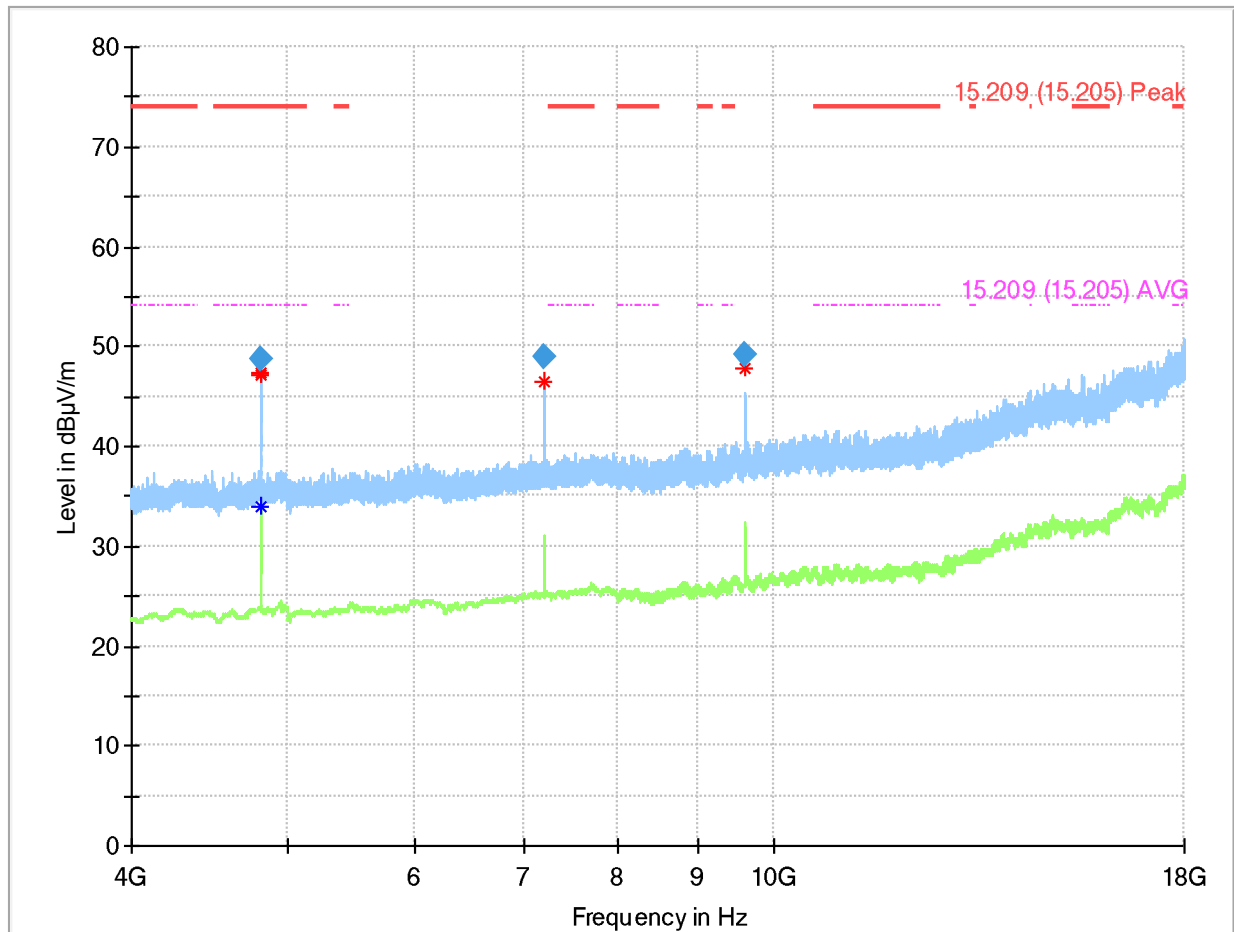


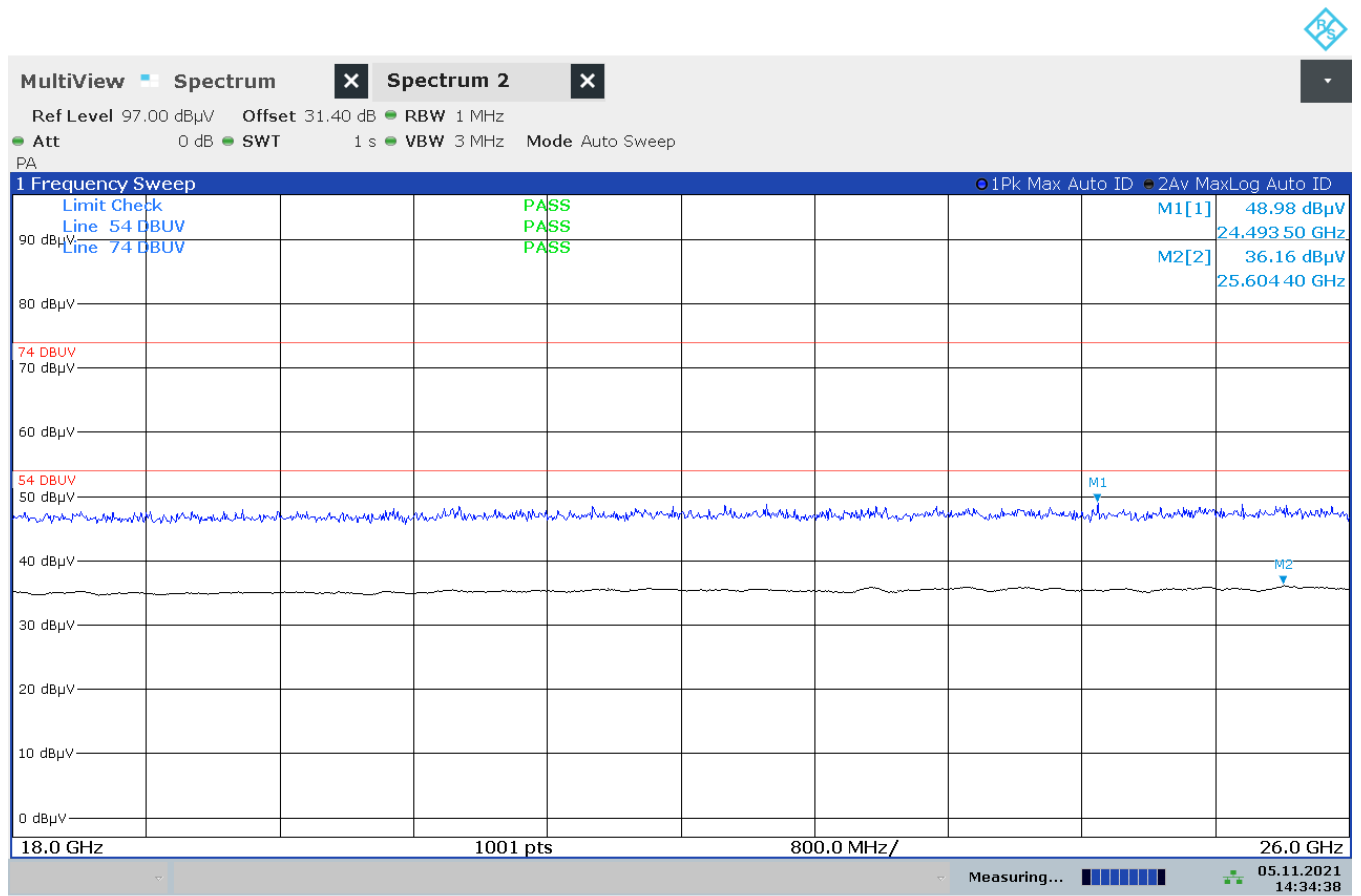
Plot 27: Mode 1, RSE 4 GHz – 18 GHz, low channel, horizontal / vertical polarisation



### Critical\_Freqs

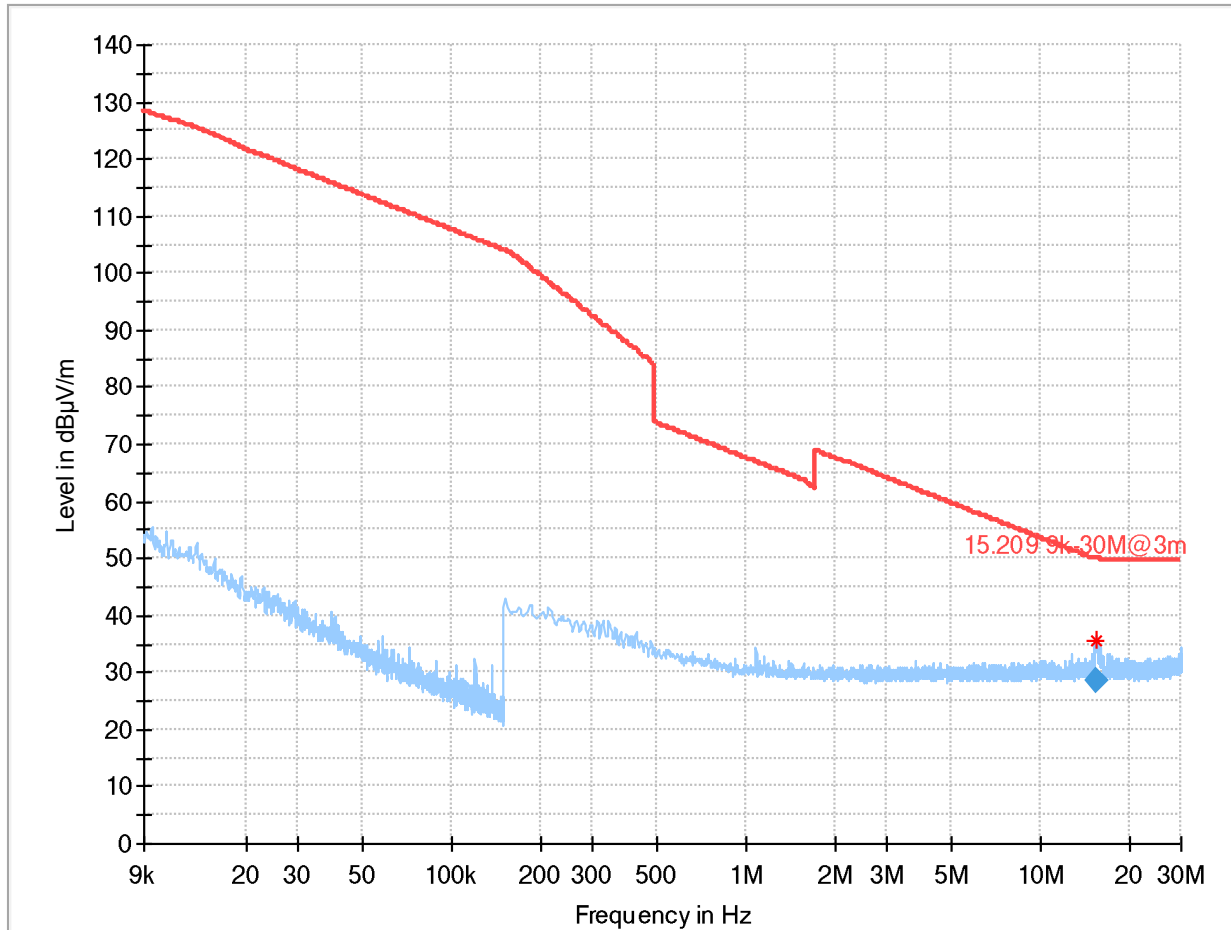
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
4809.250000	47.27	74.00	26.73	---	---	150.0	H	33.0
4811.275000	47.16	54.00	6.84	---	---	150.0	H	33.0
7213.900000	46.49	---	---	---	---	150.0	H	270.0
9618.550000	47.76	---	---	---	---	150.0	H	195.0

Plot 28: Mode 1, RSE 18 GHz – 26 GHz, low channel, horizontal / vertical polarisation



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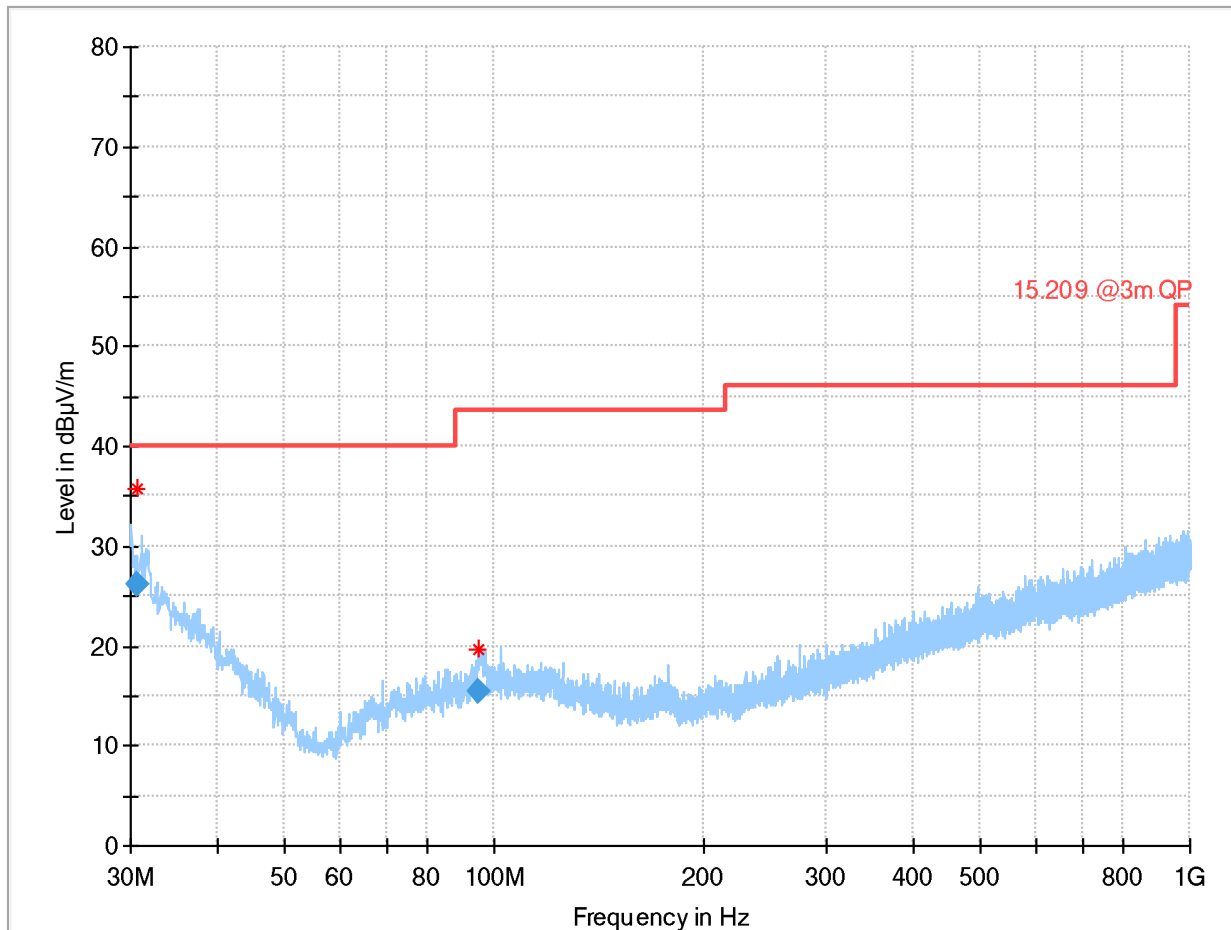
Plot 29: Mode 1, RSE 9 kHz – 30 MHz, mid channel, loop antenna



### Critical\_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB)
15.391500	35.41	50.04	14.63	---	---	H	210.0	20.5

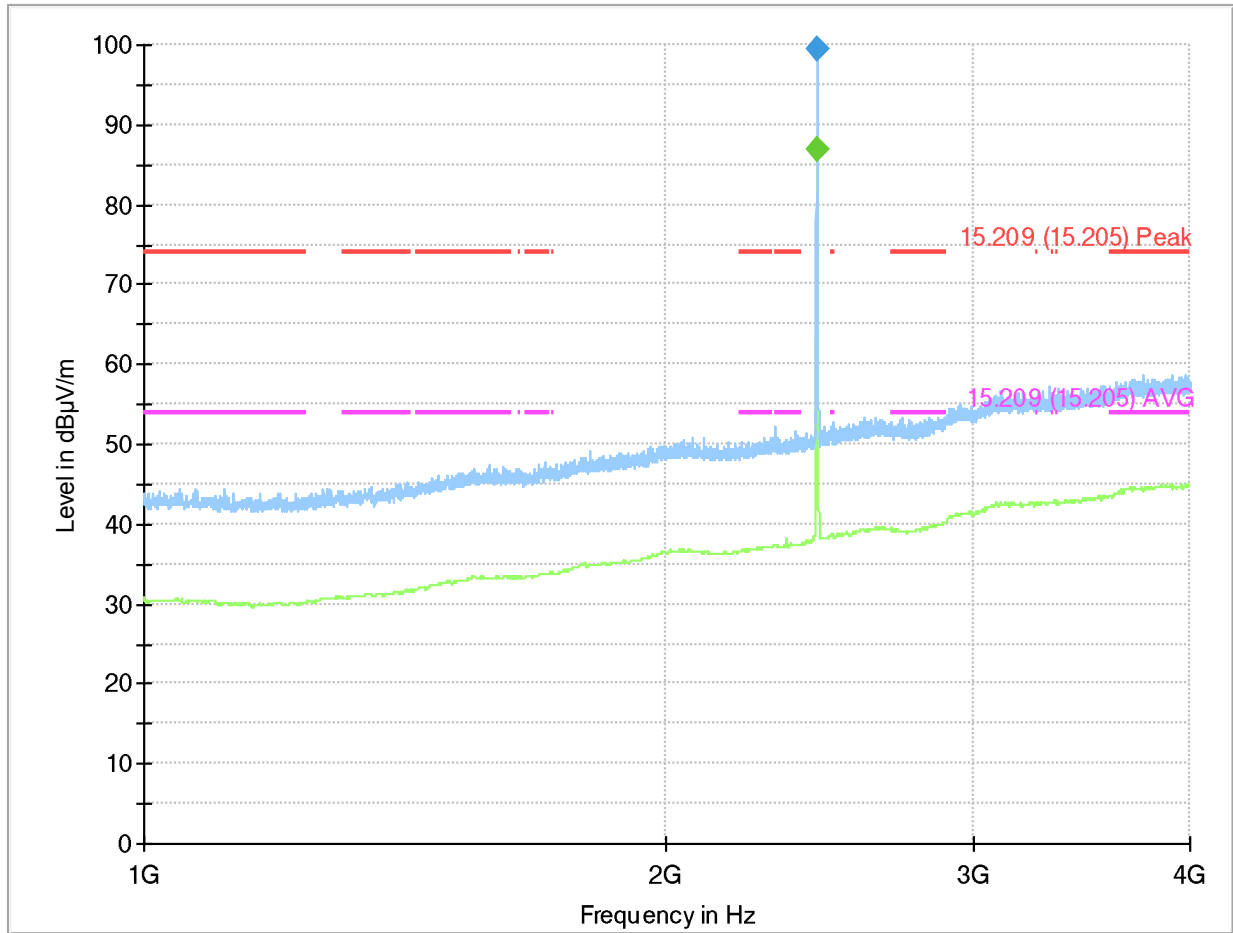
Plot 30: Mode 1, RSE 30 MHz – 1 GHz, mid channel, horizontal / vertical polarisation



### Critical\_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
30.592000	35.66	40.00	4.34	---	---	330.0	V	20.0
94.849000	19.69	43.50	23.81	---	---	142.0	V	256.0

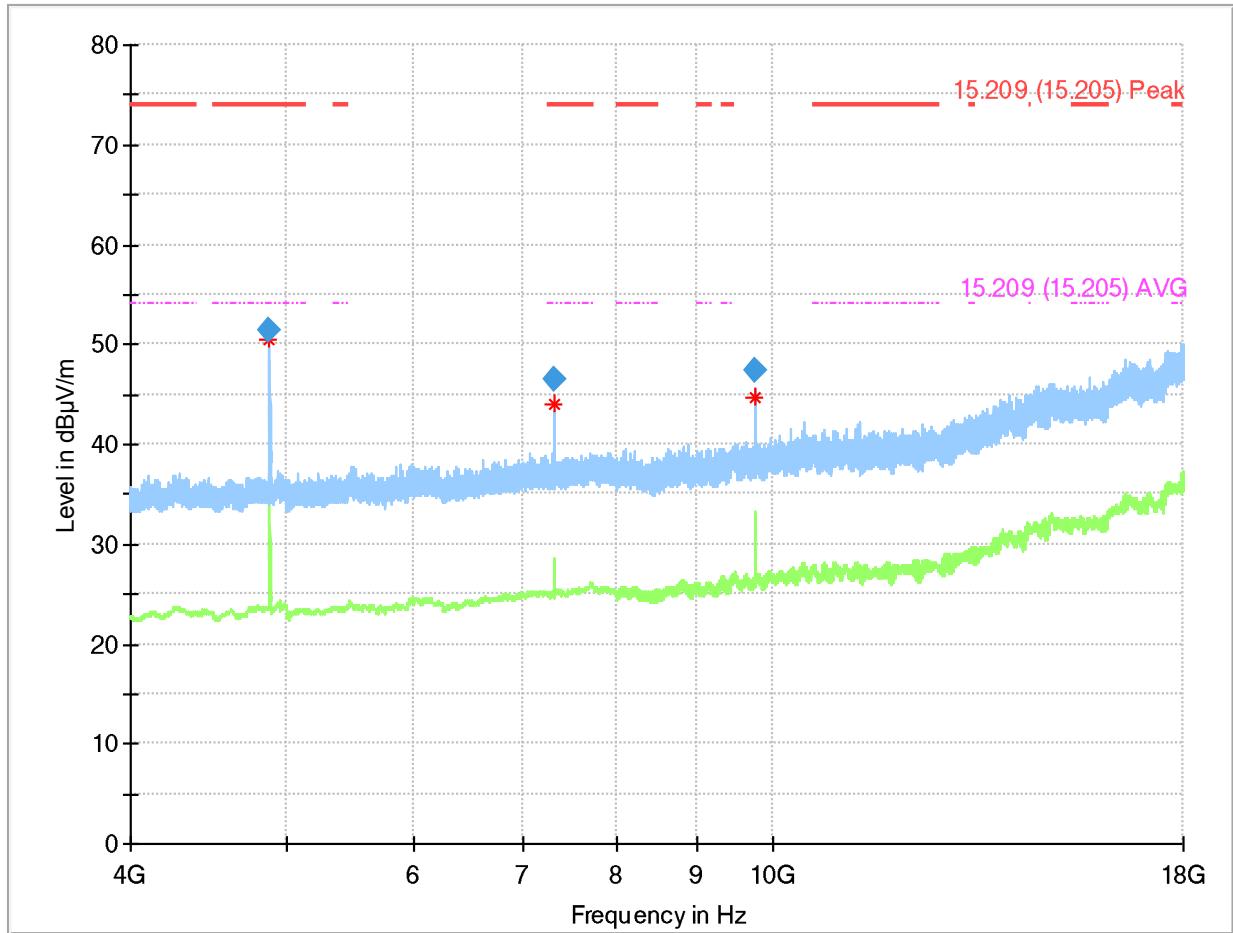
Plot 31: Mode 1, RSE 1 GHz – 4 GHz, mid channel, horizontal / vertical polarisation



### Critical\_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
2439.750000	99.46	---	---	---	---	150.0	V	279.0
2440.250000	---	---	---	---	---	150.0	V	273.0

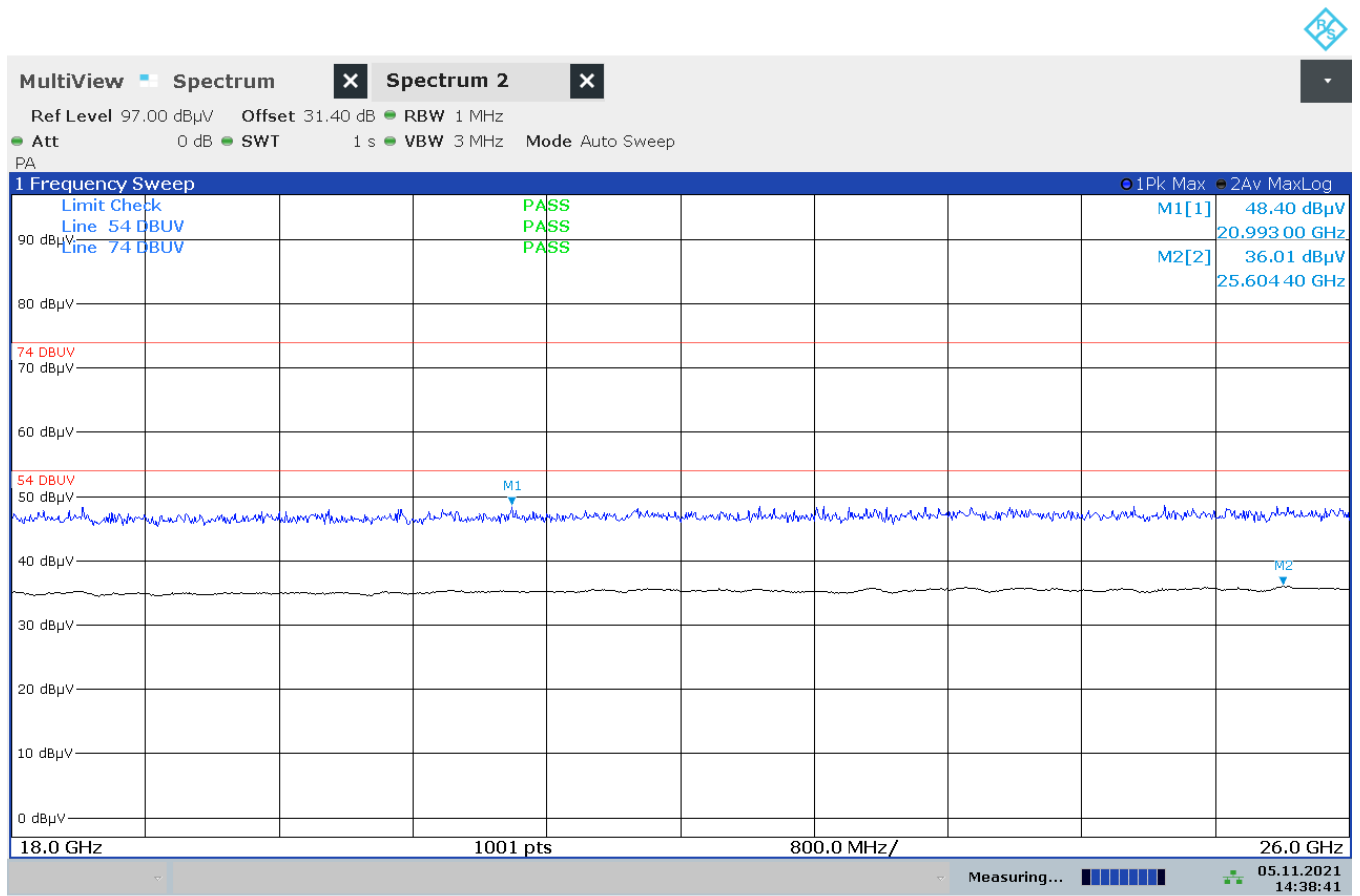
Plot 32: Mode 1, RSE 4 GHz – 18 GHz, mid channel, horizontal / vertical polarisation



### Critical\_Freqs

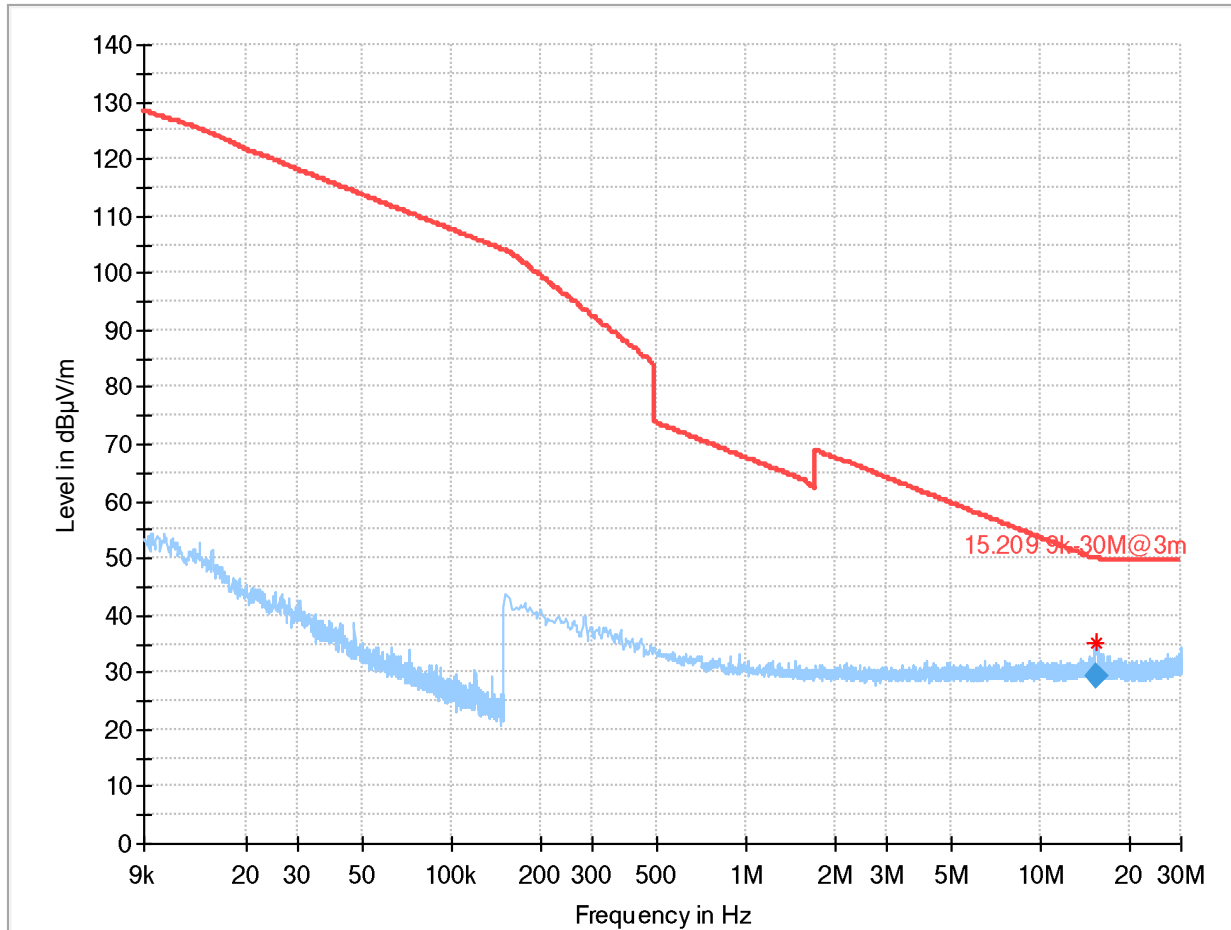
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
4881.250000	50.43	74.00	23.57	---	---	150.0	V	15.0
7318.825000	44.11	74.00	29.89	---	---	150.0	V	-7.0
9762.625000	44.65	---	---	---	---	150.0	H	244.0

Plot 33: Mode 1, RSE 18 GHz – 26 GHz, mid channel, horizontal / vertical polarisation



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Plot 34: Mode 1, RSE 9 kHz – 30 MHz, high channel, loop antenna

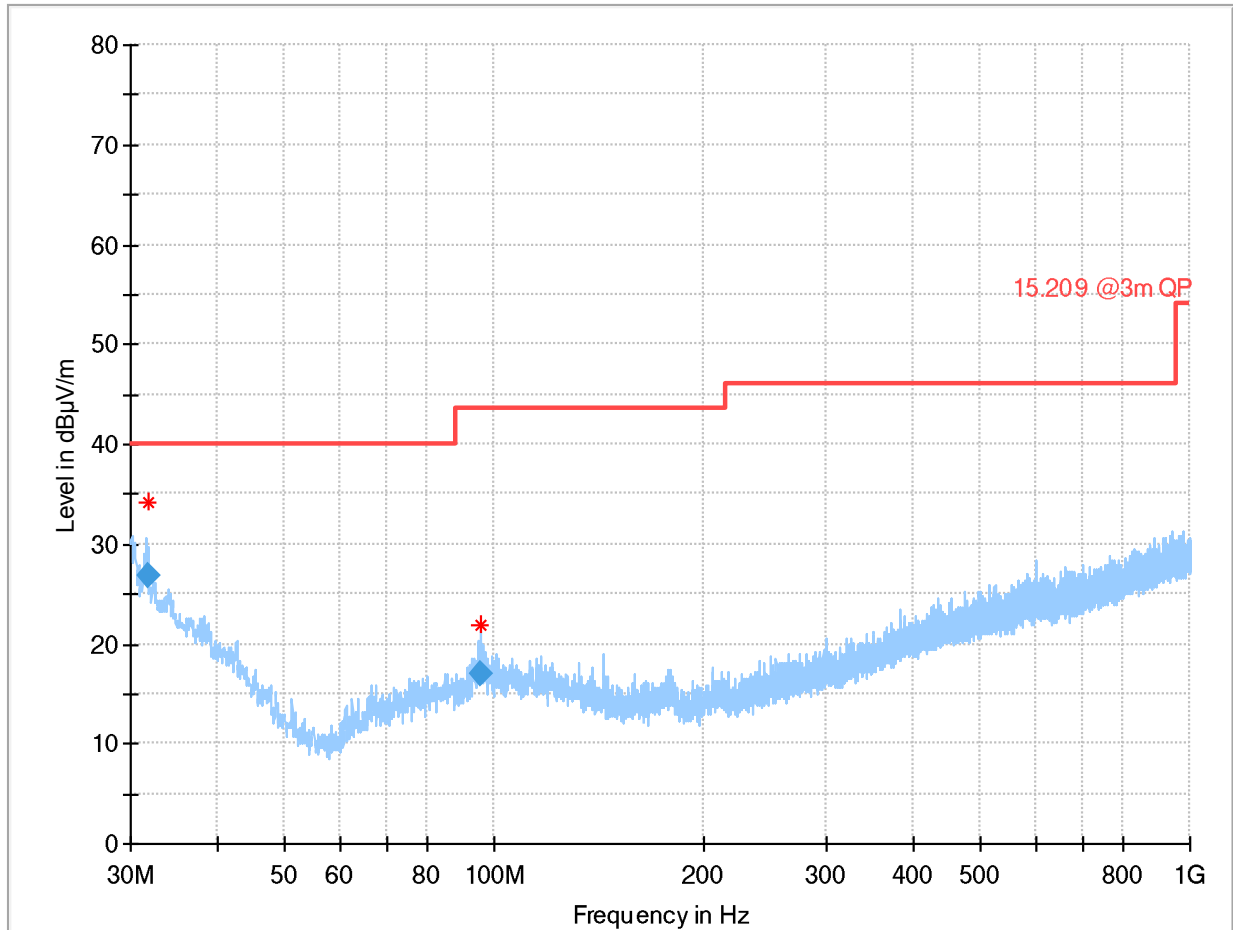


### Critical\_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB)
15.425250	35.30	50.04	14.74	---	---	H	276.0	20.5



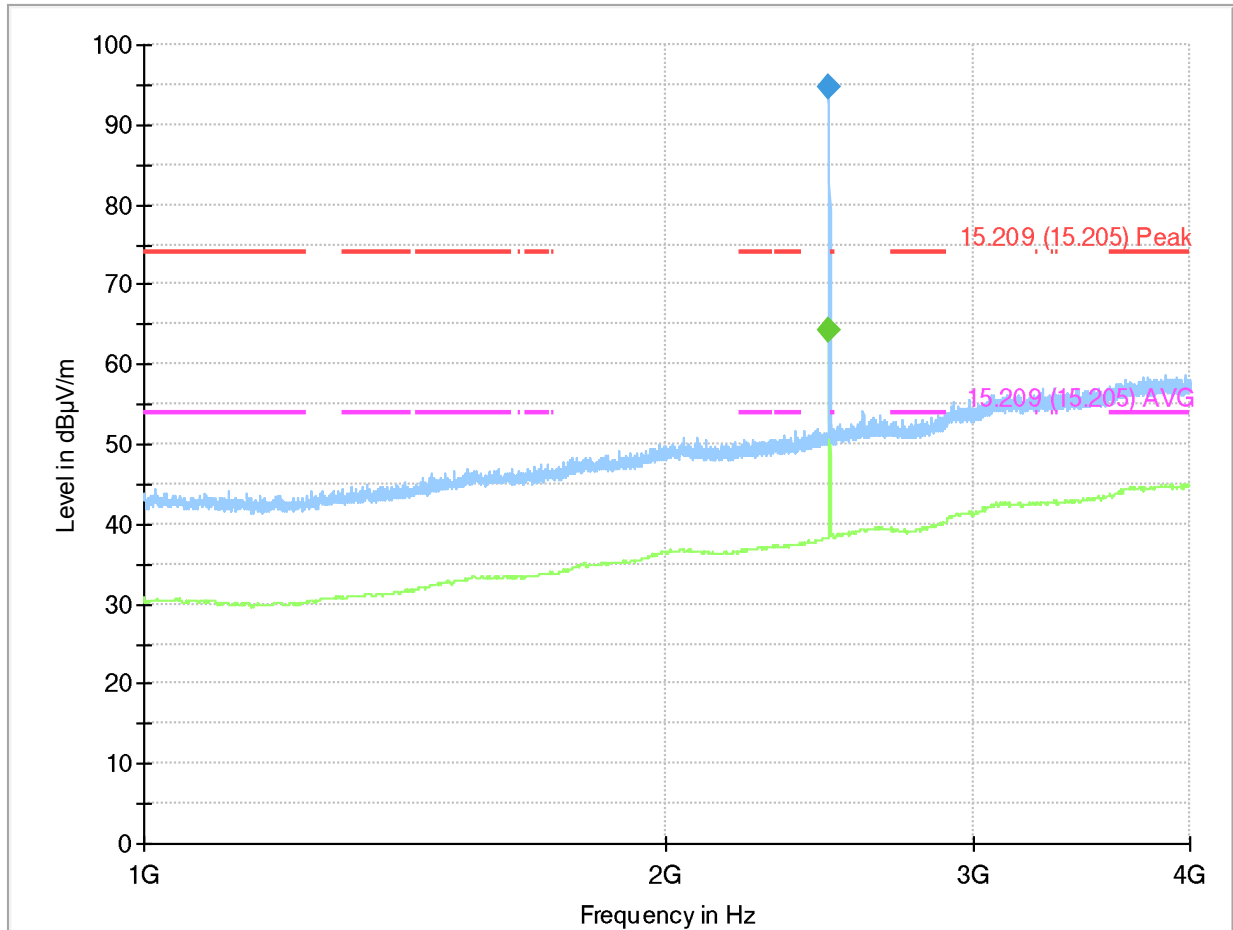
Plot 35: Mode 1, RSE 30 MHz – 1 GHz, high channel, horizontal / vertical polarisation



### Critical\_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
31.852000	34.28	40.00	5.72	---	---	342.0	H	153.0
95.500000	21.89	43.50	21.61	---	---	150.0	V	57.0

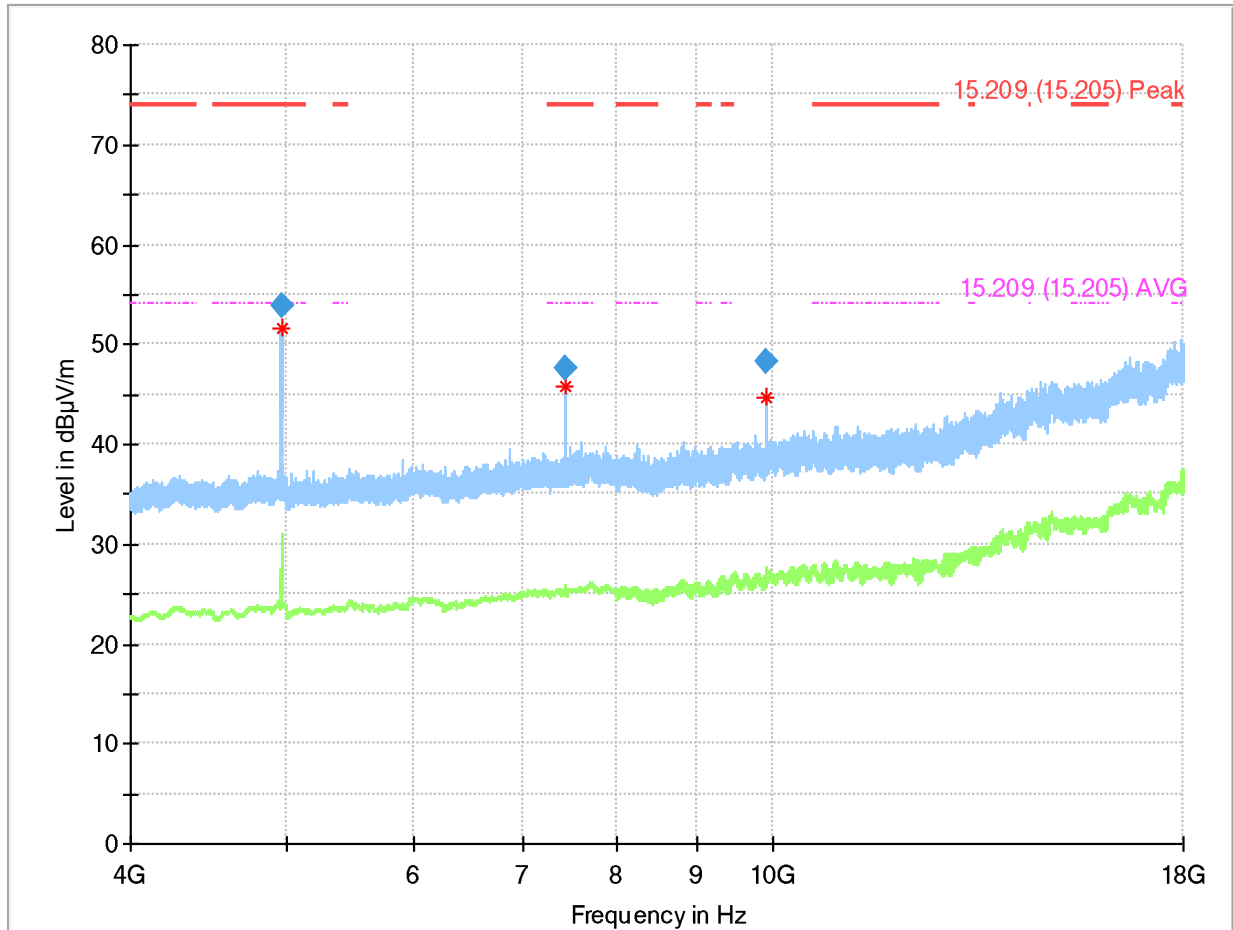
Plot 36: Mode 1, RSE 1 GHz – 4 GHz, high channel, horizontal / vertical polarisation



### Critical\_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
2480.250000	---	---	---	---	---	150.0	V	273.0
2480.500000	94.74	---	---	---	---	150.0	V	282.0

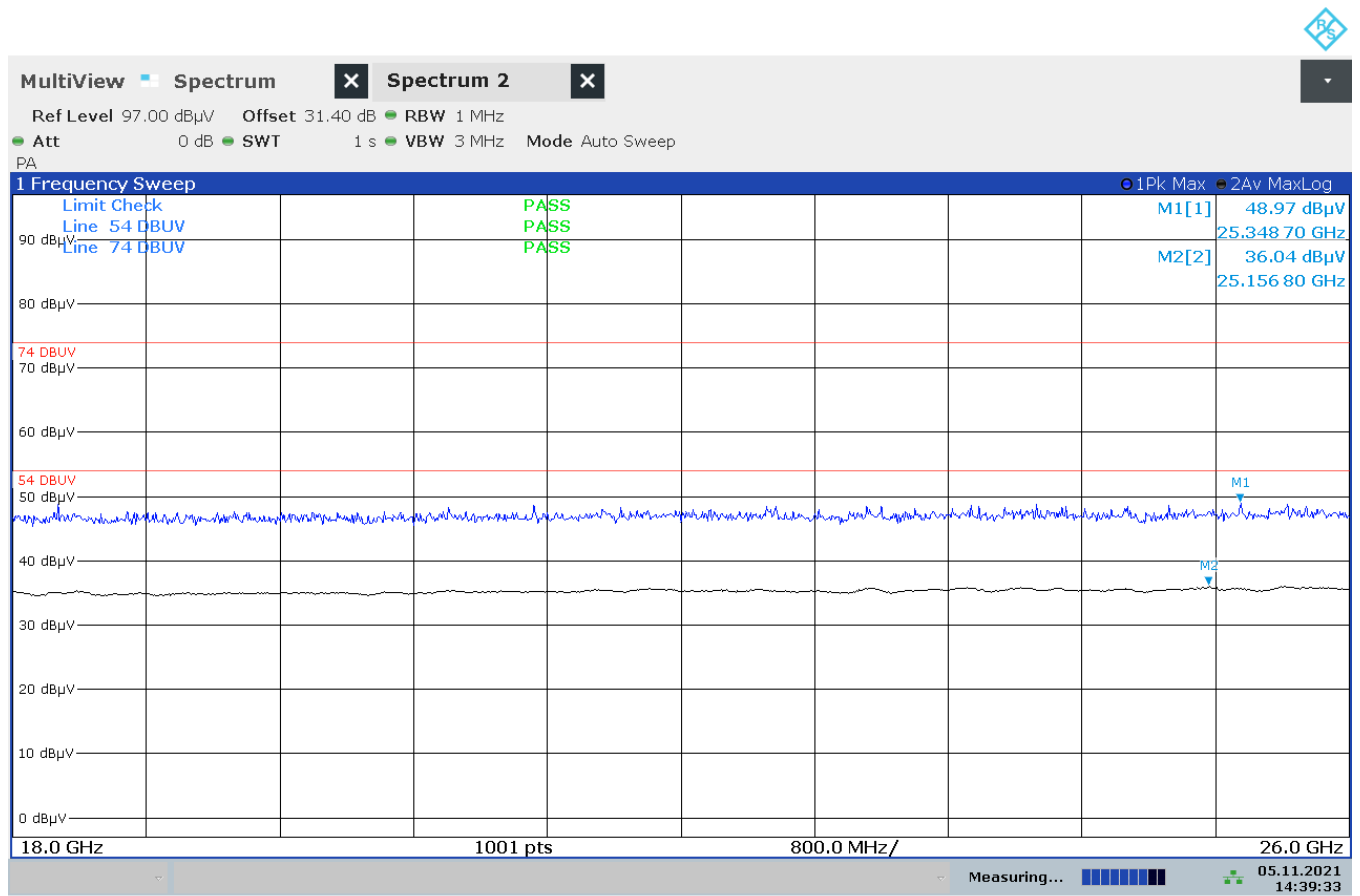
Plot 37: Mode 1, RSE 4 GHz – 18 GHz, high channel, horizontal / vertical polarisation



### Critical\_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
4961.275000	51.64	74.00	22.36	---	---	150.0	V	13.0
7438.900000	45.86	74.00	28.14	---	---	150.0	H	0.0
9922.525000	44.67	---	---	---	---	150.0	H	127.0

Plot 38: Mode 1, RSE 18 GHz – 26 GHz, high channel, horizontal / vertical polarisation

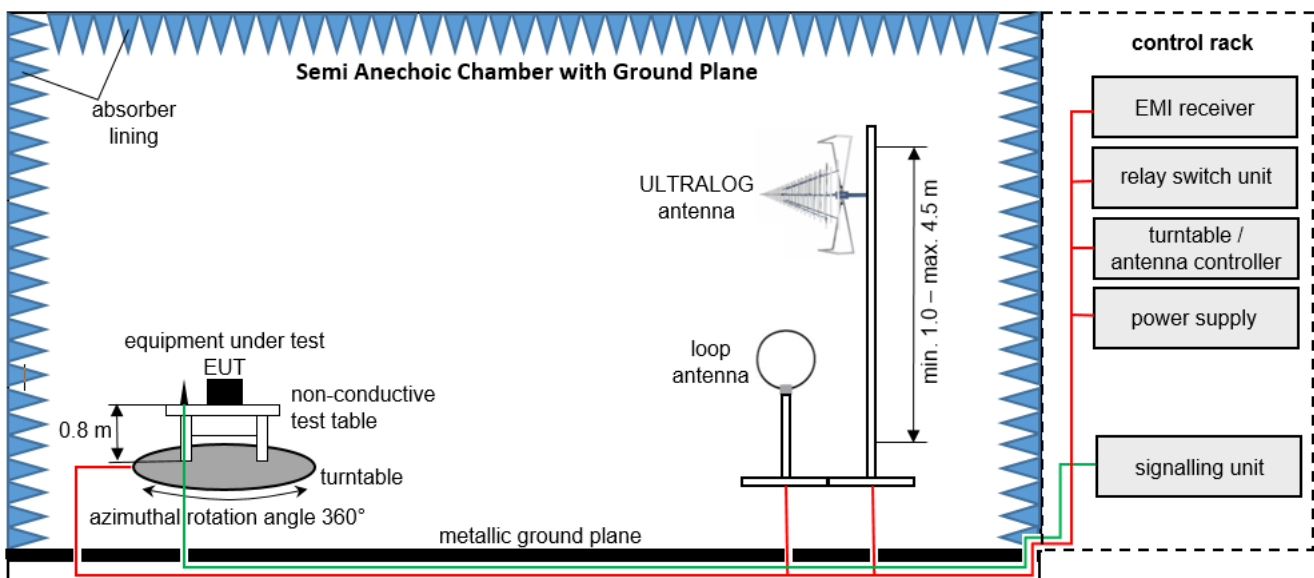


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## 8 TEST SETUP DESCRIPTION

### 8.1 Semi Anechoic Chamber with Ground Plane

Radiated measurements are performed in vertical and horizontal plane in the frequency range 30 MHz to 1 GHz in a Semi Anechoic Chamber with a metallic ground plane. The EUT is positioned on a non-conductive test table with a height of 0.80 m above the metallic ground plane that covers the whole chamber. The receiving antennas conform to specification ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices. These antennas can be moved over the height range between 1.0 m and 4.5 m in order to search for maximum field strength emitted from the EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by a spectrum analyzer where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.



Measurement distance: loop antenna 3 m, ULTRALOG antenna 3 m  
 EMC32 software version: 11.10.00

$$FS = UR + CL + AF$$

(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

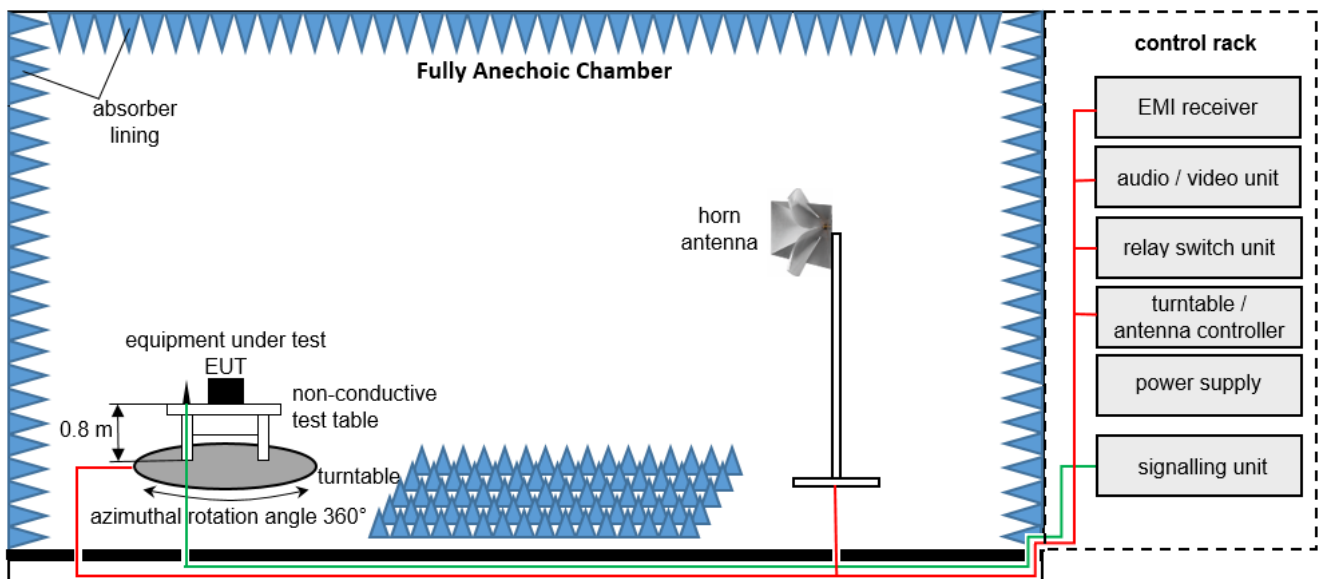
Example calculation:

$$FS \text{ [dB}\mu\text{V/m]} = 12.35 \text{ [dB}\mu\text{V/m]} + 1.90 \text{ [dB]} + 16.80 \text{ [dB/m]} = 31.05 \text{ [dB}\mu\text{V/m]} \text{ (35.69 } \mu\text{V/m)}$$

**List of test equipment used:**

No.	Equipment	Manufacturer	Type	Serial No.	IBL No.	Kind of Calibration	Calibration
1	Power Supply	Elektro-Automatik GmbH & Co. KG	EA-PSI 9080-40 T	2000230001	LAB000313	NE	–
2	Test table	innco systems GmbH	PT1208-080-RH	-	LAB000306	NE	–
3	Power Supply	Chroma	61604	616040005416	LAB000285	NE	–
4	Positioner	matur GmbH	TD 1.5-10KG		LAB000258	NE	–
5	Compressed Air	Implotex	1-850-30	-	LAB000256	NE	–
6	EMI Test Receiver	Rohde & Schwarz	ESW26	101481	LAB000236	K	2021-07-01 → 12M → 2022-07-01
78	Semi-Anechoic Chamber (SAC)	Albatross Projects GmbH	Babylon 5 (SAC 5)	20168.PRB	LAB000235	NE	–
9	Measurement Software	Rohde & Schwarz	EMC32 V11.00		LAB000226	NE	–
10	Turntable	matur GmbH	TT2.0-2t	TT2.0-2t/921	LAB000225	NE	–
11	Antenna Mast	matur GmbH	CAM4.0-P	CAM4.0-P/316	LAB000224	NE	–
12	Antenna Mast	matur GmbH	BAM4.5-P	BAM4.5-P/272	LAB000223	NE	–
132	Controller	matur GmbH	FCU 3.0	10082	LAB000222	NE	–
14	Power Supply	Elektro-Automatik GmbH & Co. KG	EA-PS 2042-10 B	2878350292	LAB000191	NE	–
14	Pre-Amplifier	Schwarzbeck Mess-Elektronik OHG	BBV 9718 C	84	LAB000169	NE	–
15	Antenna	Rohde & Schwarz	HL562E	102005	LAB000150	K	2020-07-05 → 36M → 2023-07-05
16	Open Switch and Control Platform	Rohde & Schwarz	OSP200 Base Unit 2HU	101748	LAB000149	NE	–
17	Antenna	Rohde & Schwarz	HL562E	102001	LAB000123	K	2020-07-05 → 36M → 2023-07-05
18	Antenna	Rohde & Schwarz	HFH2-Z2E - Active Loop Antenna	100954	LAB000108	K	2020-03-25 → 36M → 2023-03-25

## 8.2 Fully Anechoic Chamber



Measurement distance: horn antenna 3 meter  
EMC32 software version: 11.10.00

$$FS = UR + CL + AF$$

(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

Example calculation:

$$FS [dB\mu V/m] = 12.35 [dB\mu V/m] + 1.90 [dB] + 16.80 [dB/m] = 31.05 [dB\mu V/m] (35.69 \mu V/m)$$

$$OP = AV + D - G + CA$$

(OP-radiated output power; AV-analyzer value; D-free field attenuation of measurement distance; G-antenna gain+amplifier gain; CA-loss signal path)

Example calculation:

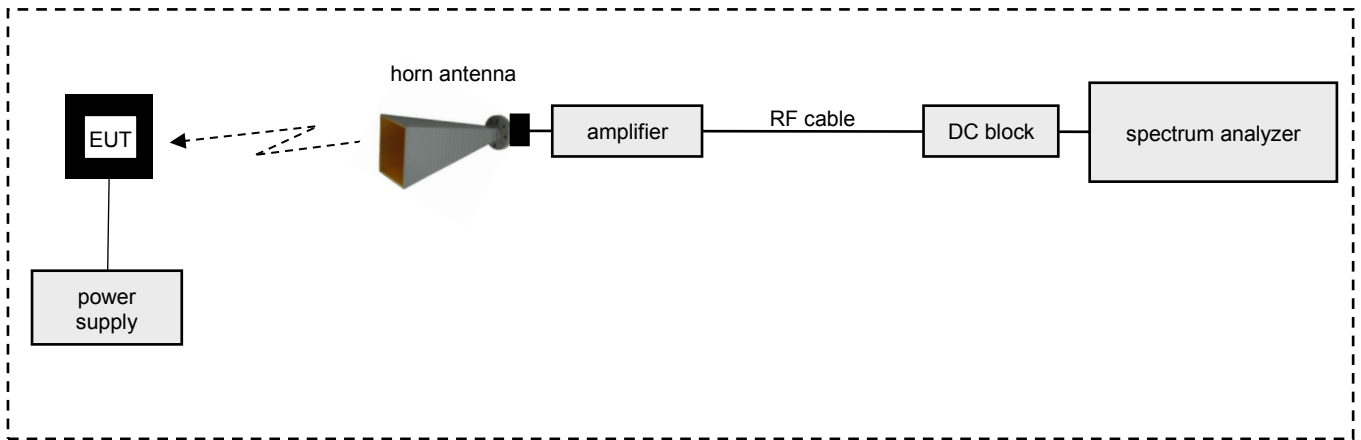
$$OP [dBm] = -65.0 [dBm] + 50 [dB] - 20 [dBi] + 5 [dB] = -30 [dBm] (1 \mu W)$$

**List of test equipment used:**

No.	Equipment	Manufacturer	Type	Serial No.	IBL No.	Kind of Calibration	Calibration
1	Power Supply	Elektro-Automatik GmbH & Co. KG	EA-PSI 9080-40 T	2000230001	LAB000313	NE	–
2	Test table	innco systems GmbH	PT1208-080-RH	-	LAB000306	NE	–
3	Power Supply	Chroma	61604	616040005416	LAB000285	NE	–
4	Positioner	matur GmbH	TD 1.5-10KG		LAB000258	NE	–
5	Compressed Air	Implotex	1-850-30	-	LAB000256	NE	–
6	EMI Test Receiver	Rohde & Schwarz	ESW26	101481	LAB000236	K	2021-07-01 → 12M → 2022-07-01
78	Semi-Anechoic Chamber (SAC)	Albatross Projects GmbH	Babylon 5 (SAC 5)	20168.PRB	LAB000235	NE	–
9	Measurement Software	Rohde & Schwarz	EMC32 V11.00		LAB000226	NE	–
10	Turntable	matur GmbH	TT2.0-2t	TT2.0-2t/921	LAB000225	NE	–
11	Antenna Mast	matur GmbH	CAM4.0-P	CAM4.0-P/316	LAB000224	NE	–
12	Antenna Mast	matur GmbH	BAM4.5-P	BAM4.5-P/272	LAB000223	NE	–
132	Controller	matur GmbH	FCU 3.0	10082	LAB000222	NE	–
14	Power Supply	Elektro-Automatik GmbH & Co. KG	EA-PS 2042-10 B	2878350292	LAB000191	NE	–
14	Pre-Amplifier	Schwarzbeck Mess-Elektronik OHG	BBV 9718 C	84	LAB000169	NE	–
15	Antenna	Rohde & Schwarz	HF907	102899	LAB000151	K	2020-04-23 → 36M → 2023-04-23
16	Open Switch and Control Platform	Rohde & Schwarz	OSP200 Base Unit 2HU	101748	LAB000149	NE	–
17	Antenna	Rohde & Schwarz	HF907	102898	LAB000124	K	2020-04-23 → 36M → 2023-04-23



### 8.3 Radiated measurements > 18 GHz

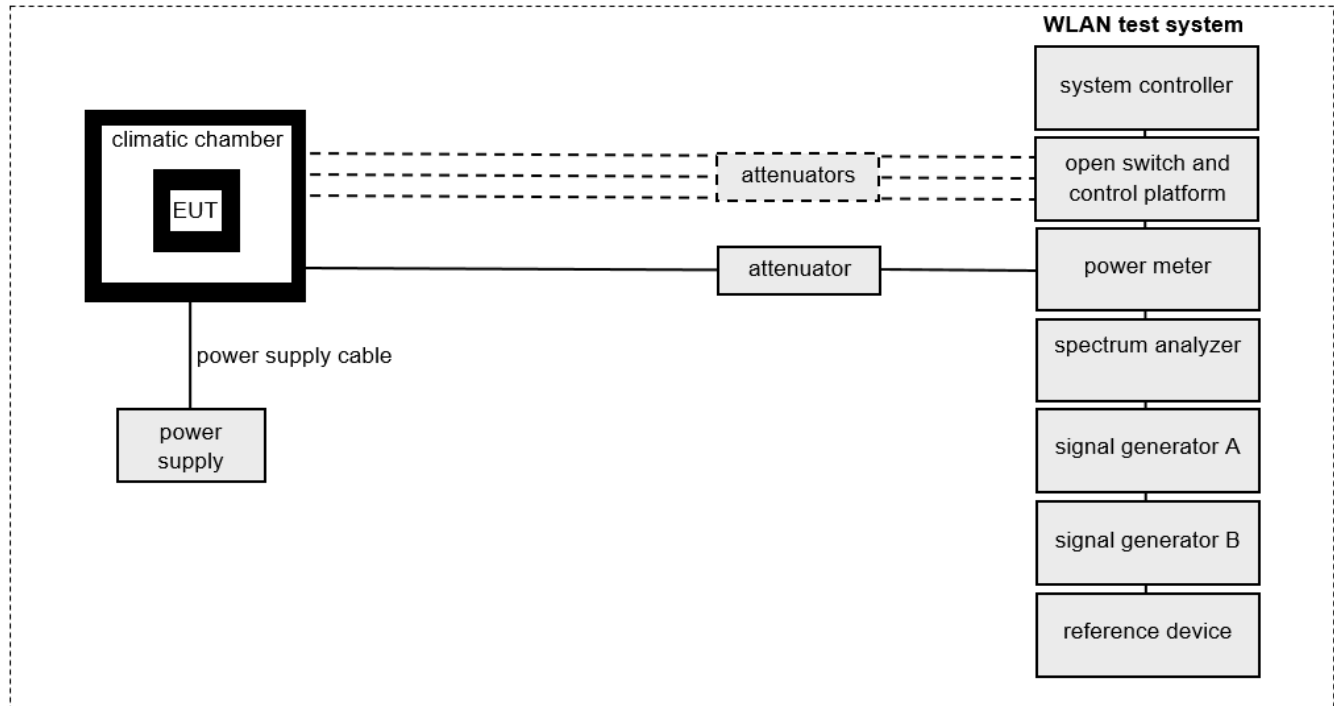


**List of test equipment used:**

No.	Equipment	Manufacturer	Type	Serial No.	IBL No.	Kind of Calibration	Calibration
1	Test table	innco systems GmbH	PT0707-RH light	-	LAB000303	NE	-
2	WG-Coax-Adapter	Flann Microwave Ltd	20093-TF30 UBR220	273373	LAB000180	ZW	2021-09-01 → 36M → 2022-09-01
3	Coaxial Cable	Huber & Suhner	SF101/1.0m	503989/1	LAB000163	ZW	2021-08-16 → 12M → 2022-08-16
4	Antenna	Flann Microwave Ltd	20240-20	266402	LAB000127	K	2020-06-29 → 36M → 2023-06-29
5	Spectrum Analyser	Rohde & Schwarz	FSW50	101450	LAB000111	K	2021-07-22 → 12M → 2022-07-22
6	Antenna Mast	Schwarzbeck Mess-Elektronik OHG	AM 9104	99	LAB000109	NE	-
7	Power Supply	Elektro-Automatik GmbH & Co. KG	EA-PS 2042-10 B	2878350255	LAB000189	NE	-

### 8.4 Conducted measurements WLAN test system R&S TS 8997

The EUT's RF signal is coupled out by the antenna connector which is supplied by the manufacturer. The losses for all signal paths are first checked within a calibration. The measurement readings on the signalling unit/spectrum analyzer are corrected by the specific test set-up loss. The attenuator, power divider, signalling unit and the spectrum analyzer are impedance matched on 50 Ohm.



EMC32/WMS32 software version: 11.00.00

#### List of test equipment used:

No.	Equipment	Manufacturer	Type	Serial No.	INV. No.	Calibration
1	TS8997-Rack	Rohde & Schwarz	TS8997-Rack	100829	LAB000322	--
2	Open Switch and Control Platform	Rohde & Schwarz	OSP-B157WX	101247	LAB000280	--
3	Open Switch and Control Platform	Rohde & Schwarz	OSP-B157W8	100982	LAB000279	--
4	Spectrum Analyser	Rohde & Schwarz	FSV40	101403	LAB000278	2021-06-15 → 2022-06-15
5	Signal Generator	Rohde & Schwarz	SMBV100A	258240	LAB000277	2021-06-02 → 2022-06-02
6	Signal Generator	Rohde & Schwarz	SMB100A-20	178175	LAB000276	2021-05-27 → 2022-05-27
7	Radio Communication Tester	Rohde & Schwarz	CMW270	101479	LAB000275	--
8	Controller	Hewlett Packard	ATS-Z230	101379	LAB000274	--
9	Power Supply	EA	PS 2042-10 B	2878350263	LAB000190	--

## 9 MEASUREMENT UNCERTAINTIES

Radio frequency	$\leq \pm 1 \times 10^{-7}$
RF power, conducted	$\leq \pm 0.75$ dB
Power spectral density	$\leq \pm 3$ dB
Maximum frequency deviation	$\leq \pm 5$ %
Deviation limitation Duty Cycle, Tx-sequence, Tx-gap	$\leq \pm 5$ %
Occupied channel bandwidth	$\leq \pm 5$ %
Conducted spurious emission of transmitter	$\leq \pm 4$ dB
Conducted emission of receivers	$\leq \pm 4$ dB
Radiated emission of transmitter	$\leq \pm 6$ dB
Radiated emission of receiver	$\leq \pm 6$ dB
Temperature	$\leq \pm 2.5$ °C
Humidity	$\leq \pm 10$ %

The indicated expanded measurement uncertainty corresponds to the standard measurement uncertainty for the measurement results multiplied by the coverage factor  $k = 2$ . It was determined in accordance with EA-4/02 M:2013. The true value is located in the corresponding interval with a probability of 95 %.

**Annex A EUT Photographs, external**

Photo No. 1:

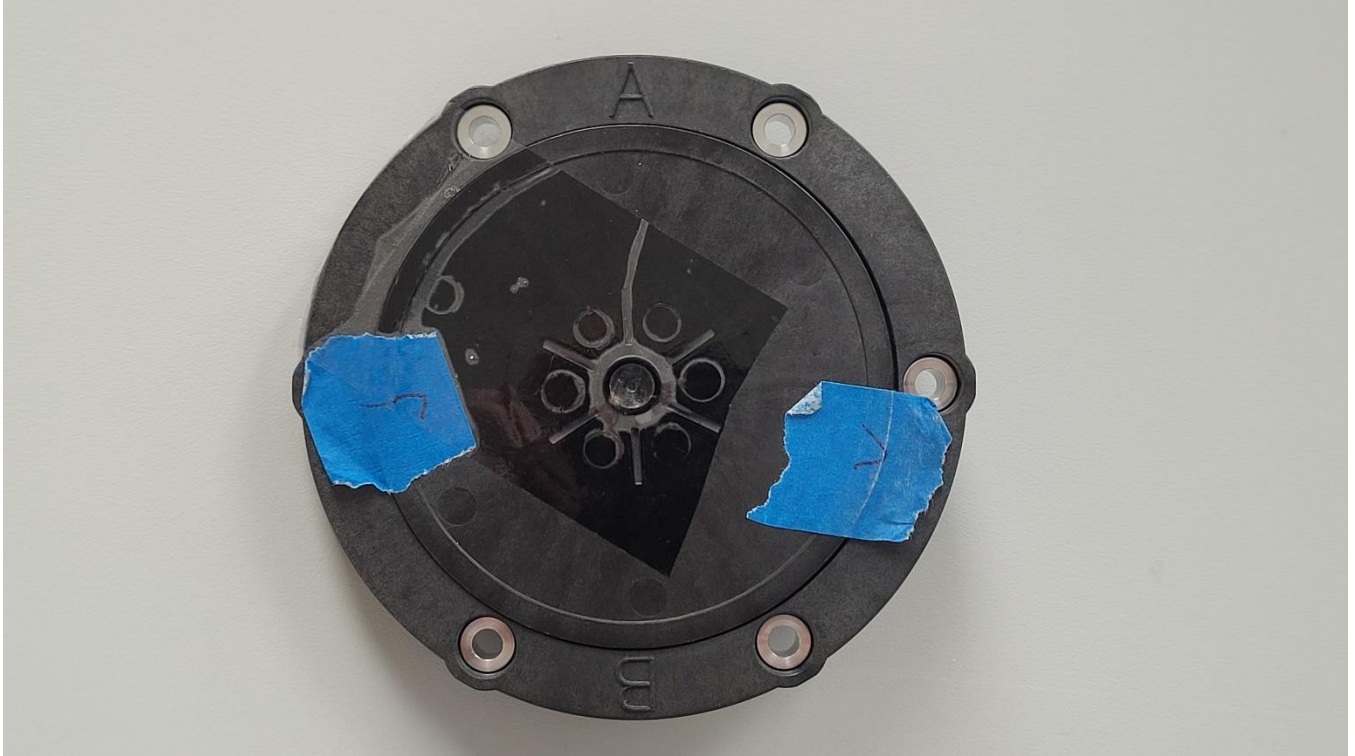


Photo No. 2:



Photo No. 3:

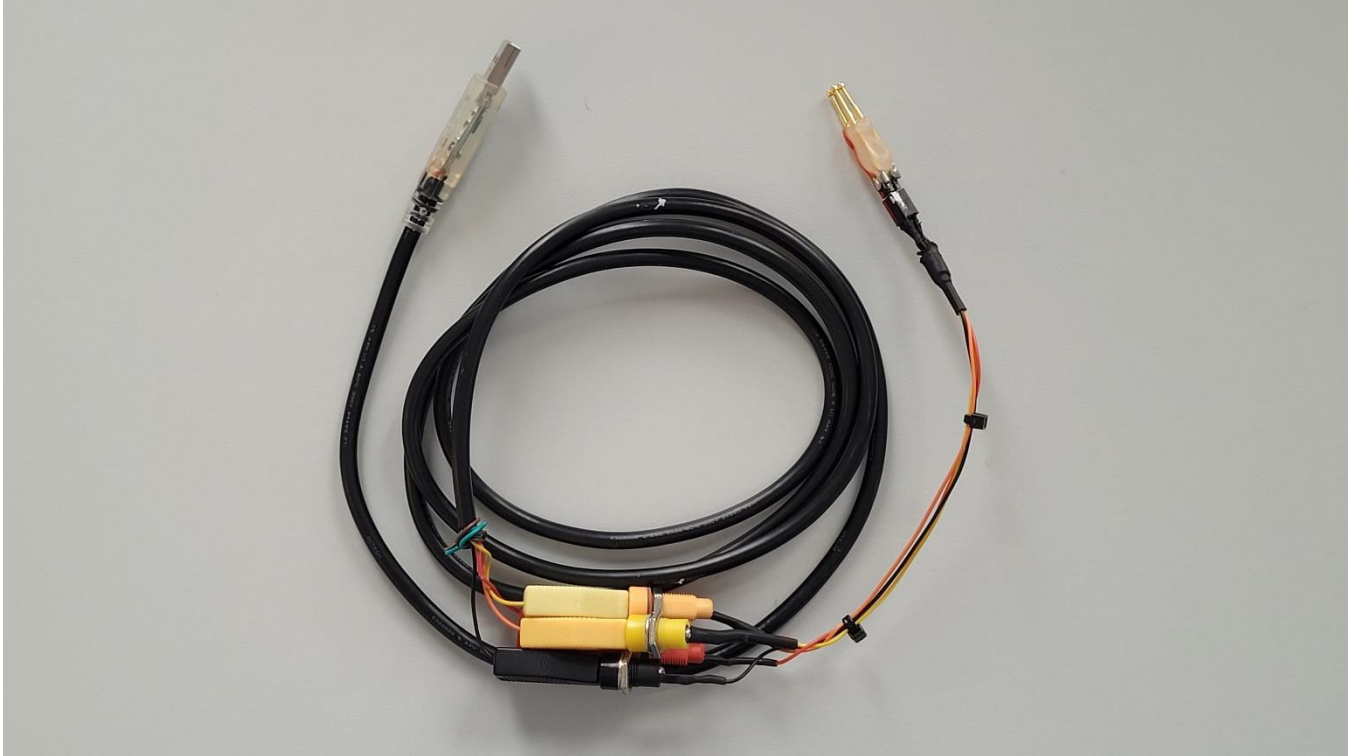


Photo No. 4:

**Annex B EUT Photographs, internal**

Photo No. 5: radiated test sample

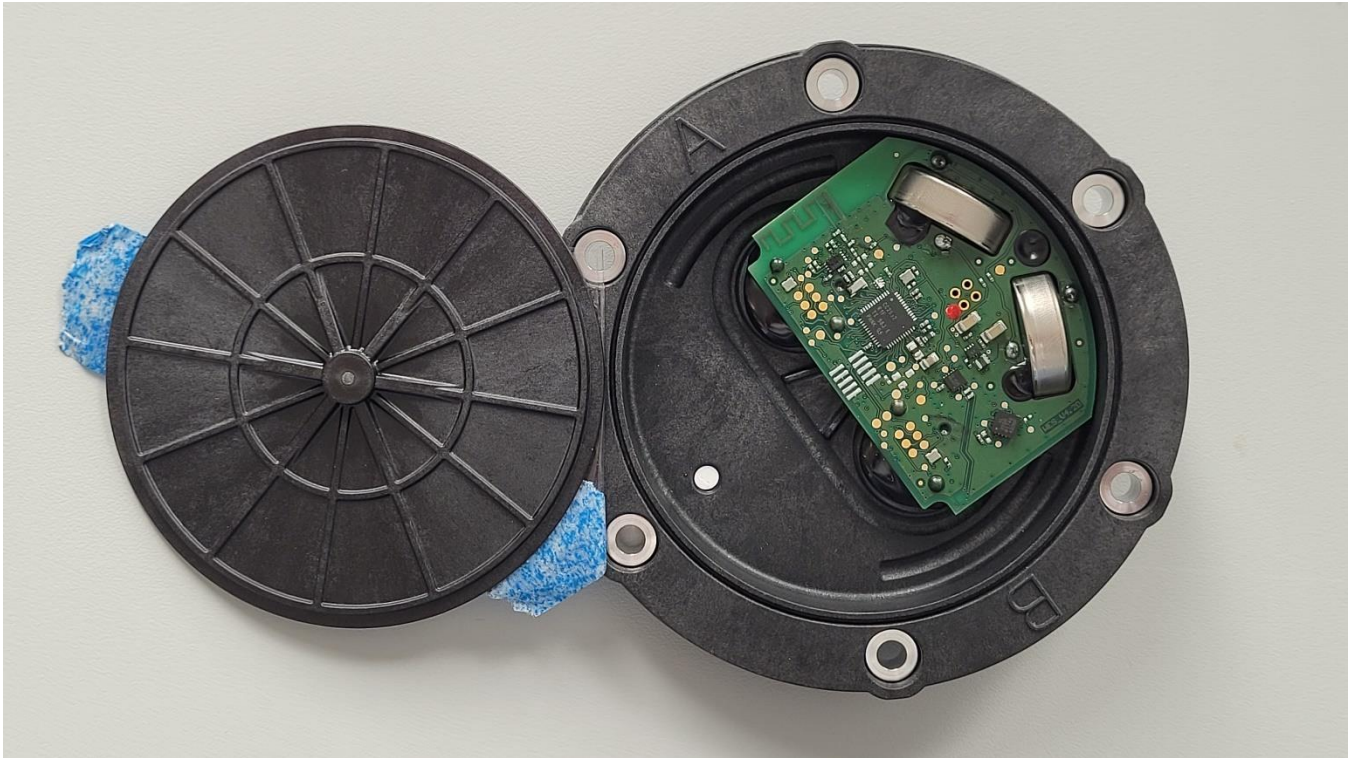


Photo No. 6: conducted test sample

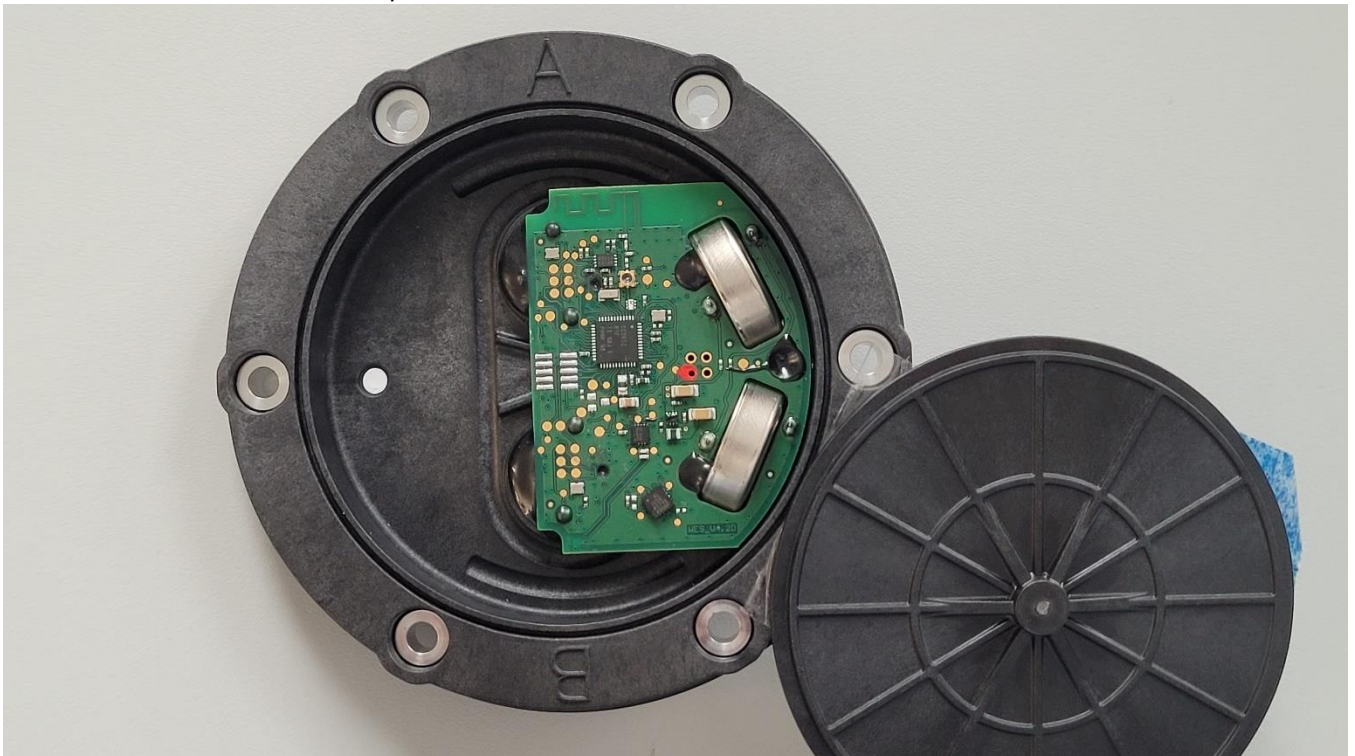


Photo No. 7: conducted test sample



Photo No. 8:

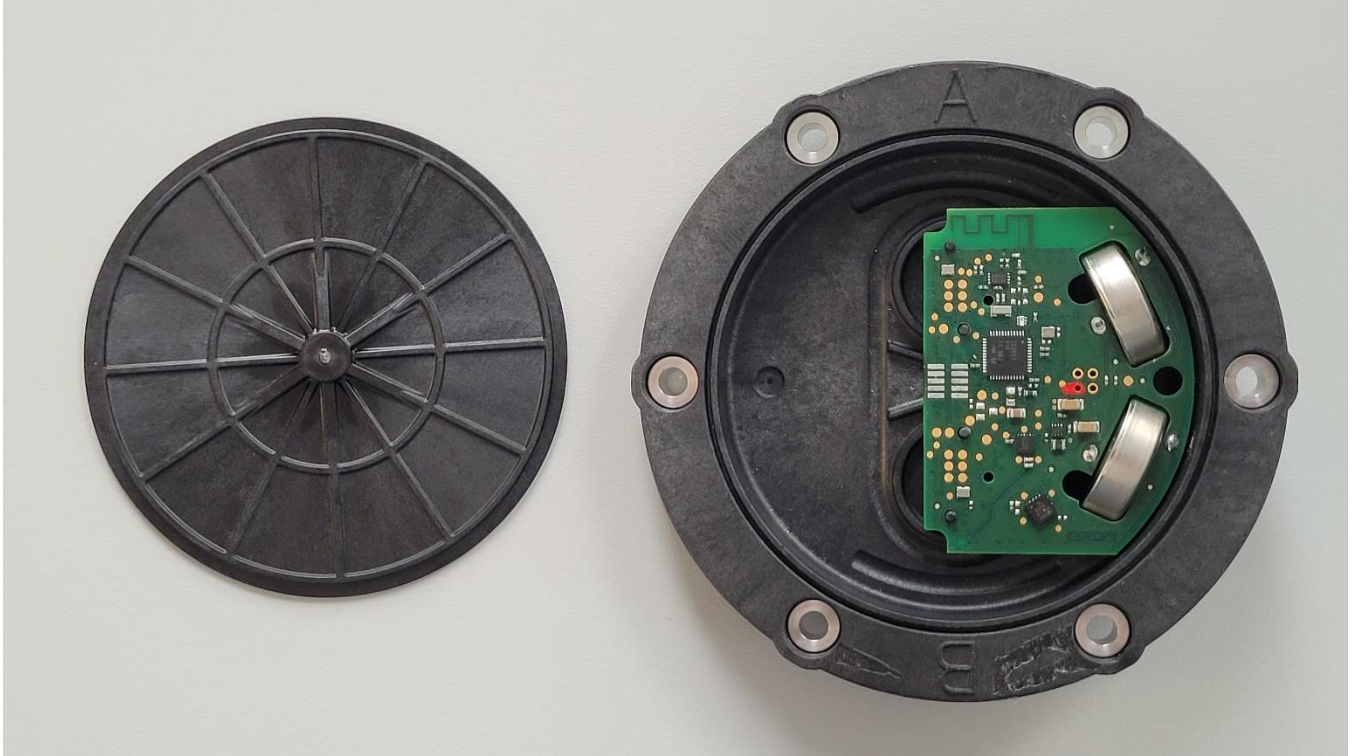


Photo No. 9:

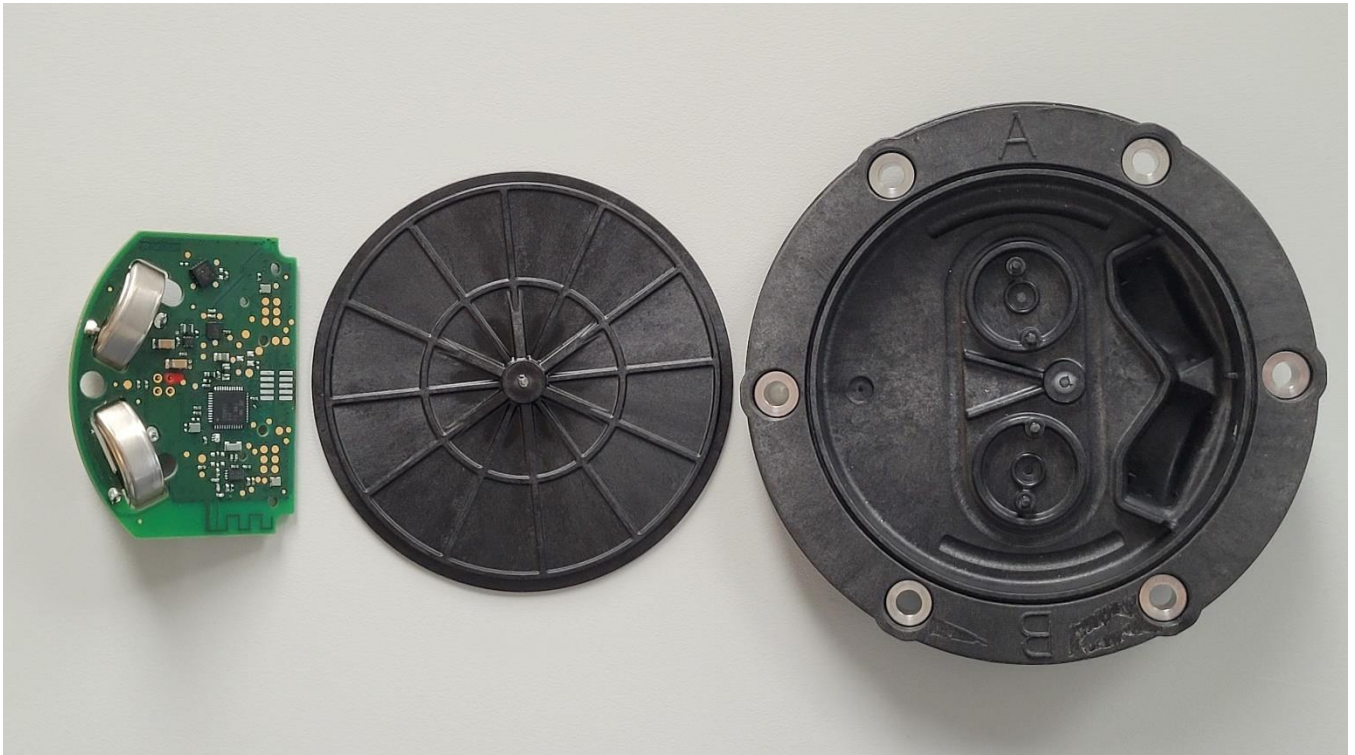




Photo No. 10:

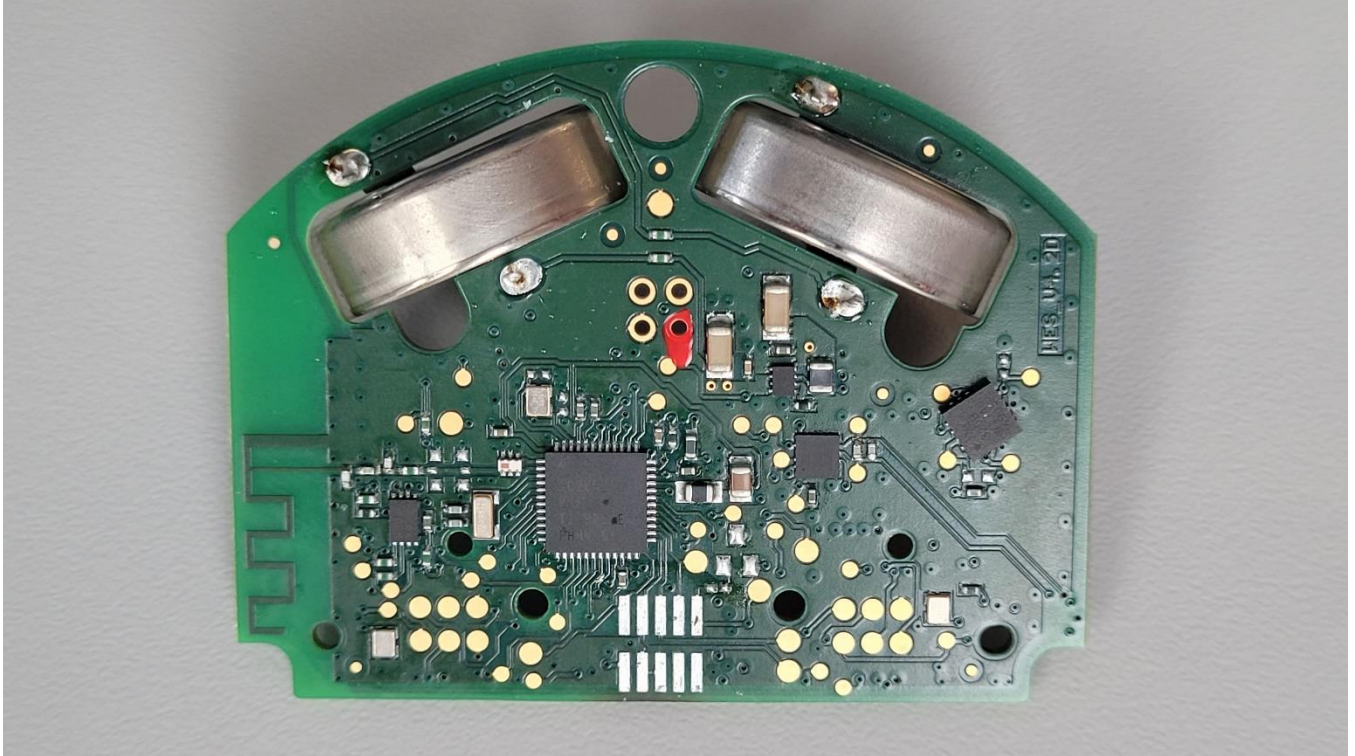


Photo No. 11:

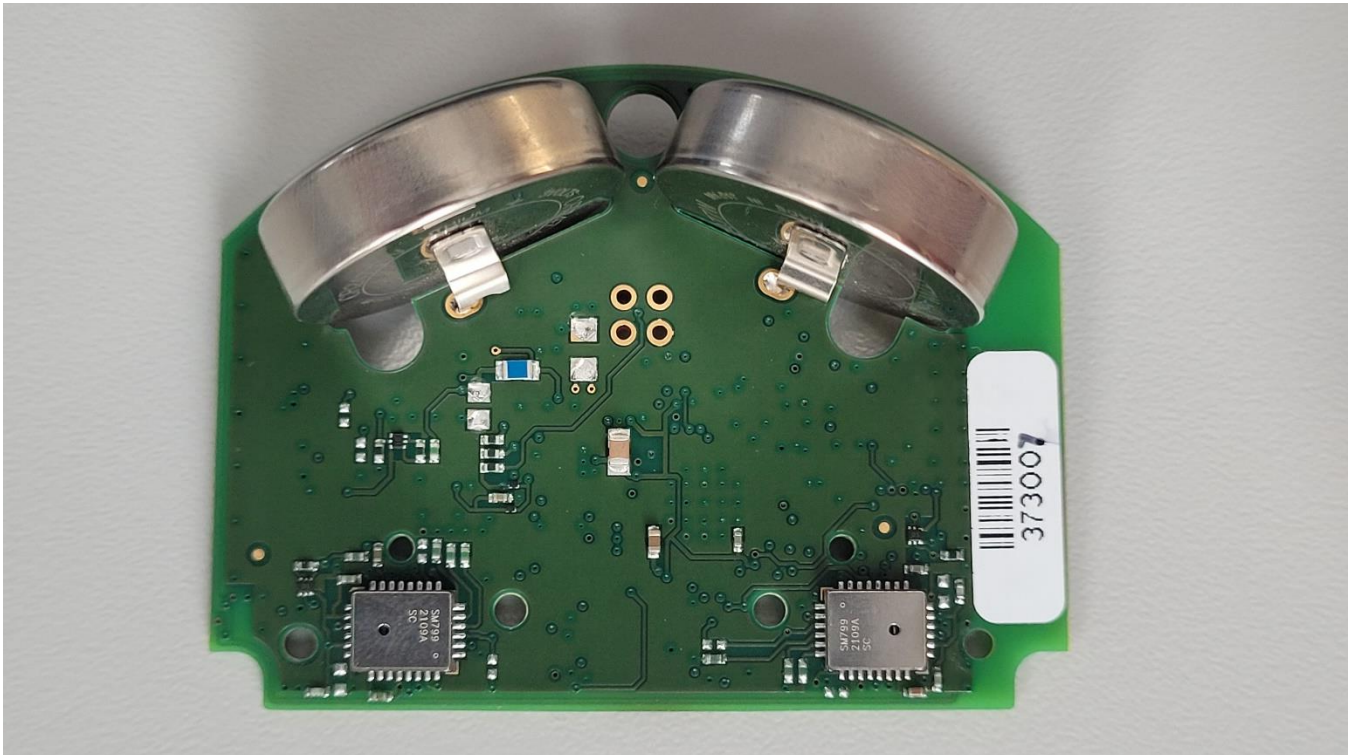


Photo No. 12:

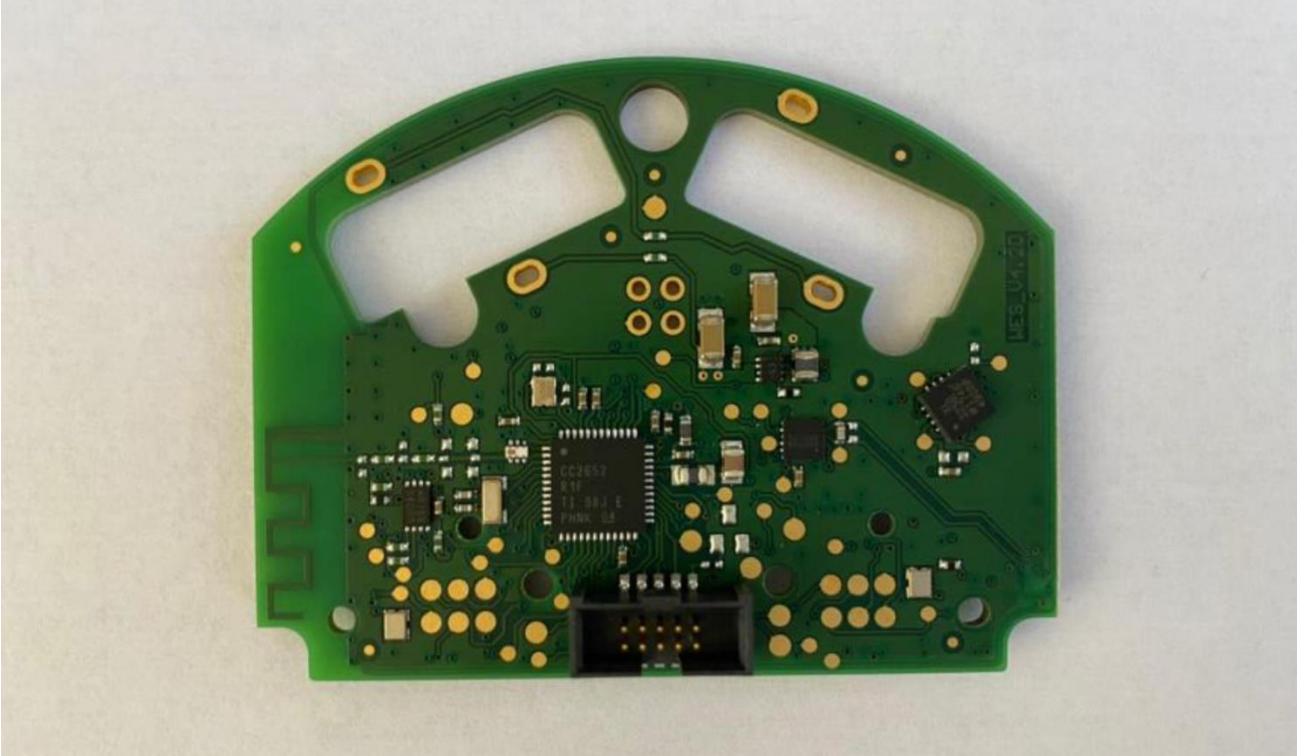
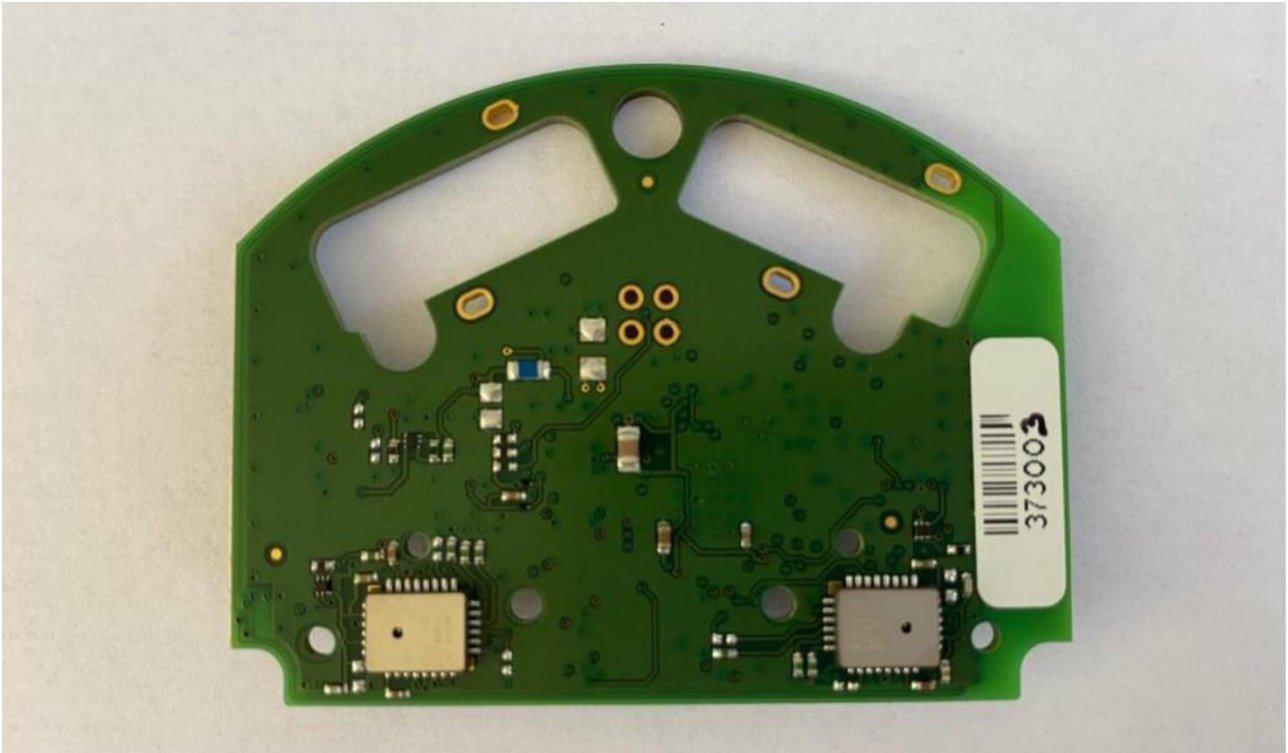


Photo No. 13:



**Annex C Test Setup Photographs**

Photo No. 14:

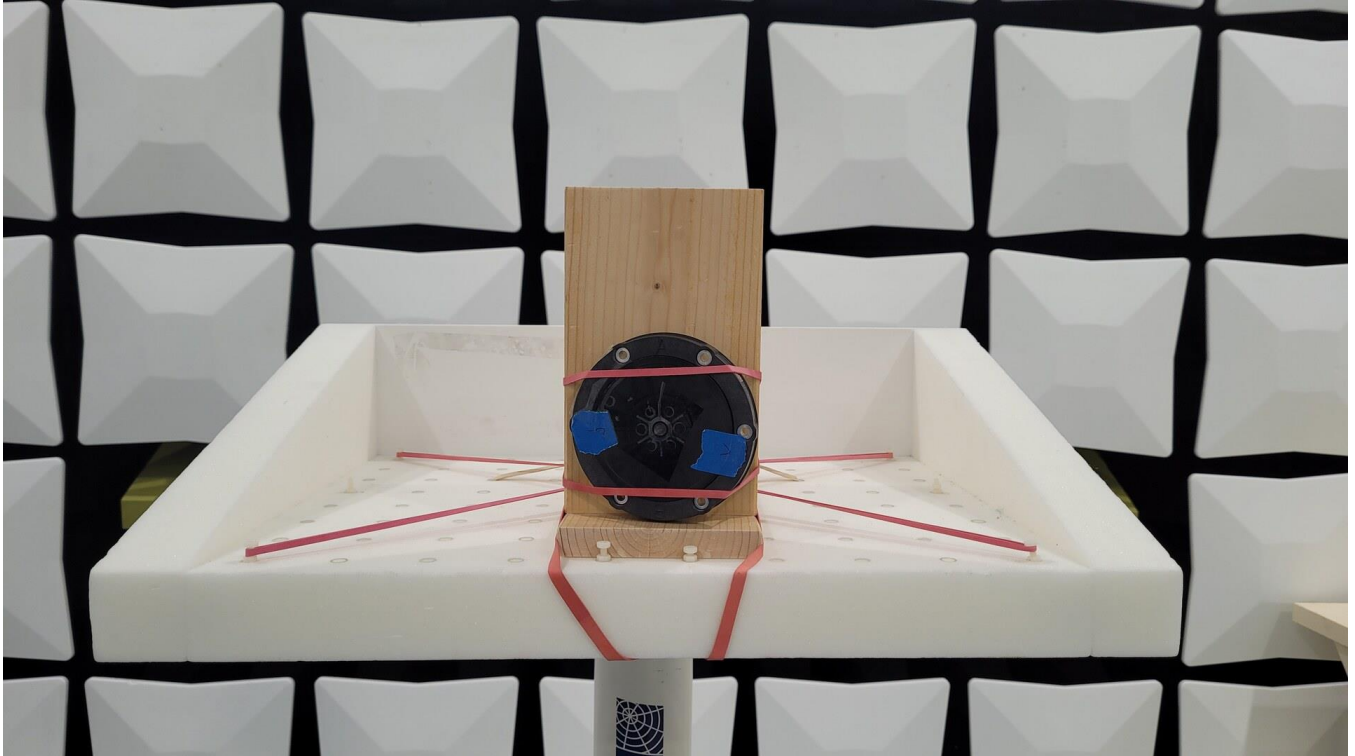


Photo No. 15:

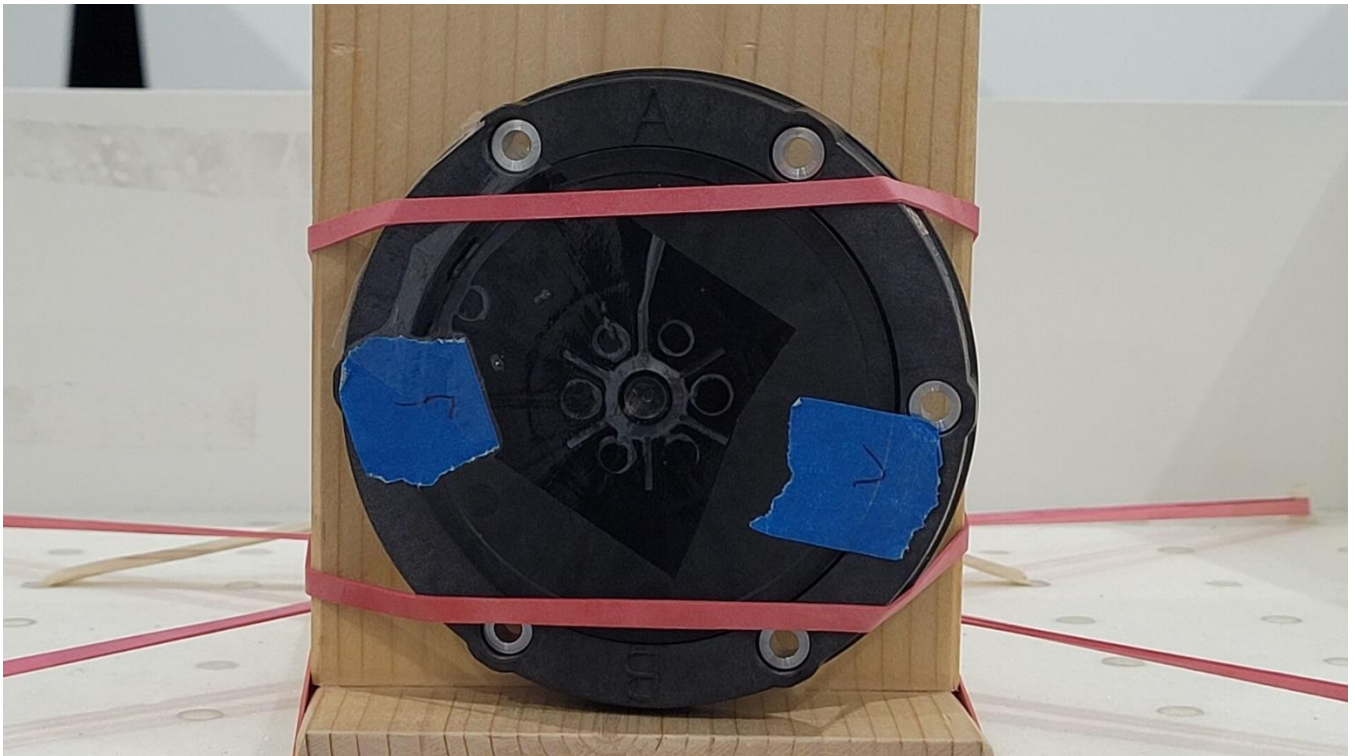


Photo No. 16:

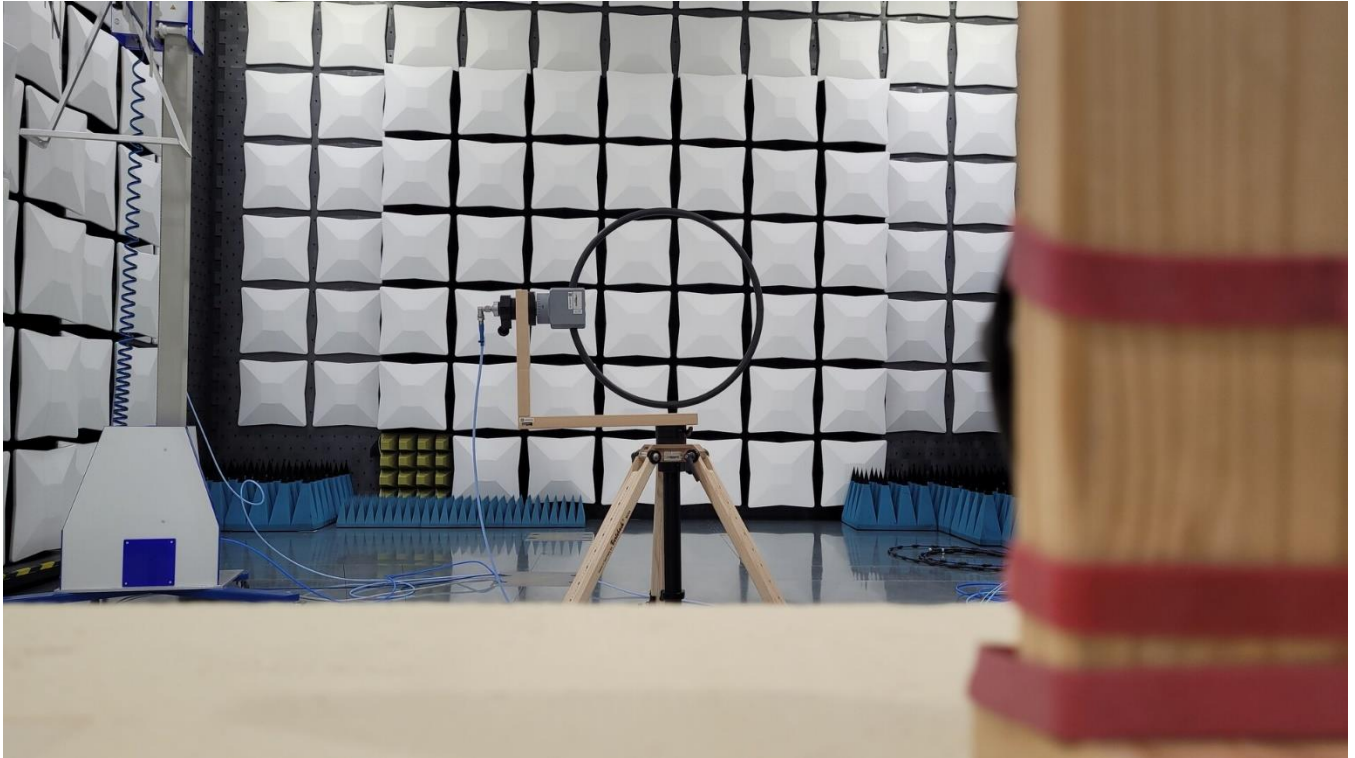


Photo No. 17:



Photo No. 18:

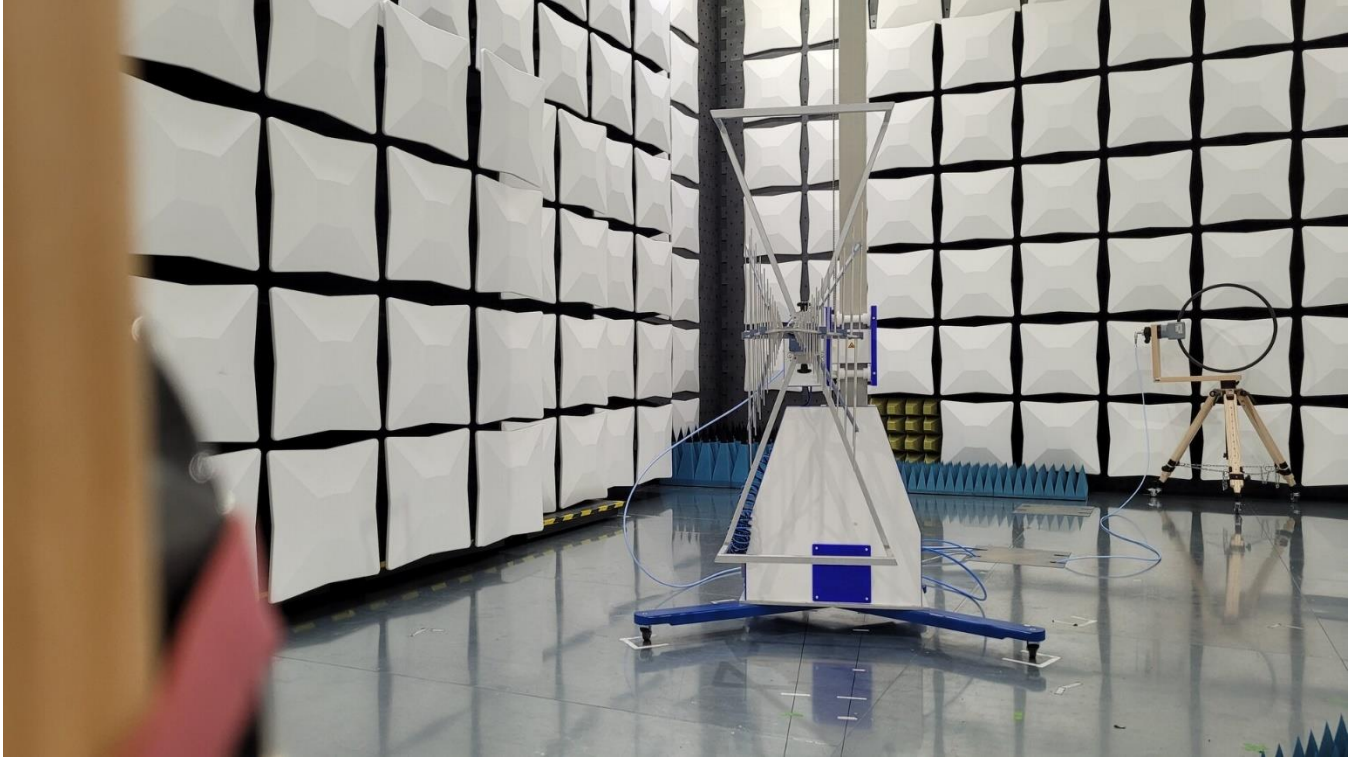
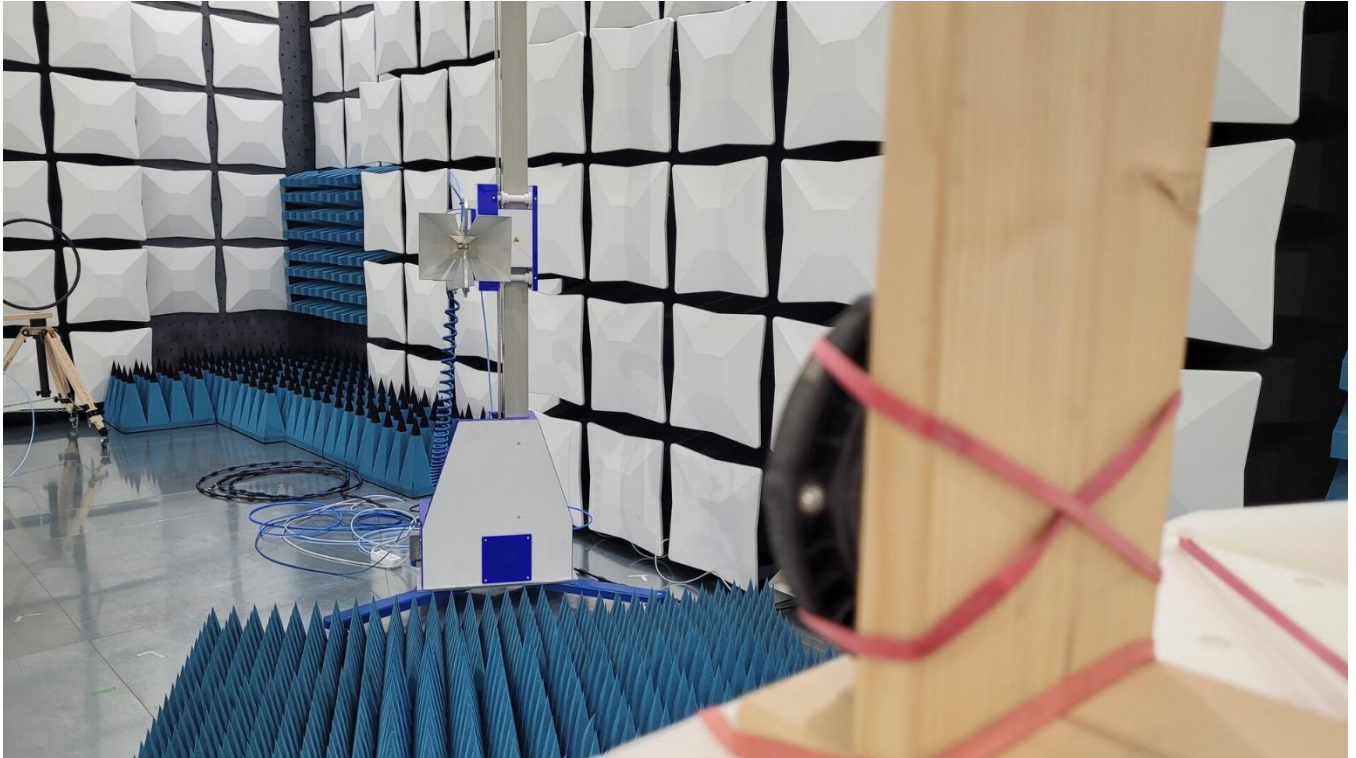


Photo No. 19:



Photo No. 20:



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**End of Test Report**

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