PHOENIX TESTLAB
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Antenna Report

Report Number:

F230973E7

Equipment under Test (EUT):

Tank level probing radar
FMR43
Antenna

Applicant:

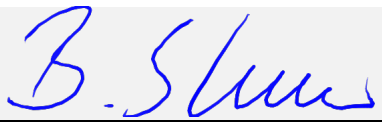
Endress+Hauser SE+Co. KG

Manufacturer:

Endress+Hauser SE+Co. KG

References

[1] None (According customer requirements)

Tested and written by	 Signature	Bernward ROHDE 31.07.2024
Reviewed and approved by:	 Signature	Bernd STEINER 31.07.2024

This test report is only valid in its original form.

The test results herein refer only to the tested sample. PHOENIX TESTLAB GmbH is not responsible for any generalisations or conclusions drawn from these test results concerning further samples. Any modification of the tested samples is prohibited and leads to the invalidity of this test report. Each page necessarily contains the PHOENIX TESTLAB Logo and the TEST REPORT NUMBER.

Contents: Page

1 Identification

1.1 Applicant

Name:	Endress+Hauser SE+Co. KG
Address:	Hauptstr. 1 79689 Maulburg
Country:	Germany
Name for contact purposes:	+49 76 22 28 – 18 90
Phone:	Mr. Ralf REIMELT
eMail address:	ralf.reimelt@endress.com
Applicant represented during the test by the following person:	None

1.2 Manufacturer

Name:	Endress+Hauser SE+Co. KG
Address:	Hauptstr. 1 79689 Maulburg
Country:	Germany
Name for contact purposes:	+49 76 22 28 – 18 90
Phone:	Mr. Ralf REIMELT
eMail address:	ralf.reimelt@endress.com
Manufacturer represented during the test by the following person:	None

1.3 Test Laboratory

The tests were carried out by:

PHOENIX TESTLAB GmbH
Königswinkel 10
32825 Blomberg
Germany

1.4 AUT (Antenna under test)

Test object: *	2.4 GHz antenna on module PCB
Model name: *	n/a

	EUT number		
	1 (radiated)	2 (conducted PCB)	3
Serial number: *	FMR43_IOL_050 (EUT 6b BT)	Engineering sample #2	-
PCB identifier: *	Sensor board: 71502194 Display board: 71548029 Mainboard: 71439136 Power board: 71502179 Terminal board: 71508546	Display board: 71548029	-
Hardware version: *	01.00.00	01.00.00	-
Software version: *	01.00.00	S140 V7.2.0 (Soft device)	-

* Declared by the applicant

One EUT was used for all tests.

Note: PHOENIX TESTLAB GmbH does not take samples. The samples used for tests are provided exclusively by the applicant.

1.5 Technical Data of Equipment

General	
Frequency Range *	2402 MHz to 2480 MHz

* Declared by the applicant

Ports / Connectors				
Identification	Connector		Length during test	Shielding (Yes / No)
	EUT	Ancillary		
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Equipment used for testing	
FMR 43 (EUT6b)	-

1.6 Dates

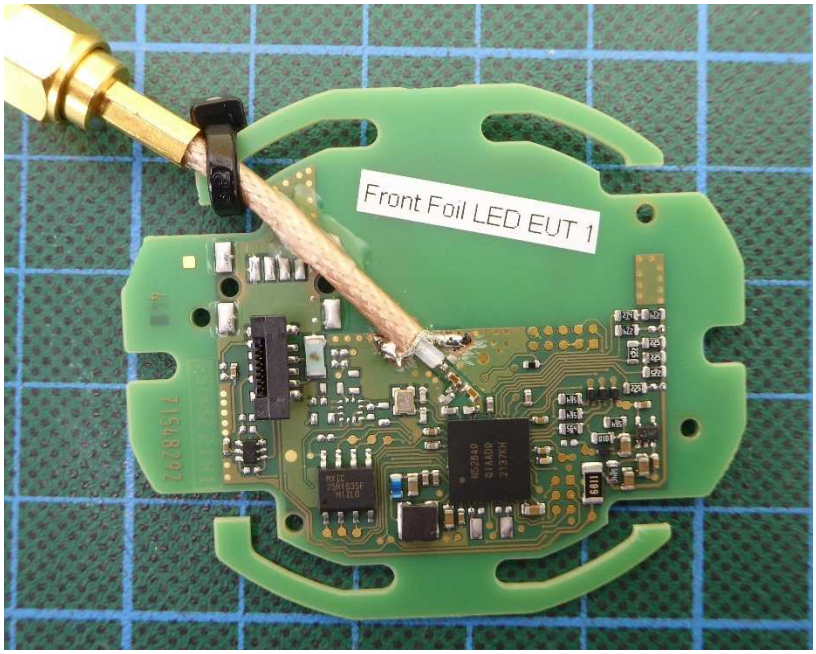
Date of receipt of test sample:	10.10.2023
Start of test:	21.05.2024
End of test:	21.05.2024

2 Operational States

During the antenna chart measurements, the antenna was supplied with a CW rf-signal generated by the EUT with a level as shown in the chapter below its antenna connector.

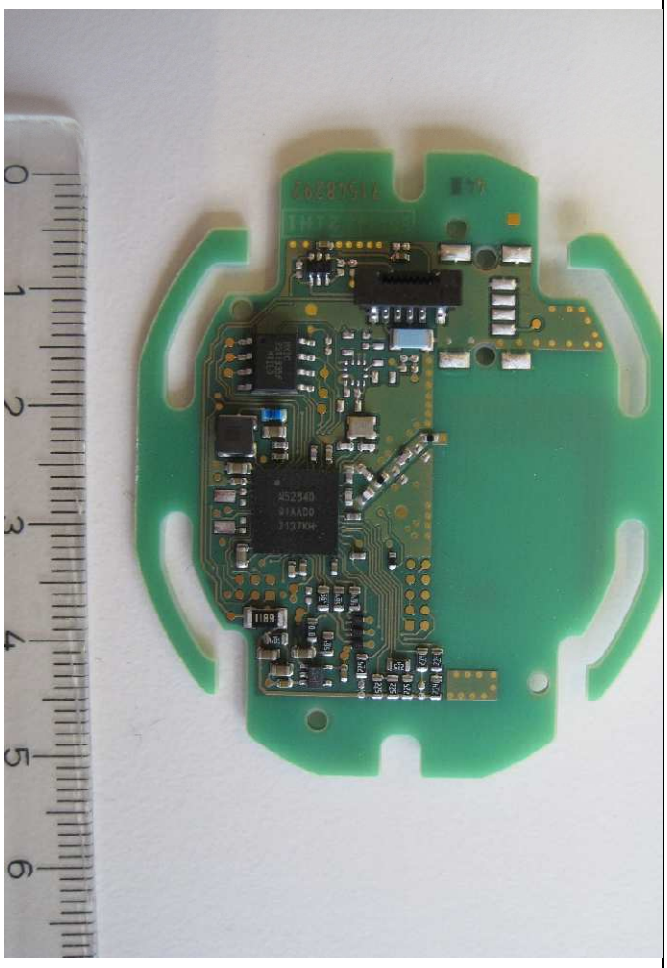
3 Additional Information

Conducted measurements were done with a modified sample as provided by the applicant.

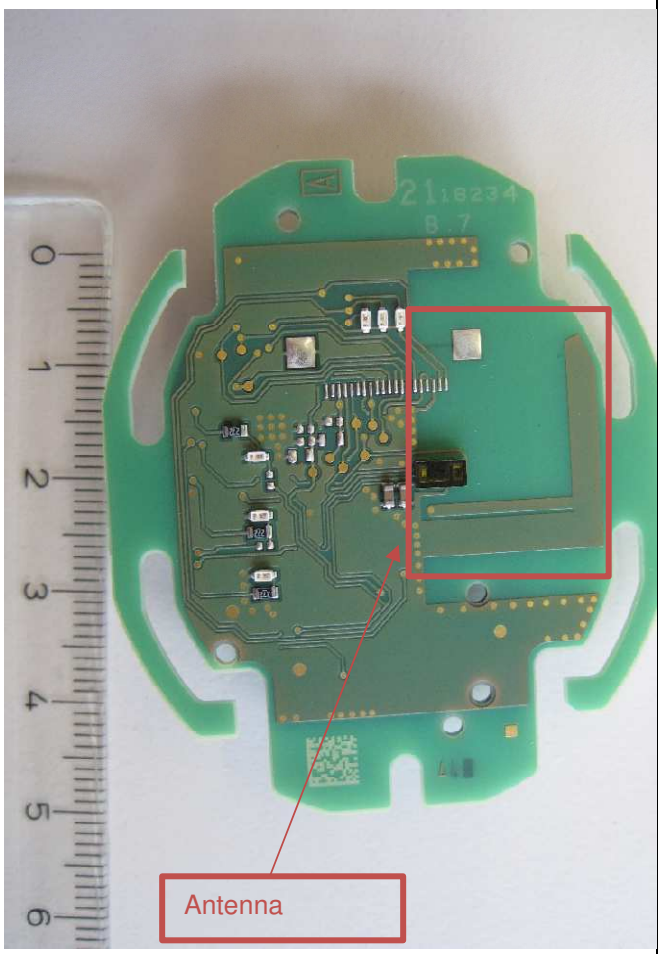


4 Antenna photographs

4.1 Internal photographs



LED board FMR43 bottom



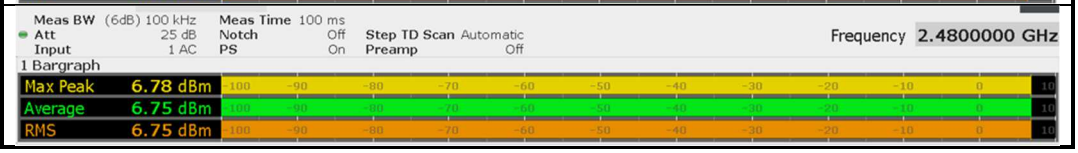
LED board FMR43 top

Photos were provided by the applicant

5 Antenna Charts

5.1 Results (Max. Gain)

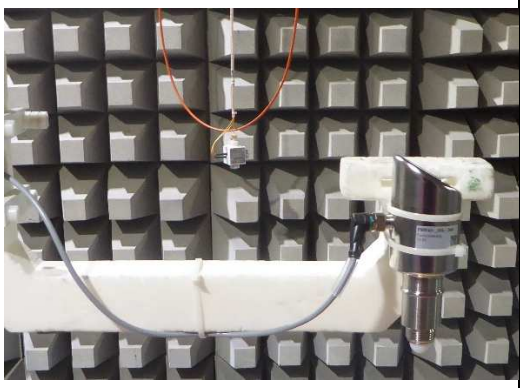
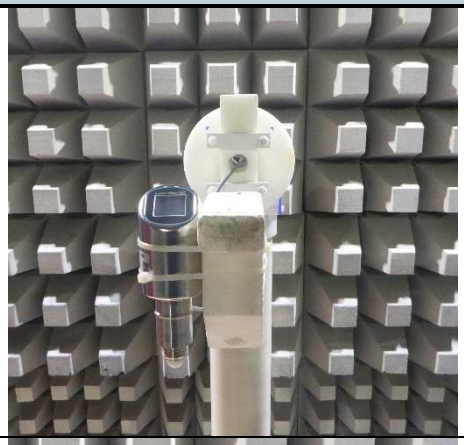
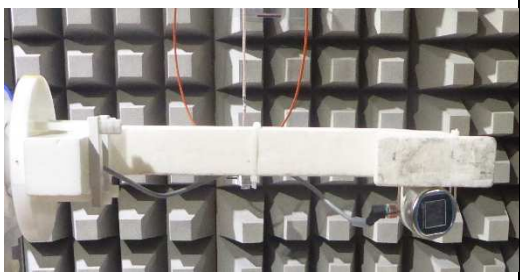
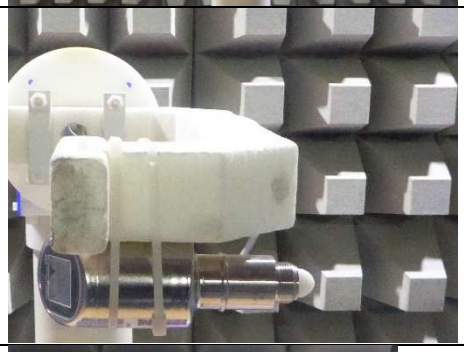
Antenna gain calculation				
		f_{low}	f_{mid}	f_{high}
Conducted output power [dBm]		6.5	6.6	6.8
Radiated EIRP [dBm EIRP]		6.7	5.3	3.8
Antenna Gain [dBi]		**0.2**	-1.3	-3.0
Position		Position 3	Position 2	Position 2
Position of maximum gain	Azimuth	356	321	295
	Polarisation	H	V	V

Conduted f_{low}	
Conduted f_{mid}	
Conduted f_{high}	

Test equipment (please refer to chapter 7 for details)
1 - 12

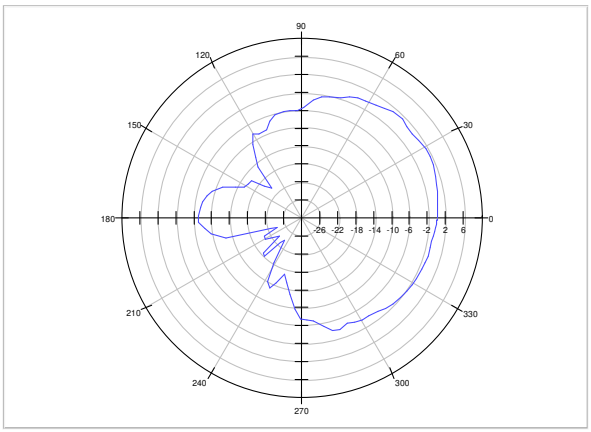
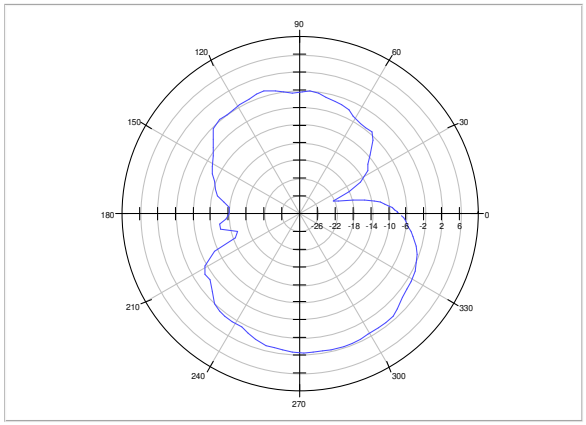
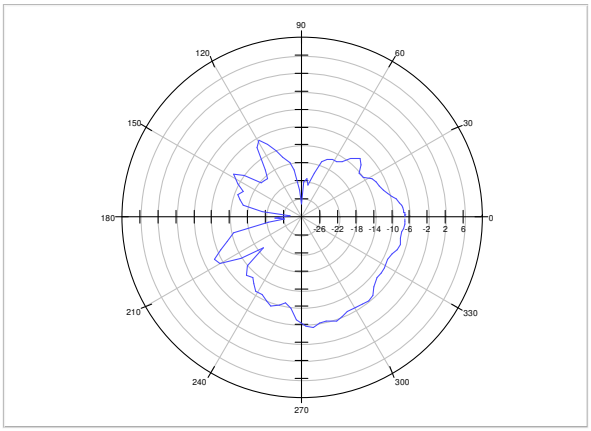
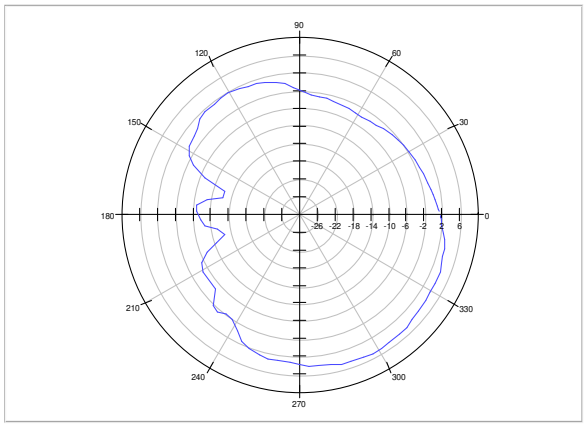
5.2 Antenna Diagrams EUT Position

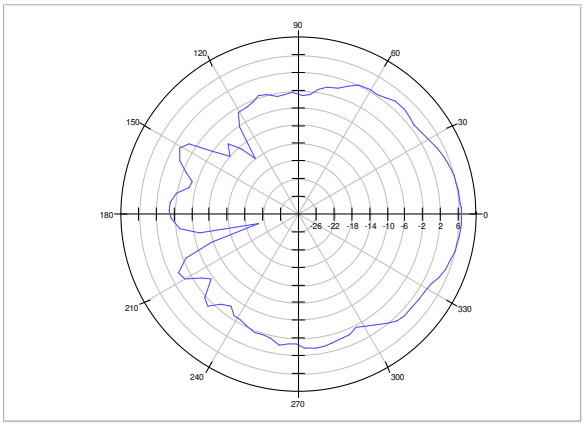
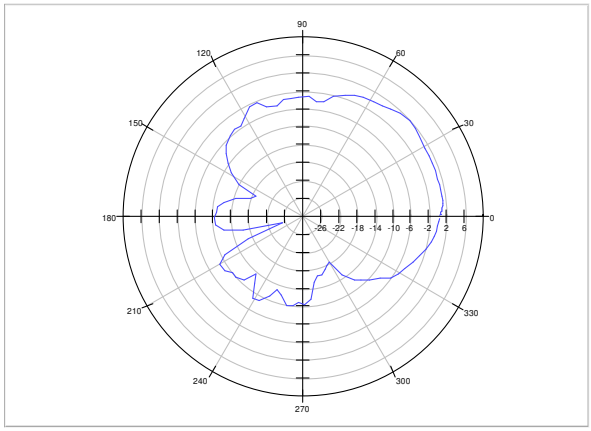
5.2.1 Test Setup Photos

Setup Photos		
Position 1		
Position 2		
Position 3		

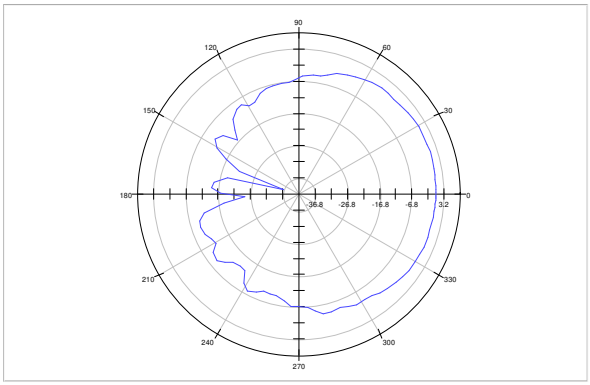
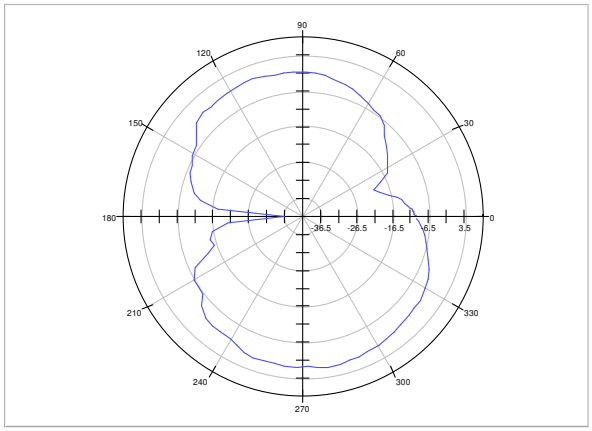
5.2.2 Azimuth charts of transmitter

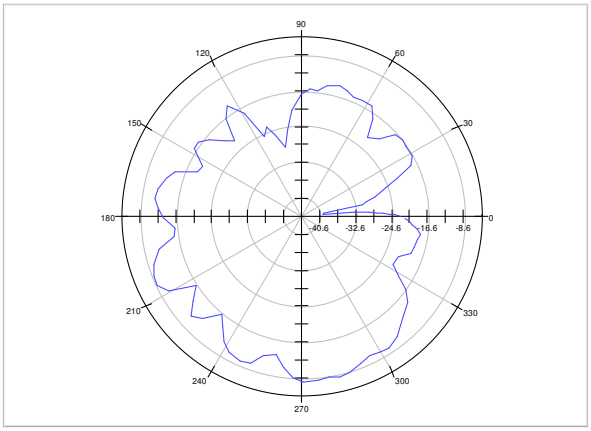
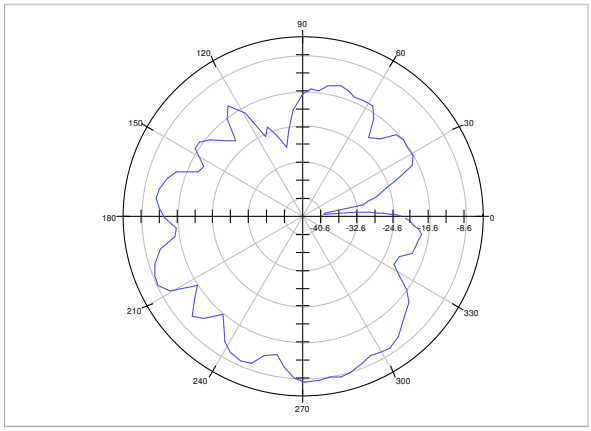
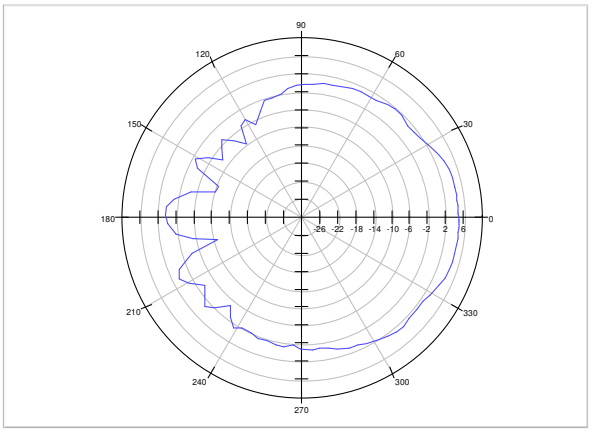
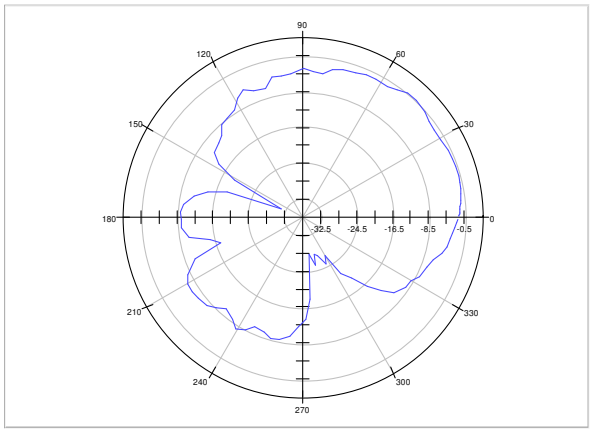
5.2.2.1 Frequency near bottom (f_{low})

Antenna chart of transmitter	
f_{low}, horizontal, pos. 1	f_{low}, vertical, pos. 1
Azimuth Chart: 0deg, Horizontal 	Azimuth Chart: 0deg, Vertical 
f_{low}, horizontal, pos. 2	f_{low}, vertical, pos. 2
Azimuth Chart: 90deg, Horizontal 	Azimuth Chart: 90deg, Vertical 

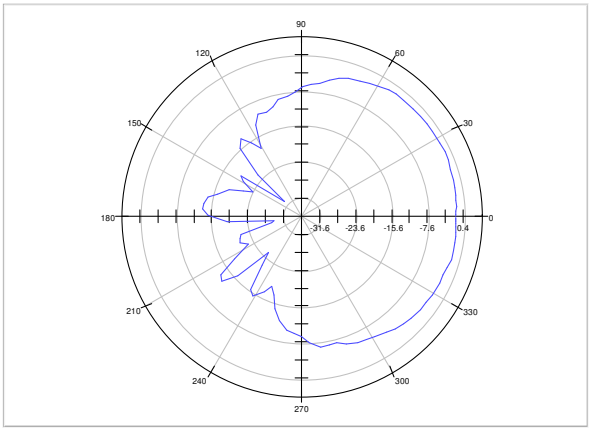
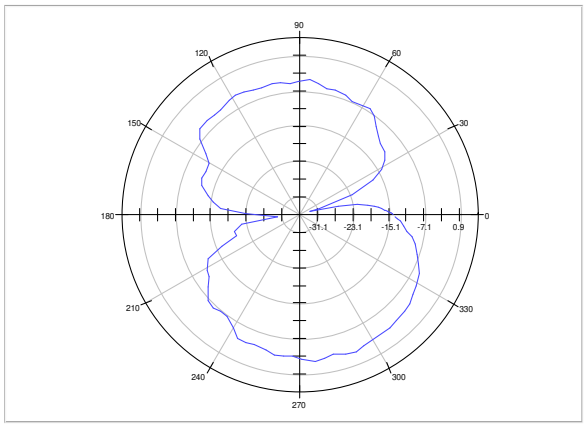
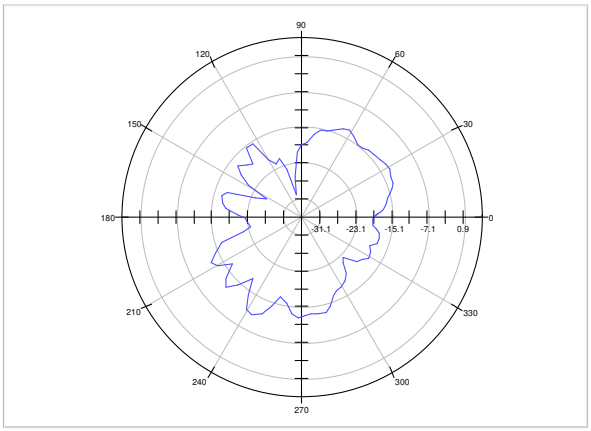
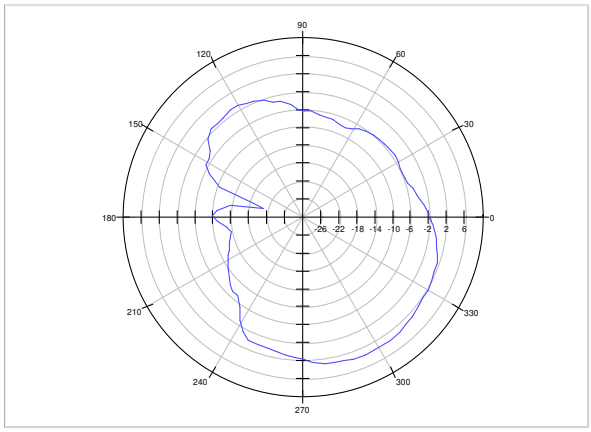
Antenna chart of transmitter	
f_{low}, horizontal, pos. 3	f_{low}, vertical, pos. 3
Azimuth Chart: 0deg, Horizontal 	Azimuth Chart: 0deg, Vertical 

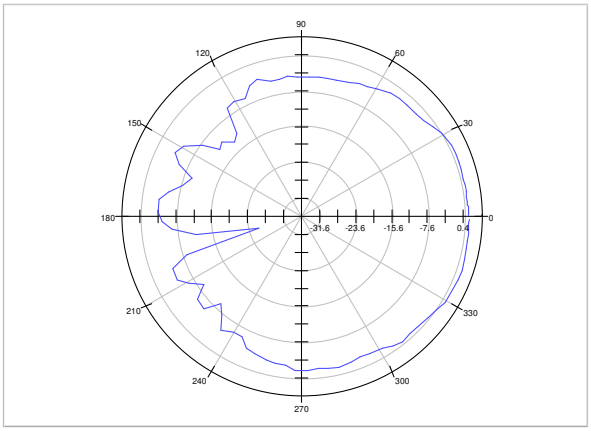
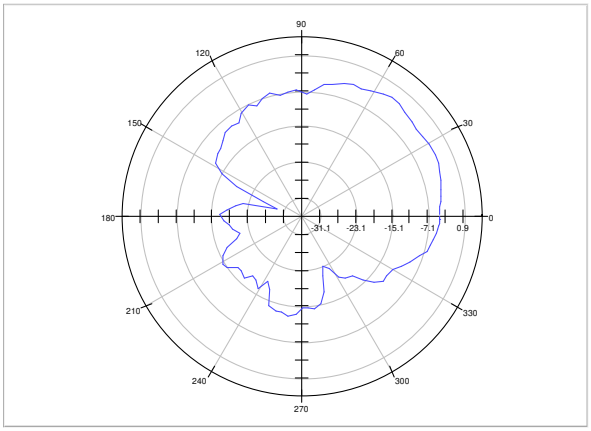
5.2.2.2 Frequency near middle (f_{mid})

Antenna chart of transmitter	
f_{mid}, horizontal, pos. 1	f_{mid}, vertical, pos. 1
Azimuth Chart: 0deg, Horizontal 	Azimuth Chart: 0deg, Vertical 

Antenna chart of transmitter	
f_{mid}, horizontal, pos. 2	f_{mid}, vertical, pos. 2
Azimuth Chart: 90deg, Horizontal	Azimuth Chart: 90deg, Horizontal
	
f_{mid}, horizontal, pos. 3	f_{mid}, vertical, pos. 3
Azimuth Chart: 0deg, Horizontal	Azimuth Chart: 0deg, Vertical
	

5.2.2.3 Frequency near top (f_{high})

Antenna chart of transmitter	
f_{high}, horizontal, pos. 1	f_{high}, vertical, pos. 1
Azimuth Chart: 0deg, Horizontal 	Azimuth Chart: 0deg, Vertical 
f_{high}, horizontal, pos. 2	f_{high}, vertical, pos. 2
Azimuth Chart: 90deg, Horizontal 	Azimuth Chart: 90deg, Vertical 

Antenna chart of transmitter	
f_{high}, horizontal, pos. 3	f_{high}, vertical, pos. 3
Azimuth Chart: 0deg, Horizontal	Azimuth Chart: 0deg, Vertical
	

6 Test Equipment used for Tests

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal Due
1	RF cable 0.5 m	Sucoflex 102	Suhner	521885/2	483401	Calibration not necessary	
2	Horn antenna 1 GHz - 12 GHz	3115	EMCO Elektronik GmbH	9609-4918	480183	13.02.2024	02.2027
3	Software	EMC32 V10.60.20	Rohde & Schwarz	---	483261	Calibration not necessary	
4	RF cable	SF106B/11N/11 N/4500.0	Huber & Suhner	500218/6B	482415	Calibration not necessary	
5	Antenna support	AS620P	Deisel	620/375	480325	Calibration not necessary	
6	Fully anechoic chamber M20	B83117-E2439-T232	Albatross Projects	103	480303	Calibration not necessary	
7	Turntable	DS420 HE	Deisel	420/620/00	480315	Calibration not necessary	
8	Multiple Control Unit	MCU	Maturo GmbH	MCU/043/971107	480832	Calibration not necessary	
9	EMI Receiver / Spectrum Analyser	ESW44	Rohde & Schwarz	101635	482467	27.02.2024	02.2026
10	Positioner	TDF 1.5- 10Kg	Maturo	15920215	482034	Calibration not necessary	
11	Antenna (Horn)	3115	EMCO Elektronik GmbH	9609-4922	480184	14.11.2022	11.2025
12	CW Generator Microwave	83650L	Agilent	3844A00554	480333	27.02.2024	02.2026

7 Report History

Report Number	Date	Comment
F230973E7	31.07.2024	Initial Test Report
-	-	-
-	-	-