Antenna Evaluated Report

Report No: 2023/SAT-1/AMT-0

Test Plan: Non-compliance with ISO17025

Applicant: Owl Labs, Inc.

Project name: Parakeet

Project Phase: (MP)

Pulse
a YAGEO company

Measurements performed at :

PingZhen's Satimo SG24 Chamber

Test Date: 2023-04-11

Issued Date: 2023-04-12

Tested by: Paul Chiu
Approved by : Tason Chang

Revised History

Date	Version	Revised Record
20230104	X01	1st Evaluated antenna report -
20230118	X02	2nd Evaluated antenna report
20230224	X03	3rd Evaluated antenna report
20230412	X04	4th Evaluated antenna report

OUTLINE

Pulse
a YAGEO company

1) Measurement System Information
    1) General Information
    2) System block diagram
    3) Typical Test setup for Satimo
    4) Chamber & Instruments View
2) Test lab information
3) Antenna's specification
    1. ANT1 & ANT 2 product specification
    2. Antennas' location
    3. Coordinate System
4) Measurement Result
    1) Return loss & Isolation
    2) 3D Peak Gain & Efficiency List Table
    3) 2D Gain Pattern
    4) 3D Gain Pattern
5) Summary

Measurement System Information

Pulse a YAGEO company

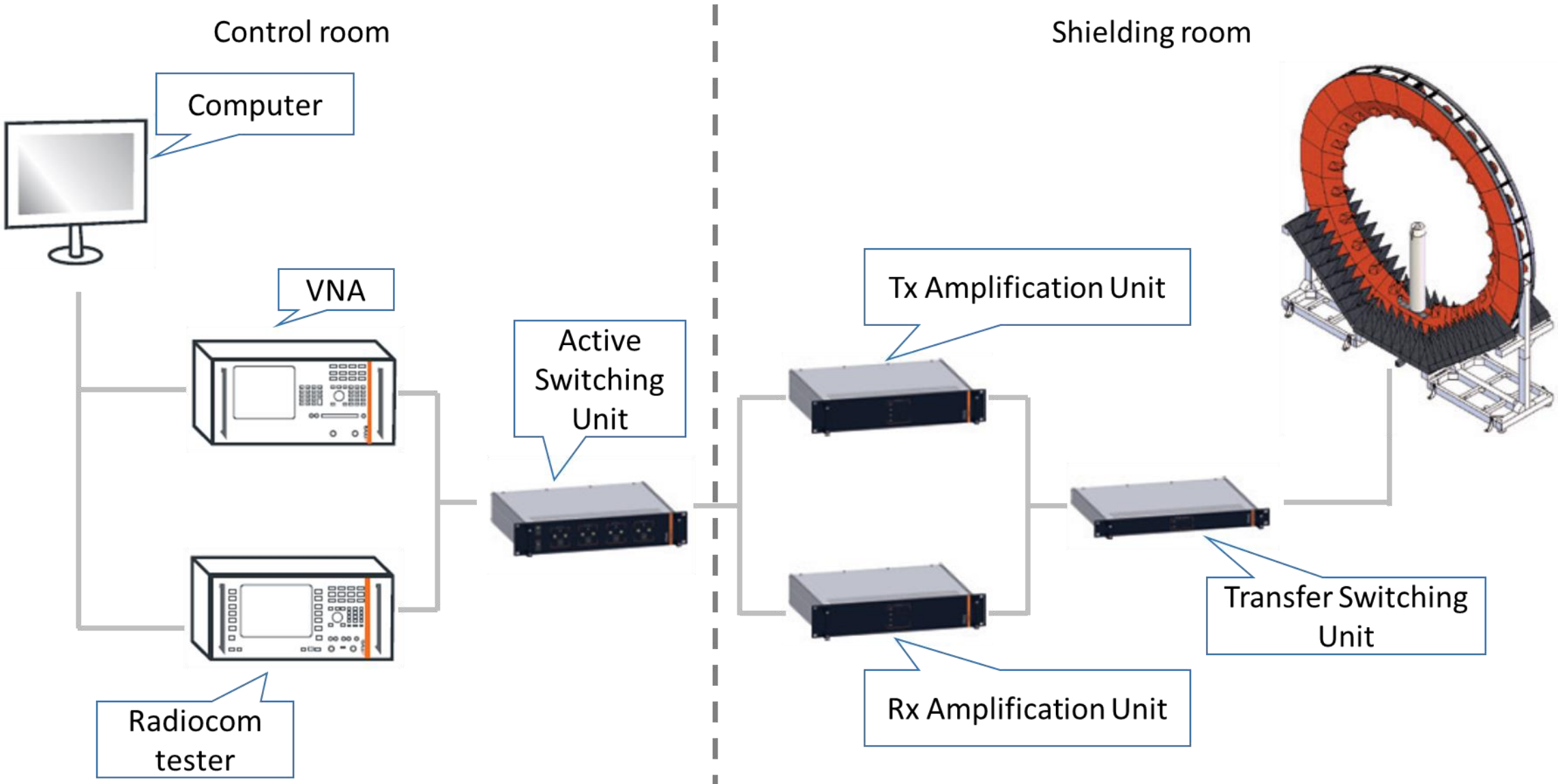
General Information

- **Testing Condition:**
  - Temperature: 22+/- 3
  - Humidity: < 80%
- **Measurement Facility:**
  - Chamber: Satimo 3D fully anechoic chamber(SG_24 Chamber)
  - Keysight E5071C ENA
- **List of Equipment**

Equipment Description	Manufacturer	ID	Current Calibration date	Next calibration date
Keysight E5071C ENA	Agilent	JP1KJ00123	20230410	20231211
SG_24 Chamber	**Satimo**	1531000323	20230403	20230501

System block diagram

Pulse
a YAGEO company



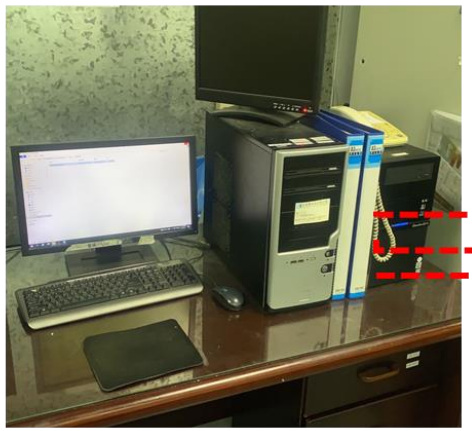
Typical Test setup for Satimo

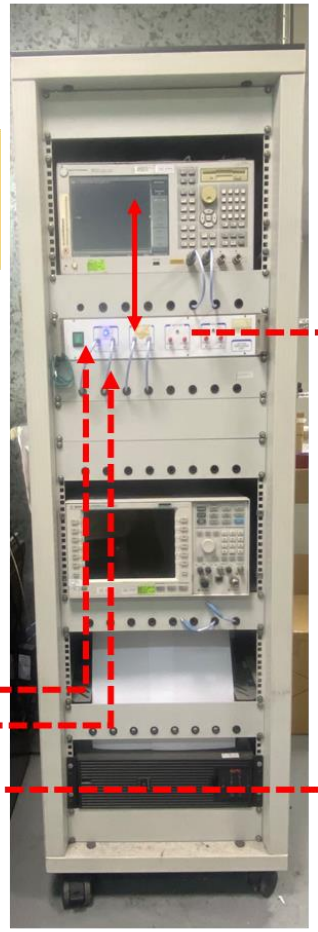
Pulse
a YAGEO company

Control room

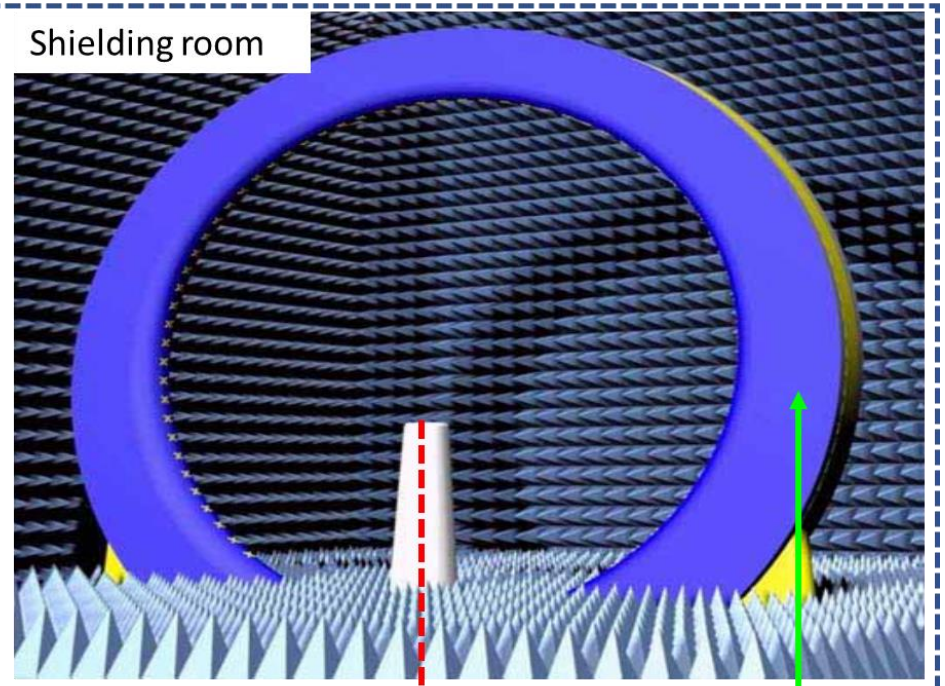
Vecter Network Analyzer Aglient E5071A

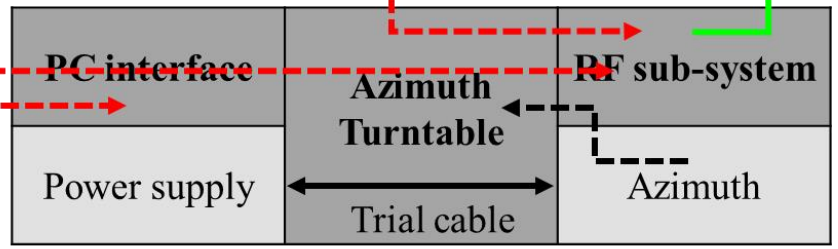
Satimo Active swiching





Shielding room





Measurement capabilities

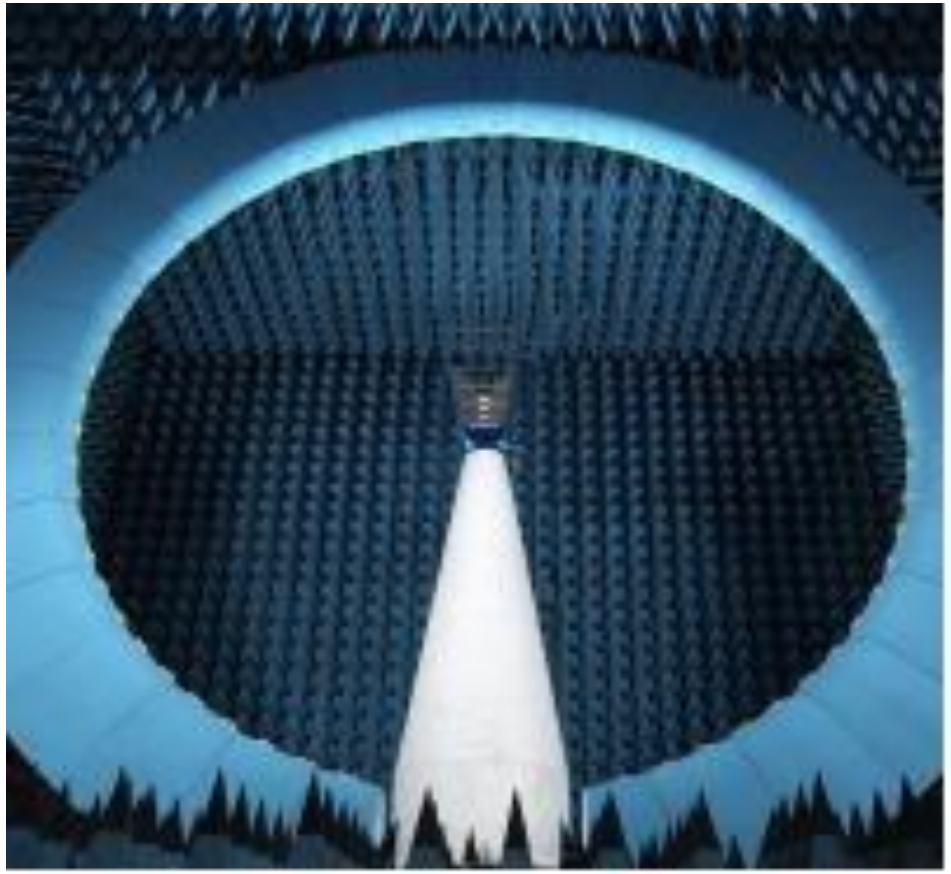
- Gain
- Directivity
- Beamwidth
- 2D/3D radiation pattern
- Antenna efficiency

SG 24 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 VNA as an RF receiver for antenna measurements.

Chamber & Instruments View

Pulse
a YAGEO company

Passive /Active antenna testing



Satimo SG_24 Chamber
Dimension: 6m*6m*7.5m

Thought put testing

Antenna tuning and matching

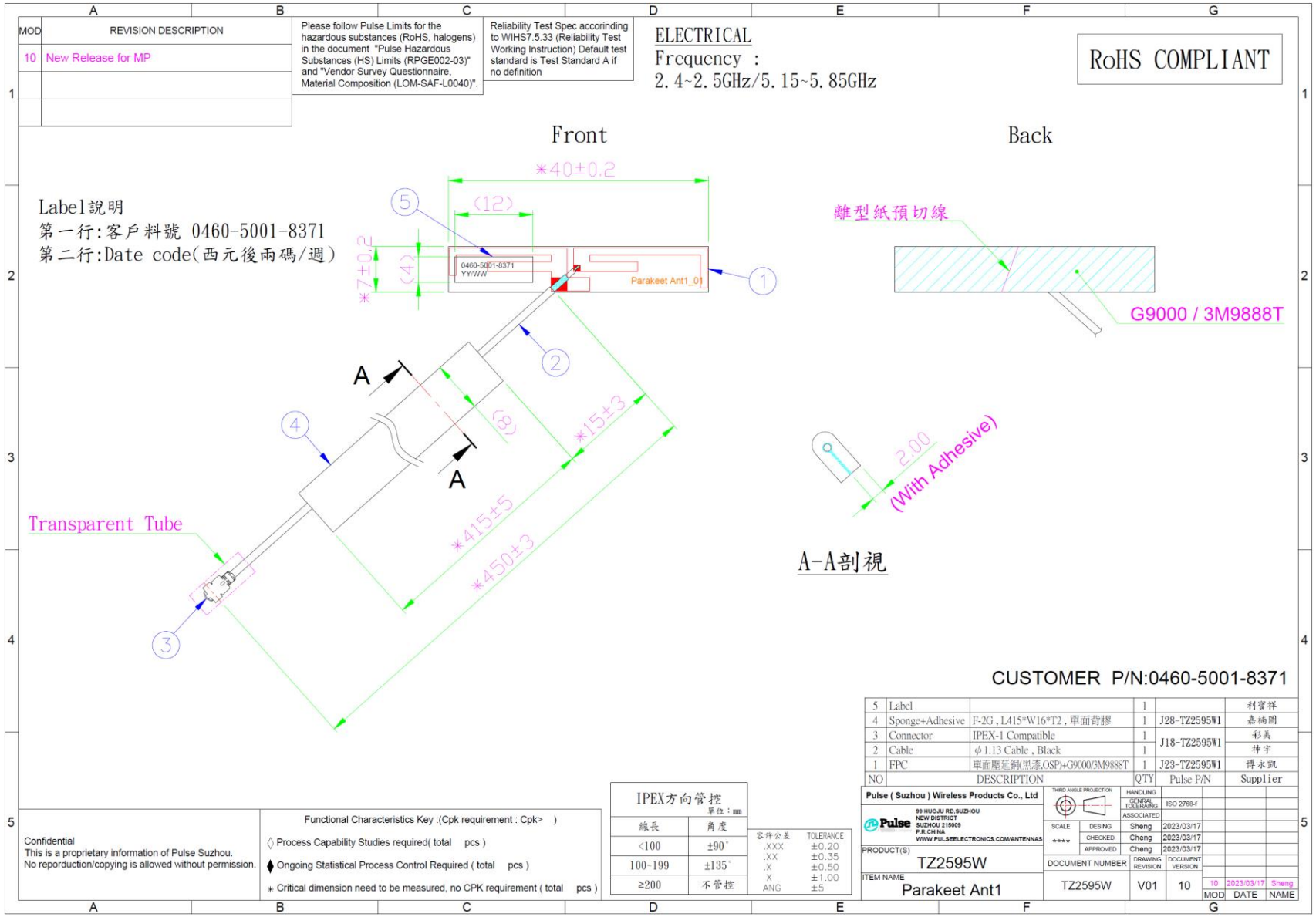
Keysight E5071C ENA 9 kHz 至 8.5 GHz

Test lab information

- Company information:
  - Company name: Pulse
  - Telephone: : (03) 415-9111 Ext:6710
  - FAX: NA
  - Internet: tason.chang@yageo.com
- Testing location:
  - PingZhen Satimo SG24
  - Telephone: (03) 415-9111 Ext:6711
  - FAX: NA
  - Internet: tason.chang@yageo.com

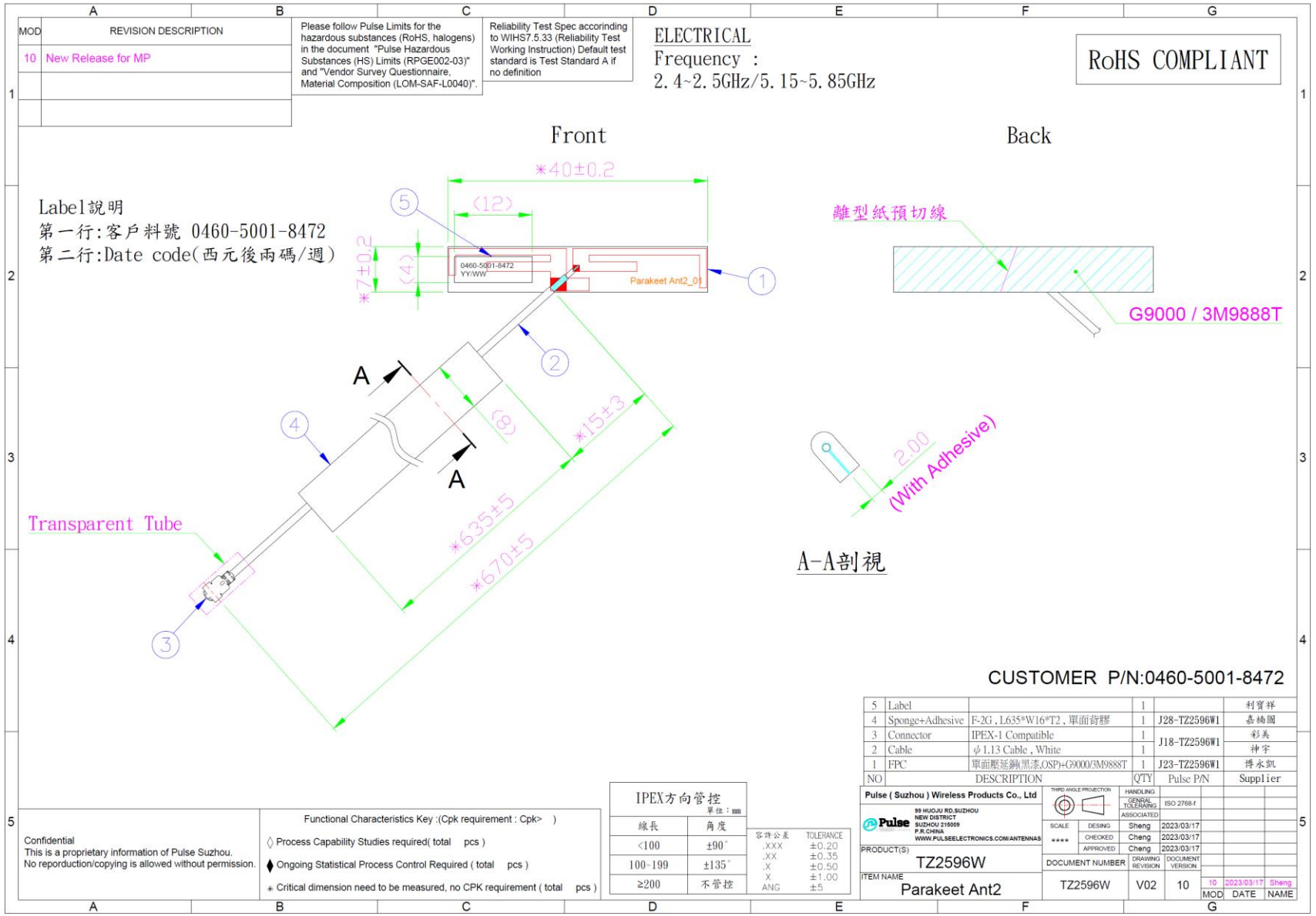
Antennas' Specification

ANT 1



Antenna brand：Pulse
Antenna part number：TZ2595W
Antenna Type: FPCB Dipole

ANT 2

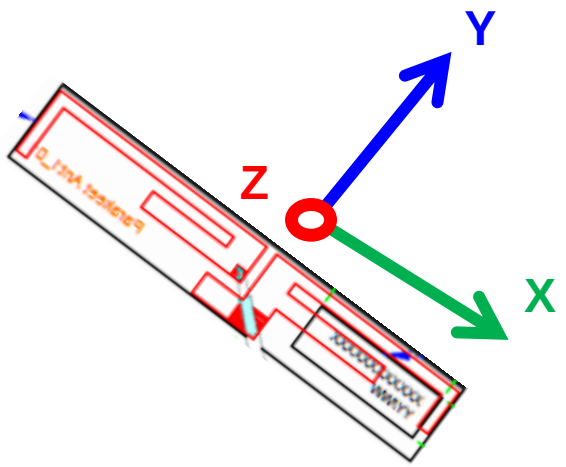


Antenna brand：Pulse
Antenna part number：TZ2596W
Antenna Type: FPCB Dipole

Antenna's location

Top View

Coordinate System



PS: ANT1 center and ANT2 center is not the same. That is , The measurement points are at the center of the respective antennas.

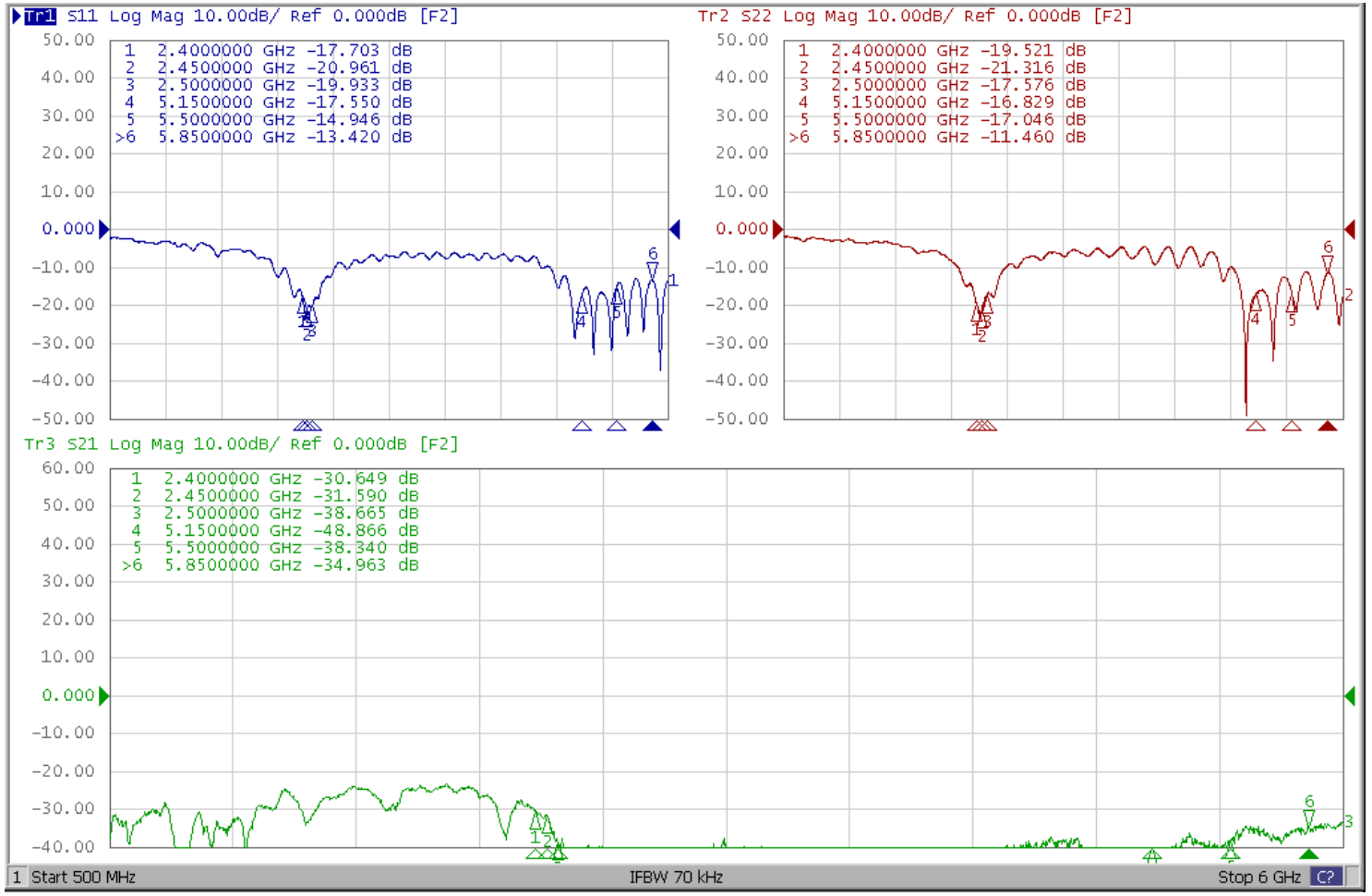
Measurement Results

Return loss & Isolation

Pulse
a YAGEO company

S11 : ANT 1

S22 : ANT 2



S21 : ANT 2 -> ANT 1

3D Peak Gain & Efficiency List Table

ANT 1				ANT 2			
Frequency	Efficiency (%)	Efficiency (dB)	Peak Gain (dBi)	Frequency	Efficiency (%)	Efficiency (dB)	Peak Gain (dBi)
2400MHz	58.91	-2.30	4.09	2400MHz	49.88	-3.02	2.33
2410MHz	59.12	-2.28	4.24	2410MHz	49.73	-3.03	2.53
2420MHz	60.20	-2.20	4.23	2420MHz	50.03	-3.01	2.70
2430MHz	59.94	-2.22	4.29	2430MHz	49.59	-3.05	2.51
2440MHz	61.89	-2.08	4.56	2440MHz	51.50	-2.88	2.77
2450MHz	63.05	-2.00	4.54	2450MHz	52.91	-2.76	3.02
2460MHz	61.89	-2.08	4.49	2460MHz	52.76	-2.78	2.84
2470MHz	61.33	-2.12	4.31	2470MHz	53.91	-2.68	2.96
2480MHz	61.14	-2.14	4.23	2480MHz	54.51	-2.64	2.67
2490MHz	60.41	-2.19	4.36	2490MHz	53.79	-2.69	2.53
2500MHz	60.21	-2.20	4.41	2500MHz	53.33	-2.73	2.66

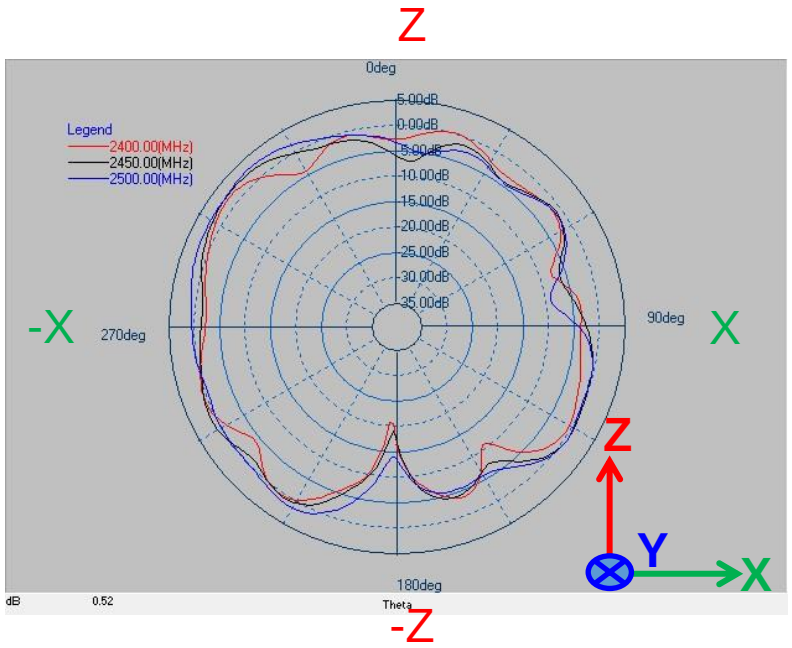
2.4Ghz Band

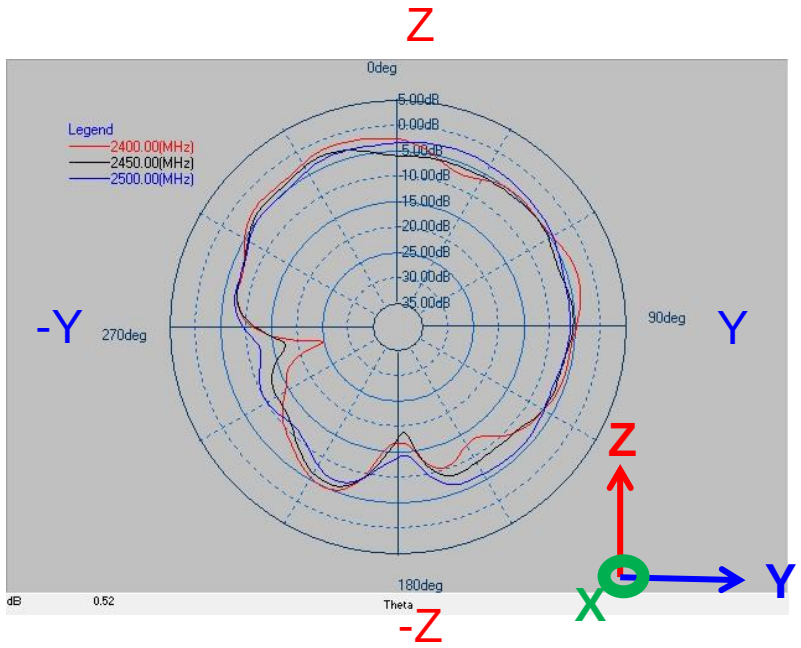
3D Peak Gain & Efficiency List Table

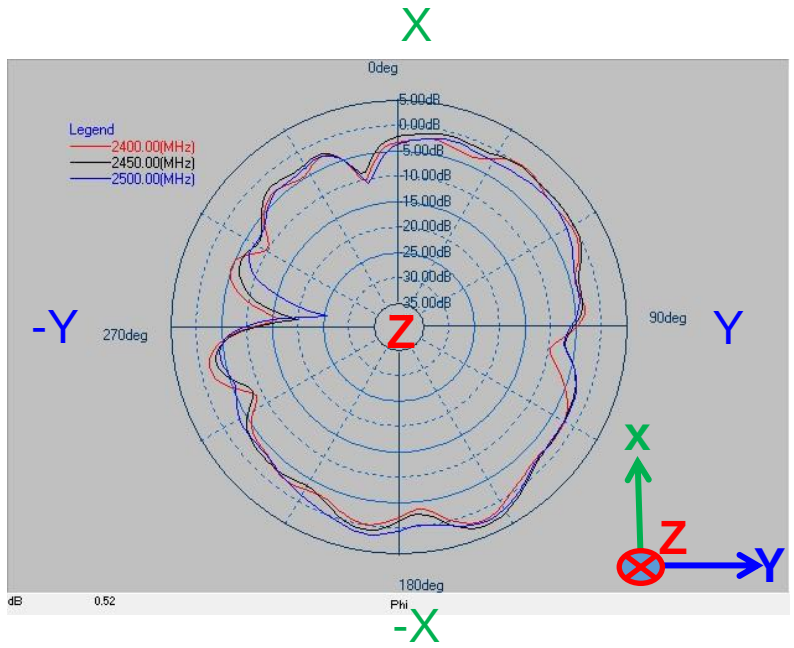
ANT 1				ANT 2			
Frequency	Efficiency (%)	Efficiency (dB)	Peak Gain (dBi)	Frequency	Efficiency (%)	Efficiency (dB)	Peak Gain (dBi)
5150MHz	53.07	-2.75	2.70	5150MHz	40.01	-3.98	3.14
5200MHz	51.51	-2.88	2.94	5200MHz	39.50	-4.03	3.29
5250MHz	52.87	-2.77	2.70	5250MHz	42.63	-3.70	3.89
5300MHz	50.37	-2.98	2.81	5300MHz	40.60	-3.92	3.82
5350MHz	52.91	-2.76	3.15	5350MHz	43.28	-3.64	4.09
5400MHz	47.24	-3.26	2.43	5400MHz	38.35	-4.16	2.81
5450MHz	49.19	-3.08	2.35	5450MHz	35.52	-4.50	2.83
5500MHz	50.39	-2.98	3.50	5500MHz	33.93	-4.69	3.25
5550MHz	44.15	-3.55	3.25	5550MHz	33.33	-4.77	3.43
5600MHz	46.97	-3.28	4.19	5600MHz	33.82	-4.71	3.59
5650MHz	53.97	-2.68	4.49	5650MHz	36.26	-4.41	3.45
5700MHz	50.67	-2.95	4.31	5700MHz	35.07	-4.55	3.69
5750MHz	52.45	-2.80	3.92	5750MHz	37.65	-4.24	4.13
5800MHz	44.77	-3.49	3.49	5800MHz	36.24	-4.41	3.77
5850MHz	51.01	-2.92	2.96	5850MHz	37.98	-4.20	4.12

5Ghz Band

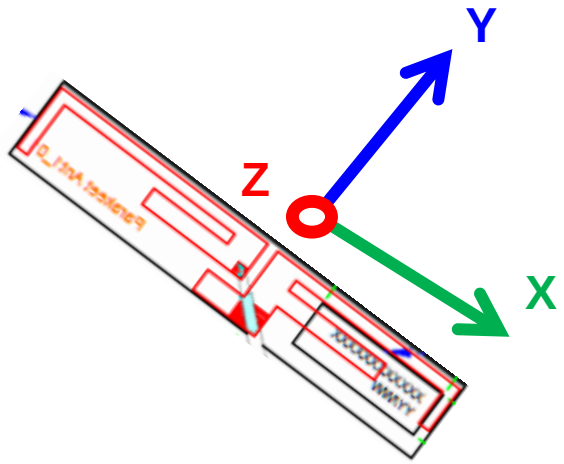
2D Gain Pattern: ANT 1 @2G



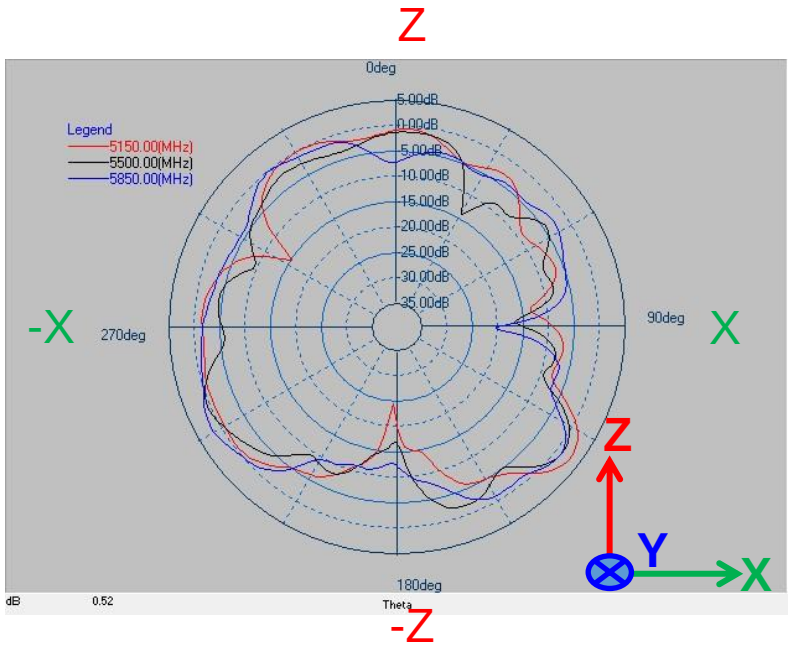


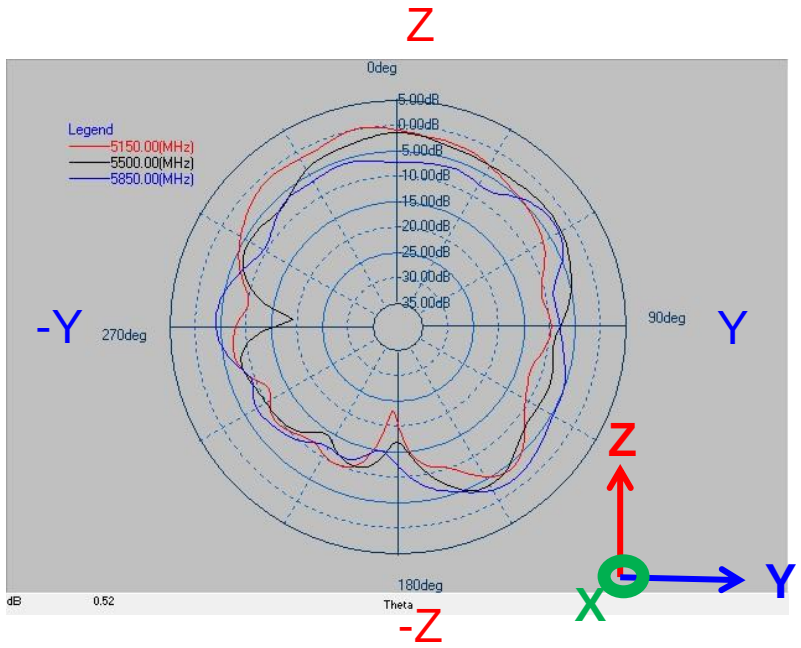


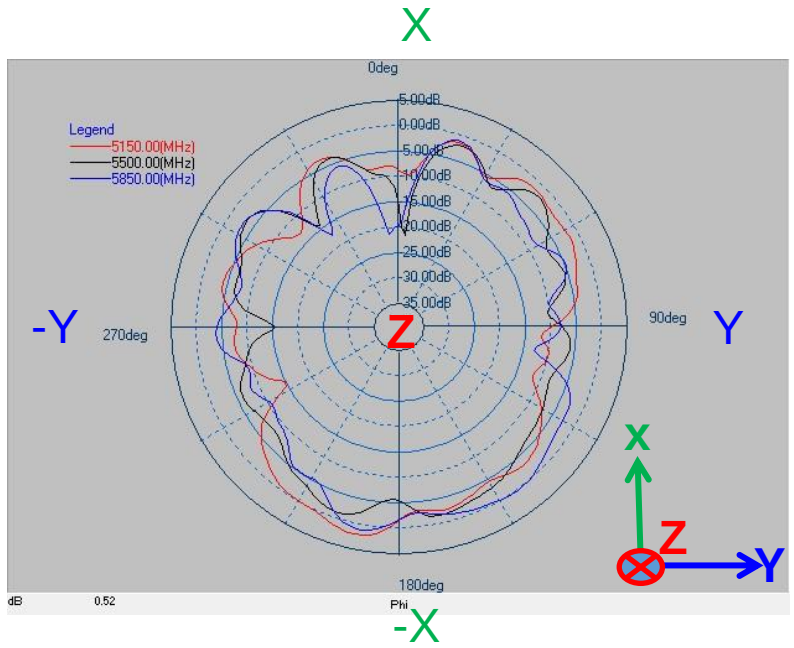
ANT1 (2.4Ghz band)		
Frequency(Mhz)	Efficiency(%)	Peak Gain
2400	58.91	4.09
2450	63.05	4.54
2500	60.21	4.41



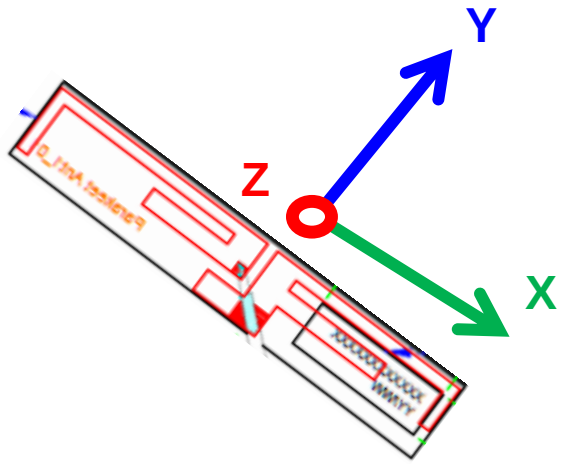
2D Gain Pattern: ANT 1 @5G



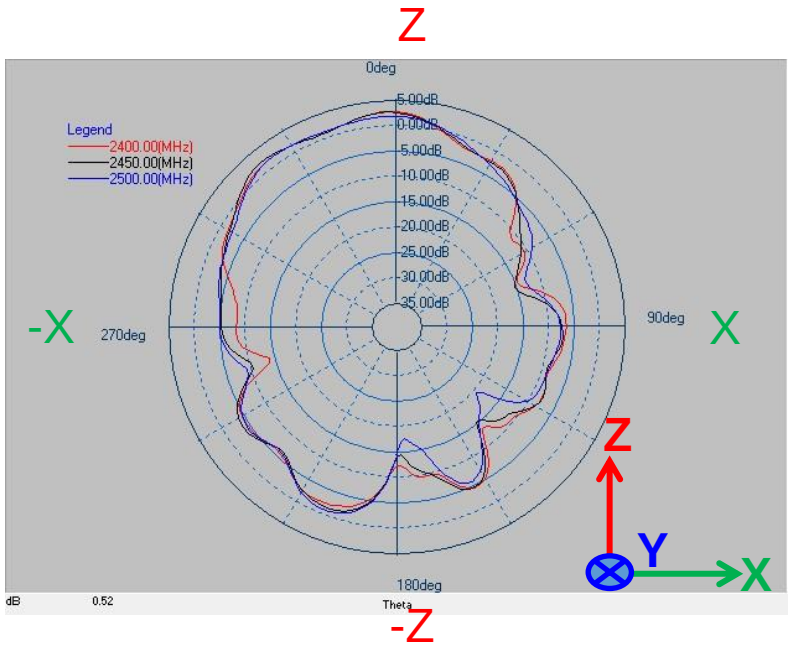


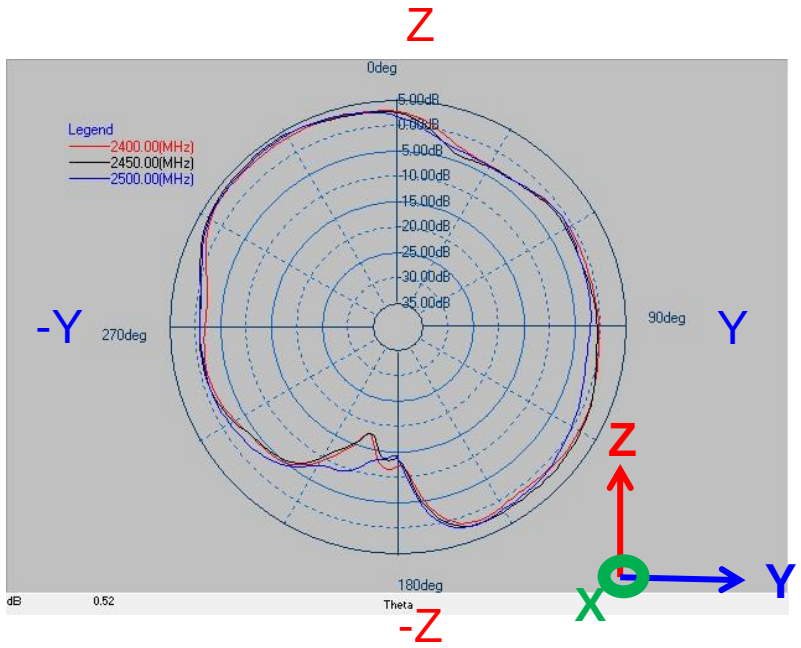


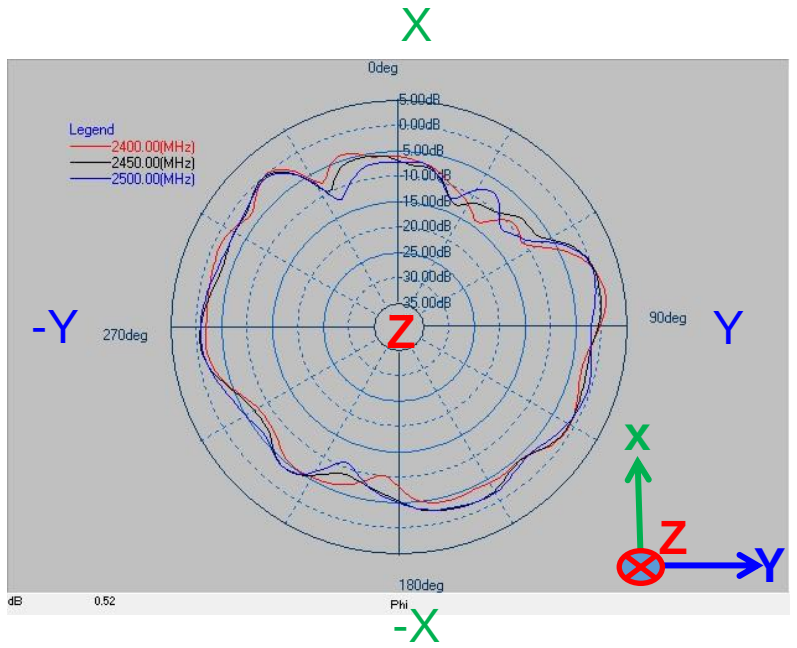
ANT1 (5Ghz band)		
Frequency(Mhz)	Efficiency(%)	Peak Gain
5150	53.07	2.70
5500	50.39	3.50
5850	51.01	2.96



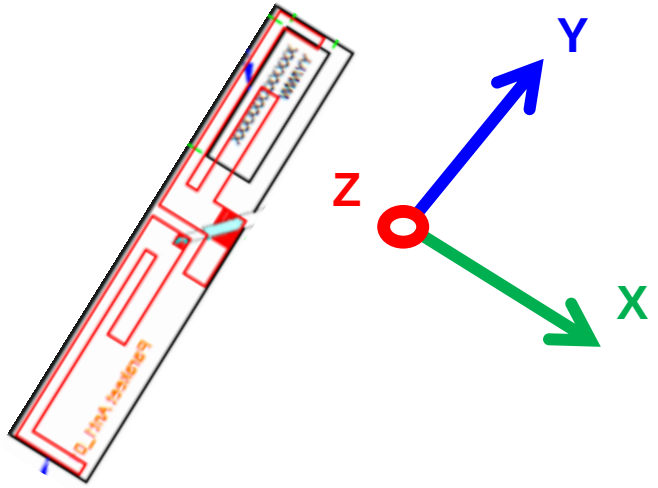
2D Gain Pattern: ANT 2 @2G



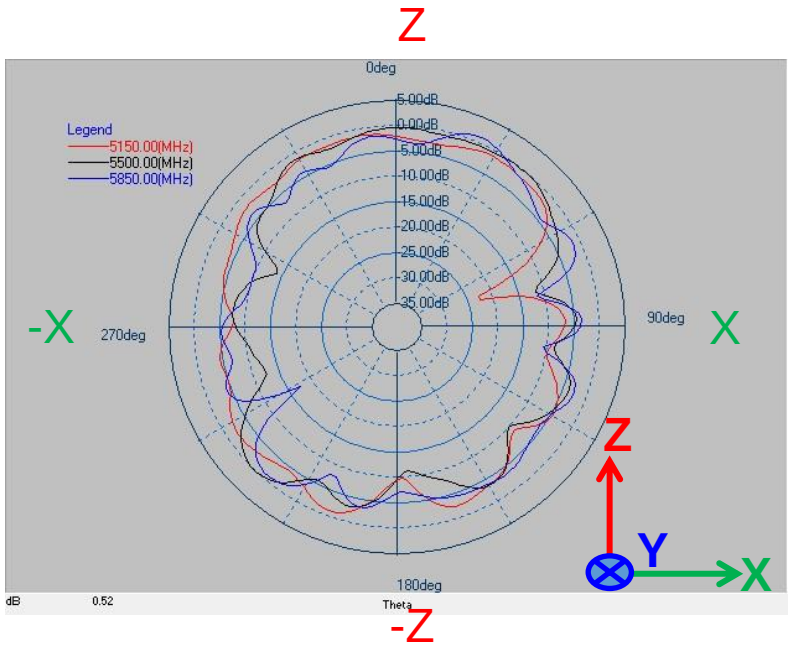


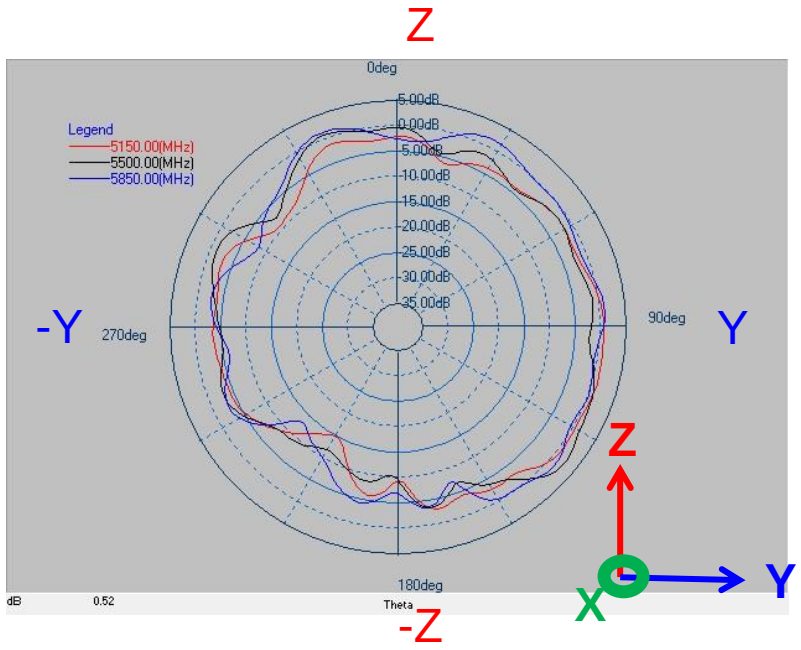


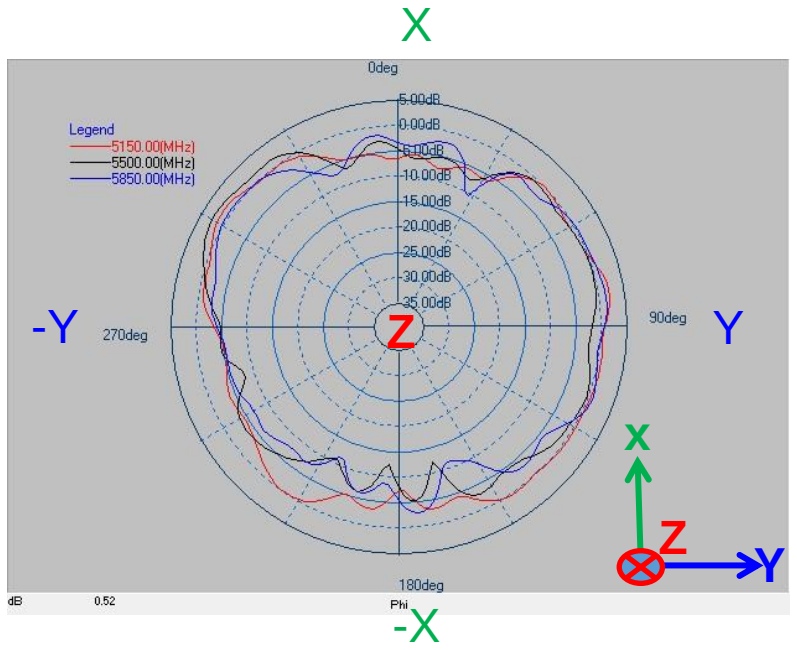
ANT2 (2.4Ghz band)		
Frequency(Mhz)	Efficiency(%)	Peak Gain
2400	49.88	2.33
2450	52.91	3.02
2500	53.33	2.66



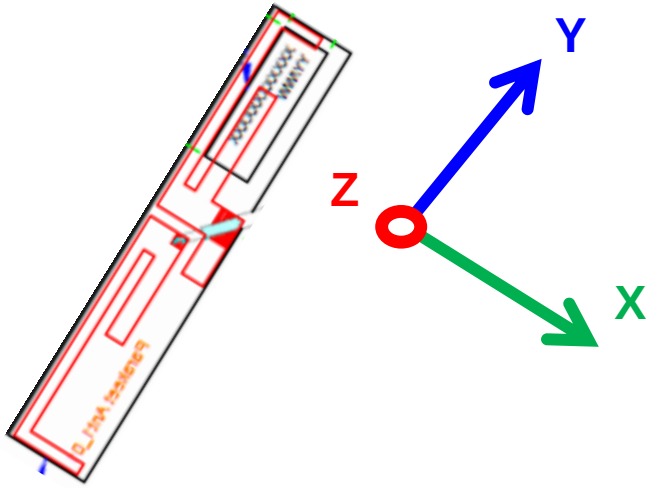
2D Gain Pattern: ANT 2 @5G





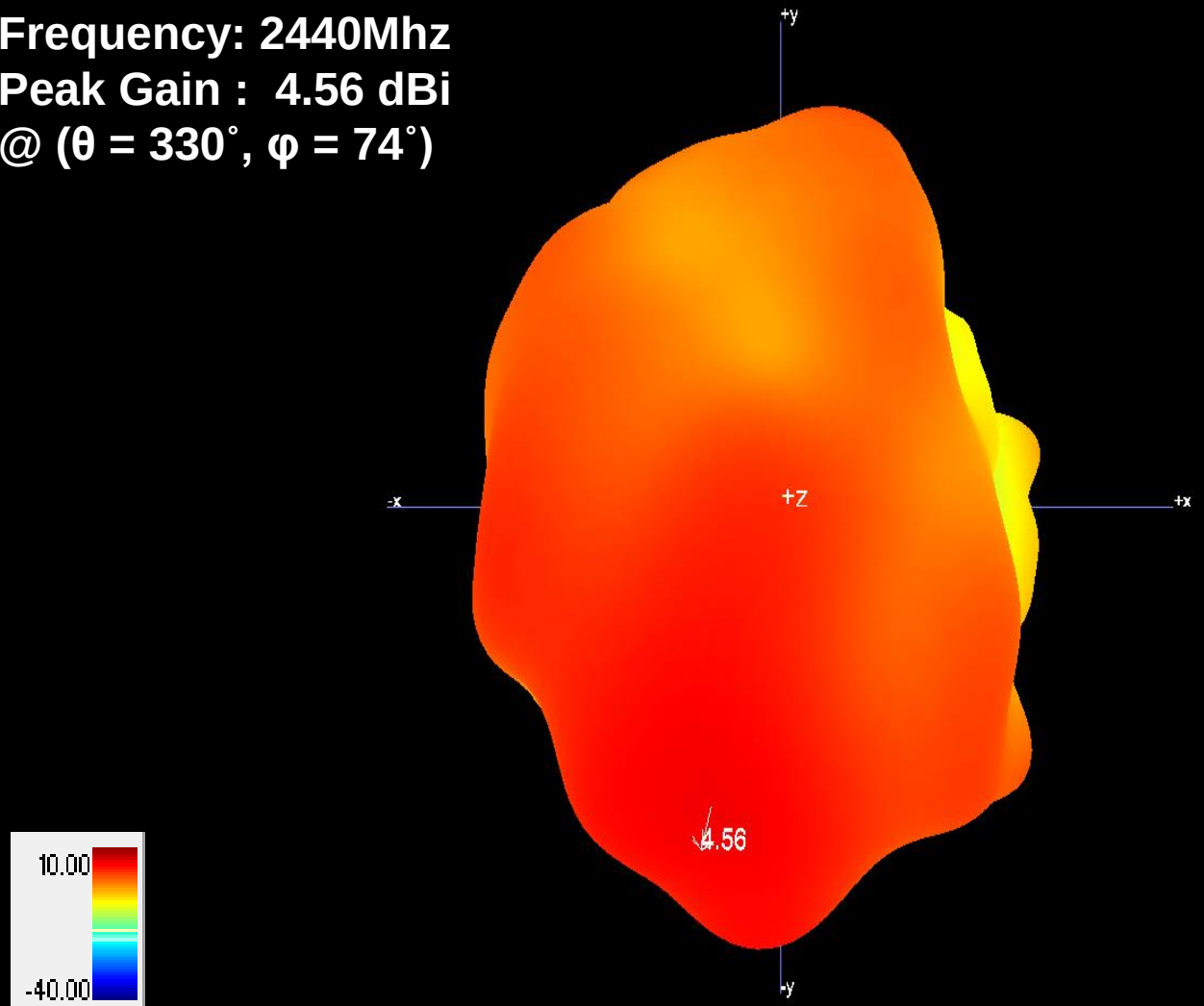


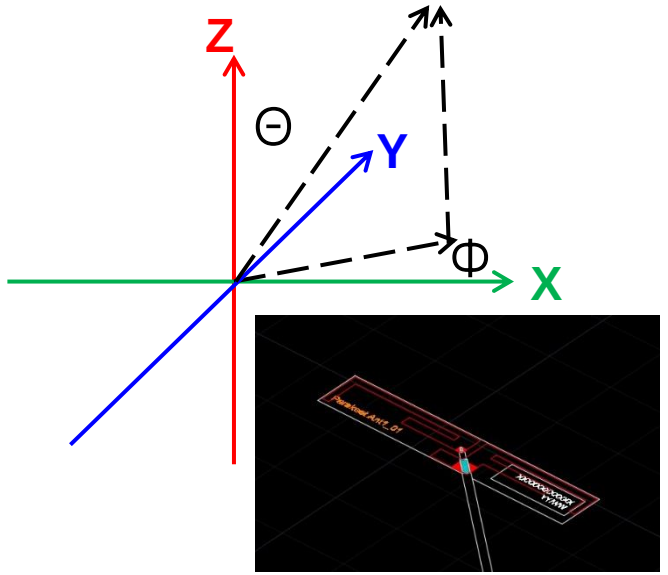
ANT2 (5Ghz band)		
Frequency(Mhz)	Efficiency(%)	Peak Gain
5150	40.01	3.14
5500	33.93	3.25
5850	37.98	4.12



3D Gain Pattern _@ANT 1_2440MHz

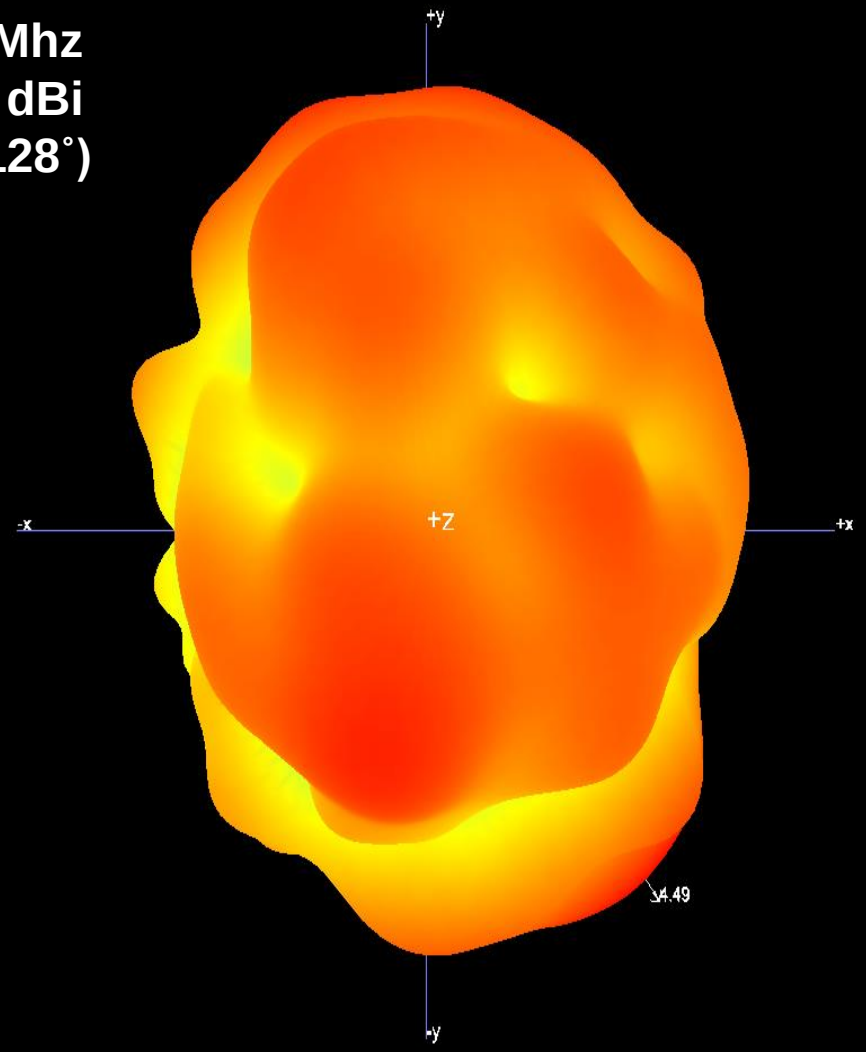
Frequency: 2440Mhz
Peak Gain : 4.56 dBi
@ (θ = 330˚, φ = 74˚)

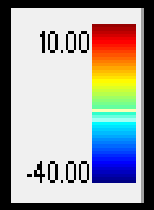


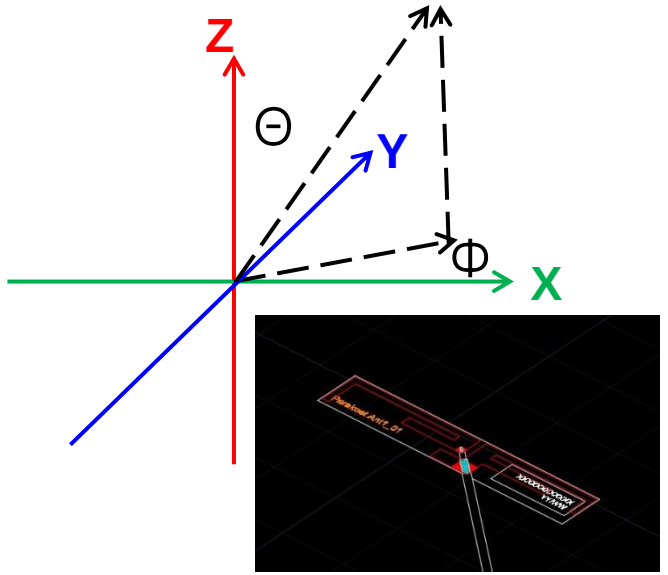


3D Gain Pattern _@ANT 1_5650MHz

Frequency: 5650Mhz
Peak Gain : 4.49 dBi
@ (θ = 260˚, φ = 128˚)

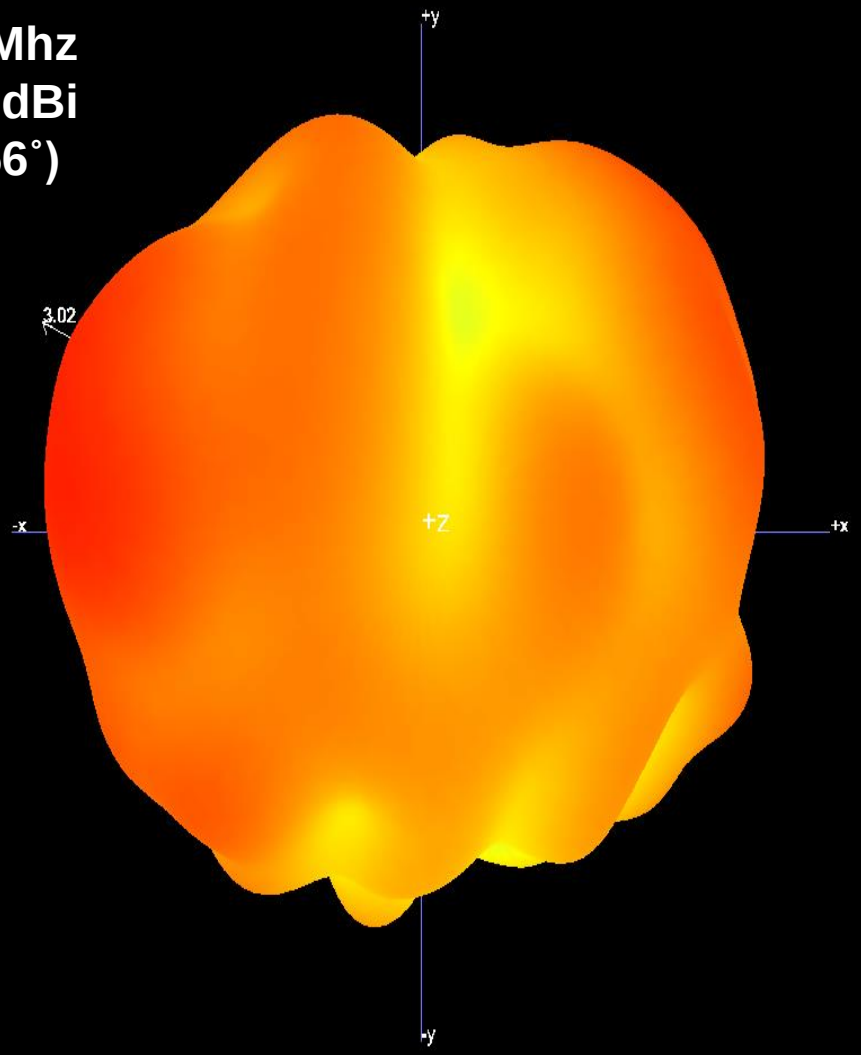


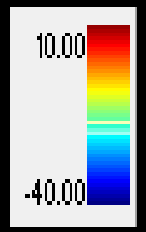


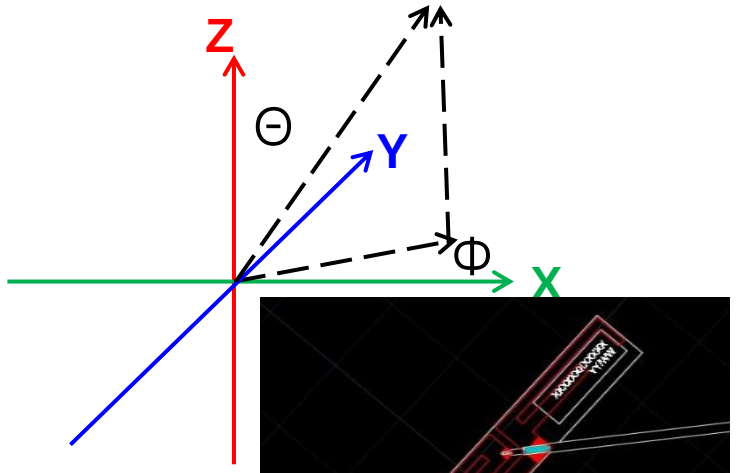


3D Gain Pattern _@ANT 2_2450MHz

Frequency: 2450Mhz
Peak Gain : 3.02 dBi
@ (θ = 88˚, φ = 156˚)

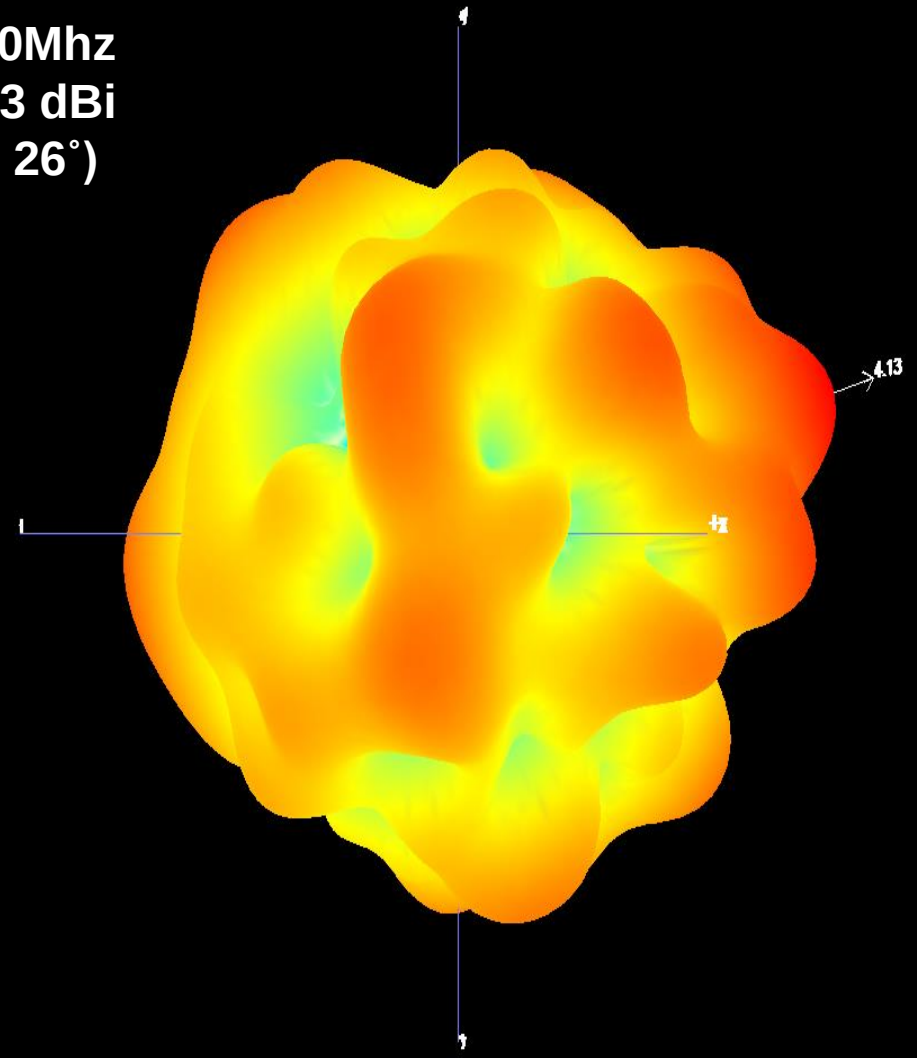


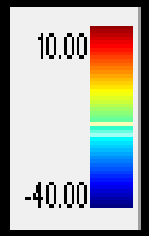


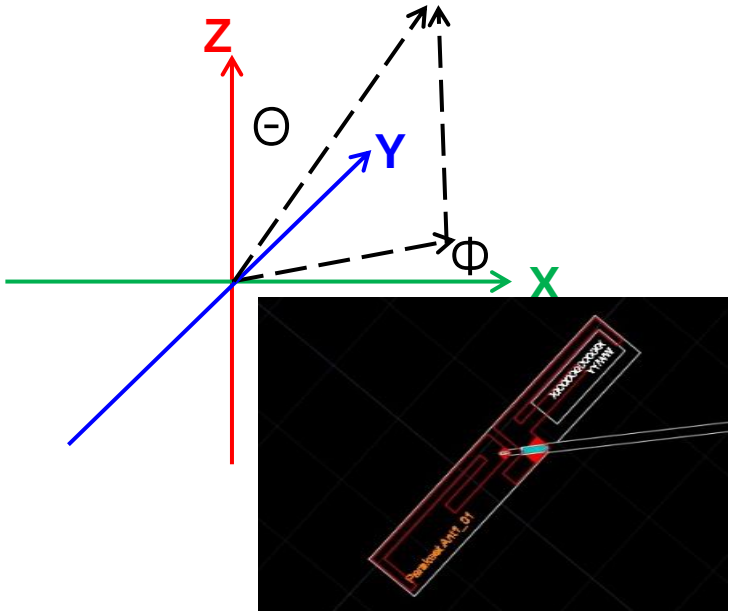


3D Gain Pattern _@ANT 2_5750MHz

Frequency: 5750Mhz
Peak Gain : 4.13 dBi
@ (θ = 140˚, φ = 26˚)







Summary

- For Ant.1, the efficiency was upon 58% at 2G operating band and 44% at 5G operating band. The maximum peak gain was 4.56dBi at 2440MHz and 4.49dBi at 5650MHz.

- For Ant.2, the efficiency was upon 49% at 2G operating band and 33% at 5G operating band. The maximum peak gain was 3.02dBi at 2450MHz and 4.13dBi at 5750MHz.

ANT1				ANT2			
Band	Frequency (Mhz)	Peak Gain (dBi)	Efficiency (%)	Band	Frequency (Mhz)	Peak Gain (dBi)	Efficiency (%)
2.4Ghz	2440	**4.56**	61.89	2.4Ghz	2450	**3.02**	52.91
5Ghz	5650	**4.49**	53.97	5Ghz	5750	**4.13**	37.65

- All the test results could be reference for Pulse's Satimo chamber in PingZhen.

End of Report

Pulse
a YAGEO company

Paul Chiu

20230412

X04