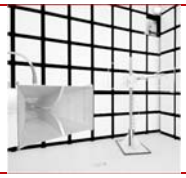
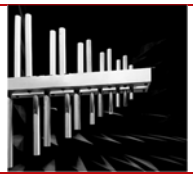
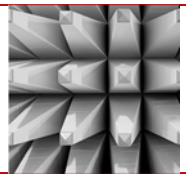

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consulting - testing - certification

TEST REPORT

Test report no.: 1-0614/15-01-02

ilac-MRA DAkkS Deutsche Akkreditierungsstelle D-PL-12076-01-00

Testing laboratory

CETECOM ICT Services GmbH
Untertuerkheimer Strasse 6 – 10
66117 Saarbruecken / Germany
Phone: + 49 681 5 98 - 0
Fax: + 49 681 5 98 - 9075
Internet: http://www.cetecom.com
e-mail: ict@cetecom.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 with the registration number: D-PL-12076-01-00

Applicant

Varian Medical Systems
Täfernstrasse 7
5405 Baden-Dättwil / SWITZERLAND
Phone: -/-
Fax: -/-
Contact: Benjamin Wyrsch
e-mail: Benjamin.Wyrsch@varian.com
Phone: +41 (0)56 203 04 04

Manufacturer

Varian Medical Systems
Täfernstrasse 7
5405 Baden-Dättwil / SWITZERLAND

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 1	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:	**WLan PAD b/g/n**
Model name:	**VCD Tablet**
FCC ID:	**2AGCP-VCDT711N**
IC:	**20822-VCDT711N**
Frequency:	ISM band 2400 MHz to 2483.5 MHz (lowest channel 01 – 2412 MHz, highest channel 11 – 2462 MHz
Technology tested:	WLAN b; g; n-HT20; n-HT40
Antenna:	Integrated antenna
Power supply:	3.6 V DC by Li Ion battery
Temperature range:	+22°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=Christoph Schneider, o=CETECOM ICT Services GmbH, ou=SND-120402, email=christoph.schneider@cetecom.com, c=DE
2015.12.10 11:30:30 +01'00'

Christoph Schneider
Testing Manager
Radio Communications & EMC

Test performed:

cn=Tobias Wittenmeier, o=CETECOM ICT Services GmbH, ou=WIT-111222, email=tobias.wittenmeier@cetecom.com, c=DE
2015.12.10 11:30:01 +01'00'

Tobias Wittenmeier
Testing 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. CETECOM ICT Services 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:	2015-09-28
Date of receipt of test item:	2015-11-12
Start of test:	2015-11-12
End of test:	2015-12-09
Person(s) present during the test:	-/-

3 Test standard/s

Test standard	Date	Test standard description
47 CFR Part 15		Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 247 Issue 1	May 2015	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence - Exempt Local Area Network (LE-LAN) Devices

3.1 Measurement guidance

Guidance	Version	Description
DTS: KDB 558074 D01	v03r03	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

4 Test environment

Temperature	:	T_{nom} T_{max} T_{min}	+22 °C during room temperature tests -/- °C during high temperature tests -/- °C during low temperature tests
Relative humidity content	:		55 %
Barometric pressure	:		not relevant for this kind of testing
Power supply	:	V_{nom} V_{max} V_{min}	3.60 V DC by Li Ion battery -/- V -/- V

5 Test item

5.1 General description

Kind of test item	:	WLan PAD b/g/n
Type identification	:	VCD Tablet
HMN	:	-/-
PMN	:	Visual Coaching Device (VCD)
HVIN	:	VCD PN: P1010528
FVIN	:	-/-
S/N serial number	:	No information available
HW hardware status	:	No information available
SW software status	:	No information available
Frequency band	:	ISM band 2400 MHz to 2483.5 MHz (lowest channel 01 – 2412 MHz, highest channel 11 – 2462 MHz
Type of radio transmission Use of frequency spectrum	: :	DSSS, OFDM
Type of modulation	:	BPSK, QPSK, 16 – QAM, 64 – QAM
Number of channels	:	11
Antenna	:	Integrated antenna
Power supply	:	3.6 V DC by Li Ion battery
Temperature range	:	+22 °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: 1-0614_15-01-01_AnnexA
1-0614_15-01-01_AnnexB
1-0614_15-01-01_AnnexD

6 Test laboratories sub-contracted

None

7 Description of the test setup

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

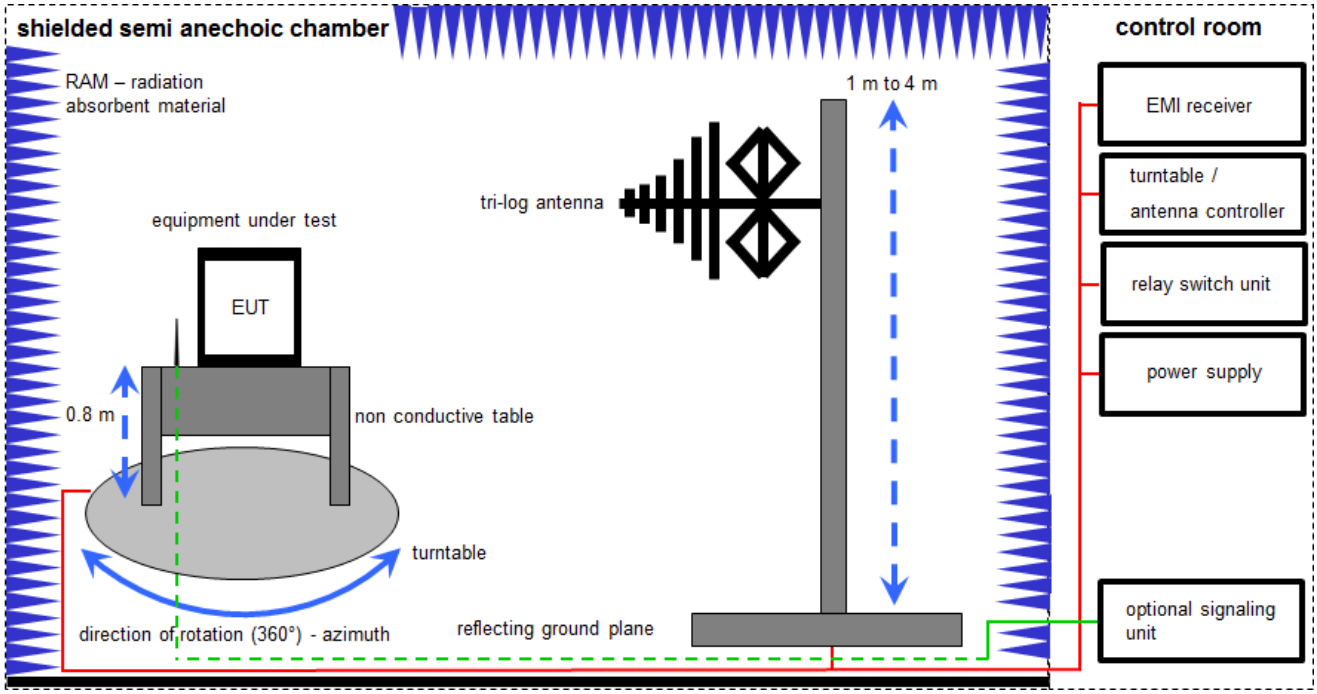
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

Agenda: Kind of Calibration

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

7.1 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. 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

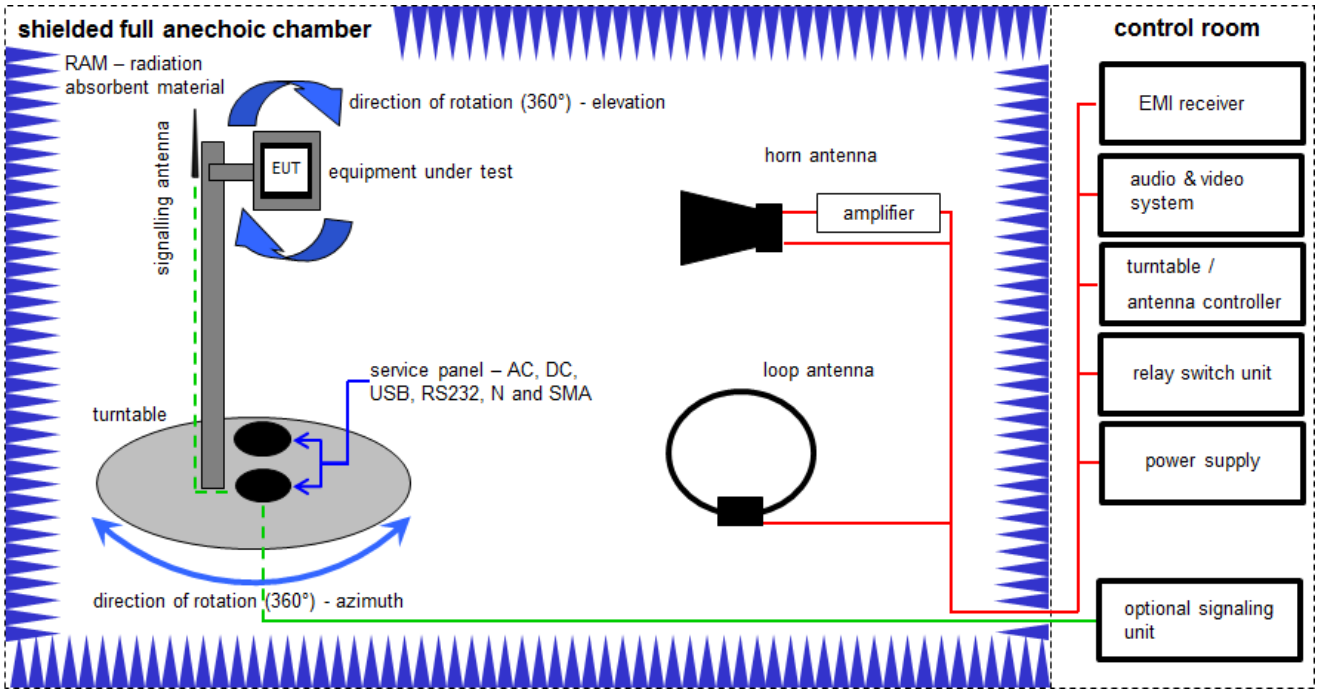
FS = UR + CL + AF
(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

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	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	Switch-Unit	3488A	HP	2719A14505	300000368	ev		
2	A	software	SPS_PHE 1.4f	Spitzenberger & Spiess	B5981; 5D1081;B5979	300000210	ne		
3	A	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	26.01.2015	26.01.2016
4	A	Analyzer-Reference-System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	Ve	11.02.2014	11.02.2016
5	A	Amplifier	JS42-00502650-28-5A	MITEQ	1084532	300003379	ev		
6	A	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw		
7	A	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw		
8	A	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw		
9	A	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787	k	22.04.2014	22.04.2016

7.2 Shielded fully anechoic chamber



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

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

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

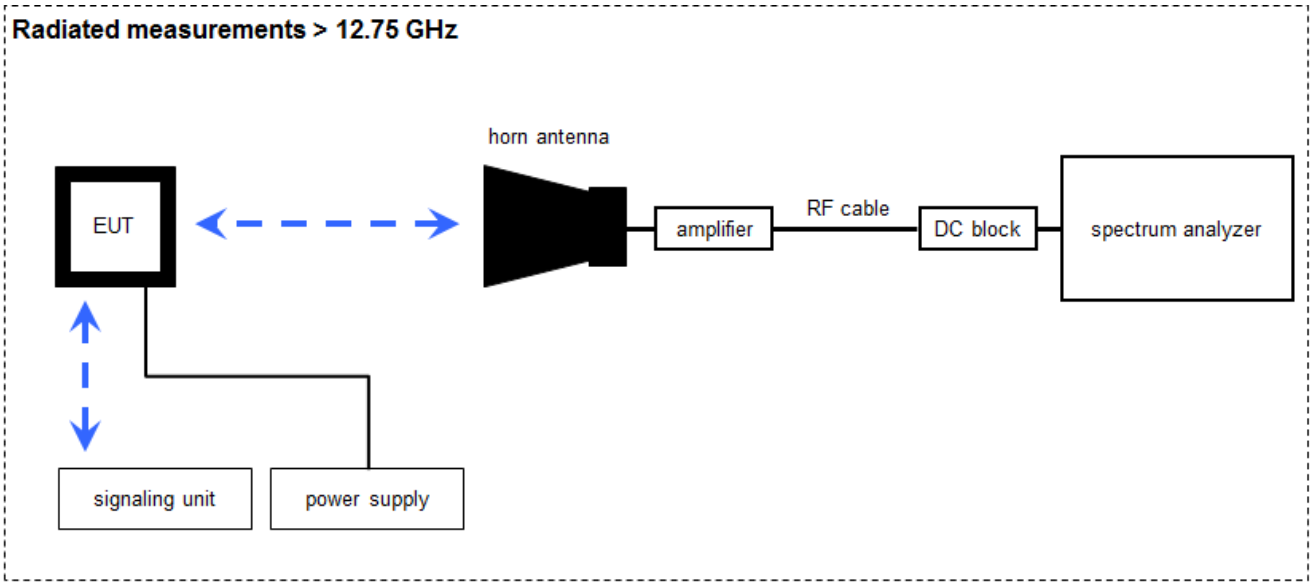
OP = AV + D - G + CA
(OP-radiated output power; AV-analyzer value; D-free field attenuation of measurement distance; G-antenna gain+amplifier gain; CA-loss signal path)

Example calculation:
OP [dBm] = -39.0 [dBm] + 57.0 [dB] - 12.0 [dBi] + (-36.0) [dB] = -30 [dBm] (1 µW)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	9709-5290	300000212	k	13.08.2015	13.08.2017
2	A	EMI Test Receiver 20Hz- 26,5GHz	ESU26	R&S	100037	300003555	k	22.01.2015	22.01.2016
3	A	Highpass Filter	WHK1.1/15G-10SS	Wainwright	37	400000148	ne		
4	A	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	18	300003789	ne		
5	A	Band Reject Filter	WRCG2400/2483-2375/2505-50/10SS	Wainwright	26	300003792	ne		
6	A	Broadband Amplifier 0.5-18 GHz	CBLU5184540	CERNEX	22050	300004482	ev		
7	A	Broadband Amplifier 5-13 GHz	CBLU5135235	CERNEX	22011	300004492	ev		
8	A	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000032	300004510	ne		
9	A	Messrechner und Monitor	Intel Core i3 3220/3,3 GHz, Prozessor	Agilent Technologies	2V2403033A5421	300004591	ne		
10	A	NEXIO EMV-Software	BAT EMC	EMCO	2V2403033A5421	300004682	ne		

7.3 Radiated measurements > 12.75 GHz



Measurement distance: horn antenna 25 cm

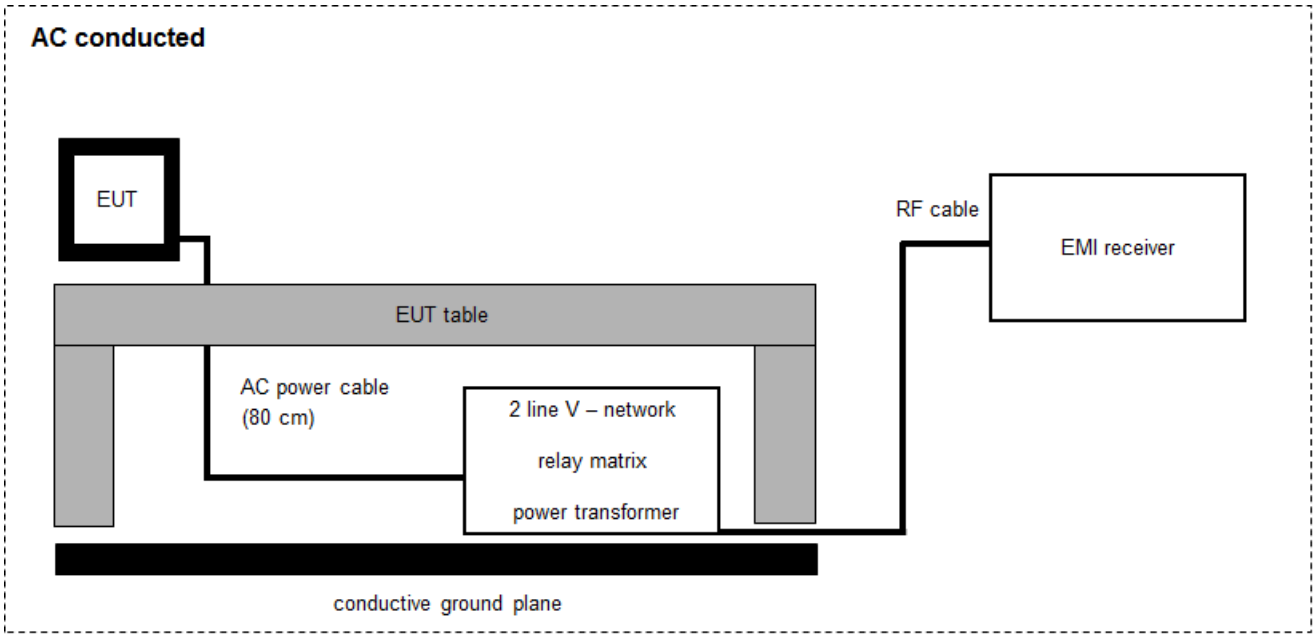
FS = UR + CA + AF
(FS-field strength; UR-voltage at the receiver; CA-loss signal path & distance correction; AF-antenna factor)

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

Equipment table:

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	Microwave System Amplifier, 0.5-26.5 GHz	83017A	HP	00419	300002268	ev		
2	A	Std. Gain Horn Antenna 12.4 to 18.0 GHz	639	Narda	8402	300000787	k	14.08.2015	14.08.2017
3	A	Std. Gain Horn Antenna 18.0 to 26.5 GHz	638	Narda	8205	300002442	k	14.08.2015	14.08.2017
4	A	Spectrum Analyzer 9kHz to 30GHz - 140..+30dBm	FSP30	R&S	100886	300003575	k	26.08.2014	26.08.2016
5	A	RF-Cable	ST18/SMAm/SMAm/60	Huber & Suhner	Batch no. 606844	400001181	ev		
6	A	DC-Blocker 0.1-40 GHz	8141A	Inmet	Batch no. 606844	400001185	ev		

7.4 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)

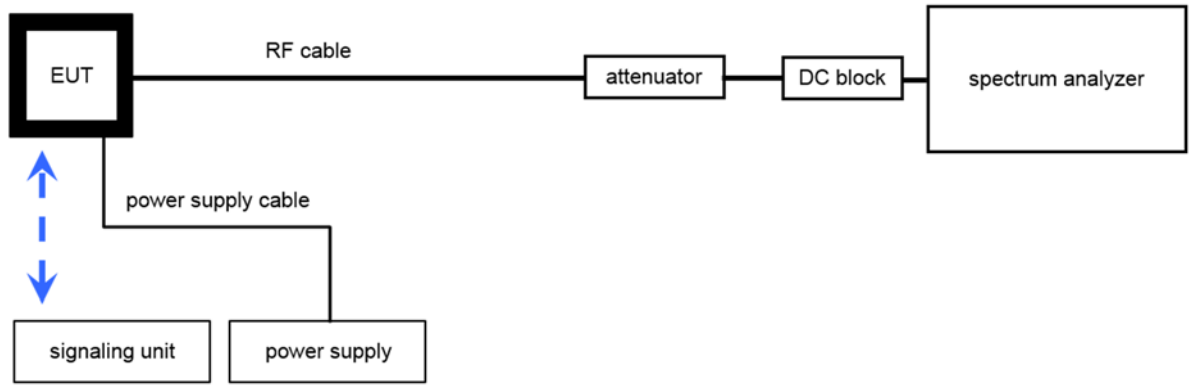
Example calculation:
FS [dBµV/m] = 37.62 [dBµV/m] + 9.90 [dB] + 0.23 [dB] = 47.75 [dBµV/m] (244.06 µV/m)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	Netznachbildung	ESH3-Z5	R&S	892475/017	300002209	k	17.06.2014	17.06.2016
2	A	EMI-Receiver	8542E	HP	3617A00170	300000568	k	28.01.2015	28.01.2016
3	A	Analyzer-Reference-System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	Ve	11.02.2014	11.02.2016

7.5 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	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A.	Signal Analyzer 40 GHz	FSV40	R&S	101042	300004517	k	22.01.2015	22.01.2016
2	A	PC-WLAN Tester	Intel Core i3 3220/3,3 GHz, Prozessor	R&S	2V2403033A4523	300004589	ne		
3	A	RF-Cable	ST18/SMAm/SMAm/48	Huber & Suhner	Batch no. 600918	400001182	ev		
4	A	DC-Blocker 0.1-40 GHz	8141A	Inmet	Batch no. 600918	400001185	ev		
5	A	Coax Attenuator 10 dB 2W 0-40 GHz	MCL BW-K10-2W44+	Mini Circuits	Batch no. 600918	400001186	ev		

8 Sequence of testing

8.1 Sequence of testing radiated spurious 9 kHz to 30 MHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, 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.

8.2 Sequence of testing radiated spurious 30 MHz to 1 GHz

Setup

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

Premeasurement

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

Final measurement

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

8.3 Sequence of testing radiated spurious 1 GHz to 12.75 GHz

Setup

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

Premeasurement

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

Final measurement

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

8.4 Sequence of testing radiated spurious above 12.75 GHz

Setup

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

Premeasurement

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

Final measurement

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

9 Measurement uncertainty

Measurement uncertainty	
Test case	**Uncertainty**
Antenna gain	± 3 dB
Power spectral density	± 1.5 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

10 Summary of measurement results

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

TC Identifier	Description	Verdict	Date	Remark
RF-Testing	CFR Part 15 RSS - 247, Issue 1	See table!	2015-12-10	-/-

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 (4)	Antenna gain	-/-	Nominal	Nominal	DSSS	☒	☐	☐	☐	-/-
§15.247(e) RSS - 247 / 5.2 (2)	Power spectral density	KDB 558074 DTS clause: 10.6	Nominal	Nominal	DSSS OFDM	☒	☐	☐	☐	-/-
§15.247(a)(2) RSS - 247 / 5.2 (1)	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 (4)	Maximum output power	KDB 558074 DTS clause: 9.2.2.5	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 radiated	KDB 558074 DTS clause: 13.3.2	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	☒	☐	☐	☐	-/-

Note: C = Complies; NC = Not complies; NA = Not applicable; NP = Not performed

11 Additional comments

Reference documents: None

Special test descriptions: None

Configuration descriptions: None

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.

12 Measurement results

12.1 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 7.2A & 7.5A
Measurement uncertainty	See sub clause 9

Limits:

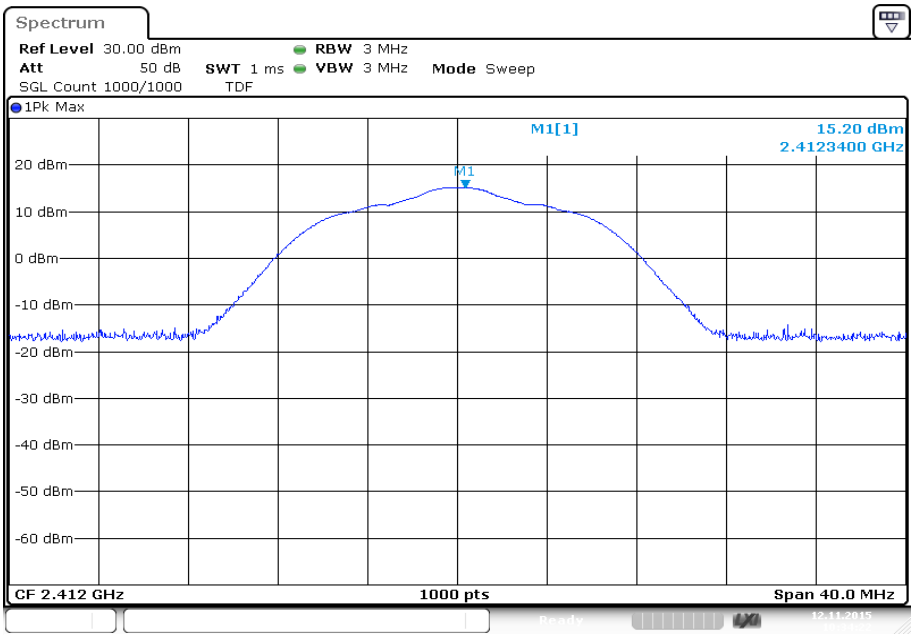
FCC	IC
6 dBi	

Results:

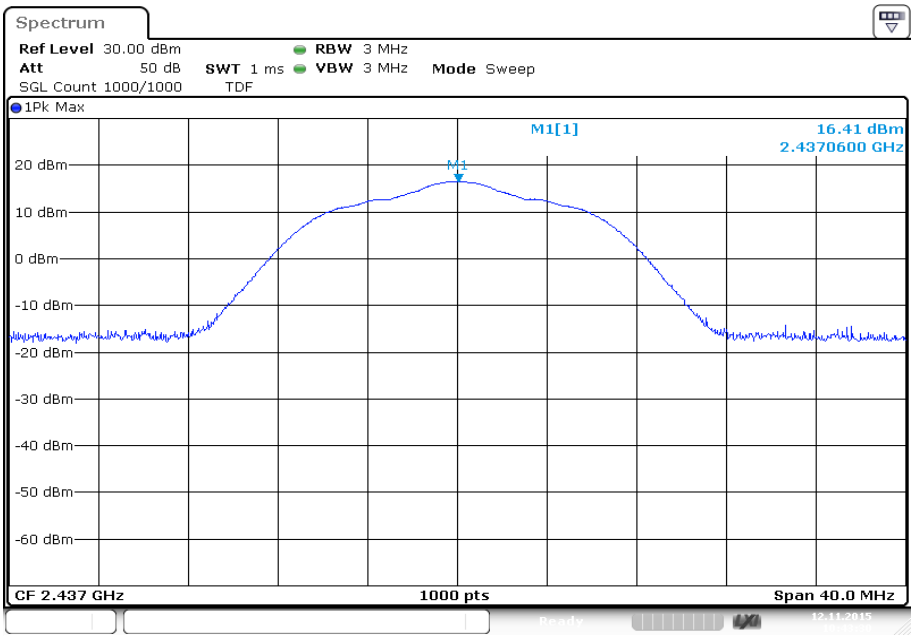
T_{nom}	V_{nom}	lowest channel 2412 MHz	middle channel 2437 MHz	highest channel 2462 MHz
Conducted power [dBm] Measured with DSSS modulation		15.20	16.41	16.88
Radiated power [dBm] Measured with DSSS modulation		17.75	17.71	17.27
Gain [dBi] Calculated		2.55	1.30	0.39

Plots: DSSS / b – mode

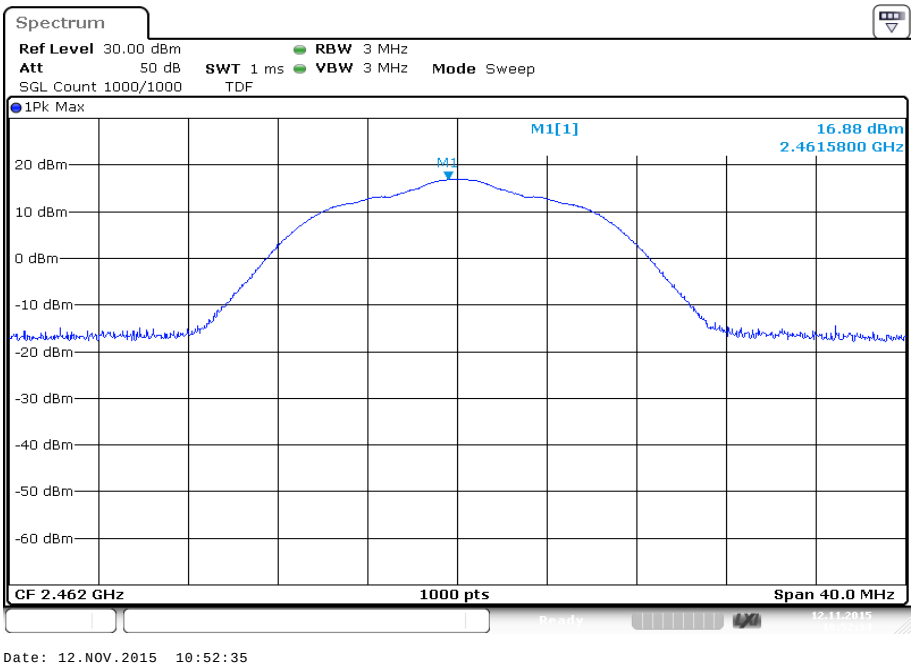
Plot 1: TX mode, lowest channel



Plot 2: TX mode, middle channel



Plot 3: TX mode, highest channel



12.2 Identify worst case data rate

Results:

Modulation	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 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: 9.2.2.5	
Detector:	RMS
Sweep time:	Auto
Resolution bandwidth:	1 – 5 % of the OBW
Video bandwidth:	≥ 3x RBW
Span:	Depends on the signal
Integration bandwidth:	99 % power - bandwidth (OBW)
Trace mode:	Max hold (allow trace to fully stabilize)
Measurement function:	Channel power with OBW
Test setup:	See sub clause 7.5A
Measurement uncertainty	See sub clause 9

Limits:

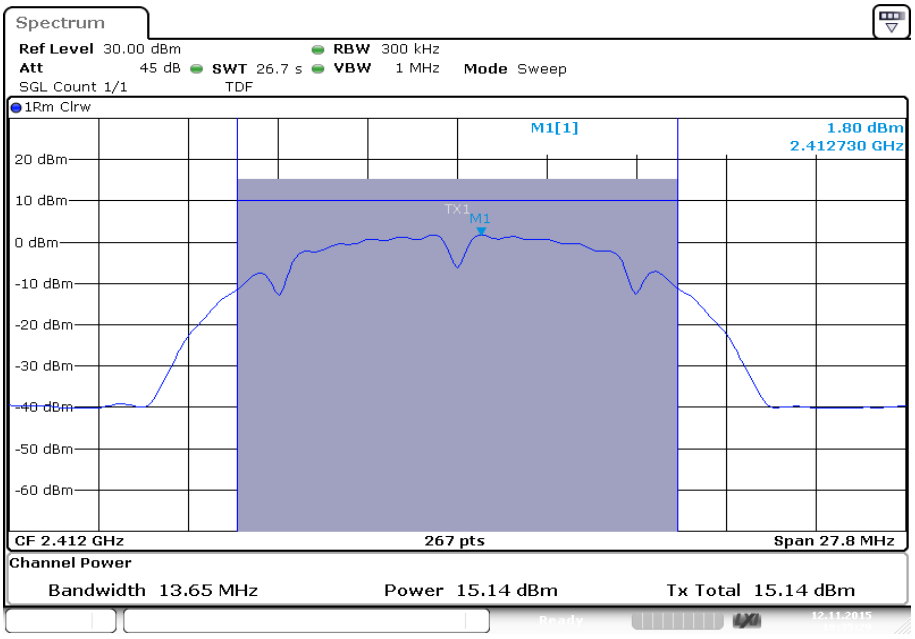
FCC	IC
Conducted: 1.0 W – Antenna gain max. 6 dBi	

Results:

Frequency	Maximum Output Power [dBm]		
	2412 MHz	2437 MHz	2462 MHz
Output power conducted DSSS / b – mode	15.14	16.41	16.91
Output power conducted DSSS / g – mode	13.12	13.49	13.58
Output power conducted DSSS / n HT20 – mode	13.06	13.45	13.52
Frequency	2422 MHz	2437 MHz	2452 MHz
Output power conducted DSSS / n HT40 – mode	13.34	13.52	13.59

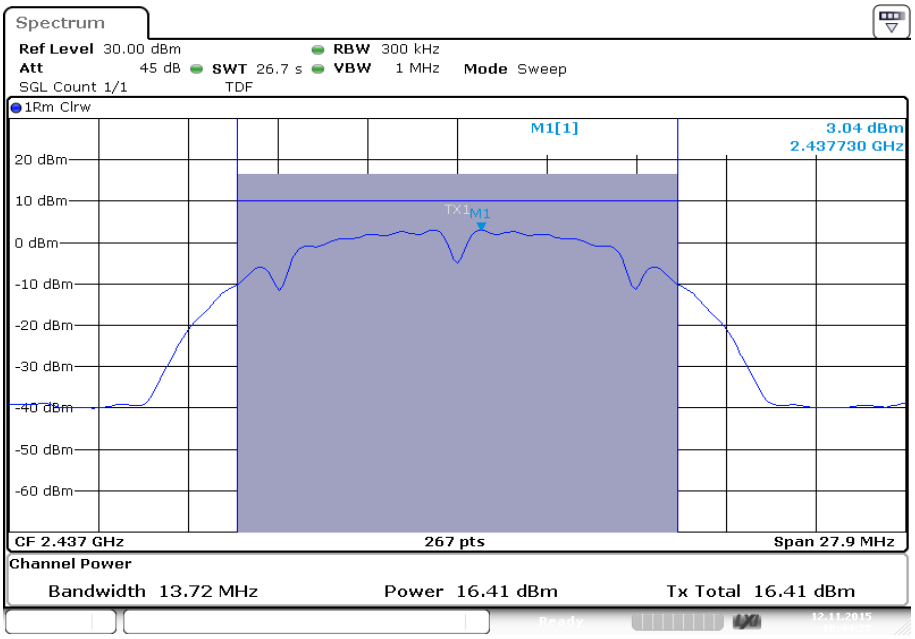
Plots: DSSS / b – mode

Plot 1: TX mode, lowest channel



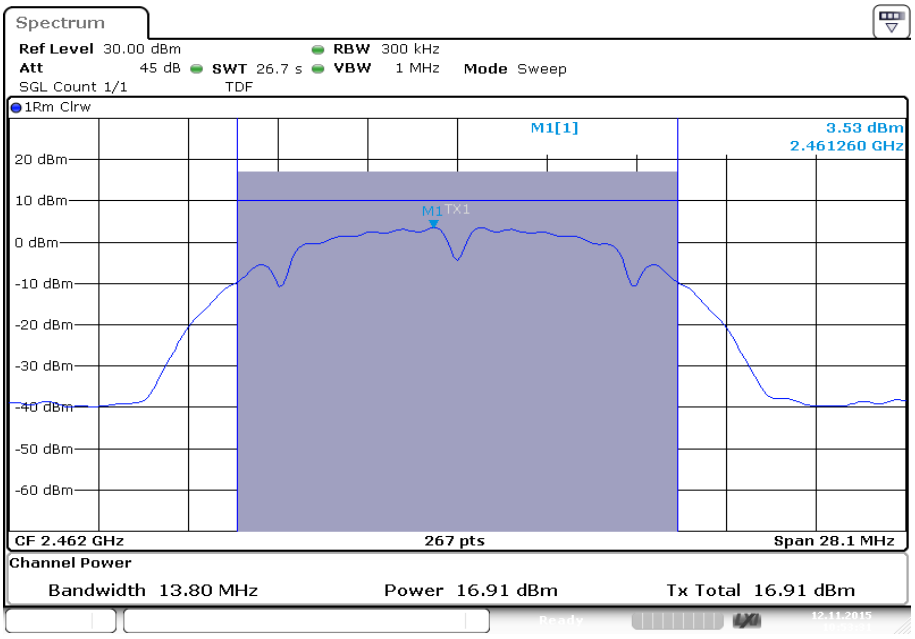
Date: 12.NOV.2015 10:35:29

Plot 2: TX mode, middle channel



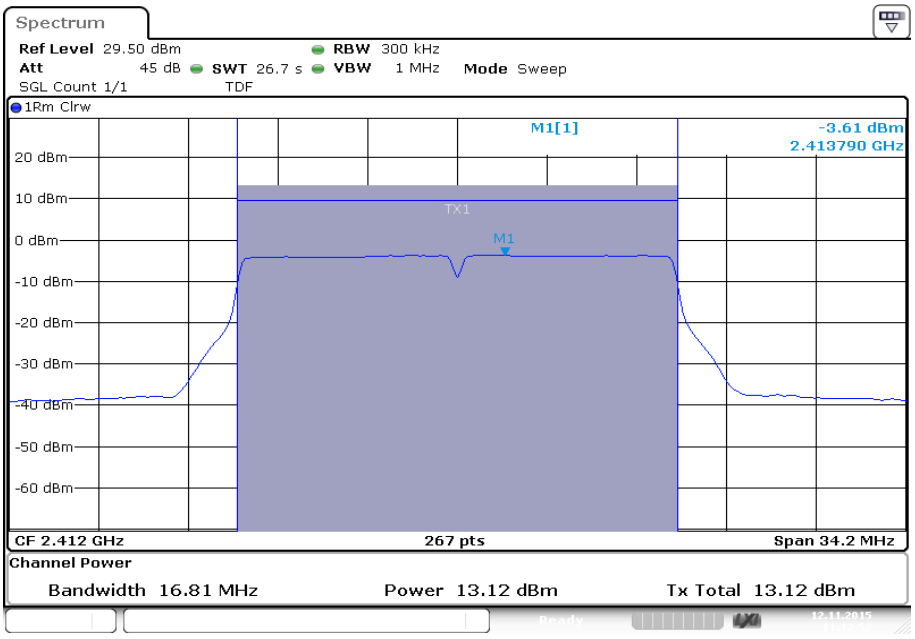
Date: 12.NOV.2015 10:44:28

Plot 3: TX mode, highest channel

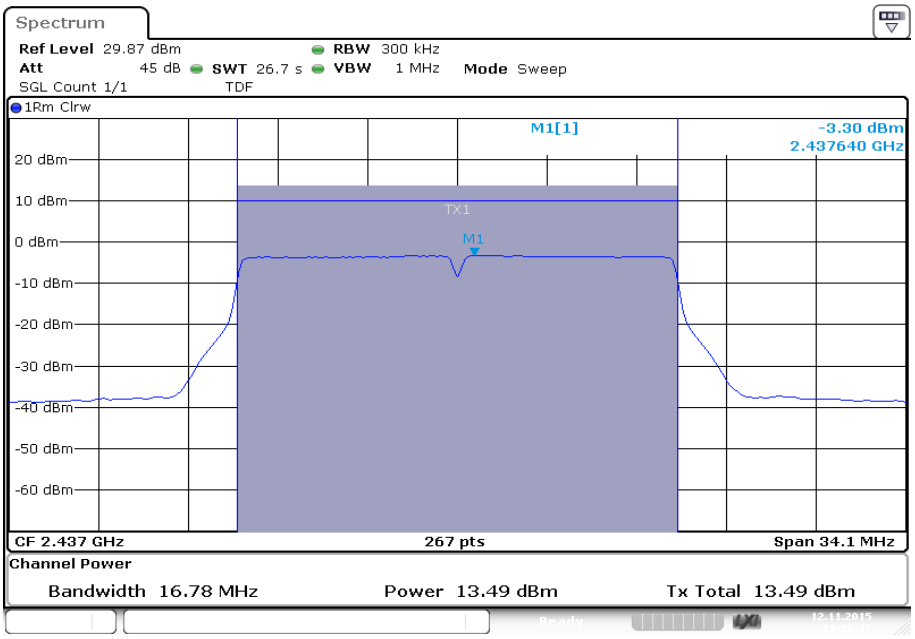


Plots: OFDM / g – mode

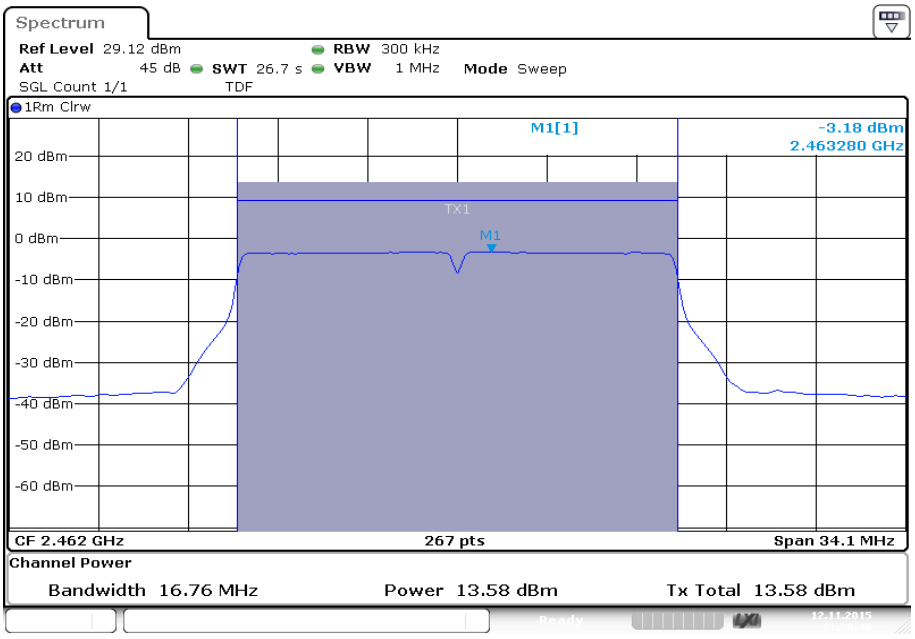
Plot 1: TX mode, lowest channel



Plot 2: TX mode, middle channel

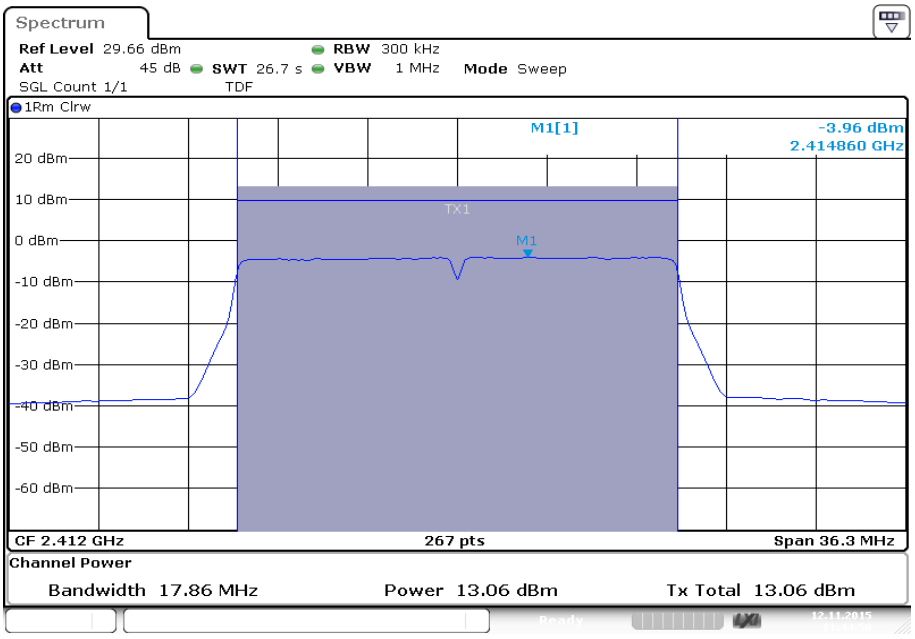


Plot 3: TX mode, highest channel

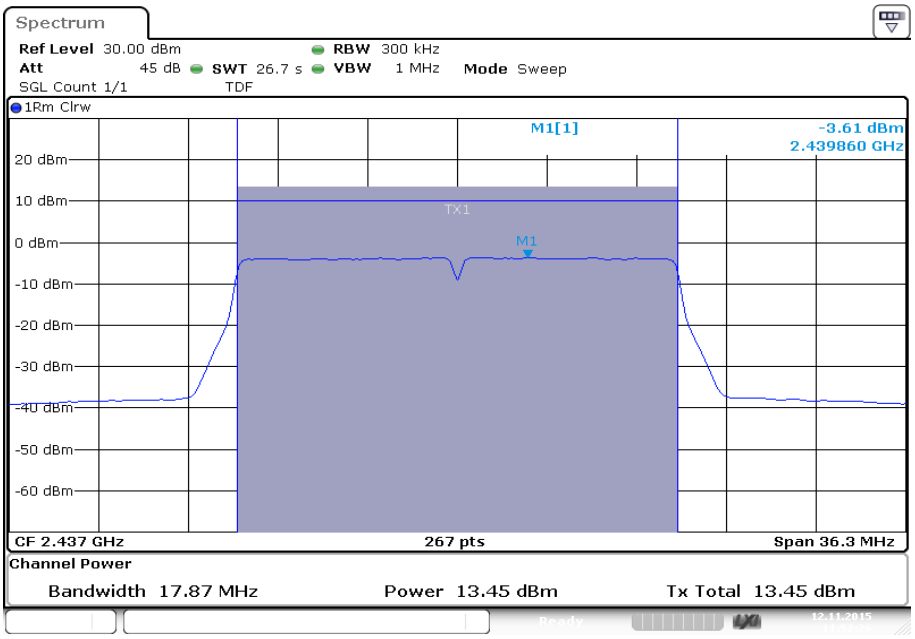


Plots: OFDM / nHT20 – mode

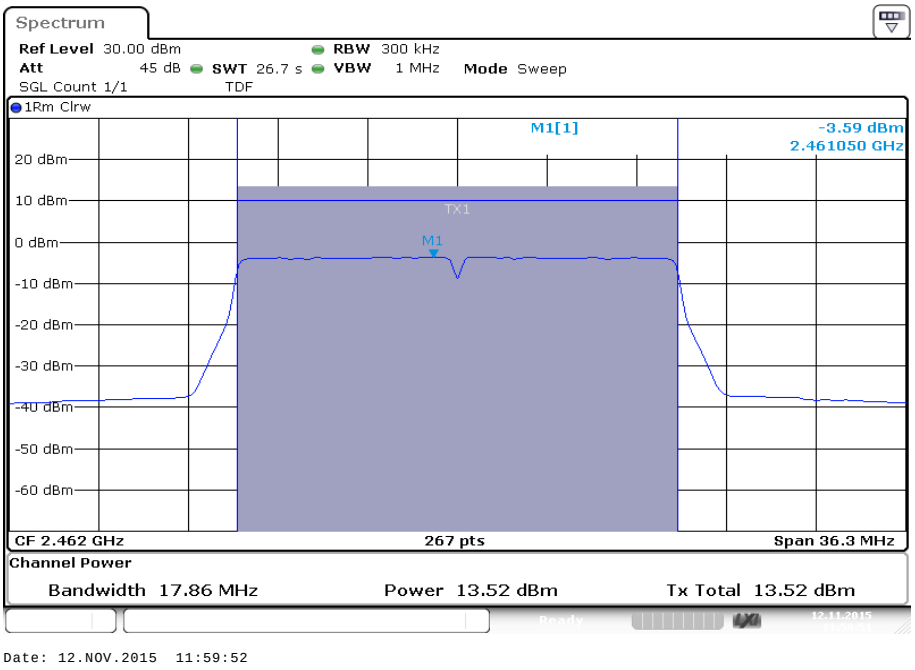
Plot 1: TX mode, lowest channel



Plot 2: TX mode, middle channel

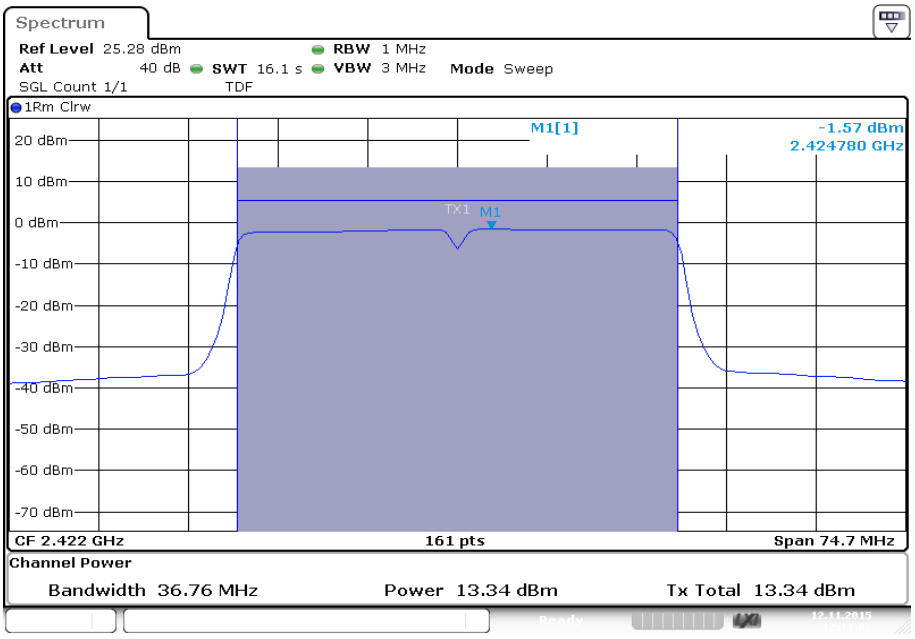


Plot 3: TX mode, highest channel



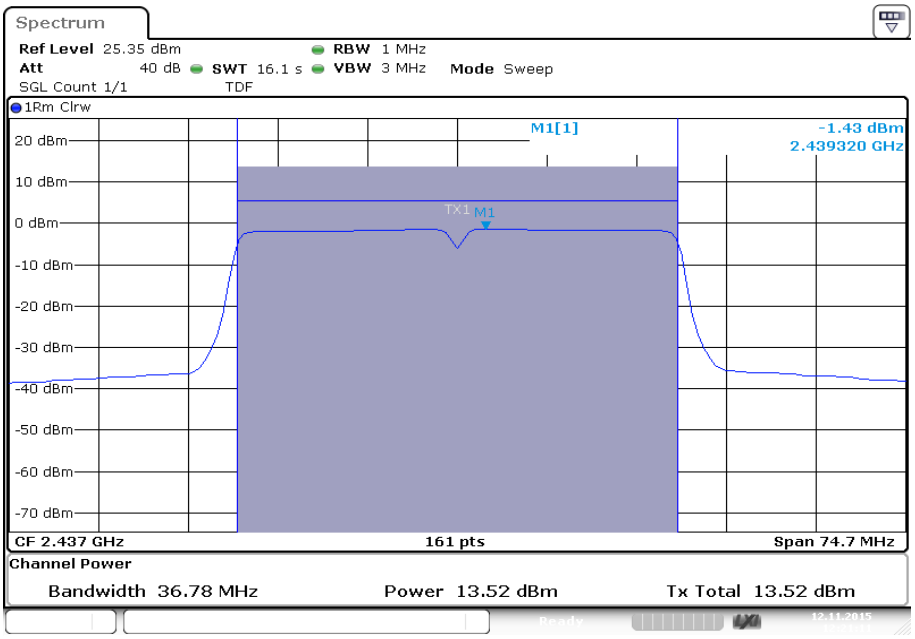
Plots: OFDM / nHT40 – mode

Plot 1: TX mode, lowest channel



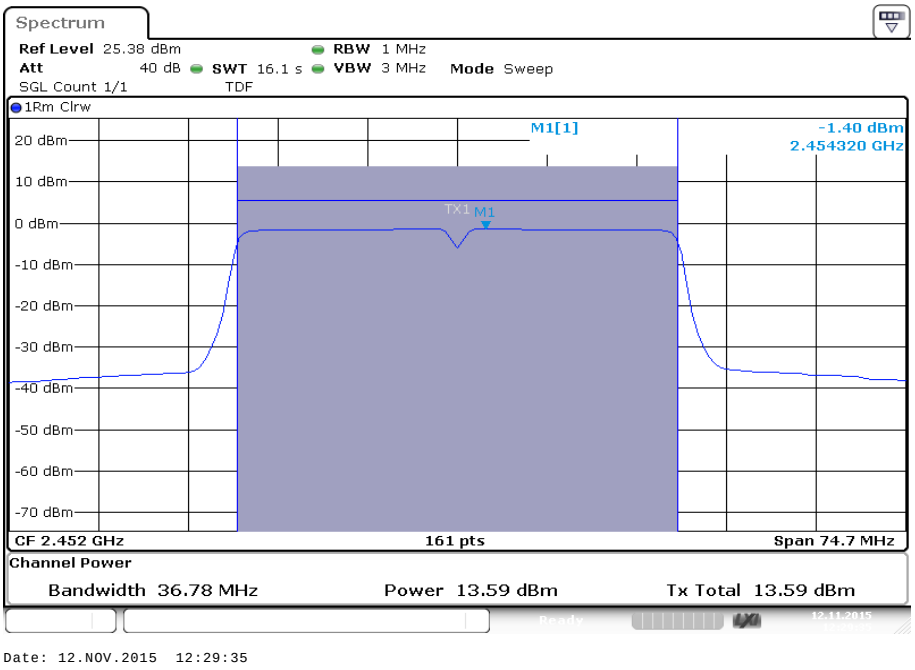
Date: 12.NOV.2015 12:13:02

Plot 2: TX mode, middle channel



Date: 12.NOV.2015 12:21:11

Plot 3: TX mode, highest channel



12.4 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: 10.6	
Detector:	RMS
Sweep time:	See plots
Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Span:	See plots
Trace mode:	Max hold (allow trace to fully stabilize)
Test setup:	See sub clause 7.5A
Measurement uncertainty	See sub clause 9

Limits:

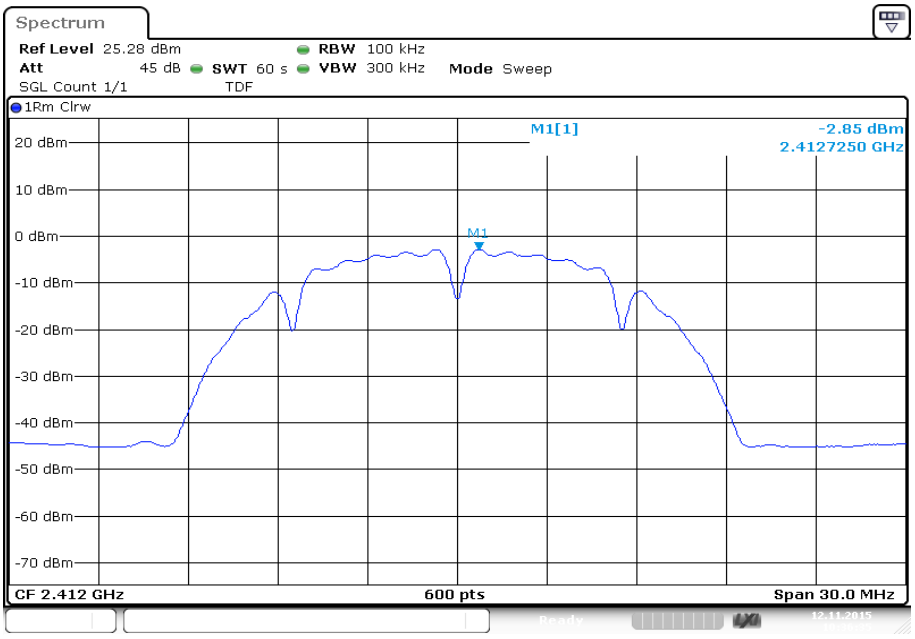
FCC	IC
8 dBm / 3kHz (conducted)	

Results:

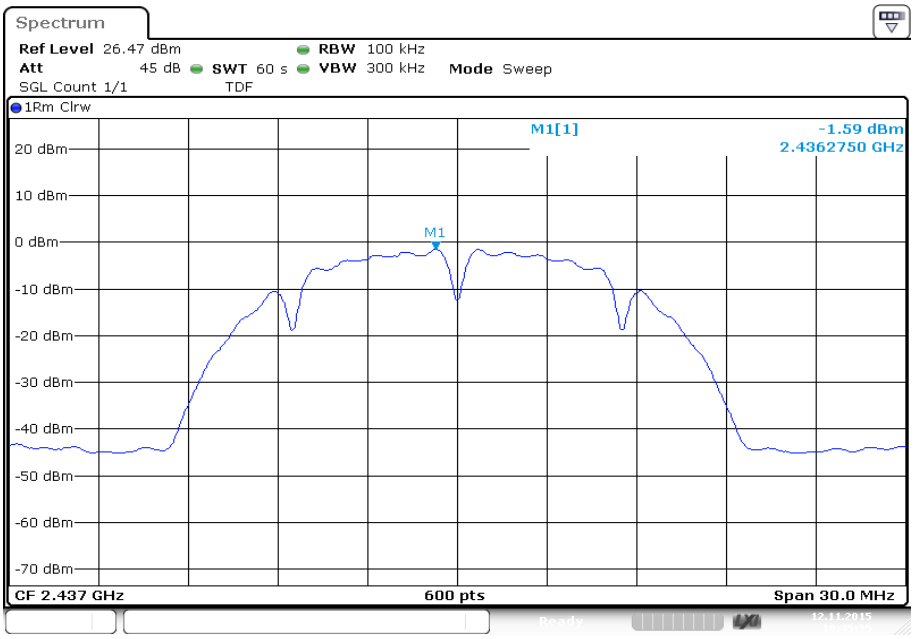
Modulation	Power Spectral density [dBm]		
Frequency	2412 MHz	2437 MHz	2462 MHz
DSSS / b – mode	-2.85	-1.59	-1.11
OFDM / g – mode	-7.27	-6.99	-6.99
OFDM / n HT20 – mode	-7.65	-7.38	-7.41
Frequency	2422 MHz	2437 MHz	2452 MHz
OFDM / n HT40 – mode	-10.42	-10.28	-10.26

Plots: DSSS / b – mode

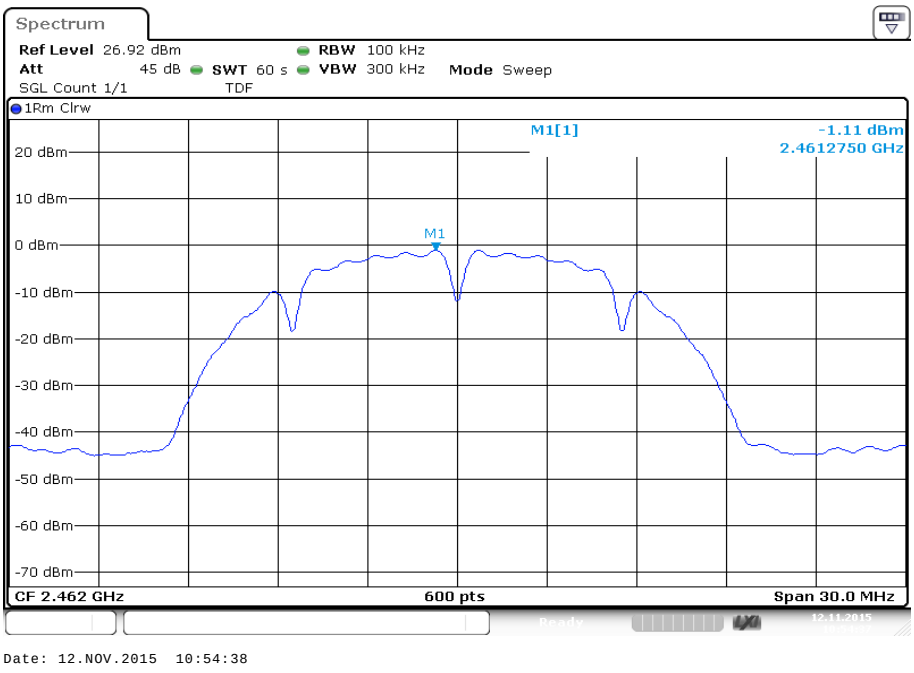
Plot 1: TX mode, lowest channel



Plot 2: TX mode, middle channel

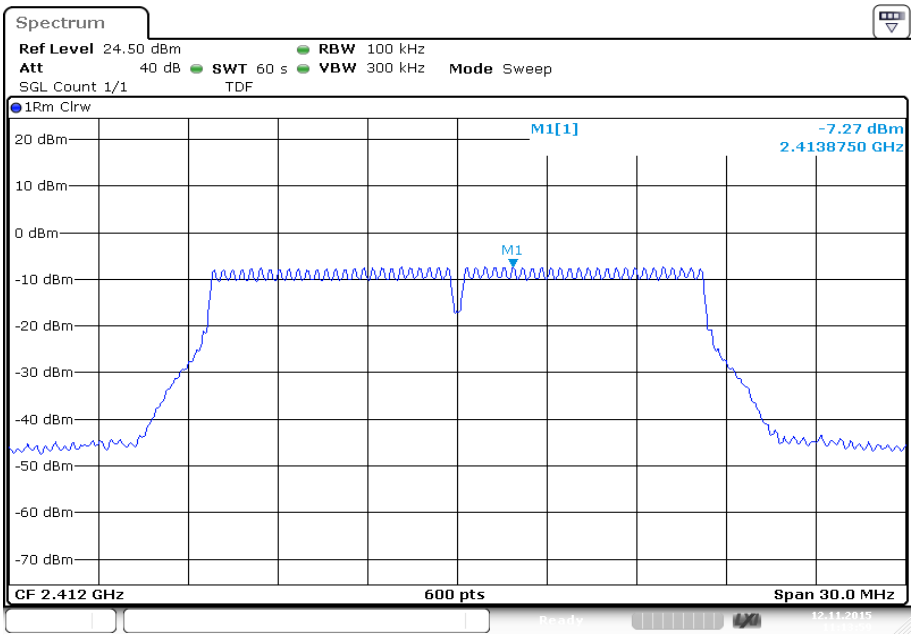


Plot 3: TX mode, highest channel

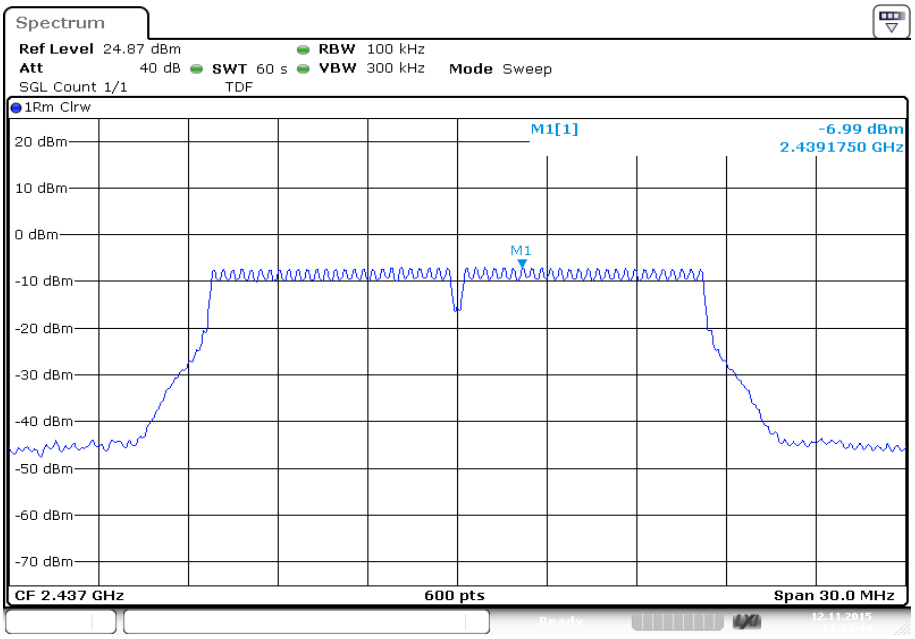


Plots: OFDM / g – mode

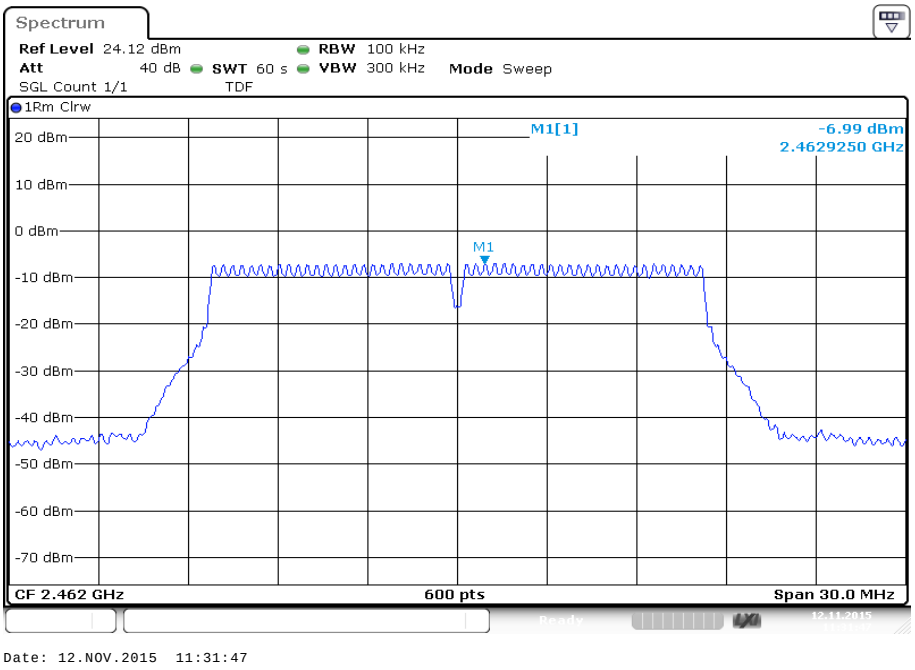
Plot 1: TX mode, lowest channel



Plot 2: TX mode, middle channel

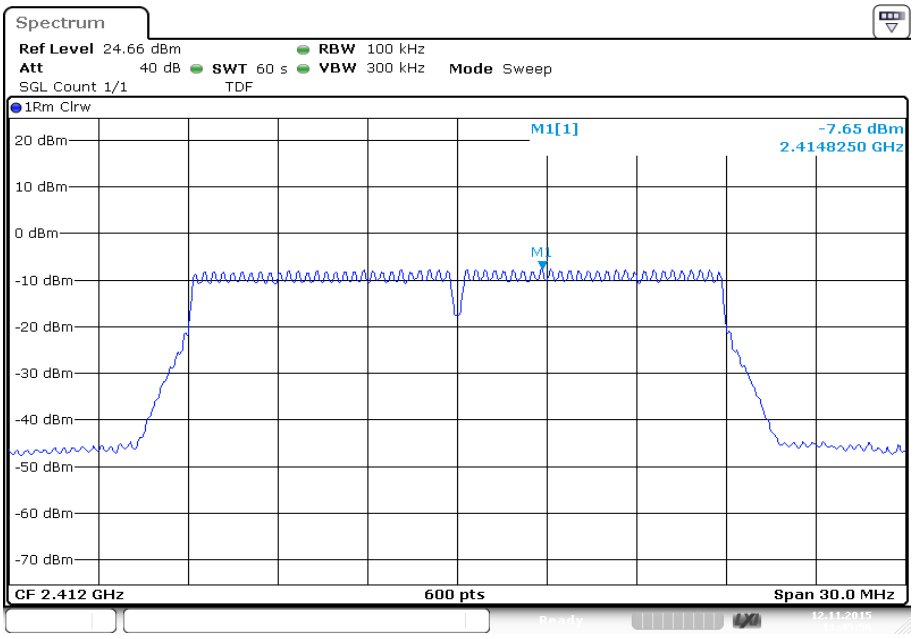


Plot 3: TX mode, highest channel

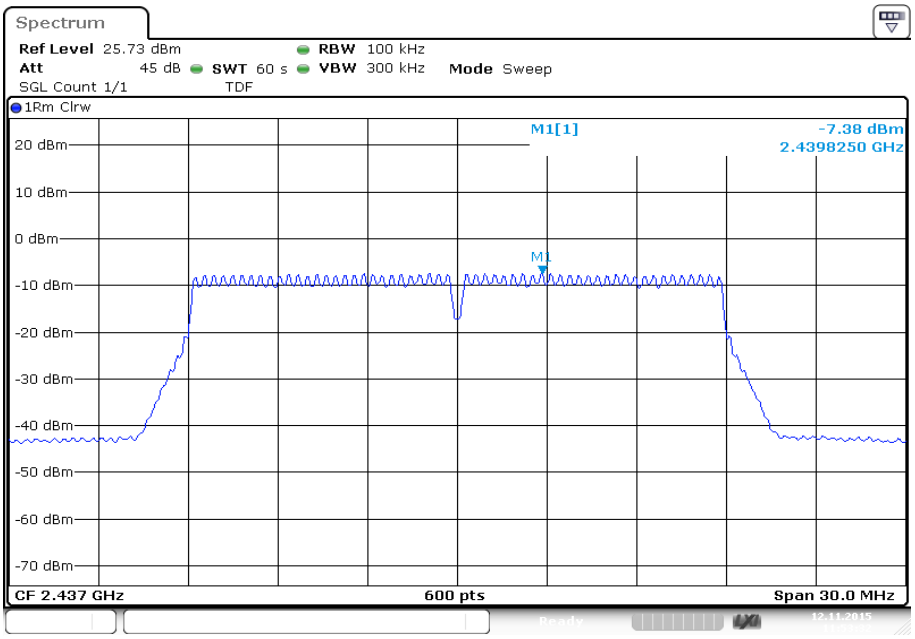


Plots: OFDM / n HT20 – mode

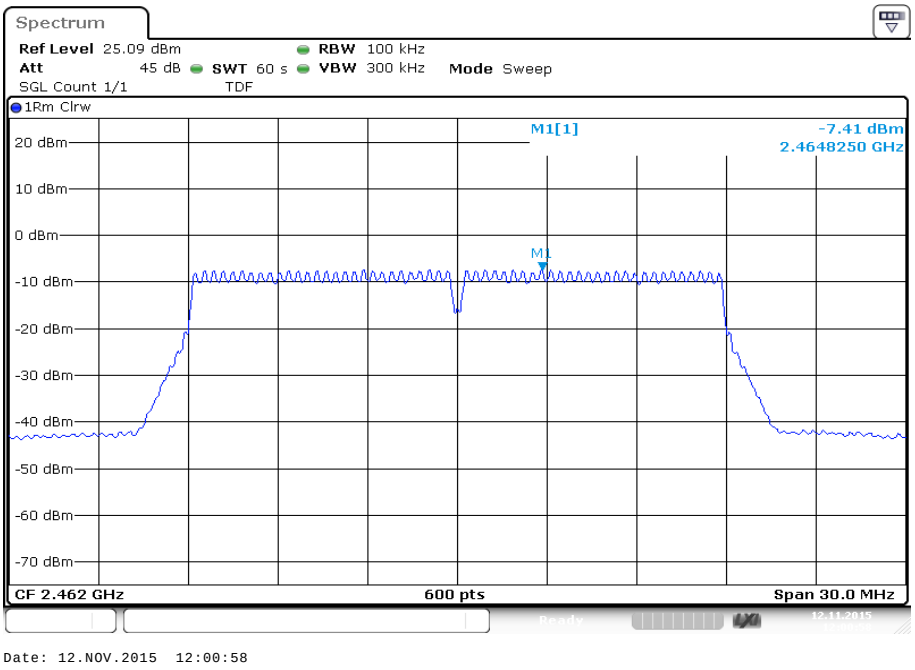
Plot 1: TX mode, lowest channel



Plot 2: TX mode, middle channel

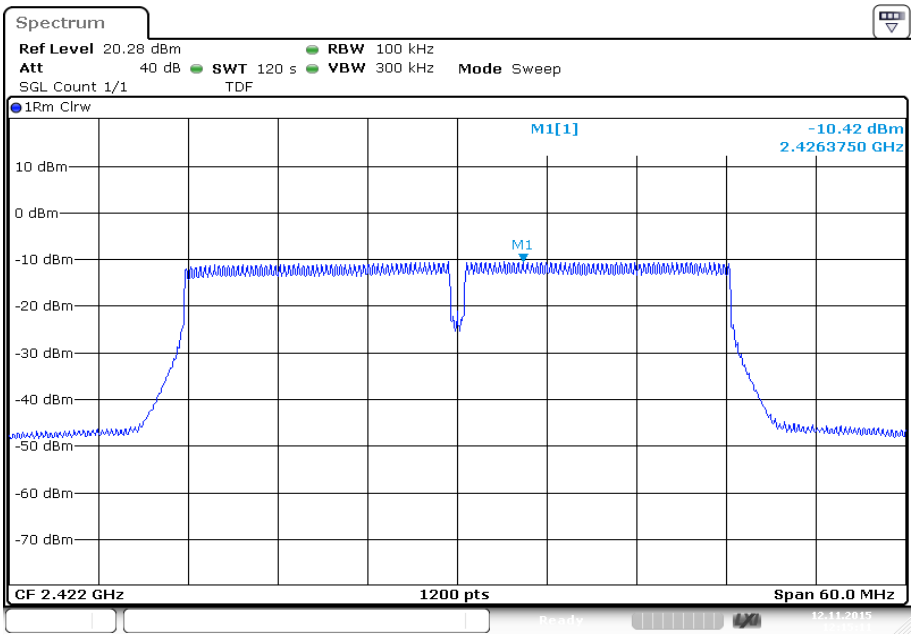


Plot 3: TX mode, highest channel

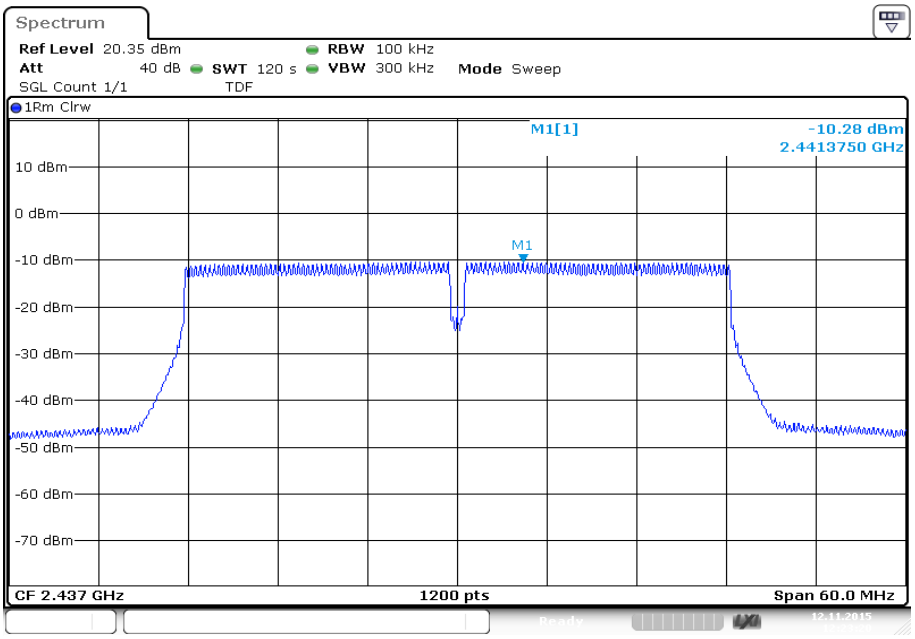


Plots: OFDM / n HT40 – mode

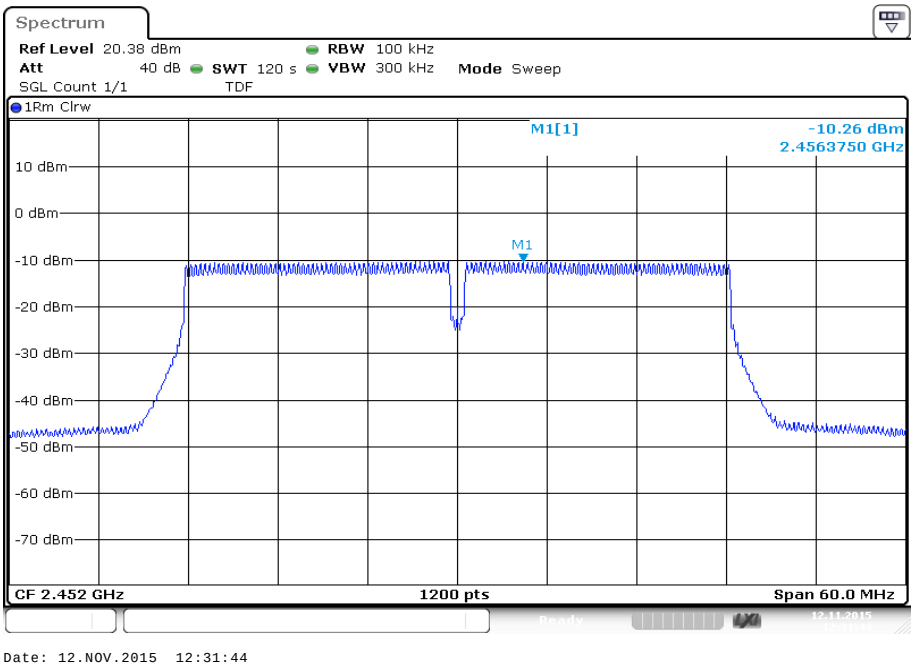
Plot 1: TX mode, lowest channel



Plot 2: TX mode, middle channel



Plot 3: TX mode, highest channel



12.5 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:	>3*RBW
Span:	40 MHz
Measurement procedure:	Measurement of the 75% bandwidth using the integration function of the analyzer
Trace mode:	Max hold (allow trace to stabilize)
Test setup:	See sub clause 7.5A
Measurement uncertainty	See sub clause 9

Limits:

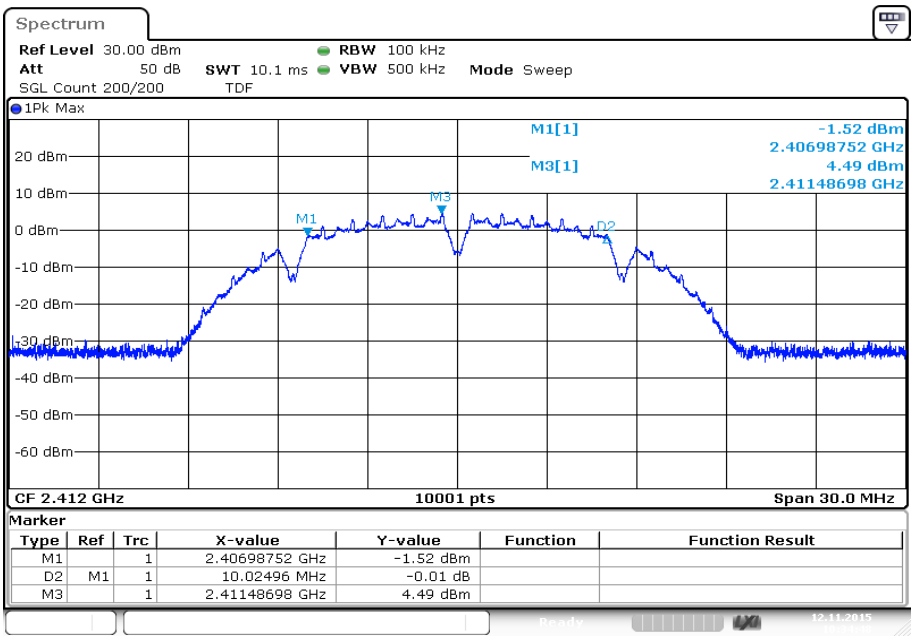
FCC	IC
Systems using digital modulation techniques may operate in the 2400–2483.5 MHz band. The minimum 6 dB bandwidth shall be at least 500 kHz.	

Results:

Frequency	6 dB bandwidth [kHz]		
	2412 MHz	2437 MHz	2462 MHz
DSSS / b – mode	10025.0	10028.0	10030.9
OFDM / g – mode	16567.3	16558.3	16540.1
OFDM / n HT20 – mode	17797.1	17800.2	17794.1
Frequency	2422 MHz	2437 MHz	2452 MHz
OFDM / n HT40 – mode	36548.5	36548.4	36554.2

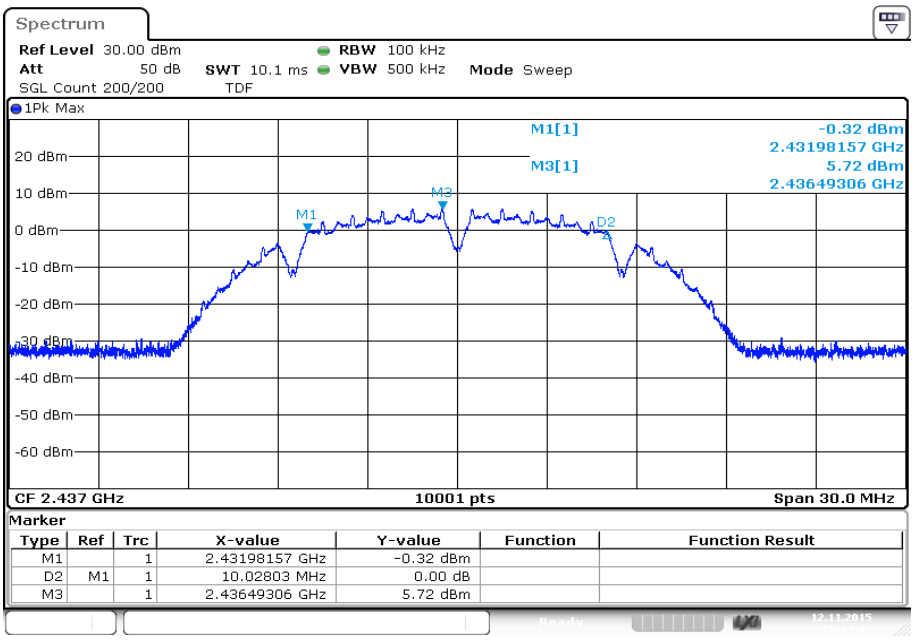
Plots: DSSS / b – mode

Plot 1: TX mode, lowest channel



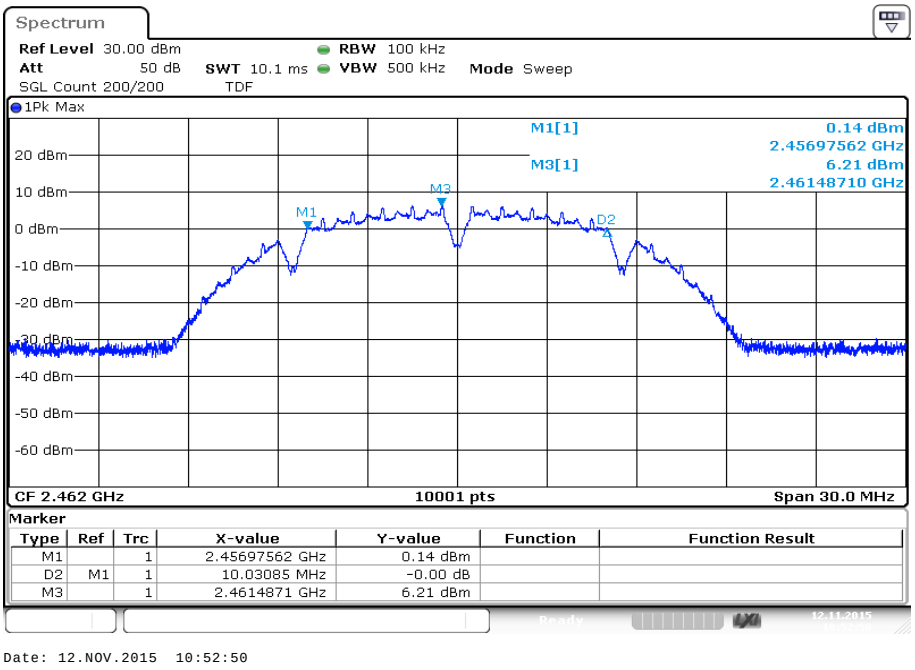
Date: 12.NOV.2015 10:34:48

Plot 2: TX mode, middle channel



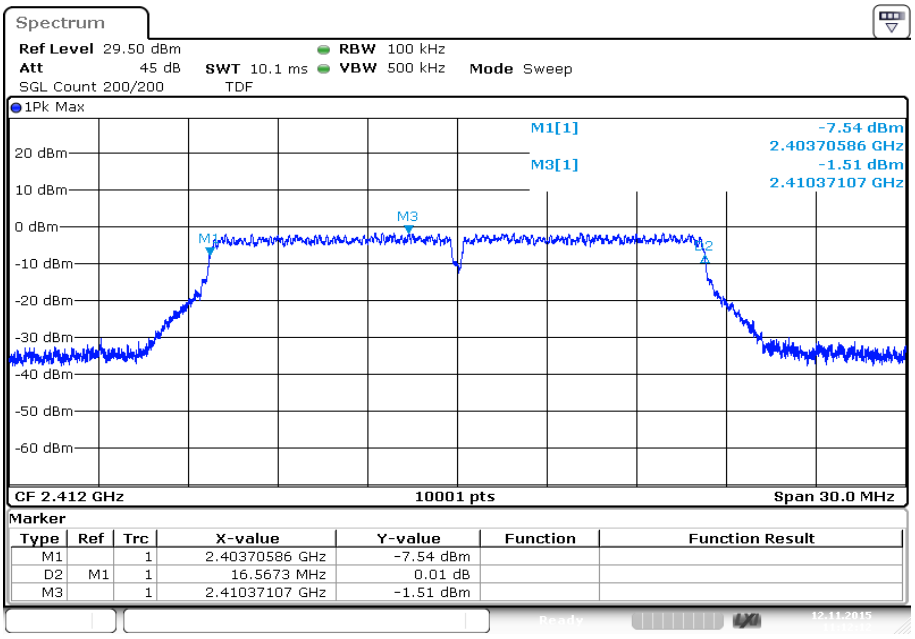
Date: 12.NOV.2015 10:43:47

Plot 3: TX mode, highest channel



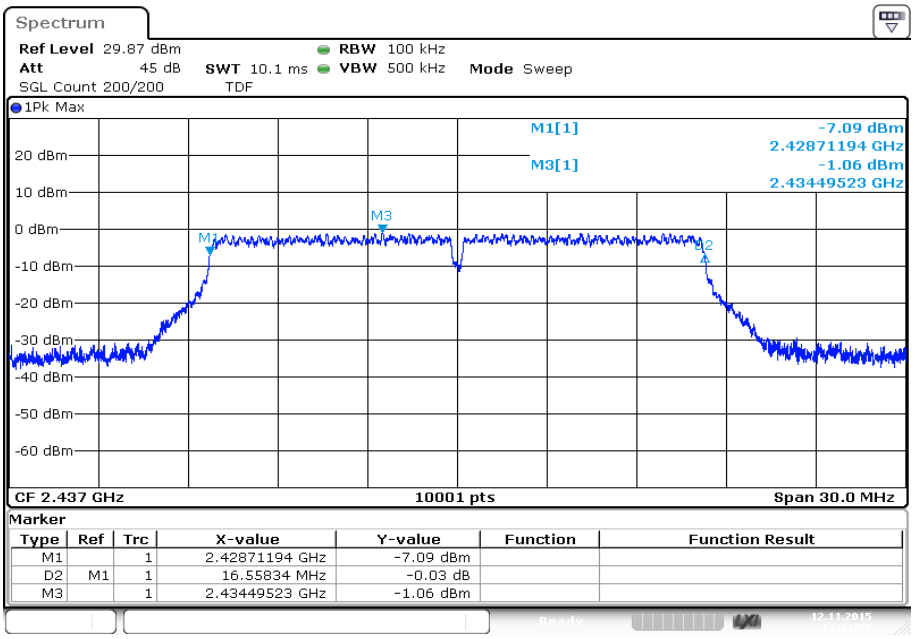
Plots: OFDM / g – mode

Plot 1: TX mode, lowest channel



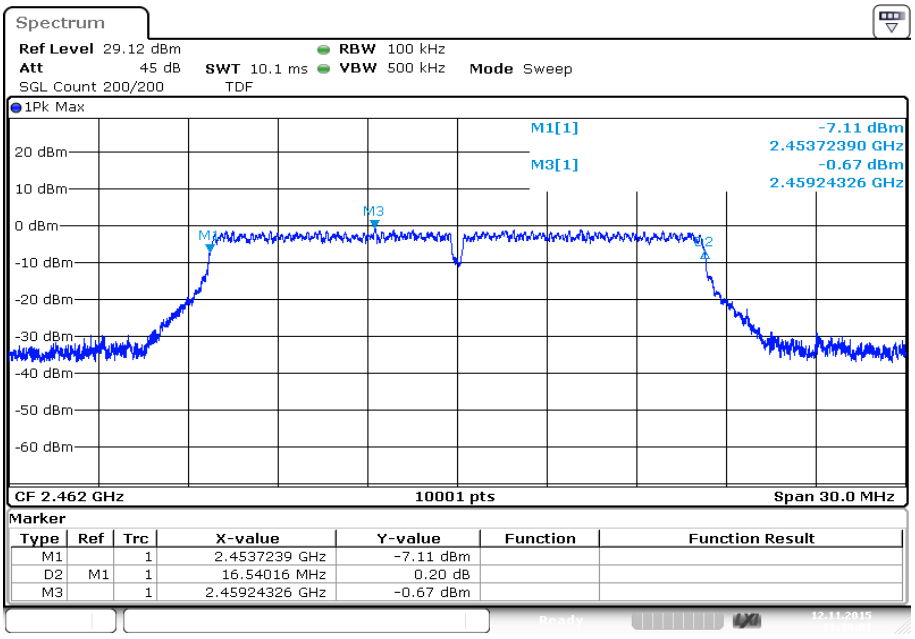
Date: 12.NOV.2015 11:12:13

Plot 2: TX mode, middle channel



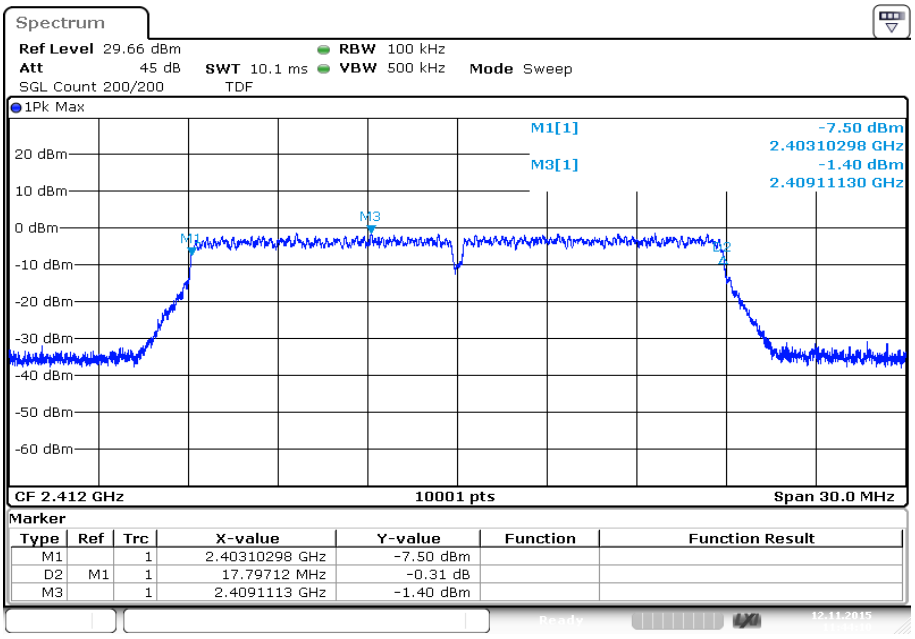
Date: 12.NOV.2015 11:21:57

Plot 3: TX mode, highest channel

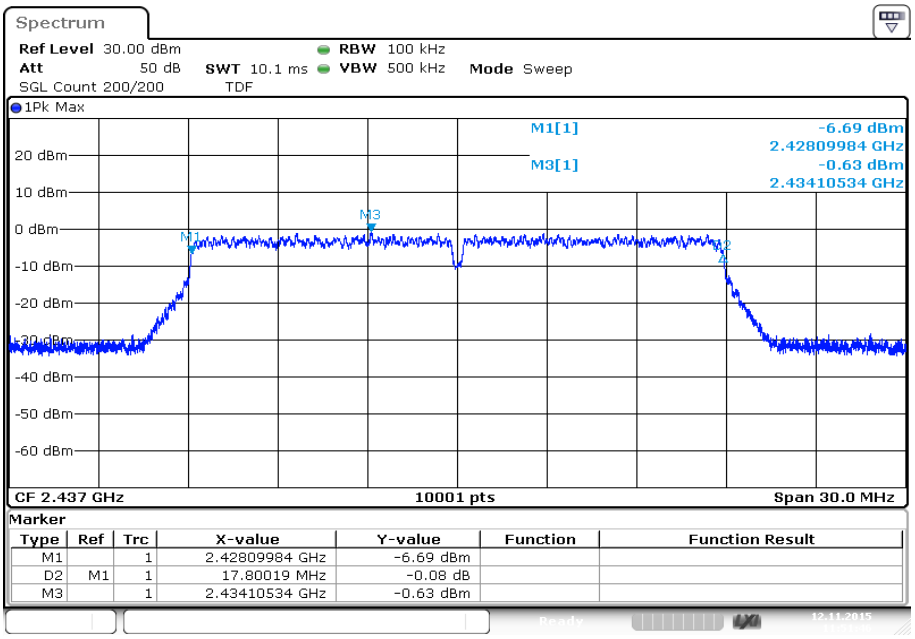


Plots: OFDM / n HT20 – mode

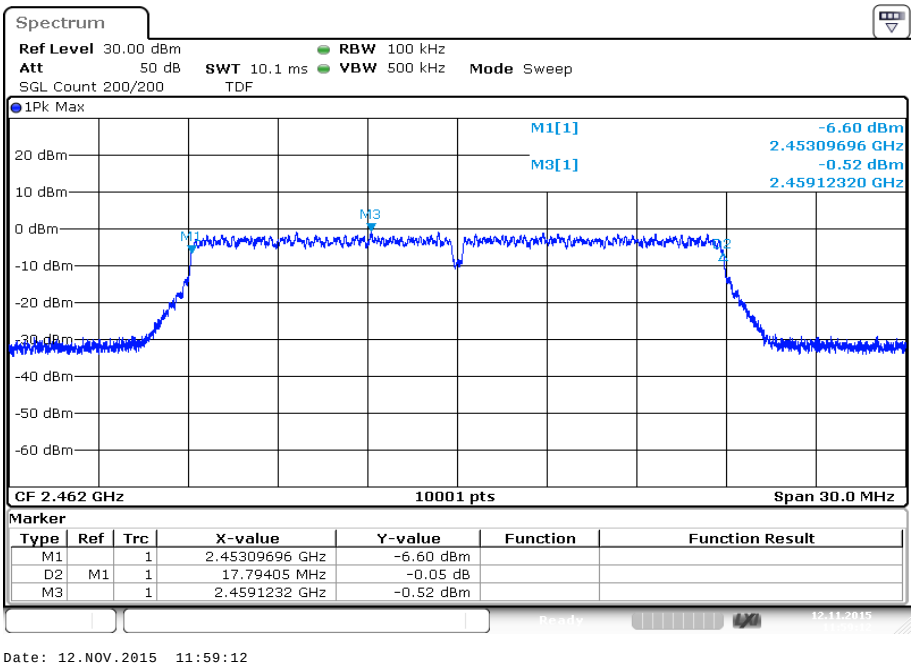
Plot 1: TX mode, lowest channel



Plot 2: TX mode, middle channel



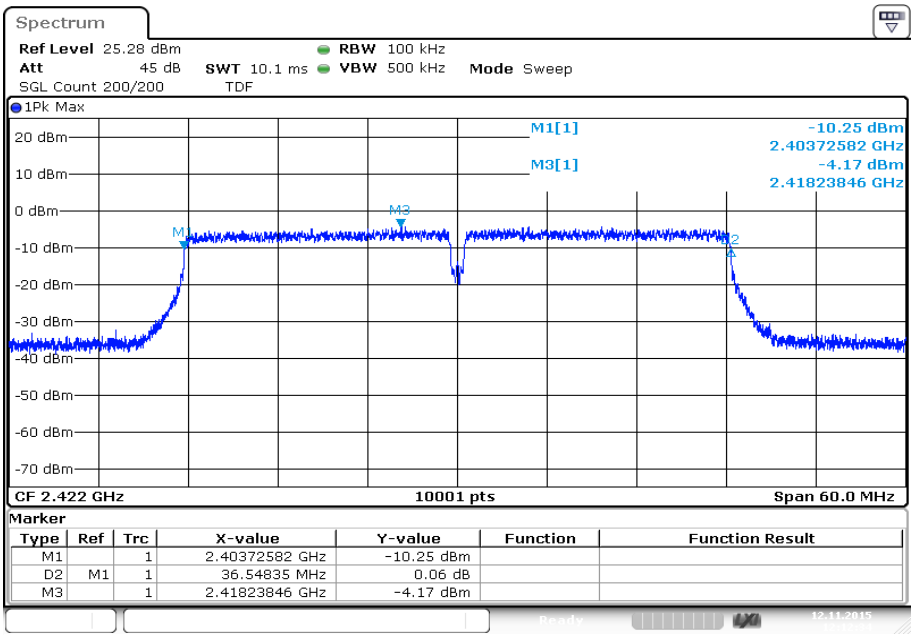
Plot 3: TX mode, highest channel



Date: 12.NOV.2015 11:59:12

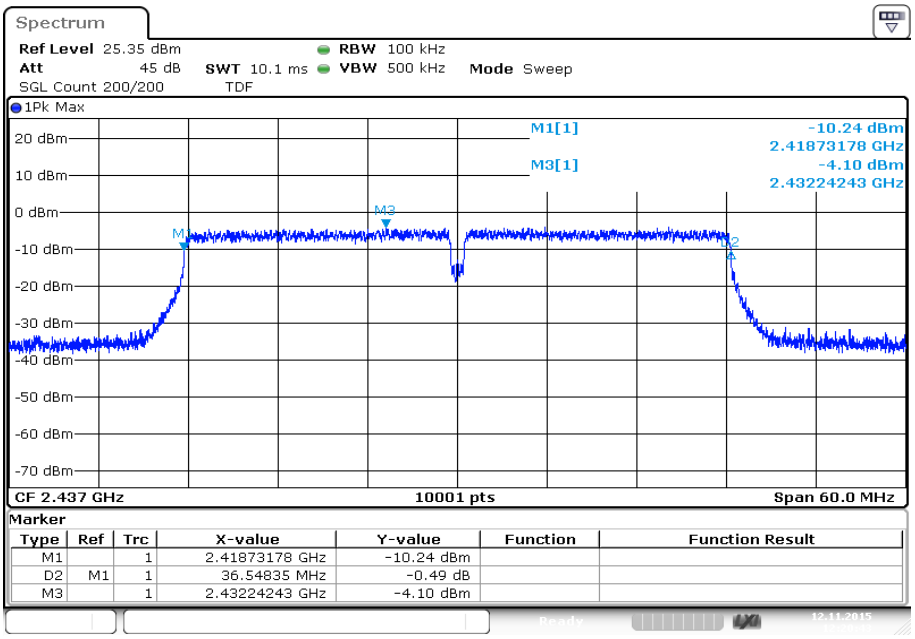
Plots: OFDM / n HT40 – mode

Plot 1: TX mode, lowest channel



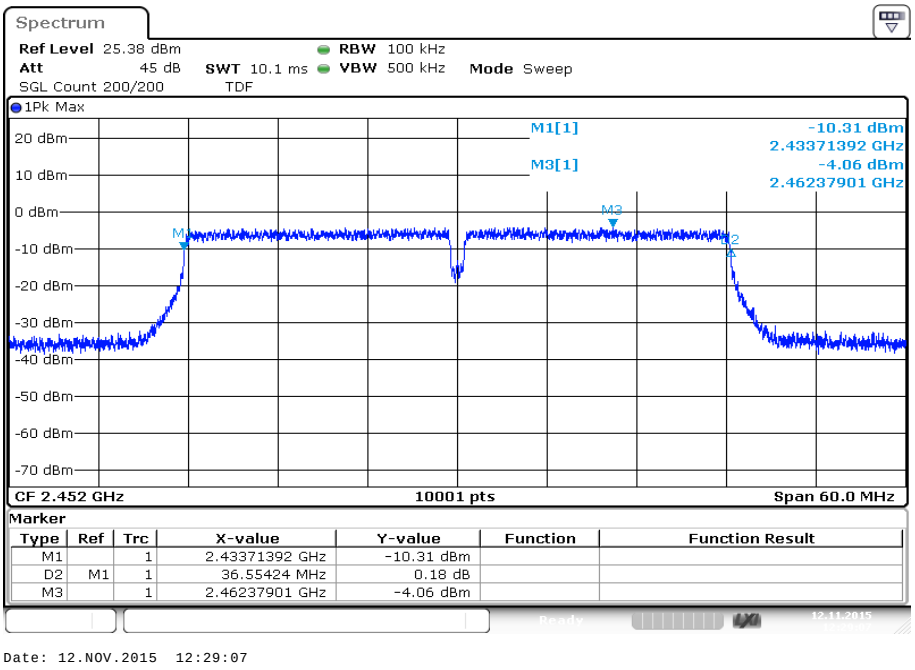
Date: 12.NOV.2015 12:12:35

Plot 2: TX mode, middle channel



Date: 12.NOV.2015 12:20:44

Plot 3: TX mode, highest channel



Date: 12.NOV.2015 12:29:07

12.6 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:	See plots
Video bandwidth:	>3*RBW
Span:	See plots
Measurement procedure:	Measurement of the 99% bandwidth using the integration function of the analyzer
Trace mode:	Max hold (allow trace to stabilize)
Test setup:	See sub clause 7.5A
Measurement uncertainty	See sub clause 9

Usage:

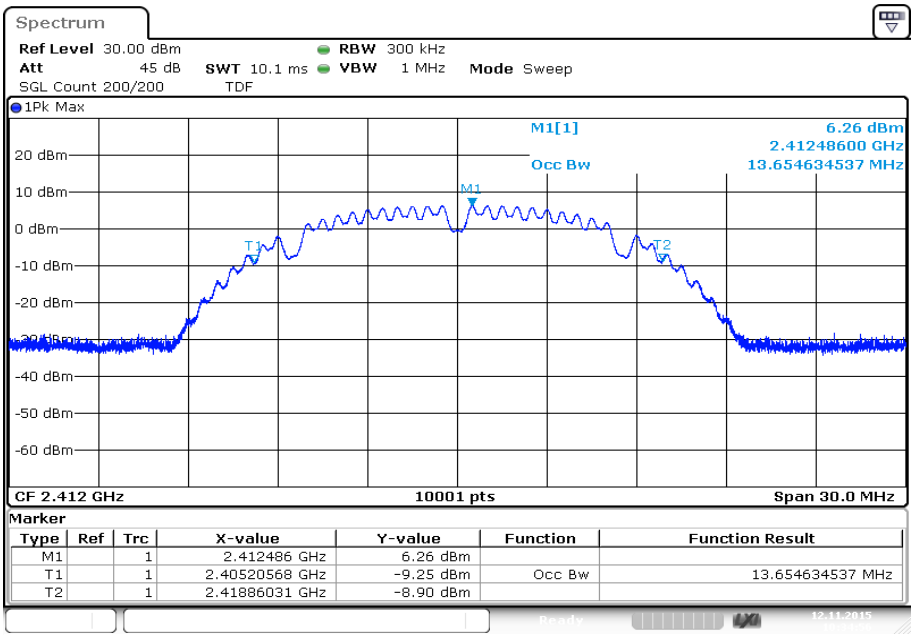
-/-	IC
OBW is necessary for Emission Designator	

Results:

Modulation	99% bandwidth [kHz]		
Frequency	2412 MHz	2437 MHz	2462 MHz
DSSS / b – mode	13654.6	13720.6	13801.6
OFDM / g – mode	16810.3	16777.3	16762.3
OFDM / n HT20 – mode	17860.2	17866.2	17863.2
Frequency	2422 MHz	2437 MHz	2452 MHz
OFDM / n HT40 – mode	36764.3	36776.3	36776.3

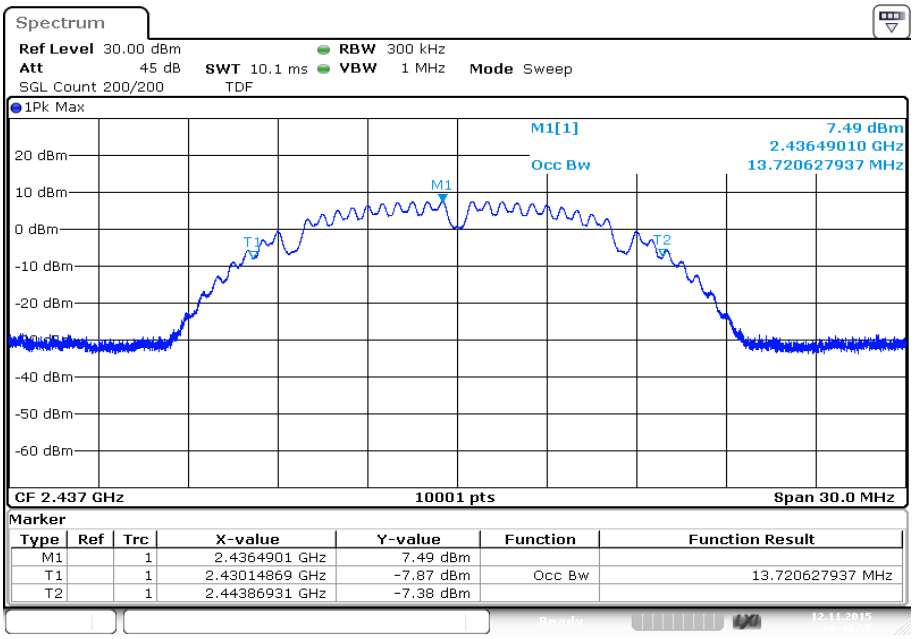
Plots: DSSS / b – mode

Plot 1: TX mode, lowest channel



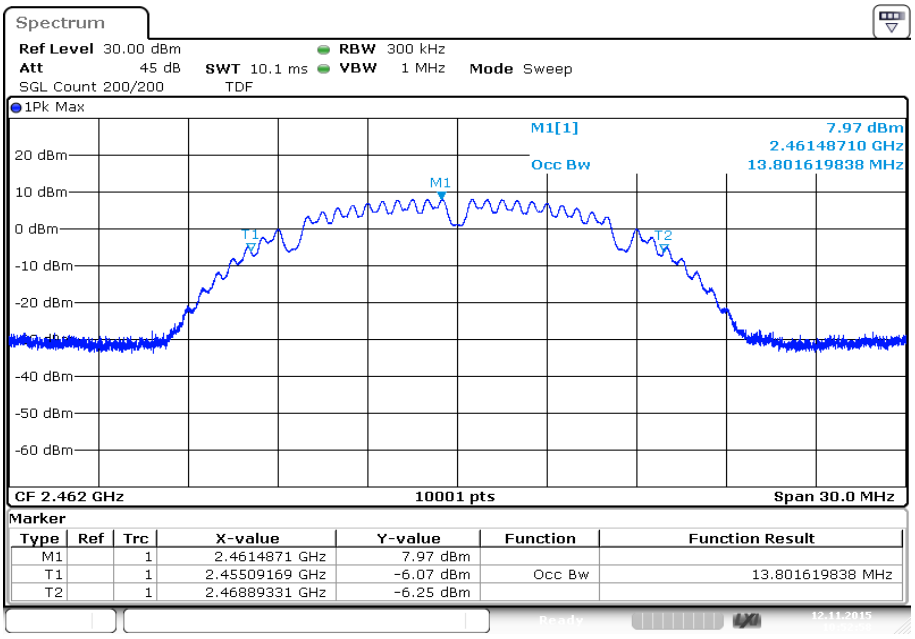
Date: 12.NOV.2015 10:34:56

Plot 2: TX mode, middle channel



Date: 12.NOV.2015 10:43:56

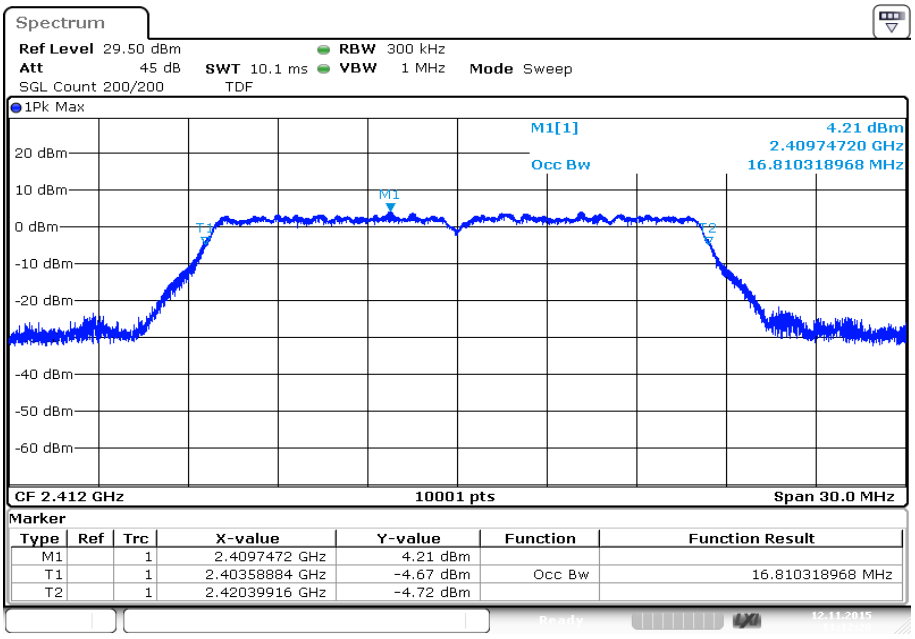
Plot 3: TX mode, highest channel



Date: 12.NOV.2015 10:52:58

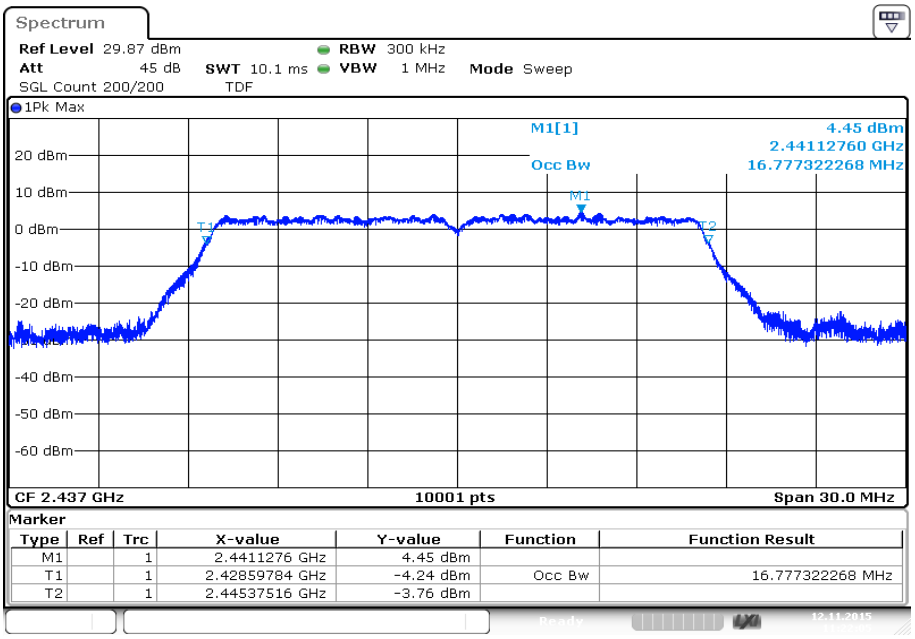
Plots: OFDM / g – mode

Plot 1: TX mode, lowest channel



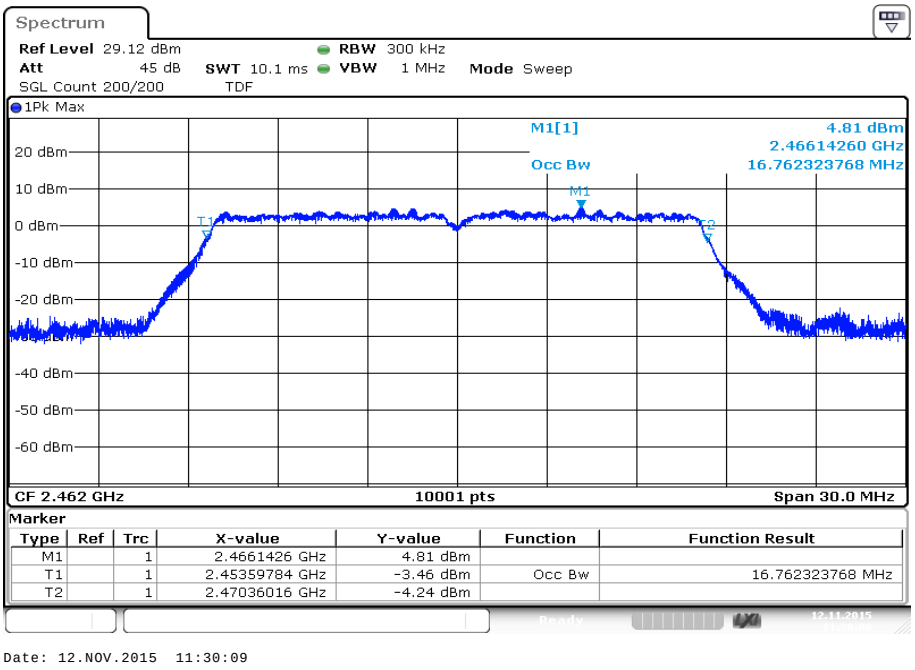
Date: 12.NOV.2015 11:12:20

Plot 2: TX mode, middle channel



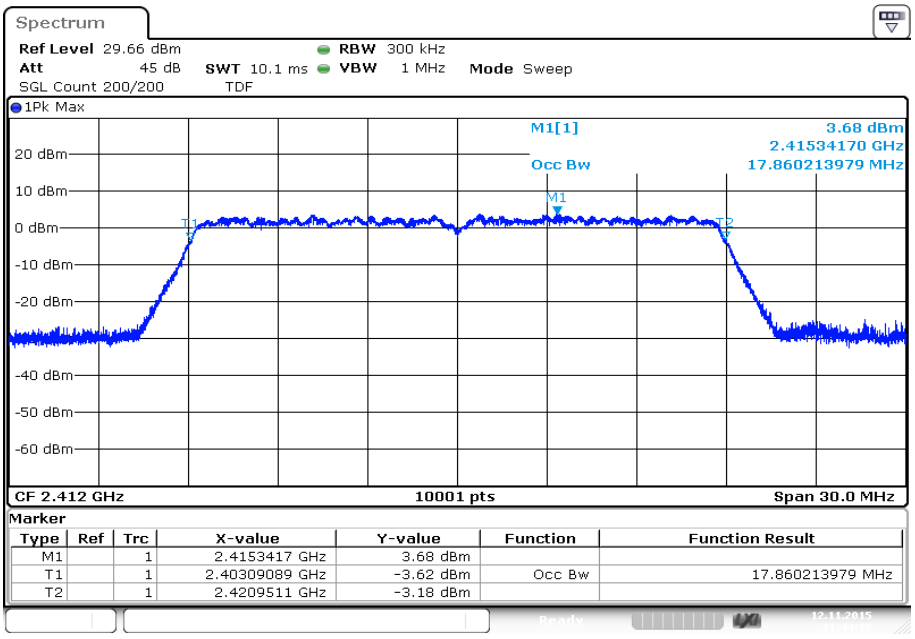
Date: 12.NOV.2015 11:22:05

Plot 3: TX mode, highest channel

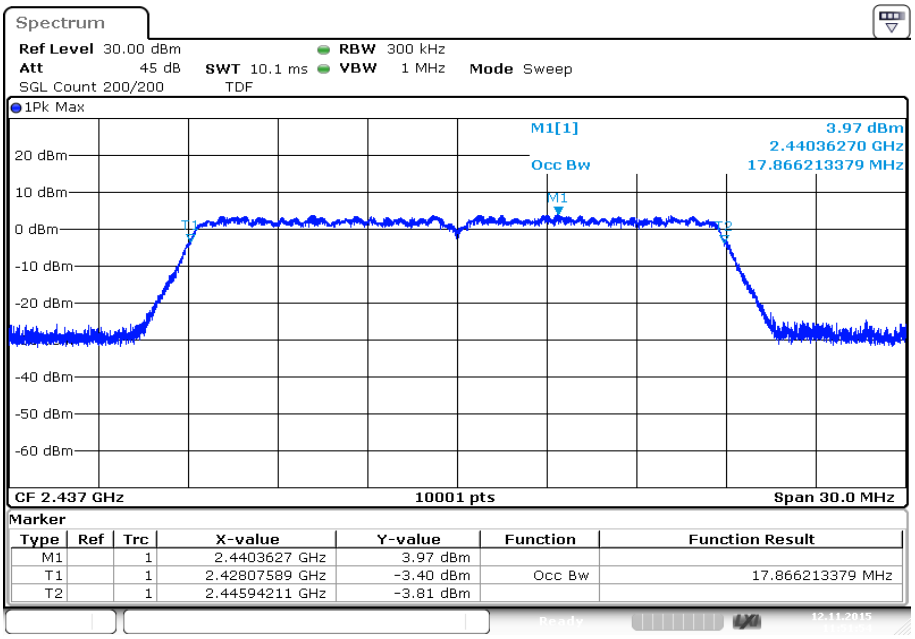


Plots: OFDM / n HT20 – mode

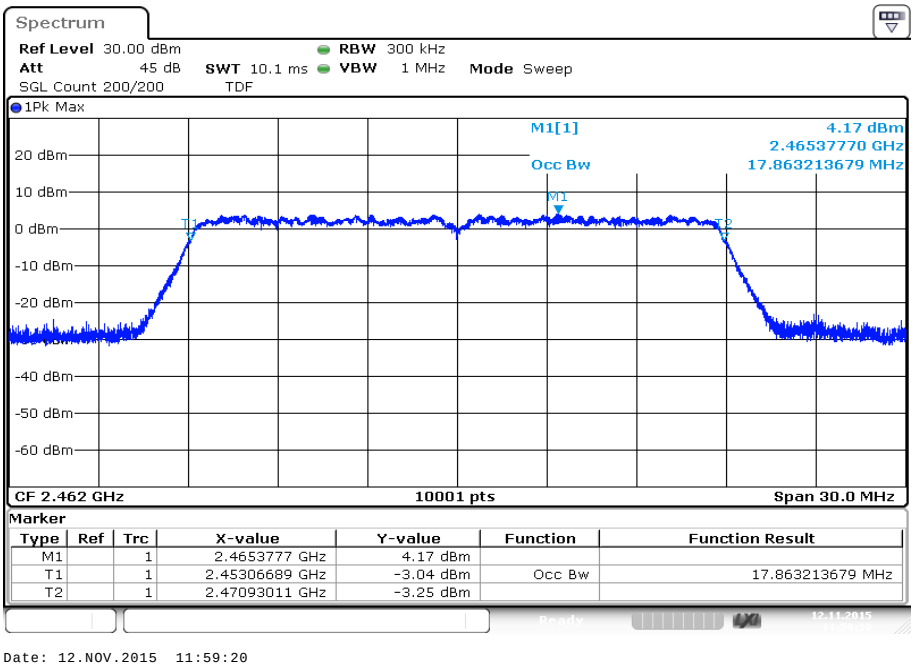
Plot 1: TX mode, lowest channel



Plot 2: TX mode, middle channel

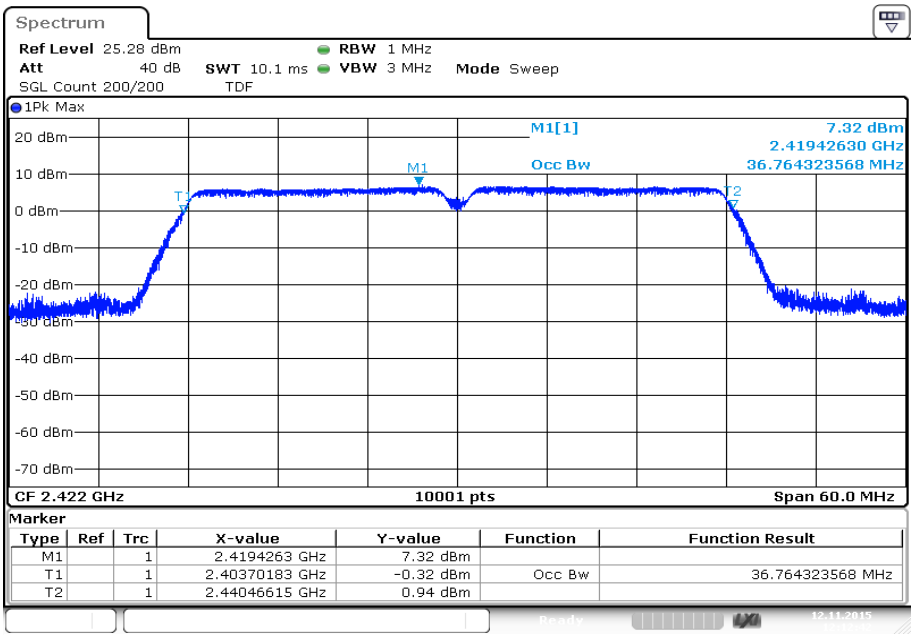


Plot 3: TX mode, highest channel



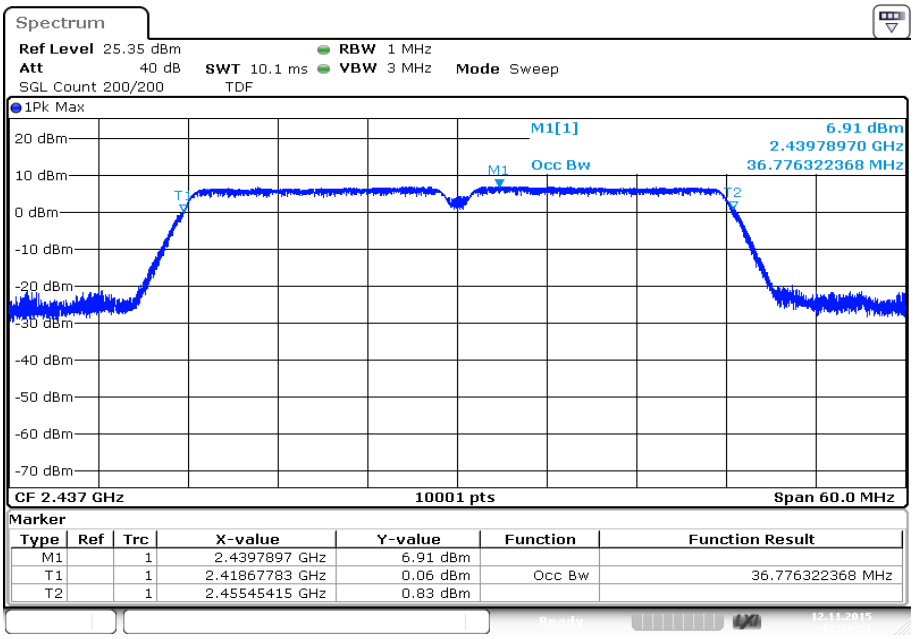
Plots: OFDM / n HT40 – mode

Plot 1: TX mode, lowest channel



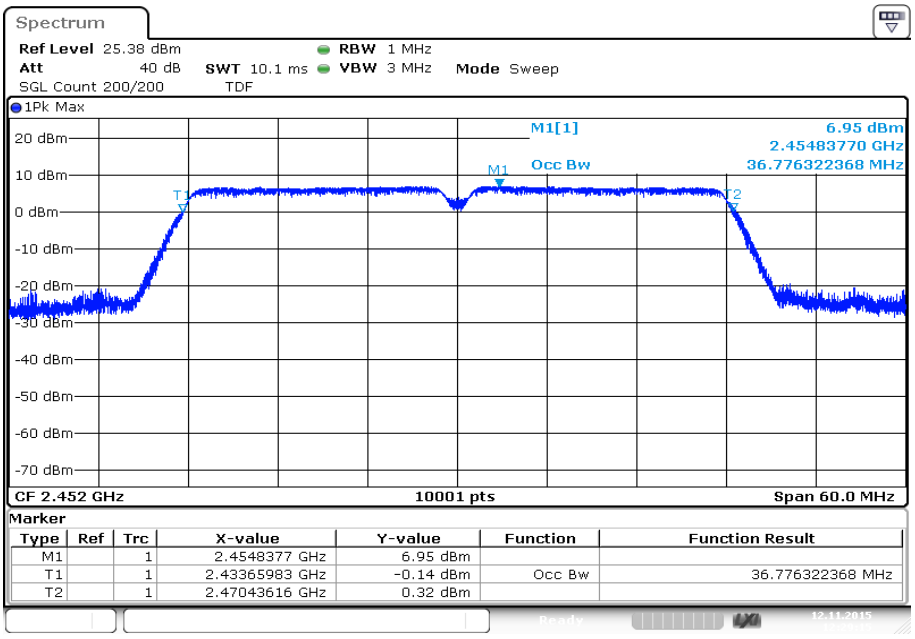
Date: 12.NOV.2015 12:12:42

Plot 2: TX mode, middle channel



Date: 12.NOV.2015 12:20:51

Plot 3: TX mode, highest channel



Date: 12.NOV.2015 12:29:15

12.7 Detailed spurious emissions @ the band edge - conducted

Description:

Measurement of the conducted band edge compliance. EUT is measured at the lower and upper band edge in both modes.

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	100 kHz
Video bandwidth:	500 kHz
Span:	Lower Band Edge: 2300 – 2425 MHz Upper Band Edge: 2450 – 2550 MHz
Trace mode:	Max hold
Test setup:	See sub clause 7.5A
Measurement uncertainty	See sub clause 9

Limits:

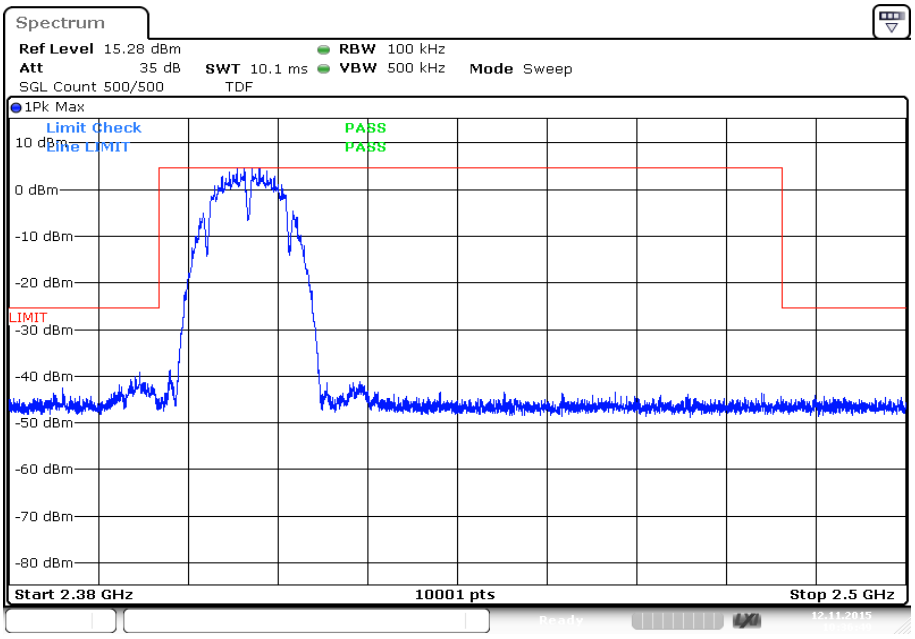
FCC	IC
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.	

Results:

Scenario	Compliance conducted [dB]			
Modulation	DSSS / b – mode	OFDM / g – mode	OFDM / n HT20 – mode	OFDM / n HT40 – mode
Lower band edge	> 30 dB	> 30 dB	> 30 dB	> 30 dB
Upper band edge	> 30 dB	> 30 dB	> 30 dB	> 30 dB

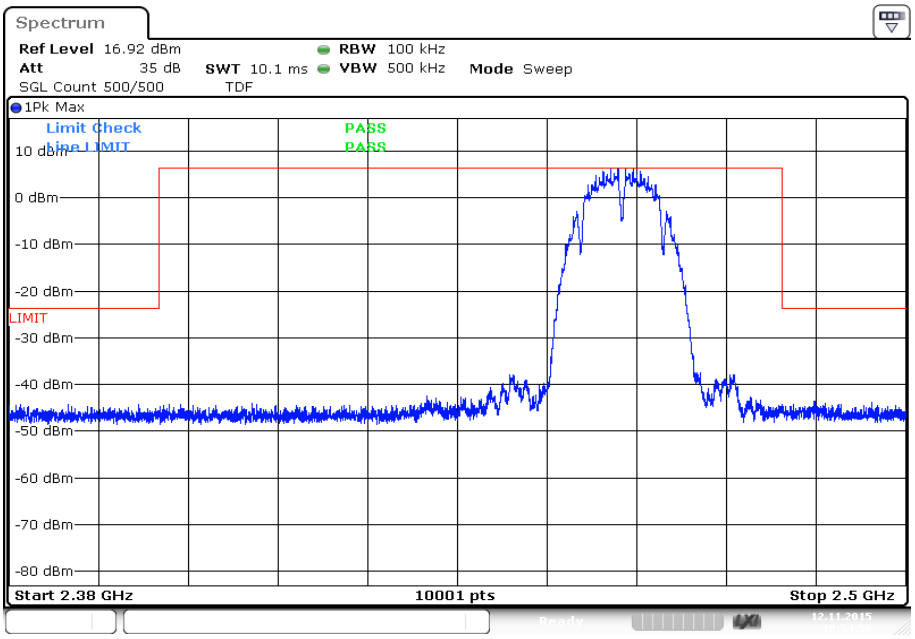
Plots: DSSS / b – mode

Plot 1: TX mode, lower band edge



Date: 12.NOV.2015 10:36:49

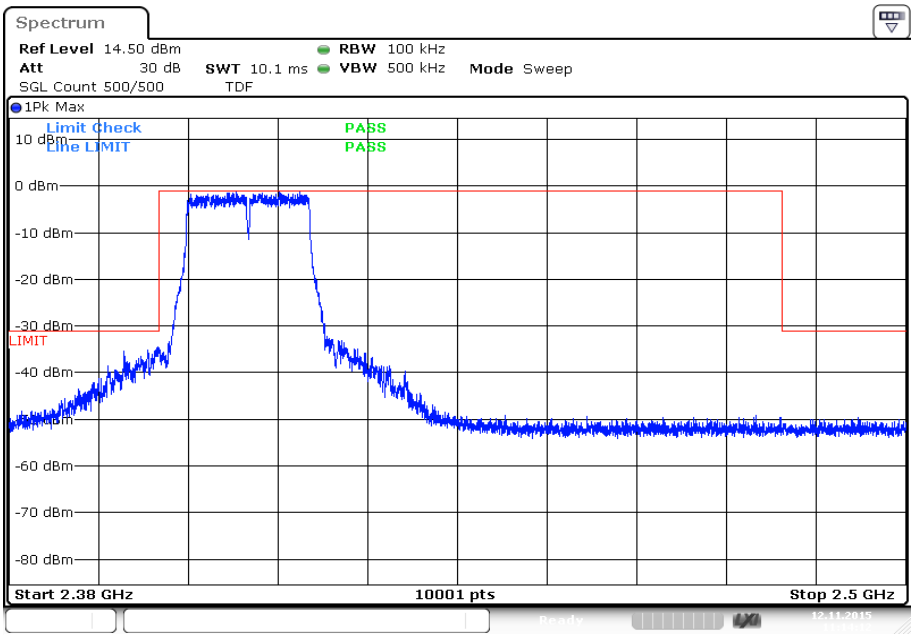
Plot 2: TX mode, upper band edge



Date: 12.NOV.2015 10:54:51

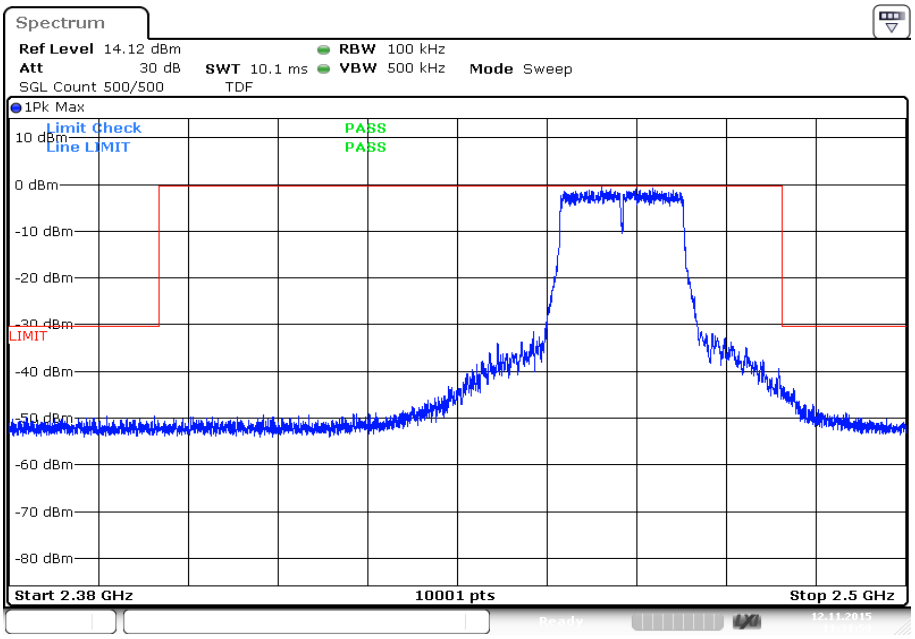
Plots: OFDM / g – mode

Plot 1: TX mode, lower band edge



Date: 12.NOV.2015 11:14:12

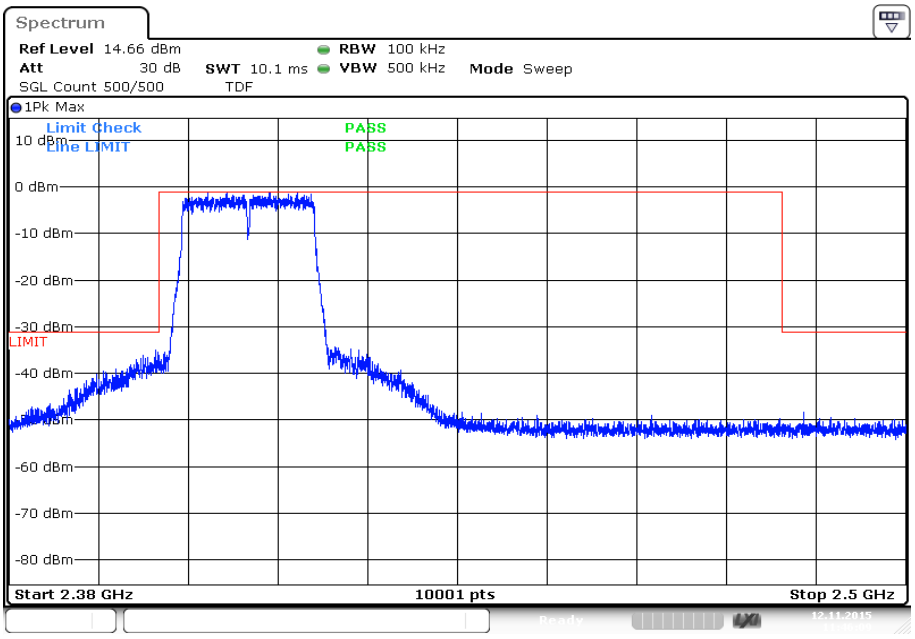
Plot 2: TX mode, upper band edge



Date: 12.NOV.2015 11:32:00

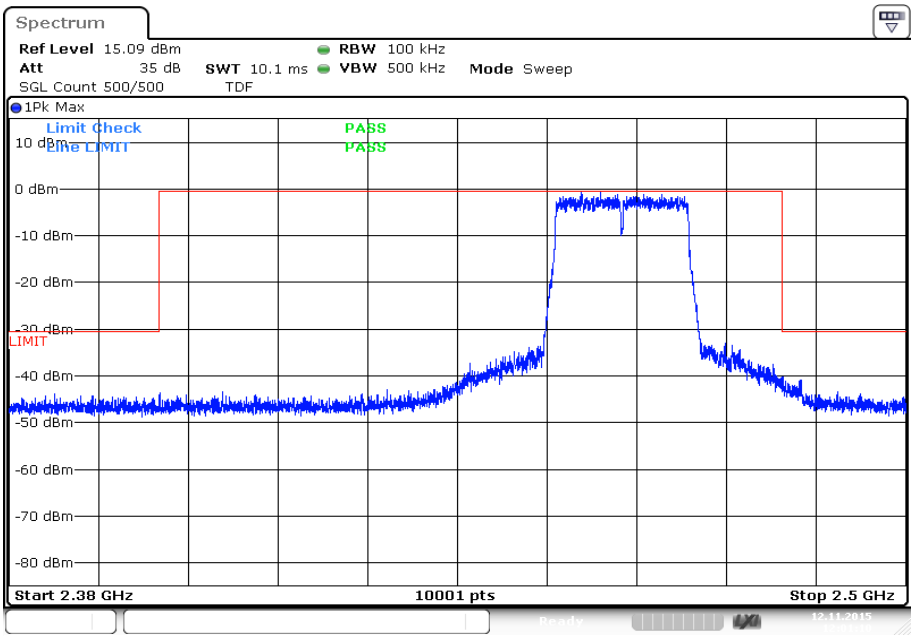
Plots: OFDM / n HT20 – mode

Plot 1: TX mode, lower band edge



Date: 12.NOV.2015 11:46:09

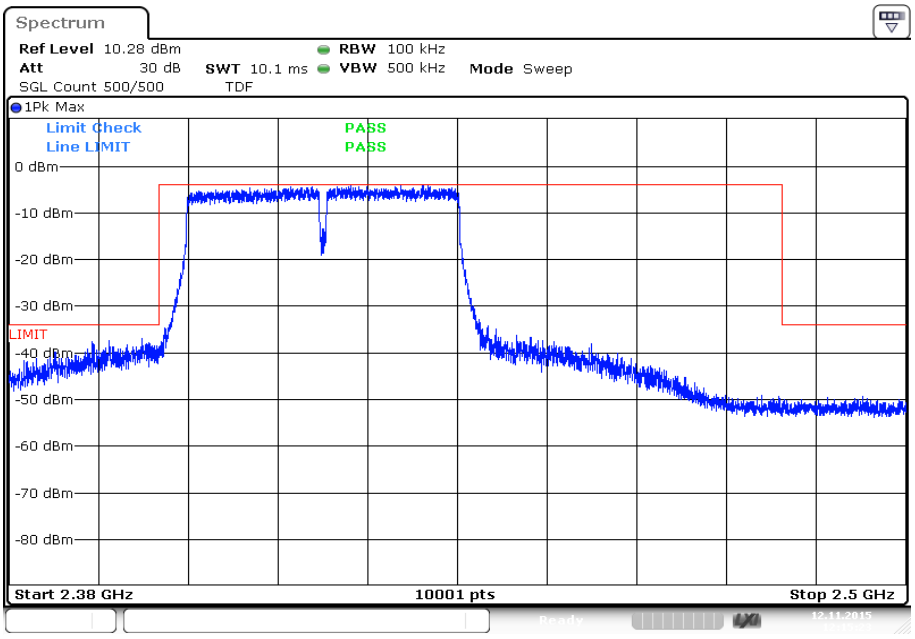
Plot 2: TX mode, upper band edge



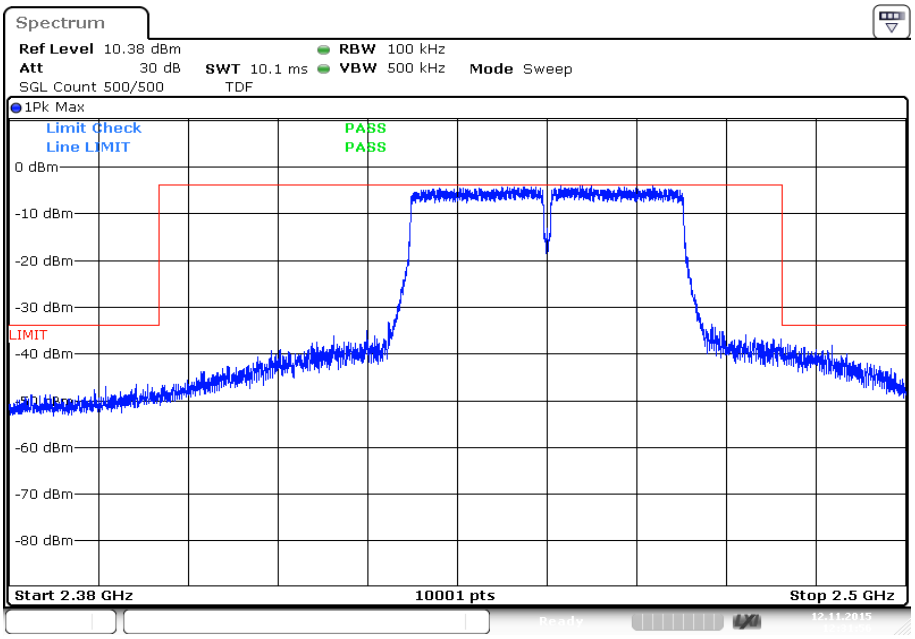
Date: 12.NOV.2015 12:01:10

Plots: OFDM / n HT40 – mode

Plot 1: TX mode, lower band edge



Plot 2: TX mode, upper band edge



12.8 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
Sweep time:	Auto
Resolution bandwidth:	1 MHz
Video bandwidth:	1 MHz
Span:	See plot!
Trace mode:	Max Hold
Test setup:	See sub clause 7.2A
Measurement uncertainty	See sub clause 9

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 7.2A
Measurement uncertainty	See sub clause 9

Limits:

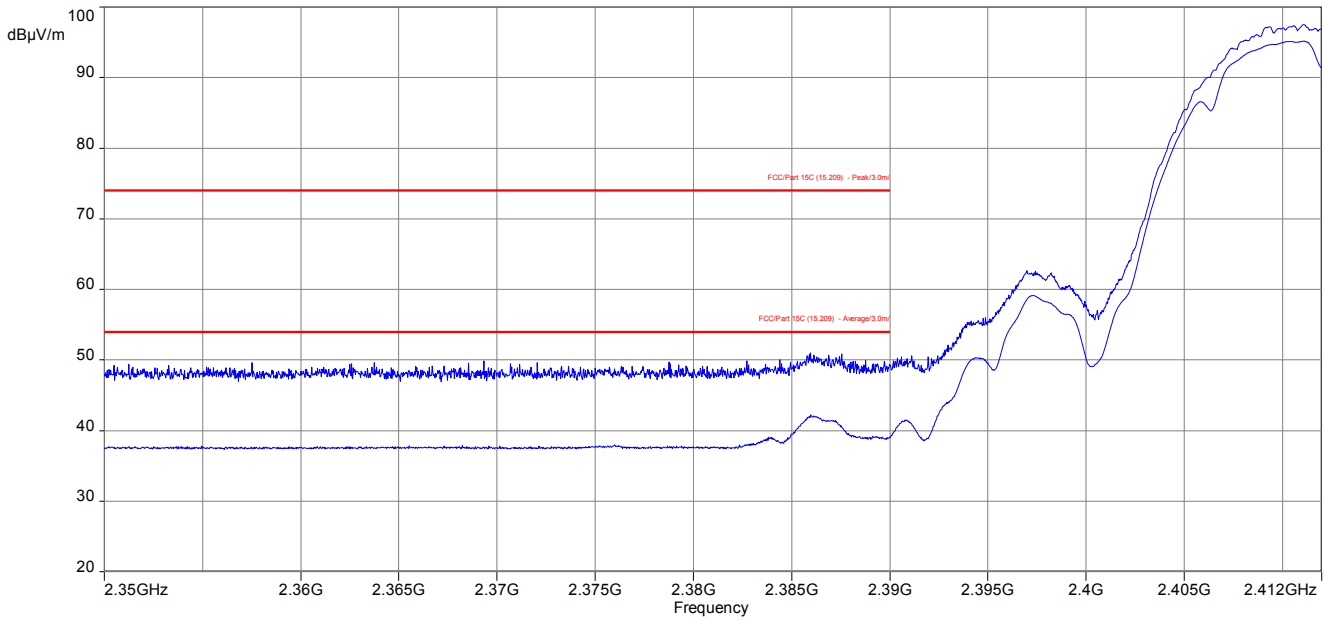
FCC	IC
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains 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:

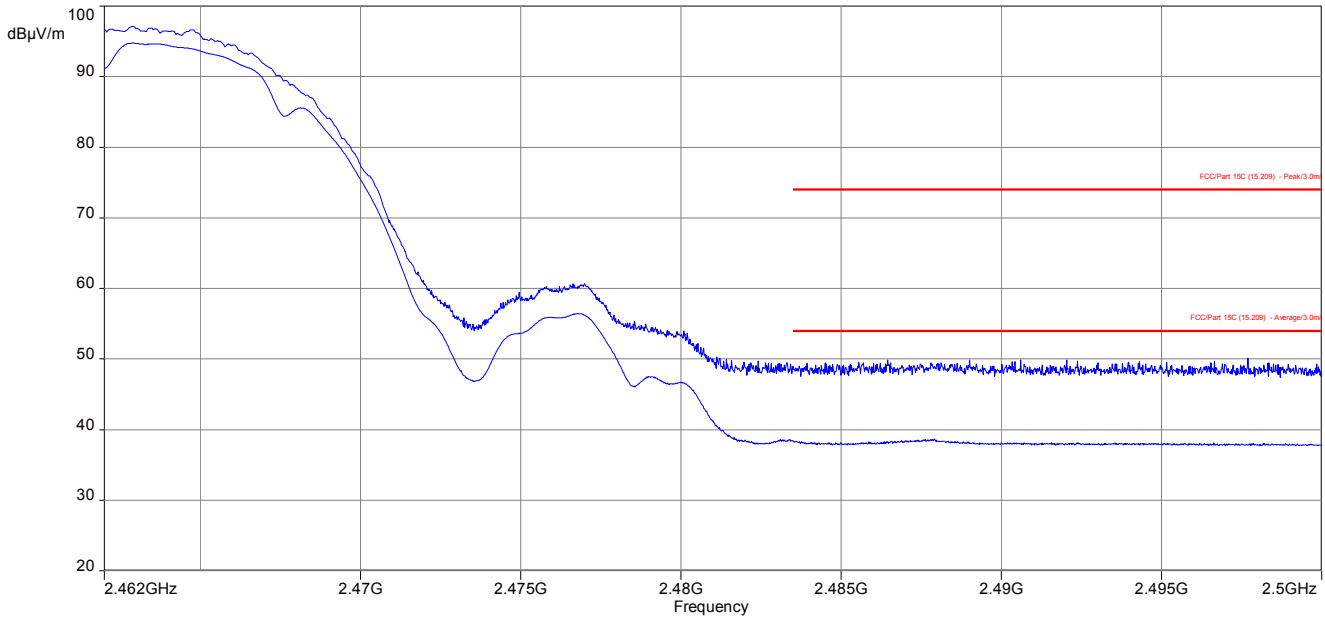
Scenario Modulation	Band edge compliance radiated [dB]			
	DSSS / b – mode	OFDM / g – mode	OFDM / n HT20 – mode	OFDM / n HT40 – mode
Lower band edge	> 20 dB (Peak) > 20 dB (AVG)	> 20 dB (Peak) > 20 dB (AVG)	> 20 dB (Peak) > 20 dB (AVG)	> 20 dB (Peak) > 20 dB (AVG)
Upper band edge	> 20 dB (Peak) > 20 dB (AVG)	> 20 dB (Peak) > 20 dB (AVG)	> 20 dB (Peak) > 20 dB (AVG)	> 20 dB (Peak) > 20 dB (AVG)

Plots: DSSS/ b – mode peak / average

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

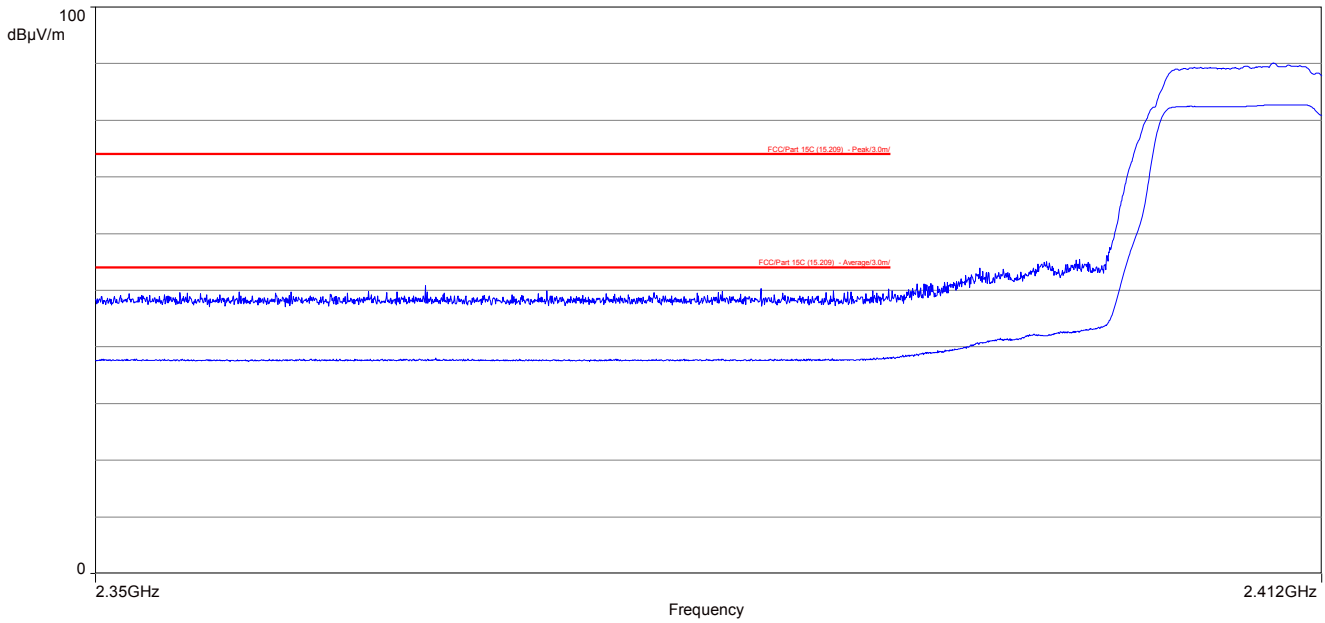


Plot 2: TX mode, upper band edge, vertical & horizontal polarization

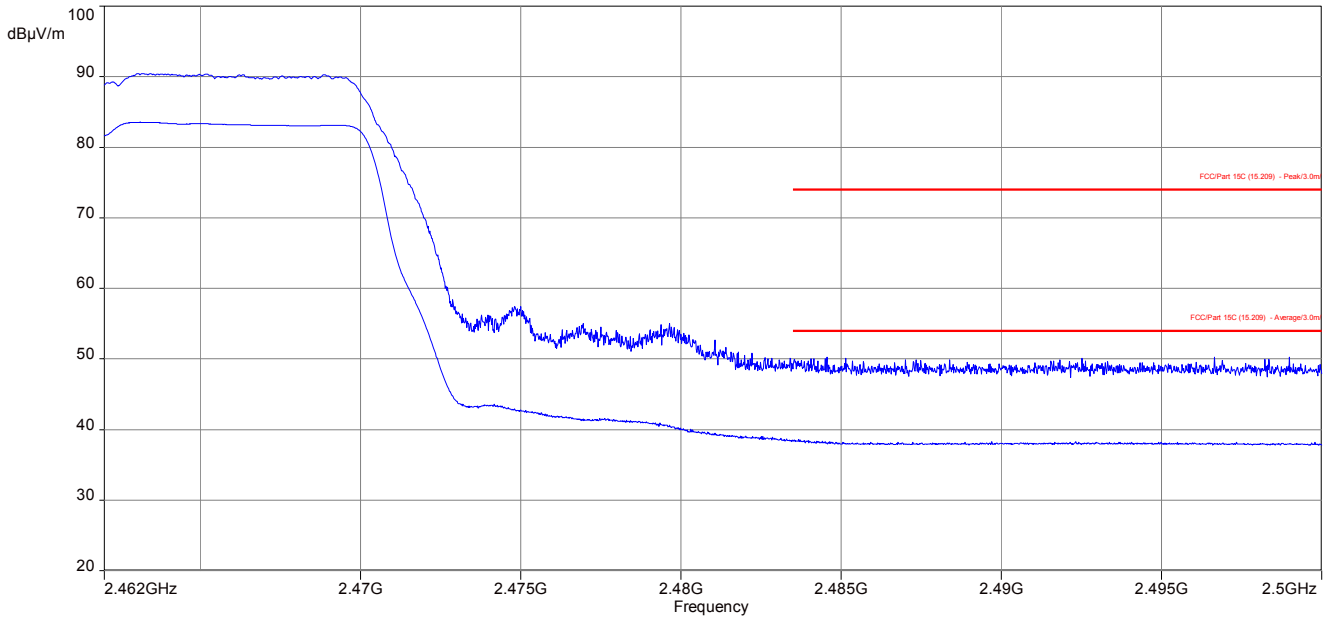


Plots: OFDM / g – mode peak / average

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

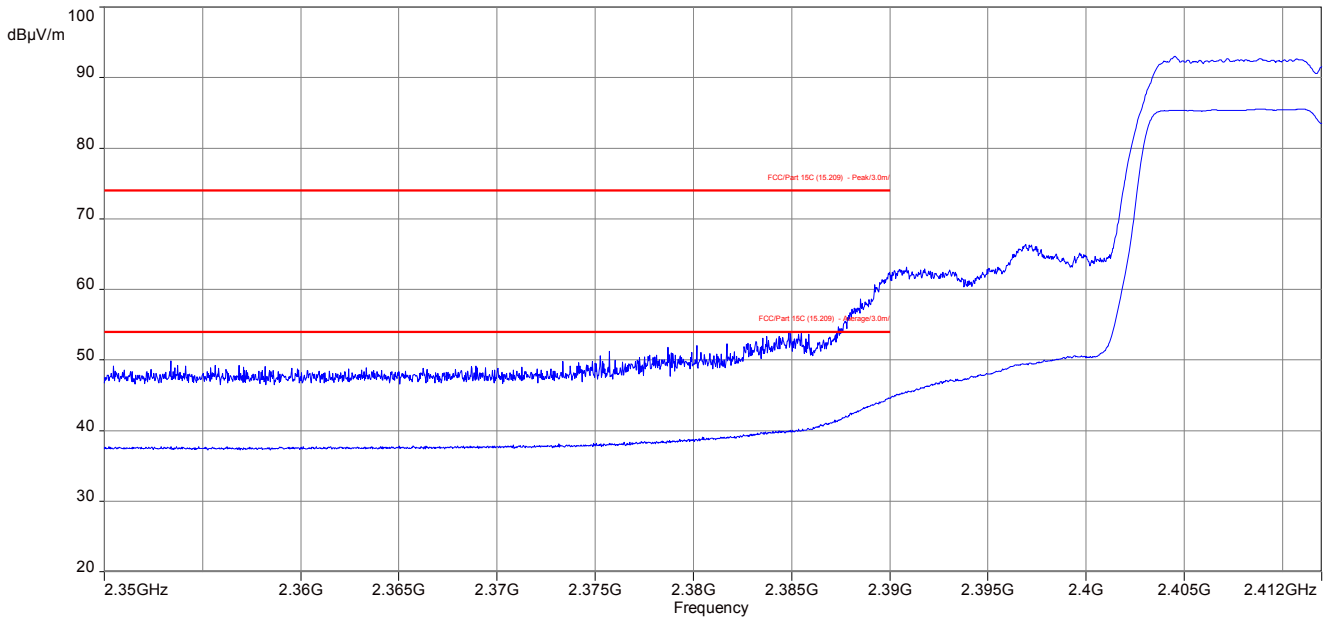


Plot 2: TX mode, upper band edge, vertical & horizontal polarization

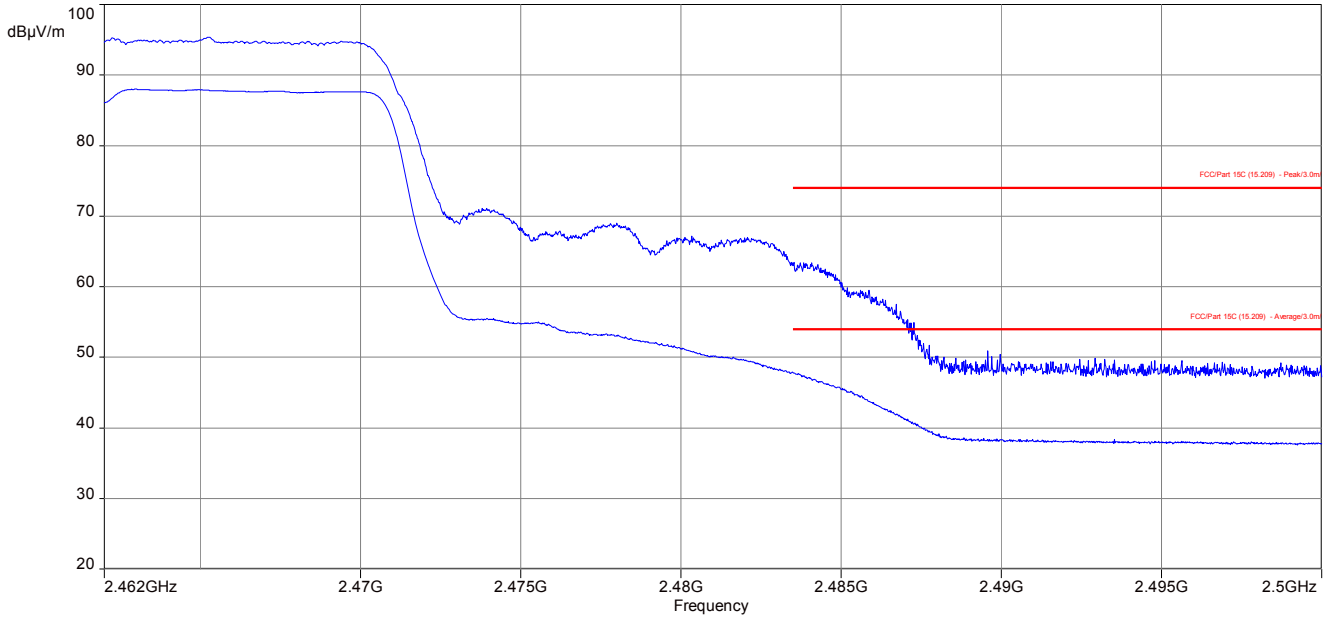


Plots: OFDM / n HT20 – mode peak / average

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

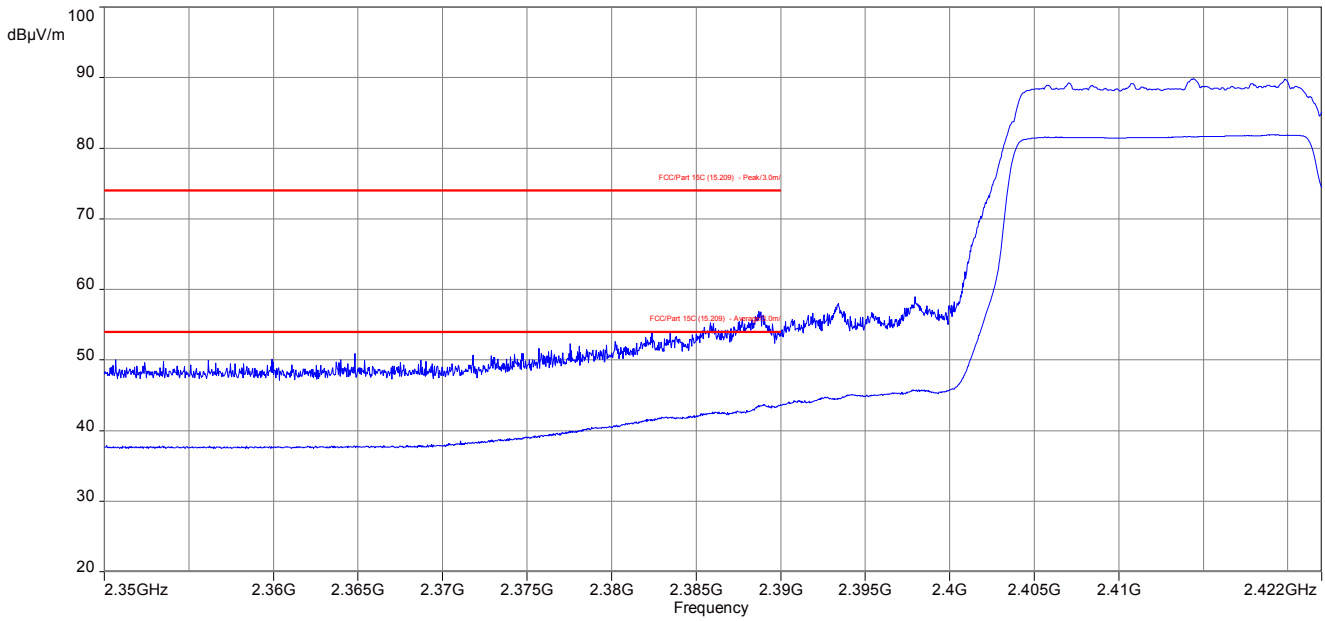


Plot 2: TX mode, upper band edge, vertical & horizontal polarization

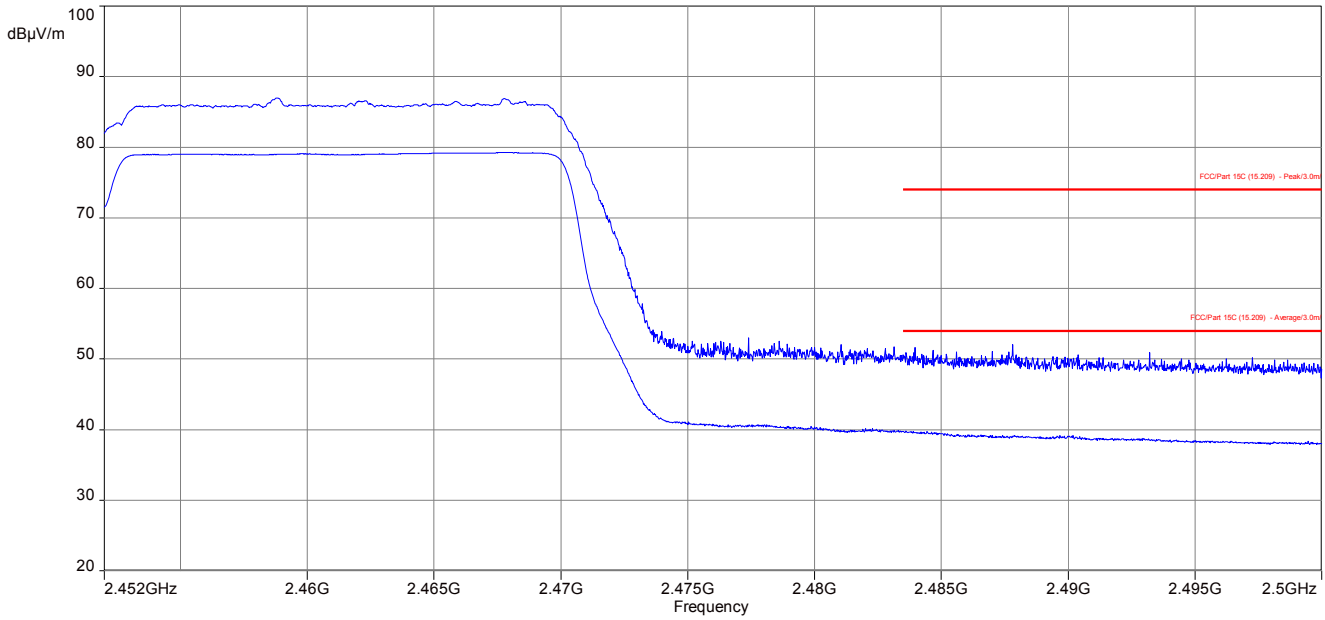


Plots: OFDM / n HT40 – mode peak / average

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



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



12.9 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 7.5A
Measurement uncertainty	See sub clause 9

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		4.34	30 dBm		Operating frequency
No peaks detected. All detected emissions are below the -30 dBc criteria.			-20 dBc (peak) -30 dBc (average)		complies
2437		5.70	30 dBm		Operating frequency
No peaks detected. All detected emissions are below the -30 dBc criteria.			-20 dBc (peak) -30 dBc (average)		complies
2462		6.21	30 dBm		Operating frequency
No peaks detected. All detected emissions are below the -30 dBc criteria.			-20 dBc (peak) -30 dBc (average)		complies
Measurement uncertainty			± 3 dB		

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		-1.22	30 dBm		Operating frequency
No peaks detected. All detected emissions are below the -30 dBc criteria.			-20 dBc (peak) -30 dBc (average)		complies
2437		-1.07	30 dBm		Operating frequency
No peaks detected. All detected emissions are below the -30 dBc criteria.			-20 dBc (peak) -30 dBc (average)		complies
2462		-1.08	30 dBm		Operating frequency
No peaks detected. All detected emissions are below the -30 dBc criteria.			-20 dBc (peak) -30 dBc (average)		complies
Measurement uncertainty			± 3 dB		

Results: OFDM / n HT20 – mode

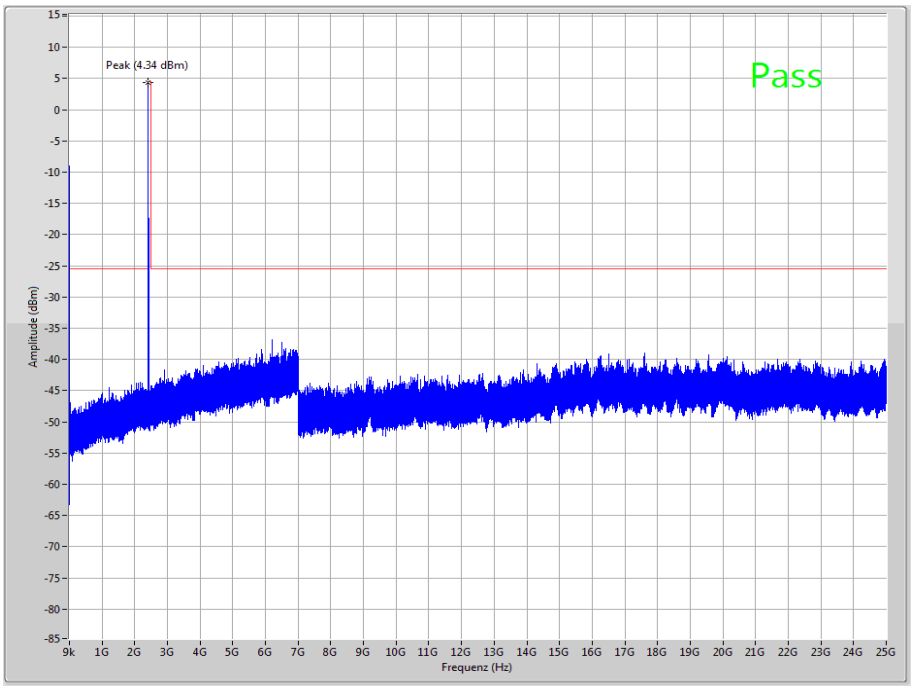
TX Spurious Emissions Conducted					
OFDM / n HT20 – mode					
f [MHz]		amplitude of emission [dBm]	limit max. allowed emission power	actual attenuation below frequency of operation [dB]	results
2412		-1.75	30 dBm		Operating frequency
No peaks detected. All detected emissions are below the -30 dBc criteria.			-20 dBc (peak) -30 dBc (average)		complies
2437		-1.50	30 dBm		Operating frequency
No peaks detected. All detected emissions are below the -30 dBc criteria.			-20 dBc (peak) -30 dBc (average)		complies
2462		-1.17	30 dBm		Operating frequency
No peaks detected. All detected emissions are below the -30 dBc criteria.			-20 dBc (peak) -30 dBc (average)		complies
Measurement uncertainty			± 3 dB		

Results: OFDM / n HT40 – mode

TX Spurious Emissions Conducted					
OFDM / n HT40 – mode					
f [MHz]		amplitude of emission [dBm]	limit max. allowed emission power	actual attenuation below frequency of operation [dB]	results
2422		-4.32	30 dBm		Operating frequency
No peaks detected. All detected emissions are below the -30 dBc criteria.			-20 dBc (peak) -30 dBc (average)		complies
2437		-4.48	30 dBm		Operating frequency
No peaks detected. All detected emissions are below the -30 dBc criteria.			-20 dBc (peak) -30 dBc (average)		complies
2452		-4.38	30 dBm		Operating frequency
No peaks detected. All detected emissions are below the -30 dBc criteria.			-20 dBc (peak) -30 dBc (average)		complies
Measurement uncertainty			± 3 dB		

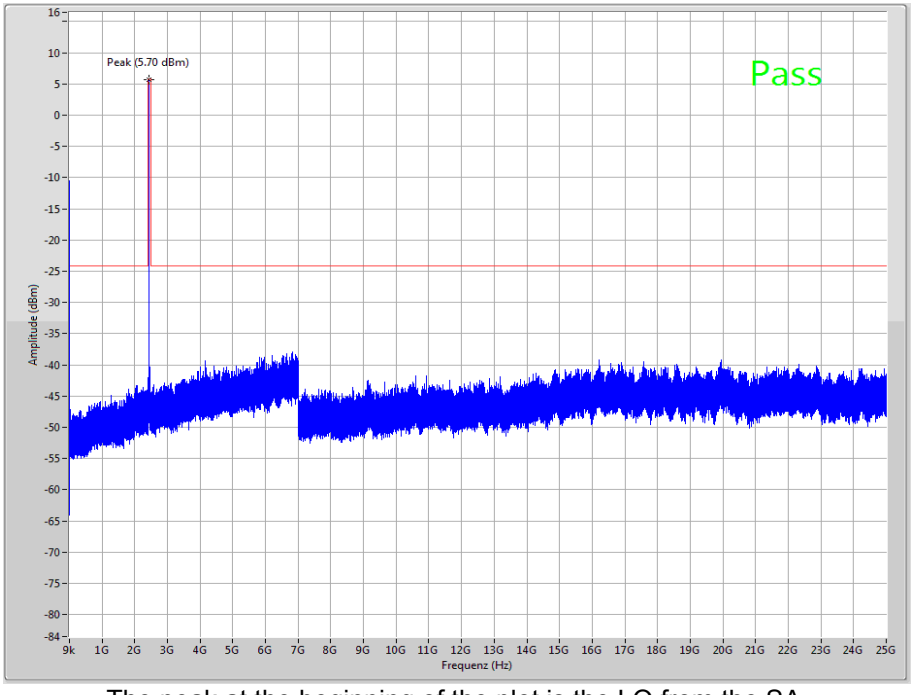
Plots: DSSS / b – mode

Plot 1: TX mode, lowest channel, up to 25 GHz



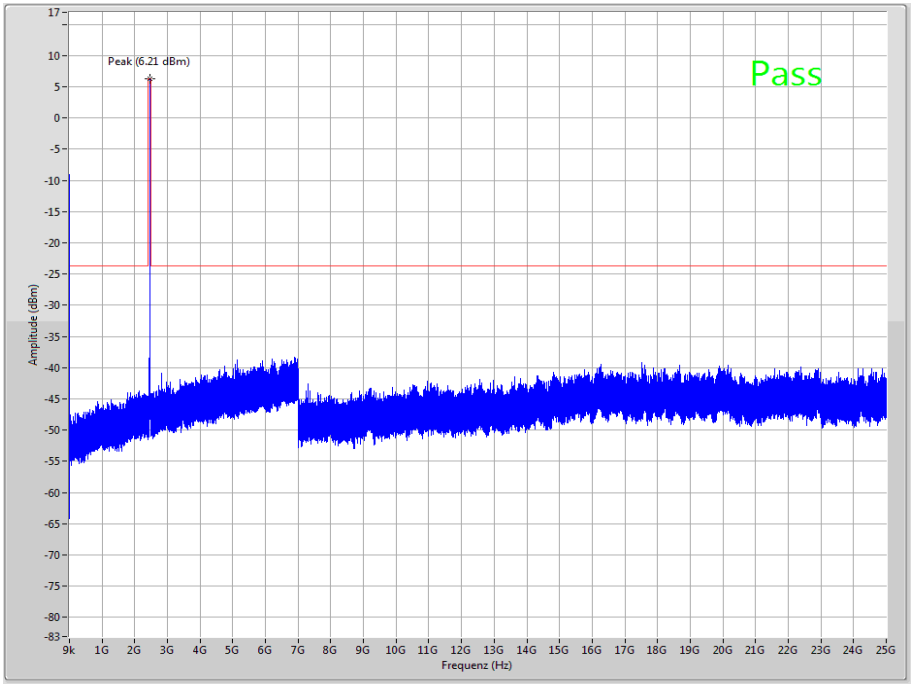
The peak at the beginning of the plot is the LO from the SA.

Plot 2: TX mode, middle channel, up to 25 GHz



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

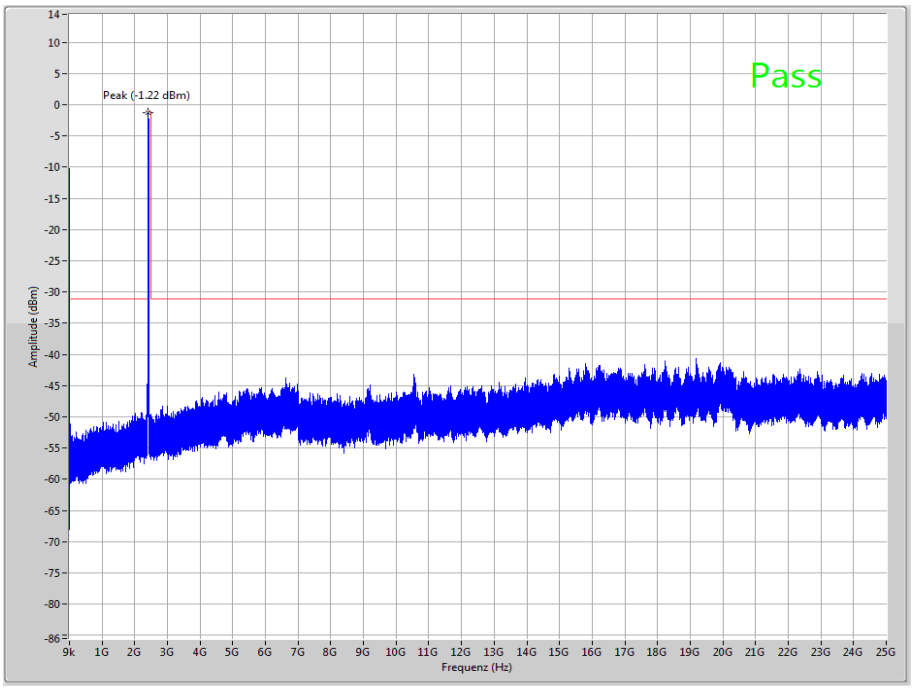
Plot 3: TX mode, highest channel, up to 25 GHz



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

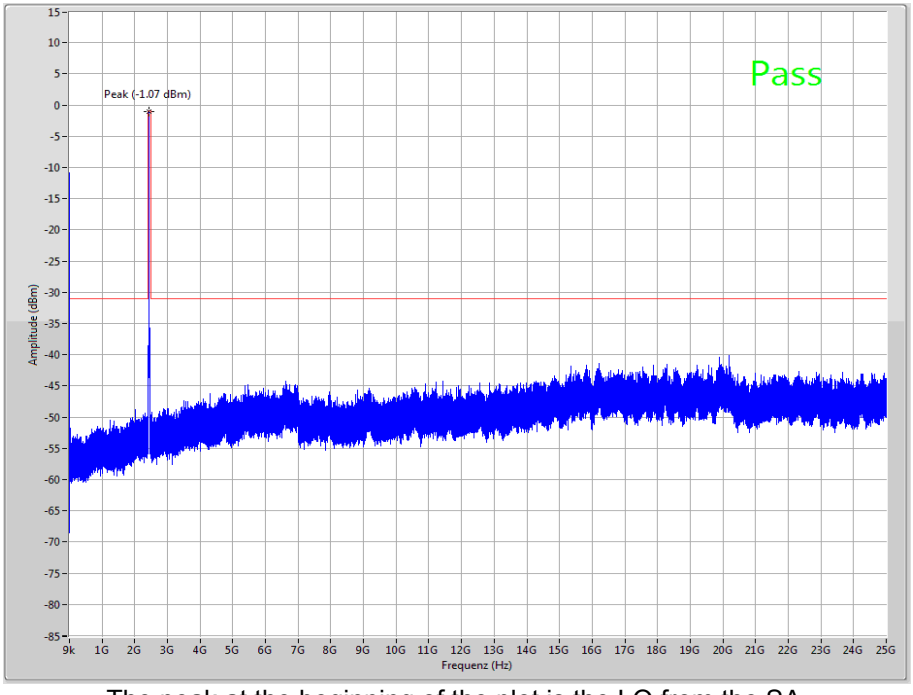
Plots: OFDM / g – mode

Plot 1: TX mode, lowest channel, up to 25 GHz



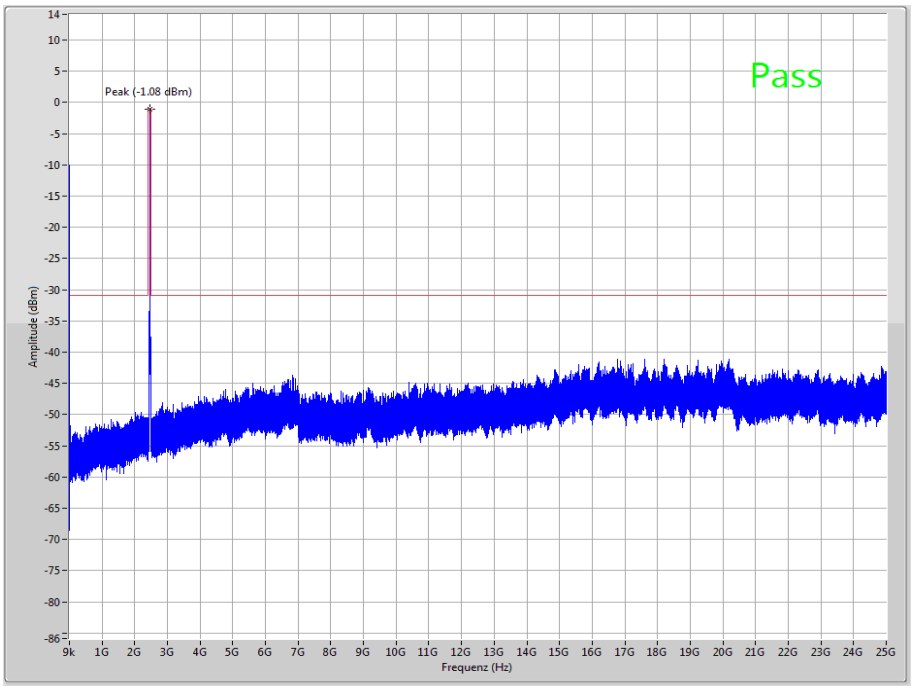
The peak at the beginning of the plot is the LO from the SA.

Plot 2: TX mode, middle channel, up to 25 GHz



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

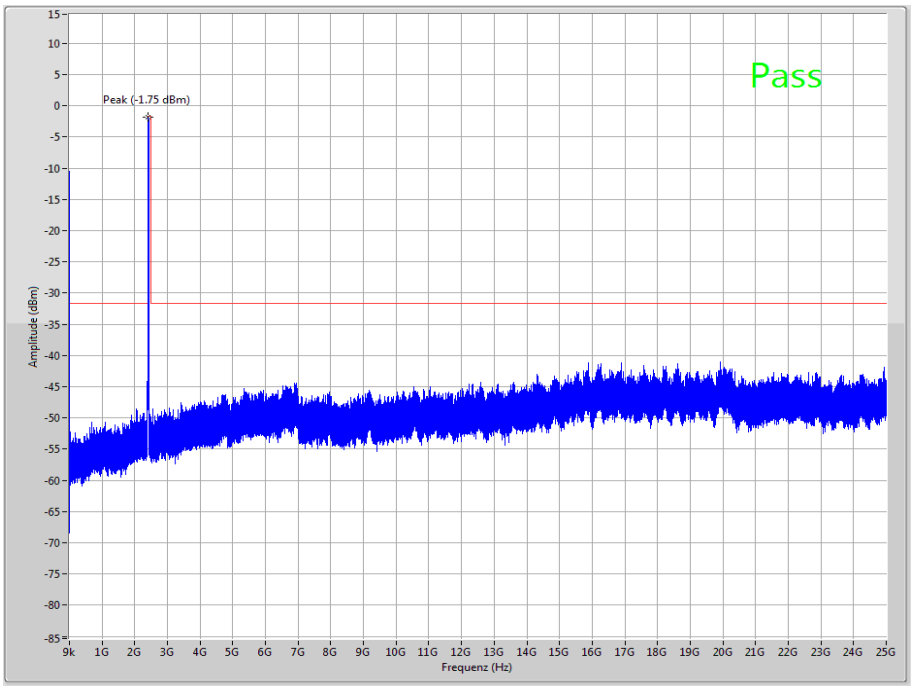
Plot 3: TX mode, highest channel, up to 25 GHz



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

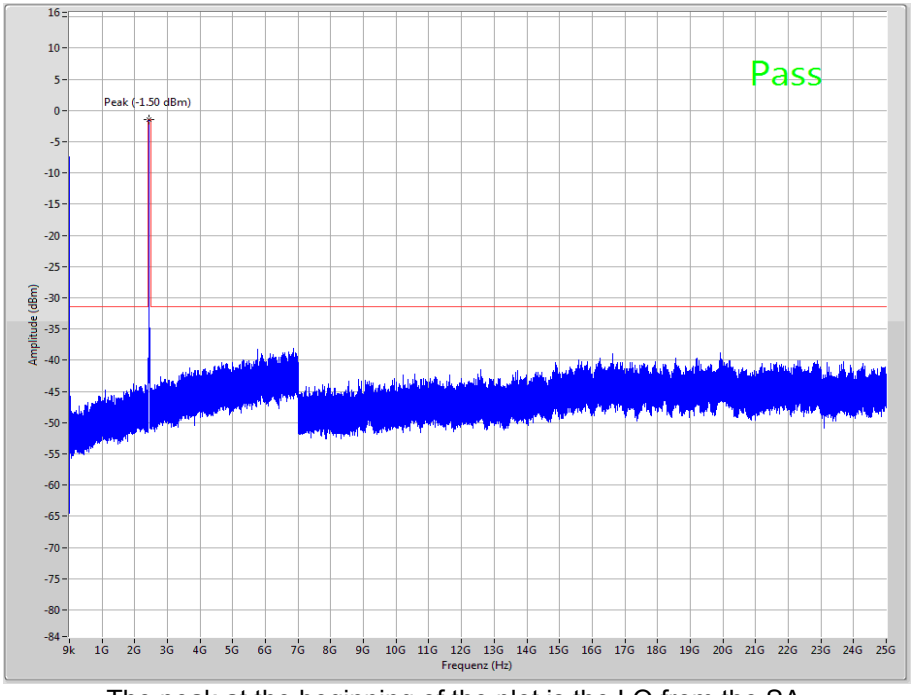
Plots: OFDM / n HT 20 – mode

Plot 1: TX mode, lowest channel, up to 25 GHz



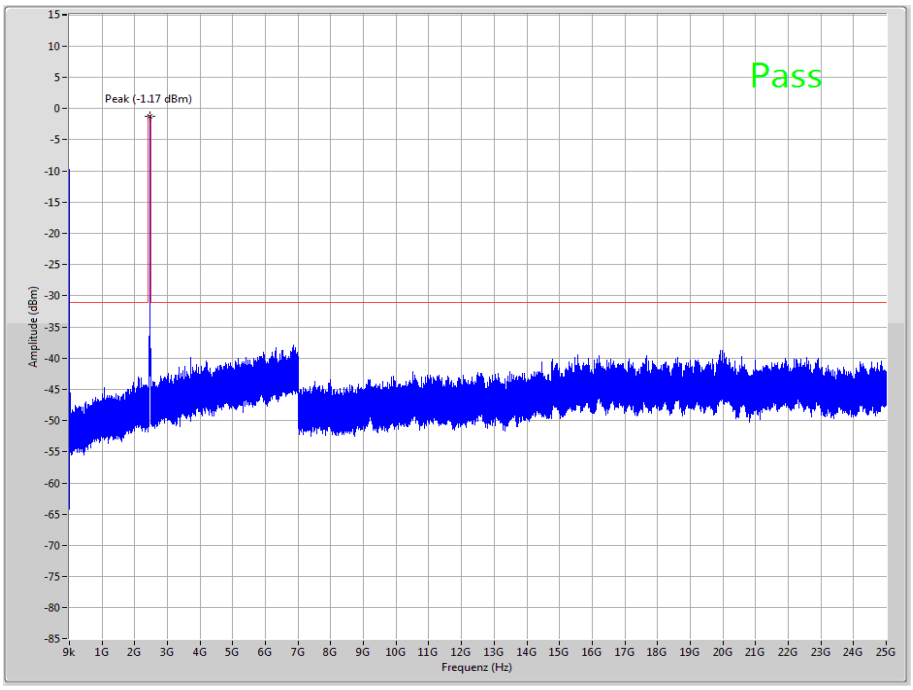
The peak at the beginning of the plot is the LO from the SA.

Plot 2: TX mode, middle channel, up to 25 GHz



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

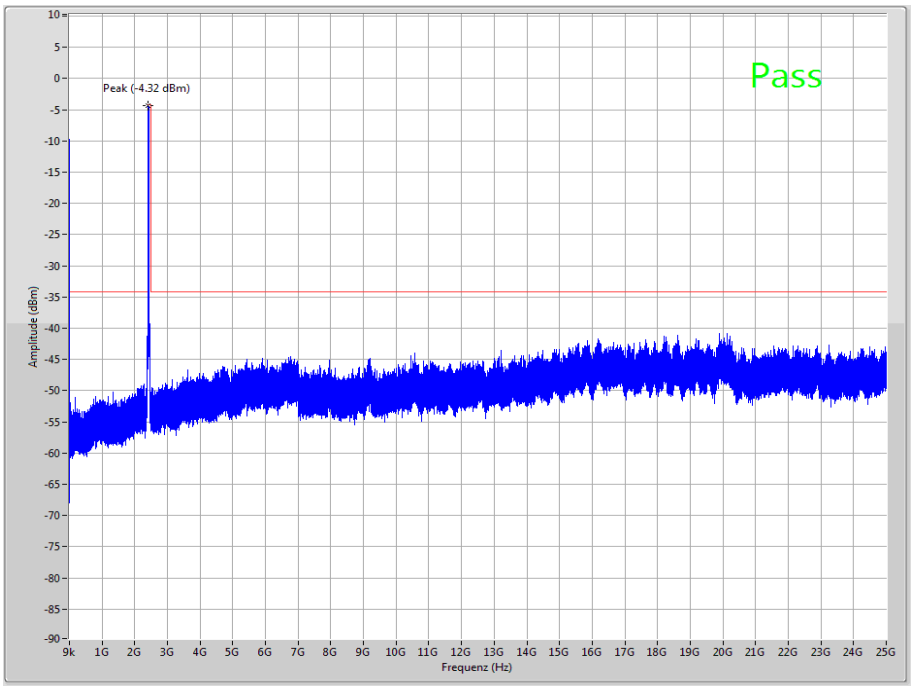
Plot 3: TX mode, highest channel, up to 25 GHz



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

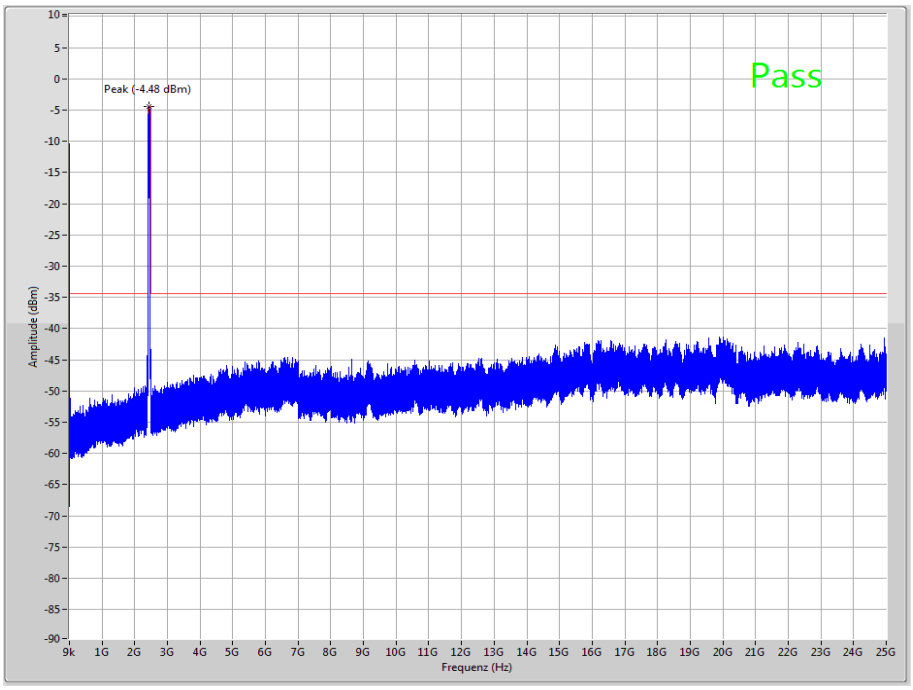
Plots: OFDM / n HT 40 – mode

Plot 1: TX mode, lowest channel, up to 25 GHz



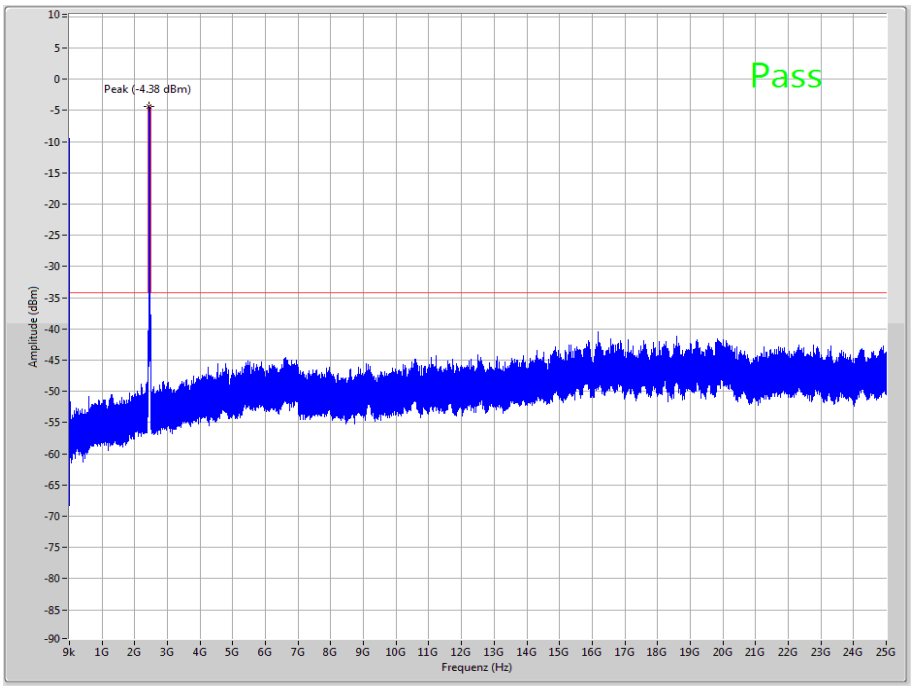
The peak at the beginning of the plot is the LO from the SA.

Plot 2: TX mode, middle channel, up to 25 GHz



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

Plot 3: TX mode, highest channel, up to 25 GHz



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

12.10 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 ☒ OFDM n HT40 – mode
Test setup:	See sub clause 7.2A
Measurement uncertainty	See sub clause 9

Limits:

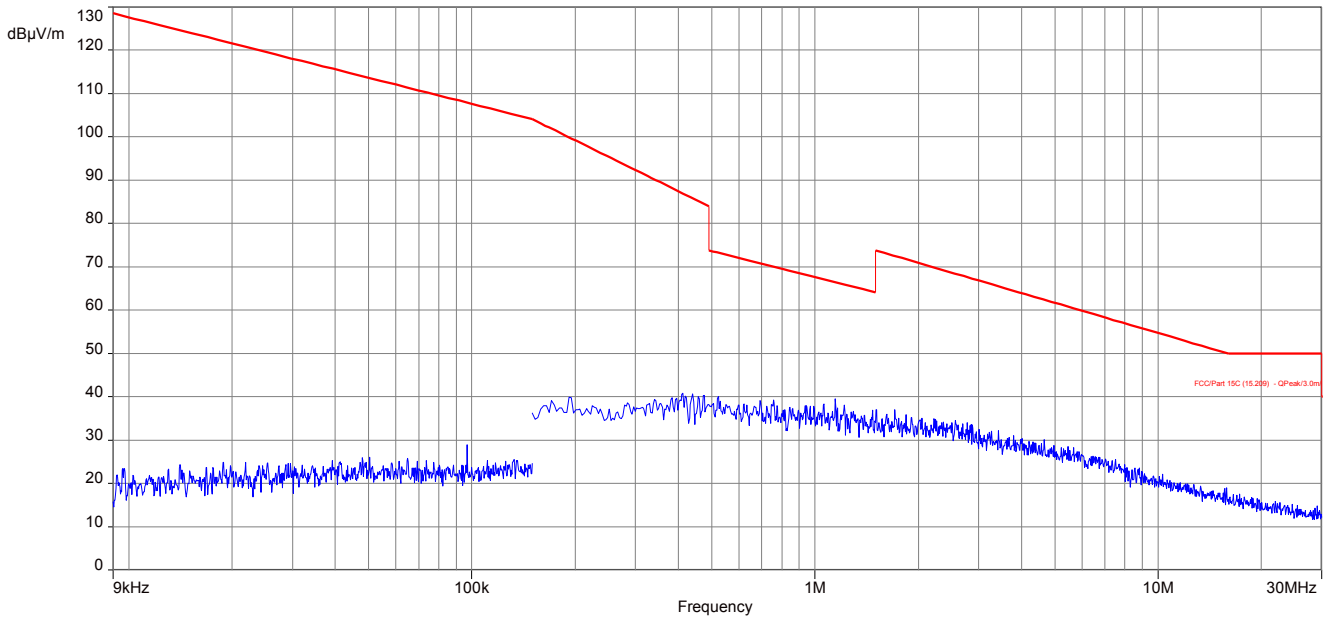
FCC		IC
Frequency (MHz)	Field Strength (dBµV/m)	Measurement distance
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30

Results:

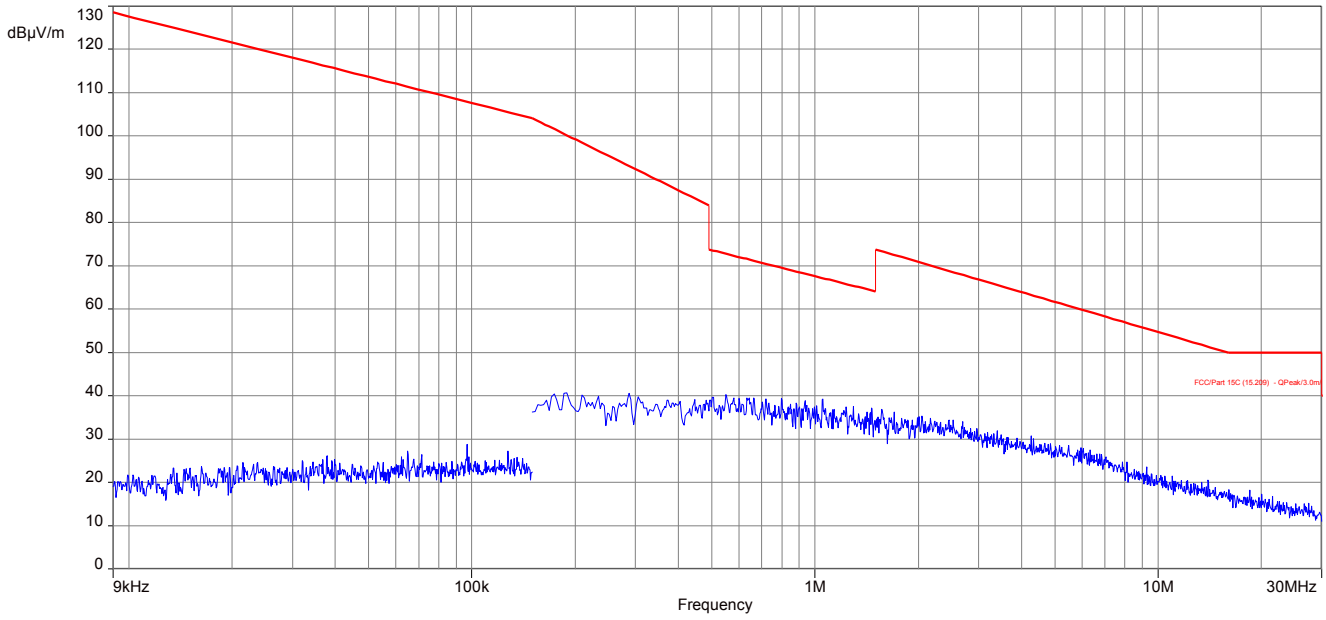
TX Spurious Emissions Radiated < 30 MHz [dBµV/m]		
F [MHz]	Detector	Level [dBµV/m]
All detected peaks are more than 20 dB below the limit.		

Plots: DSSS

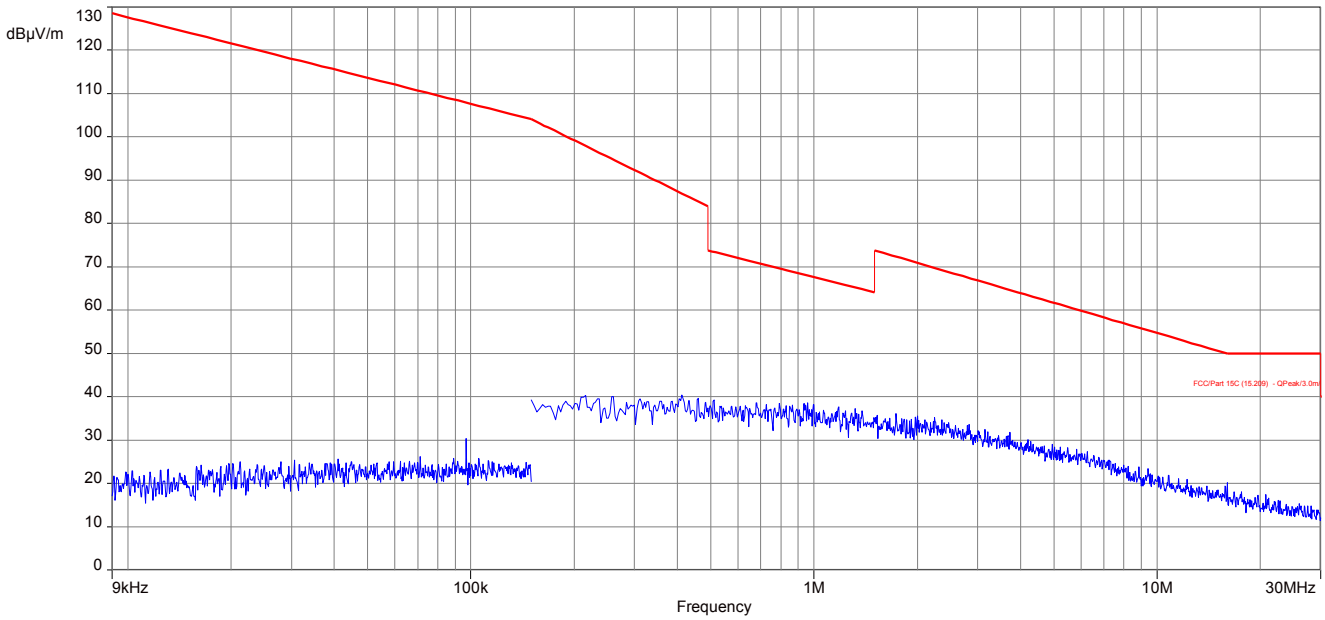
Plot 1: 9 kHz to 30 MHz, low channel



Plot 2: 9 kHz to 30 MHz, mid channel

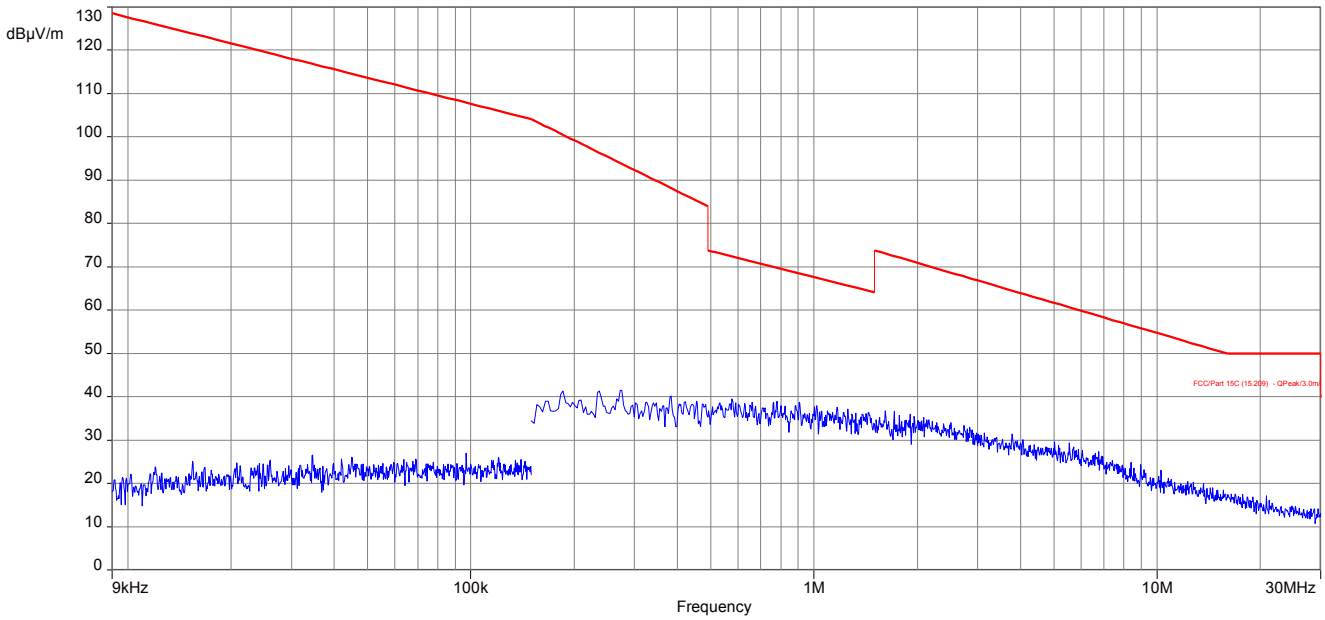


Plot 3: 9 kHz to 30 MHz, high channel

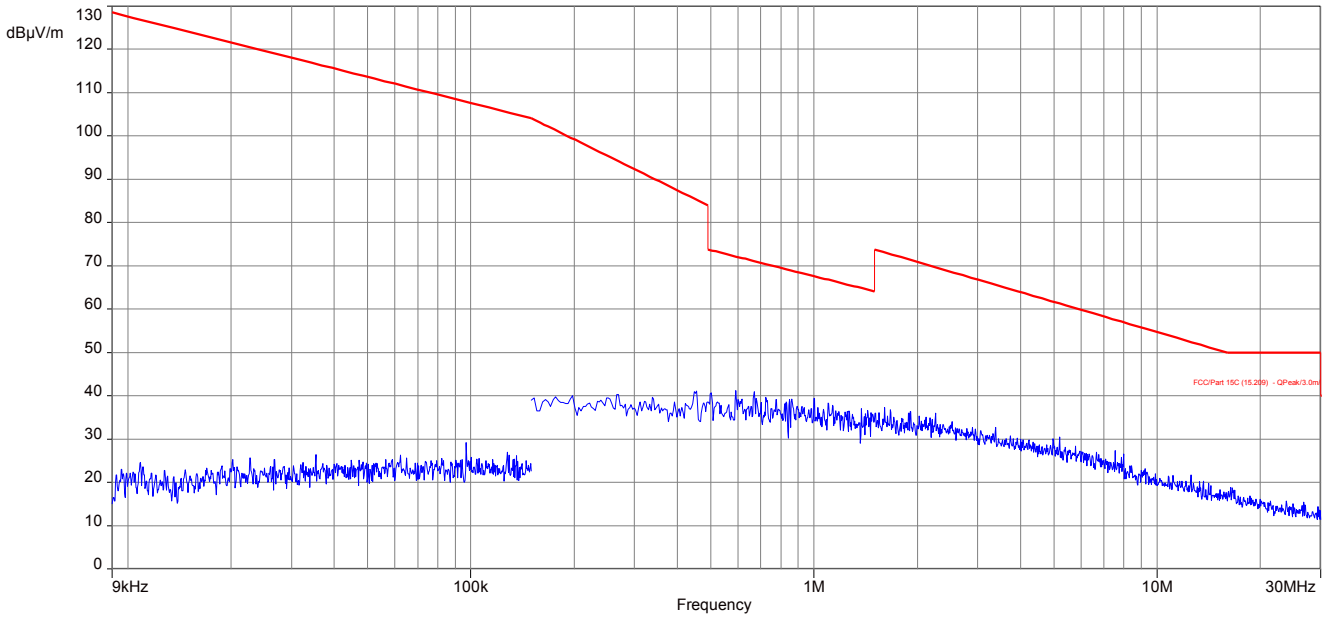


Plots: OFDM gmode

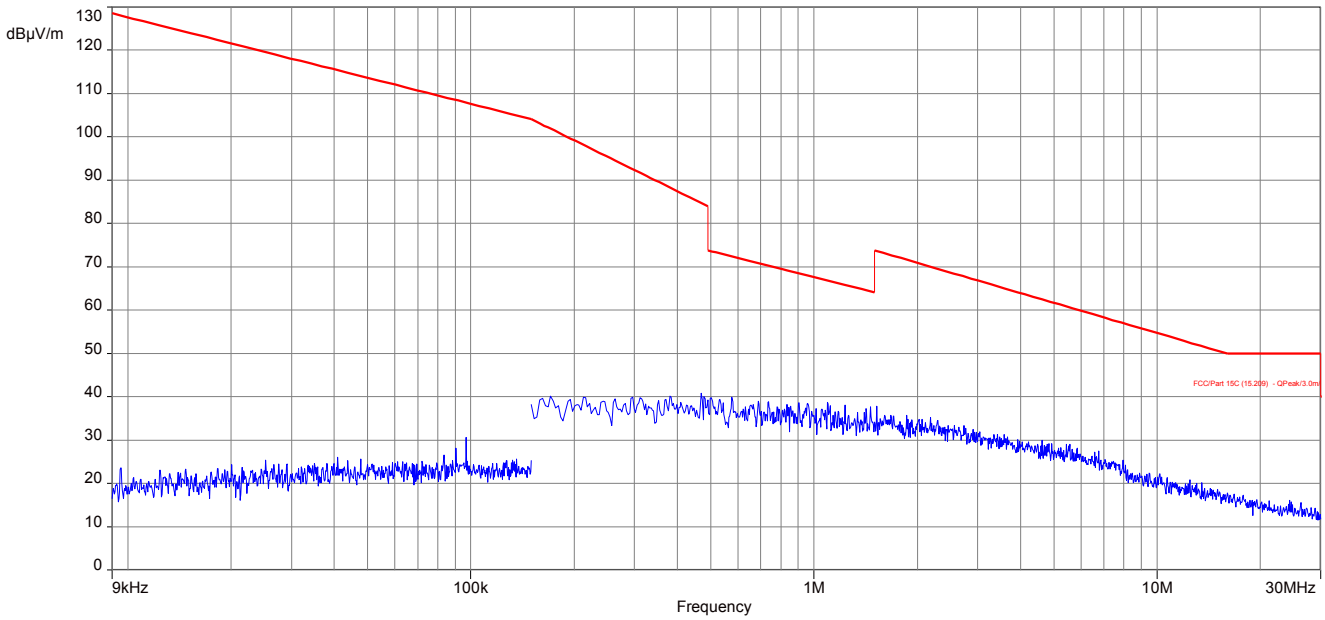
Plot 1: 9 kHz to 30 MHz, low channel



Plot 2: 9 kHz to 30 MHz, mid channel

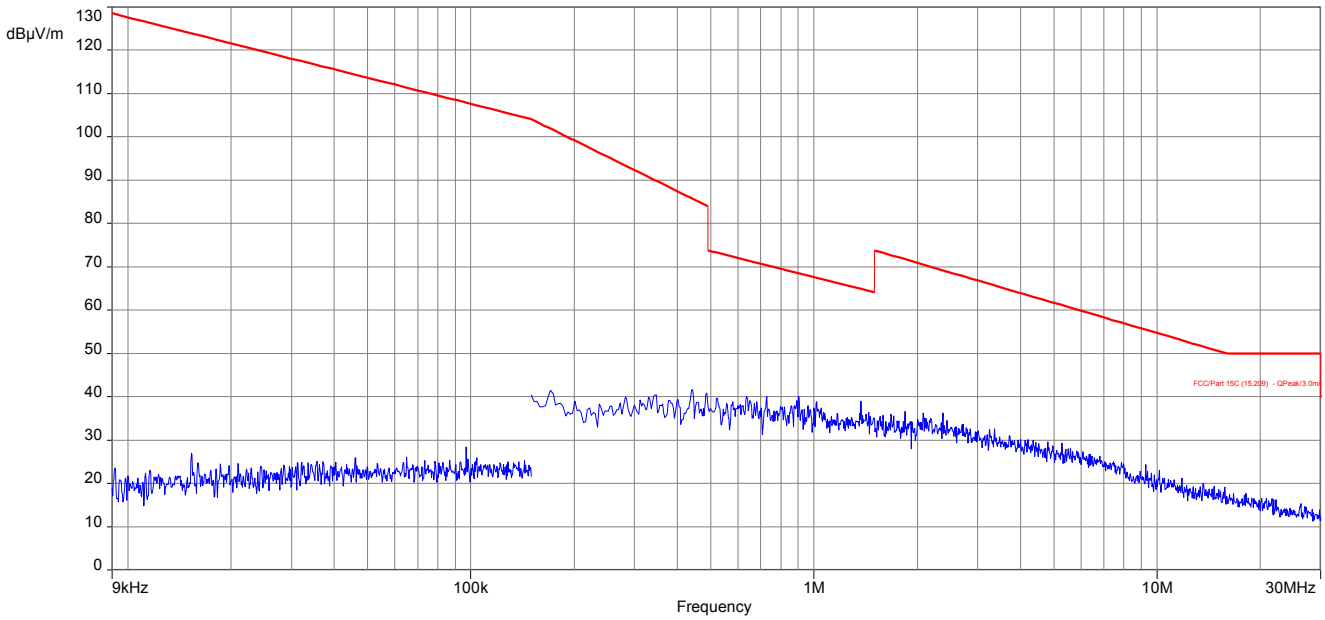


Plot 3: 9 kHz to 30 MHz, high channel

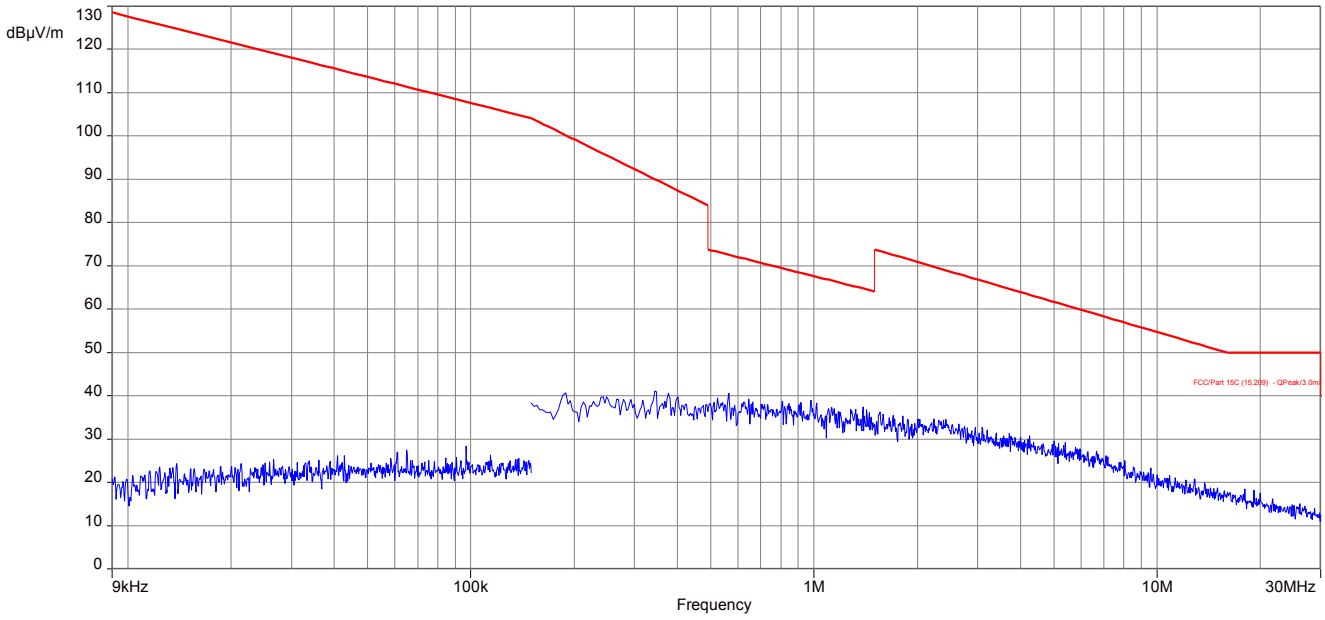


Plots: OFDM nHT40-mode

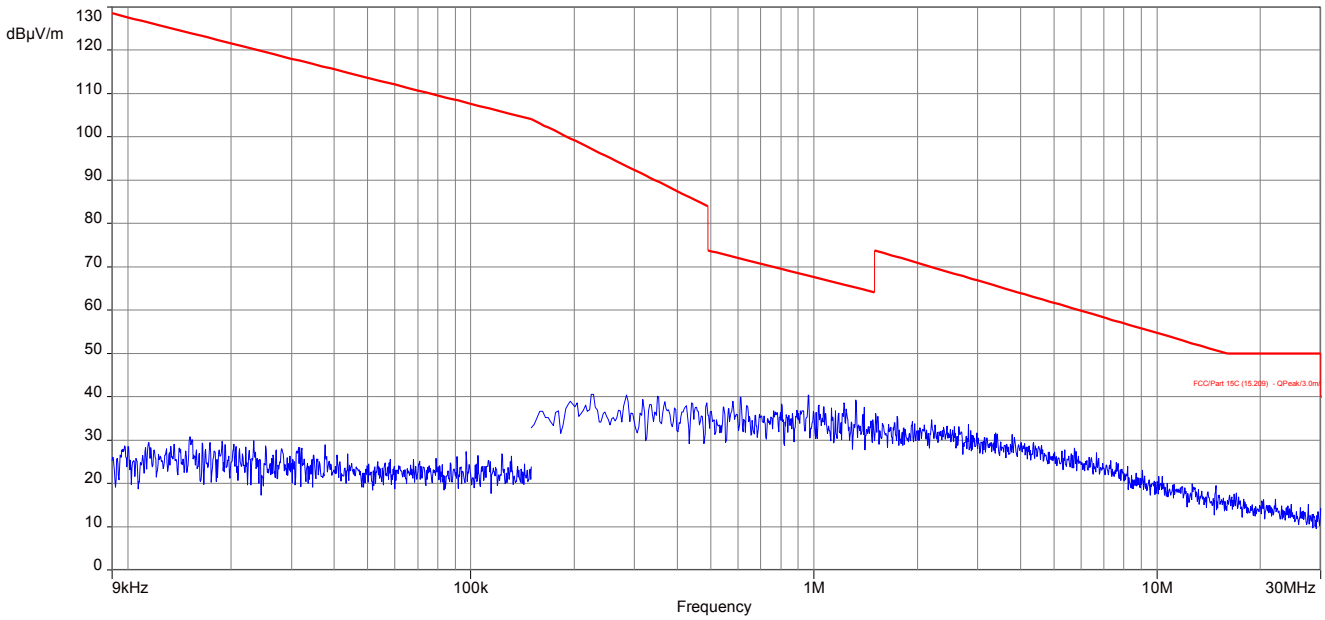
Plot 1: 9 kHz to 30 MHz, low channel



Plot 2: 9 kHz to 30 MHz, mid channel



Plot 3: 9 kHz to 30 MHz, high channel



12.11 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:	F < 1 GHz: 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 ☒ OFDM n HT40 – mode ☒ RX / Idle – mode
Test setup:	See sub clause 7.1A
Measurement uncertainty	See sub clause 9

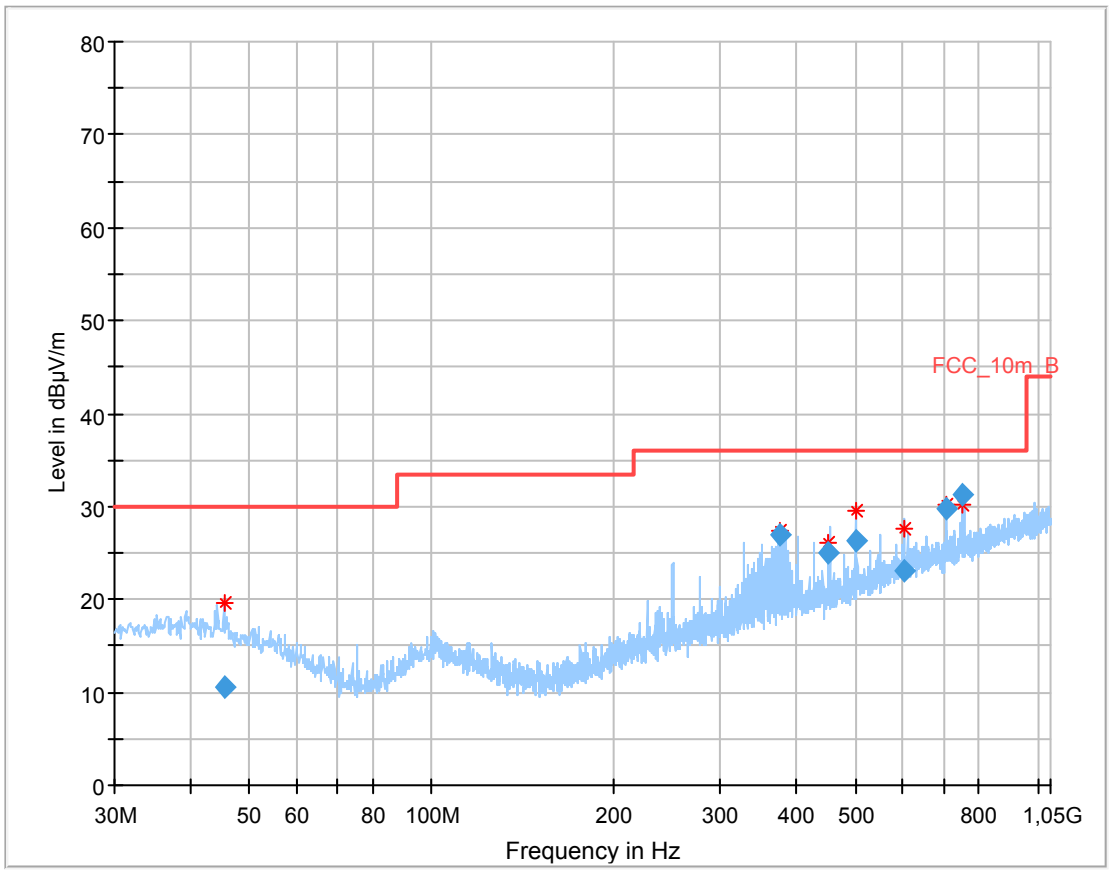
The modulation with the highest output power was used to perform the transmitter spurious emissions. If spurious were detected a re-measurement was performed on the detected frequency with each modulation.

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

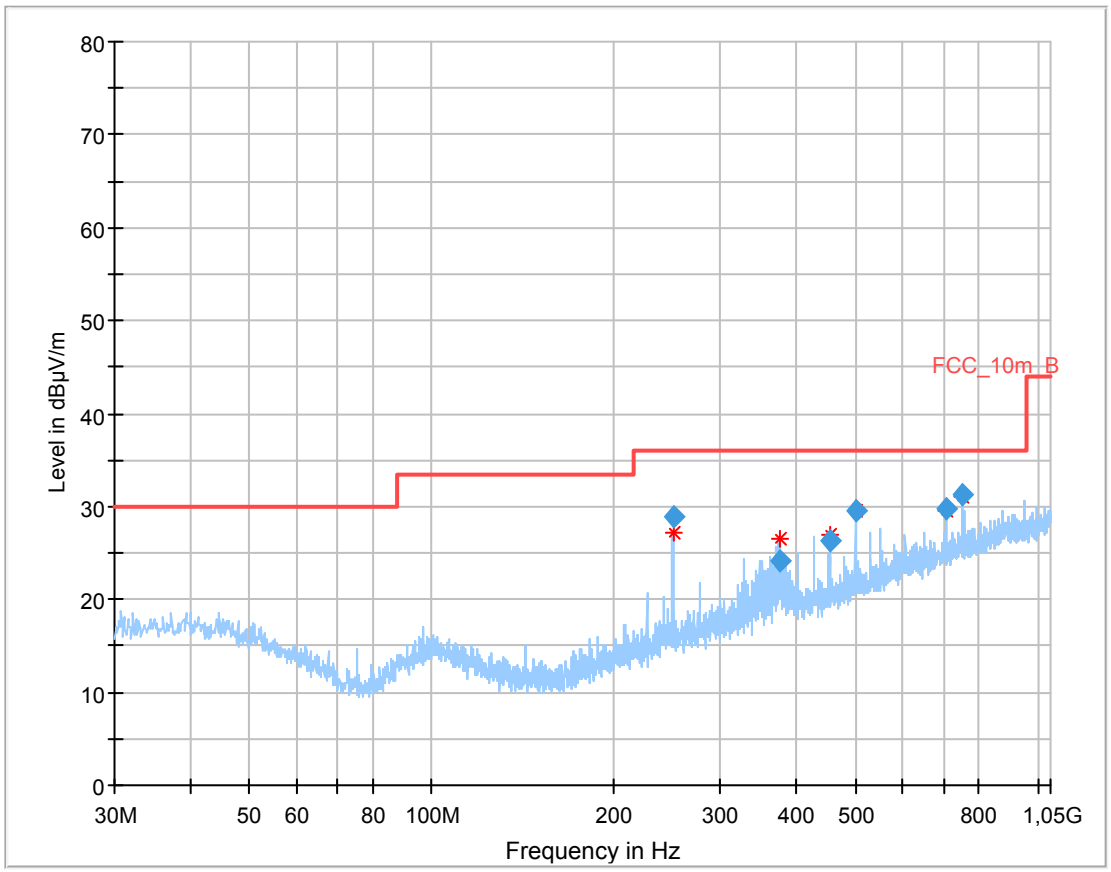
Plot 1: 30 MHz to 1 GHz, vertical & horizontal polarization, low channel



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
45.526350	10.51	30.00	19.49	1000.0	120.000	170.0	H	190	13.7
377.104200	27.00	36.00	9.00	1000.0	120.000	98.0	V	100	16.5
450.010200	25.09	36.00	10.91	1000.0	120.000	170.0	H	260	17.6
500.006400	26.25	36.00	9.75	1000.0	120.000	101.0	H	-9	18.7
604.151550	23.02	36.00	12.98	1000.0	120.000	101.0	H	-10	20.7
704.888100	29.84	36.00	6.16	1000.0	120.000	101.0	H	-10	21.6
750.004950	31.37	36.00	4.63	1000.0	120.000	98.0	H	10	22.7

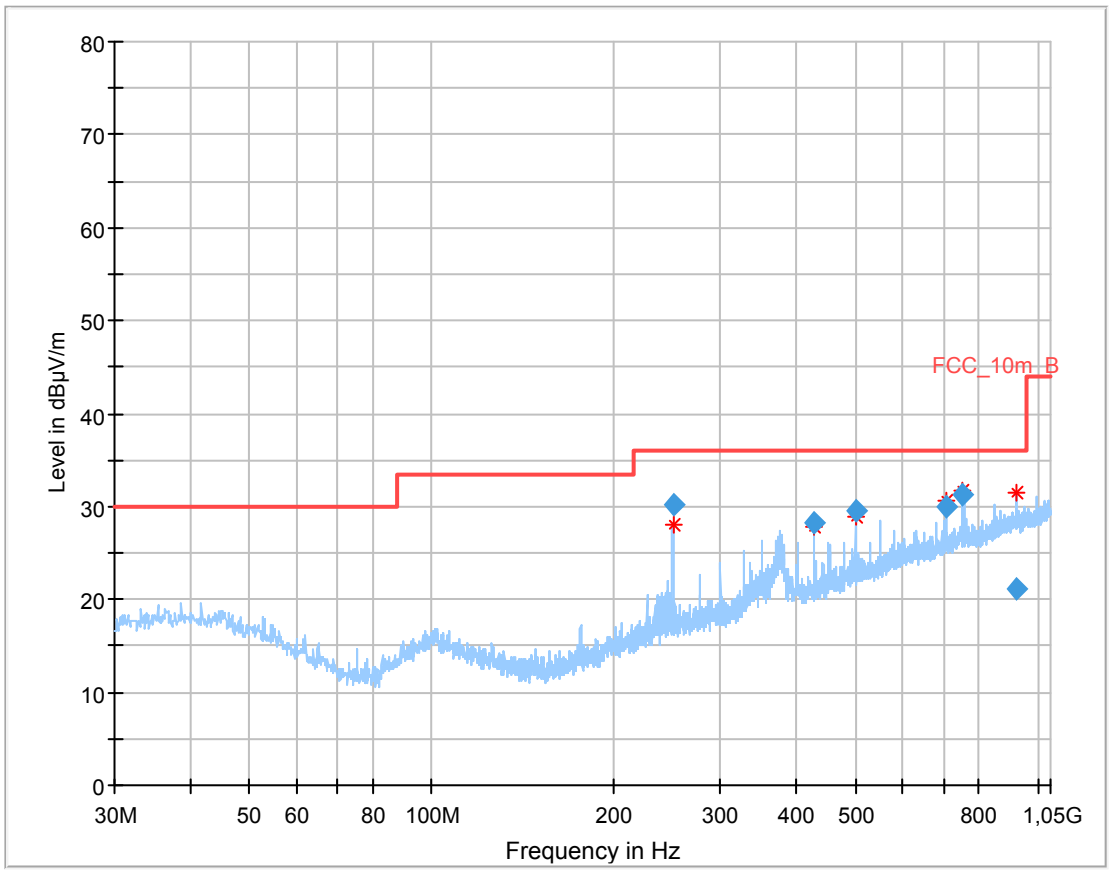
Plot 2: 30 MHz to 1 GHz, vertical & horizontal polarization, mid channel



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
250.001850	29.00	36.00	7.00	1000.0	120.000	170.0	H	10	13.4
375.024750	24.17	36.00	11.83	1000.0	120.000	101.0	H	10	16.5
453.132150	26.37	36.00	9.63	1000.0	120.000	170.0	H	171	17.7
500.008800	29.50	36.00	6.50	1000.0	120.000	170.0	H	10	18.7
704.864550	29.85	36.00	6.15	1000.0	120.000	101.0	H	-10	21.6
750.010350	31.29	36.00	4.71	1000.0	120.000	98.0	H	-9	22.7

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

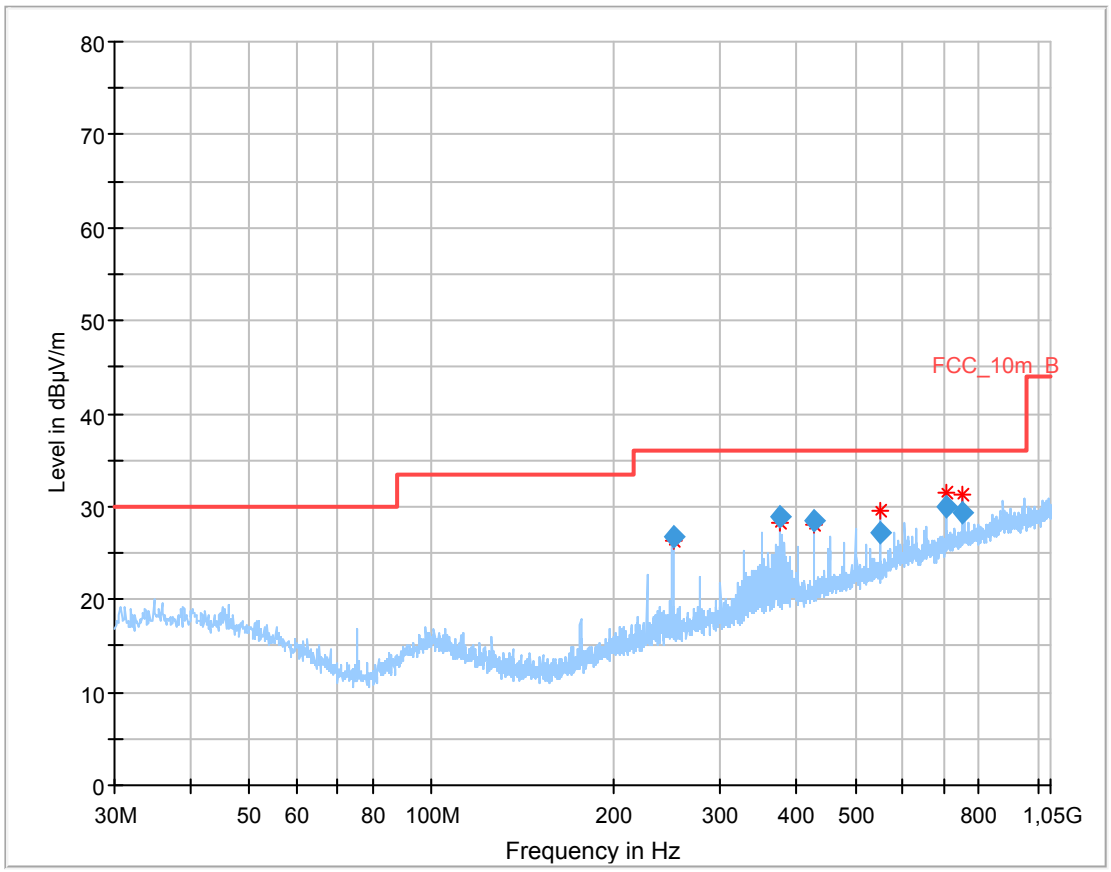


Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
250.002900	30.17	36.00	5.83	1000.0	120.000	170.0	H	0	13.4
427.961850	28.19	36.00	7.81	1000.0	120.000	170.0	H	138	17.3
499.989150	29.58	36.00	6.42	1000.0	120.000	170.0	H	4	18.7
704.867700	29.94	36.00	6.06	1000.0	120.000	101.0	H	353	21.6
750.017100	31.28	36.00	4.72	1000.0	120.000	98.0	H	0	22.7
921.149850	21.18	36.00	14.82	1000.0	120.000	170.0	V	128	24.2

Plot: OFDM gmode

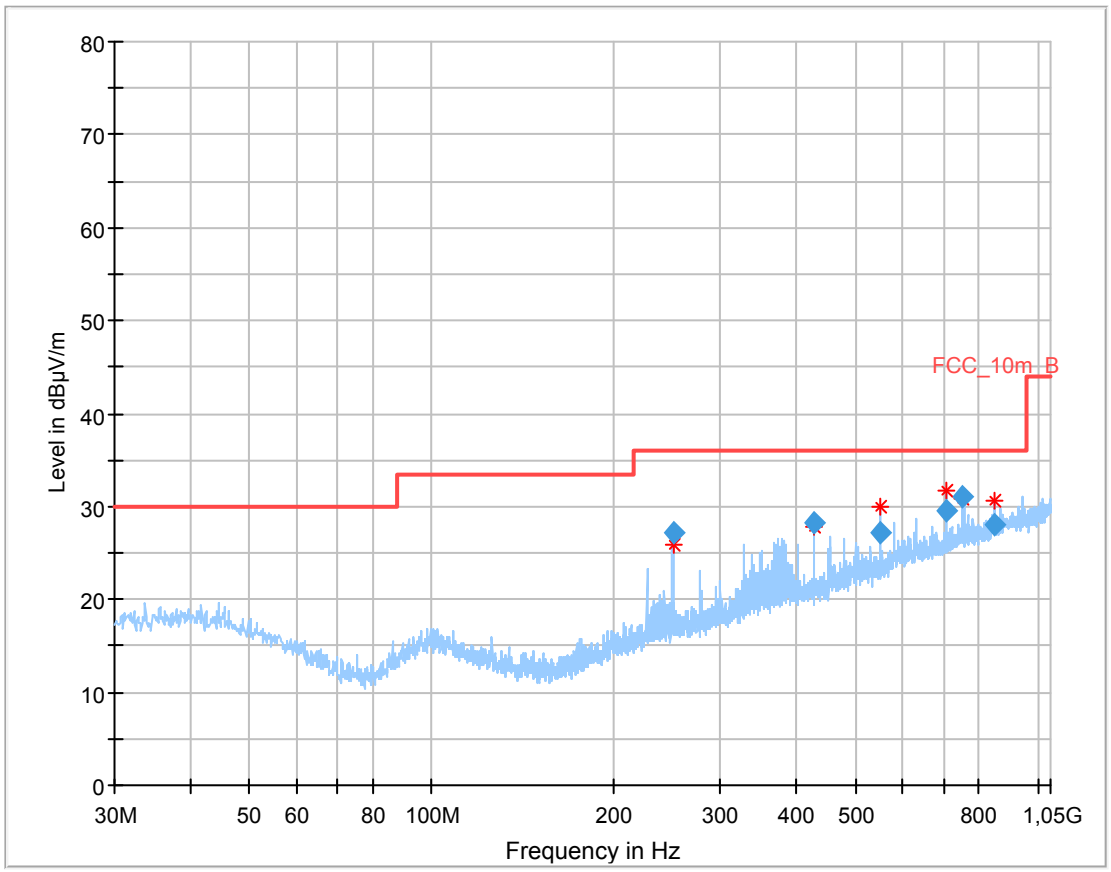
Plot 1: 30 MHz to 1 GHz, vertical & horizontal polarization, low channel



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
250.022400	26.70	36.00	9.30	1000.0	120.000	170.0	H	38	13.4
375.008700	28.96	36.00	7.04	1000.0	120.000	170.0	H	0	16.5
427.958250	28.48	36.00	7.52	1000.0	120.000	170.0	H	139	17.3
549.990450	27.17	36.00	8.83	1000.0	120.000	100.0	H	182	19.3
704.869650	29.94	36.00	6.06	1000.0	120.000	101.0	H	350	21.6
750.024600	29.37	36.00	6.63	1000.0	120.000	98.0	H	38	22.7

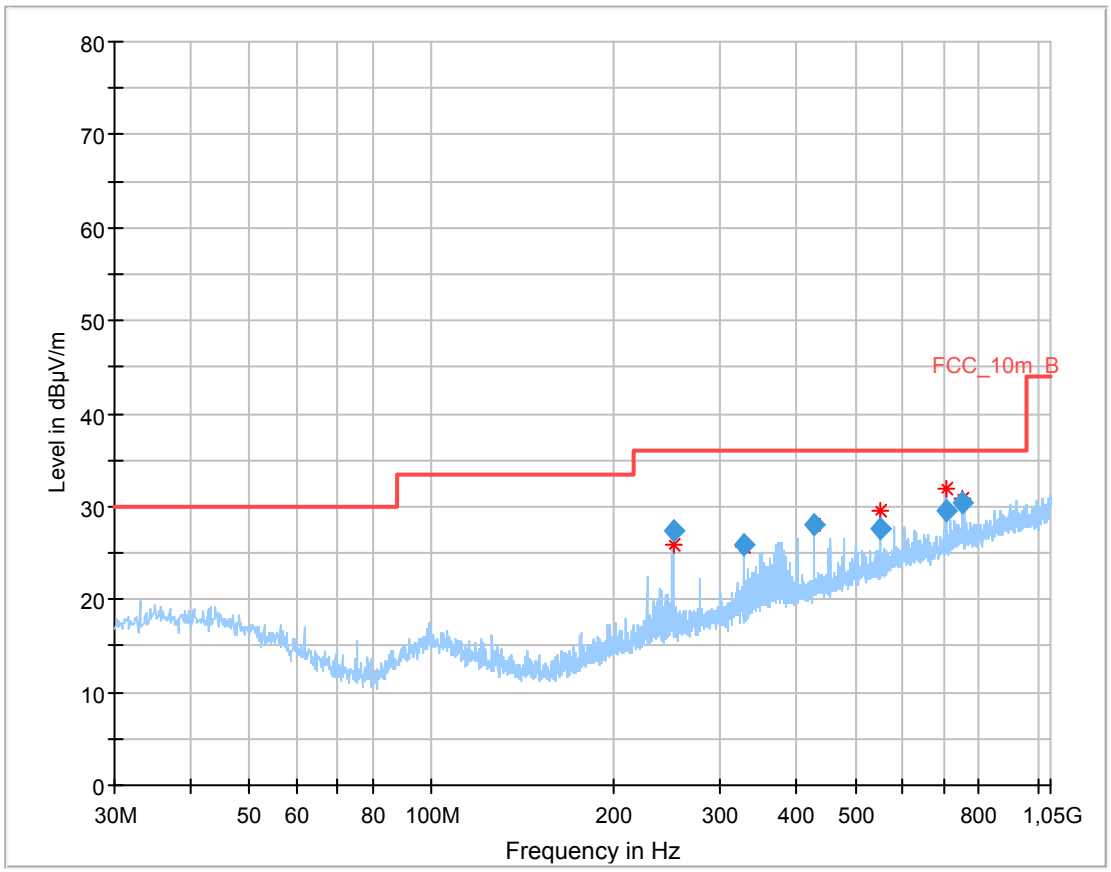
Plot 2: 30 MHz to 1 GHz, vertical & horizontal polarization, mid channel



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
250.003350	27.13	36.00	8.87	1000.0	120.000	170.0	H	0	13.4
427.959900	28.25	36.00	7.75	1000.0	120.000	170.0	H	125	17.3
550.005450	27.11	36.00	8.89	1000.0	120.000	101.0	H	195	19.3
704.898450	29.51	36.00	6.49	1000.0	120.000	100.0	H	357	21.6
750.003900	30.98	36.00	5.02	1000.0	120.000	98.0	H	7	22.7
850.000200	28.14	36.00	7.86	1000.0	120.000	98.0	H	210	23.5

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

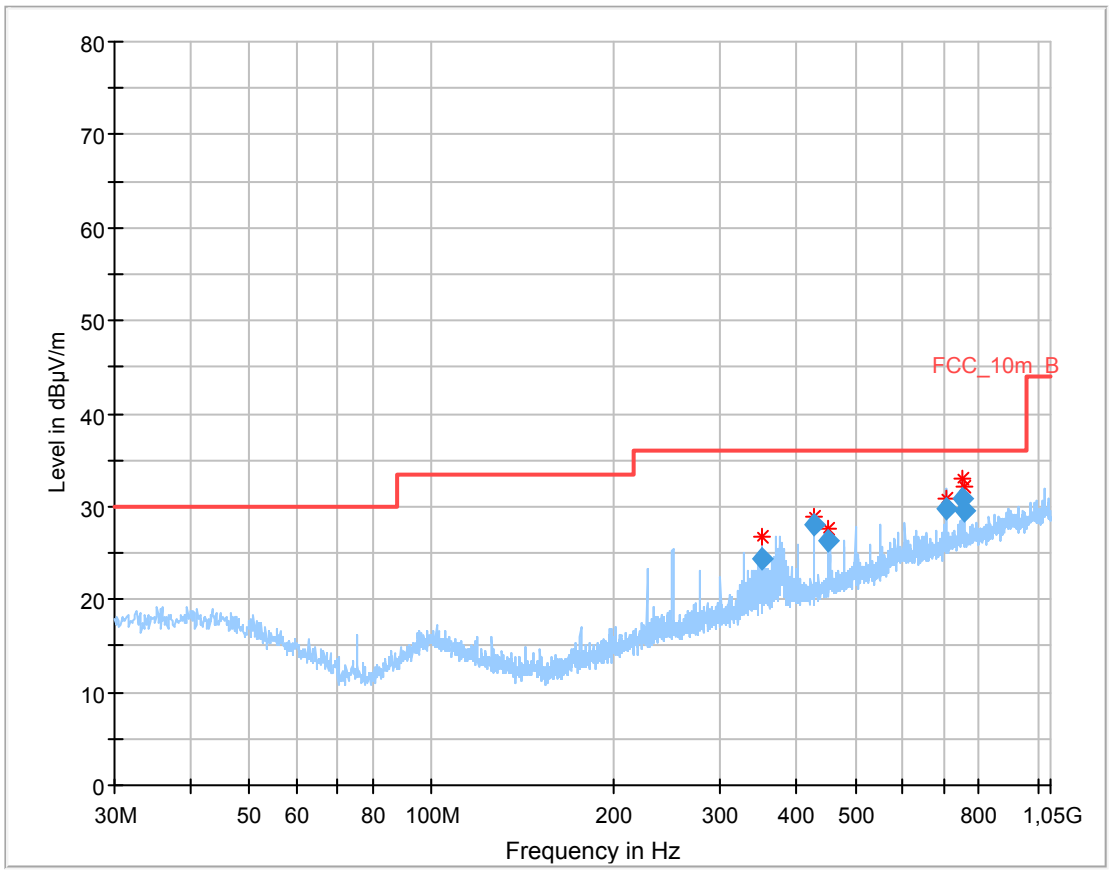


Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
250.005300	27.40	36.00	8.60	1000.0	120.000	170.0	H	10	13.4
327.261300	25.81	36.00	10.19	1000.0	120.000	170.0	H	18	15.3
427.962750	28.13	36.00	7.87	1000.0	120.000	170.0	H	141	17.3
550.006950	27.69	36.00	8.31	1000.0	120.000	101.0	H	157	19.3
704.886450	29.56	36.00	6.44	1000.0	120.000	101.0	H	7	21.6
749.991000	30.48	36.00	5.52	1000.0	120.000	98.0	H	345	22.7

Plot: OFDM nmode-HT40

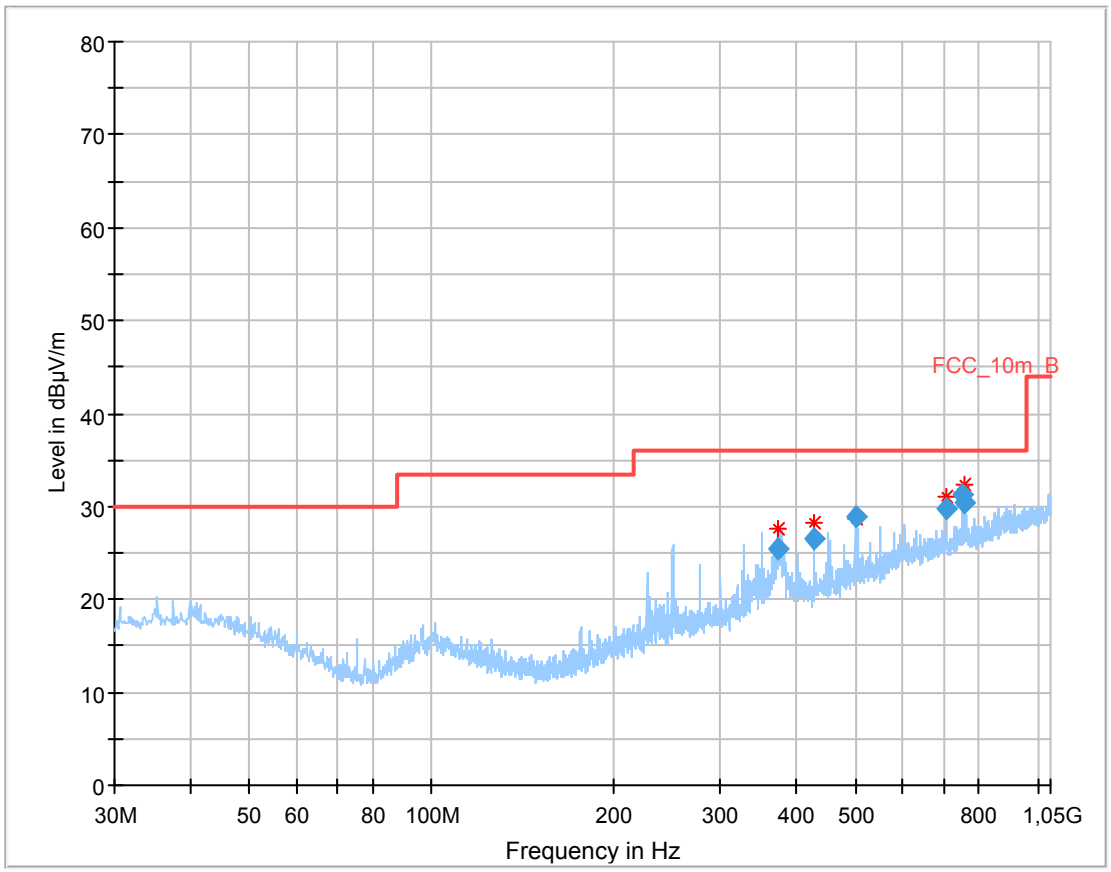
Plot 1: 30 MHz to 1 GHz, vertical & horizontal polarization, low channel



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
350.000850	24.46	36.00	11.54	1000.0	120.000	101.0	H	30	16.0
427.971750	28.14	36.00	7.86	1000.0	120.000	170.0	H	146	17.3
450.003750	26.35	36.00	9.65	1000.0	120.000	170.0	H	206	17.6
704.868450	29.85	36.00	6.15	1000.0	120.000	101.0	H	357	21.6
749.985300	30.90	36.00	5.10	1000.0	120.000	98.0	H	357	22.7
755.235150	29.47	36.00	6.53	1000.0	120.000	98.0	H	15	22.7

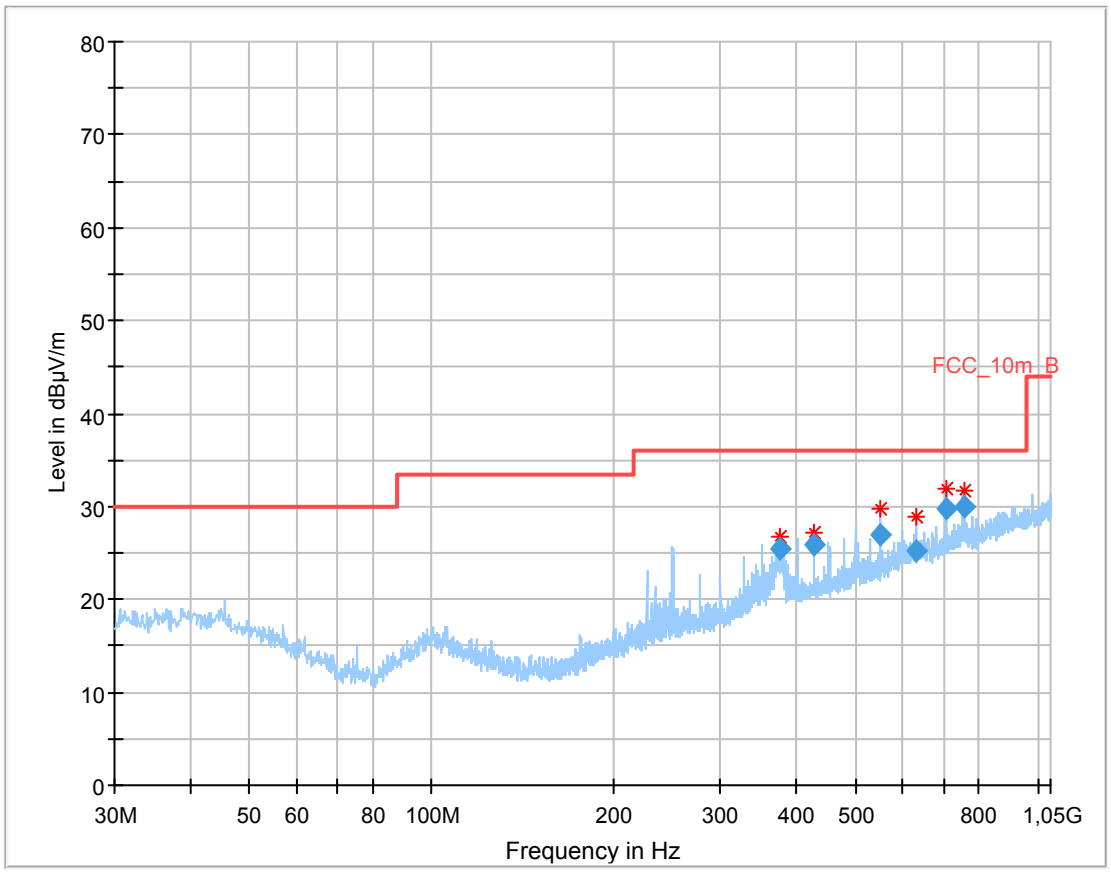
Plot 2: 30 MHz to 1 GHz, vertical & horizontal polarization, mid channel



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
371.643300	25.36	36.00	10.64	1000.0	120.000	98.0	V	174	16.4
427.945200	26.52	36.00	9.48	1000.0	120.000	170.0	H	287	17.3
500.015550	28.87	36.00	7.13	1000.0	120.000	170.0	H	7	18.7
704.869200	29.72	36.00	6.28	1000.0	120.000	98.0	H	338	21.6
750.025050	31.19	36.00	4.81	1000.0	120.000	98.0	H	357	22.7
755.226900	30.37	36.00	5.63	1000.0	120.000	98.0	H	1	22.7

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

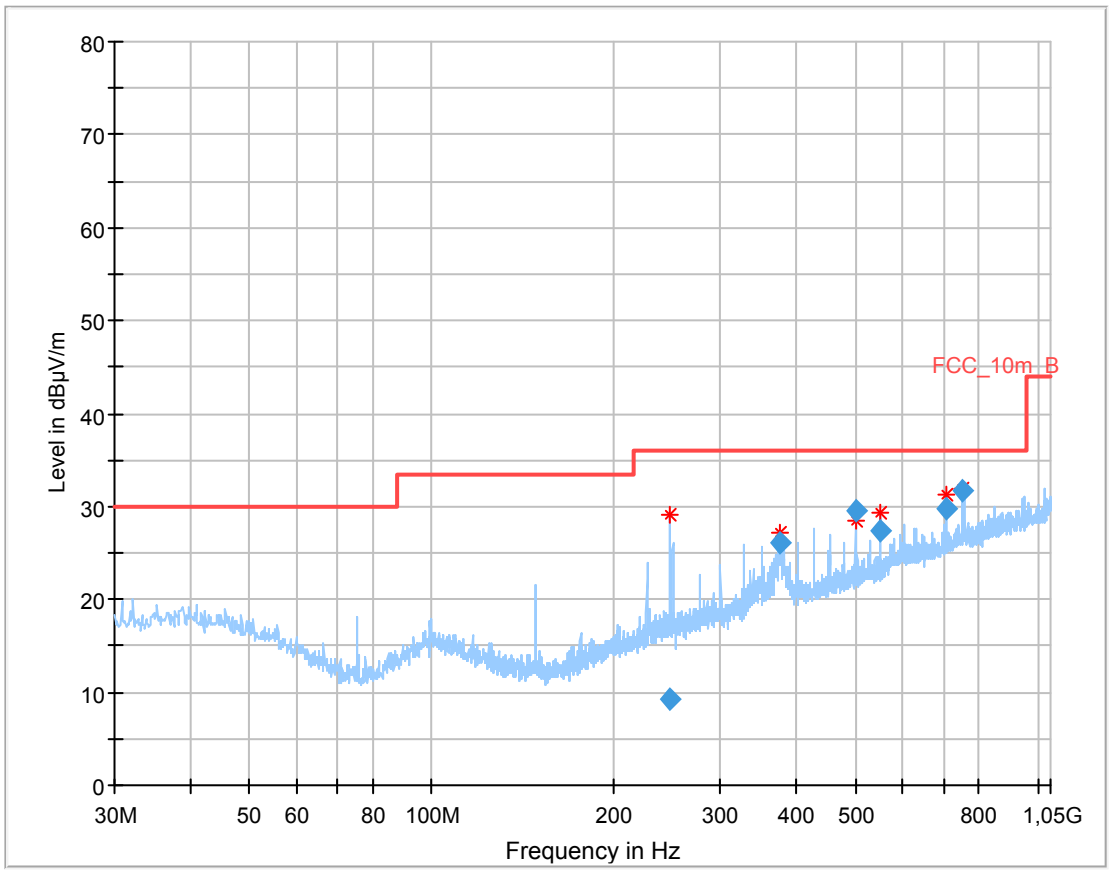


Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
374.994450	25.36	36.00	10.64	1000.0	120.000	101.0	H	15	16.5
427.966050	25.82	36.00	10.18	1000.0	120.000	101.0	H	323	17.3
550.004700	26.97	36.00	9.03	1000.0	120.000	101.0	H	192	19.3
629.359500	25.33	36.00	10.67	1000.0	120.000	101.0	H	335	21.0
704.884500	29.79	36.00	6.21	1000.0	120.000	101.0	H	335	21.6
755.210400	30.05	36.00	5.95	1000.0	120.000	98.0	H	358	22.7

Plot: RX / Idle mode

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



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
247.265550	9.18	36.00	26.82	1000.0	120.000	170.0	V	142	13.3
375.018600	26.17	36.00	9.83	1000.0	120.000	170.0	H	349	16.5
500.005650	29.47	36.00	6.53	1000.0	120.000	170.0	H	19	18.7
550.000650	27.49	36.00	8.51	1000.0	120.000	101.0	H	167	19.3
704.885850	29.77	36.00	6.23	1000.0	120.000	101.0	H	4	21.6
750.028500	31.75	36.00	4.25	1000.0	120.000	98.0	H	359	22.7

12.12 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:	F > 1 GHz: 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 ☒ OFDM n HT40 – mode ☒ RX / Idle – mode
Test setup:	See sub clause 7.2A
Measurement uncertainty	See sub clause 9

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]
All detected emissions are more than 20 dB below the limit.			All detected emissions are more than 20 dB below the limit.			All detected emissions are more than 20 dB below the limit.		
	Peak			Peak			Peak	
	AVG			AVG			AVG	
	Peak			Peak			Peak	
	AVG			AVG			AVG	

Results: OFDM

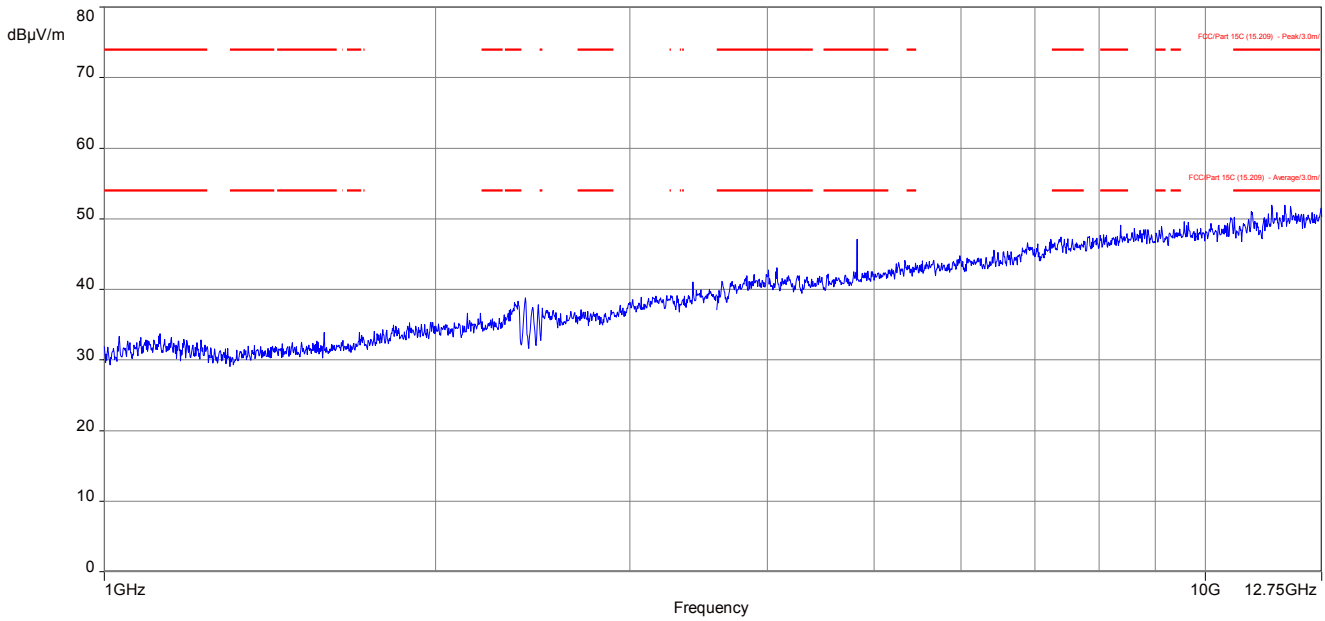
TX Spurious Emissions Radiated [dBµV/m]								
2412 MHz			2437 MHz			2462 MHz		
F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]
All detected emissions are more than 20 dB below the limit.			All detected emissions are more than 20 dB below the limit.			All detected emissions are more than 20 dB below the limit.		
	Peak			Peak			Peak	
	AVG			AVG			AVG	
	Peak			Peak			Peak	
	AVG			AVG			AVG	

Results: RX / idle – mode

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

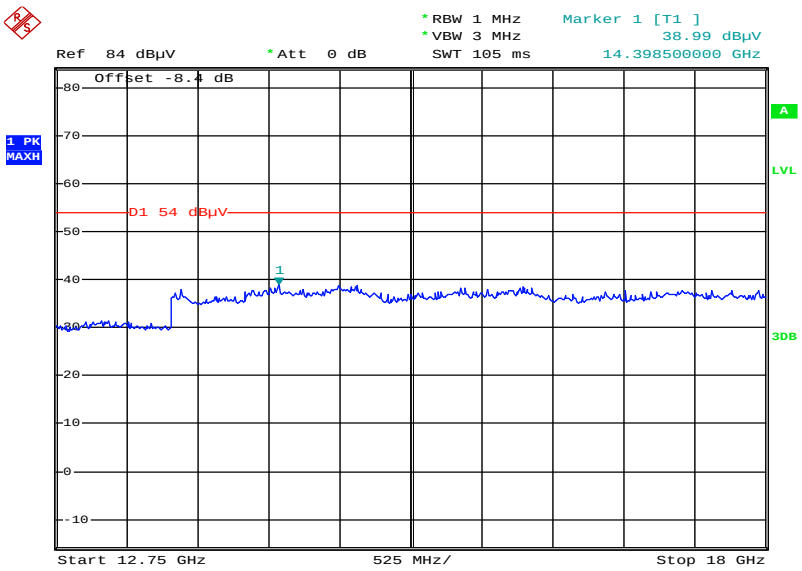
Plots: DSSS

Plot 1: Lowest channel, 1 GHz to 12.75 GHz, vertical & horizontal polarization



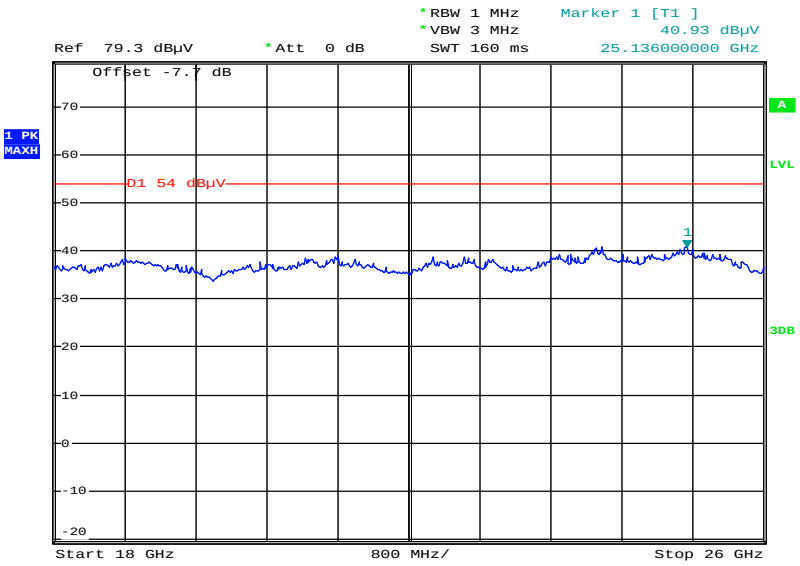
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 2: Lowest channel, 12.75 GHz to 18 GHz, vertical & horizontal polarization

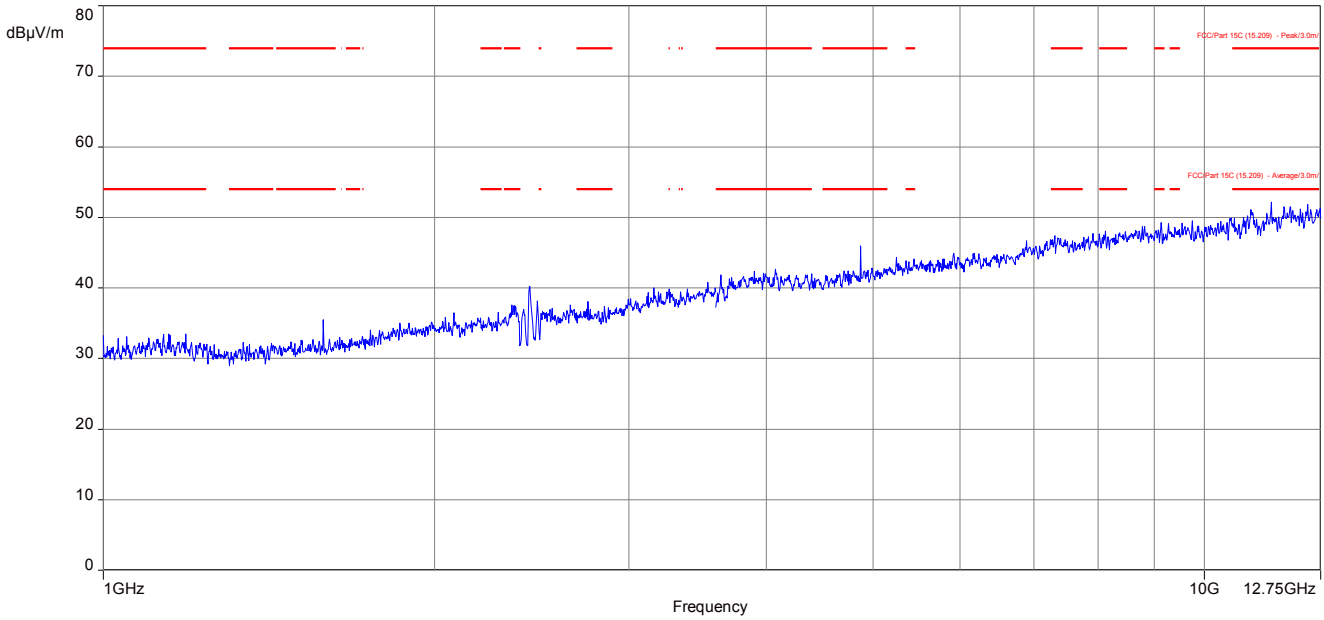


Date: 9.DEC.2015 09:08:01

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

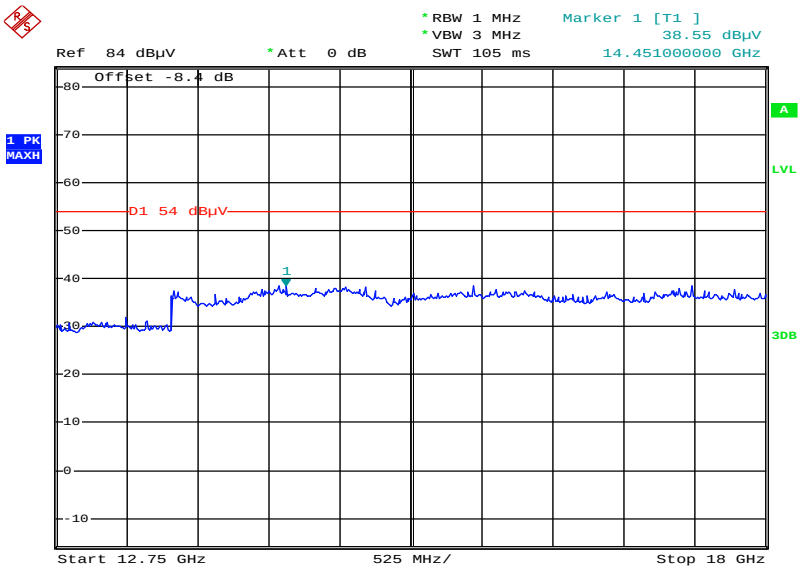


Plot 4: Middle channel, 1 GHz to 12.75 GHz, vertical & horizontal polarization



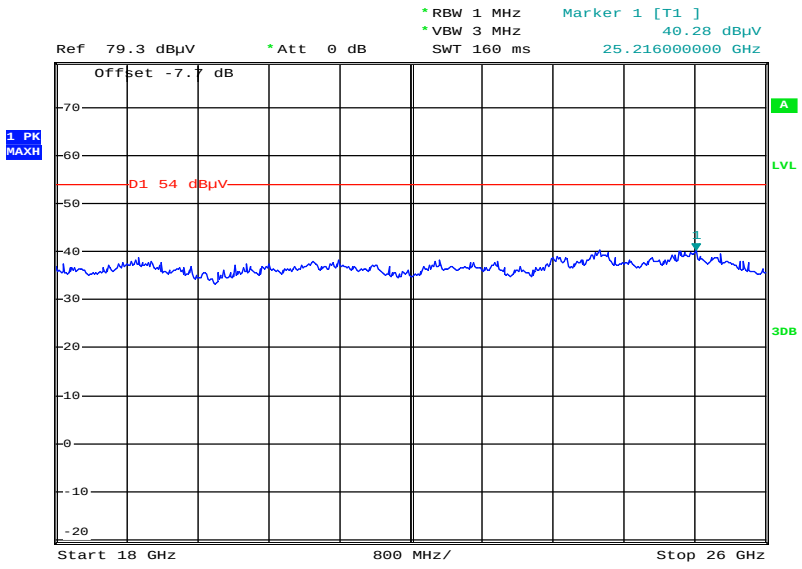
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 5: Middle channel, 12.75 GHz to 18 GHz, vertical & horizontal polarization



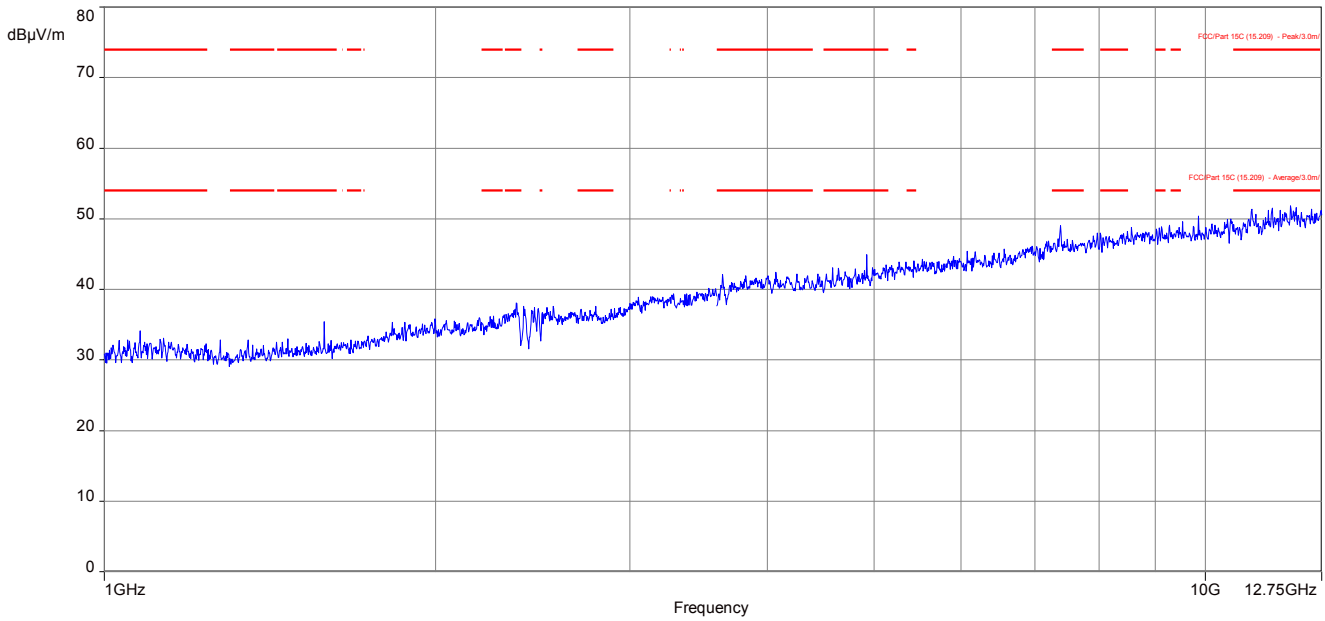
Date: 9.DEC.2015 09:08:50

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



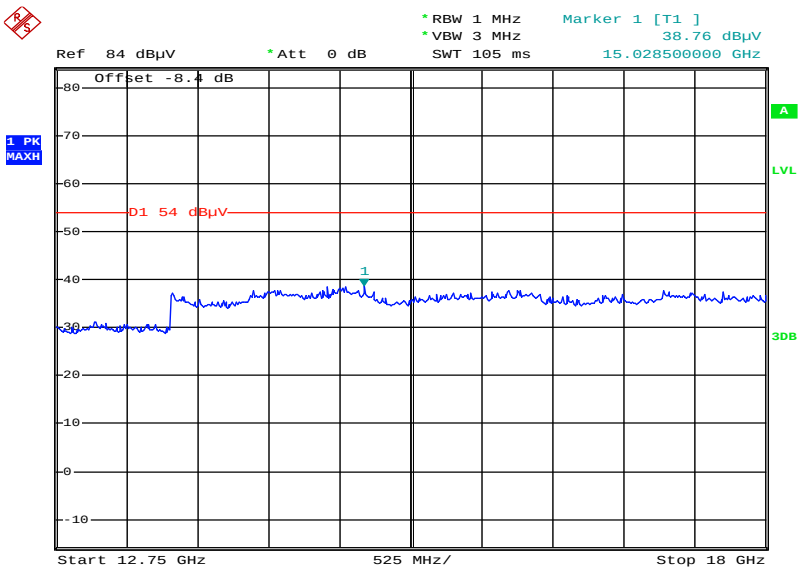
Date: 9.DEC.2015 09:19:03

Plot 7: Highest channel, 1 GHz to 12.75 GHz, vertical & horizontal polarization



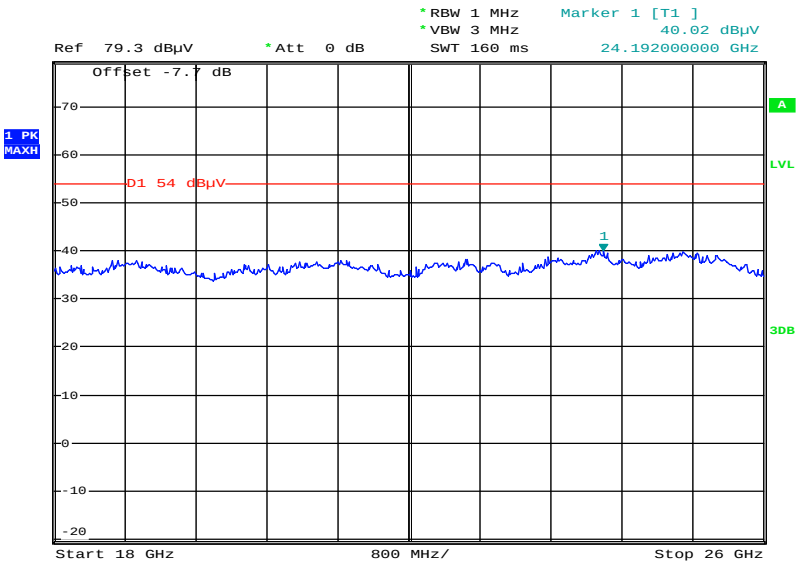
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 8: Highest channel, 12.75 GHz to 18 GHz, vertical & horizontal polarization



Date: 9.DEC.2015 09:09:36

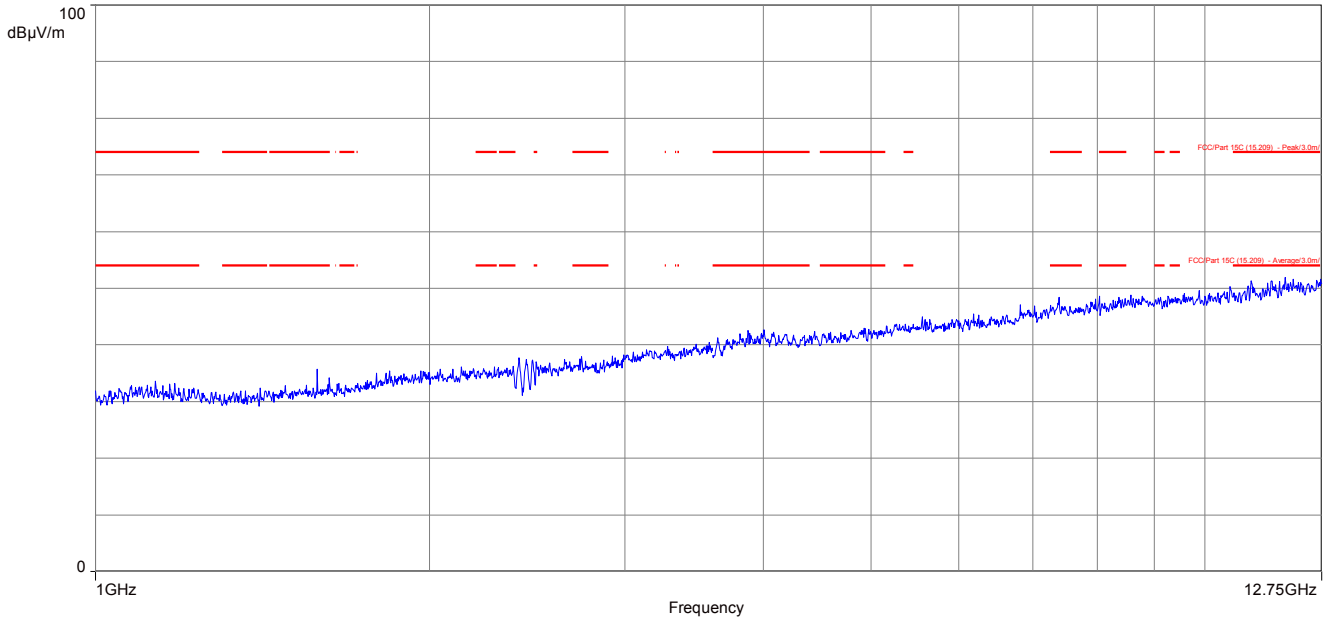
Plot 9: Highest channel, 18 GHz to 26 GHz, vertical & horizontal polarization



Date: 9.DEC.2015 09:19:44

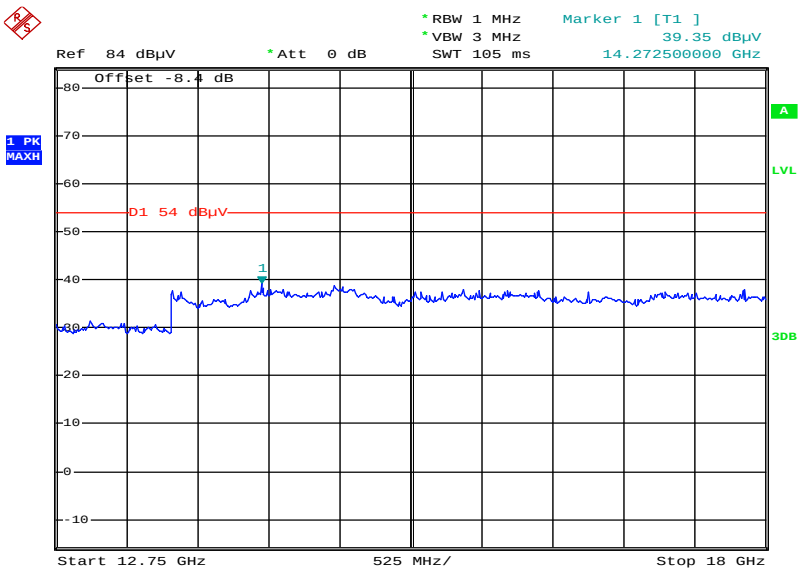
Plots: OFDM gmode

Plot 1: Lowest channel, 1 GHz to 12.75 GHz, vertical & horizontal polarization



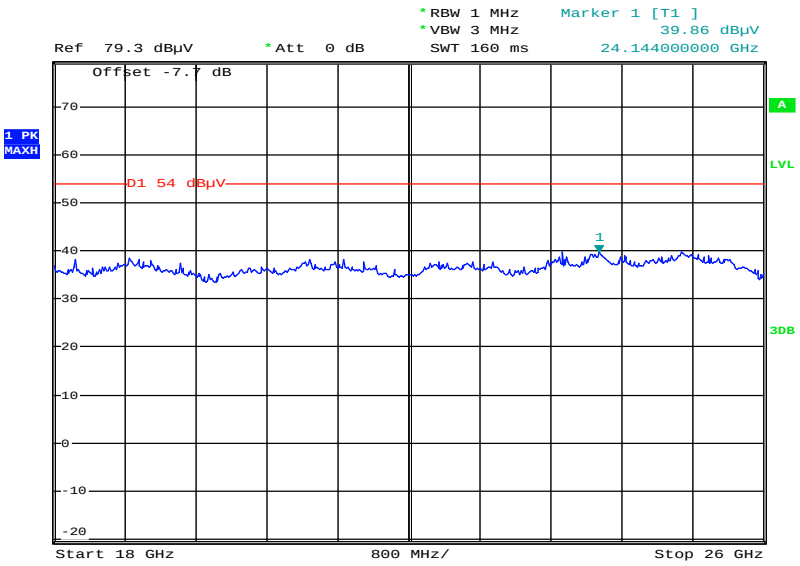
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 2: Lowest channel, 12.75 GHz to 18 GHz, vertical & horizontal polarization

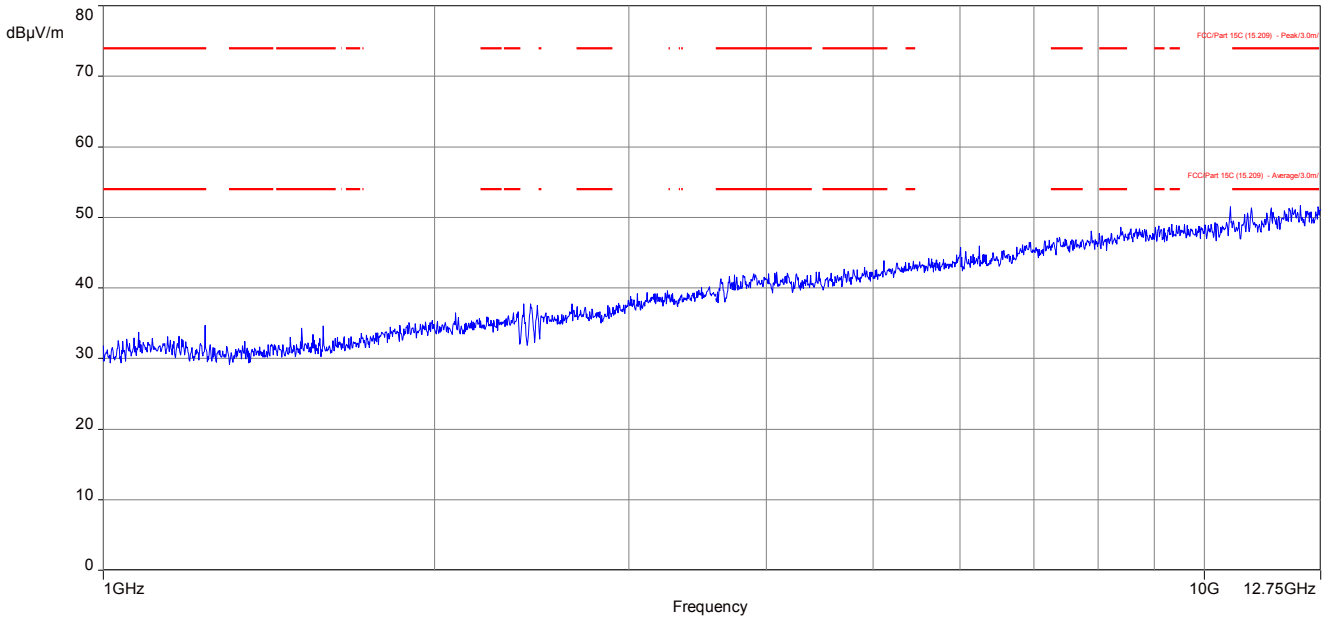


Date: 9.DEC.2015 09:10:57

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

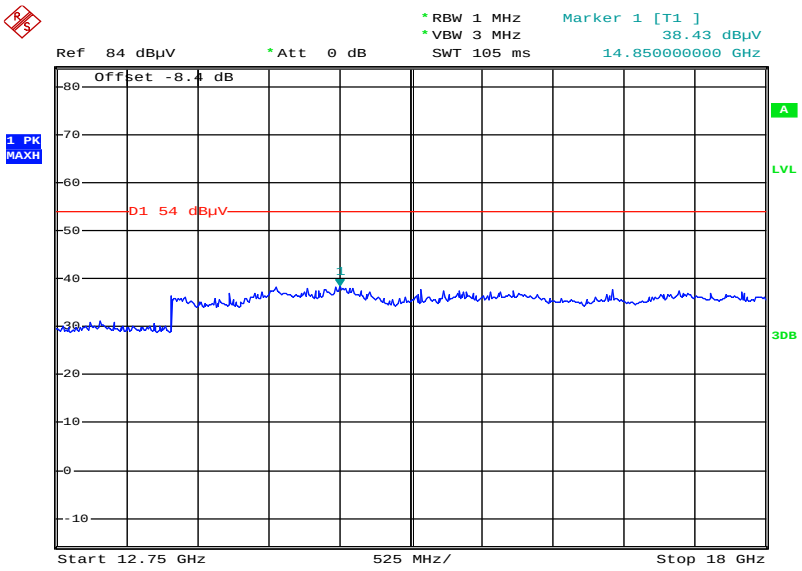


Plot 4: Middle channel, 1 GHz to 12.75 GHz, vertical & horizontal polarization



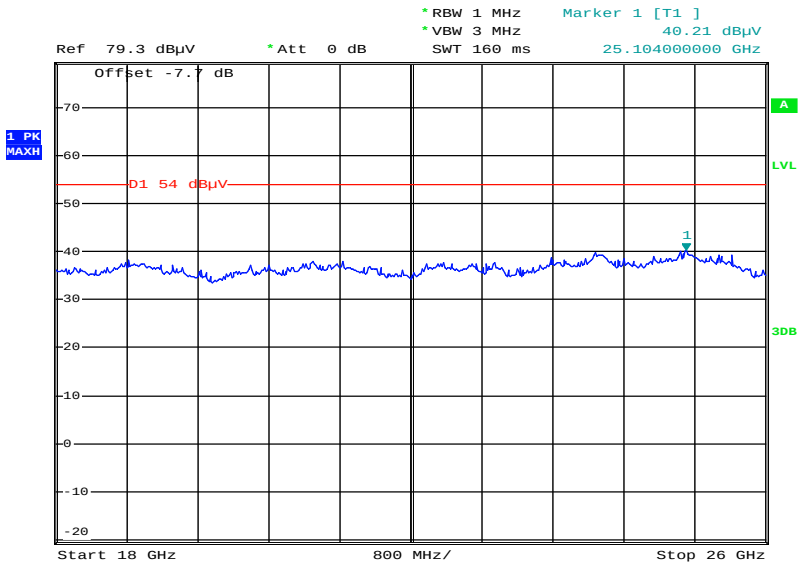
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 5: Middle channel, 12.75 GHz to 18 GHz, vertical & horizontal polarization



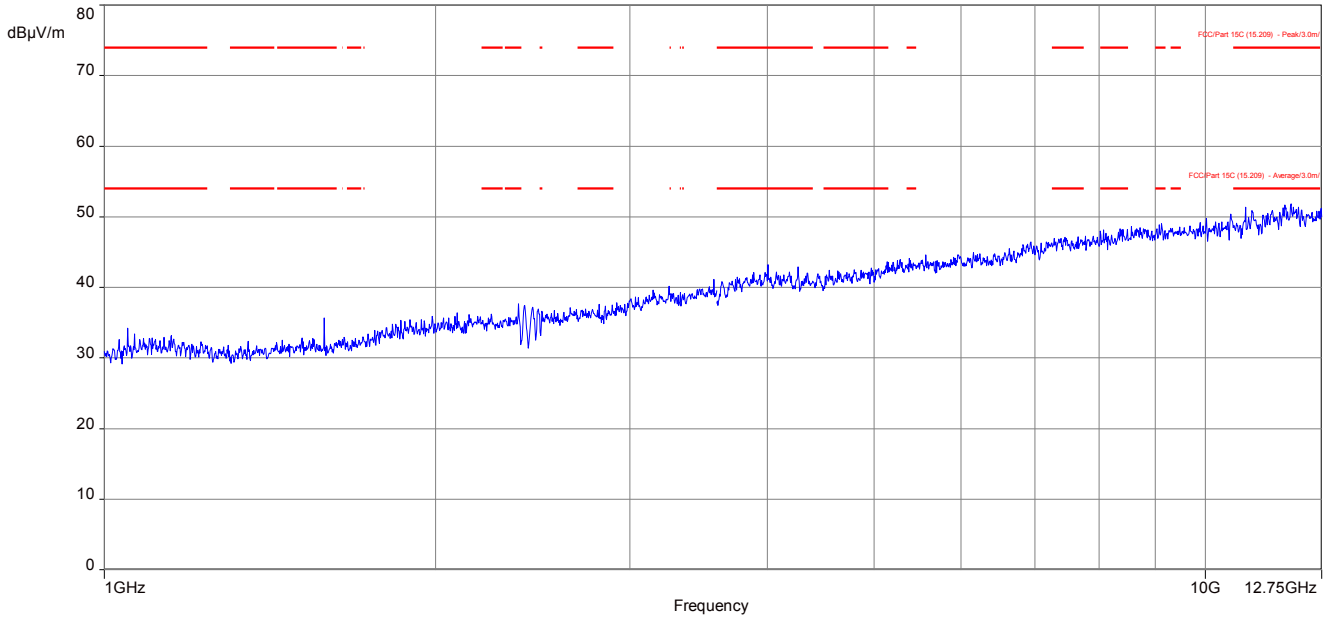
Date: 9.DEC.2015 09:11:23

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



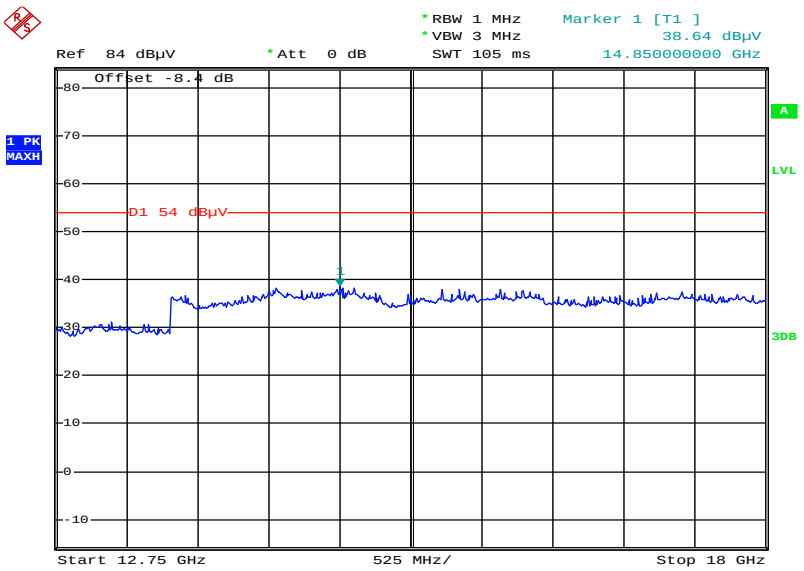
Date: 9.DEC.2015 09:21:12

Plot 7: Highest channel, 1 GHz to 12.75 GHz, vertical & horizontal polarization



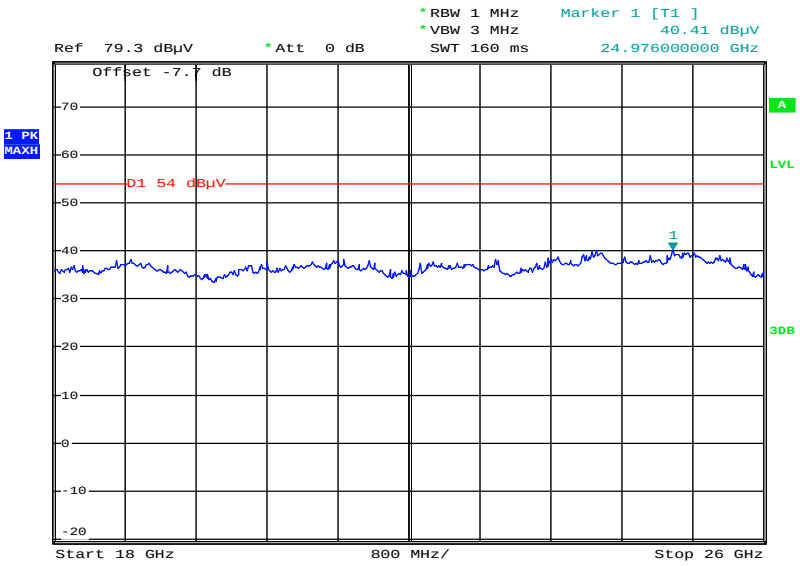
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 8: Highest channel, 12.75 GHz to 18 GHz, vertical & horizontal polarization



Date: 9.DEC.2015 09:12:04

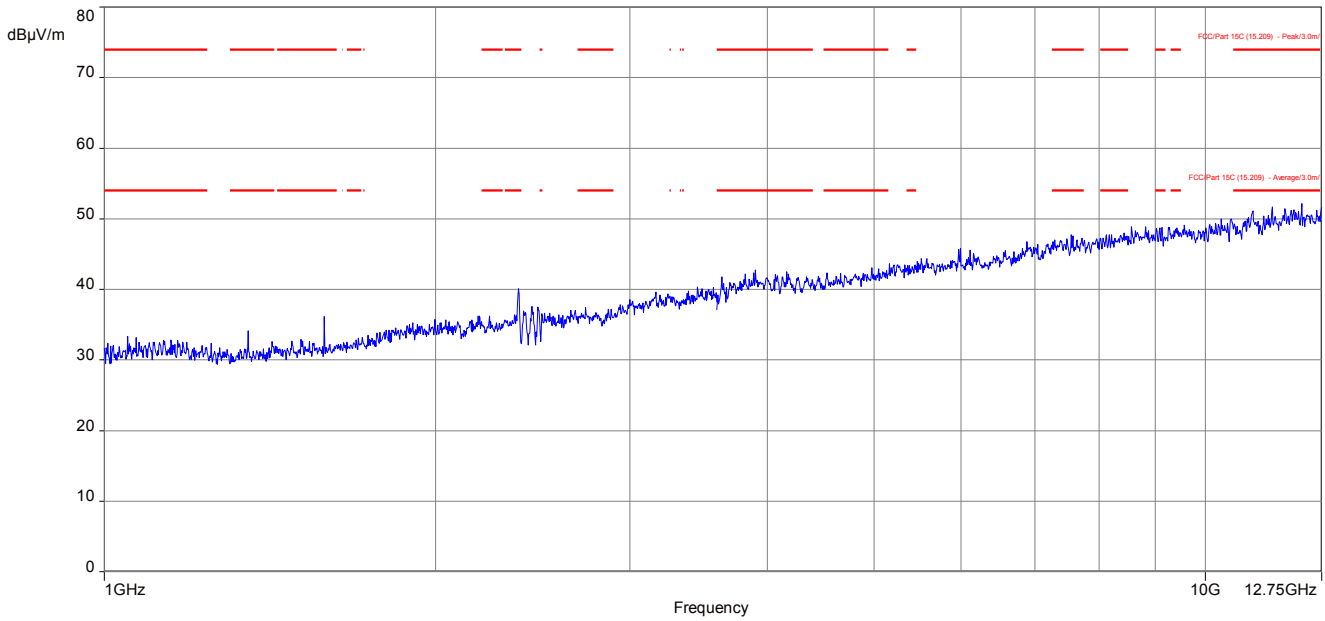
Plot 9: Highest channel, 18 GHz to 26 GHz, vertical & horizontal polarization



Date: 9.DEC.2015 09:21:53

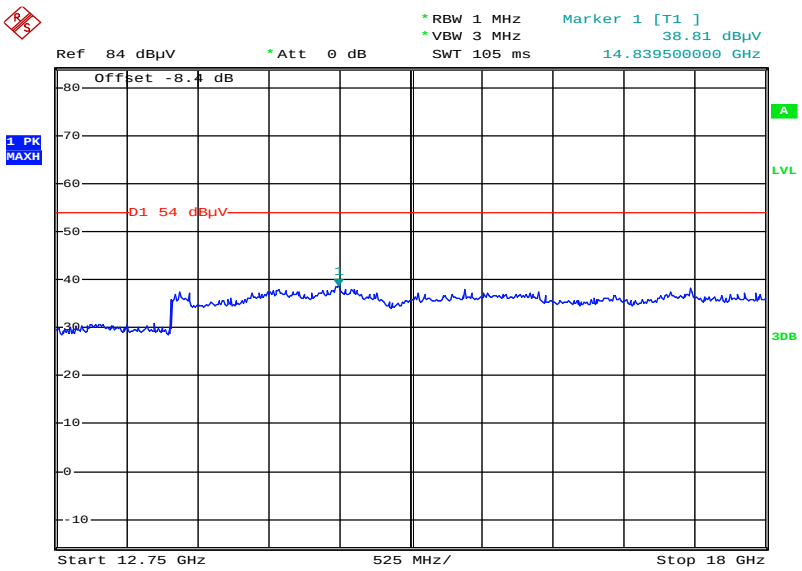
Plots: OFDM HT40-mode

Plot 1: Lowest channel, 1 GHz to 12.75 GHz, vertical & horizontal polarization



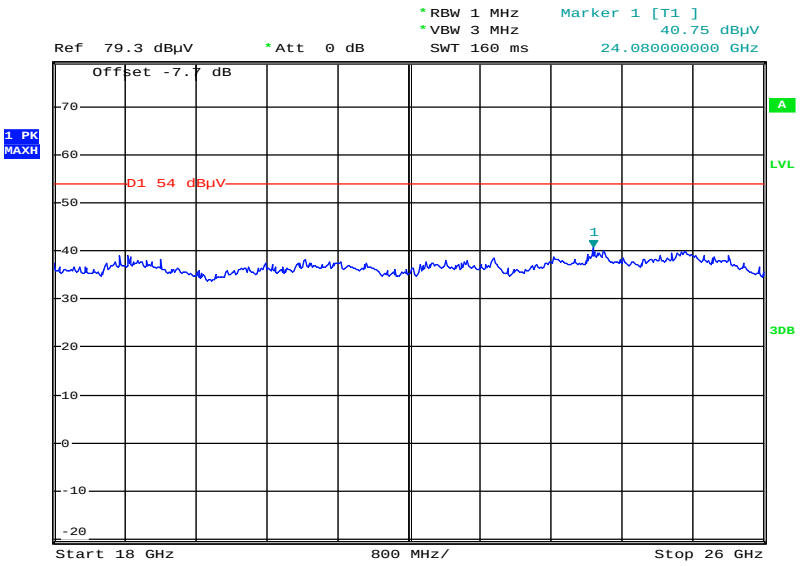
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 2: Lowest channel, 12.75 GHz to 18 GHz, vertical & horizontal polarization

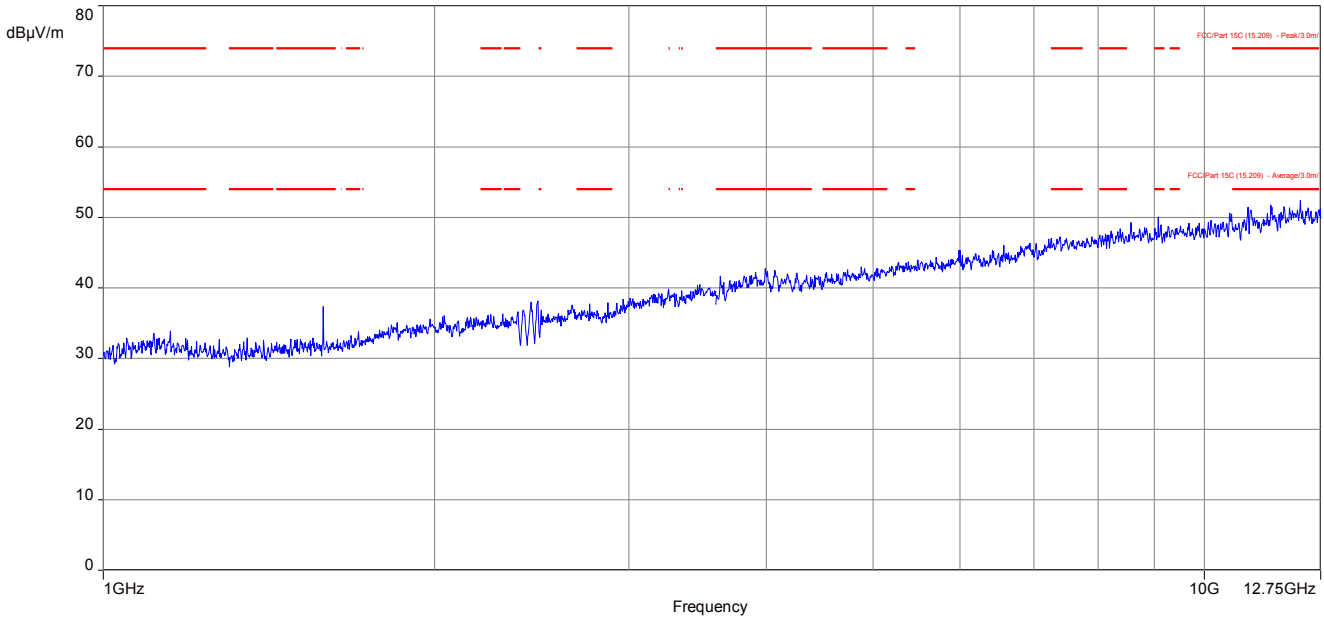


Date: 9.DEC.2015 09:13:03

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

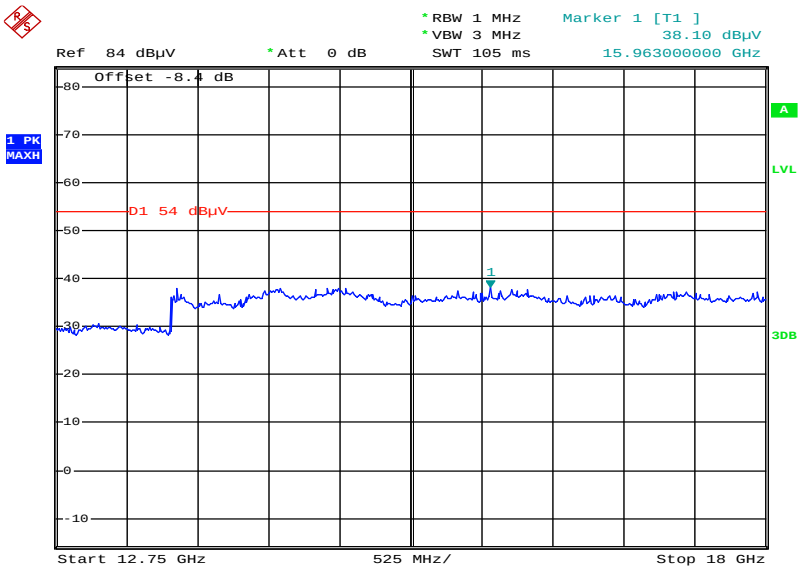


Plot 4: Middle channel, 1 GHz to 12.75 GHz, vertical & horizontal polarization



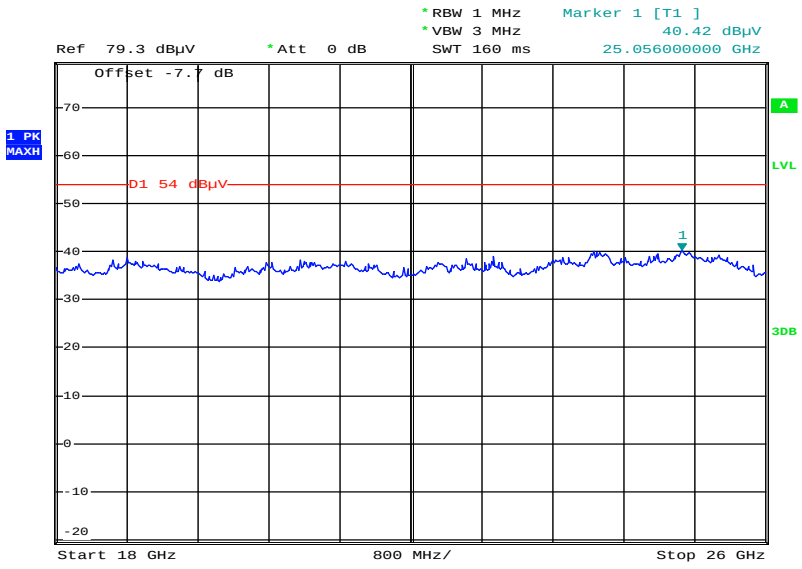
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 5: Middle channel, 12.75 GHz to 18 GHz, vertical & horizontal polarization



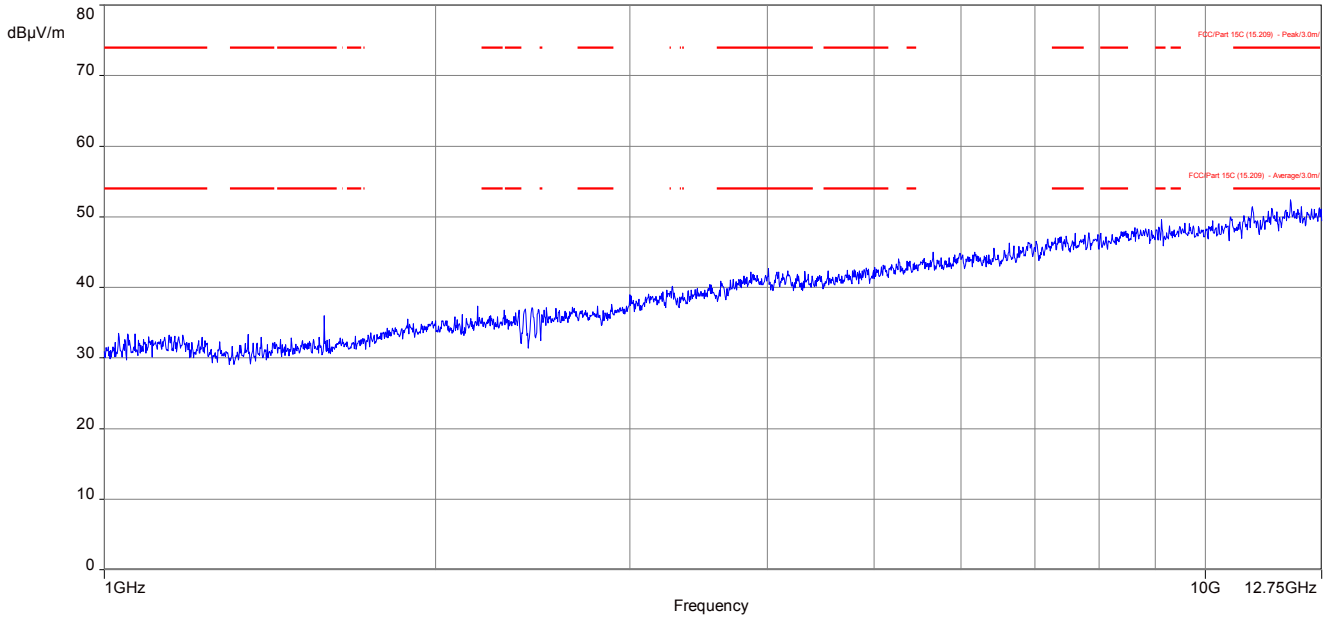
Date: 9.DEC.2015 09:13:43

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



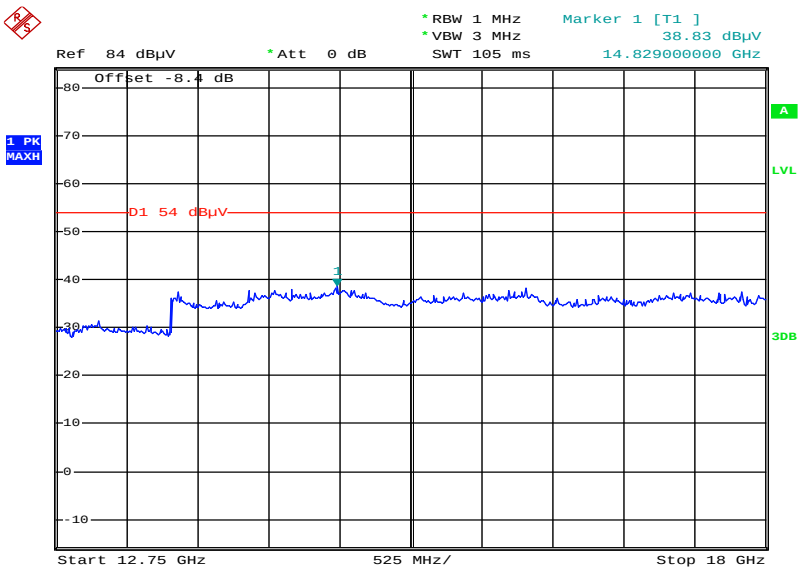
Date: 9.DEC.2015 09:23:56

Plot 7: Highest channel, 1 GHz to 12.75 GHz, vertical & horizontal polarization



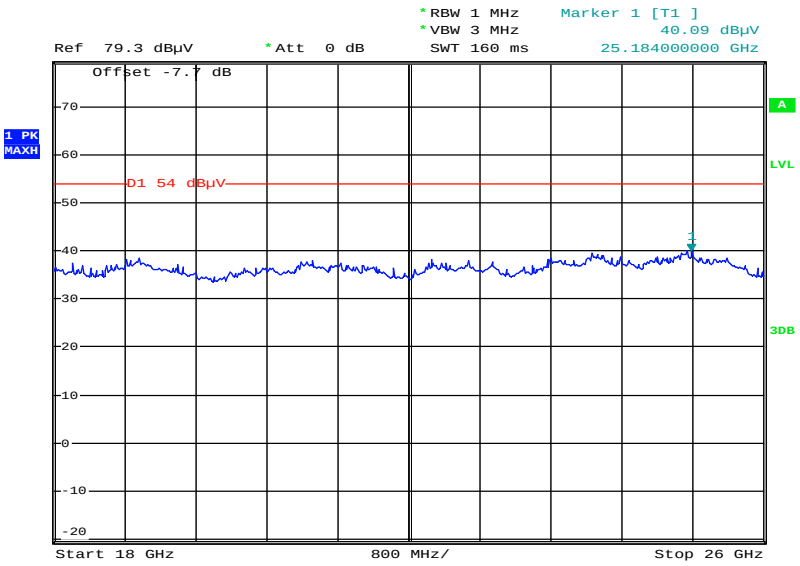
The carrier signal is notched with a 2.4 GHz band rejection filter.

Plot 8: Highest channel, 12.75 GHz to 18 GHz, vertical & horizontal polarization



Date: 9.DEC.2015 09:14:26

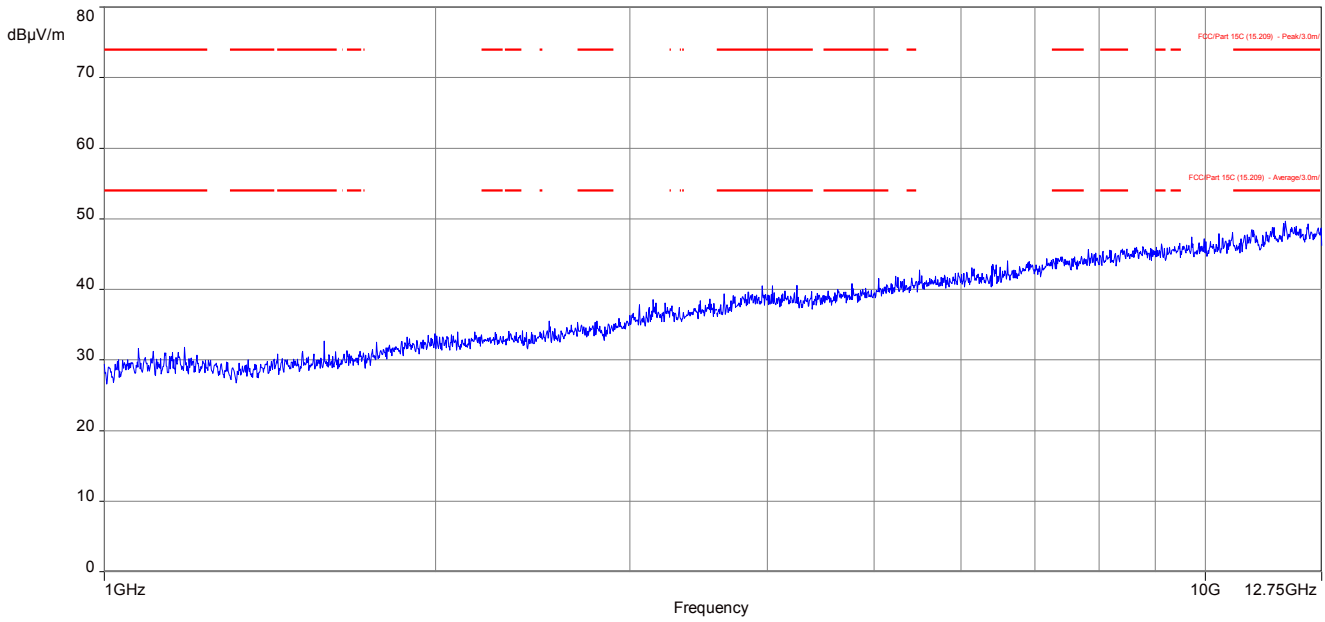
Plot 9: Highest channel, 18 GHz to 26 GHz, vertical & horizontal polarization



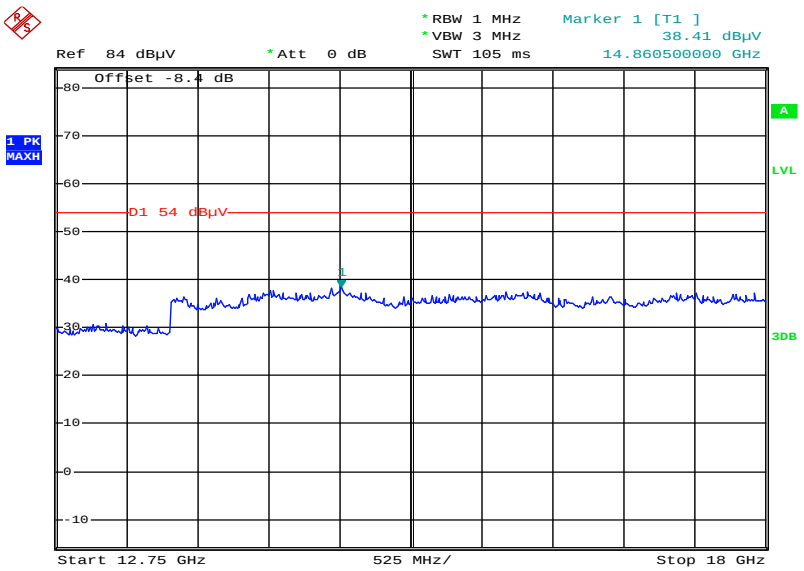
Date: 9.DEC.2015 09:24:18

Plots: RX / idle mode

Plot 1: 1 GHz to 12.75 GHz, vertical & horizontal polarization

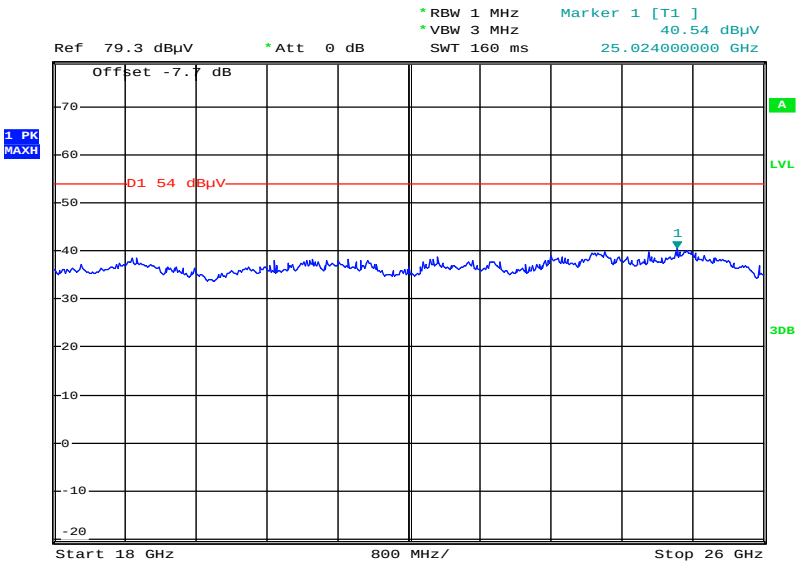


Plot 2: 12.75 GHz to 18 GHz, vertical & horizontal polarization



Date: 9.DEC.2015 09:14:58

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



Date: 9.DEC.2015 09:16:44

12.13 Spurious emissions conducted below 30 MHz (AC conducted)

Description:

Measurement of the conducted spurious emissions in transmit mode below 30 MHz. The EUT is set to channel 6. This measurement is repeated for DSSS and OFDM modulation. 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. Both power lines, phase and neutral line, are measured. Found peaks are remeasured 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 sub clause 7.4
Measurement uncertainty	See sub clause 8

Limits:

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

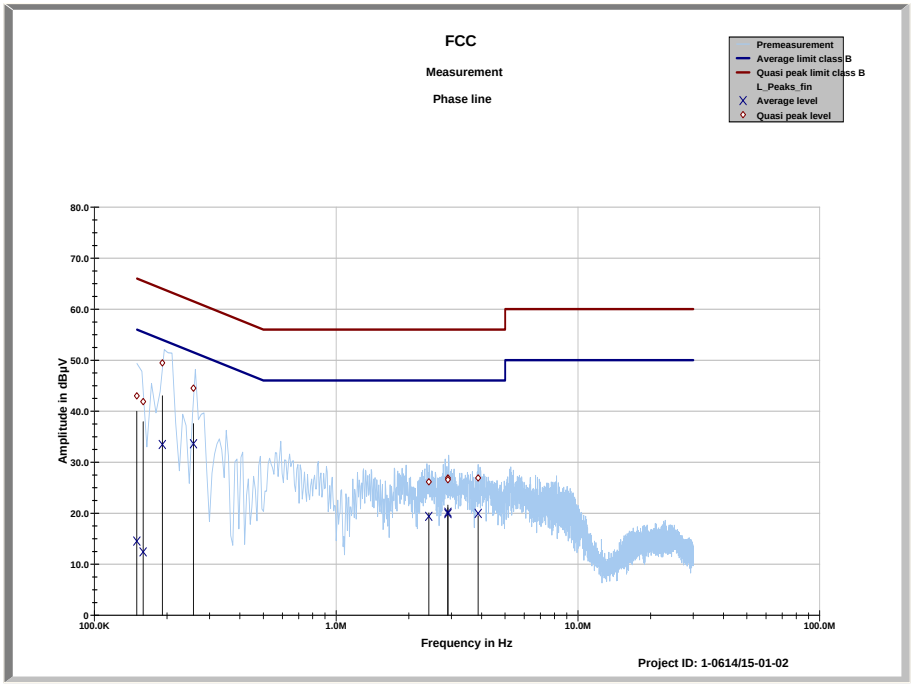
*Decreases with the logarithm of the frequency

Results:

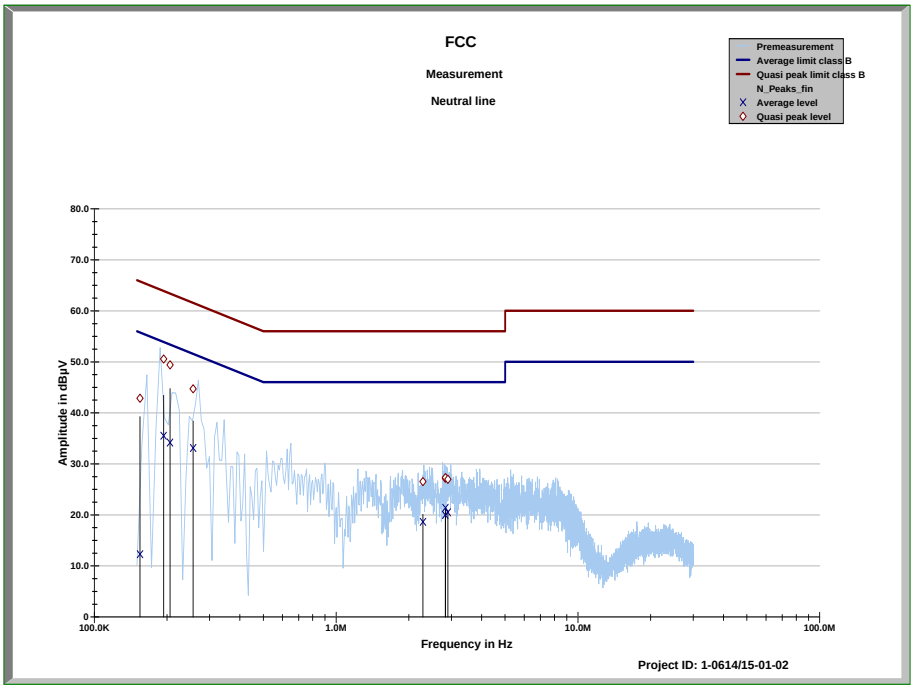
TX Spurious Emissions Conducted < 30 MHz [dBµV/m]		
F [MHz]	Detector	Level [dBµV/m]
All detected peaks are more than 20 dB below the limit.		

Plots:

Plot 1: 150 kHz to 30 MHz, phase line



Plot 2: 150 kHz to 30 MHz, neutral line



13 Observations

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

Annex A Document history

Version	Applied changes	Date of release
	Initial release	2015-12-10

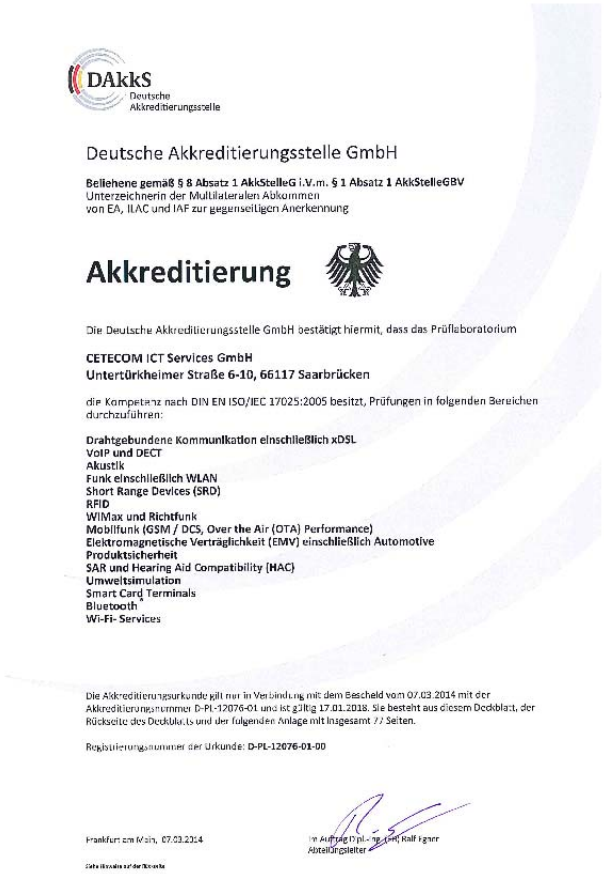
Annex B Further information

Glossary

AVG - Average
DUT - Device under test
EMC - Electromagnetic Compatibility
EN - European Standard
EUT - Equipment under test
ETSI - European Telecommunications Standard Institute
FCC - Federal Communication Commission
FCC ID - Company Identifier at FCC
HW - Hardware
IC - Industry Canada
Inv. No. - Inventory number
N/A - Not applicable
PP - Positive peak
QP - Quasi peak
S/N - Serial number
SW - Software
PMN Product marketing name
HMN Host marketing name
HVIN Hardware version identification number
FVIN Firmware version identification number

Annex C Accreditation Certificate

Front side of certificate



DAkkS
Deutsche Akkreditierungsstelle

Deutsche Akkreditierungsstelle GmbH

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Unterzeichnerin der Multilateralen Abkommen
von EA, ILAC und IAF zur gegenseitigen Anerkennung

Akkreditierung

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CETECOM ICT Services GmbH
Untertürkheimer Straße 6-10, 66117 Saarbrücken

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

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VoIP und DECT
Akustik
Funk einschließlich WLAN
Short Range Devices (SRD)
RFID
WiMax und Richtfunk
Mobilfunk (GSM / DCS, Over the Air (OTA) Performance)
Elektromagnetische Verträglichkeit (EMV) einschließlich Automotive
Produktsicherheit
SAR und Hearing Aid Compatibility (HAC)
Umweltsimulation
Smart Card Terminals
Bluetooth
Wi-Fi- Services

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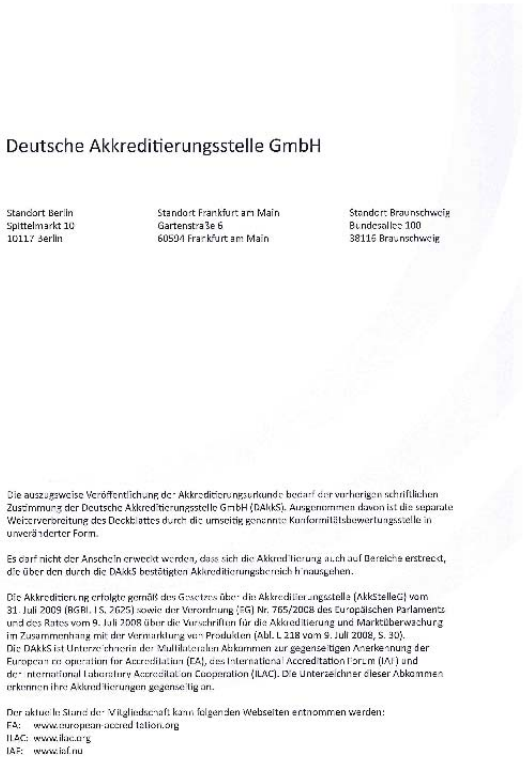
Frankfurt am Main, 07.03.2014

Im Auftrag Dipl.-Ing. (FH) Ralf Egner
Abteilungsleiter

Back side of certificate



Deutsche Akkreditierungsstelle GmbH

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Gartenstraße 6
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38116 Braunschweig

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