



TEST REPORT

BNetzA-CAB-02/21-102

Test report no.: 1-9148/19-01-03

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: <http://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 (2005) 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 Group

9 Avenue de la Gare Rovaltain

26958 Valence Cedex 9 / FRANCE

Phone: -/-

Contact: Georges Allemand

e-mail: georges.allemand@ingenico.com

Phone: +33 4 75 84 20 14

Manufacturer

Ingenico Group

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: **Lane/3000 CL/Eth/WiFi/BT**
FCC ID: **XKB-L3000CLWIBT**
IC: **2586D-L3000CLWIBT**
Frequency: DTS band 2400 MHz to 2483.5 MHz
Technology tested: WLAN
Antenna: Integrated antenna
Power supply: 8 V DC / 115 V AC by mains adapter PSC16A-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:

Marco Bertolino
Lab Manager
Radio Communications & EMC

Test performed:

Mihail Dorongovskij
Lab Manager
Radio Communications & EMC

1 Table of contents

1	Table of contents	2
2	General information	4
2.1	Notes and disclaimer	4
2.2	Application details	4
2.3	Test laboratories sub-contracted	4
3	Test standard/s, references and accreditations	5
4	Test environment	6
5	Test item	6
5.1	General description	6
5.2	Additional information	6
6	Description of the test setup.....	7
6.1	Shielded semi anechoic chamber	8
6.2	Shielded fully anechoic chamber.....	10
6.3	Radiated measurements > 18 GHz.....	12
6.4	AC conducted	13
6.5	Conducted measurements with peak power meter & spectrum analyzer	14
7	Sequence of testing	15
7.1	Sequence of testing radiated spurious 9 kHz to 30 MHz	15
7.2	Sequence of testing radiated spurious 30 MHz to 1 GHz	16
7.3	Sequence of testing radiated spurious 1 GHz to 18 GHz	17
7.4	Sequence of testing radiated spurious above 18 GHz	18
8	Measurement uncertainty	19
9	Summary of measurement results	20
10	Additional information and comments	21
11	Additional EUT parameter	23
12	Measurement results.....	24
12.1	Antenna gain.....	24
12.2	Identify worst case data rate	25
12.3	Maximum output power.....	26
12.4	Duty cycle	28
12.5	Peak power spectral density	29
12.6	6 dB DTS bandwidth	31
12.7	Occupied bandwidth – 99% emission bandwidth	33
12.8	Occupied bandwidth – 20 dB bandwidth	35
12.9	Band edge compliance conducted	37
12.10	Spurious emissions conducted	39
12.11	Spurious emissions radiated below 30 MHz.....	44
12.12	Spurious emissions radiated 30 MHz to 1 GHz	51
12.13	Spurious emissions radiated above 1 GHz	62
12.14	Spurious emissions conducted below 30 MHz (AC conducted).....	75

13	Observations.....	77
Annex A	Glossary.....	78
Annex B	Document history	79
Annex C	Accreditation Certificate – D-PL-12076-01-04.....	79
Annex D	Accreditation Certificate – D-PL-12076-01-05.....	80

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.

The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CTC advanced GmbH.

The testing service provided by CTC advanced GmbH has been rendered under the current "General Terms and Conditions for CTC advanced GmbH".

CTC advanced GmbH will not be liable for any loss or damage resulting from false, inaccurate, inappropriate or incomplete product information provided by the customer.

Under no circumstances does the CTC advanced GmbH test report include any endorsement or warranty regarding the functionality, quality or performance of any other product or service provided.

Under no circumstances does the CTC advanced GmbH test report include or imply any product or service warranties from CTC advanced GmbH, including, without limitation, any implied warranties of merchantability, fitness for purpose, or non-infringement, all of which are expressly disclaimed by CTC advanced GmbH.

All rights and remedies regarding vendor's products and services for which CTC advanced GmbH has prepared this test report shall be provided by the party offering such products or services and not by CTC advanced GmbH. In no case this test report can be considered as a Letter of Approval.

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

2.2 Application details

Date of receipt of order:	2019-12-09
Date of receipt of test item:	2020-01-14
Start of test:	2020-01-14
End of test:	2020-02-04
Person(s) present during the test:	-/-



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	March 2019	Spectrum Management and Telecommunications Radio Standards Specification - General Requirements for Compliance of Radio Apparatus

Guidance	Version	Description
KDB 558074 D01	v05r02	GUIDANCE FOR COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEM, FREQUENCY HOPPING SPREAD SPECTRUM SYSTEM, AND HYBRID SYSTEM DEVICES OPERATING UNDER SECTION 15.247 OF THE FCC RULES
ANSI C63.4-2014	-/-	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10-2013	-/-	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

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

4 Test environment

Temperature	:	T_{nom} +24 °C during room temperature tests T_{max} No tests under extreme temperature conditions required. T_{min} No tests under extreme temperature conditions required.
Relative humidity content	:	46 %
Barometric pressure	:	1014 hpa
Power supply	:	V_{nom} 8 V DC / 115 V AC by mains adapter PSC16A-080L6 V_{max} No tests under extreme voltage conditions required. V_{min} No tests under extreme voltage conditions required.

5 Test item

5.1 General description

Kind of test item	:	Payment Terminal
Model name	:	Lane/3000 CL/Eth/WiFi/BT
HMN	:	n/a
PMN	:	Lane/3000
HVIN	:	Lane/3000 CL/Eth/WiFi/BT
FVIN	:	n/a
S/N serial number	:	Radiated unit: 181397313011070602695494 Conducted unit: 181397313011070602695500
Hardware status	:	01
Software status	:	OS Version 038605/ Appli Version 010299
Firmware status	:	-/-
Frequency band	:	DTS 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
Number of channels	:	11
Antenna	:	Integrated antenna
Power supply	:	8 V DC / 115 V AC by mains adapter PSC16A-080L6
Temperature range	:	0°C to +40°C

5.2 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:

- 1-9148/19-01-01_AnnexA
- 1-9148/19-01-01_AnnexB
- 1-9148/19-01-01_AnnexD

6 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).

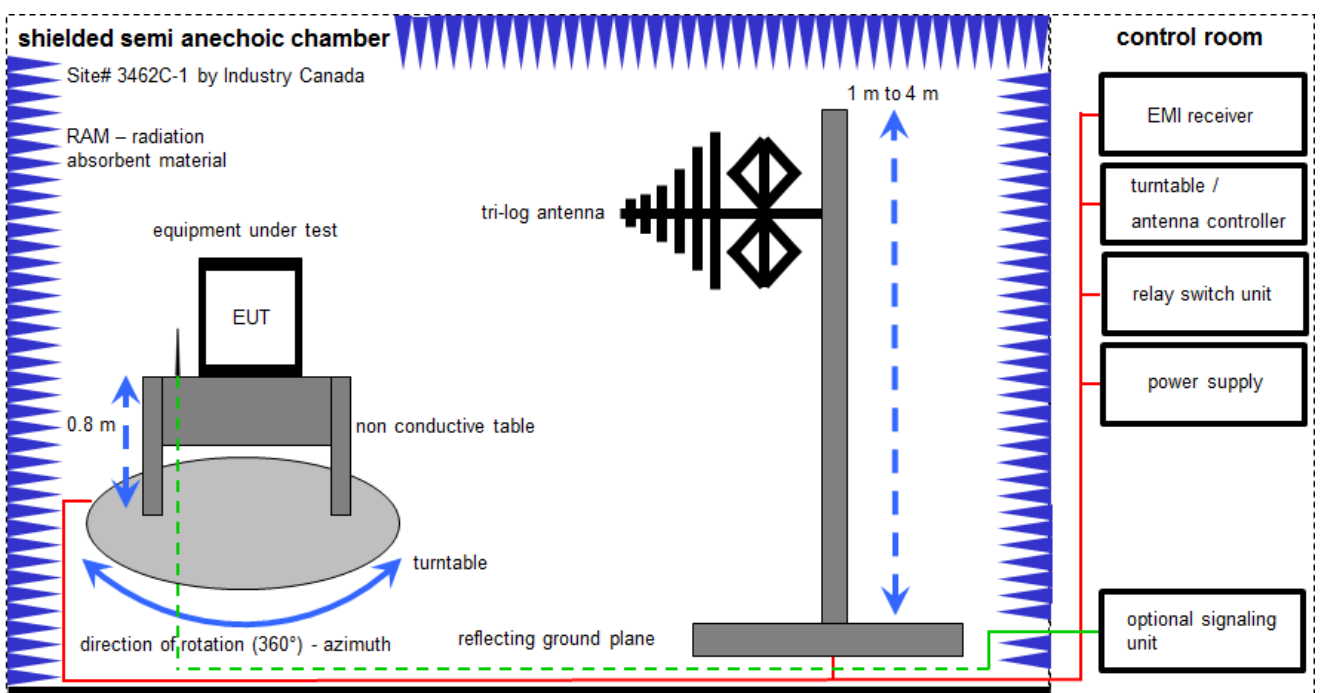
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

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

6.1 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: 10.30.0

$$FS = UR + CL + AF$$

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

Example calculation:

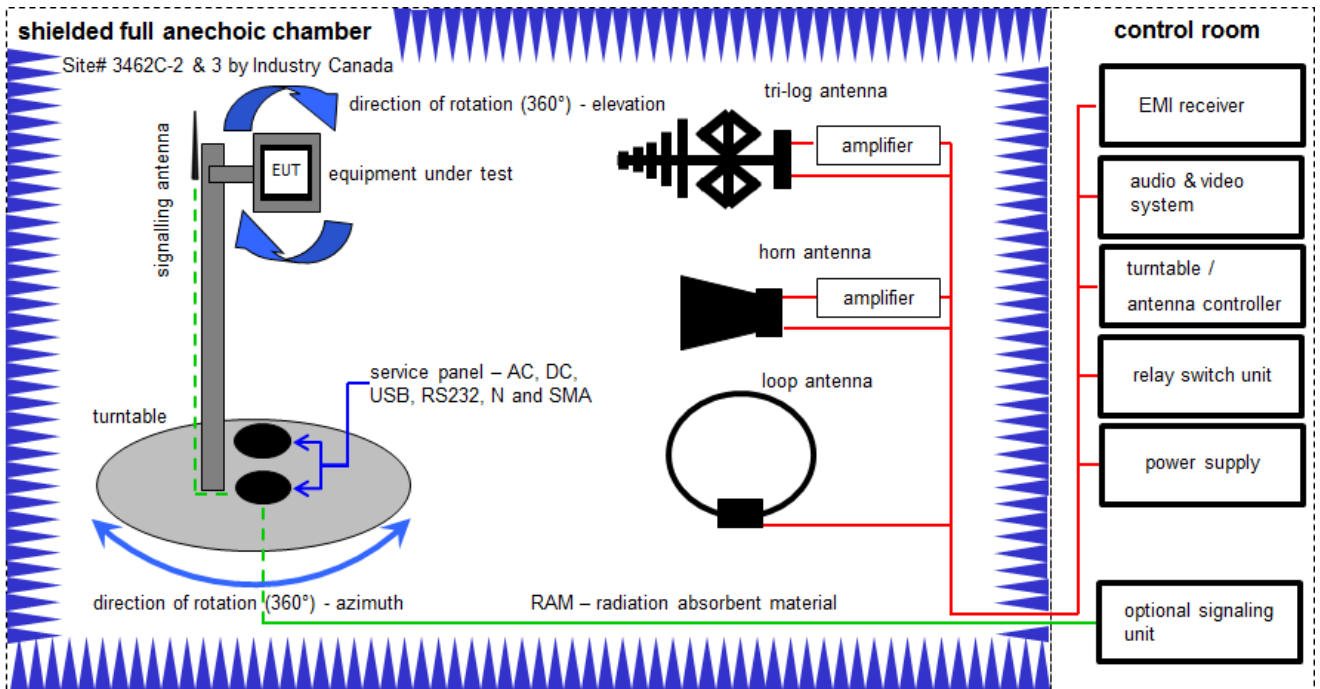
$$FS \text{ [dB}\mu\text{V/m]} = 12.35 \text{ [dB}\mu\text{V/m]} + 1.90 \text{ [dB]} + 16.80 \text{ [dB/m]} = 31.05 \text{ [dB}\mu\text{V/m]} \text{ (35.69 } \mu\text{V/m)}$$

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Switch-Unit	3488A	HP	2719A14505	300000368	ev	-/-	-/-
2	A	Meßkabine 1	HF-Absorberhalle	MWB AG 300023	-/-	300000551	ne	-/-	-/-
3	A	Analyzer-Reference-System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	vKI!	15.01.2018	14.01.2020
4	A	Analyzer-Reference-System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	vKI!	17.01.2020	16.01.2022
5	A	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw	-/-	-/-
6	A	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw	-/-	-/-

7	A	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw	-/-	-/-
8	A	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck Mess - Elektronik	295	300003787	vIK!	19.02.2019	18.02.2021
9	A	EMI Test Receiver	ESR3	Rohde & Schwarz	102587	300005771	k	21.05.2019	20.05.2020

6.2 Shielded fully anechoic chamber



Measurement distance: tri-log antenna and horn antenna 3 meter; loop antenna 3 meter

FS = UR + CA + AF

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

Example calculation:

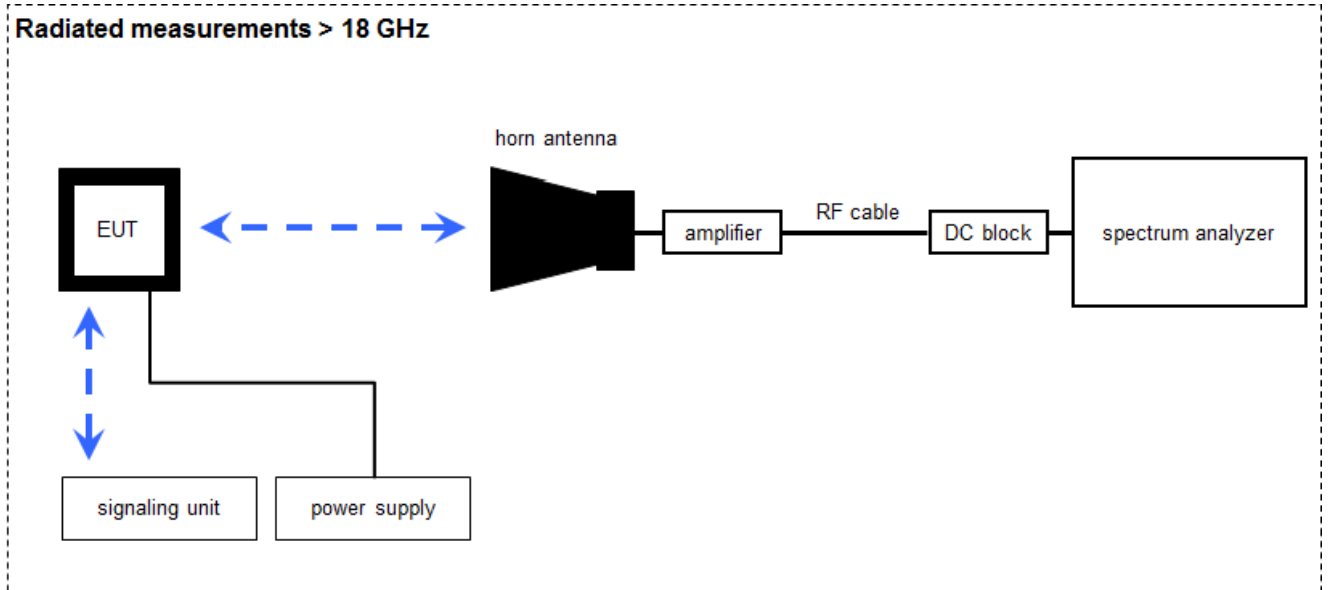
FS [dBµV/m] = 40.0 [dBµV/m] + (-35.8) [dB] + 32.9 [dB/m] = 37.1 [dBµV/m] (71.61 µV/m)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	C	Active Loop Antenna 9 kHz to 30 MHz	6502	EMCO	2210	300001015	vKI!	13.06.2019	12.06.2021
2	A, B, C	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
3	A, B	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	9107-3697	300001605	vKI!	27.02.2019	26.02.2021
4	A, B, C	Switch / Control Unit	3488A	HP	*	300000199	ne	-/-	-/-
5	A, B, C	Variable isolating transformer	MPL IEC625 Bus Variable isolating transformer	Erfi	91350	300001155	ne	-/-	-/-
6	A	Band Reject filter	WRCG2400/2483-2375/2505-50/10SS	Wainwright	11	300003351	ev	-/-	-/-
7	A, B, C	EMI Test Receiver 20Hz- 26,5GHz	ESU26	R&S	100037	300003555	k	11.12.2019	10.12.2020
8	A	Highpass Filter	WHK1.1/15G-10SS	Wainwright	3	300003255	ev	-/-	-/-
9	A	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	19	300003790	ne	-/-	-/-
10	A	Broadband Amplifier 0.5-18 GHz	CBLU5184540	CERNEX	22049	300004481	ev	-/-	-/-
11	A, B, C	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne	-/-	-/-

12	A, B, C	NEXIO EMV-Software	BAT EMC V3.19.1.9	EMCO	-/-	300004682	ne	-/-	-/-
13	A, B, C	PC	ExOne	F+W	-/-	300004703	ne	-/-	-/-
14	A	RF-Amplifier	AMF-6F06001800-30-10P-R	NARDA-MITEQ Inc	2011572	300005241	ev	-/-	-/-

6.3 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)

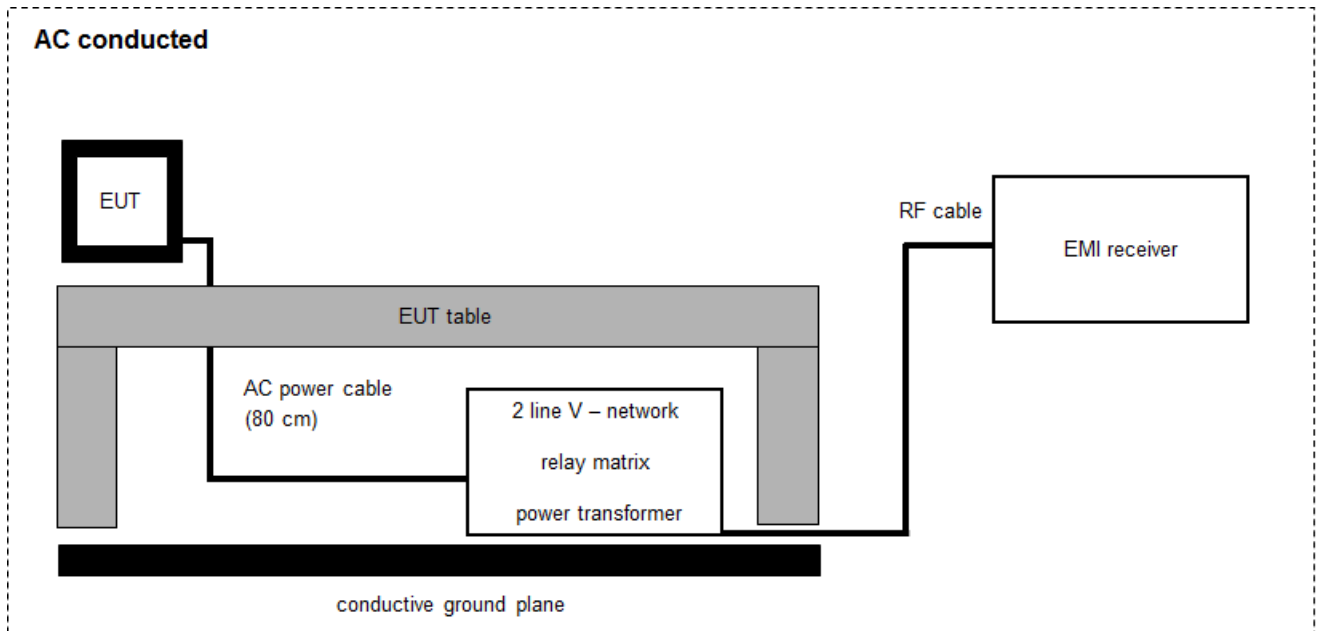
Example calculation:

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

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Microwave System Amplifier, 0.5-26.5 GHz	83017A	HP	00419	300002268	ev	-/-	-/-
2	A	Horn Antenna 18.0-40.0 GHz	LHAF180	Microw.Devel	39180-103-021	300001747	vIKI!	18.02.2019	17.02.2022
3	A	Signal Analyzer 40 GHz	FSV40	R&S	101042	300004517	k	17.12.2019	16.12.2020
4	A	RF-Cable	ST18/SMAm/SMAm /48	Huber & Suhner	Batch no. 600918	400001182	ev	-/-	-/-
5	A	RF-Cable	ST18/SMAm/SMAm /48	Huber & Suhner	Batch no. 127377	400001183	ev	-/-	-/-
6	A	DC-Blocker 0.1-40 GHz	8141A	Inmet	-/-	400001185	ev	-/-	-/-

6.4 AC conducted



$$FS = UR + CF + VC$$

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

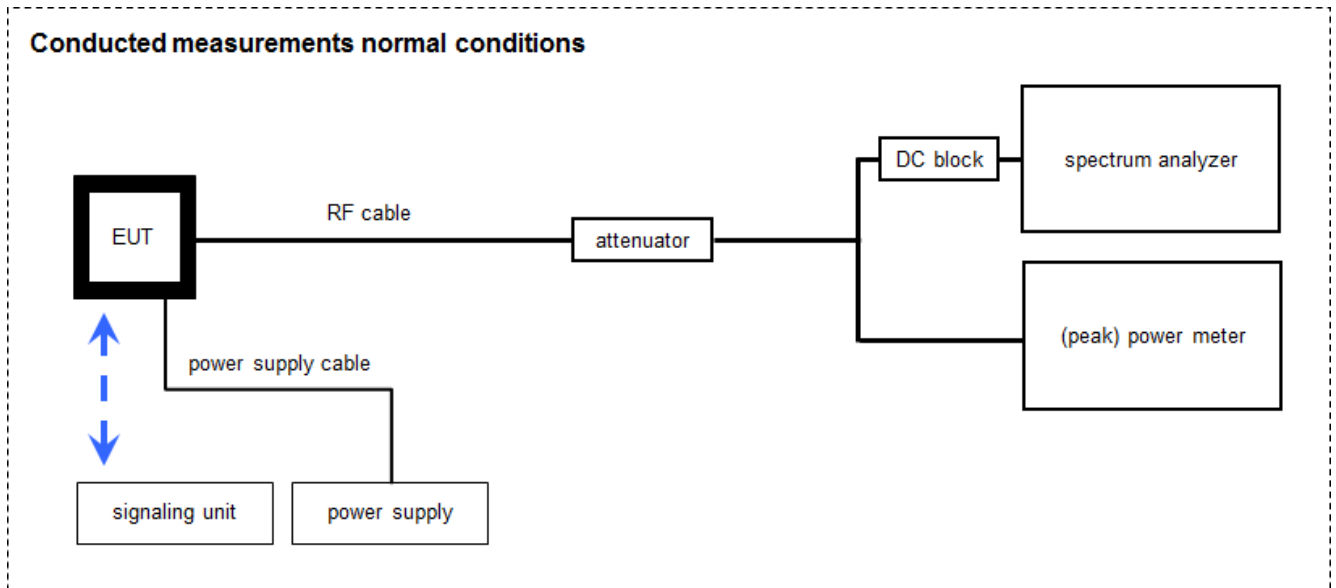
Example calculation:

$$FS [dB\mu V/m] = 37.62 [dB\mu V/m] + 9.90 [dB] + 0.23 [dB] = 47.75 [dB\mu V/m] (244.06 \mu V/m)$$

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Two-line V-Network (LISN) 9 kHz to 30 MHz	ESH3-Z5	R&S	892475/017	300002209	vKI!	11.12.2019	10.12.2021
2	A	RF-Filter-section	85420E	HP	3427A00162	300002214	NK!	-/-	-/-
3	A	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	10.12.2019	09.12.2020
4	A	Hochpass 150 kHz	EZ-25	R&S	100010	300003798	ev	-/-	-/-

6.5 Conducted measurements with peak power meter & spectrum analyzer



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.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Signal Analyzer 40 GHz	FSV40	R&S	101042	300004517	k	17.12.2019	16.12.2020
2	A, B	DC-Blocker 0.1-40 GHz	8141A	Inmet	-/-	400001185	ev	-/-	-/-
3	A, B	Isolating Transformer	RT5A	Grundig	12780	300001166	ev	-/-	-/-
4	A, B	Hygro-Thermometer	-/, 5-45°C, 20-100%rF	Thies Clima	-/-	400000108	ev	11.05.2018	10.05.2020
5	A, B	PC Tester R005	Intel Core i3 3220/3,3 GHz, Prozessor	-/-	2V2403033A45 23	300004589	ne	-/-	-/-
6	A, B	RF-Cable	ST18/SMAM/SMAM /60	Huber & Suhner	Batch no. 606844	400001181	ev	-/-	-/-
7	A, B	Coax Attenuator 10 dB 2W 0-40 GHz	MCL BW-K10-2W44+	Mini Circuits	-/-	400001186	ev	-/-	-/-
8	A, B	DC-Blocker	WA7046	Weinschel Associates	-/-	400001310	ev	-/-	-/-
9	B	USB Wideband Power Sensor (50MHz - 18GHz)	U2021XA	Keysight	MY591900010	300005802	k	11.12.2019	10.12.2020
10	A, B	Tester Software RadioStar	Version 1.0.0.X	CTC advanced GmbH	0001	400001380	ne	-/-	-/-

7 Sequence of testing

7.1 Sequence of testing radiated spurious 9 kHz to 30 MHz

Setup

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

Premeasurement*

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

Final measurement

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

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

7.2 Sequence of testing radiated spurious 30 MHz to 1 GHz

Setup

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

Premeasurement

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

Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximize the peaks by changing turntable position $\pm 45^\circ$ 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.

7.3 Sequence of testing radiated spurious 1 GHz to 18 GHz

Setup

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

Premeasurement

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

Final measurement

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

7.4 Sequence of testing radiated spurious above 18 GHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet.
- The measurement distance is as appropriate (e.g. 0.5 m).
- The EUT is set into operation.

Premeasurement

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

Final measurement

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

8 Measurement uncertainty

Measurement uncertainty		
Test case	Uncertainty	
Antenna gain	± 3 dB	
Power spectral density	± 1.15 dB	
DTS bandwidth	± 100 kHz (depends on the used RBW)	
Occupied bandwidth	± 100 kHz (depends on the used RBW)	
Maximum output power conducted	± 1.15 dB	
Detailed spurious emissions @ the band edge - conducted	± 1.15 dB	
Band edge compliance radiated	± 3 dB	
Spurious emissions conducted	> 3.6 GHz	± 1.15 dB
	> 7 GHz	± 1.15 dB
	> 18 GHz	± 1.89 dB
	≥ 40 GHz	± 3.12 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	

9 Summary of measurement results

<input checked="" type="checkbox"/>	No deviations from the technical specifications were ascertained
<input type="checkbox"/>	There were deviations from the technical specifications ascertained
<input type="checkbox"/>	This test report is only a partial test report. The content and verdict of the performed test cases are listed below.

TC Identifier	Description	Verdict	Date	Remark
RF-Testing	CFR Part 15 RSS - 247, Issue 2	See table!	2020-02-06	-/-

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

Notes:

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

10 Additional information and comments

Reference documents: ICO-OPE-03994 Wifi_labtool_Radio_agreement_procedure.pdf

Co-applicable documents: 1-9148_19-01-03_log1_conducted.pdf

Special test descriptions: None

Configuration descriptions: Used power settings for all tests:

Channel	1	2	3	4	5	6	7	8	9	10	11
11b	18	18	18	18	18	18	18	18	18	18	18
11g	14	15	16	16	16	16	16	16	16	16	14
11n-20	13	15	15	15	15	15	15	15	15	15	14
11n-40			10	11	12	13	13	12	10		

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

Provided channels:

Channels for b-mode:

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 for g-mode:

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 for n HT20-mode:

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 for n HT40-mode:

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.

11 Additional EUT parameter

- Test mode: No test mode available
lperf 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.*

12 Measurement results

12.1 Antenna gain

Description:

The antenna gain of the complete system is calculated by the difference of radiated power (@ 3 MHz) in EIRP and the conducted power (@ 3 MHz) of the module.

Measurement:

Measurement parameter	
Detector	Peak
Sweep time	Auto
Resolution bandwidth	3 MHz
Video bandwidth	3 MHz / 10 MHz
Trace mode	Max hold
Test setup	See chapter 6.2 - B (radiated)
Measurement uncertainty	See chapter 8

Measurement parameters (conducted)	
External result file(s)	1-9148_19-01-03_log1_conducted.pdf
Test setup	See sub clause 6.5 - A
Measurement uncertainty	See sub clause 8

Limits:

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

Results:

	lowest channel	middle channel	highest channel
Conducted power / dBm Measured with DSSS modulation	10.4	10.3	10.4
Radiated power / dBm Measured with DSSS modulation	13.0	14.0	13.4
Gain [dBi] / Calculated	2.6	3.7	3.0

12.2 Identify worst case data rate

Description:

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

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

Measurement:

Measurement parameter	
Detector	Peak
Sweep time	Auto
Resolution bandwidth	3 MHz
Video bandwidth	3 MHz
Trace mode	Max hold
Test setup	See chapter 6.5 - B
Measurement uncertainty	See chapter 8

Results:

Modulation scheme / bandwidth	
DSSS / b – mode	1 Mbit/s
OFDM / g – mode	6 Mbit/s
OFDM / n HT20 – mode	MCS0
OFDM / n HT40 – mode	MCS0

12.3 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)	1-9148_19-01-03_log1_conducted.pdf
Test setup	See chapter 6.5 - B
Measurement uncertainty	See chapter 8

Limits:

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

Results:

	maximum output power / dBm		
	Ch1	Ch6	Ch11
DSSS / b – mode	12.9	12.8	12.7

	maximum output power / dBm					
	Ch1	Ch2	Ch3	Ch6	Ch10	Ch11
OFDM / g – mode	15.8	16.9	16.8	16.7	17.3	15.5

	maximum output power / dBm				
	Ch1	Ch2	Ch6	Ch10	Ch11
OFDM / n HT20 – mode	13.6	15.5	15.1	15.6	14.5

	maximum output power / dBm						
	Ch3	Ch4	Ch5	Ch6	Ch7	Ch8	Ch9
OFDM / n HT40 – mode	10.4	11.9	12.2	12.8	12.5	11.9	10.0

12.4 Duty cycle

Description:

Measurement of the timing behavior.

Measurement:

Measurement parameter	
Detector	Peak
Sweep time	Depends on the signal see plot
Resolution bandwidth	10 MHz
Video bandwidth	10 MHz
Trace mode	Max hold
External result file(s)	1-9148_19-01-03_log1_conducted.pdf
Test setup	See chapter 6.5 - A
Measurement uncertainty	See chapter 8

Limits:

FCC	IC
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

12.5 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. The measurement is repeated for both modulations at the lowest, middle and highest channel.

Measurement:

Measurement parameter	
According to DTS clause: 8.4	
Detector	Positive Peak
Sweep time	Auto
Resolution bandwidth	100 kHz
Video bandwidth	300 kHz
Span	30 MHz
Trace mode	Max. hold (allow trace to fully stabilize)
External result file(s)	1-9148_19-01-03_log1_conducted.pdf
Test setup	See chapter 6.5 - A
Measurement uncertainty	See chapter 8

Limits:

FCC	IC
8 dBm / 3 kHz (conducted)	

Results:

calculated	peak power spectral density / dBm @ 3 kHz		
	Ch1	Ch6	Ch11
DSSS / b – mode	-18.52	-18.64	-17.13

calculated	peak power spectral density / dBm @ 3 kHz					
	Ch1	Ch2	Ch3	Ch6	Ch10	Ch11
OFDM / g – mode	-21.75	-20.21	-19.77	-19.8	-19.07	-21.07

calculated	peak power spectral density / dBm @ 3 kHz				
	Ch1	Ch2	Ch6	Ch10	Ch11
OFDM / n HT20 – mode	-21.59	-19.69	-19.8	-19.07	-20.09

calculated	peak power spectral density / dBm @ 3 kHz						
	Ch3	Ch4	Ch5	Ch6	Ch7	Ch8	Ch9
OFDM / n HT40 – mode	-25.68	-25.84	-25.11	-22.64	-23.05	-24.59	-26.37

12.6 6 dB DTS bandwidth

Description:

Measurement of the 6 dB bandwidth of the modulated signal.

Measurement:

Measurement parameter	
According to DTS clause: 8.2	
Detector	Peak
Sweep time	Auto
Resolution bandwidth	100 kHz
Video bandwidth	500 kHz
Span	30 MHz / 50 MHz
Trace mode	Single count with 200 counts
External result file(s)	1-9148_19-01-03_log1_conducted.pdf
Test setup	See chapter 6.5 - A
Measurement uncertainty	See chapter 8

Limits:

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

Results:

	6 dB DTS bandwidth / kHz		
	Ch1	Ch6	Ch11
DSSS / b – mode	10048	10044	10048

	6 dB DTS bandwidth / kHz					
	Ch1	Ch2	Ch3	Ch6	Ch10	Ch11
OFDM / g – mode	16556	16548	16512	16332	16452	16548

	6 dB DTS bandwidth / kHz				
	Ch1	Ch2	Ch6	Ch10	Ch11
OFDM / n HT20 – mode	17600	17796	17608	17796	17800

	6 dB DTS bandwidth / kHz						
	Ch3	Ch4	Ch5	Ch6	Ch7	Ch8	Ch9
OFDM / n HT40 – mode	36528	36320	36412	36552	36536	36328	36536

12.7 Occupied bandwidth – 99% emission bandwidth

Description:

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

Measurement:

Measurement parameter	
Detector	Peak
Sweep time	Auto
Resolution bandwidth	300 kHz
Video bandwidth	1 MHz
Span	30 MHz / 50 MHz
Measurement procedure	Measurement of the 99% bandwidth using the integration function of the analyzer
Trace mode	Single count with 200 counts
External result file(s)	1-9148_19-01-03_log1_conducted.pdf
Test setup	See chapter 6.5 - A
Measurement uncertainty	See chapter 8

Usage:

-/-	IC
OBW is necessary for Emission Designator	

Results:

	99% emission bandwidth / kHz		
	Ch1	Ch6	Ch11
DSSS / b – mode	13767	13567	13603

	99% emission bandwidth / kHz					
	Ch1	Ch2	Ch3	Ch6	Ch10	Ch11
OFDM / g – mode	17246	17294	17266	17286	17310	17254

	99% emission bandwidth / kHz				
	Ch1	Ch2	Ch6	Ch10	Ch11
OFDM / n HT20 – mode	18182	18218	18214	18230	18206

	99% emission bandwidth / kHz						
	Ch3	Ch4	Ch5	Ch6	Ch7	Ch8	Ch9
OFDM / n HT40 – mode	36948	36956	36948	36972	36956	36956	36940

12.8 Occupied bandwidth – 20 dB bandwidth

Description:

Measurement of the 20 dB bandwidth of the modulated carrier.

Measurement:

Measurement parameter	
Detector	Peak
Sweep time	Auto
Resolution bandwidth	100 kHz
Video bandwidth	500 kHz
Span	30 MHz / 50 MHz
Trace mode	Single count with min. 200 counts
External result file(s)	1-9148_19-01-03_log1_conducted.pdf
Test setup	See chapter 6.5 - A
Measurement uncertainty	See chapter 8

Usage:

-/-	IC
Within the used band!	

Results:

	20 dB bandwidth / MHz		
	Ch1	Ch6	Ch11
DSSS / b – mode	15.956	15.748	15.816

	20 dB bandwidth / MHz					
	Ch1	Ch2	Ch3	Ch6	Ch10	Ch11
OFDM / g – mode	19.668	19.652	19.612	19.664	19.656	19.668

	20 dB bandwidth / MHz				
	Ch1	Ch2	Ch6	Ch10	Ch11
OFDM / n HT20 – mode	19.996	20.012	20.068	20.116	20.028

	20 dB bandwidth / MHz						
	Ch3	Ch4	Ch5	Ch6	Ch7	Ch8	Ch9
OFDM / n HT40 – mode	40.784	40.800	40.816	40.808	40.848	40.800	40.760

12.9 Band edge compliance conducted

Description:

Measurement of the radiated band edge compliance with a conducted test setup.

Measurement:

Measurement parameter for measurements				
According to DTS clause: 8.7.3 and clause 12.2.2				
Detector	RMS			
Sweep time	Auto			
Resolution bandwidth	100 kHz			
Video bandwidth	300 kHz			
Span	2 MHz			
	lower band edge	2388 MHz	to	2390 MHz
	upper band edge	2483.5 MHz	to	2485.5 MHz
Trace mode	Trace average with 200 counts			
External result file(s)	1-9148_19-01-03_log1_conducted.pdf			
Test setup	See chapter 6.5 - A			
Measurement uncertainty	See chapter 8			

Limits:

FCC	IC
-41.26 dBm	

Results:

DSSS / b – mode	band edge compliance / dBm (gain calculation)	
	Ch1	Ch11
Max. lower band edge power conducted	-52.4	-54.9
Antenna gain / dBi	2.6	3.0
Max. lower band edge power radiated	-49.8	-51.9

OFDM / g – mode	band edge compliance / dBm (gain calculation)				
	Ch1	Ch2	Ch3	Ch10	Ch11
Max. lower band edge power conducted	-51.2	-53.4	-52.9	-47.8	-48.9
Antenna gain / dBi	2.6	2.6	2.6	3.0	3.0
Max. lower band edge power radiated	-48.6	-50.8	-50.3	-44.8	-45.9

OFDM / n HT20 – mode	band edge compliance / dBm (gain calculation)			
	Ch1	Ch2	Ch10	Ch11
Max. lower band edge power conducted	-52.1	-53.5	-51.4	-47.9
Antenna gain / dBi	2.6	2.6	3.0	3.0
Max. lower band edge power radiated	-49.5	-50.9	-48.4	-44.9

OFDM / n HT40 – mode	band edge compliance / dBm (gain calculation)					
	Ch3	Ch4	Ch5	Ch7	Ch8	Ch9
Max. lower band edge power conducted	-56.3	-55.8	-56.3	-50.7	-54.0	-55.5
Antenna gain / dBi	2.6	2.6	2.6	3.0	3.0	3.0
Max. lower band edge power radiated	-53.7	-53.2	-53.7	-47.7	-51.0	-52.5

12.10 Spurious emissions conducted

Description:

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

Measurement:

Measurement parameter	
Detector	Peak
Sweep time	Auto
Resolution bandwidth	100 kHz
Video bandwidth	500 kHz
Span	9 kHz to 25 GHz
Trace mode	Max Hold
External result file(s)	1-9148_19-01-03_log1_conducted.pdf
Test setup	See chapter 6.5 - A
Measurement uncertainty	See chapter 8

Limits:

FCC	IC
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: DSSS / b – mode

TX spurious emissions conducted					
f [MHz]		amplitude of emission [dBm]	limit max. allowed emission power	actual attenuation below frequency of operation [dB]	results
Channel 1		-0.29	30 dBm		Operating frequency
No peaks detected			-20 dBc (peak)		compliant
			-30 dBc (average)		
Channel 6		-0.47	30 dBm		Operating frequency
No peaks detected			-20 dBc (peak)		compliant
			-30 dBc (average)		
Channel 11		-0.39	30 dBm		Operating frequency
No peaks detected			-20 dBc (peak)		compliant
			-30 dBc (average)		

Results: OFDM / g – mode

TX spurious emissions conducted					
f [MHz]		amplitude of emission [dBm]	limit max. allowed emission power	actual attenuation below frequency of operation [dB]	results
Channel 1		-7.49	30 dBm		Operating frequency
No peaks detected			-20 dBc (peak) -30 dBc (average)		compliant
Channel 2		-6.18	30 dBm		Operating frequency
No peaks detected			-20 dBc (peak) -30 dBc (average)		compliant
Channel 3		-5.62	30 dBm		Operating frequency
No peaks detected			-20 dBc (peak) -30 dBc (average)		compliant
Channel 6		-6.05			Operating frequency
No peaks detected			-20 dBc (peak) -30 dBc (average)		compliant
Channel 10		-4.95	30 dBm		Operating frequency
No peaks detected			-20 dBc (peak) -30 dBc (average)		compliant
Channel 11		-7.10	30 dBm		Operating frequency
No peaks detected			-20 dBc (peak) -30 dBc (average)		compliant

Results: OFDM / n HT20 – mode;

TX spurious emissions conducted					
f [MHz]		amplitude of emission [dBm]	limit max. allowed emission power	actual attenuation below frequency of operation [dB]	results
Channel 1		-8.29	30 dBm		Operating frequency
No peaks detected			-20 dBc (peak) -30 dBc (average)		compliant
Channel 2		-6.76	30 dBm		Operating frequency
No peaks detected			-20 dBc (peak) -30 dBc (average)		compliant
Channel 6		-6.62	30 dBm		Operating frequency
No peaks detected			-20 dBc (peak) -30 dBc (average)		compliant
Channel 10		-5.83			Operating frequency
No peaks detected			-20 dBc (peak) -30 dBc (average)		compliant
Channel 11		-6.46	30 dBm		Operating frequency
No peaks detected			-20 dBc (peak) -30 dBc (average)		compliant

Results: OFDM / n HT40 – mode

TX spurious emissions conducted					
f [MHz]		amplitude of emission [dBm]	limit max. allowed emission power	actual attenuation below frequency of operation [dB]	results
Channel 3		-14.18	30 dBm		Operating frequency
No peaks detected			-20 dBc (peak) -30 dBc (average)		compliant
Channel 4		-13.04	30 dBm		Operating frequency
No peaks detected			-20 dBc (peak) -30 dBc (average)		compliant
Channel 5		-12.81	30 dBm		Operating frequency
No peaks detected			-20 dBc (peak) -30 dBc (average)		compliant
Channel 6		-11.64			Operating frequency
No peaks detected			-20 dBc (peak) -30 dBc (average)		compliant
Channel 7		-11.46	30 dBm		Operating frequency
No peaks detected			-20 dBc (peak) -30 dBc (average)		compliant
Channel 8		-12.97	30 dBm		Operating frequency
No peaks detected			-20 dBc (peak) -30 dBc (average)		compliant
Channel 9		-14.96			Operating frequency
No peaks detected			-20 dBc (peak) -30 dBc (average)		compliant

12.11 Spurious emissions radiated below 30 MHz

Description:

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

Measurement:

Measurement parameter	
Detector	Peak / Quasi Peak
Sweep time	Auto
Resolution bandwidth	F < 150 kHz: 200 Hz F > 150 kHz: 9 kHz
Video bandwidth	F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz
Span	9 kHz to 30 MHz
Trace mode	Max Hold
Measured modulation	<input checked="" type="checkbox"/> DSSS b – mode <input checked="" type="checkbox"/> OFDM g – mode <input type="checkbox"/> OFDM n HT20 – mode <input checked="" type="checkbox"/> OFDM n HT40 – mode
Test setup	See chapter 6.2 - C
Measurement uncertainty	See chapter 8

Limits:

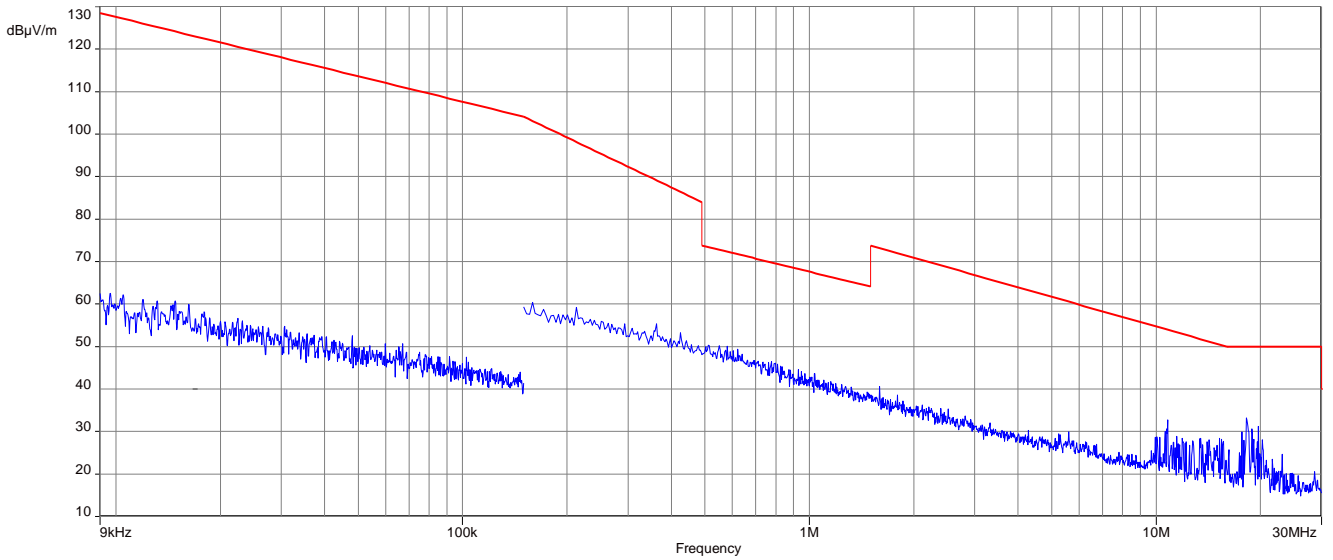
FCC		IC	
Frequency / MHz	Field Strength / (dBµV / m)	Measurement distance / m	
0.009 – 0.490	2400/F(kHz)	300	
0.490 – 1.705	24000/F(kHz)	30	
1.705 – 30.0	30	30	

Results:

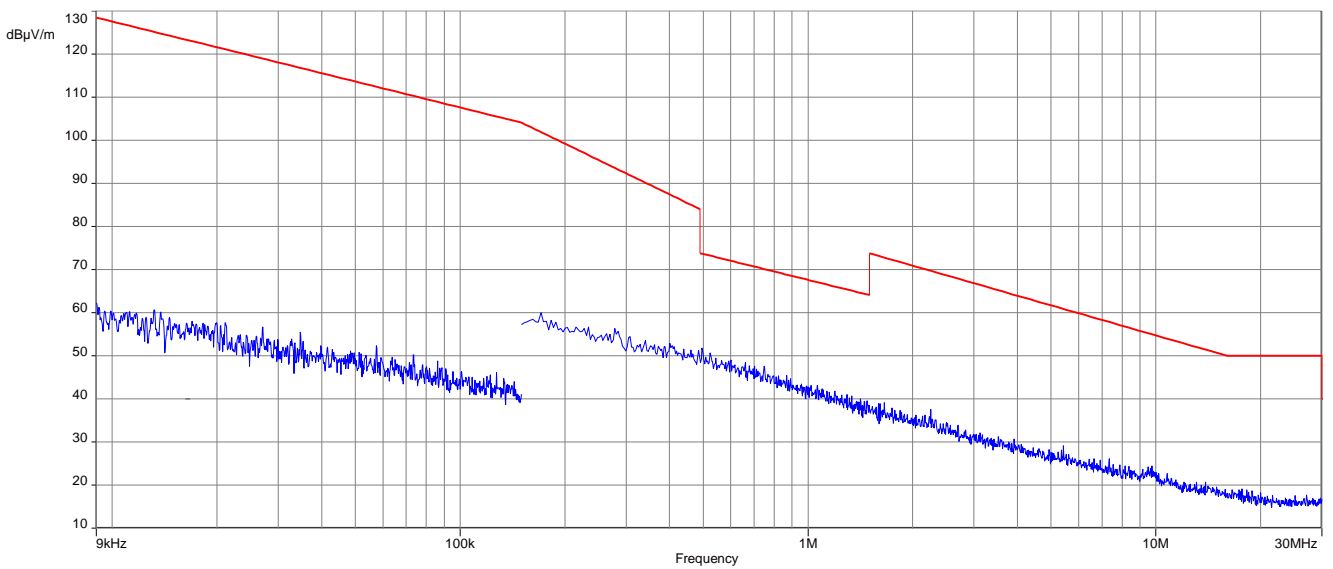
TX spurious emissions radiated < 30 MHz / (dBµV / m) @ 3 m		
Frequency / MHz	Detector	Level / (dBµV / m)
All detected peaks are more than 20 dB below the limit.		

Plots: DSSS

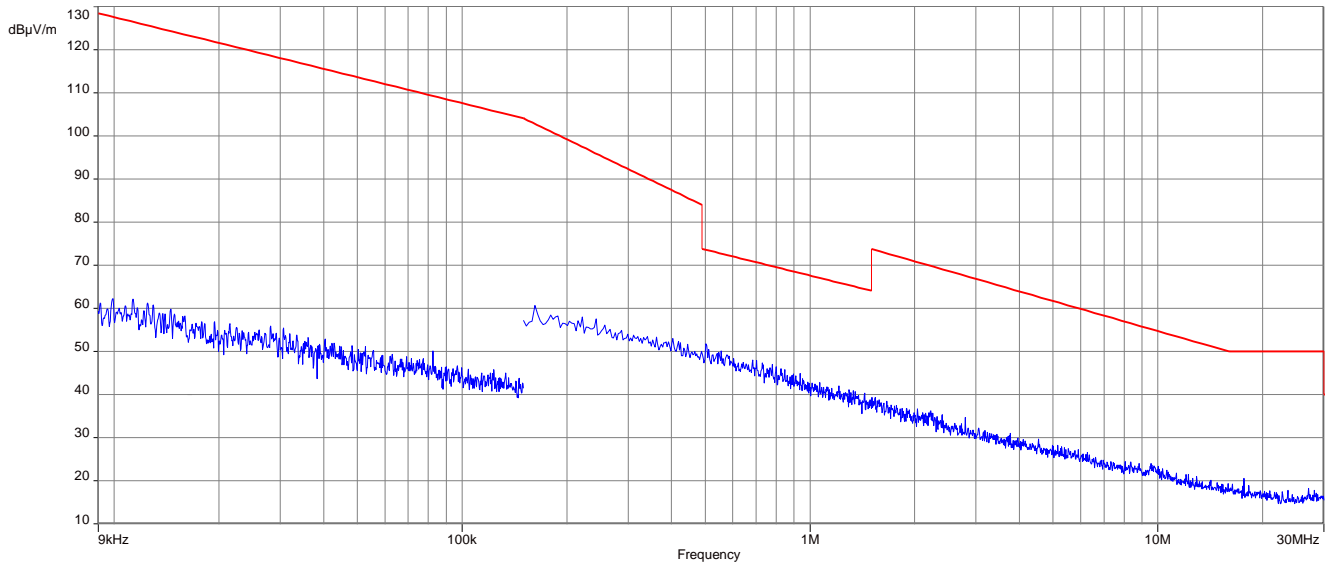
Plot 1: 9 kHz to 30 MHz, lowest channel



Plot 2: 9 kHz to 30 MHz, middle channel

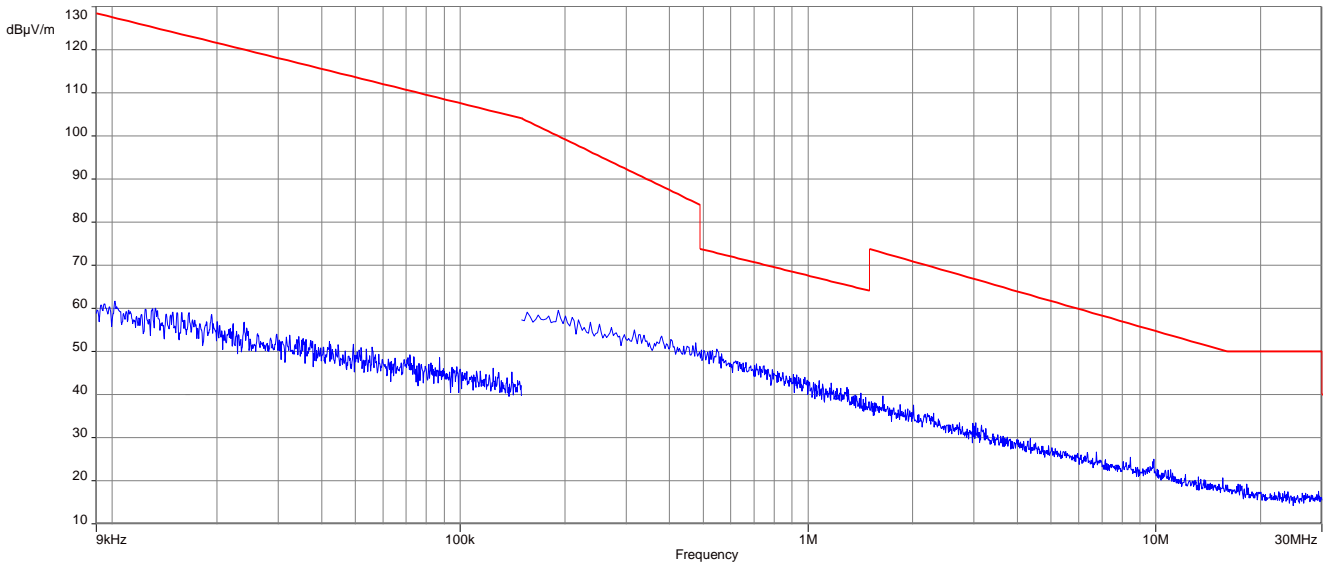


Plot 3: 9 kHz to 30 MHz, highest channel

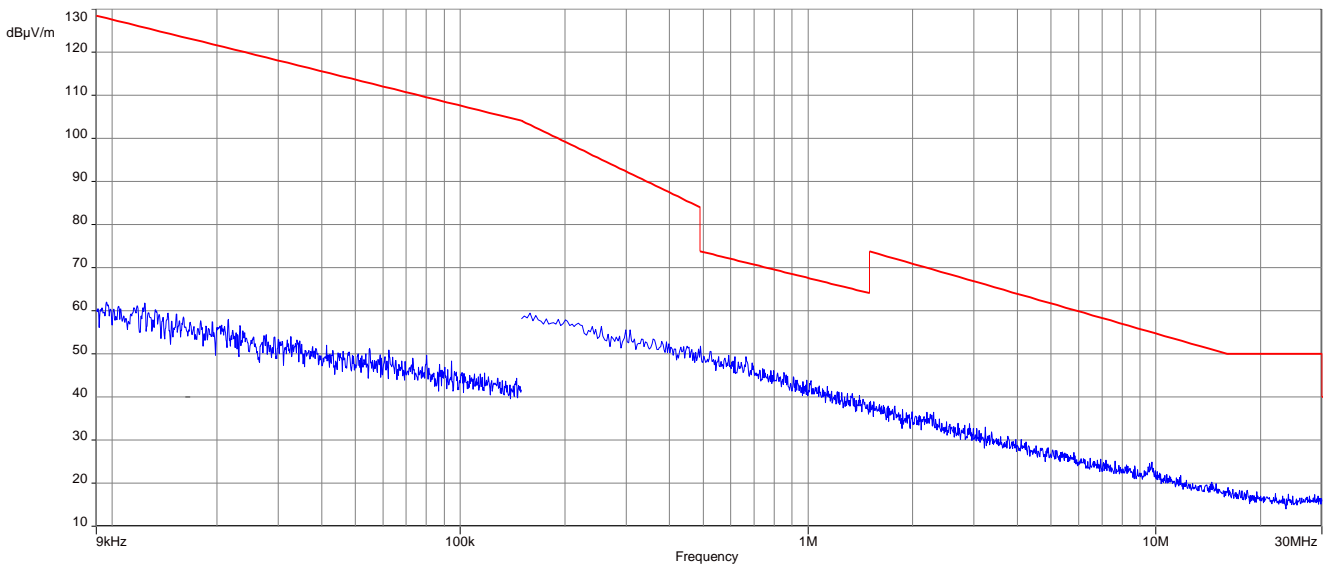


Plots: OFDM (20 MHz nominal channel bandwidth)

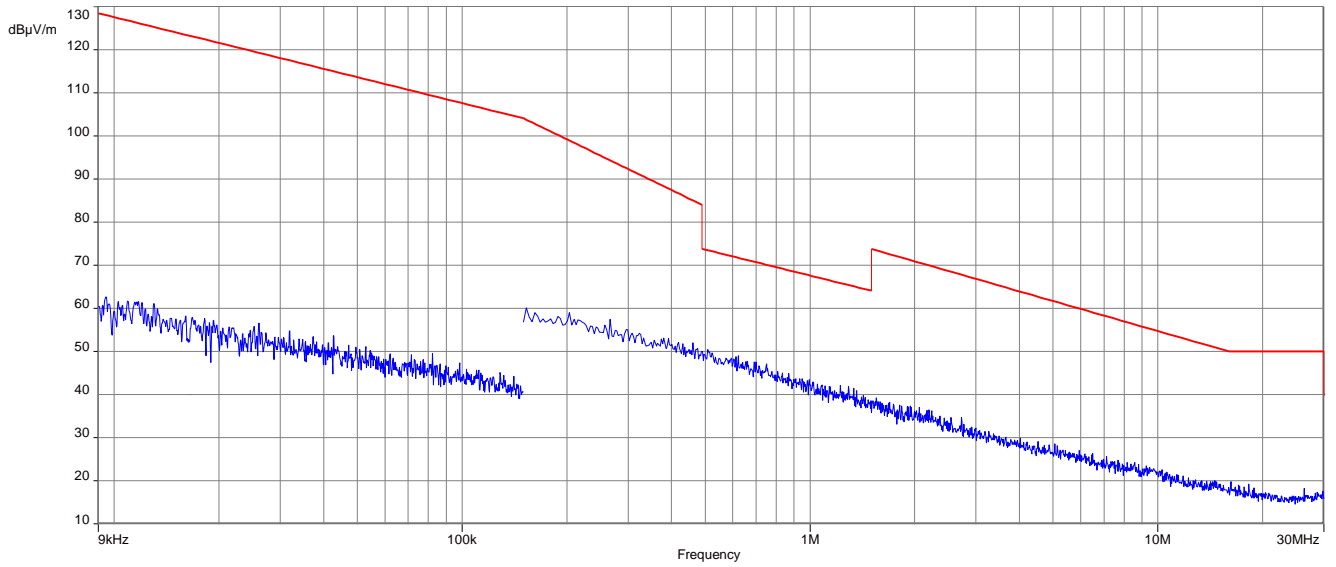
Plot 1: 9 kHz to 30 MHz, lowest channel



Plot 2: 9 kHz to 30 MHz, middle channel

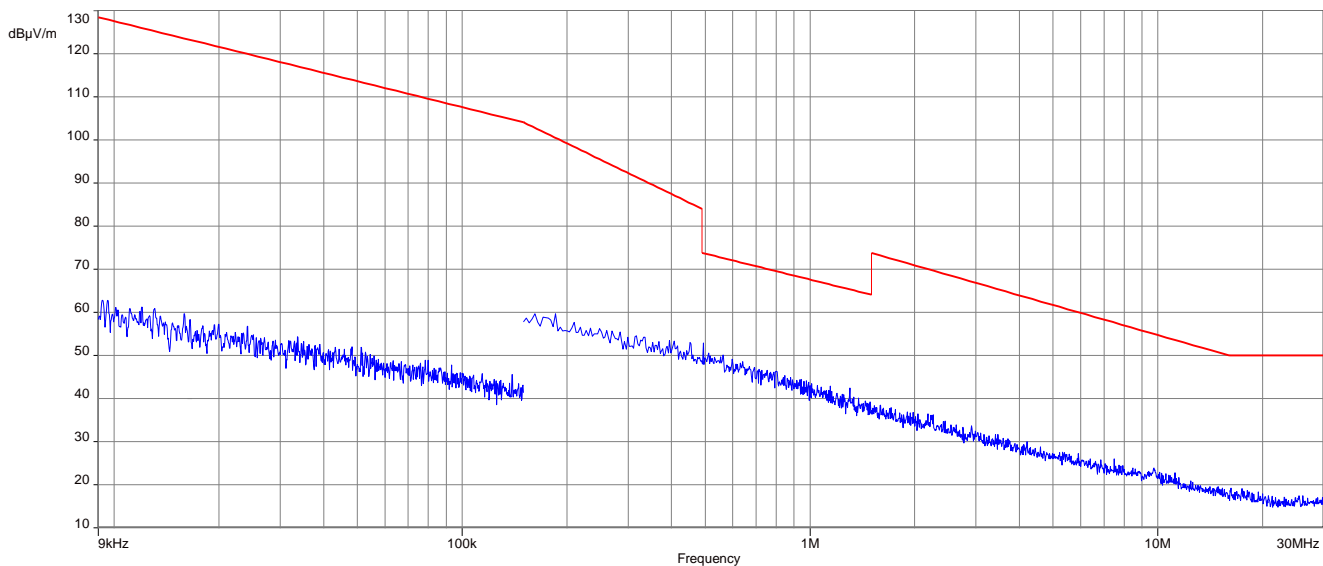


Plot 3: 9 kHz to 30 MHz, highest channel

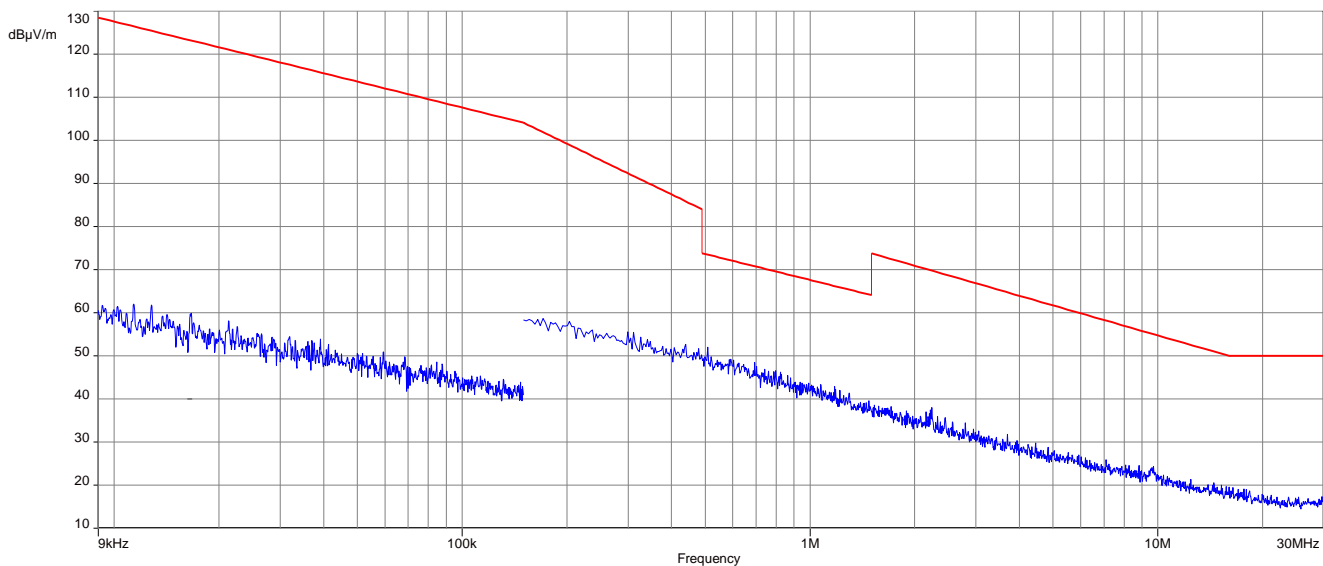


Plots: OFDM (40 MHz nominal channel bandwidth)

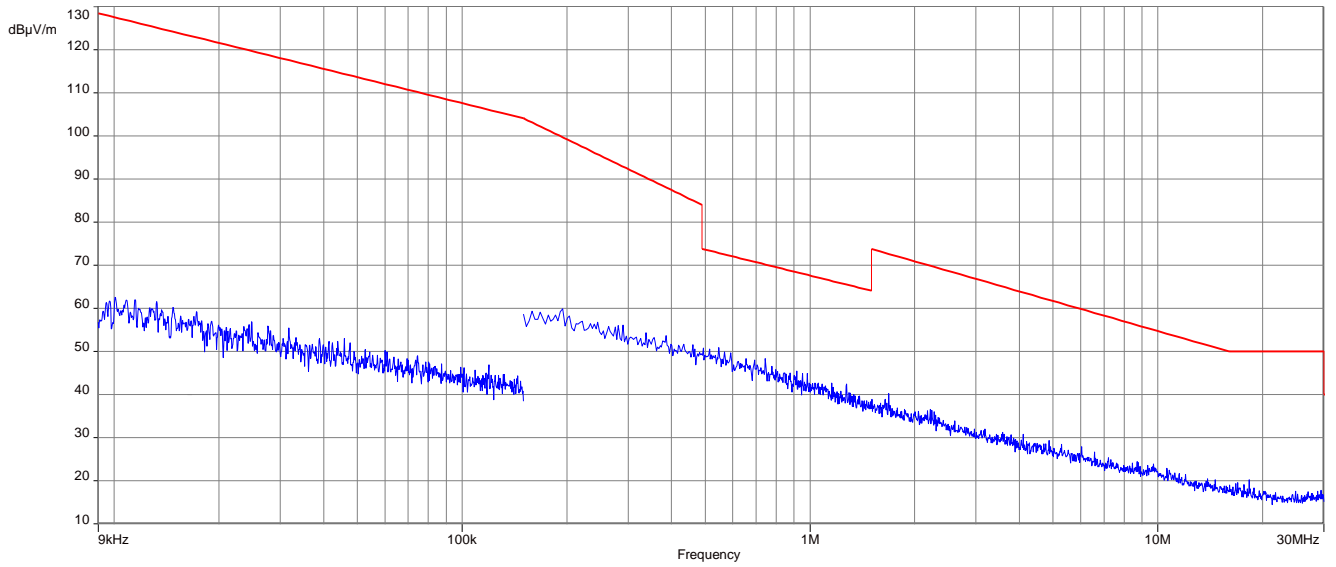
Plot 1: 9 kHz to 30 MHz, lowest channel



Plot 2: 9 kHz to 30 MHz, middle channel



Plot 3: 9 kHz to 30 MHz, highest channel



12.12 Spurious emissions radiated 30 MHz to 1 GHz

Description:

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

Measurement:

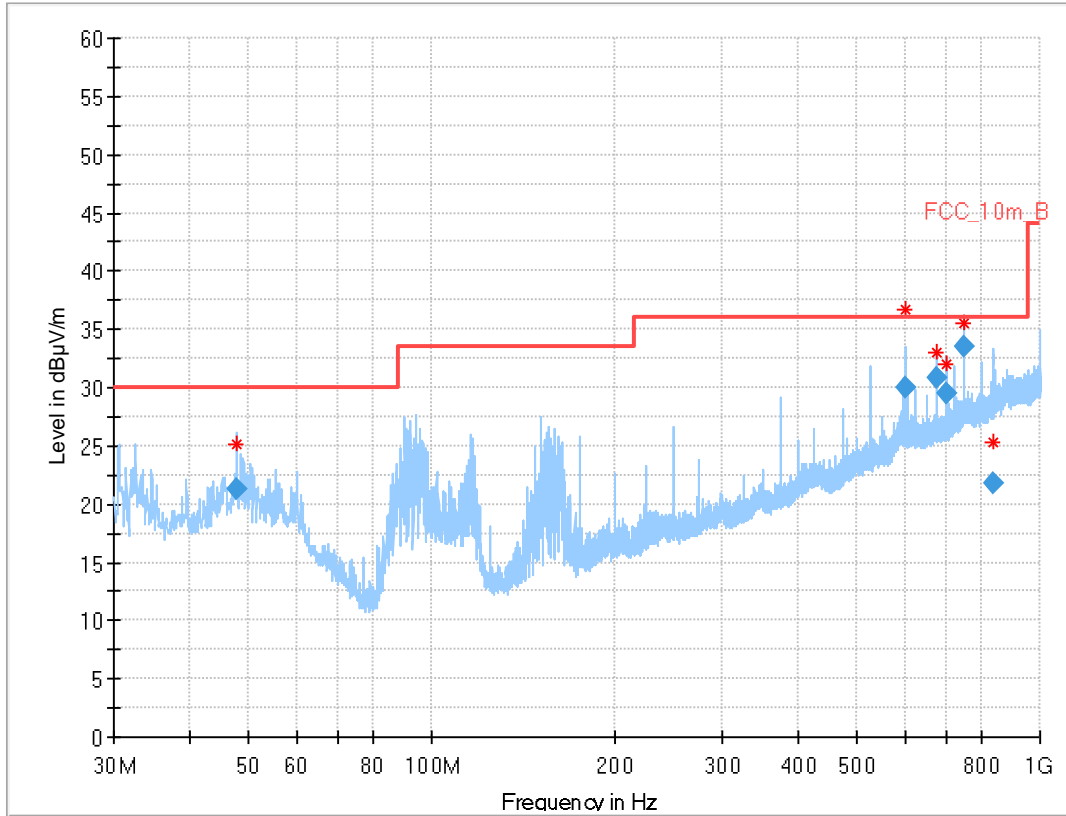
Measurement parameter	
Detector	Peak / Quasi Peak
Sweep time	Auto
Resolution bandwidth	120 kHz
Video bandwidth	3 x RBW
Span	30 MHz to 1 GHz
Trace mode	Max Hold
Measured modulation	<input checked="" type="checkbox"/> DSSS b – mode <input checked="" type="checkbox"/> OFDM g – mode <input type="checkbox"/> OFDM n HT20 – mode <input checked="" type="checkbox"/> OFDM n HT40 – mode <input checked="" type="checkbox"/> RX / Idle – mode
Test setup	See chapter 6.1 - A
Measurement uncertainty	See chapter 8

Limits:

FCC		IC	
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 / (dB μ V / m)	Measurement distance / m	
30 – 88	30.0	10	
88 – 216	33.5	10	
216 – 960	36.0	10	

Plot: DSSS

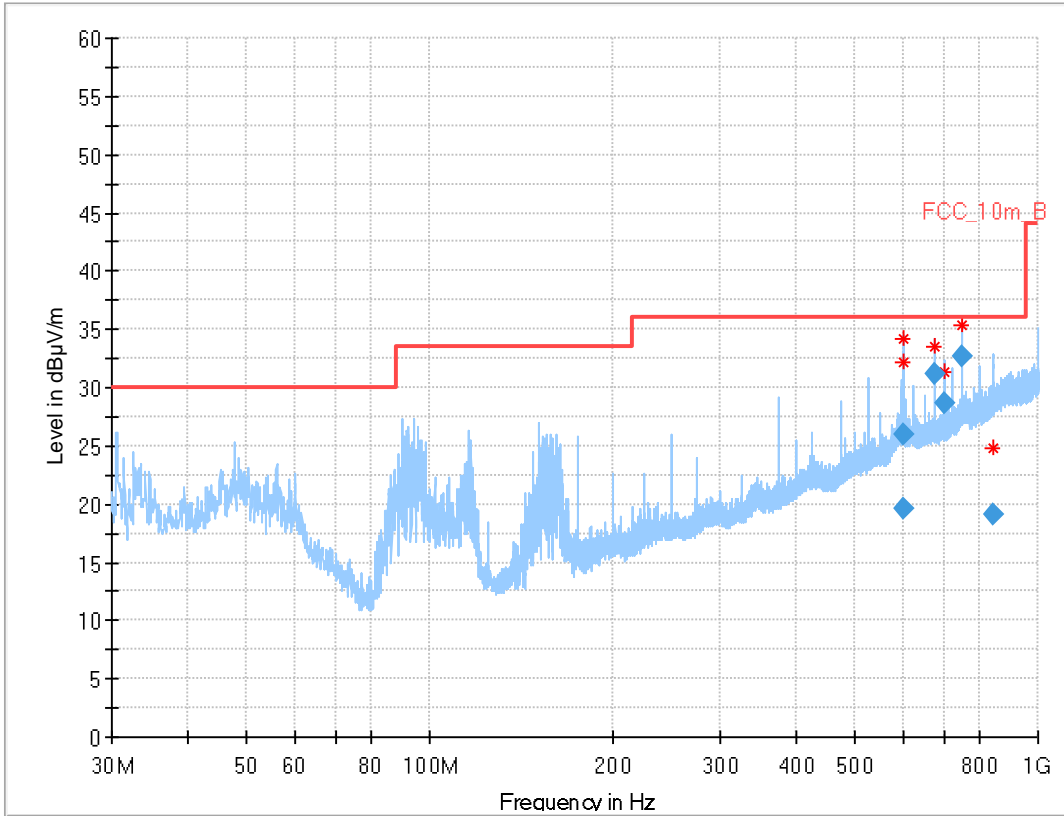
Plot 1: 30 MHz to 1 GHz, vertical & horizontal polarization, lowest channel



Final results:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
47.803	21.29	30.0	8.7	1000	120	98.0	V	100	14
599.999	29.97	36.0	6.0	1000	120	127.0	H	87	20
675.000	30.78	36.0	5.2	1000	120	129.0	H	295	21
699.995	29.53	36.0	6.5	1000	120	136.0	H	313	21
749.995	33.47	36.0	2.5	1000	120	128.0	H	323	22
837.266	21.81	36.0	14.2	1000	120	160.0	H	201	23

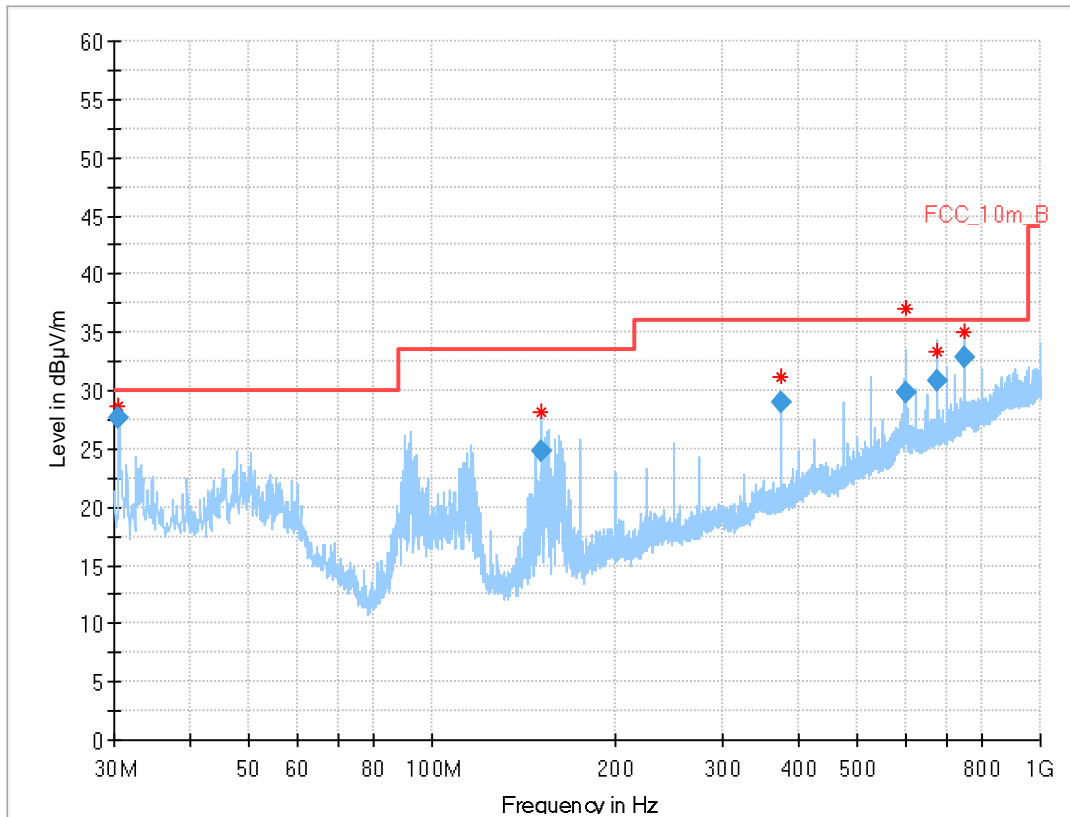
Plot 2: 30 MHz to 1 GHz, vertical & horizontal polarization, middle channel



Final results:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
599.945	26.01	36.0	10.0	1000	120	133.0	H	88	20
601.828	19.67	36.0	16.3	1000	120	151.0	H	88	20
675.003	31.11	36.0	4.9	1000	120	113.0	H	312	21
700.007	28.69	36.0	7.3	1000	120	126.0	H	328	21
750.001	32.74	36.0	3.3	1000	120	136.0	H	318	22
841.889	19.15	36.0	16.9	1000	120	121.0	V	1	23

Plot 3: 30 MHz to 1 GHz, vertical & horizontal polarization, highest channel

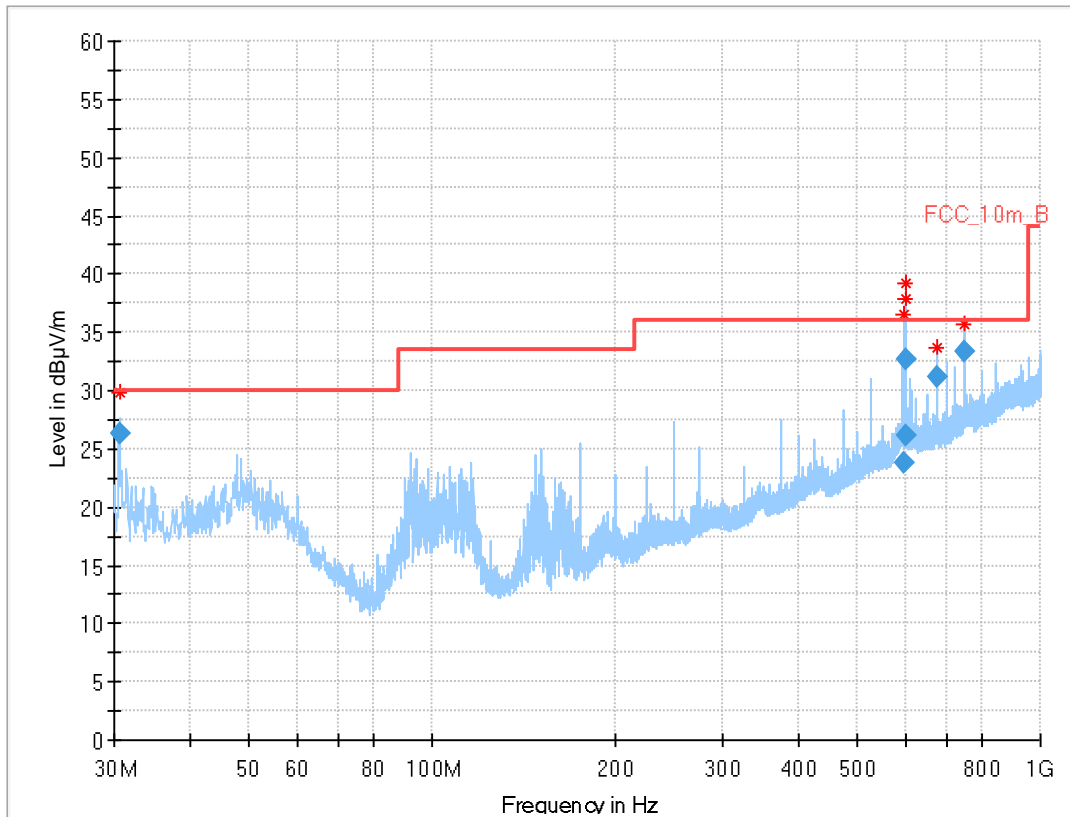


Final results:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.553	27.60	30.0	2.4	1000	120	102.0	V	71	12
151.560	24.86	33.5	8.6	1000	120	152.0	V	284	9
374.988	28.96	36.0	7.0	1000	120	160.0	H	104	16
600.005	29.85	36.0	6.2	1000	120	160.0	H	81	20
674.990	30.88	36.0	5.1	1000	120	160.0	H	301	21
750.001	32.89	36.0	3.1	1000	120	130.0	H	328	22

Plot: OFDM (20 MHz nominal channel bandwidth)

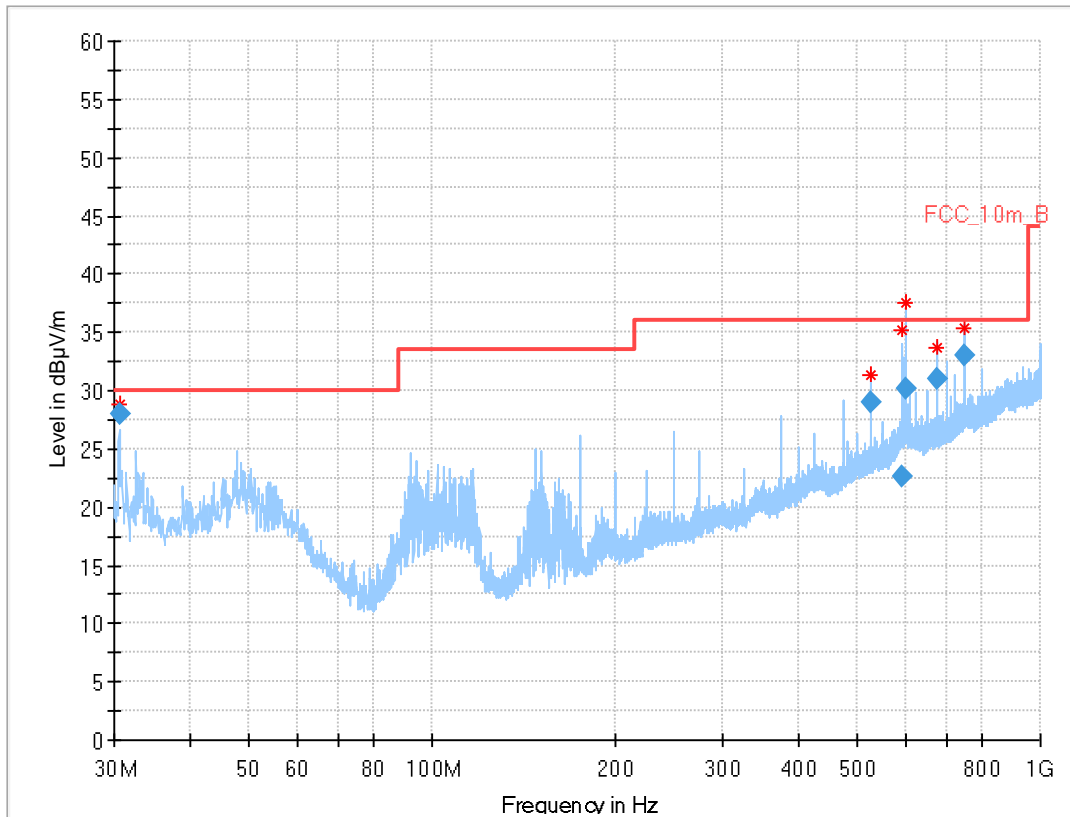
Plot 1: 30 MHz to 1 GHz, vertical & horizontal polarization, lowest channel



Final results:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.604	26.23	30.0	3.8	1000	120	104.0	V	355	12
598.469	23.84	36.0	12.2	1000	120	160.0	H	101	20
600.001	32.64	36.0	3.4	1000	120	160.0	H	101	20
601.685	26.07	36.0	9.9	1000	120	160.0	H	101	20
674.997	31.14	36.0	4.9	1000	120	160.0	H	310	21
749.990	33.31	36.0	2.7	1000	120	131.0	H	327	22

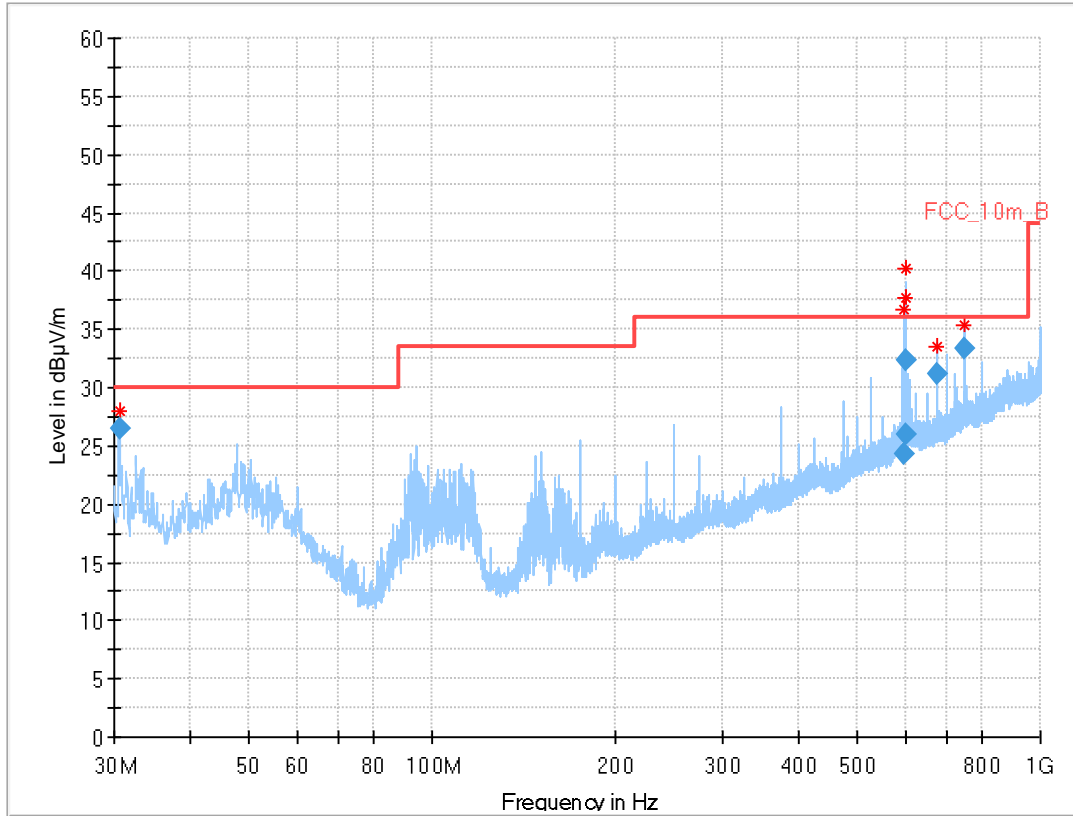
Plot 2: 30 MHz to 1 GHz, vertical & horizontal polarization, middle channel



Final results:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.609	28.06	30.0	1.9	1000	120	102.0	V	329	12
524.994	29.01	36.0	7.0	1000	120	160.0	H	103	19
591.073	22.70	36.0	13.3	1000	120	160.0	H	103	20
600.008	30.16	36.0	5.8	1000	120	160.0	H	54	20
674.998	30.97	36.0	5.0	1000	120	160.0	H	306	21
750.006	33.09	36.0	2.9	1000	120	129.0	H	328	22

Plot 3: 30 MHz to 1 GHz, vertical & horizontal polarization, highest channel

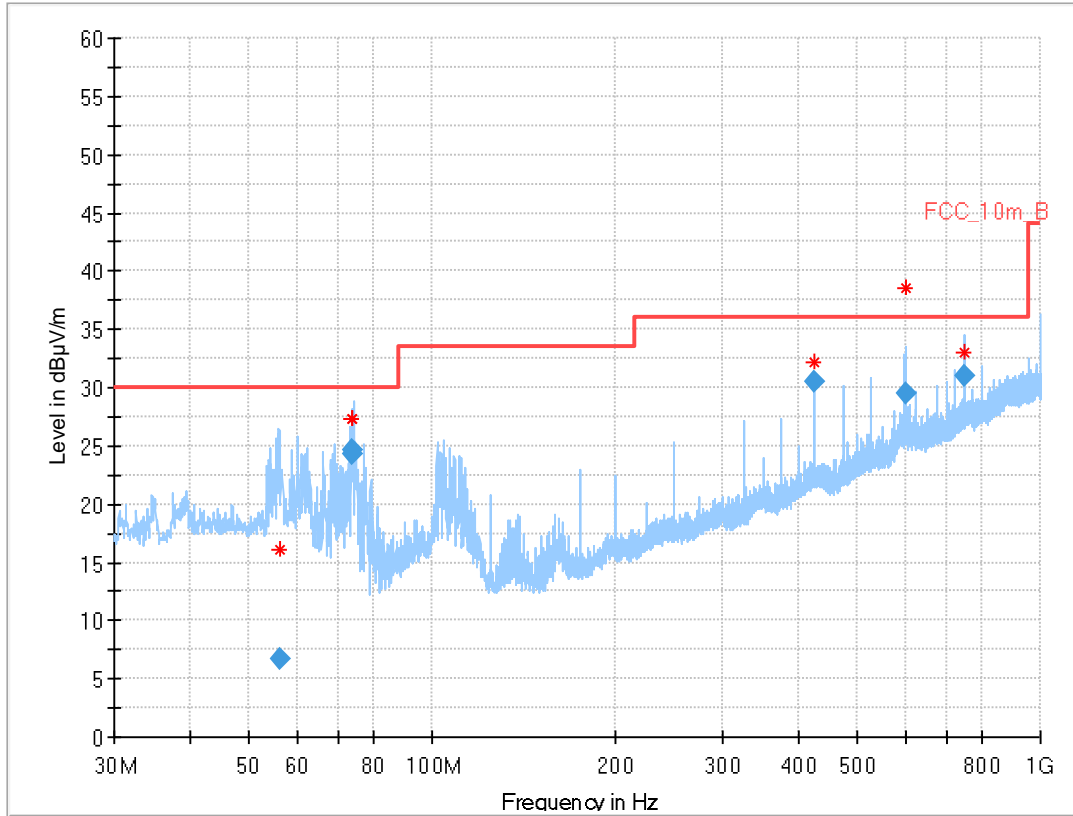


Final results:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.649	26.47	30.0	3.5	1000	120	102.0	V	136	12
598.288	24.31	36.0	11.7	1000	120	141.0	H	102	20
599.981	32.31	36.0	3.7	1000	120	160.0	H	102	20
601.690	26.05	36.0	10.0	1000	120	133.0	H	102	20
674.995	31.11	36.0	4.9	1000	120	160.0	H	311	21
749.993	33.38	36.0	2.6	1000	120	129.0	H	322	22

Plot: OFDM (40 MHz nominal channel bandwidth)

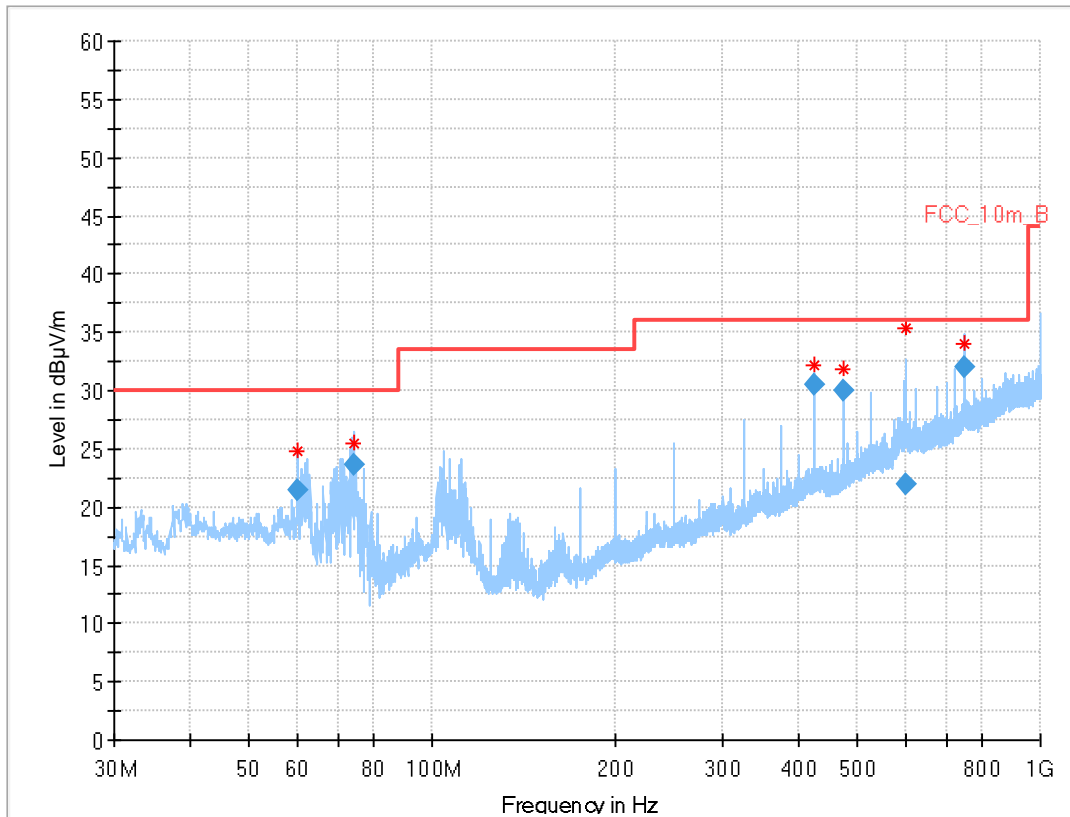
Plot 1: 30 MHz to 1 GHz, vertical & horizontal polarization, lowest channel



Final results:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
56.128	6.63	30.0	23.4	1000	120	160.0	V	0	15
73.929	24.71	30.0	5.3	1000	120	160.0	V	153	8
73.939	24.23	30.0	5.8	1000	120	160.0	V	153	8
425.003	30.43	36.0	5.6	1000	120	160.0	H	105	17
600.011	29.45	36.0	6.6	1000	120	131.0	H	44	20
749.996	31.00	36.0	5.0	1000	120	118.0	H	127	22

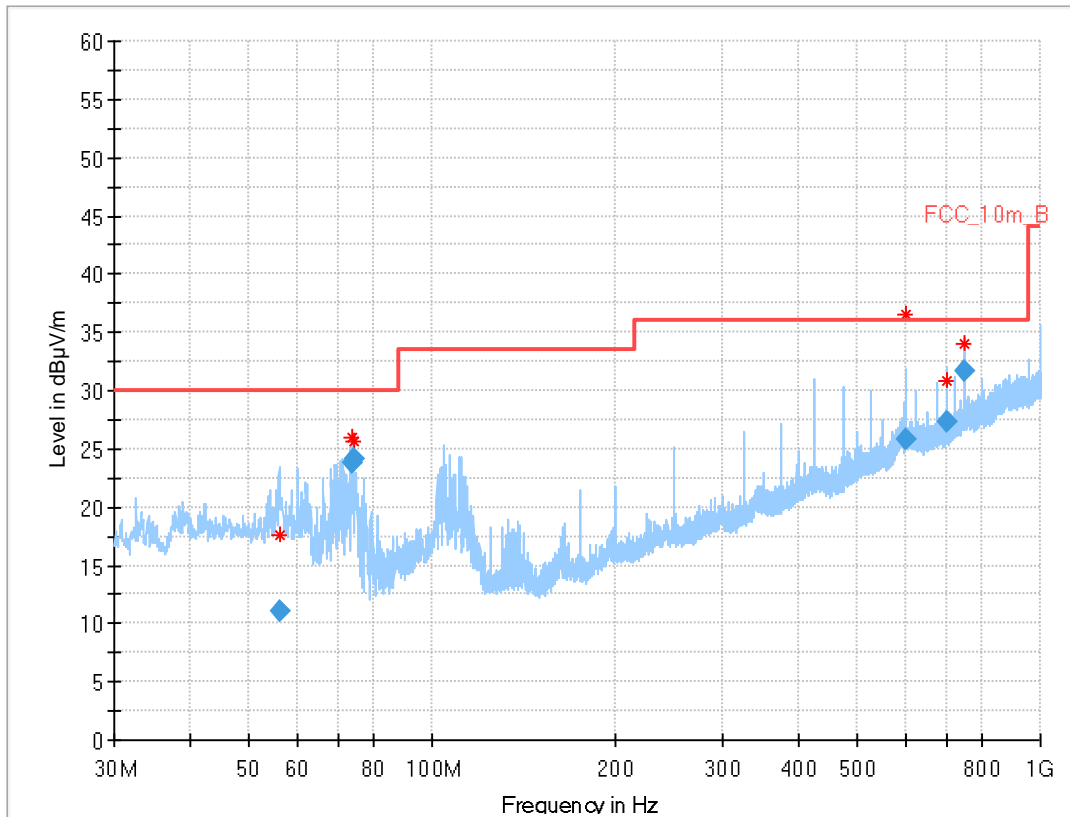
Plot 2: 30 MHz to 1 GHz, vertical & horizontal polarization, middle channel



Final results:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
60.214	21.50	30.0	8.5	1000	120	160.0	V	162	13
74.564	23.68	30.0	6.3	1000	120	160.0	V	178	8
425.008	30.43	36.0	5.6	1000	120	154.0	H	93	17
474.995	30.08	36.0	5.9	1000	120	160.0	H	109	18
601.701	22.00	36.0	14.0	1000	120	137.0	H	61	20
749.998	32.00	36.0	4.0	1000	120	131.0	H	137	22

Plot 3: 30 MHz to 1 GHz, vertical & horizontal polarization, highest channel

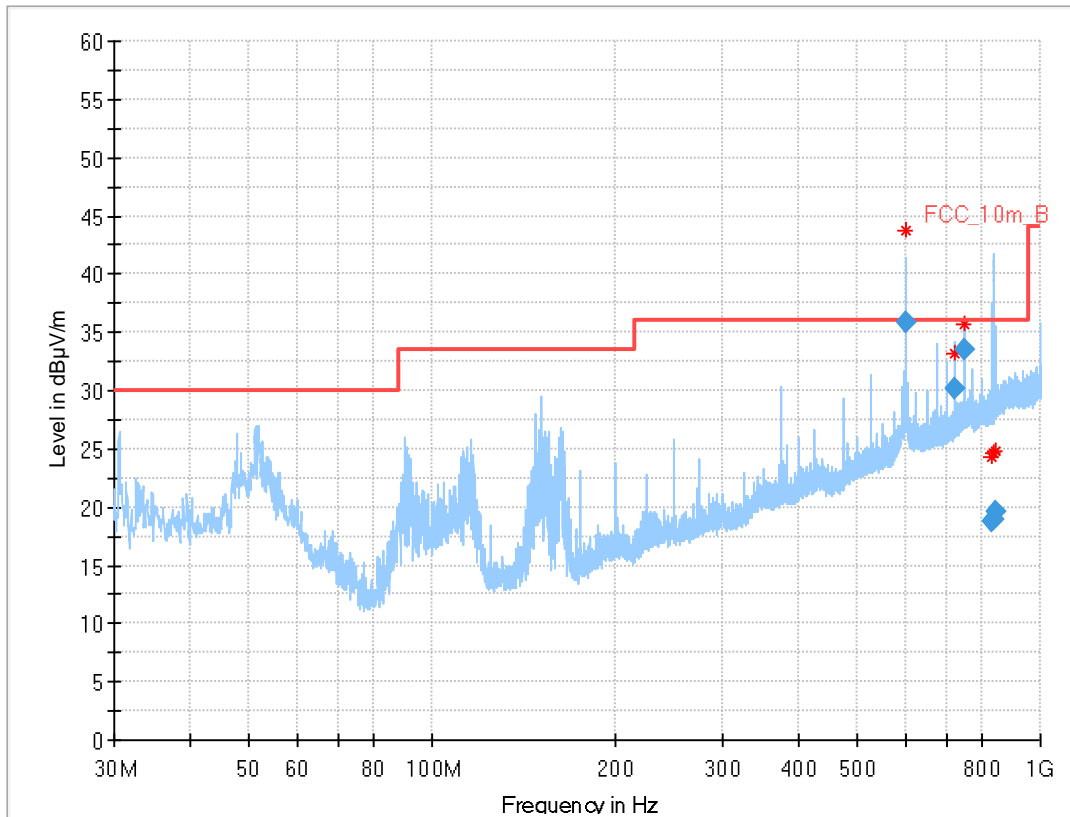


Final results:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
55.981	11.10	30.0	18.9	1000	120	160.0	V	60	15
73.935	23.78	30.0	6.2	1000	120	160.0	V	355	8
74.571	24.06	30.0	5.9	1000	120	160.0	V	355	8
599.993	25.83	36.0	10.2	1000	120	114.0	H	82	20
700.019	27.30	36.0	8.7	1000	120	153.0	H	217	21
749.989	31.65	36.0	4.4	1000	120	128.0	H	137	22

Plot: RX / Idle mode

Plot 1: 30 MHz to 1 GHz, vertical & horizontal polarization



Final results:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
599.997	35.90	36.0	0.1	1000	120	160.0	H	95	20
725.007	30.09	36.0	5.9	1000	120	160.0	H	306	21
749.998	33.50	36.0	2.5	1000	120	126.0	H	322	22
832.103	18.85	36.0	17.2	1000	120	160.0	H	95	23
837.624	18.99	36.0	17.0	1000	120	160.0	H	101	23
841.270	19.68	36.0	16.3	1000	120	160.0	H	85	23

12.13 Spurious emissions radiated above 1 GHz

Description:

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

Measurement:

Measurement parameter	
Detector	Peak / RMS
Sweep time	Auto
Resolution bandwidth	1 MHz
Video bandwidth	3 x RBW
Span	1 GHz to 26 GHz
Trace mode	Max Hold
Measured modulation	<input checked="" type="checkbox"/> DSSS b – mode <input checked="" type="checkbox"/> OFDM g – mode <input type="checkbox"/> OFDM n HT20 – mode <input checked="" type="checkbox"/> OFDM n HT40 – mode <input type="checkbox"/> RX / Idle – mode
Test setup	See chapter 6.2 - A
Measurement uncertainty	See chapter 8

Limits:

FCC		IC	
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 / dBµV/m @ 3 m								
lowest channel			middle channel			highest channel		
f / MHz	Detector	Level / dBµV/m	f / MHz	Detector	Level / dBµV/m	f / MHz	Detector	Level / dBµV/m
4824	Peak	54.6	4874	Peak	49.3	4924	Peak	50.5
	AVG	50.1		AVG	39.7		AVG	43.5
-/-	Peak	-/-	4874	Peak	51.3	-/-	Peak	-/-
	AVG	-/-		AVG	44.4		AVG	-/-

Results: OFDM (20 MHz nominal channel bandwidth)

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

Results: OFDM (40 MHz nominal channel bandwidth)

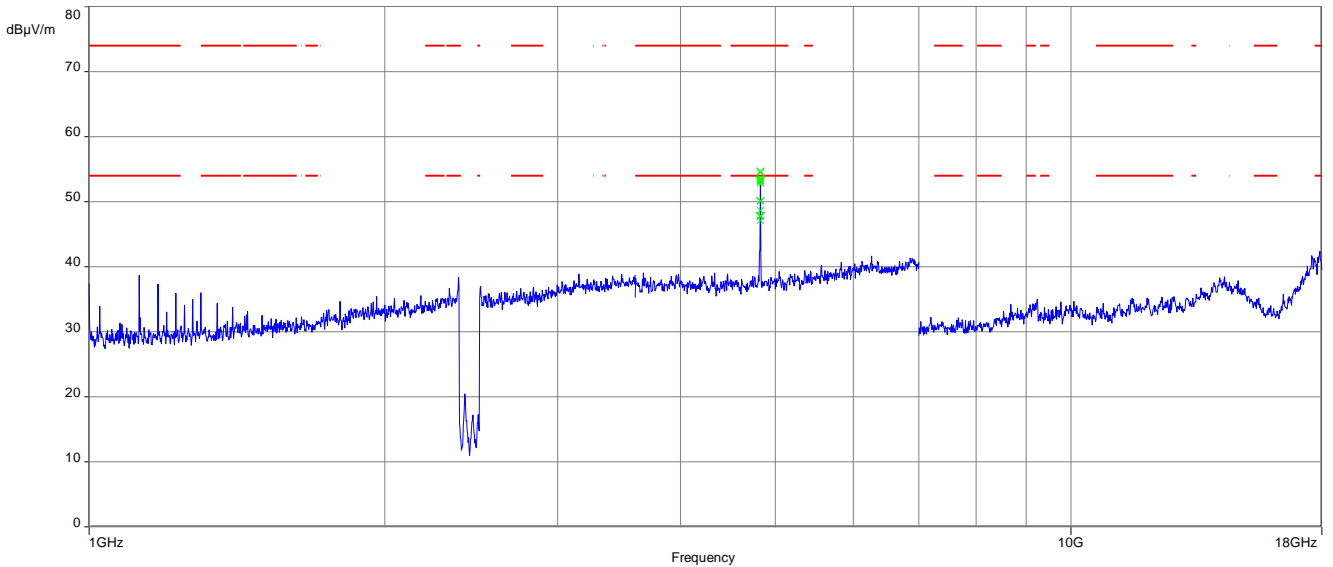
TX spurious emissions radiated / dBµV/m @ 3 m								
lowest channel			middle channel			highest channel		
f / MHz	Detector	Level / dBµV/m	f / MHz	Detector	Level / dBµV/m	f / MHz	Detector	Level / dBµV/m
All detected emissions are more than 20 dB below the limit.			All detected emissions are more than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

Results: RX / idle – mode

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

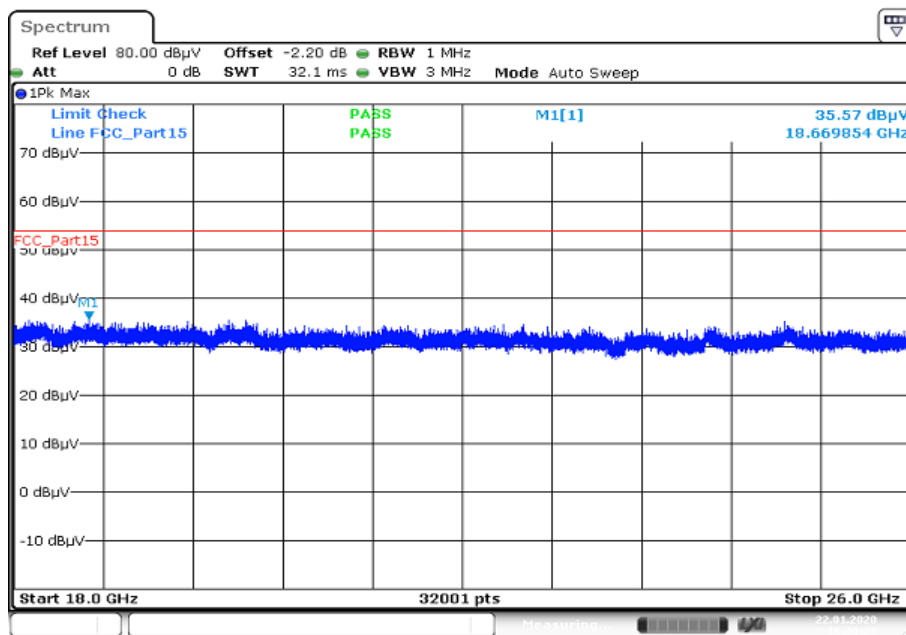
Plots: DSSS

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



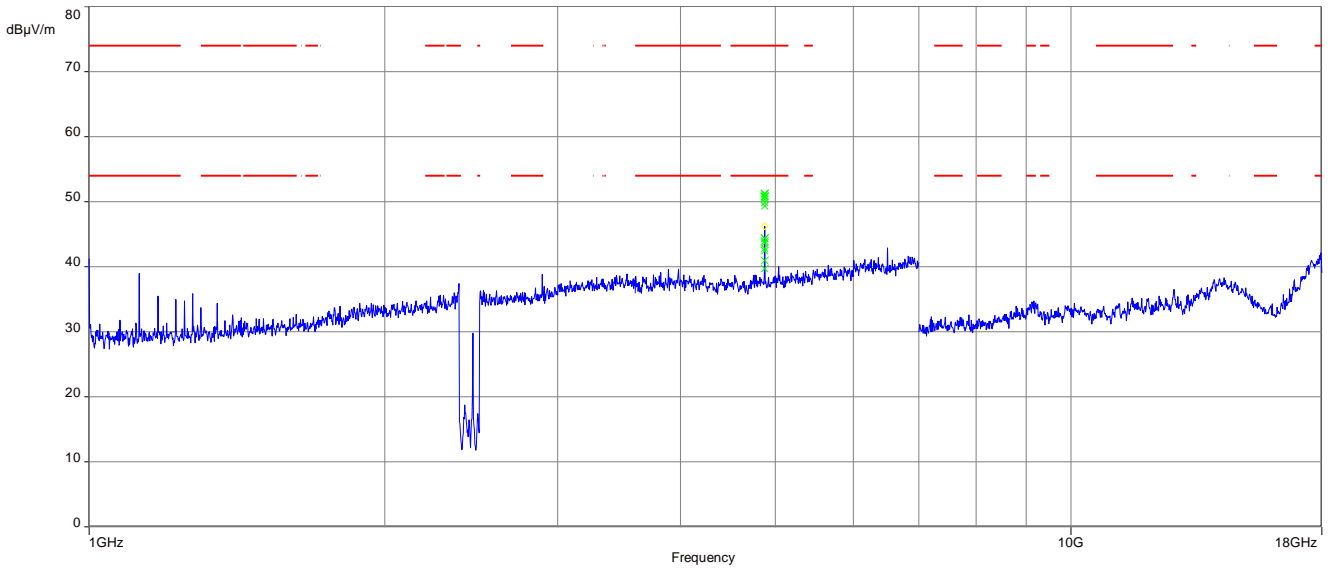
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 2: Lowest channel, 18 GHz to 26 GHz, vertical & horizontal polarization



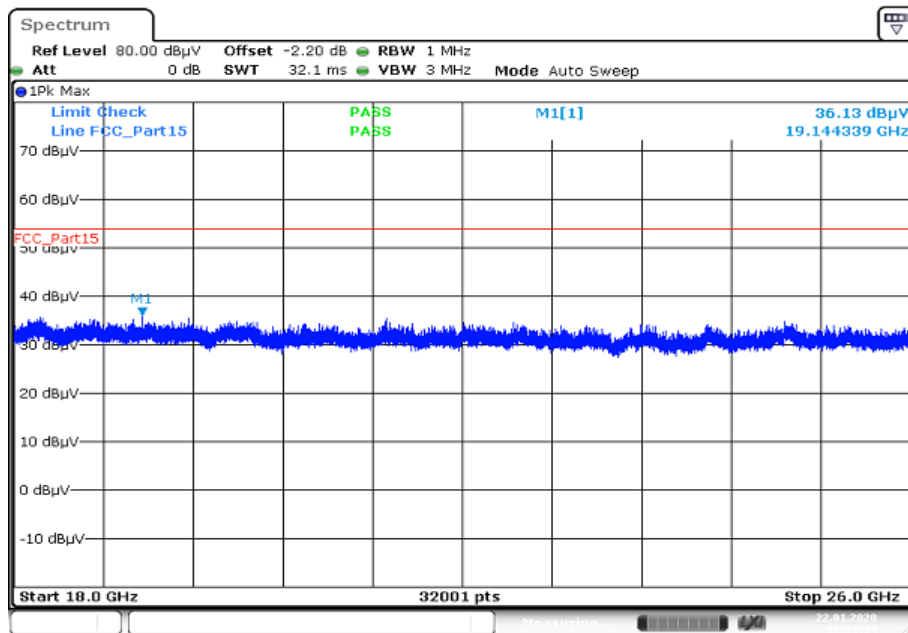
Date: 22.JAN.2020 16:30:23

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

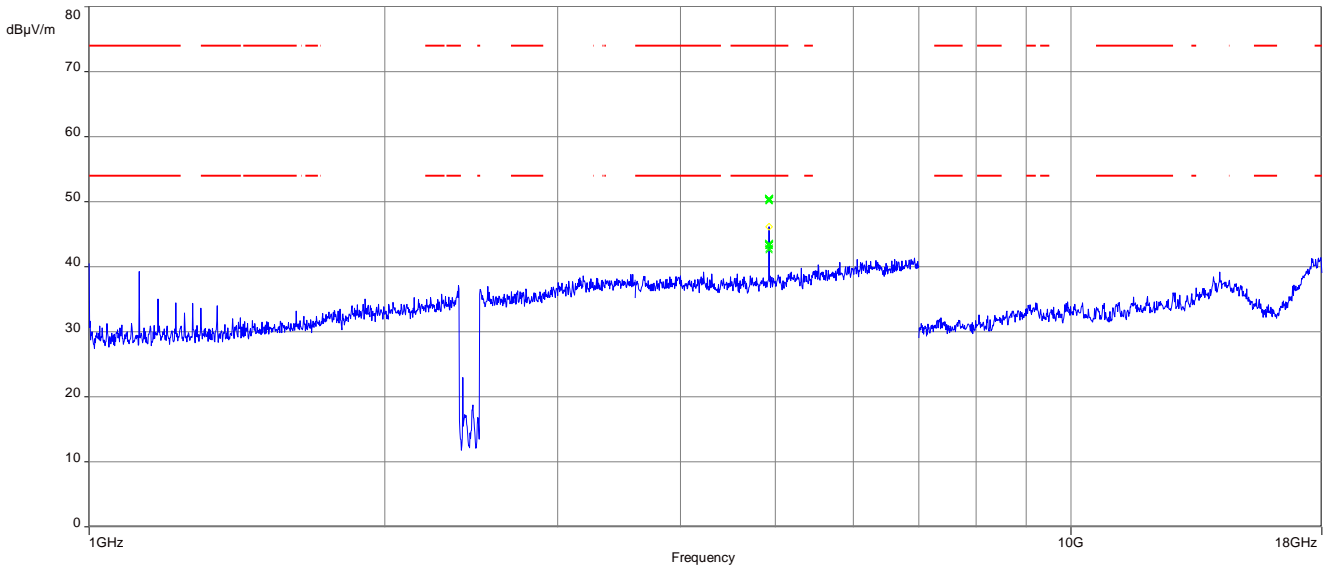


The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 4: Middle channel, 18 GHz to 26 GHz, vertical & horizontal polarization

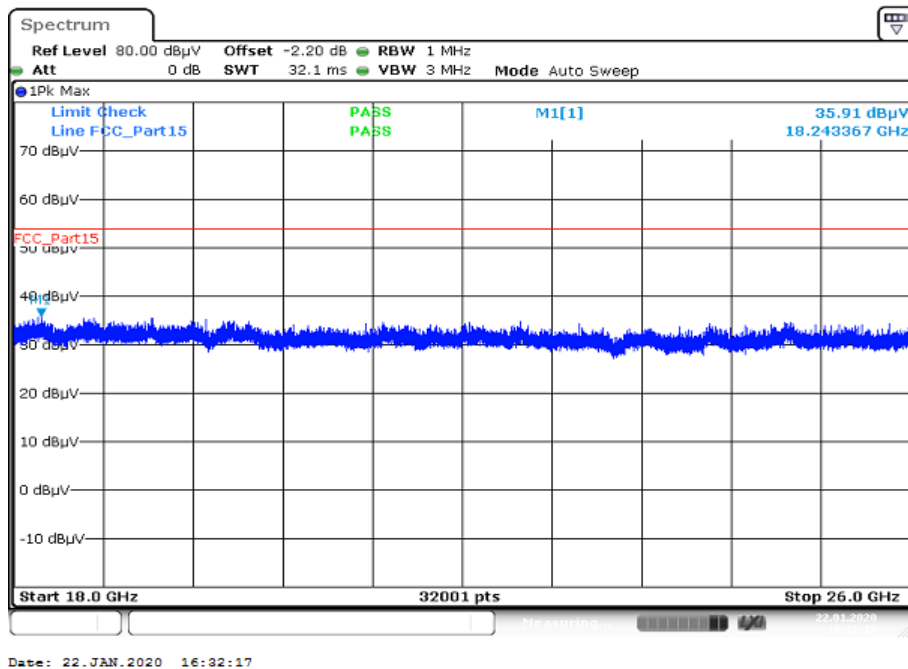


Plot 5: Highest channel, 1 GHz to 18 GHz, vertical & horizontal polarization



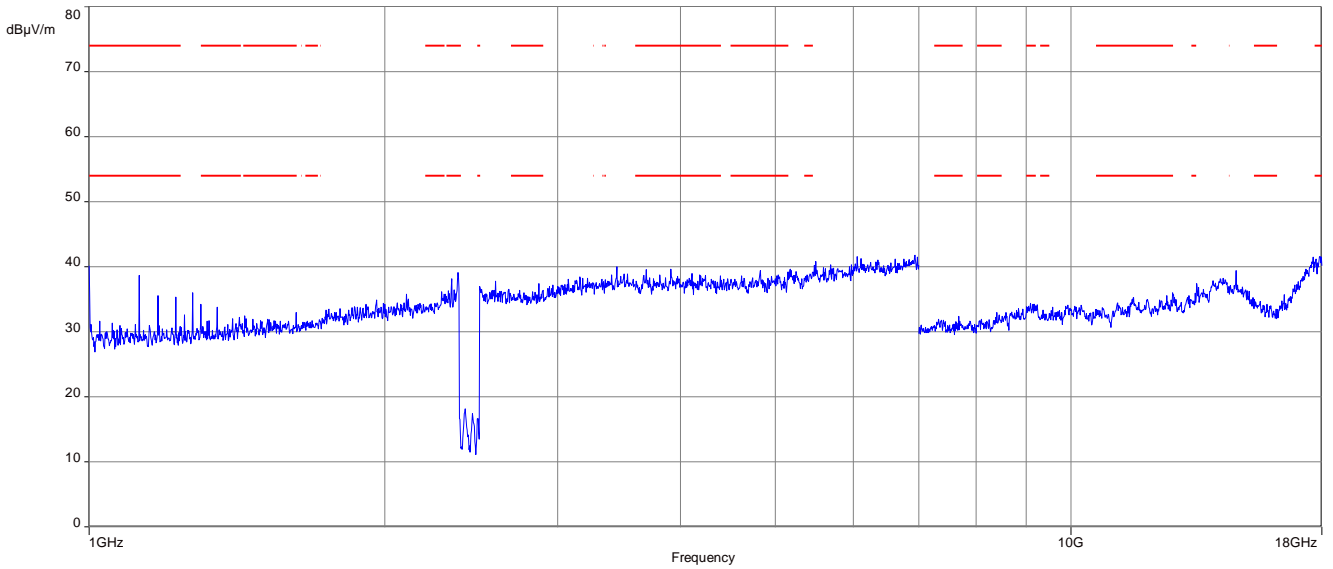
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 6: Highest channel, 18 GHz to 26 GHz, vertical & horizontal polarization



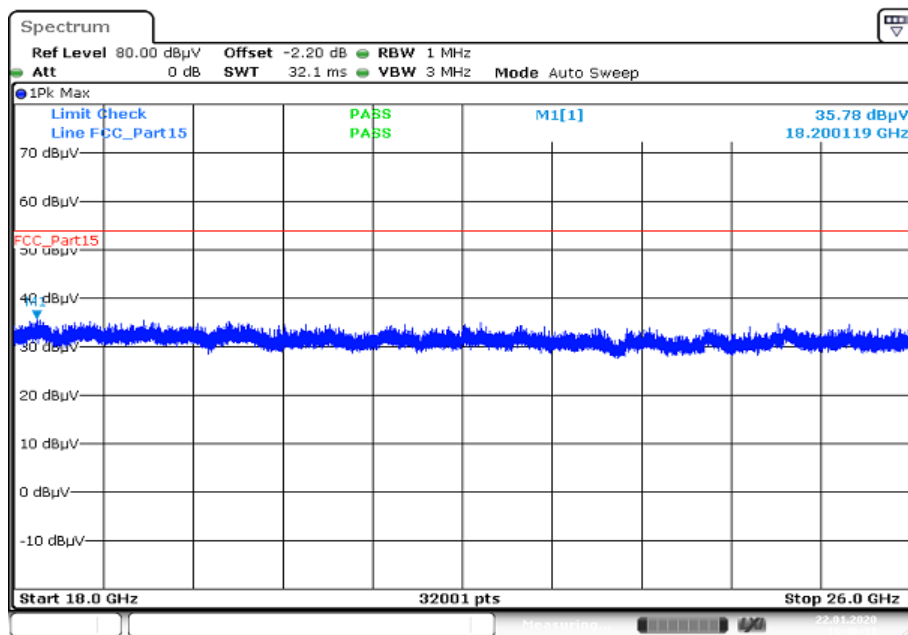
Plots: OFDM (20 MHz bandwidth)

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

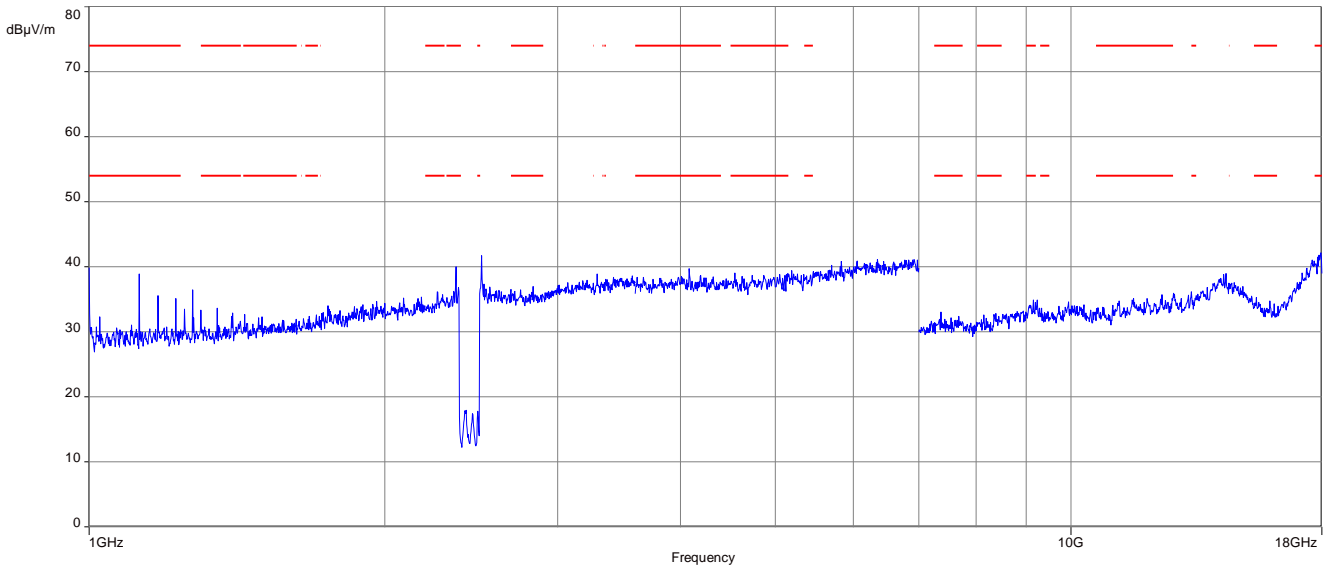


The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 2: Lowest channel, 18 GHz to 26 GHz, vertical & horizontal polarization

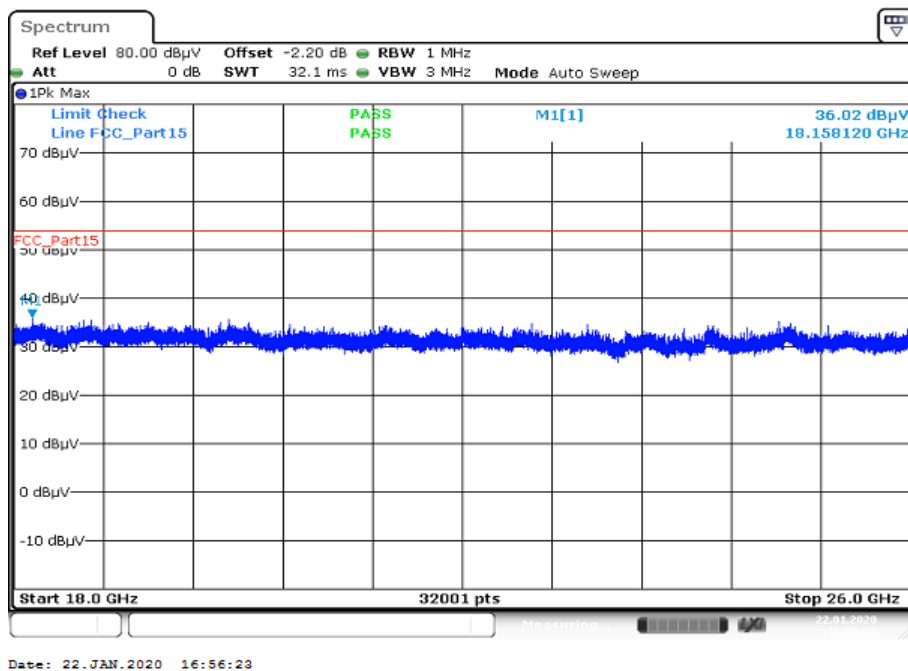


Plot 3: Middle channel, 1 GHz to 18 GHz, vertical & horizontal polarization

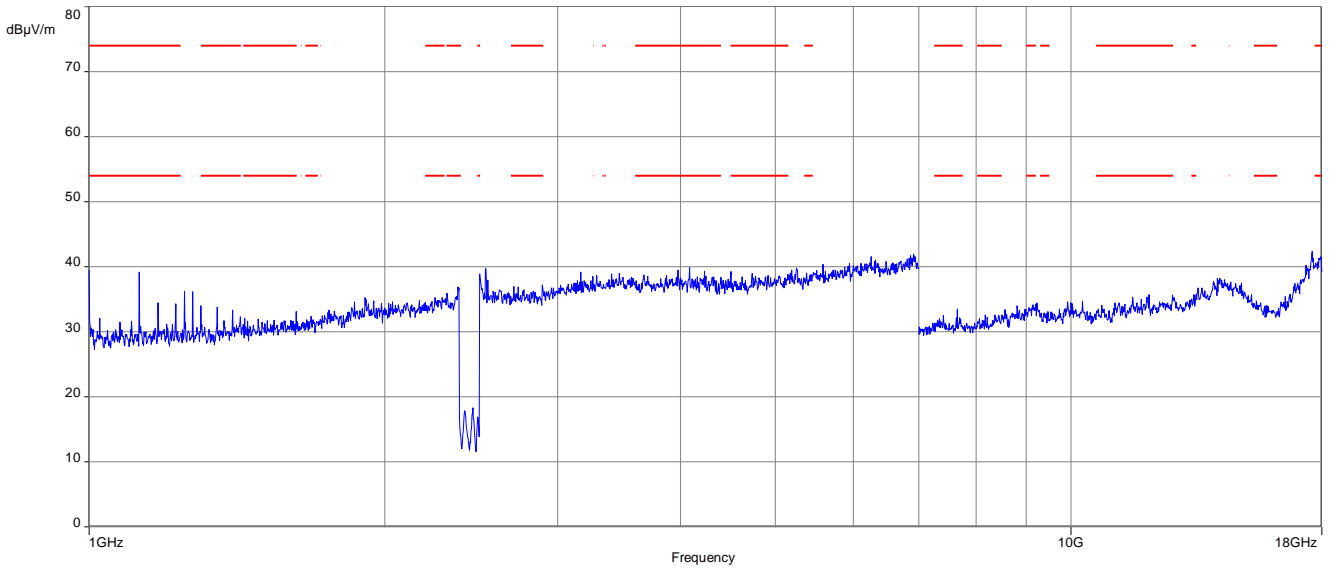


The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 4: Middle channel, 18 GHz to 26 GHz, vertical & horizontal polarization

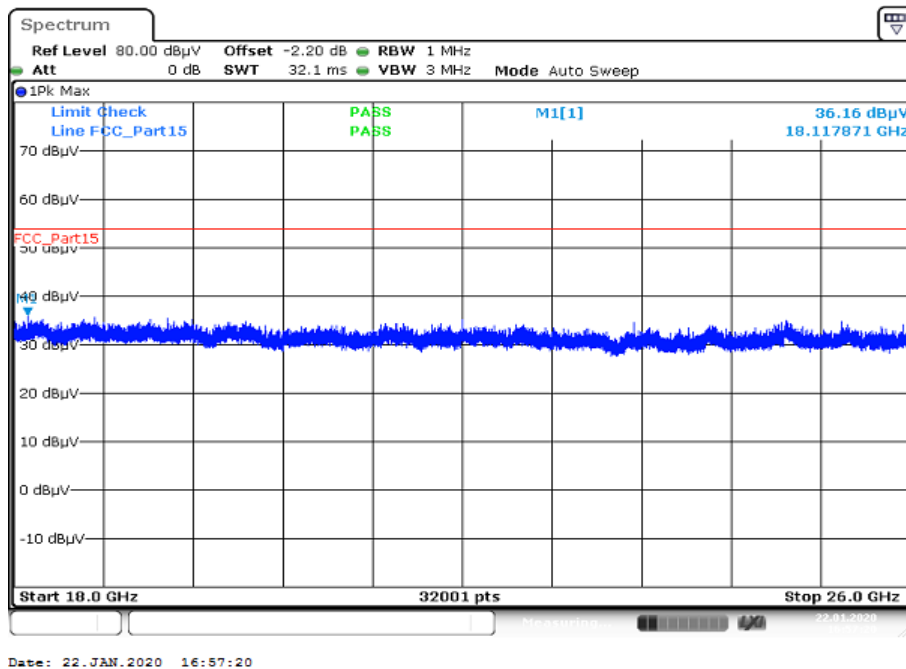


Plot 5: Highest channel, 1 GHz to 18 GHz, vertical & horizontal polarization



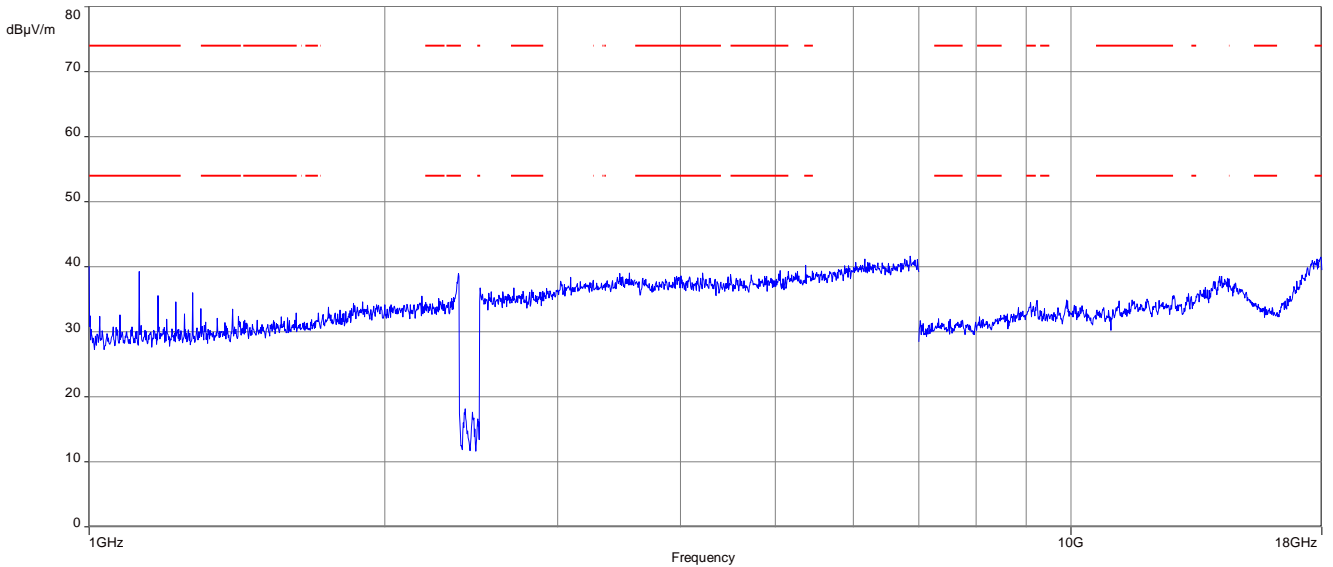
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 6: Highest channel, 18 GHz to 26 GHz, vertical & horizontal polarization



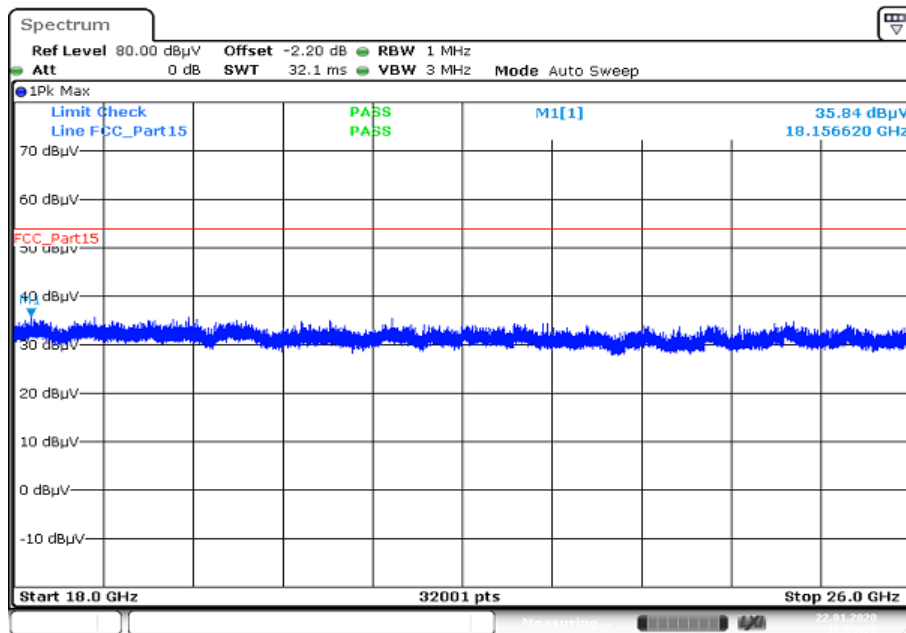
Plots: OFDM (40 MHz bandwidth)

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



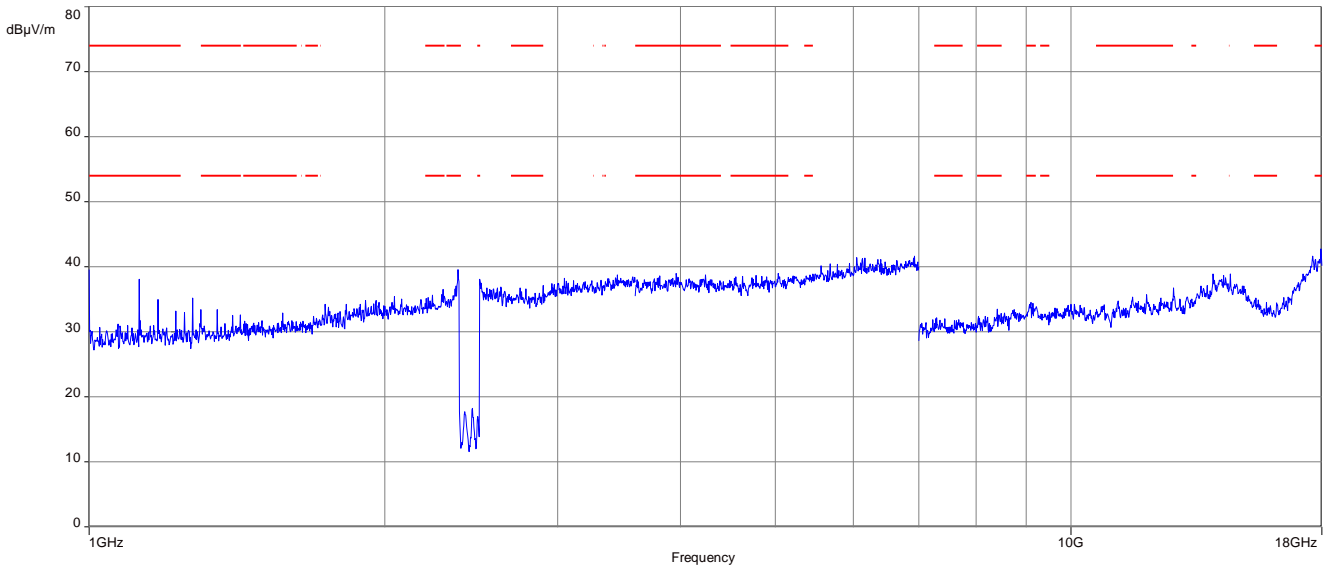
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 2: Lowest channel, 18 GHz to 26 GHz, vertical & horizontal polarization



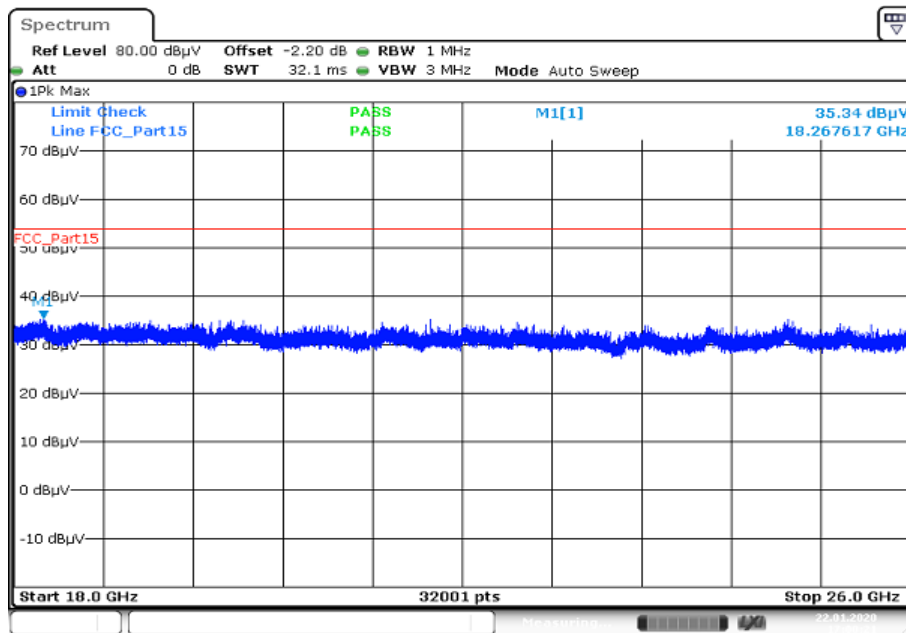
Date: 22.JAN.2020 16:59:35

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



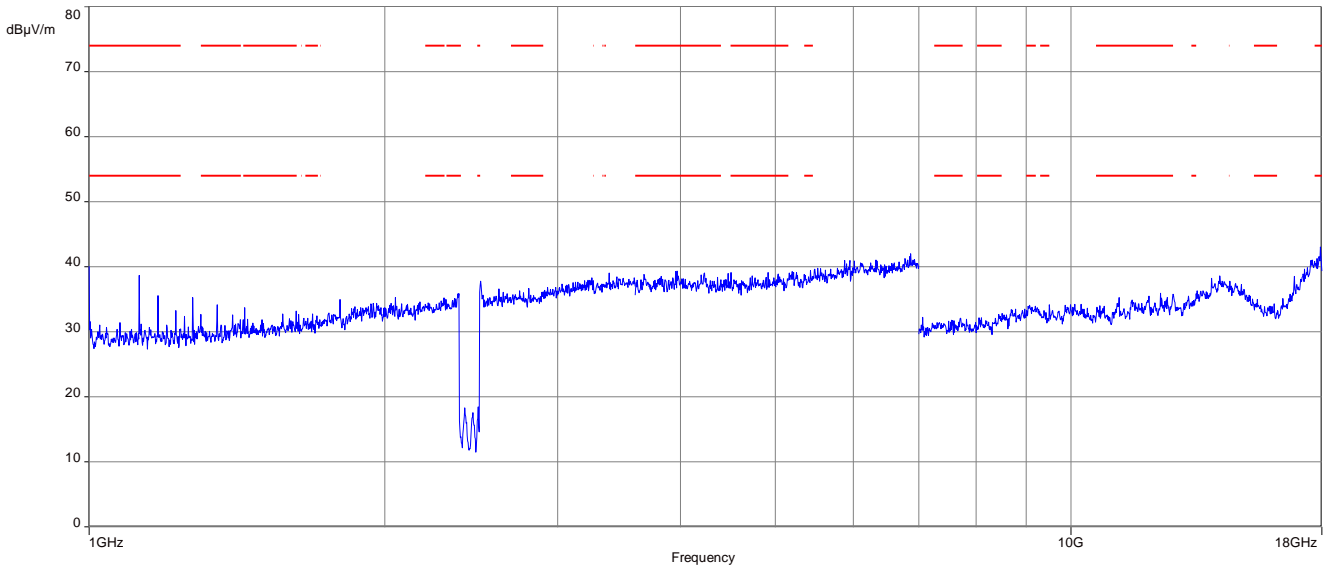
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 4: Middle channel, 18 GHz to 26 GHz, vertical & horizontal polarization



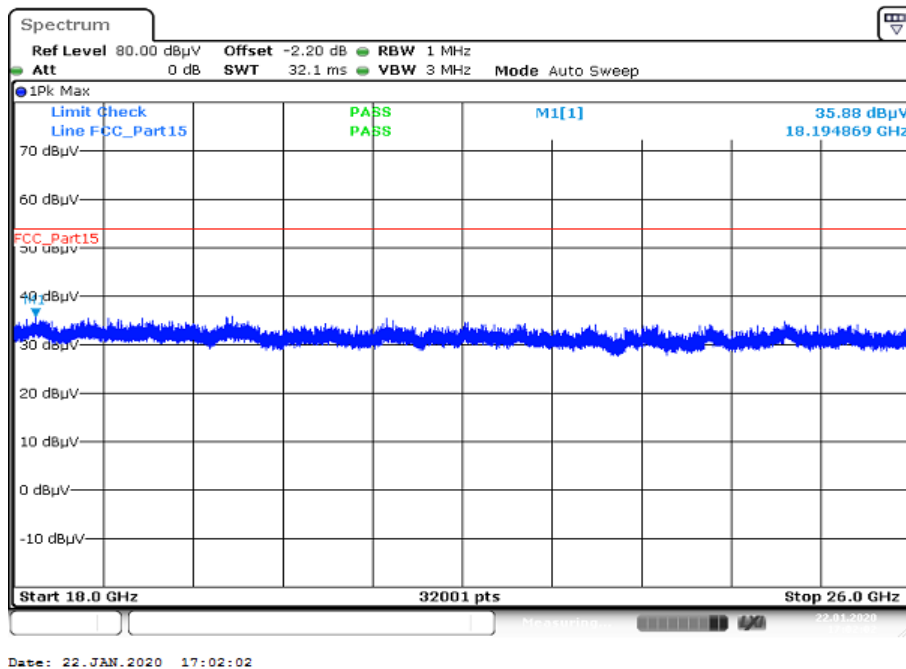
Date: 22. JAN. 2020 17:00:21

Plot 5: Highest channel, 1 GHz to 18 GHz, vertical & horizontal polarization



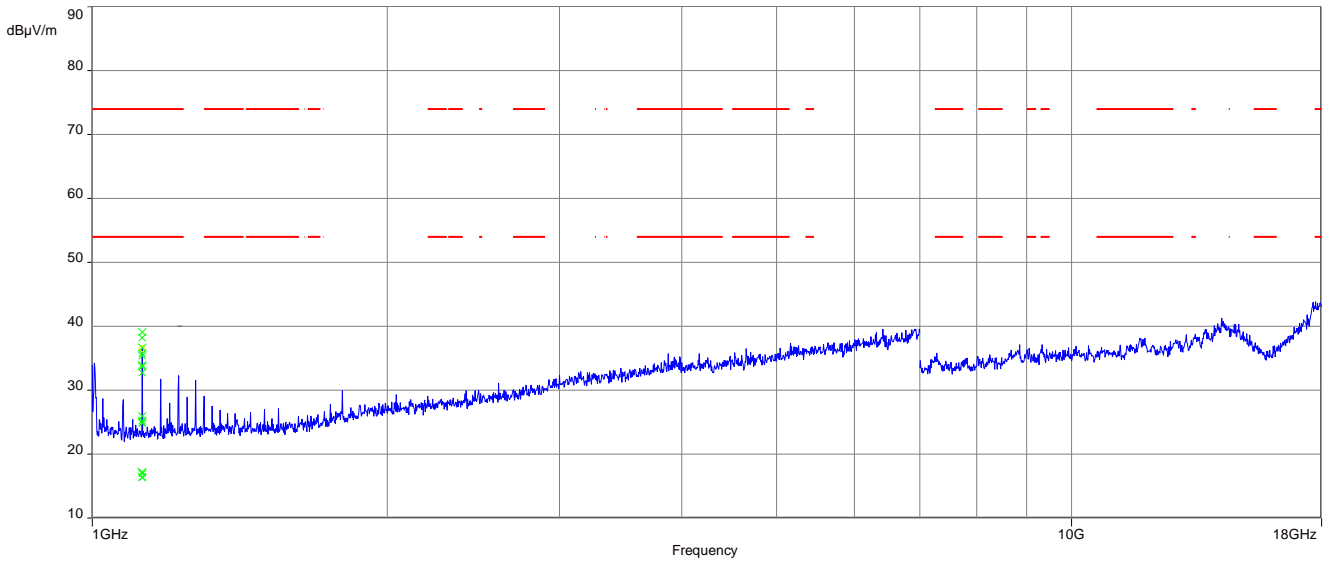
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 6: Highest channel, 18 GHz to 26 GHz, vertical & horizontal polarization

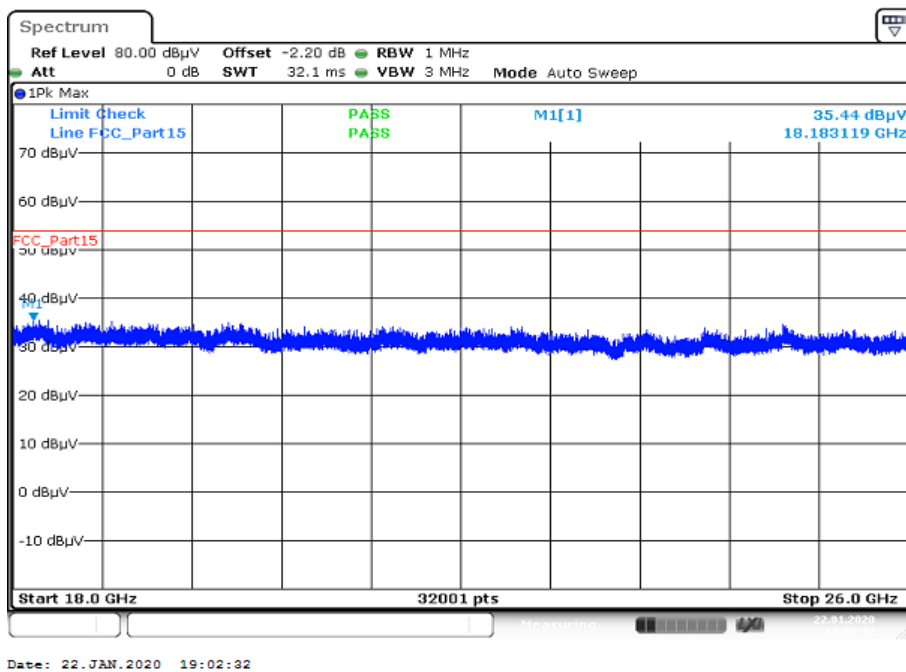


Plots: Receiver mode

Plot 1: 1 GHz to 18 GHz, RX / idle – mode, vertical & horizontal polarization



Plot 2: 18 GHz to 26 GHz, RX / idle – mode, vertical & horizontal polarization



12.14 Spurious emissions conducted below 30 MHz (AC conducted)

Description:

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

Measurement:

Measurement parameter	
Detector	Peak - Quasi Peak / Average
Sweep time	Auto
Resolution bandwidth	F < 150 kHz: 200 Hz F > 150 kHz: 9 kHz
Video bandwidth	F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz
Span	9 kHz to 30 MHz
Trace mode	Max. hold
Test setup	See chapter 6.4 - A
Measurement uncertainty	See chapter 8

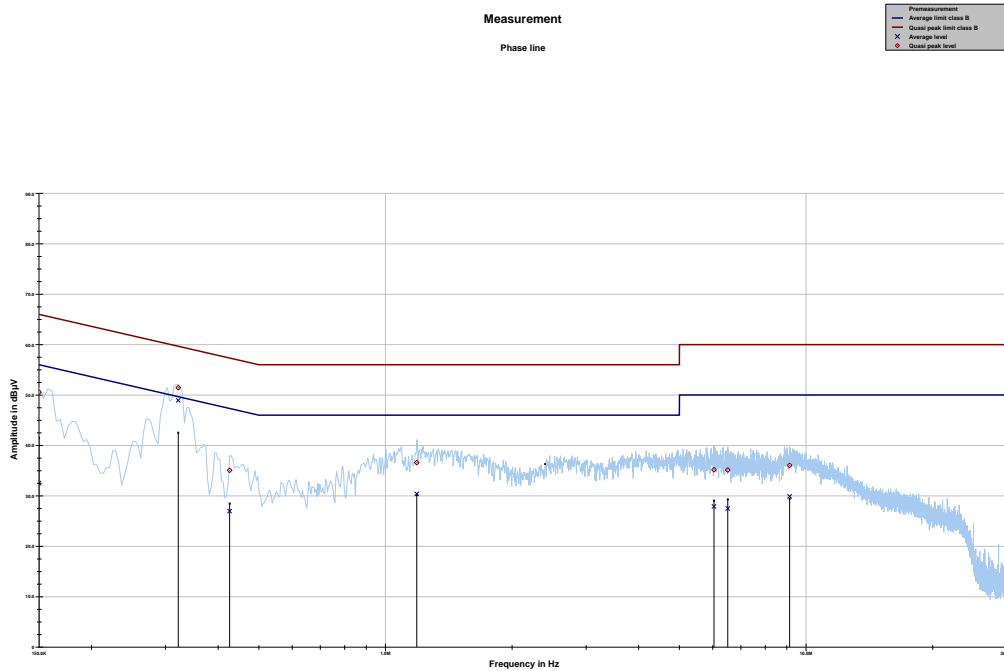
Limits:

FCC		IC
Frequency / MHz)	Quasi-Peak / (dB μ V / m)	Average / (dB μ V / m)
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30.0	60	50

*Decreases with the logarithm of the frequency

Plots:

Plot 1: 150 kHz to 30 MHz, phase line

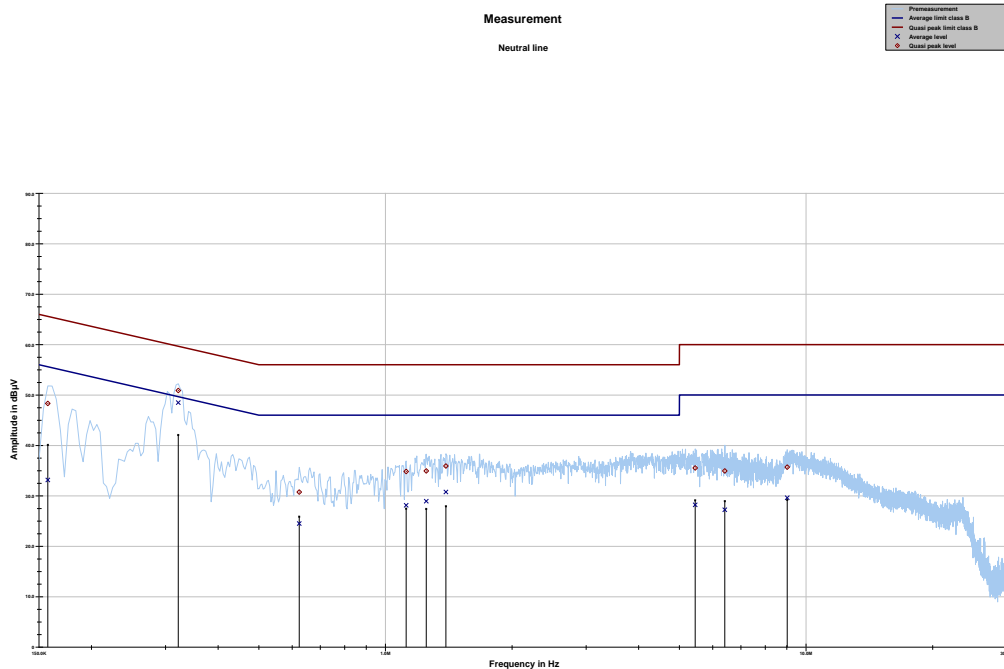


Project ID: 1-9148/19-01-03

Final results:

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.150000	50.56	15.44	66.000	32.52	23.48	56.000
0.321638	51.44	8.22	59.664	48.93	2.17	51.096
0.426113	35.07	22.26	57.328	26.99	21.12	48.111
1.187288	36.59	19.41	56.000	30.39	15.61	46.000
6.041644	35.19	24.81	60.000	27.91	22.09	50.000
6.515512	35.13	24.87	60.000	27.50	22.50	50.000
9.142312	36.04	23.96	60.000	29.89	20.11	50.000

Plot 2: 150 kHz to 30 MHz, neutral line



Project ID: 1-9148/19-01-03

Final results:

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin Average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.157463	48.32	17.27	65.597	33.15	22.64	55.787
0.321638	50.89	8.77	59.664	48.49	2.61	51.096
0.623869	30.75	25.25	56.000	24.52	21.48	46.000
1.120125	34.82	21.18	56.000	28.13	17.87	46.000
1.250719	34.94	21.06	56.000	28.94	17.06	46.000
1.392506	35.91	20.09	56.000	30.77	15.23	46.000
5.452106	35.53	24.47	60.000	28.21	21.79	50.000
6.411037	34.94	25.06	60.000	27.25	22.75	50.000
9.022913	35.69	24.31	60.000	29.63	20.37	50.000

13 Observations

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

Annex A 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

Annex B Document history

Version	Applied changes	Date of release
-/-	Initial release	2020-02-06

Annex C Accreditation Certificate – D-PL-12076-01-04

first page	last page
 <p>Deutsche Akkreditierungsstelle GmbH</p> <p>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</p> <p>Accreditation </p> <p>The Deutsche Akkreditierungsstelle GmbH attests that the testing laboratory CTC advanced GmbH Untertürkheimer Straße 6-10, 66117 Saarbrücken</p> <p>is competent under the terms of DIN EN ISO/IEC 17025:2005 to carry out tests in the following fields: Telecommunication (TC) and Electromagnetic Compatibility (EMC) for Canadian Standards</p> <p>The accreditation certificate shall only apply in connection with the notice of accreditation of 11.01.2019 with the accreditation number D-PL-12076-01 and is valid until 21.04.2021. It comprises the cover sheet, the reverse side of the cover sheet and the following annex with a total of 7 pages.</p> <p>Registration number of the certificate: D-PL-12076-01-04</p> <p>Frankfurt am Main, 11.01.2019  Dipl.-Ing. Uwe Zimmermann Head of Division</p> <p><small>See notes on sheet 1.</small></p>	<p>Deutsche Akkreditierungsstelle GmbH</p> <p>Office Berlin Spittelmarkt 10 10117 Berlin</p> <p>Office Frankfurt am Main Europa-Allee 52 60327 Frankfurt am Main</p> <p>Office Braunschweig Bundesallee 100 38116 Braunschweig</p> <p>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.</p> <p>No impression shall be made that the accreditation also extends to fields beyond the scope of accreditation attested by DAkKS.</p> <p>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.</p> <p>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.eu</p>

Note: The current certificate annex is published on the website (link see below) of the Accreditation Body DAkKS or may be received by CTC advanced GmbH on request

<https://www.dakks.de/as/ast/d/D-PL-12076-01-04.pdf>

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

first page	last page			
 <p>Deutsche Akkreditierungsstelle GmbH</p> <p>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</p> <p>Accreditation </p> <p>The Deutsche Akkreditierungsstelle GmbH attests that the testing laboratory CTC advanced GmbH Untertürkheimer Straße 6-10, 66117 Saarbrücken</p> <p>is competent under the terms of DIN EN ISO/IEC 17025:2005 to carry out tests in the following fields: Telecommunication (FCC Requirements)</p> <p>The accreditation certificate shall only apply in connection with the notice of accreditation of 11.01.2019 with the accreditation number D-PL-12076-01 and is valid until 21.04.2021. It comprises the cover sheet, the reverse side of the cover sheet and the following annex with a total of 5 pages.</p> <p>Registration number of the certificate: D-PL-12076-01-05</p> <p>Frankfurt am Main, 11.01.2019  Uwe Zimmermann Head of Division</p> <p><small>See notes on final</small></p>	<p>Deutsche Akkreditierungsstelle GmbH</p> <table border="0"> <tr> <td>Office Berlin Spittelmarkt 10 10117 Berlin</td> <td>Office Frankfurt am Main Europa-Allee 52 60527 Frankfurt am Main</td> <td>Office Braunschweig Bundesallee 100 38116 Braunschweig</td> </tr> </table> <p>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.</p> <p>No impression shall be made that the accreditation also extends to fields beyond the scope of accreditation attested by DAkKS.</p> <p>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.</p> <p>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</p>	Office Berlin Spittelmarkt 10 10117 Berlin	Office Frankfurt am Main Europa-Allee 52 60527 Frankfurt am Main	Office Braunschweig Bundesallee 100 38116 Braunschweig
Office Berlin Spittelmarkt 10 10117 Berlin	Office Frankfurt am Main Europa-Allee 52 60527 Frankfurt am Main	Office Braunschweig Bundesallee 100 38116 Braunschweig		

Note: The current certificate annex is published on the website (link see below) of the Accreditation Body DAkKS or may be received by CTC advanced GmbH on request

<https://www.dakks.de/as/ast/d/D-PL-12076-01-05.pdf>

END OF TEST REPORT