
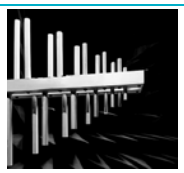
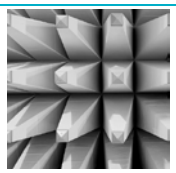

TEST REPORT

Test report no.: 1-7885-24-01-05_TR1-R01

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
e-mail: mail@cetecomadvanced.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 with the registration number:
D-PL-12047-01-00.
ISED Testing Laboratory Recognized Listing Number: DE0001
FCC designation number: DE0002

Applicant

Leica Microsystems (Schweiz) AG
Max Schmidheiny-Strasse 201
9435 Heerbrugg / SWITZERLAND
Phone: 41 71-726-3352
Contact: Stefan Jung
e-mail: stefan.jung@leica-microsystems.com

Manufacturer

Leica Microsystems (Schweiz) AG
Max Schmidheiny-Strasse 201
9435 Heerbrugg / SWITZERLAND

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
RSS - 247 Issue 3	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

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

Test Item

Kind of test item:	**Microscope with or without eyepieces**
Model name:	**EZ4 W**
FCC ID:	**2AEJM-EZ4WWIFI**
ISED certification number:	**20232-EZ4WWIFI**
Frequency:	2400 MHz to 2483.5 MHz
Technology tested:	WLAN
Antenna:	Integrated antenna
Power supply:	110 V AC by mains
Temperature range:	+10°C to +40°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=Jörg Warken, o=cetecom advanced GmbH, ou=WAK-230905, email=joerg.warken@cetecomadvanced.com, c=DE
2024.12.12 16:27:04 +01'00'

Joerg Warken
Lab Manager
Radio Labs

Test performed:

cn=Andreas Curette, o=cetecom advanced GmbH, ou=CUR-230601, email=andreas.curette@cetecomadvanced.com, c=DE
2024.12.13 09:46:47 +01'00'

Andreas Curette
Lab Manager
Radio Labs

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. 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.
The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of cetecom advanced GmbH.
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In no case this test report can be considered as a Letter of Approval.

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:	2024-06-10
Date of receipt of test item:	2024-12-04
Start of test:*	2024-12-04
End of test:*	2024-12-12
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

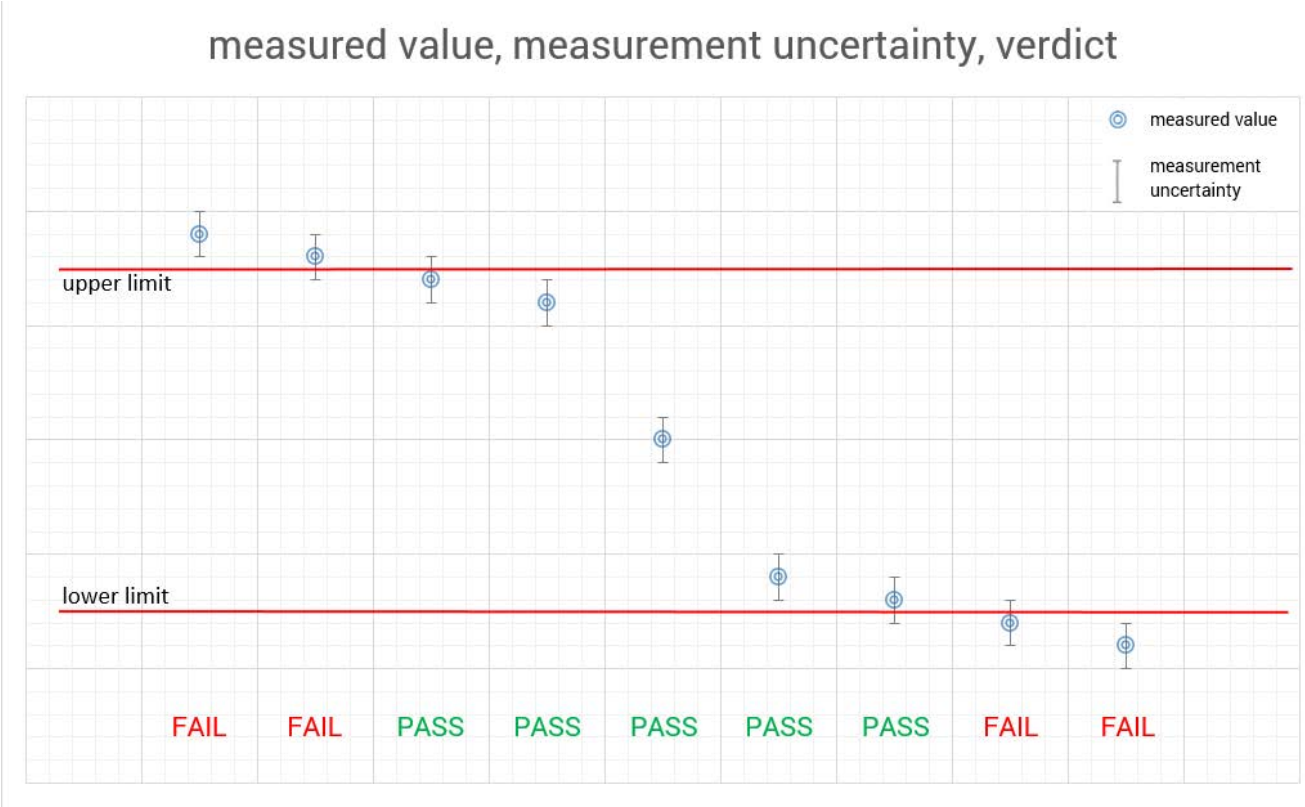
3 Test standard/s, references and accreditations

Test standard	Date	Description
FCC - Title 47 CFR Part 15		FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 247 Issue 3	August 2023	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
RSS - Gen Issue 5 incl. Amendment 1 & 2	February 2021	Spectrum Management and Telecommunications Radio Standards Specification - General Requirements for Compliance of Radio Apparatus

Guidance	Version	Description
KDB 558074 D01	v05r02	GUIDANCE FOR COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEM, FREQUENCY HOPPING SPREAD SPECTRUM SYSTEM, AND HYBRID SYSTEM DEVICES OPERATING UNDER SECTION 15.247 OF THE FCC RULES
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

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 Testing under extreme temperature conditions not required. Testing under extreme temperature conditions not required.
Relative humidity content	:		55 %
Barometric pressure	:		1021 hpa
Power supply	:	V_{nom} V_{max} V_{min}	110 V AC by mains Testing under extreme voltage conditions not required. Testing under extreme voltage conditions not required.

6 Test item

6.1 General description

Kind of test item	:	Microscope with or without eyepieces
Model name	:	EZ4 W
HMN	:	NA
PMN	:	EZ4 W Stereo Microscope
HVIN	:	EZ4 W
FVIN	:	NA
S/N serial number	:	Rad. RF sample 1(Spurious emissions testing above 1 GHz) 3923097353 (Spurious emissions testing below 1 GHz) Cond. RF sample 4
Hardware status	:	2
Software status	:	1.47.606427
Firmware status	:	1.47.606427
Frequency band	:	2400 MHz to 2483.5 MHz
Type of radio transmission Use of frequency spectrum	: :	DSSS, OFDM
Type of modulation	:	BPSK, QPSK, 16 – QAM, 64 – QAM
Number of channels	:	11
Antenna	:	Integrated antenna
Power supply	:	110 V AC by mains
Temperature range	:	+10°C to +40°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: 1-7885-24-01-01_TR1-A101-R01
1-7885-24-01-01_TR1-A104-R01

7 Sequence of testing

7.1 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.

7.2 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.

7.3 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.

7.4 Sequence of testing radiated spurious above 18 GHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- 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.
- The measurement distance is as appropriate (e.g. 0.5 m).
- The EUT is set into operation.

Premeasurement

- The test antenna is handheld and moved carefully over the EUT to cover the EUT's whole sphere and different polarizations of the antenna.

Final measurement

- The final measurement is performed at the position and antenna orientation causing the highest emissions with Peak and RMS detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement and the limit is stored.

8 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).

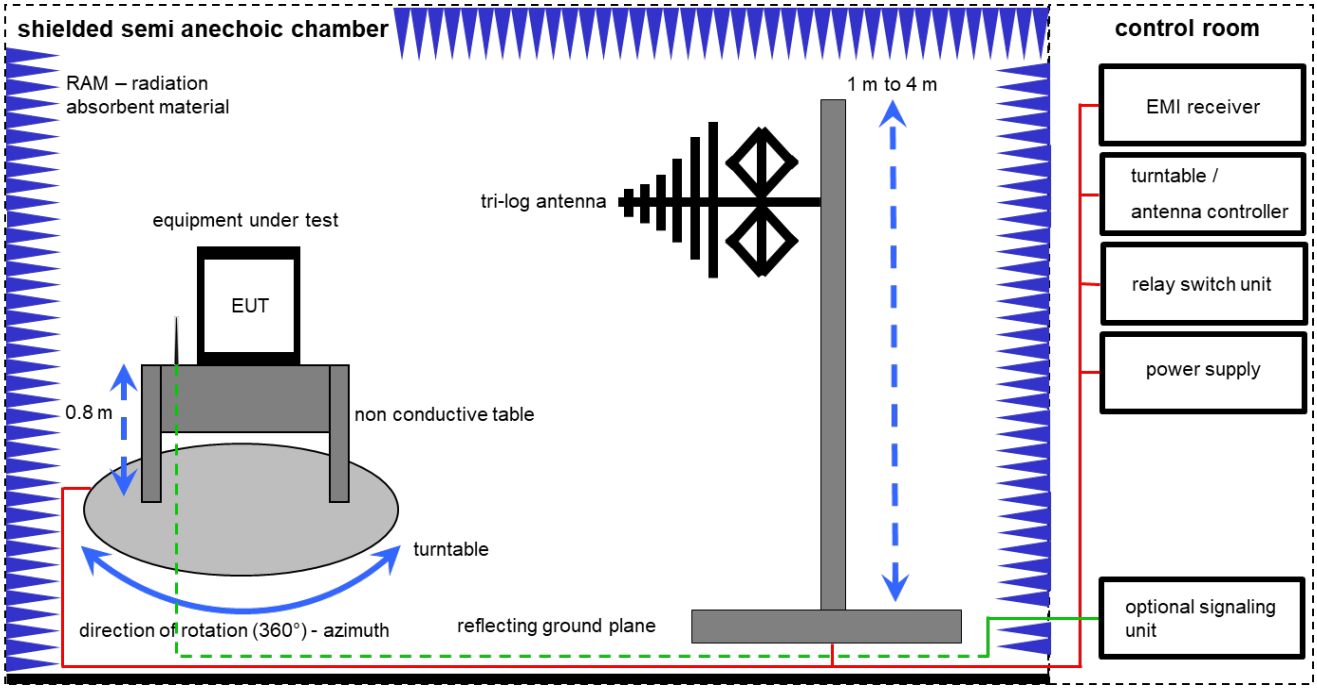
Each block diagram listed can contain several test setup configurations. All devices belonging to a test setup are identified with the same letter syntax. For example: Column Setup and all devices with an A.

Agenda: Kind of Calibration

k/cal	calibration / calibrated	EK	limited calibration
Ne/cnn	not required (k, ev, izw, zw not required)	zw	cyclical maintenance (external cyclical maintenance)
Ev/chk	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
cpu	check prior usage		

8.1 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

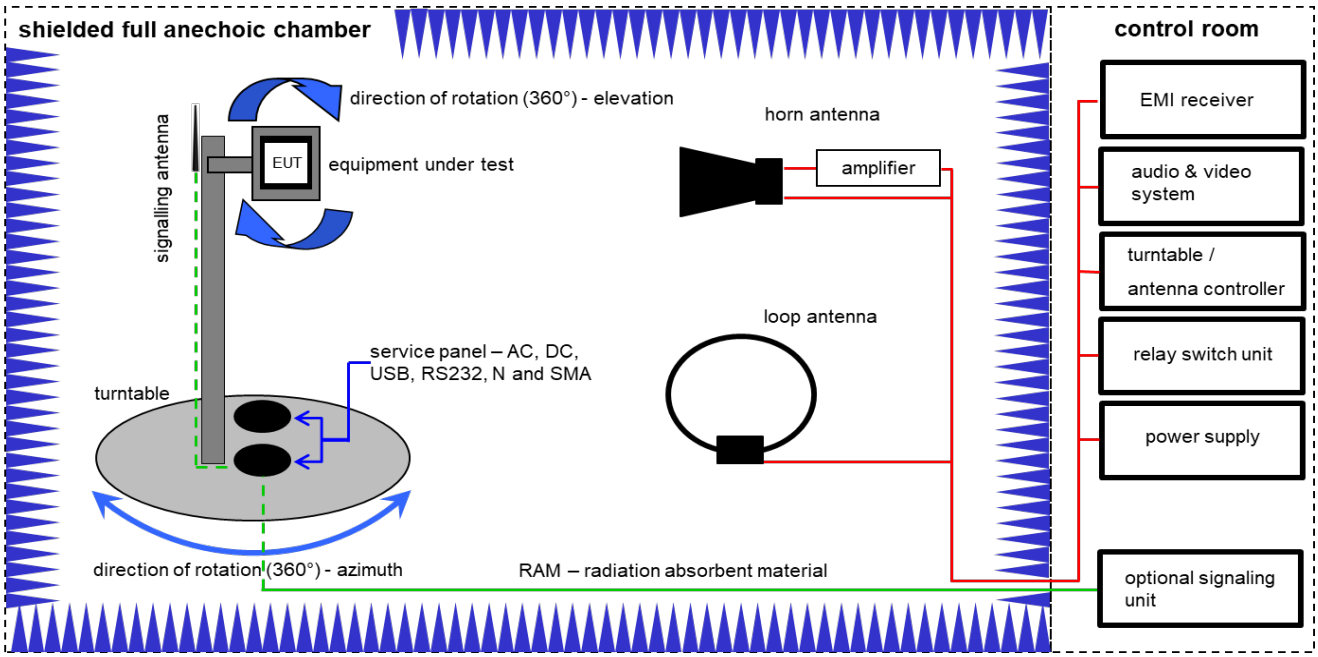
FS = UR + CL + AF
(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

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	Switch-Unit 3488A	Hewlett Packard	2719A14505	50160	cpu	-/-	-/-
2	A	Power Supply	Power Supply 6032A	Hewlett Packard	2920A04466	50161	cnn	-/-	-/-
3	A	Antenna Tower	Antenna Tower 2175	ETS-Lindgren Gmbh / Taufkirchen	64762	50279	cnn	-/-	-/-
4	A	Positioning Controller	Positioning Controller 2090	ETS-Lindgren Gmbh / Taufkirchen	64672	50280	cnn	-/-	-/-
5	A	Spectrum-Analyzer	Spectrum-Analyzer FSU26	Rohde & Schwarz Messgerätebau GmbH / Memmingen	200809	50308	cal	06.12.2023	31.12.2024
6	A	TRILOG Broadband Antenna	TRILOG Broadband Antenna VULB9163	Schwarzbeck Mess-Elektronik OHG / Schönau	1029	50403	cal	25.09.2023	30.09.2025
7	A	EMI Test Receiver	EMI Test Receiver ESR3	Rohde & Schwarz Messgerätebau GmbH / Memmingen	102587	50417	cal	06.12.2023	31.12.2024

8.2 Shielded fully anechoic chamber



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

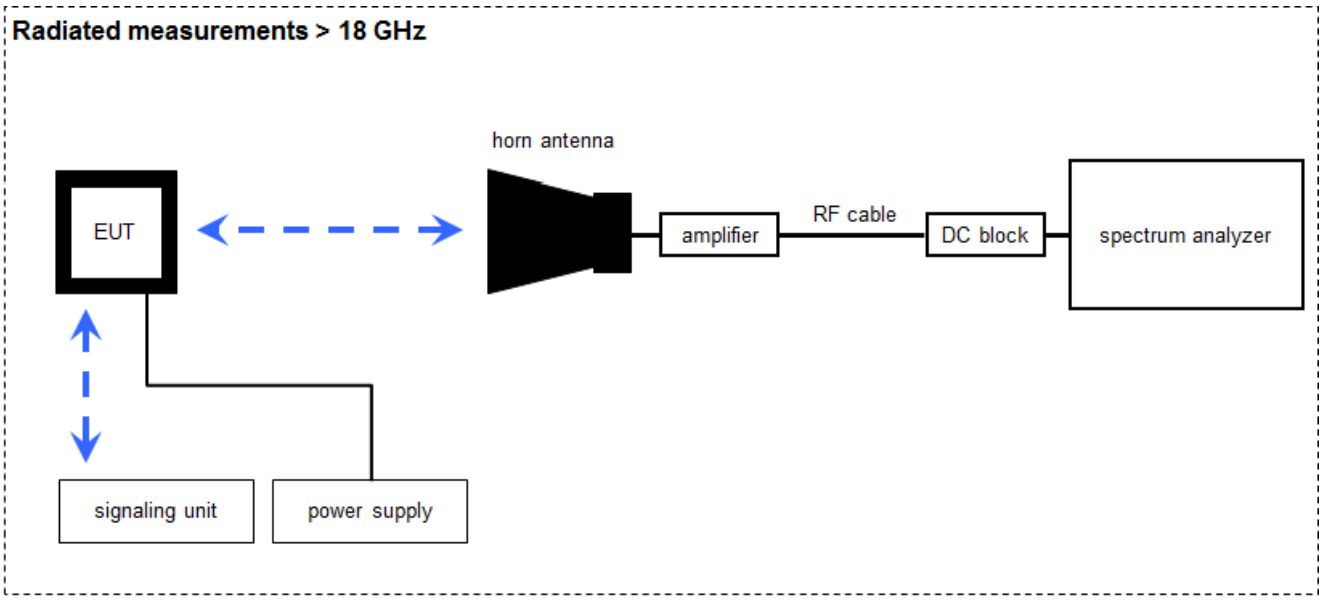
FS = UR + CA + AF
(FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

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

Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A, C	Double-Ridged Waveguide Horn Antenna	Double-Ridged Waveguide Horn Antenna 3115	EMCO Elektronik GmbH / Gilching	8812-3088	40341	cal	10.10.2023	31.10.2025
2	A, B, C	Anechoic chamber	Anechoic chamber FAC 3/5m	MEC Import: MWB / TDK	87400/02	40349	cpu	-/-	-/-
3	A, B, C	Switch / Control Unit	Switch / Control Unit 3488A	Hewlett Packard	*	40350	cnn	-/-	-/-
4	A	Band Reject filter	Band Reject filter WRCG2400/2483-2375/2505-50/10SS	Wainwright Instruments GmbH / Andechs	11	40356	cpu	-/-	-/-
5	A	Highpass Filter	Highpass Filter WHK1.1/15G-10SS	Wainwright Instruments GmbH / Andechs	3	40361	cpu	-/-	-/-
6	A	Highpass Filter	Highpass Filter WHKX7.0/18G-8SS	Wainwright Instruments GmbH / Andechs	19	40365	cnn	-/-	-/-
7	A	High Pass Filter	High Pass Filter VHF-3500+	Mini-Circuits / Brooklyn	-/-	40369	cnn	-/-	-/-
8	A	Broadband Amplifier 0.5-18 GHz	Broadband Amplifier 0.5-18 GHz CBLU5184540	MEC Import: CERNEX	22049	40373	cpu	-/-	-/-
9	A, B, C	4U RF Switch Platform	4U RF Switch Platform L4491A	Agilent Technologies Deutschland GmbH / Böblingen	MY50000037	40375	cnn	-/-	-/-
10	A, B, C	NEXIO EMV-Software	NEXIO EMV-Software BAT EMC V2022.0.32.0	MEC Import: Nexio	-/-	40383	cnn	-/-	-/-
11	A, C	RF-Amplifier	RF-Amplifier AMF-6F06001800-30-10P-R	MEC Import: NARDA-MITEQ Inc	2011572	40400	cpu	-/-	-/-
12	B	Active Loop Antenna	Active Loop Antenna 6502	EMCO Elektronik GmbH / Gilching	2210	50044	cal	02.08.2023	02.08.2025
13	A, B, C	EMI Test Receiver 20Hz- 26,5GHz	EMI Test Receiver 20Hz-26,5GHz ESU26	Rohde & Schwarz Messgerätebau GmbH / Memmingen	100037	50254	cal	11.12.2023	31.12.2024

8.3 Radiated measurements > 18 GHz



Measurement distance: horn antenna 50 cm

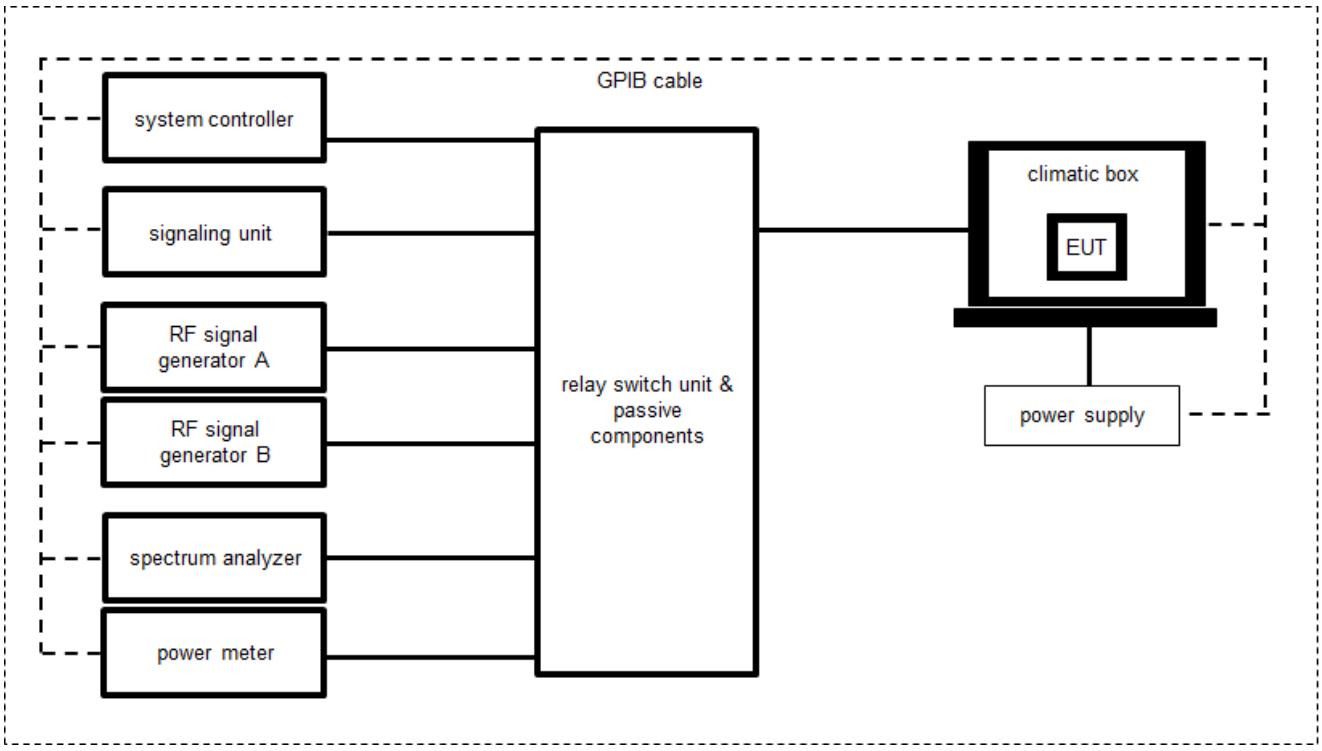
FS = UR + CA + AF
(FS-field strength; UR-voltage at the receiver; CA-loss signal path & distance correction; AF-antenna factor)

Example calculation:
FS [dBµV/m] = 40.0 [dBµV/m] + (-60.1) [dB] + 36.74 [dB/m] = 16.64 [dBµV/m] (6.79 µV/m)

Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Std. Gain Horn Antenna 18.0-26.5 GHz	638	Narda	01096	300000486	vIKI!	24.01.2024	23.01.2026
2	A	Broadband Low Noise Amplifier 18-50 GHz	CBL18503070-XX	CERNEX	19338	300004273	ev	-/-	-/-
3	A	Signal analyzer	FSV40	Rohde&Schwarz	101042	300004517	k	06.12.2023	31.12.2024
4	A	RF-Cable	ST18/SMAm/SMAm /48	Huber & Suhner	Batch no. 600918	400001182	ev	-/-	-/-
5	A	DC-Blocker 0.1-40 GHz	8141A	Inmet	-/-	400001185	ev	-/-	-/-

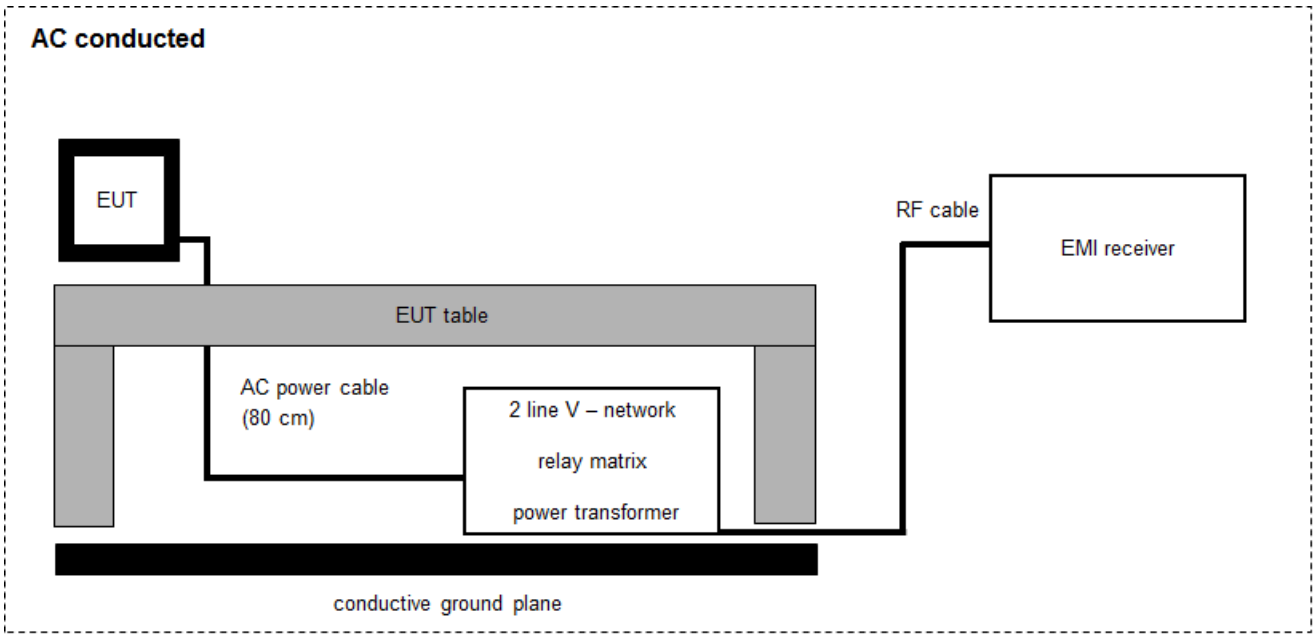
8.4 Conducted measurements system



Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	USB/GPIB interface	82357B	Agilent Technologies	MY52103346	300004390	ne	-/-	-/-
2	A	Switch Matrix	USM	cetecom advanced GmbH	B001	140607268	ev	30.01.2024	31.01.2025
3	A	Hygro-Thermometer	-/-, 5-45°C, 20-100%rF	Thies Clima	-/-	400000109	ev	25.09.2024	30.09.2026
4	A	Signal analyzer	Signal analyzer FSV30	Rohde & Schwarz Messgerätebau GmbH / Memmingen	1321.3008K30/ 103170	18373	cal	09.12.2022	31.12.2024

8.5 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!	12.12.2023	31.12.2025
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 3.6 GHz	ESR3	Rohde & Schwarz	102981	300006318	k	08.12.2023	31.12.2024

9 Measurement uncertainty

Measurement uncertainty		
Test case	**Uncertainty**	
Antenna gain	± 3 dB	
Power spectral density	± 1.56 dB	
DTS bandwidth	± 100 kHz (depends on the used RBW)	
Occupied bandwidth	± 100 kHz (depends on the used RBW)	
Maximum output power conducted	± 1.56 dB	
Detailed spurious emissions @ the band edge - conducted	± 1.56 dB	
Band edge compliance radiated	± 3 dB	
Spurious emissions conducted	> 3.6 GHz	± 1.56 dB
	> 7 GHz	± 1.56 dB
	> 18 GHz	± 2.31 dB
	≥ 40 GHz	± 2.97 dB
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	
Spurious emissions conducted below 30 MHz (AC conducted)	± 2.6 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	CFR Part 15 RSS - 247, Issue 3	See table!	2024-12-12	-/-

Test specification clause	Test case	Guideline	Temperature & voltage conditions	C	NC	NA	NP	Remark
§15.247(b)(4) RSS - 247 / 5.4 (f)(ii)	Antenna gain	-/-	Nominal	-/-				-/-
§15.35	Duty cycle	-/-	Nominal	-/-				-/-
§15.247(e) RSS - 247 / 5.2 (b)	Power spectral density	KDB 558074 DTS clause: 8.4	Nominal	☒	☐	☐	☐	-/-
§15.247(a)(2) RSS - 247 / 5.2 (a)	DTS bandwidth	KDB 558074 DTS clause: 8.2	Nominal	☒	☐	☐	☐	-/-
RSS Gen clause 4.6.1	Occupied bandwidth	-/-	Nominal	☒	☐	☐	☐	-/-
§15.247(b)(3) RSS - 247 / 5.4 (d)	Maximum output power	KDB 558074 DTS clause: 8.3.1.3	Nominal	☒	☐	☐	☐	-/-
§15.247(d) RSS - 247 / 5.5	Detailed spurious emissions @ the band edge – cond.	-/-	Nominal	☒	☐	☐	☐	-/-
§15.205 RSS - 247 / 5.5 RSS - Gen	Band edge compliance cond.	KDB 558074 DTS clause: 8.7.3	Nominal	☒	☐	☐	☐	-/-
§15.247(d) RSS - 247 / 5.5	TX spurious emissions cond.	KDB 558074 DTS clause: 8.5	Nominal	☒	☐	☐	☐	-/-
§15.209(a) RSS-Gen	TX spurious emissions rad. below 30 MHz	-/-	Nominal	☒	☐	☐	☐	-/-
§15.247(d) RSS - 247 / 5.5 RSS-Gen	TX spurious emissions rad. 30 MHz to 1 GHz	-/-	Nominal	☒	☐	☐	☐	-/-
§15.247(d) RSS - 247 / 5.5 RSS-Gen	TX spurious emissions rad. above 1 GHz	-/-	Nominal	☒	☐	☐	☐	-/-
§15.107(a) §15.207	Conducted emissions < 30 MHz	-/-	Nominal	☒	☐	☐	☐	-/-

Notes:

C	Compliant	**NC**	Not compliant	**NA**	Not applicable	**NP**	Not performed

11 Additional information and comments

Reference documents: 1-7885_24-01 Customer Questionnaire.docm
Antenna specification:
HF-A11&HF-LPA chip ANT.pdf

Co-applicable documents: 1-7885-24-01-05_TR1-A201-R1.pdf

Special test descriptions: Power settings:

Channel	1 / 6 / 11
DSSS / b – mode	23
OFDM / g – mode	1E
OFDM / n HT20 – mode	21

Configuration descriptions: The DUT has been controlled by QATool_dbg for the spurious emissions tests. Due to the size of the EUT, the tests have been performed in two different planes (horizontal and vertical)

EUT selection:
☒ Only one device available
☐ Devices selected by the customer
☐ Devices selected by the laboratory (Randomly)

Provided channels:

Channels with 20 MHz channel bandwidth:

channel number & center frequency													
channel	**1**	2	3	4	5	**6**	7	8	9	10	**11**	12	13
f_c / MHz	**2412**	2417	2422	2427	2432	**2437**	2442	2447	2452	2457	**2462**	2467	2472

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
Modulation types:	☒	Wide Band Modulation (None Hopping – e.g. DSSS, OFDM)
	☐	Frequency Hopping Spread Spectrum (FHSS)
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 Antenna gain

Limits:

FCC	ISED
6 dBi / > 6 dBi output power and power density reduction required	

Results: Extracted from antenna datasheet

	lowest channel	middle channel	highest channel
Gain [dBi] / Declared	0.8		

13.2 Identify worst case data rate

Description:

All modes of the module will be measured with an average power meter or spectrum analyzer to identify the maximum transmission power.

In further tests only the identified worst case modulation scheme or bandwidth will be measured and this mode is used as representative mode for all other modulation schemes.

Measurement:

Measurement parameter	
Detector	Peak
Sweep time	Auto
Resolution bandwidth	3 MHz
Video bandwidth	3 MHz
Trace mode	Max hold
Test setup	See chapter 8.4 setup A
Measurement uncertainty	See chapter 9

Results:

Modulation scheme / bandwidth	
DSSS / b – mode	1 Mbit/s
OFDM / g – mode	6 Mbit/s
OFDM / n HT20 – mode	MCS0

13.3 Maximum output power

Description:

Measurement of the maximum conducted peak output power. The measurements are performed using the data rate identified in the previous chapter.

Measurement:

Measurement parameter	
According to ANSI C63.10-2013 Chapter 11.9.2.2.2	
External result file(s)	1-7885-24-01-05_TR1-A201-R1.pdf
Test setup	See chapter 8.4 setup B
Measurement uncertainty	See chapter 9
Detector	RMS
Resolution bandwidth	500 kHz
Video bandwidth	2 MHz
Trace mode	Max hold

Limits:

FCC	ISED
Conducted 1.0 W / 30 dBm with an antenna gain of max. 6 dBi	

Results:

	maximum output power / dBm		
	lowest channel	middle channel	highest channel
Output power conducted DSSS / b – mode	16.8	16.7	16.8
Output power conducted OFDM / g – mode	12.0	12.1	12.2
Output power conducted OFDM / n HT20 – mode	11.5	11.2	11.3

13.4 Duty cycle

Description:

Measurement of the timing behavior.

Measurement:

Measurement parameter	
External result file(s)	1-7885-24-01-05_TR1-A201-R1.pdf
Test setup	See chapter 8.4 setup A
Measurement uncertainty	See chapter 9

Limits:

FCC	ISED
No limitation!	

Results:

T_{nom}	V_{nom}	lowest channel	middle channel	highest channel
DSSS / b – mode		100 % / 0.0 dB	100 % / 0.0 dB	100 % / 0.0 dB
OFDM / g – mode		100 % / 0.0 dB	100 % / 0.0 dB	100 % / 0.0 dB
OFDM / n HT20 – mode		100 % / 0.0 dB	100 % / 0.0 dB	100 % / 0.0 dB

13.5 Power spectral density

Measurement:

Measurement parameter	
According to ANSI C63.10-2013 Chapter 11.10.5	
Detector	RMS
Sweep time	Auto
Resolution bandwidth	100 kHz
Video bandwidth	300 kHz
Span	30 MHz
Trace mode	Max. hold (allow trace to fully stabilize)
External result file(s)	1-7885-24-01-05_TR1-A201-R1.pdf
Test setup	See chapter 8.4 setup A
Measurement uncertainty	See chapter 9

Limits:

FCC	ISED
8 dBm / 3 kHz (conducted)	

Results:

measured	power spectral density / dBm @ 3 kHz		
	Lowest channel	Middle channel	Highest channel
DSSS / b – mode	-14.8	-15.9	-15.7
OFDM / g – mode	-21.6	-21.6	-21.3
OFDM / n HT20 – mode	-21.9	-22.3	-22.1

13.6 6 dB DTS bandwidth

Description:

Measurement of the 6 dB bandwidth of the modulated signal.

Measurement:

Measurement parameter	
According to DTS clause: 8.2	
Detector	Peak
Sweep time	Auto
Resolution bandwidth	100 kHz
Video bandwidth	500 kHz
Span	30 MHz / 50 MHz
Trace mode	Single count with 200 counts
External result file(s)	1-7885-24-01-05_TR1-A201-R1.pdf
Test setup	See chapter 8.4 setup A
Measurement uncertainty	See chapter 9

Limits:

FCC	ISED
Systems using digital modulation techniques may operate in the 2400–2483.5 MHz band. The minimum 6 dB bandwidth shall be at least 500 kHz.	

Results:

	6 dB DTS bandwidth / kHz		
	lowest channel	middle channel	highest channel
DSSS / b – mode	9576	9572	9064
OFDM / g – mode	15104	15104	15092
OFDM / n HT20 – mode	15080	15088	15100

13.7 Occupied bandwidth – 99% emission bandwidth

Description:

Measurement of the 99% bandwidth of the modulated signal acc. RSS-GEN.

Measurement:

Measurement parameter	
Detector	Peak
Sweep time	Auto
Resolution bandwidth	300 kHz
Video bandwidth	1 MHz
Span	30 MHz / 50 MHz
Measurement procedure	Measurement of the 99% bandwidth using the integration function of the analyzer
Trace mode	Single count with 200 counts
External result file(s)	1-7885-24-01-05_TR1-A201-R1.pdf
Test setup	See chapter 8.4 setup A
Measurement uncertainty	See chapter 9

Usage:

-/-	ISED
OBW is necessary for Emission Designator	

Results:

	99% emission bandwidth / kHz		
	lowest channel	middle channel	highest channel
DSSS / b – mode	14455	14415	14475
OFDM / g – mode	17166	17126	17118
OFDM / n HT20 – mode	17926	17894	17898

13.8 Occupied bandwidth – 20 dB bandwidth

Description:

Measurement of the 20 dB bandwidth of the modulated carrier.

Measurement:

Measurement parameter	
Detector	Peak
Sweep time	Auto
Resolution bandwidth	100 kHz
Video bandwidth	500 kHz
Span	30 MHz / 50 MHz
Trace mode	Single count with min. 200 counts
External result file(s)	1-7885-24-01-05_TR1-A201-R1.pdf
Test setup	See chapter 8.4 setup A
Measurement uncertainty	See chapter 9

Usage:

-/-	ISED
The complete bandwidth has to be within the frequency range of the band.	

Results:

	20 dB bandwidth / MHz		
	lowest channel	middle channel	highest channel
DSSS / b – mode	16888	16840	16860
OFDM / g – mode	19376	19304	19368
OFDM / n HT20 – mode	19952	19824	19764

13.9 Band edge compliance radiated

Description:

Measurement of the radiated band edge compliance. The EUT is turned in the position that results in the maximum level at the band edge. Then a sweep over the corresponding restricted band is performed. The EUT is set to the lowest channel for the lower restricted band and to the highest channel for the upper restricted band. Measurement distance is 3 meter.

Measurement:

	Measurement parameter for peak measurements	Measurement parameter for average measurements According to DTS clause: 8.7.3
Detector	Peak	RMS
Sweep time	Auto	Auto
Resolution bandwidth	1 MHz	100 kHz
Video bandwidth	3 MHz	300 kHz
Span	See plot	2 MHz
Trace mode	Max. hold	RMS Average over 101 sweeps
Analyzer function	-/-	Band power function (Compute the power by integrating the spectrum over 1 MHz)
Test setup	See chapter 8.2 setup C	
Measurement uncertainty	See chapter 9	

Limits:

FCC	ISED
74 dBµV/m @ 3 m (Peak) 54 dBµV/m @ 3 m (AVG)	

Results: horinzontal plane

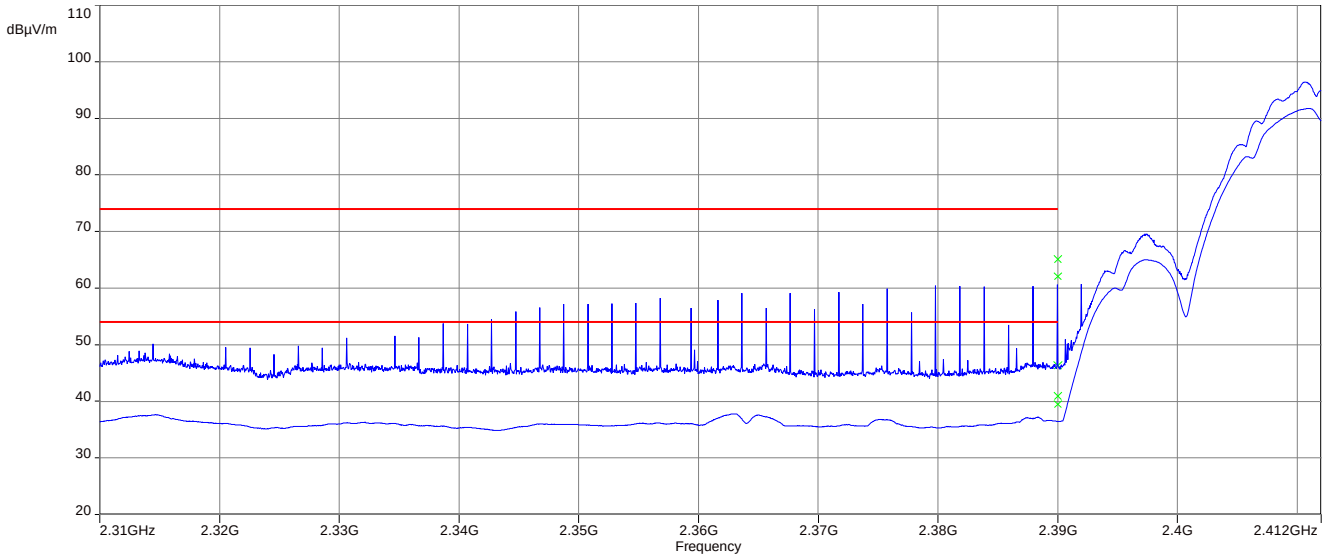
band edge compliance radiated / (dBµV / m) @ 3 m			
	DSSS / b – mode	OFDM / g – mode	OFDM / n HT20 – mode
Lower band edge	65.1 (Peak) 41.0 (AVG)	68.7 (Peak) 50.3 (AVG)	71.8 (Peak) 52.4 (AVG)
Upper band edge	49.3 (Peak) 40.6 (AVG)	70.5 (Peak) 50.1 (AVG)	71.5 (Peak) 53.8 (AVG)

Results: vertical plane

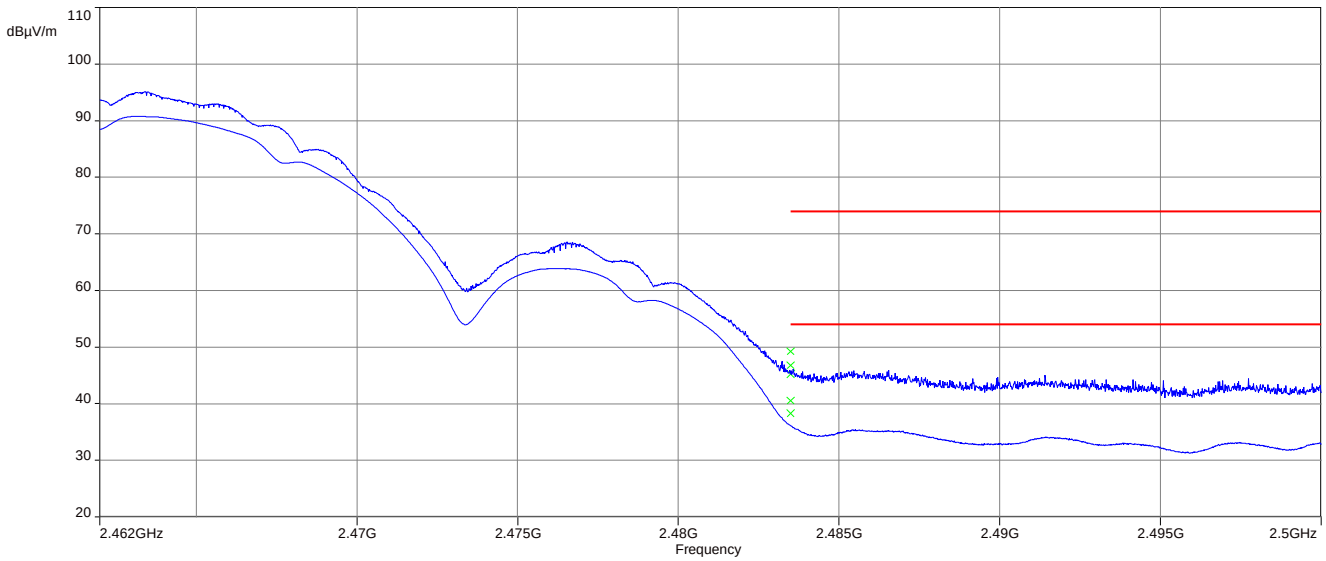
band edge compliance radiated / (dBµV / m) @ 3 m			
	DSSS / b – mode	OFDM / g – mode	OFDM / n HT20 – mode
Lower band edge	50.9 (Peak) 41.2 (AVG)	70.6 (Peak) 52.4 (AVG)	72.2 (Peak) 53.6 (AVG)
Upper band edge	52.2 (Peak) 44.1 (AVG)	72.6 (Peak) 52.7 (AVG)	73.8 (Peak) 53.9 (AVG)

Plots: DSSS - peak / average, horizontal plane

Plot 1: TX mode, lower band edge, vertical & horizontal polarization

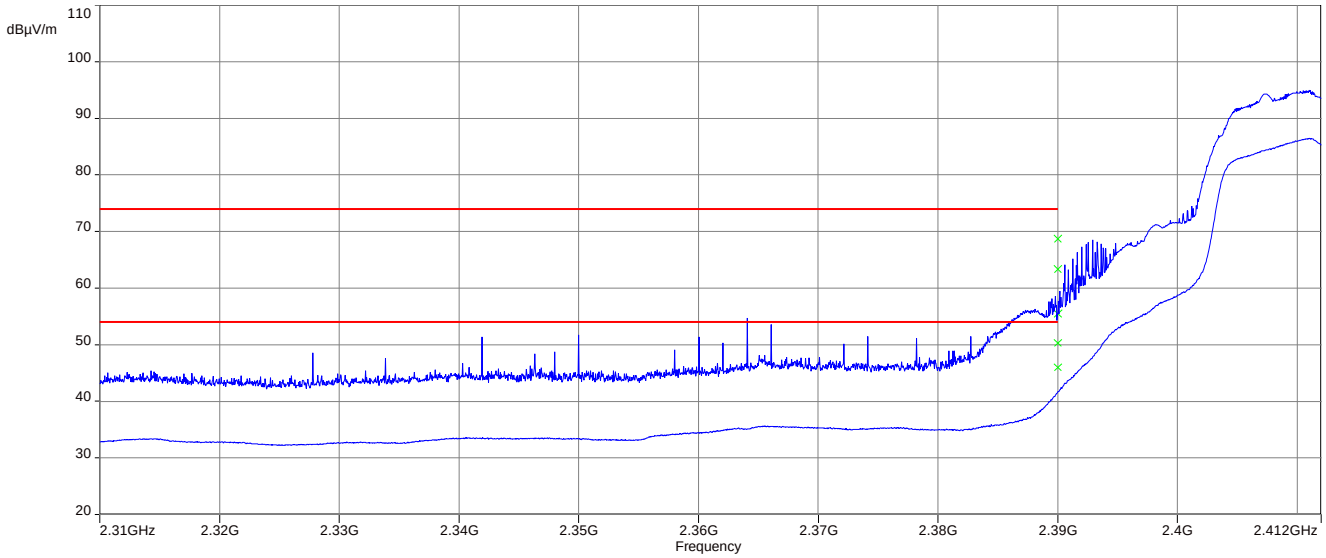


Plot 2: TX mode, upper band edge, vertical & horizontal polarization

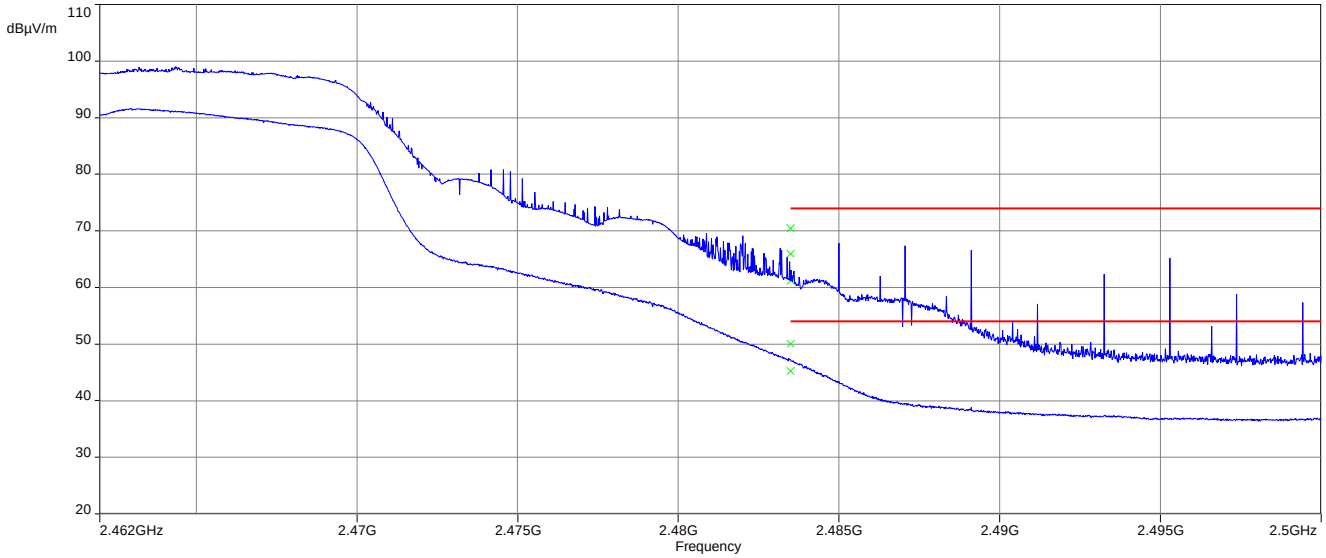


Plots: OFDM /g – mode - peak / average, horizontal plane

Plot 1: TX mode, lower band edge, vertical & horizontal polarization

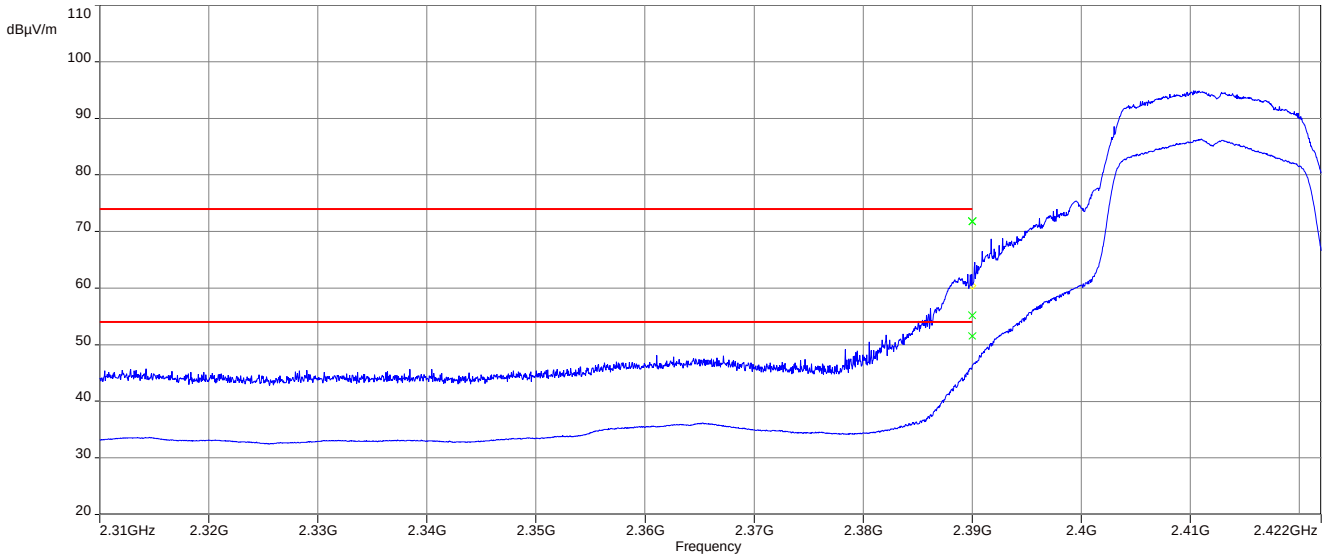


Plot 2: TX mode, upper band edge, vertical & horizontal polarization

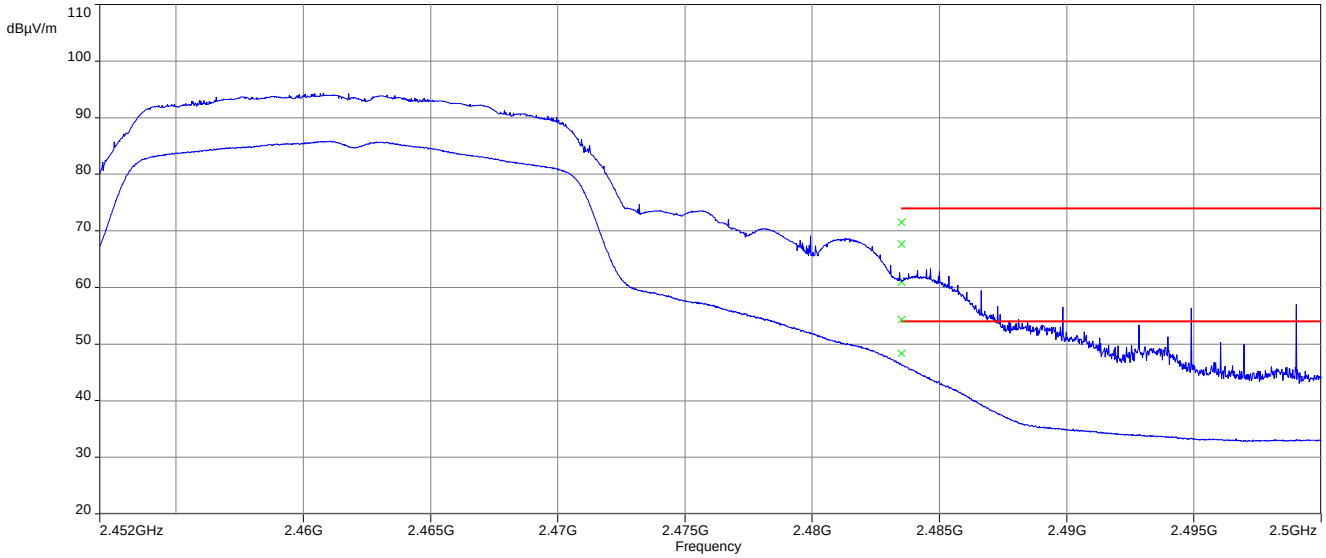


Plots: OFDM / n HT20 – mode - peak / average, horizontal plane

Plot 1: TX mode, lower band edge, vertical & horizontal polarization

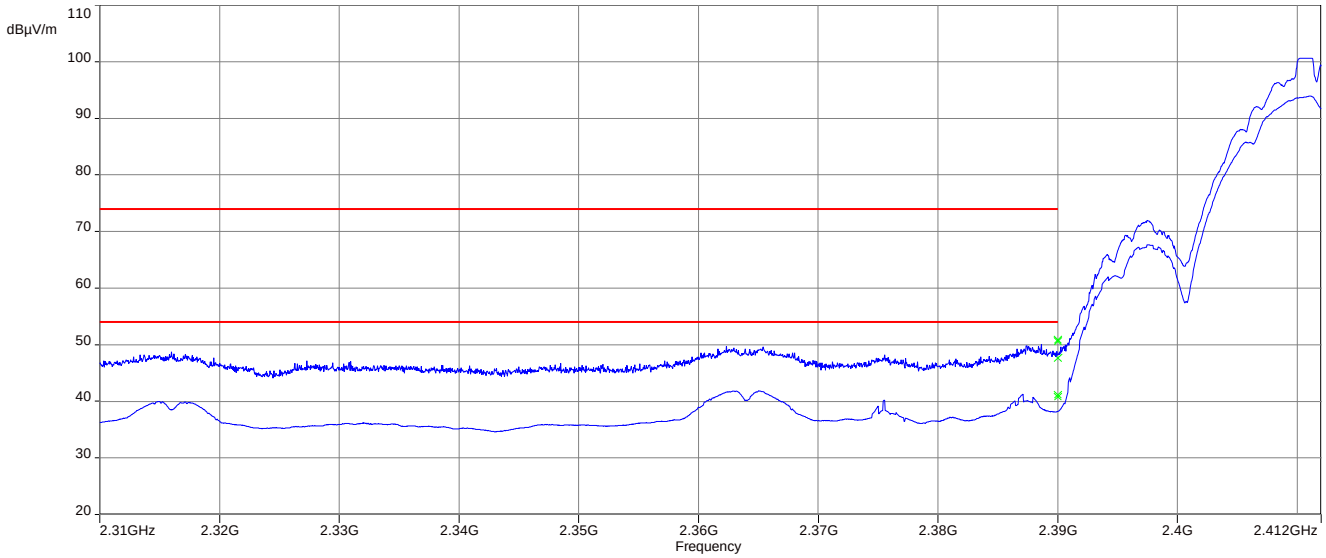


Plot 2: TX mode, upper band edge, vertical & horizontal polarization

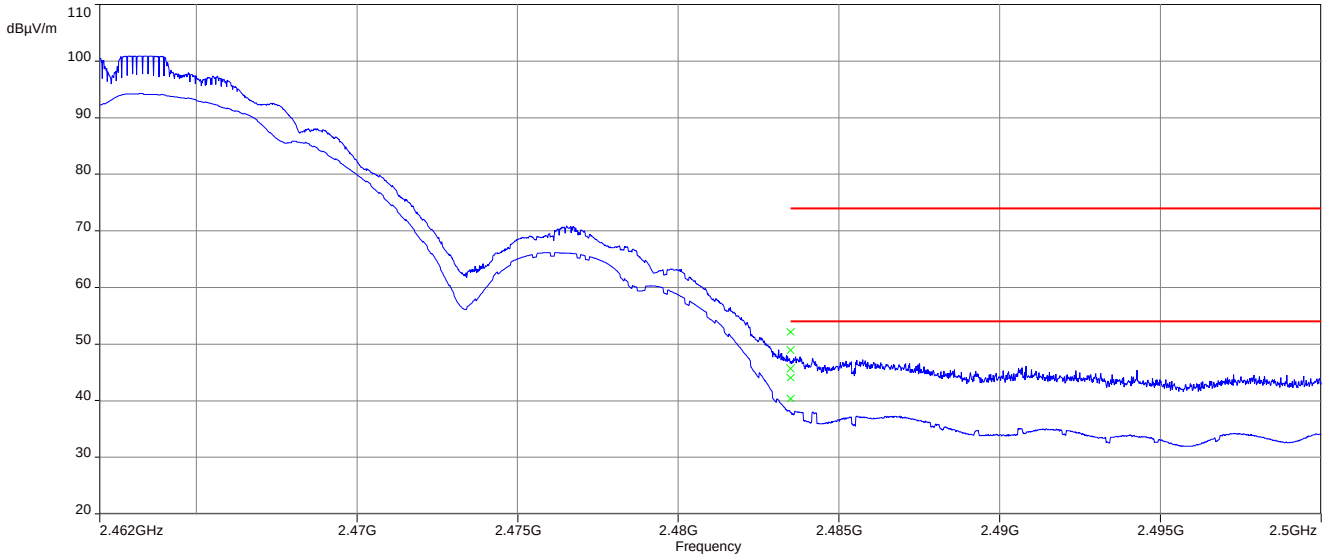


Plots: DSSS - peak / average, vertical plane

Plot 1: TX mode, lower band edge, vertical & horizontal polarization

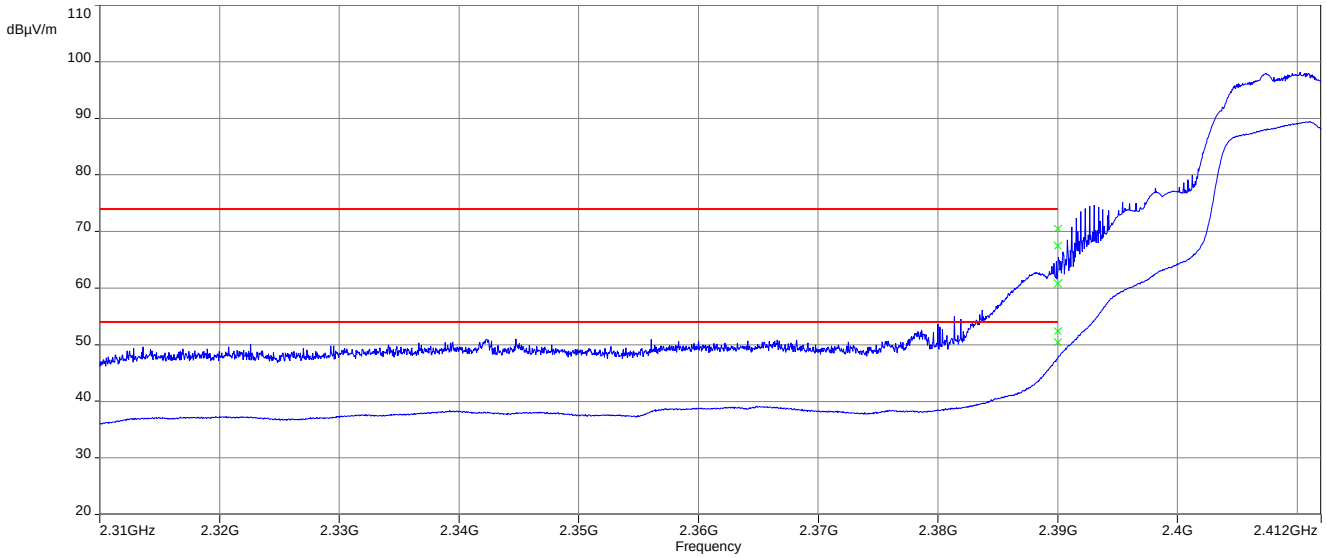


Plot 2: TX mode, upper band edge, vertical & horizontal polarization

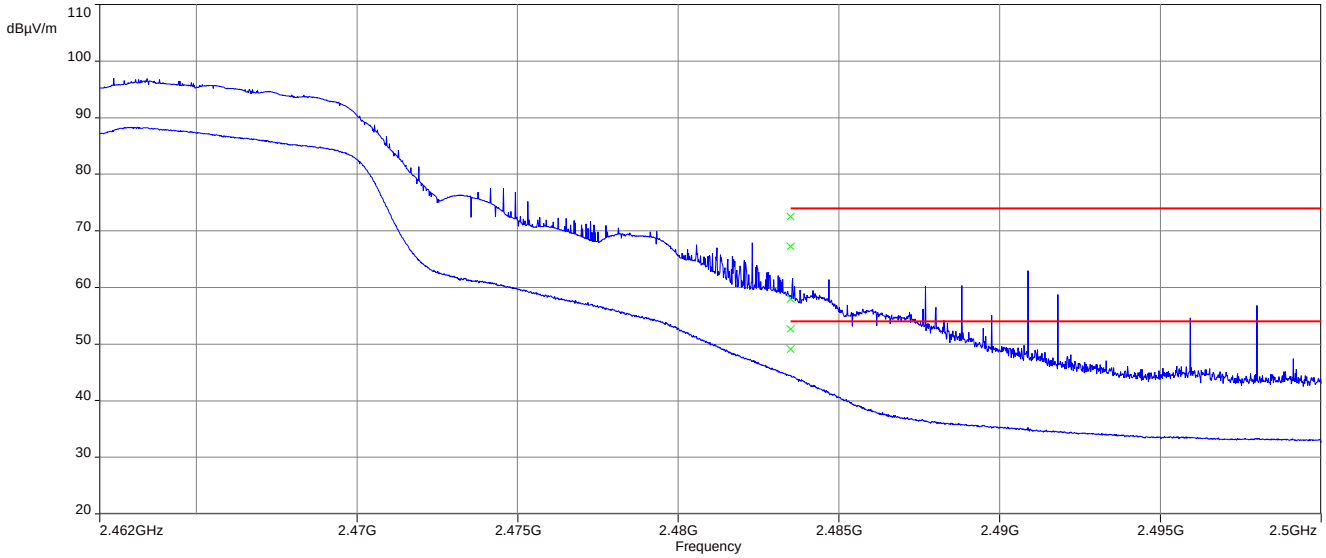


Plots: OFDM /g – mode - peak / average, vertical plane

Plot 1: TX mode, lower band edge, vertical & horizontal polarization

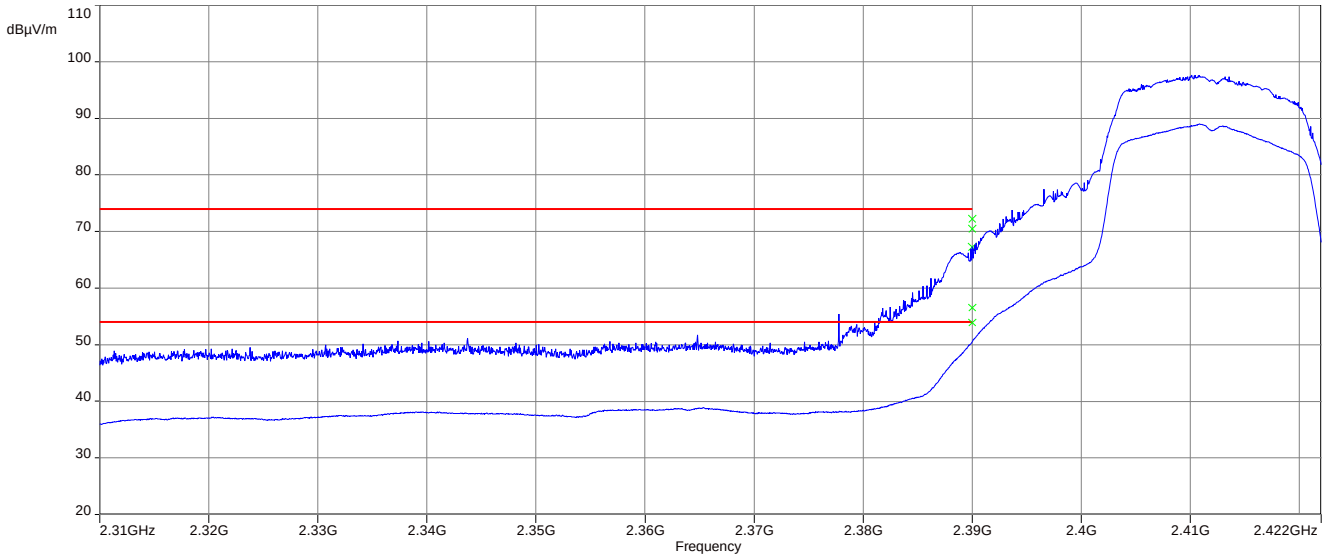


Plot 2: TX mode, upper band edge, vertical & horizontal polarization

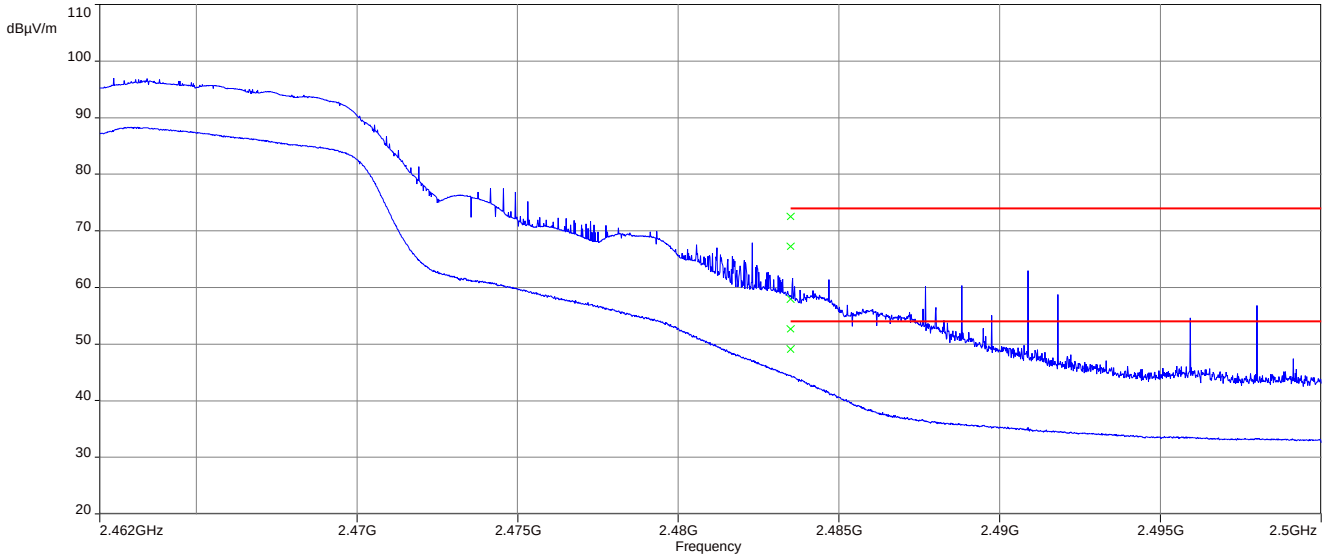


Plots: OFDM / n HT20 – mode - peak / average, vertical plane

Plot 1: TX mode, lower band edge, vertical & horizontal polarization



Plot 2: TX mode, upper band edge, vertical & horizontal polarization



13.10 Spurious emissions conducted

Description:

Measurement of the conducted spurious emissions in transmit mode. The measurement is performed at the lowest; the middle and the highest channel.

Measurement:

Measurement parameter	
Detector	Peak
Sweep time	Auto
Resolution bandwidth	100 kHz
Video bandwidth	500 kHz
Span	9 kHz to 25 GHz
Trace mode	Max Hold
External result file(s)	1-7885-24-01-05_TR1-A201-R1.pdf
Test setup	See chapter 8.4 setup A
Measurement uncertainty	See chapter 9

Limits:

FCC	ISED
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 30 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	

Results: Compliant (see external result file)

13.11 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
Measured modulation	☒ DSSS b – mode ☒ OFDM g – mode ☐ OFDM n HT20 – mode
Test setup	See chapter 8.2 setup B
Measurement uncertainty	See chapter 9

Limits:

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

Results: **horizontal plane**

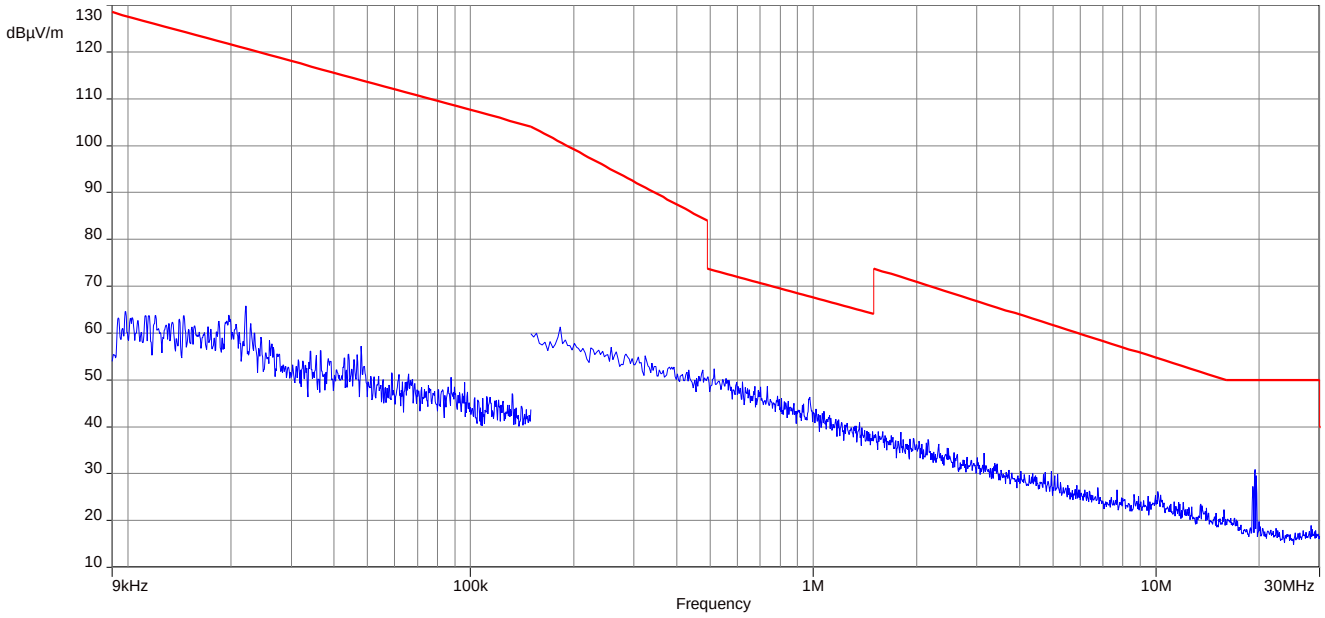
TX spurious emissions radiated < 30 MHz / (dBµV / m) @ 3 m		
Frequency / MHz	Detector	Level / (dBµV / m)
All detected peaks are more than 20 dB below the limit.		

Results: **vertical plane**

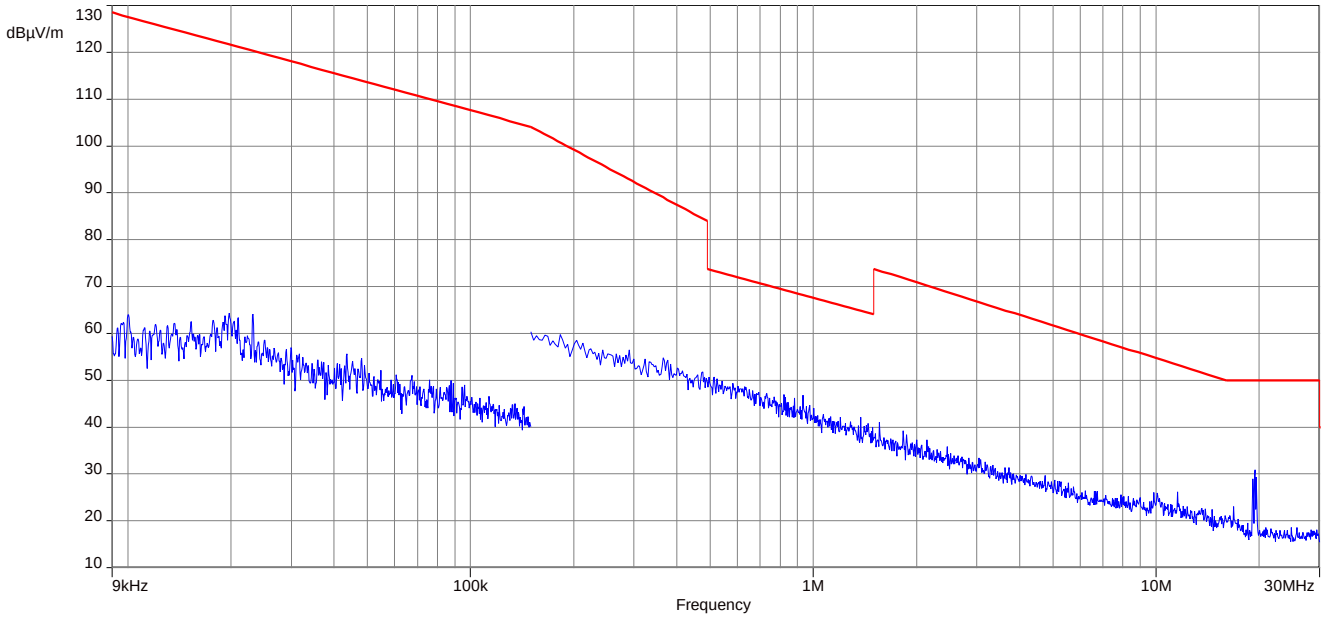
TX spurious emissions radiated < 30 MHz / (dBµV / m) @ 3 m		
Frequency / MHz	Detector	Level / (dBµV / m)
All detected peaks are more than 20 dB below the limit.		

Plots: DSSS, horizontal plane

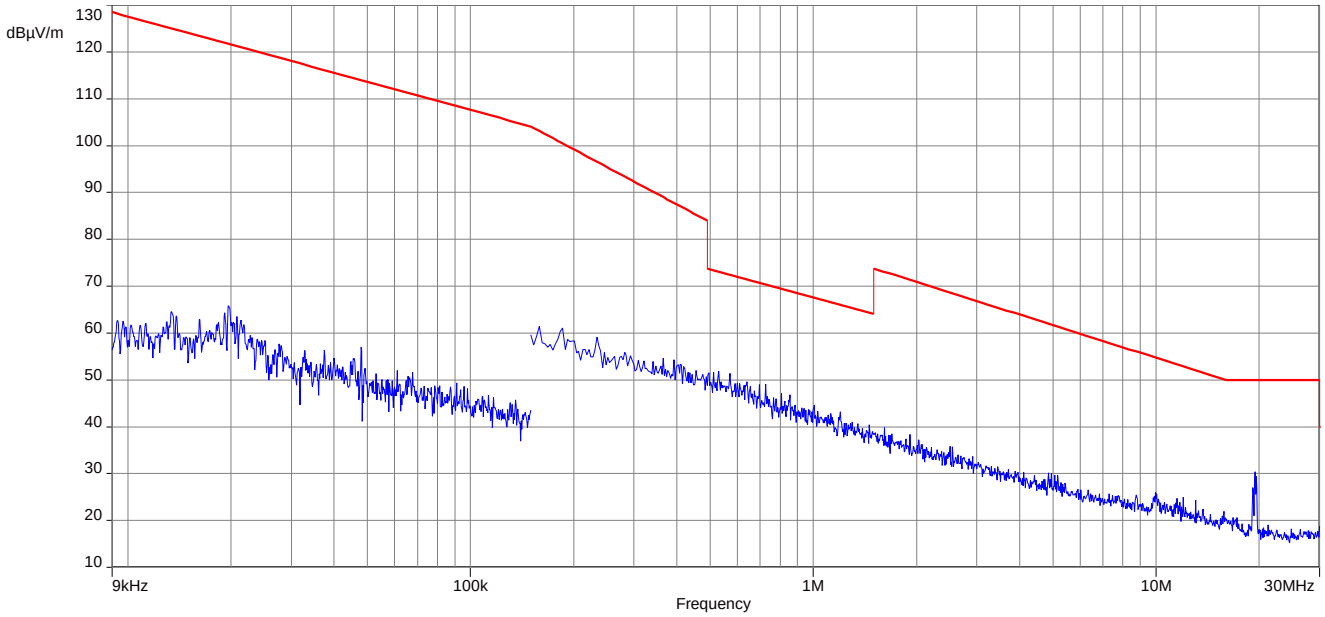
Plot 1: 9 kHz to 30 MHz, lowest channel



Plot 2: 9 kHz to 30 MHz, middle channel

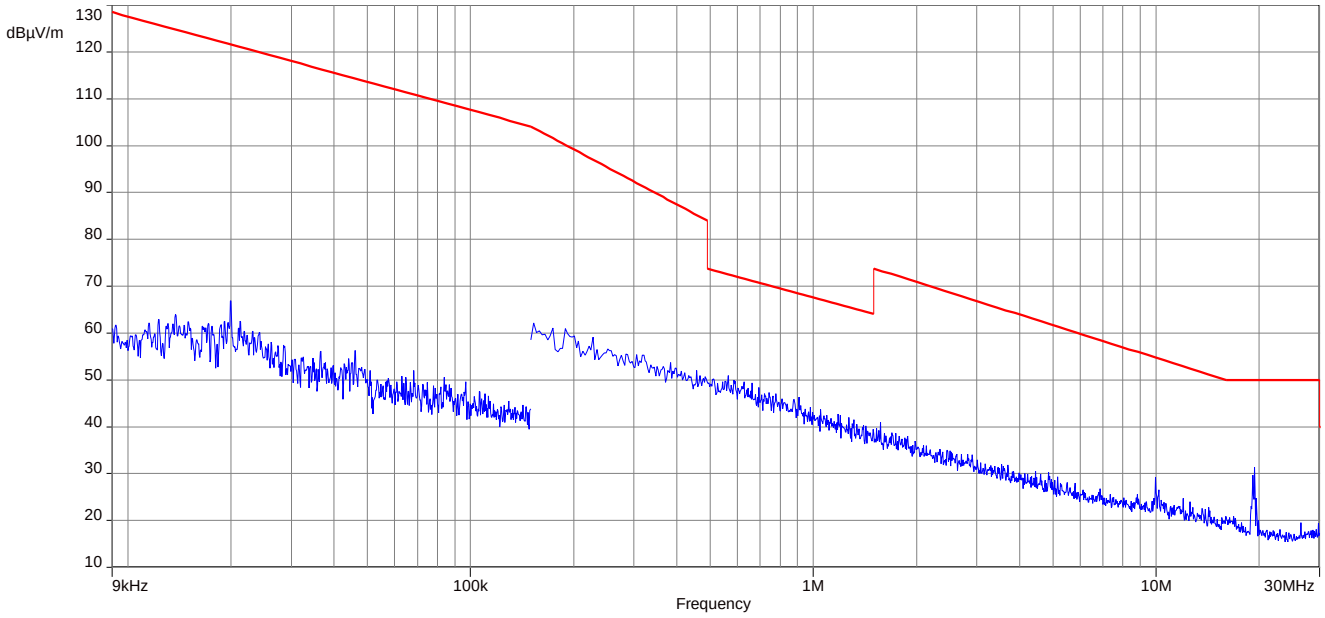


Plot 3: 9 kHz to 30 MHz, highest channel

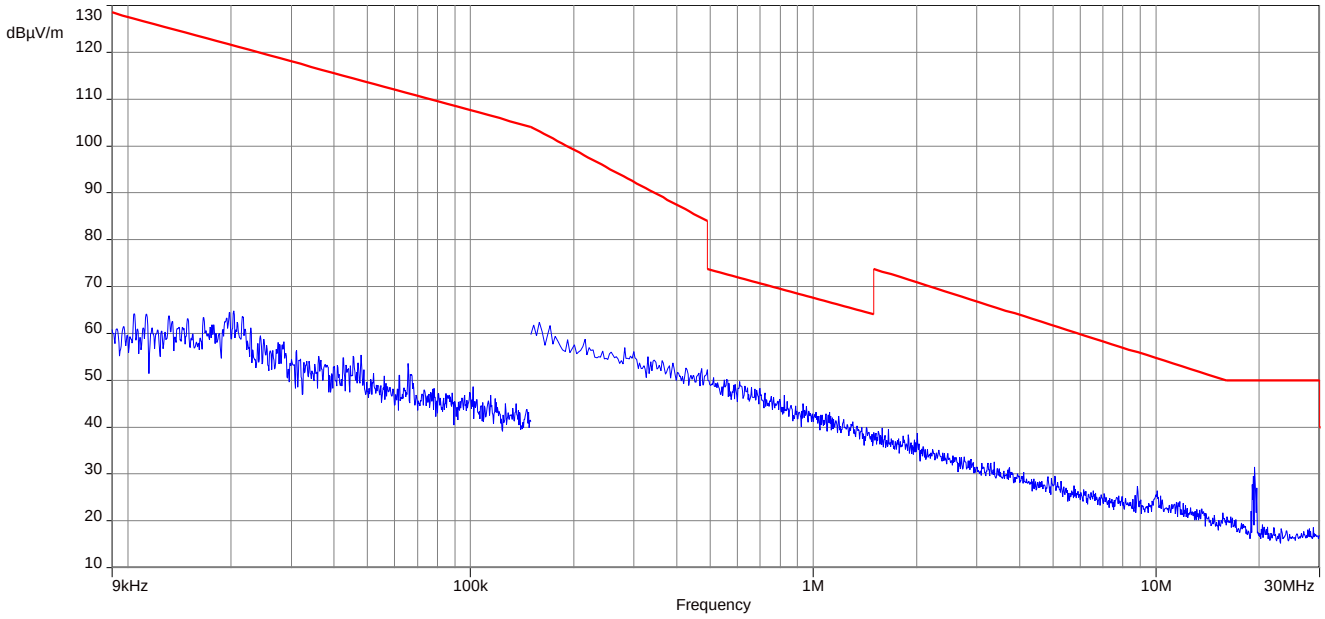


Plots: OFDM (20 MHz nominal channel bandwidth) , horizontal plane

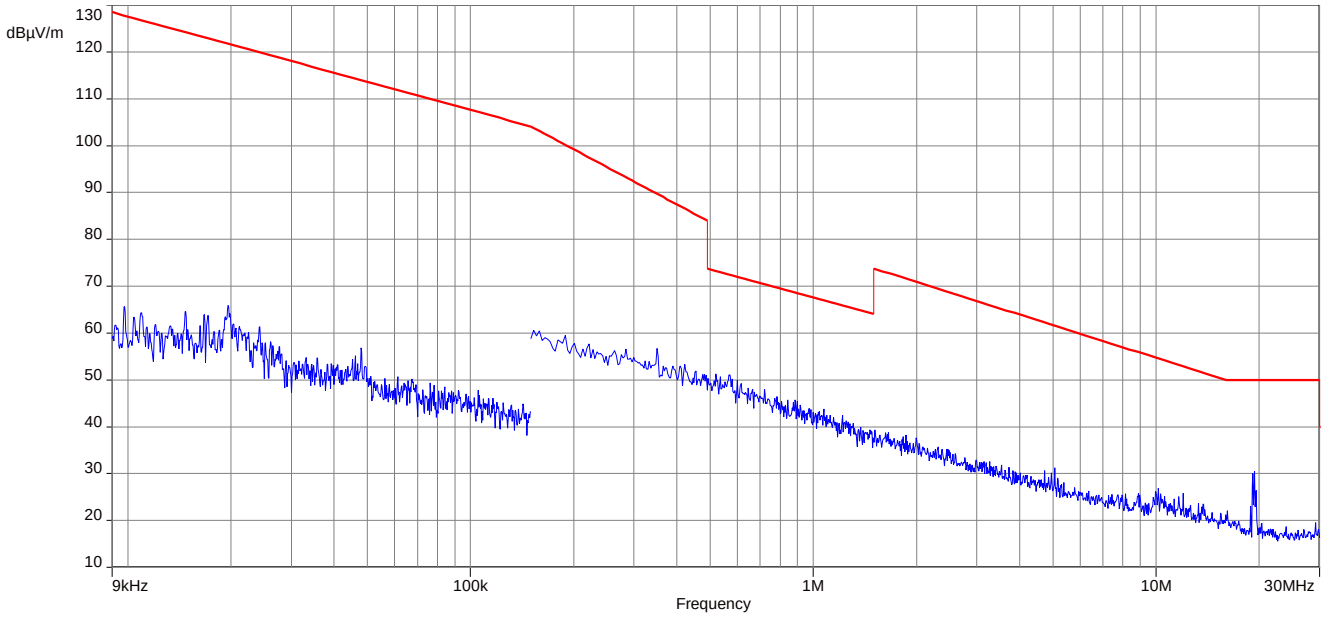
Plot 1: 9 kHz to 30 MHz, lowest channel



Plot 2: 9 kHz to 30 MHz, middle channel

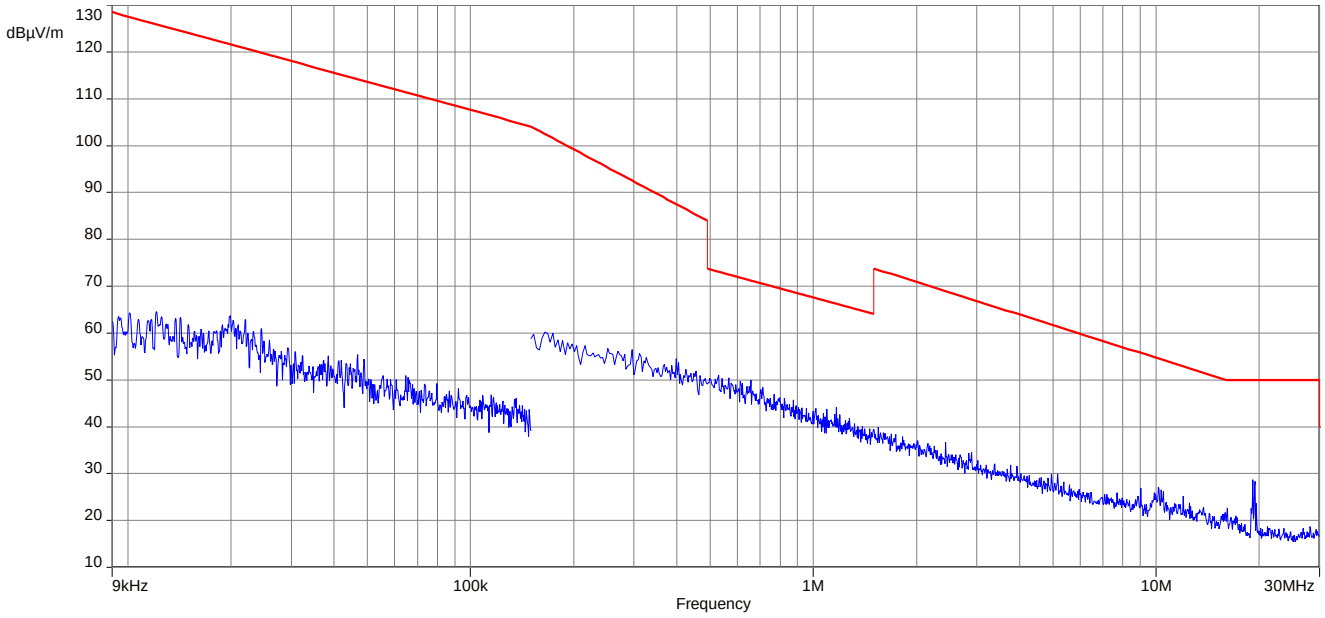


Plot 3: 9 kHz to 30 MHz, highest channel

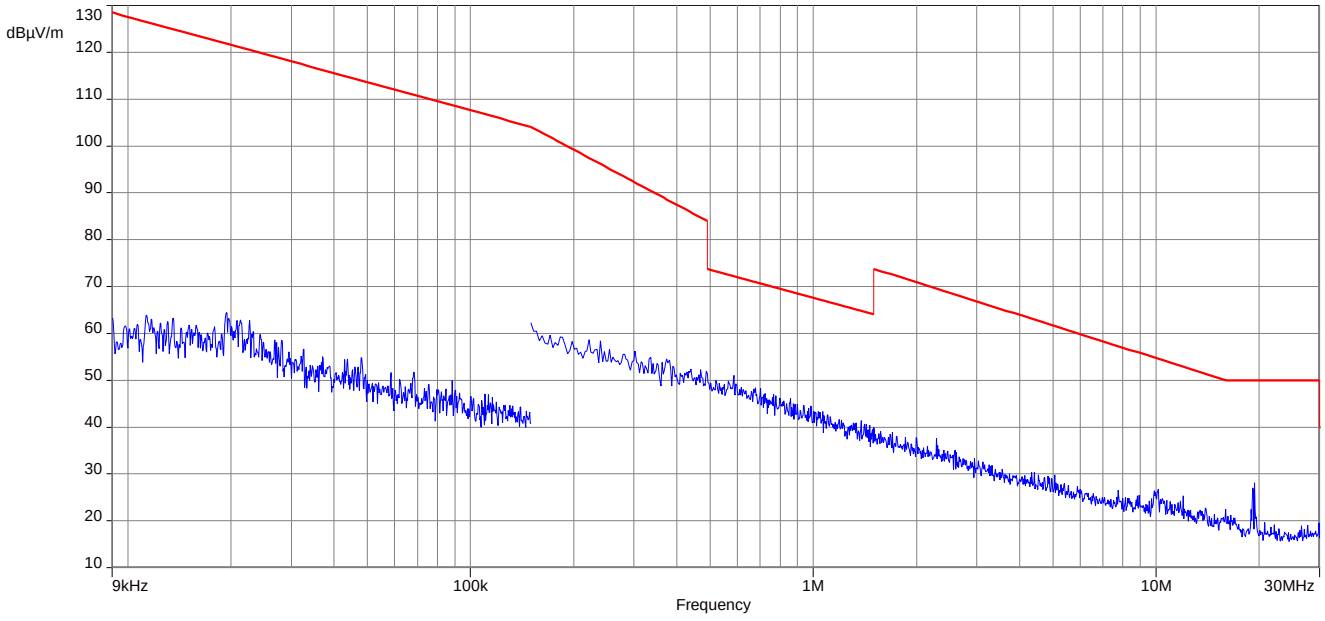


Plots: DSSS, vertical plane

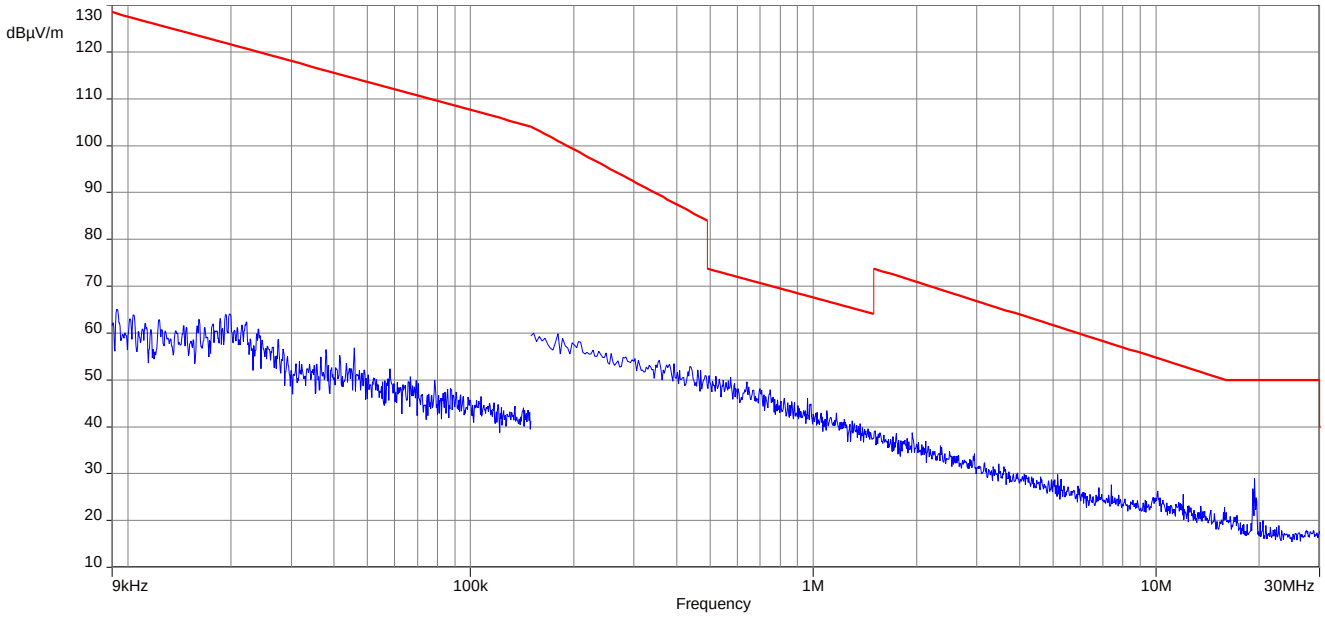
Plot 1: 9 kHz to 30 MHz, lowest channel



Plot 2: 9 kHz to 30 MHz, middle channel

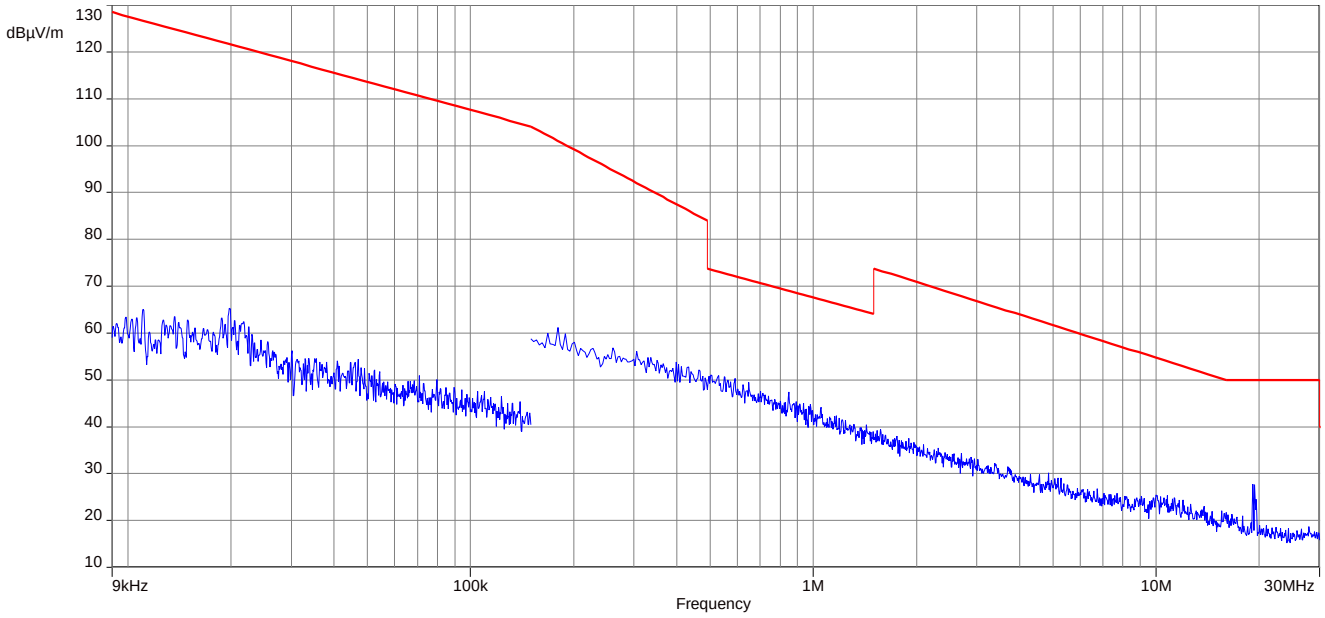


Plot 3: 9 kHz to 30 MHz, highest channel

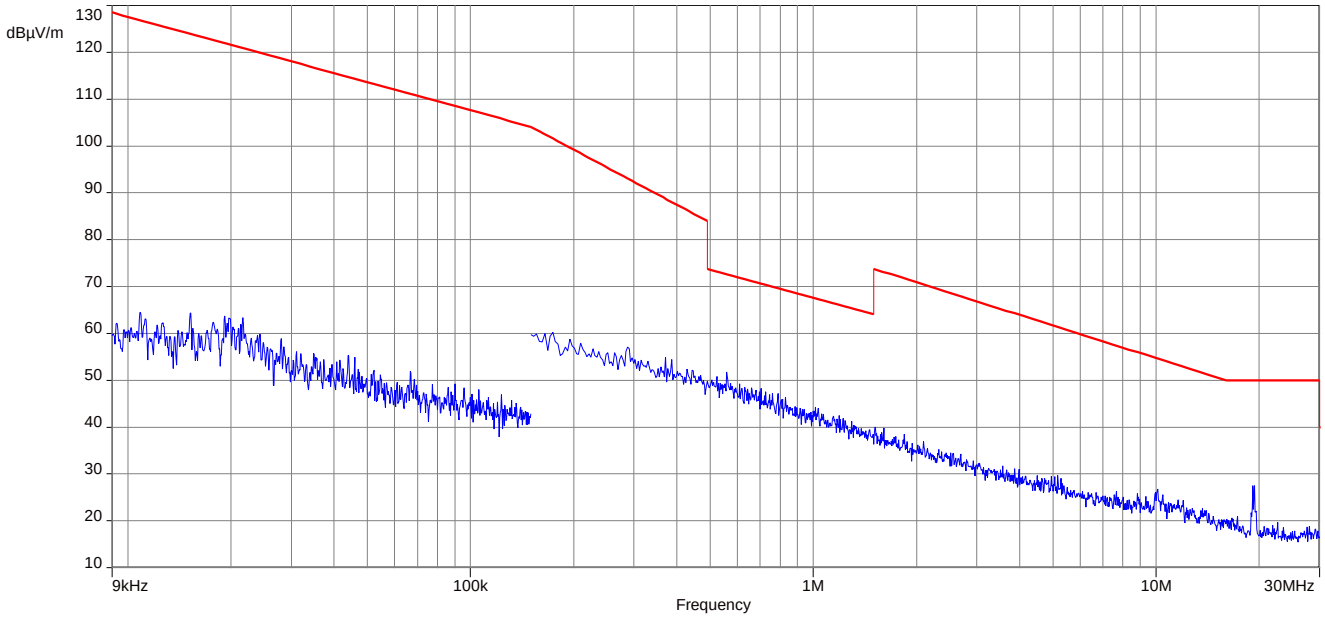


Plots: OFDM (20 MHz nominal channel bandwidth), vertical plane

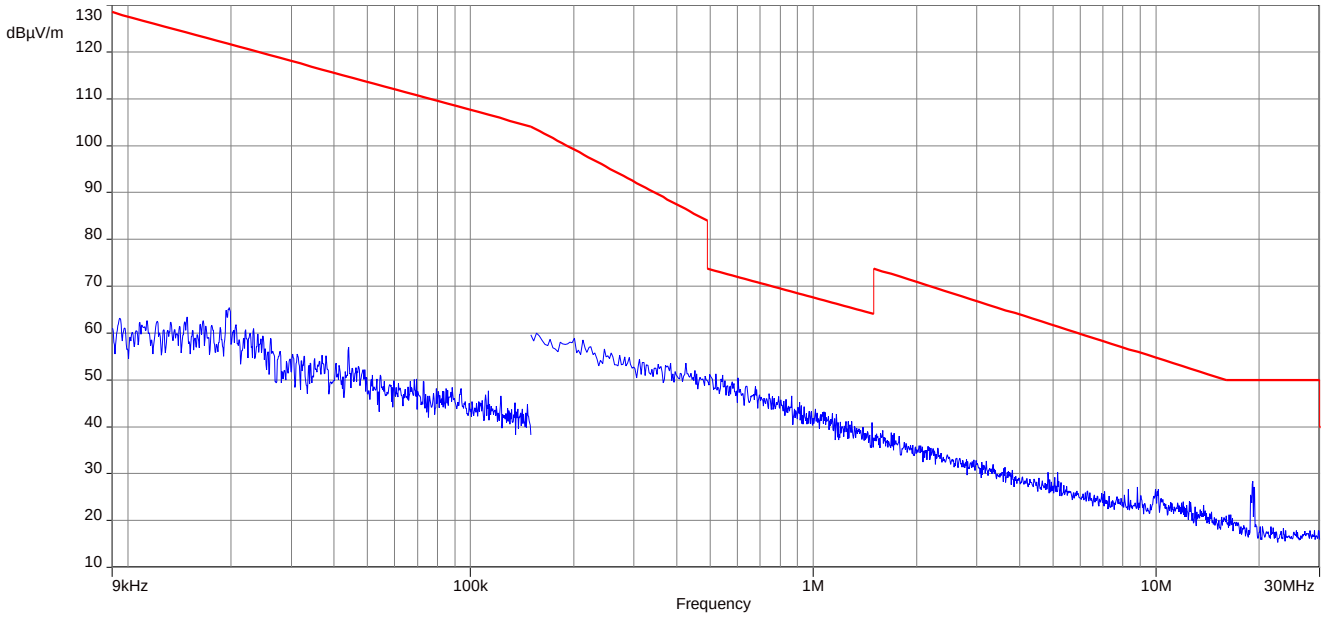
Plot 1: 9 kHz to 30 MHz, lowest channel



Plot 2: 9 kHz to 30 MHz, middle channel



Plot 3: 9 kHz to 30 MHz, highest channel



13.12 Spurious emissions radiated 30 MHz to 1 GHz

Description:

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

Measurement:

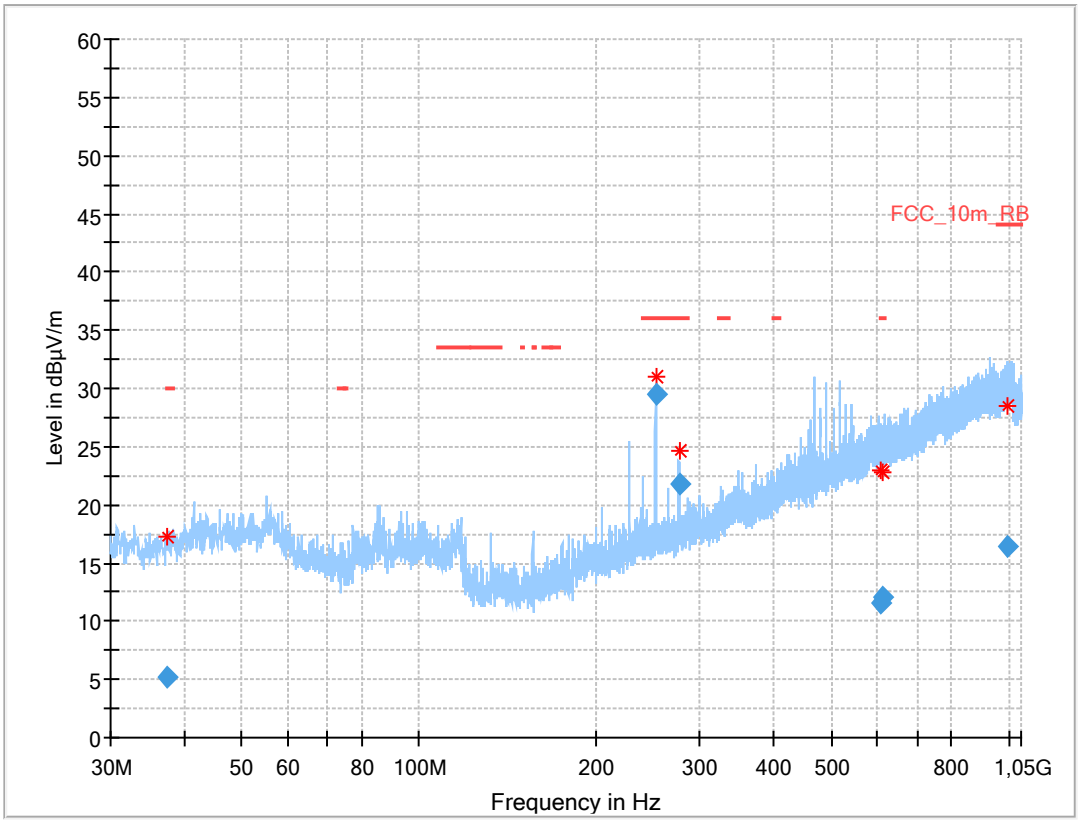
Measurement parameter	
Detector	Peak / Quasi Peak
Sweep time	Auto
Resolution bandwidth	120 kHz
Video bandwidth	3 x RBW
Span	30 MHz to 1 GHz
Trace mode	Max Hold
Test setup	See chapter 8.1 setup A
Measurement uncertainty	See chapter 9

Limits:

FCC		ISED
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 / m
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, valid for all channels and modes



Final results:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
37.517	5.24	30.0	24.8	1000	120.0	139.0	V	231	14
252.006	29.52	36.0	6.5	1000	120.0	103.0	V	144	14
276.014	21.79	36.0	14.2	1000	120.0	101.0	V	270	15
608.151	11.59	36.0	24.4	1000	120.0	200.0	H	83	22
613.670	12.00	36.0	24.0	1000	120.0	125.0	H	19	22
994.165	16.40	44.0	27.6	1000	120.0	104.0	H	86	26

13.13 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 26 GHz
Trace mode	Max Hold
Measured modulation	☒ DSSS b – mode ☒ OFDM g – mode ☐ OFDM n HT20 – mode
Test setup	See chapter 8.2 setup A & 8.3 setup A
Measurement uncertainty	See chapter 9

Limits:

FCC	ISED	
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 30 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 / m
Above 960	54.0 (AVG)	3
	74.0 (peak)	

Results: DSSS, horizontal plane

TX spurious emissions radiated / dBµV/m @ 3 m								
lowest channel			middle channel			highest channel		
f / MHz	Detector	Level / dBµV/m	f / MHz	Detector	Level / dBµV/m	f / MHz	Detector	Level / dBµV/m
4824	Peak	58.4	4874	Peak	57.6	4924	Peak	56.3
	AVG	53.6		AVG	52.8		AVG	51.5
14472	Peak	57.6	7309	Peak	53.1	7385	Peak	54.6
	AVG	52.8		AVG	50.2		AVG	51.5
-/-	Peak	-/-	12183	Peak	54.0	12311	Peak	54.8
	AVG	-/-		AVG	47.7		AVG	48.8

Results: OFDM (20 MHz nominal channel bandwidth), horizontal plane

TX spurious emissions radiated / dBµV/m @ 3 m								
lowest channel			middle channel			highest channel		
f / MHz	Detector	Level / dBµV/m	f / MHz	Detector	Level / dBµV/m	f / MHz	Detector	Level / dBµV/m
-/-	Peak	-/-	-/-	Peak	-/-	-/-	Peak	-/-
	AVG	-/-		AVG	-/-		AVG	-/-

Results: DSSS, vertical plane

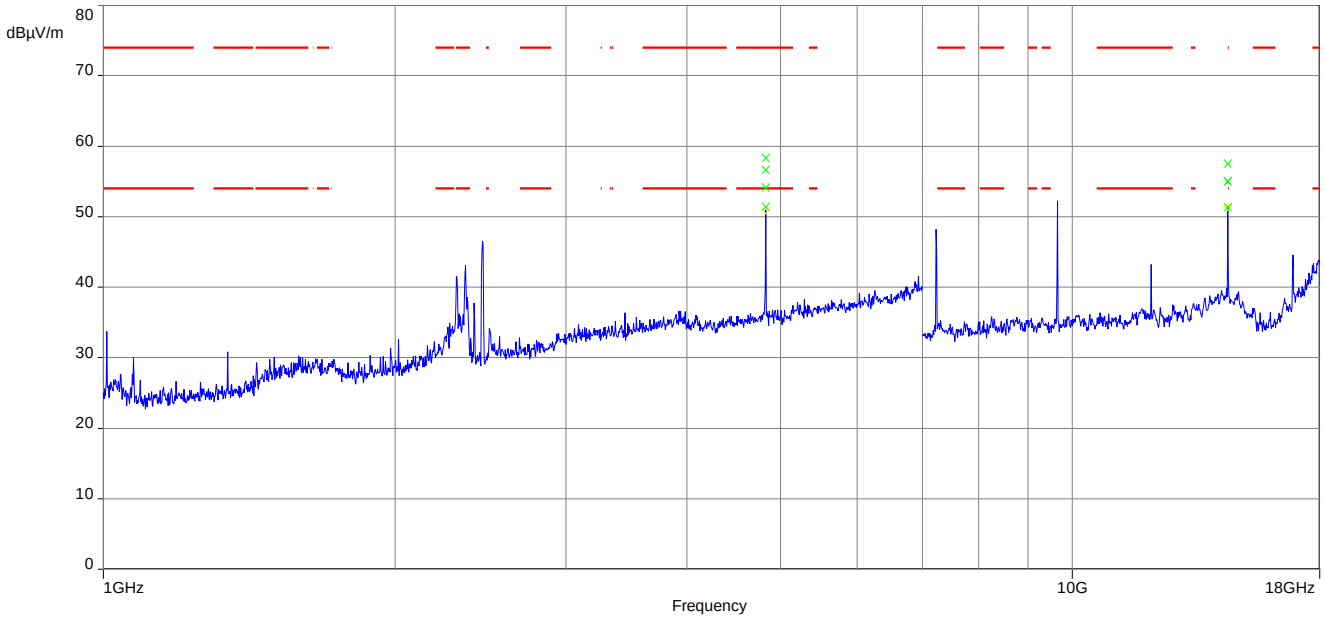
TX spurious emissions radiated / dBµV/m @ 3 m								
lowest channel			middle channel			highest channel		
f / MHz	Detector	Level / dBµV/m	f / MHz	Detector	Level / dBµV/m	f / MHz	Detector	Level / dBµV/m
4824	Peak	58.6	4874	Peak	57.5	4924	Peak	56.8
	AVG	53.8		AVG	51.7		AVG	52.0
12060	Peak	51.7	7310	Peak	59.3	7386	Peak	56.9
	AVG	46.4		AVG	53.9		AVG	51.1
14472	Peak	57.8	12185	Peak	57.0	12311	Peak	58.6
	AVG	53.3		AVG	51.7		AVG	53.5

Results: OFDM (20 MHz nominal channel bandwidth), vertical plane

TX spurious emissions radiated / dBµV/m @ 3 m								
lowest channel			middle channel			highest channel		
f / MHz	Detector	Level / dBµV/m	f / MHz	Detector	Level / dBµV/m	f / MHz	Detector	Level / dBµV/m
4825	Peak	53.9	7308	Peak	54.9	7383	Peak	54.0
	AVG	45.4		AVG	46.7		AVG	45.8

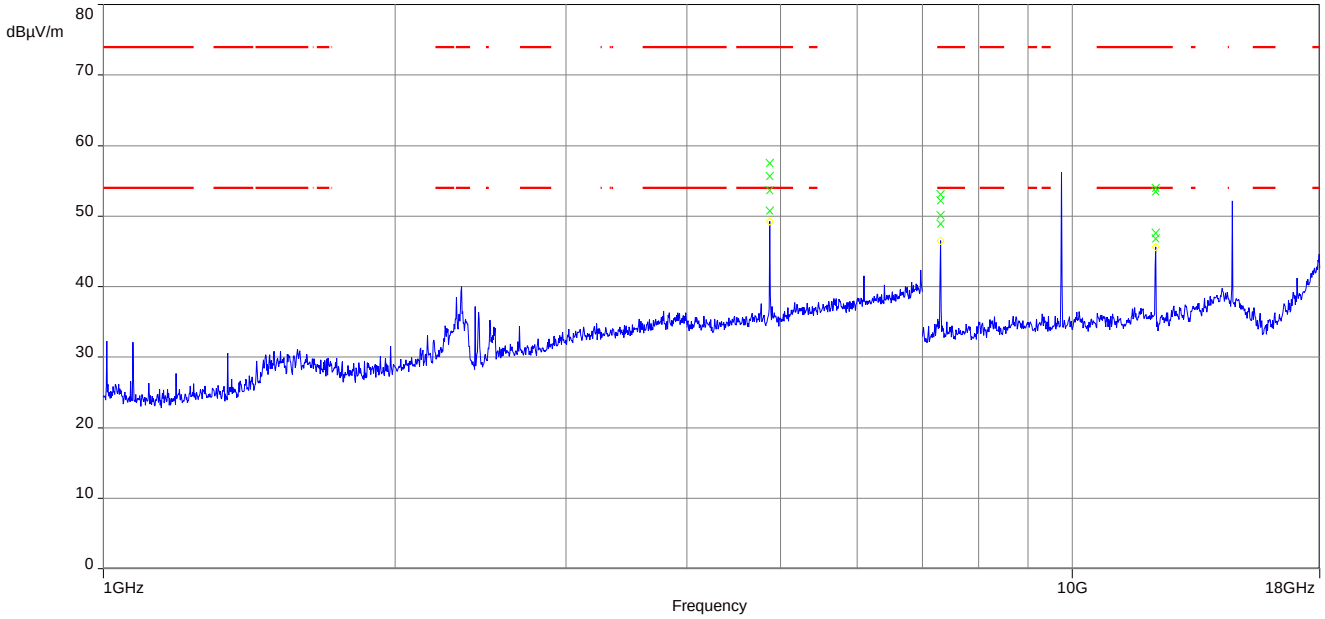
Plots: DSSS, horizontal plane

Plot 1: Lowest channel, 1 GHz to 18 GHz, vertical & horizontal polarization



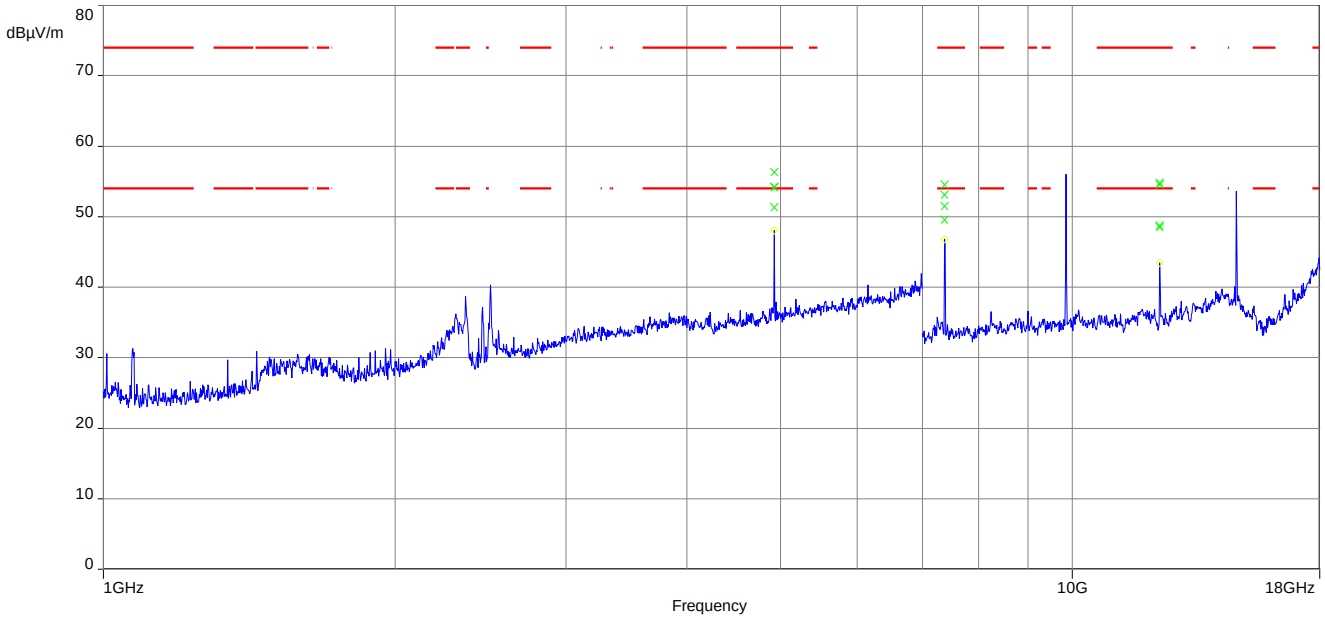
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 2: Middle channel, 1 GHz to 18 GHz, vertical & horizontal polarization



The carrier signal is notched with a 2.4 GHz band rejection filter.

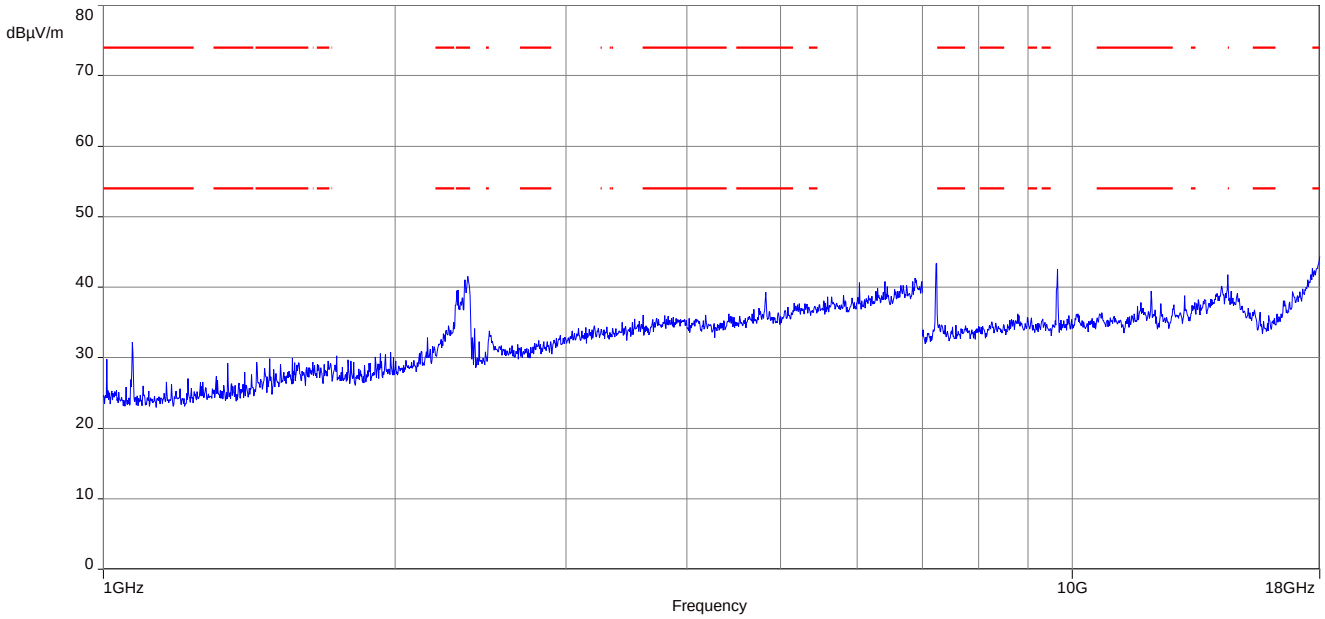
Plot 3: Highest channel, 1 GHz to 18 GHz, vertical & horizontal polarization



The carrier signal is notched with a 2.4 GHz band rejection filter.

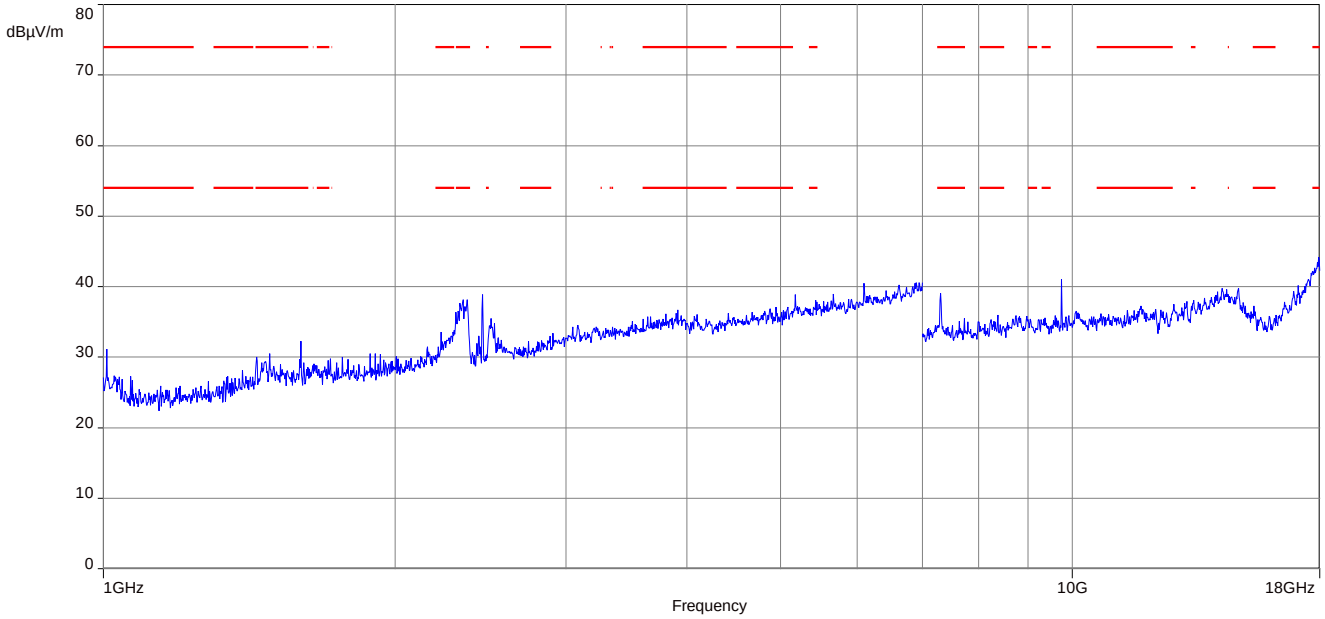
Plots: OFDM (20 MHz bandwidth), horizontal plane

Plot 1: Lowest channel, 1 GHz to 18 GHz, vertical & horizontal polarization



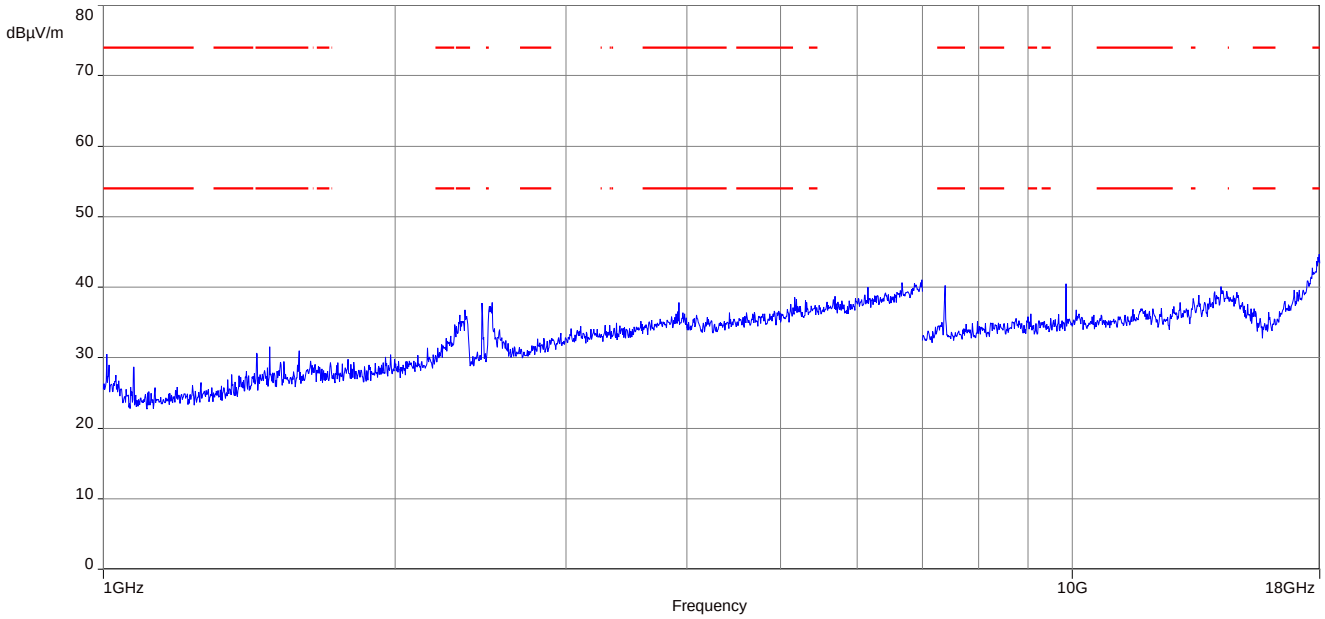
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 2: Middle channel, 1 GHz to 18 GHz, vertical & horizontal polarization



The carrier signal is notched with a 2.4 GHz band rejection filter.

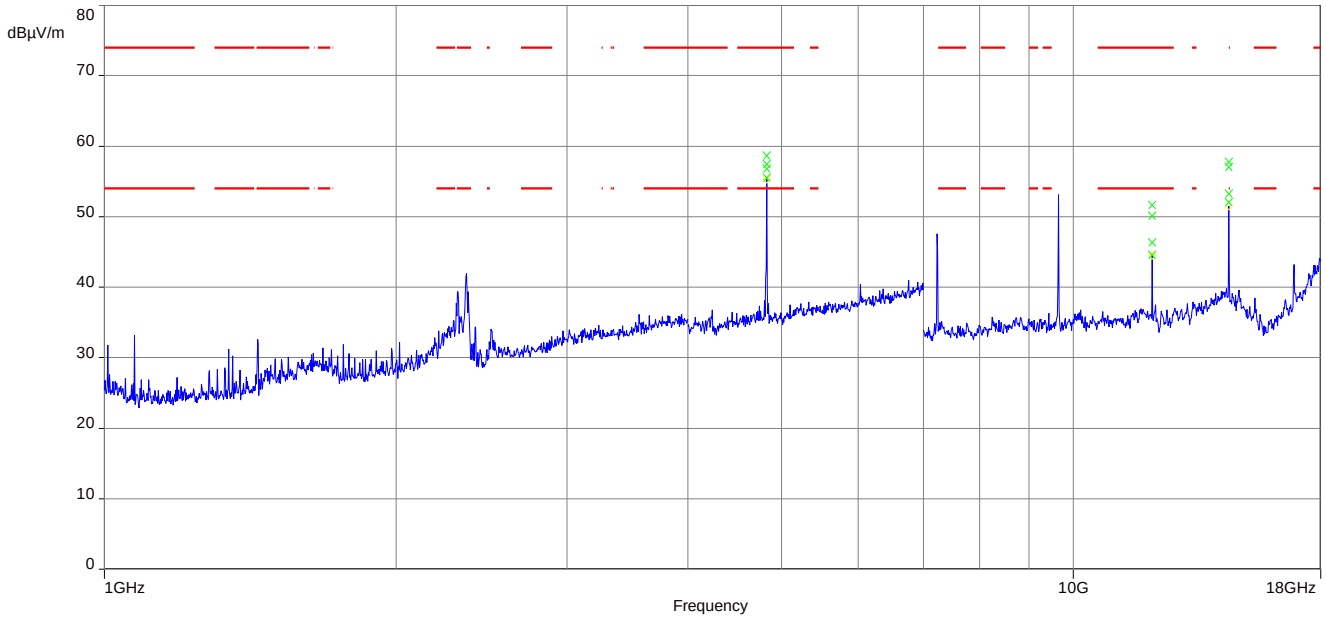
Plot 3: Highest channel, 1 GHz to 18 GHz, vertical & horizontal polarization



The carrier signal is notched with a 2.4 GHz band rejection filter.

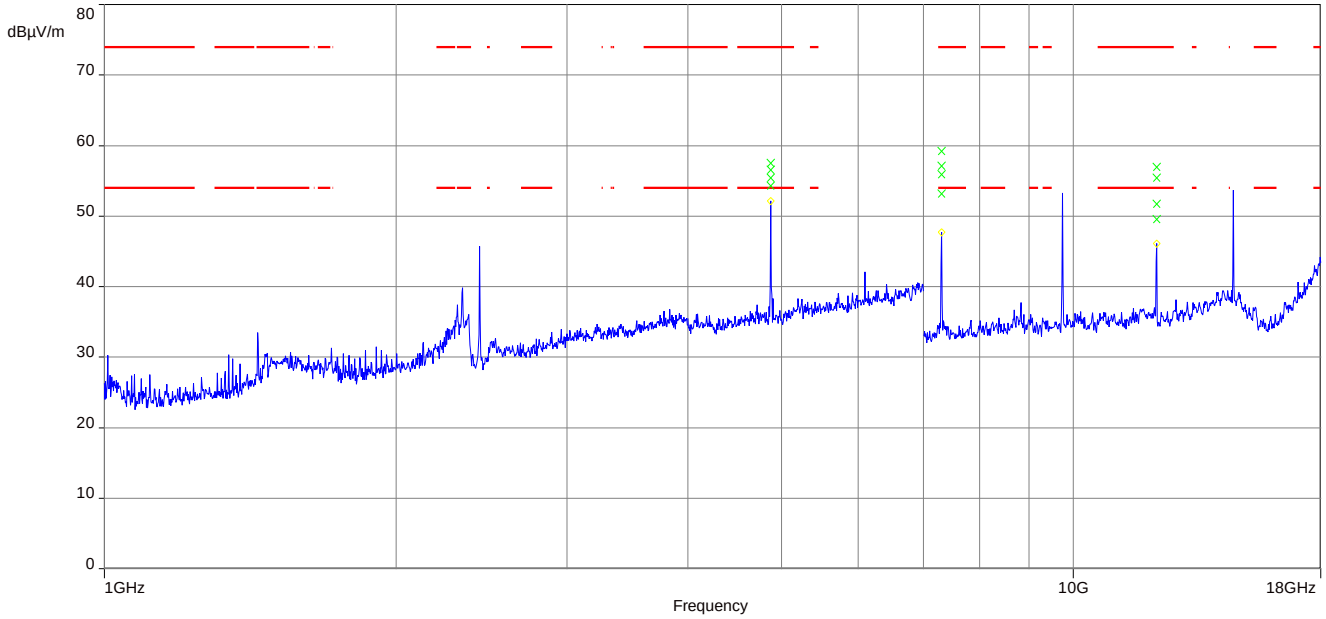
Plots: DSSS, vertical plane

Plot 1: Lowest channel, 1 GHz to 18 GHz, vertical & horizontal polarization



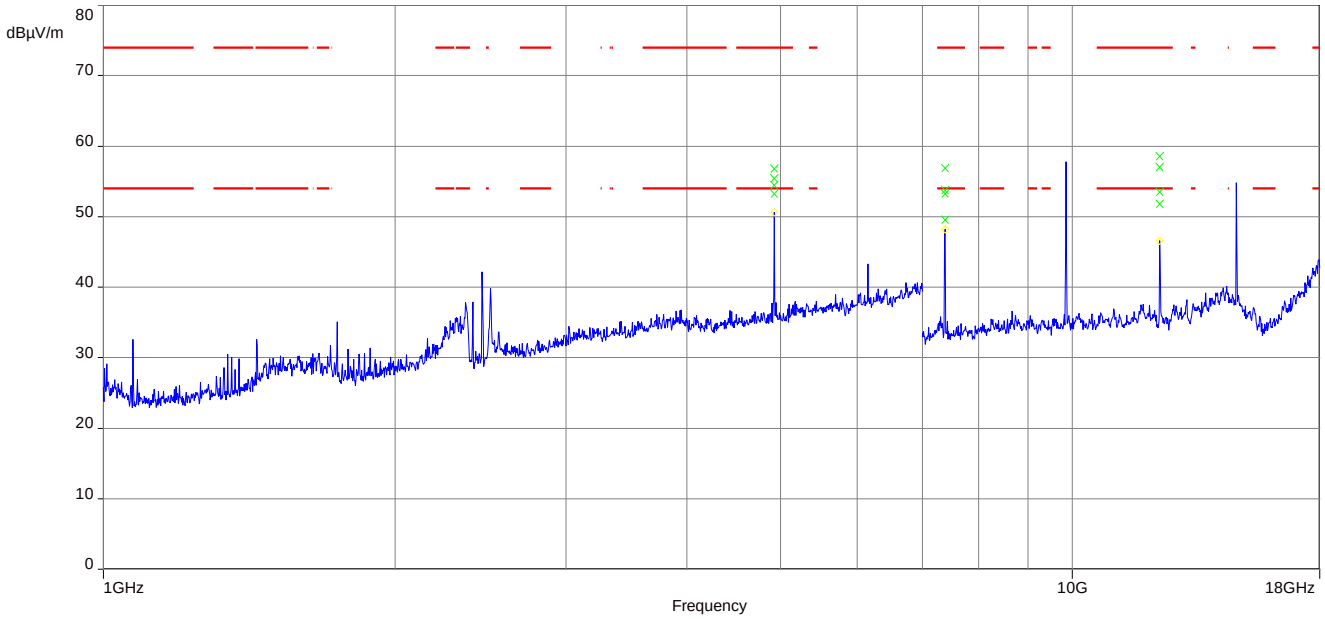
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 2: Middle channel, 1 GHz to 18 GHz, vertical & horizontal polarization



The carrier signal is notched with a 2.4 GHz band rejection filter.

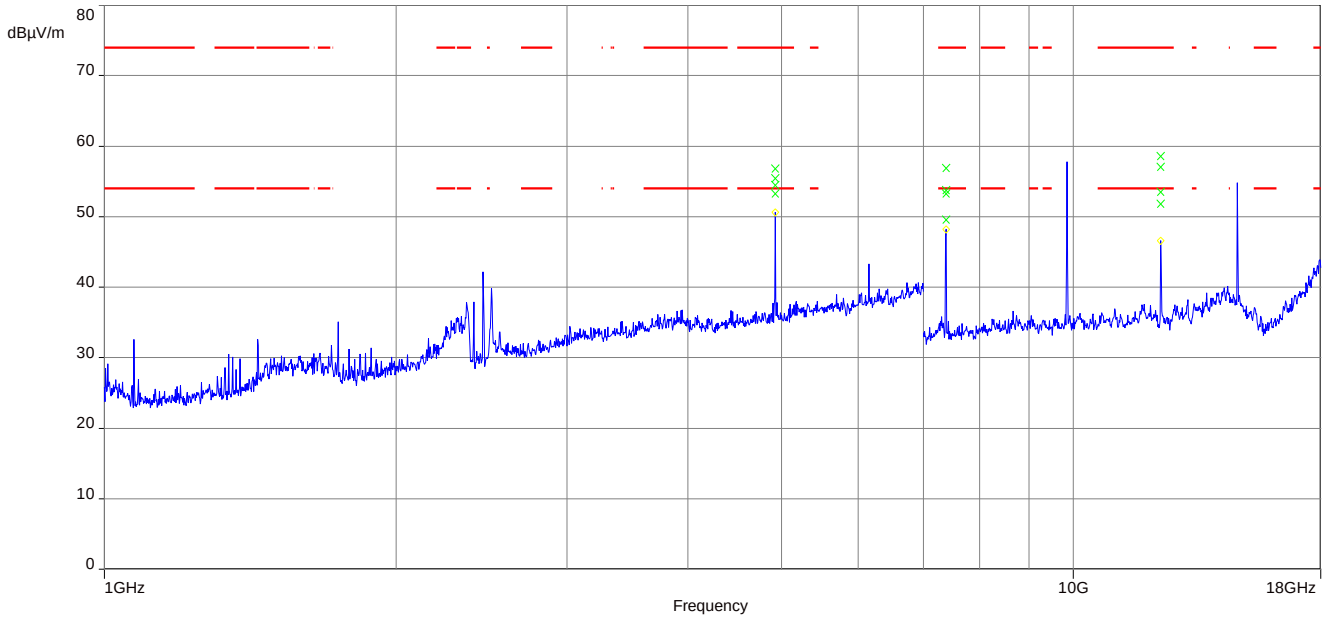
Plot 3: Highest channel, 1 GHz to 18 GHz, vertical & horizontal polarization



The carrier signal is notched with a 2.4 GHz band rejection filter.

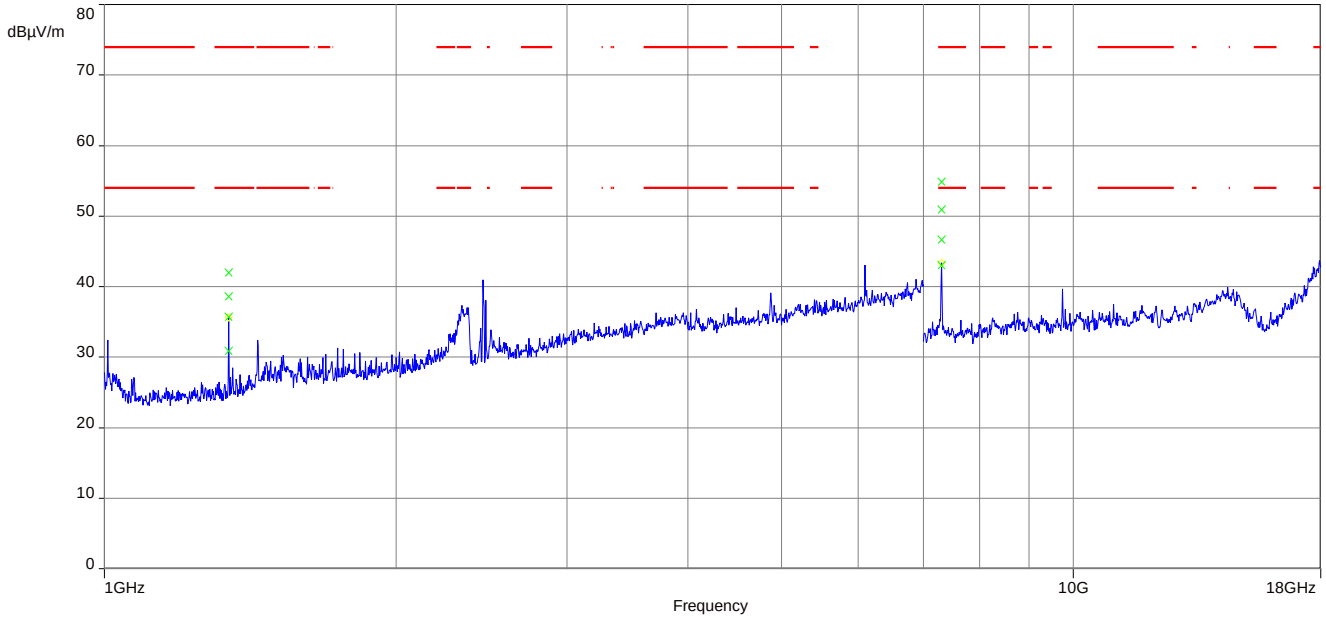
Plots: OFDM (20 MHz bandwidth), vertical plane

Plot 1: Lowest channel, 1 GHz to 18 GHz, vertical & horizontal polarization



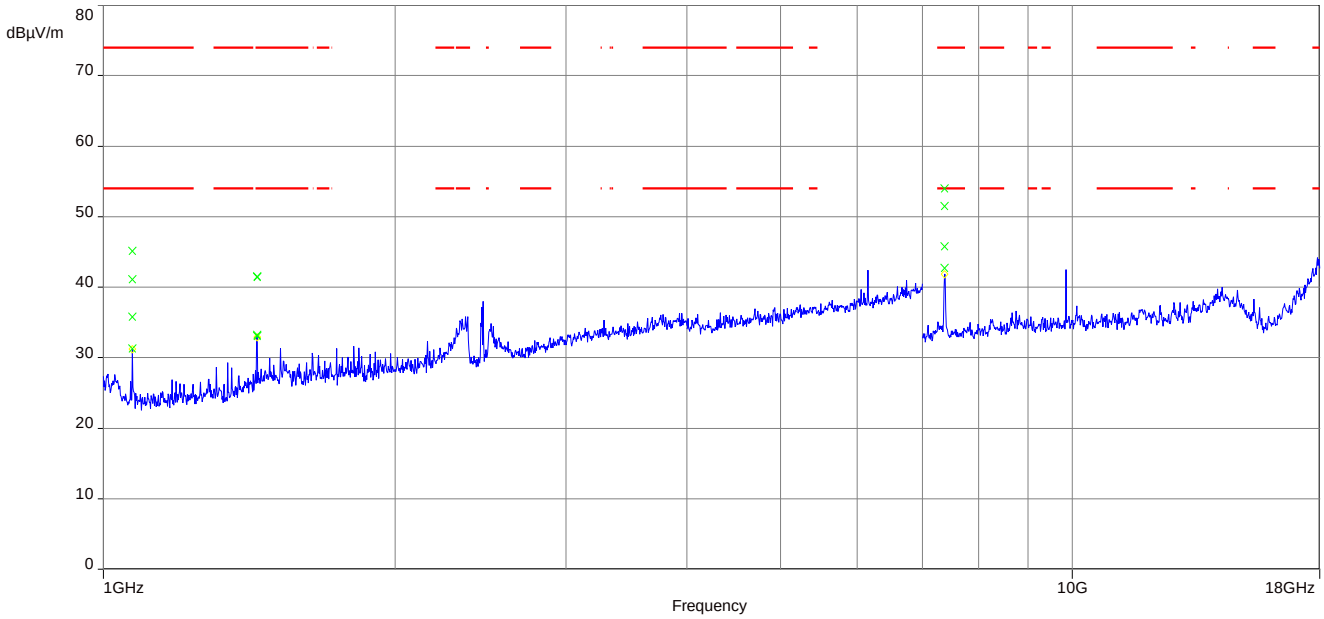
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 2: Middle channel, 1 GHz to 18 GHz, vertical & horizontal polarization



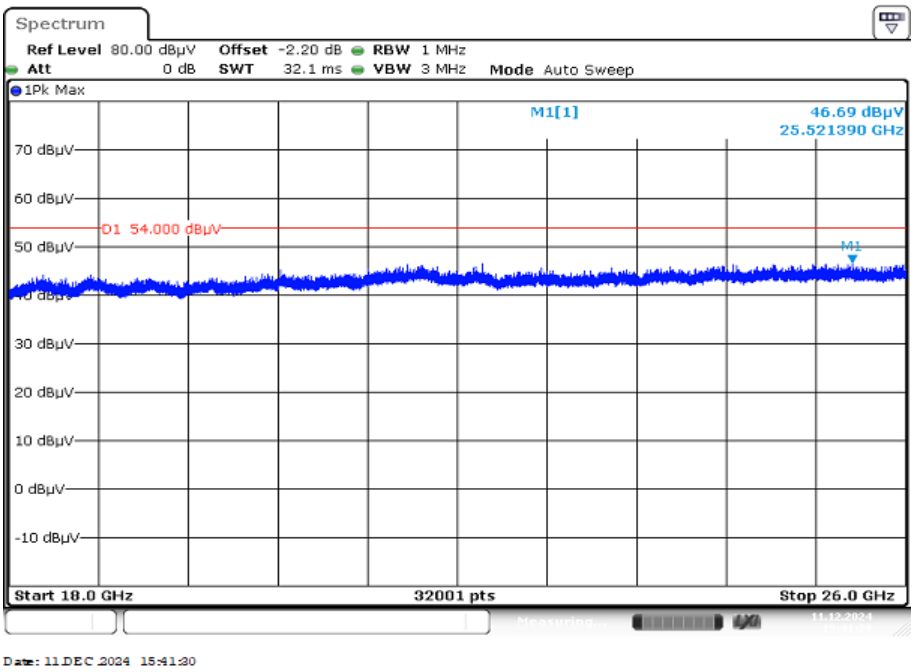
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 3: Highest channel, 1 GHz to 18 GHz, vertical & horizontal polarization



The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 4: 18 GHz to 26 GHz, vertical & horizontal polarization, valid for both planes all channels and modes



The carrier signal is notched with a 2.4 GHz band rejection filter.

13.14 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 8.5 setup A
Measurement uncertainty	See chapter 9

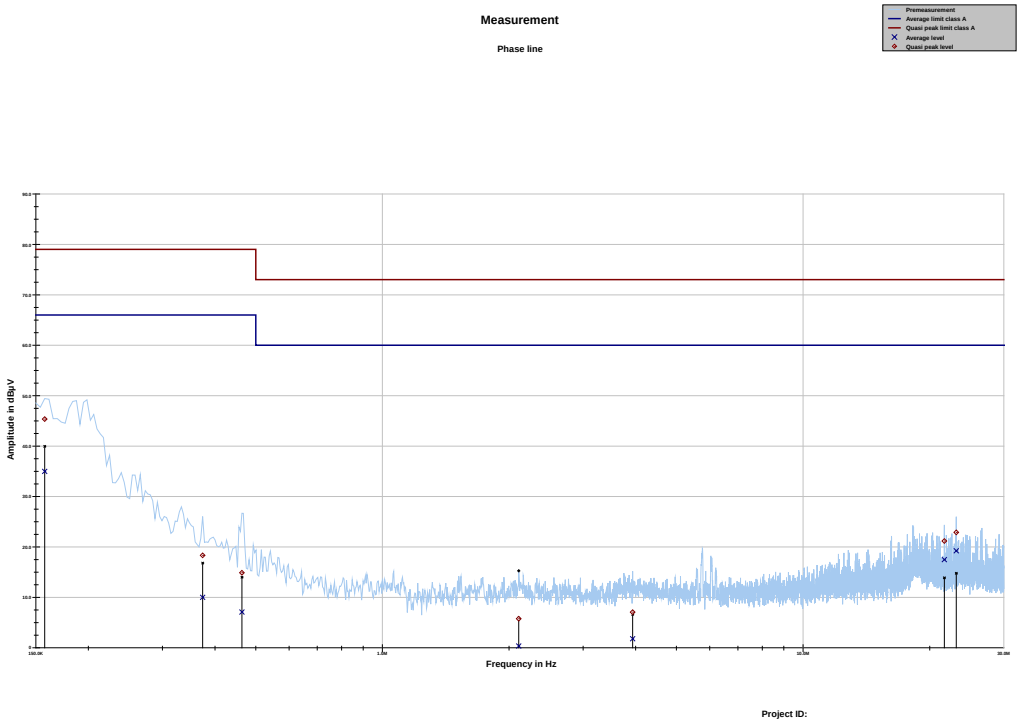
Limits:

FCC		ISED
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:

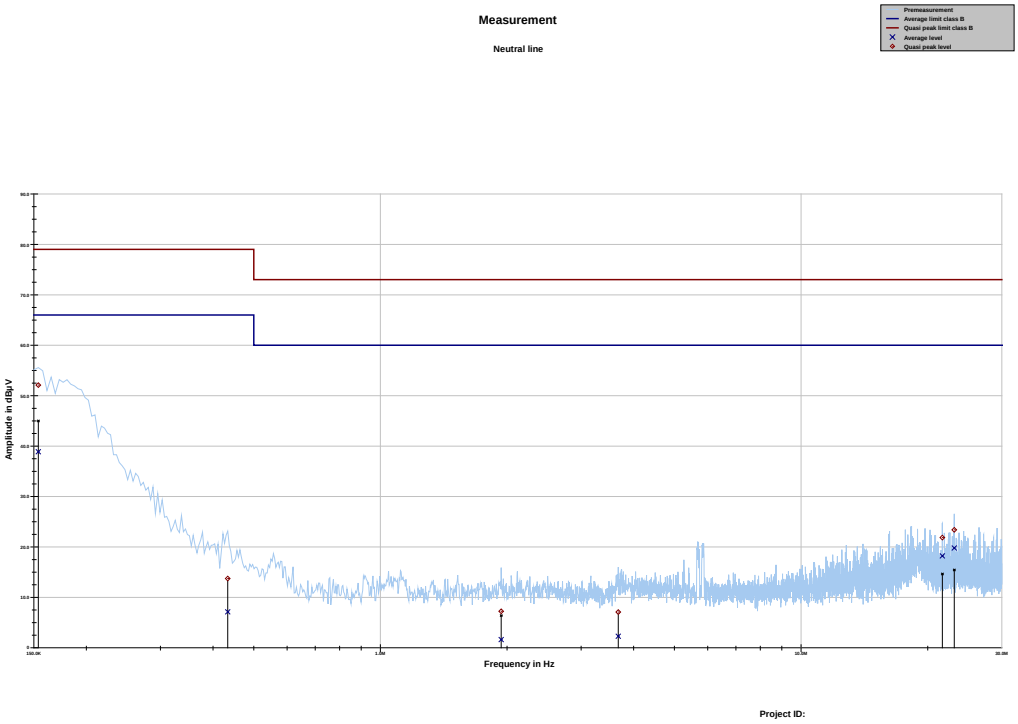
Plot 1: 150 kHz to 30 MHz, phase line



Final results:

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.157463	45.35	33.65	79.000	34.98	31.02	66.000
0.373875	18.32	60.68	79.000	10.00	56.00	66.000
0.463425	14.88	64.12	79.000	7.07	58.93	66.000
2.108906	5.75	67.25	73.000	0.34	59.66	60.000
3.933488	7.06	65.94	73.000	1.78	58.22	60.000
21.664388	21.17	51.83	73.000	17.47	42.53	60.000
23.130769	22.88	50.12	73.000	19.22	40.78	60.000

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	52.08	26.92	79.000	38.86	27.14	66.000
0.433575	13.73	65.27	79.000	7.11	58.89	66.000
1.937269	7.23	65.77	73.000	1.62	58.38	60.000
3.676031	7.08	65.92	73.000	2.27	57.73	60.000
21.664388	21.85	51.15	73.000	18.21	41.79	60.000
23.130769	23.38	49.62	73.000	19.77	40.23	60.000

14 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

15 Document history

Version	Applied changes	Date of release
R01	Initial release	2024-12-12

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