Antenna Report

FCC ID: A4RGXQ96

Sep. 30 , 2024

Google LLC

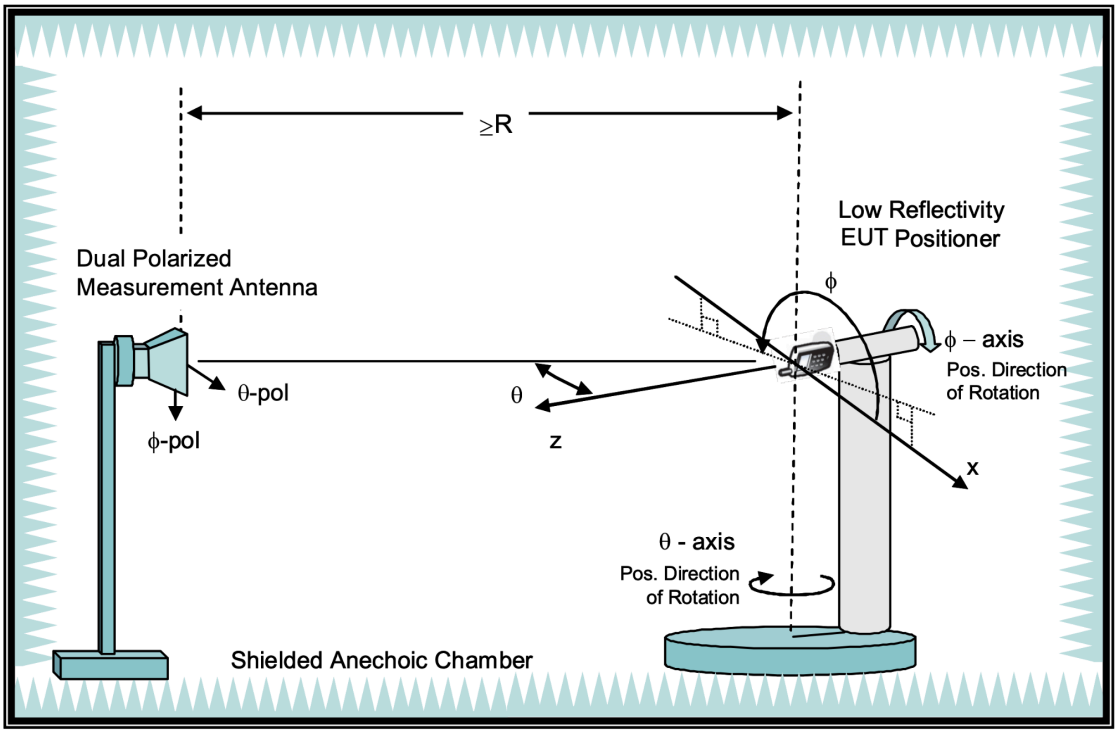
Review by: Mark Chung

1. Test Method

The antenna gains are obtained through measurements in a fully anechoic OTA chamber with a 3D positioner.

Measurements are taken in discrete steps in theta and phi direction, data is being recorded using a network analyzer (passive) for both theta and phi polarizations at each position resulting in a 3D gain pattern. Step size is <30 deg along both axes.

Gain is derived directly through spatial averaging of VNA S21 measurements (passive measurement).



R=4.9m

2. Test Equipment

Site Description	Chamber Manufacturer	Type
Great-circle	WAVEPRO	Fully Anechoic
Software Version	g.OTA Ver:1.0.80	
Site location	9F, No. 6-3, Baoqiang Rd., Xindian Dist., New Taipei City	
Prepare by	Rich Liu / Annie Chen	
Test Date	September 2024	

Description	Manufacturer	Model	Calibration Date	Due Date
Network Analyzer	Agilent	E5071C	Jun. 30, 2023	Jun. 30, 2025

3. Site Path Loss

To provide accurate antenna gain values, the chamber is calibrated with the measured path loss. The block diagram below represents the setup of the site path loss. Path loss is provided for both polarities for all WLAN frequency ranges.

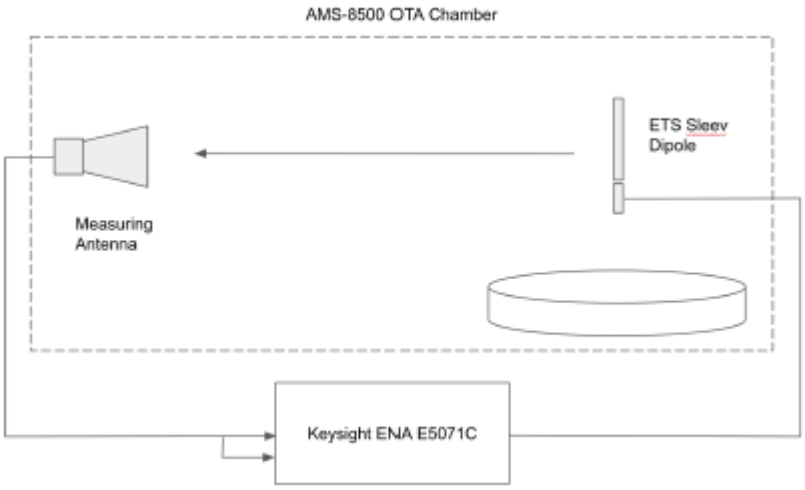


Figure: Block Diagram of Path Loss

Frequency (MHz)	H-Pol Path Loss	V-Pol Path Loss
2402	-35.5	-35.26
2412	-35.59	-35.32
2437	-35.95	-35.53
2462	-35.98	-35.63
2480	-36.09	-35.76
5150	-46.74	-47.14
5230	-43.05	-43.76
5250	-42.82	-43.23
5310	-42.49	-42.77
5340	-42.23	-42.9
5480	-42.14	-42.84
5530	-42.23	-43.28
5710	-42.68	-43.9
5795	-42.6	-43.43
5835	-42.46	-43.35
5855	-42.75	-43.9
5875	-43	-44.33

5925	-42.92	-44.45
6175	-47.48	-47.91
6425	-46.37	-45.79
6525	-45.67	-46.07
6875	-49.77	-46.85
7085	-47.62	-46.06

4. Test Setup

See separate appendix document for pictures of the test setup in this filing.

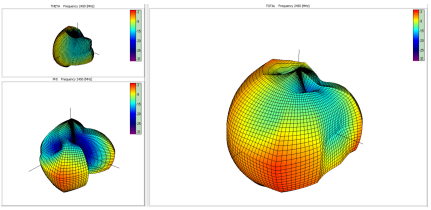
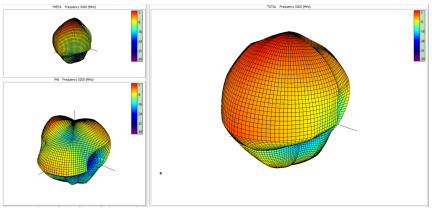
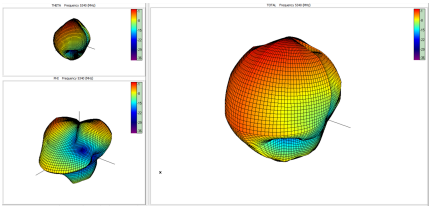
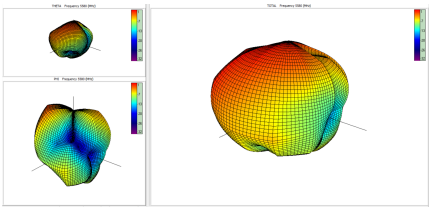
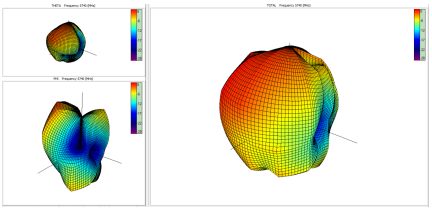
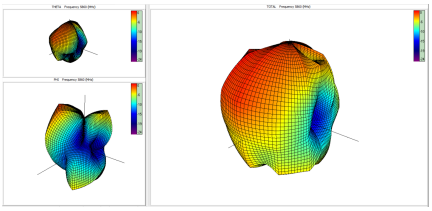
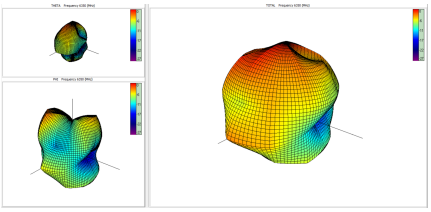
5. **Antenna Type**

Antenna	Type
Ant 3	IFA
Ant 4	IFA

6. WLAN/BT Antenna Test Data

Ant	Band	Frequency	Peak Gain(dBi)
Ant 4	WiFi/BT 2.4 GHz	2402 - 2480 MHz	-4.4
Ant 3	WiFi/BT 2.4 GHz	2402 - 2480 MHz	0.8
Ant 4	UNII-1	5200 MHz	-2.9
	UNII-2A	5340 MHz	-2.7
	UNII-2C	5580 MHz	-1.7
	UNII-3	5740 MHz	-1.8
	UNII-4	5860 MHz	-2.1
	UNII-5	6350 MHz	-1.8
	UNII-6	6450 MHz	-1.8
	UNII-7	6550 MHz	-0.9
	UNII-8	6875 MHz	-2.1
Ant 3	UNII-1	5230 MHz	-3.6
	UNII-2A	5310 MHz	-2.3
	UNII-2C	5510 MHz	-1.1
	UNII-3	5795 MHz	-3.2
	UNII-4	5855 MHz	-3.2
	UNII-5	5925 MHz	-4.9
	UNII-6	6425 MHz	-5.7
	UNII-7	6550 MHz	-2.6
	UNII-8	6920 MHz	-3.3

7. Radiation Plots for Max Gain Plane

ANT	Frequency	Pattern
ANT 4	2402 - 2480 MHz	
ANT 4	5200 MHz	
ANT 4	5340 MHz	
ANT 4	5580 MHz	
ANT 4	5740 MHz	
ANT 4	5860 MHz	
ANT 4	6350 MHz