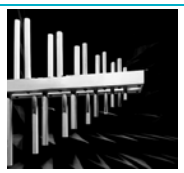
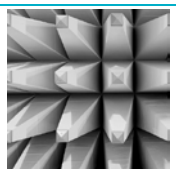

CTC advanced
member of RWTÜV group

Bundesnetzagentur

BNetzA-CAB-02/21-102

TEST REPORT

Test report no.: 1-5025/17-02-10

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

Testing laboratory

CTC advanced GmbH
Untertuerkheimer Strasse 6 – 10
66117 Saarbruecken / Germany
Phone: + 49 681 5 98 - 0
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Accredited Testing Laboratory:
The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2005) by the Deutsche Akkreditierungsstelle GmbH (DAkkS)
The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12076-01-03

Applicant

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33510 Andernos les Bains / FRANCE
Phone: +33 5 57 70 21 21
Fax: -/-
Contact: Gérard Lombard
e-mail: gerard@overline-systems.com
Phone: +33 5 57 70 21 21

Manufacturer

OVERLINE Systems
21, Avenue Sophie Wallerstein
33510 Andernos les Bains / FRANCE

Test standard/s

47 CFR Part 15	Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 247 Issue 2	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence - Exempt Local Area Network (LE-LAN) Devices
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:	**Handheld transceiver**
Model name:	**DE-DPS BELTPACK**
FCC ID:	**2ANZJDEDPS1**
IC:	**23304-DEDPS1**
Frequency:	UNII bands: 5150 MHz to 5250 MHz & 5725 MHz to 5850 MHz
Technology tested:	WLAN
Antenna:	Integrated antenna
Power supply:	3.7 V DC by Li-ion BL-5C battery
Temperature range:	+5°C to +45°C

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

Test report authorized:

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2017.11.08 14:43:52 +01'00'

Andreas Luckenbill
Lab Manager
Radio Communications & EMC

Test performed:

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2017.11.08 14:48:41 +01'00'

Marco Bertolino
Lab Manager
Radio Communications & EMC

1 Table of contents

1 Table of contents 2
2 General information 3
2.1 Notes and disclaimer 3
2.2 Application details 3
2.3 Test laboratories sub-contracted 3
3 Test standard/s and references 4
4 Test environment 5
5 Test item 5
5.1 General description 5
5.2 Additional information 5
6 Description of the test setup 6
6.1 Shielded semi anechoic chamber 7
6.2 Shielded fully anechoic chamber 8
6.3 Radiated measurements > 18 GHz 9
6.4 Conducted measurements with peak power meter & spectrum analyzer 10
7 Sequence of testing 11
7.1 Sequence of testing radiated spurious 9 kHz to 30 MHz 11
7.2 Sequence of testing radiated spurious 30 MHz to 1 GHz 12
7.3 Sequence of testing radiated spurious 1 GHz to 18 GHz 13
7.4 Sequence of testing radiated spurious above 18 GHz 14
8 Measurement uncertainty 15
9 Summary of measurement results 16
10 Additional comments 17
11 Measurement results 19
11.1 Identify worst case data rate 19
11.2 Antenna gain 20
11.3 Duty cycle 24
11.4 Maximum output power 26
11.4.1 Maximum output power according to FCC requirements 26
11.4.2 Maximum output power according to IC requirements 30
11.5 Power spectral density 34
11.5.1 Power spectral density according to FCC requirements 34
11.5.2 Power spectral density according to IC requirements 37
11.6 Minimum emission bandwidth for the band 5.725-5.85 GHz 40
11.7 Spectrum bandwidth / 26 dB bandwidth 43
11.8 Occupied bandwidth / 99% emission bandwidth 47
11.9 Band edge compliance radiated 51
11.10 Spurious emissions radiated < 30 MHz 53
11.11 TX spurious emissions radiated 57
11.12 RX spurious emissions radiated 77
12 Observations 80
Annex A Glossary 81
Annex B Document history 82
Annex C Accreditation Certificate 82

2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. CTC advanced GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.
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2.2 Application details

Date of receipt of order:	2017-09-04
Date of receipt of test item:	2017-10-09
Start of test:	2017-10-09
End of test:	2017-10-20
Person(s) present during the test:	Mr. Andreas Keller

2.3 Test laboratories sub-contracted

None

3 Test standard/s and references

Test standard	Date	Description
47 CFR Part 15	-/-	Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 247 Issue 2	February 2017	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence - Exempt Local Area Network (LE-LAN) Devices
RSS - Gen Issue 4	November 2014	Spectrum Management and Telecommunications Radio Standards Specifications - General Requirements and Information for the Certification of Radio Apparatus

Guidance	Version	Description
UNII: KDB 789033 D02	v01r04	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 temperature conditions required. No tests under extreme temperature conditions required.
Relative humidity content	:		55 %
Barometric pressure	:		1021 hpa
Power supply	:	V_{nom} V_{max} V_{min}	3.7 V DC by Li-ion BL-5C battery No tests under extreme voltage conditions required. No tests under extreme voltage conditions required.

5 Test item

5.1 General description

Kind of test item	:	Handheld transceiver
Type identification	:	DE-DPS-001
HMN	:	-/-
PMN	:	Digitear
HVIN	:	DE-DPS BELTPACK
FVIN	:	v1.0
S/N serial number	:	Radiated units: DE-DPS-001-00000055 (70B3D528F10A) Conducted units: DE-DPS-001-00000060 (70B3D528F10F) Photo units: DE-DPS-001-00000055 (external photos) DE-DPS-001-00000055 (internal photos)
HW hardware status	:	Hardware: BELTPACK REV7.1-1c, Schematic: belt pack 7.1
SW software status	:	V1.0
Frequency band	:	UNII bands: 5150 MHz to 5250 MHz & 5725 MHz to 5850 MHz
Type of radio transmission Use of frequency spectrum	: :	OFDM
Type of modulation	:	(D)BPSK, (D)QPSK, 16 – QAM, 64 – QAM
Number of channels	:	20 MHz channel bandwidth: 9
Antenna	:	Integrated antenna
Power supply	:	3.7 V DC by Li-ion BL-5C battery
Temperature range	:	+5°C to +45°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: 1-5025/17-02-38_AnnexA
1-5025/17-02-38_AnnexB
1-5025/17-02-38_AnnexD

6 Description of the test setup

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

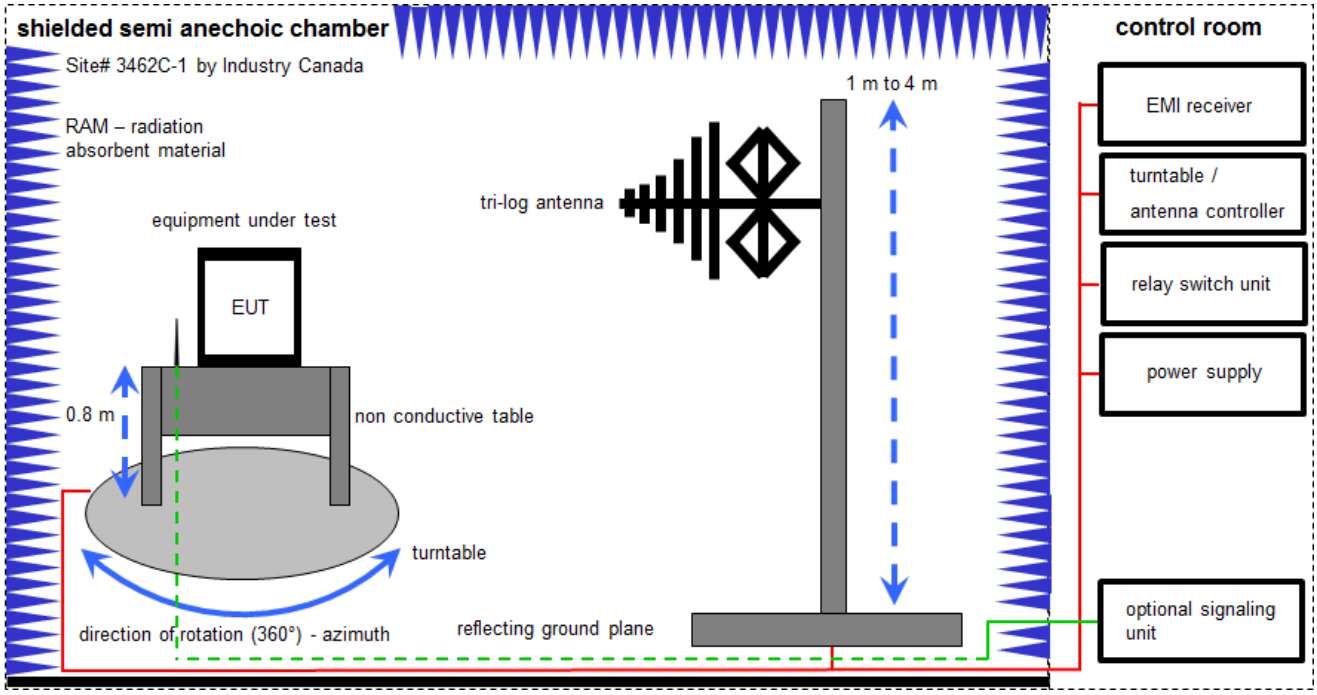
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

Agenda: Kind of Calibration

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

6.1 Shielded semi anechoic chamber

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 30 MHz to 1 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are conform to specifications ANSI C63. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analyzers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.



Measurement distance: tri-log antenna 10 meter

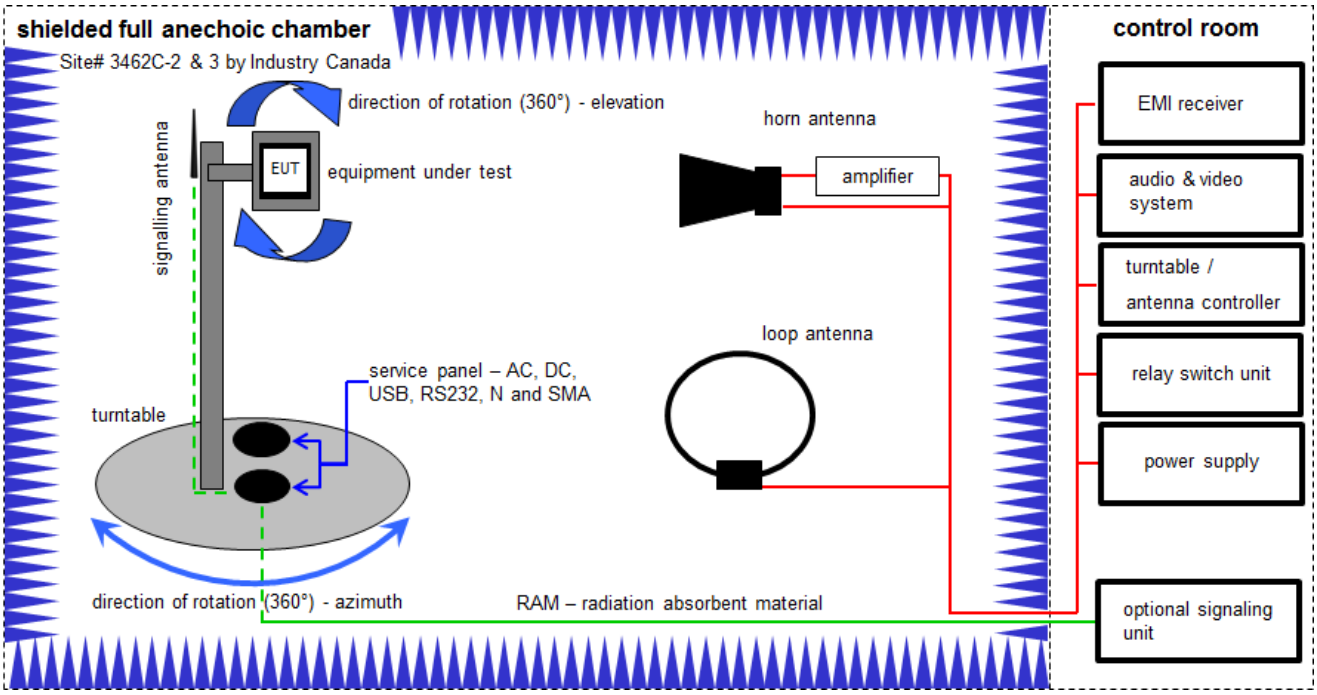
FS = UR + CL + AF
(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

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.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Switch-Unit	3488A	HP	2719A14505	300000368	ev	-/-	-/-
2	A	Meßkabine 1	HF-Absorberhalle	MWB AG 300023		300000551	ne	-/-	-/-
3	A	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	01.02.2017	31.01.2018
4	A	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw	-/-	-/-
5	A	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw	-/-	-/-
6	A	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw	-/-	-/-
7	A	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787	k	25.04.2016	25.04.2018

6.2 Shielded fully anechoic chamber



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

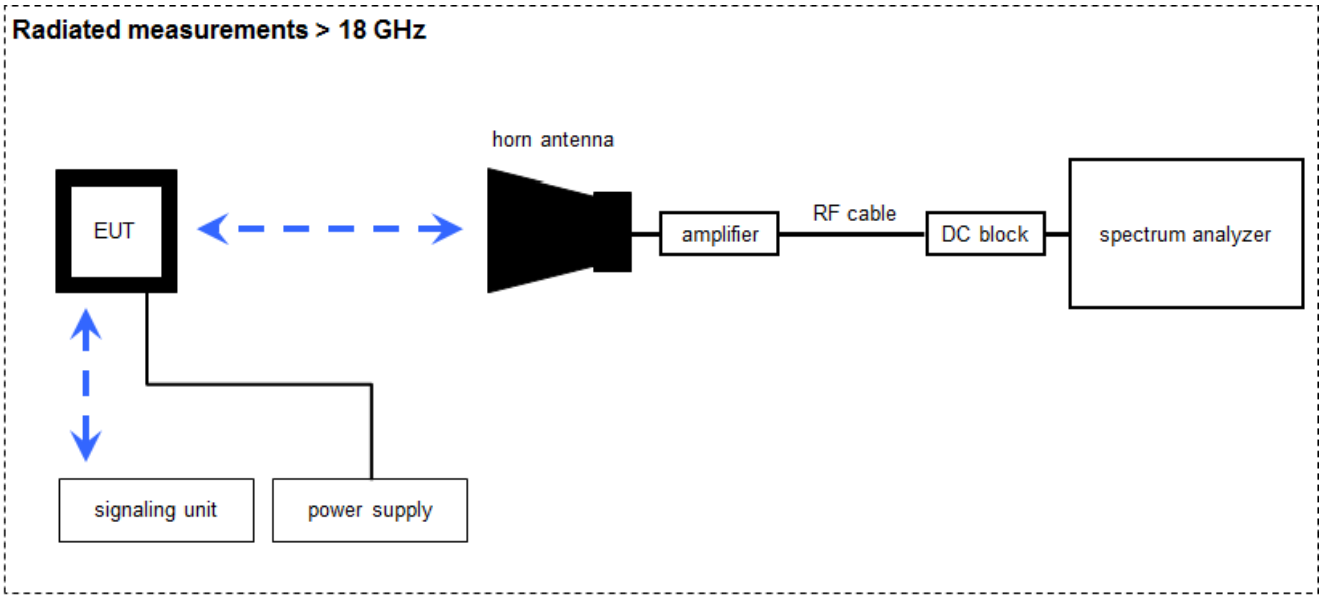
FS = UR + CA + AF
(FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

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

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Active Loop Antenna 9 kHz to 30 MHz	6502	EMCO	2210	300001015	k	07.07.2017	06.07.2019
2	A, B, C	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
3	B, C	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	9107-3697	300001605	vlKl!	14.02.2017	13.02.2019
4	A, B, C	Switch / Control Unit	3488A	HP	*	300000199	ne	-/-	-/-
5	A, B, C	EMI Test Receiver 20Hz- 26,5GHz	ESU26	R&S	100037	300003555	k	31.01.2017	30.01.2018
6	B	Highpass Filter	WHK1.1/15G-10SS	Wainwright	3	300003255	ev	-/-	-/-
7	B	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	19	300003790	ne	-/-	-/-
8	B	High Pass Filter	VHF-3500+	Mini Circuits	-/-	400000193	ne	-/-	-/-
9	B, C	Broadband Amplifier 0.5-18 GHz	CBLU5184540	CERNEX	22049	300004481	ev	-/-	-/-
10	A, B, C	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne	-/-	-/-
11	A, B, C	NEXIO EMV-Software	BAT EMC V3.16.0.49	EMCO	-/-	300004682	ne	-/-	-/-
12	A, B, C	PC	ExOne	F+W	-/-	300004703	ne	-/-	-/-

6.3 Radiated measurements > 18 GHz



Measurement distance: horn antenna 50 cm

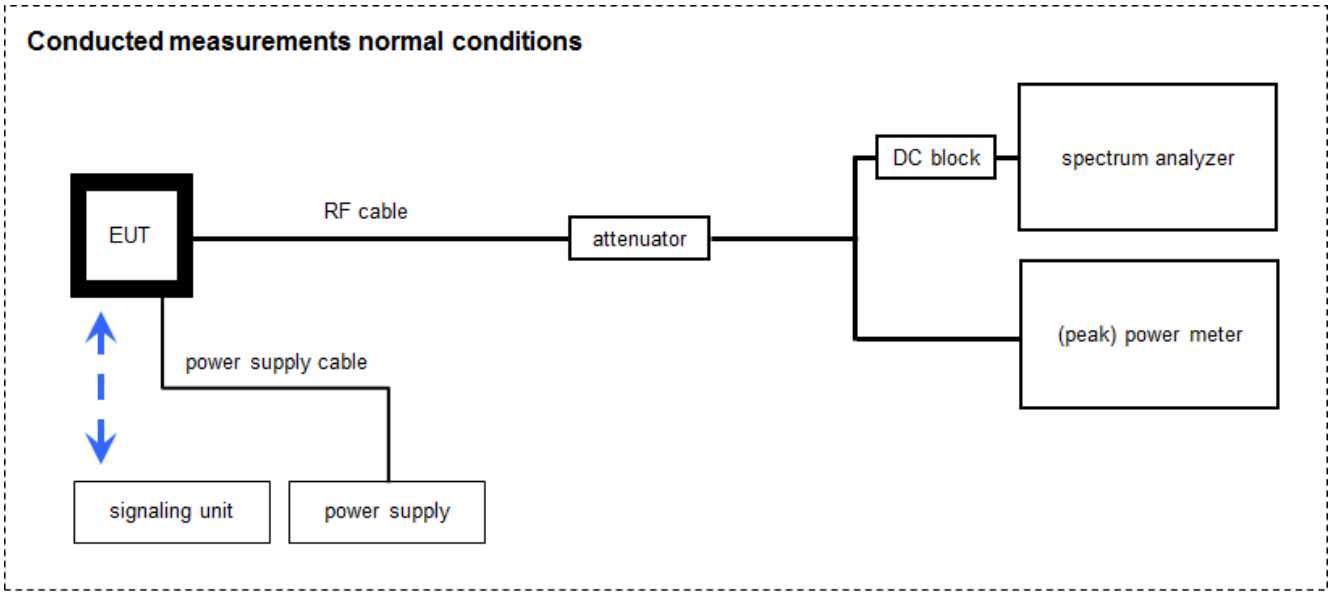
FS = UR + CA + AF
(FS-field strength; UR-voltage at the receiver; CA-loss signal path & distance correction; AF-antenna factor)

Example calculation:
FS [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.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Horn Antenna 18,0-40,0 GHz	LHAF180	Microw.Devel	39180-103-022	300001748	k	22.05.2015	22.05.2018
2	A	Signal Analyzer 40 GHz	FSV40	R&S	101042	300004517	k	25.01.2017	24.01.2018
3	A	Amplifier 2-40 GHz	JS32-02004000-57-5P	MITEQ	1777200	300004541	ev	-/-	-/-
4	A	RF-Cable	ST18/SMAm/SMAm/48	Huber & Suhner	Batch no. 600918	400001182	ev	-/-	-/-
5	A	RF-Cable	ST18/SMAm/SMAm/48	Huber & Suhner	Batch no. 127377	400001183	ev	-/-	-/-
6	A	DC-Blocker 0.1-40 GHz	8141A	Inmet	-/-	400001185	ev	-/-	-/-

6.4 Conducted measurements with peak power meter & spectrum analyzer



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

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

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Signal Analyzer 40 GHz	FSV40	R&S	101042	300004517	k	25.01.2017	24.01.2018
2	A	DC-Blocker 0.1-40 GHz	8141A	Inmet	-/-	400001185	ev	-/-	-/-
3	A	Hygro-Thermometer	-/-, 5-45C, 20-100rF	-/-	-/-	400000108	ev	-/-	-/-
4	A	PC-WLAN Tester	Intel Core i3 3220/3,3 GHz, Prozessor	-/-	2V2403033A4523	300004589	ne	-/-	-/-
5	A	Teststand	Teststand Custom Sequence Editor	National Instruments GmbH	-/-	300004590	ne	-/-	-/-
6	A	PowerSplitter/Combiner 150-6000MHz N-Type	ZB3PD-63-N+	Mini-Circuits	-/-	400000451	ev	-/-	-/-
7	A	RF-Cable	ST18/SMAm/SMAm/60	Huber & Suhner	Batch no. 606844	400001181	ev	-/-	-/-
8	A	Coax Attenuator 10 dB 2W 0-40 GHz	MCL BW-K10-2W44+	Mini Circuits	-/-	400001186	ev	-/-	-/-
9	A	Synchron Power Meter	SPM-4	CTC	1	400001294	ev	-/-	-/-

7 Sequence of testing

7.1 Sequence of testing radiated spurious 9 kHz to 30 MHz

Setup

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

Premeasurement*

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

Final measurement

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

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

7.2 Sequence of testing radiated spurious 30 MHz to 1 GHz

Setup

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

Premeasurement

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

Final measurement

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

7.3 Sequence of testing radiated spurious 1 GHz to 18 GHz

Setup

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

Premeasurement

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

Final measurement

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

7.4 Sequence of testing radiated spurious above 18 GHz

Setup

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

Premeasurement

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

Final measurement

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

8 Measurement uncertainty

Measurement uncertainty	
Test case	**Uncertainty**
Antenna gain	± 3 dB
Power spectral density	± 1.5 dB
Spectrum bandwidth	± 100 kHz (depends on the used RBW)
Occupied bandwidth	± 100 kHz (depends on the used RBW)
Maximum output power	± 1.5 dB
Minimum emissions bandwidth	± 100 kHz (depends on the used RBW)
Spurious emissions conducted	± 3 dB
Spurious emissions radiated below 30 MHz	± 3 dB
Spurious emissions radiated 30 MHz to 1 GHz	± 3 dB
Spurious emissions radiated 1 GHz to 12.75 GHz	± 3.7 dB
Spurious emissions radiated above 12.75 GHz	± 4.5 dB
Spurious emissions conducted below 30 MHz (AC conducted)	± 2.6 dB

9 Summary of measurement results

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

TC Identifier	Description	Verdict	Date	Remark
RF-Testing	CFR Part 15 RSS 247, Issue 2	See table	2017-11-08	-/-

Test specification clause	Test case	Temperature conditions	Power source voltages	C	NC	NA	NP	Remark
-/-	Output power verification (cond.)	Nominal	Nominal	-/-				Declared
-/-	Antenna gain	Nominal	Nominal	-/-				-/-
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	☒	☐	☐	☐	-/-
RSS - 247 (6.2.4.1)	Spectrum bandwidth 6dB bandwidth	Nominal	Nominal	☒	☐	☐	☐	-/-
§15.407(a) RSS - 247 (6.2.1.2)	Spectrum bandwidth 26dB bandwidth	Nominal	Nominal	☒	☐	☐	☐	-/-
RSS Gen clause 6.6	Spectrum bandwidth 99% bandwidth	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	☒	☐	☐	☐	-/-
§15.407 RSS - 247 (6.3)	DFS	Nominal	Nominal	☐	☐	☒	☐	DFS bands not supported!

Notes:

C:	Compliant	**NC:**	Not compliant	**NA:**	Not applicable	**NP:**	Not performed

10 Additional comments

Reference documents: Customer_Questionnaire

Special test descriptions: Only n HT20 supported

Configuration descriptions: Power setting 8 used for the U-N-II-1 band

Power setting 11 used for the U-N-II-3 band

U-NII-2A and 2C are not supported.

All measurements were performed in the customer declared worst-case data rate (MCS7).

Customer declared information:

Test software: https://www.lsr.com/embedded-wireless-modules/wifi-plusbluetoothmodule/

tiwi5#product-software (=>Software Downloads)
LINK firmware for LSR TiWi5 by TI: https://github.com/TI-OpenLink/ti-utils

Provided channels:

Channels with 20 MHz channel bandwidth:

U-NII-1 (5150 MHz to 5250 MHz) channel number & center frequency								
channel	**36**	**40**	**44**	-/-	-/-	-/-	-/-	-/-
f_c / MHz	**5180**	**5200**	**5220**	-/-	-/-	-/-	-/-	-/-

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

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

Test mode:

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

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

Antennas and transmit operating modes:

☒ Operating mode 1 (single antenna)

- *Equipment with 1 antenna,*
- *Equipment with 2 diversity antennas operating in switched diversity mode by which at any moment in time only 1 antenna is used,*
- *Smart antenna system with 2 or more transmit/receive chains, but operating in a mode where only 1 transmit/receive chain is used)*

☐ Operating mode 2 (multiple antennas, no beamforming)

- *Equipment operating in this mode contains a smart antenna system using two or more transmit/receive chains simultaneously but without beamforming.*

☐ Operating mode 3 (multiple antennas, with beamforming)

- *Equipment operating in this mode contains a smart antenna system using two or more transmit/receive chains simultaneously with beamforming.*
  In addition to the antenna assembly gain (G), the beamforming gain (Y) may have to be taken into account when performing the measurements.

11 Measurement results

11.1 Identify worst case data rate

Results:

OFDM – mode	Modulation scheme / bandwidth		
	U-NII-1 & U-NII-2A	U-NII-2C	U-NII-3
n HT20 – mode	MCS7	-/-	MCS7

Note: The customer declared the worst-case data rate!

11.2 Antenna gain

Description:

The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module.

Measurement parameters:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	3 MHz
Video bandwidth:	3 MHz
Trace mode:	Max. hold
Test setup:	See chapter 6.2 – C (radiated) See chapter 6.4 – A (conducted)
Measurement uncertainty:	See chapter 8

Limits:

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

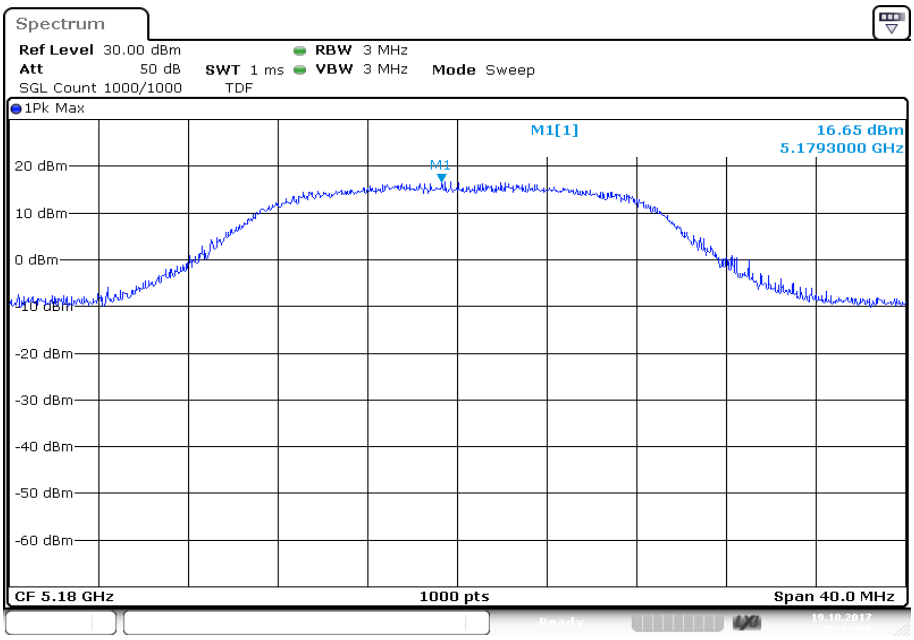
Results:

U-NII-1 (5150 MHz to 5250 MHz)	Antenna gain		
	Lowest channel	Middle channel	Highest channel
Conducted power / dBm @ 3 MHz RBW	16.65	16.26	16.11
Radiated power / dBm @ 3 MHz RBW	16.76	17.22	16.29
Gain / dBi (calculated)	0.11	0.96	0.18

U-NII-3 (5725 MHz to 5850 MHz)	Antenna gain		
	Lowest channel	Middle channel	Highest channel
Conducted power / dBm @ 3 MHz RBW	16.39	15.92	15.82
Radiated power / dBm @ 3 MHz RBW	15.64	16.76	14.38
Gain / dBi (calculated)	-0.75	0.80	-1.44

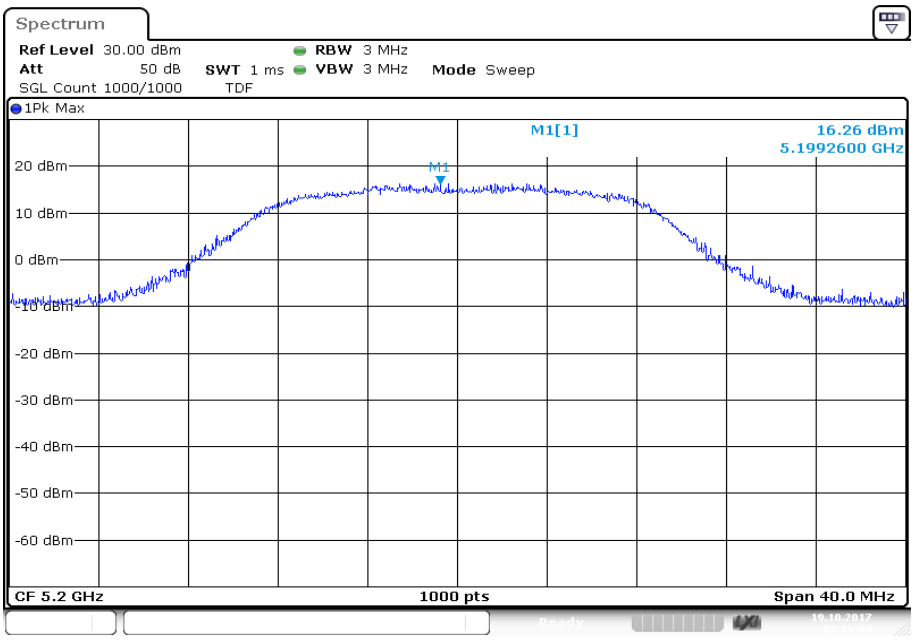
Plots (conducted):

Plot 1: U-NII-1; lowest channel



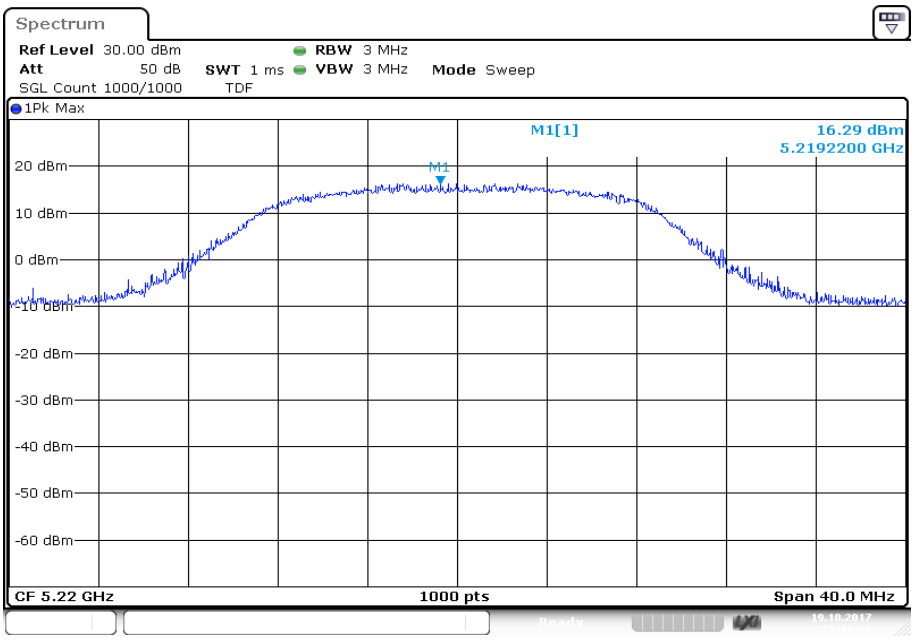
Date: 19.OCT.2017 15:12:06

Plot 2: U-NII-1; middle channel



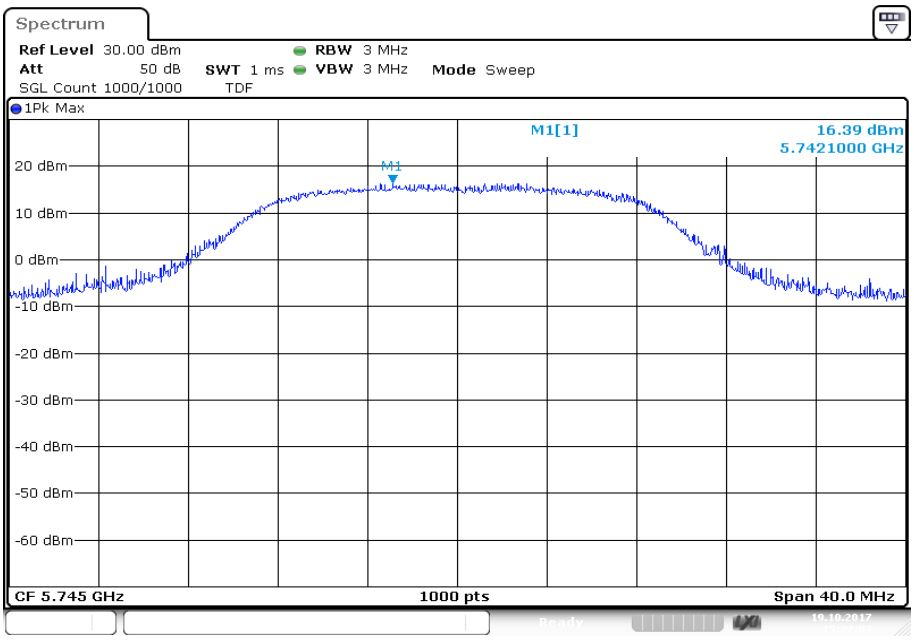
Date: 19.OCT.2017 15:15:39

Plot 3: U-NII-1; highest channel



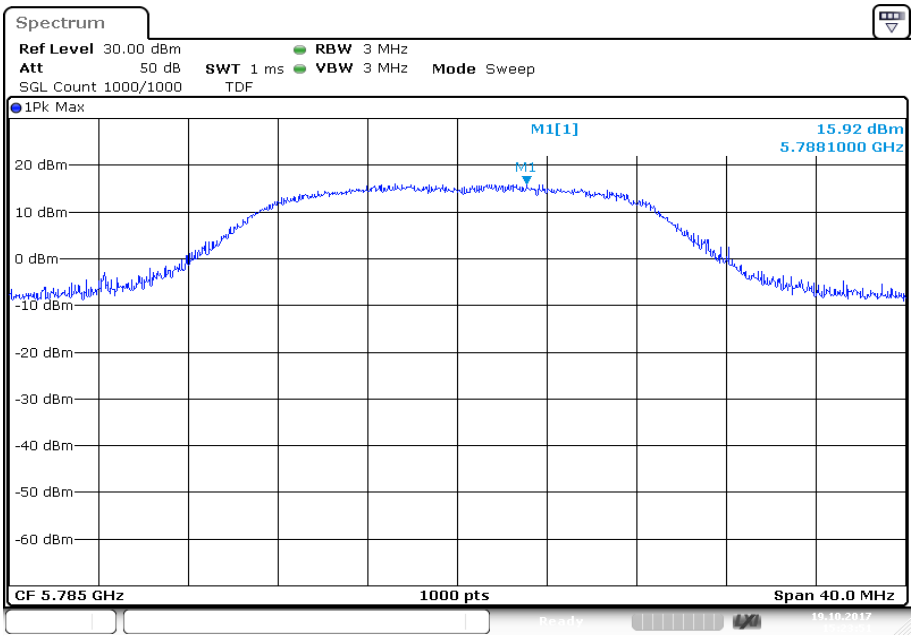
Date: 19.OCT.2017 15:17:39

Plot 4: U-NII-3; lowest channel



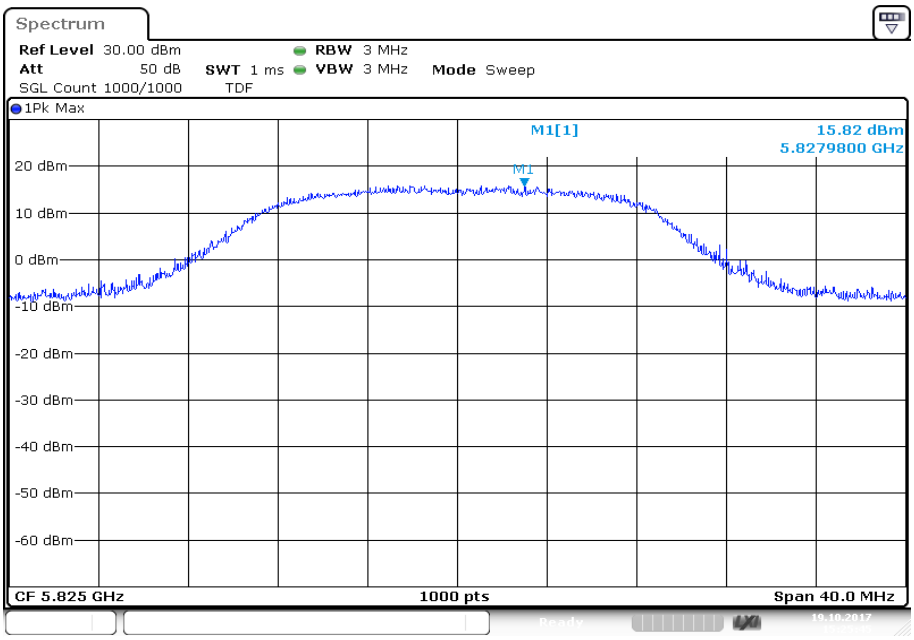
Date: 19.OCT.2017 15:22:04

Plot 5: U-NII-3; middle channel



Date: 19.OCT.2017 15:23:51

Plot 6: U-NII-3; highest channel



Date: 19.OCT.2017 15:25:46

11.3 Duty cycle

Description:

The duty cycle is necessary to compute the maximum power during an actual transmission. The shown plots and values are to show an example of the measurement procedure. The real value is measured direct during the power measurement or power density measurement. The correction value is shown in each plot of these measurements.

Measurement:

Measurement parameter	
According to: KDB789033 D02, B.	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	10 MHz
Video bandwidth:	10 MHz
Span:	Zero
Trace mode:	Video trigger / view / single sweep
Used test setup:	See chapter 6.4 – A
Measurement uncertainty:	See chapter 8

Results:

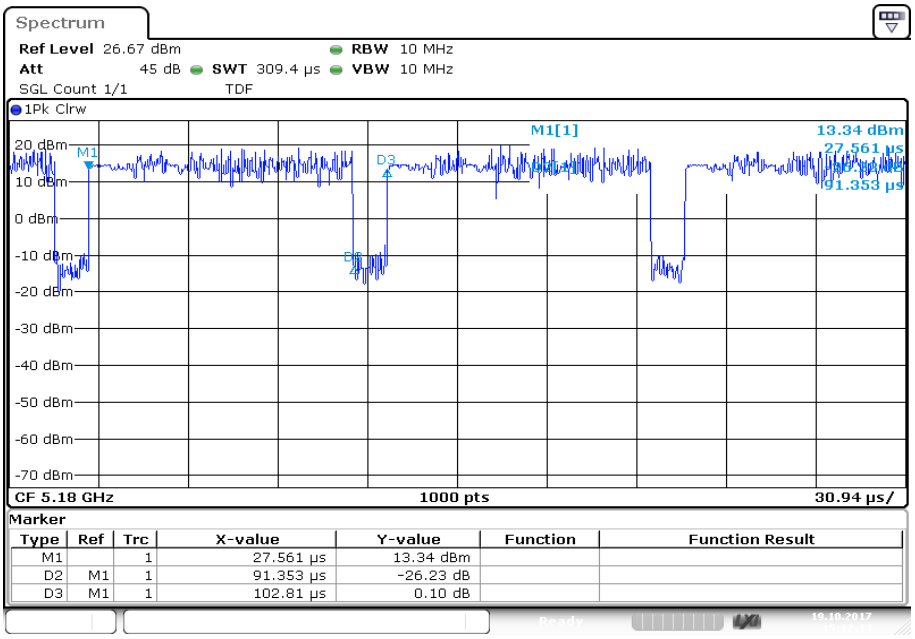
Duty cycle and correction factor:

OFDM – mode	**Calculation method**			
	T_{on} ($D2_{plot}$) * 100 / $T_{complete}$ ($D3_{plot}$) = duty cycle 10 * log(duty cycle) = correction factor			
	T_{on} ($D2_{plot}$)	**$T_{complete}$ ($D3_{plot}$)**	**Duty cycle**	**Correction factor**
n HT20 – mode	91.353 µs	102.81 µs	88.86 %	0.51 dB

Plots:

Duty cycle and correction factor (example for one channel):

Plot 1: duty cycle of the transmitter; n HT20 – mode



Date: 19.OCT.2017 15:12:14

11.4 Maximum output power

11.4.1 Maximum output power according to FCC requirements

Description:

Measurement of the maximum output power conducted

Measurement:

Measurement parameter	
According to: KDB789033 D02, E.2.e.	
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
Used test setup:	See chapter 6.4 – A
Measurement uncertainty:	See chapter 8

Limits:

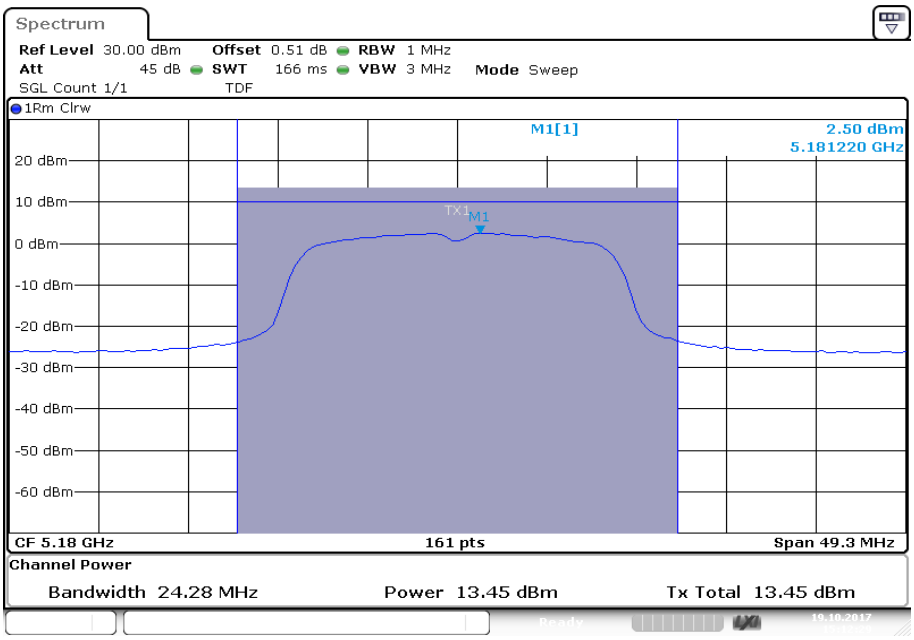
Radiated output power	Conducted output power for mobile equipment
Conducted power + 6 dBi antenna gain	250mW 5.150-5.250 GHz The lesser one of 250mW or 11 dBm + 10 log Bandwidth 5.250-5.350 GHz 250mW or 11 dBm + 10 log Bandwidth 5.470-5.725 GHz (where Bandwidth is the 26dB Bandwidth [MHz]) 1W 5.725-5.85 GHz

Results:

	Maximum output power conducted [dBm]		
	U-NII-1 (5150 MHz to 5250 MHz)		
	Lowest channel	Middle channel	Highest channel
n HT20	13.45	13.30	13.35
	U-NII-3 (5725 MHz to 5850 MHz)		
	Lowest channel	Middle channel	Highest channel
	13.99	13.57	13.30

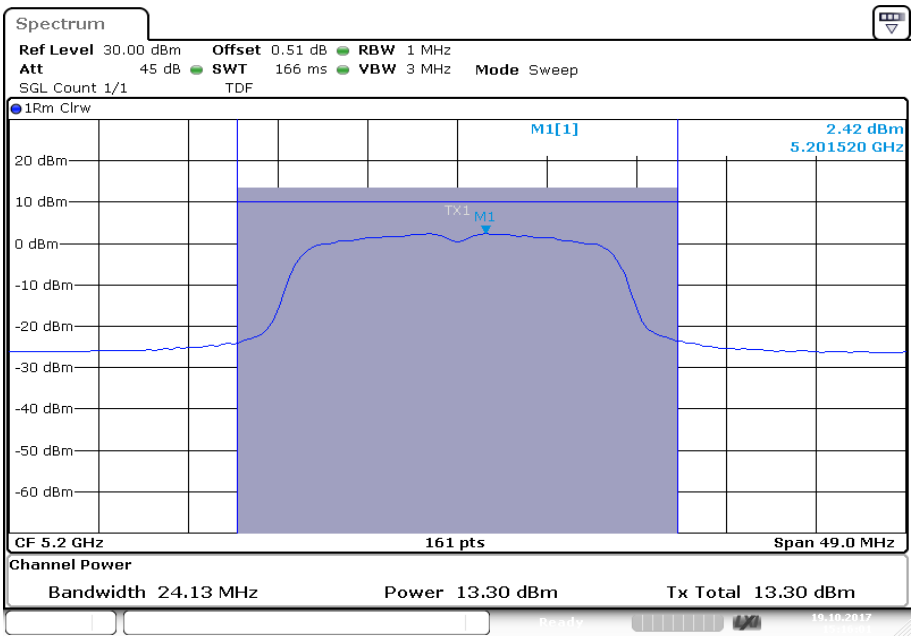
Plots: n HT20 – mode

Plot 1: U-NII-1; lowest channel



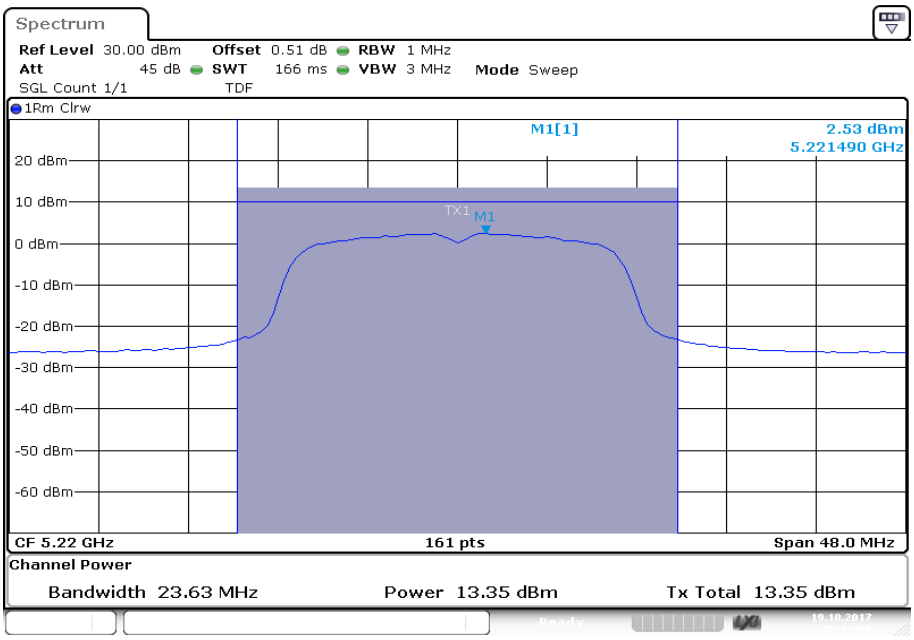
Date: 19.OCT.2017 15:12:30

Plot 2: U-NII-1; middle channel



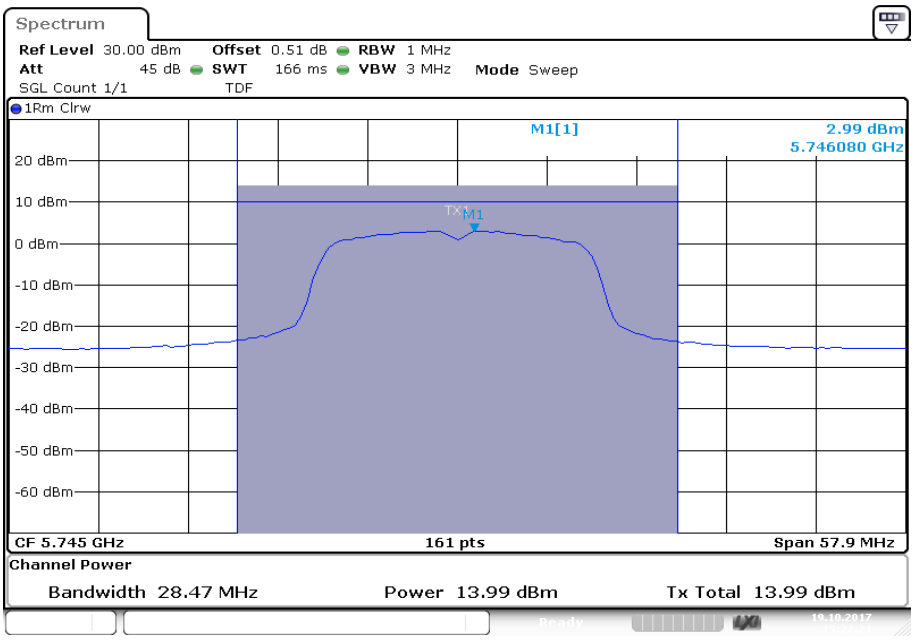
Date: 19.OCT.2017 15:16:01

Plot 3: U-NII-1; highest channel



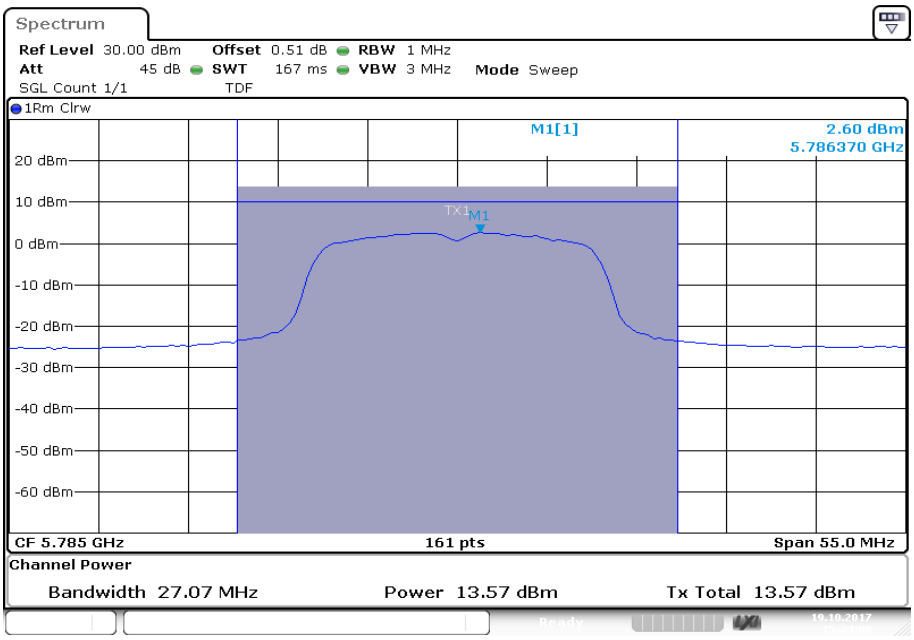
Date: 19.OCT.2017 15:17:57

Plot 4: U-NII-3; lowest channel



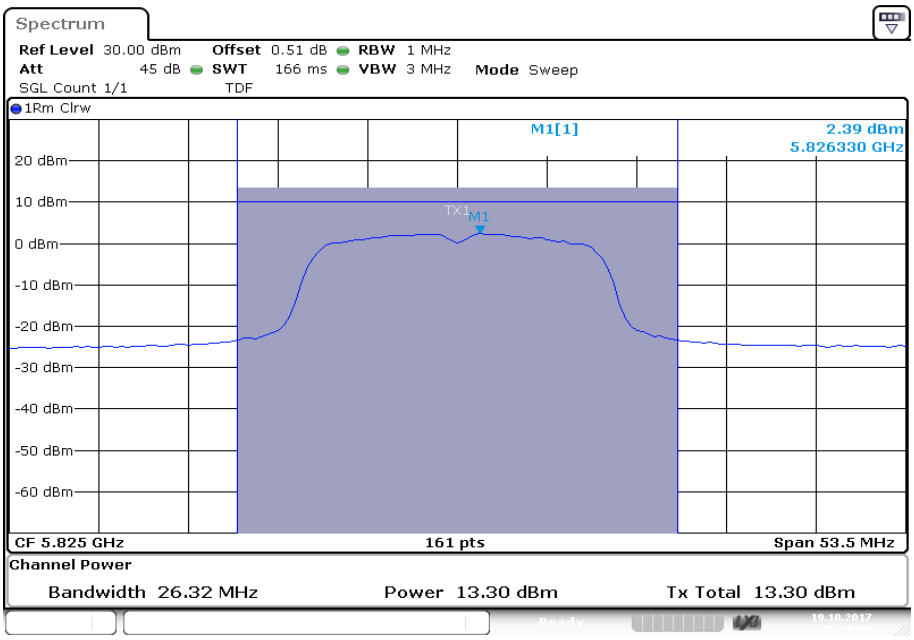
Date: 19.OCT.2017 15:22:21

Plot 5: U-NII-3; middle channel



Date: 19.OCT.2017 15:24:08

Plot 6: U-NII-3; highest channel



Date: 19.OCT.2017 15:26:05

11.4.2 Maximum output power according to IC requirements

Description:

Measurement of the maximum output power conduced + radiated

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 > 99% OBW
Used test setup:	See chapter 6.4 – A
Measurement uncertainty:	See chapter 8

Limits:

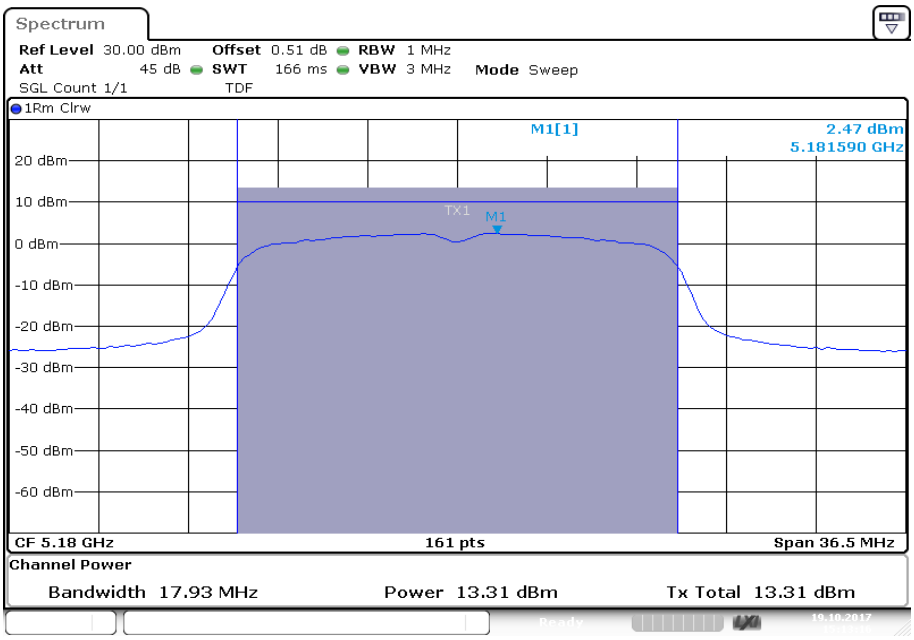
Radiated output power	Conducted output power for mobile equipment
The lesser one of 200 mW or 10 dBm + 10 log Bandwidth 5.150-5.250 GHz 1 W or 17 dBm + 10 log Bandwidth 5.250-5.350 GHz 1 W or 17 dBm + 10 log Bandwidth 5.470-5.725 GHz (where Bandwidth is the 99% Bandwidth [MHz]) Conducted power + 6dBi antenna gain 5.725-5.825 GHz	The lesser one of 250mW or 11 dBm + 10 log Bandwidth 5.250-5.350 GHz 250mW or 11 dBm + 10 log Bandwidth 5.470-5.725 GHz (where Bandwidth is the 99% Bandwidth [MHz]) 1W 5.725-5.825 GHz

Results:

	Maximum output power [dBm]		
	U-NII-1 (5150 MHz to 5250 MHz)		
	Lowest channel	Middle channel	Highest channel
	Conducted		
	13.31	13.20	13.29
	Radiated (calculated – see chapter antenna gain)		
n HT20	13.42	14.16	13.46
	U-NII-3 (5725 MHz to 5850 MHz)		
	Lowest channel	Middle channel	Highest channel
	Conducted		
	13.96	13.50	13.25
	Radiated (calculated – see chapter antenna gain)		
	13.21	14.30	11.81

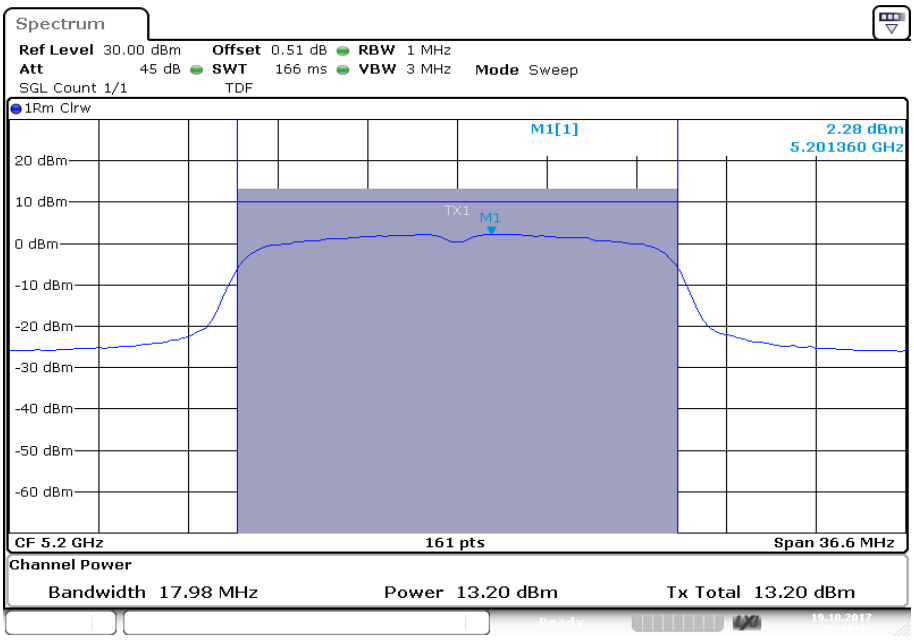
Plots: n HT20 – mode

Plot 1: U-NII-1; lowest channel



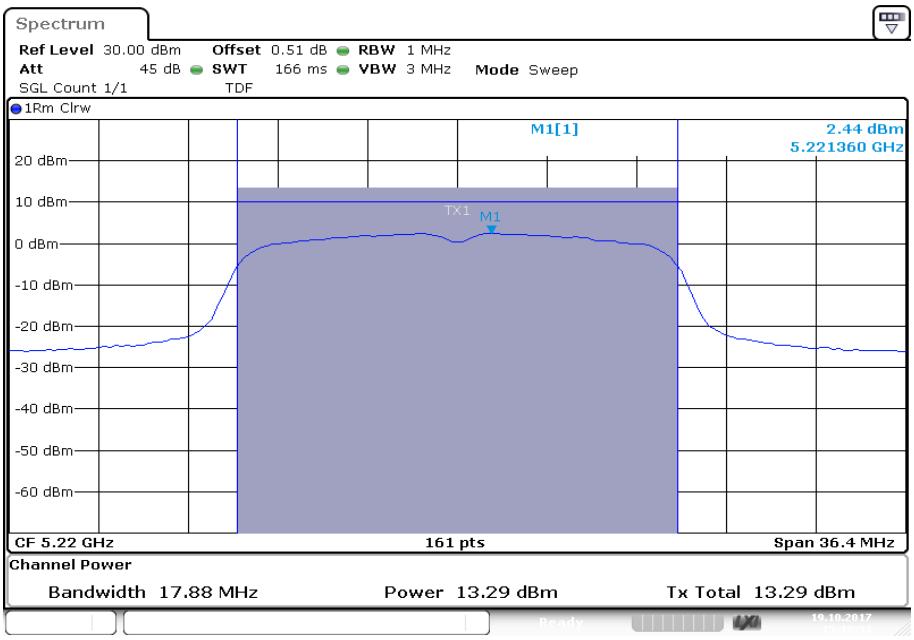
Date: 19.OCT.2017 15:13:17

Plot 2: U-NII-1; middle channel



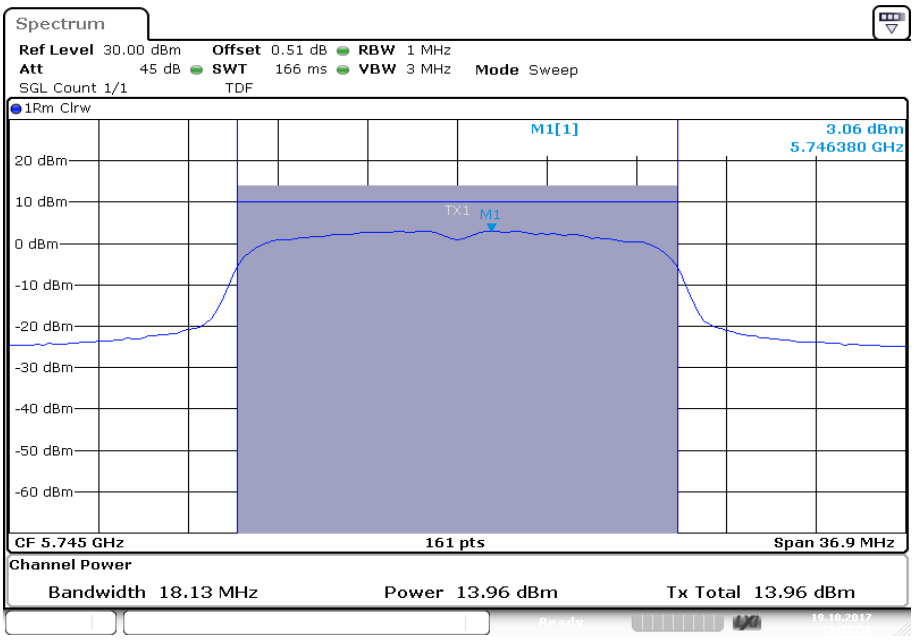
Date: 19.OCT.2017 15:16:43

Plot 3: U-NII-1; highest channel



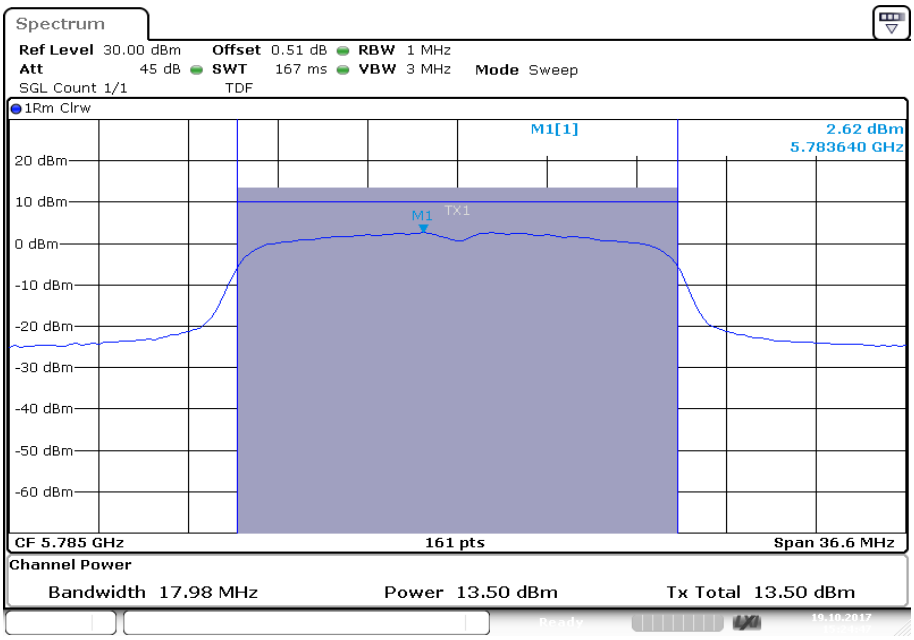
Date: 19.OCT.2017 15:18:33

Plot 4: U-NII-3; lowest channel



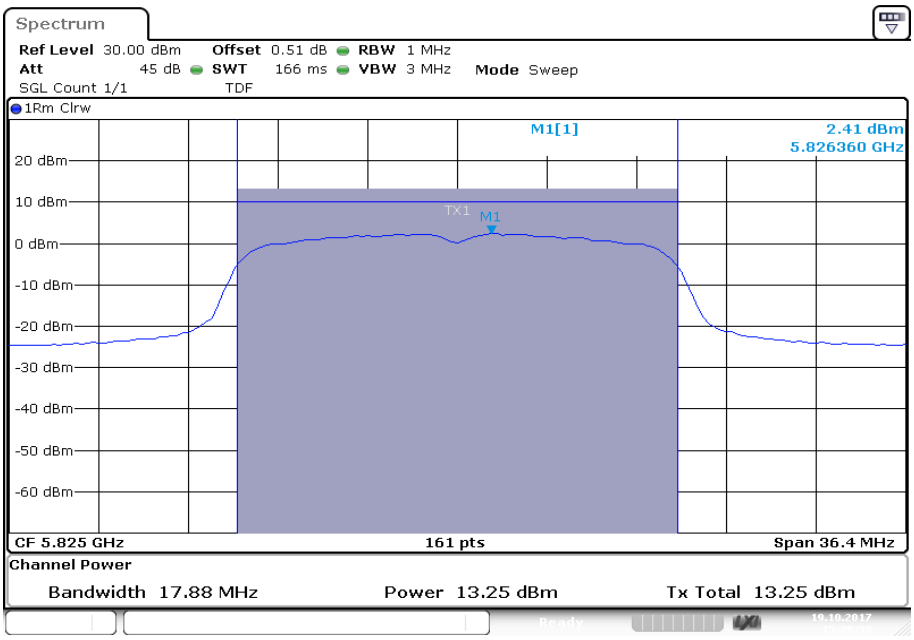
Date: 19.OCT.2017 15:22:58

Plot 5: U-NII-3; middle channel



Date: 19.OCT.2017 15:24:47

Plot 6: U-NII-3; highest channel



Date: 19.OCT.2017 15:26:40

11.5 Power spectral density

11.5.1 Power spectral density according to FCC requirements

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	
According to: KDB789033 D02, F.	
Detector:	RMS
Sweep time:	≥10*(swp points)*(total on/off time)
Resolution bandwidth:	1 MHz for U-NII-1/2A & 2C 500 kHz for U-NII-3
Video bandwidth:	≥ 3xRBW
Span:	> EBW
Trace mode:	Max hold
Used test setup:	See chapter 6.4 – A
Measurement uncertainty:	See chapter 8

Limits:

Power Spectral Density
power spectral density conducted ≤ 11 dBm in any 1 MHz band (band 5150 – 5250 MHz) power spectral density conducted ≤ 11 dBm in any 1 MHz band (band 5250 – 5350 MHz) power spectral density conducted ≤ 11 dBm in any 1 MHz band (band 5470 – 5725 MHz) power spectral density conducted ≤ 30 dBm in any 500 kHz band (band 5725 – 5850 MHz)

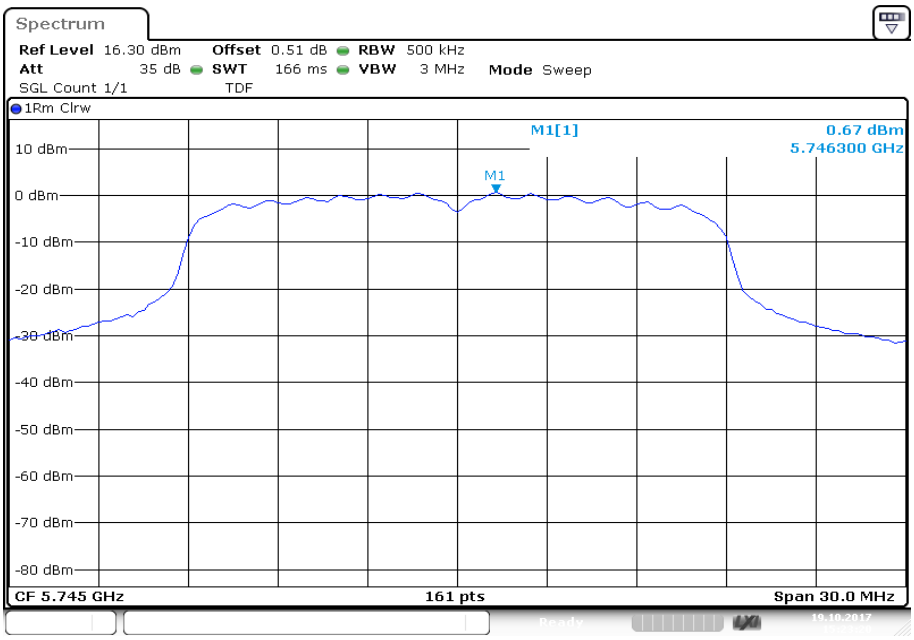
Results:

	Power spectral density (dBm/1MHz or dBm/500kHz)		
	U-NII-1 (5150 MHz to 5250 MHz)*		
	Lowest channel	Middle channel	Highest channel
n HT20	2.50	2.42	2.53
	U-NII-3 (5725 MHz to 5850 MHz)		
	Lowest channel	Middle channel	Highest channel
	0.67	0.25	0.07

*Note: U-NII-1 band values were added from chapter 11.4.1 (detected peak within the plots)

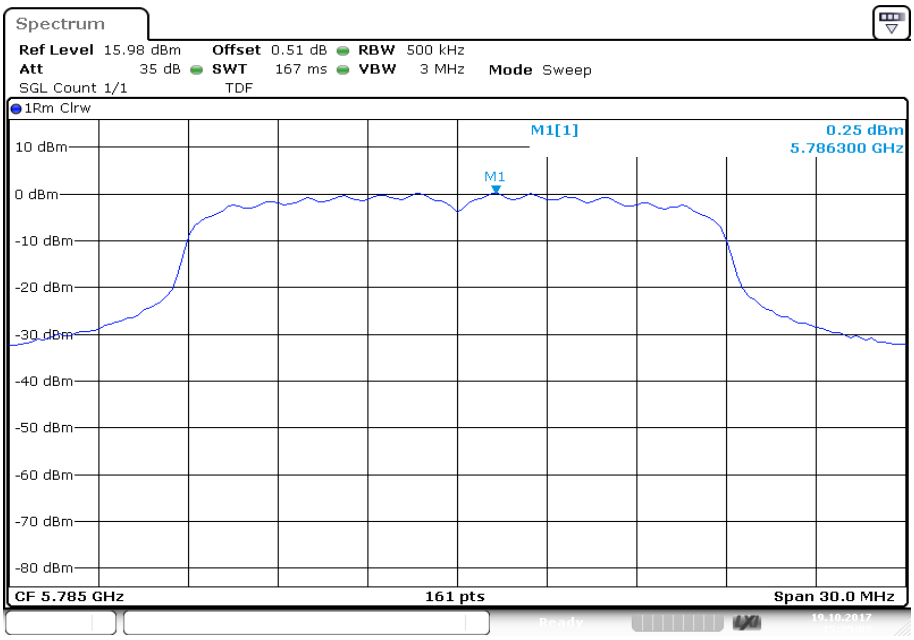
Plots: n HT20 – mode

Plot 1: U-NII-3; lowest channel



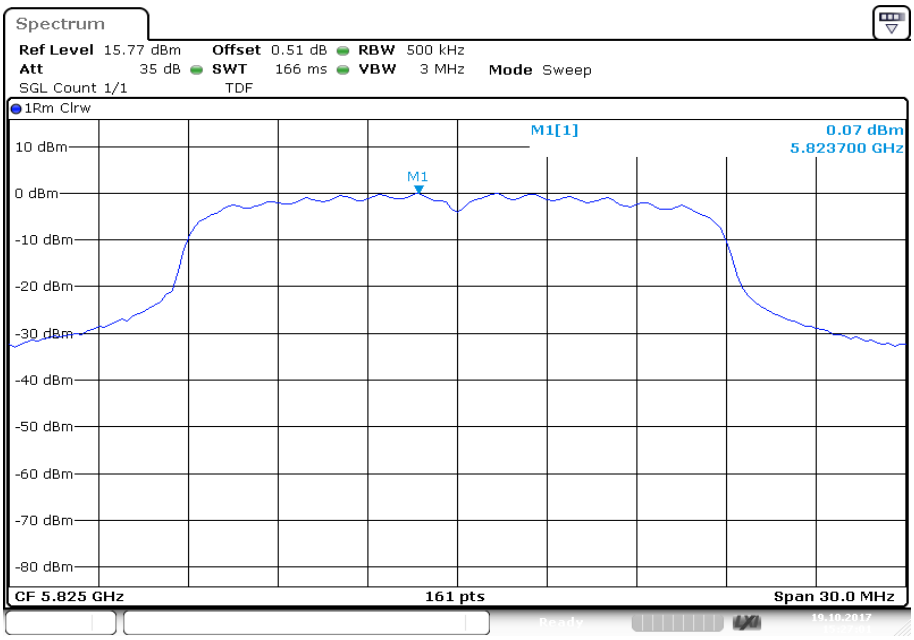
Date: 19.OCT.2017 15:23:20

Plot 2: U-NII-3; middle channel



Date: 19.OCT.2017 15:25:09

Plot 3: U-NII-3; highest channel



11.5.2 Power spectral density according to IC requirements

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 for U-NII-1/2A & 2C 500 kHz for U-NII-3
Video bandwidth:	≥ 3xRBW
Span:	> EBW
Trace mode:	Max hold
Used test setup:	See chapter 6.4 – A
Measurement uncertainty:	See chapter 8

Limits:

Power Spectral Density
power spectral density e.i.r.p. ≤ 10 dBm in any 1 MHz band (band 5150 – 5250 MHz) power spectral density conducted ≤ 11 dBm in any 1 MHz band (band 5250 – 5350 MHz) power spectral density conducted ≤ 11 dBm in any 1 MHz band (band 5470 – 5725 MHz) power spectral density conducted ≤ 30 dBm in any 500 kHz band (band 5725 – 5850 MHz)

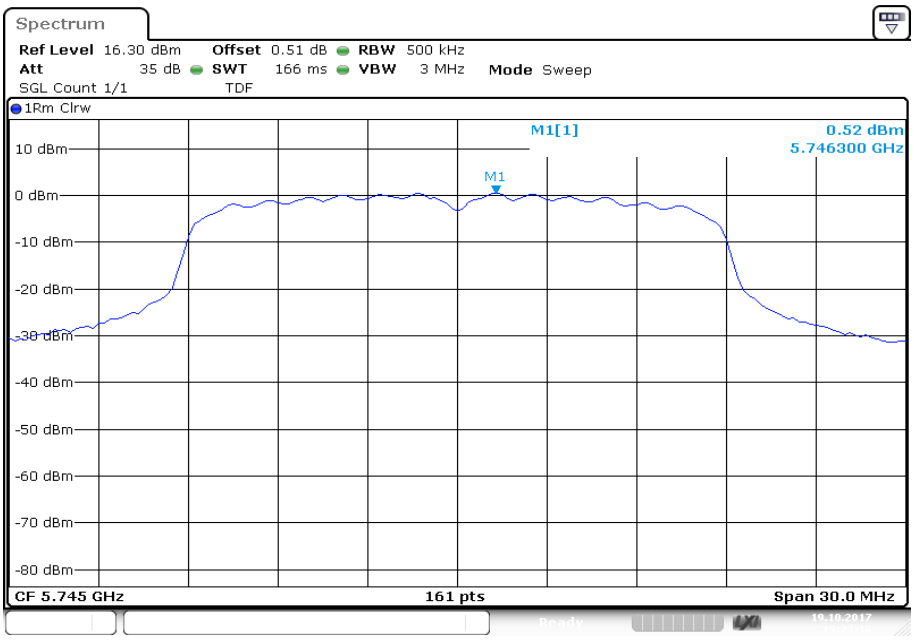
Results:

	Power spectral density (dBm/1MHz or dBm/500kHz)		
	U-NII-1 (5150 MHz to 5250 MHz)*		
	Lowest channel	Middle channel	Highest channel
	Conducted		
n HT20	2.47	2.28	2.44
	Radiated (calculated – see chapter antenna gain)		
	2.58	3.24	2.61
	U-NII-3 (5725 MHz to 5850 MHz)		
	Lowest channel	Middle channel	Highest channel
	0.52	0.31	0.04

*Note: U-NII-1 band values were added from chapter 11.4.1 (detected peak within the plots)

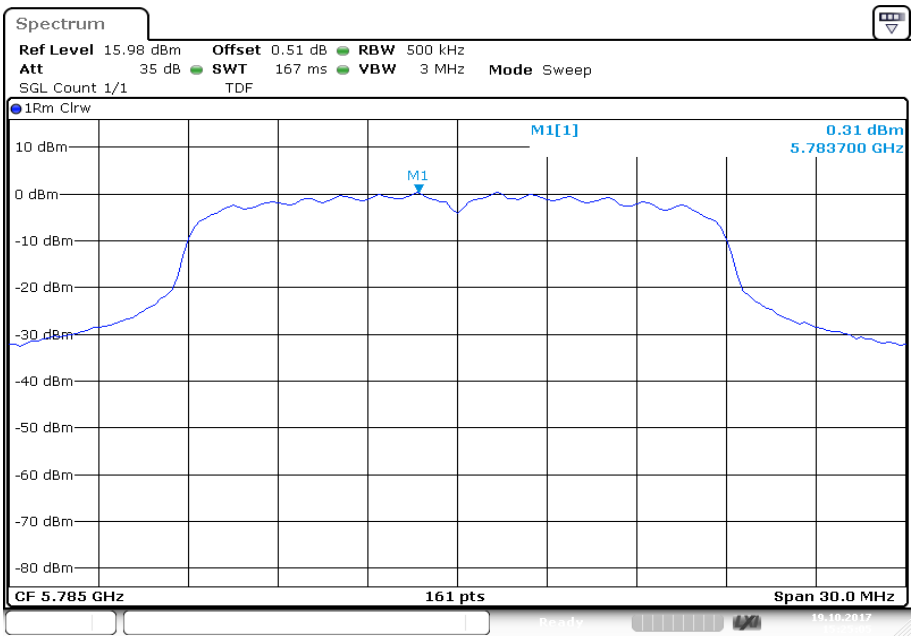
Plots: n HT20 – mode

Plot 1: U-NII-3; lowest channel



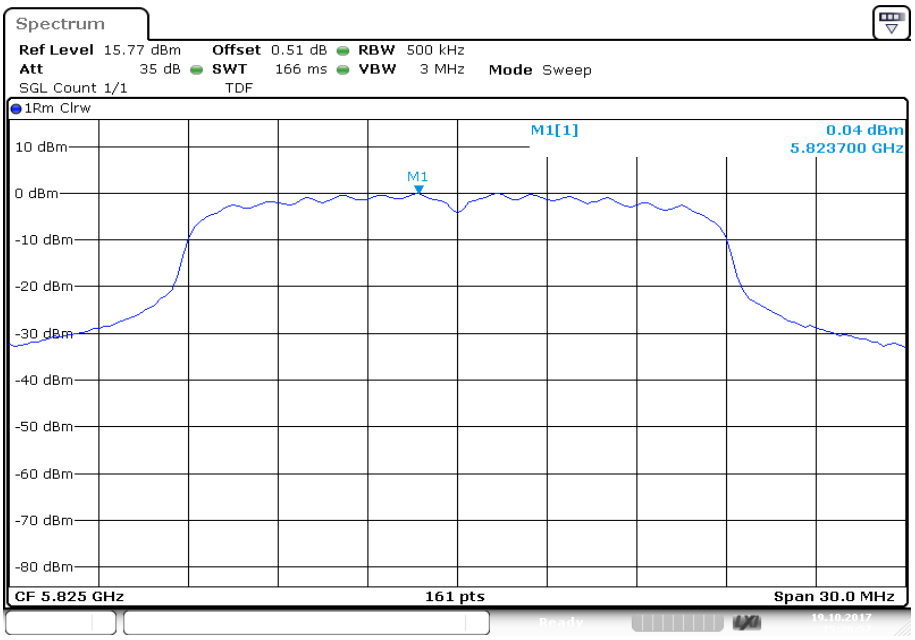
Date: 19.OCT.2017 15:23:16

Plot 2: U-NII-3; middle channel



Date: 19.OCT.2017 15:25:05

Plot 3: U-NII-3; highest channel



11.6 Minimum emission bandwidth for the band 5.725-5.85 GHz

Description:

Measurement of the 6 dB bandwidth of the modulated signal.

Measurement:

Measurement parameter	
According to: KDB789033 D02, C.2.	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Span:	40 MHz
Measurement procedure:	Using marker to find -6dBc frequencies
Trace mode:	Max hold (allow trace to stabilize)
Used test setup:	See chapter 6.4 – A
Measurement uncertainty:	See chapter 8

Limits:

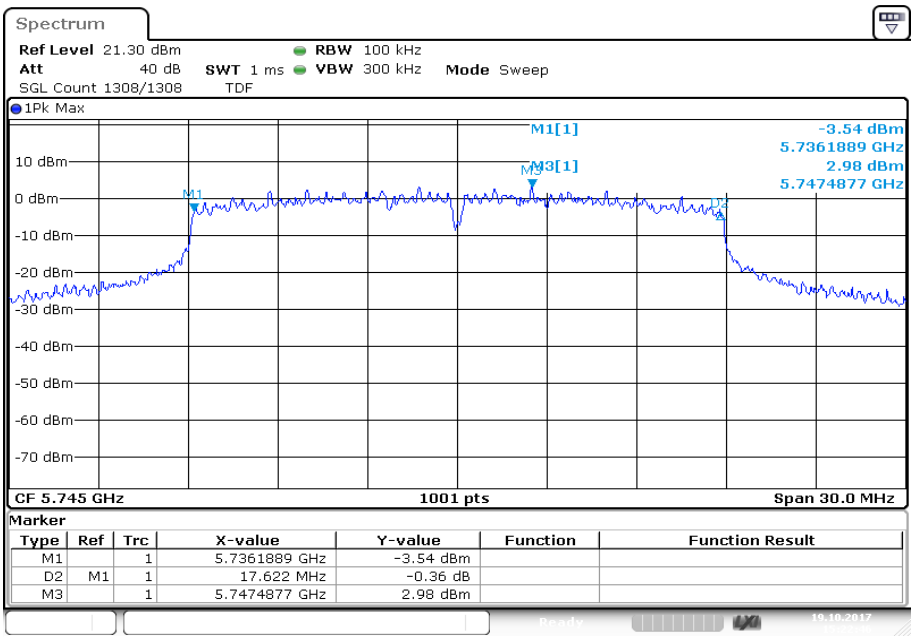
FCC	IC
The minimum 6 dB bandwidth shall be at least 500 kHz.	

Results:

n HT20	6 dB emission bandwidth (MHz)		
	U-NII-3 (5725 MHz to 5850 MHz)		
	Lowest channel	Middle channel	Highest channel
	17.62	17.29	17.59

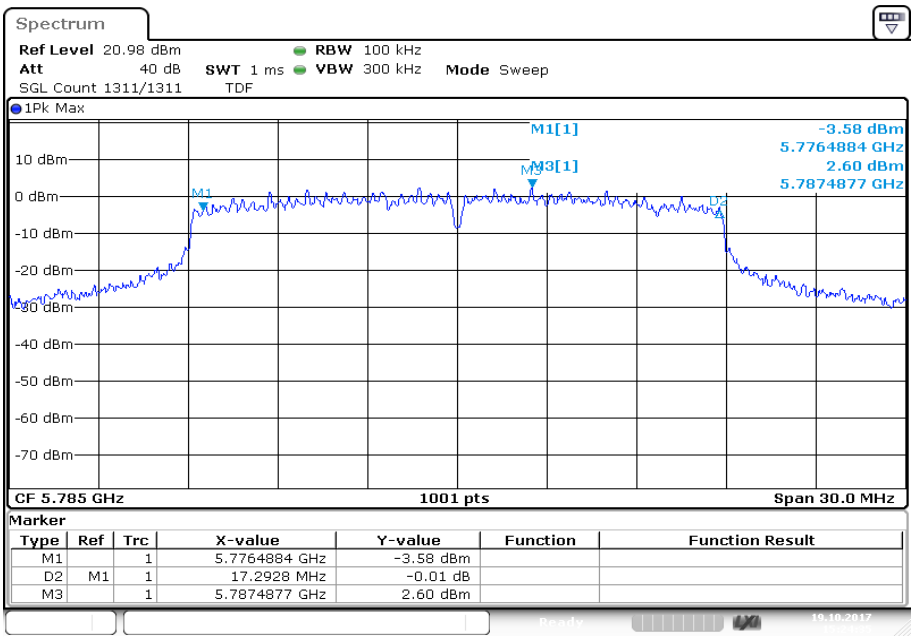
Plots: n HT20 – mode

Plot 1: U-NII-3; lowest channel



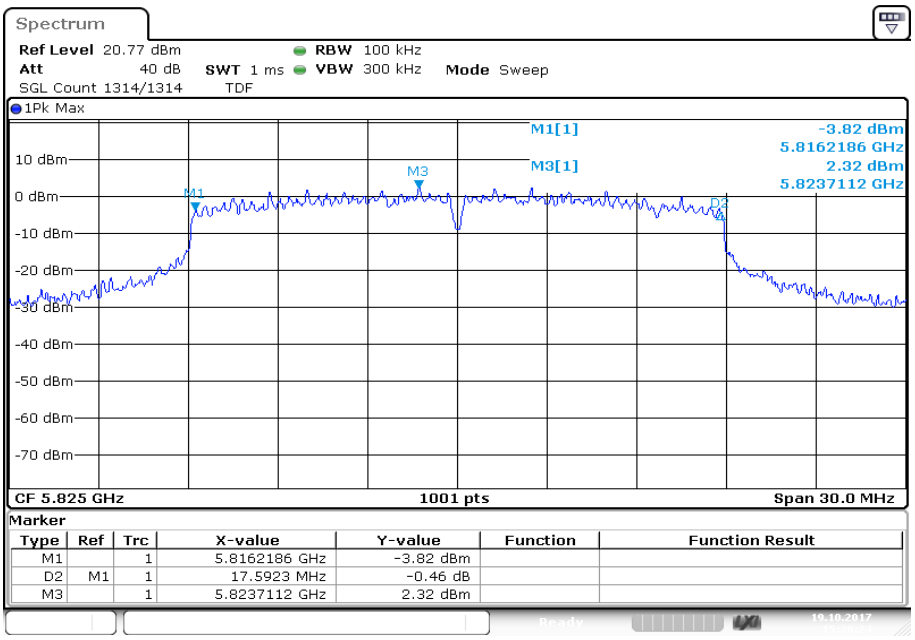
Date: 19.OCT.2017 15:22:46

Plot 2: U-NII-3; middle channel



Date: 19.OCT.2017 15:24:35

Plot 3: U-NII-3; highest channel



Date: 19.OCT.2017 15:26:25

11.7 Spectrum bandwidth / 26 dB bandwidth

Description:

Measurement of the 26 dB bandwidth of the modulated signal.

Measurement:

Measurement parameter	
According to: KDB789033 D02, C.1.	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1% EBW
Video bandwidth:	≥ RBW
Span:	> Complete signal
Trace mode:	Max hold
Used test setup:	see chapter 6.4 – A
Measurement uncertainty:	see chapter 8

Limits:

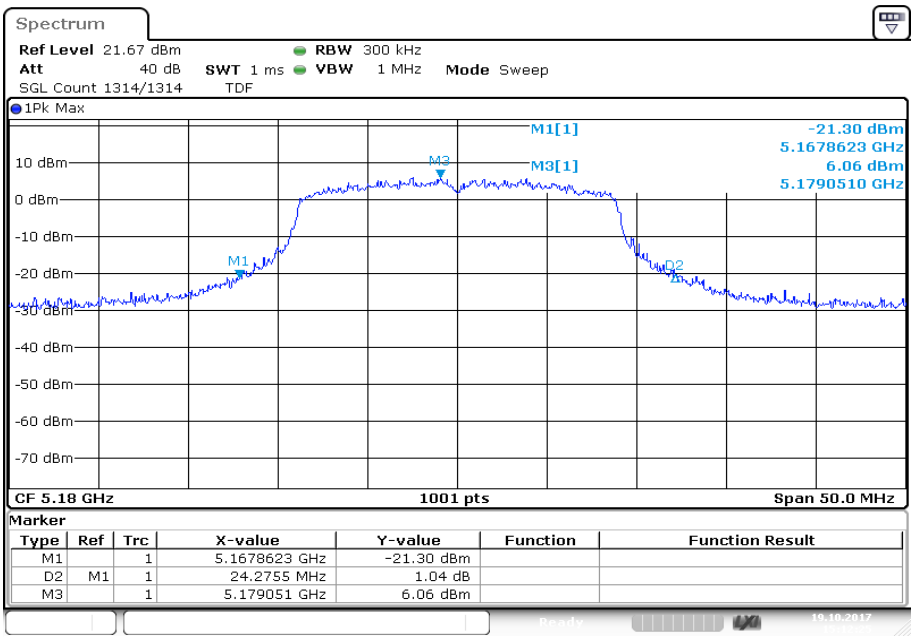
Spectrum Bandwidth – 26 dB Bandwidth
IC: Any unwanted emissions that fall into the band 5250-5350 MHz shall be attenuated below the channel power by at least 26 dB, when measured using a resolution bandwidth between 1 and 5% of the occupied bandwidth (i.e. 99% bandwidth), above 5250 MHz. The 26 dB bandwidth may fall into the 5250-5350 MHz band; however, if the occupied bandwidth also falls within the 5250-5350 MHz band, the transmission is considered as intentional and the devices shall comply with all requirements in the band 5250-5350 MHz including implementing dynamic frequency selection (DFS) and TPC, on the portion of the emission that resides in the 5250-5350 MHz band. **FCC:** Radar Detection Function of Dynamic Frequency Selection (DFS). U-NII devices operating with any part of its 26 dB emission bandwidth in the 5.25-5.35 GHz and 5.47-5.725 GHz bands shall employ a DFS radar detection mechanism to detect the presence of radar systems and to avoid co-channel operation with radar systems.

Results:

	26 dB bandwidth (MHz)		
	U-NII-1 (5150 MHz to 5250 MHz)		
	Lowest channel	Middle channel	Highest channel
	24.28	24.12	23.63
	Lowest frequency	Highest frequency	
n HT20	5167.86	5232.09	
	U-NII-3 (5725 MHz to 5850 MHz)		
	Lowest channel	Middle channel	Highest channel
	28.47	27.07	26.32
	Lowest frequency	Highest frequency	
	5731.13	5838.34	

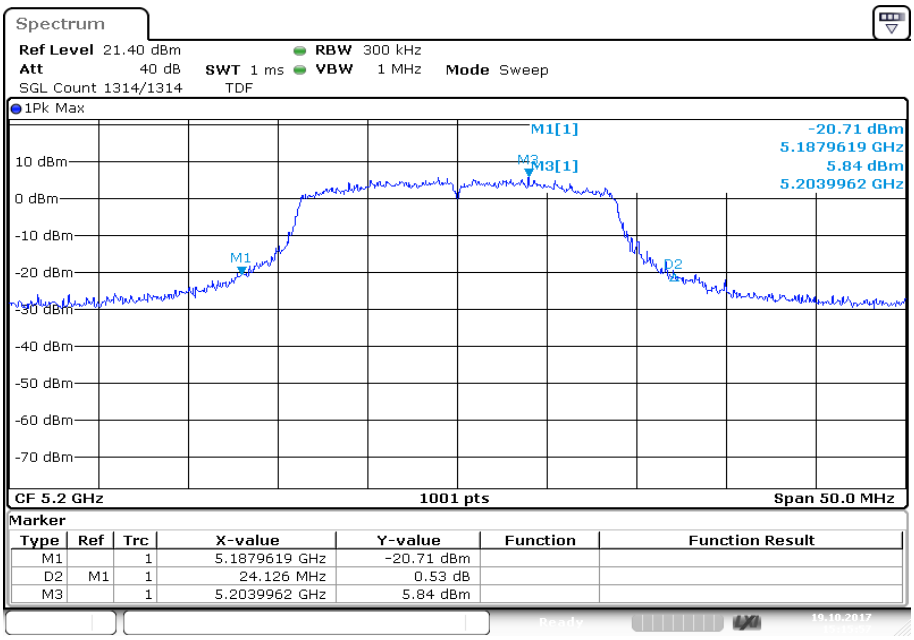
Plots: n HT20 – mode

Plot 1: U-NII-1; lowest channel



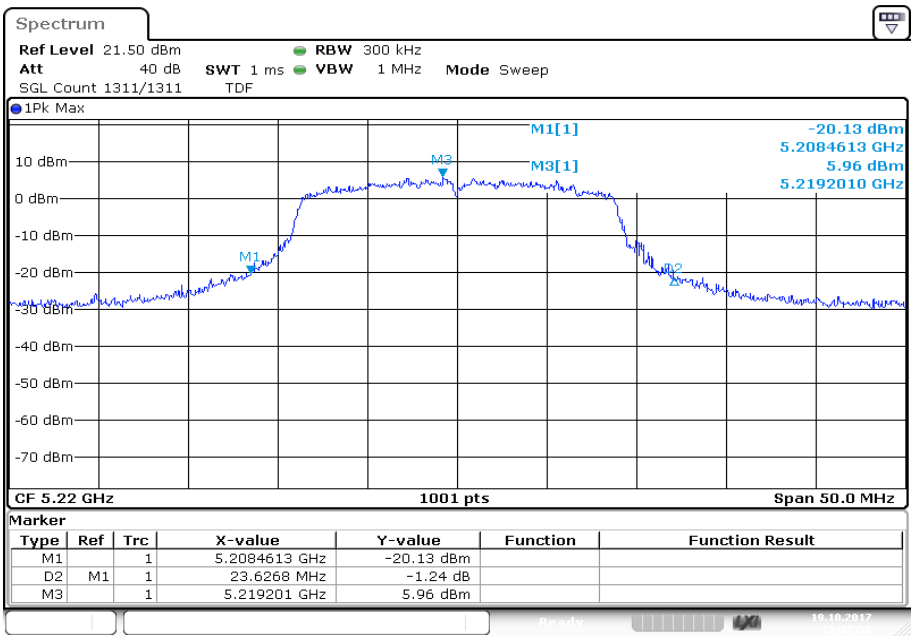
Date: 19.OCT.2017 15:12:25

Plot 2: U-NII-1; middle channel



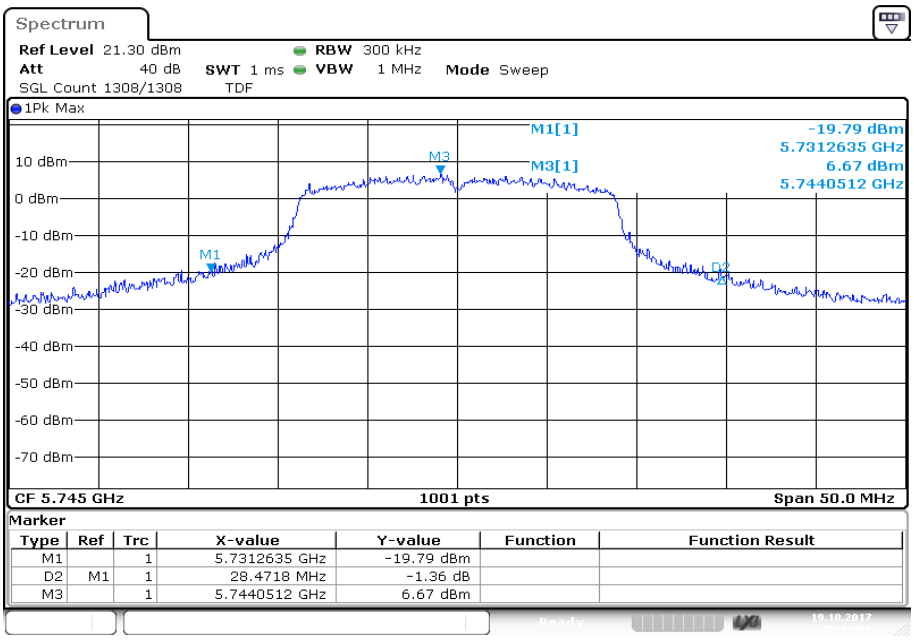
Date: 19.OCT.2017 15:15:57

Plot 3: U-NII-1; highest channel



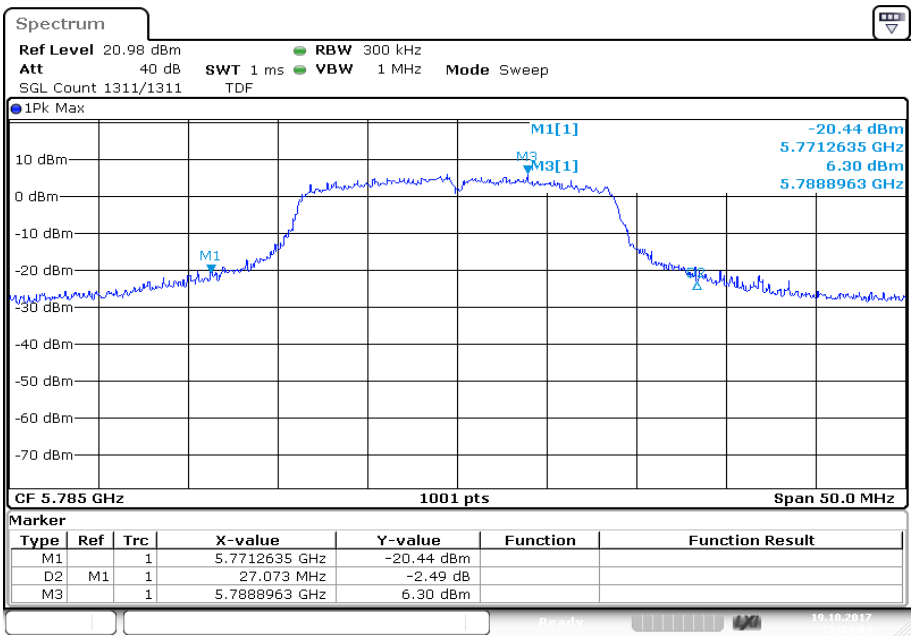
Date: 19.OCT.2017 15:17:52

Plot 4: U-NII-3; lowest channel



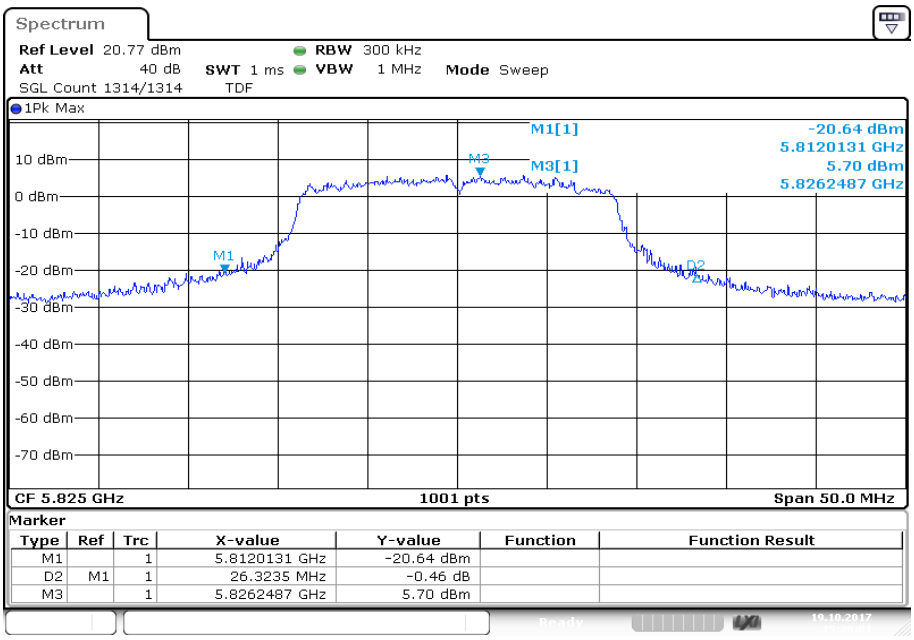
Date: 19.OCT.2017 15:22:17

Plot 5: U-NII-3; middle channel



Date: 19.OCT.2017 15:24:04

Plot 6: U-NII-3; highest channel



Date: 19.OCT.2017 15:26:01

11.8 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 analyzer
Trace mode:	Max hold (allow trace to stabilize)
Test setup:	See sub clause 6.4 – A
Measurement uncertainty:	See sub clause 8

Usage:

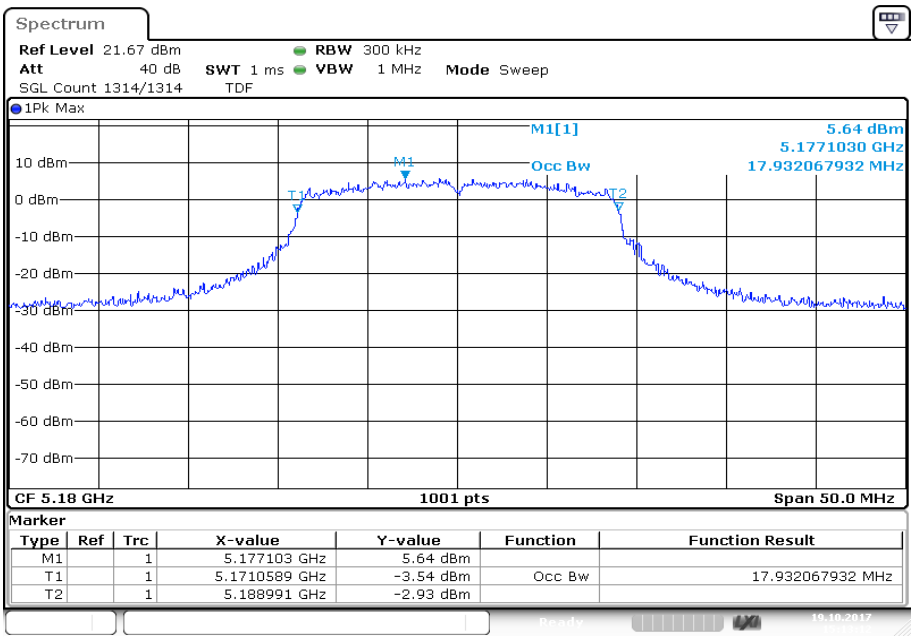
-/-	IC
OBW is necessary for Emission Designator	

Results:

	99% bandwidth (kHz)		
	U-NII-1 (5150 MHz to 5250 MHz)		
	Lowest channel	Middle channel	Highest channel
n HT20	17932	17982	17882
	U-NII-3 (5725 MHz to 5850 MHz)		
	Lowest channel	Middle channel	Highest channel
	18132	17982	17882

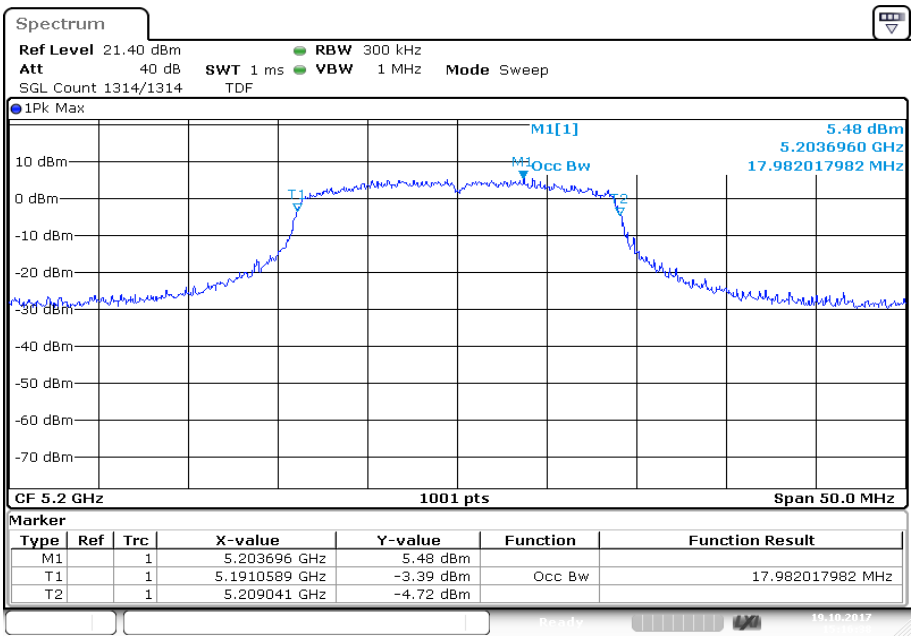
Plots: n HT20 – mode

Plot 1: U-NII-1; lowest channel



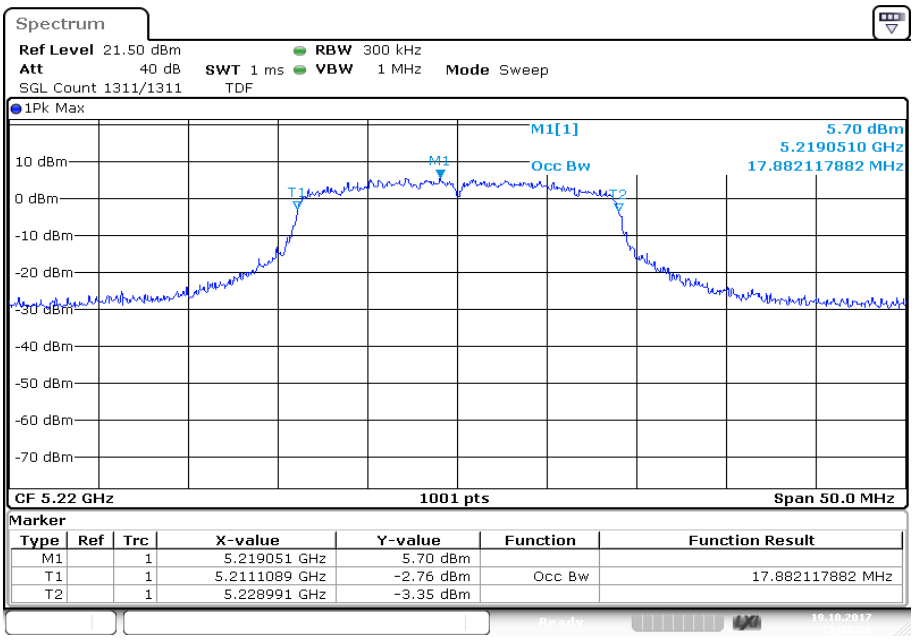
Date: 19.OCT.2017 15:13:12

Plot 2: U-NII-1; middle channel



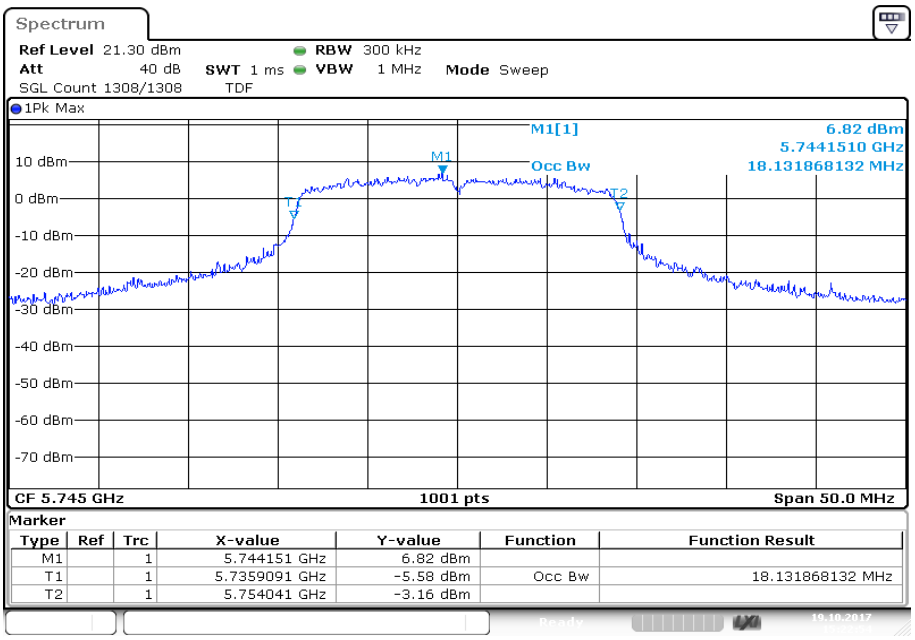
Date: 19.OCT.2017 15:16:38

Plot 3: U-NII-1; highest channel



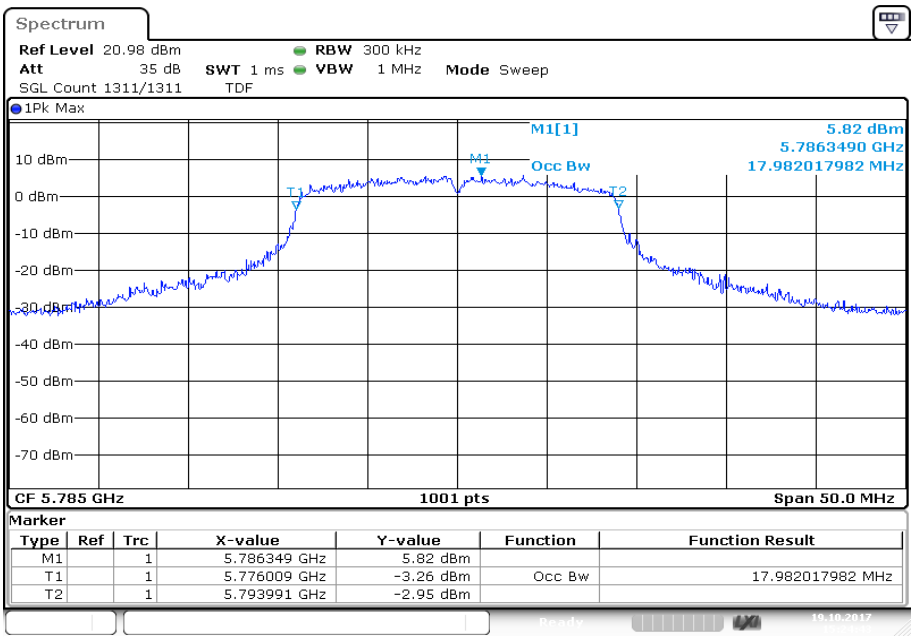
Date: 19.OCT.2017 15:18:29

Plot 4: U-NII-3; lowest channel



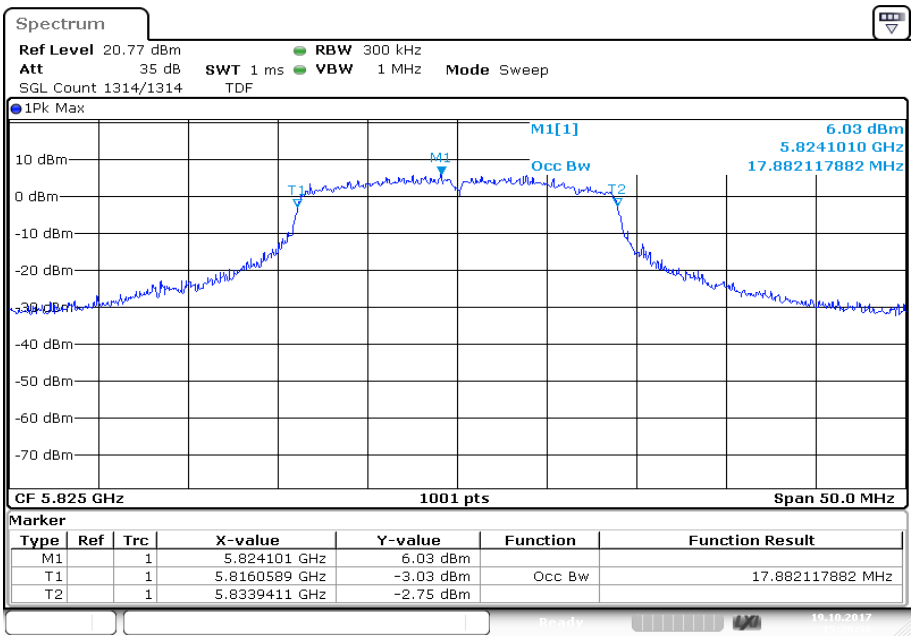
Date: 19.OCT.2017 15:22:54

Plot 5: U-NII-3; middle channel



Date: 19.OCT.2017 15:24:43

Plot 6: U-NII-3; highest channel



Date: 19.OCT.2017 15:26:36

11.9 Band edge compliance radiated

Description:

Measurement of the radiated band edge compliance. The EUT is turned in the position that results in the maximum level at the band edge. Then a sweep over the corresponding restricted band is performed. The EUT is set to 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 chapter 6.2 – C
Measurement uncertainty:	See chapter 8

Limits:

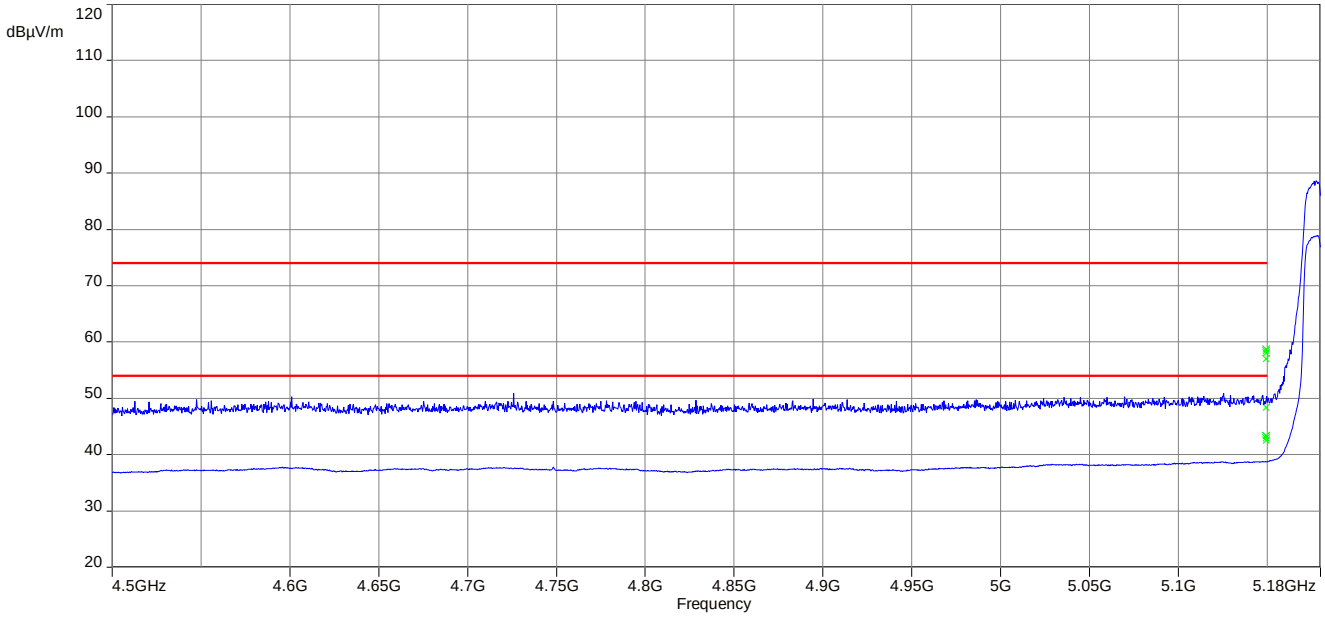
Band Edge Compliance Radiated
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within 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; U-NII-1; lowest channel; 20 MHz channel bandwidth



11.10 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 chapter 6.2 – A
Measurement uncertainty:	See chapter 8

Limits:

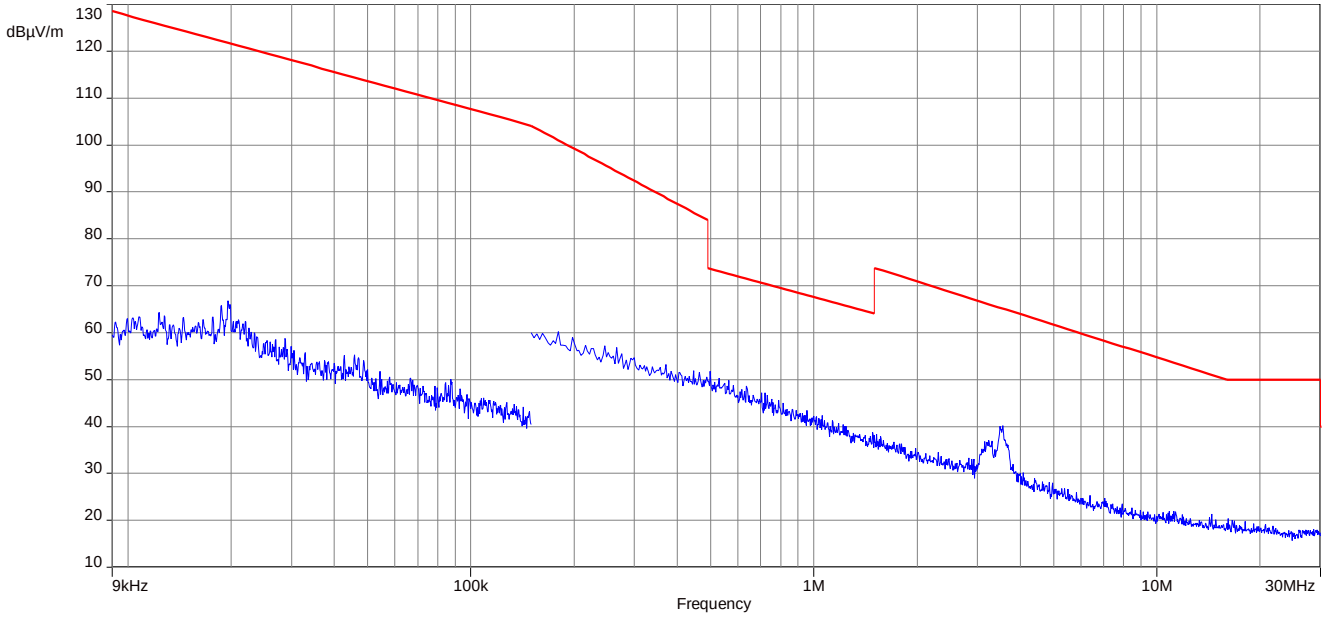
Spurious Emissions Radiated < 30 MHz		
Frequency (MHz)	Field Strength (dBµV/m)	Measurement distance
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30

Results:

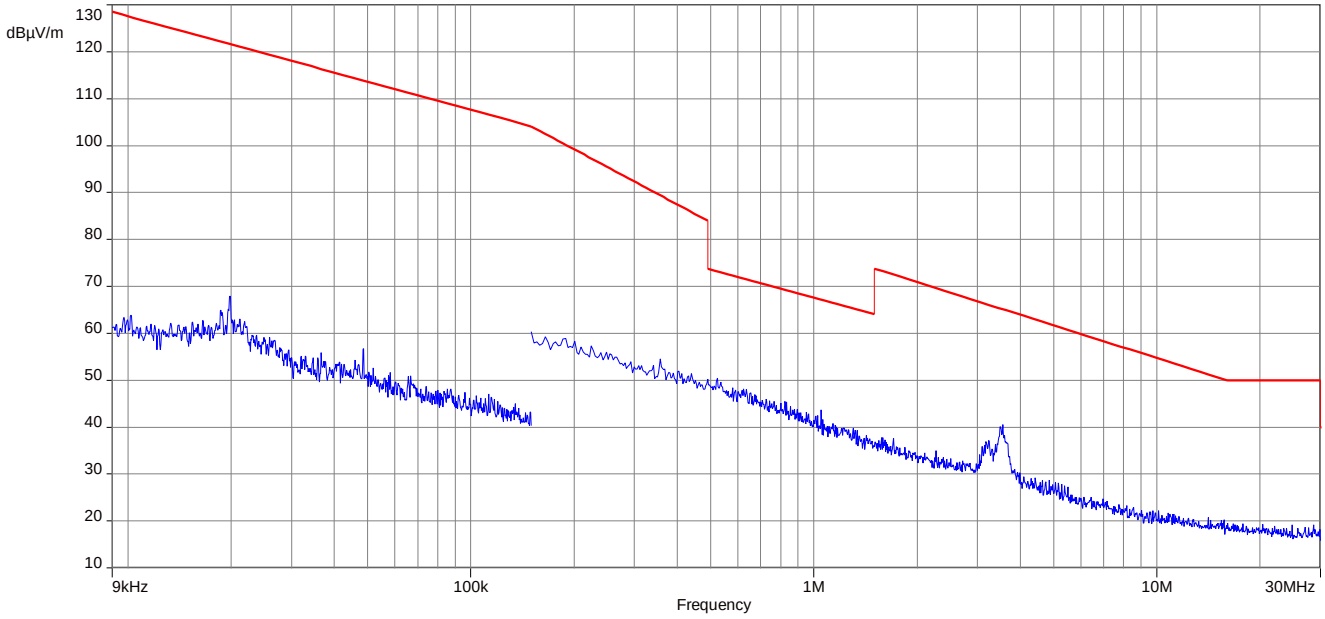
Spurious Emissions Radiated < 30 MHz [dBµV/m]		
F [MHz]	Detector	Level [dBµV/m]
All detected emissions are more than 20 dB below the limit.		

Plots: 20 MHz channel bandwidth

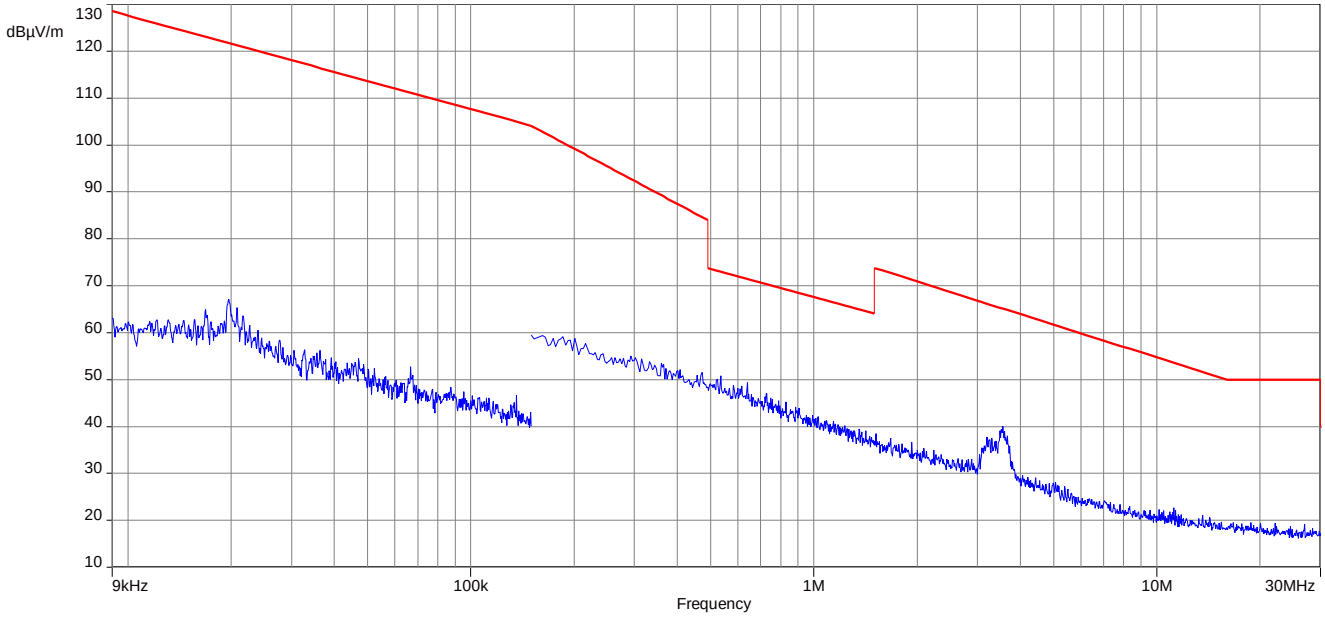
Plot 1: 9 kHz to 30 MHz, U-NII-1; lowest channel



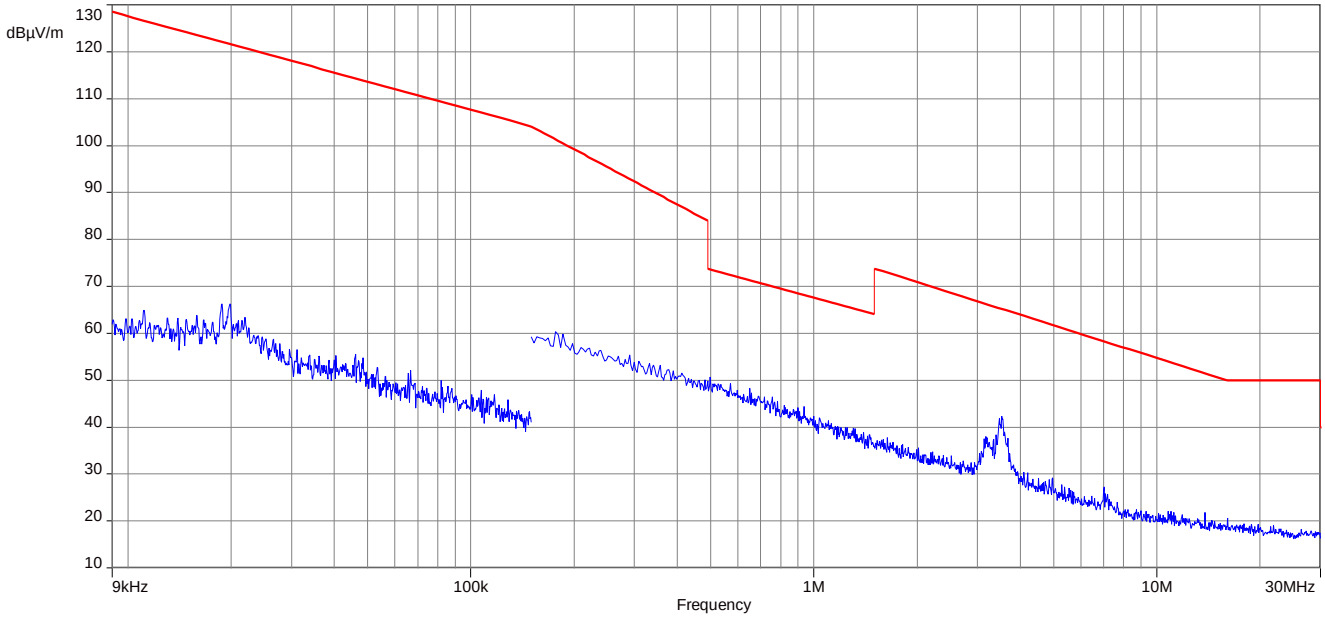
Plot 2: 9 kHz to 30 MHz, U-NII-1; middle channel



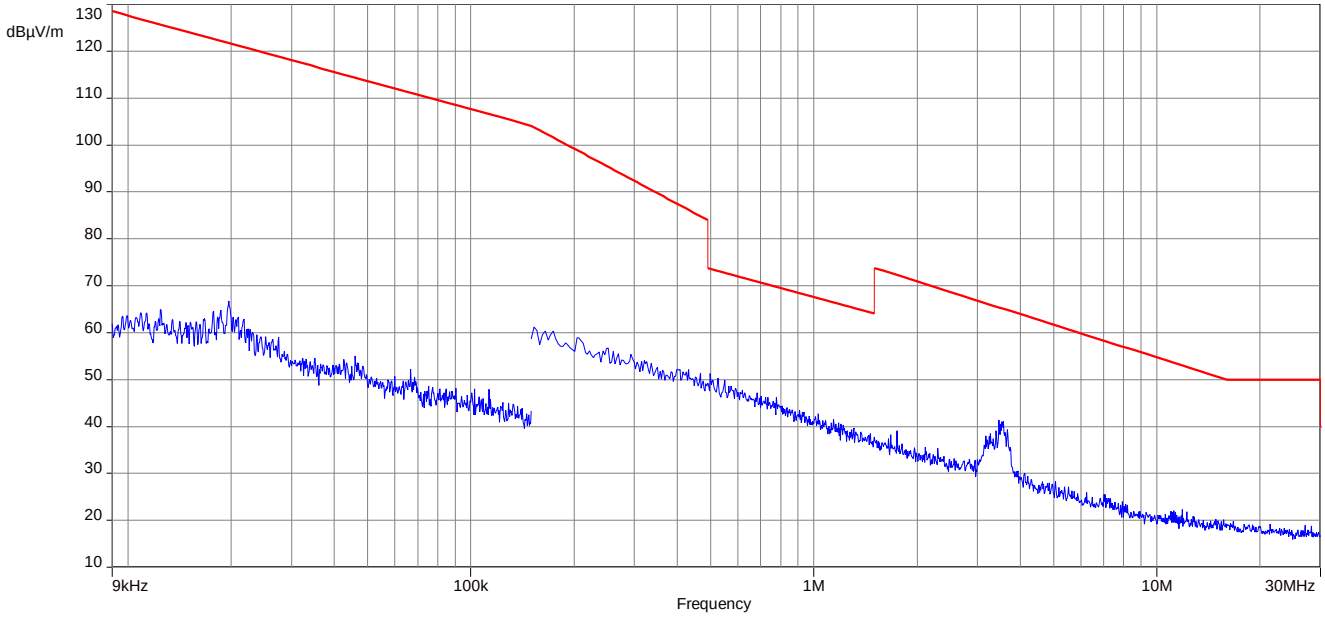
Plot 3: 9 kHz to 30 MHz, U-NII-1; highest channel



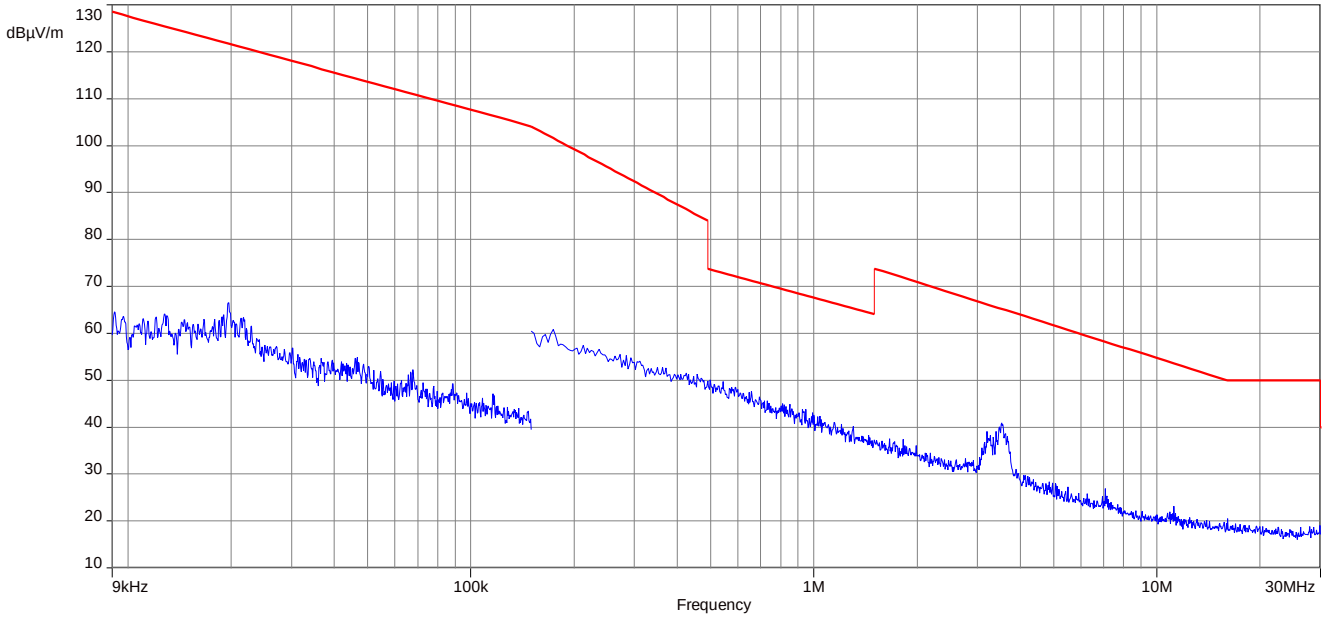
Plot 4: 9 kHz to 30 MHz, U-NII-3; lowest channel



Plot 5: 9 kHz to 30 MHz, U-NII-3; middle channel



Plot 6: 9 kHz to 30 MHz, U-NII-3; highest channel



11.11 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 chapter 6.1 – A See chapter 6.2 – B See chapter 6.3 – A
Measurement uncertainty:	See chapter 8

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	

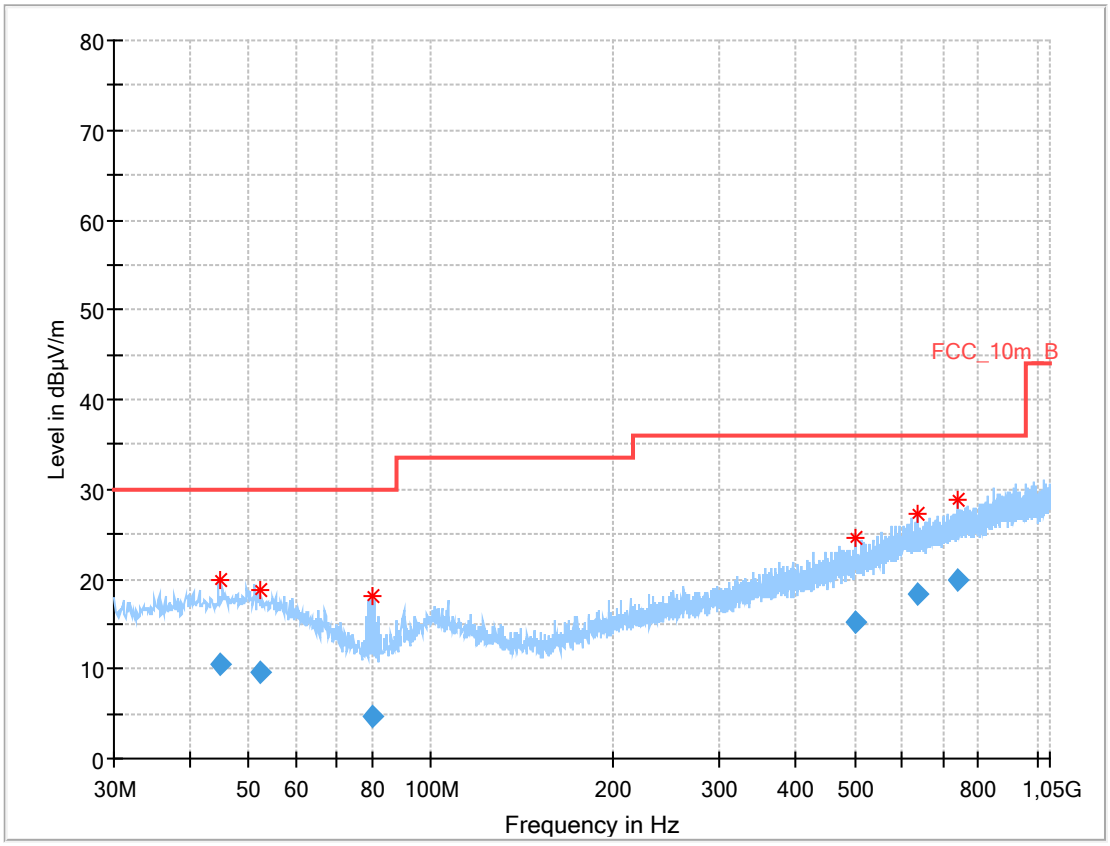
Results: 20 MHz channel bandwidth

TX Spurious Emissions Radiated [dBµV/m] / dBm								
U-NII-1 (5150 MHz to 5250 MHz)								
Lowest channel			Middle channel			Highest channel		
F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]
For emissions below 1 GHz please look at the table below the plot.			For emissions below 1 GHz please look at the table below the plot.			For emissions below 1 GHz please look at the table below the plot.		
All detected peak emissions are below the average limit. (1 GHz to 18 GHz).			All detected peak emissions are below the average limit. (1 GHz to 18 GHz).			All detected peak emissions are below the average limit. (1 GHz to 18 GHz).		
For emissions above 18 GHz please take look at the plots.			For emissions above 18 GHz please take look at the plots.			For emissions above 18 GHz please take look at the plots.		

TX Spurious Emissions Radiated [dBµV/m] / dBm								
U-NII-3 (5725 MHz to 5850 MHz)								
Lowest channel			Middle channel			Highest channel		
F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]	F [MHz]	Detector	Level [dBµV/m]
For emissions below 1 GHz please look at the table below the plot.			For emissions below 1 GHz please look at the table below the plot.			For emissions below 1 GHz please look at the table below the plot.		
All detected peak emissions are below the average limit. (1 GHz to 18 GHz).			All detected peak emissions are below the average limit. (1 GHz to 18 GHz).			All detected peak emissions are below the average limit. (1 GHz to 18 GHz).		
For emissions above 18 GHz please take look at the plots.			For emissions above 18 GHz please take look at the plots.			For emissions above 18 GHz please take look at the plots.		

Plots: 20 MHz channel bandwidth

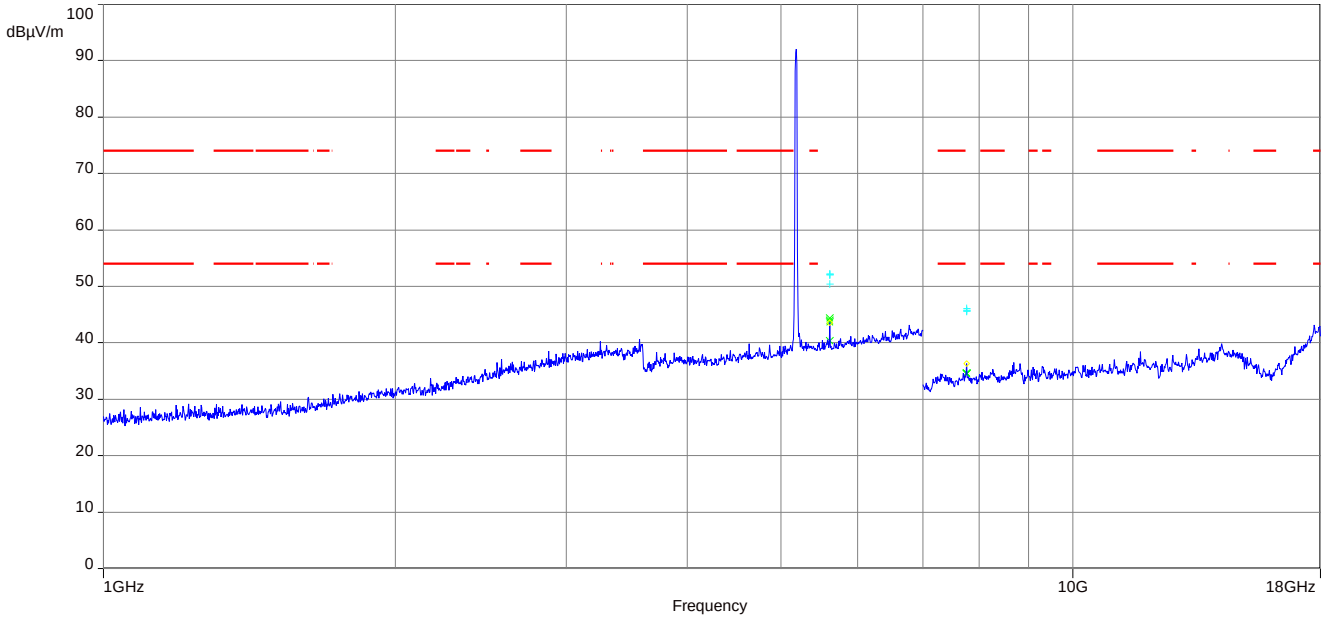
Plot 1: 30 MHz to 1 GHz; vertical & horizontal polarization; U-NII-1; lowest channel



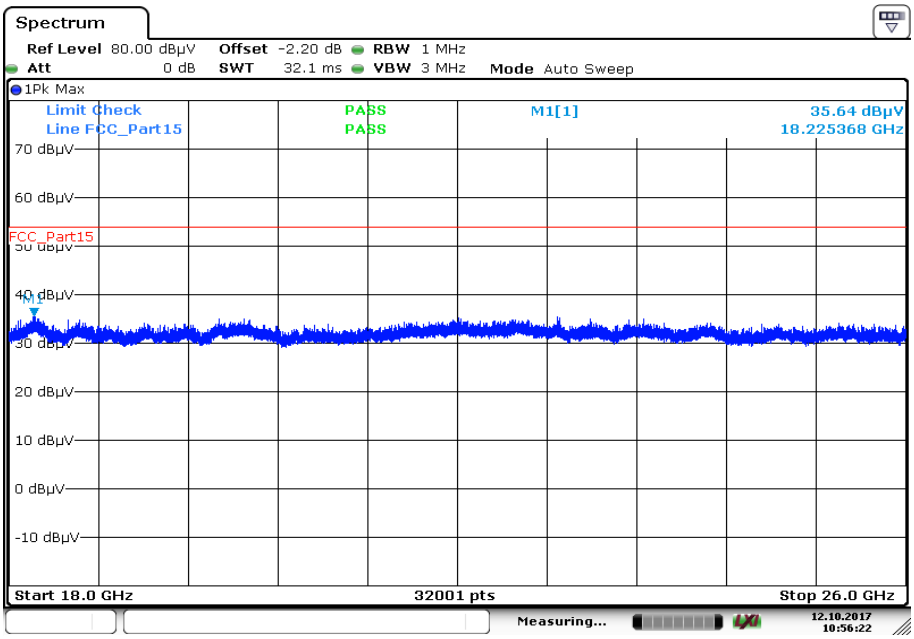
Final_Result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
44.858	10.40	30.0	19.60	1000	120	170.0	H	174.0	13.6
52.409	9.63	30.0	20.37	1000	120	101.0	V	83.0	13.4
80.378	4.60	30.0	25.40	1000	120	170.0	V	354.0	8.1
500.726	15.10	36.0	20.90	1000	120	170.0	V	1.0	18.7
635.740	18.36	36.0	17.64	1000	120	98.0	H	204.0	21.0
742.536	19.91	36.0	16.09	1000	120	101.0	H	226.0	22.5

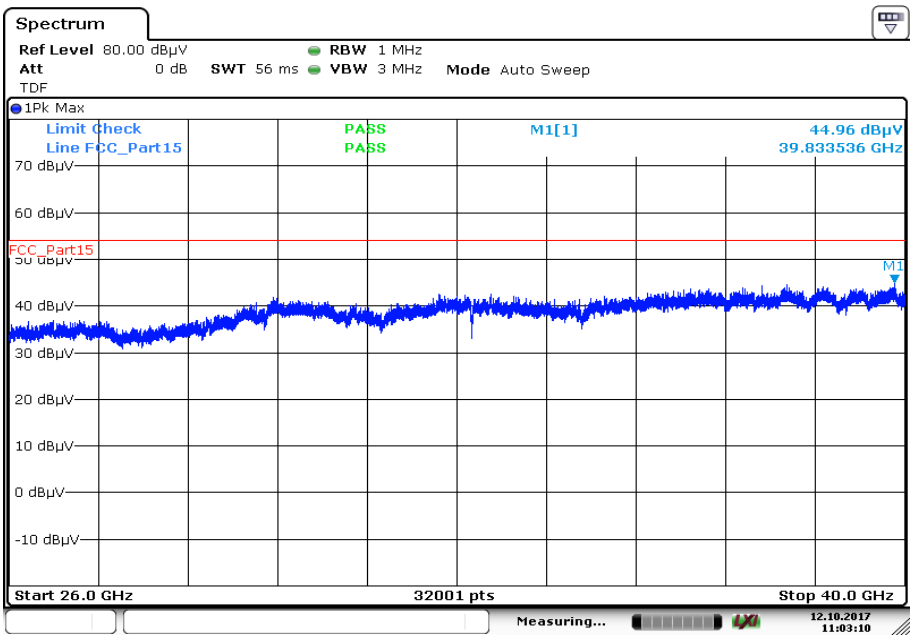
Plot 2: 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-1; lowest channel



Plot 3: 18 GHz to 26 GHz; vertical & horizontal polarization; U-NII-1; lowest channel

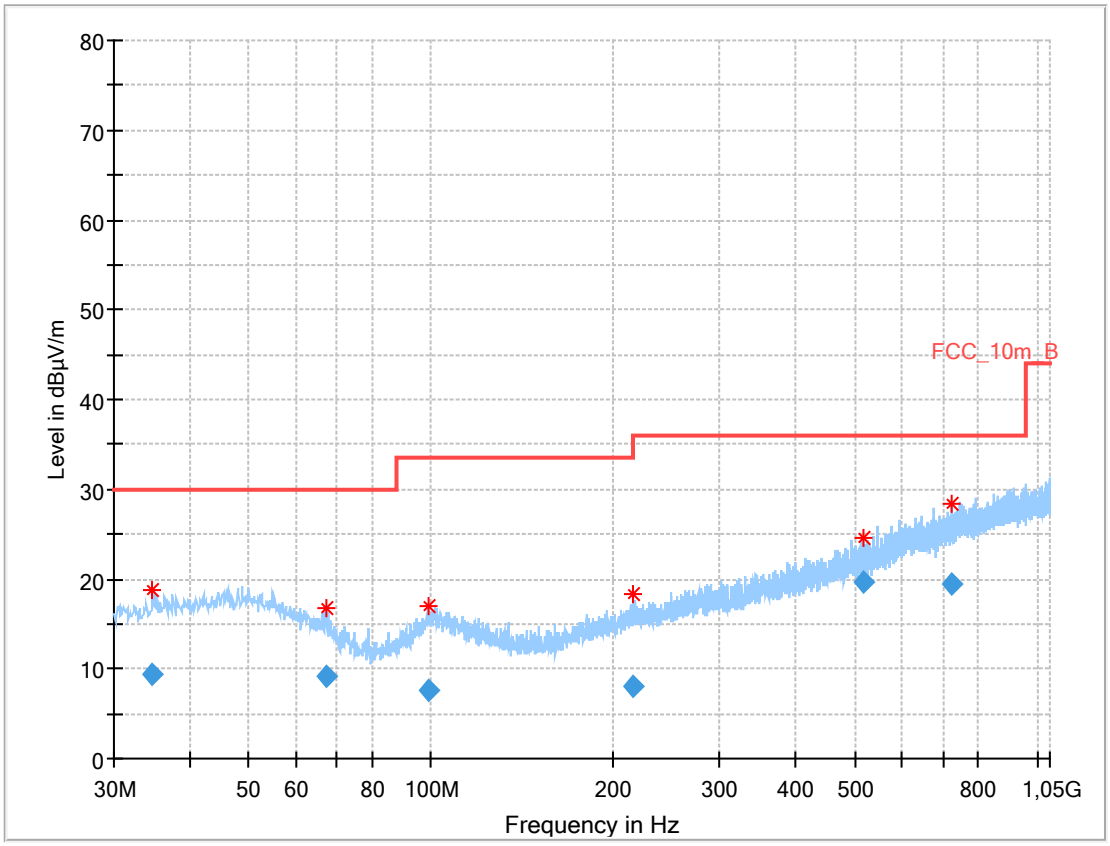


Plot 4: 26 GHz to 40 GHz; vertical & horizontal polarization; U-NII-1; lowest channel



Date: 12.OCT.2017 11:03:10

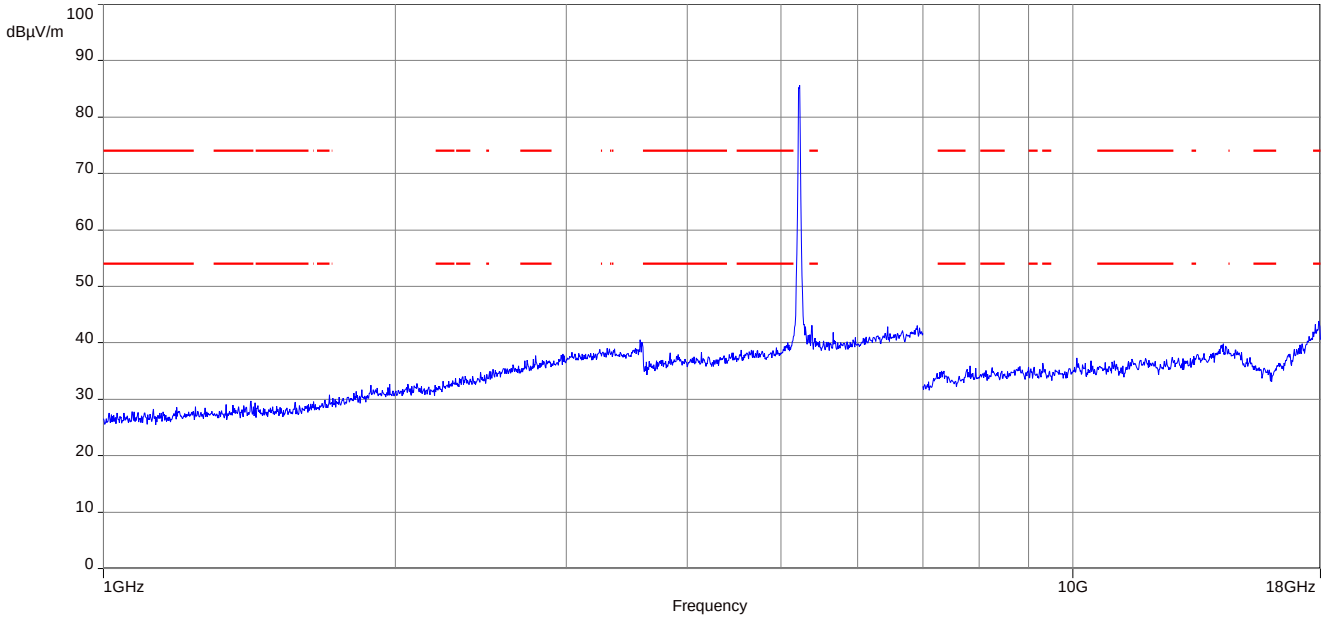
Plot 5: 30 MHz to 1 GHz; vertical & horizontal polarization; U-NII-1; middle channel



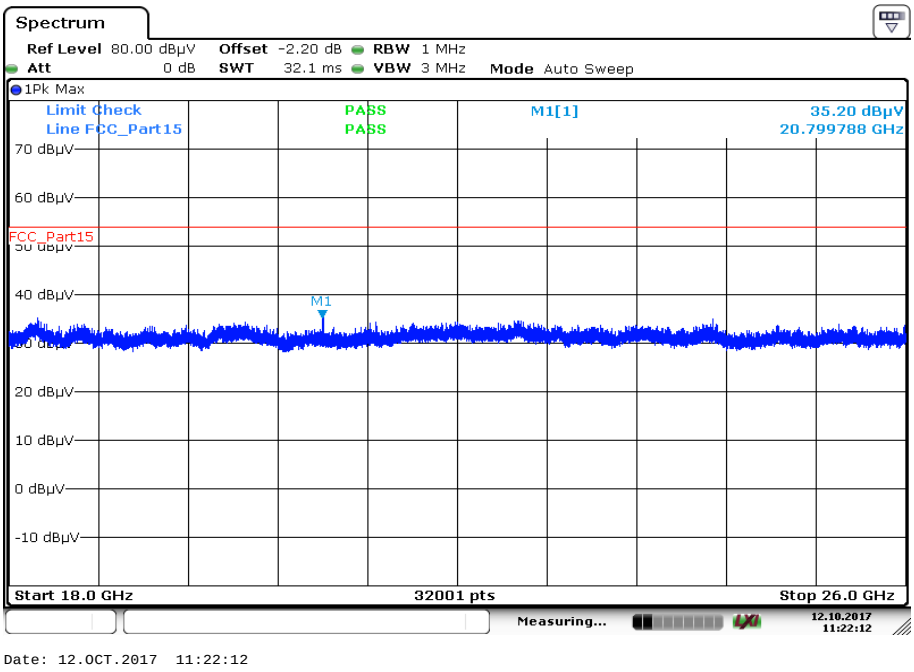
Final_Result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
34.723	9.35	30.0	20.65	1000	120	170.0	V	127.0	12.6
67.279	9.21	30.0	20.79	1000	120	170.0	V	197.0	10.3
98.981	7.51	33.5	25.99	1000	120	170.0	V	323.0	11.9
215.522	8.13	33.5	25.37	1000	120	170.0	V	0.0	12.4
515.403	19.66	36.0	16.34	1000	120	101.0	V	208.0	18.9
721.814	19.40	36.0	16.60	1000	120	170.0	H	341.0	22.1

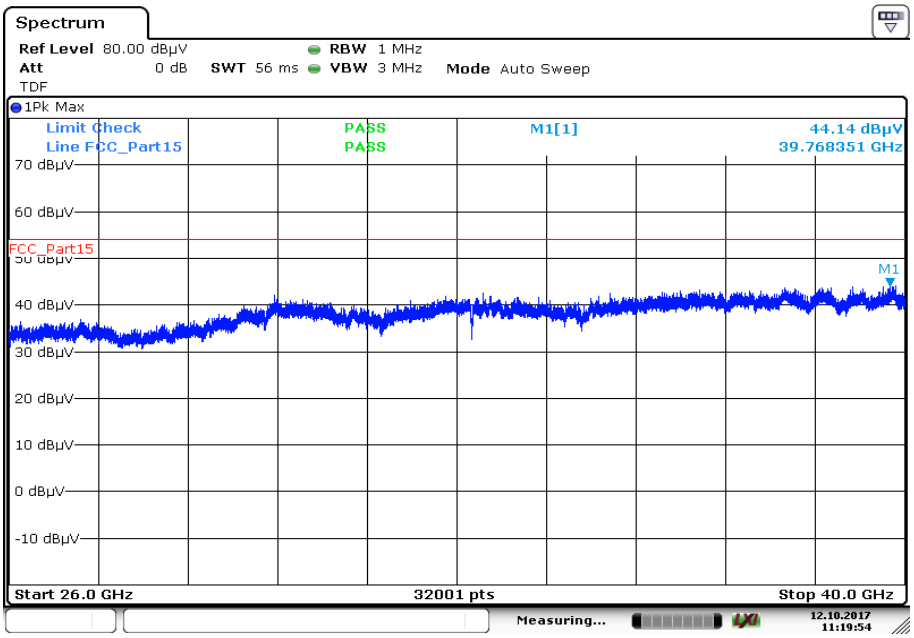
Plot 6: 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-1; middle channel



Plot 7: 18 GHz to 26 GHz; vertical & horizontal polarization; U-NII-1; middle channel



Plot 8: 26 GHz to 40 GHz; vertical & horizontal polarization; U-NII-1; middle channel



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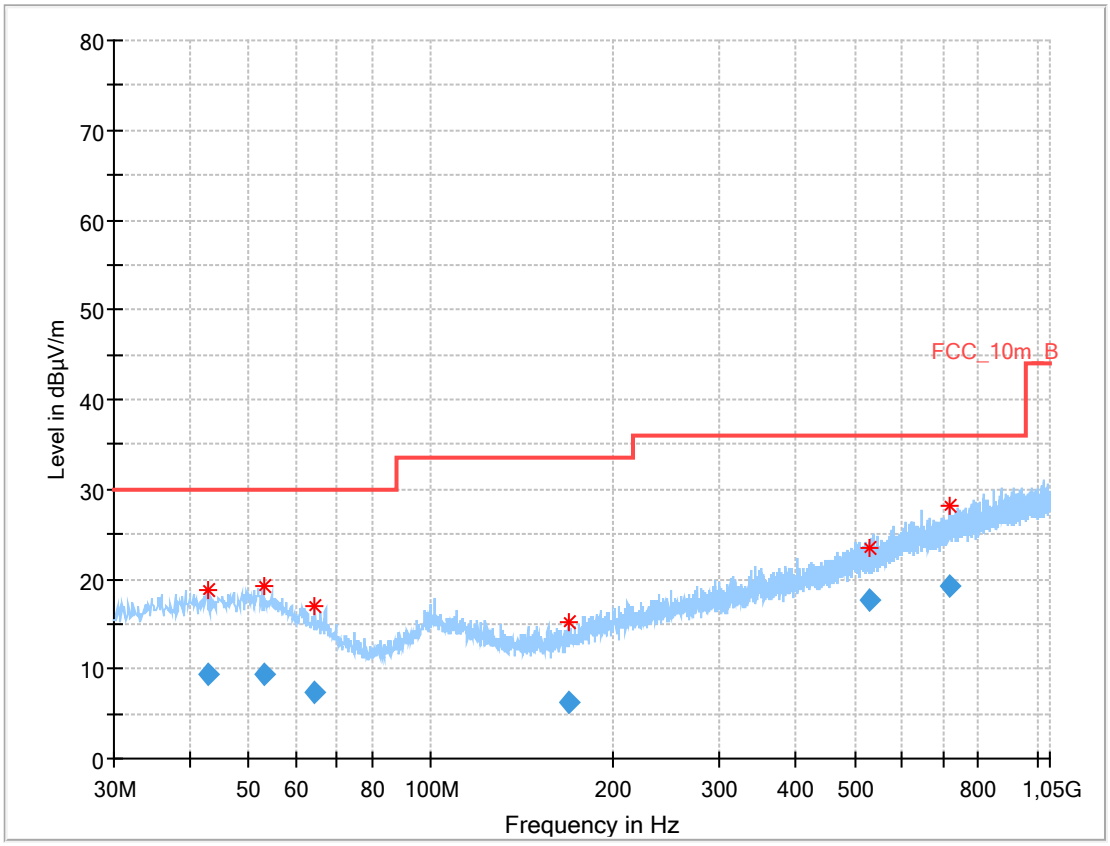
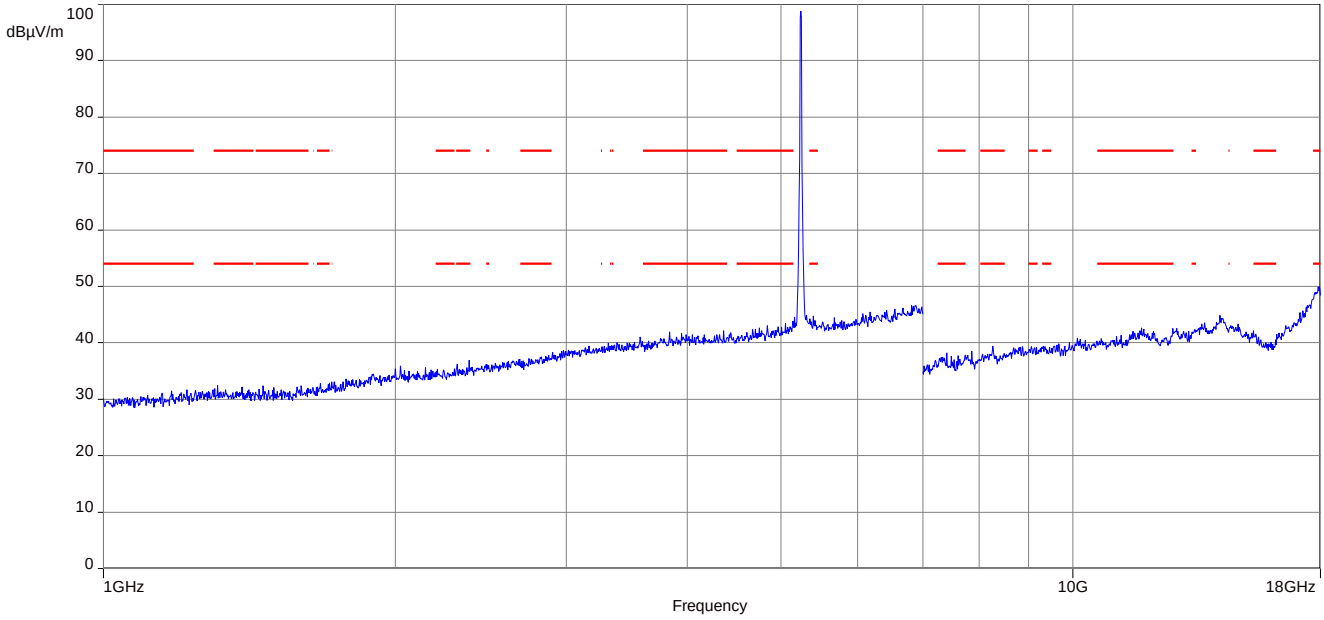
Plot 9: 30 MHz to 1 GHz; vertical & horizontal polarization; U-NII-1; highest channel



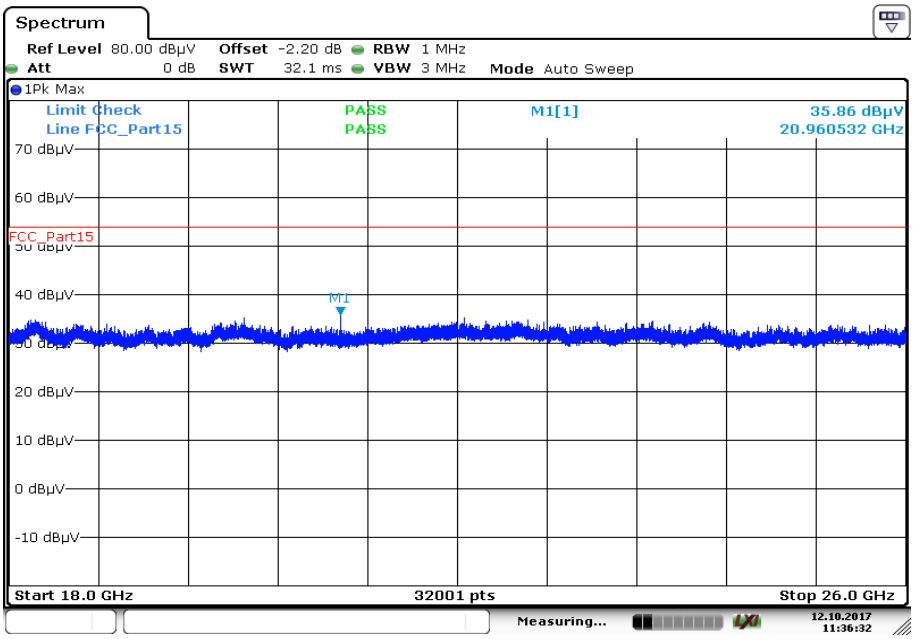
Final_Result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
42.746	9.32	30.0	20.68	1000	120	170.0	V	0.0	13.4
53.200	9.29	30.0	20.71	1000	120	170.0	V	119.0	13.3
64.102	7.27	30.0	22.73	1000	120	101.0	V	336.0	10.9
169.170	6.32	33.5	27.18	1000	120	170.0	H	351.0	10.2
529.730	17.64	36.0	18.36	1000	120	101.0	V	1.0	19.1
716.784	19.32	36.0	16.68	1000	120	98.0	H	339.0	21.9

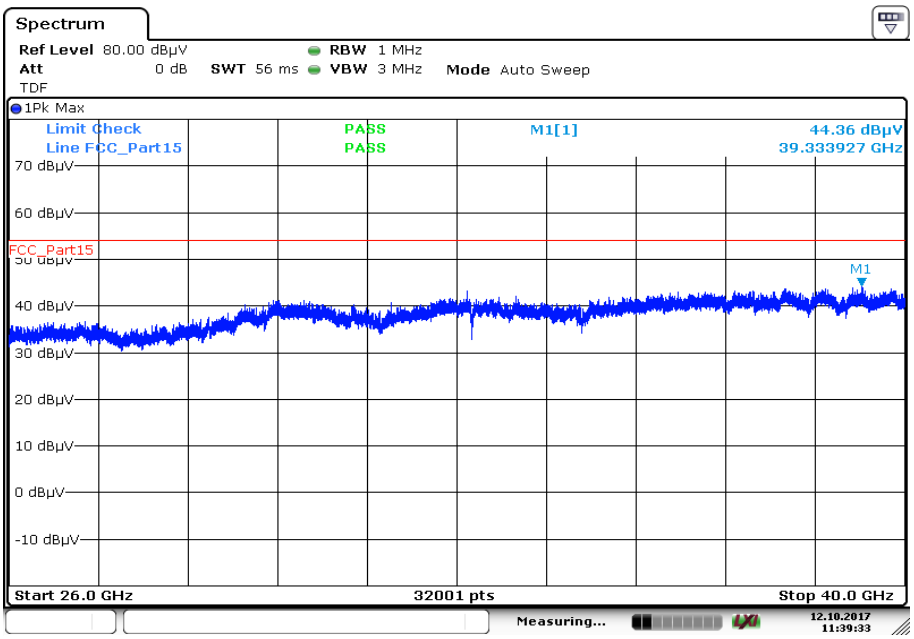
Plot 10: 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-1; highest channel



Plot 11: 18 GHz to 26 GHz; vertical & horizontal polarization; U-NII-1; highest channel



Plot 12: 26 GHz to 40 GHz; vertical & horizontal polarization; U-NII-1; highest channel



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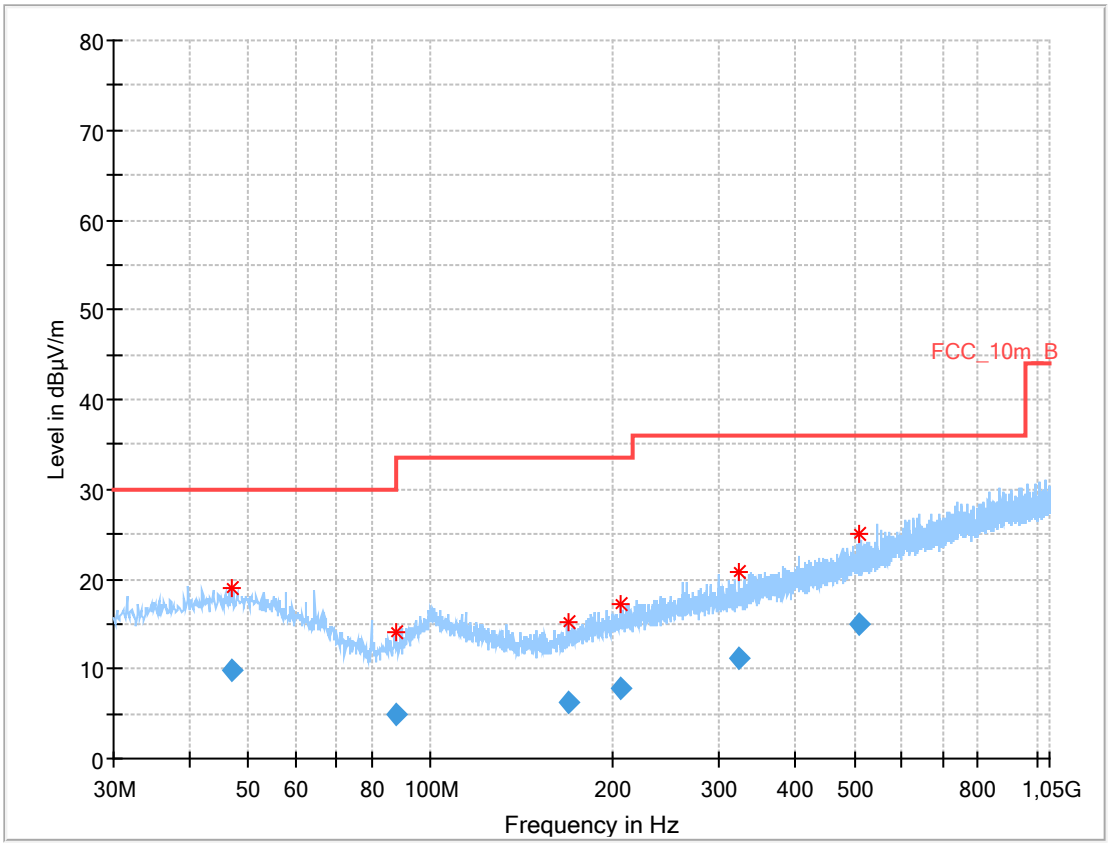
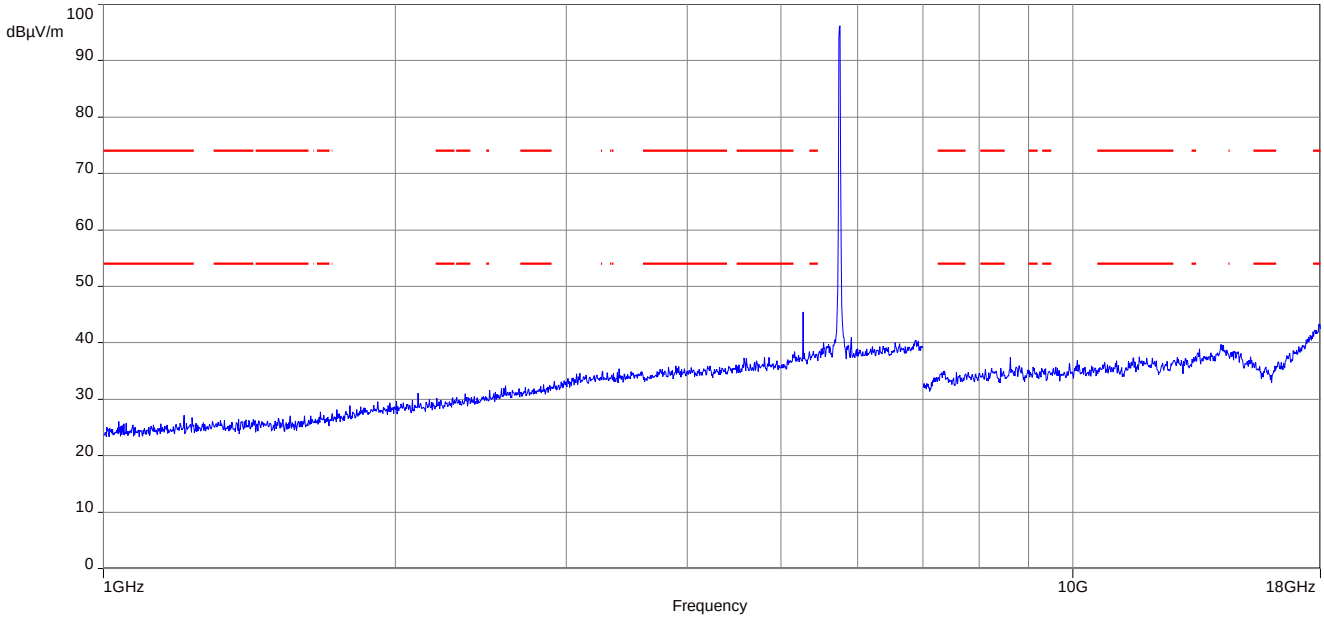
Plot 13: 30 MHz to 1 GHz; vertical & horizontal polarization; U-NII-3; lowest channel



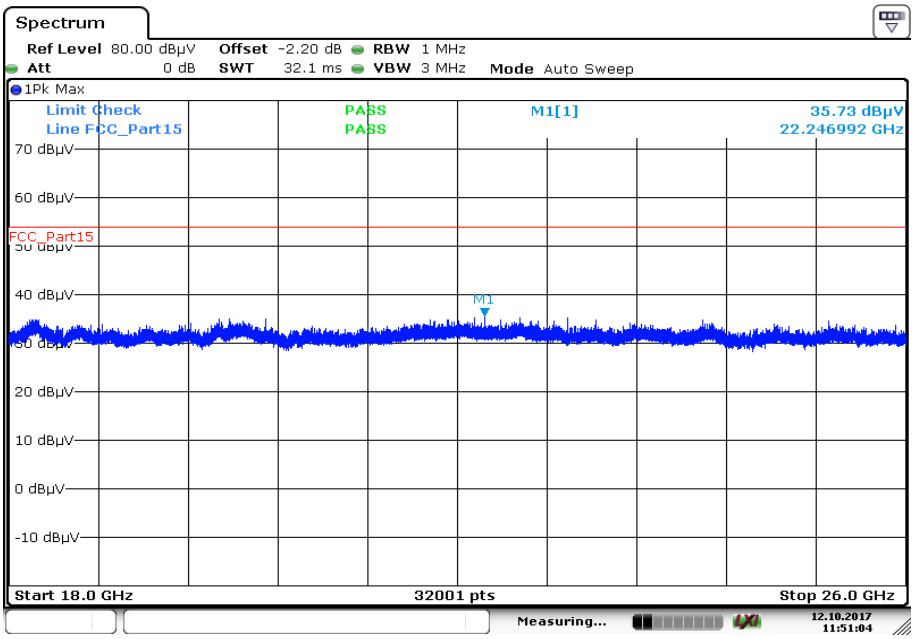
Final_Result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
46.880	9.90	30.0	20.10	1000	120	101.0	V	0.0	13.7
87.725	4.98	30.0	25.02	1000	120	100.0	V	252.0	9.1
168.647	6.31	33.5	27.19	1000	120	101.0	V	127.0	10.2
205.605	7.89	33.5	25.61	1000	120	98.0	V	56.0	12.1
322.739	11.25	36.0	24.75	1000	120	101.0	V	172.0	15.2
509.638	14.96	36.0	21.04	1000	120	98.0	H	327.0	18.8

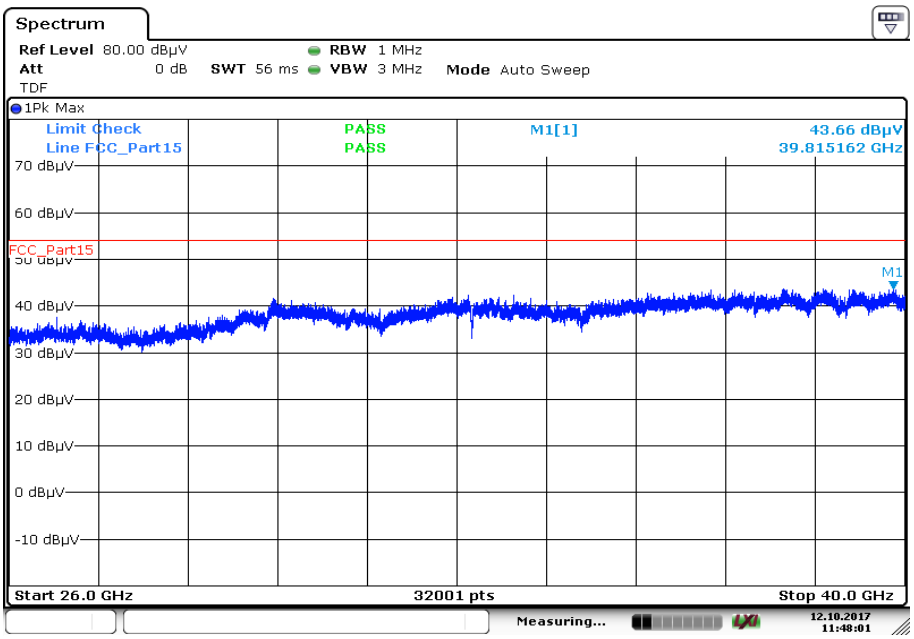
Plot 14: 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-3; lowest channel



Plot 15: 18 GHz to 26 GHz; vertical & horizontal polarization; U-NII-3; lowest channel



Plot 16: 26 GHz to 40 GHz; vertical & horizontal polarization; U-NII-3; lowest channel



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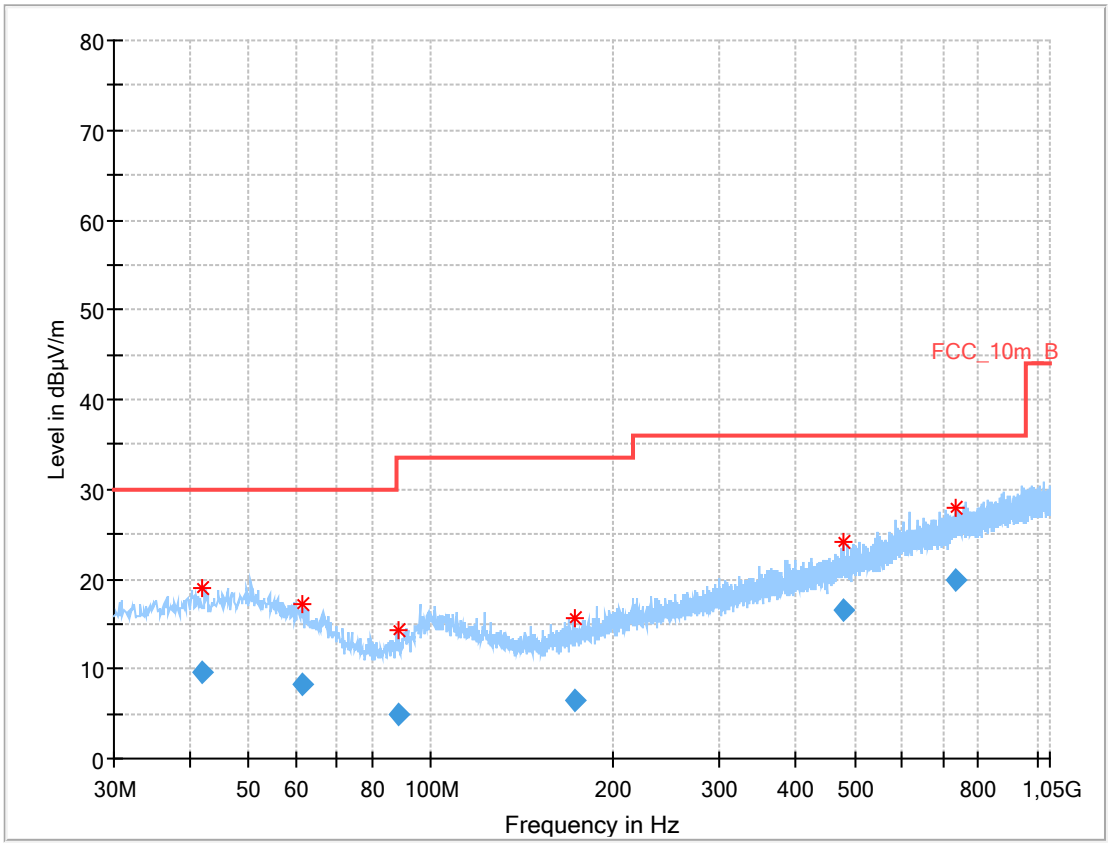
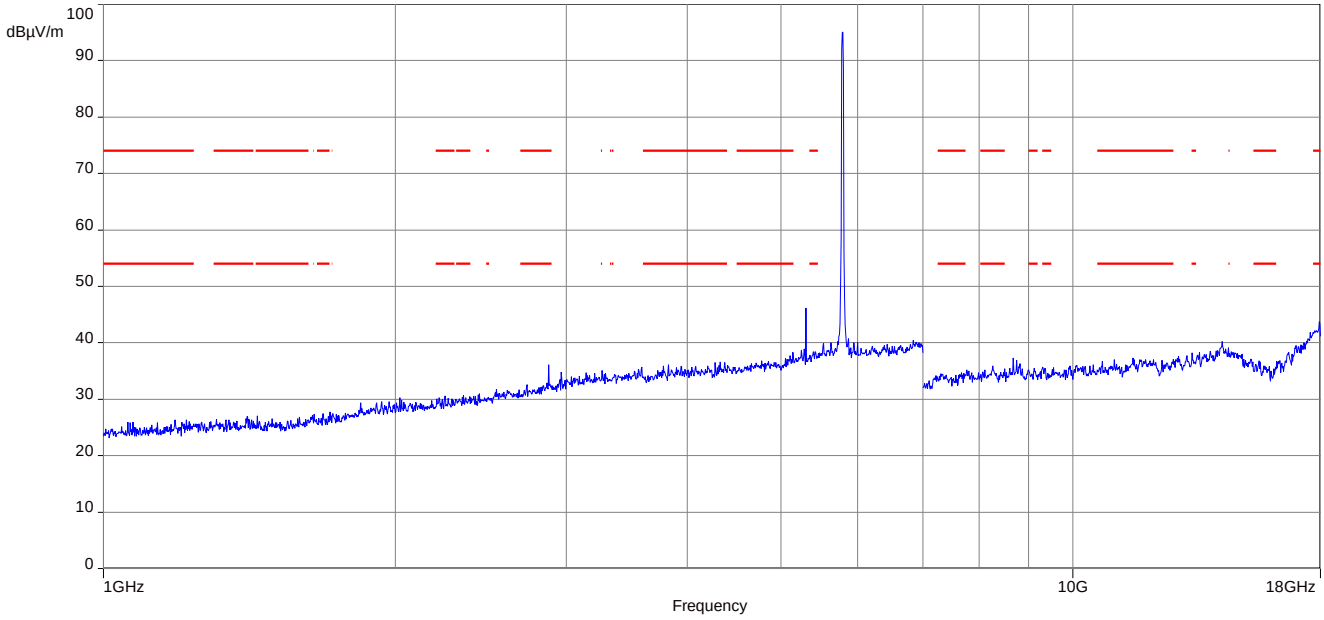
Plot 17: 30 MHz to 1 GHz; vertical & horizontal polarization; U-NII-3; middle channel



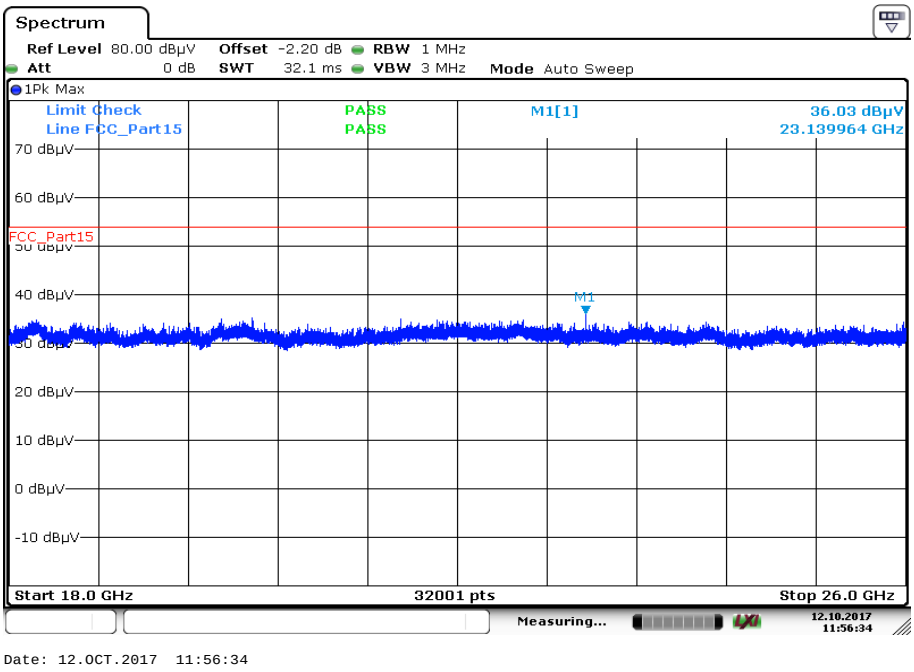
Final_Result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
41.978	9.52	30.0	20.48	1000	120	101.0	V	336.0	13.4
61.245	8.35	30.0	21.65	1000	120	170.0	H	328.0	11.6
88.254	4.88	33.5	28.62	1000	120	101.0	H	-9.0	9.1
172.375	6.48	33.5	27.02	1000	120	101.0	V	61.0	10.4
478.524	16.64	36.0	19.36	1000	120	101.0	H	61.0	18.3
735.345	19.78	36.0	16.22	1000	120	101.0	V	15.0	22.4

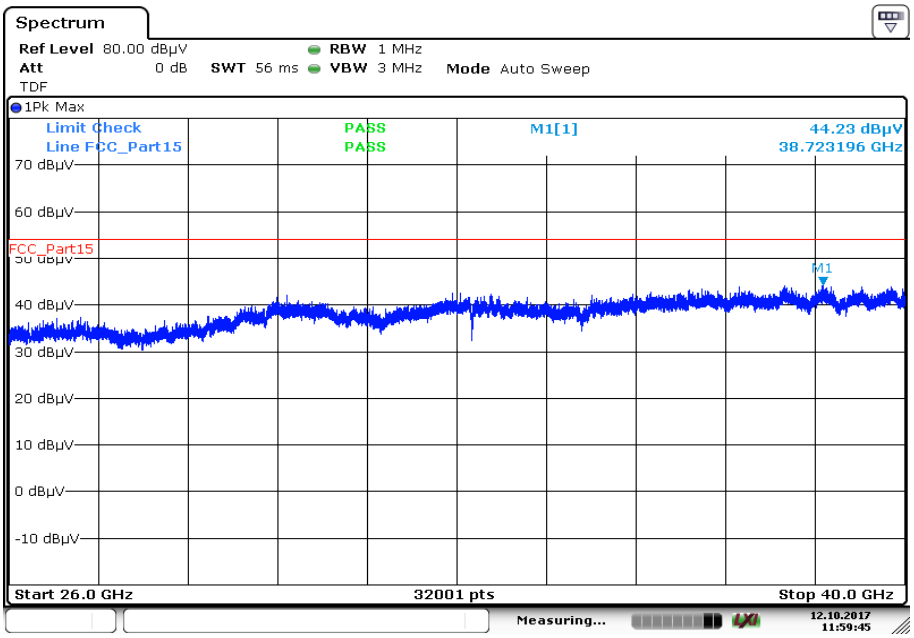
Plot 18: 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-3; middle channel



Plot 19: 18 GHz to 26 GHz; vertical & horizontal polarization; U-NII-3; middle channel



Plot 20: 26 GHz to 40 GHz; vertical & horizontal polarization; U-NII-3; middle channel



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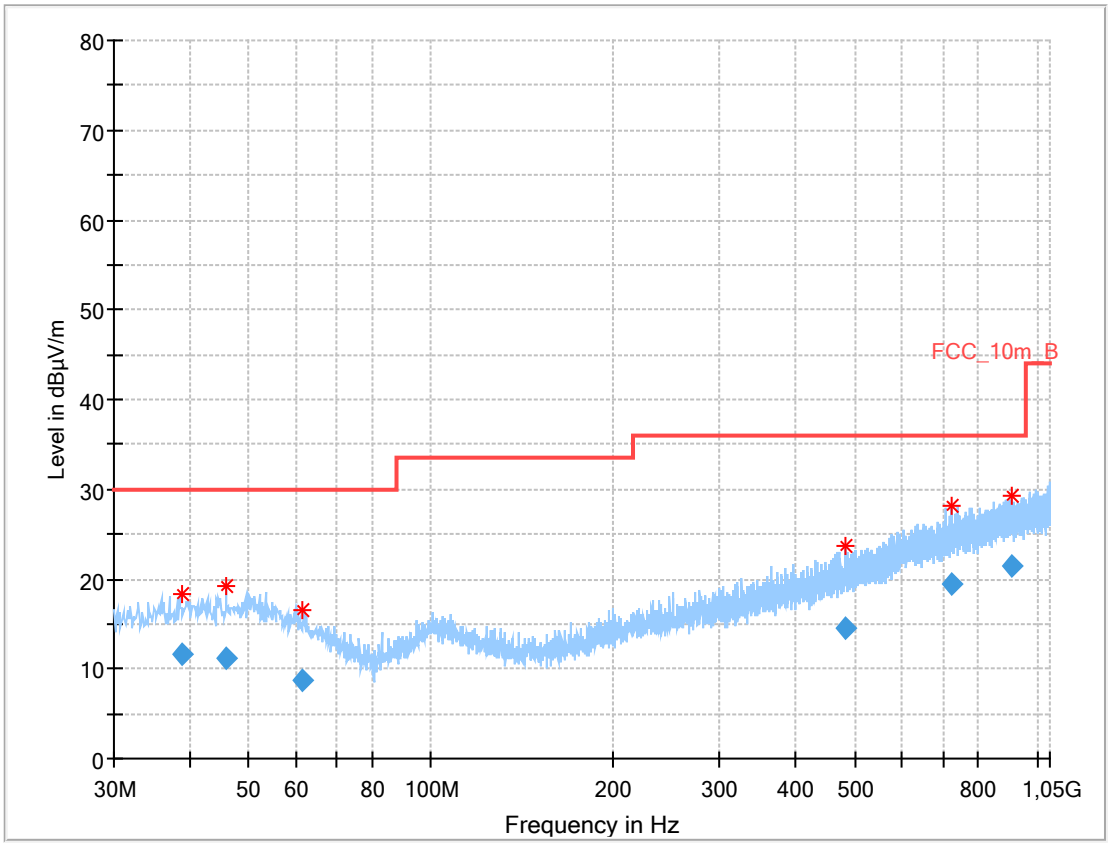
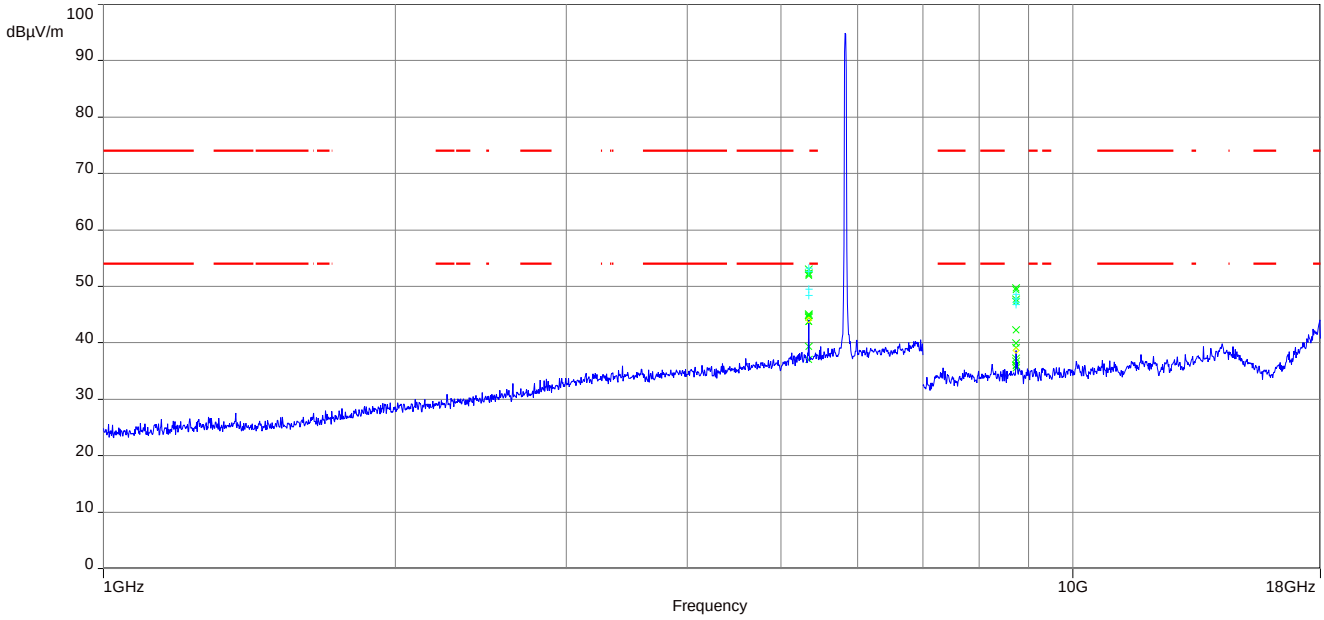
Plot 21: 30 MHz to 1 GHz; vertical & horizontal polarization; U-NII-3; highest channel



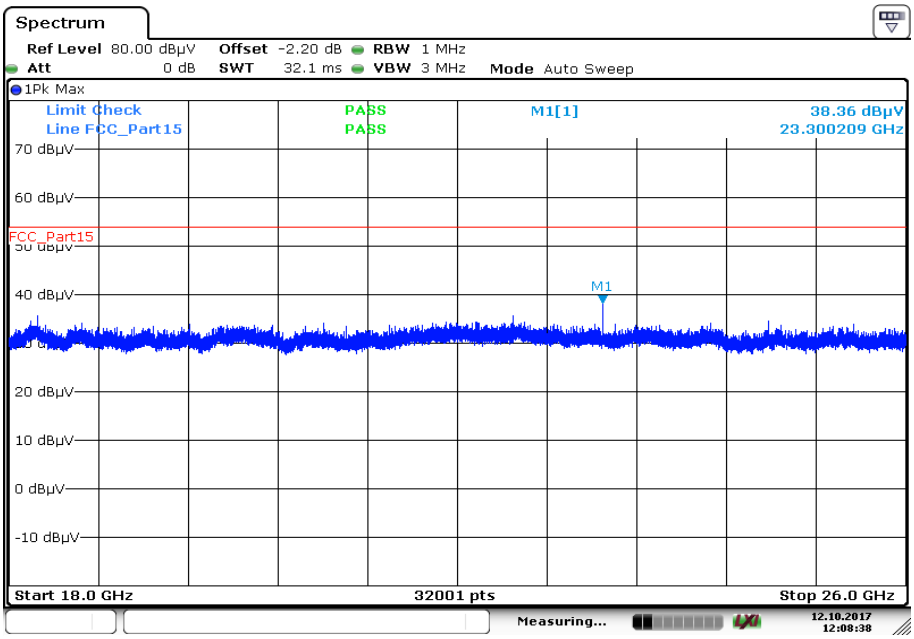
Final_Result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
38.897	11.54	30.0	18.46	1000	120	101.0	V	180.0	13.1
45.910	11.12	30.0	18.88	1000	120	170.0	V	270.0	13.6
61.360	8.65	30.0	21.35	1000	120	101.0	V	270.0	11.6
483.557	14.54	36.0	21.46	1000	120	170.0	V	270.0	18.4
721.235	19.43	36.0	16.57	1000	120	101.0	V	90.0	22.1
909.988	21.41	36.0	14.59	1000	120	170.0	V	180.0	24.2

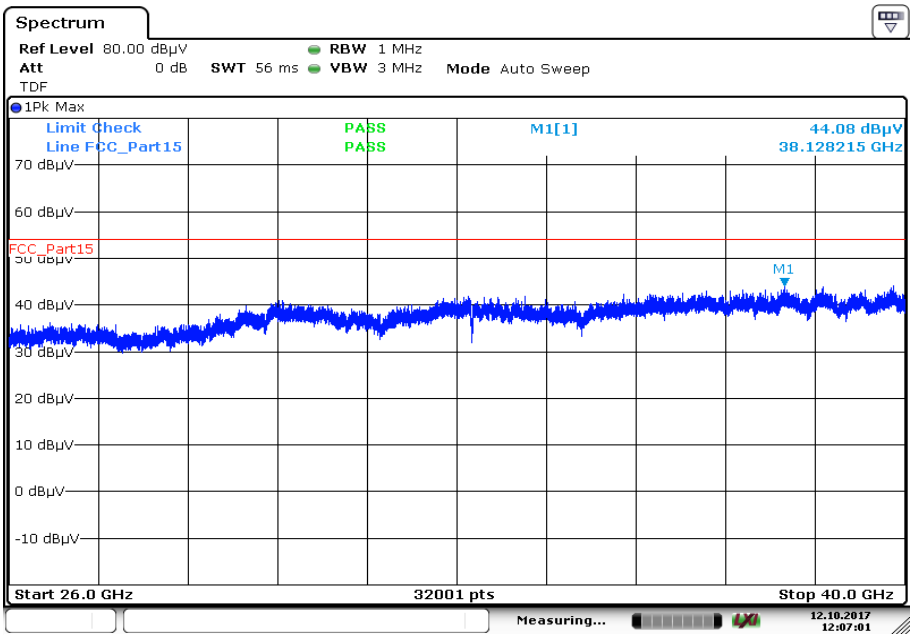
Plot 22: 1 GHz to 18 GHz; vertical & horizontal polarization; U-NII-3; highest channel



Plot 23: 18 GHz to 26 GHz; vertical & horizontal polarization; U-NII-3; highest channel



Plot 24: 26 GHz to 40 GHz; vertical & horizontal polarization; U-NII-3; highest channel



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11.12 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 chapter 6.1 – A See chapter 6.2 – C See chapter 6.3 – A
Measurement uncertainty:	See chapter 8

Limits:

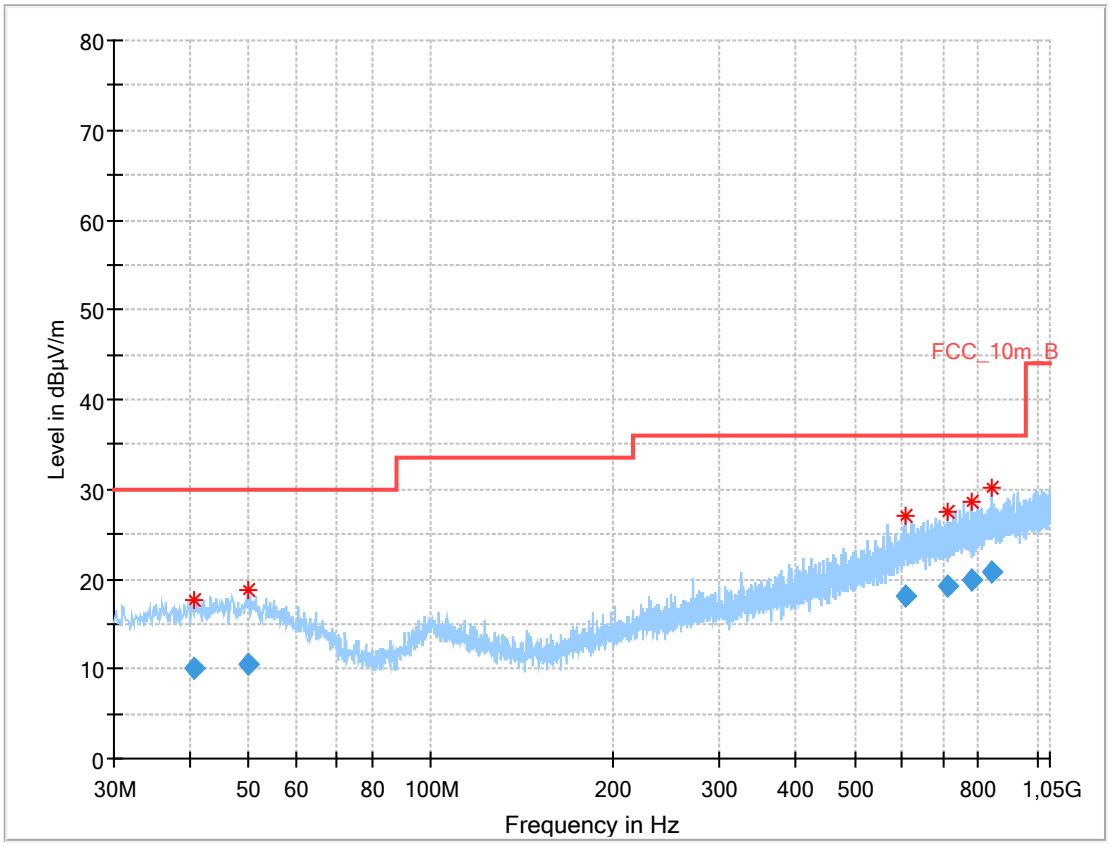
RX Spurious Emissions Radiated		
Frequency (MHz)	Field Strength (dBµV/m)	Measurement distance
30 - 88	30.0	10
88 – 216	33.5	10
216 – 960	36.0	10
Above 960	54.0	3

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 plot.		
All detected peak emissions are below the average limit. (1 GHz to 18 GHz).		
For emissions above 18 GHz please take look at the plots.		

Plots:

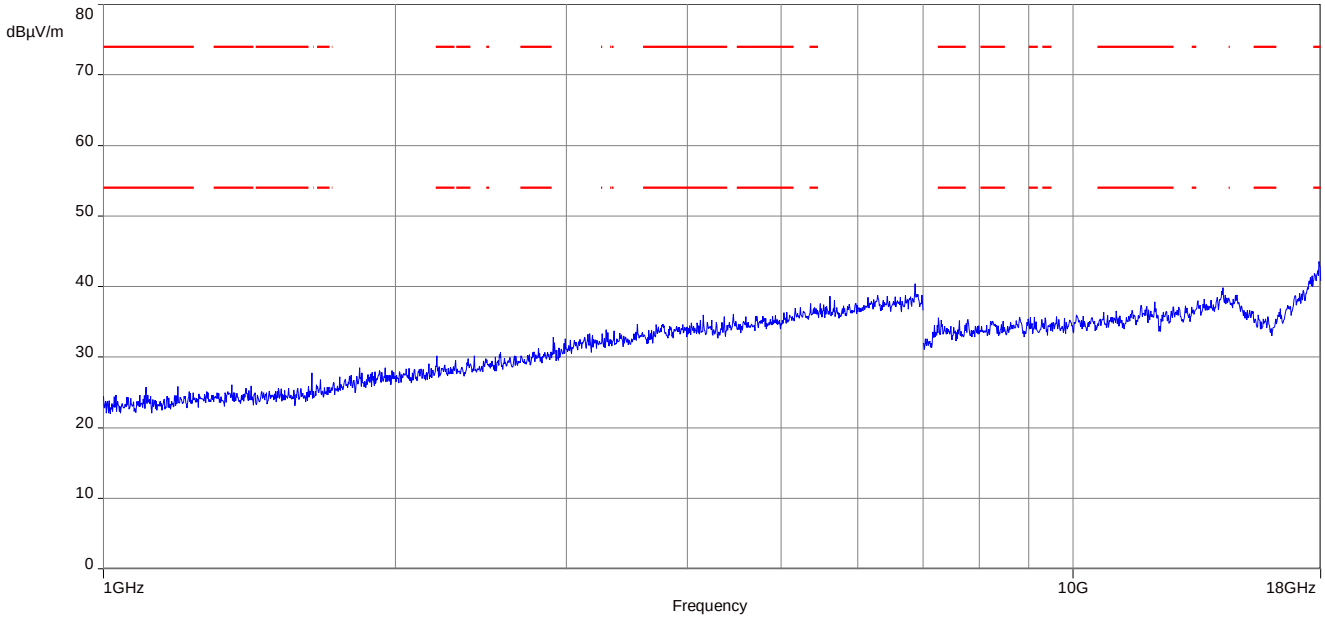
Plot 1: 30 MHz to 1 GHz, vertical & horizontal polarization



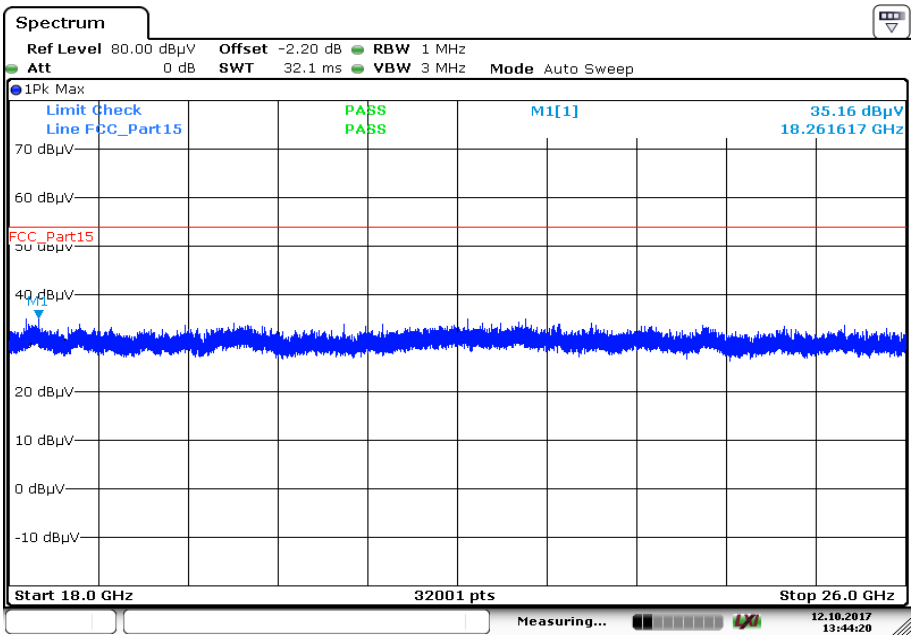
Final_Result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
40.821	10.09	30.0	19.91	1000	120	101.0	V	180.0	13.3
49.953	10.42	30.0	19.58	1000	120	170.0	H	270.0	13.7
608.630	18.18	36.0	17.82	1000	120	170.0	H	270.0	20.8
709.670	19.20	36.0	16.80	1000	120	170.0	V	270.0	21.8
781.795	19.94	36.0	16.06	1000	120	170.0	V	0.0	22.7
839.389	20.80	36.0	15.20	1000	120	170.0	V	90.0	23.4

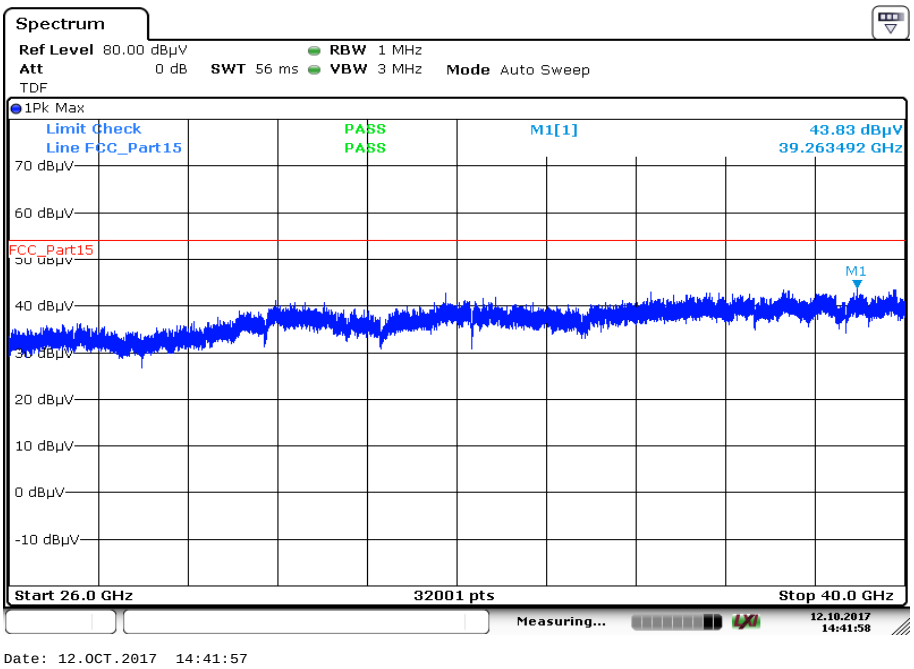
Plot 2: 1 GHz to 18 GHz, vertical & horizontal polarization



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



Plot 4: 26 GHz to 40 GHz, vertical & horizontal polarization



12 Observations

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

Annex A Glossary

EUT	Equipment under test
DUT	Device under test
UUT	Unit under test
GUE	GNSS User Equipment
ETSI	European Telecommunications Standards Institute
EN	European Standard
FCC	Federal Communications Commission
FCC ID	Company Identifier at FCC
IC	Industry Canada
PMN	Product marketing name
HMN	Host marketing name
HVIN	Hardware version identification number
FVIN	Firmware version identification number
EMC	Electromagnetic Compatibility
HW	Hardware
SW	Software
Inv. No.	Inventory number
S/N or SN	Serial number
C	Compliant
NC	Not compliant
NA	Not applicable
NP	Not performed
PP	Positive peak
QP	Quasi peak
AVG	Average
OC	Operating channel
OCW	Operating channel bandwidth
OBW	Occupied bandwidth
OOB	Out of band
DFS	Dynamic frequency selection
CAC	Channel availability check
OP	Occupancy period
NOP	Non occupancy period
DC	Duty cycle
PER	Packet error rate
CW	Clean wave
MC	Modulated carrier
WLAN	Wireless local area network
RLAN	Radio local area network
DSSS	Dynamic sequence spread spectrum
OFDM	Orthogonal frequency division multiplexing
FHSS	Frequency hopping spread spectrum
GNSS	Global Navigation Satellite System
C/N_0	Carrier to noise-density ratio, expressed in dB-Hz

Annex B Document history

Version	Applied changes	Date of release
-/-	Initial release	2017-11-08

Annex C Accreditation Certificate

first page	last page
DAkkS Deutsche Akkreditierungsstelle Deutsche Akkreditierungsstelle GmbH **Beliehene gemäß § 8 Absatz 1 AkkStelleG i.V.m. § 1 Absatz 1 AkkStelleGBV** Unterzeichnerin der Multilateralen Abkommen von EA, ILAC und IAF zur gegenseitigen Anerkennung **Akkreditierung** Die Deutsche Akkreditierungsstelle GmbH bestätigt hiermit, dass das Prüflaboratorium **CTC advanced GmbH** **Untertürkheimer Straße 6-10, 66117 Saarbrücken** die Kompetenz nach DIN EN ISO/IEC 17025:2005 besitzt, Prüfungen in folgenden Bereichen durchzuführen: **Funk** **Mobilfunk (GSM / DCS) + OTA** **Elektromagnetische Verträglichkeit (EMV)** **Produktsicherheit** **SAR / EMF** **Umwelt** **Smart Card Technology** **Bluetooth®** **Automotive** **Wi-Fi-Services** **Kanadische Anforderungen** **US-Anforderungen** **Akustik** **Near Field Communication (NFC)** Die Akkreditierungsurkunde gilt nur in Verbindung mit dem Bescheid vom 25.11.2016 mit der Akkreditierungsnummer D-PL-12076-01 und ist gültig bis 17.01.2018. Sie besteht aus diesem Deckblatt, der Rückseite des Deckblatts und der folgenden Anlage mit insgesamt 63 Seiten. Registrierungsnummer der Urkunde: **D-PL-12076-01-01** Frankfurt, 25.11.2016 Im Auftrag Dipl.-Ing. (FH) Ralf Egner Abteilungsleiter Siehe Hinweise auf der Rückseite	Deutsche Akkreditierungsstelle GmbH Standort Berlin Spittelmarkt 10 10117 Berlin Standort Frankfurt am Main Europa-Allee 52 60327 Frankfurt am Main Standort Braunschweig Bundesallee 100 38116 Braunschweig Die auszugsweise Veröffentlichung der Akkreditierungsurkunde bedarf der vorherigen schriftlichen Zustimmung der Deutsche Akkreditierungsstelle GmbH (DAkkS). Ausgenommen davon ist die separate Weiterverbreitung des Deckblattes durch die umseitig genannte Konformitätsbewertungsstelle in unveränderter Form. Es darf nicht der Anschein erweckt werden, dass sich die Akkreditierung auch auf Bereiche erstreckt, die über den durch die DAkkS bestätigten Akkreditierungsbereich hinausgehen. Die Akkreditierung erfolgte gemäß des Gesetzes über die Akkreditierungsstelle (AkkStelleG) vom 31. Juli 2009 (BGBl. I S. 2625) sowie der Verordnung (EG) Nr. 765/2008 des Europäischen Parlaments und des Rates vom 9. Juli 2008 über die Vorschriften für die Akkreditierung und Marktüberwachung im Zusammenhang mit der Vermarktung von Produkten (Abl. L 218 vom 9. Juli 2008, S. 30). Die DAkkS ist Unterzeichnerin der Multilateralen Abkommen zur gegenseitigen Anerkennung der European co-operation for Accreditation (EA), des International Accreditation Forum (IAF) und der International Laboratory Accreditation Cooperation (ILAC). Die Unterzeichner dieser Abkommen erkennen ihre Akkreditierungen gegenseitig an. Der aktuelle Stand der Mitgliedschaft kann folgenden Webseiten entnommen werden: EA: www.european-accreditation.org ILAC: www.ilac.org IAF: www.iaf.nu

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

http://www.dakks.de/as/ast/d/D-PL-12076-01-03.pdf