

TEST REPORT

Test report no.: 1-1132-25-01-04_TR1-R01



Deutsche
Akkreditierungsstelle
D-PL-12047-01-00

Testing laboratory

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Accredited Testing Laboratory:

The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2018-03) by the Deutsche Akkreditierungsstelle GmbH (DAkkS).

The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number:

D-PL-12047-01-00.

ISED Testing Laboratory Recognized Listing Number: DE0001

FCC designation number: DE0002

Applicant

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Manufacturer

AUMOVIO Engineering Solutions

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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:	Telematics Control Unit
Model name:	Nebula TCU Max
FCC ID:	2BDLN-NEBULATCU
Frequency:	2400 MHz to 2483.5 MHz
Technology tested:	WLAN
Antenna:	Two external antennas
Power supply:	11.8 V to 13.2 V DC by vehicle battery
Temperature range:	-40°C to 60°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.

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2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. cetecom advanced GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

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2.2 Application details

Date of receipt of order:	2025-09-19
Date of receipt of test item:	2025-11-13
Start of test:*	2025-11-19
End of test:*	2026-01-23
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

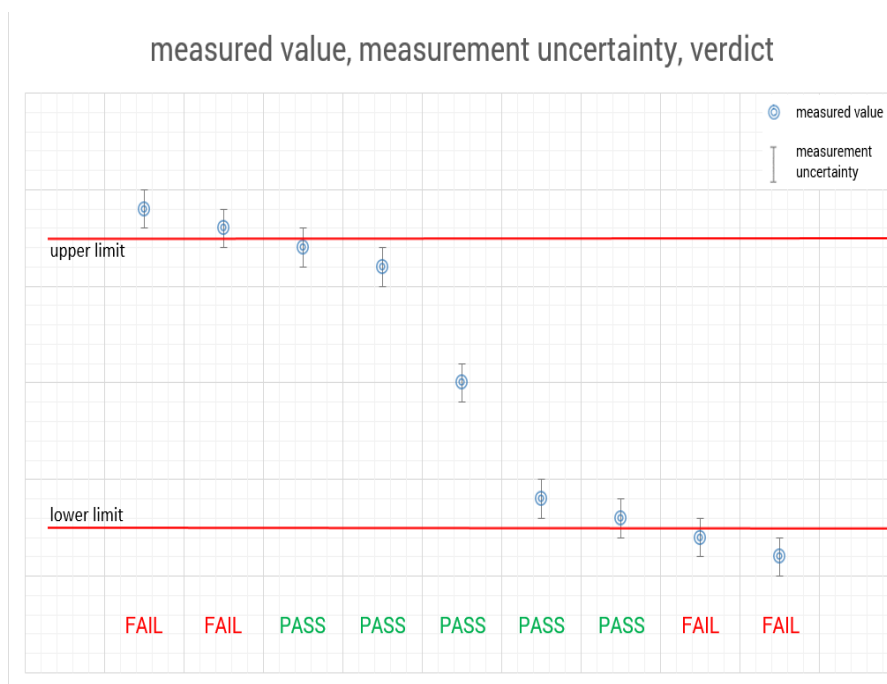
3 Test standard/s, references and accreditations

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
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 C63.4a-2017	-/-	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 C63.10-2020	-/-	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
KDB 662911 D01	v02r01	Emissions Testing of Transmitters with Multiple Outputs in the Same Band

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} 21 °C during room temperature tests T_{max} No testing under extreme temperature conditions required T_{min} No testing under extreme temperature conditions required
Relative humidity content	:	40 %
Barometric pressure	:	Not relevant for this kind of testing
Power supply	:	V_{nom} 12 V DC external power supply V_{max} No testing under extreme voltage conditions required V_{min} No testing under extreme voltage conditions required

6 Test item

6.1 General description

Kind of test item	:	Telematics Control Unit
Model name	:	Nebula TCU Max
S/N serial number	:	Rad. 450003044 Cond. 450003051
Hardware status	:	02.00
Software status	:	SWD06.00_290725
Firmware status	:	SWD06.00_290725
Frequency band	:	2400 MHz to 2483.5 MHz
Type of radio transmission	:	DSSS, OFDM
Use of frequency spectrum	:	
Type of modulation	:	CCK, (D)BPSK, (D)QPSK, 16 – QAM, 64 – QAM; 256 – QAM; 1024 – QAM
Number of channels	:	11 (20 MHz) 7 (40 MHz)
Antenna	:	Two external antennas
Power supply	:	11.8 V to 13.2 V DC by vehicle battery
Temperature range	:	-40°C to 60°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: 1-1132-25-01-01_TR1-A101-R01
1-1132-25-01-01_TR1-A103-R01

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).

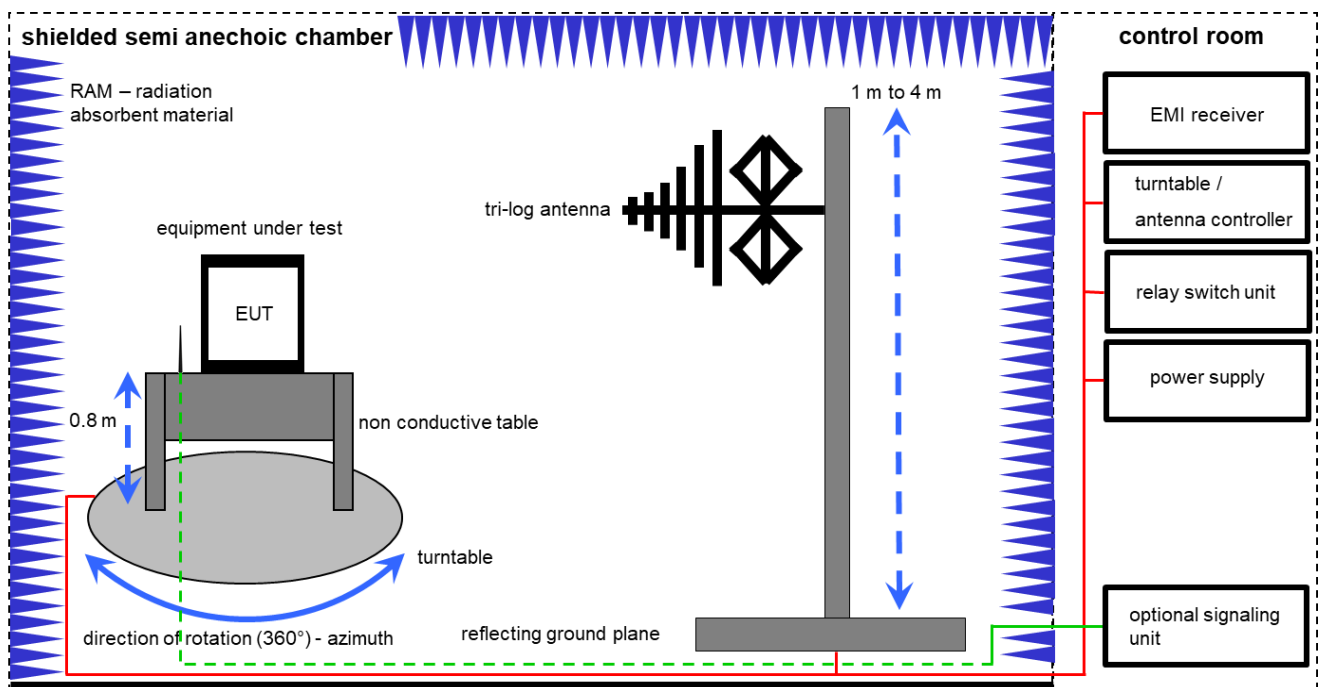
Each block diagram listed can contain several test setup configurations. All devices belonging to a test setup are identified with the same letter syntax. For example: Column Setup and all devices with an A.

Agenda: Kind of Calibration

k/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
vlk!	Attention: extended calibration interval		
NK!	Attention: not calibrated	*)	next calibration ordered / currently in progress
cpu	check prior usage		

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:

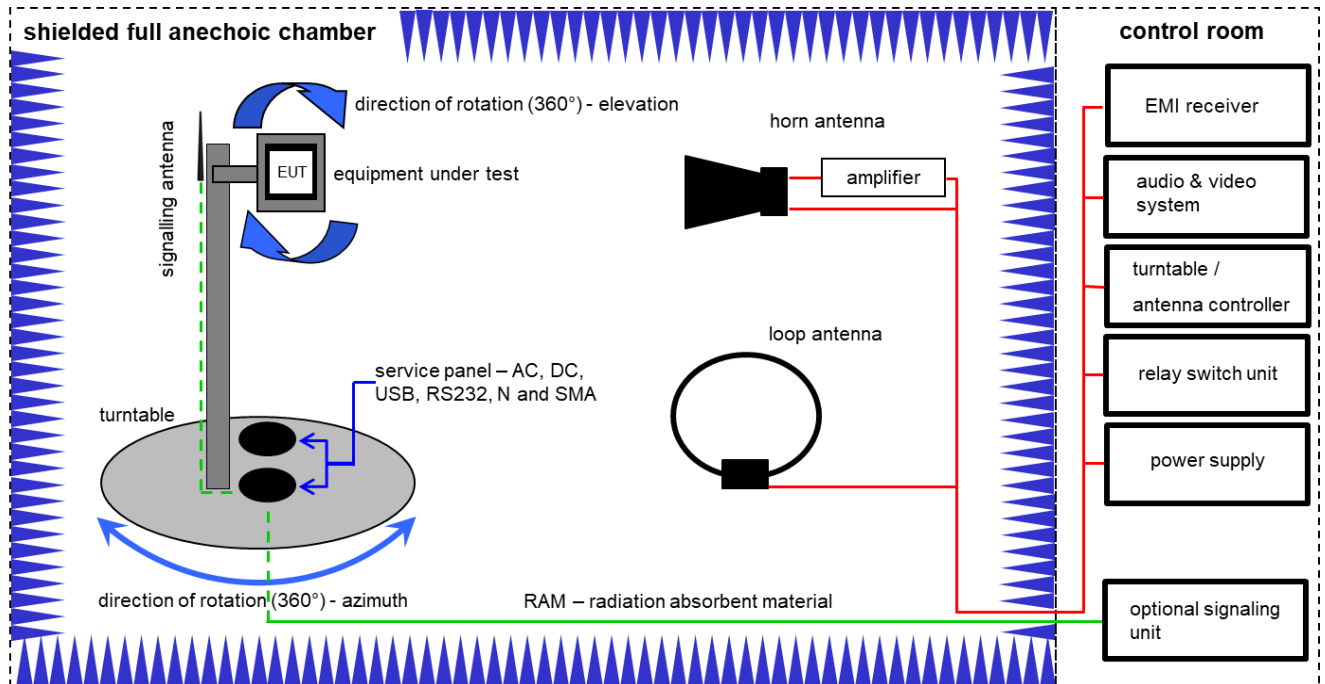
$FS [dB\mu V/m] = 12.35 [dB\mu V/m] + 1.90 [dB] + 16.80 [dB/m] = 31.05 [dB\mu V/m] (35.69 \mu V/m)$

Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Semi anechoic chamber	Semi anechoic chamber 3000023	MEC Import: MWB AG	-/-	40797	cnn	-/-	-/-
2	A	TRILOG Broadband Antenna	TRILOG Broadband Antenna VULB9163	Schwarzbeck Mess-Elektronik OHG Schönaun	371	40798	cal	11.07.2024	11.07.2026
3	A	Turntable	Turntable 2089-4.0	EMCO Elektronik GmbH Gilching	-/-	40799	cnn	-/-	-/-
4	A	Switch-Unit	Switch-Unit 3488A	Hewlett Packard	2719A14505	50160	cpu	-/-	-/-
5	A	Power Supply	Power Supply 6032A	Hewlett Packard	2920A04466	50161	cnn	-/-	-/-
6	A	Antenna Tower	Antenna Tower 2175	ETS-Lindgren GmbH Taufkirchen	64762	50279	cnn	-/-	-/-
7	A	Positioning Controller	Positioning Controller 2090	ETS-Lindgren GmbH Taufkirchen	64672	50280	cnn	-/-	-/-
8	A	EMI Test Receiver	EMI Test Receiver ESR3 9kHz-3.6GHz	Rohde & Schwarz Messgerätebau GmbH Memmingen	102587	50417	cal	08.12.2025	31.12.2026

NOTE: Tests have been performed after 08.12.2025

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)

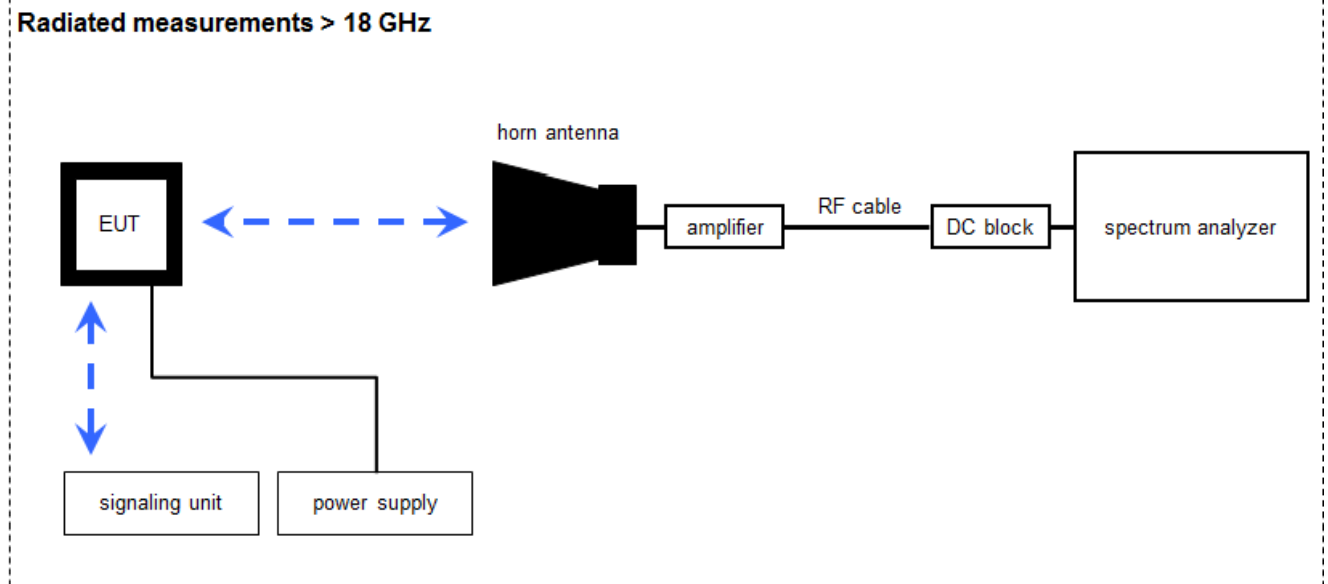
Example calculation:

$$FS \text{ [dB}\mu\text{V/m]} = 40.0 \text{ [dB}\mu\text{V/m]} + (-35.8) \text{ [dB]} + 32.9 \text{ [dB/m]} = 37.1 \text{ [dB}\mu\text{V/m]} \text{ (71.61 } \mu\text{V/m)}$$

Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A, B, C	Signal- and Spectrum Analyzer	Signal- and Spectrum Analyzer FSW26	Rohde & Schwarz Messgerätebau GmbH Memmingen	101455	40114	cal	08.12.2025	31.12.2026
2	A, B	Double-Ridged Waveguide Horn Antenna	Double-Ridged Waveguide Horn Antenna 3115	EMCO Elektronik GmbH Gilching	8812-3089	40344	cal	09.07.2024	09.07.2026
3	B	Highpass Filter	Highpass Filter WHK1.1/15G-10SS	Wainwright Instruments GmbH Andechs	37	40362	cnn	-/-	-/-
4	B	Highpass Filter	Highpass Filter WHKX7.0/18G-8SS	Wainwright Instruments GmbH Andechs	18	40364	cpu	-/-	-/-
5	B	Band Reject Filter	Band Reject Filter WRCG2400/2483-2375/2505-50/10SS	Wainwright Instruments GmbH Andechs	26	40367	cpu	-/-	-/-
6	B	Broadband Amplifier 0.5-18 GHz	Broadband Amplifier 0.5-18 GHz CBLU5184540	MEC Import: CERNEX	22050	40374	cpu	-/-	-/-
7	A, B, C	4U RF Switch Platform	4U RF Switch Platform L4491A	Agilent Technologies Deutschland GmbH Böblingen	MY50000032	40376	cnn	-/-	-/-
8	B	Highpass Filter	Highpass Filter WHKX2.6/18G-10SS	Wainwright Instruments GmbH Andechs	12	40377	cnn	-/-	-/-
9	A, B, C	NEXIO EMV-Software	NEXIO EMV-Software BAT EMC V2022.0.32.0	MEC Import: Nexio	-/-	40383	cnn	-/-	-/-
10	A, B, C	Anechoic chamber	Anechoic chamber	MEC Import: TDK	-/-	40385	cnn	-/-	-/-
11	A, B, C	Power Supply	Power Supply HMP2020	Rohde & Schwarz Messgerätebau GmbH Memmingen	120626	40410	cal	04.12.2025	31.12.2027
12	C	Active Loop Antenna 9 kHz to 30 MHz	6502	EMCO	2210	300001015	vKI!	07.07.2025	07.07.2027

7.3 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:

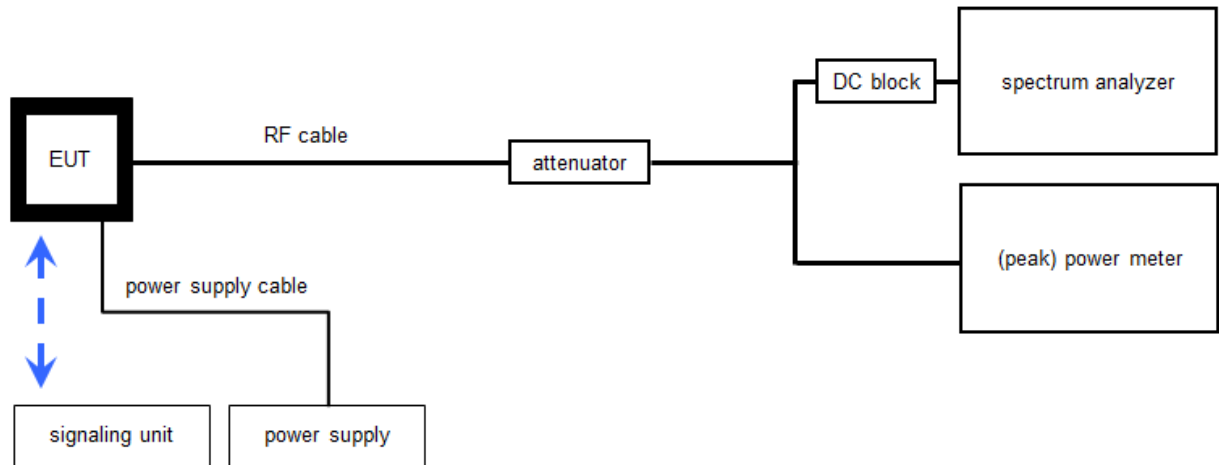
FS [dBμV/m] = 40.0 [dBμV/m] + (-60.1) [dB] + 36.74 [dB/m] = 16.64 [dBμV/m] (6.79 μV/m)

Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Broadband LNA 18-50 GHz	Broadband LNA 18-50 GHz CBL18503070PN	MEC Import: CERNEX	25240	40073	chk	22.04.2024	22.04.2026
2	A	Std. Gain Horn Antenna 18.0-26.5 GHz	Std. Gain Horn Antenna 18.0-26.5 GHz 638	Narda Microwave	8205	40085	cal	24.01.2024	31.01.2026
3	A	Signal analyzer	Signal analyzer FSV40	Rohde & Schwarz Messgerätebau GmbH Memmingen	101042	40292	cal	08.01.2026	31.01.2027
4	A	RF-Cable	RF-Cable ST18/SMAM/SMAM /72	Huber & Suhner GmbH Unterhaching	Batch no. 699714	40389	cpu	-/-	-/-
5	A	DC-Blocker 0.1-40 GHz	DC-Blocker 0.1-40 GHz 8141A	MEC Import: Inmet		40390	cpu	-/-	-/-
6	A	DC Power Supply	DC Power Supply HMP2020	Rohde & Schwarz Messgerätebau GmbH Memmingen	102850 / 101699	40306	cal	02.12.2025	31.12.2027

7.4 Conducted measurements with peak power meter & spectrum analyzer

Conducted measurements normal conditions



WLAN tester version: 1.1.13; LabView2015

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	Signal analyzer FSV40	Rohde & Schwarz Messgerätebau GmbH Memmingen	101042	40292	cal	08.01.2026	31.01.2027
2	A, B	RF-Cable	RF-Cable ST18/SMAm/SMAm /72	Huber & Suhner GmbH Unterhaching	Batch no. 699714	40389	cpu	-/-	-/-
3	A, B	DC-Blocker 0.1-40 GHz	DC-Blocker 0.1-40 GHz 8141A	MEC Import: Inmet		40390	cpu	-/-	-/-
4	A, B	DC Power Supply	DC Power Supply HMP2020	Rohde & Schwarz Messgerätebau GmbH Memmingen	102850 / 101699	40306	cal	02.12.2025	31.12.2027
5	A, B	Switch Matrix	Switch Matrix USM	cetecom advanced GmbH Saarbrücken	C001	40340	cnn	-/-	-/-
6	A, B	RF-Cable	RF-Cable ST18/SMAm/SMAm /60	Huber & Suhner GmbH Unterhaching	Batch no. 606844	40386	cpu	-/-	-/-
7	A, B	RF-Cable	RF-Cable ST18/SMAm/SMAm /48	Huber & Suhner GmbH Unterhaching	Batch no. 600918	40387	cpu	-/-	-/-
8	A, B	Coax Attenuator 10 dB 2W 0-40 GHz	Coax Attenuator 10 dB 2W 0-40 GHz MCL BW-K10-2W44+	Mini-Circuits Brooklyn		40391	cpu	-/-	-/-
9	B	USB Wideband Power Sensor (50MHz - 18GHz)	USB Wideband Power Sensor (50MHz - 18GHz) U2021XA	Keysight Technologies Deutschland GmbH Böblingen	MY591900010	40317	cal	08.12.2025	31.12.2026

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 $\pm 45^\circ$ and antenna height between 1 and 4 m.
- The final measurement is done with quasi-peak detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

8.3 Sequence of testing radiated spurious 1 GHz to 18 GHz

Setup

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

Premeasurement

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

Final measurement

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

8.4 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.

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	± 4.1 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	See table!	2026-02-23	-/-

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

Reference documents: AuroraTCUMax_Setup_Description.pdf
 QRCT_Settings.xlsx
 Aurora Innovation Self-Driving Trucks - ComboBox Antenna - Datasheet.pdf

Co-applicable documents: 1-1132-25-01-04_TR1-A201-R01 (all conducted results)
 1-1132-25-01-04_TR1-A202-R01 (PSD tests with different RU tones)

Special test descriptions: Power settings:

Channel	Power Setting
DSSS / b – mode	Default (TXPowerAuto)
OFDM / g – mode	Default (TXPowerAuto)
OFDM / nHT20 – mode	Default (TXPowerAuto)
OFDM / axHE20 – mode	Default (TXPowerAuto)
OFDM / nHT40 – mode	Default (TXPowerAuto)
OFDM / axHE40 – mode	Default (TXPowerAuto)

Configuration descriptions: All tests were performed with both ports/antenna transmitting simultaneously. b-mode and g-mode only support SISO. SISO on both chains is possible. n-mode and ax-mode support SISO and MIMO on both chains. It was verified that n-mode and ax-mode have the same output power in SISO and MIMO mode on each port. So the MIMO results of n-mode and ax-mode are also representative for SISO mode.

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

Channels with 40 MHz channel bandwidth:

channel number & center frequency													
channel	-/-	-/-	3	4	5	6	7	8	9	10	11	-/-	-/-
f _c / MHz	-/-	-/-	2422	2427	2432	2437	2442	2447	2452	2457	2462	-/-	-/-

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

Antenna gain declared by the customer (see referenced documents, section 11).

Peak antenna gain [dBi]	
SISO single antenna	5.9
MIMO combined gain	Not supported
MIMO beamforming gain	Not supported

13.2 Identify worst case data rate

Results:

Modulation scheme / bandwidth	
DSSS / b – mode SISO	1 Mbit/s
OFDM / g – mode SISO	6 Mbit/s
OFDM / n HT20 – mode MIMO	MCS0
OFDM / n HT40 – mode MIMO	MCS0
OFDM / ax HE20 – mode MIMO	MCS0
OFDM / ax HE40 – mode MIMO	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 DTS clause: 8.3.1.3	
Peak power meter	
External result file(s)	1-1132-25-01-04_TR1-A201-R01.pdf
Test setup	See chapter 7.4 setup B
Measurement uncertainty	See chapter 9

Limits:

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

Results:

antenna port 1	maximum output power / dBm		
	lowest channel	middle channel	highest channel
Output power conducted DSSS / b – mode	18.6	18.1	18.3
Output power conducted OFDM / g – mode	23.3	22.9	23.2
Output power conducted OFDM / n HT20 – mode	23.4	22.7	23.0
Output power conducted OFDM / n HT40 – mode	21.8	21.6	21.7
Output power conducted OFDM / ax HE20 – mode	24.8	24.1	23.8
Output power conducted OFDM / ax HE40 – mode	22.7	22.3	22.3

antenna port 2	maximum output power / dBm		
	lowest channel	middle channel	highest channel
Output power conducted DSSS / b – mode	16.2	16.8	17.1
Output power conducted OFDM / g – mode	20.9	21.3	21.8
Output power conducted OFDM / n HT20 – mode	20.6	21.6	21.9
Output power conducted OFDM / n HT40 – mode	21.9	21.8	22.1
Output power conducted OFDM / ax HE20 – mode	22.0	22.7	23.6
Output power conducted OFDM / ax HE40 – mode	20.3	21.3	20.9

antenna port 1 + 2 calculated	maximum output power / dBm		
	lowest channel	middle channel	highest channel
Output power conducted OFDM / n HT20 – mode	25.2	25.2	25.5
Output power conducted OFDM / n HT40 – mode	24.9	24.7	24.9
Output power conducted OFDM / ax HE20 – mode	26.6	26.5	26.7
Output power conducted OFDM / ax HE40 – mode	24.7	24.8	24.7

13.4 Duty cycle

Description:

Measurement of the timing behavior.

Measurement:

Measurement parameter	
External result file(s)	1-1132-25-01-04_TR1-A201-R01.pdf
Test setup	See chapter 7.4 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
OFDM / n HT40 – mode		100 % / 0.0 dB	100 % / 0.0 dB	100 % / 0.0 dB
OFDM / ax HE20 – mode		100 % / 0.0 dB	100 % / 0.0 dB	100 % / 0.0 dB
OFDM / ax HE40 – mode		100 % / 0.0 dB	100 % / 0.0 dB	100 % / 0.0 dB

13.5 Peak power spectral density

Description:

Measurement of the peak power spectral density of a digital modulated system. The PSD shows the strength of the variations as a function of the frequency.

Measurement:

Measurement parameter	
According to DTS clause: 8.4	
External result file(s)	1-1132-25-01-04_TR1-A201-R01.pdf
Test setup	See chapter 7.4 setup A
Measurement uncertainty	See chapter 9

Limits:

FCC	ISED
8 dBm / 3 kHz (conducted)	

Results: antenna port 0

measured	peak power spectral density / dBm @ 3 kHz		
	Lowest channel	Middle channel	Highest channel
DSSS / b – mode SISO	-8.3	-8.8	-8.4
OFDM / g – mode SISO	-11.6	-11.7	-11.4
OFDM / n HT20 – mode MIMO	-10.9	-10.8	-10.4
OFDM / n HT40 – mode MIMO	-15.1	-15.7	-14.8
OFDM / ax HE20 – mode MIMO	-11.6	-11.6	-11.1
OFDM / ax HE40 – mode MIMO	-14.6	-16.2	-14.9

Results: antenna port 1

measured	peak power spectral density / dBm @ 3 kHz		
	Lowest channel	Middle channel	Highest channel
DSSS / b – mode SISO	-10.5	-9.1	-10.5
OFDM / g – mode SISO	-13.1	-12.8	-12.2
OFDM / n HT20 – mode MIMO	-12.5	-11.9	-11.9
OFDM / n HT40 – mode MIMO	-15.1	-15.0	-14.8
OFDM / ax HE20 – mode MIMO	-14.1	-13.5	-12.8
OFDM / ax HE40 – mode MIMO	-16.7	-17.5	-17.6

Results: antenna port 0 + 1

calculated	peak power spectral density / dBm @ 3 kHz		
	Lowest channel	Middle channel	Highest channel
OFDM / n HT20 – mode MIMO	-8.6	-8.3	-8.1
OFDM / n HT40 – mode MIMO	-12.1	-12.3	-11.8
OFDM / ax HE20 – mode MIMO	-9.7	-9.4	-8.9
OFDM / ax HE40 – mode MIMO	-12.5	-13.8	-13.0

13.6 Average power spectral density with different RU tones

Measurement:

Measurement parameter	
According to DTS clause: 8.4	
External result file(s)	1-1132-25-01-04_TR1-A201-R02.pdf
Test setup	See chapter 7.4 setup A
Measurement uncertainty	See chapter 9

Limits:

FCC	ISED
8 dBm / 3 kHz (conducted)	

Results: Average PSD [dBm/3 kHz]

2.4 GHz ax-mode 20 MHz(Chain 1 only)	Low	Mid	High
FULL RU	-20.22	-19.9	-19.3
RU26 Tone plan 10-S	-21.74	-21.91	-21.26
RU26 Tone plan 10-L	-21.16	-21.29	-20.42
RU26 Tone plan 20-L	-21.18	-21.15	-20.77
RU26 Tone plan 30-L	-21.21	-21.18	-21.16
RU52 Tone plan 50-L	-20.62	-20.73	-19.99
RU52 Tone plan 60-L	-20.29	-20.1	-19.85
RU52 Tone plan 70-S	-20.98	-20.94	-20.62
RU52 Tone plan 70-L	-20.37	-20.56	-20.28
RU106 Tone plan 80-L	-20.4	-20.43	-20.09
RU106 Tone plan 90-L	-20.37	-20.38	-19.75
RU242 Tone plan 95-L	-21.12	-20.19	-20.48
2.4 GHz ax-mode 40 MHz(Chain 1 only)	Low	Mid	High
FULL RU	-21.7	-21.19	-20.06
RU26 Tone plan 10-S	-22.88	-23.04	-22.69
RU26 Tone plan 10-L	-22.48	-22.67	-22.32
RU26 Tone plan 20-L	-22.08	-22.08	-21.59
RU26 Tone plan 30-L	-21.83	-21.96	-21.47
RU52 Tone plan 50-L	-22.16	-22.51	-22.07
RU52 Tone plan 60-L	-21.73	-21.86	-21.41
RU52 Tone plan 70-S	-21.77	-21.89	-21.42
RU52 Tone plan 70-L	-21.7	-21.65	-21.24
RU106 Tone plan 80-L	-22.07	-21.99	-21.64
RU106 Tone plan 90-L	-21.7	-21.66	-21.23
RU242 Tone plan 95-L	-22.27	-22.36	-22.03

Conclusion: The PSD for FULL RU configuration is the highest. Therefore no additional testing for different RU tone configurations are required.

13.7 6 dB DTS bandwidth

Description:

Measurement of the 6 dB bandwidth of the modulated signal.

Measurement:

Measurement parameter	
According to DTS clause: 8.2	
External result file(s)	1-1132-25-01-04_TR1-A201-R01.pdf
Test setup	See chapter 7.4 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:

antenna port 1	6 dB DTS bandwidth / kHz		
	lowest channel	middle channel	highest channel
DSSS / b – mode SISO	7100	8064	7096
OFDM / g – mode SISO	16280	16292	16024
OFDM / n HT20 – mode MIMO	16912	17272	16772
OFDM / n HT40 – mode MIMO	35680	35536	35856
OFDM / ax HE20 – mode MIMO	18568	18560	18676
OFDM / ax HE40 – mode MIMO	37472	37752	37760

antenna port 2	6 dB DTS bandwidth / kHz		
	lowest channel	middle channel	highest channel
DSSS / b – mode SISO	7092	7104	8052
OFDM / g – mode SISO	16292	16036	16024
OFDM / n HT20 – mode MIMO	17516	16872	16896
OFDM / n HT40 – mode MIMO	35496	35112	35880
OFDM / ax HE20 – mode MIMO	18660	18472	18568
OFDM / ax HE40 – mode MIMO	37200	37448	37884

13.8 Occupied bandwidth – 99% emission bandwidth

Description:

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

Measurement:

Measurement parameter	
External result file(s)	1-1132-25-01-04_TR1-A201-R01.pdf
Test setup	See chapter 7.4 setup A
Measurement uncertainty	See chapter 9

Usage:

-/-	ISED
OBW is necessary for Emission Designator	

Results:

antenna port 1	99% emission bandwidth / kHz		
	lowest channel	middle channel	highest channel
DSSS / b – mode SISO	13027	13047	13051
OFDM / g – mode SISO	16574	16578	16566
OFDM / n HT20 – mode MIMO	17674	17674	17674
OFDM / n HT40 – mode MIMO	36036	36084	36068
OFDM / ax HE20 – mode MIMO	18942	18934	18934
OFDM / ax HE40 – mode MIMO	37780	37820	37780

antenna port 2	99% emission bandwidth / kHz		
	lowest channel	middle channel	highest channel
DSSS / b – mode SISO	13107	13015	13027
OFDM / g – mode SISO	16598	16566	16566
OFDM / n HT20 – mode MIMO	17678	17654	17666
OFDM / n HT40 – mode MIMO	36068	36084	36228
OFDM / ax HE20 – mode MIMO	18946	18918	18918
OFDM / ax HE40 – mode MIMO	37748	37764	37876

13.9 Occupied bandwidth – 20 dB bandwidth

Description:

Measurement of the 20 dB bandwidth of the modulated carrier.

Measurement:

Measurement parameter	
External result file(s)	1-1132-25-01-04_TR1-A201-R01.pdf
Test setup	See chapter 7.4 setup A
Measurement uncertainty	See chapter 9

Usage:

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

Results:

antenna port 1	20 dB bandwidth / MHz		
	lowest channel	middle channel	highest channel
DSSS / b – mode SISO	15.2	15.2	15.2
OFDM / g – mode SISO	18.3	18.4	18.3
OFDM / n HT20 – mode MIMO	19.3	19.4	19.3
OFDM / n HT40 – mode MIMO	39.2	39.1	39.2
OFDM / ax HE20 – mode MIMO	20.4	20.5	20.5
OFDM / ax HE40 – mode MIMO	40.3	40.3	40.3

antenna port 2	20 dB bandwidth / MHz		
	lowest channel	middle channel	highest channel
DSSS / b – mode SISO	15.3	15.2	15.2
OFDM / g – mode SISO	18.4	18.3	18.3
OFDM / n HT20 – mode MIMO	19.3	19.3	19.3
OFDM / n HT40 – mode MIMO	39.0	39.0	39.2
OFDM / ax HE20 – mode MIMO	20.5	20.5	20.4
OFDM / ax HE40 – mode MIMO	40.3	40.3	40.3

13.10 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 7.2 setup A	
Measurement uncertainty	See chapter 9	

Limits:

FCC	ISED
74 dB μ V/m @ 3 m (Peak) 54 dB μ V/m @ 3 m (AVG)	

Results:

band edge compliance radiated / (dB μ V / m) @ 3 m			
	DSSS / b – mode SISO 1+2	OFDM / g – mode SISO 1+2	OFDM / n HT20 – mode MIMO
Lower band edge	59.6 (Peak) 48.1 (AVG)	60.0 (Peak) 48.2 (AVG)	60.6 (Peak) 48.3 (AVG)
Upper band edge	60.9 (Peak) 48.0 (AVG)	59.8 (Peak) 48.1 (AVG)	59.7 (Peak) 48.3 (AVG)
	OFDM / n HT40 – mode MIMO	OFDM / ax HE20 – mode MIMO	OFDM / ax HE40 – mode MIMO
Lower band edge	60.1 (Peak) 48.4 (AVG)	59.3 (Peak) 48.0 (AVG)	59.9 (Peak) 48.1 (AVG)
Upper band edge	59.7 (Peak) 48.3 (AVG)	60.0 (Peak) 48.5 (AVG)	59.7 (Peak) 48.1 (AVG)

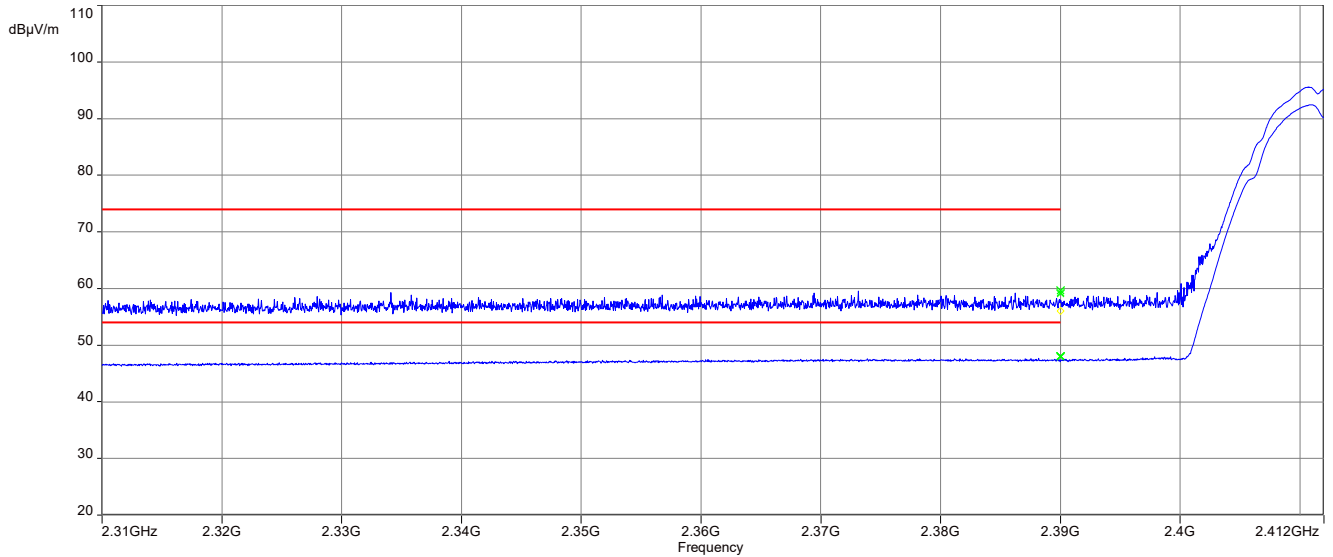
Results:

band edge compliance radiated / (dB μ V / m) @ 3 m			
	axHE20-mode MIMO / 10-S tone plan	axHE20-mode MIMO / 50-L tone plan	axHE20-mode MIMO / 80-L tone plan
Lower band edge	46.7 (Peak) 33.5 (AVG)	46.6 (Peak) 34.4 (AVG)	63.0 (Peak) 51.9 (AVG)

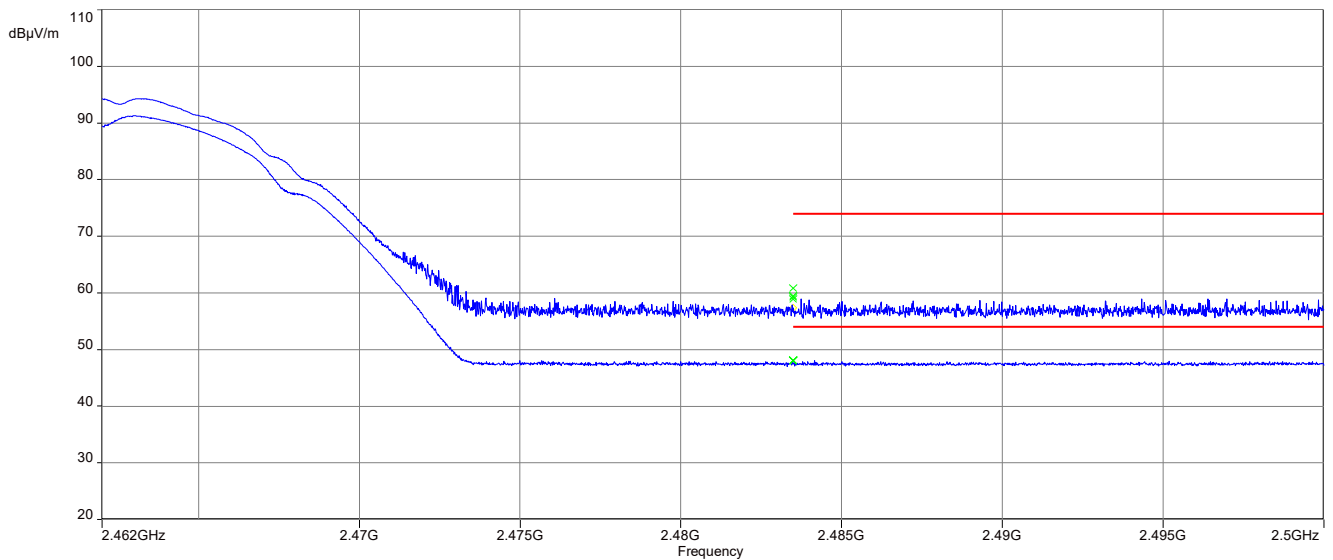
band edge compliance radiated / (dB μ V / m) @ 3 m			
	axHE20-mode MIMO / 30-L tone plan	axHE20-mode MIMO / 70-S tone plan	axHE20-mode MIMO / 90-L tone plan
Upper band edge	44.7 (Peak) 32.9 (AVG)	63.5 (Peak) 40.7 (AVG)	65.0 (Peak) 51.9 (AVG)

Plots: b-mode - peak / average SISO 1+2

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

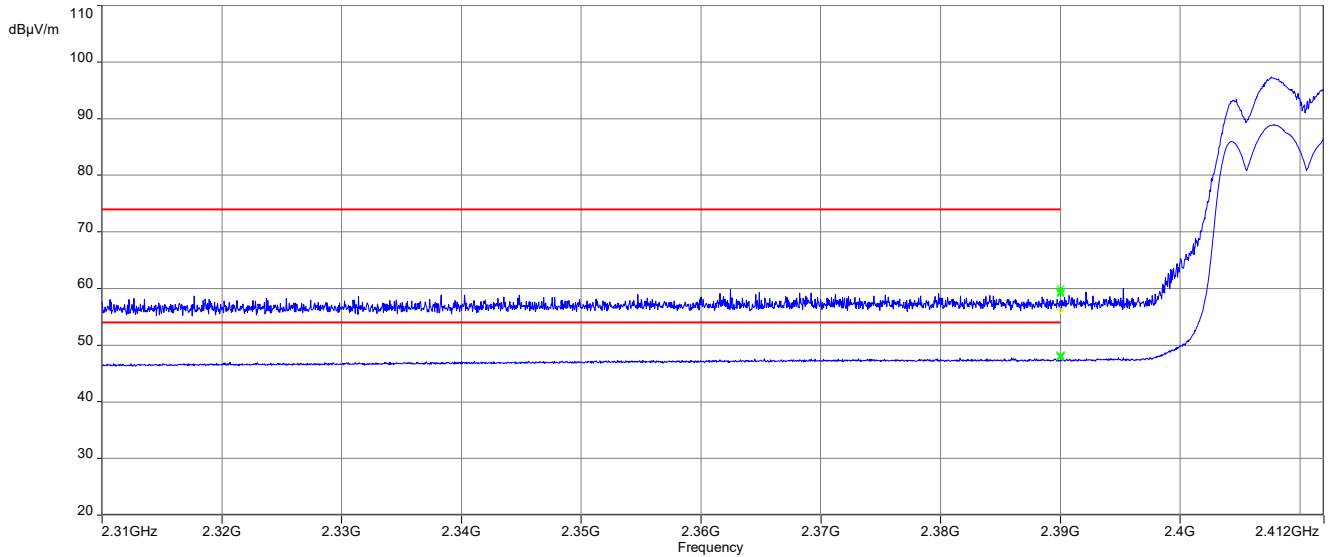


Plot 2: TX mode, upper band edge, vertical & horizontal polarization

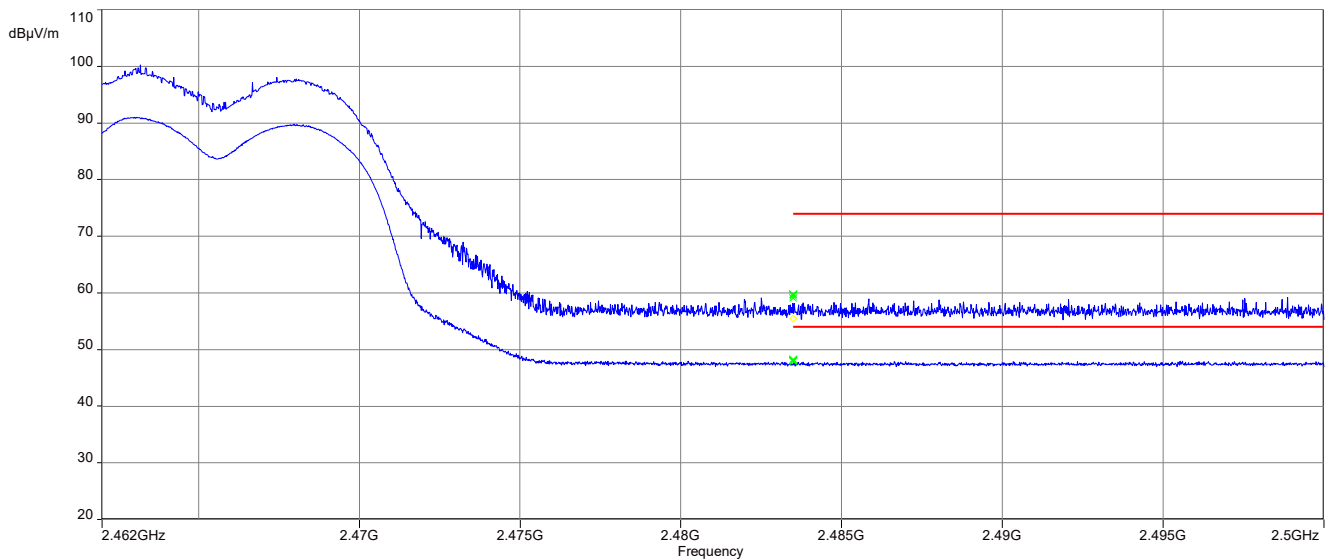


Plots: g-mode - peak / average SISO 1+2

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

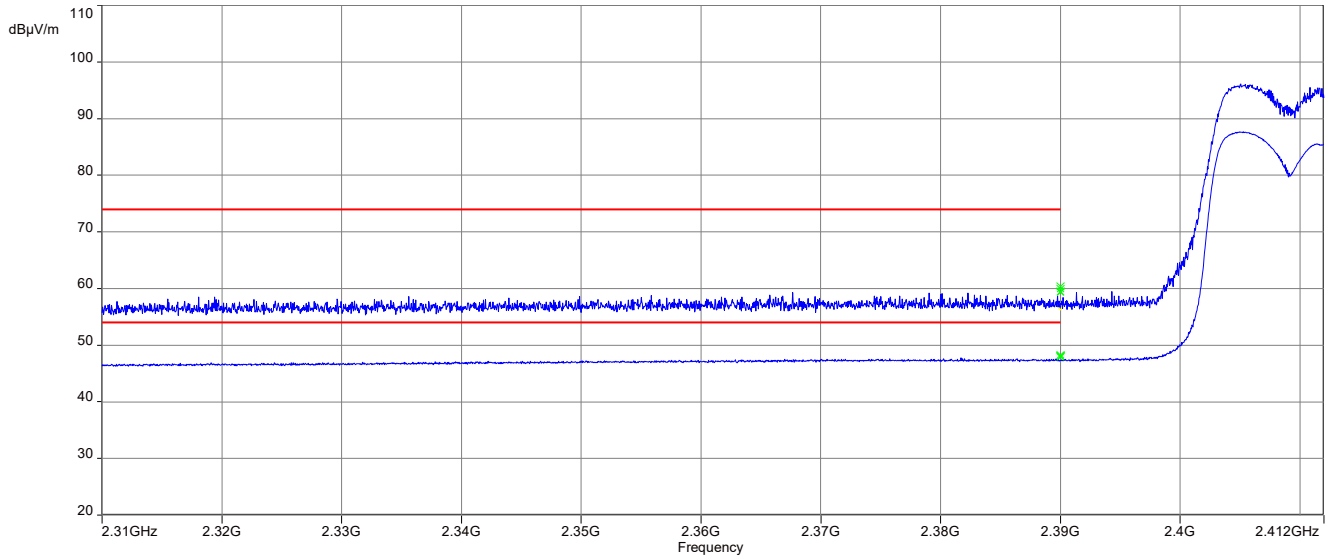


Plot 2: TX mode, upper band edge, vertical & horizontal polarization

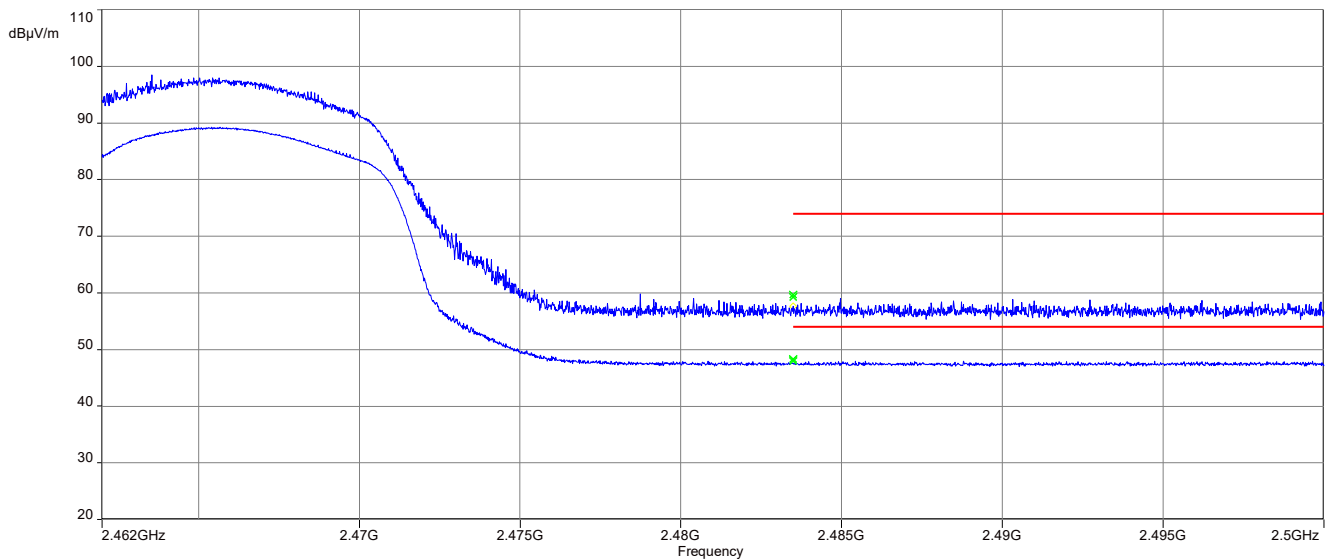


Plots: OFDM / n HT20 – mode - peak / average MIMO

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

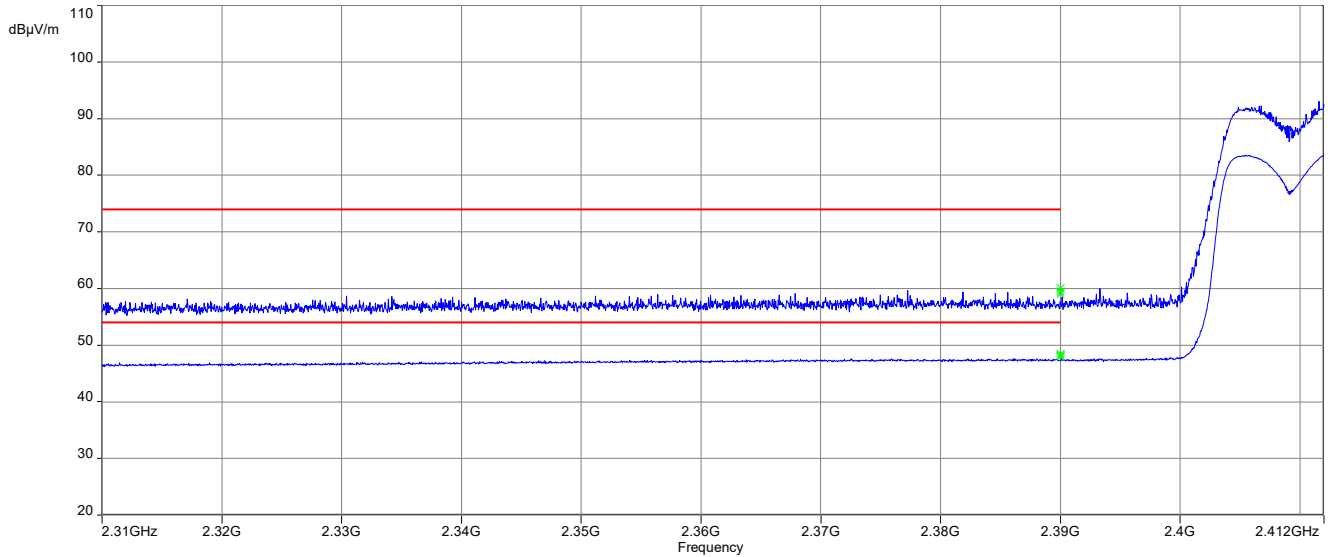


Plot 2: TX mode, upper band edge, vertical & horizontal polarization

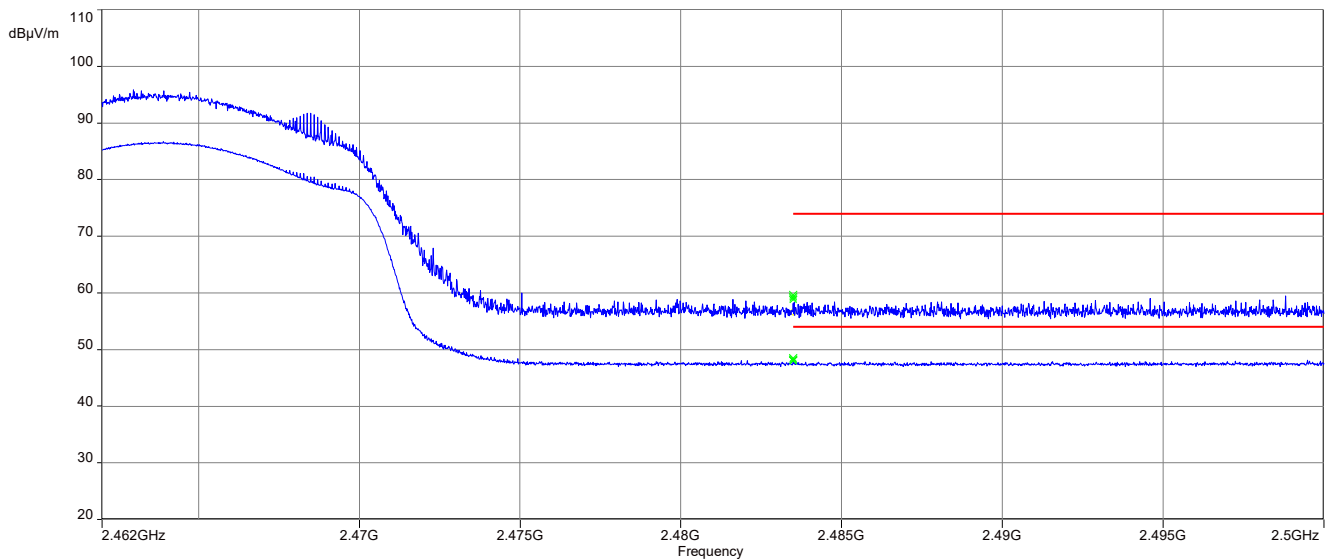


Plots: OFDM / n HT40 – mode - peak / average MIMO

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

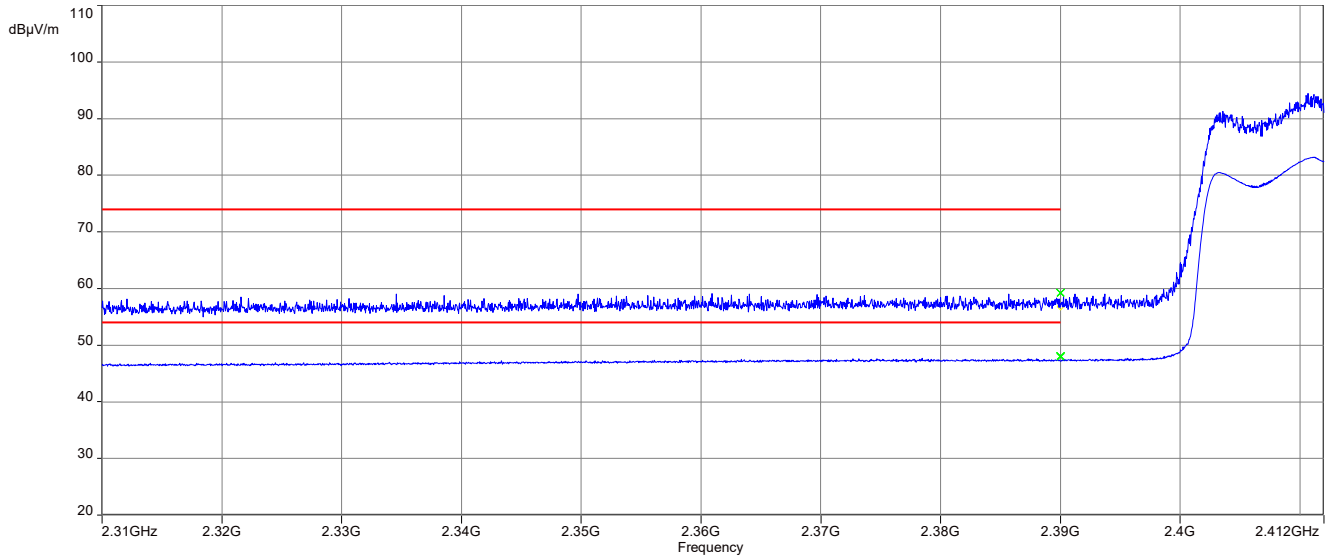


Plot 2: TX mode, upper band edge, vertical & horizontal polarization

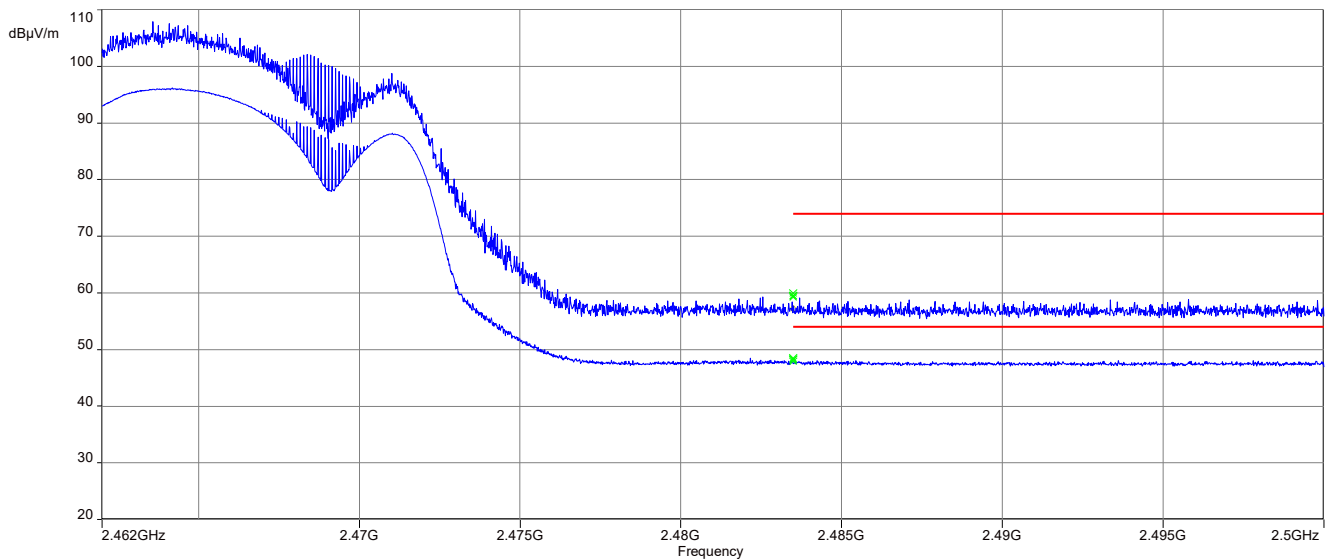


Plots: OFDM / ax HE20 – mode - peak / average MIMO

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

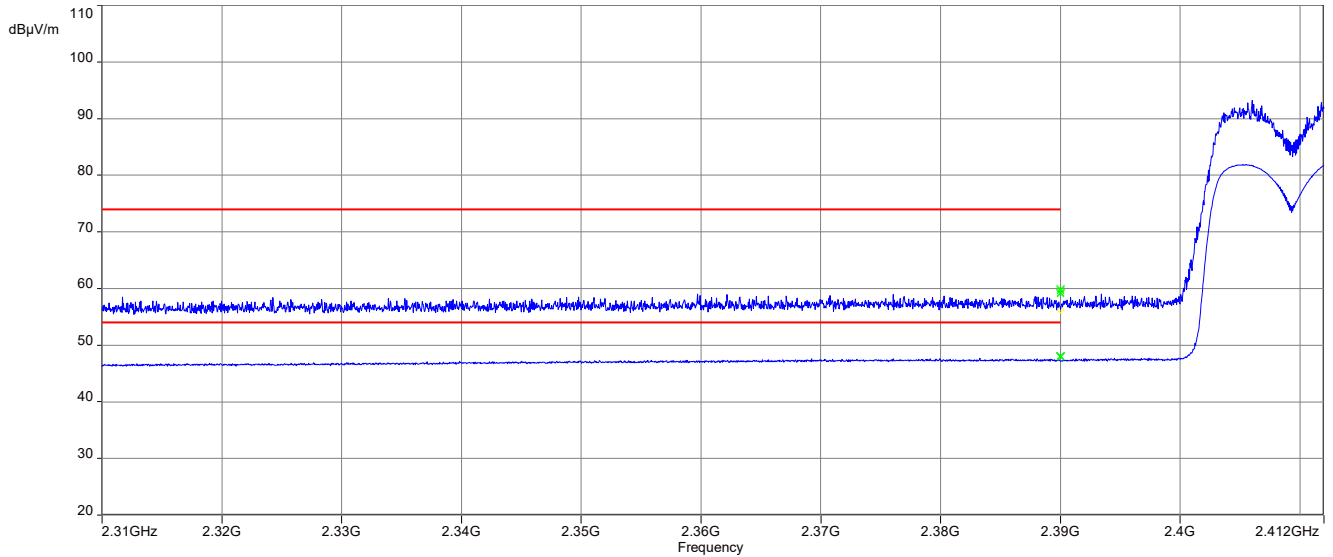


Plot 2: TX mode, upper band edge, vertical & horizontal polarization

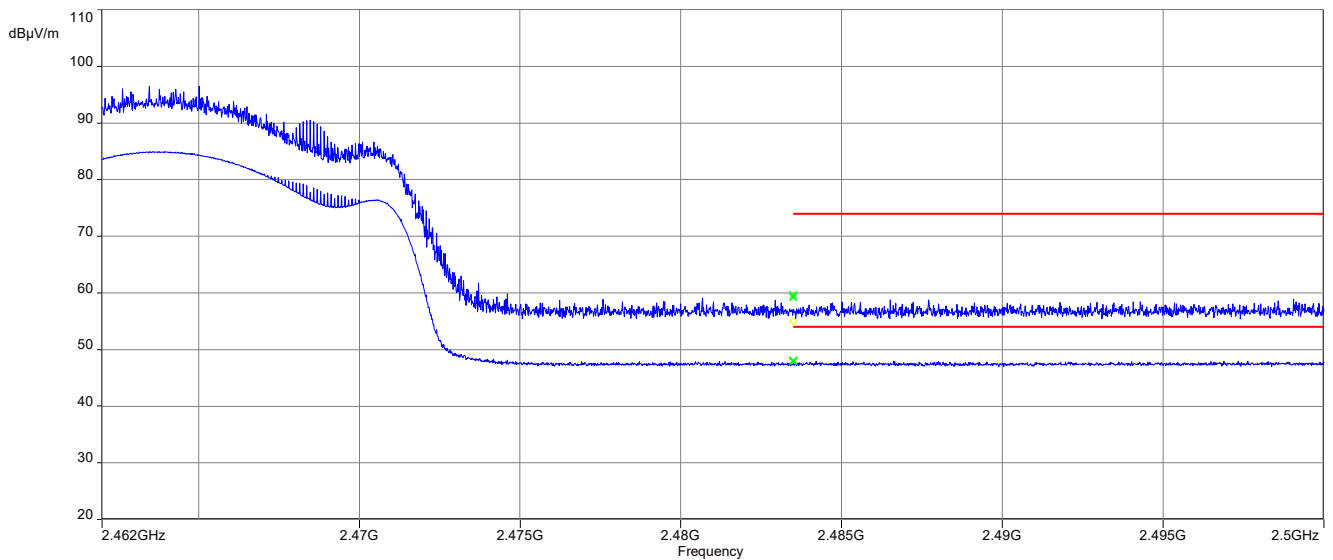


Plots: OFDM / ax HE40 – mode - peak / average MIMO

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

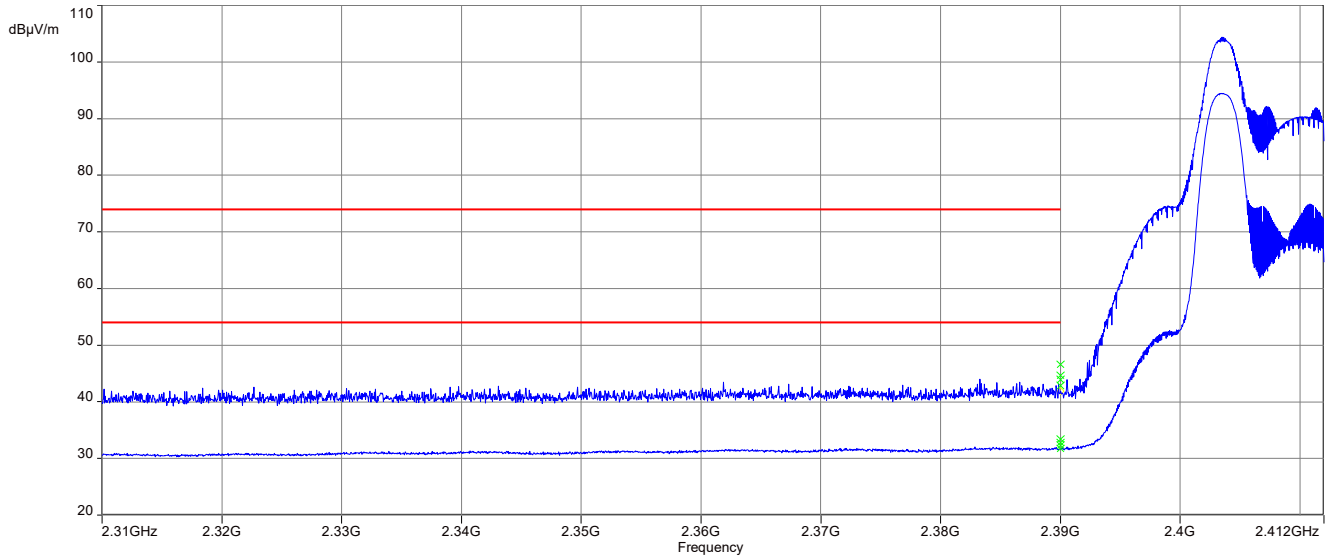


Plot 2: TX mode, upper band edge, vertical & horizontal polarization

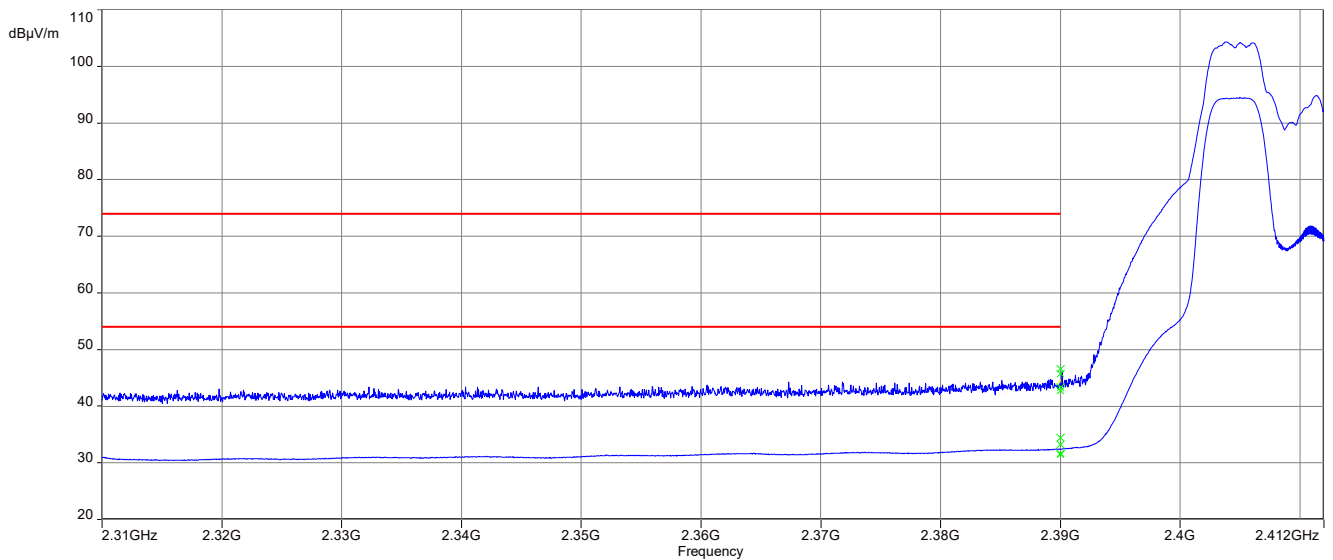


Plots: OFDM / ax HE20 – mode - peak / average MIMO

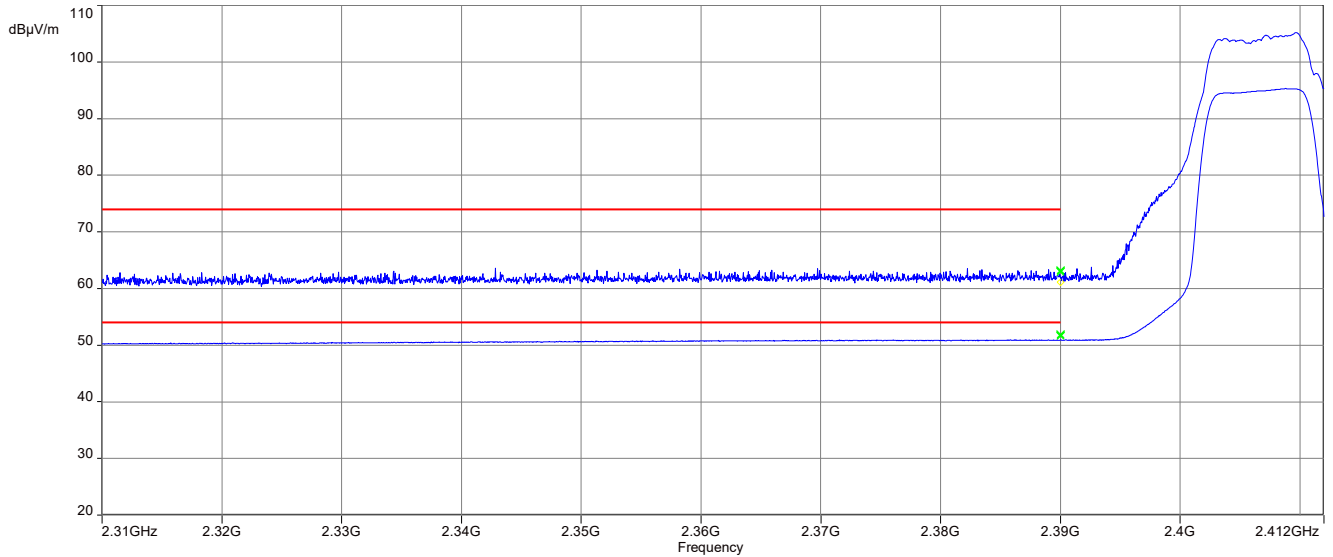
Plot 1: TX mode, lower band edge, vertical & horizontal polarization, 10-S tone plan



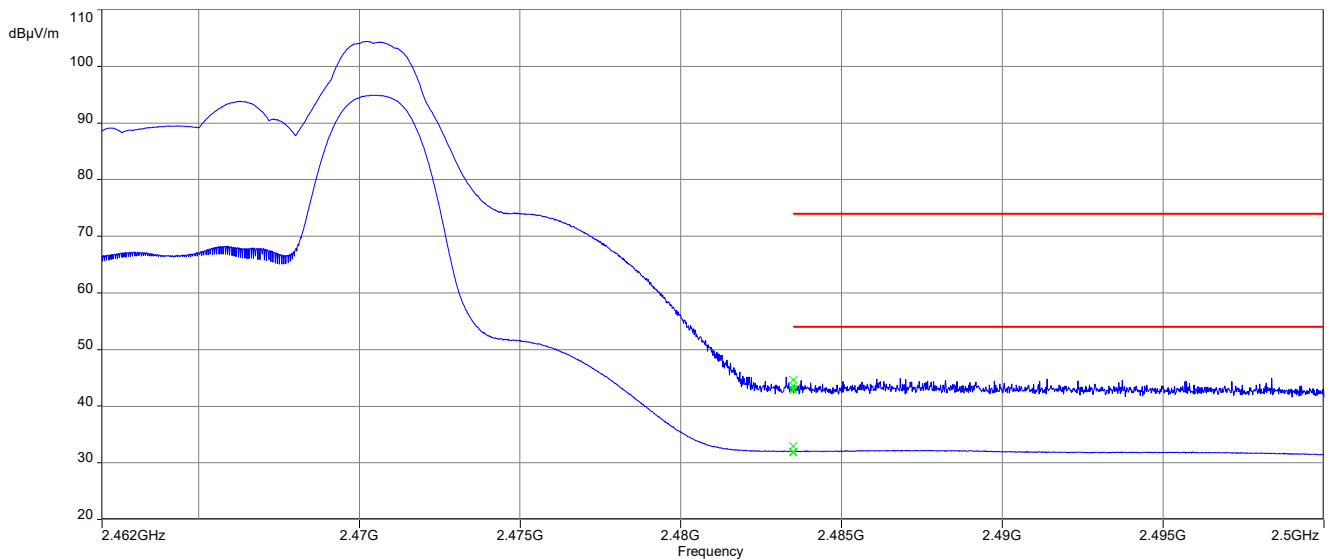
Plot 2: TX mode, lower band edge, vertical & horizontal polarization, 50-L tone plan



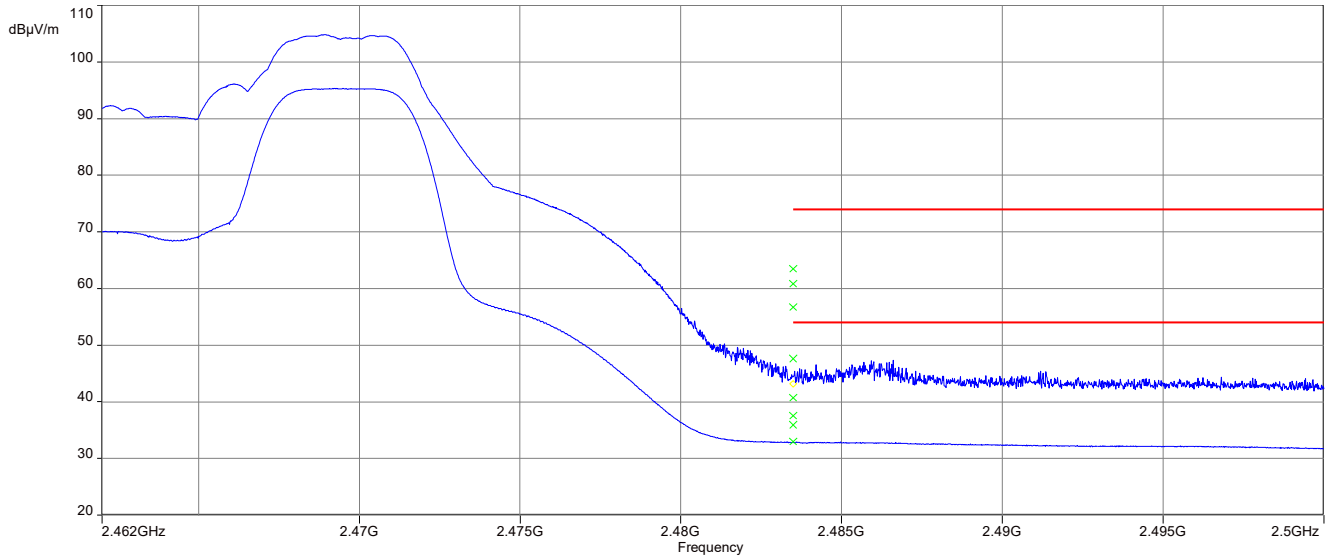
Plot 3: TX mode, lower band edge, vertical & horizontal polarization, 80-L tone plan



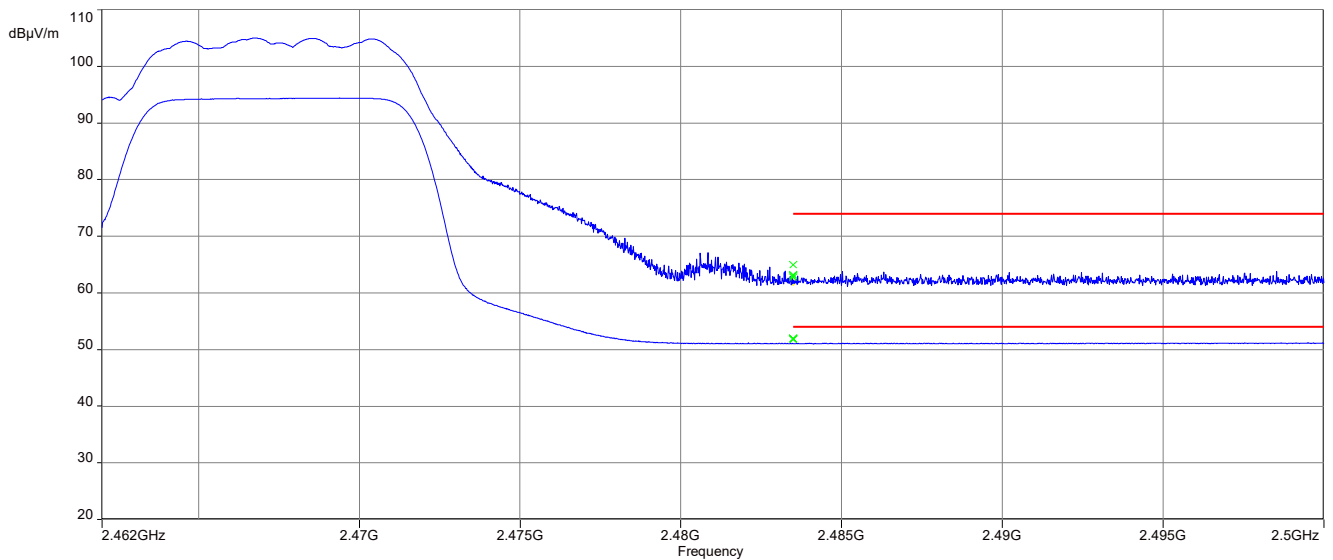
Plot 4: TX mode, upper band edge, vertical & horizontal polarization, 30-L tone plan



Plot 5: TX mode, upper band edge, vertical & horizontal polarization, 70-S tone plan



Plot 6: TX mode, upper band edge, vertical & horizontal polarization, 90-L tone plan



13.11 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	
External result file(s)	1-1132-25-01-04_TR1-A201-R01.pdf
Test setup	See chapter 7.4 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)

13.12 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 chapter 7.2 setup C
Measurement uncertainty	See chapter 9

Limits:

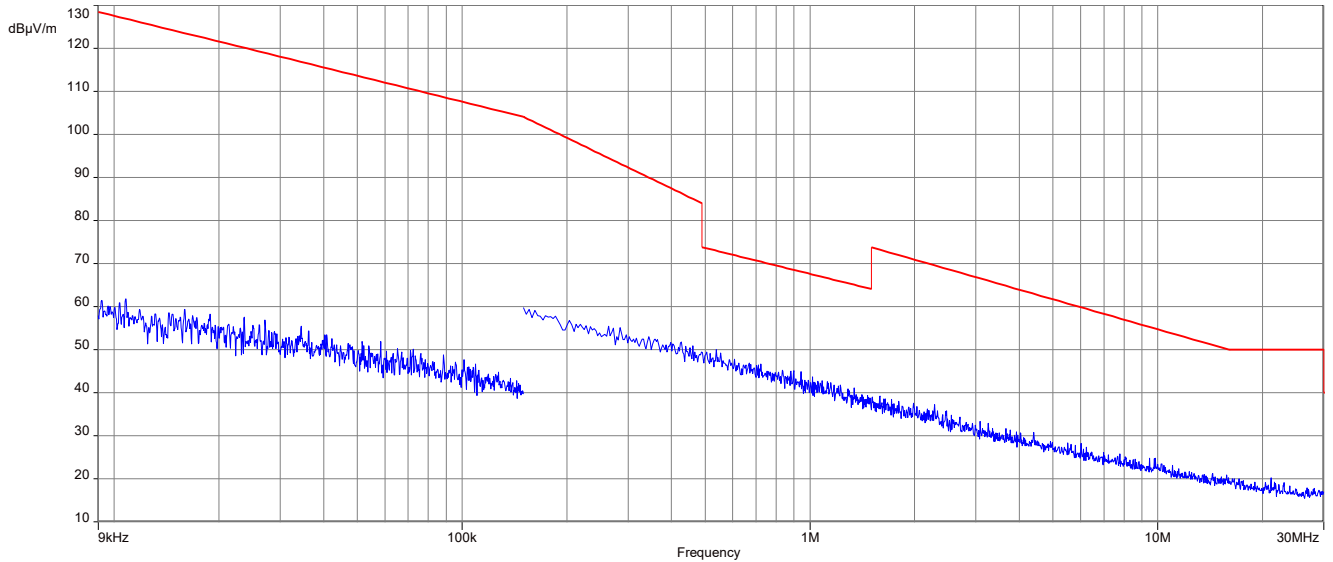
FCC		ISED
Frequency / MHz	Field Strength / ($\mu\text{V} / \text{m}$)	Measurement distance / m
0.009 – 0.490	$2400/F(\text{kHz})$	300
0.490 – 1.705	$24000/F(\text{kHz})$	30
1.705 – 30.0	30	30

Results:

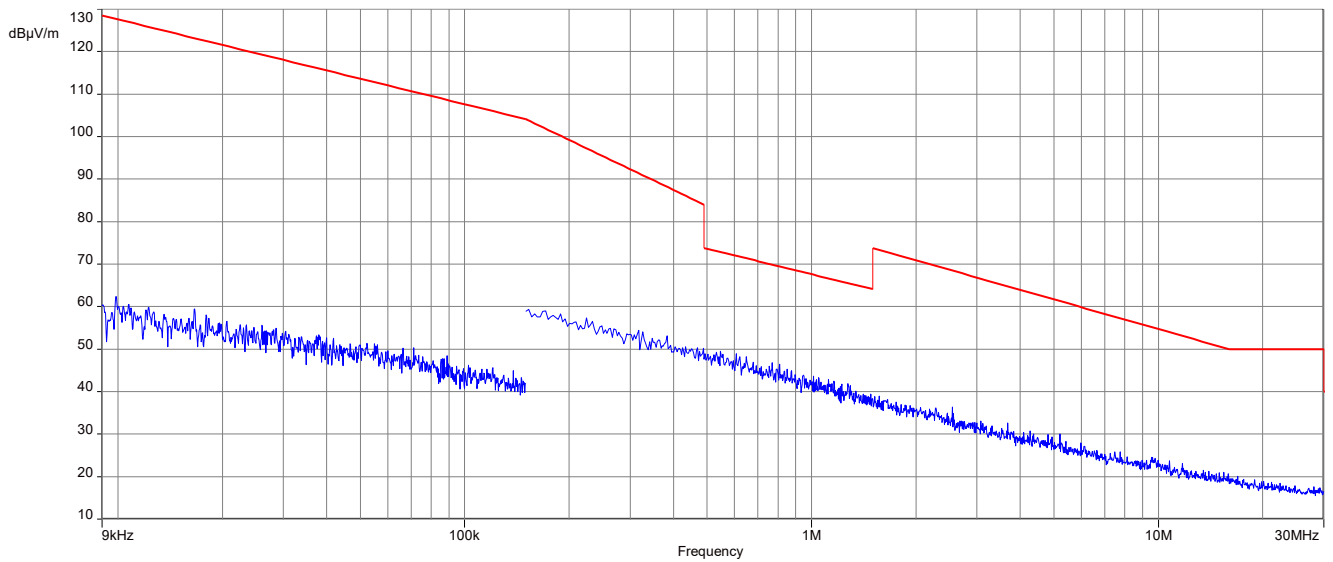
TX spurious emissions radiated < 30 MHz / (dB $\mu\text{V} / \text{m}$) @ 3 m		
Frequency / MHz	Detector	Level / (dB $\mu\text{V} / \text{m}$)
All detected peaks are more than 20 dB below the limit.		

Plots: DSSS

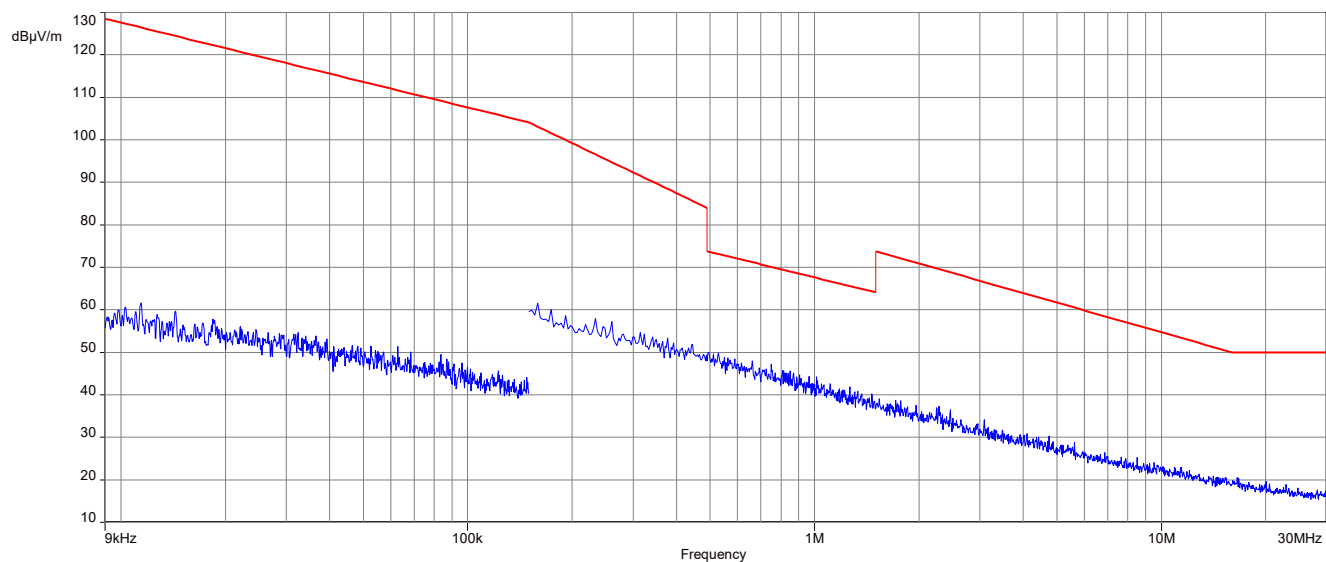
Plot 1: 9 kHz to 30 MHz, lowest channel



Plot 2: 9 kHz to 30 MHz, middle channel

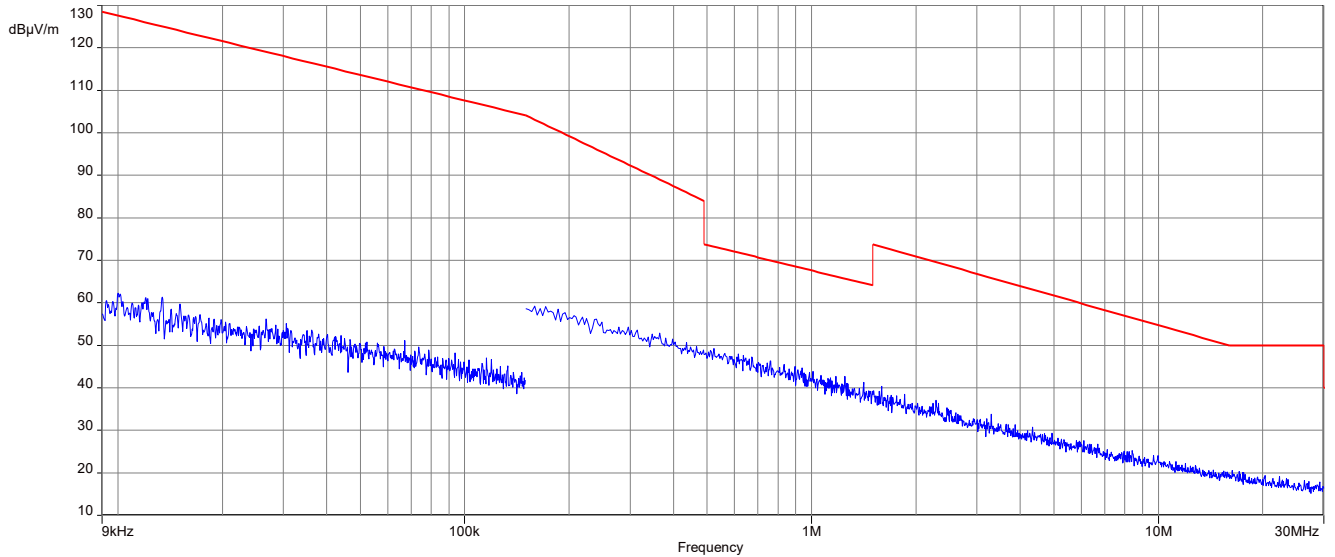


Plot 3: 9 kHz to 30 MHz, highest channel

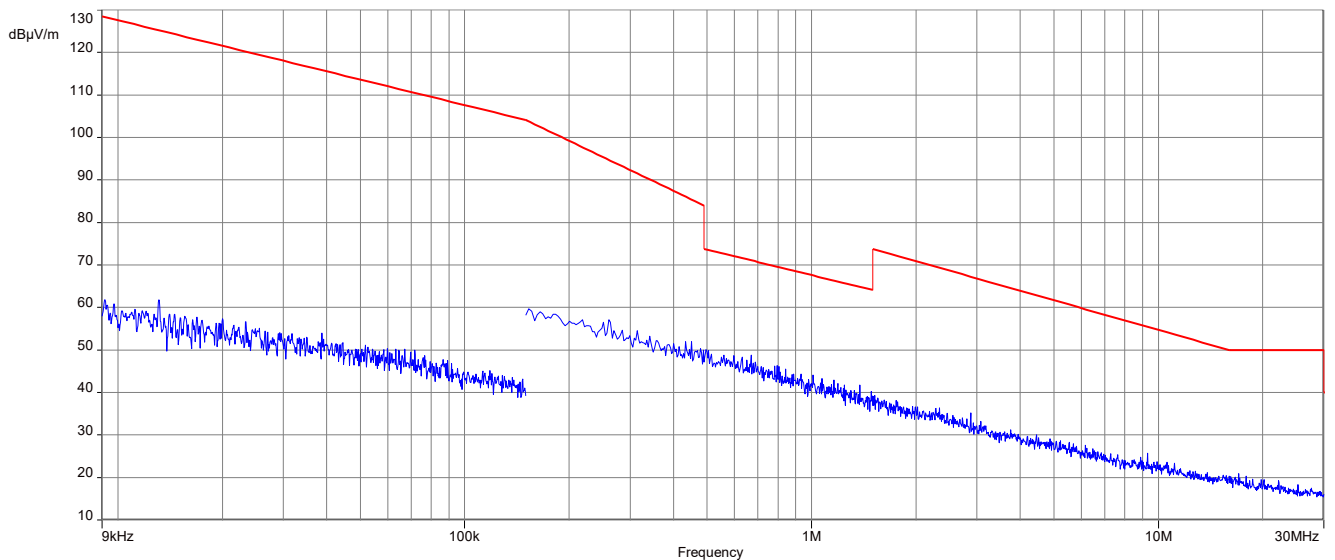


Plots: OFDM (20 MHz nominal channel bandwidth)

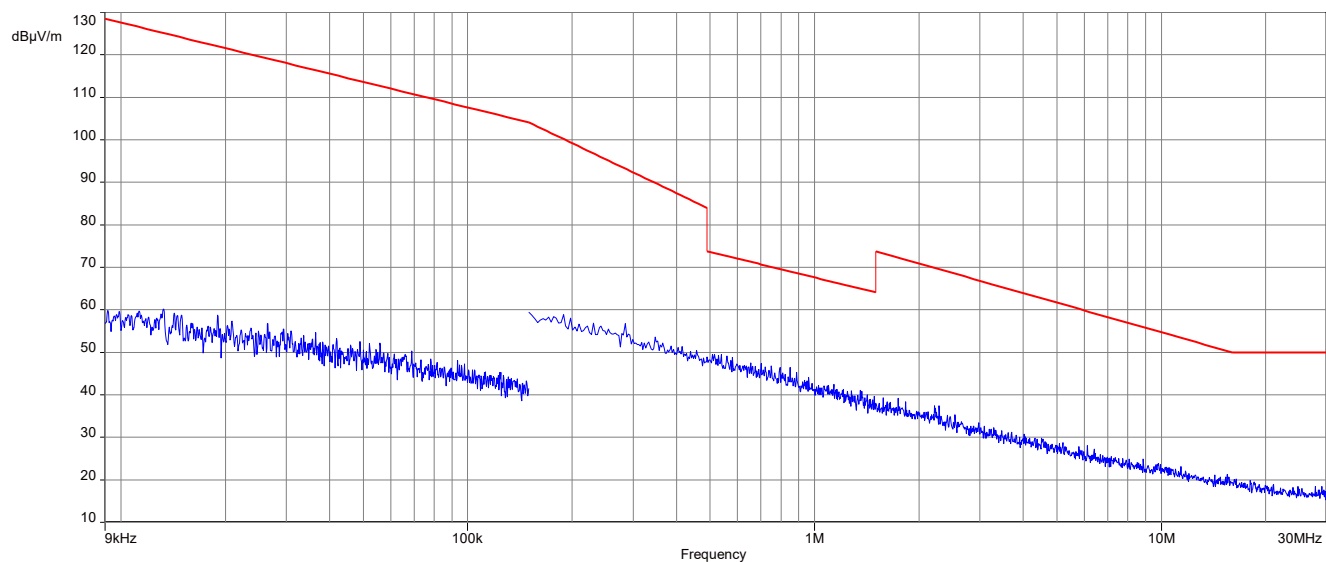
Plot 1: 9 kHz to 30 MHz, lowest channel



Plot 2: 9 kHz to 30 MHz, middle channel

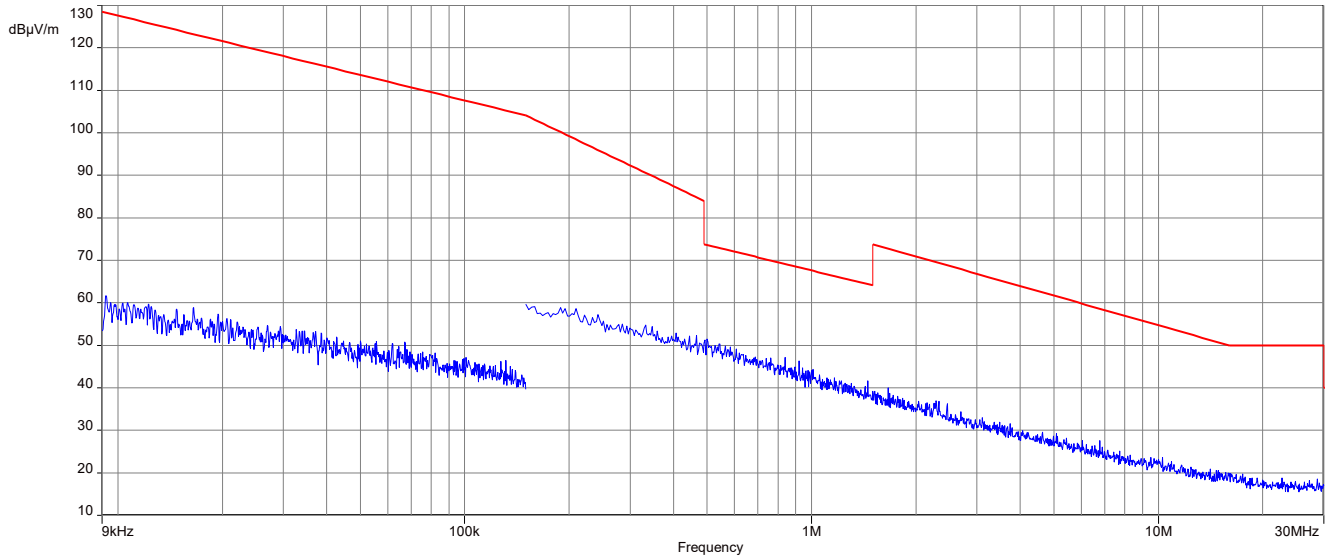


Plot 3: 9 kHz to 30 MHz, highest channel

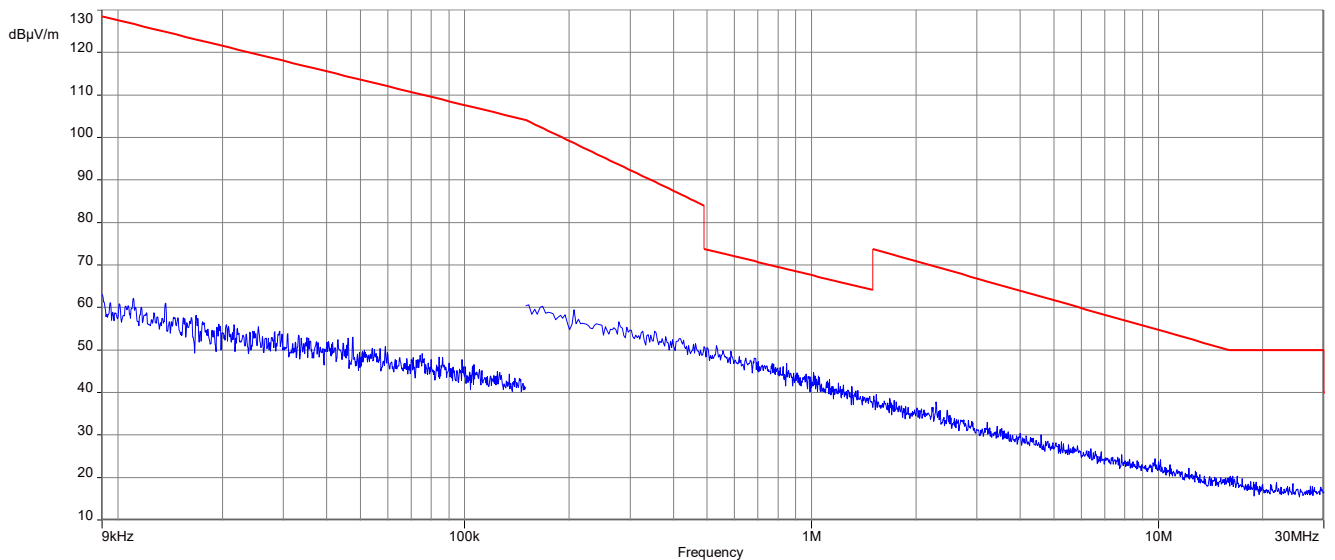


Plots: OFDM (40 MHz nominal channel bandwidth)

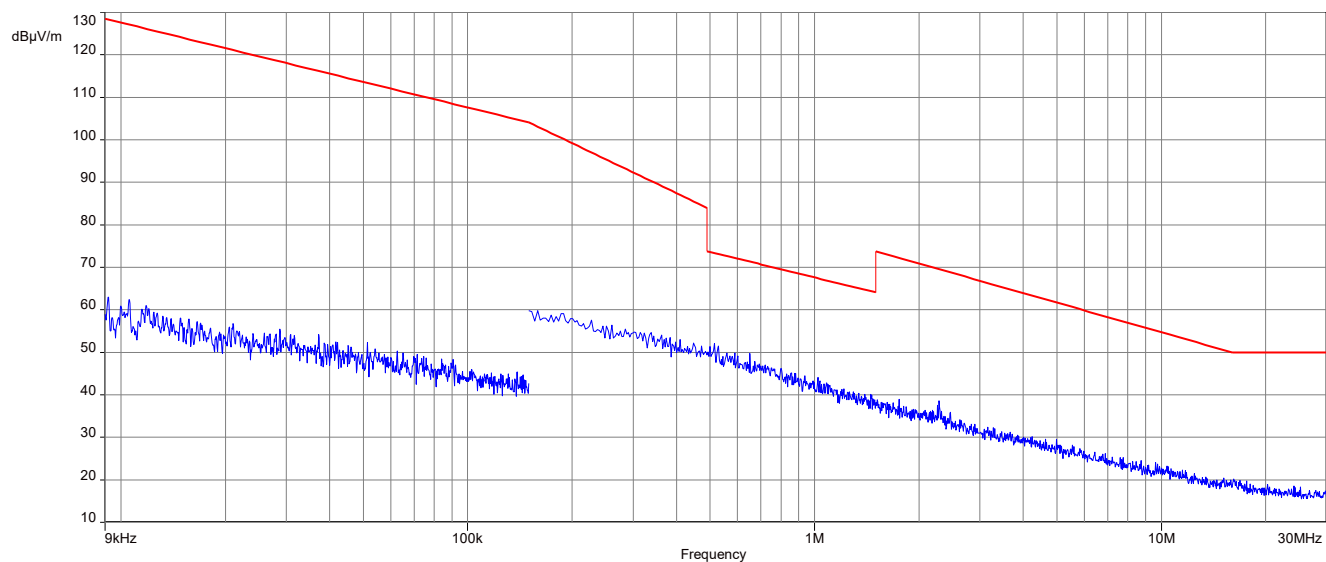
Plot 1: 9 kHz to 30 MHz, lowest channel



Plot 2: 9 kHz to 30 MHz, middle channel



Plot 3: 9 kHz to 30 MHz, highest channel



13.13 Spurious emissions radiated 30 MHz to 1 GHz

Description:

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

Measurement:

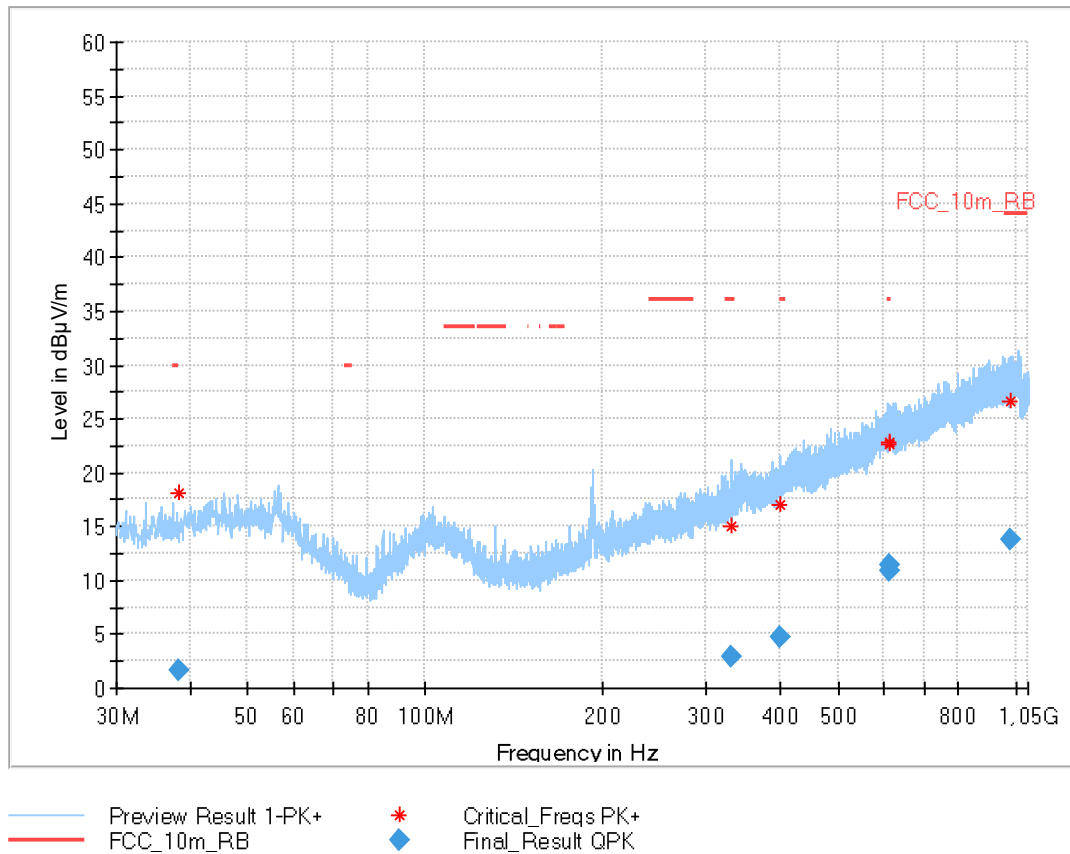
Measurement parameter	
Detector	Peak / Quasi Peak
Sweep time	Auto
Resolution bandwidth	120 kHz
Video bandwidth	3 x RBW
Span	30 MHz to 1 GHz
Trace mode	Max Hold
Test setup	See chapter 7.1 setup A
Measurement uncertainty	See chapter 9

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: DSSS

Plot 1: 30 MHz to 1 GHz, vertical & horizontal polarization, valid for all channels

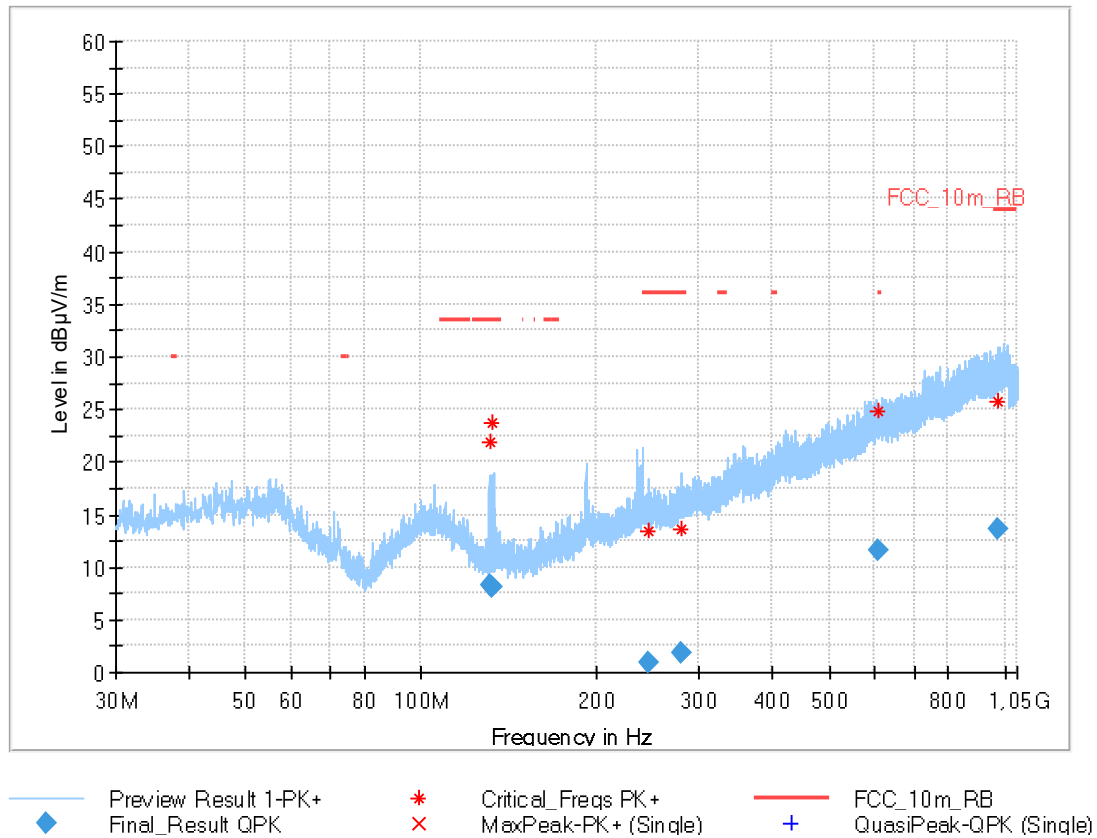


Final results:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
38.245	1.60	30.0	28.4	1000	120.0	184.0	H	339	14
329.813	2.85	36.0	33.2	1000	120.0	103.0	H	225	16
400.208	4.74	36.0	31.3	1000	120.0	300.0	H	46	18
610.404	11.41	36.0	24.6	1000	120.0	110.0	V	348	22
611.169	10.86	36.0	25.1	1000	120.0	236.0	V	45	22
983.752	13.78	44.0	30.2	1000	120.0	400.0	H	225	26

Plot: OFDM/OFDMA (20 MHz nominal channel bandwidth)

Plot 1: 30 MHz to 1 GHz, vertical & horizontal polarization, valid for all channels and modes

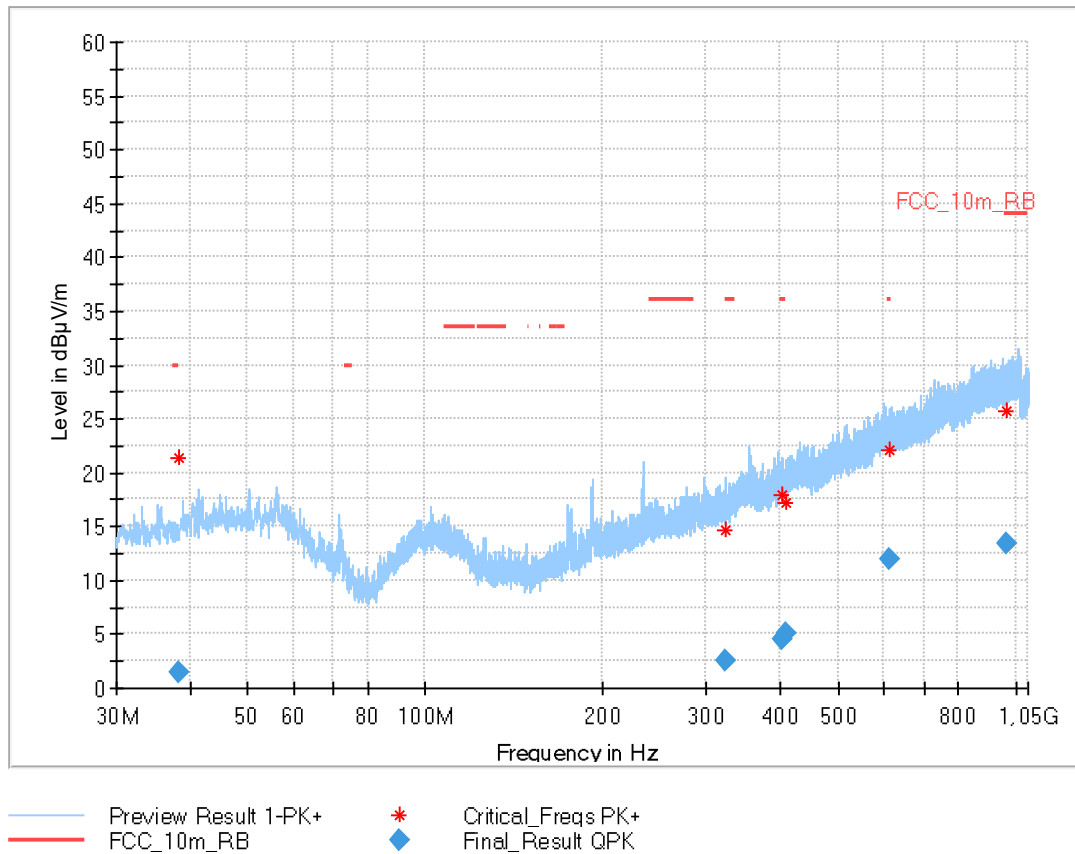


Final results:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
131.325	8.23	33.5	25.3	1000	120.0	221.0	V	241	10
132.759	8.18	33.5	25.3	1000	120.0	204.0	V	237	10
244.617	0.99	36.0	35.0	1000	120.0	182.0	H	176	14
278.775	1.92	36.0	34.1	1000	120.0	314.0	V	-5	15
609.090	11.68	36.0	24.3	1000	120.0	272.0	V	351	22
970.365	13.60	44.0	30.4	1000	120.0	200.0	H	288	25

Plot: OFDM/OFDMA (40 MHz nominal channel bandwidth)

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)
38.160	1.43	30.0	28.6	1000	120.0	357.0	H	279	14
322.676	2.56	36.0	33.4	1000	120.0	104.0	V	292	16
401.060	4.62	36.0	31.4	1000	120.0	103.0	H	49	18
408.049	5.09	36.0	30.9	1000	120.0	200.0	H	315	18
613.399	11.99	36.0	24.0	1000	120.0	162.0	V	168	22
966.897	13.44	44.0	30.6	1000	120.0	400.0	H	131	25

13.14 Spurious emissions radiated above 1 GHz

Description:

Measurement of the radiated spurious emissions above 1 GHz in transmit 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
Test setup	See chapter 7.2 setup B & 7.3 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 / (dB μ V / m)	Measurement distance / m
Above 960	54.0 (AVG)	3
	74.0 (peak)	

Results: DSSS

TX spurious emissions radiated / dB μ V/m @ 3 m								
lowest channel			middle channel			highest channel		
f / MHz	Detector	Level / dB μ V/m	f / MHz	Detector	Level / dB μ V/m	f / MHz	Detector	Level / dB μ V/m
All detected emissions are more than 20 dB below the limit.			All detected emissions are more than 20 dB below the limit.			All detected emissions are more than 20 dB below the limit.		
	Peak			Peak			Peak	
	AVG			AVG			AVG	
	Peak			Peak			Peak	
	AVG			AVG			AVG	

Results: OFDM (20 MHz nominal channel bandwidth), g-mode

TX spurious emissions radiated / dB μ V/m @ 3 m								
lowest channel			middle channel			highest channel		
f / MHz	Detector	Level / dB μ V/m	f / MHz	Detector	Level / dB μ V/m	f / MHz	Detector	Level / dB μ V/m
All detected emissions are more than 20 dB below the limit.			All detected emissions are more than 20 dB below the limit.			All detected emissions are more than 20 dB below the limit.		
	Peak			Peak			Peak	
	AVG			AVG			AVG	
	Peak			Peak			Peak	
	AVG			AVG			AVG	

Results: OFDM (20 MHz nominal channel bandwidth), axHE20-mode

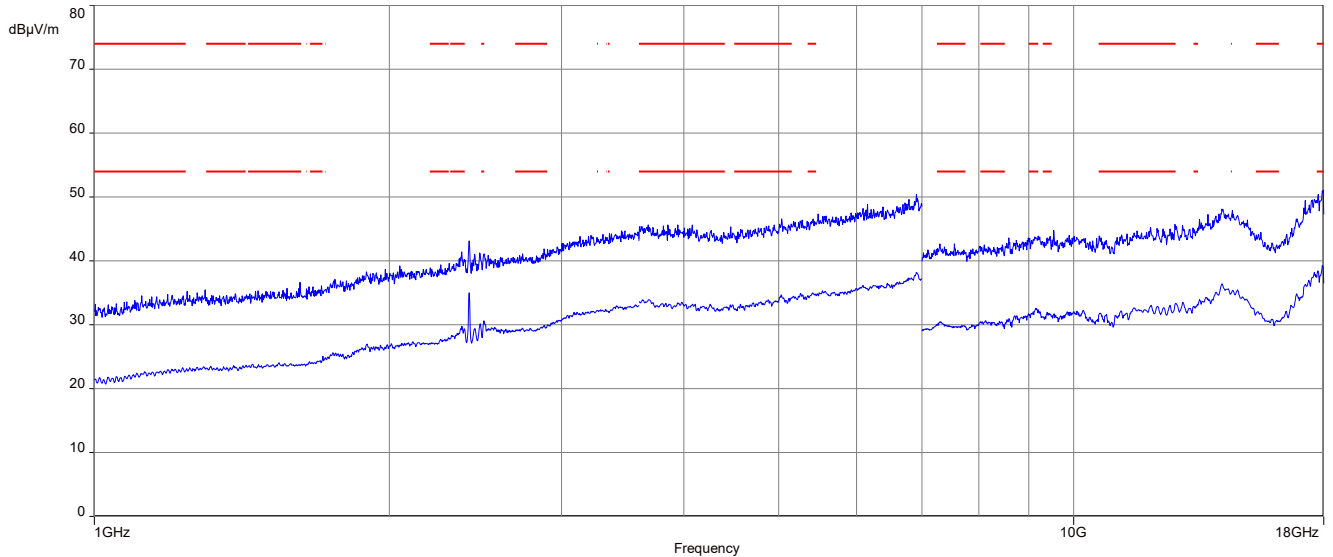
TX spurious emissions radiated / dB μ V/m @ 3 m								
lowest channel			middle channel			highest channel		
f / MHz	Detector	Level / dB μ V/m	f / MHz	Detector	Level / dB μ V/m	f / MHz	Detector	Level / dB μ V/m
All detected emissions are more than 20 dB below the limit.			All detected emissions are more than 20 dB below the limit.			All detected emissions are more than 20 dB below the limit.		
	Peak			Peak			Peak	
	AVG			AVG			AVG	
	Peak			Peak			Peak	
	AVG			AVG			AVG	

Results: OFDM (40 MHz nominal channel bandwidth), nHT40-mode

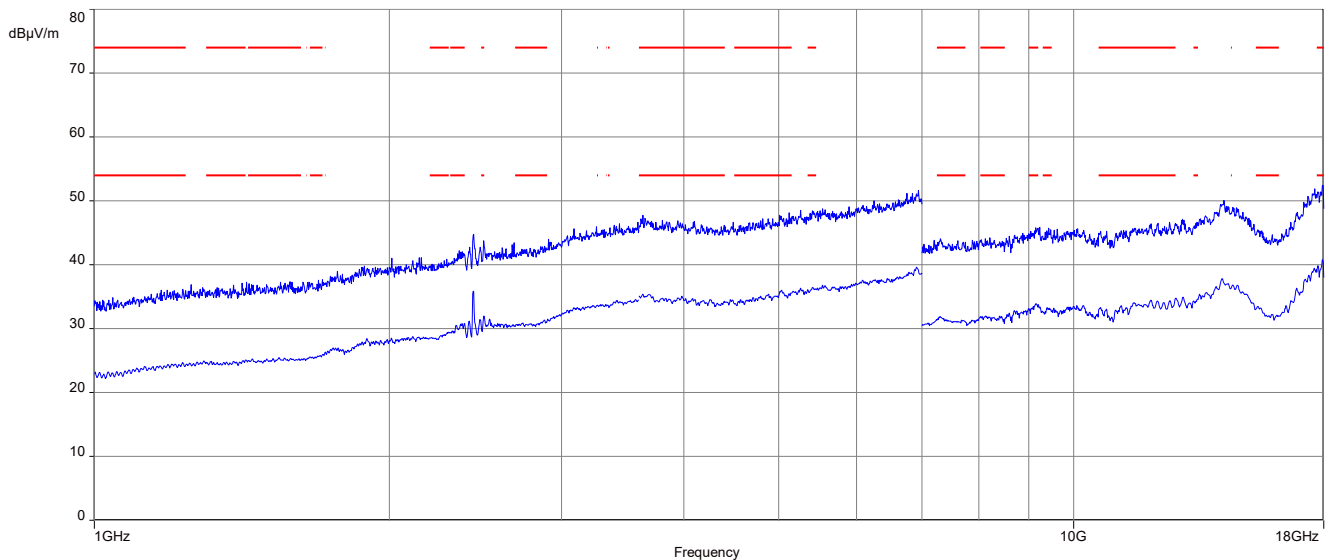
TX spurious emissions radiated / dB μ V/m @ 3 m								
lowest channel			middle channel			highest channel		
f / MHz	Detector	Level / dB μ V/m	f / MHz	Detector	Level / dB μ V/m	f / MHz	Detector	Level / dB μ V/m
All detected emissions are more than 20 dB below the limit.			All detected emissions are more than 20 dB below the limit.			All detected emissions are more than 20 dB below the limit.		
	Peak			Peak			Peak	
	AVG			AVG			AVG	
	Peak			Peak			Peak	
	AVG			AVG			AVG	

Results: OFDM (40 MHz nominal channel bandwidth), axHE40-mode

TX spurious emissions radiated / dB μ V/m @ 3 m								
lowest channel			middle channel			highest channel		
f / MHz	Detector	Level / dB μ V/m	f / MHz	Detector	Level / dB μ V/m	f / MHz	Detector	Level / dB μ V/m
All detected emissions are more than 20 dB below the limit.			All detected emissions are more than 20 dB below the limit.			All detected emissions are more than 20 dB below the limit.		
	Peak			Peak			Peak	
	AVG			AVG			AVG	
	Peak			Peak			Peak	
	AVG			AVG			AVG	

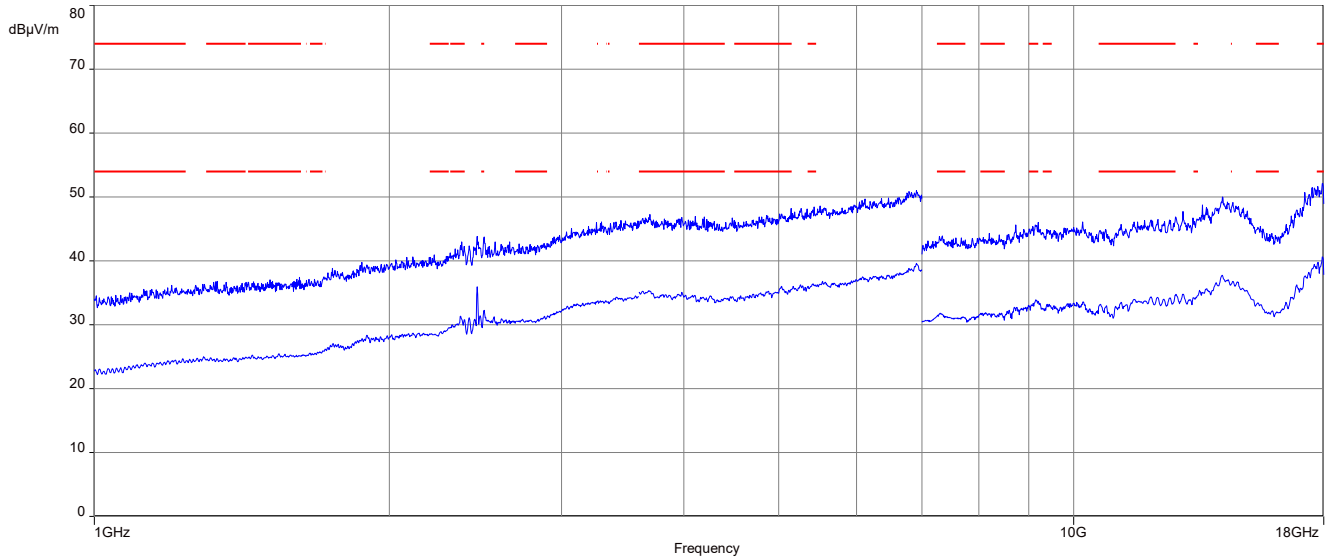
Plots: DSSS**Plot 1:** Lowest channel, 1 GHz to 18 GHz, vertical & horizontal polarization

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.

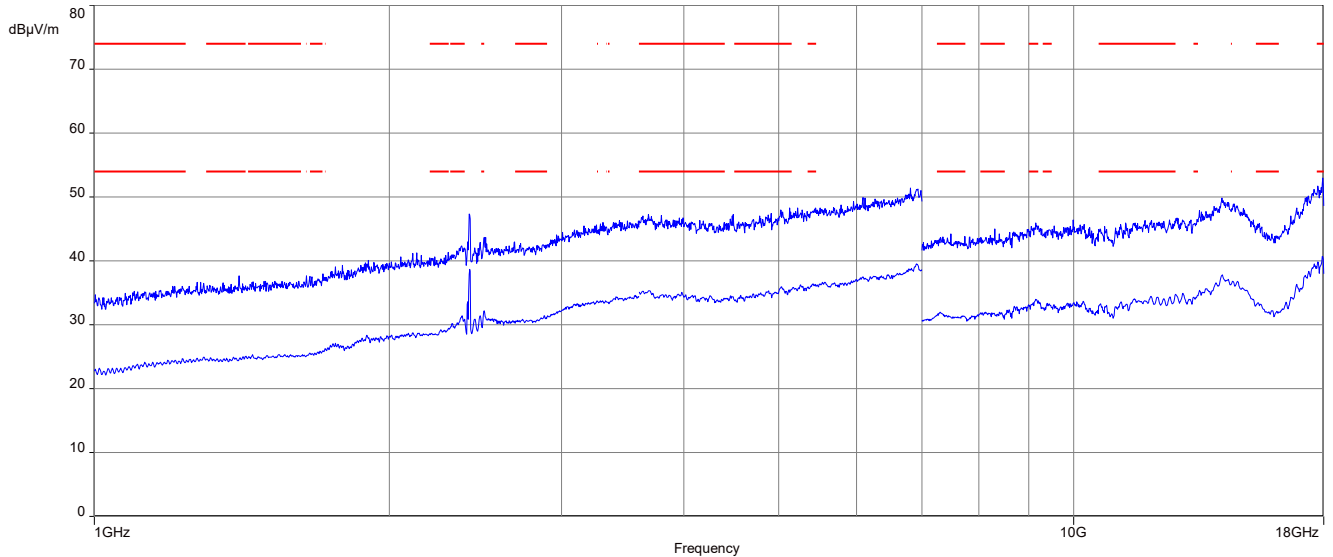
Plot 3: Highest channel, 1 GHz to 18 GHz, vertical & horizontal polarization



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

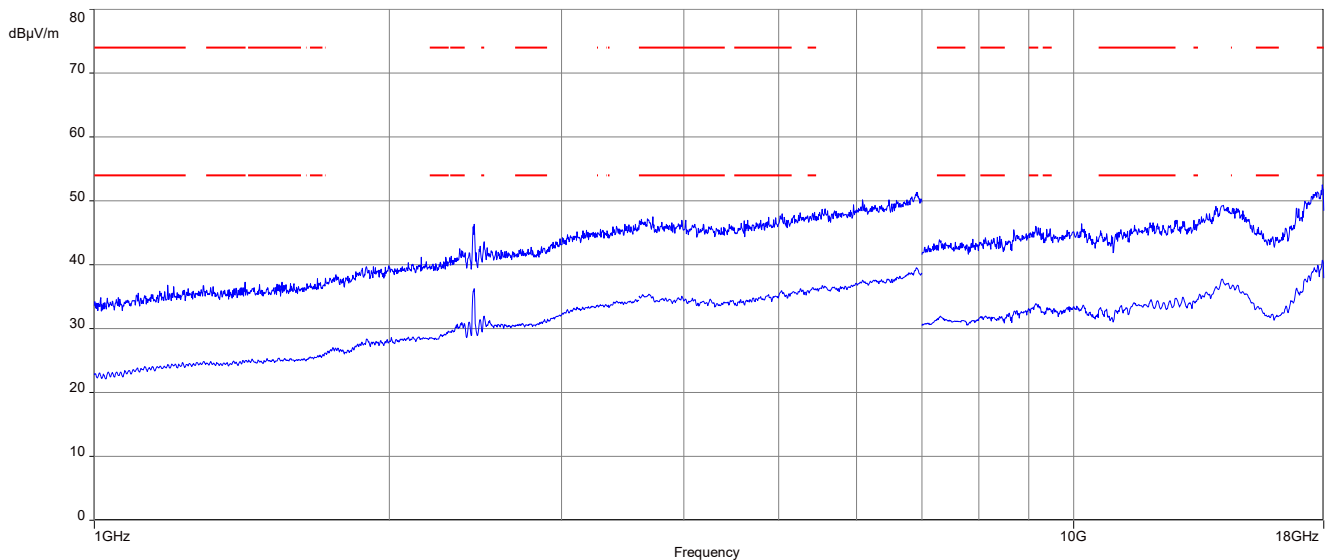
Plots: OFDM (20 MHz bandwidth), g-mode

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



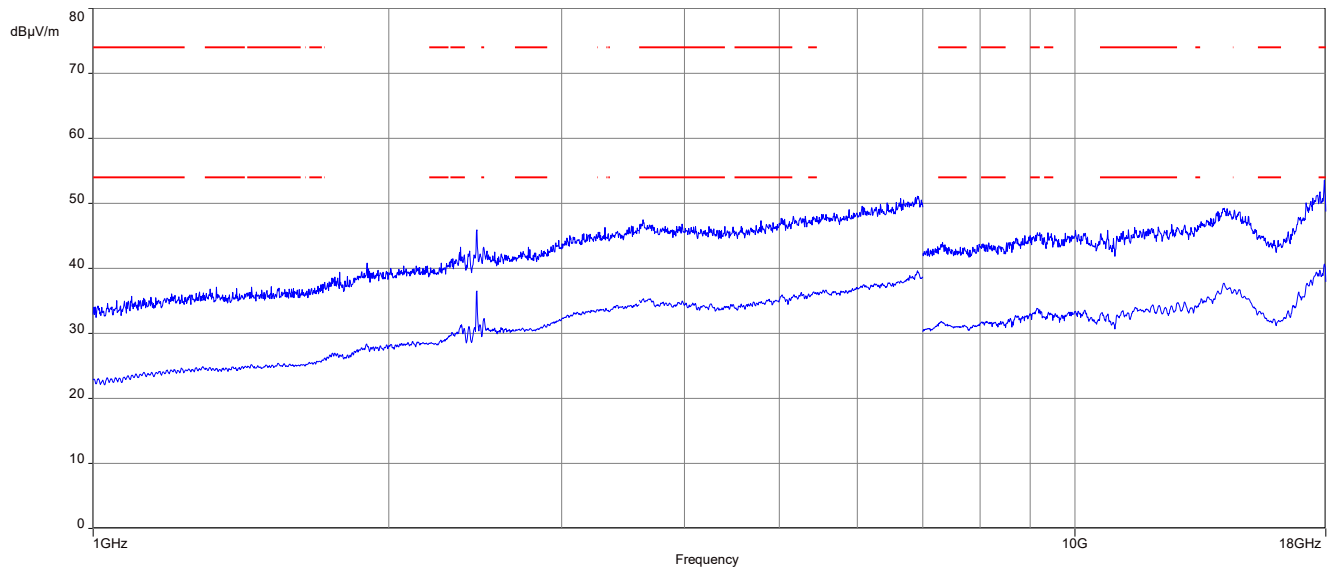
The carrier signal is notched with a 2.4 GHz band rejection filter.

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.

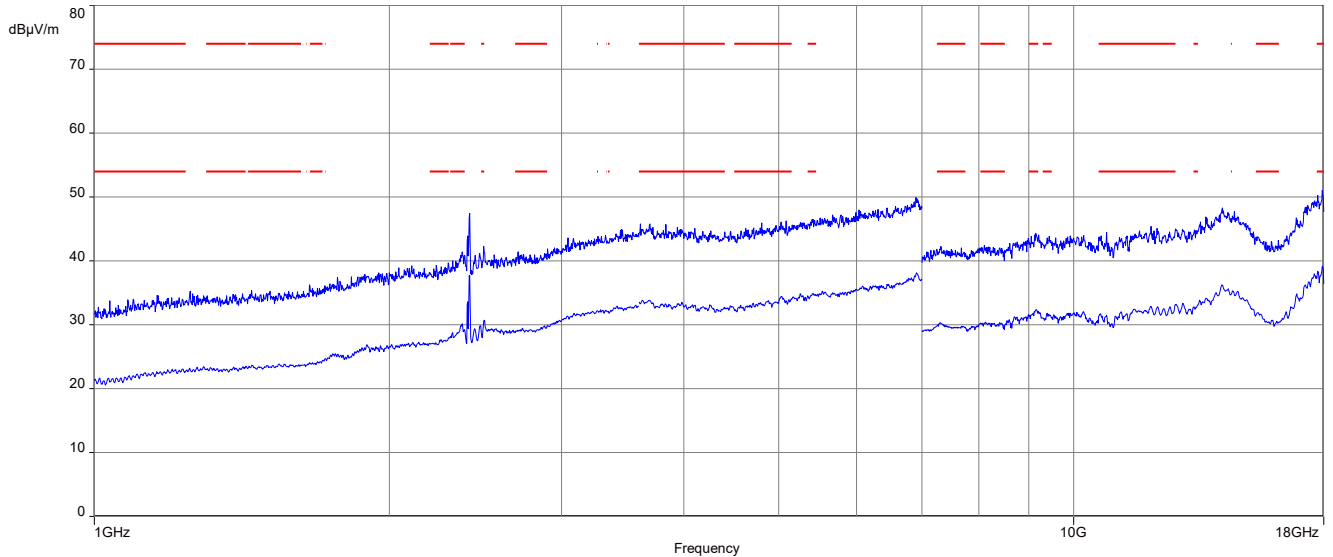
Plot 3: Highest channel, 1 GHz to 18 GHz, vertical & horizontal polarization



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

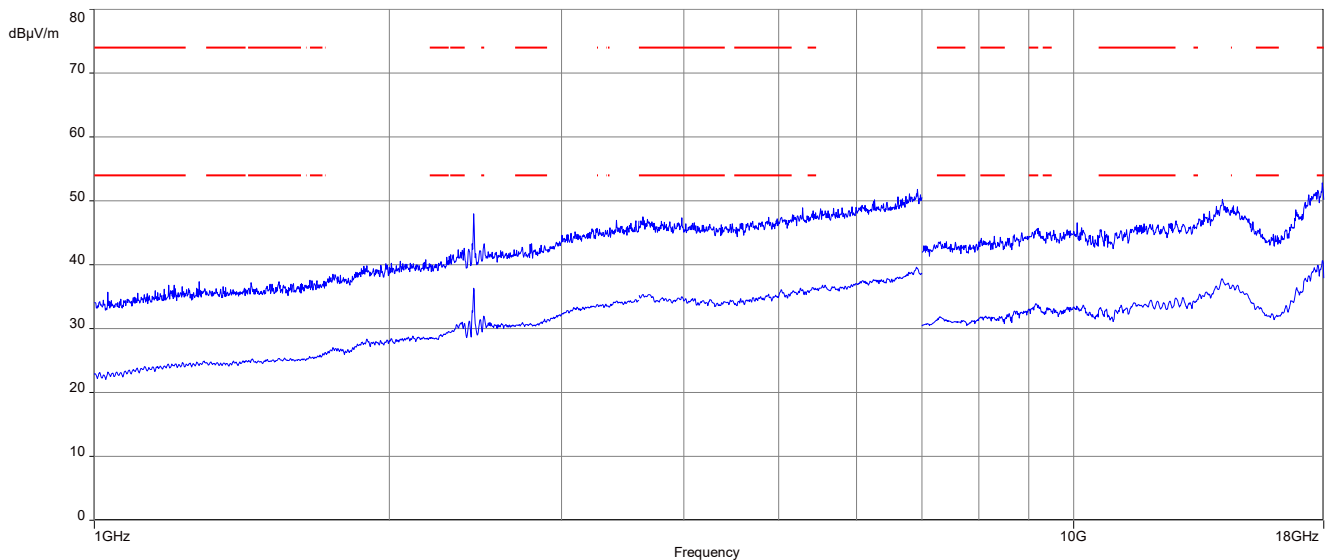
Plots: OFDM (20 MHz bandwidth); axHE20-mode

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



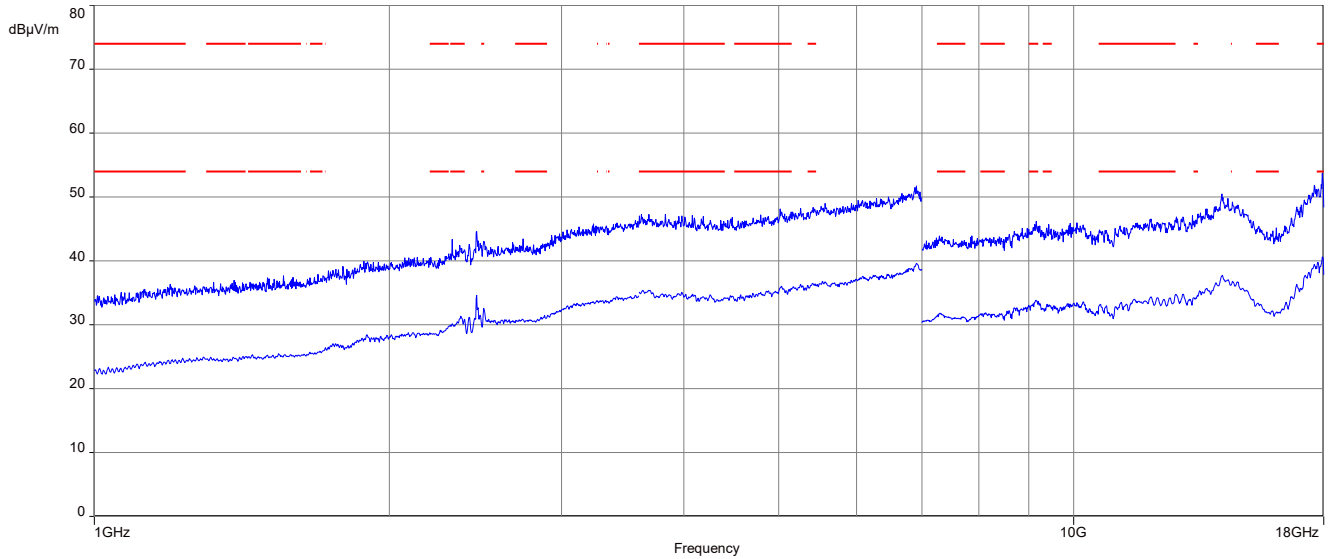
The carrier signal is notched with a 2.4 GHz band rejection filter.

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.

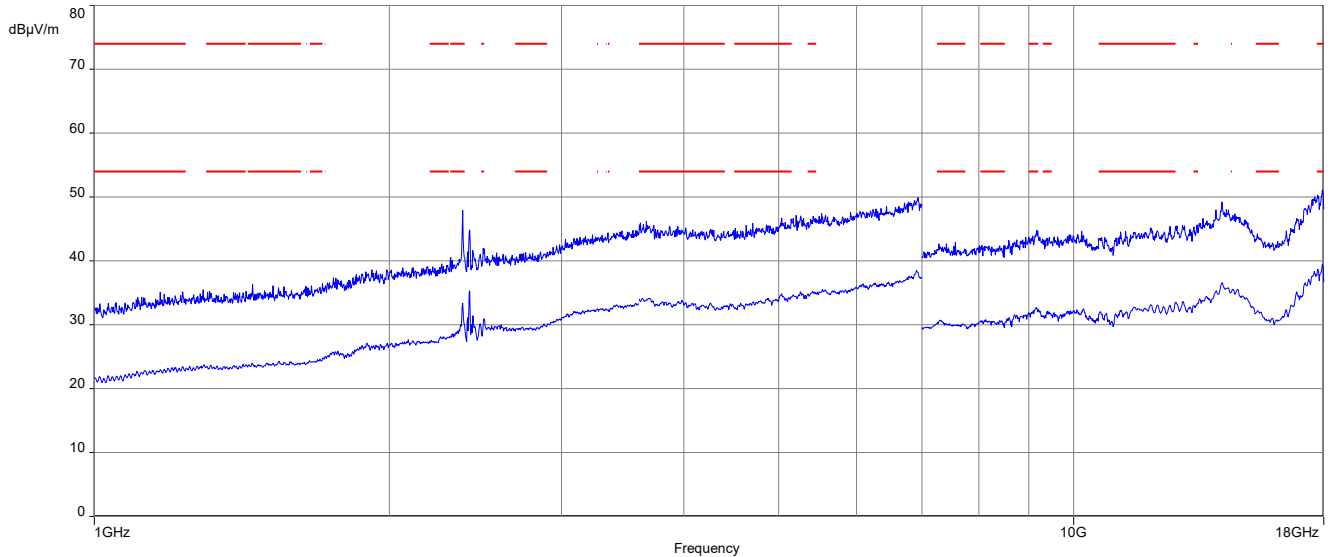
Plot 3: Highest channel, 1 GHz to 18 GHz, vertical & horizontal polarization



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

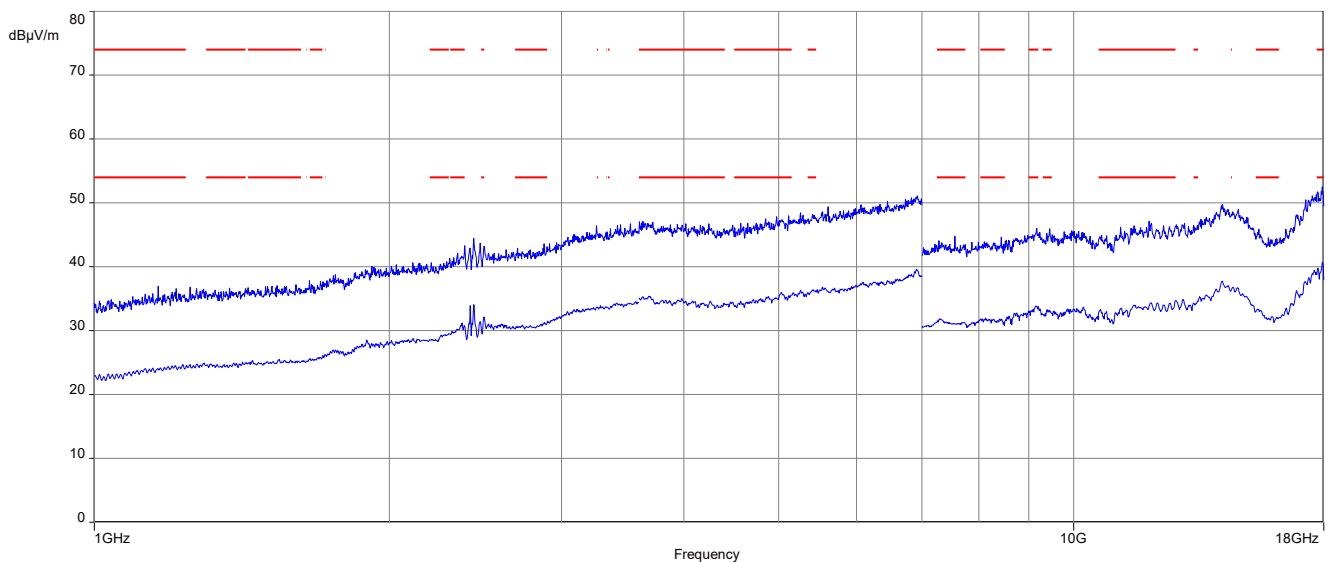
Plots: OFDM (40 MHz bandwidth); nHT40-mode

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



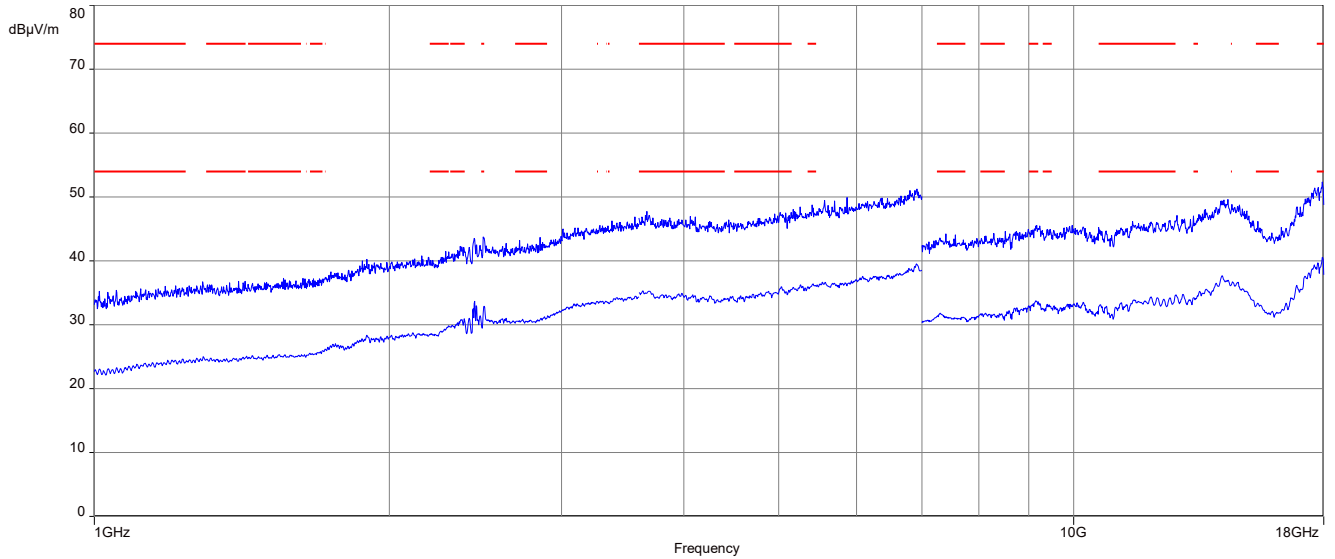
The carrier signal is notched with a 2.4 GHz band rejection filter.

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.

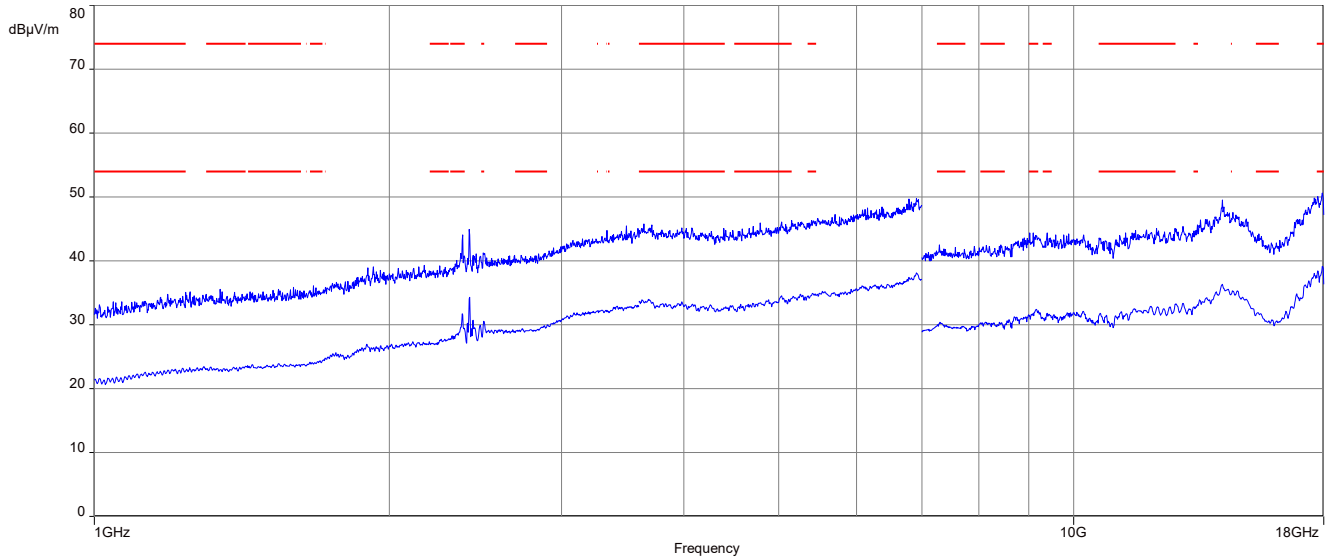
Plot 3: Highest channel, 1 GHz to 18 GHz, vertical & horizontal polarization



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

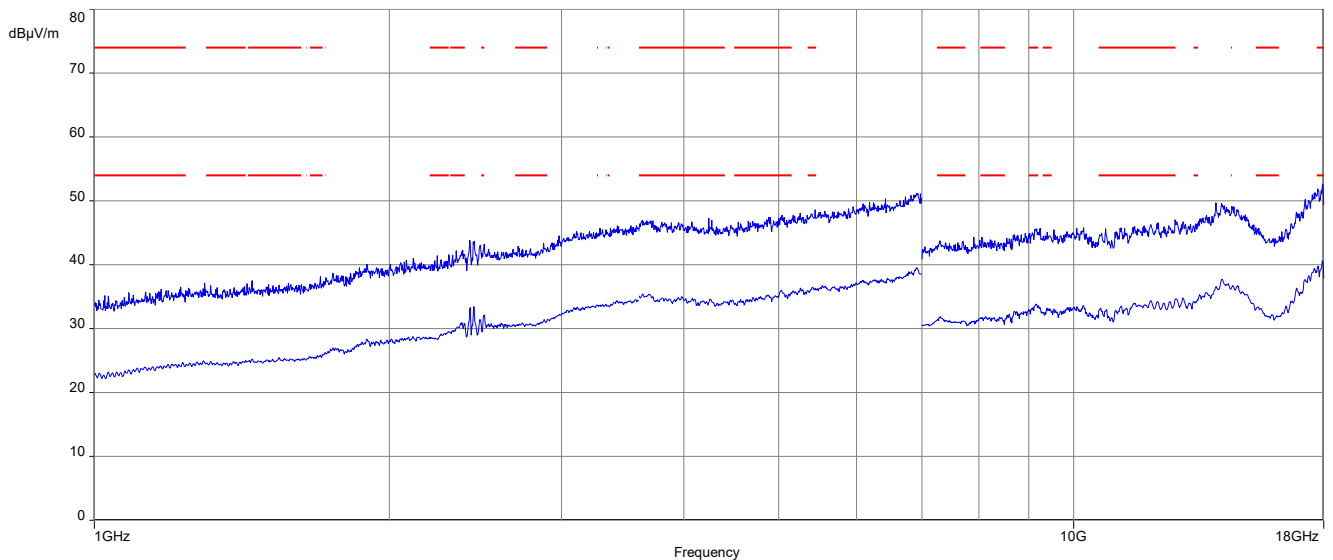
Plots: OFDM (40 MHz bandwidth); axHE40-mode

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

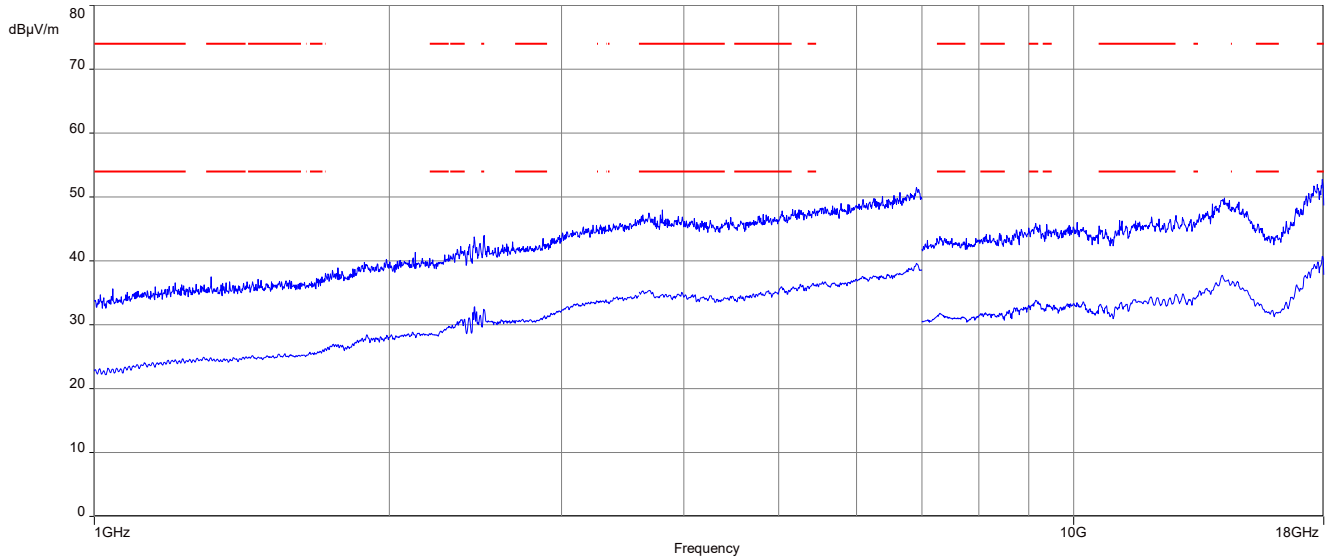


The carrier signal is notched with a 2.4 GHz band rejection filter.

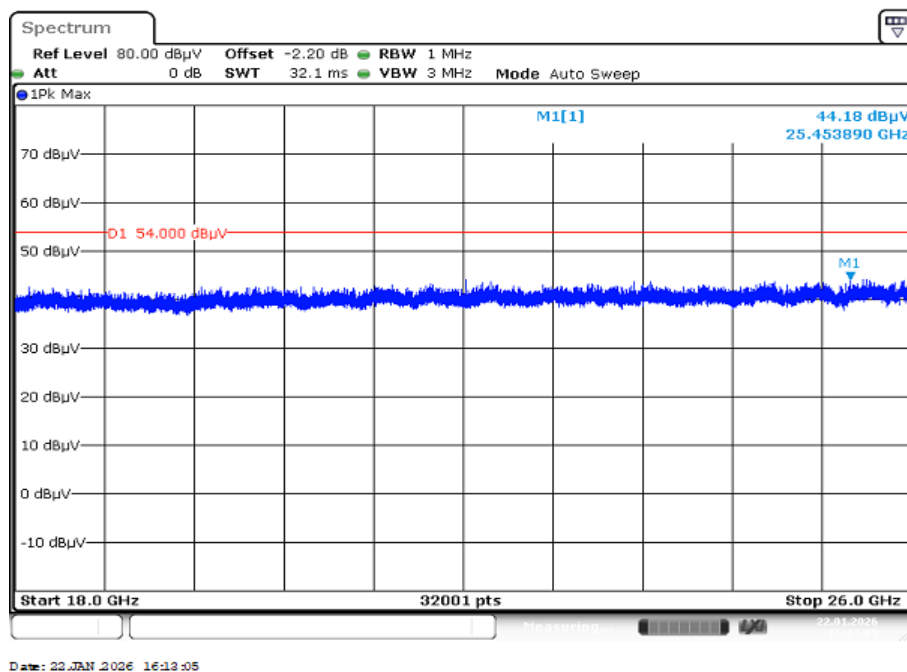
Plot 2: Middle channel, 1 GHz to 18 GHz, vertical & horizontal polarization



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 all channels and modes

Date: 22.JAN.2026 16:13:05

14 Observations

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

15 Glossary

AVG	Average
C	Compliant
C/N₀	Carrier to noise-density ratio, expressed in dB-Hz
CAC	Channel availability check
CW	Clean wave
DC	Duty cycle
DSSS	Dynamic sequence spread spectrum
DUT	Device under test
EMC	Electromagnetic Compatibility
EUT	Equipment under test
FCC	Federal Communications Commission
FCC ID	Combination of Grantee Code and Equipment Product Code
FHSS	Frequency hopping spread spectrum
FVIN	Firmware version identification number
HMN	Host marketing name
HVIN	Hardware version identification number
HW	Hardware
ISED	Innovation, Science and Economic Development Canada
Inv. No.	Inventory number
MC	Modulated carrier
NA	Not applicable
NC	Not compliant
NOP	Non occupancy period
NP	Not performed
OBW	Occupied bandwidth
OC	Operating channel
OCW	Operating channel bandwidth
OFDM	Orthogonal frequency division multiplexing
OOB	Out of band
OP	Occupancy period
PER	Packet error rate
PMN	Product marketing name
PP	Positive peak
QP	Quasi peak
RLAN	Radio local area network
S/N or SN	Serial number
SW	Software
UUT	Unit under test
WLAN	Wireless local area network

16 Document history

Version	Applied changes	Date of release
R01	Initial release	2026-02-23

END OF TEST REPORT