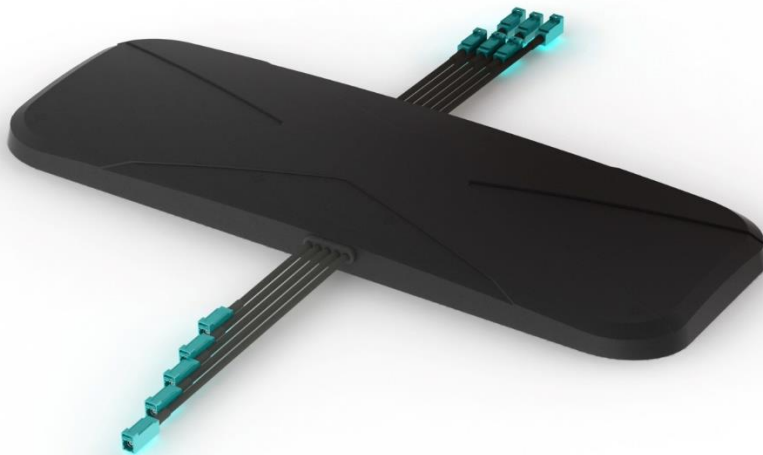


DRAFT SPECIFICATION

- Part No. : **MA9000.A.LBIWXYZCGHM.001**
- Product Name : MA9000 11in1 Adhesive Mount Guardian Antenna
LTE MIMO + Wi-Fi MIMO + GNSS
- Features : 6*LTE MIMO Antennas (3x2 MIMO)
698-960MHz/1710-2170MHz/2490-2690MHz
4*MIMO Dual Band Wi-Fi Antenna (2x2 MIMO)
2400-2500MHz/4900-5850MHz
Worldwide 4G Bands including 3G and 2G
GPS/GLONASS 1575.42-1602MHz Active Patch
IP67 Enclosure
Dims: 540*185*35mm
1M cable (CFD-200-FR) with Fakra connectors as standard
Custom Cables and Connectors Available
RoHS Compliant



1 Introduction

The MA9000 Guardian 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 Wi-Fi performance.

This unique product delivers powerful worldwide 4G LTE MIMO antenna technology at 700MHz/800MHz/1700MHz/1800MHz/2600MHz and dual band Wi-Fi. It uses Flame Retardant Cables making it ideal for Airline, Bus and Rail applications.

Typical applications:

- Passenger Bus / Rail / Air Applications.
- Automotive and Heavy Equipment Vehicle Tracking and Telematics
- Remote Asset and Pipeline Monitoring
- HD Video over LTE
- First Responder and Emergency Services
- M2M Applications/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. 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, increased number of drops, and may indeed not make a system connection at all.

Cable length and connector types are customizable.

Contact your regional Taoglas sales office for support.

2 Specification

2G/3G/4G Cellular						
LTE Band Class	20	8	3	1	40	7
Frequency MHz	791~862	880~960	1710~1880	1920~2170	2300~2400	2500~2690
Efficiency (%)						
LTE - Antenna 1	50	46	48	48	34	39
LTE - Antenna 2	37	24	43	35	44	50
LTE - Antenna 3	36	26	48	48	50	48
LTE - Antenna 7	38	27	47	39	43	48
LTE - Antenna 8	43	28	42	26	51	45
LTE - Antenna 9	56	47	58	45	38	39
Peak Gain (dBi)						
LTE - Antenna 1	2.6	1.6	1.1	1.1	0.4	1.8
LTE - Antenna 2	-0.3	-1.9	2.6	1.2	1.2	2.8
LTE - Antenna 3	0.1	-1.7	3.2	3.0	3.1	3.6
LTE - Antenna 7	1.3	0.2	2.1	1.2	2.4	3.4
LTE - Antenna 8	0	-1.0	1.5	0.4	2.0	2.0
LTE - Antenna 9	1.6	0.6	1.9	2.2	1.0	1.7

Wi-Fi Antenna Performance						
	2400MHz	2450MHz	2500MHz	5150MHz	5300MHz	5800MHz
Efficiency (%)						
Wi-Fi - Antenna 4	57	52	59	-	-	-
Wi-Fi - Antenna 5	45	39	46	38	46	37
Wi-Fi - Antenna 6	43	38	42	25	37	38
Wi-Fi - Antenna 10	53	53	56	-	-	-
Peak Gain (dBi)						
Wi-Fi - Antenna 4	3.9	4.0	4.4	-	-	-
Wi-Fi - Antenna 5	2.5	2.5	2.9	2.8	3.9	2.6
Wi-Fi - Antenna 6	1.3	1.9	3.0	0.6	2.8	3.1
Wi-Fi - Antenna 10	2.8	2.1	2.2	-	-	-

Impedance	50Ω
Polarization	Linear
VSWR	< 3 (when measured with 100mm 1.37 cable)
Cable	1 meter CFD-200-FR standard, fully customizable
Connector	Fakra standard, fully customizable

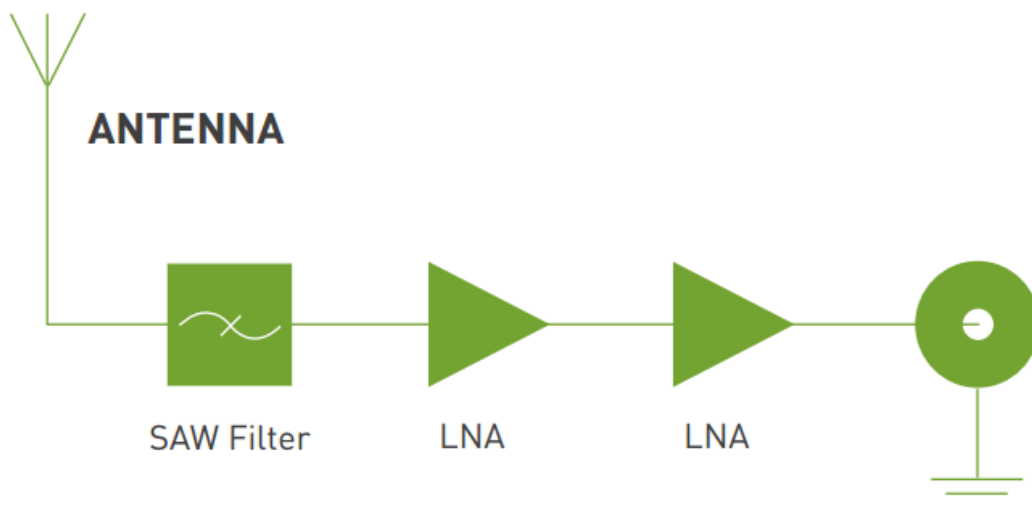
GNSS Antenna	
Frequency	GPS: 1575.42 ± 1.023MHz GLONASS: 1602 ± 5MHz
Polarization	RHCP
Antenna Gain at Zenith (Ceramic Patch only)	GPS: 1.5 dBi typ. @zenith GLONASS: +0 dBi typ. @zenith
Total Antenna Gain at Zenith (Antenna+SAW+LNA+ Cable+Connector)	GPS 1575.42MHz: 26 ± 3dBi GLONASS 1602MHz: 27.5 ± 3dBi
Impedance	50Ω
Output VSWR	Max 2.0
MECHANICAL	
Connector	Fakra
Cable	1M CFD-200-FR

ELECTRICAL			
Frequency	1574~1610MHz.		
Out of Band Attenuation	1592 ± 140MHz 15dB min		
Output Impedance	50Ω		
Output VSWR	2.0 Max		
Pout at 1dB Gain	-2 dBm Typ.		
Compression Point	-6dBm Min		
LNA Gain, Power Consumption and Noise Figure			
Voltage	LNA Gain (Typ)	Power Consumption (Typ)	Noise Figure (Typ)
Min 1.8V	22dB	5mA	2.6dB
Typ 3.0V	28dB	10mA	2.6dB
Max 5.5V	31dB	23mA	2.9dB

MECHANICAL	
Antenna Dimension	540*185*35mm
Casing	PC coated UV stabilized ABS
Connector	Fakra
Cable	1M CFD-200-FR
Weight(g)	TBC
Base and Thread	TBC

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

2.1 GNSS



3 Test Set Up

New image to be included here.

Figure 1. Left: S_{11} and VSWR test set up; Right: OTA test set up in Taoglas Ireland ETS-Lindgren Chamber

In all measurements 1m CFD-200-FR cable with a 100mm Fakra to SMA pigtail was used to connect to the antenna board.

4 Antenna Performance

4.1 Return Loss

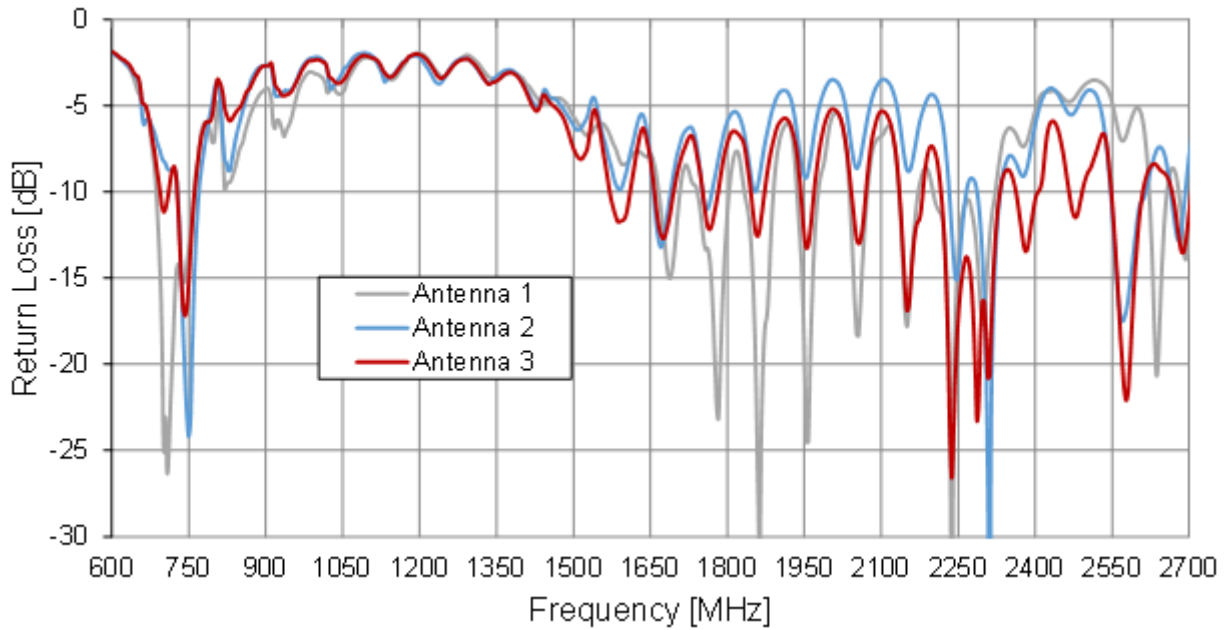


Figure 2. Return Loss of Antenna 1, 2, 3

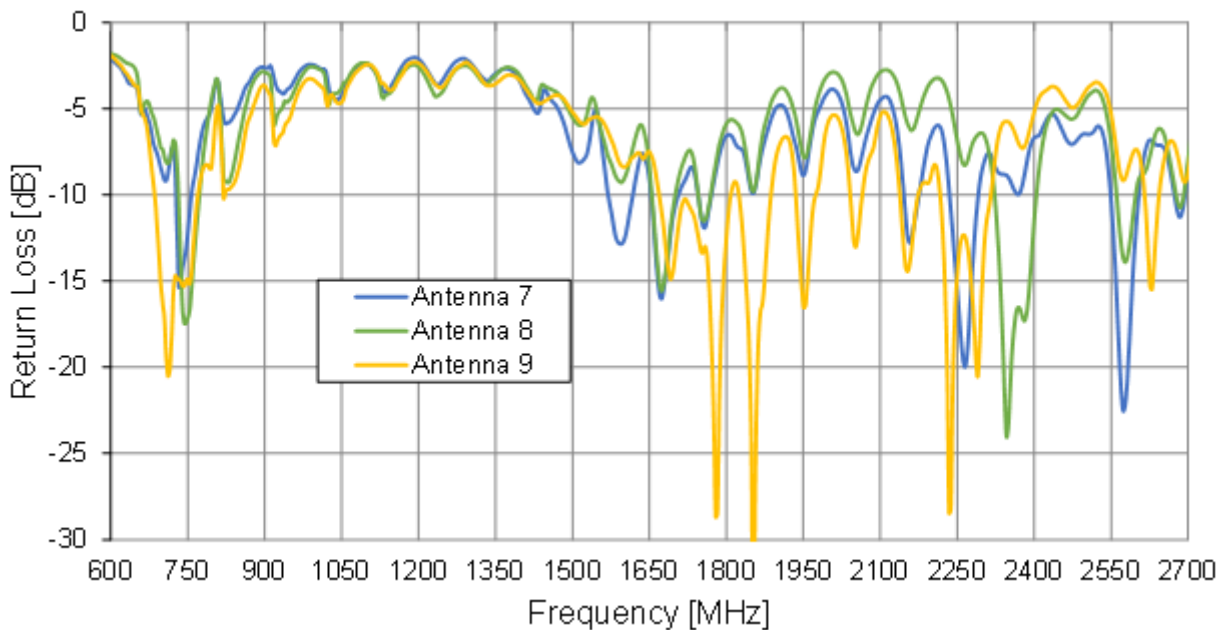


Figure 3. Return Loss of Antenna 7, 8, 9

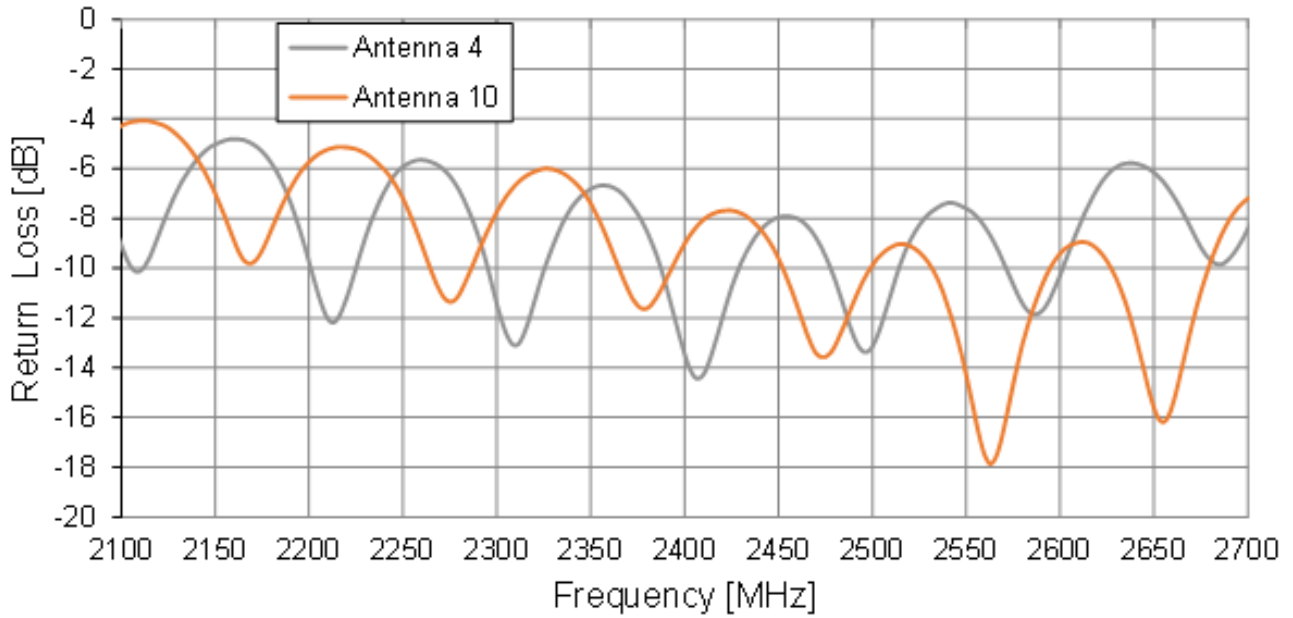


Figure 4. Return Loss of the Wi-Fi Antenna 4 and 10

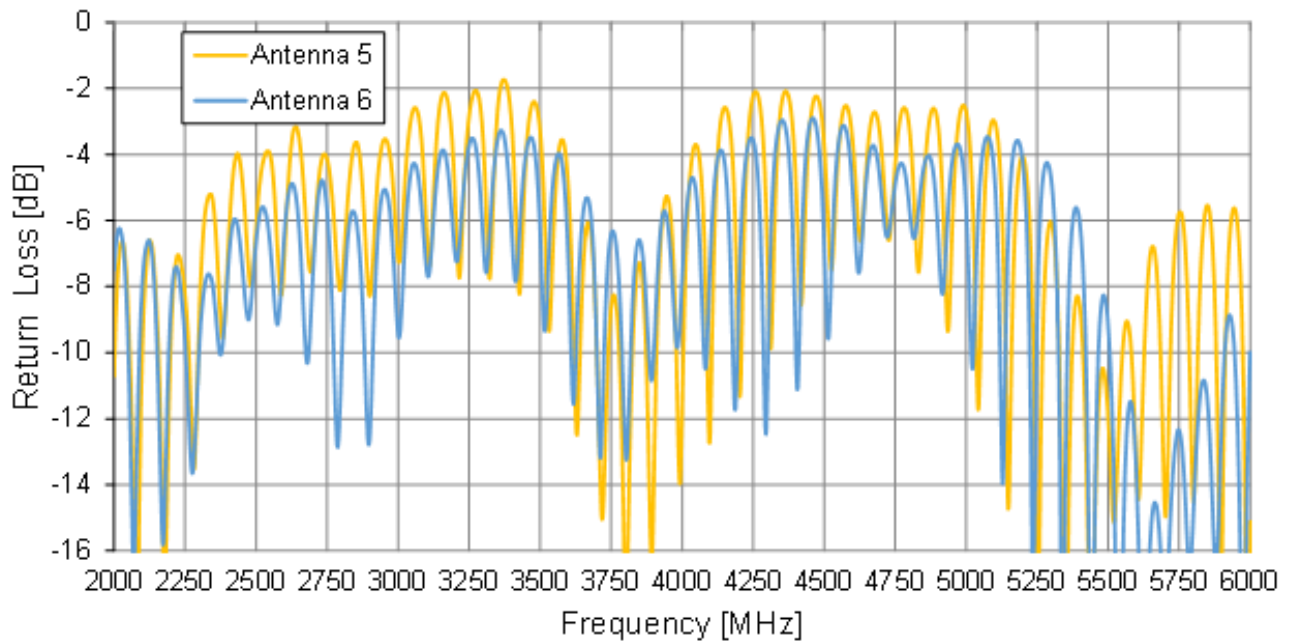


Figure 5. Return Loss of the Wi-Fi Antenna 6

4.2 VSWR

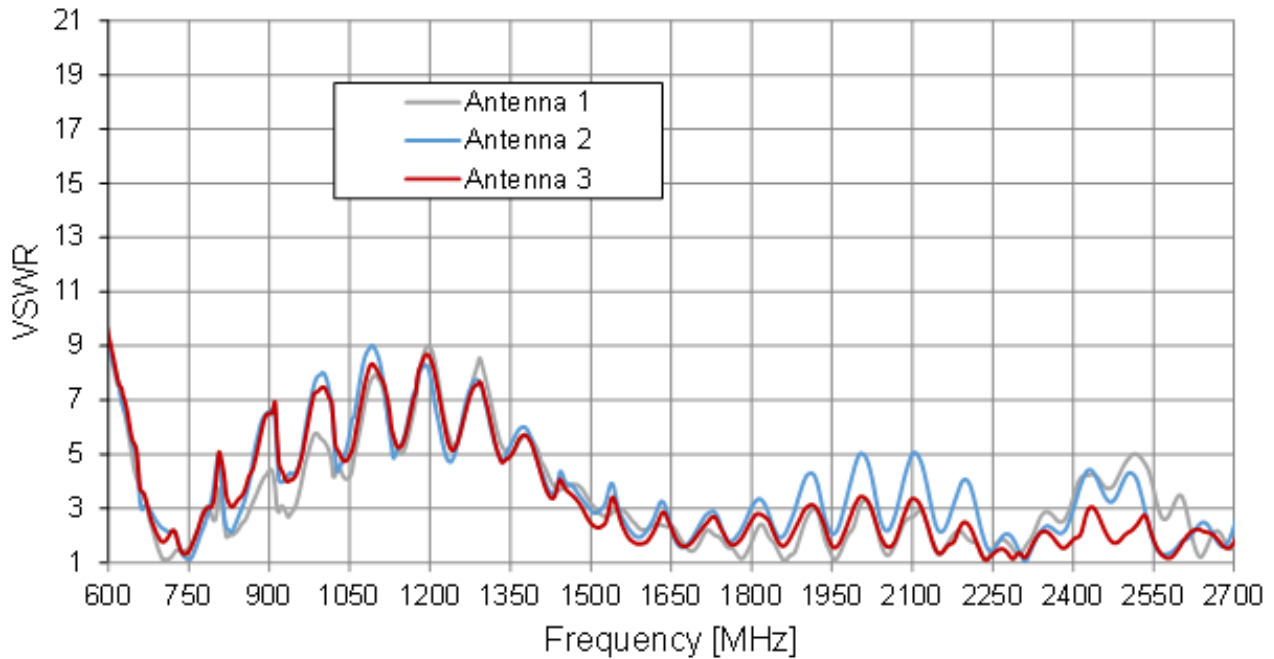


Figure 6. VSWR of the Antenna 1, 2, 3

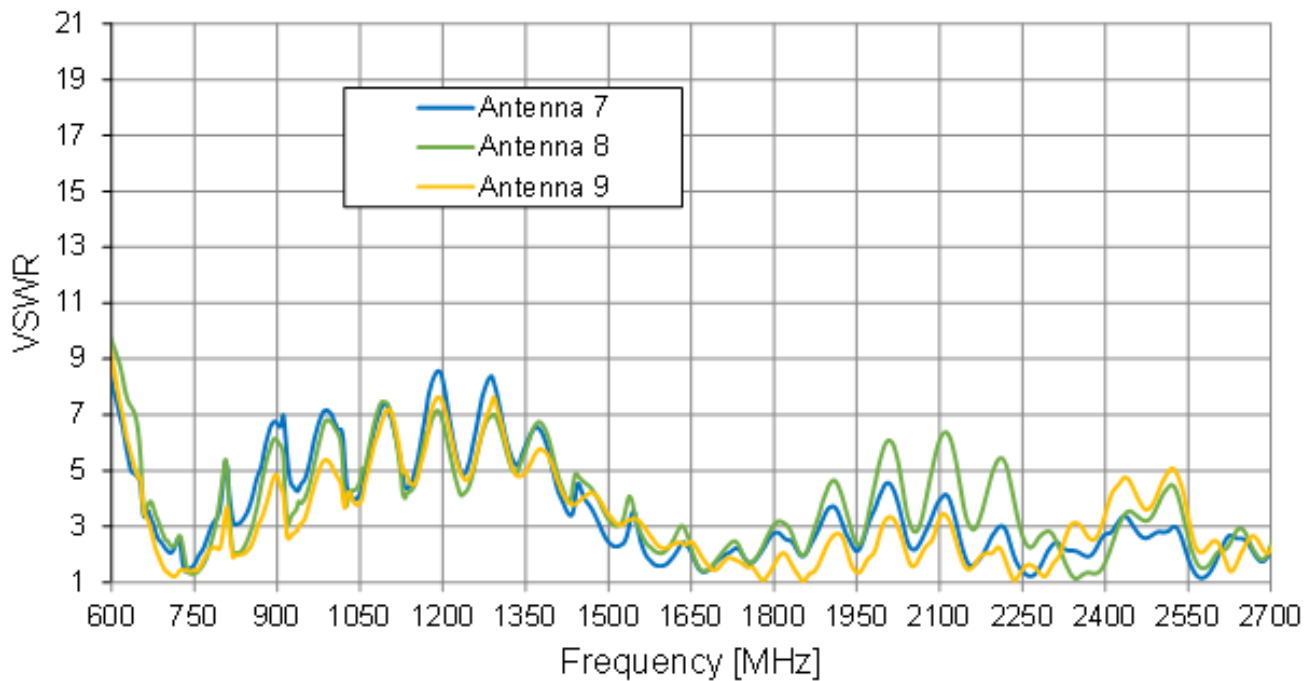


Figure 7. VSWR of Antenna 7, 8, 9

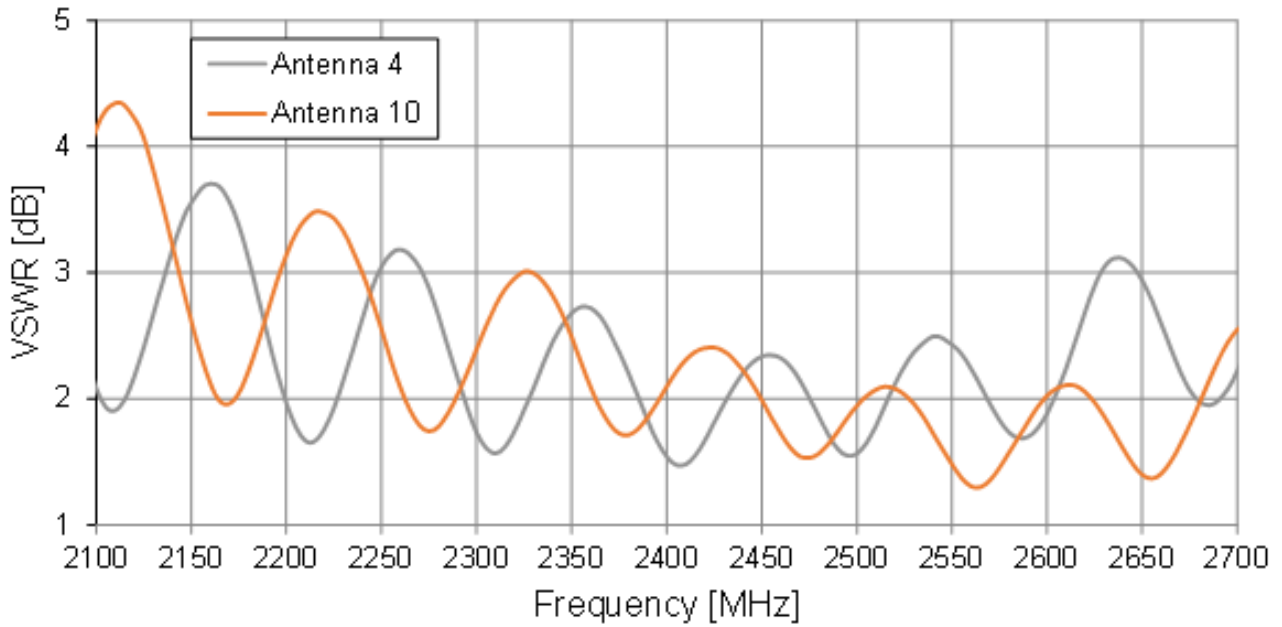


Figure 8. VSWR of Antenna 4 and 10

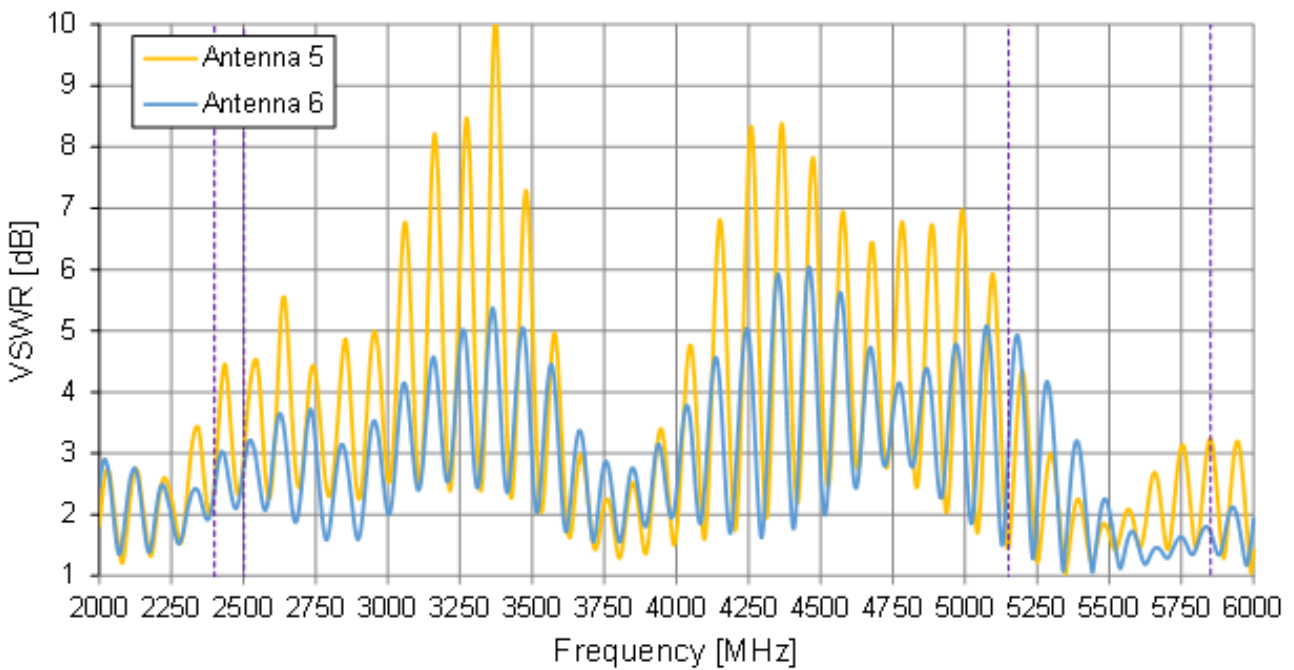


Figure 9. VSWR of Antenna 6

4.3 Isolation

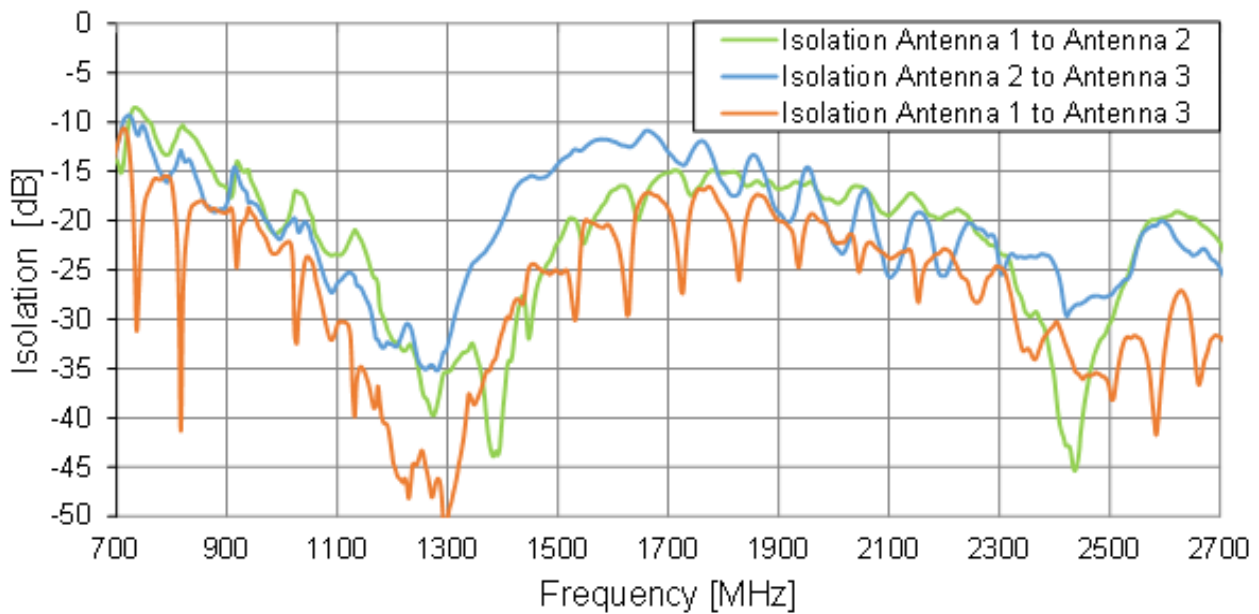


Figure 10. Isolation results between LTE antennas

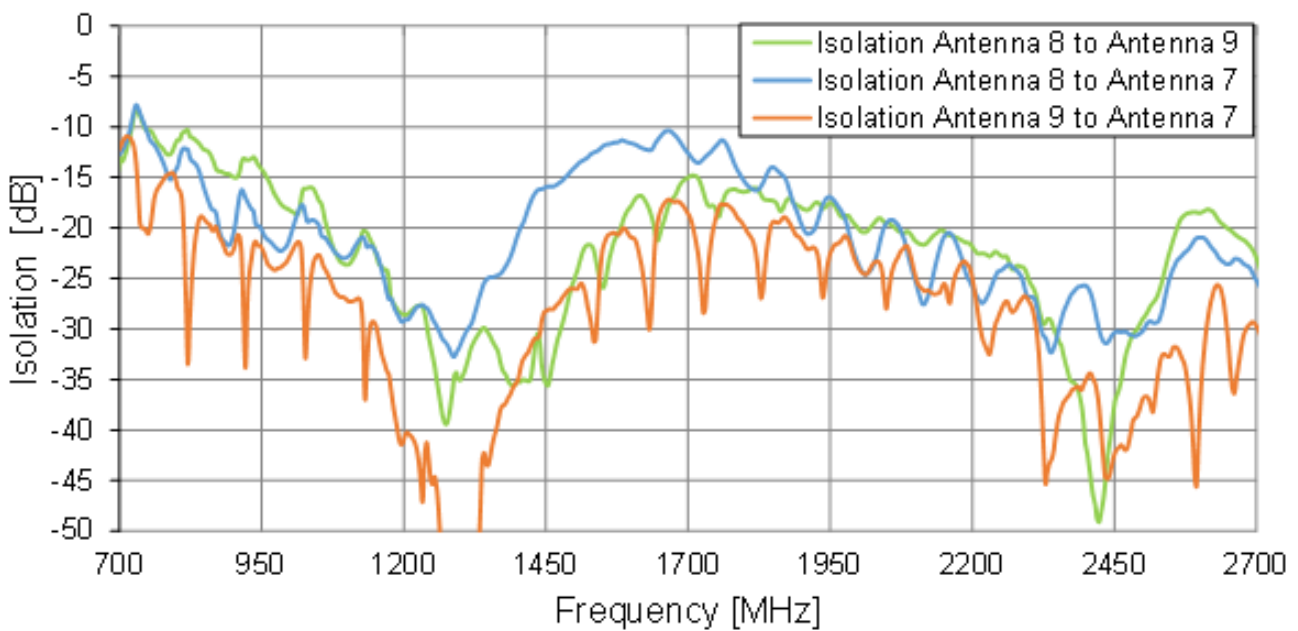


Figure 11. Isolation results between LTE antennas

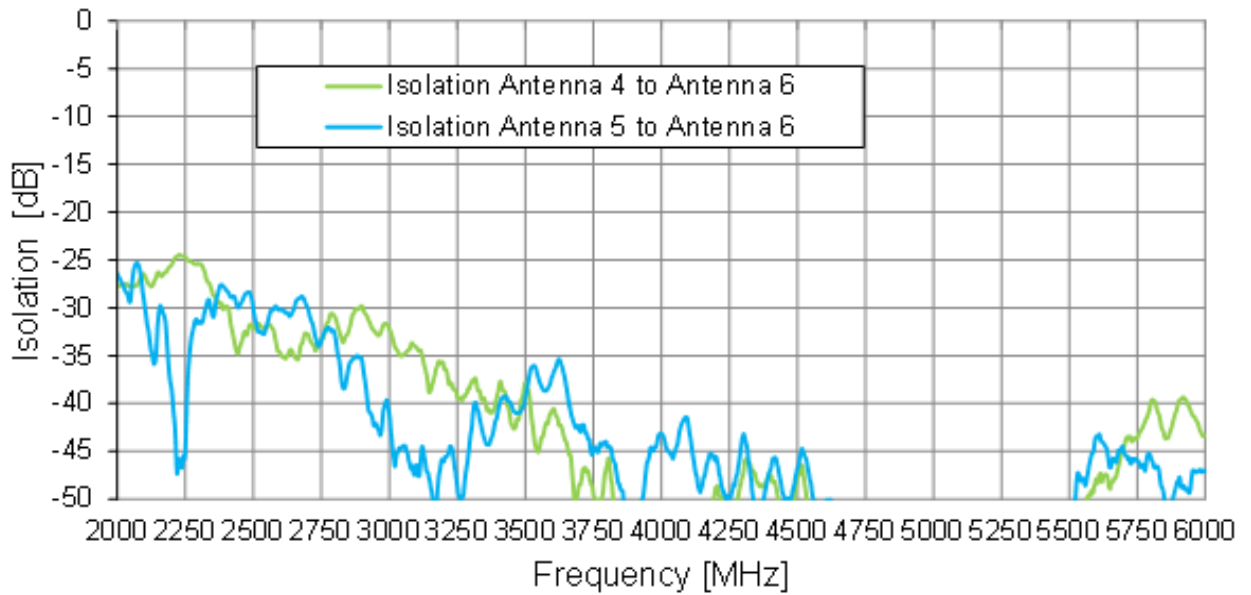


Figure 12. Isolation results between Wi-Fi antennas

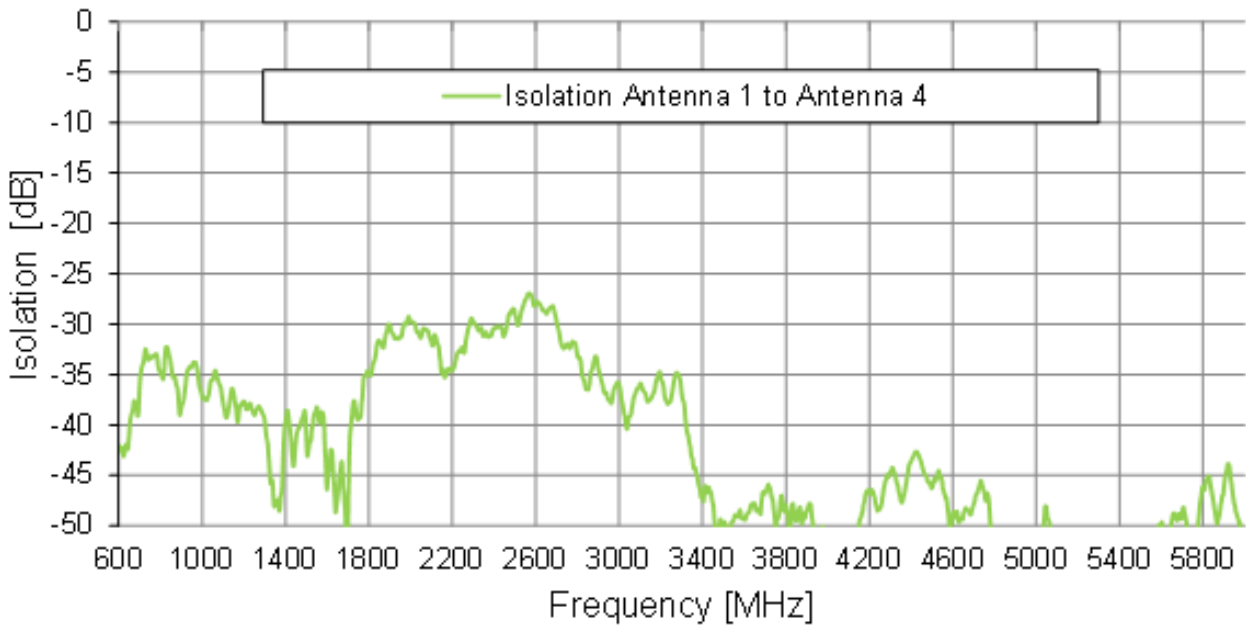


Figure 13. Isolation result between Wi-Fi Antenna 4G & LTE Antenna 1 antennas

4.4 Efficiency

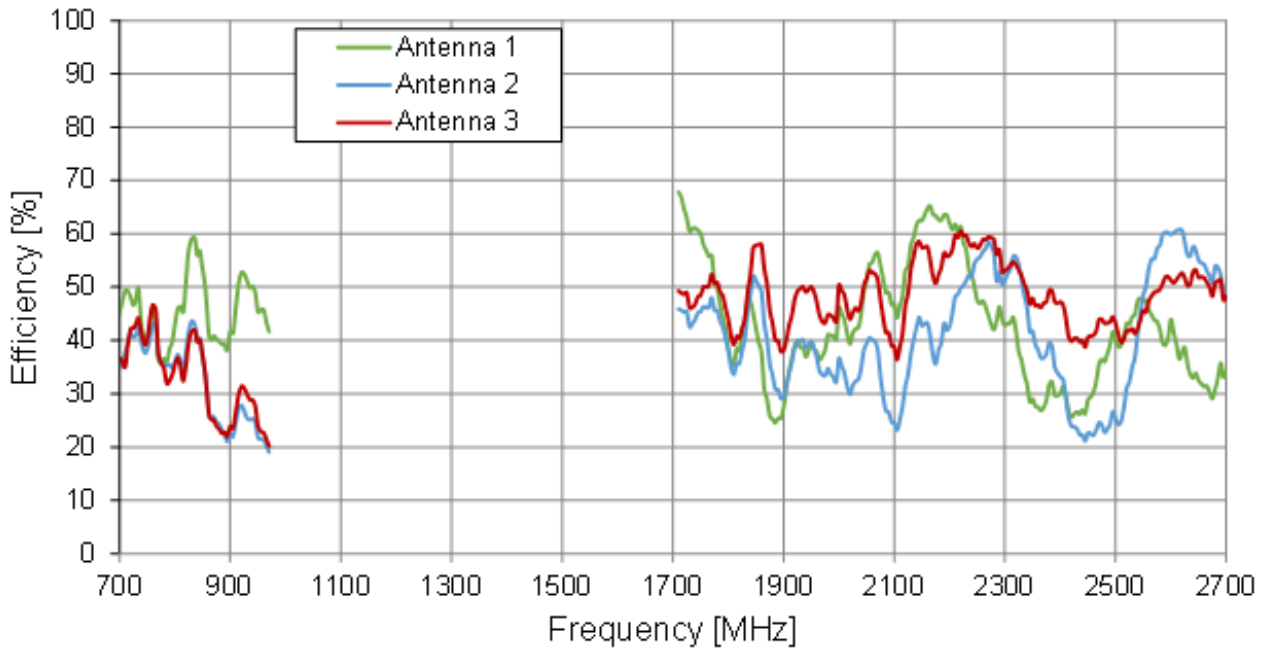


Figure 14. Efficiency of Antennas 1, 2, 3

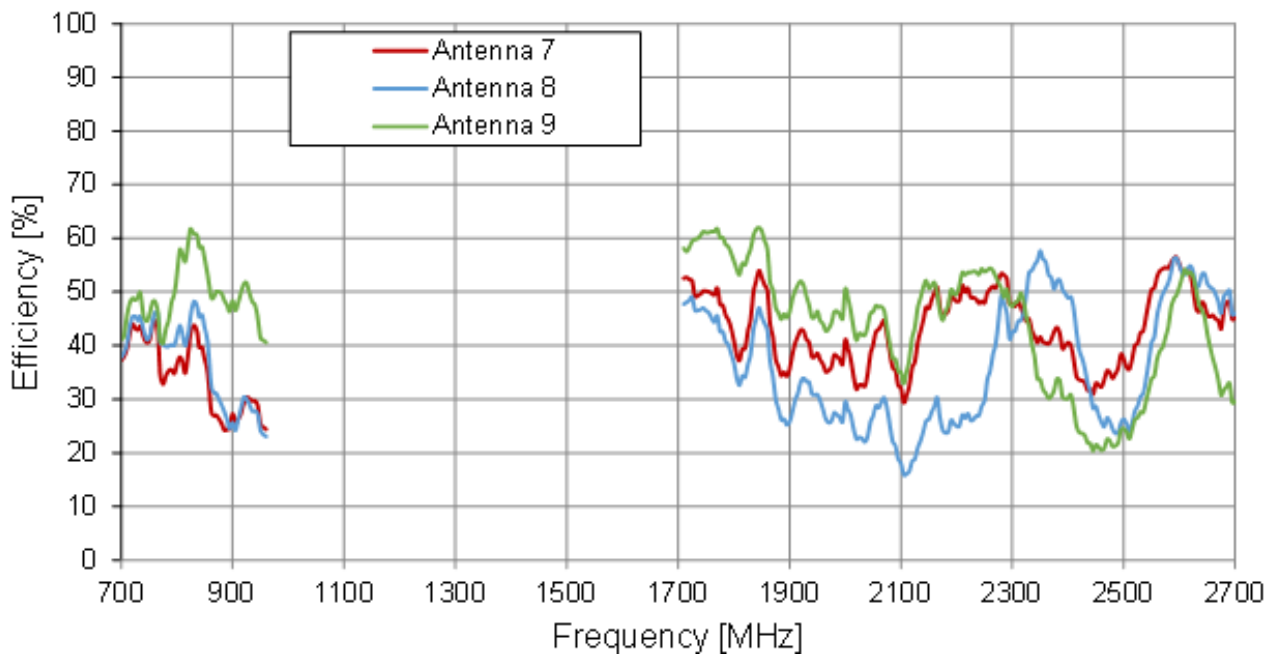


Figure 15. Efficiency of Antennas 7, 8, 9

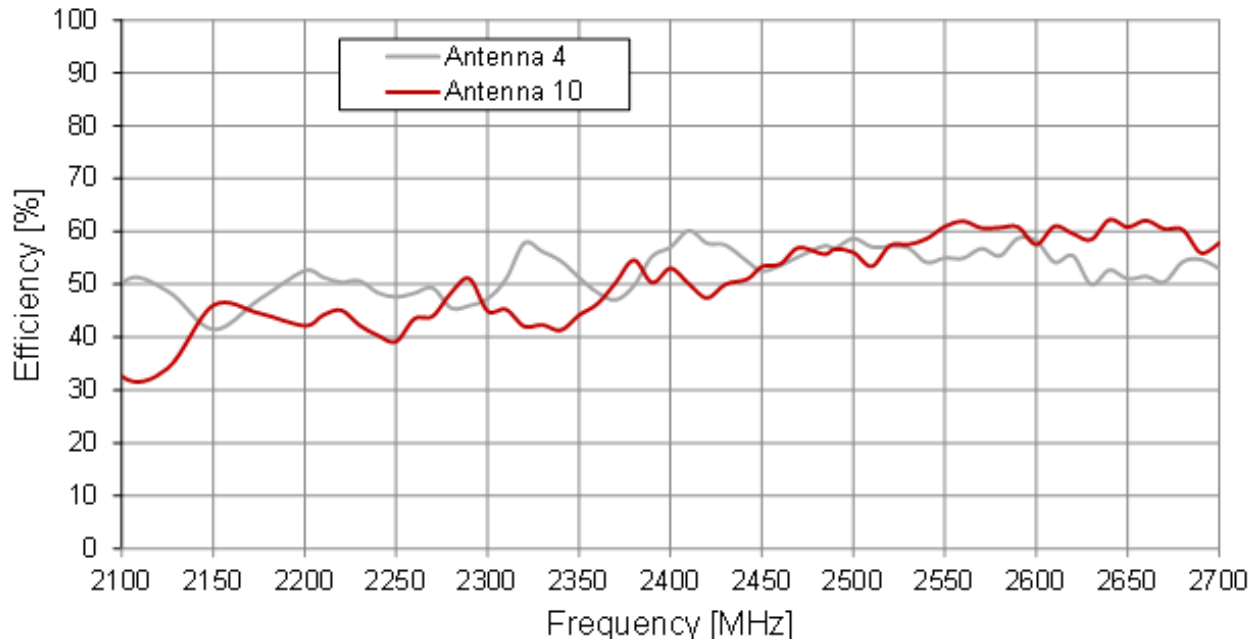


Figure 16. Efficiency of Antennas 4 and 10

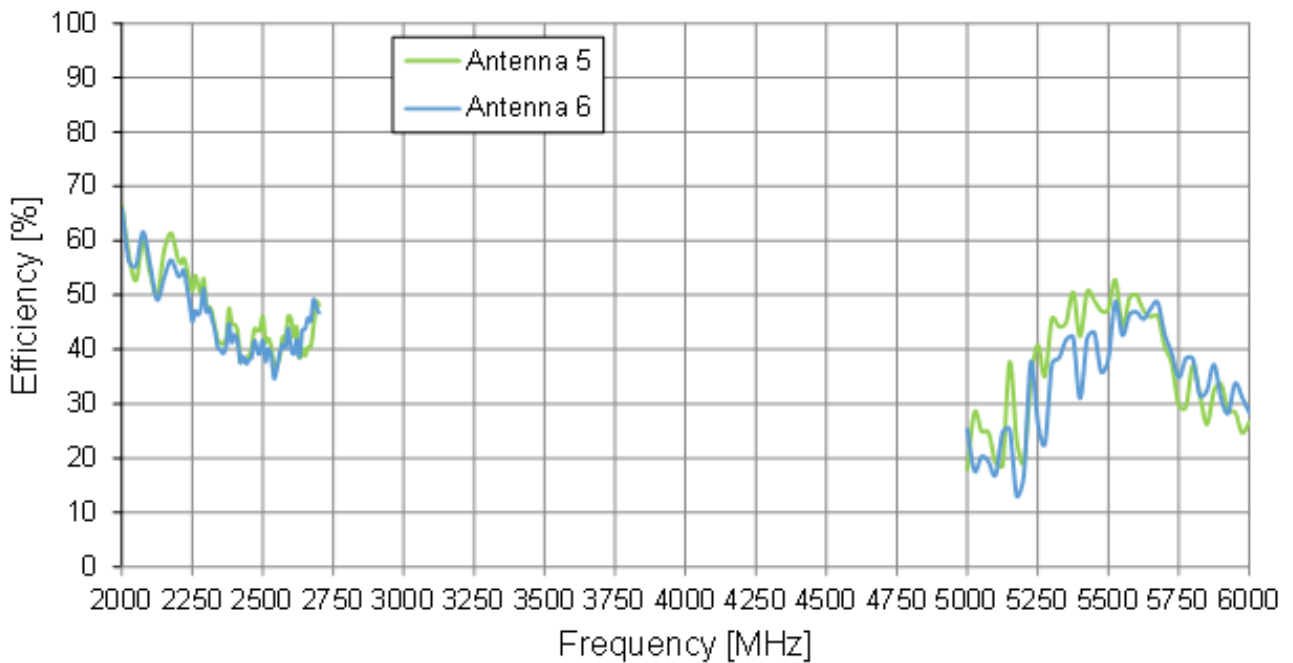


Figure 17. Efficiency of Antennas 5 and 6

4.5 Peak Gain

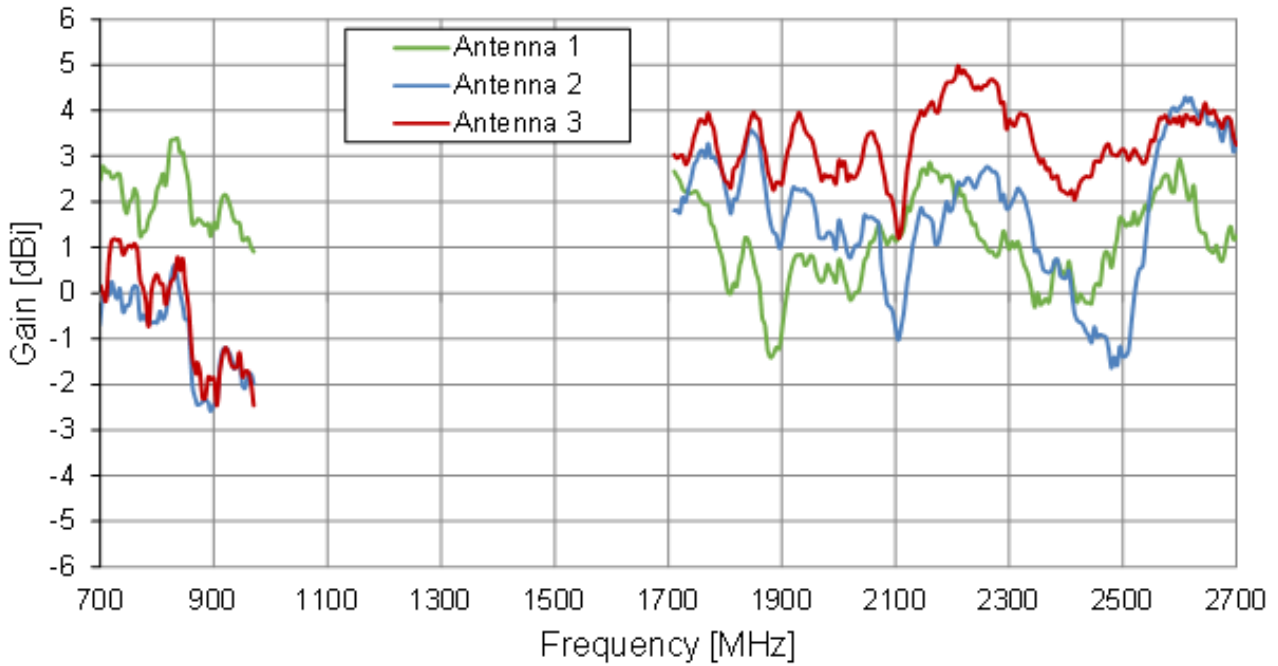


Figure 18. Peak gain of Antenna 1, 2, 3

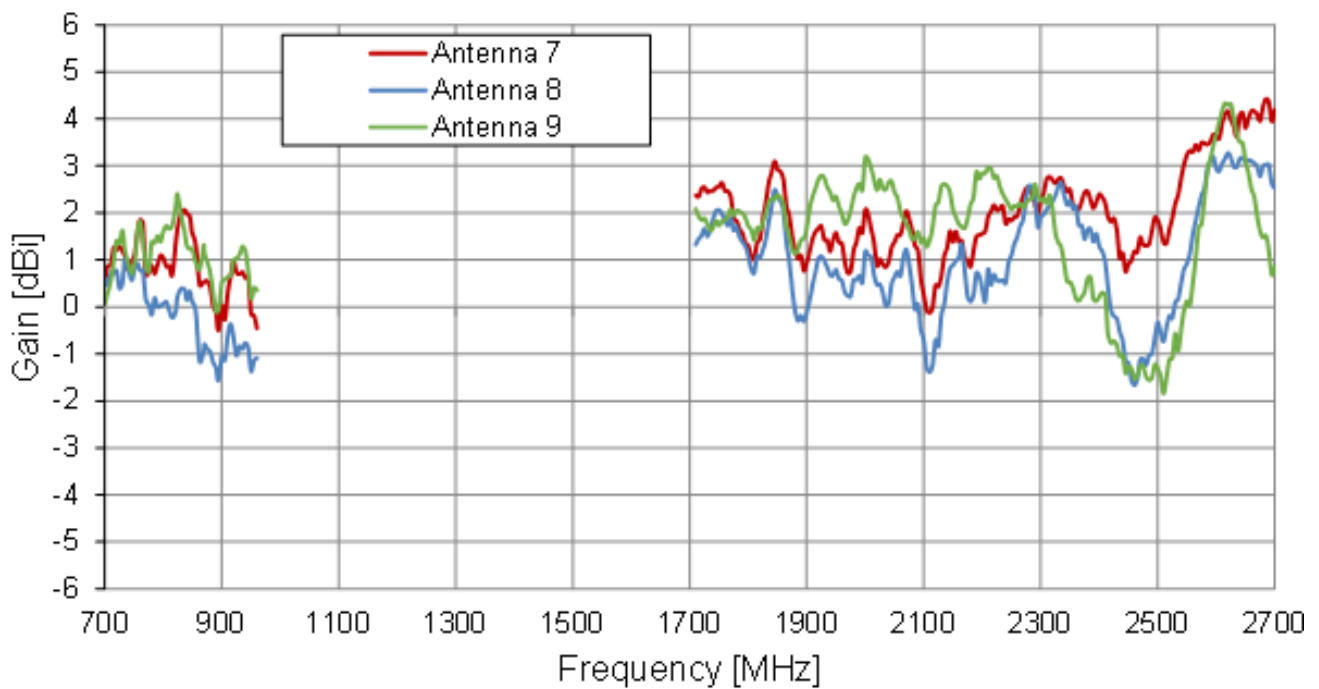


Figure 19. Peak gain of Antenna 7, 8, 9

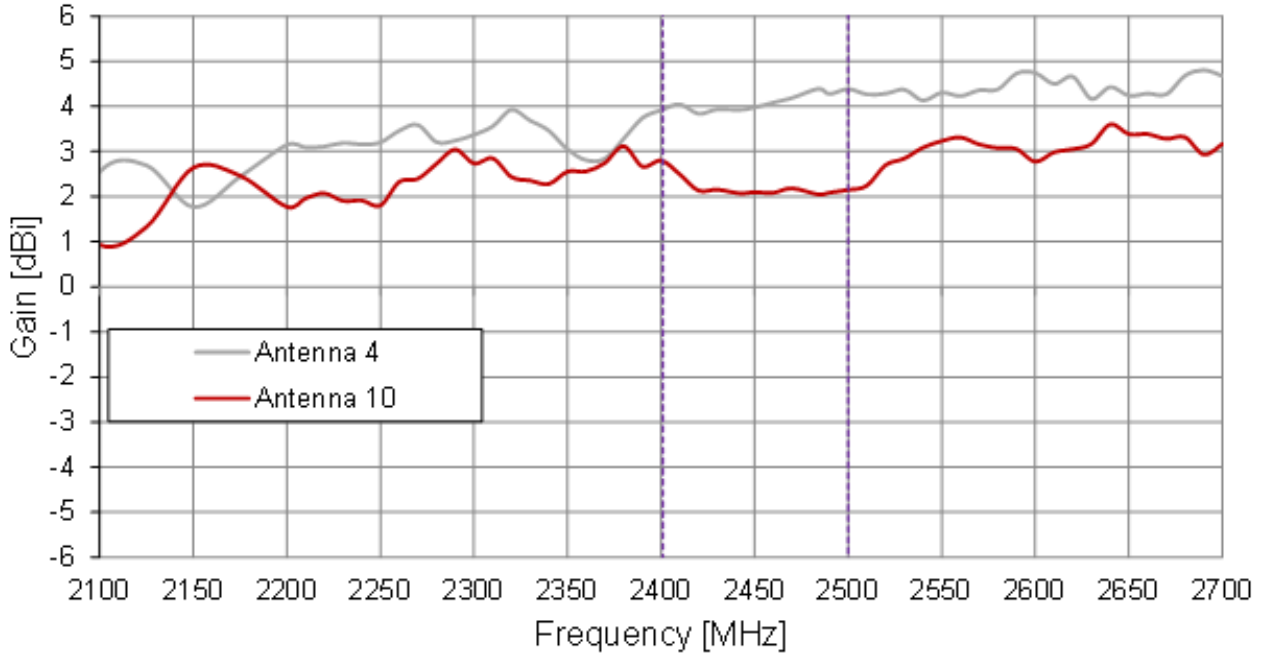


Figure 20. Peak gain of Antenna 4 and 10

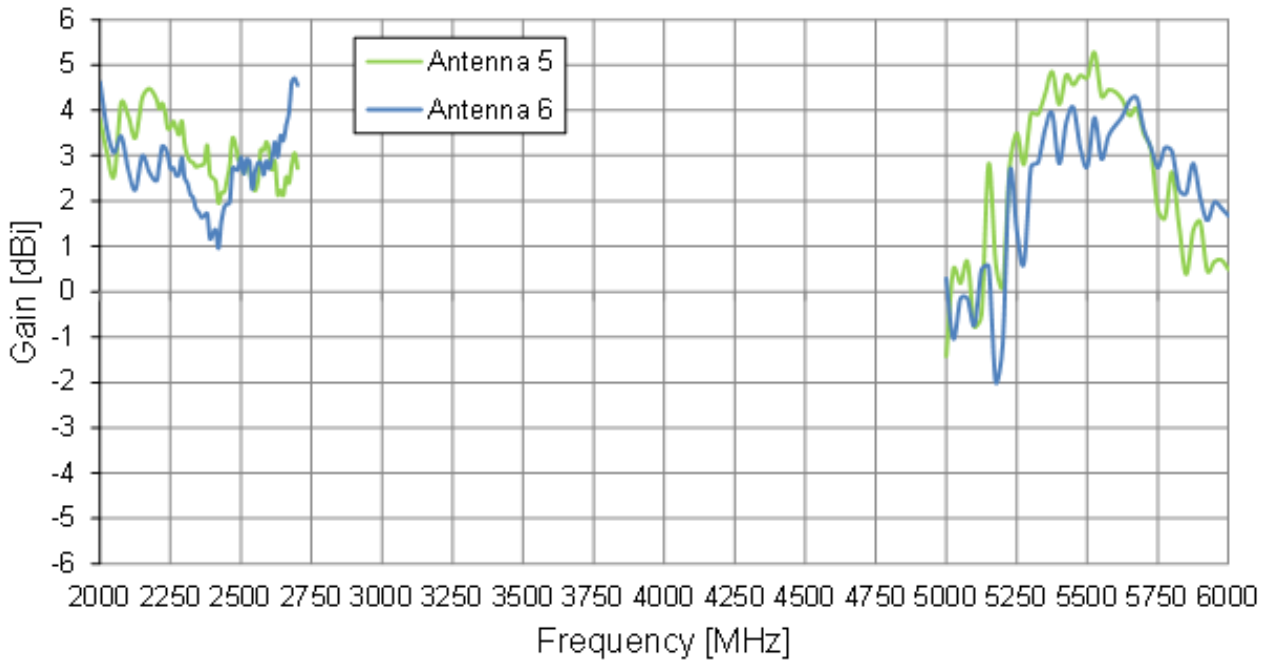


Figure 21. Peak gain of Antennas 5 and 6

4.6 Average Gain

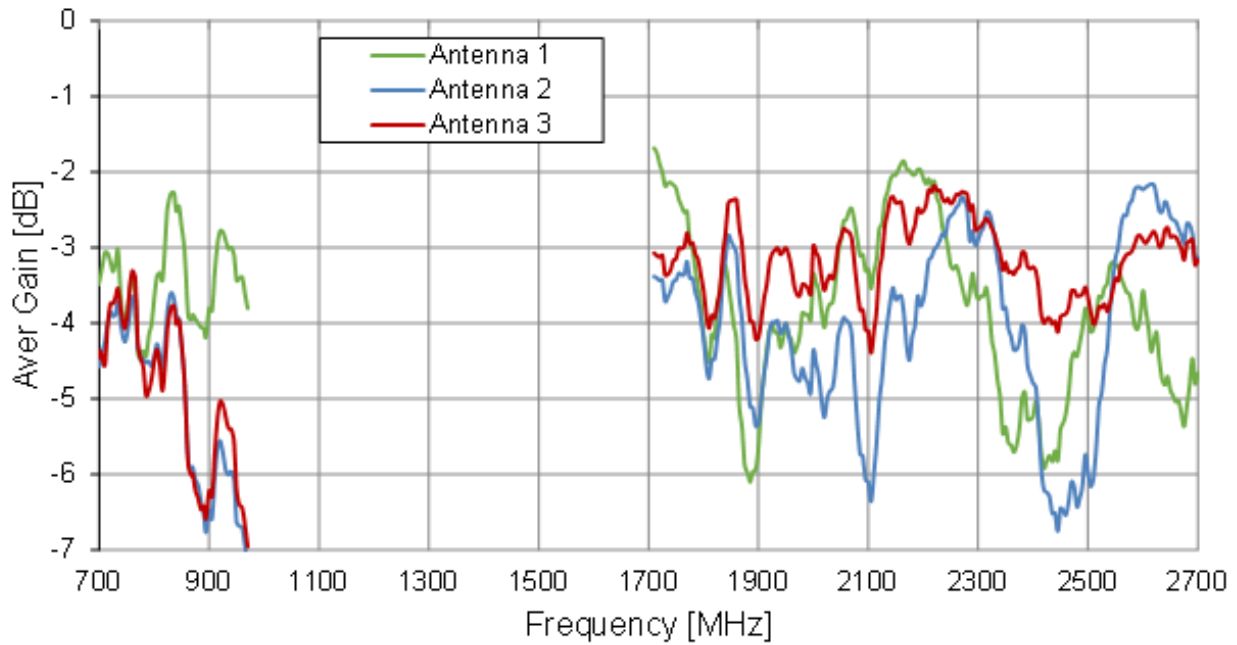


Figure 22. Average gain of Antennas 1, 2, 3

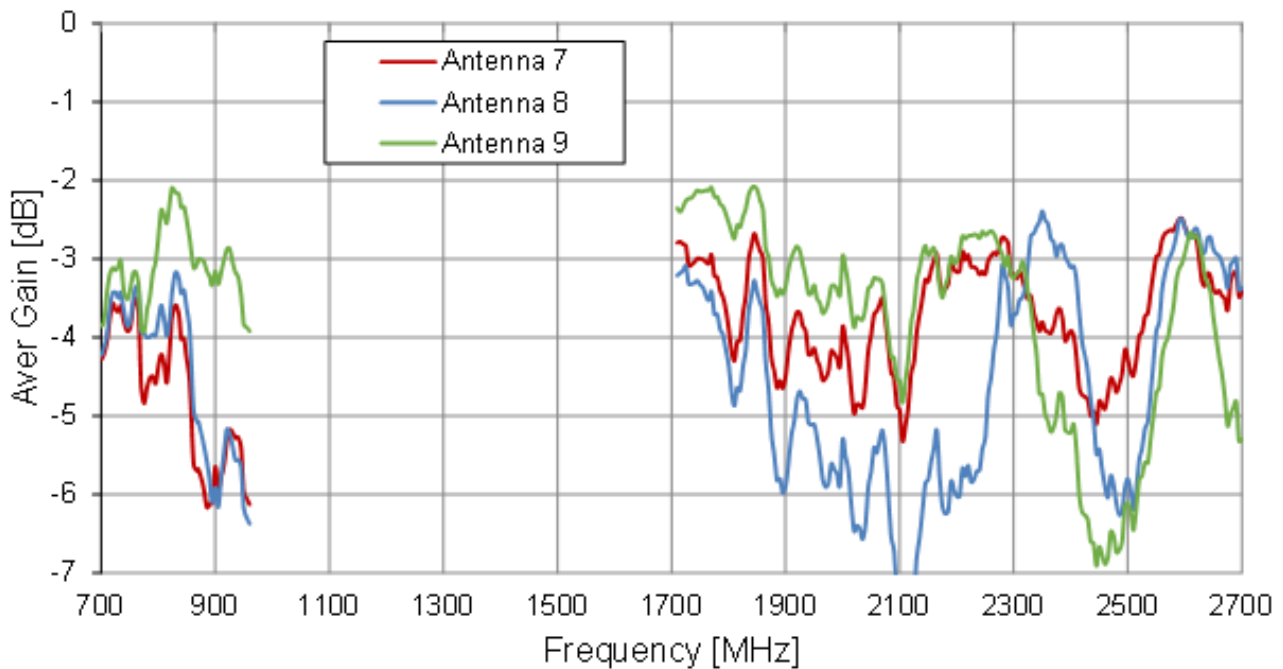


Figure 23. Average gain of Antennas 7, 8, 9

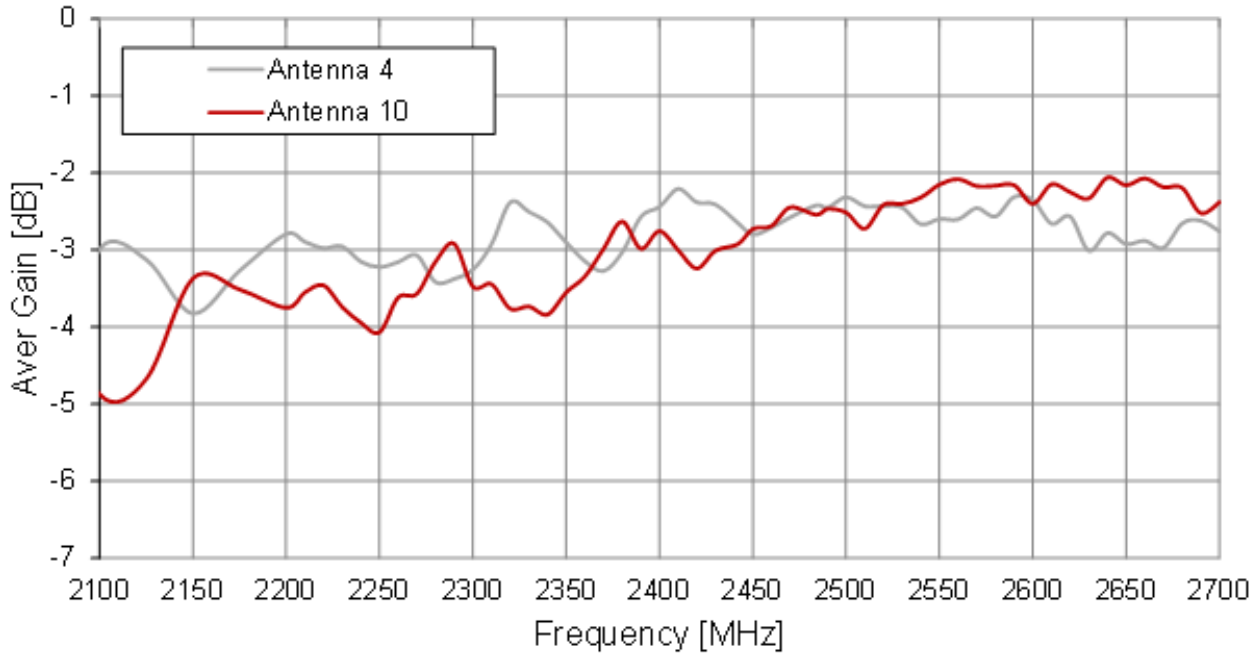


Figure 24. Average gain of Antennas 4 and 10

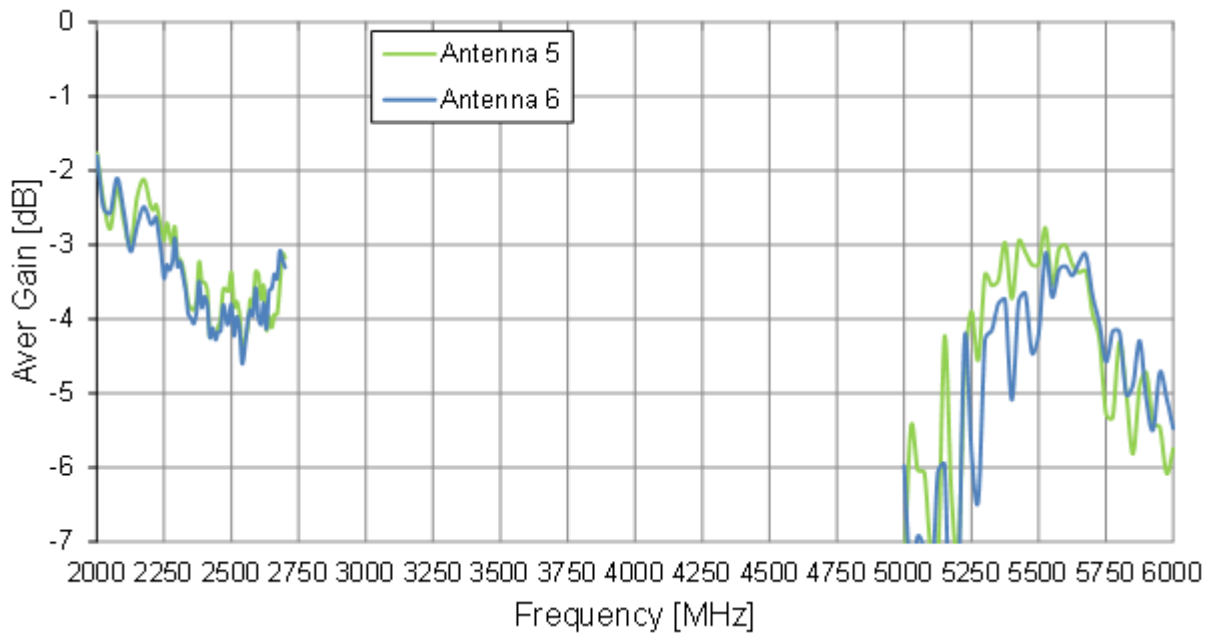
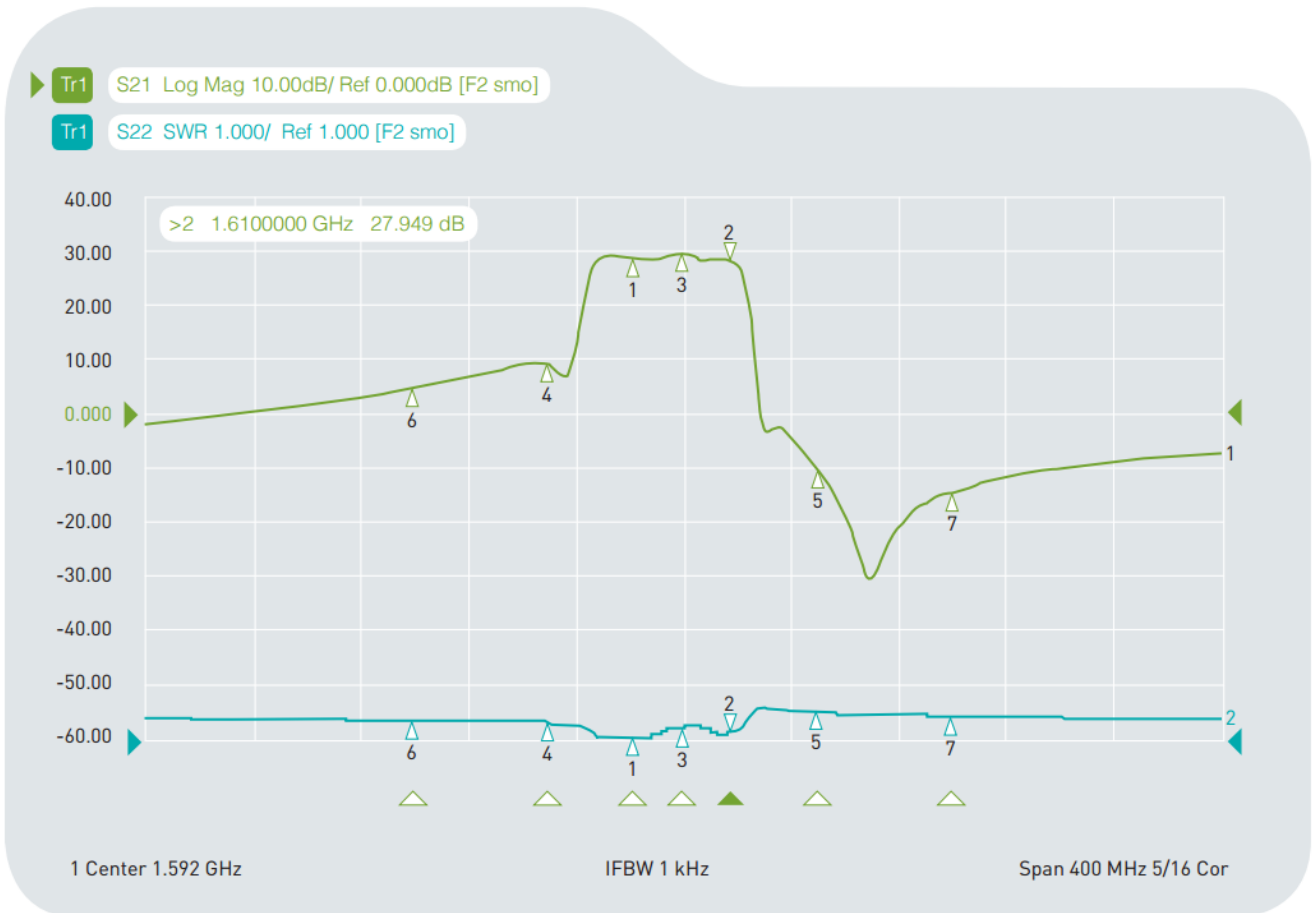


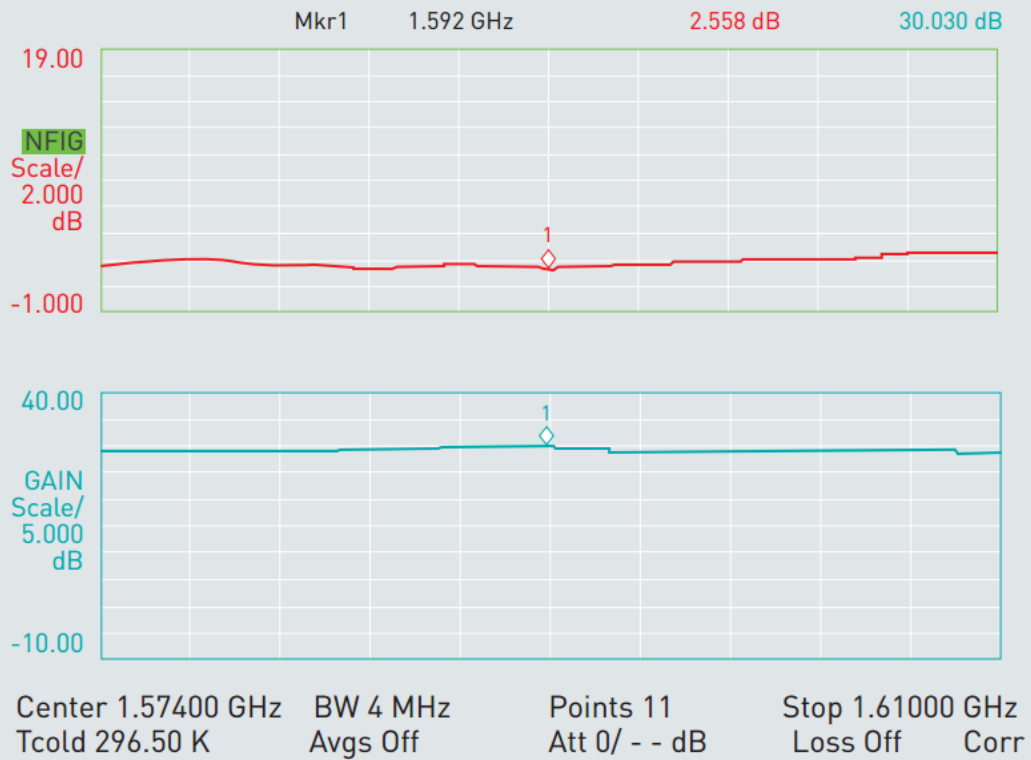
Figure 25. Average gain of Antennas 5 and 6

4.7 LNA Gain and Out Band Rejection @ 3V



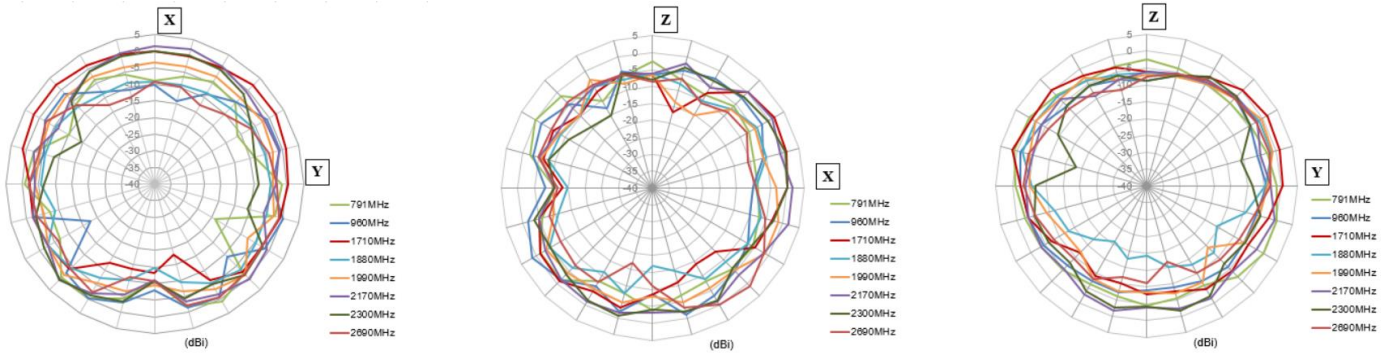
Ch1	Tr1	S21	1	1.5740000 GHz	28.186 dB
Ch1	Tr1	S21	>2	1.6100000 GHz	27.949 dB
Ch1	Tr1	S21	3	1.5920000 GHz	29.044 dB
Ch1	Tr1	S21	4	1.5420000 GHz	9.0245 dB
Ch1	Tr1	S21	5	1.6420000 GHz	-10.035 dB
Ch1	Tr1	S21	6	1.4920000 GHz	4.4105 dB
Ch1	Tr1	S21	7	1.6920000 GHz	-14.431 dB
Ch1	Tr2	S22	1	1.5740000 GHz	1.0816
Ch1	Tr2	S22	2	1.6100000 GHz	1.1855
Ch1	Tr2	S22	3	1.5920000 GHz	1.2488
Ch1	Tr2	S22	4	1.5420000 GHz	1.3486

4.8 LNA Noise Figure @ 3V

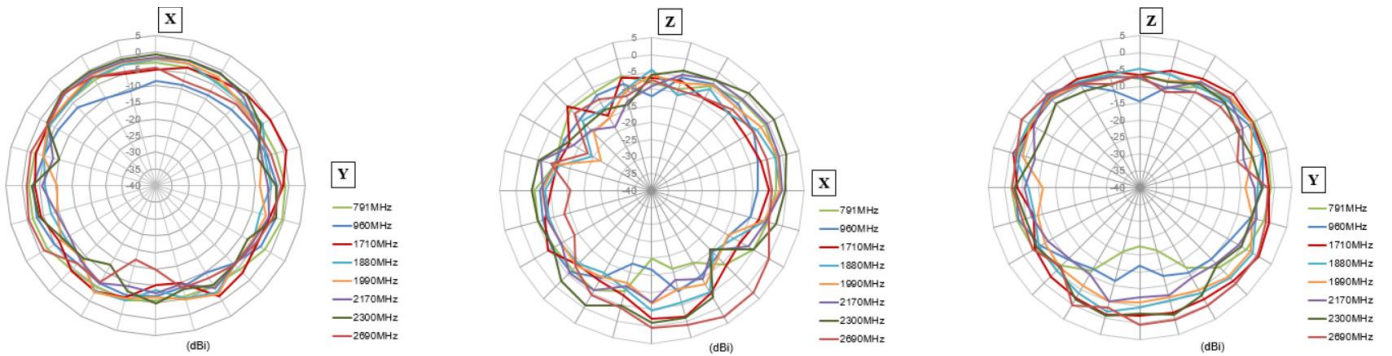


4.9 2D Radiation Patterns

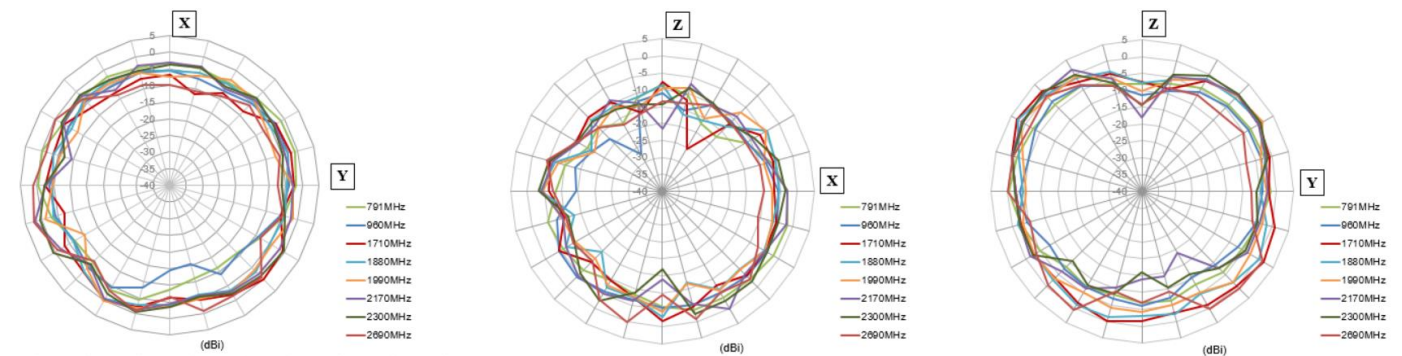
4.9.1 Antenna 1



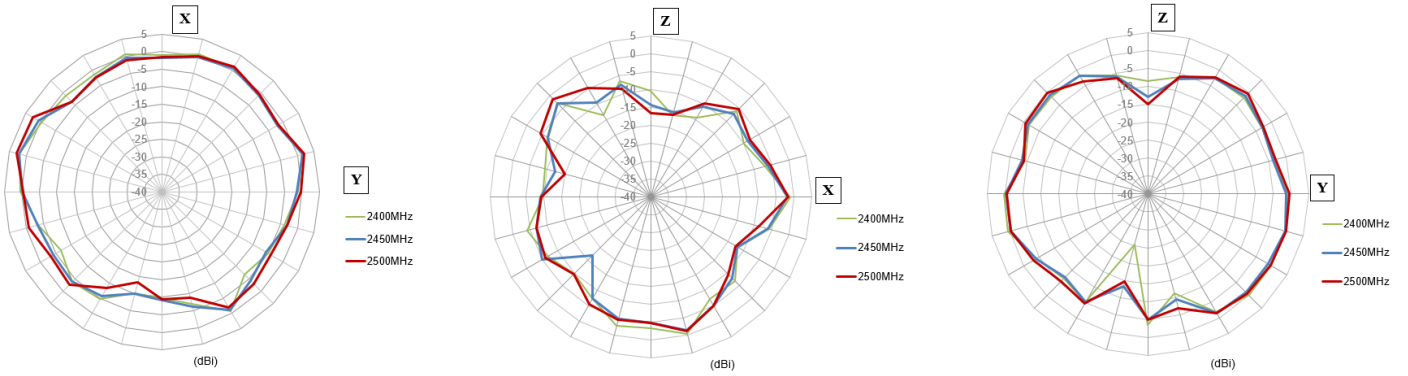
4.9.2 Antenna 2



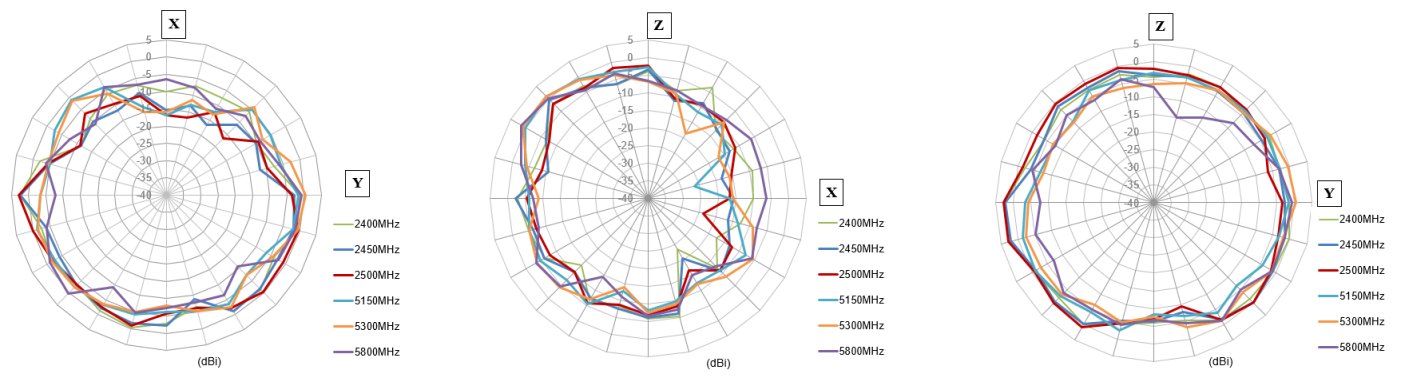
4.9.3 Antenna 3



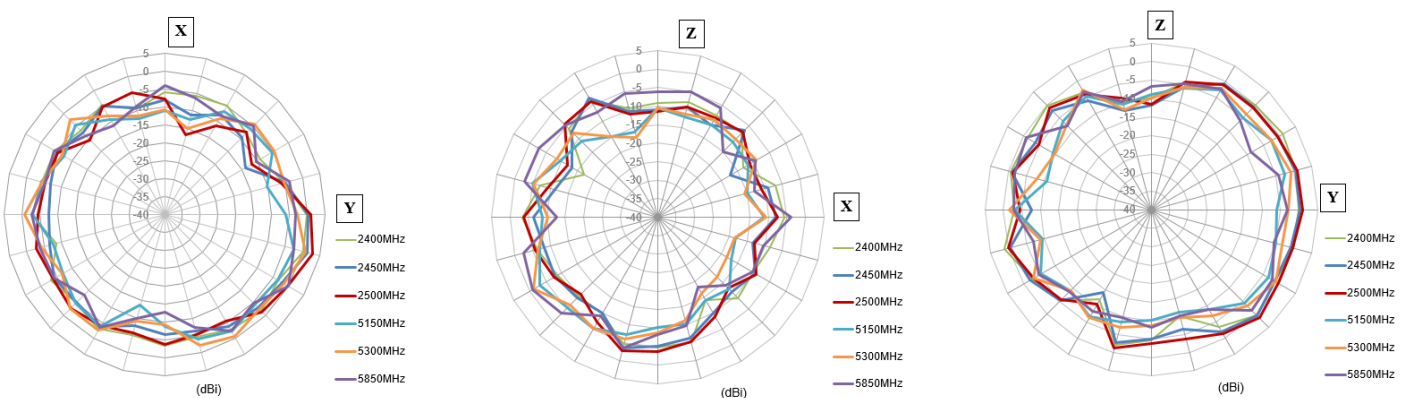
4.9.4 Antenna 4



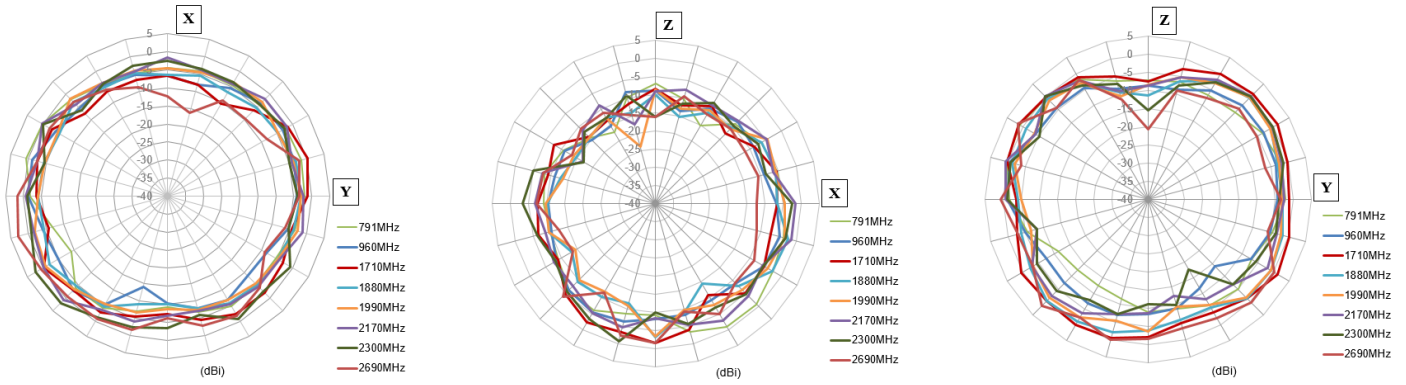
4.9.5 Antenna 5



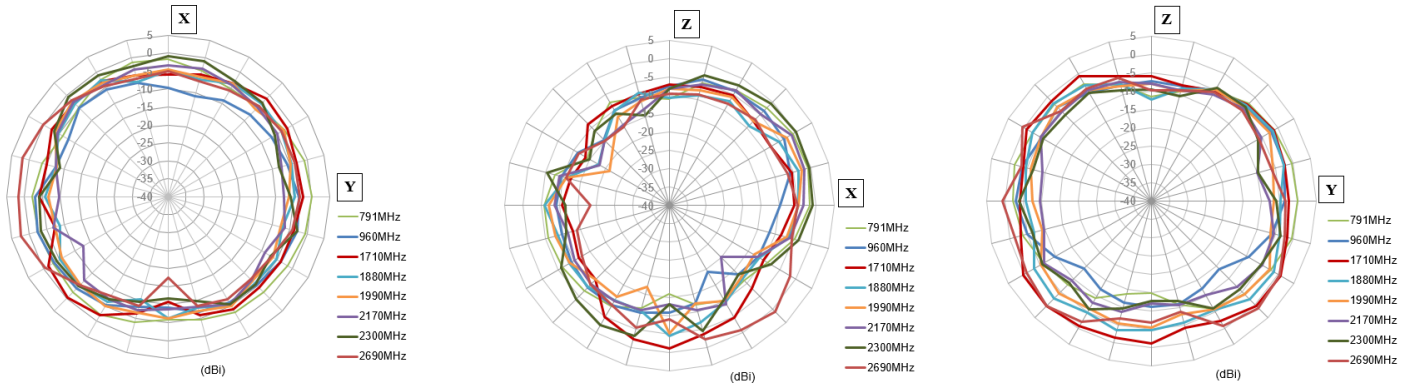
4.9.6 Antenna 6



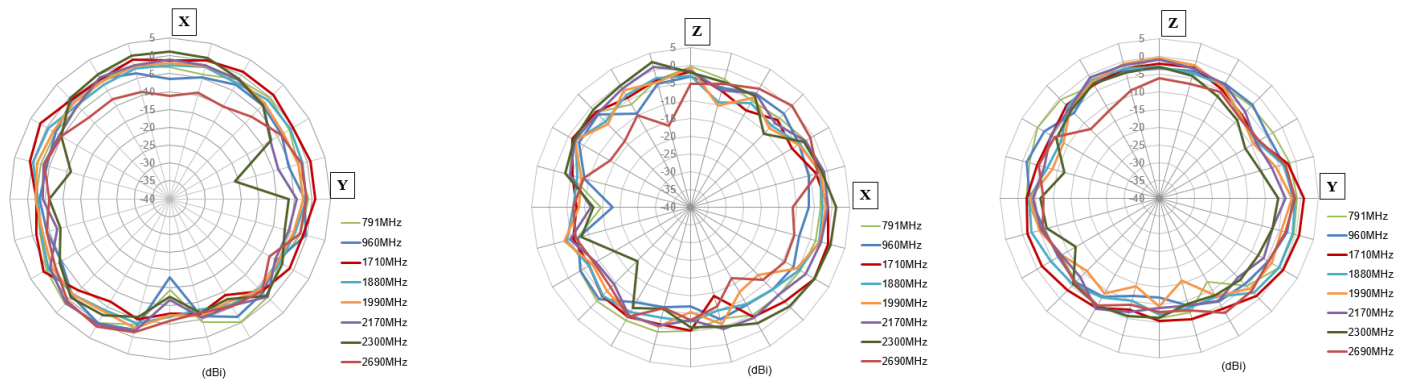
4.9.7 Antenna 7



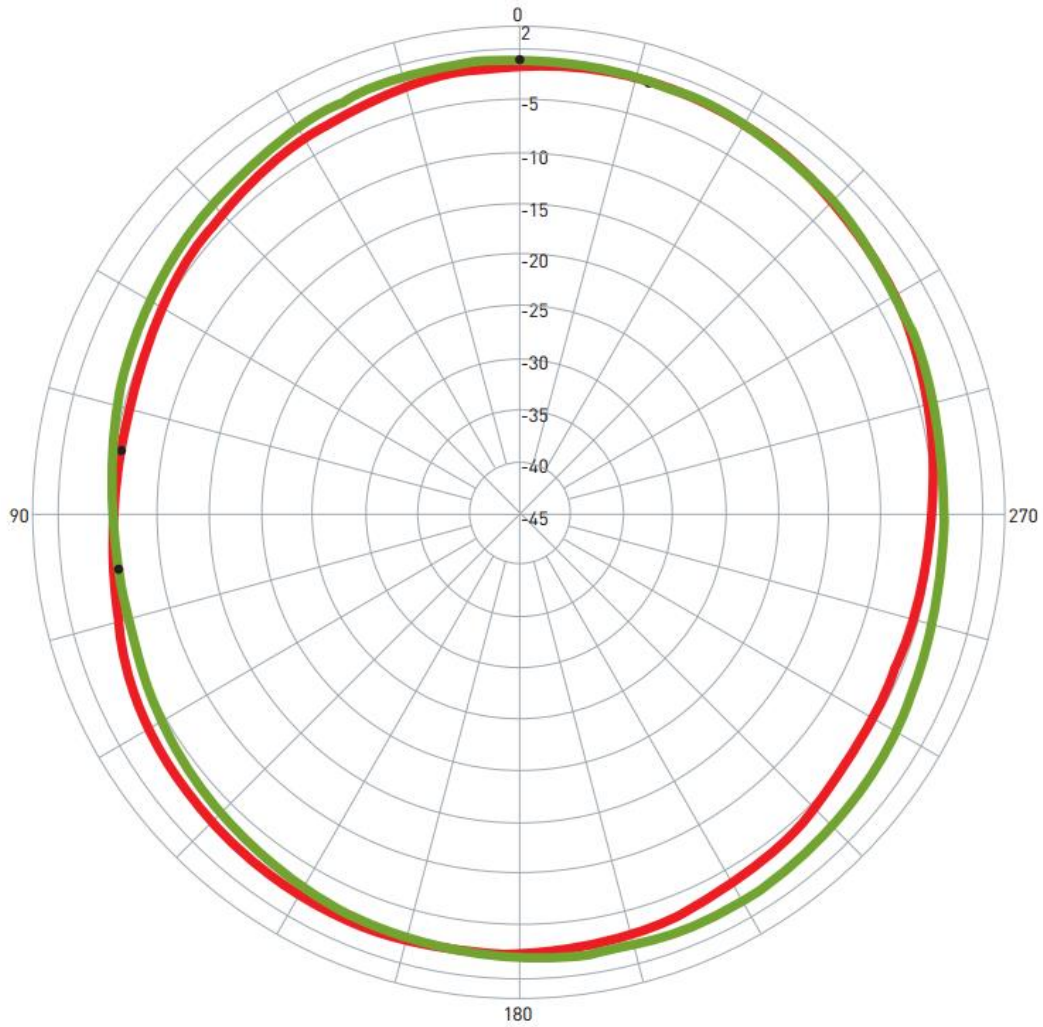
4.9.8 Antenna 8



4.9.9 Antenna 9

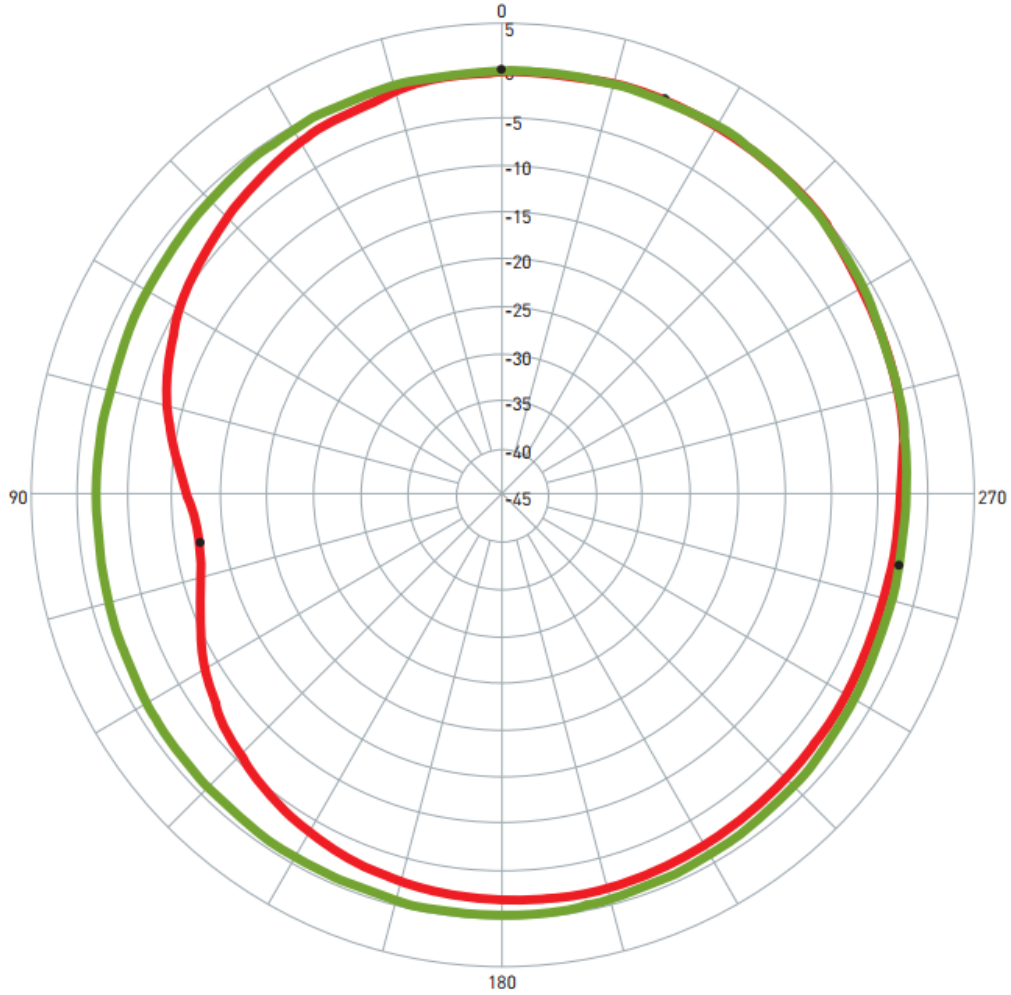


4.10 2D Radiation Pattern for 1575.42MHz XZ & YZ Plane



Pattern	Model No.	Test Mode	Freq (MHz)	Max Gain(dBi)	Min Gain(dBi)	Avg. Gain(dBi)	Source Polar.
1	AGGP.25F.07.0060A	XZ	1575.42	-1.41 / 343.00	-5.88 / 82.00	-3.32	V+H
2	AGGP.25F.07.0060A	YZ	1575.42	-1.09 / 0.00	-5.80 / 99.00	-2.76	V+H

4.11 2D Radiation Pattern for 1602MHZ XZ & YZ Plane



Pattern	Model No.	Test Mode	Freq (MHz)	Max Gain(dBi)	Min Gain(dBi)	Avg. Gain(dBi)	Source Polar.
1	AGGP.25F.07.0060A	XZ	1602.00	0.28 / 338.00	-12.36 / 99.00	-2.49	V+H
2	AGGP.25F.07.0060A	YZ	1602.00	0.19 / 0.00	-2.17 / 260.00	-0.91	V+H



5 Mechanical Drawing

Currently under development



6 Packing Information

Currently under development



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.