

ANTENNA UNDER TEST REPORT Antenna operating within the 2400.0 MHz - 2483.5 MHz	
Report Reference No	G0M-2404-2541-TFCAUT-V01
Testing Laboratory	Eurofins Product Service GmbH
Address	Storkower Str. 38c 15526 Reichenwalde Germany
Applicant	Andreas Stihl AG & Co. KG
Address	Badstraße 115 71336 Waiblingen Germany
Equipment under Test (EUT):	
Product Description	battery pack 4871 AR
Model(s)	AR 2000 L
Additional Model(s)	None
Brand Name(s)	Andreas Stihl AG & Co. KG
Hardware Version(s)	03.11
Software Version(s)	00.16
FCC ID	2ALP8AR1

Testing:		
Test Lab Temperature	20 °C - 30 °C	
Test Lab Humidity	25 % - 55 %	
Date of receipt of test item	2024-11-26	
Report:		
Compiled by	Ehsan Sohrabi	
Tested by (+ signature) (Responsible for Test)	Ehsan Sohrabi	
Approved by (+ signature) (Test Lab Engineer)	Florian Voigt	
Date of Issue	2024-12-10	
Total number of pages	22	
General Remarks:		
The test results presented in this report relate only to the object tested. The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report. This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.		
Additional Comments:		
None		

Test Report No.: G0M-2404-2541-TFCAUT-V01

Eurofins Product Service GmbH
Storkower Str. 38c, D-15526 Reichenwalde, Germany

VERSION HISTORY

Version History			
Version	Issue Date	Remarks	Revised By
01	2024-12-10	Initial Release	--

ABBREVIATIONS AND ACRONYMS

Acronyms	
Acronym	Description
EUT	Equipment Under Test
AUT	Antenna Under Test
HPBA	Half Power Beam Angle
T _{NOM}	Nominal temperature
V _{NOM}	Nominal supply voltage

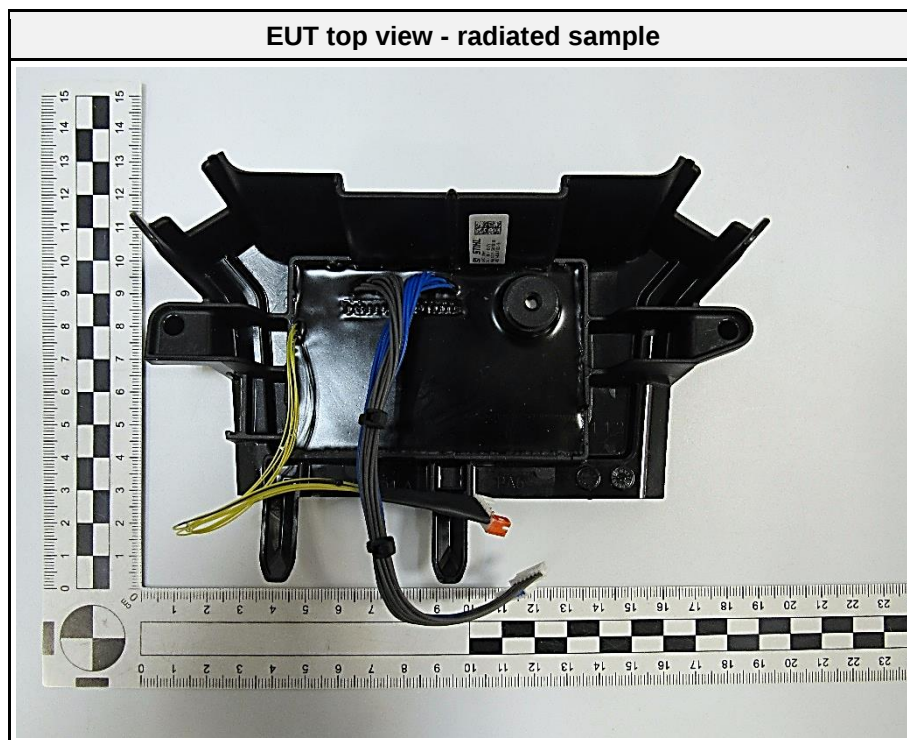
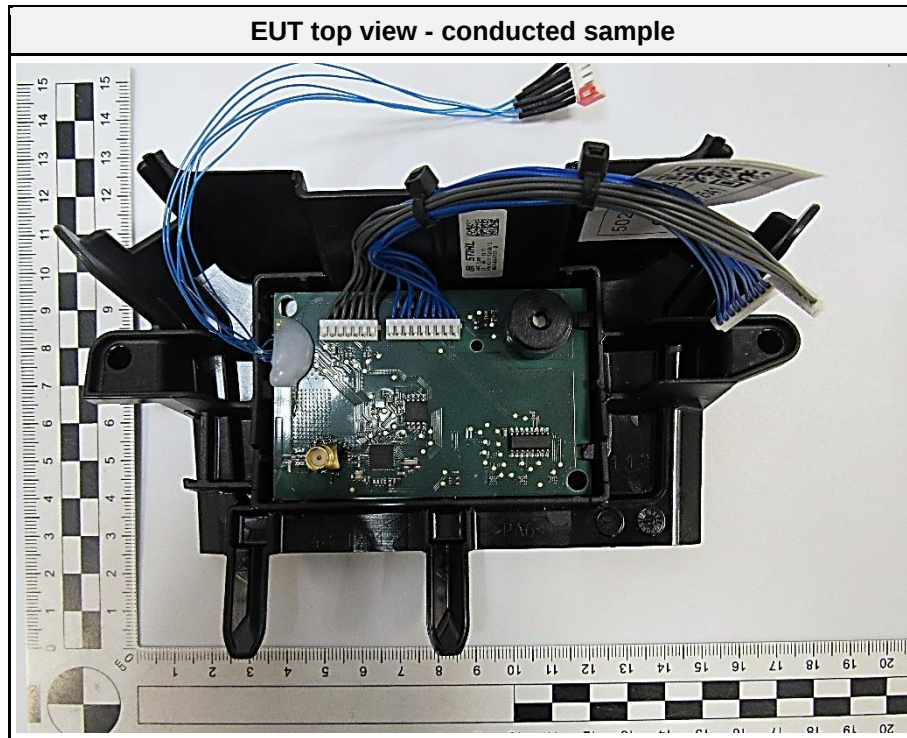
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1 Equipment (Test Item) Under Test

Description	battery pack 4871 AR	
Model	AR 2000 L	
Additional Model(s)	None	
Brand Name(s)	Andreas Stihl AG & Co. KG	
Sample identification	Serial Number	Test Sample ID
	Prototype	50295
Hardware Version(s)	03.11	
Software Version(s)	00.16	
Equipment type	End Product	
Radio type	Transceiver	
Assigned frequency range	2400.0 MHz - 2483.5 MHz	
Radio technology	Bluetooth LE 5.0	
Modulation	GFSK	
Antenna	Type	Integrated antenna
	Model	Inverted F
	Manufacturer	PCB Antenna
	Gain	1.1 dBi (by measurement)
Supply Voltage	V _{NOM}	36 V DC via external AC/DC charger
Operating Temperature	T _{NOM}	25 °C
Dedicated AC/DC-Adaptor	Model	STIHL AL 301.0 B
	Vendor	STIHL
	Input	120 V / 60 Hz
	Output	36 V
Manufacturer	Andreas Stihl AG & Co. KG Badstraße 115 71336 Waiblingen Germany	

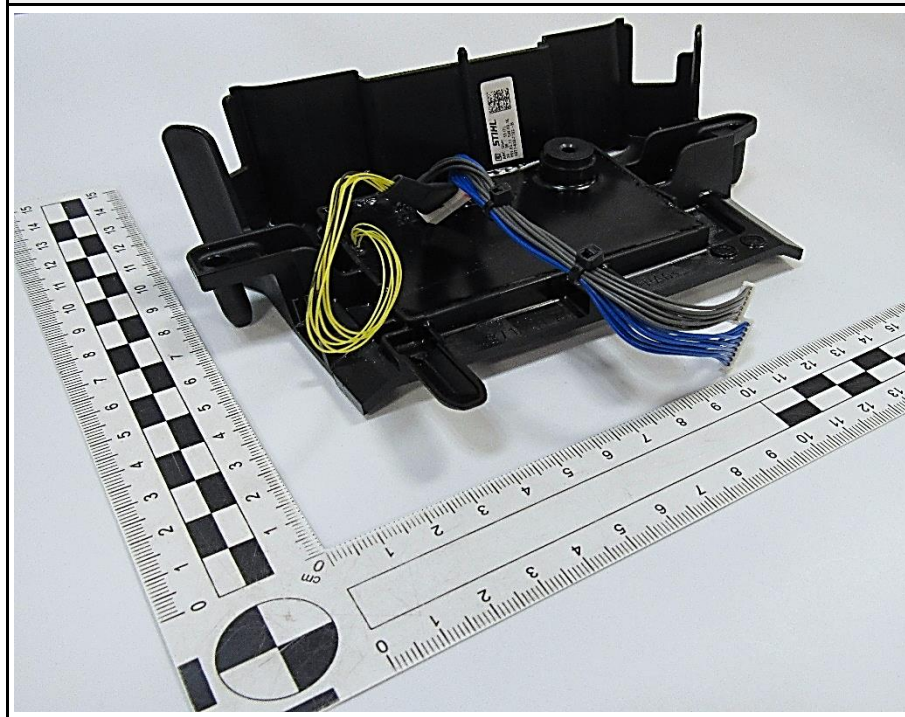
1.1 Photos – Equipment



EUT bottom view - radiated sample



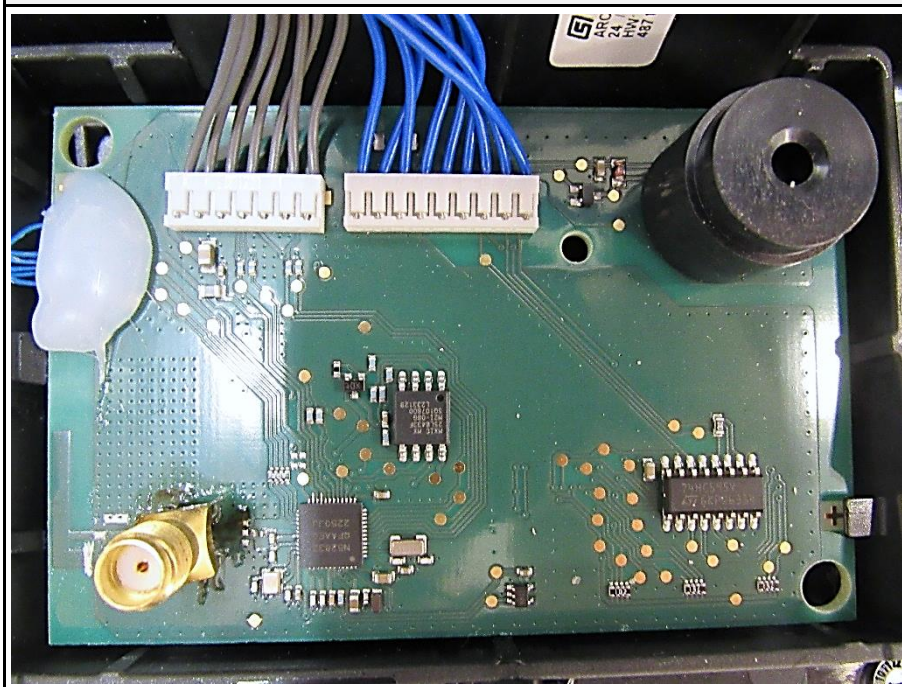
Perspective view 1 - radiated sample



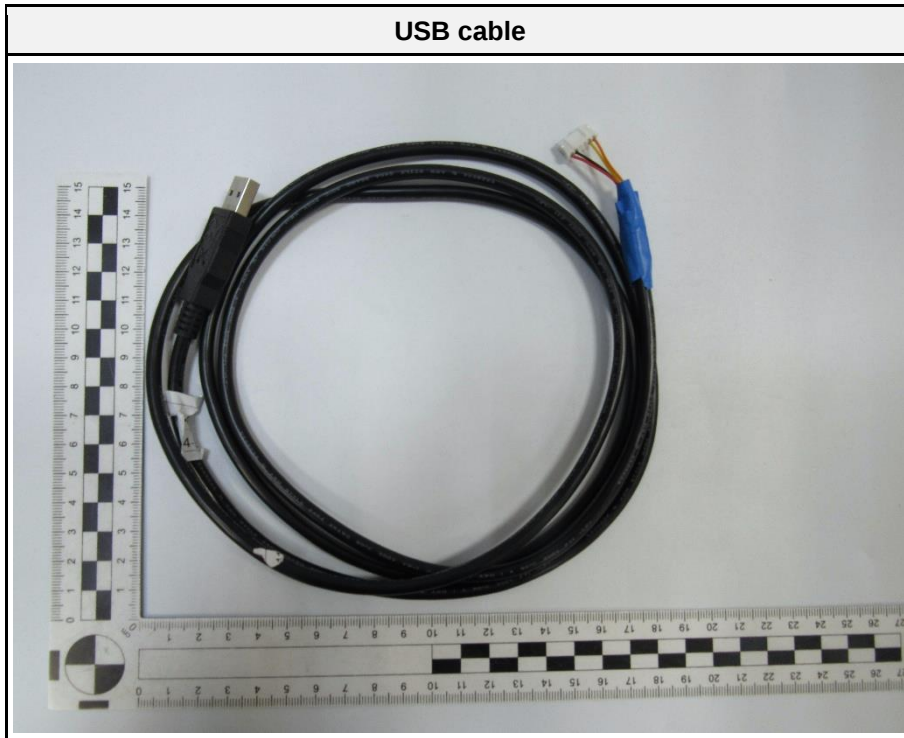
Perspective view 2 - radiated sample



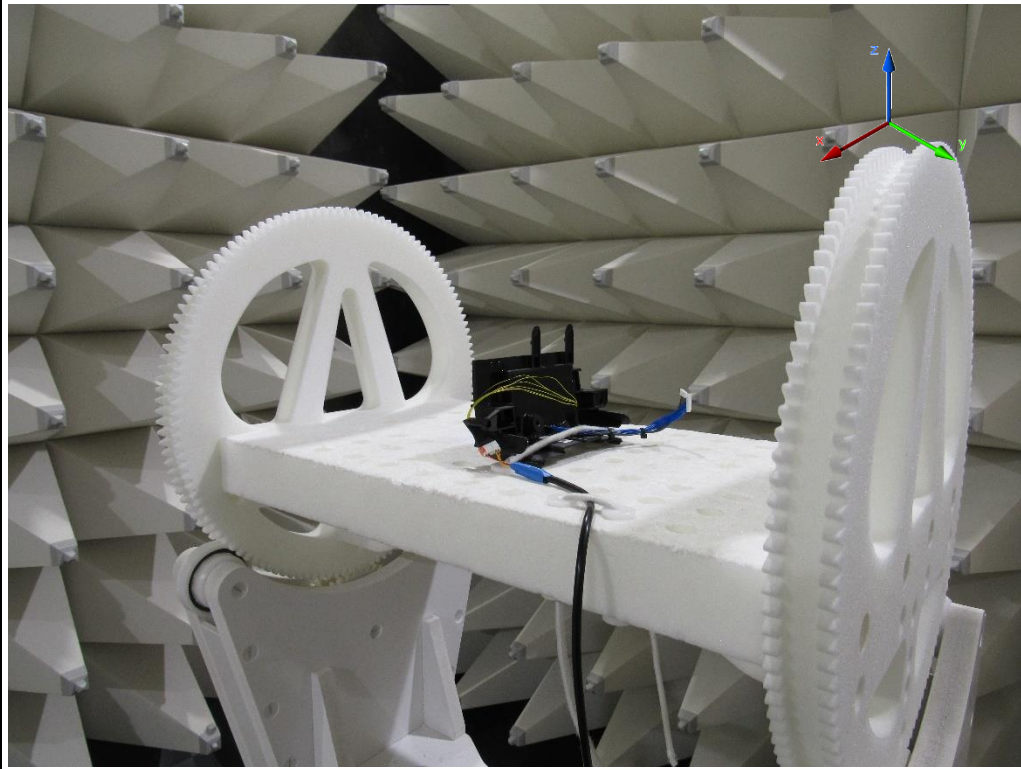
PCB view – conducted sample



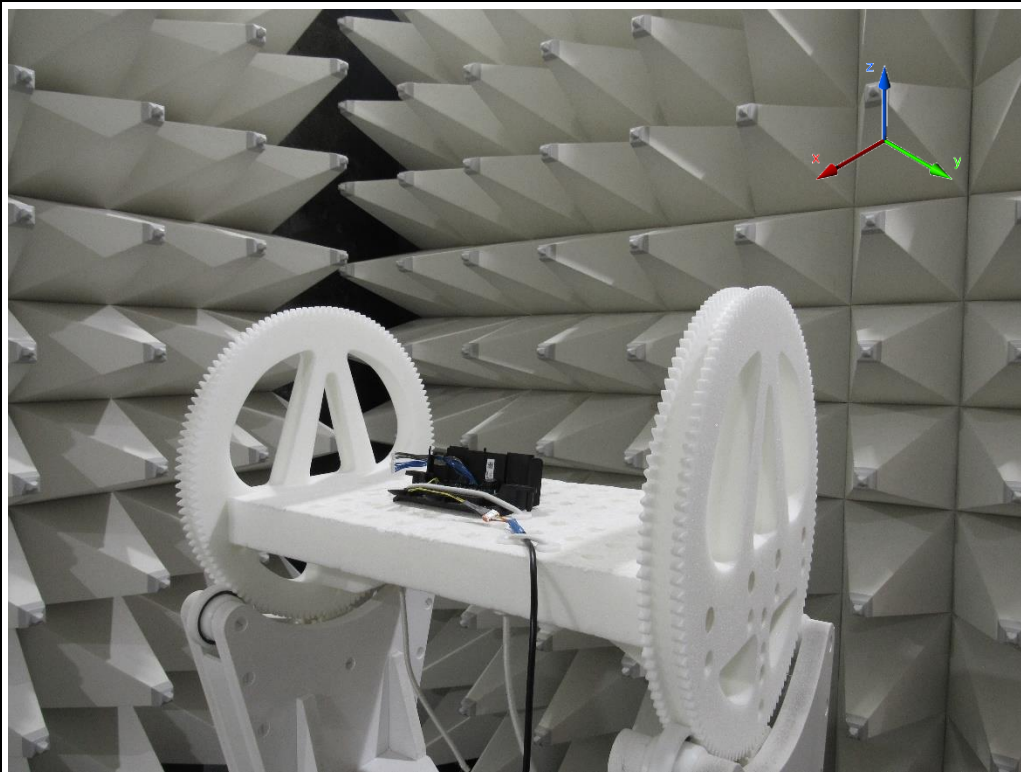
USB cable



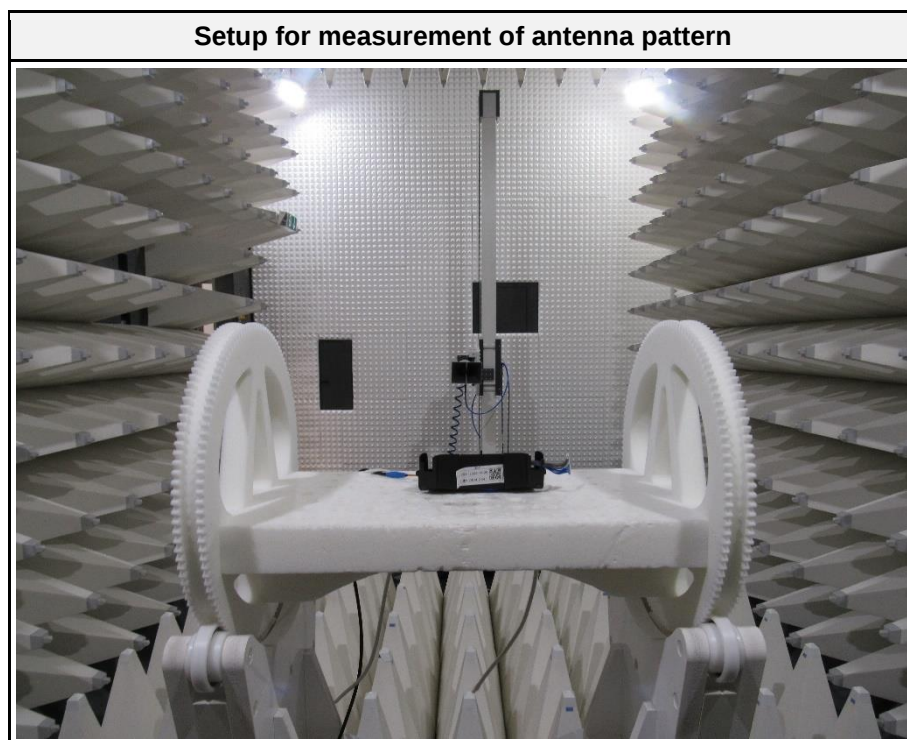
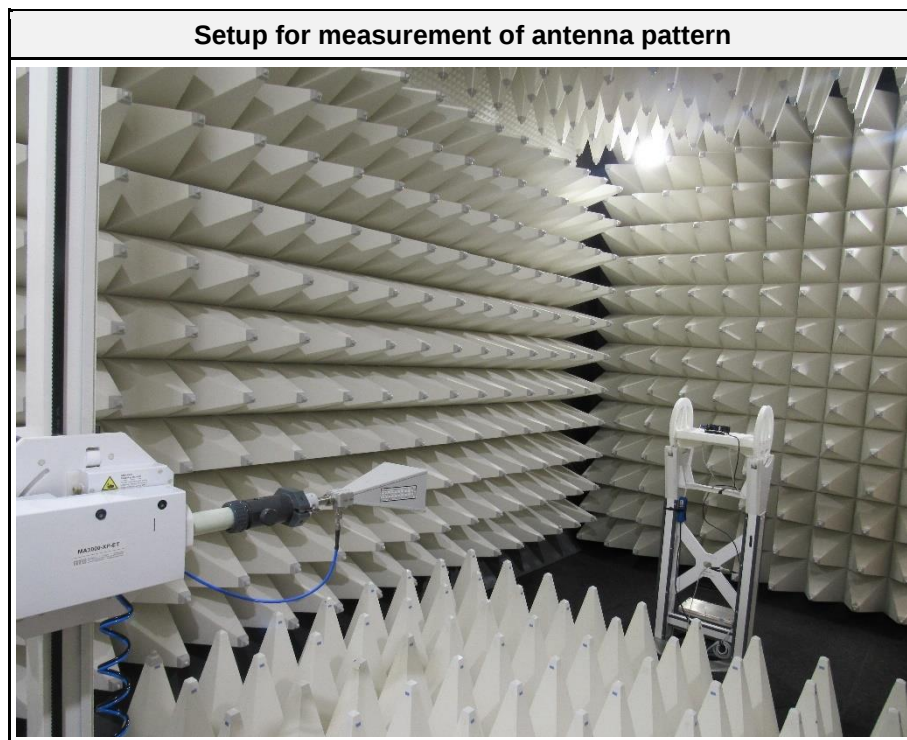
Test setup - Antenna position to the axis - Measuring antenna horizontal



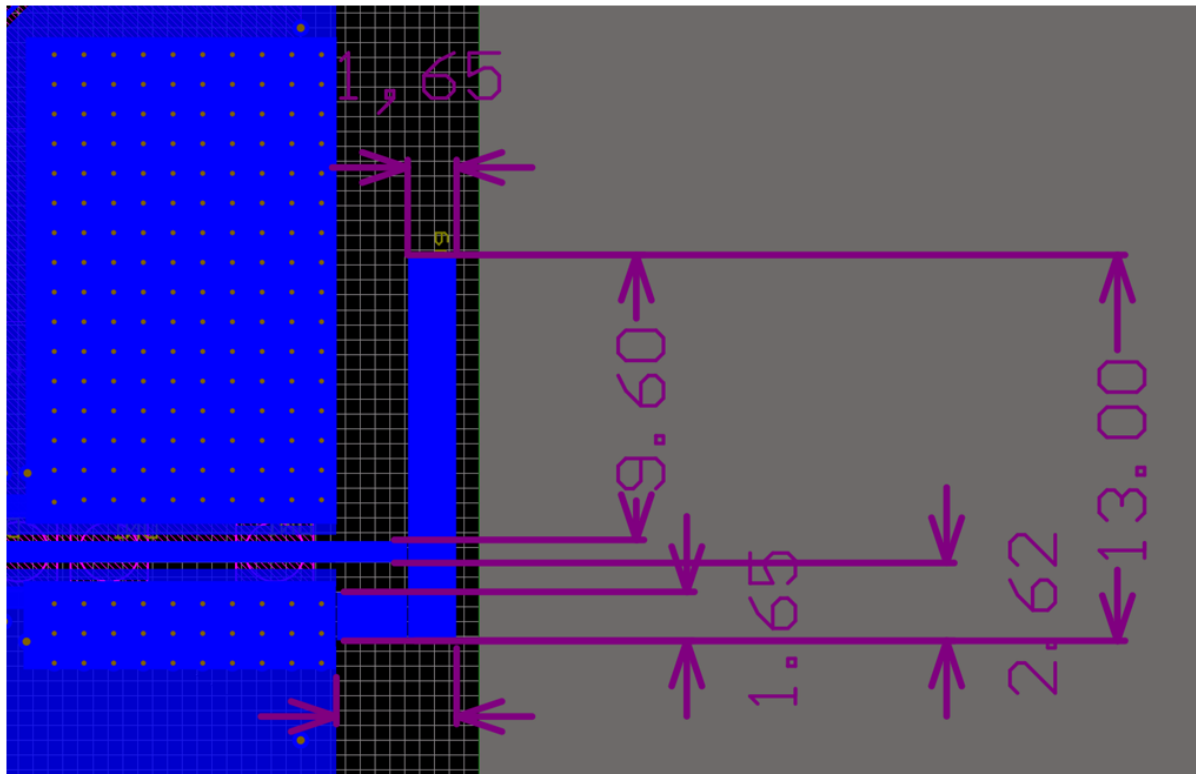
Test setup - Antenna position to the axis - Measuring antenna vertical



1.2 Photos Test Setup



1.3 Antenna Mechanical Properties



1.4 Support Equipment

Product Type	Device	Manufacturer	Model	Comment
AE	Laptop	Lenovo	L470	For setting test modes
CBL	USB cable	---	---	To connect laptop to EUT
SFT	Remote control software	Nordic Semiconductor	nrfconnect 5.0.0	For configuring test modes
Description:				
AE	Auxiliary Equipment			
SIM	Simulator			
CBL	Connecting Cable			
SFT	Software			
Comment: --				

1.5 Test Modes

Mode	Description
GFSK 1 Mbps	Mode = Transmit Modulation = GFSK Spreading = None Packet length = 193 Bytes Power setting = 8 dBm (by software)

1.6 Test Frequencies

Designator	Mode	Frequency [MHz]
F1	Tx	2440.0

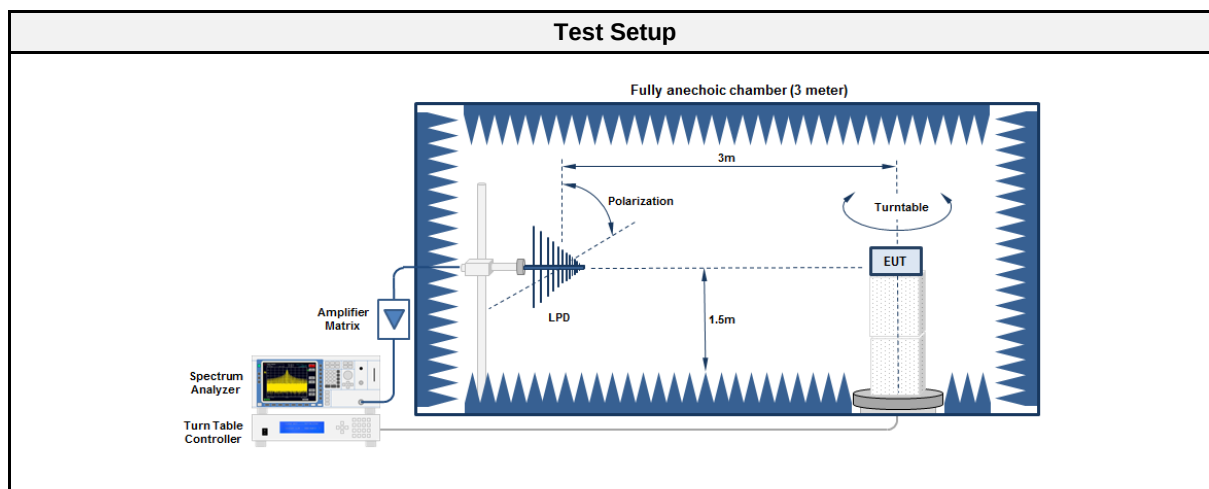
2 Test Conditions and Results

2.1 Test Conditions and Results – Antenna pattern

2.1.1 Information

Test Information	
Operator	Ehsan Sohrabi
Measurement uncertainty	± 4.42 dB
Date	2024-11-27 - 2024-11-29

2.1.2 Setup



2.1.3 Equipment

Test Equipment					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Anechoic chamber	Frankonia	AC 2	EF01616	2024-07	2025-07
Spectrum analyzer	R&S	FSW43	EF00896	2024-07	2025-07
Antenna	Schwarzbeck	BBHA 9120B	EF01678	2024-05	2027-05

2.1.4 Procedure

Test Procedure	
1.	EUT set to the test mode and the conducted output power has been determined as reference value
2.	EUT is placed on a non-conducting support at the center of a turn table 1.5 m above the ground
3.	The Spectrum analyzer is set to the appropriate RBW, and detector.
4.	The EIRP is measured and recorded in the azimuth plane through 0° to 360° and in the elevation plane through 0° to 180°.
5.	procedure is repeated for horizontal and vertical polarization.

2.1.5 Results

Test Result				
Channel [MHz]	Measuring antenna polarization	Conducted Power [dBm]	Max. rad. Power [dBm e.i.r.p]	Max. antenna gain [dBi]
2440.0	Vertical	4.4	5.5	1.1
	Horizontal	4.4	4.61	0.21

ANNEX A Antenna patterns

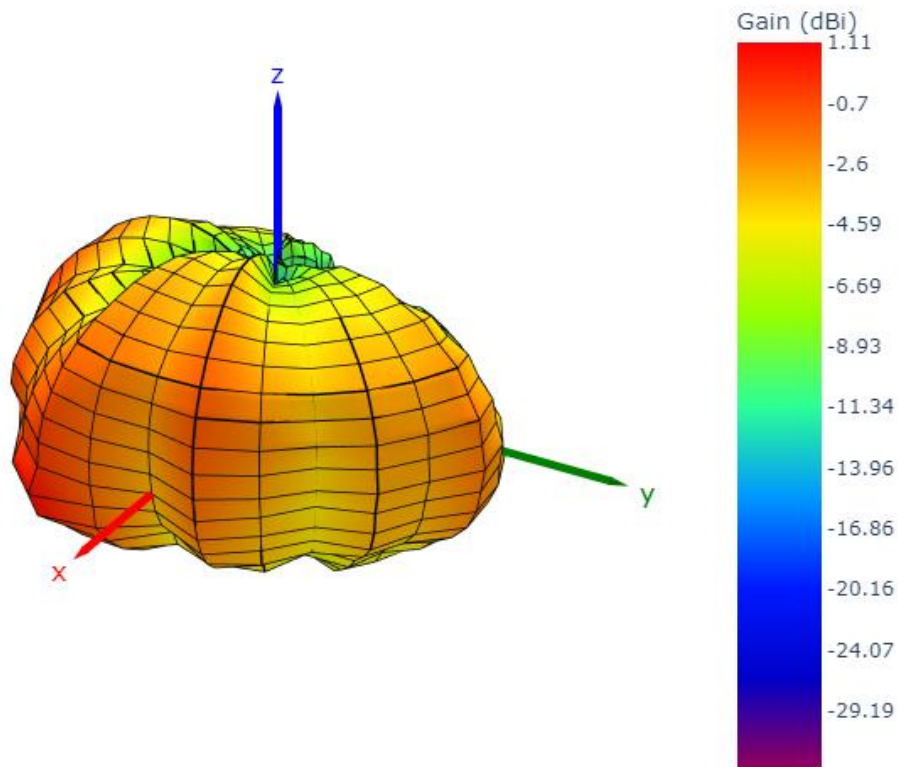
Antenna Pattern 2.4 GHz (Receive antenna vertical)

Project Number: G0M-2404-2541
 Product: battery pack 4871 AR-C
 Model: AR 2000 L
 EUT Antenna: PCB antenna
 Operating Frequency: 2440 MHz
 Detector: RMS
 RBW: 1 MHz
 VBW: 3 MHz
 Sweep Time: 20 ms
 Conducted Power: 4.40 dBm
 Operator: Ehsan Sohrabi
 Date: 2024-11-28

Result Summary

EUT orientation at max power (θ , ϕ)	HPBA (Azimuth plain)	HPBA (Elevation plain)	Max. rad. power [dBm e.i.r.p.]	Max. antenna gain [dBi]
(276°,102°)	93°	87°	5.5	1.10

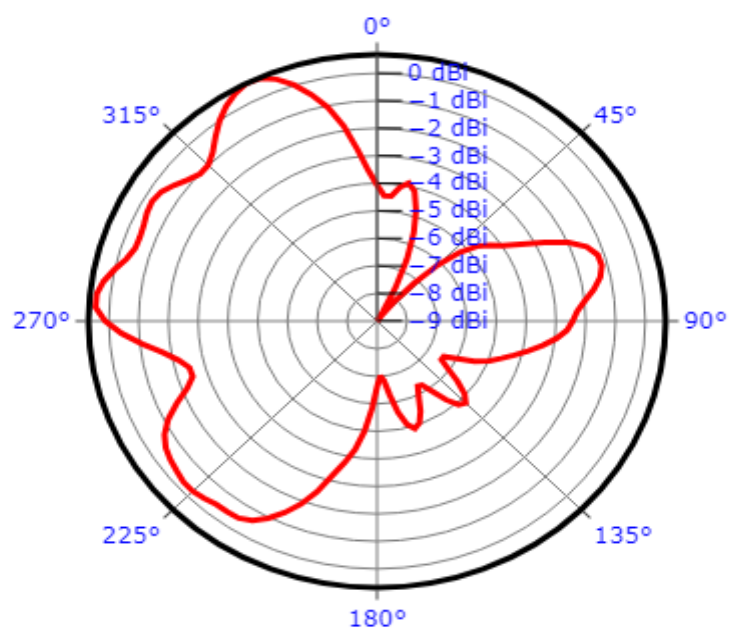
3D Radiation pattern



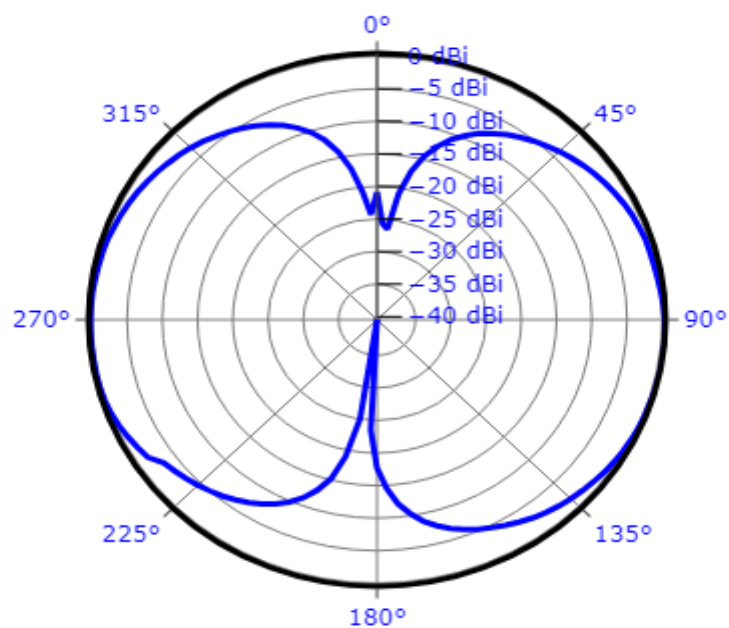
Vertical 3D antenna pattern

2D Polar plot at maximum radiation

Polar radiation pattern at $\theta = 98^\circ$



Polar radiation pattern at $\phi = 274^\circ$



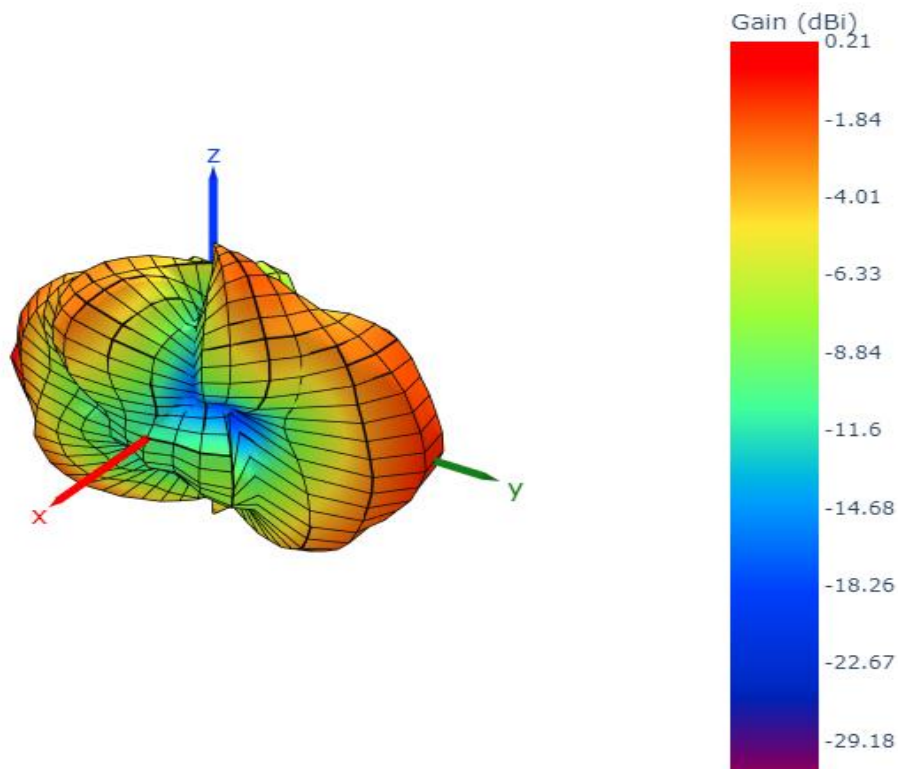
Antenna Pattern 2.4 GHz (Receive antenna horizontal)

Project Number: G0M-2404-2541
 Product: battery pack 4871 AR-C
 Model: AR 2000 L
 EUT Antenna: PCB antenna
 Operating Frequency: 2440 MHz
 Detector: RMS
 RBW: 1 MHz
 VBW: 3 MHz
 Sweep Time: 20 ms
 Conducted Power: 4.40 dBm
 Operator: Ehsan Sohrabi
 Date: 2024-11-28

Result Summary

EUT orientation at max power (θ, φ)	HPBA (Azimuth plain)	HPBA (Elevation plain)	Max. rad. power [dBm e.i.r.p.]	Max. antenna gain [dBi]
(276°, 96°)	24°	90°	4.61	0.21

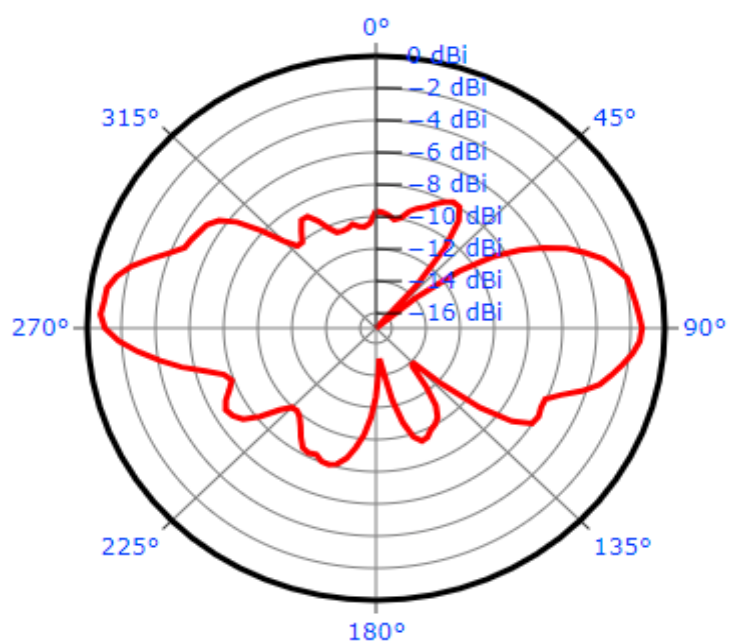
3D Radiation pattern



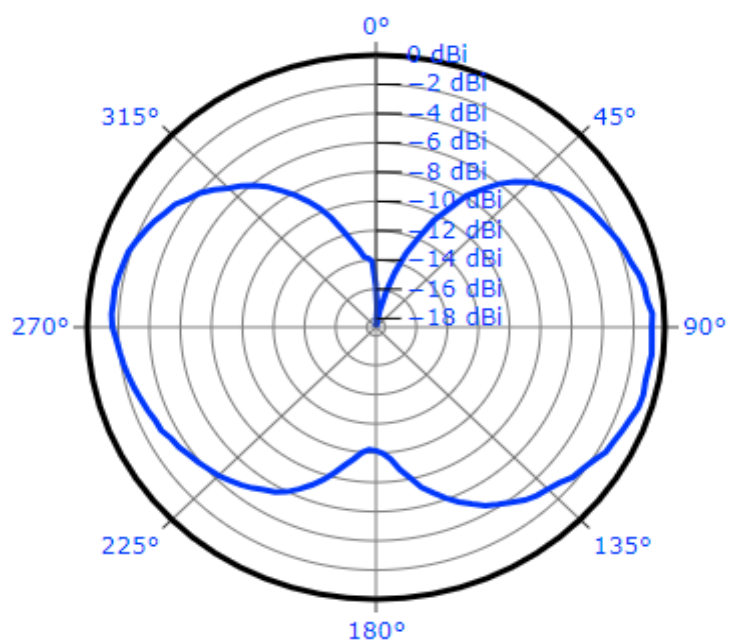
[Horizontal 3D antenna pattern](#)

2D Polar plot at maximum radiation

Polar radiation pattern at $\theta = 96^\circ$



Polar radiation pattern at $\phi = 274^\circ$



== END OF TEST REPORT ==