



Antenna Performance Verification

27 December 2024

S/N: 5-02531-01
GTT PN #: 1037G00000190 RevX4

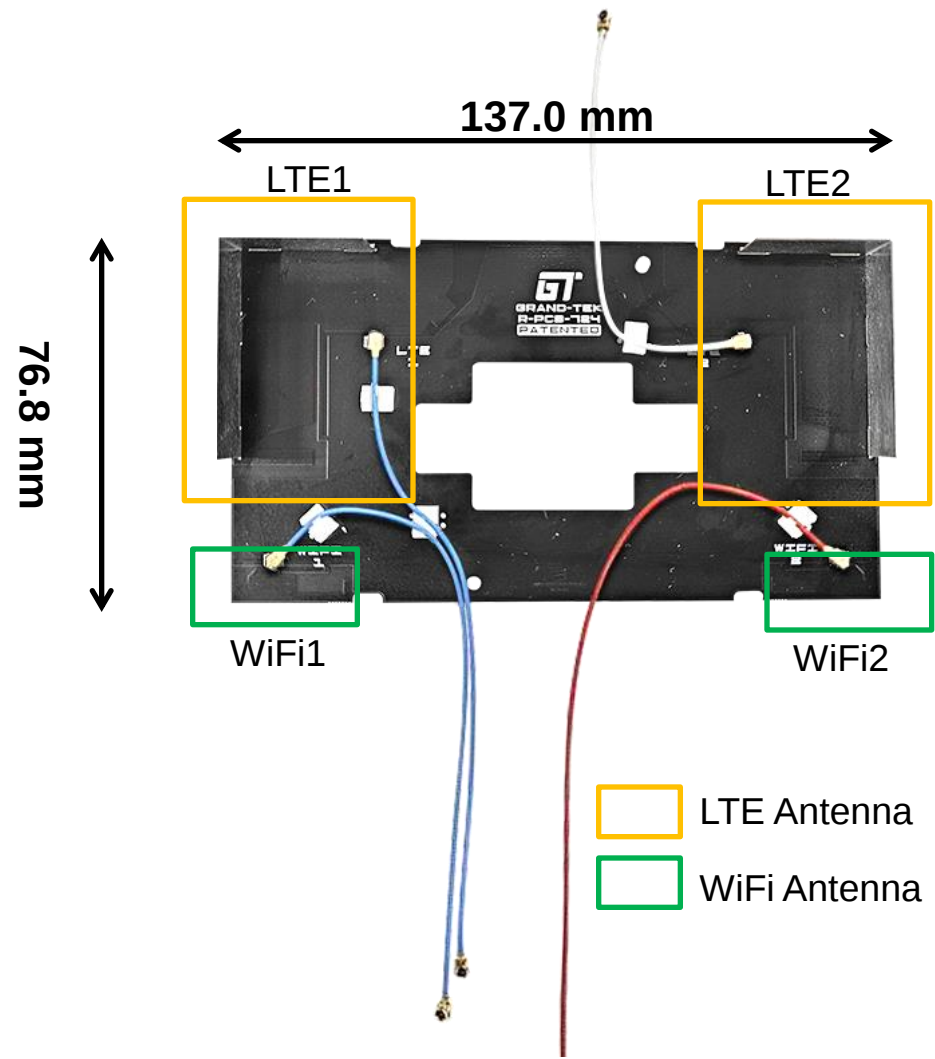


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Antenna Under Test

LTE / Wifi Combo Antenna



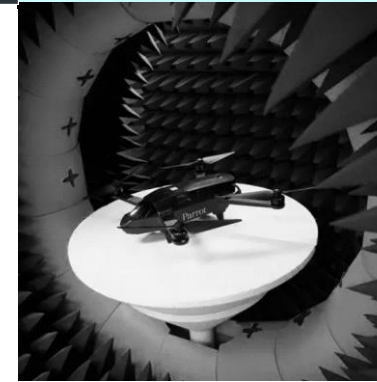
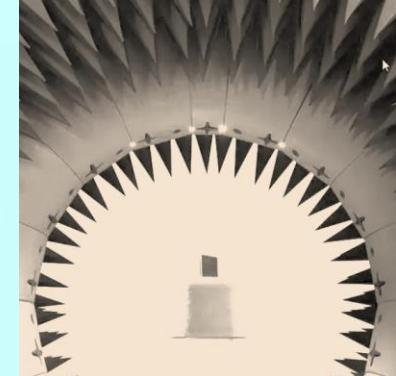
Antenna	Description	Frequency band	Jumper Cable
LTE1	4G (LTE) Multi-band Modified Inverted-F Antenna	698~960 MHz 1710~2170 MHz 2300~2690 MHz	IPEX-I / Blue OD1.13mm L150mm
LTE2	4G (LTE) Multi-band Modified Inverted-F Antenna	698~960 MHz 1710~2170 MHz 2300~2690 MHz	IPEX-I / White OD1.13mm L100mm
WiFi1	Dual-band Modified Inverted-F Antenna	2400~2500 MHz 5150~5850 MHz	IPEX-I / Blue OD1.13mm L150mm
WiFi2	Dual-band Modified Inverted-F Antenna	2400~2500 MHz 5150~5850 MHz	IPEX-I / Red OD1.13mm L200mm



Measurement Setup

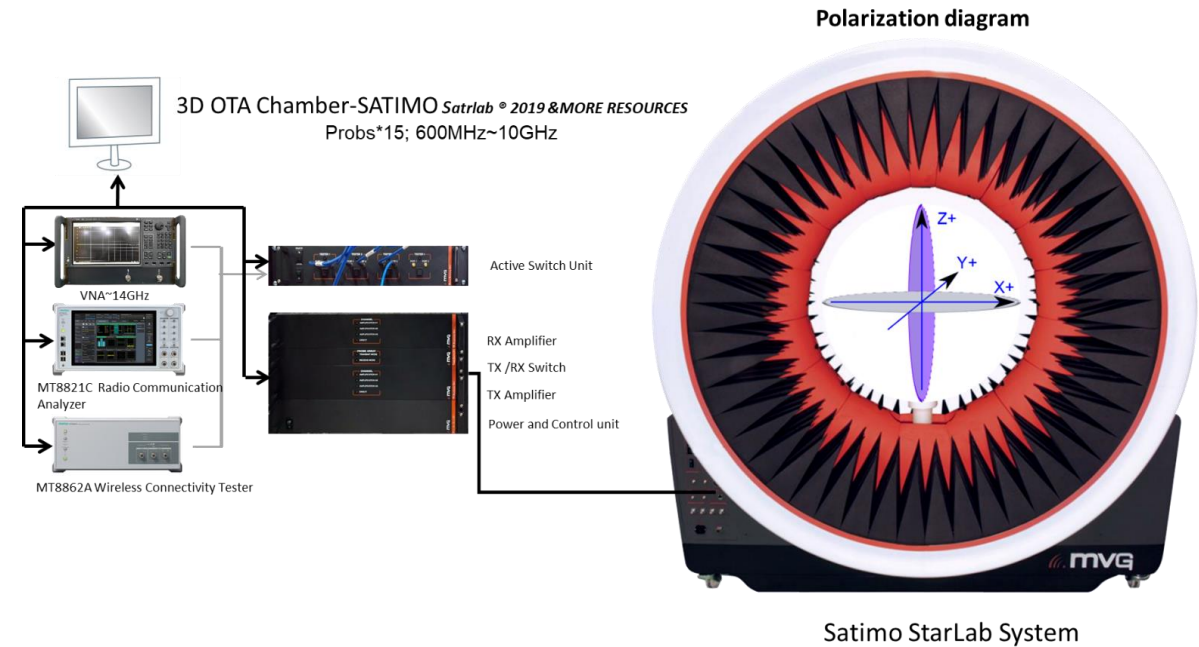
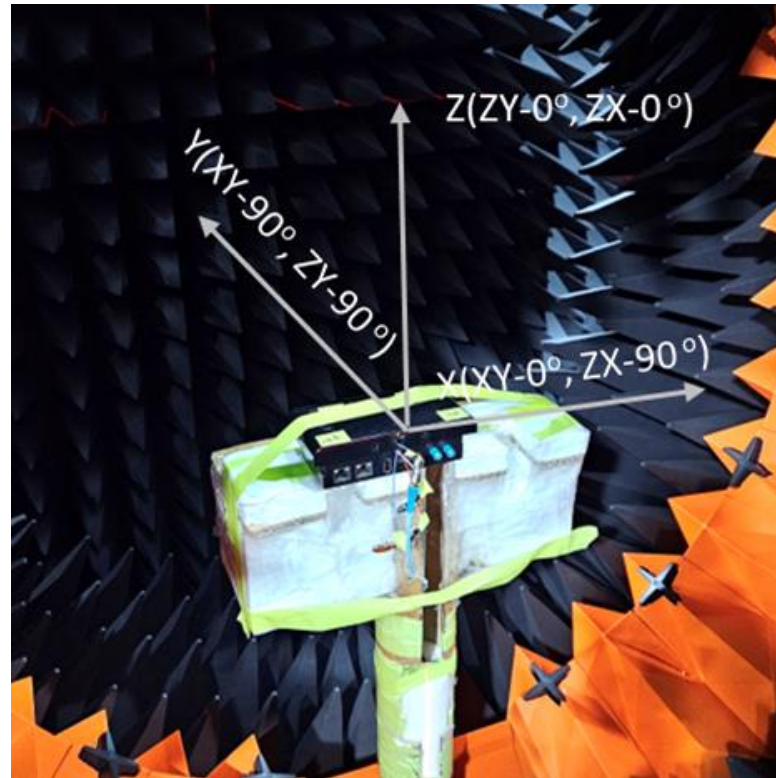
Antenna Pattern Measurement Setup

Satimo Starlab® Multi-Probe 3D Antenna Test System (Calibration up to 10GHz)

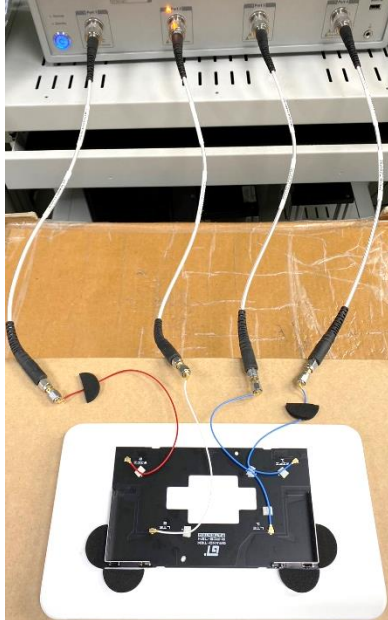


Antenna Pattern Measurement Setup

Satimo Starlab® Antenna Pattern Spherical Coordinate System

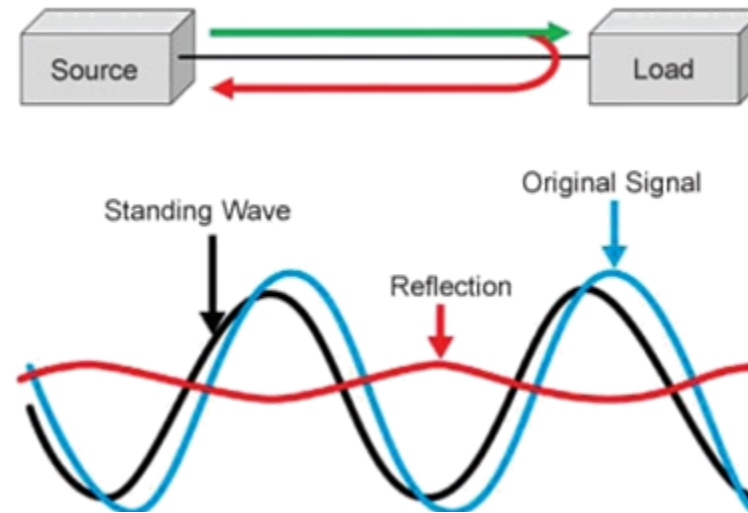


VSWR & Isolation Measurement Setup

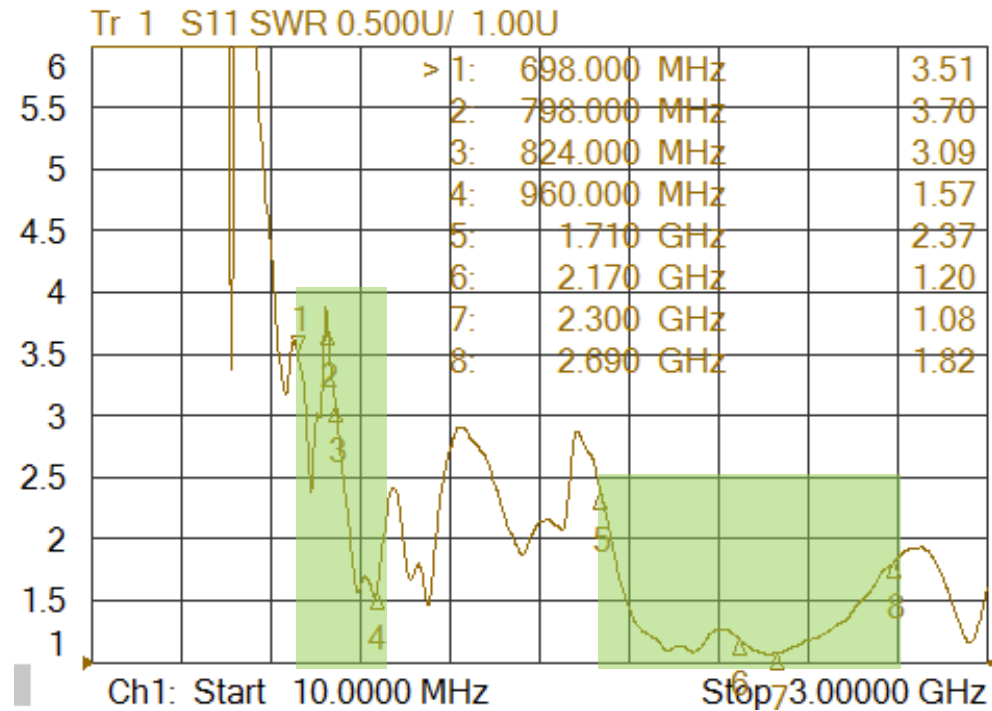


- All AUTs (antenna under test) are measured simultaneously by 4-port vector network analyzer (VNA) in the LTE and WiFi bands.
- VSWR (Voltage Standing Wave Ratio) & Isolation between antennas are measured simultaneously.
- VNA setup :
 10 MHz ~ 8.5 GHz
 1601 points / Span 8.49 GHz / Step 5.30625 MHz
- LTE bands : 698~960 / 1710~2170 / 2300~2690 MHz
- WiFi bands: 2400~2500 / 5150~5850 MHz

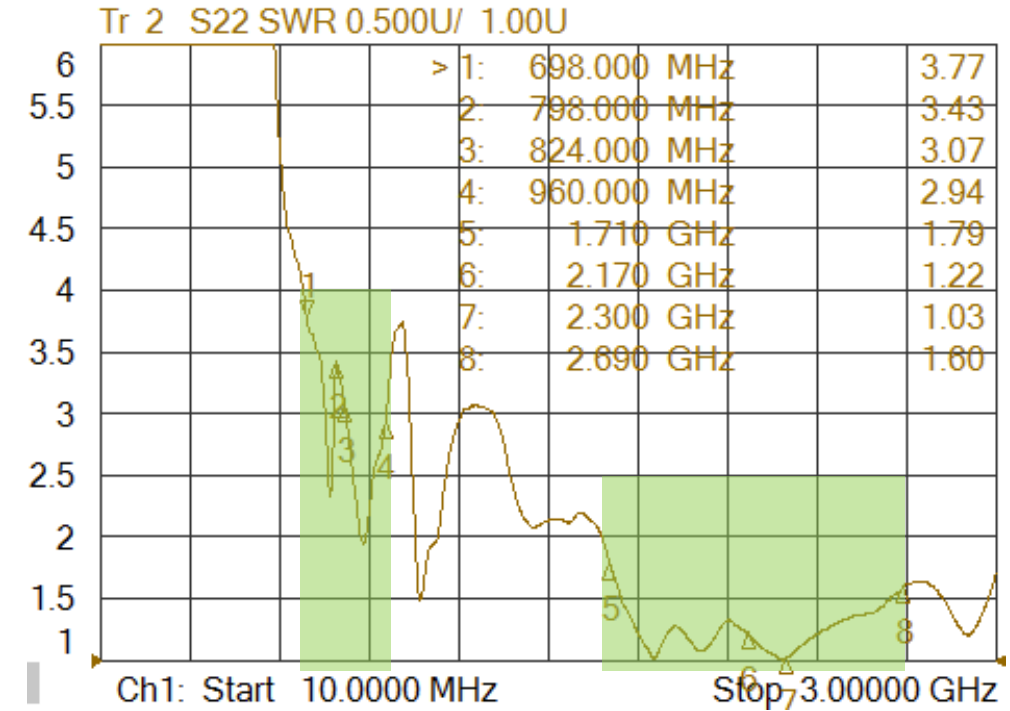
VSWR Measurement Results



VSWR – LTE1 & LTE2

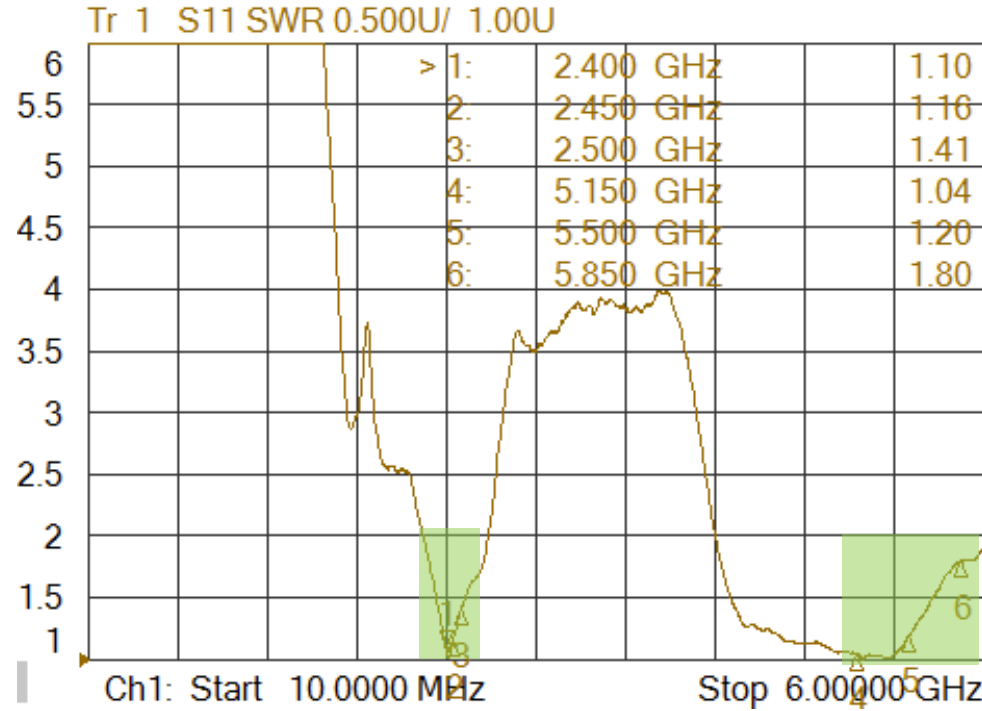


VSWR < 4.0:1 @ 698 ~ 960 MHz
 VSWR < 2.5:1 @ 1710 ~ 2170 MHz
 VSWR < 2.5:1 @ 2300 ~ 2690 MHz

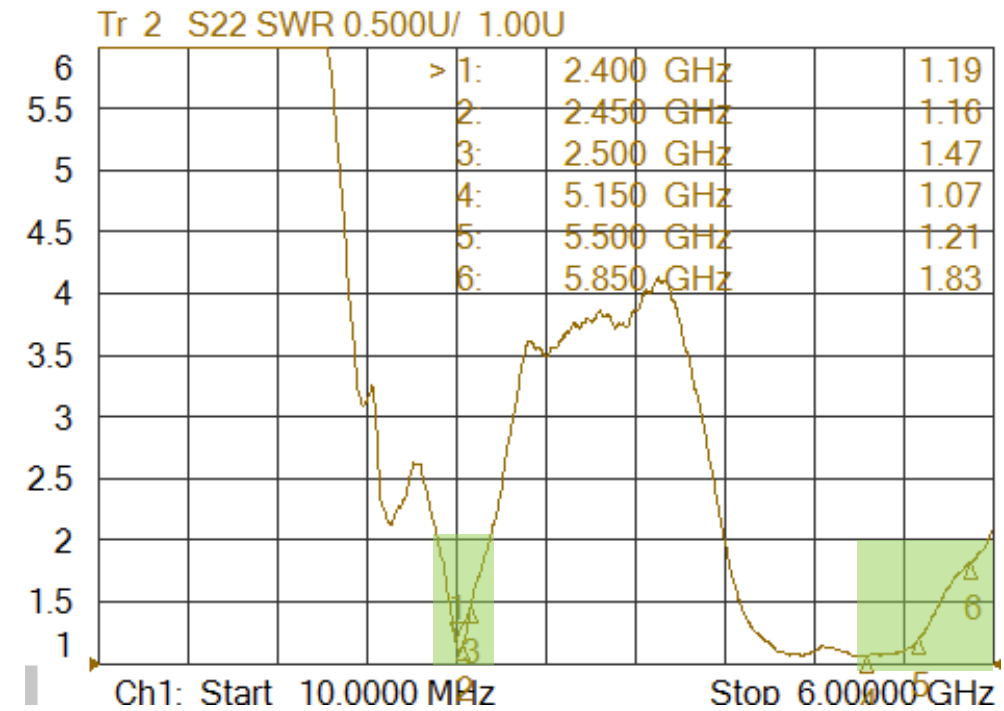


VSWR < 4.0:1 @ 698 ~ 960 MHz
 VSWR < 2.5:1 @ 1710 ~ 2170 MHz
 VSWR < 2.5:1 @ 2300 ~ 2690 MHz

VSWR – WiFi1 & WiFi2

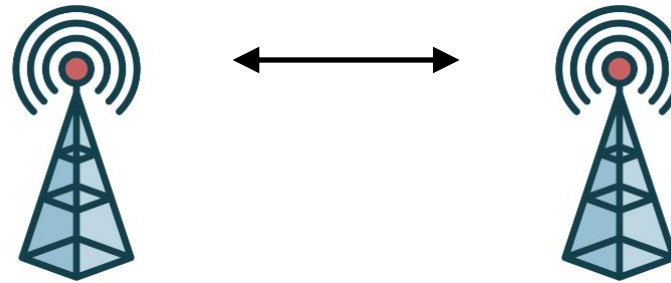


VSWR < 2.0:1 @ 2400 ~ 2500 MHz
VSWR < 2.0:1 @ 5150 ~ 5850 MHz

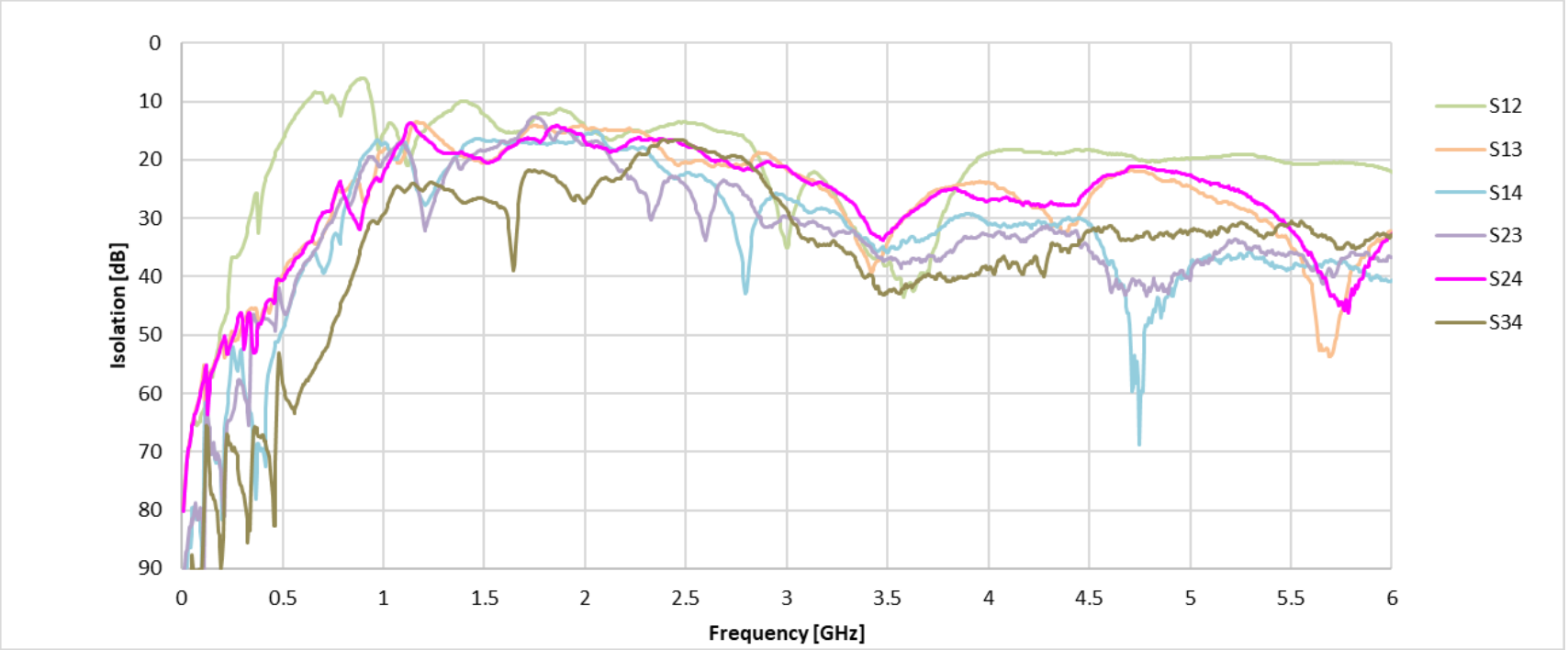
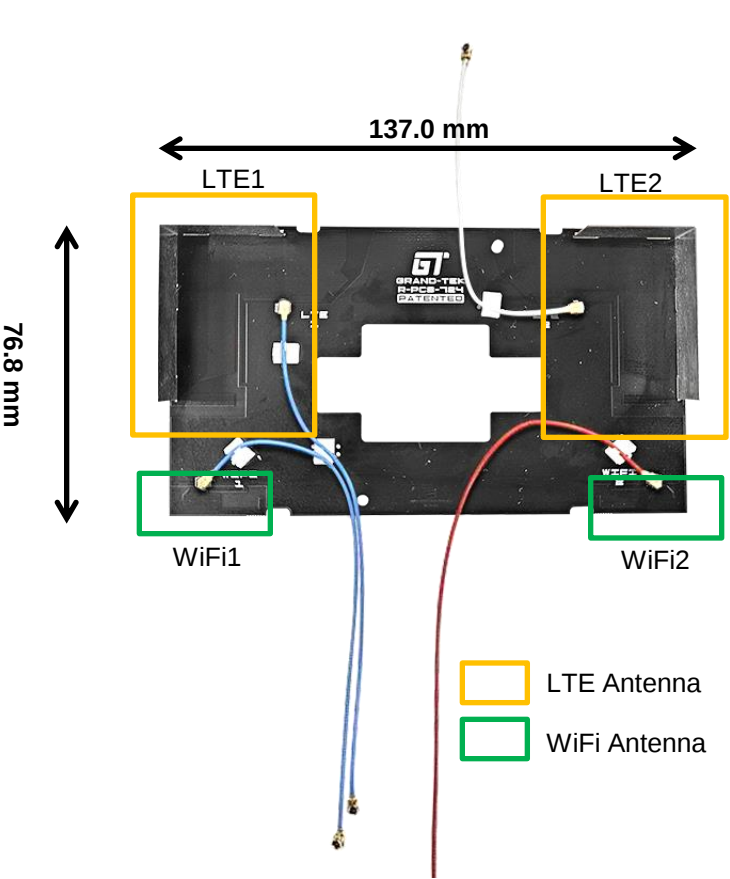


VSWR < 2.0:1 @ 2400 ~ 2500 MHz
VSWR < 2.0:1 @ 5150 ~ 5850 MHz

Isolation Measurement Results

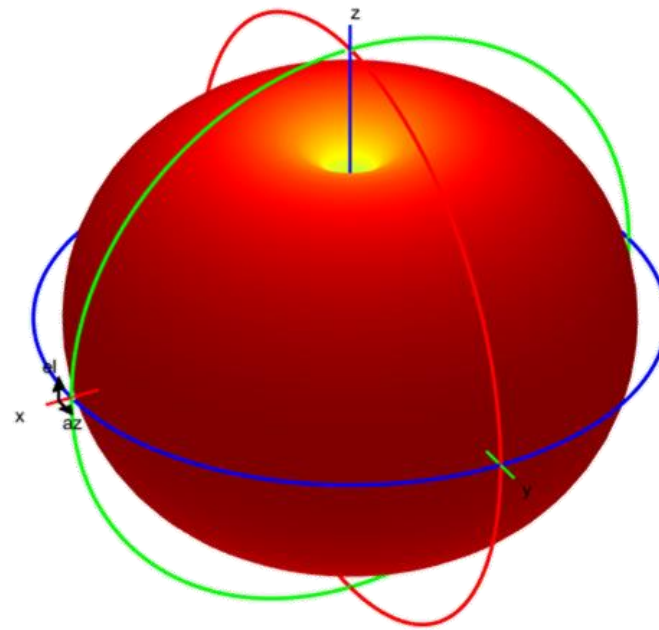


Isolation



Antenna	Frequency	Isolation
LTE vs LTE	698~960 MHz	6 dB min.
	1710~2170 MHz	11 dB min.
	2300~2690 MHz	13 dB min.
WiFi vs WiFi	2400~2500 MHz	16 dB min.
	5150~5850 MHz	32 dB min.
LTE vs WiFi	2400~2500 MHz	20 dB min.

Pattern Measurement Results



LTE1

Frequency (MHz)	3D		
	Efficiency	Avg. Gain	Peak Gain
698	37%	-4.4	0.2
710	39%	-4.1	0.7
734	34%	-4.7	0.0
751	26%	-5.8	-1.0
768	27%	-5.8	-2.3
798	26%	-5.9	-2.6
824	34%	-4.7	0.0
849	34%	-4.7	0.1
869	28%	-5.6	-0.4
894	29%	-5.4	0.9
900	29%	-5.3	1.0
925	30%	-5.2	1.0
960	31%	-5.1	0.8
1710	62%	-2.0	1.6
1805	58%	-2.4	2.0
1880	58%	-2.4	2.6
1900	60%	-2.2	2.6
1920	62%	-2.1	2.6
2110	64%	-1.9	3.4
2170	70%	-1.5	3.8
2200	71%	-1.5	3.7
2300	72%	-1.4	3.8
2305	73%	-1.4	3.7
2315	72%	-1.4	3.7
2350	74%	-1.3	3.5
2360	74%	-1.3	3.5
2400	74%	-1.3	3.5
2500	71%	-1.5	3.8
2595	72%	-1.4	4.4
2690	66%	-1.8	4.0

LTE2

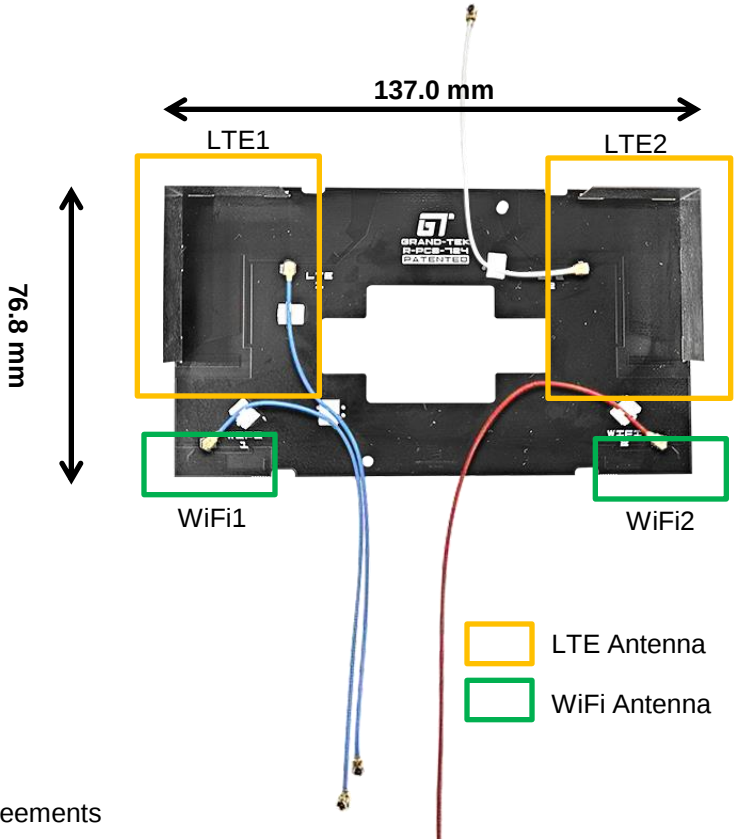
Frequency (MHz)	3D		
	Efficiency	Avg. Gain	Peak Gain
698	36%	-4.5	-0.4
710	37%	-4.3	0.3
734	35%	-4.5	-0.2
751	38%	-4.2	0.4
768	41%	-3.9	1.2
798	27%	-5.7	-2.8
824	34%	-4.7	-0.7
849	34%	-4.7	0.1
869	34%	-4.7	1.2
894	33%	-4.8	-0.2
900	34%	-4.7	-0.3
925	33%	-4.9	-0.3
960	33%	-4.9	-0.4
1710	63%	-2.0	2.7
1805	63%	-2.0	3.3
1880	63%	-2.0	2.3
1900	63%	-2.0	1.9
1920	62%	-2.1	1.7
2110	65%	-1.9	2.2
2170	70%	-1.6	3.2
2200	71%	-1.5	3.5
2300	71%	-1.5	3.6
2305	71%	-1.5	3.5
2315	71%	-1.5	3.5
2350	73%	-1.4	3.5
2360	73%	-1.4	3.5
2400	72%	-1.4	3.6
2500	69%	-1.6	3.6
2595	69%	-1.6	3.9
2690	69%	-1.6	4.0

WiFi1

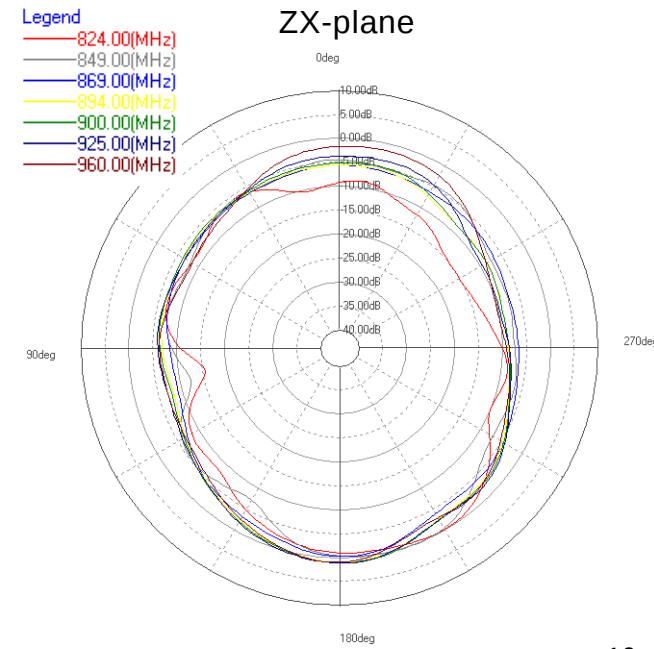
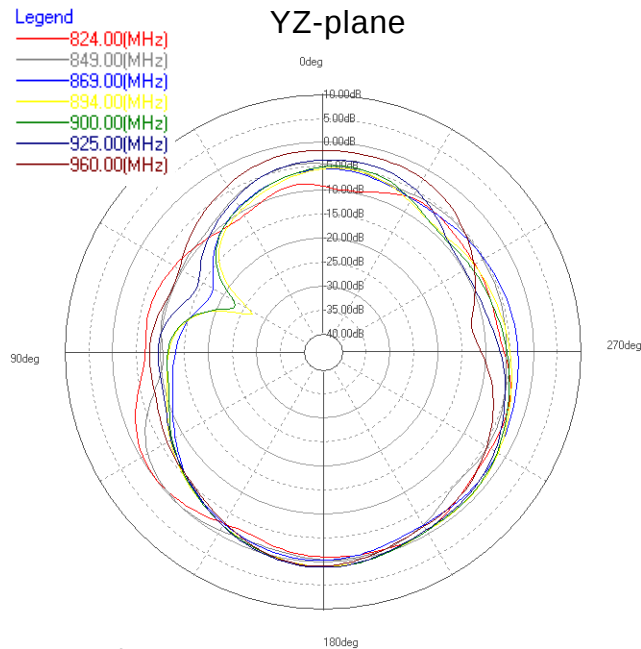
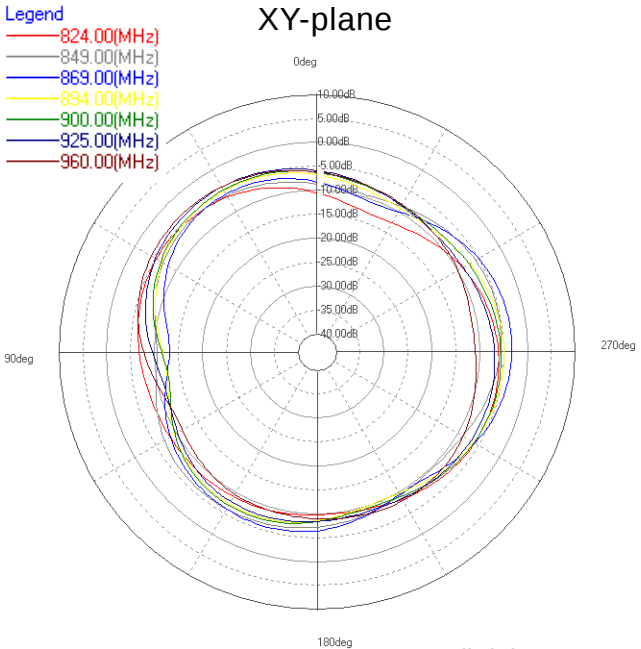
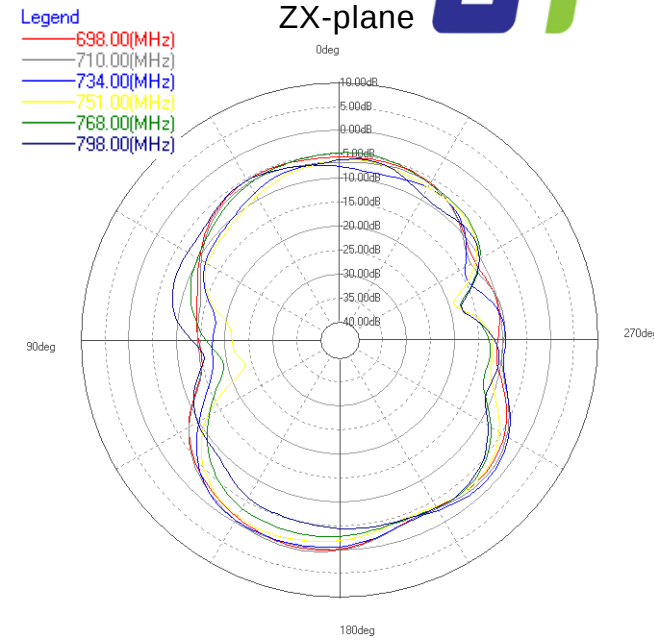
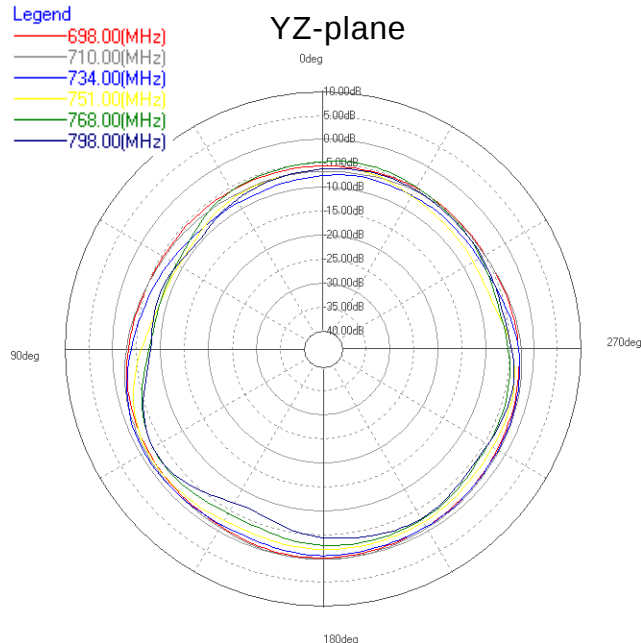
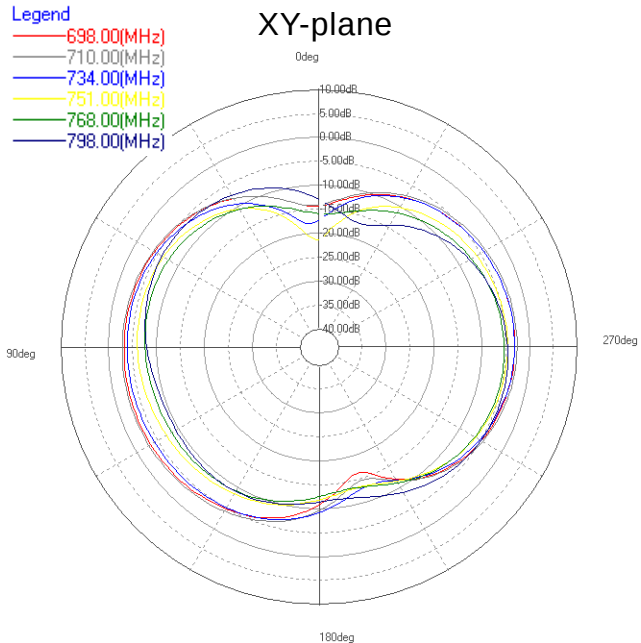
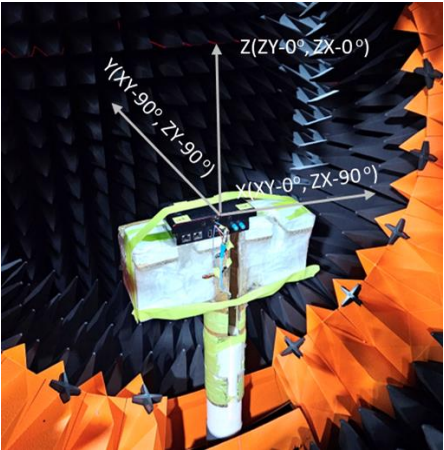
Frequency (MHz)	3D		
	Efficiency	Avg. Gain	Peak Gain
2400	71%	-1.5	3.3
2450	73%	-1.4	3.1
2500	72%	-1.4	3.0
5150	76%	-1.2	3.8
5350	78%	-1.1	4.2
5500	77%	-1.1	4.2
5675	78%	-1.1	4.5
5850	77%	-1.1	5.2

WiFi2

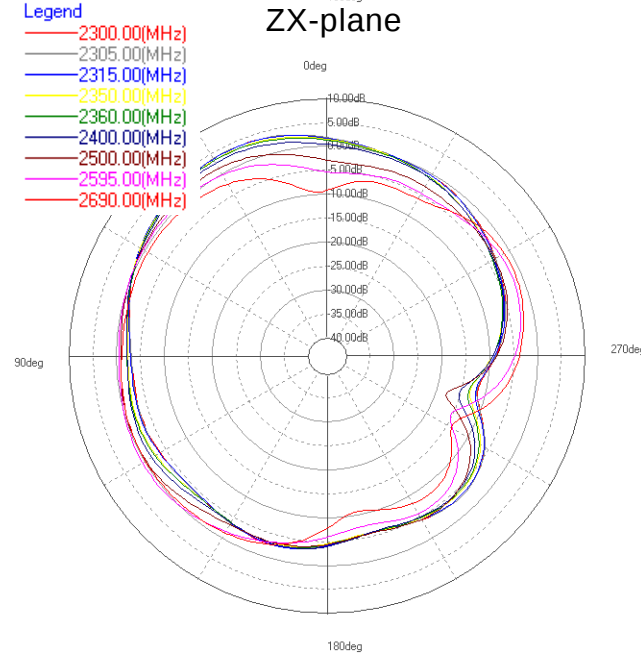
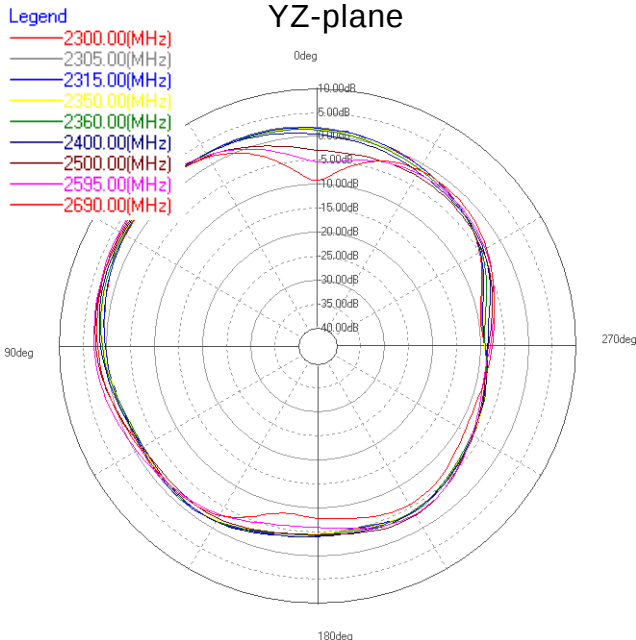
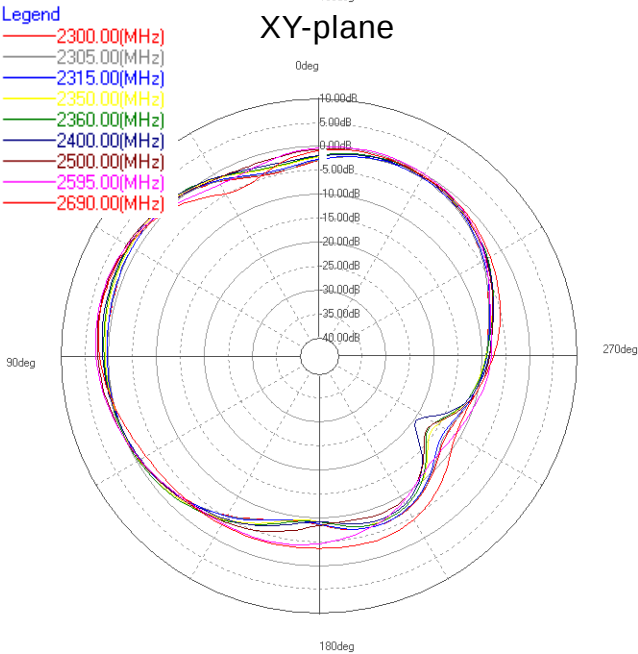
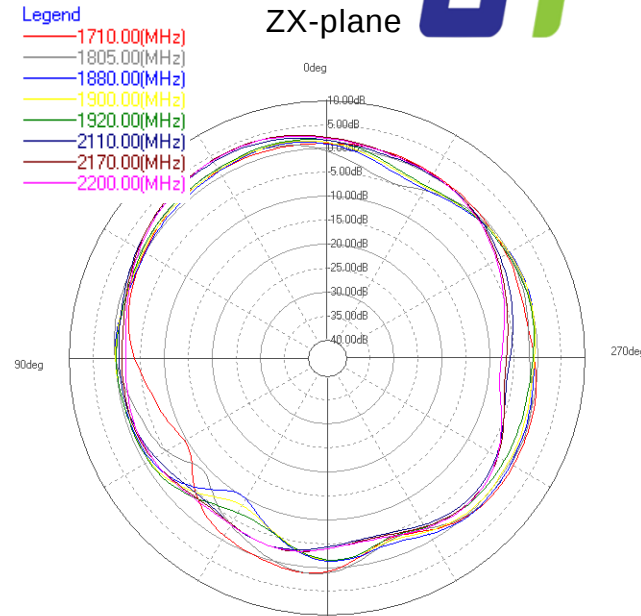
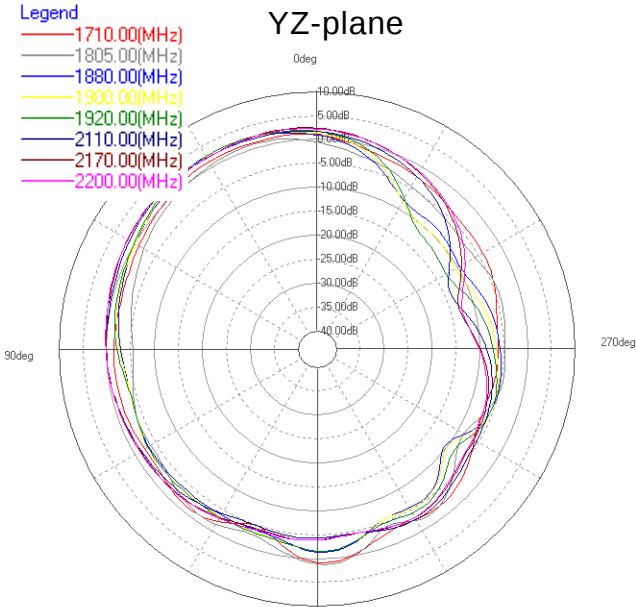
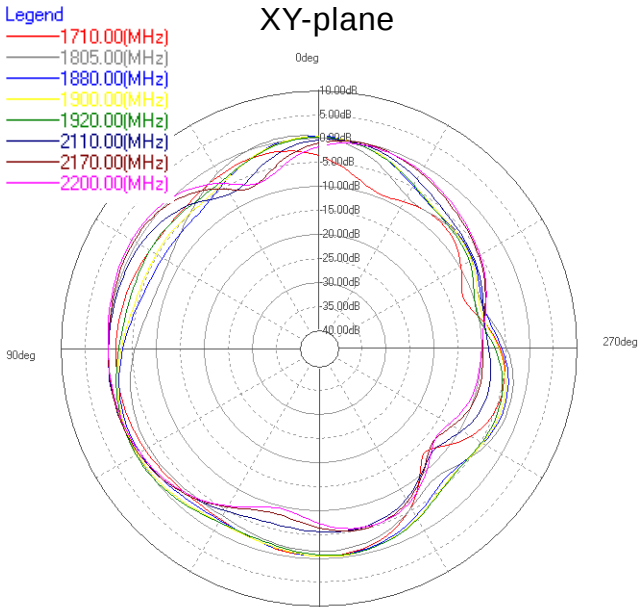
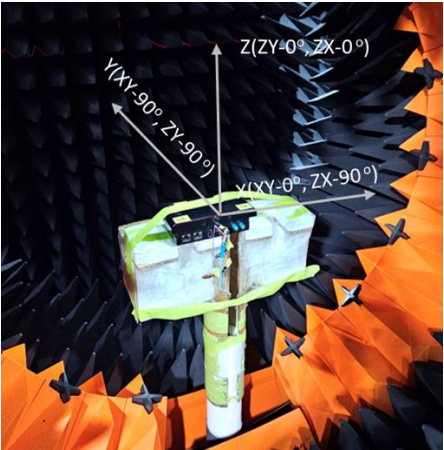
Frequency (MHz)	3D		
	Efficiency	Avg. Gain	Peak Gain
2400	67%	-1.7	3.4
2450	69%	-1.6	2.5
2500	68%	-1.6	1.6
5150	75%	-1.2	4.7
5350	77%	-1.1	5.2
5500	76%	-1.2	5.2
5675	78%	-1.1	5.5
5850	77%	-1.1	5.4



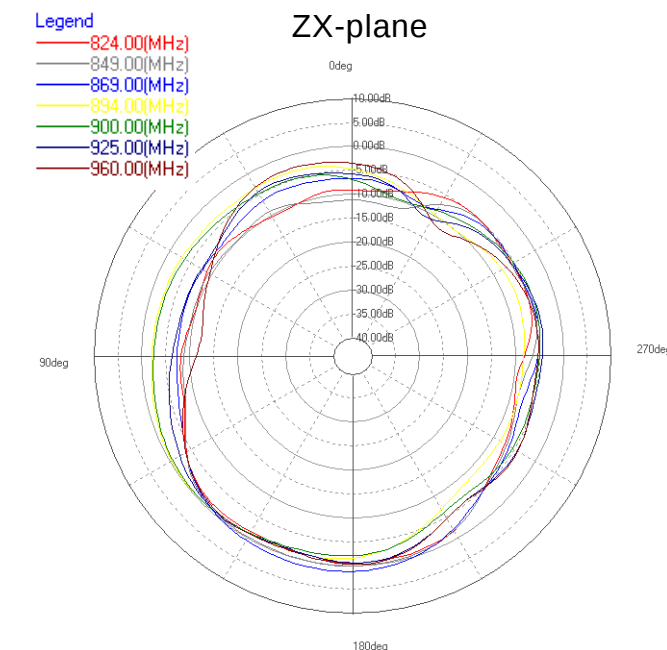
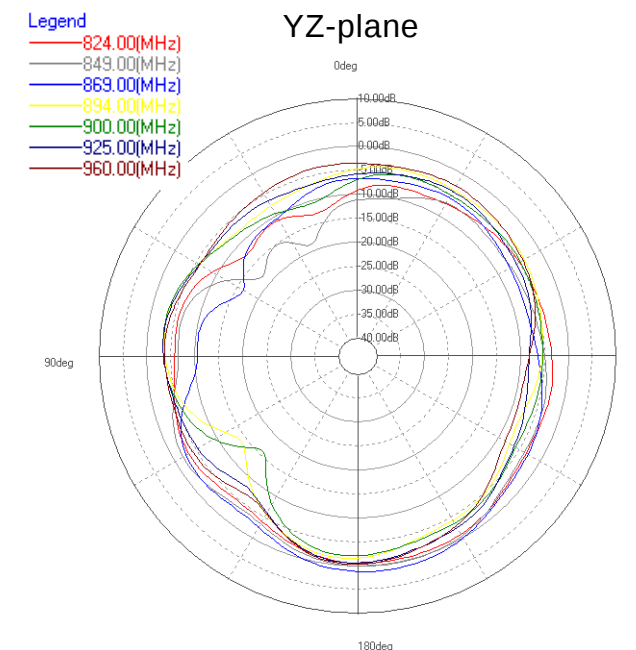
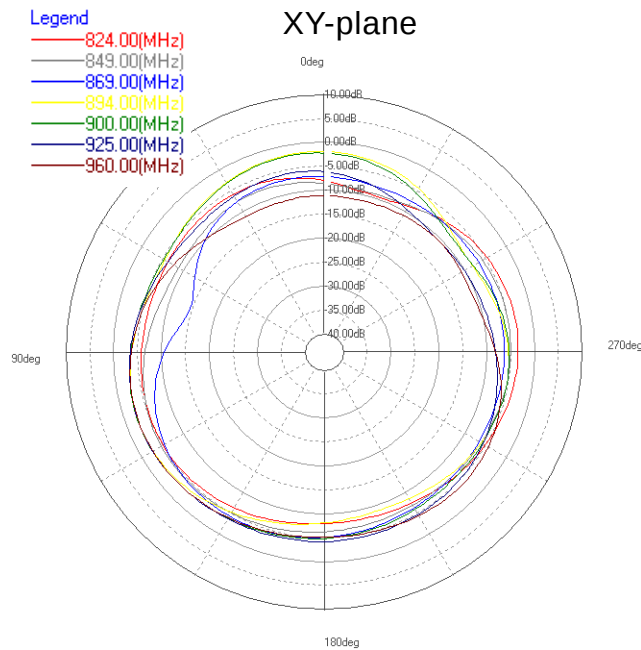
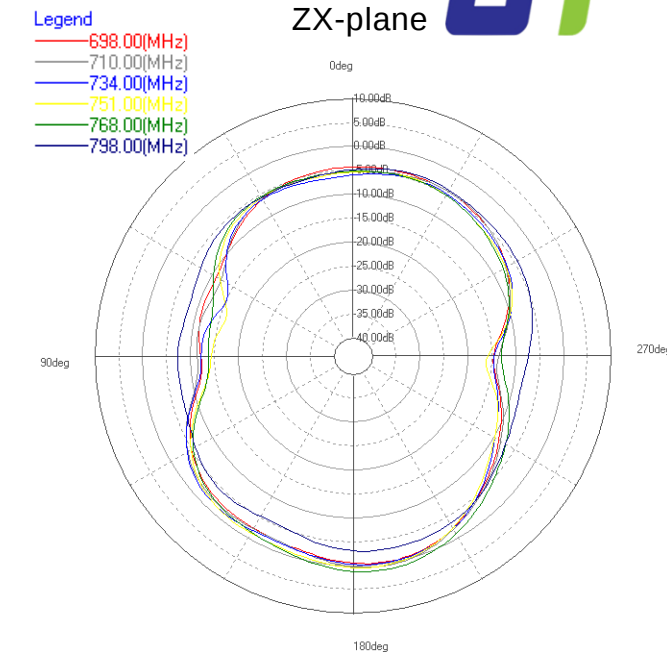
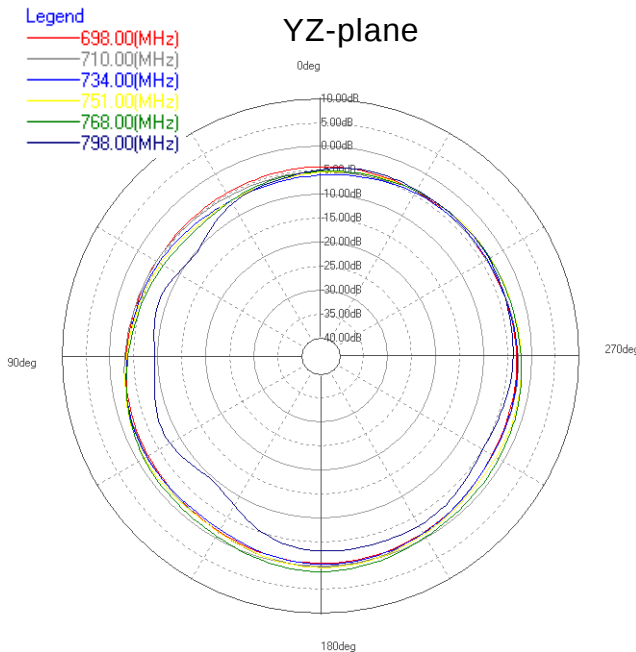
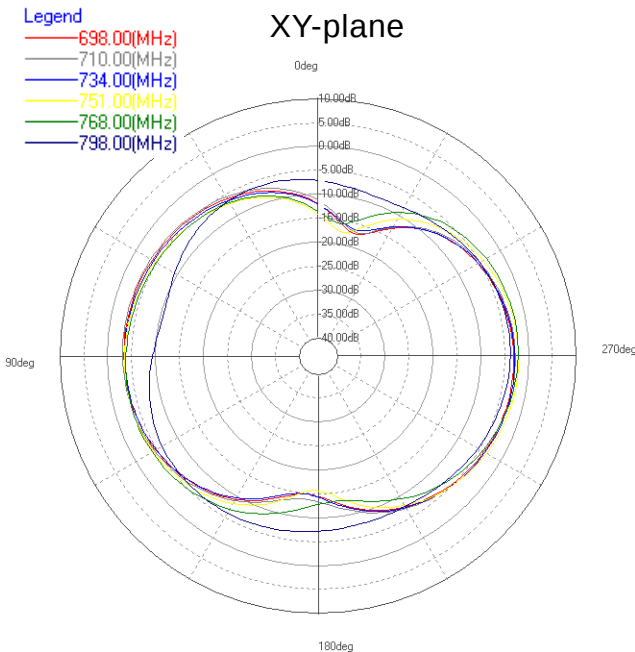
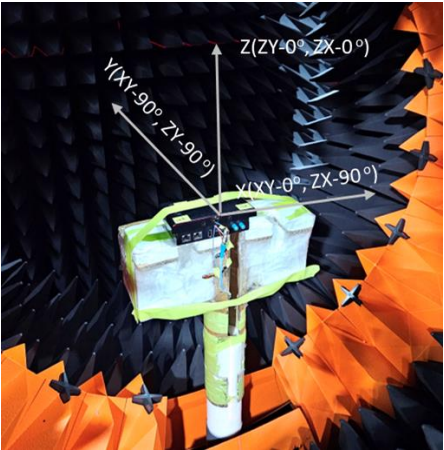
2D Pattern – LTE1



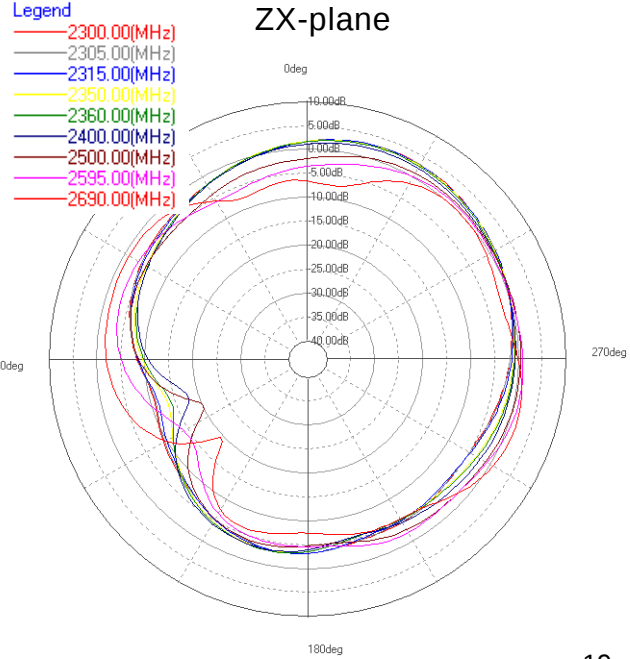
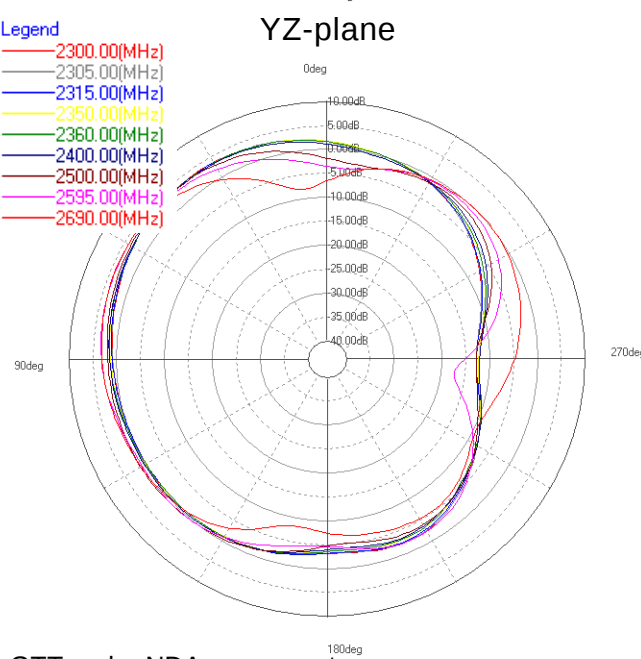
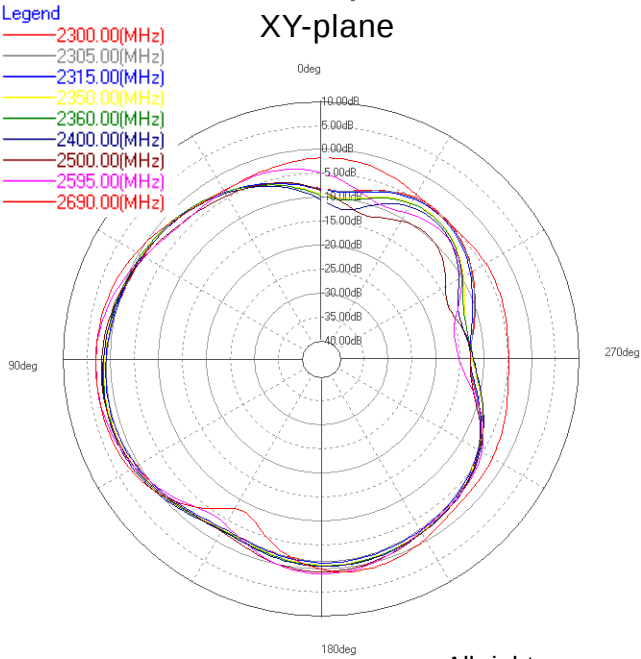
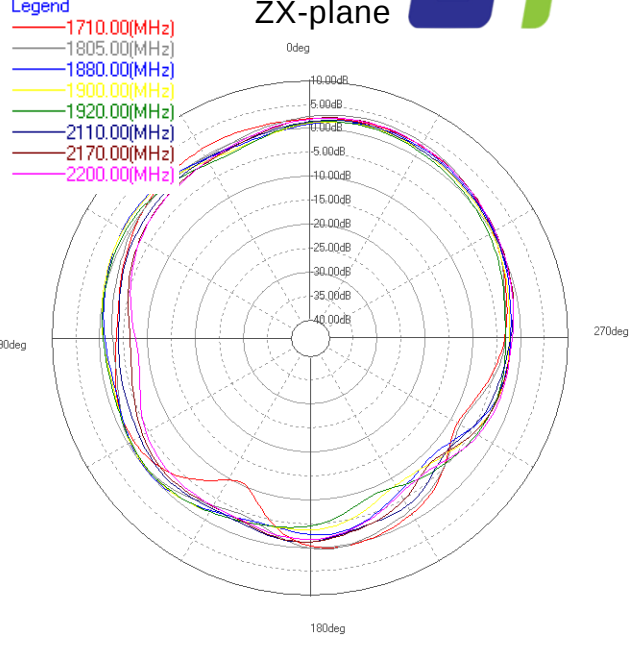
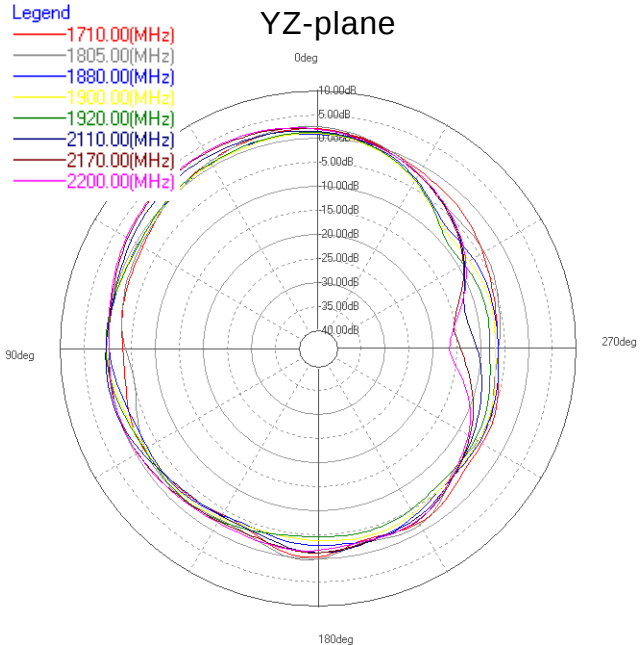
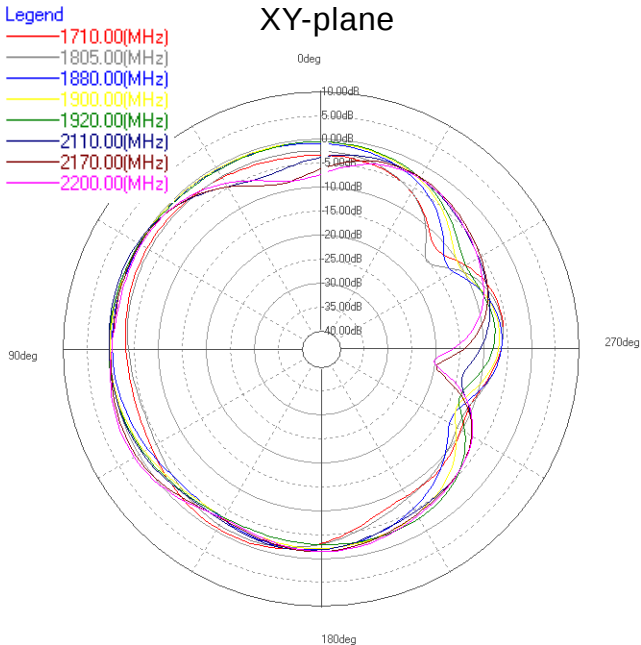
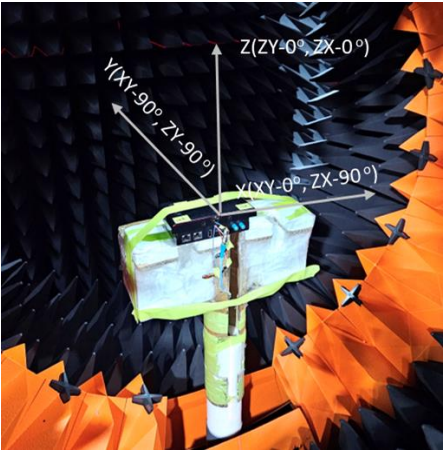
2D Pattern – LTE1



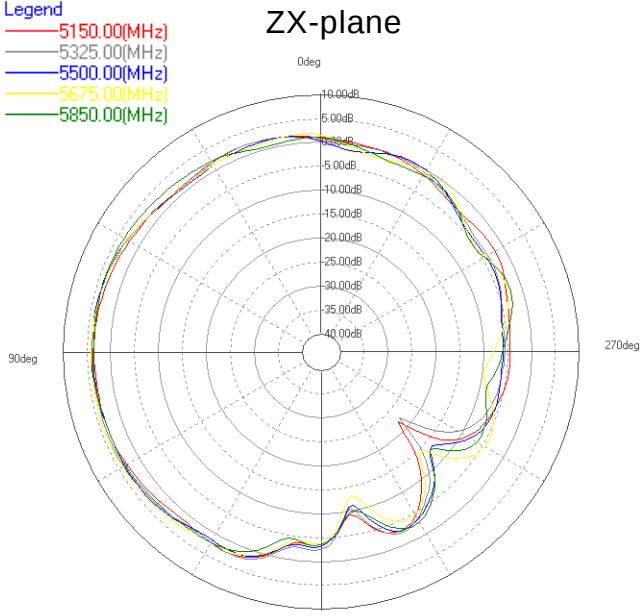
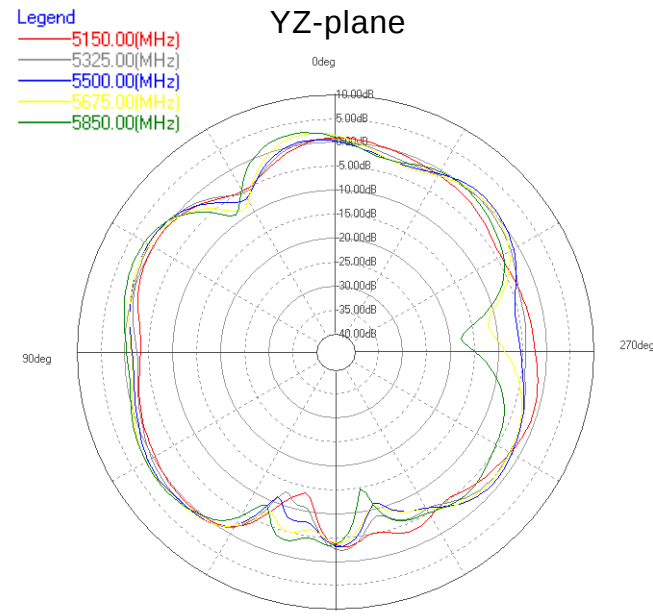
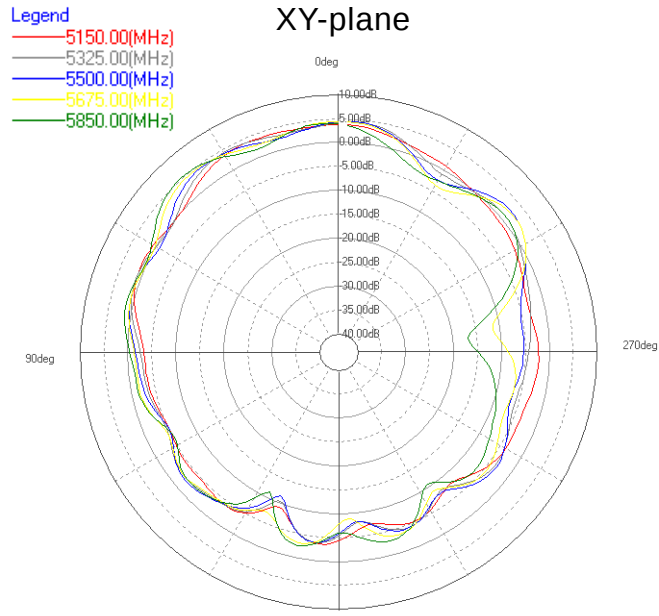
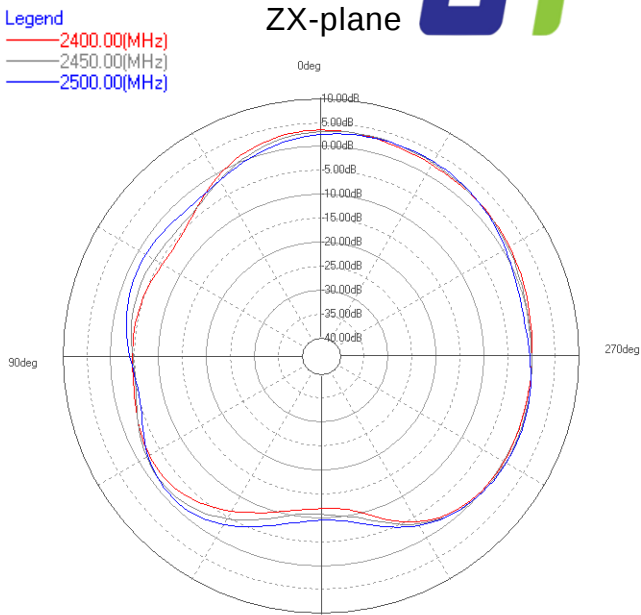
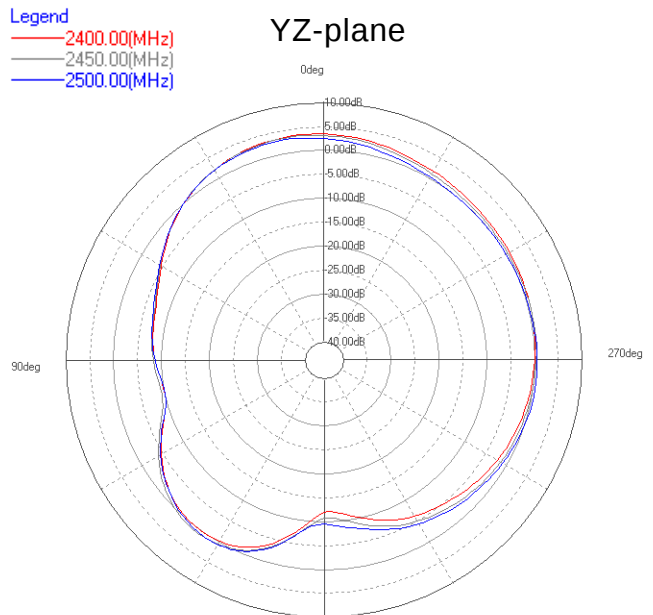
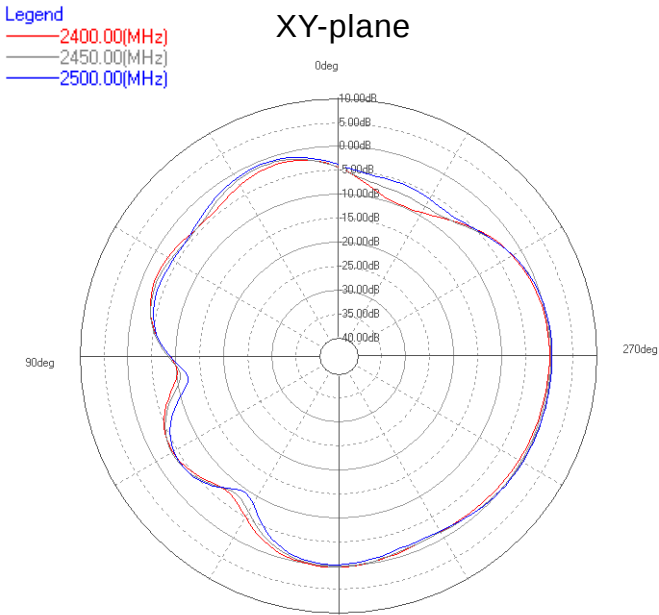
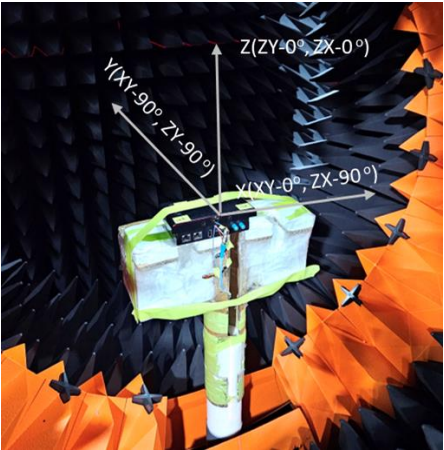
2D Pattern – LTE2



2D Pattern – LTE2



2D Pattern – WiFi1



2D Pattern – WiFi2

