

3D Antenna Measurement Summary Report

REPORT NO.: OR200430C01 R3

MODEL NAME: FML2.4W45A-160-MHF4L

ANTENNA TYPE: PIFA Antenna

TRADE NAME: Nissei

TESTED DATE: 2020.4.29 ~ 2020.5.19

ISSUED: 2022.11.16

APPLICANT: Hakko Electronics Co., Ltd.

ADDRESS : 890-1, Kamikashiwano-machi, Hakusan-shi, Ishikawa,
924-0035, Japan

ISSUED BY: Bureau Veritas Consumer Products Service (H.K.) Ltd.,
Taoyuan Branch Lin Kou Laboratories.

ADDRESS: No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New
Taipei City, Taiwan (R.O.C)

TEST LOCATION: No. 19, Hwa Ya 2nd rd., Kueishan, Taoyuan, Taiwan,
R.O.C.

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RELEASE CONTROL RECORD

REPORT NO.	REASON FOR CHANGE	DATE ISSUED
OR200430C01	Original release	2020.5.11
OR200430C01 R1	Add 5850MHz	2020.5.20
OR200430C01 R2	Add antenna type by Hakko Electronics Co., Ltd.	2022.3.18
OR200430C01 R3	Update antenna type, add Test engineer, Measurement Software information, Test methods and Description of the anechoic chamber	2022.11.16

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GENERAL INFORMATION

APPLICANT:	Hakko Electronics Co., Ltd.
MANUFACTURER:	Nissei Limited
MODEL NO.:	FML2.4W45A-160-MHF4L

Test Standard: ANSI/IEEE Std. 149 1979.

TEST BY : Leo Chen , DATE : 2022.11.16
Leo Chen / Engineer

PREPARED BY : Leo Chen , DATE : 2022.11.16
Leo Chen / Engineer

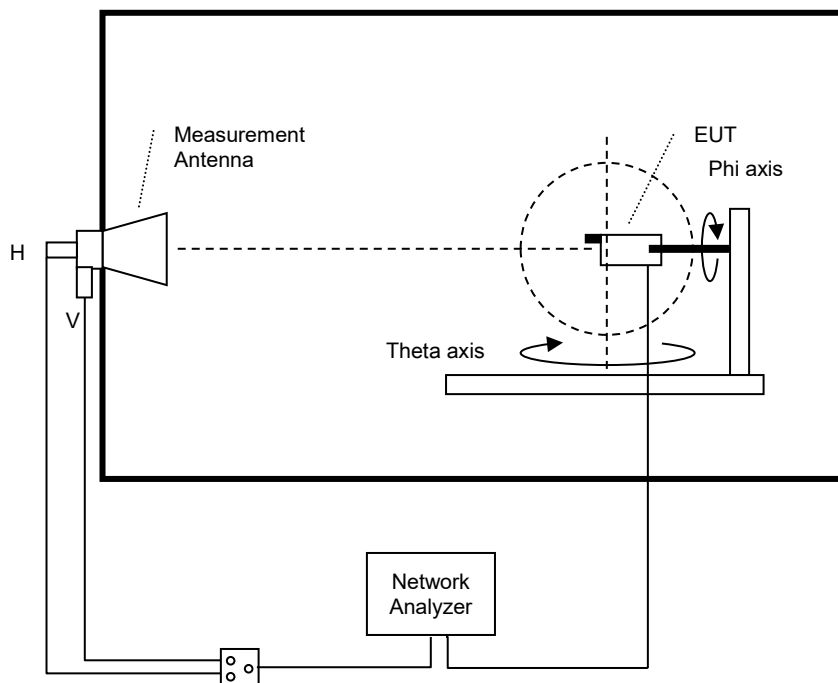
APPROVED BY : Johnny Liu , DATE : 2022.11.16
Johnny Liu / Supervisor

1. Test Methods

The Antenna Gain Test is performed according to The ANSI/IEEE Std 149 12.3.1 Antenna Gain (Small size (< 42cm) Linear Polarization Antennas), using a two-axis support device and one fixed measurement antenna. The EUT is positioned along the required MAPS centerline fixture holder. The EUT is then stepped between 0 and 180 degrees along the theta axis in 15-degree increments. At each theta position, the phi axis is stepped from 0-360 degrees in 15-degree increments. Data is recorded using the Network analyzer for both theta and phi polarizations at each position. Depending on the protocol, an appropriate filter is used in the EMQuest software to process the data. Upon completion of the test, test results (angular dependent EIRP) is calculated at each measurement point and the required value is automatically calculated. This test procedure is repeated for frequency and configuration as required.

2. Description of the anechoic chamber:

Length: 7.32 m
Width: 3.66 m
Height: 3.51 m



3. Test Equipment List

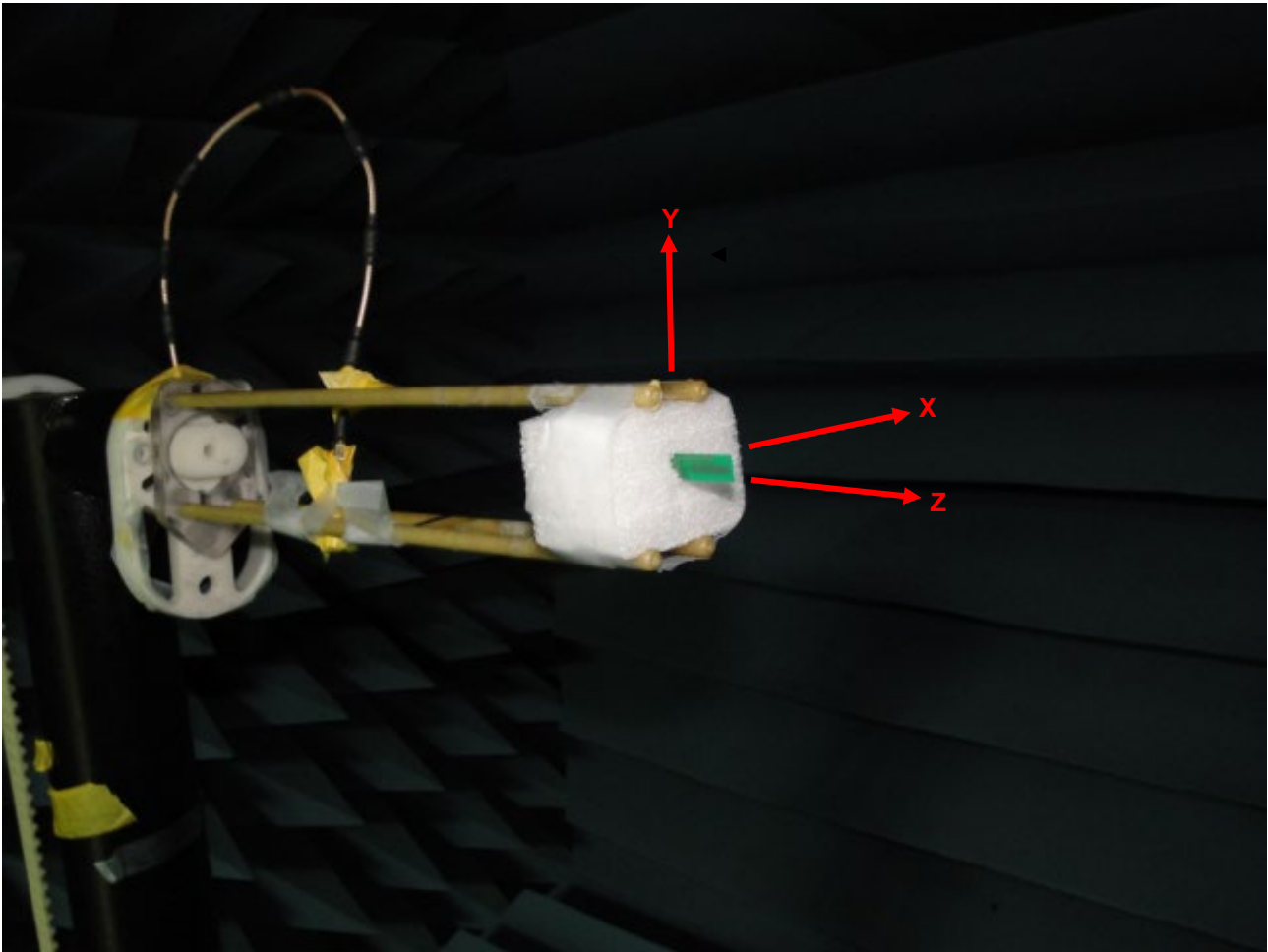
TYPE OF EQUIPMENT	MODEL NUMBER	SERIAL NUMBER	CALIBRATION DUE DATE
ETS Anechoic Chamber	AMS-8500	N/A	N/A
Measurement Software	ETS Lindgren EMQuest V1.14 build 31654	1153	N/A
Multi-Axis Positioning System	ETS 2090-OPTI	N/A	N/A
Horn Antenna	ETS 3164-06	N/A	N/A
Switch Control	Agilent 3499A	N/A	N/A
Network Analyzer	E5071C	MY46212595	2021/3/3

4. Measurement Uncertainty

Expanded Uncertainty for Measurement (k=2 or 95.45% Confidence Level) at Passive antenna test over frequency range:.

FREQUENCY RANGE	MEASUREMENT UNCERTAINTY
780~2200 MHz	1.57 dB
2200~3000 MHz	1.75 dB
3000~6000 MHz	4.17 dB

5. Testing Setup Photo



6. Antenna Radiation Performance

6.1. Peak Gain

Frequency (MHz)	2400	2450	2483.5	5150	5350	5470	5725	5825	5850
Peak Gain (dBi)	2.93	3.03	3.13	-0.52	0.26	2.91	4.94	4.45	3.43

6.2. AVG Gain

Frequency (MHz)	2400	2450	2483.5	5150	5350	5470	5725	5825	5850
Average Gain (dBi)	-2.75	-2.52	-2.26	-4.11	-3.53	-3.40	-2.59	-3.00	-4.34

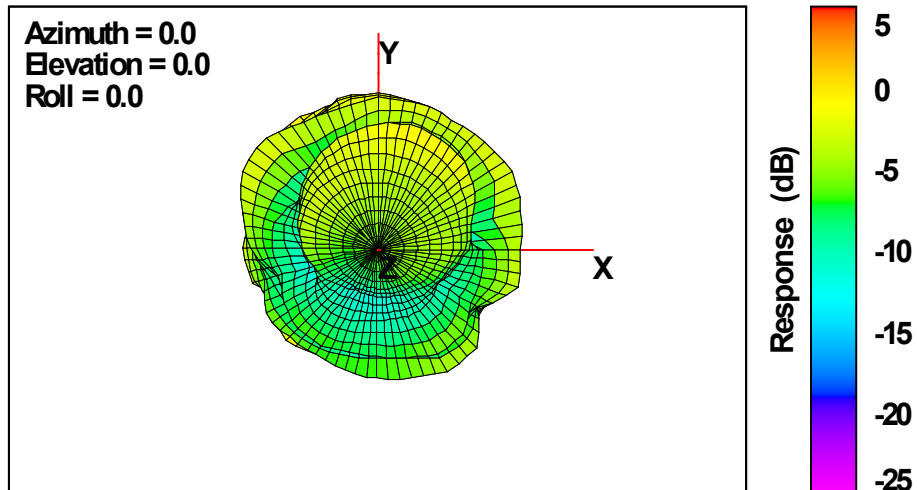
6.3. Efficiency

Frequency (MHz)	2400	2450	2483.5	5150	5350	5470	5725	5825	5850
Efficiency (%)	53.05	55.98	59.50	38.85	44.35	45.66	55.12	50.07	36.85

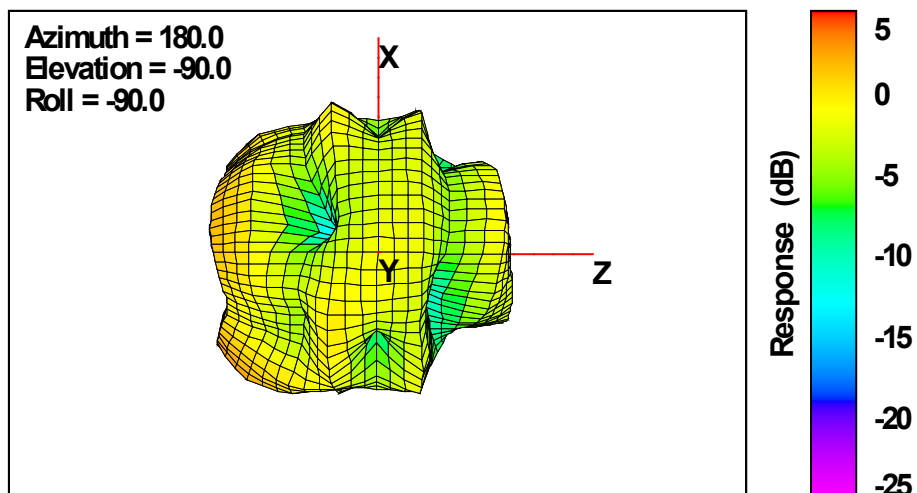
7. 3D Antenna Patterns

2400MHz

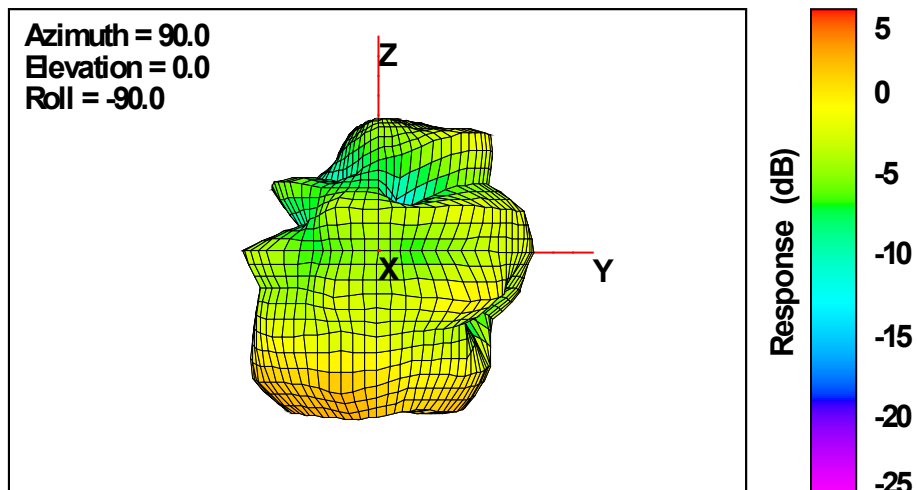
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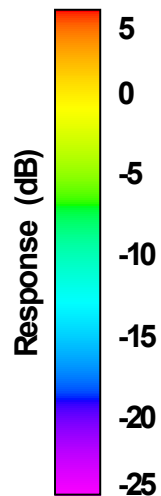
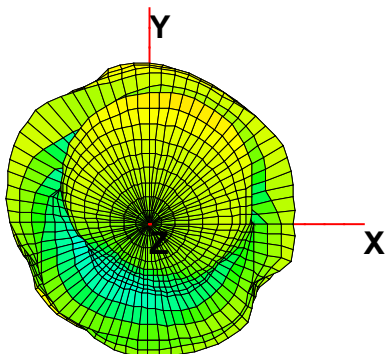




2450MHz

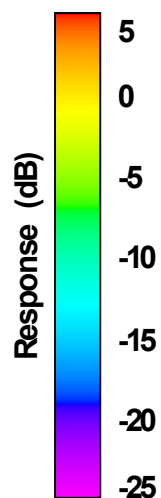
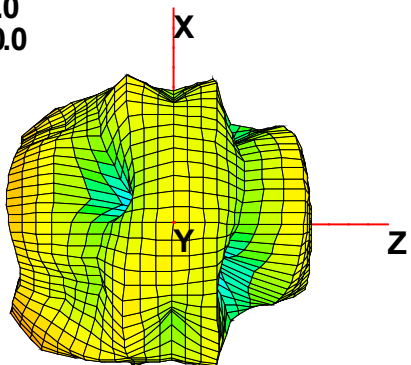
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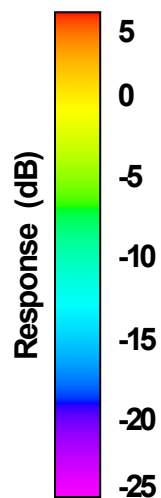
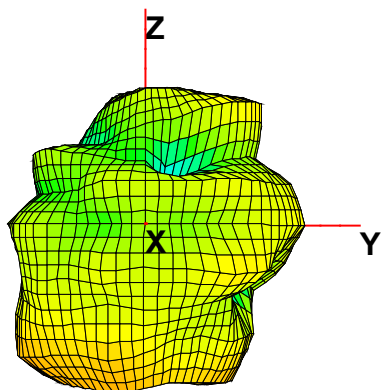
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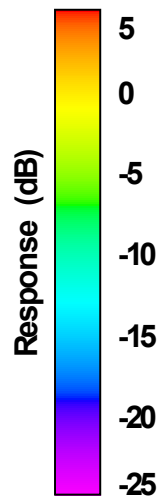
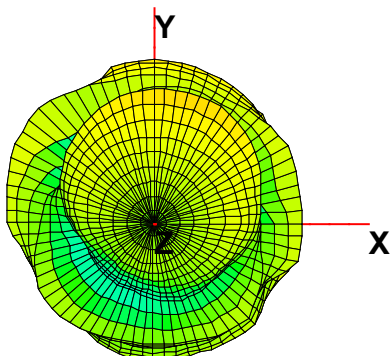




2483.5MHz

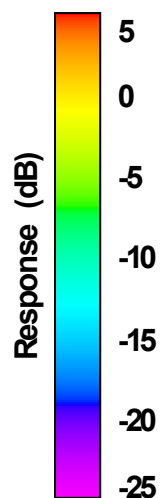
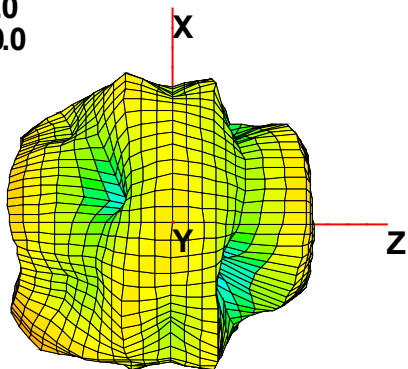
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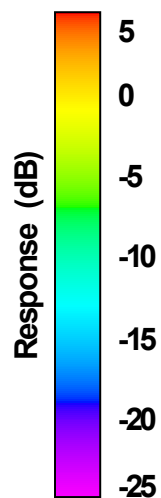
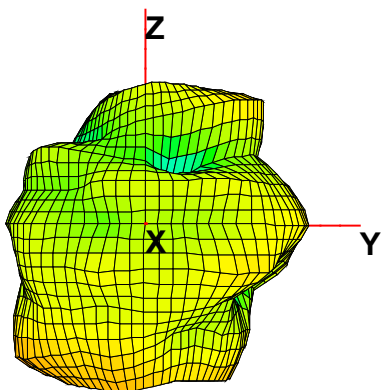
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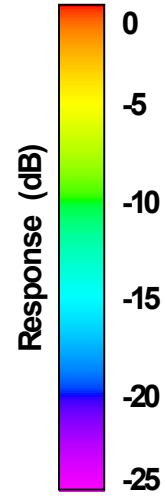
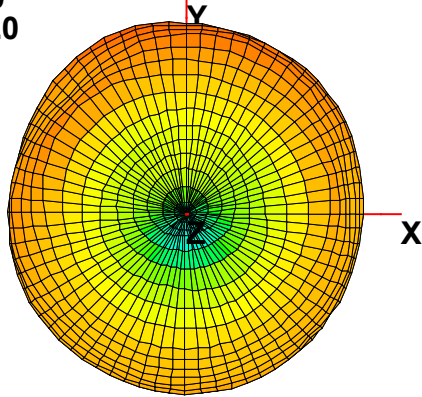




5150MHz

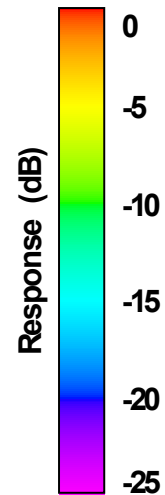
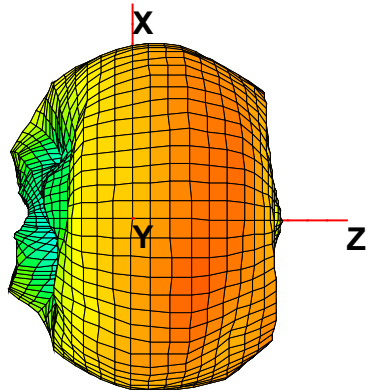
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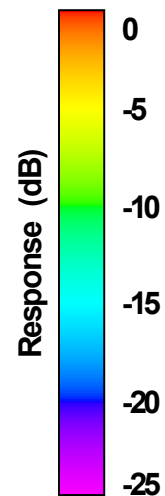
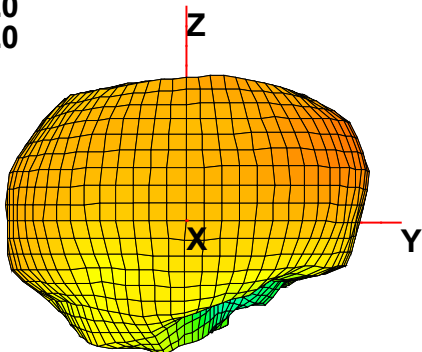
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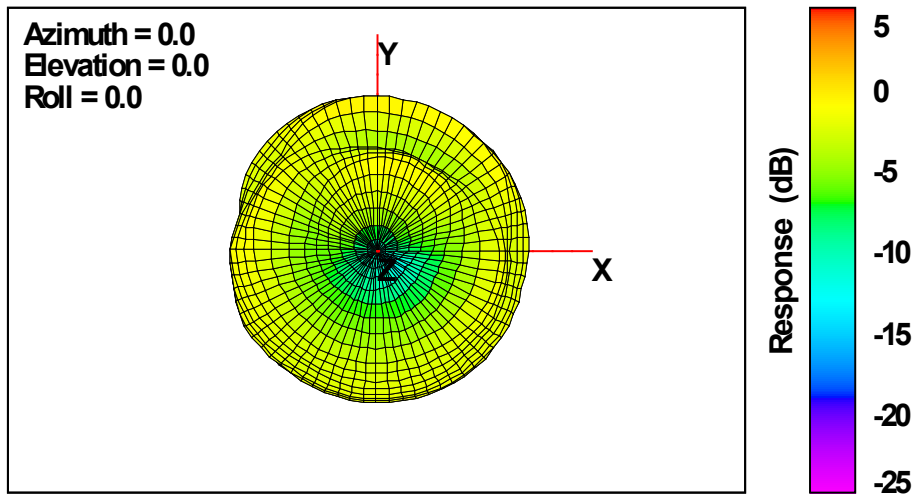
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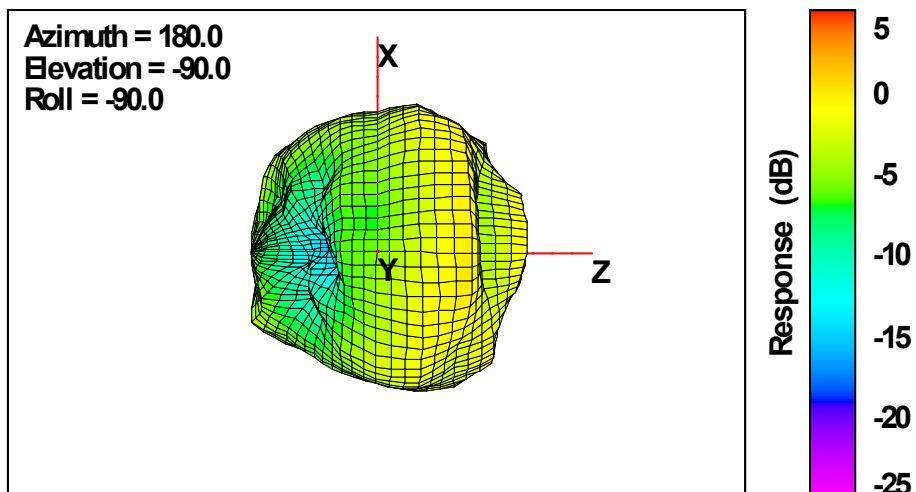


5350MHz

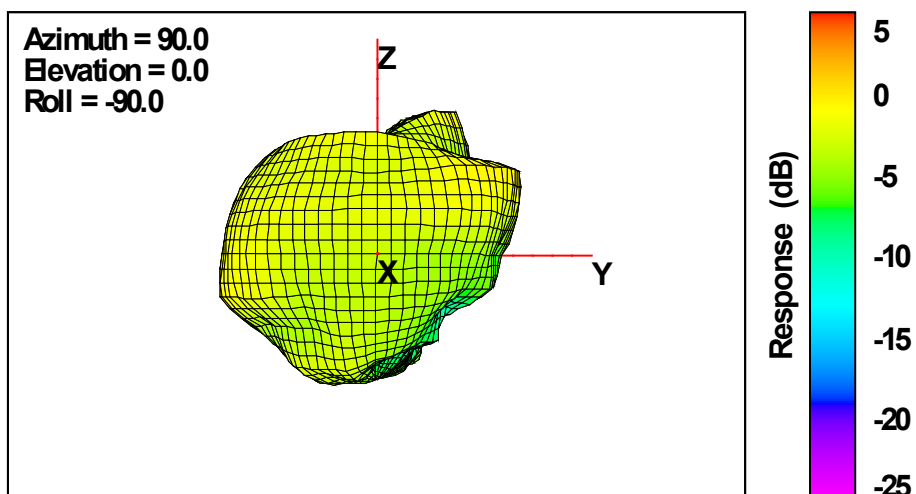
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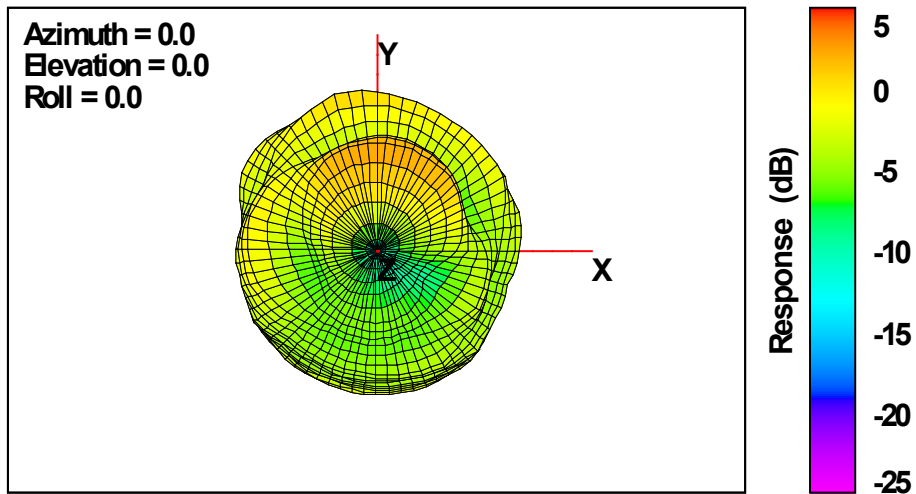


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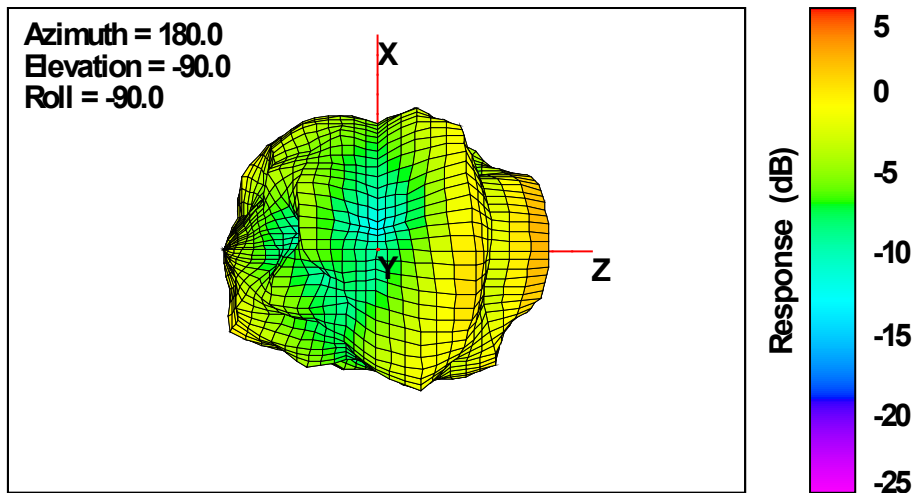


5470MHz

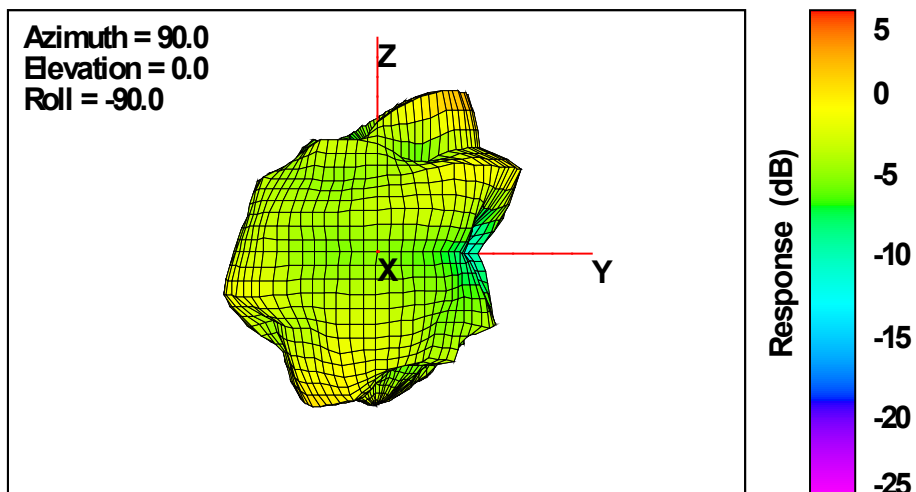
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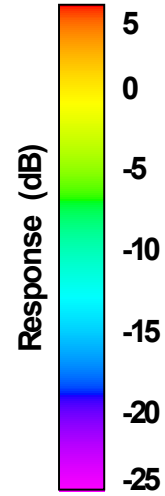
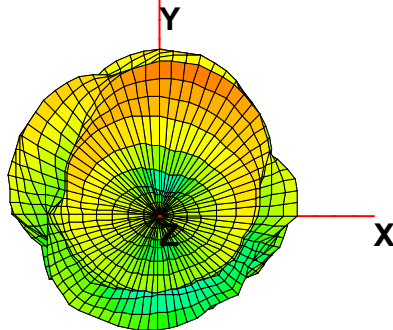




5725MHz

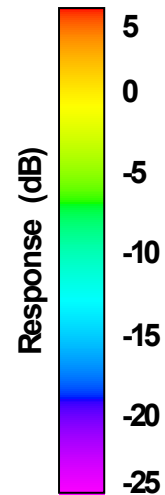
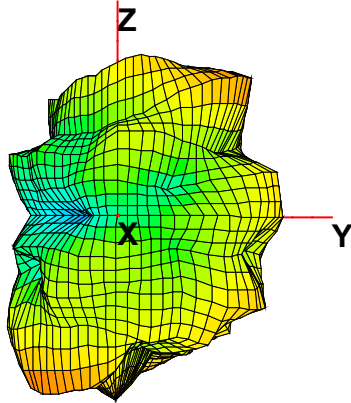
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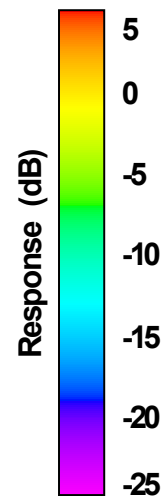
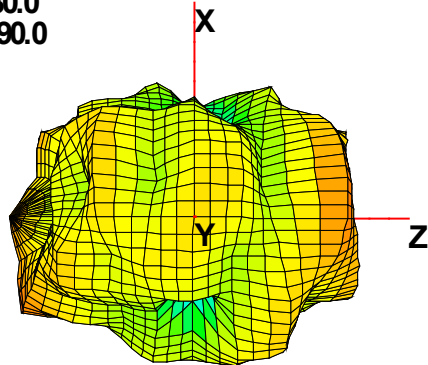
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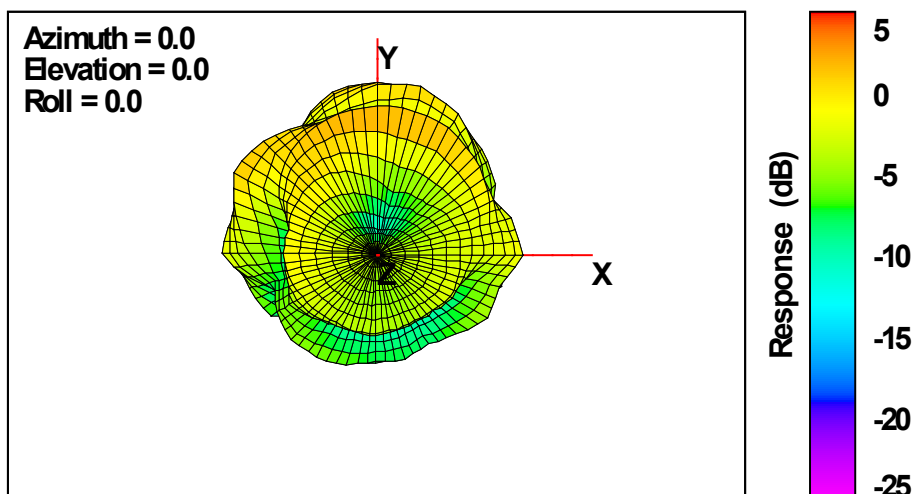
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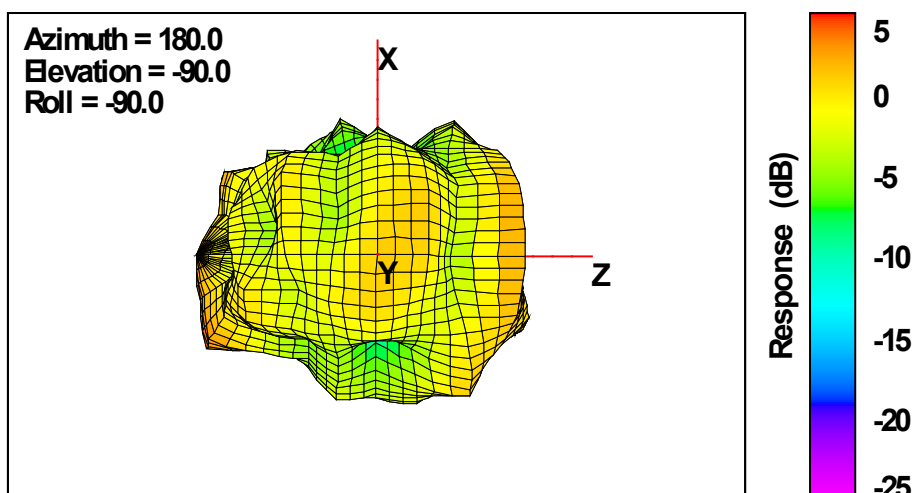


5825MHz

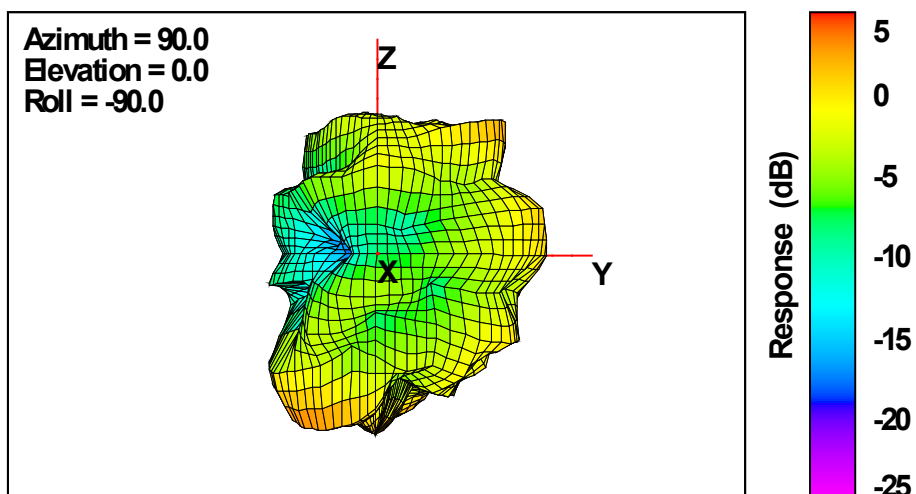
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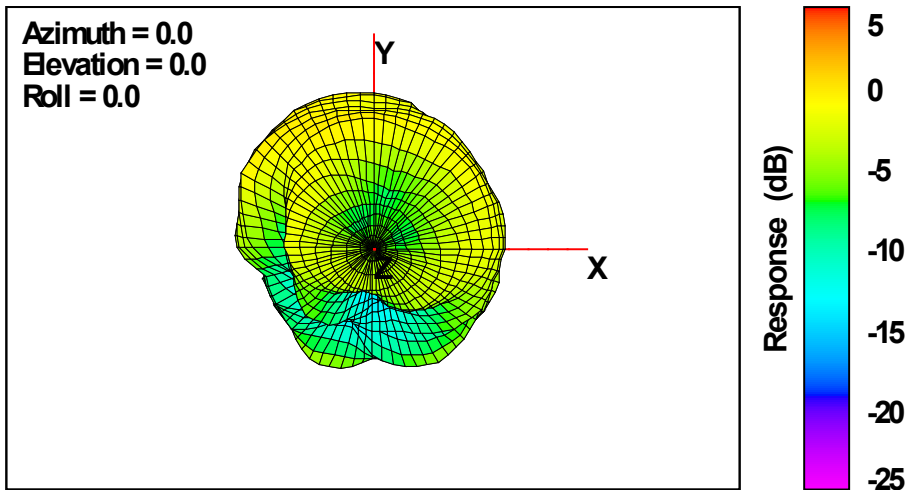


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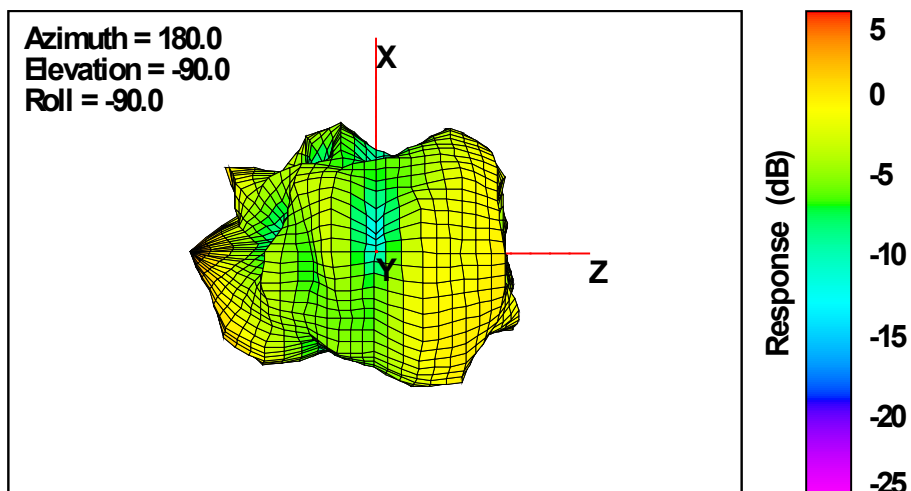


5850MHz

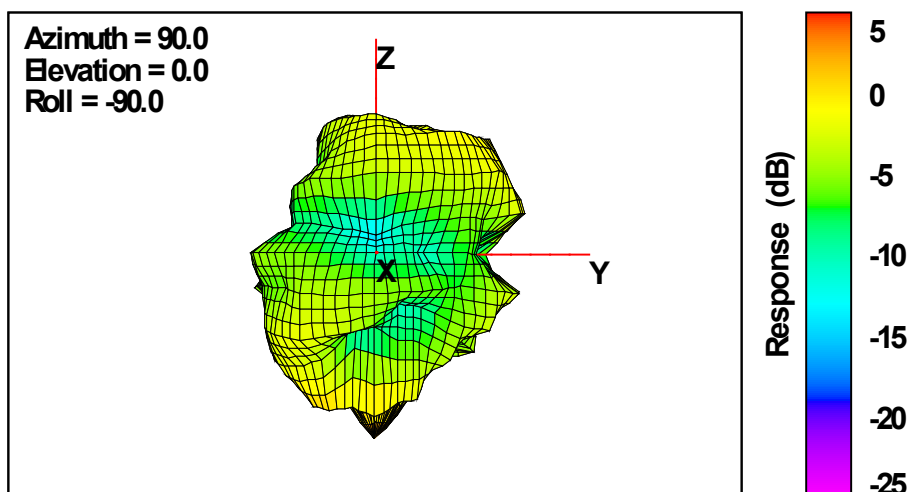
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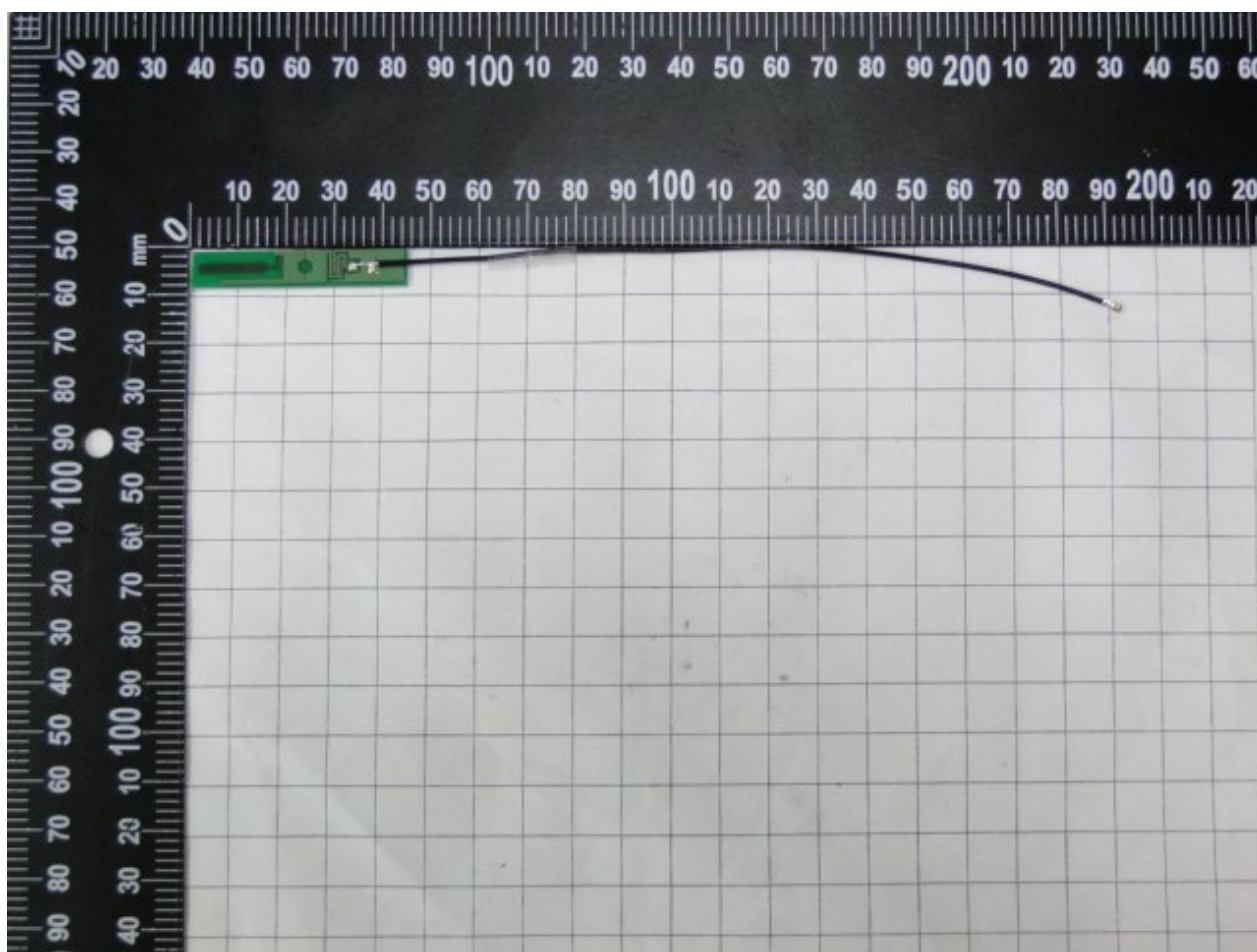
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APPENDIX. Antenna photograph



Antenna