
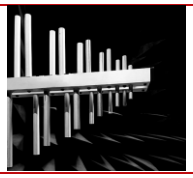
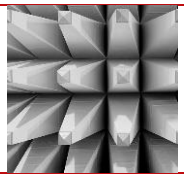

CETECOM™

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consulting - testing - certification ➤➤➤

TEST REPORT

Test report no.: 1-1504/16-01-03

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

Testing laboratory

CETECOM ICT Services GmbH
Untertuerkheimer Strasse 6 – 10
66117 Saarbruecken / Germany
Phone: + 49 681 5 98 - 0
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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-12076-01-01

Applicant

CPAC Systems AB
Bergskroken 3
SE- 431 37 Mölndal / SWEDEN
Phone: +46 31 352 16 00
Fax: -/-
Contact: Lars-Gunnar Sundin
e-mail: lars-gunnar.sundin@cpacsystems.se
Phone: +46 3 17 34 21 96

Manufacturer

CPAC Systems AB
Bergskroken 3
SE- 431 37 Mölndal / SWEDEN

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
RSS - Gen Issue 4	Spectrum Management and Telecommunications Radio Standards Specifications - General Requirements and Information for the Certification of Radio Apparatus

For further applied test standards please refer to section 3 of this test report.

Test Item

Kind of test item:	**WLAN Slave Device (IEEE 802.11 a/n) with Hi-gain antenna**
Model name:	**CICU**
FCC ID:	**EUT: AHV-CPAC1054** **Module: U-BLOX ODIN-W260: FCC ID: PVH0965**
IC:	**EUT: 10111A- CPAC1054** **Module: U-BLOX ODIN-W260: 5325A-0965**
Frequency:	UNII band 5150 MHz to 5250 MHz
Technology tested:	WLAN (OFDM/a-; n HT20 & n HT40-mode)
Antenna:	External Huber+Suhner antenna type 1354.17.0001 with 7.5 m coaxial feed cable
Power supply:	24 V DC by external power supply
Temperature range:	-40°C to +85°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=Andreas Luckenbill, o=CETECOM ICT Services GmbH, ou=LUC-111202, email=andreas.luckenbill@cetecom.com, c=DE
2016.05.19 15:20:44 +02'00'

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Lab Manager
Radio Communications & EMC

Test performed:

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2016.05.19 15:17:30 +02'00'

Marco Bertolino
Lab Manager
Radio Communications & EMC

1 Table of contents

2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. 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:	2016-04-27
Date of receipt of test item:	2016-05-09
Start of test:	2016-05-09
End of test:	2016-05-18
Person(s) present during the test:	-/-

3 Test standard/s and references

Test standard	Date	Description
47 CFR Part 15	-/-	Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 247 Issue 1	May 2015	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence - Exempt Local Area Network (LE-LAN) Devices
RSS - Gen Issue 4	November 2014	Spectrum Management and Telecommunications Radio Standards Specifications - General Requirements and Information for the Certification of Radio Apparatus

Guidance	Version	Description
UNII: KDB 789033 D02	v01r02	Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E
ANSI C63.4-2014	-/-	American national standard for methods of measurement of radio-noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz
ANSI C63.10-2013	-/-	American national standard of procedures for compliance testing of unlicensed wireless devices

4 Test environment

Temperature	:	T_{nom} T_{max} T_{min}	+22 °C during room temperature tests No tests under extreme conditions required. No tests under extreme conditions required.
Relative humidity content	:		55 %
Barometric pressure	:		not relevant for this kind of testing
Power supply	:	V_{nom} V_{max} V_{min}	24 V DC by external power supply No tests under extreme conditions required. No tests under extreme conditions required.

5 Test item

5.1 General description

Kind of test item	:	WLAN Slave Device (IEEE 802.11 a/n) with Hi-gain antenna
Type identification	:	CICU
HMN	:	-/-
PMN	:	CPAC-1054
HVIN	:	CPAC-1054
FVIN	:	-/-
S/N serial number	:	Radiated unit: 00002221 Conducted unit: 00002224 Photos: 00002217
HW hardware status	:	R7A
SW software status	:	2.2.1
FW firmware status	:	1.0.0
Frequency band	:	UNII band 5150 MHz to 5250 MHz (lowest channel 5180 MHz; highest channel 5240 MHz)
Type of radio transmission Use of frequency spectrum	: :	OFDM
Type of modulation	:	BPSK, QPSK, 16 – QAM, 64 – QAM
Number of channels	:	20 MHz channels: 4 40 MHz channels: 2
Antenna	:	External Huber+Suhner antenna type 1354.17.0001 with 7.5 m coaxial feed cable
Power supply	:	24 V DC by external power supply
Temperature range	:	-40°C to +85°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: 1-1504/16-01-01_AnnexA
1-1504/16-01-01_AnnexB
1-1504/16-01-01_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).

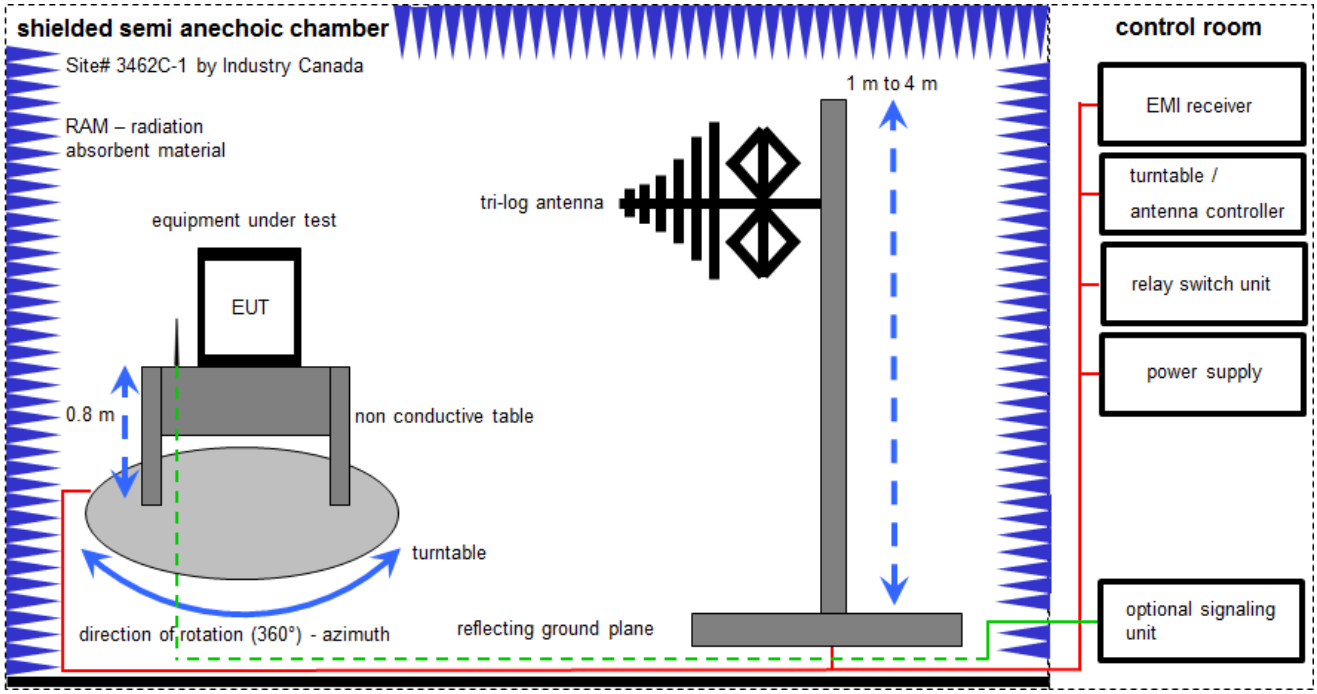
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

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

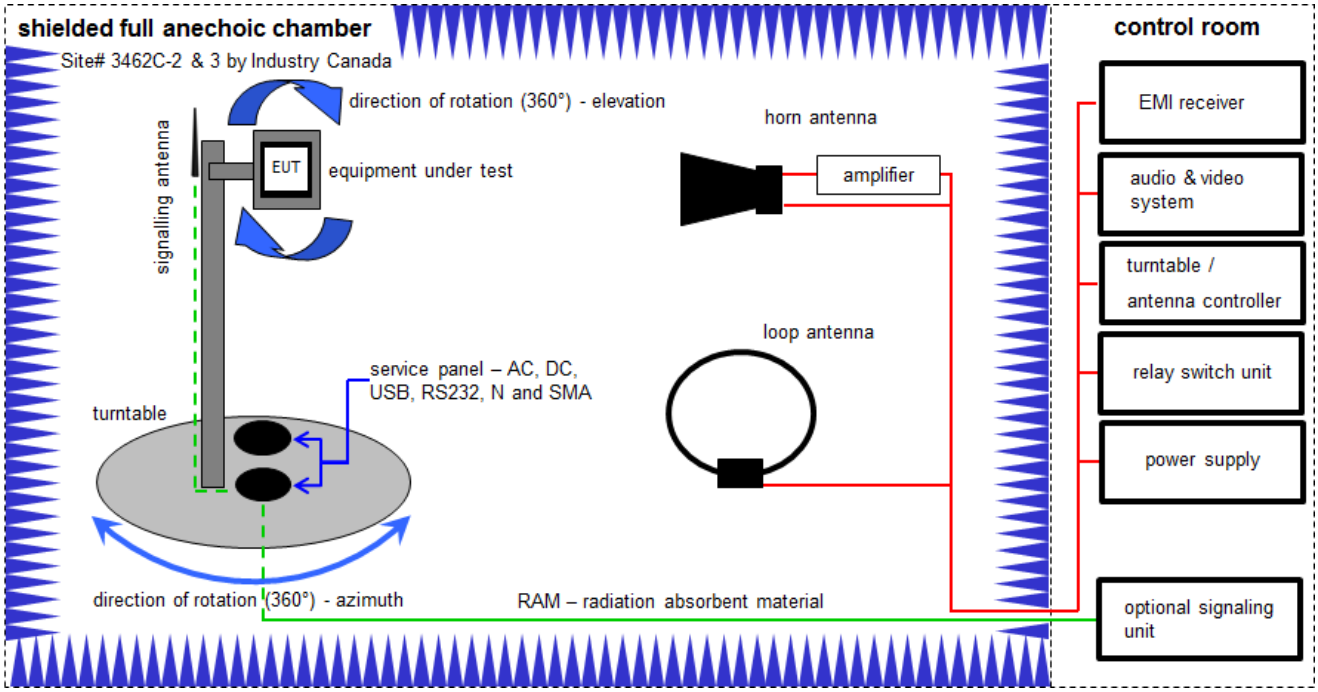
FS = UR + CL + AF
(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

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	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	26.01.2016	27.01.2017
2	A	Analyzer-Reference-System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	Ve	02.02.2016	02.02.2018
3	A	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw	-/-	-/-
4	A	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw	-/-	-/-
5	A	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw	-/-	-/-
6	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 / 1 meter

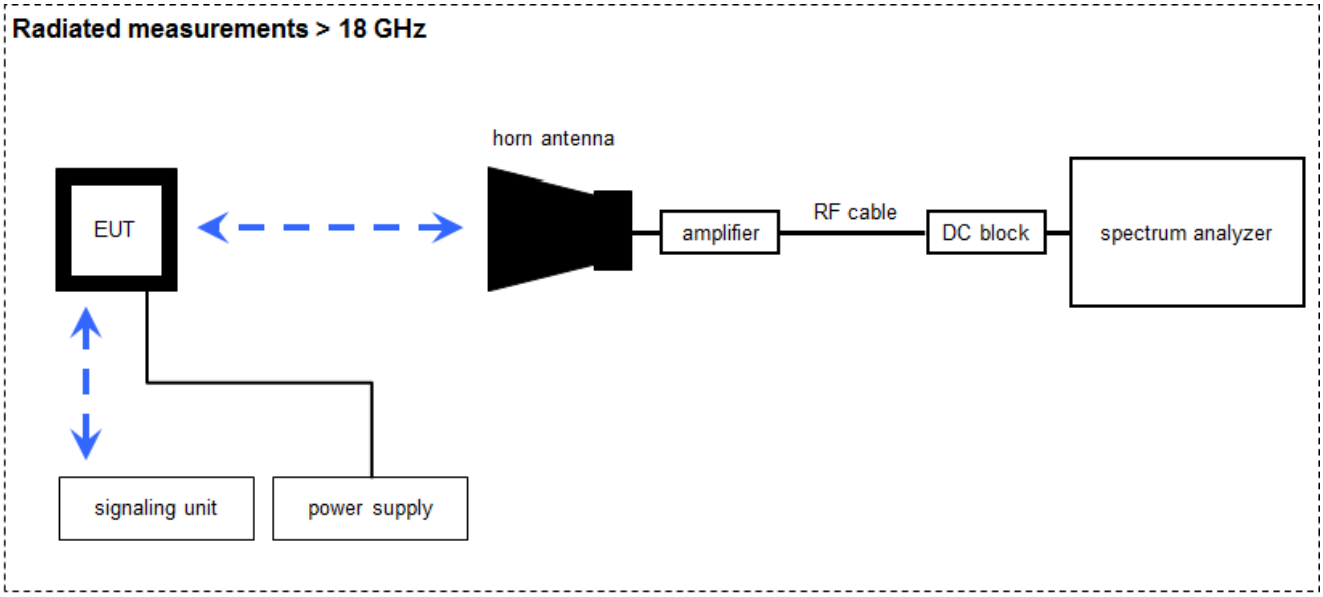
FS = UR + CA + AF
(FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

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

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A, B	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2818A03450	300001040	Ve	20.01.2015	20.01.2018
2	A	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	vlKl!	20.05.2015	20.05.2017
3	A, B	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
4	A, B	Switch / Control Unit	3488A	HP	*	300000199	ne	-/-	-/-
5	A, B	Active Loop Antenna 10 kHz to 30 MHz	6502	EMCO/2	8905-2342	300000256	k	24.06.2015	24.06.2017
6	A	Amplifier	js42-00502650-28-5a	Parzich GMBH	928979	300003143	ne	-/-	-/-
7	A	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	18	300003789	ne	-/-	-/-
8	A	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne	-/-	-/-
9	A, B	EMI Test Receiver 9kHz-26,5GHz	ESR26	R&S	101376	300005063	k	04.09.2015	04.09.2016
10	C	Signal Analyzer	FSV40	R&S	101042	300004517	k	21.01.2016	21.01.2017
11	C	Amplifier 2-40 GHz	JS32-02004000-57-5P	MITEQ	1777200	300004541	ev	-/-	-/-
12	C	RF-Cable	ST18/SMAm/SMAm/48	Huber & Suhner	Batch no. 600918	400001182	ev	-/-	-/-
13	C	RF-Cable	ST18/SMAm/SMm/48	Huber & Suhner	Batch no. 127377	400001183	ev	-/-	-/-
14	C	DC-Blocker 0.1-40 GHz	8141A	Inmet	Batch no. 606844	400001185	ev	-/-	-/-
15	C	Std. Gain Horn Antenna 12.4 to 18.0 GHz	639	Narda	8402	300000787	k	14.08.2015	14.08.2017

7.3 Radiated measurements > 18 GHz



Measurement distance: horn antenna 50 cm

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

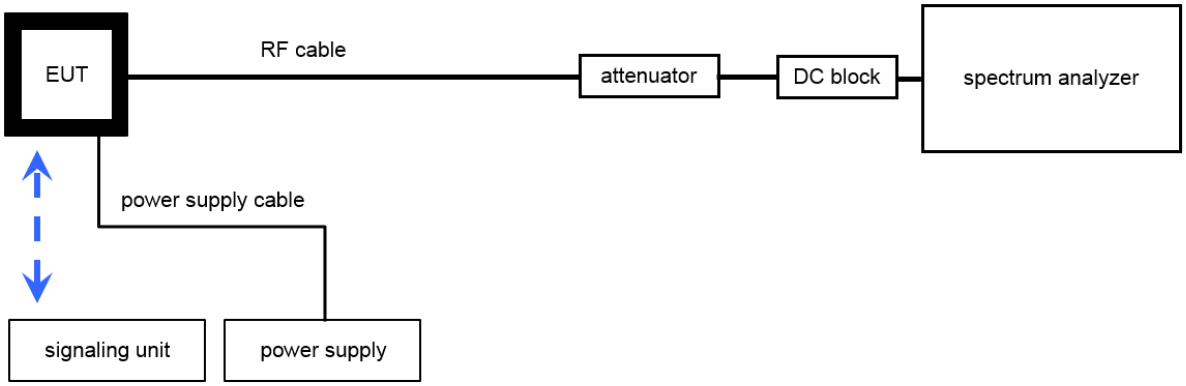
Example calculation:
FS [dBµV/m] = 40.0 [dBµV/m] + (-60.1) [dB] + 36.74 [dB/m] = 16.64 [dBµV/m] (6.79 µV/m)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	Signal Analyzer 40 GHz	FSV40	R&S	101042	300004517	k	21.01.2016	21.01.2017
2	A	Amplifier 2-40 GHz	JS32-02004000-57-5P	MITEQ	1777200	300004541	ev	-/-	-/-
3	A	RF-Cable	ST18/SMAm/SMAm/48	Huber & Suhner	Batch no. 600918	400001182	ev	-/-	-/-
4	A	RF-Cable	ST18/SMAm/SMm/48	Huber & Suhner	Batch no. 127377	400001183	ev	-/-	-/-
5	A	DC-Blocker 0.1-40 GHz	8141A	Inmet	Batch no. 606844	400001185	ev	-/-	-/-
6	A	Std. Gain Horn Antenna 18.0 to 26.5 GHz	638	Narda	8402	300000486	k	10.09.2015	10.09.2017
7	A	Std. Gain Horn Antenna 26.5 to 40.0 GHz	V637	Narda	82-16	300000510	k	14.08.2015	14.08.2017

7.4 Conducted measurements

Conducted measurements normal conditions



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

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

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A, B	PC-WLAN Tester	Intel Core i3 3220/3,3 GHz, Prozessor	-/-	2V2403033A4523	300004589	ne	-/-	-/-
2	A, B	Teststand	Teststand Custom Sequence Editor	National Instruments GmbH	2V2403033A4523	300004590	ne	-/-	-/-
3	A, B	RF-Cable	ST18/SMAm/SMAm/60	Huber & Suhner	Batch no. 606844	400001181	ev	-/-	-/-
4	A, B	DC-Blocker 0.1-40 GHz	8141A	Inmet	Batch no. 606844	400001185	ev	-/-	-/-
5	B	Signal Analyzer 40 GHz	FSV40	R&S	101042	300004517	k	21.01.2016	21.01.2017
6	A	NRP Power meter Display and control unit AC sup	NRP	R&S	100212	300003780	vlKI!	25.01.2016	24.01.2017
7	A, B	Coax Attenuator 10 dB 2W 0-40 GHz	MCL BW-K10-2W44+	Mini Circuits	Batch no. 127377	400001186	ev	-/-	-/-
8	A, B	Switch / Control Unit	3488A	HP	2719A15013	300000151	ne	-/-	-/-

8 Sequence of testing

8.1 Sequence of testing radiated spurious 9 kHz to 30 MHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, 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 18 GHz

Setup

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

Premeasurement

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

Final measurement

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

8.4 Sequence of testing radiated spurious above 18 GHz

Setup

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

Premeasurement

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

Final measurement

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

9 Measurement uncertainty

Measurement uncertainty	
Test case	**Uncertainty**
Antenna gain	± 3 dB
Power spectral density	± 1.5 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	2016-05-19	-/-

Test specification clause	Test case	Temperature conditions	Power source voltages	C	NC	NA	NP	Remark
-/-	Output power verification (conducted)	Nominal	Nominal	-/-				-/-
-/-	Gain	Nominal	Nominal	-/-				Declared
U-NII Part 15	Duty cycle	Nominal	Nominal	-/-				-/-
§15.407(a) RSS - 247 (6.2.1) (1) RSS - 247 (6.2.2) (1) RSS - 247 (6.2.3) (1) RSS - 247 (6.2.4) (1)	Maximum output power (conducted & radiated)	Nominal	Nominal	☒	☐	☐	☐	-/-
§15.407(a) RSS - 247 (6.2.1) (1) RSS - 247 (6.2.2) (1) RSS - 247 (6.2.3) (1) RSS - 247 (6.2.4) (1)	Power spectral density	Nominal	Nominal	☒	☐	☐	☐	-/-
§15.407(a)	Spectrum bandwidth 26dB bandwidth	Nominal	Nominal	☒	☐	☐	☐	-/-
RSS Gen clause 6.6	Spectrum bandwidth 99% bandwidth	Nominal	Nominal	-/-				-/-
§15.407(a)	Peak excursion measurements	Nominal	Nominal	☒	☐	☐	☐	-/-
§15.205 RSS - 247 (6.2.1) (2) RSS - 247 (6.2.2) (2) RSS - 247 (6.2.3) (2) RSS - 247 (6.2.4) (2)	Band edge compliance radiated	Nominal	Nominal	☒	☐	☐	☐	-/-
§15.407(b) RSS - 247 (6.2.1) (2) RSS - 247 (6.2.2) (2) RSS - 247 (6.2.3) (2) RSS - 247 (6.2.4) (2)	TX spurious emissions radiated	Nominal	Nominal	☒	☐	☐	☐	-/-
§15.109 RSS-Gen	RX spurious emissions radiated	Nominal	Nominal	☒	☐	☐	☐	-/-
§15.209(a) RSS-Gen	Spurious emissions radiated < 30 MHz	Nominal	Nominal	☒	☐	☐	☐	-/-
§15.107(a) §15.207	Spurious emissions conducted emissions < 30 MHz	Nominal	Nominal	☐	☐	☒	☐	No mains connection – vehicle system!

Note: C = Compliant; NC = Not Compliant; NA = Not Applicable; NP = Not Performed

11 Additional comments

Reference documents: Cetecom_Customer_Questionnaire
HUBER+SUHNER_1354.17.0001_dataSheet.pdf

Special test descriptions: None

Configuration descriptions: Used test commands:

OFDM / a – mode:	at+uprodwtx=1,36,4,16,15000,20
OFDM / n HT20 – mode:	at+uprodwtx=1,36,13,16,15000,20
OFDM / n HT40 – mode:	at+uprodwtx=1,40,13,18,15000,20

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 Identify worst case data rate

Measurement:

All modes of the module will be measured with an average power meter to identify the maximum transmission power on low, mid and high channel. In the case that only one or two channels are available, only these will be measured.

In further tests only the identified worst case modulation scheme or bandwidth will be measured.
Additional the band edge compliance test will be performed in the lowest and highest modulation scheme.

Measurement:

Measurement parameter	
power meter	
Test setup:	See sub clause 7.4 – A
Measurement uncertainty:	See sub clause 9

Results:

Modulation	Modulation scheme / bandwidth
Frequency	UNII band 5150 MHz to 5250 MHz (channel 36)
OFDM / a – mode	6 Mbit/s
OFDM / n HT20 – mode	MCS0
Frequency	UNII band 5150 MHz to 5250 MHz (channel 38)
OFDM / n HT40 – mode	MCS0

12.2 Gain

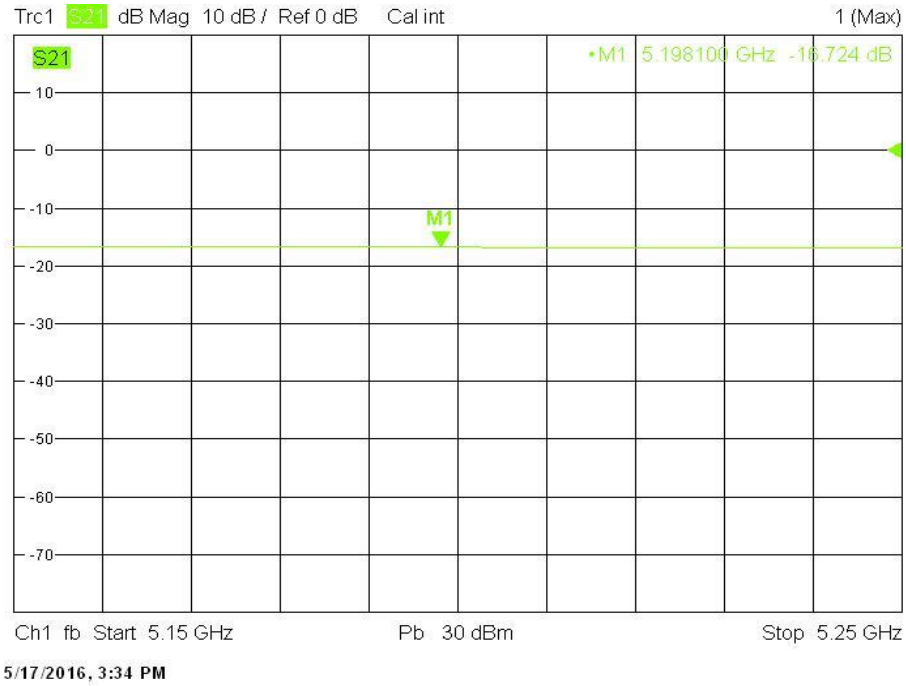
Limits:

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

Results:

T_{nom}	V_{nom}	UNII bands
Gain [dBi] According antenna datasheet & cable loss measurement		6.3 dBi (Directivity 23 dBi - Cable attenuation 16.7 dB for a 7.5 m coaxial feed cable)

Plot 1: cable loss (7.5 m cable + connector)



12.3 Duty cycle

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	10 MHz
Video bandwidth:	10 MHz
Span:	Zero
Trace mode:	Video trigger / view / single sweep
Test setup:	See sub clause 7.4 – B
Measurement uncertainty:	See sub clause 9

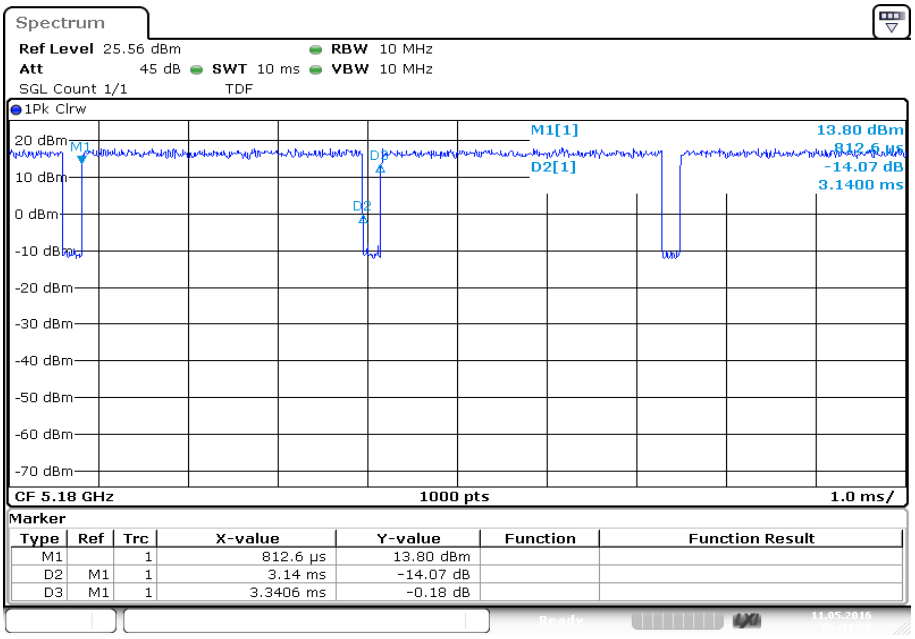
Results:

Duty cycle and correction factor: example for one channel

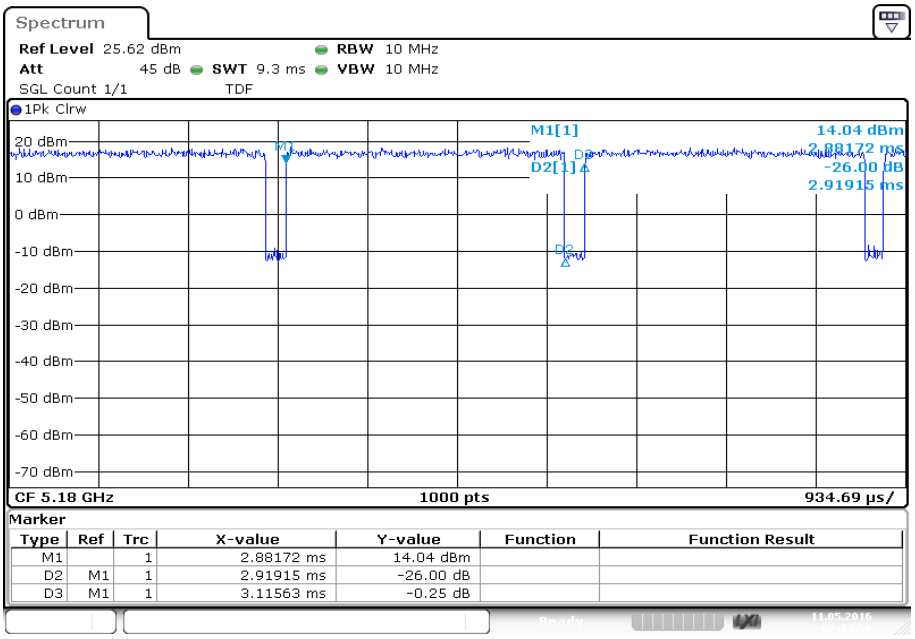
OFDM / a – mode:	94.0 % duty cycle	=>	0.27 dB
OFDM / n HT20 – mode:	93.7 % duty cycle	=>	0.28 dB
OFDM / n HT40 – mode:	87.7 % duty cycle	=>	0.57 dB

Plots:

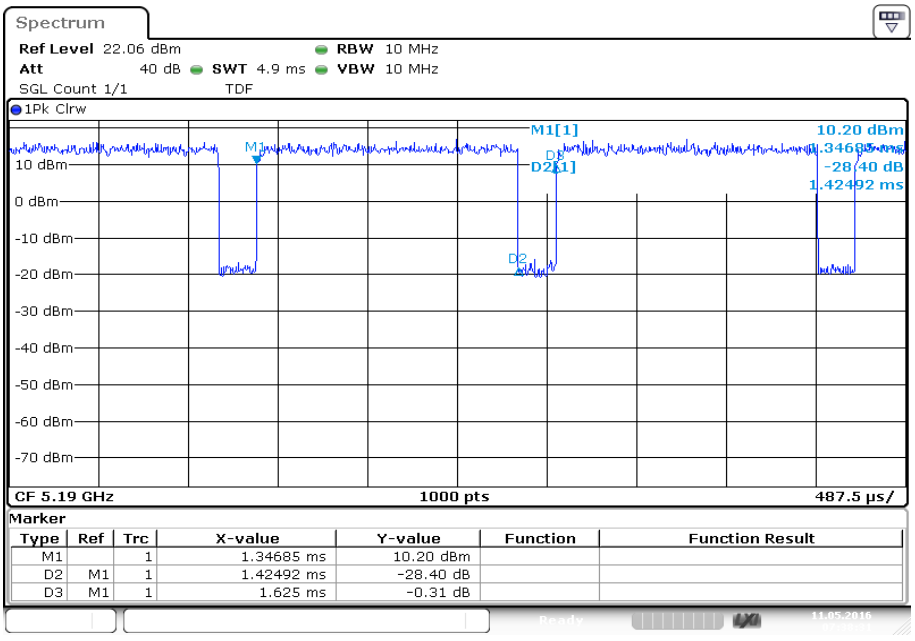
Plot 1: duty cycle of the transmitter – OFDM / a – mode



Plot 2: duty cycle of the transmitter – OFDM / n HT20 – mode



Plot 3: duty cycle of the transmitter – OFDM / n HT40 – mode



12.4 Maximum output power

Description:

Measurement of the maximum output power conduced

Measurement:

Measurement parameter	
Detector:	RMS
Sweep time:	≥10*(swp points)*(total on/off time)
Resolution bandwidth:	1 MHz
Video bandwidth:	≥ 3 MHz
Span:	> EBW
Trace-Mode:	Max hold
Analyzer function	Band power / channel power Interval ≥ 26 dB EBW (FCC) Interval ≥ 99 % OBW (IC)
Test setup:	See sub clause 7.4 – B
Measurement uncertainty:	See sub clause 9

Limits:

FCC:

Radiated output power	Conducted output power for mobile equipment
Conducted power + 6 dBi antenna gain	250 mW 5.150-5.250 GHz (FCC)
Conducted power + 6.3 dBi antenna gain (measured)	250 mW 5.150-5.250 GHz (FCC) – 0.3 dB (gain requirement) 23.98 dBm -0.3 dB = **23.68 dBm**

IC:

Radiated output power	Conducted output power for mobile equipment
The lesser one of 200 mW or 10 dBm + 10 log Bandwidth 5.150-5.250 GHz (IC) (where Bandwidth is the 99% Bandwidth [MHz])	-/-
Bandwidth ≥ 16.88 MHz; Limit: 169 mW → 22.3 dBm	-/-

12.4.1 Maximum output power conducted for FCC requirement

Result: a – mode; FCC requirement

OFDM / a – mode	Maximum output power conducted [dBm]			
Channel	5180 MHz	5200 MHz	5220 MHz	5240 MHz
Including duty cycle correction factor	11.70	11.88	12.16	12.28

Result: n HT20 – mode; FCC requirement

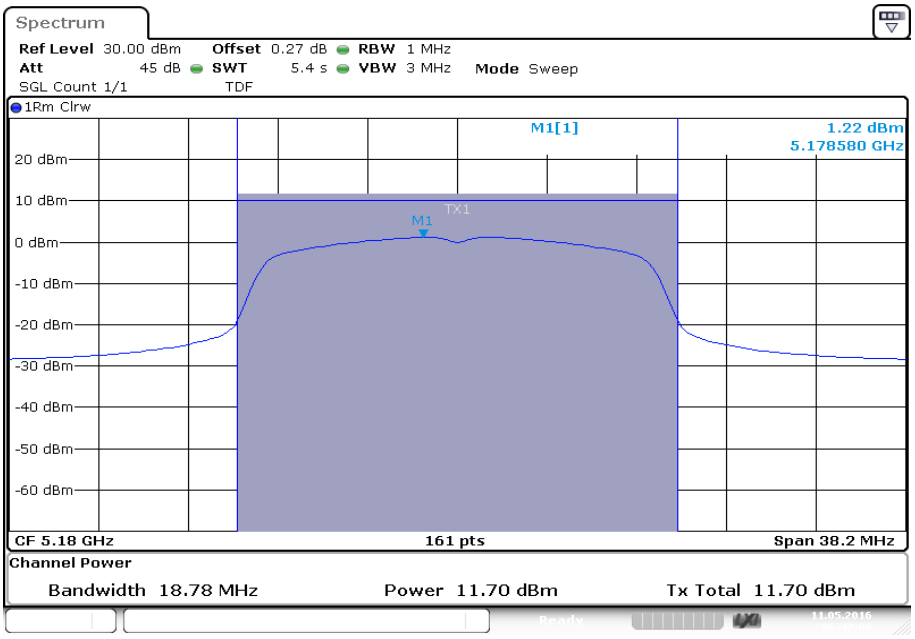
OFDM / n HT20 – mode	Maximum output power conducted [dBm]			
Channel	5180 MHz	5200 MHz	5220 MHz	5240 MHz
Including duty cycle correction factor	11.96	12.07	12.37	12.42

Result: n HT40 – mode; FCC requirement

OFDM / n HT40 – mode	Maximum output power conducted [dBm]	
Channel	5190 MHz	5230 MHz
Including duty cycle correction factor	11.96	12.43

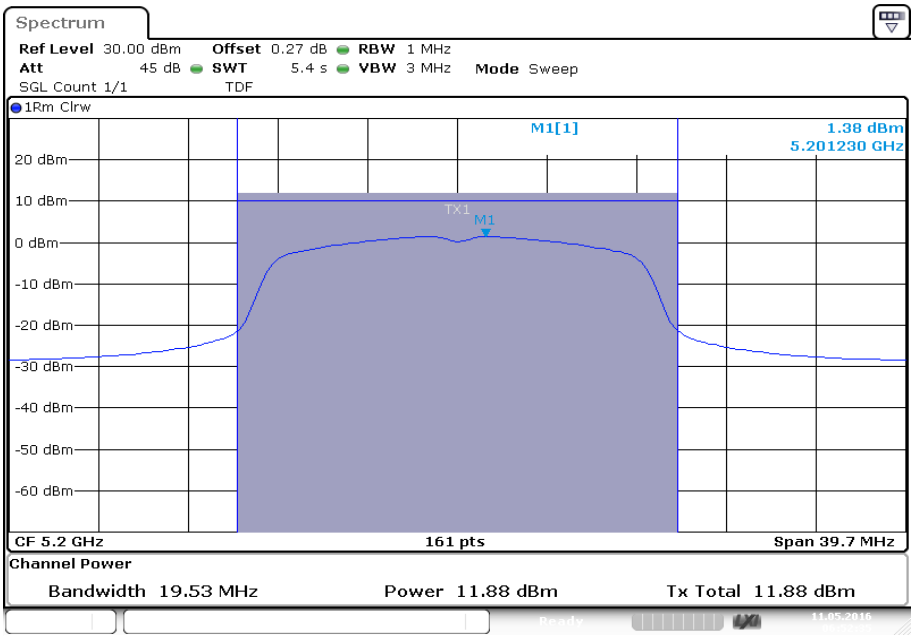
Plots: OFDM / a – mode, FCC requirement

Plot 1: 5180 MHz



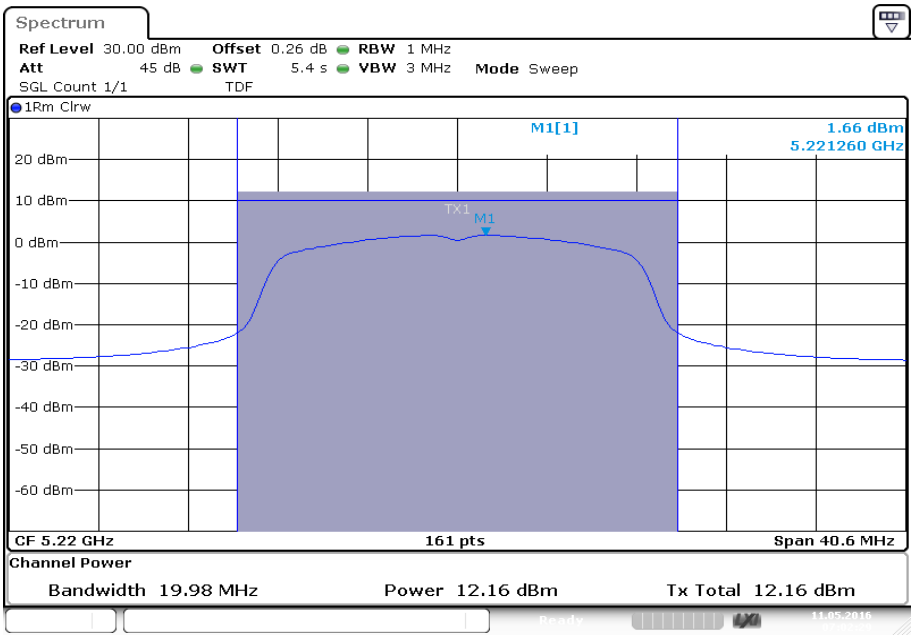
Date: 11.MAY.2016 06:42:01

Plot 2: 5200 MHz



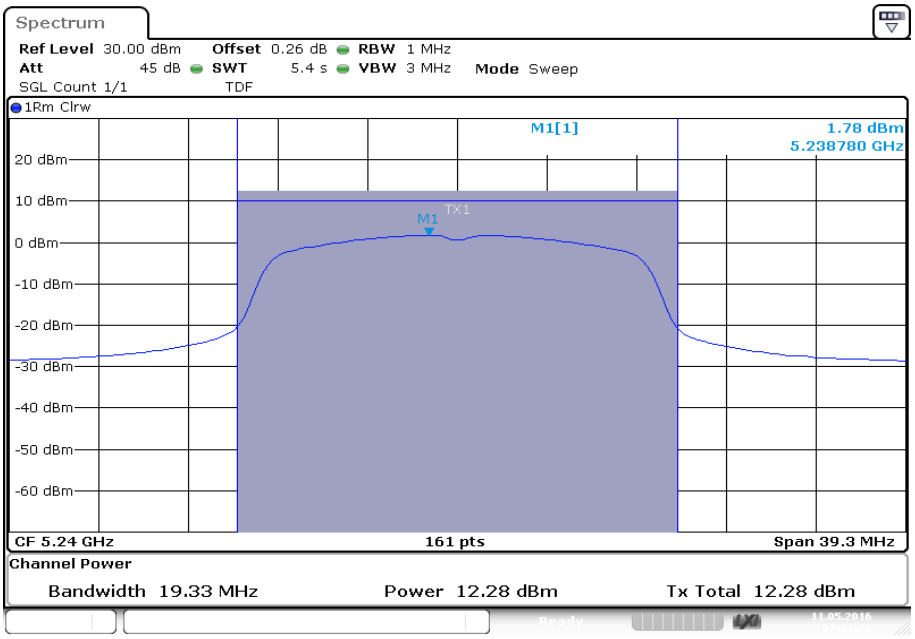
Date: 11.MAY.2016 06:52:35

Plot 3: 5220 MHz



Date: 11.MAY.2016 07:02:29

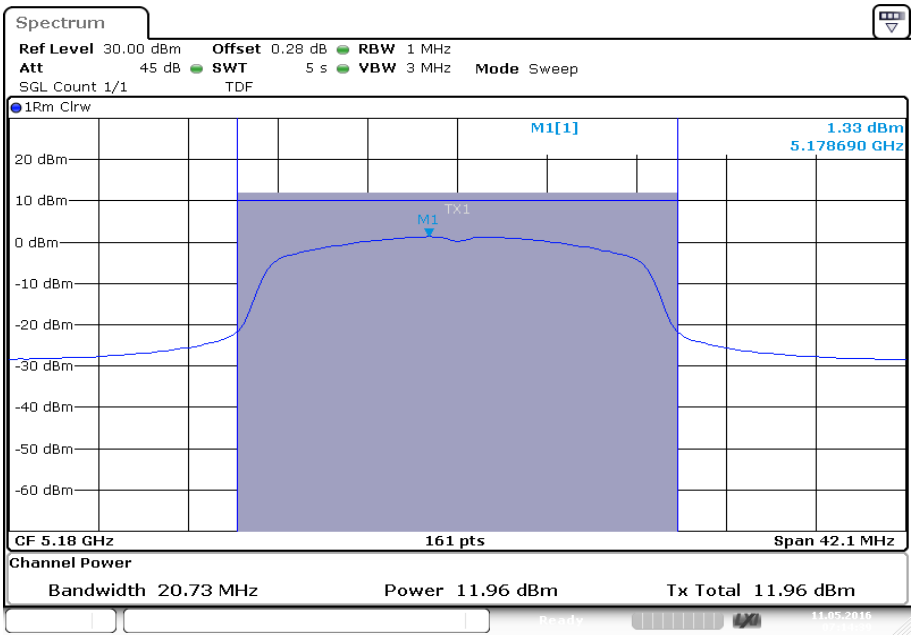
Plot 4: 5240 MHz



Date: 11.MAY.2016 07:07:06

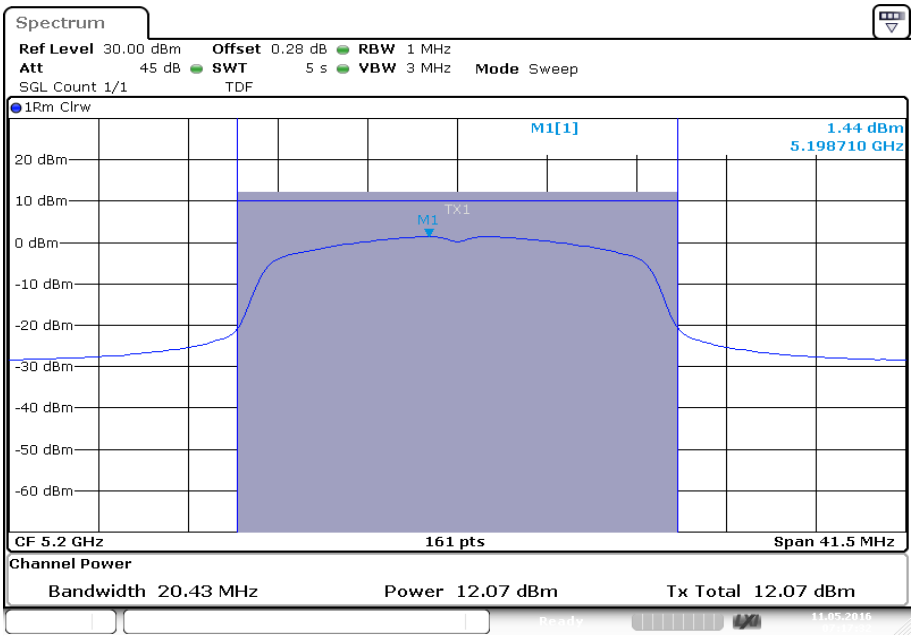
Plots: OFDM / n HT20 – mode, FCC requirement

Plot 1: 5180 MHz



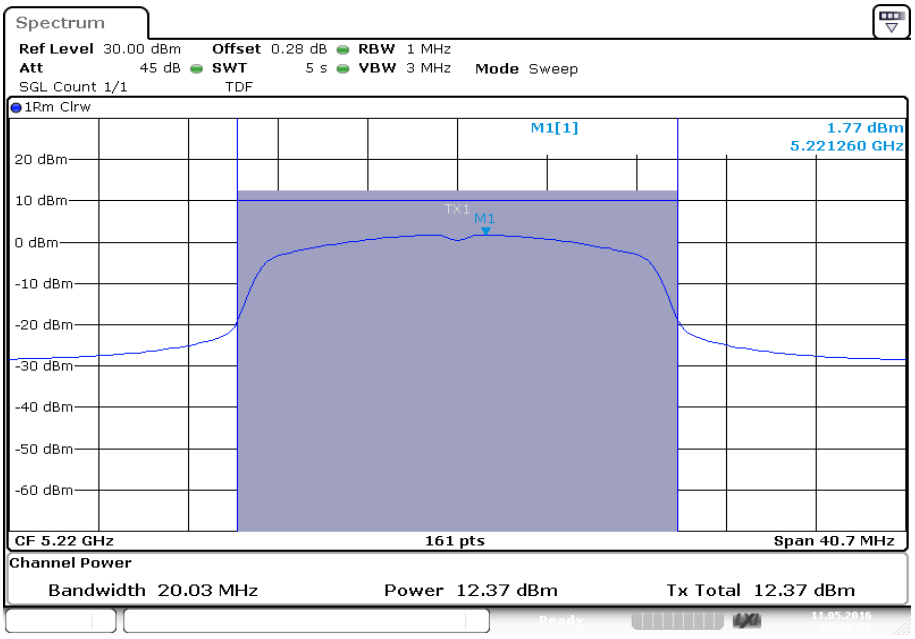
Date: 11.MAY.2016 07:14:39

Plot 2: 5200 MHz



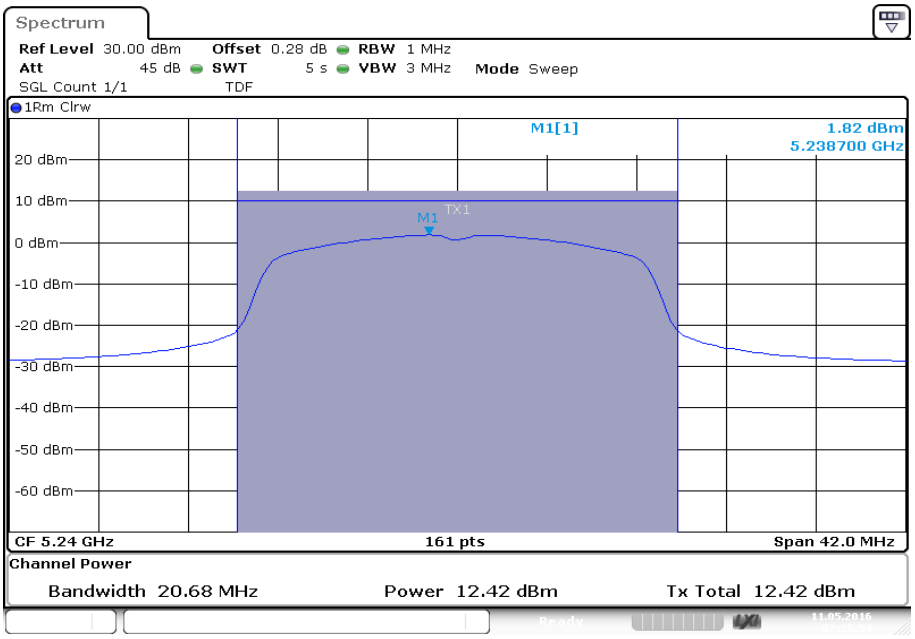
Date: 11.MAY.2016 07:17:32

Plot 3: 5220 MHz



Date: 11.MAY.2016 07:20:58

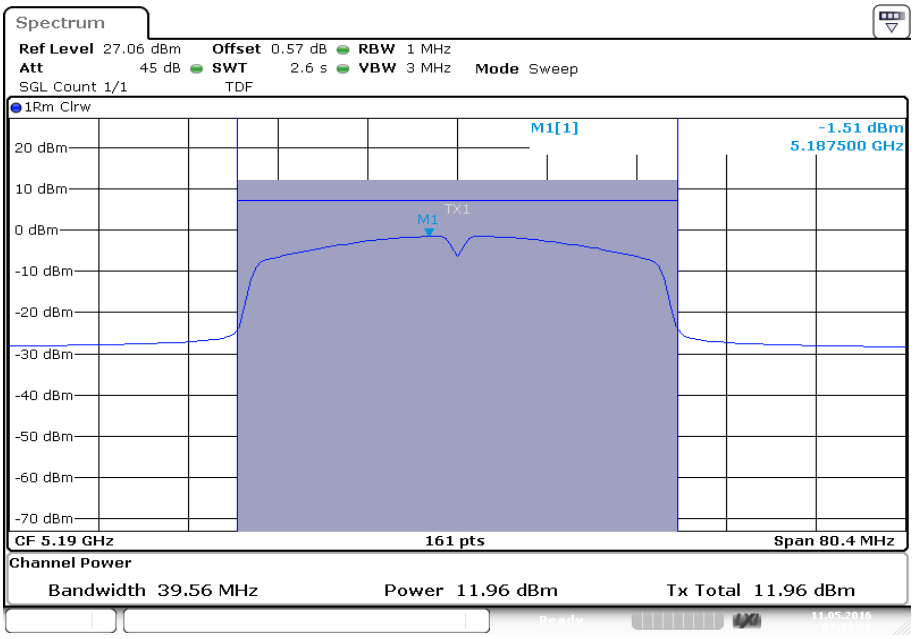
Plot 4: 5240 MHz



Date: 11.MAY.2016 07:25:54

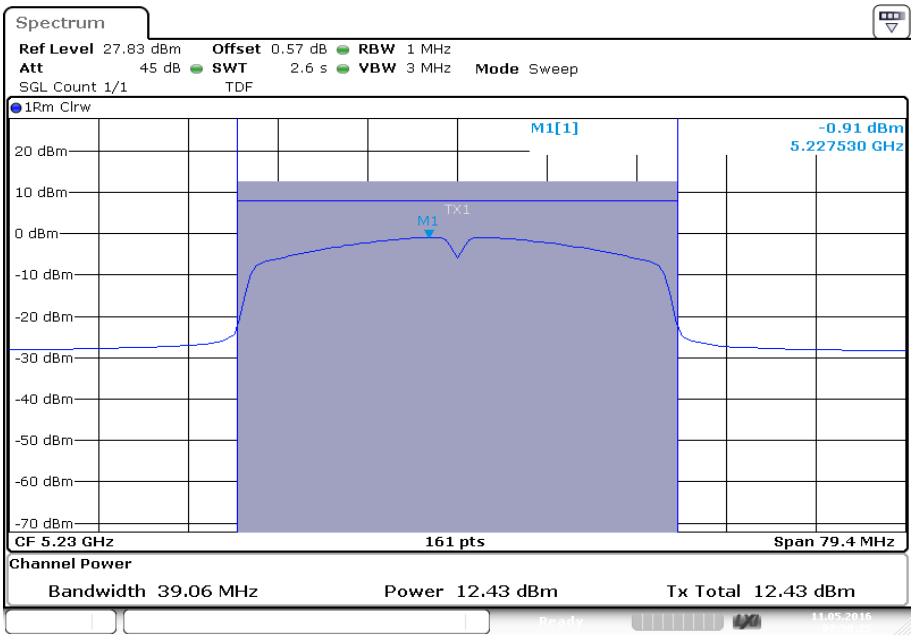
Plots: OFDM / n HT40 – mode, FCC requirement

Plot 1: 5190 MHz



Date: 11.MAY.2016 07:39:23

Plot 2: 5230 MHz



Date: 11.MAY.2016 07:50:25

12.4.2 Maximum output power EIRP for IC requirement

Result: a – mode; IC requirement

OFDM / a – mode	Maximum output power EIRP [dBm]			
Channel	5180 MHz	5200 MHz	5220 MHz	5240 MHz
Including duty cycle correction factor and antenna gain	17.96	18.14	18.42	18.55

Result: n HT20 – mode; IC requirement

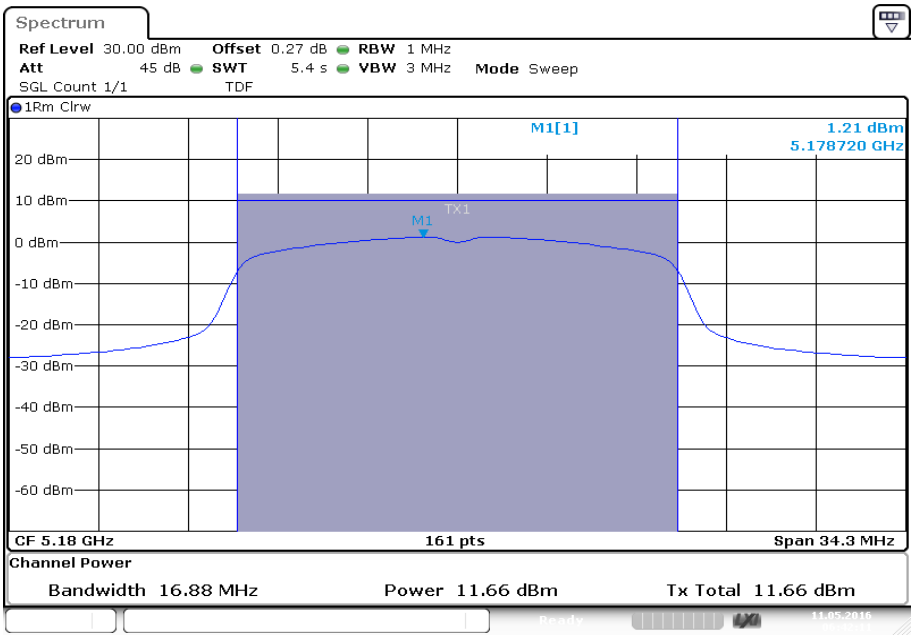
OFDM / n HT20 – mode	Maximum output power EIRP [dBm]			
Channel	5180 MHz	5200 MHz	5220 MHz	5240 MHz
Including duty cycle correction factor and antenna gain	18.22	18.33	18.63	18.69

Result: n HT40 – mode; IC requirement

OFDM / n HT40 – mode	Maximum output power EIRP [dBm]	
Channel	5190 MHz	5230 MHz
Including duty cycle correction factor and antenna gain	18.24	18.71

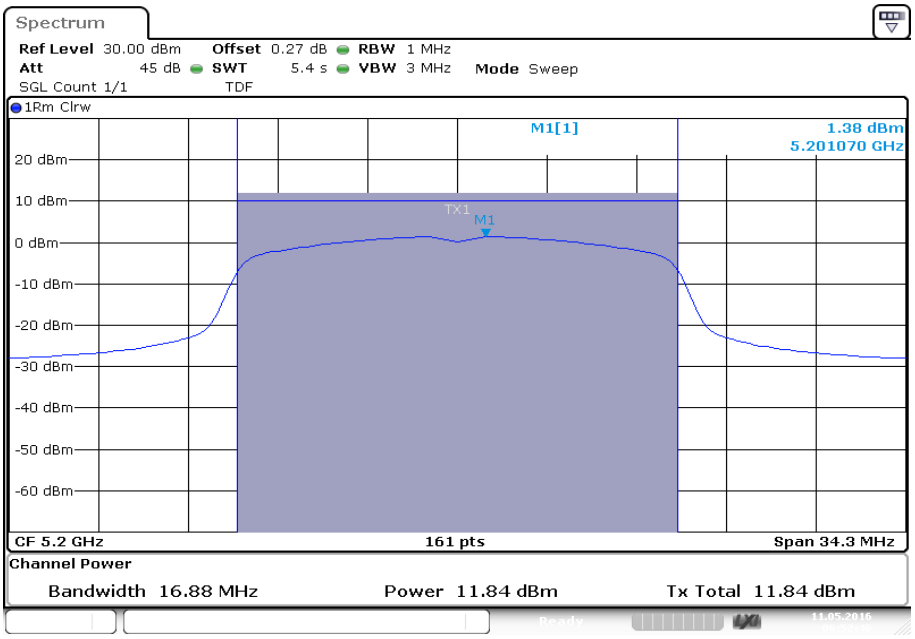
Plots: OFDM / a – mode, IC requirement

Plot 1: 5180 MHz



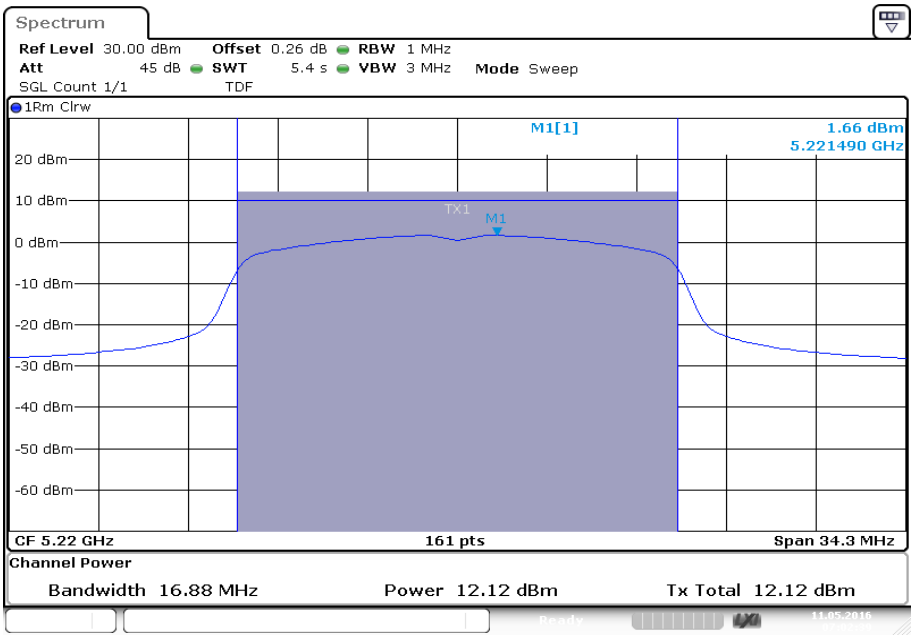
Date: 11.MAY.2016 06:42:11

Plot 2: 5200 MHz



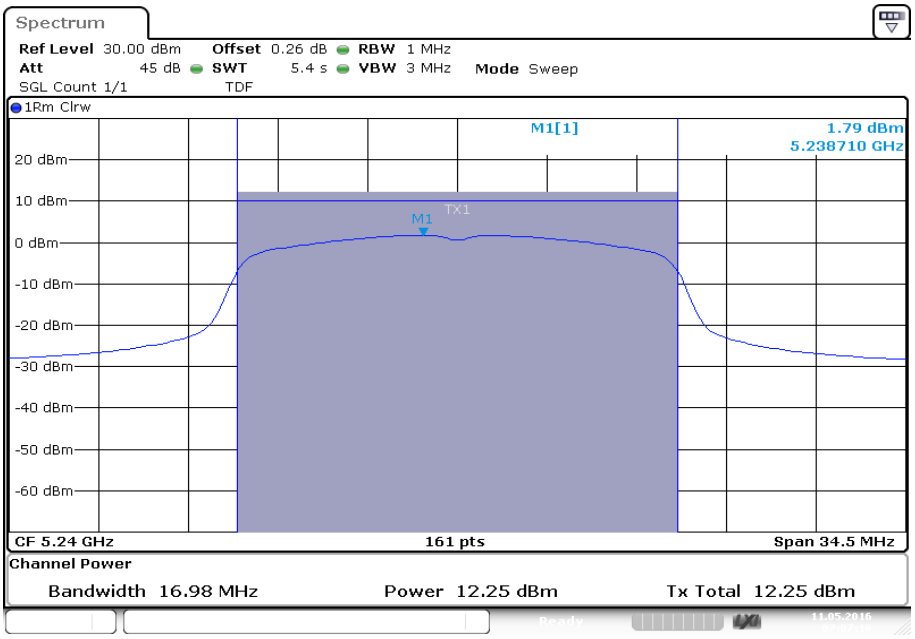
Date: 11.MAY.2016 06:52:46

Plot 3: 5220 MHz



Date: 11.MAY.2016 07:02:39

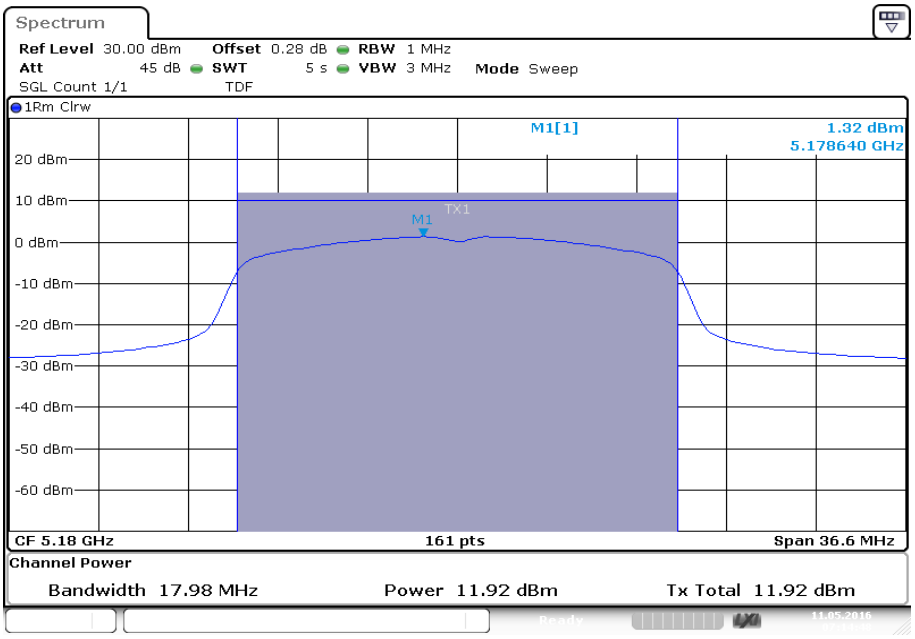
Plot 4: 5240 MHz



Date: 11.MAY.2016 07:07:16

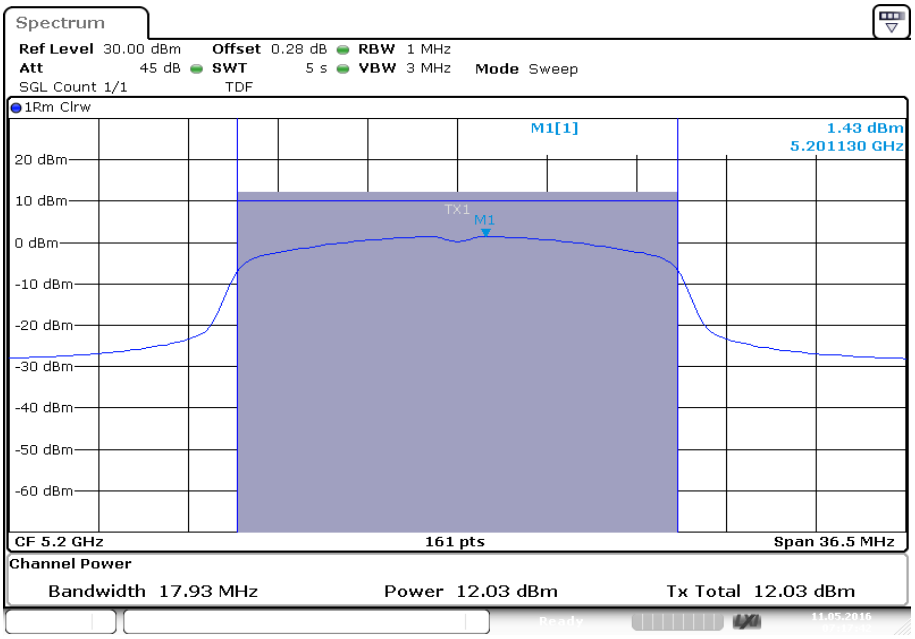
Plots: OFDM / n HT20 – mode, IC requirement

Plot 1: 5180 MHz



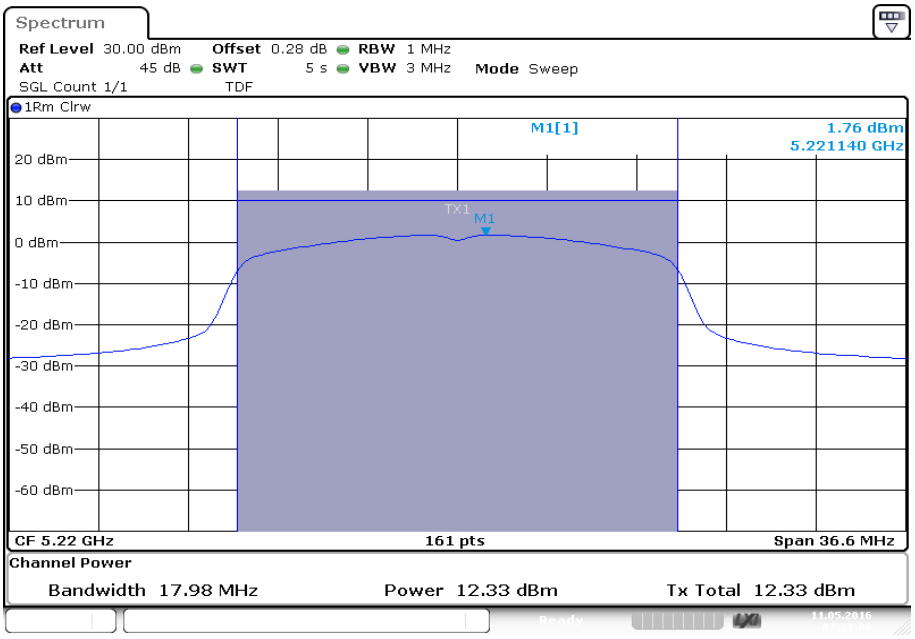
Date: 11.MAY.2016 07:14:48

Plot 2: 5200 MHz



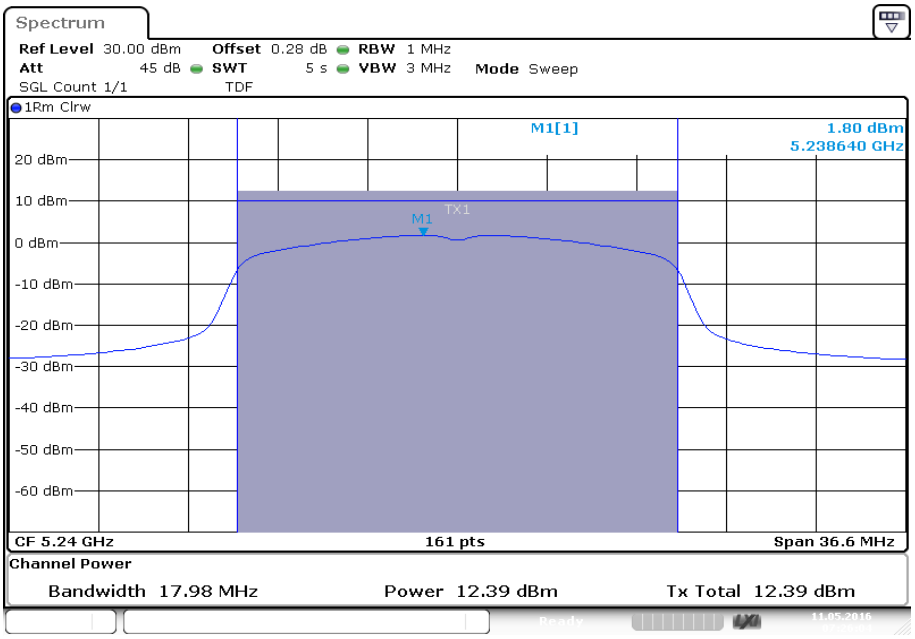
Date: 11.MAY.2016 07:17:42

Plot 3: 5220 MHz



Date: 11.MAY.2016 07:21:08

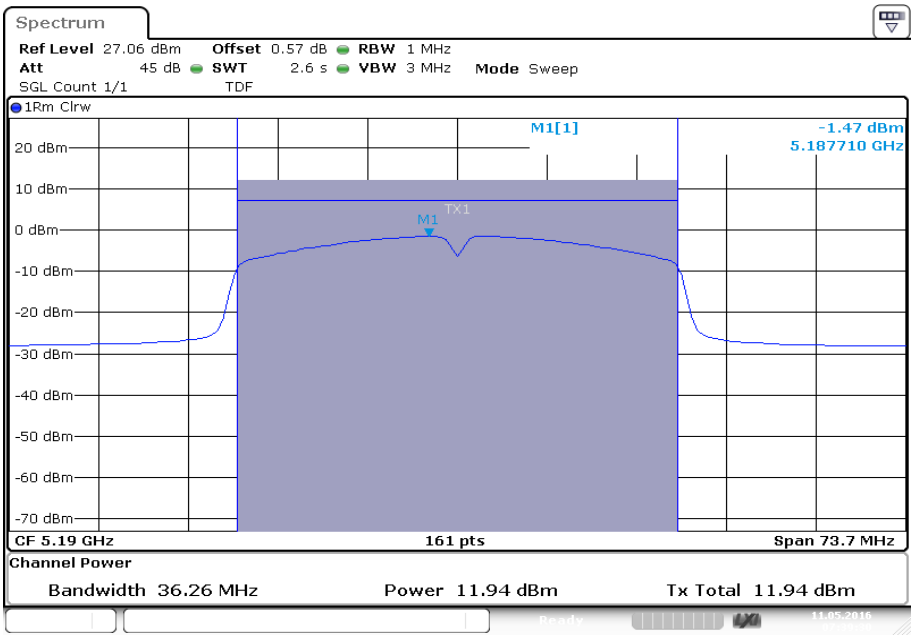
Plot 4: 5240 MHz



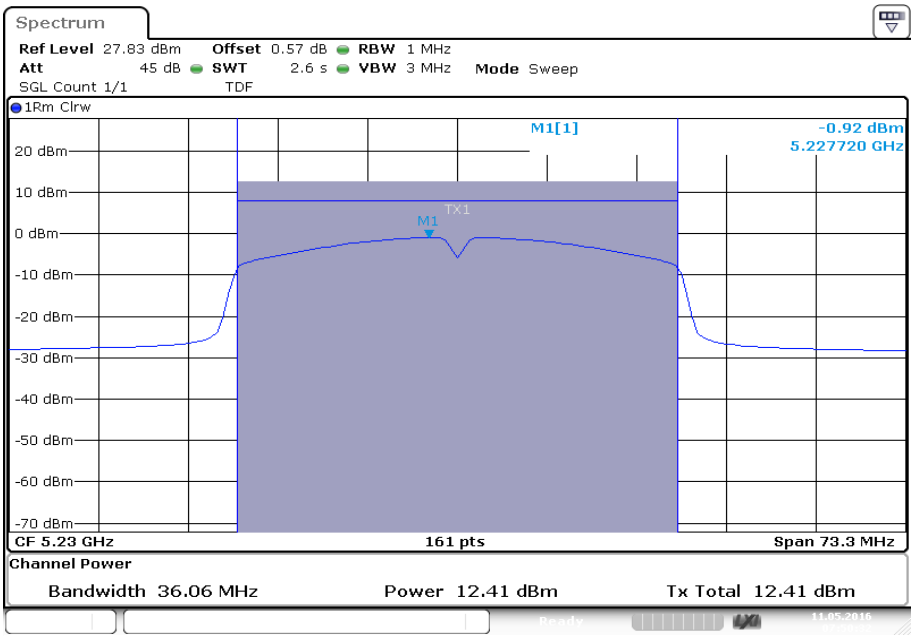
Date: 11.MAY.2016 07:26:04

Plots: OFDM / n HT40 – mode, IC requirement

Plot 1: 5190 MHz



Plot 2: 5230 MHz



12.5 Power spectral density

Description:

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

Measurement:

Measurement parameter	
Detector:	RMS
Sweep time:	≥10*(swp points)*(total on/off time)
Resolution bandwidth:	1 MHz
Video bandwidth:	≥ 3xRBW
Span:	> EBW
Trace mode:	Max hold
Test setup:	See sub clause 7.4 – B
Measurement uncertainty:	See sub clause 9

Limits:

Power Spectral Density
FCC power spectral density conducted ≤ 11 dBm in any 1 MHz band (band 5150 – 5250 MHz) power spectral density conducted ≤ 17 dBm in any 1 MHz band (band 5150 – 5250 MHz) **IC** power spectral density e.i.r.p. ≤ 10 dBm in any 1 MHz band (band 5150 – 5250 MHz)

12.5.1 Power spectral density for FCC requirement

Result: a – mode; FCC requirement*

OFDM / a – mode	Power spectral density [dBm/MHz]			
Channel	5180 MHz	5200 MHz	5220 MHz	5240 MHz
	1.22	1.38	1.66	1.78

Result: n HT20 – mode; FCC requirement*

OFDM / n HT20 – mode	Power spectral density [dBm/MHz]			
Channel	5180 MHz	5200 MHz	5220 MHz	5240 MHz
	1.33	1.44	1.77	1.82

Result: n HT40 – mode; FCC requirement*

OFDM / n HT40 – mode	Power spectral density [dBm/MHz]	
Channel	5190 MHz	5230 MHz
	-1.51	-0.91

*Plots: see chapter 12.4.1

12.5.2 Power spectral density for IC requirement

Result: a – mode; IC requirement*

OFDM / a – mode	Power spectral density [dBm/MHz]			
Channel	5180 MHz	5200 MHz	5220 MHz	5240 MHz
Including duty cycle correction factor and antenna gain	7.51	7.68	7.96	8.09

Result: n HT20 – mode; IC requirement*

OFDM / n HT20 – mode	Power spectral density [dBm/MHz]			
Channel	5180 MHz	5200 MHz	5220 MHz	5240 MHz
Including duty cycle correction factor and antenna gain	7.62	7.73	8.06	8.10

Result: n HT40 – mode; IC requirement*

OFDM / n HT40 – mode	Power spectral density [dBm/MHz]	
Channel	5190 MHz	5230 MHz
Including duty cycle correction factor and antenna gain	4.83	5.38

*Plots: see chapter 12.4.2

12.6 Spectrum bandwidth – 26 dB bandwidth

Description:

Measurement of the 26 dB bandwidth of the modulated signal.

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1% EBW
Video bandwidth:	≥ RBW
Span:	> complete signal!
Trace – mode:	Max hold
Test setup:	See sub clause 7.4 – B
Measurement uncertainty:	See sub clause 9

Limits:

Spectrum Bandwidth – 26 dB Bandwidth
-/-

Result:

OFDM / a – mode	26 dB bandwidth [MHz]			
Channel	5180 MHz	5200 MHz	5220 MHz	5240 MHz
	24.73	24.08	25.42	25.77

Result:

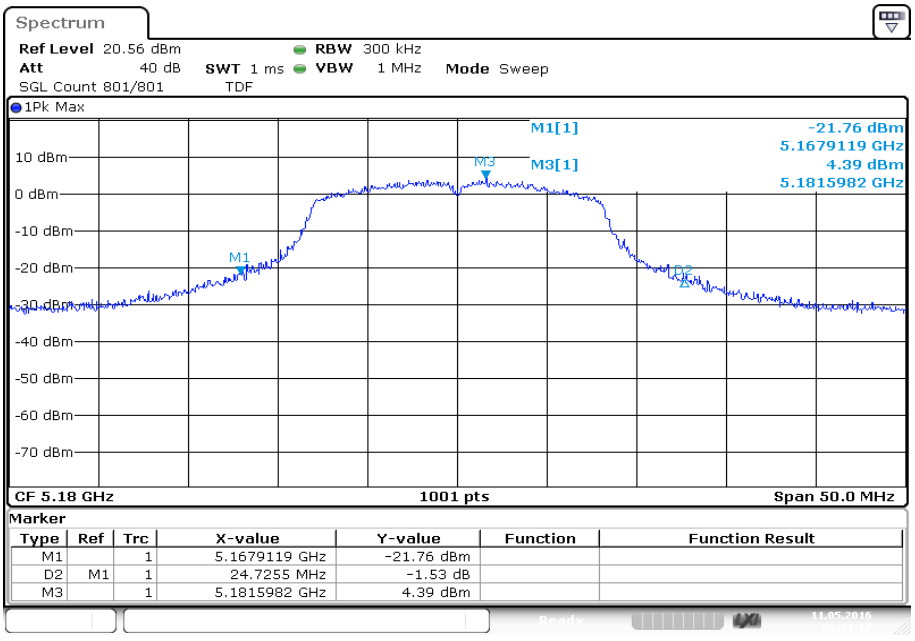
OFDM / n HT20 – mode	26 dB bandwidth [MHz]			
Channel	5180 MHz	5200 MHz	5220 MHz	5240 MHz
	28.07	26.22	25.62	25.03

Result:

OFDM / n HT40 – mode	26 dB bandwidth [MHz]	
Channel	5190 MHz	5230 MHz
	48.25	50.15

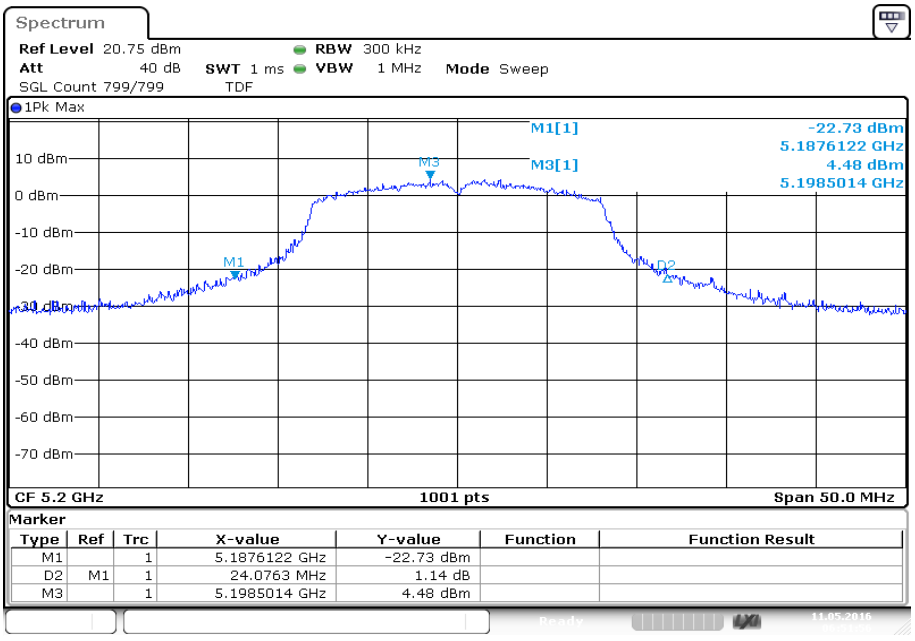
Plots: OFDM / a – mode

Plot 1: 5180 MHz



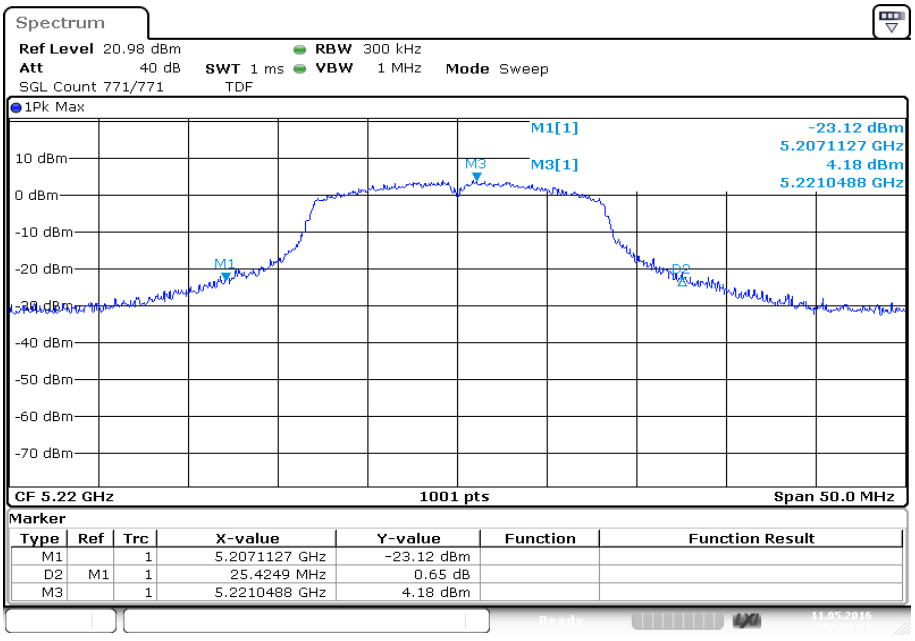
Date: 11.MAY.2016 06:41:17

Plot 2: 5200 MHz



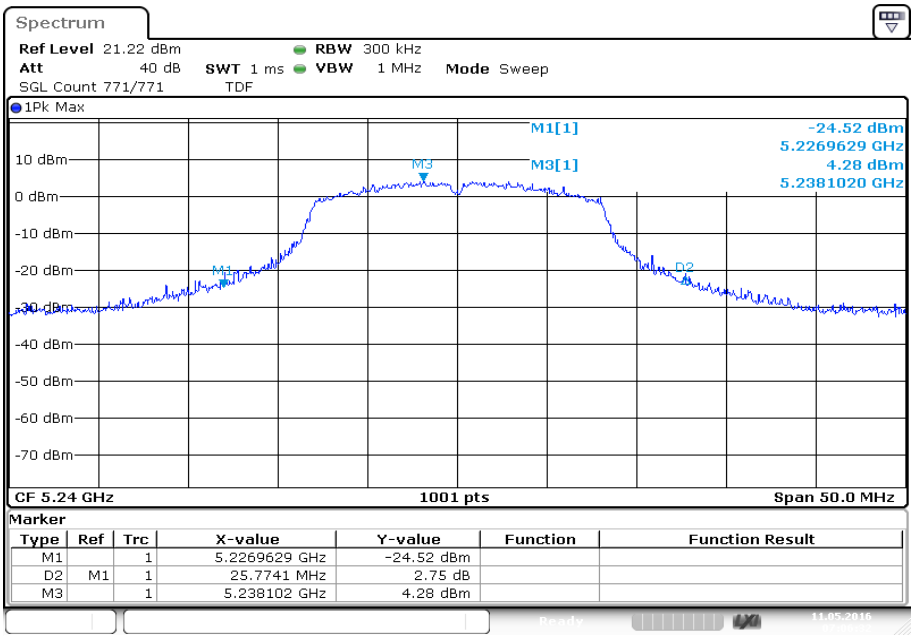
Date: 11.MAY.2016 06:51:56

Plot 3: 5220 MHz



Date: 11.MAY.2016 07:01:53

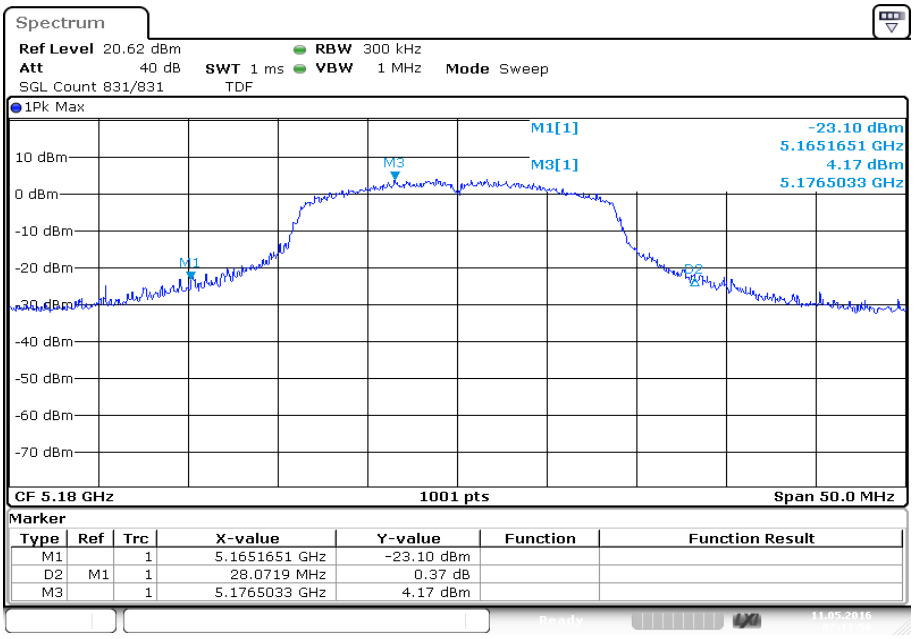
Plot 4: 5240 MHz



Date: 11.MAY.2016 07:06:32

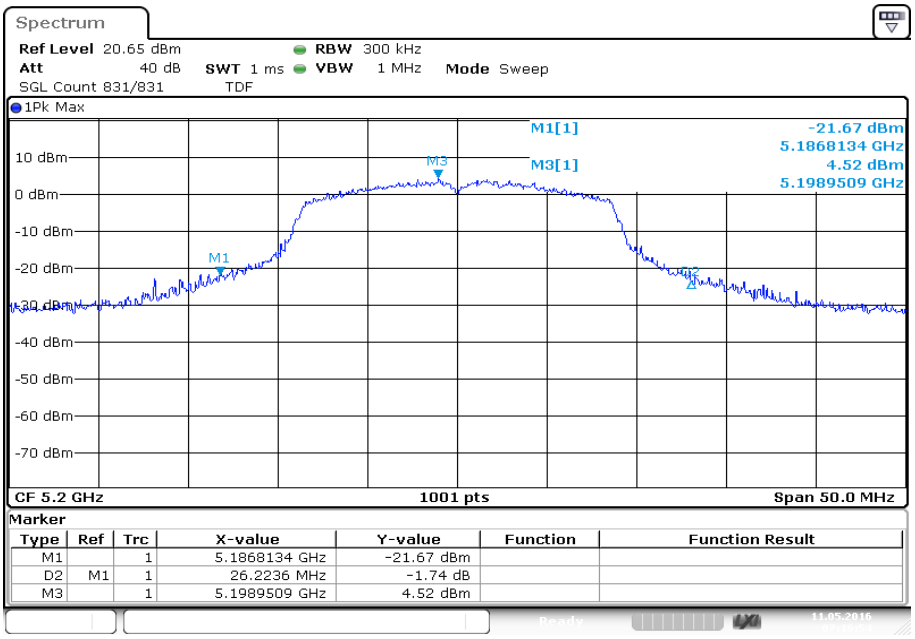
Plots: OFDM / n HT20 – mode

Plot 1: 5180 MHz



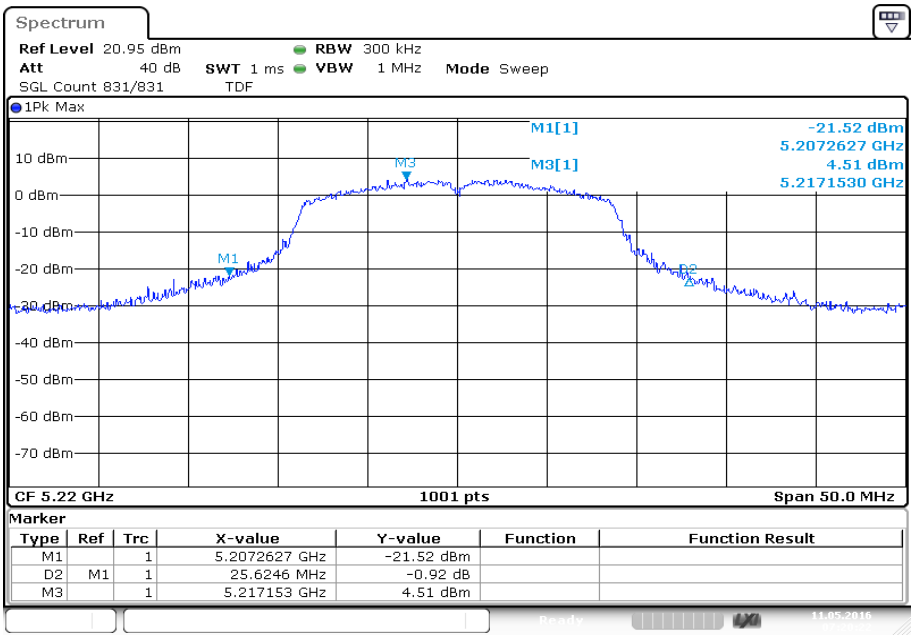
Date: 11.MAY.2016 07:13:58

Plot 2: 5200 MHz

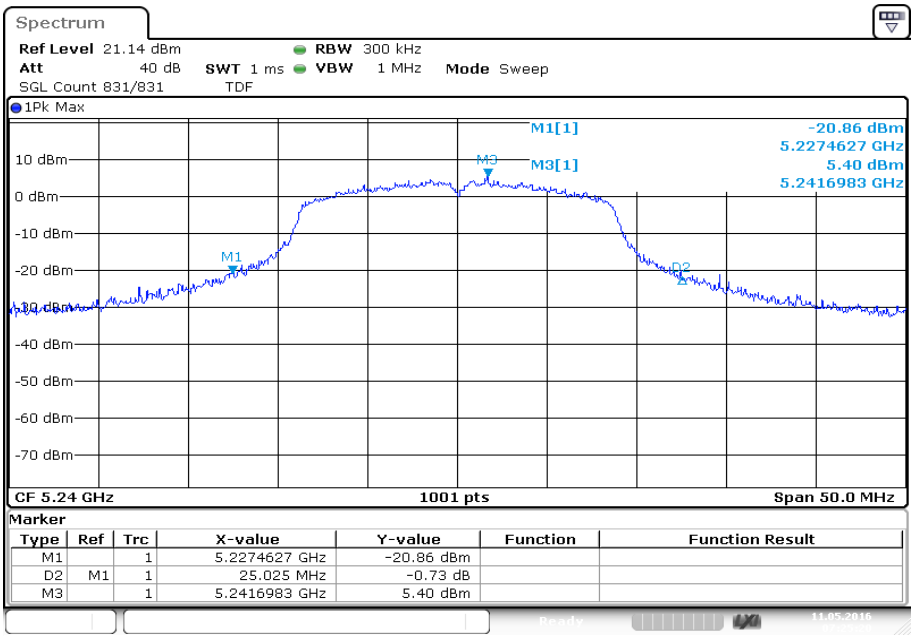


Date: 11.MAY.2016 07:16:54

Plot 3: 5220 MHz

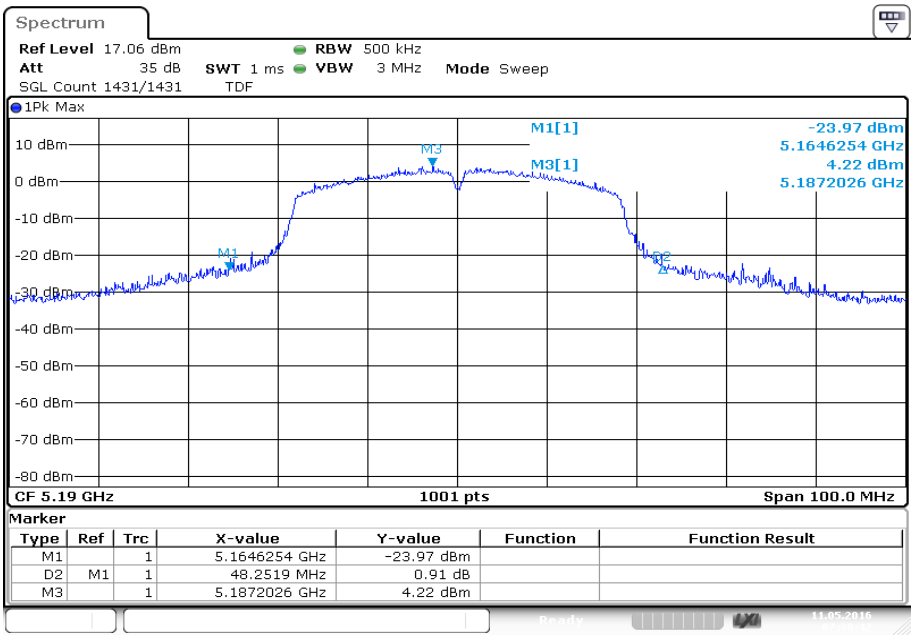


Plot 4: 5240 MHz



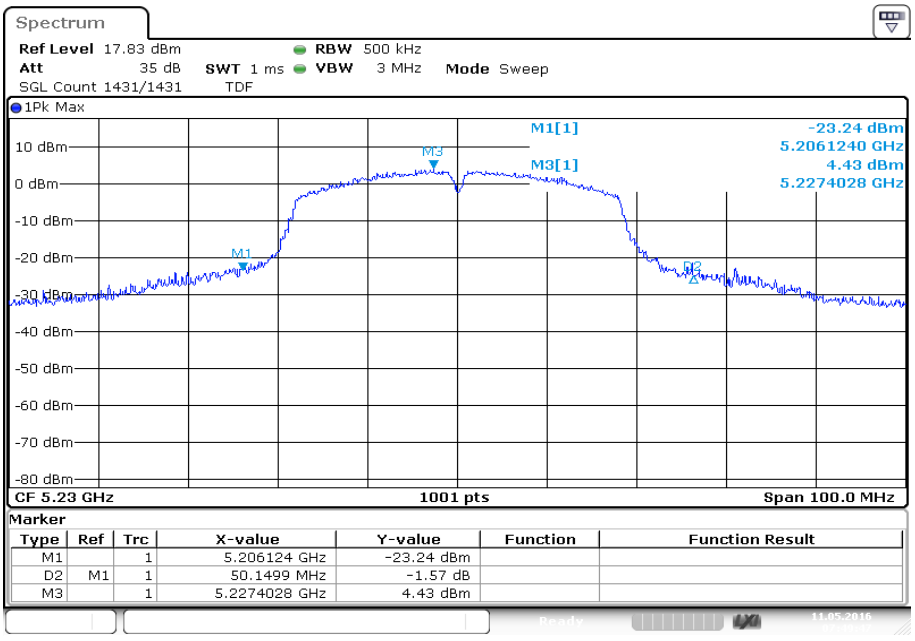
Plots: OFDM / n HT40 – mode

Plot 1: 5190 MHz



Date: 11.MAY.2016 07:38:42

Plot 2: 5230 MHz



Date: 11.MAY.2016 07:49:47

12.7 Occupied bandwidth – 99% emission bandwidth

Description:

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

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	300 kHz / 500 kHz
Video bandwidth:	1 MHz / 3 MHz
Span:	50 MHz / 100 MHz
Measurement procedure:	Measurement of the 99% bandwidth using the integration function of the analyser
Trace – mode:	Max hold (allow trace to stabilize)
Test setup:	See sub clause 7.4 – B
Measurement uncertainty:	See sub clause 9

Usage:

-/-	IC
Occupied Bandwidth – 99% emission bandwidth	
OBW is necessary for Emission Designator	

Result:

OFDM / a – mode	99% bandwidth [MHz]			
Channel	5180 MHz	5200 MHz	5220 MHz	5240 MHz
	16.88	16.88	16.88	16.98

Result:

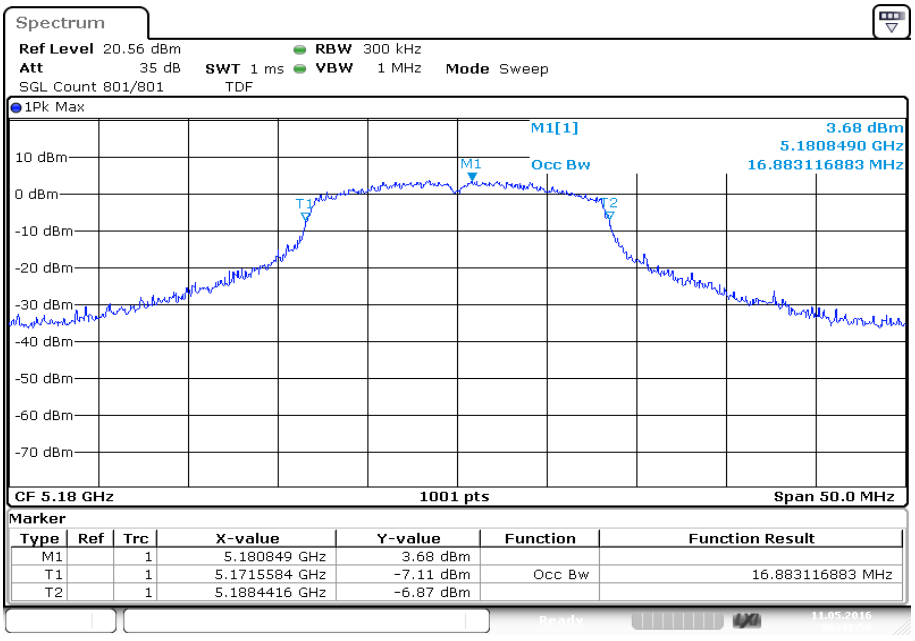
OFDM / n HT20 – mode	99% bandwidth [MHz]			
Channel	5180 MHz	5200 MHz	5220 MHz	5240 MHz
	17.98	17.93	17.98	17.98

Result:

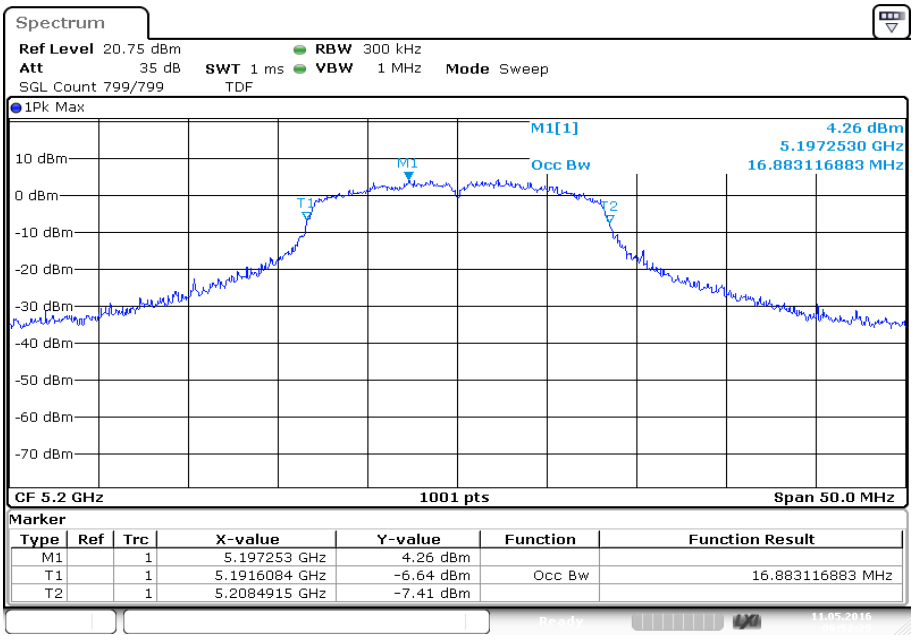
OFDM / n HT40 – mode	99% bandwidth [MHz]	
Channel	5190 MHz	5230 MHz
	36.26	36.06

Plots: OFDM / a – mode

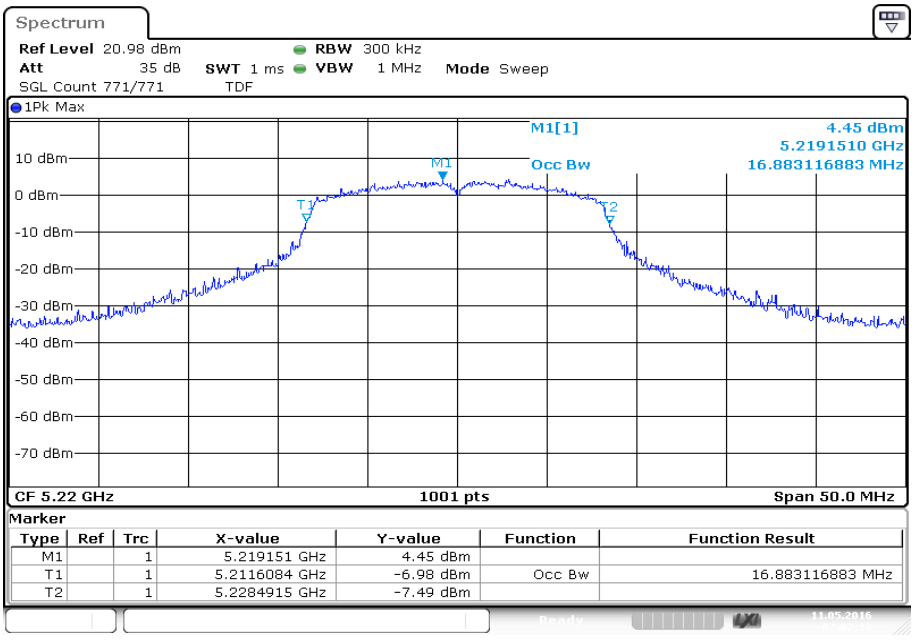
Plot 1: 5180 MHz



Plot 2: 5200 MHz

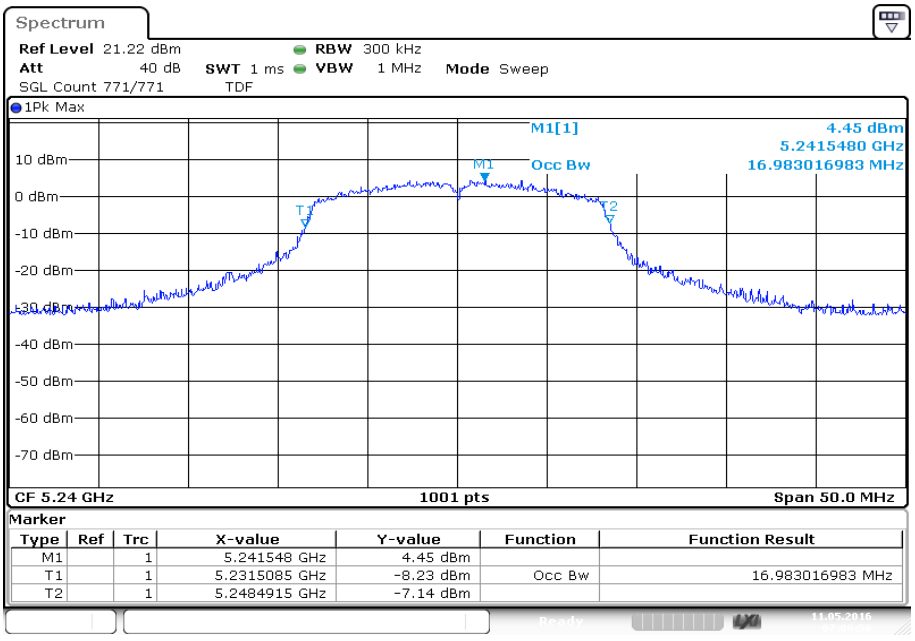


Plot 3: 5220 MHz



Date: 11.MAY.2016 07:02:19

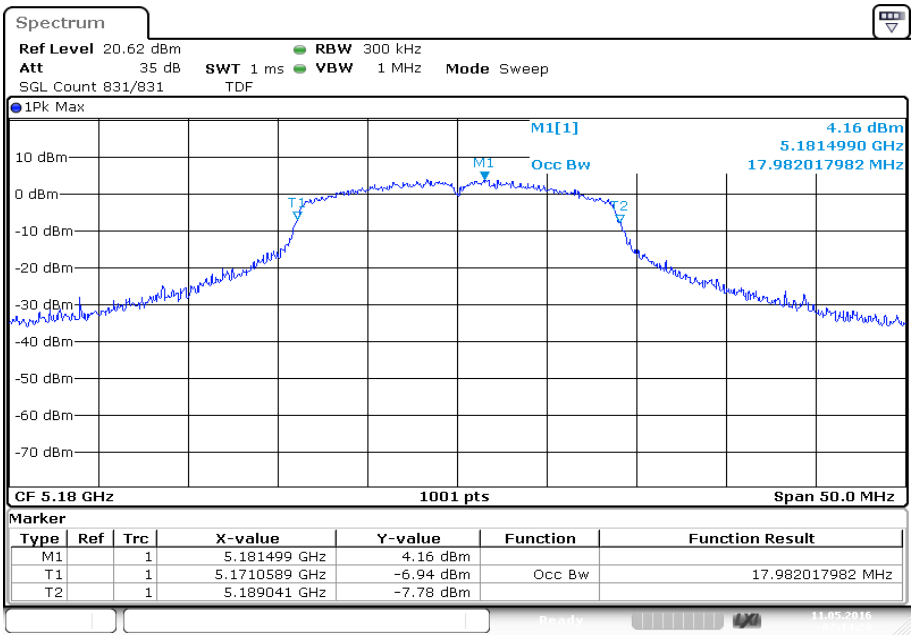
Plot 4: 5240 MHz



Date: 11.MAY.2016 07:06:56

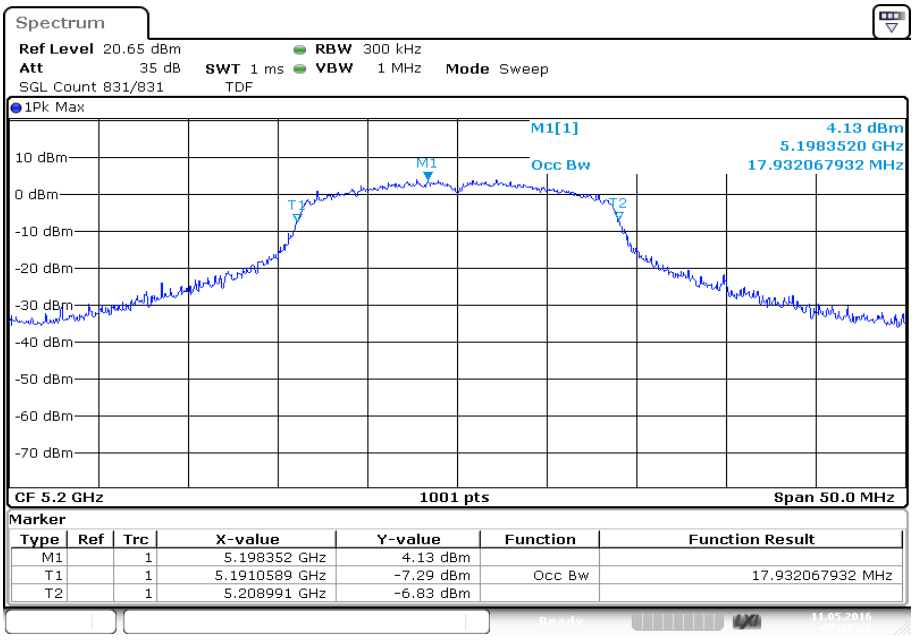
Plots: OFDM / n HT20 – mode

Plot 1: 5180 MHz



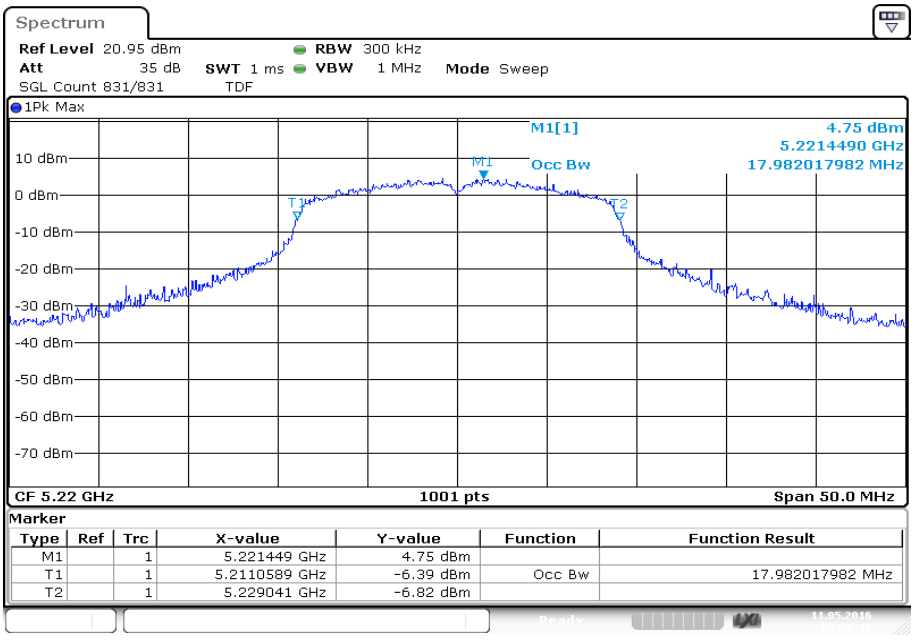
Date: 11.MAY.2016 07:14:29

Plot 2: 5200 MHz

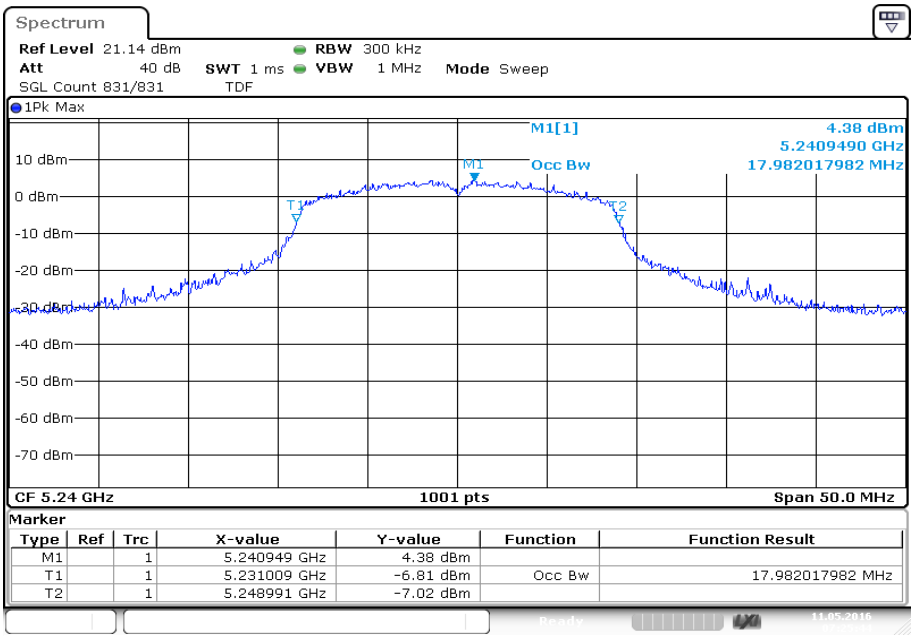


Date: 11.MAY.2016 07:17:22

Plot 3: 5220 MHz

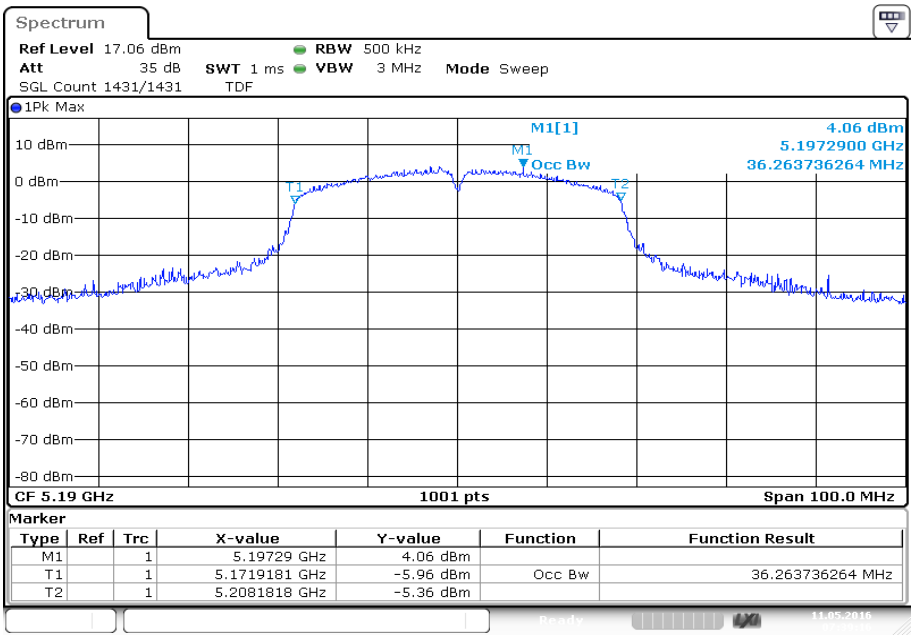


Plot 4: 5240 MHz



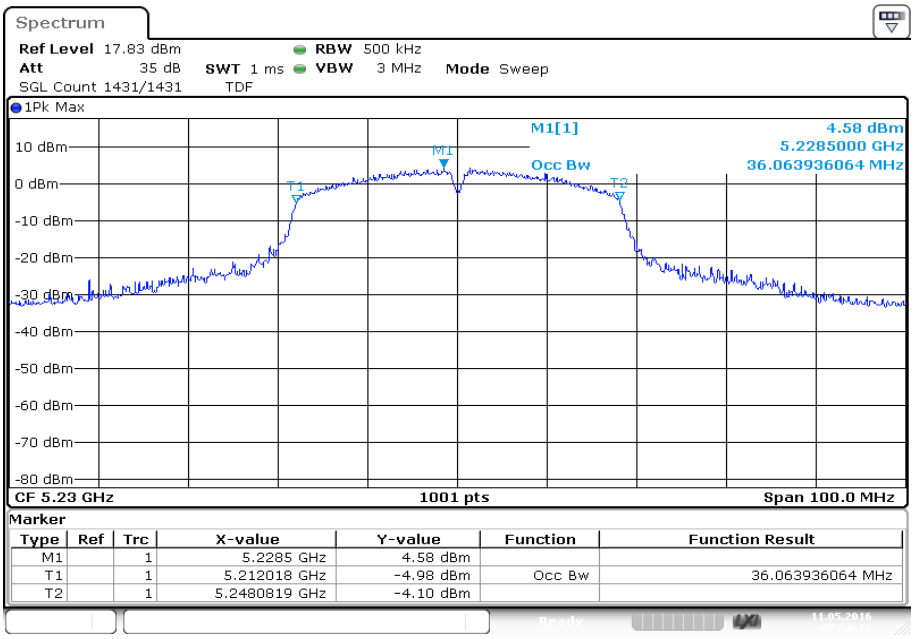
Plots: OFDM / n HT40 – mode

Plot 1: 5190 MHz



Date: 11.MAY.2016 07:39:16

Plot 2: 5230 MHz



Date: 11.MAY.2016 07:50:17

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 the lowest channel for the lower restricted band and to the highest channel for the upper restricted band. Measurement distance is 3m.

Measurement:

Measurement parameter	
Detector:	Peak / RMS
Sweep time:	Auto
Resolution bandwidth:	1 MHz
Video bandwidth:	≥ 3 x RBW
Span:	See plots!
Trace – mode:	Max Hold
Test setup:	See sub clause 7.2 – A
Measurement uncertainty:	See sub clause 9

Limits:

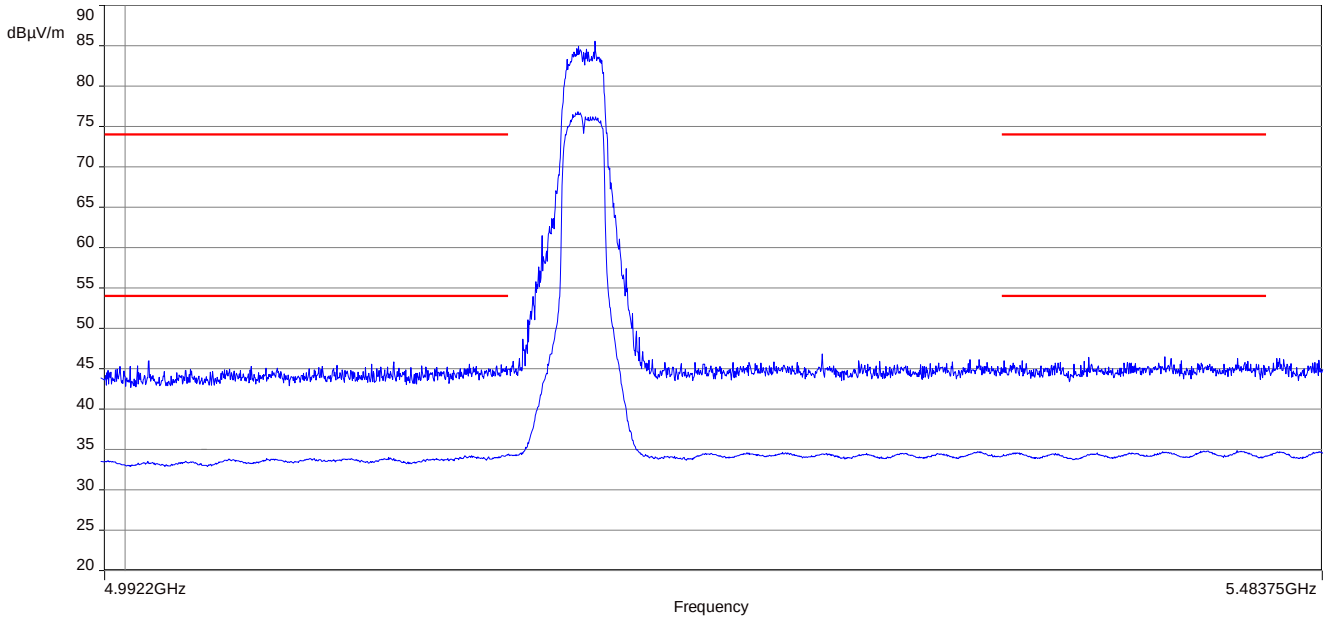
Band Edge Compliance Radiated
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 5.205(c)).
74 dBµV/m (peak) 54 dBµV/m (average)

Result:

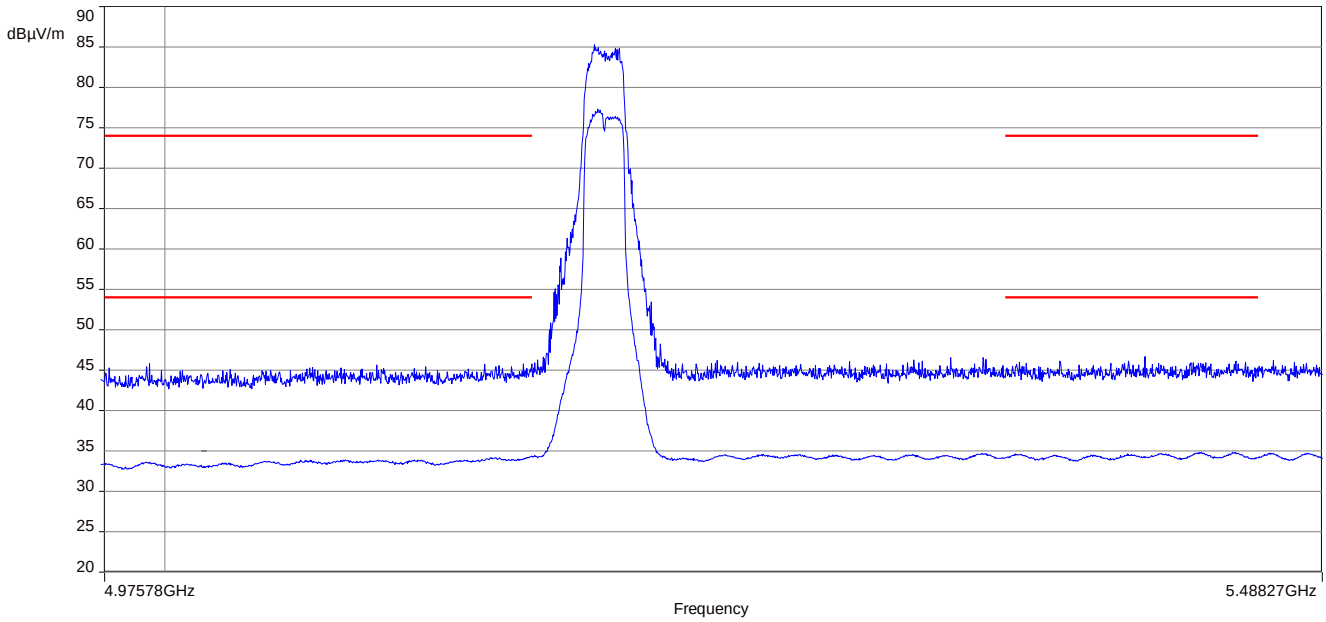
Scenario	Band Edge Compliance Radiated [dBµV/m]
band edge	< 74 dBµV/m (peak) < 54 dBµV/m (average)

Plots:

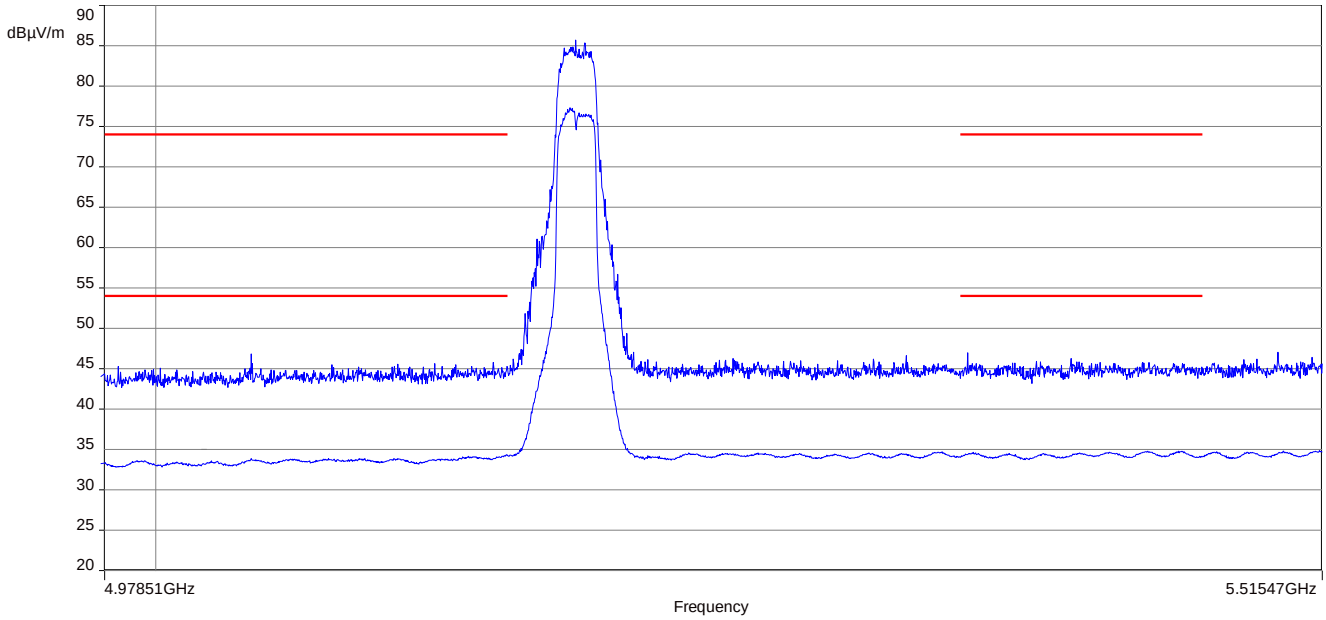
Plot 1: lower band edge, vertical & horizontal polarization – OFDM 20 MHz (a – mode), 5180 MHz



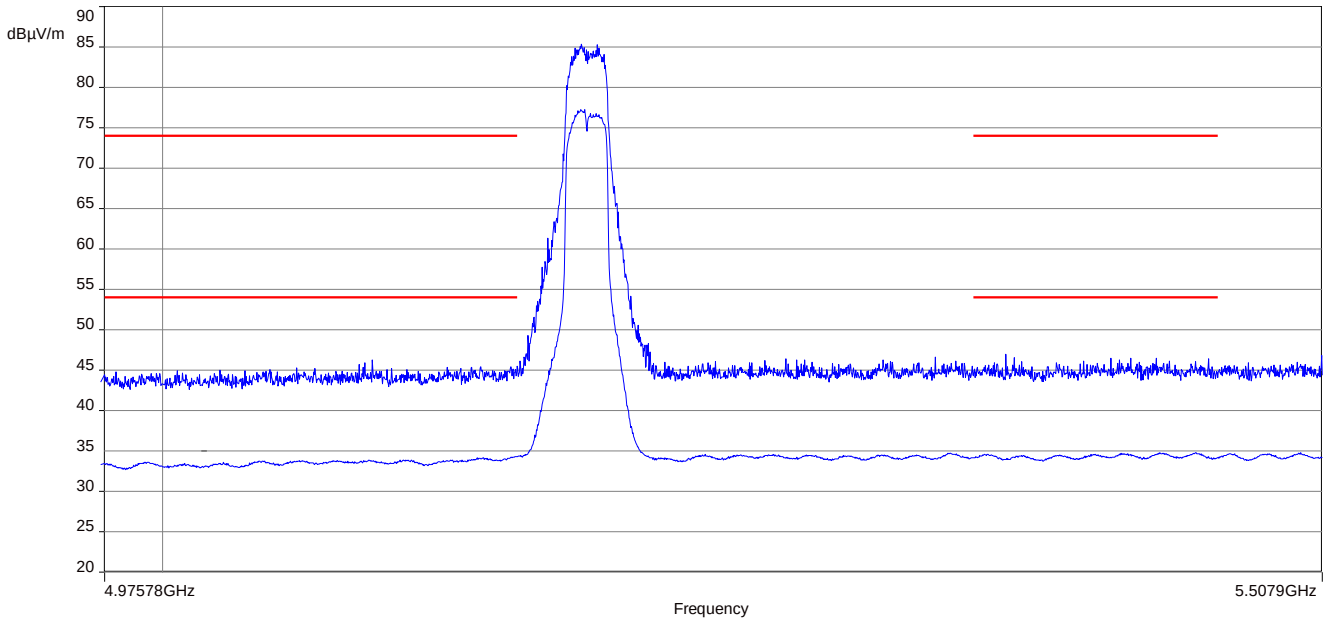
Plot 2: lower band edge, vertical & horizontal polarization – OFDM 20 MHz (a – mode), 5240 MHz



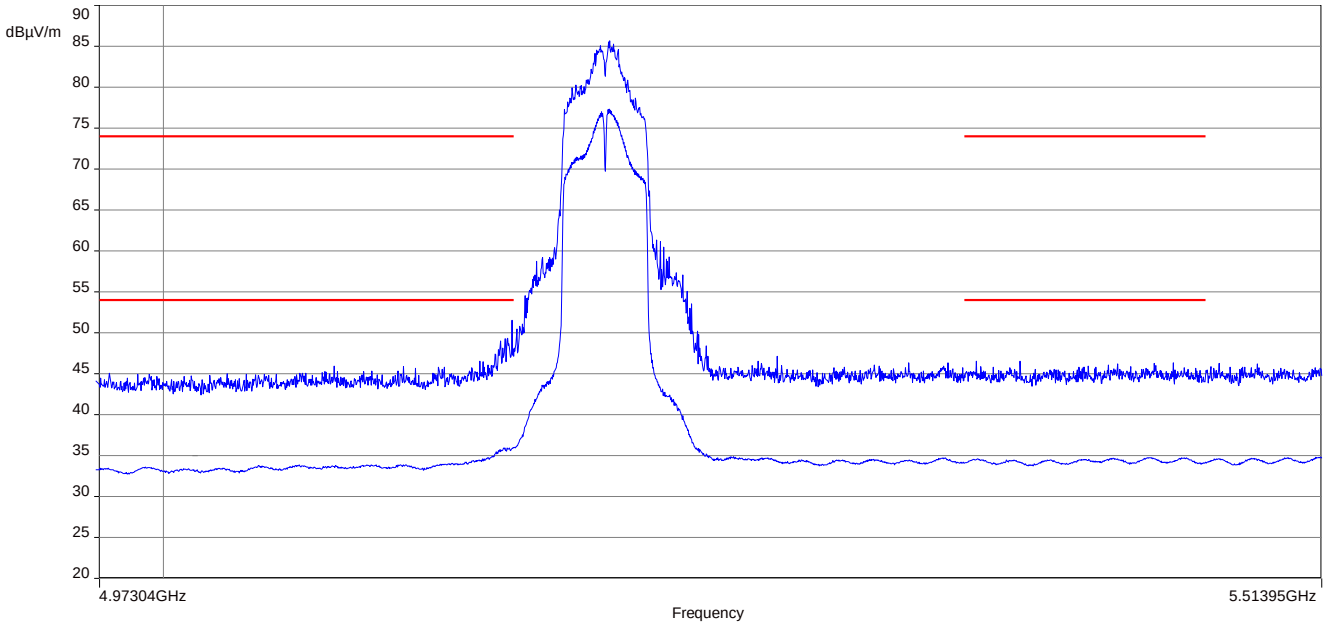
Plot 3: lower band edge, vertical & horizontal polarization – OFDM 20 MHz (n – mode), 5180 MHz



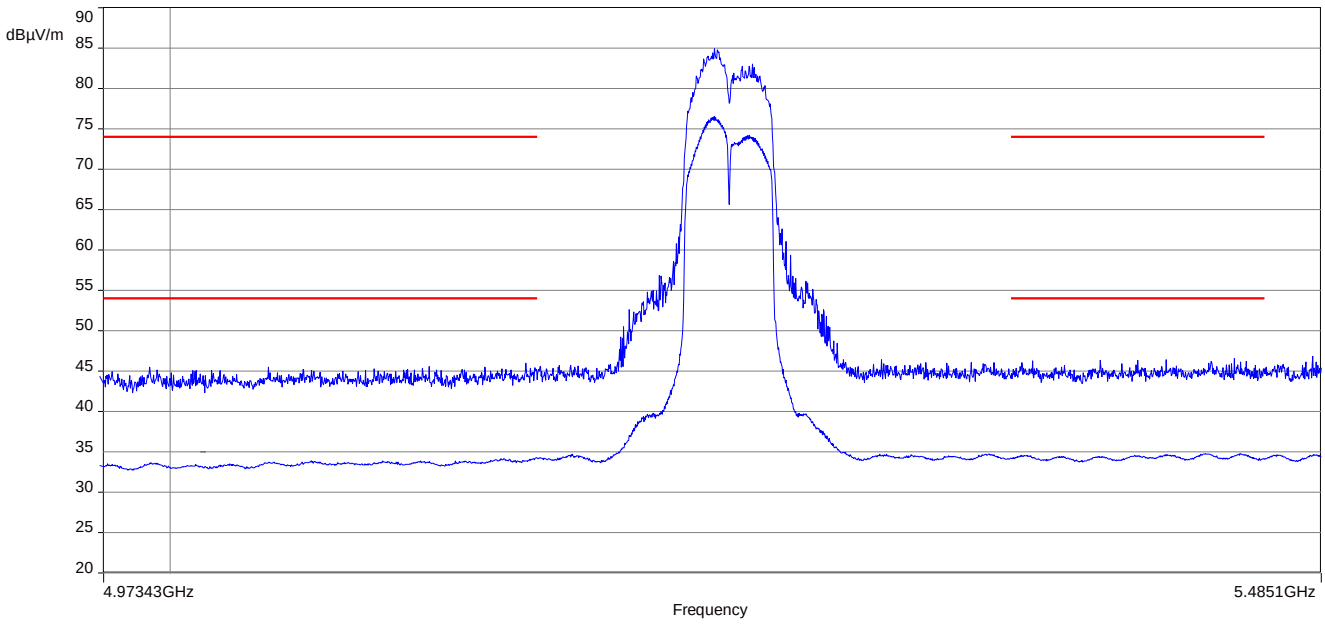
Plot 4: lower band edge, vertical & horizontal polarization – OFDM 20 MHz (n – mode), 5240 MHz



Plot 5: lower band edge, vertical & horizontal polarization – OFDM 40 MHz, 5190 MHz



Plot 6: lower band edge, vertical & horizontal polarization – OFDM 40 MHz, 5230 MHz



12.9 TX spurious emissions radiated

Description:

Measurement of the radiated spurious emissions in transmit mode. The measurement is performed at lowest, middle and highest channel.

Measurement:

Measurement parameter	
Detector:	Quasi Peak below 1 GHz (alternative Peak) Peak above 1 GHz / RMS
Sweep time:	Auto
Resolution bandwidth:	F < 1 GHz: 100 kHz F > 1 GHz: 1 MHz
Video bandwidth:	F < 1 GHz: 100 kHz F > 1 GHz: ≥ 3 MHz / 1 MHz
Span:	30 MHz to 40 GHz
Trace – mode:	Max Hold / Average with 100 counts + 20 log (1 / X) for duty cycle lower than 100 %
Test setup:	See sub clause 7.1 – A See sub clause 7.2 – B See sub clause 7.3 – A
Measurement uncertainty:	See sub clause 9

Limits:

TX Spurious Emissions Radiated		
§15.209		
Frequency (MHz)	Field Strength (dBµV/m)	Measurement distance
30 - 88	30.0	10
88 – 216	33.5	10
216 – 960	36.0	10
Above 960	54.0	3
§15.407		
Outside the restricted bands!	-27 dBm / MHz	

Results: OFDM (20 MHz bandwidth)

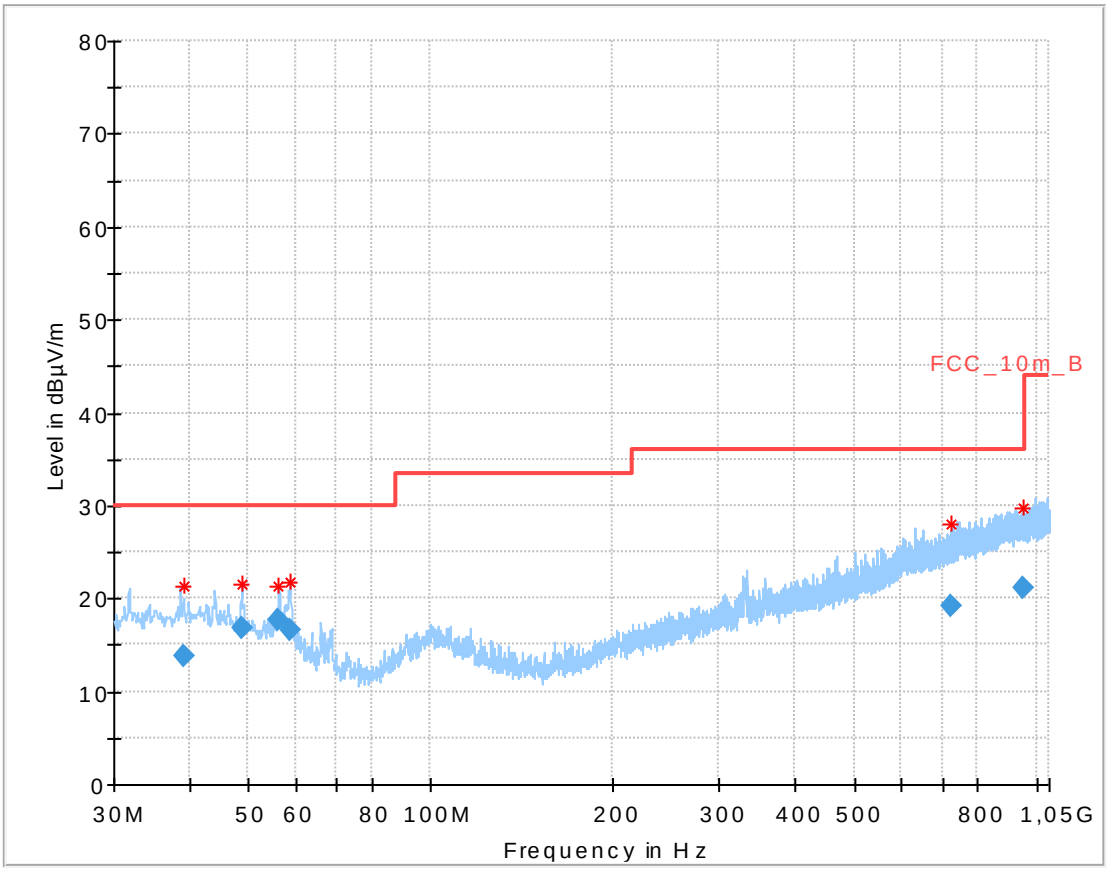
TX Spurious Emissions Radiated [dBµV/m] / dBm								
Lowest 5180 MHz			Middle 5200 MHz			Highest 5240 MHz		
F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]
-/-	Peak	-/-	-/-	Peak	-/-	-/-	Peak	-/-
	AVG	-/-		AVG	-/-		AVG	-/-
-/-	Peak	-/-	-/-	Peak	-/-	-/-	Peak	-/-
	AVG	-/-		AVG	-/-		AVG	-/-
For emissions below 1 GHz, please look at the table below the 1 GHz plot.			For emissions below 1 GHz, please look at the table below the 1 GHz plot.			For emissions below 1 GHz, please look at the table below the 1 GHz plot.		
No spurious emissions detected above 1 GHz, please look at the plots.			No spurious emissions detected above 1 GHz, please look at the plots.			No spurious emissions detected above 1 GHz, please look at the plots.		

Results: OFDM (40 MHz bandwidth)

TX Spurious Emissions Radiated [dBµV/m] / dBm								
Lowest 5190 MHz			-/-			Highest 5230 MHz		
F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]
-/-	Peak	-/-	-/-			-/-	Peak	-/-
	AVG	-/-					AVG	-/-
-/-	Peak	-/-				-/-	Peak	-/-
	AVG	-/-					AVG	-/-
For emissions below 1 GHz, please look at the table below the 1 GHz plot.						For emissions below 1 GHz, please look at the table below the 1 GHz plot.		
No spurious emissions detected above 1 GHz, please look at the plots.						No spurious emissions detected above 1 GHz, please look at the plots.		

Plots: OFDM / 20 MHz

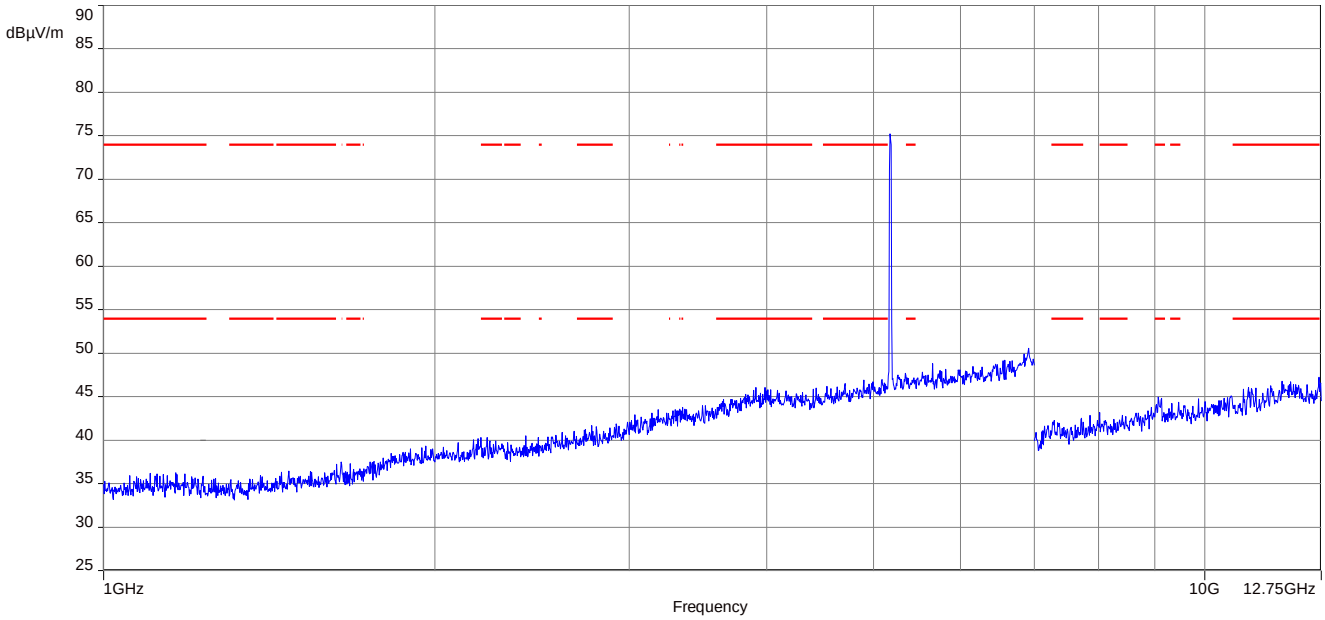
Plot 1: 30 MHz to 1 GHz, 5180 MHz, vertical & horizontal polarization



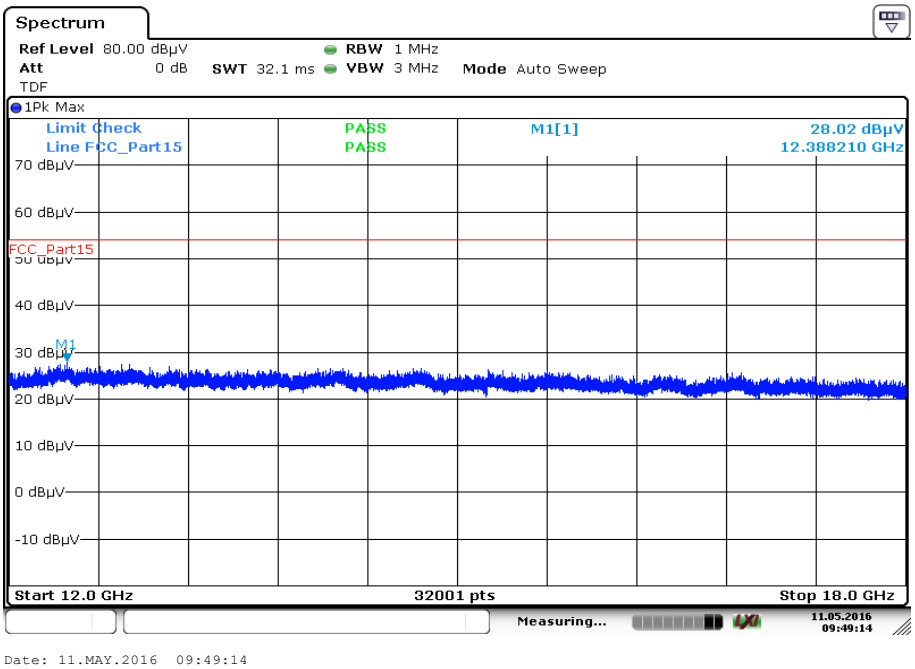
Final_Result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
39.079650	13.79	30.00	16.21	1000.0	120.000	101.0	V	233.0	14.0
48.824850	16.92	30.00	13.08	1000.0	120.000	101.0	V	315.0	12.9
56.066100	17.68	30.00	12.32	1000.0	120.000	185.0	V	233.0	11.6
58.487250	16.64	30.00	13.36	1000.0	120.000	185.0	V	121.0	10.9
725.745900	19.18	36.00	16.82	1000.0	120.000	185.0	H	273.0	22.1
951.335700	21.20	36.00	14.80	1000.0	120.000	185.0	H	246.0	24.3

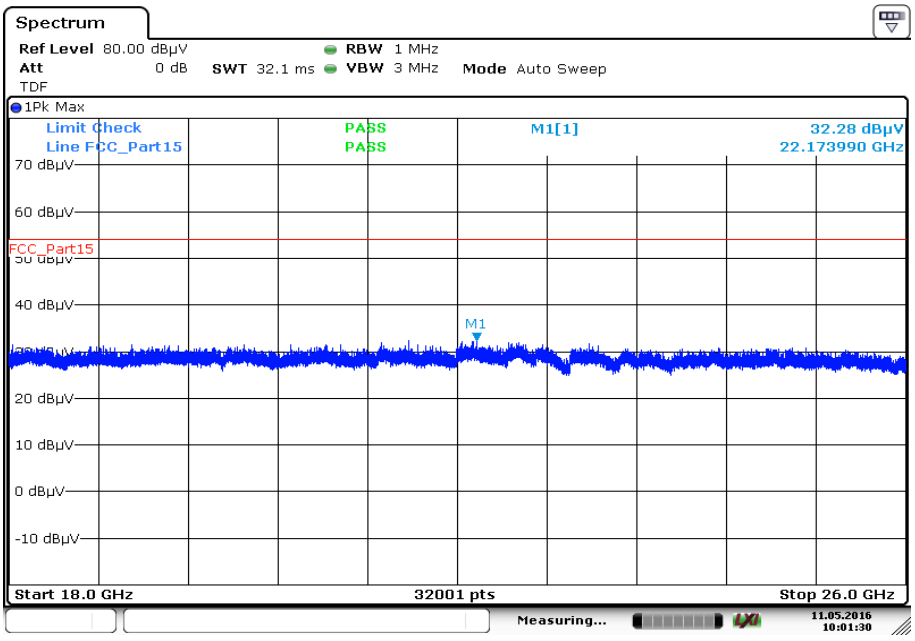
Plot 2: 1 GHz to 12.75 GHz, 5180 MHz, vertical & horizontal polarization



Plot 3: 12.75 GHz to 18 GHz, 5180 MHz, vertical & horizontal polarization

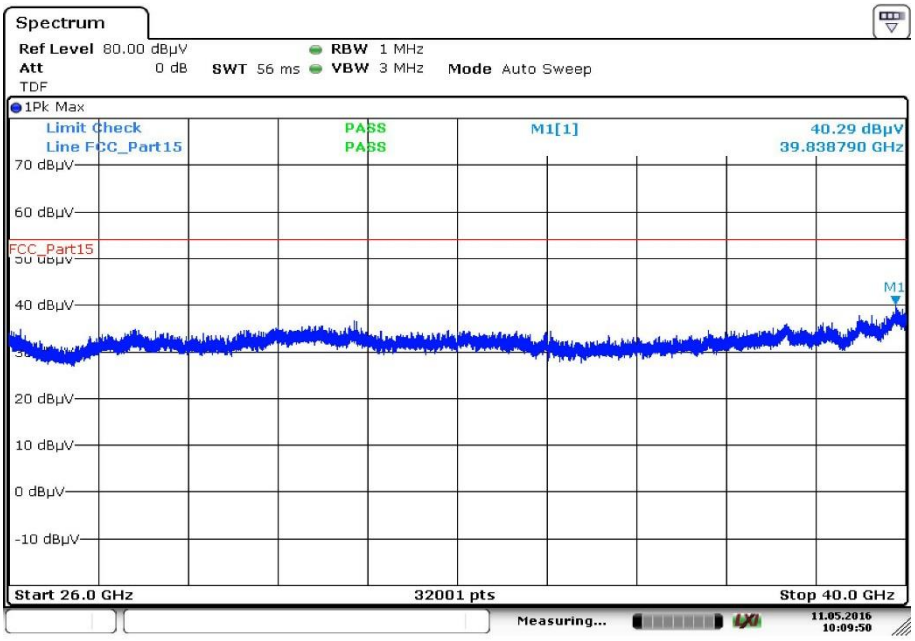


Plot 4: 18 GHz to 26 GHz, 5180 MHz, vertical & horizontal polarization



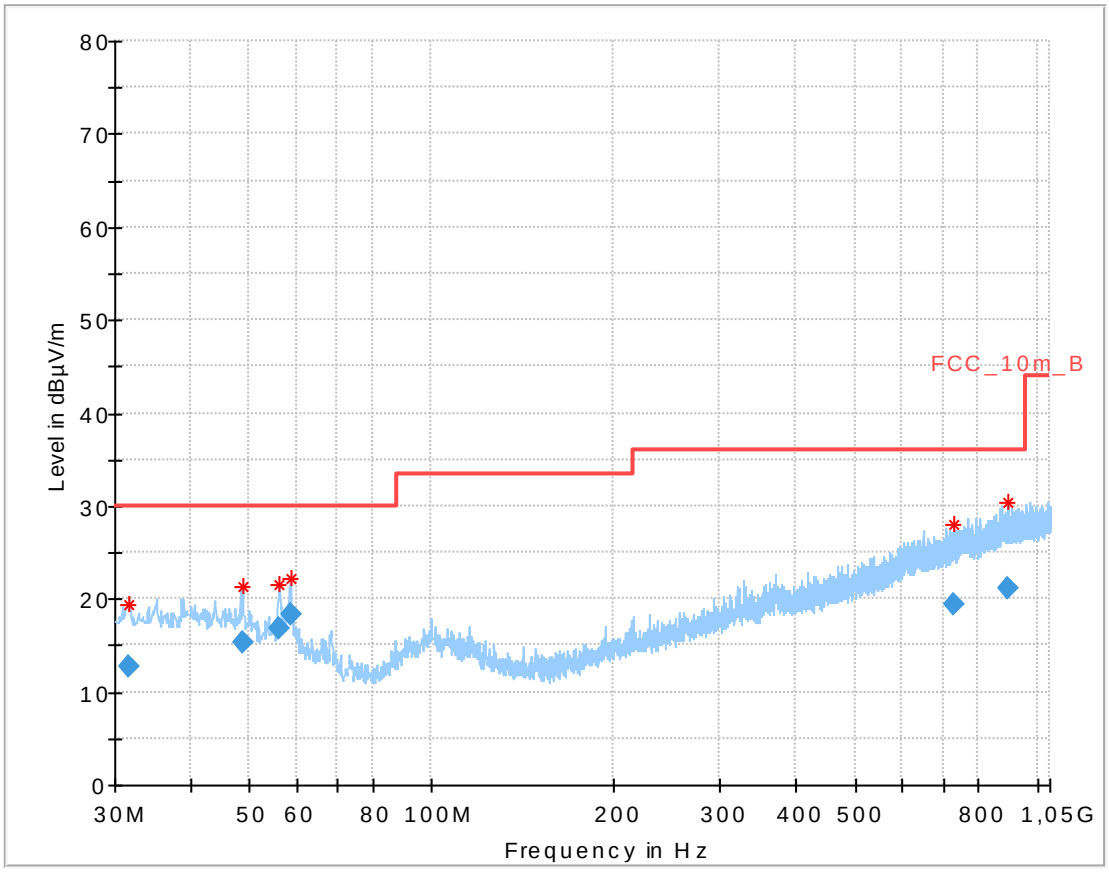
Date: 11.MAY.2016 10:01:30

Plot 5: 26 GHz to 40 GHz, 5180 MHz, vertical & horizontal polarization



Date: 11.MAY.2016 10:09:51

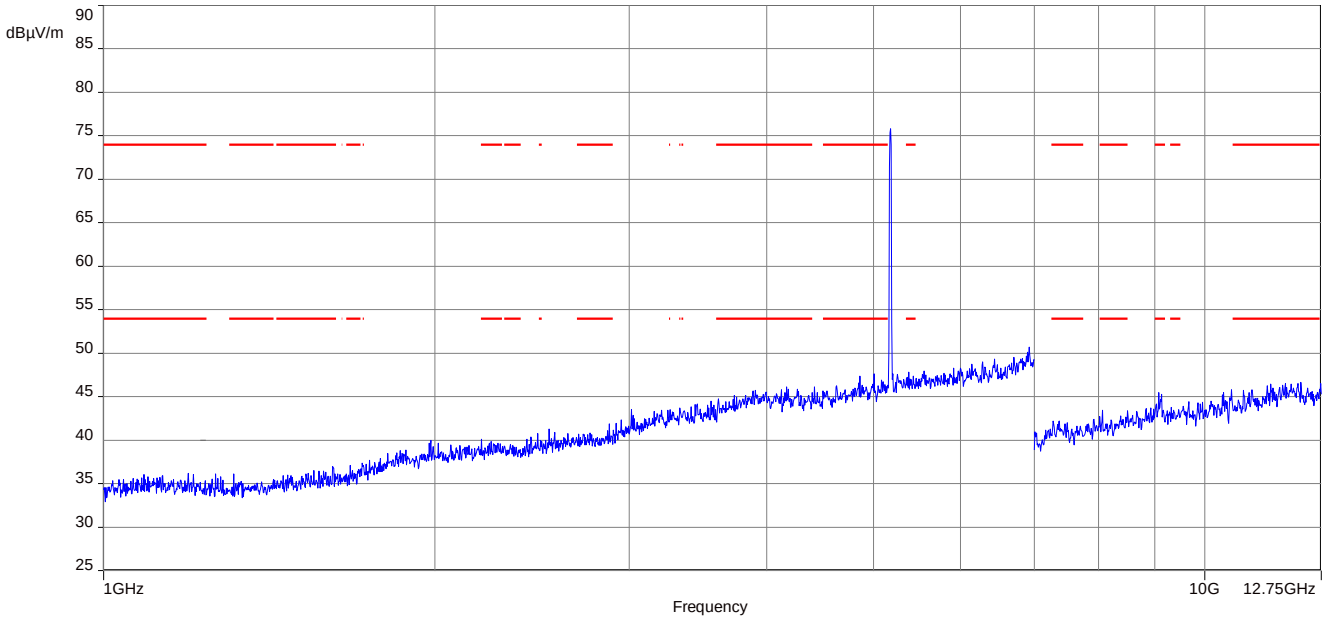
Plot 6: 30 MHz to 1 GHz, 5220 MHz, vertical & horizontal polarization



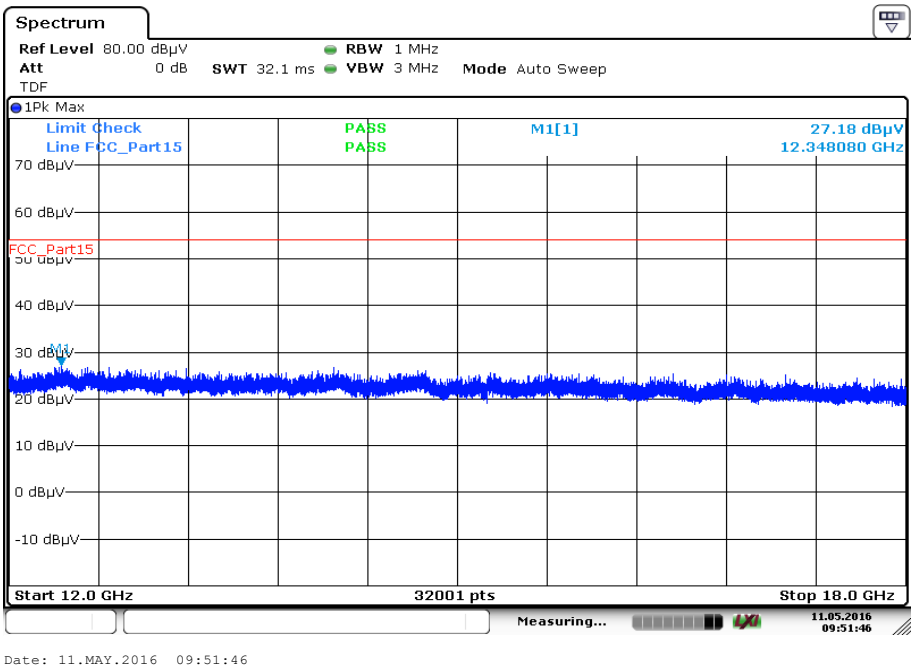
Final_Result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
31.583700	12.79	30.00	17.21	1000.0	120.000	185.0	V	302.0	13.5
48.831750	15.37	30.00	14.63	1000.0	120.000	98.0	V	183.0	12.9
56.094600	16.82	30.00	13.18	1000.0	120.000	101.0	V	344.0	11.6
58.529250	18.32	30.00	11.68	1000.0	120.000	98.0	V	52.0	10.9
730.107000	19.36	36.00	16.64	1000.0	120.000	98.0	V	0.0	22.2
896.975850	21.08	36.00	14.92	1000.0	120.000	101.0	H	331.0	24.1

Plot 7: 1 GHz to 12.75 GHz, 5220 MHz, vertical & horizontal polarization

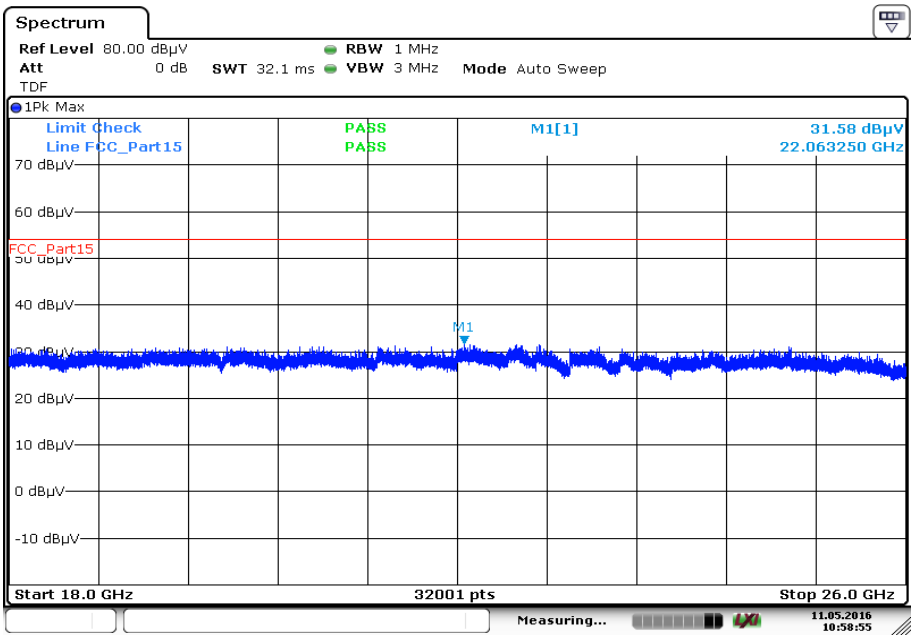


Plot 8: 12.75 GHz to 18 GHz, 5220 MHz, vertical & horizontal polarization



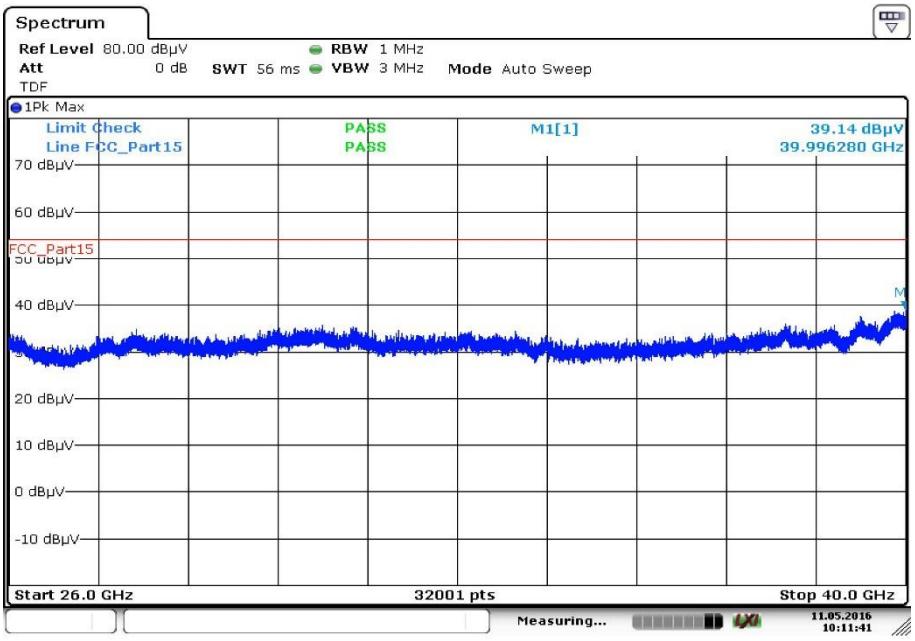
Date: 11.MAY.2016 09:51:46

Plot 9: 18 GHz to 26 GHz, 5220 MHz, vertical & horizontal polarization



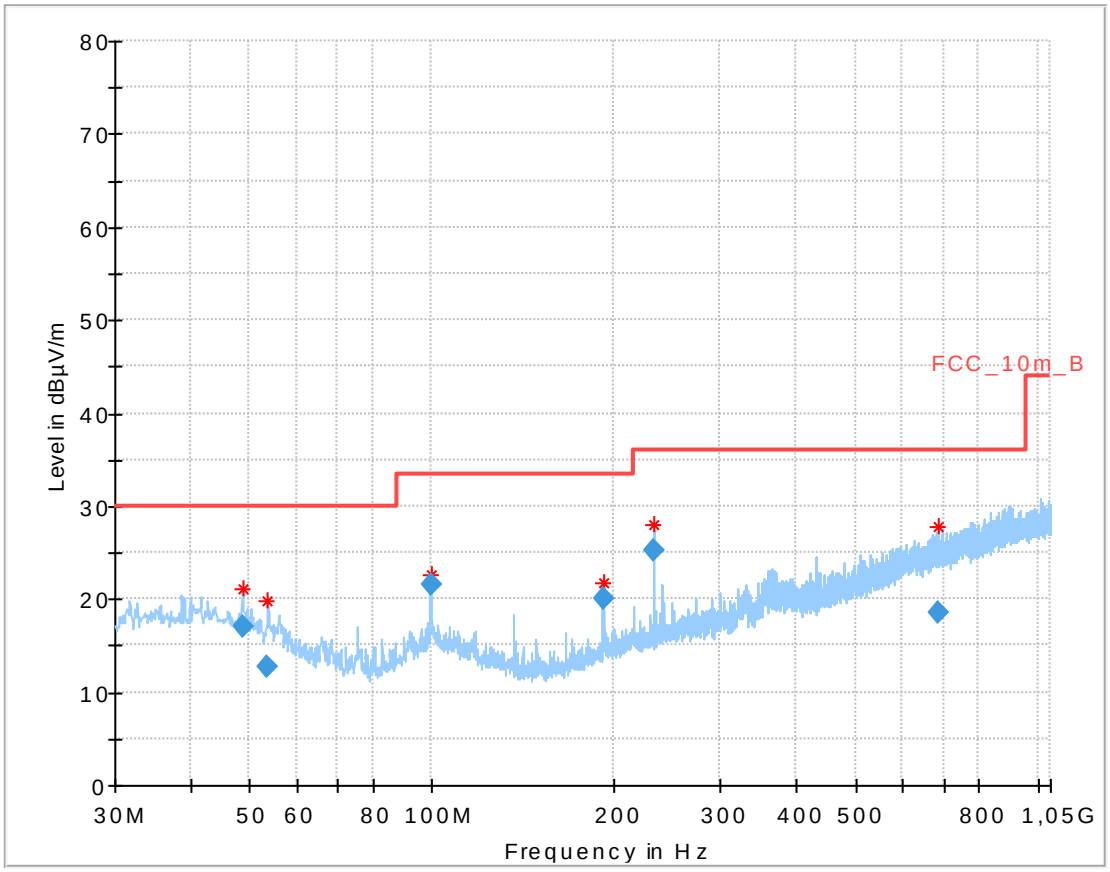
Date: 11.MAY.2016 10:58:56

Plot 10: 26 GHz to 40 GHz, 5220 MHz, vertical & horizontal polarization



Date: 11.MAY.2016 10:11:41

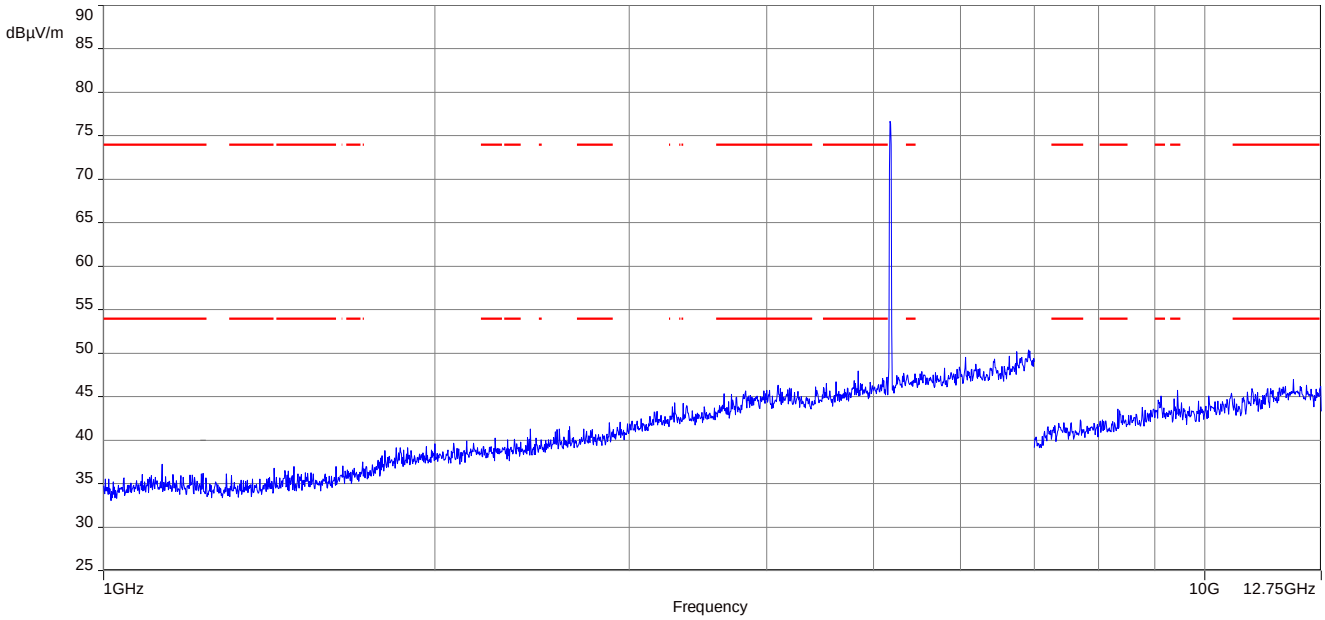
Plot 11: 30 MHz to 1 GHz, 5240 MHz, vertical & horizontal polarization



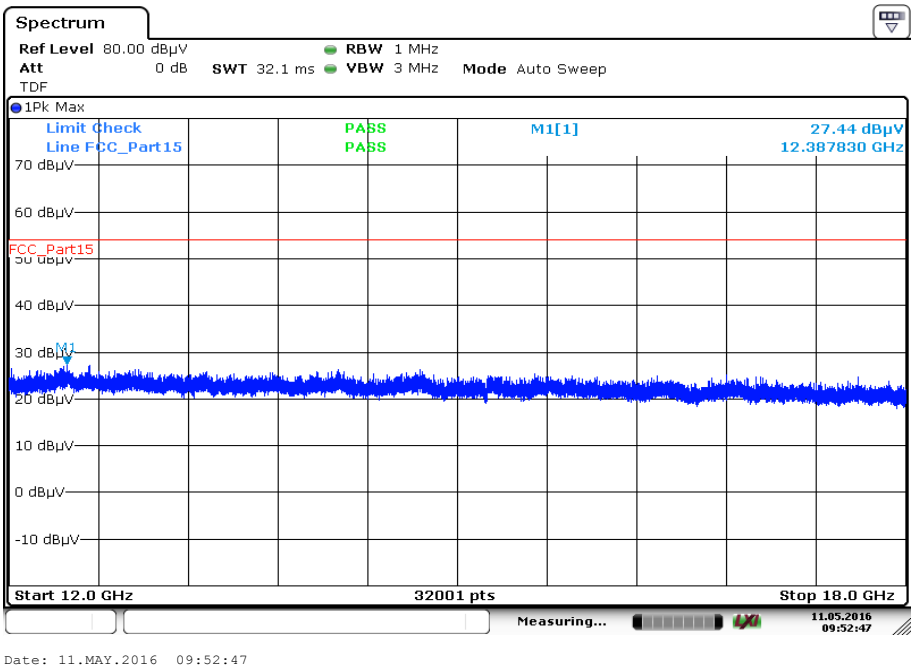
Final_Result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
48.732450	17.09	30.00	12.91	1000.0	120.000	101.0	V	5.0	12.9
53.709450	12.77	30.00	17.23	1000.0	120.000	101.0	V	351.0	12.0
99.569400	21.60	33.50	11.90	1000.0	120.000	100.0	V	240.0	12.1
192.007800	19.99	33.50	13.51	1000.0	120.000	98.0	V	19.0	11.2
232.797300	25.31	36.00	10.69	1000.0	120.000	98.0	V	65.0	12.8
686.041800	18.52	36.00	17.48	1000.0	120.000	101.0	H	252.0	21.4

Plot 12: 1 GHz to 12.75 GHz, 5240 MHz, vertical & horizontal polarization

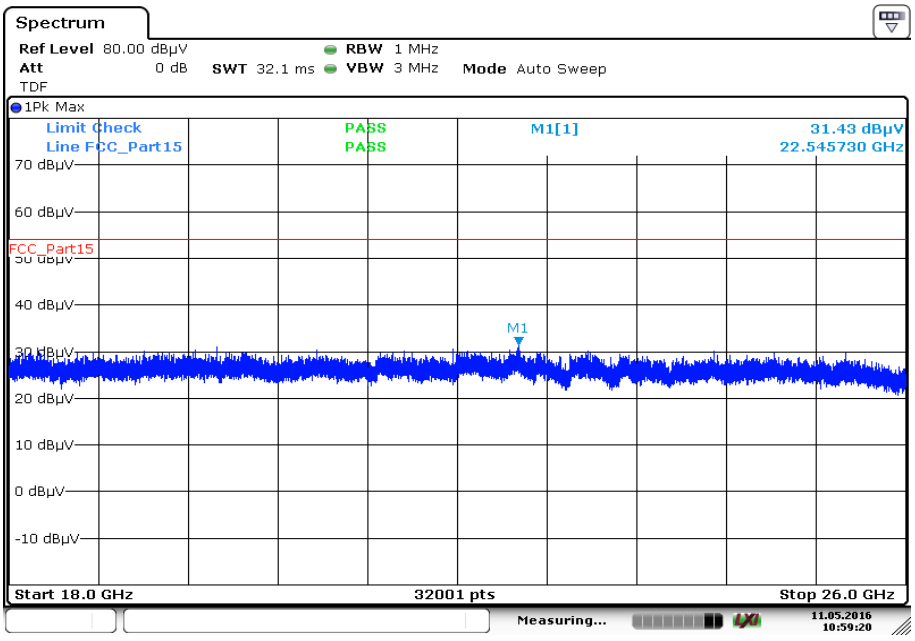


Plot 13: 12.75 GHz to 18 GHz, 5240 MHz, vertical & horizontal polarization



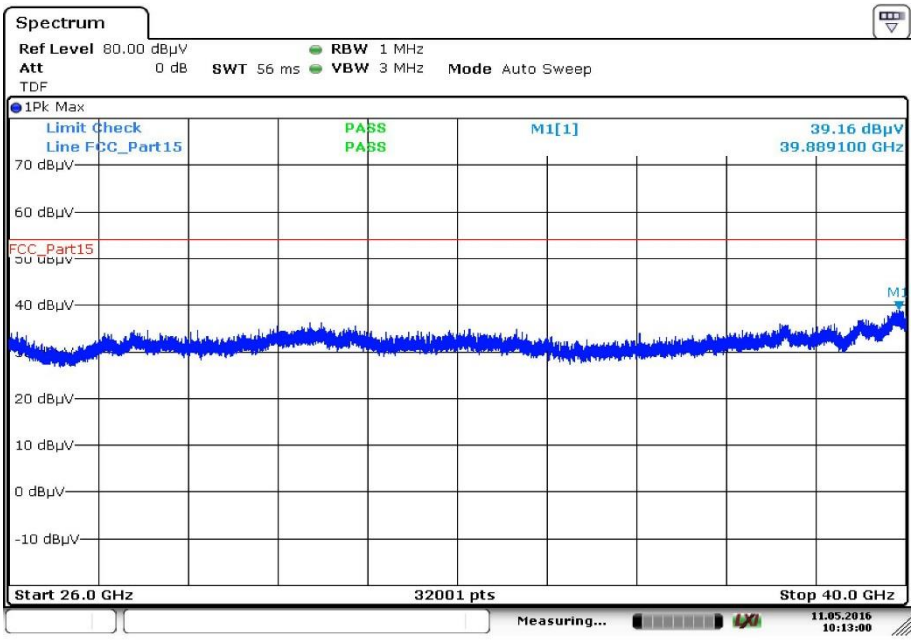
Date: 11.MAY.2016 09:52:47

Plot 14: 18 GHz to 26 GHz, 5240 MHz, vertical & horizontal polarization



Date: 11.MAY.2016 10:59:21

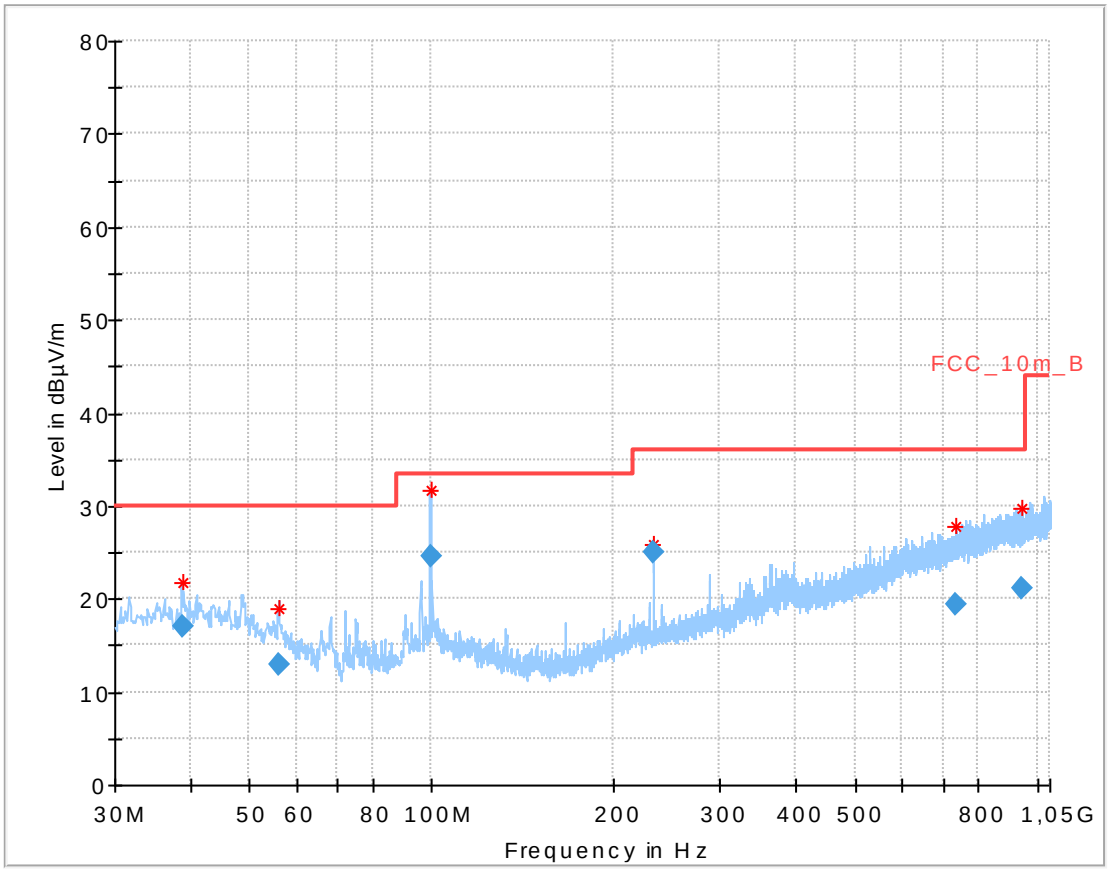
Plot 15: 26 GHz to 40 GHz, 5240 MHz, vertical & horizontal polarization



Date: 11.MAY.2016 10:13:00

Plots: OFDM / 40 MHz

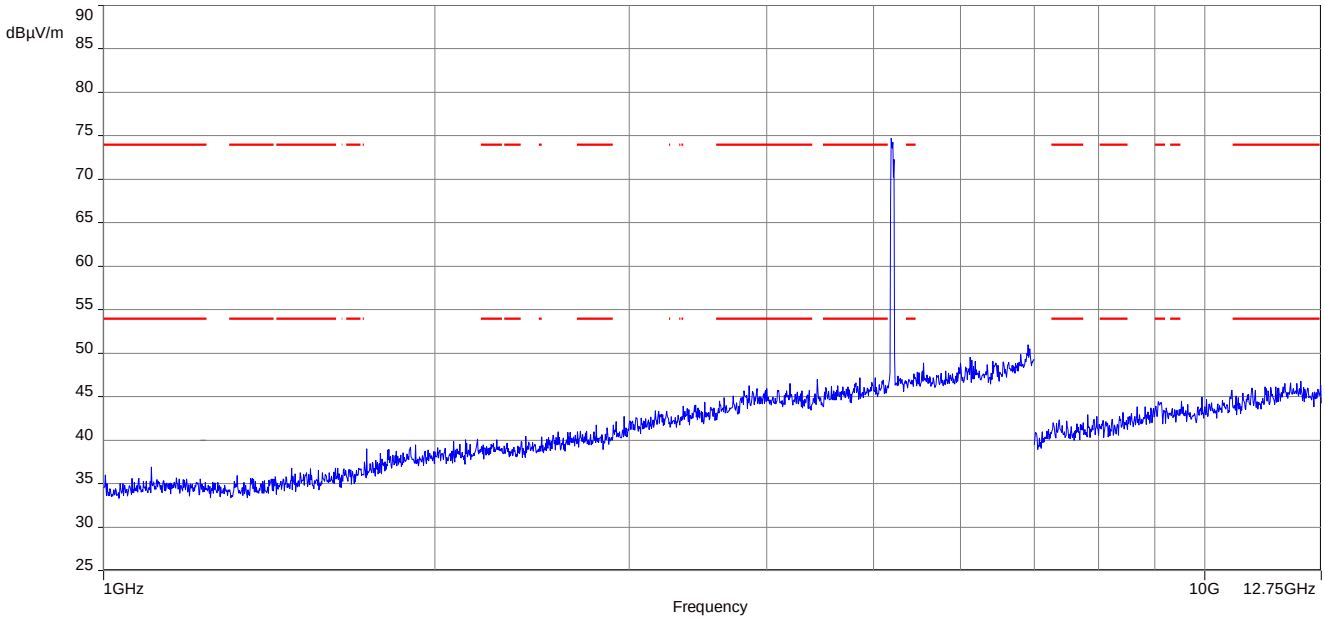
Plot 1: 30 MHz to 1 GHz, 5190 MHz, vertical & horizontal polarization



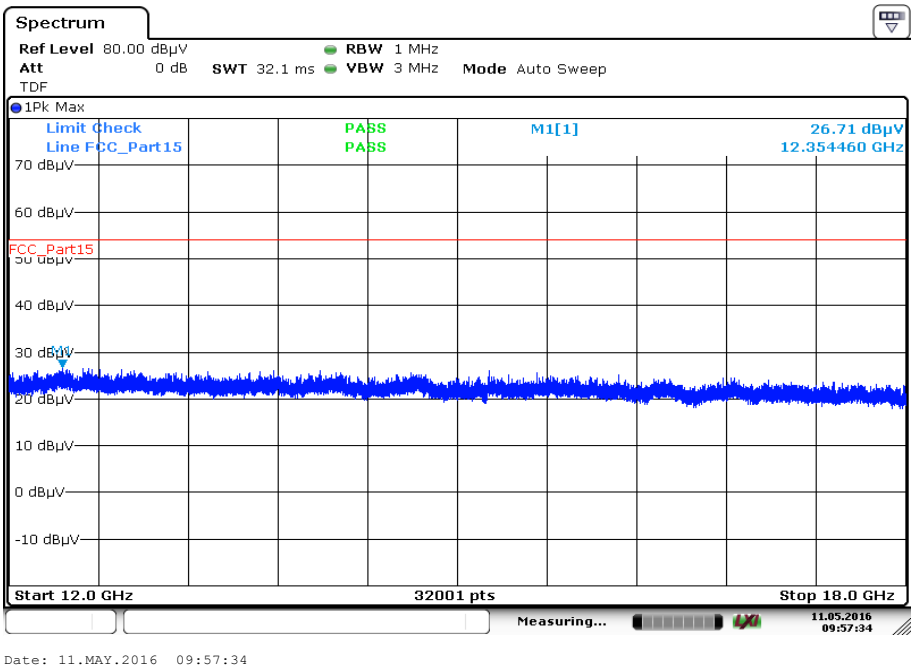
Final_Result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
38.718450	17.04	30.00	12.96	1000.0	120.000	98.0	V	7.0	14.0
55.968450	12.86	30.00	17.14	1000.0	120.000	101.0	V	259.0	11.6
99.581400	24.55	33.50	8.95	1000.0	120.000	98.0	V	149.0	12.1
232.378200	25.06	36.00	10.94	1000.0	120.000	101.0	V	286.0	12.8
734.846550	19.45	36.00	16.55	1000.0	120.000	185.0	V	92.0	22.3
942.415800	21.22	36.00	14.78	1000.0	120.000	101.0	H	351.0	24.2

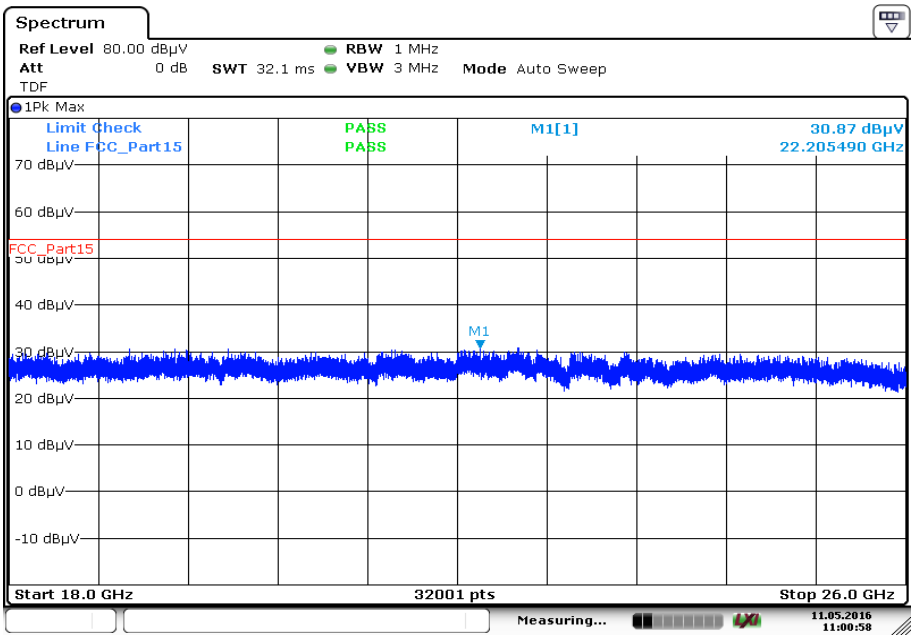
Plot 2: 1 GHz to 12.75 GHz, 5190 MHz, vertical & horizontal polarization



Plot 3: 12.75 GHz to 18 GHz, 5190 MHz, vertical & horizontal polarization



Plot 4: 18 GHz to 26 GHz, 5190 MHz, vertical & horizontal polarization



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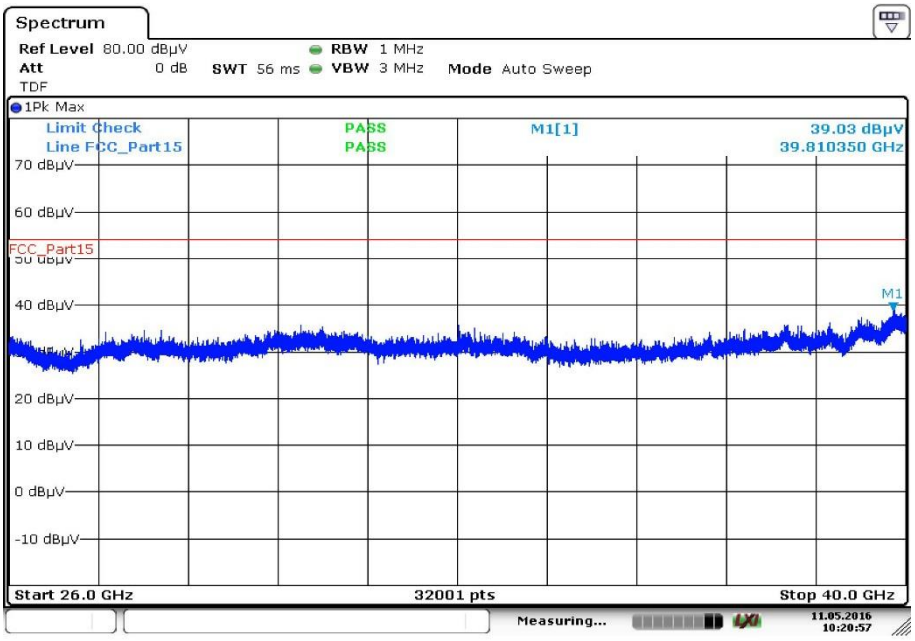
Plot 5: 26 GHz to 40 GHz, 5190 MHz, vertical & horizontal polarization



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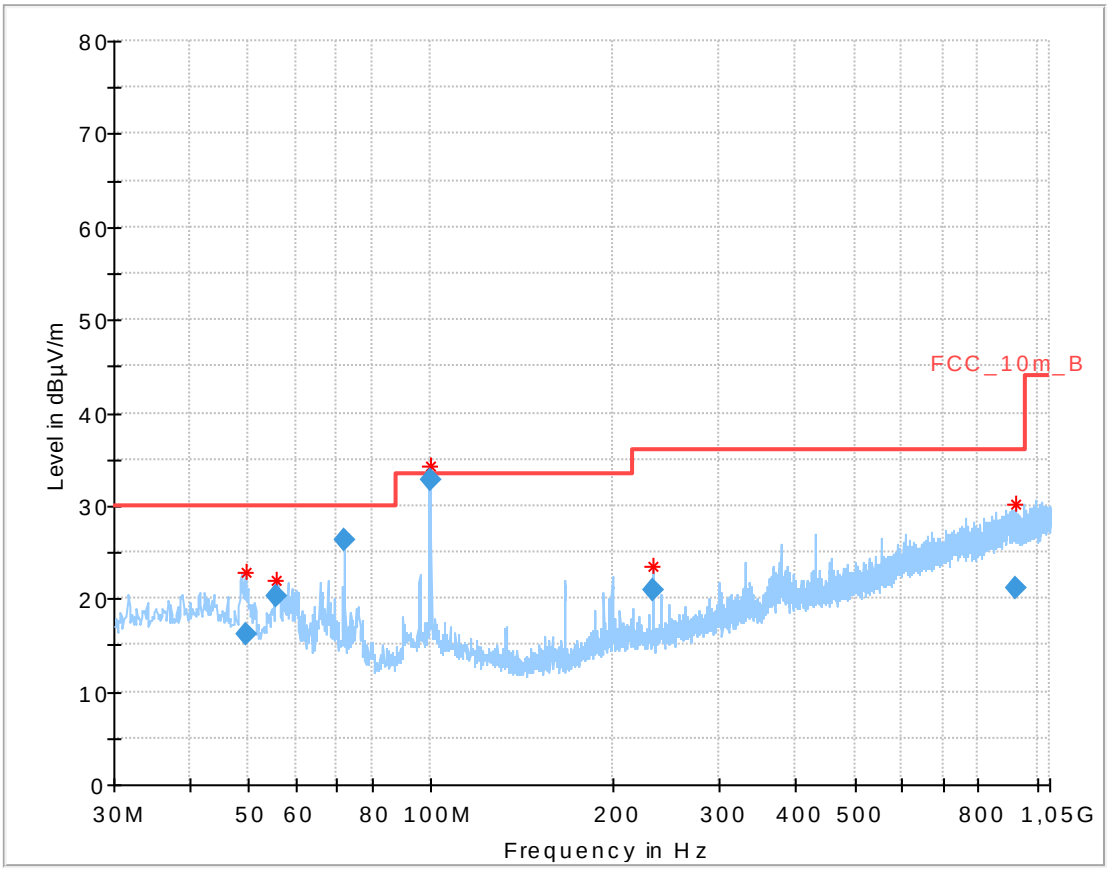
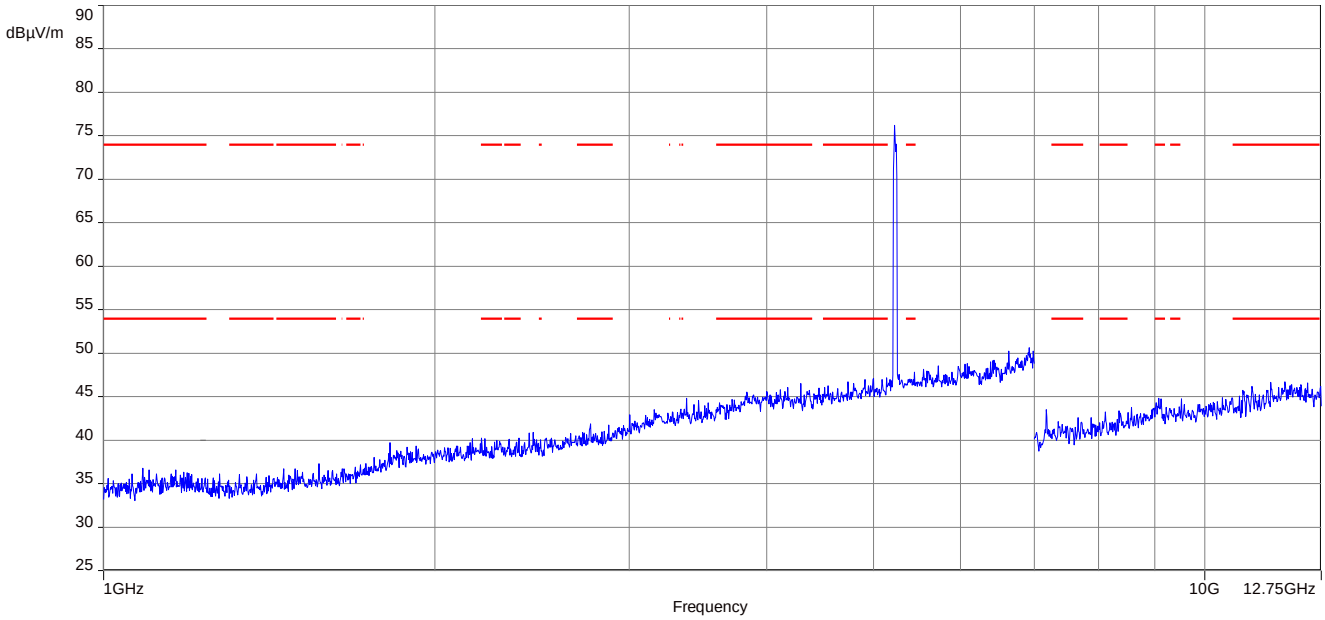
Plot 6: 30 MHz to 1 GHz, 5230 MHz, vertical & horizontal polarization



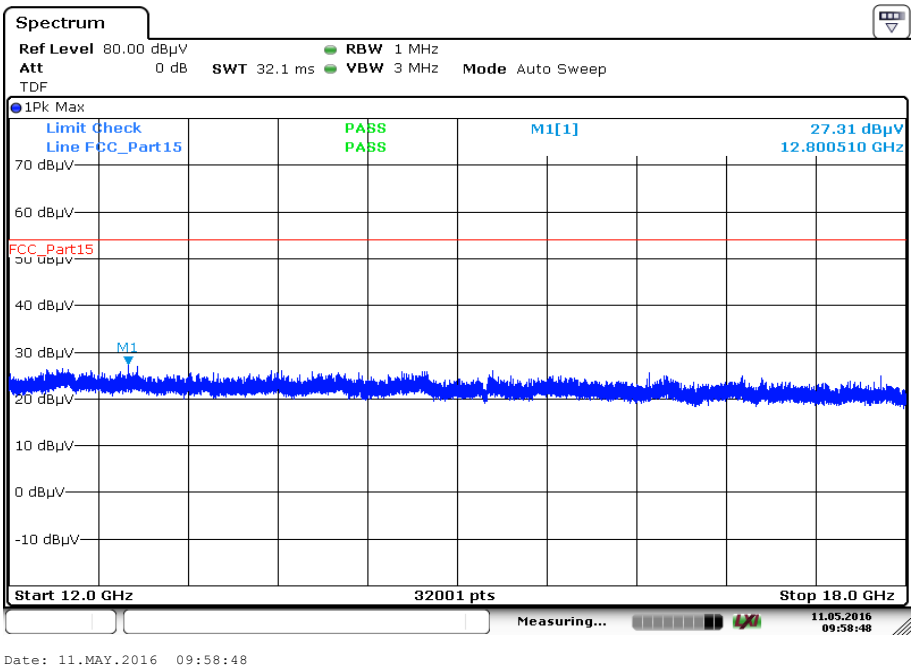
Final_Result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
49.453500	16.28	30.00	13.72	1000.0	120.000	185.0	V	144.0	12.8
55.557300	20.37	30.00	9.63	1000.0	120.000	180.0	V	237.0	11.7
72.004200	26.29	30.00	3.71	1000.0	120.000	185.0	V	269.0	8.4
99.579600	32.83	33.50	0.67	1000.0	120.000	98.0	V	144.0	12.1
232.761300	21.00	36.00	15.00	1000.0	120.000	98.0	V	61.0	12.8
920.822700	21.15	36.00	14.85	1000.0	120.000	98.0	H	106.0	24.2

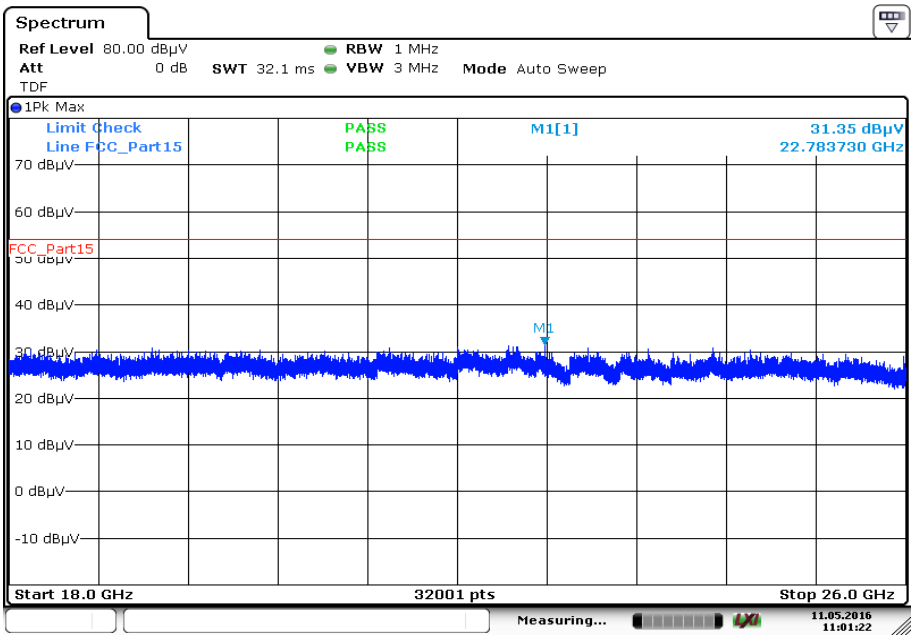
Plot 7: 1 GHz to 12.75 GHz, 5230 MHz, vertical & horizontal polarization



Plot 8: 12.75 GHz to 18 GHz, 5230 MHz, vertical & horizontal polarization



Plot 9: 18 GHz to 26 GHz, 5230 MHz, vertical & horizontal polarization



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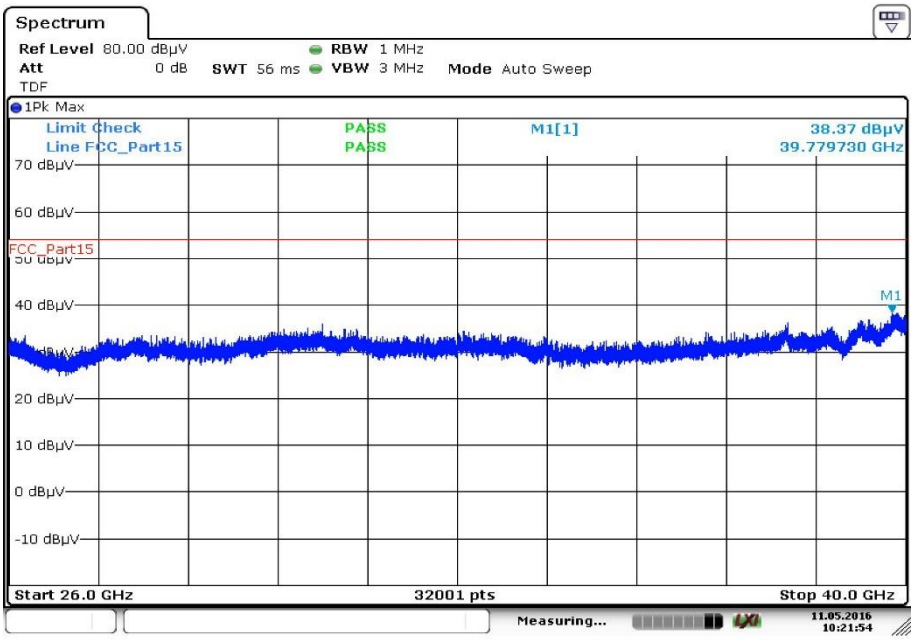
Plot 10: 26 GHz to 40 GHz, 5230 MHz, vertical & horizontal polarization



Date: 11.MAY.2016 10:21:54

12.10 RX spurious emissions radiated

Description:

Measurement of the radiated spurious emissions in idle/receive mode.

Measurement:

Measurement parameter	
Detector:	Quasi Peak below 1 GHz (alternative Peak) Peak above 1 GHz / RMS
Sweep time:	Auto
Resolution bandwidth:	F < 1 GHz: 100 kHz F > 1 GHz: 1 MHz
Video bandwidth:	F < 1 GHz: 100 kHz F > 1 GHz: ≥ 3 MHz
Span:	30 MHz to 40 GHz
Trace – mode:	Max Hold / Average with 100 counts + 20 log (1 / X) for duty cycle lower than 100 %
Test setup:	See sub clause 7.2 – B
Measurement uncertainty:	See sub clause 9

Limits:

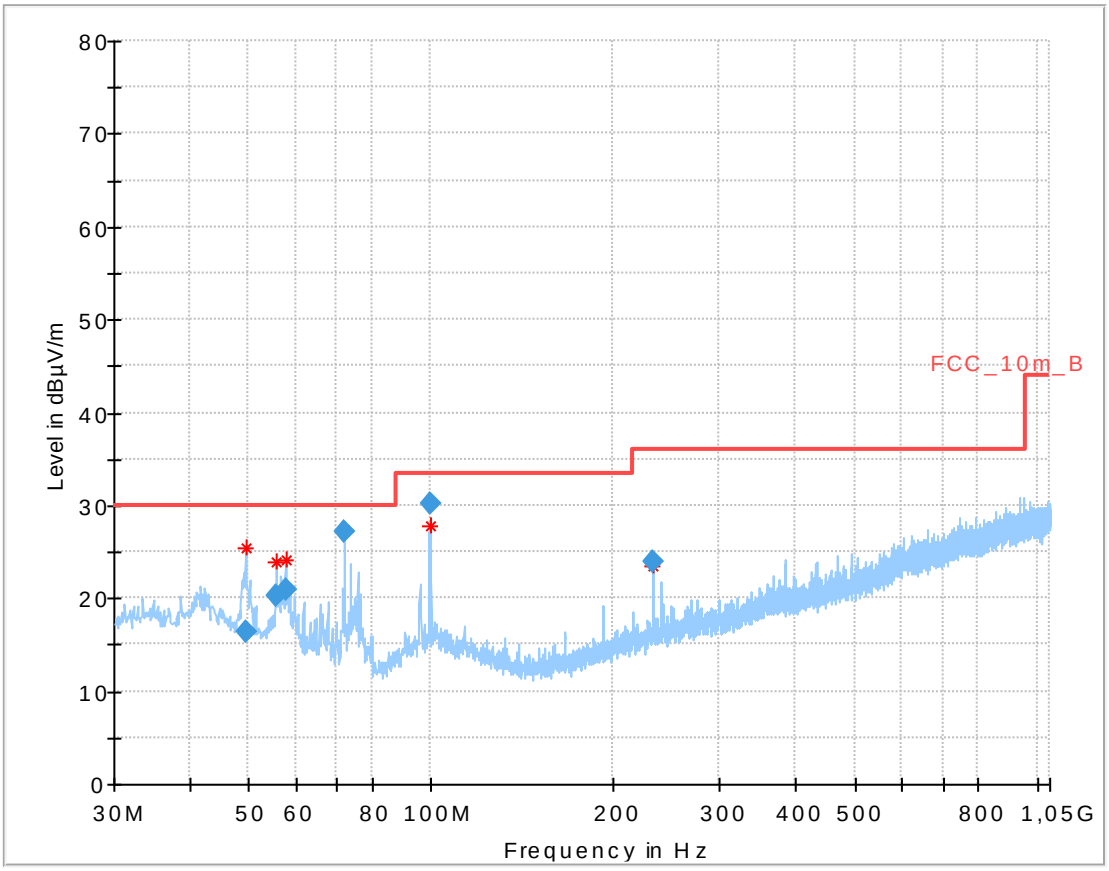
RX Spurious Emissions Radiated		
Frequency (MHz)	Field Strength (dBµV/m)	Measurement distance
30 - 88	30.0	10
88 – 216	33.5	10
216 – 960	36.0	10
Above 960	54.0	3

Results:

RX Spurious Emissions Radiated [dBµV/m]		
F [MHz]	Detector	Level [dBµV/m]
For emissions below 1 GHz, please look at the table below the 1 GHz plot.		
No spurious emissions detected above 1 GHz, please look at the plots.		

Plots:

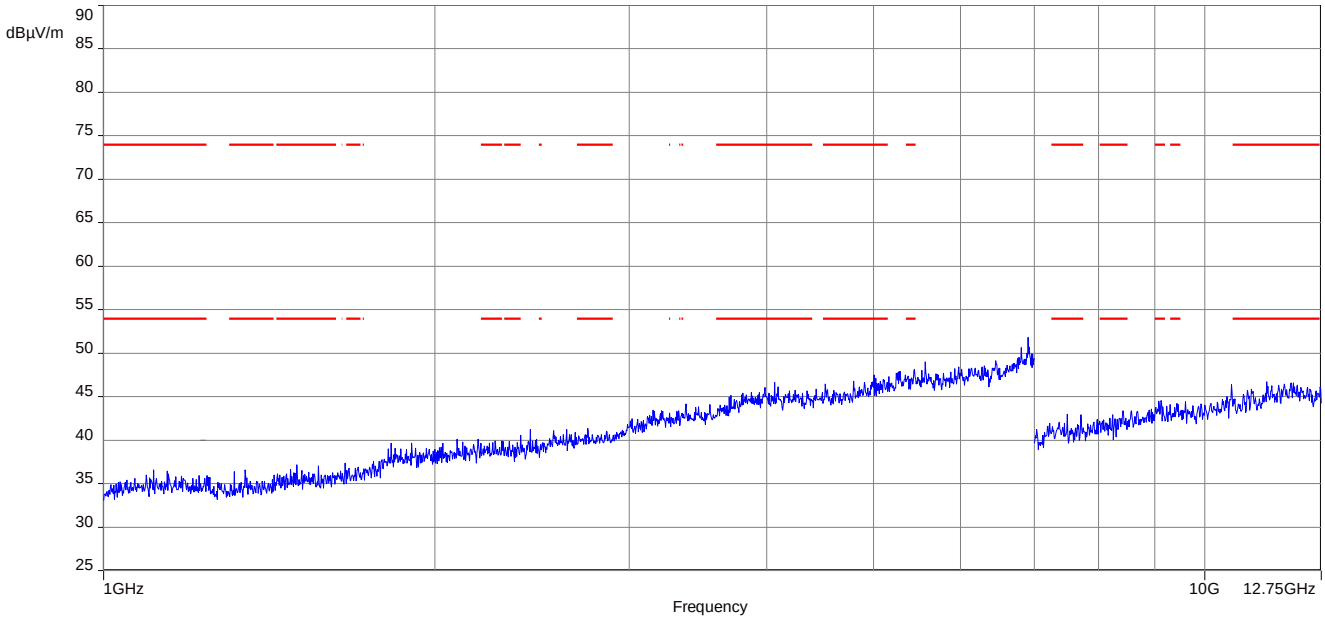
Plot 1: 30 MHz to 1 GHz, vertical & horizontal polarization



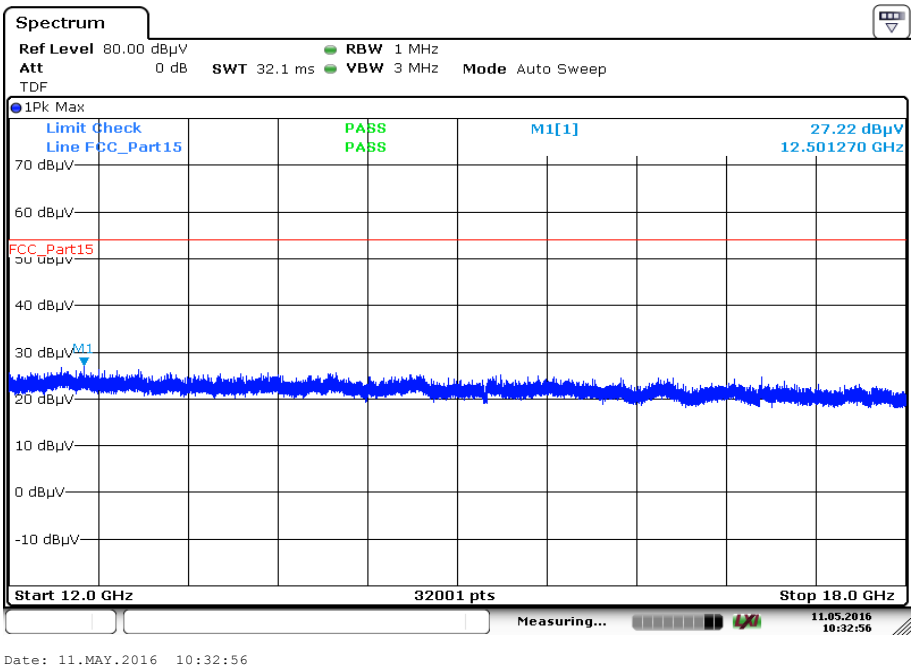
Final_Result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
49.760250	16.44	30.00	13.56	1000.0	120.000	98.0	V	155.0	12.7
55.515450	20.19	30.00	9.81	1000.0	120.000	178.0	V	243.0	11.7
57.556200	20.94	30.00	9.06	1000.0	120.000	185.0	V	2.0	11.2
71.999700	27.12	30.00	2.88	1000.0	120.000	185.0	V	282.0	8.4
99.758250	30.18	33.50	3.32	1000.0	120.000	98.0	V	213.0	12.1
232.790250	24.00	36.00	12.00	1000.0	120.000	101.0	V	86.0	12.8

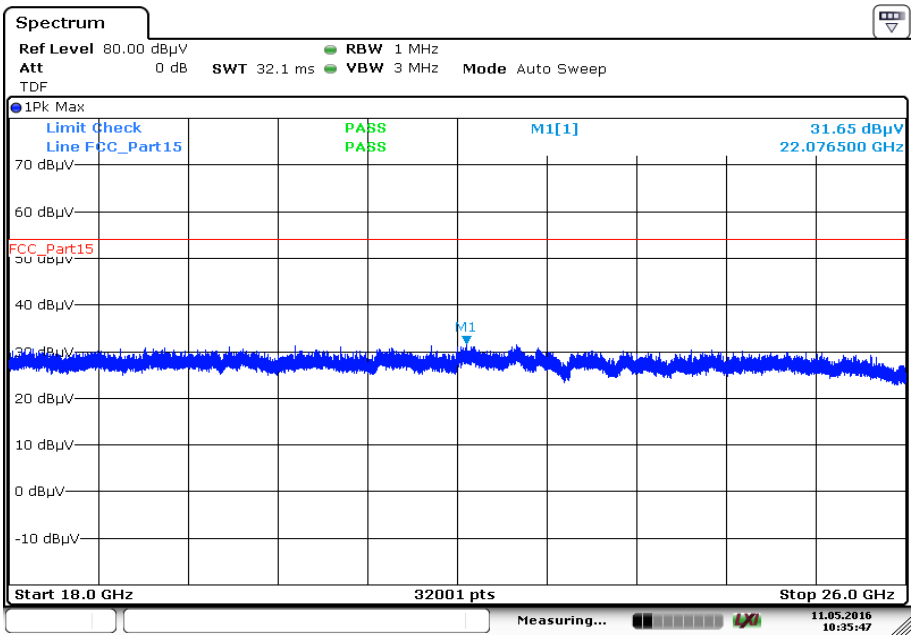
Plot 2: 1 GHz to 12.75 GHz, vertical & horizontal polarization



Plot 3: 12.75 GHz to 18 GHz, vertical & horizontal polarization

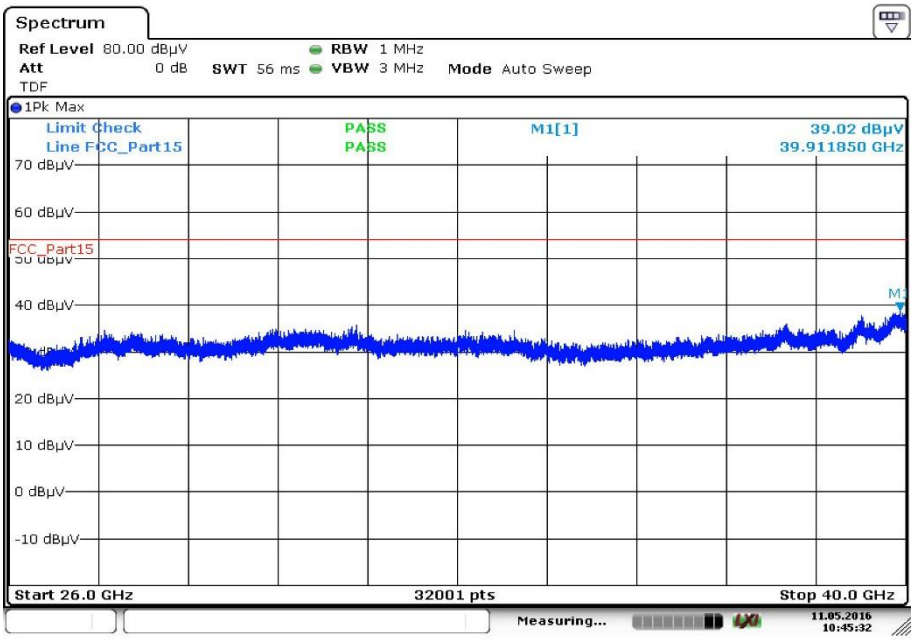


Plot 4: 18 GHz to 26 GHz, vertical & horizontal polarization



Date: 11.MAY.2016 10:35:48

Plot 5: 26 GHz to 40 GHz, vertical & horizontal polarization



Date: 11.MAY.2016 10:45:32

12.11 Spurious emissions radiated < 30 MHz

Description:

Measurement of the radiated spurious emissions in transmit mode and receive mode below 30 MHz. The EUT is set first to middle channel. This measurement is representative for all channels and modes. If critical peaks are found the lowest channel and the highest channel will be measured too. Then the EUT is set to receive or idle mode. 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
Video bandwidth:	F < 150 kHz: 200 Hz F > 150 kHz: 9 kHz
Resolution bandwidth:	F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz
Span:	9 kHz to 30 MHz
Trace – mode:	Max Hold
Test setup:	See sub clause 7.2 – C
Measurement uncertainty:	See sub clause 9

Limits:

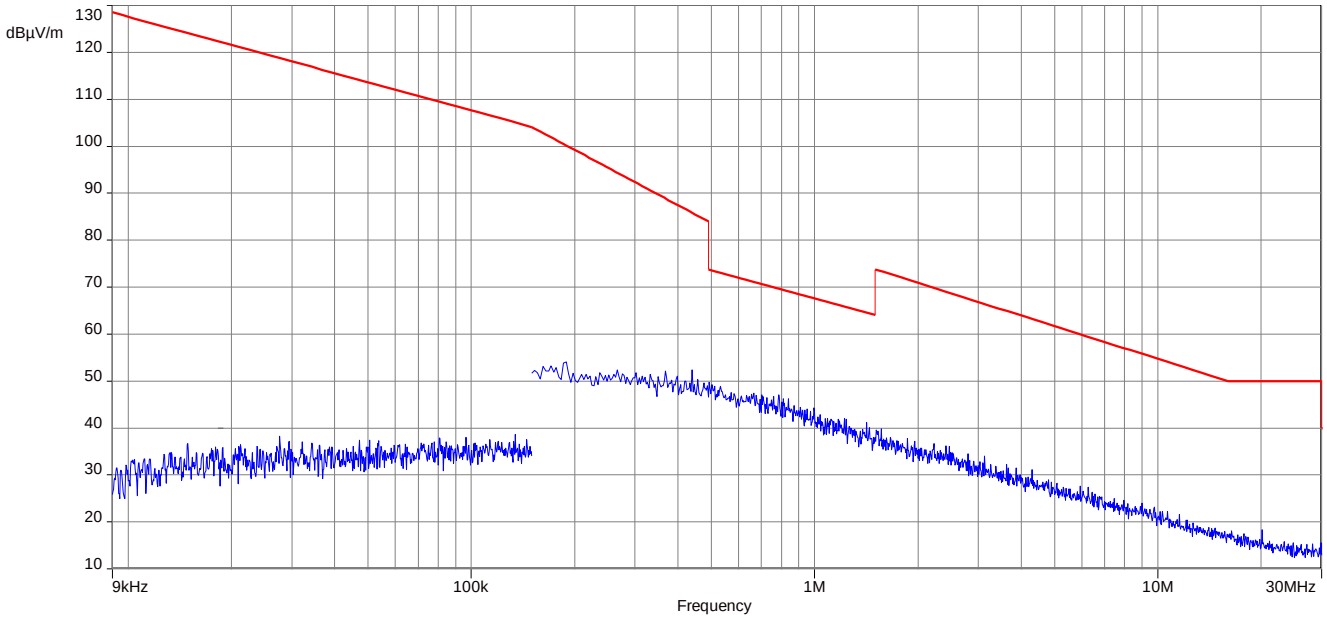
Spurious Emissions Radiated < 30 MHz		
Frequency (MHz)	Field Strength (dBµV/m)	Measurement distance
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30

Results:

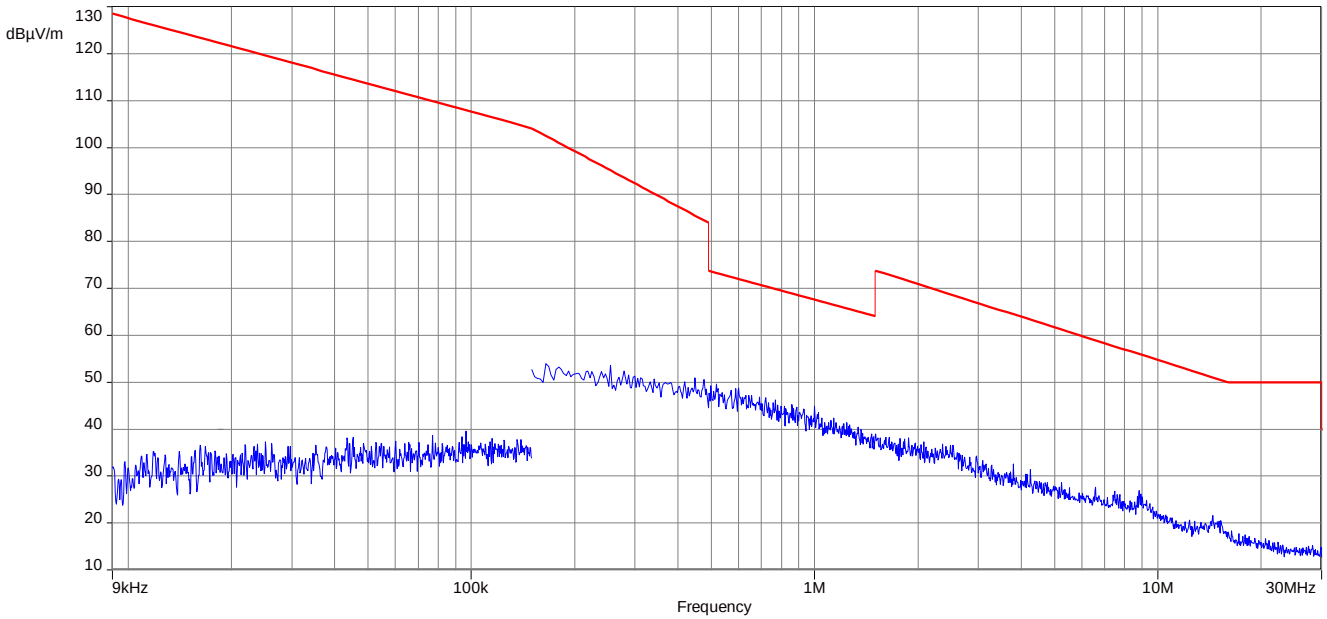
Spurious Emissions Radiated < 30 MHz [dBµV/m]		
F [MHz]	Detector	Level [dBµV/m]
All detected emissions are more than 20 dB below the limit.		

Plots:

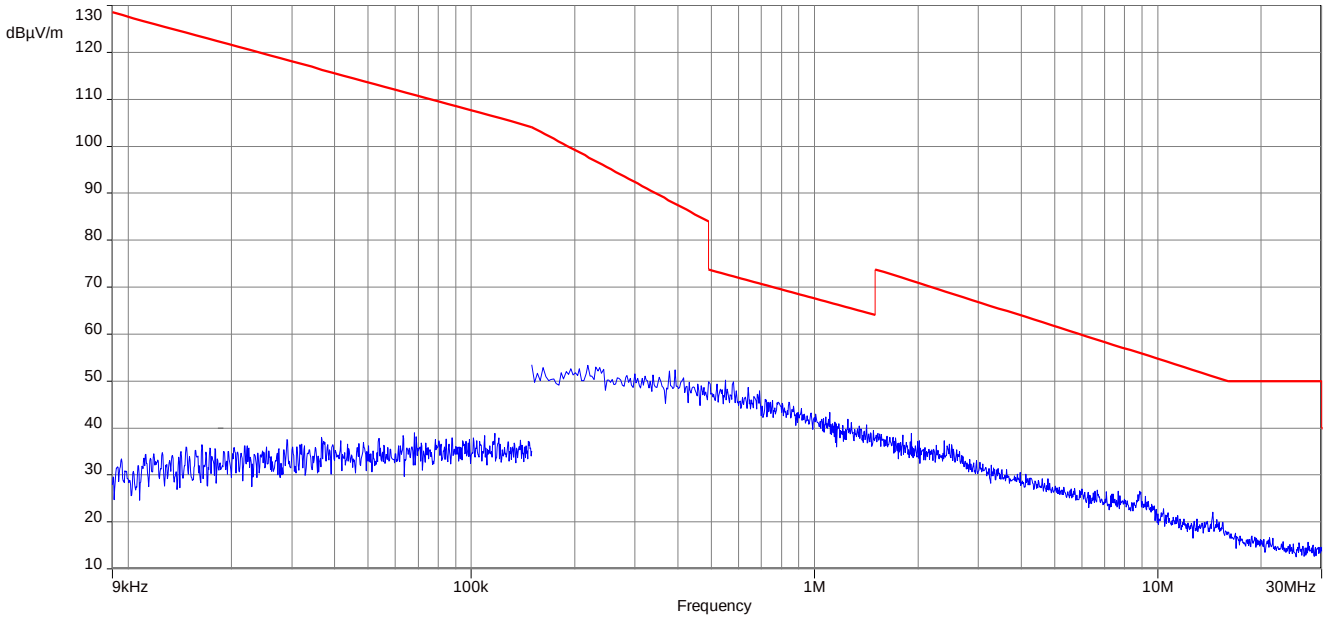
Plot 1: 9 kHz to 30 MHz, OFDM 20 MHz, 5180 MHz



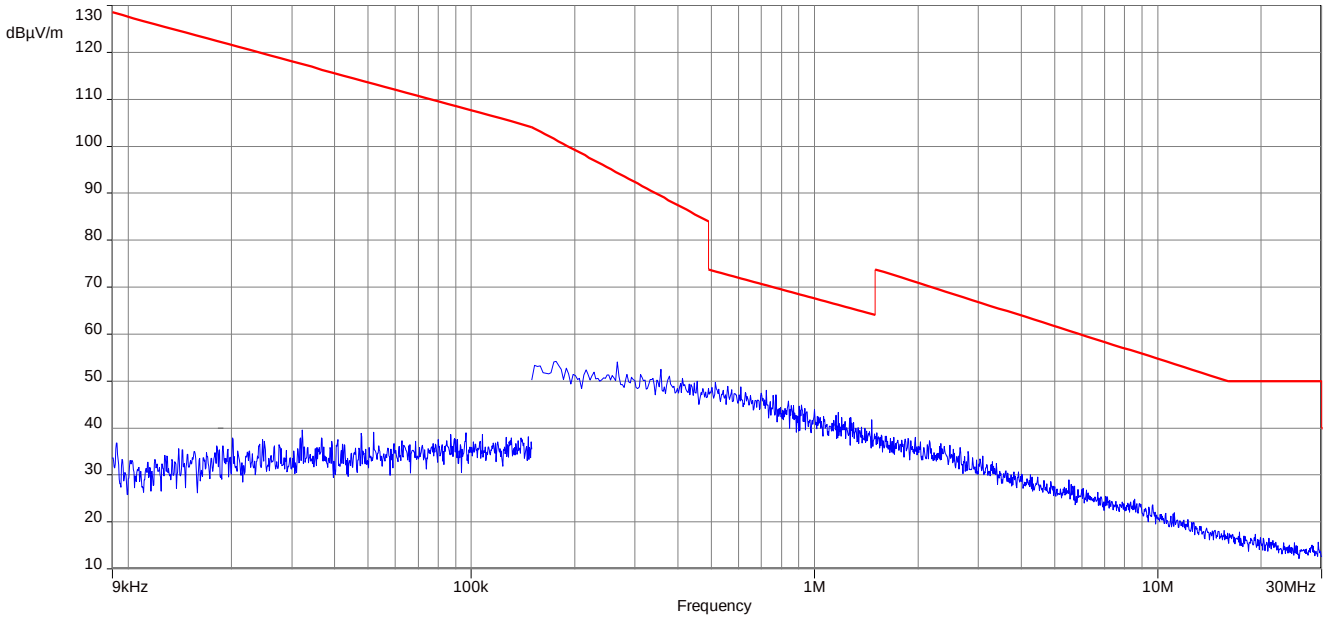
Plot 2: 9 kHz to 30 MHz, OFDM 20 MHz, 5220 MHz



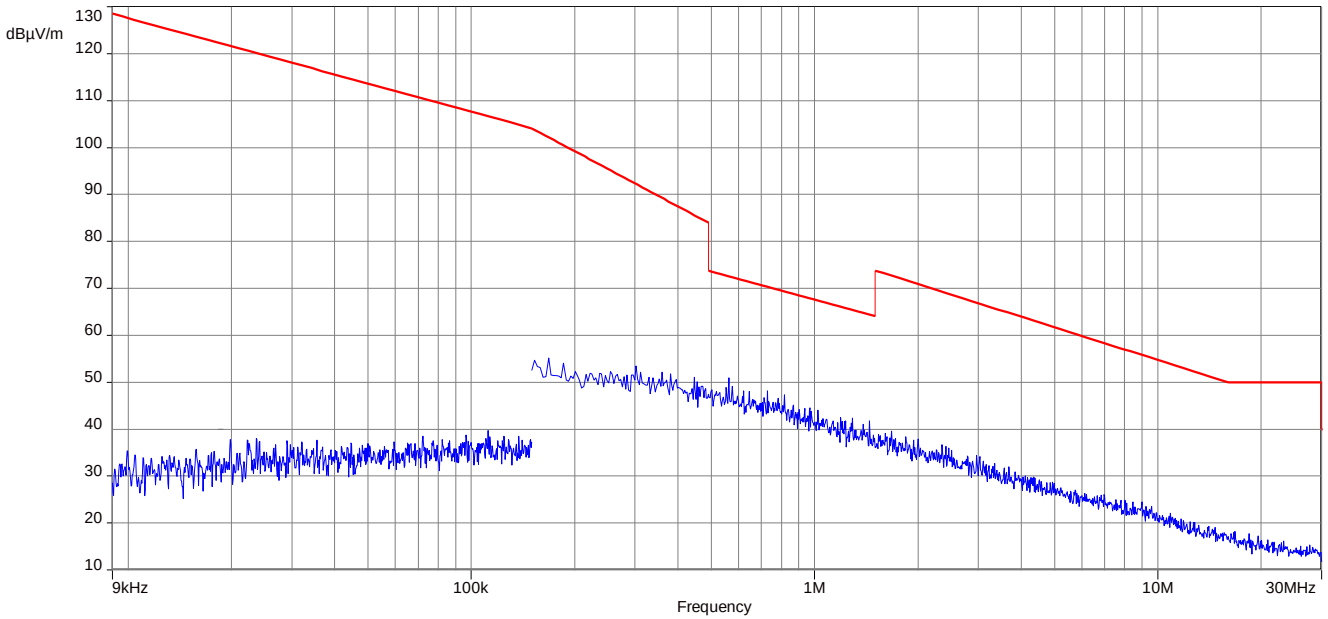
Plot 3: 9 kHz to 30 MHz, OFDM 20 MHz, 5240 MHz



Plot 4: 9 kHz to 30 MHz, OFDM 40 MHz, 5190 MHz



Plot 5: 9 kHz to 30 MHz, OFDM 40 MHz, 5230 MHz



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	2016-05-19

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

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

Akkreditierung

Die Deutsche Akkreditierungsstelle GmbH bestätigt hiermit, dass das Prüflaboratorium

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Untertürkheimer Straße 6-10, 66117 Saarbrücken

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Produktsicherheit
SAR / EMF
Umwelt
Smart Card Technology
Bluetooth*
Automotive
WI-FI-Services
Kanadische Anforderungen
US-Anforderungen
Akustik
Near Field Communication (NFC)

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Frankfurt, 04.05.2016

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

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