
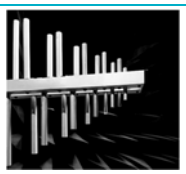
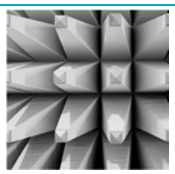

CTC advanced
member of RWTÜV group

TEST REPORT

Test report no.: 1-1475/16-02-18

ilac-MRA DAkkS Deutsche Akkreditierungsstelle D-PL-12076-01-01

Testing laboratory

CTC advanced GmbH
Untertuerkheimer Strasse 6 – 10
66117 Saarbruecken / Germany
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Fax: + 49 681 5 98 - 9075
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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 with the registration number: D-PL-12076-01-01

Applicant

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78052 Villingen-Schwenningen / GERMANY
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Fax: +49 7721 67 79 2802
Contact: Marion Grüner
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Phone: +49 7721 67 2802

Manufacturer

Continental Automotiva Guadalajara Mexico, S.A. de C.V.
Periferico Sur #7999-D. Santa Maria Tequepexpan
45601 Jalisco, Tlaquepaque / MEXICO

Test standard/s

47 CFR Part 15	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:	**Display Controller Subsystem**
Model name:	**Multiview Media Display**
FCC ID:	**2AJW5MVMDISPLAY**
IC:	**21979-MVMDISPLAY**
Frequency:	2400.0 MHz to 2483.5 MHz DTS band
Technology tested:	WLAN
Antenna:	Integrated antenna
Power supply:	8 V to 18 V DC by battery
Temperature range:	-40°C to 60°C

This test report is electronically signed and valid without handwriting 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-161128, email=Marco.Bertolino@ctcadvanced.com, c=DE
2017.07.14 08:33:41 +02'00'

Marco Bertolino
Lab Manager
Radio Communications & EMC

Test performed:

Digital unterschrieben von David Lang
DN: cn=David Lang, o=CTC advanced GmbH, ou=LNG-161129, email=david.lang@ctcadvanced.com, c=DE
Datum: 2017.07.14 08:39:07 +02'00'

David Lang
Lab Manager
Radio Communications & EMC

1 Table of contents

2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. CTC advanced GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.
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This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

2.2 Application details

Date of receipt of order:	2016-09-29
Date of receipt of test item:	2016-09-29
Start of test:	2016-09-29
End of test:	2017-06-29
Person(s) present during the test:	Mr. Tom Gollasch

2.3 Test laboratories sub-contracted

None

3 Test standard/s and references

Test standard	Date	Description
47 CFR Part 15	-/-	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 4	November 2014	Spectrum Management and Telecommunications Radio Standards Specifications - General Requirements and Information for the Certification of Radio Apparatus

Guidance	Version	Description
DTS: KDB 558074 D01	V04	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247
ANSI C63.4-2014	-/-	American national standard for methods of measurement of radio-noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz
ANSI C63.10-2013	-/-	American national standard of procedures for compliance testing of unlicensed wireless devices

4 Test environment

Temperature	:	T_{nom} T_{max} T_{min}	22 °C during room temperature tests 60 °C during high temperature tests -40 °C during low temperature tests
Relative humidity content	:		45 %
Barometric pressure	:		1021 hpa
Power supply	:	V_{nom} V_{max} V_{min}	12 V DC by battery 18 V 8 V

5 Test item

5.1 General description

Kind of test item	:	Display Controller Subsystem
Type identification	:	Multiview Media Display
HMN	:	-/-
PMN	:	Multiview Media
HVIN	:	A2C100372
FVIN	:	-/-
S/N serial number	:	Rad. 163630070 (below 1GHz), 163630069 (above 1GHz) Cond. 163630071
HW hardware status	:	No information available
SW software status	:	No information available
Frequency band	:	2400.0 MHz to 2483.5 MHz DTS band
Type of radio transmission Use of frequency spectrum	: :	DSSS, OFDM
Type of modulation	:	BPSK, QPSK, 16 – QAM, 64 – QAM
Number of channels	:	11
Antenna	:	Integrated antenna
Power supply	:	8 V to 18 V DC by battery
Temperature range	:	-40°C to 60°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: 1-1475/16-02-01_AnnexA
1-1475/16-02-01_AnnexB
1-1475/16-02-01_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).

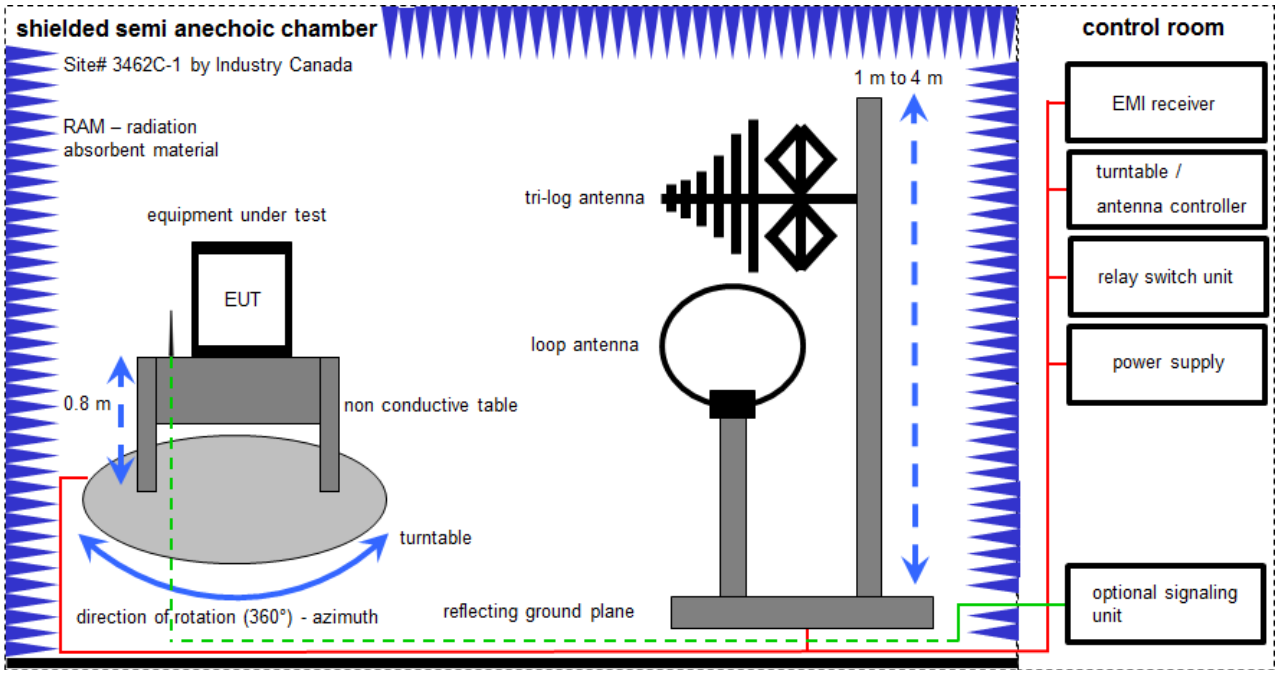
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

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
vlkl!	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 9 kHz 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 confirmed with specifications ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices. 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; loop antenna 10 meter

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

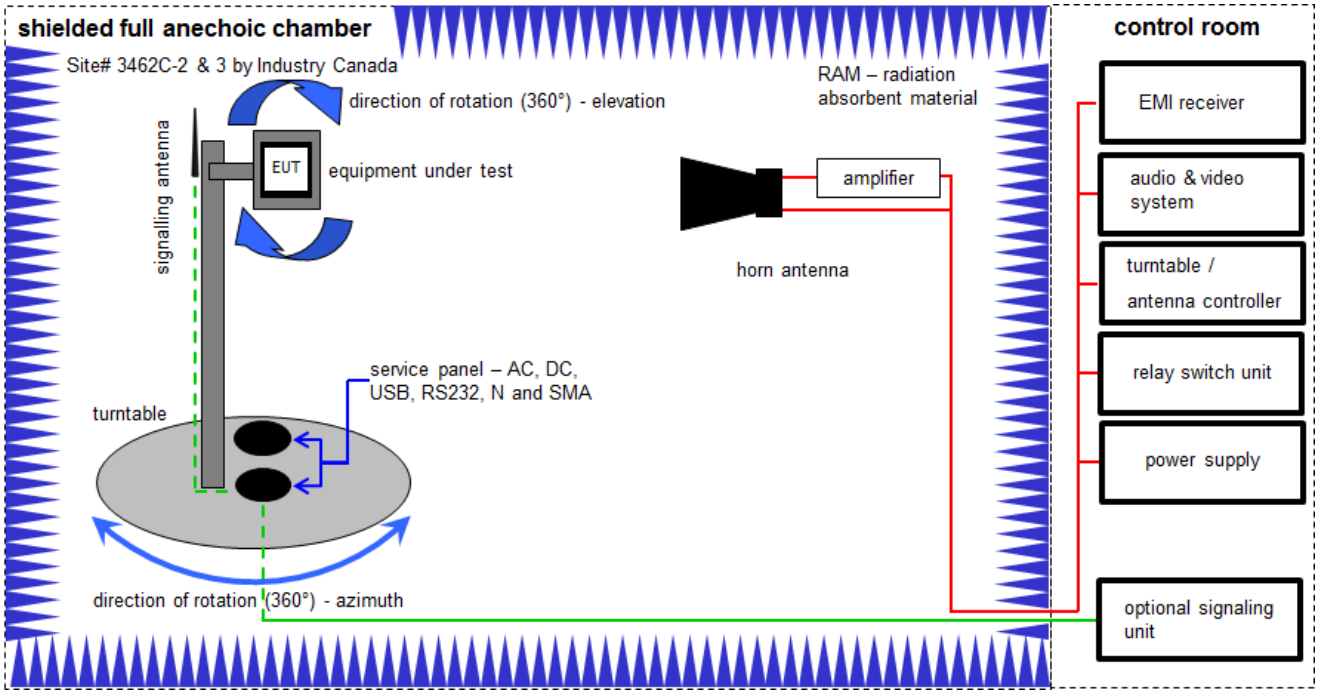
Example calculation:
FS [dBµV/m] = 12.35 [dBµV/m] + 1.90 [dB] + 16.80 [dB/m] = 31.05 [dBµV/m] (35.69 µV/m)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A + B	Switch-Unit	3488A	HP	2719A14505	300000368	ev	-/-	-/-
2	A + B	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2920A04466	300000580	ne	-/-	-/-
3	A + B	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	08.03.2016	08.03.2017
4	A + B	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw	-/-	-/-
5	A + B	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw	-/-	-/-
6	A + B	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw	-/-	-/-
7	B	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787	k	25.04.2016	25.04.2018
8	A	Active Loop Antenna 10 kHz to 30 MHz	6502	EMCO/2	8905-2342	300000256	k	24.06.2015	24.06.2017

Note: All radiated tests performed before calibration end date.

6.2 Shielded fully anechoic chamber



Measurement distance: horn antenna 3 meter and 1 meter

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

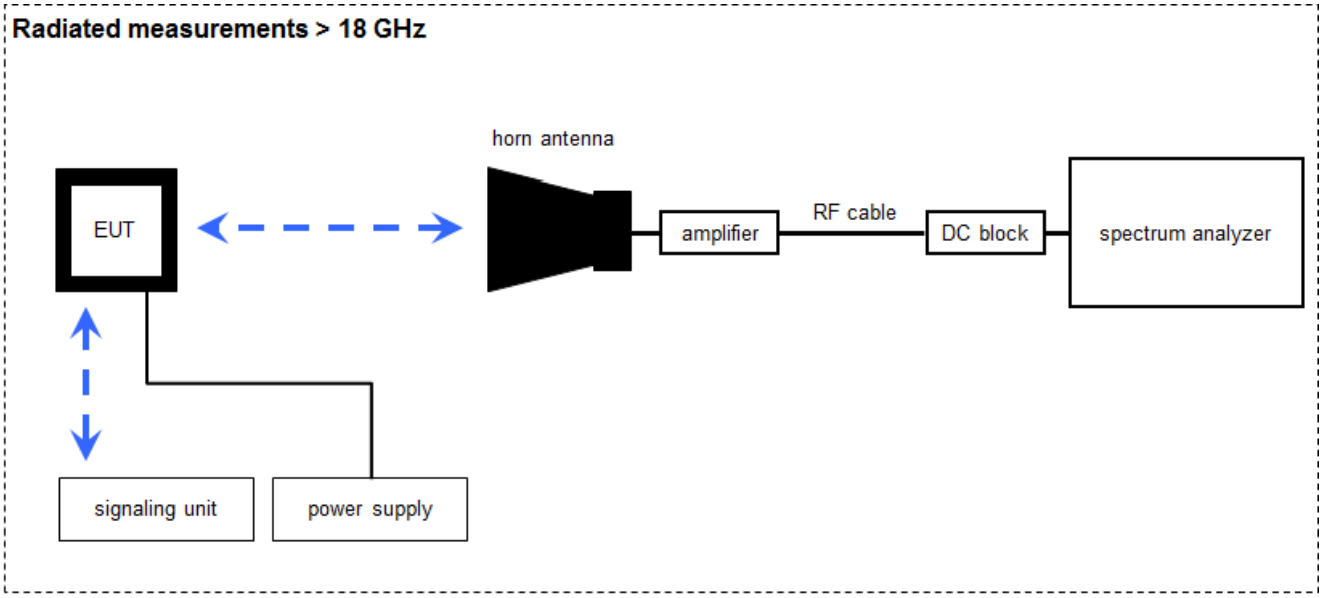
Example calculation:
FS [dBµV/m] = 40.0 [dBµV/m] + (-35.8) [dB] + 32.9 [dB/m] = 37.1 [dBµV/m] (71.61 µV/m)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2818A03450	300001040	Ve	20.01.2015	20.01.2018
2	A	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	vIKI!	20.05.2015	20.05.2017
3	A	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
4	A	Switch / Control Unit	3488A	HP	*	300000199	ne	-/-	-/-
5	A	Amplifier	js42-00502650-28-5a	Parzich GMBH	928979	300003143	ne	-/-	-/-
6	A	Band Reject filter	WRCG2400/2483-2375/2505-50/10SS	Wainwright	11	300003351	ev	-/-	-/-
7	A	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	18	300003789	ne	-/-	-/-
8	A	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne	-/-	-/-
9	A	EMI Test Receiver 9kHz-26,5GHz	ESR26	R&S	101376	300005063	vIKI!	13.09.2016	13.03.2018

Note: All radiated tests performed before calibration end date.

6.3 Radiated measurements > 18 GHz



Measurement distance: horn antenna 50 cm

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

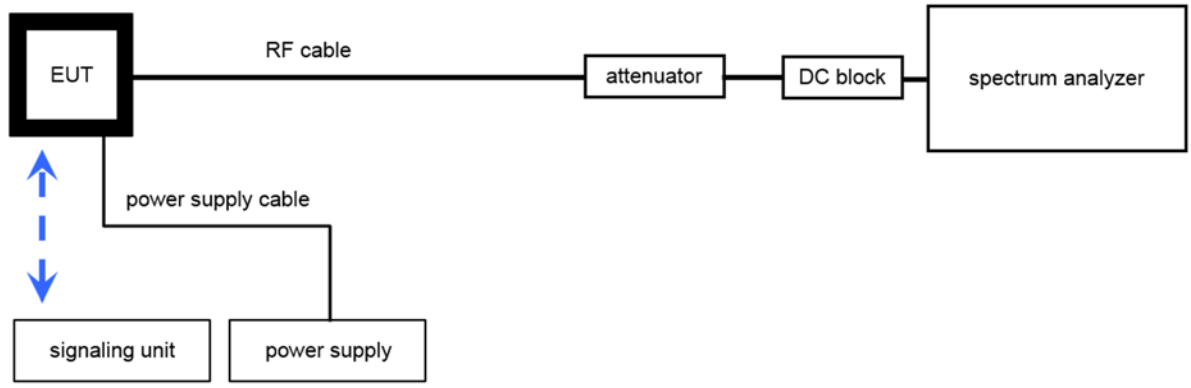
Example calculation:
FS [dBµV/m] = 40.0 [dBµV/m] + (-60.1) [dB] + 36.74 [dB/m] = 16.64 [dBµV/m] (6.79 µV/m)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	DC Power Supply, 60V, 10A	6038A	HP	3122A11097	300001204	Ve	21.01.2015	21.01.2018
2	A	Signal Analyzer 40 GHz	FSV40	R&S	101353	300004819	k	19.09.2016	19.09.2017
3	A	Std. Gain Horn Antenna 18.0 to 26.5 GHz	638	Narda	-/-	300000486	k	10.09.2015	10.09.2017
4	A	Broadband Low Noise Amplifier 18-50 GHz	CBL18503070-XX	CERNEX	19338	300004273	ev	-/-	-/-
5	A	RF-Cable WLAN-Tester Analyzer	ST18/SMAm/SMAm/36	Huber & Suhner	Batch no. 54876	400001220	ev	-/-	-/-

6.4 Conducted measurements

Conducted measurements normal conditions



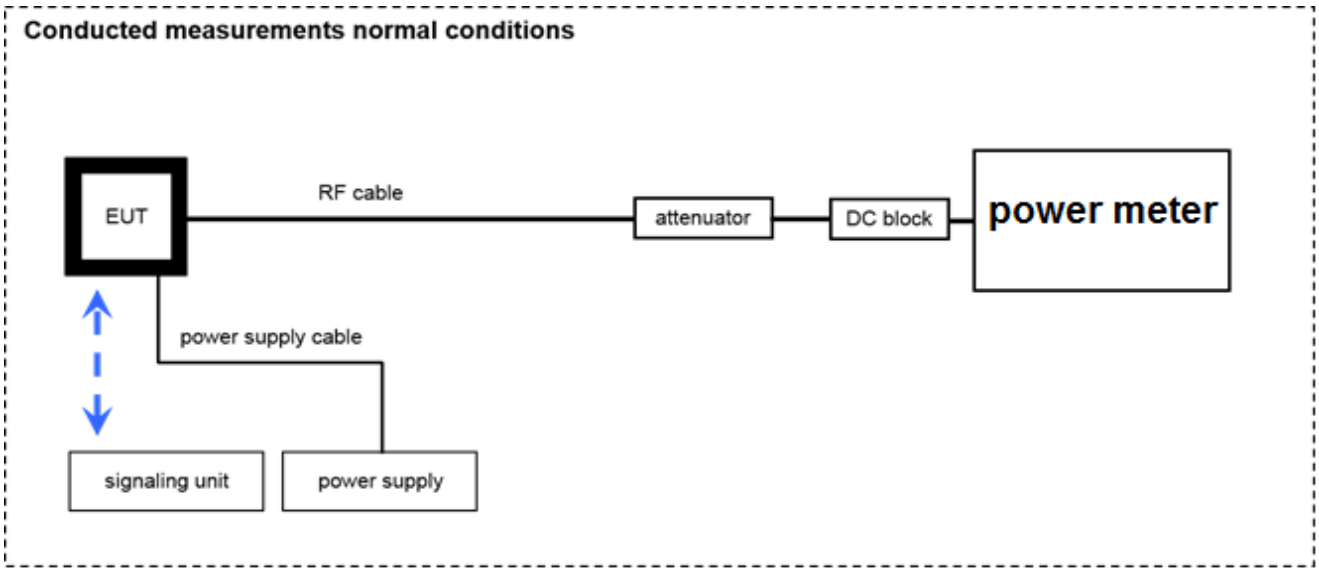
OP = AV + CA
(OP-output power; AV-analyzer value; CA-loss signal path)

Example calculation:
OP [dBm] = 6.0 [dBm] + 11.7 [dB] = 17.7 [dBm] (58.88 mW)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	DC Power Supply, 60V, 10A	6038A	HP	3122A11097	300001204	Ve	21.01.2015	21.01.2018
2	A	Signal Analyzer 40 GHz	FSV40	R&S	101353	300004819	k	19.09.2016	19.09.2017
3	A	RF-Cable WLAN-Tester Analyzer	ST18/SMAm/SMAm/36	Huber & Suhner	Batch no. 54876	400001220	ev	-/-	-/-

6.5 Conducted measurements



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 Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A+B	DC Power Supply, 60V, 10A	6038A	HP	3122A11097	300001204	Ve	21.01.2015	21.01.2018
2	A	Power Sensor 10 MHz to 18 GHz	NRP-Z22	R&S	100039	400000189	k	21.09.2016	21.09.2018
3	A	NRP Power meter Display and control unit AC sup	NRP	R&S	100212	300003780	vlKI!	26.01.2017	25.01.2019
4	B	Synchron Power Meter	SPM-4	CTC	1	400001294	ev	-/-	-/-

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, 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 height is 1.5 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 premeasurement are maximized by the software by rotating the turntable from 0° to 360°. In case of the 2-axis positioner is used the elevation axis is also rotated from 0° to 360°.
- 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.

7.2 Sequence of testing radiated spurious 30 MHz to 1 GHz

Setup

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

Premeasurement

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

Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximize the peaks by changing turntable position ± 45° and antenna height between 1 and 4 m.
- The final measurement is done with quasi-peak detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

7.3 Sequence of testing radiated spurious 1 GHz to 18 GHz

Setup

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

Premeasurement

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

Final measurement

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

7.4 Sequence of testing radiated spurious above 18 GHz

Setup

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

Premeasurement

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

Final measurement

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

8 Measurement uncertainty

Measurement uncertainty	
Test case	**Uncertainty**
Antenna gain	± 3 dB
Power spectral density	± 1.5 dB
DTS bandwidth	± 100 kHz (depends on the used RBW)
Occupied bandwidth	± 100 kHz (depends on the used RBW)
Maximum output power	± 1.5 dB
Detailed spurious emissions @ the band edge - conducted	± 1.5 dB
Band edge compliance radiated	± 3 dB
Spurious emissions conducted	± 3 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

☒	No deviations from the technical specifications were ascertained
☐	There were deviations from the technical specifications ascertained
☐	This test report is only a partial test report. The content and verdict of the performed test cases are listed below.

TC Identifier	Description	Verdict	Date	Remark
RF-Testing	CFR Part 15 RSS - 247, Issue 2	See table!	2017-07-14	-/-

Test specification clause	Test case	Guideline	Temperature conditions	Power source voltages	Mode	C	NC	NA	NP	Remark
§15.247(b)(4) RSS - 247 / 5.4 (f)(ii)	Antenna gain	-/-	Nominal	Nominal	DSSS	-/-				-/-
-/-	Duty cycle	-/-	Nominal	Nominal	DSSS OFDM	-/-				-/-
§15.247(e) RSS - 247 / 5.2 (b)	Power spectral density	KDB 558074 DTS clause: 10.2	Nominal	Nominal	DSSS OFDM	☒	☐	☐	☐	-/-
§15.247(a)(2) RSS - 247 / 5.2 (a)	DTS bandwidth	KDB 558074 DTS clause: 8.1	Nominal	Nominal	DSSS OFDM	☒	☐	☐	☐	-/-
RSS Gen clause 4.6.1	Occupied bandwidth	-/-	Nominal	Nominal	DSSS OFDM	☒	☐	☐	☐	-/-
§15.247(b)(3) RSS - 247 / 5.4 (d)	Maximum output power	KDB 558074 DTS clause: 9.1.2	Nominal	Nominal	DSSS OFDM	☒	☐	☐	☐	-/-
§15.247(d) RSS - 247 / 5.5	Detailed spurious emissions @ the band edge - conducted	-/-	Nominal	Nominal	DSSS OFDM	☒	☐	☐	☐	-/-
§15.205 RSS - 247 / 5.5 RSS - Gen	Band edge compliance conducted and radiated	KDB 558074 DTS clause: 13.3.2 and clause 12.2.2	Nominal	Nominal	DSSS OFDM	☒	☐	☐	☐	-/-
§15.247(d) RSS - 247 / 5.5	TX spurious emissions conducted	KDB 558074 DTS clause: 11.1 & 11.2 11.3	Nominal	Nominal	DSSS OFDM	☒	☐	☐	☐	-/-
§15.209(a) RSS-Gen	TX spurious emissions radiated below 30 MHz	-/-	Nominal	Nominal	DSSS OFDM	☒	☐	☐	☐	-/-
§15.247(d) RSS - 247 / 5.5 RSS-Gen	TX spurious emissions radiated 30 MHz to 1 GHz	-/-	Nominal	Nominal	DSSS OFDM	☒	☐	☐	☐	-/-
§15.247(d) RSS - 247 / 5.5 RSS-Gen	TX spurious emissions radiated above 1 GHz	-/-	Nominal	Nominal	DSSS OFDM	☒	☐	☐	☐	-/-
§15.109 RSS-Gen	RX spurious emissions radiated 30 MHz to 1 GHz	-/-	Nominal	Nominal	RX / idle	☒	☐	☐	☐	-/-
§15.109 RSS-Gen	RX spurious emissions radiated above 1 GHz	-/-	Nominal	Nominal	RX / idle	☒	☐	☐	☐	-/-
§15.107(a) §15.207	Conducted emissions < 30 MHz	-/-	Nominal	Nominal	DSSS OFDM	☐	☐	☒	☐	Battery powered

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

10 Additional comments

Reference documents: None

Special test descriptions: None

Configuration descriptions: All operation modes were tested with the output power parameter set to 16 dBm.

Test mode:

☐ No test mode available.
Iperf was used to ping another device with the largest support packet size

☒ Special software is used.
EUT is transmitting pseudo random data by itself

Antennas and transmit operating modes:

☒ Operating mode 1 (single antenna)

- *Equipment with 1 antenna,*
- *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.

11 Measurement results

11.1 Antenna gain

Measurement:

The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module. For normal WLAN devices, the DSSS mode is used.

Measurement parameters:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	3 MHz
Video bandwidth:	3 MHz
Trace mode:	Max hold
Test setup:	See sub clause 6.2 A & 6.4 A
Measurement uncertainty:	See sub clause 8

Limits:

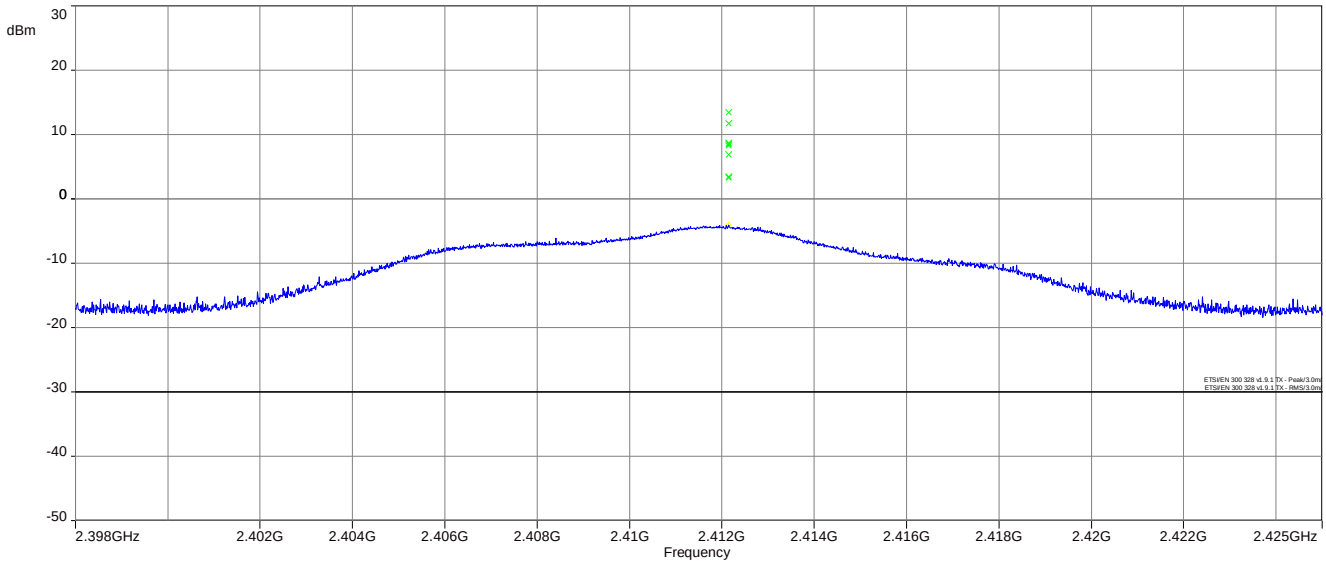
FCC	IC
6 dBi	

Results:

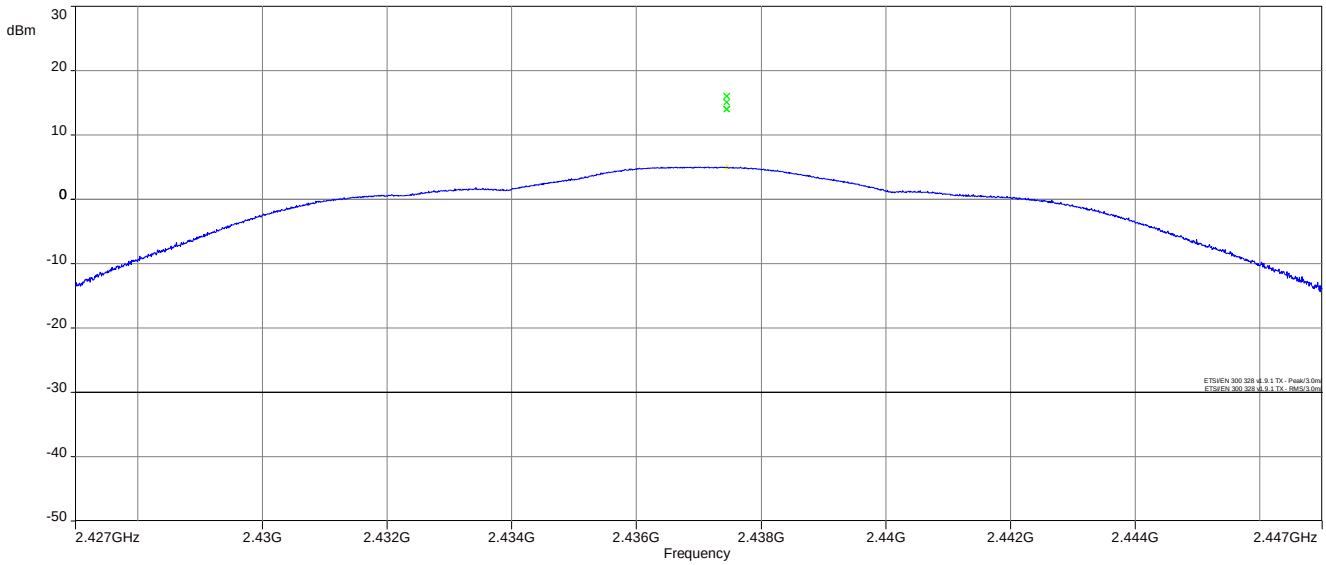
T_{nom}	V_{nom}	lowest channel 2412 MHz	middle channel 2437 MHz	highest channel 2462 MHz
Conducted power [dBm] Measured with DSSS modulation		14.3	13.2	14.0
Radiated power [dBm] Measured with DSSS modulation		13.5	16.0	11.8
Gain [dBi] Calculated		-0.8	2.8	-2.2

Plots: DSSS / b – mode

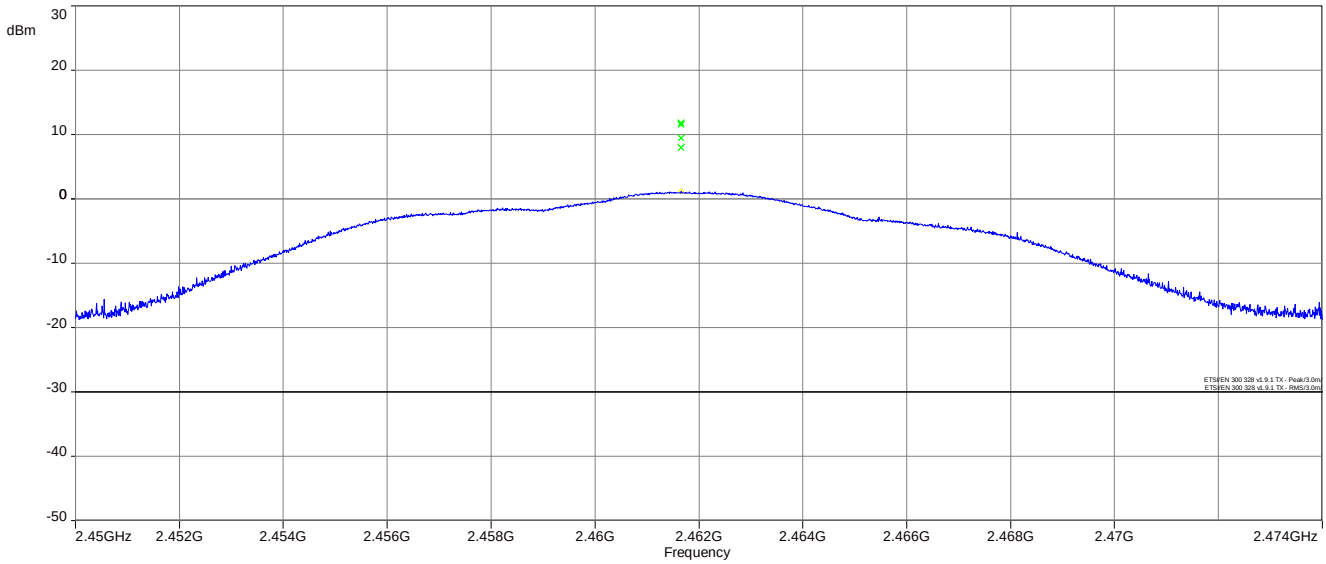
Plot 1: Lowest channel



Plot 2: Middle channel



Plot 3: Highest channel



11.2 Identify worst case data rate

Measurement:

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 parameters:

Measurement parameter	
Power Meter	
Test setup:	See sub clause 6.5 – A
Measurement uncertainty:	See sub clause 8

Results:

Modulation	Modulation scheme / bandwidth [Mbit/s]	Average Power [dBm]
DSSS / b – mode	1.0	13.2
	2.0	13.2
	5.5	13.1
	11.0	13.1
OFDM / g – mode	6.0	12.2
	9.0	12.1
	12.0	12.1
	18.0	12.2
	24.0	12.0
	36.0	11.9
	48.0	11.9
	54.0	11.8
OFDM / n HT20 – mode	6.5	12.0
	13.0	11.5
	19.5	12.0
	26.0	11.9
	39.0	11.8
	52.0	11.8
	58.5	11.7
	65.0	11.7

11.3 Maximum output power

Description:

Measurement of the maximum output power conducted and radiated. The measurements are performed using the data rate producing the highest conducted output power.

Measurement:

Measurement parameter	
According to DTS clause: 9.1.2	
Peak power meter	
Test setup:	See sub clause 6.5 B
Measurement uncertainty	See sub clause 8

Limits:

FCC	IC
Conducted: 1.0 W – Antenna gain with max. 6 dBi	

Results:

Frequency	Maximum Output Power [dBm]		
	2412 MHz	2437 MHz	2462 MHz
Output power conducted DSSS / b – mode	14.2	14.1	15.7
Output power conducted OFDM / g – mode	20.0	19.0	20.4
Output power conducted OFDM / n HT20 – mode	20.3	19.0	20.3

11.4 Duty cycle

Measurement:

Measurement parameters:

Measurement parameter	
Detector:	Peak
Sweep time:	Depends on the signal see plot
Resolution bandwidth:	10 MHz
Video bandwidth:	10 MHz
Trace mode:	Max hold
Test setup:	See sub clause 6.4 - A
Measurement uncertainty:	See sub clause 8

Limits:

FCC	IC
-/-	

Results:

T_{nom}	V_{nom}	lowest channel 2412 MHz	middle channel 2437 MHz	highest channel 2462 MHz
DSSS / b – mode		100%	100%	100%
OFDM / g – mode		100%	100%	100%
OFDM / n HT20 – mode		100%	100%	100%

11.5 Peak power spectral density

Description:

Measurement of the power spectral density of a digital modulated system. The measurement is repeated for both modulations at the lowest, middle and highest channel.

Measurement:

Measurement parameter	
According to DTS clause: 10.2	
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)
Test setup:	See sub clause 6.4 – A
Measurement uncertainty	See sub clause 8

Limits:

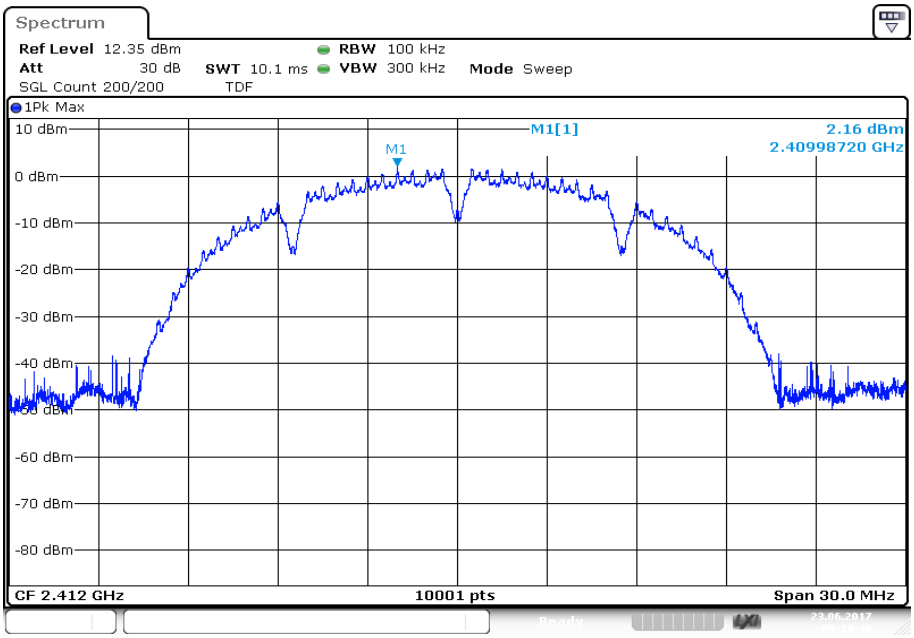
FCC	IC
8 dBm / 3kHz (conducted)	

Results:

Modulation	Peak power spectral density [dBm]		
Frequency	2412 MHz	2437 MHz	2462 MHz
DSSS / b – mode	2.2	1.5	1.9
OFDM / g – mode	-0.5	-0.9	-0.1
OFDM / n HT20 – mode	-0.1	-0.9	-0.2

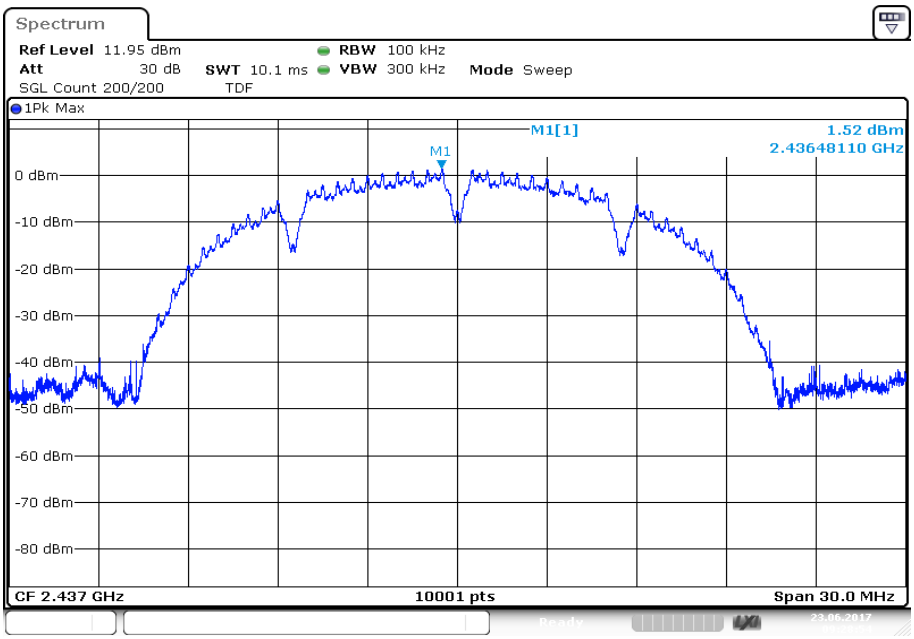
Plots: DSSS / b – mode

Plot 1: Lowest channel



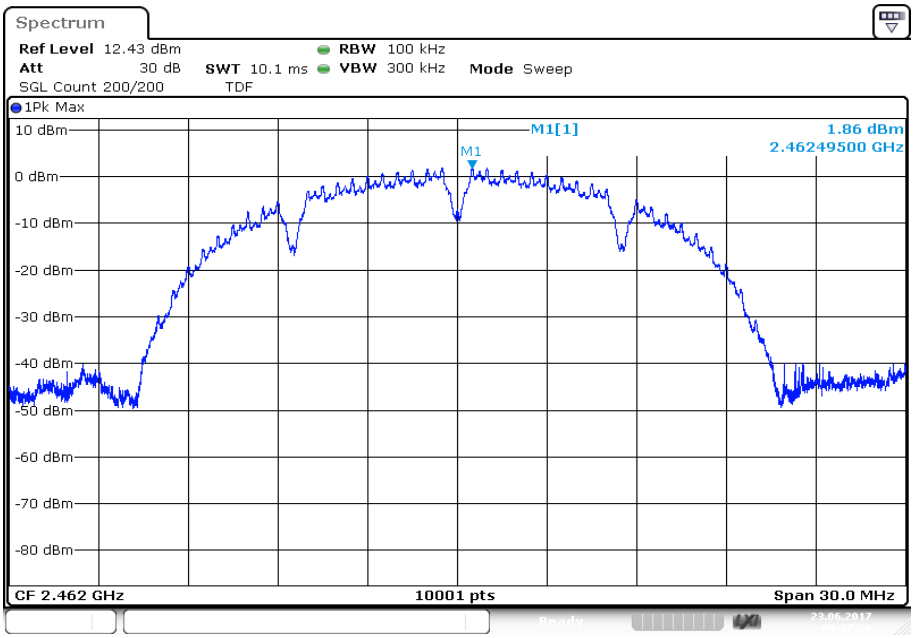
Date: 23.JUN.2017 09:19:49

Plot 2: Middle channel



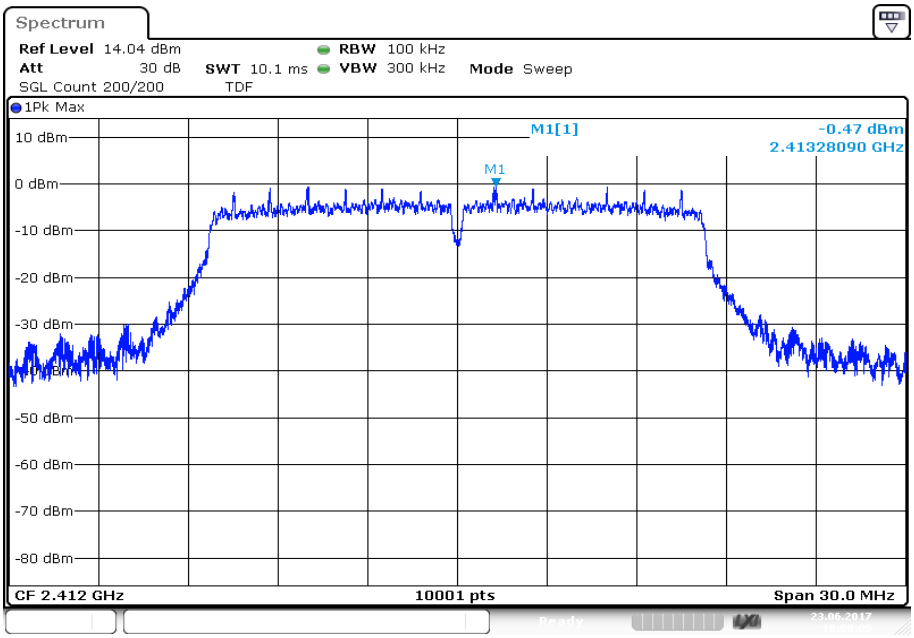
Date: 23.JUN.2017 09:28:55

Plot 3: Highest channel



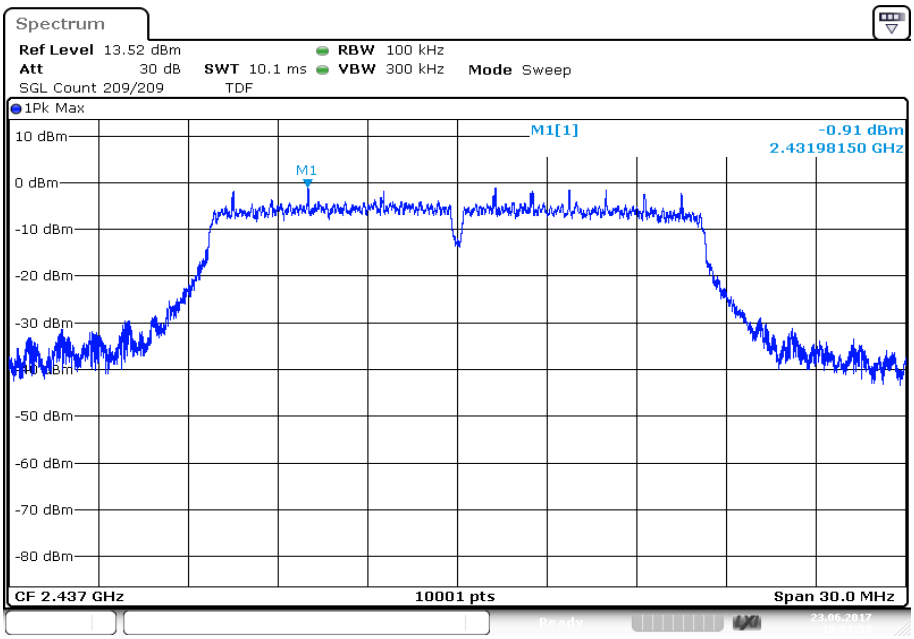
Plots: OFDM / g – mode

Plot 1: Lowest channel



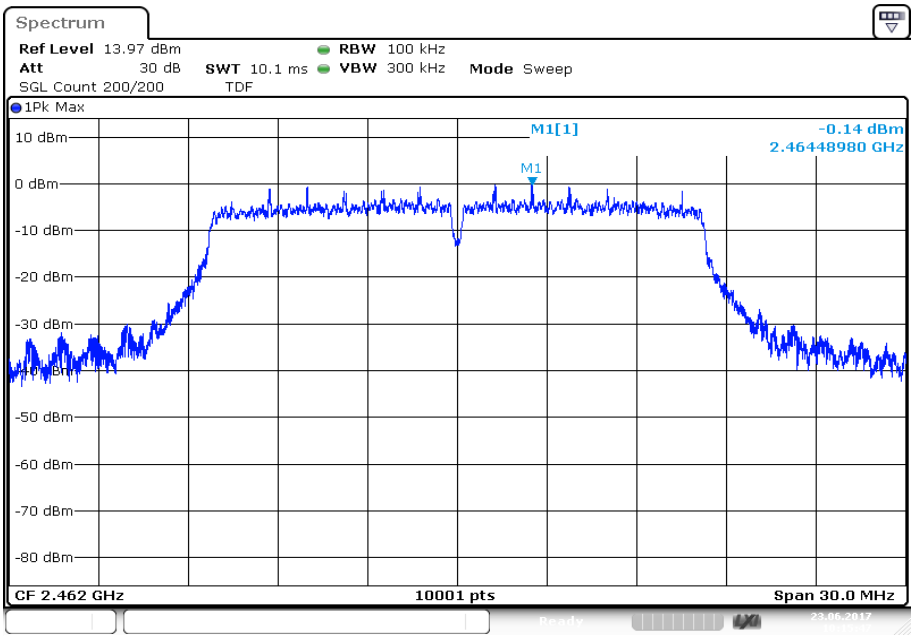
Date: 23.JUN.2017 10:00:06

Plot 2: Middle channel



Date: 23.JUN.2017 10:07:54

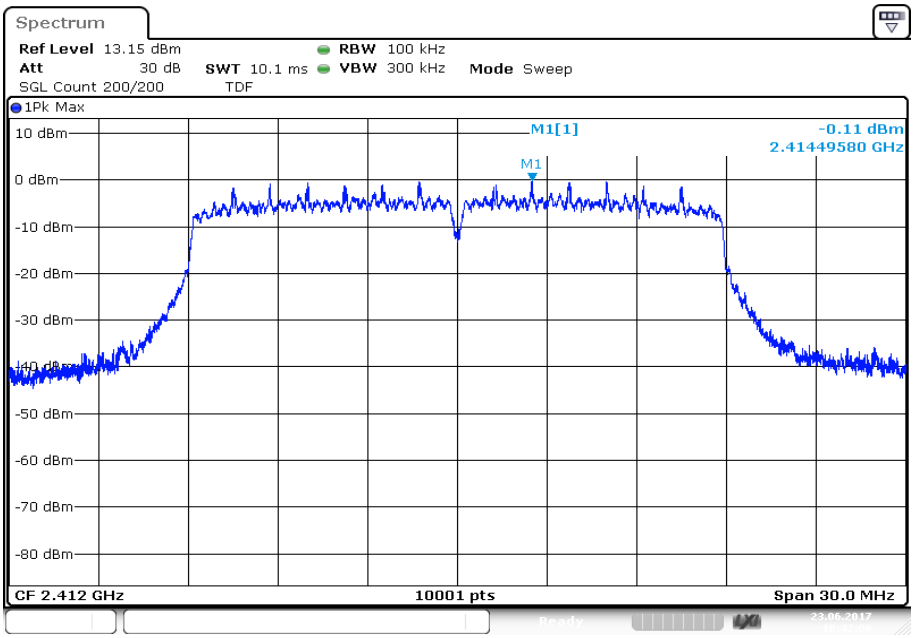
Plot 3: Highest channel



Date: 23.JUN.2017 10:15:47

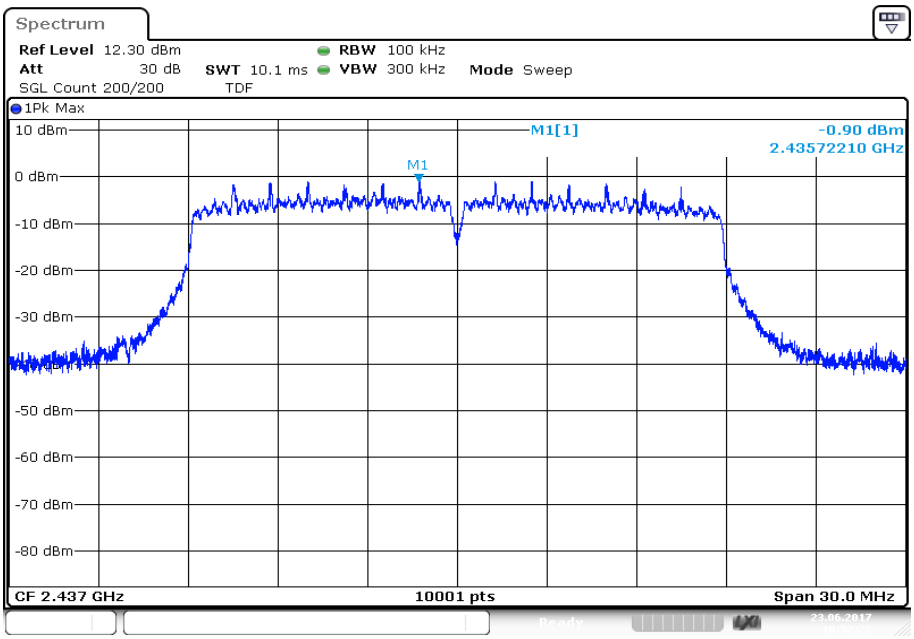
Plots: OFDM / n HT20 – mode

Plot 1: Lowest channel



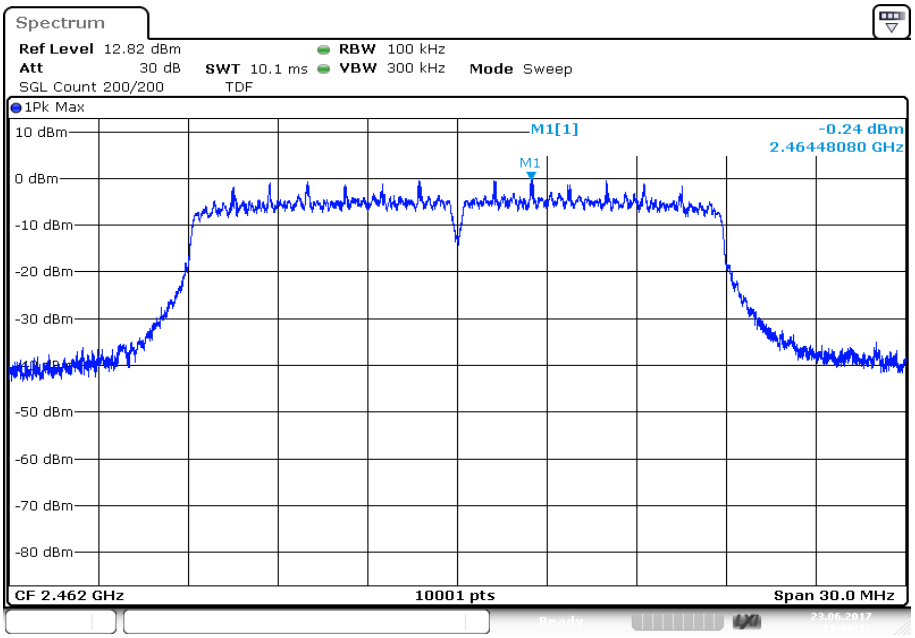
Date: 23.JUN.2017 10:42:06

Plot 2: Middle channel



Date: 23.JUN.2017 10:52:23

Plot 3: Highest channel



11.6 6 dB DTS bandwidth

Description:

Measurement of the 6 dB bandwidth of the modulated signal.

Measurement:

Measurement parameter	
According to DTS clause: 8.1	
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
Test setup:	See sub clause 6.4 – A
Measurement uncertainty	See sub clause 8

Limits:

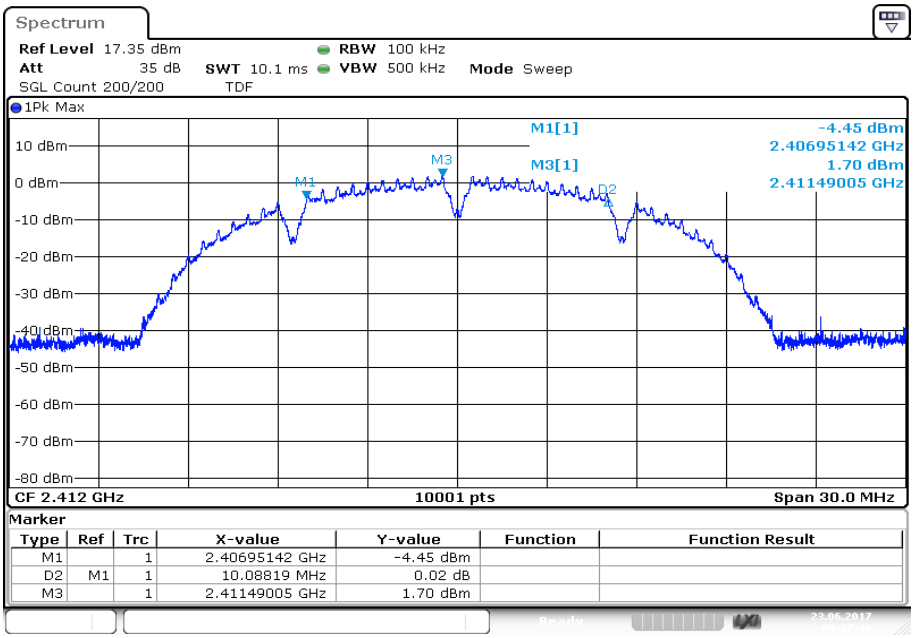
FCC	IC
Systems using digital modulation techniques may operate in the 2400–2483.5 MHz band. The minimum 6 dB bandwidth shall be at least 500 kHz.	

Results:

Frequency	6 dB DTS bandwidth [kHz]		
	2412 MHz	2437 MHz	2462 MHz
DSSS / b – mode	10088.2	10082.1	10088.0
OFDM / g – mode	16300.3	16297.5	16297.2
OFDM / n HT20 – mode	16672.5	16972.3	16696.3

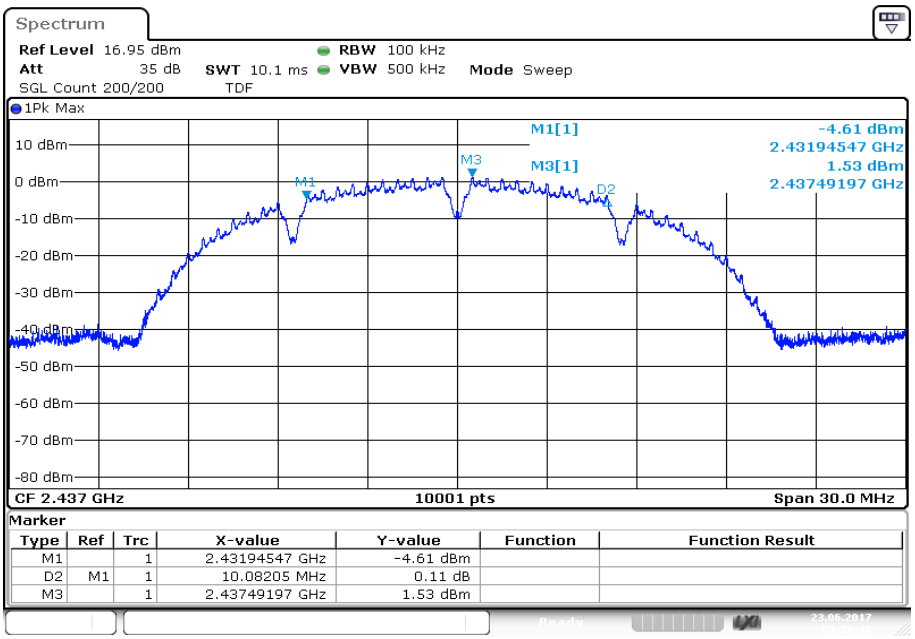
Plots: DSSS / b – mode

Plot 1: Lowest channel



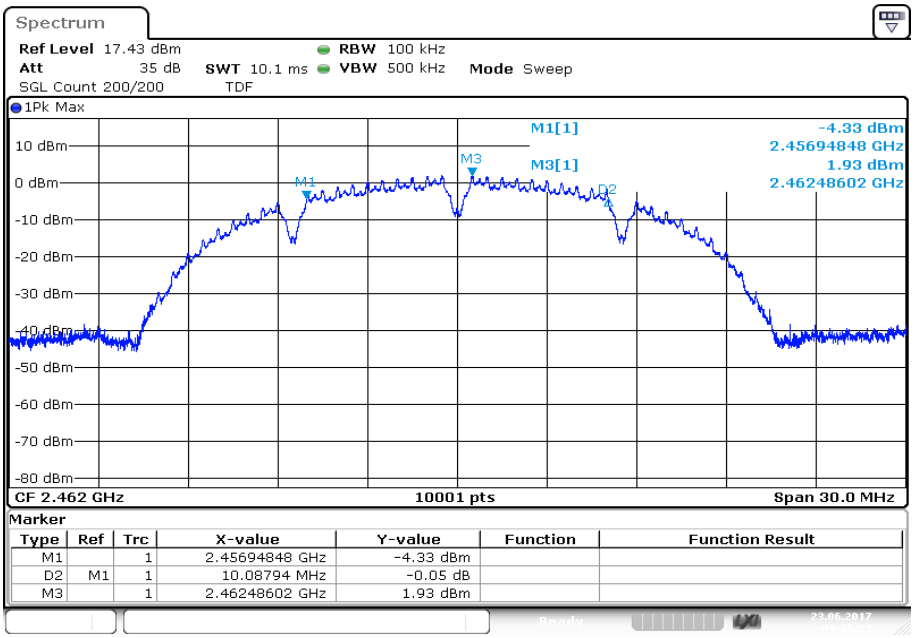
Date: 23.JUN.2017 09:17:41

Plot 2: Middle channel



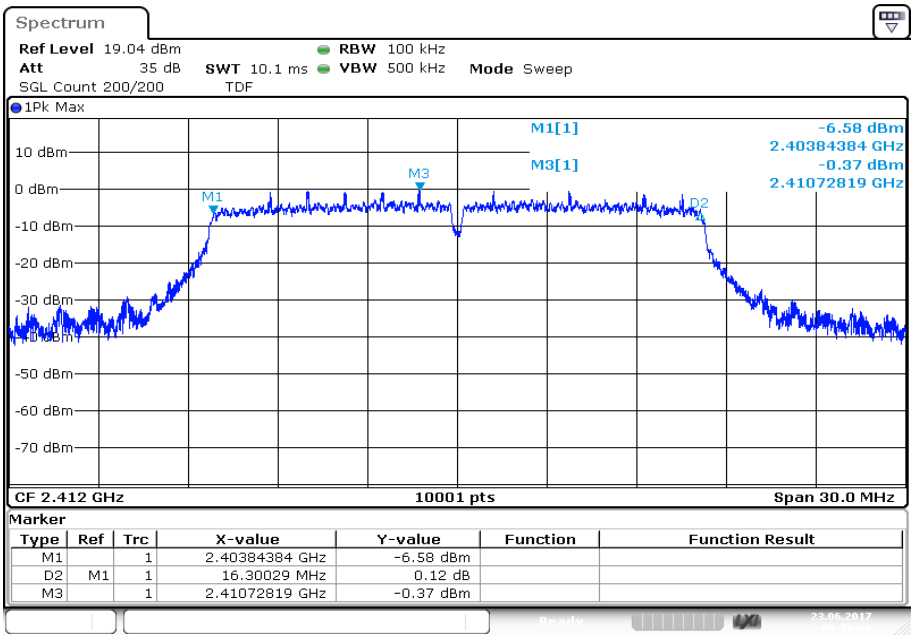
Date: 23.JUN.2017 09:26:48

Plot 3: Highest channel

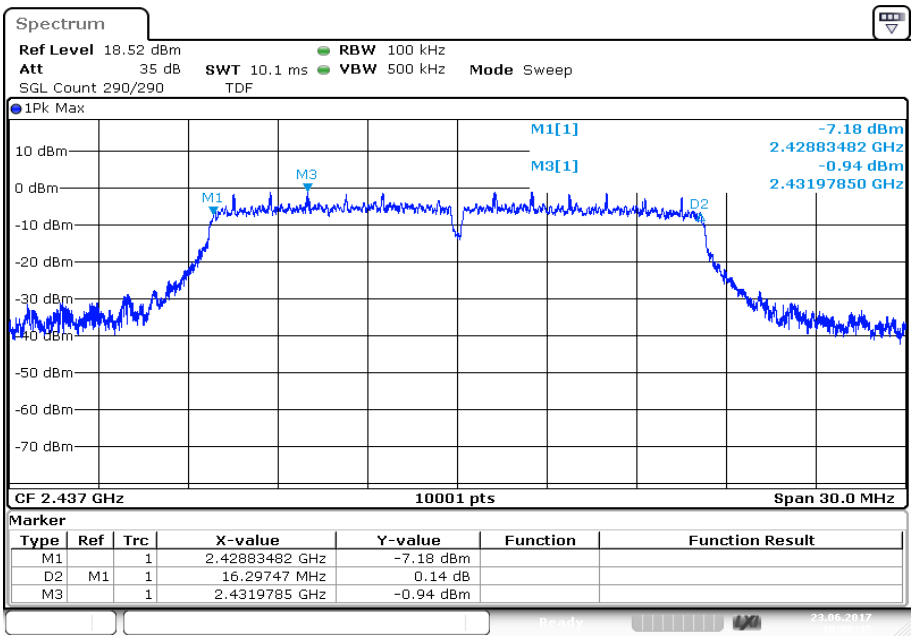


Plots: OFDM / g – mode

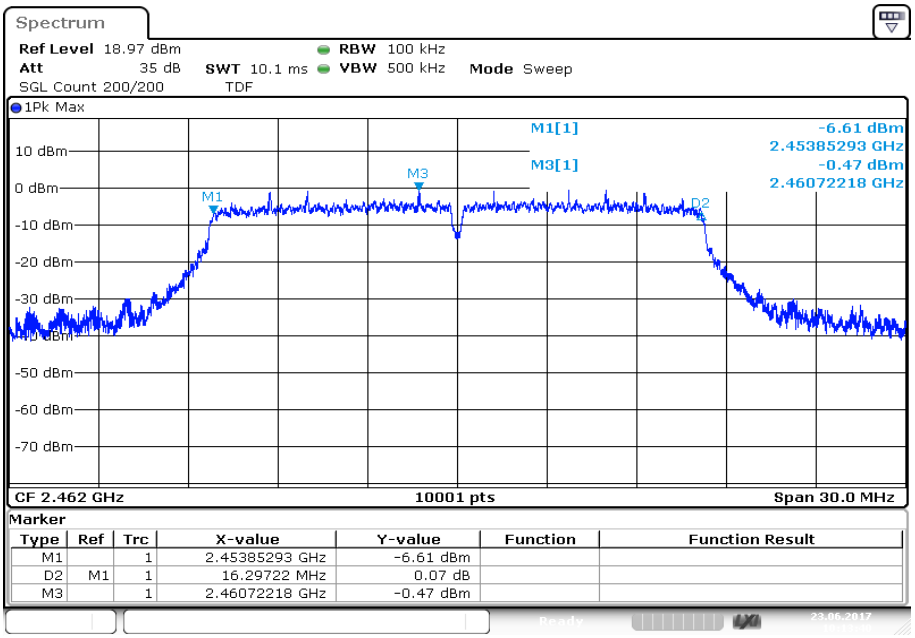
Plot 1: Lowest channel



Plot 2: Middle channel

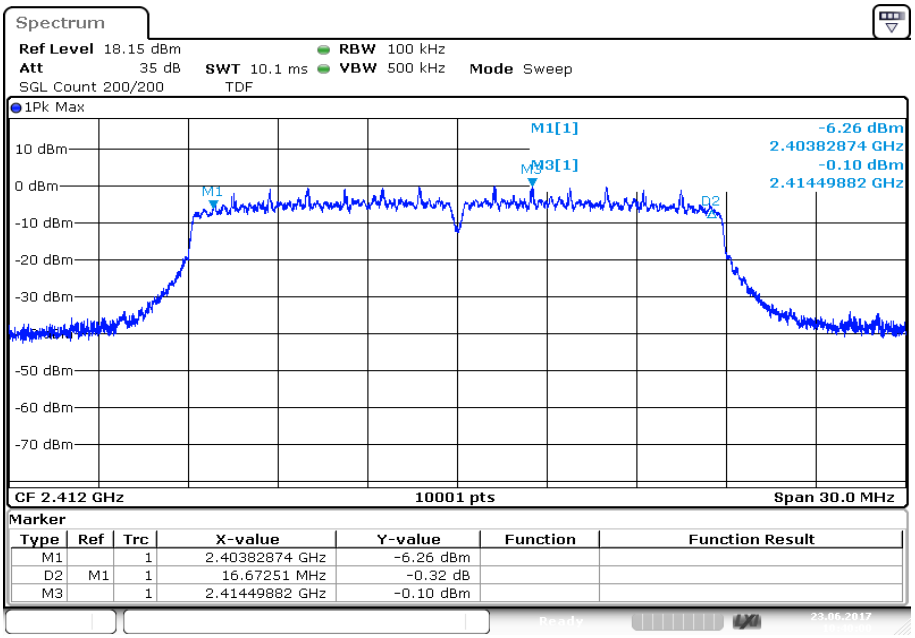


Plot 3: Highest channel



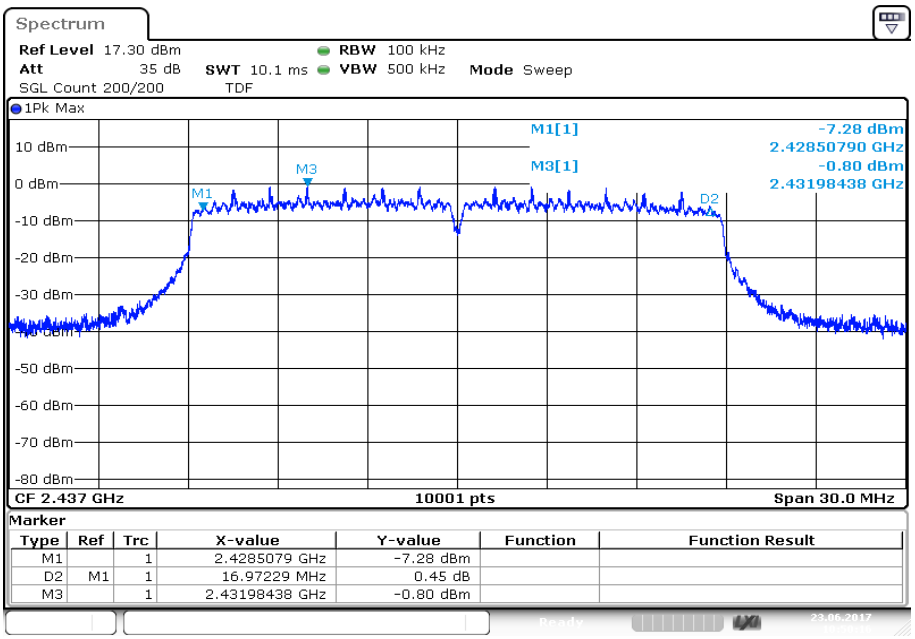
Plots: OFDM / n HT20 – mode

Plot 1: Lowest channel



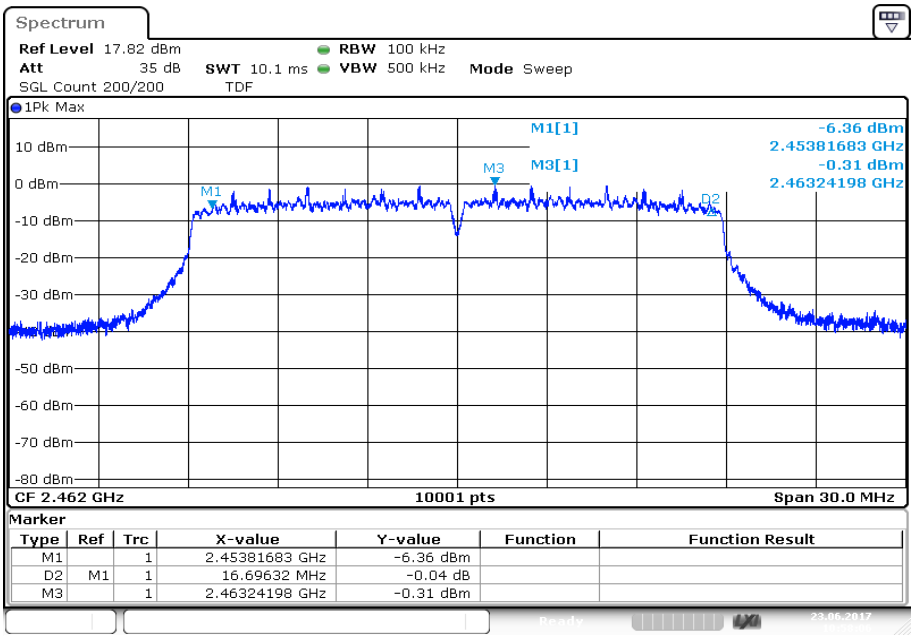
Date: 23.JUN.2017 10:40:01

Plot 2: Middle channel



Date: 23.JUN.2017 10:50:17

Plot 3: Highest channel



11.7 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
Test setup:	See sub clause 6.4 – A
Measurement uncertainty	See sub clause 8

Usage:

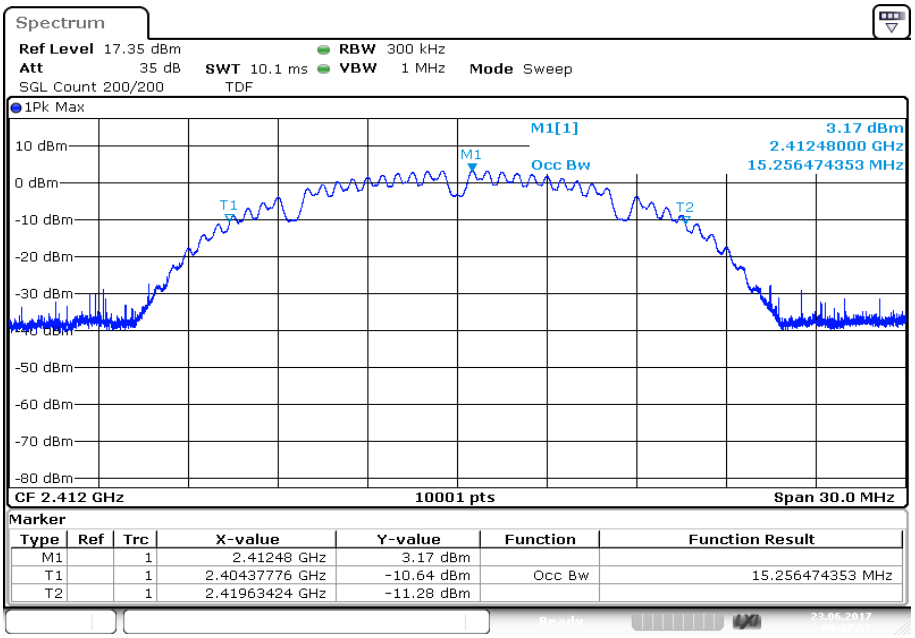
-/-	IC
OBW is necessary for Emission Designator	

Results:

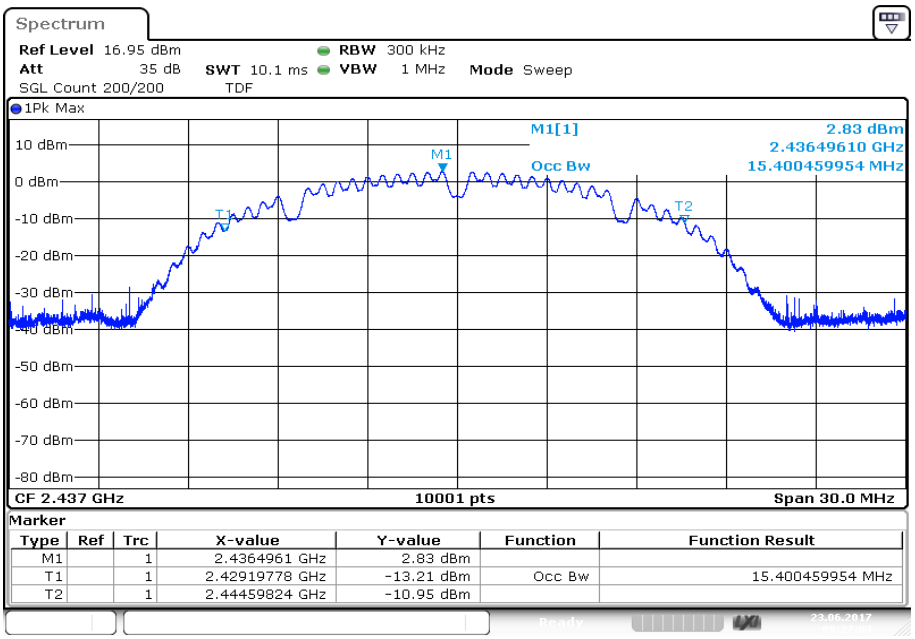
Modulation	99% bandwidth [kHz]		
Frequency	2412 MHz	2437 MHz	2462 MHz
DSSS / b – mode	15256.5	15400.5	15376.5
OFDM / g – mode	16708.3	16783.3	16741.3
OFDM / n HT20 – mode	17608.2	17638.2	17635.2

Plots: DSSS / b – mode

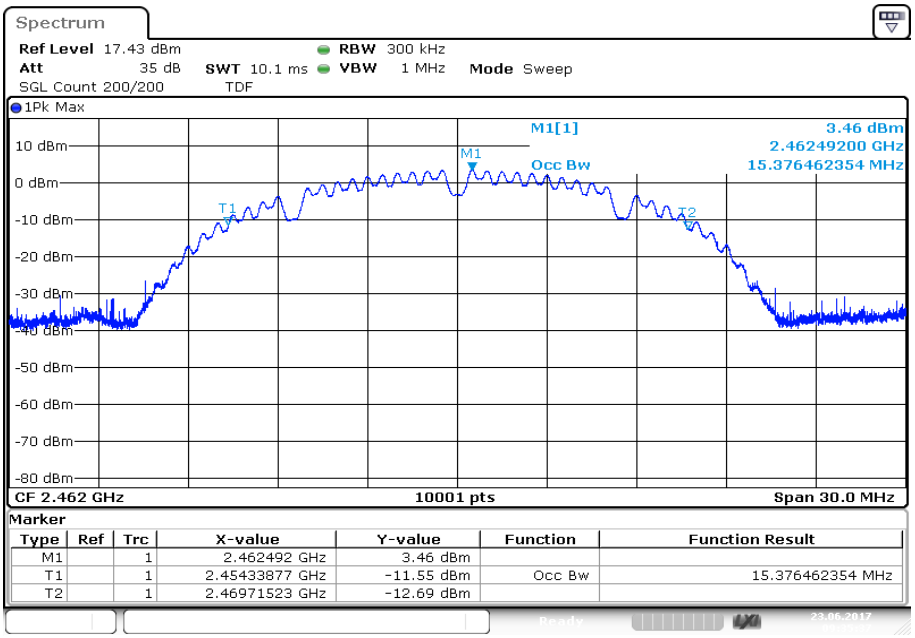
Plot 1: Lowest channel



Plot 2: Middle channel

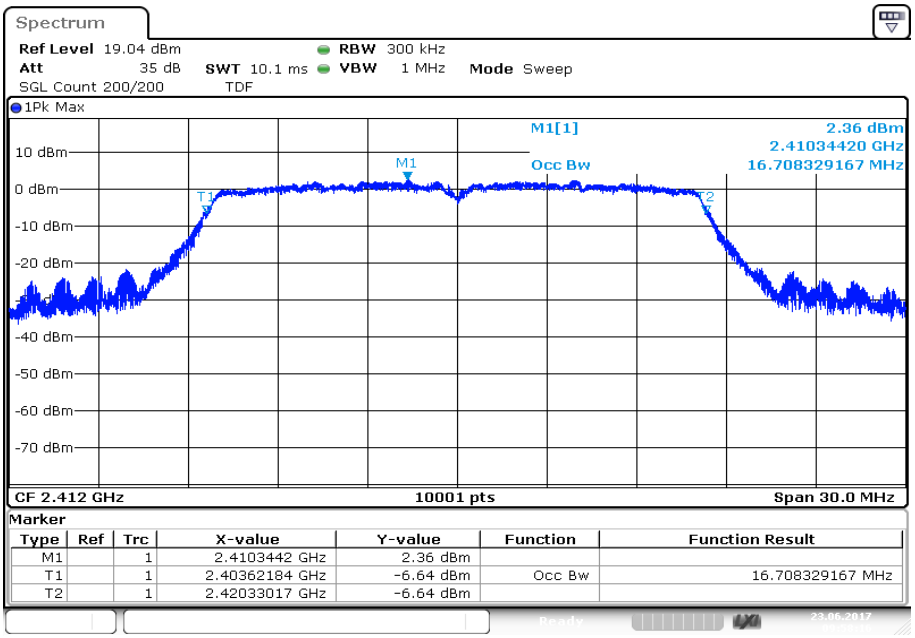


Plot 3: Highest channel



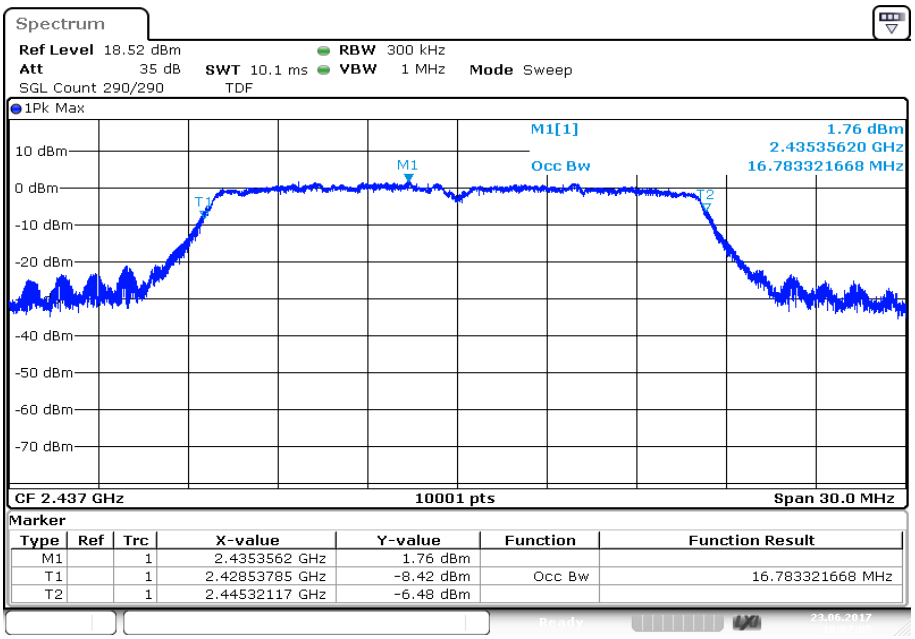
Plots: OFDM / g – mode

Plot 1: Lowest channel



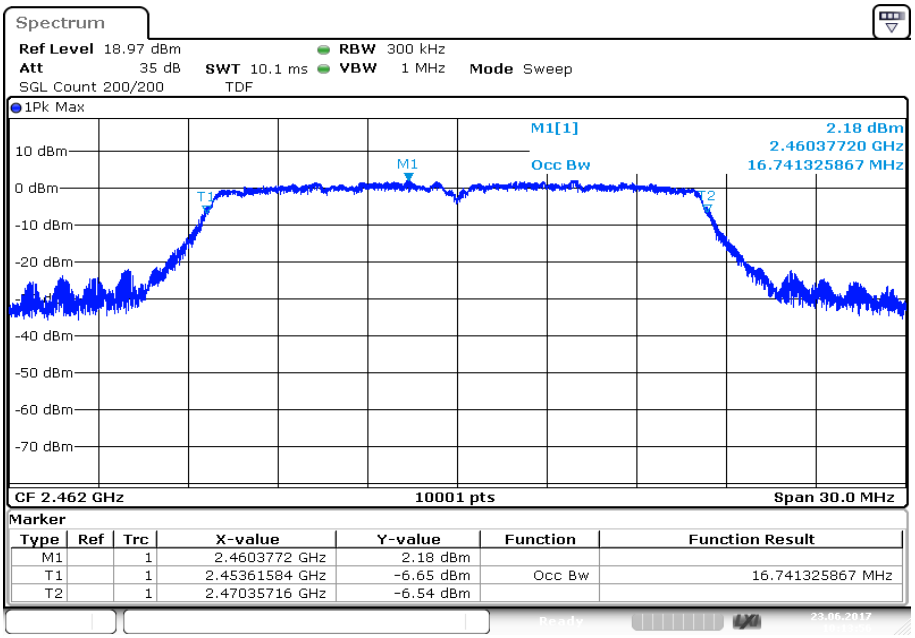
Date: 23.JUN.2017 09:58:16

Plot 2: Middle channel



Date: 23.JUN.2017 10:07:05

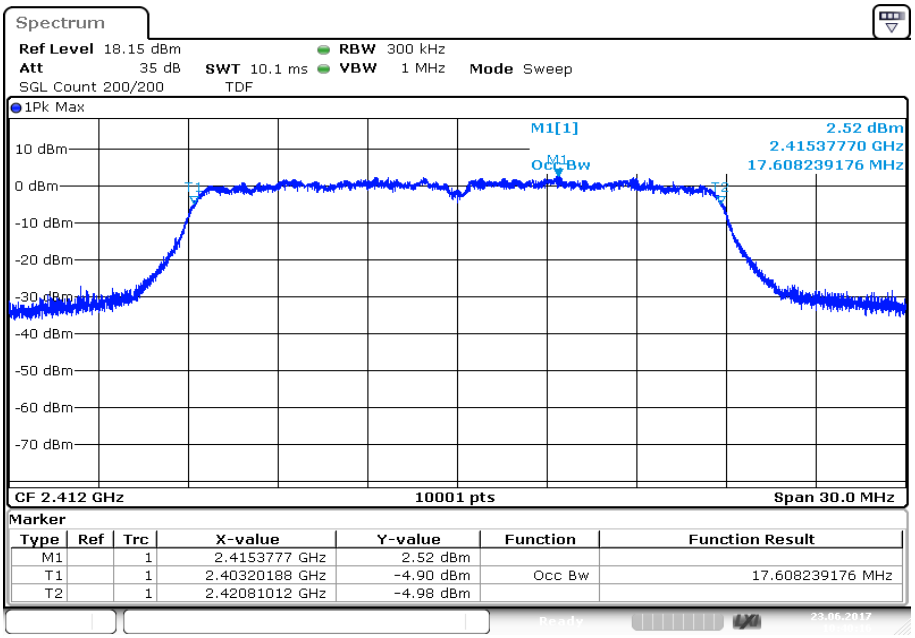
Plot 3: Highest channel



Date: 23.JUN.2017 10:13:56

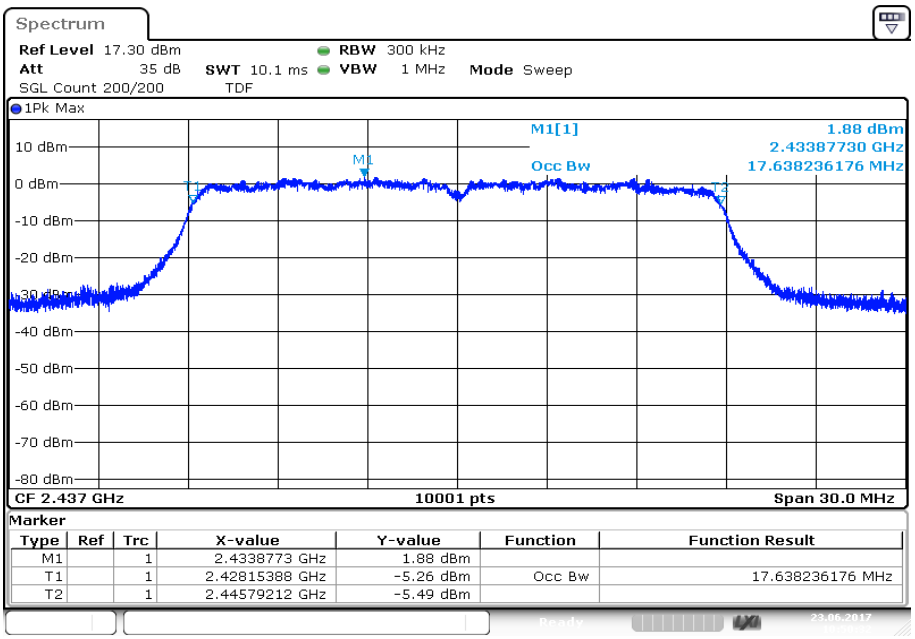
Plots: OFDM / n HT20 – mode

Plot 1: Lowest channel



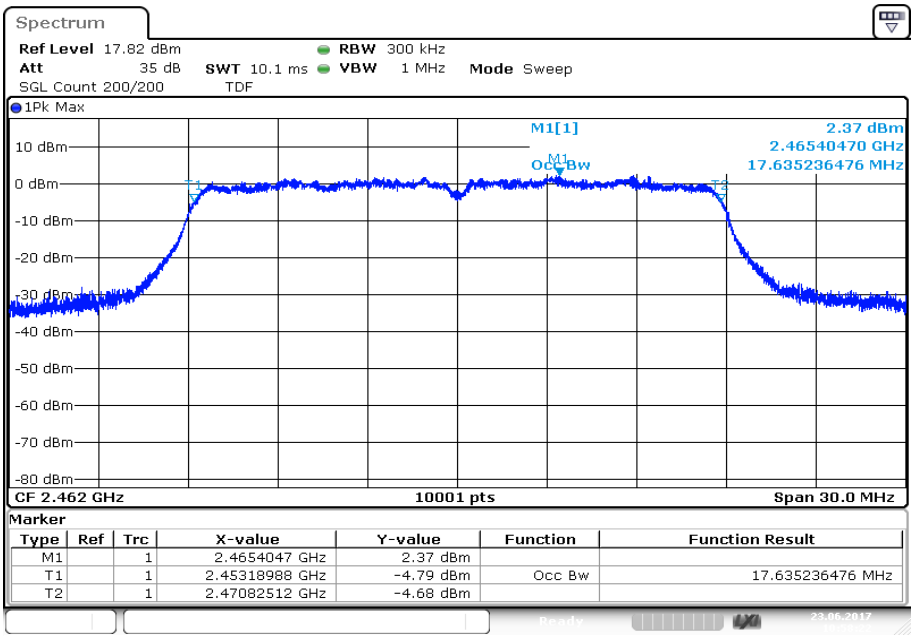
Date: 23.JUN.2017 10:40:16

Plot 2: Middle channel



Date: 23.JUN.2017 10:50:33

Plot 3: Highest channel



Date: 23.JUN.2017 10:58:22

11.8 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
Test setup:	See sub clause 6.4 – A
Measurement uncertainty	See sub clause 8

Usage:

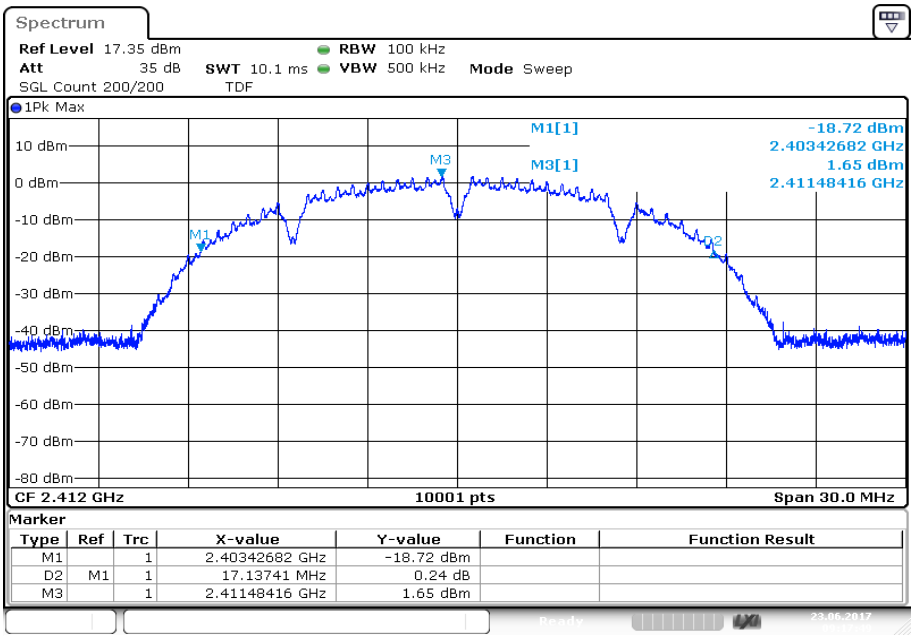
-/-	IC
Within the used band!	

Results:

Modulation	20 dB bandwidth [MHz]		
Frequency	2412 MHz	2437 MHz	2462 MHz
DSSS / b – mode	17.1	17.2	17.1
OFDM / g – mode	17.5	17.6	17.7
OFDM / n HT20 – mode	18.3	18.3	18.3

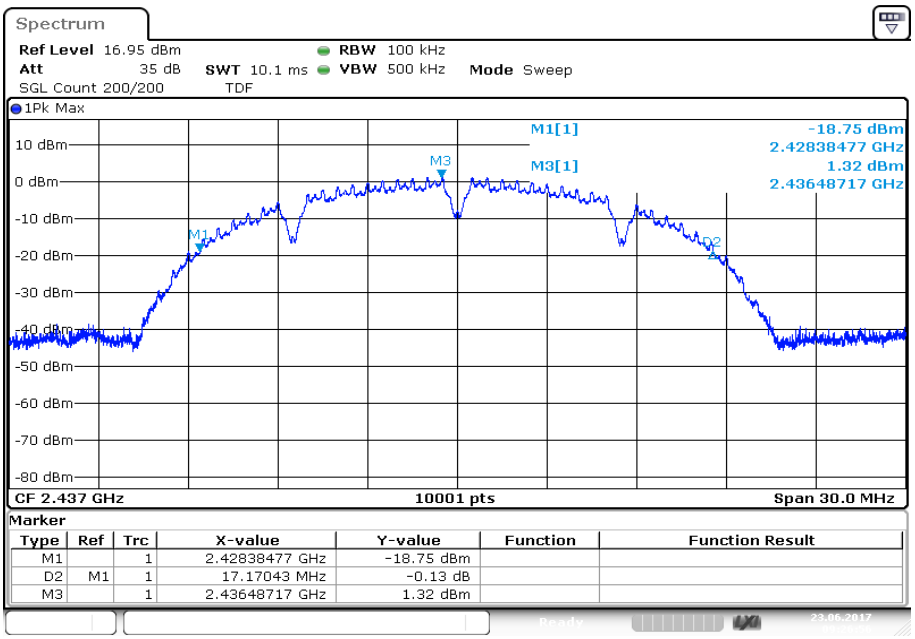
Plots: DSSS / b – mode

Plot 1: Lowest channel



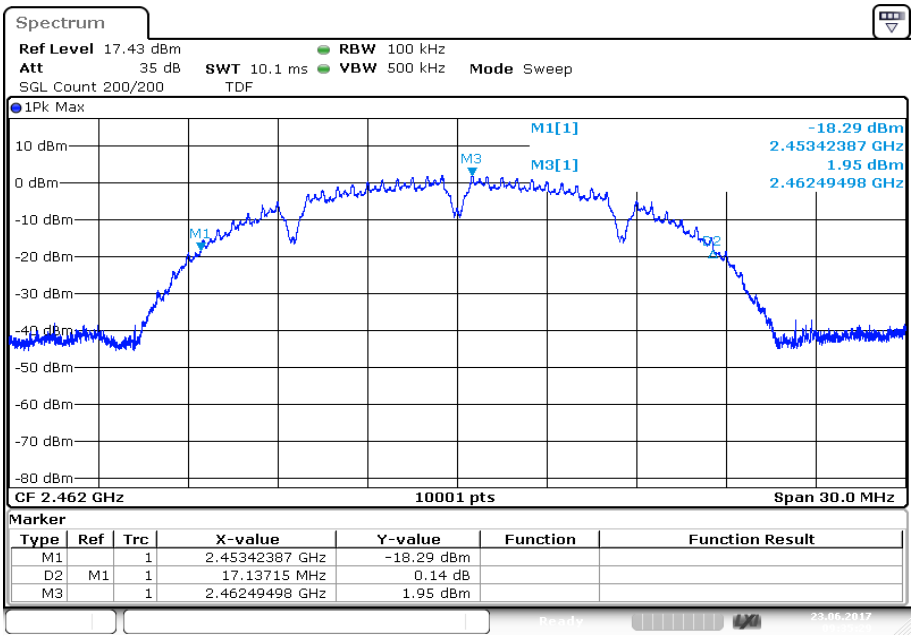
Date: 23.JUN.2017 09:17:49

Plot 2: Middle channel



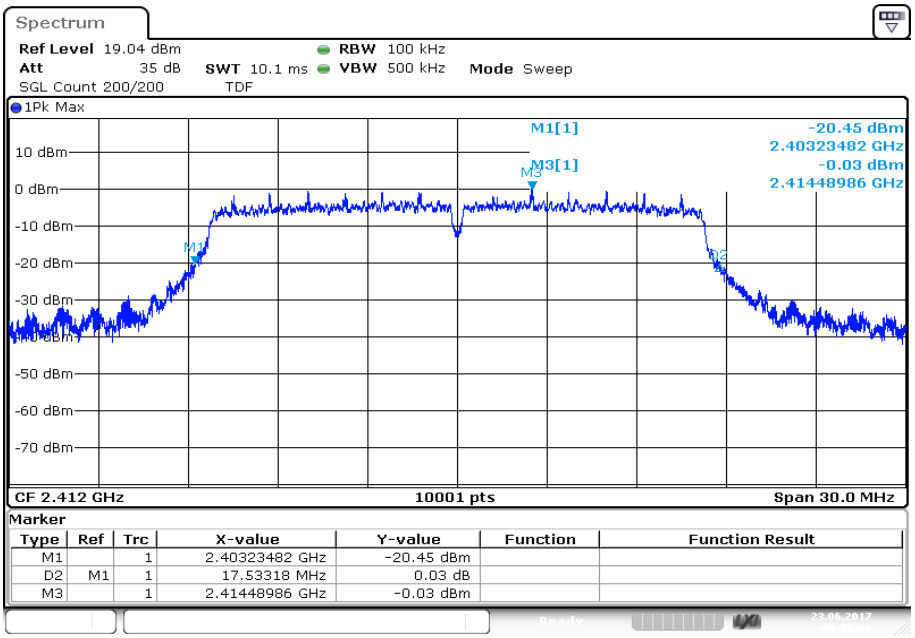
Date: 23.JUN.2017 09:26:56

Plot 3: Highest channel



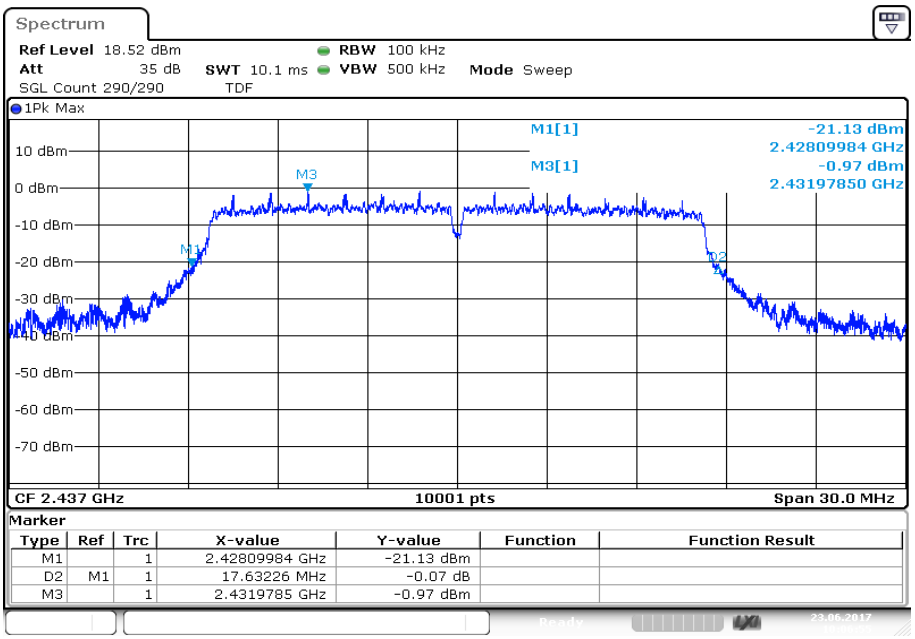
Plots: OFDM / g – mode

Plot 1: Lowest channel



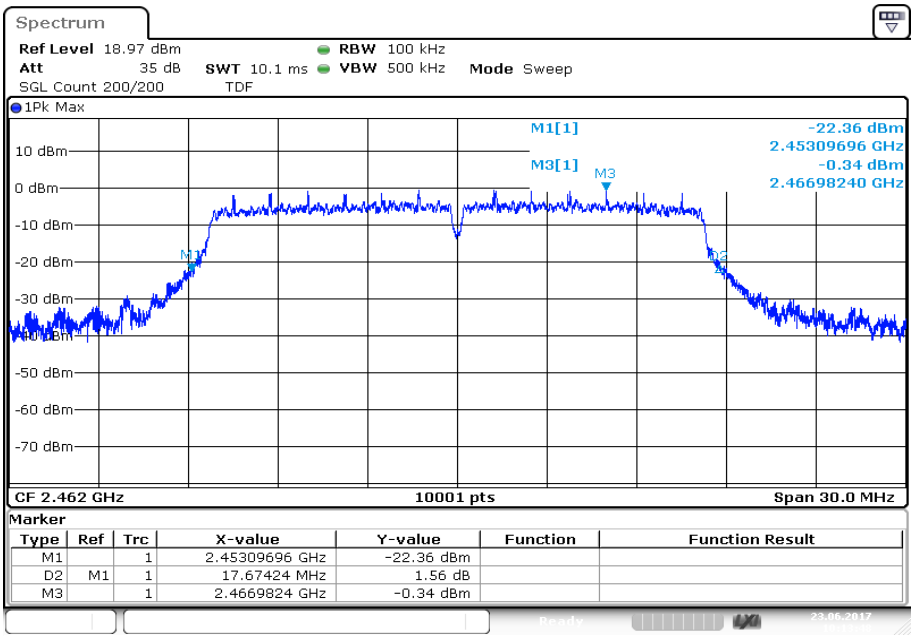
Date: 23.JUN.2017 09:58:08

Plot 2: Middle channel



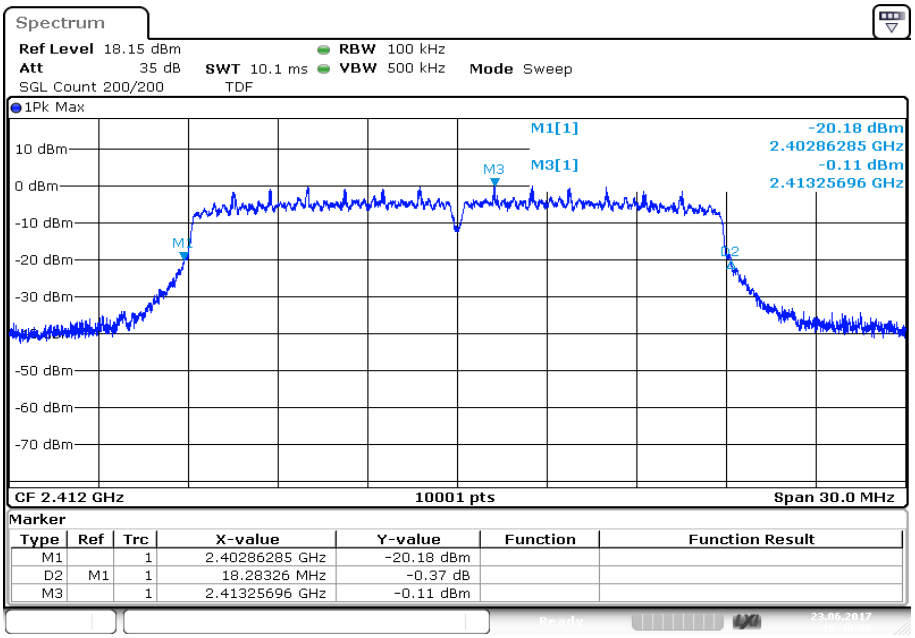
Date: 23.JUN.2017 10:06:56

Plot 3: Highest channel



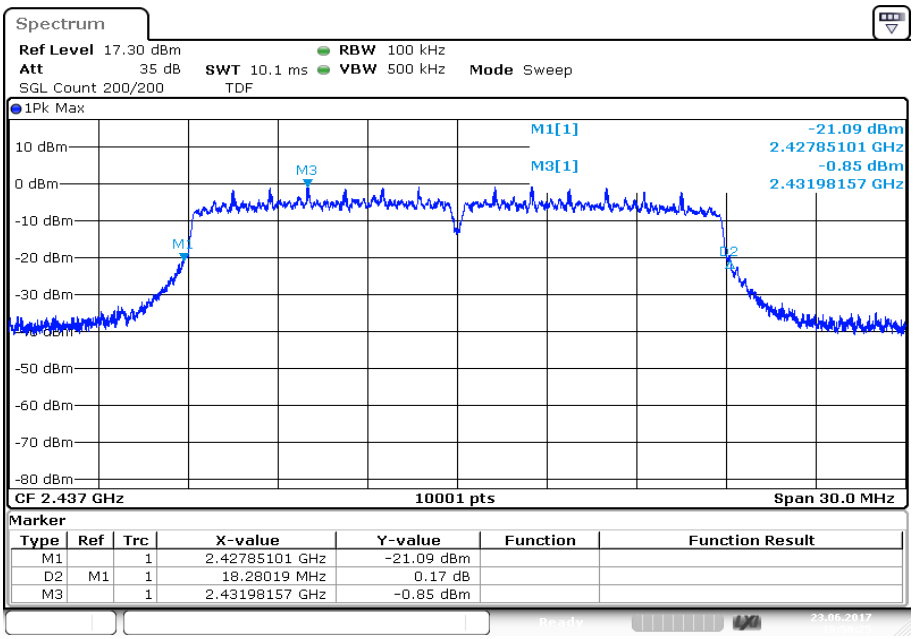
Plots: OFDM / n HT20 – mode

Plot 1: Lowest channel



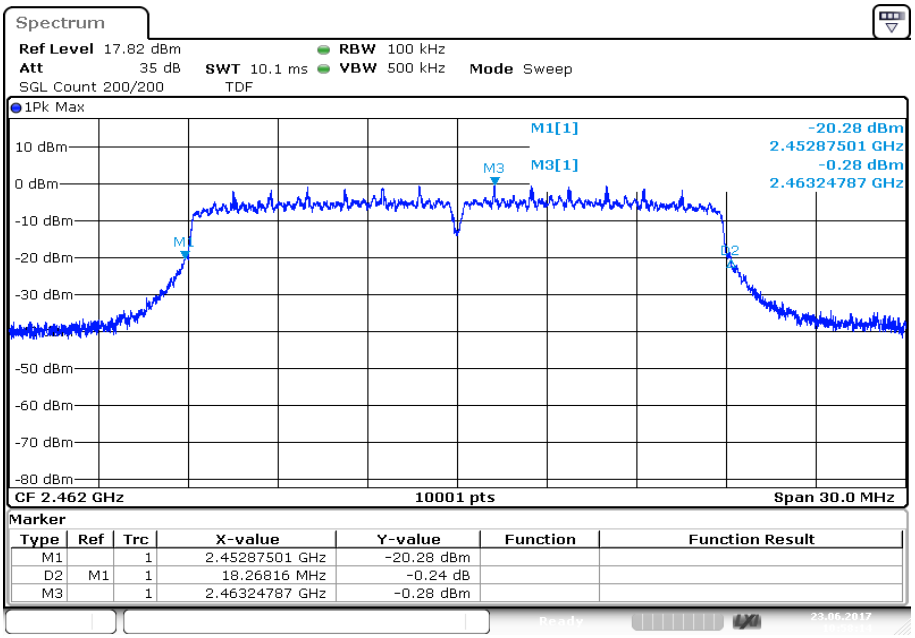
Date: 23.JUN.2017 10:40:08

Plot 2: Middle channel



Date: 23.JUN.2017 10:50:25

Plot 3: Highest channel



11.9 Band edge compliance radiated

Description:

Measurement of the radiated band edge compliance. The EUT is turned in the position that results in the maximum level at the band edge. Then a sweep over the corresponding restricted band is performed. The EUT is set to channel 1 for the lower restricted band and to channel 11 for the upper restricted band. The measurement is repeated for all modulations. Measurement distance is 3 m.

Measurement:

Measurement parameter for peak measurements	
Detector:	Peak / RMS
Sweep time:	Auto
Resolution bandwidth:	1 MHz
Video bandwidth:	1 MHz
Span:	See plot!
Trace mode:	Max Hold
Test setup:	See sub clause 6.2
Measurement uncertainty	See sub clause 8

Measurement parameter for average measurements	
According to DTS clause: 13.3.2	
Detector:	RMS
Sweep time:	Auto
Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Span:	2 MHz
Trace mode:	RMS Average over 101 sweeps
Test setup:	See sub clause 6.2
Measurement uncertainty	See sub clause 8

Limits:

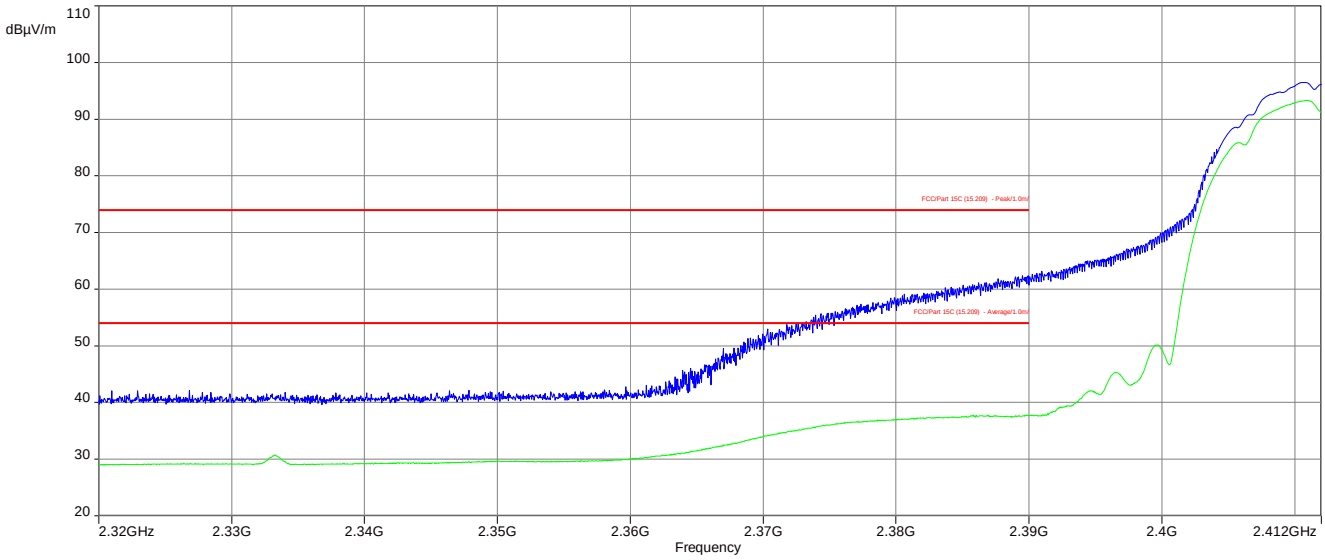
FCC	IC
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains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

Results:

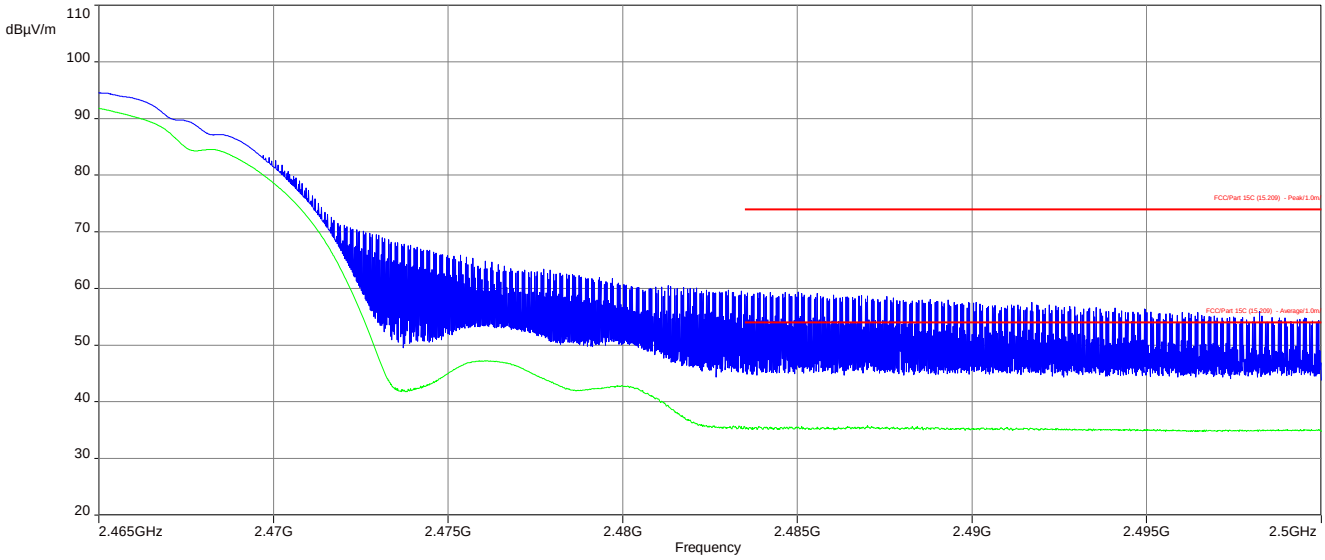
Scenario Modulation	Band edge compliance radiated [dB]		
	DSSS	OFDM (20 MHz bandwidth)	OFDM (40 MHz bandwidth)
Lower band edge	> 20 dB (Peak) > 20 dB (AVG)	> 20 dB (Peak) > 20 dB (AVG)	> 20 dB (Peak) > 20 dB (AVG)
Upper band edge	> 20 dB (Peak) > 20 dB (AVG)	> 20 dB (Peak) > 20 dB (AVG)	> 20 dB (Peak) > 20 dB (AVG)

Plots: DSSS - peak / average

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

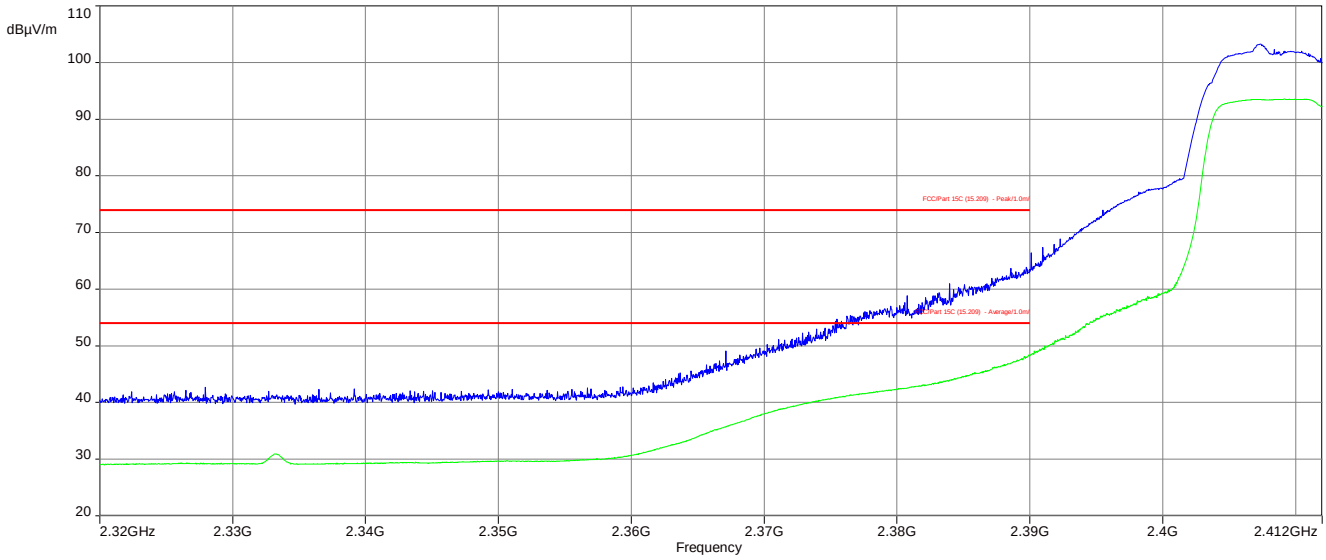


Plot 2: TX mode, upper band edge, vertical & horizontal polarization

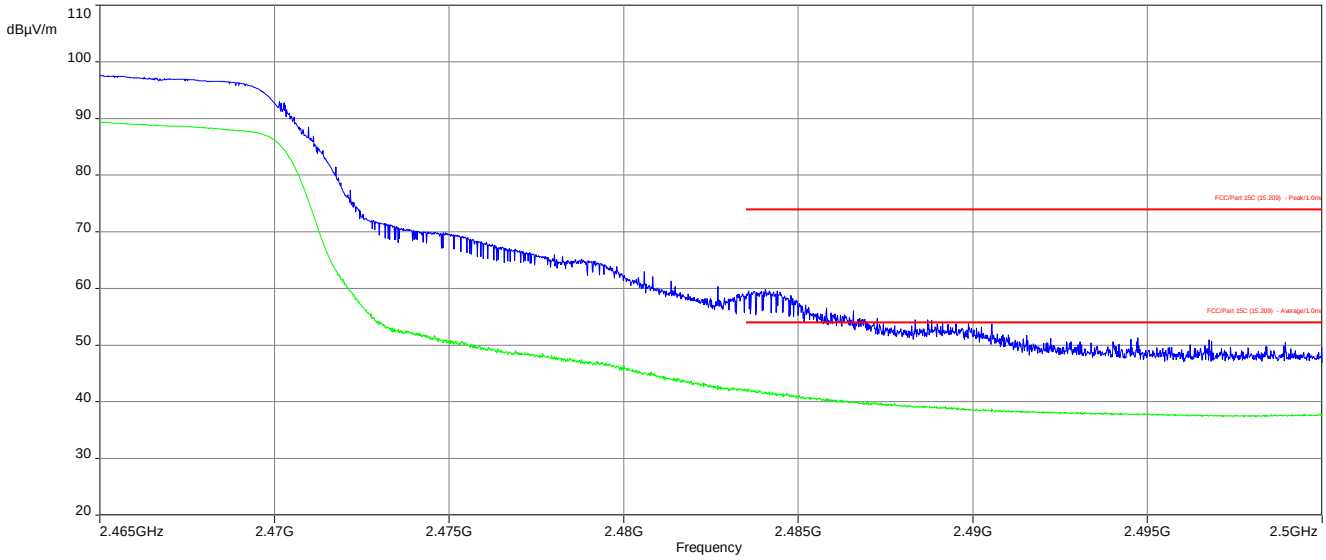


Plots: OFDM (20 MHz bandwidth) - peak / average (g – mode)

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



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



11.10 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: 13.3.2 and clause 12.2.2	
Detector:	RMS
Sweep time:	Auto
Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Span:	Lower band edge: 2388 MHz to 2390 MHz (2 MHz) Upper band edge: 2483.5 MHz to 2485.5 MHz (2 MHz)
Trace mode:	Trace average with 200 counts
Test setup:	See sub clause 6.4 – A
Measurement uncertainty	See sub clause 8

Limits:

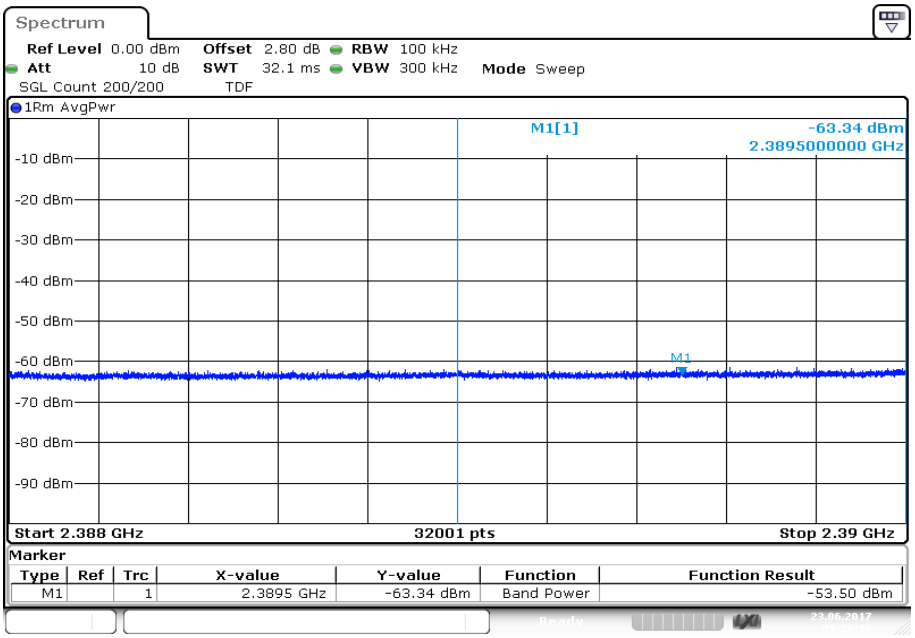
FCC	IC
-41.26 dBm	

Results:

Scenario Modulation	Band edge compliance [dBm]			
	DSSS / b – mode	OFDM / g – mode	OFDM / n HT20 – mode	OFDM / n HT40 – mode
Max. lower band edge power	-53.5	-45.9	-45.6	-/-
Max. upper band edge power	-51.6	-44.2	-42.9	-/-

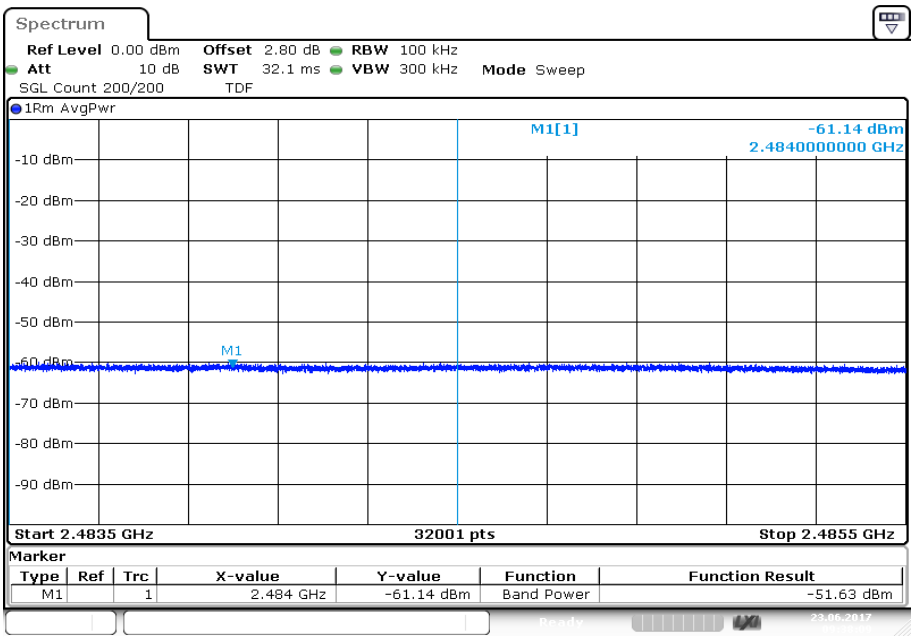
Plots: DSSS / b – mode

Plot 1: Lower band edge



Date: 23.JUN.2017 09:20:16

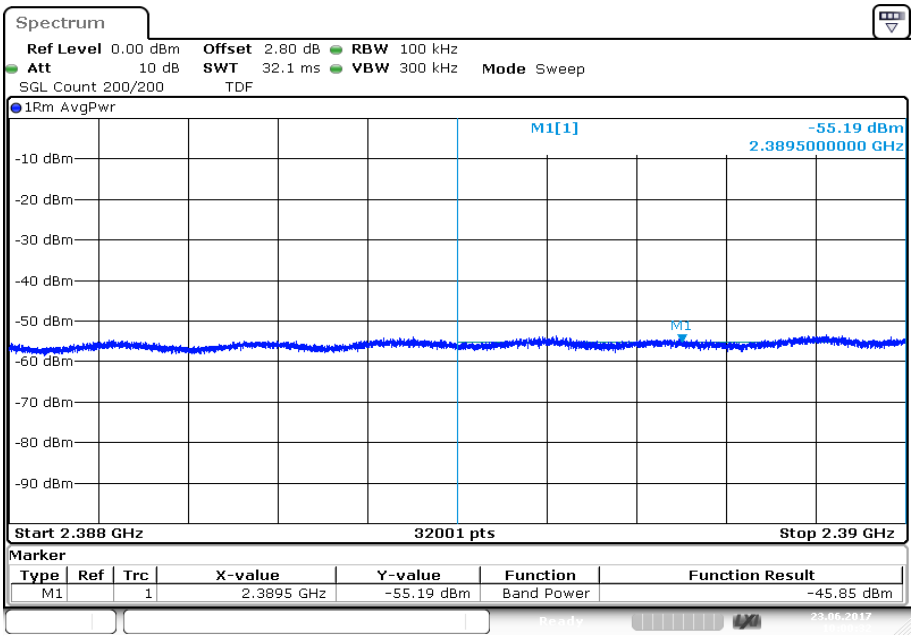
Plot 2: Upper band edge



Date: 23.JUN.2017 09:38:10

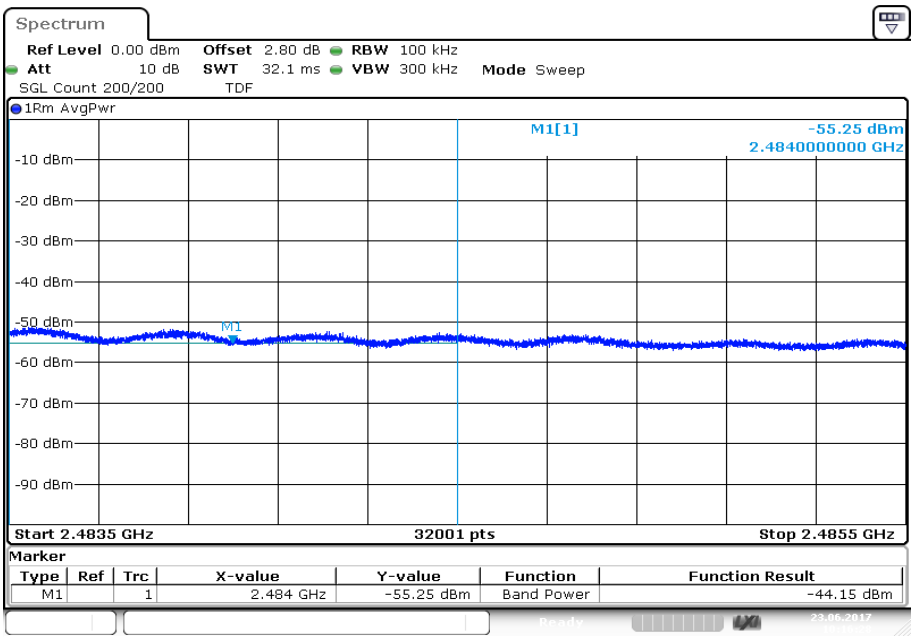
Plots: OFDM / g – mode

Plot 1: Lower band edge



Date: 23.JUN.2017 10:00:32

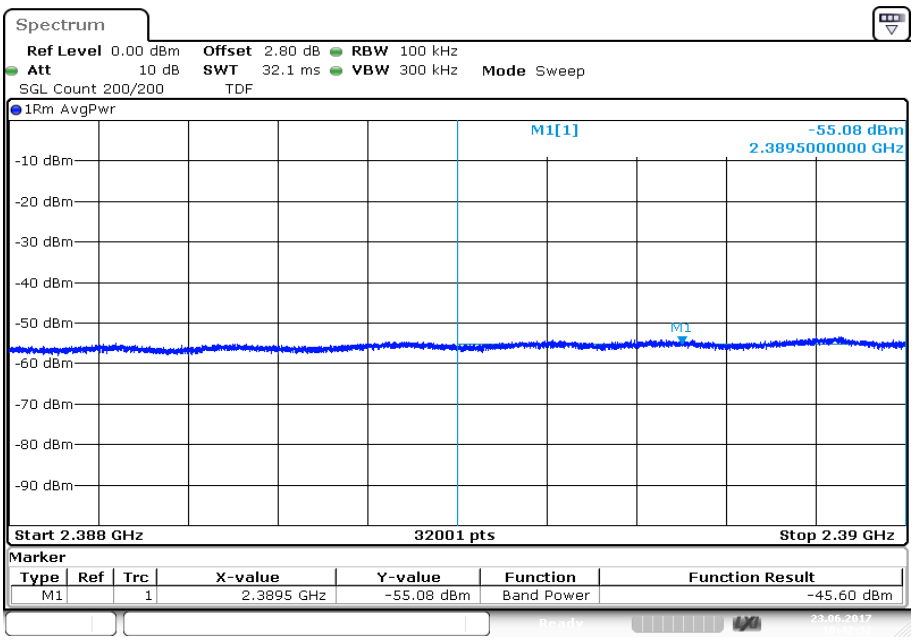
Plot 2: Upper band edge



Date: 23.JUN.2017 10:16:28

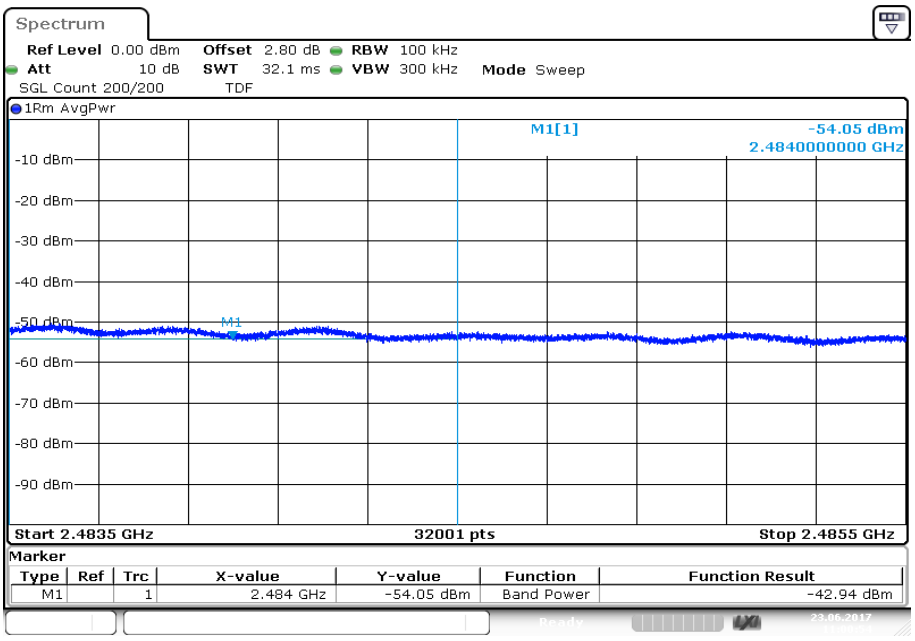
Plots: OFDM / n HT20 – mode

Plot 1: Lower band edge



Date: 23.JUN.2017 10:42:32

Plot 2: Upper band edge



Date: 23.JUN.2017 11:00:54

11.11 Spurious emissions conducted

Description:

Measurement of the conducted spurious emissions in transmit mode. The measurement is performed at channel 1, 6 and 11. 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
Test setup:	See sub clause 6.4 – A
Measurement uncertainty:	See sub clause 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					
DSSS / b – mode					
f [MHz]		amplitude of emission [dBm]	limit max. allowed emission power	actual attenuation below frequency of operation [dB]	results
2412		1.2	30 dBm		Operating frequency
No peaks detected.			-20 dBc (peak) -30 dBc (average)	-/-	compliant
2437		1.2	30 dBm		Operating frequency
No peaks detected.			-20 dBc (peak) -30 dBc (average)	-/-	compliant
2462		1.9	30 dBm		Operating frequency
No peaks detected.			-20 dBc (peak) -30 dBc (average)	-/-	compliant

Results: OFDM / g – mode

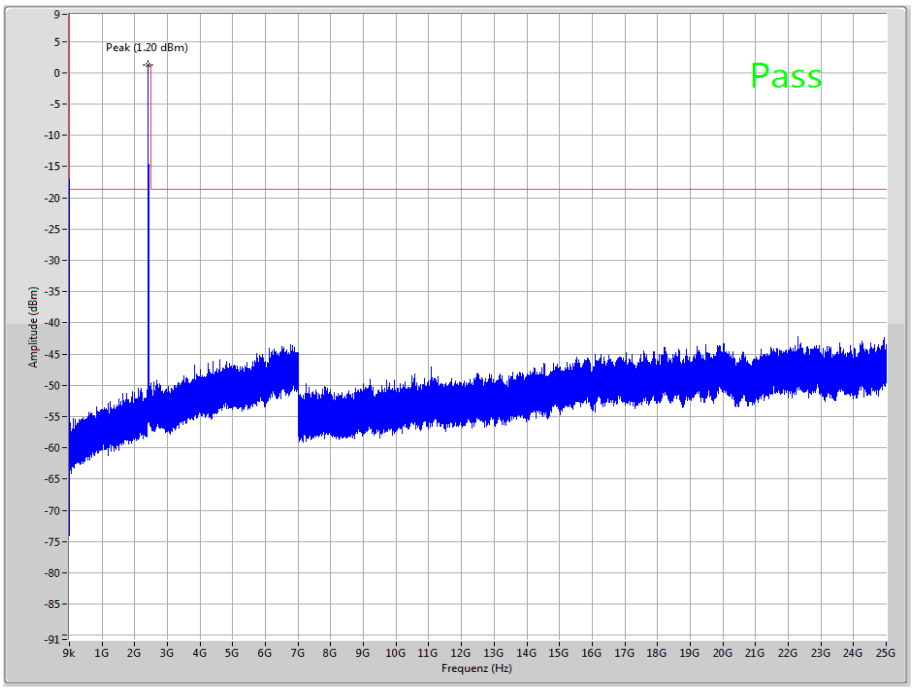
TX Spurious Emissions Conducted					
OFDM / g – mode					
f [MHz]		amplitude of emission [dBm]	limit max. allowed emission power	actual attenuation below frequency of operation [dB]	results
2412		-0.9	30 dBm		Operating frequency
No peaks detected.			-20 dBc (peak) -30 dBc (average)	-/-	compliant
2437		-1.7	30 dBm		Operating frequency
No peaks detected.			-20 dBc (peak) -30 dBc (average)	-/-	compliant
2462		-0.4	30 dBm		Operating frequency
No peaks detected.			-20 dBc (peak) -30 dBc (average)	-/-	compliant

Results: OFDM / n HT20 – mode

TX Spurious Emissions Conducted					
OFDM / n HT20 – mode					
f [MHz]		amplitude of emission [dBm]	limit max. allowed emission power	actual attenuation below frequency of operation [dB]	results
2412		-0.8	30 dBm		Operating frequency
No peaks detected.			-20 dBc (peak) -30 dBc (average)	-/-	compliant
2437		-1.2	30 dBm		Operating frequency
No peaks detected.			-20 dBc (peak) -30 dBc (average)	-/-	compliant
2462		-1.0	30 dBm		Operating frequency
No peaks detected.			-20 dBc (peak) -30 dBc (average)	-/-	compliant

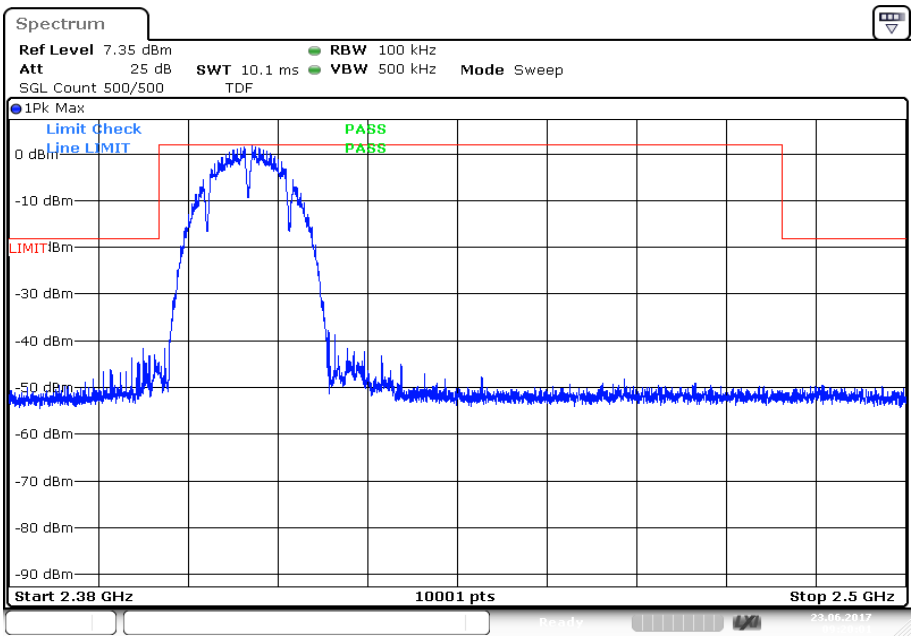
Plots: DSSS / b – mode

Plot 1: Lowest channel, up to 25 GHz



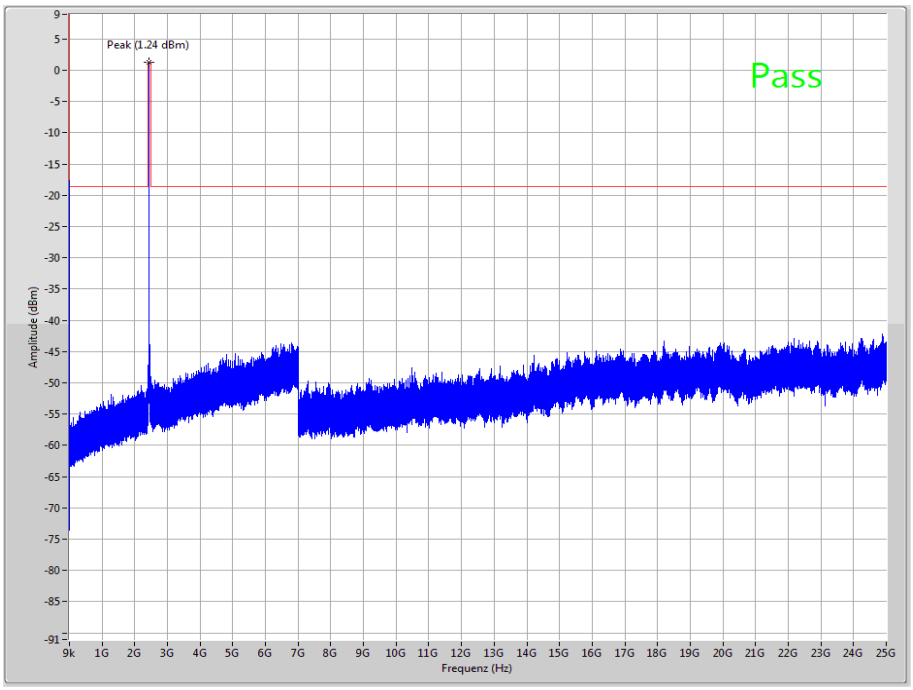
The peak at the beginning of the plot is the LO from the SA.

Plot 2: Lowest channel, zoomed carrier



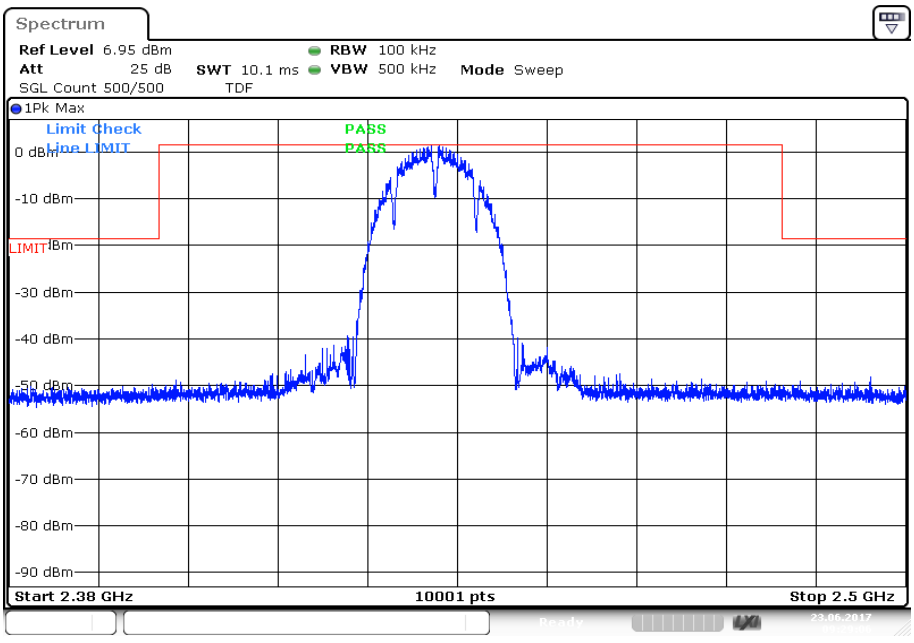
Date: 23.JUN.2017 09:20:01

Plot 3: Middle channel, up to 25 GHz



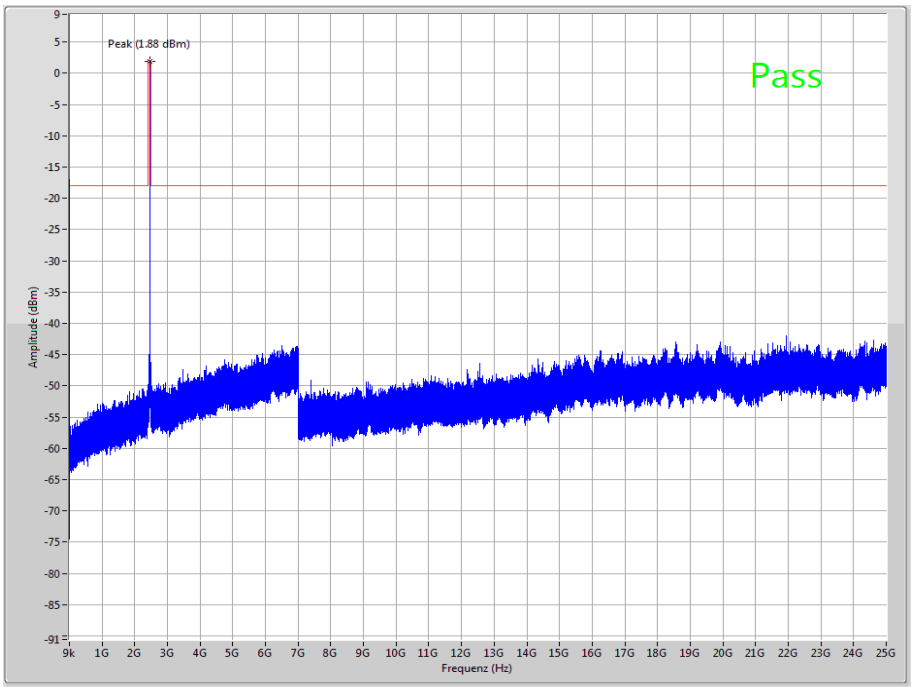
The peak at the beginning of the plot is the LO from the SA.

Plot 4: Middle channel, zoomed carrier



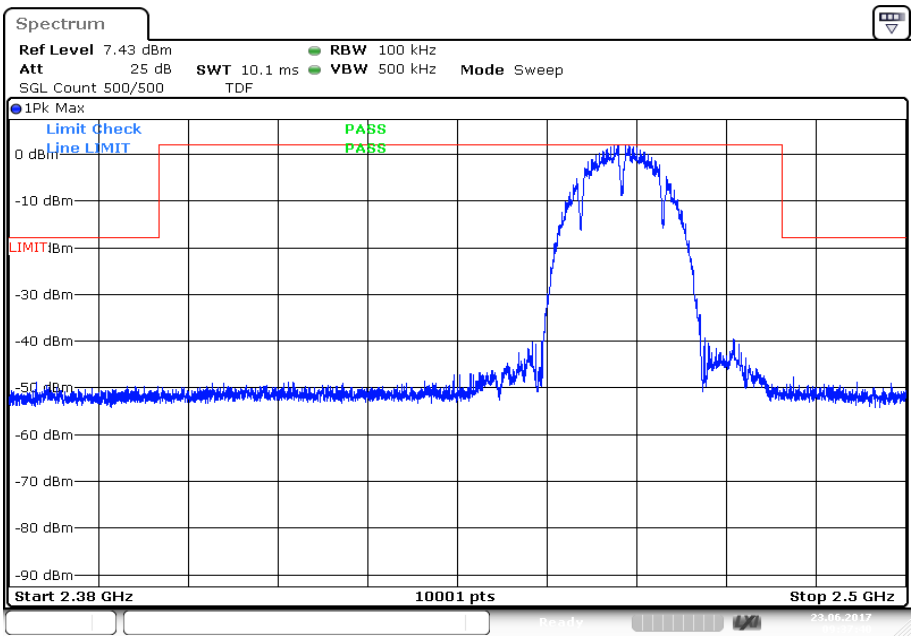
Date: 23.JUN.2017 09:29:07

Plot 5: Highest channel, up to 25 GHz



The peak at the beginning of the plot is the LO from the SA.

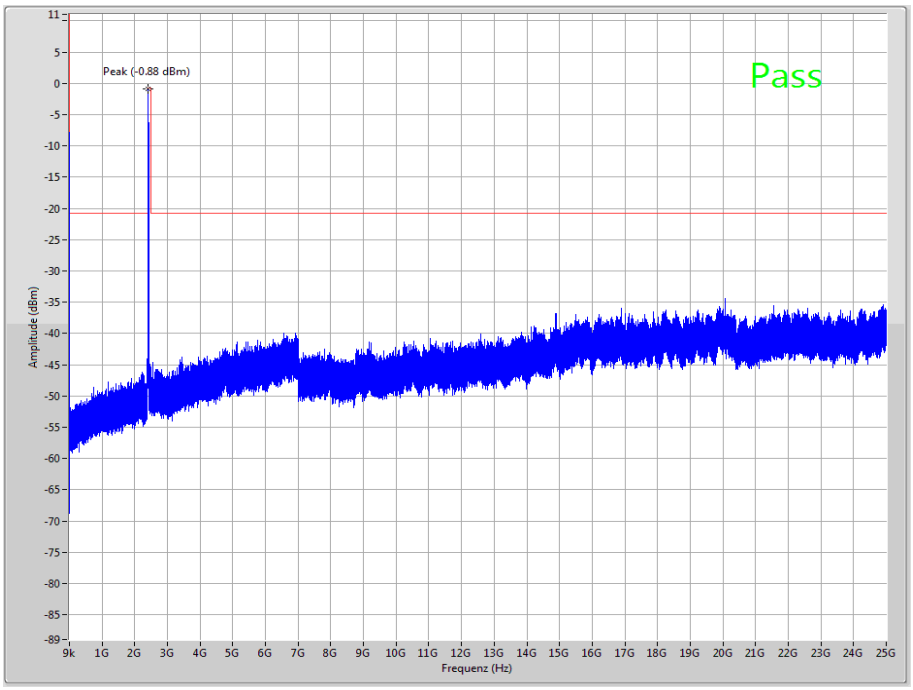
Plot 6: Highest channel, zoomed carrier



Date: 23.JUN.2017 09:37:40

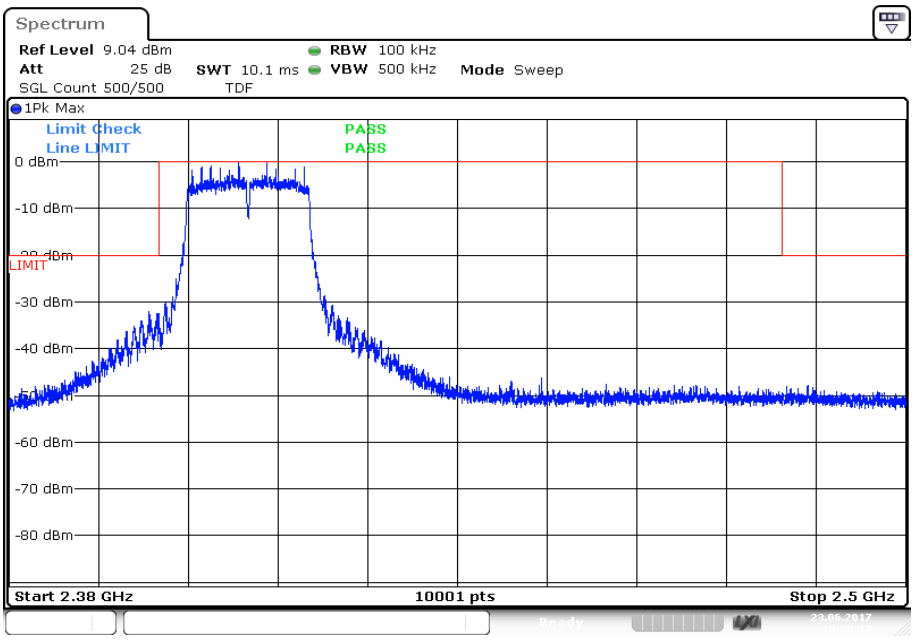
Plots: OFDM / g – mode

Plot 1: Lowest channel, up to 25 GHz



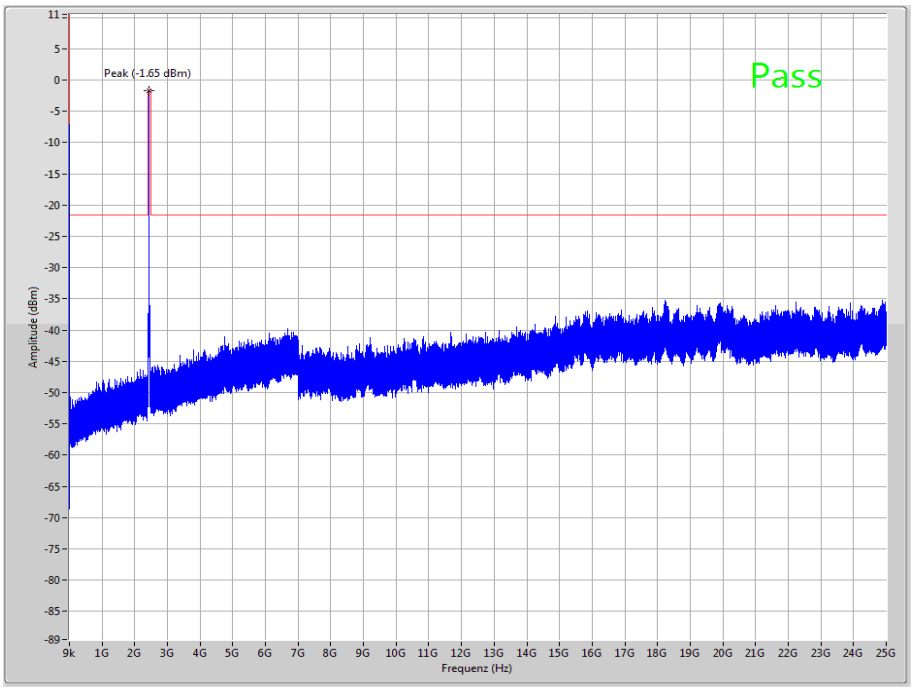
The peak at the beginning of the plot is the LO from the SA.

Plot 2: Lowest channel, zoomed carrier



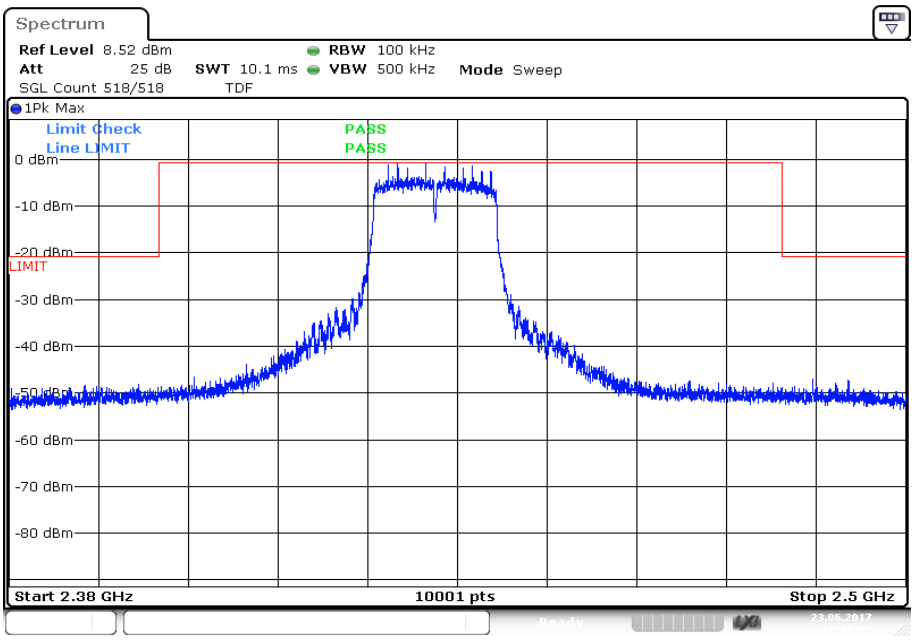
Date: 23.JUN.2017 10:00:17

Plot 3: Middle channel, up to 25 GHz

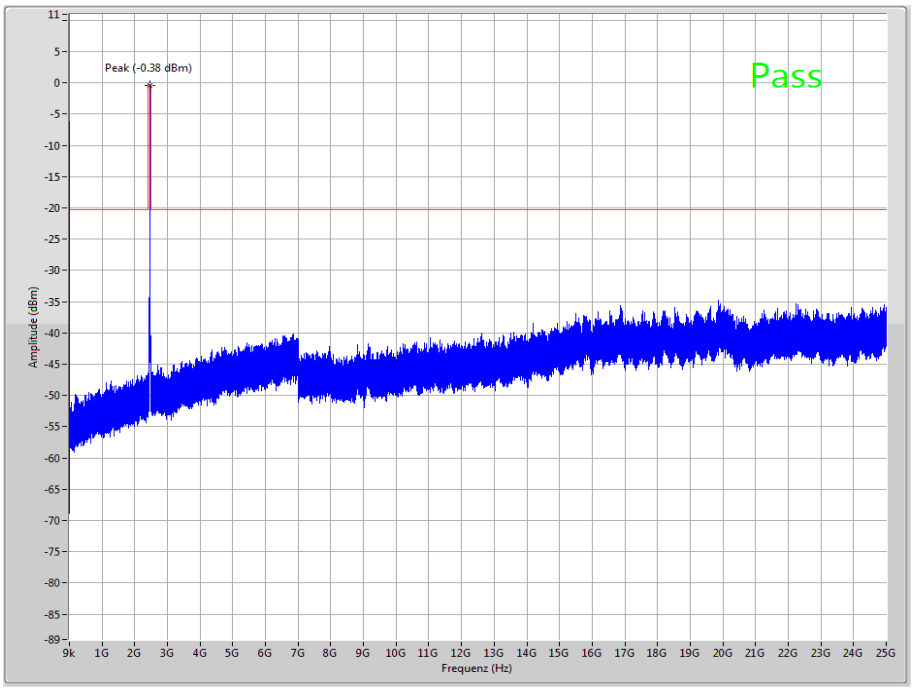


The peak at the beginning of the plot is the LO from the SA.

Plot 4: Middle channel, zoomed carrier

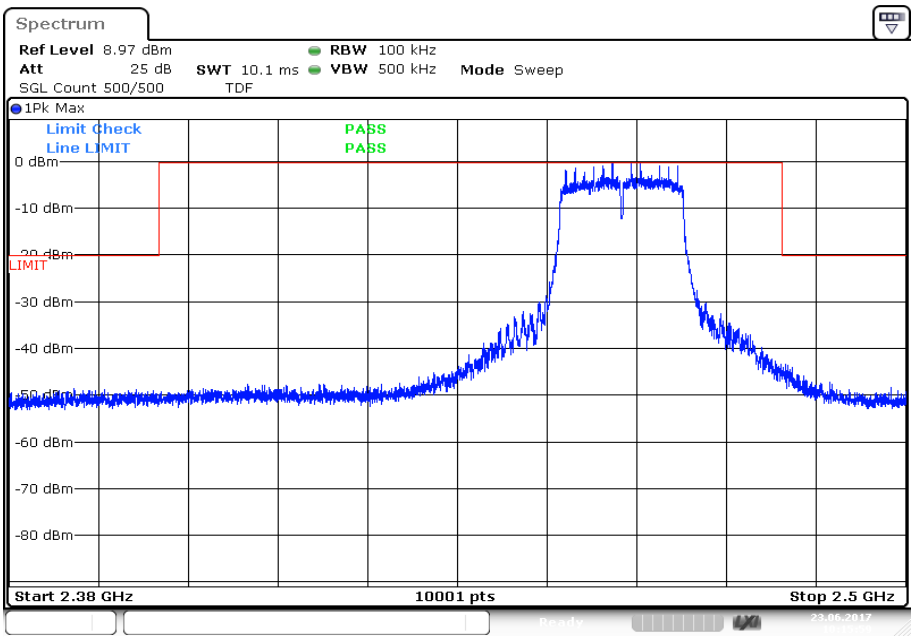


Plot 5: Highest channel, up to 25 GHz



The peak at the beginning of the plot is the LO from the SA.

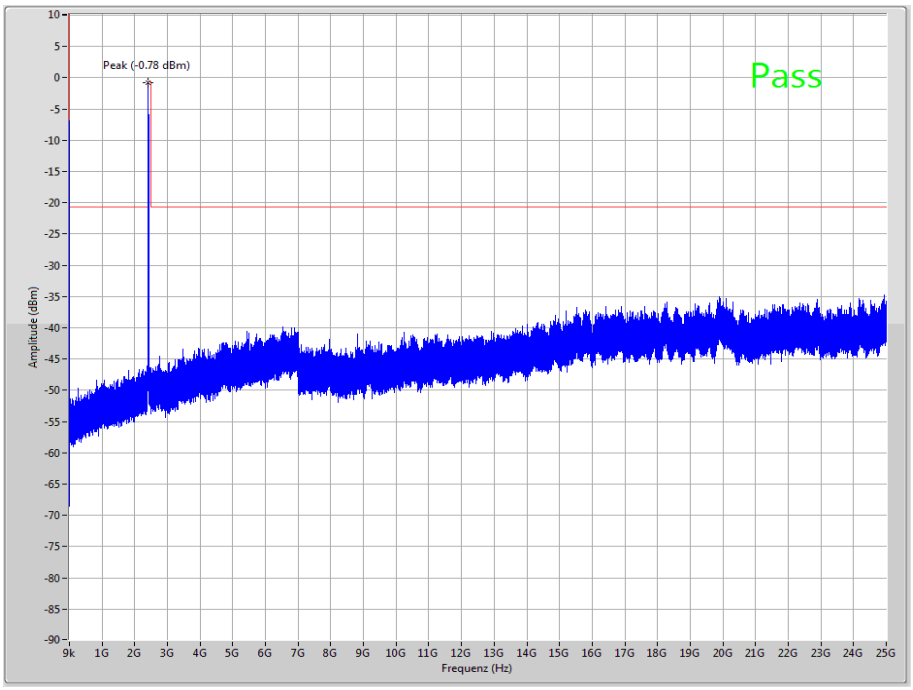
Plot 6: Highest channel, zoomed carrier



Date: 23.JUN.2017 10:15:59

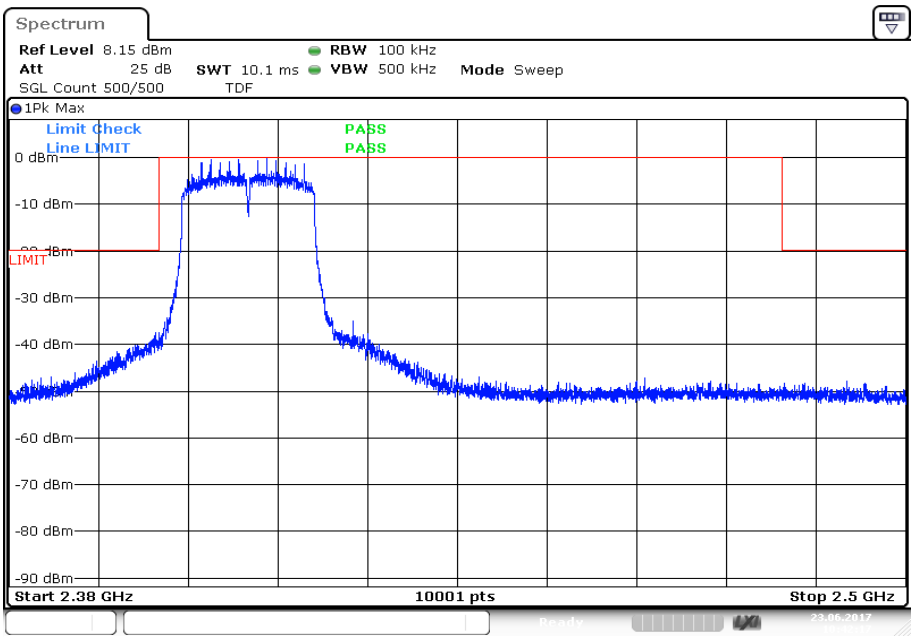
Plots: OFDM / n HT 20 – mode

Plot 1: Lowest channel, up to 25 GHz



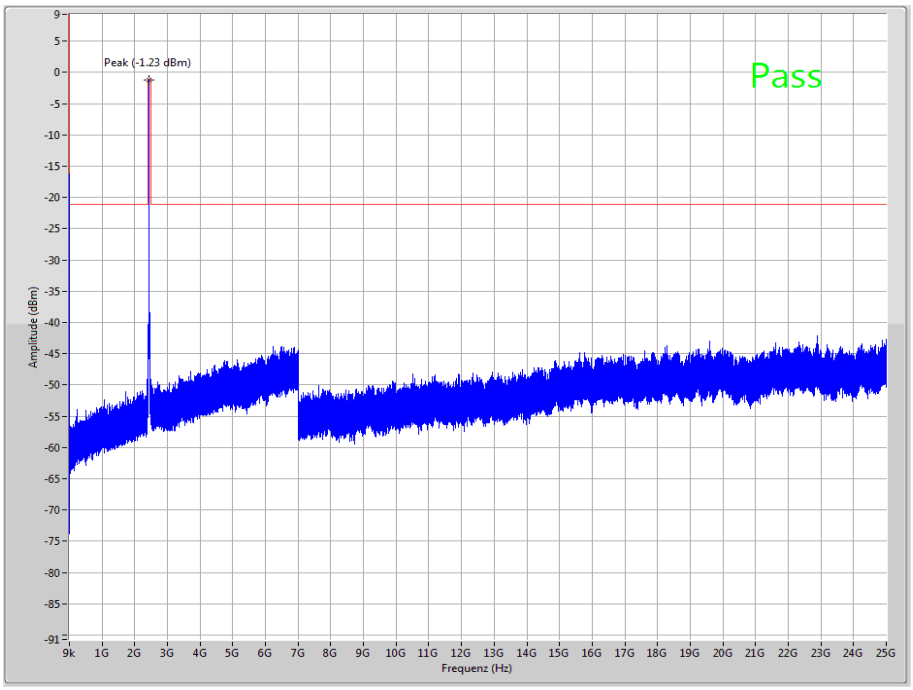
The peak at the beginning of the plot is the LO from the SA.

Plot 2: Lowest channel, zoomed carrier



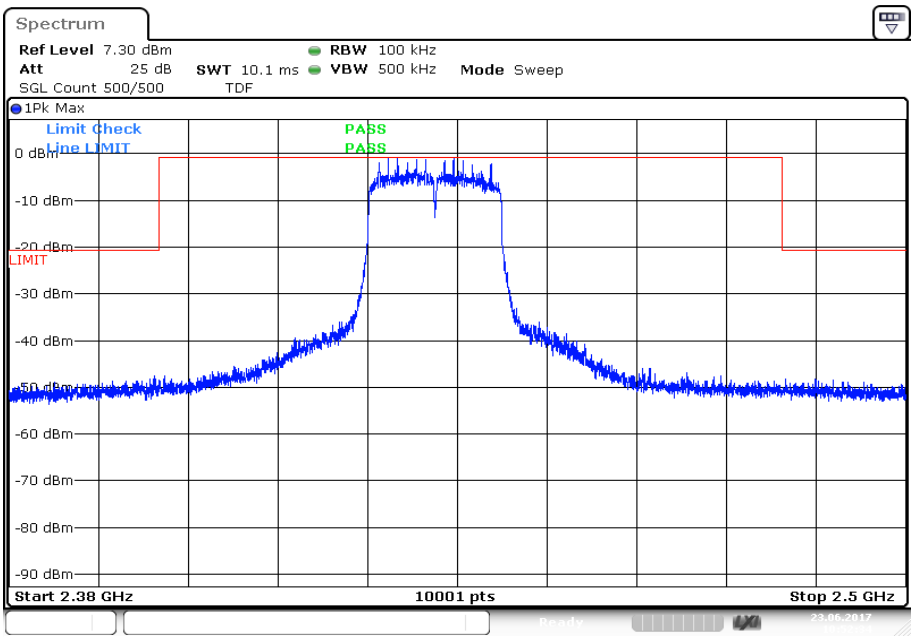
Date: 23.JUN.2017 10:42:18

Plot 3: Middle channel, up to 25 GHz



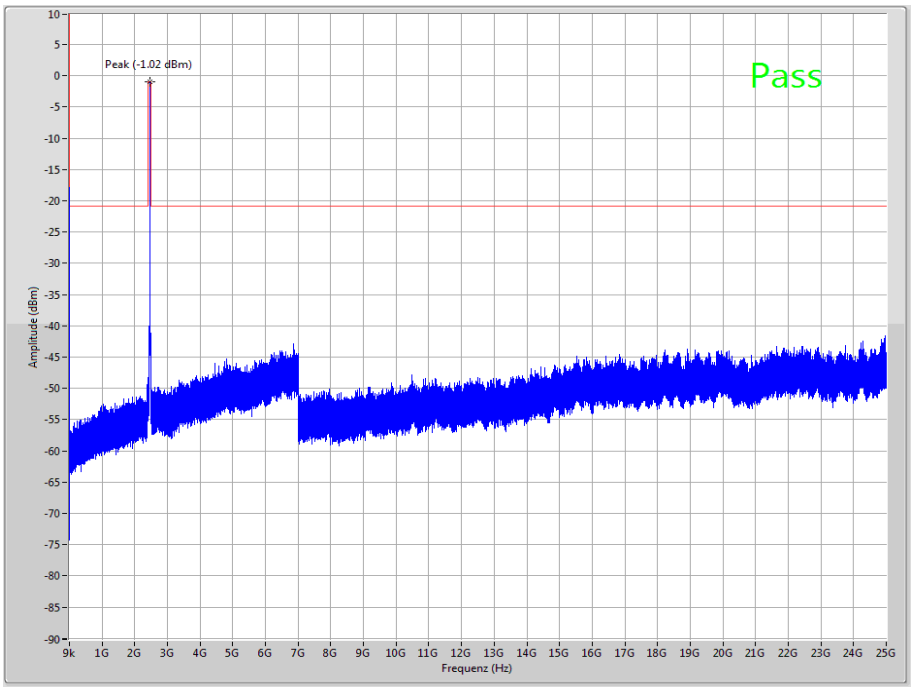
The peak at the beginning of the plot is the LO from the SA.

Plot 4: Middle channel, zoomed carrier



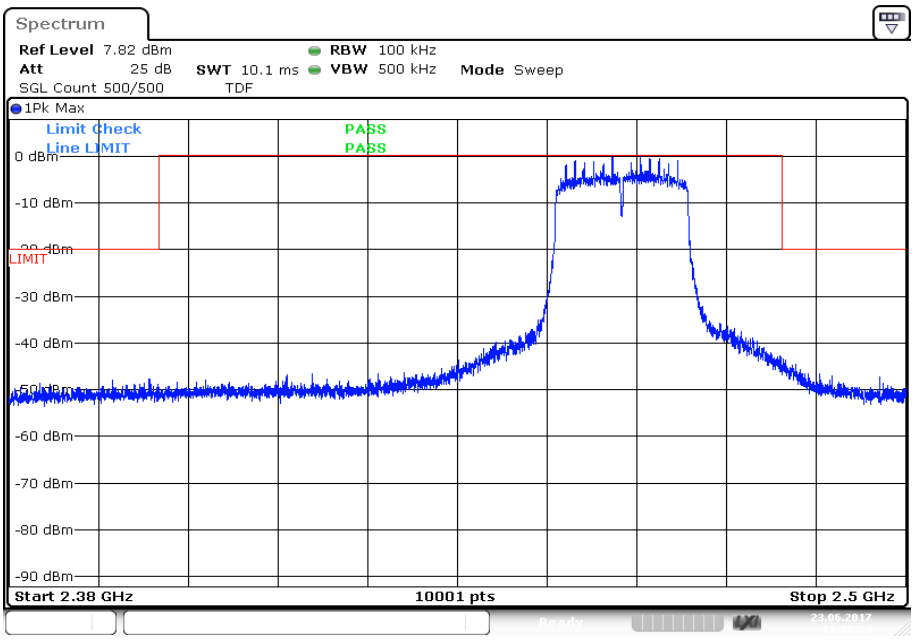
Date: 23.JUN.2017 10:52:34

Plot 5: Highest channel, up to 25 GHz



The peak at the beginning of the plot is the LO from the SA.

Plot 6: Highest channel, zoomed carrier



Date: 23.JUN.2017 11:00:25

11.12 Spurious emissions radiated below 30 MHz

Description:

Measurement of the radiated spurious emissions in transmit mode below 30 MHz. The EUT is set to channel 6. This measurement is representative for all channels and modes. If peaks are found channel 1 and channel 11 will be measured too. The measurement is performed with the data rate producing the highest output power. The limits are recalculated to a measurement distance of 3 m with 40 dB/decade according CFR Part 2.

Measurement:

Measurement parameter	
Detector:	Peak / Quasi Peak
Sweep time:	Auto
Resolution bandwidth:	F < 150 kHz: 200 Hz F > 150 kHz: 9 kHz
Video bandwidth:	F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz
Span:	9 kHz to 30 MHz
Trace mode:	Max Hold
Measured modulation	☒ DSSS b – mode ☒ OFDM g – mode ☐ OFDM n HT20 – mode
Test setup:	See sub clause 6.1 A
Measurement uncertainty	See sub clause 8

Limits:

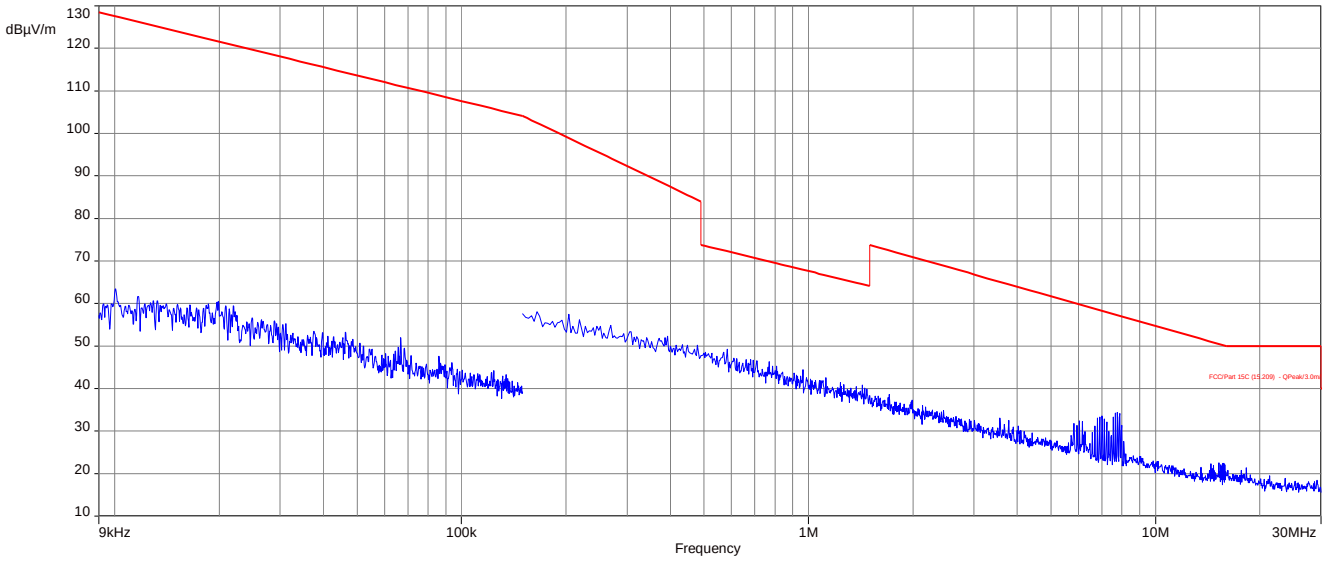
FCC		IC
Frequency (MHz)	Field Strength (dBµV/m)	Measurement distance
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30

Results:

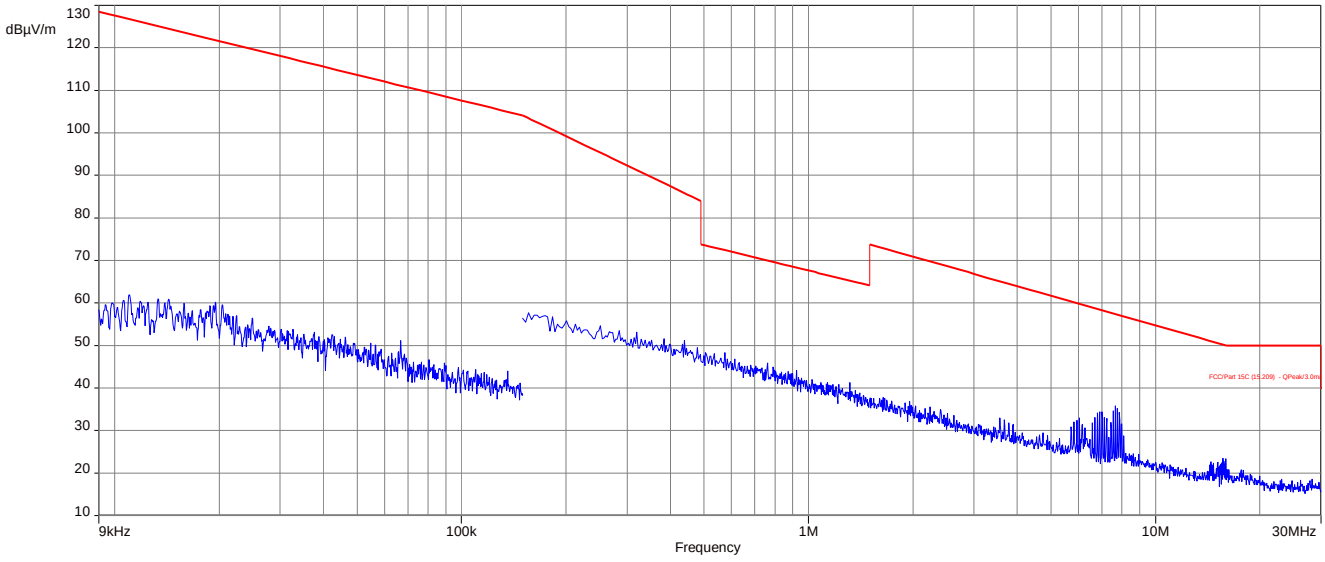
TX Spurious Emissions Radiated < 30 MHz [dBµV/m]		
F [MHz]	Detector	Level [dBµV/m]
All detected peaks are more than 20 dB below the limit.		

Plots: DSSS

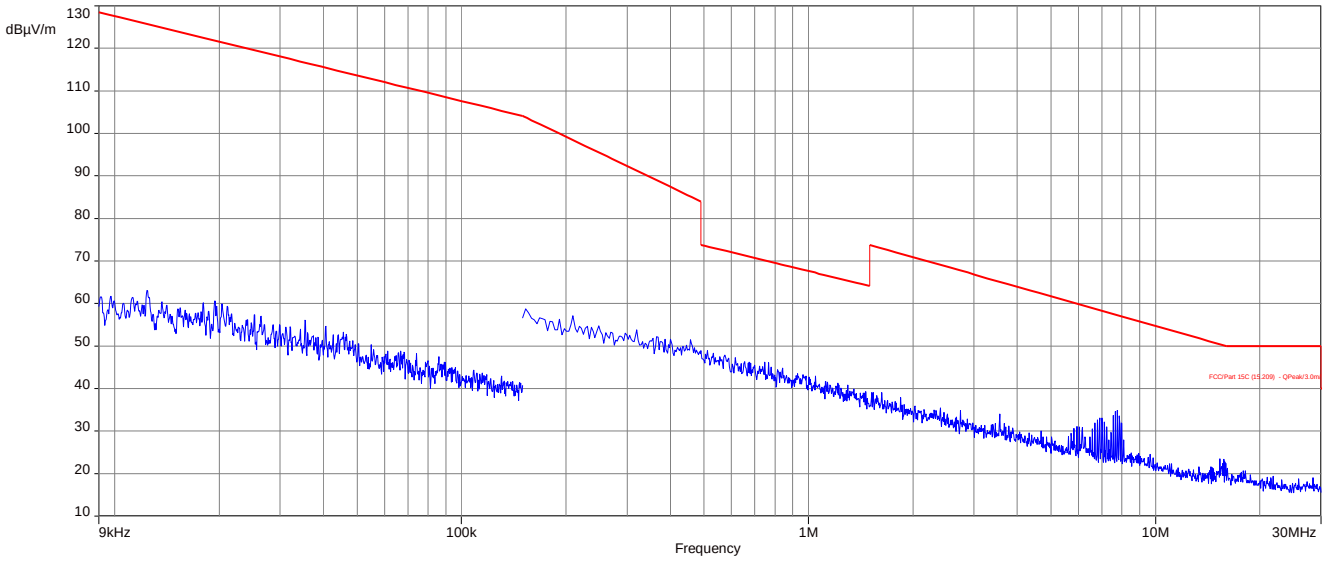
Plot 1: 9 kHz to 30 MHz, low channel



Plot 2: 9 kHz to 30 MHz, mid channel

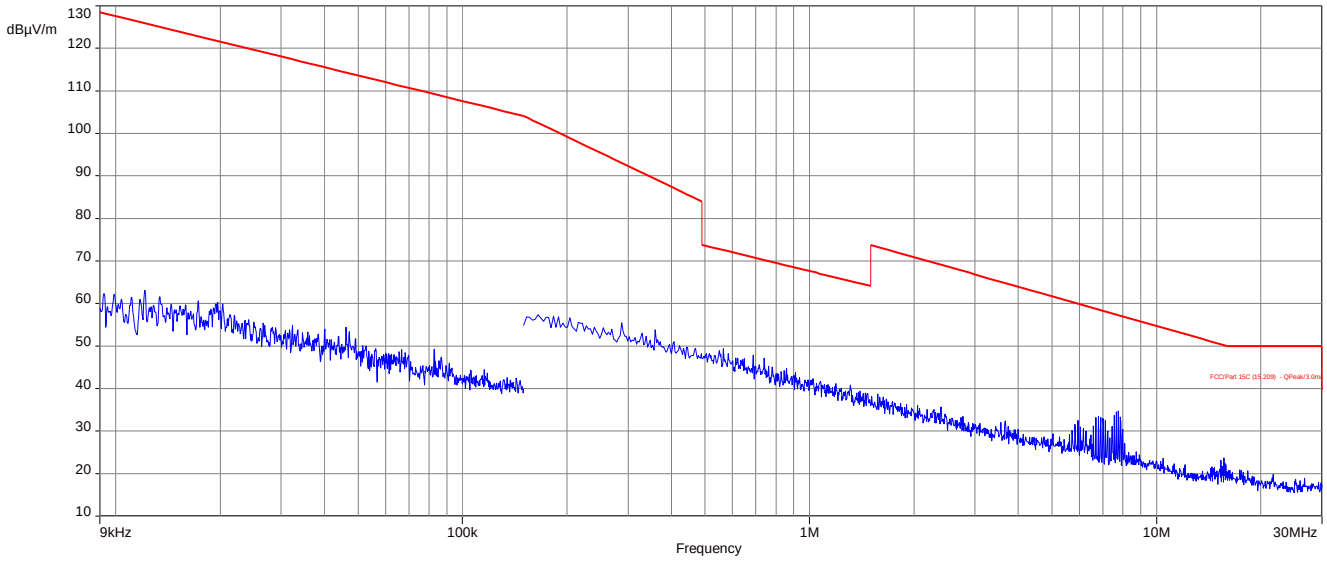


Plot 3: 9 kHz to 30 MHz, high channel

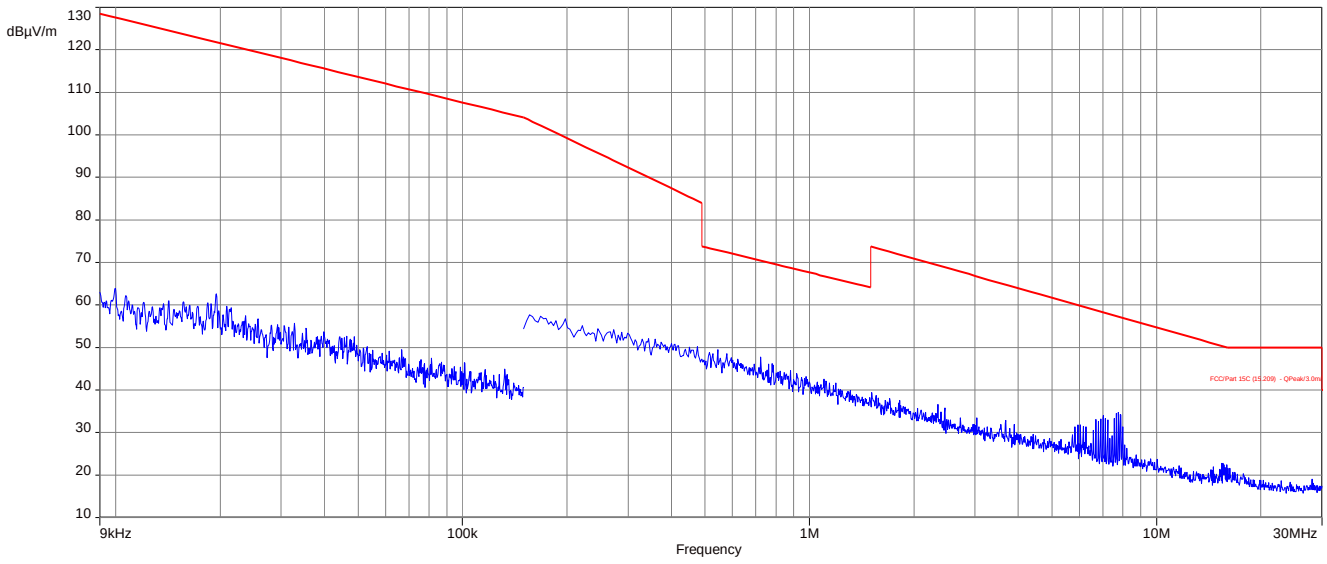


Plots: OFDM (20 MHz bandwidth)

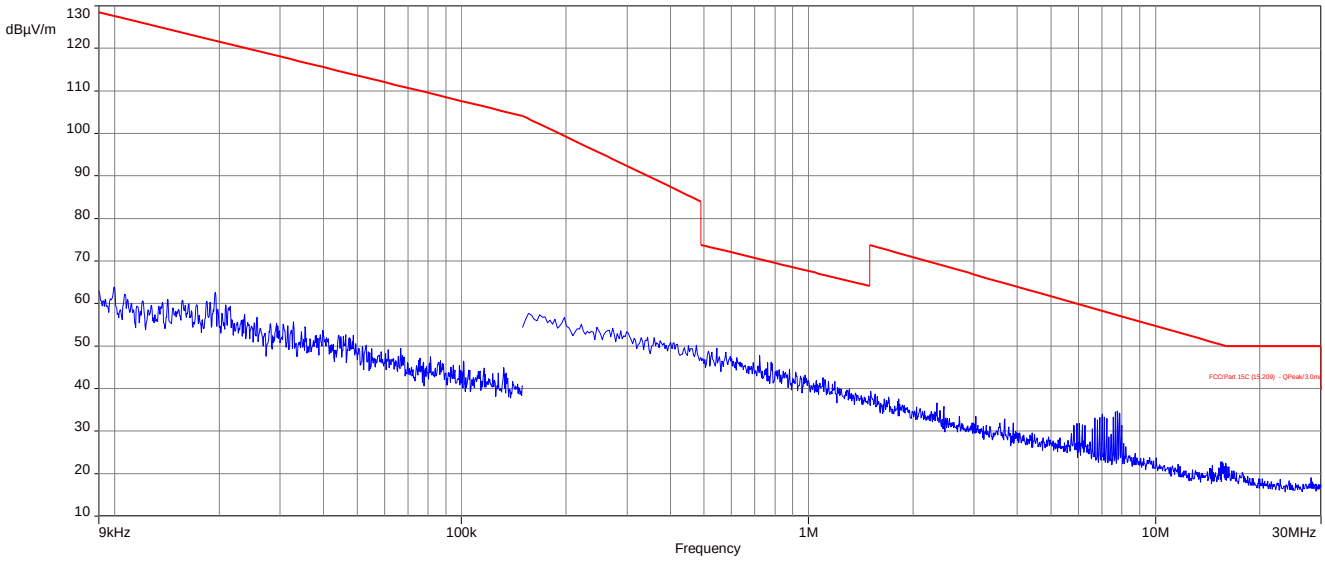
Plot 1: 9 kHz to 30 MHz, low channel



Plot 2: 9 kHz to 30 MHz, mid channel



Plot 3: 9 kHz to 30 MHz, high channel



11.13 Spurious emissions radiated 30 MHz to 1 GHz

Description:

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

Measurement:

Measurement parameter	
Detector:	Peak / Quasi Peak
Sweep time:	Auto
Resolution bandwidth:	120 kHz
Video bandwidth:	3 x RBW
Span:	30 MHz to 1 GHz
Trace mode:	Max Hold
Measured modulation	☒ DSSS b – mode ☒ OFDM g – mode ☐ OFDM n HT20 – mode ☒ RX / Idle – mode
Test setup:	See sub clause 6.1
Measurement uncertainty:	See sub clause 8

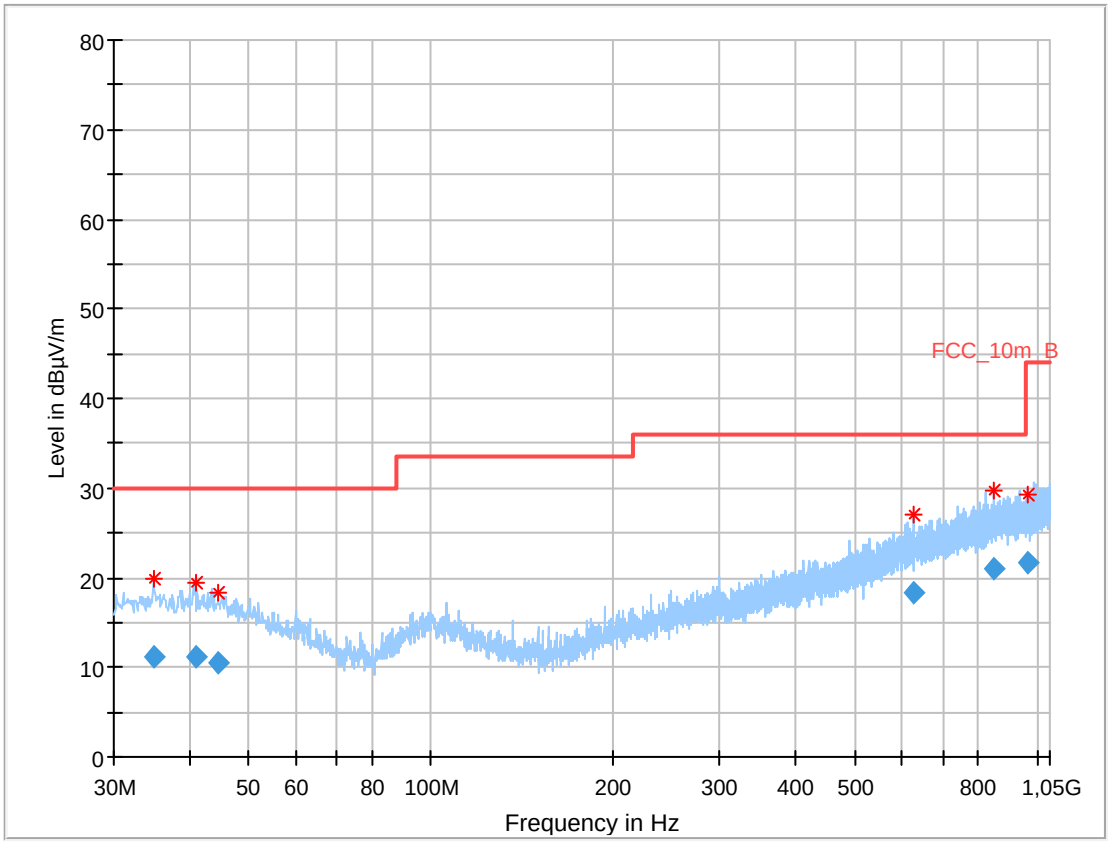
The modulation with the highest output power was used to perform the transmitter spurious emissions. If spurious were detected a re-measurement was performed on the detected frequency with each modulation.

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 (dBµV/m)	Measurement distance
30 - 88	30.0	10
88 – 216	33.5	10
216 – 960	36.0	10

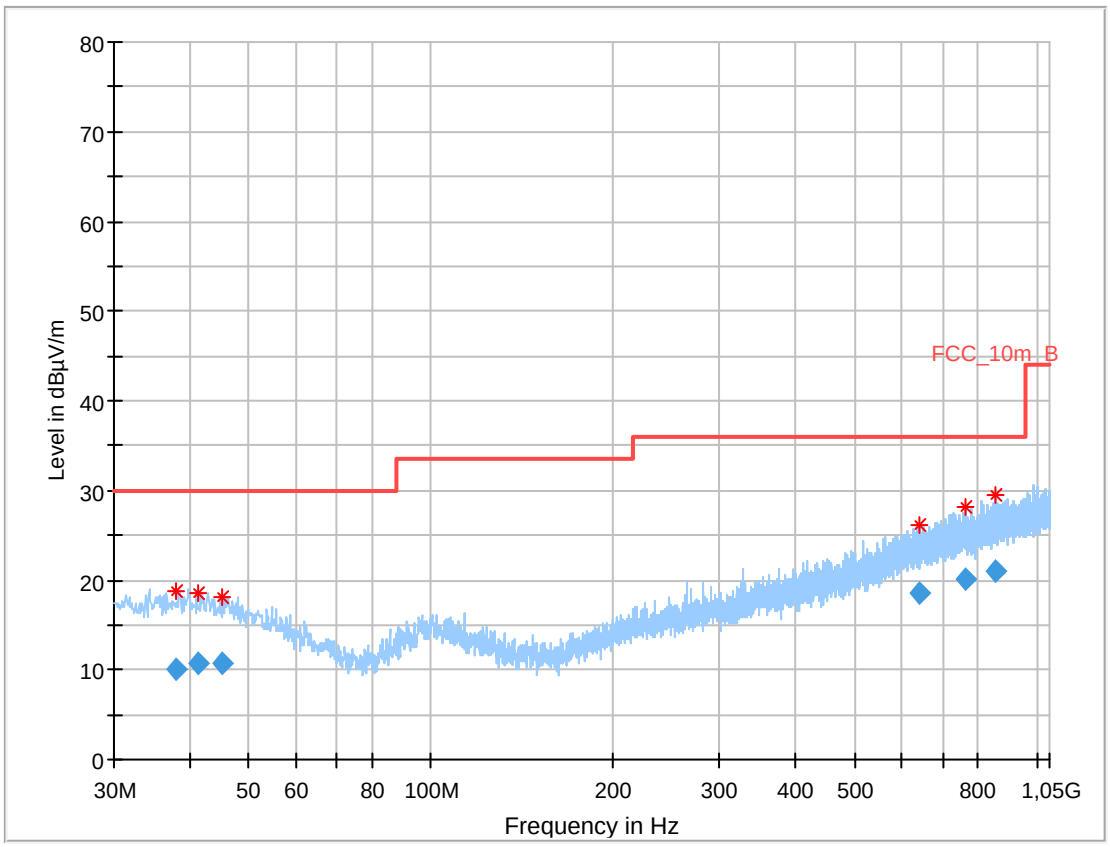
Plot: DSSS

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



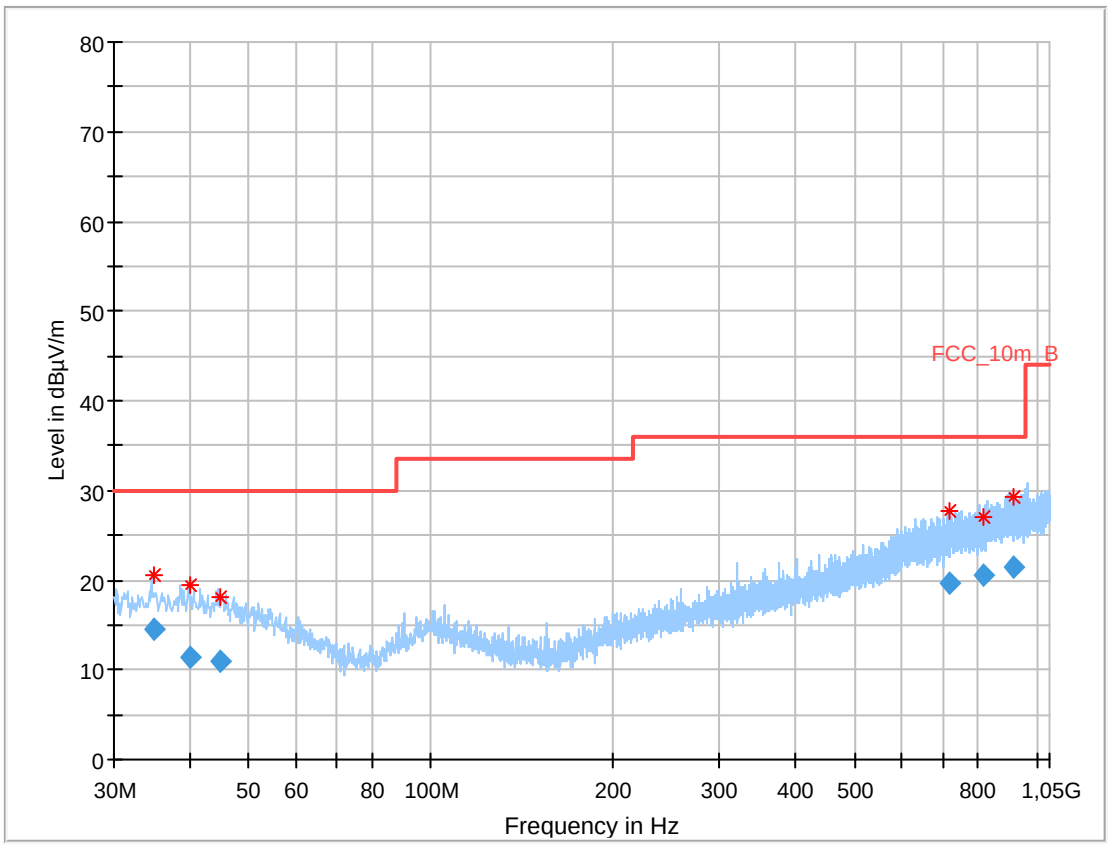
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
34.815000	11.15	30.00	18.85	1000.0	120.000	103.0	V	10.0	13.8
40.984500	11.23	30.00	18.77	1000.0	120.000	101.0	V	280.0	14.0
44.457900	10.53	30.00	19.47	1000.0	120.000	170.0	H	100.0	13.9
625.982700	18.39	36.00	17.61	1000.0	120.000	101.0	H	190.0	20.9
851.411850	20.99	36.00	15.01	1000.0	120.000	170.0	V	170.0	23.5
963.872100	21.76	44.00	22.24	1000.0	120.000	98.0	H	10.0	24.4

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



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
38.105100	9.96	30.00	20.04	1000.0	120.000	101.0	H	80.0	14.0
41.277450	10.71	30.00	19.29	1000.0	120.000	100.0	H	-10.0	14.0
45.375000	10.74	30.00	19.26	1000.0	120.000	101.0	H	100.0	13.8
639.519450	18.45	36.00	17.55	1000.0	120.000	101.0	V	280.0	21.0
764.742450	20.10	36.00	15.90	1000.0	120.000	100.0	H	170.0	22.7
853.595850	21.02	36.00	14.98	1000.0	120.000	170.0	H	190.0	23.5

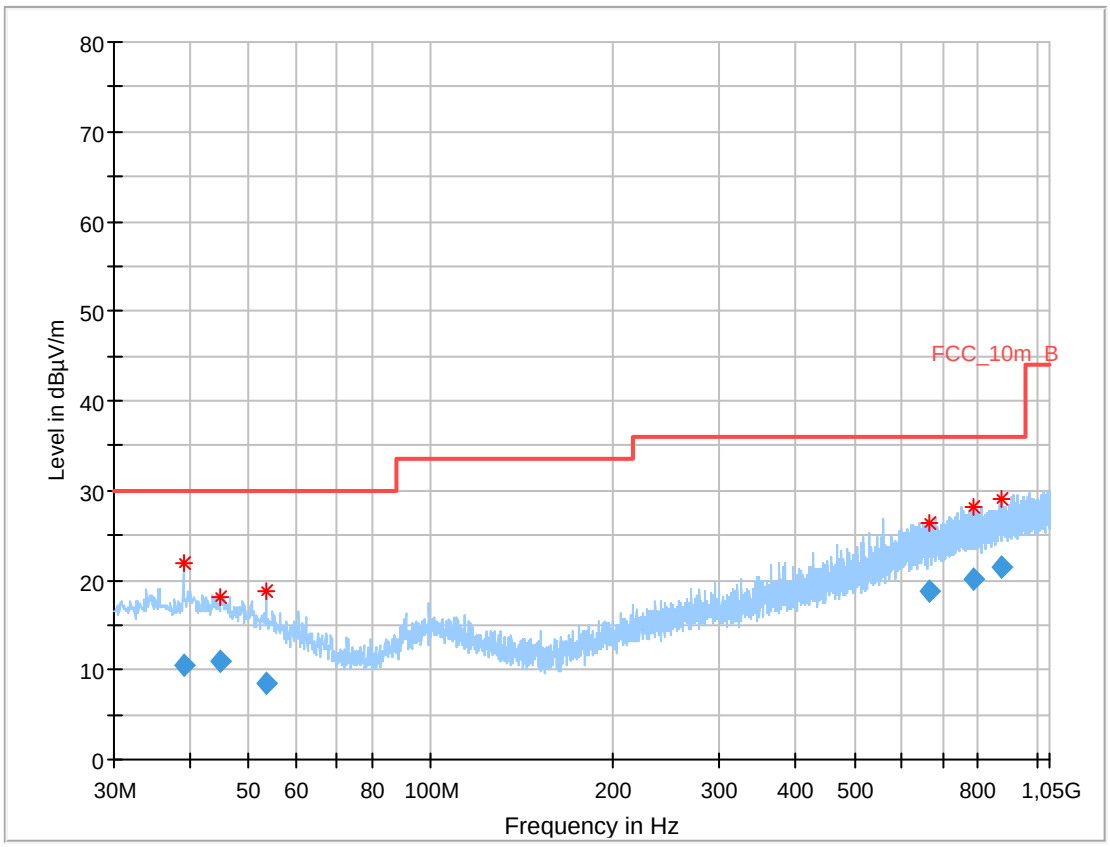
Plot 3: 30 MHz to 1 GHz, vertical & horizontal polarization, high channel



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
35.006250	14.48	30.00	15.52	1000.0	120.000	170.0	V	100.0	13.8
40.182600	11.38	30.00	18.62	1000.0	120.000	170.0	V	100.0	14.0
44.945850	10.95	30.00	19.05	1000.0	120.000	101.0	H	81.0	13.9
718.522200	19.69	36.00	16.31	1000.0	120.000	170.0	V	280.0	22.0
815.173650	20.62	36.00	15.38	1000.0	120.000	170.0	H	260.0	23.0
916.250100	21.53	36.00	14.47	1000.0	120.000	170.0	V	81.0	24.2

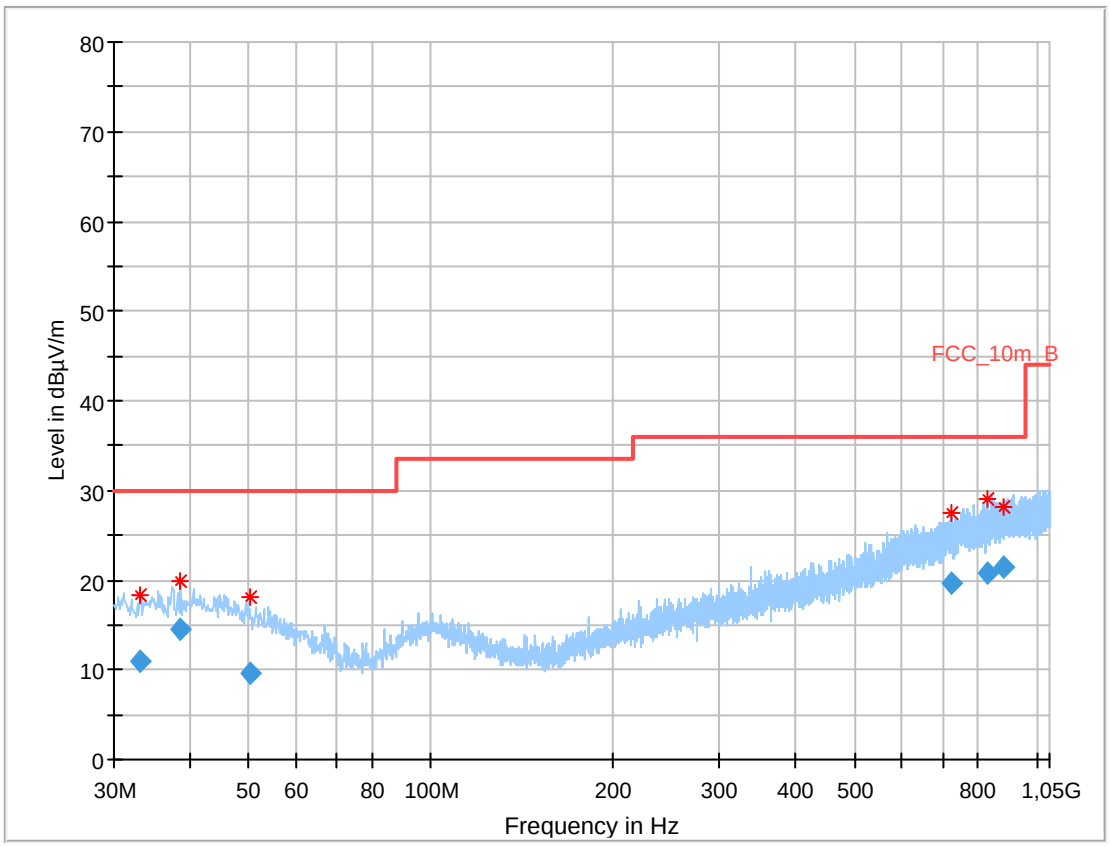
Plot: OFDM (20 MHz bandwidth)

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



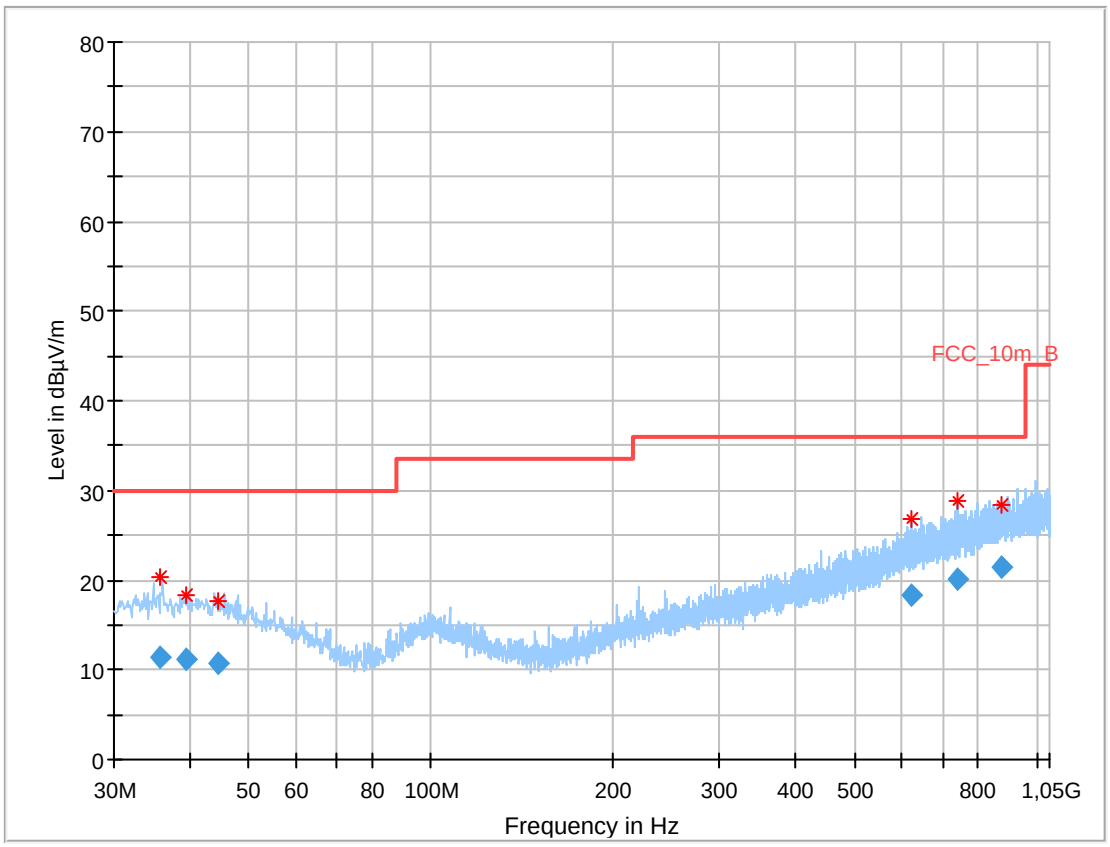
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
39.062400	10.50	30.00	19.50	1000.0	120.000	98.0	H	10.0	14.0
45.042300	10.93	30.00	19.07	1000.0	120.000	101.0	V	100.0	13.8
53.647350	8.53	30.00	21.47	1000.0	120.000	101.0	V	170.0	12.1
666.924750	18.77	36.00	17.23	1000.0	120.000	170.0	H	280.0	21.3
783.793650	20.13	36.00	15.87	1000.0	120.000	170.0	V	190.0	22.7
872.486100	21.47	36.00	14.53	1000.0	120.000	101.0	V	100.0	23.8

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



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
33.236100	11.06	30.00	18.94	1000.0	120.000	101.0	V	80.0	13.6
38.694600	14.62	30.00	15.38	1000.0	120.000	101.0	V	170.0	14.0
50.437500	9.55	30.00	20.45	1000.0	120.000	101.0	H	280.0	12.6
723.288450	19.68	36.00	16.32	1000.0	120.000	170.0	V	171.0	22.1
827.367750	20.68	36.00	15.32	1000.0	120.000	170.0	H	171.0	23.1
881.099250	21.49	36.00	14.51	1000.0	120.000	101.0	H	100.0	23.9

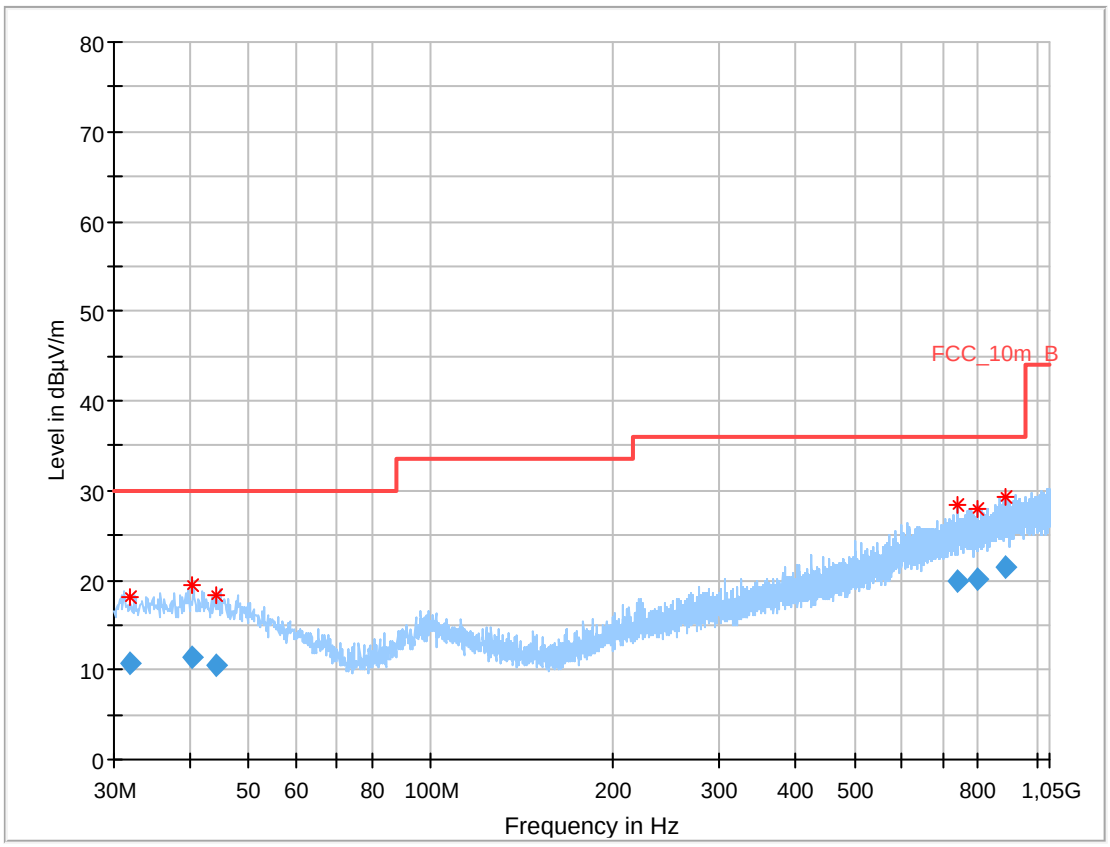
Plot 3: 30 MHz to 1 GHz, vertical & horizontal polarization, high channel



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
35.794200	11.45	30.00	18.55	1000.0	120.000	101.0	V	280.0	13.8
39.473550	11.12	30.00	18.88	1000.0	120.000	101.0	V	280.0	14.0
44.560350	10.69	30.00	19.31	1000.0	120.000	104.0	V	-10.0	13.9
618.845250	18.30	36.00	17.70	1000.0	120.000	170.0	V	80.0	20.9
741.932250	20.02	36.00	15.98	1000.0	120.000	170.0	H	81.0	22.5
871.363950	21.46	36.00	14.54	1000.0	120.000	170.0	H	171.0	23.7

Plot: RX / Idle mode

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



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
31.987200	10.78	30.00	19.22	1000.0	120.000	101.0	H	100.0	13.5
40.462350	11.40	30.00	18.60	1000.0	120.000	101.0	V	100.0	14.0
44.328150	10.58	30.00	19.42	1000.0	120.000	101.0	V	10.0	13.9
738.546300	19.86	36.00	16.14	1000.0	120.000	98.0	V	100.0	22.4
796.318800	20.09	36.00	15.91	1000.0	120.000	101.0	V	-9.0	22.7
890.265150	21.47	36.00	14.53	1000.0	120.000	101.0	V	280.0	24.0

11.14 Spurious emissions radiated above 1 GHz

Description:

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

Measurement:

Measurement parameter	
Detector:	Peak / RMS
Sweep time:	Auto
Resolution bandwidth:	1 MHz
Video bandwidth:	3 x RBW
Span:	1 GHz to 26 GHz
Trace mode:	Max Hold
Measured modulation	☒ DSSS b – mode ☒ OFDM g – mode ☐ OFDM n HT20 – mode ☒ RX / Idle – mode
Test setup:	See sub clause 6.2, 6.3
Measurement uncertainty	See sub clause 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 (dBµV/m)	Measurement distance
Above 960	54.0	3

Results: DSSS

TX Spurious Emissions Radiated [dBµV/m]								
2412 MHz			2437 MHz			2462 MHz		
F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]
17955	Peak	56.2	17978	Peak	56.2	17982	Peak	56.3
	AVG	44.8		AVG	44.7		AVG	44.9

Results: OFDM (20 MHz bandwidth)

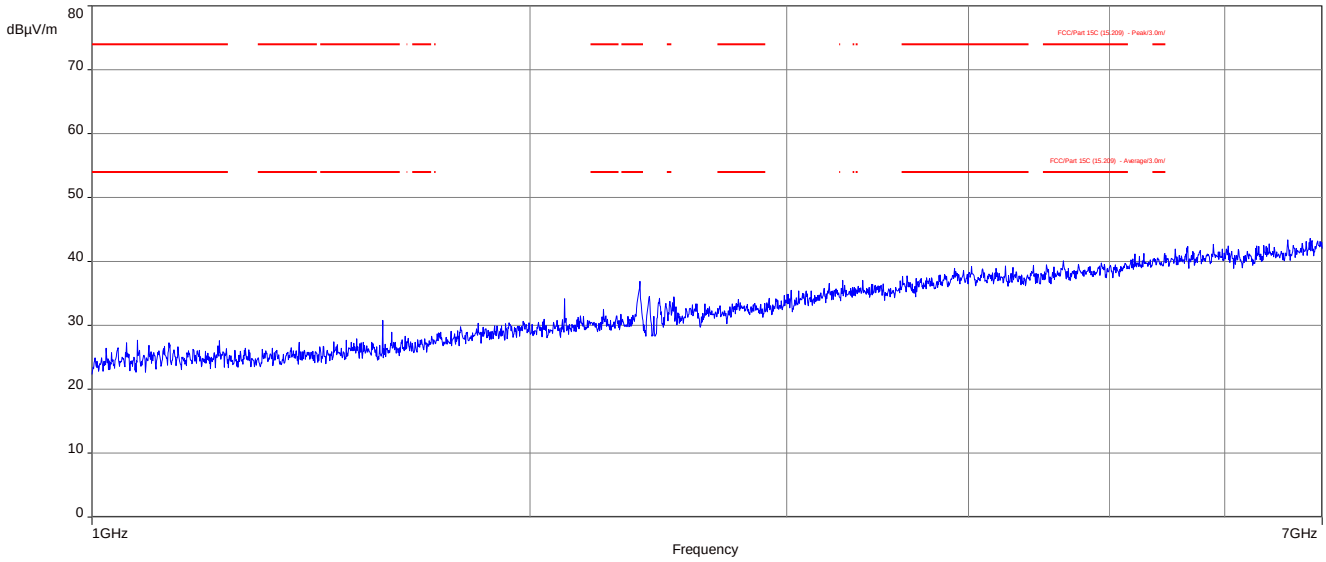
TX Spurious Emissions Radiated [dBµV/m]								
2412 MHz			2437 MHz			2462 MHz		
F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]
17978	Peak	56.4	17951	Peak	56.1	17954	Peak	55.9
	AVG	44.9		AVG	44.7		AVG	44.2

Results: RX / idle – mode

TX Spurious Emissions Radiated [dBµV/m]		
F [MHz]	Detector	Level [dBµV/m]
17974	Peak	56.5
	AVG	44.7

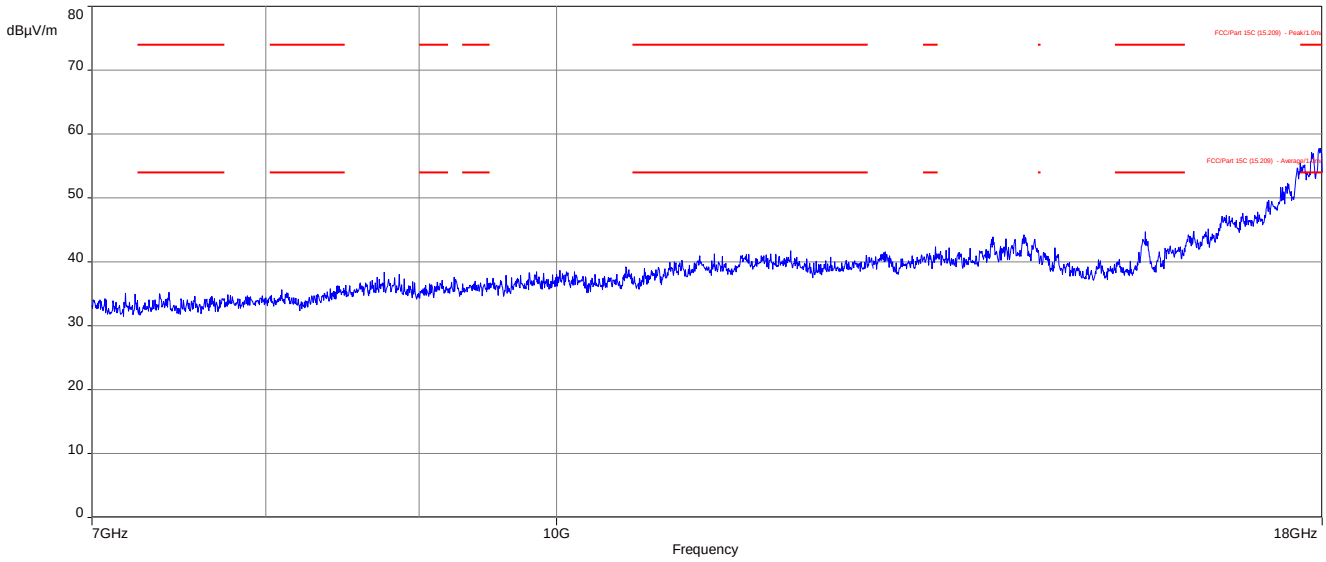
Plots: DSSS

Plot 1: Lowest channel, 1 GHz to 7 GHz, vertical & horizontal polarization

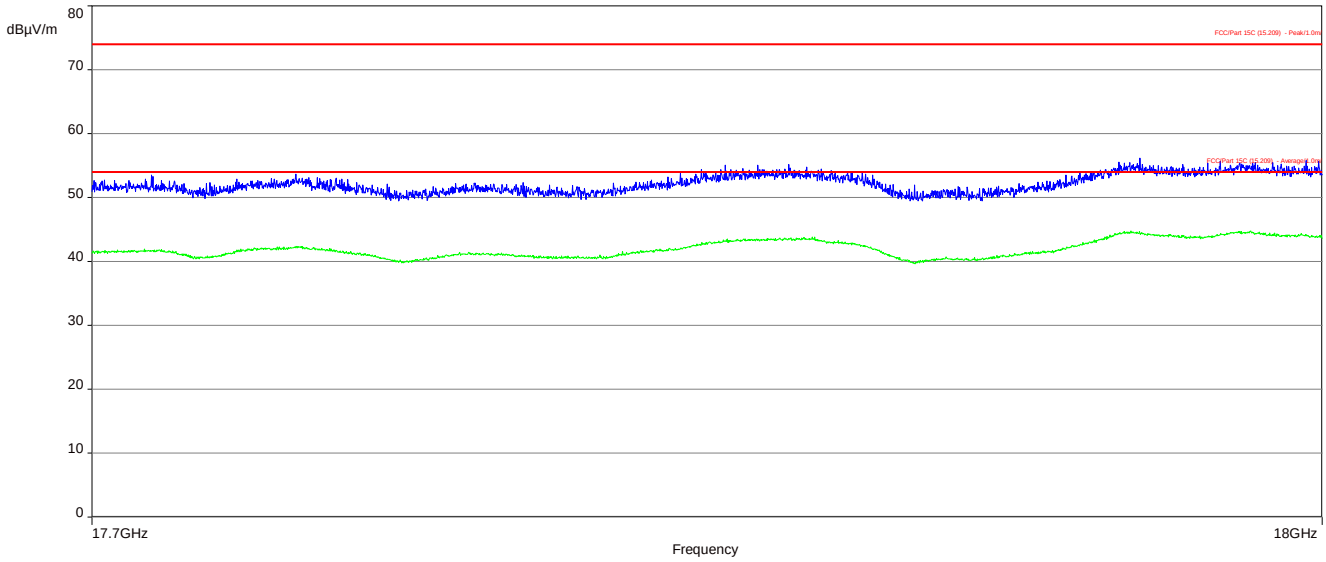


The carrier signal is notched with a 2.4 GHz band rejection filter.

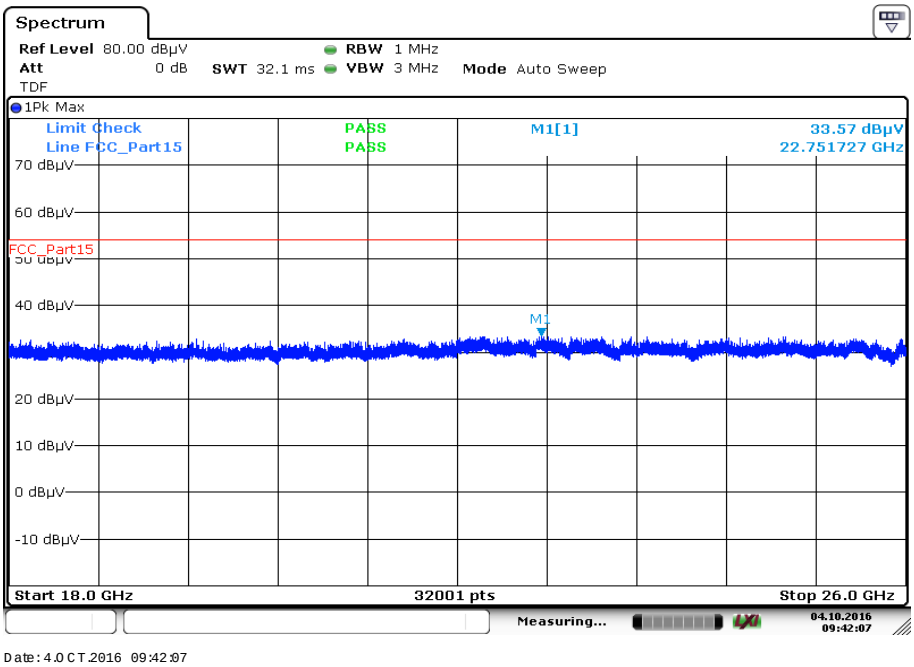
Plot 2: Lowest channel, 7 GHz to 18 GHz, vertical & horizontal polarization



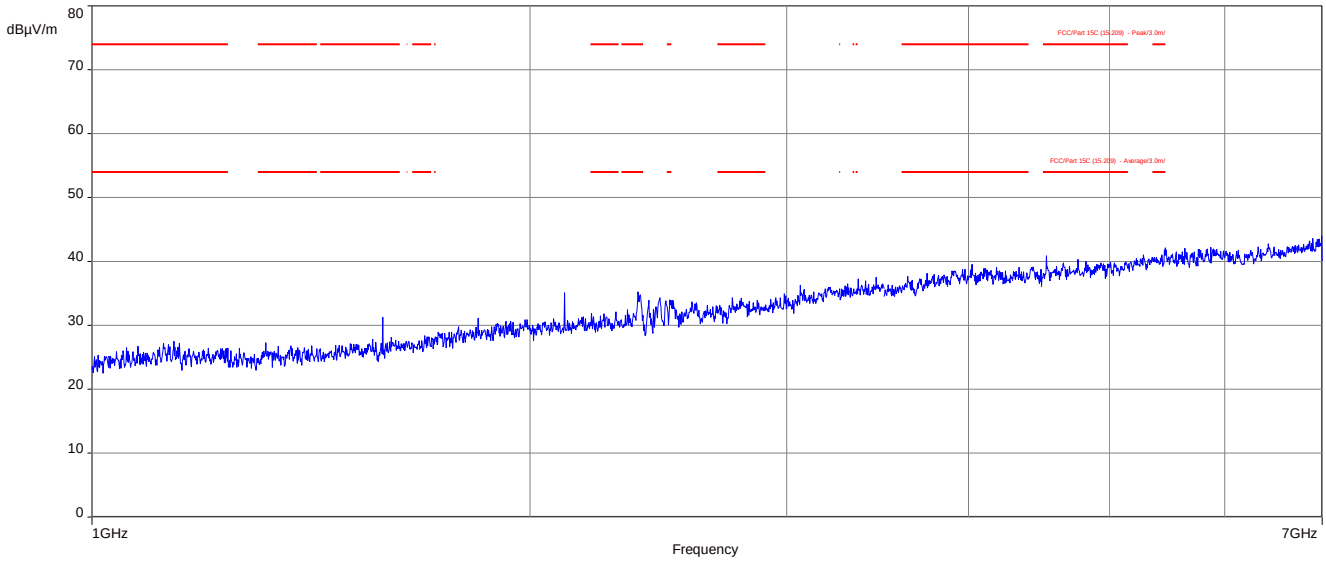
Plot 3: Lowest channel, 17.7 GHz to 18 GHz, vertical & horizontal polarization, average & peak



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

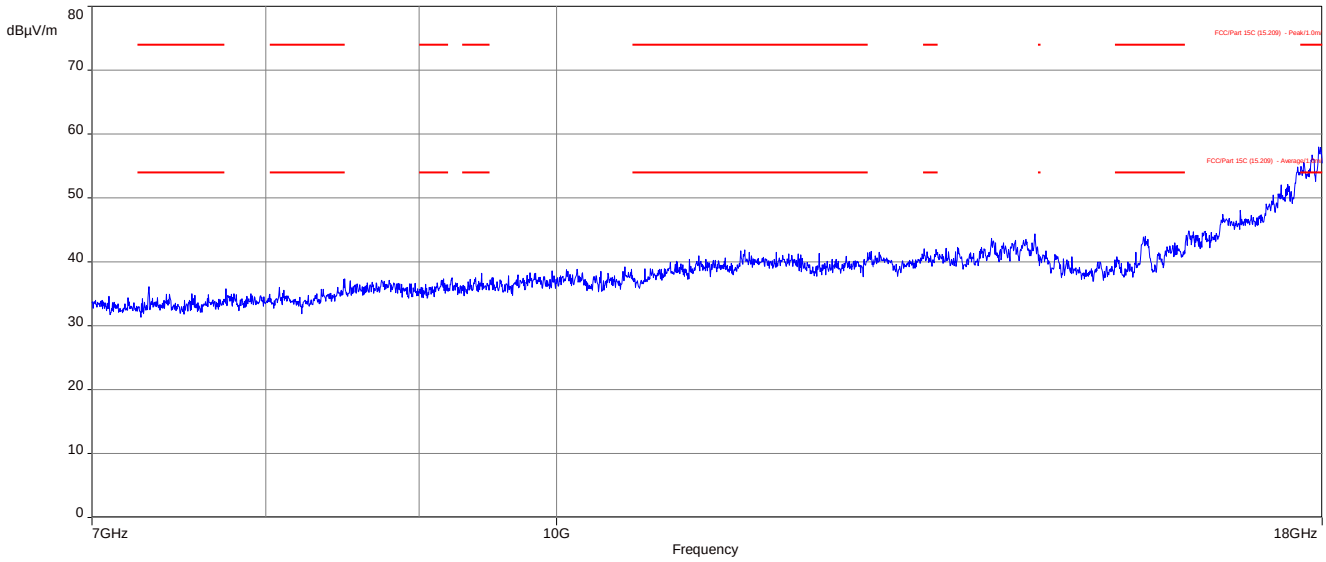


Plot 5: Middle channel, 1 GHz to 7 GHz, vertical & horizontal polarization

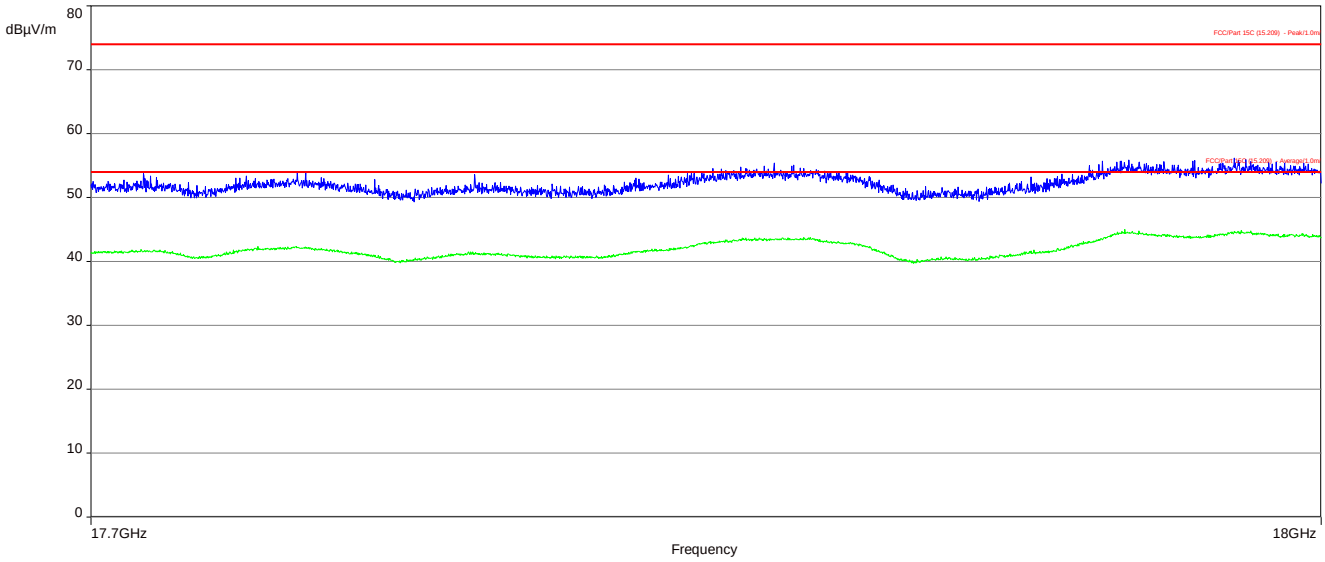


The carrier signal is notched with a 2.4 GHz band rejection filter.

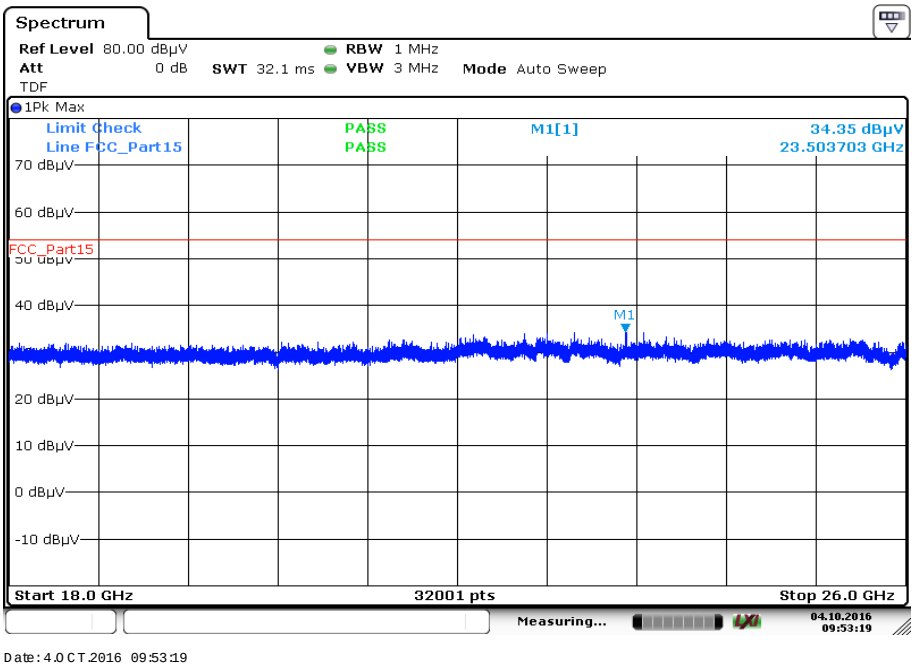
Plot 6: Middle channel, 7 GHz to 18 GHz, vertical & horizontal polarization



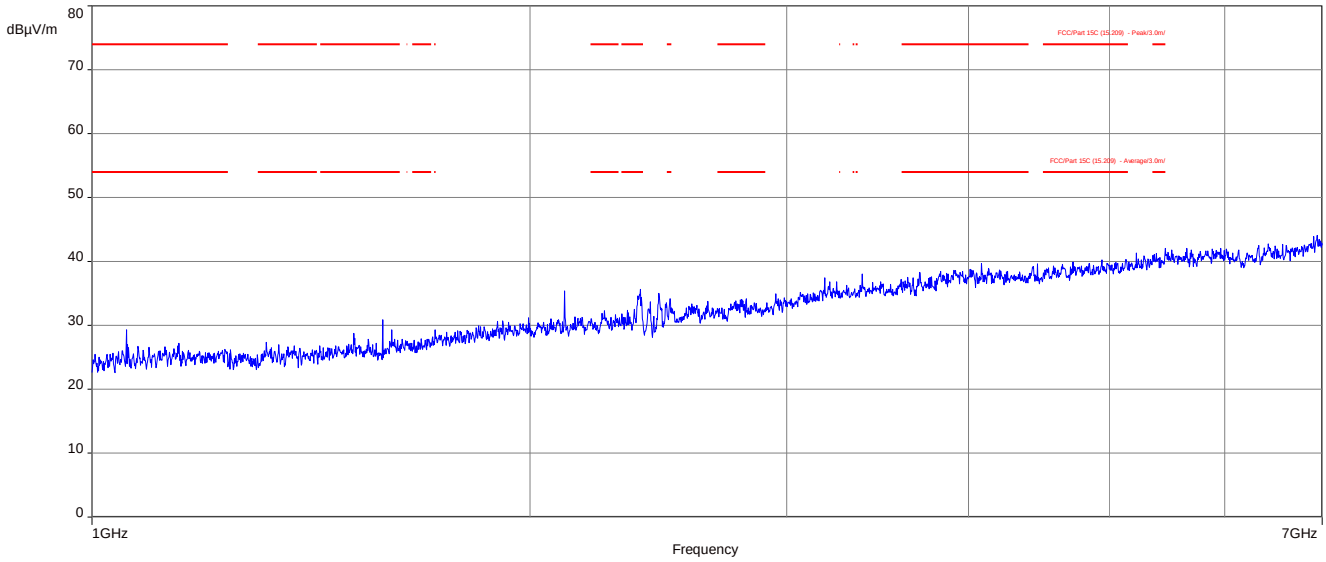
Plot 7: Middle channel, 17.7 GHz to 18 GHz, vertical & horizontal polarization



Plot 8: Middle channel, 18 GHz to 26 GHz, vertical & horizontal polarization

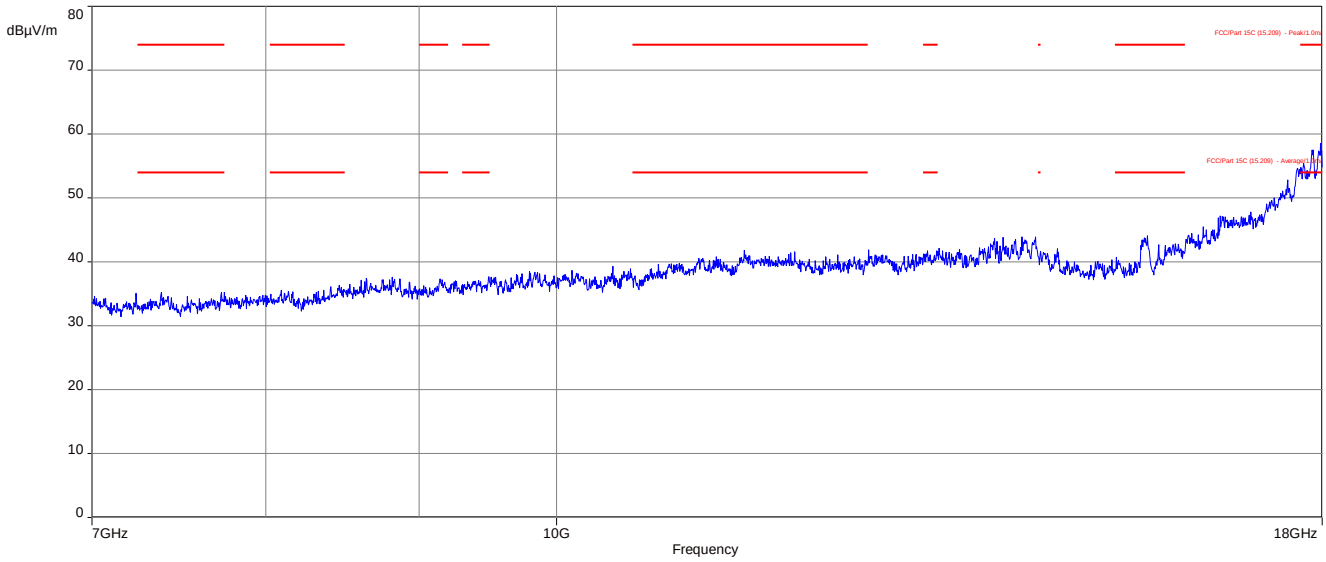


Plot 9: Highest channel, 1 GHz to 7 GHz, vertical & horizontal polarization

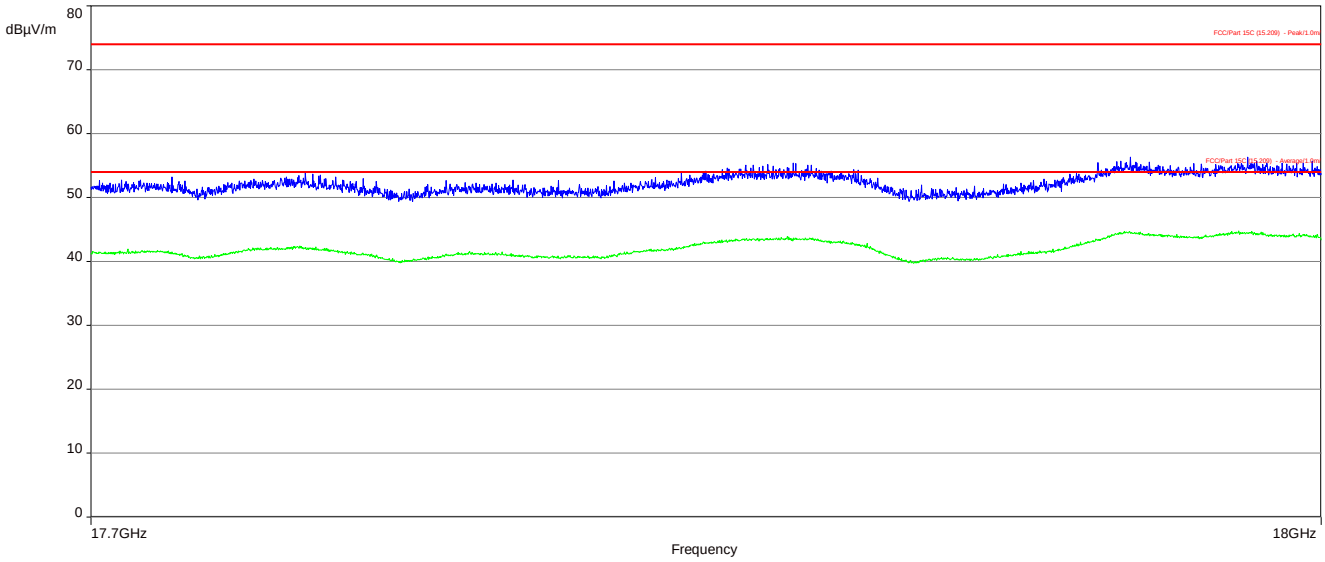


The carrier signal is notched with a 2.4 GHz band rejection filter.

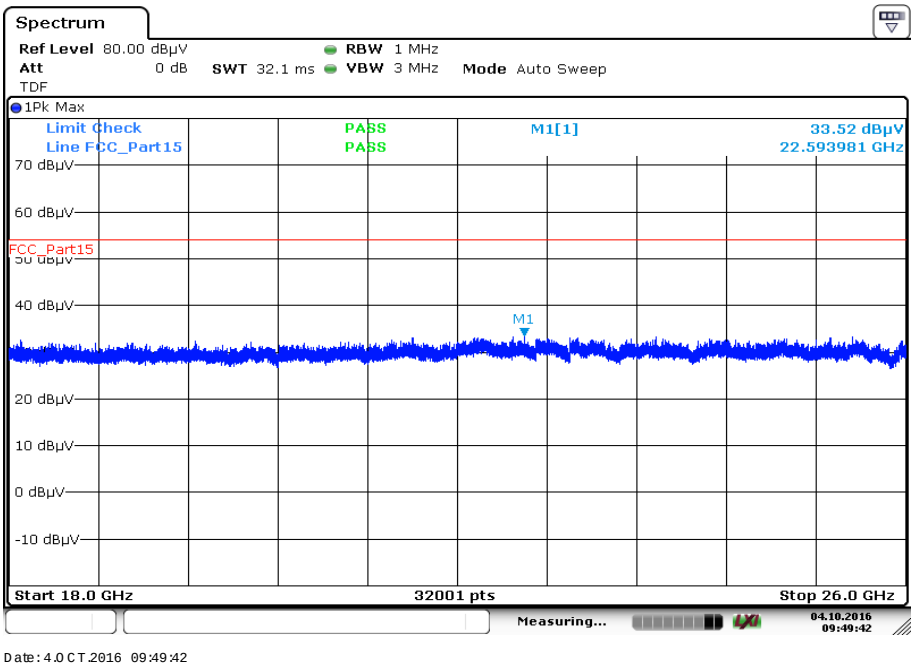
Plot 10: Highest channel, 7 GHz to 18 GHz, vertical & horizontal polarization



Plot 11: Highest channel, 17.7 GHz to 18 GHz, vertical & horizontal polarization

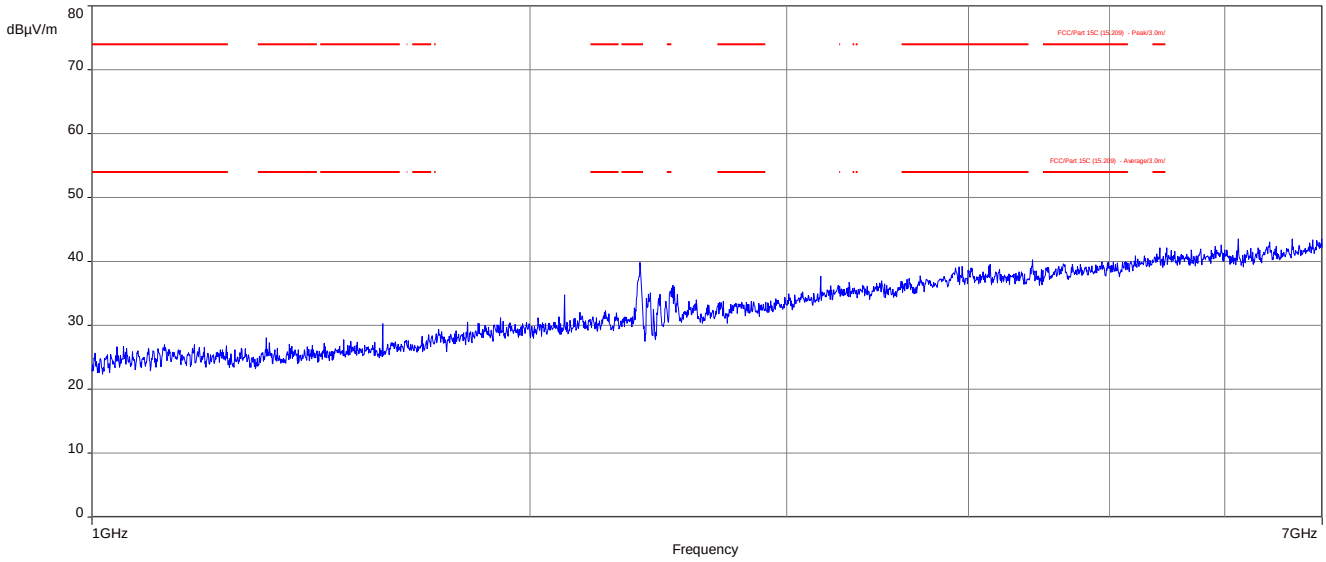


Plot 12: Highest channel, 18 GHz to 26 GHz, vertical & horizontal polarization



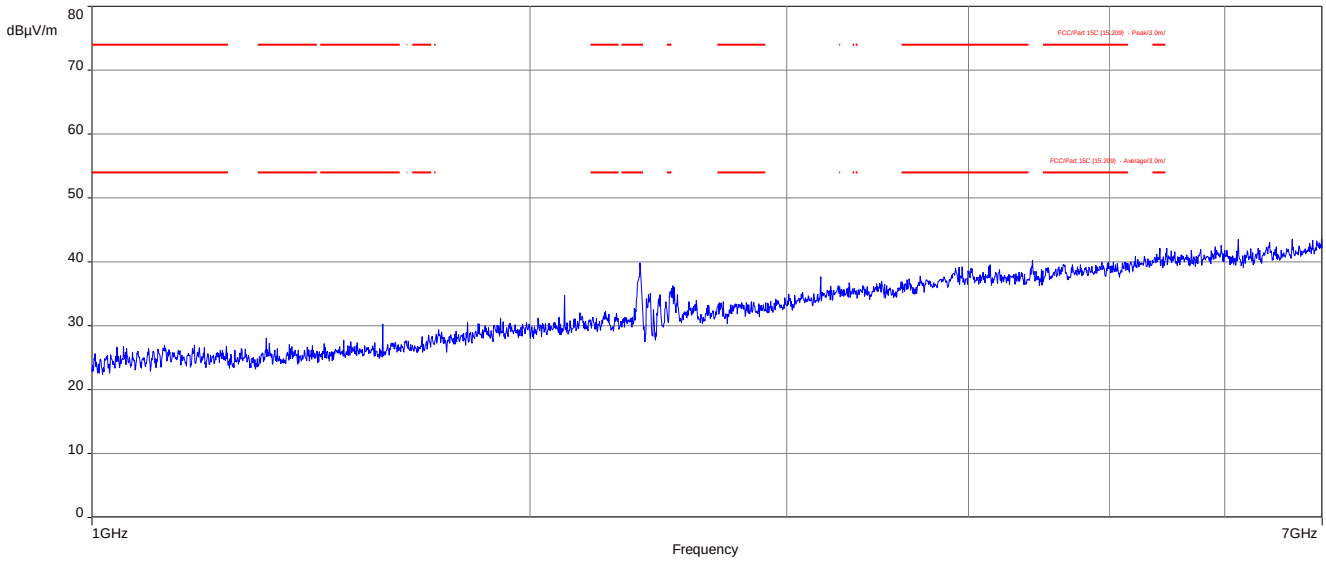
Plots: OFDM (20 MHz bandwidth)

Plot 1: Lowest channel, 1 GHz to 7 GHz, vertical & horizontal polarization

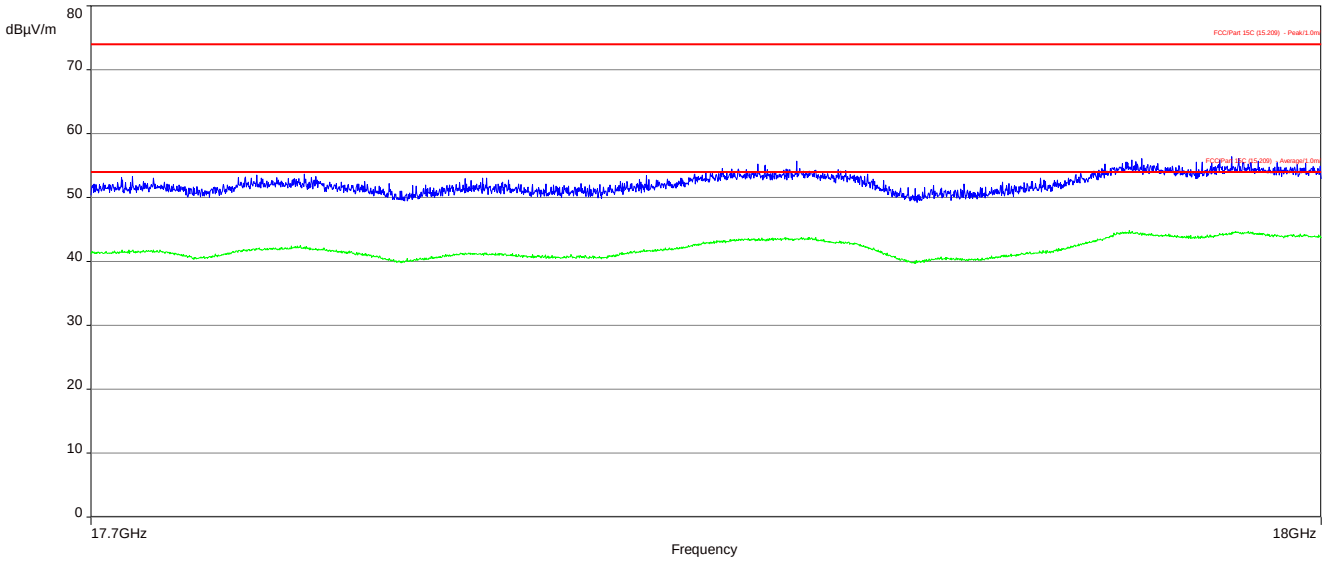


The carrier signal is notched with a 2.4 GHz band rejection filter.

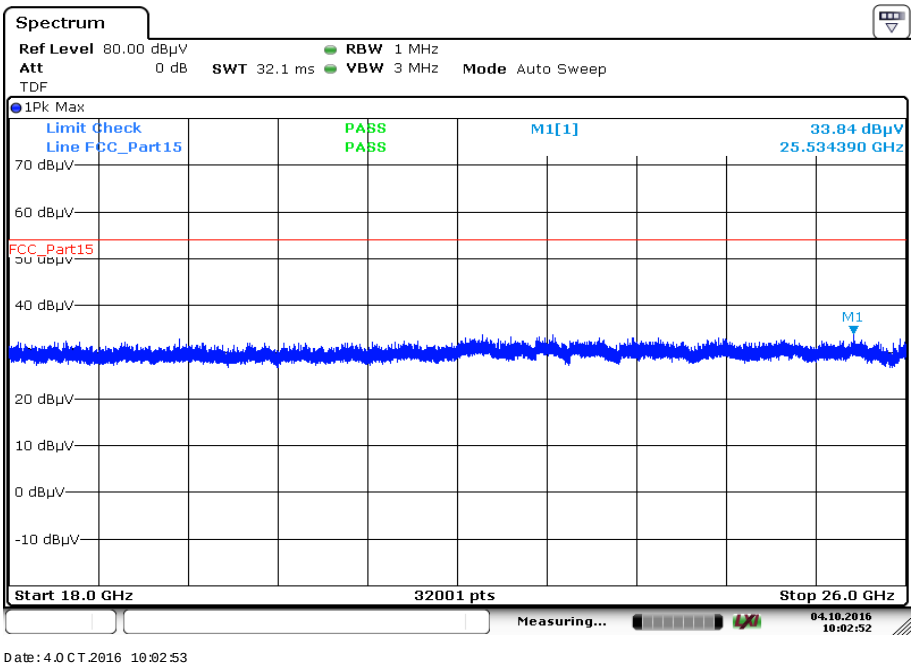
Plot 2: Lowest channel, 7 GHz to 18 GHz, vertical & horizontal polarization



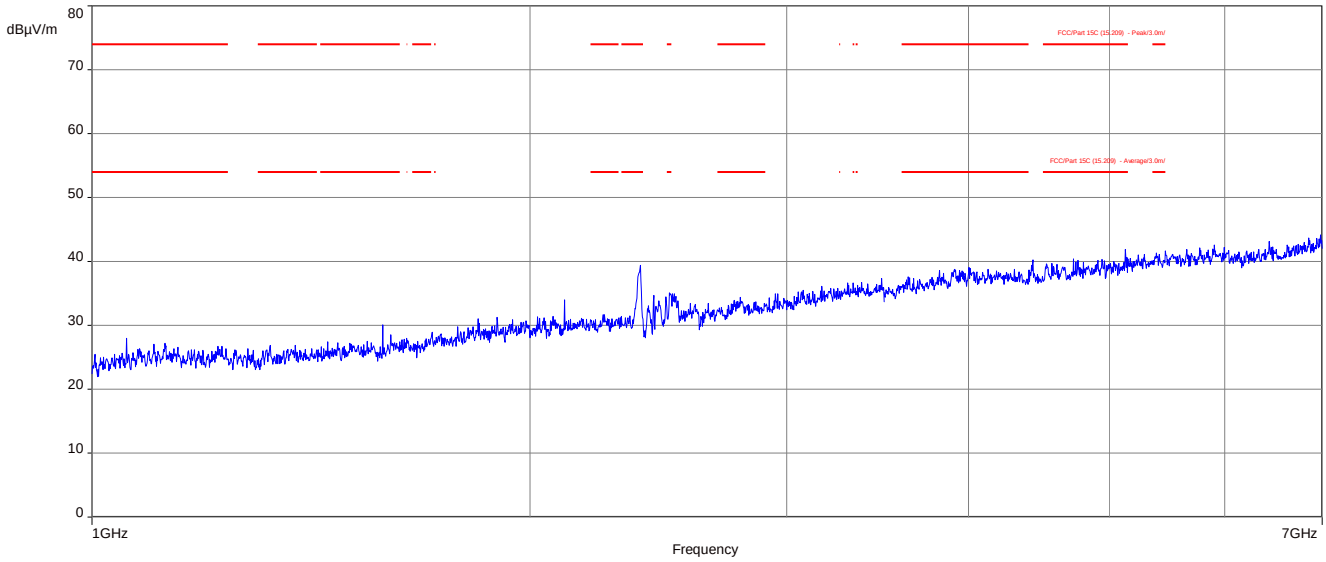
Plot 3: Lowest channel, 17.7 GHz to 18 GHz, vertical & horizontal polarization, average & peak



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

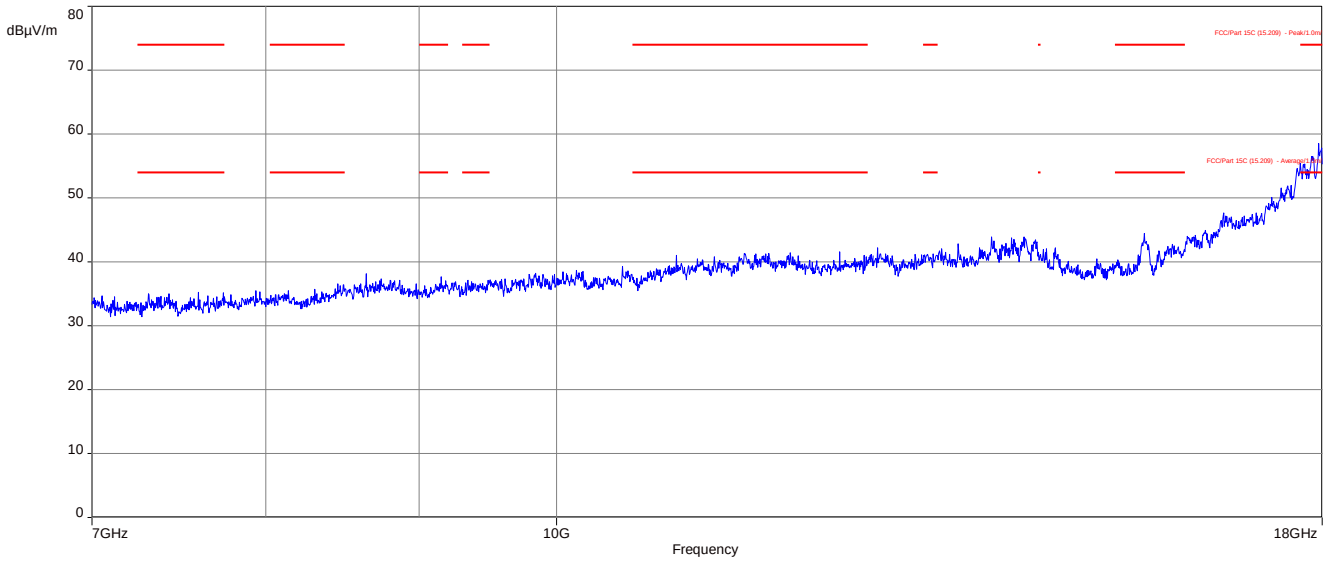


Plot 5: Middle channel, 1 GHz to 7 GHz, vertical & horizontal polarization

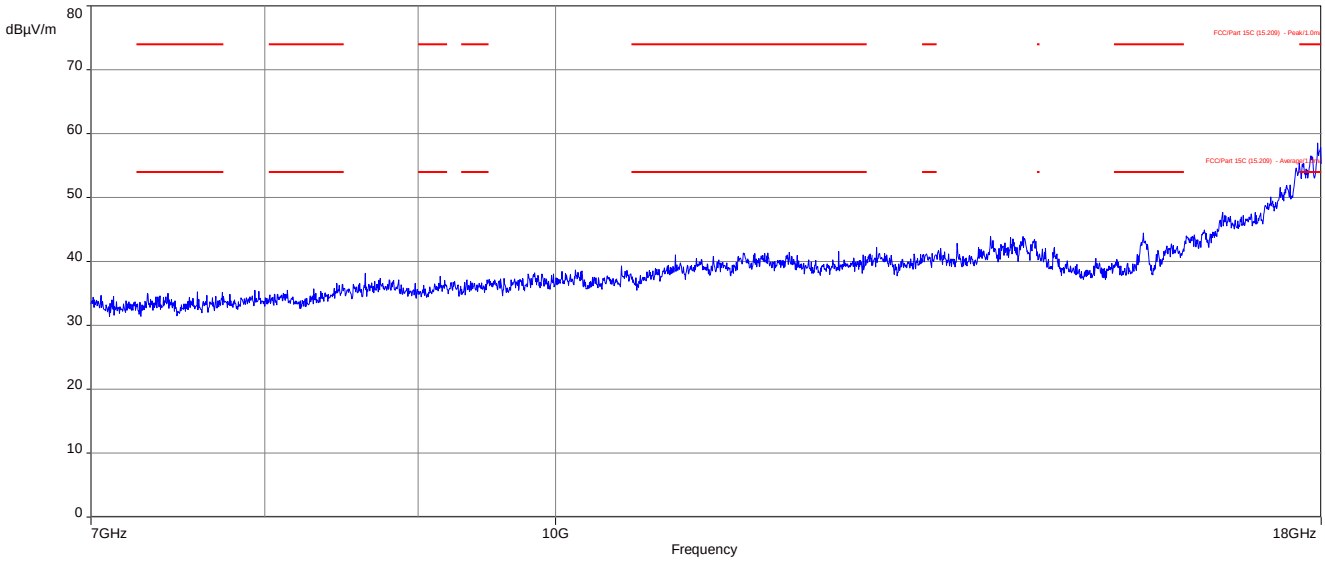


The carrier signal is notched with a 2.4 GHz band rejection filter.

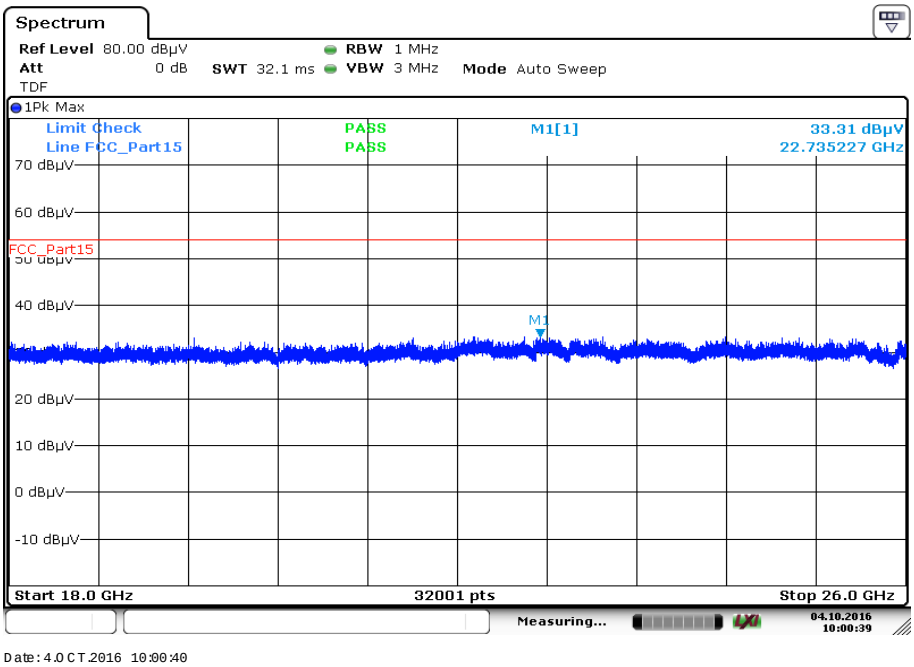
Plot 6: Middle channel, 7 GHz to 18 GHz, vertical & horizontal polarization



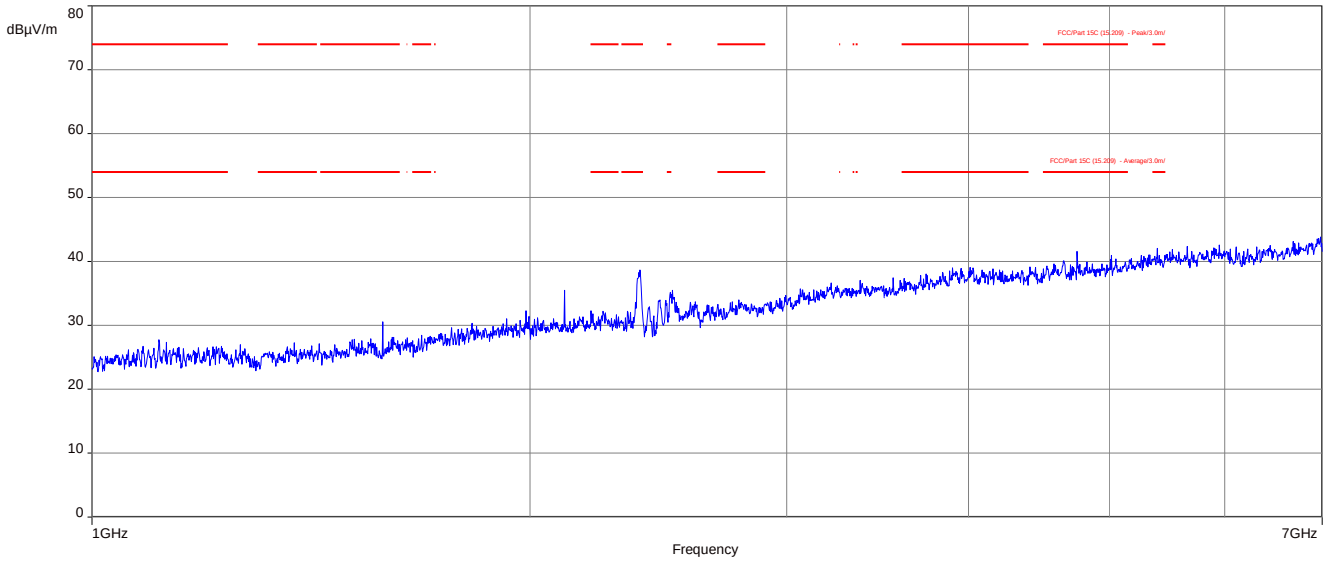
Plot 7: Middle channel, 17.7 GHz to 18 GHz, vertical & horizontal polarization



Plot 8: Middle channel, 18 GHz to 26 GHz, vertical & horizontal polarization

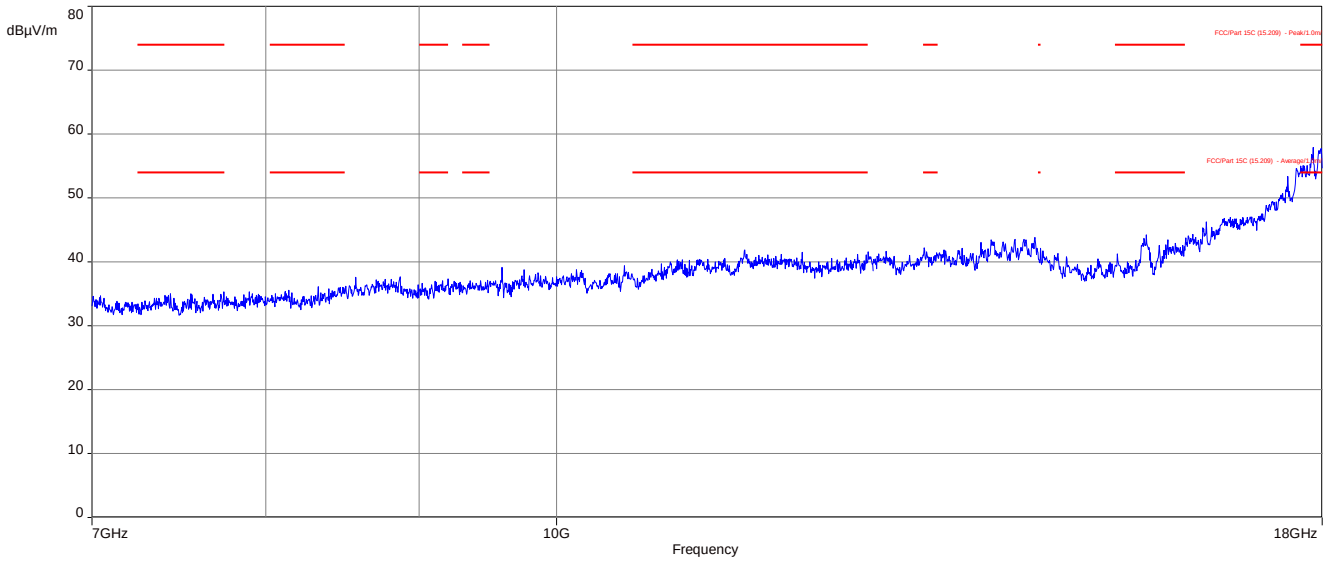


Plot 9: Highest channel, 1 GHz to 7 GHz, vertical & horizontal polarization

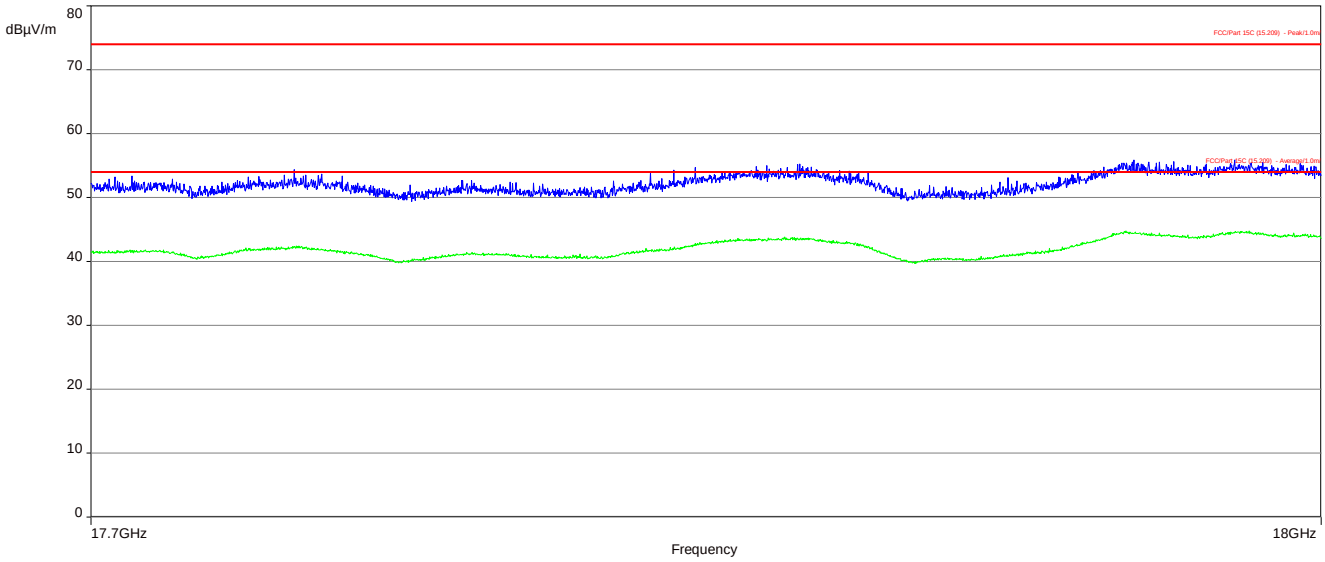


The carrier signal is notched with a 2.4 GHz band rejection filter.

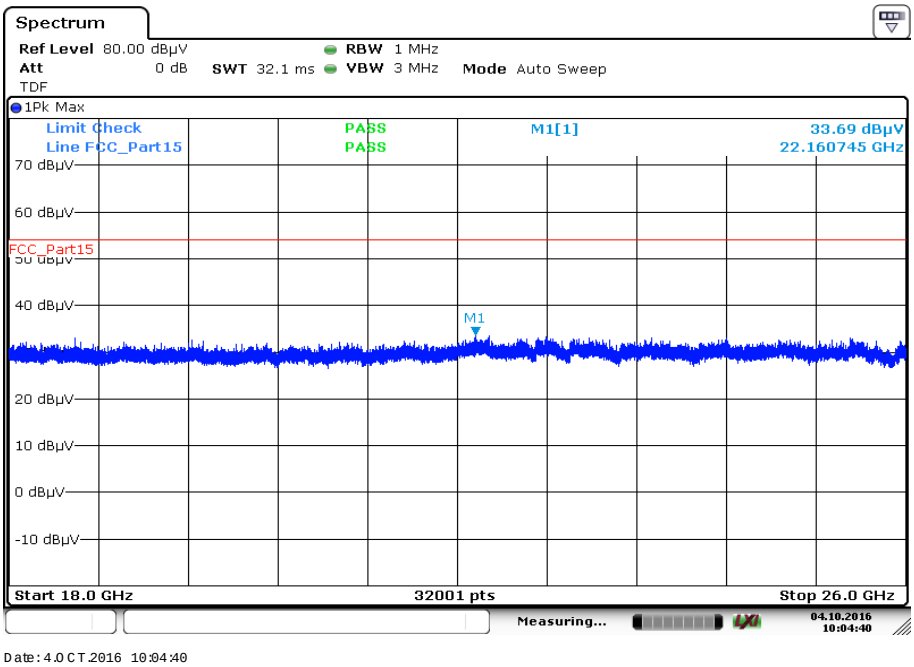
Plot 10: Highest channel, 7 GHz to 18 GHz, vertical & horizontal polarization



Plot 11: Highest channel, 17.7 GHz to 18 GHz, vertical & horizontal polarization

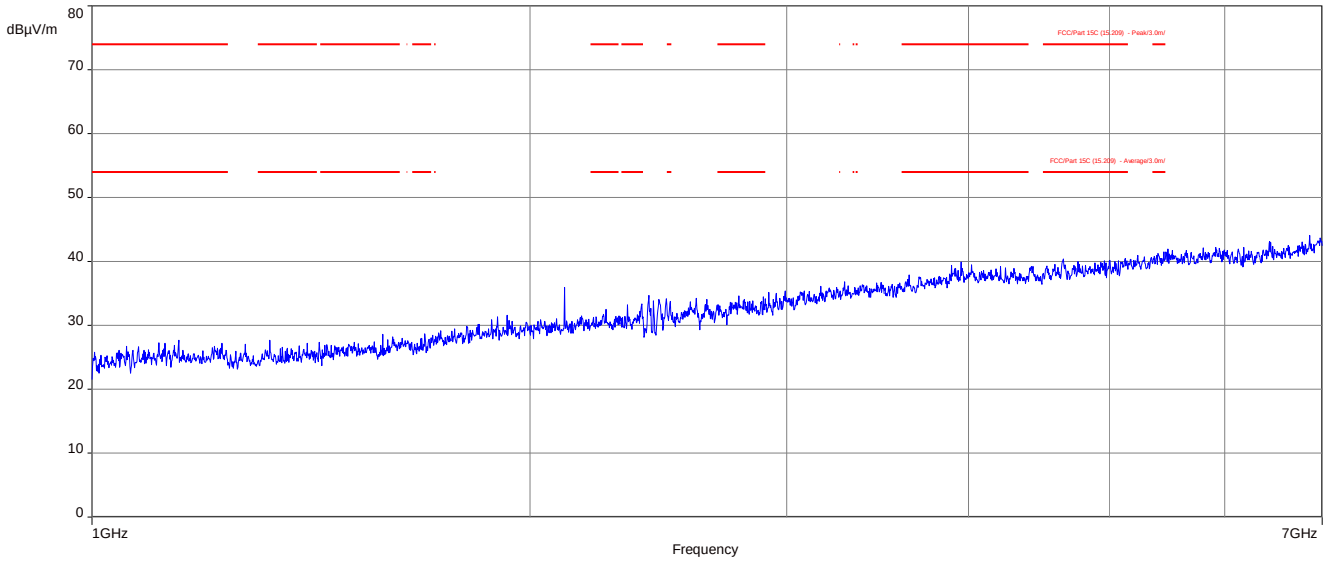


Plot 12: Highest channel, 18 GHz to 26 GHz, vertical & horizontal polarization

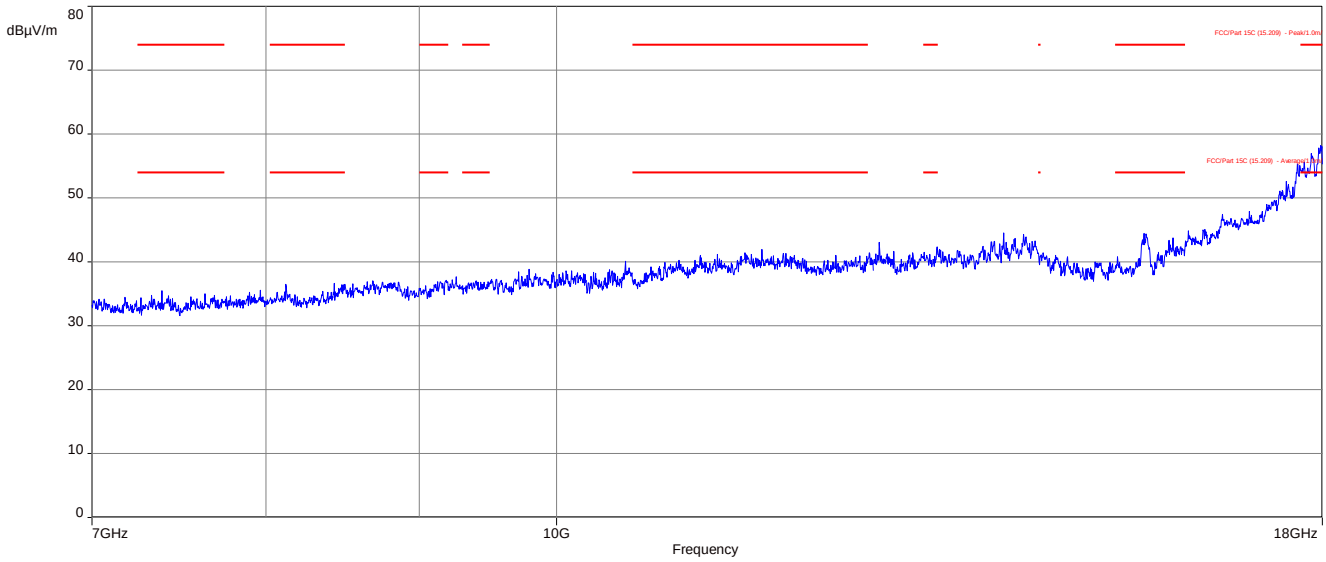


Plots: RX / idle mode

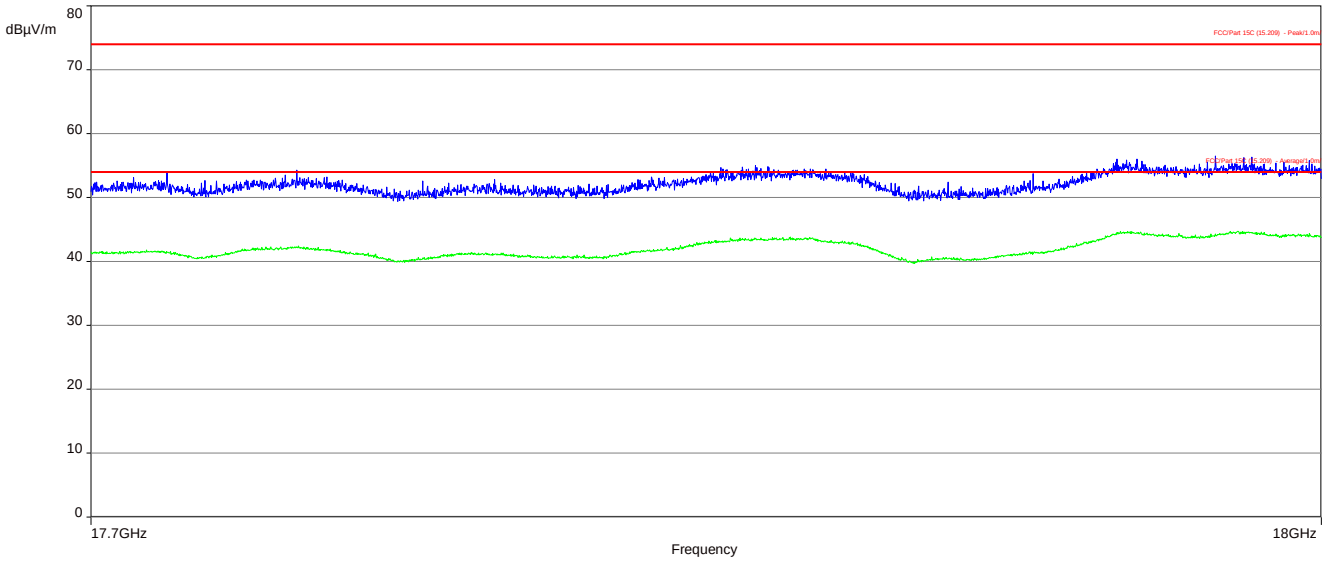
Plot 1: 1 GHz to 7 GHz, vertical & horizontal polarization



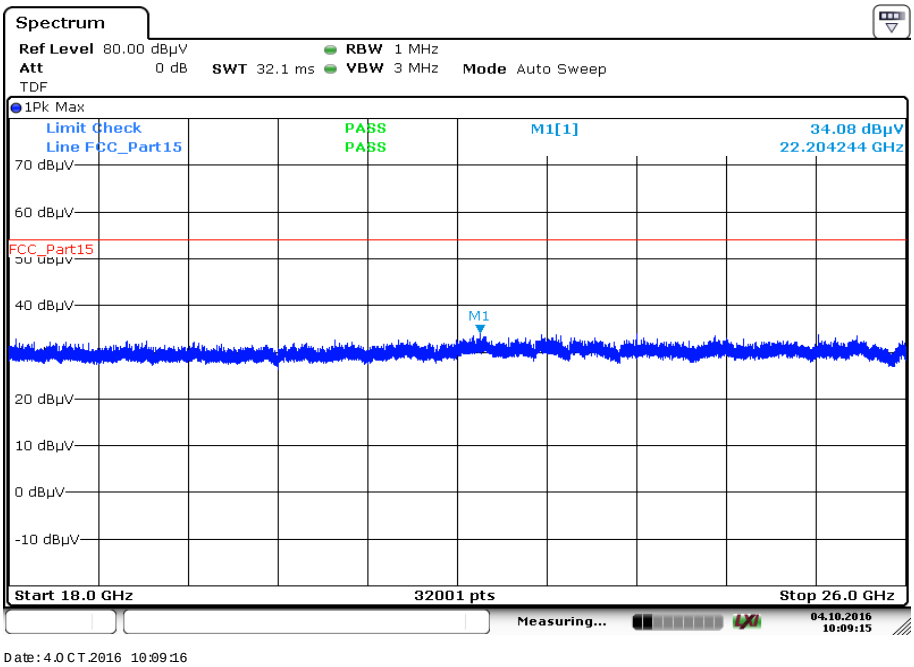
Plot 2: 7 GHz to 18 GHz, vertical & horizontal polarization



Plot 3: 17.7 GHz to 18 GHz, vertical & horizontal polarization



Plot 3: 18 GHz to 26 GHz, vertical & horizontal polarization



12 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
ETSI	European Telecommunications Standard Institute
EN	European Standard
FCC	Federal Communication 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

Annex B Document history

Version	Applied changes	Date of release
-/-	Initial release	2017-07-14

Annex C Accreditation Certificate

first page	last page
	

DAkkS Deutsche Akkreditierungsstelle

Deutsche Akkreditierungsstelle GmbH

Beliehene gemäß § 8 Absatz 1 AkkStelleG i.V.m. § 1 Absatz 1 AkkStelleGBV
Unterzeichnerin der Multilateralen Abkommen
von EA, ILAC und IAF zur gegenseitigen Anerkennung

Akkreditierung

Die Deutsche Akkreditierungsstelle GmbH bestätigt hiermit, dass das Prüflaboratorium

CTC advanced GmbH
Untertürkheimer Straße 6-10, 66117 Saarbrücken

die Kompetenz nach DIN EN ISO/IEC 17025:2005 besitzt, Prüfungen in folgenden Bereichen durchzuführen:

Funk
Mobilfunk (GSM / DCS) + OTA
Elektromagnetische Verträglichkeit (EMV)
Produktsicherheit
SAR / EMF
Umwelt
Smart Card Technology
Bluetooth®
Automotive
Wi-Fi-Services
Kanadische Anforderungen
US-Anforderungen
Akustik
Near Field Communication (NFC)

Die Akkreditierungsurkunde gilt nur in Verbindung mit dem Bescheid vom 25.11.2016 mit der Akkreditierungsnummer D-PL-12076-01 und ist gültig bis 17.01.2018. Sie besteht aus diesem Deckblatt, der Rückseite des Deckblatts und der folgenden Anlage mit insgesamt 63 Seiten.

Registrierungsnummer der Urkunde: **D-PL-12076-01-01**

Frankfurt, 25.11.2016

Im Auftrag Dipl.-Ing. (FH) Ralf Egner
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Die auszugsweise Veröffentlichung der Akkreditierungsurkunde bedarf der vorherigen schriftlichen Zustimmung der Deutsche Akkreditierungsstelle GmbH (DAkkS). Ausgenommen davon ist die separate Weiterverbreitung des Deckblattes durch die umseitig genannte Konformitätsbewertungsstelle in unveränderter Form.

Es darf nicht der Anschein erweckt werden, dass sich die Akkreditierung auch auf Bereiche erstreckt, die über den durch die DAkkS bestätigten Akkreditierungsbereich hinausgehen.

Die Akkreditierung erfolgte gemäß des Gesetzes über die Akkreditierungsstelle (AkkStelleG) vom 31. Juli 2009 (BGBl. I S. 2625) sowie der Verordnung (EG) Nr. 765/2008 des Europäischen Parlaments und des Rates vom 9. Juli 2008 über die Vorschriften für die Akkreditierung und Marktüberwachung im Zusammenhang mit der Vermarktung von Produkten (Abl. L 218 vom 9. Juli 2008, S. 30).
Die DAkkS ist Unterzeichnerin der Multilateralen Abkommen zur gegenseitigen Anerkennung der European co-operation for Accreditation (EA), des International Accreditation Forum (IAF) und der International Laboratory Accreditation Cooperation (ILAC). Die Unterzeichner dieser Abkommen erkennen ihre Akkreditierungen gegenseitig an.

Der aktuelle Stand der Mitgliedschaft kann folgenden Webseiten entnommen werden:
EA: www.european-accreditation.org
ILAC: www.ilac.org
IAF: www.iaf.nu

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

http://www.dakks.de/as/ast/d/D-PL-12076-01-01.pdf

http://www.dakks.de/as/ast/d/D-PL-12076-01-02.pdf