Antenna Performance
Test Report 21-1-0042603T01a_C01

Deutsche Akkreditierungsstelle
D-PL-12047-01-01
D-PL-12047-01-03
D-PL-12047-01-04

Number of pages:	19	**Date of Report:**	30-Nov-2022
Testing company:	CETECOM GmbH Im Teelbruch 116 45219 Essen Germany Tel. + 49 (0) 20 54 / 95 19-0 Fax: + 49 (0) 20 54 / 95 19-150	**Customer:**	Witte-Velbert GmbH & Co. KG Höferstr. 3-15 D 42551 Velbert Germany
Product: **Model:**	**BTLE enabled secure vehicle access box** **flinkey CAN**		
Frequency Range:	**2402 MHz to 2480 MHz**		
Test Specification:	**CTIA Test Plan for Wireless Device Over the Air Performance, Method of Measurement for Radiated RF Power and Receiver Performance [1].**		

The current version of Test Report 21-1-0042603T01a_C1 replaces the test report 21-1-0042603T01a dated 22-Jun-2022. The replaced test report is herewith invalid.

Signatures:

Dipl. Ing. Ninovic Perez
Authorization of Test Report

B.Eng. Martin Nunier
Test Execution and Author of Report

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1 General information

1.1 Disclaimer and Notes

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1.2 Summary of Test Results

Frequency [MHz]	2402	2426	2440	2480
Efficiency [dB]	-3.30	-3.42	-3.76	-3.23
Directivity [dBi]	4.95	5.15	5.29	5.34
Gain [dBi]	1.65	1.74	1.53	2.11

Tab 1: Data Summary

2 Administrative Data

2.1 Identification of Entity Providing the Service

Company address:	CETECOM GmbH / Im Teelbruch 116 / 45219 Essen / Germany
Internet site:	www.cetecom.com
Responsible for laboratory:	Dipl. Ing. Ninovic Perez
Accreditation scope:	DAkkS Webpage
Test location:	CETECOM GmbH / Im Teelbruch 116 / 45219 Essen / Germany

2.2 General Limits for Environmental Conditions

Temperature:	Room temperature: (22 ± 2) °C
Humidity:	Relative. humidity: 45±15% rH

2.3 Organizational Items

CETECOM project number:	21-1-0042603T01a_C01
Test Date(s):	09-Jun-2022
Witness during tests:	None
Responsible for test report:	B.Eng. Martin Nunier
Date of report:	30-Nov-2022

2.4 Customer Details

Customer address:	Witte-Velbert GmbH & Co. KG Höferstr. 3-15 Germany
Contact person:	Mr. Christian Goldschmidt <christian.goldschmidt@witte-digital>

2.5 EUT: Type, S/N etc. and short descriptions used in this test report

Short description*)	PMT Sample No.	Product	Model	Type	S/N	HW status	SW status
EUT 01	21-1-00426S27_C01	BTLE enabled secure vehicle access box	flinkey CAN	--	--	8.0	CERT

3 Test Set Up and Method

3.1 TRP Test

The measurement of the total radiated power was done in a CTIA certified OTA lab and according to the appropriate test specification [0]. A schematic drawing of the actual set up is shown in Fig. 1. The antenna was fed using an external RF source and the antenna pattern have been measured (taking both polarizations into account) with an angular resolution of 15°.

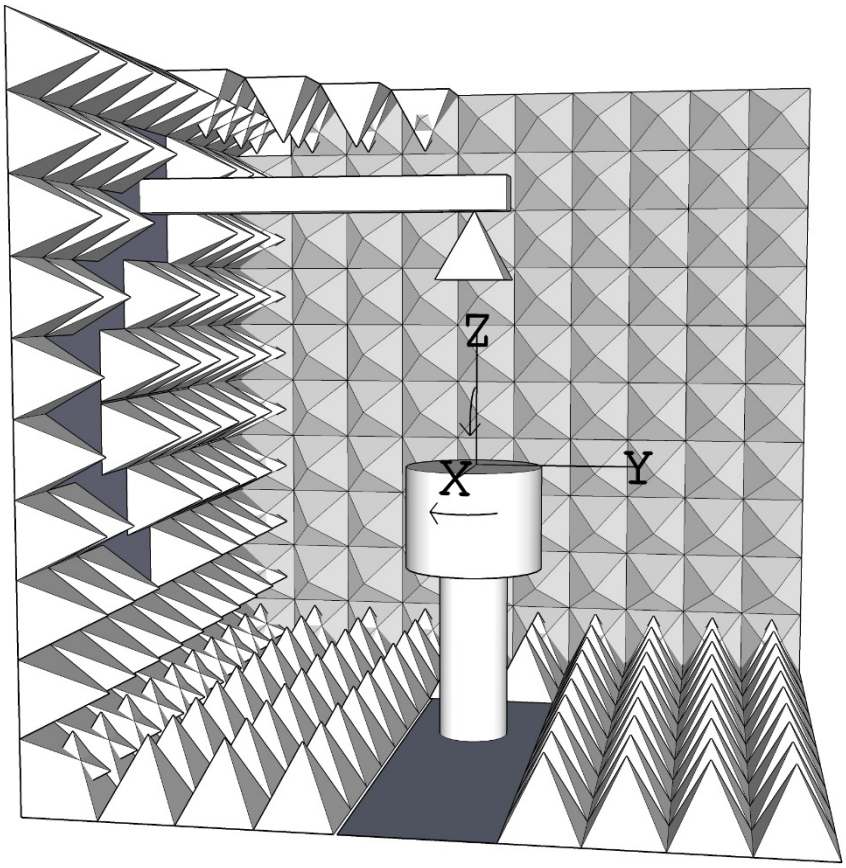

Fig 1: 3D OTA test set up.

MHz	Efficiency [%]	Directivity [dBi]	Gain [dBi]
2402	46.79	4.95	1.65
2426	45.53	5.15	1.74
2440	42.09	5.29	1.53
2480	47.54	5.34	2.11

Tab 2: Selected numerical results for efficiency, directivity and gain.

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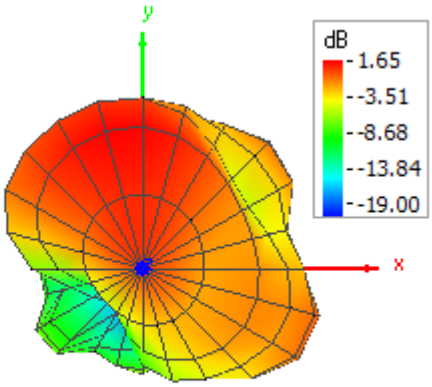

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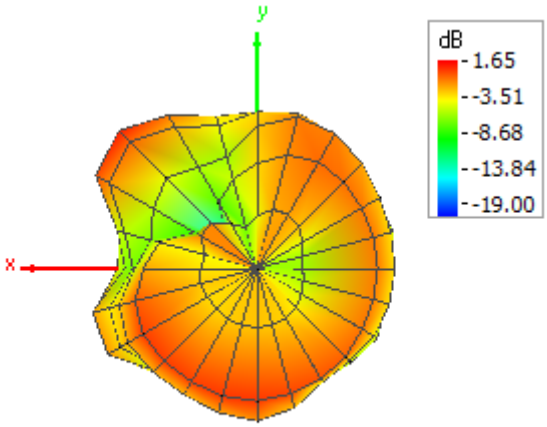

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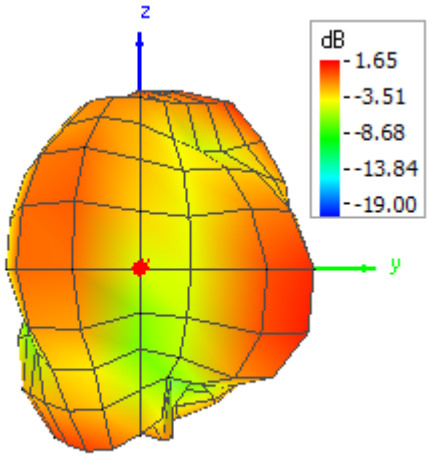

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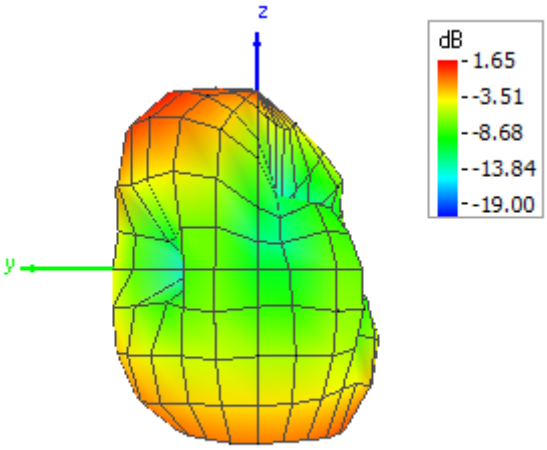
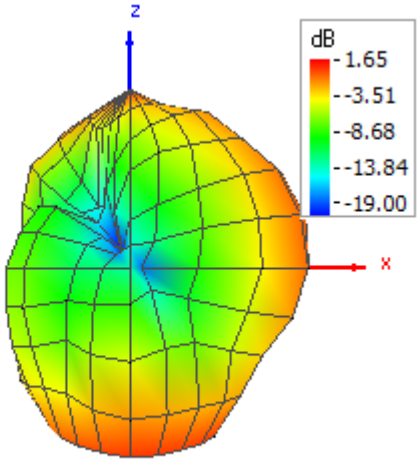


Theta = 90, Phi = 270



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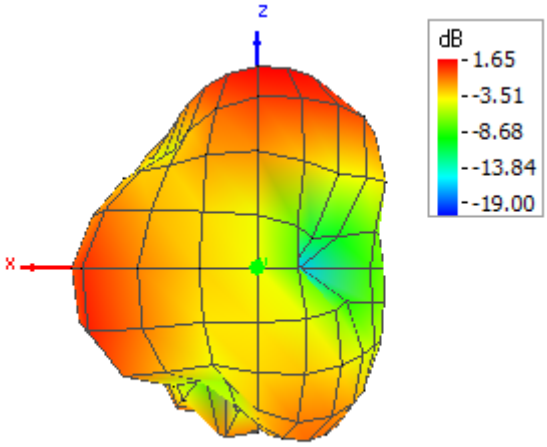

Fig 2: 3D OTA test result: Antenna pattern for 2402 MHz,

Test antenna input power setting was 0 dBm.

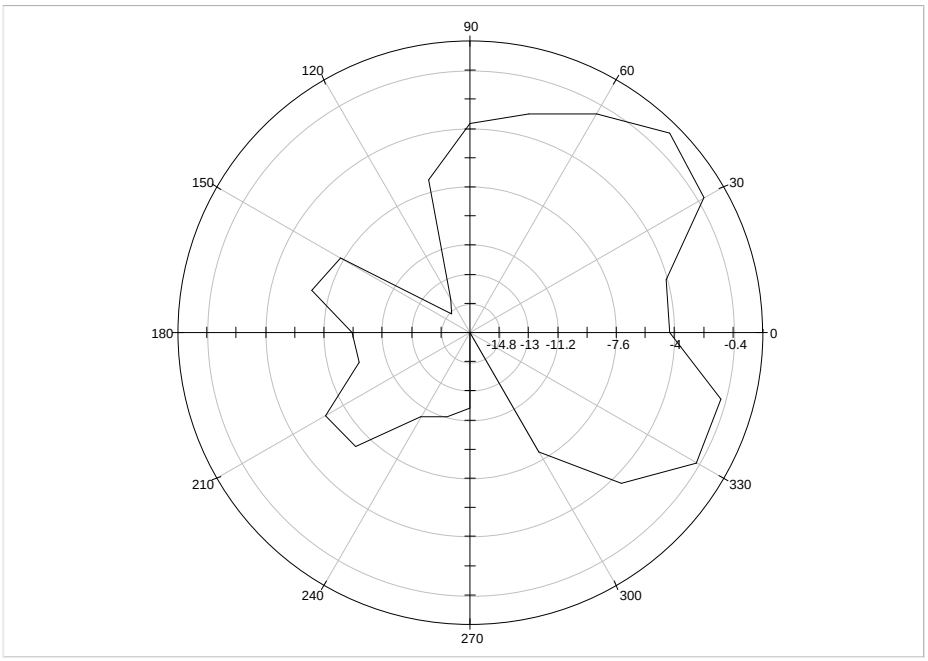

Fig 3: MainCutsPlot_XY_Plane for 2402 MHz

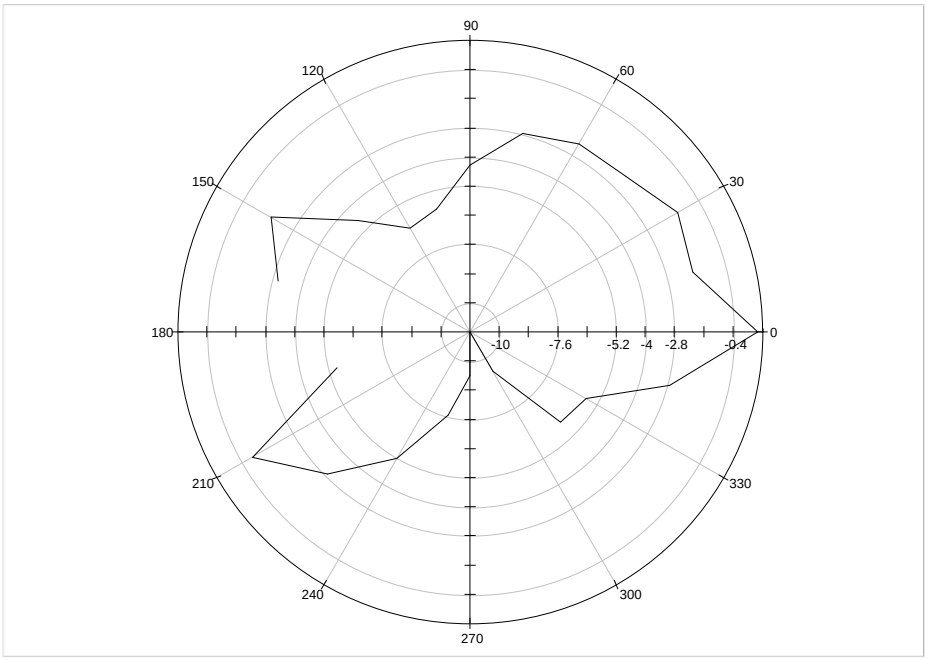

Fig 4: MainCutsPlot_XZ_Plane for 2402 MHz

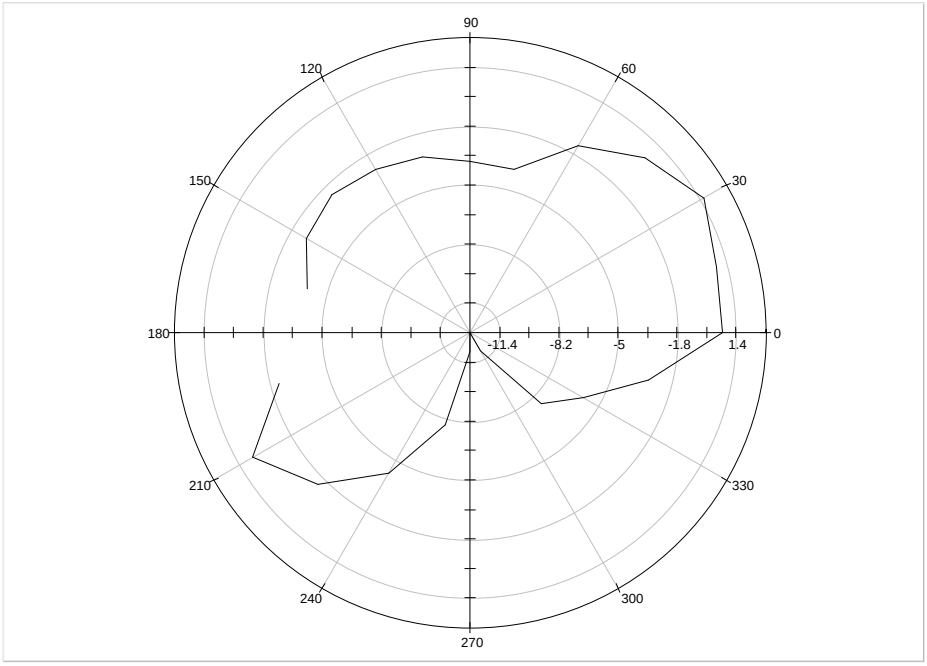

Fig 5: MainCutsPlot_YZ_Plane for 2402 MHz

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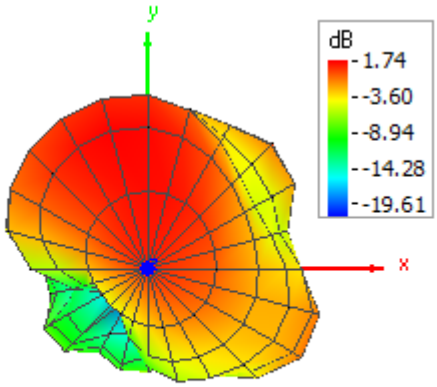
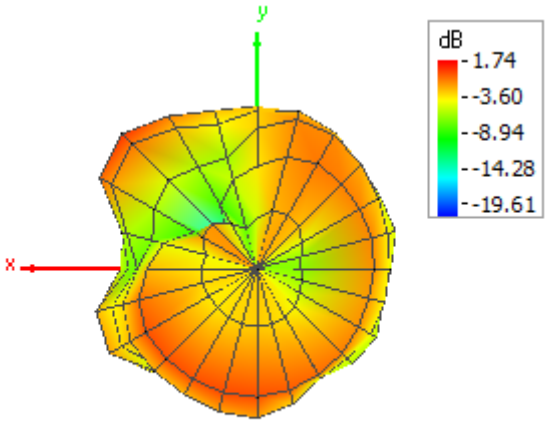


Theta = 180, Phi = 0



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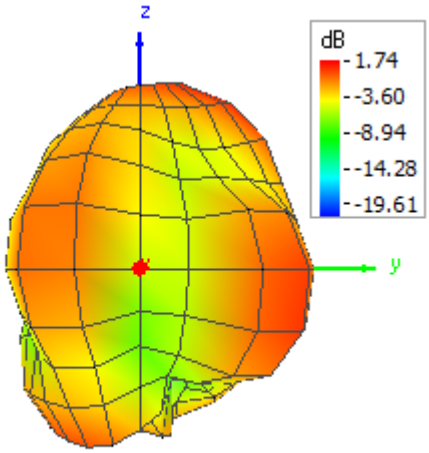

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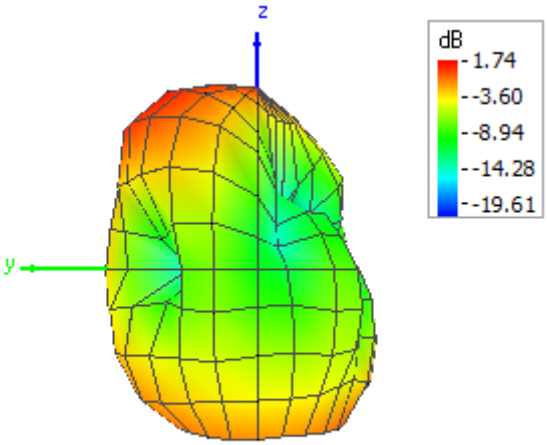

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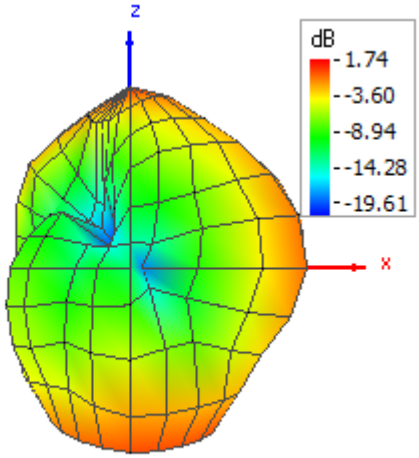

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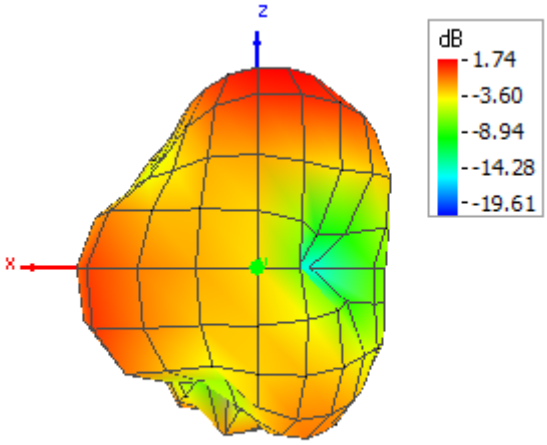


Fig 6: 3D OTA test result: Antenna pattern for 2426 MHz.

Test antenna input power setting was 0 dBm.

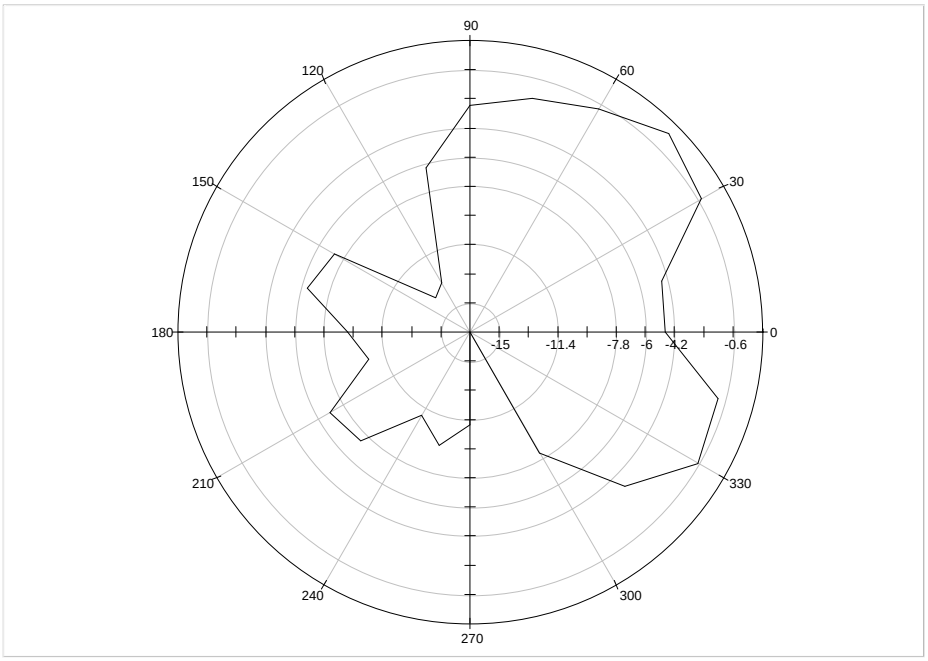


Fig 7: MainCutsPlot_XY_Plane for 2426 MHz.

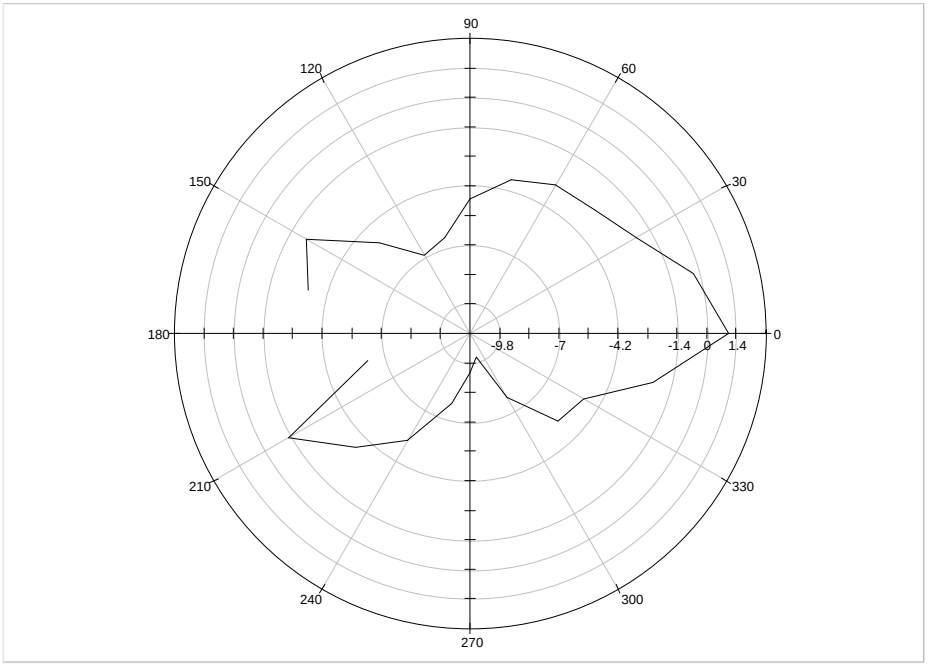


Fig 8: MainCutsPlot_XZ_Plane for 2426 MHz.

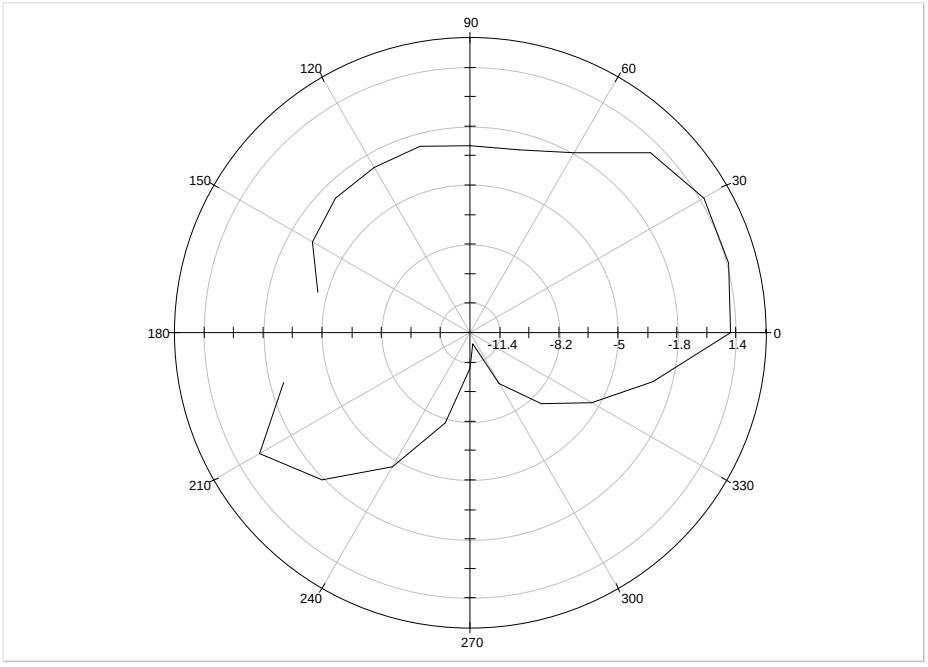
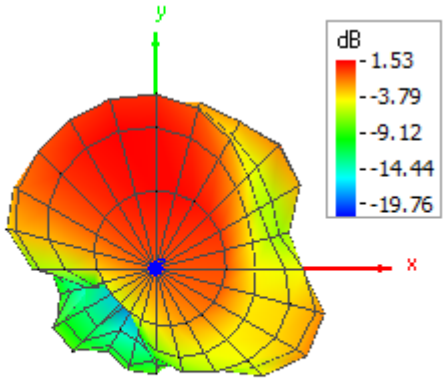


Fig 9: MainCutsPlot_YZ_Plane for 2426 MHz.

Theta = 0, Phi = 0



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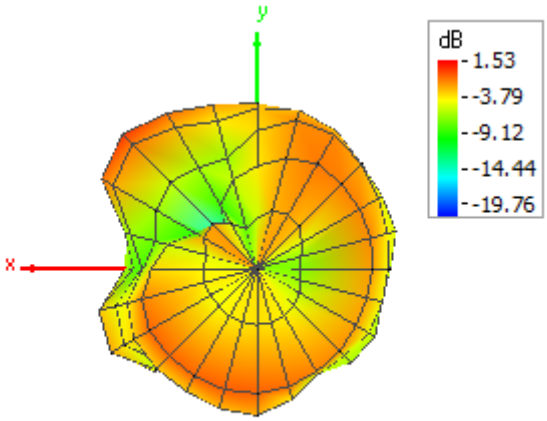

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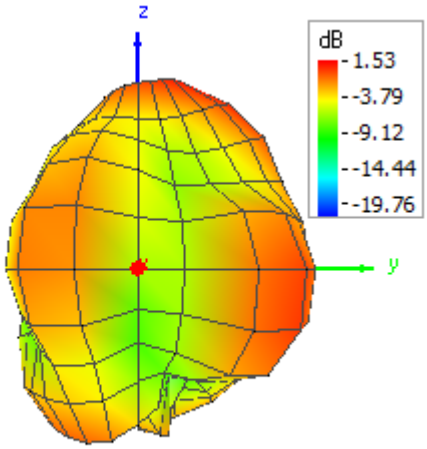

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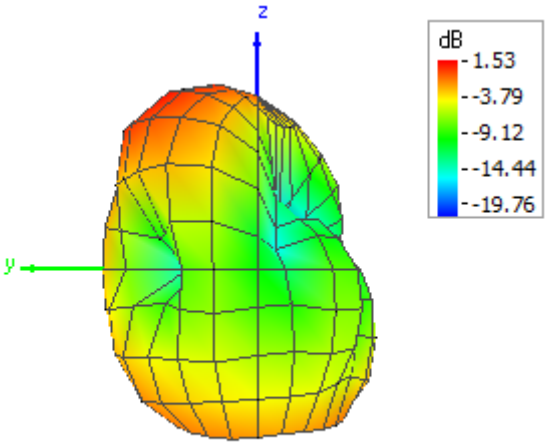
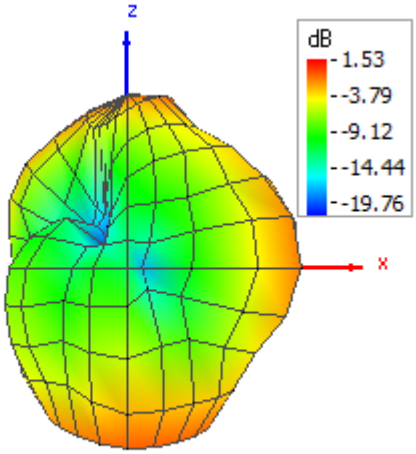


Theta = 90, Phi = 270



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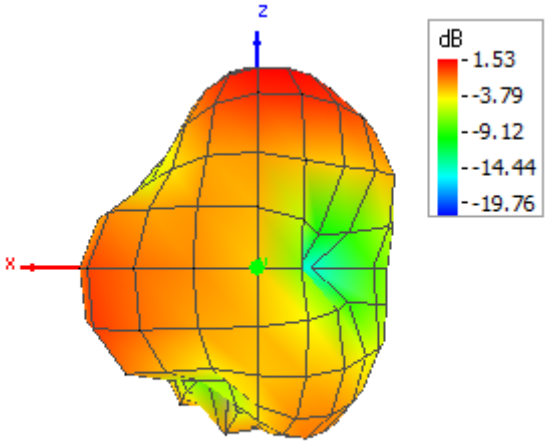

Fig 10: 3D OTA test result: Antenna pattern for 2440 MHz.

Test antenna input power setting was 0 dBm.

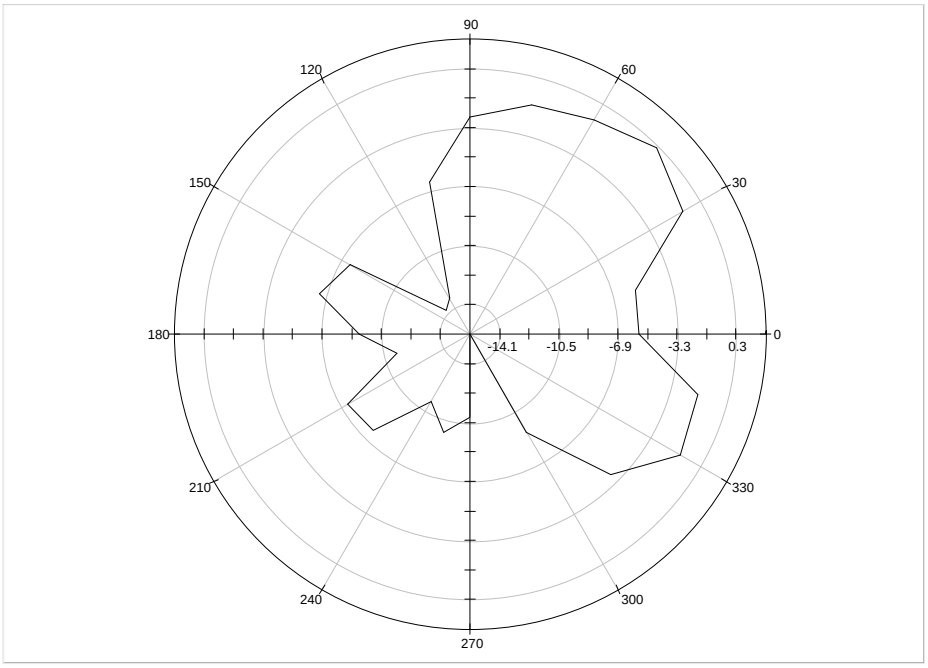

Fig 11: MainCutsPlot_XY_Plane for 2440 MHz.

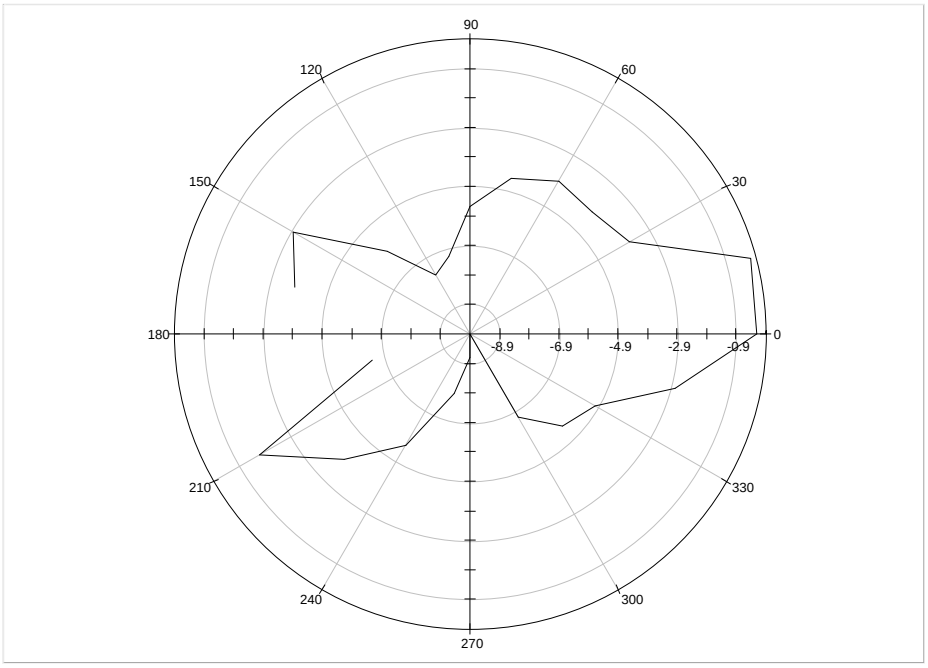

Fig 12: MainCutsPlot_XZ_Plane for 2440 MHz.

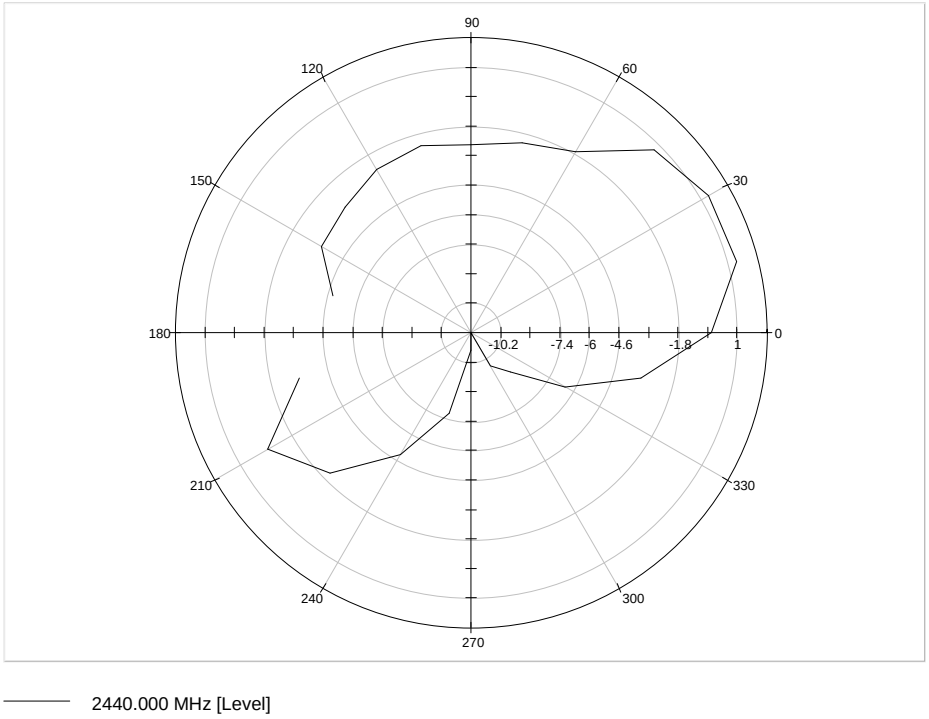

Fig 13: MainCutsPlot_YZ_Plane for 2440 MHz.

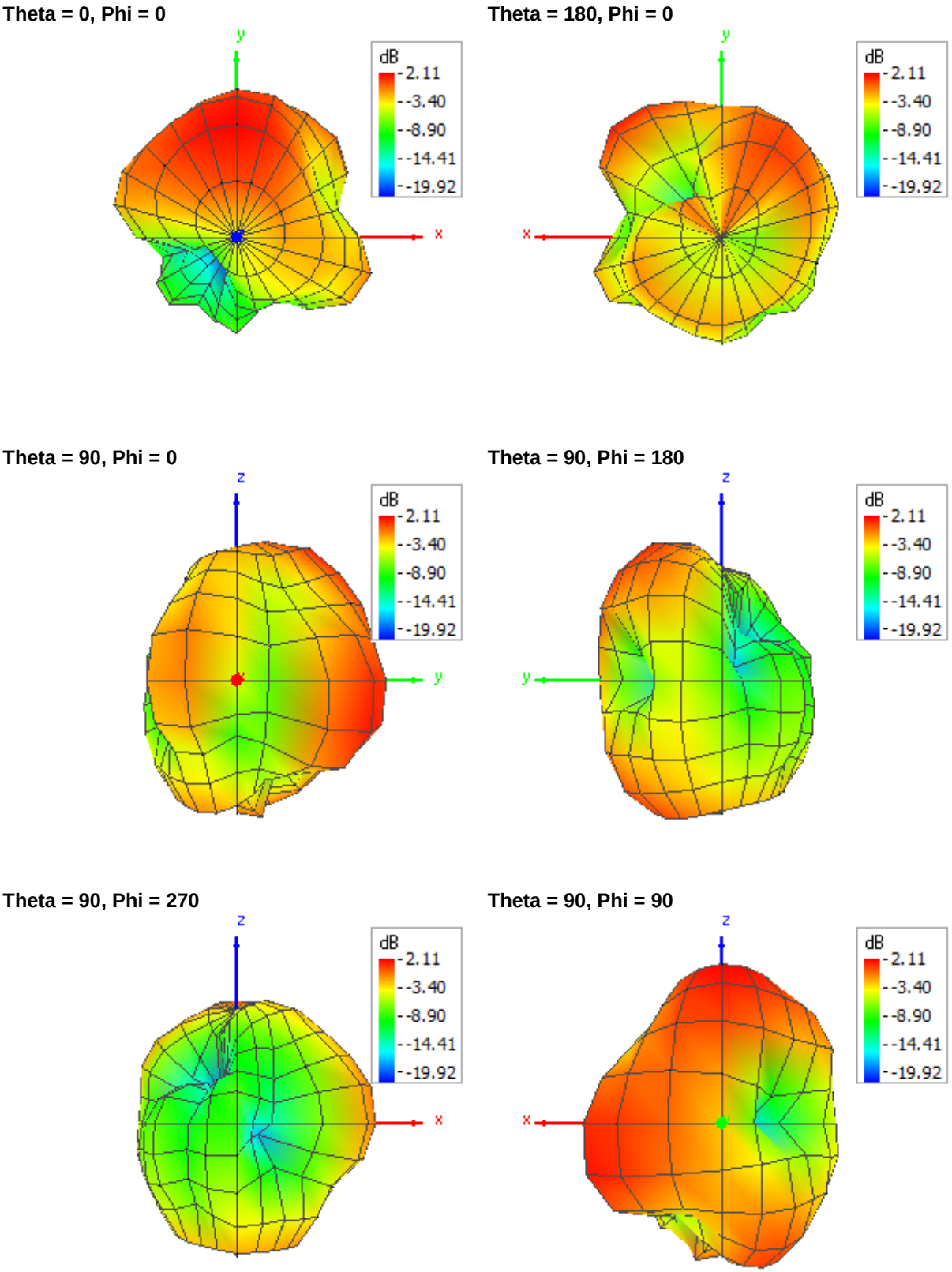

Fig 14: 3D OTA test result: Antenna pattern for 2480 MHz.

Test antenna input power setting was 0 dBm.

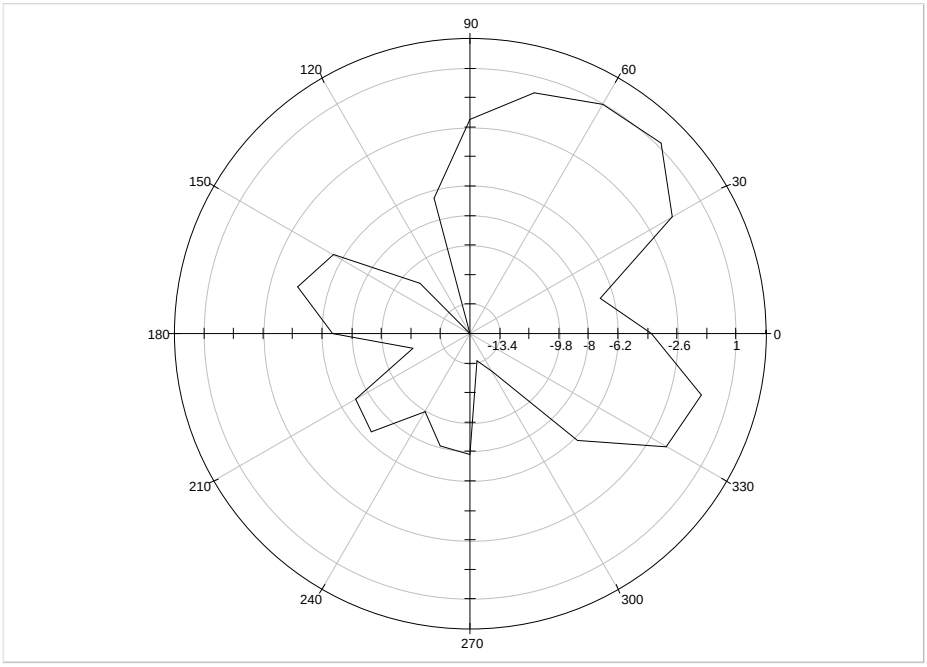

Fig 15: MainCutsPlot_XY_Plane for 2480 MHz.

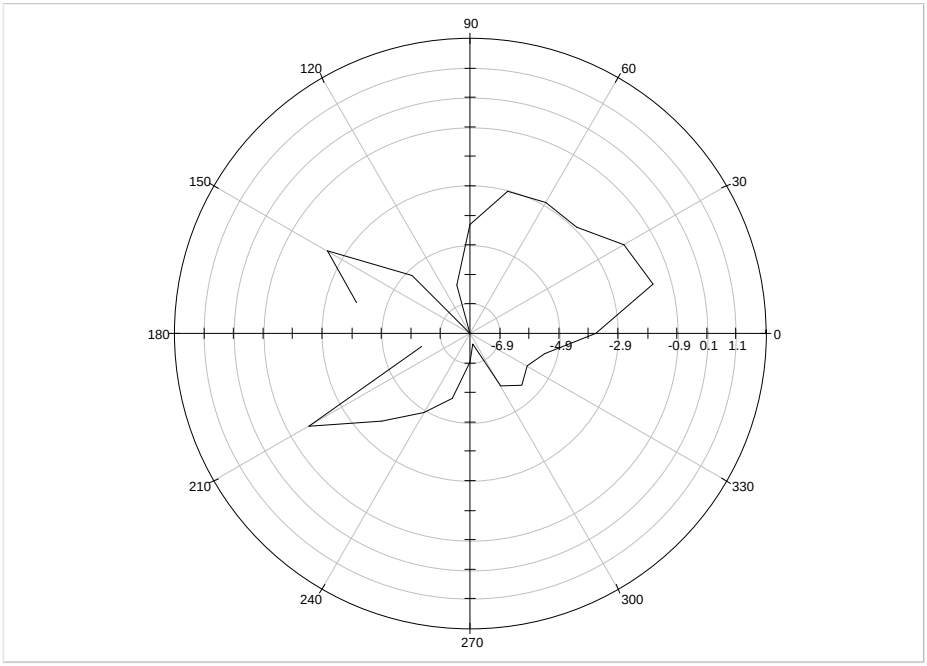

Fig 16: MainCutsPlot_XZ_Plane for 2480 MHz.

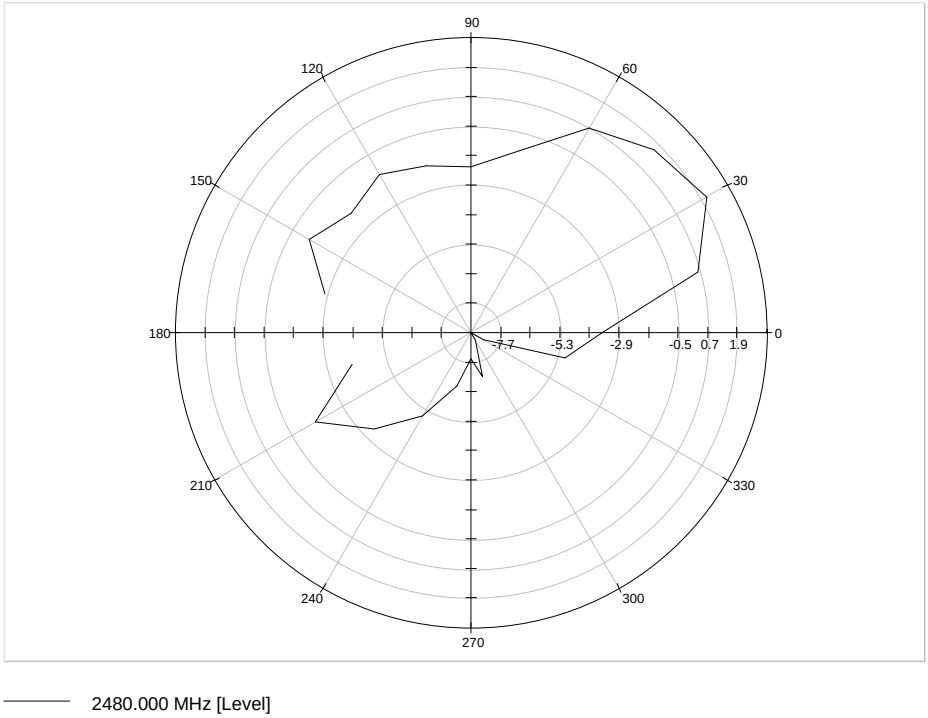

Fig 17: MainCutsPlot_YZ_Plane for 2480 MHz.

4 Equipment lists

ID	Description	Manufacturer / Type	Serial Number
20557	System CTC-OTA-2 R&S TS8991	Rohde & Schwarz Messgerätebau GmbH	--
20560	Power Sensor NRP-Z11	Rohde & Schwarz Messgerätebau GmbH	100404
20562	Power Sensor NRP-Z11	Rohde & Schwarz Messgerätebau GmbH	100404
20566	Open switch and control Platform OSP120 with OSP-B105	Rohde & Schwarz Messgerätebau GmbH	100057
20567	Quad Ridged Horn Antenna QR-1	The Howland Company Inc.	1007-5V978
20570	Motion Control Unit P008 Motion Control Unit	The Howland Company Inc.	123

4.1 Measurement Uncertainty

4.1.1 TRP and Efficiency

According to a separate uncertainty calculation following the procedure as outlined by CTIA [1], for free space and frequencies below 3 GHz for TRP and also efficiency results an uncertainty of ±1.1 dB has been calculated [2].

5 References

[1] CTIA OTA Test Requirement, “Test Plan for Wireless Device Over the Air Performance, Method of Measurement for Radiated RF Power and Receiver Performance”, Revision 3.9.4, February 2022.

[2] Document “OTA v3.9.x LAD v1.2” incl. “v3.9.X Measurement Uncertainty Template”, Version 1.2 for calculating the measurement uncertainty according CTIA OTA Test Plan v3.9.x.

6 Versions of test reports (change history)

Version	Applied changes	Date of release
--	Initial release	22-Jun-2022
C01	Photos in separate annex A1	30-Nov-2022
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End of Report