Antenna Measurement Data

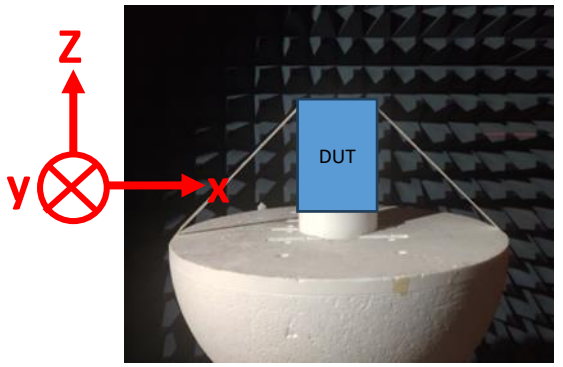
Introduction

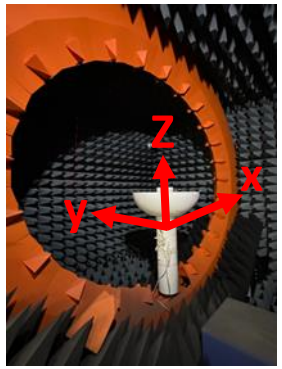
This report provides Wi-Fi antenna passive measurement results which include:

- General Information
- Antenna Measurement System Information
- Test Procedure
- DUT Information
- Test Result (Antenna Peak Gain)
- Test Result 2D Radiation Pattern and 3D Raw Data
- Directional Gain Result
- Set-up Photo

General Information

- Antenna Vendor : Pegatron
- Test Date: 20240820
- Test Engineer: Darren Huang
- Measurement System: SATIMO SG24 Chamber
- Software Name: Wave Studio
- Software Version: 22.5.5





Pegatron's SATIMO SG24 chamber

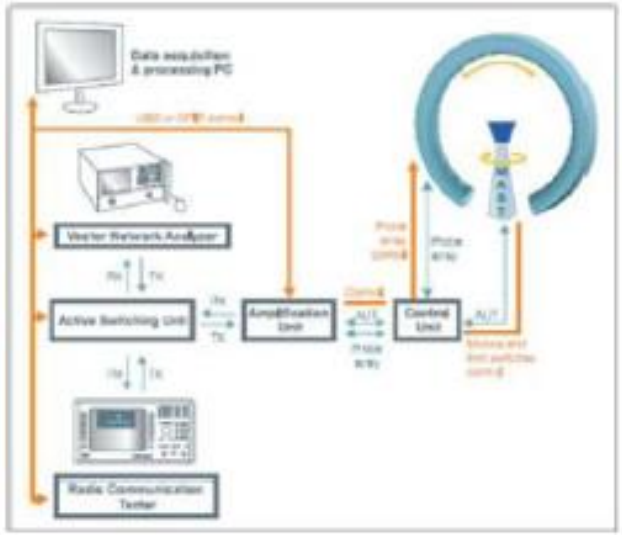
Antenna Measurement System Information

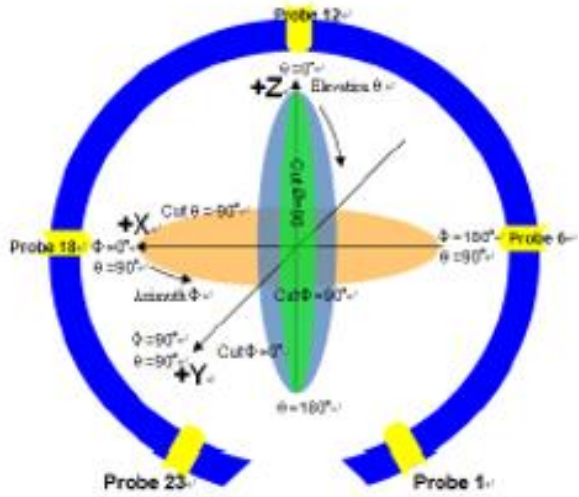
- Measurement System: SATIMO SG24 Chamber

Measurement Setup:

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

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



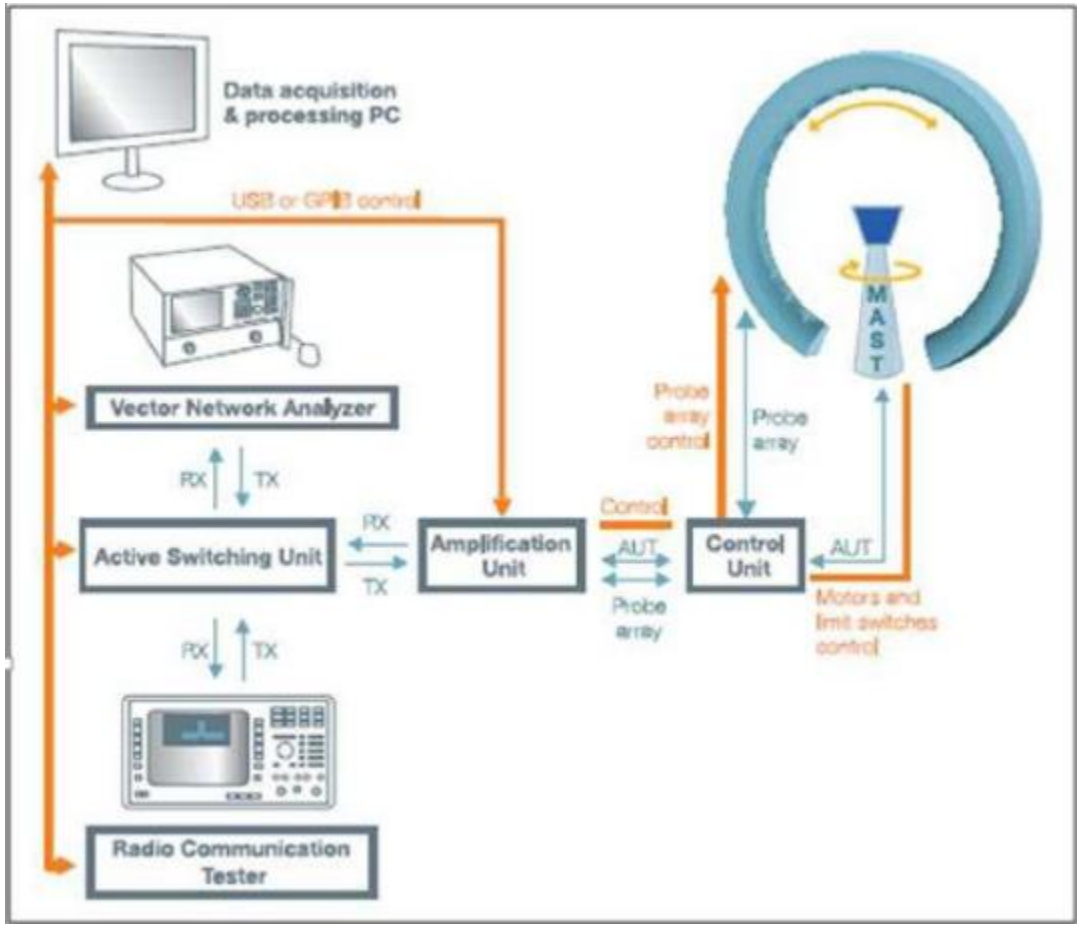


- Calibration Information

Description	Model No.	Serial No.	Calibrated Date	Calibrated Until
Chamber	Satimo SG24	MVG/HKG0147S	2023/09/15	2024/09/16
Network Analyzer	E5071C	MY46212481	2023/05/15	2024/05/16

Test Procedure

1. Place the device to be tested on the fixture and align it with the center of the chamber.
2. Connect the antenna cable to the RF connector of the chamber.
3. Use the SW to configure parameters (antenna name, frequency points, measurement angles, antenna dimension), and then run the test SW (wave studio).
4. By phi from 0° to 360° and theta from 0° to 180° with a step size of 2 degrees, get the 3D data, including efficiency, peak gain, 2D and 3D radiation patterns.
5. This is far field test for antenna verification.
6. This is passive measurement, which means the device is off and not in any operating mode.



DUT Information

- DUT Operation Mode

Support Band	TX/RX	Operation Mode
2.4G	2TX/2RX	11b/11g/11n/11ac/11ax
5G UNII-1	2TX/2RX	11a/11n/11ac/11ax
5G UNII-2a	2TX/2RX	11a/11n/11ac/11ax
5G UNII-2c	2TX/2RX	11a/11n/11ac/11ax
5G UNII-3	2TX/2RX	11a/11n/11ac/11ax

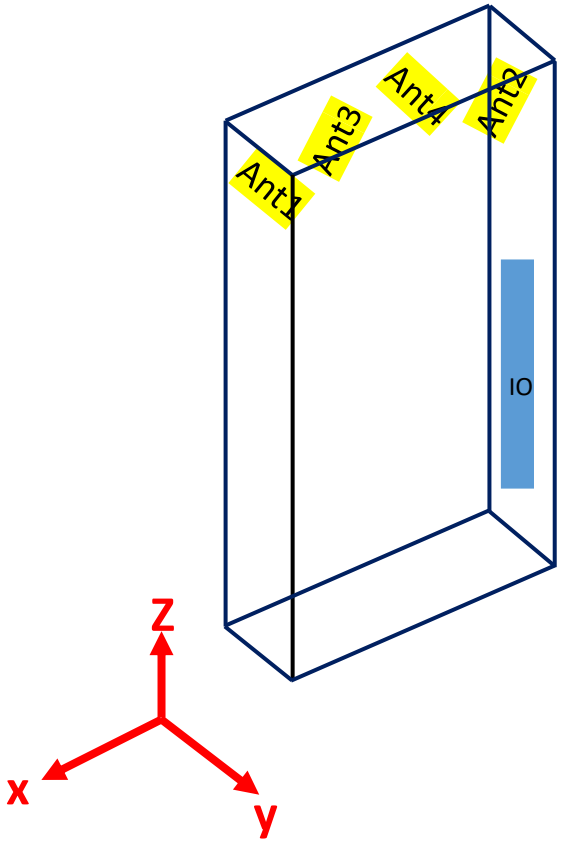
DUT Information

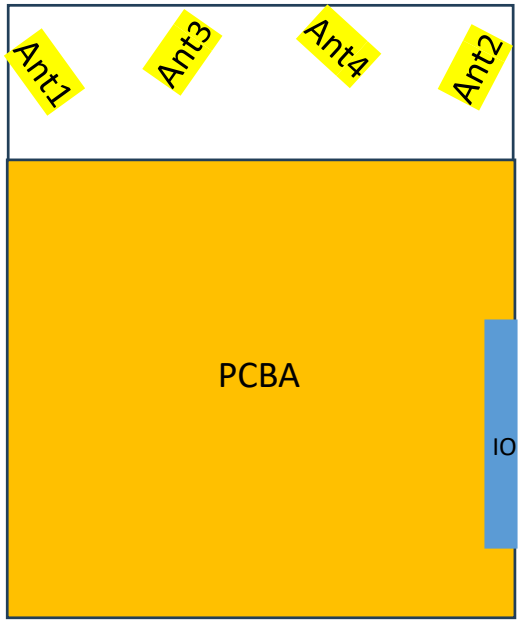
- Antenna System information

Antenna NO.	RF Chain NO.	Support Function	Antenna Type	Connector Type
Ant1	0	2.4G	Dipole	I-PEX
Ant2	1	2.4G	Dipole	I-PEX
Ant3	0	5G	Dipole	I-PEX
Ant4	1	5G	Dipole	I-PEX

DUT Information

- Antenna Placement





Test Result (Antenna Peak Gain)

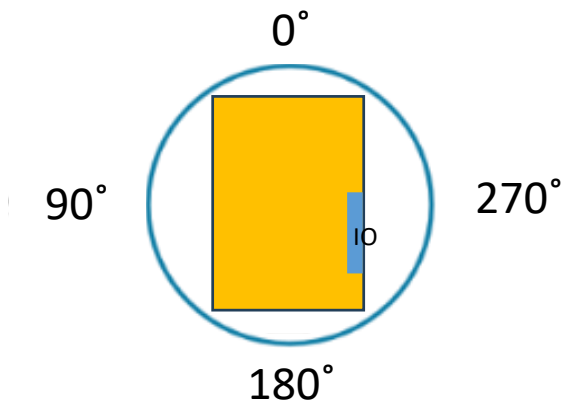
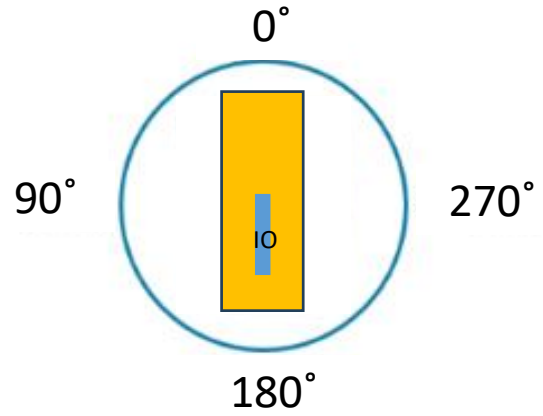
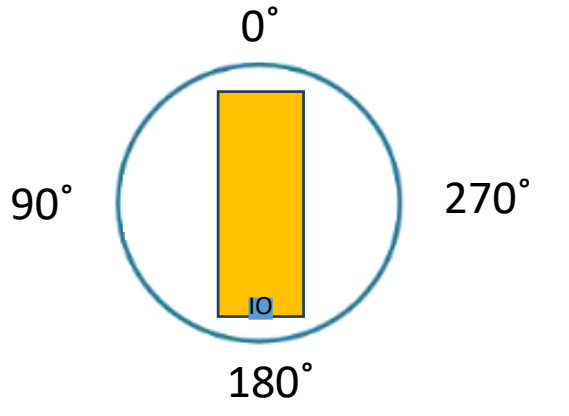
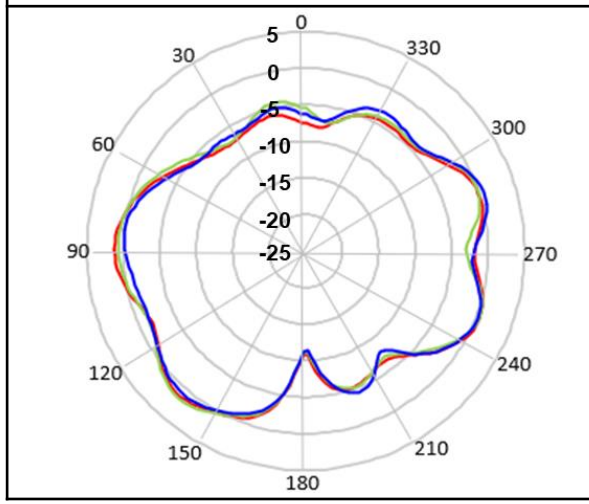
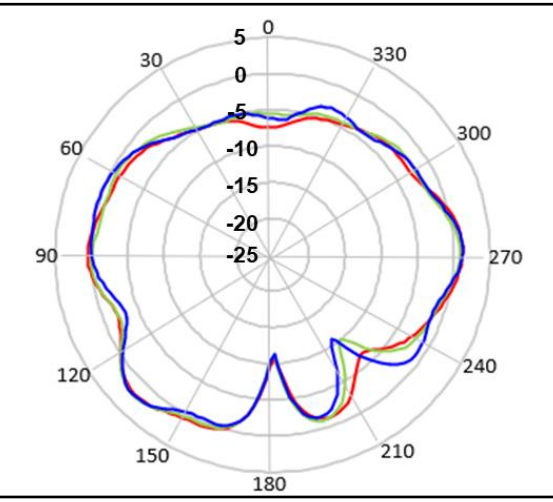
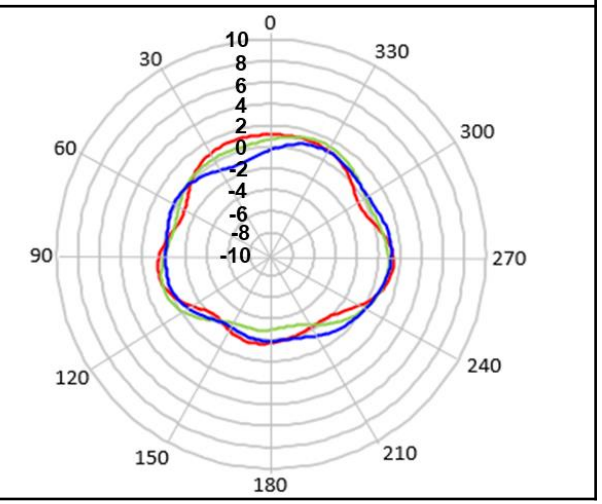
Antenna NO.	Model	Test Frequency (MHz)	Peak Gain (dBi)
Ant1	U4.2	2450	3.26
Ant2	U4.2	2450	2.75
Ant3	U4.2	5800	3.91
Ant4	U4.2	5300	3.51

Band	2.4G (2.4G~2.4835GHz)	UNII-1 (5.15G~5.25GHz)	UNII-2a (5.25G~5.35GHz)	UNII-2c (5.47G~5.725GHz)	UNII-3 (5.725G~5.85GHz)
Frequency (GHz)	2.45GHz	5.18GHz	5.3GHz	5.5GHz	5.8GHz

Test Result 2D Radiation Pattern and 3D Raw Data

- Ant No.: Ant1
- Model No.: 1415-0AVK000

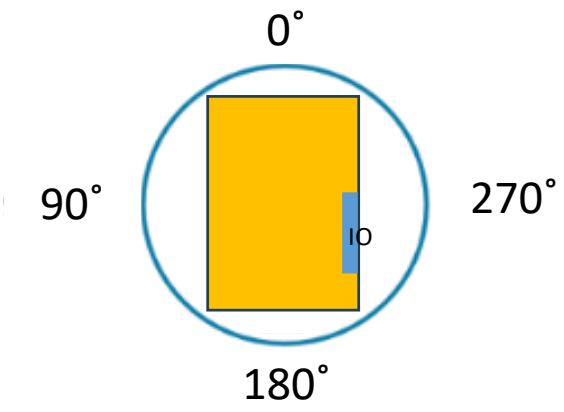
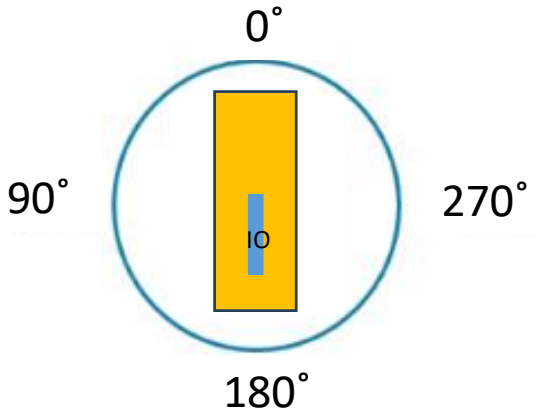
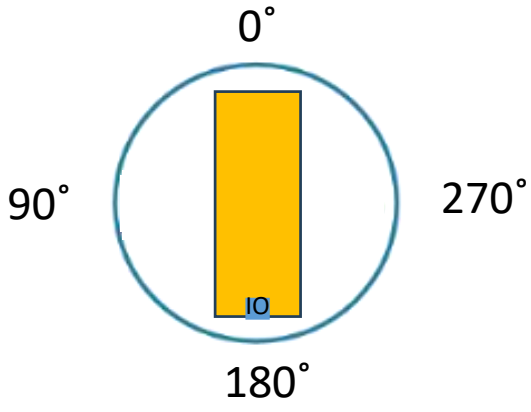
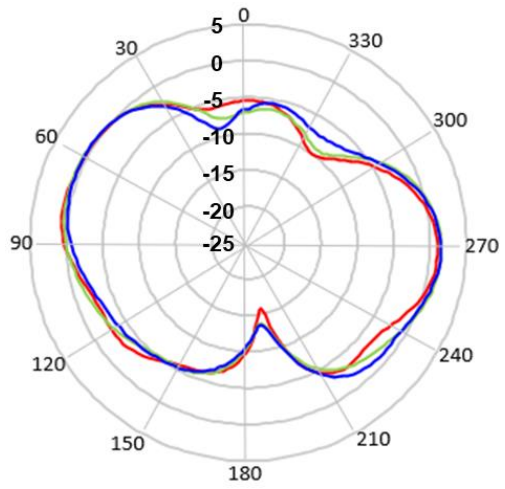
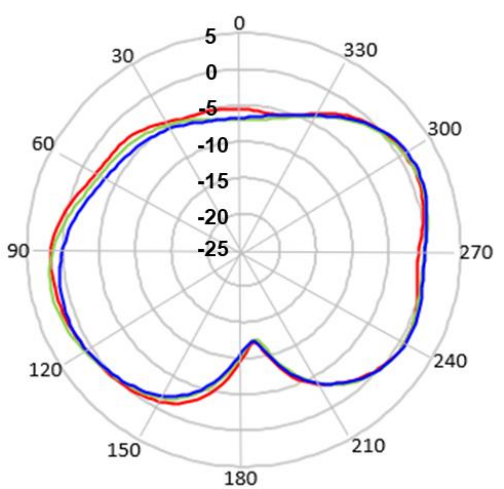
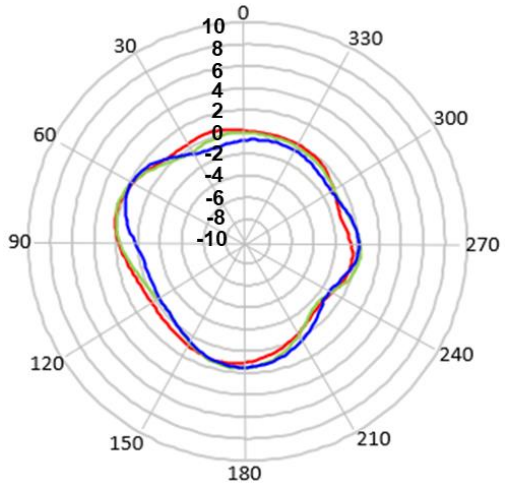
2400 MHz
2450 MHz
2500 MHz

X-Z plane	Y-Z plane	X-Y plane
		
		

Test Result 2D Radiation Pattern and 3D Raw Data

- Ant No.: Ant2
- Model No.: 1415-0AVJ000

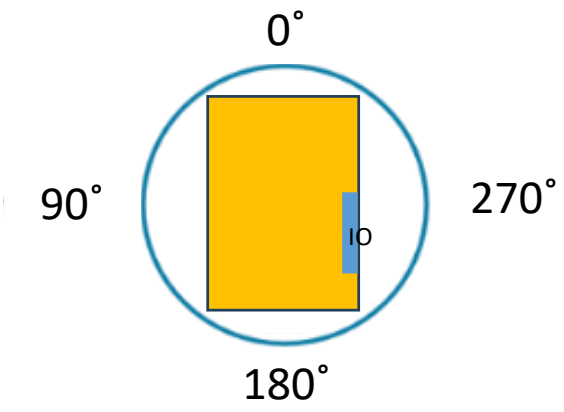
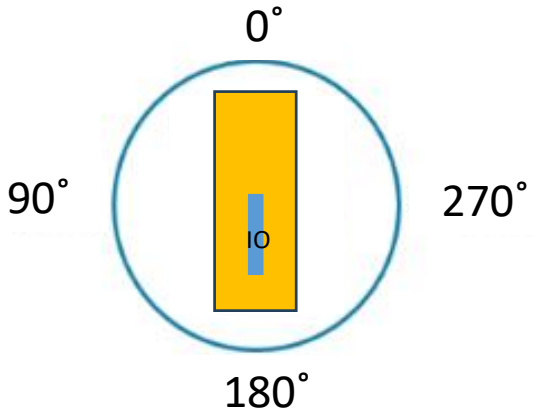
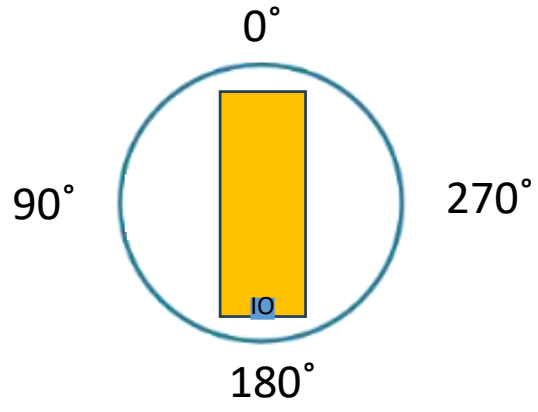
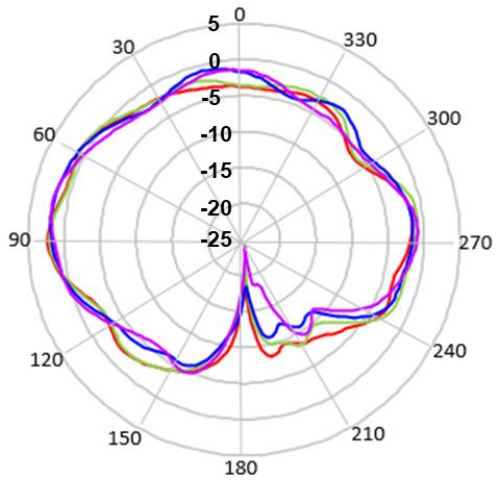
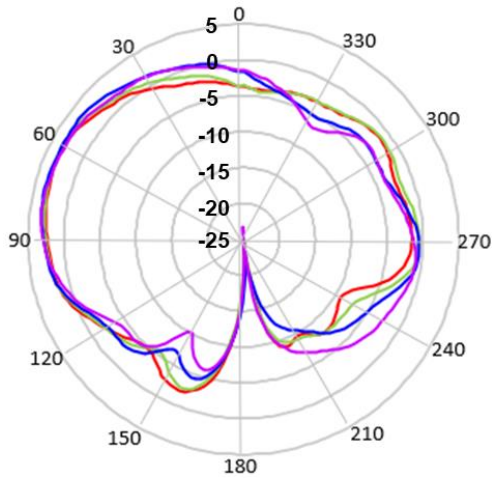
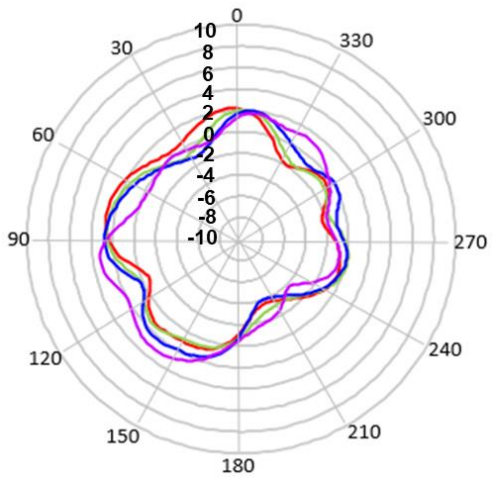
2400 MHz
2450 MHz
2500 MHz

X-Z plane	Y-Z plane	X-Y plane
		
		

Test Result 2D Radiation Pattern and 3D Raw Data

- Ant No.: Ant3
- Model No.: 1415-0AVH000

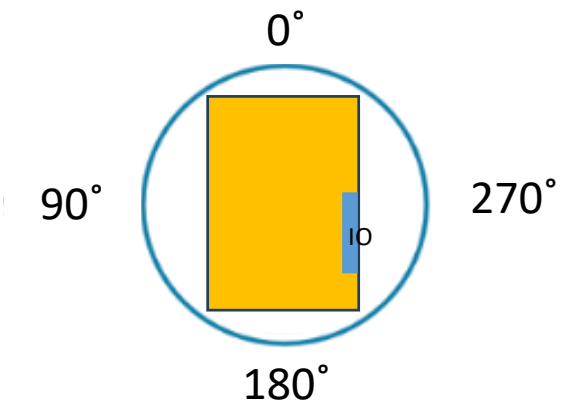
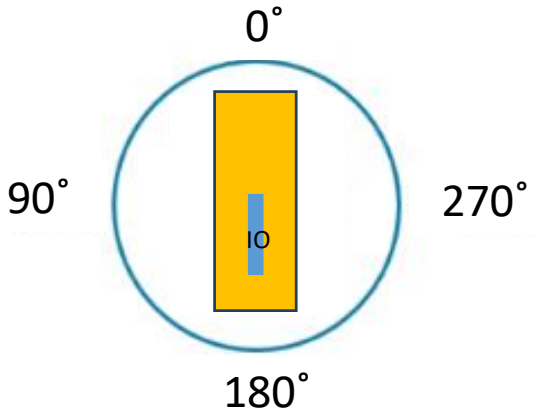
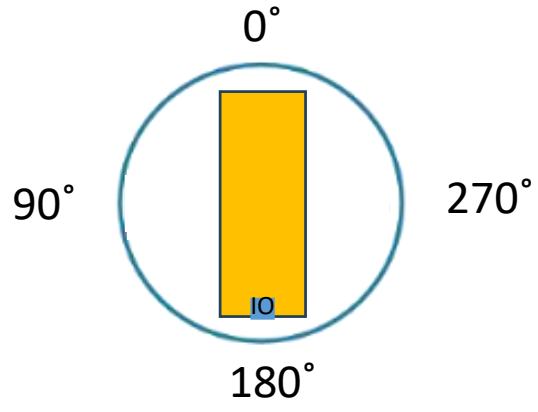
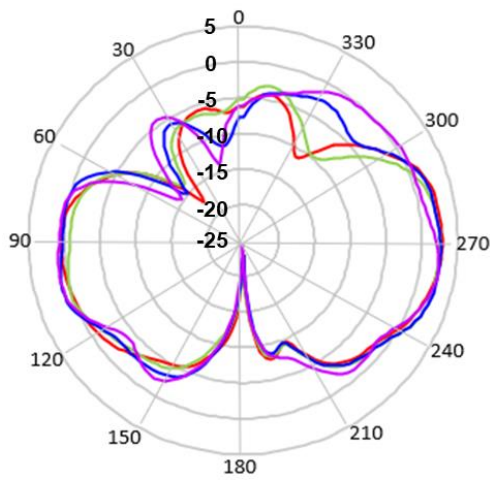
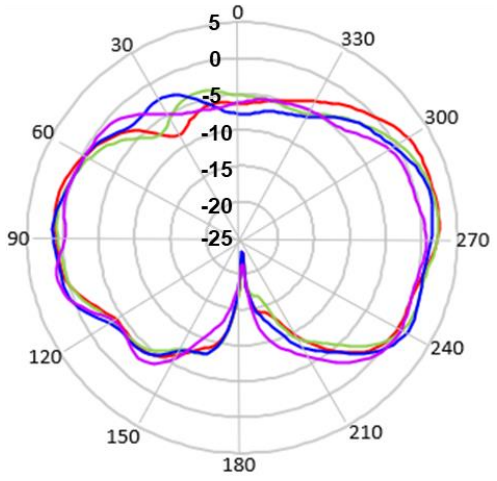
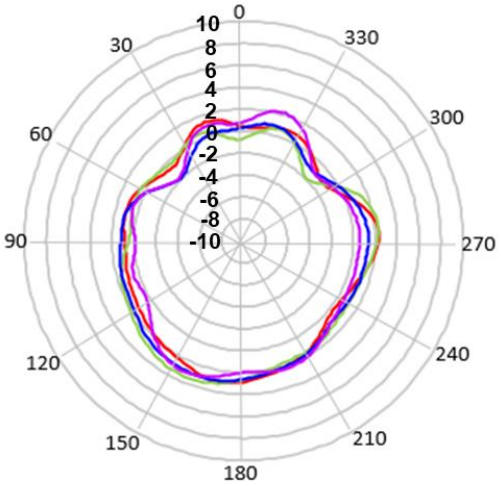
5180 MHz
5300 MHz
5500 MHz
5800 MHz

X-Z plane	Y-Z plane	X-Y plane
		
		

Test Result 2D Radiation Pattern and 3D Raw Data

- Ant No.: Ant4
- Model No.: 1415-0AVG000

5180 MHz
5300 MHz
5500 MHz
5800 MHz

X-Z plane	Y-Z plane	X-Y plane
		
		

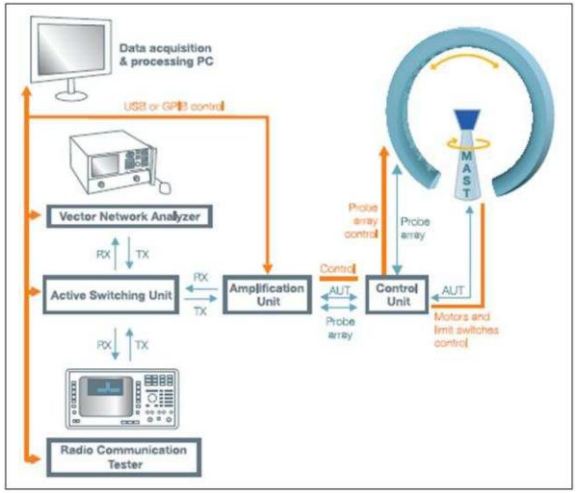
Measurement Setup

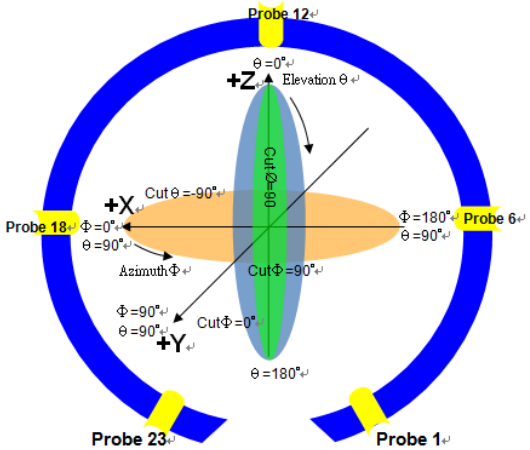
- Procedure
  a) sub-divide the whole sphere surface into many 2x2 degree subsection.
  b) Measure the gain contributed from each antenna within each subsection position.
  c) Apply the KDB 662911 D01 correlated directional gain formula to calculate directional gain for each subsection.
  d) After all 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.

d) *Unequal antenna gains, with equal transmit powers.* For antenna gains given by G_1, G_2, …, G_N dBi

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

Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2 / N_{ANT}]$ 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.]





Directional Gain Result

- Summary Result

Calculated Directional Gain: theta(V)

Directional Gain _ Maximum Gain Value and Positions					
Frequency Bands (MHz)	2400-2483.5	5150-5250	5250-5350	5470-5725	5725-5850
Frequency (MHz)	2450	5180	5300	5500	5800
Ant 1 (dBi)	3.26	X	X	X	X
Ant 2 (dBi)	2.75	X	X	X	X
Ant 3 (dBi)	X	3.43	3.51	3.58	3.91
Ant 4 (dBi)	X	3.08	3.51	3.36	3.39
Directional Gain _ 1SS	4.1	4.6	4.5	4.8	5.1
Polarization / θ/ Φ	theta (92,84)	theta (88,74)	theta (86,146)	theta (88,158)	theta (94,154)

Set-up Photo