

TEST REPORT

BNNetzA-CAB-02/21-102

Test report no.: 1-3390_21-01-07

Testing laboratory

CTC advanced GmbH

Untertuerkheimer Strasse 6 – 10

66117 Saarbruecken / Germany

Phone: + 49 681 5 98 - 0

Fax: + 49 681 5 98 - 9075

Internet: <https://www.ctcadvanced.com>

e-mail: mail@ctcadvanced.com

Accredited Testing Laboratory:

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

The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate starting with the registration number: D-PL-12076-01.

Applicant

Ingenico

9 Avenue de la Gare Rovaltain

26958 Valence Cedex 9 / FRANCE

Phone: -/-

Contact: Léonce Mutel

e-mail: leonce.mutel@ingenico.com

Manufacturer

Ingenico

9 Avenue de la Gare Rovaltain

26958 Valence Cedex 9 / FRANCE

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 2

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: Payment Terminal

Model name: Desk/3500

FCC ID: XKB-D3500CLWIV2

ISED certification number: 2586D-D3500CLWIV2

Frequency: UNII bands: 5150 MHz to 5250 MHz; 5250 MHz to 5350 MHz; 5470 MHz to 5725 MHz; 5725 MHz to 5850 MHz

Technology tested: WLAN

Antenna: Integrated antenna

Power supply: 110 V AC / 8 V DC by AC/DC mains adapter PSM24W-080L6

Temperature range: 0°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=Marco Bertolino, o=CTC advanced GmbH,
ou=BTL-211209,
email=marco.bertolino@ctcadvanced.com, c=DE
2022.09.28 15:14:24 +02'00'

Marco Bertolino
Lab Manager
Radio Communications

Test performed:

cn=Michael Dorongovski, o=CTC advanced GmbH,
ou=DOR-210422,
email=Michael.Dorongovski@ctcadvanced.com, c=DE
2022.09.28 16:11:45 +02'00'

Michael Dorongovski
Lab Manager
Radio Communications

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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. CTC advanced GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

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2.2 Application details

Date of receipt of order: 2021-10-25

Date of receipt of test item: 2022-08-23

Start of test:* 2022-09-12

End of test:* 2022-09-21

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 2	February 2017	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 789033 D02	v02r01	Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E
ANSI C63.4-2014	-/-	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10-2013	-/-	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

Accreditation	Description
D-PL-12076-01-04	Telecommunication and EMC Canada https://www.dakks.de/as/ast/d/D-PL-12076-01-04e.pdf
D-PL-12076-01-05	Telecommunication FCC requirements https://www.dakks.de/as/ast/d/D-PL-12076-01-05e.pdf



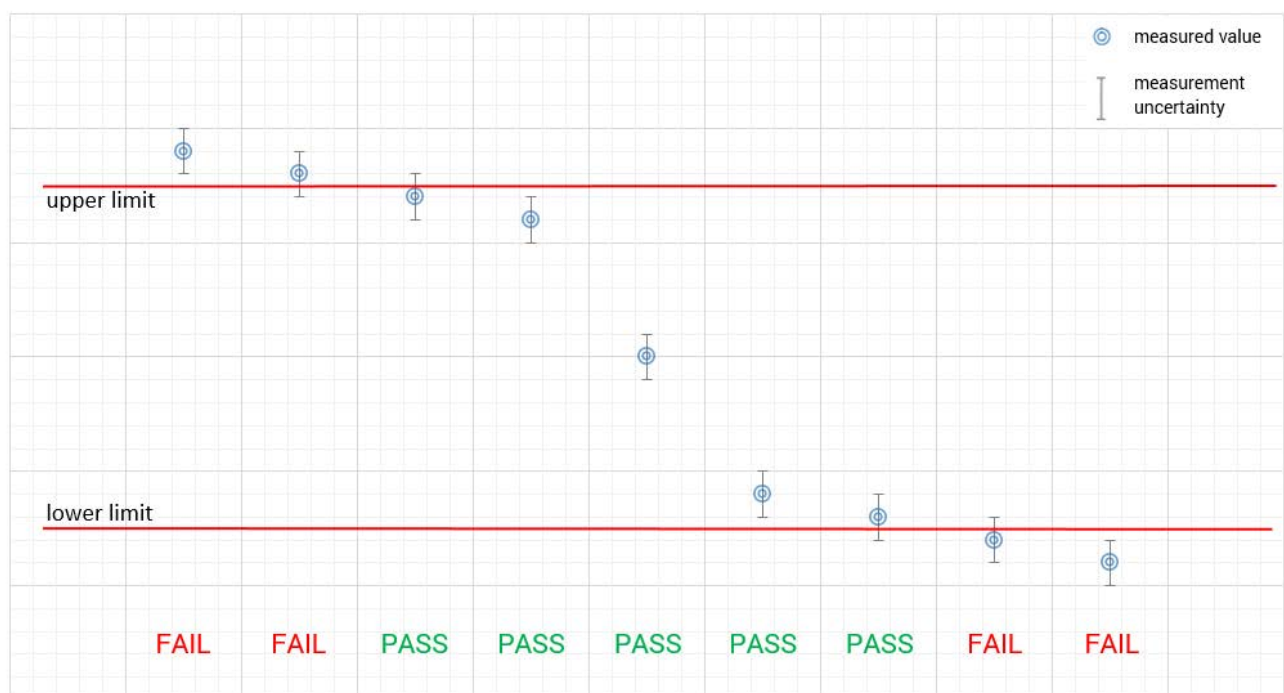
ISED Testing Laboratory Recognized Listing Number: DE0001
 FCC designation number: DE0002

4 Reporting statements of conformity – decision rule

Only the measured values related to their corresponding limits will be used to decide whether the equipment under test meets the requirements of the test standards listed in chapter 3.

The measurement uncertainty is mentioned in this test report, see chapter 9, but is not taken into account - neither to the limits nor to the measurement results. Measurement results with a smaller margin to the corresponding limits than the measurement uncertainty have a potential risk of more than 5% that the decision might be wrong."

measured value, measurement uncertainty, verdict



5 Test environment

Temperature :	T_{nom} T_{max} T_{min}	+22 °C during room temperature tests No tests under extreme voltage conditions required. No tests under extreme voltage conditions required.
Relative humidity content :		55 %
Barometric pressure :		1021 hpa
Power supply :	V_{nom} V_{max} V_{min}	110 V AC / 8 V DC by AC/DC mains adapter PSM24W-080L6 No tests under extreme voltage conditions required. No tests under extreme voltage conditions required.

6 Test item

6.1 General description

Kind of test item :	Payment Terminal
Model name :	Desk/3500
HMN :	-/-
PMN :	Desk/3500
HVIN :	Desk/3500 CL/Eth/Mod/WiFiv2
FVIN :	-/-
S/N serial number :	Rad. 220807303251257424251396 Cond. 213057303301252022380465
Hardware status :	-/-
Software status :	OS 038004 _ APPLI 008400
Firmware status :	OS 038004 _ APPLI 008400
Frequency band :	UNII bands: 5150 MHz to 5250 MHz; 5250 MHz to 5350 MHz; 5470 MHz to 5725 MHz; 5725 MHz to 5850 MHz (lowest channel 5180 MHz; highest channel 5825 MHz)
Type of radio transmission : Use of frequency spectrum :	OFDM
Type of modulation :	BPSK, QPSK, 16 – QAM, 64 – QAM
Number of channels :	20 MHz channels: 24 40 MHz channels: 11
Antenna :	Integrated antenna
Power supply :	110 V AC / 8 V DC by AC/DC mains adapter PSM24W-080L6
Temperature range :	0°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: 1-3390/21-01-01_AnnexA
 1-3390/21-01-01_AnnexB
 1-3390/21-01-01_AnnexD

7 Description of the test setup

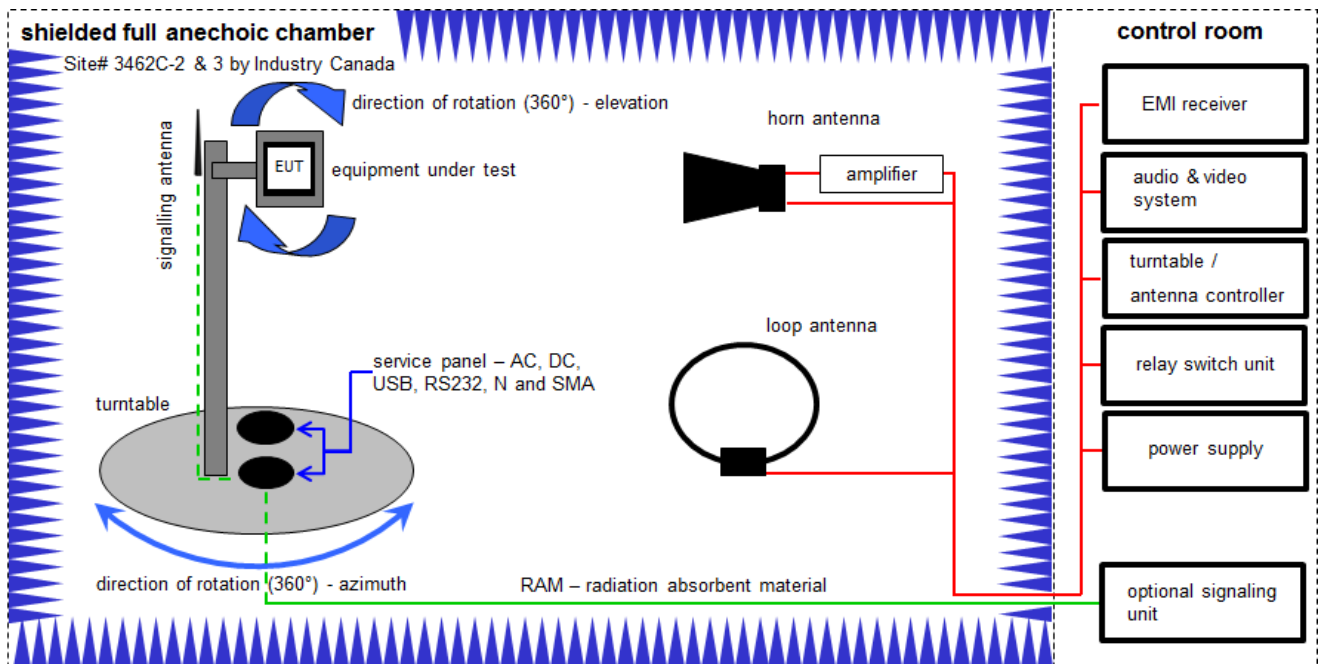
Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements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

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

Agenda: Kind of Calibration

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

7.1 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:

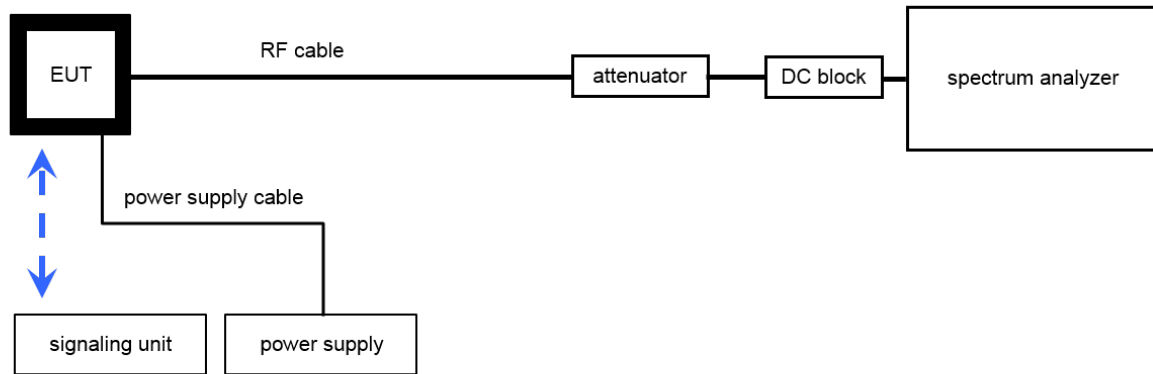
$$FS \text{ [dB}\mu\text{V/m]} = 40.0 \text{ [dB}\mu\text{V/m]} + (-35.8) \text{ [dB]} + 32.9 \text{ [dB/m]} = 37.1 \text{ [dB}\mu\text{V/m]} (71.61 \mu\text{V/m})$$

Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	B	Active Loop Antenna 9 kHz to 30 MHz	6502	EMCO	2210	300001015	vKI!	01.07.2021	31.07.2023
2	A	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	9107-3696	300001604	vKI!	12.03.2021	11.03.2023
3	A	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	18	300003789	ne	-/-	-/-
4	A	Broadband Amplifier 0.5-18 GHz	CBLU5184540	CERNEX	22051	300004483	ev	-/-	-/-
5	A, B	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000032	300004510	ne	-/-	-/-
6	A, B	Computer	Intel Core i3 3220/3,3 GHz, Prozessor	-/-	2V2403033A54 21	300004591	ne	-/-	-/-
7	A, B	NEXIO EMV-Software	BAT EMC V3.21.0.27	EMCO	-/-	300004682	ne	-/-	-/-
8	A, B	Anechoic chamber	-/-	TDK	-/-	300003726	ne	-/-	-/-
9	A, B	EMI Test Receiver 9kHz-26,5GHz	ESR26	Rohde & Schwarz	101376	300005063	k	15.12.2021	31.12.2022
13	A	RF-Amplifier	AMF-6F06001800-30-10P-R	NARDA-MITEQ Inc	2011571	300005240	ev	-/-	-/-

7.2 Conducted measurements

Conducted measurements normal conditions



$$OP = AV + CA$$

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

Example calculation:

$$OP \text{ [dBm]} = 6.0 \text{ [dBm]} + 11.7 \text{ [dB]} = 17.7 \text{ [dBm]} \text{ (58.88 mW)}$$

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	PC Laboratory	Exone	Fröhlich + Walter	S2642279-03 / 10	300004179	ne	-/-	-/-
3	A	Signal analyzer	FSV30	Rohde&Schwarz	1321.3008K30/103809	300005359	vKI!	08.12.2020	07.12.2022
4	A	Tester Software RadioStar (C.BER2 for BT Conformance)	Version 1.0.0.X	CTC advanced GmbH	0001	400001380	ne	-/-	-/-

8 Sequence of testing

8.1 Sequence of testing radiated spurious 9 kHz to 30 MHz

Setup

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

Premeasurement*

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

Final measurement

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

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

8.2 Sequence of testing radiated spurious 1 GHz to 18 GHz

Setup

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

Premeasurement

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

Final measurement

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

9 Measurement uncertainty

Measurement uncertainty		
Test case	Uncertainty	
Antenna gain	± 3 dB	
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 Title 47 Part 15 RSS 247, Issue 2	See table	2022-09-28	Tests according to customer demand

Test specification clause	Test case	C	NC	NA	NP	Remark
-/-	Output power verification (cond.)	-/-				Declared
-/-	Antenna gain	-/-				Declared
U-NII Part 15	Duty cycle	-/-				-/-
§15.407(a) RSS - 247 (6.2.x.1)	Maximum output power (conducted & radiated)	☐	☐	☐	☒	-/-
§15.407(a) RSS - 247 (6.2.x.1)	Power spectral density	☐	☐	☐	☒	-/-
RSS - 247 (6.2.4.1)	Spectrum bandwidth 6dB bandwidth	☐	☐	☐	☒	-/-
§15.407(a) RSS - 247 (6.2.x.2)	Spectrum bandwidth 26dB bandwidth	☐	☐	☐	☒	-/-
RSS Gen clause 6.6	Spectrum bandwidth 99% bandwidth	-/-				-/-
§15.205 RSS - 247 (6.2.x.2)	Band edge compliance radiated	☒	☐	☐	☐	Only a-mode tested
§15.407(b) RSS - 247 (6.2.x.2)	TX spurious emissions radiated	☒	☐	☐	☐	Only 1 GHz to 18 GHz tested
§15.209(a) RSS-Gen	Spurious emissions radiated < 30 MHz	☒	☐	☐	☐	-/-
§15.107(a) §15.207	Spurious emissions conducted emissions < 30 MHz	☐	☐	☐	☒	-/-
§15.407 RSS - 247 (6.3)	DFS	-/-				-/-

Notes:

C:	Compliant	NC:	Not compliant	NA:	Not applicable	NP:	Not performed
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11 Additional comments

Reference documents: None

Special test descriptions: Used power settings for all tests:

Channel	36	40	44	48	52	56	60	64	100	120	140	149	157	165
11a	13	13	13	13	13	13	13	13	13	13	13	13	13	13
11n-20	12	12	12	12	12	12	12	12	12	12	12	12	12	12
11n-40	9	9	9	9	9	9	9	9	6	9	9	9	9	9

Configuration descriptions: None

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:

U-NII-1 & U-NII-2A (5150 MHz to 5250 MHz & 5250 MHz to 5350 MHz) channel number & center frequency								
channel	36	40	44	48	52	56	60	64
f _c / MHz	5180	5200	5220	5240	5260	5280	5300	5320

U-NII-2C (5470 MHz to 5725 MHz) channel number & center frequency											
channel	100	104	108	112	116	120	124	128	132	136	140
f _c / MHz	5500	5520	5540	5560	5580	5600	5620	5640	5660	5680	5700

U-NII-3 (5725 MHz to 5850 MHz) channel number & center frequency					
channel	149	153	157	161	165
f _c / MHz	5745	5765	5785	5805	5825

Channels with 40 MHz channel bandwidth:

U-NII-1 & U-NII-2A (5150 MHz to 5250 MHz & 5250 MHz to 5350 MHz) channel number & center frequency				
channel	38	46	54	62
f _c / MHz	5190	5230	5270	5310

U-NII-2C (5470 MHz to 5725 MHz) channel number & center frequency				
channel	102	110	118	126
f _c / MHz	5510	5550	5590	5630

U-NII-3 (5725 MHz to 5850 MHz) channel number & center frequency		
channel	151	159
f _c / MHz	5755	5795

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

Test mode:

- ☐ No test mode available.
 Iperf is used to transmit data to a companion device
- ☒ Special software is used.
 EUT is transmitting pseudo random data by itself

Antennas and transmit operating modes:

- ☒ Operating mode 1 (single antenna)
- Equipment with 1 antenna,
 - Equipment with 2 diversity antennas operating in switched diversity mode by which at any moment in time only 1 antenna is used,
 - Smart antenna system with 2 or more transmit/receive chains, but operating in a mode where only 1 transmit/receive chain is used)
- ☐ Operating mode 2 (multiple antennas, no beamforming)
- Equipment operating in this mode contains a smart antenna system using two or more transmit/receive chains simultaneously but without beamforming.
- ☐ Operating mode 3 (multiple antennas, with beamforming)
- Equipment operating in this mode contains a smart antenna system using two or more transmit/receive chains simultaneously with beamforming.
- In addition to the antenna assembly gain (G), the beamforming gain (Y) may have to be taken into account when performing the measurements.

12 Measurement results

12.1 Antenna gain

Limits:

Antenna Gain
6 dBi / > 6 dBi output power and power density reduction required

Results: Extracted from test report no. 1-4862_17-01-03

U-NII-1 (5150 MHz to 5250 MHz)	Antenna gain		
	Lowest channel	Middle channel	Highest channel
Conducted power / dBm @ 3 MHz RBW	14.4	14.3	13.8
Radiated power / dBm @ 3 MHz RBW	18.3	18.1	17.4
Gain / dBi calculated	4.0	3.8	3.6

U-NII-2A (5250 MHz to 5350 MHz)	Antenna gain		
	Lowest channel	Middle channel	Highest channel
Conducted power / dBm @ 3 MHz RBW	13.9	14.3	14.9
Radiated power / dBm @ 3 MHz RBW	18.1	18.7	19.6
Gain / dBi calculated	4.2	4.4	4.7

U-NII-2C (5470 MHz to 5725 MHz)	Antenna gain		
	Lowest channel	Middle channel	Highest channel
Conducted power / dBm @ 3 MHz RBW	17.3	15.0	14.7
Radiated power / dBm @ 3 MHz RBW	22.6	19.5	18.2
Gain / dBi calculated	5.3	4.5	3.5

U-NII-3 (5725 MHz to 5850 MHz)	Antenna gain		
	Lowest channel	Middle channel	Highest channel
Conducted power / dBm @ 3 MHz RBW	15.4	15.0	16.0
Radiated power / dBm @ 3 MHz RBW	19.3	18.4	19.1
Gain / dBi calculated	3.9	3.4	3.1

12.2 Testability check

12.2.1 Maximum output power according to FCC requirements

Description:

Measurement of the maximum output power conducted

Measurement:

Measurement parameter	
According to: KDB789033 D02, E.2.e.	
Used test setup:	See chapter 7.2 – A
Measurement uncertainty:	See chapter 9
Standard parts:	FCC: § 15.407 (a)

Limits:

Limits	
Radiated output power	Conducted output power
Band 5150 MHz – 5250 MHz	
For an outdoor access point: Conducted power + 6 dBi antenna gain For an indoor access point: Conducted power + 6 dBi antenna gain For fixed point-to-point access points Conducted power + 23 dBi antenna gain For client devices Conducted power + 6 dBi antenna gain (If the Antenna gain is greater than the Limit: 1dB reduction in the max. conducted output power for each 1 dB of antenna gain in excess of the Limit)	For an outdoor access point: output power $\leq 1\text{W}/30\text{dBm}$ The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm) For an indoor access point output power $\leq 1\text{W}/30\text{dBm}$ For fixed point-to-point access points output power $\leq 1\text{W}/30\text{dBm}$ For client devices output power $\leq 250\text{ mW}/24\text{dBm}$
Band 5250MHz – 5350 MHz	

Conducted power + 6 dBi antenna gain (Antenna gain higher than the Limit: 1dB reduction in the max. conducted output power for each 1 dB of antenna gain in excess of the Limit)	Output power $\leq$ lesser of 250mW or 11dBm +10logB (B is the 26 dB emission bandwidth in megahertz)
Band 5470MHz – 5725 MHz	
Conducted power + 6 dBi antenna gain (Antenna gain higher than the Limit: 1dB reduction in the max. conducted output power for each 1 dB of antenna gain in excess of the Limit)	Output power $\leq$ lesser of 250mW or 11dBm +10logB (B is the 26 dB emission bandwidth in megahertz)
Band 5725MHz – 5850 MHz	
Conducted power + 6 dBi antenna gain (Antenna gain higher than the Limit: 1dB reduction in the max. conducted output power for each 1 dB of antenna gain in excess of the Limit Exception: fixed point-to-point U-NII devices, no corresponding reduction in transmitter conducted power)	output power $\leq$ 1W/30dBm

Results:

a-mode Original test results from test report no. 1-4862_17-01-03	Maximum output power conducted [dBm]		
	U-NII-1 (5150 MHz to 5250 MHz)		
	Lowest channel	Middle channel	Highest channel
	11.8	11.8	11.6
	U-NII-2A (5250 MHz to 5350 MHz)		
	Lowest channel	Middle channel	Highest channel
	11.7	12.6	12.7
	U-NII-2C (5470 MHz to 5725 MHz)		
	Lowest channel	Middle channel	Highest channel
	15.0	13.6	12.2
	U-NII-3 (5725 MHz to 5850 MHz)		
	Lowest channel	Middle channel	Highest channel
	13.1	12.9	13.6

a-mode New test results	Maximum output power conducted [dBm]		
	U-NII-1 (5150 MHz to 5250 MHz)		
	Lowest channel	Middle channel	Highest channel
	11.0	12.0	12.0
	U-NII-2A (5250 MHz to 5350 MHz)		
	Lowest channel	Middle channel	Highest channel
	12.5	11.3	12.4
	U-NII-2C (5470 MHz to 5725 MHz)		
	Lowest channel	Middle channel	Highest channel
	15.7	14.8	13.8
	U-NII-3 (5725 MHz to 5850 MHz)		
	Lowest channel	Middle channel	Highest channel
	14.3	14.5	14.8

12.2.2 Maximum output power according to ISED requirements

Description:

Measurement of the maximum output power conducted + radiated

Measurement:

Measurement parameter	
Used test setup:	See chapter 7.2 – A
Measurement uncertainty:	See chapter 9

Limits:

Radiated output power	Conducted output power for mobile equipment
The lesser one of 200 mW or 10 dBm + 10 log Bandwidth 5.150-5.250 GHz 1 W or 17 dBm + 10 log Bandwidth 5.250-5.350 GHz 1 W or 17 dBm + 10 log Bandwidth 5.470-5.725 GHz (where Bandwidth is the 99% Bandwidth [MHz]) Conducted power + 6dBi antenna gain 5.725-5.825 GHz Devices other than client devices 5925-7125 MHz: ≤ 30dBm Client devices 5925-7125 MHz: ≤ 24dBm	The lesser one of 250mW or 11 dBm + 10 log Bandwidth 5.250-5.350 GHz 250mW or 11 dBm + 10 log Bandwidth 5.470-5.725 GHz (where Bandwidth is the 99% Bandwidth [MHz]) 1W 5.725-5.825 GHz

Results:

a-mode Original test results from test report no. 1-4862_17-01-03	Maximum output power [dBm]		
	U-NII-1 (5150 MHz to 5250 MHz)		
	Lowest channel	Middle channel	Highest channel
	Conducted		
	12.0	11.6	11.4
	U-NII-2A (5250 MHz to 5350 MHz)		
	Lowest channel	Middle channel	Highest channel
	Conducted		
	11.5	12.4	12.5
	U-NII-2C (5470 MHz to 5725 MHz)		
	Lowest channel	Middle channel	Highest channel
	Conducted		
	14.8	12.4	12.1
	U-NII-3 (5725 MHz to 5850 MHz)		
	Lowest channel	Middle channel	Highest channel
	Conducted		
	12.9	12.7	13.8

a-mode New test results	Maximum output power [dBm]		
	U-NII-1 (5150 MHz to 5250 MHz)		
	Lowest channel	Middle channel	Highest channel
	Conducted		
	11.3	12.0	11.9
	U-NII-2A (5250 MHz to 5350 MHz)		
	Lowest channel	Middle channel	Highest channel
	Conducted		
	12.3	11.2	12.3
	U-NII-2C (5470 MHz to 5725 MHz)		
	Lowest channel	Middle channel	Highest channel
	Conducted		
	15.7	14.3	13.7
	U-NII-3 (5725 MHz to 5850 MHz)		
	Lowest channel	Middle channel	Highest channel
	Conducted		
	14.3	14.6	15.0

12.3 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 3m.

Measurement:

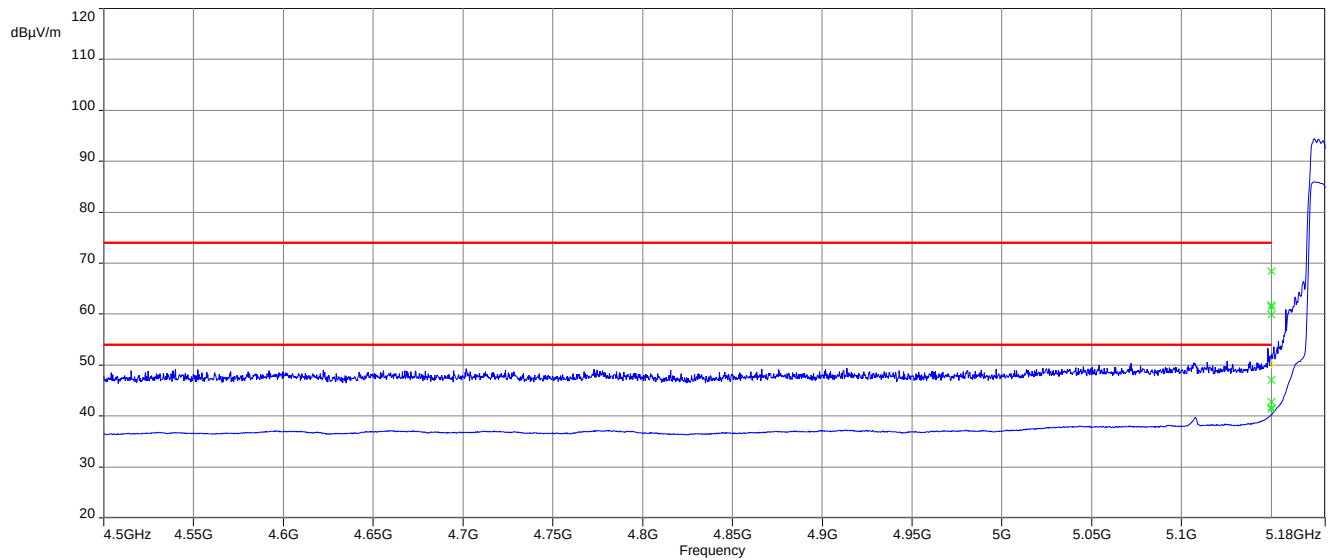
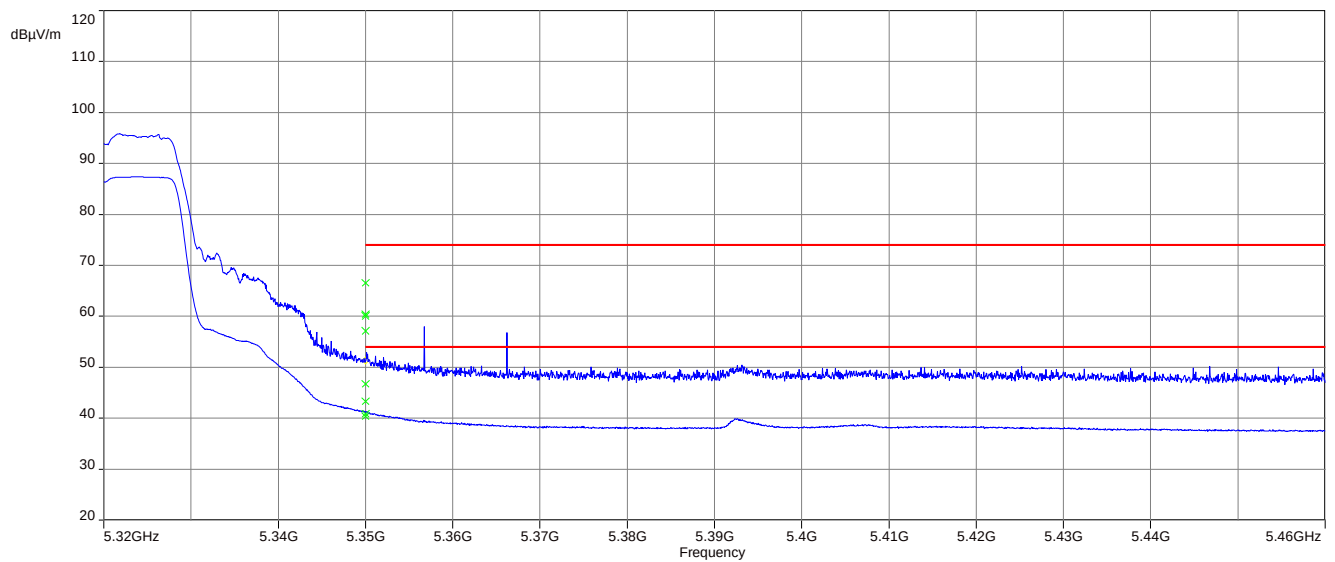
Measurement parameter	
Detector:	Peak / RMS
Sweep time:	Auto
Resolution bandwidth:	1 MHz
Video bandwidth:	$\geq 3 \times \text{RBW}$
Span:	See plots!
Trace mode:	Max Hold
Test setup:	See sub clause 7.1 – A
Measurement uncertainty:	See chapter 9

Limits:

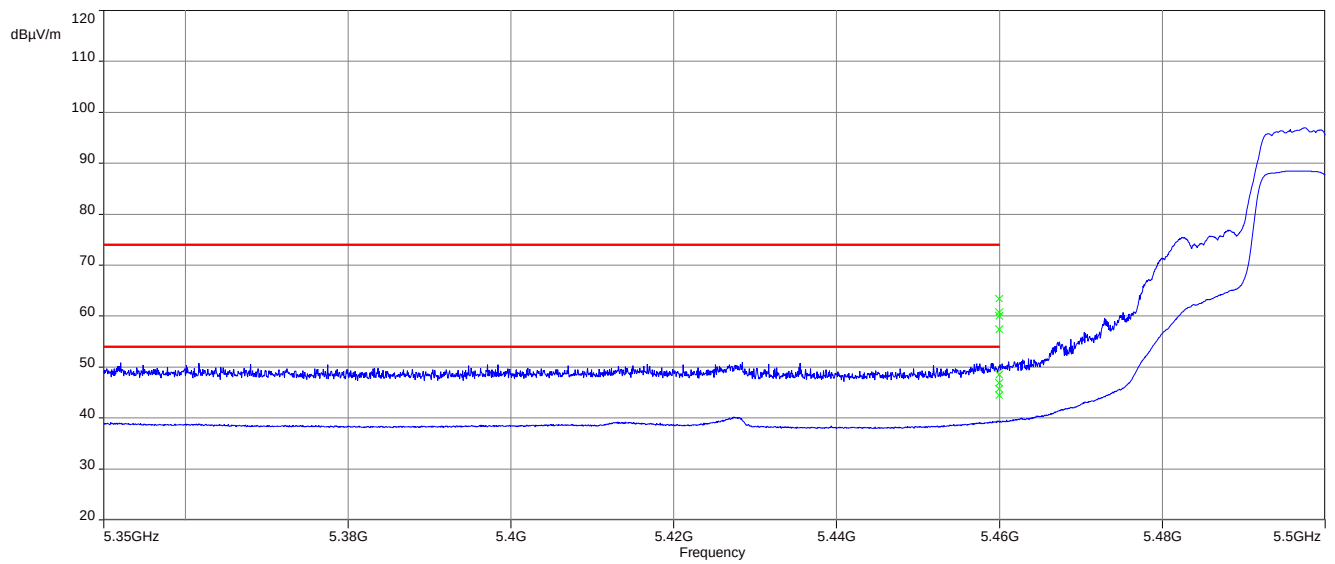
Band Edge Compliance Radiated
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within 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 Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 5.205(c)).
74 dB μ V/m (peak) 54 dB μ V/m (average)

Result:

Band Edge Compliance radiated	Emission frequency [MHz]	Detector	Level [dBuV/m]
Lower band edge; U-NII-1; lowest channel, 802.11a	5150	Peak	68.4
		AVG	47.0
Upper band edge; U-NII-2A; highest channel, 802.11a	5350	Peak	66.6
		AVG	46.8
Lower band edge; U-NII-2C; lowest channel, 802.11a	5460	Peak	63.5
		AVG	48.5

Plots:**Plot 1:** lower band edge; U-NII-1; lowest channel; 20 MHz channel bandwidth**Plot 2:** upper band edge; U-NII-2A; highest channel; 20 MHz channel bandwidth

Plot 3: lower band edge; U-NII-2C; lowest channel; 20 MHz channel bandwidth



12.4 Spurious emissions radiated below 30 MHz

Description:

Measurement of the radiated spurious emissions in transmit mode below 30 MHz. The limits are re-calculated 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
Video bandwidth:	F < 150 kHz: 200 Hz F > 150 kHz: 9 kHz
Resolution bandwidth:	F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz
Span:	9 kHz to 30 MHz
Trace mode:	Max Hold
Test setup:	See sub clause 7.1 – B
Measurement uncertainty:	See chapter 9

Limits:

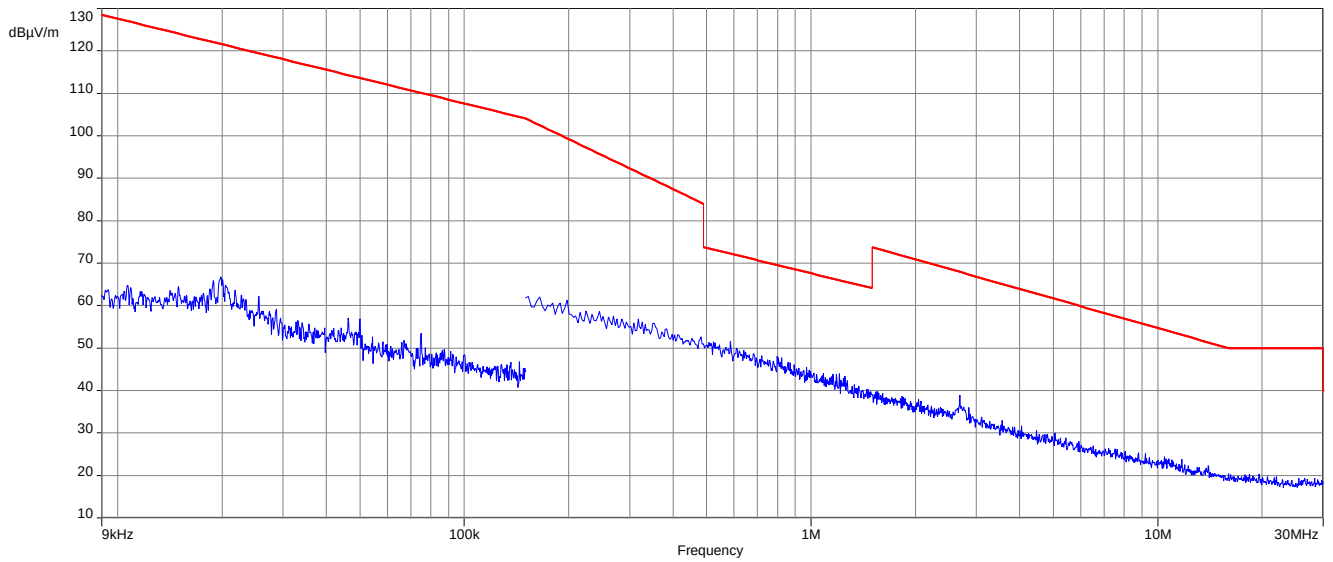
Spurious Emissions Radiated < 30 MHz		
Frequency (MHz)	Field Strength (dBµV/m)	Measurement distance
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30

Results:

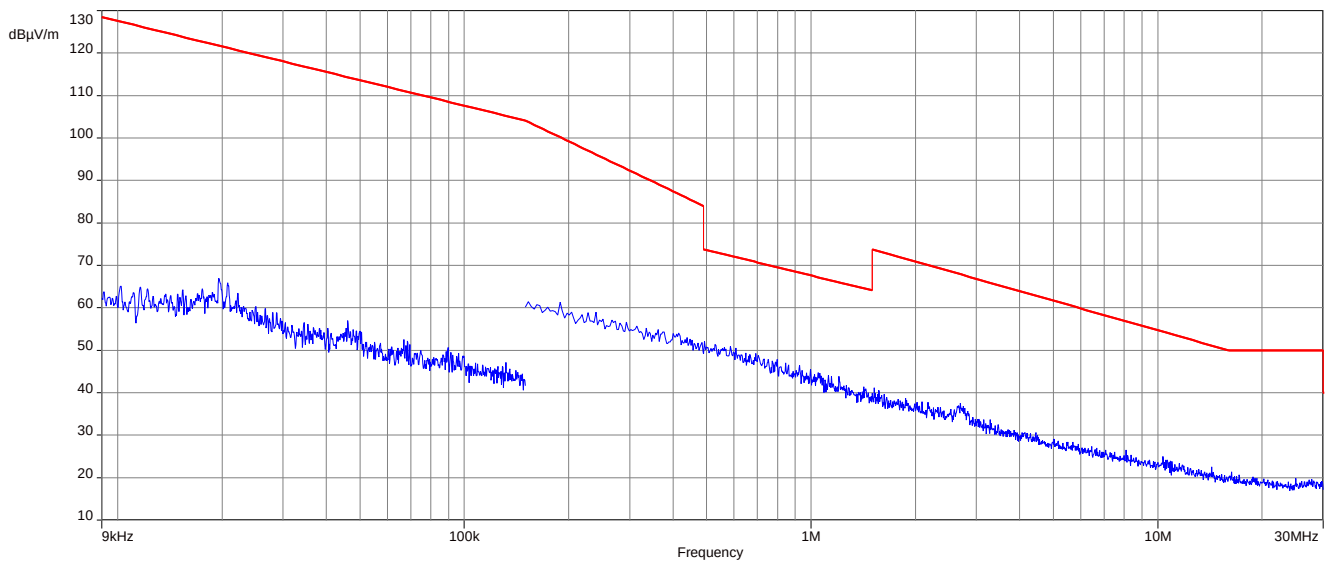
Spurious Emissions Radiated < 30 MHz [dBµV/m]		
F [MHz]	Detector	Level [dBµV/m]
All detected emissions are more than 20 dB below the limit.		

Plots: 20 MHz channel bandwidth

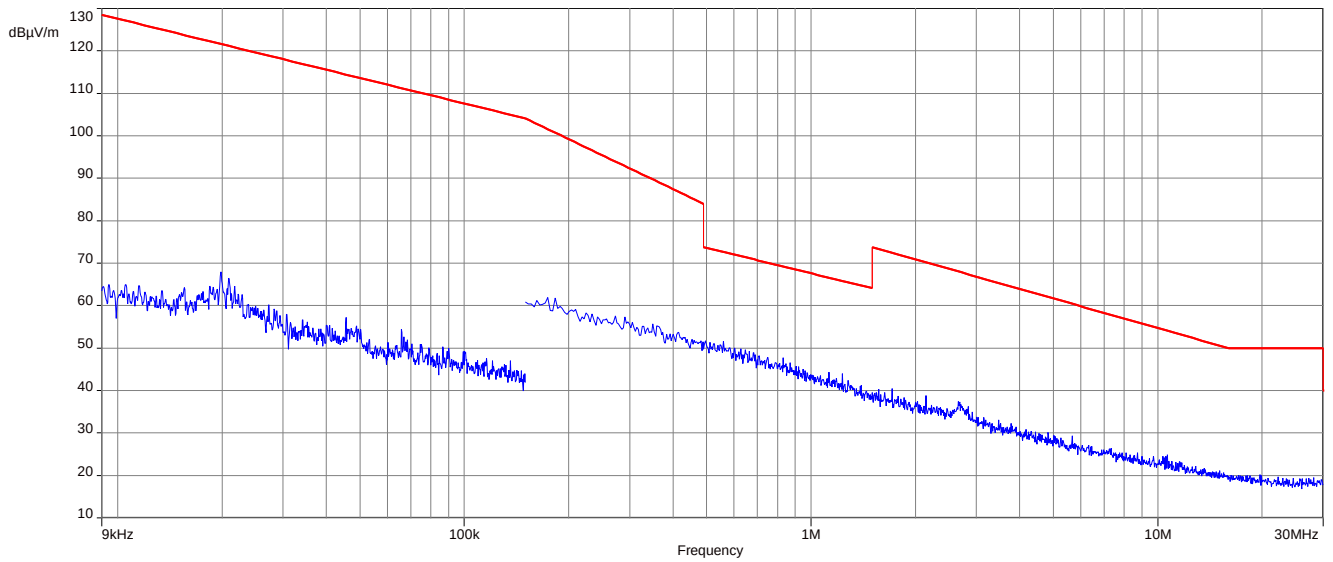
Plot 1: 9 kHz to 30 MHz, U-NII-1; lowest channel



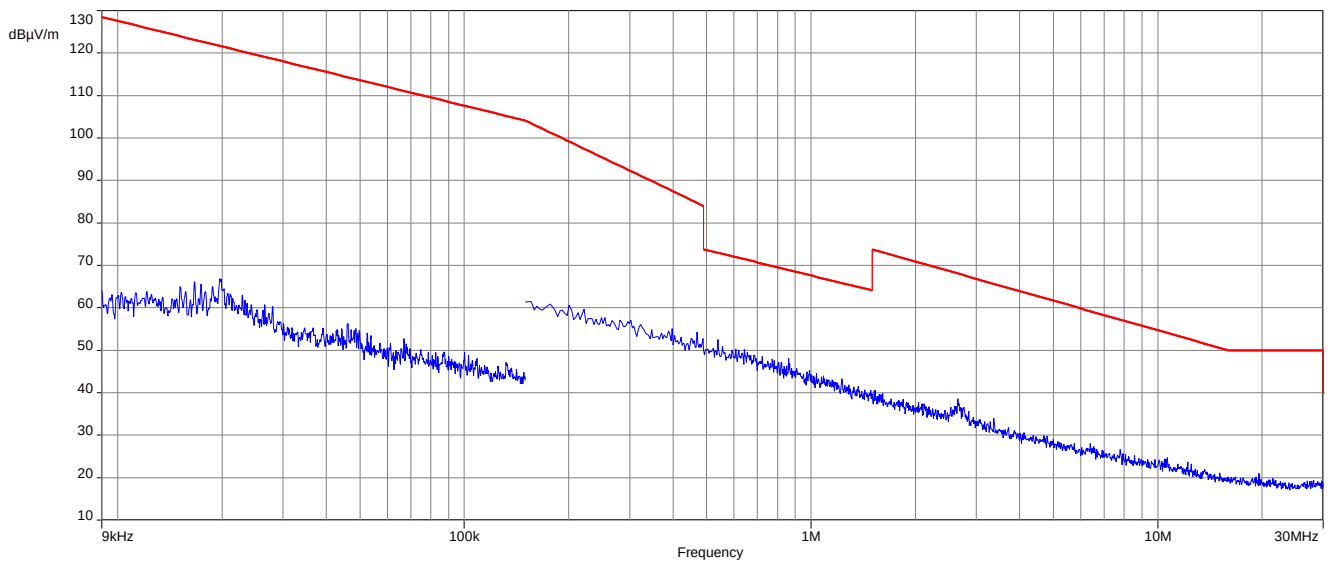
Plot 2: 9 kHz to 30 MHz, U-NII-1; middle channel



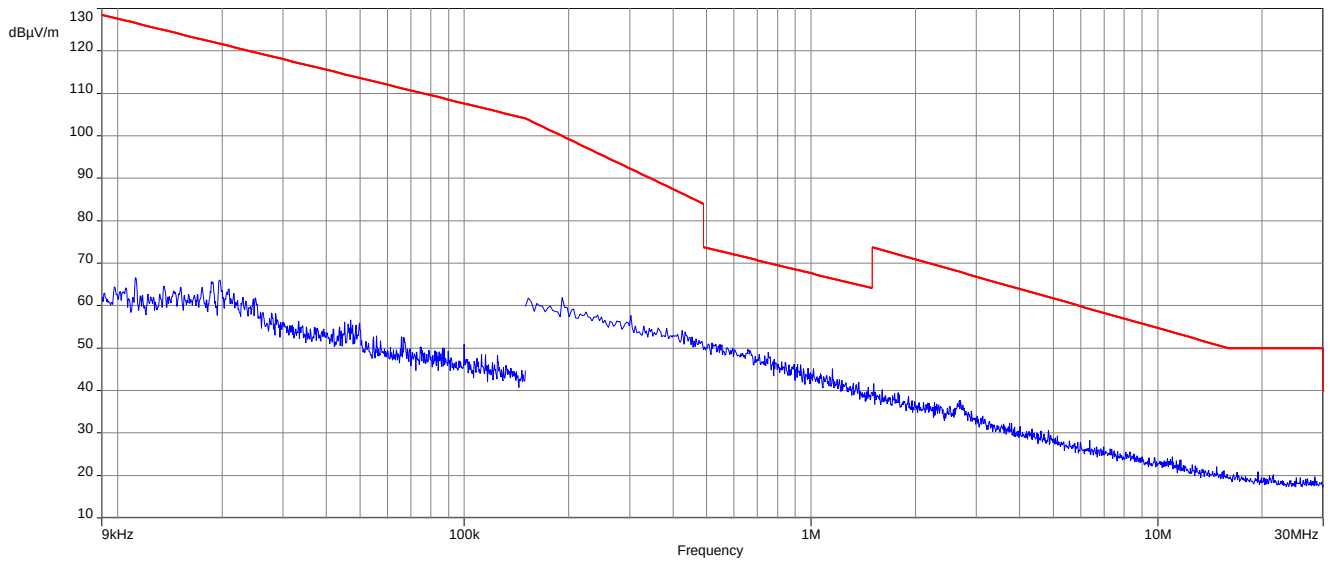
Plot 3: 9 kHz to 30 MHz, U-NII-1; highest channel



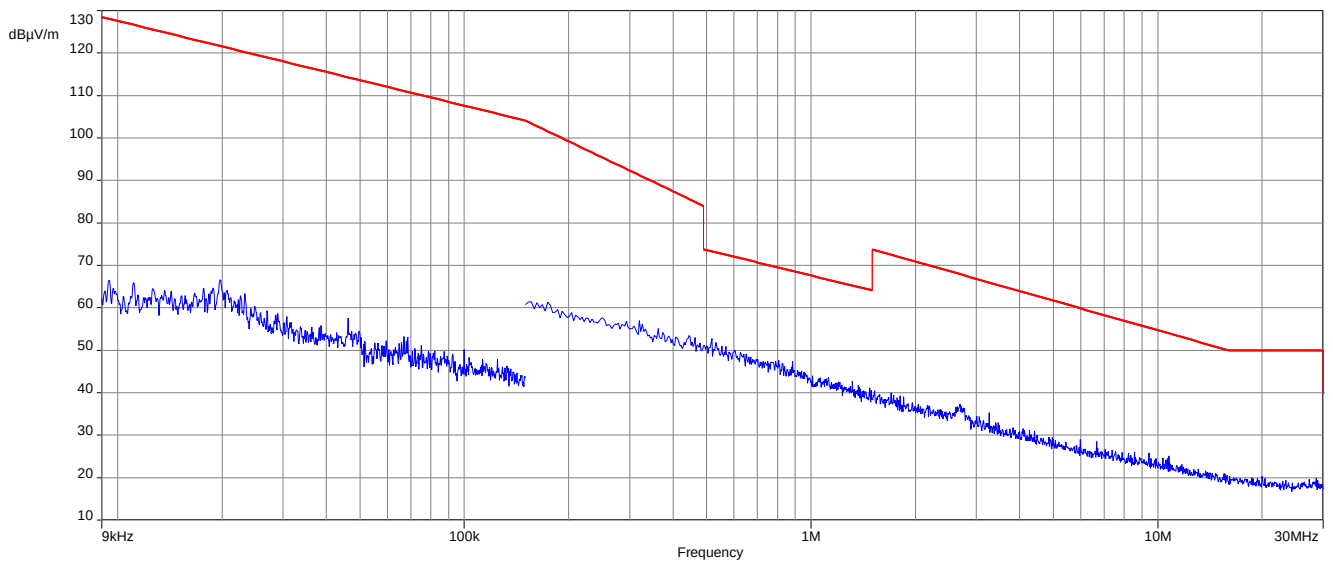
Plot 4: 9 kHz to 30 MHz, U-NII-2A; lowest channel



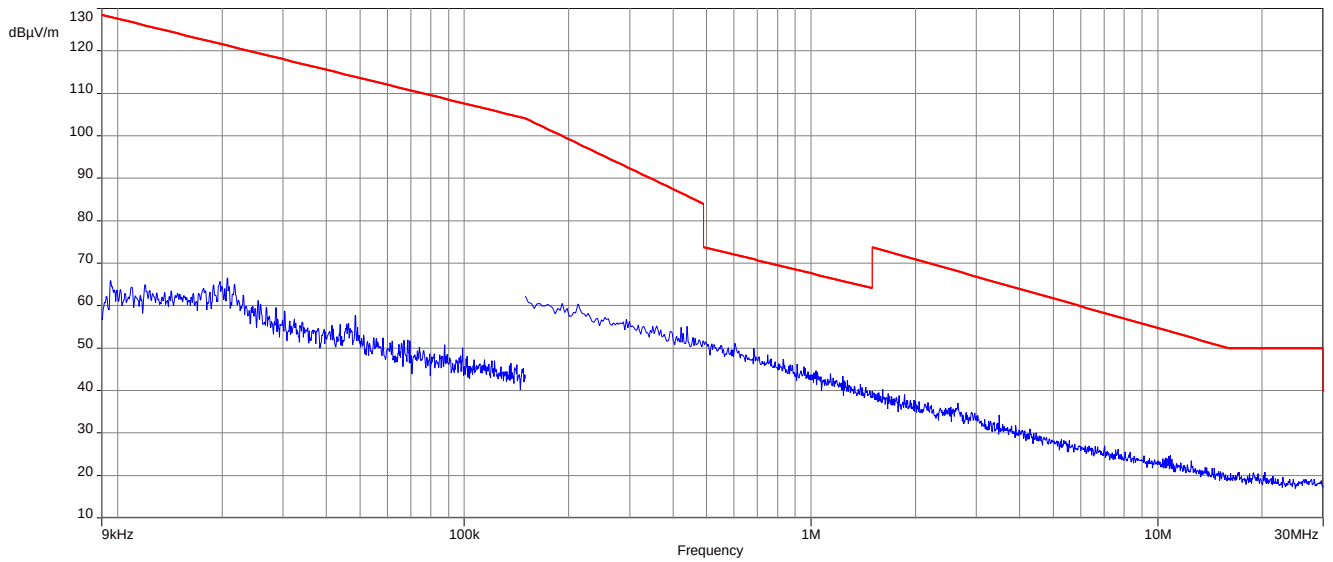
Plot 5: 9 kHz to 30 MHz, U-NII-2A; middle channel



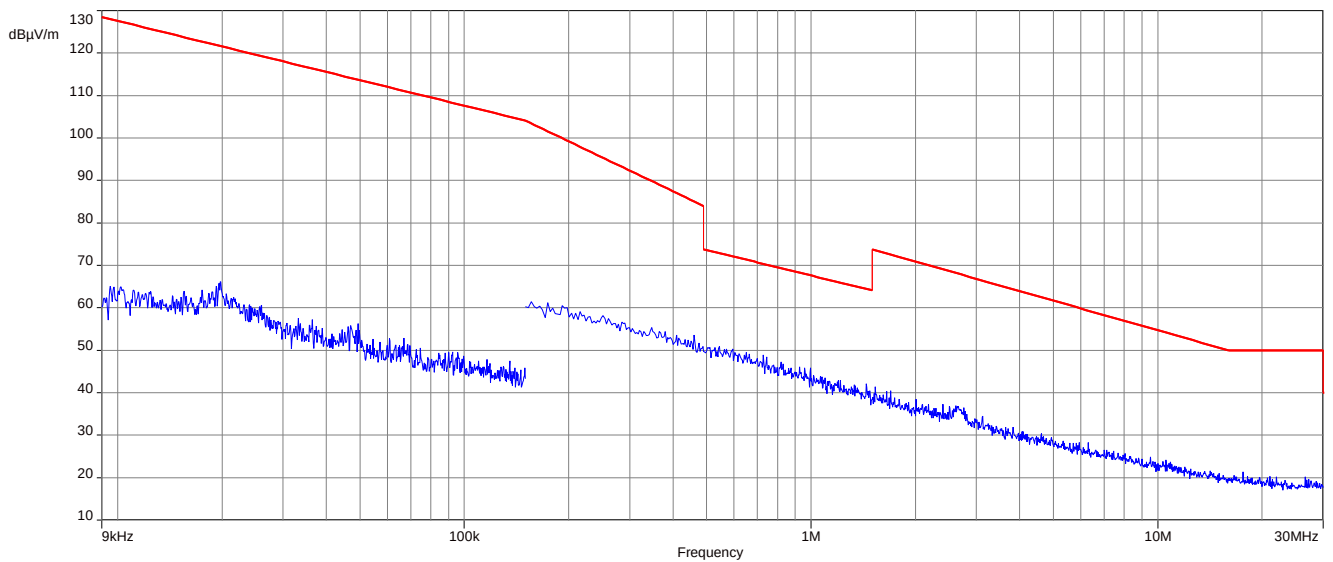
Plot 6: 9 kHz to 30 MHz, U-NII-2A; highest channel



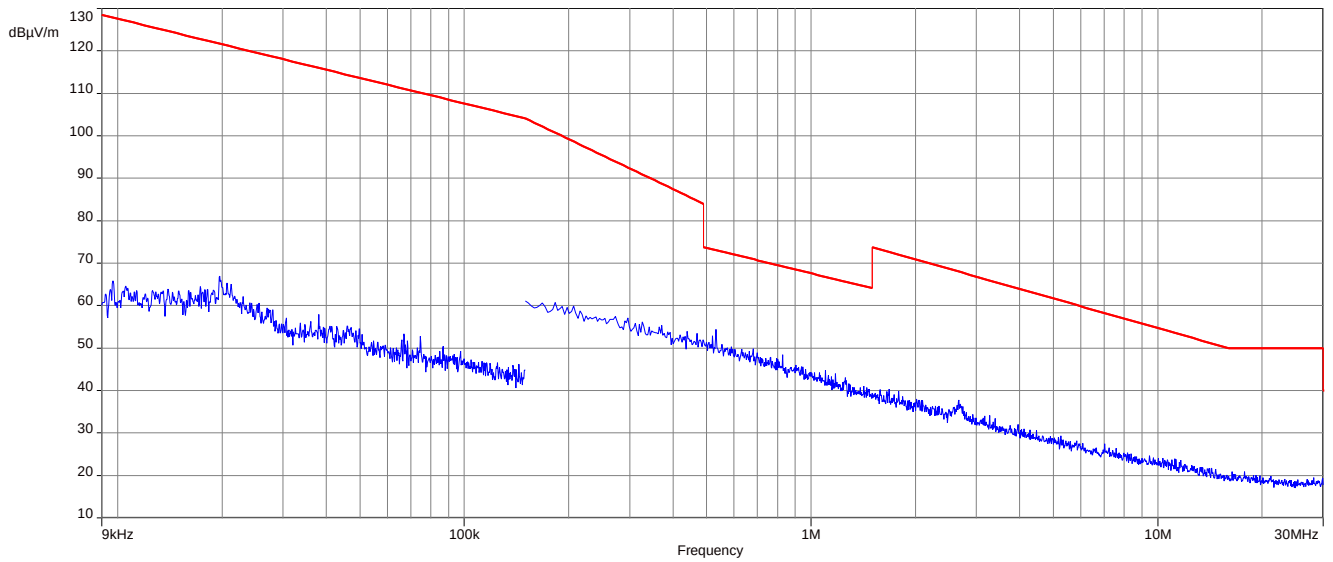
Plot 7: 9 kHz to 30 MHz, U-NII-2C; lowest channel



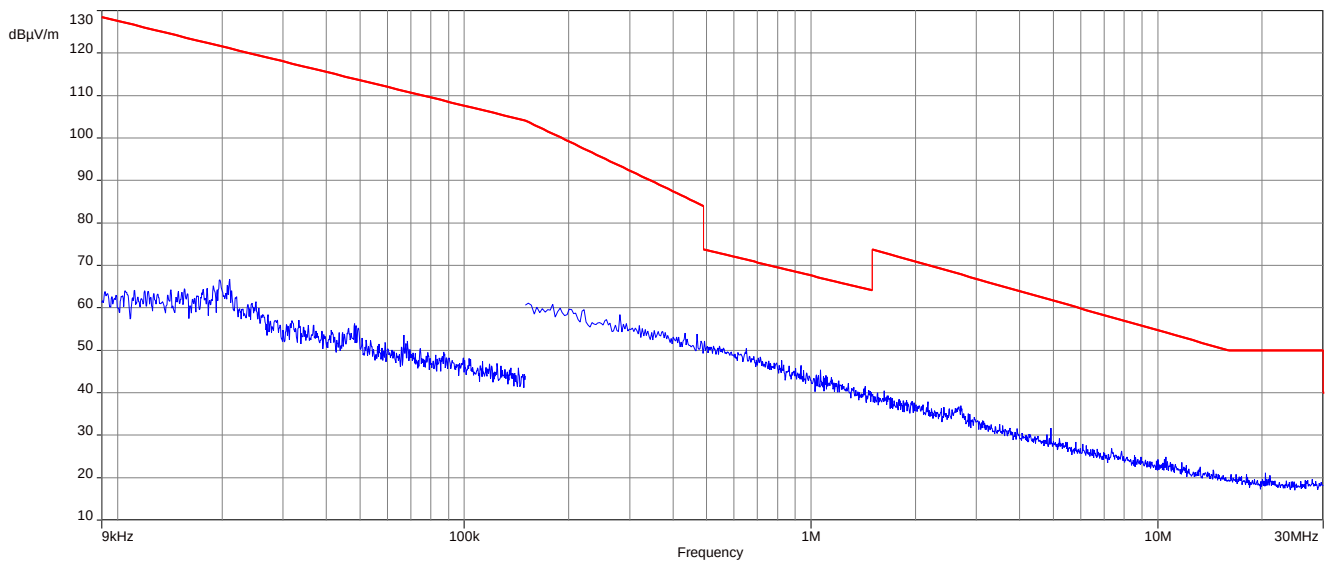
Plot 8: 9 kHz to 30 MHz, U-NII-2C; middle channel



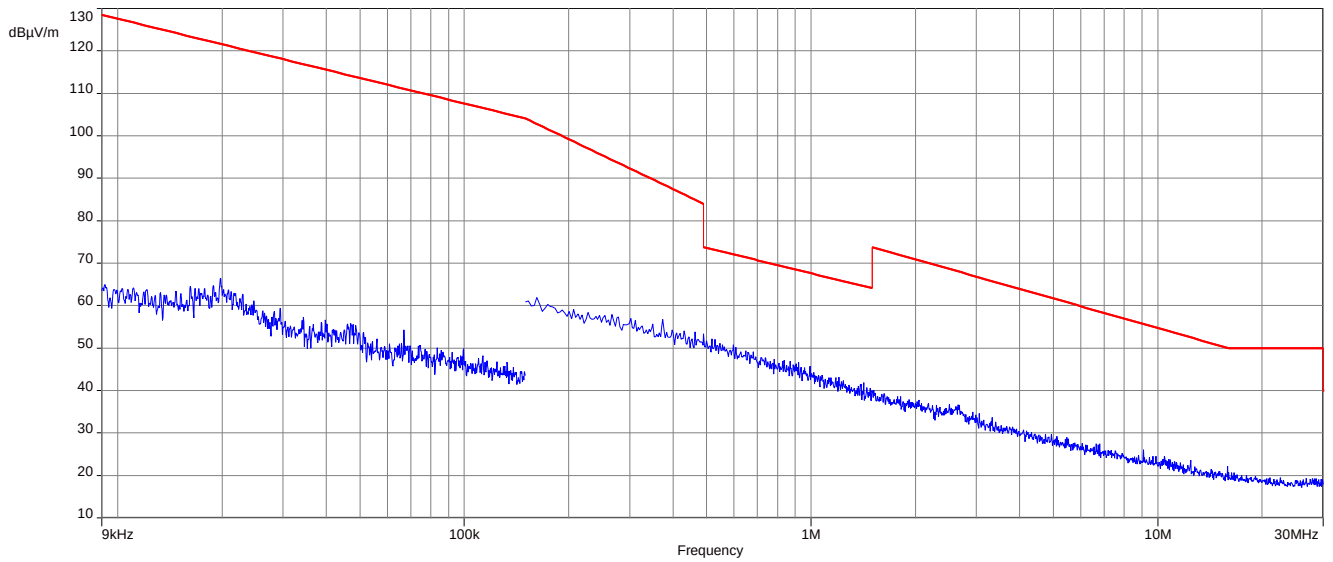
Plot 9: 9 kHz to 30 MHz, U-NII-2C; highest channel



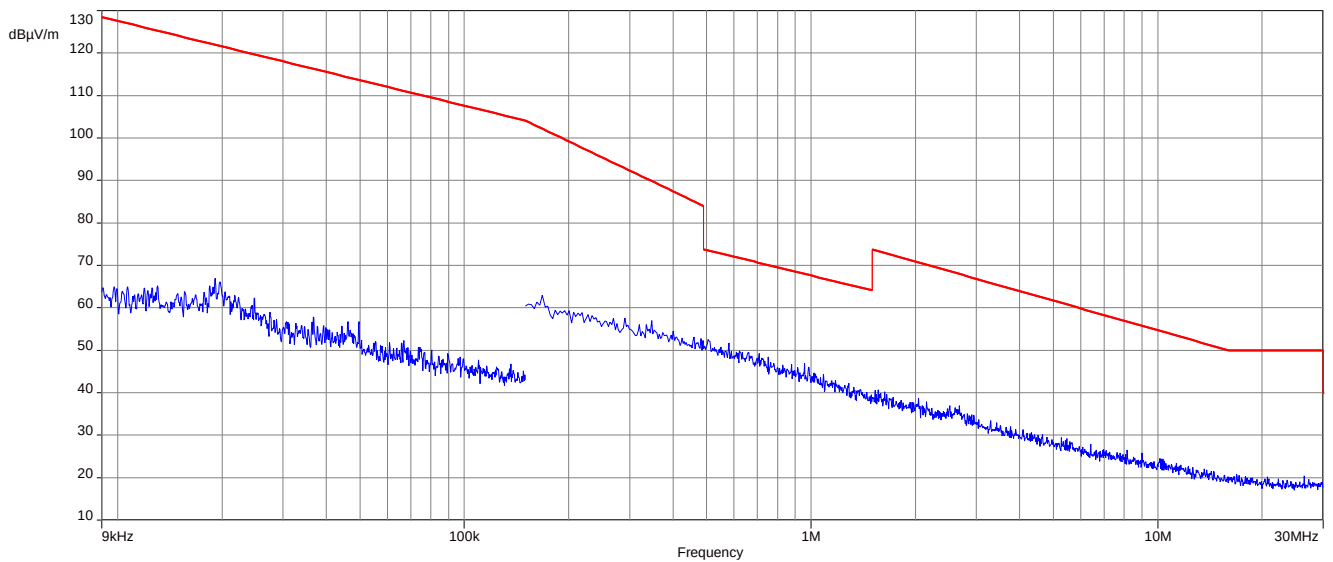
Plot 10: 9 kHz to 30 MHz, U-NII-3; lowest channel



Plot 11: 9 kHz to 30 MHz, U-NII-3; middle channel

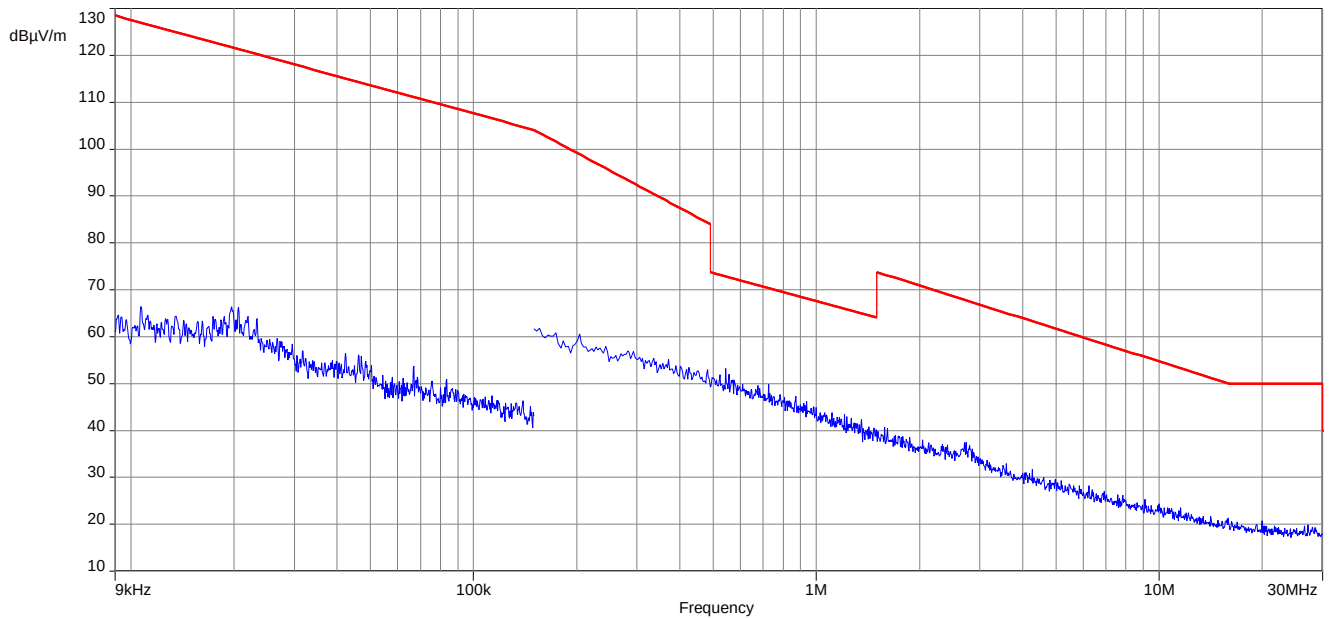


Plot 12: 9 kHz to 30 MHz, U-NII-3; highest channel

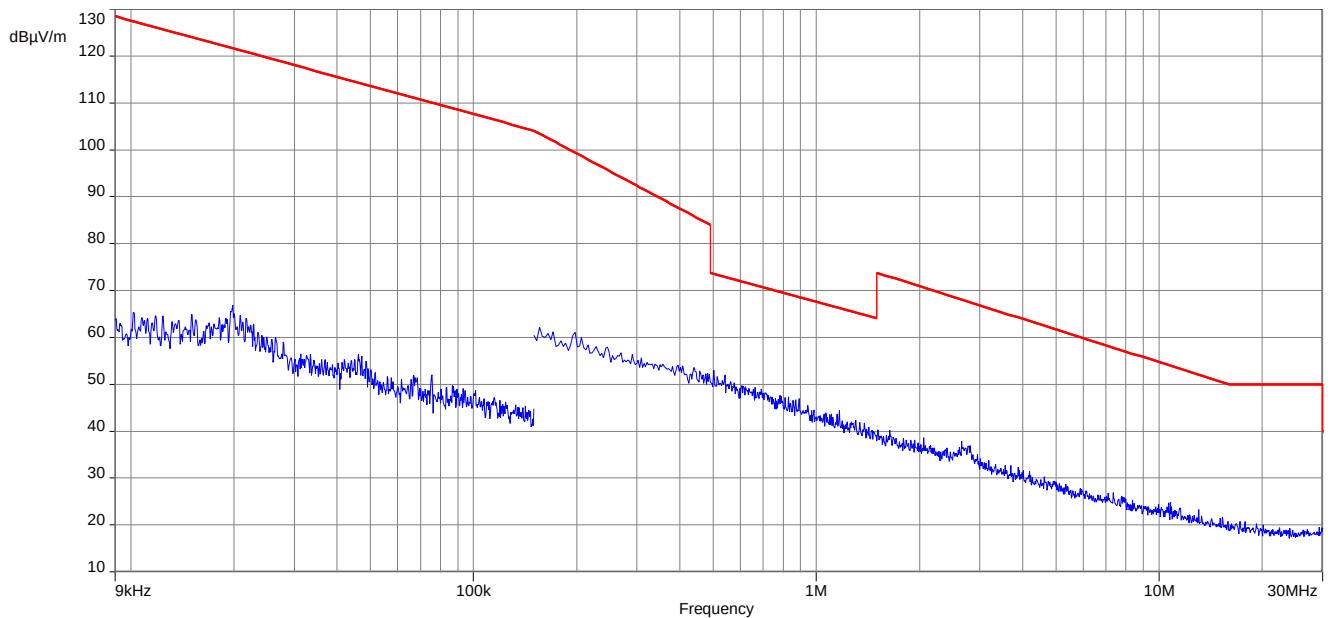


Plots: 40 MHz channel bandwidth

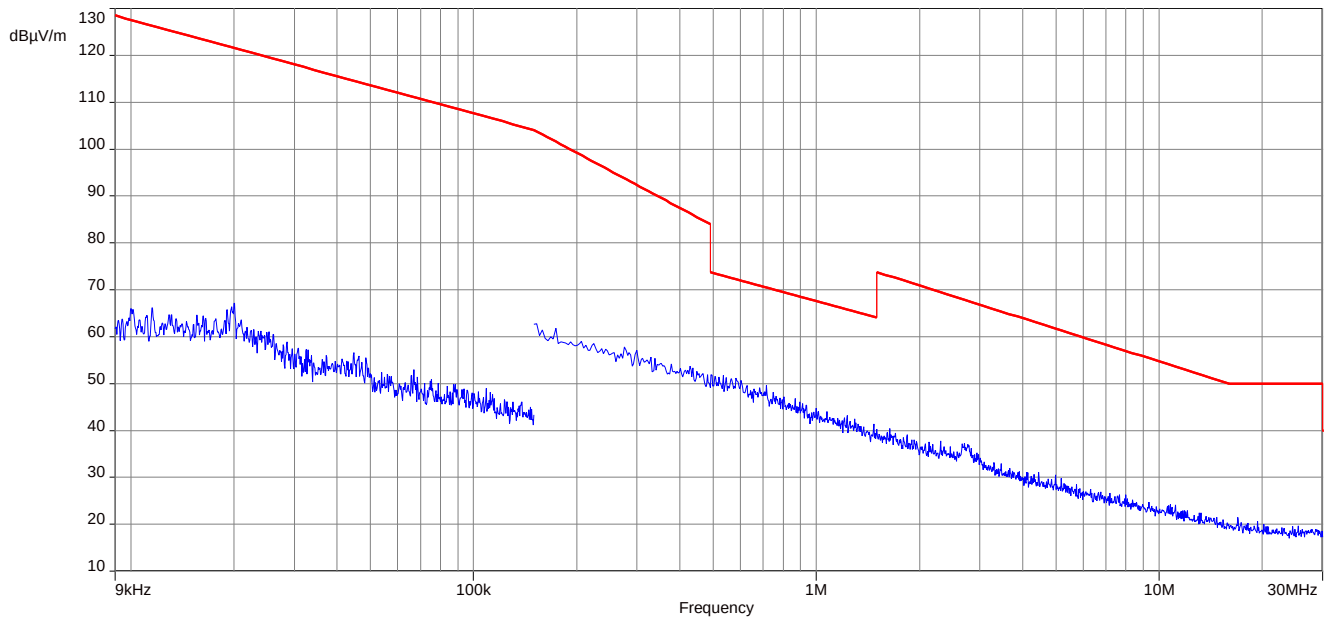
Plot 1: 9 kHz to 30 MHz, U-NII-1; lowest channel



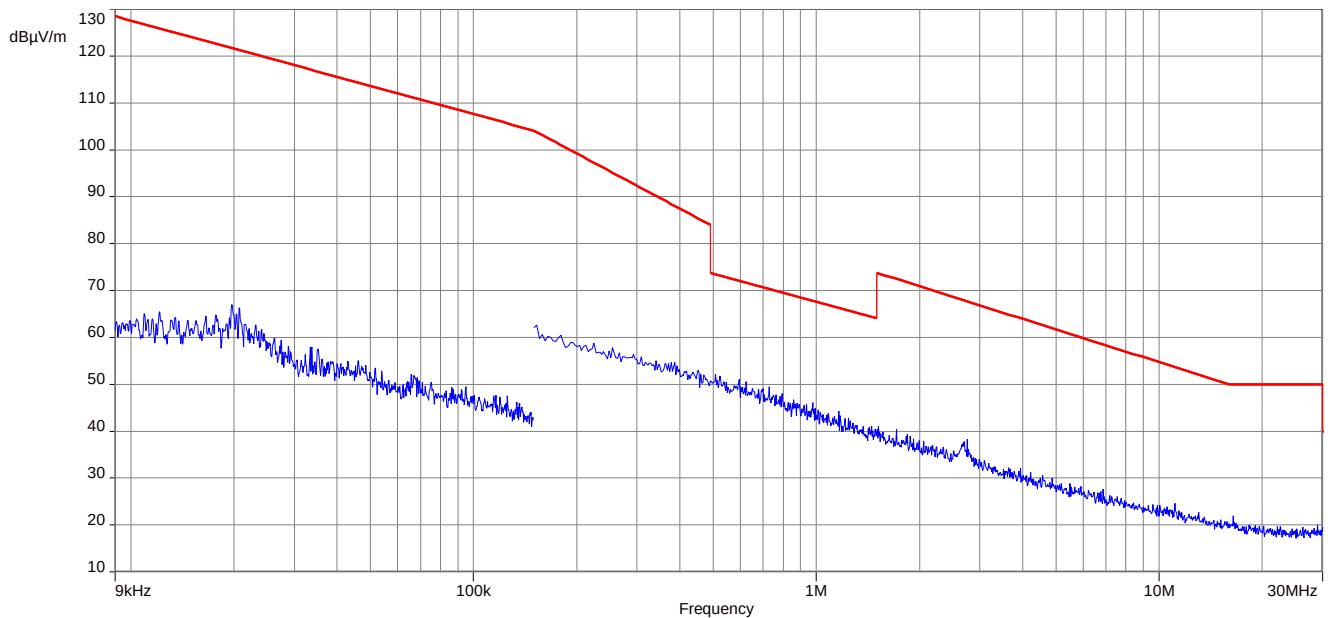
Plot 2: 9 kHz to 30 MHz, U-NII-1; highest channel



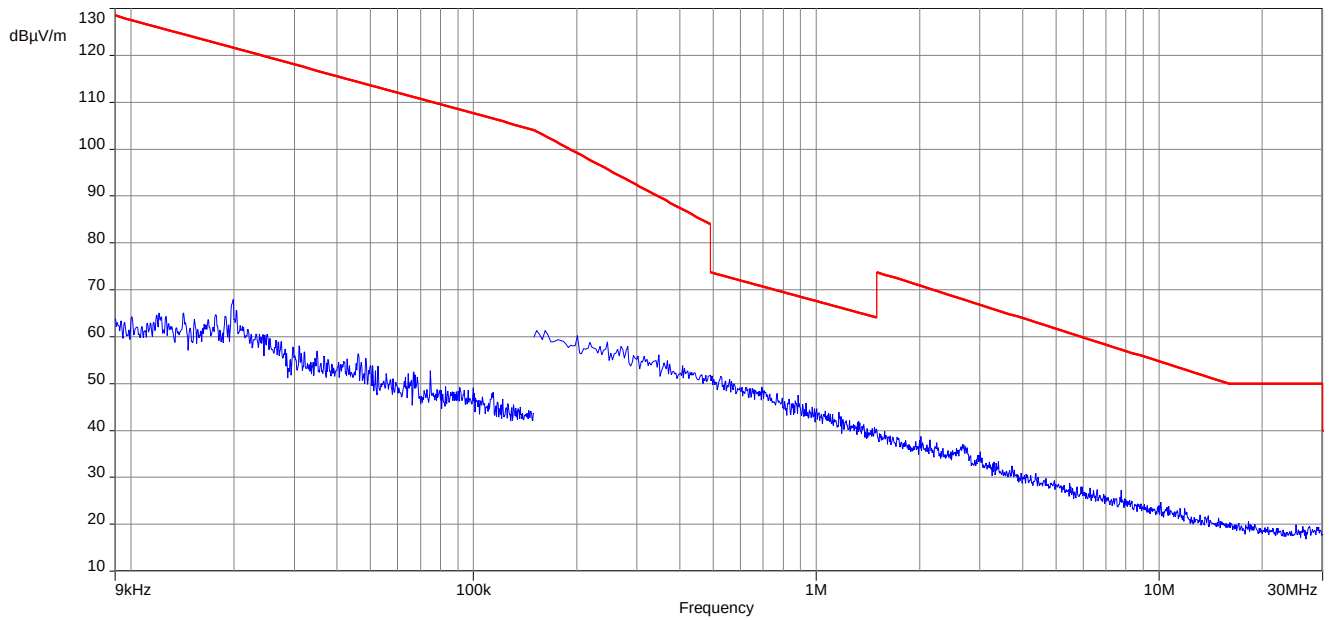
Plot 3: 9 kHz to 30 MHz, U-NII-2A; lowest channel



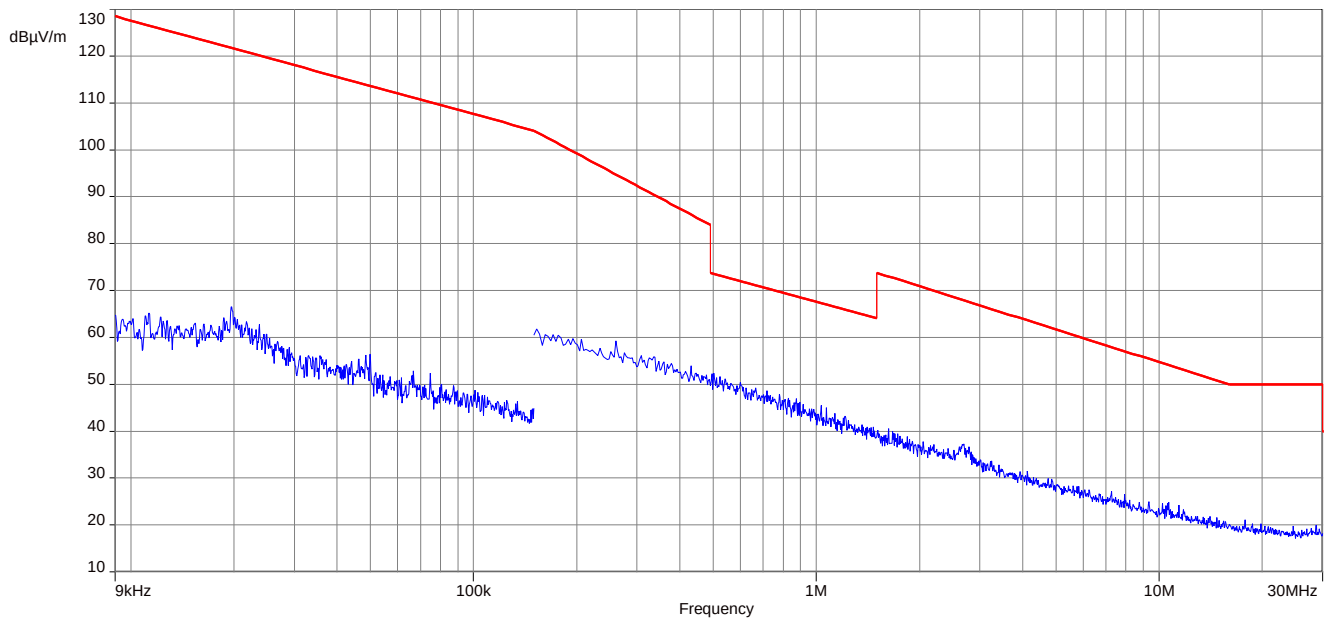
Plot 4: 9 kHz to 30 MHz, U-NII-2A; highest channel



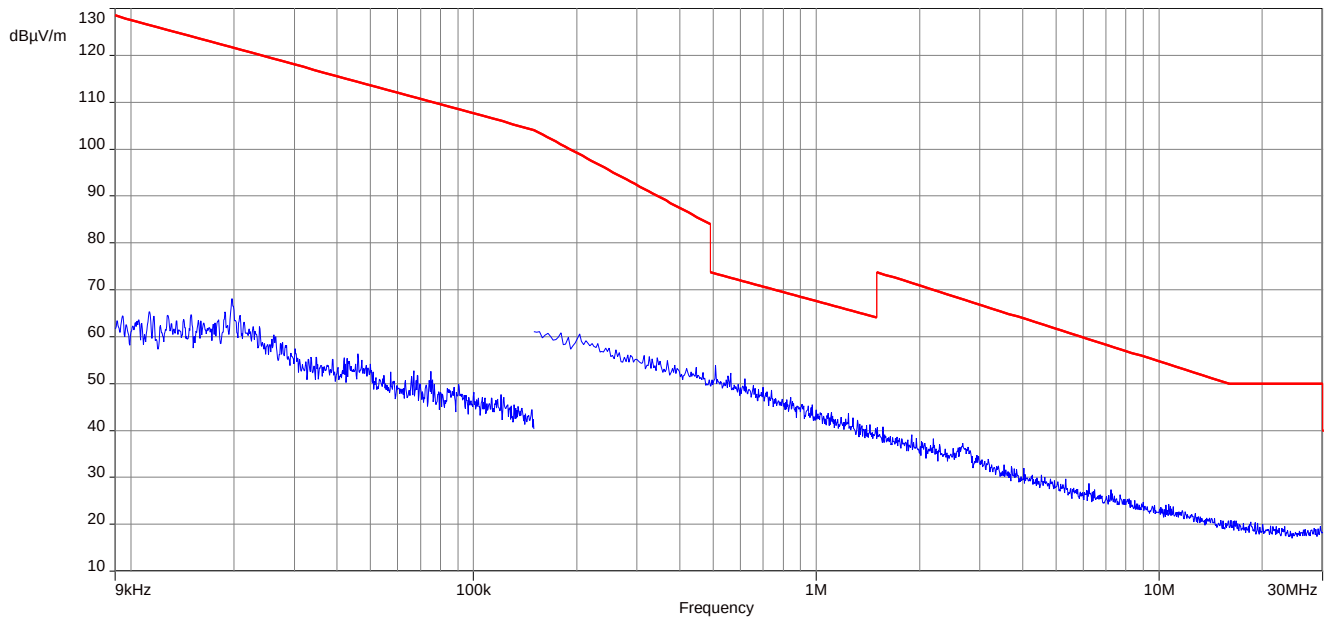
Plot 5: 9 kHz to 30 MHz, U-NII-2C; lowest channel



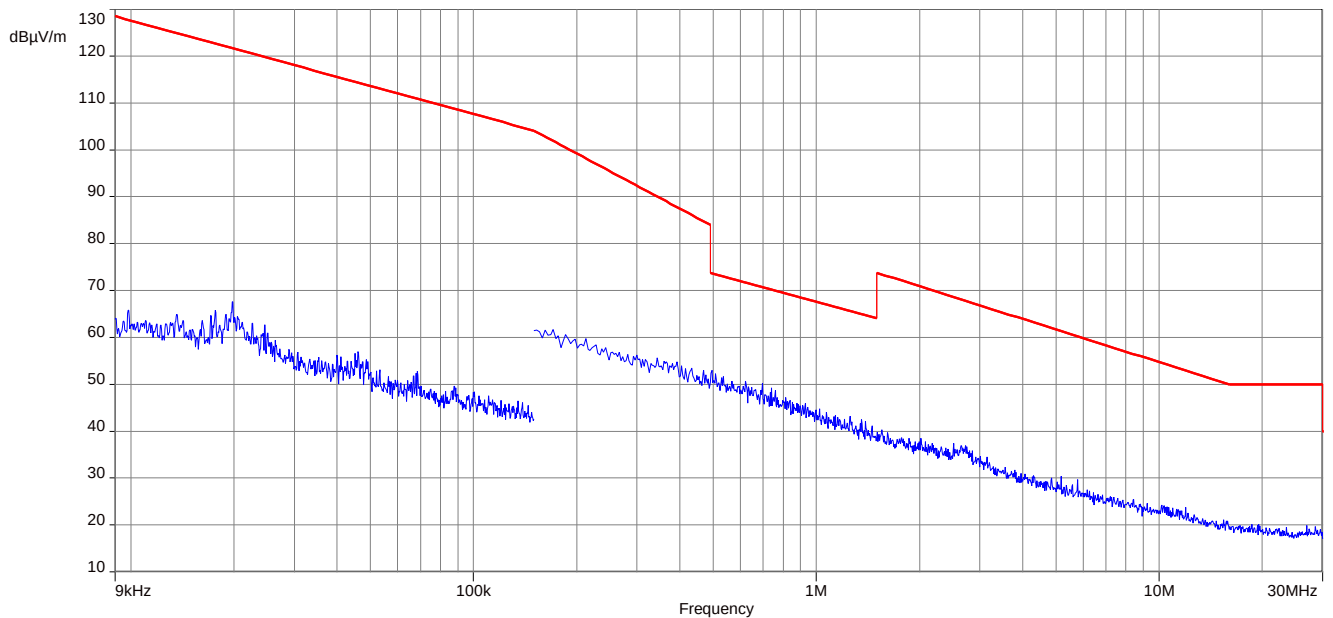
Plot 6: 9 kHz to 30 MHz, U-NII-2C; middle channel



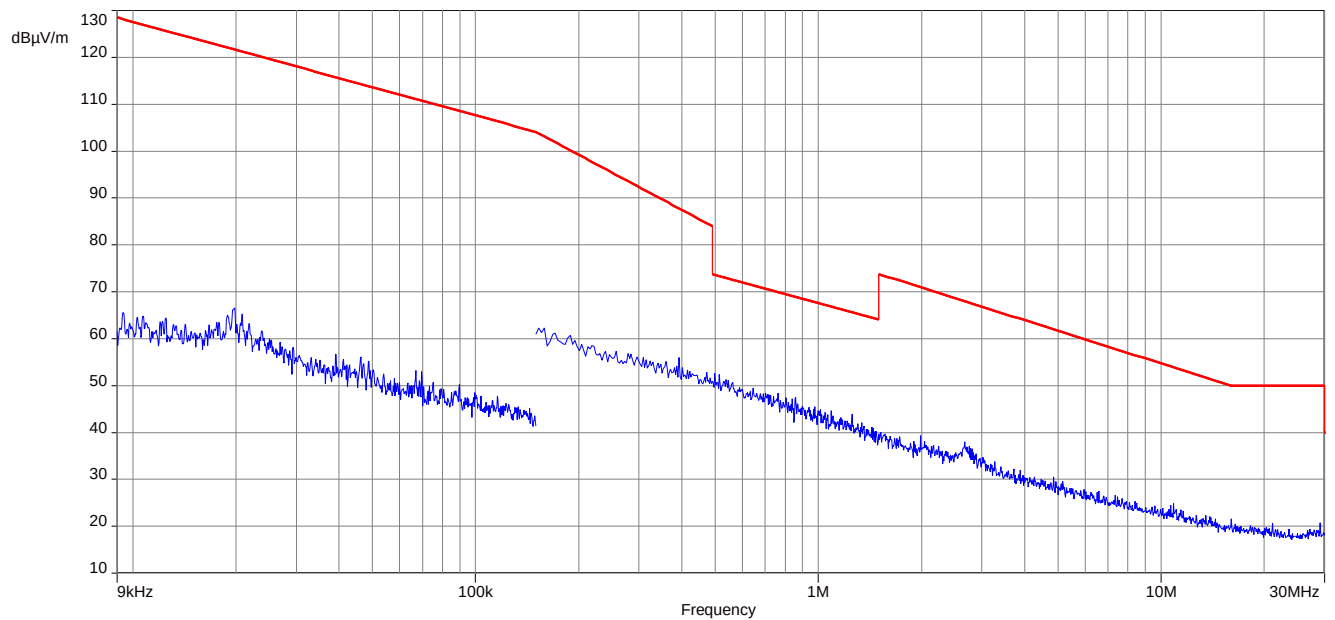
Plot 7: 9 kHz to 30 MHz, U-NII-2C; highest channel



Plot 8: 9 kHz to 30 MHz, U-NII-3; lowest channel



Plot 9: 9 kHz to 30 MHz, U-NII-3; highest channel



12.5 Spurious emissions radiated 1 GHz to 18 GHz

Description:

Measurement of the radiated spurious emissions and cabinet radiations from 1 GHz to 18 GHz.

Measurement:

Measurement parameter	
Detector:	Quasi Peak below 1 GHz (alternative Peak) Peak above 1 GHz / RMS
Sweep time:	Auto
Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Span:	1 GHz to 18 GHz
Test setup:	See sub clause 7.1 – A
Measurement uncertainty:	See chapter 9

Limits:

TX Spurious Emissions Radiated		
§15.209 / RSS-247		
Frequency (MHz)	Field Strength (dBµV/m)	Measurement distance
Above 960	54.0	3
§15.407		
Outside the restricted bands!	-27 dBm / MHz	

Results: 20 MHz channel bandwidth

TX Spurious Emissions Radiated [dBµV/m] / dBm								
U-NII-1 (5150 MHz to 5250 MHz)								
Lowest channel			Middle channel			Highest channel		
F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]
1350	Peak	44.4	1350	Peak	44.4	1350	Peak	44.4
	AVG	42.3		AVG	42.3		AVG	42.3
For emissions above 18 GHz please take look at the plots.			For emissions above 18 GHz please take look at the plots.			For emissions above 18 GHz please take look at the plots.		

TX Spurious Emissions Radiated [dBµV/m] / dBm								
U-NII-2A (5250 MHz to 5350 MHz)								
Lowest channel			Middle channel			Highest channel		
F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]
1350	Peak	44.4	1350	Peak	44.4	1350	Peak	44.4
	AVG	42.3		AVG	42.3		AVG	42.3
For emissions above 18 GHz please take look at the plots.			For emissions above 18 GHz please take look at the plots.			For emissions above 18 GHz please take look at the plots.		

TX Spurious Emissions Radiated [dBµV/m] / dBm								
U-NII-2C (5470 MHz to 5725 MHz)								
Lowest channel			Middle channel			Highest channel		
F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]
1350	Peak	44.4	1350	Peak	44.4	1350	Peak	44.4
	AVG	42.3		AVG	42.3		AVG	42.3
For emissions above 18 GHz please take look at the plots.			For emissions above 18 GHz please take look at the plots.			For emissions above 18 GHz please take look at the plots.		

TX Spurious Emissions Radiated [dBµV/m] / dBm								
U-NII-3 (5725 MHz to 5850 MHz)								
Lowest channel			Middle channel			Highest channel		
F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]
11490	Peak	63.3	11573	Peak	59.4	11651	Peak	63.7
	AVG	53.0		AVG	50.9		AVG	52.2

Results: 40 MHz channel bandwidth

TX Spurious Emissions Radiated [dB μ V/m] / dBm								
U-NII-1 (5150 MHz to 5250 MHz)								
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]
1350	Peak	44.4	1350	Peak	44.4	1350	Peak	44.4
	AVG	42.3		AVG	42.3		AVG	42.3
For emissions above 18 GHz please take look at the plots.			For emissions above 18 GHz please take look at the plots.			For emissions above 18 GHz please take look at the plots.		

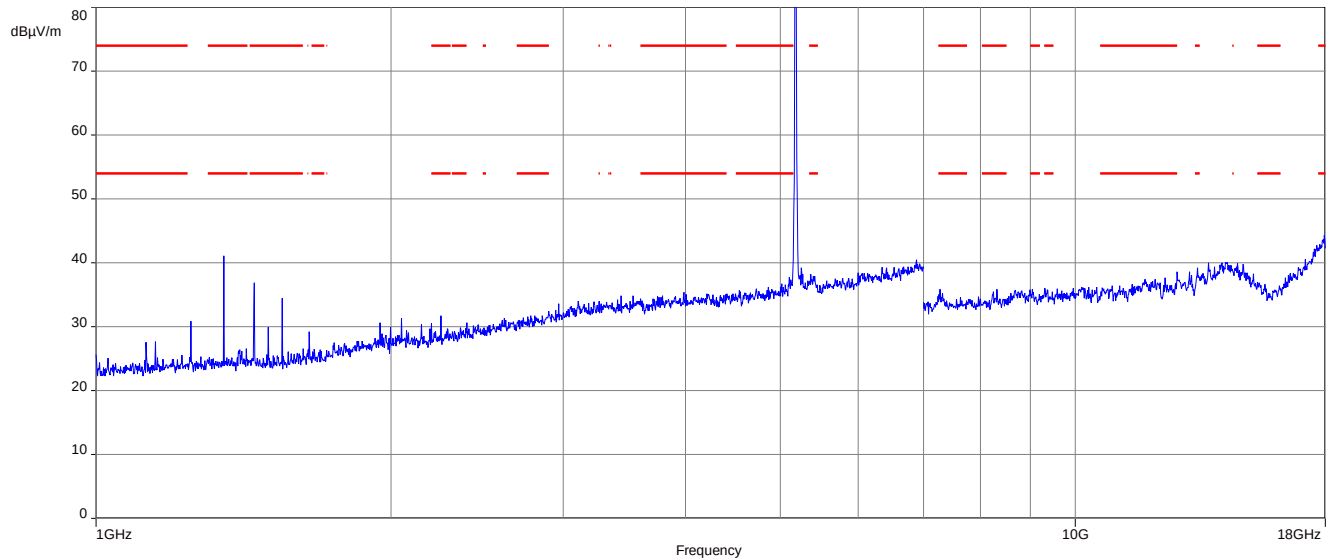
TX Spurious Emissions Radiated [dB μ V/m] / dBm								
U-NII-2A (5250 MHz to 5350 MHz)								
Lowest channel			Middle channel			Highest channel		
F [MHz]	Detector	Level [dB μ V/m]	F [MHz]	Detector	Level [dB μ V/m]	F [MHz]	Detector	Level [dB μ V/m]
1350	Peak	44.4	1350	Peak	44.4	1350	Peak	44.4
	AVG	42.3		AVG	42.3		AVG	42.3
For emissions above 18 GHz please take look at the plots.			For emissions above 18 GHz please take look at the plots.			For emissions above 18 GHz please take look at the plots.		

TX Spurious Emissions Radiated [dB μ V/m] / dBm								
U-NII-2C (5470 MHz to 5725 MHz)								
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]
1350	Peak	44.4	1350	Peak	44.4	1350	Peak	44.4
	AVG	42.3		AVG	42.3		AVG	42.3
For emissions above 18 GHz please take look at the plots.			For emissions above 18 GHz please take look at the plots.			For emissions above 18 GHz please take look at the plots.		

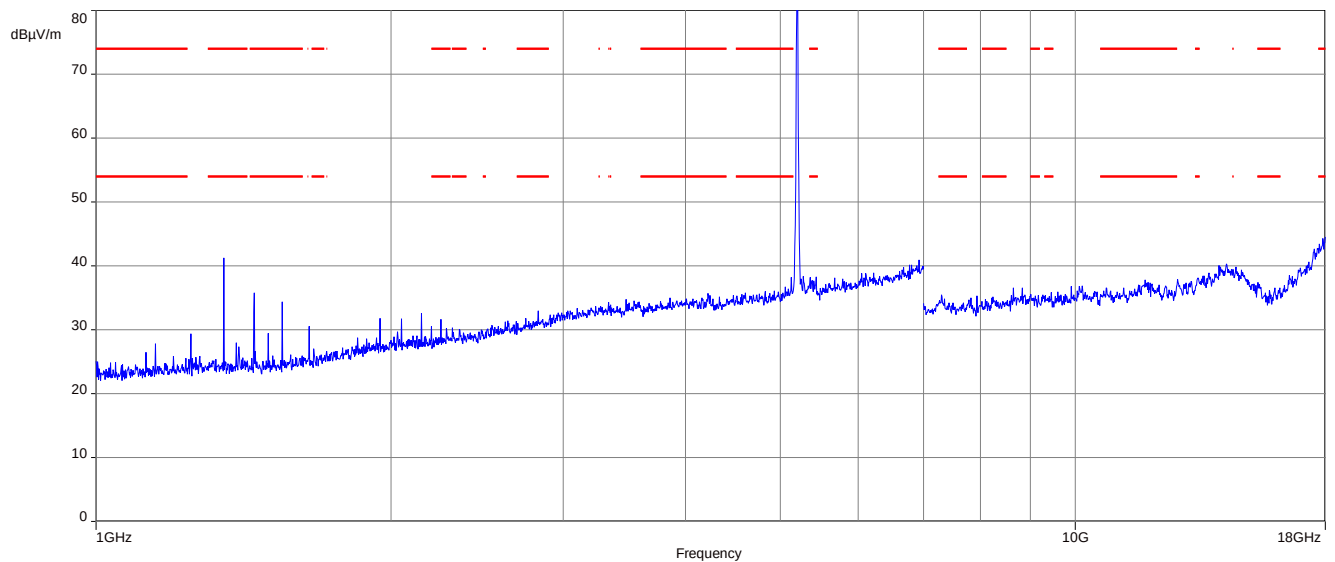
TX Spurious Emissions Radiated [dB μ V/m] / dBm								
U-NII-3 (5725 MHz to 5850 MHz)								
Lowest channel			Middle channel			Highest channel		
F [MHz]	Detector	Level [dB μ V/m]	F [MHz]	Detector	Level [dB μ V/m]	F [MHz]	Detector	Level [dB μ V/m]
1350	Peak	44.4	1350	Peak	44.4	1350	Peak	44.4
	AVG	42.3		AVG	42.3		AVG	42.3
For emissions above 18 GHz please take look at the plots.			For emissions above 18 GHz please take look at the plots.			For emissions above 18 GHz please take look at the plots.		

Plots: 20 MHz channel bandwidth

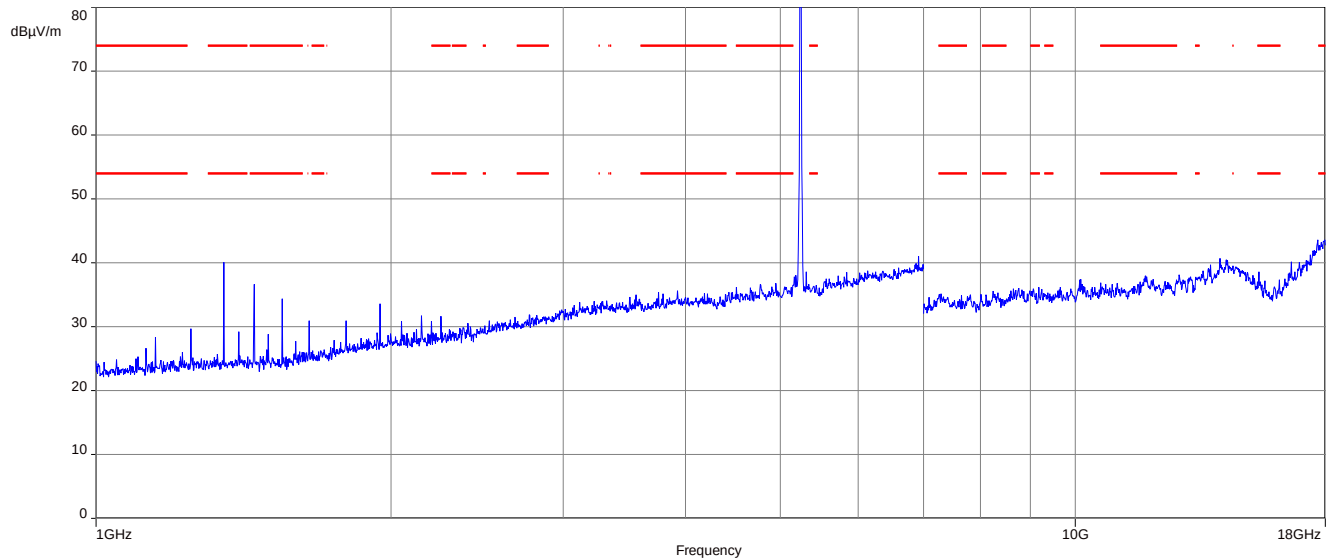
Plot 1: 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-1; lowest channel



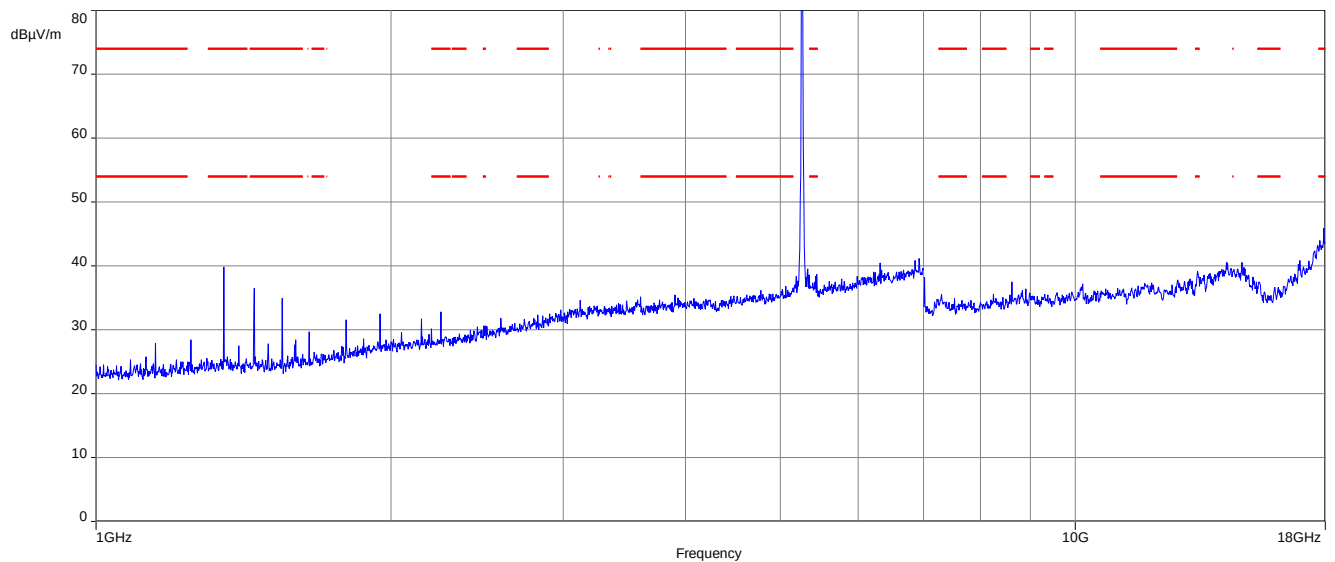
Plot 2: 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-1; middle channel



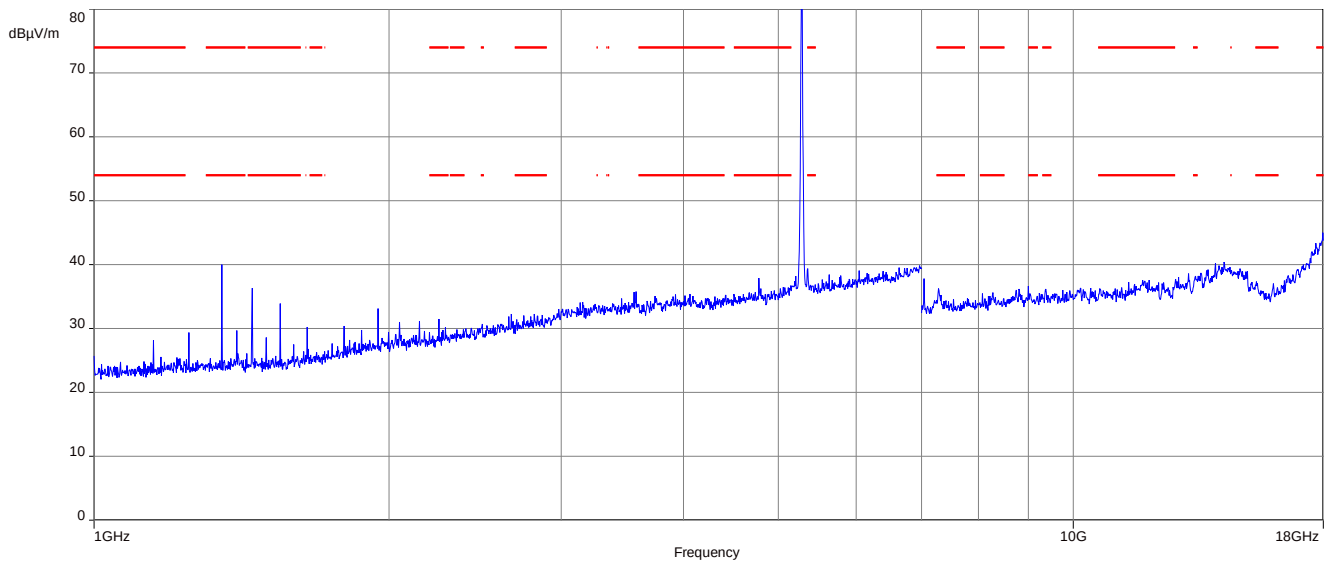
Plot 3: 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-1; highest channel



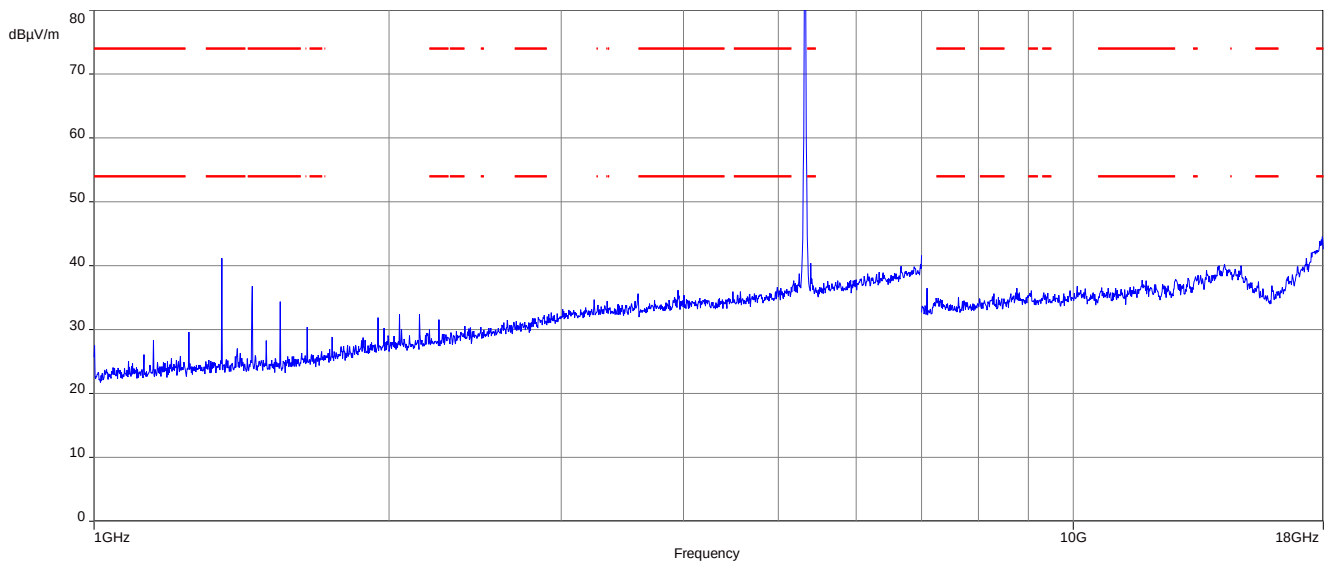
Plot 4: 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-2A; lowest channel



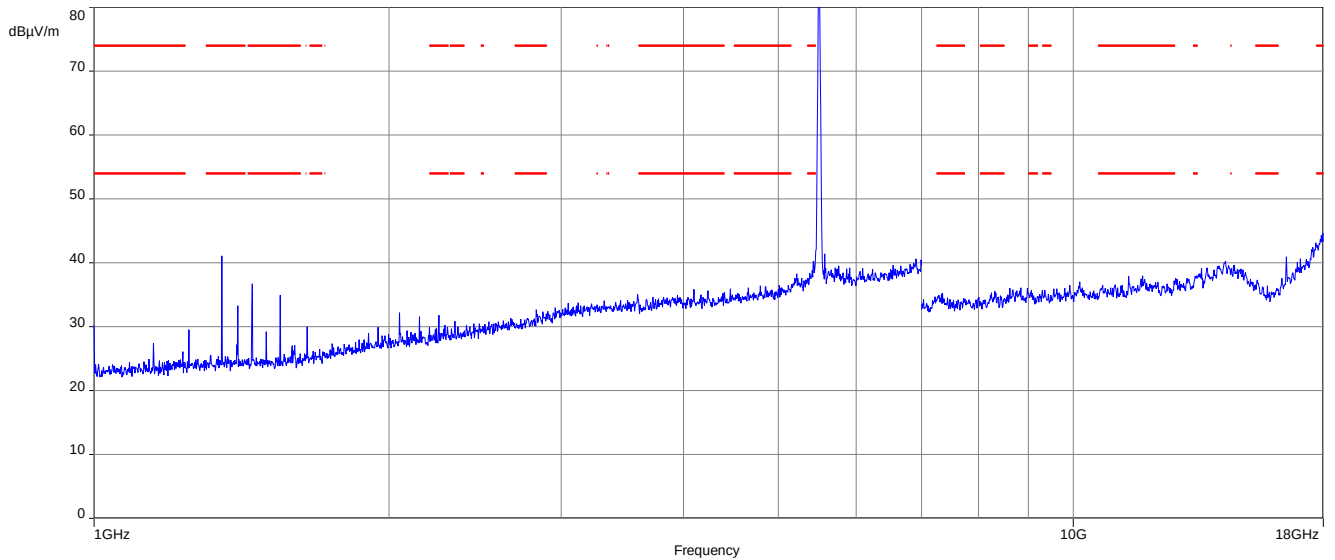
Plot 5: 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-2A; middle channel



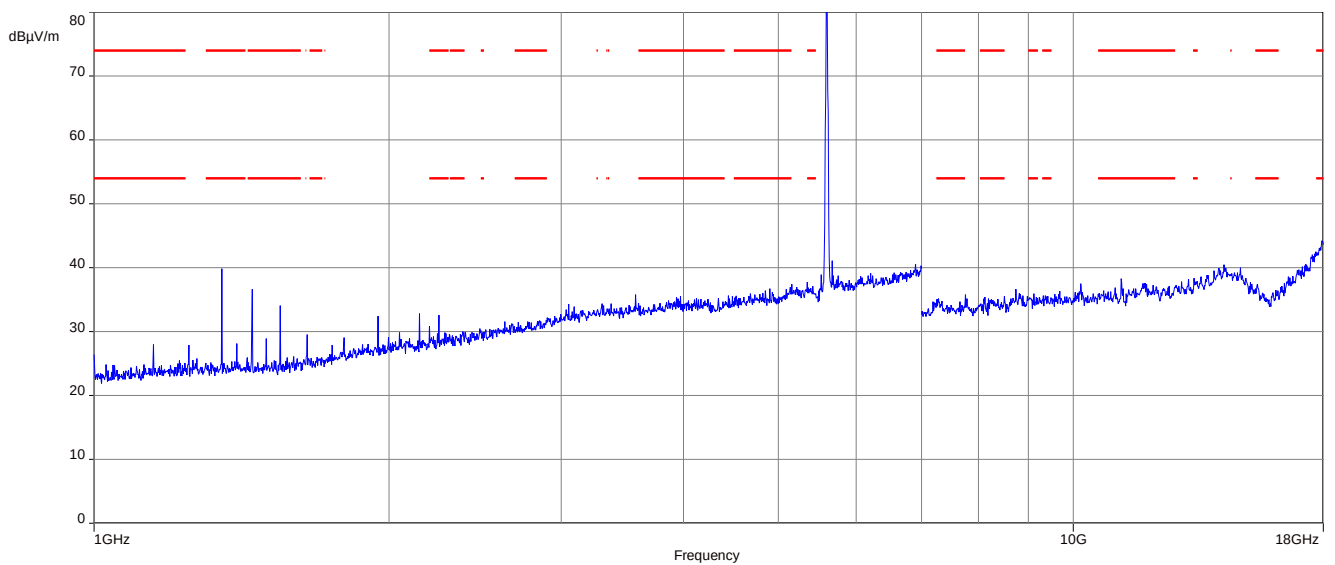
Plot 6: 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-2A; highest channel



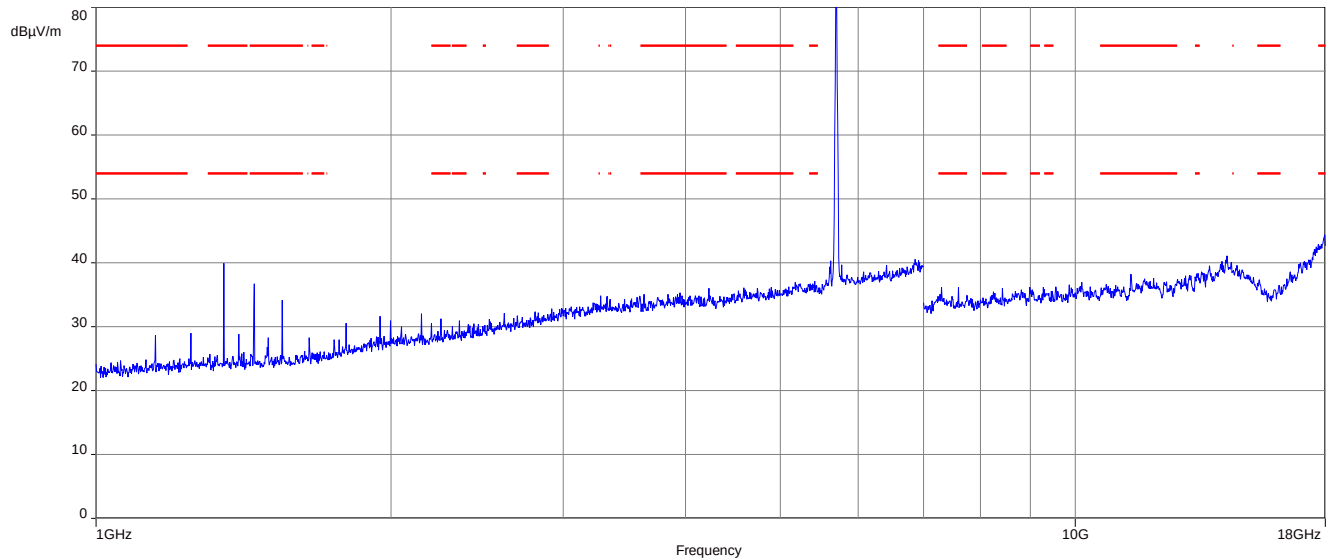
Plot 7: 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-2C; lowest channel



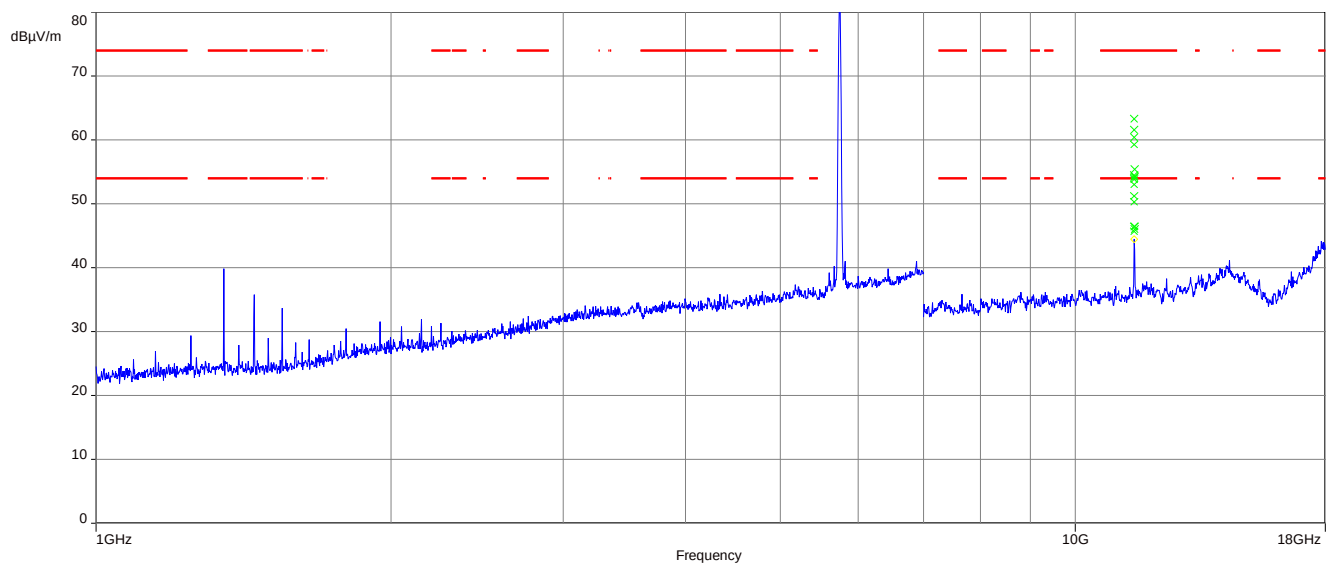
Plot 8: 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-2C; middle channel



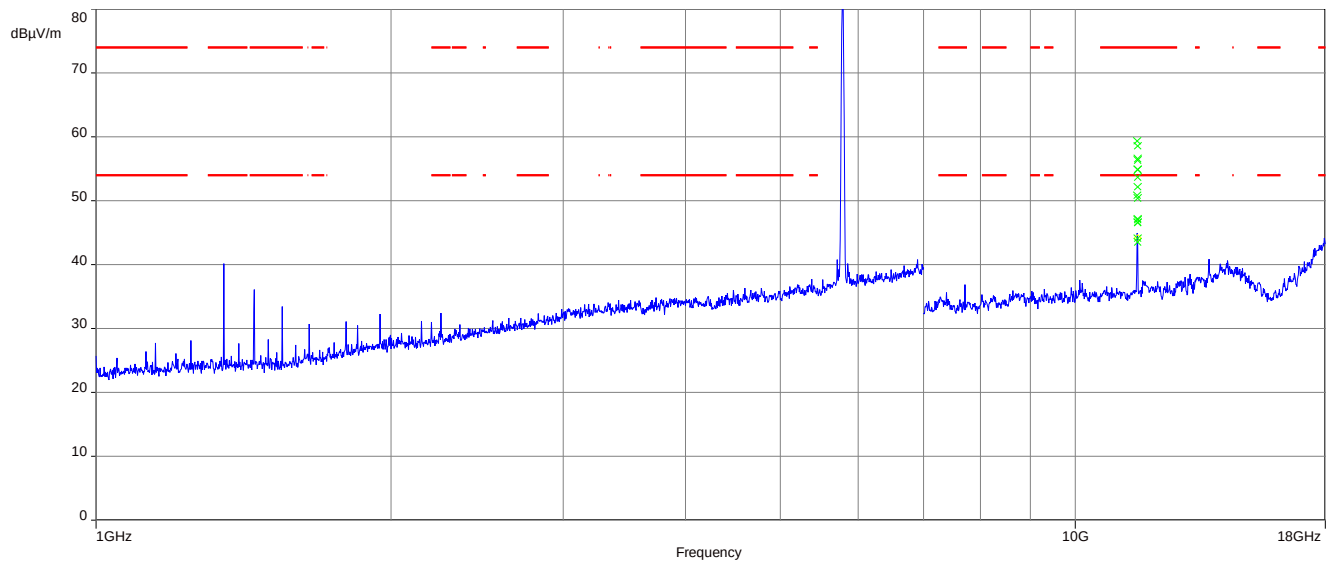
Plot 9: 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-2C; highest channel



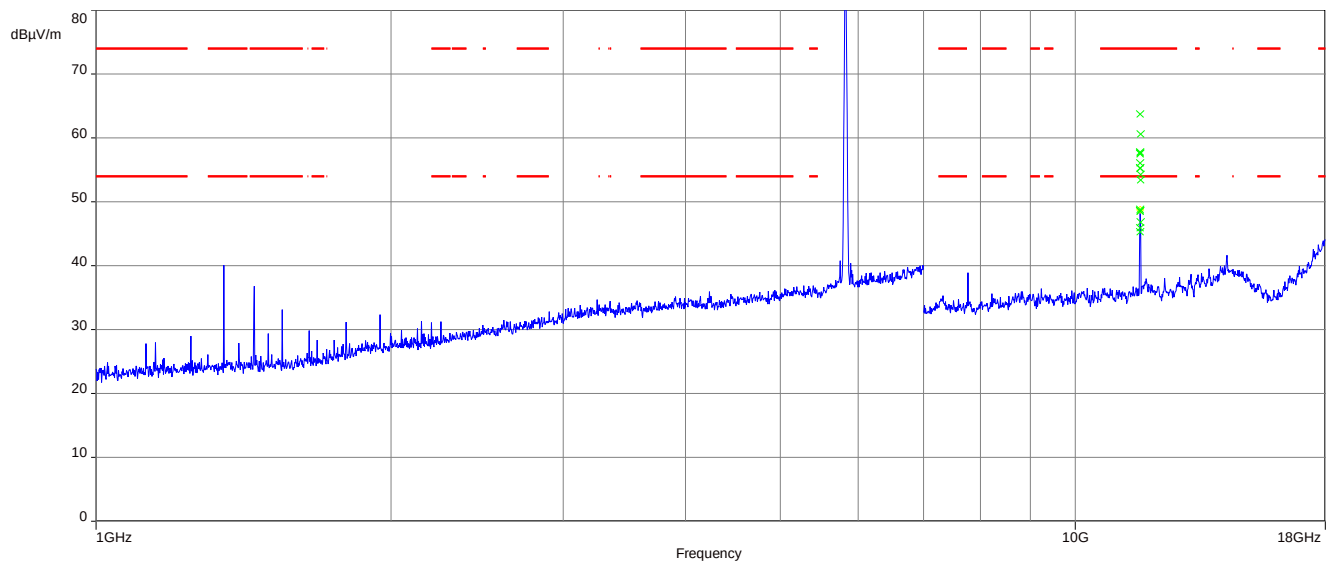
Plot 10: 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-3; lowest channel



Plot 11: 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-3; middle channel

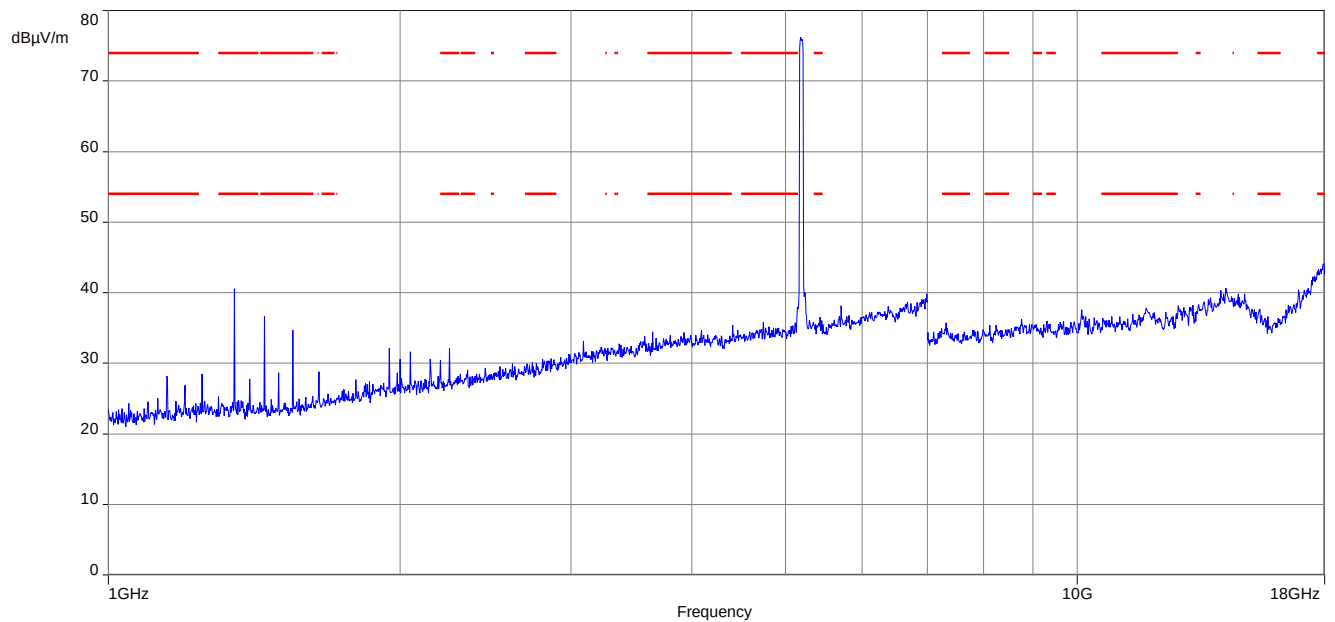


Plot 12: 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-3; highest channel

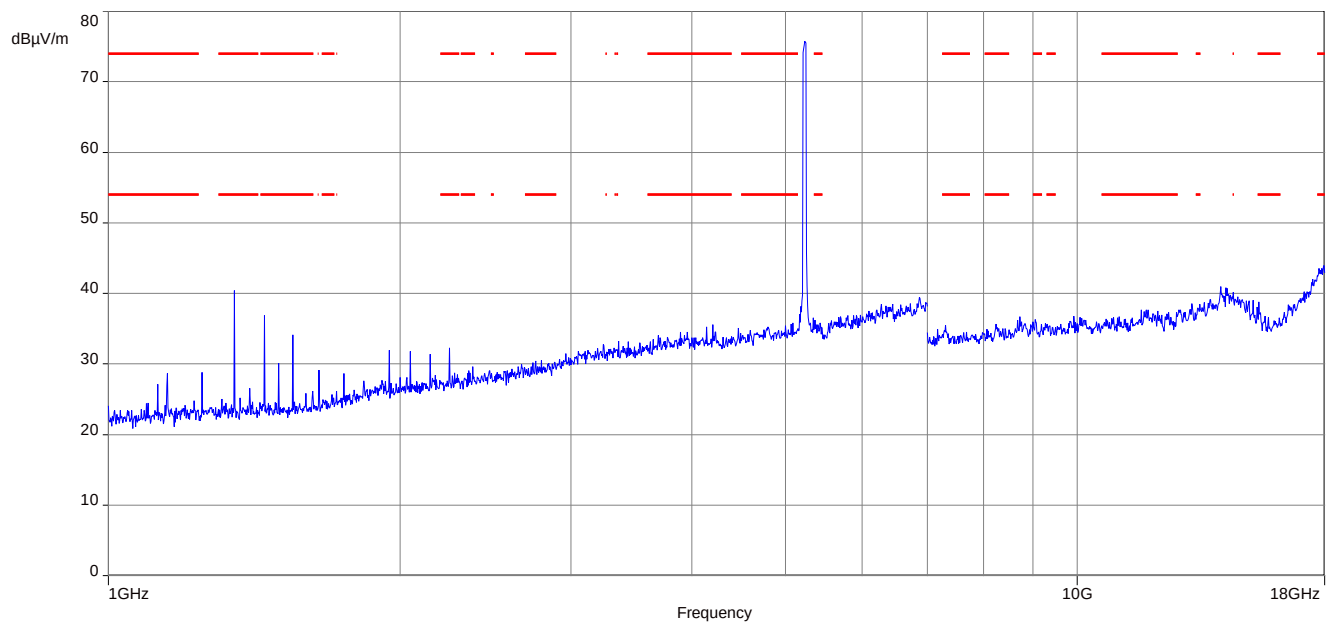


Plots: 40 MHz channel bandwidth

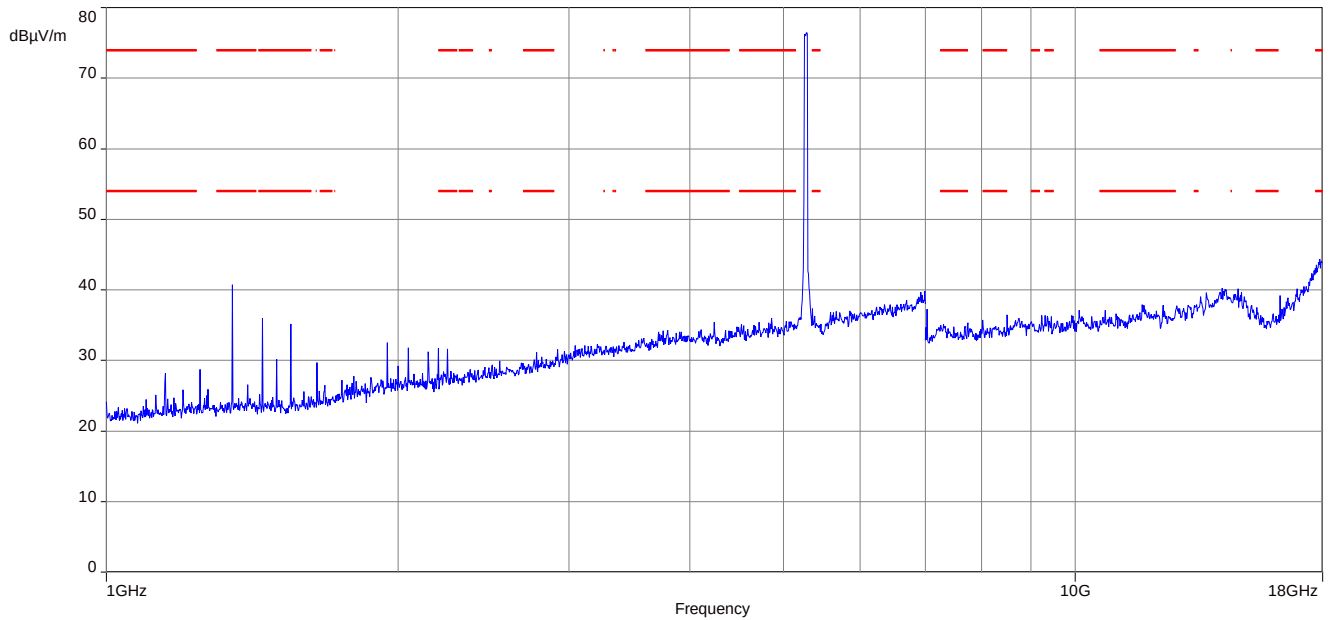
Plot 1: 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-1; lowest channel



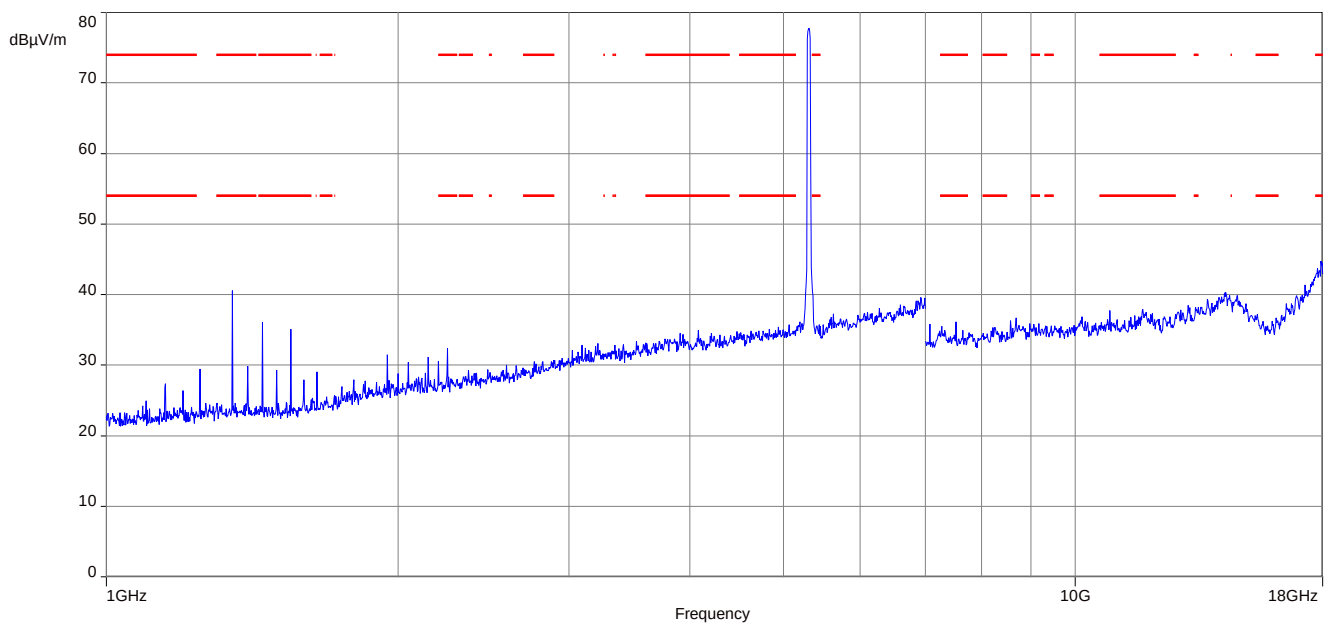
Plot 2: 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-1; highest channel



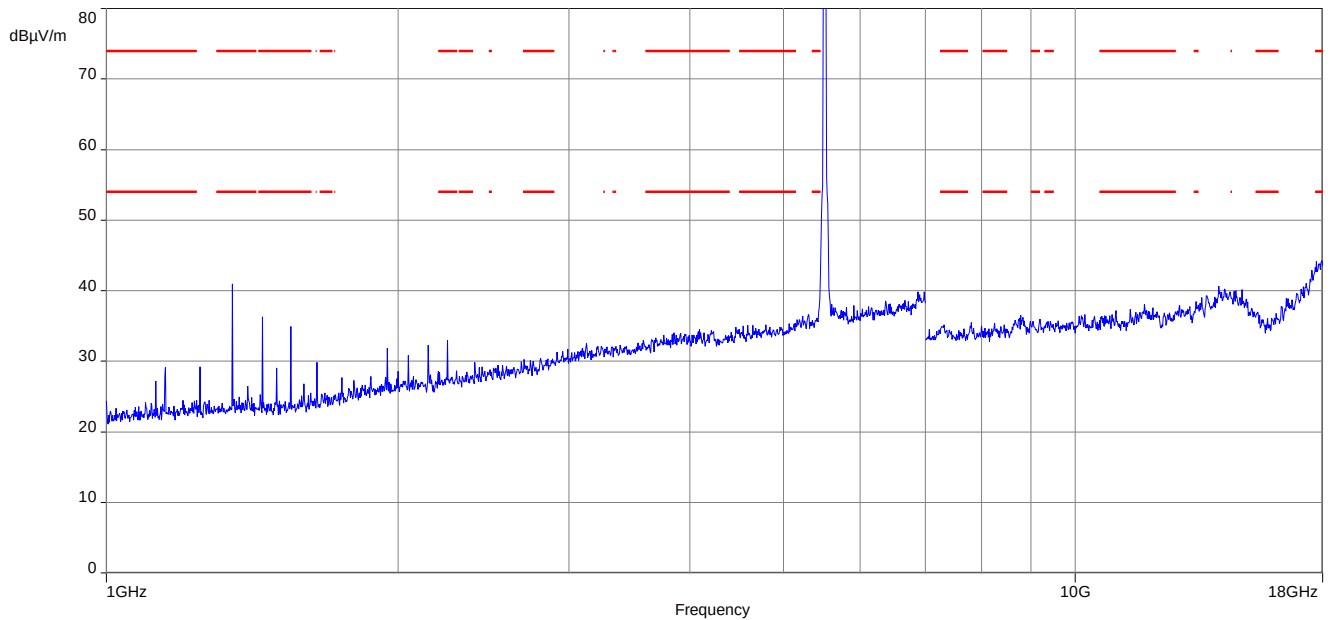
Plot 3: 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-2A; lowest channel



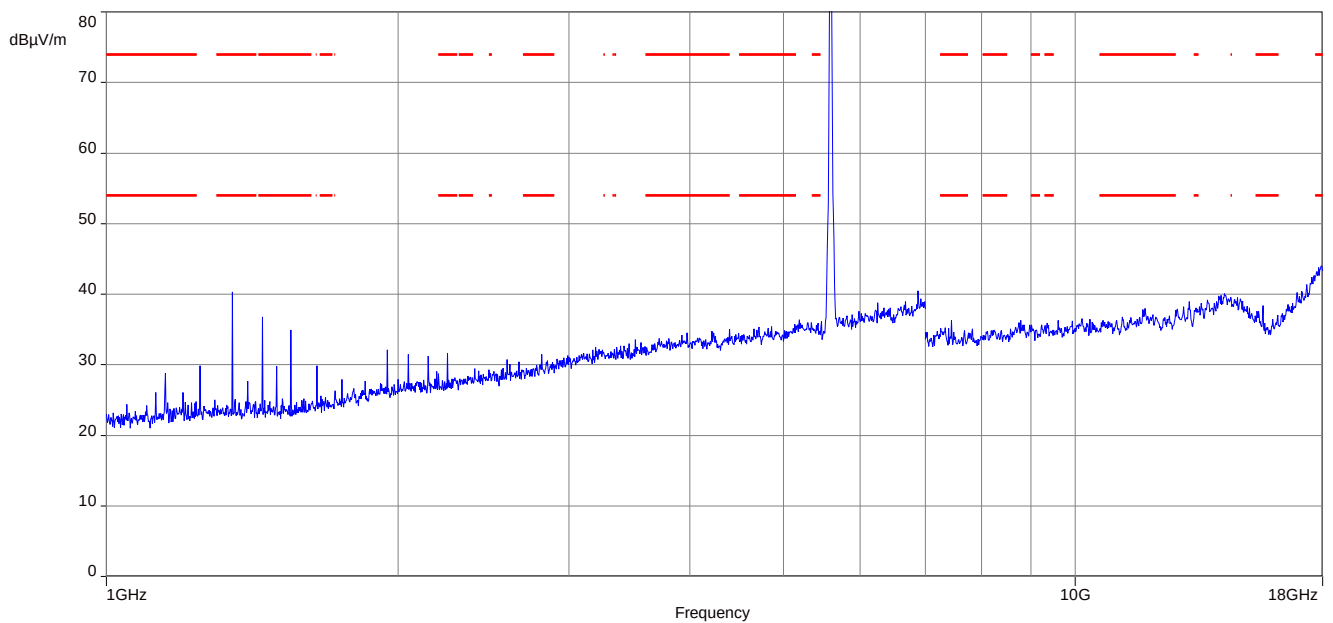
Plot 4: 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-2A; highest channel

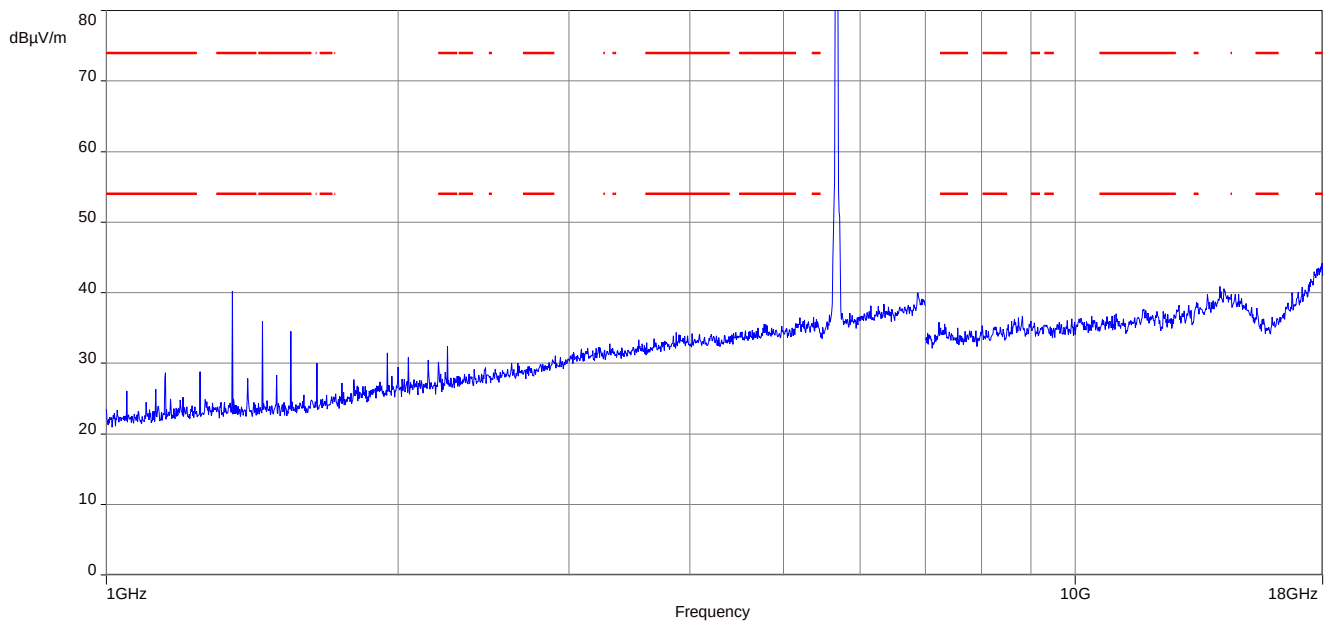
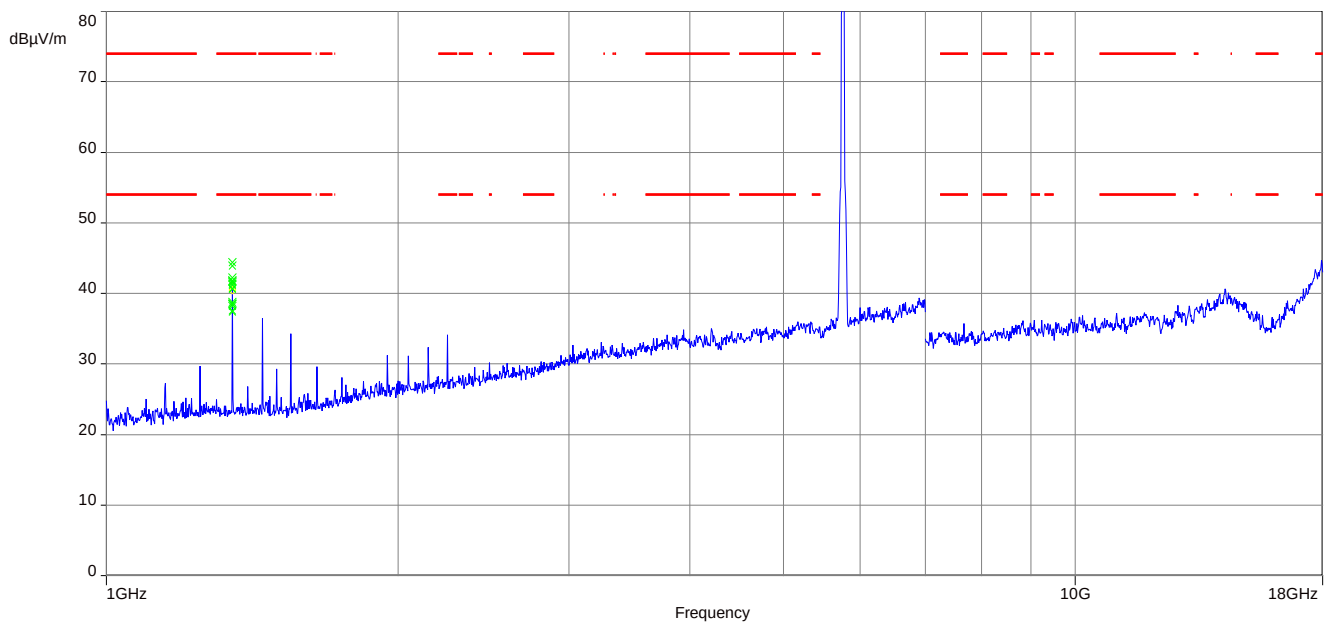


Plot 5: 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-2C; lowest channel

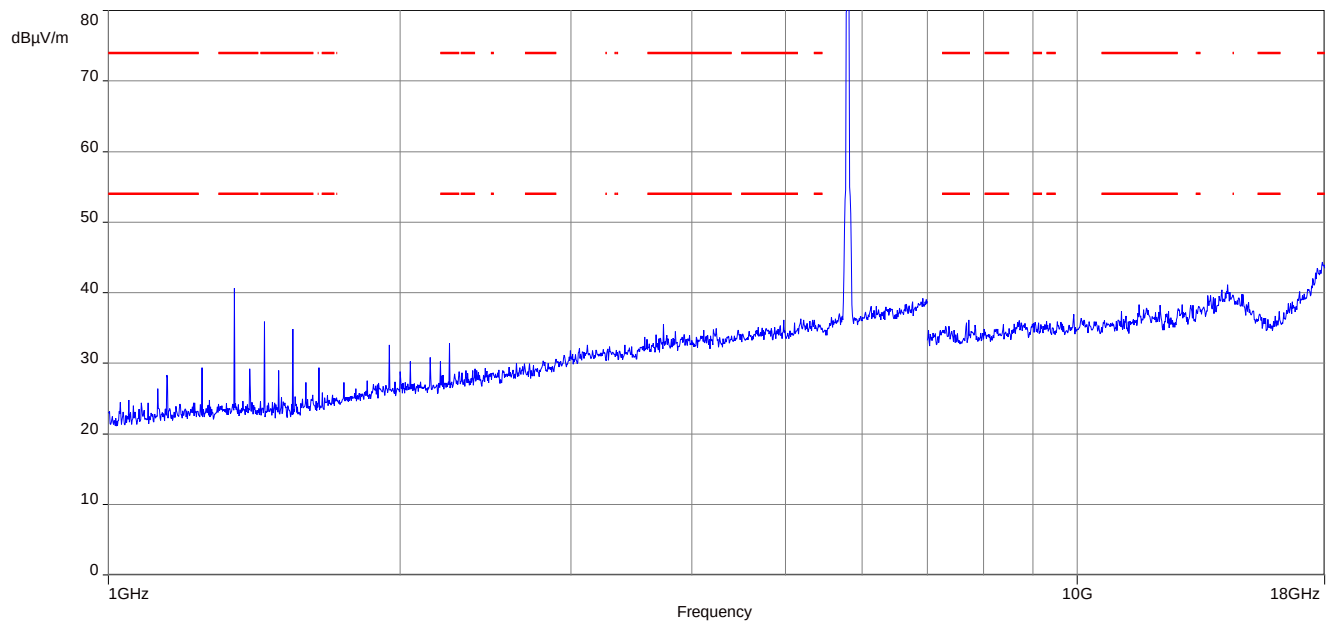


Plot 6: 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-2C; middle channel



Plot 7: 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-2C; highest channel**Plot 8:** 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-3; lowest channel

Plot 9: 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-3; highest channel



13 Glossary

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

14 Document history

Version	Applied changes	Date of release
-/-	Initial release	2022-09-28

15 Accreditation Certificate – D-PL-12076-01-04

first page	last page
 Deutsche Akkreditierungsstelle GmbH Entrusted according to Section 8 subsection 1 AkkStelleG in connection with Section 1 subsection 1 AkkStelleGBV Signatory to the Multilateral Agreements of EA, ILAC and IAF for Mutual Recognition Accreditation  The Deutsche Akkreditierungsstelle GmbH attests that the testing laboratory CTC advanced GmbH Untertürkheimer Straße 6-10, 66117 Saarbrücken is competent under the terms of DIN EN ISO/IEC 17025:2018 to carry out tests in the following fields: Telecommunication (TC) and Electromagnetic Compatibility (EMC) for Canadian Standards The accreditation certificate shall only apply in connection with the notice of accreditation of 09.06.2020 with the accreditation number D-PL-12076-01. It comprises the cover sheet, the reverse side of the cover sheet and the following annex with a total of 07 pages. Registration number of the certificate: D-PL-12076-01-04 Frankfurt am Main, 09.06.2020 by order: Prof.-Ing. (FH) Peter Egner Head of Division The certificate together with its annex reflects the status at the time of the date of issue. The current status of the scope of accreditation can be found in the database of accredited bodies of Deutsche Akkreditierungsstelle GmbH. https://www.dakks.de/en/content/accredited-bodies-dakks See notes on final.	Deutsche Akkreditierungsstelle GmbH Office Berlin Spittelmarkt 10 10117 Berlin Office Frankfurt am Main Europa-Allee 52 60327 Frankfurt am Main Office Braunschweig Bundesallee 100 38116 Braunschweig The publication of extracts of the accreditation certificate is subject to the prior written approval by Deutsche Akkreditierungsstelle GmbH (DAKKS). Exempted is the unchanged form of separate disseminations of the cover sheet by the conformity assessment body mentioned overleaf. No impression shall be made that the accreditation also extends to fields beyond the scope of accreditation attested by DAKKS. The accreditation was granted pursuant to the Act on the Accreditation Body (AkkStelleG) of 31 July 2009 (Federal Law Gazette I p. 2625) and the Regulation (EC) No 765/2008 of the European Parliament and of the Council of 9 July 2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products (Official Journal of the European Union L 218 of 9 July 2008, p. 30). DAKKS is a signatory to the Multilateral Agreements for Mutual Recognition of the European co-operation for Accreditation (EA), International Accreditation Forum (IAF) and International Laboratory Accreditation Cooperation (ILAC). The signatories to these agreements recognise each other's accreditations. The up-to-date state of membership can be retrieved from the following websites: EA: www.european-accreditation.org ILAC: www.ilac.org IAF: www.iaf.nu

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

<https://www.dakks.de/files/data/as/pdf/D-PL-12076-01-04e.pdf>

or

https://ctcadvanced.com/app/uploads/2020/06/D-PL-12076-01-04_Canada_TCEMC.pdf

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

first page	last page
 Deutsche Akkreditierungsstelle GmbH Entrusted according to Section 8 subsection 1 AkkStelleG in connection with Section 1 subsection 1 AkkStelleGBV Signatory to the Multilateral Agreements of EA, ILAC and IAF for Mutual Recognition Accreditation  The Deutsche Akkreditierungsstelle GmbH attests that the testing laboratory CTC advanced GmbH Untertürkheimer Straße 6-10, 66117 Saarbrücken is competent under the terms of DIN EN ISO/IEC 17025:2018 to carry out tests in the following fields: Telecommunication (FCC Requirements) The accreditation certificate shall only apply in connection with the notice of accreditation of 09.06.2020 with the accreditation number D-PL-12076-01. It comprises the cover sheet, the reverse side of the cover sheet and the following annex with a total of 05 pages. Registration number of the certificate: D-PL-12076-01-05 Frankfurt am Main, 09.06.2020 by order: Dipl.-Ing. (FH) Prof. Dr. Egner Head of Division The certificate together with its annex reflects the status at the time of the date of issue. The current status of the scope of accreditation can be found in the database of accredited bodies of Deutsche Akkreditierungsstelle GmbH. https://www.dakks.de/en/content/accredited-bodies-dakks See notes involved.	Deutsche Akkreditierungsstelle GmbH Office Berlin Spittelmarkt 10 10117 Berlin Office Frankfurt am Main Europa-Allee 52 60327 Frankfurt am Main Office Braunschweig Bundesallee 100 38116 Braunschweig The publication of extracts of the accreditation certificate is subject to the prior written approval by Deutsche Akkreditierungsstelle GmbH (DAkkS). Exempted is the unchanged form of separate disseminations of the cover sheet by the conformity assessment body mentioned overleaf. No impression shall be made that the accreditation also extends to fields beyond the scope of accreditation attested by DAkkS. The accreditation was granted pursuant to the Act on the Accreditation Body (AkkStelleG) of 31 July 2009 (Federal Law Gazette I p. 2625) and the Regulation (EC) No 765/2008 of the European Parliament and of the Council of 9 July 2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products (Official Journal of the European Union L 218 of 9 July 2008, p. 30). DAkkS is a signatory to the Multilateral Agreements for Mutual Recognition of the European co-operation for Accreditation (EA), International Accreditation Forum (IAF) and International Laboratory Accreditation Cooperation (ILAC). The signatories to these agreements recognise each other's accreditations. The up-to-date state of membership can be retrieved from the following websites: EA: www.european-accreditation.org ILAC: www.ilac.org IAF: www.iaf.nu

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

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

or

https://ctcadvanced.com/app/uploads/2020/06/D-PL-12076-01-05_TCB_USA.pdf

END OF TEST REPORT