

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

Reviewed and
approved by:

Signature

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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		
---	---	---	---	---

Equipment used for testing	
FMR 43 (EUT6b)	-

1.6 Dates

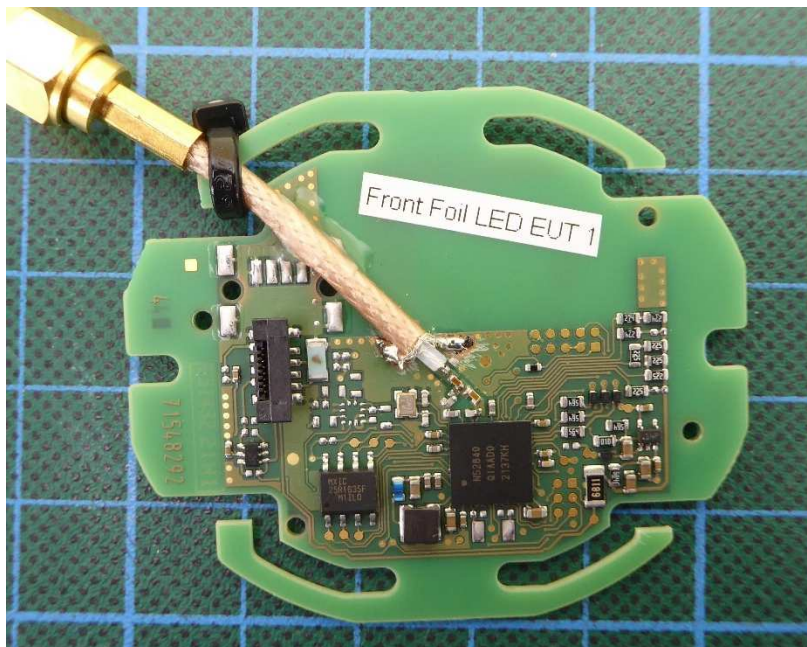
Date of receipt of test sample:	10.10.2023
Start of test:	21.05.2024
End of test:	21.05.2024

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.

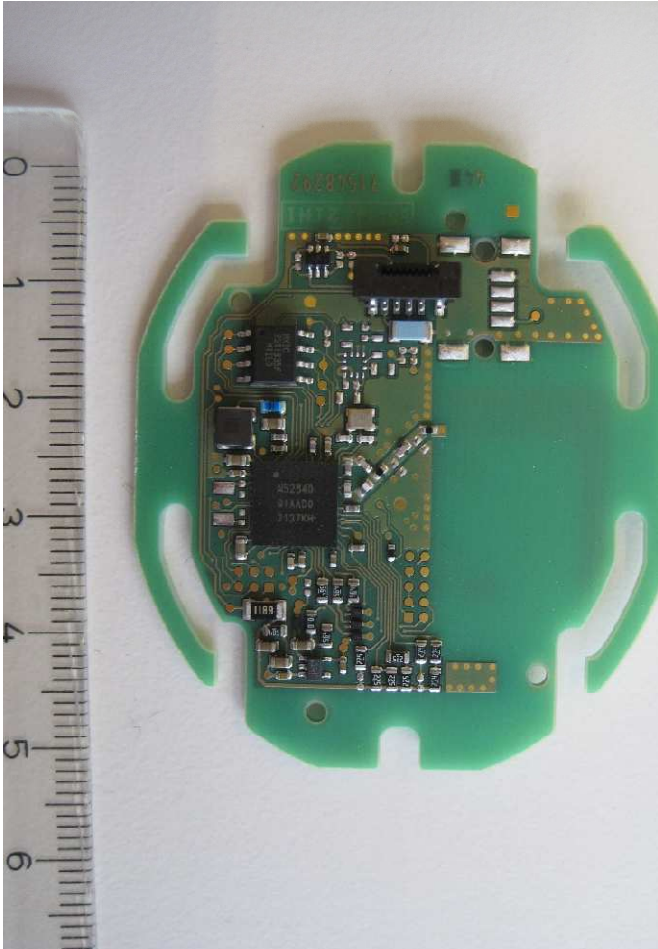
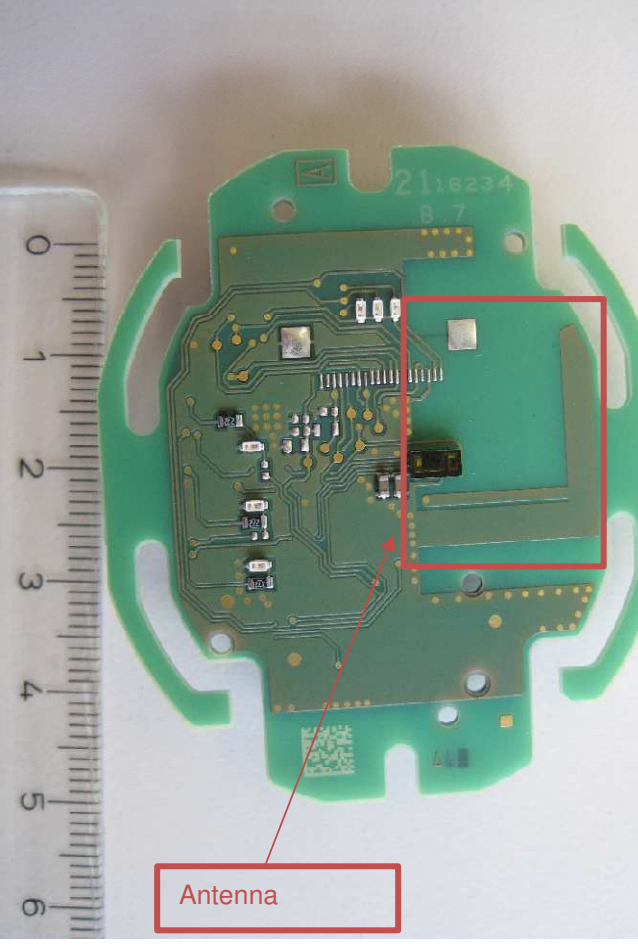
3 Additional Information

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



4 Antenna photographs

4.1 Internal photographs

 A photograph of the bottom view of a green LED board (FMR43). The board is irregularly shaped with several cutouts. It features various electronic components, including a large black integrated circuit (IC) in the center, several smaller ICs, and numerous surface-mount components. A ruler is visible on the left side for scale.	 A photograph of the top view of the same LED board (FMR43). A red rectangular box highlights a specific area on the right side of the board, which contains a small, square, metallic component. A red arrow points from a label 'Antenna' to this component. The label 'Antenna' is enclosed in a red rectangular box. A ruler is visible on the left side for scale.
LED board FMR43 bottom	LED board FMR43 top

Photos were provided by the applicant

5 Antenna Charts

5.1 Results (Max. Gain)

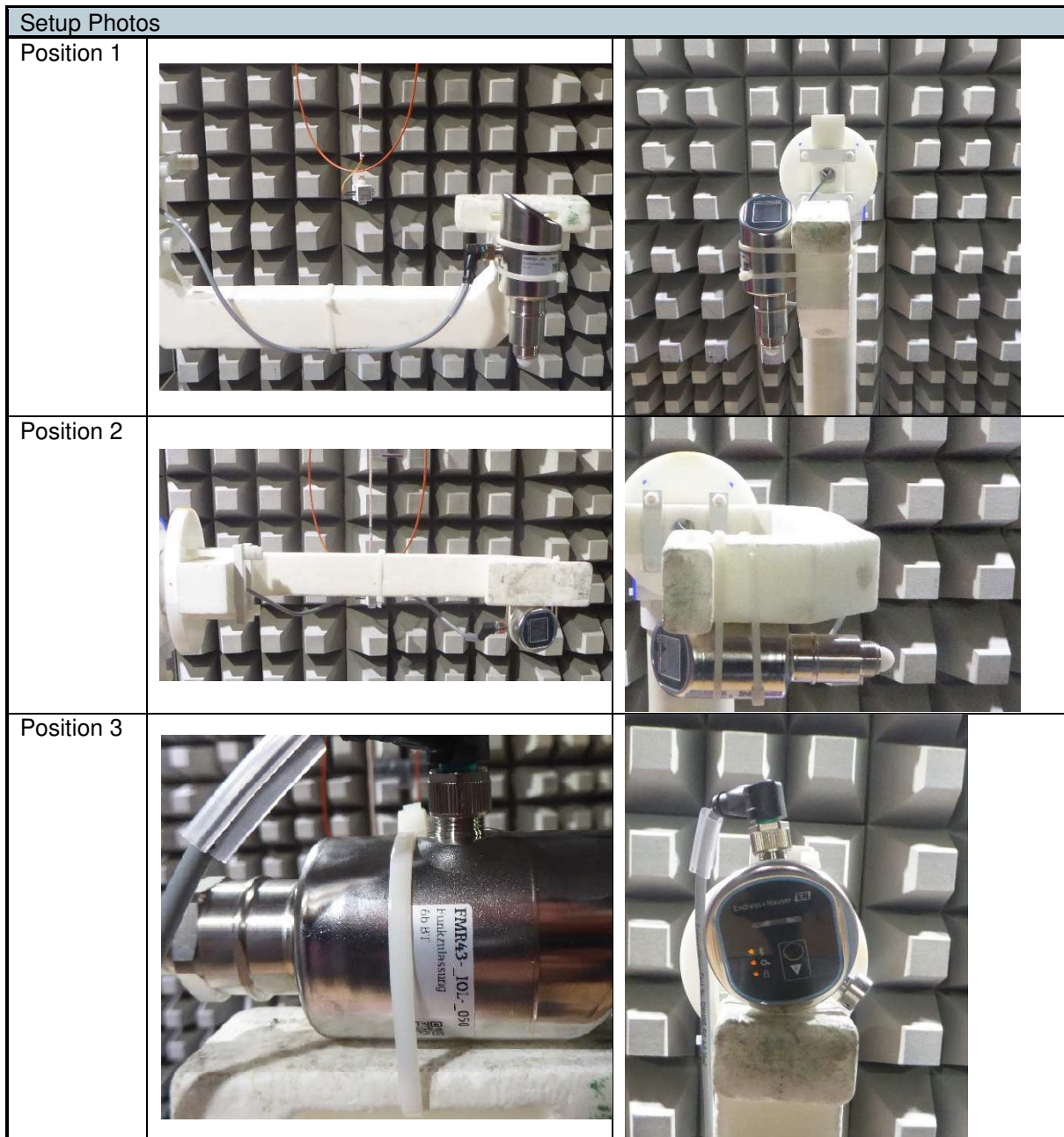
Antenna gain calculation				
		f_{low}	f_{mid}	f_{high}
Conducted output power [dBm]		6.5	6.6	6.8
Radiated EIRP [dBm EIRP]		6.7	5.3	3.8
Antenna Gain [dBi]		0.2	-1.3	-3.0
Position		Position 3	Position 2	Position 2
Position of maximum gain	Azimuth	356	321	295
	Polarisation	H	V	V

Conducted f_{low}	Meas BW (6dB) 100 kHz	Meas Time 100 ms	Step TD Scan Automatic	Frequency 2.4020000 GHz
	Att 25 dB	Notch Off	Preamp Off	
	Input 1 AC	PS		
	1 Bargraph			
Conducted f_{mid}	Meas BW (6dB) 100 kHz	Meas Time 100 ms	Step TD Scan Automatic	Frequency 2.4400000 GHz
	Att 25 dB	Notch Off	Preamp Off	
	Input 1 AC	PS		
	1 Bargraph			
Conducted f_{high}	Meas BW (6dB) 100 kHz	Meas Time 100 ms	Step TD Scan Automatic	Frequency 2.4800000 GHz
	Att 25 dB	Notch Off	Preamp Off	
	Input 1 AC	PS		
	1 Bargraph			

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

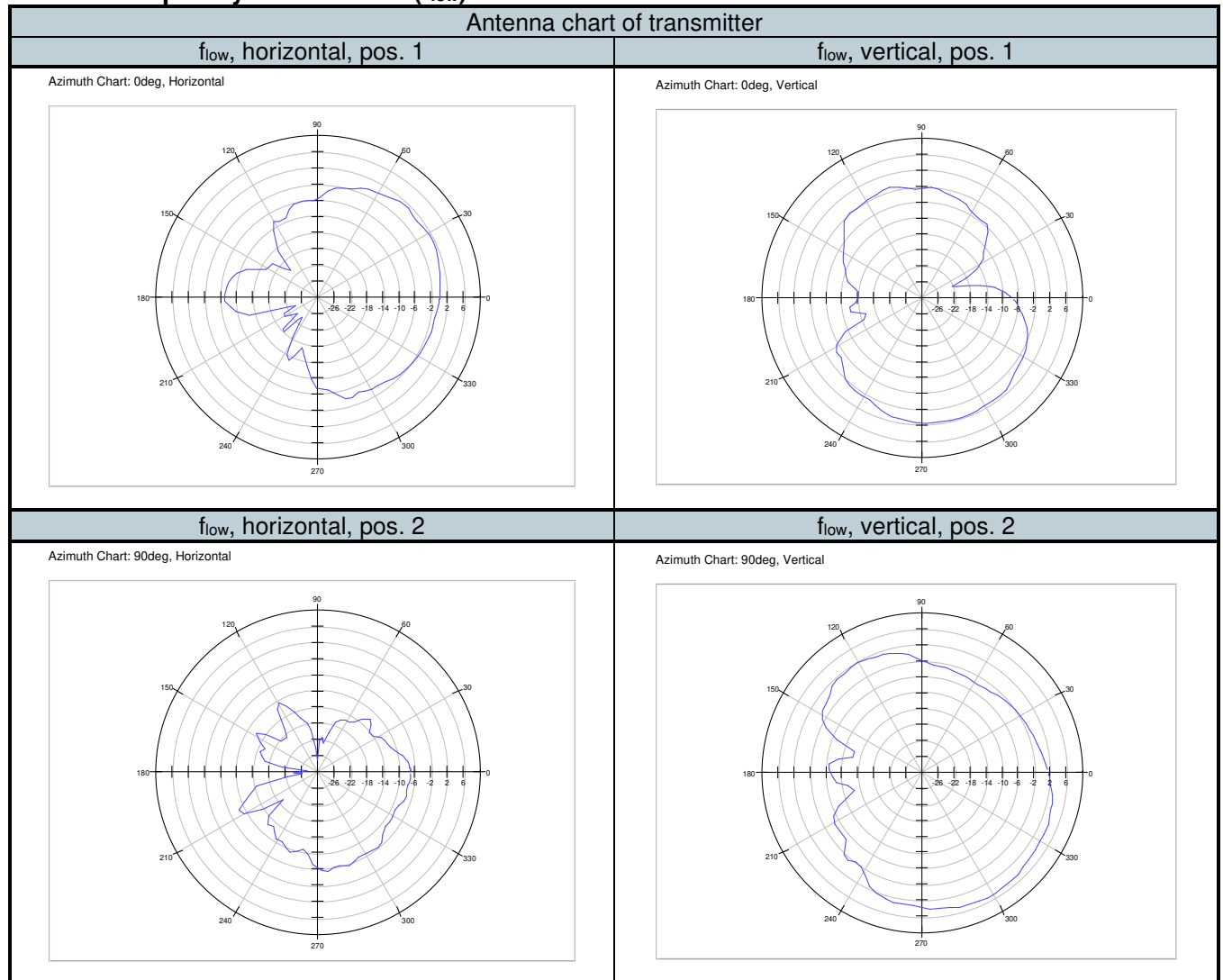
5.2 Antenna Diagrams EUT Position

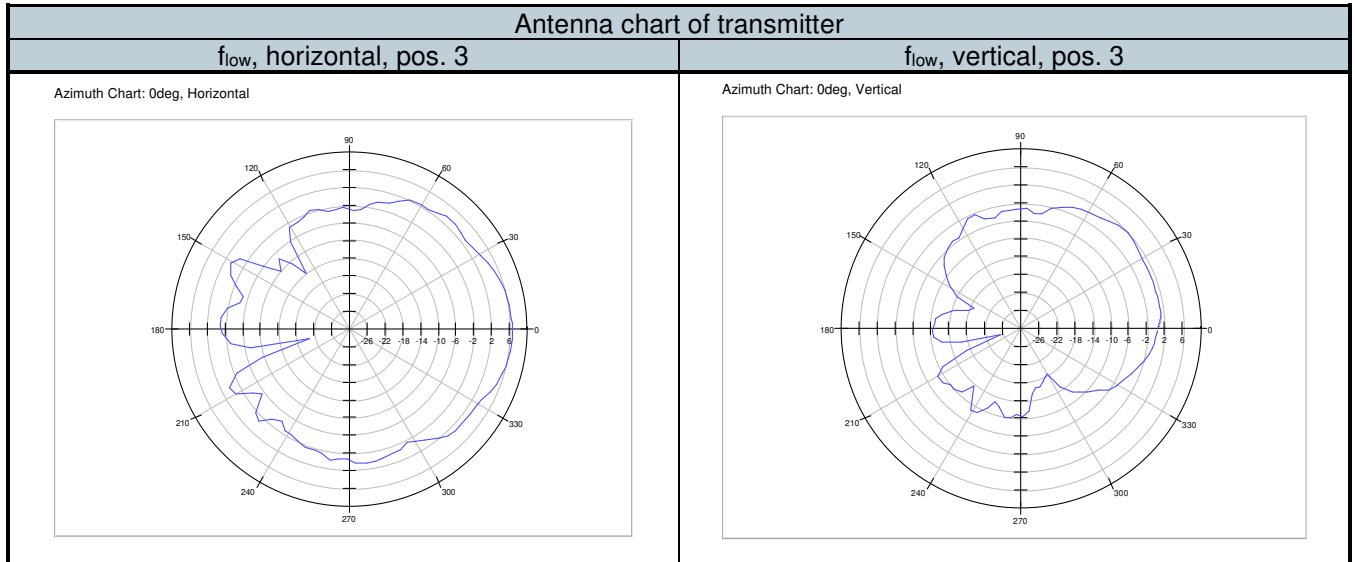
5.2.1 Test Setup Photos



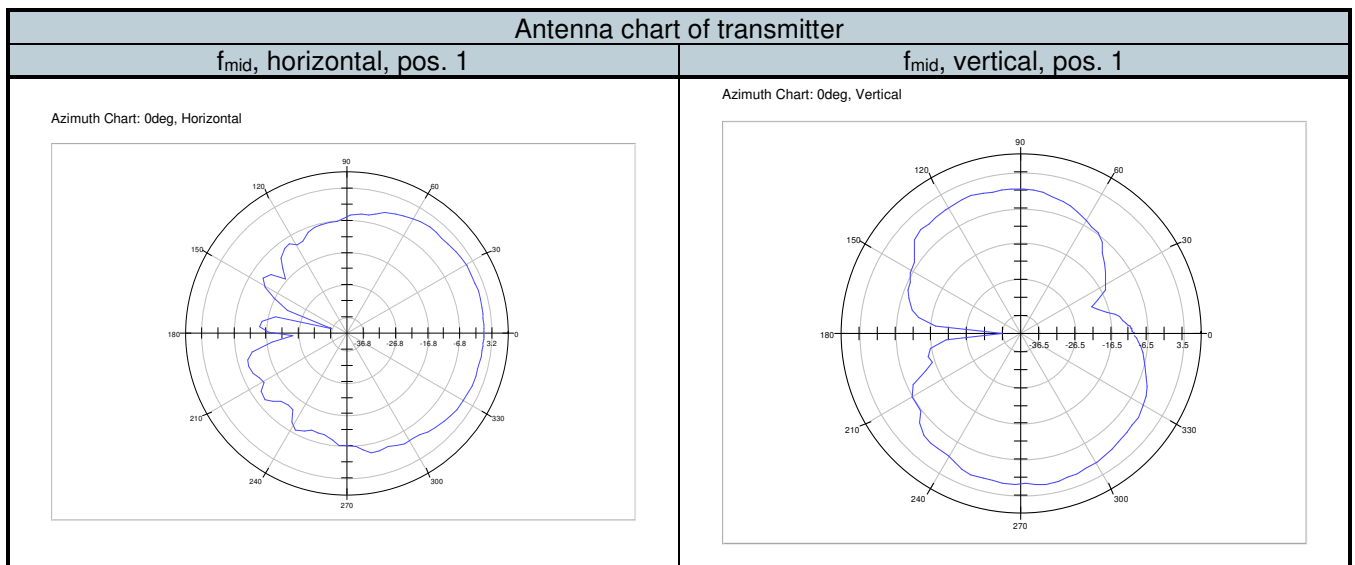
5.2.2 Azimuth charts of transmitter

5.2.2.1 Frequency near bottom (f_{low})





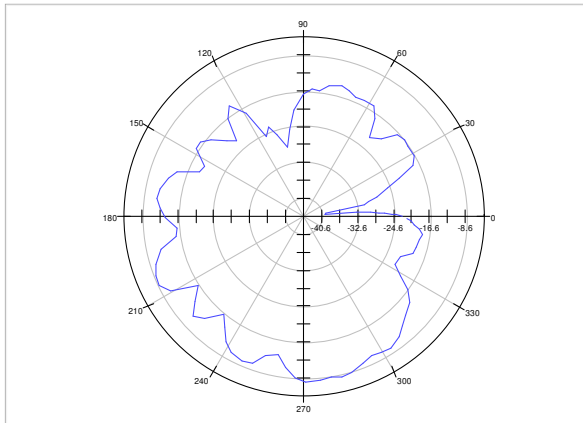
5.2.2.2 Frequency near middle (f_{mid})



Antenna chart of transmitter

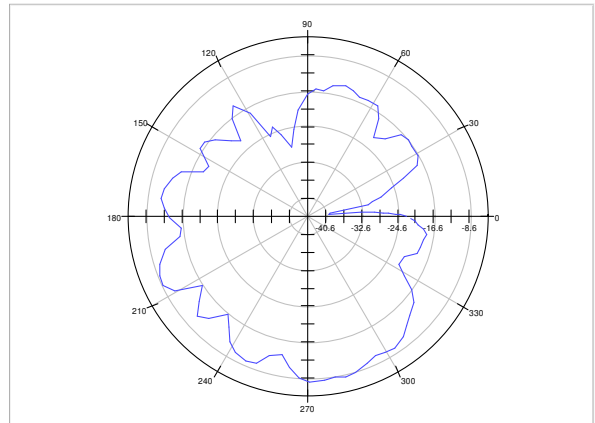
f_{mid} , horizontal, pos. 2

Azimuth Chart: 90deg, Horizontal



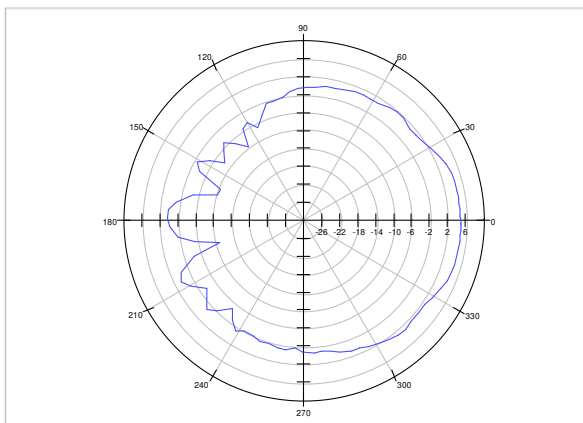
f_{mid} , vertical, pos. 2

Azimuth Chart: 90deg, Horizontal



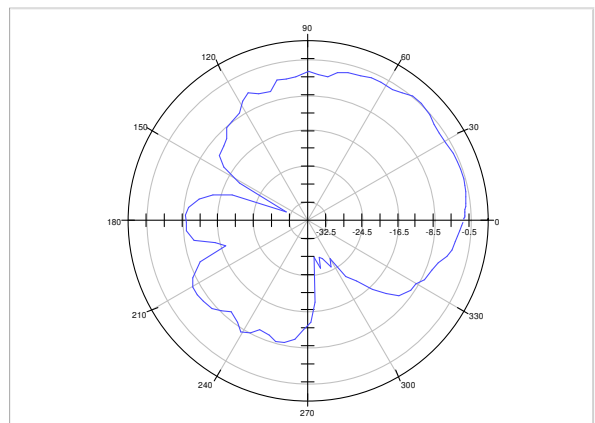
f_{mid} , horizontal, pos. 3

Azimuth Chart: 0deg, Horizontal

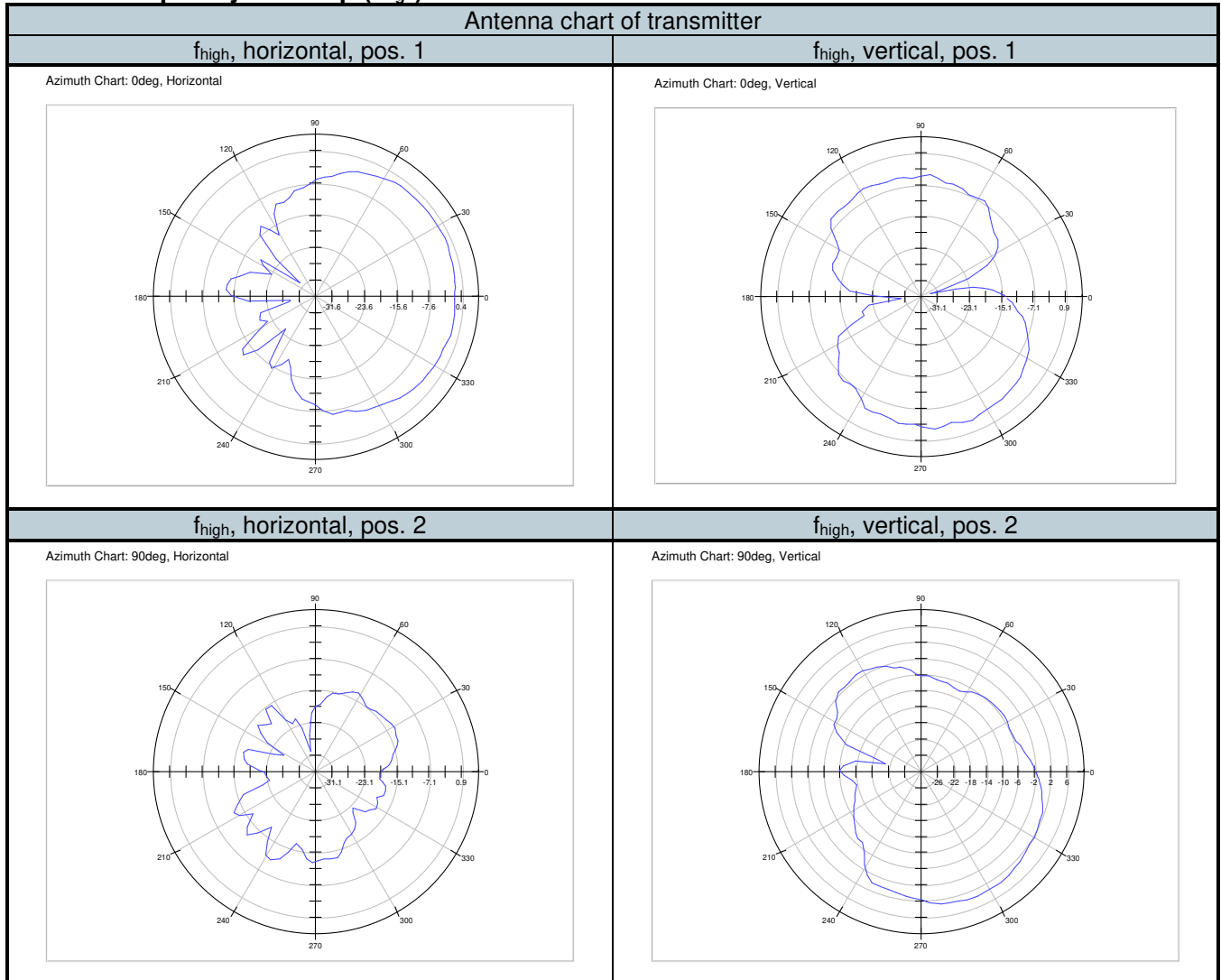


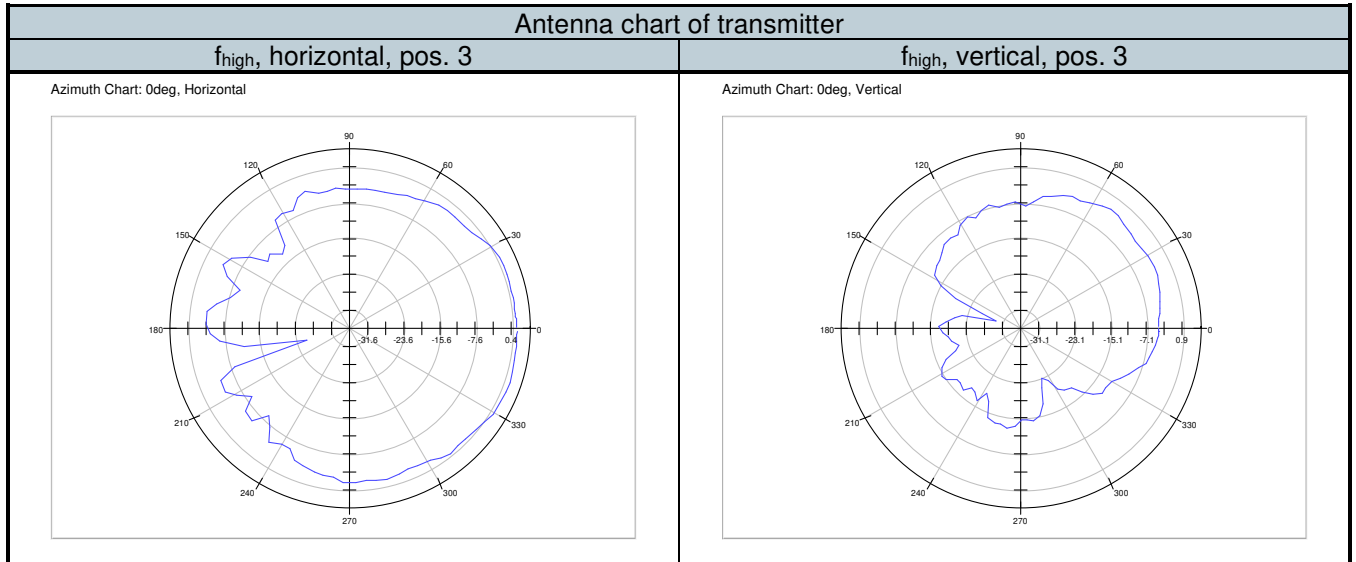
f_{mid} , vertical, pos. 3

Azimuth Chart: 0deg, Vertical



5.2.2.3 Frequency near top (f_{high})





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/043/97110 7	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
-	-	-
-	-	-