

TMO-G4AR

XC33AX447M-F100-T0

FCC Antenna Report

Antenna Test Report

Test Date

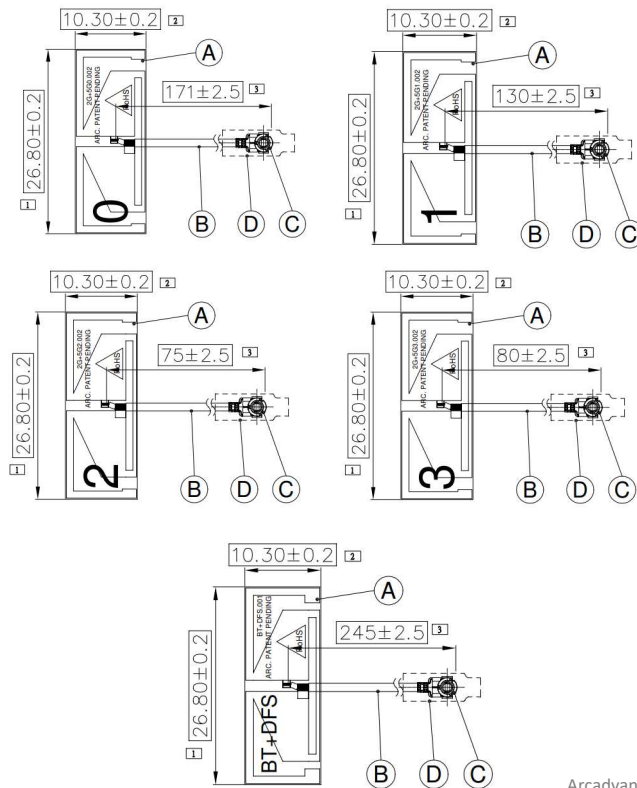
27th Feb, 2023

Antenna Engineer: Peko Li
Version R01



Antenna Specification

● WiFi / 2.4G+5G & BT+DFS

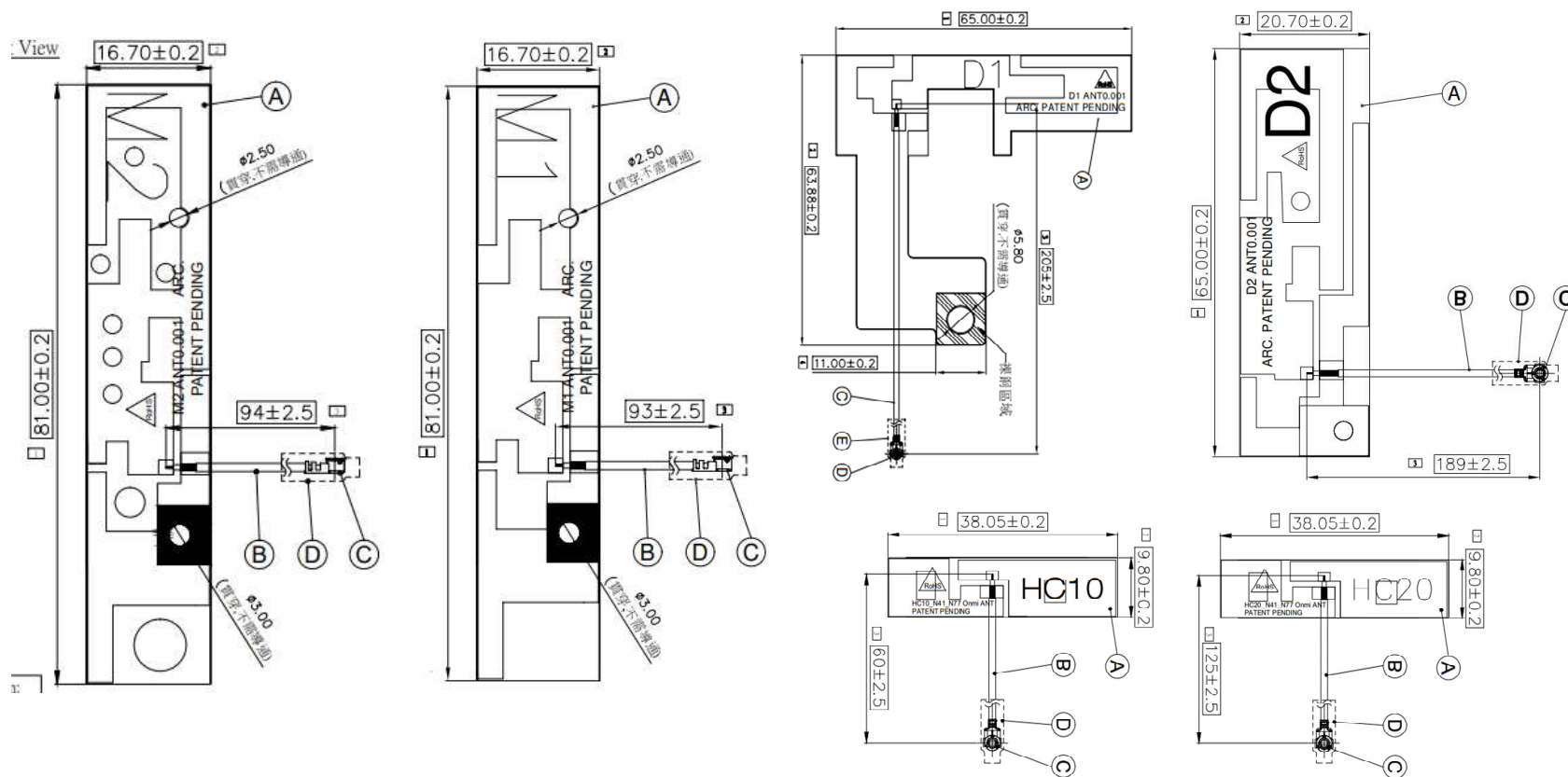


Antenna NO.	RF Chain	Brand	Model Number	Freq.	Antenna Type	Connector	Cable Length
0	W0	PSA	RFPCA261017IM LB403_A	2.4G+5G	Dipole	I-PEX(MHF1)	171mm
1	W1	PSA	RFPCA261013IM LB402_A	2.4G+5G	Dipole	I-PEX(MHF1)	130mm
2	W2	PSA	RFPCA261007IM LB402_A	2.4G+5G	Dipole	I-PEX(MHF1)	75mm
3	W3	PSA	RFPCA261008IM LB401_A	2.4G+5G	Dipole	I-PEX(MHF1)	80mm
BT+DFS	BT+DFS	PSA	RFPCA261024IM LB401_A	2.4G+5G	Dipole	I-PEX(MHF1)	245mm

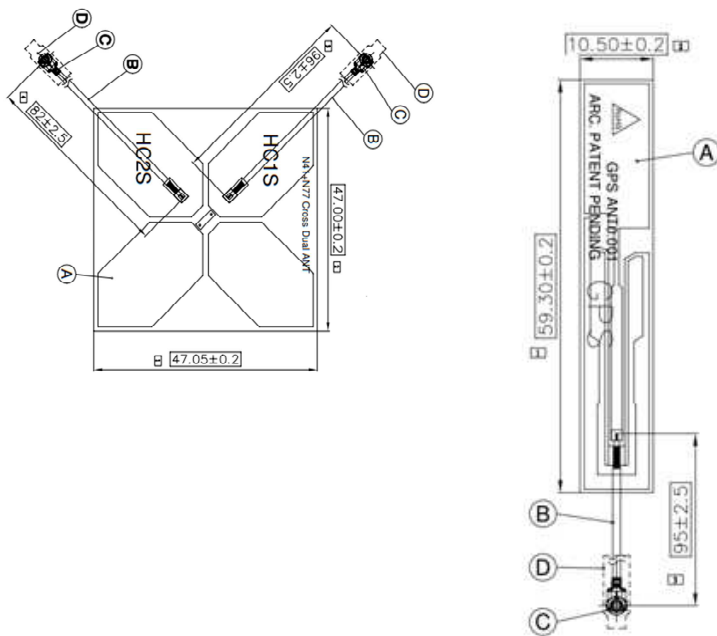
PSA 華新科技股份有限公司
WALSIN TECHNOLOGY CORPORATION

566-1, Kao-shi Road Yang-Mei, Tao-Yuan, 32642, Taiwan, R.O.C.

LTE Antenna Specification



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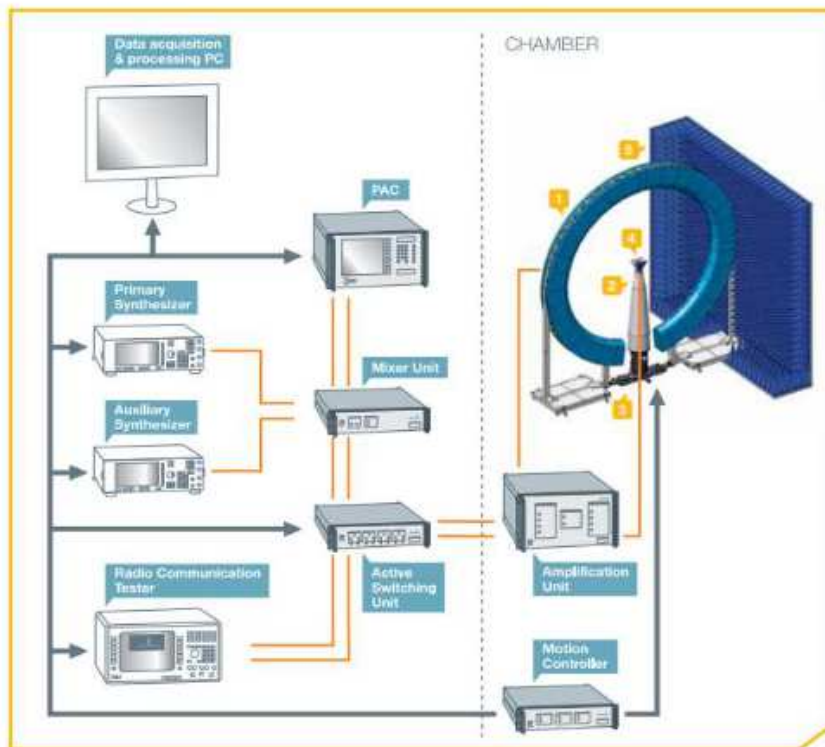
566-1, Kao-shi Road Yang-Mei, Tao-Yuan, 32642, Taiwan, R.O.C.

Antenna NO.	RF Chain	Brand	Model Number	Freq.	Antenna Type	Connector	Cable Length
M2	M2	PSA	RFPCA811 609IMMB4 03_B	617~4200	Monopole	I-PEX(MHF1)	94mm
M1	M1	PSA	RFPCA811 609IMMB4 02_A	617~4200	Monopole	I-PEX(MHF1)	93mm
D2	D2	PSA	RFFPA656 320IMMB4 01_B	617~2200	Monopole	I-PEX(MHF1)	189mm
D1	D1	PSA	RFPCA652 018IMMB4 01_A	617~2200	Monopole	I-PEX(MHF1)	205mm
HC1O	HC1O	PSA	RFPCA380 906IMMB4 01_A	2496~4200	Dipole	I-PEX(MHF1)	60mm
HC2O	HC2O	PSA	RFPCA380 912IMMB4 01_A	2496~4200	Dipole	I-PEX(MHF1)	125mm
HC1S	HC1S	PSA	RFPCA474 709IMMB4 01_A	2496~4200	Dipole	I-PEX(MHF1)	96mm
HC2S	HC2S	PSA	RFPCA474 709IMMB4 01_A	2496~4200	Dipole	I-PEX(MHF1)	82mm
GPS	GPS	PSA	RFPCA591 009IMGB4 01_A	1575.42	Microstrip	I-PEX(MHF1)	95mm

Test Equipment and Calibration

ENA Series Network Analyzer	AGILENT	E5071C	MY46419201	100kHz~8.5GHz	Feb. 21, 2022	Feb. 20, 2023
VNA Calibration Kit	TS RF	TS85033E-F	-	DC~9GHz	N.C.R.	N.C.R.

Test Equipment and Calibration



SG 64 uses analog RF signal generators to emit EM waves from the probe array to the antenna under test (AUT) or vice versa.

It uses the NPAC as an RF receiver for antenna measurements. The NPAC also drives the electronic scanning of the probe array.

The NPAC includes the fastest and most accurate sources and receivers on the market.

Test Equipment and Calibration

Device	Type/Model	Serial#	Manufacturer	Calibrated Date	Calibrated Until
SG64 Chamber	Standard	SG64	MVG	2022/03/30	2023/03/30
Turn Table	Customization	-	Machinery Dept.	2022/03/30	2023/03/30
New Probe Array Controller	N/A	1102341-4535	MVG	2022/03/30	2023/03/30
Power Supply Unit	N/A	1103211-13204	MVG	2022/03/30	2023/03/30
Active Switching Unit	N/A	1102347-7214	MVG	2022/03/30	2023/03/30
TX Amplification Unit	N/A	1102527-5909	MVG	2022/03/30	2023/03/30
RX Amplification Unit	N/A	1102536-3823	MVG	2022/03/30	2023/03/30
Transfer Switching Unit	N/A	1102183-3351	MVG	2022/03/30	2023/03/30
Mixer Unit	N/A	1102545-7208	MVG	2022/03/30	2023/03/30
Power And Control Unit	N/A	1102706-7209	MVG	2022/03/30	2023/03/30
Antenna Probe	DP 400-6000	-	MVG	2022/03/30	2023/03/30
Cable 13.7m - 400MHz to 18GHz	SS402	00100A1F5A1XXS	Woken	2022/03/30	2023/03/30

Antenna Efficiency of WiFi/BT+DFS/GPS

● WiFi / 2.4G+5G

▣ Antenna Efficiency Table of WiFi Ant 0/1/2/3

WIFI Ant	2.4G (Effi./Peak Gain)			5G (Effi./Peak Gain)					
Frequency	2412	2442	2484	5150	5350	5550	5750	5850	MHz
Ant. 0	69%/1.77	69%/1.51	69%/1.37	75%/0.68	74%/0.81	73%/0.70	72%/1.25	70%/2.35	
Ant. 1	68%/1.49	67%/1.11	68%/1.42	70%/0.42	71%/1.01	72%/0.93	70%/1.68	72%/2.14	
Ant. 2	70%/1.16	65%/1.33	65%/1.29	73%/0.71	73%/1.12	70%/1.09	75%/1.54	72%/2.13	
Ant. 3	70%/1.03	67%/1.16	69%/1.25	71%/0.58	72%/1.23	73%/1.13	73%/1.49	73%/2.32	
BT+DFS	60%/4.09	62%/4.32	62%/4.72	75%/3.90	76%/4.23	73%/4.15	73%/4.43	73%/4.32	
Min PeakGain	WiFi0/1/2/3: 1.37 / 1.11 / 1.16 /1.03			WiFi0/1/2/3: 0.68/ 0.42 / 0.71 / 0.58					

● GPS L1+L5

▣ Antenna Efficiency Table of GPS

GPS Ant	L1+L5	
Frequency	1176MHz	1575.42MHz
GPS	48%/3.17	55%/4.66

Antenna Efficiency of LTE/5G NR-Low Band

● LTE/5G NR Low Band: 71/12

▣ Antenna **M2** (TRx) Efficiency & Peak Gain Table

Frequency (MHz)	B71(n71)	B12	B5
Efficiency (dB)	-2.25	-2.43	-2.82
Efficiency (%)	59.63	57.16	52.19
Gain (dBi)	3.17	3.34	1.68
Min. Gain	3.01	3.12	1.03

● LTE/5G NR Low Band: 71

▣ Antenna **M1** (Rx) Efficiency & Peak Gain Table

Frequency (MHz)	B71(n71)	B12
Efficiency (dB)	-2.21	
Efficiency (%)	60.11	
Gain (dBi)	3.10	
Min. Gain	2.92	

● LTE/5G NR Low Band: 71

▣ Antenna **D1** (Rx) Efficiency & Peak Gain Table

Frequency (MHz)	B71(n71)	B12
Efficiency (dB)	-2.54	
Efficiency (%)	55.73	
Gain (dBi)	2.09	
Min. Gain	1.45	

● LTE/5G NR Low Band: 71/12

▣ Antenna **D2** (Rx) Efficiency & Peak Gain Table

Frequency (MHz)	B71(n71)	B12	B5
Efficiency (dB)	-2.61	-2.48	-2.99
Efficiency (%)	54.79	56.45	50.23
Gain (dBi)	2.01	2.05	0.63
Min. Gain	1.13	1.78	0.43

Antenna Efficiency of LTE/5G NR-M/H/UH/C-Band

● LTE/5G NR M/H/UH Band: 2/25/4/66/41/48/n77

□ Antenna **M2** (TRx) Efficiency & Peak Gain Table

Frequency (MHz)	B2/B25 (n25)	B4/B66 (n66)	B41 (n41)	B48	n77
Efficiency (dB)	-2.12	-2.00	-1.82	-1.92	-1.78
Efficiency (%)	61.34	63.09	65.79	64.32	66.30
Gain (dBi)	3.33	3.69	2.78	0.94	0.84
Min. Gain	2.69	2.17	2.55	0.63	0.79

● LTE/5G NR M/H/UH Band: 2/25/4/66/41/48/n77

□ Antenna **M1** (TRx) Efficiency & Peak Gain Table

Frequency (MHz)	B2/B25 (n25)	B4/B66 (n66)	B41 (n41)	B48	n77
Efficiency (dB)	-2.18	-2.07	-1.93	-2.04	-1.81
Efficiency (%)	60.53	62.00	64.11	62.53	65.93
Gain (dBi)	4.78	5.13	3.02	1.02	0.91
Min. Gain	3.72	4.79	2.23	0.87	0.88

● LTE/5G NR M/H/UH Band: 2/25/4/66

□ Antenna **D1** (Rx) Efficiency & Peak Gain Table

Frequency (MHz)	B2/B25 (n25)	B4/B66 (n66)
Efficiency (dB)	-2.27	-2.17
Efficiency (%)	59.33	60.62
Gain (dBi)	3.79	4.26
Min. Gain	3.16	3.87

● LTE/5G NR M/H/UH Band: 2/25/4/66

□ Antenna **D2** (Rx) Efficiency & Peak Gain Table

Frequency (MHz)	B2/B25 (n25)	B4/B66 (n66)
Efficiency (dB)	-1.97	-2.06
Efficiency (%)	63.58	62.30
Gain (dBi)	4.11	4.10
Min. Gain	3.36	3.73

Antenna Efficiency of LTE/5G NR-UH/C-Band

- *LTE/5G NR C-Band: 41/48/n77*

- ▣ *Omni-Antenna HC10 (Rx) Efficiency & Peak Gain Table*

Frequency (MHz)	B41 (n41)	B48	n77
Efficiency (dB)	-1.82	-1.79	-1.66
Efficiency (%)	65.73	66.25	68.23
Gain (dBi)	4.45	4.64	4.73
Min. Gain	4.00	3.99	4.51

- *LTE/5G NR C-Band: 41/48/n77*

- ▣ *Semi-Antenna HC1S (Rx) Efficiency & Peak Gain Table*

Frequency (MHz)	B41 (n41)	B48	n77
Efficiency (dB)	-1.53	-1.46	-1.45
Efficiency (%)	70.35	71.43	71.57
Gain (dBi)	7.59	7.67	7.98
Min. Gain	7.51	7.59	7.77

- *LTE/5G NR C-Band: 41/48/n77*

- ▣ *Omni-Antenna HC20 (Rx) Efficiency & Peak Gain*

Frequency (MHz)	B41 (n41)	B48	n77
Efficiency (dB)	-1.91	-2.04	-1.70
Efficiency (%)	64.44	62.56	67.63
Gain (dBi)	3.67	4.03	4.14
Min. Gain	3.22	3.73	3.73

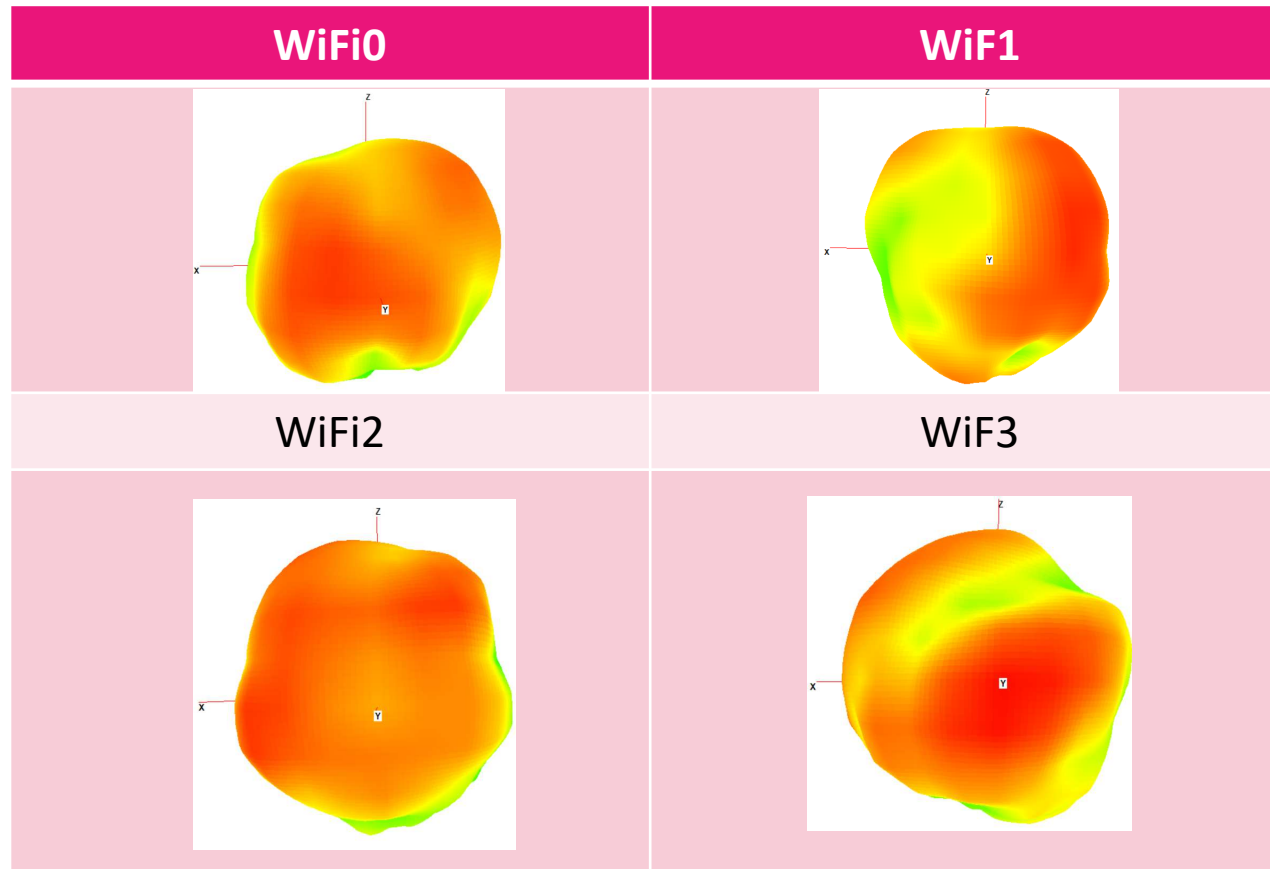
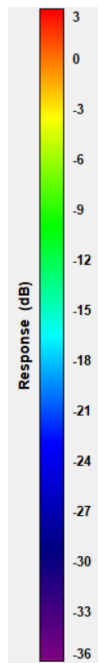
- *LTE/5G NR C-Band: 41/48/n77*

- ▣ *Semi-Antenna HC2S (Rx) Efficiency & Peak Gain*

Frequency (MHz)	B41 (n41)	B48	n77
Efficiency (dB)	-1.46	-1.39	-1.34
Efficiency (%)	71.46	72.54	73.45
Gain (dBi)	7.76	8.01	8.13
Min. Gain	7.70	7.90	7.91

Antenna Radiation of WiFi

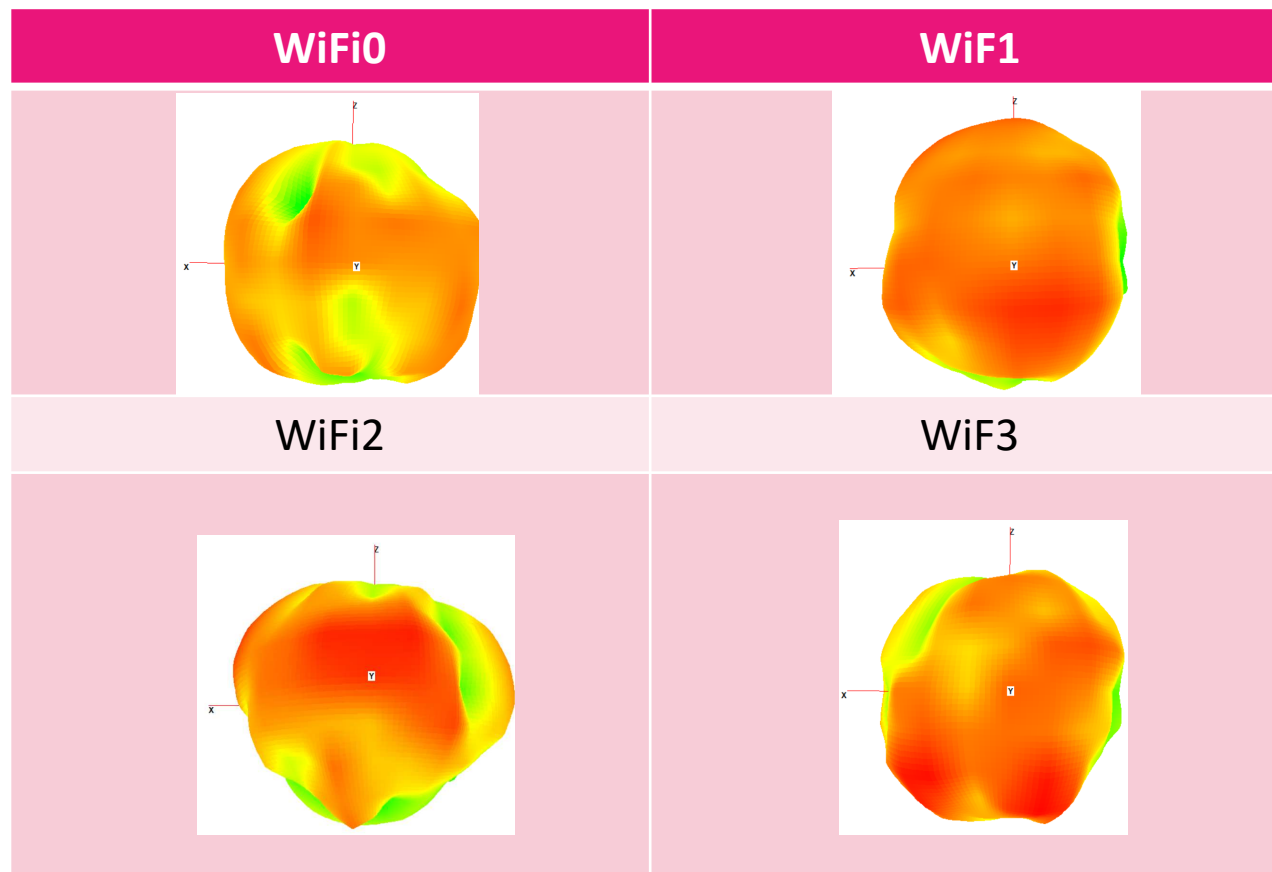
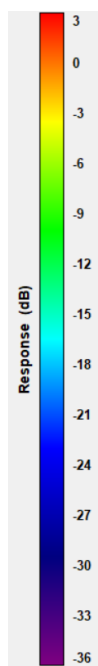
● WiFi/ 2.4G



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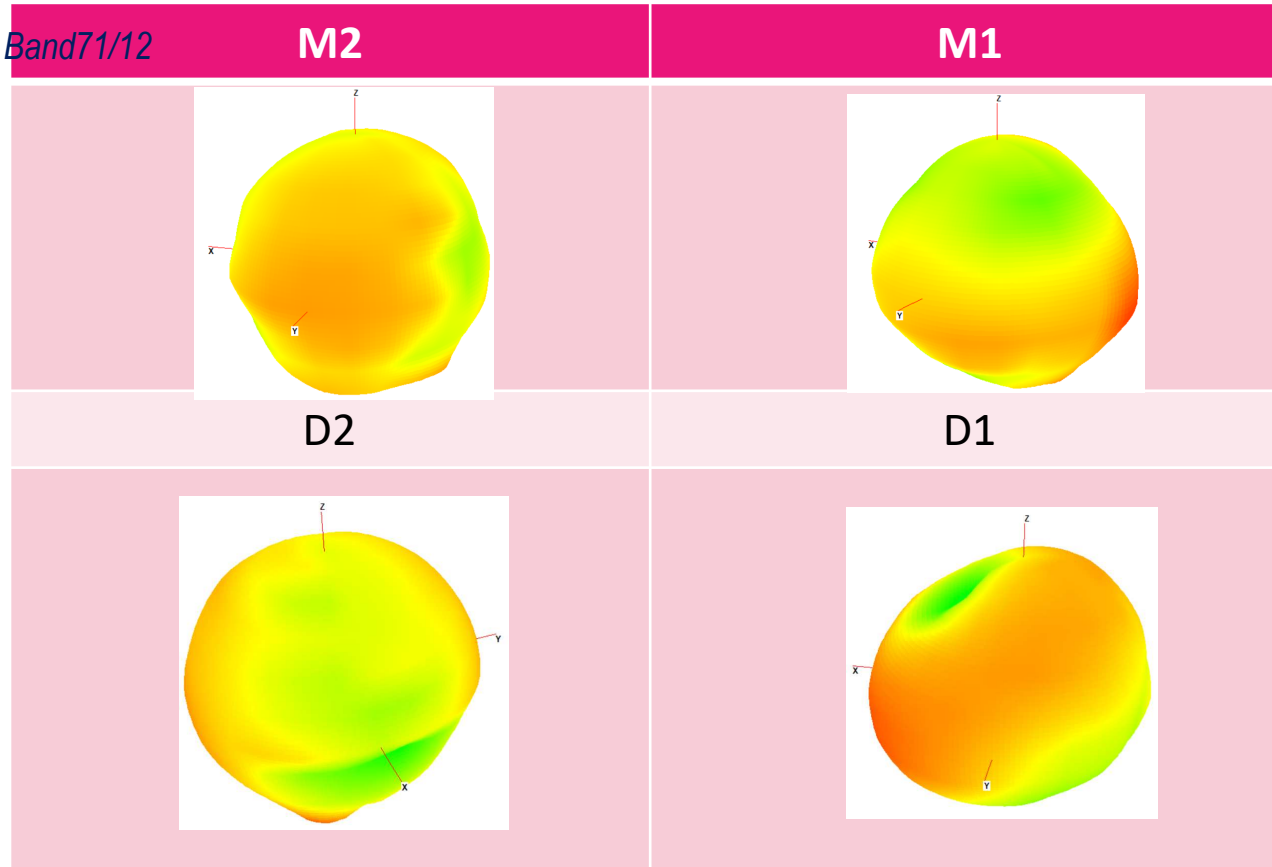
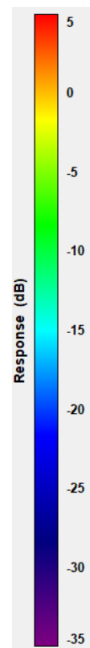
Antenna Radiation of WiFi

● WiFi/ 5G



Antenna Radiation of LTE/5G NR

● LTE/5G NR Band71/12

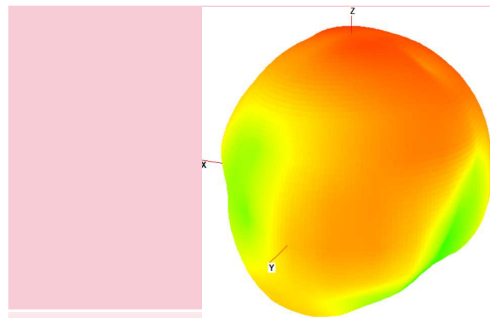
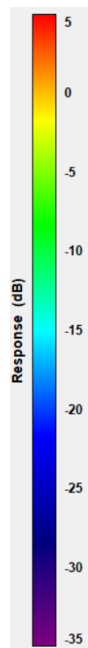


Antenna Radiation of LTE/5G NR

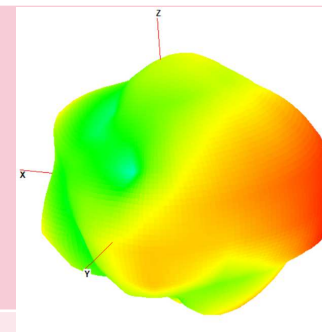
● LTE/5G NR M/H Band2/4/66/25

M2

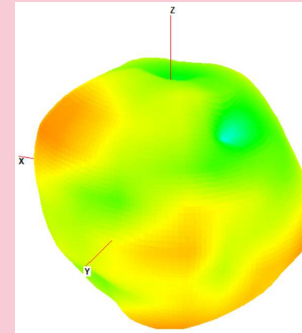
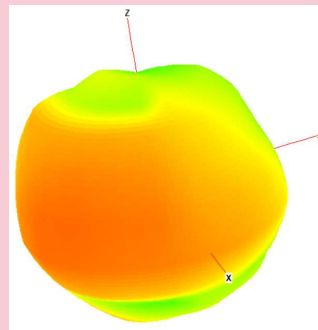
M1



D2

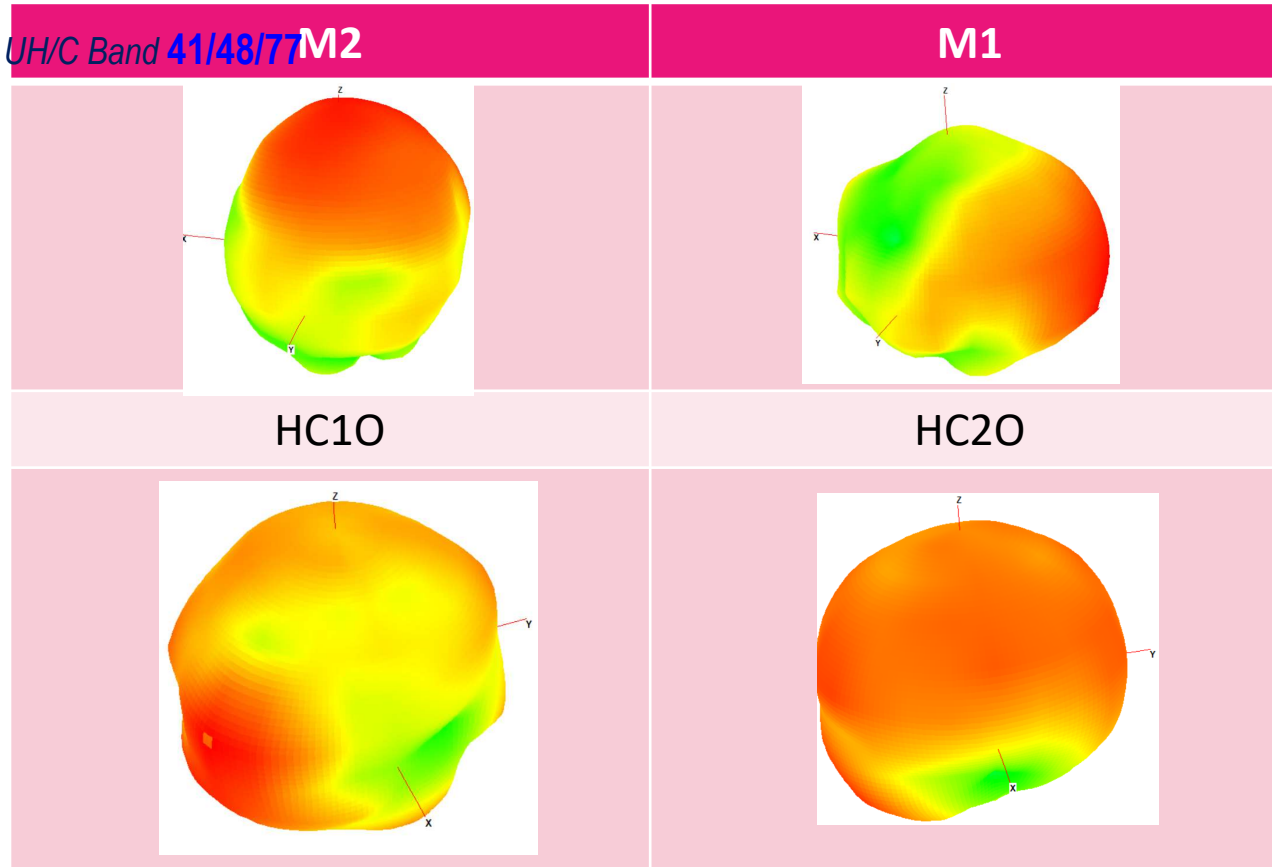
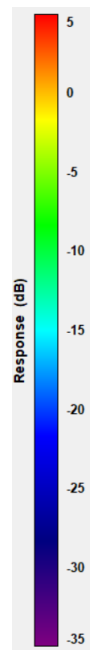


D1



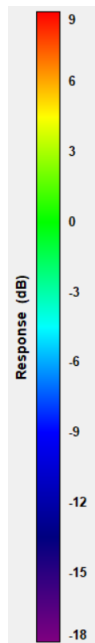
Antenna Radiation of LTE/5G NR

● LTE/5G NR UH/C Band 41/48/77

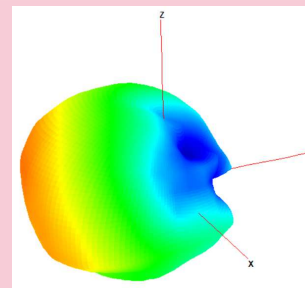


Antenna Radiation of LTE/5G NR

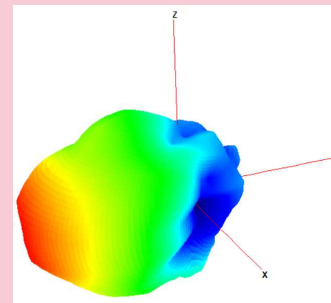
- LTE/5G NR UH/C Band 41/48/77 High Gain



HC1S



HC2S



Antenna Radiation of GPS

● *GPS Radiation*

