

Test report No:
5021ERM.001A1

Antenna Gain Test report

(*) Identification of item tested	Automotive Front Passenger Display Module (FPDM)
(*) Trademark	Harman
(*) Model and /or type reference tested	FPDM WL MCA
Other identification of the product	FCC ID: 2AHPN-BE2880 IC ID: 6434C-BE2880
(*) Features	Bluetooth v4.1
Manufacturer	Harman de México, S. de R.L de C.V Av. Industria Minera 502 Parque Industrial, Queretaro, Qro, CP 76220. México.
Test method requested, standard	-
Summary	See Annex A
Approved by (name / position & signature)	Domingo Galvez EMC&RF Lab Manager
Date of issue	04-24-2025
Report template No	FDT08_23 (*) "Data provided by the client"

Index

Competences and guarantees3

General conditions3

Uncertainty3

Data provided by the client.....4

Usage of samples4

Test sample description5

Identification of the client.....6

Testing period and place.....6

Document history7

Environmental conditions7

Remarks and comments7

Testing verdicts.....8

Summary8

List of equipment used during the test.....8

Appendix A: Test results (Product Certification Antenna Test)10

Appendix B: Photographs20

Competences and guarantees

In order to assure the traceability to other national and international laboratories, DEKRA Certification Inc. has a calibration and maintenance program for its measurement equipment.

DEKRA Certification Inc. guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at DEKRA Certification Inc. at the time of performance of the test.

DEKRA Certification Inc. is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

IMPORTANT: No parts of this report may be reproduced or quoted out of context, in any form or by any means, except in full, without the previous written permission of DEKRA Certification Inc.

General conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA Certification Inc.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Certification Inc. and the Accreditation Bodies.

Uncertainty

Uncertainty (factor $k=2$) was calculated according to the DEKRA Certification Inc. internal document PODT000.

Test Case	U ($k=2$)	Units
Passive Antenna Min/Average/Max Gain	3.30	dB

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").
2. The sample consists of a device which is intended to be installed in a passenger vehicle and powered by the vehicle's main battery. The device is an original equipment manufacturer (OEM) application and is installed by the OEM during vehicle assembly. Device is not available by normal means in the consumer market. This device is a stylized display module for use by the front seat passenger and includes a Bluetooth radio for connecting to headphones with Bluetooth capability.

DEKRA declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Usage of samples

Samples used for the test have been selected by: The client

Sample S/01 is composed of the following elements, accessories and auxiliary equipment:

Id	Control Number	Description	Manufacturer / Model	Serial N°	Date of Reception	Application
S/01	4382/03	FPDM(Radiated)	Harman / MY 25	T00141944E0012	2024-10-21	Element Under Test
S/01	4382/08	Ethernet to USB	Harman / MY 25	-	2024-10-21	Accessory
S/01	4382/10	RI Module	Harman / MY 25	-	2024-10-21	Accessory
S/01	4382/12	PCB Board	Harman / MY 25	-	2024-10-21	Accessory
S/01	4382/15	RI Harness	Harman / MY 25	-	2024-10-21	Accessory
S/01	4382/15	FPDM Harness	Harman / MY 25		2024-10-21	Accessory

Sample S/01, was used for the following test(s): All Radiated tests indicated in appendix A.

Test sample description

Ports..... :	Port name and description		Cable				
			Specified length [m]	Attached during test	Shielded	Coupled to patient	
	No Data Provided			☐	☐	☐	
				☐	☐	☐	
				☐	☐	☐	
				☐	☐	☐	
				☐	☐	☐	
Supplementary information to the ports..... :	No Data Provided						
Rated power supply..... :	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	☐	AC:	☐	☐	☐	☐	☐
	☐	AC:	☐	☐	☐	☐	☐
	☒	DC: 14V nominal, 9V to 16V max					
☐	DC:						
Rated Power..... :	9-16 DC, 5A max						
Clock frequencies..... :	No Data Provided						
Other parameters..... :	No Data Provided						
Software version..... :	No Data Provided						
Hardware version..... :	DV						
Dimensions in cm (W x H x D)..... :	609mm (H) x 135mm (W) x 70mm						
Mounting position..... :	☐	<i>Table top equipment</i>					
	☐	<i>Wall/Ceiling mounted equipment</i>					
	☐	<i>Floor standing equipment</i>					
	☐	<i>Hand-held equipment</i>					
	☒	<i>Other: Display module for use by the front seat passenger</i>					
Modules/parts..... :	Module/parts of test item		Type		Manufacturer		
	No Data Provided						
Accessories (not part of the test item)..... :	Description		Type		Manufacturer		
	FPDM Power Harness						
	P-CAN Adapter						
	OABR Board						
	LAN cable With USB 2.0 to Fast Ethernet Adapter						
	-						
	-						

Identification of the client

Testing period and place

Test Location	DEKRA Certification Inc.
Date (start)	02-14-2025
Date (finish)	02-18-2025

Document history

Report number	Date	Description
5021ERM.001	04-08-2025	First release.
5021ERM.001A1	04-24-2025	Second release. Corrected the frequency in page 18. This Modified test report cancels and replaces the test report 5021ERM.001.

Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 30 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

In the semi anechoic chamber, the following limits were not exceeded during the test.

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 30 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

In the chamber for conducted measurements, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 30 % Max. = 60 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

Remarks and comments

The tests have been performed by the technical personnel: Yuqi Wang, Yuri Barone and Koji Nishimoto.

Internal procedure (PERMUSA404) was used to perform the antenna gain tests.

Testing verdicts

Not applicable :	N/A
Pass :	P
Fail :	F
Not measured :	N/M

Summary

Report Section	Product Certification Antenna Test
	Requirement – Test case
A.1	5.1 Passive Antenna Max Gain

List of equipment used during the test

1. Equipment used for Product Certification Antenna Test

CONTROL NUMBER	DESCRIPTION	MANUFACTURER	MODEL	LAST CALIBRATION	NEXT CALIBRATION	CERTIFICATION NUMBER
0018	Spectrum Analyzer	Agilent SA	N9010A	10-04-2024	10-04-2026	HCT2024A02072
0019	Switch/Control System	Agilent	3499C	N/A	N/A	N/A
0030	Positioning Controller	ETC EMCO	2090	N/A	N/A	N/A
0033	Anechoic Chamber	ETS-LINDGREN	AMS-8500	N/A	N/A	N/A
1006	Signal Generator	Rohde & Schwarz	SMC100A	02-20-2024	02-20-2026	HCT2024A01288
1296	Spiral Antenna	ETS LINDGREN	3102L	N/A	N/A	N/A

Appendix A: Test results (Product Certification Antenna Test)

Appendix A Content

PRODUCT INFORMATION 12

SECTION A.1: Passive Antenna Min/Average/Max Gain 13

Appendix B: Photographs 20

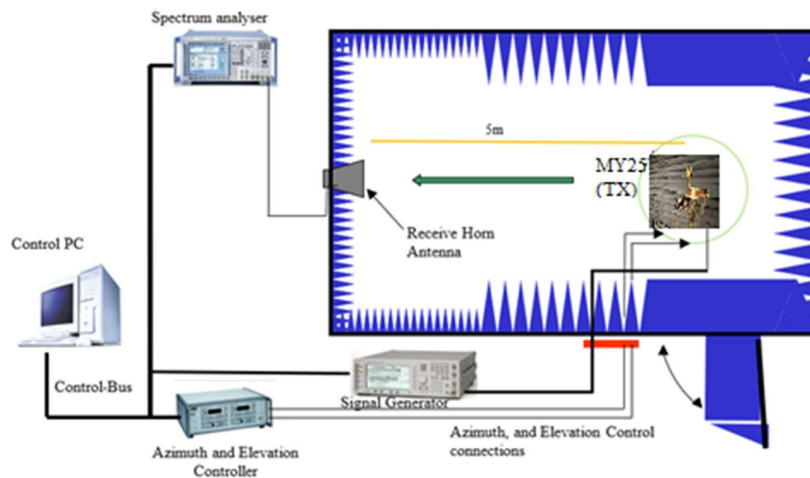
PRODUCT INFORMATION

The following information is provided by the supplier

Information	Description
Modulation	GFSK, $\pi/4$ -DQPSK, 8-DPSK
Operation mode 1:	
Operating Frequency Range	2402MHz - 2483.5MHz (Basic Rate EDR with 3 Mbps Baud rate over UART)
Nominal Channel Bandwidth	962.0 kHz
RF Output Power	0.0068 W
Antenna type	non-removable Internal PCB trace antenna
Antenna gain	---
Nominal Voltage	
- Supply Voltage	12 Vdc
- Type of power source	DC power supply
Equipment type	Bluetooth Classic

SECTION A.1: Passive Antenna Min/Average/Max Gain

Test Case ID:	Harman MY25 Non-removable Internal PCB trace antenna
Test Condition TC 01	<u>Modulation:</u> GFSK <u>Test Frequency for Antenna tests:</u> Channel 2402 MHz All measurements shall be done at room temperature.
Test Condition TC 02	<u>Modulation:</u> GFSK <u>Test Frequency for Antenna tests:</u> Channel 2441 MHz All Gain measurements shall be done at room temperature.
Test Condition TC 03	<u>Modulation:</u> GFSK <u>Test Frequency for Antenna tests:</u> Channel 2480 MHz All Gain measurements shall be done at room temperature.
TEST SETUP:	



Test set up for Test case 5.1

The following measurement shows the pure antenna gain without including any cable losses.
Internal procedure (PERMUSA404) was used to perform the antenna gain tests.

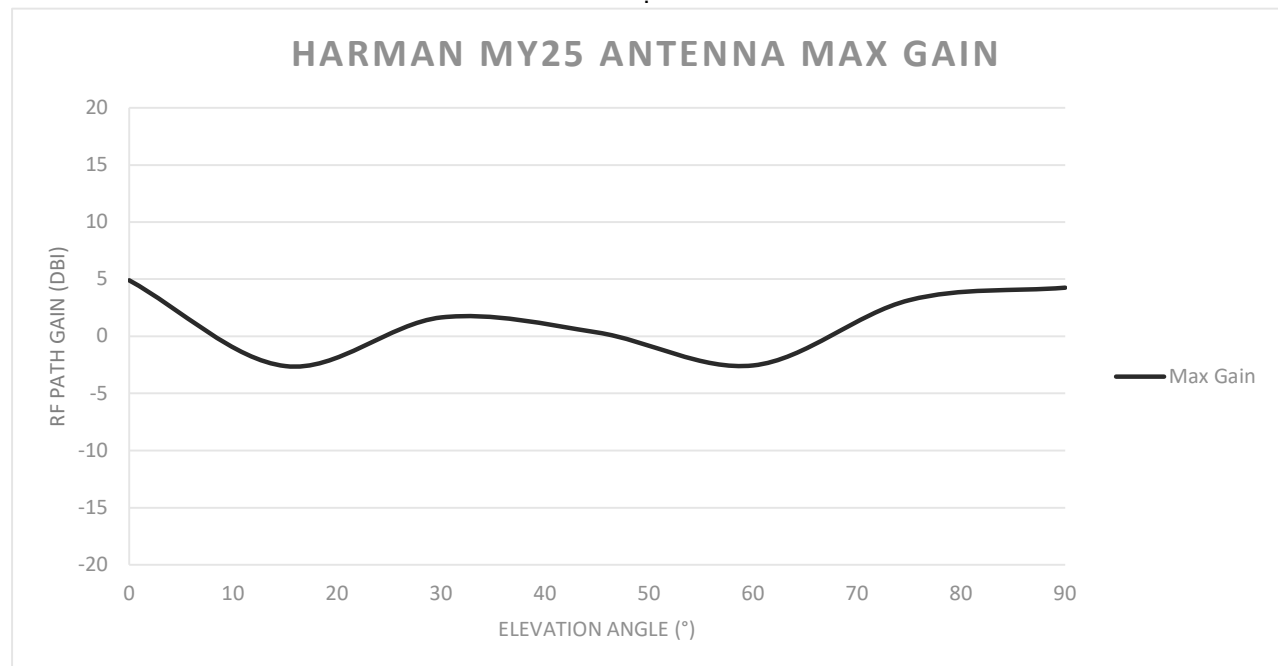
TESTED SAMPLES:	S/01
TESTED CONDITIONS MODES:	TC#01
TEST RESULTS:	PASS

Frequency: 2402 MHz

Elevation Angle: 0 to 90°: Whereas 90° is towards RX antenna.

Azimuth Angle: -180 to 180°

Detector: + Peak



Antenna Gain (dBi)	Elevation Angle (°)						
	0	15	30	45	60	75	90
Max	4.91	-2.61	1.65	0.35	-2.55	3.18	4.26

TEST RESULTS (Cont.):

Theta Angle (°)	0	15	30	45	60	75	90
Azimuth Phi Angle (°)	Gain (dBi)	Gain (dBi)	Gain (dBi)	Gain (dBi)	Gain (dBi)	Gain (dBi)	Gain (dBi)
0	-1.41	-10.68	-1.84	-8.97	-8.17	0.79	-1.88
10	-1.04	-9.97	-8.24	-7.89	-3.95	0.34	3.30
20	-0.63	-8.99	-6.51	-7.01	-6.33	-5.59	-3.23
30	4.89	-5.13	-2.80	-1.05	-5.47	-6.11	3.28
40	3.62	-3.67	-5.75	-5.90	-5.88	-3.93	-2.98
50	4.51	-4.25	-1.82	0.35	-6.68	3.18	3.10
60	4.25	-4.05	-6.01	-4.26	-7.97	-3.66	-3.18
70	3.86	-3.99	-0.56	0.15	-7.41	0.76	-4.69
80	3.89	-5.44	-1.64	-4.14	-6.21	-4.49	-2.45
90	4.35	-6.36	1.38	-4.56	-4.81	-1.16	3.93
100	-1.02	-5.17	0.47	-5.22	-4.66	-2.84	3.65
110	4.51	-8.94	0.21	-0.76	-6.63	0.69	3.12
120	-1.48	-10.22	-5.27	-7.55	-7.08	0.91	-4.77
130	4.42	-3.92	-4.64	-4.91	-4.20	-1.74	-2.31
140	-1.62	-8.28	0.37	-3.65	-4.11	-1.58	3.48
150	3.66	-2.61	0.78	-0.65	-7.57	-5.60	4.26
160	-2.61	-8.55	1.65	-0.72	-7.99	-5.59	-1.41
170	2.92	-2.72	0.90	-1.29	-7.66	-0.58	-1.18
180	2.18	-8.87	-8.42	-7.43	-10.08	0.33	-2.90
190	4.71	-3.35	-2.90	-1.57	-6.78	1.16	3.79
200	4.91	-4.10	1.62	-6.85	-8.58	-5.25	-3.37
210	-8.58	-3.44	-4.61	-0.51	-8.19	-4.21	3.19
220	-2.29	-8.59	0.43	-0.52	-7.92	-4.80	-2.72
230	-9.10	-3.36	-6.29	-1.12	-6.93	1.29	3.48
240	-1.04	-9.22	-2.27	-6.58	-9.00	-3.87	-1.60
250	4.21	-4.46	-7.24	-9.31	-7.26	1.14	-2.97
260	4.48	-11.96	-1.00	-7.14	-8.16	-4.59	4.08
270	-0.94	-10.52	-9.76	-1.25	-4.69	1.47	3.33
280	-9.72	-10.72	-1.65	-1.55	-7.50	-3.61	-1.04
290	-9.00	-5.40	-5.21	-6.74	-4.78	-5.03	3.83
300	3.25	-10.46	1.02	-3.62	-2.55	-0.15	-5.14
310	-2.27	-6.73	0.53	-2.17	-2.60	0.57	3.08
320	3.41	-8.37	-6.57	-3.54	-4.39	-5.25	-2.77
330	-2.07	-4.21	-4.23	-1.47	-5.71	1.63	2.90
340	-8.10	-7.93	-4.14	-6.29	-11.69	-5.22	-2.98
350	-2.65	-3.89	-4.07	-0.97	-10.78	2.30	2.85
360	1.93	-4.62	0.81	-7.00	-9.59	-2.27	-1.32

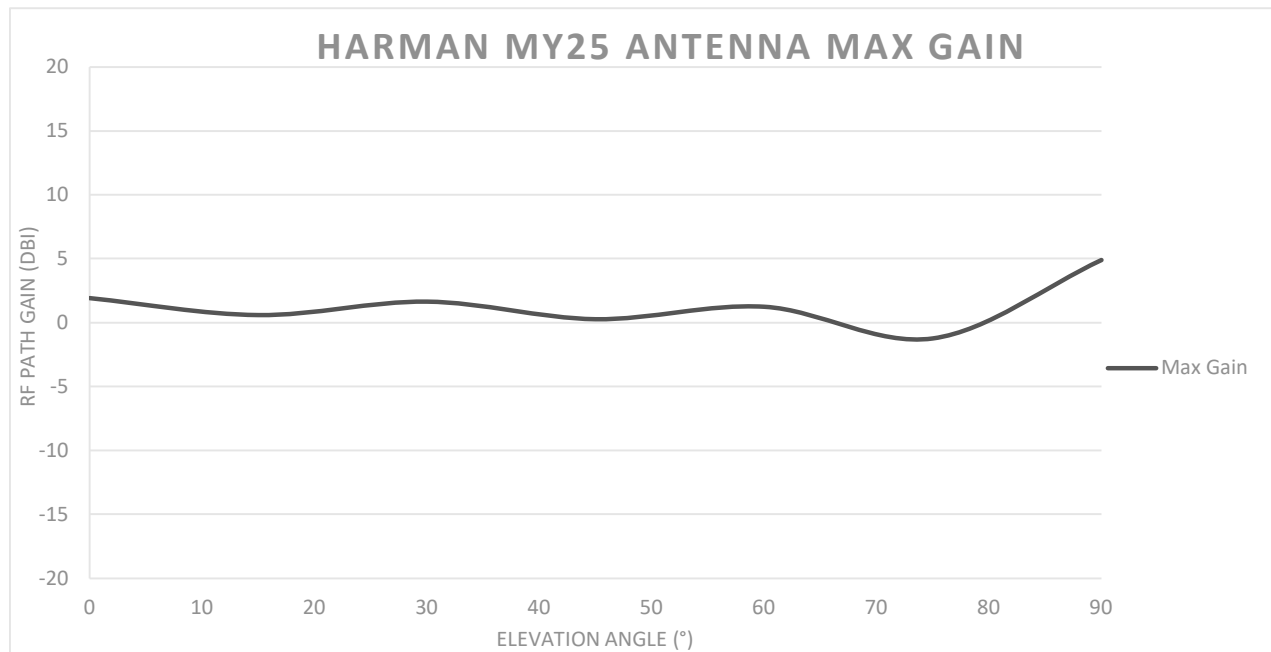
TESTED SAMPLES:	S/01
TESTED CONDITIONS MODES:	TC#02
TEST RESULTS:	PASS

Frequency: 2441 MHz

Elevation Angle: 0 to 90°: Whereas 90° is towards RX antenna.

Azimuth Angle: -180 to 180°

Detector: + Peak



Antenna Gain (dBi)	Elevation Angle (°)						
	0	15	30	45	60	75	90
Max	1.91	0.59	1.65	0.27	1.25	-1.23	4.89

TEST RESULTS (Cont.):

Theta Angle (°)	0	15	30	45	60	75	90
Azimuth Phi Angle (°)	Gain (dBi)	Gain (dBi)	Gain (dBi)	Gain (dBi)	Gain (dBi)	Gain (dBi)	Gain (dBi)
0	-11.72	-4.06	-0.07	-1.41	-9.25	-8.15	4.32
10	-10.10	-5.18	-0.87	-0.73	-0.58	-2.24	3.71
20	-1.16	-2.71	0.02	-1.65	-0.41	-2.08	-6.00
30	-0.34	-1.34	0.65	-7.05	-0.10	-2.77	4.88
40	-0.40	-0.49	0.97	-2.75	-6.60	-4.15	-5.89
50	-4.94	-0.97	-4.37	-11.11	-0.43	-5.60	4.62
60	-0.48	-3.32	1.58	-2.12	-6.39	-1.90	4.22
70	-5.36	-1.88	-4.34	-4.05	-0.02	-1.81	3.80
80	0.41	-8.22	0.77	-2.44	0.58	-3.00	3.65
90	-6.51	-6.70	-4.82	-5.94	-0.75	-1.61	4.50
100	0.70	-6.93	-0.16	-2.71	-3.94	-1.47	4.14
110	-6.58	-0.11	-0.55	-3.87	0.29	-5.46	4.40
120	1.52	-0.51	-0.64	-3.77	1.15	-4.68	-1.61
130	1.91	0.32	0.06	-4.29	1.25	-1.23	-1.08
140	1.52	-11.93	-0.36	-3.63	-2.59	-2.33	-0.96
150	-4.81	0.09	-6.07	-4.81	-5.05	-8.27	4.69
160	-5.87	0.59	-0.56	-4.57	-4.88	-5.74	4.62
170	-7.73	0.49	-0.65	-5.81	-0.45	-5.73	4.38
180	-0.49	-8.99	0.20	-8.38	-14.08	-5.10	4.01
190	0.04	-0.88	-5.15	-9.15	-0.90	-3.80	2.25
200	-0.72	-1.08	0.08	-3.59	-13.79	-3.03	3.60
210	-0.75	-0.85	1.10	-12.26	-0.94	-5.43	-4.86
220	-11.08	-0.98	1.65	-3.58	-1.17	-3.63	4.14
230	-0.27	-3.09	1.60	-9.28	-1.80	-2.91	-1.93
240	-0.50	-14.10	0.20	-1.93	-0.91	-5.59	-3.45
250	-0.14	-12.27	-6.00	-1.88	-6.37	-5.19	3.97
260	-5.76	0.34	-4.82	-0.23	-6.27	-2.01	4.01
270	-0.63	0.02	0.62	-0.59	-5.05	-4.14	3.86
280	-8.40	-0.80	-0.19	-2.32	-0.87	-3.84	3.54
290	-0.62	-15.03	0.08	-7.21	-2.79	-4.47	-1.47
300	-1.01	-6.53	-5.20	-5.39	-2.20	-3.10	4.61
310	-2.06	-8.07	-0.98	-1.90	-1.75	-2.67	4.79
320	-2.52	-3.27	-1.30	0.24	-0.35	-4.66	4.89
330	-2.51	-2.94	-0.56	0.27	-1.23	-6.87	-1.50
340	-2.20	-2.13	-1.54	-1.10	-1.99	-3.51	3.64
350	-2.74	-8.80	-0.80	-1.44	-6.36	-3.62	-3.24
360	-8.60	-3.13	-6.41	-2.12	0.03	-4.29	4.79

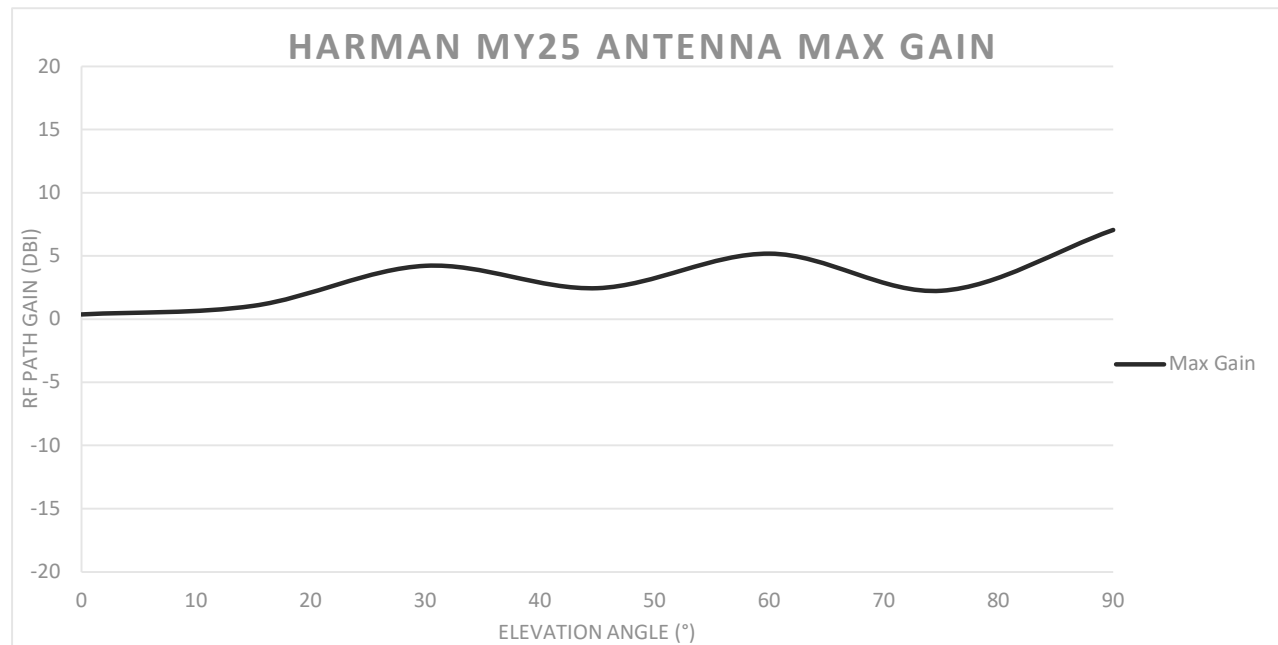
TESTED SAMPLES:	S/01
TESTED CONDITIONS MODES:	TC#03
TEST RESULTS:	PASS

Frequency: 2480 MHz

Elevation Angle: 0 to 90°: Whereas 90° is towards RX antenna.

Azimuth Angle: -180 to 180°

Detector: + Peak



Antenna Gain (dBi)	Elevation Angle (°)						
	0	15	30	45	60	75	90
Max	0.37	1.05	4.22	2.45	5.18	2.24	7.06

TEST RESULTS (Cont.):

Theta Angle (°)	0	15	30	45	60	75	90
Azimuth Phi Angle (°)	Gain (dBi)	Gain (dBi)	Gain (dBi)	Gain (dBi)	Gain (dBi)	Gain (dBi)	Gain (dBi)
0	-7.26	-3.89	3.45	-6.37	3.60	-7.69	5.00
10	-4.49	-11.72	-12.42	-1.54	2.26	-5.26	3.00
20	-9.92	-4.15	3.22	-1.61	-7.69	-6.56	-6.29
30	-2.58	0.67	3.89	-0.13	1.96	-3.25	4.85
40	-3.74	-1.77	4.22	-7.93	4.17	-4.06	4.61
50	-5.97	-3.82	3.57	-0.77	3.62	-6.20	5.34
60	-0.71	-3.16	-8.47	-5.46	4.30	-4.34	6.48
70	-4.18	1.05	-6.05	-1.05	0.69	-9.89	-1.68
80	0.37	-2.87	1.12	1.77	2.34	-1.29	2.25
90	-2.17	1.01	3.12	2.45	3.98	2.03	6.47
100	-2.98	-5.41	2.05	-4.72	4.71	2.24	3.06
110	-0.58	-9.71	-15.97	-1.10	-5.39	-6.08	6.60
120	-7.29	-1.00	-15.19	-15.15	2.52	-1.71	3.40
130	-7.18	-11.86	1.95	-0.99	2.33	1.22	7.06
140	-2.47	-1.02	0.98	-2.38	4.82	1.02	4.30
150	-4.52	-10.01	3.01	-0.27	3.89	-6.55	6.05
160	-1.13	-0.36	-5.02	-6.78	1.54	-0.57	-1.98
170	-2.41	-0.63	-5.87	-8.28	2.78	-4.83	-1.79
180	-10.15	-16.53	2.61	-2.22	1.20	-0.23	5.82
190	-3.36	-1.22	2.03	-2.41	3.32	-0.04	6.60
200	-2.57	-8.22	2.74	-1.67	2.04	-9.54	4.86
210	-2.30	-3.16	-12.03	-11.58	1.93	-5.45	-6.50
220	-8.86	-0.46	-12.91	-11.19	1.96	-5.21	-4.74
230	-7.95	-0.28	1.40	0.50	1.16	-0.29	2.67
240	-3.03	-5.64	1.22	1.28	2.64	-1.71	5.96
250	-1.89	-0.04	-12.22	-6.11	3.76	-1.65	2.87
260	-2.74	-11.56	1.07	1.01	-5.84	-5.54	-4.45
270	-2.85	-2.38	-10.59	-7.08	1.59	-5.24	2.99
280	-10.13	-3.79	2.31	-0.35	4.39	-3.73	6.35
290	-1.06	-3.19	3.04	-3.19	1.53	-4.49	3.07
300	-4.59	-7.82	1.35	1.31	4.78	-5.28	5.23
310	-2.20	-7.25	3.54	-1.96	1.87	-2.44	-3.39
320	-3.14	-4.43	1.64	2.10	5.18	-4.28	5.32
330	-6.02	-16.21	1.53	-0.72	1.35	-5.20	2.93
340	-2.90	-3.14	1.28	-12.23	4.39	-6.55	4.32
350	-3.82	-10.67	-3.78	-3.66	-8.90	-6.62	4.94
360	-4.44	-7.56	2.82	-6.05	3.40	-7.24	3.25

Appendix B: Photographs

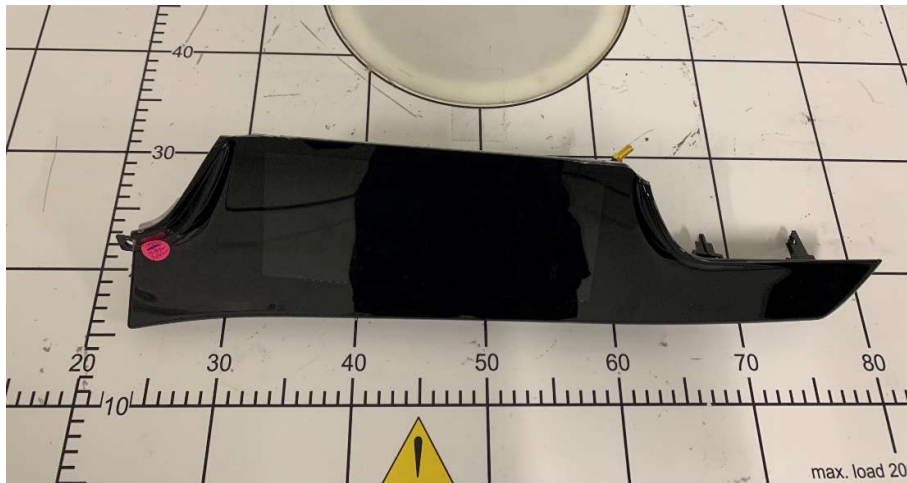


Figure B1: Top View of DUT

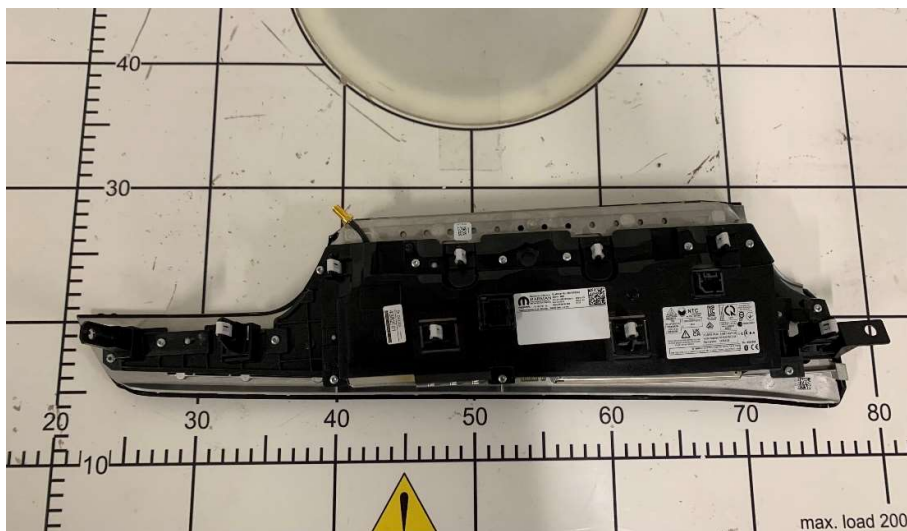


Figure B2: Bottom View of DUT



Figure B3: Side View of DUT

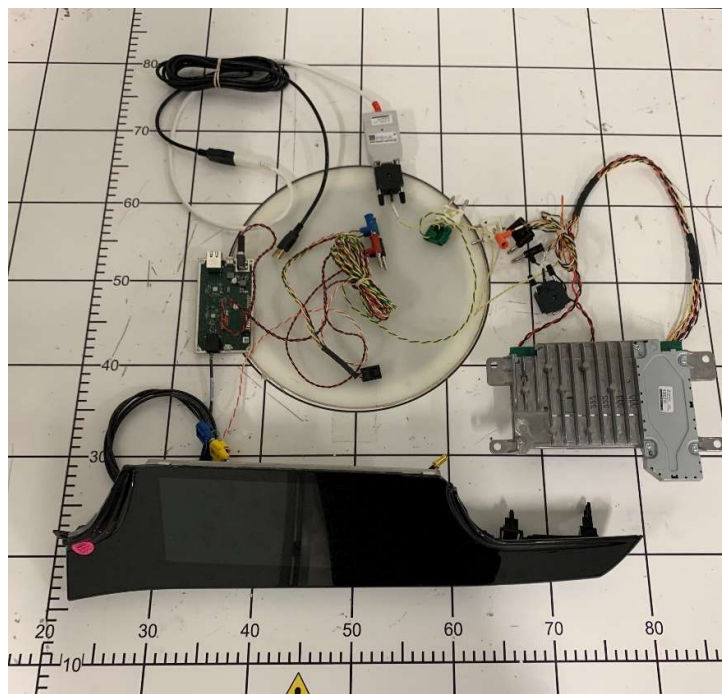


Figure B4: Top View of DUT with Accessories

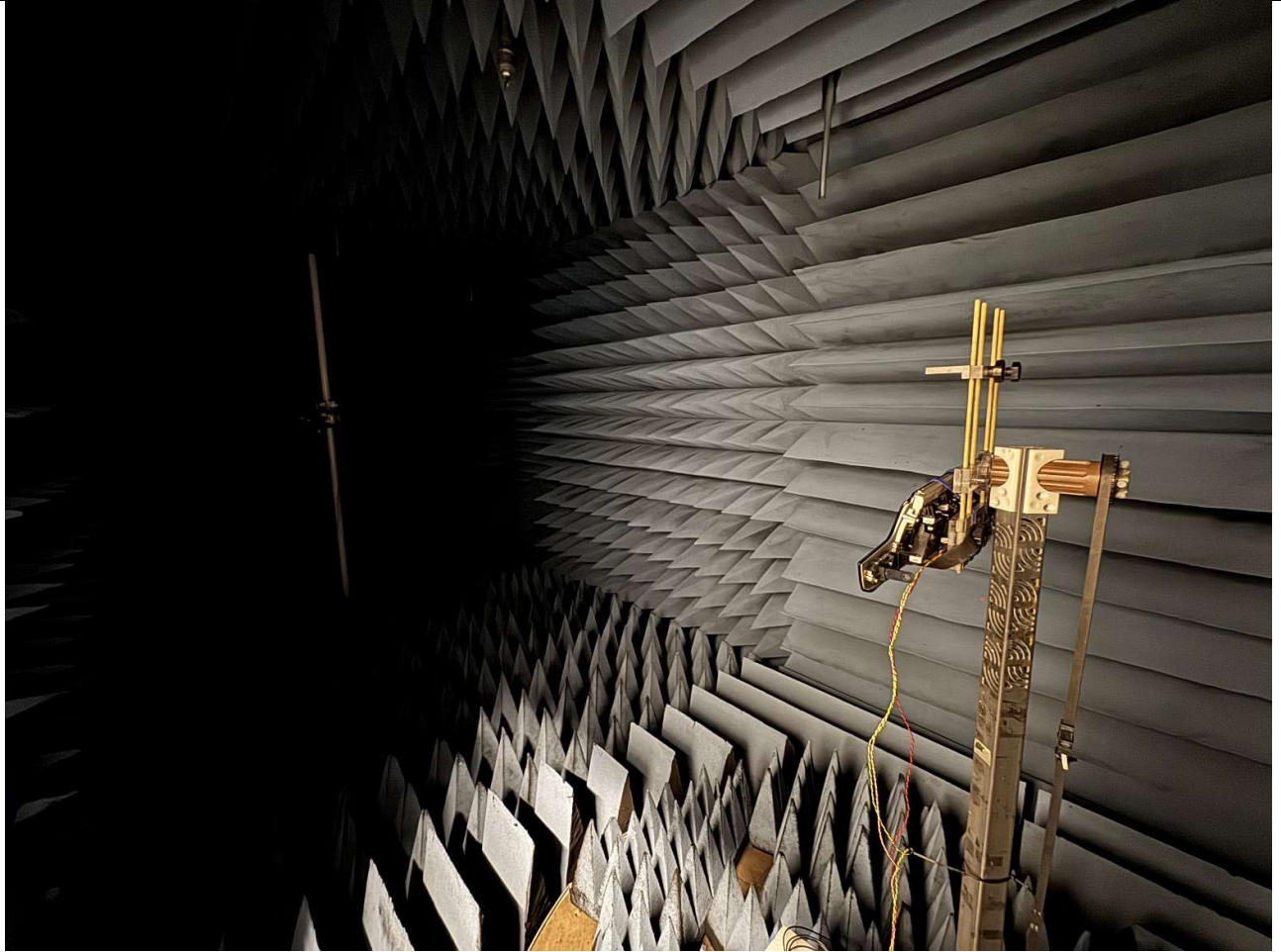


Figure B5: DUT In the Anechoic Chamber.