
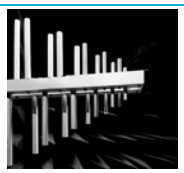
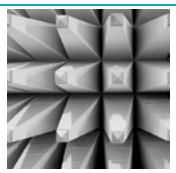

CTC advanced
member of RWTÜV group

Bundesnetzagentur

BNetzA-CAB-02/21-102

TEST REPORT

Test report no.: 1-2331/21-01-02

Testing laboratory

CTC advanced GmbH
Untertuerkheimer Strasse 6 – 10
66117 Saarbruecken / Germany
Phone: + 49 681 5 98 - 0
Fax: + 49 681 5 98 - 9075
Internet: https://www.ctcadvanced.com
e-mail: mail@ctcadvanced.com

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 starting with the registration number: D-PL-12076-01.

Applicant

E. Dold & Söhne GmbH & Co.KG
Bregstr. 18
78120 Furtwangen / GERMANY
Phone: +49 7723 654 331
Contact: M. Colpi
e-mail: certifications@dold.com

Manufacturer

E. Dold & Söhne GmbH & Co.KG
Bregstr. 18
78120 Furtwangen / GERMANY

Test standard/s

FCC - Title 47 CFR Part 15	FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices

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

Test Item

Kind of test item:	**Safety oriented bi-directional radio transmission system**
Model name:	**SAFEMASTER W UH6900**
FCC ID:	2A3XQUH6900
Frequency:	911.79 MHz to 918.16
Technology tested:	proprietary
Antenna:	external antenna FSP 900/925-SMA(m)
Power supply:	20.4 V to 27.6 V DC by power supply
Temperature range:	-25°C to +55°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=Christoph Schneider, o=CTC advanced GmbH, ou=SND-211129, email=christoph.schneider@ctcadvanced.com, c=DE
2022.03.14 11:15:32 +01'00'

Christoph Schneider
Lab Manager
Radio Communications

Test performed:

cn=Wolsdorfer Hans-Joachim, o=CTC advanced GmbH, ou=WLD-200810, email=joachim.wolsdorfer@ctcadvanced.com, c=DE
2022.03.14 11:28:18 +01'00'

Hans-Joachim Wolsdorfer
Lab Manager
Radio Communications

1 Table of contents

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. CTC 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.

2.2 Application details

Date of receipt of order:	2021-06-30
Date of receipt of test item:	2021-11-23
Start of test:*	2021-11-23
End of test:*	2021-11-24
Person(s) present during the test:	Mr. Stefan Müller

*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 15		FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices

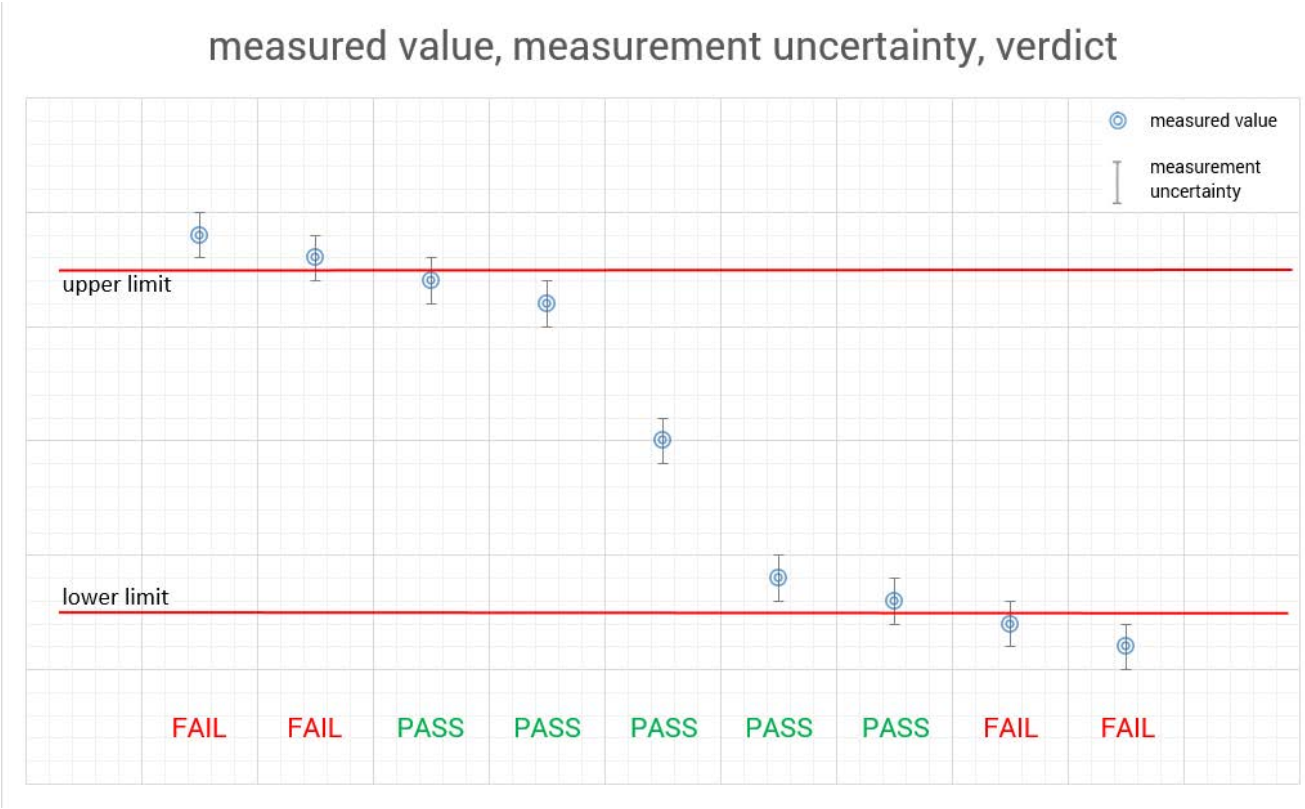
Guidance	Version	Description
ANSI C63.4-2014	-/-	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10-2013	-/-	American National Standard of Procedures for Compliance Testing of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

Accreditation	Description
D-PL-12076-01-05	Telecommunication FCC requirements https://www.dakks.de/as/ast/d/D-PL-12076-01-05e.pdf

FCC designation number: DE0002

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}	+20 °C during room temperature tests +55 °C during high temperature tests -25 °C during low temperature tests
Relative humidity content	:		55 %
Barometric pressure	:		1021 hpa
Power supply	:	V_{nom} V_{max} V_{min}	24.0 V DC by power supply 27.6 V 20.4 V

6 Test item

6.1 General description

Kind of test item	:	Safety oriented bi-directional radio transmission system
Model name	:	SAFEMASTER W UH6900
S/N serial number	:	Rad. FCC205.0, FCC205.1 Cond. FCC205.0
Hardware status	:	1.0
Software status	:	-/-
Firmware status	:	11.0
Frequency band	:	911.79 MHz to 918.16
Type of radio transmission Use of frequency spectrum	: :	modulated carrier
Type of modulation	:	2-GFSK
Number of channels	:	128
Antenna	:	external antenna FSP 900/925-SMA(m)
Power supply	:	20.4 V to 27.6 V DC by power supply
Temperature range	:	-25°C to +55°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: 1-2331/21-01-02_AnnexA
1-2331/21-01-02_AnnexB
1-2331/21-01-02_AnnexD

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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).

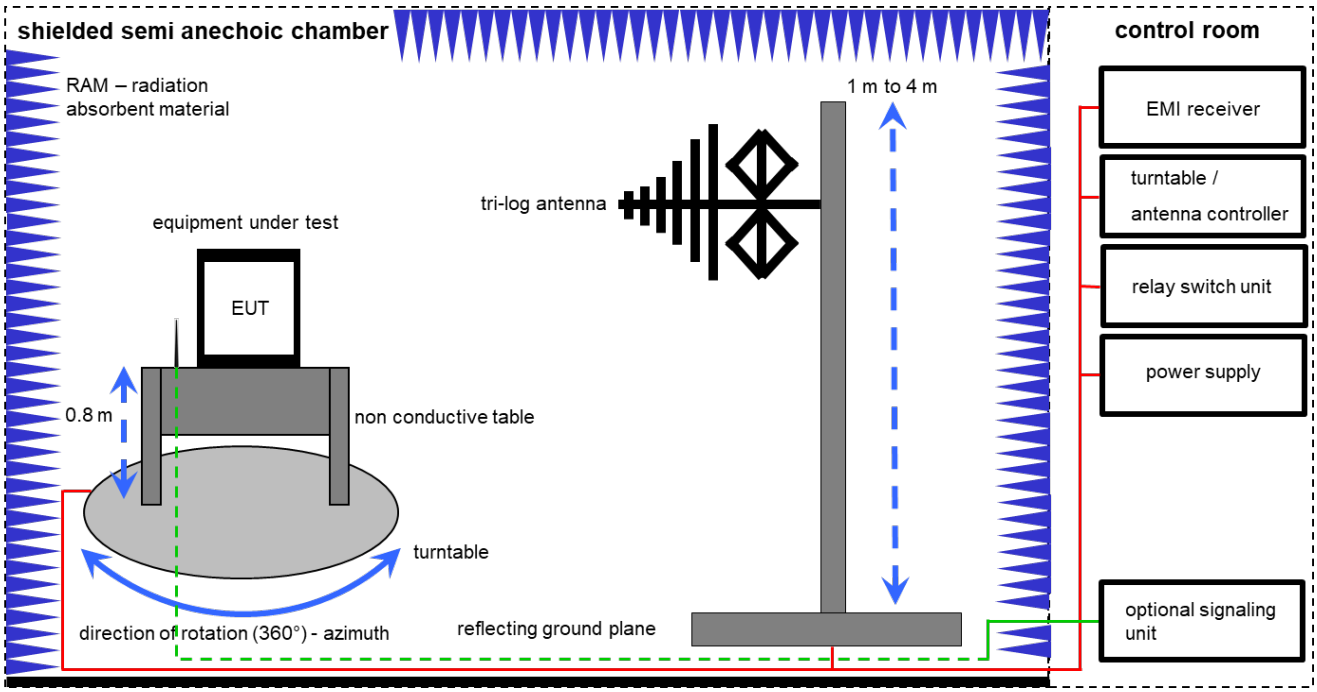
Each block diagram listed can contain several test setup configurations. All devices belonging to a test setup are identified with the same letter syntax. For example: Column Setup and all devices with an A.

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

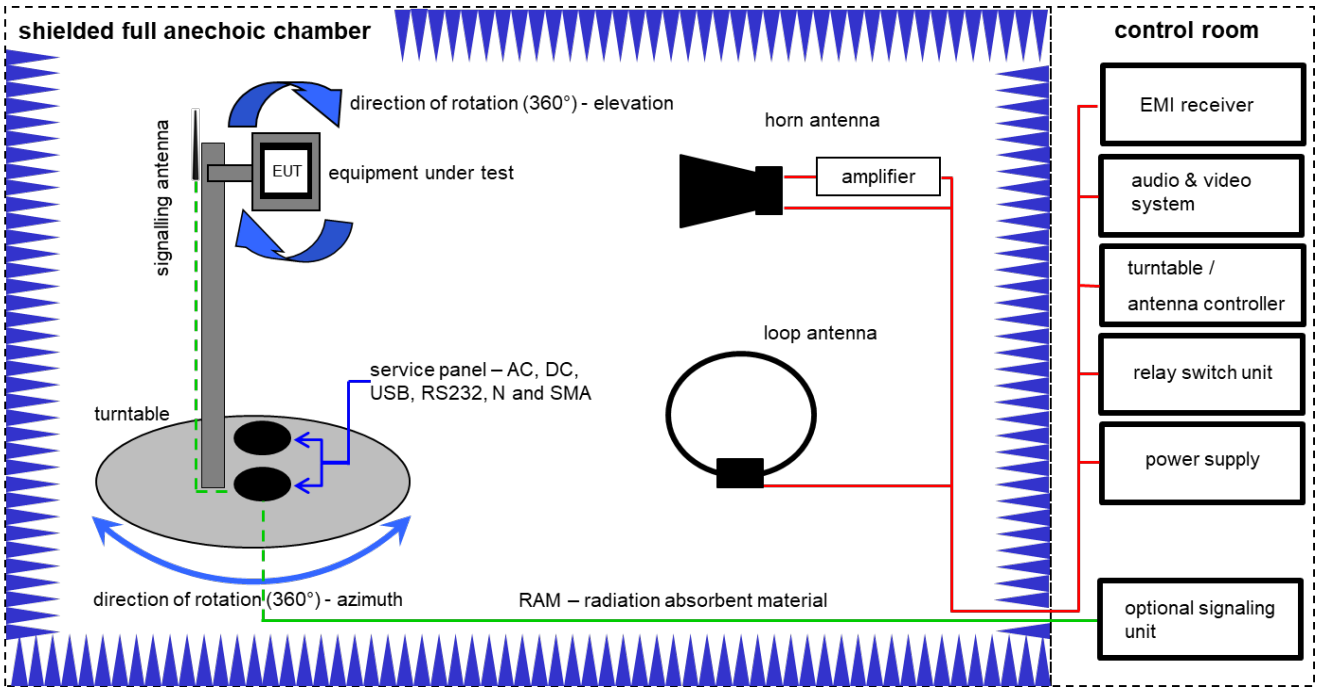
FS = UR + CL + AF
(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

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	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw	-/-	-/-
5	A	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw	-/-	-/-
6	A	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw	-/-	-/-
7	A	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck Mess - Elektronik	318	300003696	vlKl!	30.09.2021	29.09.2023
8	A	Turntable	2089-4.0	EMCO	19	300004394	ne	-/-	-/-
9	A	PC	TecLine	F+W	22049	300004388	ne	-/-	-/-
10	A	EMI Test Receiver	ESR3	Rohde & Schwarz	102587	300005771	k	10.12.2020	09.12.2021

7.2 Shielded fully anechoic chamber



Measurement distance: horn antenna 3 meter; loop antenna 3 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)

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)

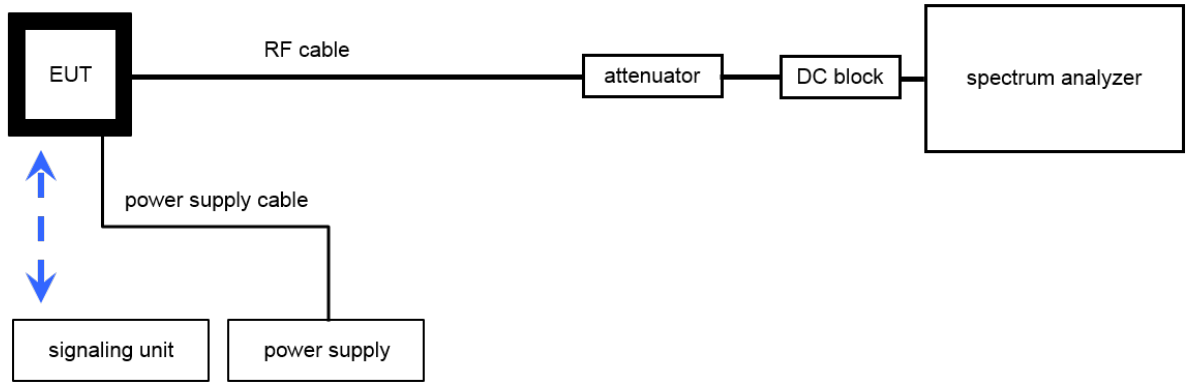
Example calculation:
OP [dBm] = -39.0 [dBm] + 57.0 [dB] - 12.0 [dBi] + (-36.0) [dB] = -30 [dBm] (1 µW)

Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A, B	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2818A03450	300001040	vIKI!	09.12.2020	08.12.2023
2	A	Active Loop Antenna 9 kHz to 30 MHz	6502	EMCO	2210	300001015	vIKI!	01.07.2021	30.06.2023
3	A, B	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
4	B	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	9107-3697	300001605	vIKI!	12.03.2021	11.03.2023
5	A, B	Switch / Control Unit	3488A	HP	*	300000199	ne	-/-	-/-
6	A, B	EMI Test Receiver 20Hz- 26,5GHz	ESU26	R&S	100037	300003555	k	11.12.2020	10.12.2021
7	B	Highpass Filter	WHK1.1/15G-10SS	Wainwright	3	300003255	ev	-/-	-/-
8	B	Broadband Amplifier 0.5-18 GHz	CBLU5184540	CERNEX	22049	300004481	ev	-/-	-/-
9	A, B	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne	-/-	-/-
10	A, B	NEXIO EMV-Software	BAT EMC V3.20.0.26	EMCO	101274, 100877	300004682	ne	-/-	-/-

7.3 Conducted measurements

Conducted measurements normal & extreme voltage conditions



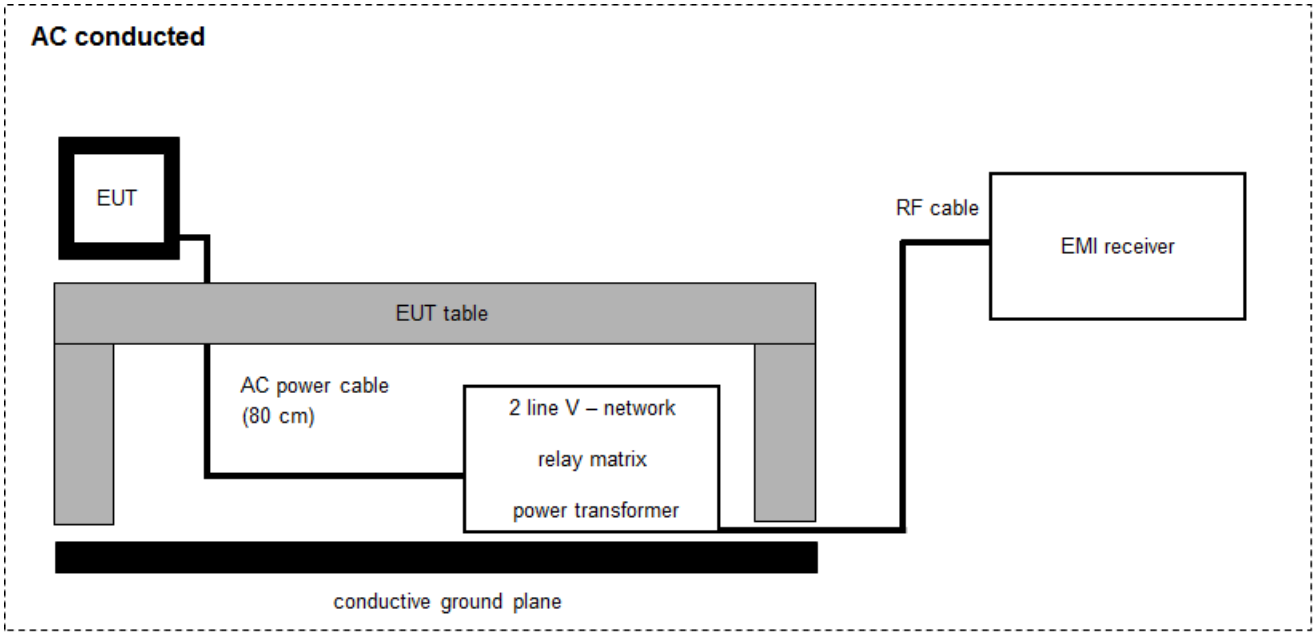
OP = AV + CA
(OP-output power; AV-analyzer value; CA-loss signal path)

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	Signal analyzer	FSW26	Rohde&Schwarz	101455	300004528	k	25.02.2021	24.02.2022
2	A	RF-Cable SRD021 No. 1	Enviroflex 316 D	Huber & Suhner	2210	400001311	ev	-/-	-/-
3	A	Power Supply	HMP2020	Rohde & Schwarz	101961	300006102	k	04.08.2020	03.08.2022

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	vIKI!	11.12.2019	10.12.2021
2	A	RF-Filter-section	85420E	HP	3427A00162	300002214	NK!	-/-	-/-
3	A	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	09.12.2020	08.12.2021
4	A	Analyzer-Reference-System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	vIKI!	17.01.2020	16.01.2022
5	A	Hochpass 150 kHz	EZ-25	R&S	100010	300003798	ev	-/-	-/-
6	A	PC	TecLine	F+W	100037	300003532	ne	-/-	-/-

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.

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8.3 Sequence of testing radiated spurious 1 GHz to 12.75 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.

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9 Measurement uncertainty

Measurement uncertainty	
Test case	**Uncertainty**
Occupied bandwidth	± 100 kHz (depends on the used RBW)
Spurious emissions radiated below 30 MHz	± 3 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

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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 15	See table!	2022-03-14	-/-

Test specification clause	Test case	Temperature conditions	Power source voltages	C	NC	NA	NP	Remark
§15.249(a)	**Field strength of emissions (wanted signal)**	Nominal	Nominal	☒	☐	☐	☐	-/-
-/-	**Occupied bandwidth (99% bandwidth)**	Nominal	Nominal	☒	☐	☐	☐	-/-
§15.209(a) / §15.249(b)(1)(2)(3)	**Field strength of emissions (spurious)**	Nominal	Nominal	☒	☐	☐	☐	-/-
§15.207(a)	**Conducted emissions < 30 MHz**	Nominal	Nominal	☒	☐	☐	☐	-/-
§15.109	**Field strength of emissions (spurious)**	Nominal	Nominal	☒	☐	☐	☐	-/-

Note: C = Compliant; NC = Not compliant; NA = Not applicable; NP = Not performed

11 Additional comments

Reference documents:	UH6900 - Customer Questionnaire (FCC, Japan).docx fsp-900-sma.de-DE.pdf
Special test descriptions:	None
Configuration descriptions:	see chapter 14, page 47
Test mode:	☐ No test mode available. Iperf was used to ping another device with the largest support packet size
	☒ 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, antenna cable length 0m (direct), 2m, 5m and 10m* - *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)*

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12 Measurement results

12.1 Field strength of emissions (wanted signal)

Description:

Measurement of the maximum radiated field strength of the wanted signal.

Measurement:

Measurement parameter	
Detector:	Peak / Quasi peak
Resolution bandwidth:	1 MHz (> OBW)
Video bandwidth:	3x RBW
Span:	Depends on the signal
Trace mode:	Max. hold

Limits:

FCC		
Field strength of emissions		
The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:		
Frequency [MHz]	Field Strength [dBµV/m]	Measurement distance
902 – 928 MHz	94	3

Result:

Test condition	Maximum field strength	
	Frequency / MHz	Field strength / dBµV/m @ 3 m*
T_{nom} / V_{nom}, 2m cable length	911.80	93.66
T_{nom} / V_{nom}, 2m cable length	918.15	93.33
T_{nom} / V_{nom}, 5m cable length	911.80	93.76
T_{nom} / V_{nom}, 5m cable length	918.15	92.66
T_{nom} / V_{nom}, 10m cable length	911.80	92.22
T_{nom} / V_{nom}, 10m cable length	918.15	92.22
T_{nom} / V_{nom}, antenna direct connected	911.80	92.86
T_{nom} / V_{nom}, antenna direct connected	918.15	91.86

* recalculated from 10m to 3m by 10.46

12.2 Occupied bandwidth (99% bandwidth)

Description:

Measurement of the 99% bandwidth of the wanted signal.

Measurement:

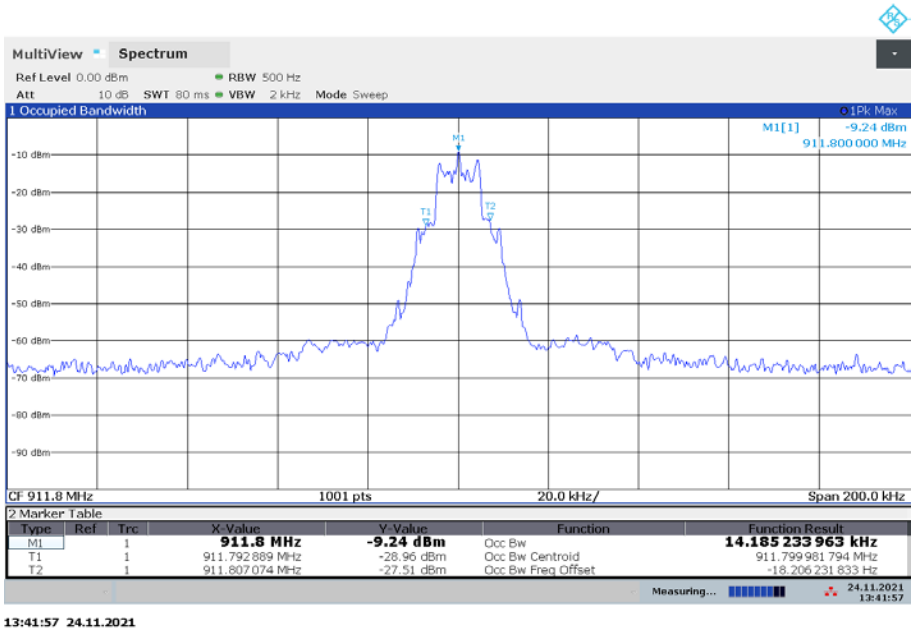
Measurement parameters	
Detector:	Peak
Resolution bandwidth:	1 % – 5 % of the occupied bandwidth
Video bandwidth:	≥ 3x RBW
Trace mode:	Max hold
Analyzer function:	99 % power function
Used equipment:	See chapter 7.3 A
Measurement uncertainty:	See chapter 9

Results:

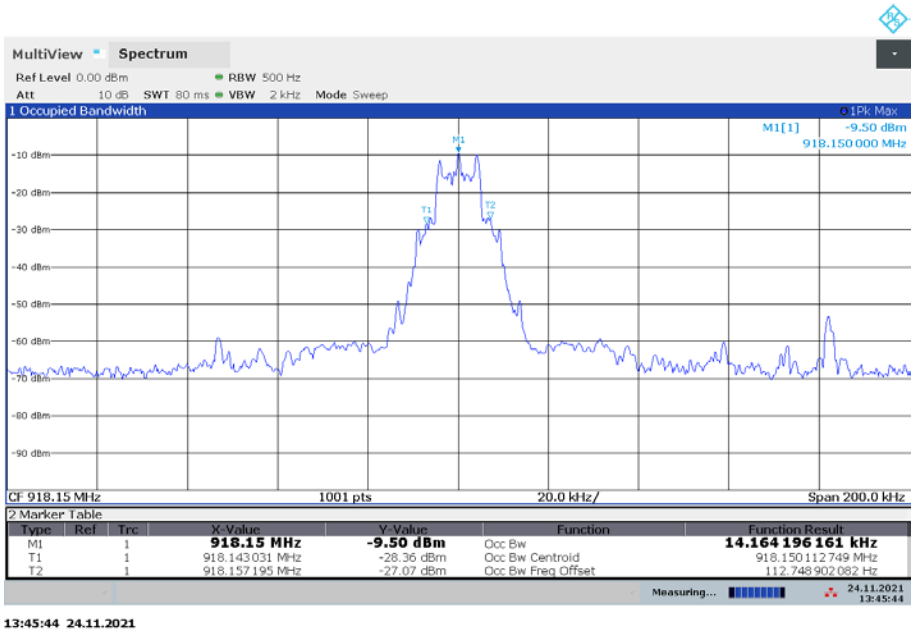
Test condition	Occupied bandwidth	
	Frequency / MHz	Occupied bandwidth / kHz
T_{nom} / V_{nom}	911.80	14.185
T_{nom} / V_{nom}	918.15	14.164

Plots:

Plot 1: low channel (911.8 MHz)



Plot 2: high channel (918.15 MHz)



12.3 Spurious emissions radiated below 30 MHz

Description:

Measurement of the radiated spurious emissions in transmit mode below 30 MHz. The limits are recalculated to a measurement distance of 3 m with 40 dB/decade according CFR Part 2.

Measurement:

Measurement parameter	
Detector:	Peak / Quasi Peak
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 7.2 A
Measurement uncertainty	See sub clause 9

Limits:

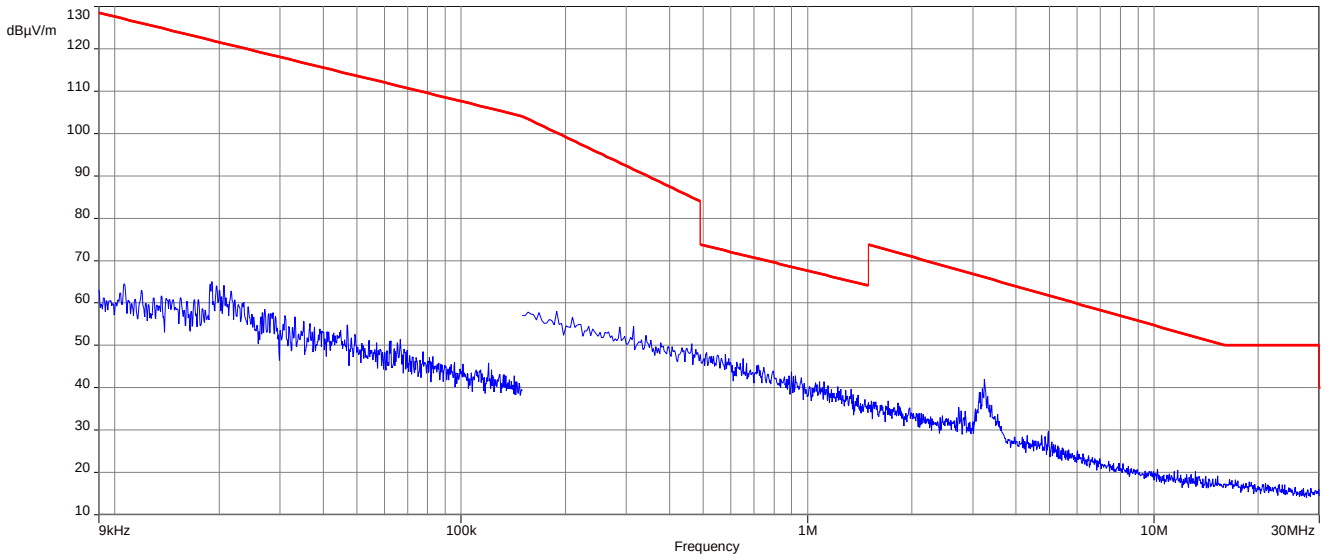
FCC		
Frequency (MHz)	Field Strength (µV/m)	Measurement distance
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30

Results:

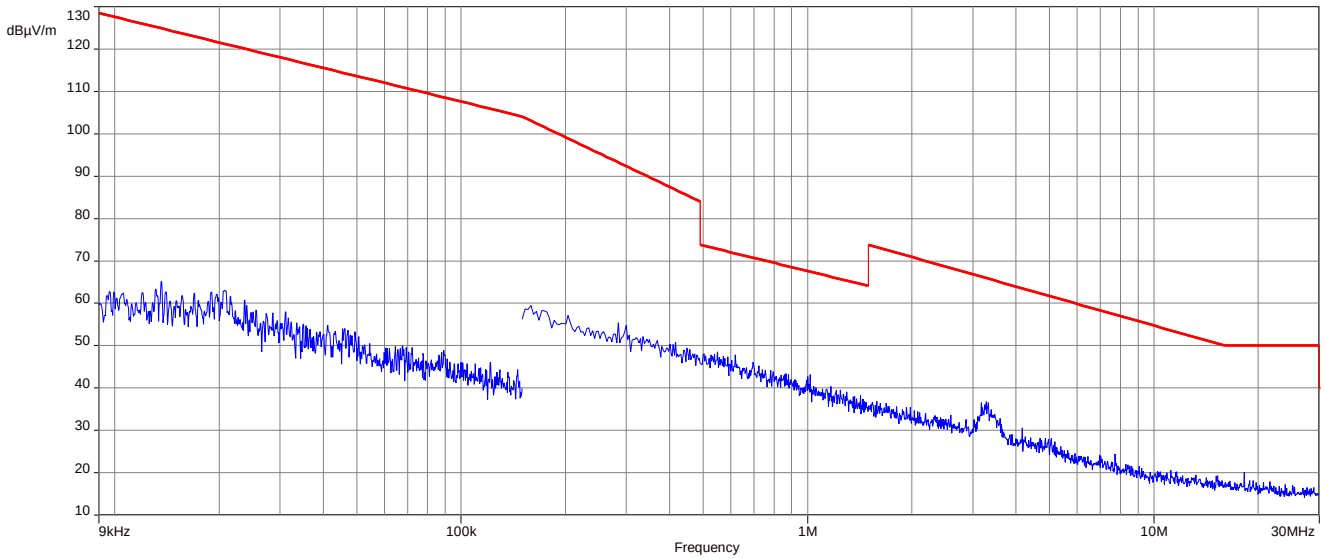
TX Spurious Emissions Radiated < 30 MHz [dBµV/m]		
F [MHz]	Detector	Level [dBµV/m]
All detected peaks are more than 20 dB below the limit.		

Plots:

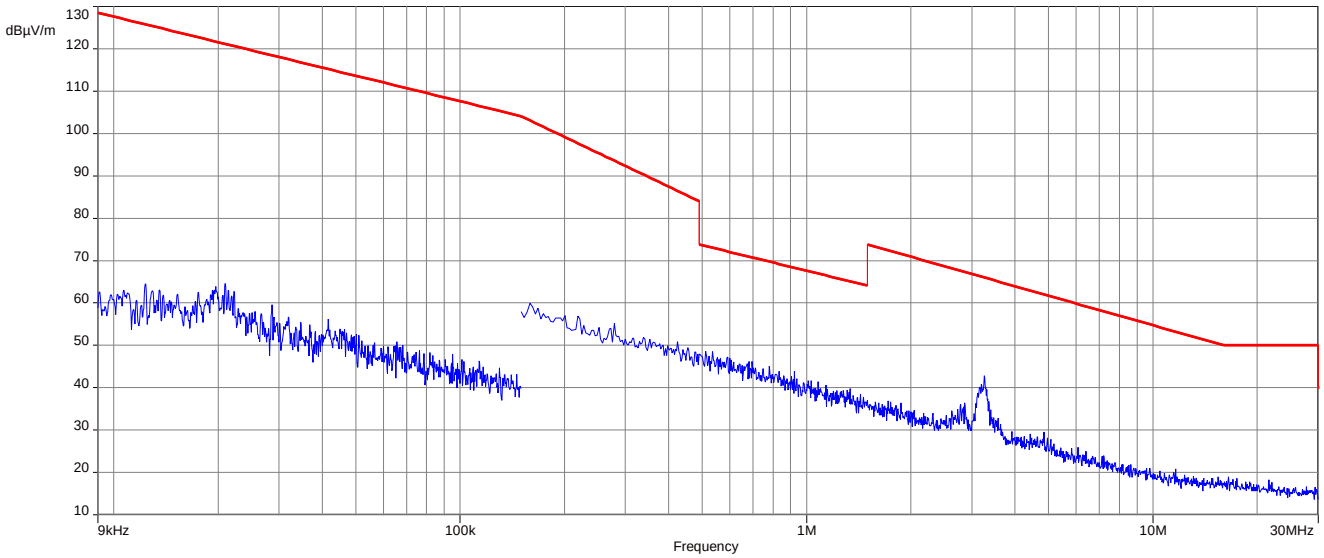
Plot 1: 9 kHz to 30 MHz, 2m cable length, low channel



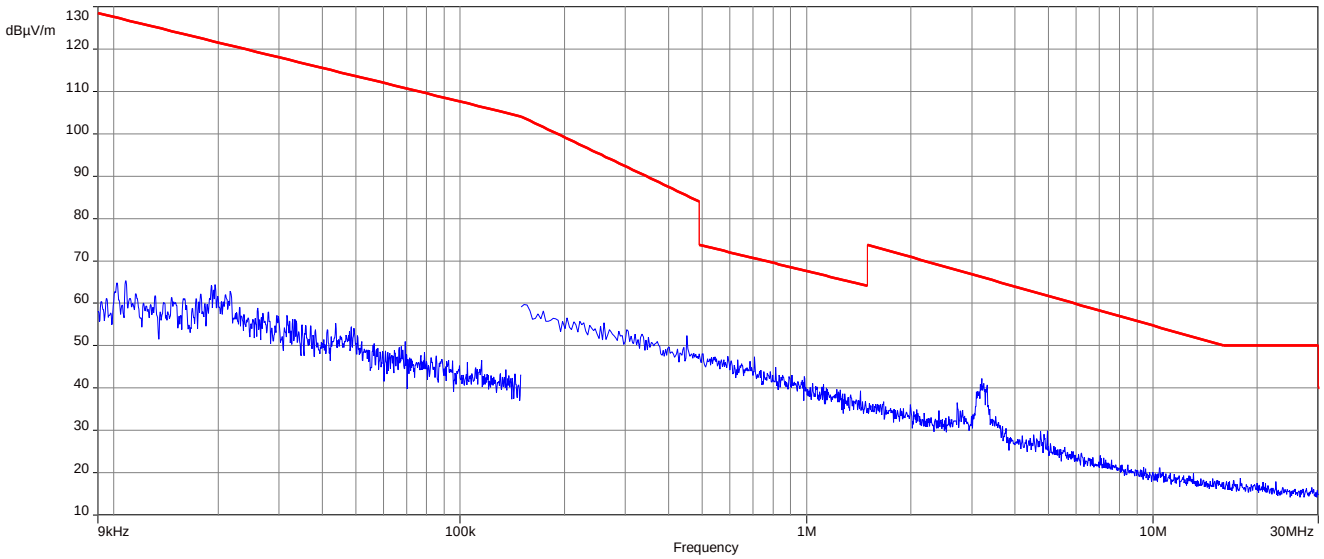
Plot 2: 9 kHz to 30 MHz, 2m cable length, high channel



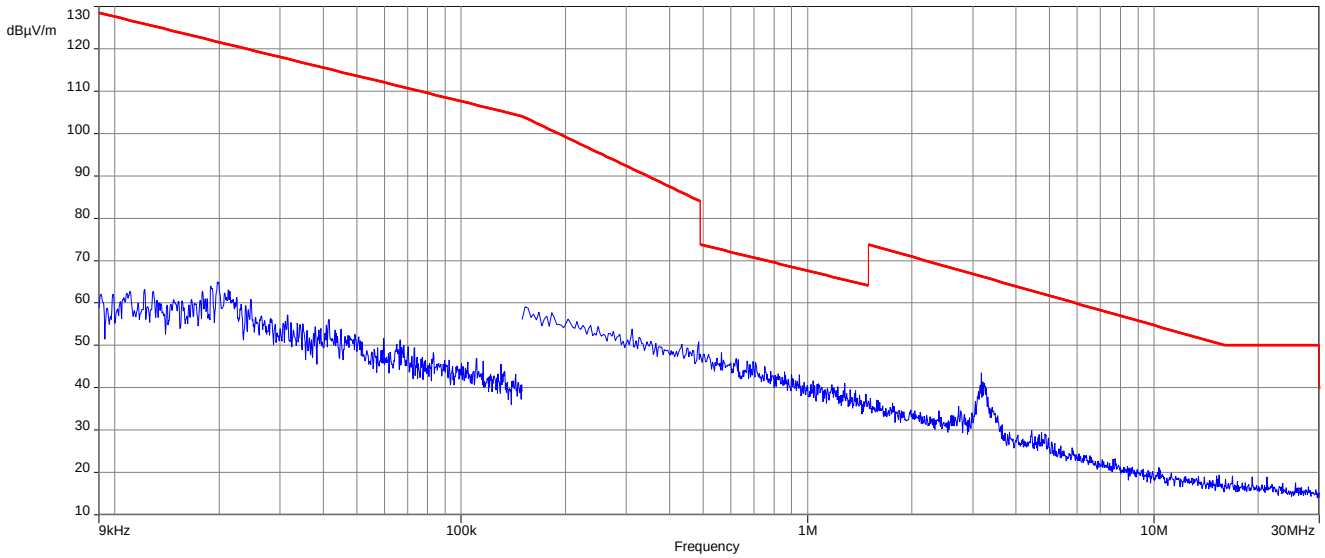
Plot 3: 9 kHz to 30 MHz, 5m cable length, low channel



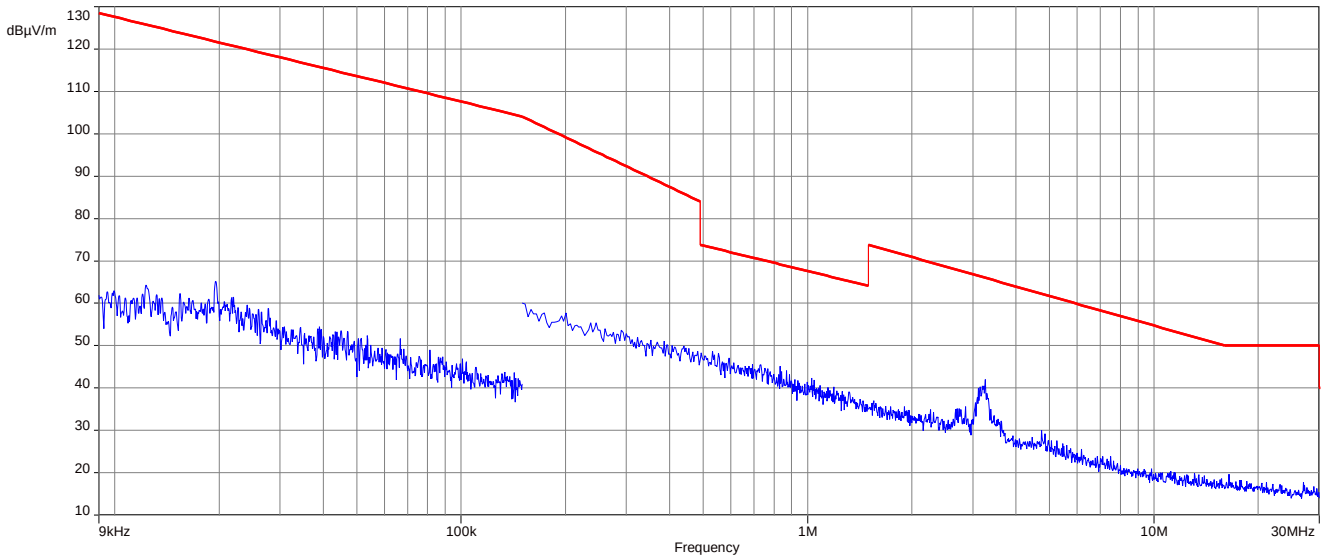
Plot 4: 9 kHz to 30 MHz, 5m cable length, high channel



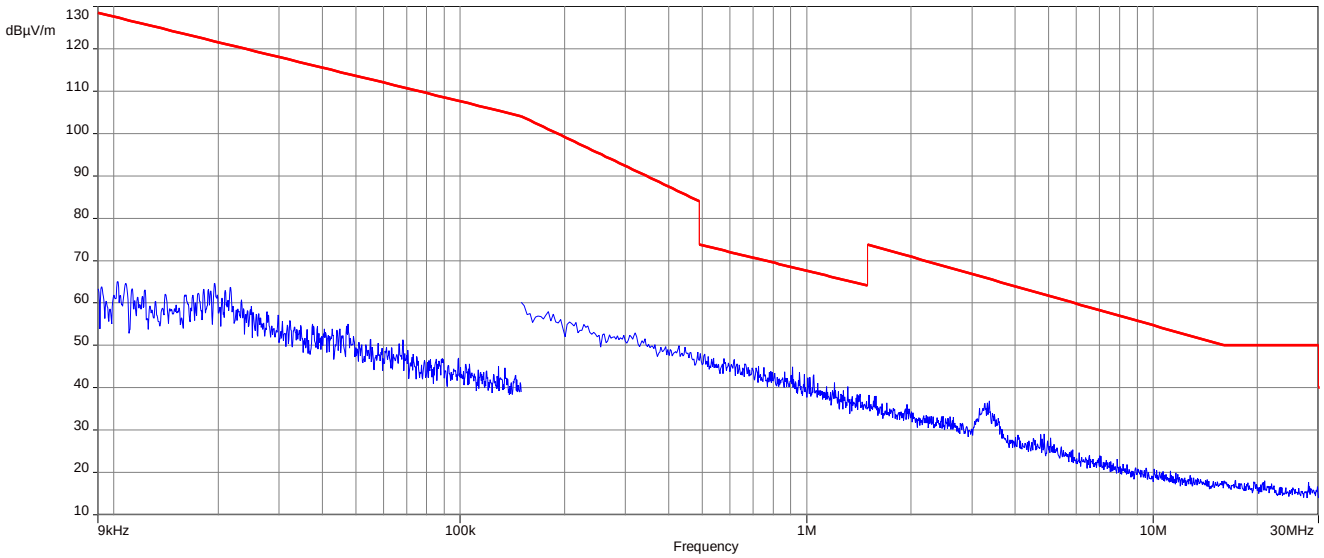
Plot 5: 9 kHz to 30 MHz, 10m cable length, low channel



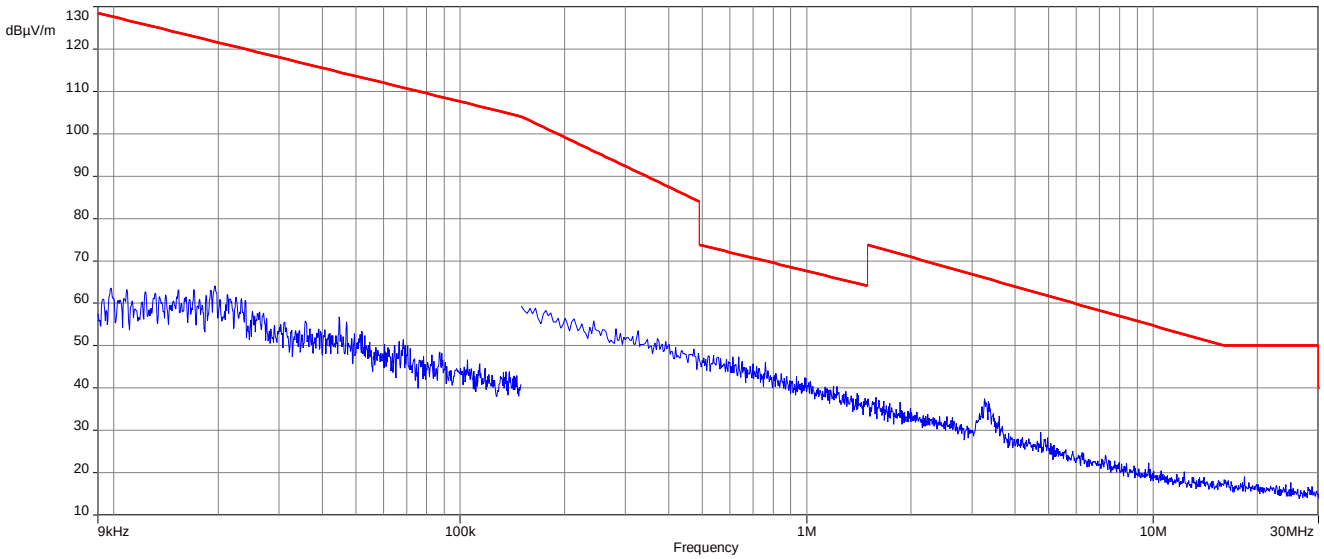
Plot 6: 9 kHz to 30 MHz, 10m cable length, high channel



Plot 7: 9 kHz to 30 MHz, antenna direct connected, low channel



Plot 8: 9 kHz to 30 MHz, antenna direct connected, high channel



12.4 Spurious emissions radiated 30 MHz to 1 GHz

Description:

Measurement of the radiated spurious emissions and cabinet radiations below 1 GHz.

Measurement:

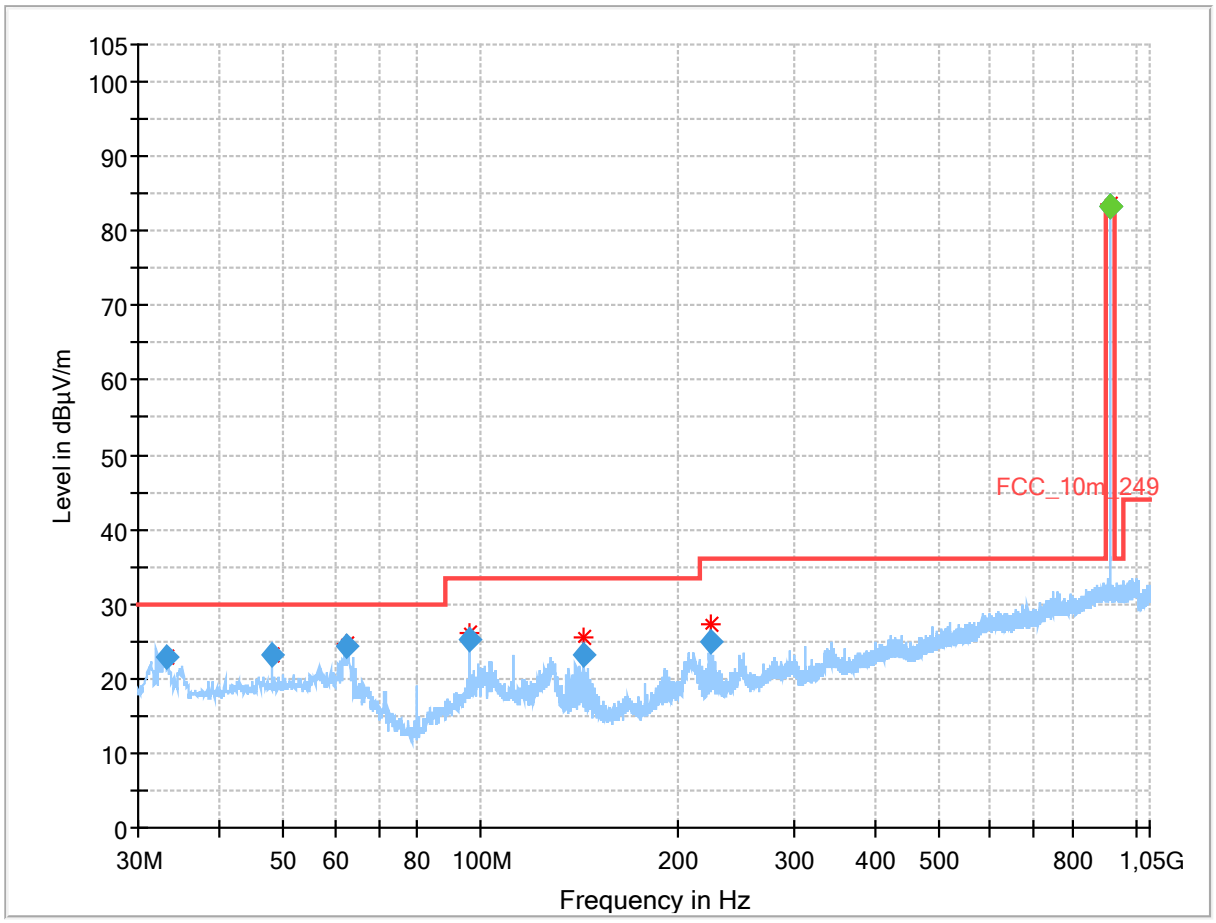
Measurement parameter	
Detector:	Peak / Quasi Peak
Sweep time:	Auto
Resolution bandwidth:	120 kHz
Video bandwidth:	3 x RBW
Span:	30 MHz to 1 GHz
Trace mode:	Max Hold
Test setup:	See sub clause 7.1
Measurement uncertainty	See sub clause 9

Limits:

FCC		
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).		
Frequency (MHz)	Field Strength (dBµV/m)	Measurement distance
30 - 88	30.0	10
88 – 216	33.5	10
216 – 960	36.0	10

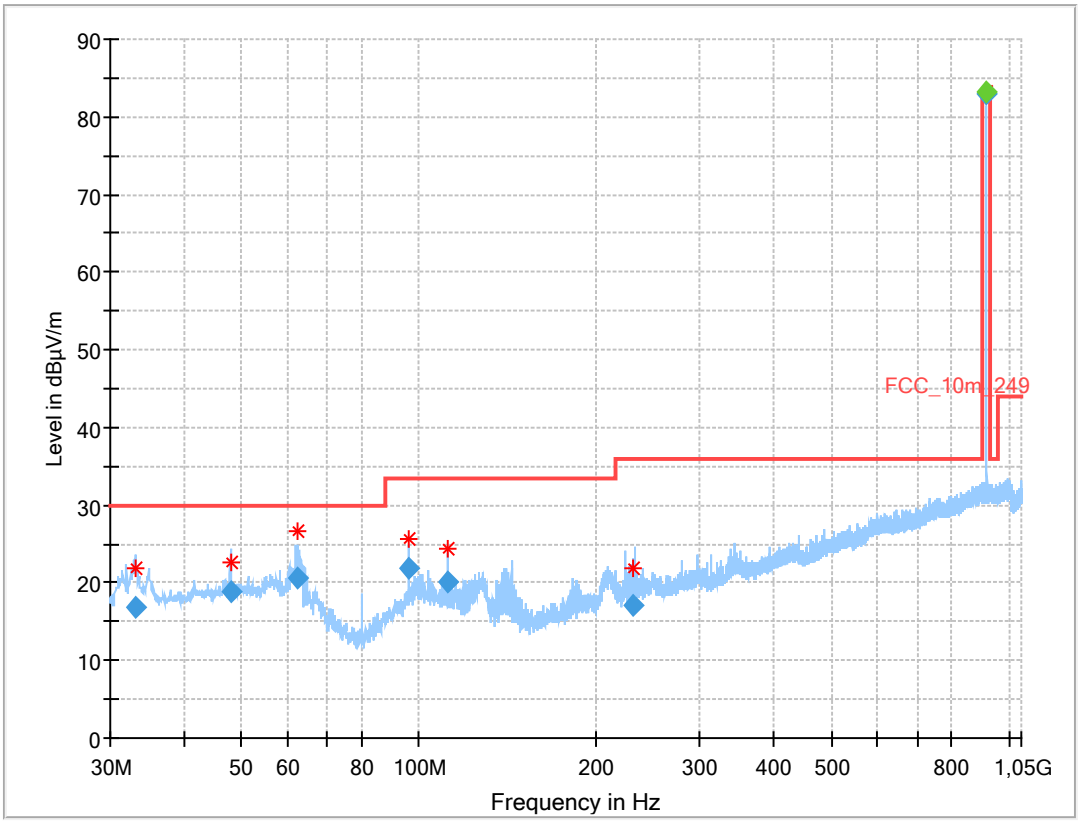
Plot:

Plot 1: 30 MHz to 1 GHz, vertical & horizontal polarization, 2m cable length, low channel



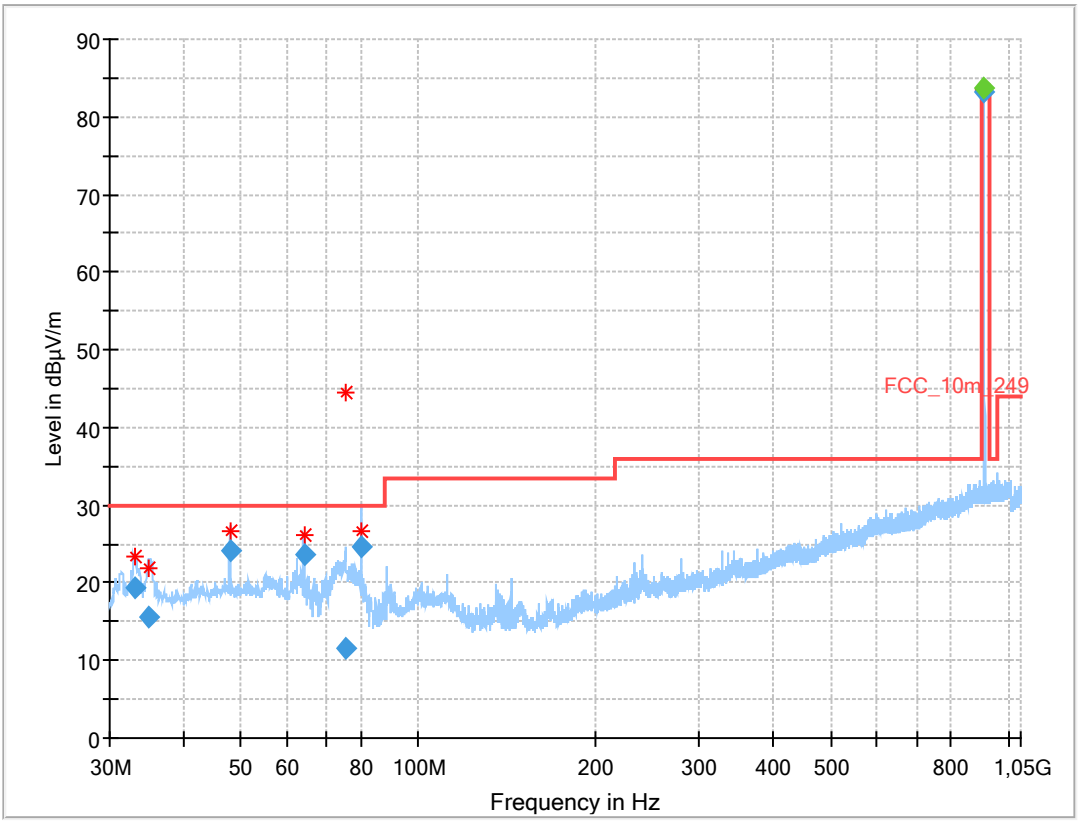
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
33.111	22.74	30.0	7.26	1000	120.0	106.0	V	270	15
48.021	23.21	30.0	6.79	1000	120.0	114.0	V	0	13
62.364	24.47	30.0	5.53	1000	120.0	104.0	V	181	13
95.989	25.11	33.5	8.39	1000	120.0	139.0	V	227	10
144.010	23.21	33.5	10.29	1000	120.0	113.0	V	76	13
223.981	24.87	36.0	11.13	1000	120.0	100.0	V	270	15
911.805	83.20	83.5	0.3	1000	120.0	116.0	V	-14	26

Plot 2: 30 MHz to 1 GHz, vertical & horizontal polarization, 2m cable length, high channel



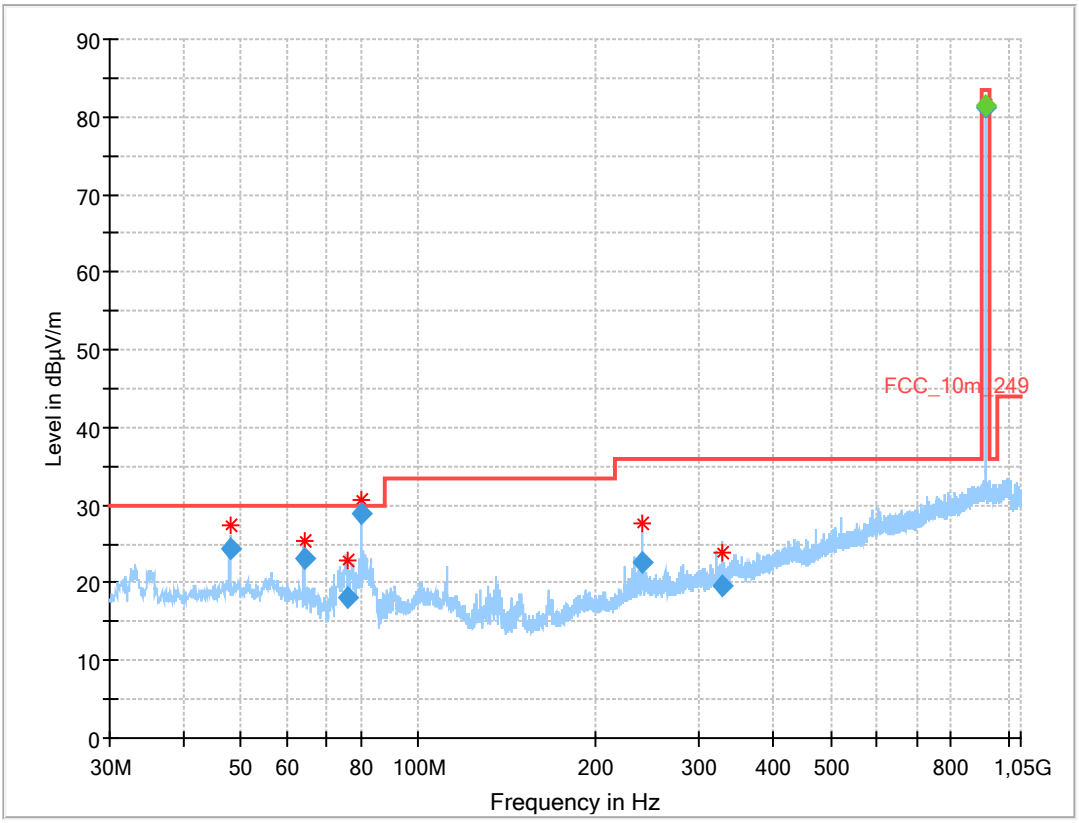
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
33.212	16.76	30.0	13.2	1000	120.0	103.0	V	137	13
48.014	18.83	30.0	11.2	1000	120.0	144.0	V	10	15
62.379	20.63	30.0	9.4	1000	120.0	101.0	V	297	13
96.008	21.94	33.5	11.6	1000	120.0	200.0	V	34	13
111.991	20.14	33.5	13.4	1000	120.0	100.0	V	48	13
231.458	17.09	36.0	18.9	1000	120.0	100.0	V	0	14
918.151	82.87	83.5	0.6	1000	120.0	118.0	V	19	26

Plot 3: 30 MHz to 1 GHz, vertical & horizontal polarization, 5m cable length, low channel



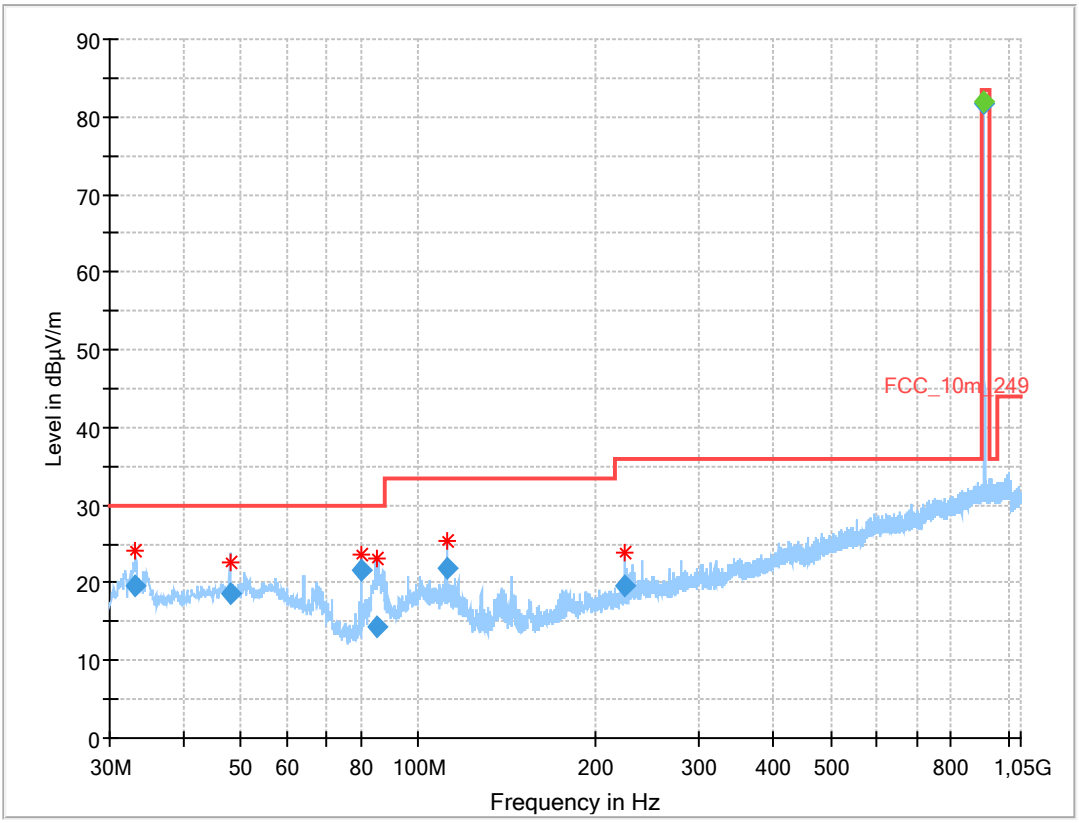
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
33.175	19.42	30.0	10.6	1000	120.0	109.0	V	0	13
34.816	15.63	30.0	14.4	1000	120.0	128.0	V	127	13
47.987	24.24	30.0	5.8	1000	120.0	100.0	V	274	15
64.001	23.55	30.0	6.5	1000	120.0	123.0	V	236	13
75.245	11.49	30.0	18.5	1000	120.0	400.0	V	151	9
80.017	24.61	30.0	5.4	1000	120.0	200.0	V	113	8
911.797	83.31	83.5	0.2	1000	120.0	115.0	V	-17	26

Plot 4: 30 MHz to 1 GHz, vertical & horizontal polarization, 5m cable length, high channel



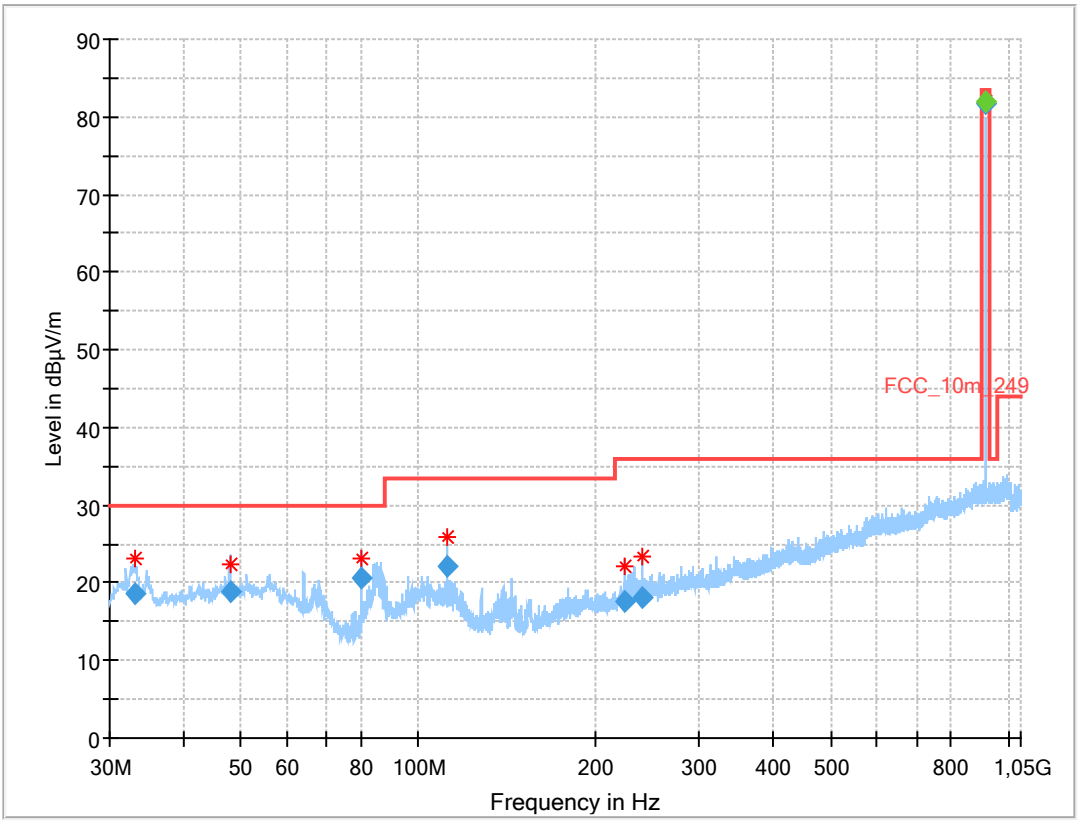
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
48.009	24.50	30.0	5.5	1000	120.0	100.0	V	-37	15
64.005	23.04	30.0	7.0	1000	120.0	108.0	V	308	13
75.975	18.13	30.0	11.9	1000	120.0	268.0	V	19	9
80.007	28.93	30.0	1.1	1000	120.0	204.0	V	67	8
239.990	22.58	36.0	13.4	1000	120.0	133.0	V	225	14
327.997	19.64	36.0	16.4	1000	120.0	104.0	V	45	16
918.151	82.2	83.5	1.3	1000	120.0	118.0	V	10	26

Plot 5: 30 MHz to 1 GHz, vertical & horizontal polarization, 10m cable length, low channel



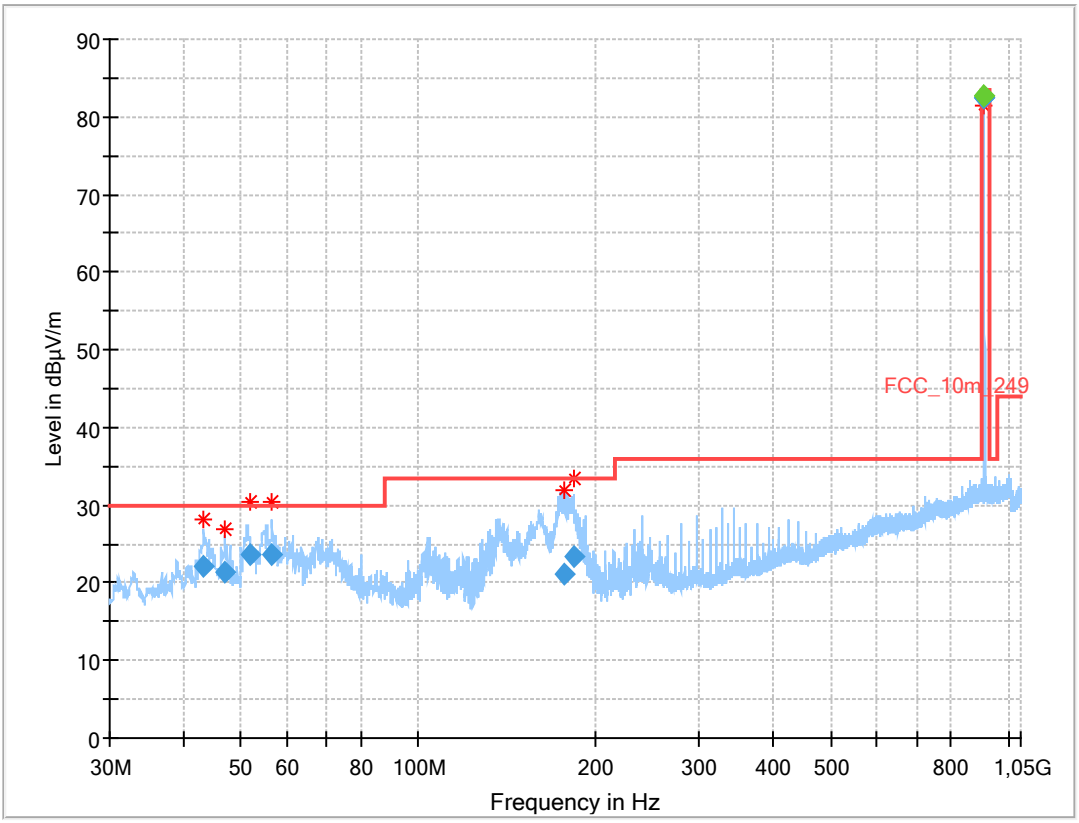
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
33.158	19.51	30.0	10.5	1000	120.0	102.0	V	130	13
48.009	18.60	30.0	11.4	1000	120.0	104.0	V	350	15
79.985	21.54	30.0	8.5	1000	120.0	205.0	V	116	8
84.848	14.44	30.0	15.6	1000	120.0	334.0	V	215	10
112.016	21.90	33.5	11.6	1000	120.0	151.0	V	-18	13
224.011	19.70	36.0	16.3	1000	120.0	104.0	V	90	13
911.800	81.76	83.5	1.8	1000	120.0	112.0	V	35	26

Plot 6: 30 MHz to 1 GHz, vertical & horizontal polarization, 10m cable length, high channel



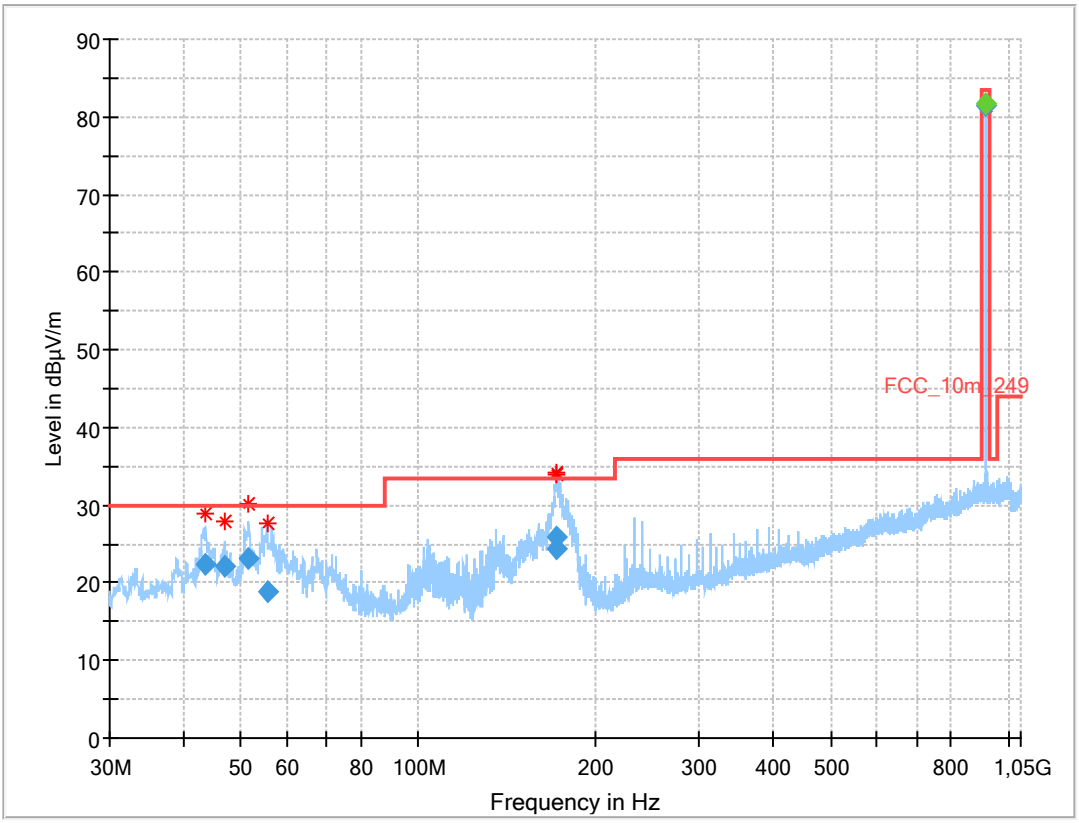
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
33.203	18.68	30.0	11.3	1000	120.0	112.0	V	3	13
47.996	18.74	30.0	11.3	1000	120.0	106.0	V	226	15
80.020	20.49	30.0	9.5	1000	120.0	272.0	V	159	8
112.008	22.10	33.5	11.4	1000	120.0	109.0	V	225	13
223.998	17.70	36.0	18.3	1000	120.0	200.0	V	250	13
240.002	18.12	36.0	17.9	1000	120.0	104.0	V	193	14
918.151	81.76	83.5	1.8	1000	120.0	116.0	V	22	26

Plot 7: 30 MHz to 1 GHz, vertical & horizontal polarization, antenna direct connected, low channel



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
43.342	22.09	30.0	7.9	1000	120.0	166.0	V	80	15
46.997	21.36	30.0	8.6	1000	120.0	118.0	V	111	15
51.713	23.61	30.0	6.4	1000	120.0	169.0	V	36	15
56.573	23.62	30.0	6.4	1000	120.0	103.0	V	99	16
177.349	21.21	33.5	12.3	1000	120.0	171.0	V	36	11
183.447	23.48	33.5	10.0	1000	120.0	146.0	V	149	11
911.804	82.40	83.5	1.1	1000	120.0	305.0	V	-7	26

Plot 8: 30 MHz to 1 GHz, vertical & horizontal polarization, antenna direct connected, high channel



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
43.713	22.44	30.0	7.6	1000	120.0	136.0	V	97	15
47.037	22.15	30.0	7.9	1000	120.0	109.0	V	90	15
51.662	23.13	30.0	6.9	1000	120.0	137.0	V	-41	15
55.792	18.87	30.0	11.1	1000	120.0	102.0	V	45	16
171.533	24.45	33.5	9.1	1000	120.0	103.0	V	4	11
171.770	25.82	33.5	7.7	1000	120.0	104.0	V	32	11
918.146	81.40	83.5	2.1	1000	120.0	310.0	V	26	26

12.5 Spurious emissions radiated above 1 GHz

Description:

Measurement of the radiated spurious emissions above 1 GHz in transmit mode and receiver / idle mode.

Measurement:

Measurement parameter	
Detector:	Peak / RMS
Sweep time:	Auto
Resolution bandwidth:	1 MHz
Video bandwidth:	3 x RBW
Span:	1 GHz to 12.75 GHz
Trace mode:	Max Hold
Test setup:	See sub clause 7.2 B
Measurement uncertainty	See sub clause 9

Limits:

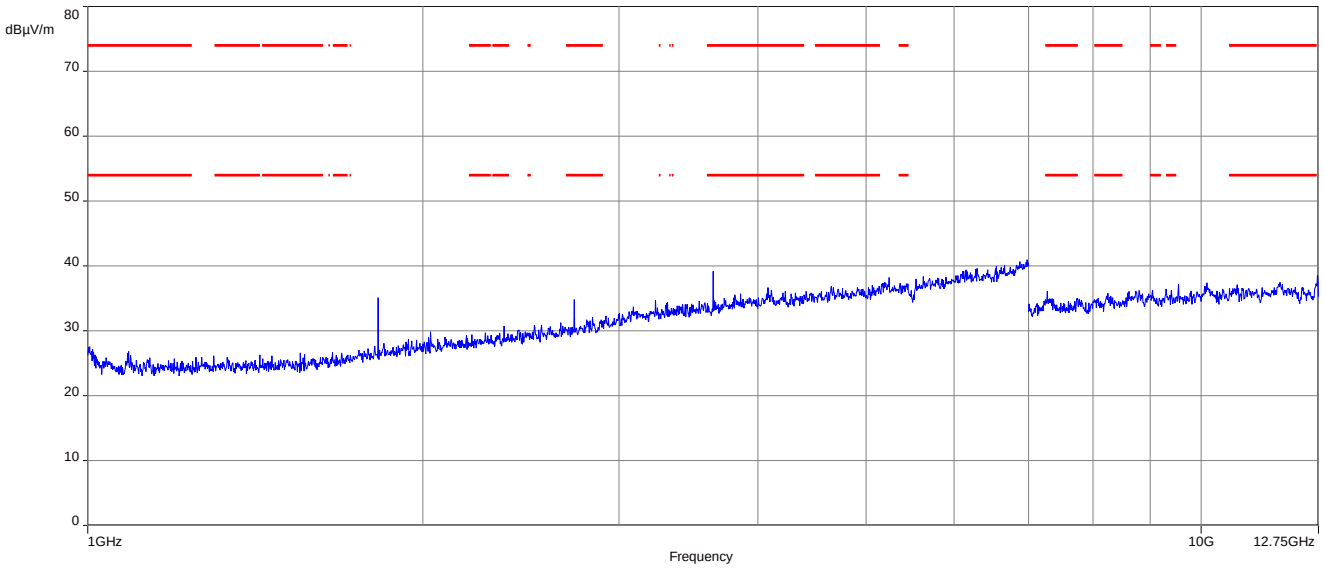
FCC		
Frequency (MHz)	Field Strength (dBµV/m)	Measurement distance
Above 960	54.0	3

Results:

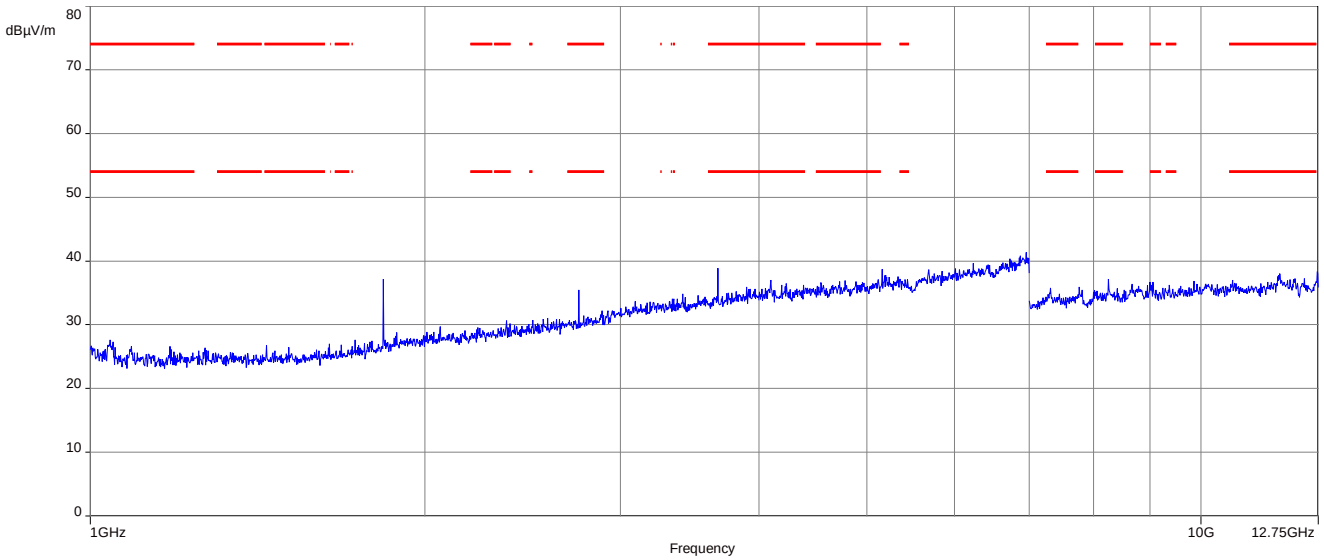
TX Spurious Emissions Radiated [dBµV/m]								
low channel			mid channel			high channel		
F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]
All detected emissions are more than 20 dB below the limit.			-/-			All detected emissions are more than 20 dB below the limit.		

Plots:

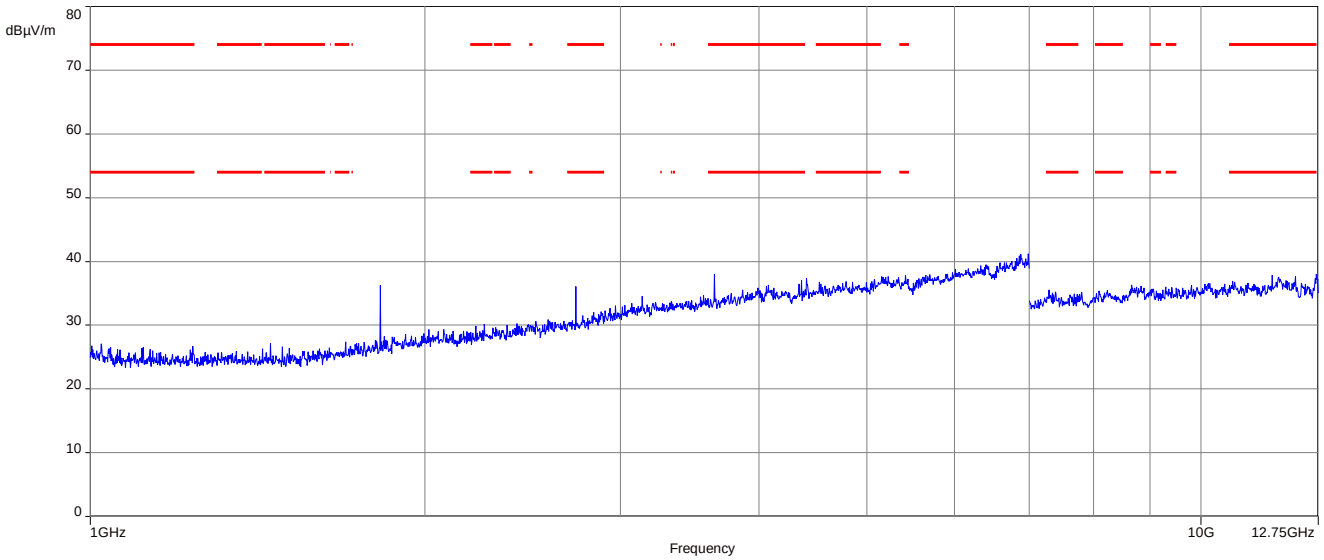
Plot 1: 1 GHz to 12.75 GHz, vertical & horizontal polarization, 2m cable length, low channel



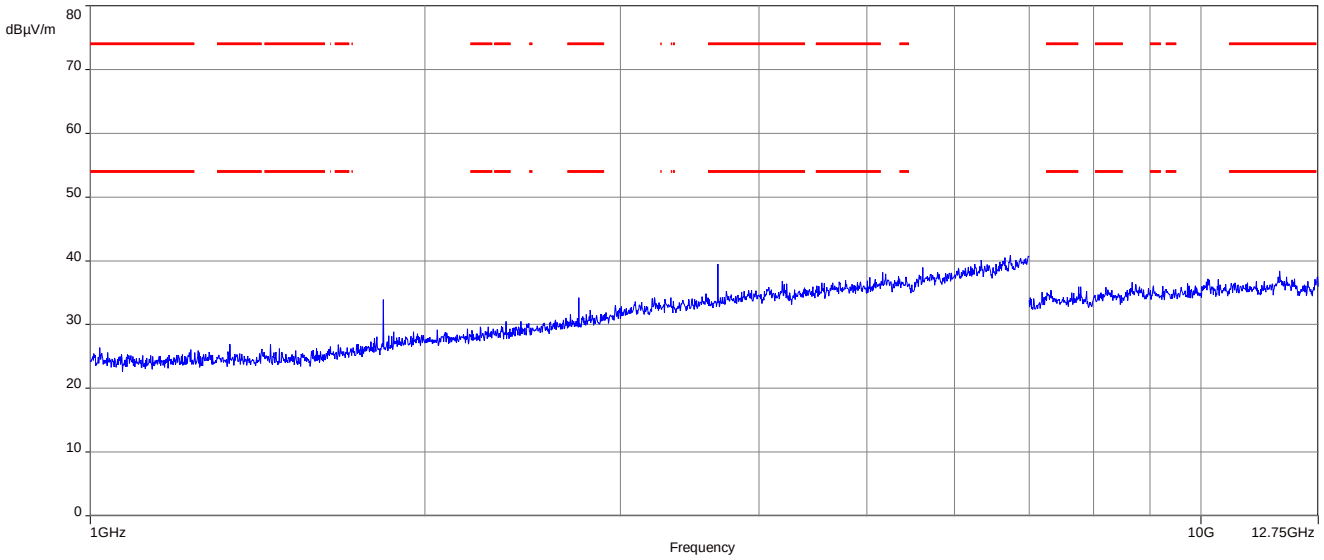
Plot 2: 1 GHz to 12.75 GHz, vertical & horizontal polarization, 2m cable length, high channel



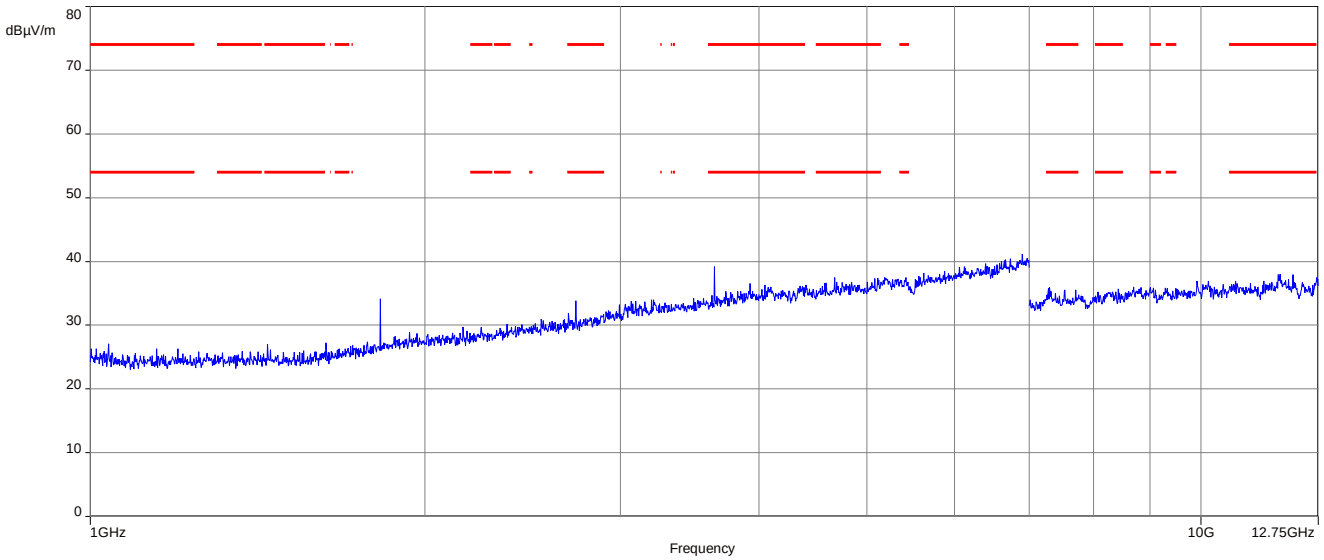
Plot 3: 1 GHz to 12.75 GHz, vertical & horizontal polarization, 5m cable length, low channel



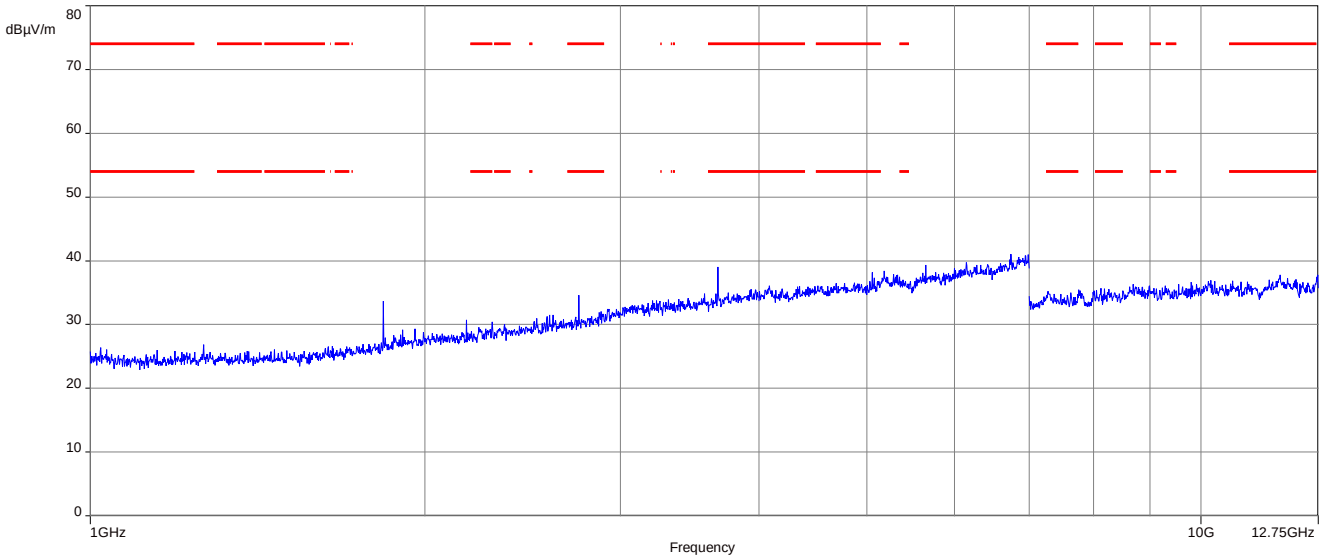
Plot 4: 1 GHz to 12.75 GHz, vertical & horizontal polarization, 5m cable length, high channel



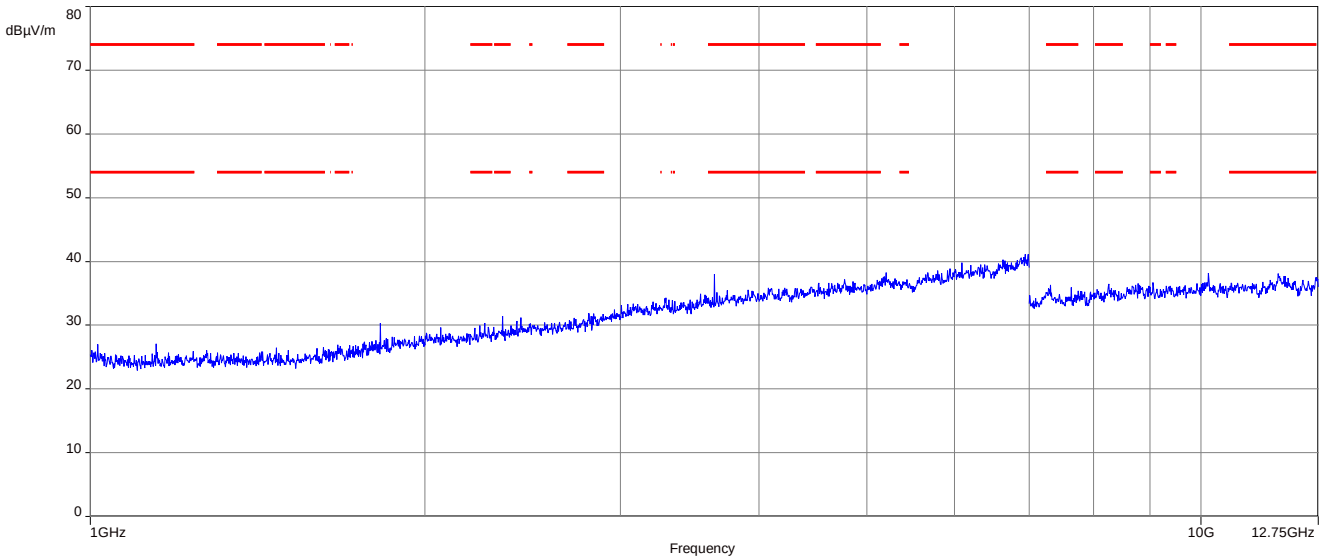
Plot 5: 1 GHz to 12.75 GHz, vertical & horizontal polarization, 10m cable length, low channel



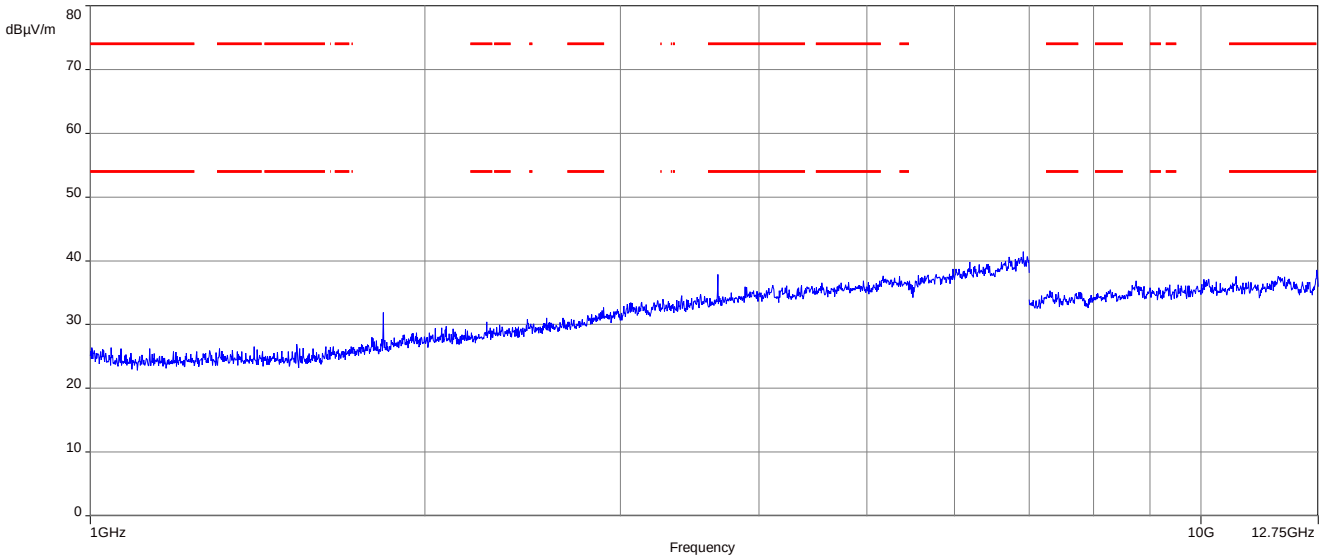
Plot 6: 1 GHz to 12.75 GHz, vertical & horizontal polarization, 10m cable length, high channel



Plot 7: 1 GHz to 12.75 GHz, vertical & horizontal polarization, antenna direct connected, low channel



Plot 8: 1 GHz to 12.75 GHz, vertical & horizontal polarization, antenna direct connected, high channel



12.6 Spurious emissions conducted below 30 MHz (AC conducted)

Description:

Measurement of the conducted spurious emissions in transmit mode below 30 MHz. Both power lines, phase and neutral line, are measured. Found peaks are re-measured with average and quasi peak detection to show compliance to the limits.

Measurement:

Measurement parameter	
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 chapter 7.4 A
Measurement uncertainty	See chapter 9

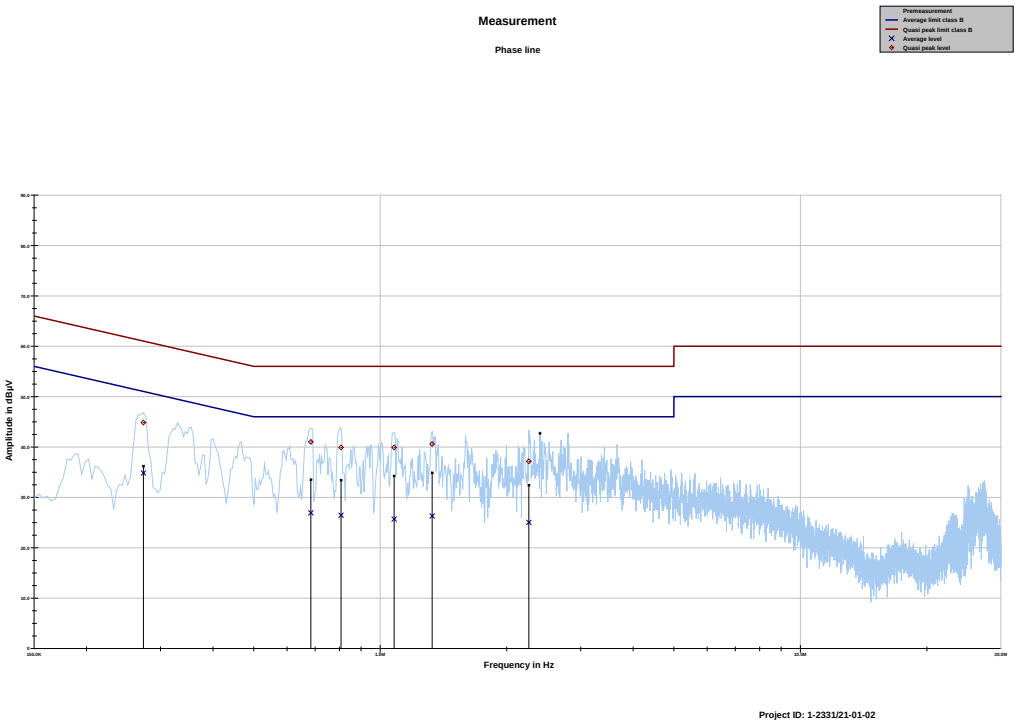
Limits:

FCC		
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

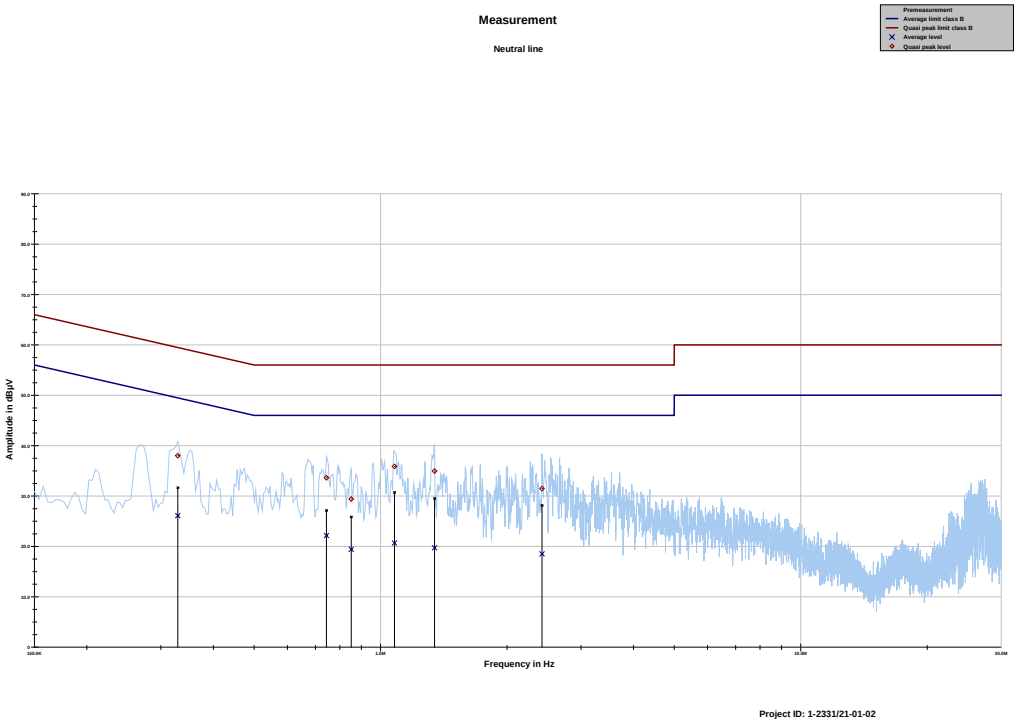
Plots:

Plot 1: 150 kHz to 30 MHz, phase line



Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.273131	44.85	16.18	61.022	34.82	17.66	52.482
0.683569	41.02	14.98	56.000	26.93	19.07	46.000
0.806700	39.91	16.09	56.000	26.44	19.56	46.000
1.079081	39.90	16.10	56.000	25.69	20.31	46.000
1.329075	40.58	15.42	56.000	26.30	19.70	46.000
2.258156	37.16	18.84	56.000	25.03	20.97	46.000

Plot 2: 150 kHz to 30 MHz, neutral line



Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin Average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.329100	38.00	21.48	59.474	26.09	24.79	50.883
0.743269	33.62	22.38	56.000	22.15	23.85	46.000
0.851475	29.40	26.60	56.000	19.40	26.60	46.000
1.079081	35.86	20.14	56.000	20.67	25.33	46.000
1.344000	34.93	21.07	56.000	19.71	26.29	46.000
2.422331	31.48	24.52	56.000	18.51	27.49	46.000

13 Observations

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

14 Power output register settings

frequency:	antenna cable length:	power setting
911.80 MHz	2m	-7.5
918.15 MHz	2m	-7.5
911.80 MHz	5m	-5
918.15 MHz	5m	-5
911.80 MHz	10m	-3.5
918.15 MHz	10m	-3.5
911.80 MHz	direkt (0m)	-7.5
918.15 MHz	direkt (0m)	-7.5

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15 list of channels

Kanal	Frequenz MHz	Kanal	Frequenz MHz	Kanal	Frequenz MHz	Kanal	Frequenz MHz
1	911,800	33	913,400	65	915,000	97	916,600
2	911,850	34	913,450	66	915,050	98	916,650
3	911,900	35	913,500	67	915,100	99	916,700
4	911,950	36	913,550	68	915,150	100	916,750
5	912,000	37	913,600	69	915,200	101	916,800
6	912,050	38	913,650	70	915,250	102	916,850
7	912,100	39	913,700	71	915,300	103	916,900
8	912,150	40	913,750	72	915,350	104	916,950
9	912,200	41	913,800	73	915,400	105	917,000
10	912,250	42	913,850	74	915,450	106	917,050
11	912,300	43	913,900	75	915,500	107	917,100
12	912,350	44	913,950	76	915,550	108	917,150
13	912,400	45	914,000	77	915,600	109	917,200
14	912,450	46	914,050	78	915,650	110	917,250
15	912,500	47	914,100	79	915,700	111	917,300
16	912,550	48	914,150	80	915,750	112	917,350
17	912,600	49	914,200	81	915,800	113	917,400
18	912,650	50	914,250	82	915,850	114	917,450
19	912,700	51	914,300	83	915,900	115	917,500
20	912,750	52	914,350	84	915,950	116	917,550
21	912,800	53	914,400	85	916,000	117	917,600
22	912,850	54	914,450	86	916,050	118	917,650
23	912,900	55	914,500	87	916,100	119	917,700
24	912,950	56	914,550	88	916,150	120	917,750
25	913,000	57	914,600	89	916,200	121	917,800
26	913,050	58	914,650	90	916,250	122	917,850
27	913,100	59	914,700	91	916,300	123	917,900
28	913,150	60	914,750	92	916,350	124	917,950
29	913,200	61	914,800	93	916,400	125	918,000
30	913,250	62	914,850	94	916,450	126	918,050
31	913,300	63	914,900	95	916,500	127	918,100
32	913,350	64	914,950	96	916,550	128	918,150

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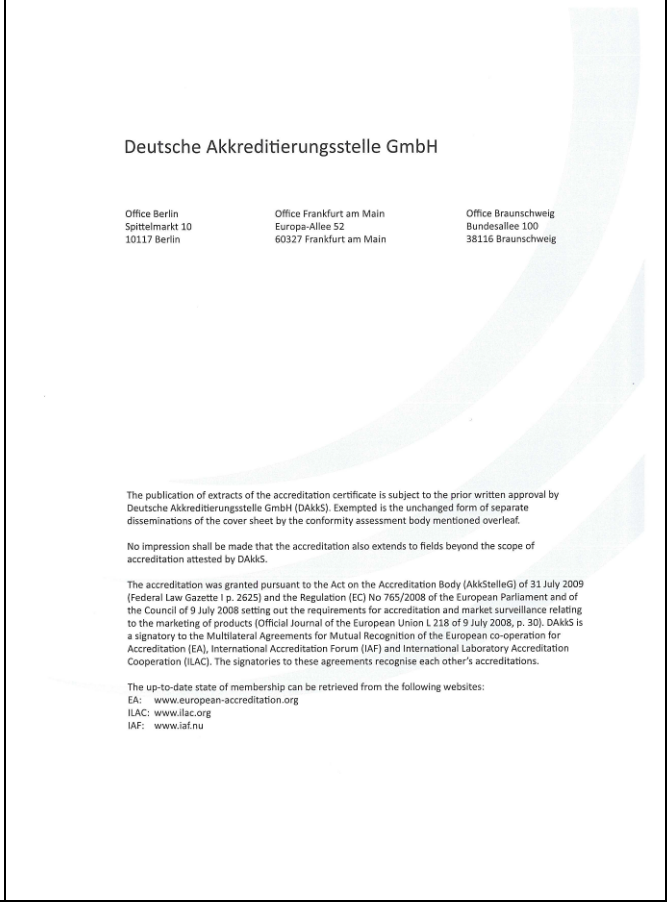
16 Glossary

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

17 Document history

Version	Applied changes	Date of release
-/-	Initial release	2022-03-14

18 Accreditation Certificate – D-PL-12076-01-05

first page	last page
	

Note: The current certificate annex is published on the websites (link see below).

https://www.dakks.de/files/data/as/pdf/D-PL-12076-01-05.pdf

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