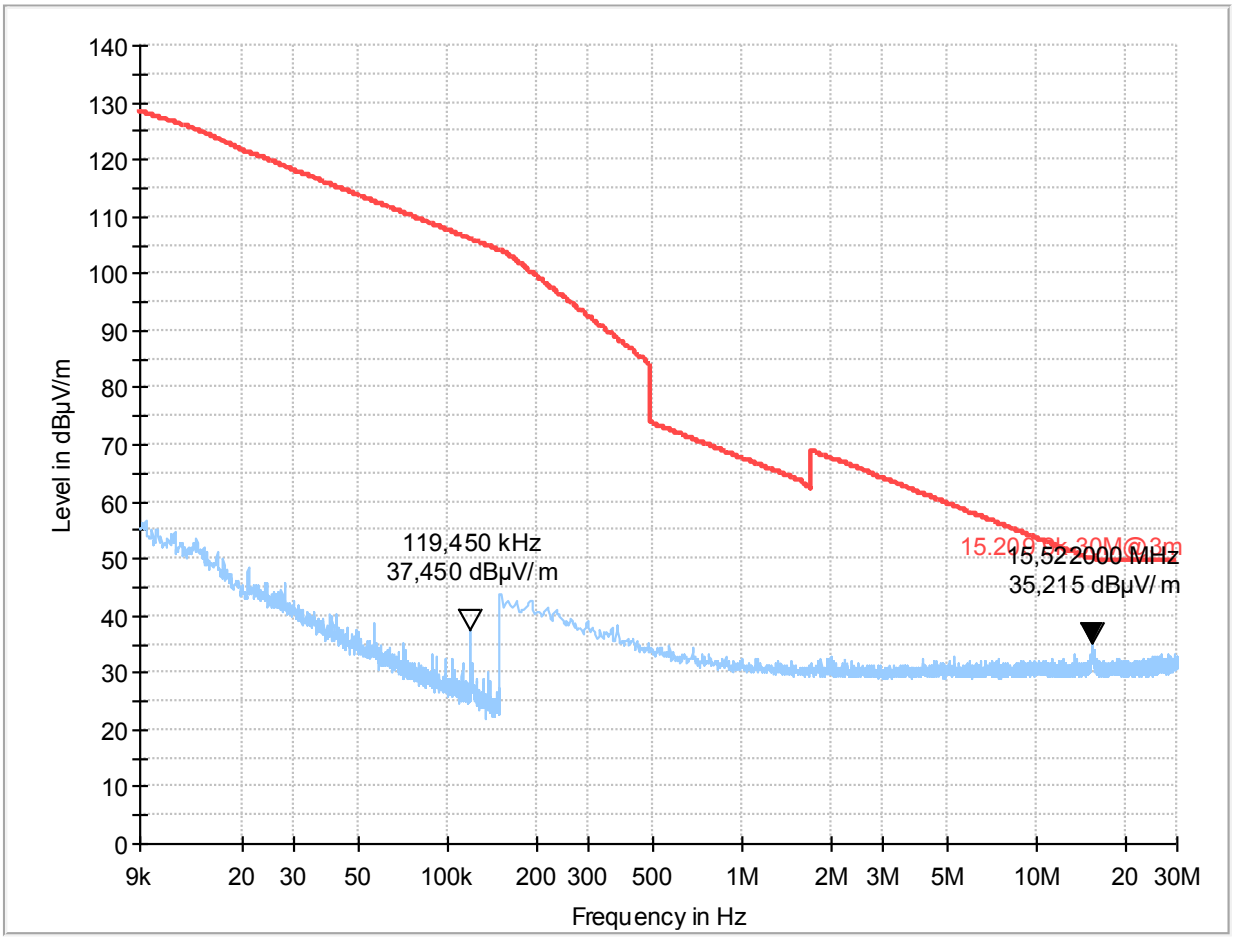
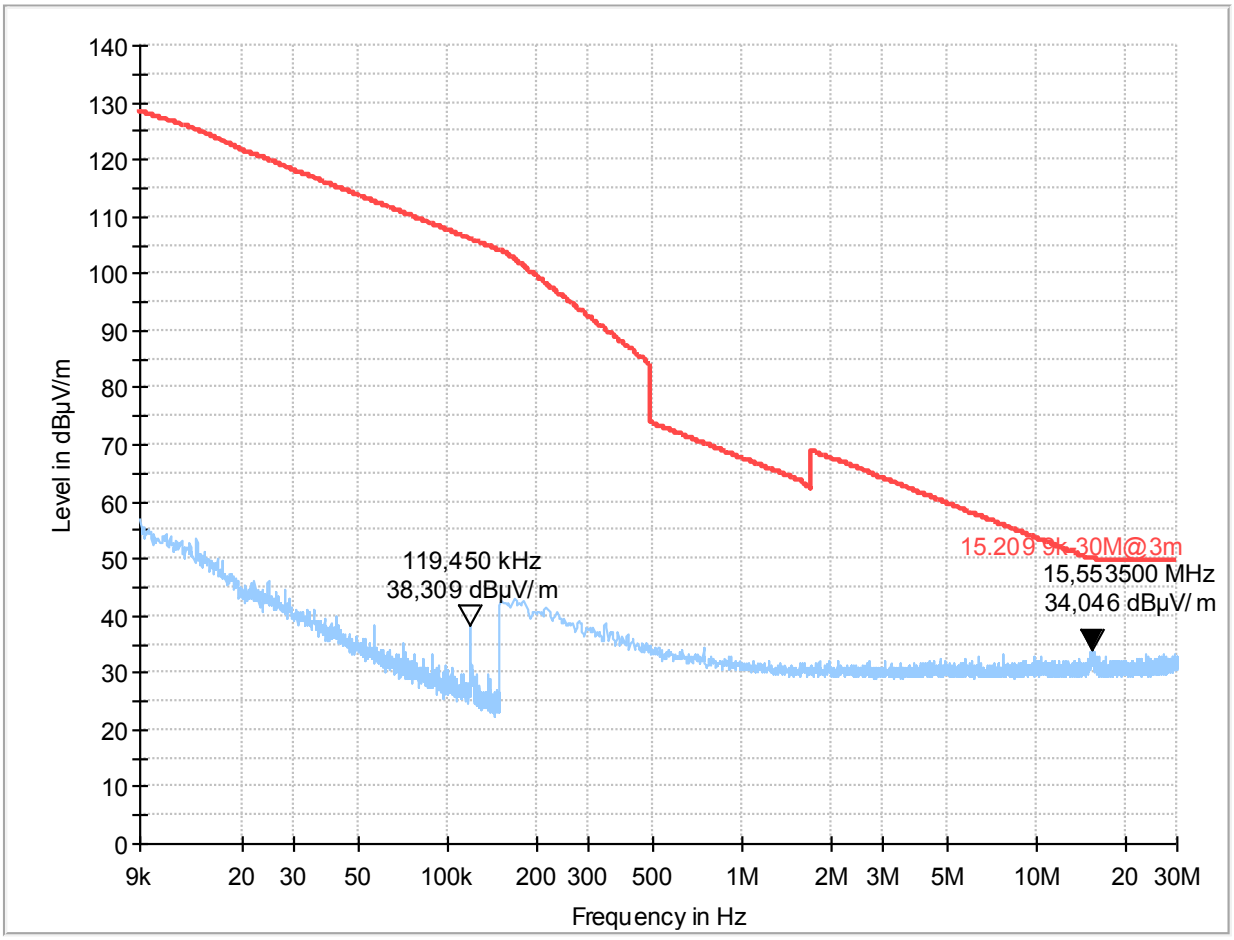
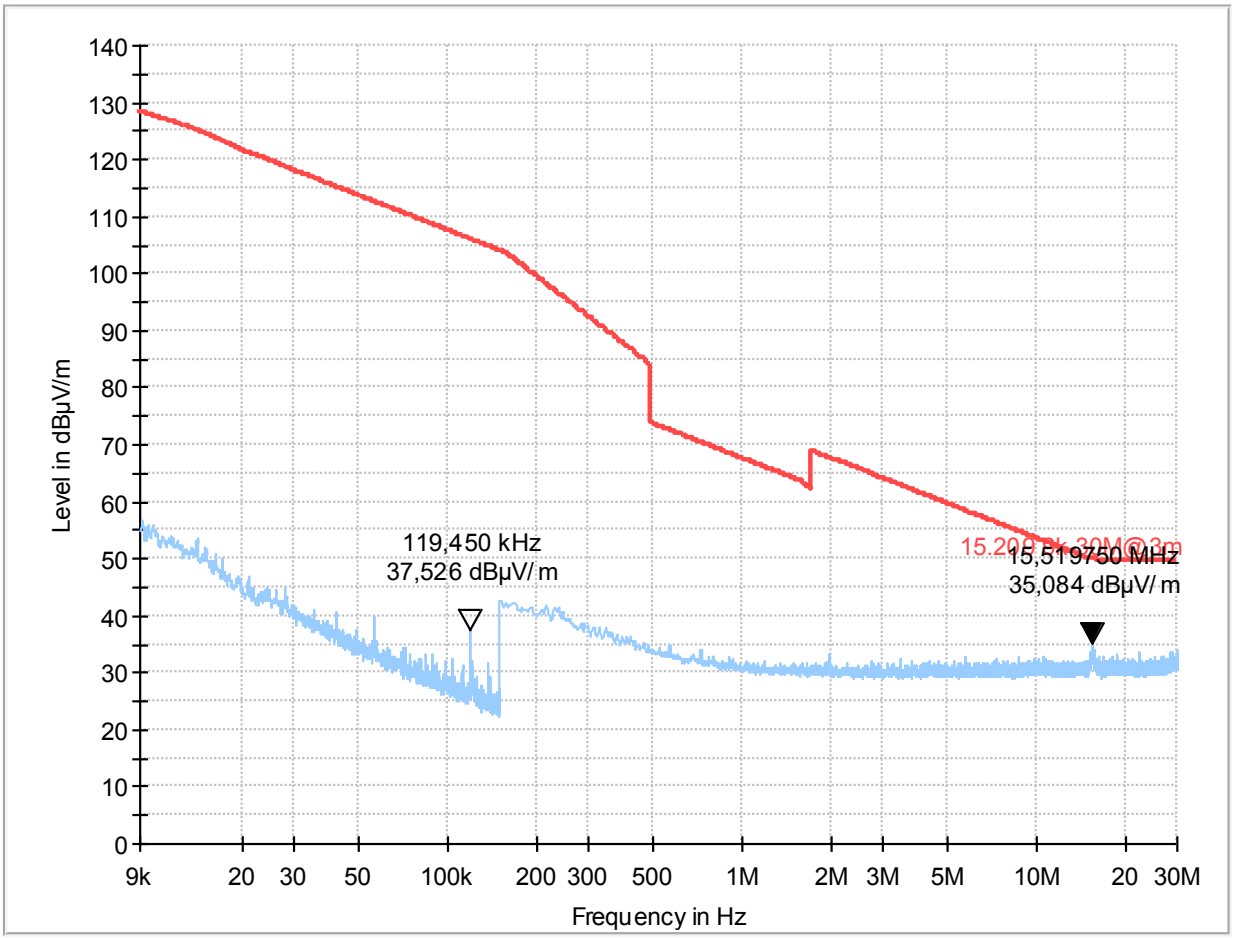
Plot 105: Mode 2, RSE, 9 kHz – 30 MHz, low channel, loop antenna (EUT standing)



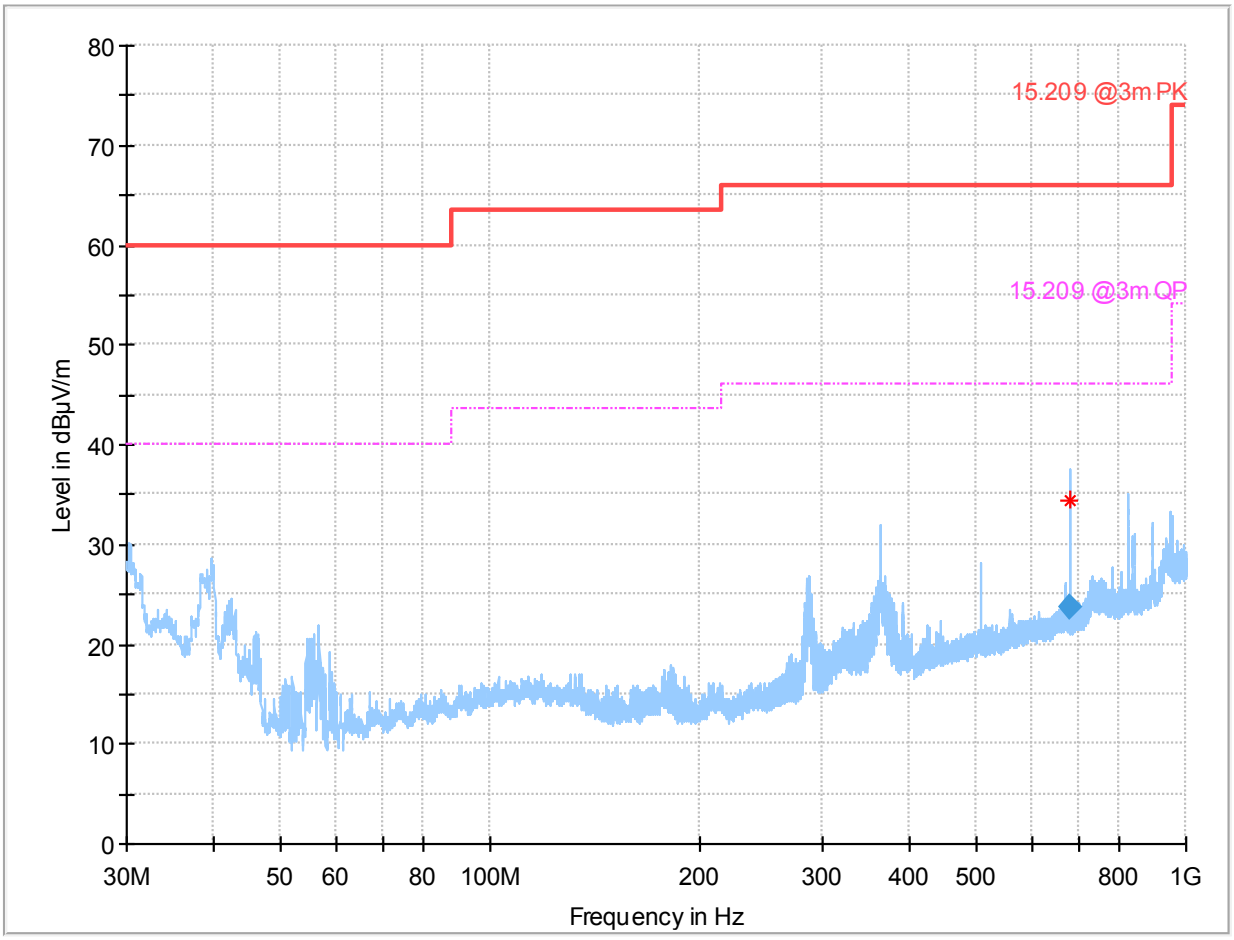
Plot 106: Mode 2, RSE, 9 kHz – 30 MHz, high channel, loop antenna (EUT laying)



Plot 107: Mode 2, RSE, 9 kHz – 30 MHz, high channel, loop antenna (EUT standing)



Plot 108: Mode 2, RSE, 30 MHz – 1 GHz, low channel, horizontal / vertical polarisation (EUT laying)



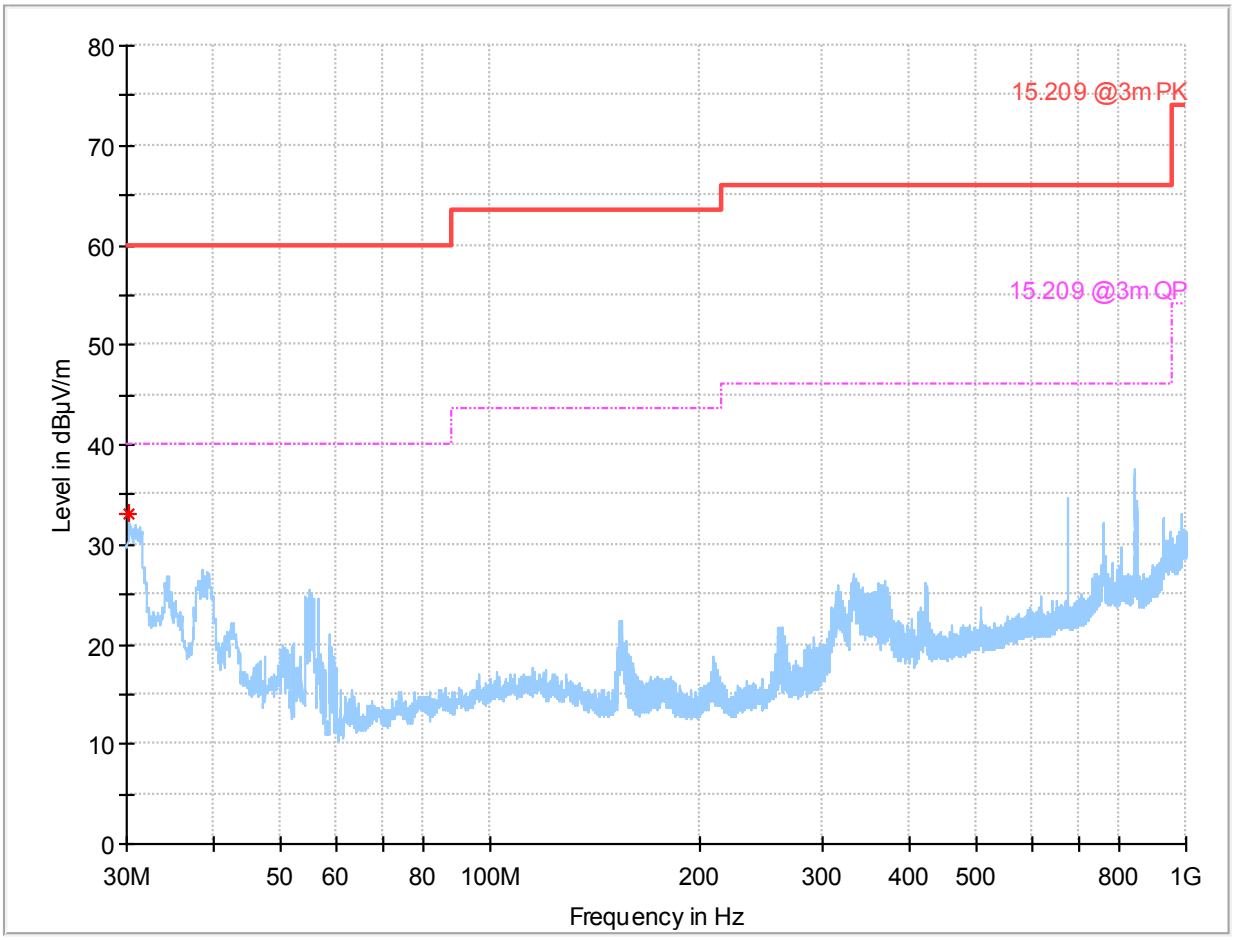
Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
681.600000	23.72	66.00	42.28	100.0	120.000	165.0	V	61.0

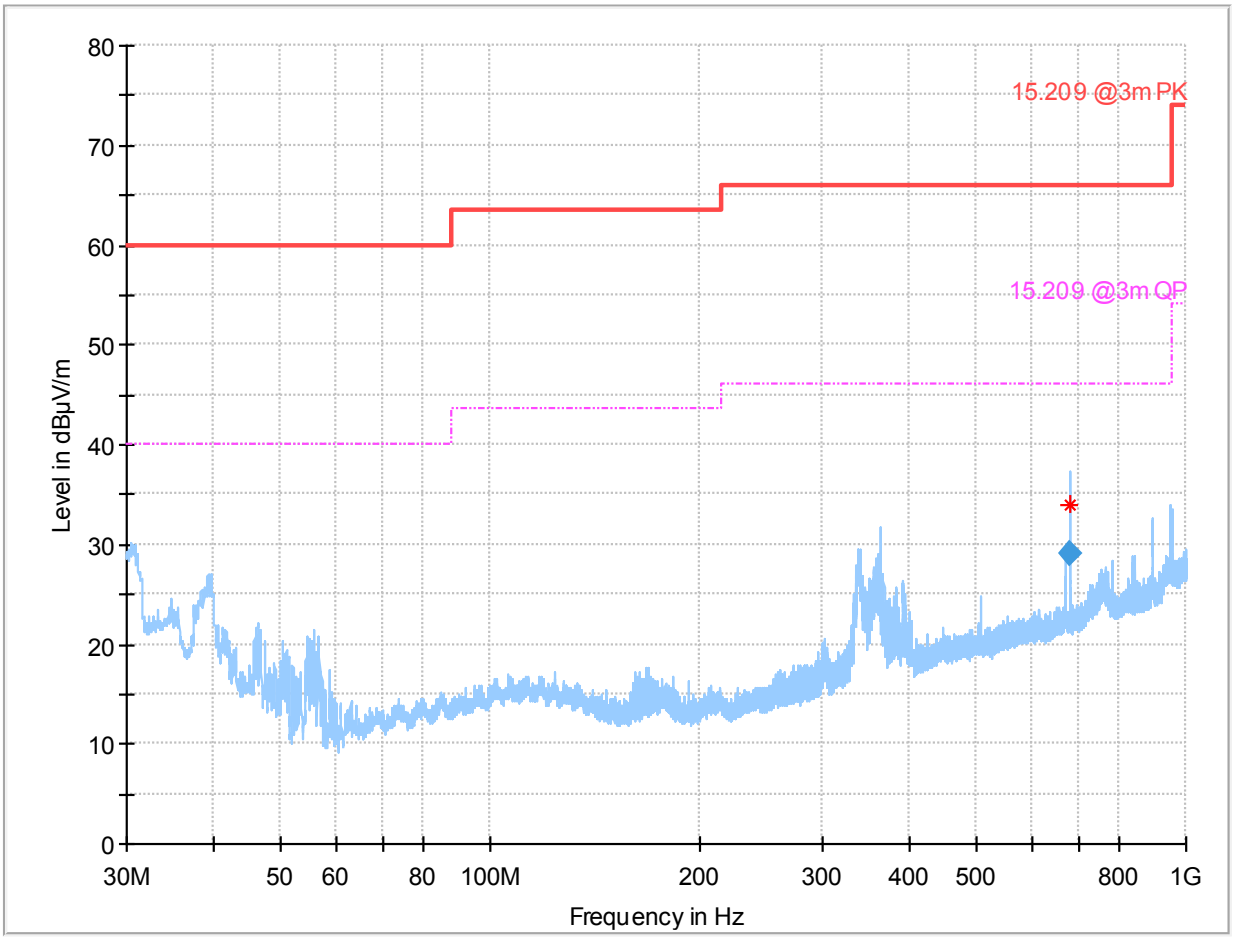
(continuation of the "Final_Result" table from column 15 ...)

Frequency (MHz)	Corr. (dB/m)	Comment
681.600000	20.6	17:07:14 - 02.08.2021

Plot 109: Mode 2, RSE, 30 MHz – 1 GHz, high channel, horizontal / vertical polarisation (EUT standing)



Plot 110: Mode 2, RSE, 30 MHz – 1 GHz, high channel, horizontal / vertical polarisation (EUT laying)



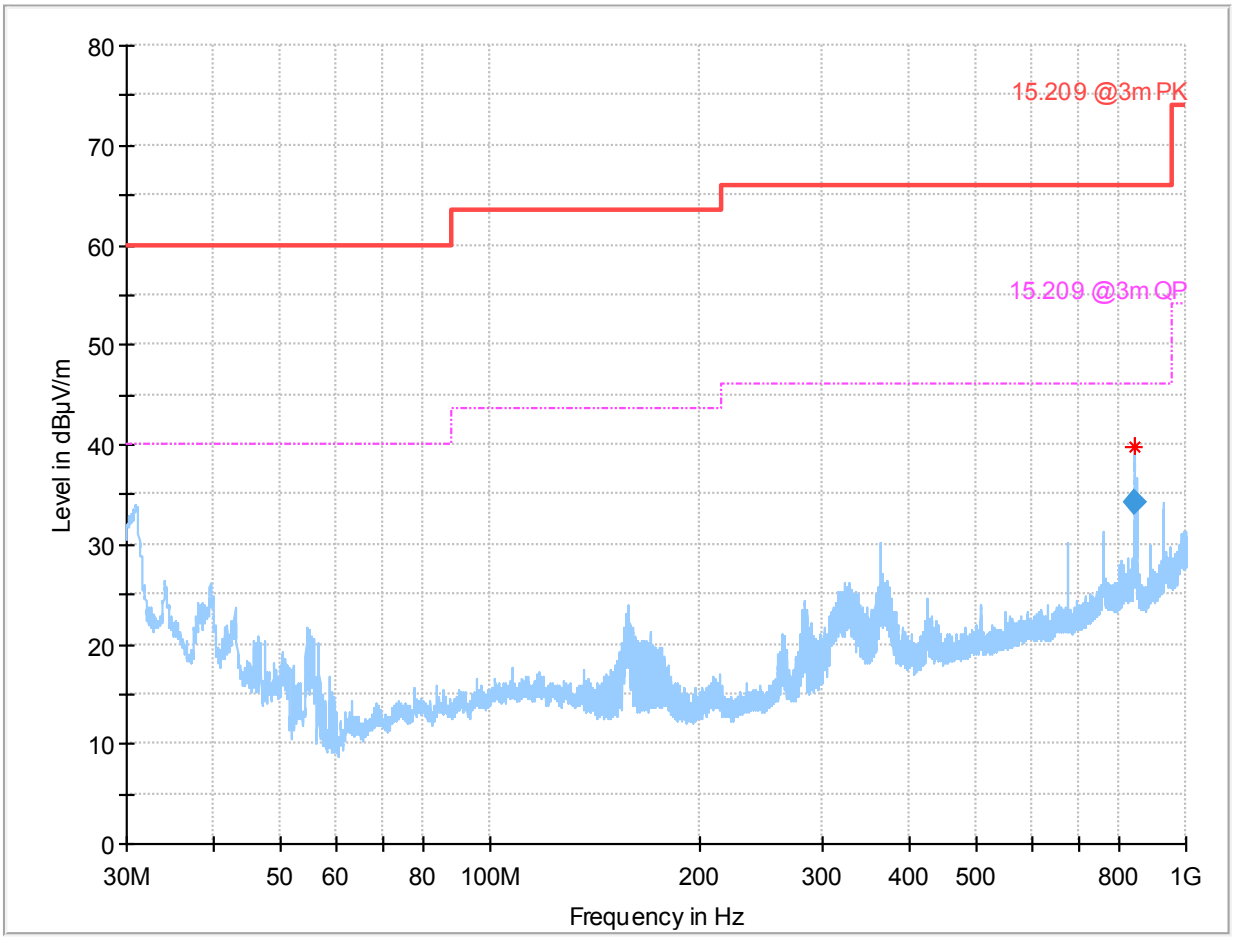
Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
681.600000	29.08	66.00	36.92	100.0	120.000	118.0	V	213.0

(continuation of the "Final_Result" table from column 15 ...)

Frequency (MHz)	Corr. (dB/m)	Comment
681.600000	20.6	18:13:49 - 02.08.2021

Plot 111: Mode 2, RSE, 30 MHz – 1 GHz, high channel, horizontal / vertical polarisation (EUT standing)



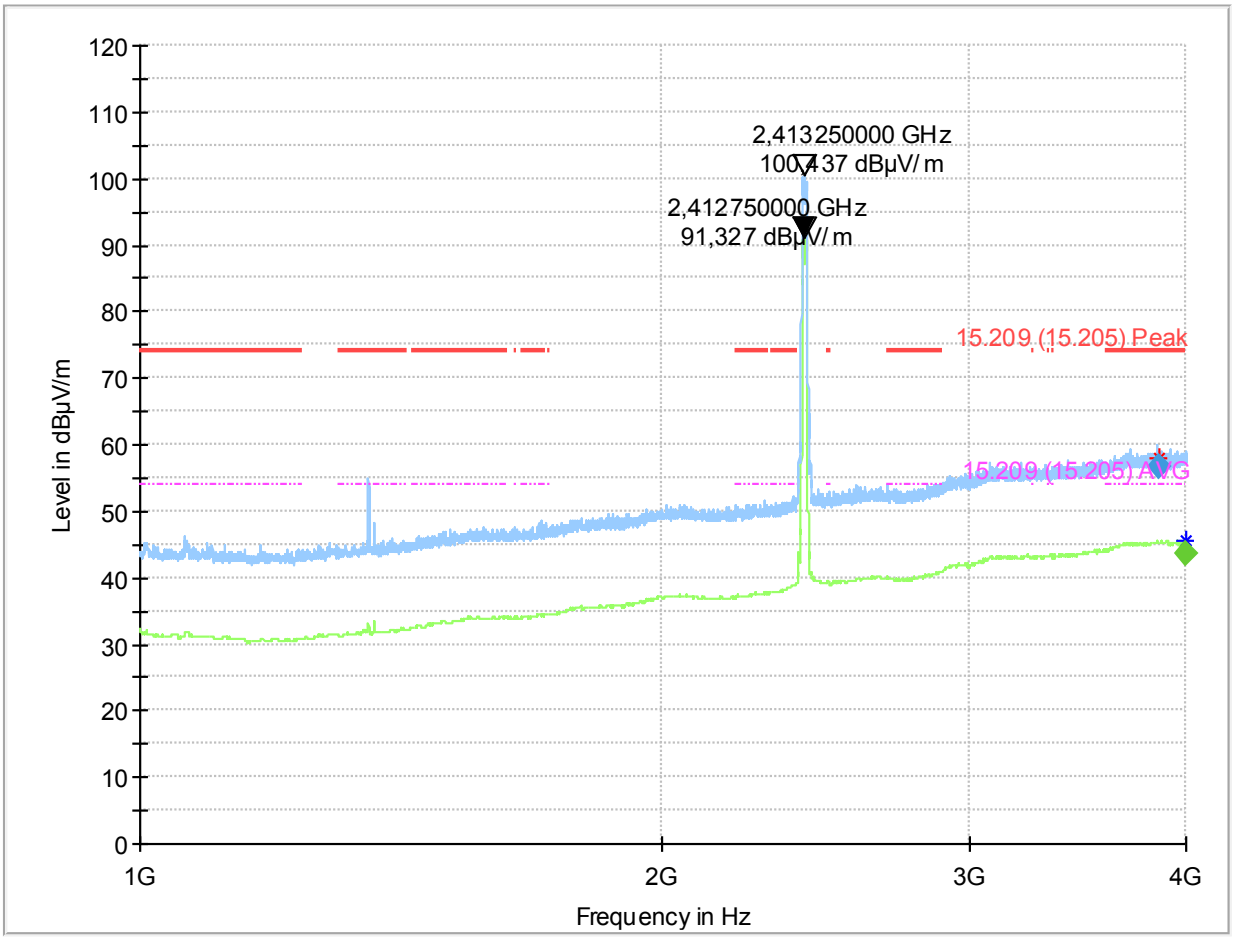
Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
846.050000	34.10	66.00	31.90	100.0	120.000	123.0	V	180.0

(continuation of the "Final_Result" table from column 15 ...)

Frequency (MHz)	Corr. (dB/m)	Comment
846.050000	22.5	10:26:06 - 03.08.2021

Plot 112: Mode 2, RSE 1 GHz – 4 GHz, low channel, horizontal / vertical polarisation



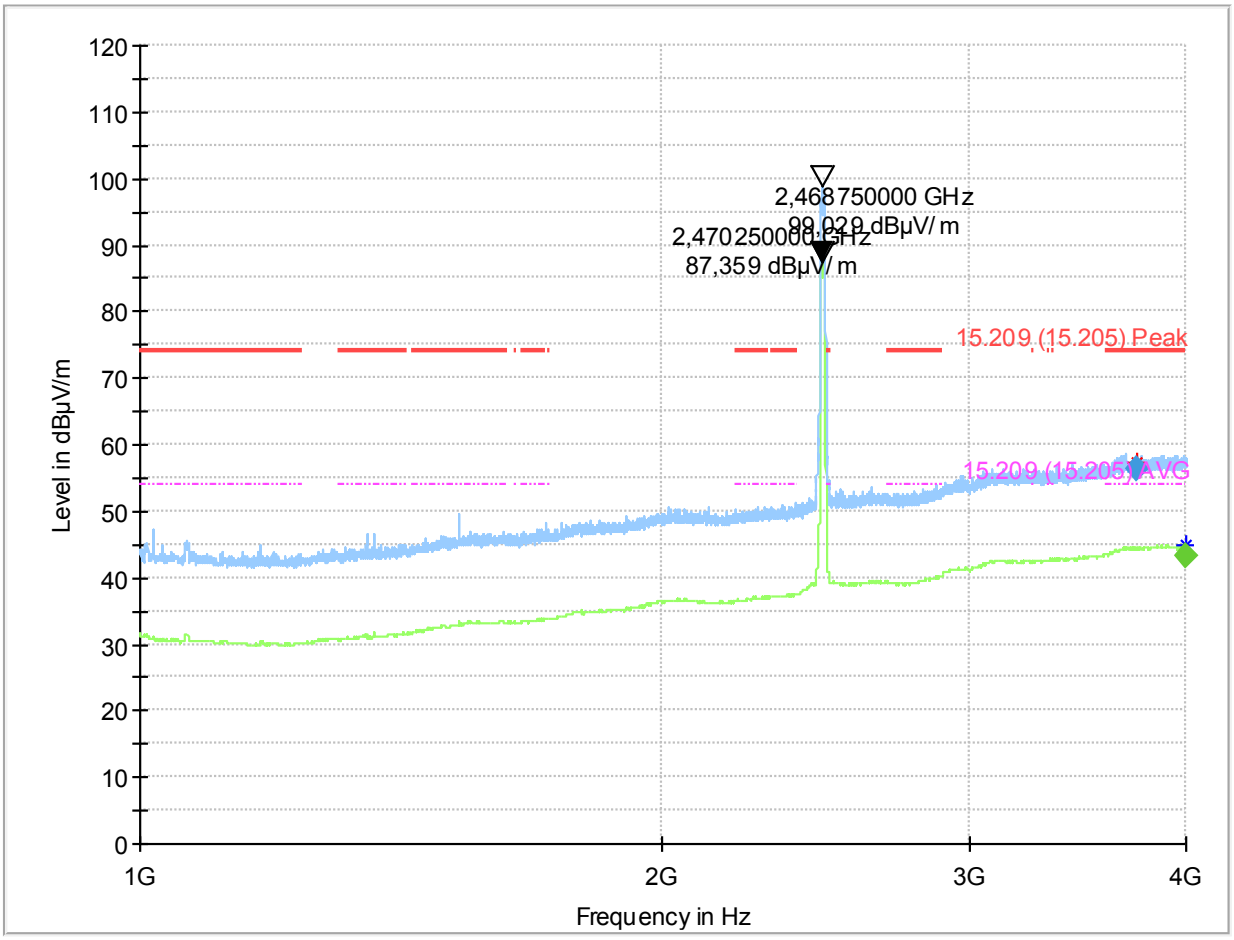
Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol
3855.000000	56.68	---	74.00	17.32	100.0	1000.000	150.0	V
3999.750000	---	43.50	54.00	10.50	100.0	1000.000	150.0	H

(continuation of the "Final_Result" table from column 14 ...)

Frequency (MHz)	Azimuth (deg)	Corr. (dB/m)	Comment
3855.000000	146.0	38.6	12:49:53 - 31.07.2021
3999.750000	138.0	38.5	12:50:33 - 31.07.2021

Plot 113: Mode 2, RSE, 1 GHz – 4 GHz, high channel, horizontal / vertical polarisation



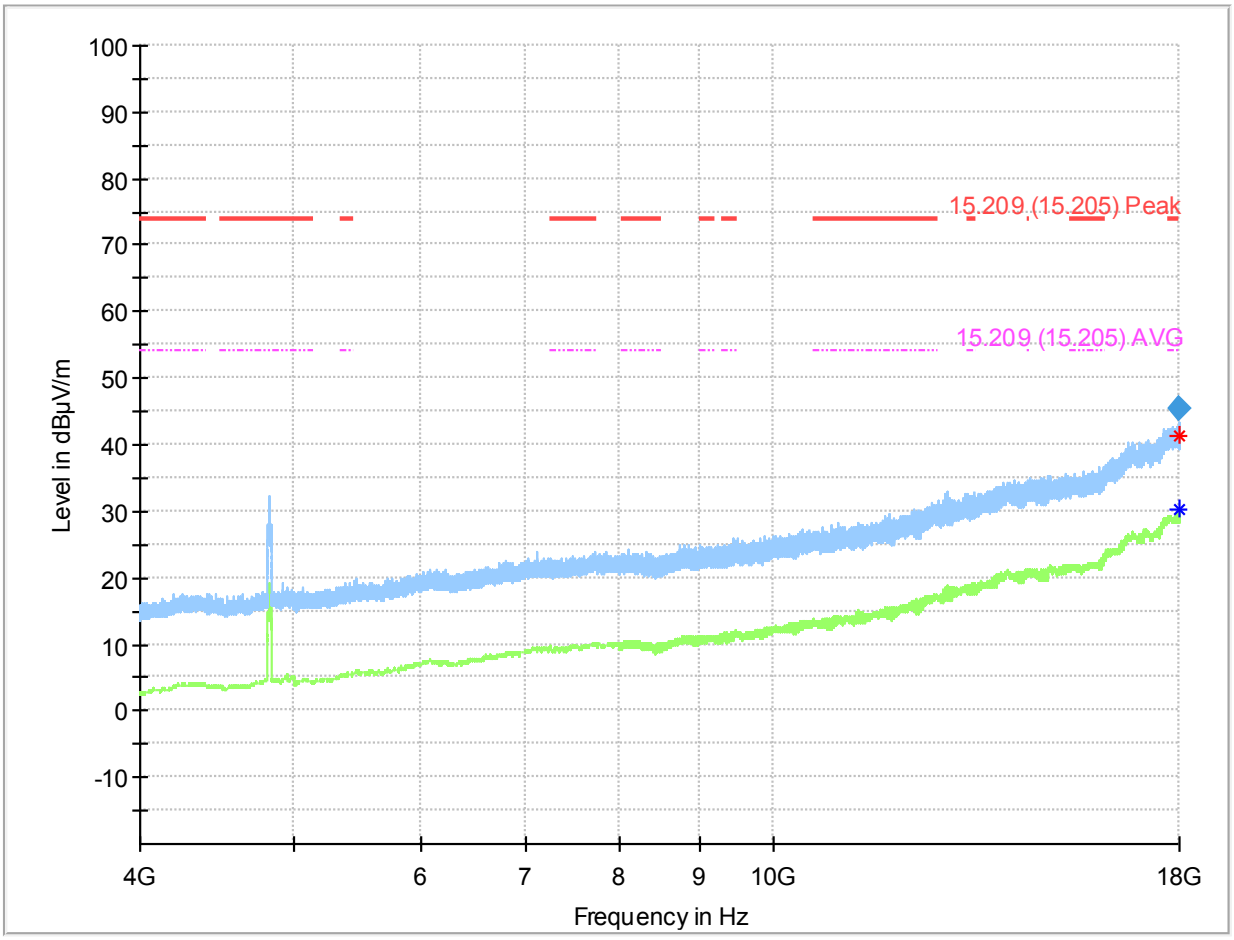
Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol
3749.250000	56.24	---	74.00	17.76	100.0	1000.000	150.0	V
3999.750000	---	43.09	54.00	10.91	100.0	1000.000	150.0	H

(continuation of the "Final_Result" table from column 14 ...)

Frequency (MHz)	Azimuth (deg)	Corr. (dB/m)	Comment
3749.250000	319.0	38.2	16:28:43 - 31.07.2021
3999.750000	3.0	38.5	16:29:53 - 31.07.2021

Plot 114: Mode 2, RSE, 4 GHz – 18 GHz, low channel, horizontal / vertical polarisation



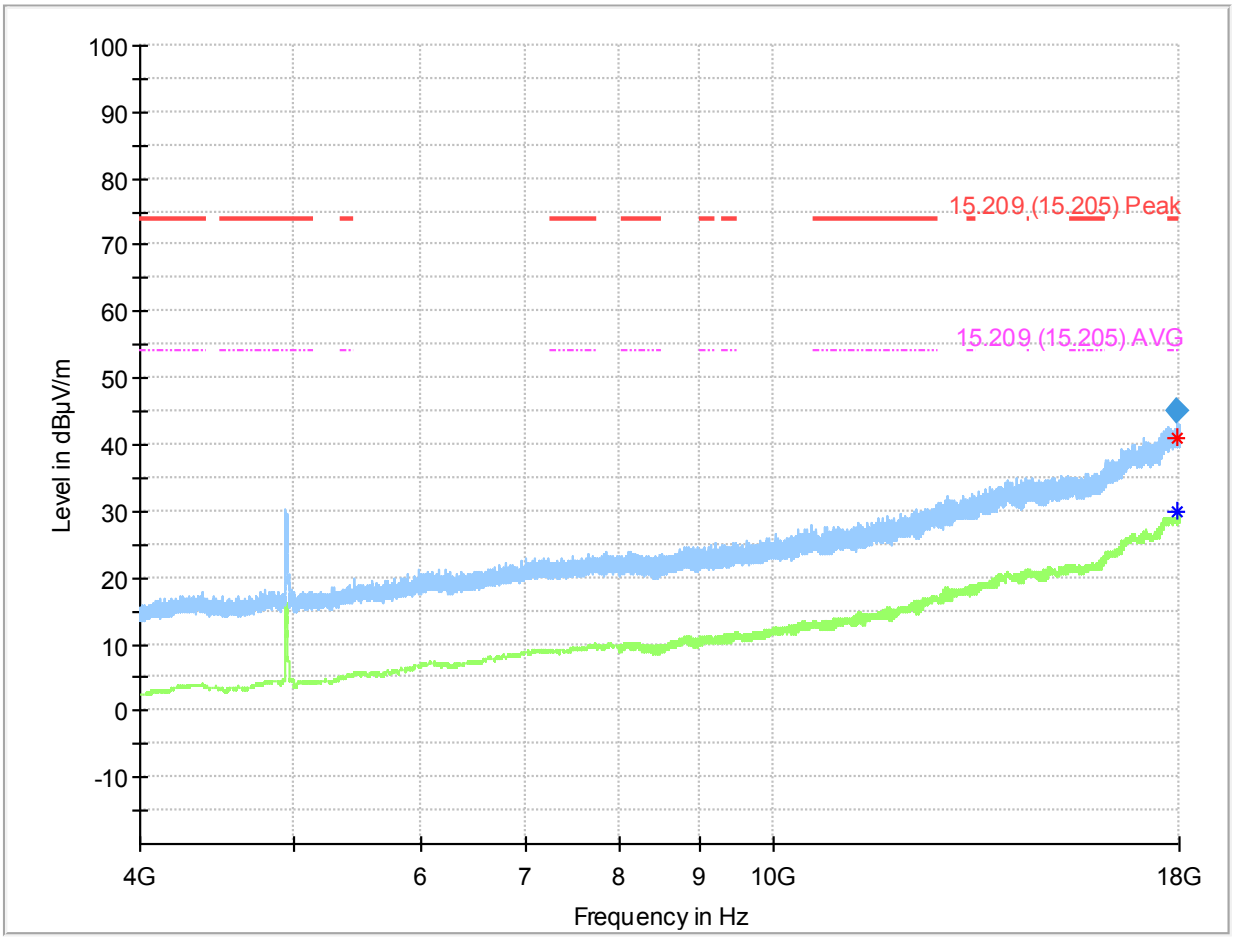
Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
17981.875000	45.43	74.00	28.57	100.0	1000.000	150.0	H	150.0

(continuation of the "Final_Result" table from column 15 ...)

Frequency (MHz)	Corr. (dB/m)	Comment
17981.875000	29.4	13:28:52 - 31.07.2021

Plot 115: Mode 2, RSE 4 GHz – 18 GHz, high channel, horizontal / vertical polarisation



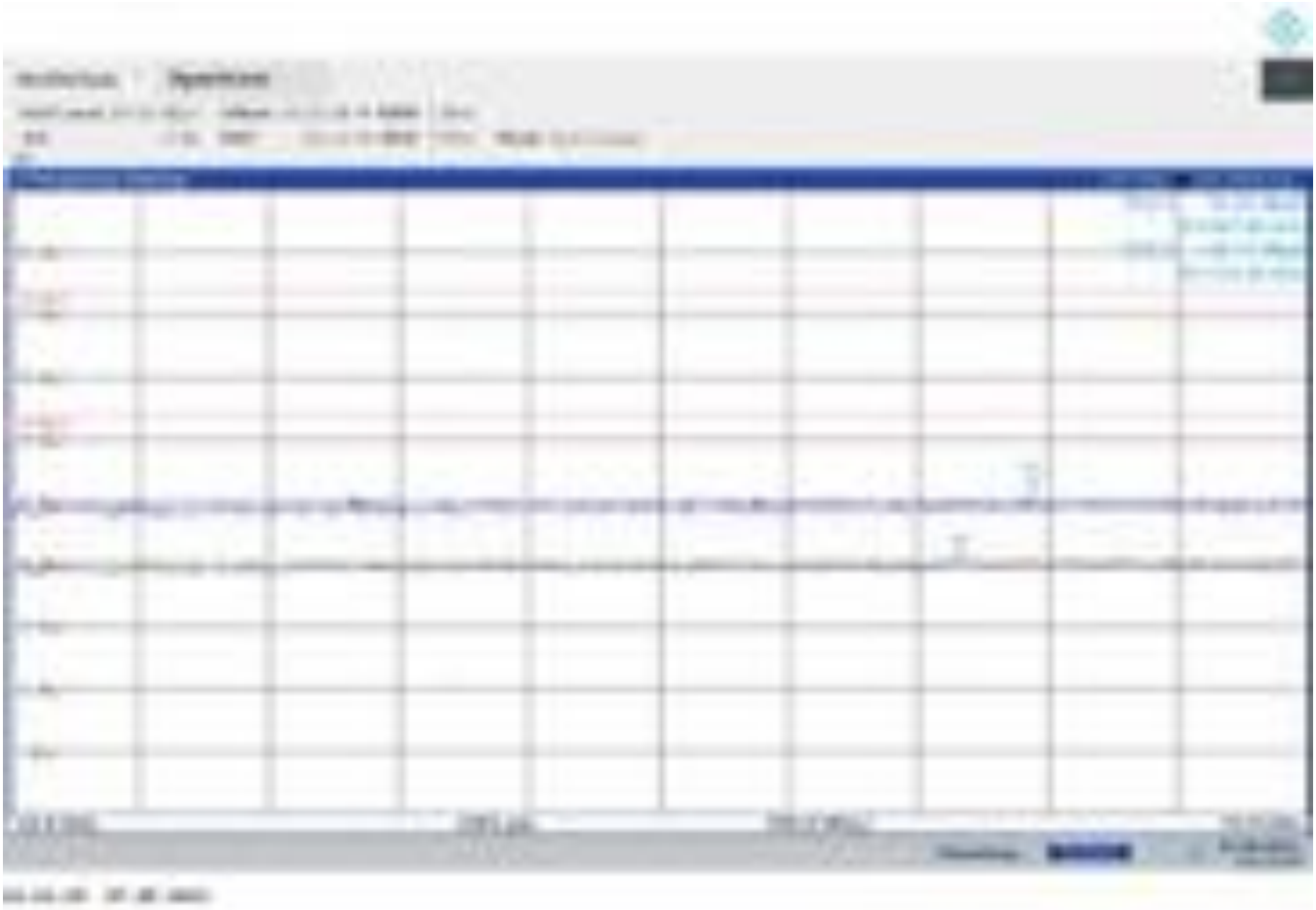
Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
17965.900000	44.90	74.00	29.10	100.0	1000.000	150.0	V	78.0

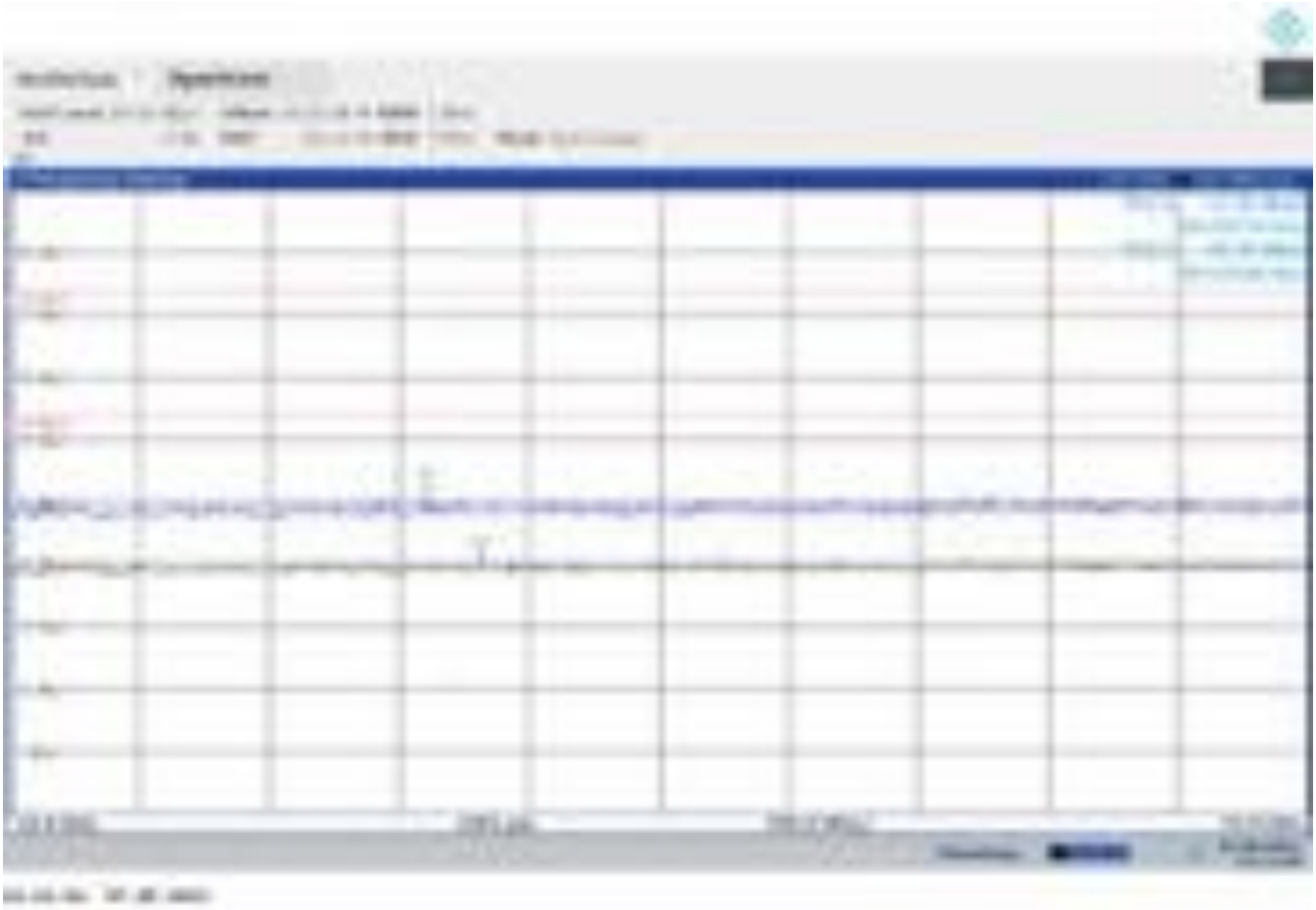
(continuation of the "Final_Result" table from column 15 ...)

Frequency (MHz)	Corr. (dB/m)	Comment
17965.900000	29.3	17:03:03 - 31.07.2021

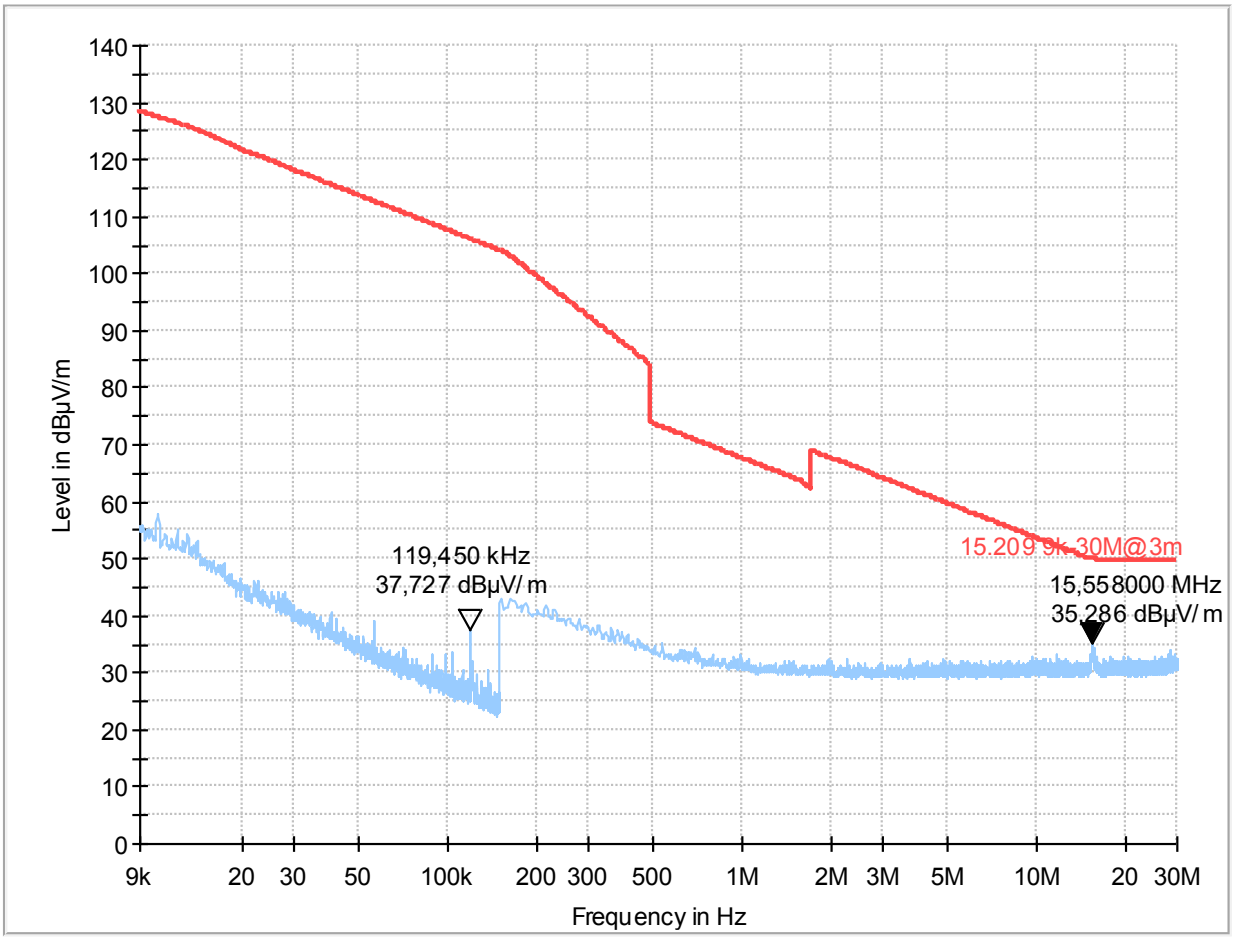
Plot 116: Mode 2, RSE, 18 GHz – 26.5 GHz, low channel, horizontal / vertical polarisation



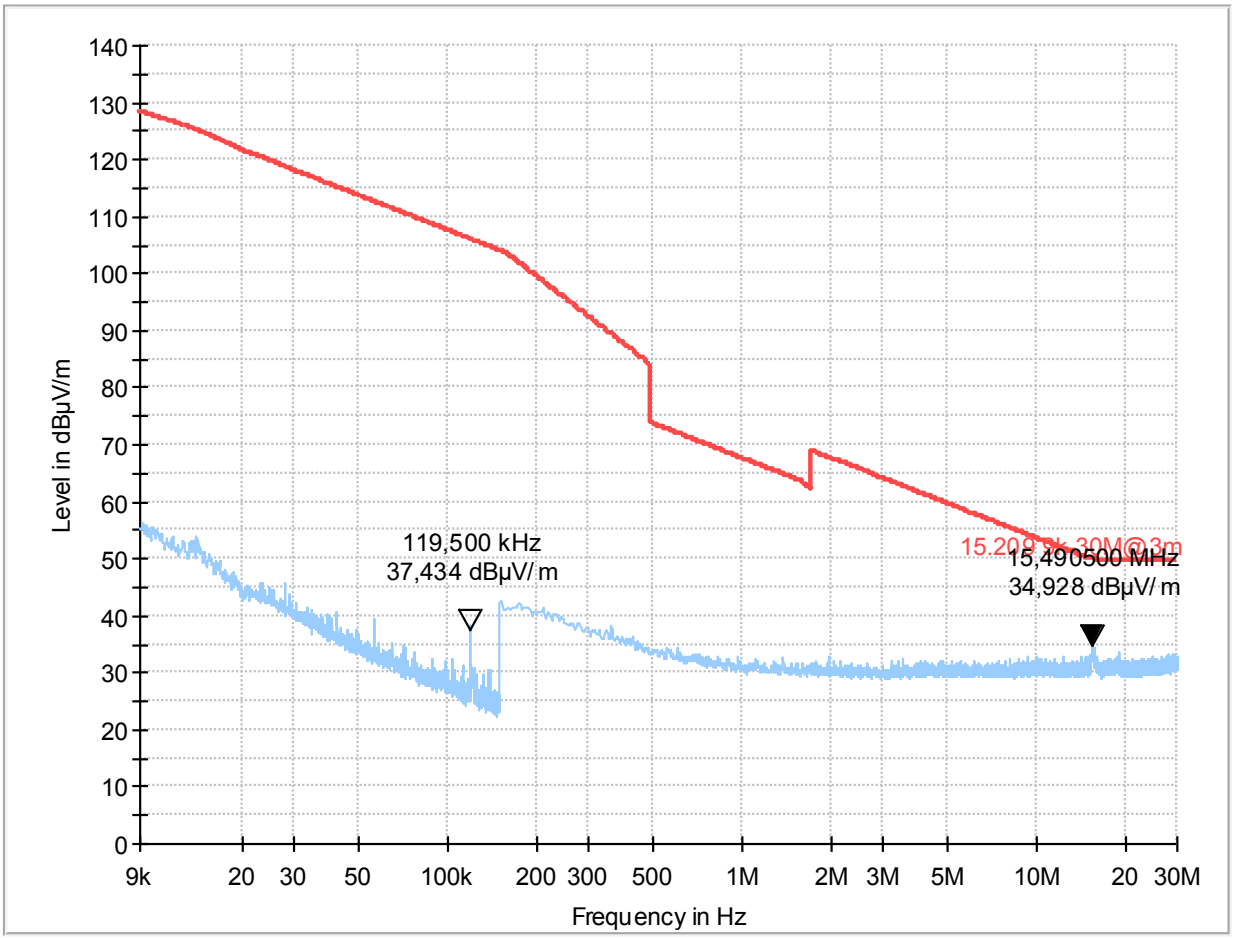
Plot 117: Mode 2, RSE, 18 GHz – 26.5 GHz, high channel, horizontal / vertical polarisation



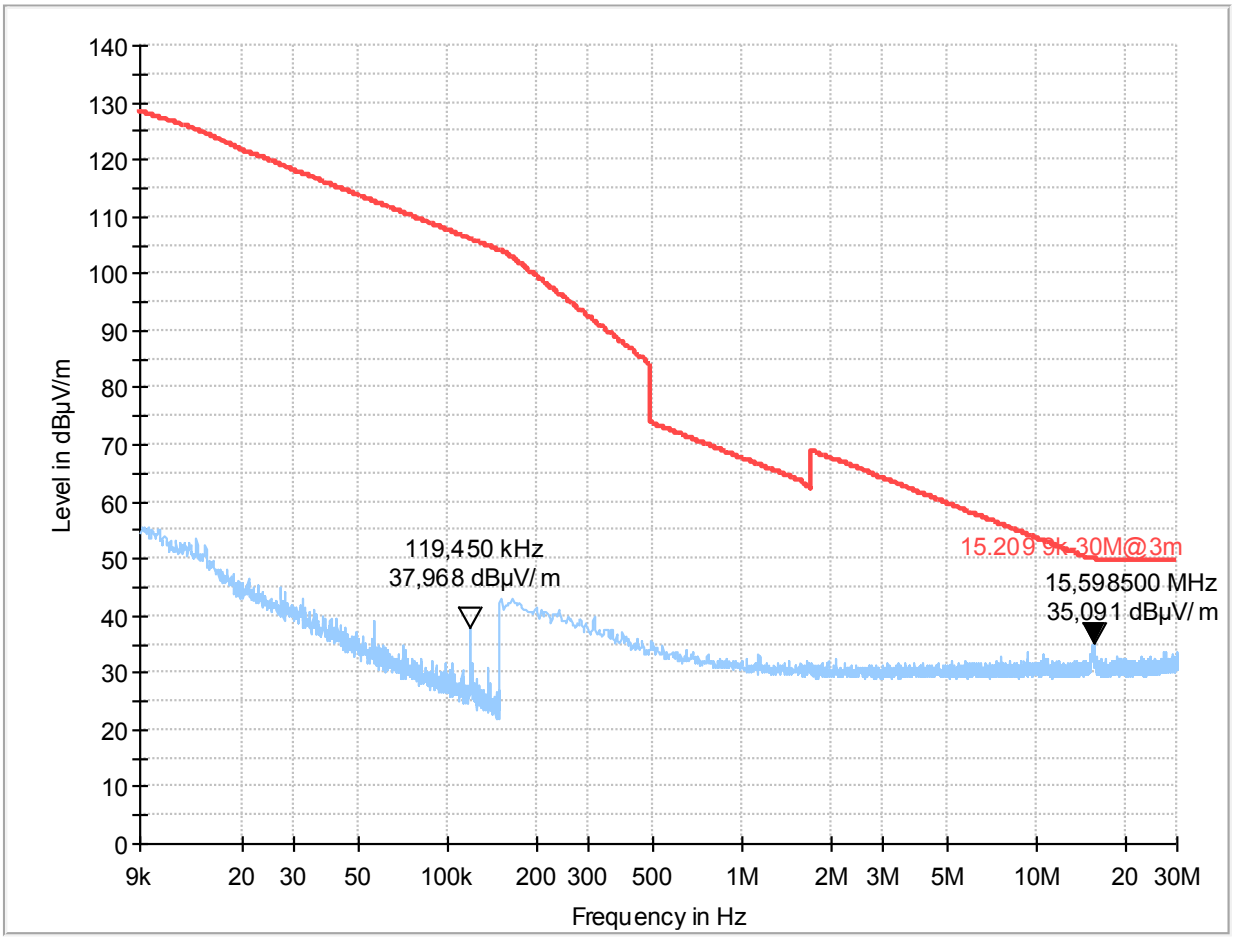
Plot 118: Mode 3, RSE 9 kHz – 30 MHz, low channel, loop antenna (EUT laying)



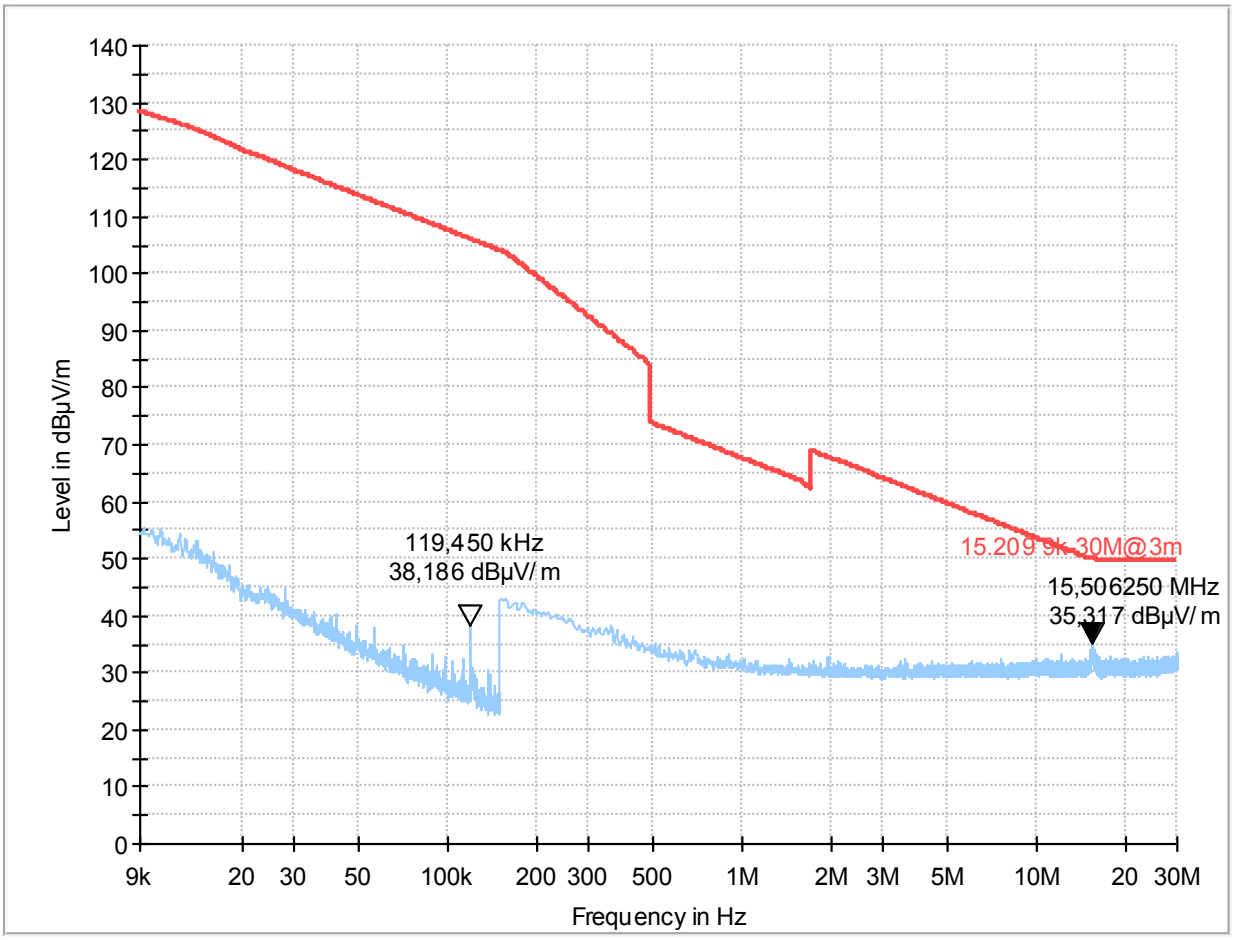
Plot 119: Mode 3, RSE 9 kHz – 30 MHz, low channel, loop antenna (EUT standing)



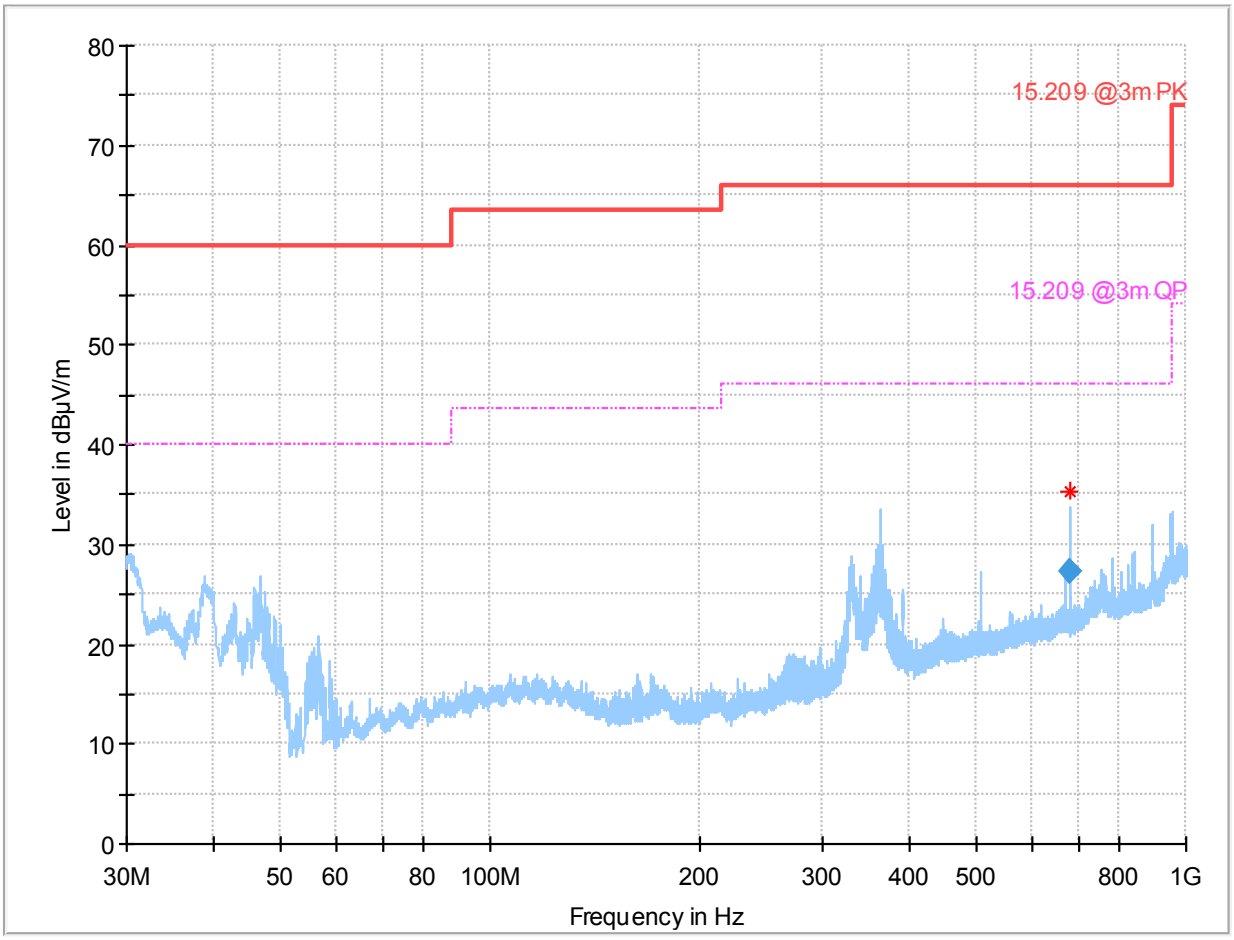
Plot 120: Mode 3, RSE 9 kHz – 30 MHz, high channel, loop antenna (EUT laying)



Plot 121: Mode 3, RSE 9 kHz – 30 MHz, high channel, loop antenna (EUT standing)



Plot 122: Mode 3, RSE 30 MHz – 1 GHz, low channel, horizontal / vertical polarisation (EUT laying)



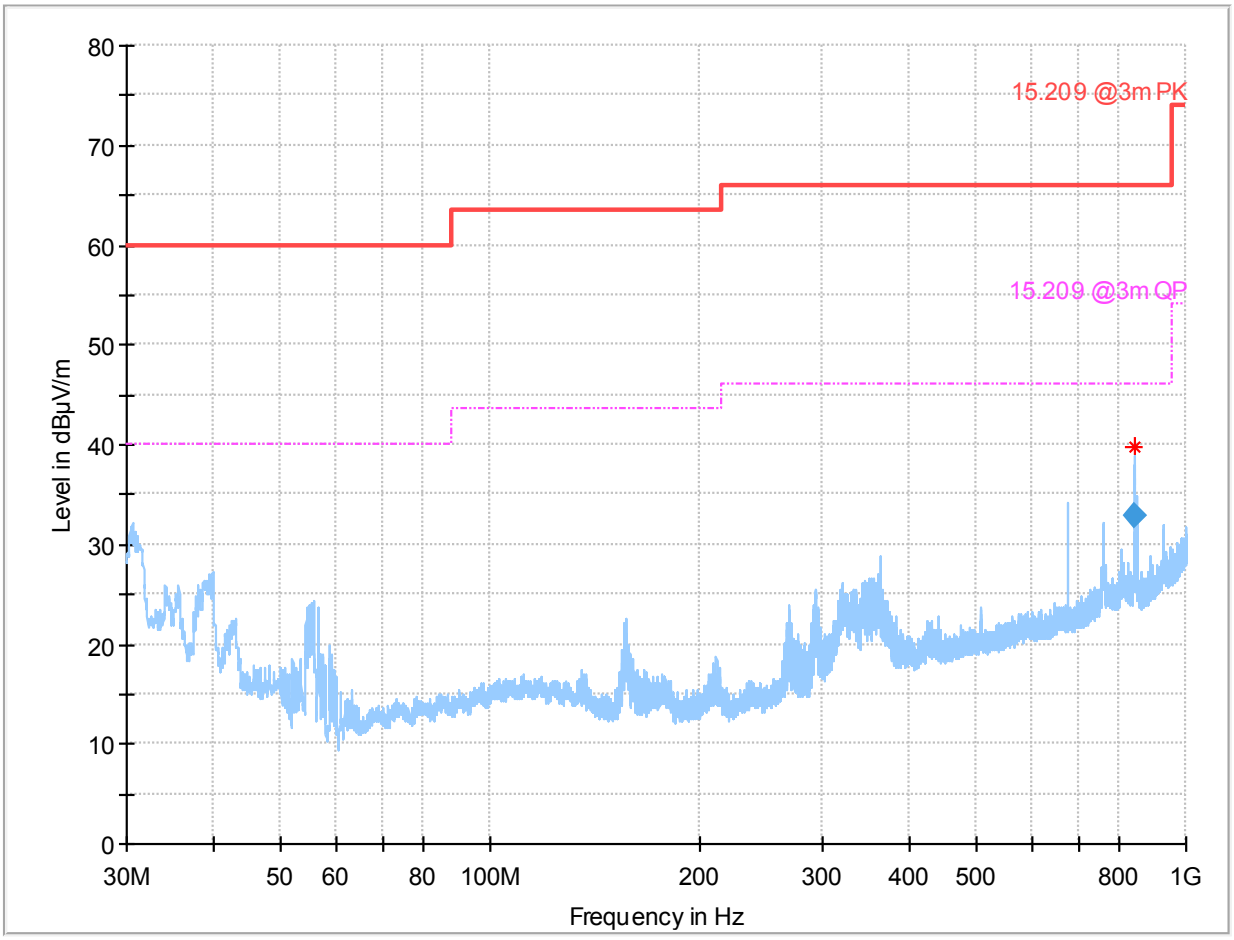
Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
681.600000	27.26	66.00	38.74	100.0	120.000	120.0	V	165.0

(continuation of the "Final_Result" table from column 15 ...)

Frequency (MHz)	Corr. (dB/m)	Comment
681.600000	20.6	17:36:41 - 02.08.2021

Plot 123: Mode 3, RSE 30 MHz – 1 GHz, low channel, horizontal / vertical polarisation (EUT standing)



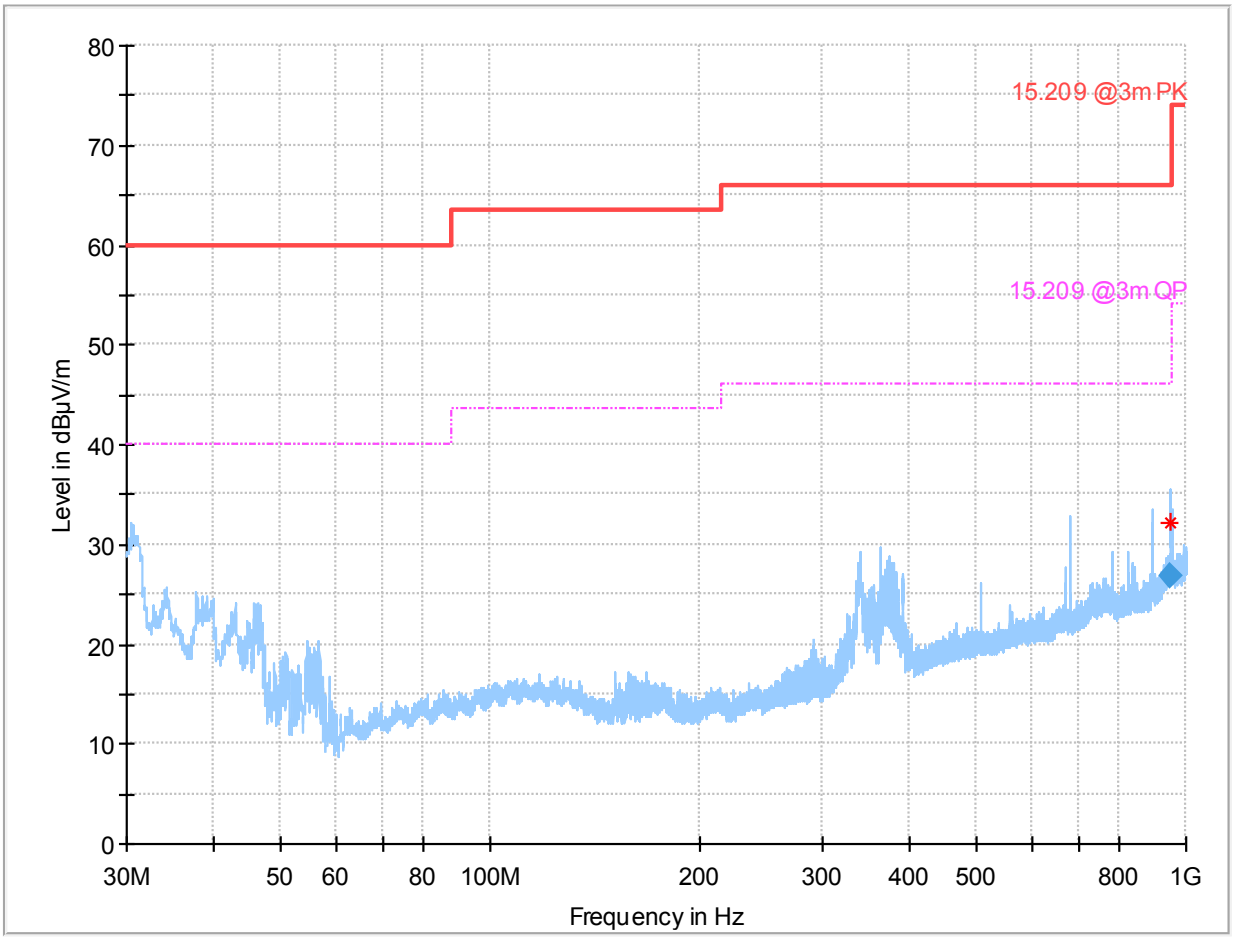
Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
846.200000	32.83	66.00	33.17	100.0	120.000	118.0	V	156.0

(continuation of the "Final_Result" table from column 15 ...)

Frequency (MHz)	Corr. (dB/m)	Comment
846.200000	22.5	09:53:07 - 03.08.2021

Plot 124: Mode 3, RSE 30 MHz – 1 GHz, high channel, horizontal / vertical polarisation (EUT laying)



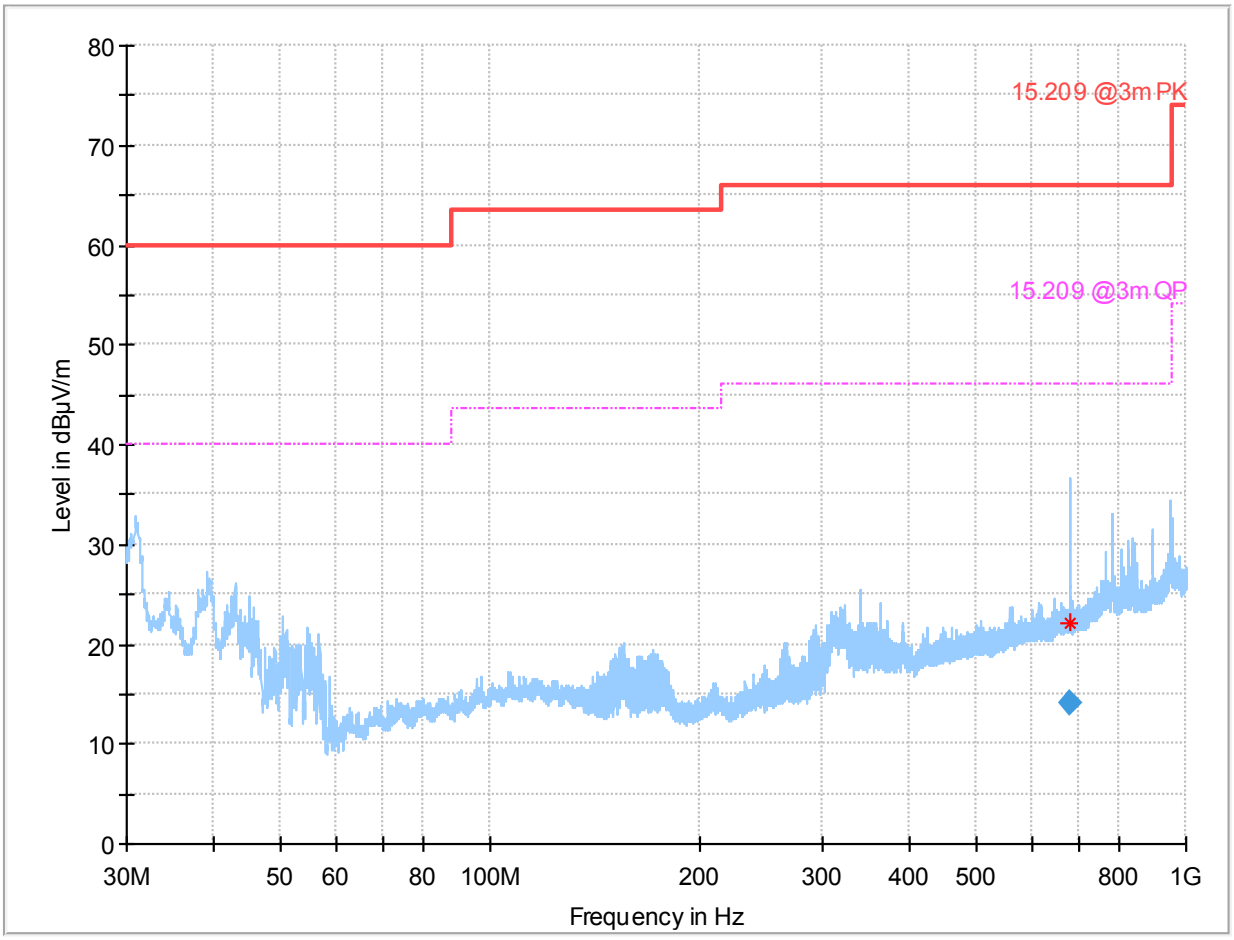
Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
950.100000	26.79	66.00	39.21	100.0	120.000	103.0	V	185.0

(continuation of the "Final_Result" table from column 15 ...)

Frequency (MHz)	Corr. (dB/m)	Comment
950.100000	23.5	18:30:45 - 02.08.2021

Plot 125: Mode 3, RSE 30 MHz – 1 GHz, high channel, horizontal / vertical polarisation (EUT standing)



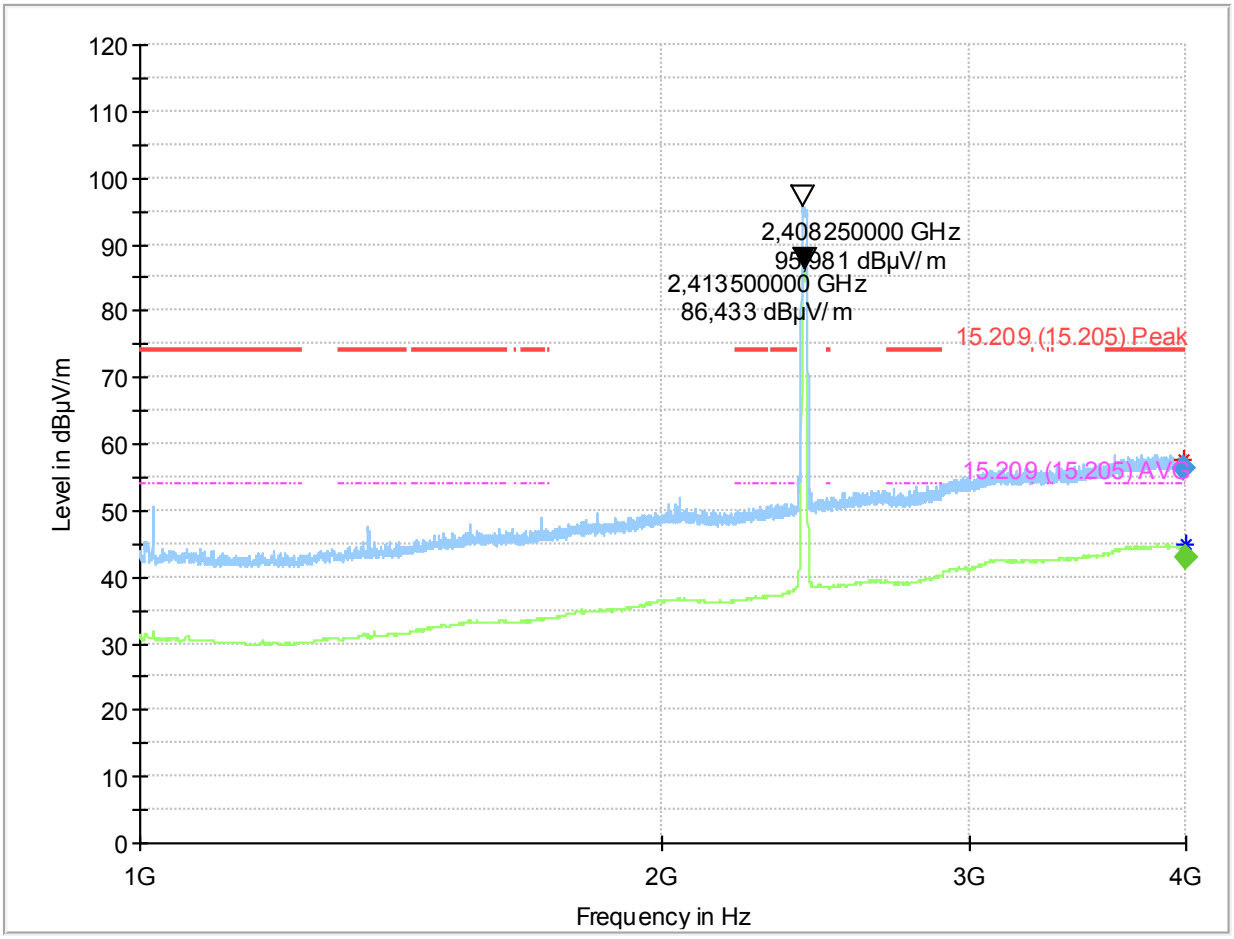
Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
681.100000	14.02	66.00	51.98	100.0	120.000	228.0	V	300.0

(continuation of the "Final_Result" table from column 15 ...)

Frequency (MHz)	Corr. (dB/m)	Comment
681.100000	20.6	18:49:49 - 02.08.2021

Plot 126: Mode 3, RSE 1 GHz – 4 GHz, low channel, horizontal / vertical polarisation



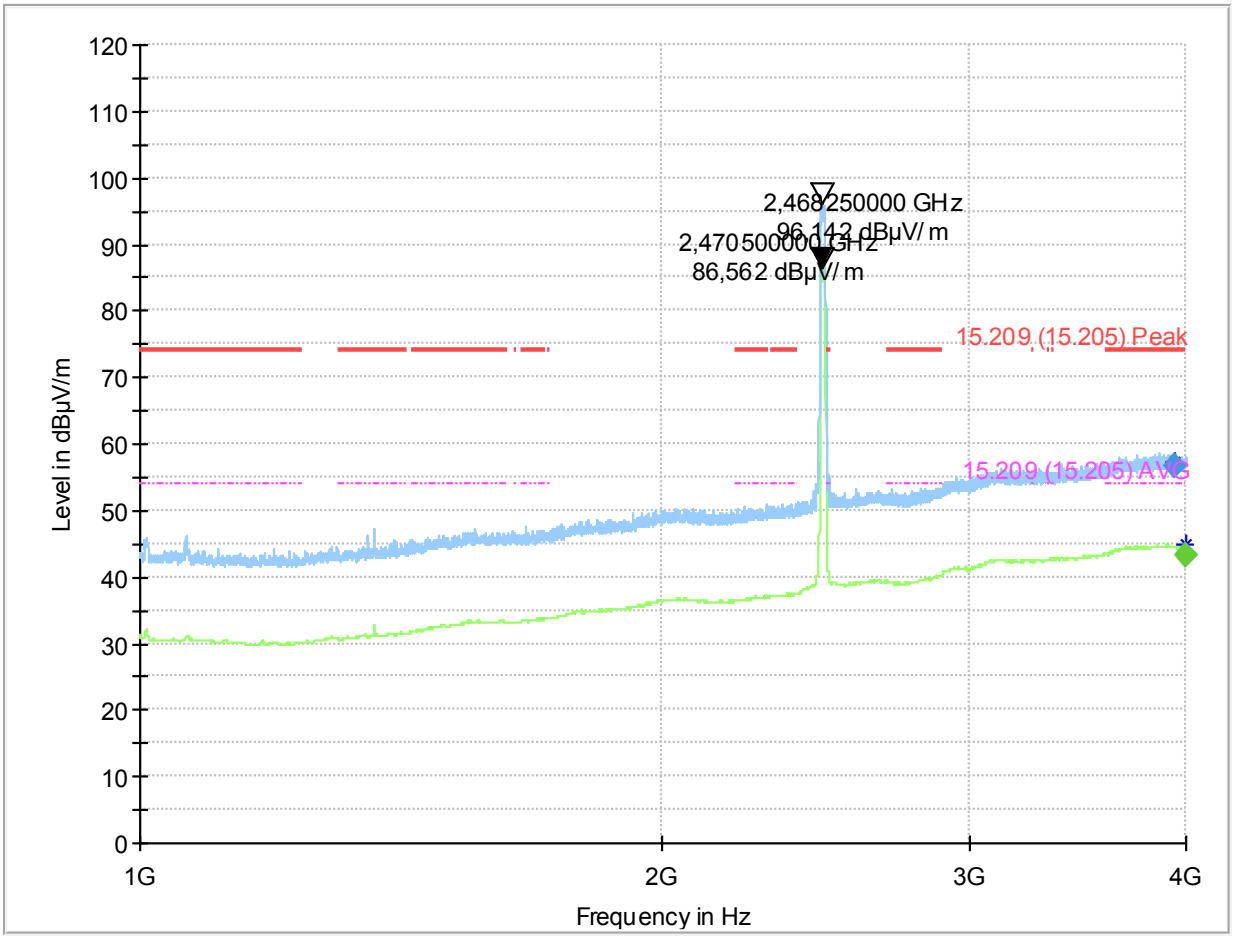
Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol
3988.000000	56.45	---	74.00	17.55	100.0	1000.000	150.0	H
4000.000000	---	42.84	54.00	11.16	100.0	1000.000	150.0	H

(continuation of the "Final_Result" table from column 14 ...)

Frequency (MHz)	Azimuth (deg)	Corr. (dB/m)	Comment
3988.000000	150.0	38.5	13:54:10 - 31.07.2021
4000.000000	3.0	38.5	13:54:54 - 31.07.2021

Plot 127: Mode 3, RSE 1 GHz – 4 GHz, high channel, horizontal / vertical polarisation



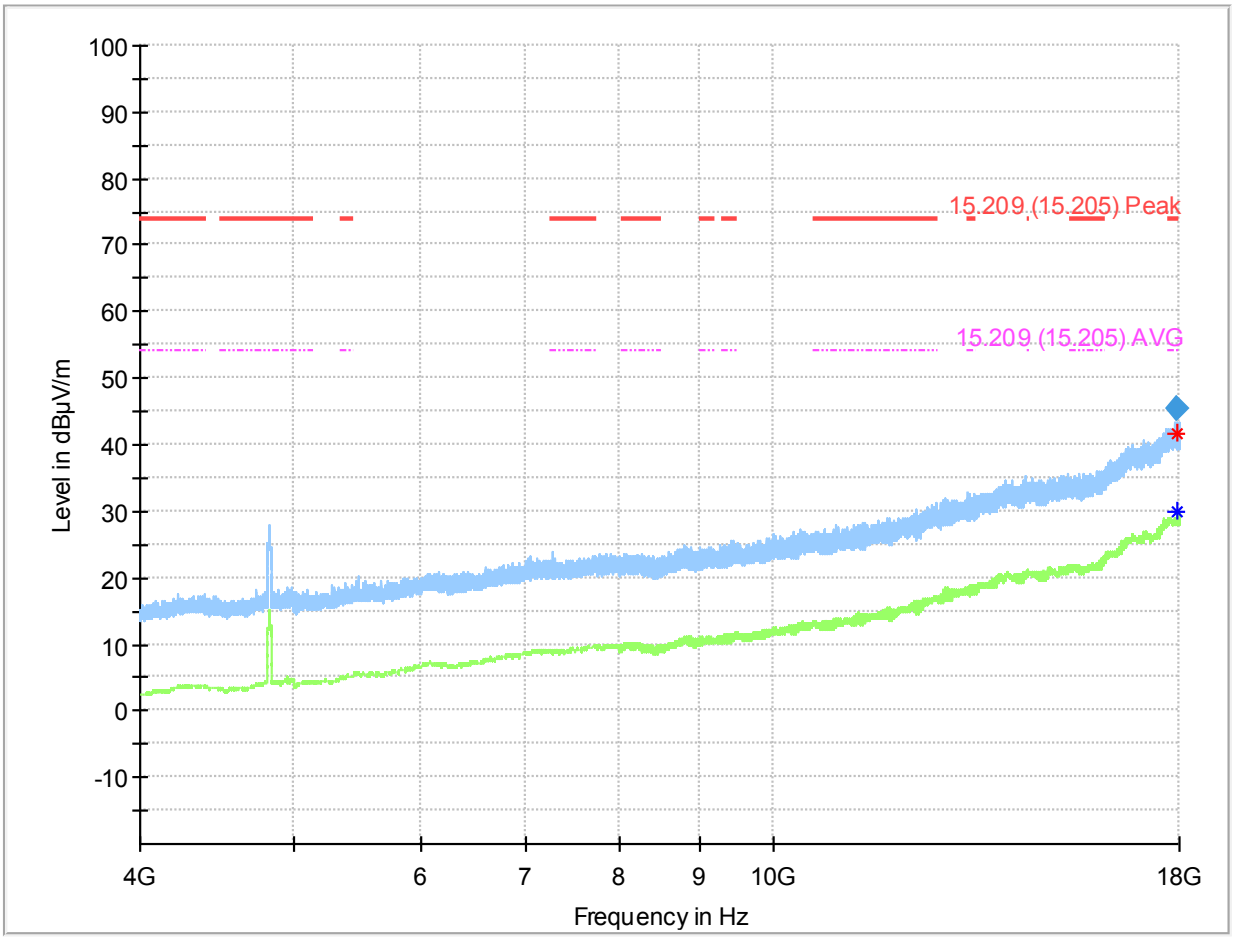
Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol
3943.500000	56.65	---	74.00	17.35	100.0	1000.000	150.0	V
3997.250000	---	43.07	54.00	10.93	100.0	1000.000	150.0	H

(continuation of the "Final_Result" table from column 14 ...)

Frequency (MHz)	Azimuth (deg)	Corr. (dB/m)	Comment
3943.500000	114.0	38.4	17:36:38 - 31.07.2021
3997.250000	273.0	38.5	17:37:35 - 31.07.2021

Plot 128: Mode 3, RSE 4 GHz – 18 GHz, low channel, horizontal / vertical polarisation



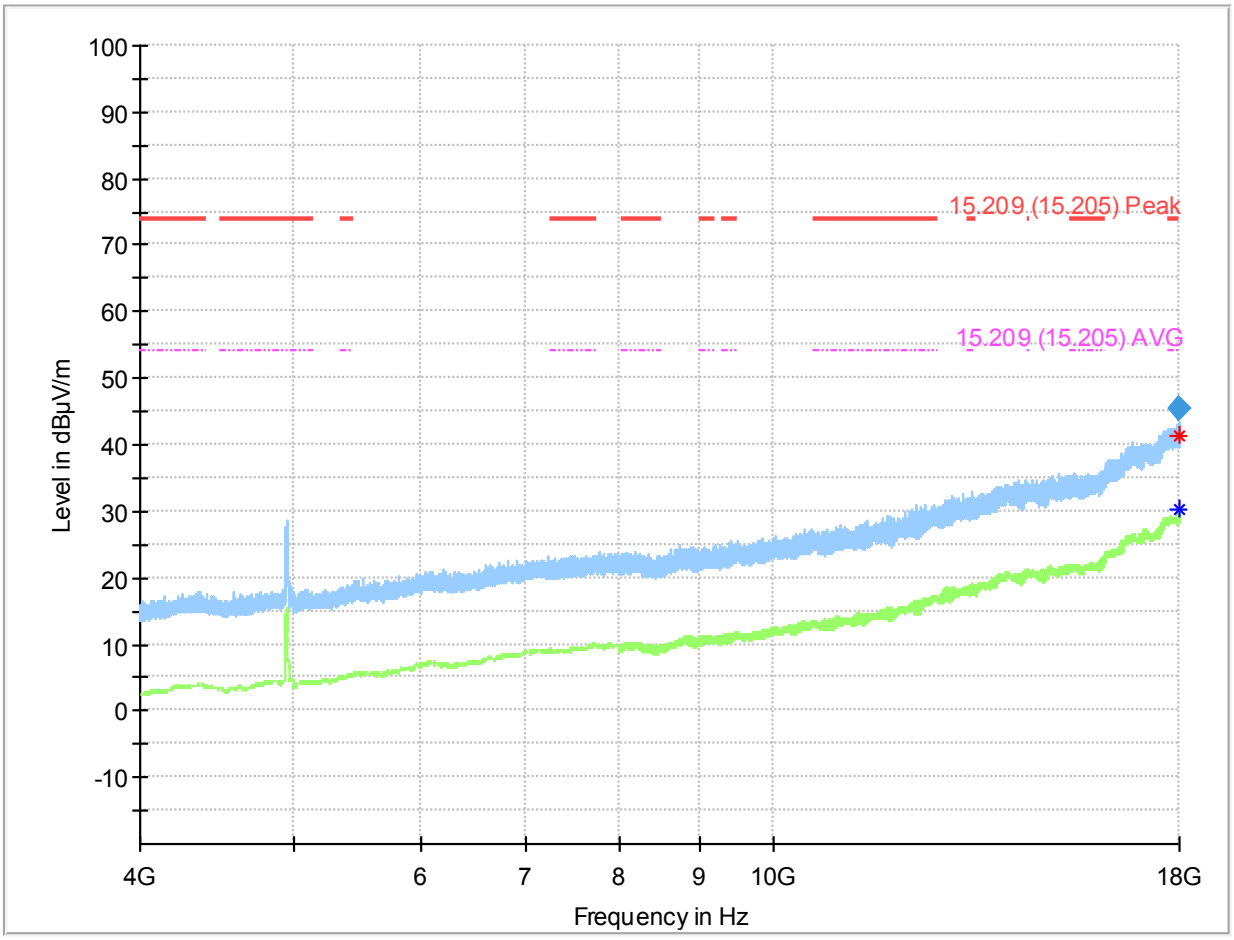
Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
17967.175000	45.21	74.00	28.79	100.0	1000.000	150.0	V	120.0

(continuation of the "Final_Result" table from column 15 ...)

Frequency (MHz)	Corr. (dB/m)	Comment
17967.175000	29.3	14:26:26 - 31.07.2021

Plot 129: Mode 3, RSE 4 GHz – 18 GHz, high channel, horizontal / vertical polarisation



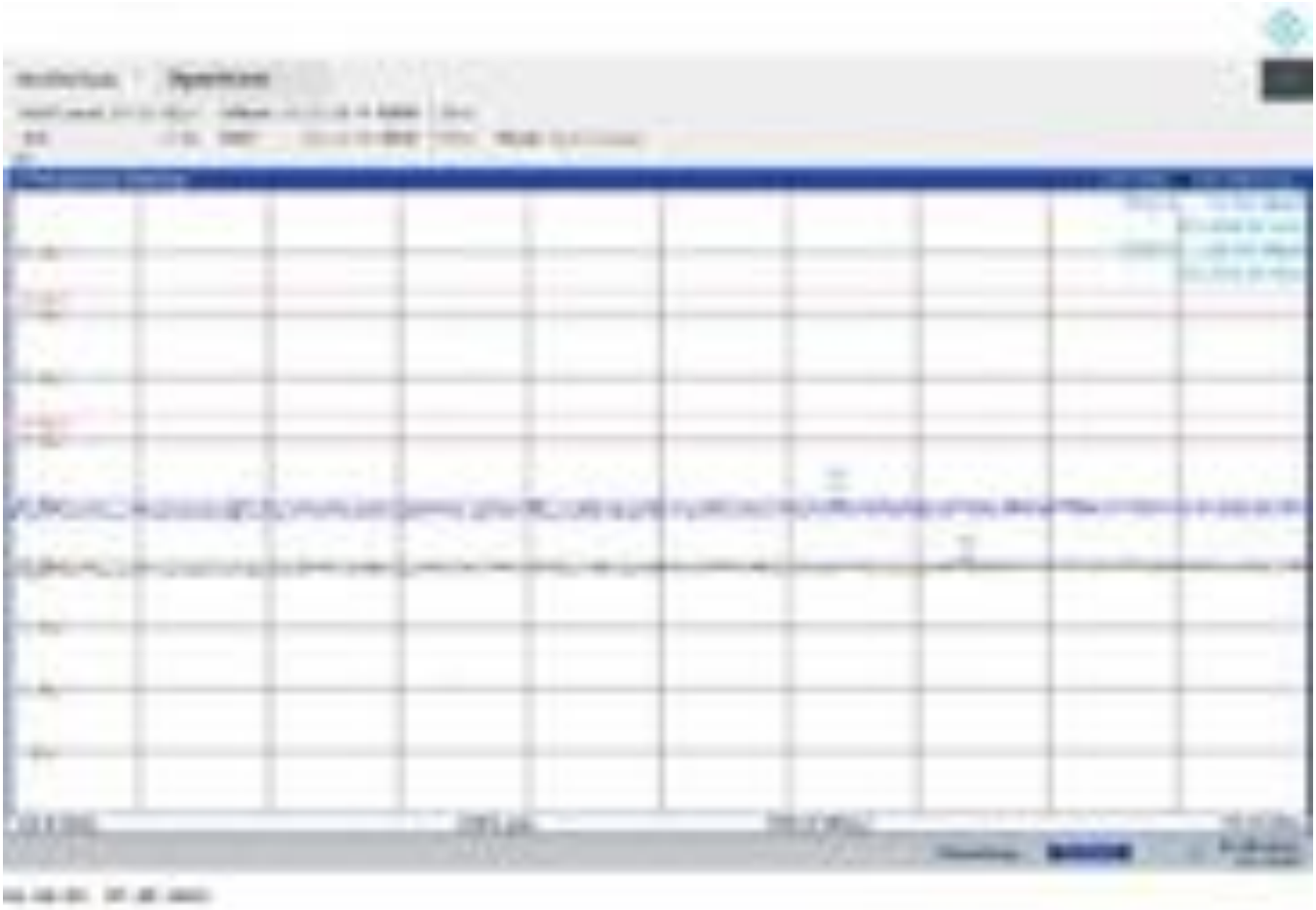
Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
17996.350000	45.32	74.00	28.68	100.0	1000.000	150.0	H	240.0

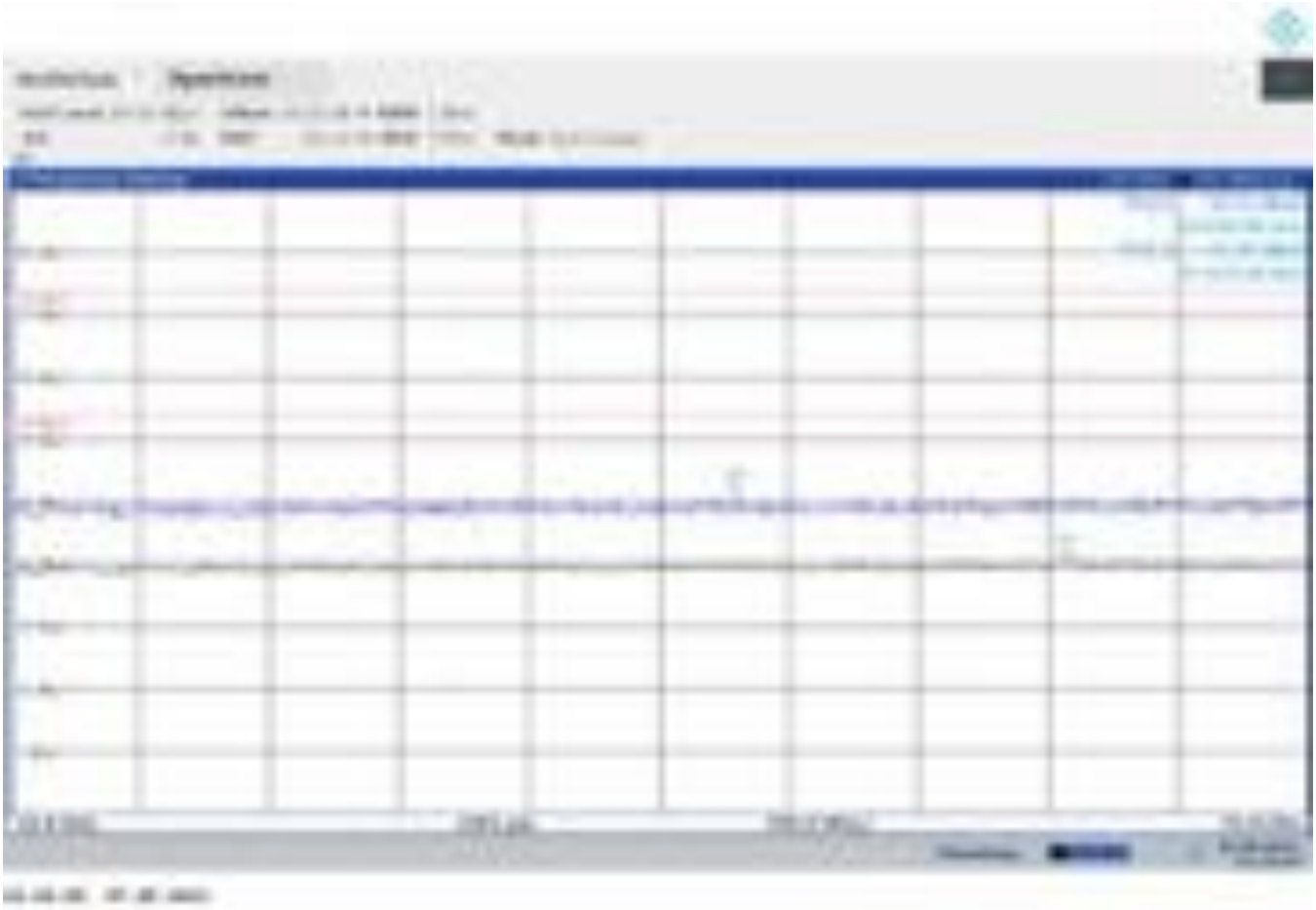
(continuation of the "Final_Result" table from column 15 ...)

Frequency (MHz)	Corr. (dB/m)	Comment
17996.350000	29.4	18:25:39 - 31.07.2021

Plot 130: Mode 2, RSE, 18 GHz – 26.5 GHz, low channel, horizontal / vertical polarisation



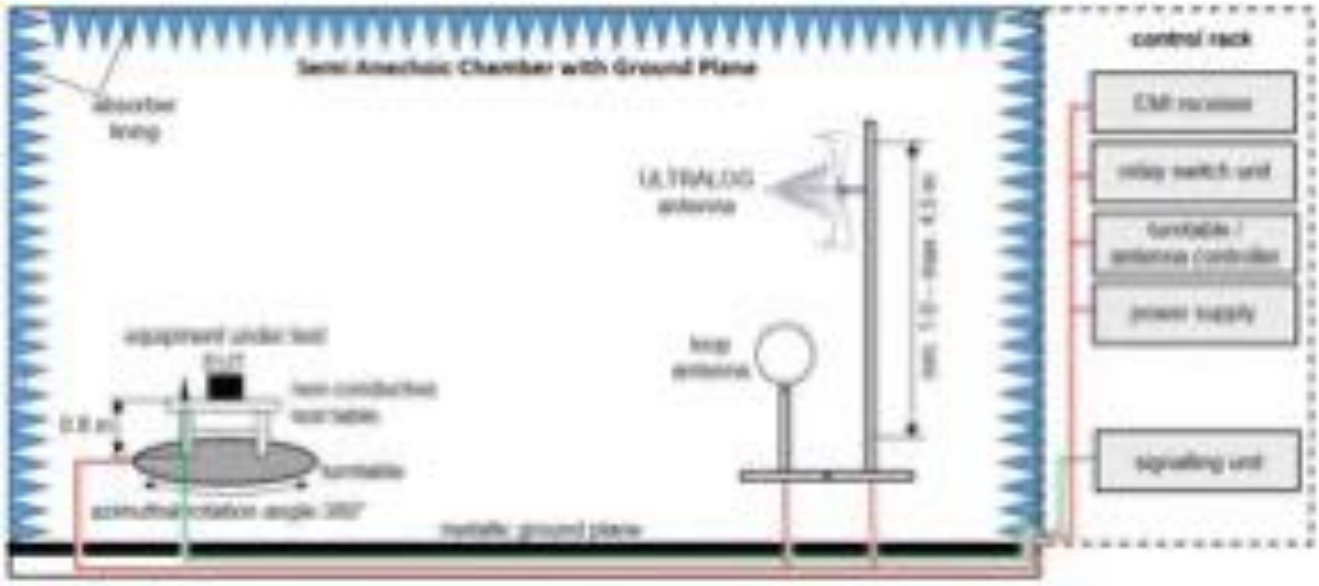
Plot 131: Mode 2, RSE, 18 GHz – 26.5 GHz, high channel, horizontal / vertical polarisation



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

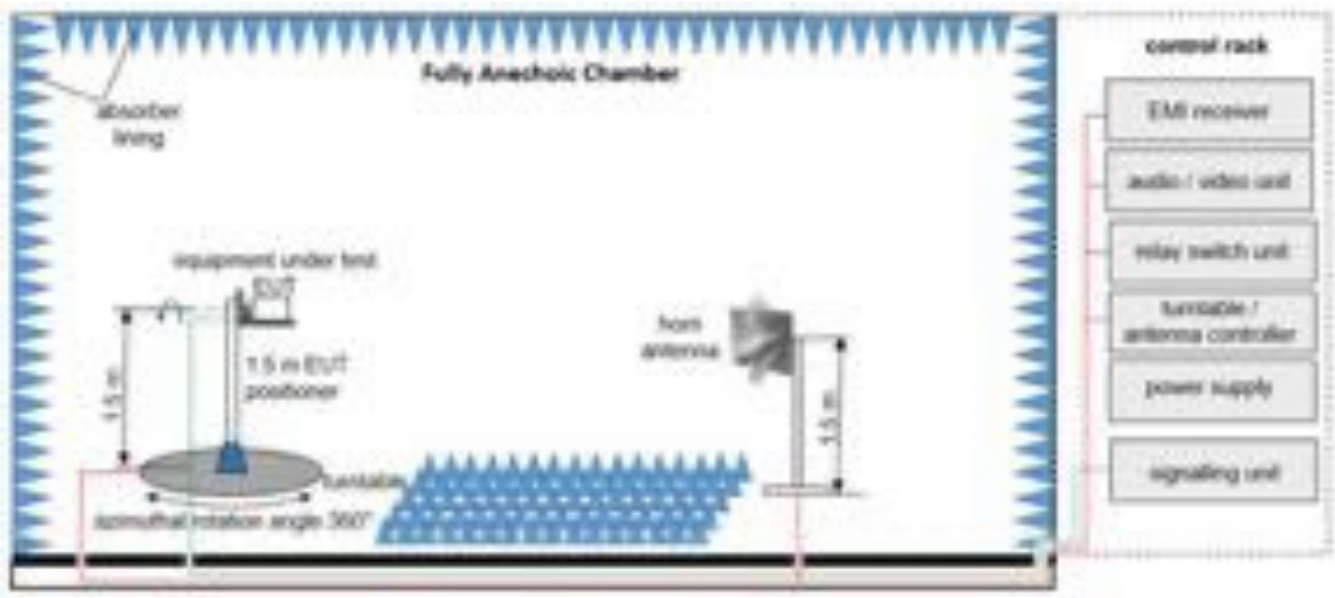
FS = UR + CL + AF
(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

Example calculation:
FS [dBµV/m] = 12.35 [dBµV/m] + 1.90 [dB] + 16.80 [dB/m] = 31.05 [dBµV/m] (35.69 µV/m)

List of test equipment used:

No.	Equipment	Manufacturer	Type	Serial No.	INV. No.	Last / Next Calibration
1	Power Supply	Elektro-Automatik GmbH & Co. KG	EA-PSI 9080-40 T	2000230001	LAB000313	–
2	Test table	innco systems GmbH	PT1208-080-RH	-	LAB000306	–
3	Power Supply	Chroma	61604	616040005416	LAB000285	–
4	Positioner	maturo GmbH	TD 1.5-10KG		LAB000258	–
5	Compressed Air	Implotex	1-850-30	-	LAB000256	–
6	EMI Test Receiver	Rohde & Schwarz	ESW26	101517	LAB000363	2021-02-05 → 2022-02-05
7	Semi-Anechoic Chamber (SAC)	Albatross Projects GmbH	SAC 5 (Babylon 5)	20168.PRB	LAB000235	–
8	Measurement Software	Rohde & Schwarz	EMC32 V11.00.10		LAB000226	–
9	Turntable	maturo GmbH	TT2.0-2t	TT2.0-2t/921	LAB000225	–
10	Antenna Mast	maturo GmbH	CAM4.0-P	CAM4.0-P/316	LAB000224	–
11	Antenna Mast	maturo GmbH	BAM4.5-P	BAM4.5-P/272	LAB000223	–
12	Controller	maturo GmbH	FCU 3.0	10082	LAB000222	–
13	Power Supply	Elektro-Automatik GmbH & Co. KG	PS 2042-10 B	2878350292	LAB000191	–
14	Pre-Amplifier	Schwarzbeck Mess-Elektronik OHG	BBV 9718 C	84	LAB000169	–
15	Open Switch and Control Platform	Rohde & Schwarz	OSP200 Base Unit 2HU	101748	LAB000149	–
16	Antenna	Rohde & Schwarz	HL562E	102001	LAB000123	2020-07-05 → 2023-07-05
17	Antenna	Rohde & Schwarz	HFH2-Z2E - Active Loop Antenna	100954	LAB000108	2020-03-25 → 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 [dBµV/m] = 12.35 [dBµV/m] + 1.90 [dB] + 16.80 [dB/m] = 31.05 [dBµV/m] (35.69 µV/m)

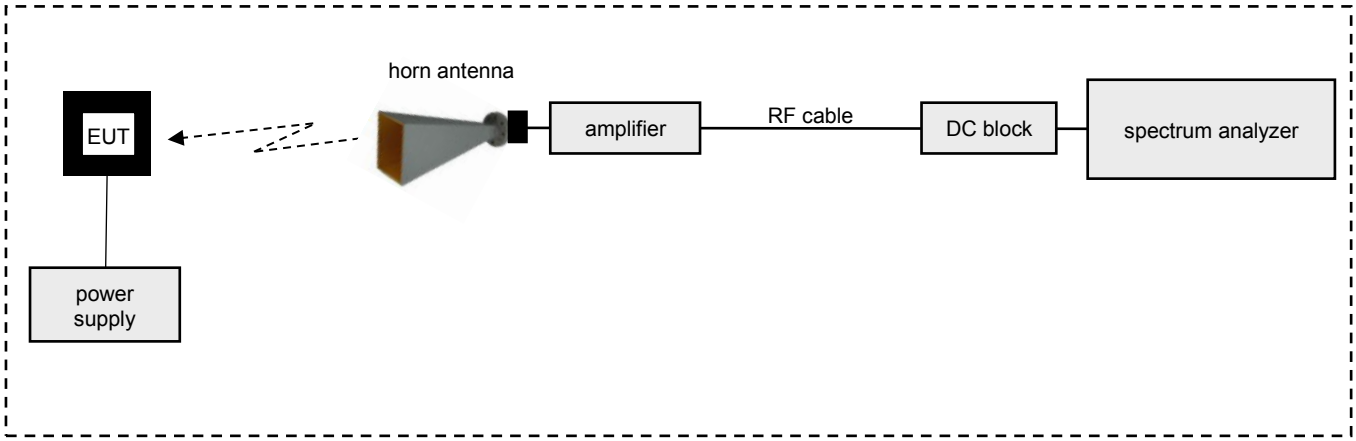
OP = AV + D - G + CA
(OP-radiated output power; AV-analyzer value; D-free field attenuation of measurement distance; G-antenna gain+amplifier gain; CA-loss signal path)

Example calculation:
OP [dBm] = -65.0 [dBm] + 50 [dB] - 20 [dBi] + 5 [dB] = -30 [dBm] (1 µW)

List of test equipment used:

No.	Equipment	Manufacturer	Type	Serial No.	INV. No.	Last / Next Calibration
1	Power Supply	Elektro-Automatik GmbH & Co. KG	EA-PSI 9080-40 T	2000230001	LAB000313	–
2	Test table	innco systems GmbH	PT1208-080-RH	-	LAB000306	–
3	Power Supply	Chroma	61604	616040005416	LAB000285	–
4	Positioner	maturo GmbH	TD 1.5-10KG	–	LAB000258	–
5	Compressed Air	Implotex	1-850-30	-	LAB000256	–
6	EMI Test Receiver	Rohde & Schwarz	ESW26	101517	LAB000363	2021-02-05 → 2022-02-05
7	Semi-Anechoic Chamber (SAC)	Albatross Projects GmbH	SAC 5 (Babylon 5)	20168.PRB	LAB000235	–
8	Measurement Software	Rohde & Schwarz	EMC32 V11.00.10	–	LAB000226	–
9	Turntable	maturo GmbH	TT2.0-2t	TT2.0-2t/921	LAB000225	–
10	Antenna Mast	maturo GmbH	BAM4.5-P	BAM4.5-P/272	LAB000223	–
11	Controller	maturo GmbH	FCU 3.0	10082	LAB000222	–
12	Power Supply	Elektro-Automatik GmbH & Co. KG	PS 2042-10 B	2878350292	LAB000191	–
13	Pre-Amplifier	Schwarzbeck Mess-Elektronik OHG	BBV 9718 C	84	LAB000169	–
14	Open Switch and Control Platform	Rohde & Schwarz	OSP200 Base Unit 2HU	101748	LAB000149	–
15	Antenna	Rohde & Schwarz	HF907	102898	LAB000124	2020-04-23 → 2023-04-23
16	HP-filter	AtlantRF	–	–	LAB000382	–

8.3 Radiated measurements > 18 GHz

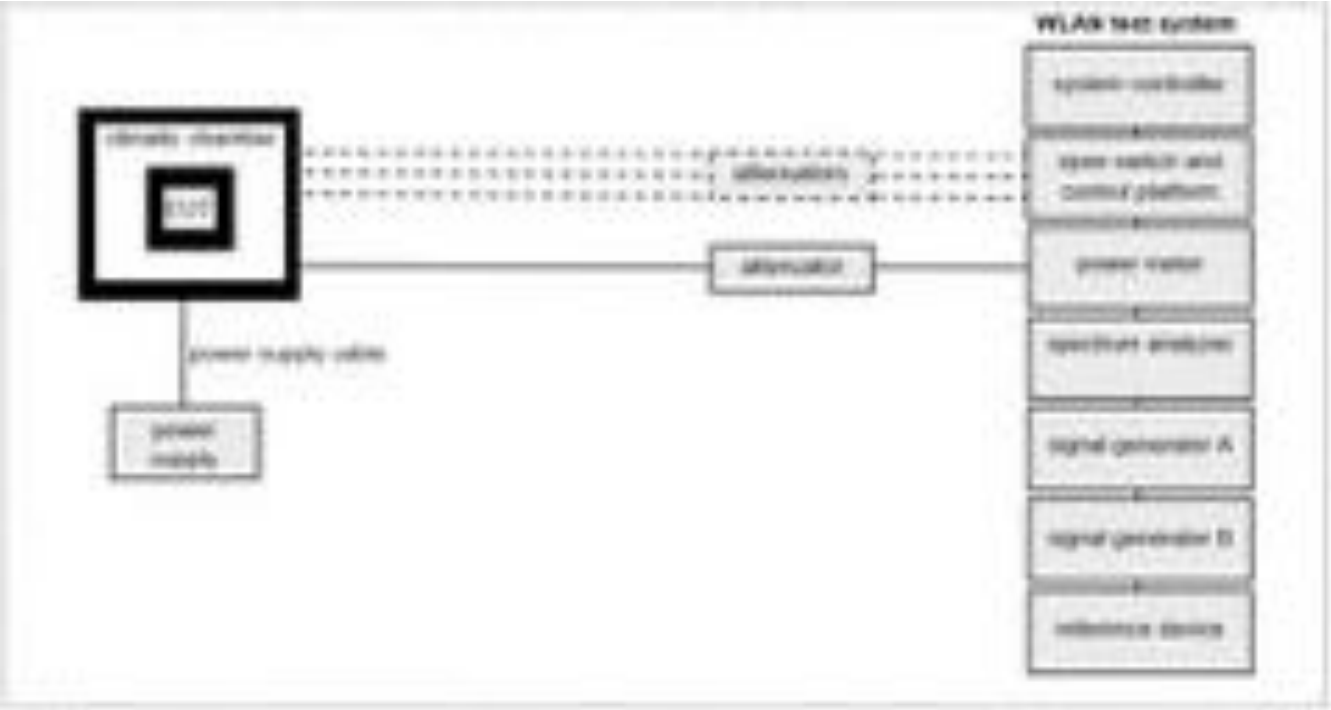


List of test equipment used:

No.	Equipment	Manufacturer	Type	Serial No.	INV. No.	Last / Next Calibration
1	Test table	innco systems GmbH	PT0707-RH light	-	LAB000303	–
2	WG-Coax-Adapter	Flann Microwave Ltd	20093-TF30 UBR220	273374	LAB000181	–
3	Coaxial Cable	Huber & Suhner	SF101/1.5m	503987/1	LAB000165	–
4	Antenna	Flann Microwave Ltd	20240-20	266403	LAB000128	2020-06-29 → 2023-06-29
5	Spectrum Analyser	Rohde & Schwarz	FSW43	101391	LAB000289	2021-07-02 → 2022-07-02

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.	Last / Next 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	≤ ± 1 x 10^{-7}
RF power, conducted	≤ ± 0.75 dB
Power spectral density	≤ ± 3 dB
Maximum frequency deviation	≤ ± 5 %
Deviation limitation Duty Cycle, Tx-sequence, Tx-gap	≤ ± 5 %
Occupied channel bandwidth	≤ ± 5 %
Conducted spurious emission of transmitter	≤ ± 4 dB
Conducted emission of receivers	≤ ± 4 dB
Radiated emission of transmitter	≤ ± 6 dB
Radiated emission of receiver	≤ ± 6 dB
Temperature	≤ ± 2.5 °C
Humidity	≤ ± 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 %.