

東莞台霖電子通訊有限公司

>>>>>>>>>> 样品承认书 <<<<<<<<<<<<<<

样品名称：RF Antenna Assembly			云联友科
样品料号：PJ-NZLJX-144-1(C4220-510080-A)			
规格描述：AX835(方殼)			
应用机型：			承认版本：V2
承认书份数	1份	样品数量：	
申请原因	☒ 新產品需求(新增)	☐ 替代料	原物料型号：
	☐ 增加备用供应商	☐ 原供应商：	
	☐ 成本降低(降低)	☐ 其 他：	
承认注意事项	1、		
	2、		
导入审核：			
供 应 商 签 名	工程：[Signature] 审核：[Signature] 		
客 户 签 名	采购申请：	开发确认：	设计确认：
	经理审核：	经理审核：	经理审核：
客 户 意 见	总经理： (签名)		

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RF Antenna Assembly

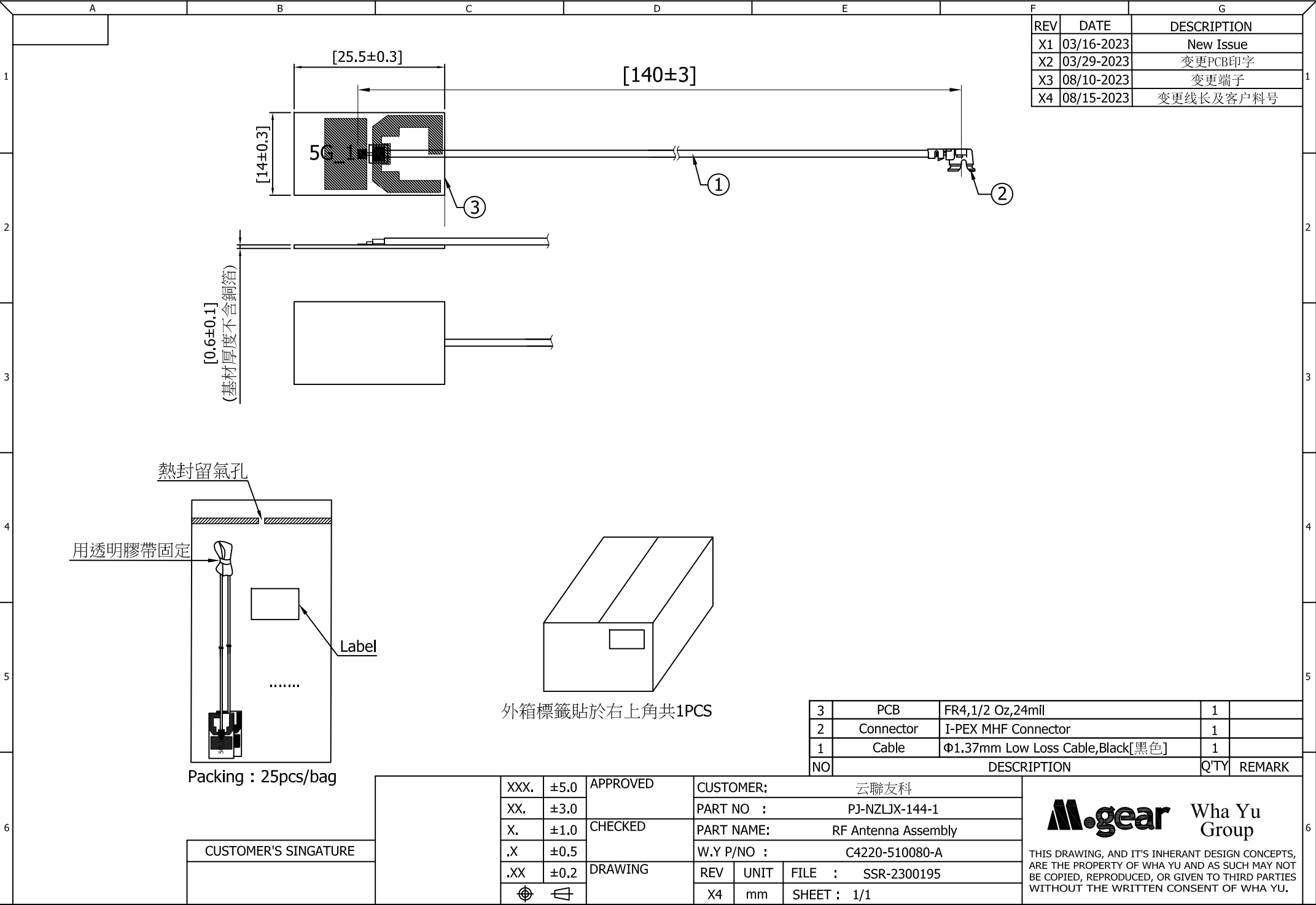
Specification

1. Electrical Properties : With Housing

- 1.1 Frequency Range..... 5150-5850 MHz
- 1.2 Impedance 50Ω Nominal
- 1.3 VSWR 2.0:1 Max.
- 1.4 Return Loss 9.54 dB Min.
- 1.5 Peak Gain 3.5 dBi Min.
- 1.6 Radiation Omni-directional
- 1.7 Admitted Power..... 1 W
- 1.8 Polarization..... Linear
- 1.9 Cable..... 1.37mm Low Loss Cable
- 1.10 Cable..... I-PEX MHF Plug Connector

2. Physical Properties :

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





We connect the wireless world.

TNP-23003 Antenna Test Report

(Model: AX835-P2-V2)

Version: 1.2.1

Released Date: 2023/08/29

Prepared by: James

Reviewed by: Daniel

Outline

- Revised History
- Specification
- Antenna Placement & Solution
- Test Setup for S-parameters Measurement
- Return Loss 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
2023/03/07	1.0	AX835-P2-V2 (Square case) antenna evaluation
2023/03/20	1.1	Update antenna S/N as customer's requirement
2023/03/22	1.2	Change 2G-1& 5G-2 cable length as customer's requirement
2023/08/29	1.2.1	Active test with IPEX MHF Conn. (p.35-36)

Specification



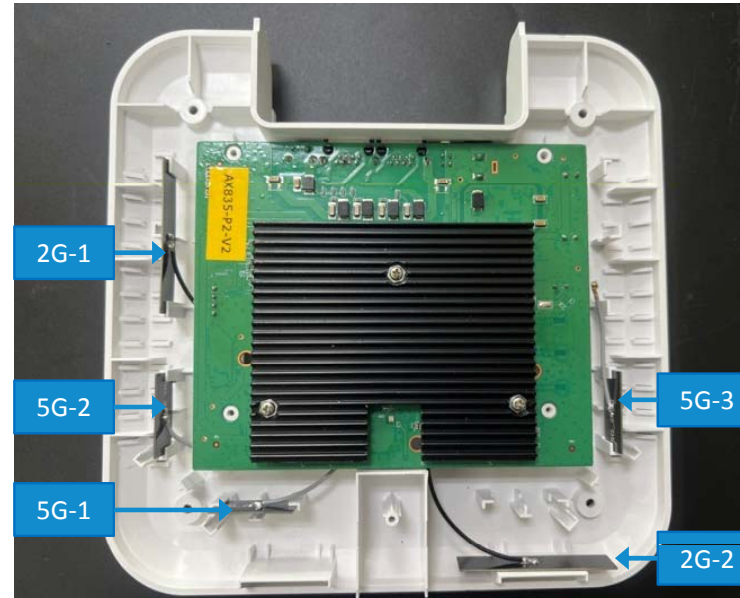
Requirements of Antenna Design

RF Function	Number of ANT	Frequency Band	Remark
2G	2	2400-2500MHz	2G-1, 2G-2
5G	3	5150-5850MHz	5G-1, 5G-2, 5G-3

Requirements of Measurement

Test Item		Specification	Remark
V.S.W.R	2G	2.0:1 Max @2400-2500MHz	
	5G	2.0:1 Max @5150-5850MHz	
Isolation		<-20dB	
Peak Gain	2G	≥5.0dBi @2400-2500MHz	
	5G	≥3.5dBi @5150-5850MHz	
Efficiency	2G	≥60% @2400-2500MHz	
	5G	≥60% @5150-5850MHz	
Radiation Pattern		Scale: +5 - -45 dBi, Angle step size: 5 degree	

Antenna Placement & Solution



Antenna	Antenna Type	Size (L * W * H)	Cable Length	Cable Type
2G-1	PCB	49*11.5*0.6 mm	148mm (for OTA Test)	1.37 LOW LOSS (Grey)
2G-2	PCB	49*11.5*0.6 mm	65mm (for OTA Test)	1.37 LOW LOSS (Grey)
5G-1	PCB	25.5*14*0.6 mm	140mm (for OTA Test)	1.37 LOW LOSS (Black)
5G-2	PCB	25.5*14*0.6 mm	165mm (for OTA Test)	1.37 LOW LOSS (Black)
5G-3	PCB	25.5*14*0.6 mm	43mm (for OTA Test)	1.37 LOW LOSS (Black)

Antenna Placement & Solution



Test Setup for Return Loss Test



Equipment	Brand	Model	S/N
Network Analyzer	Keysight	E5071C	XXXXXXX



V.S.W.R Test

V.S.W.R Test

2G-1 (2400-2500MHz)



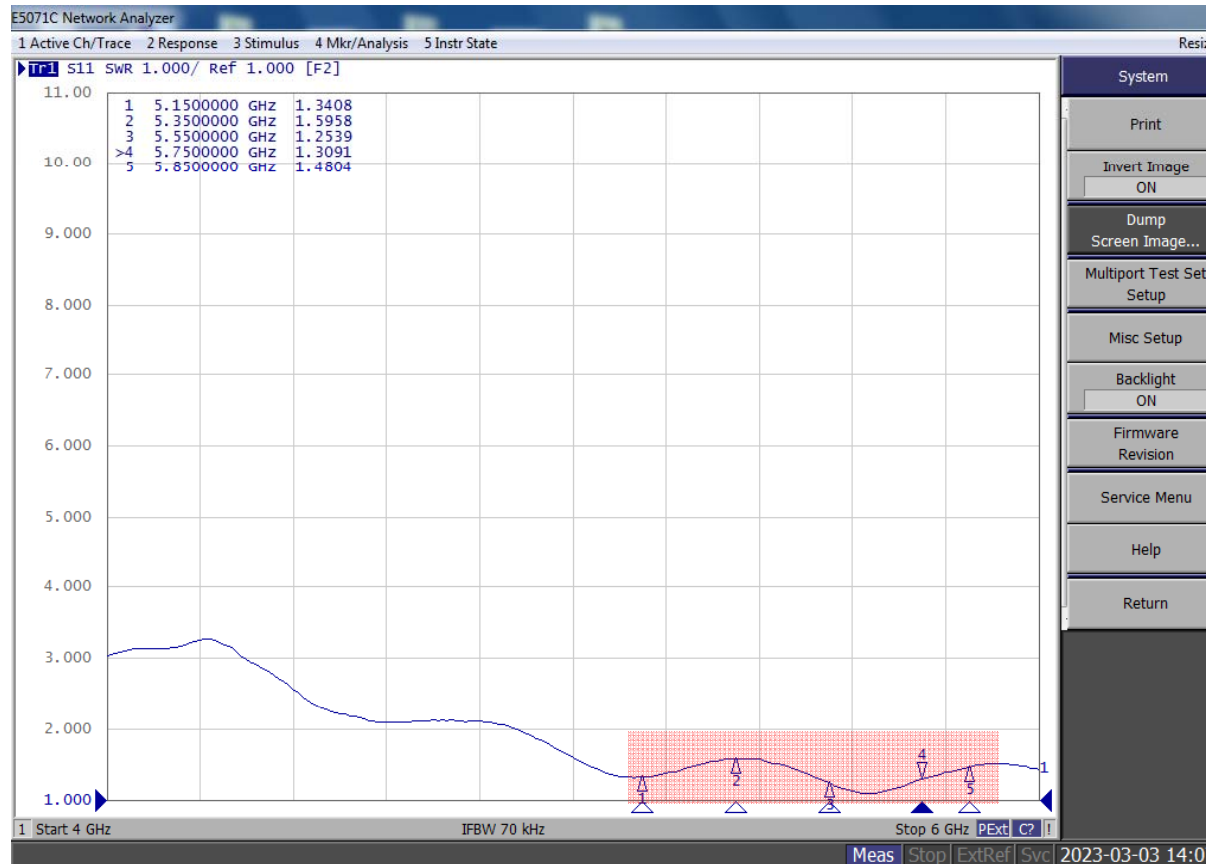
V.S.W.R Test

2G-2 (2400-2500MHz)



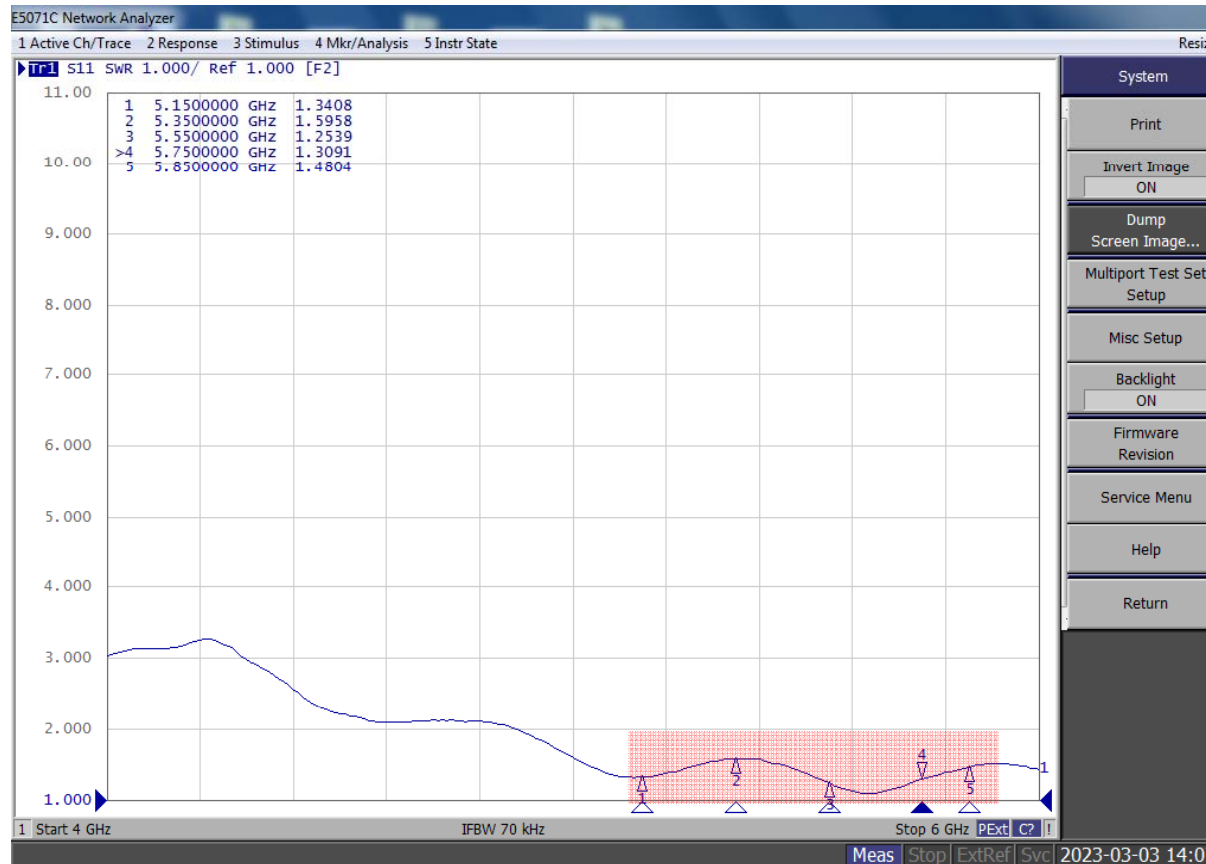
V.S.W.R Test

5G-1 (5150-585MHz)



V.S.W.R Test

5G-2 (5150-585MHz)



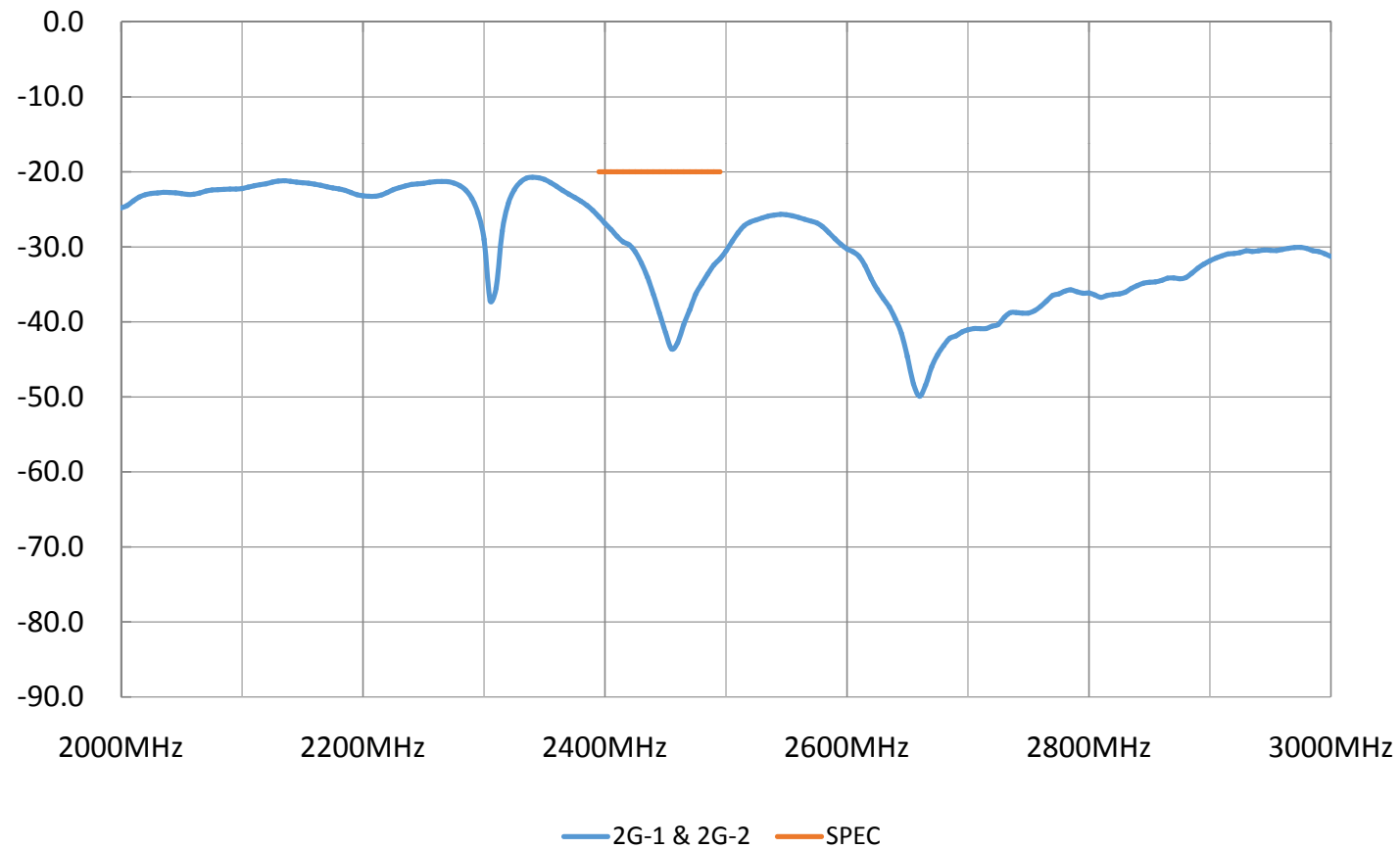
V.S.W.R Test

5G-3 (5150-585MHz)

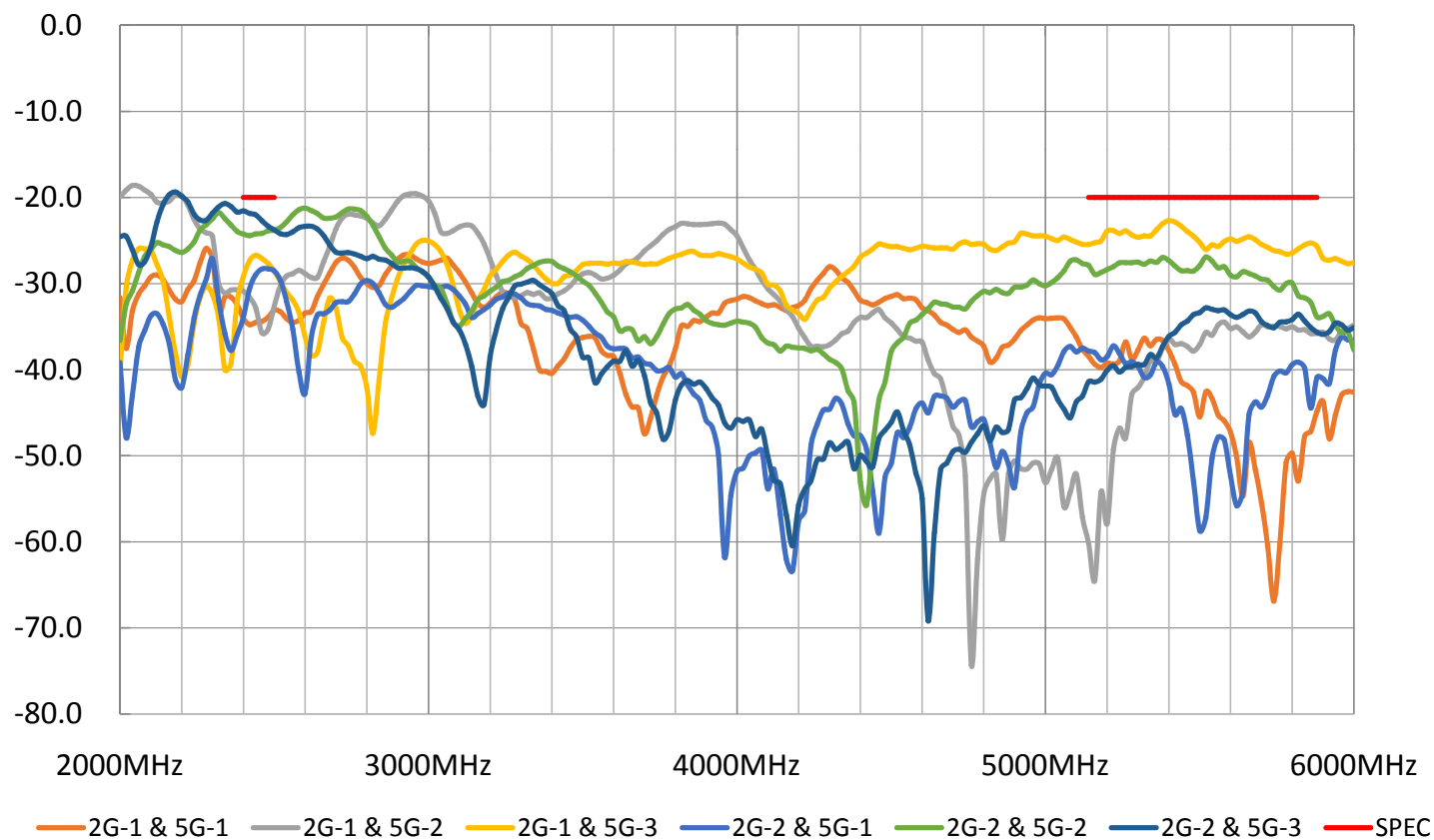


Isolation Test

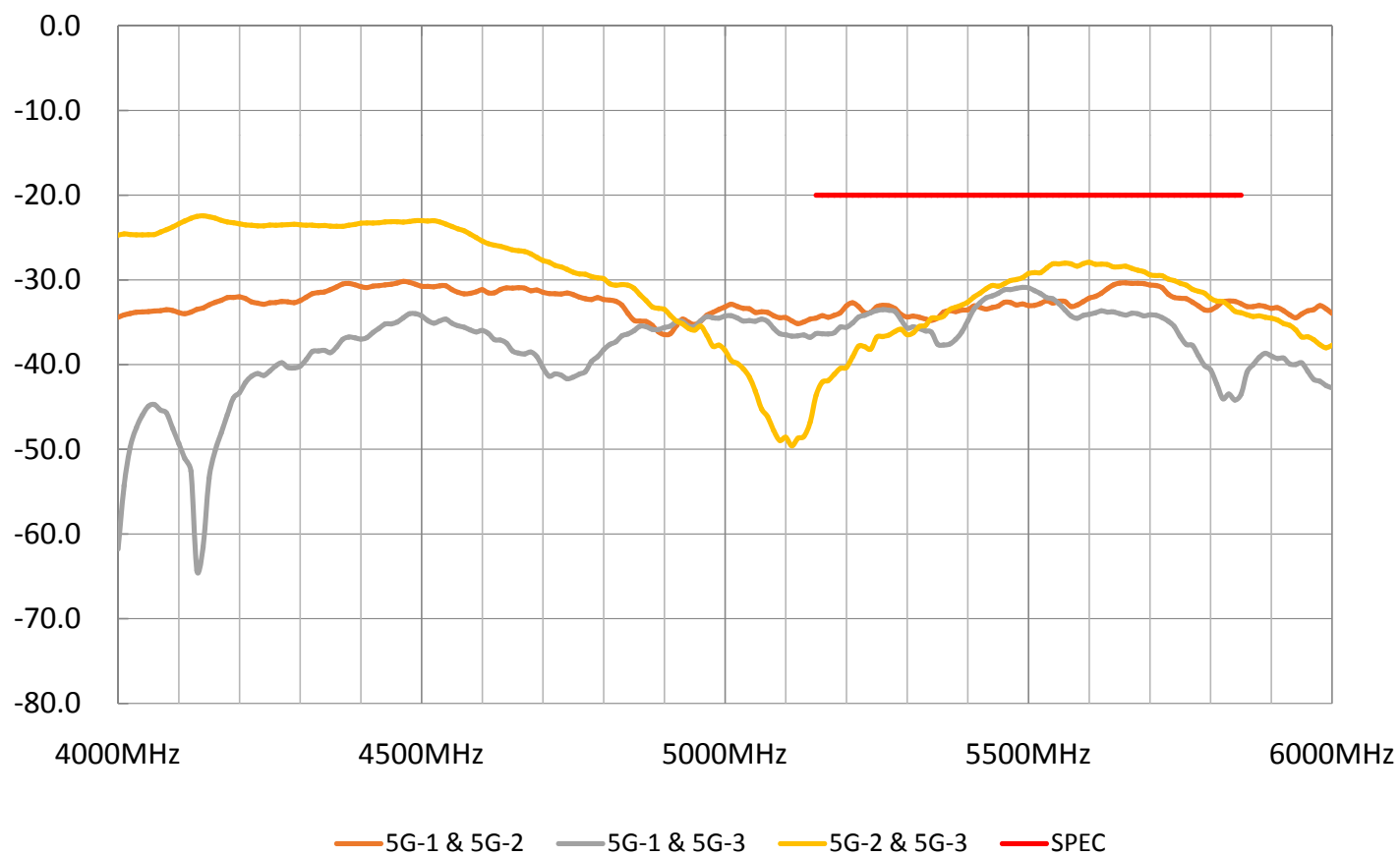
Isolation Test



Isolation Test



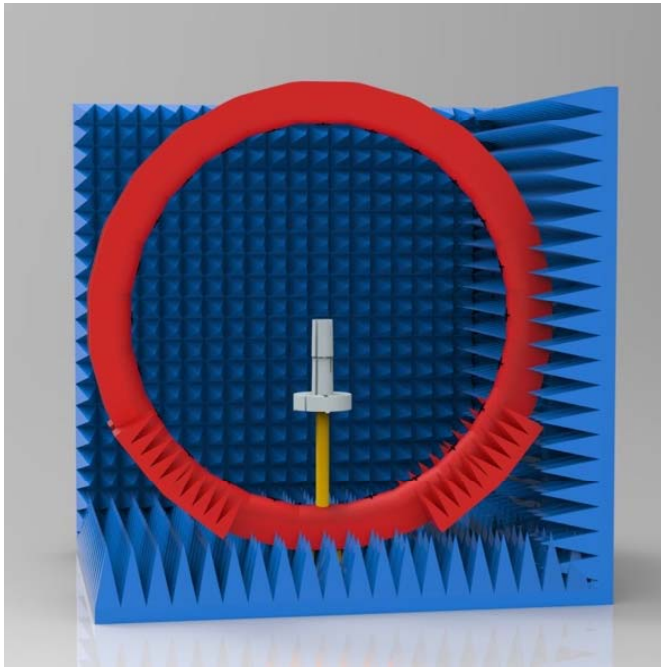
Isolation Test



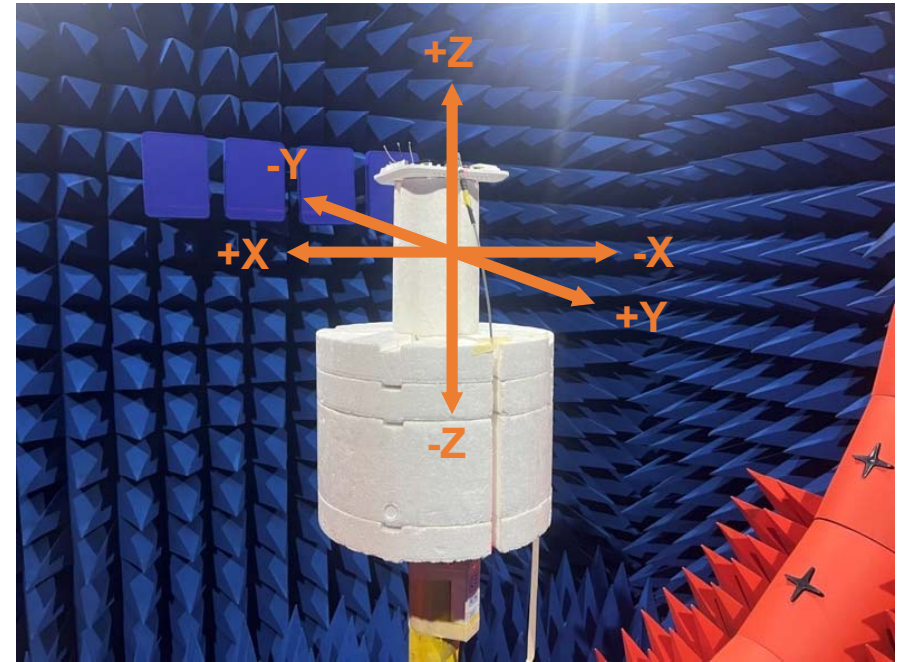
Test Setup for OTA Measurement



Chamber Information



Test Setup for DUT

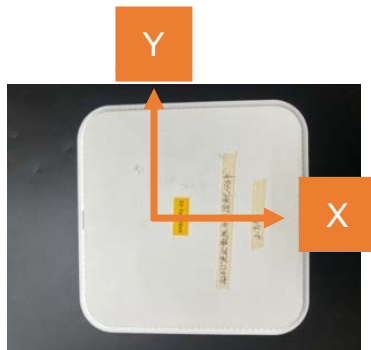
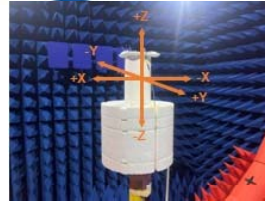


Chamber	Brand	Model	Dimension	Freq. Range	Max DUT Size	Function	Location
Multi-probe	Fei-Tu	FT-OTA24	4*4*4M	0.4-8.5GHz	0.6-1.2M (base on different freq. band)	• Antenna Gain and Efficiency • TRP & TIS test for 2G/3G/4G LTE/NB-IOT • WLAN 802.11 a/b/g/n/ac, WiFi 6 • WiFi / WiFi 6 Throughput	China, Dongguan

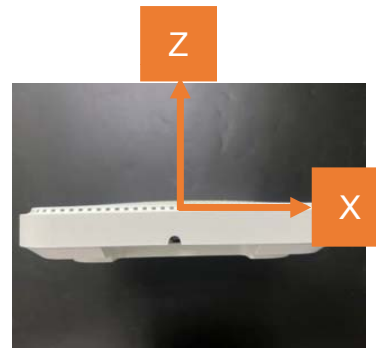
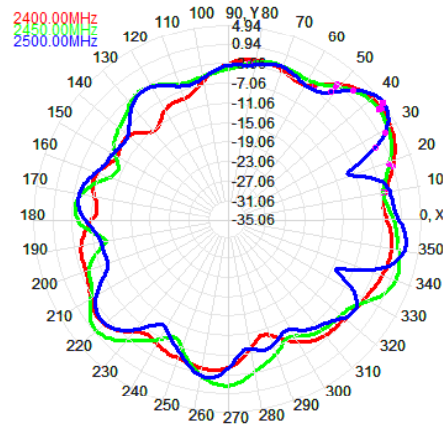
Radiation Patterns

2D Radiation Patterns

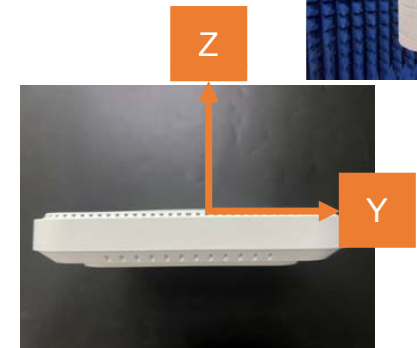
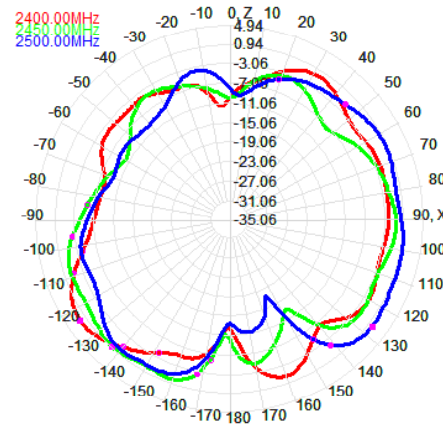
2G-1



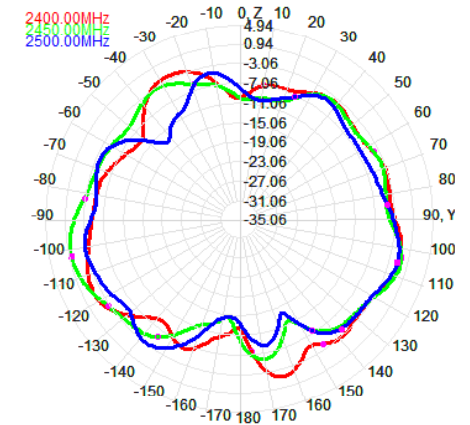
XY



XZ

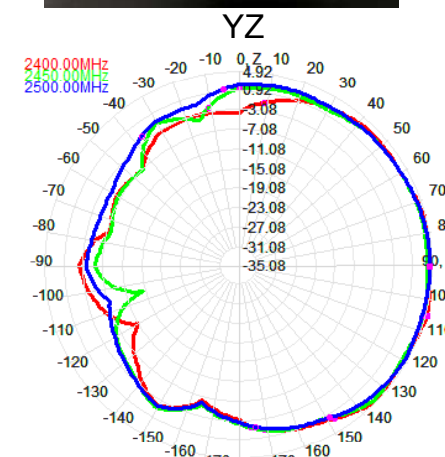
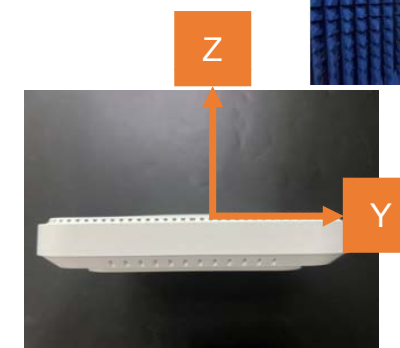
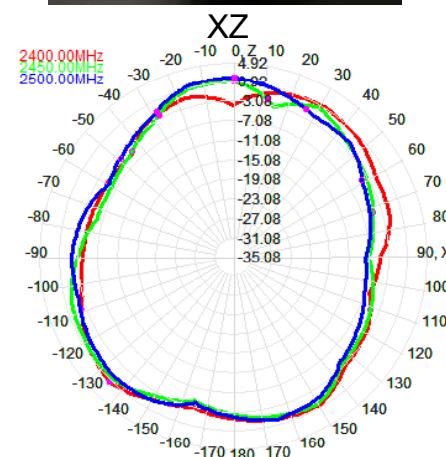
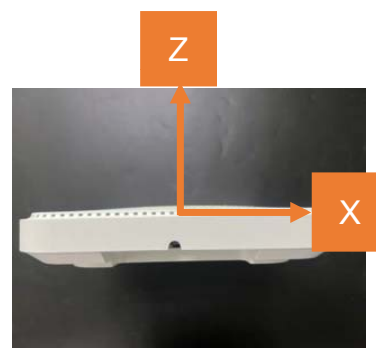
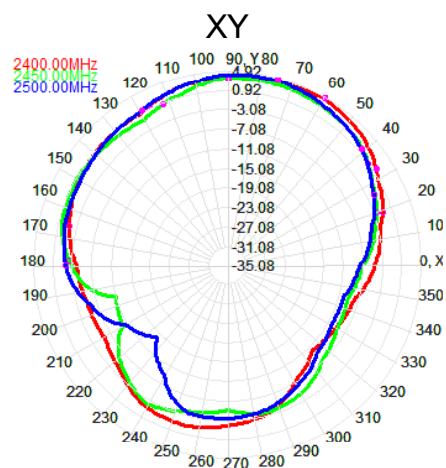
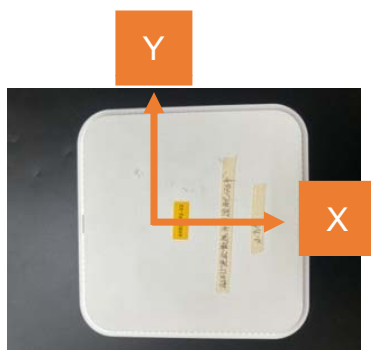
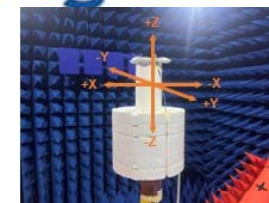


YZ



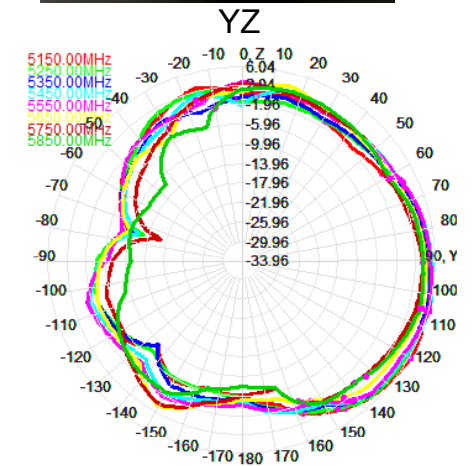
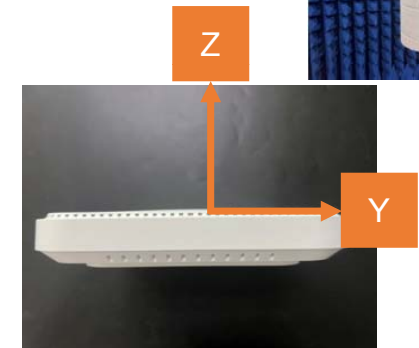
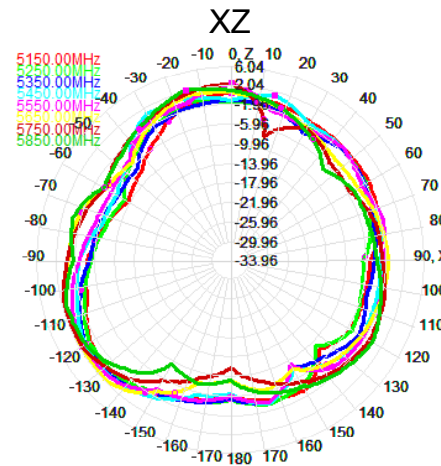
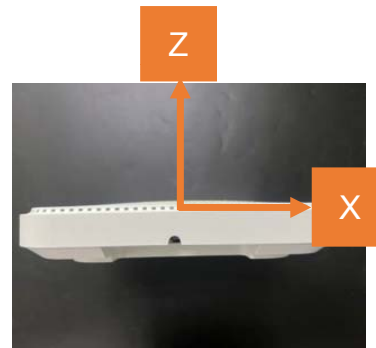
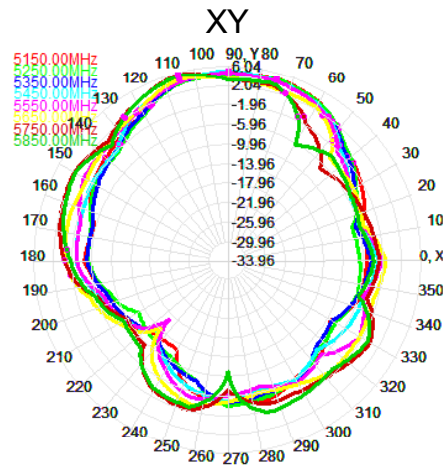
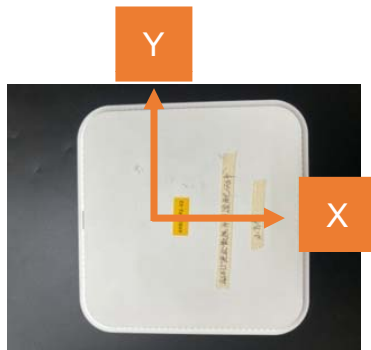
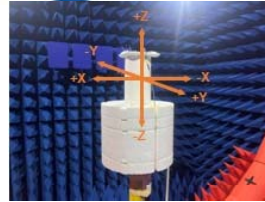
2D Radiation Patterns

2G-2



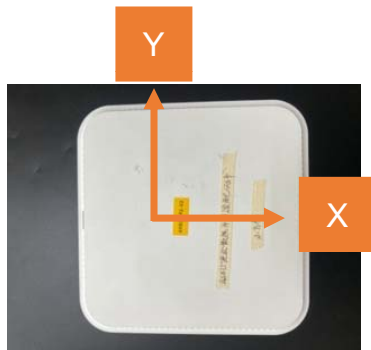
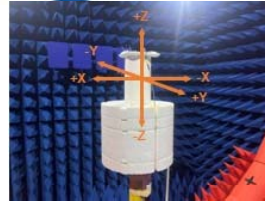
2D Radiation Patterns

5G-1

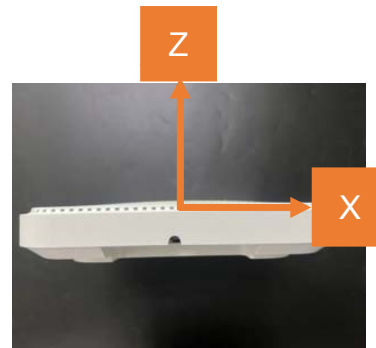
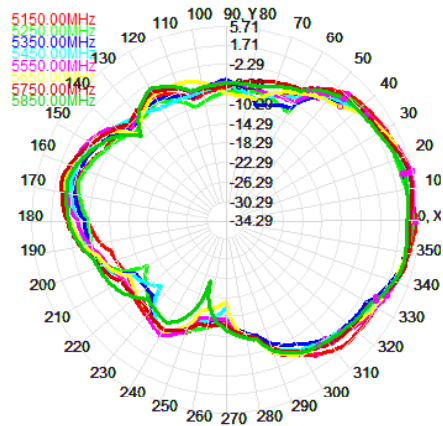


2D Radiation Patterns

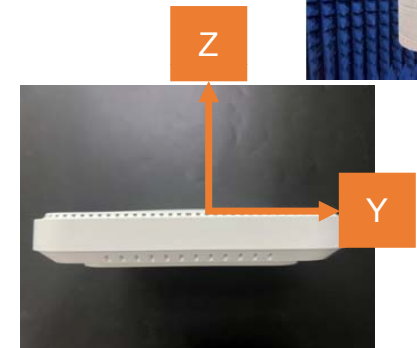
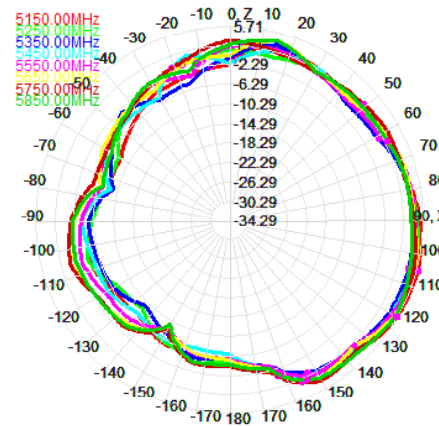
5G-2



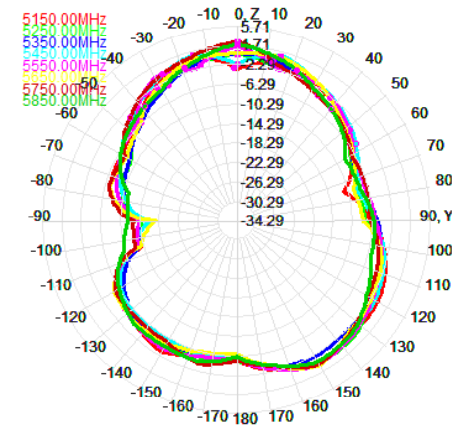
XY



XZ

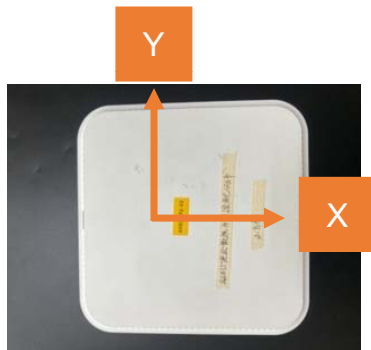
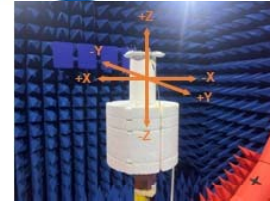


YZ

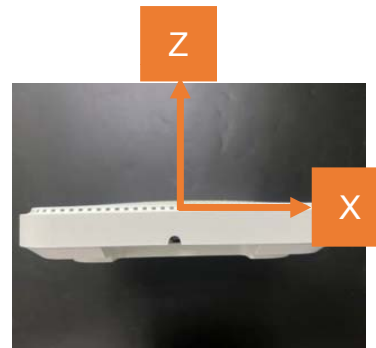
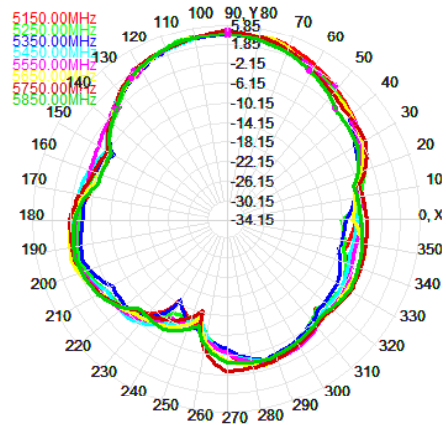


2D Radiation Patterns

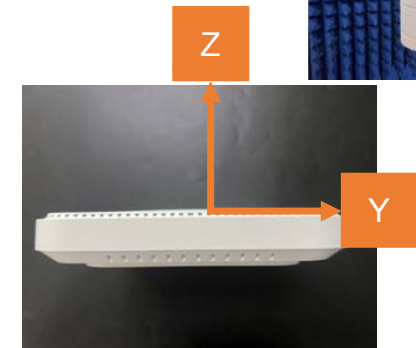
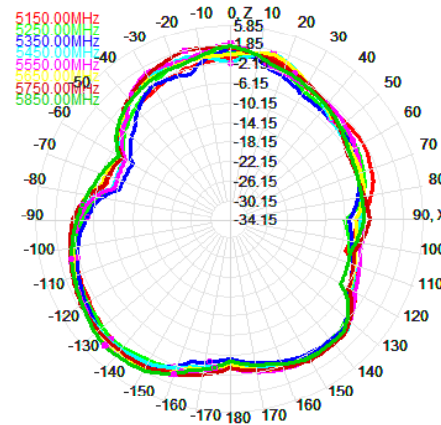
5G-3



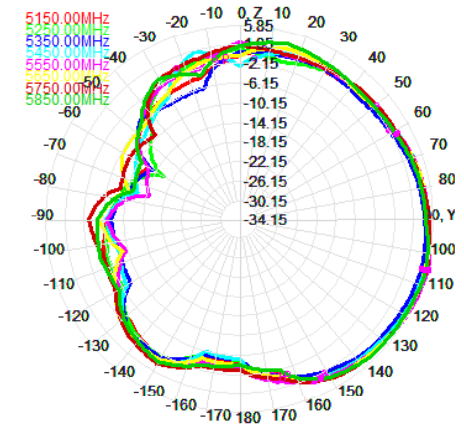
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XZ

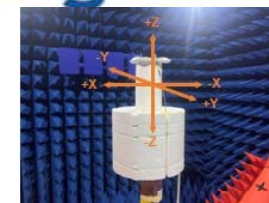


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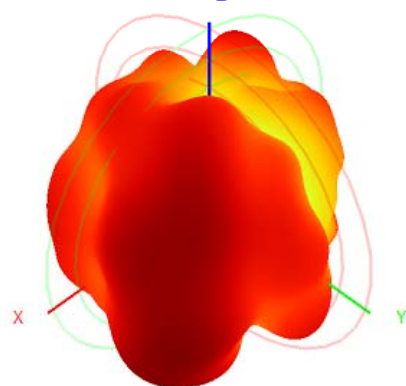
3D Radiation Patterns

2G-1



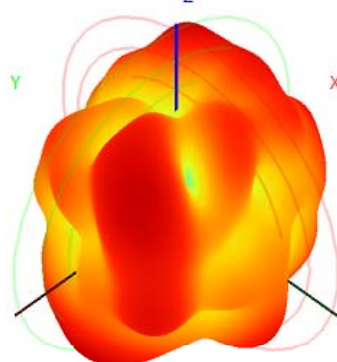
2400 MHz

Z



Front View

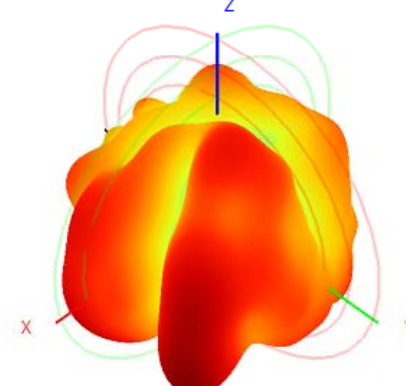
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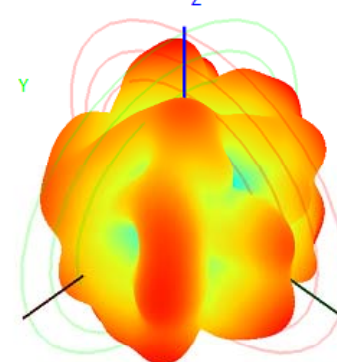
Back View

2500 MHz

Z

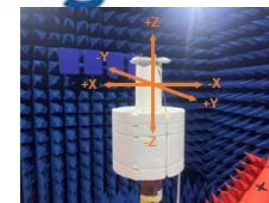


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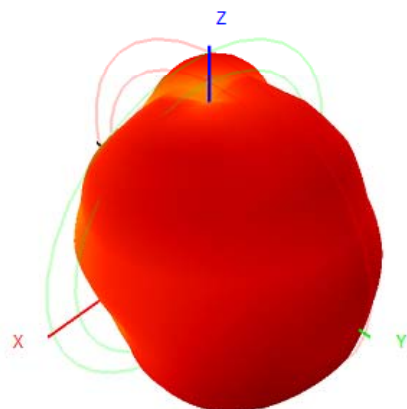


3D Radiation Patterns

2G-2

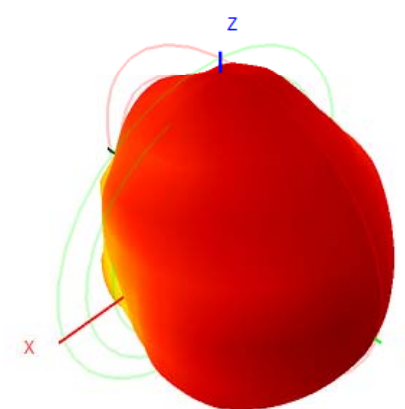


2400 MHz

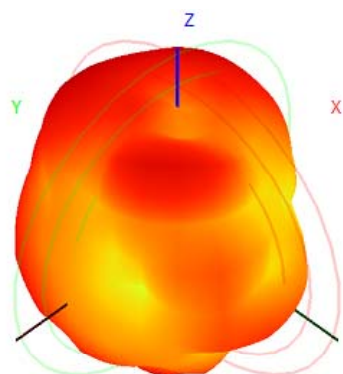


Front View

2500 MHz

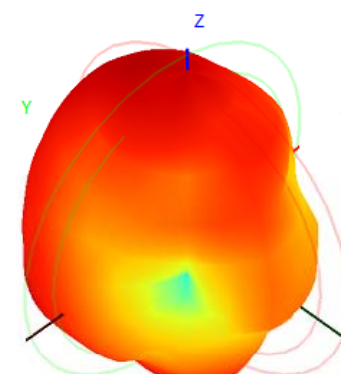


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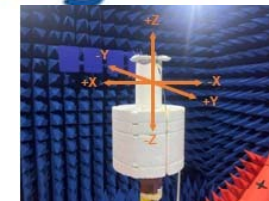
Back View

Z

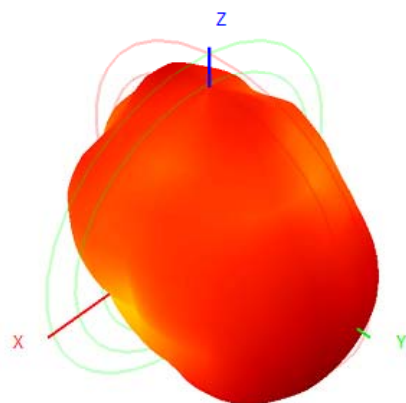


3D Radiation Patterns

5G-1

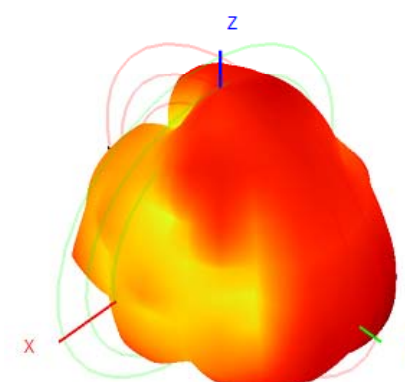


5150 MHz

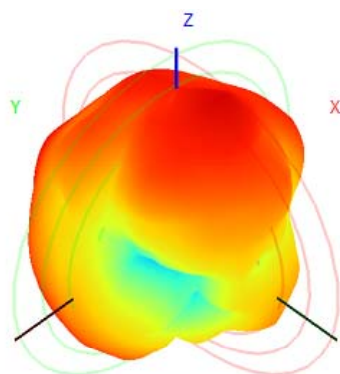


Front View

5850 MHz

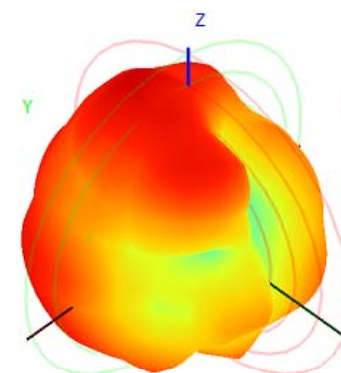


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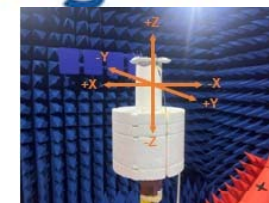
Back View

Z

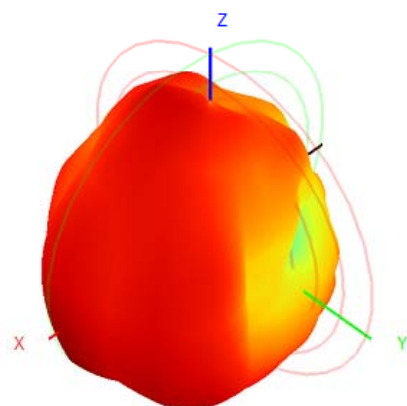


3D Radiation Patterns

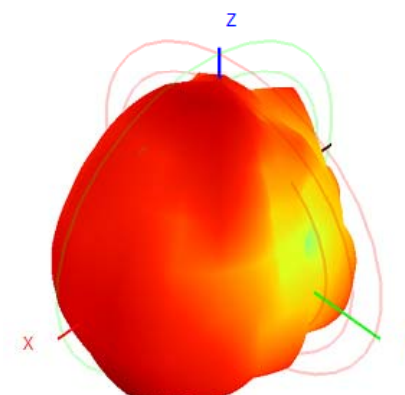
5G-2



5150 MHz

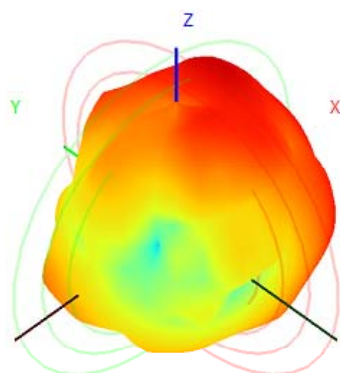


5850 MHz

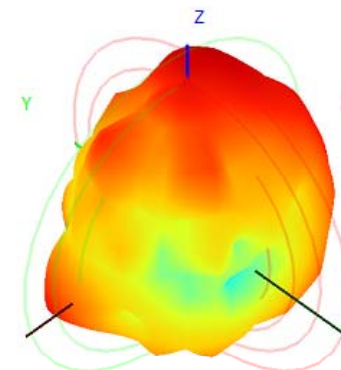


Front View

Z



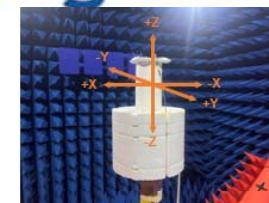
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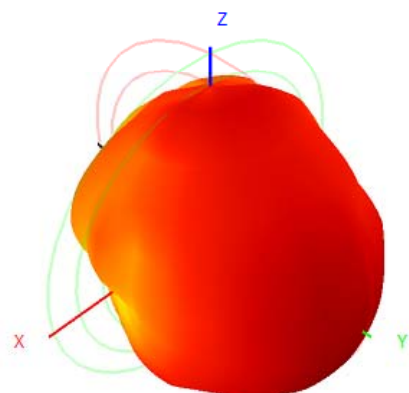
Back View

3D Radiation Patterns

5G-3

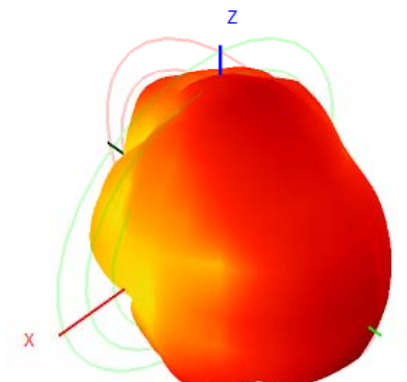


5150 MHz

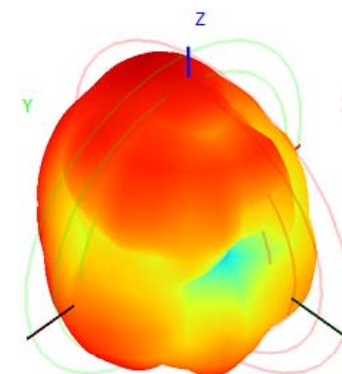
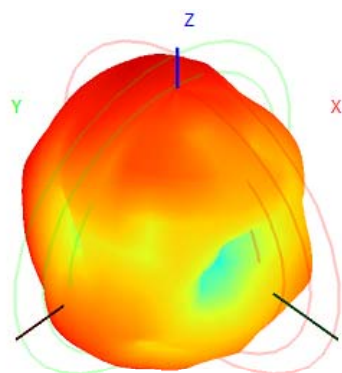


Front View

5850 MHz



Back View



Results Summary

V.S.W.R



(2400-2500 / 5150-5850MHz) (Criterion: 2.0:1 Max)

Frequency (MHz)	2G-1	2G-2	5G-3	5G-2	5G-1
2400	1.25	1.26	-	-	-
2450	1.16	1.31	-	-	-
2500	1.31	1.39	-	-	-
5150	-	-	1.25	1.34	1.17
5350	-	-	1.27	1.59	1.10
5550	-	-	1.52	1.25	1.26
5750	-	-	1.56	1.30	1.26
5850	-	-	1.49	1.48	1.29

Isolation



(Criterion: <- 20dB)

Frequency (MHz)	2G-2 & 2G-1 (dB)	2G-2 & 5G-3 (dB)	2G-2 & 5G-2 (dB)	2G-2 & 5G-1 (dB)	2G-1 & 5G-3 (dB)	2G-1 & 5G-2 (dB)	2G-1 & 5G-1 (dB)	5G-3 & 5G-2 (dB)	5G-3 & 5G-1 (dB)	5G-2 & 5G-1 (dB)
2400	-26	-34	-30	-29	-33	-24	-21	-	-	-
2450	-41	-34	-32	-26	-28	-24	-22	-	-	-
2500	-30	-33	-32	-28	-28	-23	-23	-	-	-
5150	-	-38	-60	-25	-37	-27	-41	-34	-36	-43
5350	-	-37	-38	-24	-40	-27	-38	-34	-37	-34
5550	-	-45	-37	-25	-58	-27	-33	-32	-32	-28
5850	-	-47	-35	-25	-39	-32	-34	-32	-43	-33

Peak Gain & Efficiency



2G (Peak Gain: $\geq 5\text{dBi}$)(Efficiency: $\geq 60\%$)

Frequency (MHz)	2G-2 (dBi)	2G-2 (%)	2G-1 (dBi)	2G-1 (%)
2400	5.13	61	4.23	62
2450	4.26	61	4.34	64
2500	4.56	63	5.24	65

Peak Gain & Efficiency



5G (Peak Gain: $\geq 3.5\text{dBi}$) (Efficiency: $\geq 60\%$)

Frequency (MHz)	5G-3 (dBi)	5G-3 (%)	5G-2 (dBi)	5G-2 (%)	5G-1 (dBi)	5G-1 (%)
5150	4.98	67	5.71	69	6.04	65
5350	4.58	67	4.11	63	5.31	67
5550	5.85	71	6.32	66	6.03	66
5750	5.55	70	6.10	67	6.89	67
5850	5.45	68	6.17	64	6.38	65

Active antenna test



TRP/TIS (802.11n)

2G (with IPEX MHF Conn.)								
Band	chnwidth	Channel	Frequency	TRP (dBm)	Band	Channel	Frequency	TIS (dBm)
802.11n (65m)	20MHz	1	2.412	19.84	802.11n (65m)	1	2.412	-73.91
		6	2.442	20.07		6	2.442	-75.38
		11	2.462	20.15		11	2.462	-75.41

TRP/TIS (802.11g)

2G (with IPEX MHF Conn.)								
Band	chnwidth	Channel	Frequency	TRP (dBm)	Band	Channel	Frequency	TIS (dBm)
802.11g (54m)	20MHz	1	2.412	19.98	802.11g (54m)	1	2.412	-75.89
		6	2.442	20.11		6	2.442	-76.20
		11	2.462	20.15		11	2.462	-75.41

Active antenna test



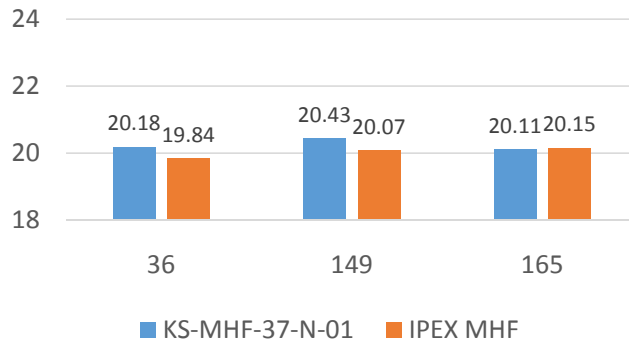
TRP/TIS (802.11ac)

5G (with IPEX MHF Conn.)								
Band	chnwidth	Channel	Frequency	TRP (dBm)	Band	Channel	Frequency	TIS (dBm)
802.11ac (MCS Index 7)	20MHz	36	5.180	25.72	802.11ac (MCS Index 7)	36	5.180	-78.50
		149	5.745	25.07		149	5.745	-78.27
		165	5.825	24.22		165	5.825	-77.71

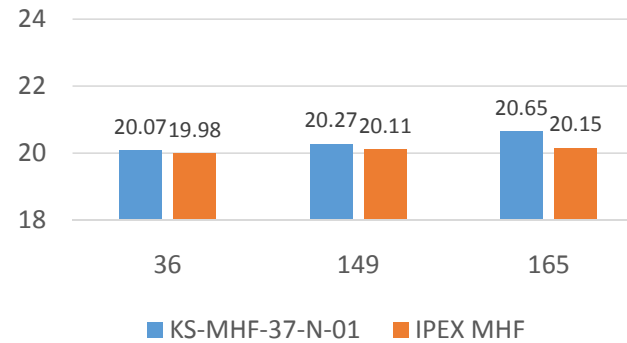
Performance Comparison of Active antenna test



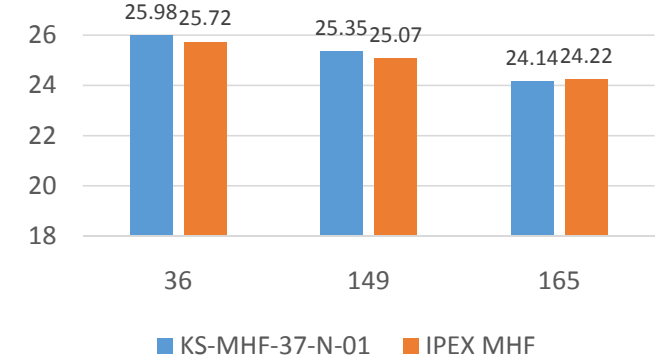
TRP (802.11n)



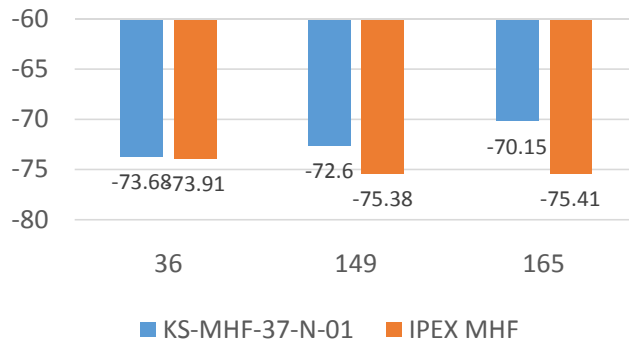
TRP (802.11g)



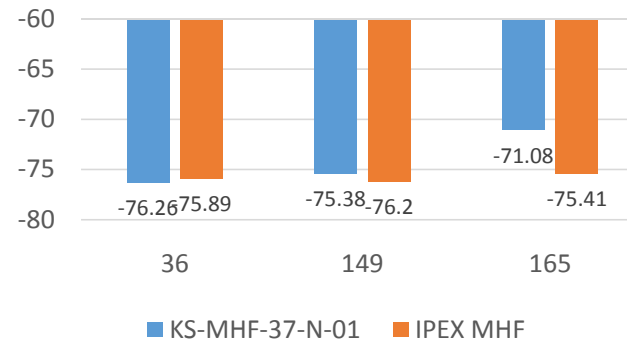
TRP (802.11ac)



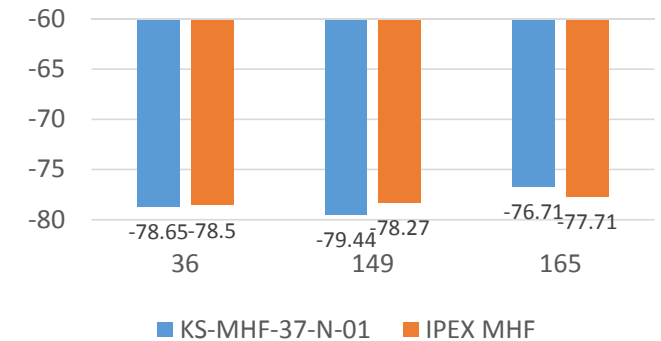
TIS (802.11n)



TIS (802.11g)



TIS (802.11ac)



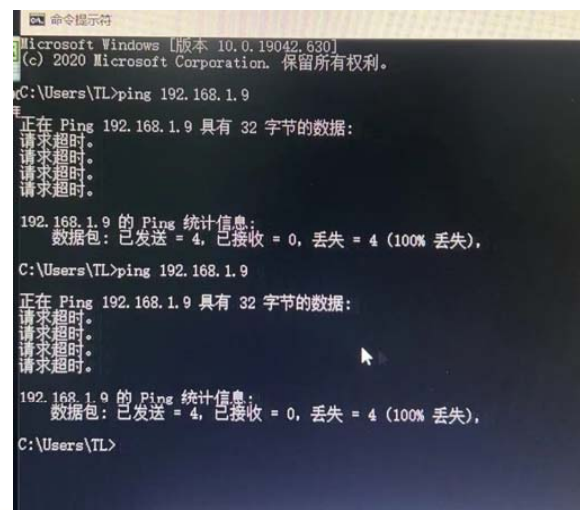
Conclusion & Comments

Antenna Performance Summary

- VSWR, Isolation, peak gain and efficiency of 2.4/5G antenna meet specification
- Fail to run throughput test, need customer check software setup.
- Antenna Shareability
 - Only 2G ANT of AX835-P2-V1 (Circular case) can be adopted in AX835-P2-V2 (Square Case).
 - 5G ANT: TNP-22030 5G-2 ANT were adopted in this solution.
- Consideration of throughput performance, antenna placement of 2G-2 (with EVA foam, t=1.0mm) in p.5 is recommended.
- Performance of active antenna test is acceptable after replace IPEX MHF Conn.

Comments for Further Improvement

- To be confirmed by customer



```
命令提示符
Microsoft Windows [版本 10.0.19042.630]
(c) 2020 Microsoft Corporation. 保留所有权利。

C:\Users\TL>ping 192.168.1.9

正在 Ping 192.168.1.9 具有 32 字节的数据:
请求超时。
请求超时。
请求超时。
请求超时。

192.168.1.9 的 Ping 统计信息:
    数据包: 已发送 = 4, 已接收 = 0, 丢失 = 4 (100% 丢失),

C:\Users\TL>ping 192.168.1.9

正在 Ping 192.168.1.9 具有 32 字节的数据:
请求超时。
请求超时。
请求超时。
请求超时。

192.168.1.9 的 Ping 统计信息:
    数据包: 已发送 = 4, 已接收 = 0, 丢失 = 4 (100% 丢失),

C:\Users\TL>
```



Thank You

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