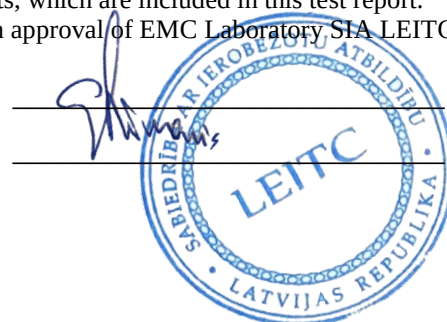


TEST REPORT

Type of equipment:	Antenna
Model:	HM-U-4
Marketing name:	-
Sub model:	-
Serial number:	-
Applicant:	SIA HackMotion
Manufacturer:	-
Test standard:	Testing carried out according to LEITC internal procedure P-17 Current tests are outside the scope of accreditation.
Test report no.:	LEITC-TR-26-013
Identification no.:	ID_1808
Testing laboratory:	SIA LEITC
Result summary:	-

The results applies only to the sample tested, according to the carried tests, which are included in this test report.
This test report shall not be reproduced expect in full, without the written approval of EMC Laboratory SIA LEITC.

Test responsible:	Gundars Ašmanis
Laboratory responsible:	Gundars Ašmanis
Date of issue:	17.02.2026.



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1. REVISION HISTORY

Revision no.	Description	Date	Pages revised
00	First release.	17.02.2026.	N/A

2. LABORATORY INFORMATION



Latvian Electronic Equipment Testing Centre

Testing laboratory: SIA LEITC

Address: Azenes street 12, Riga, Latvia, LV-1048

Telephone number: +371 22001023

Contact Person: Gundars Ašmanis

E-mail: info@leitic.lv

Web site: <http://www.leitic.lv>



3. CLIENT INFORMATION

Applicant: SIA HackMotion

Address: HACKMOTION, ZIRNU IELA 1-68, LATVIA 1013 RIGA,
LATVIA, Latvija

Telephone number: +371 28327897

Contact Person: Girts Kagis

E-mail: girts.kagis@hackmotion.com

Web: -

Manufacturer: -

Address: -

Telephone number: -

Contact Person: -

E-mail: -

Web: -

4. SUMMARY OF TEST RESULTS

Standard:	Internal procedure P-17			
Title:	Integrated antenna gain measurement using Friis free space equation			
Reference Standard:	-			
Title:	-			
No.	Measurement type	Reference standard	Applicability	Result
1.	Gain	-	Y	N/A
Notes: Y- applied; N/A – not applicable.				
Deviations from standard specification: no deviations from the test standards.				

5. DESCRIPTION OF EQUIPMENT UNDER TEST

5.1 Description of EUT						
LEITC identification no.: ID_1808						
HM-U-4 with PCB Version HM_MasterBoard_5.1.0						
No.	EUT	Model	Serial No.	Manufacturer		
1.	Antenna	HM-U-4	-	-		
5.2 Peripherals and associated equipment						
No.	Description	Model	Serial No.	Manufacturer		
1.	-	-	-	-		
5.3 Cables used during the testing						
No.	Cable type	Shielded	Ferrite	Length used during test	Connection 1	Connection2
1.	-	☐	☐	-	-	-
5.4 EUT configuration						
Device was prepared specially for antenna gain measurements. Integrated antennas were soldered to external coaxial cables. Two internal LoRa antennas measured. LoRa1 and LoRa2						
		Parameter	Min	Max	Step	
		Frequencies	2400MHz 2440MHz 2483.5MHz			
		Angle	-180°	+180°	5°	
		Distance between antennas	4.5850m			
		Distance above ground	1.8m			
5.4.1 Operating modes/load						
1.	-					
5.4.2 Modification state						
1.	No modification made.					
5.4.3 Radio frequency transmitters incorporated in EUT						
No.	Description	Frequency			Modulation	
1.	-	-			-	

6. INSTRUMENTATION AND CALIBRATION

Equipment and EUT during the tests are operated in temperature range of 21⁰ to 25⁰C, humidity range of 40% to 60%, if not mentioned more precisely next to measurement data.

The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with manufacturer's recommendations or quality manager deliverance and it is traceable under the ISO/IEC 17025 to international or national standards. Equipment has been calibrated by accredited calibration laboratories.

The following list contains measurement equipment used for testing. The equipment conforms to the requirements of CISPR 16-1 and other standard requirements.

Antenna radiation pattern measurements				
Device	Manufacturer	Model	Serial number	Notes
Antenna	Rohde & Schwarz	HL562E	102093	Certificate of calibration No. 1020A300797836; 28.08.2025
Receiver	Rohde & Schwarz	ESIB26	1088.7490K26	Certificate of calibration 202404880.00 28.01.2025
Generator	Rohde & Schwarz	SMR20		Certificate of calibration 1020A300772895 24.01.2025
Turntable	FRANKONIA	FCTAM01	-	Not applicable.
Test site	FRANKONIA	SAC3	-	Not applicable.
Software for EMC measurements EMC32	Rohde & Schwarz	Version 8.53.0	-	Not applicable.

7. TEST PROCEDURES

P-17 Integrated antenna gain measurement using Friis free space equation

Assuming that semi-anechoic chamber is fulfilling free space conditions and antennas are located in far field, gain is calculated based on Friis equation:

$$P_{rx} = P_{tx} G_{tx} G_{rx} \left(\frac{\lambda}{4\pi d} \right)^2$$

where

P_{rx} – Power at receiving antenna output;

P_{tx} – Power at transmitting antenna input;

G_{rx} – Receiving antenna gain;

G_{tx} – Transmitting antenna gain;

λ – wavelength, where $\lambda = c/f$, c = speed of light, f = frequency;

d – Distance, between two antennas;

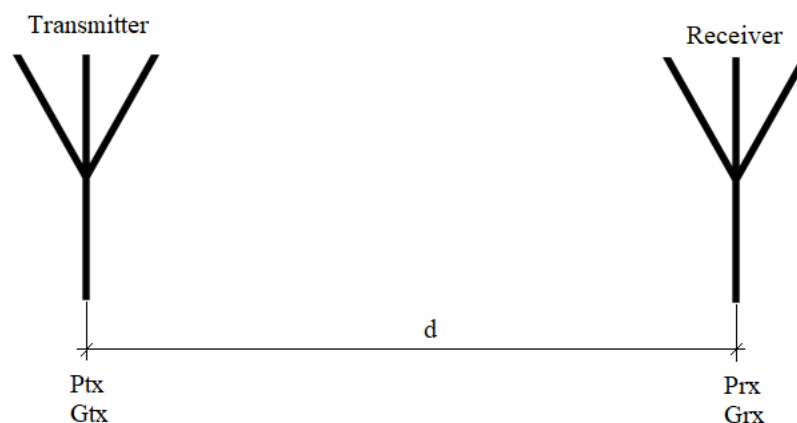
c – Speed of light in vacuum 299.972458×10^6 m/s;

Gain of the transmitting antenna can be calculated as follows:

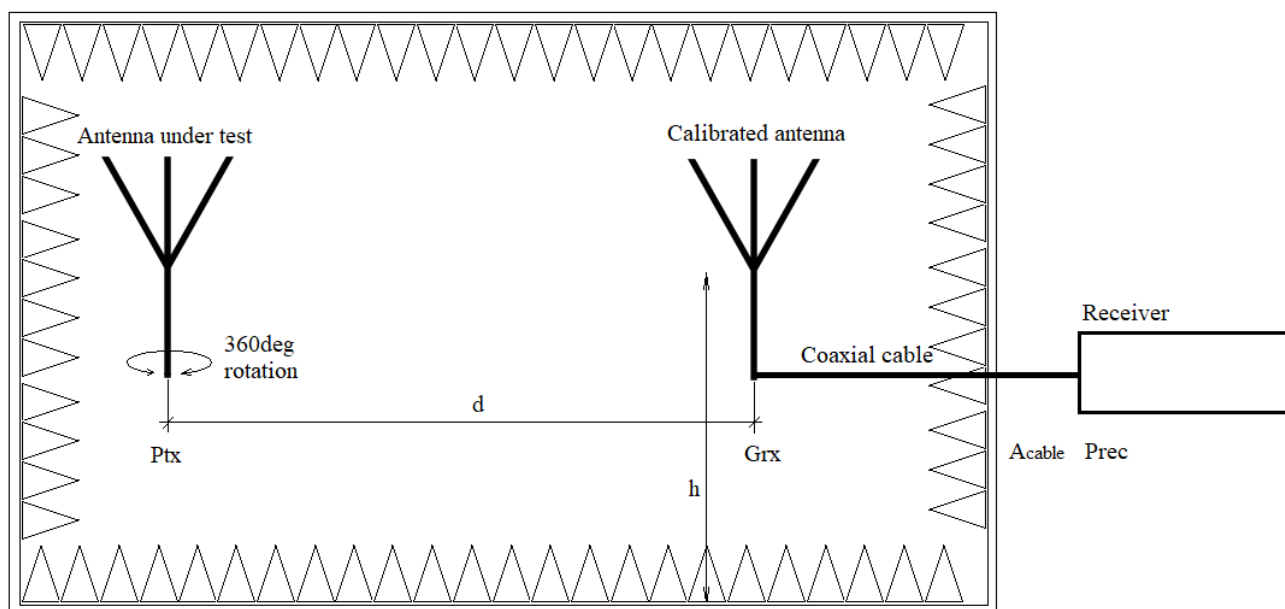
$$G_{tx} = \frac{P_{rx}}{P_{tx} G_{rx}} \left(\frac{4\pi d}{\lambda} \right)^2$$

Or in terms of dB

$$G_{tx} = P_{rx} - P_{tx} - G_{rx} - 20 \log_{10} \left(\frac{\lambda}{4\pi d} \right)^2$$



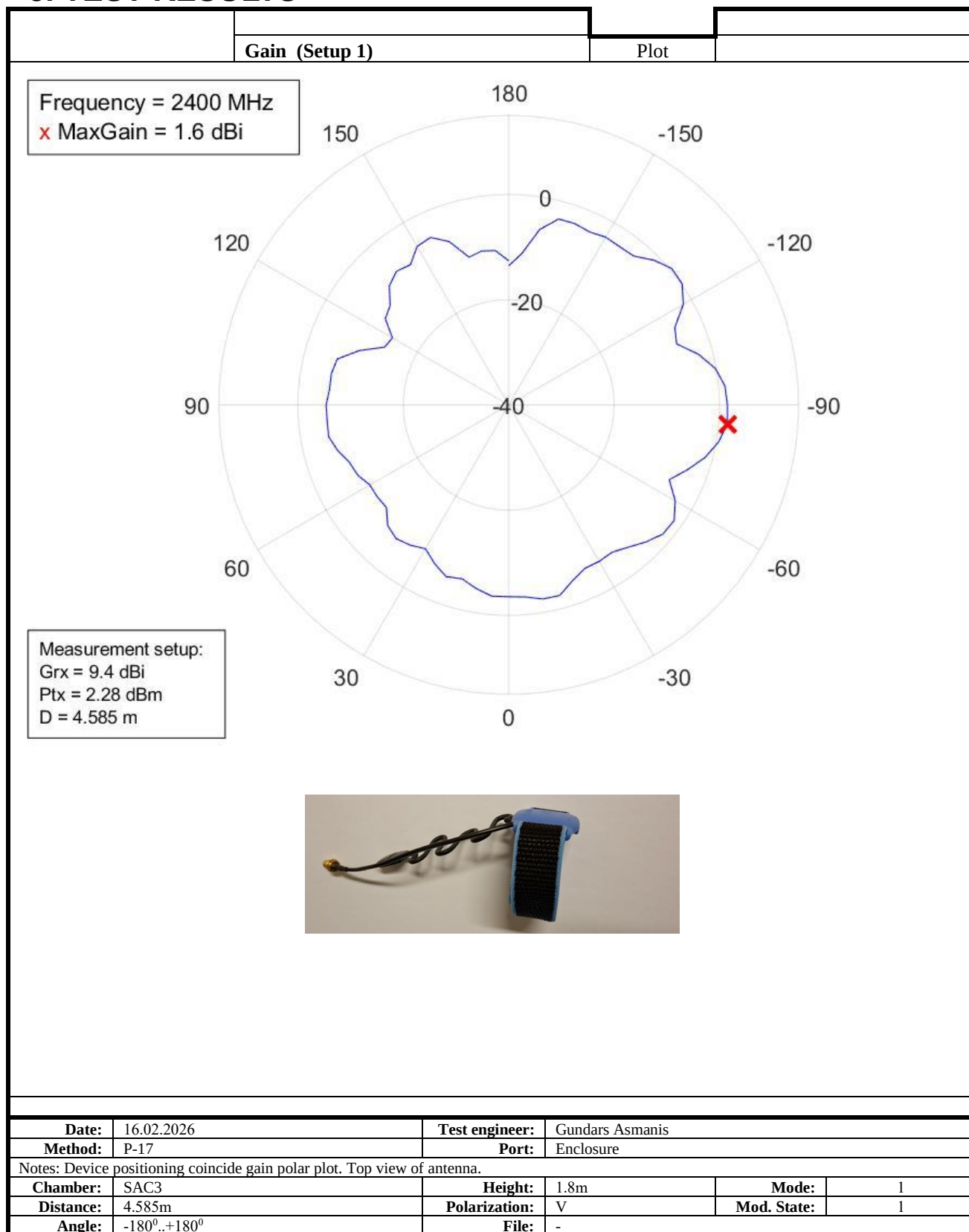
Antenna under test (transmitting antenna) is integrated in IoT product that has an internal RF power source providing power P_{tx} . Calibrated receiving antenna with known G_{rx} is connected to receiver via coaxial cable with cable loss A_{cable} . Receiver reading P_{rec} . Both antennas are located at the same height above reference ground plane h . Antenna under test is rotated 360deg to measure antenna pattern. Calibrated antenna positioning (polarization) is not changed during the measurements.



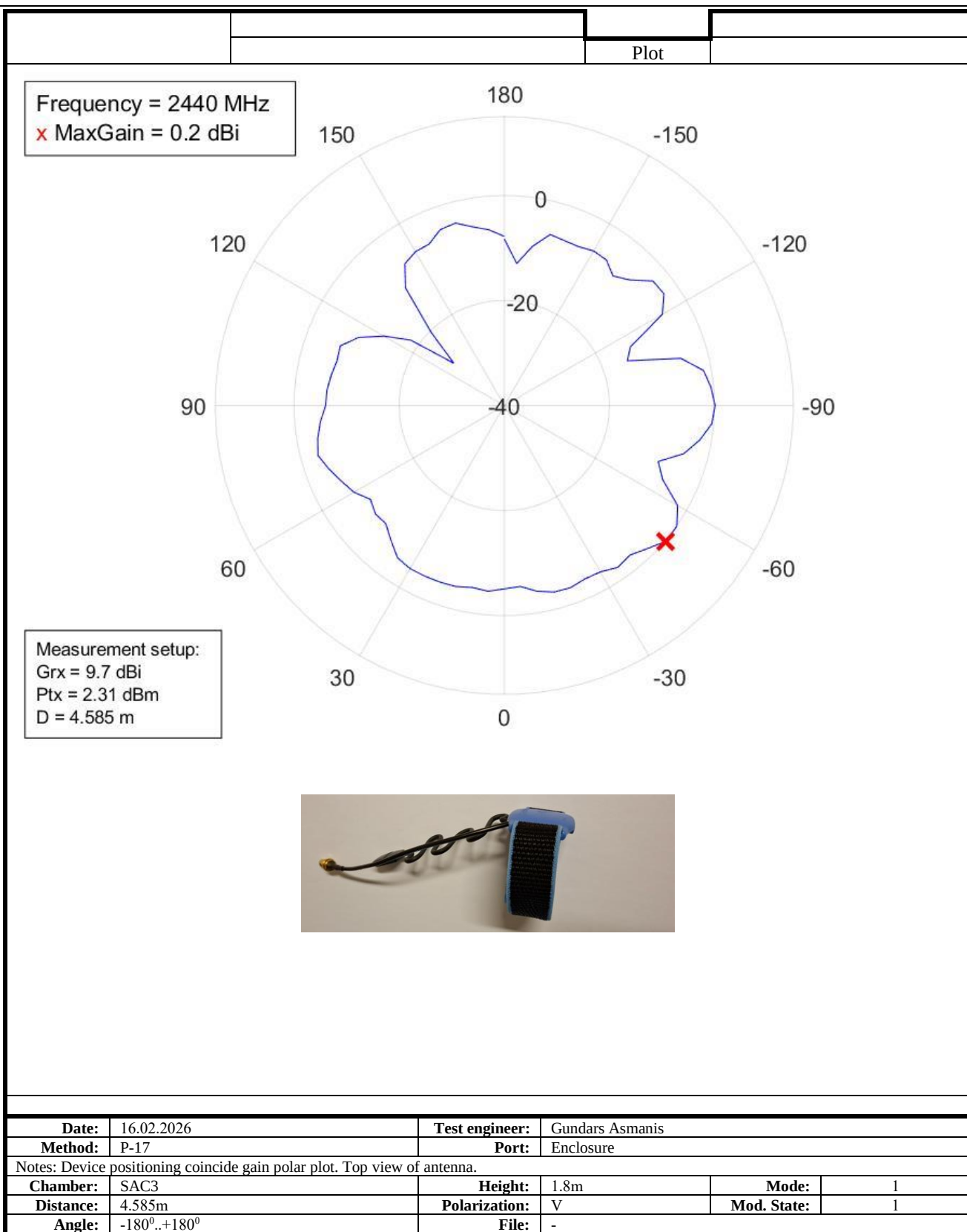
Gain of antenna under test is calculated as follows:

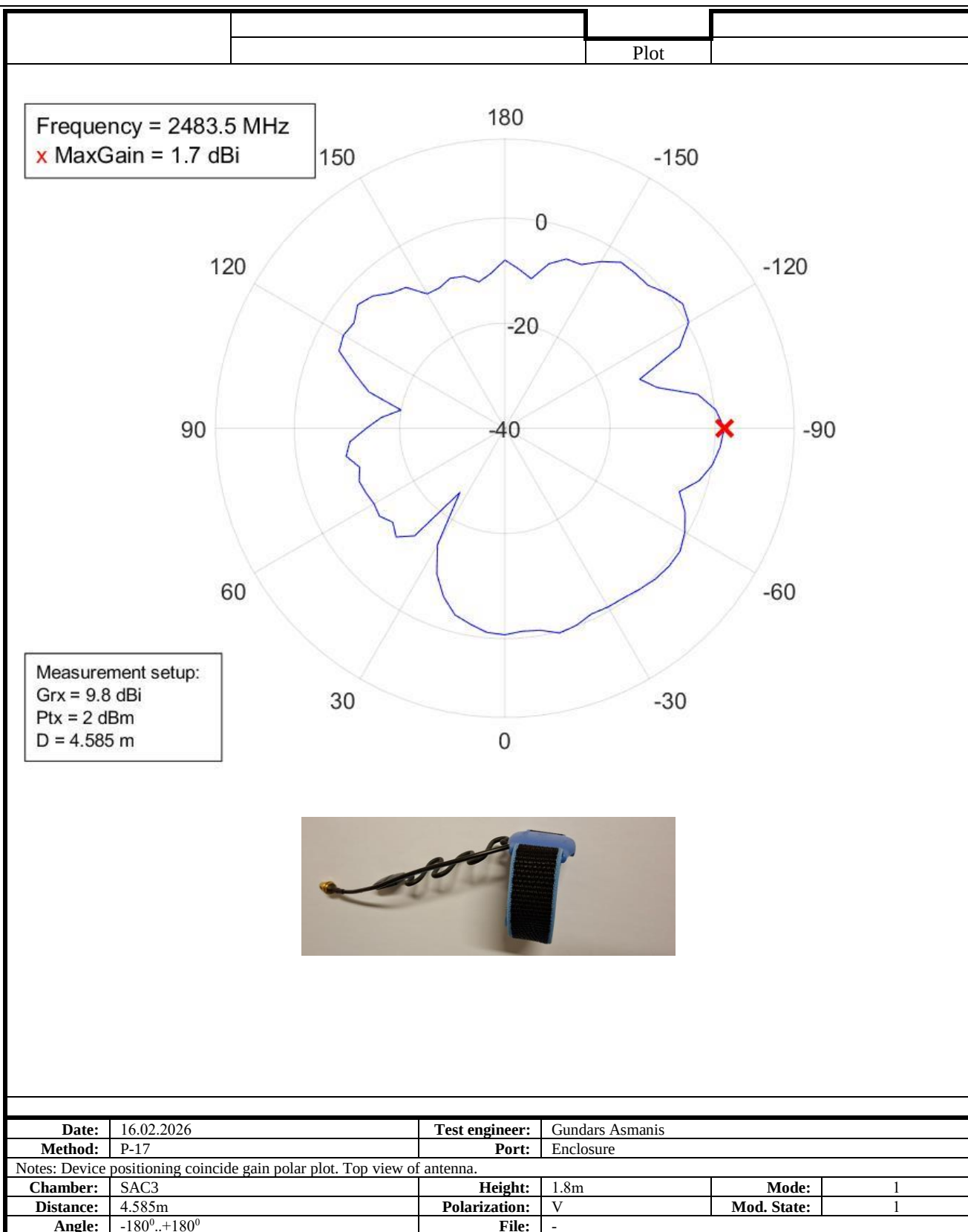
$$G_{tx} = P_{rec} + A_{cable} - P_{tx} - G_{rx} - 20 \log_{10} \left(\frac{\lambda}{4\pi d} \right)^2$$

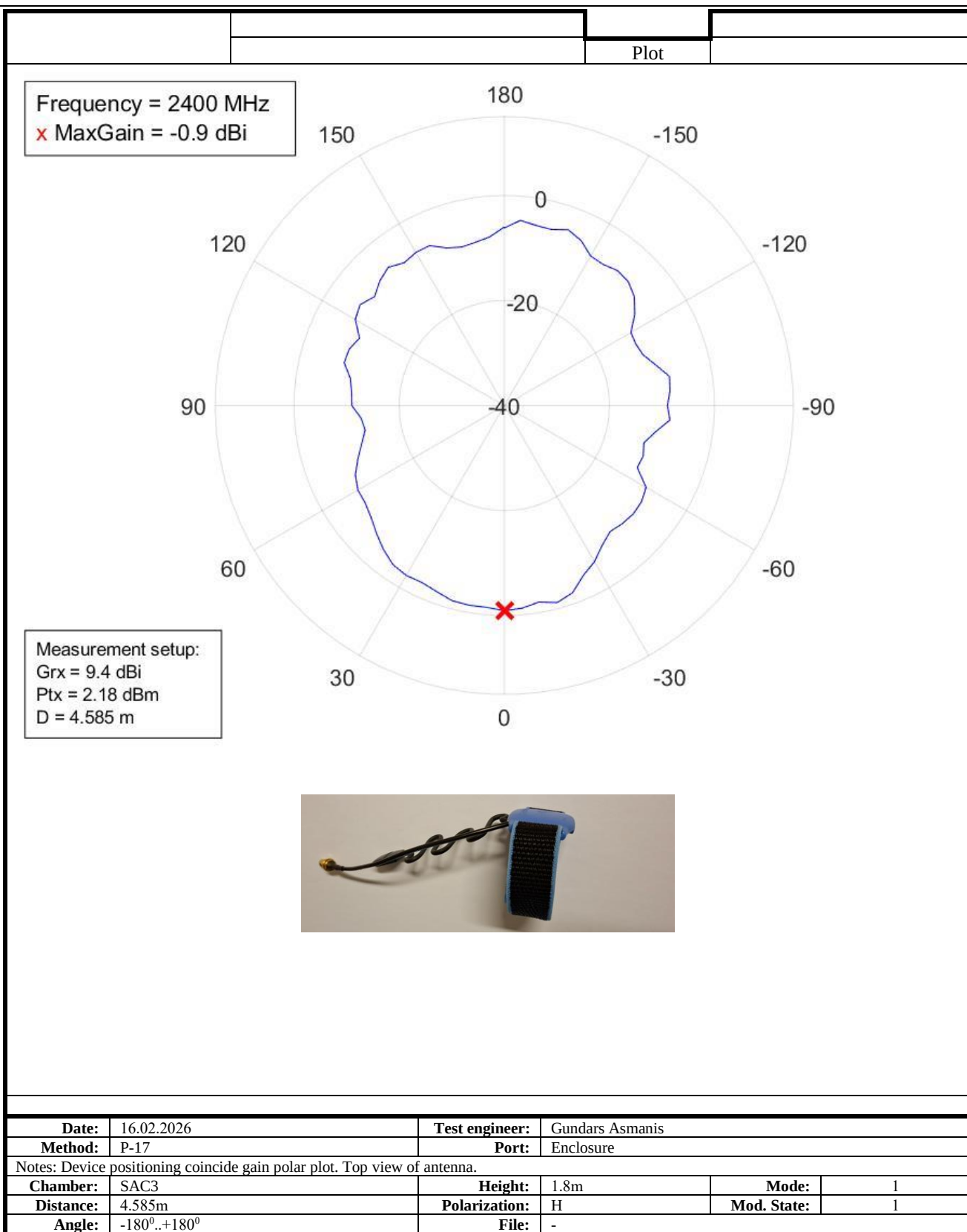
8. TEST RESULTS

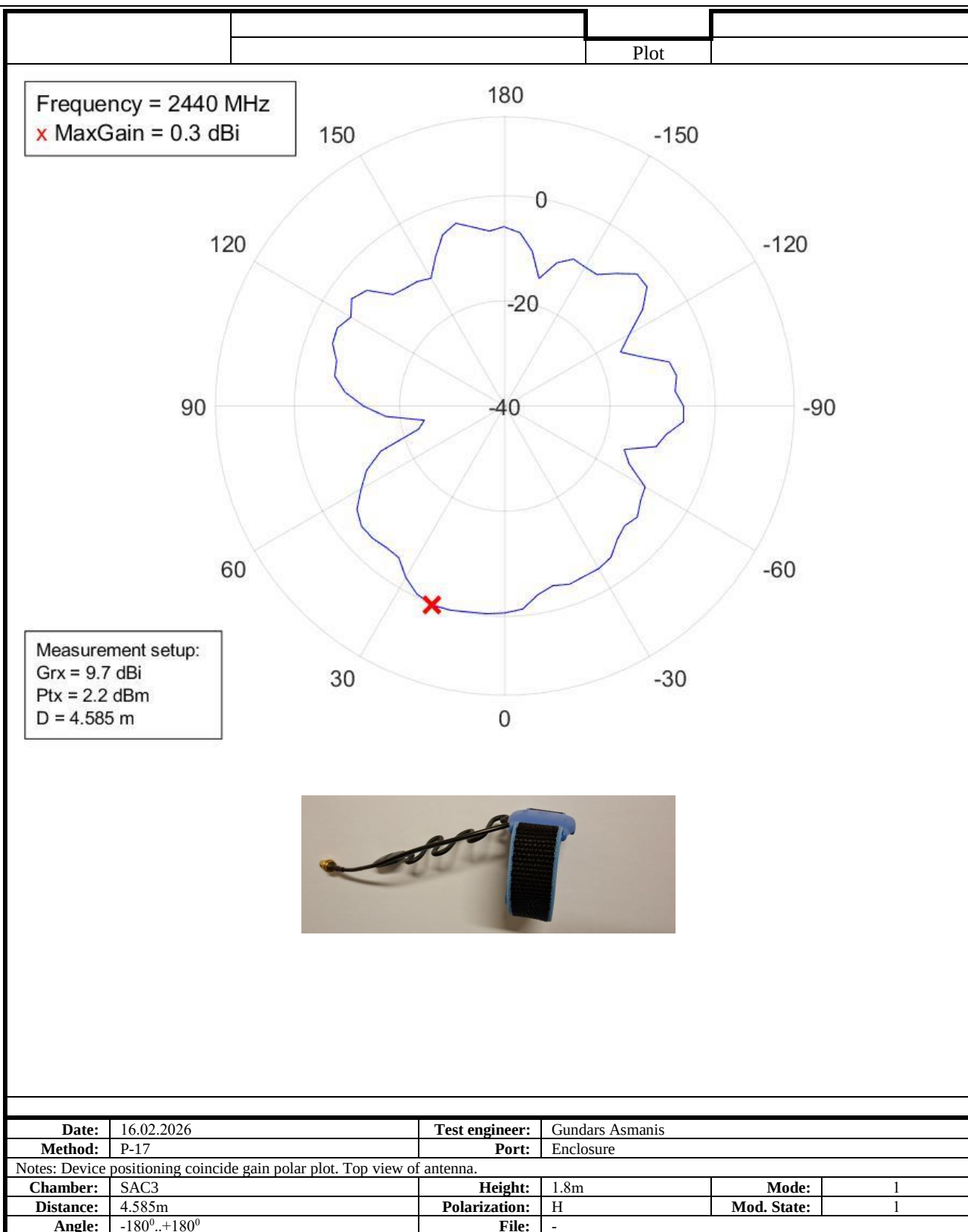


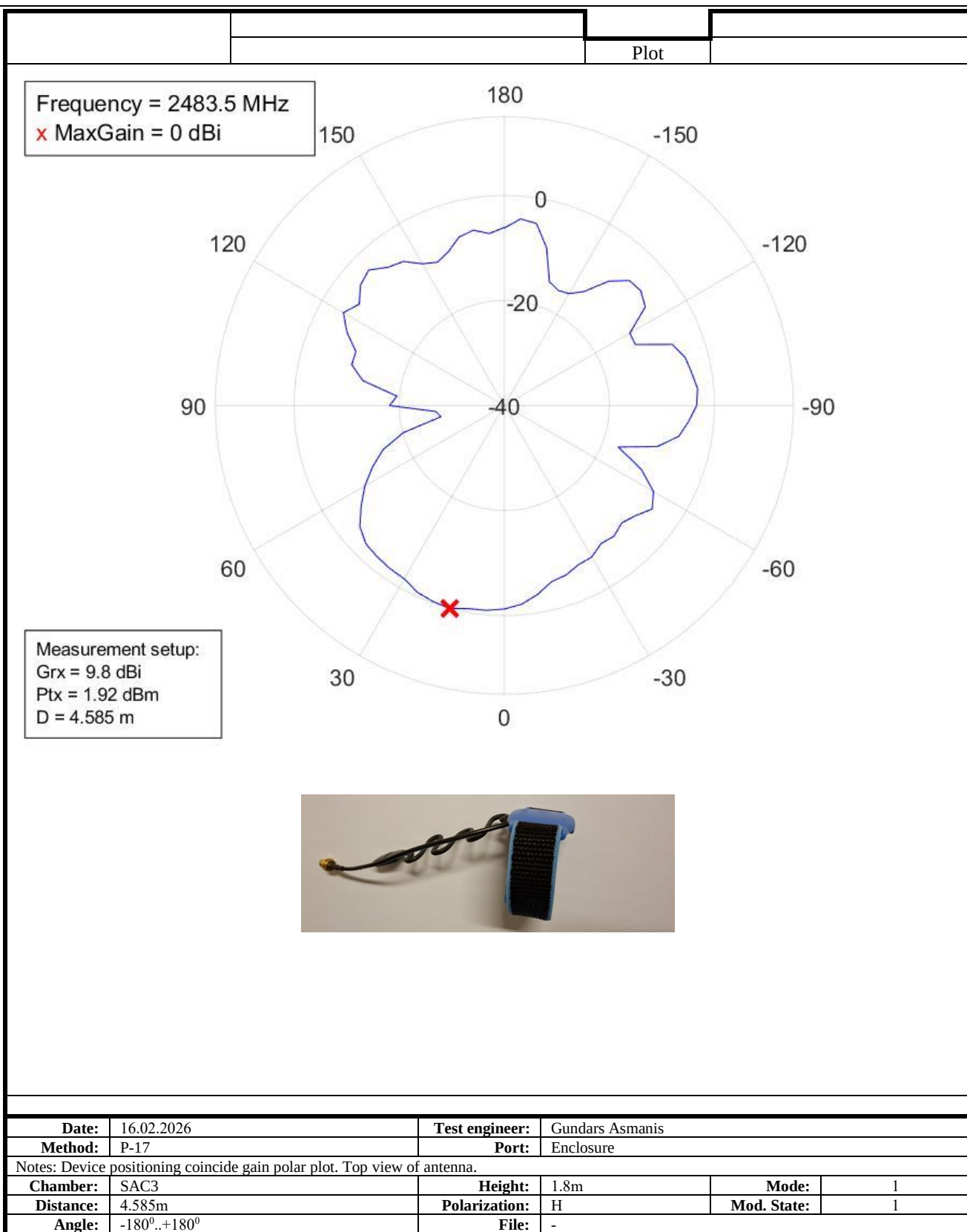
The test results relate only to the sample tested. This test report shall not be reproduced except in full, without the written approval of SIA LEITC.

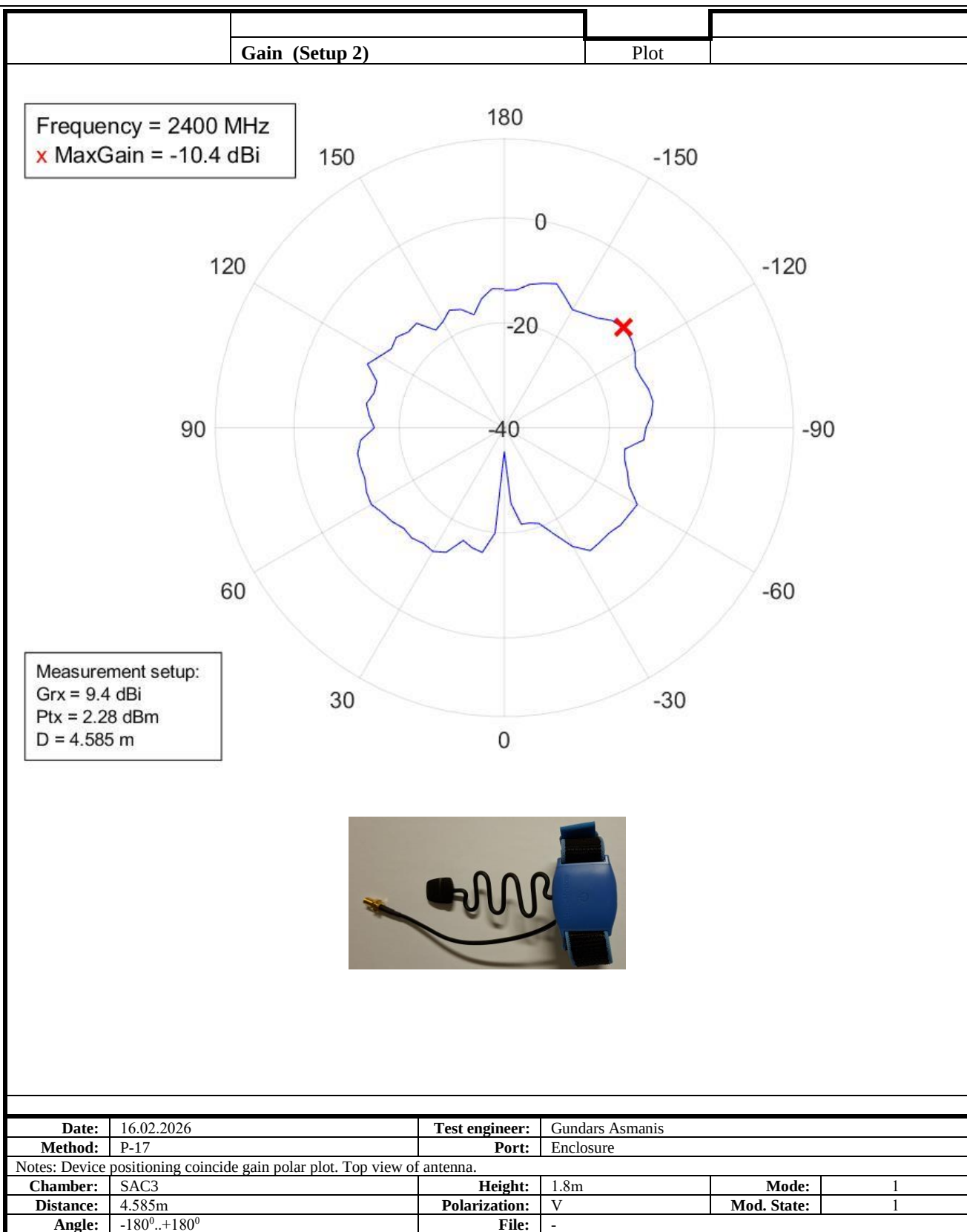


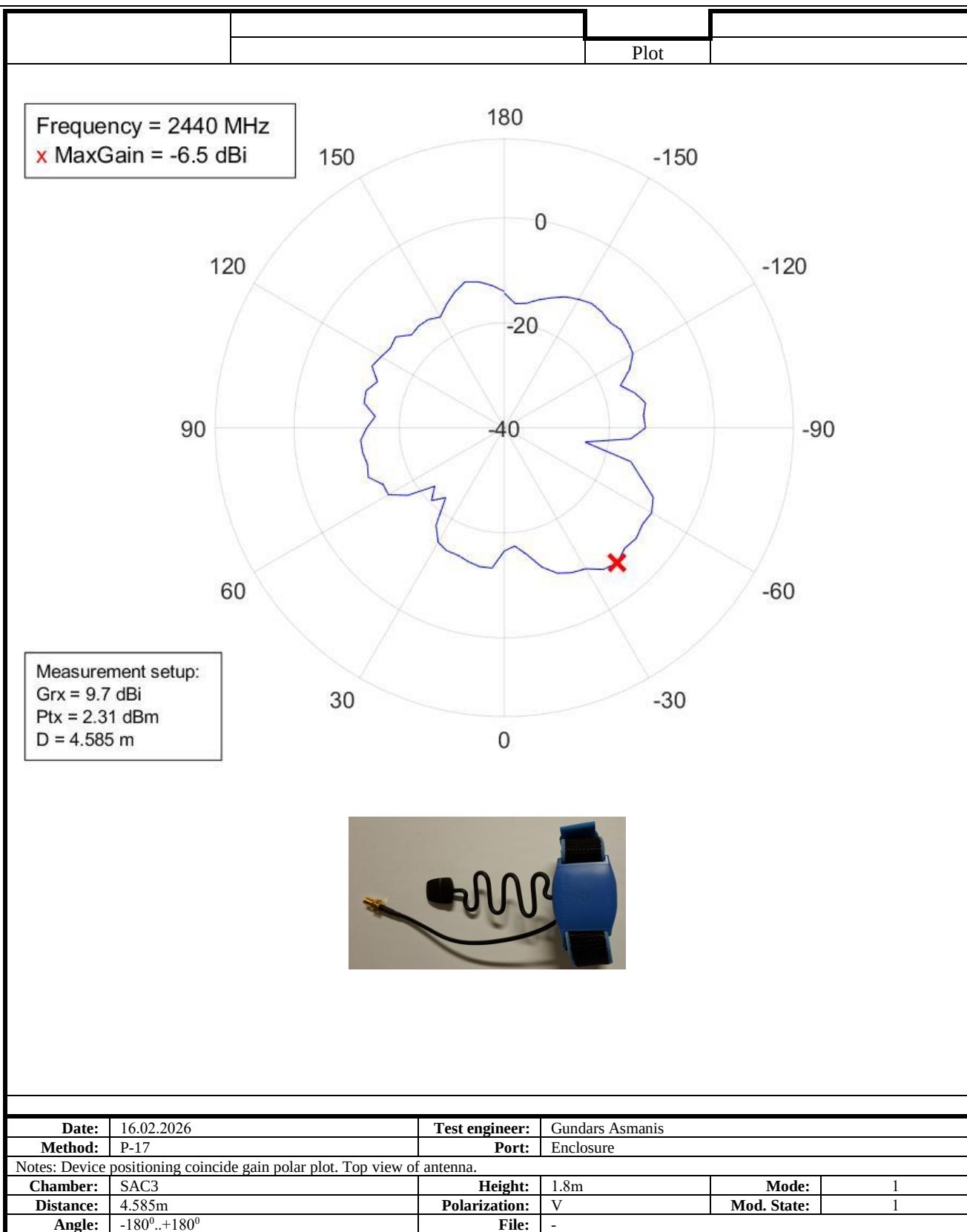


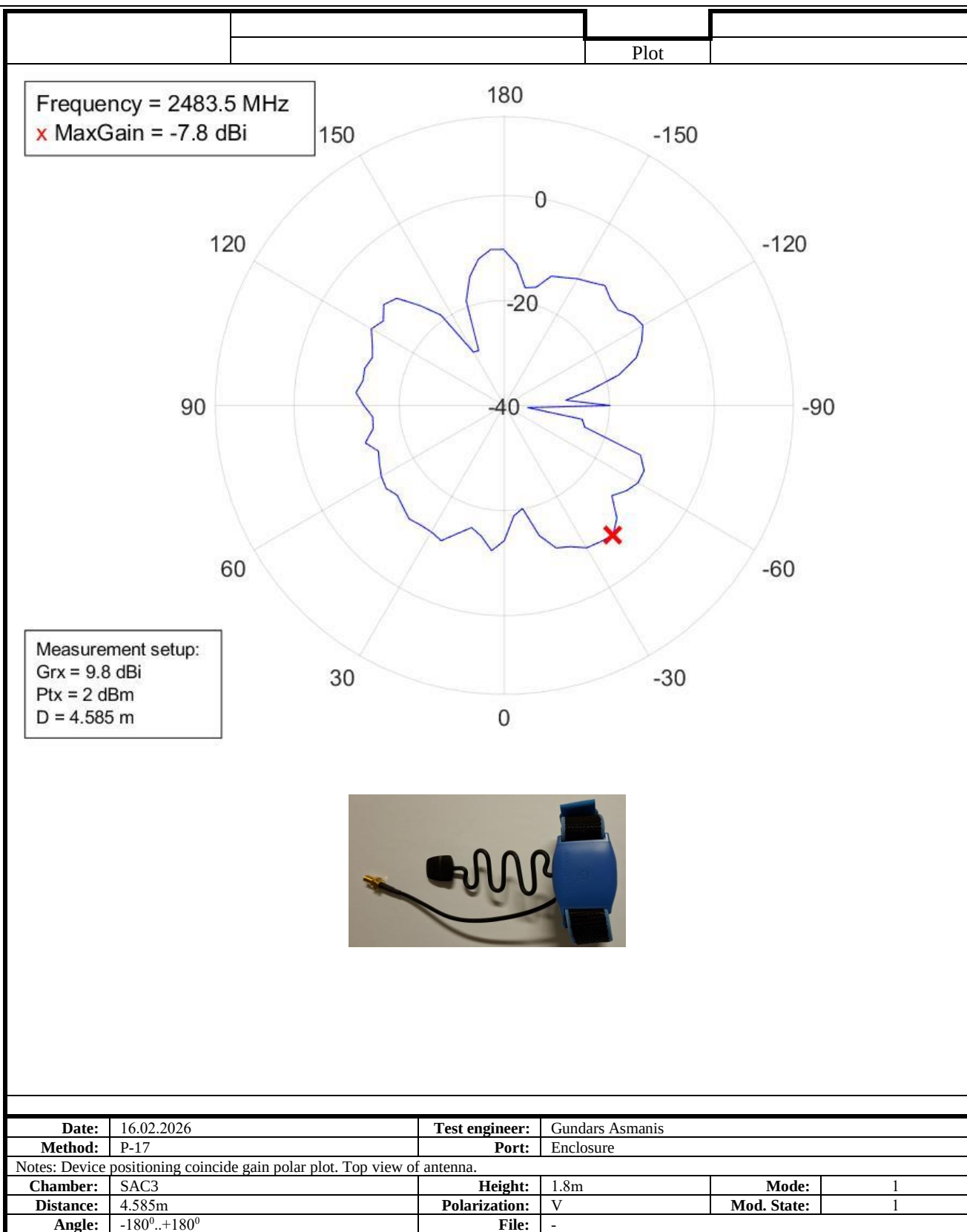


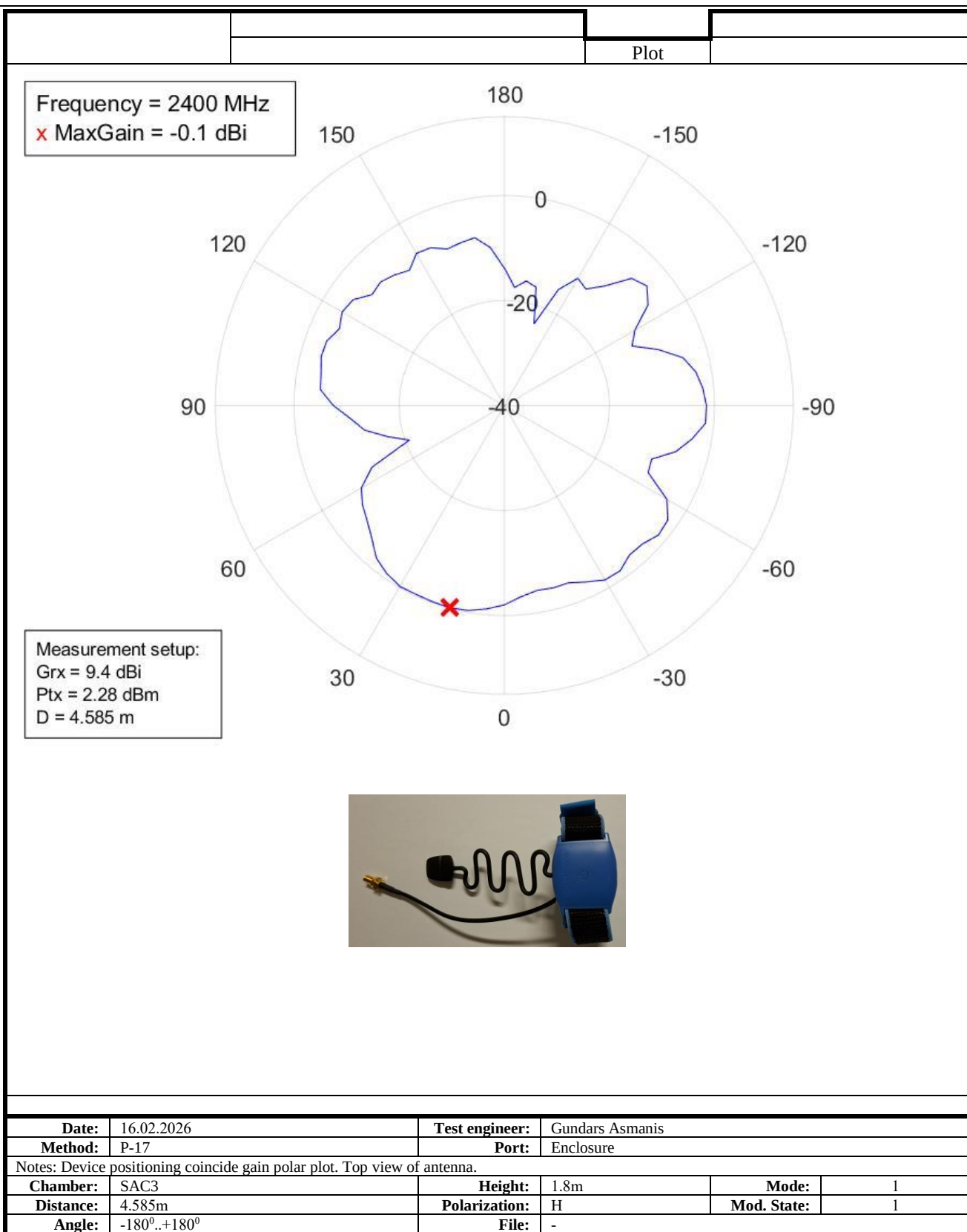


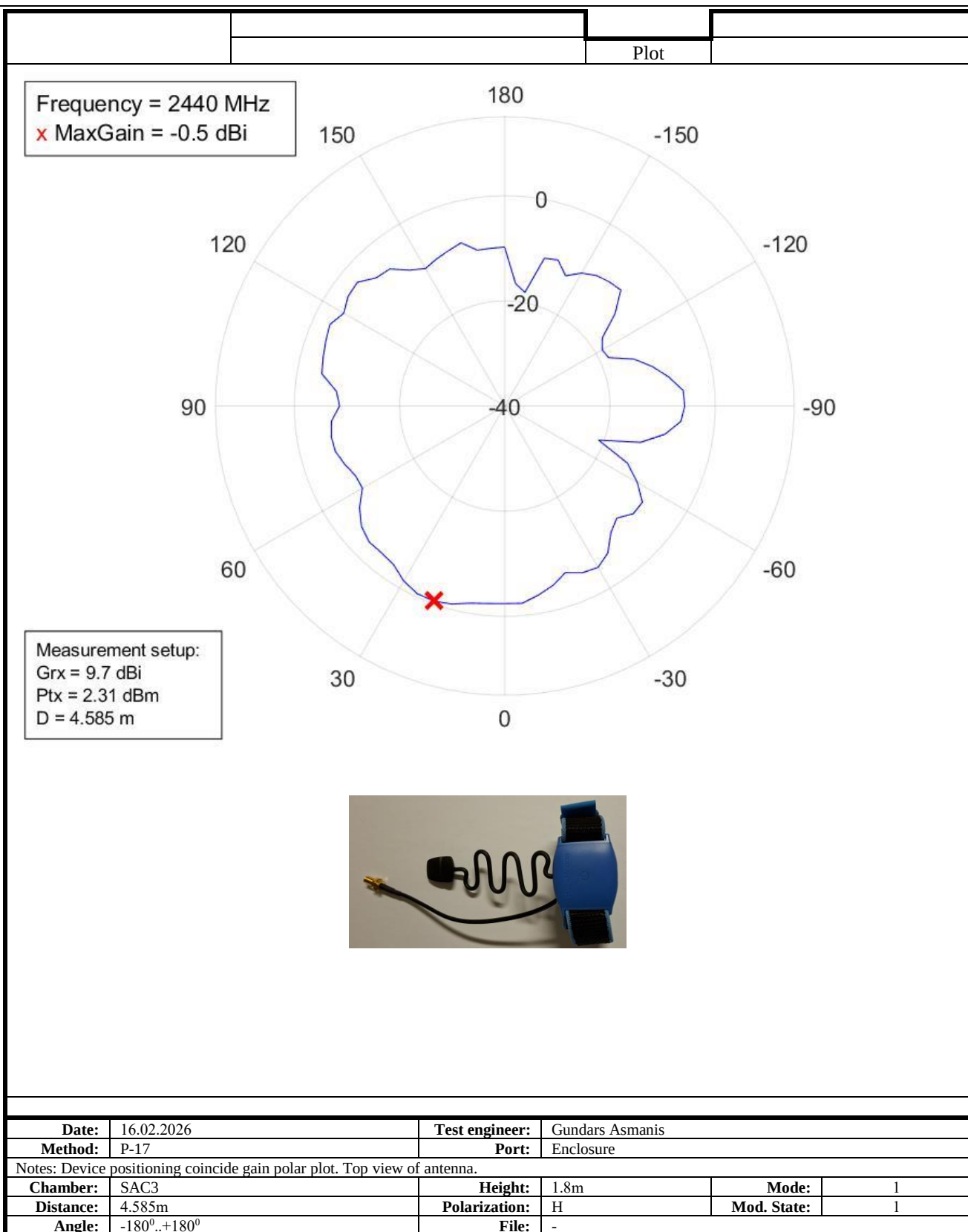


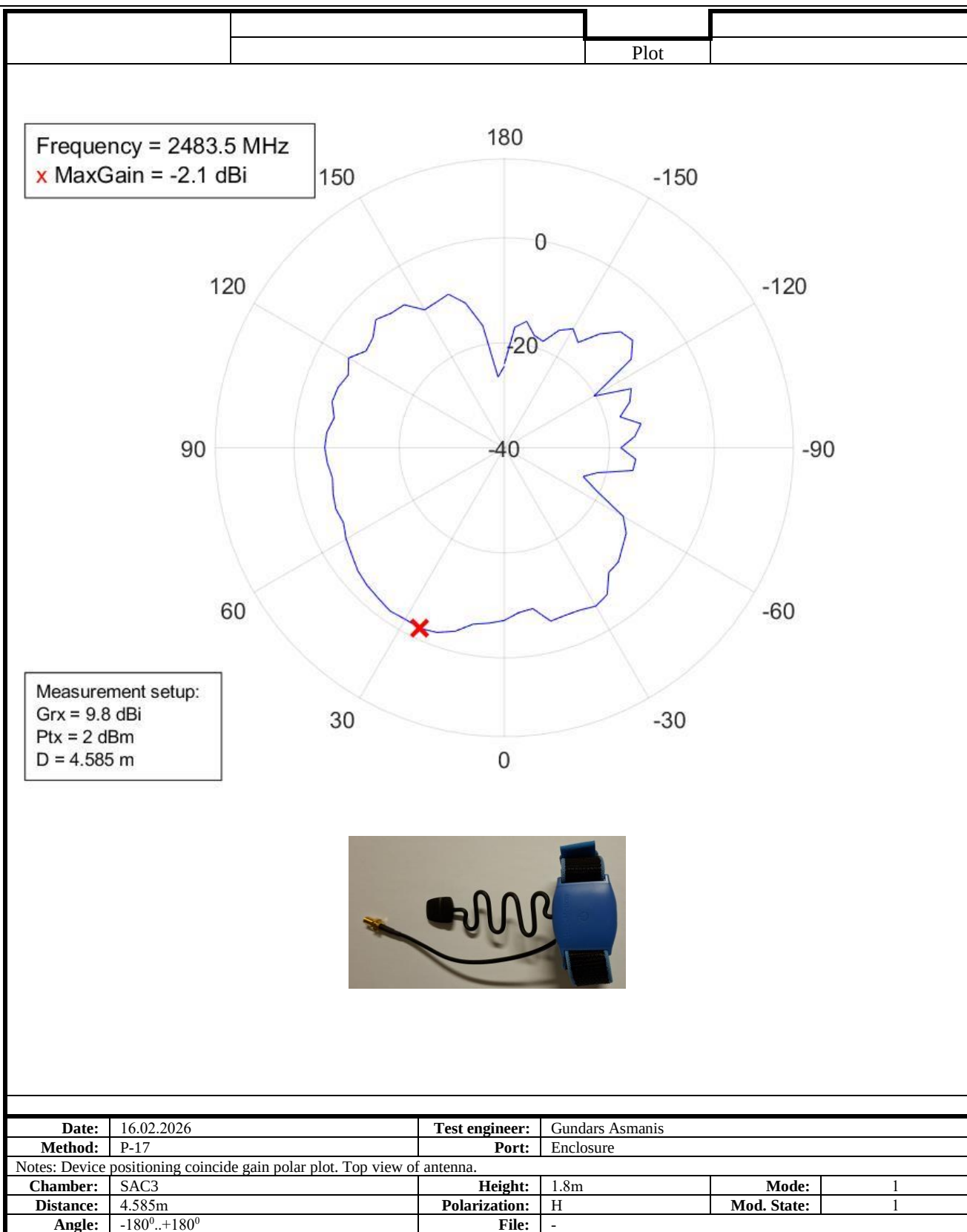


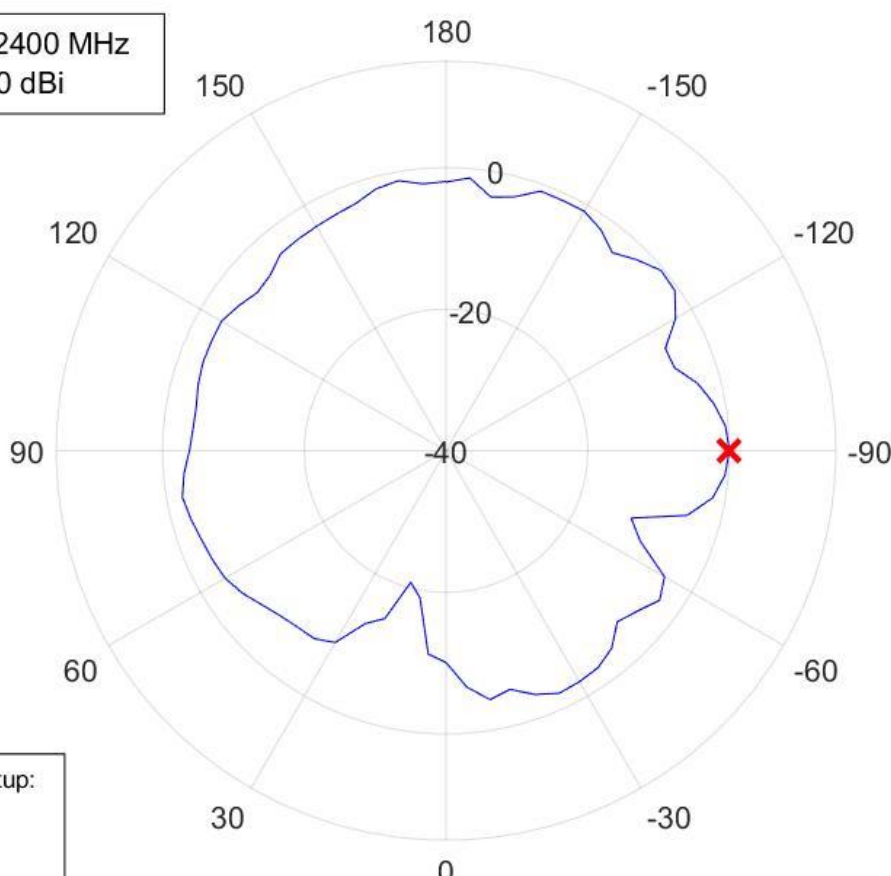


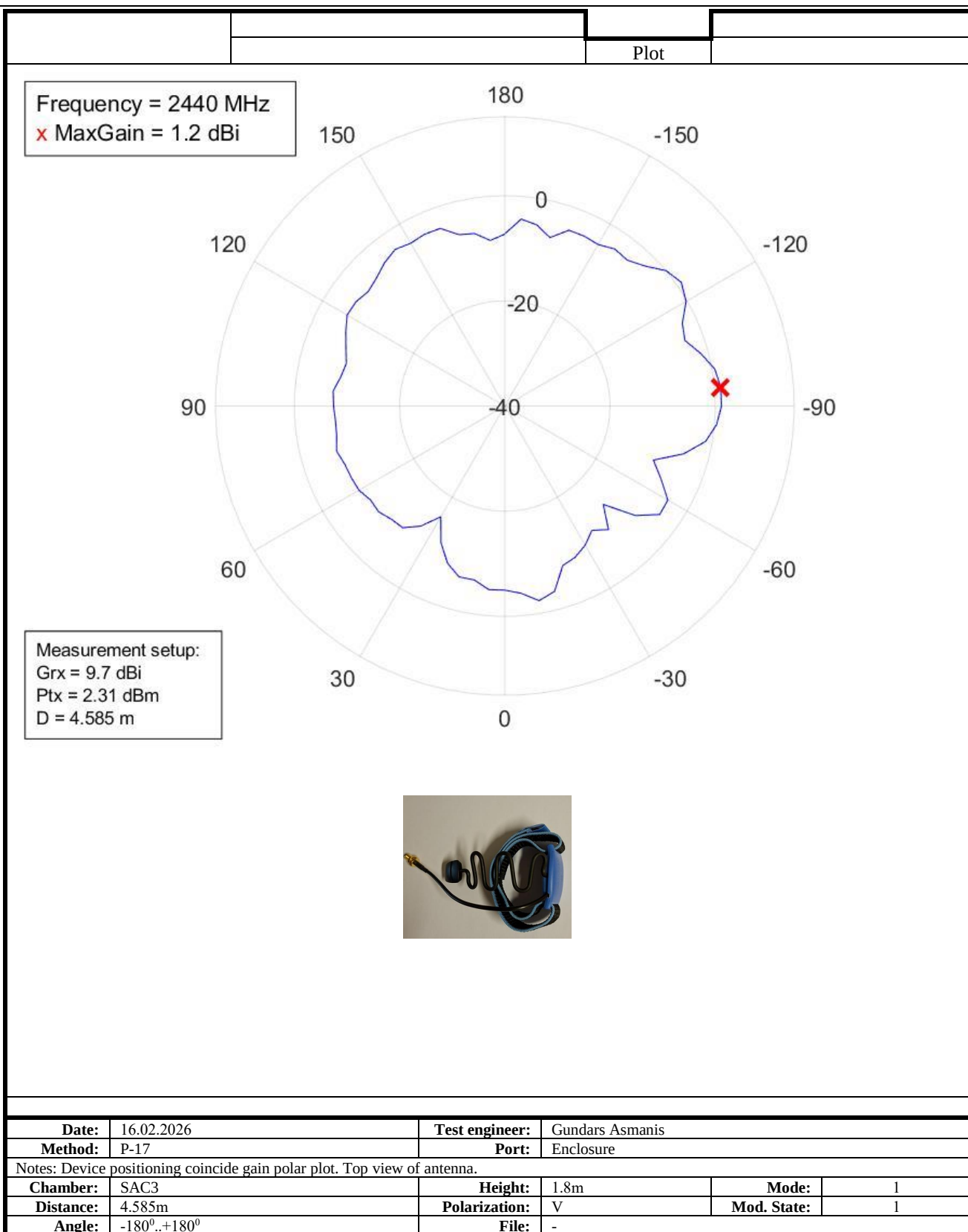


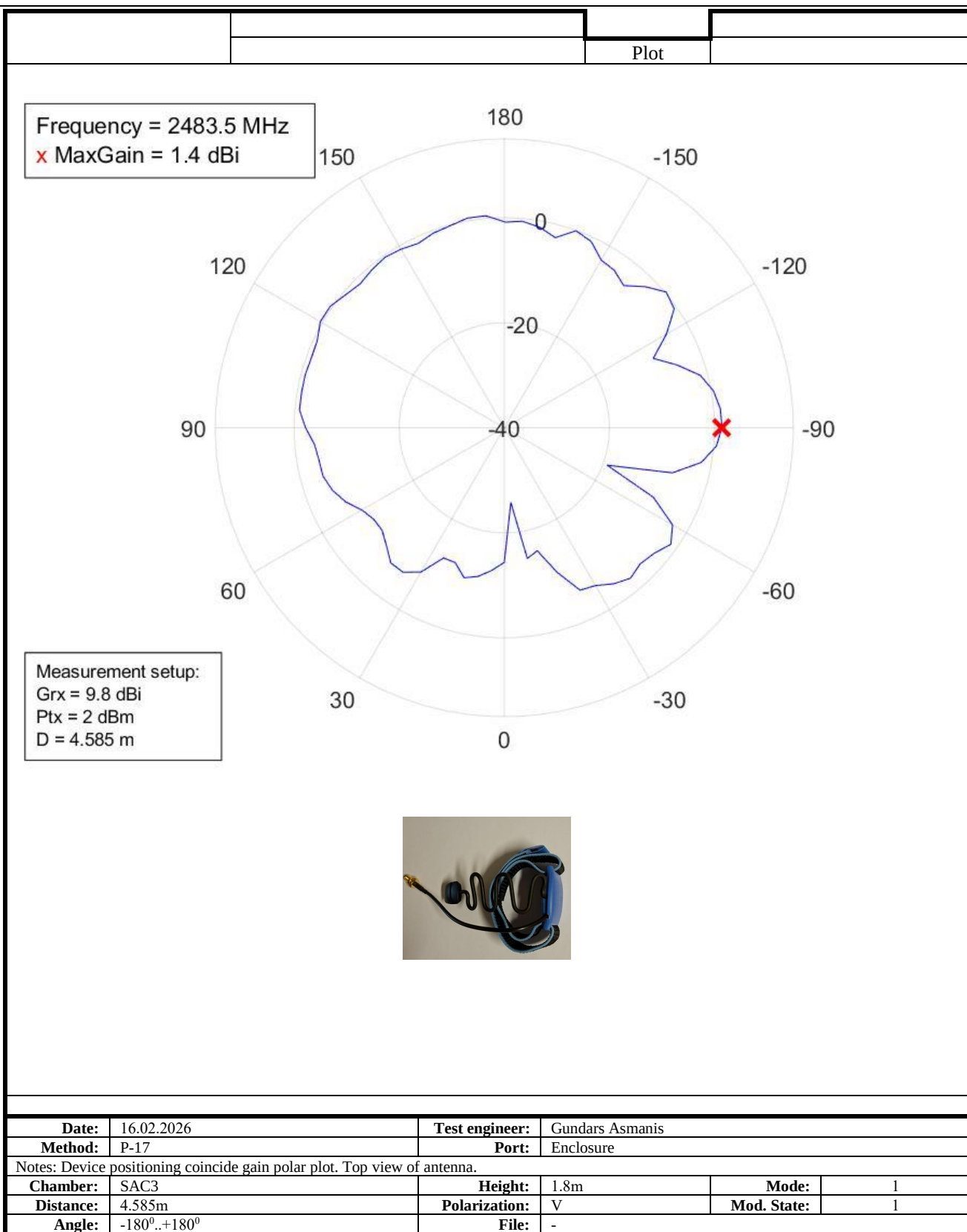


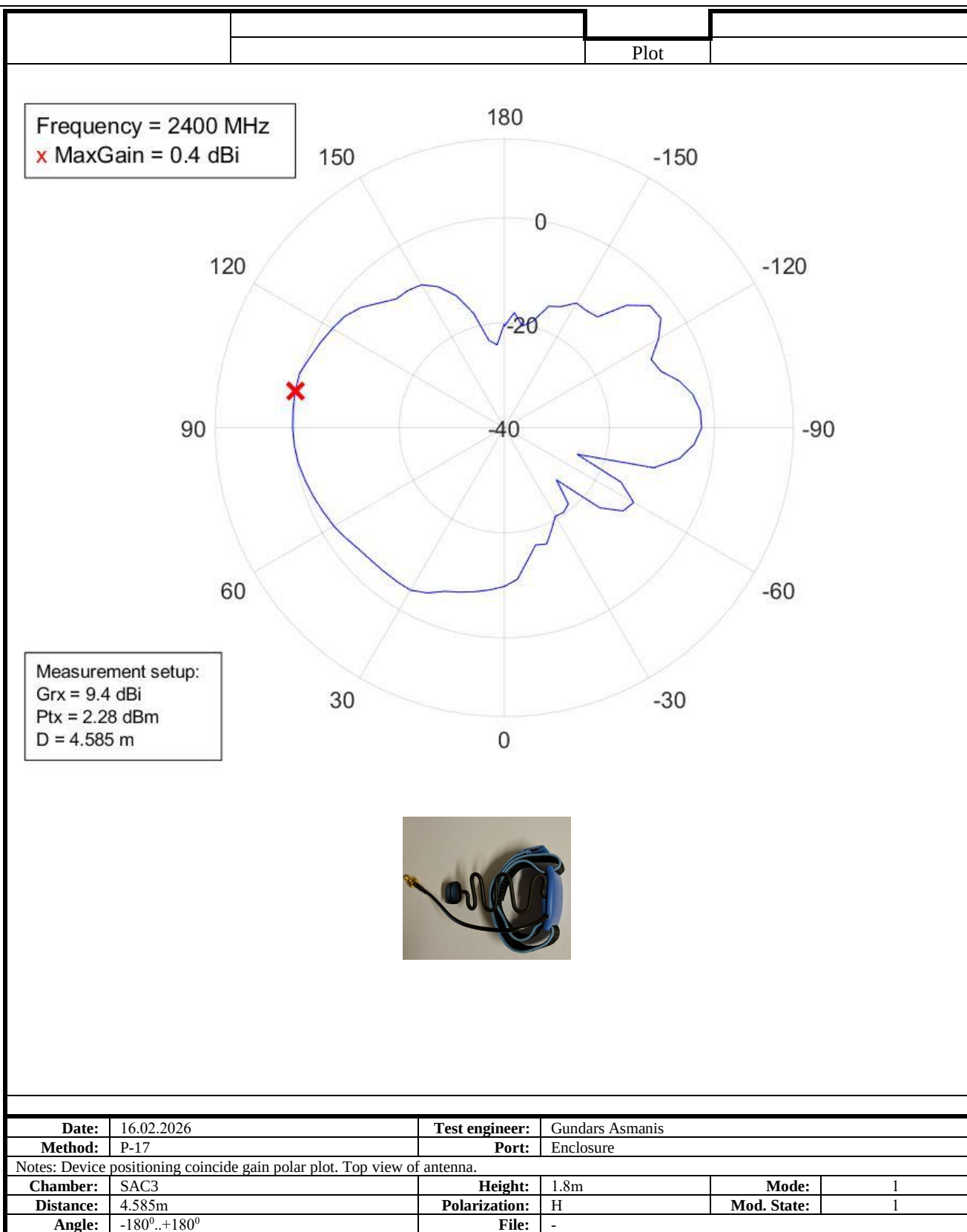


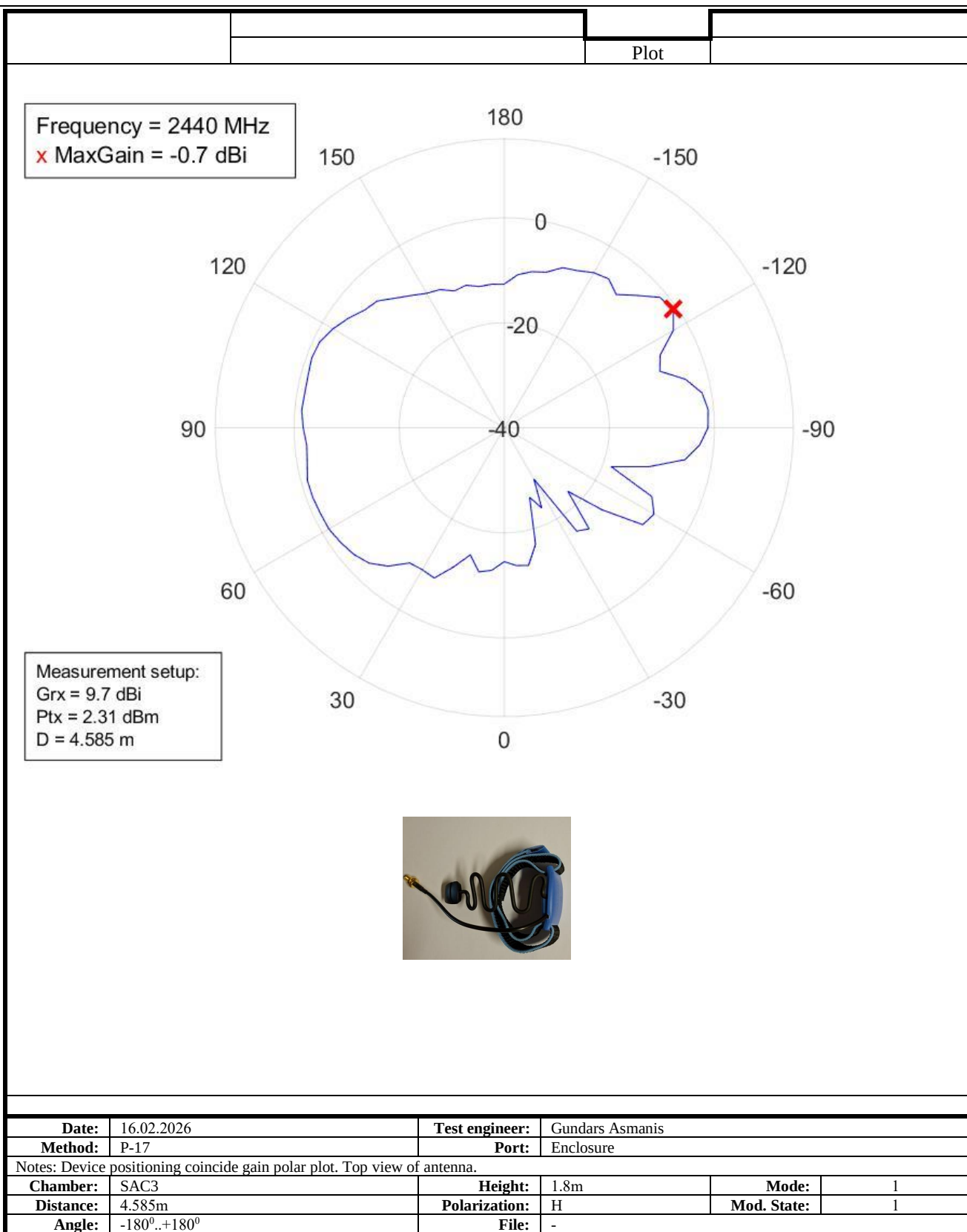


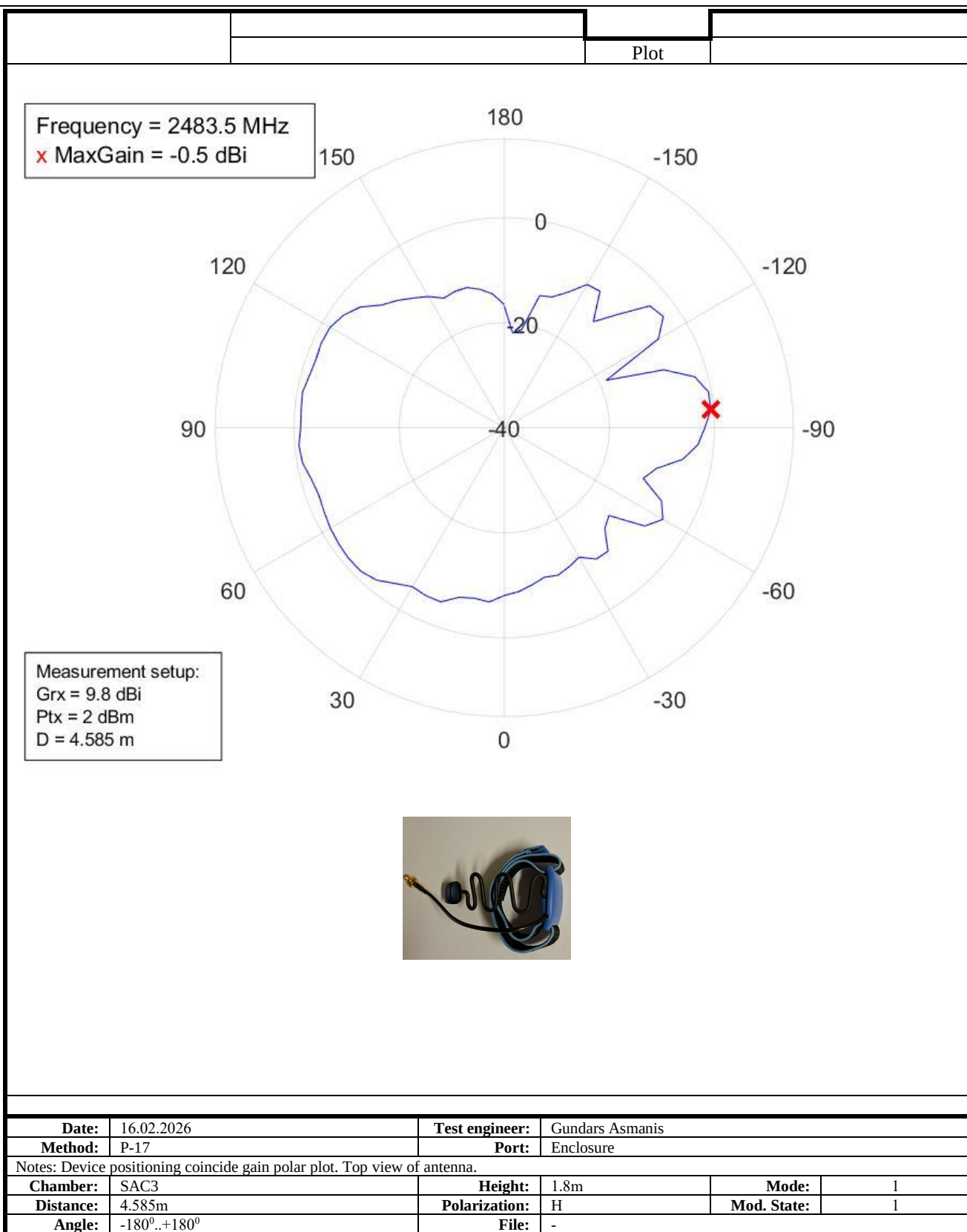
Gain (Setup 3)		Plot			
Frequency = 2400 MHz x MaxGain = 0 dBi  Measurement setup: Grx = 9.4 dBi Ptx = 2.28 dBm D = 4.585 m 					
Notes: Device positioning coincide gain polar plot. Top view of antenna.					
Date:	16.02.2026	Test engineer:	Gundars Asmanis		
Method:	P-17	Port:	Enclosure		
Chamber:	SAC3	Height:	1.8m	Mode:	1
Distance:	4.585m	Polarization:	V	Mod. State:	1
Angle:	-180°..+180°	File:	-		











9. TEST PHOTOGRAPHS

EUT-equipment under test:



