

Antenna measurement report for CGA-437C project (with LAB2A PCBA & SATIMO chamber SG24)

Pegatron BU6
2025/6/19

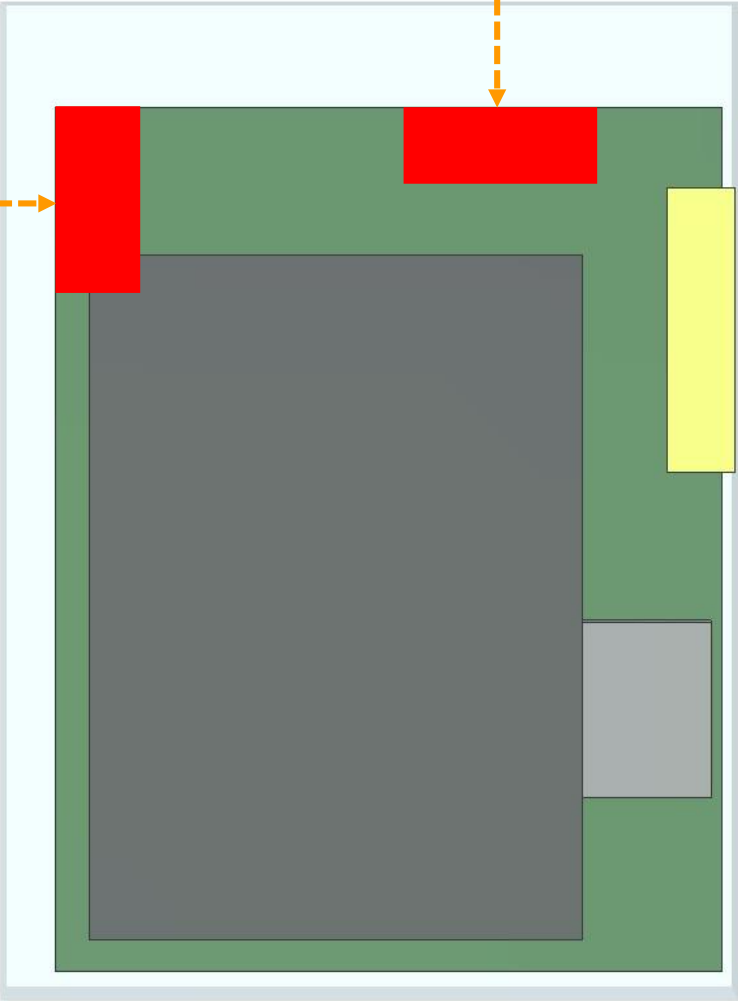
Antenna specification

Antenna Proposal		
Wireless Function	■ Wi-Fi 2 x 2.4GHz antenna ■ Wi-Fi 2 x 5GHz antenna	
Antenna type	■ On-board : 2G+5G dual band antenna*2	
Specification and Measurement data		
	Customer spec.	Measurement data
Return loss	<-10 dB	<-12 dB
Isolation	< -20 dB	■ DB to DB antenna < -28 dB
Peak Gain	2G Peak < 4.5 dBi 5G Peak < 6 dBi	■ 2G Peak < 4.11 dBi ■ 5G Peak < 5.37 dBi

Antenna placement

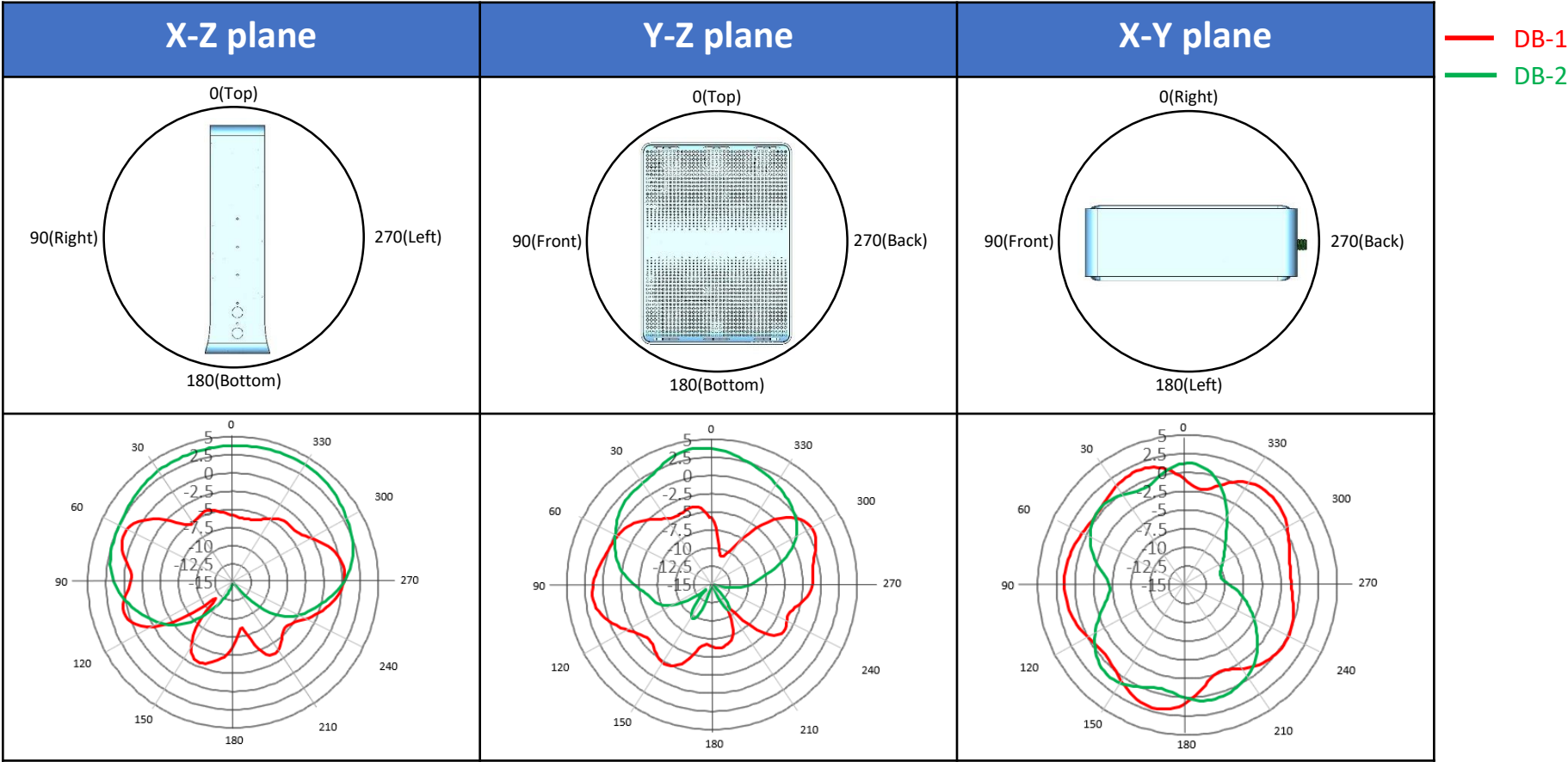
2.4G port 0/5G port1
Dual Band-1 (2G/5G)
(On board Ant.)

2.4G port 1/5G port0
Dual Band-2 (2G/5G)
(On board Ant.)



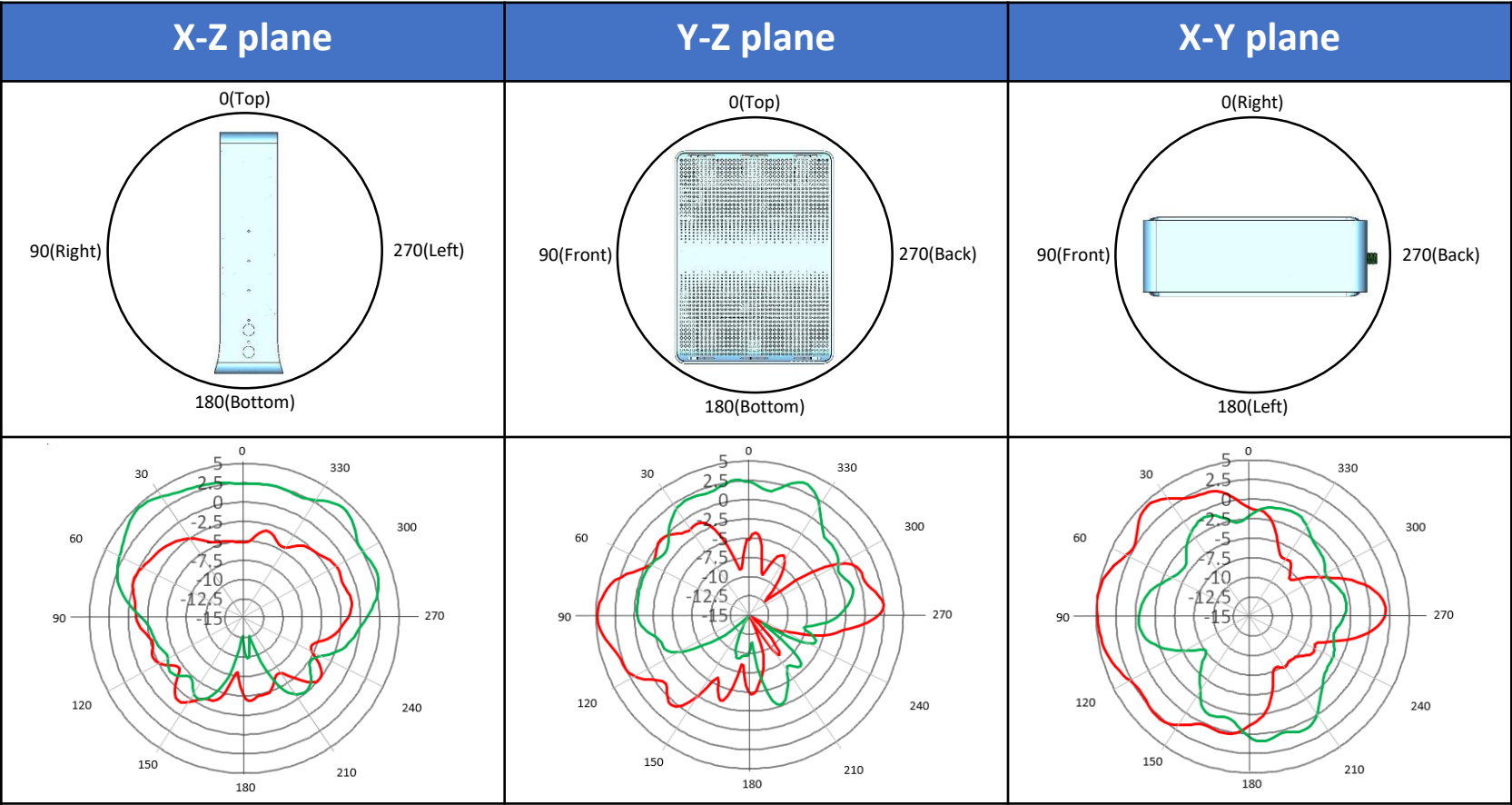
Measurement data

- Radiation pattern – 2.45G



Measurement data

- Radiation pattern – 5.47G



— DB-1
— DB-2

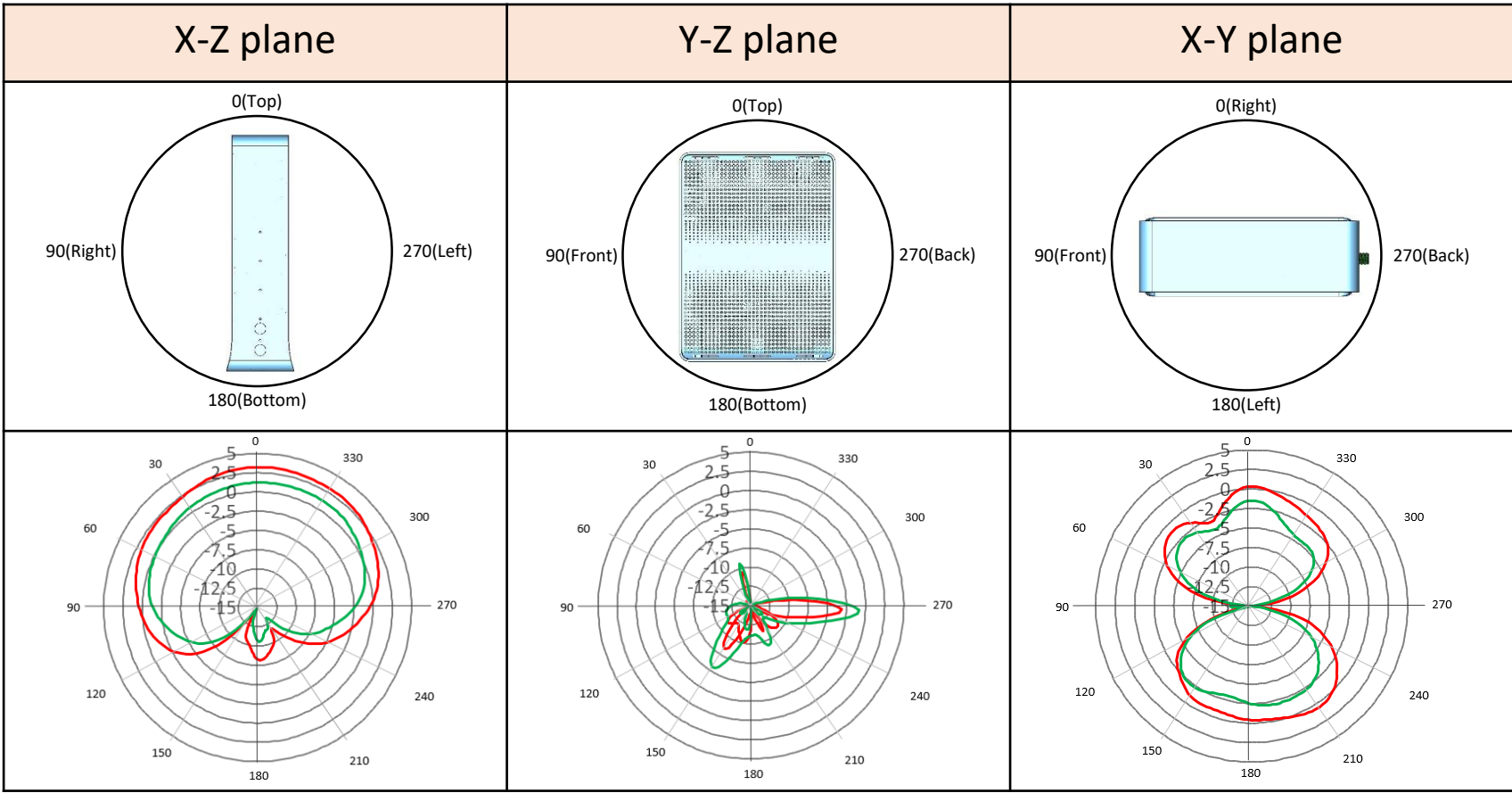
Measurement data

- Gain table

Frequency	(MHz)	2400	2450	2500	5150	5200	5300	5400	5470	5500	5600	5700	5800	5850
DB-1	Peak Gain (dBi)	2.47	2.27	1.96	4.59	4.57	4.5	4.42	4.76	5.02	5.37	5.01	4.87	4.4
	Position (θ,Φ)	(26,66)	(20,102)	(86,94)	(52,88)	(50,88)	(46,90)	(44,84)	(82,92)	(82,92)	(76,92)	(38,86)	(72,80)	(68,82)
	Polarization	Theta	Theta	Theta	Theta	Theta	Theta	Theta	Theta	Theta	Theta	Theta	Theta	Theta
DB-2	Peak Gain (dBi)	4.11	3.98	3.69	4.97	4.87	4.71	4.52	4.69	4.5	4.4	4.15	3.91	3.83
	Position (θ,Φ)	(86,4)	(176,26)	(178,34)	(178,20)	(178,-34)	(178,-38)	(0,40)	(0,42)	(0,44)	(2,46)	(4,48)	(2,50)	(2,52)
	Polarization	Theta	Phi	Phi	Phi	Phi	Phi	Phi	Phi	Phi	Phi	Phi	Phi	Phi

Measurement data

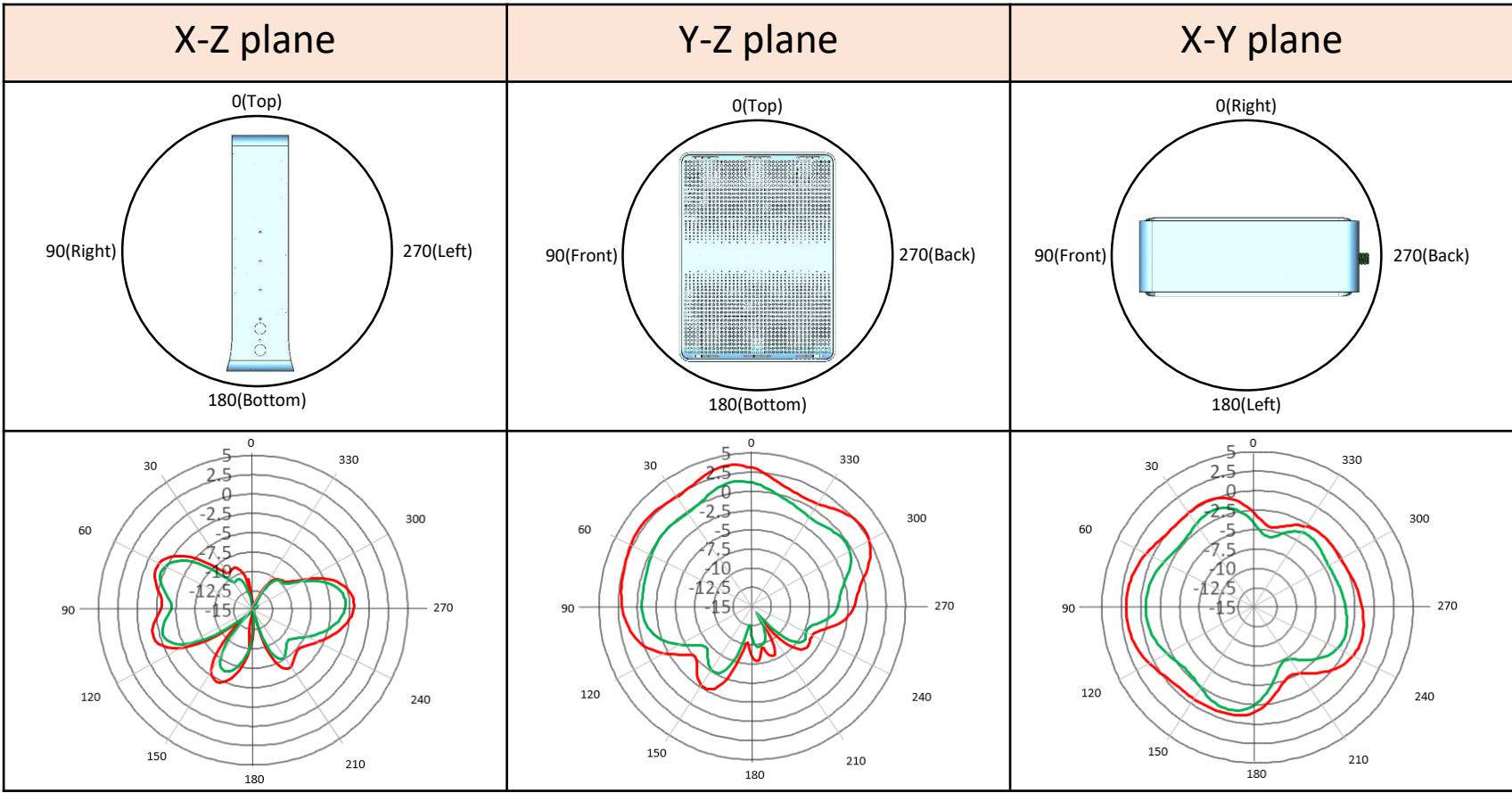
- Radiation pattern – Correlated 2.45GHz_Phi



— Correlated
— Uncorrelated

Measurement data

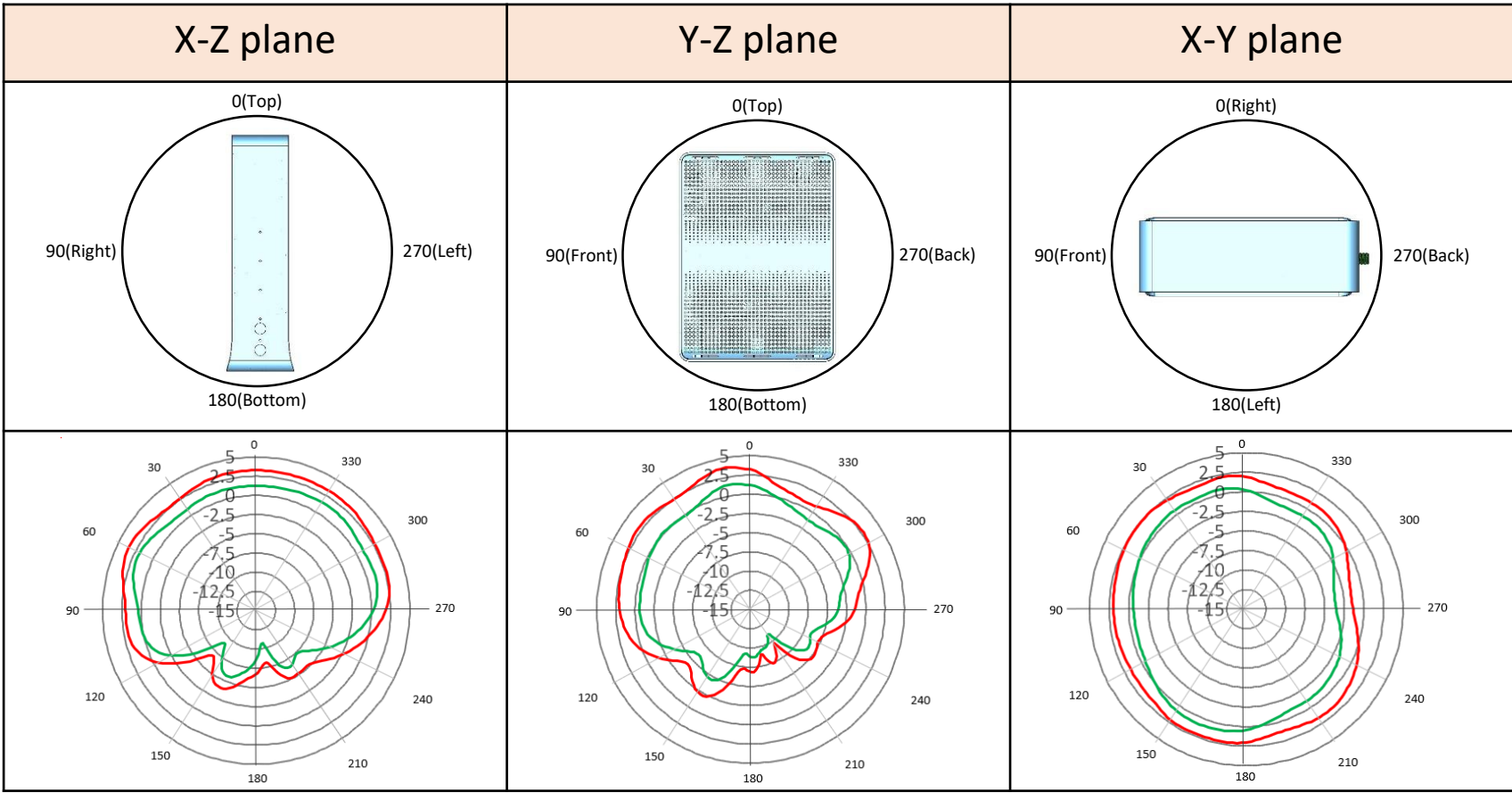
- Radiation pattern – Correlated 2.45GHz_Theta



— Correlated
— Uncorrelated

Measurement data

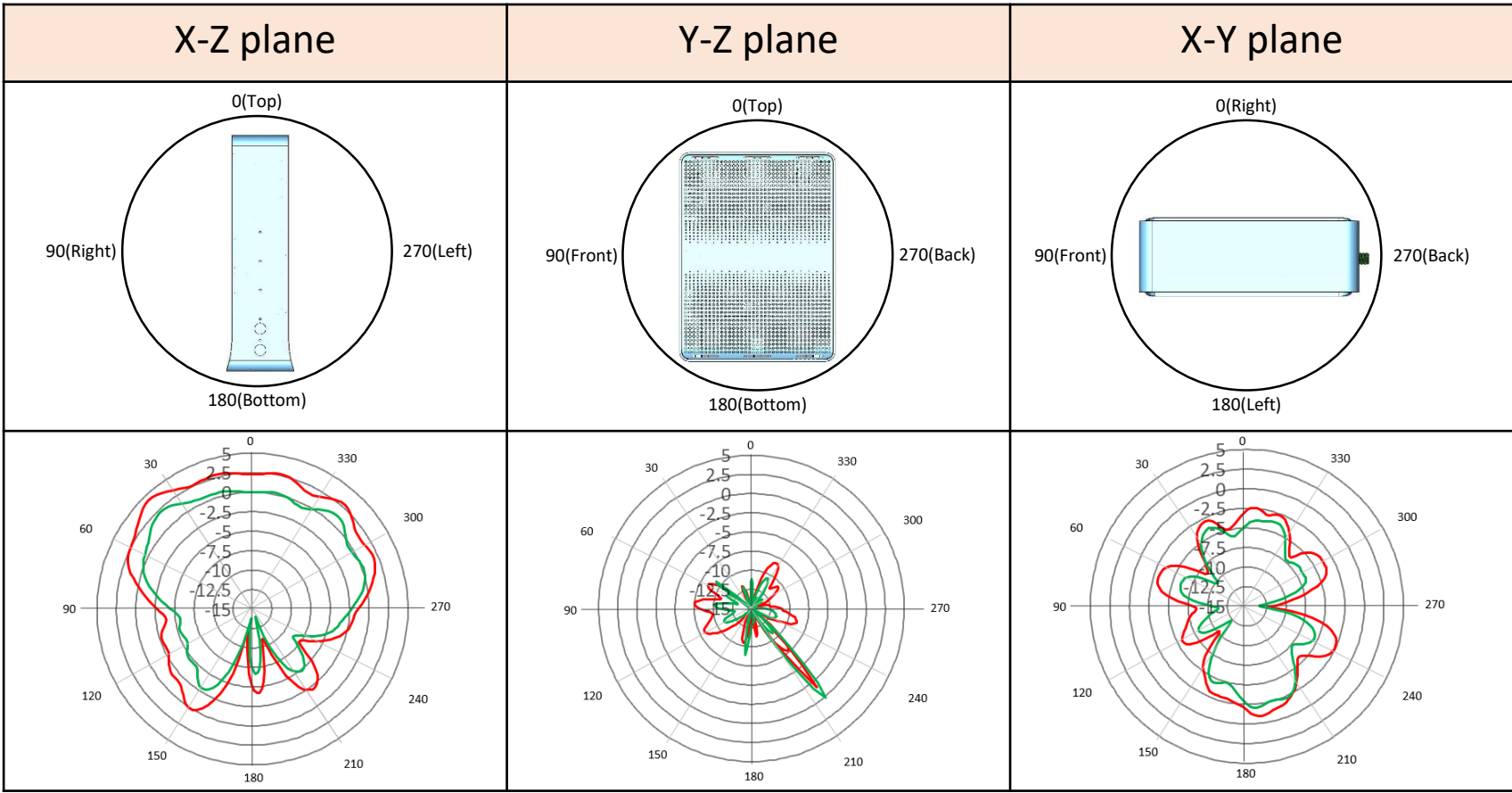
- Radiation pattern – Correlated 2.45GHz_E-total



— Correlated
— Uncorrelated

Measurement data

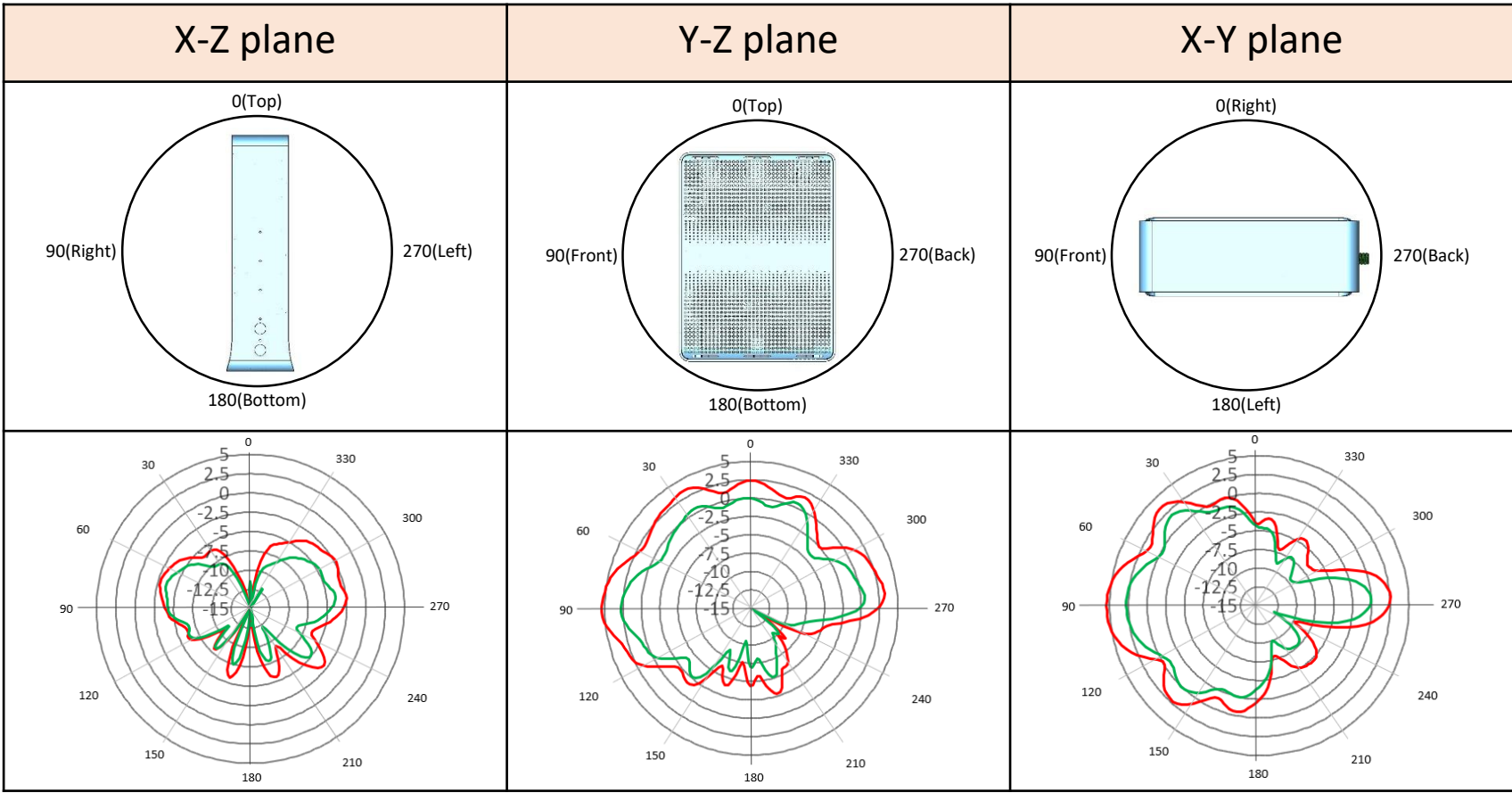
- Radiation pattern – Correlated 5.47GHz_Phi



— Correlated
— Uncorrelated

Measurement data

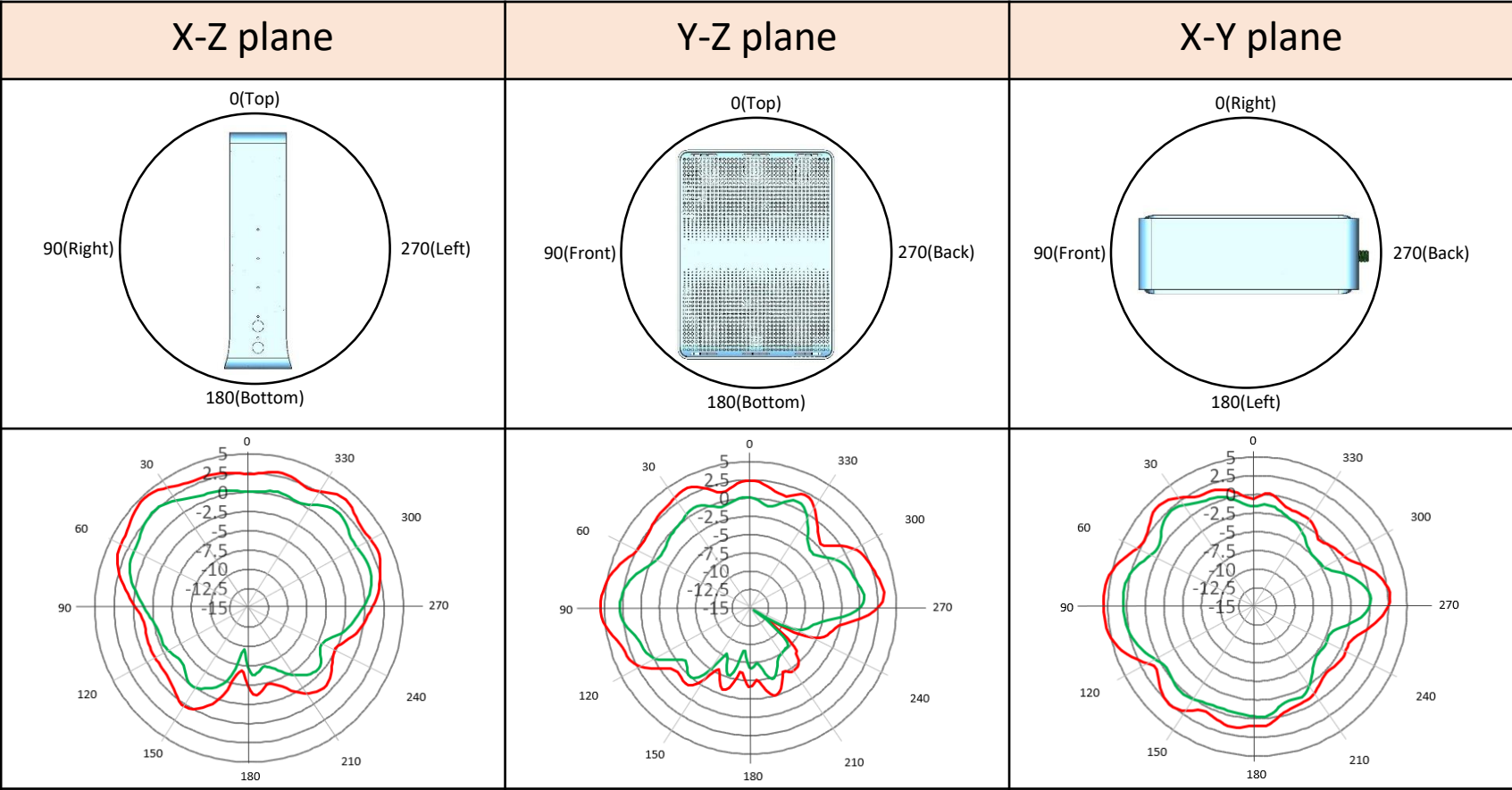
- Radiation pattern – Correlated 5.47GHz_Theta



— Correlated
— Uncorrelated

Measurement data

- Radiation pattern – Correlated 5.47GHz_E-total



— Correlated
— Uncorrelated

Measurement data

❖ Directional gain table

Frequency (MHz)	2400	2450	2500	5150	5200	5300	5400	5470	5500	5600	5700	5800	5850
DB-1(dBi)	-4.22	-4.21	-4.39	-4.83	-5.25	-3.32	4.05	4.67	4.92	5.11	4.80	4.19	3.42
DB-2(dBi)	3.78	3.83	3.46	4.87	4.84	4.58	-0.62	-0.64	-0.89	0.40	0.80	0.46	0.41
Position (θ,Φ)	(86,12)	(84,8)	(82,8)	(178,-26)	(0,34)	(2,40)	(88,90)	(88,90)	(88,90)	(88,80)	(86,80)	(84,78)	(84,76)
Polarization	Theta	Theta	Theta	Phi	Phi	Phi	Theta	Theta	Theta	Theta	Theta	Theta	Theta
Directional Gain= $10\log[(10^{G1/20}+10^{G2/20}+.....+10^{Gn/20})^2/N_{ANT}]$ dBi													
Directional Gain(dBi)	3.68	3.72	3.4	4.32	4.19	4.51	5.03	5.42	5.5	6.08	6.04	5.53	5.06

Unit: dBi

Summary

- The return loss of all antenna can meet -10 dB spec.
- The efficiency of all antenna can meet 60% spec.
- The isolation of all antenna can meet -20 dB spec.
- For certification, We used the formulas as below which is based on FCC document 662911 to calculate directional gain.

(i) If transmit signals are *correlated*, then

Directional gain = $10 \log[(10^{G_1/20} + 10^{G_2/20} + \dots + 10^{G_N/20})^2 / N_{ANT}]$ dBi [Note the “20”s in the denominator of each exponent and the square of the sum of terms; the object is to combine the signal levels coherently.]

(ii) If all transmit signals are *completely uncorrelated*, then

Directional gain = $10 \log[(10^{G_1/10} + 10^{G_2/10} + \dots + 10^{G_N/10}) / N_{ANT}]$ dBi

Frequency (MHz)	Peak Gain of 3D Directional pattern					
	Phi		Theta		E-total	
	Correlated	Uncorrelated	Correlated	Uncorrelated	Correlated	Uncorrelated
2400	3.02	1.32	3.68	1.52	4.39	2.21
2450	3.27	1.31	3.72	1.46	4.13	2.11
2500	2.95	1.04	3.40	1.11	3.95	1.87
5150	4.32	2.30	4.03	1.75	4.78	2.84
5200	4.19	2.24	4.01	1.73	4.66	2.75
5300	4.51	2.27	4.51	1.73	4.94	2.66
5400	4.34	2.11	5.03	2.31	5.31	2.65
5470	4.30	2.18	5.42	2.78	5.64	3.05
5500	4.04	1.96	5.50	2.93	5.71	3.19
5600	3.88	1.84	6.08	3.36	6.17	3.48
5700	4.22	1.84	6.04	3.25	6.12	3.34
5800	4.47	1.86	5.53	2.76	5.72	3.07
5850	4.44	1.80	5.06	2.26	5.32	2.78

Antenna Information

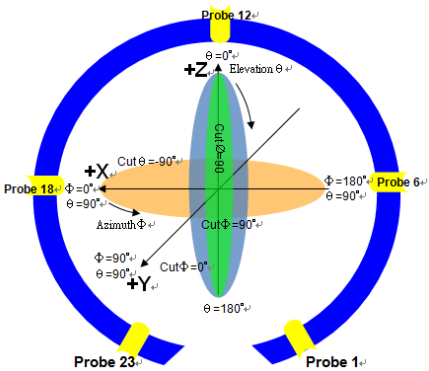
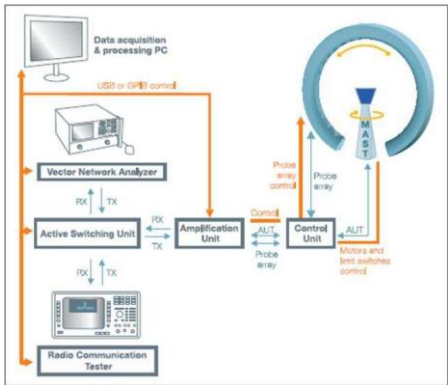
Ant.	2.4G port	5G port	Brand Name	Model Name	Ant. Type	Connector	Support	Radio	Manufacturer
1(DB-1)	0	1	Pegatron	DB-1	PCB Antenna	N/A	2.4G+5G	Radio 0+Radio 1	PEGA No. 150, Lide Rd., Beitou Dist., Taipei City 112019, Taiwan (R.O.C.)
2(DB-2)	1	0	Pegatron	DB-2	PCB Antenna	N/A	2.4G+5G	Radio 1+Radio 0	PEGA No. 150, Lide Rd., Beitou Dist., Taipei City 112019, Taiwan (R.O.C.)

Antenna Vendor Info & Measurement Setup

- Antenna Vendor: Pegatron
- Test Date: 20250513
- Test Engineer :Joe Liu
- Measurement Setup:
 - Reflection Coefficient Measurement:
 1. Network Analyzer (Keysight Agilent E5071C)
 2. Setup:
 - calibrate the Network Analyzer by one port calibration using 85033E calibration kit.
 - connect the antenna under test to the Network Analyzer.
 - measure the S11 (return loss)& S12(isolation)

- Pattern & Gain measurement:
 1. Satimo chamber (SG24)
 2. Satimo program (wave studio)
 3. system overview :

- Test Item
 1. Antenna passive test 400MHz~6GHz



Description	Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
OTA Chamber	Satimo	SG24	MVG/HKG0147S	2024/09/16	2025/09/15
Network Analyzer	Keysight	E5071C	MY46212481	2025/5/16	2026/5/15

Test Procedure

- a) sub-divide the whole sphere surface into many 2x2 degree subsection.
- b) Measure the gain contributed from each antenna within each subsection position.
- c) Apply the KDB 662911 D01 correlated directional gain formula to calculate directional gain for each subsection.
- d) After all subsections have been evaluated, the largest calculated value among all positions evaluated is picked as the worst-case directional gain for the system and used in RF/EMC test report.