



WHA YU INDUSTRIAL CO., LTD.(HEAD OFFICE)



DONGGUAN AEON TECH CO.,LTD.(CHINA)

SPECIFICATION FOR APPROVAL

CUSTOMER: 慧源創新

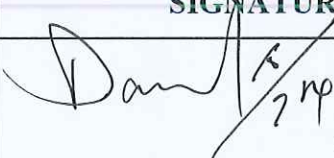
PART NAME: RF Antenna Assembly

PART NO.: 01.08.01.096

REVISION:

W. Y. P/NO.: C4278-620004-A(SSR-2400051)

REV.: X1

	MANUFACTURER SIGNATURE	CUSTOMER SIGNATURE
APPROVED BY :	 2/14	
DATE :	 12/94	

WHA YU GROUP

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RF Antenna Assembly

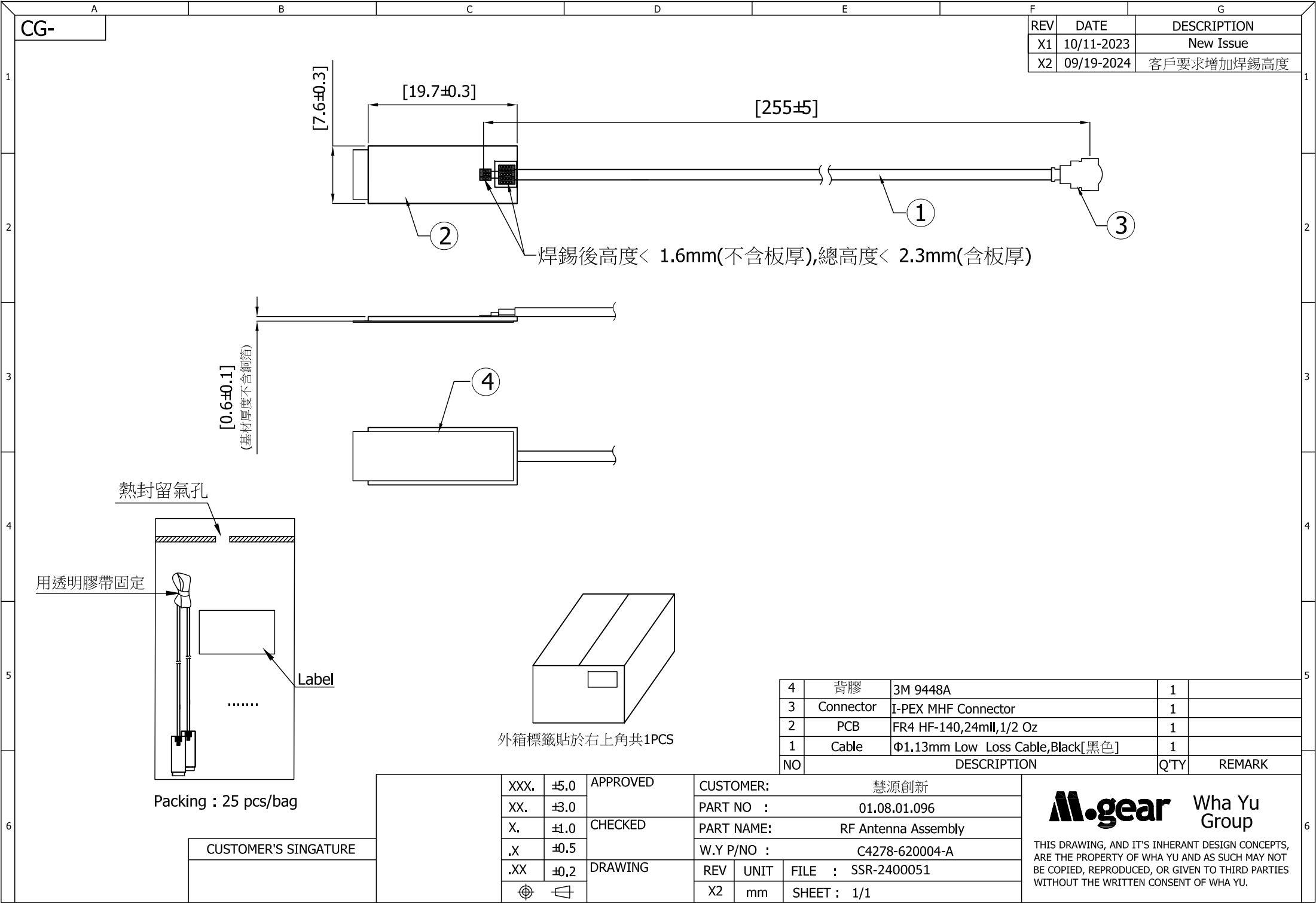
Specification

1. Electrical Properties :

- 1.1 Frequency Range..... 5.15~5.85GHz
- 1.2 Impedance 50Ω Nominal
- 1.3 VSWR 2.0:1 Max.
- 1.4 Return Loss..... 9.54 dB Min.
- 1.5 Peak Gain 1.9 dBi Min.
- 1.6 Radiation Omni-directional
- 1.7 Polarization..... Linear
- 1.8 Cable..... 1.13mm Low Loss Cable
- 1.9 Connector..... I-PEX MHF Connector

2. Physical Properties :

- 2.1 Operating Temp. -10°C ~ +60°C
- 2.2 Storage Temp. -10°C ~ +70°C



REV	DATE	DESCRIPTION
X1	10/11-2023	New Issue
X2	09/19-2024	客戶要求增加焊錫高度

4	背膠	3M 9448A	1	
3	Connector	I-PEX MHF Connector	1	
2	PCB	FR4 HF-140,24mil,1/2 Oz	1	
1	Cable	Φ1.13mm Low Loss Cable,Black[黑色]	1	
NO	DESCRIPTION		Q'TY	REMARK

Packing : 25 pcs/bag

CUSTOMER'S SINGATURE

XXX.	±5.0	APPROVED
XX.	±3.0	
X.	±1.0	
.X	±0.5	CHECKED
.XX	±0.2	
⊕	⊖	DRAWING

CUSTOMER: 慧源創新		
PART NO : 01.08.01.096		
PART NAME: RF Antenna Assembly		
W.Y P/NO : C4278-620004-A		
REV	UNIT	FILE : SSR-2400051
X2	mm	SHEET : 1/1

M.gear Wha Yu Group

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We connect the wireless world.

TNP-23016 Antenna Test Report

(Model: SM_W4)

Version: 1.0

Released Date: 2023/05/16

Prepared by: James

Reviewed by: Daniel

Outline

- Revised History
- Specification
- Antenna Placement & Solution
- Test Setup for S-parameters Measurement
- VSWR Test
- Isolation Test
- Test Setup for OTA Measurement
- 2D Radiation Patterns
- 3D Radiation Patterns
- Results Summary
- Conclusion & Comments

Revised History



Released Date	Version	Revised Records
2023/05/16	1.0	5.8GHz antenna evaluation for SM_W4 and remote controller.

Specification



Requirements of Antenna Design

RF Function	Number of ANT	Frequency Band	Remark
5G	2	5150-5850MHz	5G-1, 5G-2 for drone
5G	2	5150-5850MHz	5G-3, 5G-4 for remote controller

Requirements of Measurement

Test Item		Specification	Remark
V.S.W.R	5G	2.0:1 Max @5150-5850MHz	
Isolation		<-19dB	
Peak Gain	5G	≥1.9dBi @5150-5850MHz	
Efficiency	5G	≥50% @5150-5850MHz	
Radiation Pattern		Scale: +5 - -45 dBi, Angle step size: 5 degree	

Antenna Placement & Solution



Antenna	Antenna Type	Cable Length	Cable Type
5G-1	Metal dipole	300mm (for OTA Test)	1.13mm (Black)
5G-2	Metal dipole	300mm (for OTA Test)	1.13mm (Black)
5G-3	PCB dipole	255mm (for OTA Test)	1.13mm (Black)
5G-4	PCB dipole	255mm (for OTA Test)	1.13mm (Black)

Test Setup for Return Loss Test



Equipment	Brand	Model	S/N
Network Analyzer	Keysight	E5071C	XXXXXXXX



Antenna

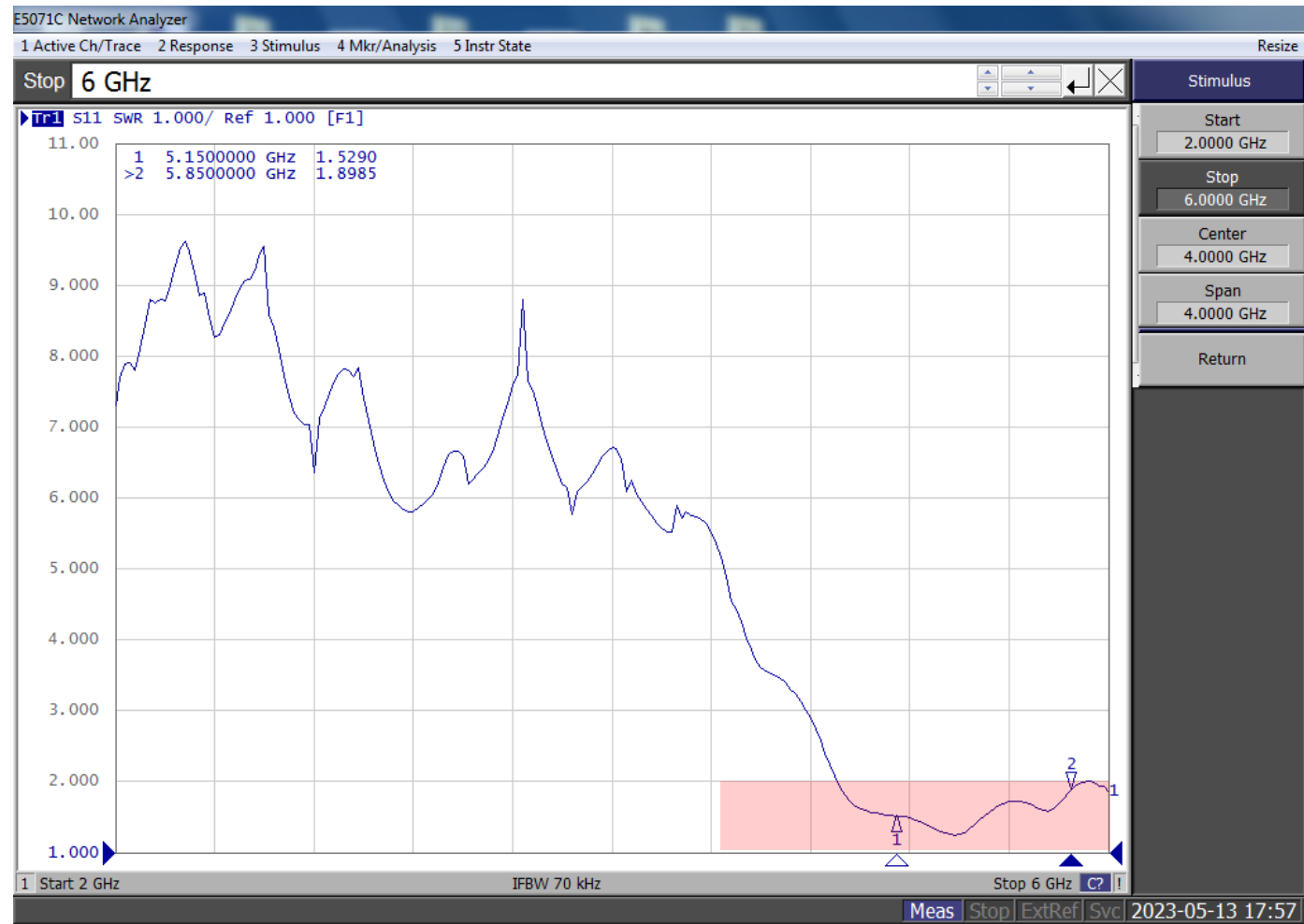
RF Cable +
KS-MHF-1.13-N-01 Conn.

Network Analyzer

V.S.W.R Test

V.S.W.R Test

5G-1 (5150-5850MHz)



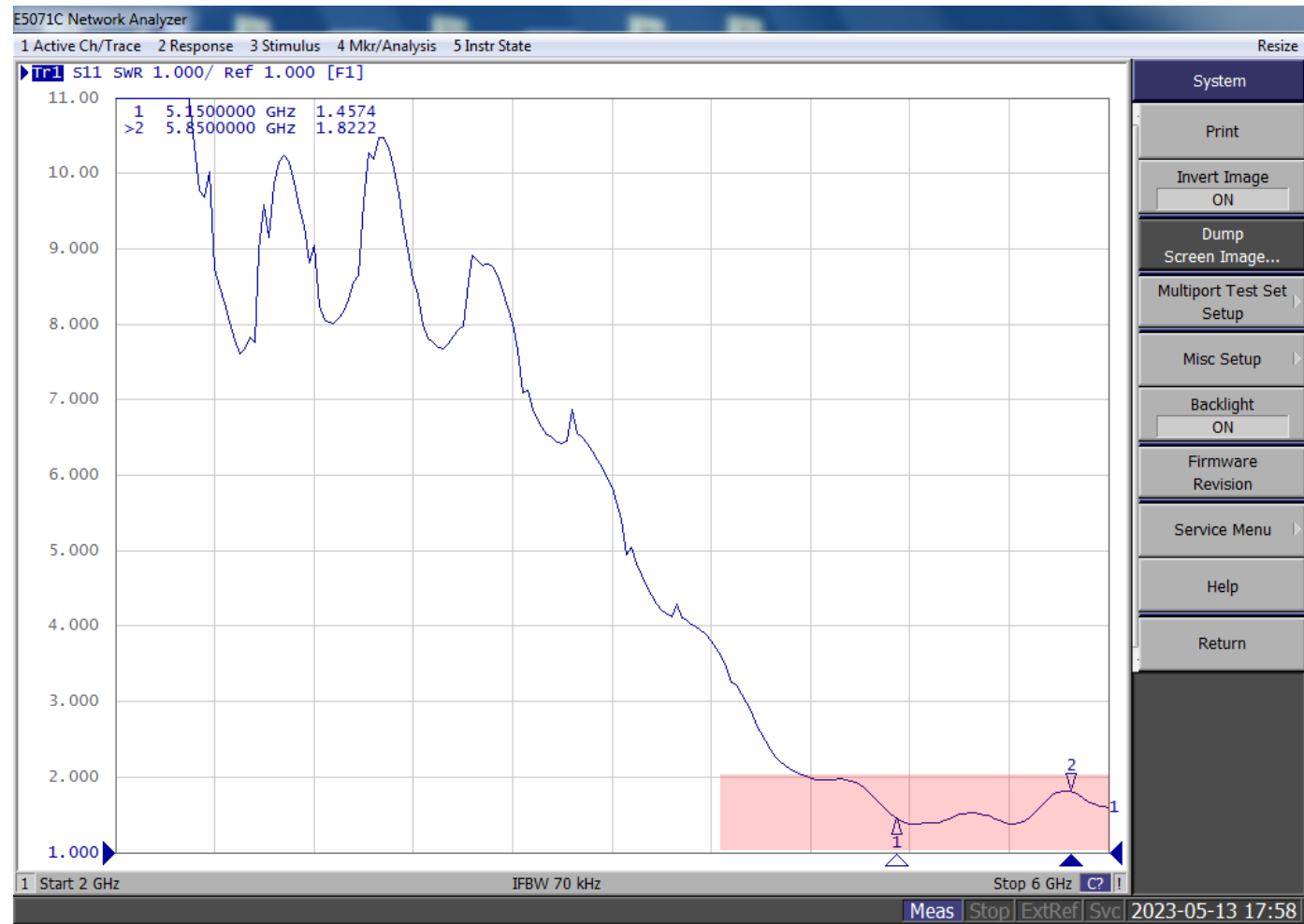
V.S.W.R Test

5G-2 (5150-5850MHz)



V.S.W.R Test

5G-3 (5150-5850MHz)



V.S.W.R Test

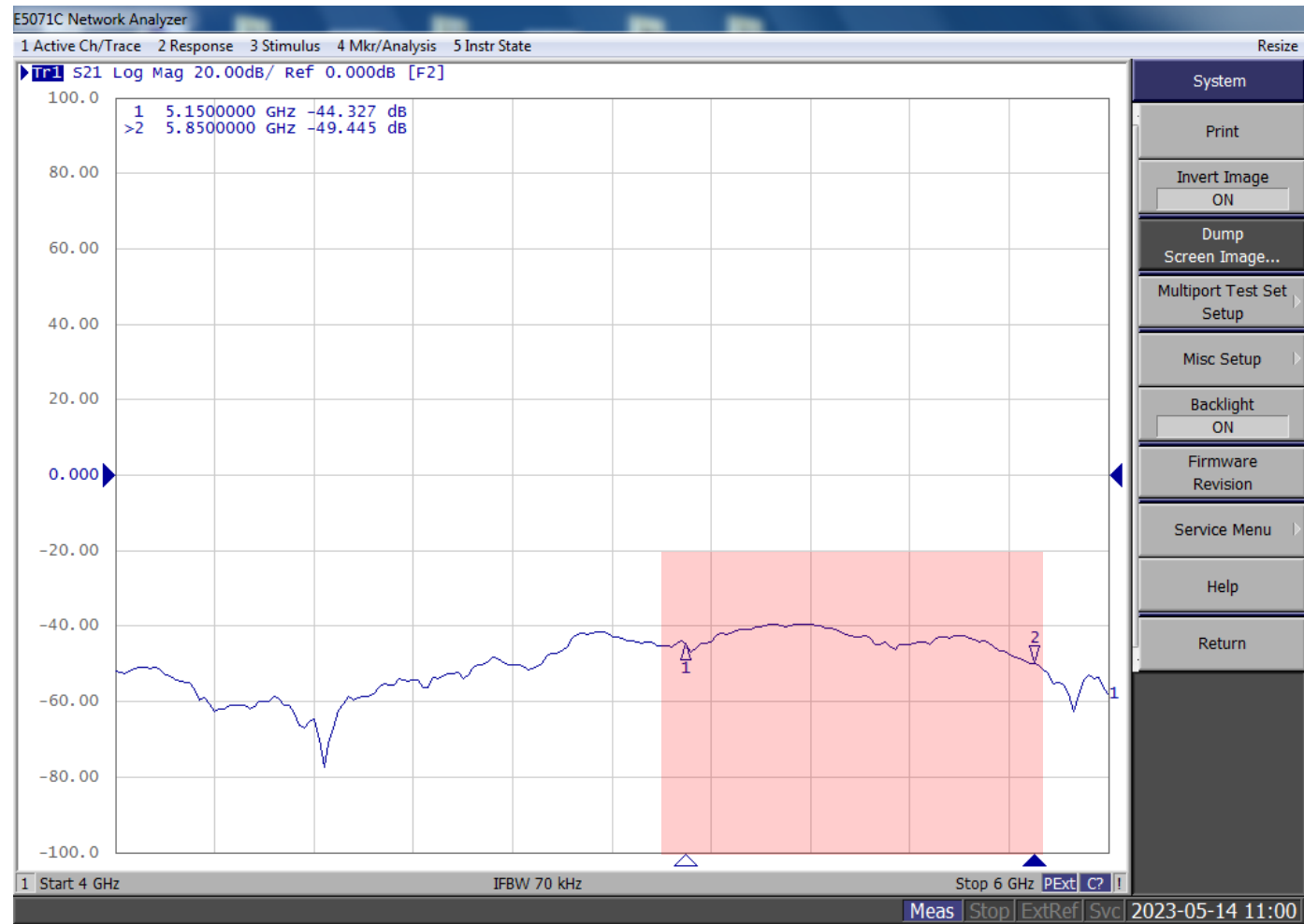
5G-4 (5150-5850MHz)



Isolation Test

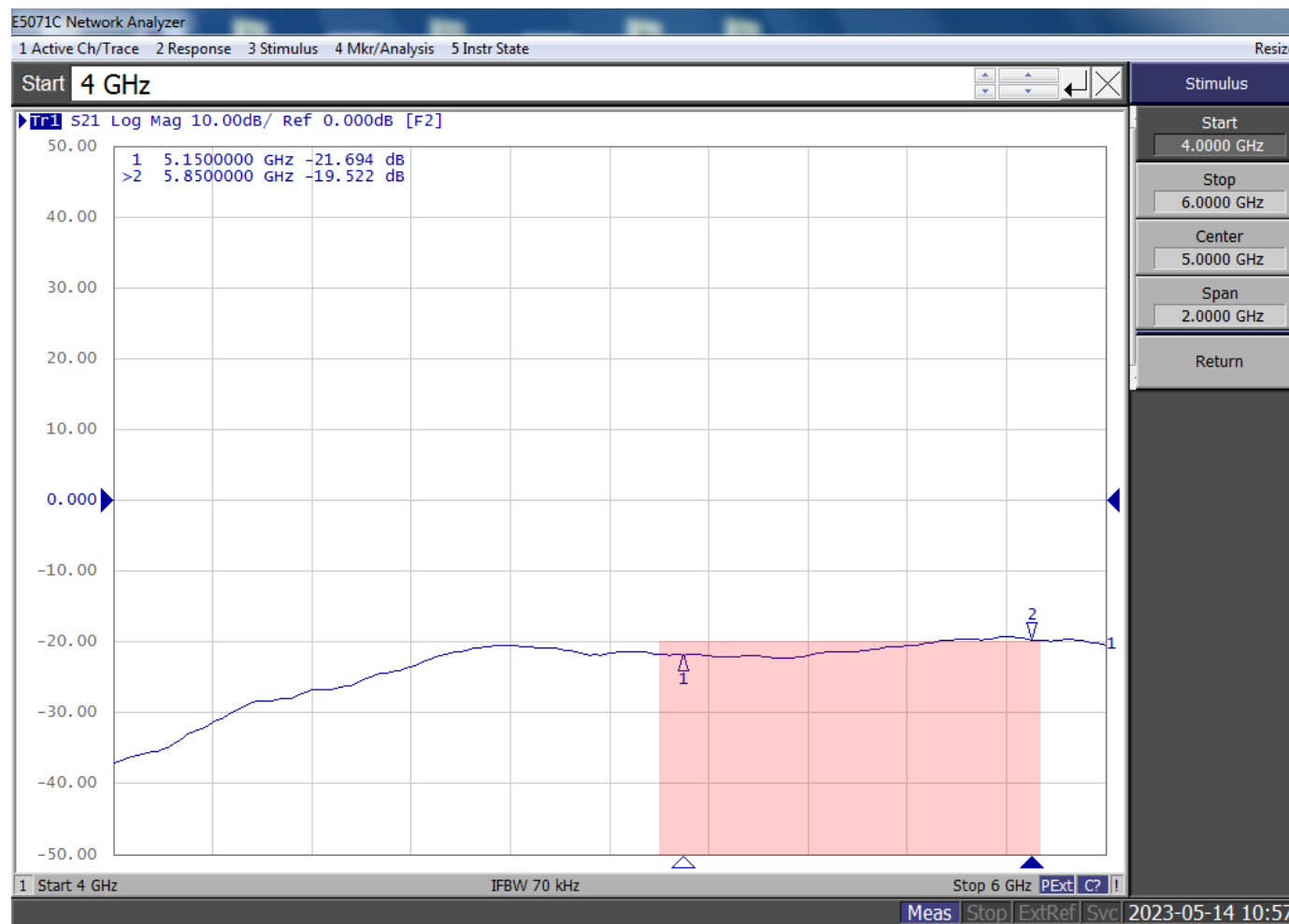
Isolation Test

5G-1 & 5G-2



Isolation Test

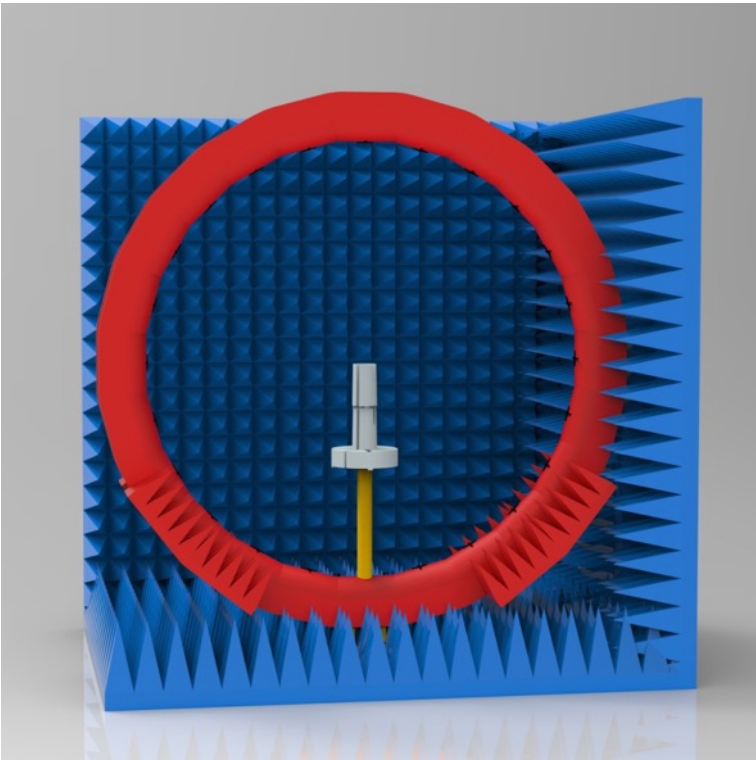
5G-3 & 5G-4



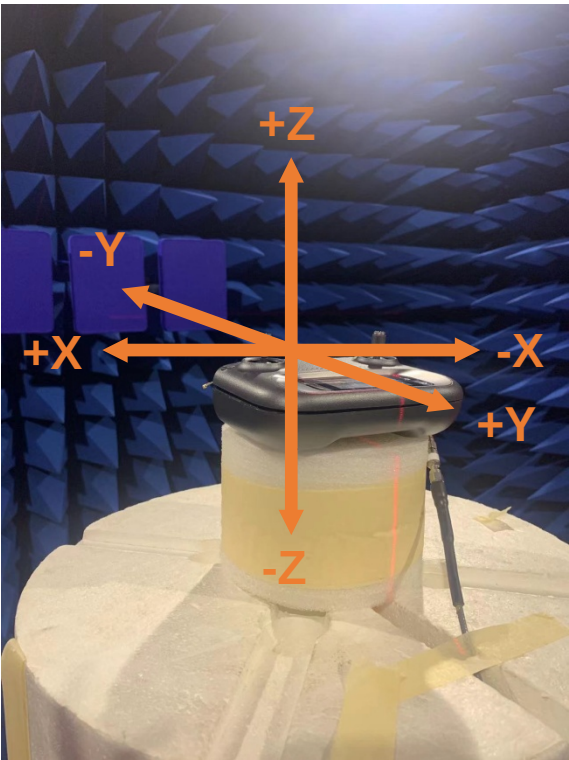
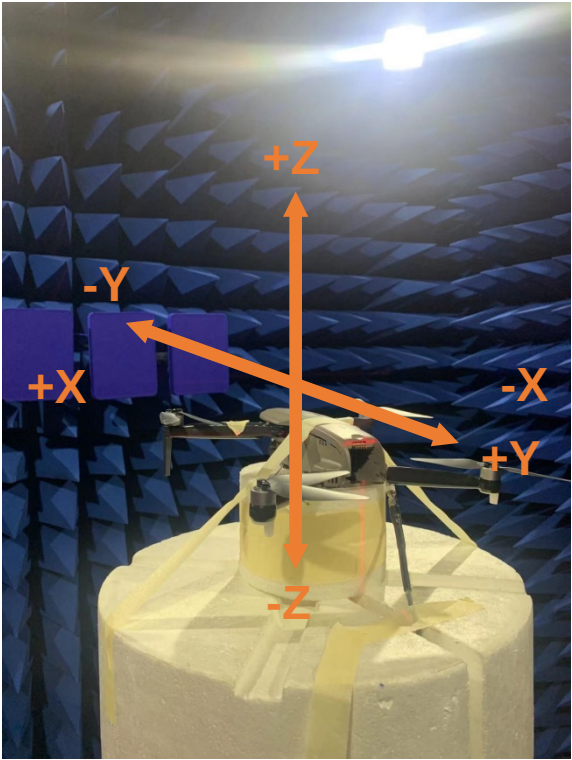
Test Setup for OTA Measurement



Chamber Information



Test Setup for DUT

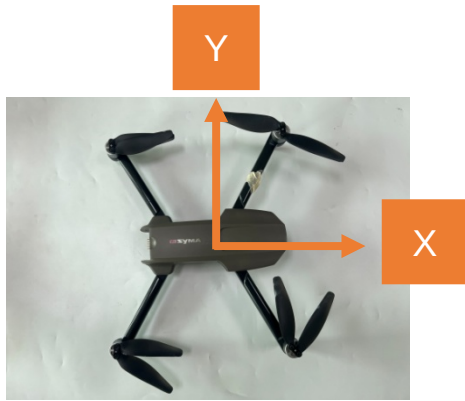


Chamber	Brand	Model	Dimension	Freq. Range	Max DUT Size	Function	Location
Multi-probe	Fei-Tu	FT-OTA24	4*4*4M	0.4-8.5GHz	0.6-1.2M (base on different freq. band)	• Antenna Gain and Efficiency • TRP & TIS test for 2G/3G/4G LTE/NB-IOT • WLAN 802.11 a/b/g/n/ac, WiFi 6 • WiFi / WiFi 6 Throughput	China, Dongguan

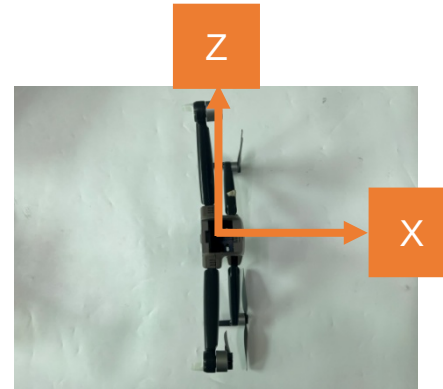
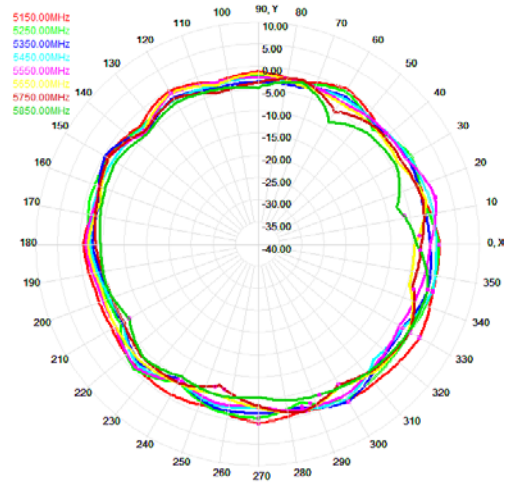
Radiation Patterns

2D Radiation Patterns

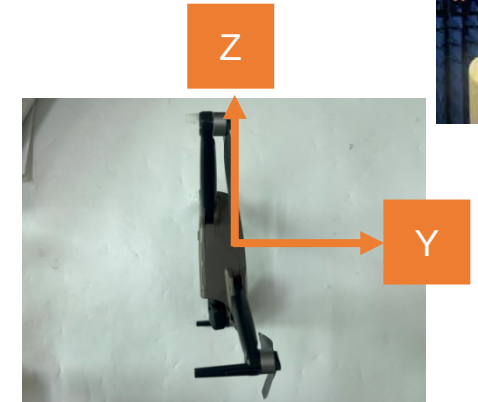
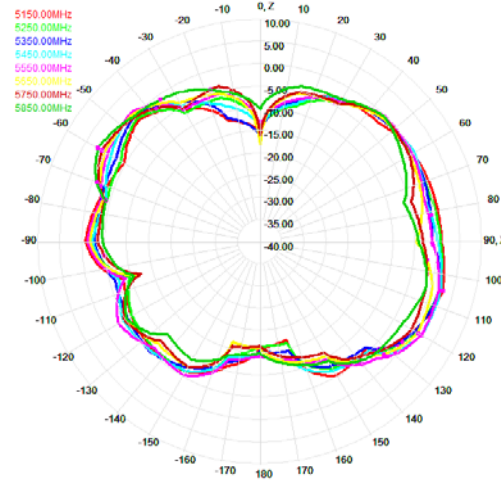
5G-1



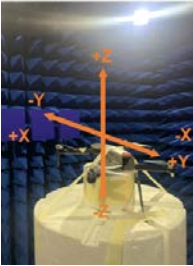
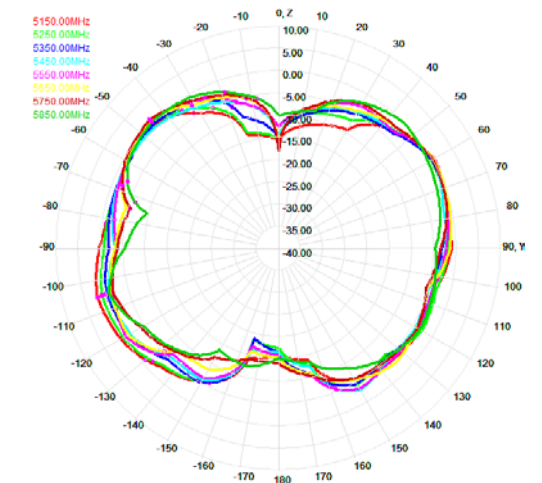
XY



XZ

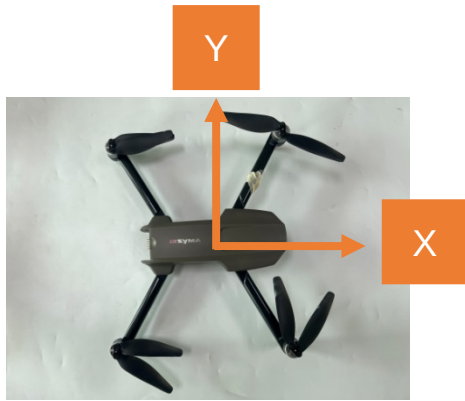


YZ

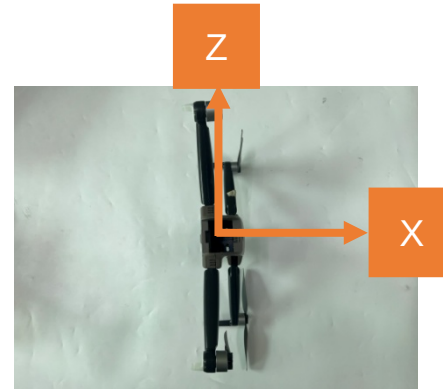
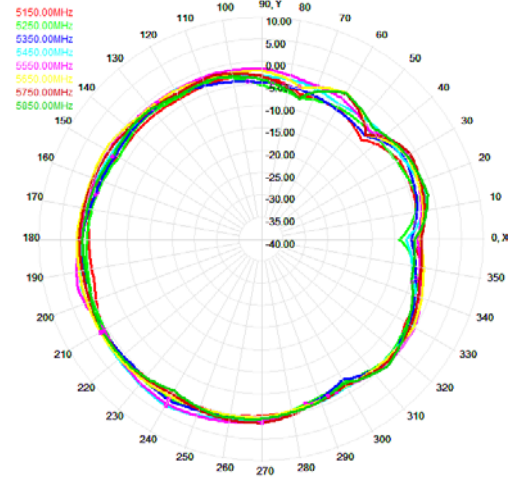


2D Radiation Patterns

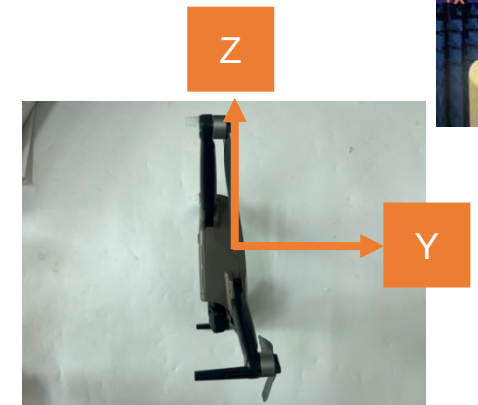
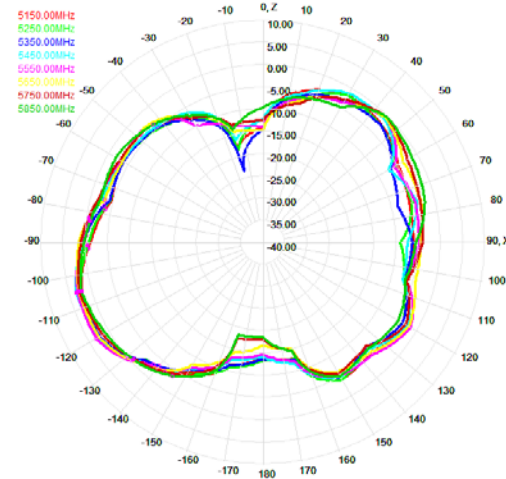
5G-2



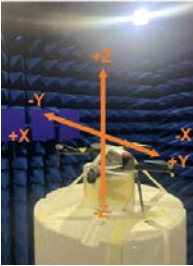
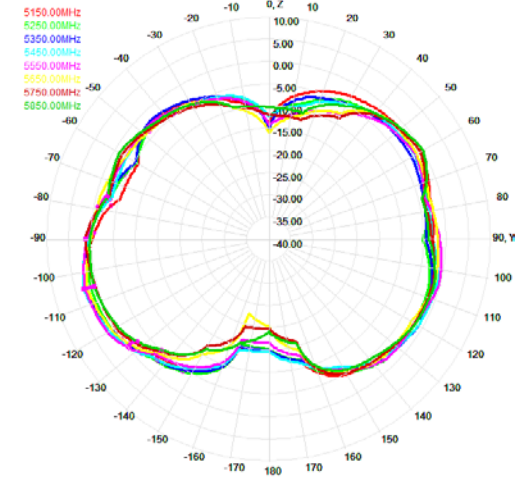
XY



XZ



YZ

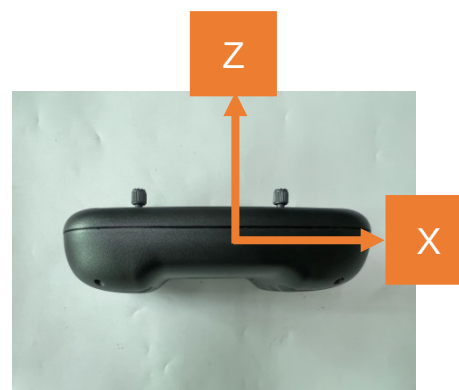
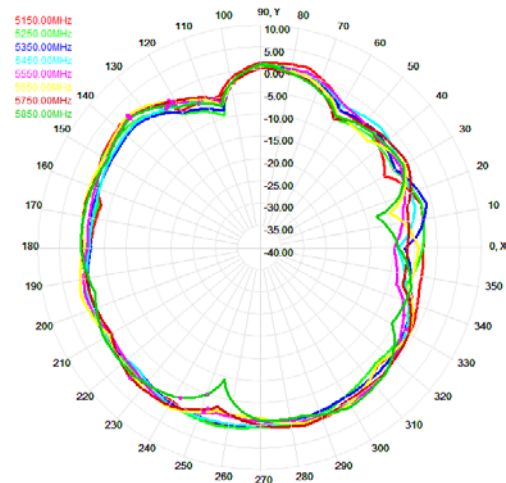


2D Radiation Patterns

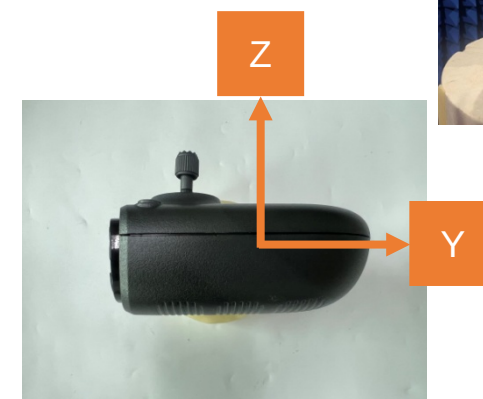
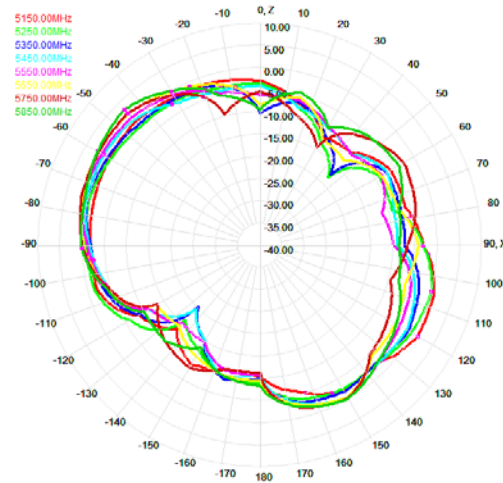
5G-3



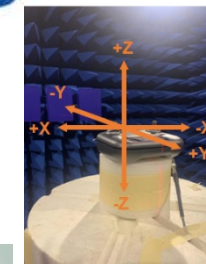
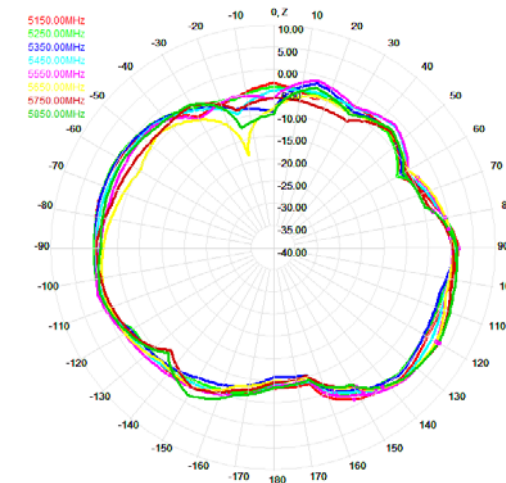
XY



XZ



YZ

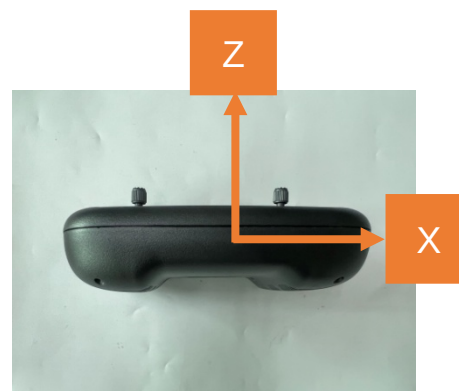
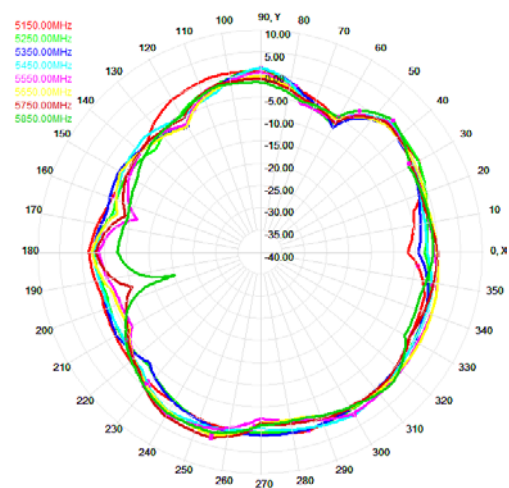


2D Radiation Patterns

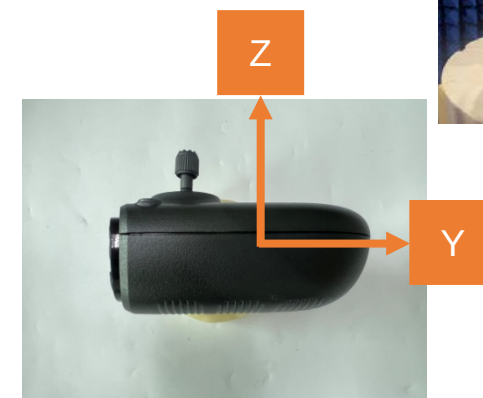
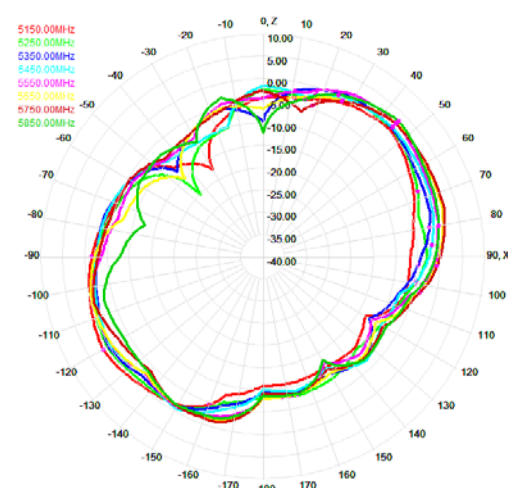
5G-4



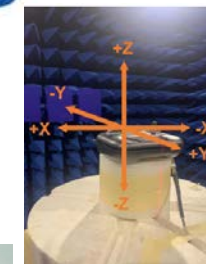
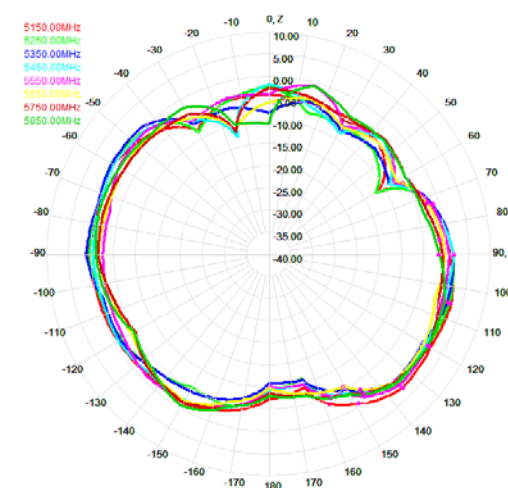
XY



XZ

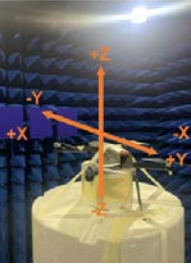


YZ

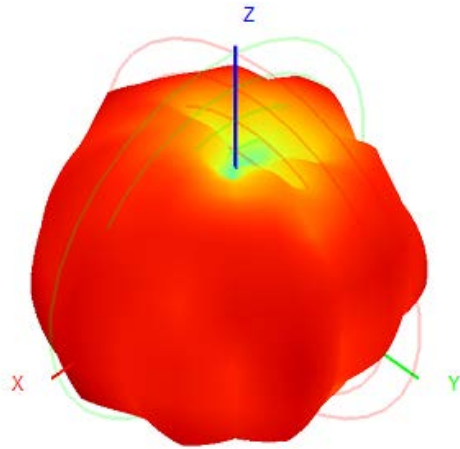


3D Radiation Patterns

5G-1

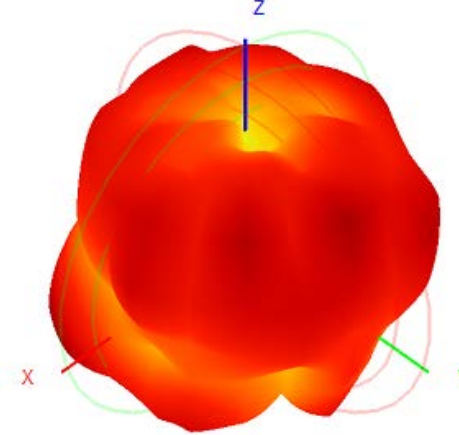


5150 MHz

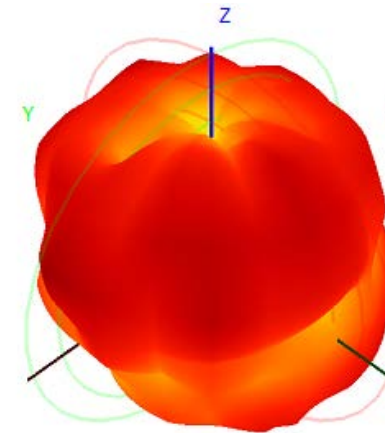
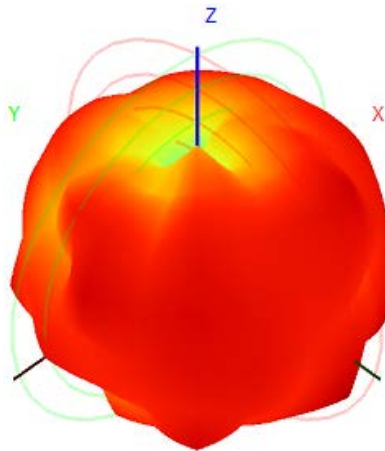


Front View

5850 MHz

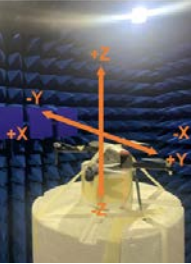


Back View

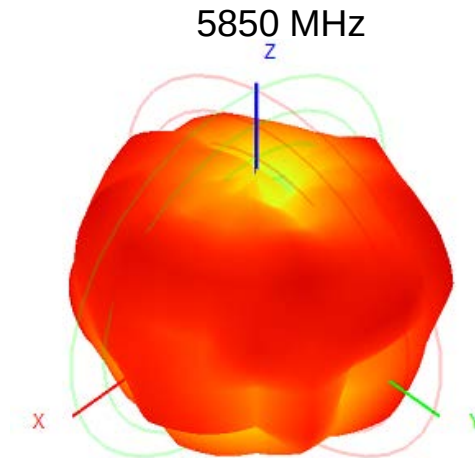
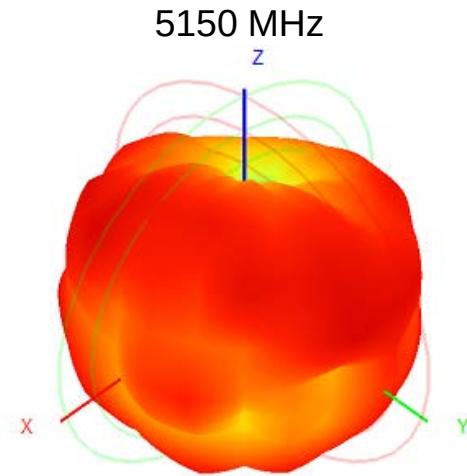


3D Radiation Patterns

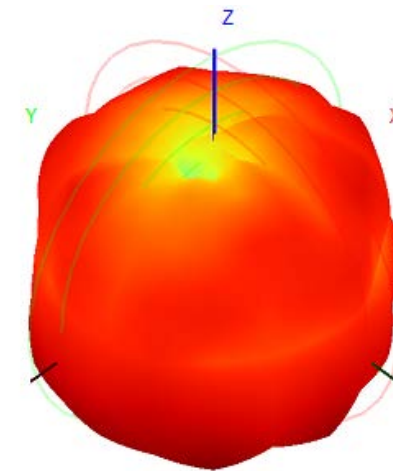
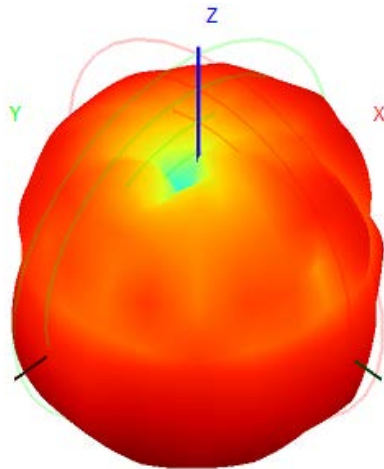
5G-2



Front View

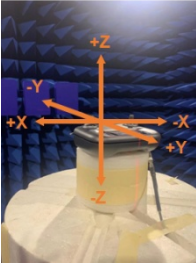


Back View

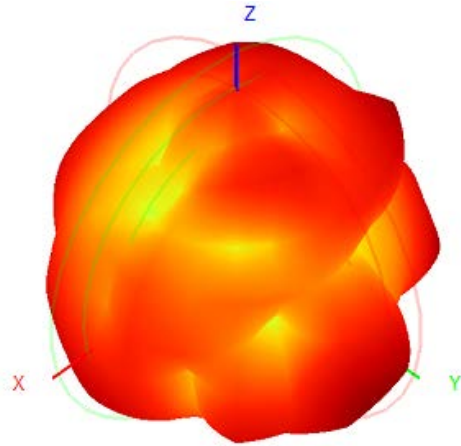


3D Radiation Patterns

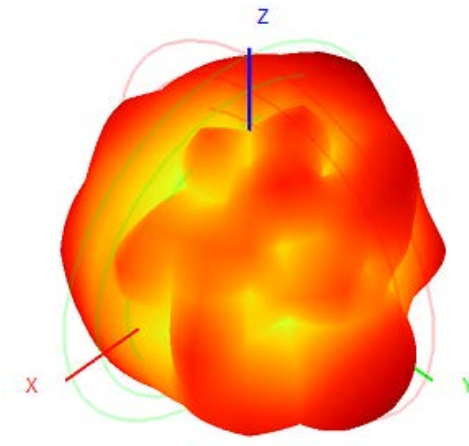
5G-3



5150 MHz

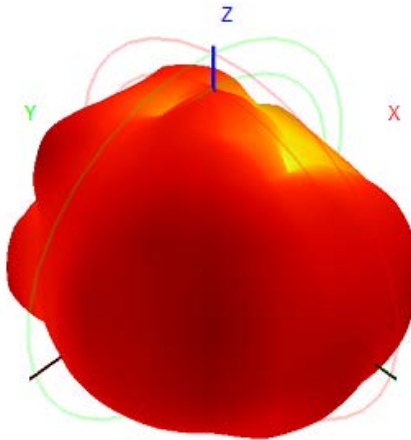


5850 MHz

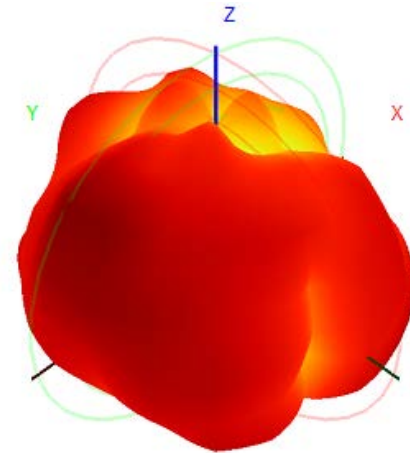


Front View

Z



Z

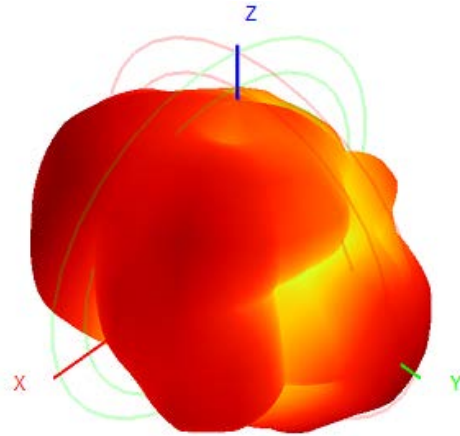


Back View

3D Radiation Patterns

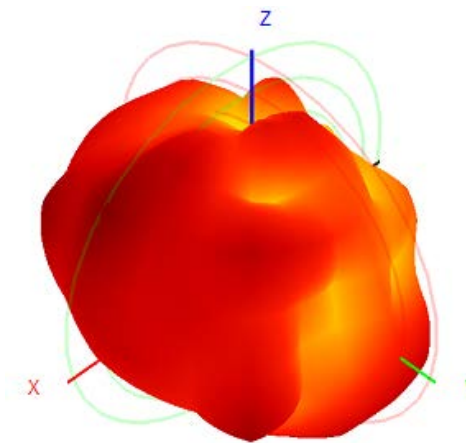
5G-4

5150 MHz

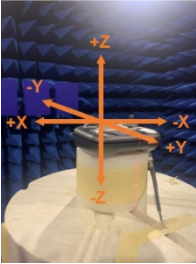
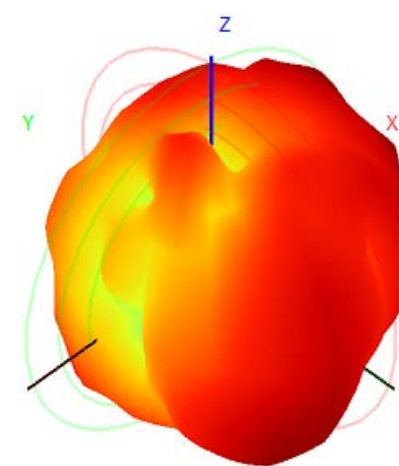
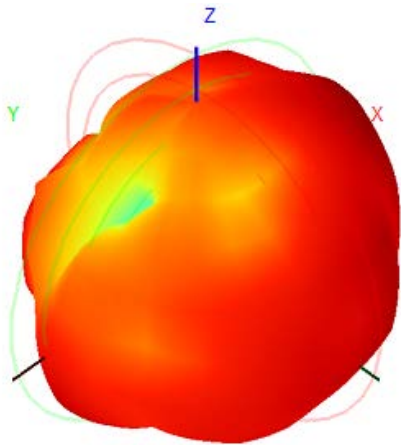


Front View

5850 MHz



Back View



Results Summary

V.S.W.R



(5150-5850MHz) (Criterion: 2.0:1 Max)

Frequency (MHz)	Drone		Remote Controller	
	5G-1	5G-2	5G-3	5G-4
5150	1.52	1.67	1.45	1.37
5850	1.89	1.67	1.82	1.60

Isolation

(Criterion: <- 19dB)



Frequency (MHz)	5G-1 & 5G-2 (dB)	5G-3 & 5G-4 (dB)
5150	-44	-21
5850	-49	-19

Peak Gain & Efficiency



(Peak Gain: $\geq 1.9\text{dBi}$) (Efficiency: $\geq 50\%$)

Frequency (MHz)	Drone				Remote Controller			
	5G-1 (dBi)	5G-1 (%)	5G-2 (dBi)	5G-2 (%)	5G-3 (dBi)	5G-3 (%)	5G-4 (dBi)	5G-4 (%)
5150	3.51	62	3.20	59	3.51	61	3.94	60
5250	2.16	57	3.07	58	2.39	57	2.97	55
5350	2.27	54	3.94	57	1.95	54	2.28	53
5450	2.63	59	3.71	64	3.49	58	3.5	58
5550	3.32	61	3.66	67	2.61	61	3.29	61
5650	2.32	57	2.92	63	2.22	59	3.6	58
5750	2.10	54	2.96	59	2.85	58	3.09	57
5850	3.17	51	3.60	60	3.17	57	3.13	56

Conclusion & Comments

Antenna Performance Summary

- The flight range of the drone can reach 2.0 km.
- Image transmission: smooth and clear during test
- 5.8 GHz antenna of drone
 - Peak gain: over 2.0dBi
 - Efficiency: reach 50-60%
- 5.8 GHz antenna of remote controller
 - Peak gain: over 1.9dBi
 - Efficiency: 53-60%

Comments for Further Improvement

- To be confirmed by customer





Thank You

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