FCC 47 CFR PART 15 SUBPART E

TEST REPORT

For

802.11a/b/g/n/ac, 2T2R Wireless LAN USB2.0 Module

Model: WN4505L

Trade Name: LITE-ON

Issued to

Lite-On Technology Corp.
4F, 90, Chien 1 Road, Chung Ho, New Taipei City 23585, Taiwan, R.O.C.

Issued by

Compliance Certification Services Inc.
No.11, Wugong 6th Rd., Wugu Dist.,
New Taipei City 24891, Taiwan. (R.O.C.)
http://www.ccsrf.com
service@ccsrf.com
Issued Date: October 4, 2016

Testing Laboratory
1309

Revision History

Rev.		Issue Date		Revisions	Effect Page	Revised By
00		July 17, 2014		Initial Issue	ALL	Angel Cheng
01		October 4, 2016		1. Update standards.	ALL	Doris Chu

TABLE OF CONTENTS

1. TEST RESULT CERTIFICATION

Applicant: Lite-On Technology Corp.
4F, 90, Chien 1 Road, Chung Ho, New Taipei City 23585, Taiwan, R.O.C.

Equipment Under Test: 802.11a/b/g/n/ac, 2T2R Wireless LAN USB2.0 Module

Model Number: WN4505L

Trade Name: LITE-ON

Date of Test: April 22, 2014 ~ September 30, 2016

APPLICABLE STANDARDS	
STANDARD	**TEST RESULT**
FCC 47 CFR Part 15 Subpart E	No non-compliance noted

We hereby certify that:

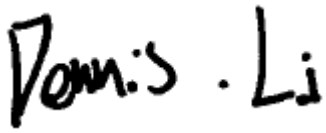
Compliance Certification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The test results of this report relate only to the tested sample identified in this report.

Approved by:

Miller Lee
Manager
Compliance Certification Services Inc.

Tested by:



Dennis Li
Engineer
Compliance Certification Services Inc.

2. EUT DESCRIPTION

Product	802.11a/b/g/n/ac, 2T2R Wireless LAN USB2.0 Module
Model Number	WN4505L
Trade Name	LITE-ON
Power Supply	Powered from host device.
Received Date	September 20, 2016
Frequency Range	IEEE 802.11a/ IEEE 802.11n HT 20 MHz: 5745~5825 MHz IEEE 802.11n HT 40 MHz: 5755~5795 MHz IEEE 802.11ac VHT 80 mode: 5775MHz
Transmit Power	IEEE 802.11a mode: 18.58 dBm IEEE 802.11n HT 20 MHz mode: 17.06 dBm IEEE 802.11n HT 40 MHz mode: 16.75 dBm IEEE 802.11ac VHT 80 MHz mode: 16.84 dBm
Number of Channels	IEEE 802.11a mode: 5 Channels IEEE 802.11n HT 20 MHz mode: 5 Channels IEEE 802.11n HT 40 MHz mode: 2 Channels IEEE 802.11ac VHT 80 mode: 1 Channel
Antenna Specification	LITE-ON / 3010000271ID Integral Antenna / Gain: 1.59 dBi
Product SW/HW version	V01
Radio SW version	V01
Radio HW version	V01

Note: The device is restricted to transmit in the band 5600 ~ 5650 Mhz

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10: 2013 and FCC CFR 47 Part 15.207, 15.209, 15.407 and KDB 789033 D02 General UNII Test Procedures New Rules v01r02.

3.1 EUT CONFIGURATION

The EUT configuration for testing is installed for RF field strength measurement to meet the Commissions requirement, and is operated in a manner intended to generate the maximum emission in a continuous normal application.

3.2 EUT EXERCISE

The EUT is operated in the engineering mode to fix the Tx frequency for the purposes of measurement.

According to its specifications, the EUT must comply with the requirements of Section 15.407 under the FCC Rules Part 15 Subpart E.

3.3 GENERAL TEST PROCEDURES

Conducted Emissions

According to the requirements in ANSI C63.10: 2013, the conducted emission from the EUT is measured in the frequency range between 0.15 MHz and 30MHz, using the CISPR Quasi-Peak detector mode.

Radiated Emissions

The EUT is placed on the turntable, which is 1.5 m above the ground plane. The turntable is then rotated for 360 degrees to determine the proper orientation for the maximum emission level. The EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission level. And, each emission is to be maximized by changing the horizontal and vertical polarization of the receiving antenna. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in ANSI C63.10: 2013.

3.4 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 -	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.52525	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	([2])
13.36 - 13.41	322 - 335.4		

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

[2] Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

3.5 DESCRIPTION OF TEST MODES

The EUT (model: WN4505L) had been tested under operating condition.

The EUT is a 2x2 configuration spatial MIMO (2Tx & 2Rx) without beam forming function that operate in double TX chains and double RX chains. The 2x2 configuration is implemented with two outside TX & RX chains (Chain 0 and 1).

Software used to control the EUT for staying in continuous transmitting and receiving mode was programmed.

After verification, all tests were carried out with the worst case test modes as shown below except radiated spurious emission below 1GHz, which worst case was in normal link mode only.

IEEE 802.11a mode / 5745 ~ 5825MHz
Channel Low (5745MHz), Channel Mid (5785MHz) and Channel High (5825MHz) with 6Mbps data rate were chosen for full testing.

IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz
Channel Low(5745MHz), Channel Mid(5785MHz) and Channel High(5825MHz) with 6.5Mbps data rate were chosen for full testing.

IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz
Channel Low(5755MHz) and Channel High(5795MHz) with 13.5Mbps data rate were chosen for full testing.

IEEE 802.11ac VHT 80 MHz mode for 5775MHz:
Channel (5775MHz) with 6.5Mbps data rate were chosen for full testing.

The field strength of spurious emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in lie-down position (Y axis) and the worst case was recorded.

3.6 THE WORST CASE POWER SETTING PARAMETER

IEEE 802.11a mode / 5745 ~ 5825MHz

Channel	Frequency (MHz)	RF power setting in TEST SW
Low	5745	58
Mid	5785	58
High	5825	58

IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz

Channel	Frequency (MHz)	RF power setting in TEST SW (Chin 0)	RF power setting in TEST SW (Chin 1)
Low	5745	53	42
Mid	5785	54	43
High	5825	51	44

IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz

Channel	Frequency (MHz)	RF power setting in TEST SW (Chin 0)	RF power setting in TEST SW (Chin 1)
Low	5755	56	43
High	5795	55	44

IEEE 802.11ac VHT 80 MHz mode / 5775MHz

Channel	Frequency (MHz)	RF power setting in TEST SW (Chin 0)	RF power setting in TEST SW (Chin 1)
Mid	5775	55	50

4. INSTRUMENT CALIBRATION

4.1 MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

4.2 MEASUREMENT EQUIPMENT USED

Equipment Used for Emissions Measurement

Remark: *Each piece of equipment is scheduled for calibration once a year and Loop Antenna is scheduled for calibration once three years.*

Conducted Emissions Test Site					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
Power Meter	Anritsu	ML2495A	1012009	07/04/16	07/03/17
Power Meter	Anritsu	MA2411B	917072	07/04/16	07/03/17
Spectrum Analyzer	R&S	FSV 40	101073	08/01/16	07/31/17

Wugu 966 Chamber A					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
Spectrum Analyzer	Agilent	E4446A	US42510252	12/08/15	12/07/16
Loop Ant	COM-POWER	AL-130	121051	02/25/16	02/24/17
Bilog Antenna	Sunol Sciences	JB3	A030105	07/03/16	07/02/17
Pre-Amplifier	EMEC	EM330	60609	06/08/16	06/07/17
Horn Antenna	ETC	MCTD 1209	DRH13M02003	09/02/16	09/01/17
Antenna Tower	CCS	CC-A-1F	N/A	N.C.R	N.C.R
Controller	CCS	CC-C-1F	N/A	N.C.R	N.C.R
Turn Table	CCS	CC-T-1F	N/A	N.C.R	N.C.R
Software	EZ-EMC (CCS-3A1RE)				

Conducted Emission room # A				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
EMI Test Receiver	R&S	ESI	101203	09/12/2014
LISN	R&S	ESH3-Z5	848773/014	12/05/2014
Coaxial Cable	Commate	CFD300-NL	NA	12/05/2014
Test S/W	CCS-3A1-CE			

4.3 MEASUREMENT UNCERTAINTY

PARAMETER	UNCERTAINTY
Powerline Conducted Emission	+/- 1.2575
3M Semi Anechoic Chamber / 30M~200M	+/- 4.0138
3M Semi Anechoic Chamber / 200M~1000M	+/- 3.9483
3M Semi Anechoic Chamber / 1G~8G	+/- 2.5975
3M Semi Anechoic Chamber / 8G~18G	+/- 2.6112
3M Semi Anechoic Chamber / 18G~26G	+/- 2.7389
3M Semi Anechoic Chamber / 26G~40G	+/- 2.9683

***Remark**: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.*

5 FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

☐ No.199, Chunghsen Road, Hsintien City, Taipei Hsien, Taiwan, R.O.C.
Tel: 886-2-2217-0894 / Fax: 886-2-2217-1029

☒ No.11, Wugong 6th Rd., Wugu Dist., New Taipei City 248, Taiwan (R.O.C.)
Tel: 886-2-2299-9720 / Fax: 886-2-2298-4045

☐ No.81-1, Lane 210, Bade 2nd Rd., Lujhu Township, Taoyuan County 33841, TAIWAN, R.O.C.
Tel: 886-3-324-0332 / Fax: 886-3-324-5235

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.10: 2013 and CISPR Publication 22.

All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

5.2 LABORATORY ACCREDITATIONS AND LISTING

The test facilities used to perform radiated and conducted emissions tests are accredited by American Association for Laboratory Accreditation Program for the specific scope accreditation under Lab Code: 0824-01 to perform Electromagnetic Interference tests according to FCC Part 15 and CISPR 22 requirements. In addition, the test facilities are listed with Industry Canada, Certification and Engineering Bureau, IC 2324G-1 for 3M Semi Anechoic Chamber A, IC 2324G-2 for 3M Semi Anechoic Chamber B.

5.3 TABLE OF ACCREDITATIONS AND LISTINGS

Country	Agency	Scope of Accreditation	Logo
USA	FCC	3M Semi Anechoic Chamber (FCC MRA: TW1039) to perform FCC Part 15 measurements	FCC MRA: TW1039
Taiwan	TAF	LP0002, RTTE01, FCC Method-47 CFR Part 15 Subpart C, D, E, RSS-247, RSS-310 IDA TS SRD, AS/NZS 4268, AS/NZS 4771, TS 12.1 & 12,2, ETSI EN 300 440-1, ETSI EN 300 440-2, ETSI EN 300 328, ETSI EN 300 220-1, ETSI EN 300 220-2, ETSI EN 301 893, ETSI EN 301 489-1/3/7/17 FCC OET Bulletin 65 + Supplement C, EN 50360, EN 50361, EN 50371, RSS 102, EN 50383, EN 50385, EN 50392, IEC 62209, CNS 14958-1, CNS 14959 FCC Method –47 CFR Part 15 Subpart B IEC / EN 61000-3-2, IEC / EN 61000-3-3, IEC / EN 61000-4-2/3/4/5/6/8/11	TAF Testing Laboratory 1309
Canada	Industry Canada	3M Semi Anechoic Chamber (IC 2324G-1 / IC 2324G-2) to perform	Canada IC 2324G-1 IC 2324G-2

** No part of this report may be used to claim or imply product endorsement by A2LA or any agency of the US Government.*

6 SETUP OF EQUIPMENT UNDER TEST

6.1 SETUP CONFIGURATION OF EUT

See test photographs attached in Appendix I for the actual connections between EUT and support equipment.

6.2 SUPPORT EQUIPMENT

No.	Device Type	Brand	Model	Series No.	FCC ID	Data Cable	Power Cord
1	Notebook PC	IBM	7663 (T61)	L3E9812	N/A	N/A	AC I/P: Unshielded, 1.8m DC O/P: Unshielded, 1.8m with a core
2	Notebook PC	DELL	PP19L	7B3ZP1S	N/A	N/A	AC I/P: Unshielded, 1.8m DC O/P: Unshielded, 1.8m with a core
3	Notebook PC	ACER	Z01	R33142	QDS-BRCM 1018	N/A	AC I/P: Unshielded, 1.8m DC O/P: Unshielded, 1.8m with a core

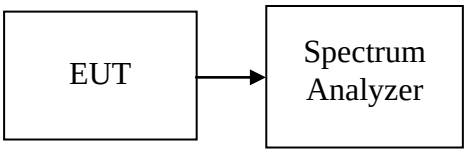
Remark:

1. *All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.*
2. *Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.*

7 FCC PART 15 REQUIREMENTS

7.1 99%BANDWIDTH

Test Configuration



TEST PROCEDURE

The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used since a peak or, peak hold.

TEST RESULTS

No non-compliance noted.

Test Data

Test mode: IEEE 802.11a mode

Channel	Frequency (MHz)	99%Bandwidth (MHz)
Low	5745	16.6714
Mid	5785	16.7149
High	5825	17.0188

Test mode: IEEE 802.11n HT 20 MHz mode / Chain 0

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5745	17.6700
Mid	5785	17.6700
High	5825	17.6700

Test mode: IEEE 802.11n HT 20 MHz mode / Chain 1

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5745	17.6266
Mid	5785	17.6266
High	5825	17.6266

Test mode: IEEE 802.11n HT 40 MHz mode / Chain 0

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5755	36.1215
High	5795	36.1215

Test mode: IEEE 802.11n HT 40 MHz mode / Chain 1

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5755	36.1215
High	5795	36.1215

Test mode: IEEE 802.11ac VHT 80 MHz mode / 5775MHz / Chain 0

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Mid	5755	75.9479

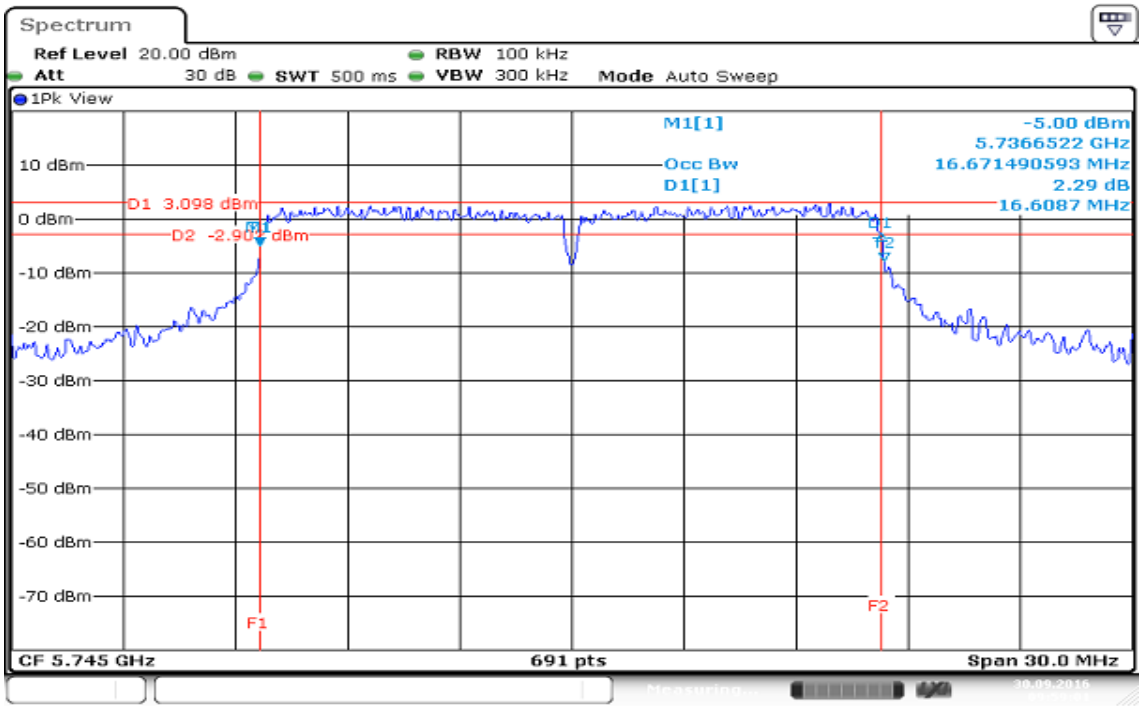
Test mode: IEEE 802.11ac VHT 80 MHz mode / 5775MHz / Chain 1

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Mid	5755	66.9175

Test Plot

IEEE 802.11a mode / 5745 ~ 5825MHz

99% Bandwidth (CH Low)



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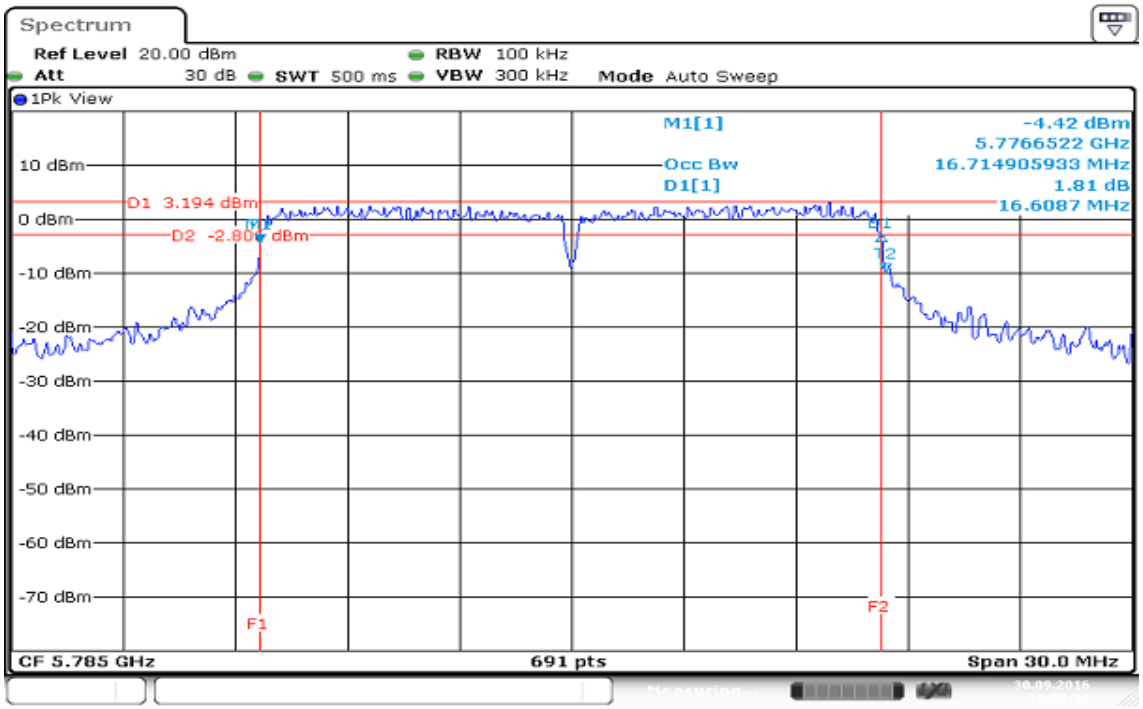
99% Bandwidth (CH Mid)



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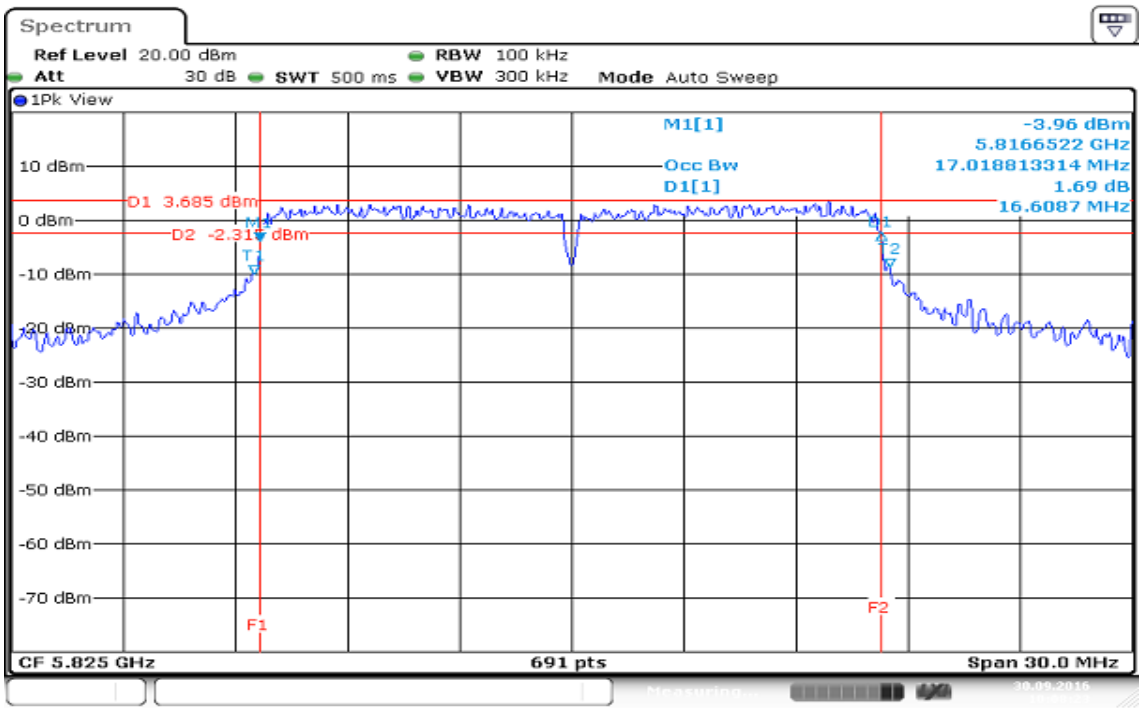

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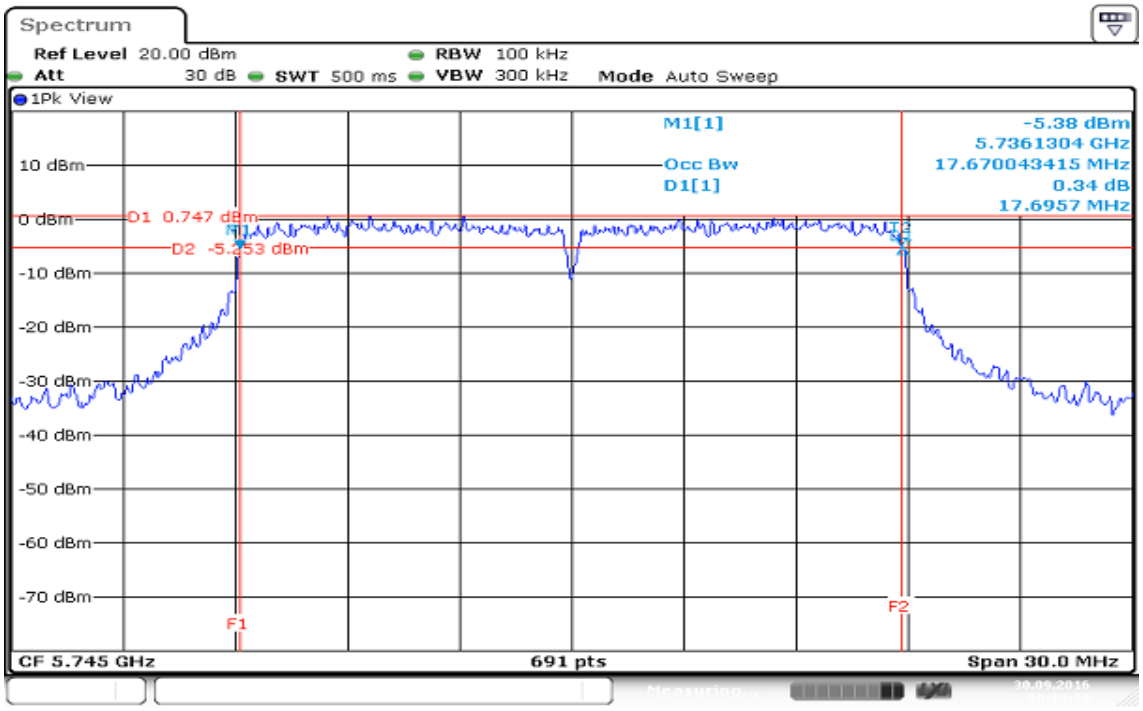
IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz / Chain 0

99% Bandwidth (CH Low)



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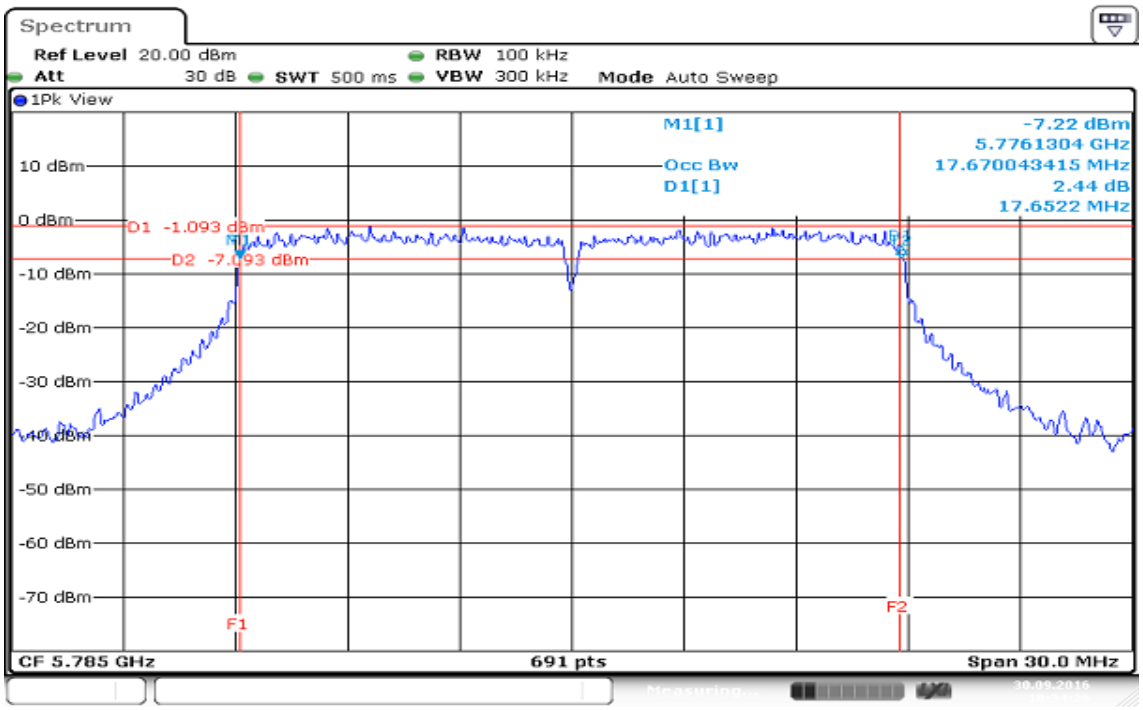
99% Bandwidth (CH Mid)



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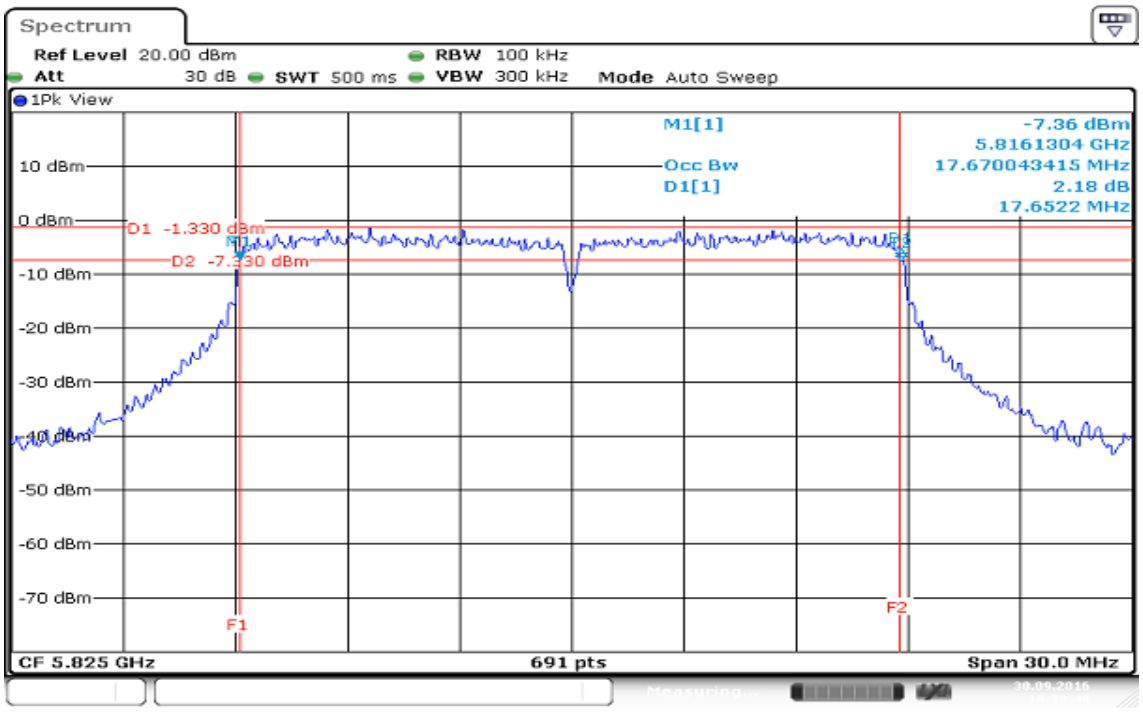
99% Bandwidth (CH High)



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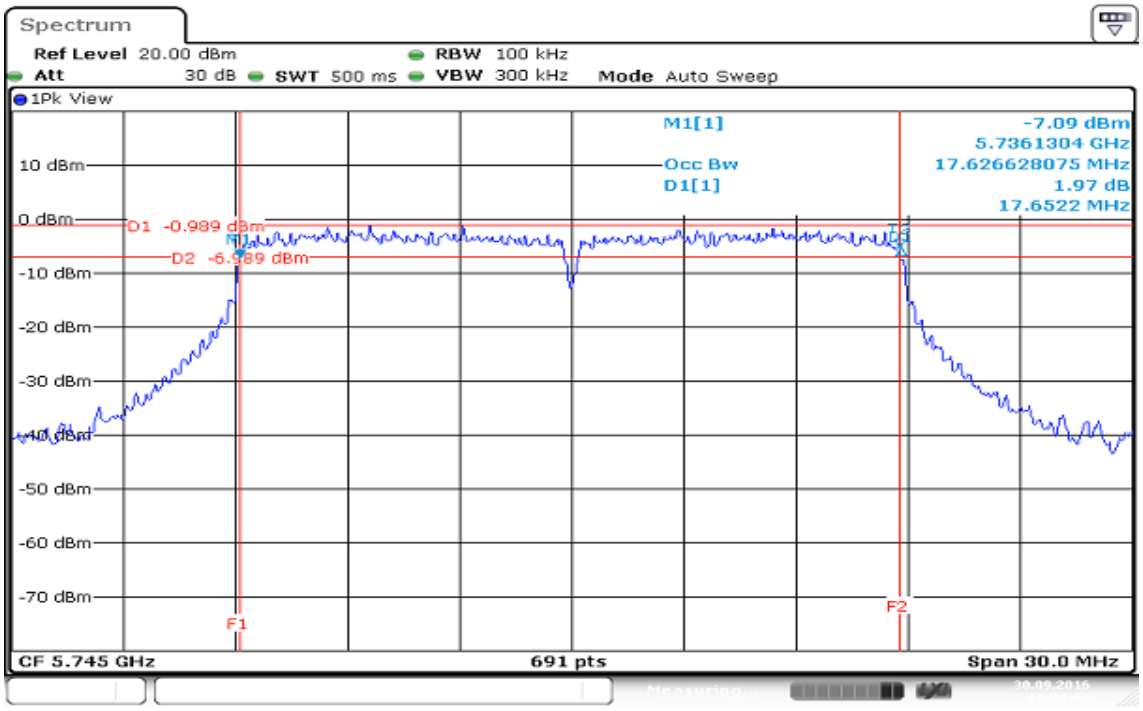
IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz / Chain 1

99% Bandwidth (CH Low)



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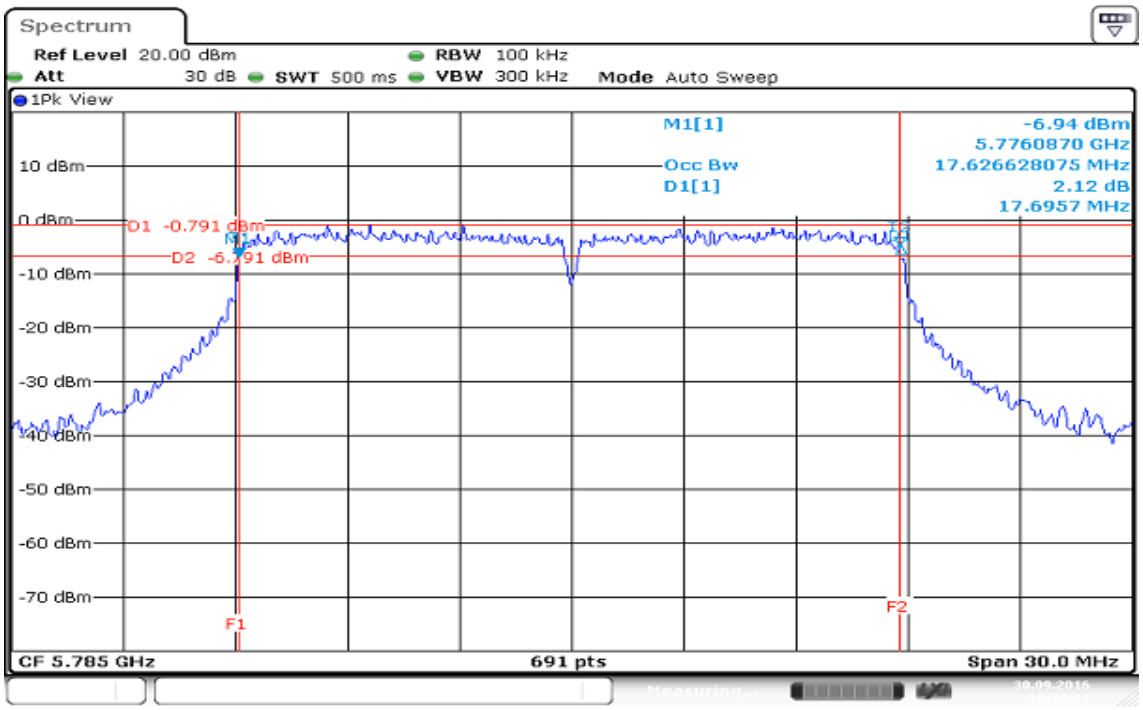
99% Bandwidth (CH Mid)



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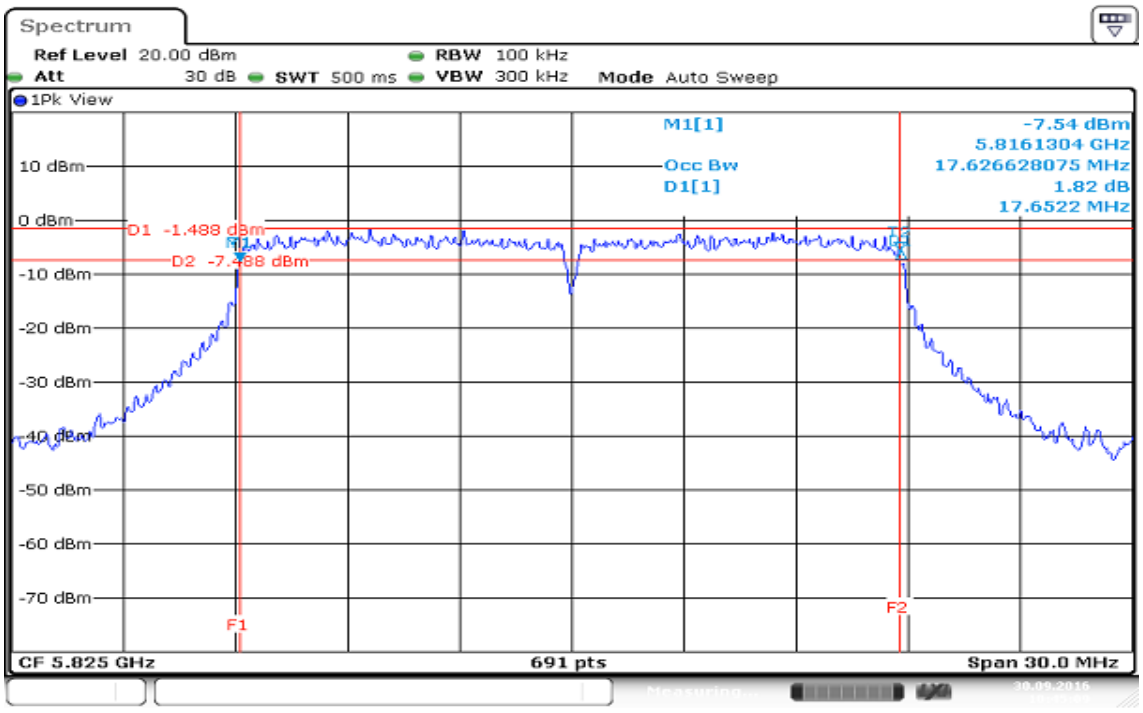
99% Bandwidth (CH High)



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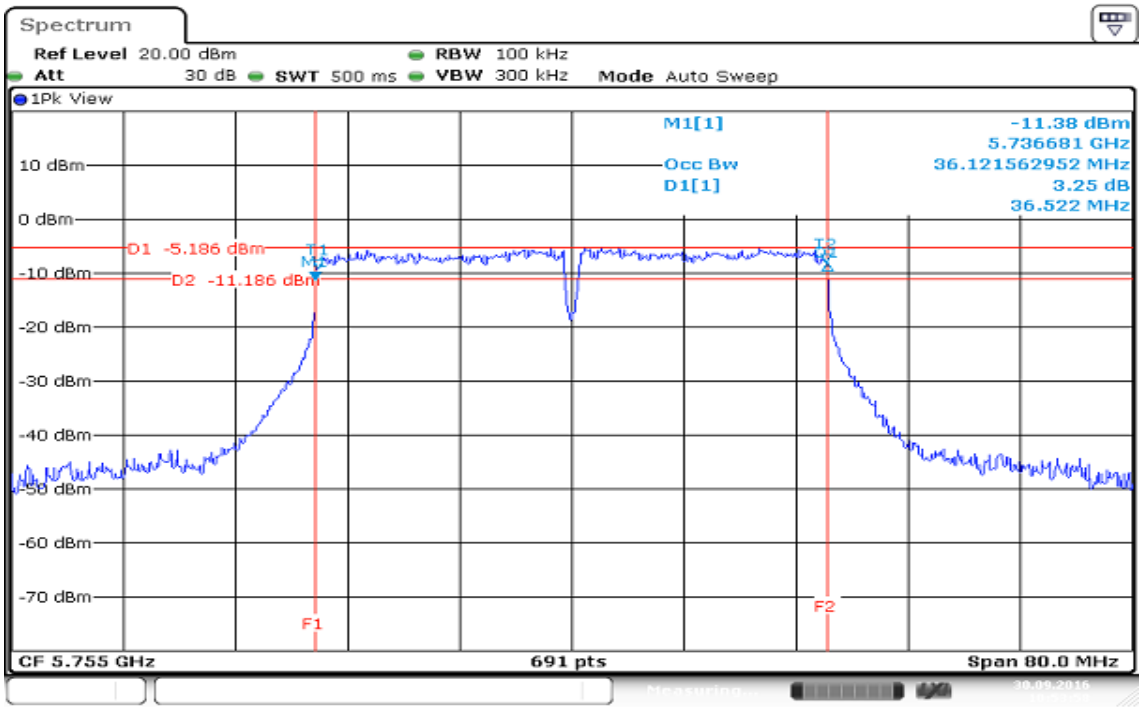
IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz / Chain 0

99% Bandwidth (CH Low)



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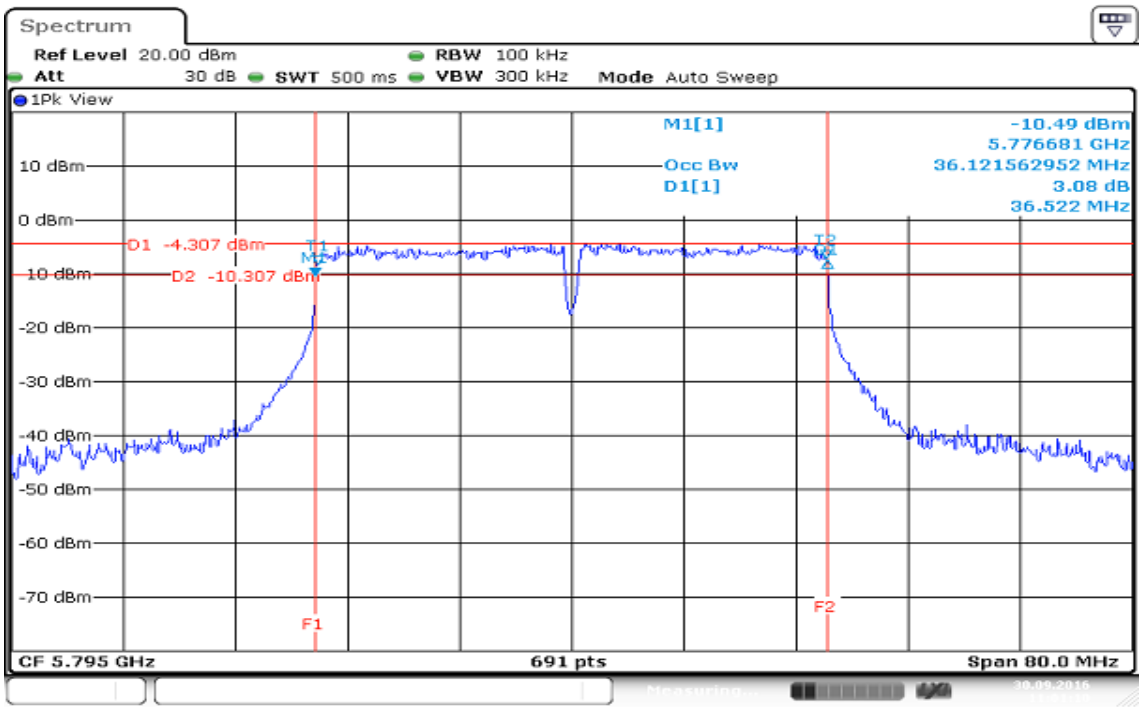
99% Bandwidth (CH High)



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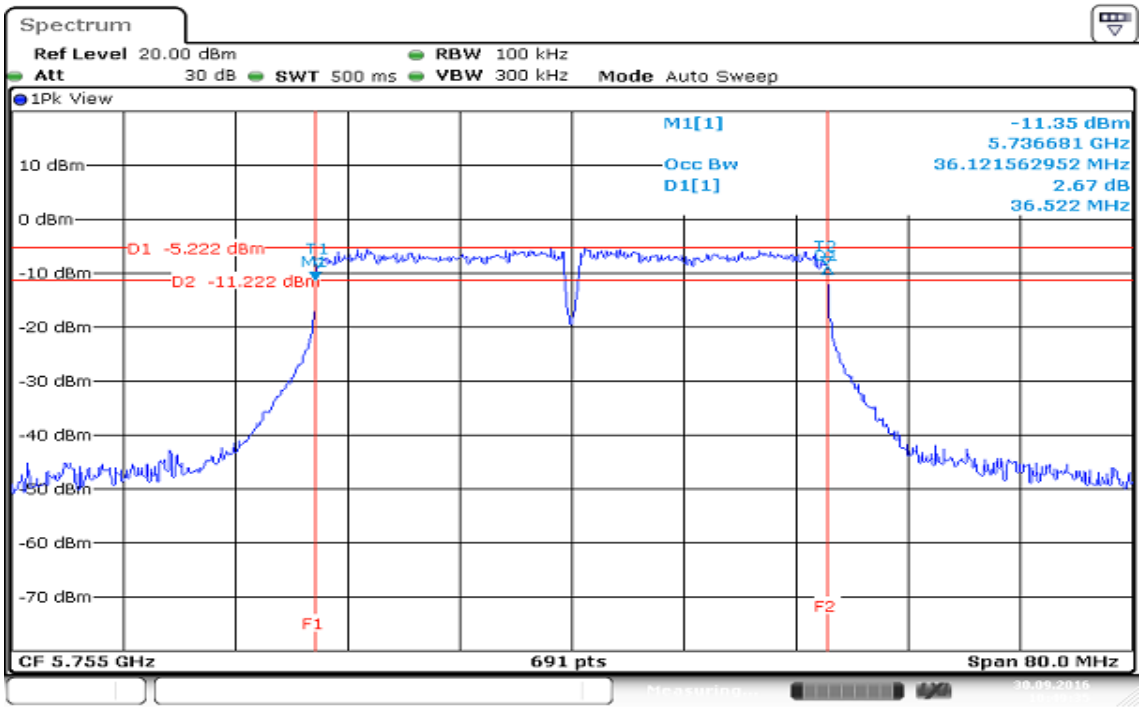
IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz / Chain 1

99% Bandwidth (CH Low)



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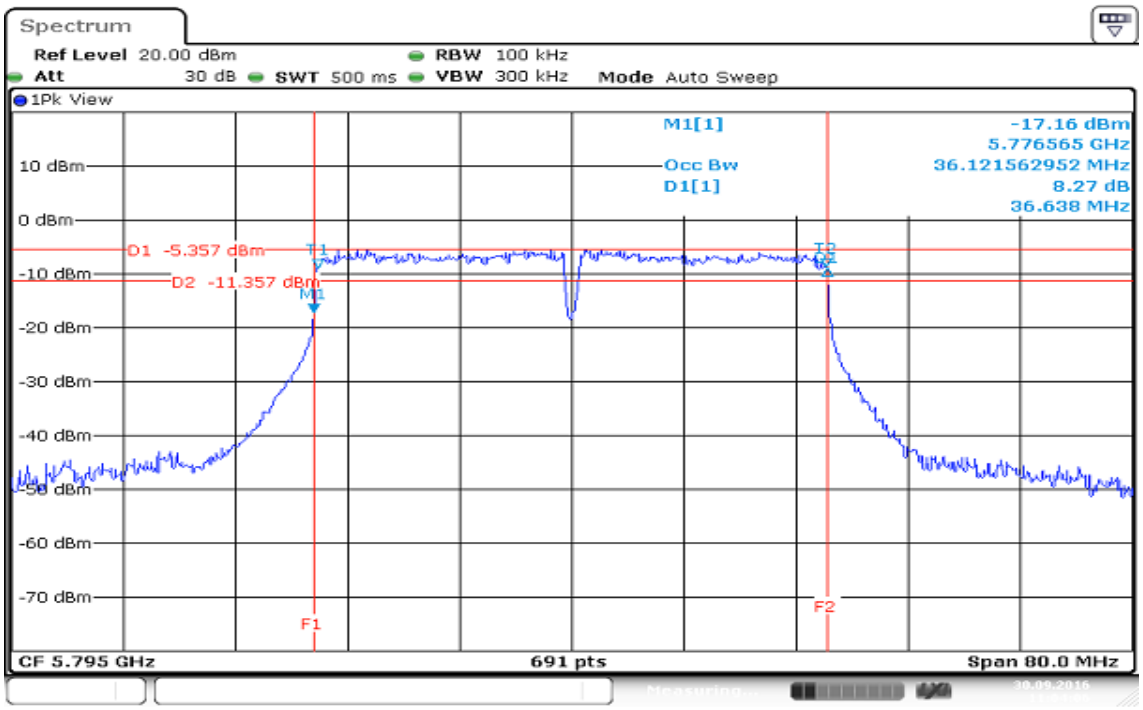
99% Bandwidth (CH High)



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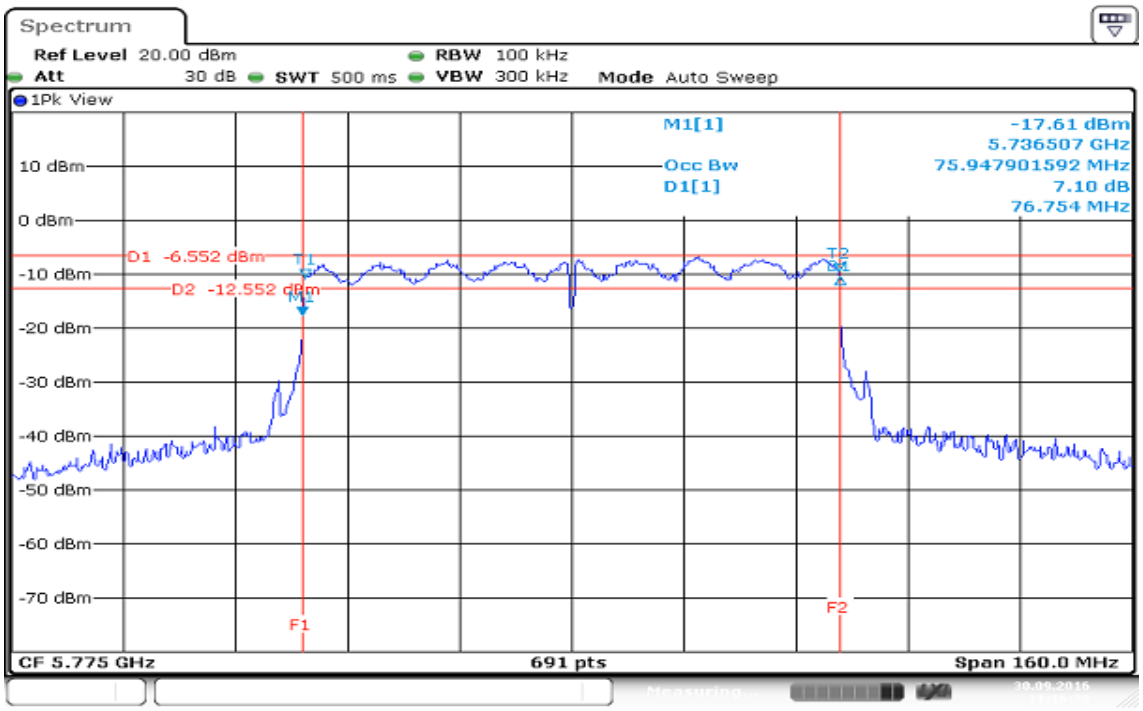
IEEE 802.11ac VHT 80 MHz mode / 5775MHz / Chain 0

99% Bandwidth (CH Mid)



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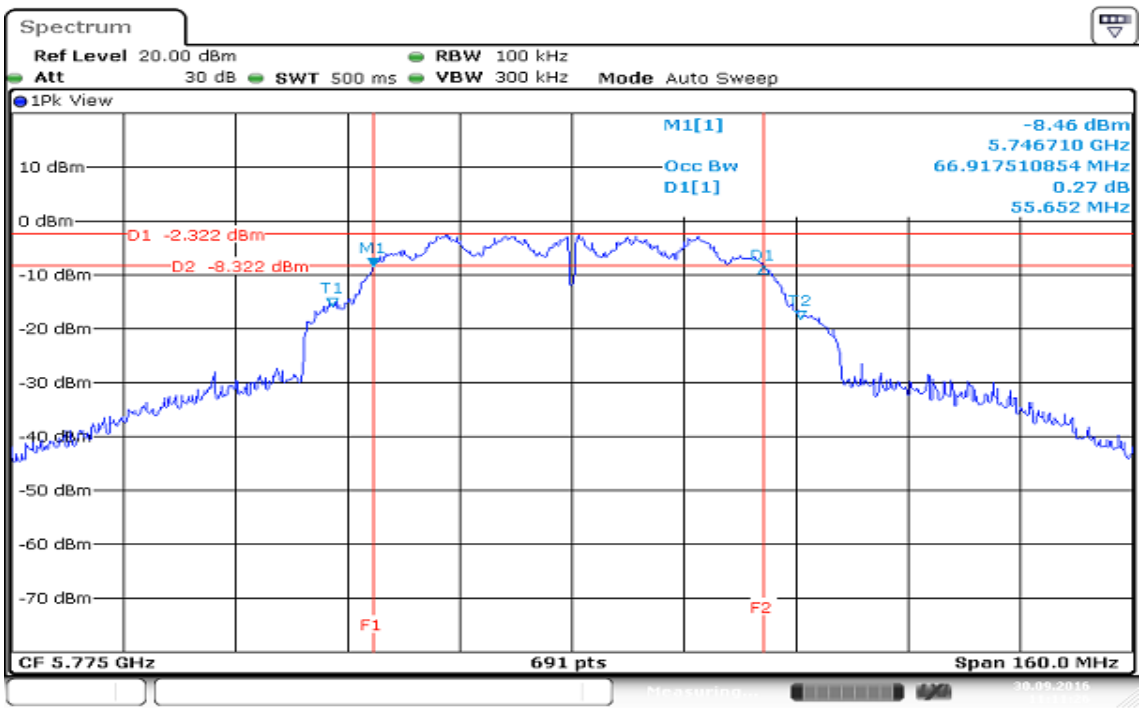
IEEE 802.11ac VHT 80 MHz mode / 5775MHz / Chain 1

99% Bandwidth (CH Mid)



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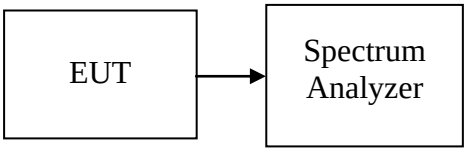
7.2 6DB BANDWIDTH

LIMIT

According to §15.407, systems using digital modulation techniques may operate in the 5725 - 5850 MHz bands. The minimum 6dB bandwidth shall be at least 500 kHz.

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW = 100kHz, VBW = 3 x RBW, Span = 50MHz, Sweep = auto.
4. Mark the peak frequency and –6dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

TEST RESULTS

No non-compliance noted

Test Data

Test mode: IEEE 802.11a mode

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (kHz)	Result
Low	5745	16.6087	>500	PASS
Mid	5785	16.6087		PASS
High	5825	16.6087		PASS

Test mode: IEEE 802.11n HT 20 MHz mode / Chain 0

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (kHz)	Result
Low	5745	17.6957	>500	PASS
Mid	5785	17.6522		PASS
High	5825	17.6522		PASS

Test mode: IEEE 802.11n HT 20 MHz mode / Chain 1

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (kHz)	Result
Low	5745	17.6522	>500	PASS
Mid	5785	17.6957		PASS
High	5825	17.6522		PASS

Test mode: IEEE 802.11n HT 40 MHz mode / Chain 0

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (kHz)	Result
Low	5755	36.5220	>500	PASS
High	5795	36.5220		PASS

Test mode: IEEE 802.11n HT 40 MHz mode / Chain 1

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (kHz)	Result
Low	5755	36.5220	>500	PASS
High	5795	36.6380		PASS

Test mode: IEEE 802.11ac VHT 80 MHz mode / 5775MHz / Chain 0

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (kHz)	Result
Mid	5755	76.7540	>500	PASS

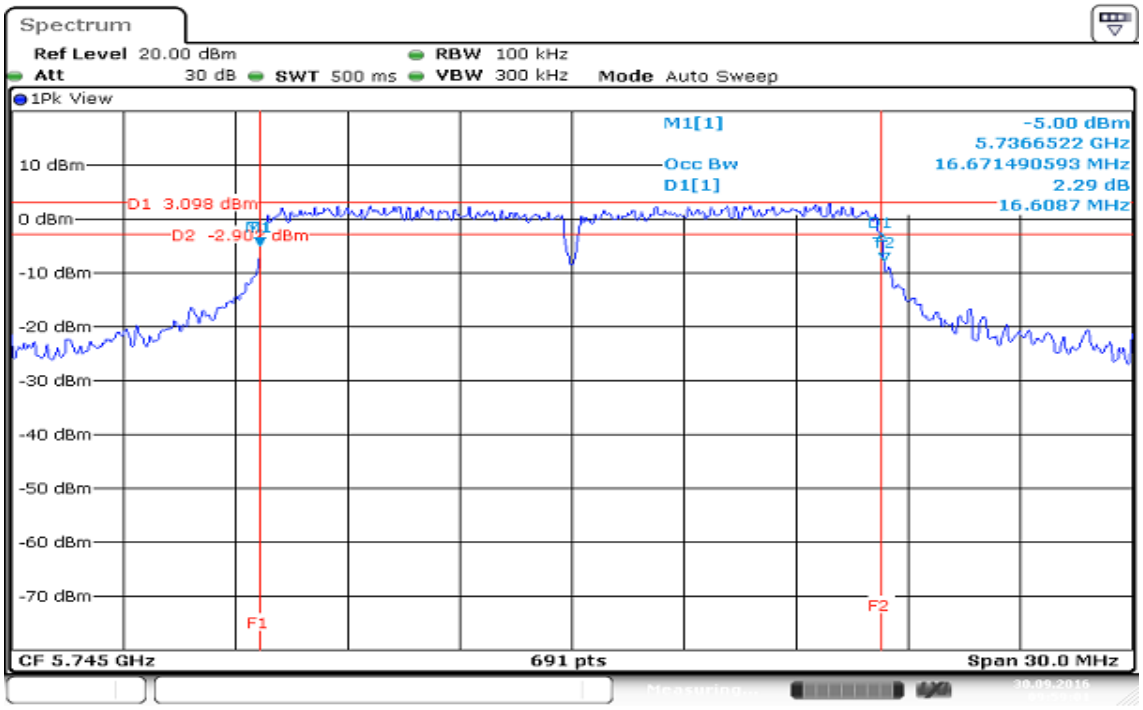
Test mode: IEEE 802.11ac VHT 80 MHz mode / 5775MHz / Chain 1

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (kHz)	Result
Mid	5755	55.6520	>500	PASS

Test Plot

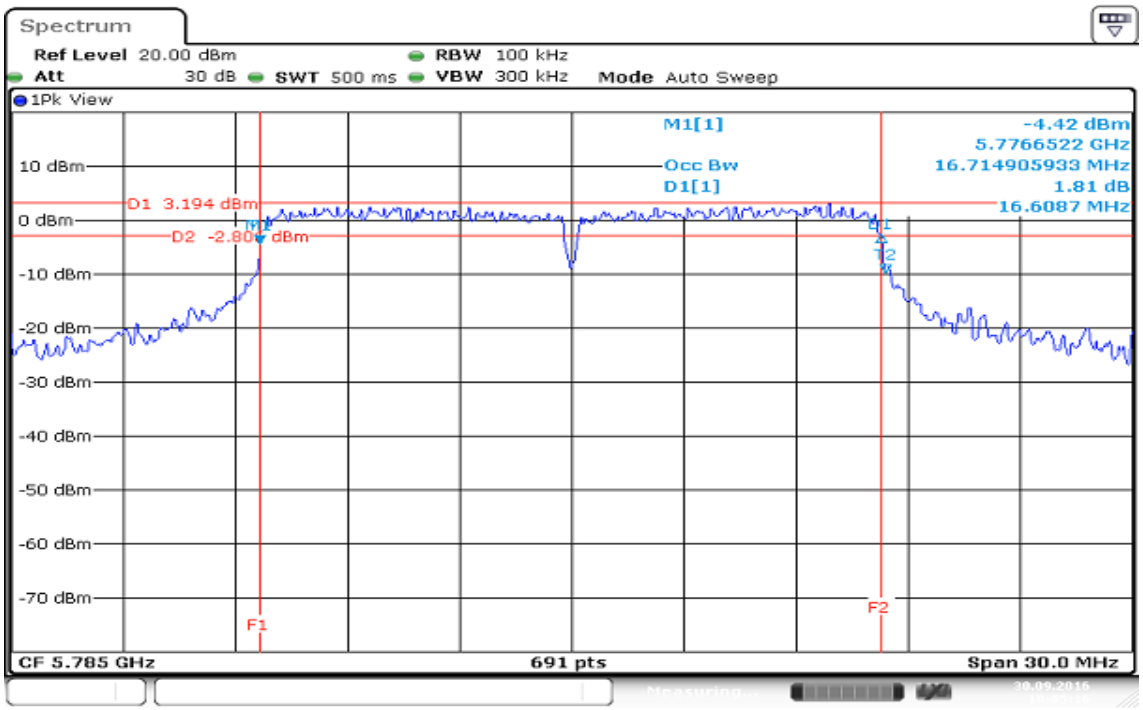
IEEE 802.11a mode / 5745 ~ 5825MHz

6dB Bandwidth (CH Low)



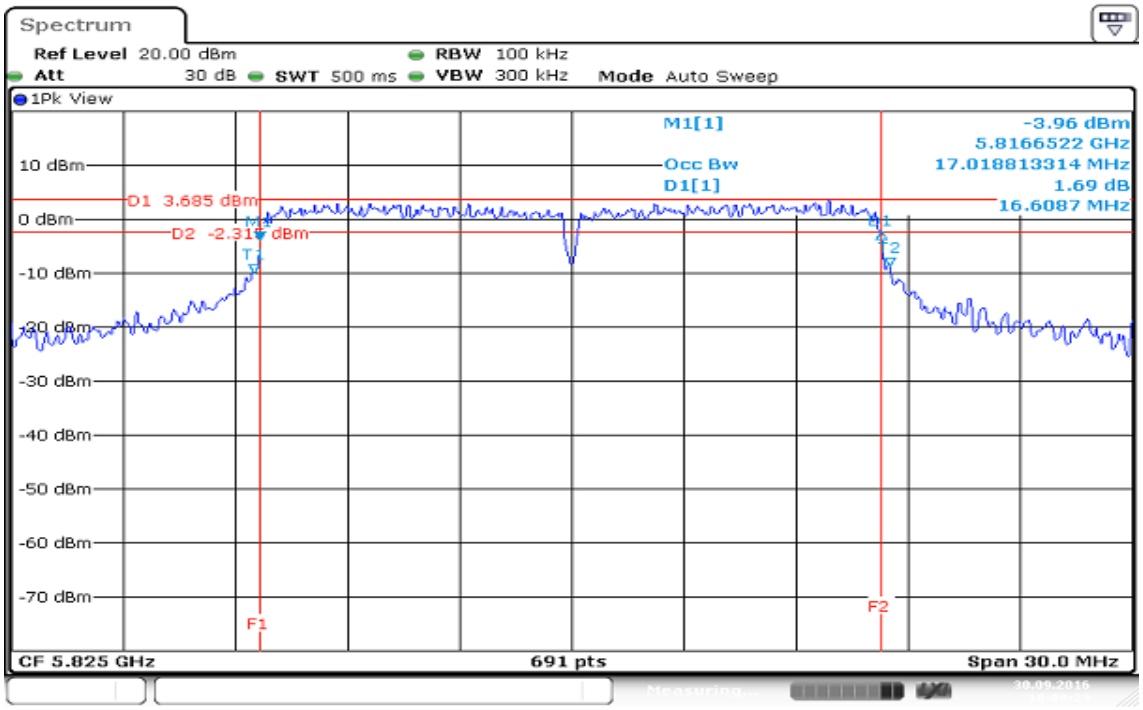
Date: 30.SEP.2016 09:59:02

6dB Bandwidth (CH Mid)



Date: 30.SEP.2016 10:05:16

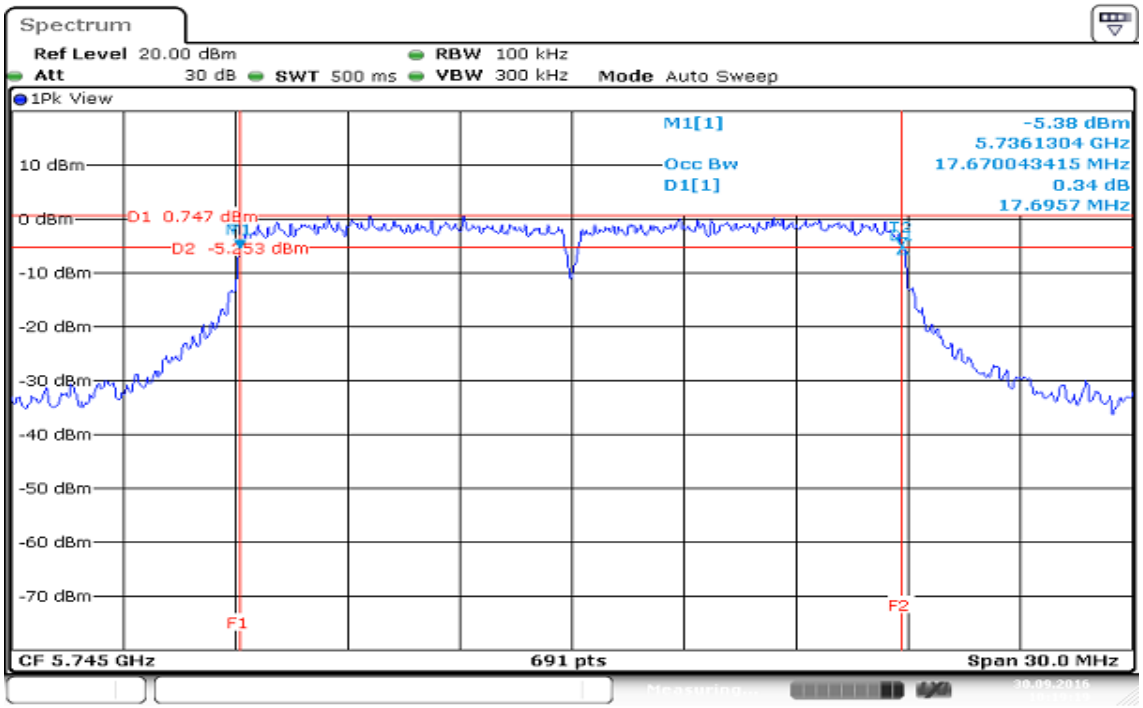
6dB Bandwidth (CH High)



Date: 30.SEP.2016 10:08:23

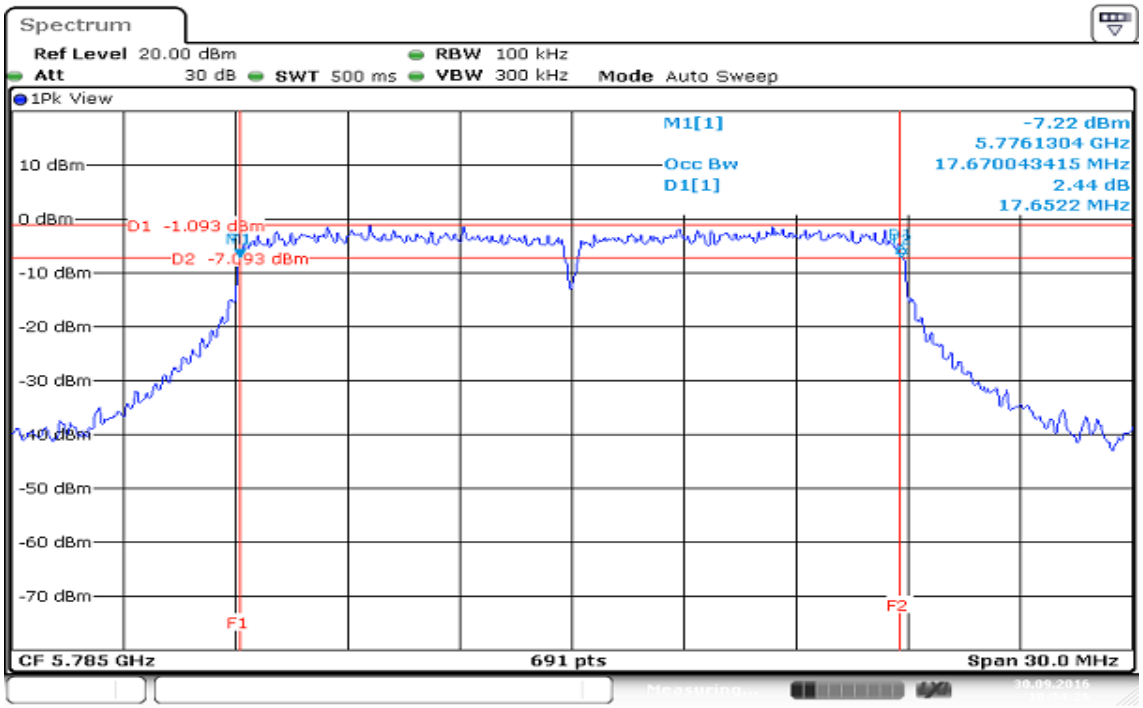
IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz / Chain 0

6dB Bandwidth (CH Low)



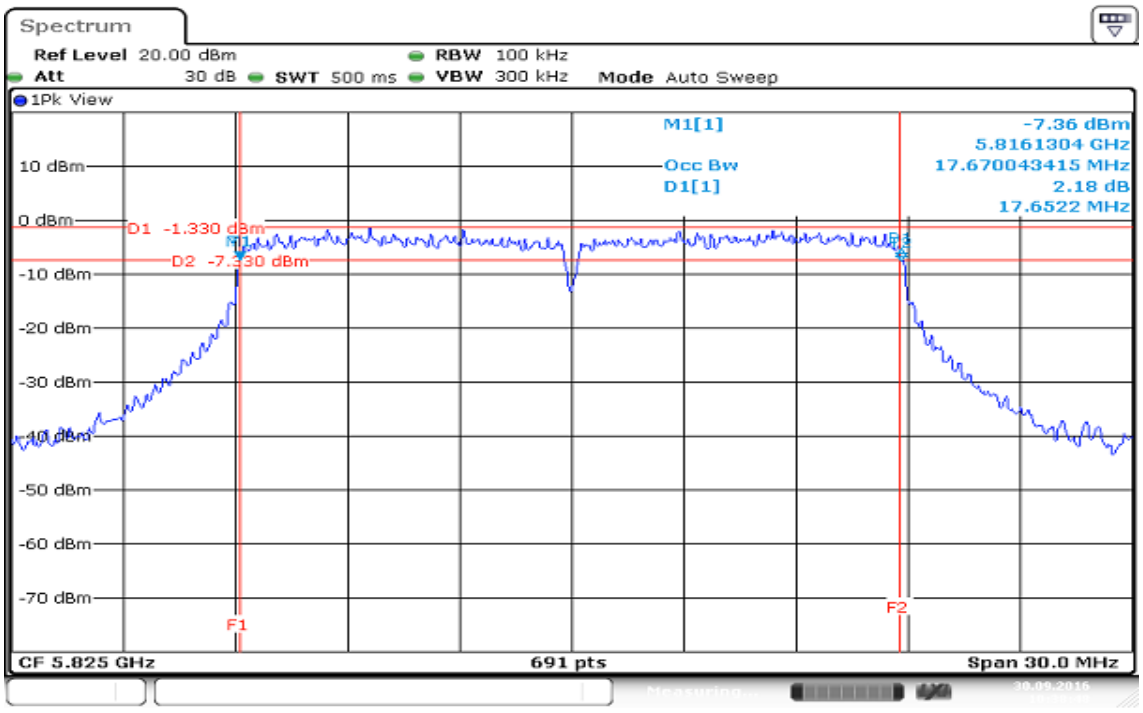
Date: 30.SEP.2016 10:19:20

6dB Bandwidth (CH Mid)



Date: 30.SEP.2016 10:34:27

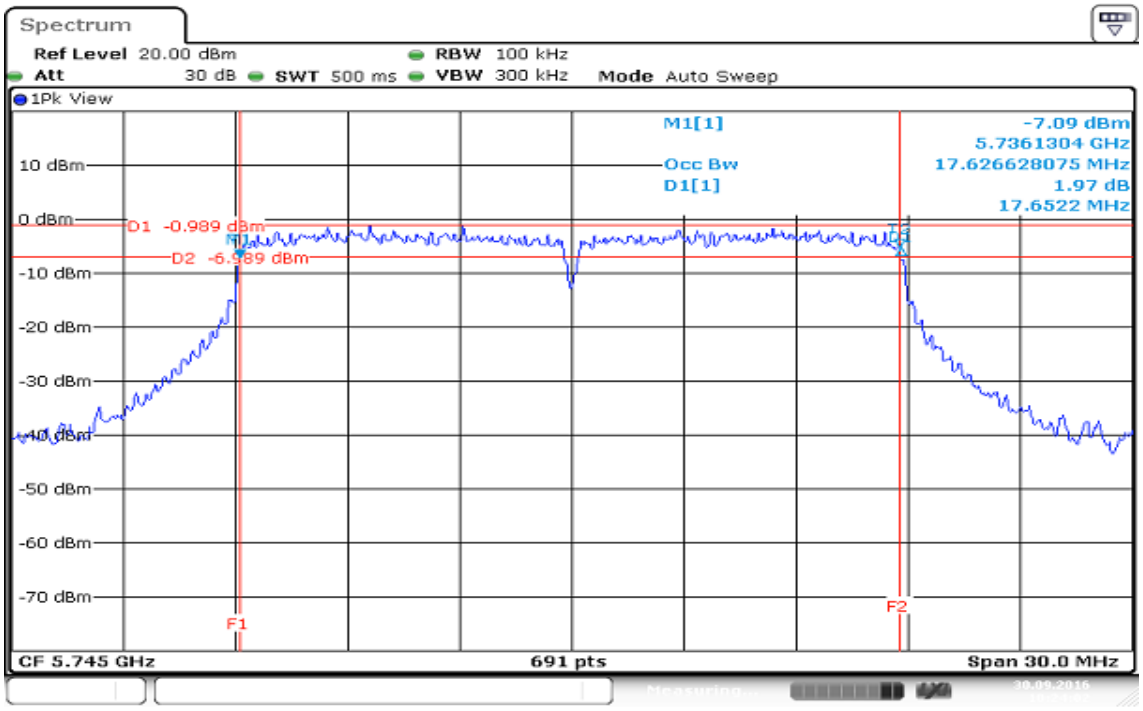
6dB Bandwidth (CH High)



Date: 30.SEP.2016 10:38:49

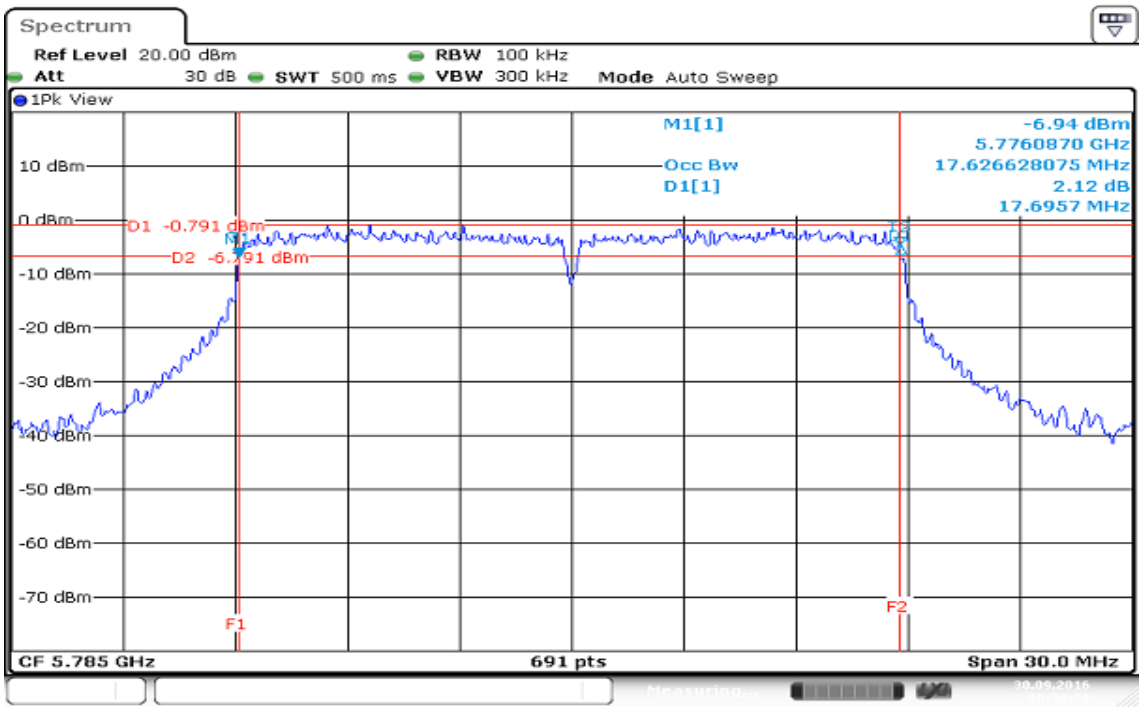
IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz / Chain 1

6dB Bandwidth (CH Low)



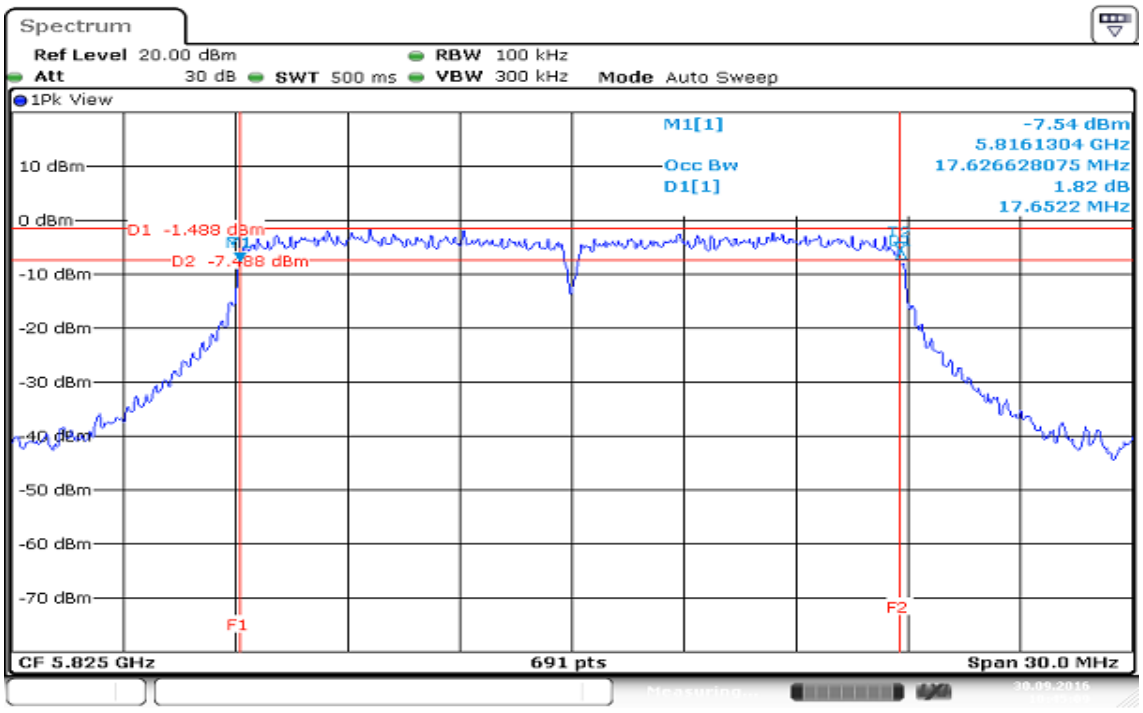
Date: 30.SEP.2016 10:24:02

6dB Bandwidth (CH Mid)



Date: 30.SEP.2016 10:30:21

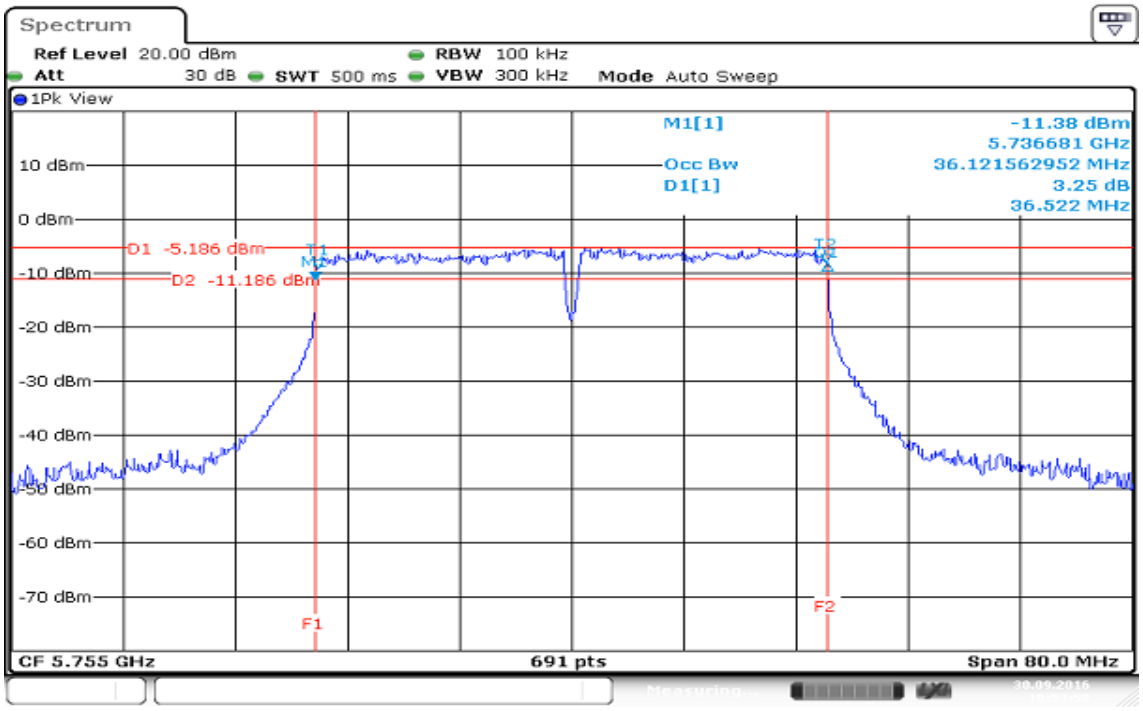
6dB Bandwidth (CH High)



Date: 30.SEP.2016 10:45:10

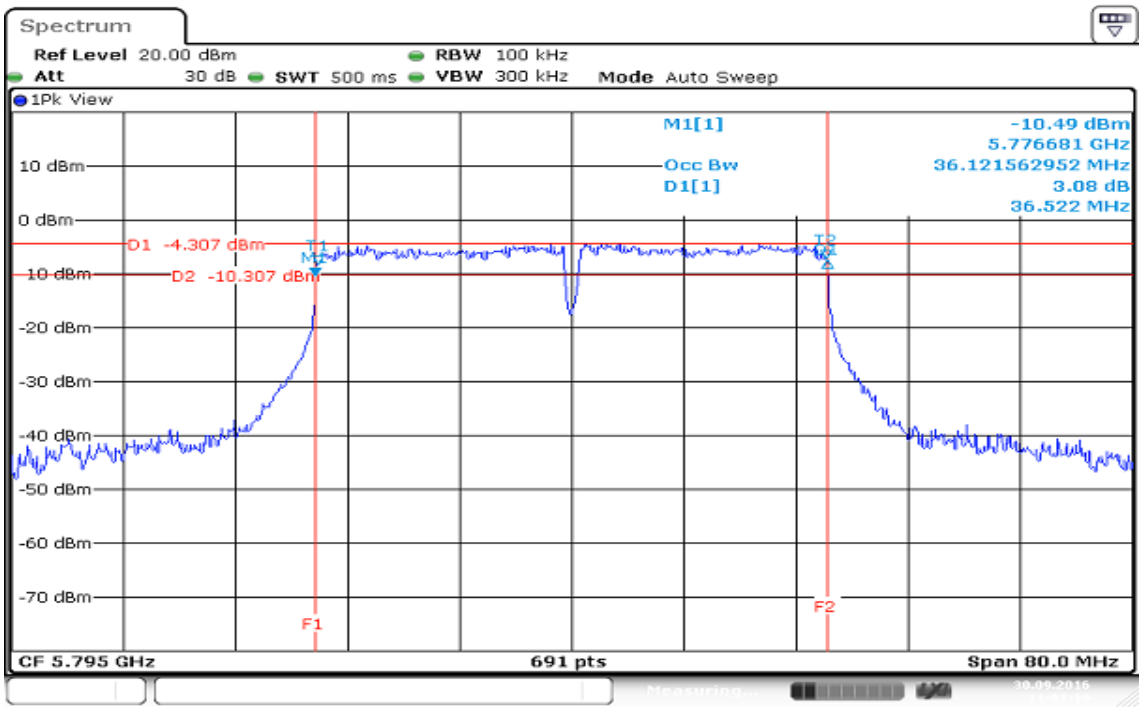
IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz / Chain 0

6dB Bandwidth (CH Low)



Date: 30.SEP.2016 10:53:58

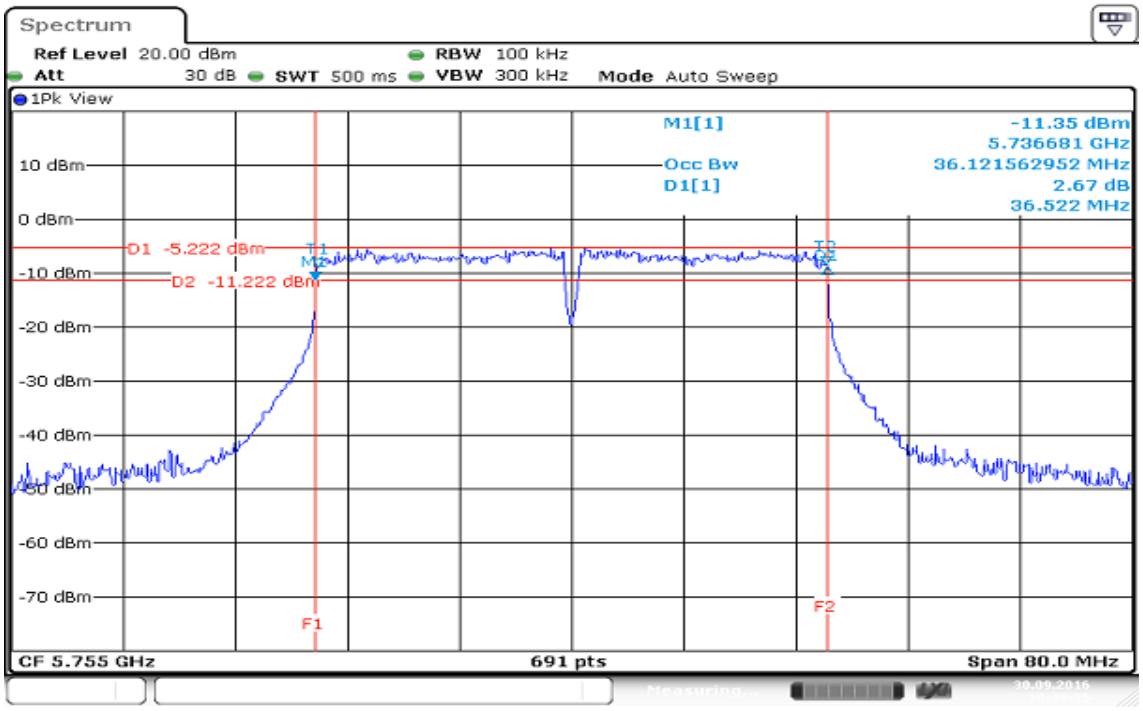
6dB Bandwidth (CH High)



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

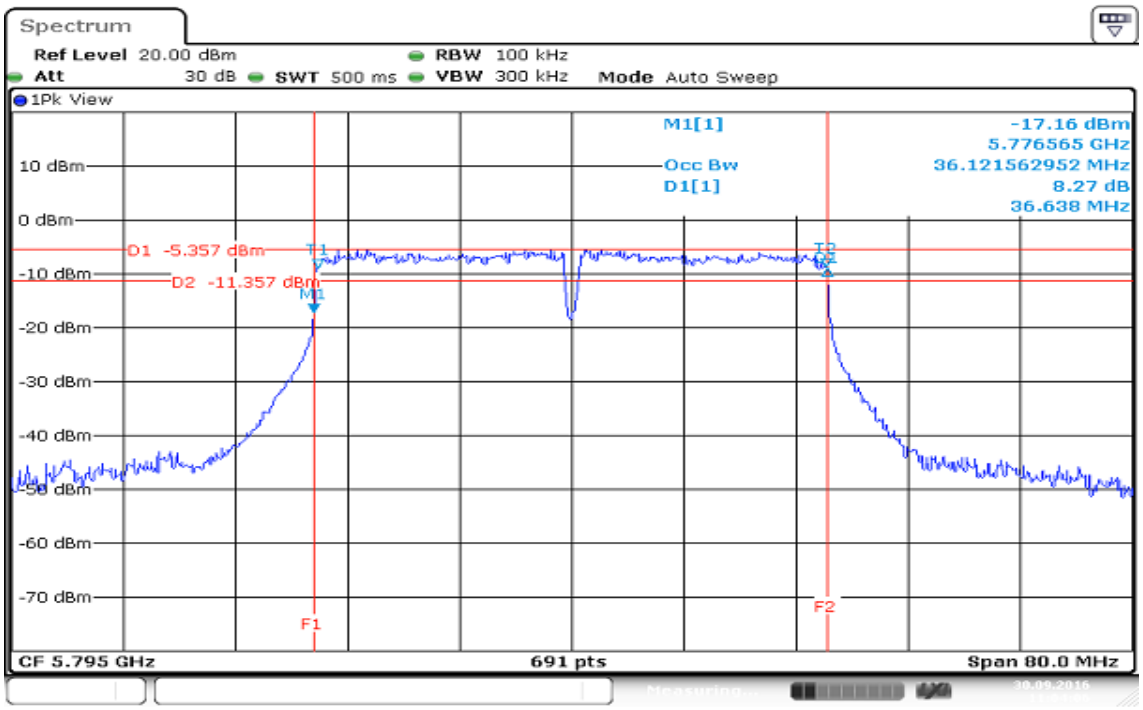
IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz / Chain 1

6dB Bandwidth (CH Low)



Date: 30.SEP.2016 10:49:35

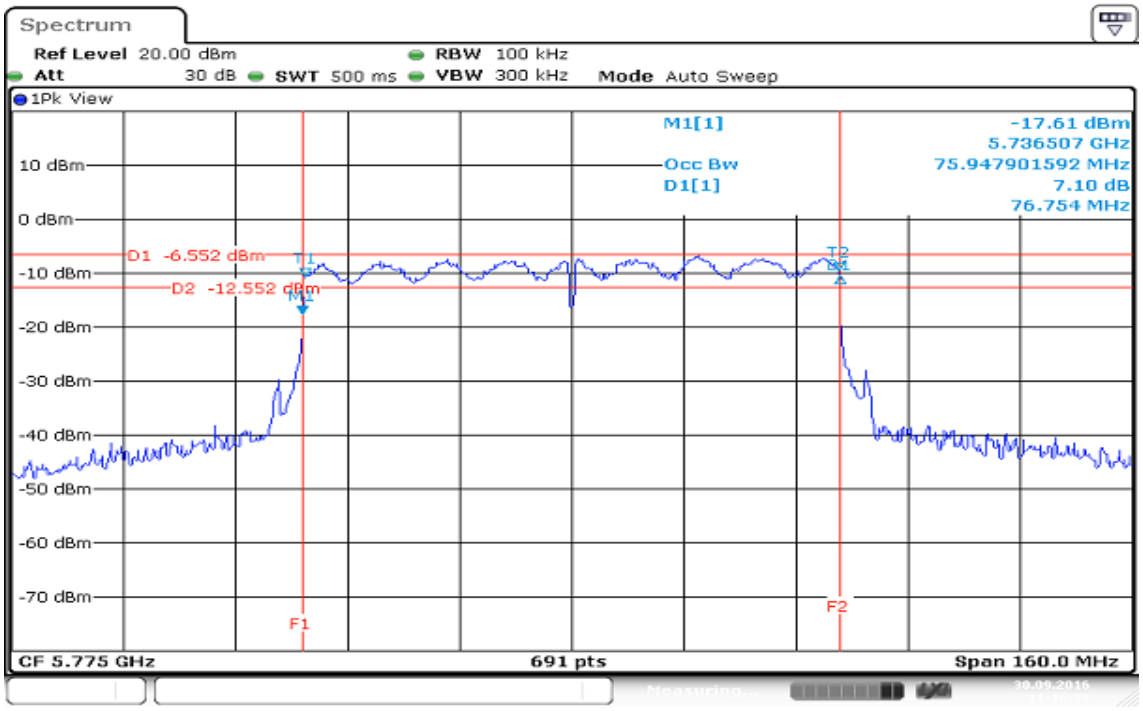
6dB Bandwidth (CH High)



Date: 30.SEP.2016 11:04:06

IEEE 802.11ac VHT 80 MHz mode / 5775MHz / Chain 0

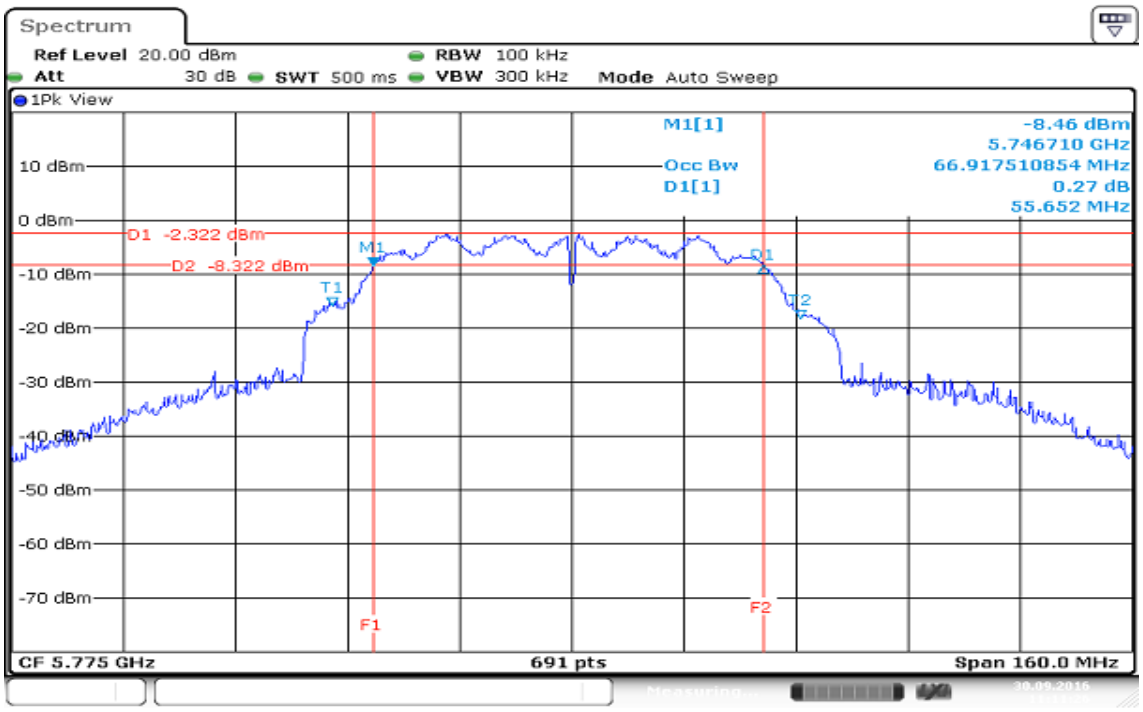
6dB Bandwidth (CH Mid)



Date: 30.SEP.2016 11:16:38

IEEE 802.11ac VHT 80 MHz mode / 5775MHz / Chain 1

6dB Bandwidth (CH Mid)



Date: 30.SEP.2016 11:11:27

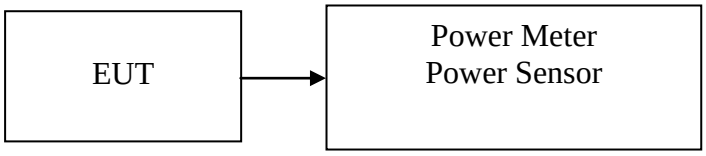
7.3 MAXIMUM CONDUCTED OUTPUT POWER

LIMIT

The maximum peak output power of the intentional radiator shall not exceed the following:

1. According to §15.407, for systems using digital modulation in the bands of 5725-5850 MHz: 1 Watt.

Test Configuration



TEST PROCEDURE

The transmitter output is connected to the Power Meter. The Power Meter is set to the peak power detection.

TEST RESULTS

No non-compliance noted

Test Data

Test mode: IEEE 802.11a mode / 5745 ~ 5825MHz

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (dBm)
Low	5745	17.99	0.0630	30
Mid	5785	18.28	0.0673	30
High	5825	***18.58**	0.0721	30

Test mode: IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz

Channel	Frequency (MHz)	Chain 0 Output Power (dBm)	Chain 1 Output Power (dBm)	Output Power (dBm)	Output Power (W)	Limit (dBm)
Low	5745	13.45	14.05	16.77	0.0475	30
Mid	5785	13.85	14.25	***17.06**	0.0508	30
High	5825	13.23	14.01	16.65	0.0462	30

Test mode: IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz

Channel	Frequency (MHz)	Chain 0 Output Power (dBm)	Chain 1 Output Power (dBm)	Output Power (dBm)	Output Power (W)	Limit (dBm)
Low	5755	14.02	13.44	***16.75**	0.0473	30
High	5795	13.98	13.25	16.64	0.0461	30

Test mode: IEEE 802.11ac VHT 80 MHz mode / 5775MHz

Channel	Frequency (MHz)	Chain 0 Output Power (dBm)	Chain 1 Output Power (dBm)	Output Power (dBm)	Output Power (W)	Limit (dBm)
Mid	5775	13.12	14.44	***16.84**	0.0483	30

Remark:

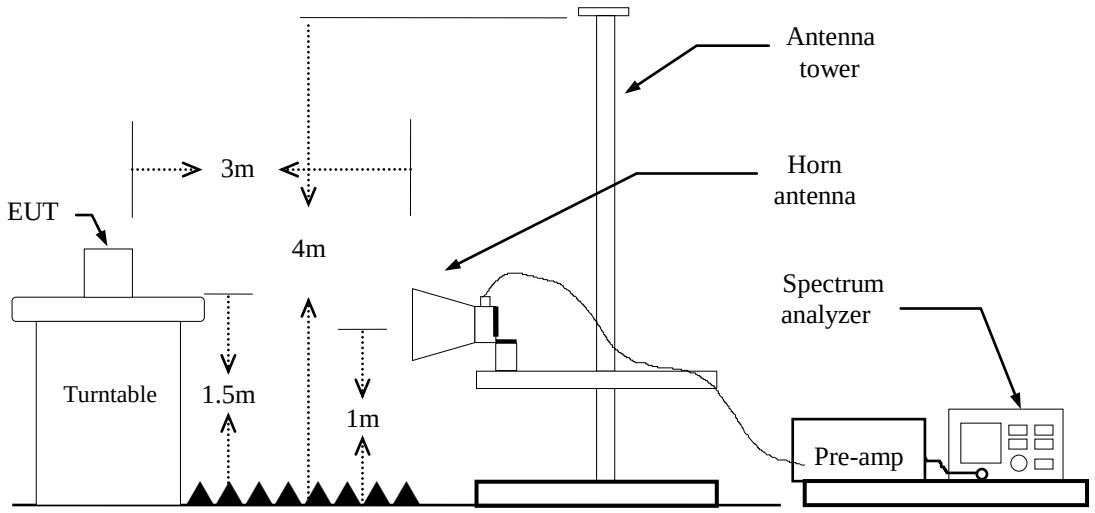
1. Total Output Power (w) = Chain 0 (10^(Output Power /10)/1000)+ Chain 1 (10^(Output Power /10)/1000)

7.4 BAND EDGES MEASUREMENT

LIMIT

According to §15.407(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in 15.209(a) (see Section 15.205(c)).

Test Configuration



TEST PROCEDURE

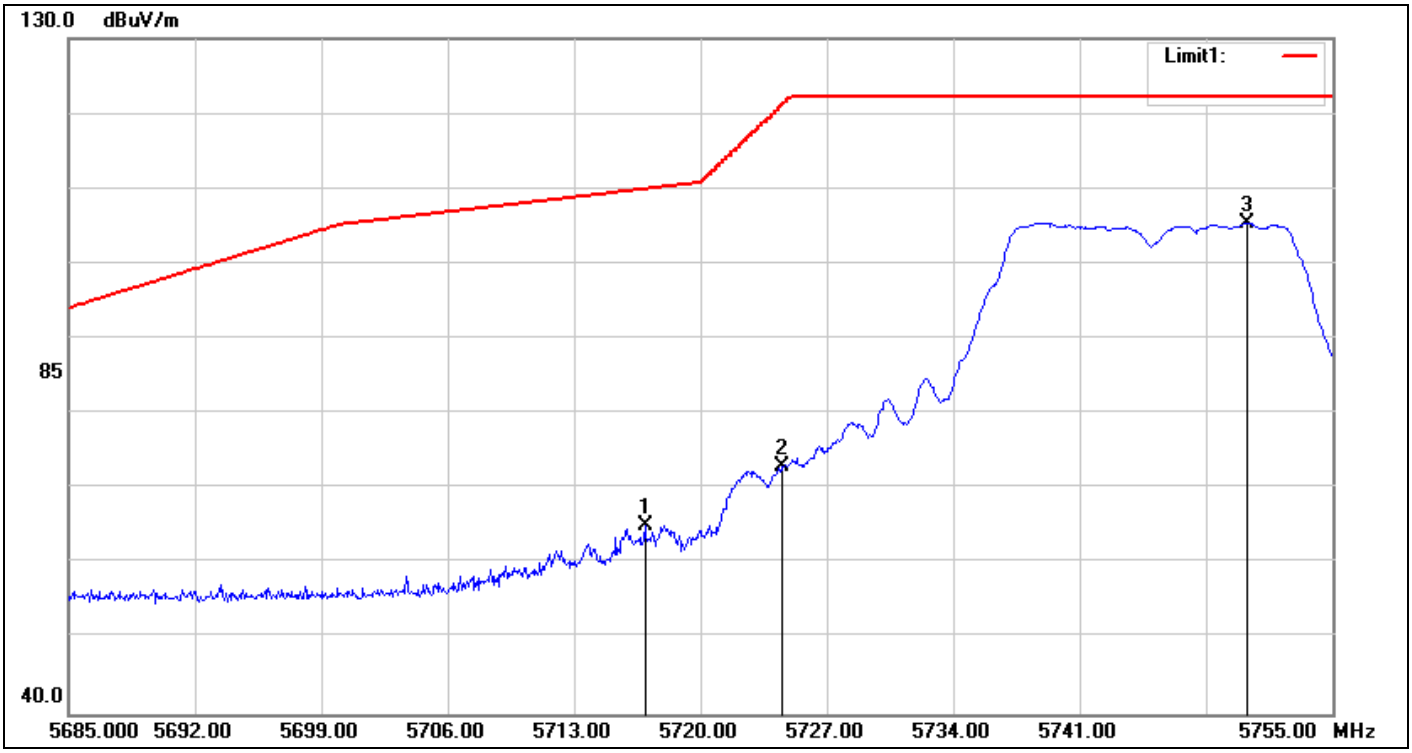
1. The EUT is placed on a turntable, which is 1.5m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
   (a) PEAK: RBW=VBW=1MHz / Sweep=AUTO
   (b) AVERAGE: RBW=1MHz,
   if duty cycle≧98%, VBW=10Hz.
   if duty cycle<98% VBW=1/T.
   IEEE 802.11a mode: ≧98%, VBW=10Hz
   IEEE 802.11n HT 20 MHz mode: =96%, VBW=820Hz
   IEEE 802.11n HT 40 MHz mode: =85%, VBW=1.6kHz
   IEEE 802.11ac VHT 80 MHz mode: =48%, VBW=3kHz
5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.
6. Result = Spectrum Reading + cable loss(spectrum to Amp) - Amp Gain + Cable loss(Amp to receive Ant)+ Receive Ant

TEST RESULTS

Refer to attach spectrum analyzer data chart.

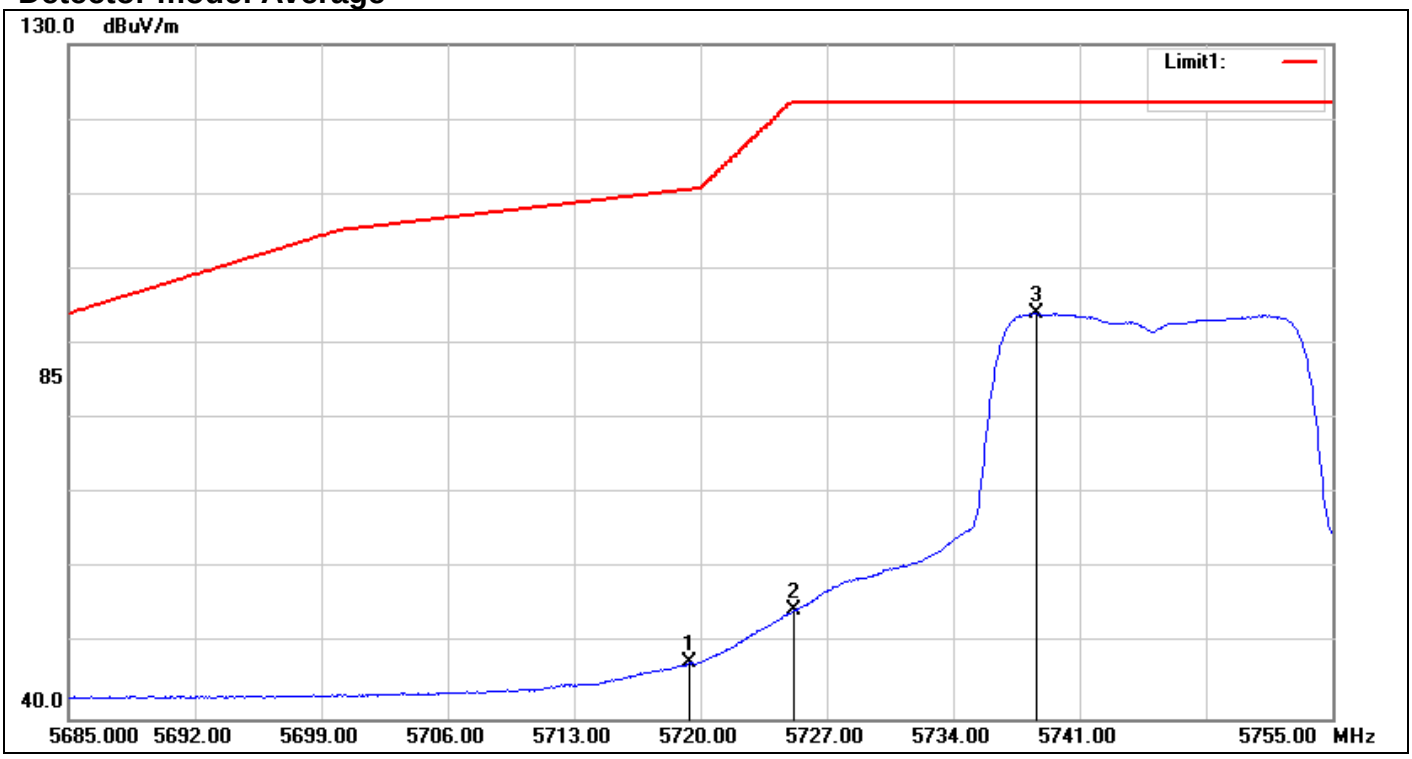
Band Edges (IEEE 802.11a mode / CH Low)

Detector mode: Peak



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5716.920	58.95	6.17	65.12	109.94	-44.82	peak
2	5724.480	66.65	6.21	72.86	121.01	-48.15	peak
3	5750.310	99.15	6.32	105.47	-	-	peak

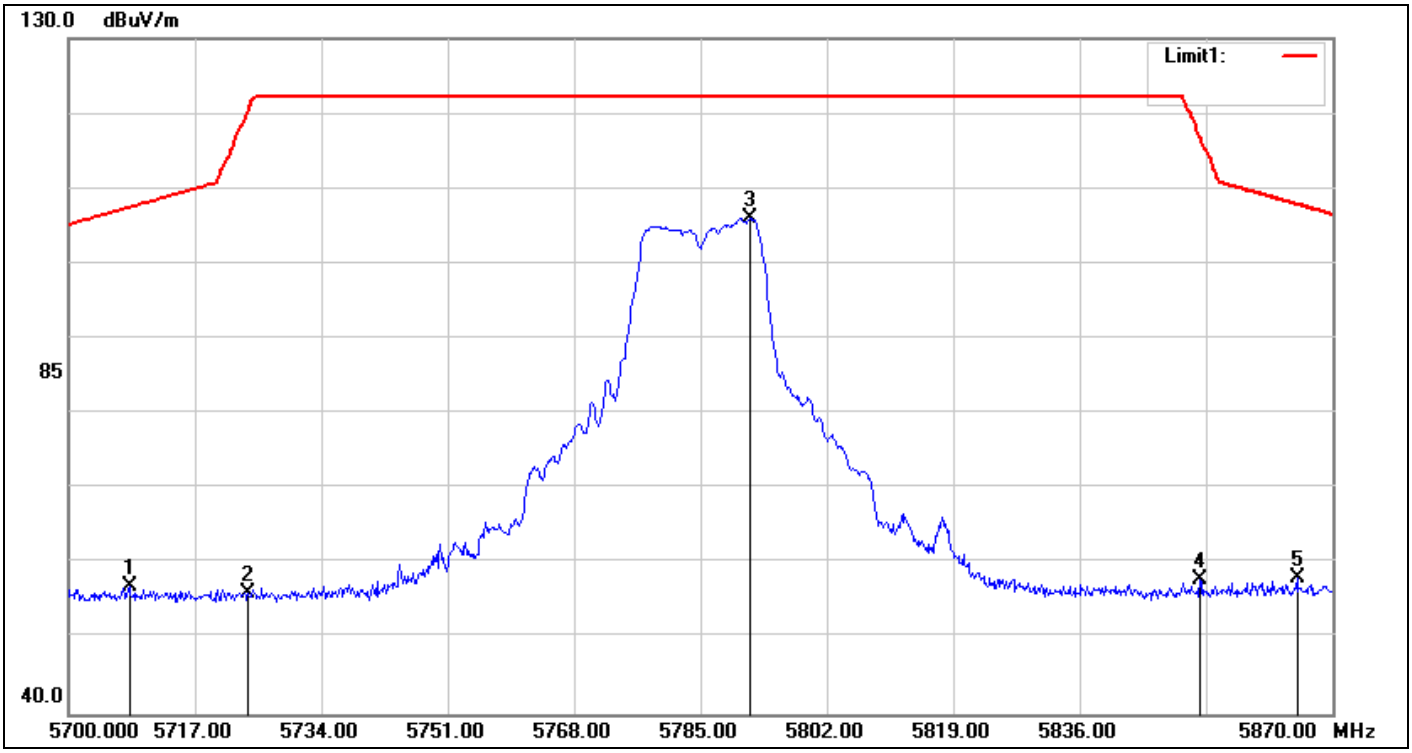
Detector mode: Average



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5719.370	41.34	6.18	47.52	110.62	-63.10	AVG
2	5725.180	48.20	6.21	54.41	122.20	-67.79	AVG
3	5738.620	87.81	6.27	94.08	-	-	AVG

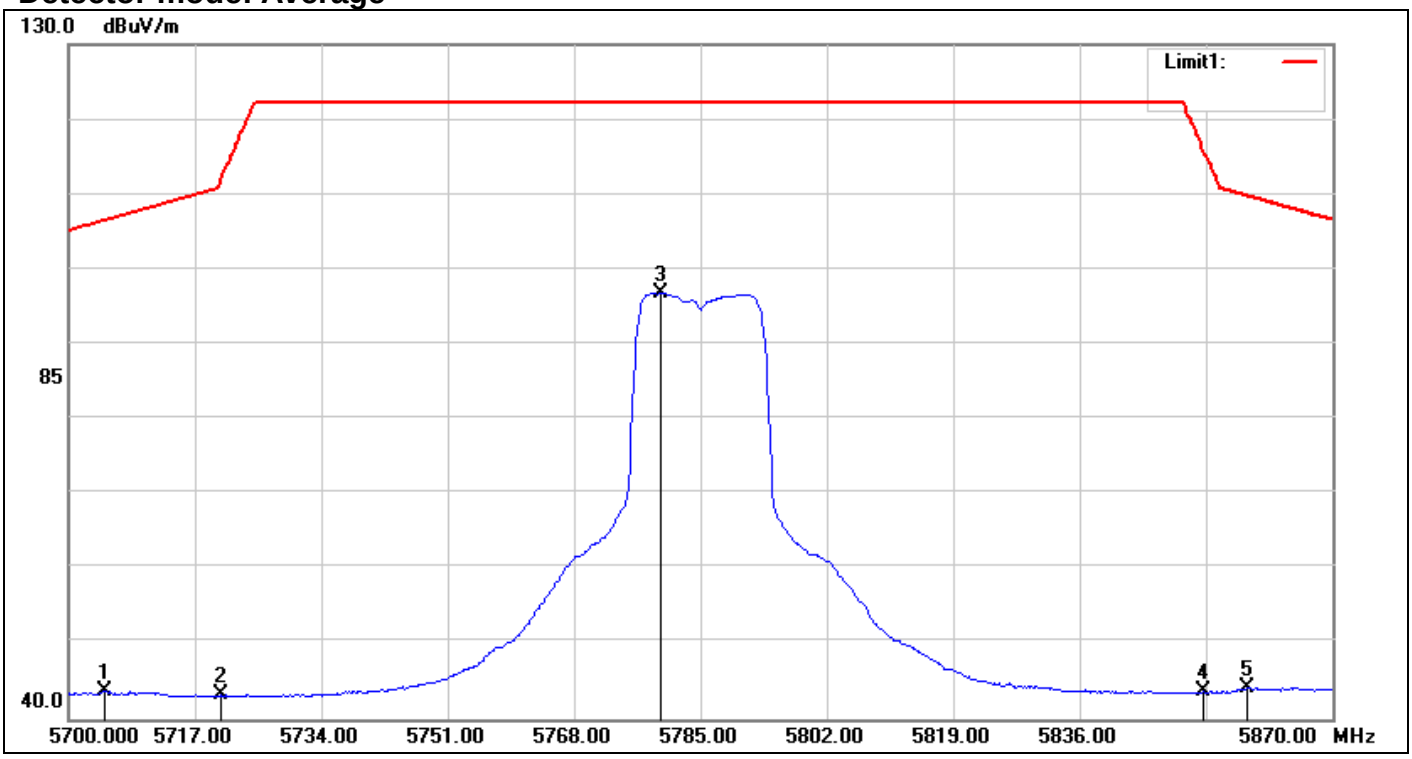
Band Edges (IEEE 802.11a mode / CH Mid)

Detector mode: Peak



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5708.160	50.76	6.14	56.90	107.48	-50.58	peak
2	5724.140	49.96	6.20	56.16	120.24	-64.08	peak
3	5791.630	99.62	6.49	106.11	-	-	peak
4	5852.150	51.03	6.75	57.78	117.30	-59.52	peak
5	5865.240	51.20	6.81	58.01	107.93	-49.92	peak

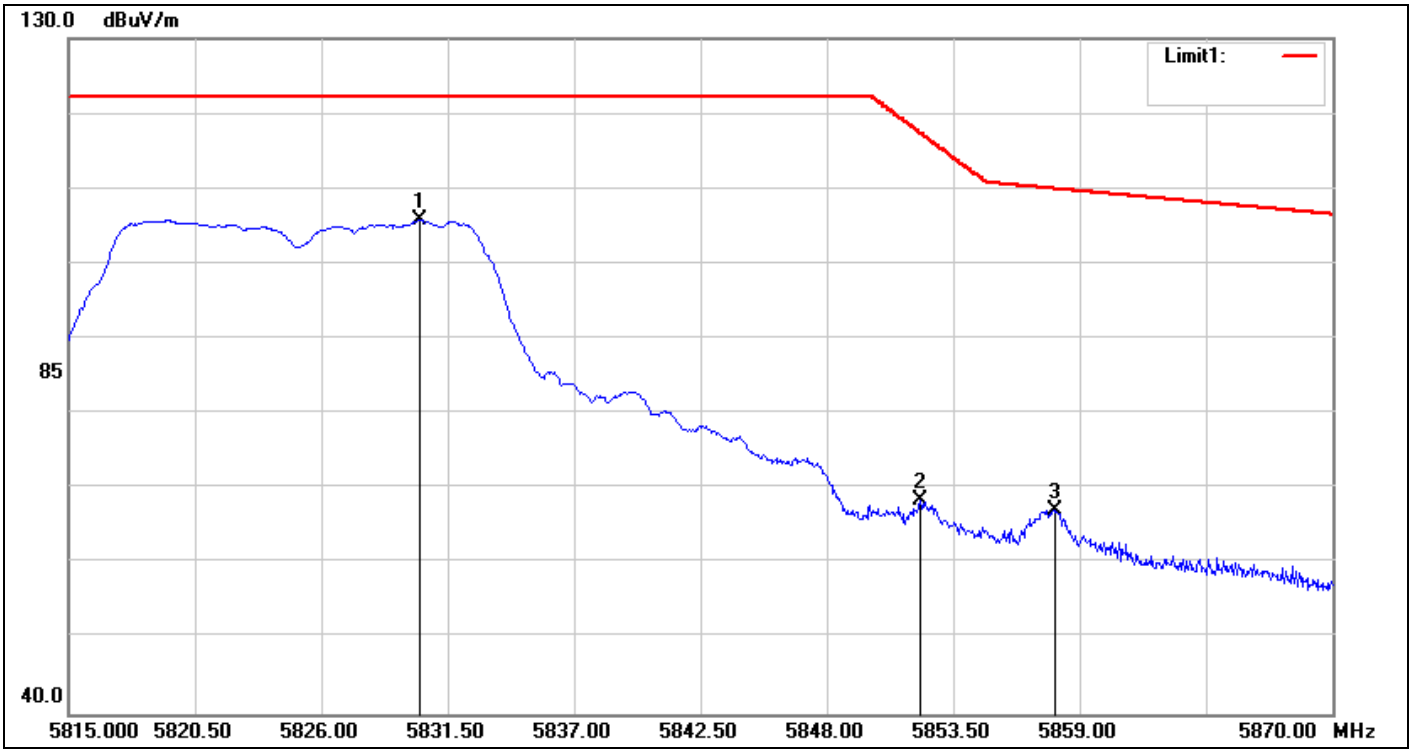
Detector mode: Average



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5704.760	37.62	6.12	43.74	106.53	-62.79	AVG
2	5720.570	37.00	6.19	43.19	112.10	-68.91	AVG
3	5779.730	90.39	6.44	96.83	-	-	AVG
4	5852.660	36.90	6.75	43.65	116.14	-72.49	AVG
5	5858.610	37.39	6.78	44.17	109.79	-65.62	AVG

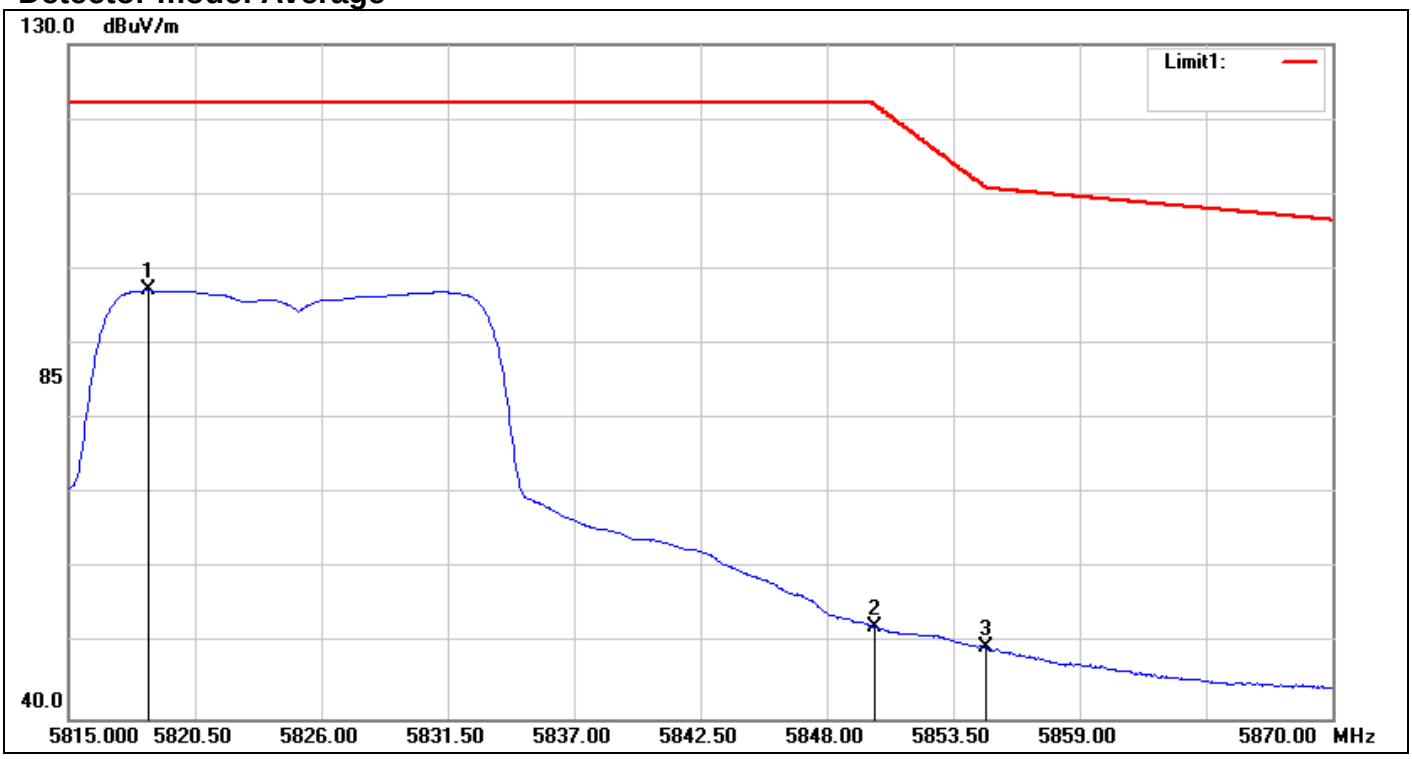
Band Edges (IEEE 802.11a mode / CH High)

Detector mode: Peak



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5830.290	99.13	6.66	105.79	-	-	peak
2	5852.070	61.61	6.75	68.36	117.48	-49.12	peak
3	5857.955	60.35	6.77	67.12	109.97	-42.85	peak

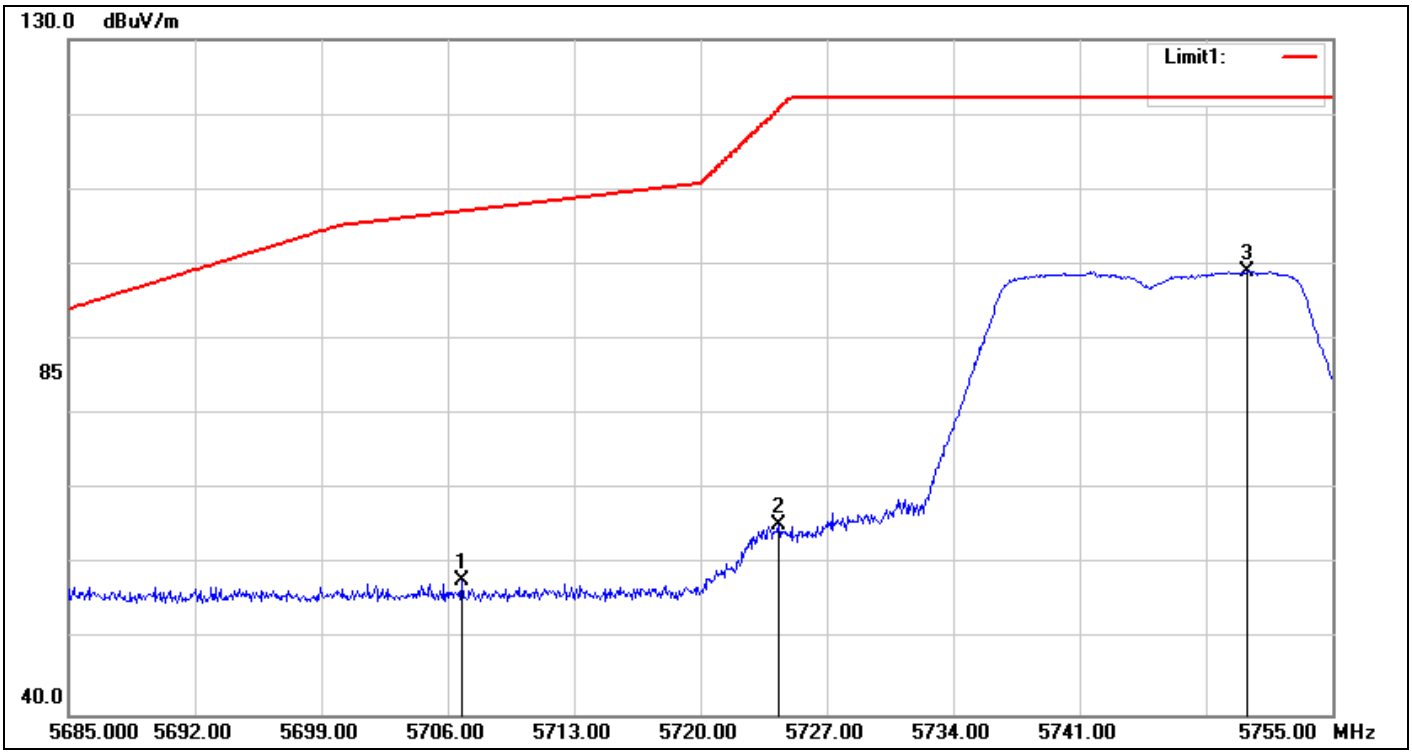
Detector mode: Average



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5818.465	90.59	6.61	97.20	-	-	AVG
2	5850.090	45.63	6.74	52.37	121.99	-69.62	AVG
3	5854.930	42.74	6.76	49.50	110.96	-61.46	AVG

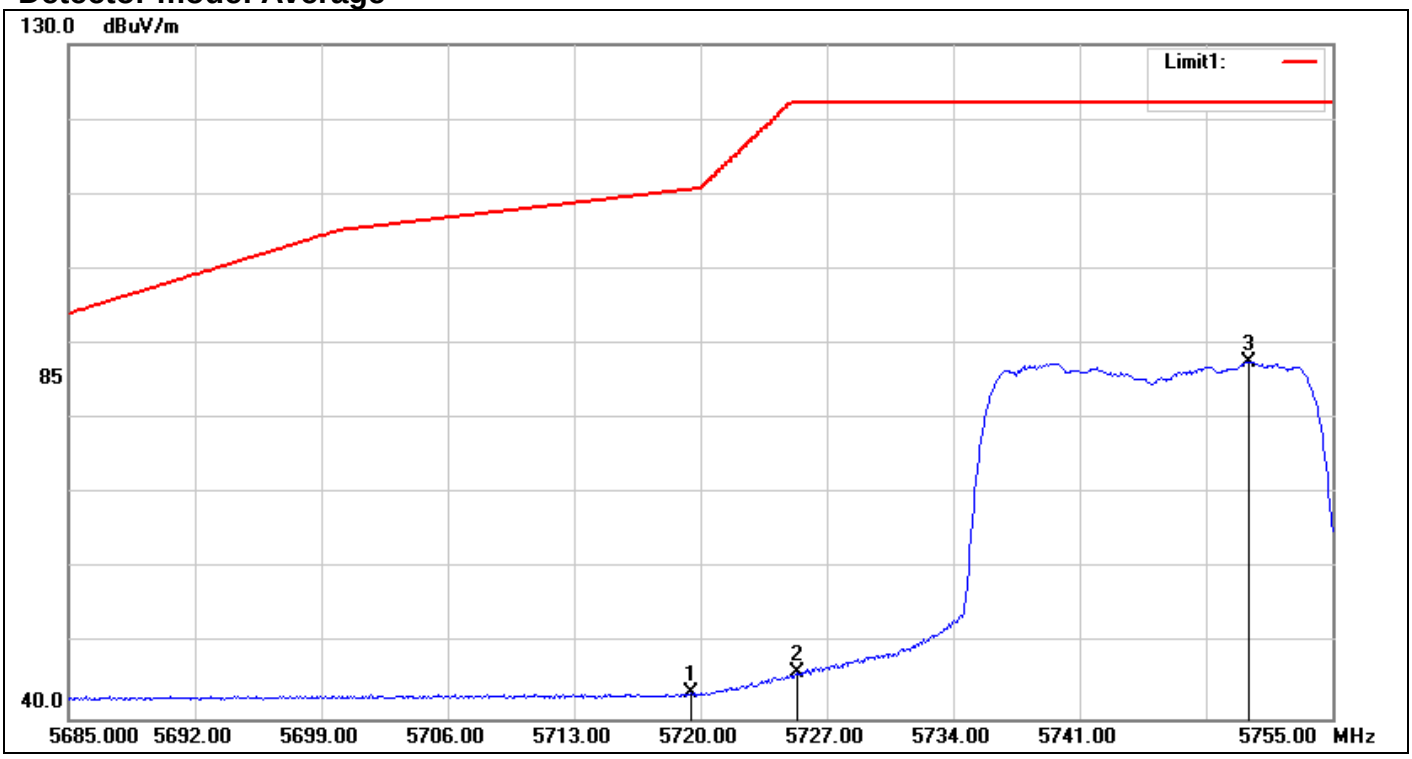
Band Edges (IEEE 802.11n HT 20 MHz mode / CH Low)

Detector mode: Peak



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5706.770	51.76	6.13	57.89	107.10	-49.21	peak
2	5724.340	59.11	6.21	65.32	120.70	-55.38	peak
3	5750.310	92.73	6.32	99.05	-	-	peak

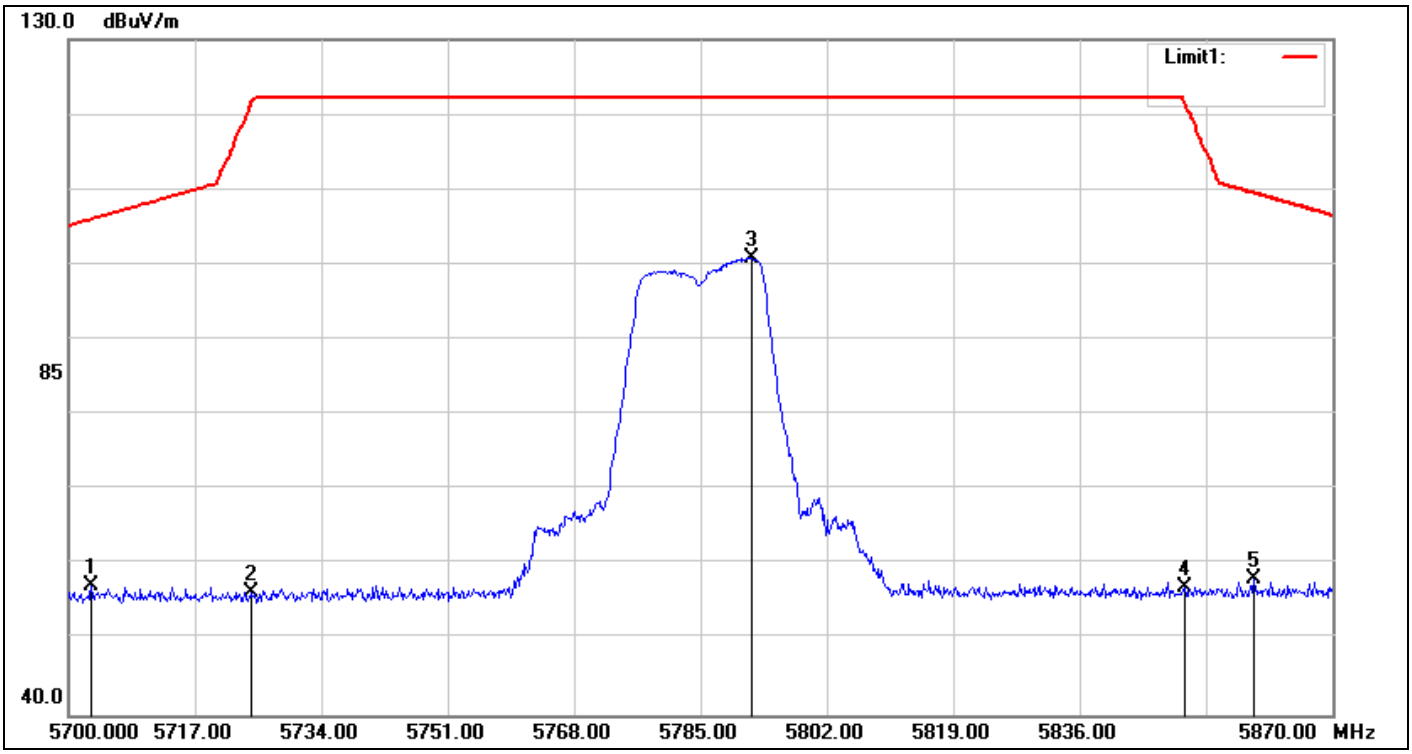
Detector mode: Average



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5719.440	37.30	6.18	43.48	110.64	-67.16	AVG
2	5725.320	40.03	6.21	46.24	122.20	-75.96	AVG
3	5750.380	81.33	6.32	87.65	-	-	AVG

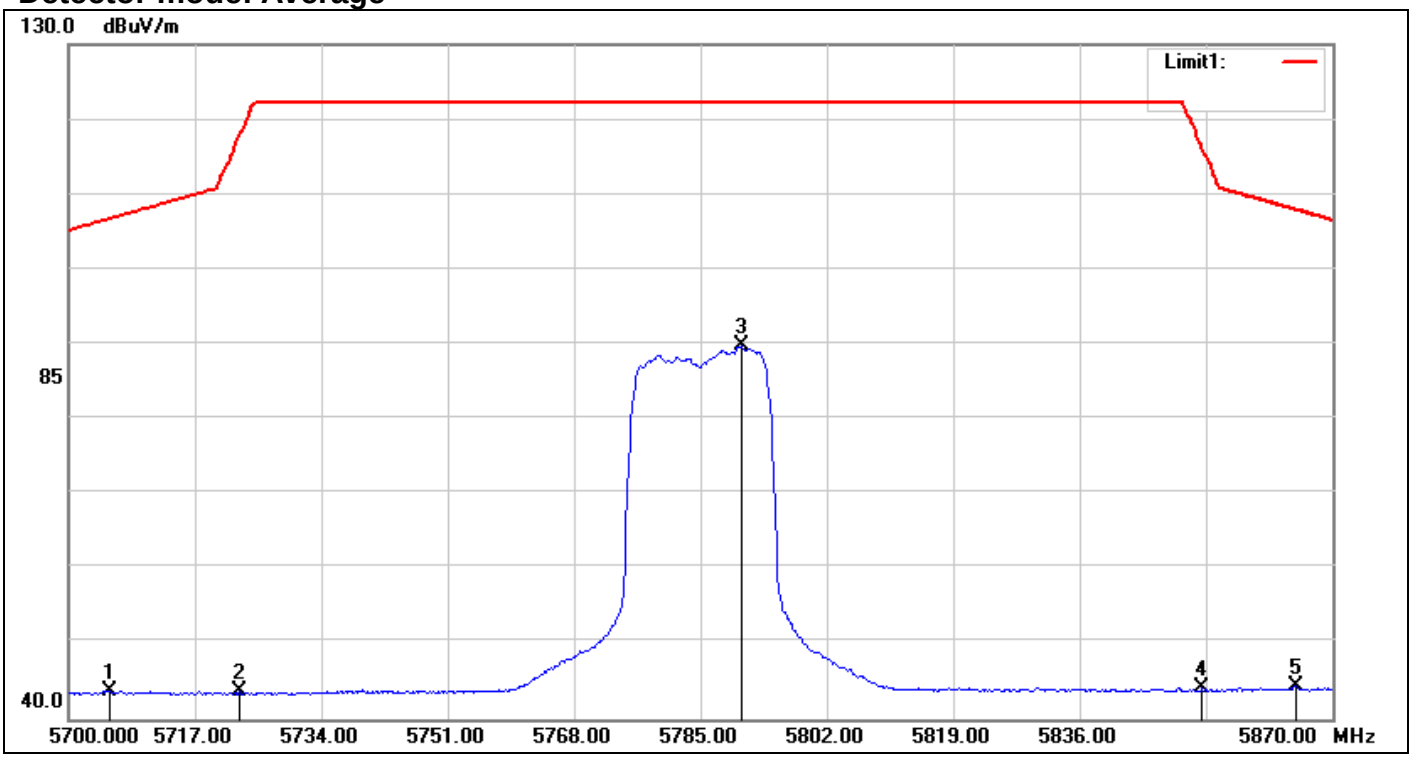
Band Edges (IEEE 802.11n HT 20 MHz mode / CH Mid)

Detector mode: Peak



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5703.060	51.20	6.12	57.32	106.06	-48.74	peak
2	5724.480	50.12	6.21	56.33	121.01	-64.68	peak
3	5791.800	94.42	6.49	100.91	-	-	peak
4	5850.110	50.33	6.74	57.07	121.95	-64.88	peak
5	5859.460	51.23	6.78	58.01	109.55	-51.54	peak

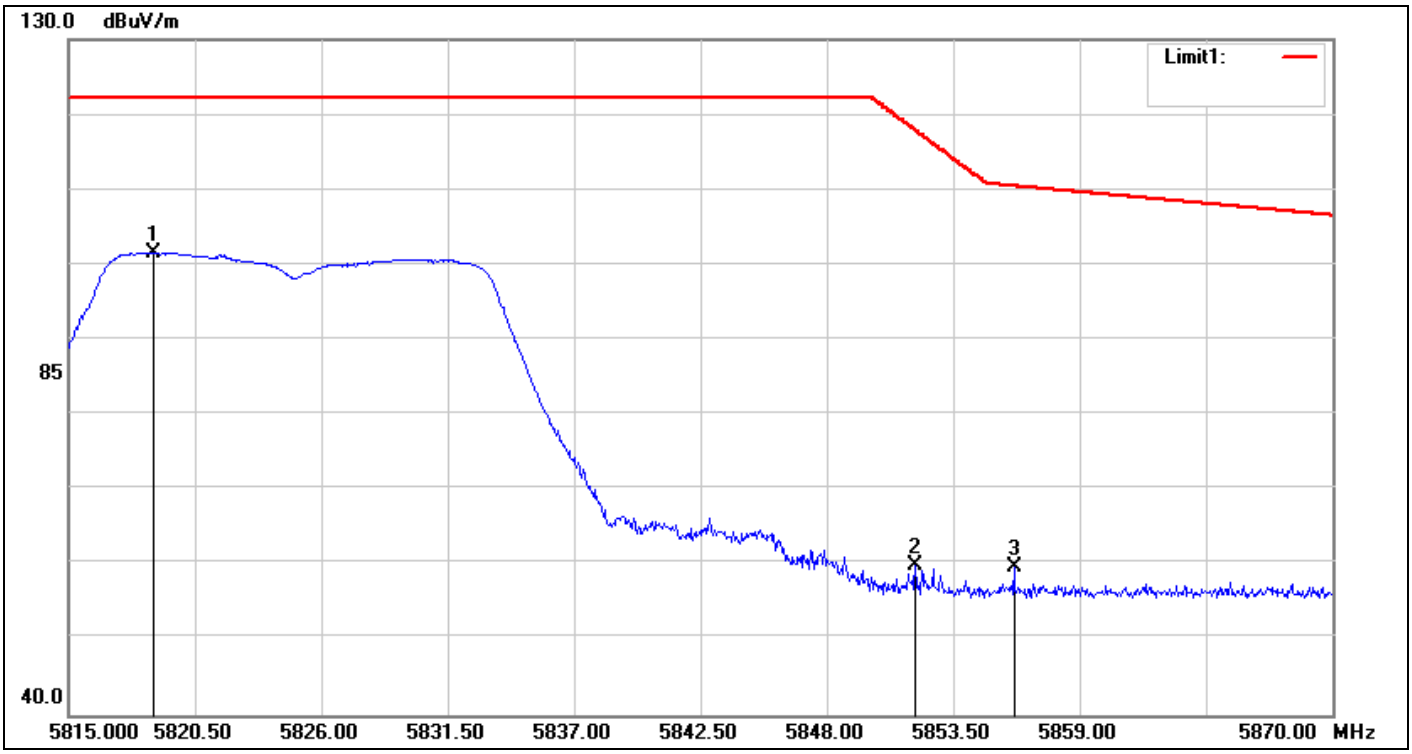
Detector mode: Average



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5705.440	37.66	6.13	43.79	106.72	-62.93	AVG
2	5722.950	37.43	6.20	43.63	117.53	-73.90	AVG
3	5790.610	83.37	6.49	89.86	-	-	AVG
4	5852.490	37.37	6.75	44.12	116.52	-72.40	AVG
5	5865.070	37.56	6.81	44.37	107.98	-63.61	AVG

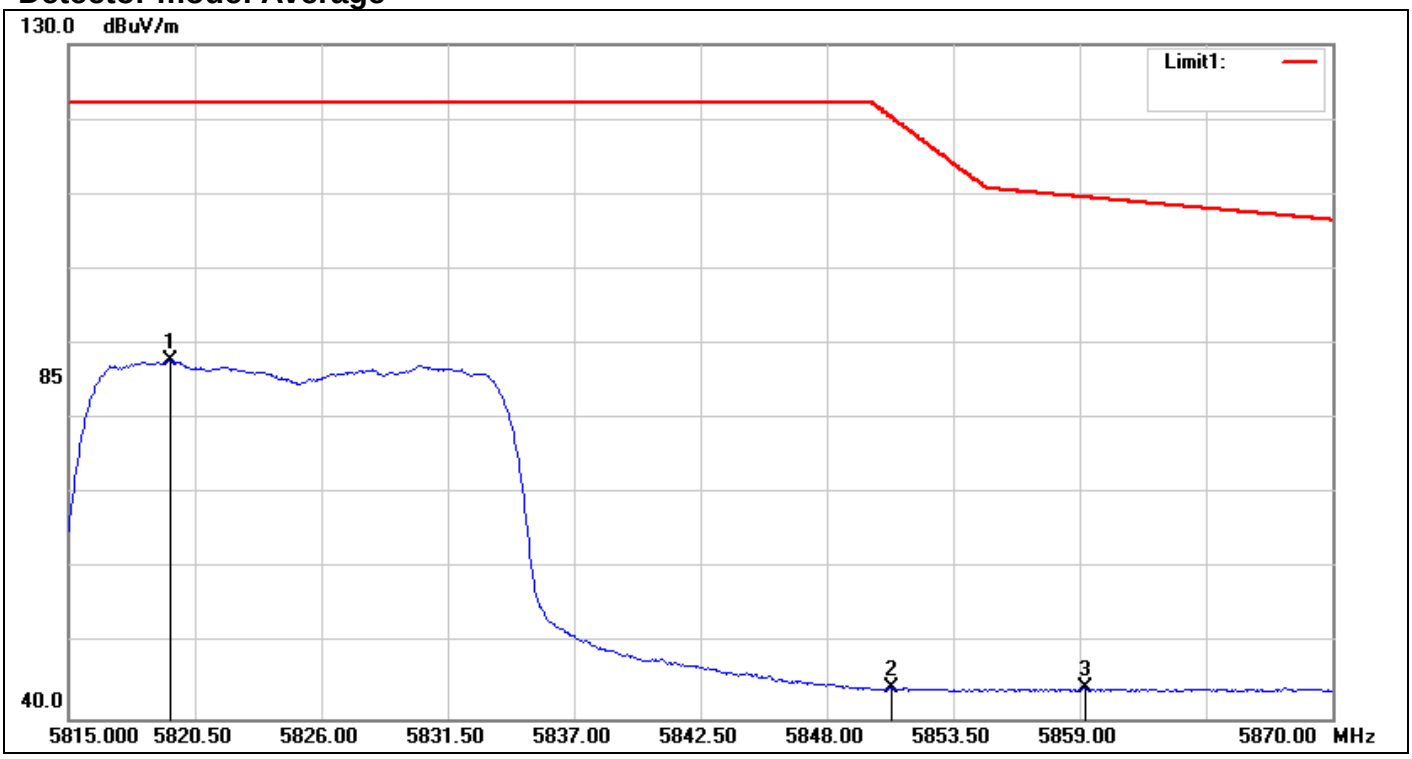
Band Edges (IEEE 802.11n HT 20 MHz mode / CH High)

Detector mode: Peak



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5818.685	94.97	6.61	101.58	-	-	peak
2	5851.850	53.11	6.75	59.86	117.98	-58.12	peak
3	5856.140	52.94	6.77	59.71	110.48	-50.77	peak

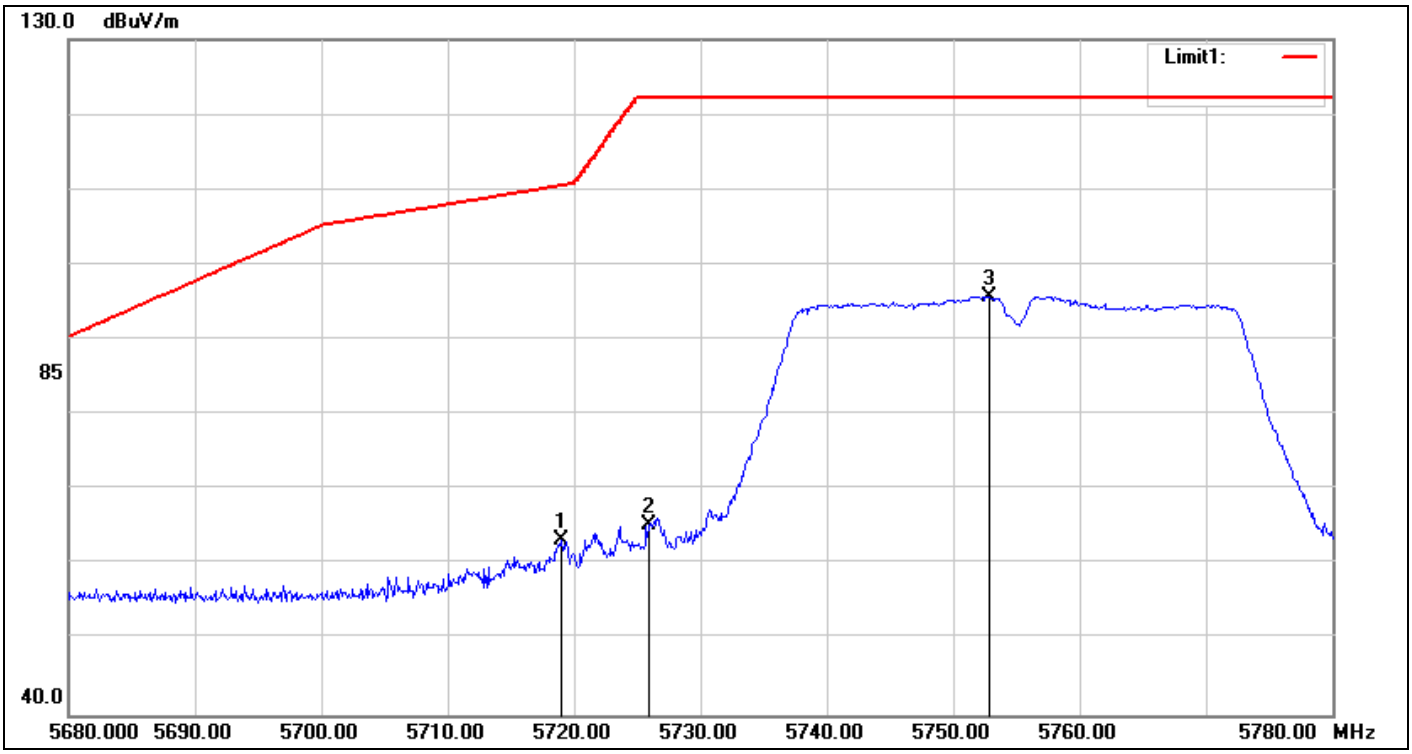
Detector mode: Average



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5819.455	81.22	6.61	87.83	-	-	AVG
2	5850.805	37.41	6.74	44.15	120.36	-76.21	AVG
3	5859.220	37.32	6.78	44.10	109.62	-65.52	AVG

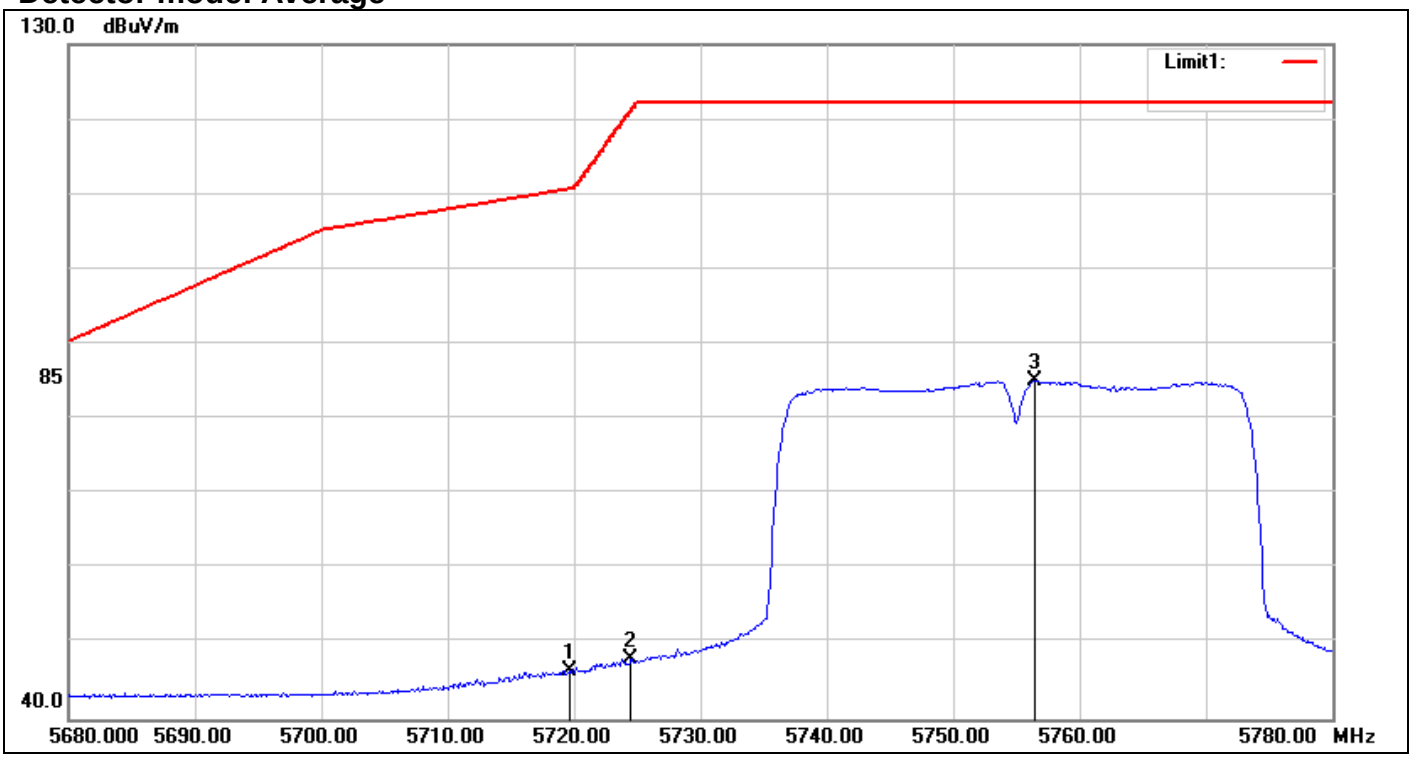
Band Edges (IEEE 802.11n HT 40 MHz mode / CH Low)

Detector mode: Peak



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5719.000	57.12	6.18	63.30	110.52	-47.22	peak
2	5725.900	59.17	6.21	65.38	122.20	-56.82	peak
3	5752.900	89.43	6.33	95.76	-	-	peak

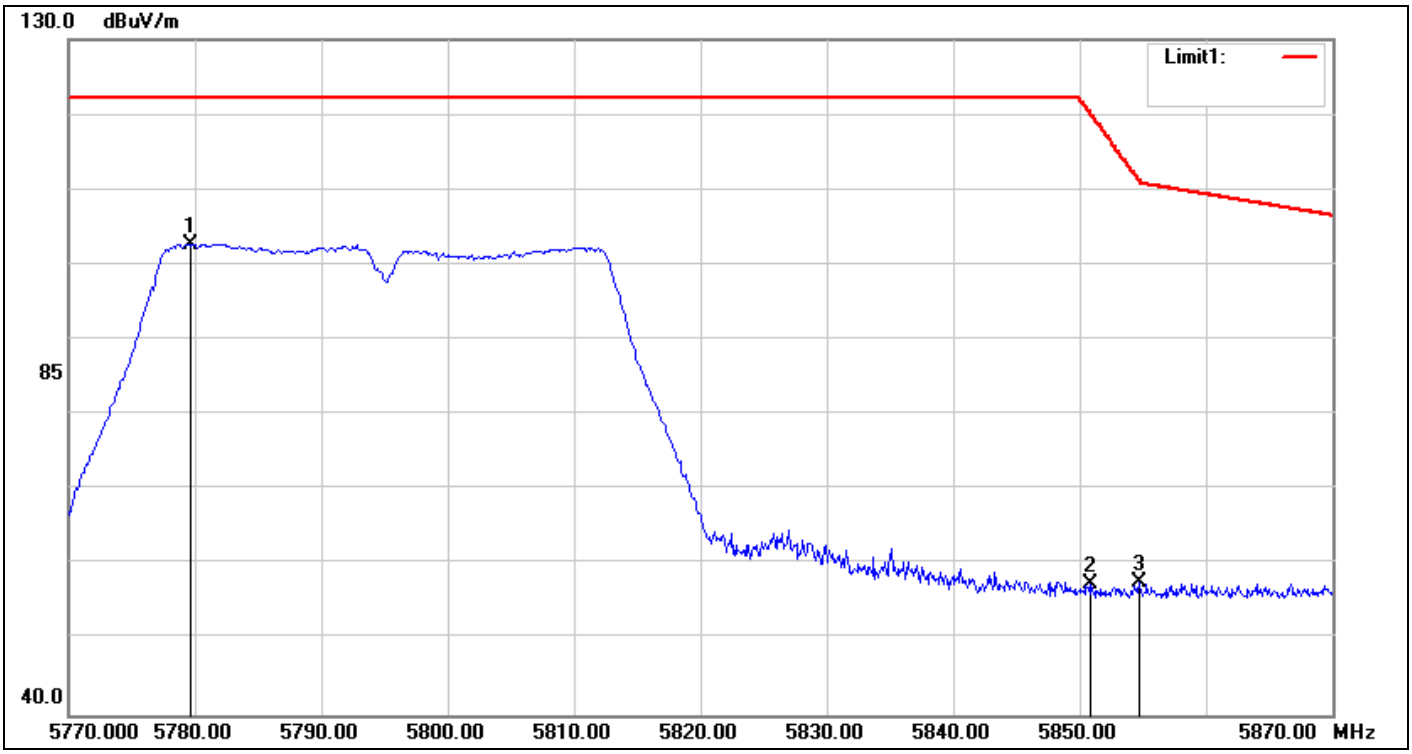
Detector mode: Average



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5719.600	40.33	6.19	46.52	110.69	-64.17	AVG
2	5724.500	41.88	6.21	48.09	121.06	-72.97	AVG
3	5756.400	78.80	6.34	85.14	-	-	AVG

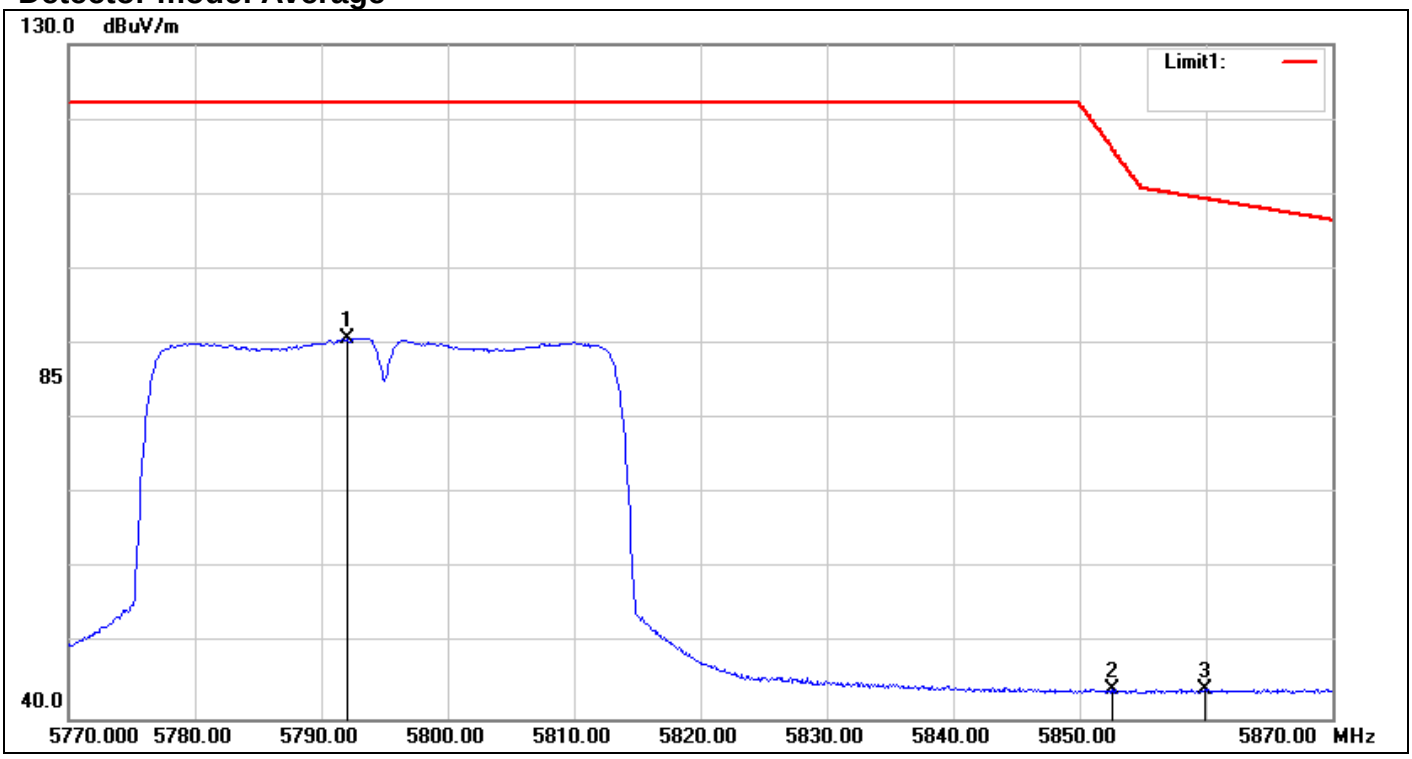
Band Edges (IEEE 802.11n HT 40 MHz mode / CH High)

Detector mode: Peak



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5779.600	96.32	6.44	102.76	-	-	peak
2	5850.900	50.78	6.74	57.52	120.15	-62.63	peak
3	5854.700	50.84	6.76	57.60	111.48	-53.88	peak

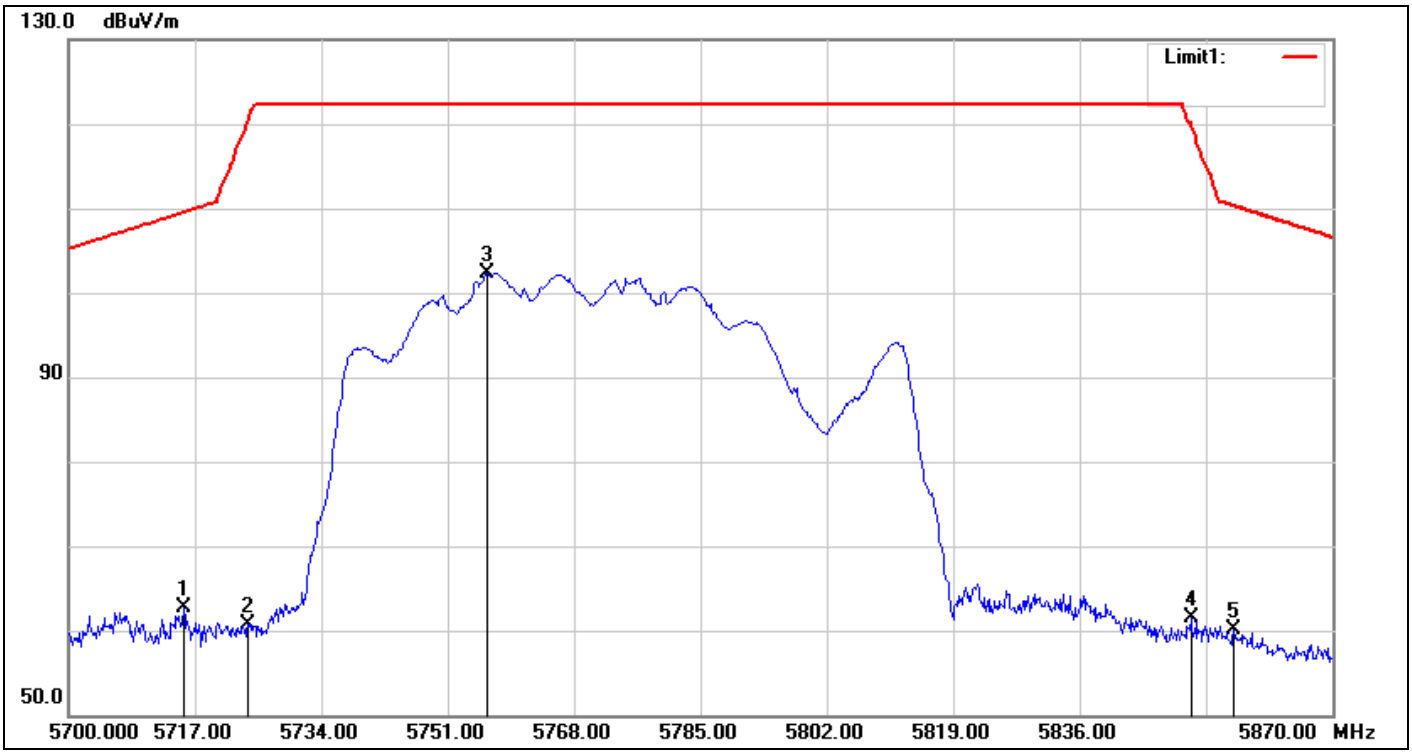
Detector mode: Average



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5792.000	84.35	6.49	90.84	-	-	AVG
2	5852.600	37.18	6.75	43.93	116.27	-72.34	AVG
3	5859.900	37.16	6.78	43.94	109.43	-65.49	AVG

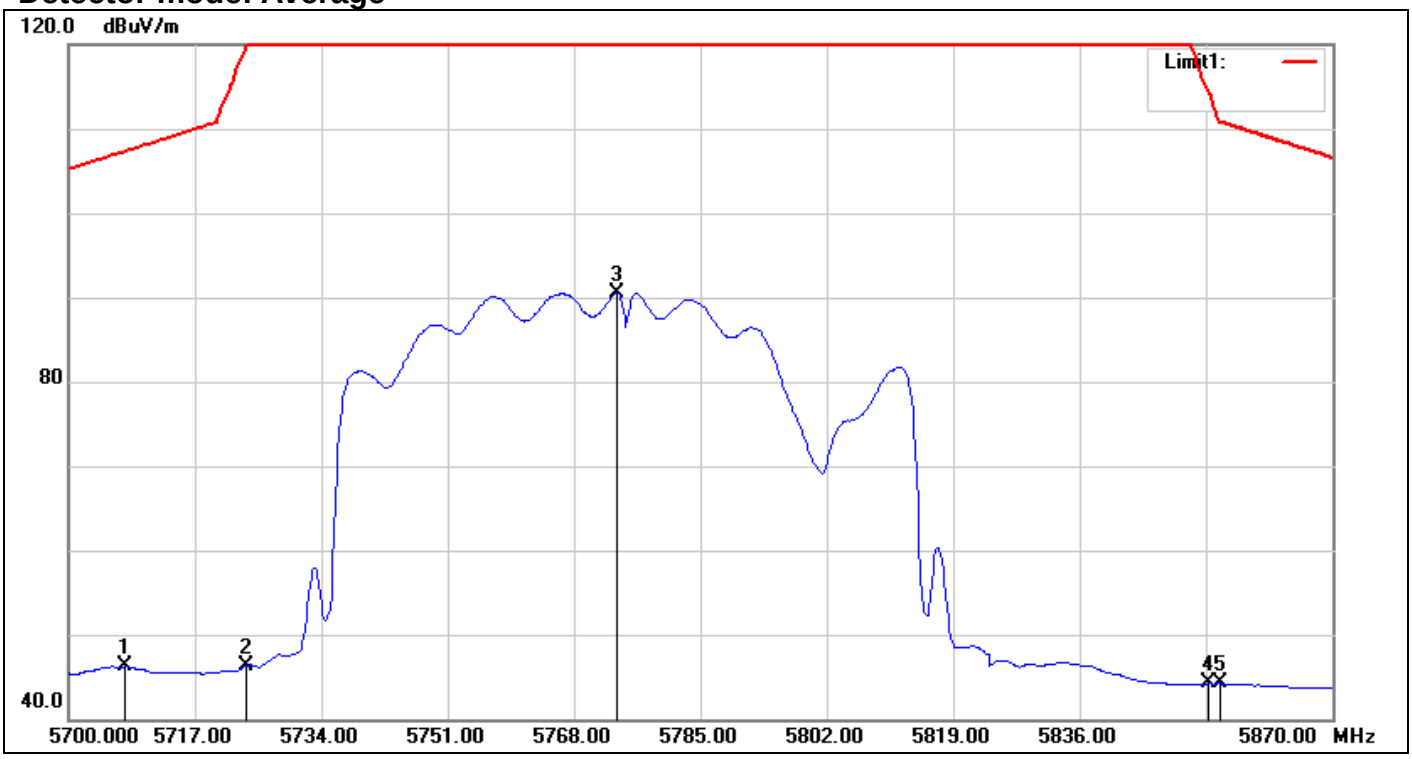
Band Edges (IEEE 802.11ac VHT 80 MHz mode / CH Mid)

Detector mode: Peak



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5715.470	56.48	6.17	62.65	109.53	-46.88	peak
2	5724.140	54.50	6.20	60.70	120.24	-59.54	peak
3	5756.270	96.02	6.34	102.36	-	-	peak
4	5850.960	54.78	6.75	61.53	120.01	-58.48	peak
5	5856.740	53.31	6.77	60.08	110.31	-50.23	peak

Detector mode: Average



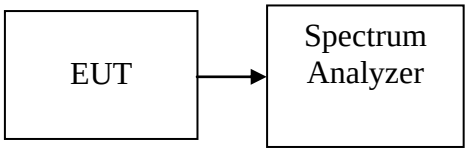
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5707.650	40.12	6.13	46.25	107.34	-61.09	AVG
2	5723.970	40.13	6.20	46.33	119.85	-73.52	AVG
3	5773.780	84.09	6.42	90.51	-	-	AVG
4	5853.340	37.45	6.76	44.21	114.58	-70.37	AVG
5	5854.870	37.45	6.76	44.21	111.10	-66.89	AVG

7.5 PEAK POWER SPECTRAL DENSITY

LIMIT

1. According to §15.407, for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 30 dBm in any 500 kHz band during any time interval of continuous transmission.

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
   Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set the spectrum analyzer as RBW = 500kHz, VBW = 3 x RBW, Span = 1.5 x bandwidth, Sweep=auto
3. Record the max. reading.
4. Repeat the above procedure until the measurements for all frequencies are completed.

TEST RESULTS

No non-compliance noted

Test Data

Test mode: IEEE 802.11a mode/ 5745 ~ 5825MHz

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Result
Low	5745	10.82	30.00	PASS
Mid	5785	11.40		PASS
High	5825	11.78		PASS

Test mode: IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz

Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	PPSD (dBm)	Limit (dBm)	Result
Low	5745	7.67	6.85	10.29	30.00	PASS
Mid	5785	7.25	7.13	10.20		PASS
High	5825	6.53	6.80	9.68		PASS

Test mode: IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz

Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	PPSD (dBm)	Limit (dBm)	Result
Low	5755	3.99	3.06	6.56	30.00	PASS
High	5795	4.45	3.87	7.18		PASS

Test mode: IEEE 802.11ac VHT 80 MHz mode / 5775MHz

Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	PPSD (dBm)	Limit (dBm)	Result
Mid	5775	2.45	5.30	7.12	30.00	PASS

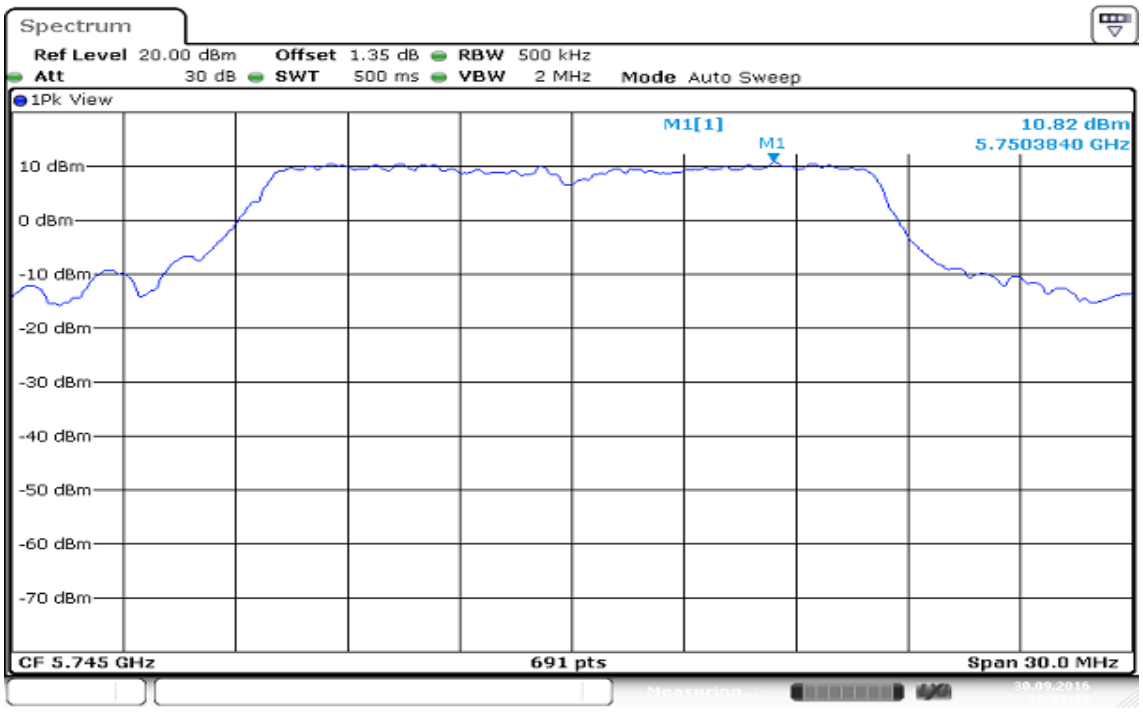
Remark:

*1. Total PPSD (dBm) = 10*LOG(10^(Chain 0 PPSD / 10)+10^(Chain 1 PPSD /10))*

Test Plot

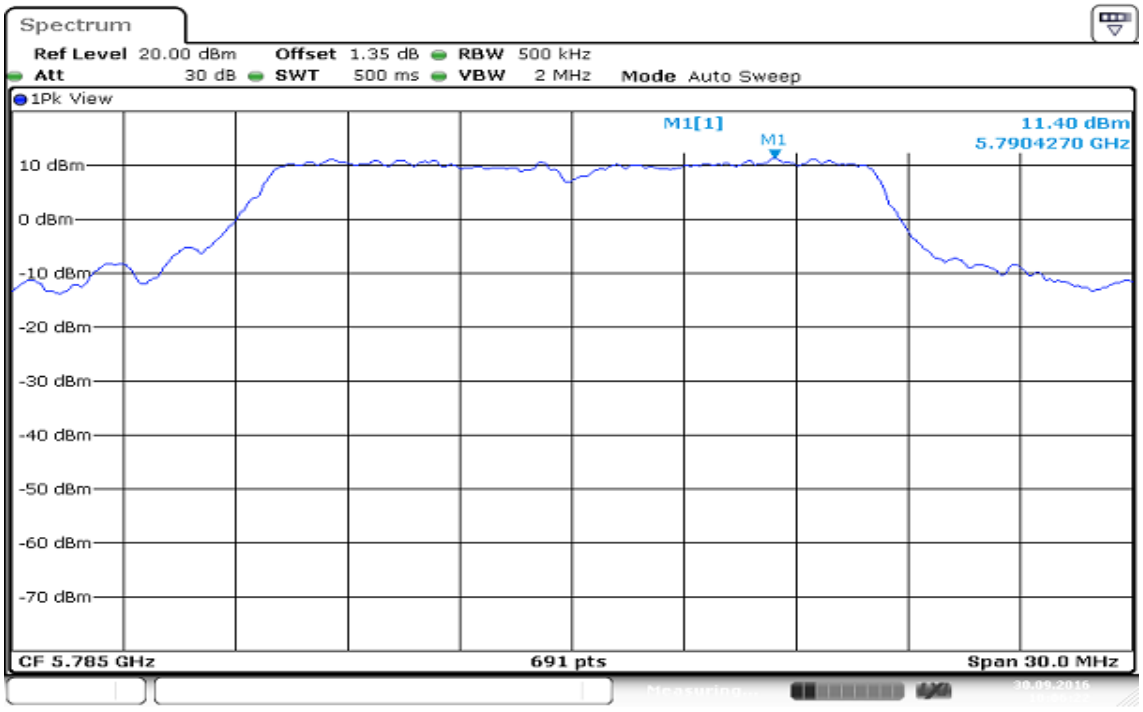
IEEE 802.11a MHz mode / 5745 ~ 5825MHz

PPSD (CH Low)



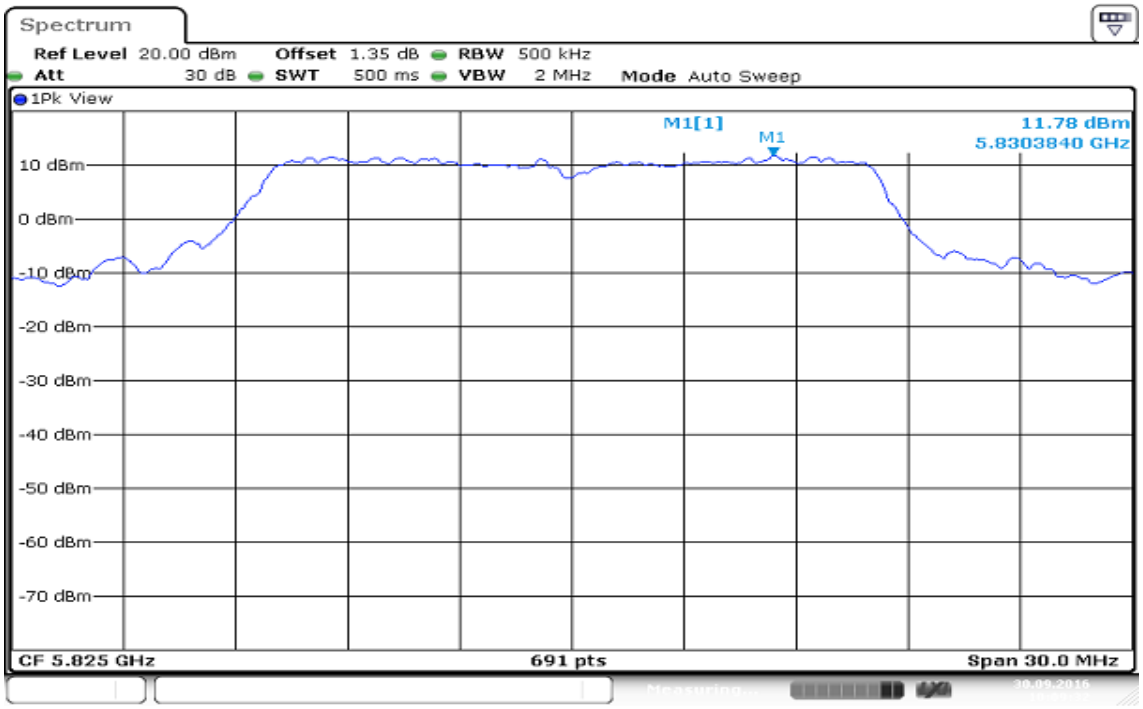
Date: 30.SEP.2016 10:03:30

PPSD (CH Mid)



Date: 30.SEP.2016 10:06:23

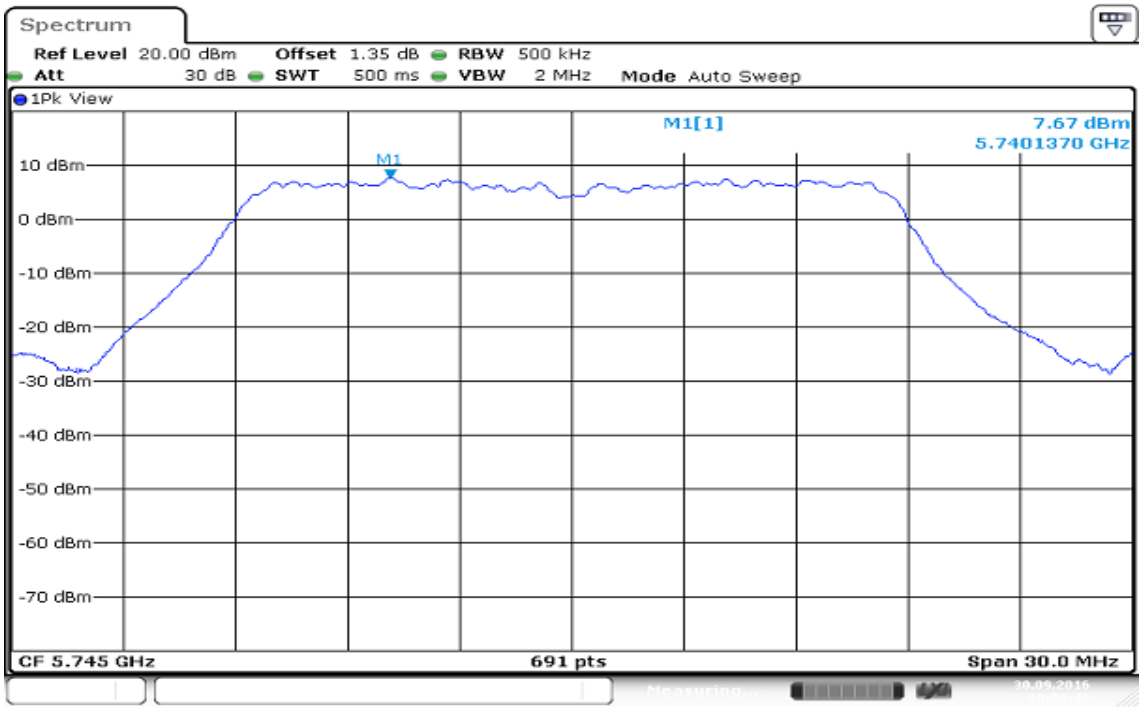
PPSD (CH High)



Date: 30.SEP.2016 10:09:33

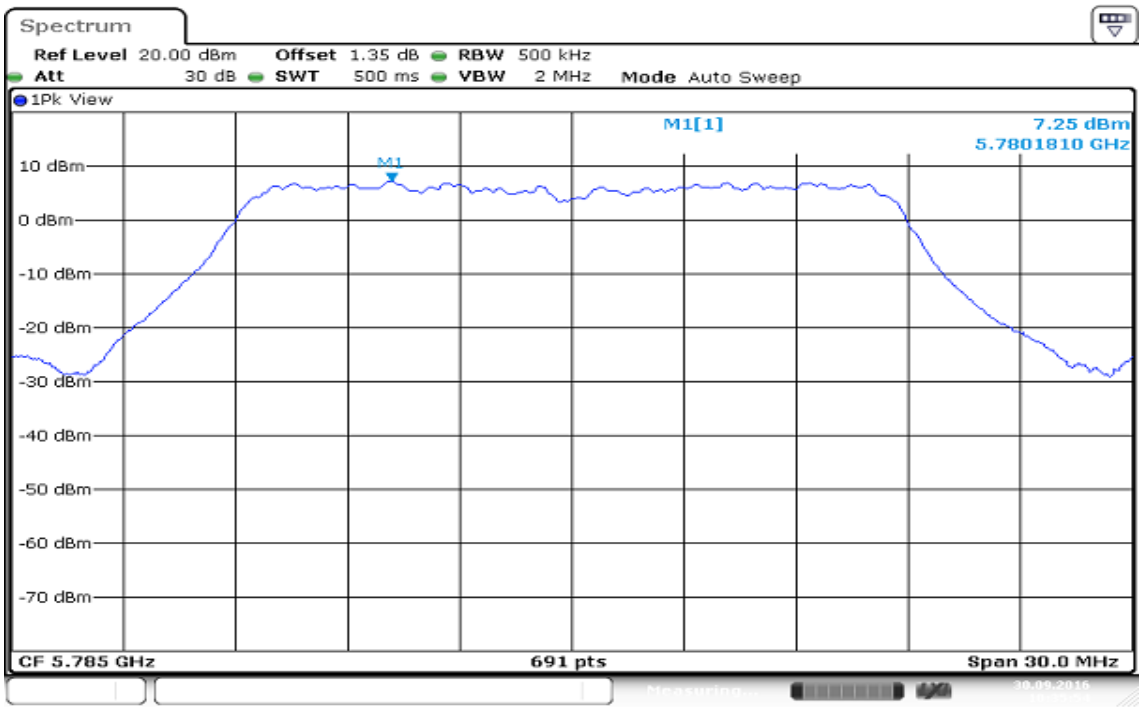
IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz / Chain 0

PPSD (CH Low)



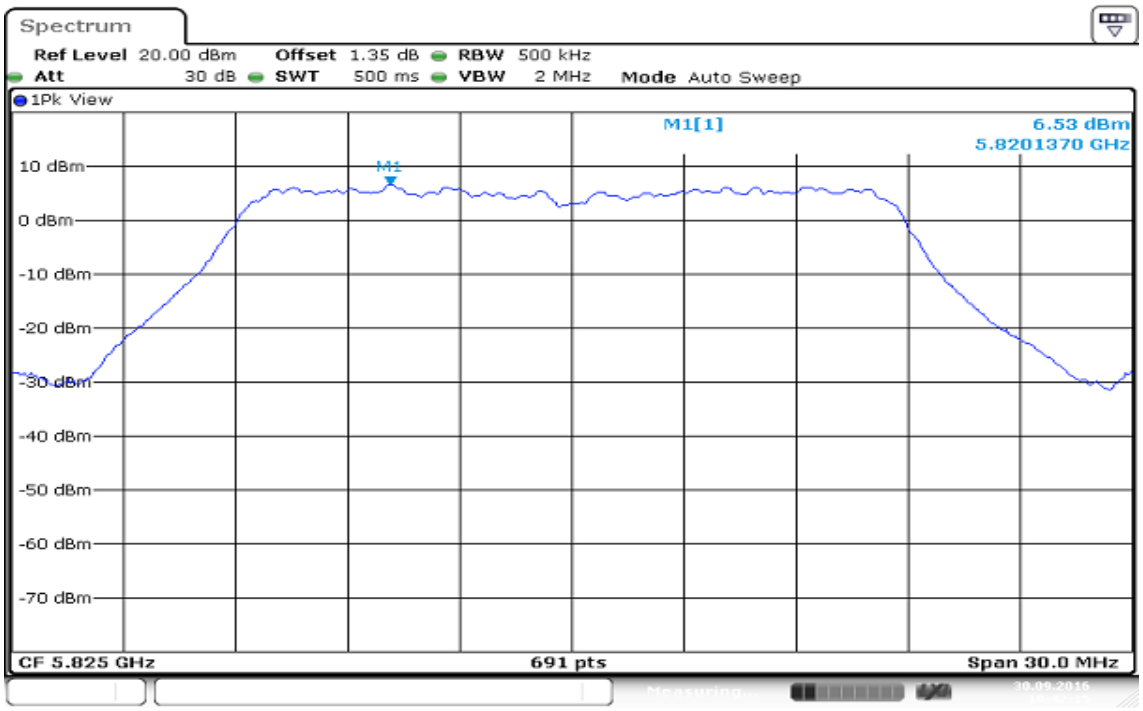
Date: 30.SEP.2016 10:20:42

PPSD (CH Mid)



Date: 30.SEP.2016 10:35:54

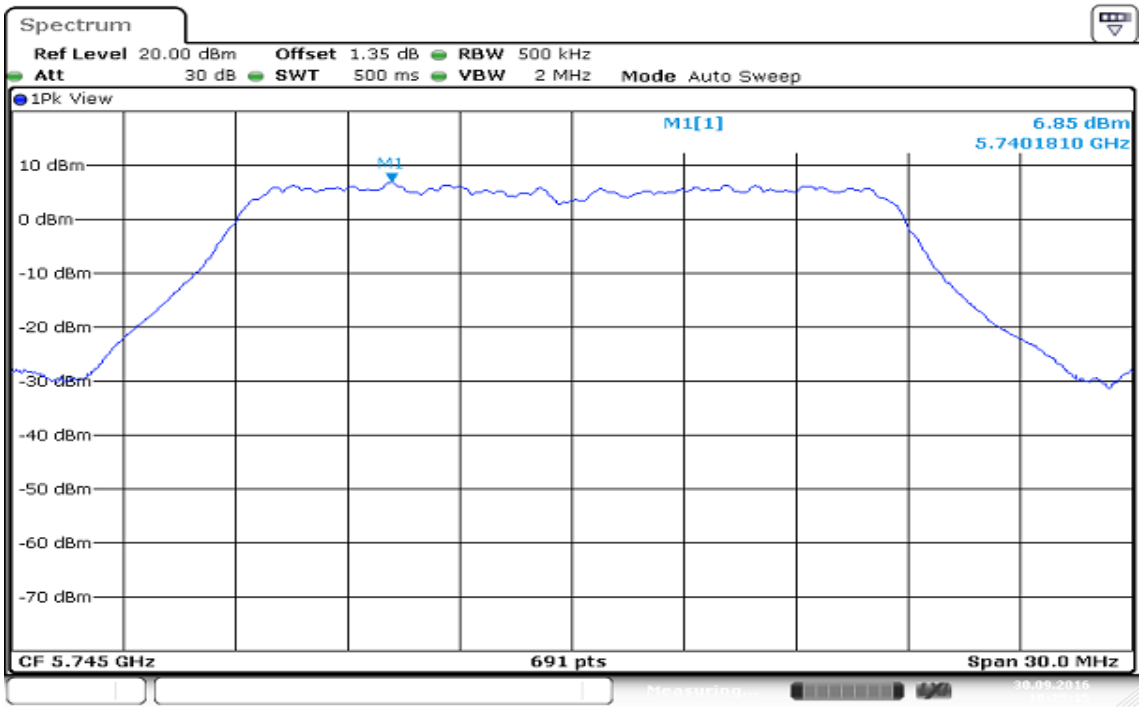
PPSD (CH High)



Date: 30.SEP.2016 10:42:15

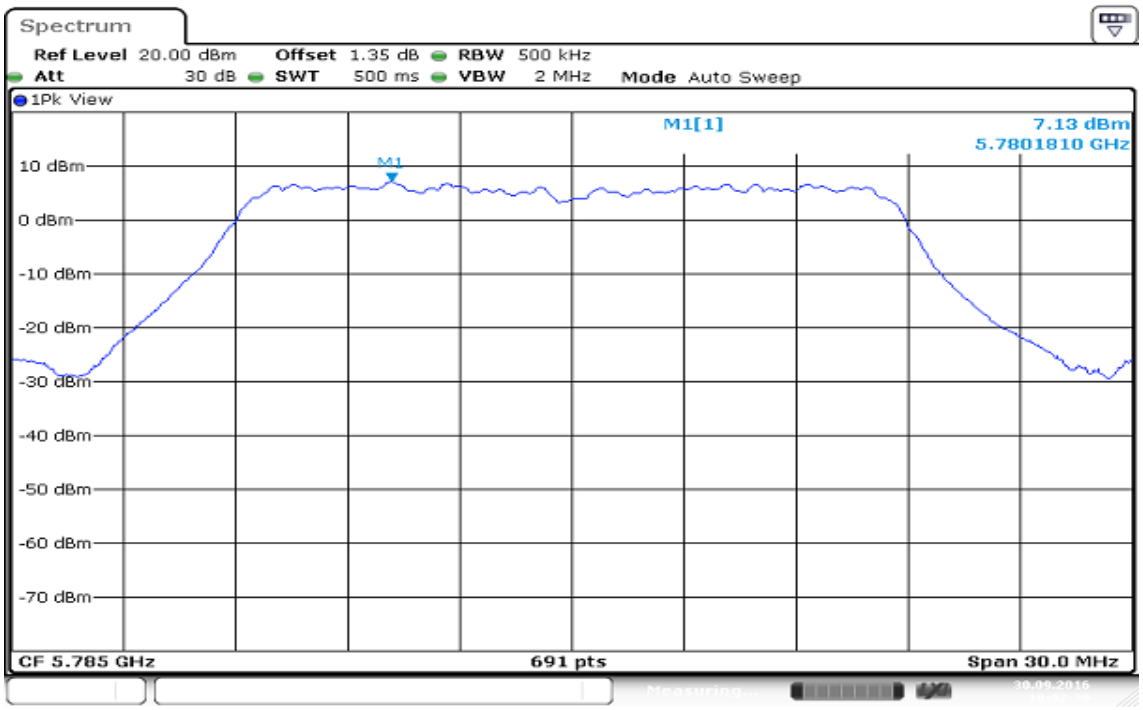
IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz / Chain 1

PPSD (CH Low)



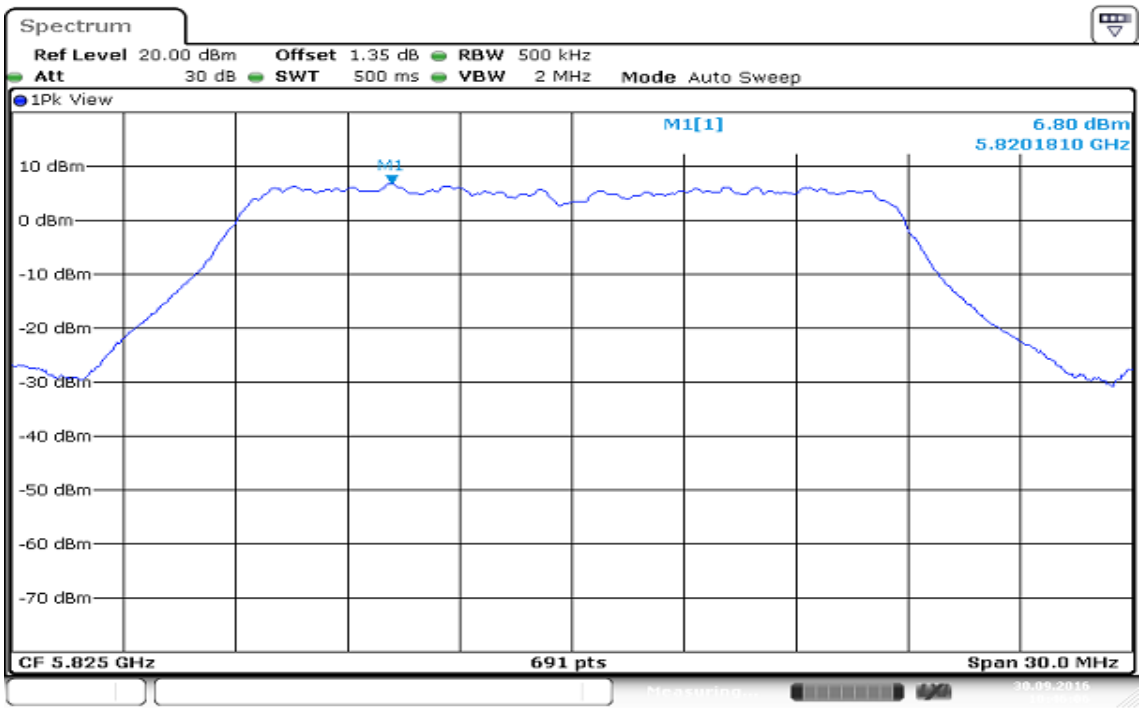
Date: 30.SEP.2016 10:25:15

PPSD (CH Mid)



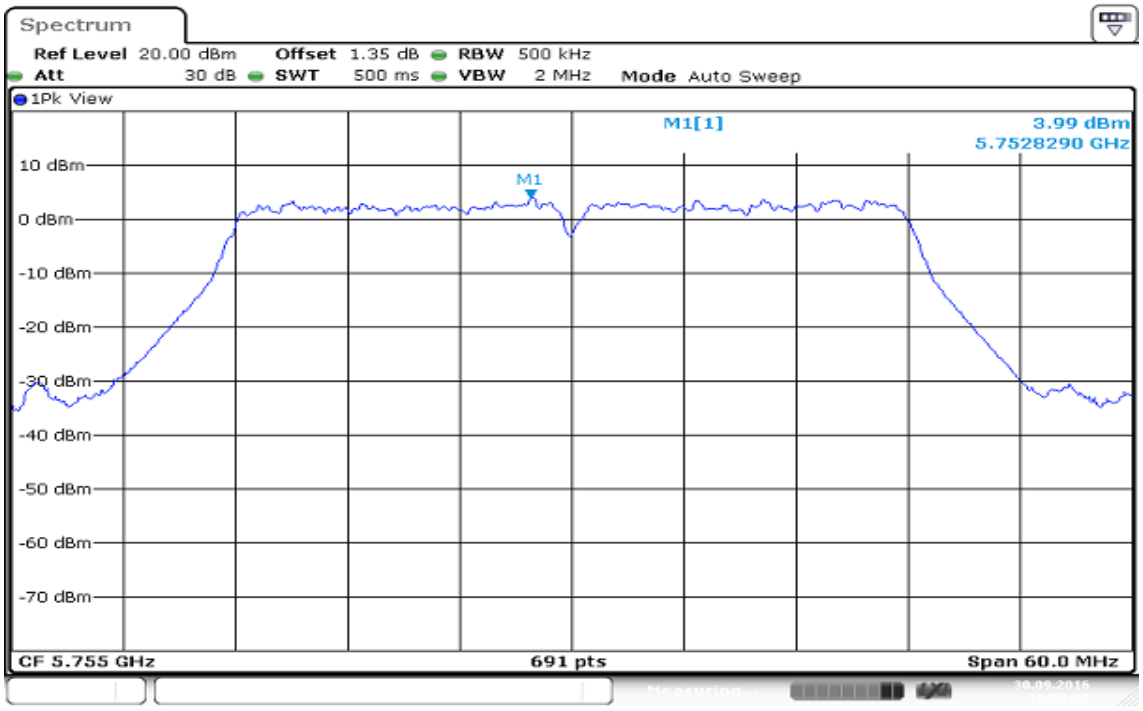
Date: 30.SEP.2016 10:32:30

PPSD (CH High)


Spectrum
Ref Level 20.00 dBm Offset 1.35 dB RBW 500 kHz
Att 30 dB SWT 500 ms VBW 2 MHz Mode Auto Sweep
1Pk View
M1[1]
6.80 dBm
5.8201810 GHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
CF 5.825 GHz
691 pts
Span 30.0 MHz
Date: 30.SEP.2016 10:46:07

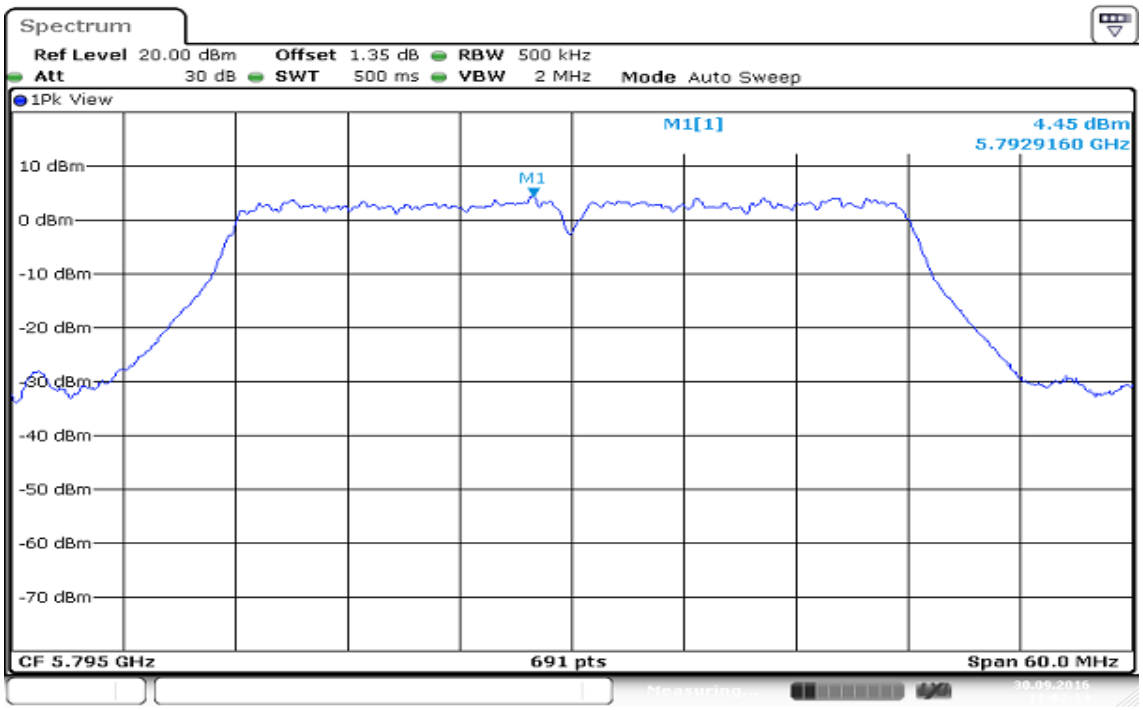
IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz / Chain 0

PPSD (CH Low)



Date: 30.SEP.2016 10:55:25

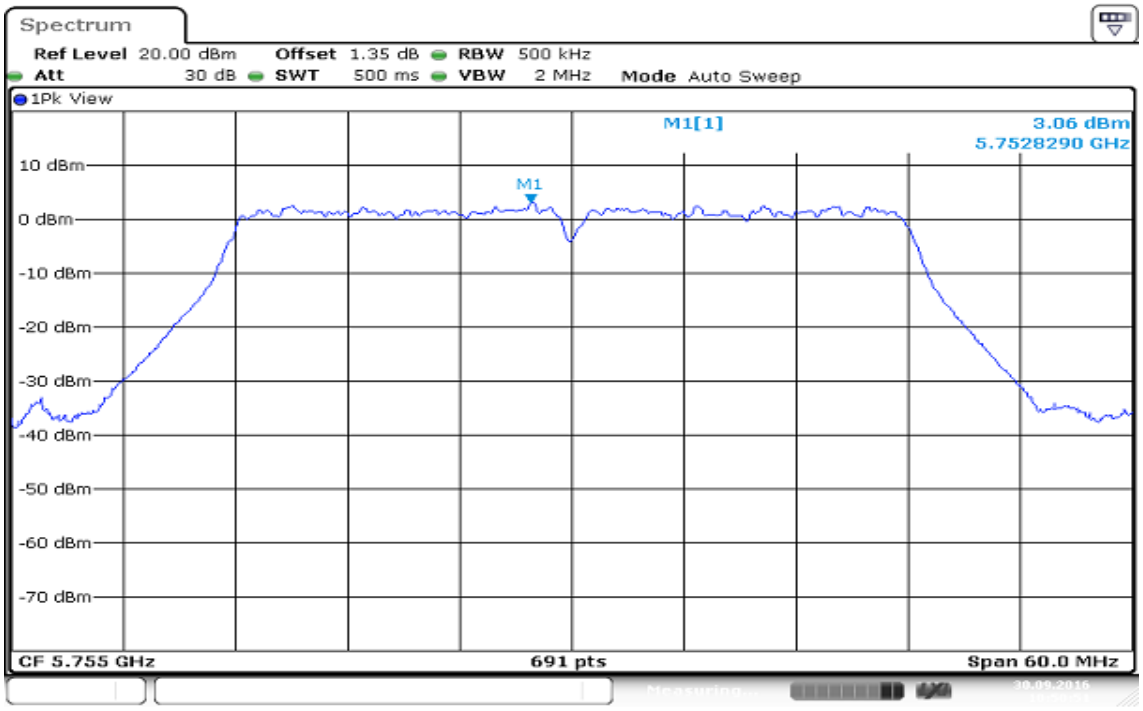
PPSD (CH High)



Date: 30.SEP.2016 11:02:14

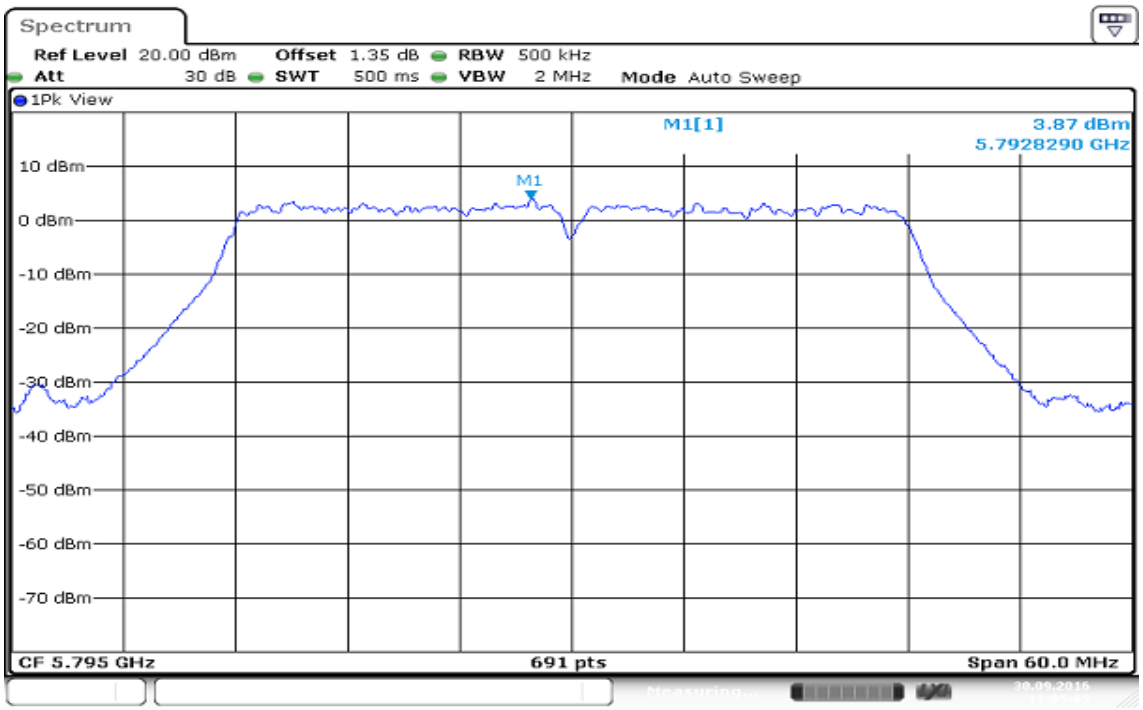
IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz / Chain 1

PPSD (CH Low)



Date: 30.SEP.2016 10:50:51

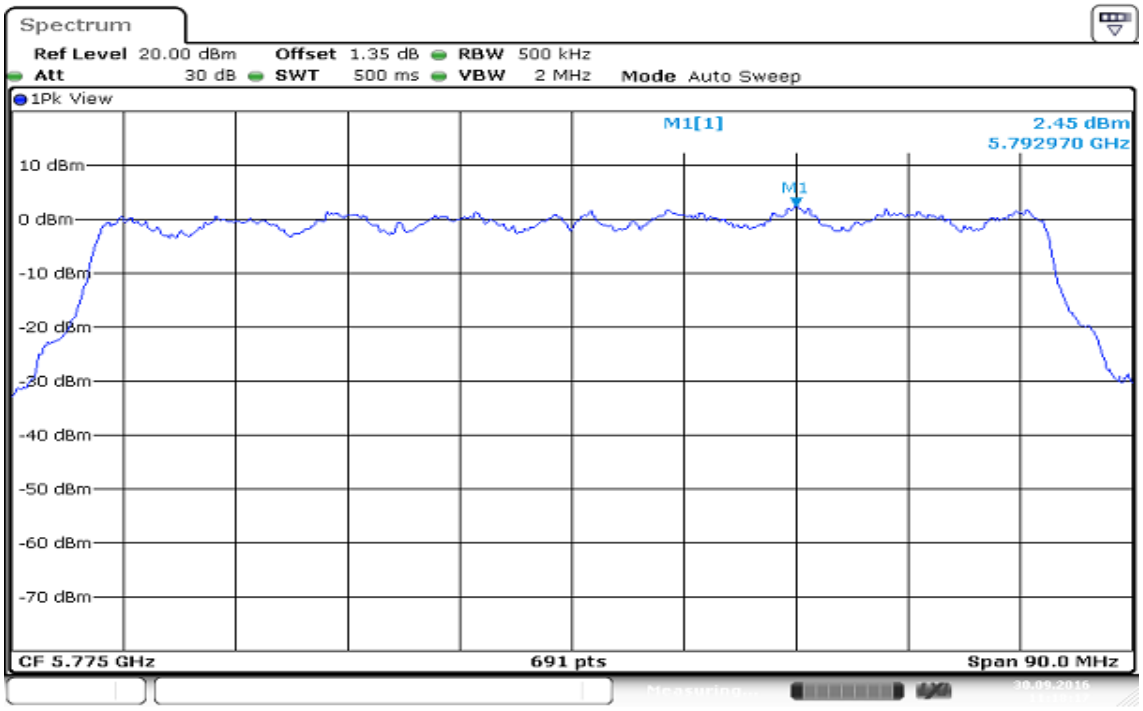
PPSD (CH High)



Date: 30.SEP.2016 11:05:05

IEEE 802.11ac VHT 80 MHz mode / 5775MHz / Chain 0

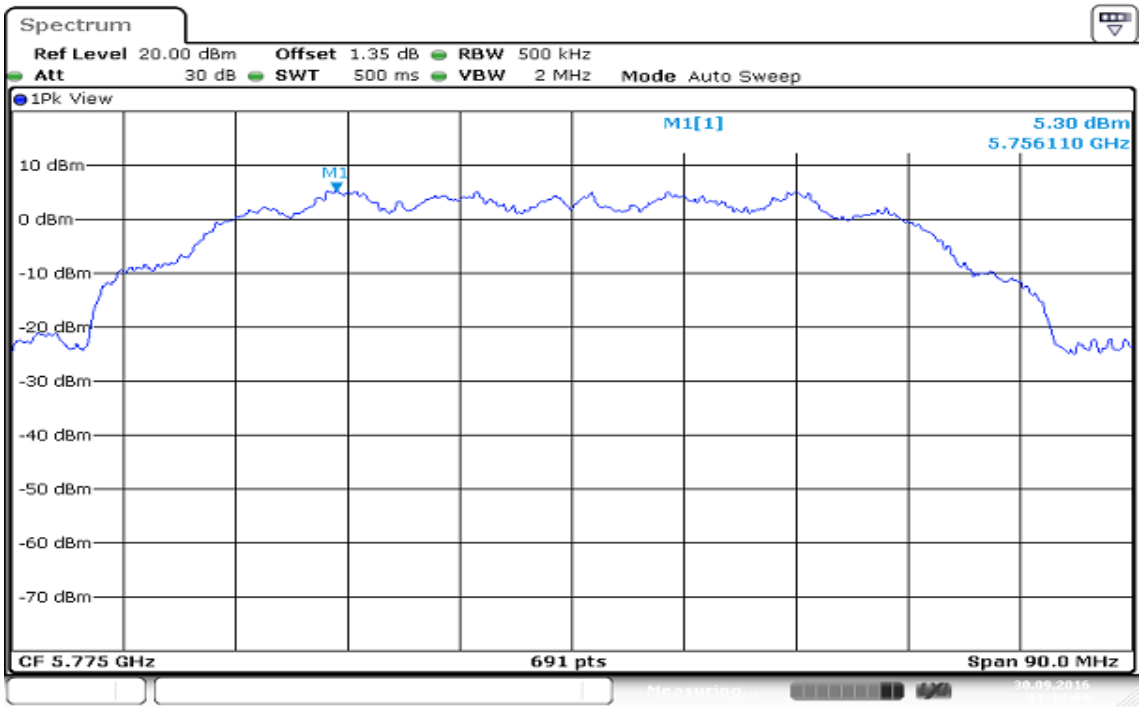
PPSD (CH Mid)



Date: 30.SEP.2016 11:18:17

IEEE 802.11ac VHT 80 MHz mode / 5775MHz / Chain 1

PPSD (CH Mid)



Date: 30.SEP.2016 11:13:09

7.6 RADIATED EMISSIONS

LIMIT

1. According to §15.209(a), except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

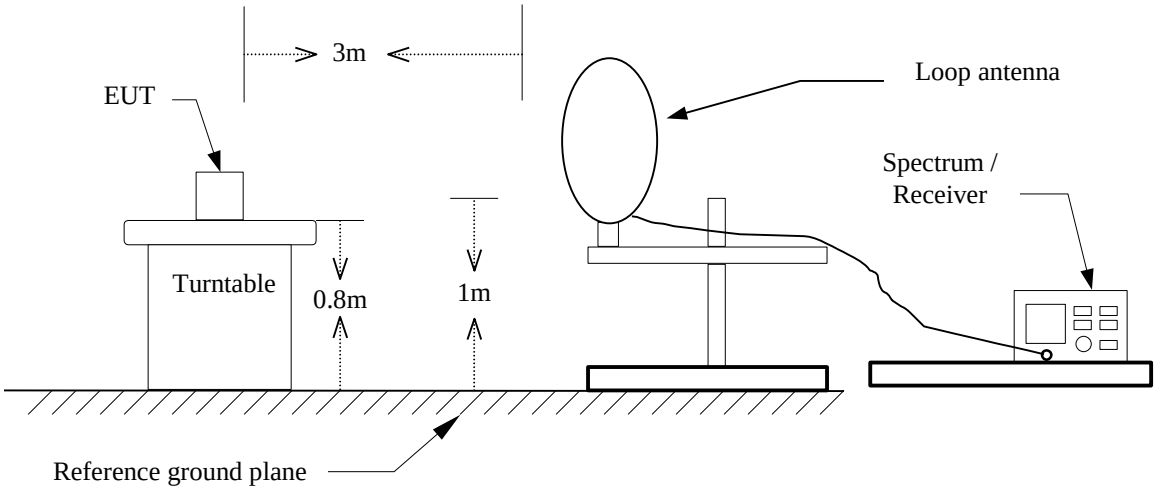
Remark: *Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.*

2. In the emission table above, the tighter limit applies at the band edges.

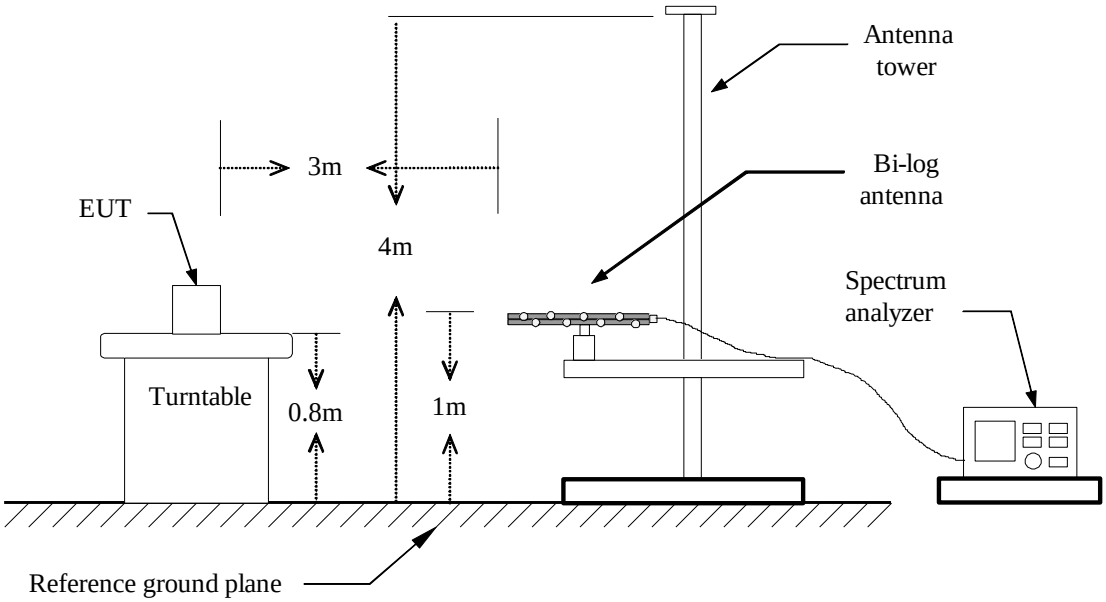
Frequency (MHz)	Field Strength (μV/m at 3-meter)	Field Strength (dBμV/m at 3-meter)
0.009 - 0.490	2400/F(kHz) +80	20LOG((2400/F(kHz))+80)
0.490 - 1.705	24000/F(kHz) +40	20LOG((24000/F(kHz))+40)
1.705 – 30.0	30	69.54
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

Test Configuration

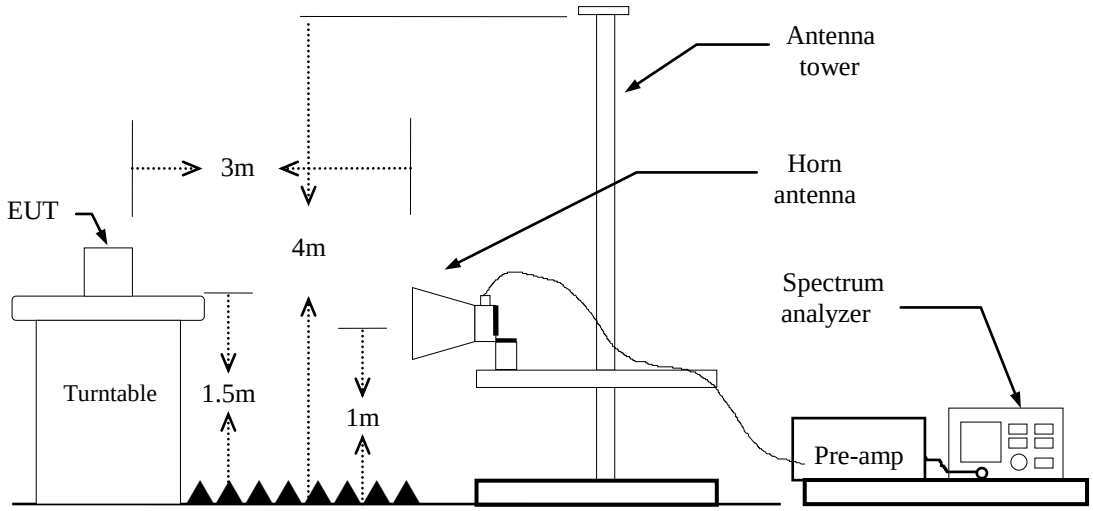
9kHz ~ 30MHz



30MHz ~ 1GHz



Above 1 GHz


Antenna
tower
Horn
antenna
Spectrum
analyzer
3m
EUT
4m
Turntable
1.5m
1m
Pre-amp

TEST PROCEDURE

1. The EUT is placed on a turntable, Above 1 GHz is 1.5m high and below 1 GHz is 0.8m high above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Set the spectrum analyzer in the following setting as:

   Below 1GHz:

   RBW=100kHz / VBW=300kHz / Sweep=AUTO

   Above 1GHz:

   (a) PEAK: RBW=VBW=1MHz / Sweep=AUTO
   (b) AVERAGE: RBW=1MHz,
   if duty cycle≧98%, VBW=10Hz.
   if duty cycle<98% VBW=1/T.

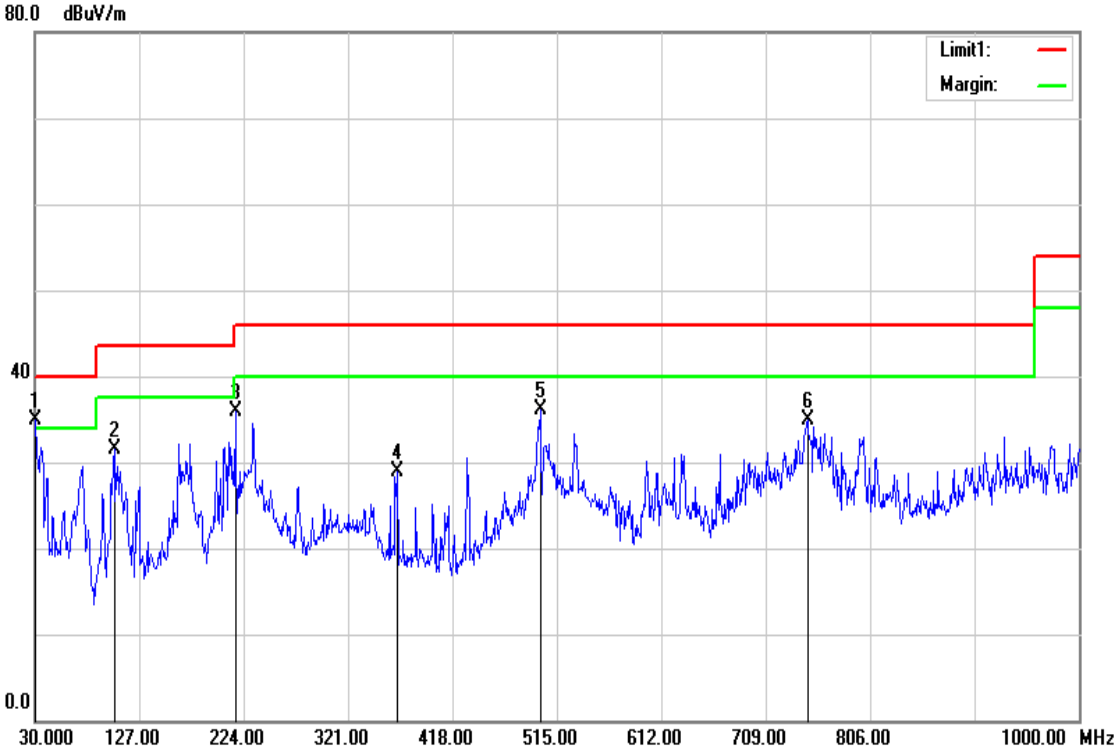
   IEEE 802.11a mode: ≧98%, VBW=10Hz
   IEEE 802.11n HT 20 MHz mode: =96%, VBW=820Hz
   IEEE 802.11n HT 40 MHz mode: =85%, VBW=1.6kHz
   IEEE 802.11ac VHT 80 MHz mode: =48%, VBW=3kHz

7. Repeat above procedures until the measurements for all frequencies are complete.
8. Result = Spectrum Reading + cable loss(spectrum to Amp) - Amp Gain + Cable loss(Amp to receive Ant)+ Receive Ant

Note: We checked every harmonics frequencies from Fundamental frequencies with reduced VBW, and we mark a point to prove pass or not if we find any emission. For this case, there are no emissions hidden in the noise floor.

Below 1 GHz

Operation Mode: Normal Link
Test Date: April 22, 2014
Temperature: 27°C
Tested by: David Shu
Humidity: 53% RH
Polarity: Ver.

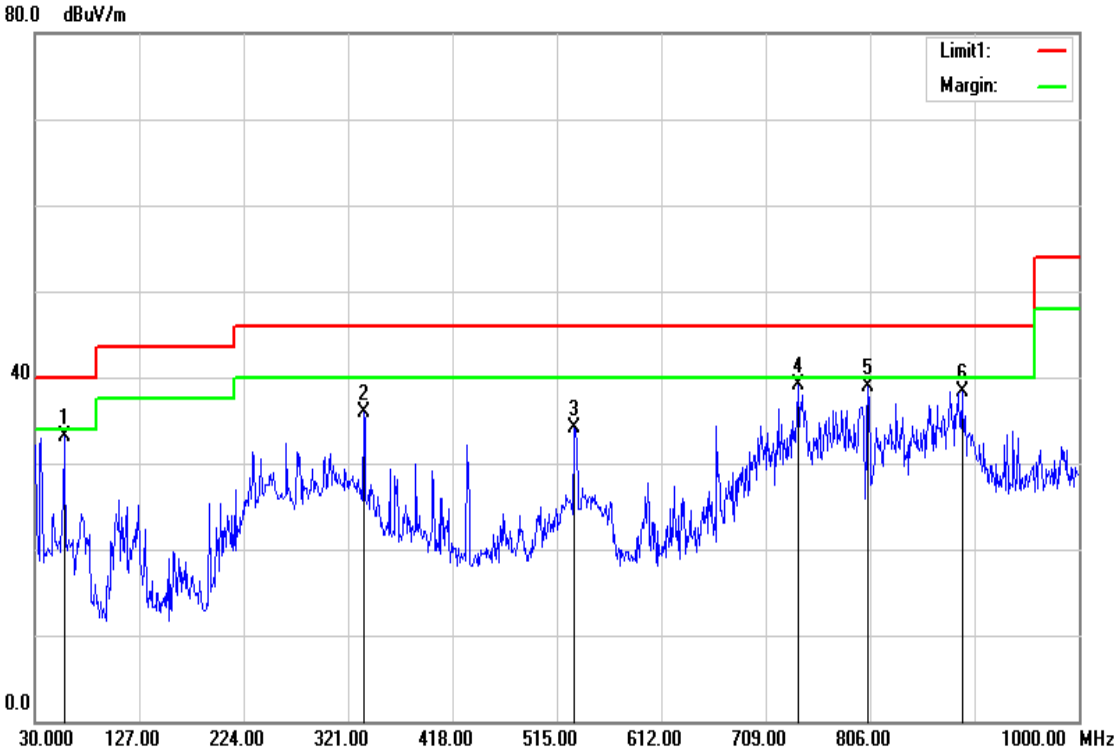


Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
30.9700	45.54	-10.58	34.96	40.00	-5.04	peak	V
103.7200	51.76	-20.26	31.50	43.50	-12.00	peak	V
216.2400	54.58	-18.72	35.86	46.00	-10.14	peak	V
366.5900	43.62	-14.80	28.82	46.00	-17.18	peak	V
499.4800	47.93	-11.84	36.09	46.00	-9.91	peak	V
747.8000	42.88	-7.92	34.96	46.00	-11.04	peak	V

Remark:

1. *No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).*
2. *Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using peak/quasi-peak detector mode.*
3. *Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.*
4. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
5. *Margin (dB) = Remark result (dBuV/m) – Quasi-peak limit (dBuV/m).*

Operation Mode: Normal Link
Test Date: April 22, 2014
Temperature: 27°C
Tested by: David Shu
Humidity: 53% RH
Polarity: Hor.



Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
57.1600	56.82	-23.64	33.18	40.00	-6.82	peak	H
335.5500	51.36	-15.54	35.82	46.00	-10.18	peak	H
531.4900	45.36	-11.31	34.05	46.00	-11.95	peak	H
739.0700	47.10	-8.08	39.02	46.00	-6.98	peak	H
804.0600	46.23	-7.33	38.90	46.00	-7.10	peak	H
891.3600	44.61	-6.27	38.34	46.00	-7.66	peak	H

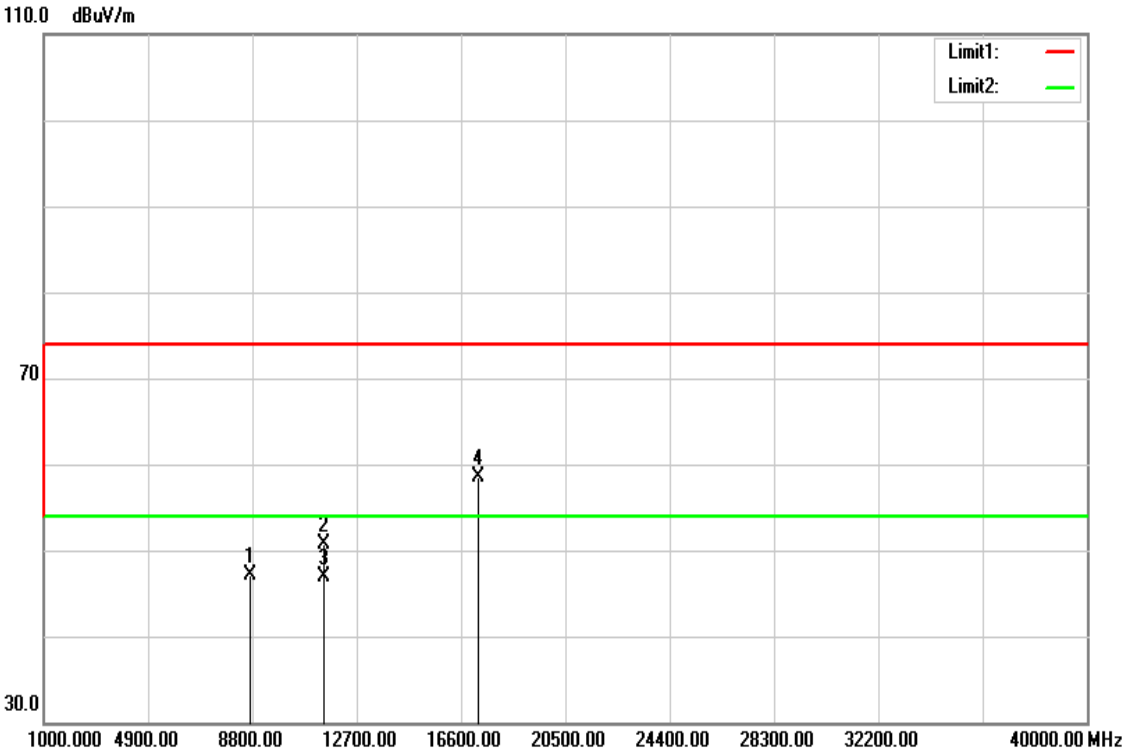
Remark:

1. *No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).*
2. *Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using peak/quasi-peak detector mode.*
3. *Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.*
4. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
5. *Margin (dB) = Remark result (dBuV/m) – Quasi-peak limit (dBuV/m).*

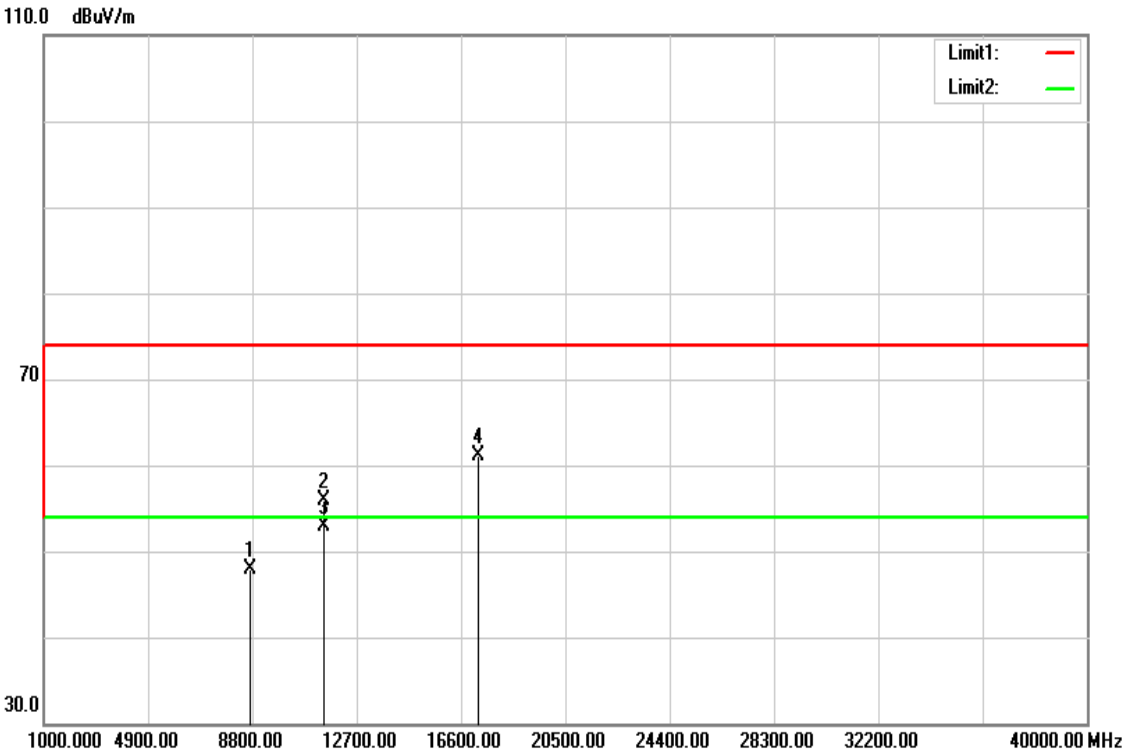
Above 1 GHz

TX / IEEE 802.11a mode / CH Low

Polarity: Vertical



Polarity: Horizontal



Operation Mode:	TX / IEEE 802.11a mode / CH Low	**Test Date:**	September 30, 2016
Temperature:	27°C	**Tested by:**	Dennis Li
Humidity:	53% RH	**Polarity:**	Ver. / Hor.

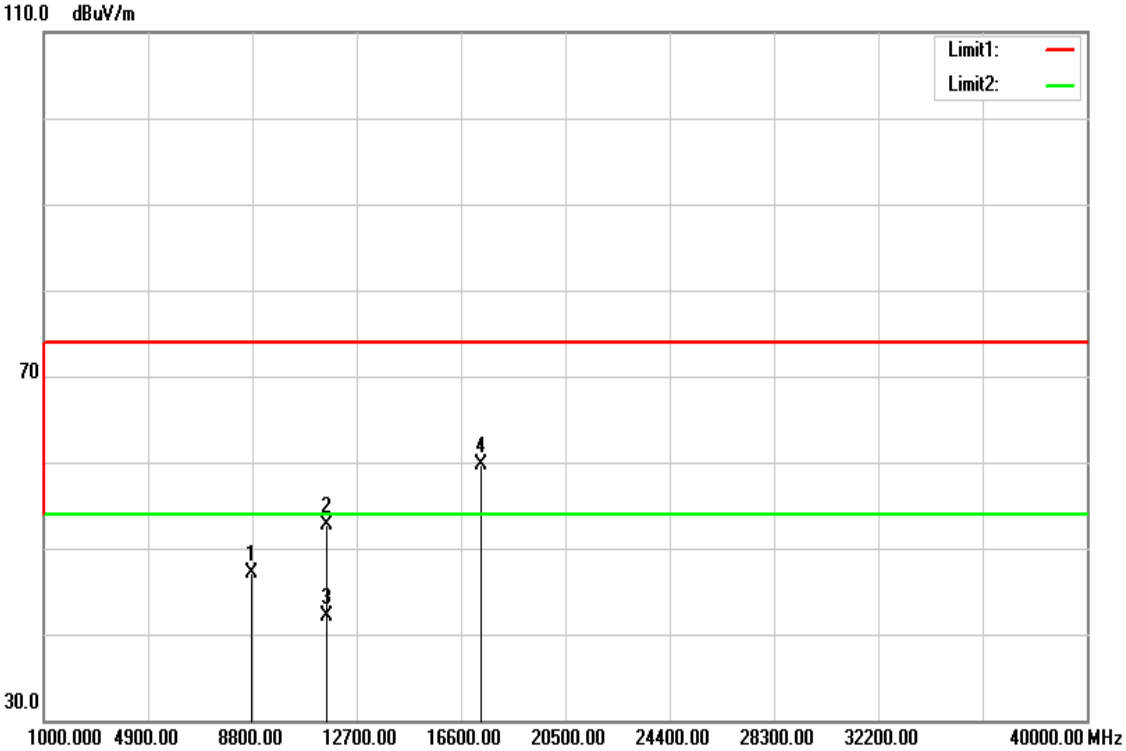
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
8710.000	33.42	13.74	47.16	74.00	-26.84	peak	V
11490.000	33.89	16.78	50.67	74.00	-23.33	peak	V
11490.000	30.12	16.78	46.90	54.00	-7.10	AVG	V
17235.000	33.13	25.28	58.41	74.00	-15.59	peak	V
N/A							
8720.000	34.10	13.74	47.84	74.00	-26.16	peak	H
11490.000	39.10	16.78	55.88	74.00	-18.12	peak	H
11490.000	36.16	16.78	52.94	54.00	-1.06	AVG	H
17235.000	35.91	25.28	61.19	74.00	-12.81	peak	H
N/A							

Remark:

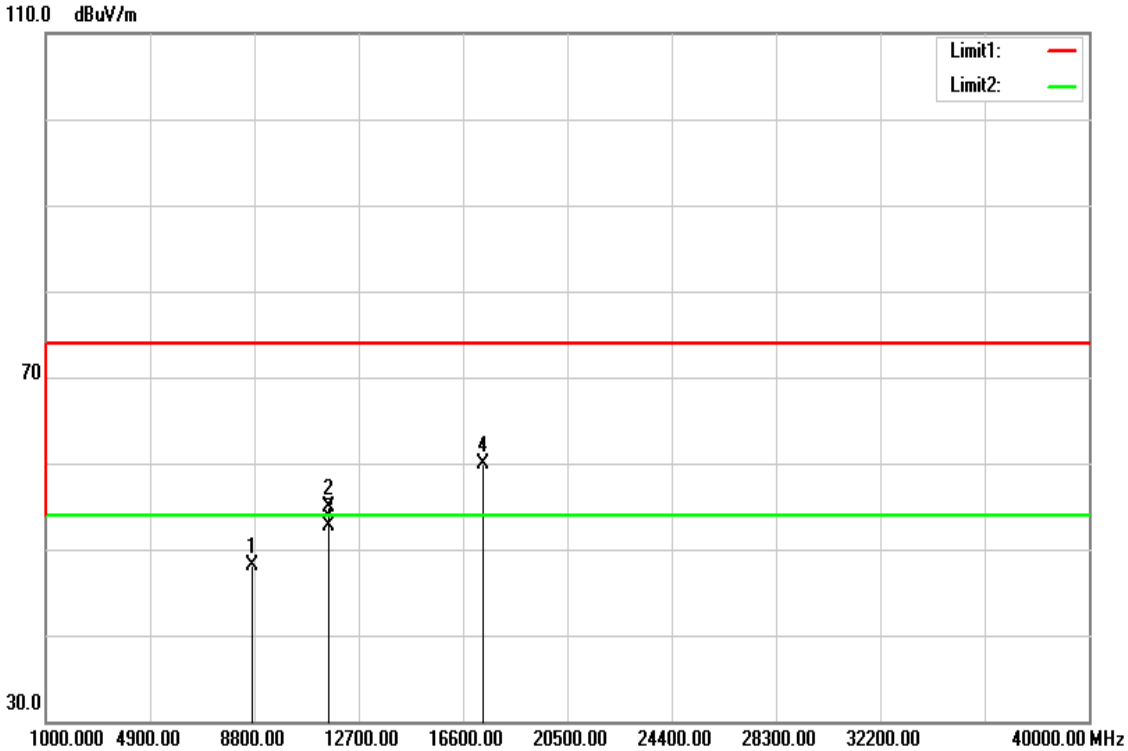
1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

TX / IEEE 802.11a mode / CH Mid

Polarity: Vertical



Polarity: Horizontal



Operation Mode:	TX / IEEE 802.11a mode / CH Mid	**Test Date:**	September 30, 2016
Temperature:	27°C	**Tested by:**	Dennis Li
Humidity:	53% RH	**Polarity:**	Ver. / Hor.

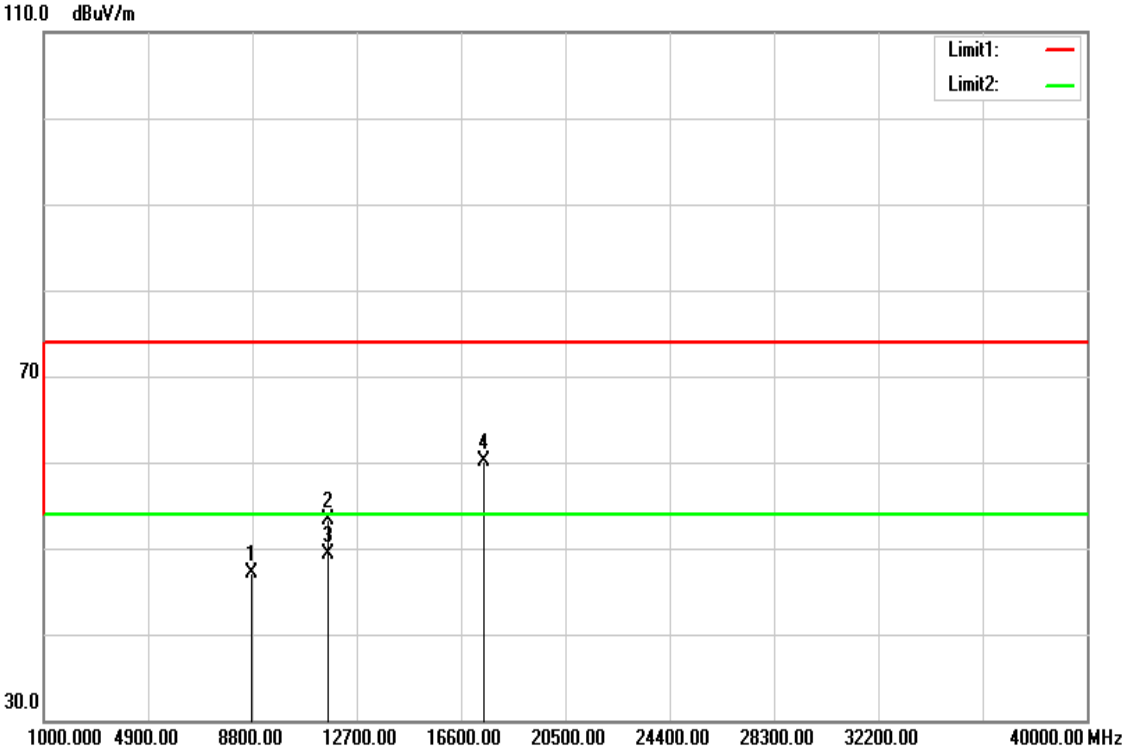
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
8750.000	33.26	13.75	47.01	74.00	-26.99	peak	V
11570.000	35.86	16.84	52.70	74.00	-21.30	peak	V
11570.000	25.33	16.84	42.17	54.00	-11.83	AVG	V
17355.000	33.97	25.75	59.72	74.00	-14.28	peak	V
N/A							
8730.000	34.32	13.75	48.07	74.00	-25.93	peak	H
11570.000	38.12	16.84	54.96	74.00	-19.04	peak	H
11570.000	35.84	16.84	52.68	54.00	-1.32	AVG	H
17355.000	34.13	25.75	59.88	74.00	-14.12	peak	H
N/A							

Remark:

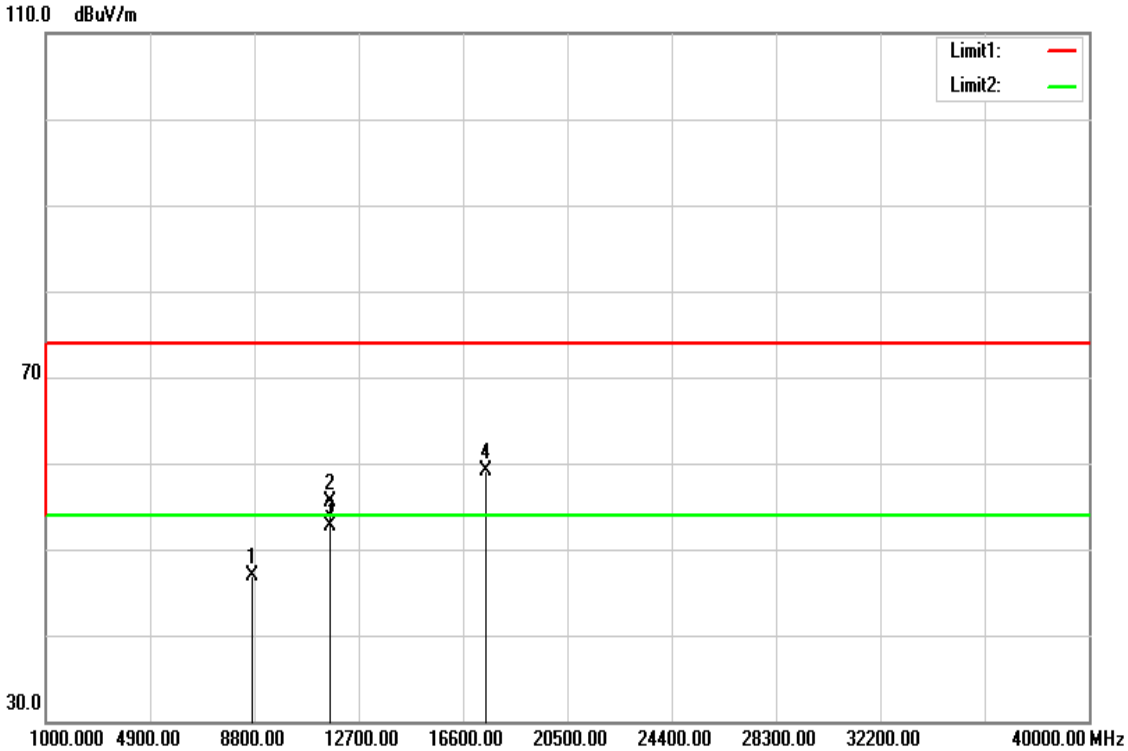
1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

TX / IEEE 802.11a mode / CH High

Polarity: Vertical



Polarity: Horizontal



Operation Mode:	TX / IEEE 802.11a mode / CH High	**Test Date:**	September 30, 2016
Temperature:	27°C	**Tested by:**	Dennis Li
Humidity:	53% RH	**Polarity:**	Ver. / Hor.

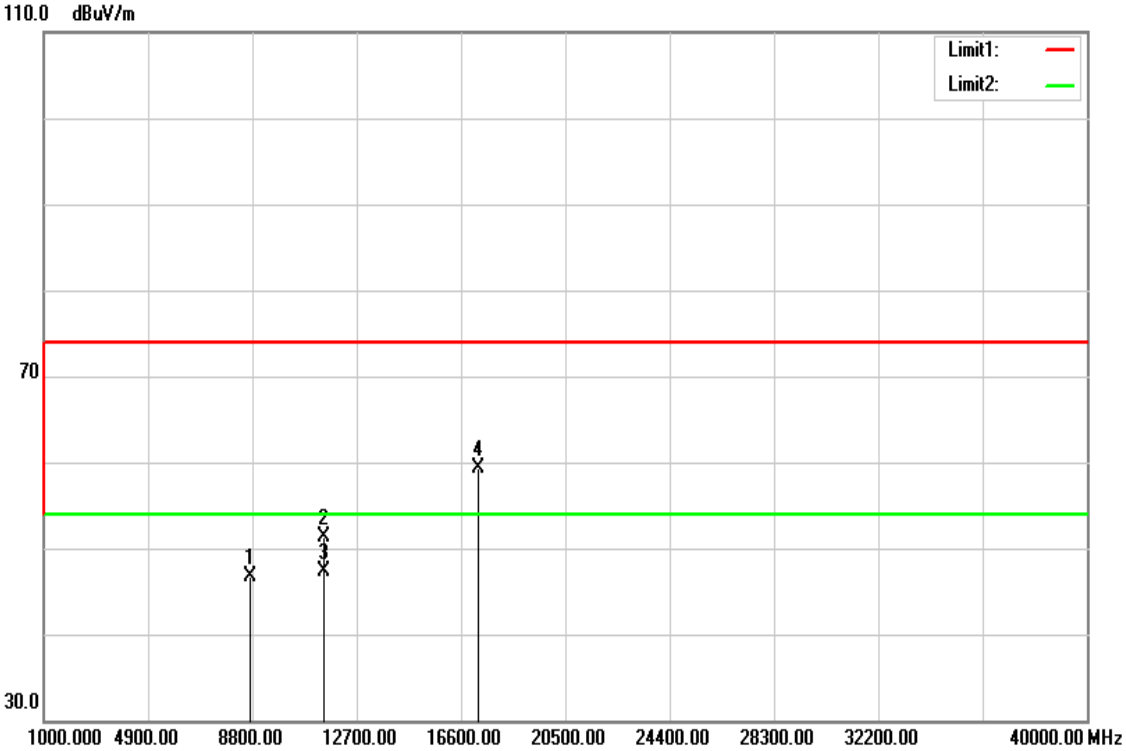
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
8770.000	33.42	13.76	47.18	74.00	-26.82	peak	V
11650.000	36.43	16.91	53.34	74.00	-20.66	peak	V
11650.000	32.34	16.91	49.25	54.00	-4.75	AVG	V
17475.000	33.95	26.22	60.17	74.00	-13.83	peak	V
N/A							
8730.000	33.25	13.75	47.00	74.00	-27.00	peak	H
11650.000	38.57	16.91	55.48	74.00	-18.52	peak	H
11650.000	35.71	16.91	52.62	54.00	-1.38	AVG	H
17475.000	32.90	26.22	59.12	74.00	-14.88	peak	H
N/A							

Remark:

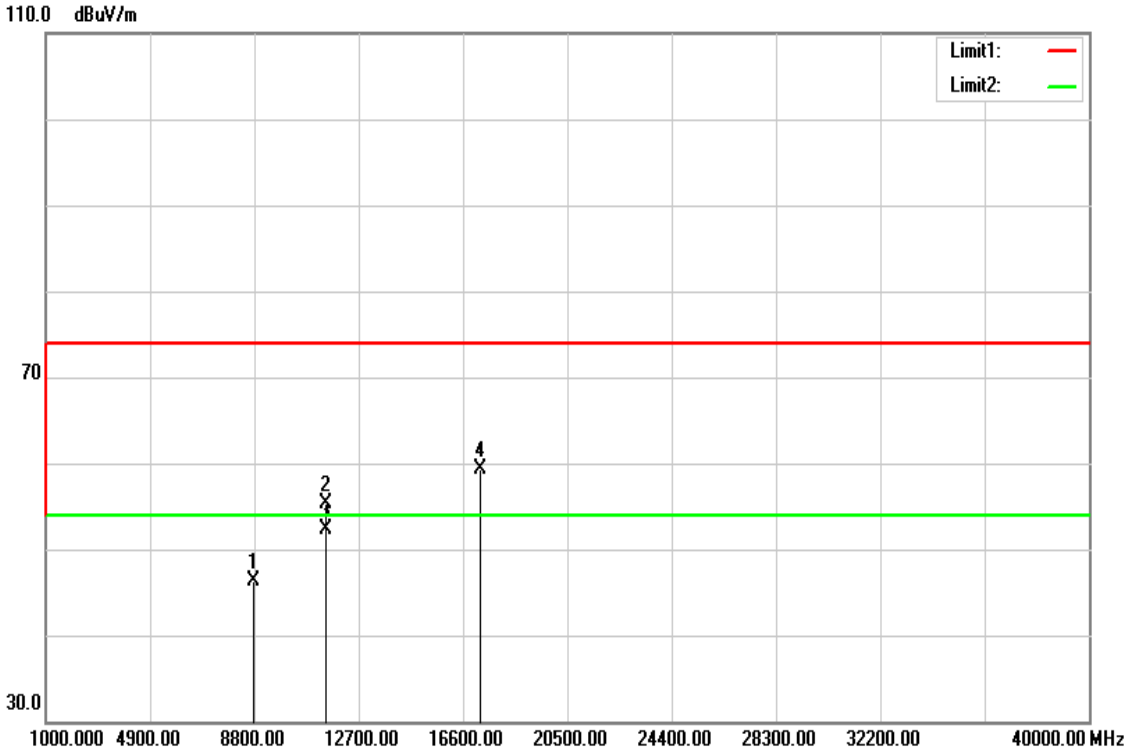
1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

TX / IEEE 802.11n HT 20 MHz mode / CH Low

Polarity: Vertical



Polarity: Horizontal



Operation Mode:	TX / IEEE 802.11n HT 20 MHz mode / CH Low	**Test Date:**	September 30, 2016
Temperature:	27°C	**Tested by:**	Dennis Li
Humidity:	53% RH	**Polarity:**	Ver. / Hor.

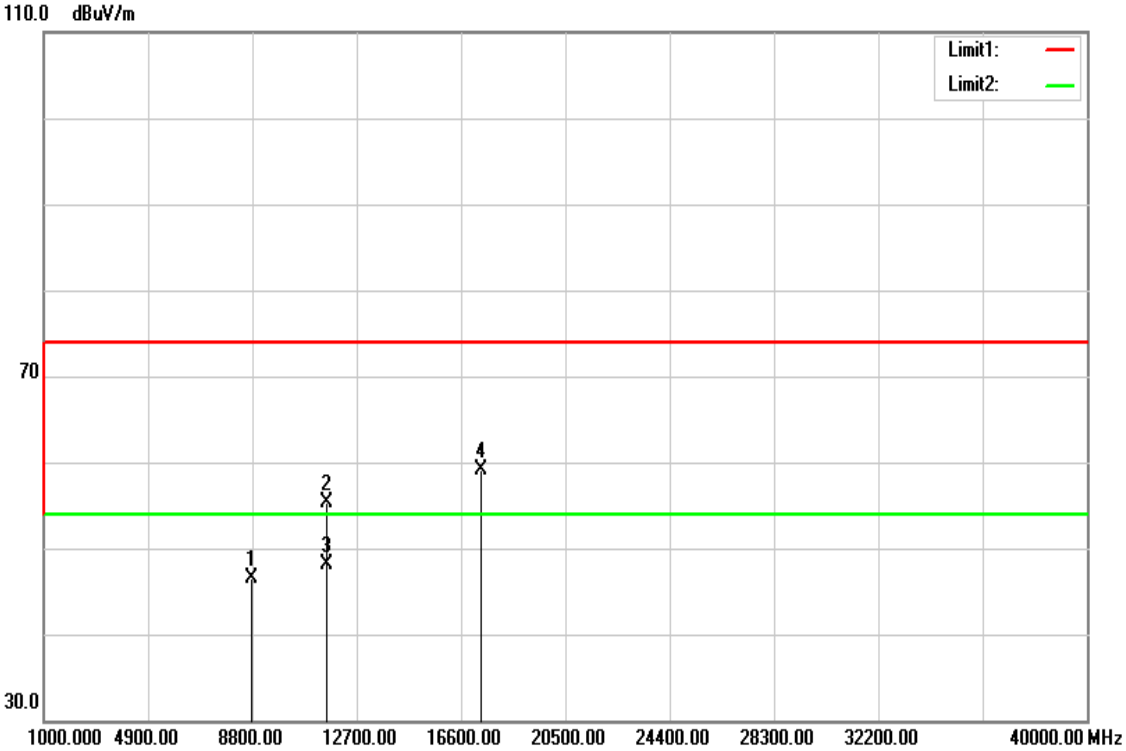
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
8740.000	32.87	13.75	46.62	74.00	-27.38	peak	V
11490.000	34.50	16.78	51.28	74.00	-22.72	peak	V
11490.000	30.47	16.78	47.25	54.00	-6.75	AVG	V
17235.000	34.02	25.28	59.30	74.00	-14.70	peak	V
N/A							
8760.000	32.44	13.76	46.20	74.00	-27.80	peak	H
11490.000	38.58	16.78	55.36	74.00	-18.64	peak	H
11490.000	35.58	16.78	52.36	54.00	-1.64	AVG	H
17235.000	34.07	25.28	59.35	74.00	-14.65	peak	H
N/A							

Remark:

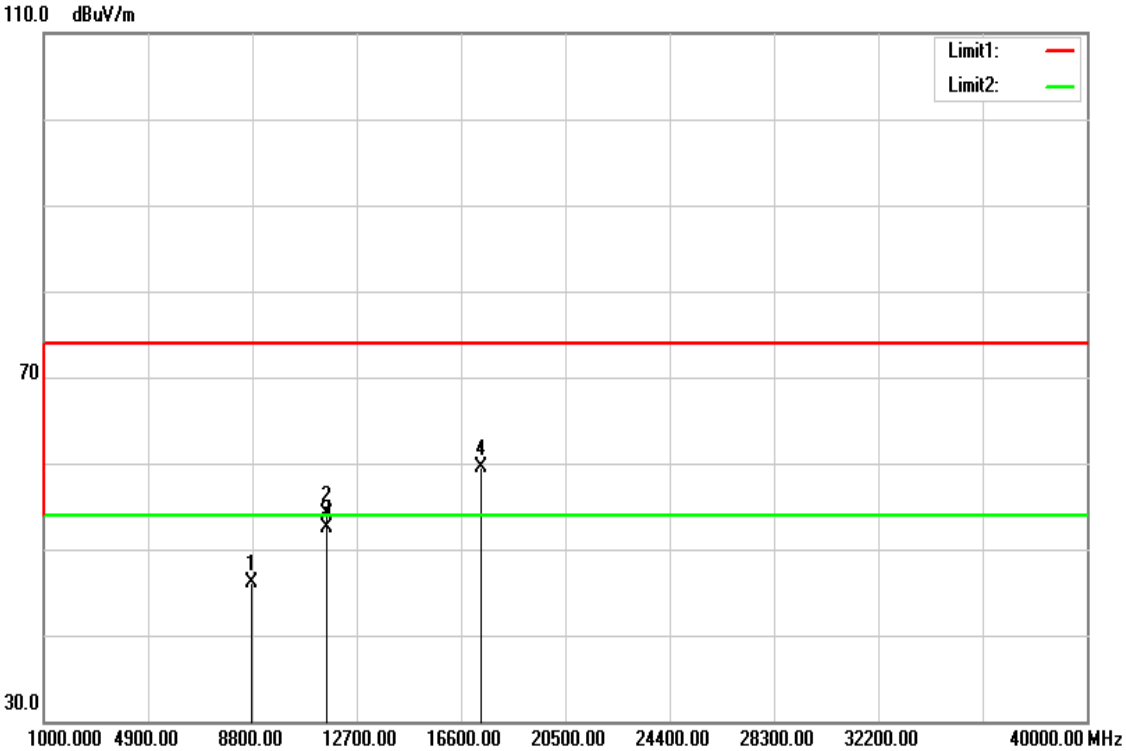
1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

TX / IEEE 802.11n HT 20 MHz mode / CH Mid

Polarity: Vertical



Polarity: Horizontal



Operation Mode:	TX / IEEE 802.11n HT 20 MHz mode / CH Mid	**Test Date:**	September 30, 2016
Temperature:	27°C	**Tested by:**	Dennis Li
Humidity:	53% RH	**Polarity:**	Ver. / Hor.

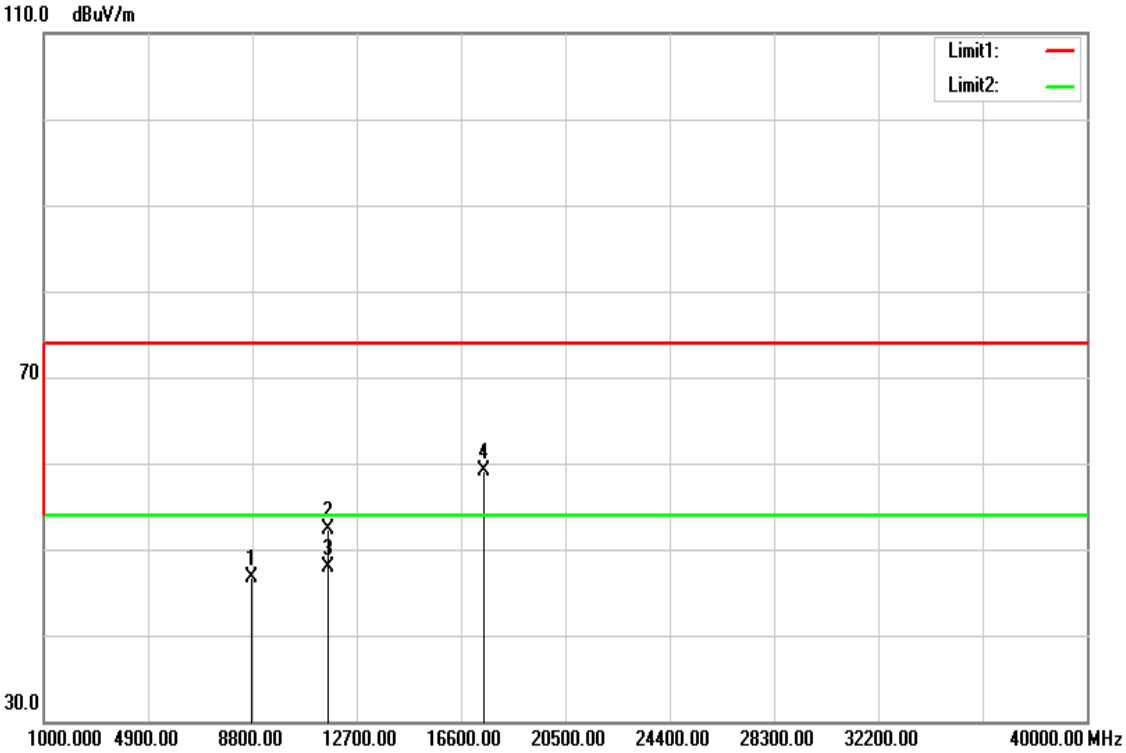
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
8760.000	32.70	13.76	46.46	74.00	-27.54	peak	V
11570.000	38.42	16.84	55.26	74.00	-18.74	peak	V
11570.000	31.19	16.84	48.03	54.00	-5.97	AVG	V
17355.000	33.34	25.75	59.09	74.00	-14.91	peak	V
N/A							
8750.000	32.41	13.75	46.16	74.00	-27.84	peak	H
11570.000	37.32	16.84	54.16	74.00	-19.84	peak	H
11570.000	35.63	16.84	52.47	54.00	-1.53	AVG	H
17355.000	33.70	25.75	59.45	74.00	-14.55	peak	H
N/A							

Remark:

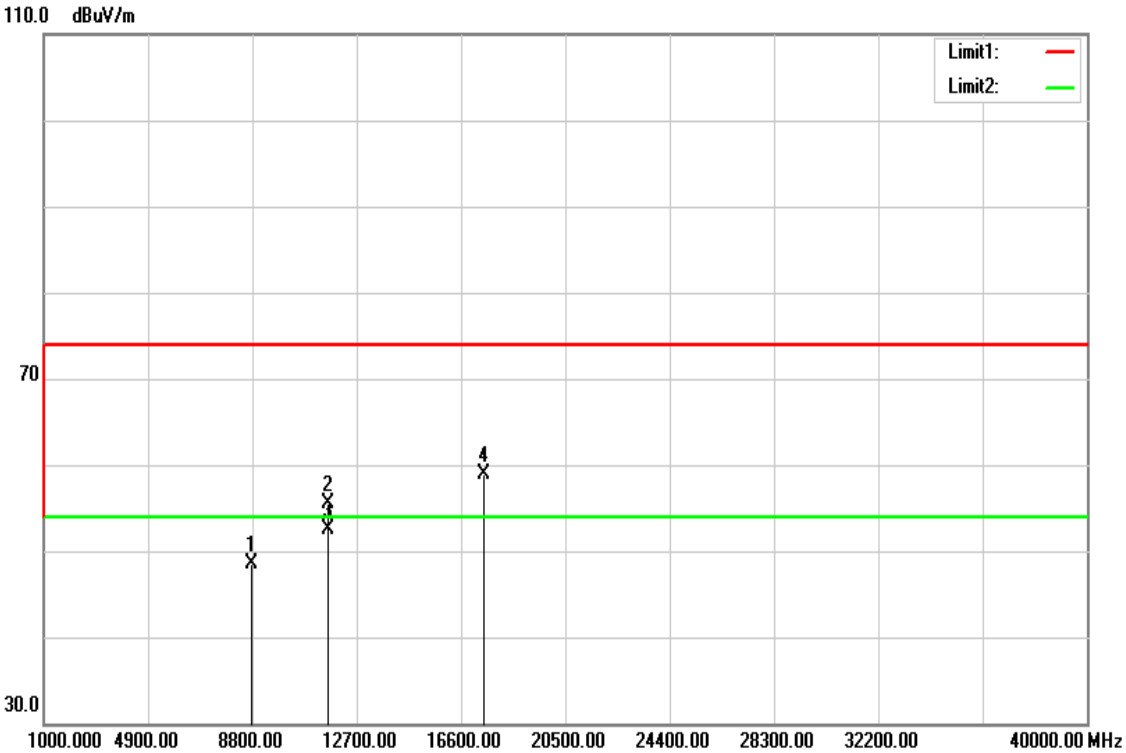
1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

TX / IEEE 802.11n HT 20 MHz mode / CH High

Polarity: Vertical



Polarity: Horizontal



Operation Mode:	TX / IEEE 802.11n HT 20 MHz mode / CH High	**Test Date:**	September 30, 2016
Temperature:	27°C	**Tested by:**	Dennis Li
Humidity:	53% RH	**Polarity:**	Ver. / Hor.

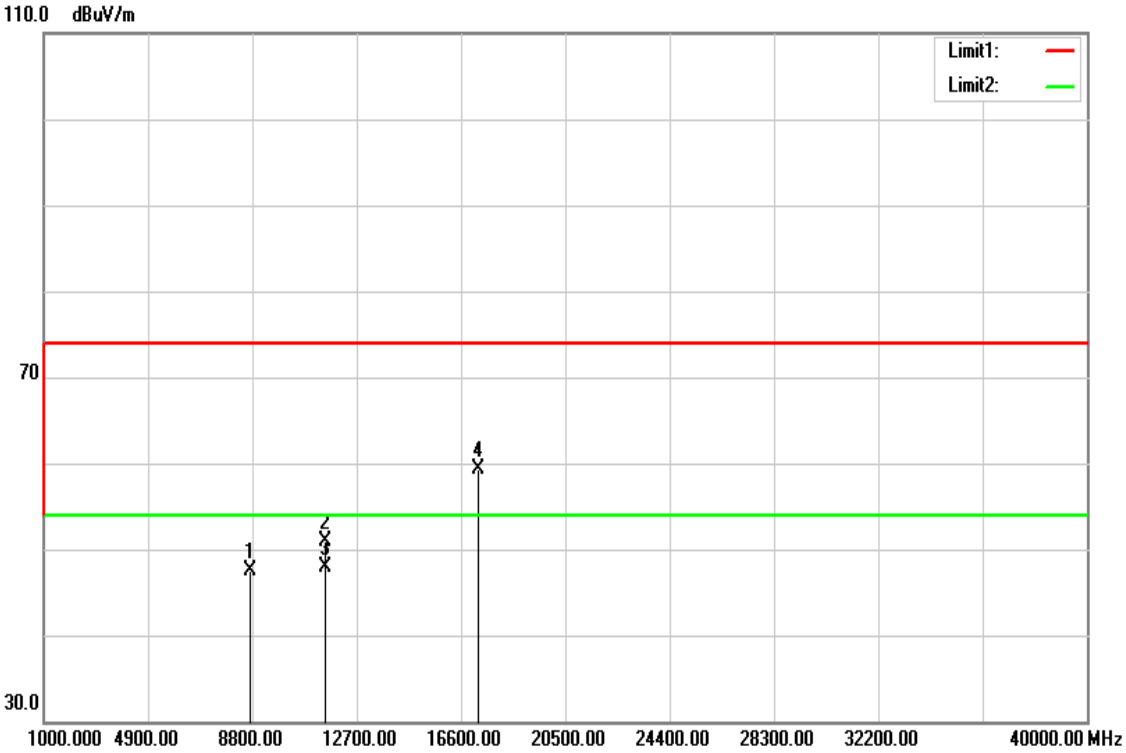
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
8790.000	32.94	13.77	46.71	74.00	-27.29	peak	V
11650.000	35.42	16.91	52.33	74.00	-21.67	peak	V
11650.000	31.07	16.91	47.98	54.00	-6.02	AVG	V
17475.000	32.80	26.22	59.02	74.00	-14.98	peak	V
N/A							
8770.000	34.80	13.76	48.56	74.00	-25.44	peak	H
11650.000	38.57	16.91	55.48	74.00	-18.52	peak	H
11650.000	35.54	16.91	52.45	54.00	-1.55	AVG	H
17475.000	32.73	26.22	58.95	74.00	-15.05	peak	H
N/A							

Remark:

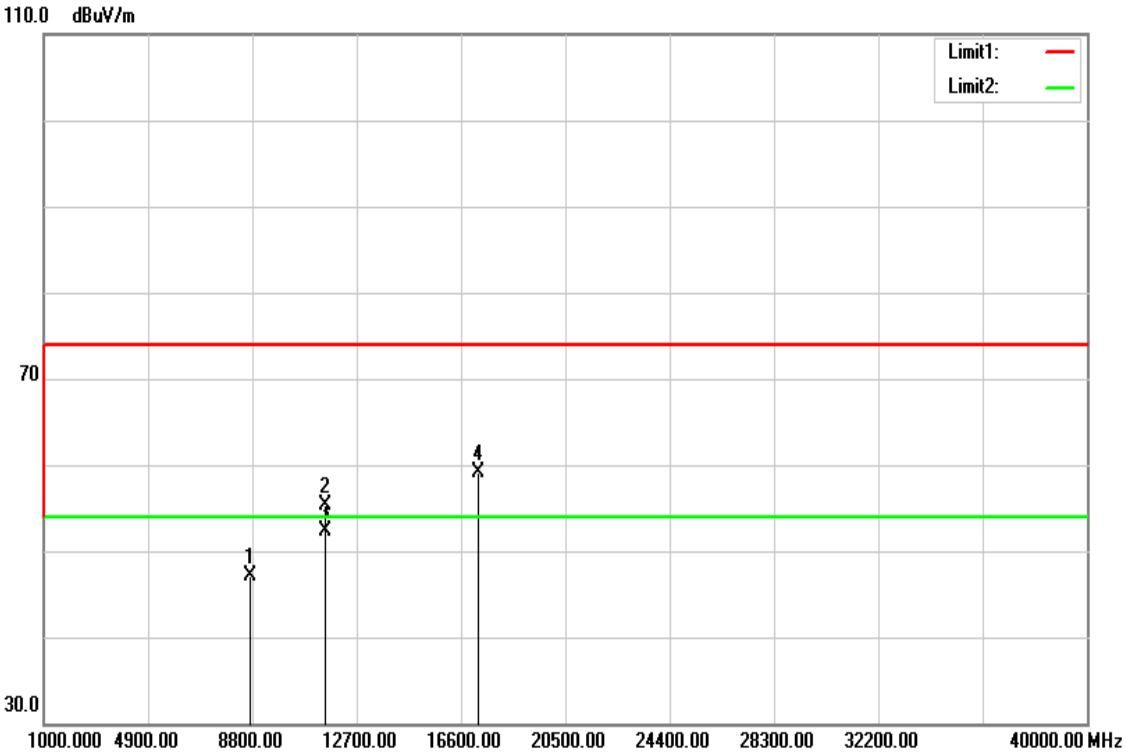
1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

TX / IEEE 802.11n HT 40 MHz mode / CH Low

Polarity: Vertical



Polarity: Horizontal



Operation Mode:	TX / IEEE 802.11n HT 40 MHz mode / CH Low	**Test Date:**	September 30, 2016
Temperature:	27°C	**Tested by:**	Dennis Li
Humidity:	53% RH	**Polarity:**	Ver. / Hor.

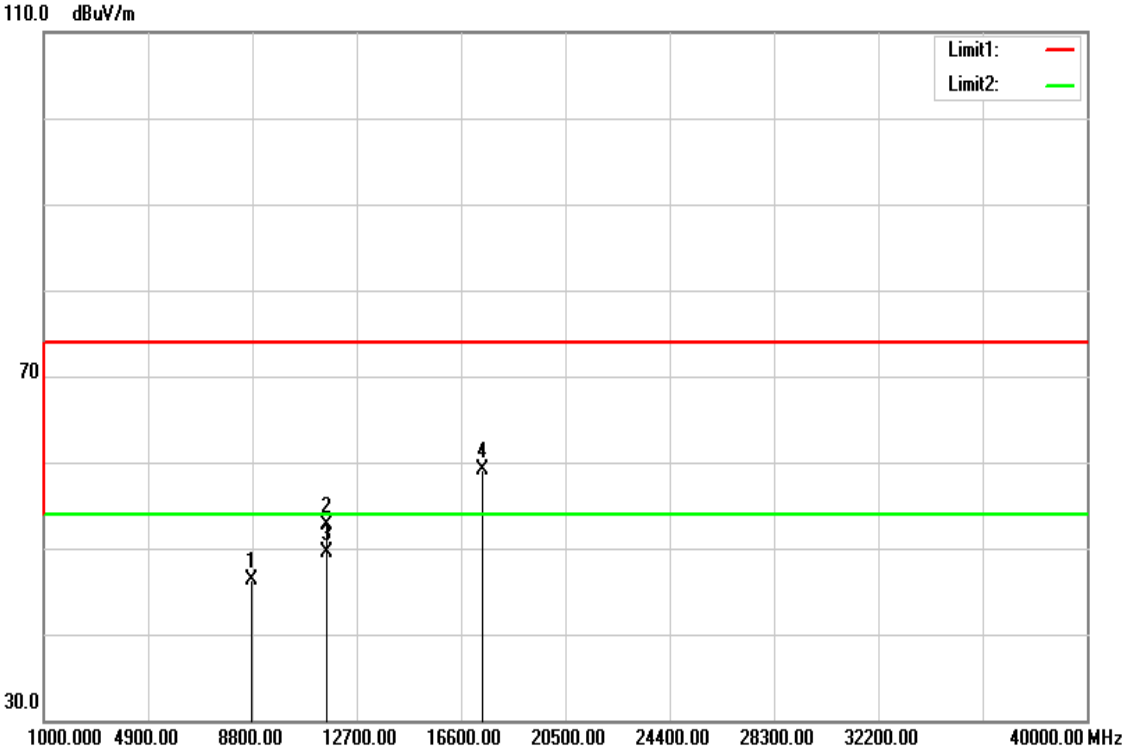
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
8730.000	33.66	13.75	47.41	74.00	-26.59	peak	V
11510.000	34.10	16.79	50.89	74.00	-23.11	peak	V
11510.000	31.03	16.79	47.82	54.00	-6.18	AVG	V
17265.000	33.84	25.40	59.24	74.00	-14.76	peak	V
N/A							
8710.000	33.31	13.74	47.05	74.00	-26.95	peak	H
11510.000	38.59	16.79	55.38	74.00	-18.62	peak	H
11510.000	35.41	16.79	52.20	54.00	-1.80	AVG	H
17265.000	33.67	25.40	59.07	74.00	-14.93	peak	H
N/A							

Remark:

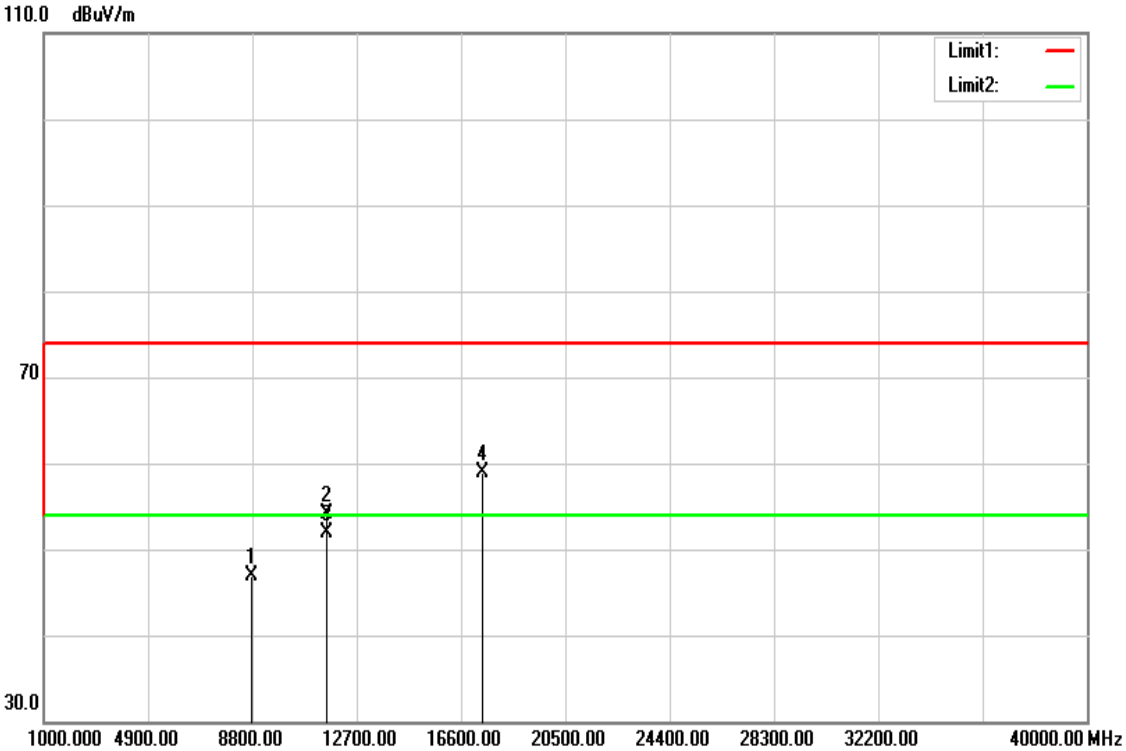
1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

TX / IEEE 802.11n HT 40 MHz mode / CH High

Polarity: Vertical



Polarity: Horizontal



Operation Mode:	TX / IEEE 802.11n HT 40 MHz mode / CH High	**Test Date:**	September 30, 2016
Temperature:	27°C	**Tested by:**	Dennis Li
Humidity:	53% RH	**Polarity:**	Ver. / Hor.

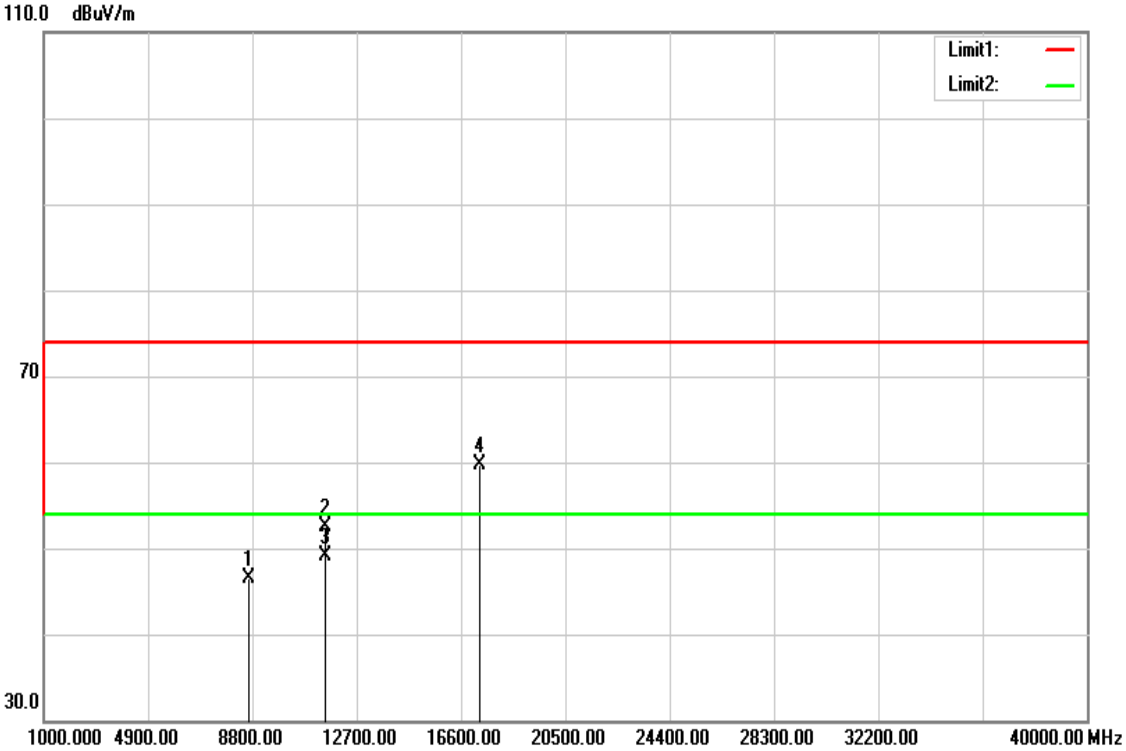
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
8780.000	32.52	13.77	46.29	74.00	-27.71	peak	V
11590.000	35.76	16.86	52.62	74.00	-21.38	peak	V
11590.000	32.63	16.86	49.49	54.00	-4.51	AVG	V
17385.000	33.25	25.87	59.12	74.00	-14.88	peak	V
N/A							
8760.000	33.05	13.76	46.81	74.00	-27.19	peak	H
11590.000	37.23	16.86	54.09	74.00	-19.91	peak	H
11590.000	35.13	16.86	51.99	54.00	-2.01	AVG	H
17385.000	32.97	25.87	58.84	74.00	-15.16	peak	H
N/A							

Remark:

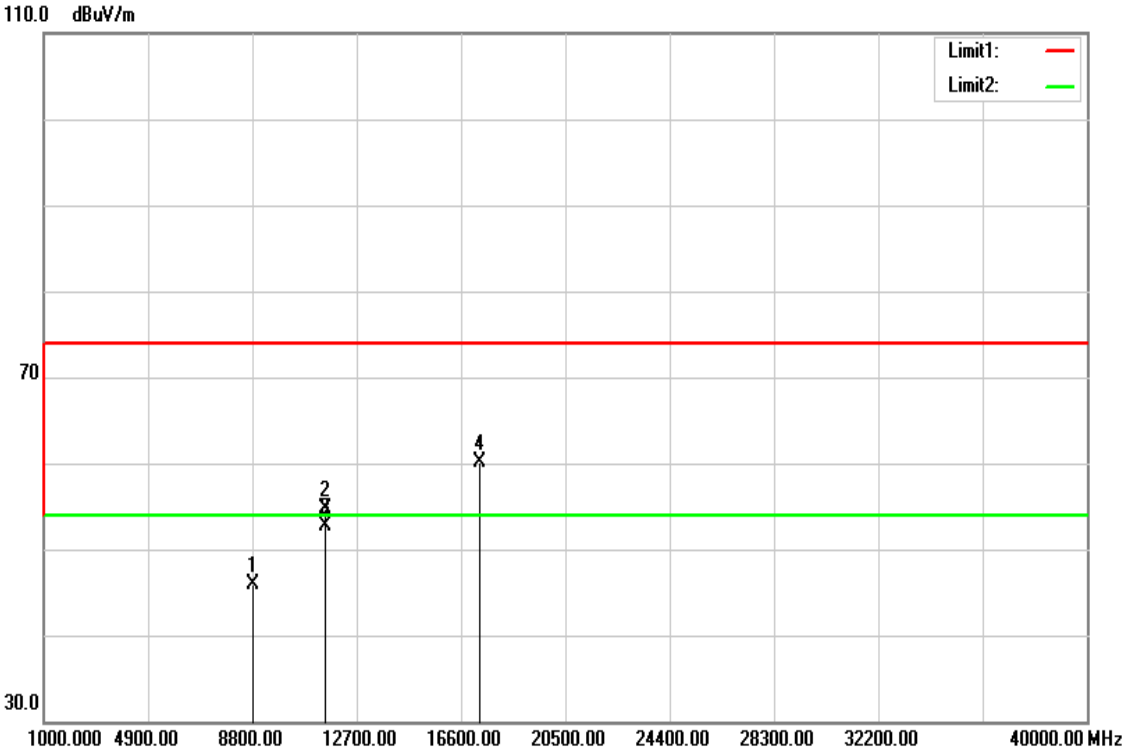
1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Tx / IEEE 802.11ac VHT 80 MHz mode / CH Mid

Polarity: Vertical



Polarity: Horizontal



Operation Mode:	Tx / IEEE 802.11ac VHT 80 MHz mode / CH Mid	**Test Date:**	September 30, 2016
Temperature:	27°C	**Tested by:**	Dennis Li
Humidity:	53% RH	**Polarity:**	Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
8650.000	32.75	13.71	46.46	74.00	-27.54	peak	V
11550.000	35.59	16.82	52.41	74.00	-21.59	peak	V
11550.000	32.27	16.82	49.09	54.00	-4.91	AVG	V
17325.000	34.05	25.63	59.68	74.00	-14.32	peak	V
N/A							
8820.000	32.02	13.79	45.81	74.00	-28.19	peak	H
11550.000	37.80	16.82	54.62	74.00	-19.38	peak	H
11550.000	35.92	16.82	52.74	54.00	-1.26	AVG	H
17325.000	34.47	25.63	60.10	74.00	-13.90	peak	H
N/A							

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

7.7 POWERLINE CONDUCTED EMISSIONS

LIMIT

According to §15.207(a), except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency Range (MHz)	Limits (dBμV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

** DECREASES WITH THE LOGARITHM OF THE FREQUENCY.*

Test Configuration

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

TEST PROCEDURE

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

TEST RESULTS

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

Test Data

Operation Mode:	Normal Link	**Test Date:**	May 9, 2014
Temperature:	24°C	**Tested by:**	Sehni Hu
Humidity:	50% RH		

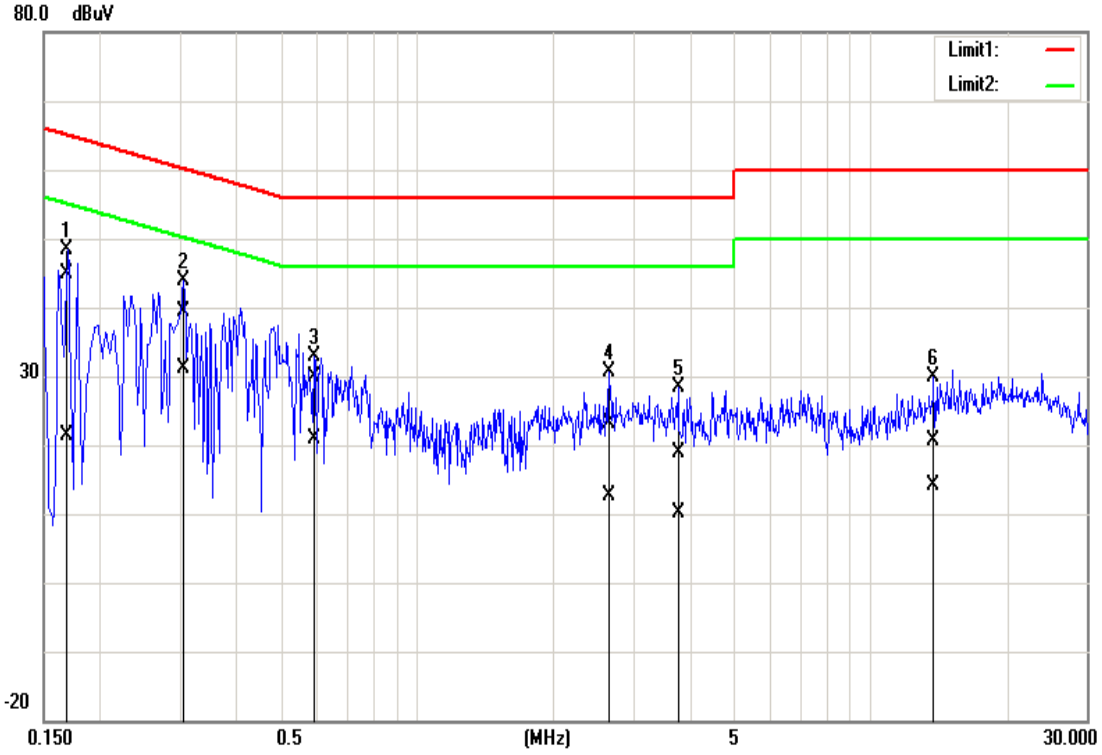
Freq. (MHz)	QP Reading (dBuV)	AV Reading (dBuV)	Corr. factor (dB/m)	QP Result (dBuV/m)	AV Result (dBuV/m)	QP Limit (dBuV)	AV Limit (dBuV)	QP Margin (dB)	AV Margin (dB)	Note
0.1700	44.71	21.12	0.19	44.90	21.31	64.96	54.96	-20.06	-33.65	L1
0.3060	39.17	30.91	0.20	39.37	31.11	60.08	50.08	-20.71	-18.97	L1
0.5940	29.67	20.62	0.20	29.87	20.82	56.00	46.00	-26.13	-25.18	L1
2.6540	22.87	12.44	0.16	23.03	12.60	56.00	46.00	-32.97	-33.40	L1
3.7660	18.75	10.06	0.19	18.94	10.25	56.00	46.00	-37.06	-35.75	L1
13.7780	19.99	13.35	0.68	20.67	14.03	60.00	50.00	-39.33	-35.97	L1
0.1580	44.13	38.40	0.19	44.32	38.59	65.57	55.57	-21.25	-16.98	L2
0.1980	42.19	35.85	0.19	42.38	36.04	63.69	53.69	-21.31	-17.65	L2
0.2860	43.67	33.09	0.19	43.86	33.28	60.64	50.64	-16.78	-17.36	L2
0.3780	37.96	27.12	0.19	38.15	27.31	58.32	48.32	-20.17	-21.01	L2
0.4940	34.21	23.06	0.19	34.40	23.25	56.10	46.10	-21.70	-22.85	L2
13.9060	23.00	15.79	0.53	23.53	16.32	60.00	50.00	-36.47	-33.68	L2

Remark:

1. *Measuring frequencies from 0.15 MHz to 30MHz.*
2. *The emissions measured in frequency range from 0.15 MHz to 30MHz were made with an instrument using Quasi-peak detector and average detector.*
3. *The IF bandwidth of SPA between 0.15MHz and 30MHz was 10 kHz; the IF bandwidth of Test Receiver between 0.15MHz and 30MHz was 9 kHz;*
4. *L1 = Line One (Live Line) / L2 = Line Two (Neutral Line)*

Test Plots

Conducted emissions (Line 1)



Conducted emissions (Line 2)