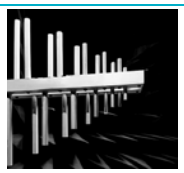
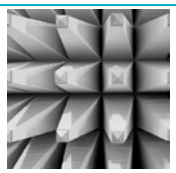

cetecom advanced

Bundesnetzagentur

BNetzA-CAB-02/21-102

TEST REPORT

ilac-MRA DAkkS Deutsche Akkreditierungsstelle D-PL-12047-01-00

Test report no.: 1-4466_22-01-05-A

Testing laboratory

cetecom advanced GmbH
Untertuerkheimer Strasse 6 – 10
66117 Saarbruecken / Germany
Phone: + 49 681 5 98 - 0
Fax: + 49 681 5 98 - 9075
Internet: https://cetecomadvanced.com
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Accredited Testing Laboratory:
The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2018-03) by the Deutsche Akkreditierungsstelle GmbH (DAkkS).
The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12047-01-00.
ISED Testing Laboratory Recognized Listing Number: DE0001
FCC designation number: DE0002

Applicant

Philips Medizin Systeme Böblingen GmbH
Hewlett-Packard-Strasse 2
71034 Böblingen / GERMANY
Phone: +4970314631122
Contact: Segun Adeniji
e-mail: Segun.Adeniji@philips.com

Manufacturer

Philips Medizin Systeme Böblingen GmbH
Hewlett-Packard-Strasse 2
71034 Böblingen / GERMANY

Test standard/s

FCC - Title 47 CFR Part 95	FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 95 - Personal Radio Services
RSS - 210 Issue 10	Spectrum Management and Telecommunications Radio Standards Specification - Licence-Exempt Radio Apparatus: Category I Equipment

For further applied test standards please refer to section 3 of this test report.

Test Item

Kind of test item:	**Evoline - WMTS Radio Transceiver**
Model name:	**WMTS-BBN1**
FCC ID:	**PQC-WMTS-BBN1**
ISED certification number:	**N/A**
Frequency:	FCC: 1395 MHz to 1400 MHz, 1427 MHz to 1432 MHz ISED: 1395 MHz to 1400 MHz, 1427 MHz to 1429.5 MHz
Technology tested:	WMTS
Antenna:	Three different external antenna
Power supply:	3.3 V DC by external power supply
Temperature range:	-5°C to +70°C

This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

Test report authorized:

cn=Michael Dorongovski, o=cetecom advanced GmbH, ou=DOR-230601, email=michael.dorongovski@cetecomadvanced.com, c=DE
2024.03.22 08:20:09 +01'00'

Michael Dorongovski
Lab Manager
Radio Labs

Test performed:

cn=René Oelmann, o=cetecom advanced GmbH, ou=OEL-230530, email=rene.oelmann@cetecomadvanced.com, c=DE
2024.03.22 09:03:26 +01'00'

René Oelmann
Lab Manager
Radio Labs

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2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. cetecom advanced GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.
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This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

This test report replaces the test report no. 1-4466_22-01-05 dated on 2023-10-19.

2.2 Application details

Date of receipt of order:	2023-05-15
Date of receipt of test item:	2023-05-15
Start of test:*	2023-05-15
End of test:*	2023-07-05
Person(s) present during the test:	-/-

*Date of each measurement, if not shown in the plot, can be requested. Dates are stored in the measurement software.

2.3 Test laboratories sub-contracted

None

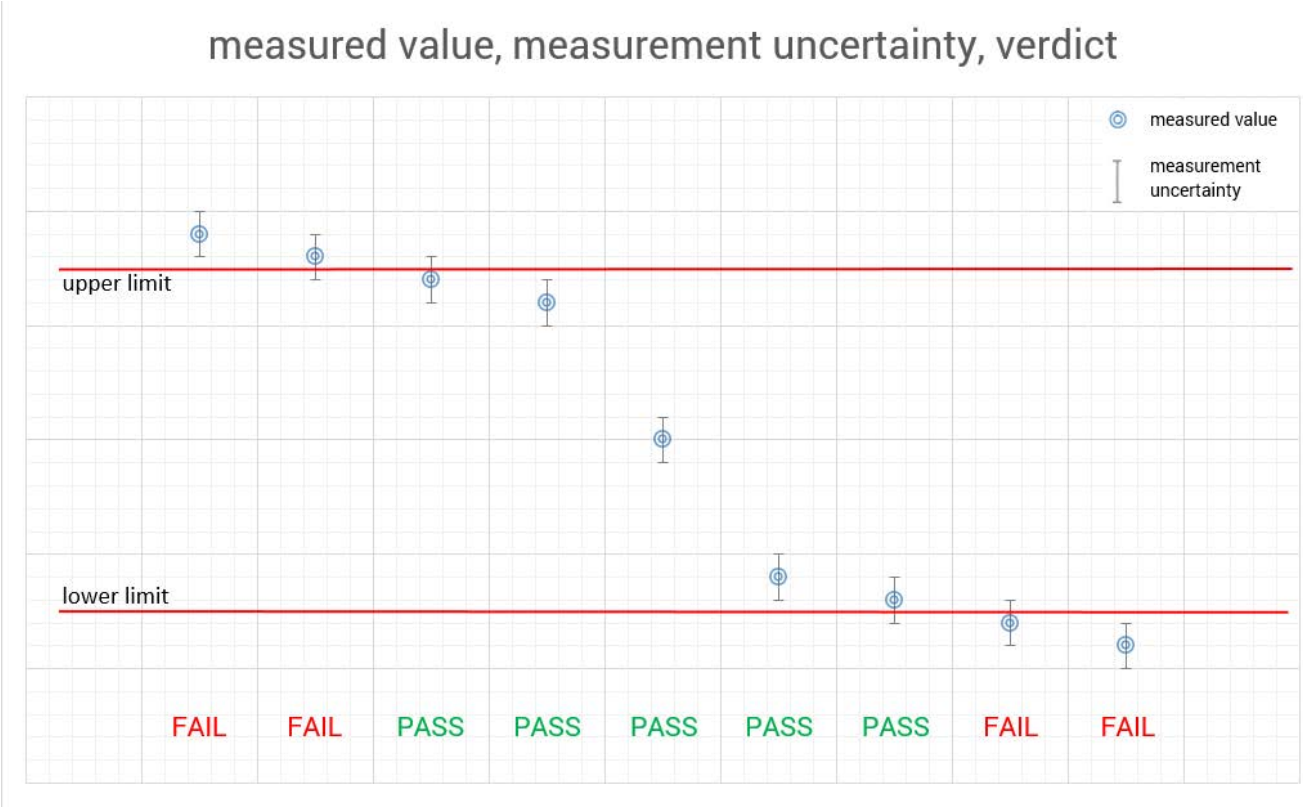
3 Test standard/s, references and accreditations

Test standard	Date	Description
FCC - Title 47 CFR Part 95	-/-	FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 95 - Personal Radio Services
RSS - 210 Issue 10	December 2019	Spectrum Management and Telecommunications Radio Standards Specification - Licence-Exempt Radio Apparatus: Category I Equipment

Guidance	Version	Description
ANSI C63.4-2014	-/-	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10-2013	-/-	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
ANSI C63.26-2015	-/-	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services

4 Reporting statements of conformity – decision rule

Only the measured values related to their corresponding limits will be used to decide whether the equipment under test meets the requirements of the test standards listed in chapter 3.
The measurement uncertainty is mentioned in this test report, see chapter 9, but is not taken into account - neither to the limits nor to the measurement results. Measurement results with a smaller margin to the corresponding limits than the measurement uncertainty have a potential risk of more than 5% that the decision might be wrong."



5 Test environment

Temperature :	T_{nom} T_{max} T_{min}	+22 °C during room temperature tests +55 °C during high temperature tests -30 °C during low temperature tests
Relative humidity content :		55 %
Barometric pressure :		1021 hpa
Power supply :	V_{nom} V_{max} V_{min}	3.3 V DC by external power supply 3.8 V DC by external power supply 2.8 V DC by external power supply

6 Test item

6.1 General description

Kind of test item :	Evoline - WMTS Radio Transceiver
Model name :	WMTS-BBN1
HMN :	-/-
PMN :	N/A
HVIN :	N/A
FVIN :	-/-
S/N serial number :	Sample #1
Hardware status :	2226
Software status :	N/A
Firmware status :	V0503
Frequency band :	FCC: 1395 MHz to 1400 MHz, 1427 MHz to 1432 MHz ISED: 1395 MHz to 1400 MHz, 1427 MHz to 1429.5 MHz
Type of radio transmission : Use of frequency spectrum :	Modulated carrier
Type of modulation :	Legacy mode: GFSK SH2.0 mode: BPSK; DQPSK; D8PSK Terestrial mode: BPSK; DQPSK; D8PSK
Number of channels :	Legacy mode: 7 (Channel 1 to 7) SH2.0 mode: 4 (Channel 8 to 11) Terestrial mode: 1 (Channel 14)
Antenna :	Three different external antenna Antenna 1: 453564271931 Antenna 2: 453564682551 Antenna 3: 453564521801 (not tested)
Power supply :	3.3 V DC by external power supply
Temperature range :	-5°C to +70°C

6.2 Additional information

The content of the following annexes is defined in the QA. It may be that not all of the listed annexes are necessary for this report, thus some values in between may be missing.

Test setup and EUT photos are included in test report:	1-4466_22-01-01_AnnexA 1-4466_22-01-01_AnnexB 1-4466_22-01-01_AnnexD

7 Description of the test setup

Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, RF generating and signaling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

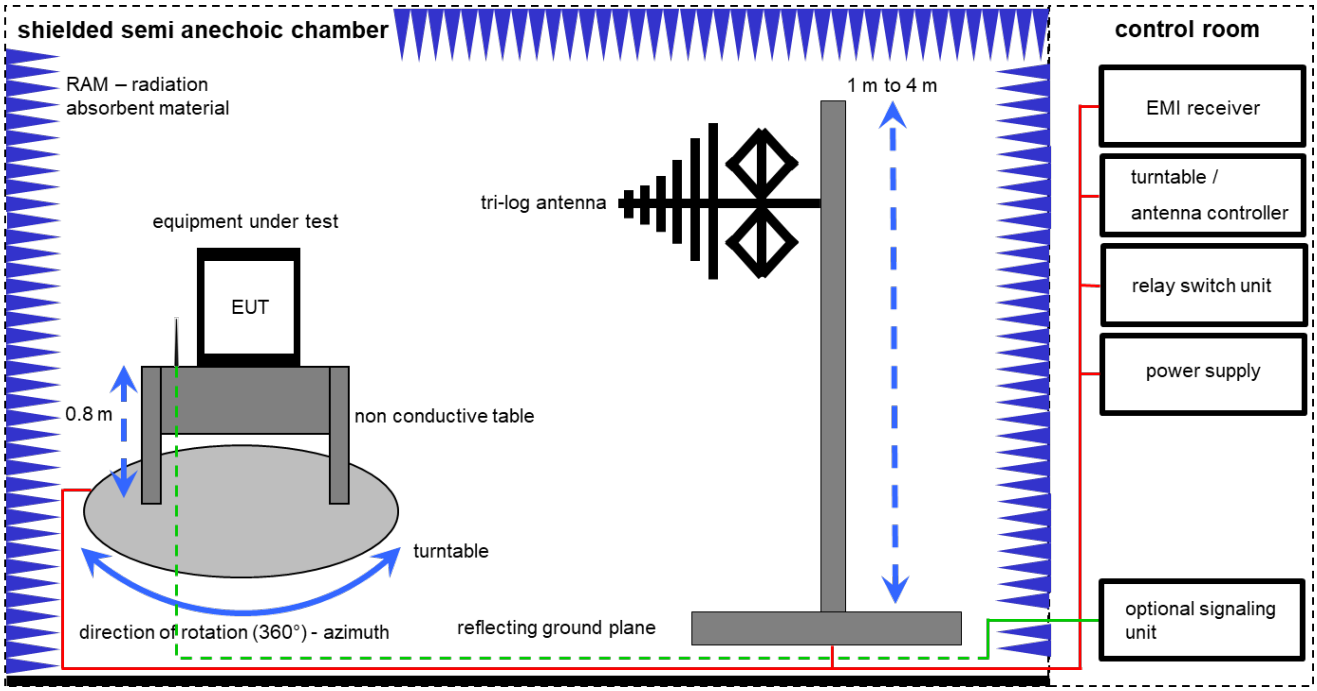
Each block diagram listed can contain several test setup configurations. All devices belonging to a test setup are identified with the same letter syntax. For example: Column Setup and all devices with an A.

Agenda: Kind of Calibration

k	calibration / calibrated	EK	limited calibration
ne	not required (k, ev, izw, zw not required)	zw	cyclical maintenance (external cyclical maintenance)
ev	periodic self verification	izw	internal cyclical maintenance
Ve	long-term stability recognized	g	blocked for accredited testing
vlkl!	Attention: extended calibration interval		
NK!	Attention: not calibrated	*)	next calibration ordered / currently in progress

7.1 Shielded semi anechoic chamber

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 30 MHz to 1 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are conform to specifications ANSI C63. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from 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 spectrum analyzers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.



Measurement distance: tri-log antenna 10 meter; EMC32 software version: 10.59.00

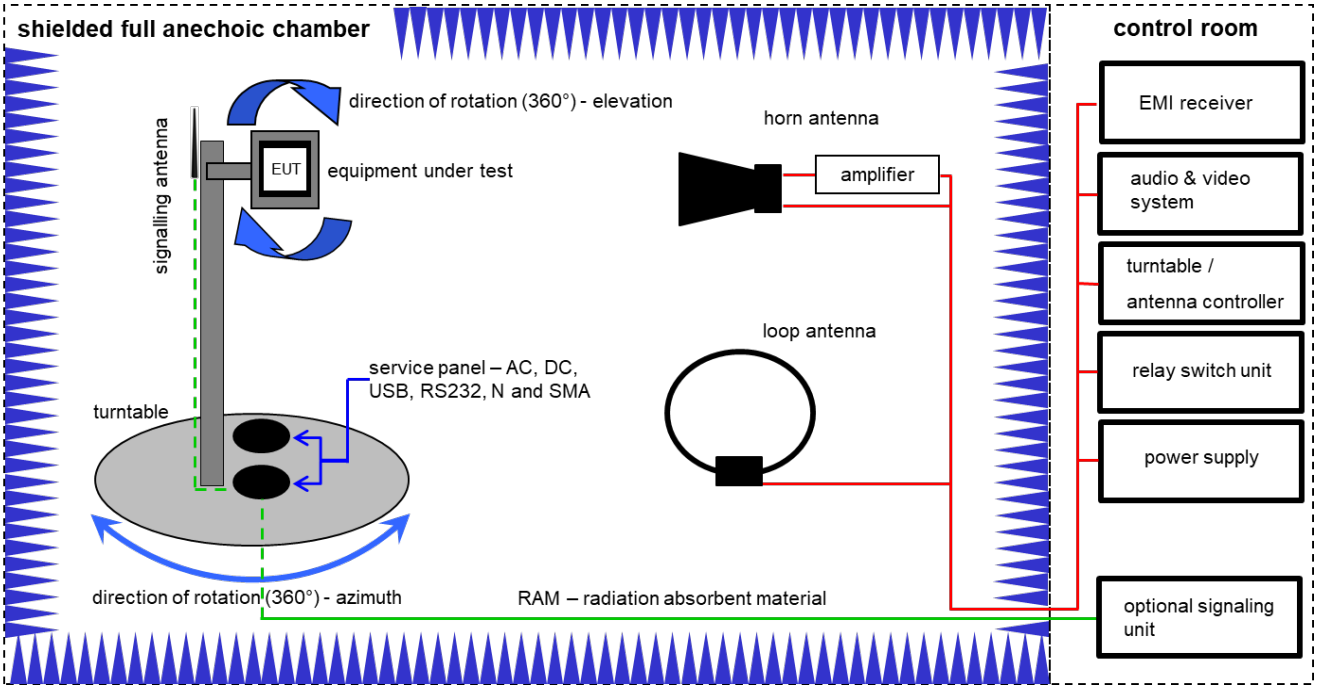
FS = UR + CL + AF
(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

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

Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Switch-Unit	3488A	HP	2719A14505	300000368	ev	-/-	-/-
2	A	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2920A04466	300000580	ne	-/-	-/-
3	A	Semi anechoic chamber	3000023	MWB AG	87400/02	300000551	ne	-/-	-/-
4	A	EMI Test Receiver	ESR3	Rohde & Schwarz	102587	300005771	k	09.12.2022	31.12.2023
5	A	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck Mess - Elektronik	318	300003696	vlKl!	30.09.2021	29.09.2023

7.2 Shielded fully anechoic chamber



Measurement distance: horn antenna 3 meter; loop antenna 3 meter / 1 meter

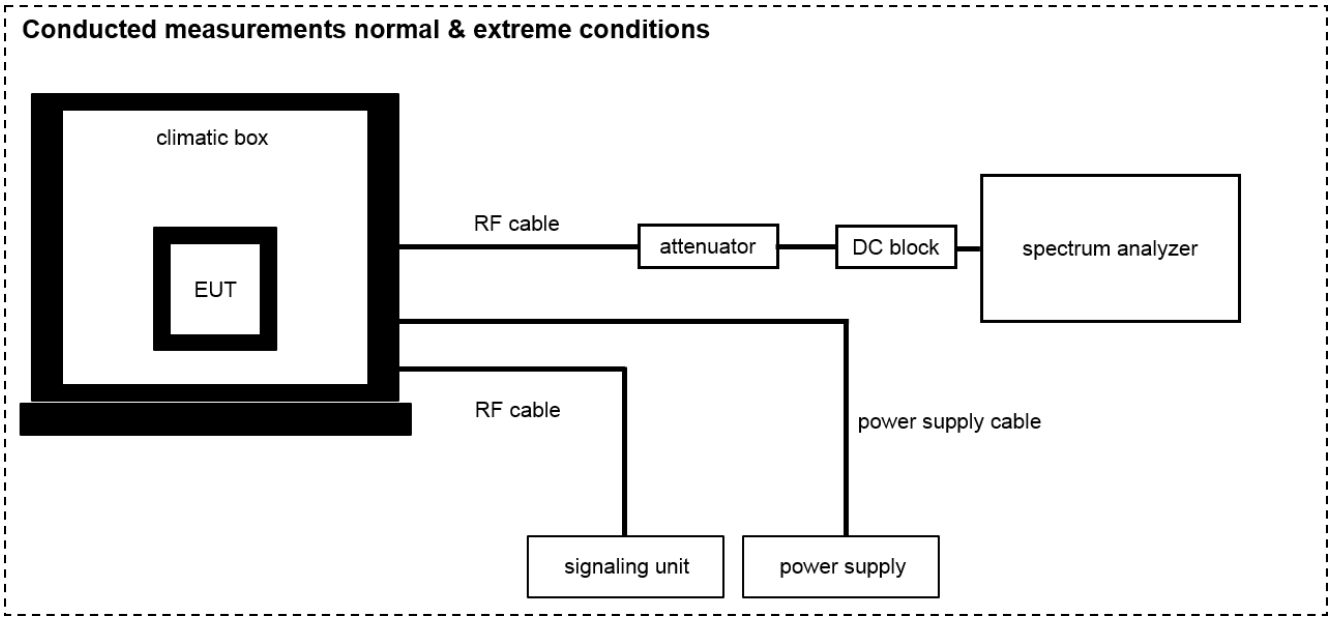
FS = UR + CA + AF
(FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

Example calculation:
FS [dBµV/m] = 40.0 [dBµV/m] + (-35.8) [dB] + 32.9 [dB/m] = 37.1 [dBµV/m] (71.61 µV/m)

Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2818A03450	300001040	vlKl!	09.12.2020	08.12.2023
2	A	Active Loop Antenna 9 kHz to 30 MHz	6502	EMCO	2210	300001015	vlKl!	01.07.2021	31.07.2023
3	A	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
4	A	Switch / Control Unit	3488A	HP	*	300000199	ne	-/-	-/-
5	A	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3089	300000307	vlKl!	11.02.2022	29.02.2024
6	A	EMI Test Receiver 20Hz- 26,5GHz	ESU26	R&S	100037	300003555	k	07.12.2022	31.12.2023
7	A	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	19	300003790	ne	-/-	-/-
8	A	Active Loop Antenna 9 kHz to 30 MHz	6502	EMCO	2210	300001015	vlKl!	01.07.2021	31.07.2023
9	A	Broadband Amplifier 0.5-18 GHz	CBLU5184540	CERNEX	22049	300004481	ev	-/-	-/-
10	A	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne	-/-	-/-
11	A	NEXIO EMV-Software	BAT EMC V2022.0.22.0	Nexio		300004682	ne	-/-	-/-

7.3 Conducted measurements normal and extreme conditions



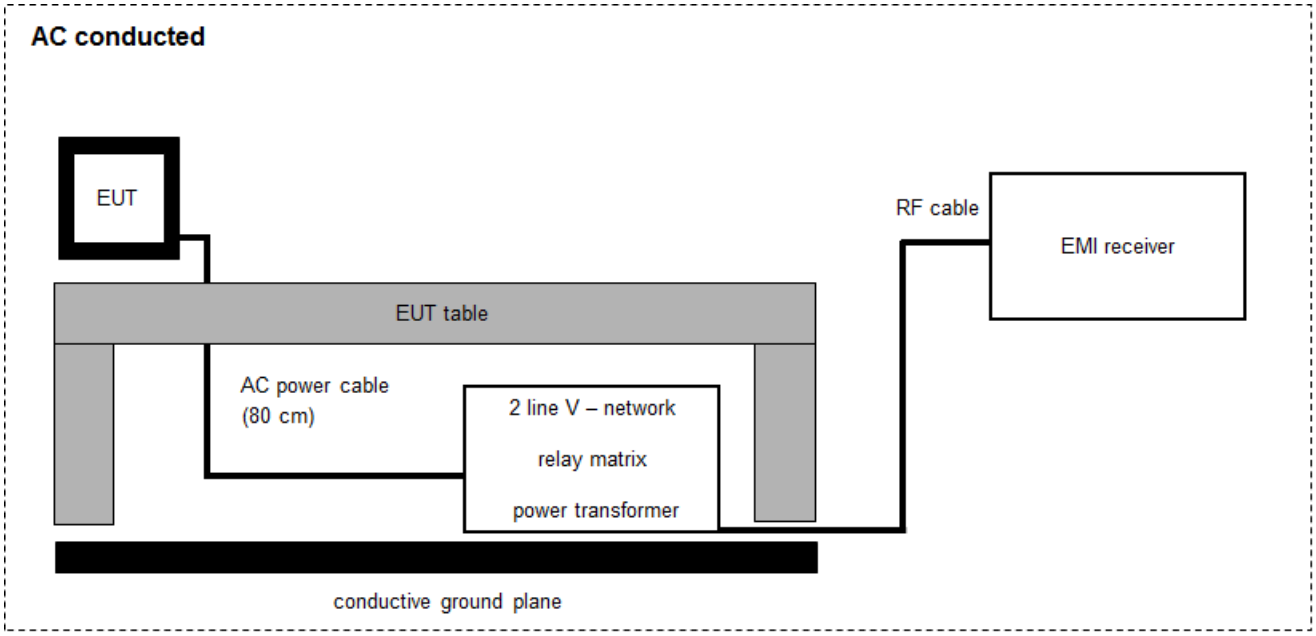
OP = AV + CA
(OP-output power; AV-analyzer value; CA-loss signal path)

Example calculation:
OP [dBm] = 6.0 [dBm] + 11.7 [dB] = 17.7 [dBm] (58.88 mW)

Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Power supply GPIB dc power supply, 0-50 Vdc, 0-2 A	6633A	HP	2851A01222	300001530	vlKl!	15.12.2022	31.12.2025
2	A	Spectrum Analyzer 9kHz - 30 GHz	FSP30	R&S	100623	300003464	vlKl!	14.12.2022	31.12.2024
3	A	Temperature Test Chamber	VT 4002	Heraeus Voetsch	521/83761	300002326	ev	12.05.2022	31.05.2024

7.4 AC conducted



FS = UR + CF + VC
(FS-field strength; UR-voltage at the receiver; CR-loss of the cable and filter; VC-correction factor of the ISN)

Example calculation:
FS [dBµV/m] = 37.62 [dBµV/m] + 9.90 [dB] + 0.23 [dB] = 47.75 [dBµV/m] (244.06 µV/m)

Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Two-line V-Network (LISN) 9 kHz to 30 MHz	ESH3-Z5	Rohde & Schwarz	892475/017	300002209	vlKl!	14.12.2021	13.12.2023
2	A	RF-Filter-section	85420E	HP	3427A00162	300002214	NK!	-/-	-/-
3	A	Analyzer-Reference-System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	NK!	-/-	-/-
4	A	Hochpass 150 kHz	EZ-25	R&S	100010	300003798	ev	-/-	-/-
5	A	PC	TecLine	F+W	-/-	300003532	ne	-/-	-/-
6	A	Netzsimulation 1600/2000 A	ACS-1600-PS	-/-	2002-001247-0	300006074	ev	-/-	-/-
7	A	EMI Test Receiver	ESR	R&S	102981	300006318	k	24.05.2022	23.05.2023

NOTE: These tests were performed before 23.05.2023

8 Sequence of testing

8.1 Sequence of testing radiated spurious 9 kHz to 30 MHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, it is placed on a table with 0.8 m height.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement*

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna height is 1 m.
- At each turntable position the analyzer sweeps with positive-peak detector to find the maximum of all emissions.

Final measurement

- Identified emissions during the pre-measurement are maximized by the software by rotating the turntable from 0° to 360°.
- Loop antenna is rotated about its vertical axis for maximum response at each azimuth about the EUT. (For certain applications, the loop antenna plane may also need to be positioned horizontally at the specified distance from the EUT)
- The final measurement is done in the position (turntable and elevation) causing the highest emissions with quasi-peak (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. A plot with the graph of the premeasurement and the limit is stored.

*)Note: The sequence will be repeated three times with different EUT orientations.

8.2 Sequence of testing radiated spurious 30 MHz to 1 GHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 10 m or 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 m to 3 m.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximize the peaks by changing turntable position ± 45° and antenna height between 1 and 4 m.
- The final measurement is done with quasi-peak detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

8.3 Sequence of testing radiated spurious 1 GHz to 18 GHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a 2-axis positioner with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height is 1.5 m.
- At each turntable position and antenna polarization the analyzer sweeps with positive peak detector to find the maximum of all emissions.

Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximizes the peaks by rotating the turntable from 0° to 360°. This measurement is repeated for different EUT-table positions (0° to 150° in 30°-steps) and for both antenna polarizations.
- The final measurement is done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and RMS detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

9 Measurement uncertainty

Measurement uncertainty	
Test case	**Uncertainty**
Antenna gain	± 3 dB
Occupied BW (20MHz Ref BW)	2.24 E+05 Hz
RF output power	0.349 dB
Power Timing (HW Timing Error)	< 500ns
Power Spectral Density	± 0.22 dB
Transmitter unwanted emissions (< 7GHz)	± 1.65 dB
Transmitter unwanted emissions (> 7GHz)	± 2.59 dB
Spurious emissions radiated 30 MHz to 1 GHz	± 3 dB
Spurious emissions radiated 1 GHz to 12.75 GHz	± 3.7 dB
Spurious emissions radiated above 12.75 GHz	± 4.5 dB
Level accuracy (Blocking Signal)	± 1.24 dB
Level accuracy (Wanted Signal)	± 1.06 dB

10 Summary of measurement results

☒	No deviations from the technical specifications were ascertained
☐	There were deviations from the technical specifications ascertained
☐	This test report is only a partial test report. The content and verdict of the performed test cases are listed below.

TC Identifier	Description	Verdict	Date	Remark
RF-Testing	47 CFR Part 2 47 CFR Part 95 H RSS Gen Issue 5 RSS 210 Issue 10	Passed	2024-03-22	-/-

Test Specification Clause	Test Case	Temperature Conditions	Power Source Voltages	C	NC	NA	NP	Remark
FCC 47 CFR § 2.1046 § 95.2369 RSS 210 Issue 10 C.4	Radiated field strength	Nominal	Nominal	☒	☐	☐	☐	-/-
FCC 47 CFR § 2.1055 § 95.2565 RSS-Gen Issue 5 8.11	Frequency stability	Nominal	Extreme	☒	☐	☐	☐	-/-
		Extreme	Nominal	☒	☐	☐	☐	
FCC 47 CFR § 2.1049 (1) RSS 210 Issue 10 C.4	Occupied bandwidth	Nominal	Nominal	☒	☐	☐	☐	-/-
FCC 47 CFR § 2.1053 § 95.2379 RSS 210 Issue 10 C.4	Field strength of spurious radiation Transmitter unwanted emissions	Nominal	Nominal	☒	☐	☐	☐	-/-
§15.107(a) §15.207 RSS - Gen	Conducted emissions below 30 MHz (AC conducted)	Nominal	Nominal	☒	☐	☐	☐	-/-

Notes:

C	Compliant	NC	Not compliant	NA	Not applicable	NP	Not performed

11 Additional information and comments

Reference documents: Customer_Questionnaire_WMTS (002).docx
IIT Board controller - user guide.docx
Test report no. 1-4466_22-03-02 (FCC Part 27 test report)

Special test descriptions: Radiated emissions tests have been performed on both antennas. Radiated field strength tests have been performed on the antenna with the higher gain.

Configuration descriptions: Channel 14 of the terrestrial mode is not covered completely in the FCC Part 95 Subpart H. The rest of the channel is covered under FCC Part 27. The channel was tested according to FCC Part 95 Subpart H and FCC Part 27 requirements.

EUT selection:

☒ Only one device available

☐ Devices selected by the customer

☐ Devices selected by the laboratory (Randomly)

Provided channels:

FCC Part 95

channel number & center frequency - Legacy mode							
channel	**1**	2	**3**	**4**	5	**6**	7
f_c / MHz	**1395.898**	1397.497	**1399.096**	**1427.898**	1429.497	**1431.097**	1430.241

channel number & center frequency – SH2.0 mode				
channel	**8**	**9**	**10**	**11**
f_c / MHz	**1396.636**	**1398.368**	**1428.513**	**1430.241**

RSS-210 Issue 10

channel number & center frequency - Legacy mode				
channel	**1**	2	**3**	**4**
f_c / MHz	**1395.898**	1397.497	**1399.096**	**1427.898**

channel number & center frequency – SH2.0 mode			
channel	**8**	**9**	**10**
f_c / MHz	**1396.636**	**1398.368**	**1428.513**

Note: The channels used for the tests are marked in bold in the list.

12 Additional EUT parameter

Test mode:

☐ No test mode available
Iperf was used to ping another device with the largest support packet size

☒ Test mode available
Special software is used.
EUT is transmitting pseudo random data by itself

Antennas and transmit operating modes:

☒ Operating mode 1 (single antenna)

- *Equipment with 1 antenna,*
- *Equipment with 2 diversity antennas operating in switched diversity mode by which at any moment in time only 1 antenna is used,*
- *Smart antenna system with 2 or more transmit/receive chains, but operating in a mode where only 1 transmit/receive chain is used)*

☐ Operating mode 2 (multiple antennas, no beamforming)

- *Equipment operating in this mode contains a smart antenna system using two or more transmit/receive chains simultaneously but without beamforming.*

☐ Operating mode 3 (multiple antennas, with beamforming)

- *Equipment operating in this mode contains a smart antenna system using two or more transmit/receive chains simultaneously with beamforming.*
  In addition to the antenna assembly gain (G), the beamforming gain (Y) may have to be taken into account when performing the measurements.

13 Measurement results

13.1 Radiated field strength

Measurement:

Measurement parameter	
Detector	Average
Sweep time	Auto
Resolution bandwidth	1 MHz
Video bandwidth	3 MHz
Trace mode	Max hold
Test setup	See chapter 7.2 setup B (radiated)
Measurement uncertainty	See chapter 9

Limits:

FCC	IC
CFR § 2.1046 CFR § 95.2369	RSS 210 Issue 10 C.4 (a)
Radiated field strength	
740 mV/m @ 3 m (117 dBµV/m @ 3 m)	

Results: FCC

Legacy Mode

Frequency	Modulation	Radiated field strength
1395.898 MHz	GFSK	102.2 dBµV/m @ 3m
1399.096 MHz	GFSK	103.1 dBµV/m @ 3m
1427.898 MHz	GFSK	102.8 dBµV/m @ 3m
1431.097 MHz	GFSK	103.0 dBµV/m @ 3m

SH2.0 Mode

Frequency	Modulation	Radiated field strength
1396.636 MHz	DBPSK	107.1 dBµV/m @ 3m
1398.368 MHz	DBPSK	107.2 dBµV/m @ 3m
1428.513 MHz	DBPSK	107.5 dBµV/m @ 3m
1430.241 MHz	DBPSK	107.2 dBµV/m @ 3m
1396.636 MHz	DQPSK	106.2 dBµV/m @ 3m
1398.368 MHz	DQPSK	106.4 dBµV/m @ 3m
1428.513 MHz	DQPSK	106.6 dBµV/m @ 3m
1430.241 MHz	DQPSK	106.4 dBµV/m @ 3m
1396.636 MHz	D8PSK	106.2 dBµV/m @ 3m
1398.368 MHz	D8PSK	106.2 dBµV/m @ 3m
1428.513 MHz	D8PSK	106.3 dBµV/m @ 3m
1430.241 MHz	D8PSK	106.1 dBµV/m @ 3m

Results: ISED

Legacy Mode

Frequency	Modulation	Radiated field strength
1395.898 MHz	GFSK	102.2 dBµV/m @ 3m
1399.096 MHz	GFSK	103.1 dBµV/m @ 3m
1427.898 MHz	GFSK	102.8 dBµV/m @ 3m

SH2.0 Mode

Frequency	Modulation	Radiated field strength
1396.636 MHz	DBPSK	107.1 dBµV/m @ 3m
1398.368 MHz	DBPSK	107.2 dBµV/m @ 3m
1428.513 MHz	DBPSK	107.5 dBµV/m @ 3m
1396.636 MHz	DQPSK	106.2 dBµV/m @ 3m
1398.368 MHz	DQPSK	106.4 dBµV/m @ 3m
1428.513 MHz	DQPSK	106.6 dBµV/m @ 3m
1396.636 MHz	D8PSK	106.2 dBµV/m @ 3m
1398.368 MHz	D8PSK	106.2 dBµV/m @ 3m
1428.513 MHz	D8PSK	106.3 dBµV/m @ 3m

13.2 Frequency accuracy

Measurement:

Measurement parameter	
Detector	Peak
Sweep time	Auto
Resolution bandwidth	100 Hz
Video bandwidth	100 Hz
Trace mode	Max hold
Test setup	See chapter 7.2 setup B (radiated)
Measurement uncertainty	See chapter 9

Limits:

FCC	IC
CFR § 2.1055 CFR § 95.2365	RSS Gen Issue 10 C.4
Manufacturers of wireless medical telemetry devices are responsible for ensuring frequency accuracy such that all emissions are maintained within the designated bands of operation under all of the manufacturer's specified conditions.	

Results Legacy mode 1395 MHz to 1400 MHz:

low channel

Temperature	Frequency (MHz)	Emission within band
-30 °C	1395.89775	Yes
-20 °C	1395.89575	Yes
-10 °C	1395.89575	Yes
0 °C	1395.89575	Yes
10 °C	1395.89575	Yes
20 °C (V nom)	1395.89575	Yes
30 °C	1395.89575	Yes
40 °C	1395.89775	Yes
50 °C	1395.89575	Yes
Voltage		
85 %	1395.89575	Yes
115 %	1395.89575	Yes

high channel

Temperature	Frequency (MHz)	Emission within band
-30 °C	1399.10025	Yes
-20 °C	1399.10025	Yes
-10 °C	1399.09825	Yes
0 °C	1399.09625	Yes
10 °C	1399.09625	Yes
20 °C (V nom)	1399.09625	Yes
30 °C	1399.09625	Yes
40 °C	1399.09825	Yes
50 °C	1399.09825	Yes
Voltage		
85 %	1399.09625	Yes
115 %	1399.09625	Yes

Results Legacy mode 1427 MHz to 1432 MHz:

low channel

Temperature	Frequency (MHz)	Emission within band
-30 °C	1427.89875	Yes
-20 °C	1427.89675	Yes
-10 °C	1427.89875	Yes
0 °C	1427.89875	Yes
10 °C	1427.89675	Yes
20 °C (V nom)	1427.89675	Yes
30 °C	1427.89675	Yes
40 °C	1427.89675	Yes
50 °C	1427.89875	Yes
Voltage		
85 %	1427.89675	Yes
115 %	1427.89875	Yes

high channel

Temperature	Frequency (MHz)	Emission within band
-30 °C	1431.09738	Yes
-20 °C	1431.09738	Yes
-10 °C	1431.09538	Yes
0 °C	1431.09738	Yes
10 °C	1431.09538	Yes
20 °C (V nom)	1431.09538	Yes
30 °C	1431.09538	Yes
40 °C	1431.09738	Yes
50 °C	1431.09738	Yes
Voltage		
85 %	1431.09538	Yes
115 %	1431.09538	Yes

Results SH2.0 mode 1395 MHz to 1400 MHz:

low channel

Temperature	Frequency (MHz)	Emission within band
-30 °C	1396.64025	Yes
-20 °C	1396.63625	Yes
-10 °C	1396.63825	Yes
0 °C	1396.63625	Yes
10 °C	1396.63625	Yes
20 °C (V nom)	1396.63625	Yes
30 °C	1396.63625	Yes
40 °C	1396.63825	Yes
50 °C	1396.63825	Yes
Voltage		
85 %	1396.63625	Yes
115 %	1396.63625	Yes

high channel

Temperature	Frequency (MHz)	Emission within band
-30 °C	1398.36788	Yes
-20 °C	1398.36588	Yes
-10 °C	1398.36788	Yes
0 °C	1398.36588	Yes
10 °C	1398.36388	Yes
20 °C (V nom)	1398.36388	Yes
30 °C	1398.36388	Yes
40 °C	1398.36788	Yes
50 °C	1398.36588	Yes
Voltage		
85 %	1398.36388	Yes
115 %	1398.36588	Yes

Results SH2.0 mode 1427 MHz to 1432 MHz:

low channel

Temperature	Frequency (MHz)	Emission within band
-30 °C	1428.51463	Yes
-20 °C	1428.51463	Yes
-10 °C	1428.51263	Yes
0 °C	1428.51263	Yes
10 °C	1428.51263	Yes
20 °C (V nom)	1428.51263	Yes
30 °C	1428.51263	Yes
40 °C	1428.51263	Yes
50 °C	1428.51463	Yes
Voltage		
85 %	1428.51263	Yes
115 %	1428.51263	Yes

high channel

Temperature	Frequency (MHz)	Emission within band
-30 °C	1430.24238	Yes
-20 °C	1430.24238	Yes
-10 °C	1430.24038	Yes
0 °C	1430.24038	Yes
10 °C	1430.24038	Yes
20 °C (V nom)	1430.24038	Yes
30 °C	1430.24038	Yes
40 °C	1430.24238	Yes
50 °C	1430.24238	Yes
Voltage		
85 %	1430.24038	Yes
115 %	1430.24038	Yes

13.3 Occupied bandwidth

Measurement:

Measurement parameter	
Detector	Peak
Sweep time	Auto
Resolution bandwidth	10 kHz
Video bandwidth	30 kHz
Span	5 MHz
Measurement procedure	Measurement of the 99% bandwidth using the integration function of the analyzer
Test setup	See chapter 7.3 setup A
Measurement uncertainty	See chapter 9

Limits:

FCC	IC
47 CFR § 2.1049 (1)	RSS Gen Issue 10 C.4
When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured.	

Result:

Legacy Mode

Frequency	Modulation	99% Bandwidth
1395.898 MHz	GFSK	1190 kHz
1399.096 MHz	GFSK	1180 kHz
1427.898 MHz	GFSK	1180 kHz
1431.097 MHz	GFSK	1180 kHz

SH2.0 Mode

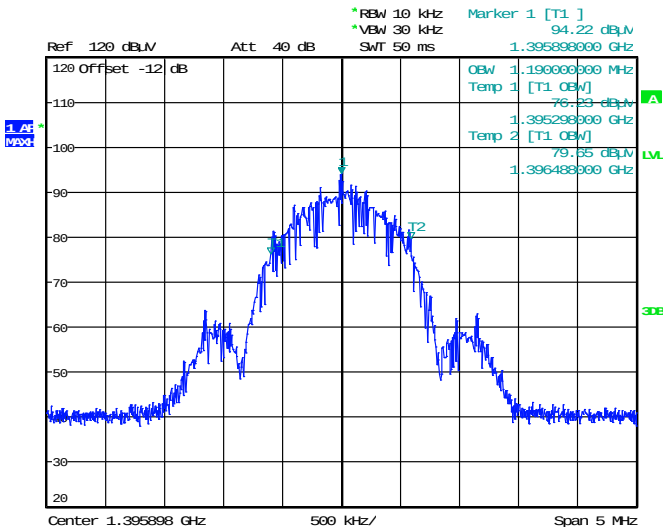
Frequency	Modulation	99% Bandwidth
1396.636 MHz	DBPSK	1450 kHz
1398.368 MHz	DBPSK	1450 kHz
1428.513 MHz	DBPSK	1450 kHz
1430.241 MHz	DBPSK	1450 kHz
1396.636 MHz	DQPSK	1450 kHz
1398.368 MHz	DQPSK	1440 kHz
1428.513 MHz	DQPSK	1440 kHz
1430.241 MHz	DQPSK	1440 kHz
1396.636 MHz	D8PSK	1440 kHz
1398.368 MHz	D8PSK	1430 kHz
1428.513 MHz	D8PSK	1440 kHz
1430.241 MHz	D8PSK	1430 kHz

Please check the applicability for RSS 210 in the channel list in chapter 11 on page 16!

Plots of the measurements

Legacy mode – low band

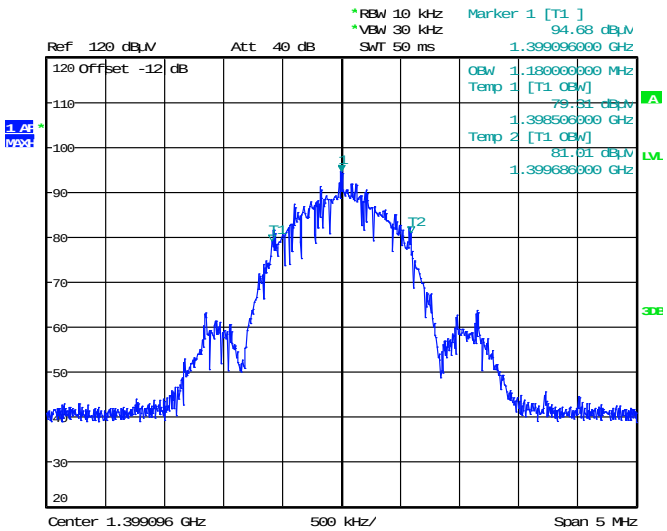
Plot 1: low channel



NOP

Date: 5.JUL.2023 10:14:24

Plot 2: high channel

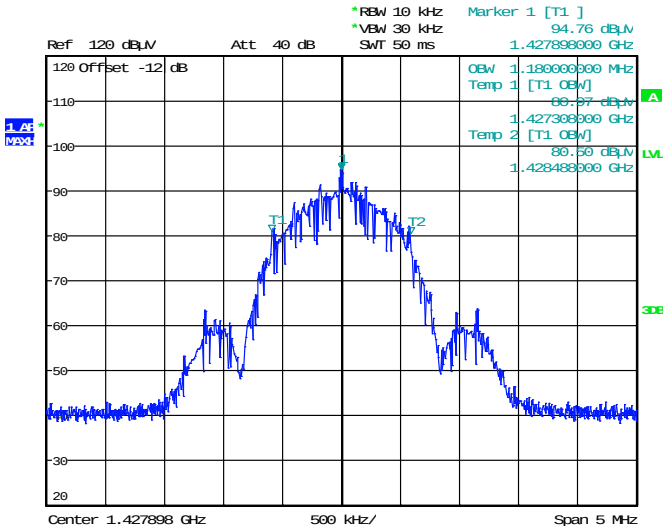


NOP

Date: 5.JUL.2023 10:22:25

Legacy mode – high band

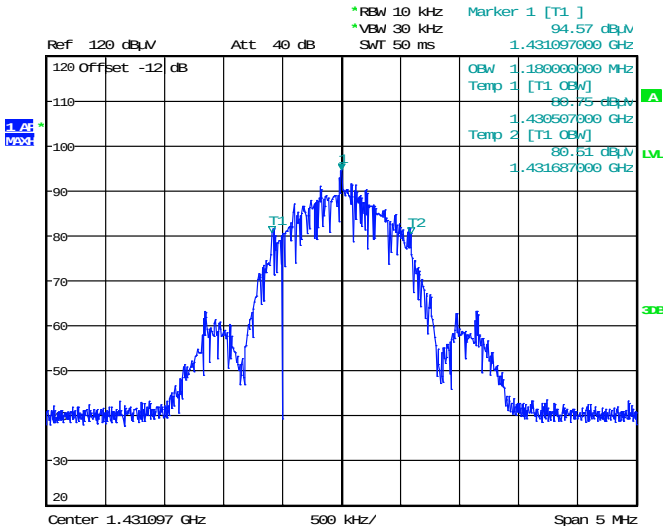
Plot 3: low channel



NOP

Date: 5.JUL.2023 10:28:32

Plot 4: high channel

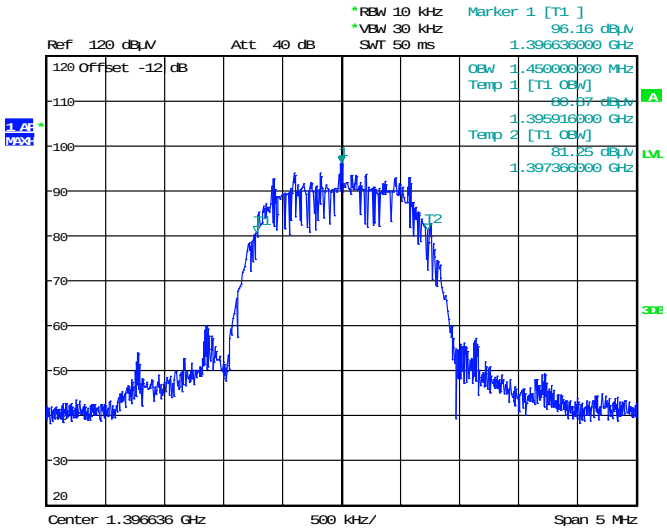


NOP

Date: 5.JUL.2023 10:31:37

SH2.0 mode DBPSK (worst case) – low band

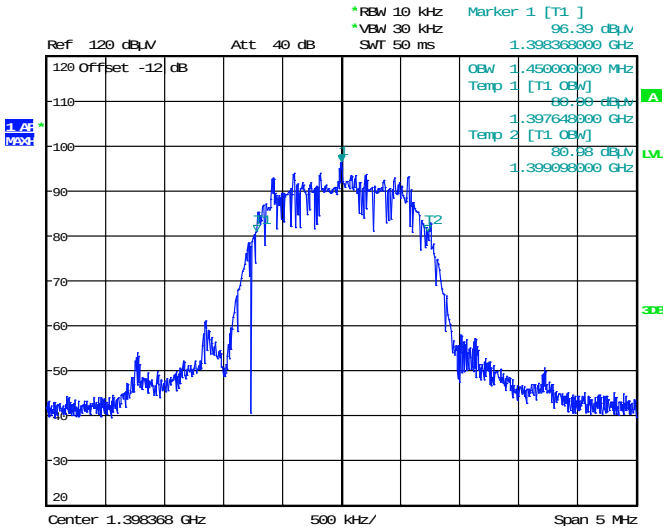
Plot 1: low channel



NOP

Date: 5.JUL.2023 10:35:52

Plot 2: high channel

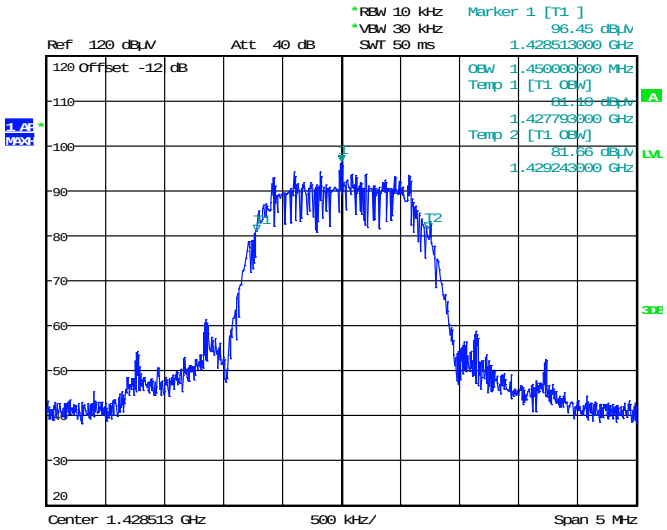


NOP

Date: 5.JUL.2023 10:52:34

SH2.0 mode DBPSK (worst case) – high band

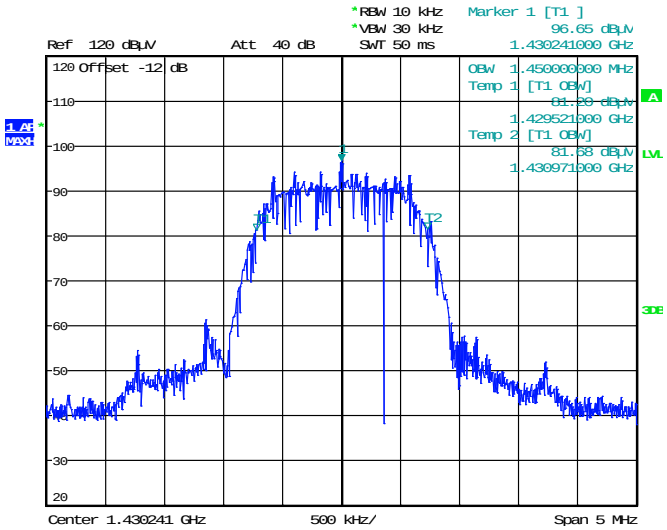
Plot 3: low channel



NOP

Date: 5.JUL.2023 11:04:49

Plot 4: high channel

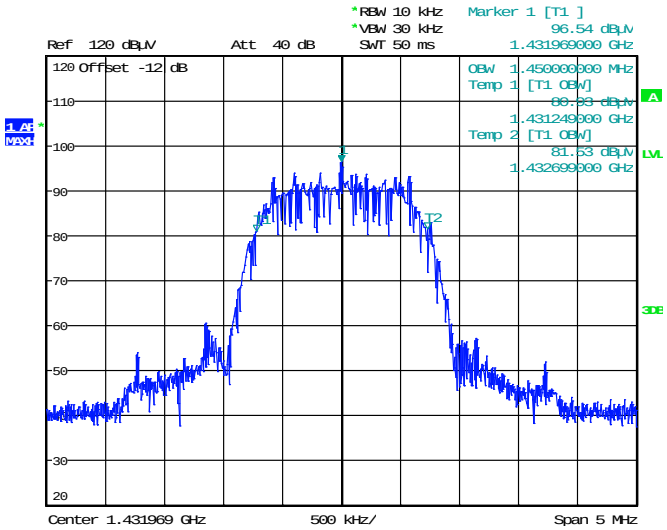


NOP

Date: 5.JUL.2023 13:13:07

Terestrial mode

Plot 1: low channel



NOP

Date: 5.JUL.2023 13:29:42

13.4 Field strength of spurious radiation

Measurement:

Measurement parameter	
Detector	Peak / Quasi Peak
Sweep time	Auto
Resolution bandwidth	F < 960 kHz: 120 kHz F > 960 kHz: 1 MHz
Video bandwidth	F < 960 kHz: 500 kHz F > 960 kHz: 3 MHz
Span	9 kHz to 15 GHz
Trace mode	Max Hold
Test setup	See chapter 7.2 setup A
Measurement uncertainty	See chapter 9

Limits:

FCC	IC
47 CFR § 2.1053 47 CFR § 95.2379	RSS Gen Issue 10 C.4
Out-of band emissions below 960 MHz are limited to 200 microvolts/meter, as measured at a distance of 3 meters, using measuring instrumentation with a CISPR quasi-peak detector. Out-of-band emissions above 960 MHz are limited to 500 microvolts/meter as measured at a distance of 3 meters, using measuring equipment with an averaging detector and a 1 MHz measurement bandwidth.	

NOTE: These results are valid for all modulations. The tests have been performed with the modulation which has the highest output power

Legacy mode – low band, antenna 1

SPURIOUS EMISSIONS LEVEL								
Lowest channel			Middle channel			Highest channel		
Frequency [MHZ]	Detector	Level [dBµV/m]	Frequency [MHZ]	Detector	Level [dBµV/m]	Frequency [MHZ]	Detector	Level [dBµV/m]
-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-
All detected spurious emissions are more than 20 dB below the limit.			-/-			All detected spurious emissions are more than 20 dB below the limit.		

Legacy mode – high band, antenna 1

SPURIOUS EMISSIONS LEVEL								
Lowest channel			Middle channel			Highest channel		
Frequency [MHZ]	Detector	Level [dBµV/m]	Frequency [MHZ]	Detector	Level [dBµV/m]	Frequency [MHZ]	Detector	Level [dBµV/m]
1382.5	RMS	50.2	-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-
-/-			-/-			All detected spurious emissions are more than 20 dB below the limit.		

SH2.0 mode – low band, antenna 1

SPURIOUS EMISSIONS LEVEL								
Lowest channel			Middle channel			Highest channel		
Frequency [MHZ]	Detector	Level [dBµV/m]	Frequency [MHZ]	Detector	Level [dBµV/m]	Frequency [MHZ]	Detector	Level [dBµV/m]
-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-
All detected spurious emissions are more than 20 dB below the limit.			-/-			All detected spurious emissions are more than 20 dB below the limit.		

SH2.0 mode – high band, antenna 1

SPURIOUS EMISSIONS LEVEL								
Lowest channel			Middle channel			Highest channel		
Frequency [MHZ]	Detector	Level [dBµV/m]	Frequency [MHZ]	Detector	Level [dBµV/m]	Frequency [MHZ]	Detector	Level [dBµV/m]
-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-
All detected spurious emissions are more than 20 dB below the limit.			-/-			All detected spurious emissions are more than 20 dB below the limit.		

Terestrial mode – high band, antenna 1

SPURIOUS EMISSIONS LEVEL								
Lowest channel			Middle channel			Highest channel		
Frequency [MHZ]	Detector	Level [dBµV/m]	Frequency [MHZ]	Detector	Level [dBµV/m]	Frequency [MHZ]	Detector	Level [dBµV/m]
-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-
All detected spurious emissions are more than 20 dB below the limit.			All detected spurious emissions are more than 20 dB below the limit.			All detected spurious emissions are more than 20 dB below the limit.		

Legacy mode – low band, antenna 2

SPURIOUS EMISSIONS LEVEL								
Lowest channel			Middle channel			Highest channel		
Frequency [MHZ]	Detector	Level [dBµV/m]	Frequency [MHZ]	Detector	Level [dBµV/m]	Frequency [MHZ]	Detector	Level [dBµV/m]
-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-
All detected spurious emissions are more than 20 dB below the limit.			-/-			All detected spurious emissions are more than 20 dB below the limit.		

Legacy mode – high band, antenna 2

SPURIOUS EMISSIONS LEVEL								
Lowest channel			Middle channel			Highest channel		
Frequency [MHZ]	Detector	Level [dBµV/m]	Frequency [MHZ]	Detector	Level [dBµV/m]	Frequency [MHZ]	Detector	Level [dBµV/m]
1382.5	RMS	50.2	-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-
-/-			-/-			All detected spurious emissions are more than 20 dB below the limit.		

SH2.0 mode – low band, antenna 2

SPURIOUS EMISSIONS LEVEL								
Lowest channel			Middle channel			Highest channel		
Frequency [MHZ]	Detector	Level [dBµV/m]	Frequency [MHZ]	Detector	Level [dBµV/m]	Frequency [MHZ]	Detector	Level [dBµV/m]
-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-
All detected spurious emissions are more than 20 dB below the limit.			-/-			All detected spurious emissions are more than 20 dB below the limit.		

SH2.0 mode – high band, antenna 2

SPURIOUS EMISSIONS LEVEL								
Lowest channel			Middle channel			Highest channel		
Frequency [MHZ]	Detector	Level [dBµV/m]	Frequency [MHZ]	Detector	Level [dBµV/m]	Frequency [MHZ]	Detector	Level [dBµV/m]
-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-
All detected spurious emissions are more than 20 dB below the limit.			-/-			All detected spurious emissions are more than 20 dB below the limit.		

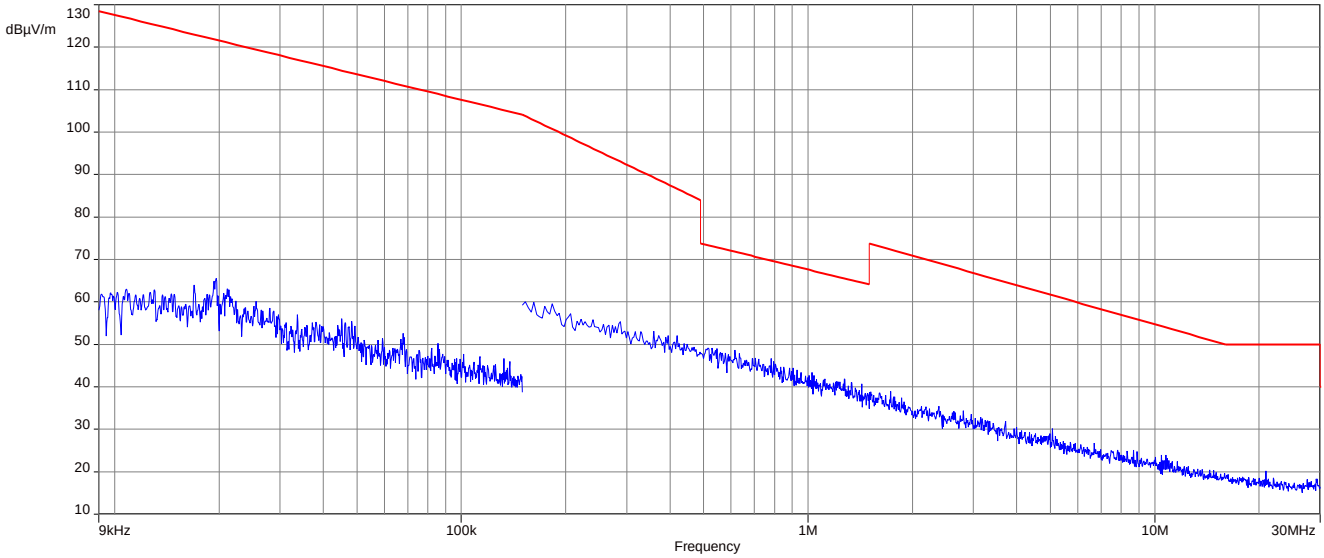
Terestrial mode – high band, antenna 2

SPURIOUS EMISSIONS LEVEL								
Lowest channel			Middle channel			Highest channel		
Frequency [MHZ]	Detector	Level [dBµV/m]	Frequency [MHZ]	Detector	Level [dBµV/m]	Frequency [MHZ]	Detector	Level [dBµV/m]
-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-	-/-
All detected spurious emissions are more than 20 dB below the limit.			All detected spurious emissions are more than 20 dB below the limit.			All detected spurious emissions are more than 20 dB below the limit.		

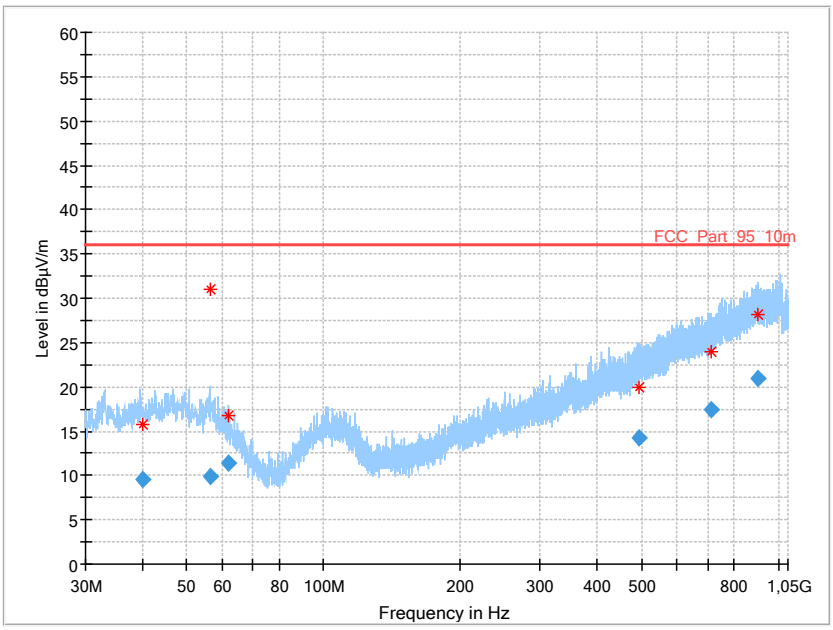
Plots: antenna 1

Legacy mode – low band

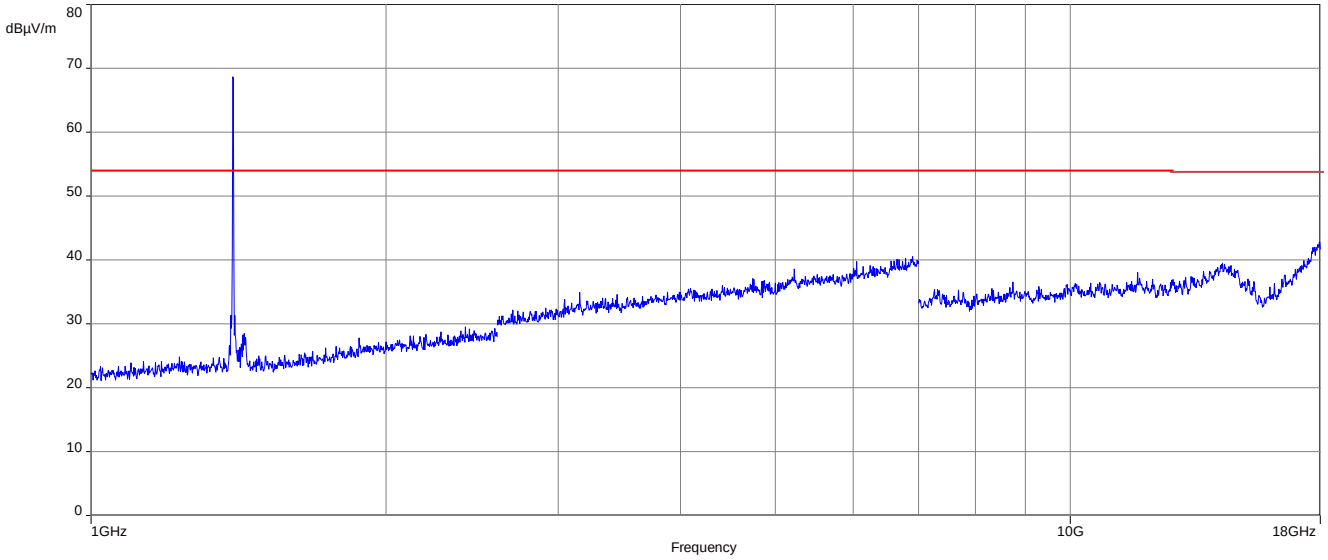
Plot 1: 9 kHz – 30 MHz, low channel



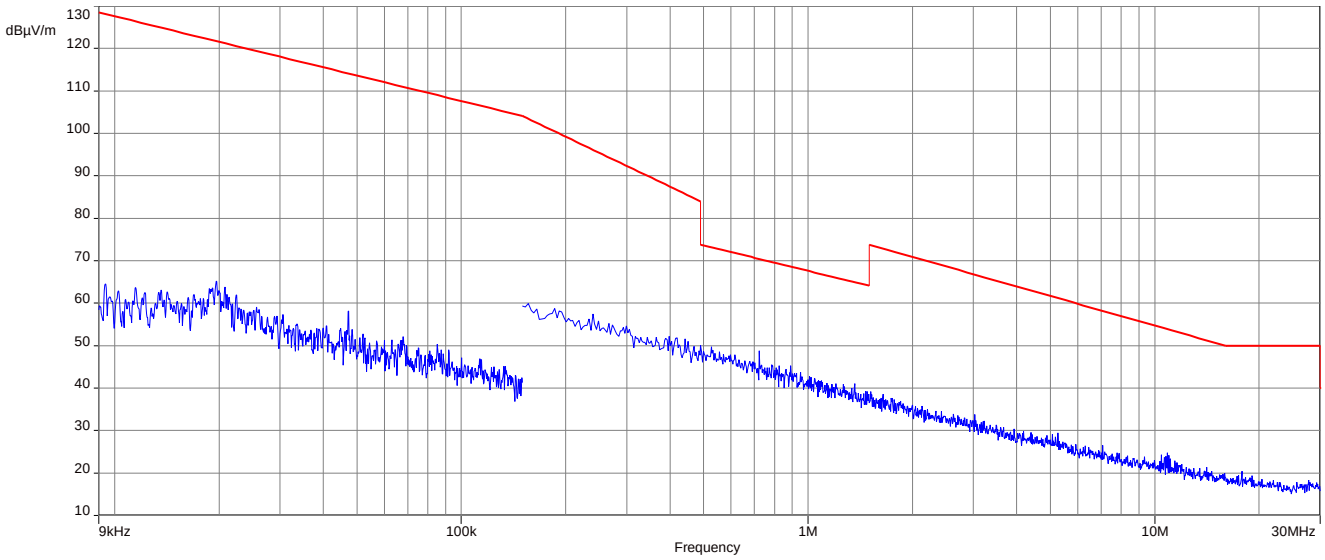
Plot 2: 30 MHz – 1 GHz, low channel



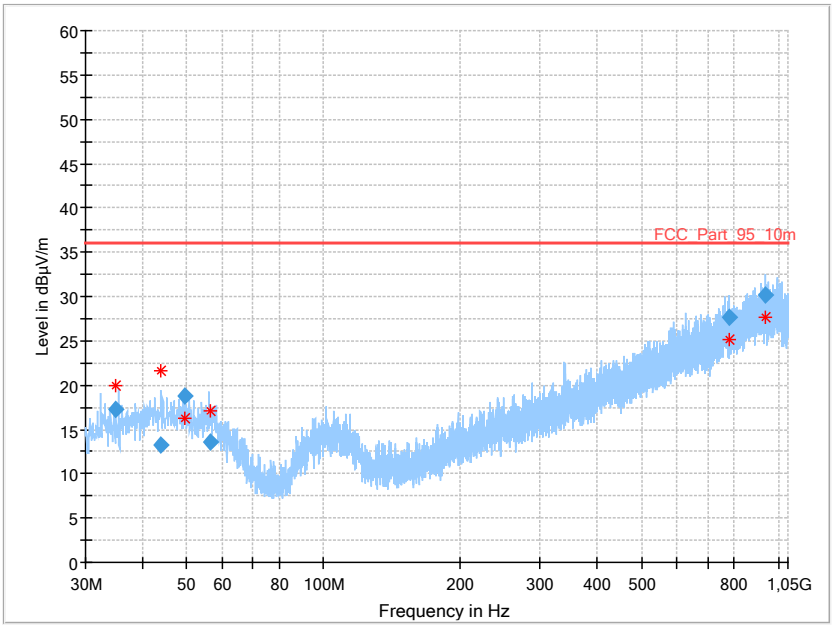
Plot 3: 1 GHz – 18 GHz, low channel, antenna horizontal/vertical



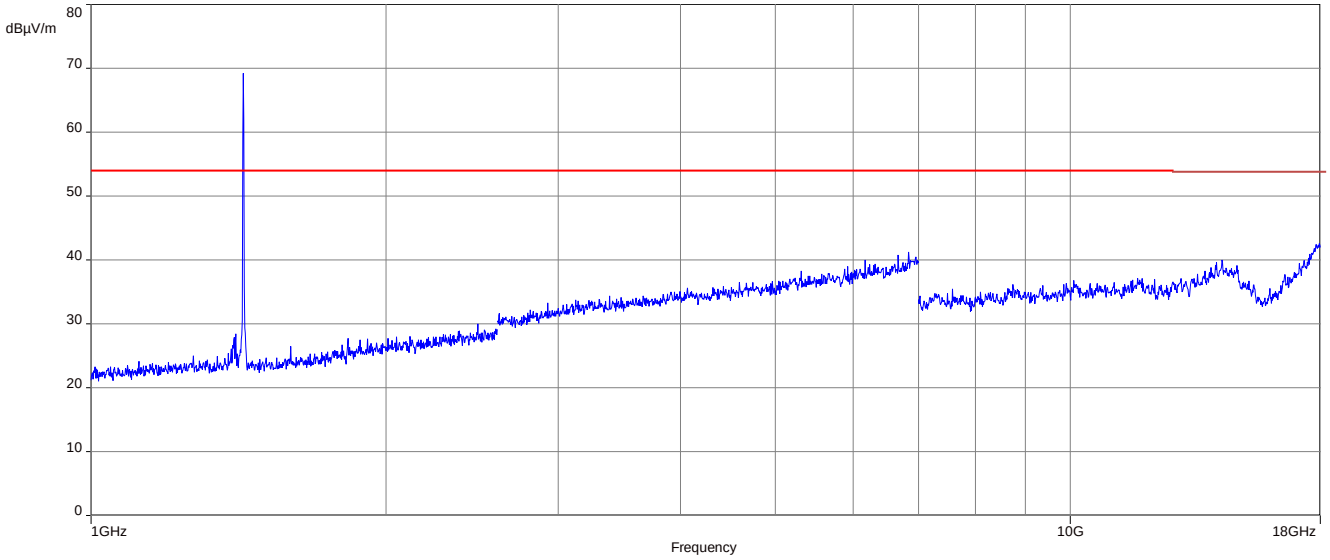
Plot 4: 9 kHz – 30 MHz, high channel



Plot 5: 30 MHz – 1 GHz, high channel

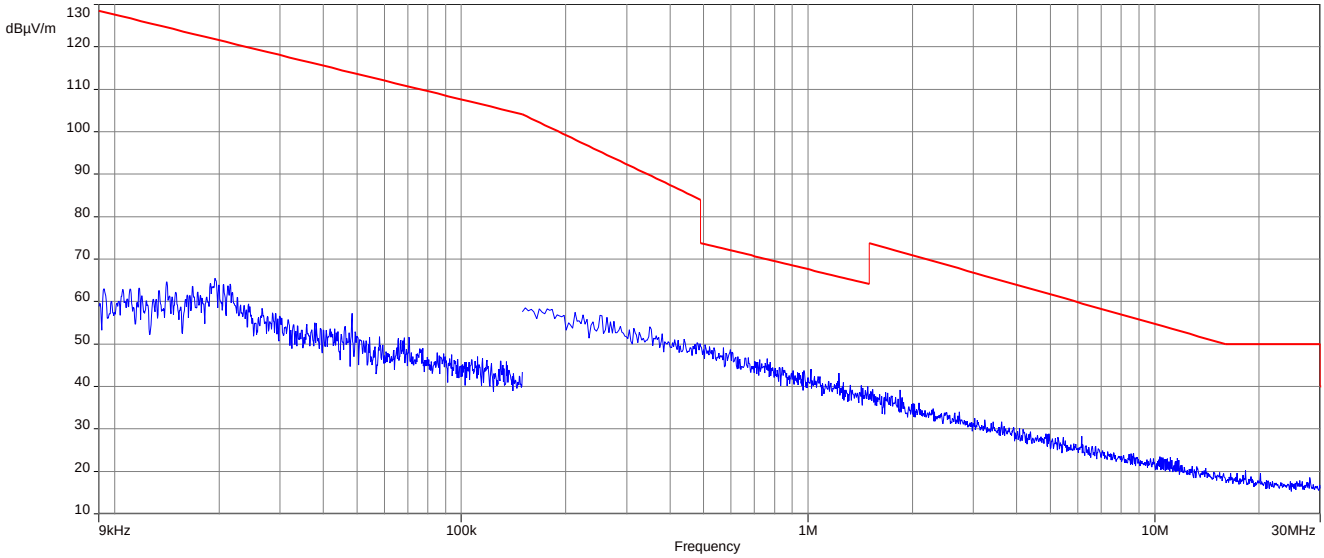


Plot 6: 1 GHz – 18 GHz, high channel, antenna horizontal/vertical

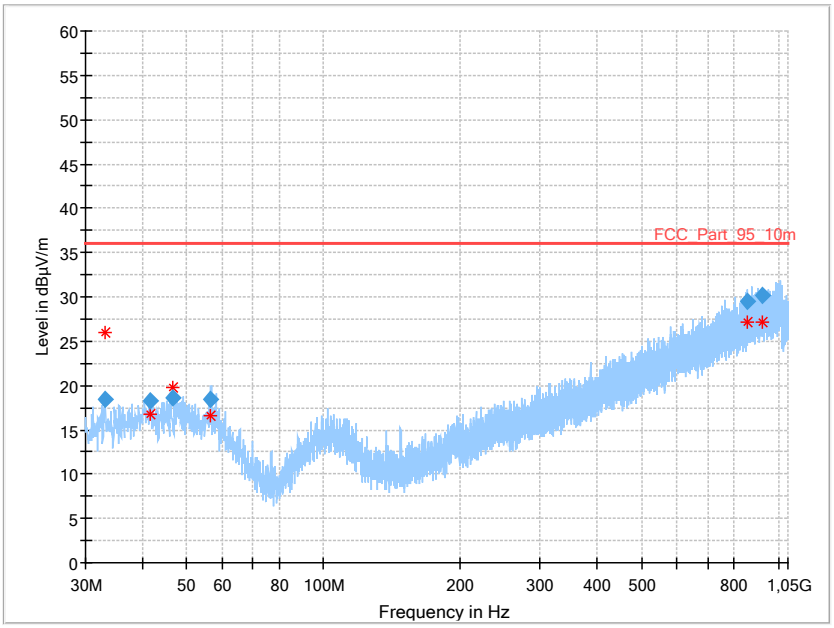


Legacy mode – high band

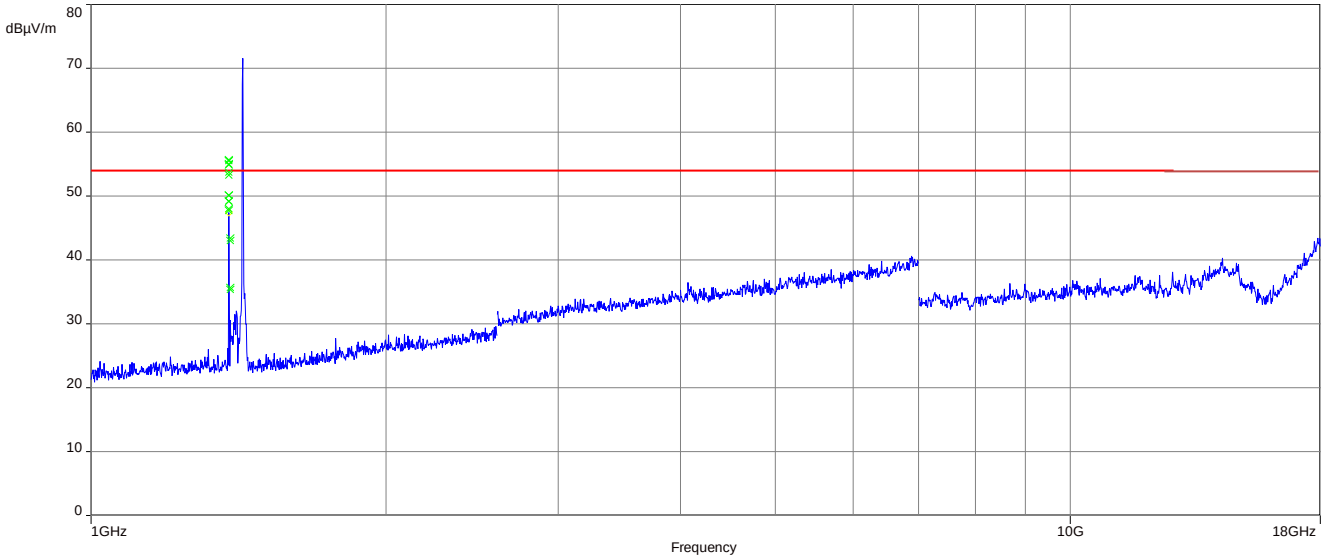
Plot 1: 9 kHz – 30 MHz, low channel



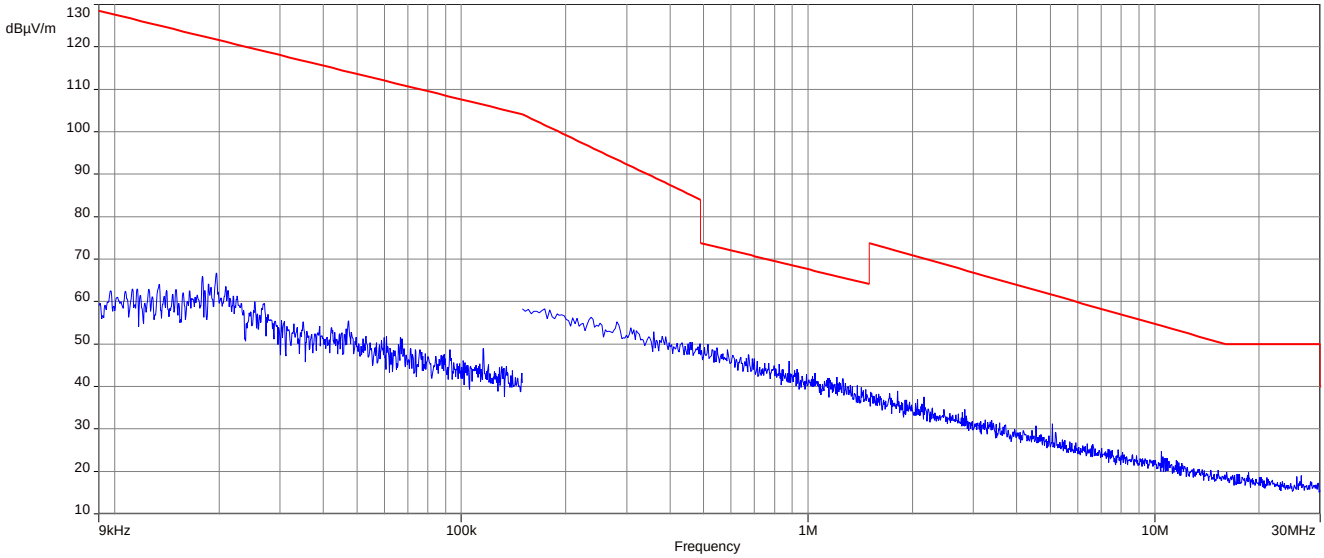
Plot 2: 30 MHz – 1 GHz, low channel



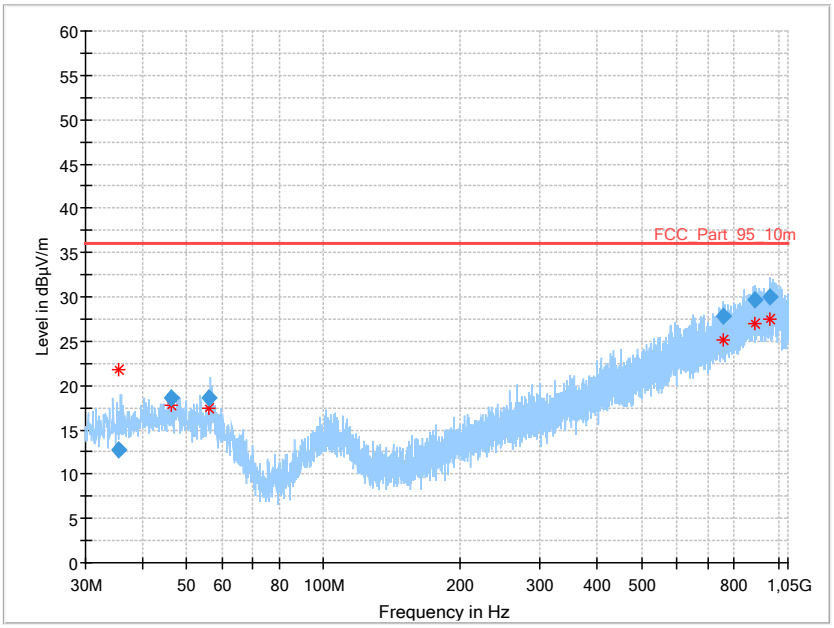
Plot 3: 1 GHz – 18 GHz, low channel, antenna horizontal/vertical



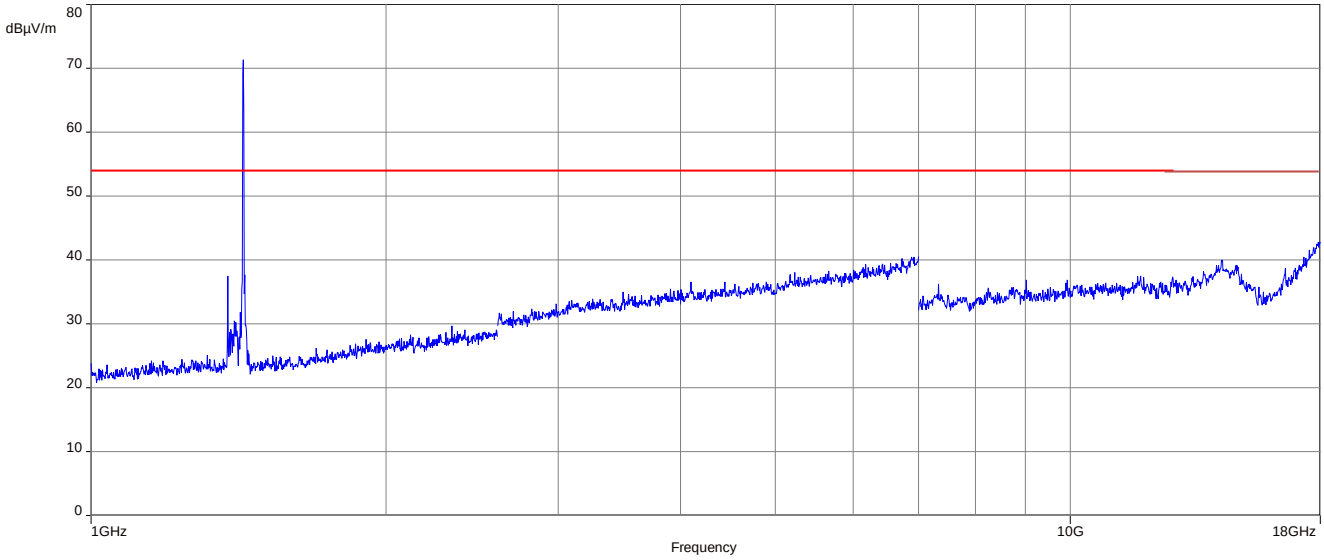
Plot 4: 9 kHz – 30 MHz, high channel



Plot 5: 30 MHz – 1 GHz, high channel

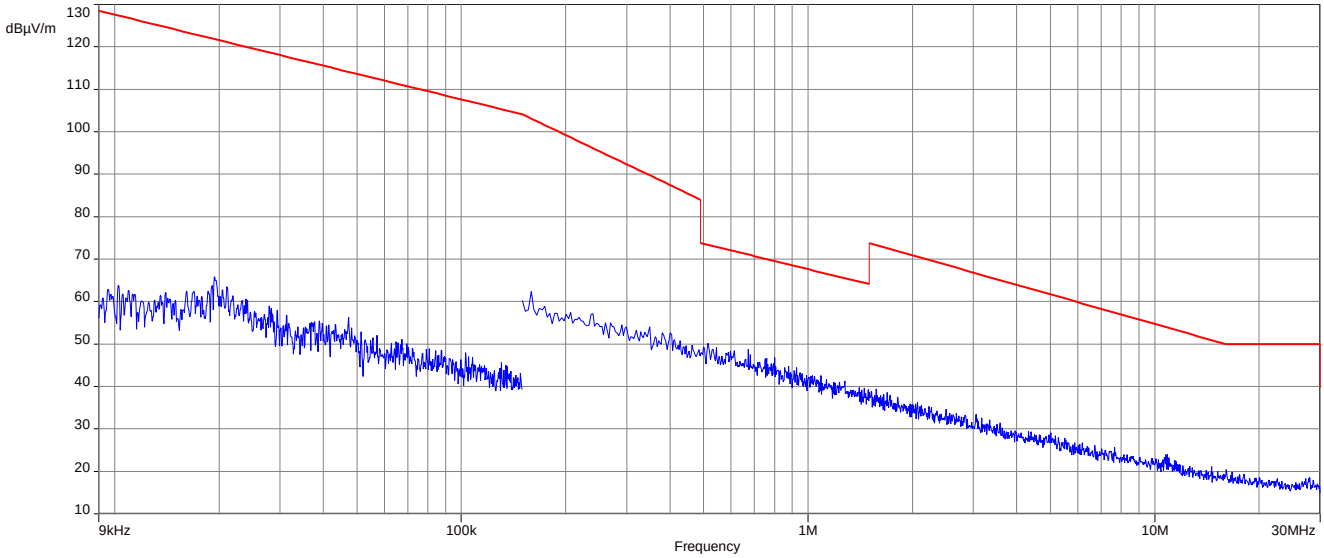


Plot 6: 1 GHz – 18 GHz, high channel, antenna horizontal/vertical

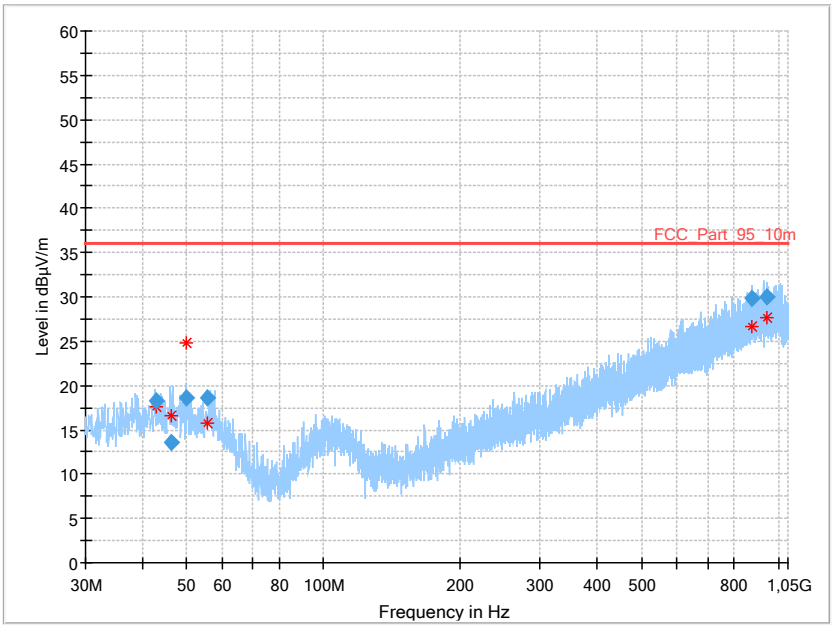


SH2.0 mode – low band

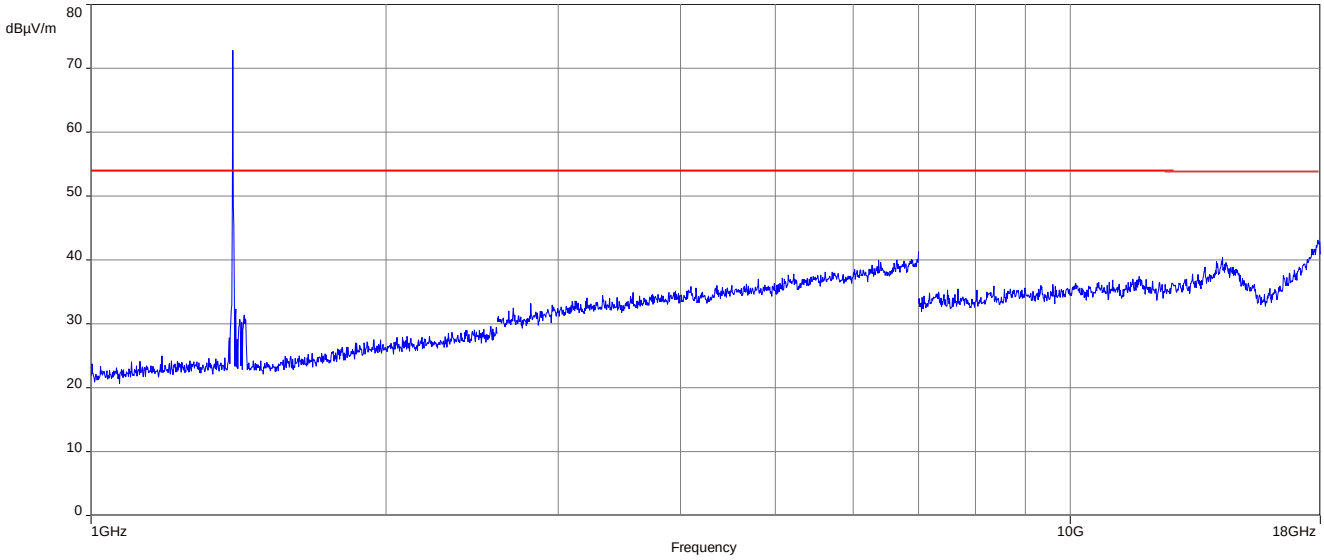
Plot 1: 9 kHz – 30 MHz, low channel



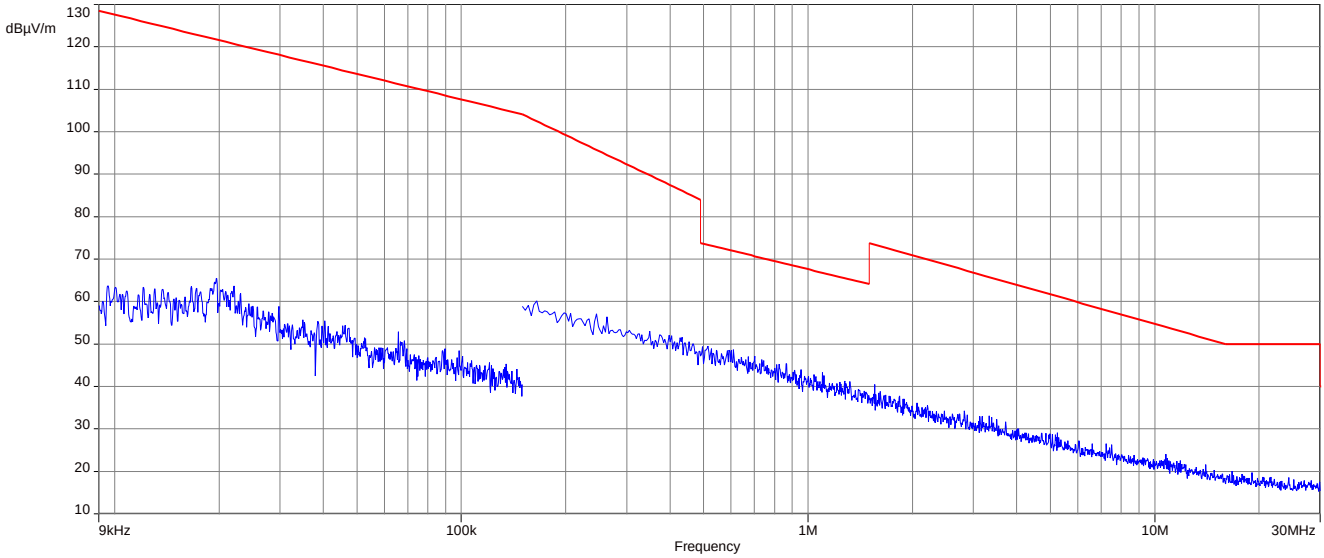
Plot 2: 30 MHz – 1 GHz, low channel



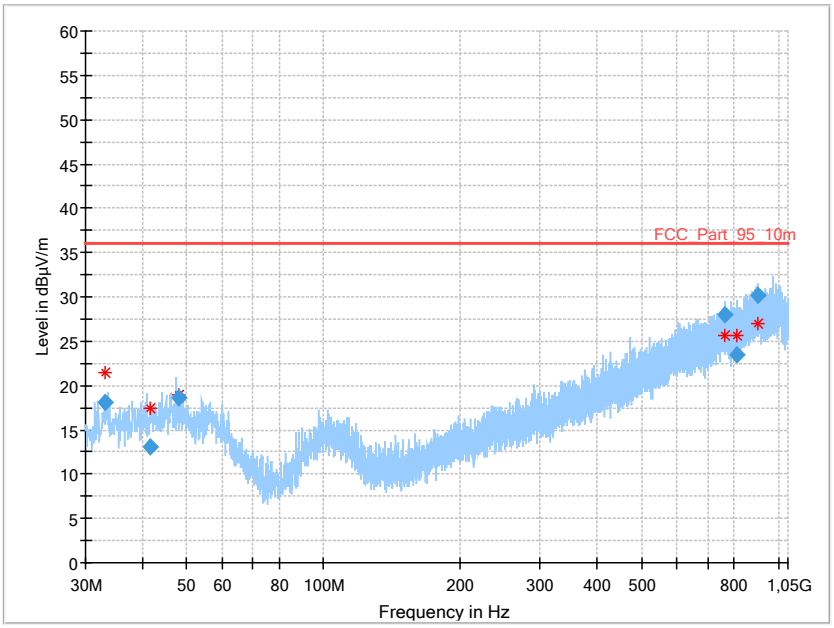
Plot 3: 1 GHz – 18 GHz, low channel, antenna horizontal/vertical



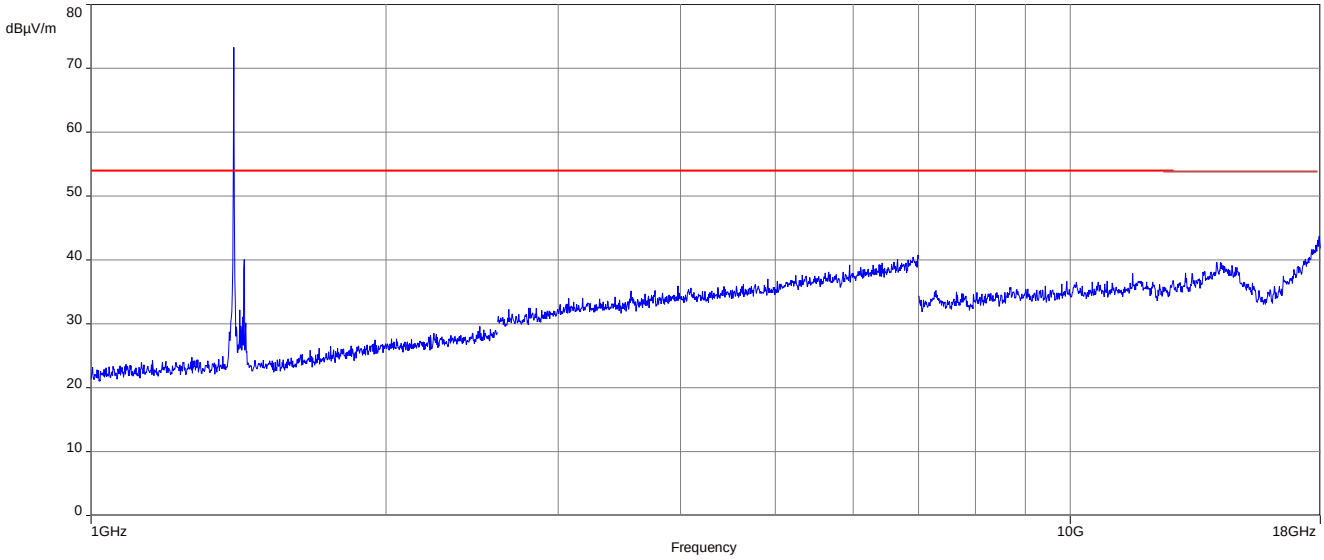
Plot 4: 9 kHz – 30 MHz, high channel



Plot 5: 30 MHz – 1 GHz, high channel

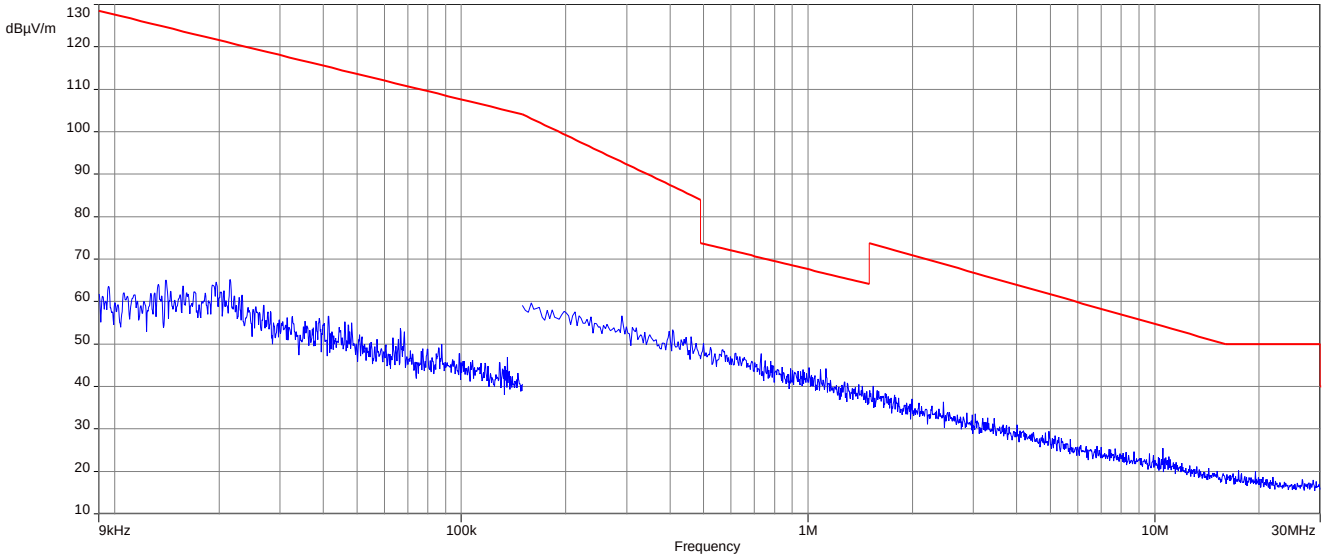


Plot 6: 1 GHz – 18 GHz, high channel, antenna horizontal/vertical

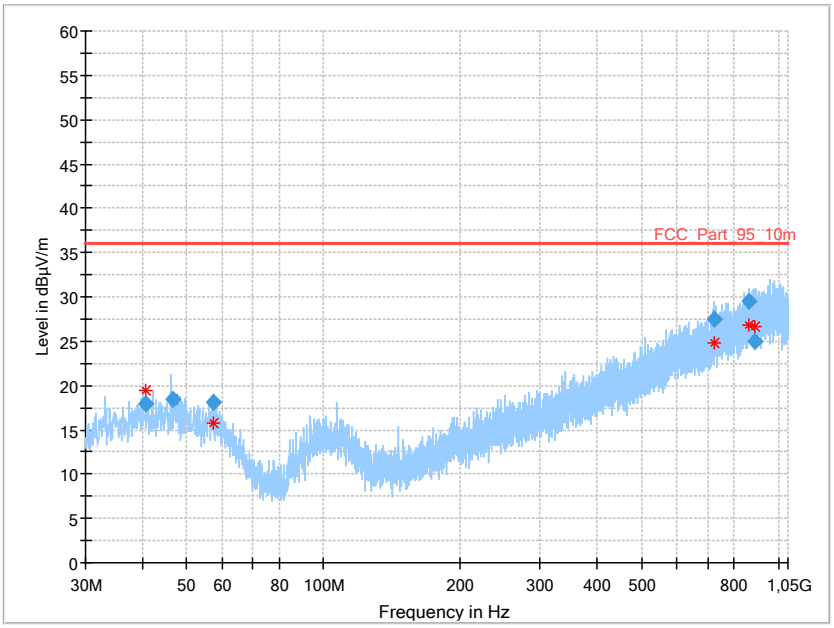


SH2.0 mode – high band

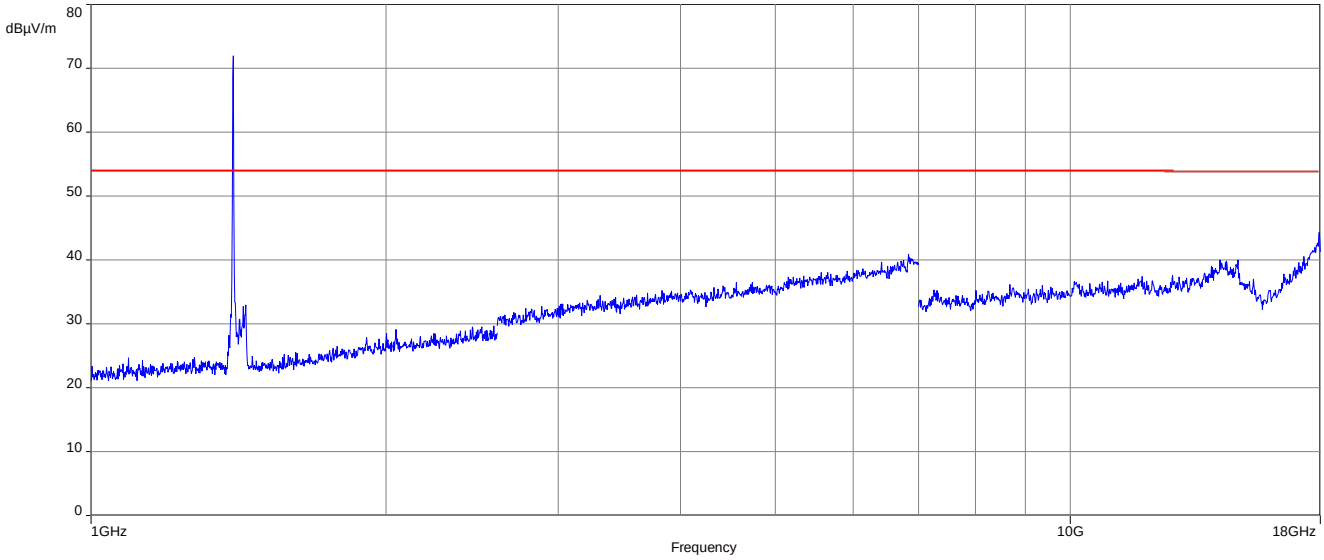
Plot 1: 9 kHz – 30 MHz, low channel



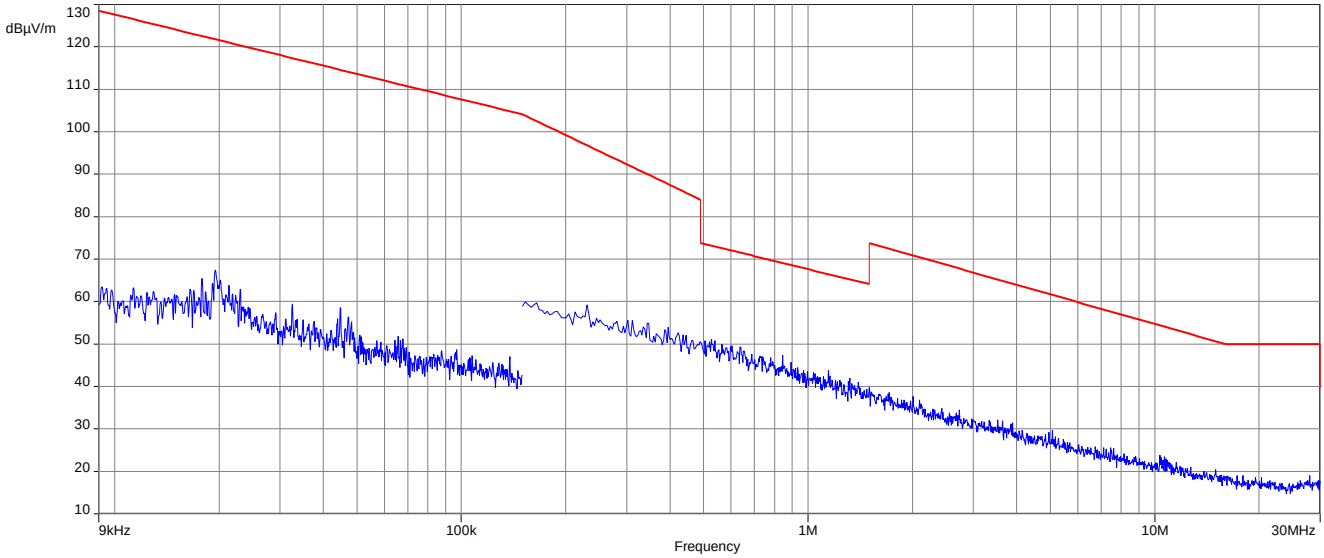
Plot 2: 30 MHz – 1 GHz, low channel



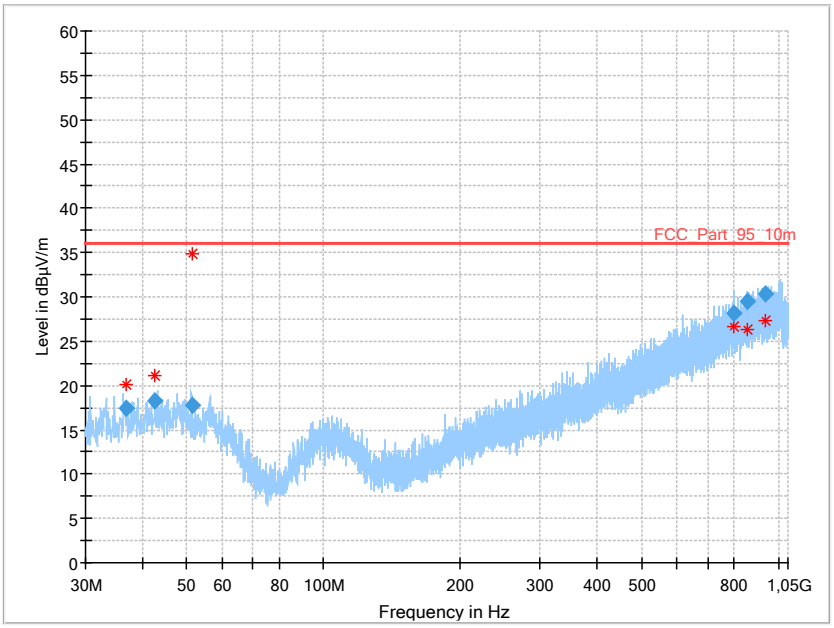
Plot 3: 1 GHz – 18 GHz, low channel, antenna horizontal/vertical



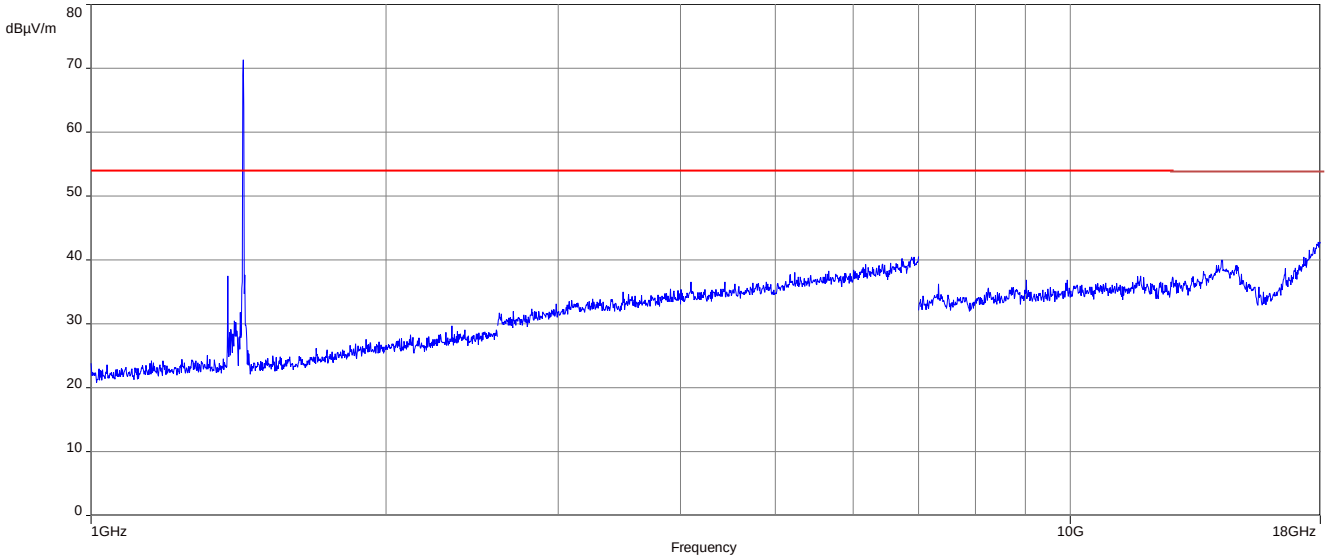
Plot 4: 9 kHz – 30 MHz, high channel



Plot 5: 30 MHz – 1 GHz, high channel

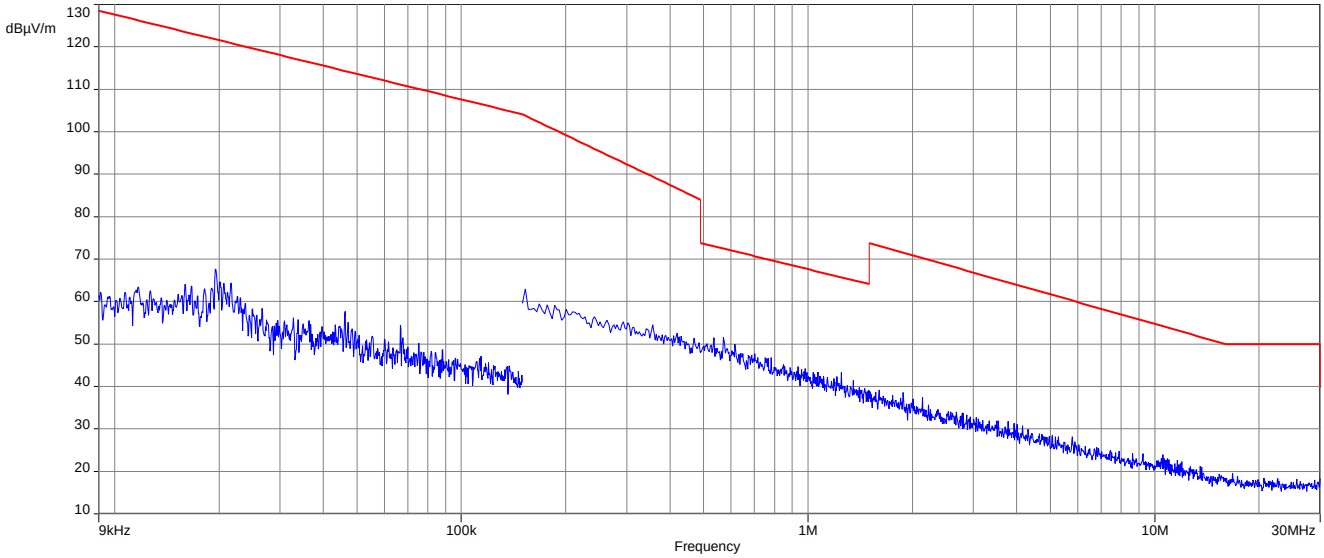


Plot 6: 1 GHz – 18 GHz, high channel, antenna horizontal/vertical

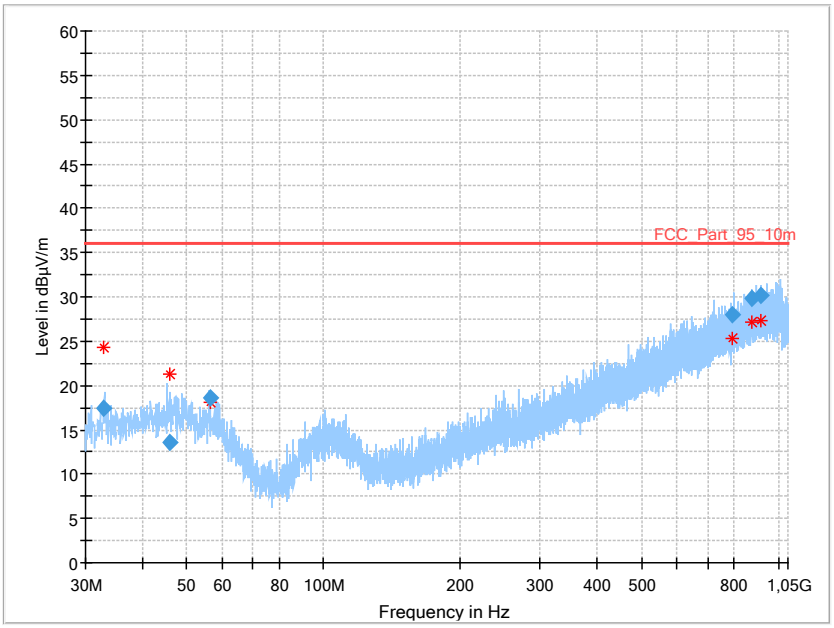


Terestrial mode

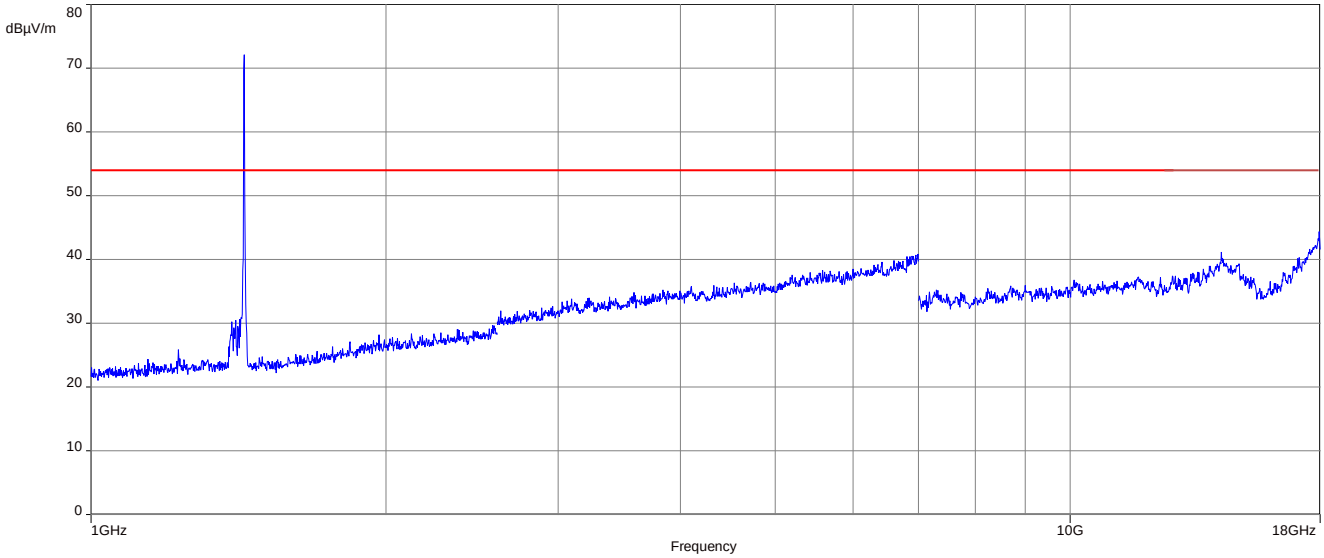
Plot 1: 9 kHz – 30 MHz



Plot 2: 30 MHz – 1 GHz



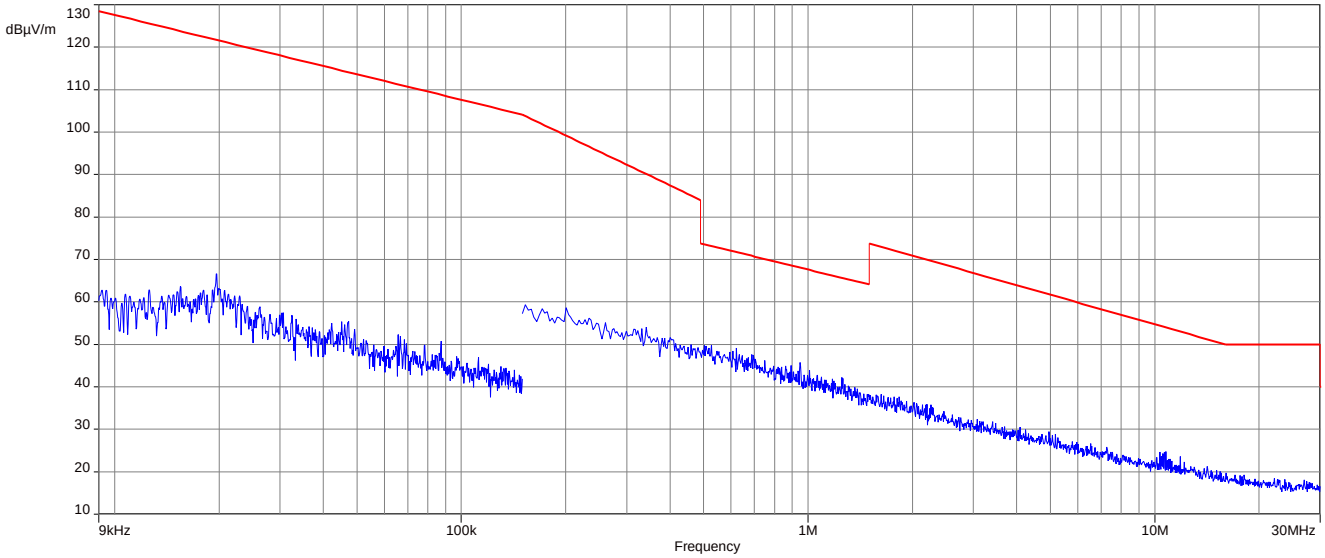
Plot 3: 1 GHz – 18 GHz, antenna horizontal/vertical



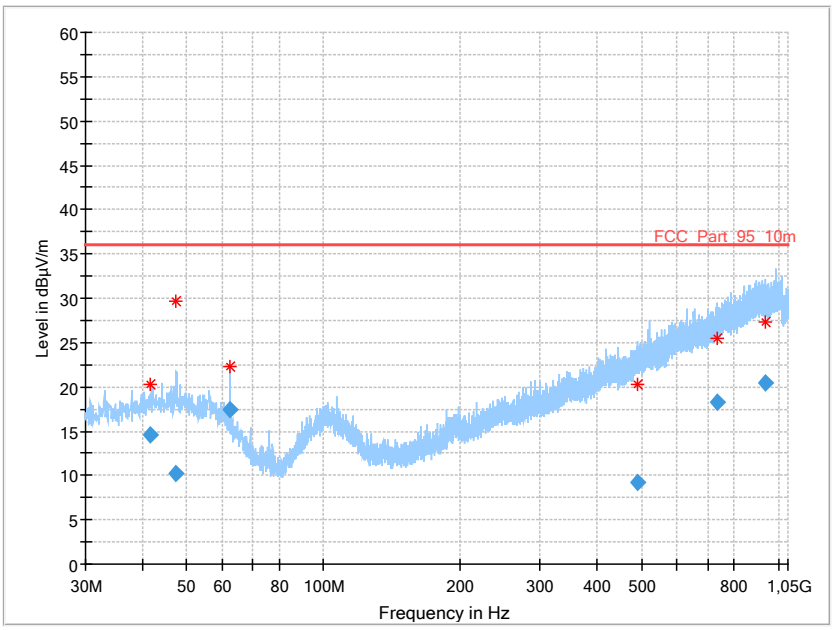
Plots: antenna 1

Legacy mode – low band

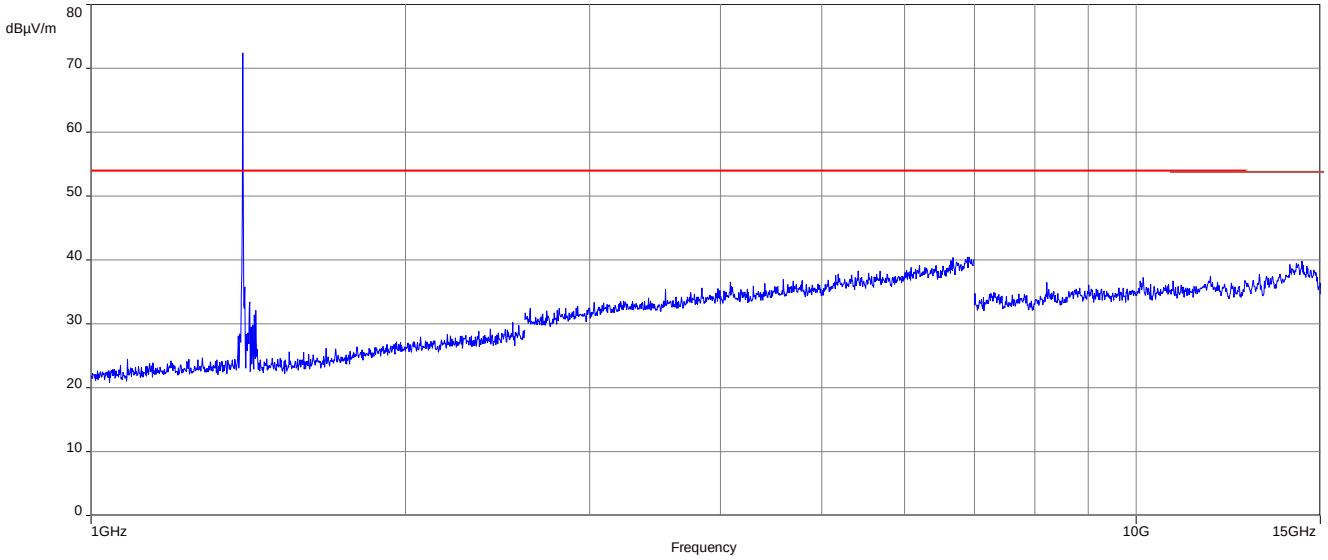
Plot 1: 9 kHz – 30 MHz, low channel



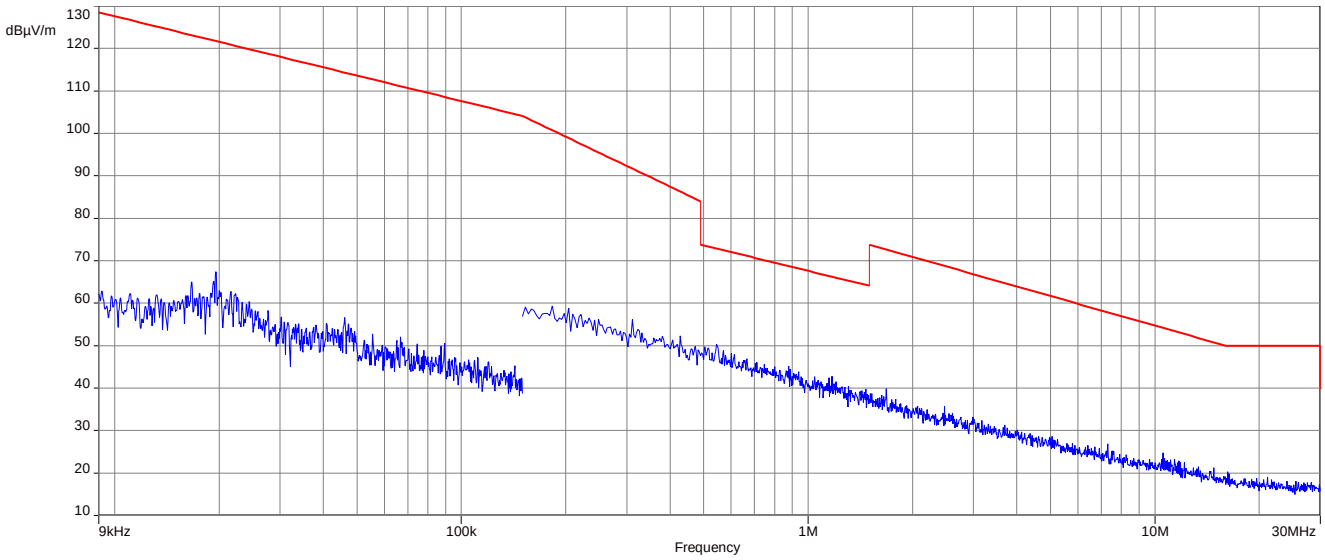
Plot 2: 30 MHz – 1 GHz, low channel



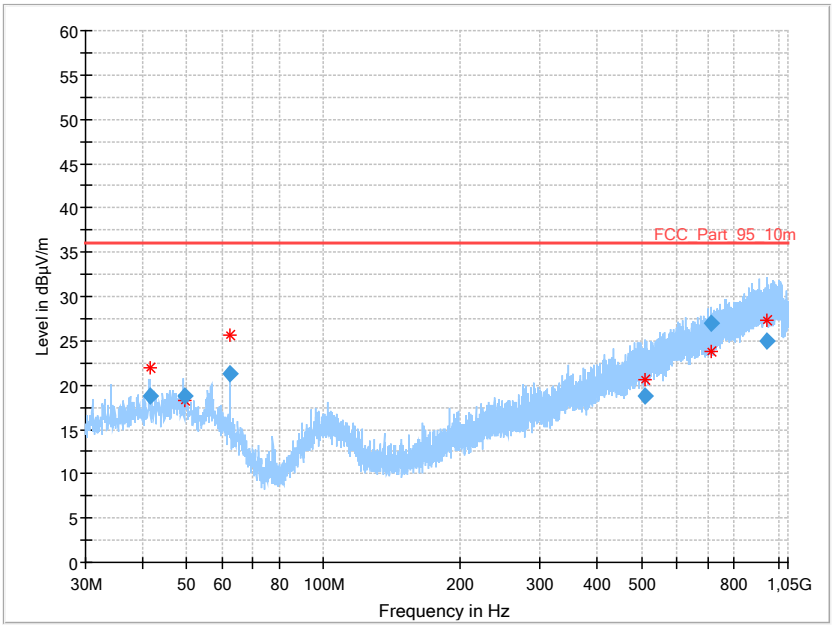
Plot 3: 1 GHz – 15 GHz, low channel, antenna horizontal/vertical



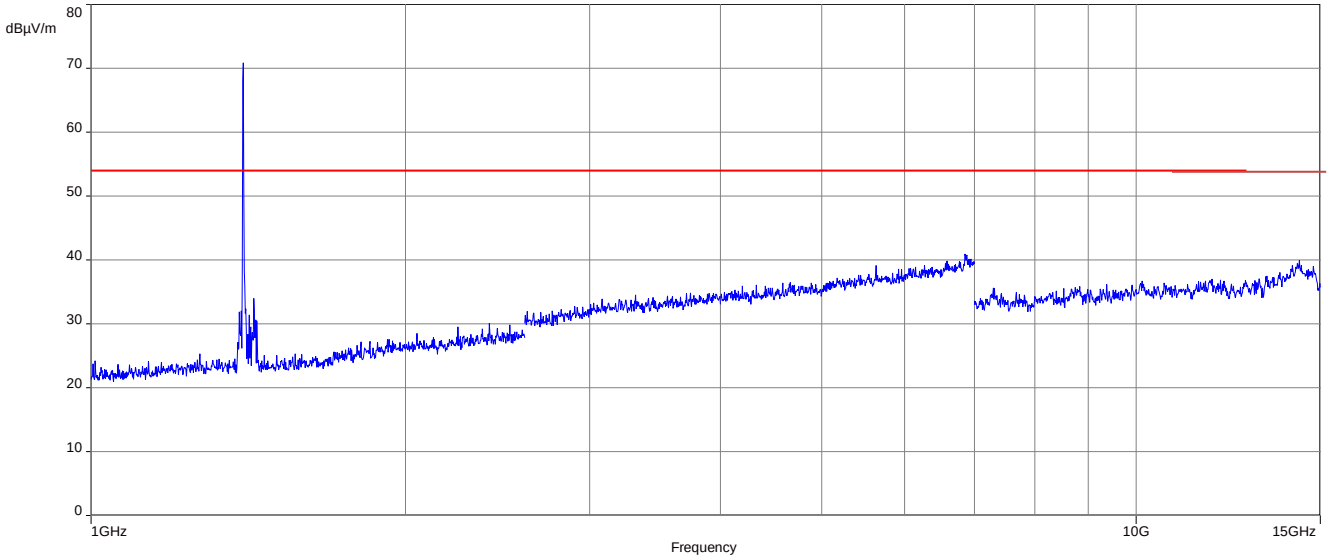
Plot 4: 9 kHz – 30 MHz, high channel



Plot 5: 30 MHz – 1 GHz, high channel

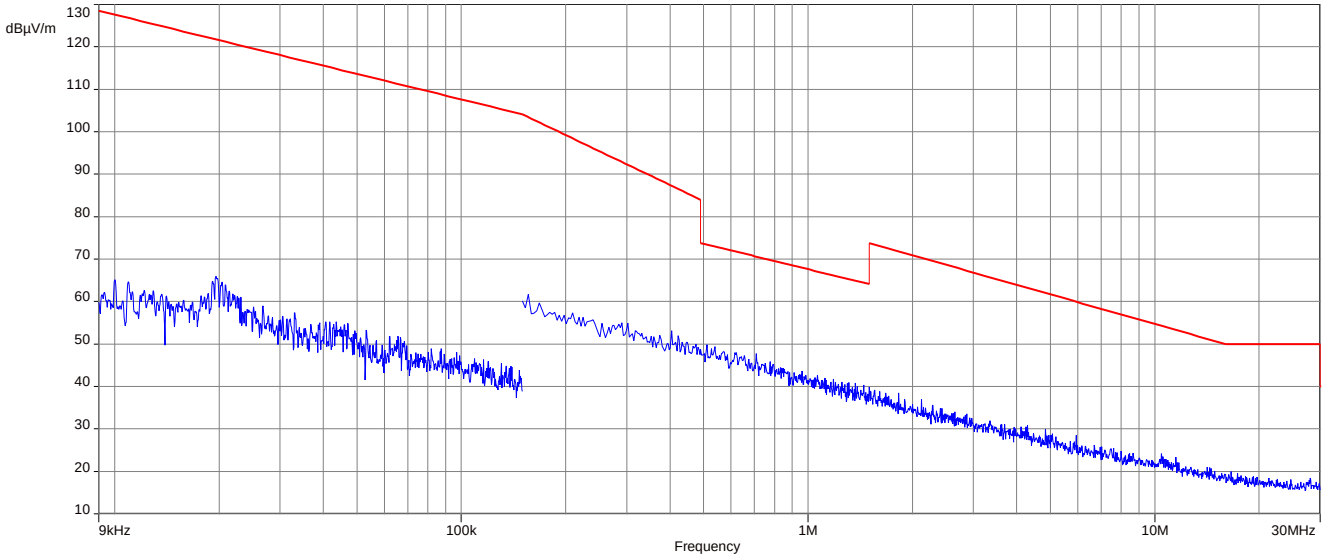


Plot 6: 1 GHz – 15 GHz, high channel, antenna horizontal/vertical

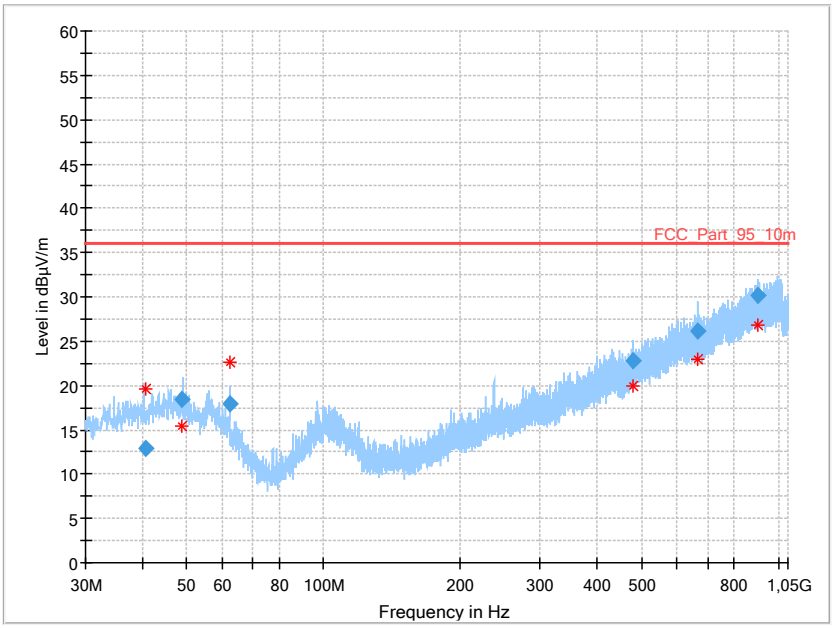


Legacy mode – high band

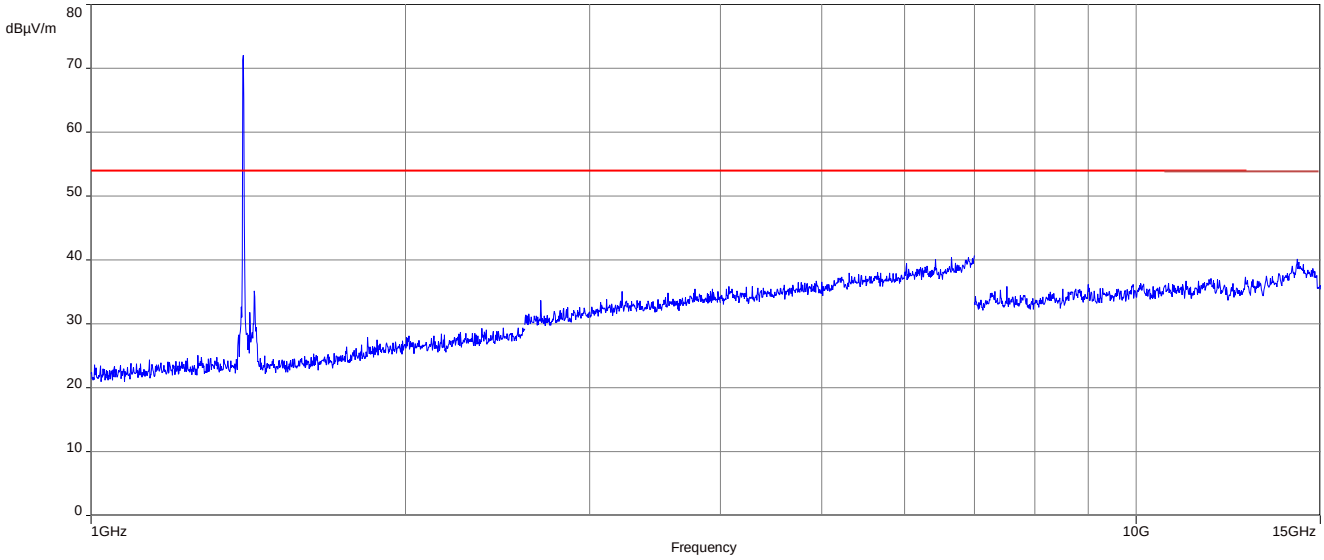
Plot 1: 9 kHz – 30 MHz, low channel



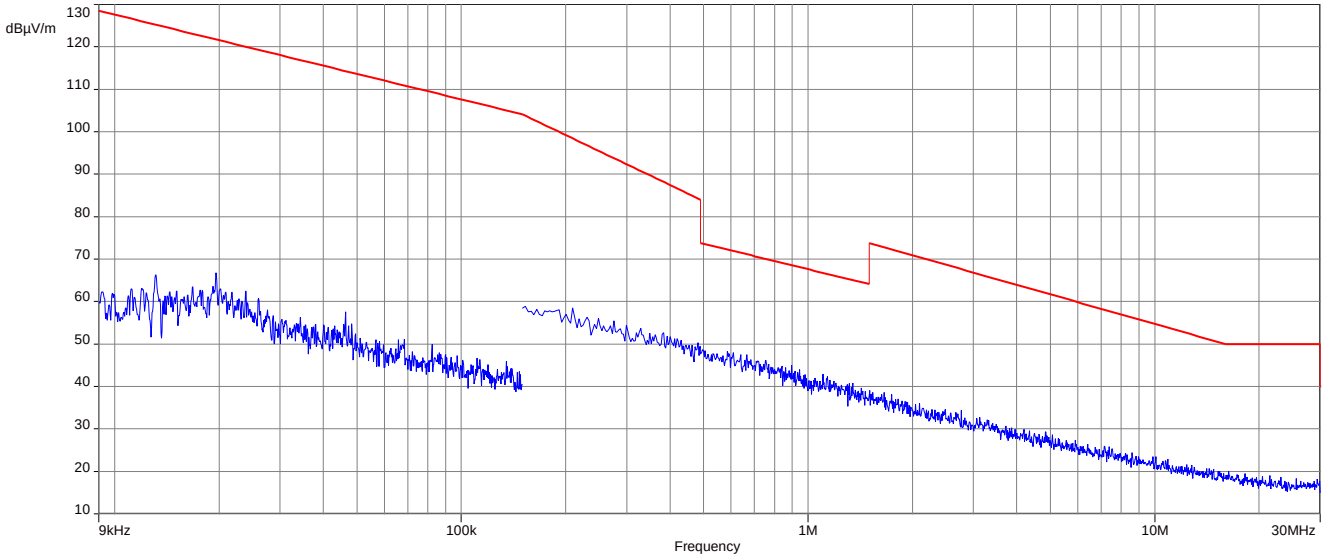
Plot 2: 30 MHz – 1 GHz, low channel



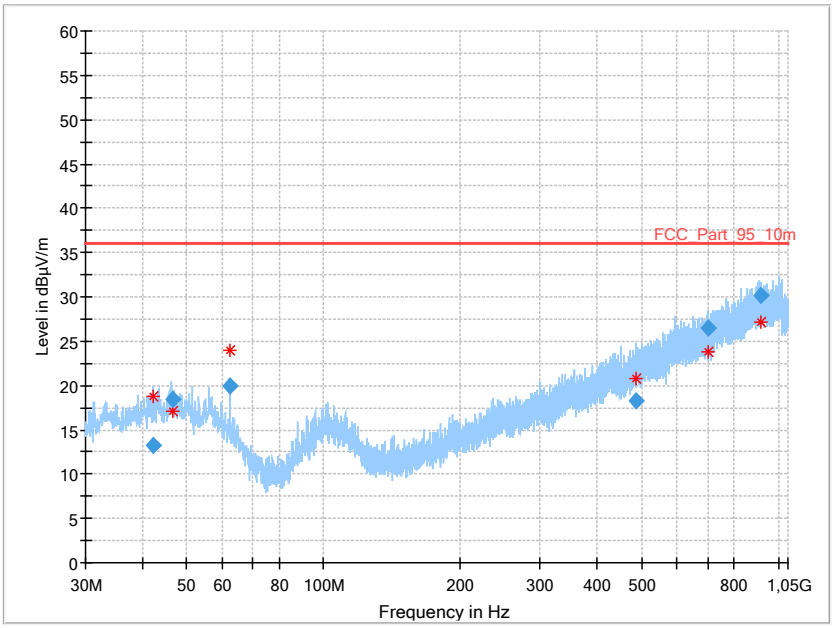
Plot 3: 1 GHz – 15 GHz, low channel, antenna horizontal/vertical



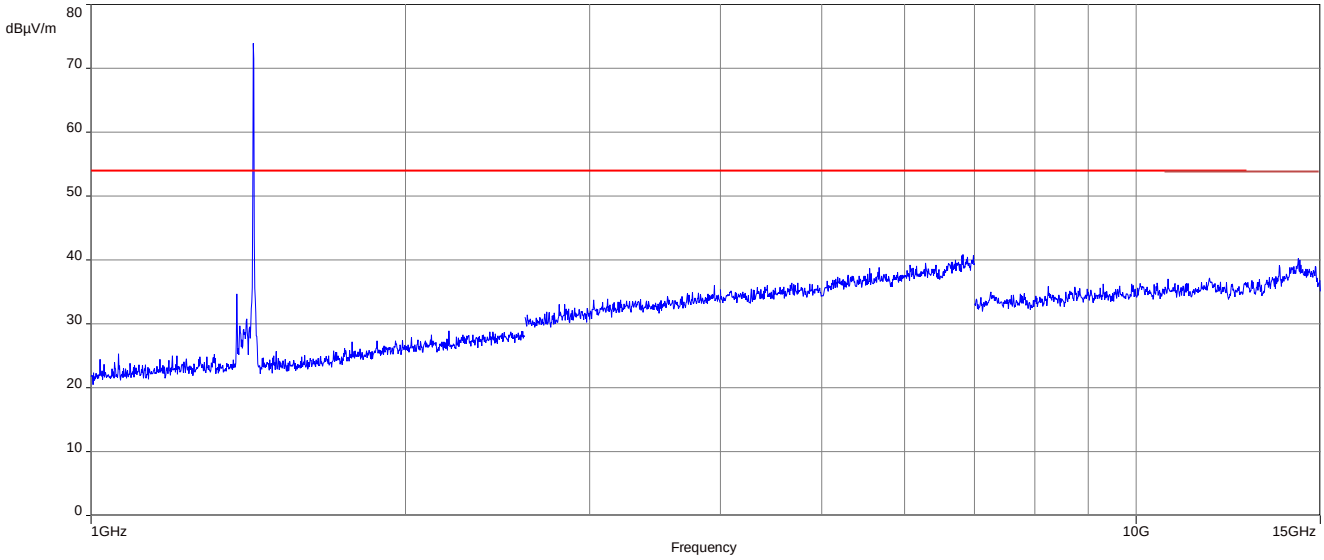
Plot 4: 9 kHz – 30 MHz, high channel



Plot 5: 30 MHz – 1 GHz, high channel

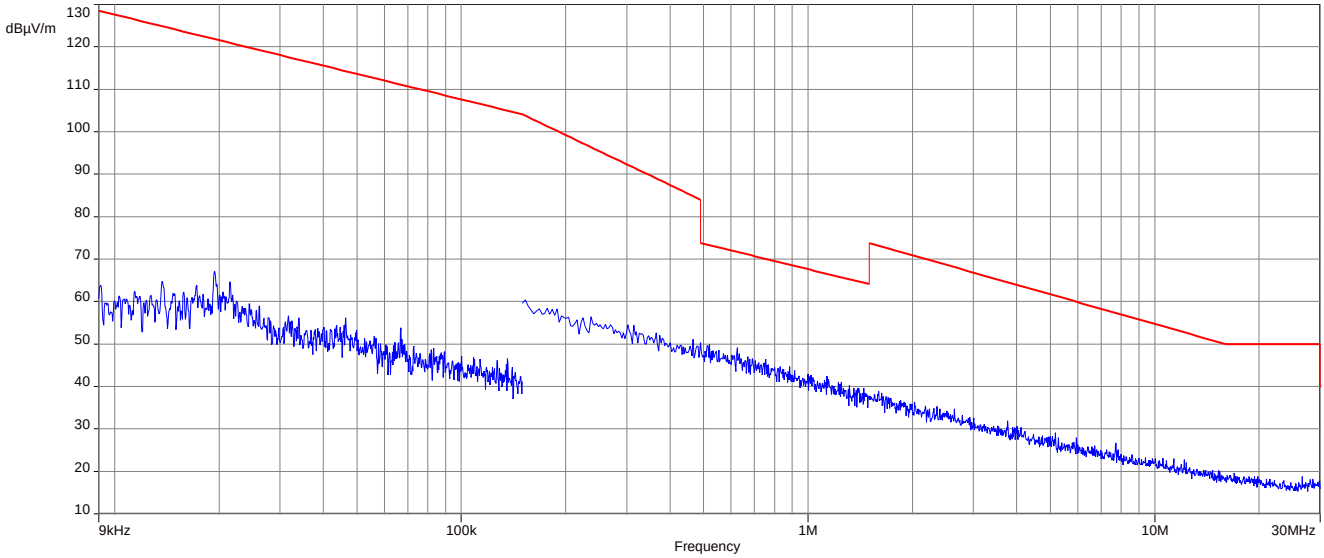


Plot 6: 1 GHz – 15 GHz, high channel, antenna horizontal/vertical

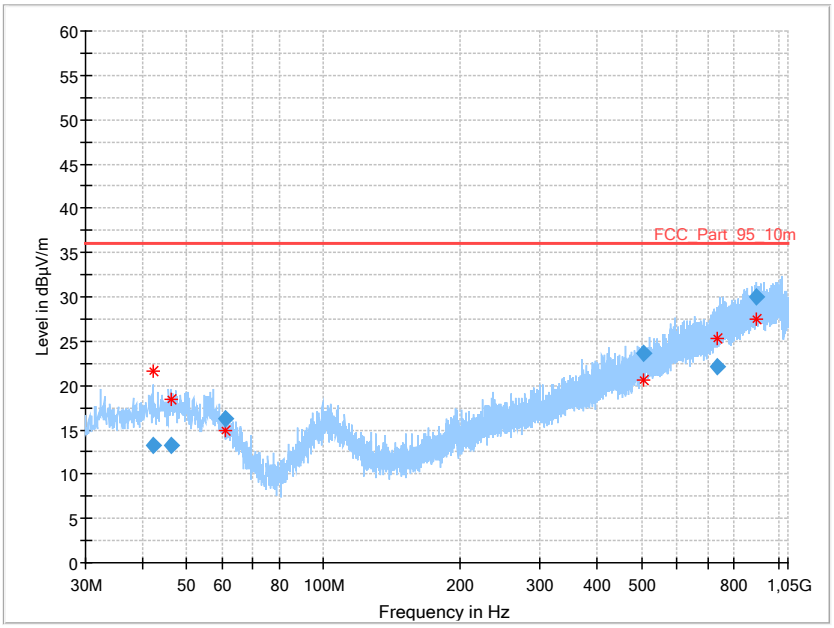


SH2.0 mode – low band

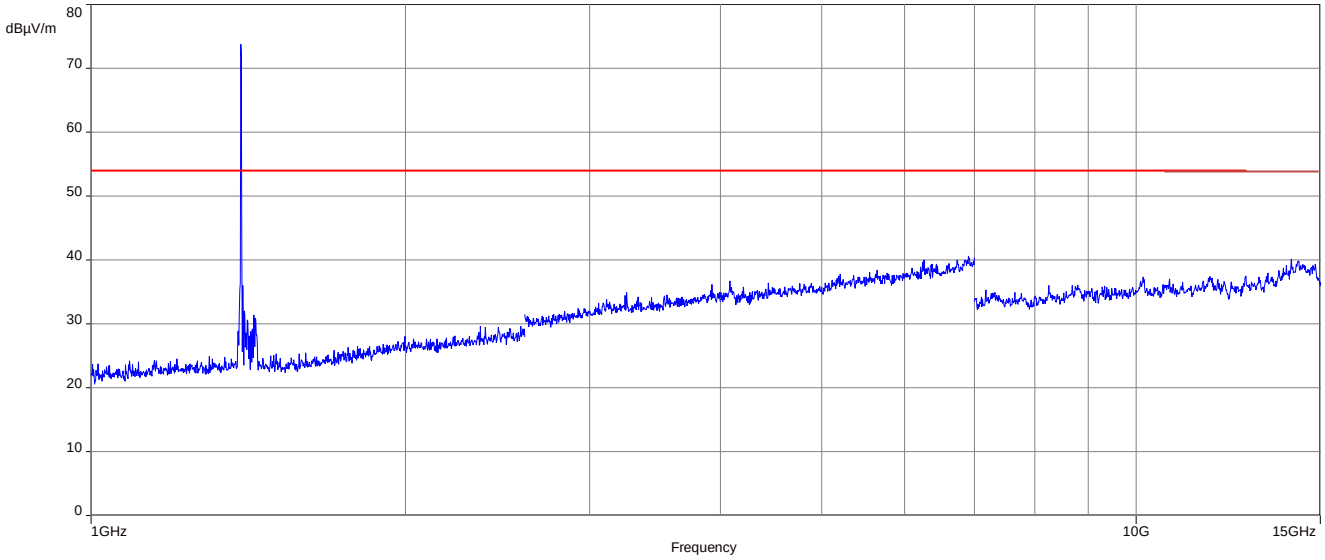
Plot 1: 9 kHz – 30 MHz, low channel



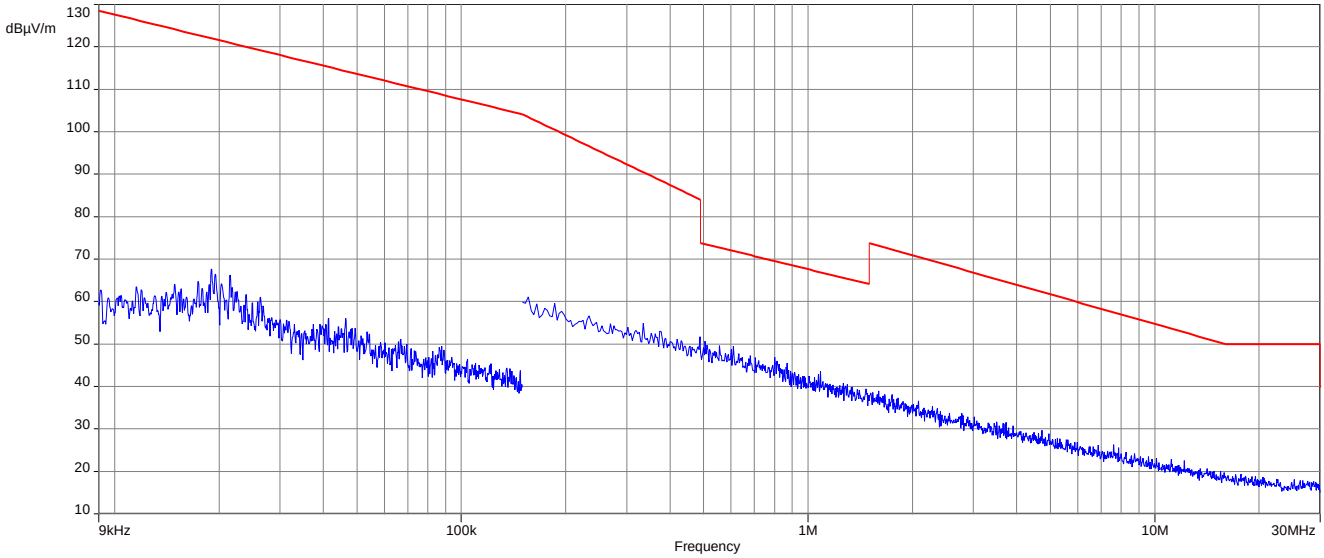
Plot 2: 30 MHz – 1 GHz, low channel



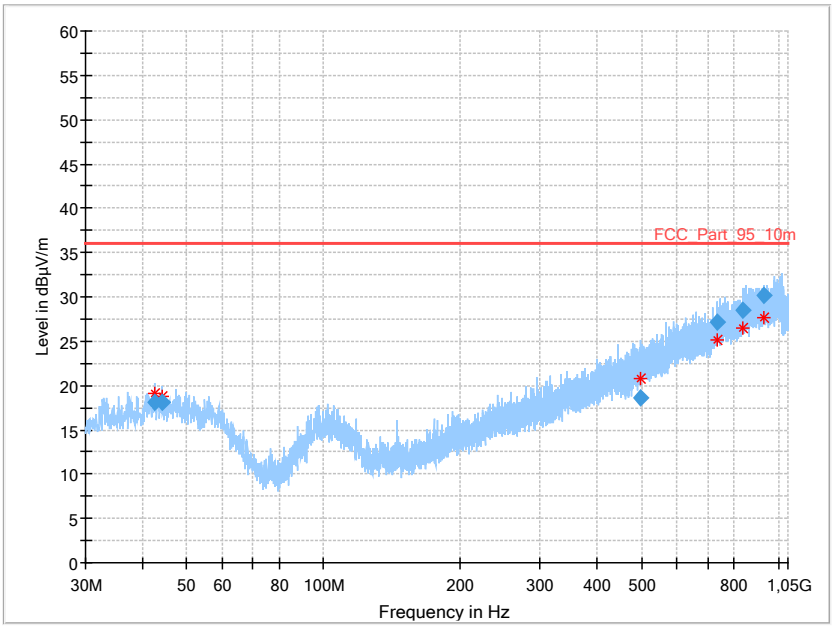
Plot 3: 1 GHz – 15 GHz, low channel, antenna horizontal/vertical



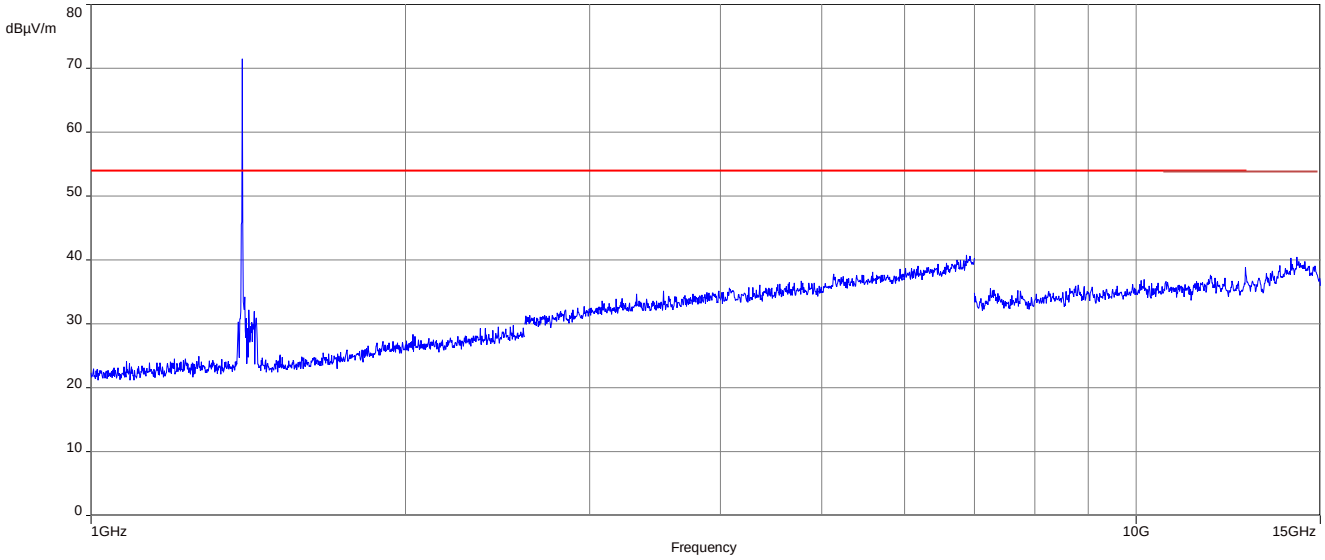
Plot 4: 9 kHz – 30 MHz, high channel



Plot 5: 30 MHz – 1 GHz, high channel

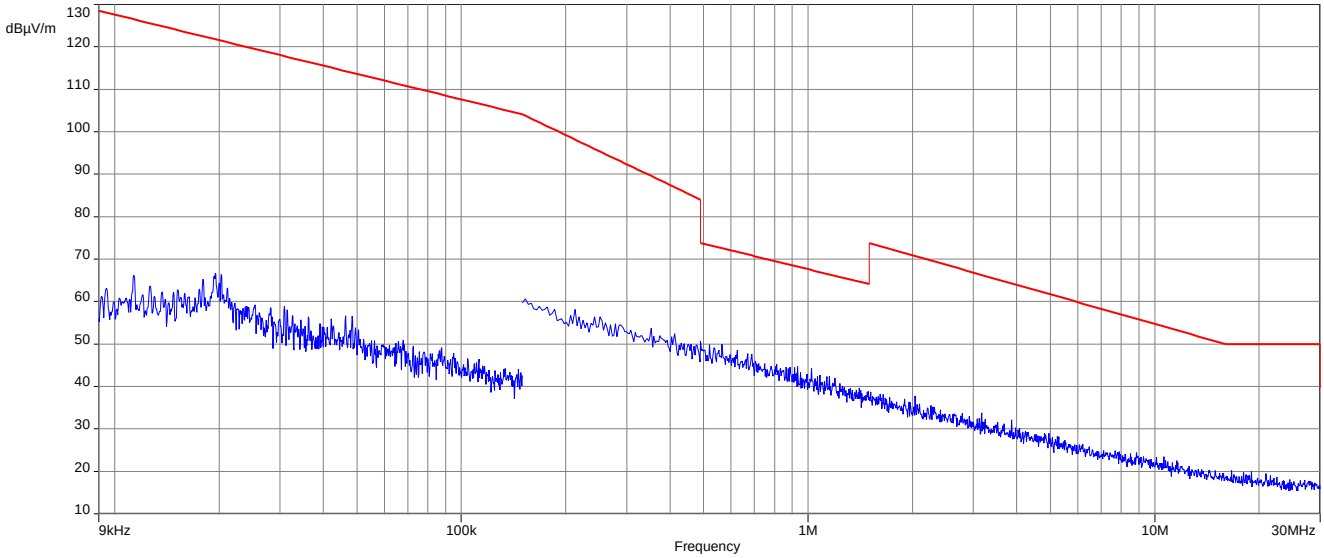


Plot 6: 1 GHz – 15 GHz, high channel, antenna horizontal/vertical

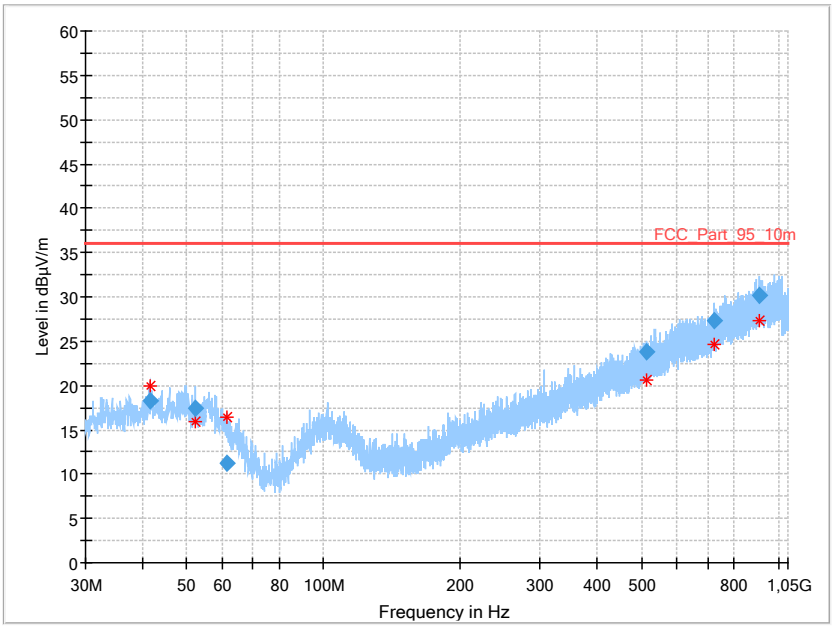


SH2.0 mode – high band

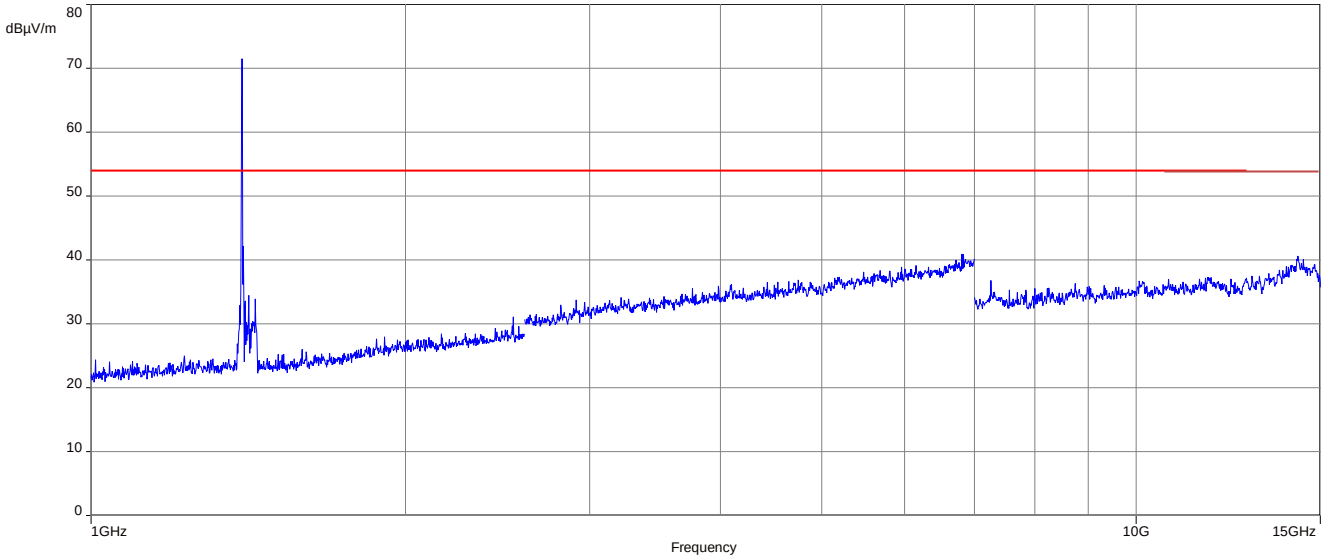
Plot 1: 9 kHz – 30 MHz, low channel



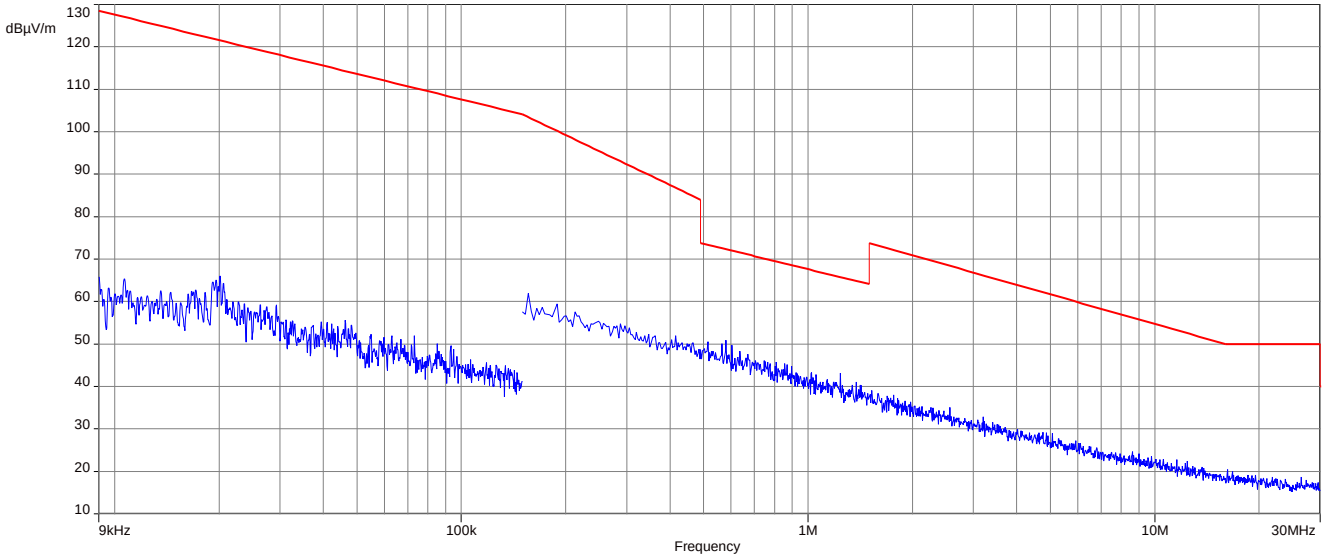
Plot 2: 30 MHz – 1 GHz, low channel



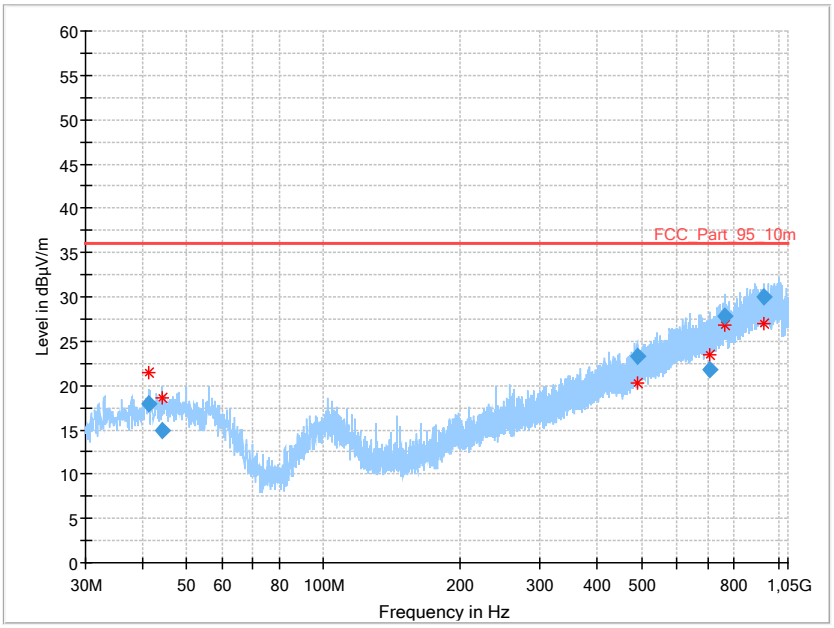
Plot 3: 1 GHz – 15 GHz, low channel, antenna horizontal/vertical



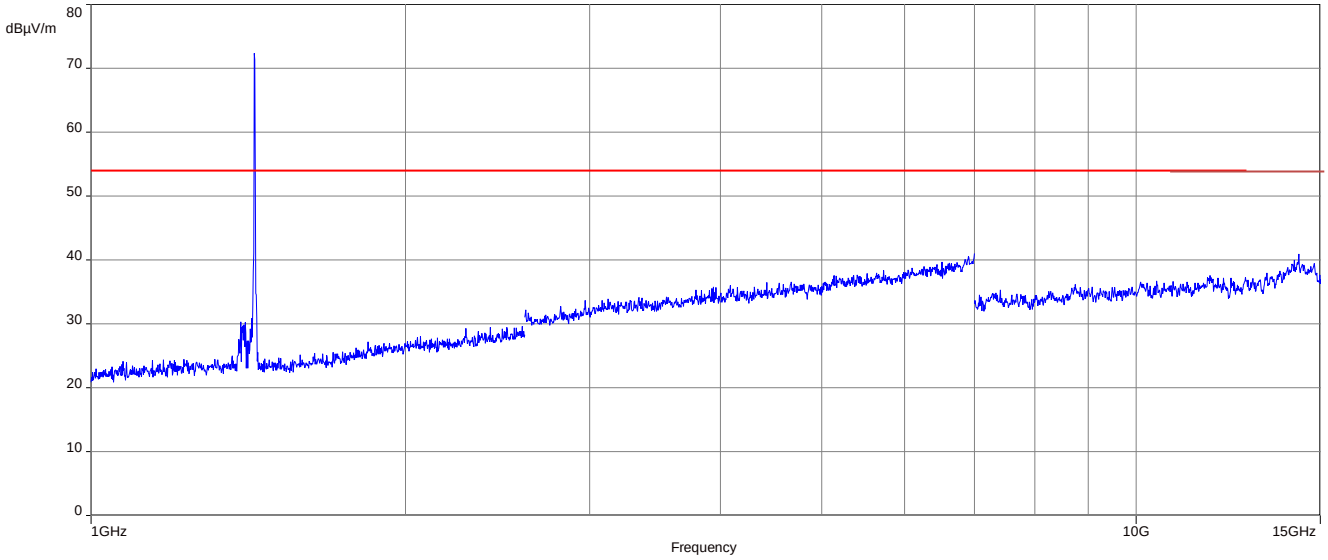
Plot 4: 9 kHz – 30 MHz, high channel



Plot 5: 30 MHz – 1 GHz, high channel

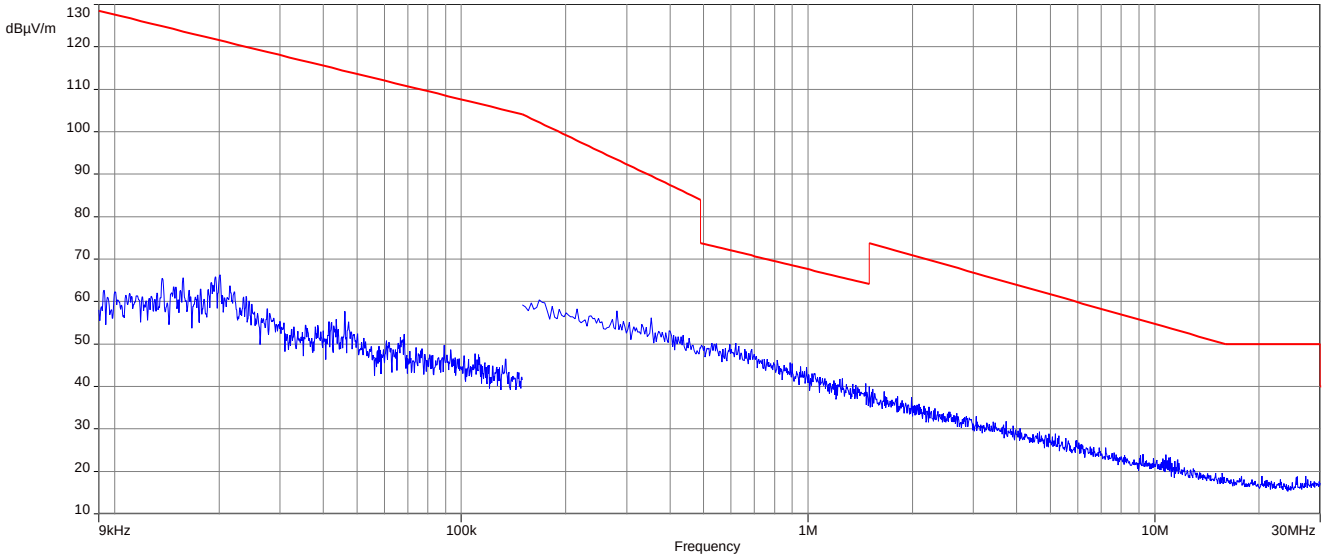


Plot 6: 1 GHz – 15 GHz, high channel, antenna horizontal/vertical

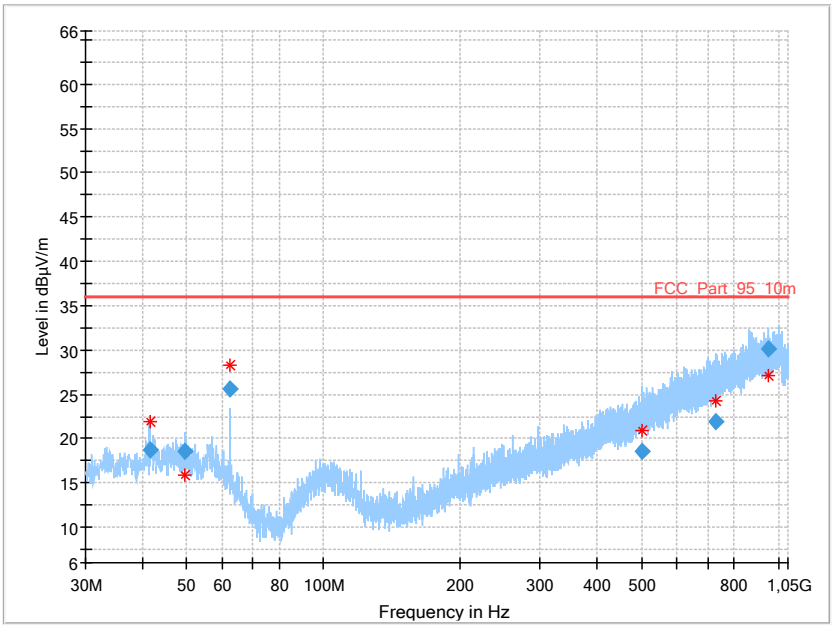


Terestrial mode

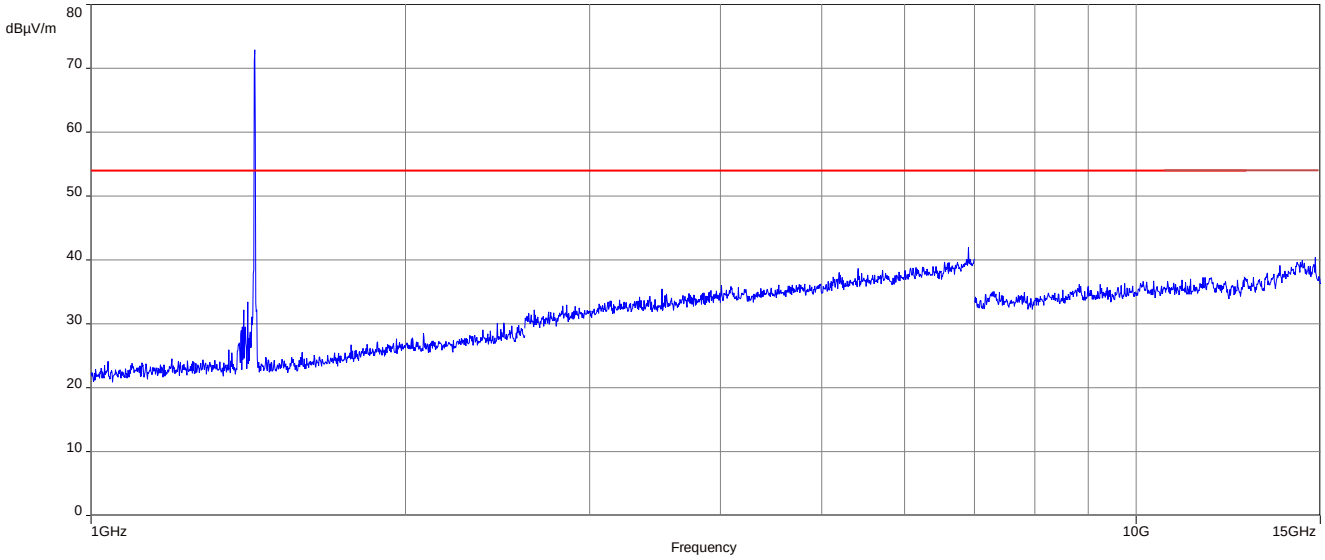
Plot 1: 9 kHz – 30 MHz



Plot 2: 30 MHz – 1 GHz



Plot 3: 1 GHz – 15 GHz, antenna horizontal/vertical



13.5 Spurious emissions conducted below 30 MHz (AC conducted)

Measurement parameters	
Detector	Peak - Quasi peak / average
Sweep time	Auto
Resolution bandwidth	F < 150 kHz: 200 Hz F > 150 kHz: 9 kHz
Video bandwidth	F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz
Span:	9 kHz to 30 MHz
Trace mode:	Max hold
Test setup	See sub clause 7.4 setup A
Measurement uncertainty	See sub clause 9

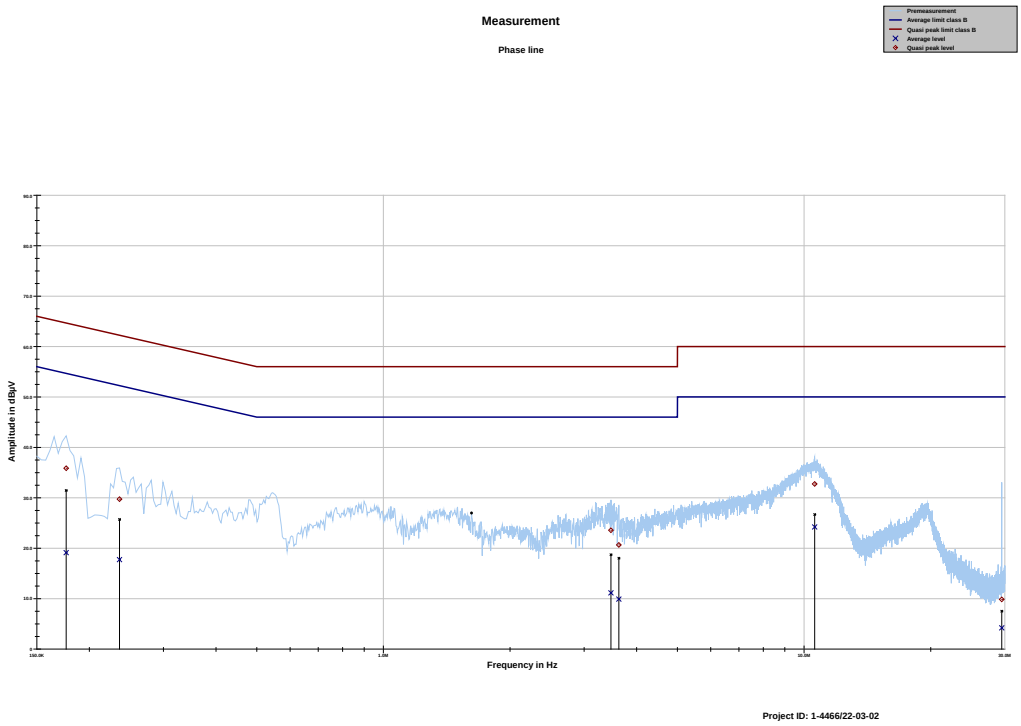
Limits:

FCC		ISED
TX spurious emissions conducted < 30 MHz		
Frequency (MHz)	Quasi-peak (dBµV/m)	Average (dBµV/m)
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30.0	60	50

*Decreases with the logarithm of the frequency

Plots:

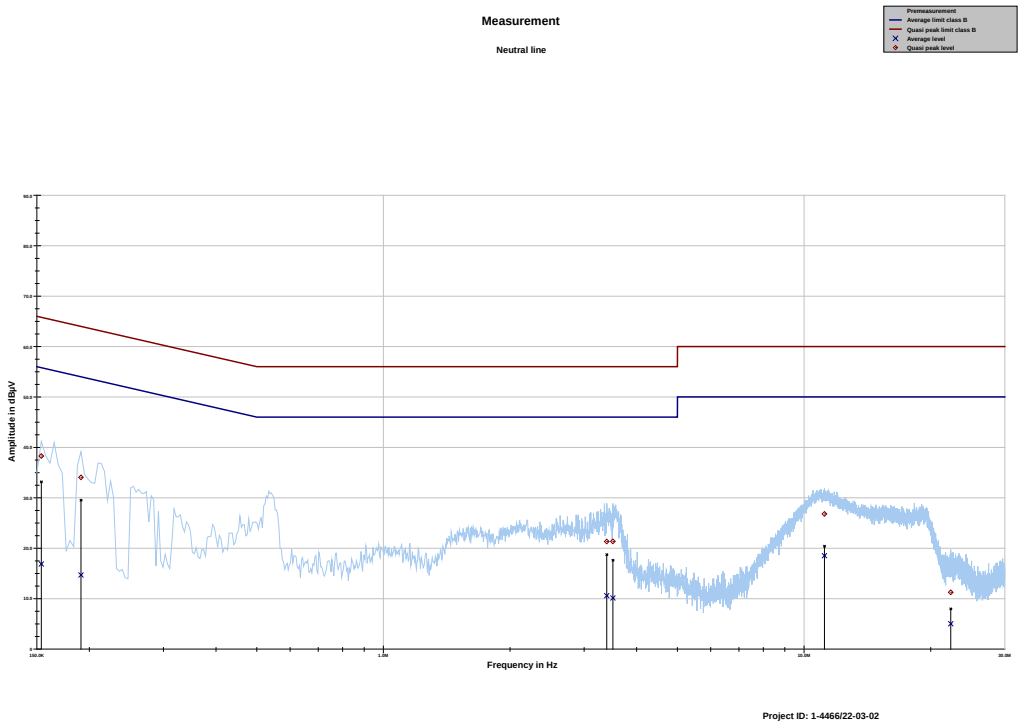
Plot 1: 150 kHz to 30 MHz, phase line



Final results:

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.176119	35.86	28.81	64.667	19.12	36.13	55.254
0.235819	29.73	32.51	62.242	17.73	35.82	53.548
3.474544	23.56	32.44	56.000	11.14	34.86	46.000
3.627525	20.64	35.36	56.000	9.90	36.10	46.000
10.597500	32.74	27.26	60.000	24.21	25.79	50.000
29.500013	9.84	50.16	60.000	4.20	45.80	50.000

Plot 2: 150 kHz to 30 MHz, neutral line



Final results:

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.153731	38.28	27.52	65.796	16.86	39.04	55.893
0.191044	34.06	29.93	63.991	14.69	40.14	54.827
3.396187	21.34	34.66	56.000	10.59	35.41	46.000
3.511856	21.36	34.64	56.000	10.12	35.88	46.000
11.179575	26.79	33.21	60.000	18.50	31.50	50.000
22.321088	11.26	48.74	60.000	5.01	44.99	50.000

14 Observations

No observations except those reported with the single test cases have been made.

15 Glossary

AVG	Average
C	Compliant
C/N_0	Carrier to noise-density ratio, expressed in dB-Hz
CAC	Channel availability check
CW	Clean wave
DC	Duty cycle
DFS	Dynamic frequency selection
DSSS	Dynamic sequence spread spectrum
DUT	Device under test
EN	European Standard
ETSI	European Telecommunications Standards Institute
EMC	Electromagnetic Compatibility
EUT	Equipment under test
FCC	Federal Communications Commission
FCC ID	Company Identifier at FCC
FHSS	Frequency hopping spread spectrum
FVIN	Firmware version identification number
GNSS	Global Navigation Satellite System
GUE	GNSS User Equipment
HMN	Host marketing name
HVIN	Hardware version identification number
HW	Hardware
IC	Industry Canada
Inv. No.	Inventory number
MC	Modulated carrier
NA	Not applicable
NC	Not compliant
NOP	Non occupancy period
NP	Not performed
OBW	Occupied bandwidth
OC	Operating channel
OCW	Operating channel bandwidth
OFDM	Orthogonal frequency division multiplexing
OOB	Out of band
OP	Occupancy period
PER	Packet error rate
PMN	Product marketing name
PP	Positive peak
QP	Quasi peak
RLAN	Radio local area network
S/N or SN	Serial number
SW	Software
UUT	Unit under test
WLAN	Wireless local area network

16 Document history

Version	Applied changes	Date of release
-/-	Initial release	2023-10-19
A	AC conducted results added, antenna information added	2024-03-22

################################ END OF TEST REPORT ################################