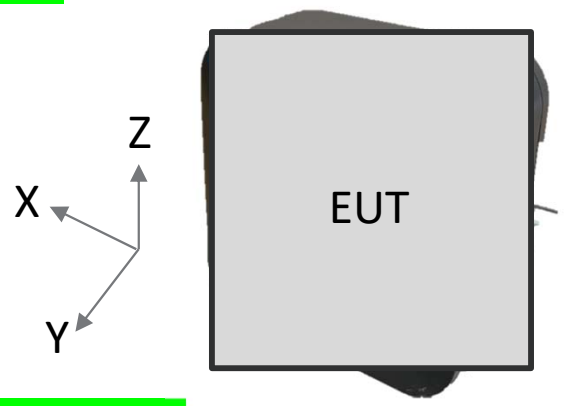
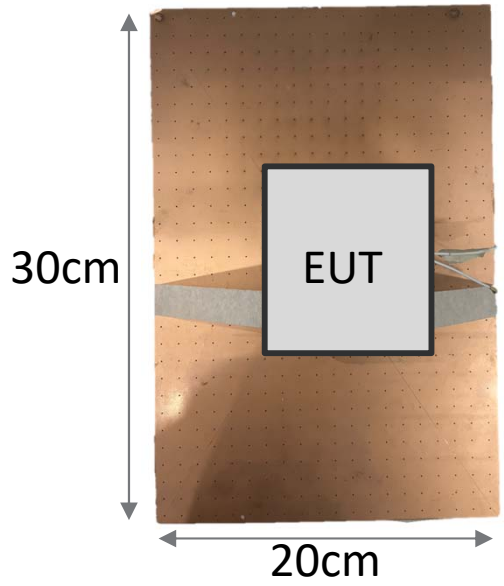
Antenna proposal and specification

Free space

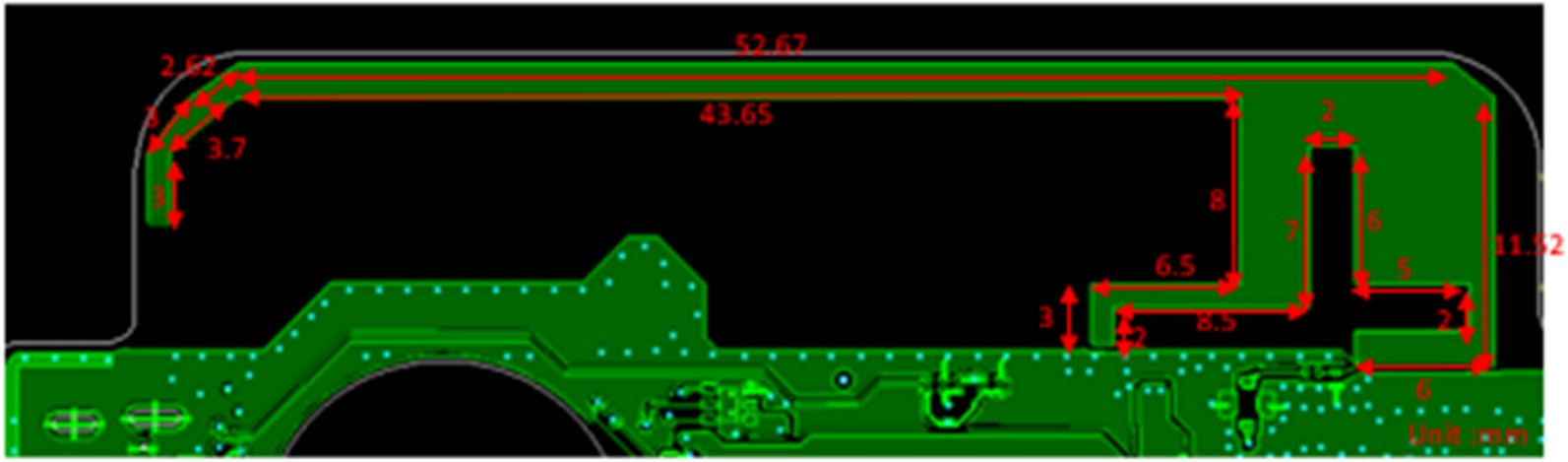


With metal plate



Antenna Proposal	
Wireless Function	**900MHz 802.11ah Wifi HaLow**
Antenna type	**■Wi-Fi HaLow: On board printing antenna**
	Measurement data
Return loss	**WiFi HaLow < -10dB**
Isolation	**Wi-Fi HaLow**: <-20 dB
Peak Gain	**WiFi HaLow < 0.03 dB (free space)** **WiFi HaLow < 1.65 dB (metal plate)**
Efficiency	**WiFi HaLow** > 40% **(free space)** **WiFi HaLow** > 36% **(metal plate)**

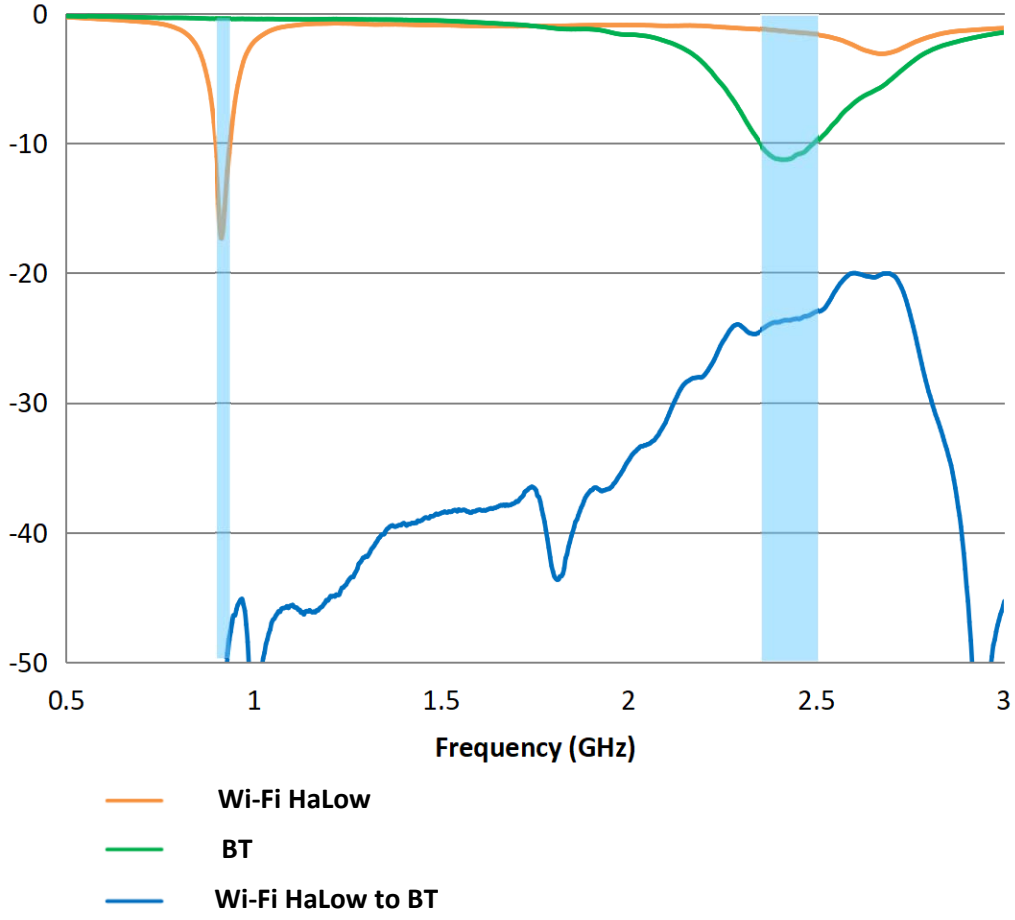
Antenna placement and experiment structure



Stackup Control Required						
Lyr	Image	Foil	Thk(mil)	Generic Name	Er	Df
11		0.5OZ	1.1	Foil 0.5oz(1295mm)		
			3.08	联茂 IT158 1080 RC71% 300M/R	3.35	0.02
		1 OZ	1.2			
12/13		Core	25.59	联茂 IT158 Core 0.650MM 1/1 86X49IN 不含铜	4.21	0.01
		1 OZ	1.2			
			2.98	联茂 IT158 1080 RC71% 300M/R	3.35	0.02
14		0.5OZ	1.1	Foil 0.5oz(1295mm)		
Finish Board Thickness:1mm+0.1mm/-0.1mm						

Measurement data

❖ S-parameter : Return loss & Isolation

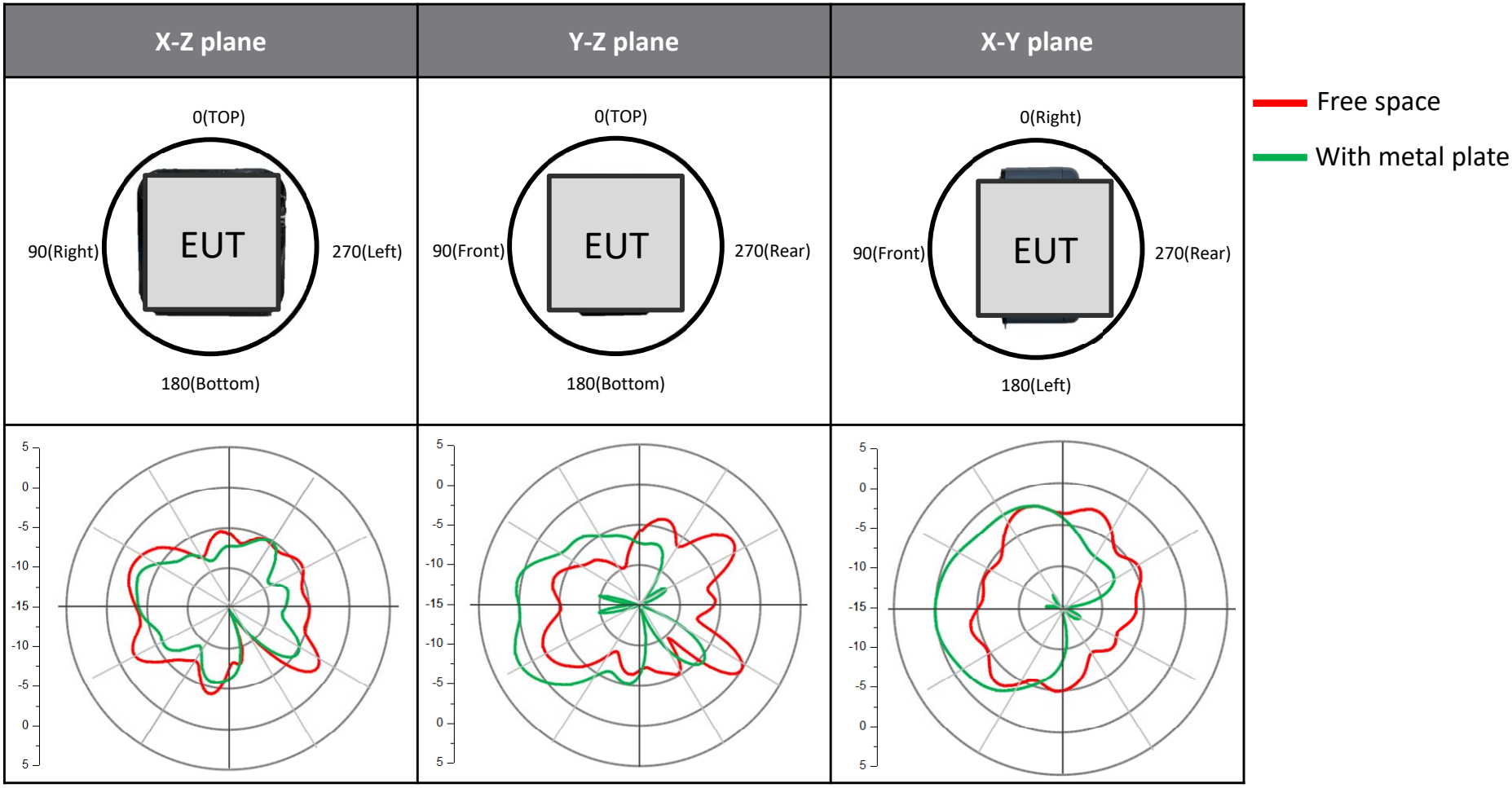


Frequency (MHz)	Wi-Fi HaLow	BT	Wi-Fi HaLow to BT
902	-11.03	--	-61.44
908	-14.73	--	-55.70
916	-16.57	--	-52.36
920	-16.76	--	-51.46
928	-13.60	--	-50.19
2400	--	-11.25	-23.84
2450	--	-10.91	-23.55
2500	--	-10.07	-23.12

Unit:dB

Measurement data

❖ Radiation pattern : HaLow 908 MHz



Measurement data (Free space)

- Gain table: (In Free space)

HaLow antenna

Frequency (MHz)	E-total (dBi)	Efficiency (%)
902	-0.3	40
908	-0.01	42
916	0.03	44
920	-0.31	42
928	-0.28	40

- Gain table: (with metal plate)

HaLow antenna

Frequency (MHz)	E-total (dBi)	Efficiency (%)
902	0.81	37
908	1.48	39
916	1.65	40
920	0.97	38
928	0.82	36

Summary

- Return loss

HaLow and BT antenna are under -10 dB.

- Efficiency

HaLow antenna has 40% up in free space and has around 36% when having the metal plate at the backside.

- Radiation

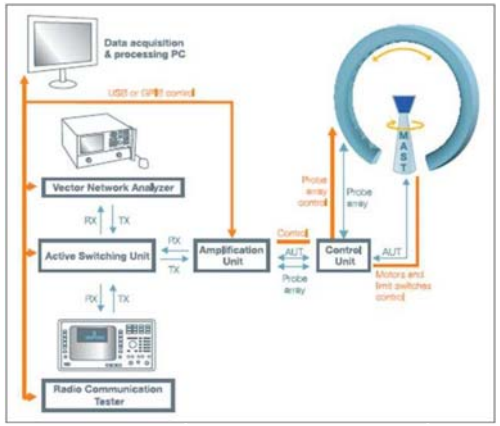
When the metal plate is in the back of the DUT , HaLow antenna radiation will be impacted by metal plate . There is null point at the backside and antenna gain would be increase in the front side.

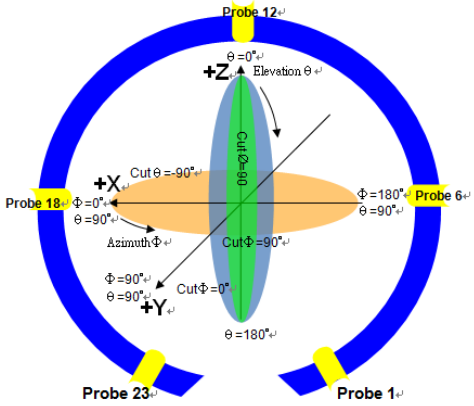
Antenna Vendor Info & Measurement Setup

- Antenna Vendor: Pegatron
- Test Date: 20240815
- Test Engineer :Angus Huang
- 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	2023/09/16	2024/09/15
Network Analyzer	Keysight E5071C	MY46212481	2024/5/16	2025/5/15

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.