

FCC 47 CFR PART 15 SUBPART E

TEST REPORT

For

WLAN + BT Combo Module

Model: WCBN4511R

Trade Name: LITE-ON

Issued to

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

Issued by

**Compliance Certification Services Inc.
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New Taipei City 24891, Taiwan. (R.O.C.)
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Issued Date: July 20, 2016**



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Revision History

Rev.		Issue Date		Revisions	Effect Page	Revised By
00		July 20, 2016		Initial Issue	ALL	Doris Chu
01		August 24, 2016		1. Added Product SW/HW version, Radio SW/HW version, Test SW Version. 2. Added the worst case power setting parameter. 3. Added 99% bandwidth. 4. Modify peak power spectral density to added duty cycle and duty factor.	P.5, P.9, P.15 ~ P.27, P.64	Doris Chu

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1. TEST RESULT CERTIFICATION

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

Equipment Under Test: WLAN + BT Combo Module

Model Number: WCBN4511R

Trade Name: LITE-ON

Date of Test: June 20 ~ July 15, 2016

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

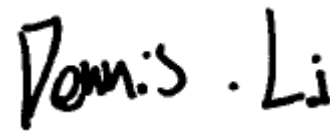
We hereby certify that:

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:

Tested by:



Miller Lee
Manager
Compliance Certification Services Inc.

Dennis Li
Engineer
Compliance Certification Services Inc.

2. EUT DESCRIPTION

Product	WLAN + BT Combo Module
Model Number	WCBN4511R
Trade Name	LITE-ON
Power Supply	Powered from host device.
Received Date	June 8, 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: 18.79 dBm IEEE 802.11n HT 20 MHz mode: 18.58 dBm IEEE 802.11n HT 40 MHz mode: 16.91 dBm IEEE 802.11ac VHT 80 MHz mode: 12.01 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 / WCBN4511R PIFA Antenna ANT-L: Gain: 2.94dBi ANT-R: Gain: 3.35dBi
Product SW/HW version	V02/V02
Radio SW version	V02/V02
Radio HW version	V1.0.3.19

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: WCBN4511R) 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 (Chin 0)	RF power setting in TEST SW (Chin 1)
Low	5745	17	17
Mid	5785	23	23
High	5825	1D	1D

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	1A	1A
Mid	5785	26	26
High	5825	20	20

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	16	16
High	5795	23	23

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	1D	1D

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
DC Power Supplies	GW Instek	SPS-3610	GPE880163	01/19/2016	01/18/2017
Power Meter	Anritsu	ML2495A	1012009	07/04/2016	07/03/2017
Power Sensor	Anritsu	MA2411B	917072	07/04/2016	07/03/2017
Signal Analyzer	R&S	FSV 40	101073	07/20/2015	07/19/2016
Spectrum Analyzer	Agilent	E4446A	US42510268	02/15/2016	02/14/2017
Thermostatic/Hrgrosatic Chamber	TAICHY	MHG-150LF	930619	10/08/2015	10/07/2016
Vector Signal Generator	R&S	SMU 200A	102239	03/10/2016	03/09/2017
AC Power Source	EXTECH	6205	1140845	N.C.R	N.C.R

Wugu 966 Chamber A					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Bilog Antenna	Sunol Sciences	JB3	A030105	08/06/2015	08/05/2016
EMI Test Receiver	R&S	ESCI	100064	05/31/2016	05/30/2017
Horn Antenna	EMCO	3117	55165	02/24/2016	02/23/2017
Horn Antenna	EMCO	3116	26370	01/15/2016	01/14/2017
K Type Cable	Huber+Suhner	SUCOFLEX 102	29406/2	01/12/2016	01/11/2017
K Type Cable	Huber+Suhner	SUCOFLEX 102	22470/2	01/12/2016	01/11/2017
Pre-Amplifier	MITEQ	AMF-6F-2604 00-40-8P	985646	01/14/2016	01/13/2017
Pre-Amplifier	EMCI	EMC 012635	980151	06/23/2016	06/22/2017
Pre-Amplifier	EMCI	EM330	N/A	06/08/2016	06/07/2017
Spectrum Analyzer	Agilent	E4446A	US42510252	12/08/2015	12/07/2016
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 # B					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
EMI Test Receiver	R&S	ESCI	101073	09/09/2015	09/08/2016
LISN	SCHWARZBECK	NSLK 8127	8127-541	11/23/2015	11/22/2016
LISN	R&S	ENV216	101054	05/11/2016	05/10/2017
Capacitive Voltage Probe	FCC	F-CVP-1	100185	03/09/2016	03/08/2017
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

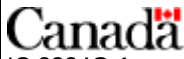
The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.10: 2013 and CISPR Publication 22.

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	
Canada	Industry Canada	3M Semi Anechoic Chamber (IC 2324G-1 / IC 2324G-2) to perform	 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	Equipment	Brand	Model	Series No.	FCC ID	Data Cable	Power Cord
1	Notebook PC	ASUS	M5200AE	5BN0AG019631	PD9WM3B2100	N/A	AC I/P: Unshielded, 1.8m with a core DC O/P: Unshielded, 1.8m

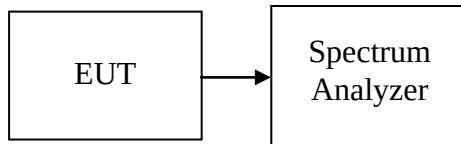
Remark:

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 / Chain 0

Channel	Frequency (MHz)	99%Bandwidth (MHz)
Low	5745	16.4109
Mid	5785	17.2793
High	5825	16.5412

Test mode: IEEE 802.11a mode / Chain 1

Channel	Frequency (MHz)	99%Bandwidth (MHz)
Low	5745	16.4544
Mid	5785	17.0188
High	5825	16.4978

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

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5745	17.5832
Mid	5785	17.8871
High	5825	17.6266

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

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5745	17.5397
Mid	5785	17.8871
High	5825	17.6266

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

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5755	35.8900
High	5795	36.3531

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

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5755	35.8900
High	5795	36.2373

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

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Mid	5755	75.0217

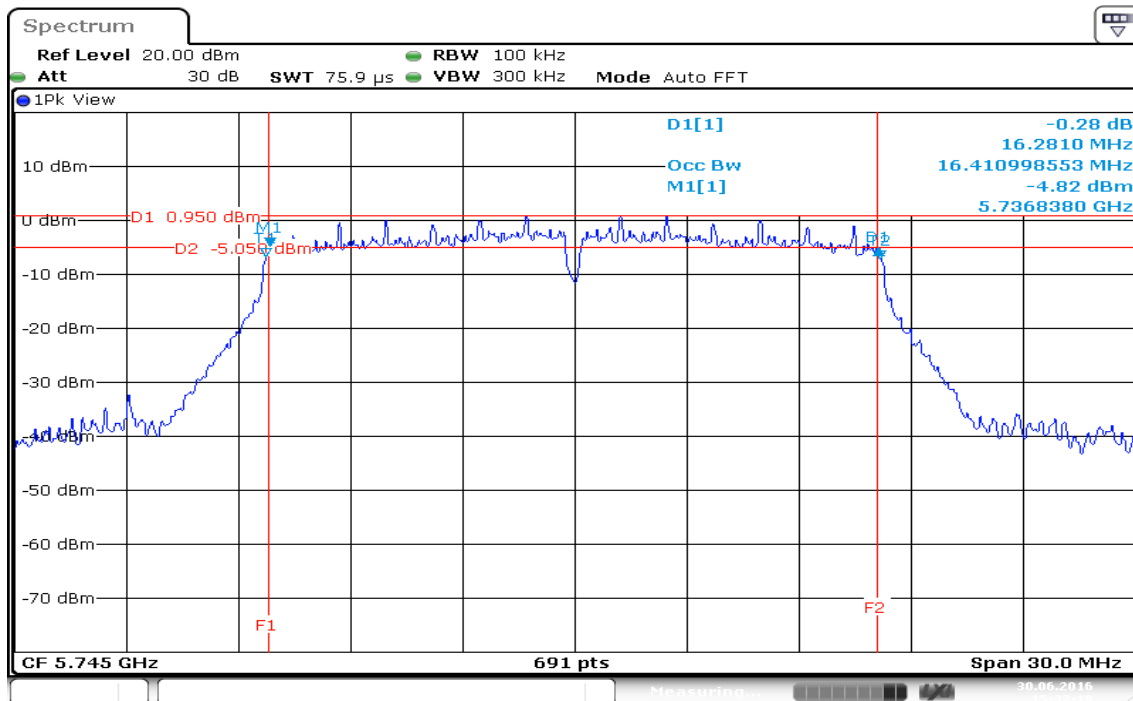
Test mode: IEEE 802.11ac VHT 80 MHz mode / 5775MHz / Chain 1

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Mid	5755	75.0217

Test Plot

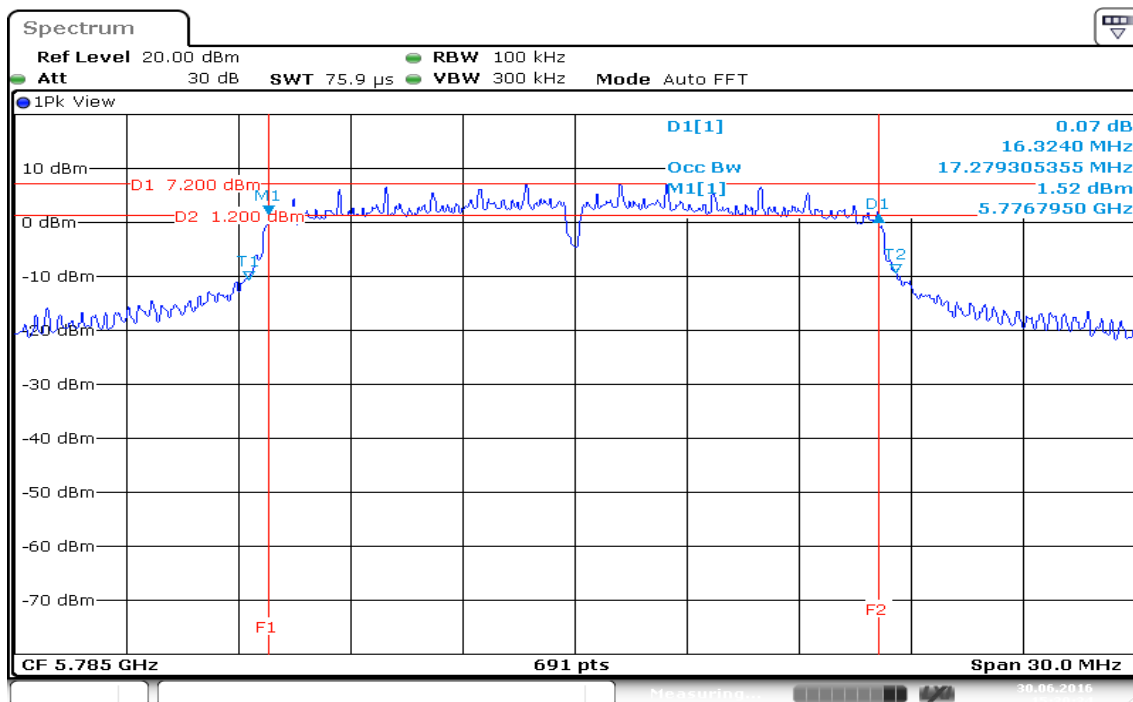
IEEE 802.11a mode / 5745 ~ 5825MHz / Chain 0

99% Bandwidth (CH Low)



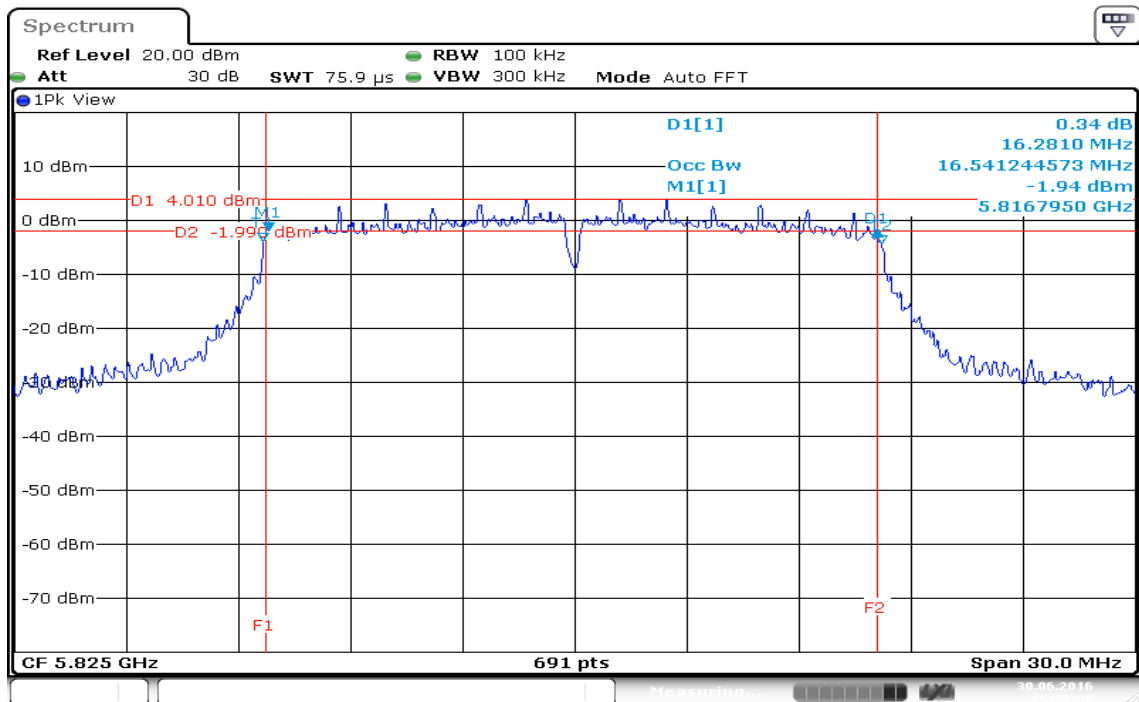
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99% Bandwidth (CH Mid)



Date: 30 JUN 2016 15:30:34

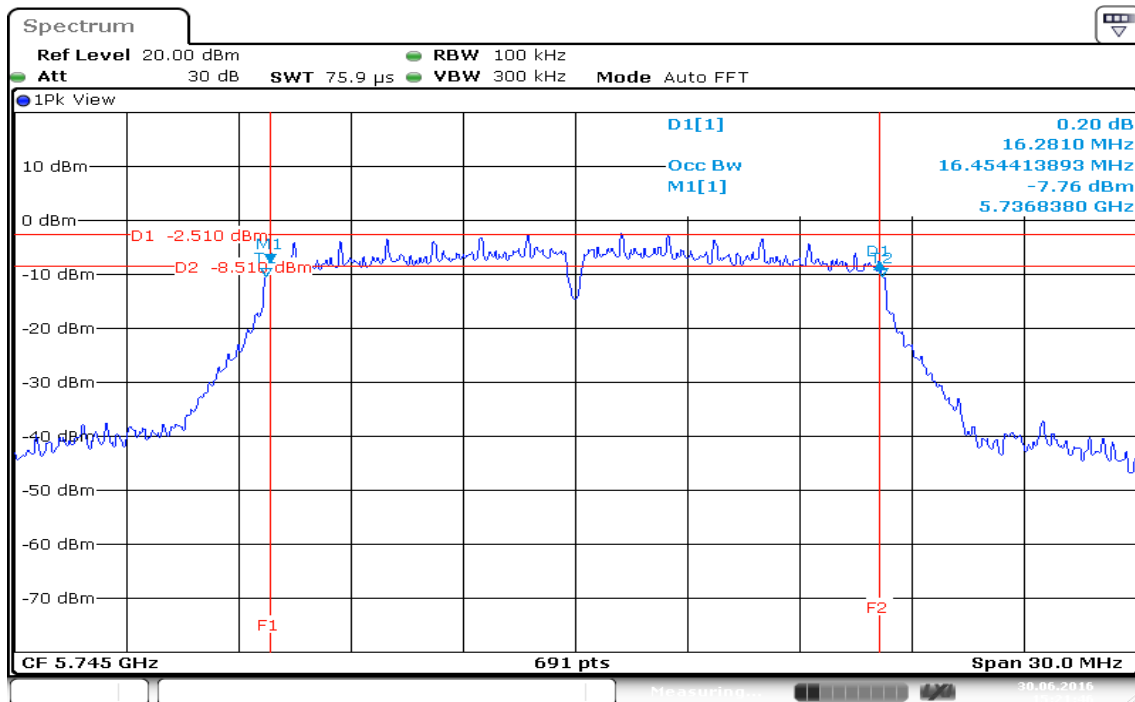
99% Bandwidth (CH High)



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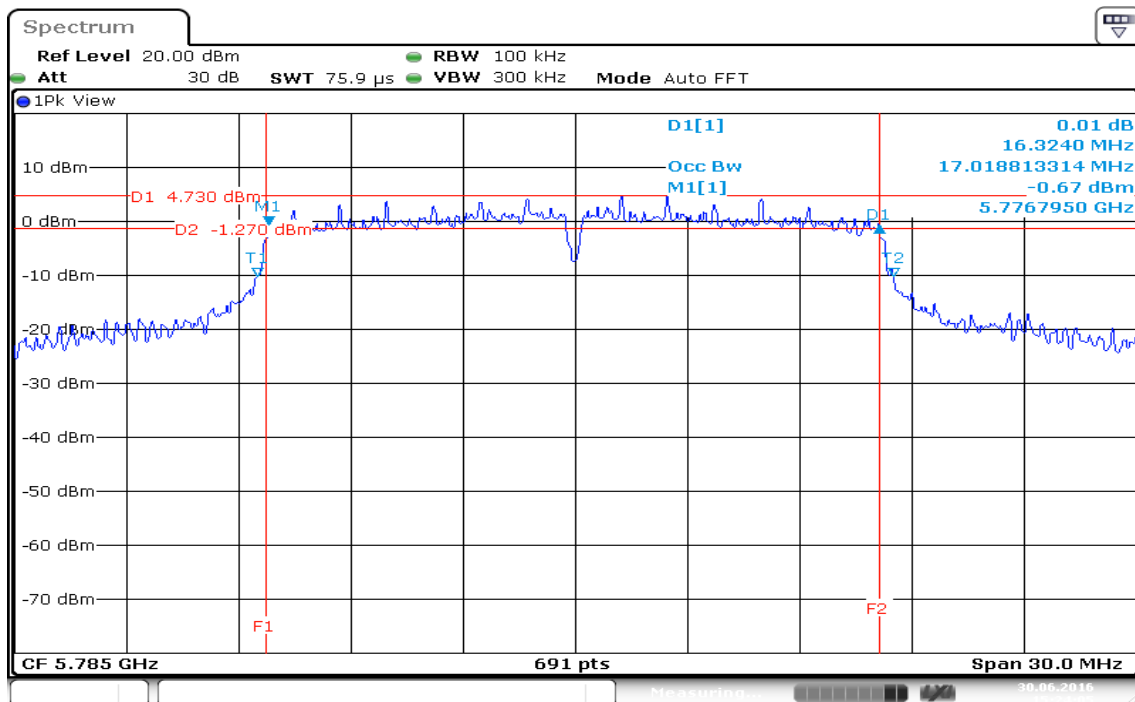
IEEE 802.11a mode / 5745 ~ 5825MHz / Chain 1

99% Bandwidth (CH Low)



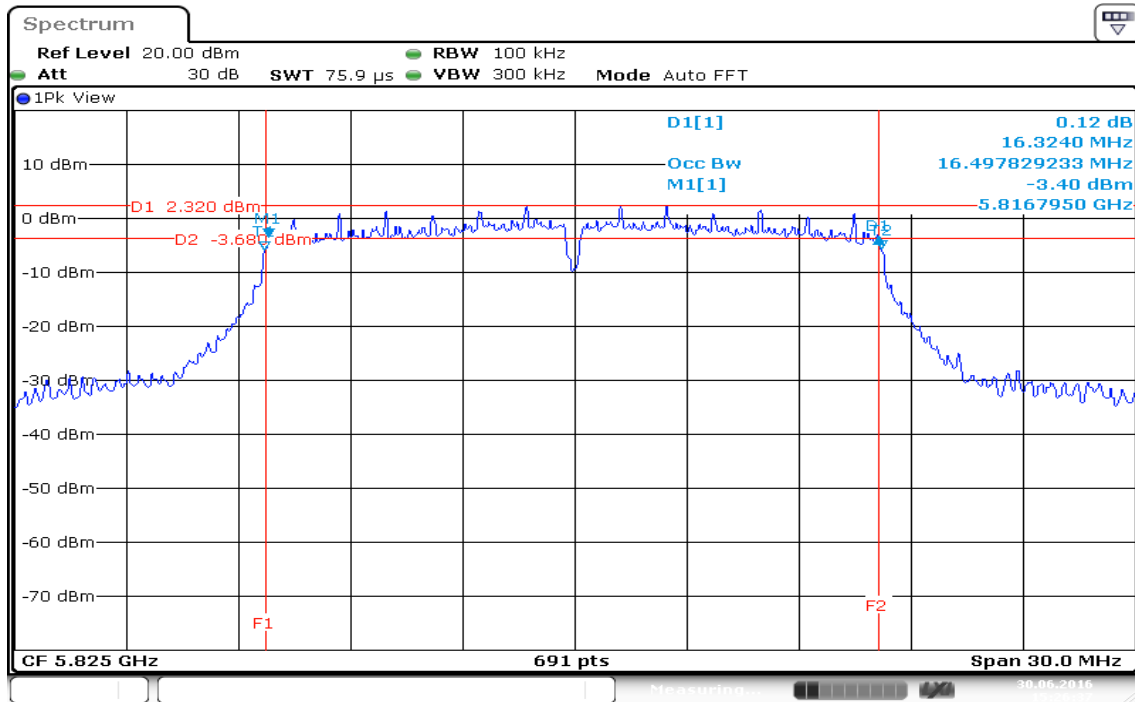
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99% Bandwidth (CH Mid)



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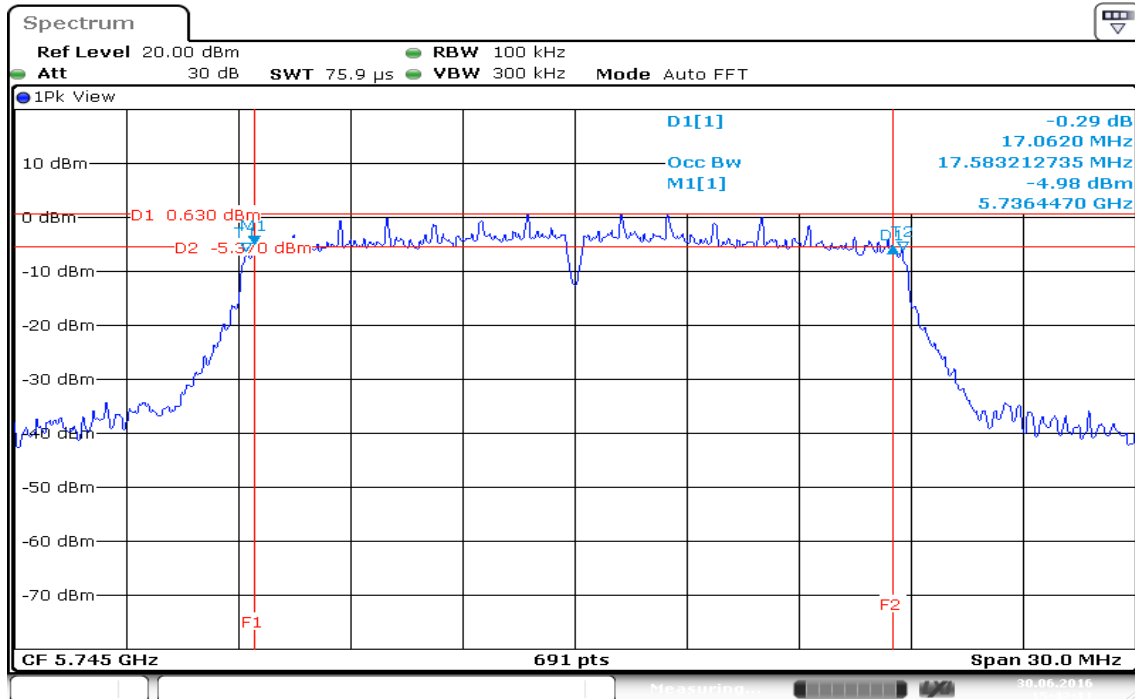
99% Bandwidth (CH High)



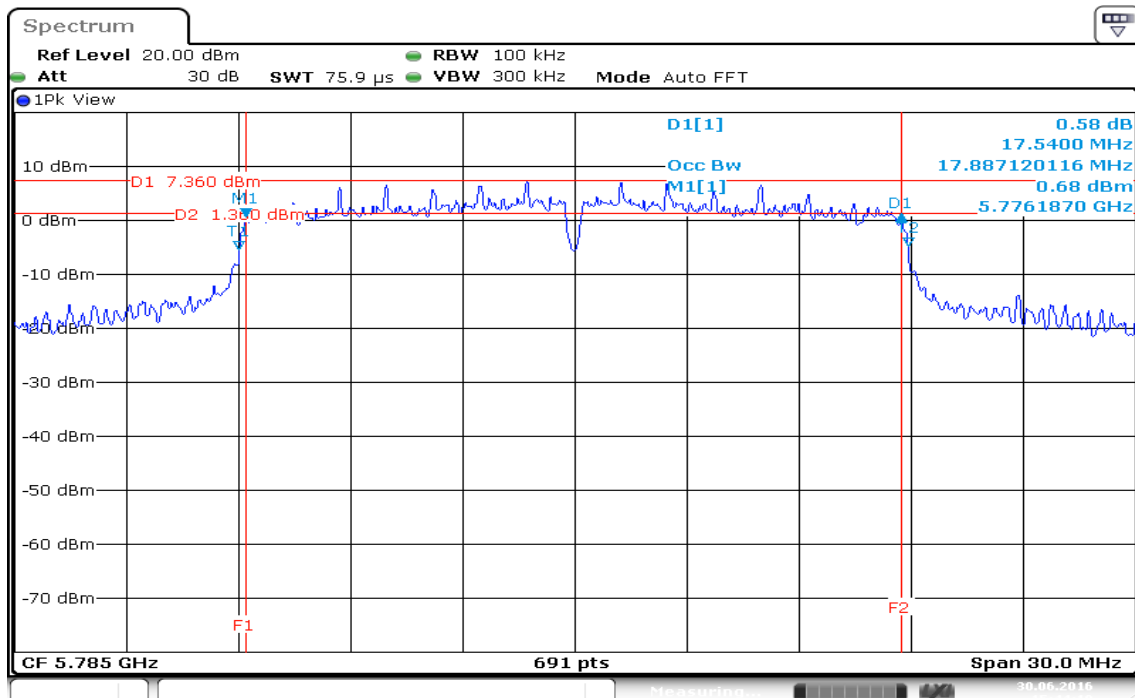
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IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz / Chain 0

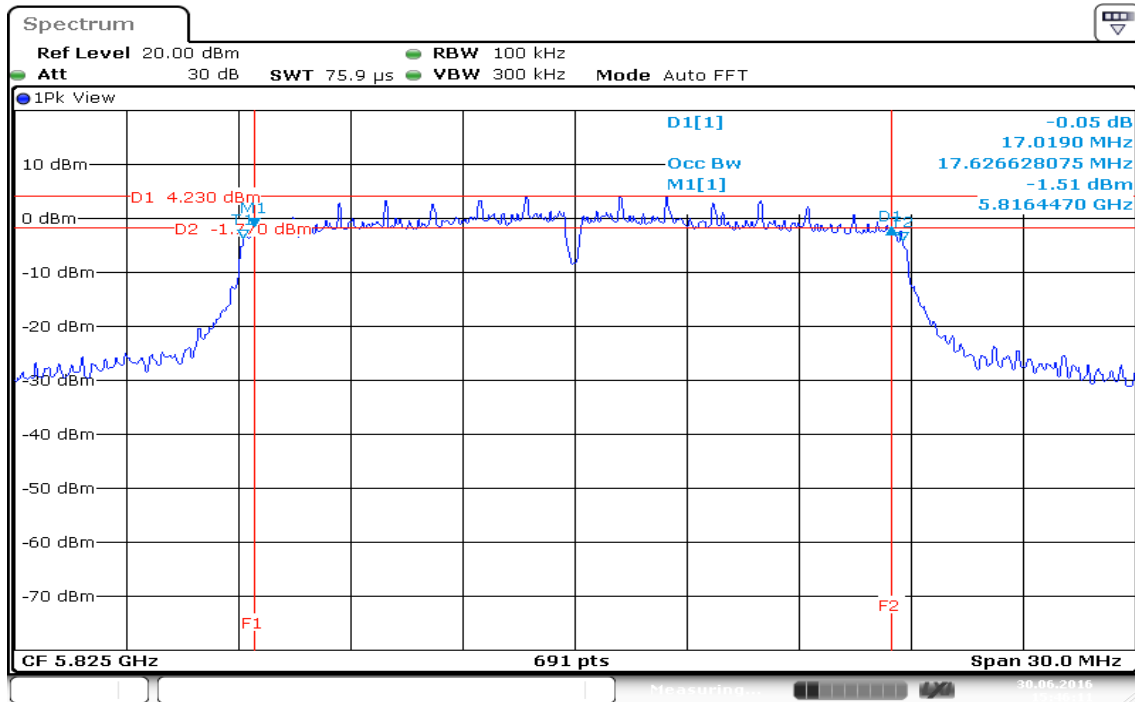
99% Bandwidth (CH Low)



99% Bandwidth (CH Mid)



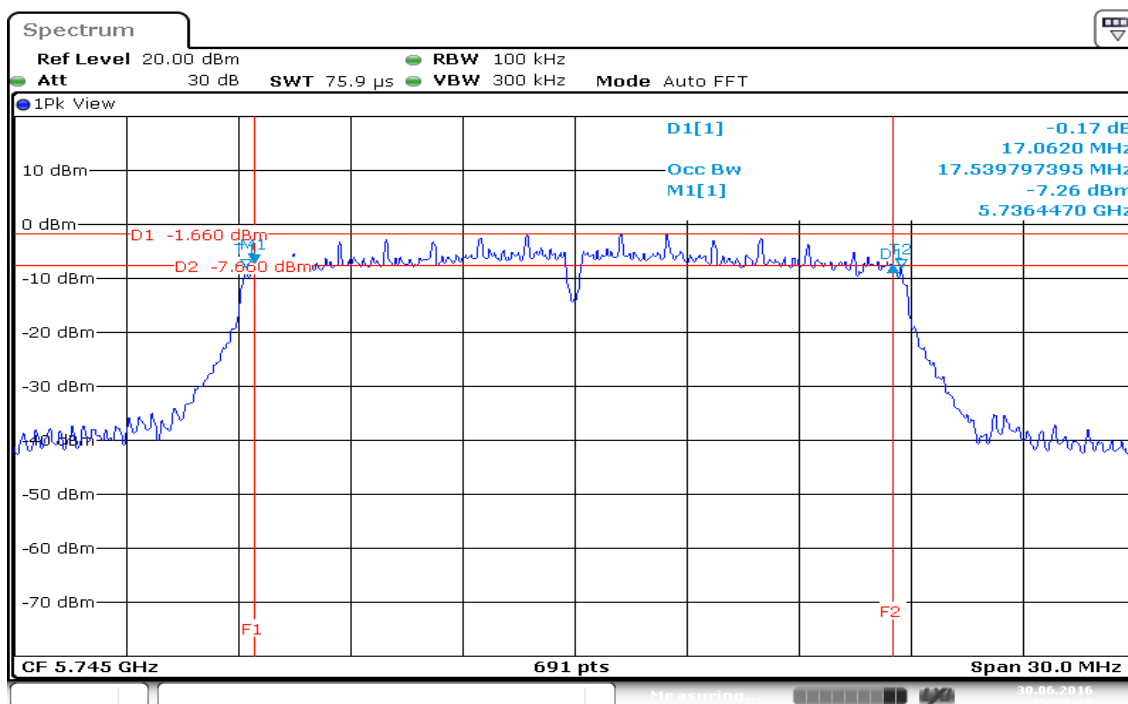
99% Bandwidth (CH High)



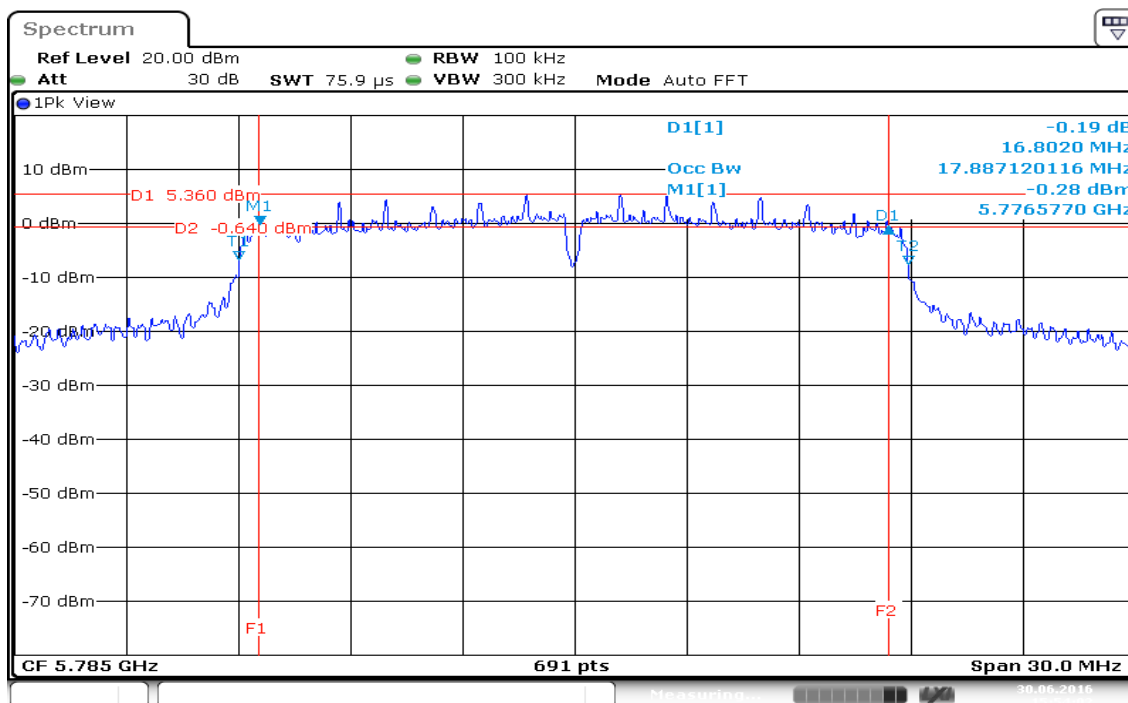
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IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz / Chain 1

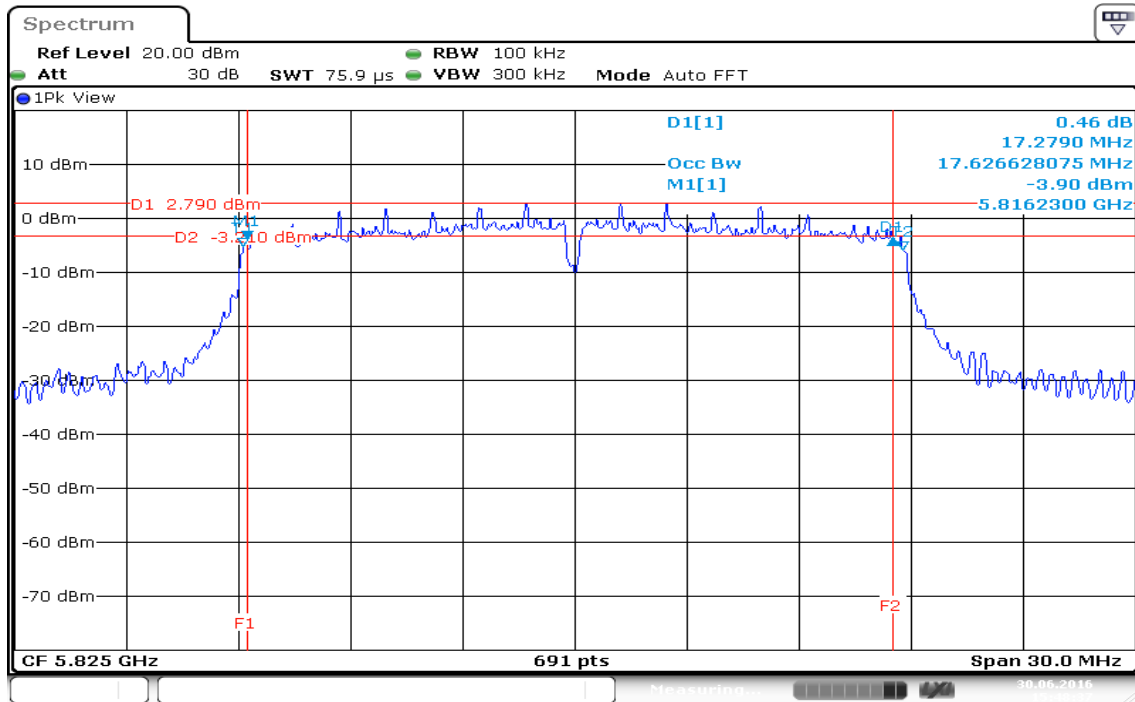
99% Bandwidth (CH Low)



99% Bandwidth (CH Mid)



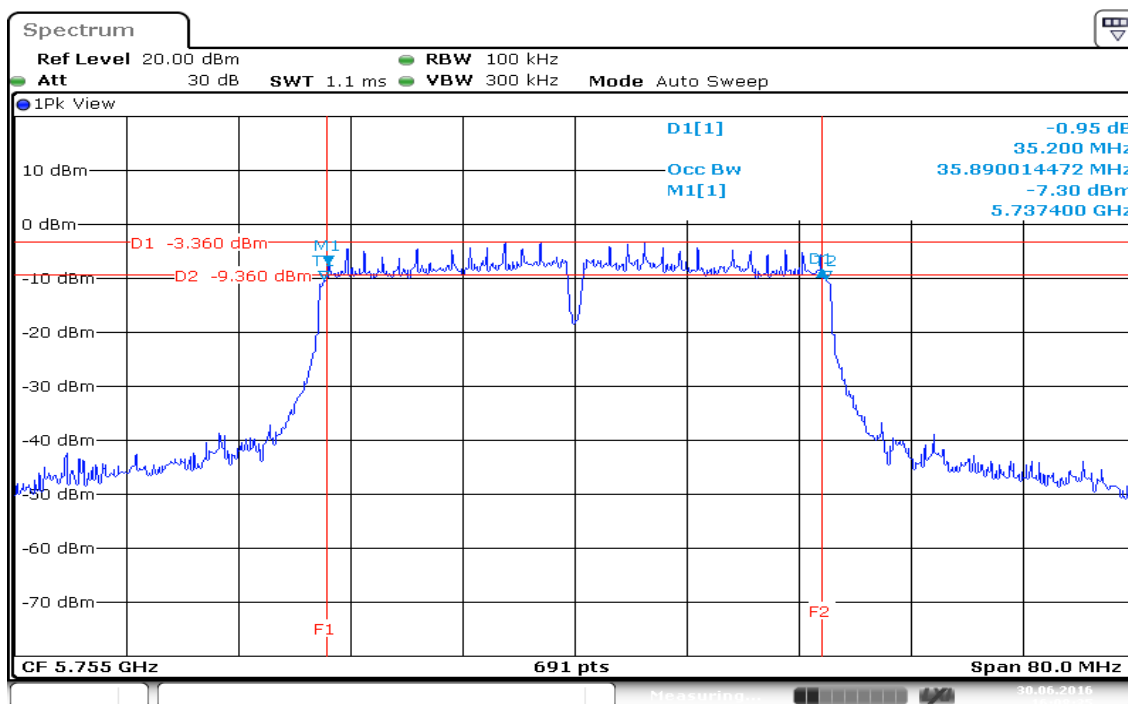
99% Bandwidth (CH High)



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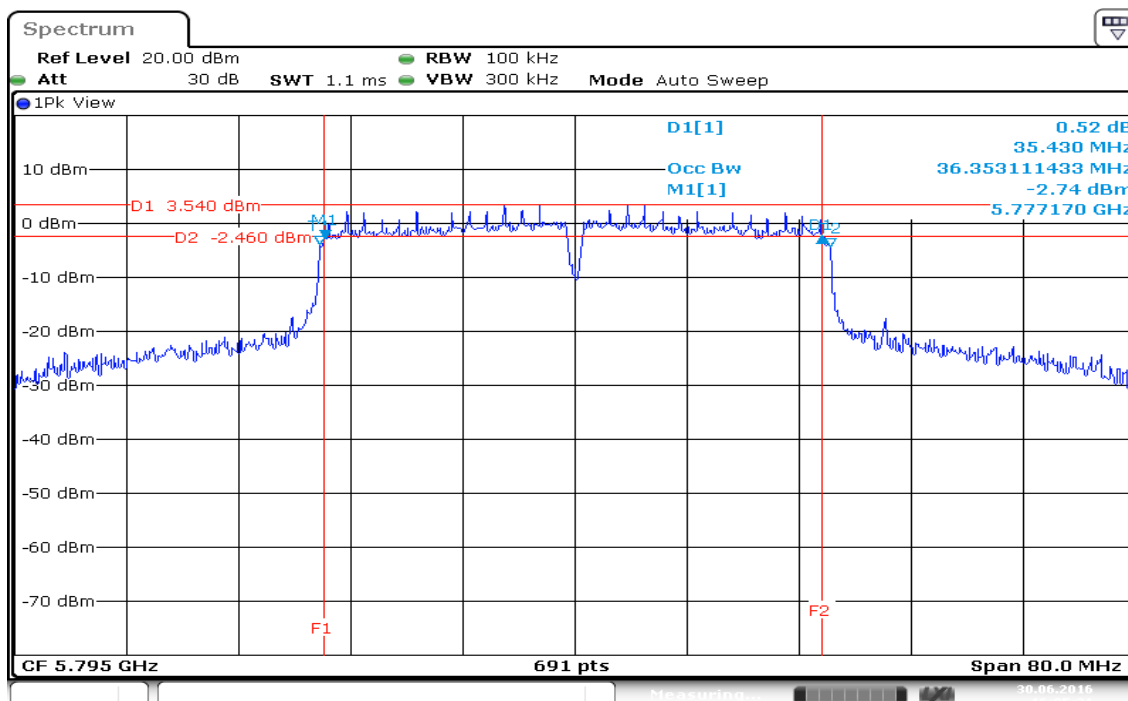
IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz / Chain 0

99% Bandwidth (CH Low)



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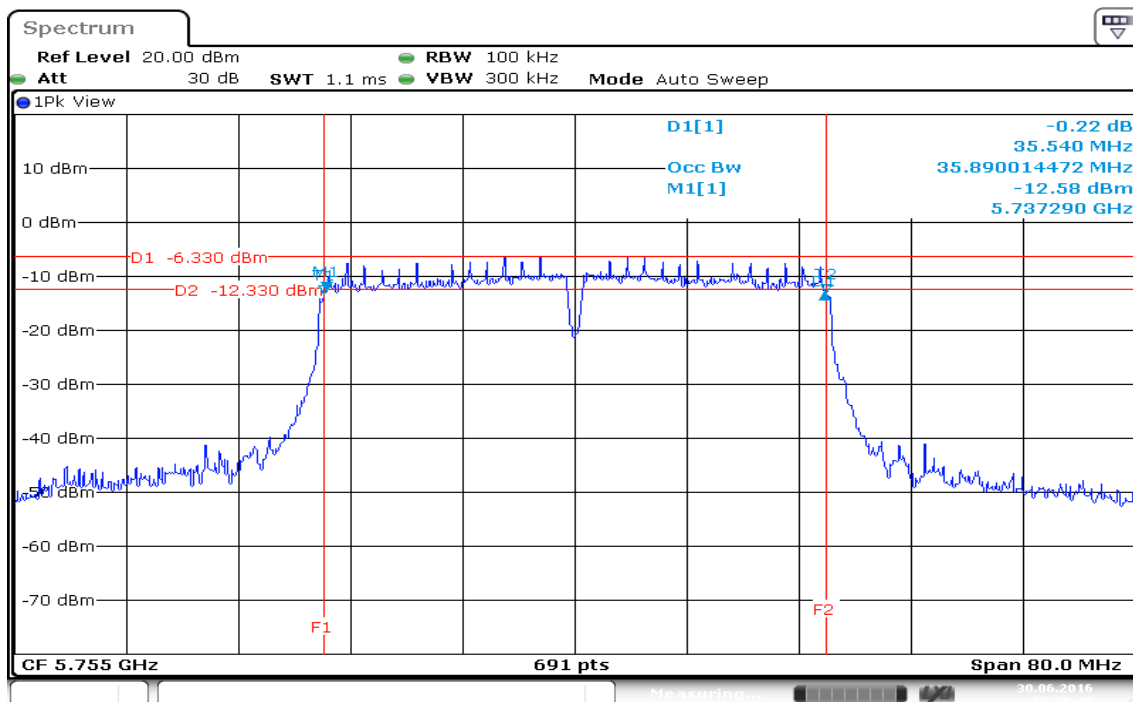
99% Bandwidth (CH High)



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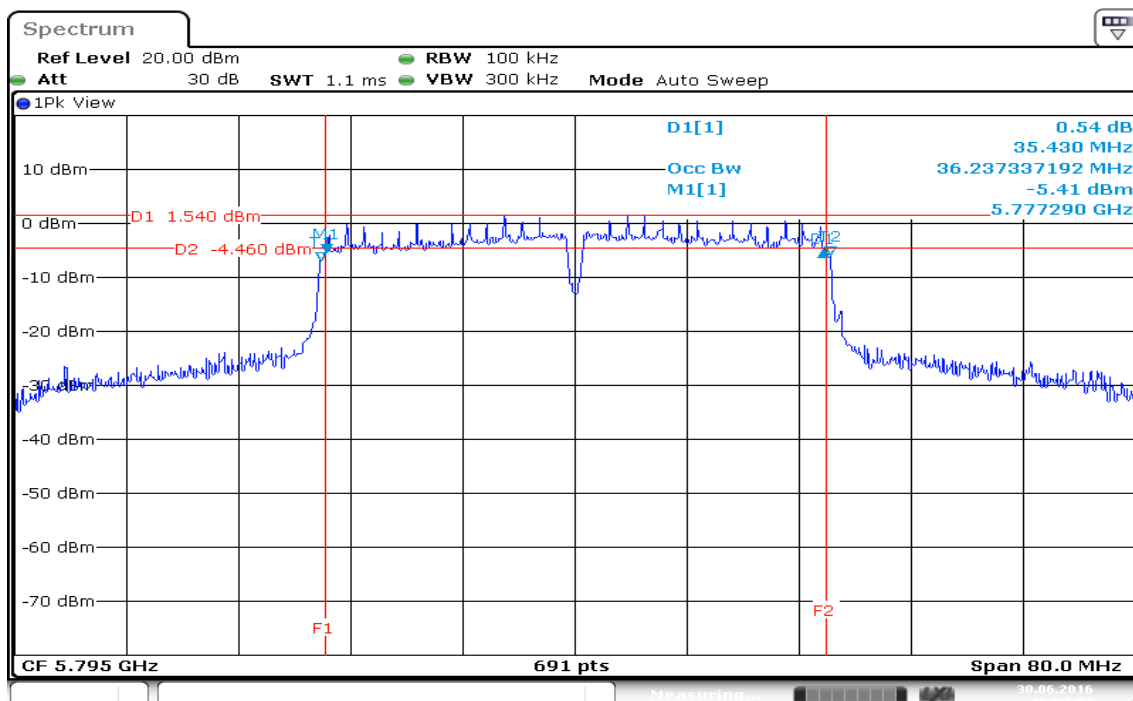
IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz / Chain 1

99% Bandwidth (CH Low)



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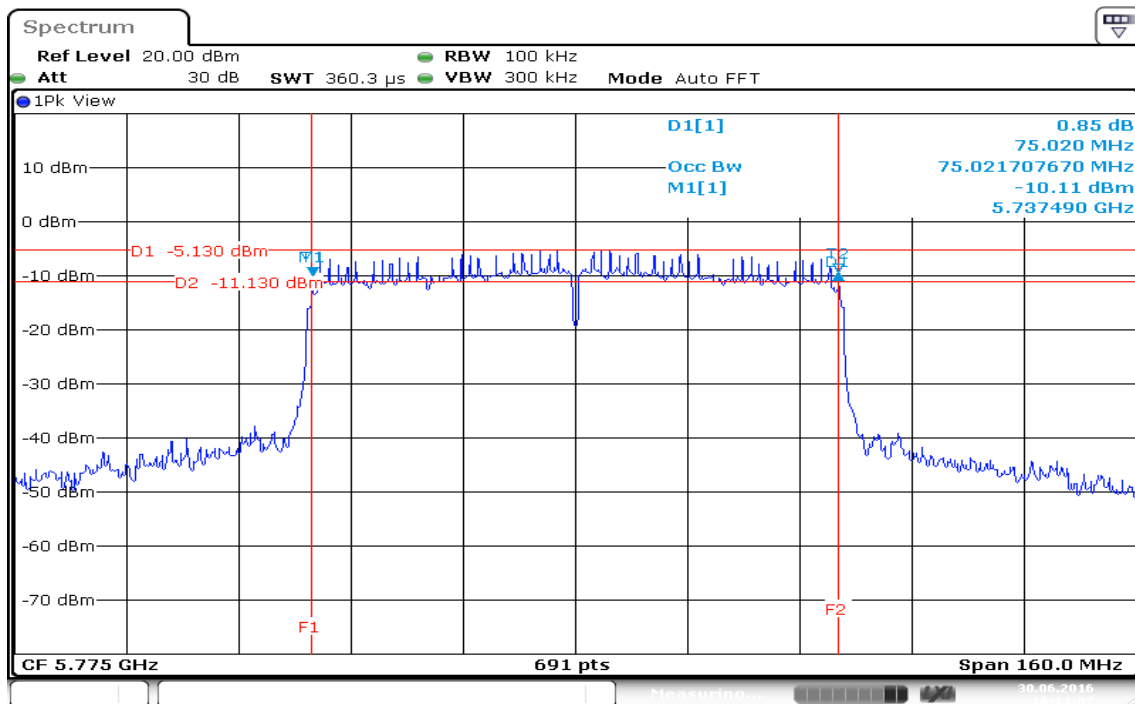
99% Bandwidth (CH High)



Date: 30 JUN 2016 16:03:07

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

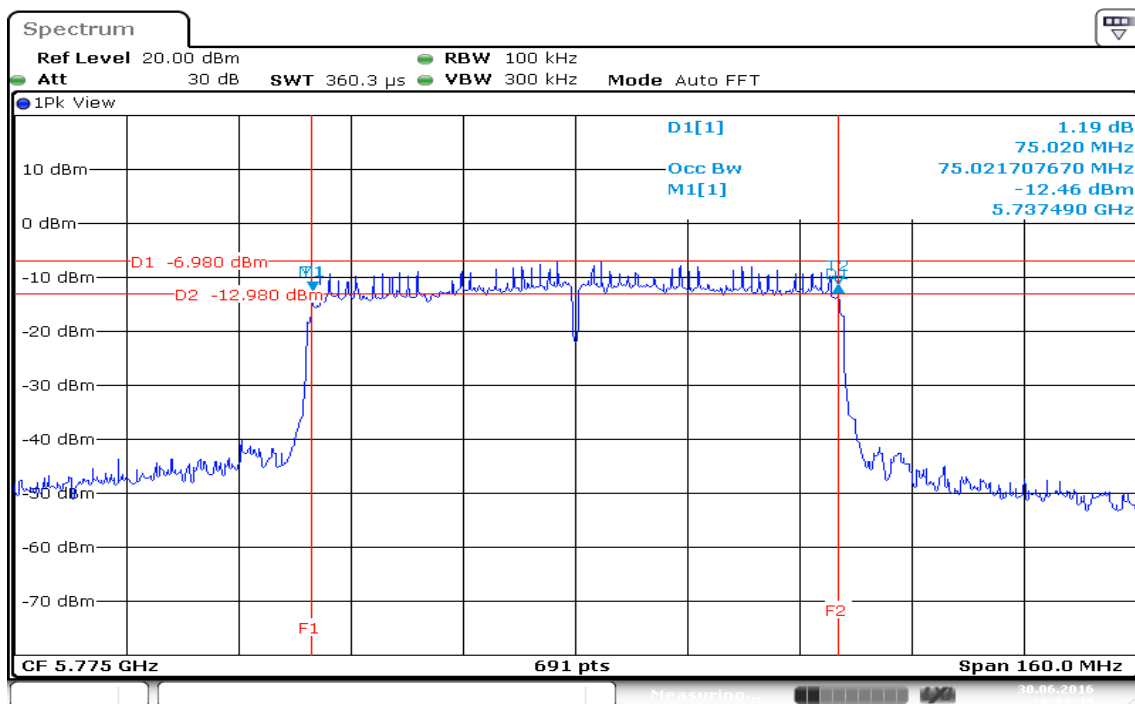
99% Bandwidth (CH Mid)



Date: 30 JUN 2016 16:11:07

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

99% Bandwidth (CH Mid)



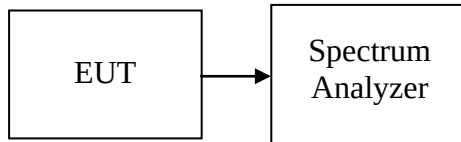
Date: 30 JUN 2016 16:12:45

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 / Chain 0**

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (kHz)	Result
Low	5745	16.2810	>500	PASS
Mid	5785	16.3240		PASS
High	5825	16.2810		PASS

Test mode: IEEE 802.11a mode / Chain 1

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (kHz)	Result
Low	5745	16.2810	>500	PASS
Mid	5785	16.3240		PASS
High	5825	16.3240		PASS

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

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (kHz)	Result
Low	5745	17.0620	>500	PASS
Mid	5785	17.5400		PASS
High	5825	17.0190		PASS

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

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (kHz)	Result
Low	5745	17.0620	>500	PASS
Mid	5785	17.8020		PASS
High	5825	17.2790		PASS

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

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (kHz)	Result
Low	5755	35.2000	>500	PASS
High	5795	35.4300		PASS

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

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (kHz)	Result
Low	5755	35.5400	>500	PASS
High	5795	35.4300		PASS

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

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (kHz)	Result
Mid	5755	75.0200	>500	PASS

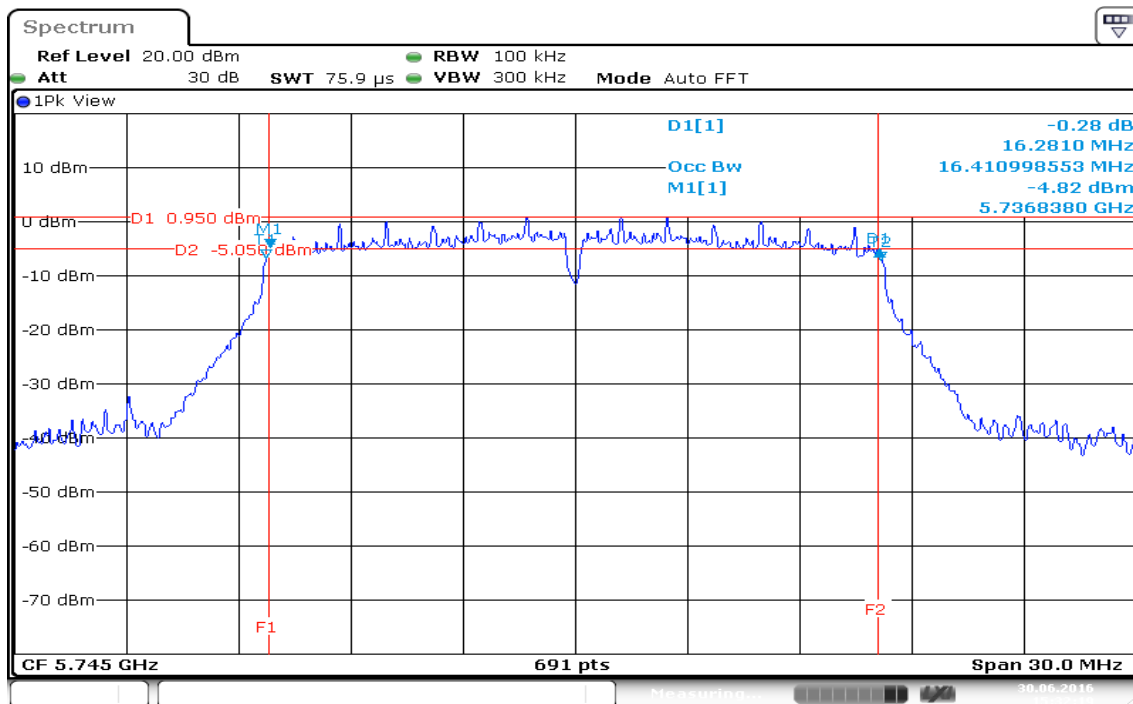
Test mode: IEEE 802.11ac VHT 80 MHz mode / 5775MHz / Chain 1

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (kHz)	Result
Mid	5755	75.0200	>500	PASS

Test Plot

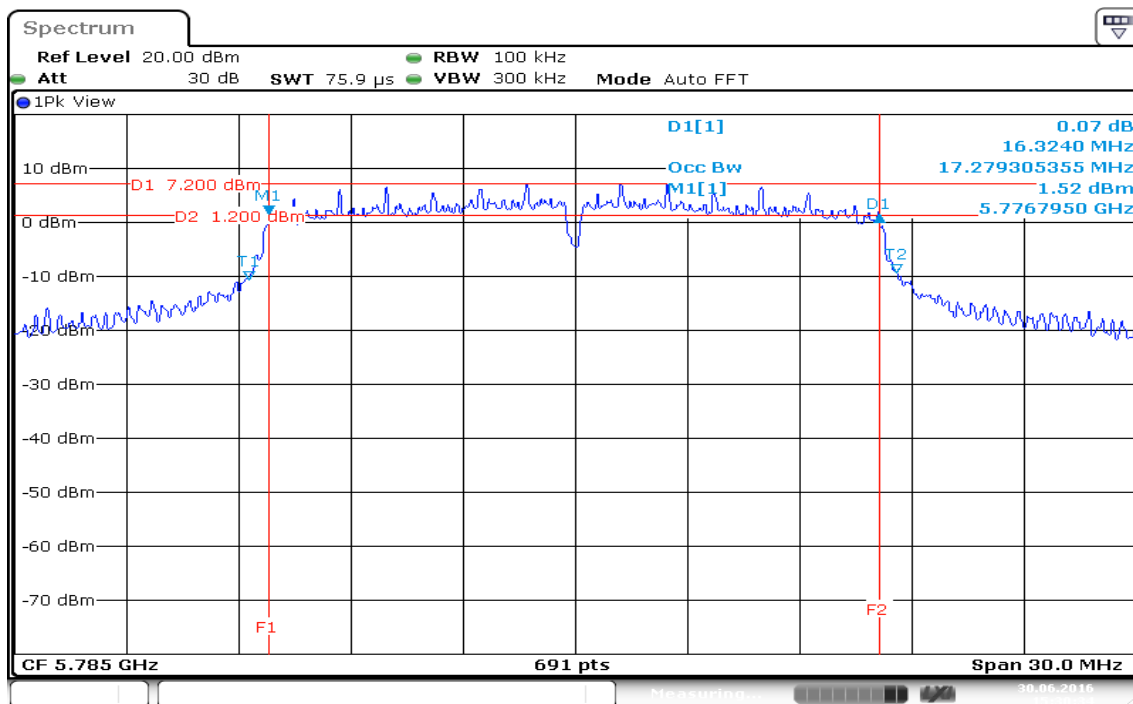
IEEE 802.11a mode / 5745 ~ 5825MHz / Chain 0

6dB Bandwidth (CH Low)



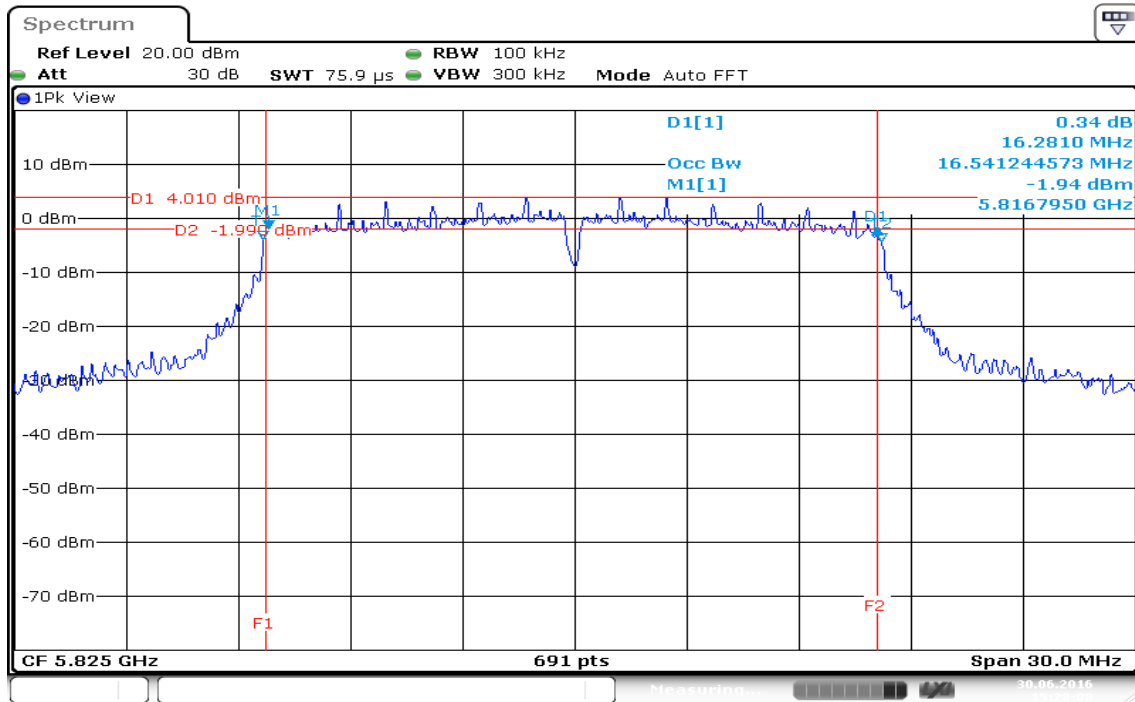
Date: 30 JUN 2016 15:32:19

6dB Bandwidth (CH Mid)



Date: 30 JUN 2016 15:30:34

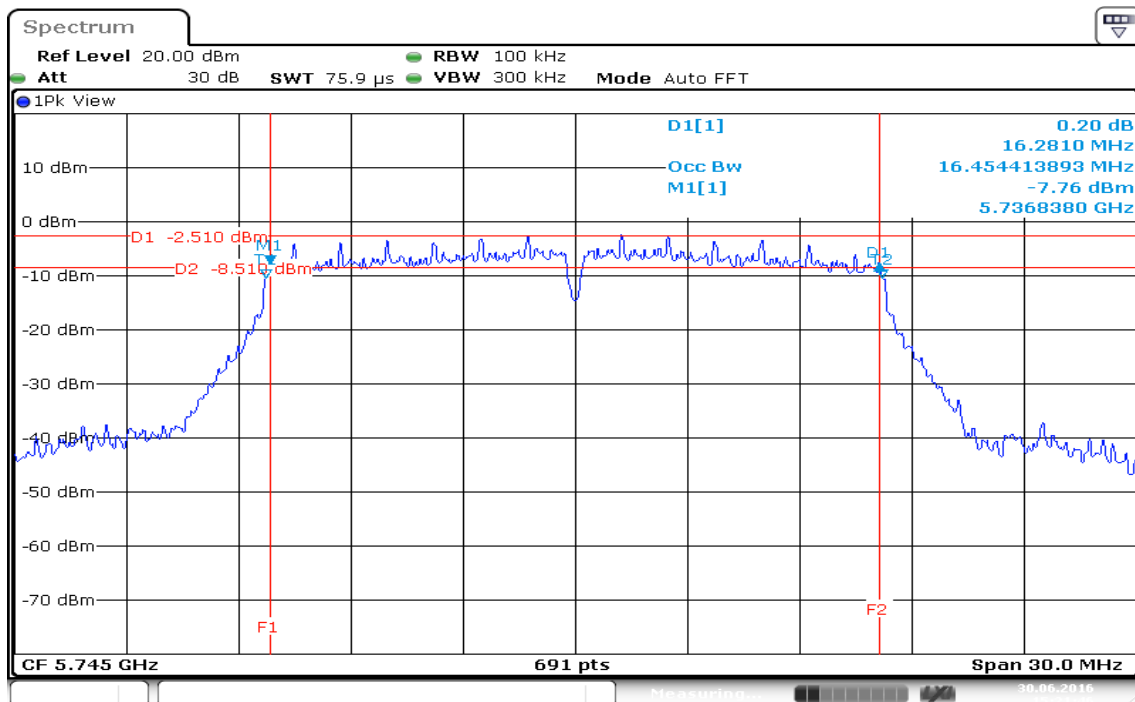
6dB Bandwidth (CH High)



Date: 30 JUN 2016 15:28:08

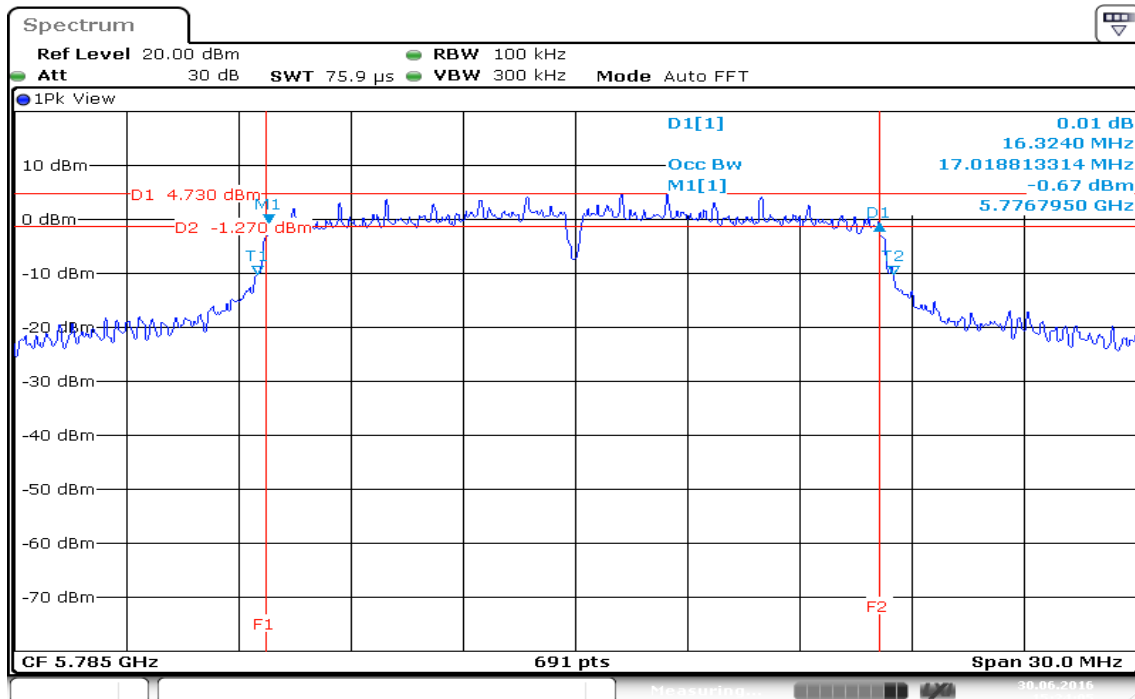
IEEE 802.11a mode / 5745 ~ 5825MHz / Chain 1

6dB Bandwidth (CH Low)



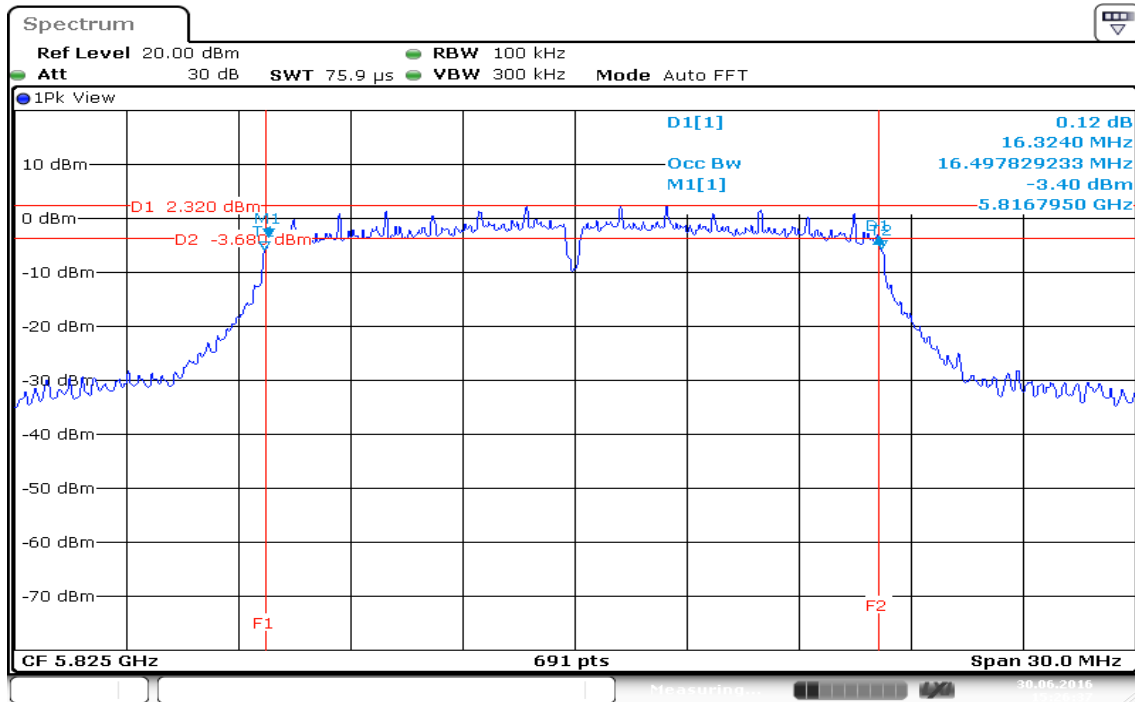
Date: 30 JUN 2016 15:21:47

6dB Bandwidth (CH Mid)



Date: 30 JUN 2016 15:24:06

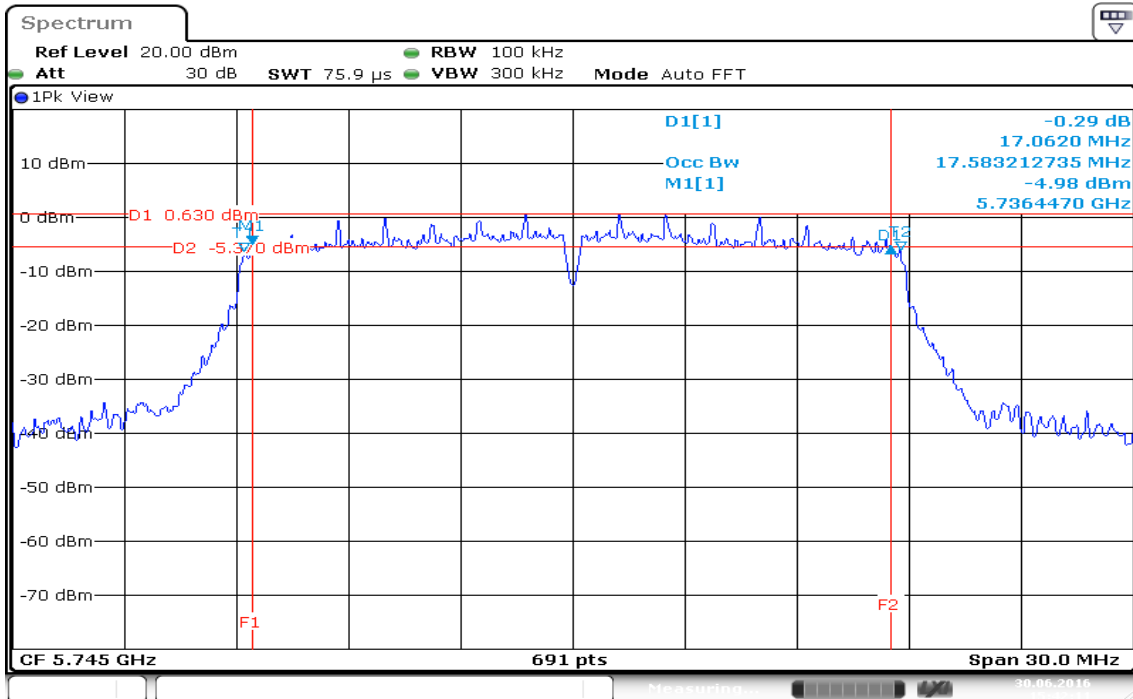
6dB Bandwidth (CH High)



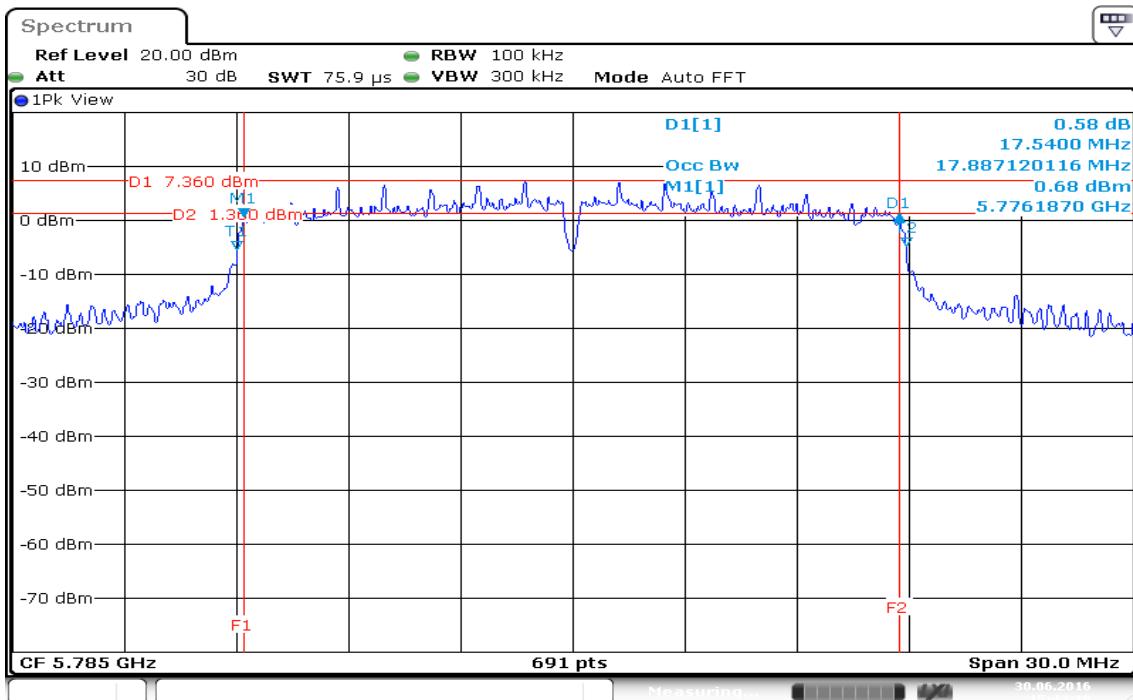
Date: 30 JUN 2016 15:26:37

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

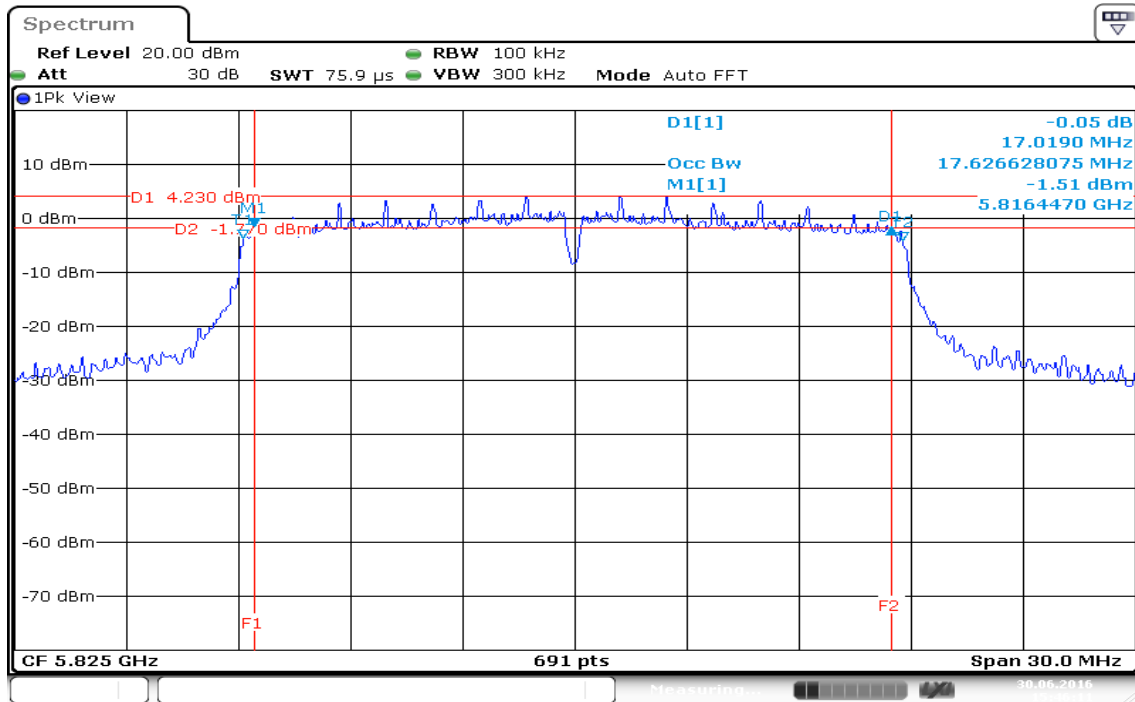
6dB Bandwidth (CH Low)



6dB Bandwidth (CH Mid)



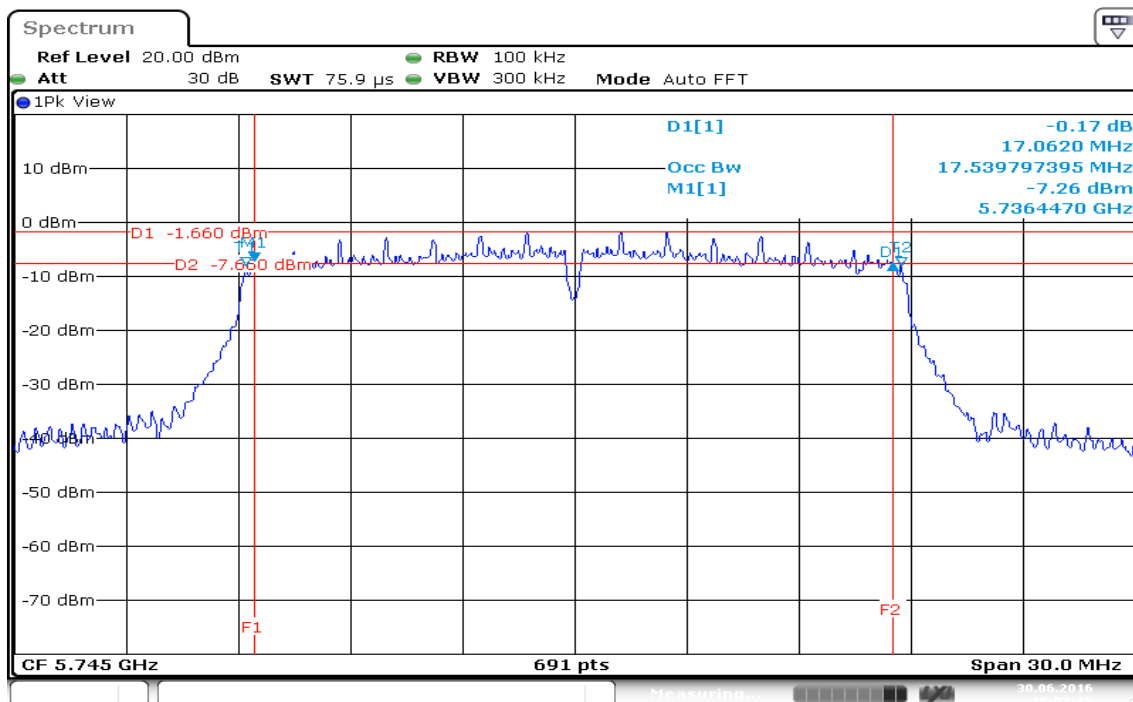
6dB Bandwidth (CH High)



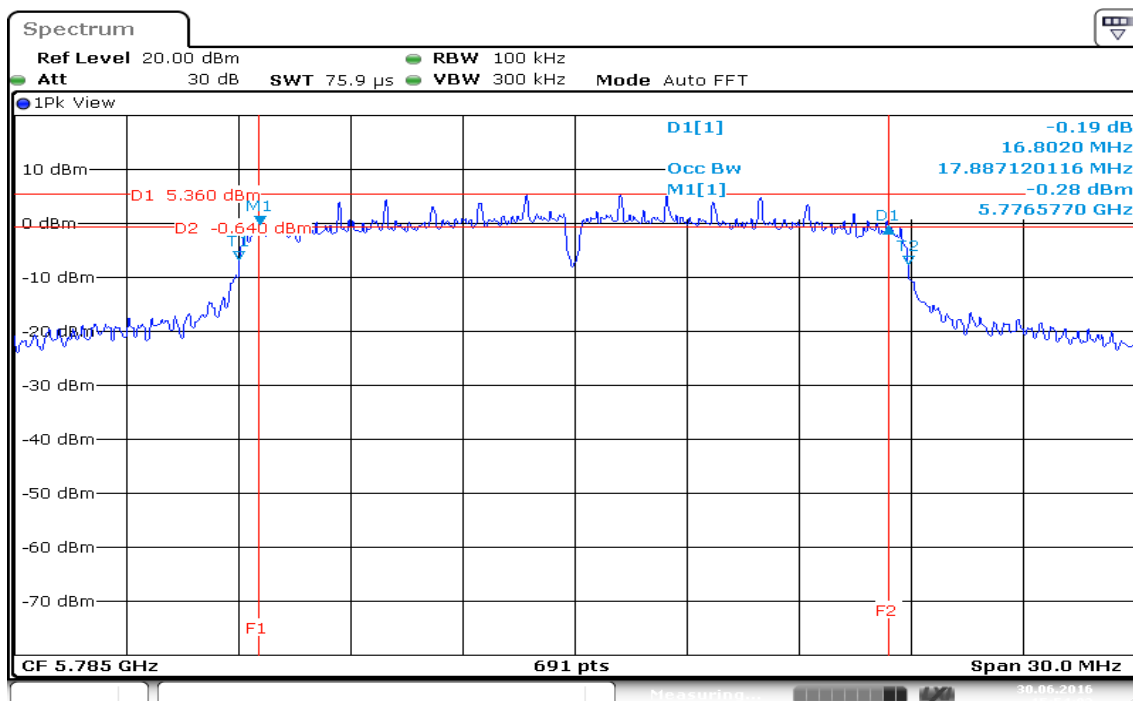
Date: 30 JUN 2016 15:46:11

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

6dB Bandwidth (CH Low)



6dB Bandwidth (CH Mid)



Spectrum

Ref Level 20.00 dBm RBW 100 kHz
 Att 30 dB SWT 75.9 μ s VBW 300 kHz Mode Auto FFT

1Pk View

10 dBm
 0 dBm
 -10 dBm
 -20 dBm
 -30 dBm
 -40 dBm
 -50 dBm
 -60 dBm
 -70 dBm

D1[1] 0.46 dB
 Occ Bw 17.2790 MHz
 M1[1] 17.626628075 MHz
 D2[1] -3.90 dBm
 5.8162300 GHz

D1 2.790 dBm
 D2 -3.90 dBm

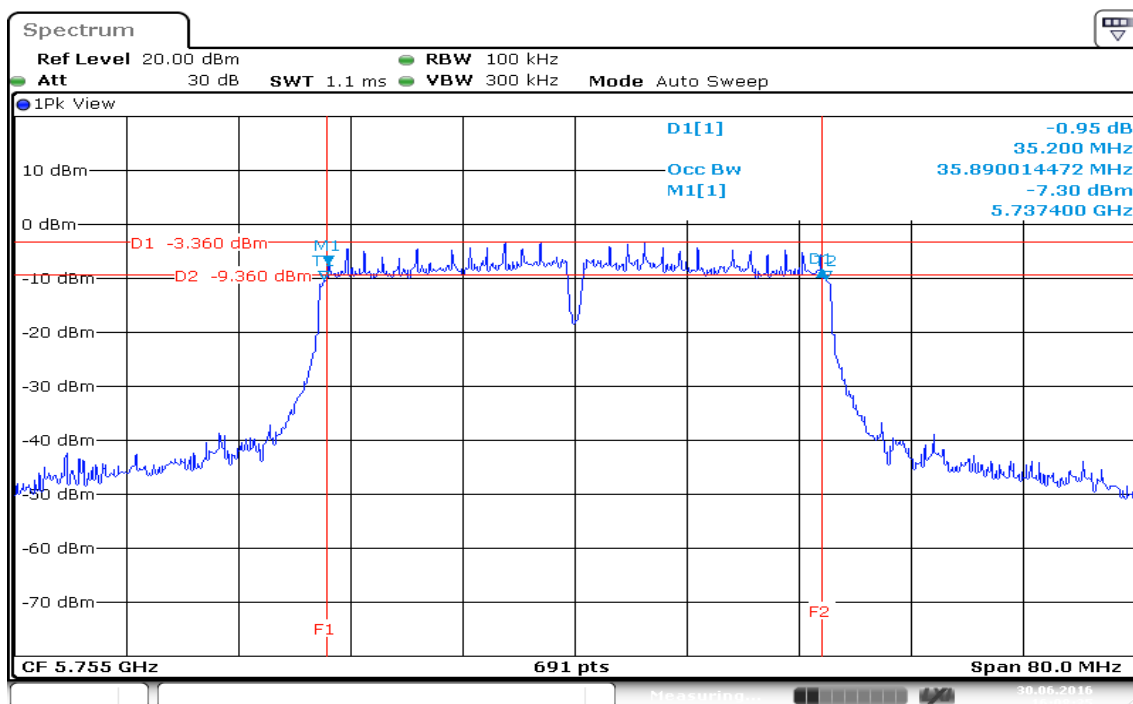
F1 F2

CF 5.825 GHz 691 pts Span 30.0 MHz

Date: 30 JUN 2016 15:48:37

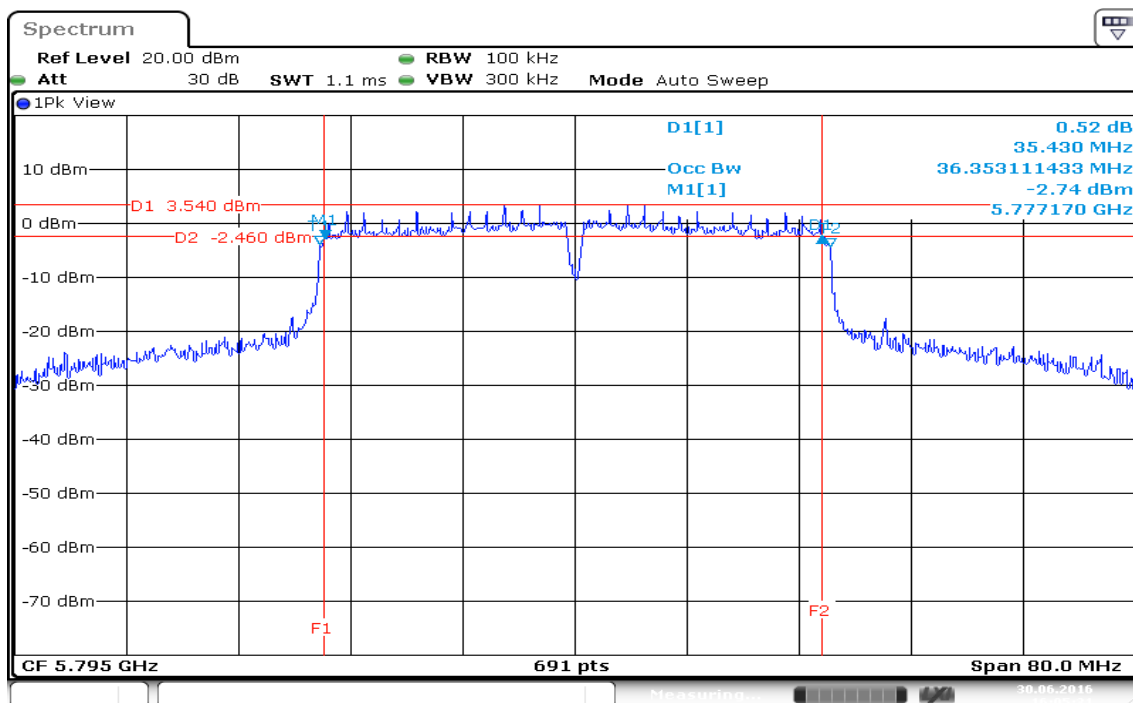
IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz / Chain 0

6dB Bandwidth (CH Low)



Date: 30 JUN 2016 16:08:36

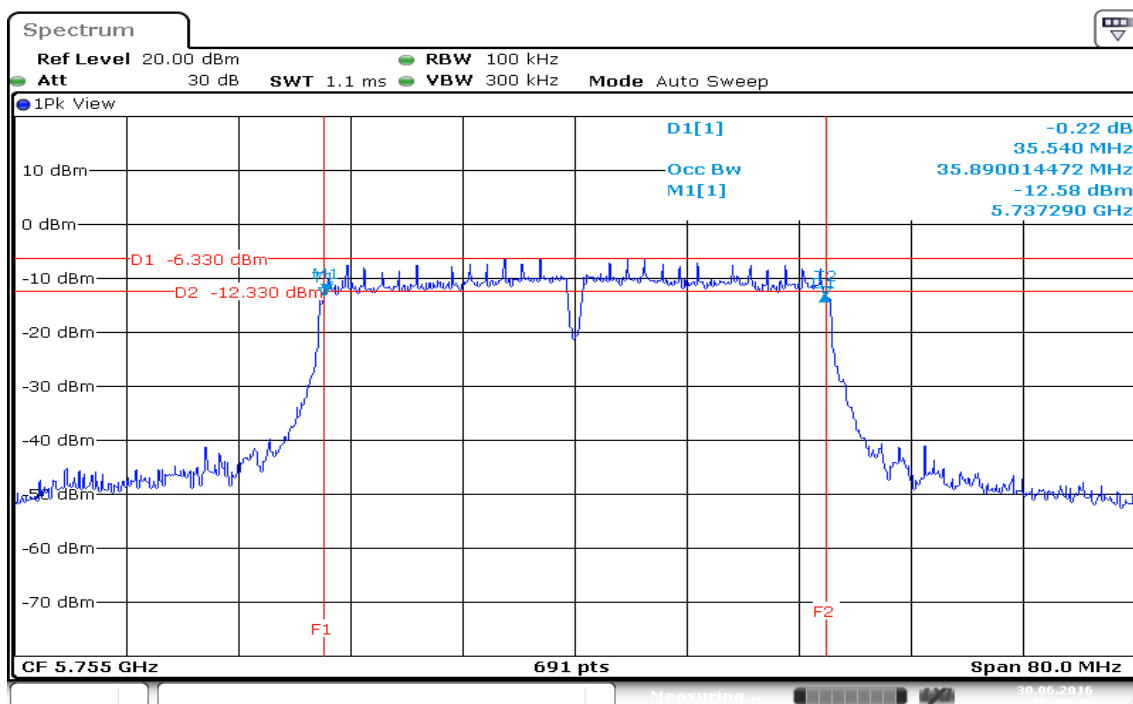
6dB Bandwidth (CH High)



Date: 30 JUN 2016 16:05:31

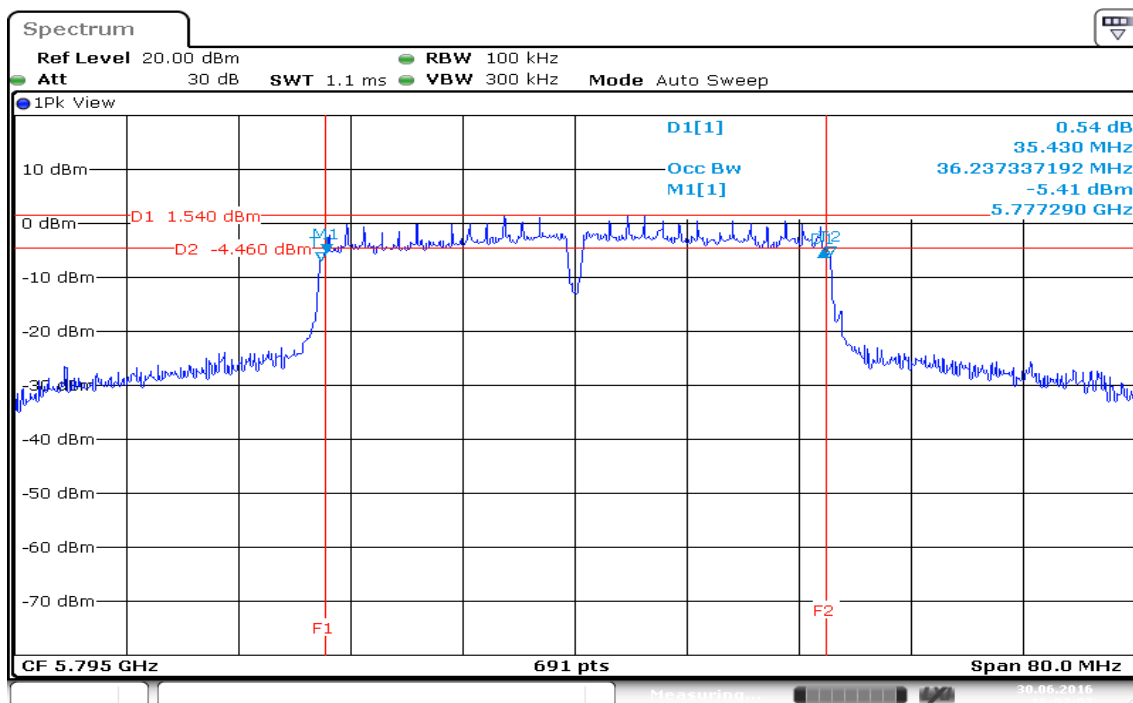
IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz / Chain 1

6dB Bandwidth (CH Low)



Date: 30 JUN 2016 15:59:49

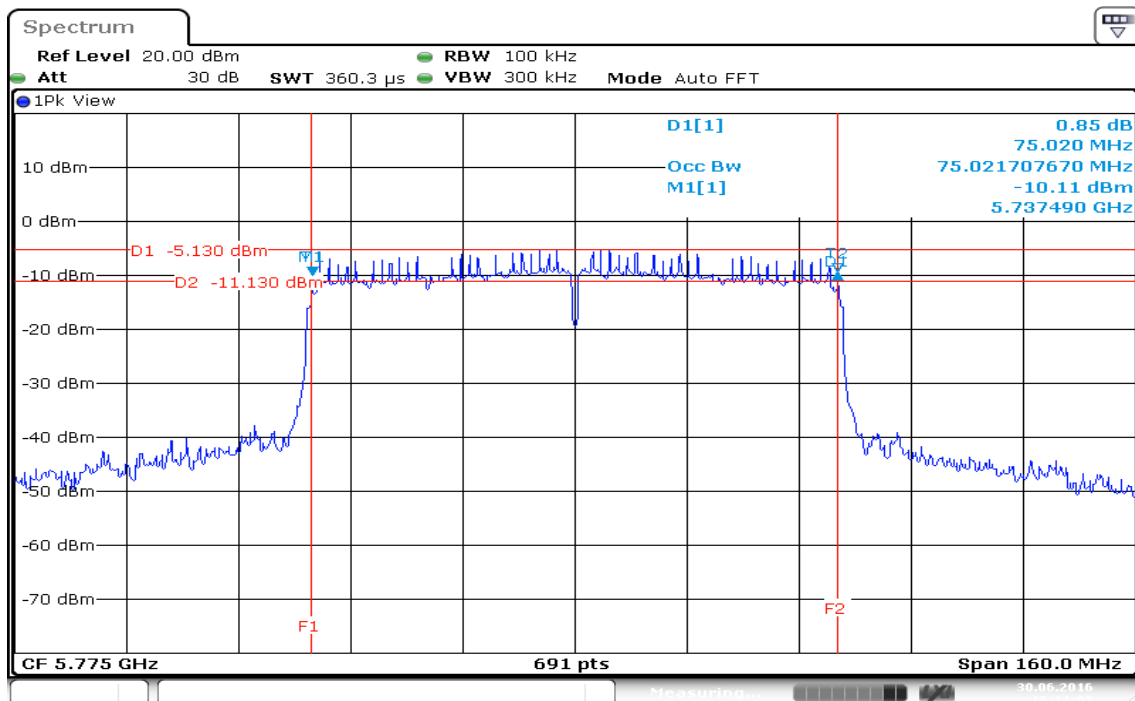
6dB Bandwidth (CH High)



Date: 30 JUN 2016 16:03:07

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

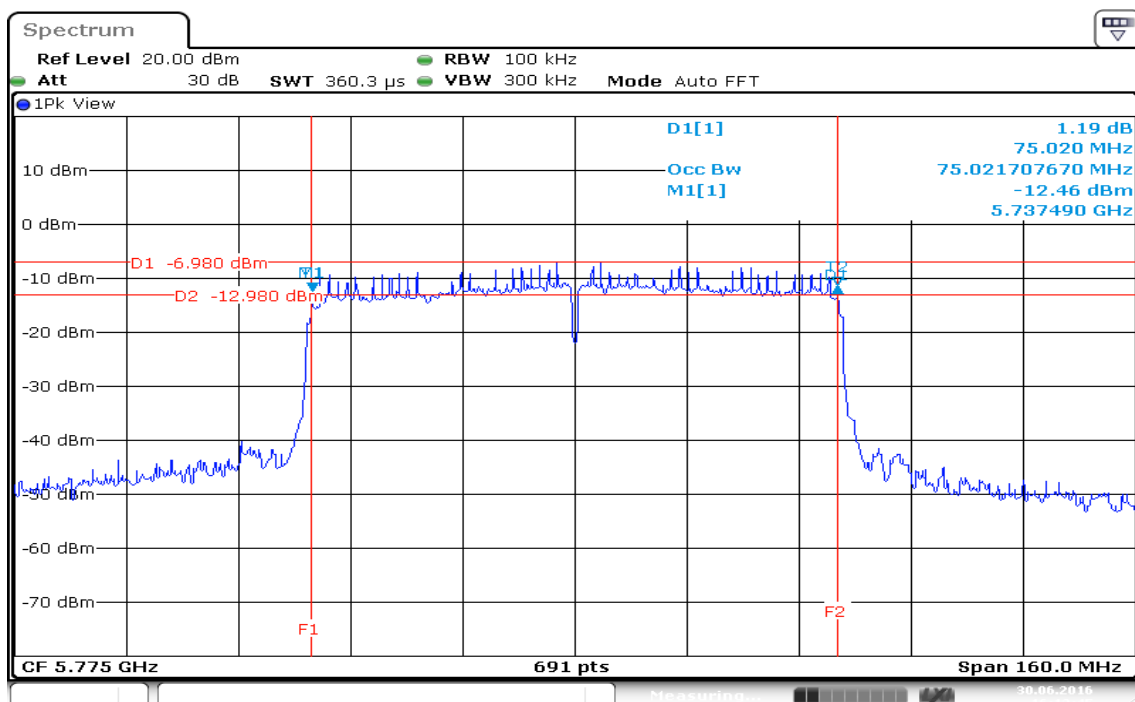
6dB Bandwidth (CH Mid)



Date: 30 JUN 2016 16:11:07

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

6dB Bandwidth (CH Mid)



Date: 30 JUN 2016 16:12:45

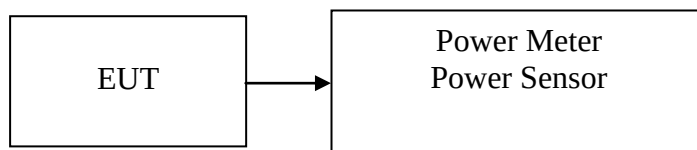
7.3 MAXIMUM CONDUCTED OUTPUT POWER

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)	Chain 0 Output Power (dBm)	Chain 1 Output Power (dBm)	Output Power (dBm)	Output Power (W)	Limit (dBm)
Low	5745	9.87	10.47	13.19	0.0208	30
Mid	5785	15.76	15.79	*18.79	0.0757	30
High	5825	13.22	12.98	16.11	0.0408	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	9.11	10.81	13.05	0.0202	30
Mid	5785	15.19	15.92	*18.58	0.0721	30
High	5825	13.08	13.64	16.38	0.0435	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	6.78	7.53	10.18	0.0104	30
High	5795	13.64	14.14	*16.91	0.0491	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	8.52	9.43	*12.01	0.0159	30

Remark:

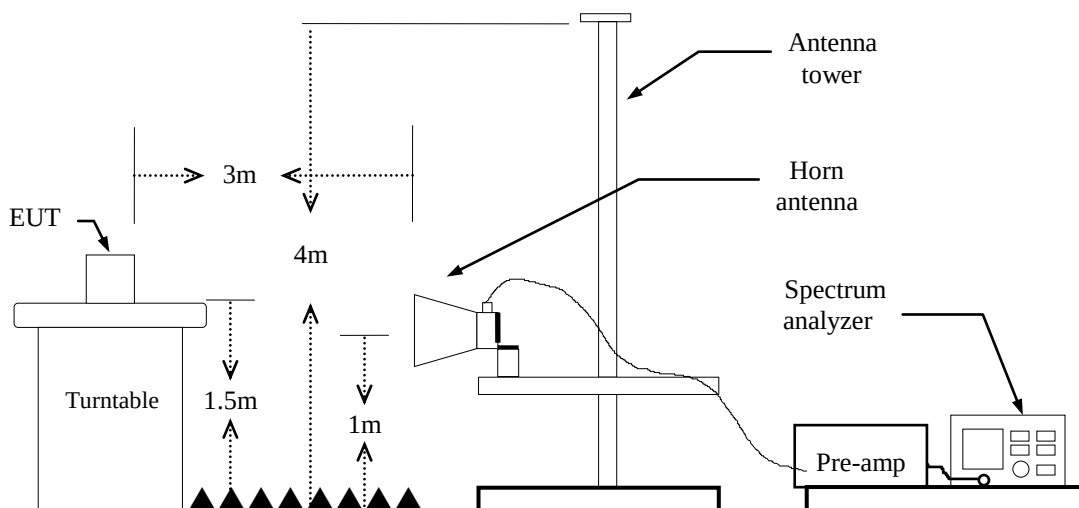
1. Total Output Power (w) = Chain 0 ($10^{(\text{Output Power}/10)/1000}$) + Chain 1 ($10^{(\text{Output Power}/10)/1000}$)

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 is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. 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

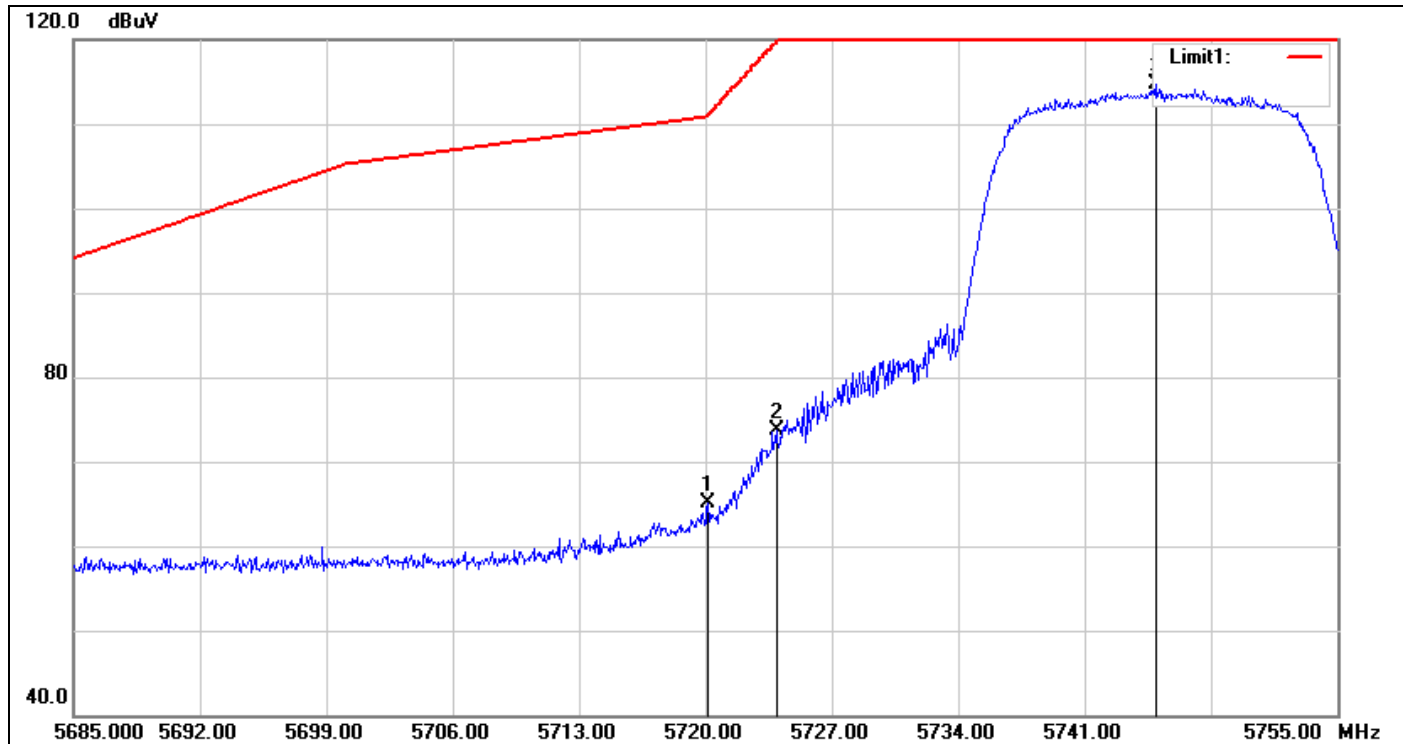
1. The EUT is placed on a turntable, which is 1.5m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the 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 $\geq 98\%$, VBW=10Hz.
if duty cycle $< 98\%$ VBW=1/T.
IEEE 802.11a mode: =94%, VBW=680Hz
IEEE 802.11n HT 20 MHz mode: =89%, VBW=750Hz
IEEE 802.11n HT 40 MHz mode: =81%, VBW=1.5kHz
IEEE 802.11ac VHT 80 MHz mode: =68%, 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.

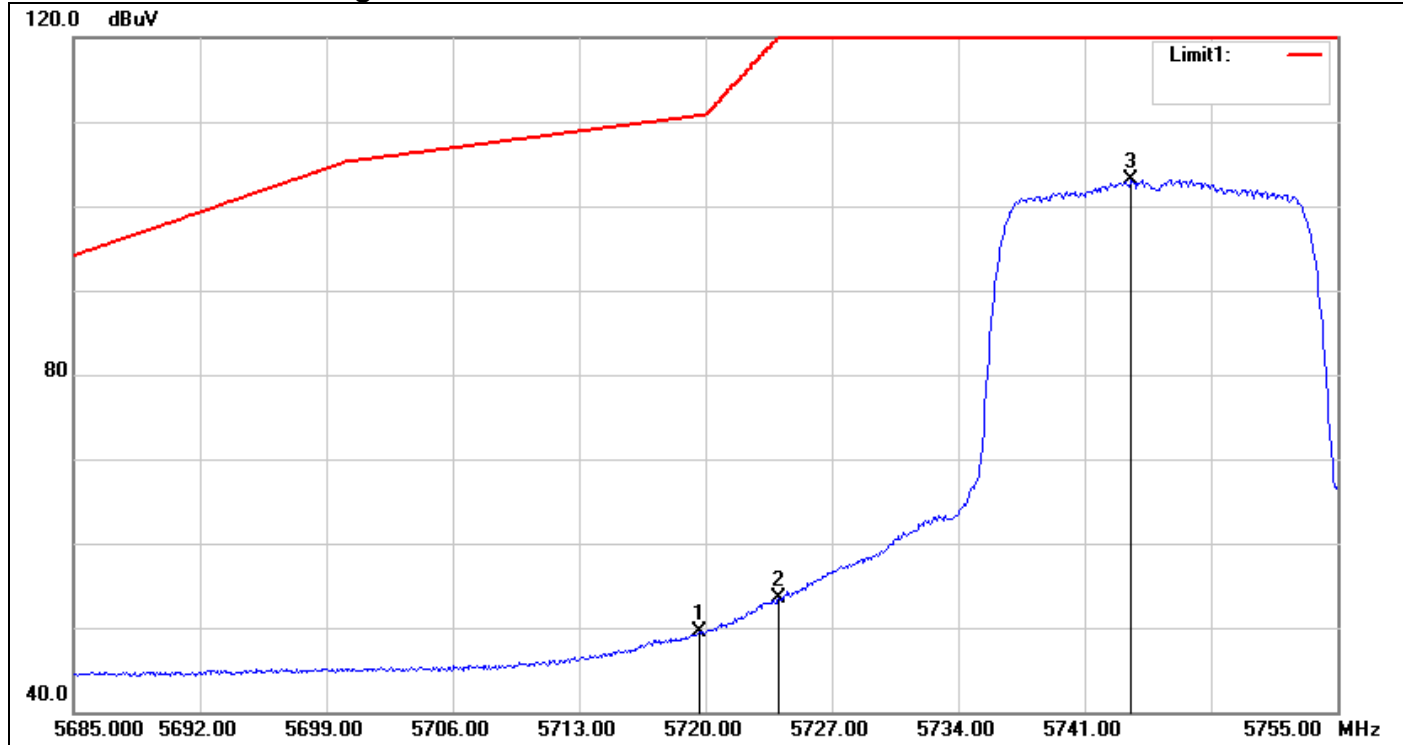
Band Edges (IEEE 802.11a mode / CH Low)

Detector mode: Peak



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	5720.140	58.93	6.19	65.12	111.12	-46.00	peak
2	5723.920	67.43	6.20	73.63	119.74	-46.11	peak
3	5744.920	108.38	6.29	114.67	-	-	peak

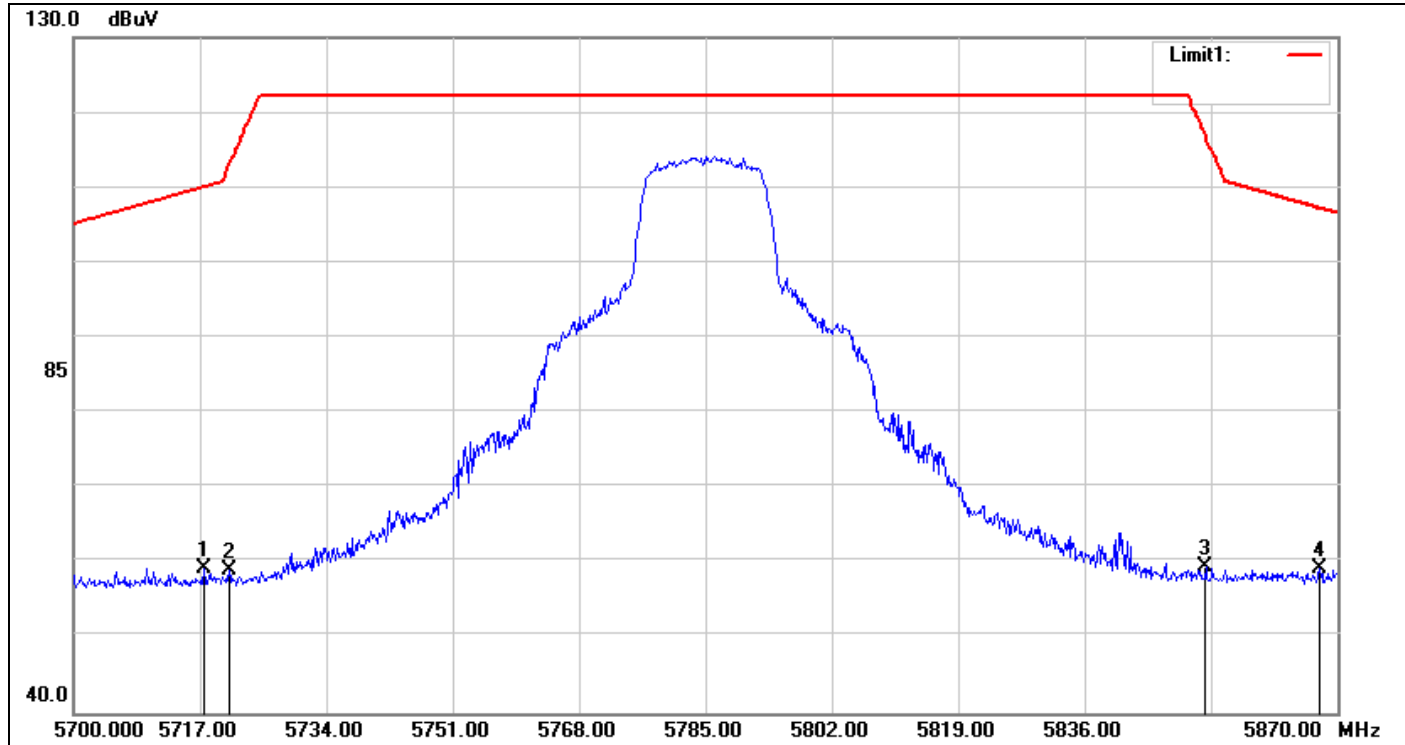
Detector mode: Average



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	5719.650	43.37	6.19	49.56	110.70	-61.14	AVG
2	5724.060	47.28	6.20	53.48	120.06	-66.58	AVG
3	5743.590	96.77	6.29	103.06	-	-	AVG

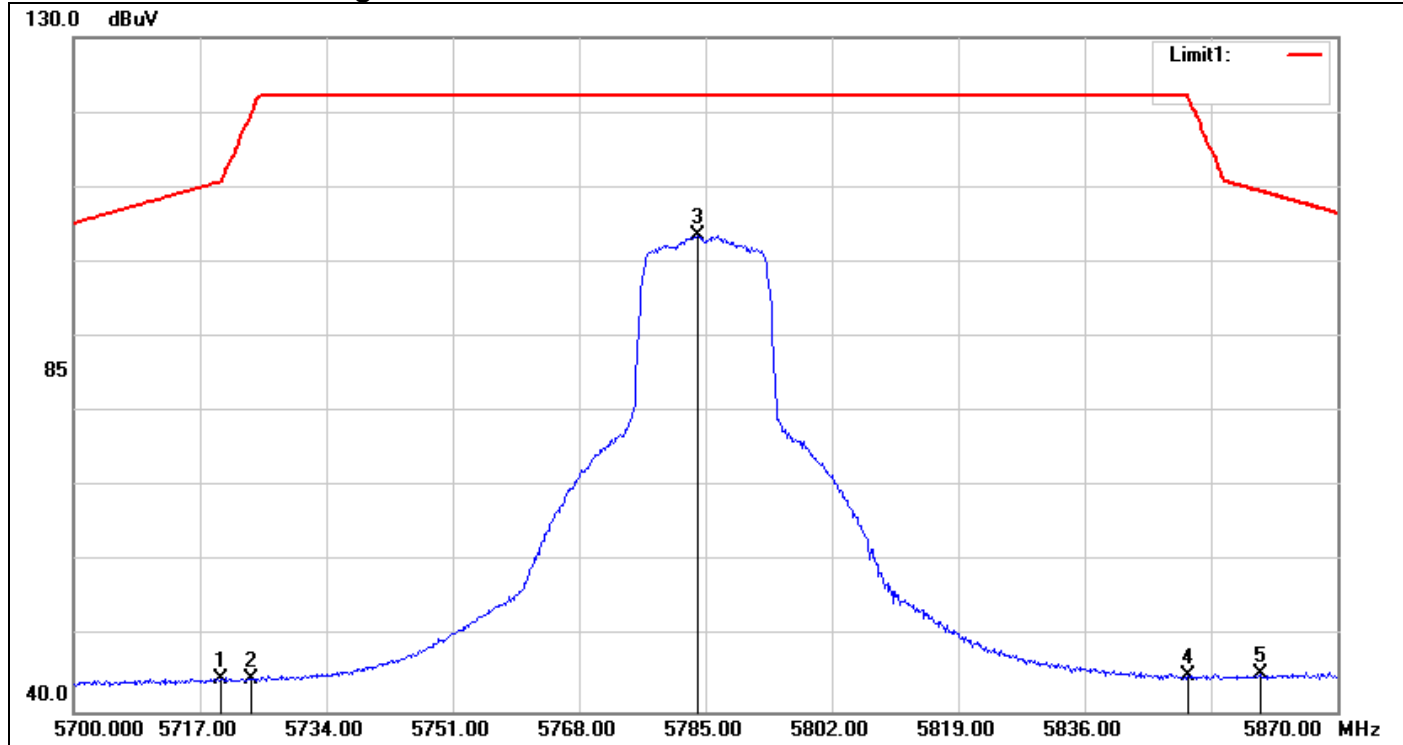
Band Edges (IEEE 802.11a mode / CH Mid)

Detector mode: Peak



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	5717.510	53.04	6.18	59.22	110.10	-50.88	peak
2	5720.910	52.73	6.19	58.92	112.87	-53.95	peak
3	5852.320	52.80	6.75	59.55	116.91	-57.36	peak
4	5867.620	52.33	6.82	59.15	107.27	-48.12	peak

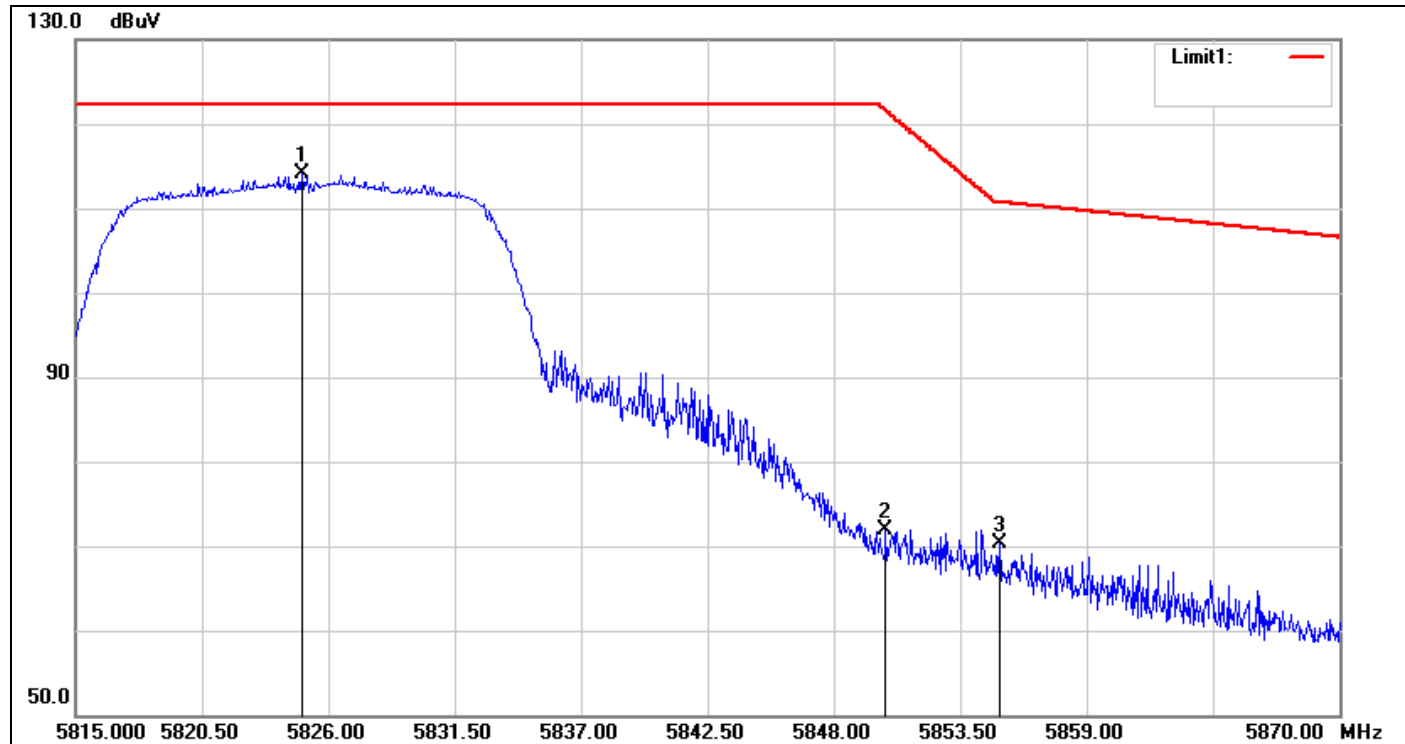
Detector mode: Average



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	5719.890	38.29	6.19	44.48	110.77	-66.29	AVG
2	5723.800	38.29	6.20	44.49	119.46	-74.97	AVG
3	5783.980	97.12	6.46	103.58	-	-	AVG
4	5849.940	38.14	6.74	44.88	122.20	-77.32	AVG
5	5859.630	38.18	6.78	44.96	109.50	-64.54	AVG

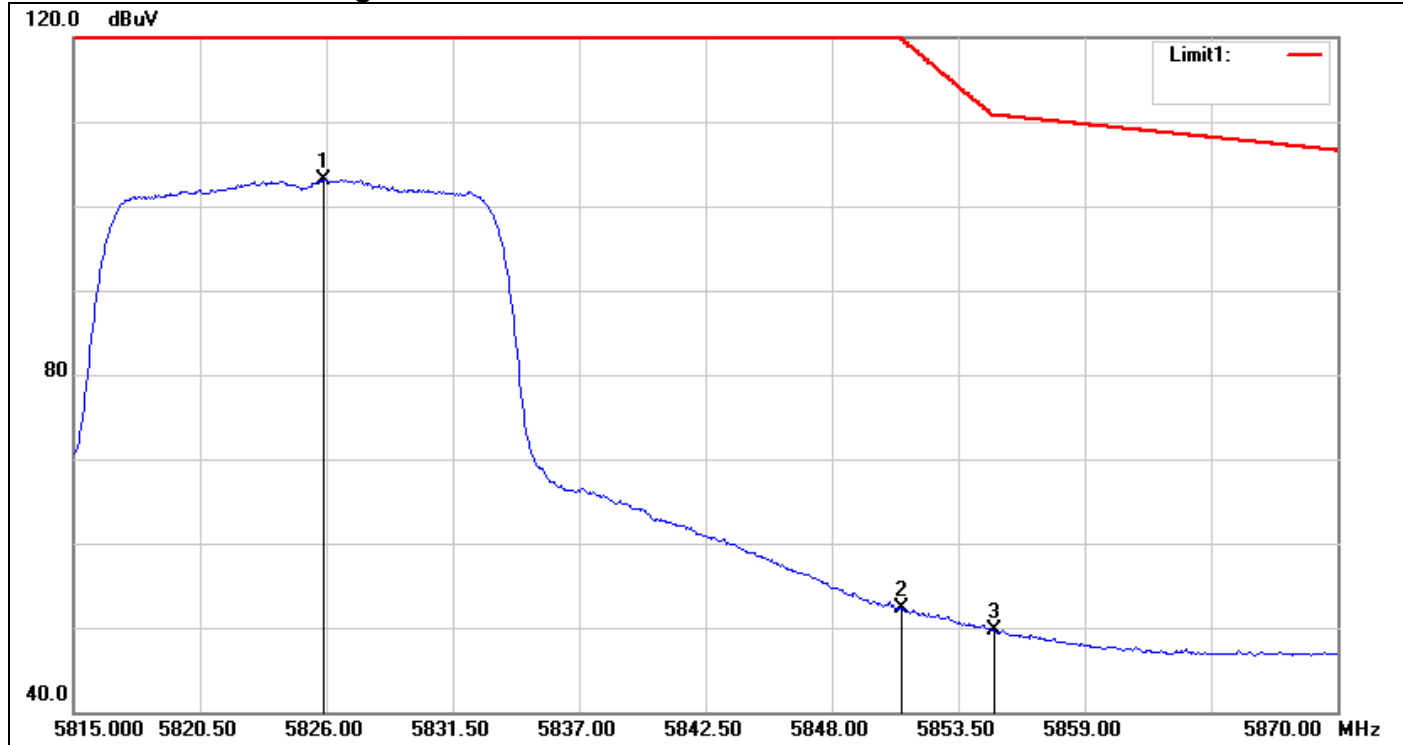
Band Edges (IEEE 802.11a mode / CH High)

Detector mode: Peak



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	5824.845	107.46	6.63	114.09	-	-	peak
2	5850.255	65.23	6.74	71.97	121.62	-49.65	peak
3	5855.205	63.60	6.76	70.36	110.74	-40.38	peak

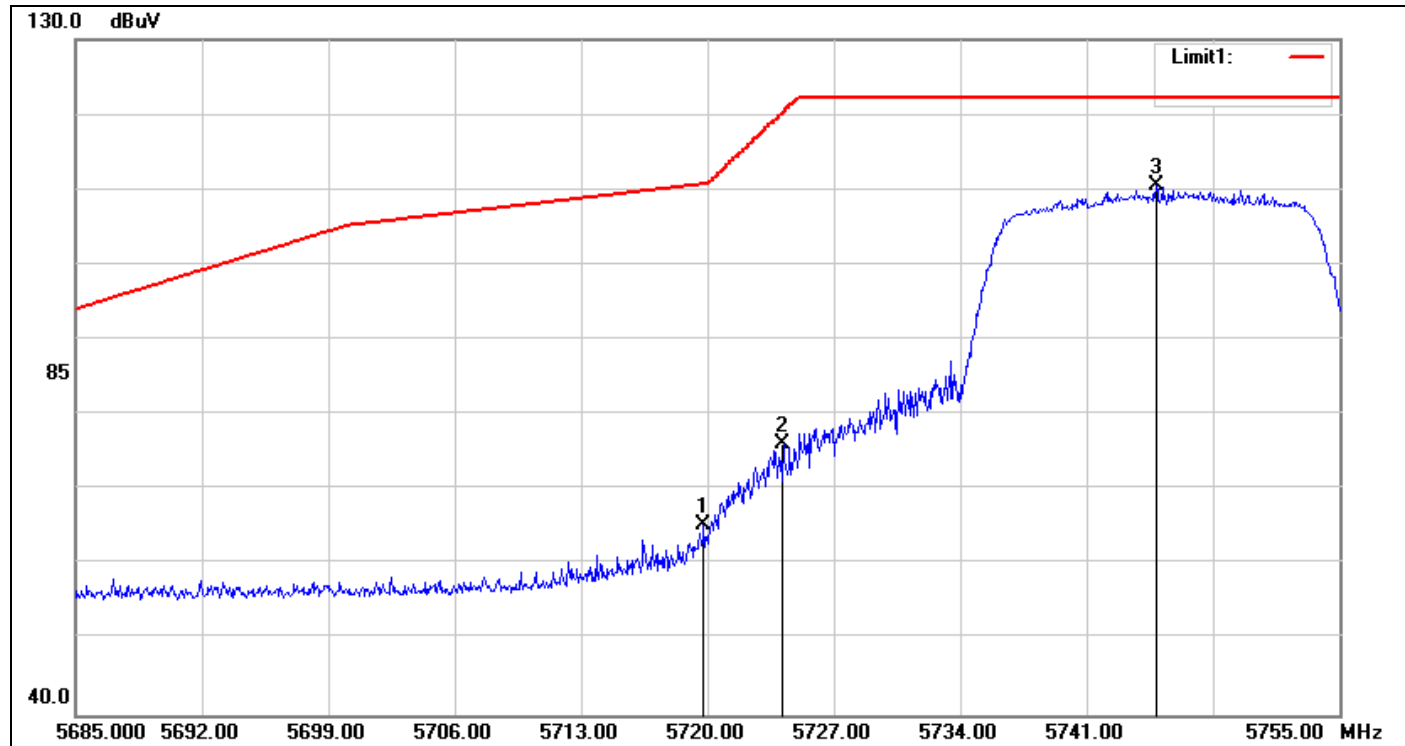
Detector mode: Average



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	5825.890	96.49	6.64	103.13	-	-	AVG
2	5851.025	45.52	6.75	52.27	119.86	-67.59	AVG
3	5855.095	42.95	6.76	49.71	110.77	-61.06	AVG

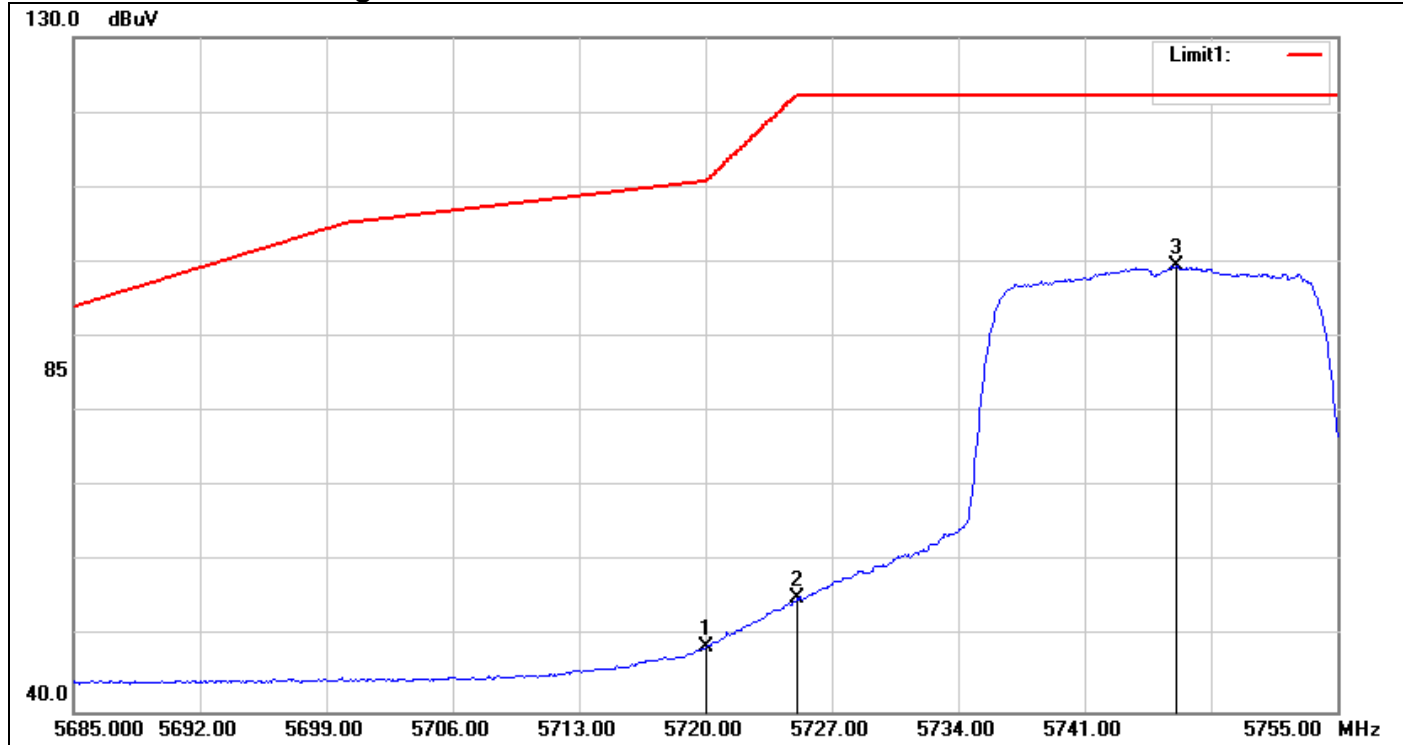
Band Edges (IEEE 802.11n HT 20 MHz mode / CH Low)

Detector mode: Peak



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	5719.790	59.12	6.19	65.31	110.74	-45.43	peak
2	5724.200	69.82	6.21	76.03	120.38	-44.35	peak
3	5744.850	104.26	6.29	110.55	-	-	peak

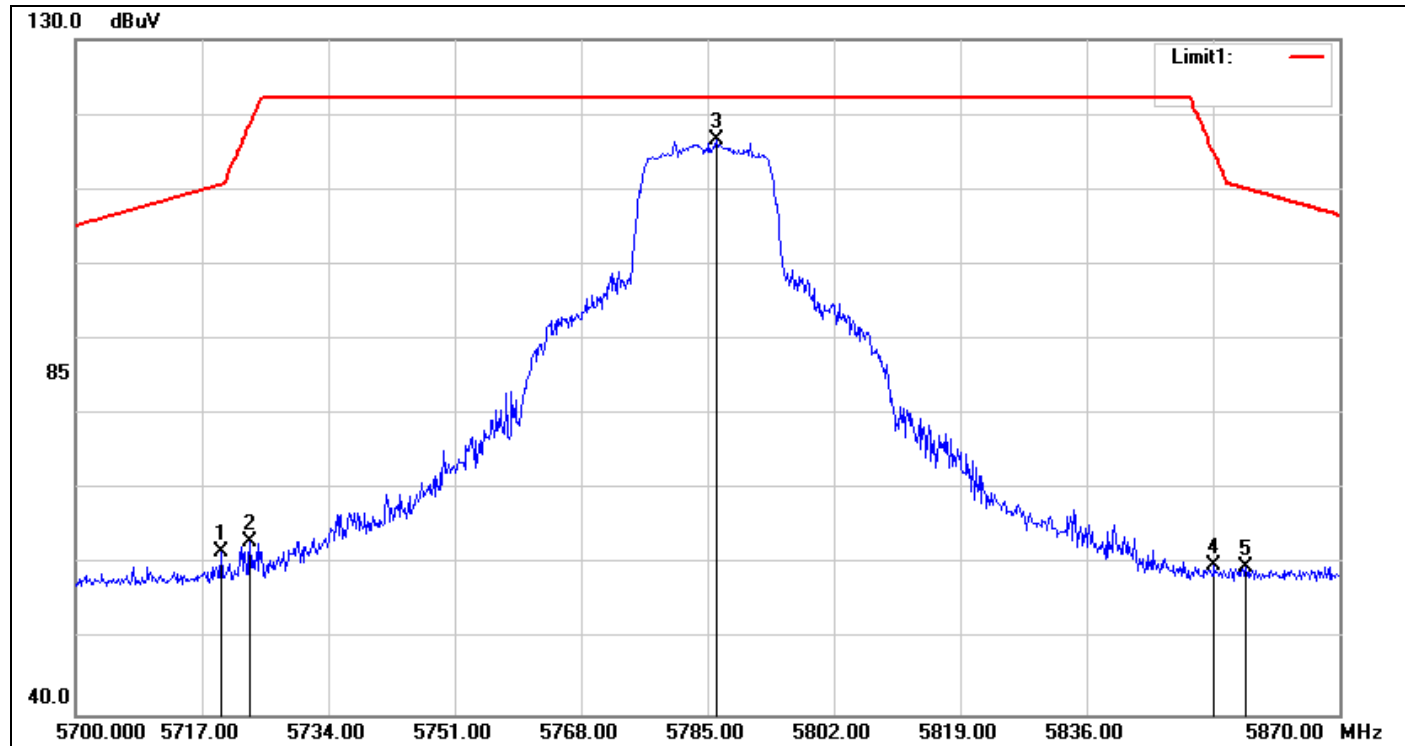
Detector mode: Average



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	5720.070	42.47	6.19	48.66	110.96	-62.30	AVG
2	5725.110	48.87	6.21	55.08	122.20	-67.12	AVG
3	5746.110	93.18	6.30	99.48	-	-	AVG

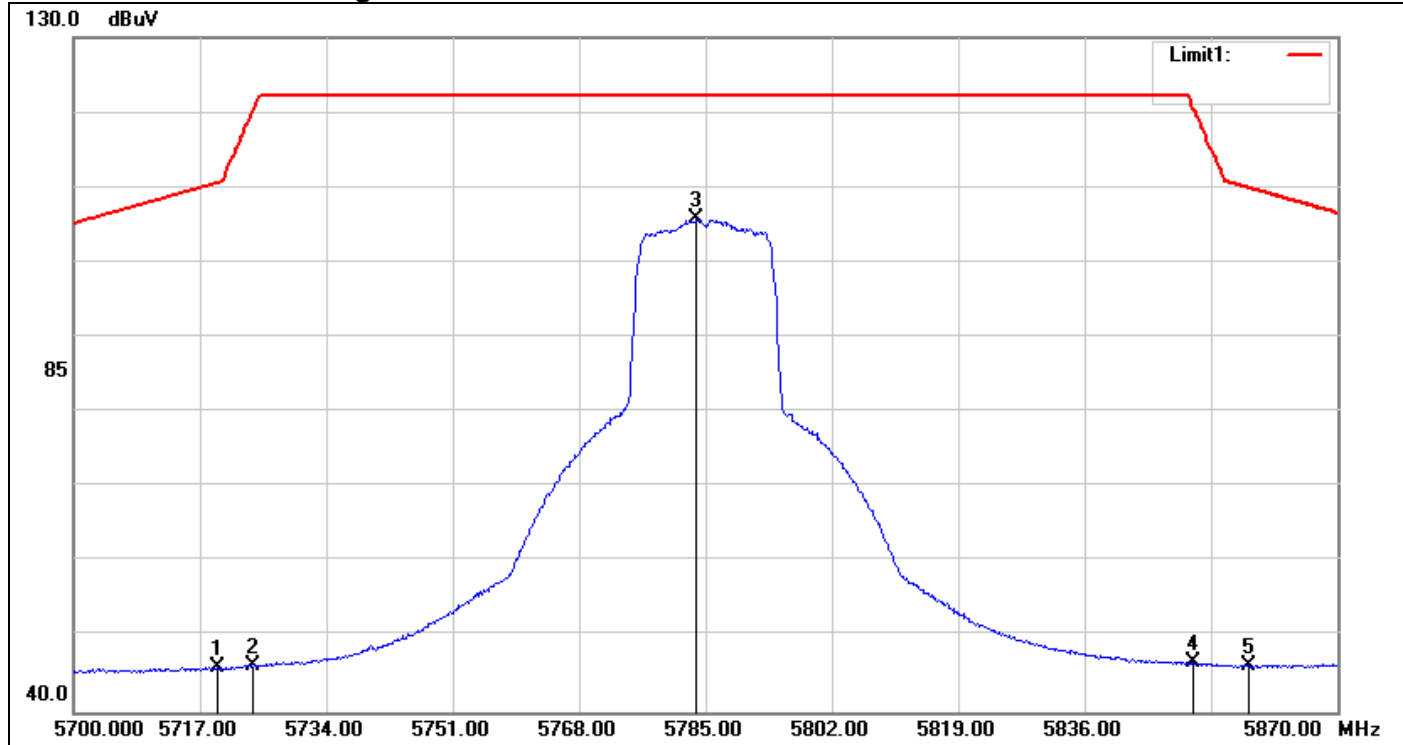
Band Edges (IEEE 802.11n HT 20 MHz mode / CH Mid)

Detector mode: Peak



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	5719.550	55.41	6.19	61.60	110.67	-49.07	peak
2	5723.460	56.97	6.20	63.17	118.69	-55.52	peak
3	5786.190	110.08	6.47	116.55	-	-	peak
4	5853.170	53.07	6.75	59.82	114.97	-55.15	peak
5	5857.420	52.96	6.77	59.73	110.12	-50.39	peak

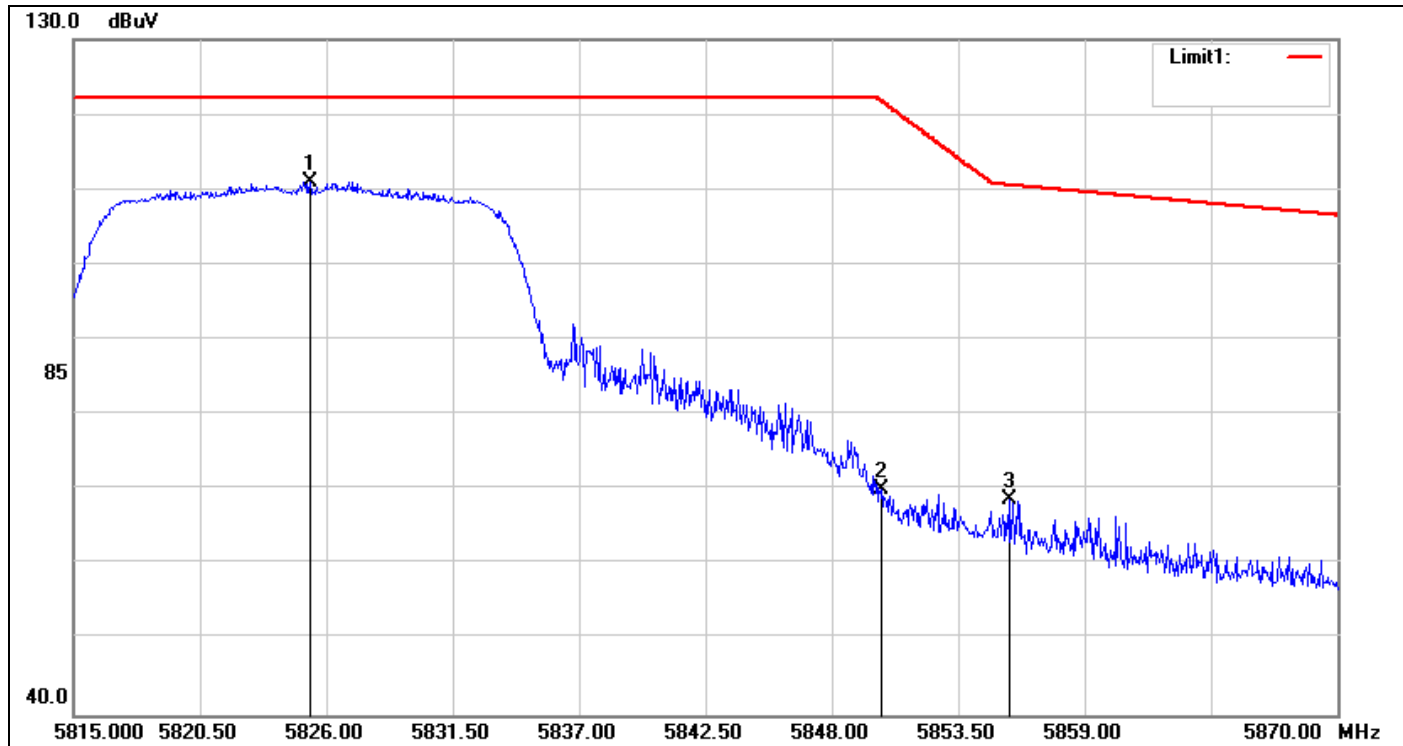
Detector mode: Average



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	5719.380	39.88	6.18	46.06	110.63	-64.57	AVG
2	5724.140	40.10	6.20	46.30	120.24	-73.94	AVG
3	5783.810	99.26	6.46	105.72	-	-	AVG
4	5850.620	39.83	6.74	46.57	120.79	-74.22	AVG
5	5858.100	39.52	6.78	46.30	109.93	-63.63	AVG

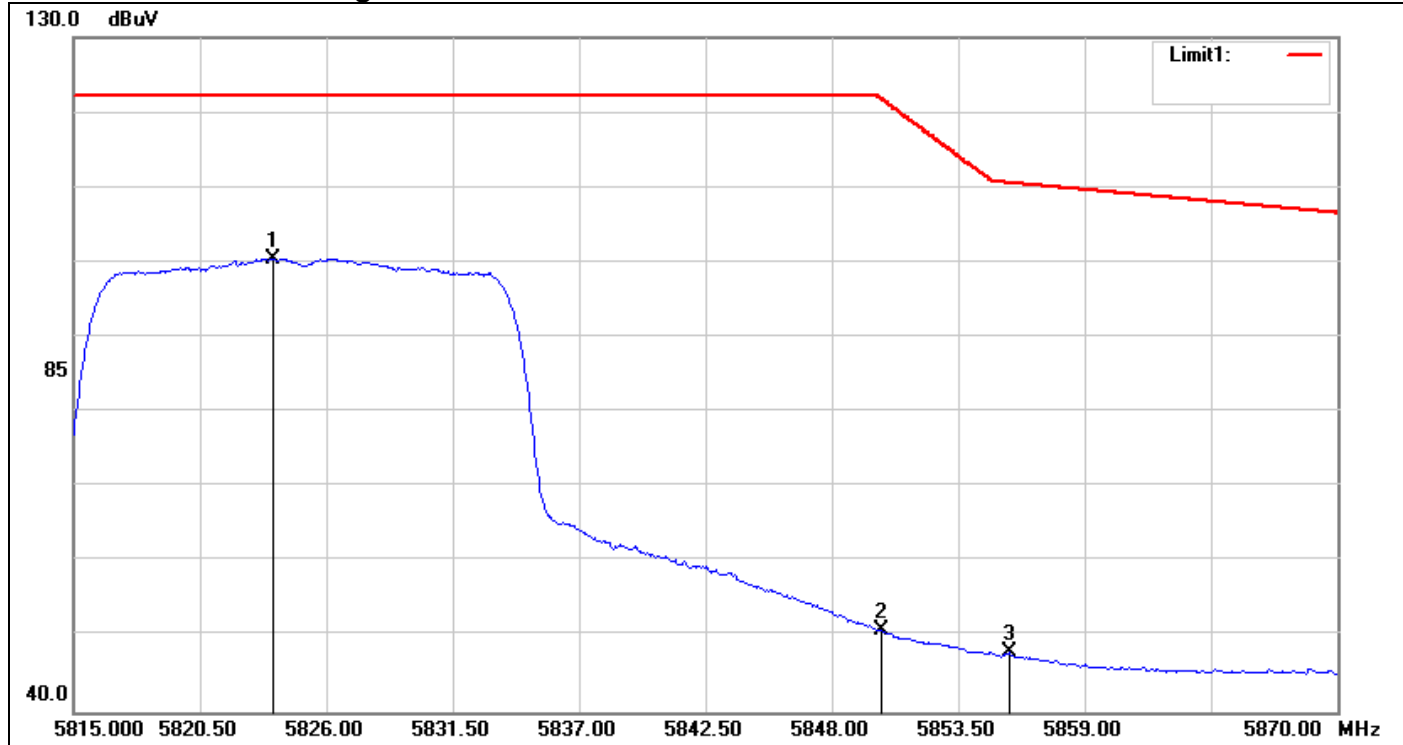
Band Edges (IEEE 802.11n HT 20 MHz mode / CH High)

Detector mode: Peak



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	5825.285	104.45	6.64	111.09	-	-	peak
2	5850.145	63.24	6.74	69.98	121.87	-51.89	peak
3	5855.755	61.84	6.77	68.61	110.59	-41.98	peak

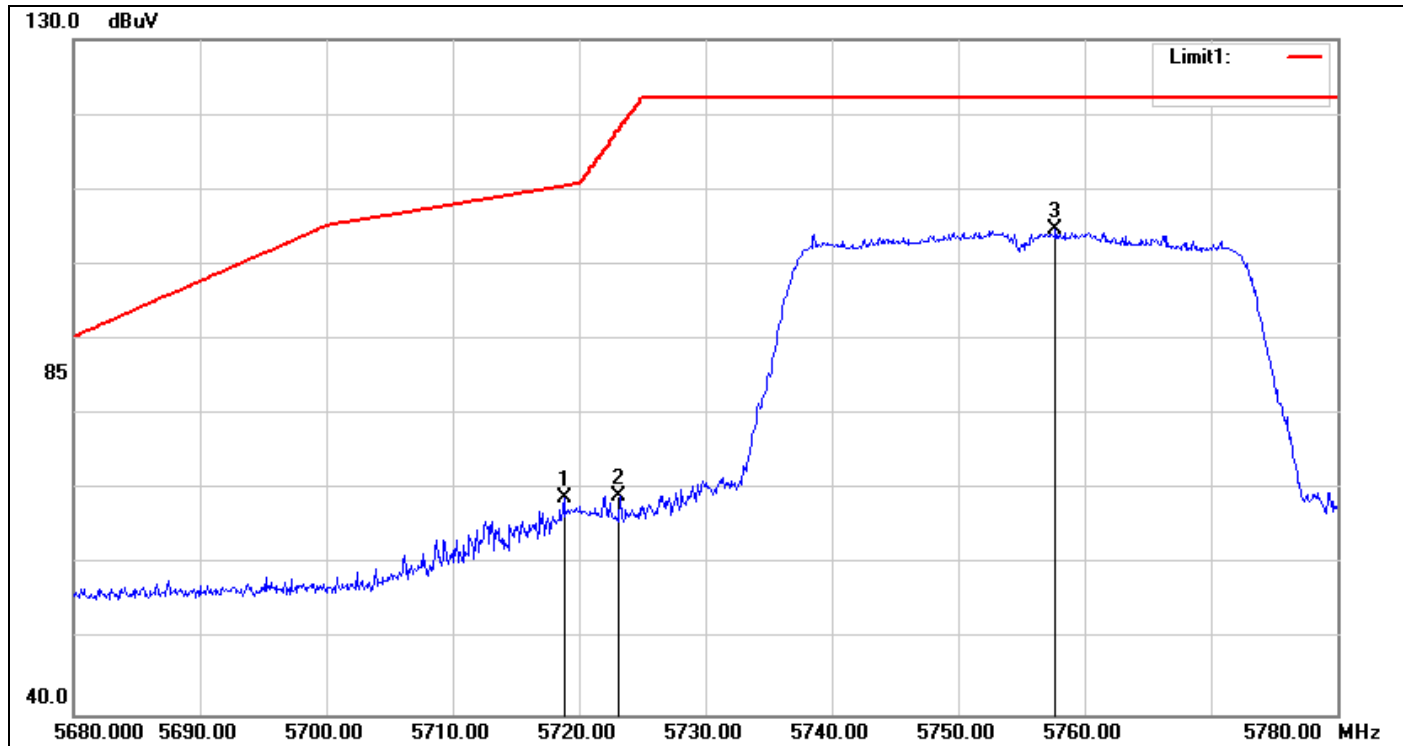
Detector mode: Average



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	5823.690	93.89	6.63	100.52	-	-	AVG
2	5850.145	44.12	6.74	50.86	121.87	-71.01	AVG
3	5855.755	41.13	6.77	47.90	110.59	-62.69	AVG

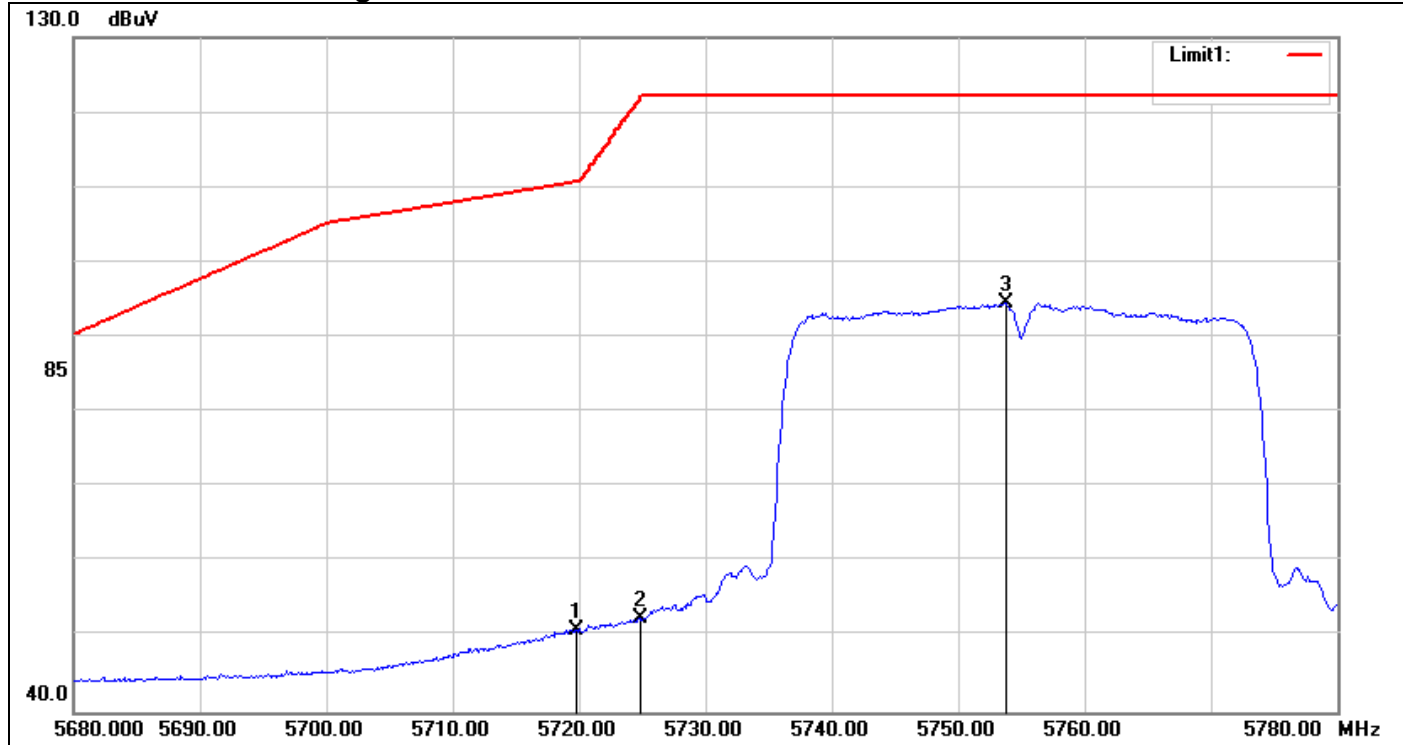
Band Edges (IEEE 802.11n HT 40 MHz mode / CH Low)

Detector mode: Peak



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	5718.800	62.80	6.18	68.98	110.46	-41.48	peak
2	5723.200	62.95	6.20	69.15	118.10	-48.95	peak
3	5757.700	98.23	6.35	104.58	-	-	peak

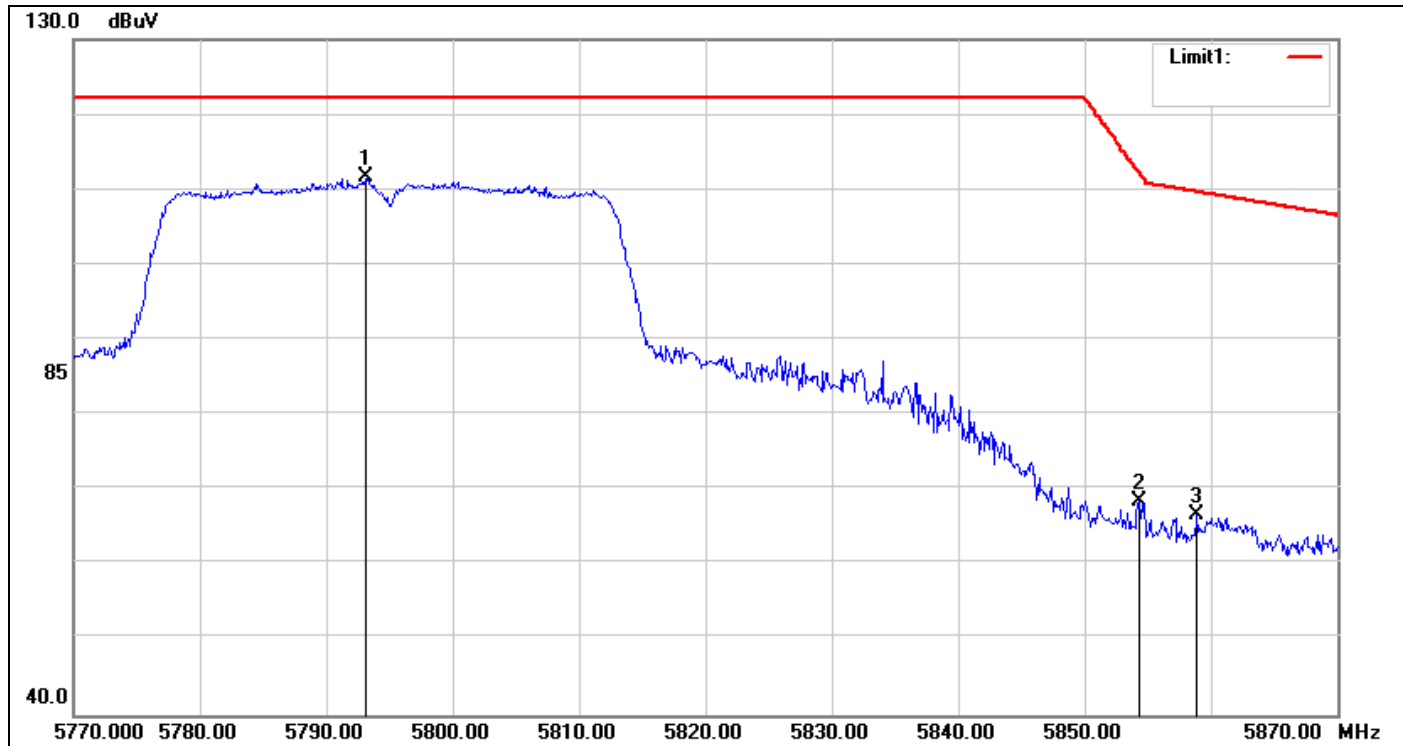
Detector mode: Average



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	5719.800	44.72	6.19	50.91	110.74	-59.83	AVG
2	5724.900	46.20	6.21	52.41	121.97	-69.56	AVG
3	5753.800	88.26	6.33	94.59	-	-	AVG

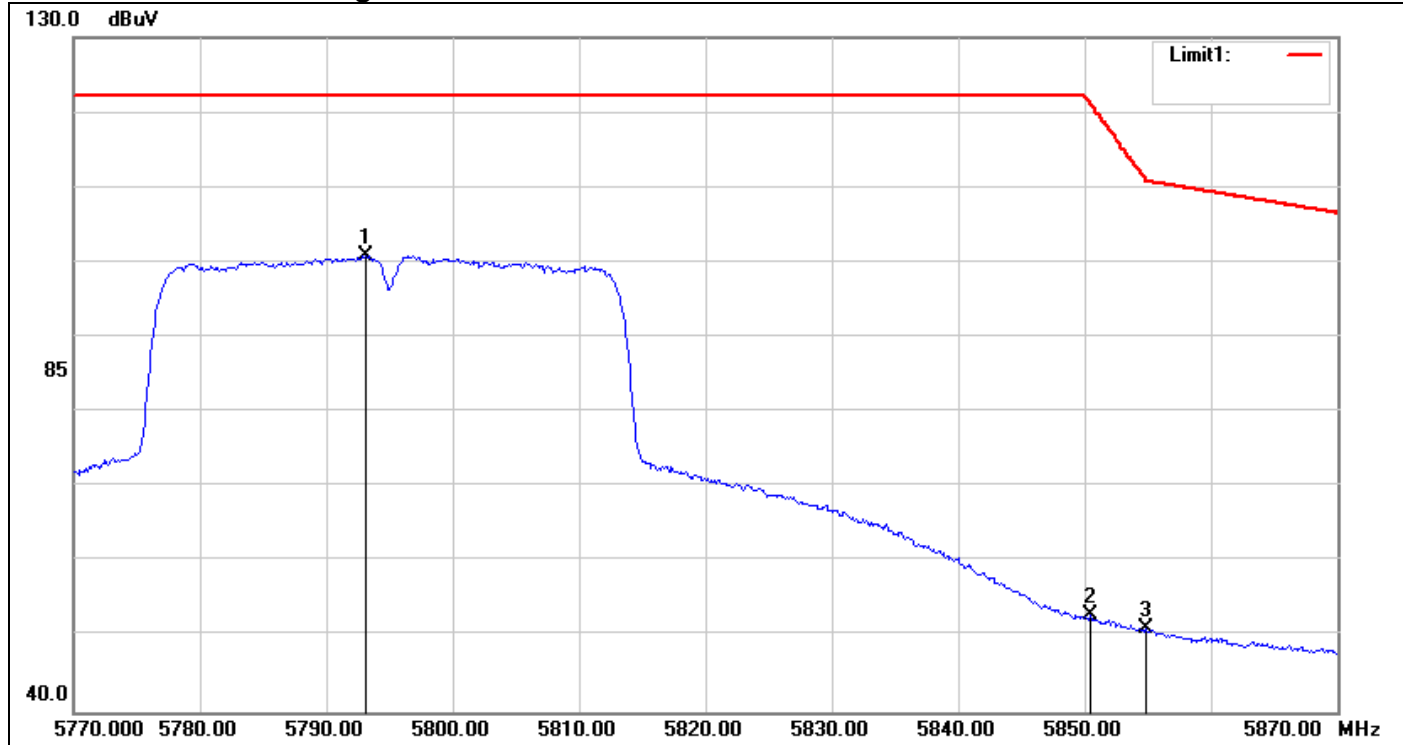
Band Edges (IEEE 802.11n HT 40 MHz mode / CH High)

Detector mode: Peak



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	5793.200	105.20	6.50	111.70	-	-	peak
2	5854.300	61.61	6.76	68.37	112.40	-44.03	peak
3	5858.900	59.78	6.78	66.56	109.71	-43.15	peak

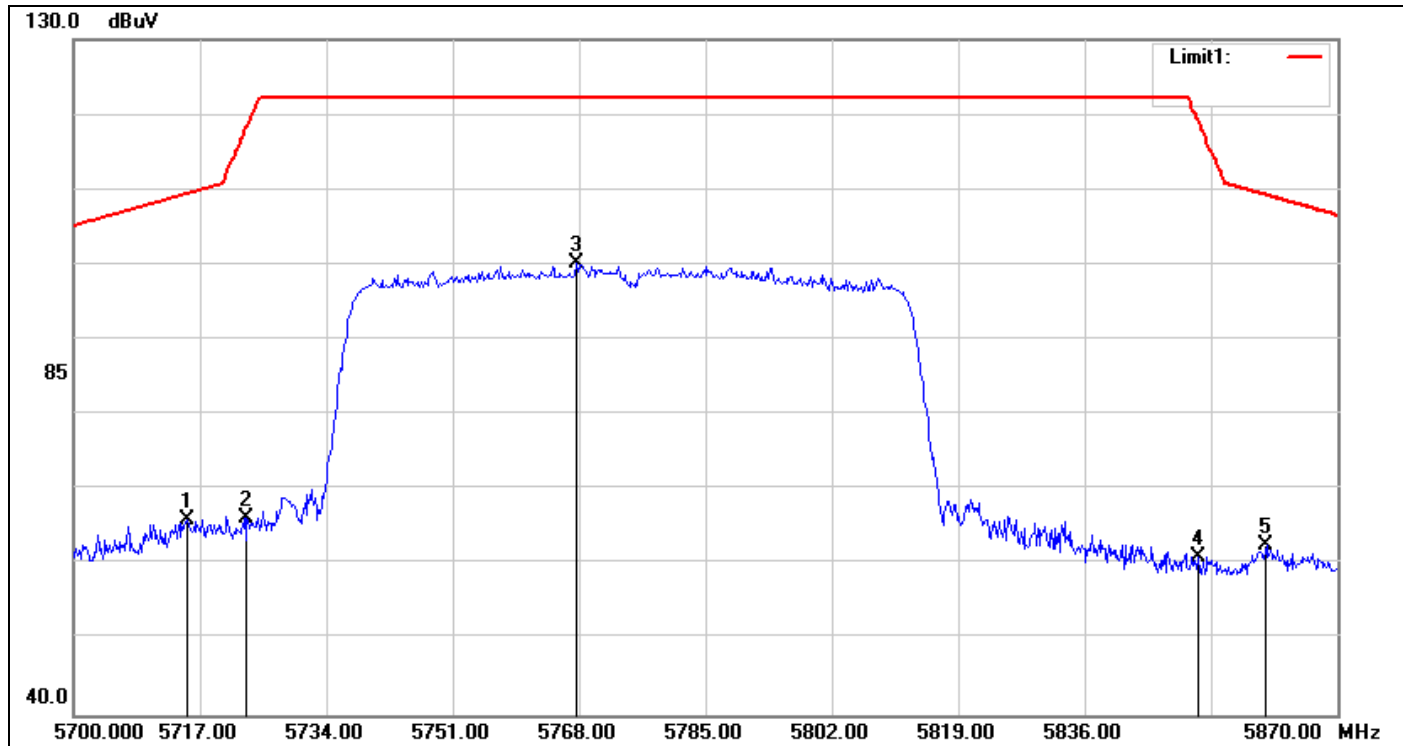
Detector mode: Average



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	5793.100	94.31	6.50	100.81	-	-	AVG
2	5850.500	46.11	6.74	52.85	121.06	-68.21	AVG
3	5854.900	44.28	6.76	51.04	111.03	-59.99	AVG

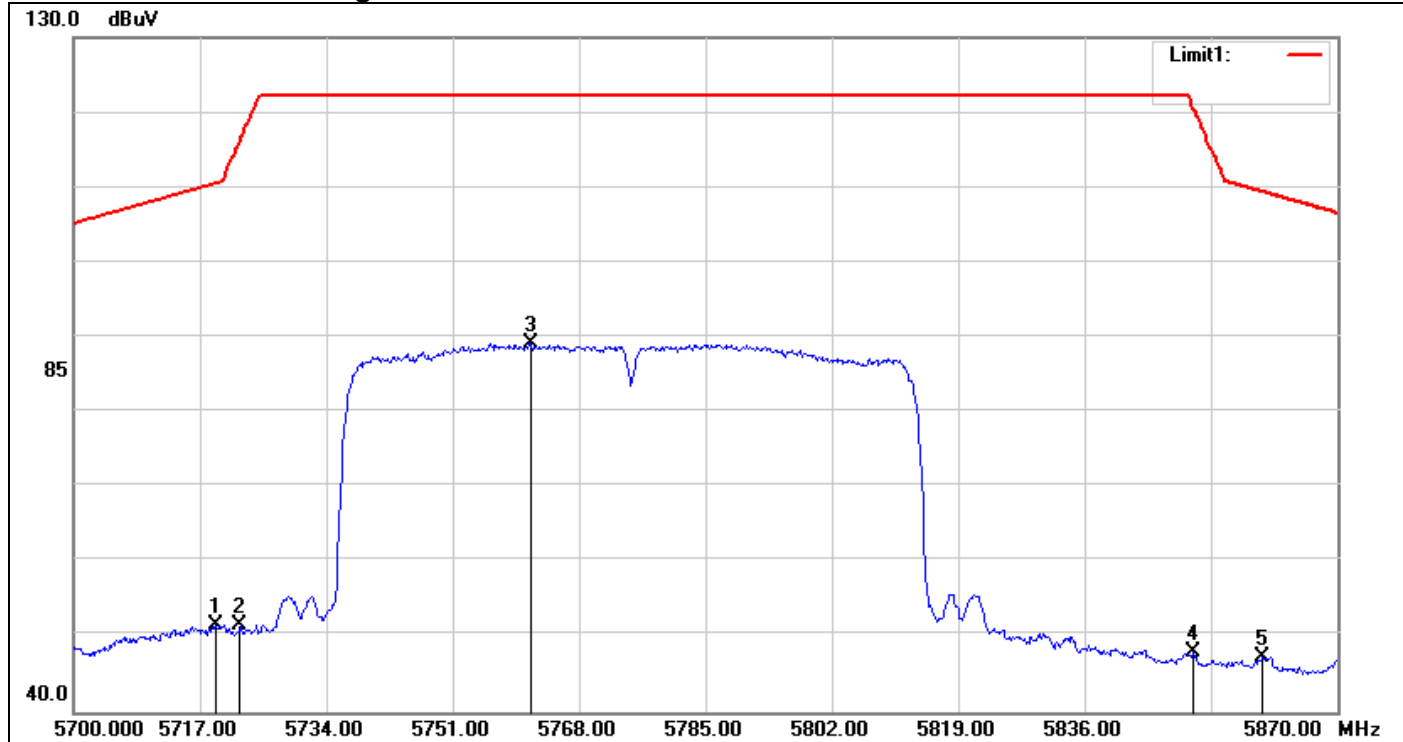
Band Edges (IEEE 802.11ac VHT 80 MHz mode / CH Mid)

Detector mode: Peak



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	5715.300	59.90	6.17	66.07	109.48	-43.41	peak
2	5723.290	60.05	6.20	66.25	118.30	-52.05	peak
3	5767.660	93.80	6.39	100.19	-	-	peak
4	5851.300	54.32	6.75	61.07	119.24	-58.17	peak
5	5860.480	55.92	6.79	62.71	109.27	-46.56	peak

Detector mode: Average



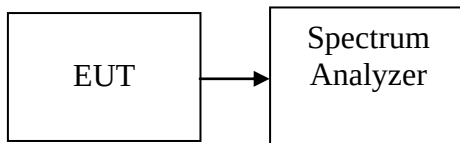
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	5719.040	45.33	6.18	51.51	110.53	-59.02	AVG
2	5722.440	45.38	6.20	51.58	116.36	-64.78	AVG
3	5761.540	82.82	6.36	89.18	-	-	AVG
4	5850.620	41.17	6.74	47.91	120.79	-72.88	AVG
5	5859.970	40.56	6.78	47.34	109.41	-62.07	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**

Duty Cycle = 89.47% Duty Factor = 0.48

Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	PPSD (dBm)	Limit (dBm)	Result
Low	5745	7.42	9.22	11.91	30.00	PASS
Mid	5785	11.81	13.79	16.41		PASS
High	5825	10.35	11.80	14.63		PASS

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

Duty Cycle = 88.89% Duty Factor = 0.51

Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	PPSD (dBm)	Limit (dBm)	Result
Low	5745	7.10	8.98	11.66	30.00	PASS
Mid	5785	11.92	13.51	16.31		PASS
High	5825	10.21	11.67	14.52		PASS

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

Duty Cycle = 80.00% Duty Factor = 0.97

Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	PPSD (dBm)	Limit (dBm)	Result
Low	5755	2.37	4.62	7.62	30.00	PASS
High	5795	8.52	9.88	13.23		PASS

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

Duty Cycle = 67.57% Duty Factor = 1.70

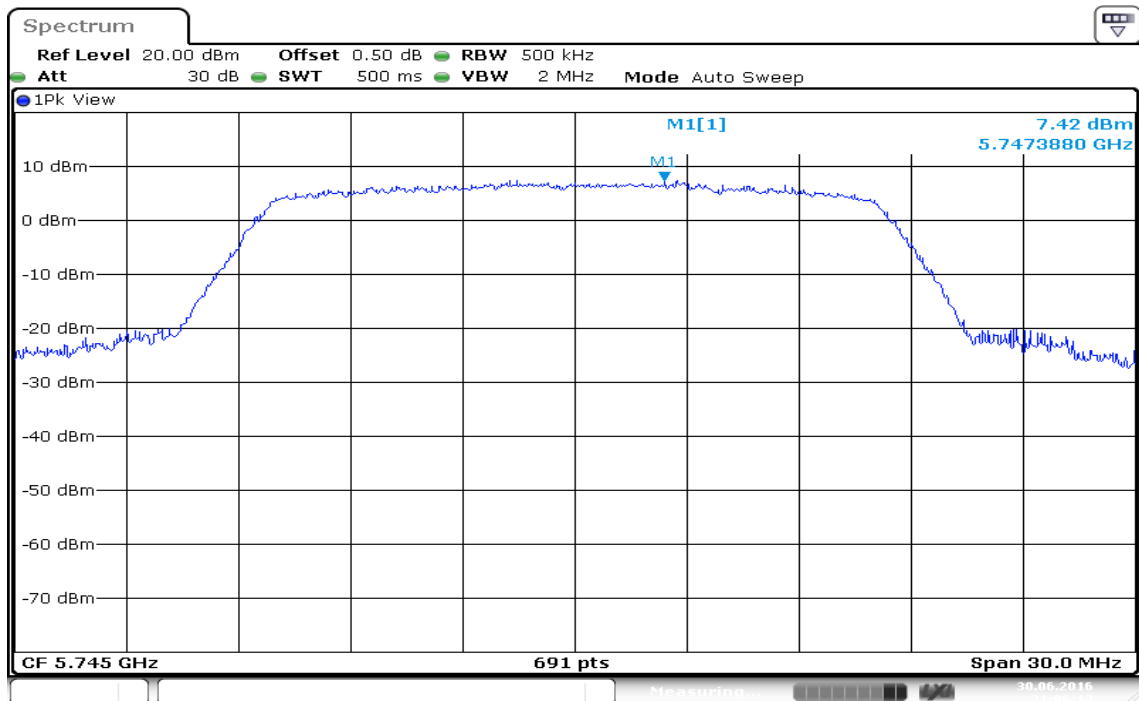
Channel	Frequency (MHz)	Chain 0 PPSD (dBm)	Chain 1 PPSD (dBm)	PPSD (dBm)	Limit (dBm)	Result
Mid	5775	1.59	3.72	7.50	30.00	PASS

Remark:1. Total PPSD (dBm) = $10 \cdot \log(10^{(\text{Chain 0 PPSD} / 10)} + 10^{(\text{Chain 1 PPSD} / 10)})$

Test Plot

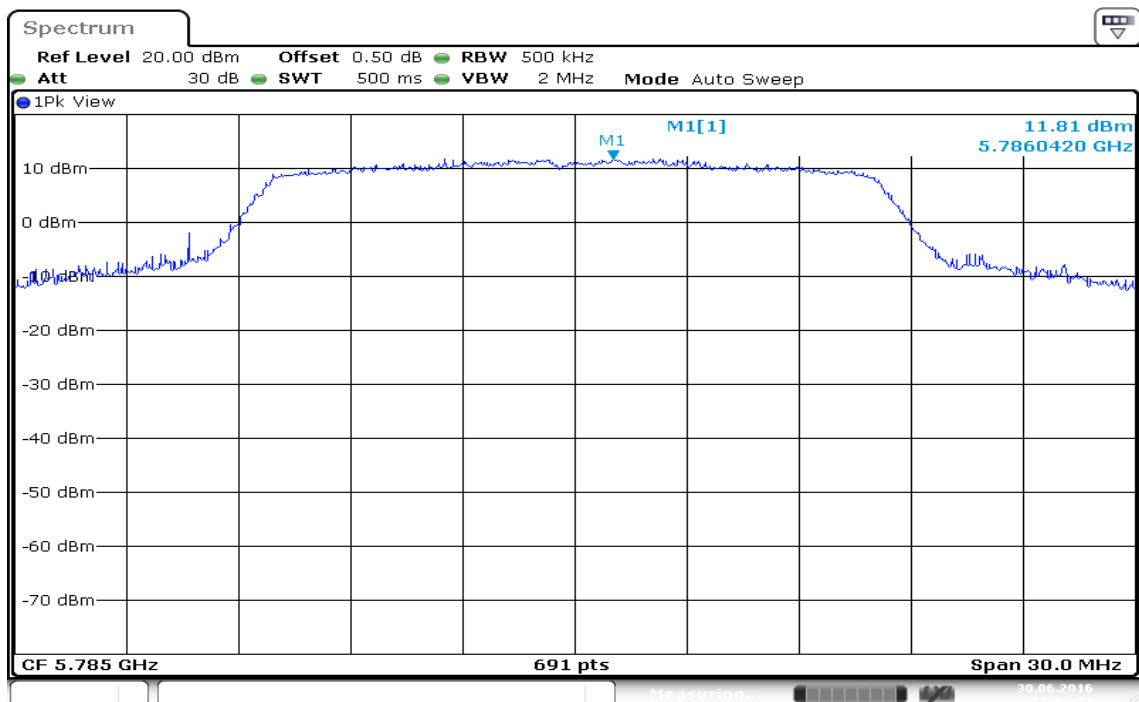
IEEE 802.11a MHz mode / 5745 ~ 5825MHz / Chain 0

PPSD (CH Low)



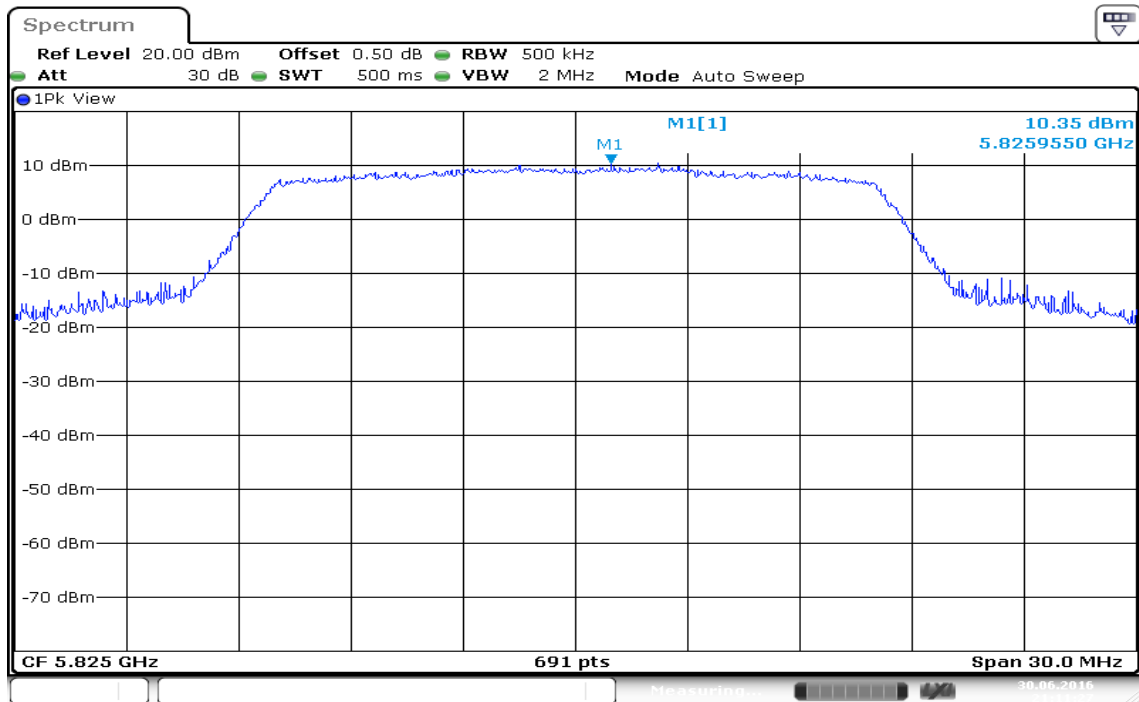
Date: 30 JUN 2016 21:06:12

PPSD (CH Mid)

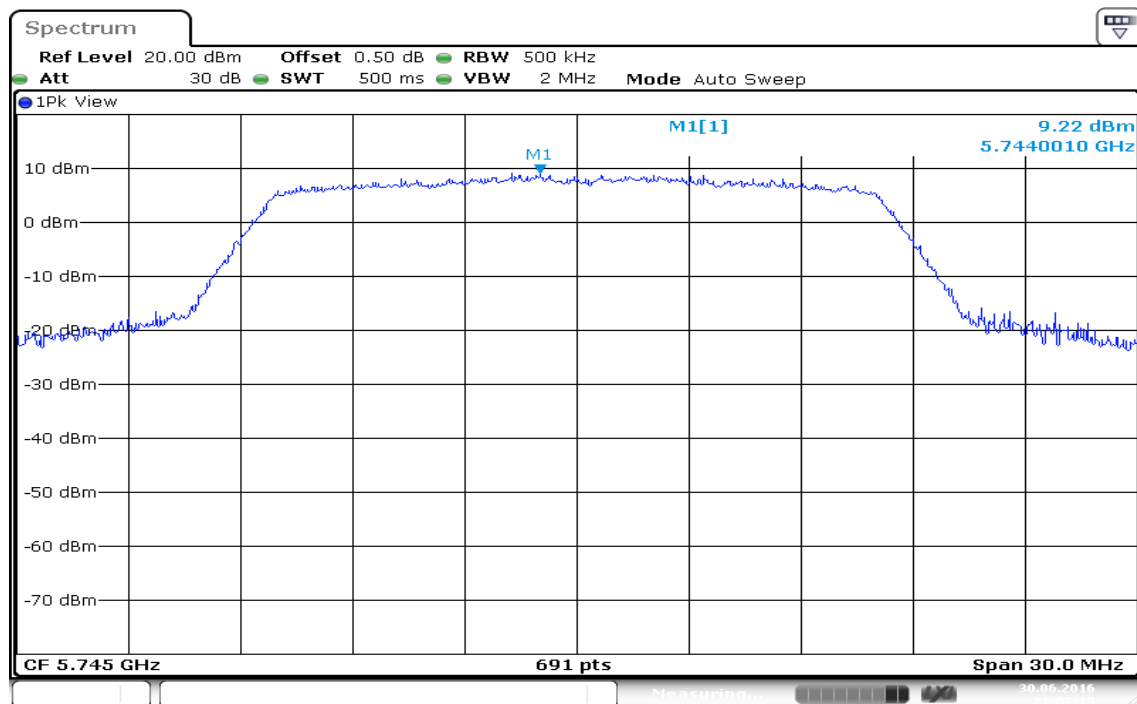


Date: 30 JUN 2016 21:09:51

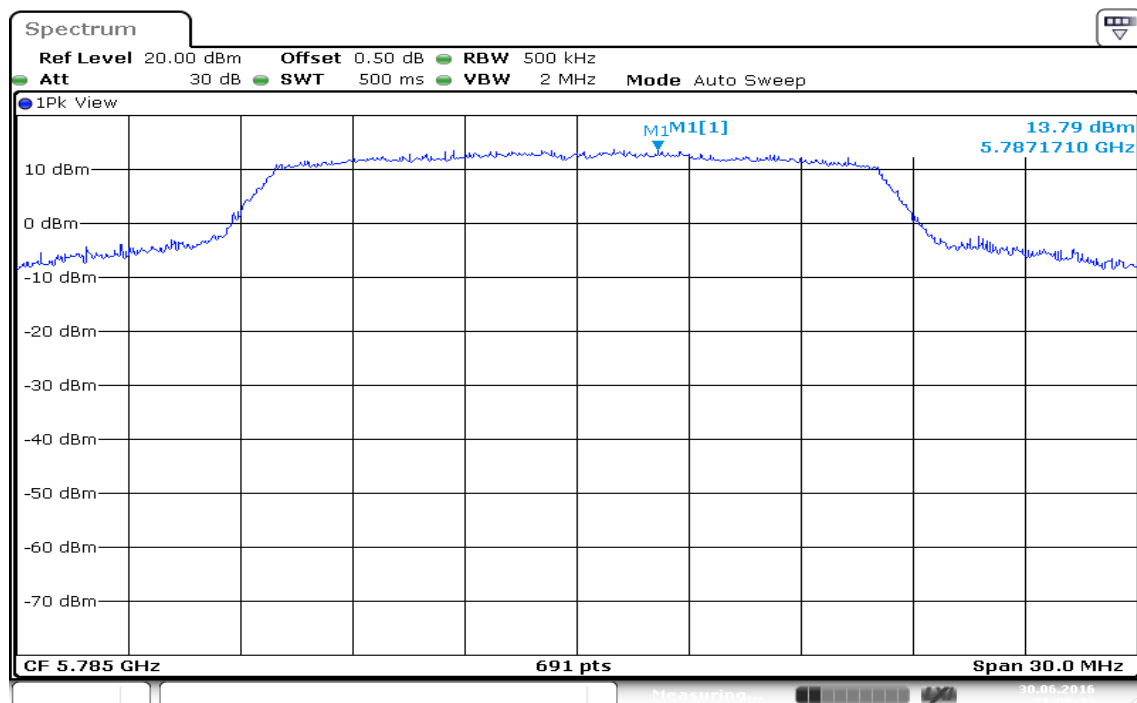
PPSD (CH High)



Date: 30 JUN 2016 21:11:28

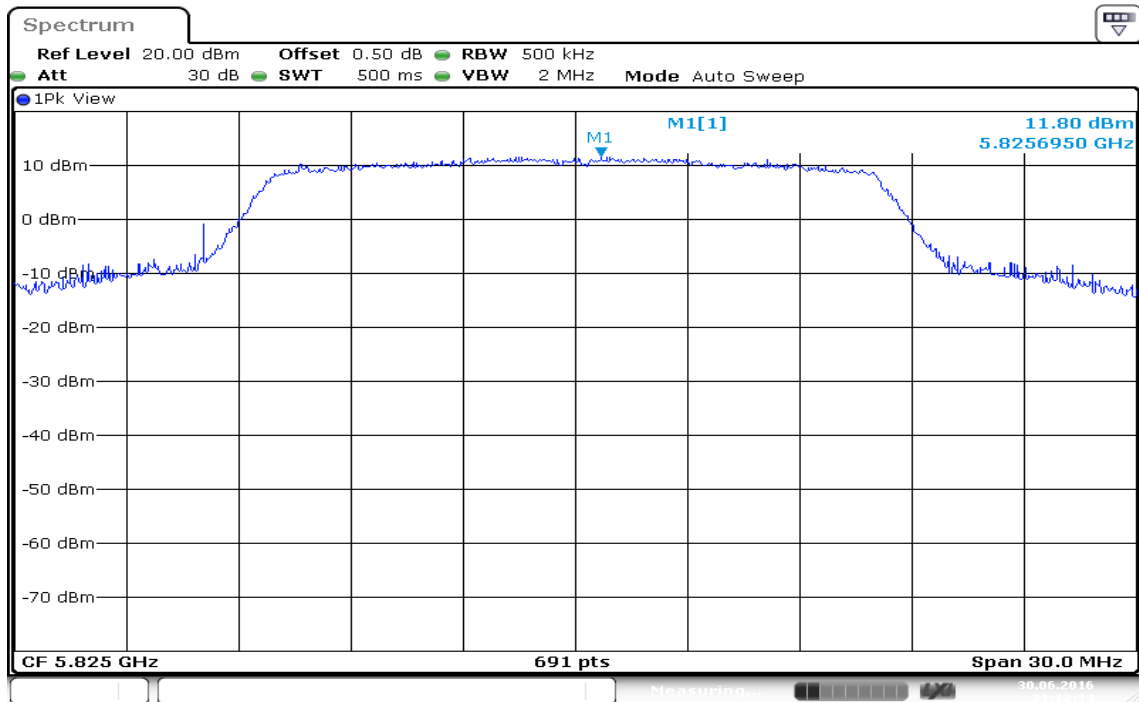
IEEE 802.11a MHz mode / 5745 ~ 5825MHz / Chain 1**PPSD (CH Low)**

Date: 30 JUN 2016 21:07:15

PPSD (CH Mid)

Date: 30 JUN 2016 21:08:32

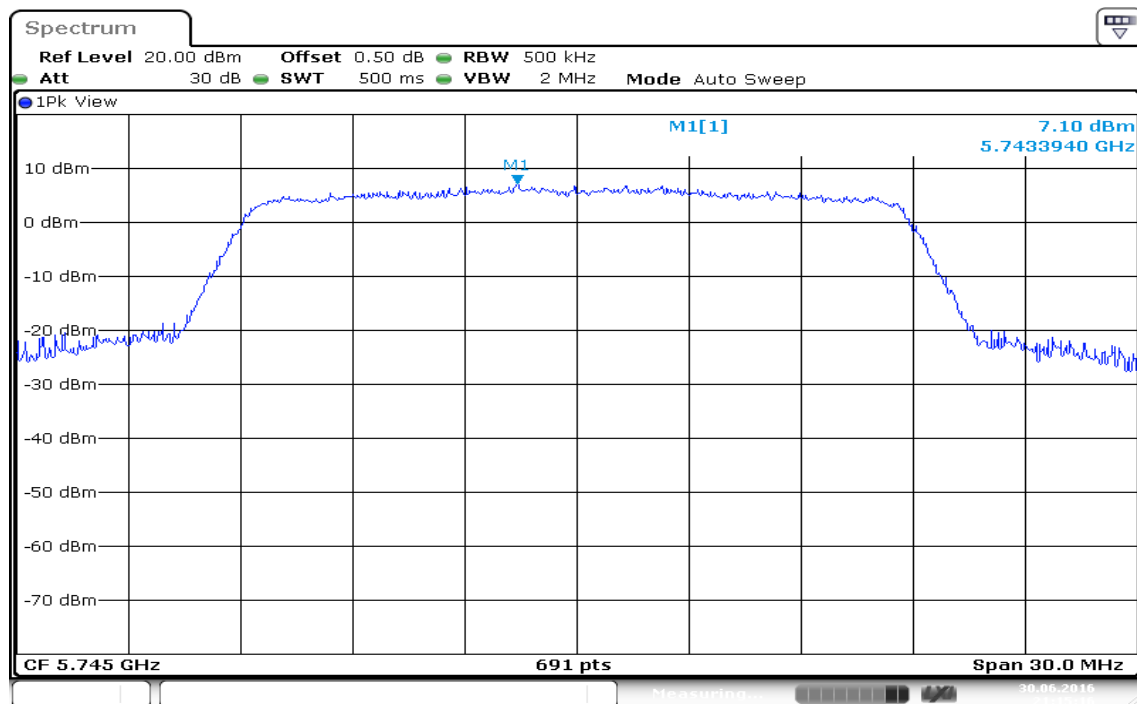
PPSD (CH High)



Date: 30 JUN 2016 21:12:35

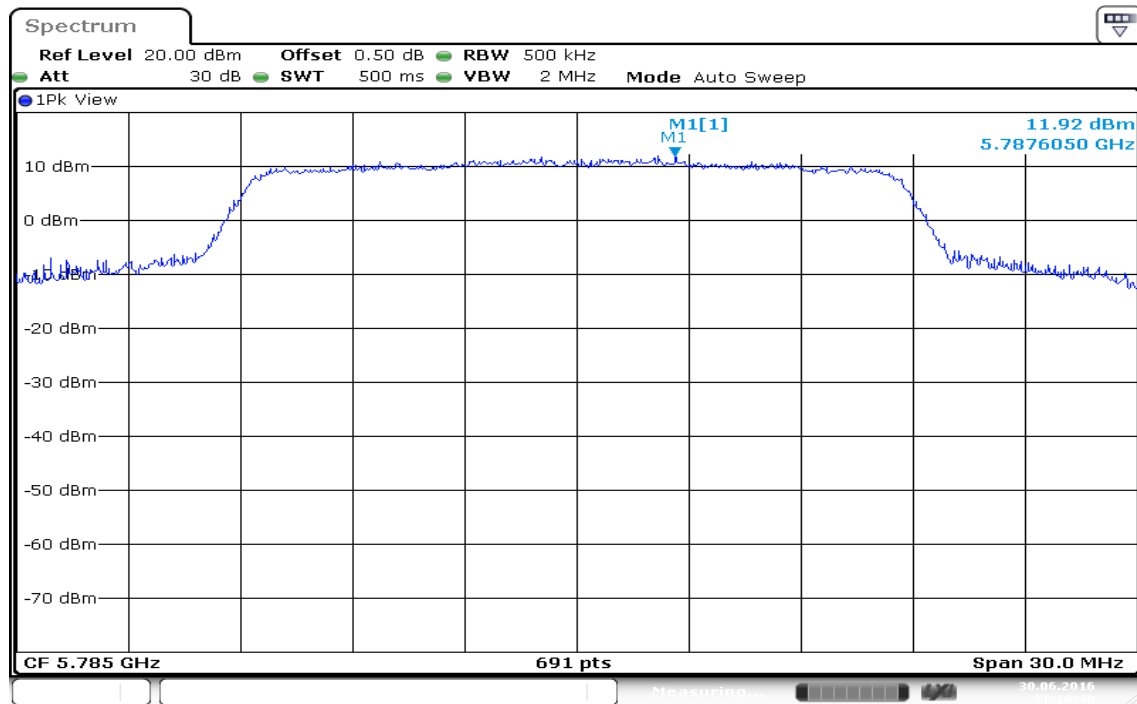
IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz / Chain 0

PPSD (CH Low)



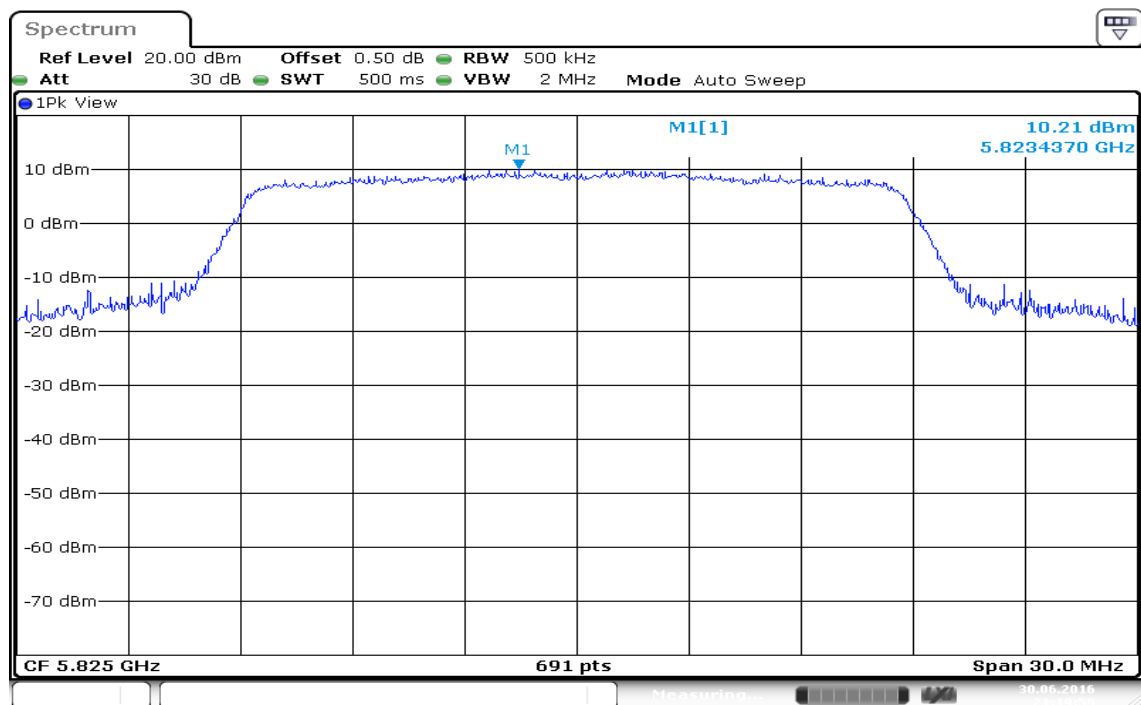
Date: 30 JUN 2016 21:15:17

PPSD (CH Mid)



Date: 30 JUN 2016 21:16:40

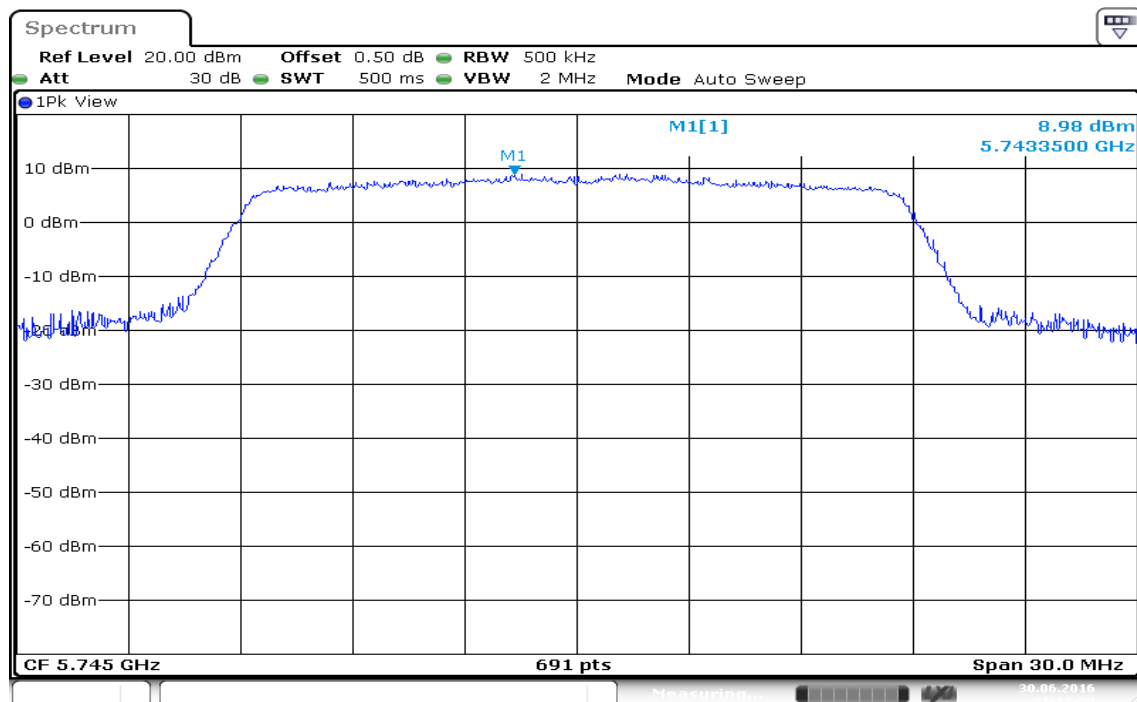
PPSD (CH High)



Date: 30 JUN 2016 21:20:00

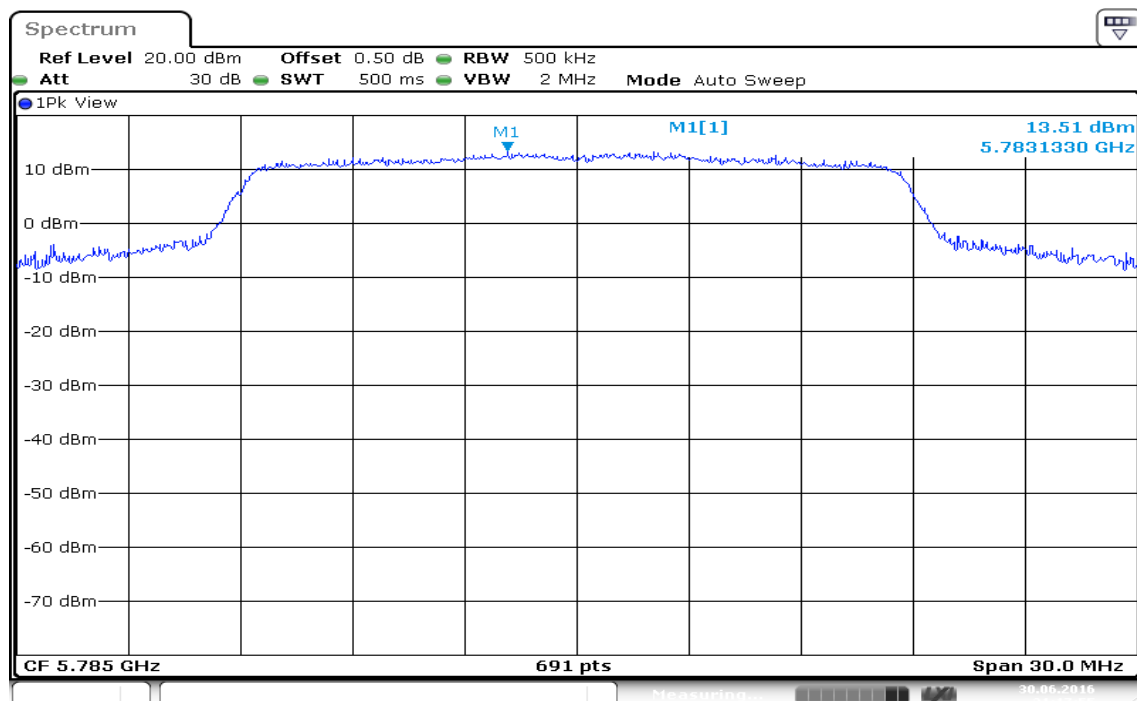
IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz / Chain 1

PPSD (CH Low)



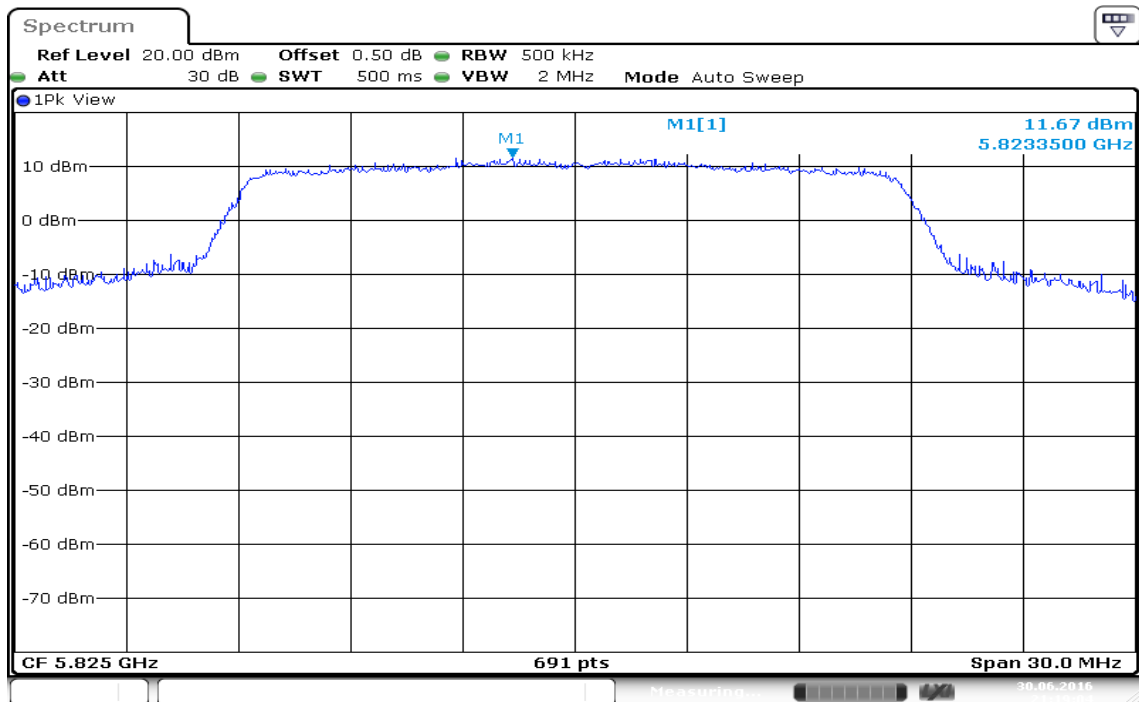
Date: 30 JUN 2016 21:13:51

PPSD (CH Mid)



Date: 30 JUN 2016 21:17:54

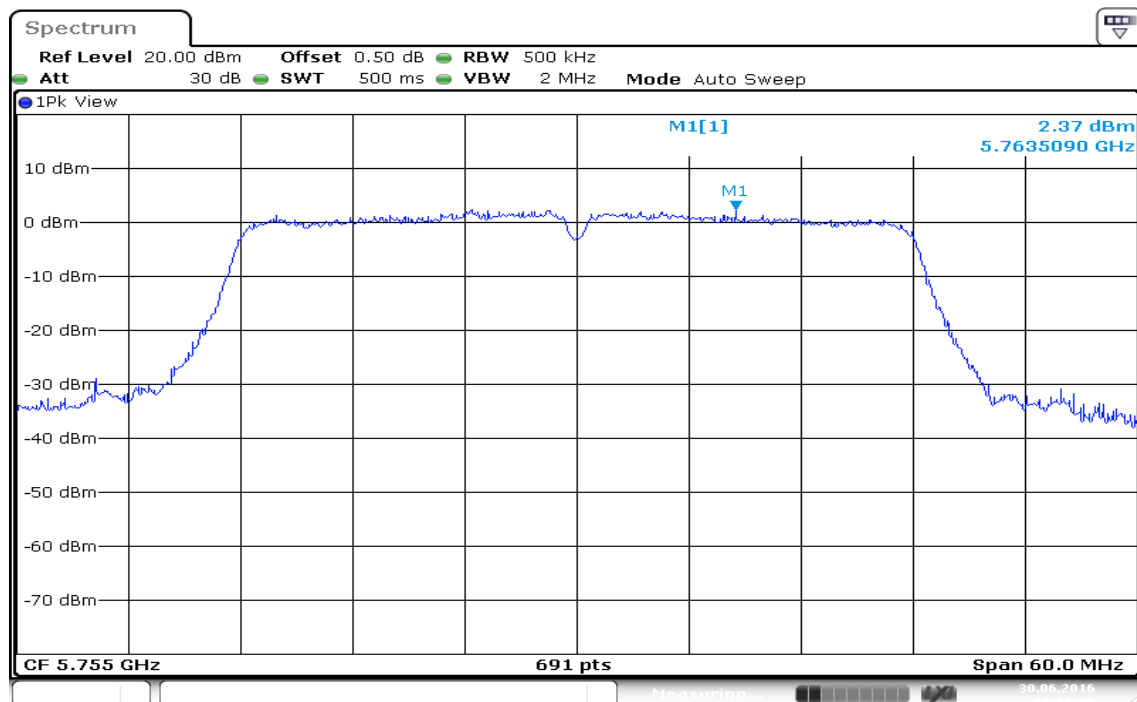
PPSD (CH High)



Date: 30 JUN 2016 21:19:04

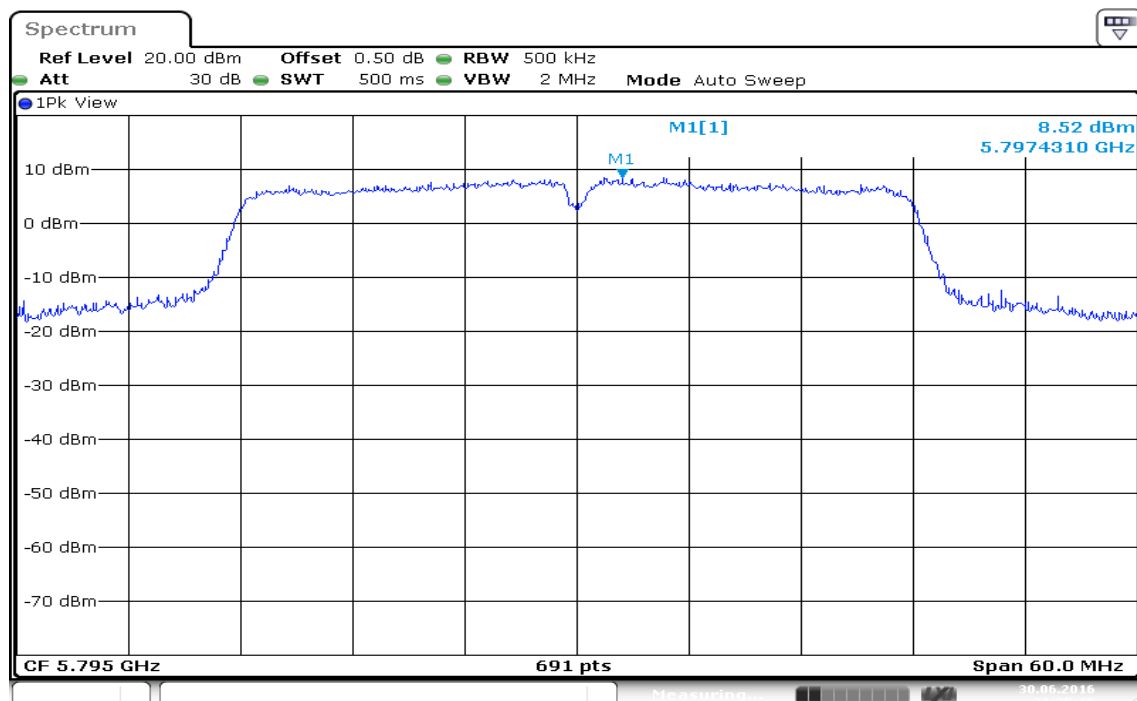
IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz / Chain 0

PPSD (CH Low)



Date: 30 JUN 2016 21:21:29

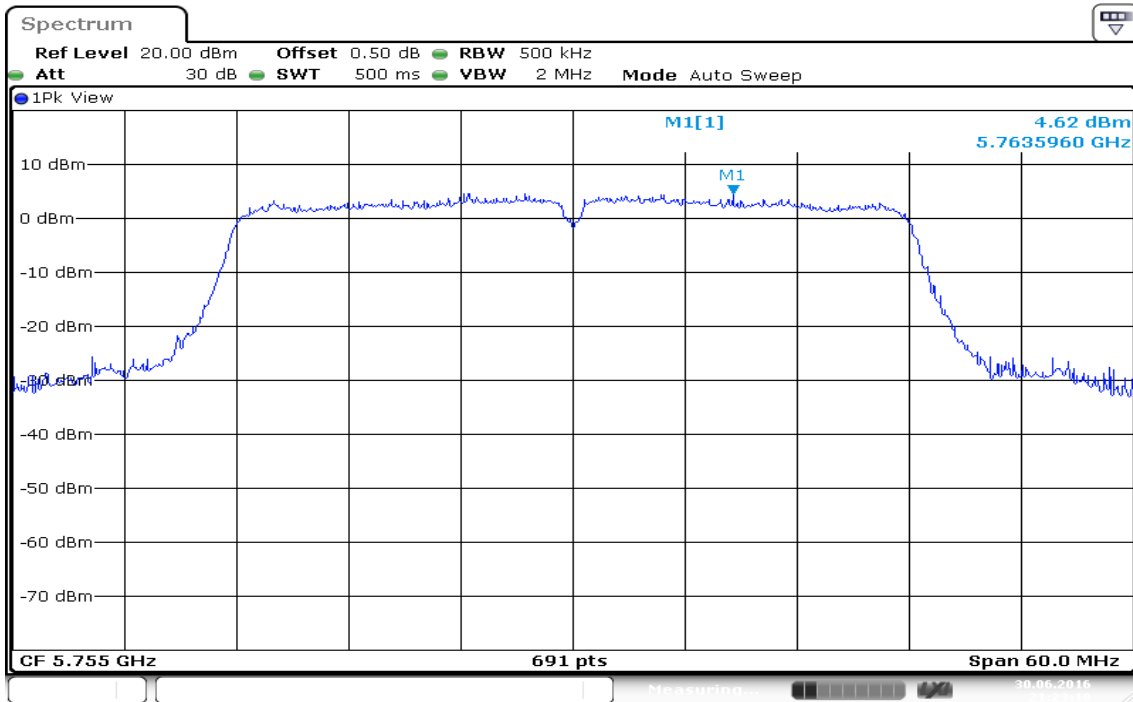
PPSD (CH High)



Date: 30 JUN 2016 21:25:15

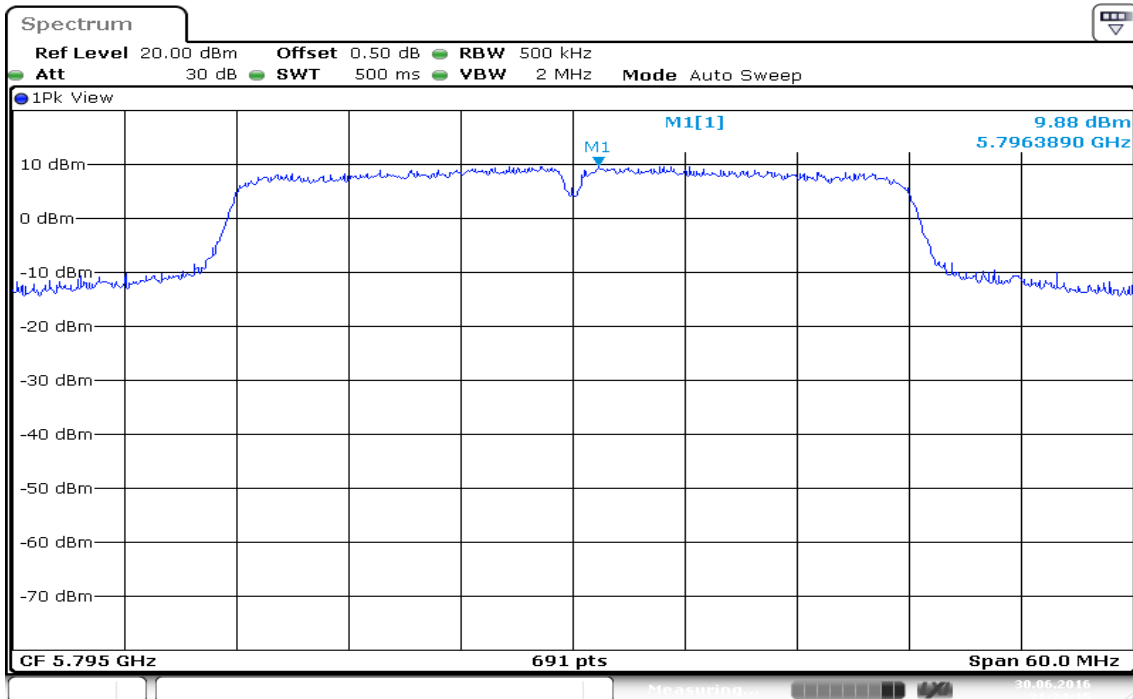
IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz / Chain 1

PPSD (CH Low)



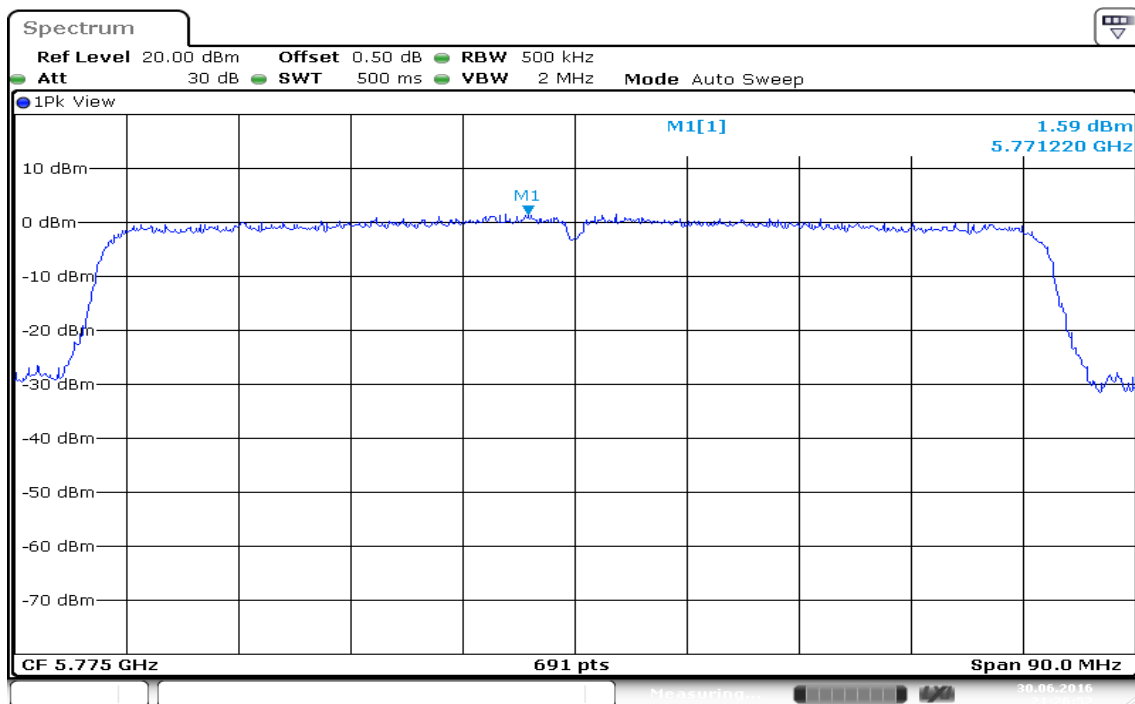
Date: 30 JUN 2016 21:23:11

PPSD (CH High)



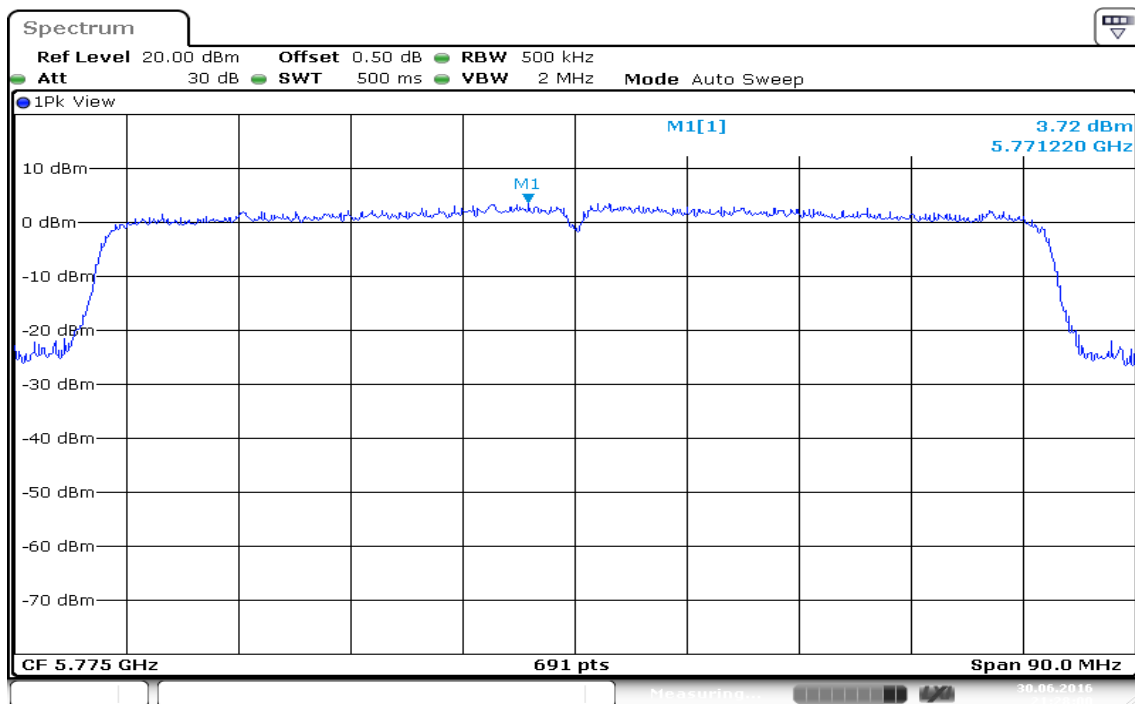
Date: 30 JUN 2016 21:24:15

IEEE 802.11ac VHT 80 MHz mode / 5775MHz / Chain 0
PPSD (CH Mid)



Date: 30 JUN 2016 21:26:53

IEEE 802.11ac VHT 80 MHz mode / 5775MHz / Chain 1
PPSD (CH Mid)



Date: 30 JUN 2016 21:28:01

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

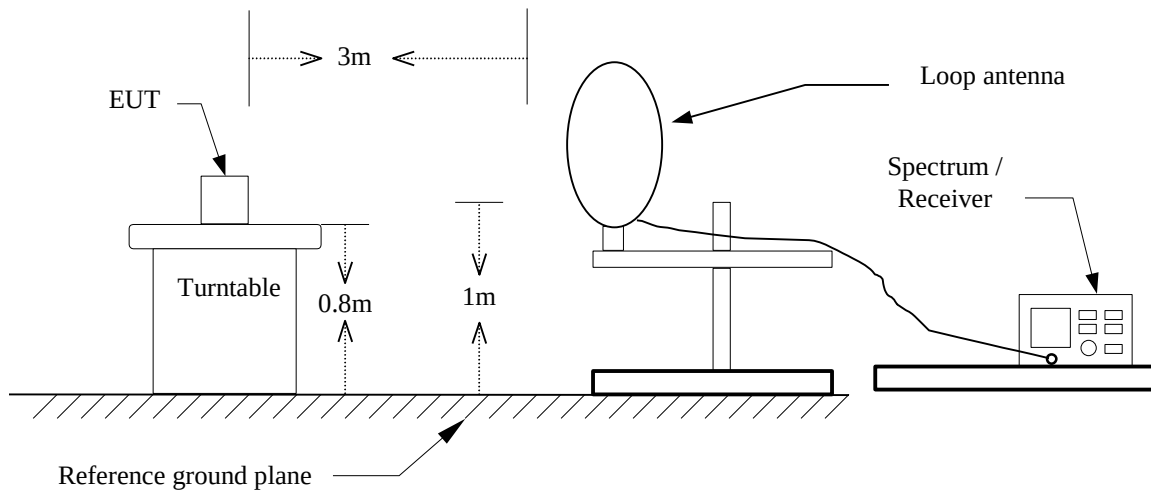
Remark: Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of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

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

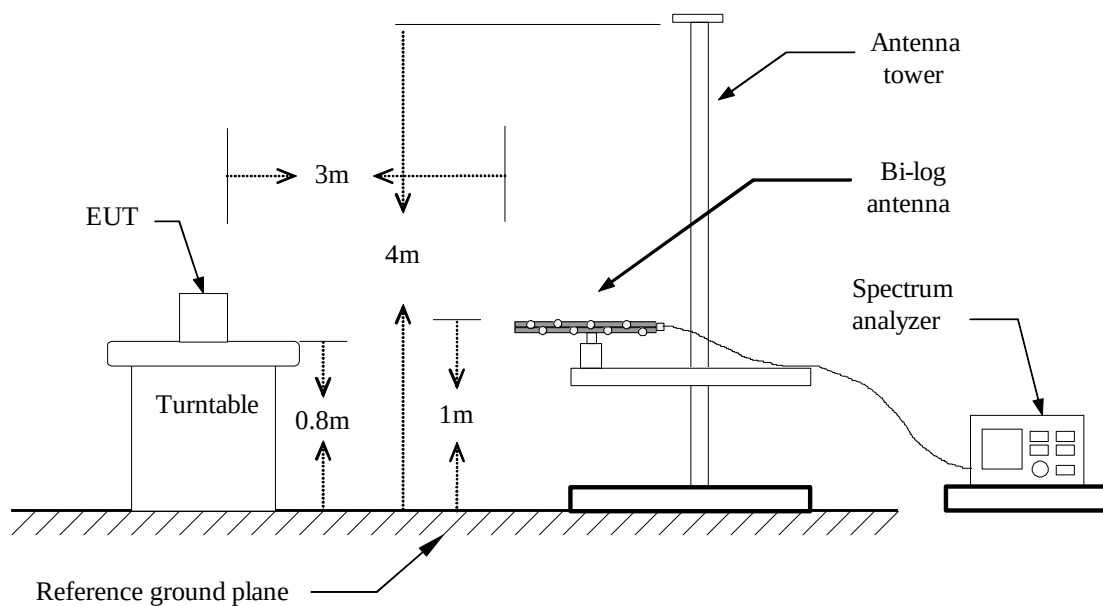
Frequency (MHz)	Field Strength (μV/m at 3-meter)	Field Strength (dBμV/m at 3-meter)
0.009 - 0.490	2400/F(kHz) +80	20LOG((2400/F(kHz))+80)
0.490 - 1.705	24000/F(kHz) +40	20LOG((24000/F(kHz))+40)
1.705 – 30.0	30	69.54
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

Test Configuration

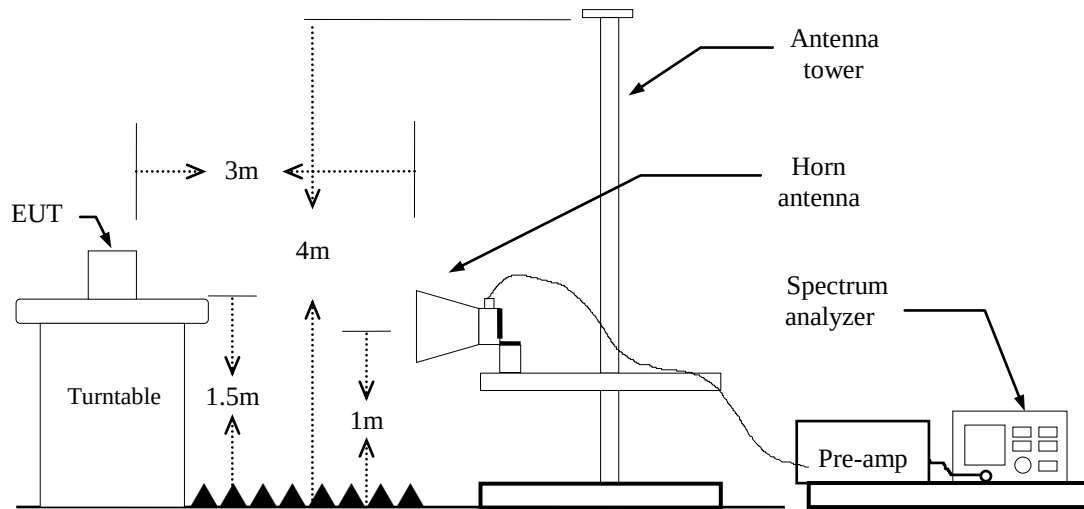
9kHz ~ 30MHz



30MHz ~ 1GHz



Above 1 GHz



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 $\geq$ 98%, VBW=10Hz.
if duty cycle < 98% VBW=1/T.

IEEE 802.11a mode: =94%, VBW=680Hz

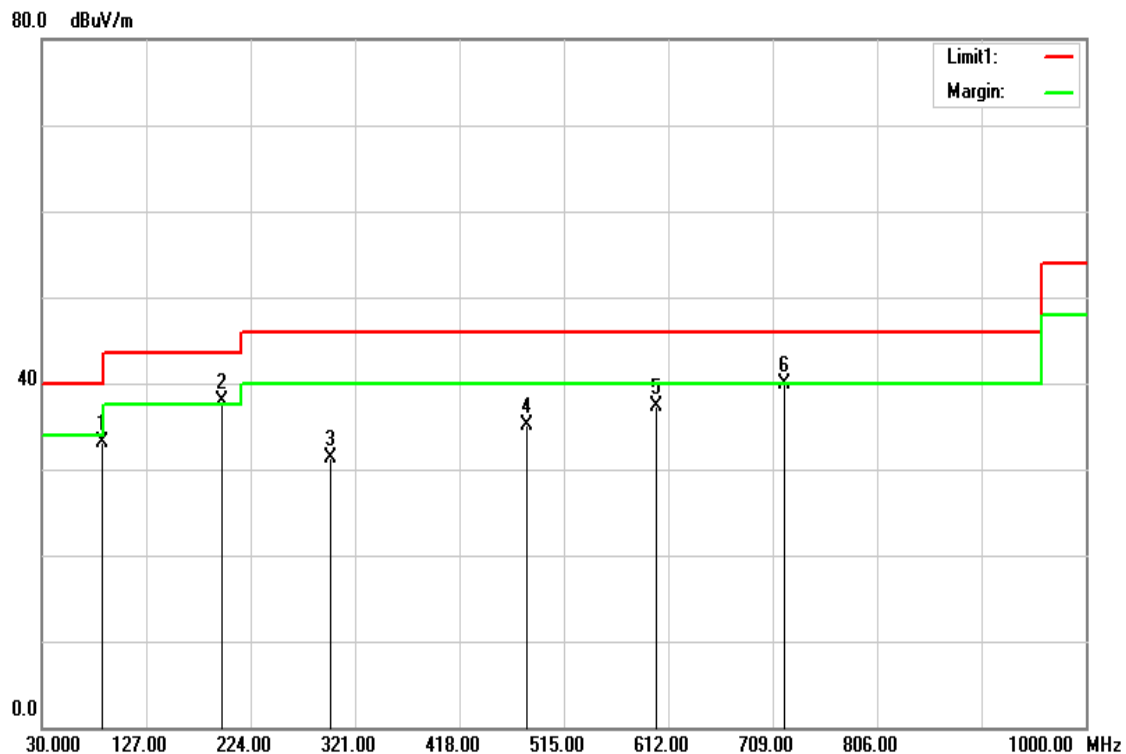
IEEE 802.11n HT 20 MHz mode: =89%, VBW=750Hz

IEEE 802.11n HT 40 MHz mode: =81%, VBW=1.5kHz

IEEE 802.11ac VHT 80 MHz mode: =68%, 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:** July 15, 2016**Temperature:** 27°C**Tested by:** Dennis Li**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)
86.2600	54.58	-21.41	33.17	40.00	-6.83	peak	V
196.8400	53.64	-15.83	37.81	43.50	-5.69	peak	V
298.6900	45.58	-14.26	31.32	46.00	-14.68	peak	V
480.0800	44.63	-9.62	35.01	46.00	-10.99	peak	V
600.3600	45.03	-7.75	37.28	46.00	-8.72	peak	V
719.6700	45.61	-5.62	39.99	46.00	-6.01	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

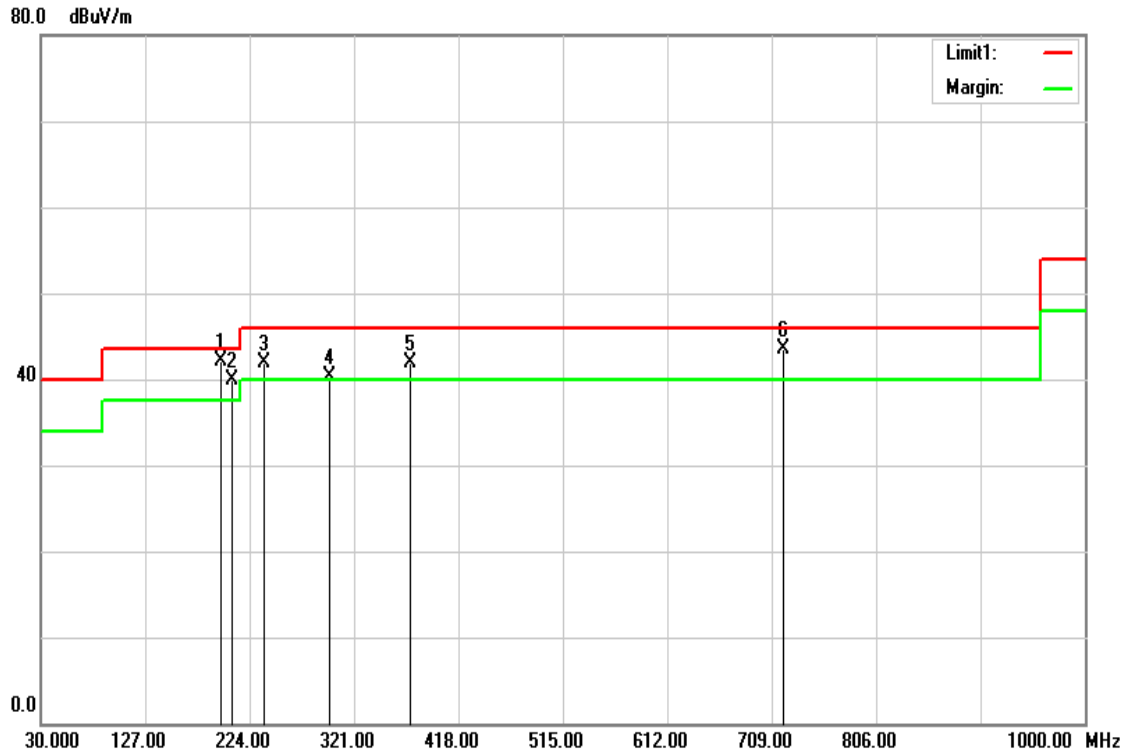
Test Date: July 15, 2016

Temperature: 27°C

Tested by: Dennis Li

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)
196.8400	57.88	-15.83	42.05	43.50	-1.45	QP	H
207.5100	55.99	-16.08	39.91	43.50	-3.59	QP	H
237.5800	58.42	-16.56	41.86	46.00	-4.14	QP	H
298.6900	54.49	-14.26	40.23	46.00	-5.77	peak	H
373.3800	54.29	-12.33	41.96	46.00	-4.04	peak	H
719.6700	49.08	-5.62	43.46	46.00	-2.54	QP	H

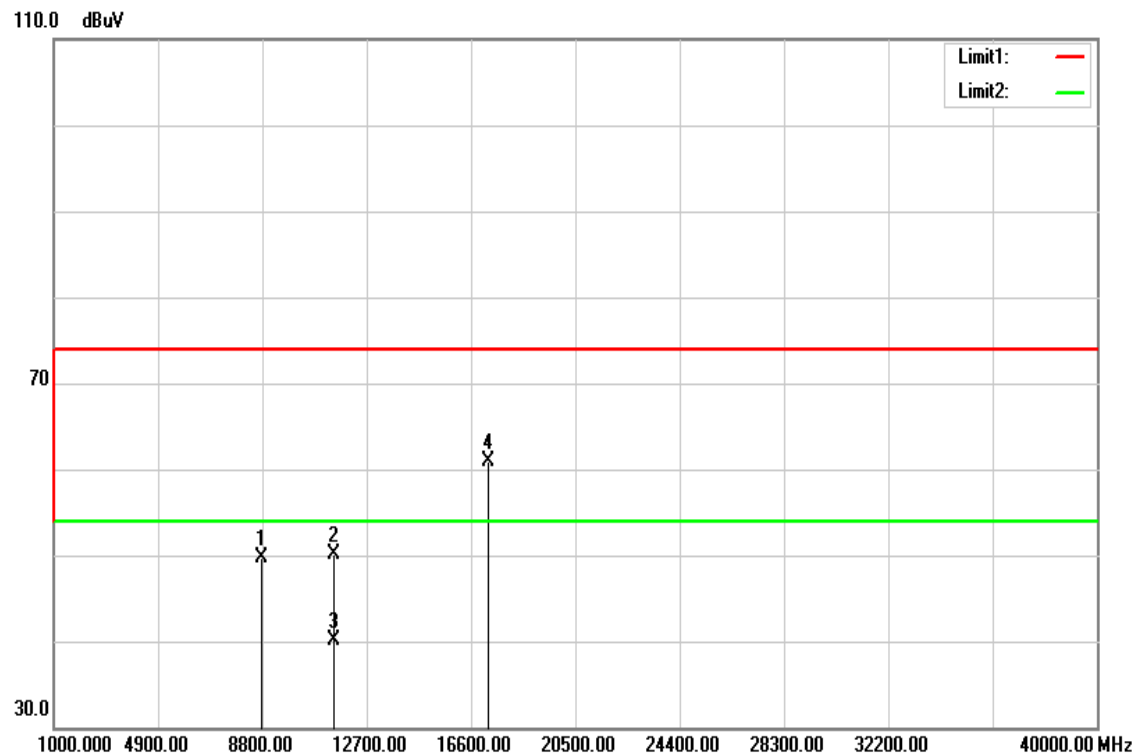
Remark:

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).

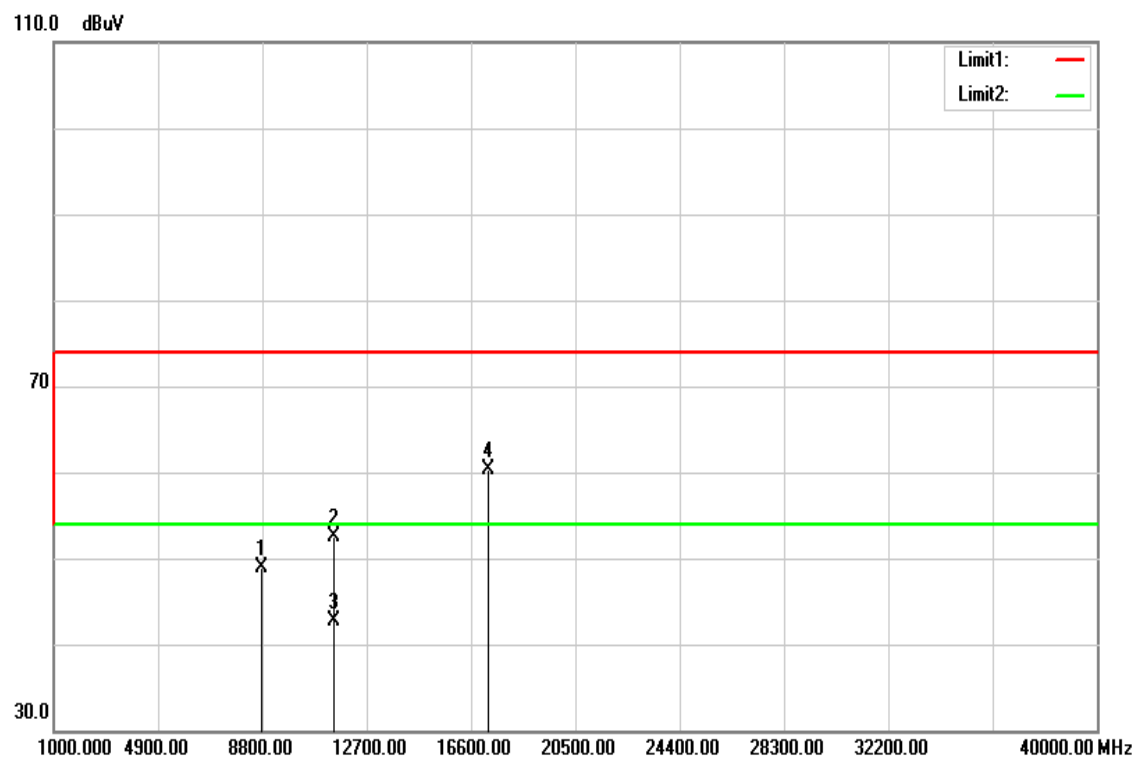
Above 1 GHz

TX / IEEE 802.11a mode / CH Low

Polarity: Vertical



Polarity: Horizontal



Operation Mode: TX / IEEE 802.11a mode / CH Low **Test Date:** June 22, 2016
Temperature: 27°C **Tested by:** Dennis Li
Humidity: 53% RH **Polarity:** Ver. / Hor.

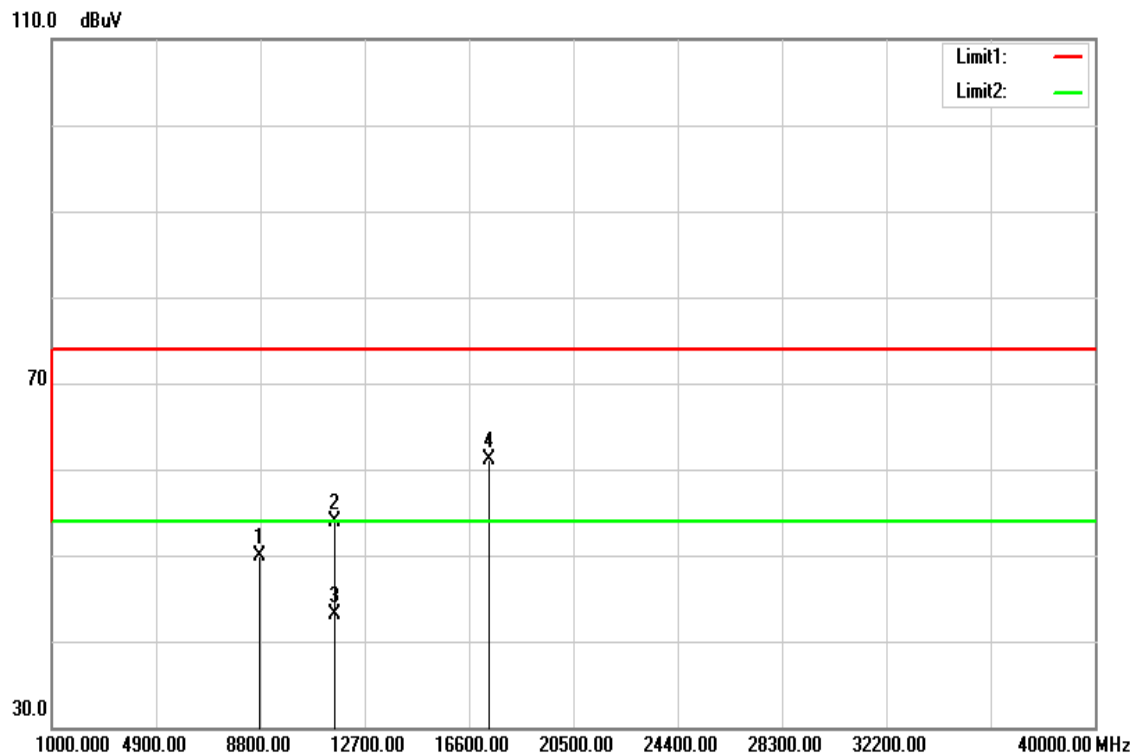
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
8754.000	35.96	13.76	49.72	74.00	-24.28	peak	V
11490.000	33.26	16.78	50.04	74.00	-23.96	peak	V
11490.000	23.34	16.78	40.12	54.00	-13.88	AVG	V
17235.000	35.61	25.28	60.89	74.00	-13.11	peak	V
N/A							
8754.000	35.13	13.76	48.89	74.00	-25.11	peak	H
11490.000	35.80	16.78	52.58	74.00	-21.42	peak	H
11490.000	25.91	16.78	42.69	54.00	-11.31	AVG	H
17235.000	35.00	25.28	60.28	74.00	-13.72	peak	H
N/A							

Remark:

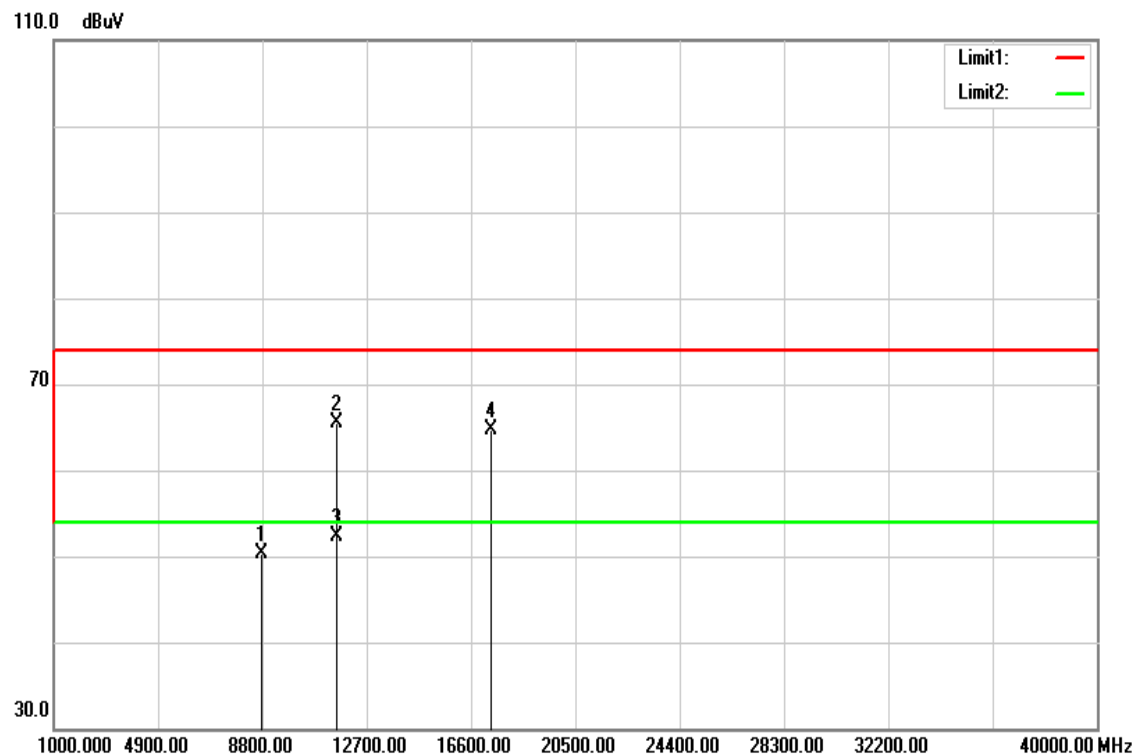
1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit.
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:** June 22, 2016
Temperature: 27°C **Tested by:** Dennis Li
Humidity: 53% RH **Polarity:** Ver. / Hor.

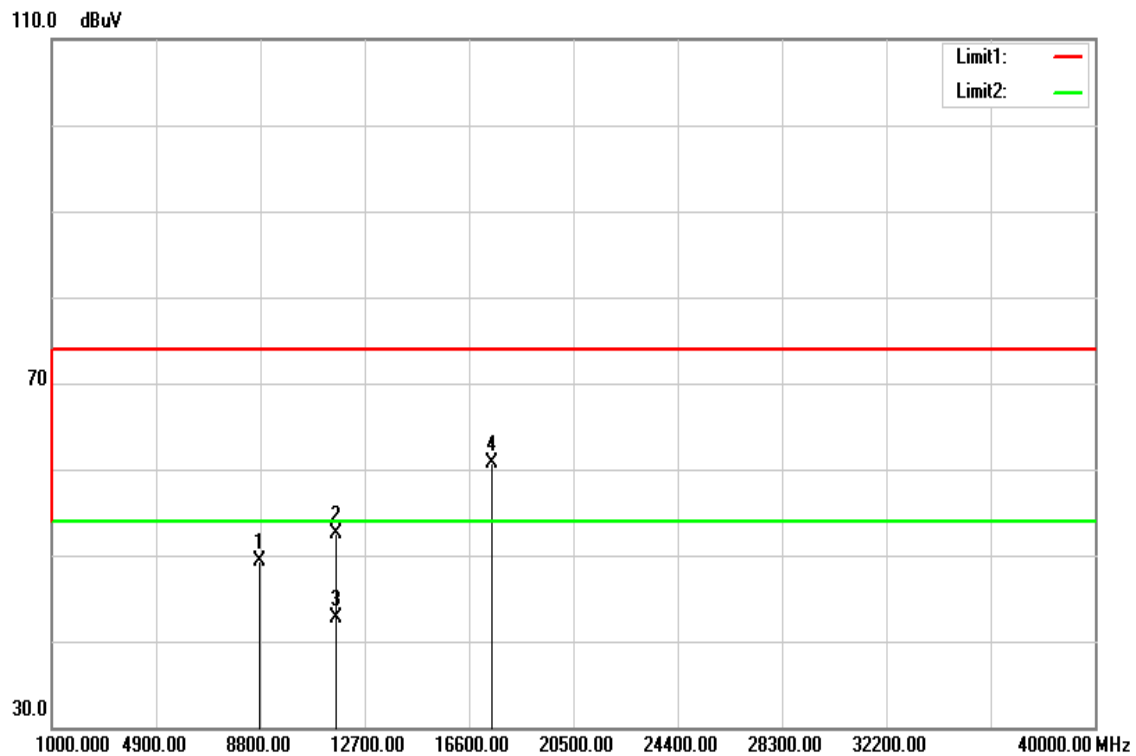
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
8798.000	36.09	13.78	49.87	74.00	-24.13	peak	V
11570.000	37.03	16.84	53.87	74.00	-20.13	peak	V
11570.000	26.28	16.84	43.12	54.00	-10.88	AVG	V
17355.000	35.29	25.75	61.04	74.00	-12.96	peak	V
N/A							
8762.000	36.45	13.76	50.21	74.00	-23.79	peak	H
11570.000	48.67	16.84	65.51	74.00	-8.49	peak	H
11570.000	35.55	16.84	52.39	54.00	-1.61	AVG	H
17355.000	39.02	25.75	64.77	74.00	-9.23	peak	H
N/A							

Remark:

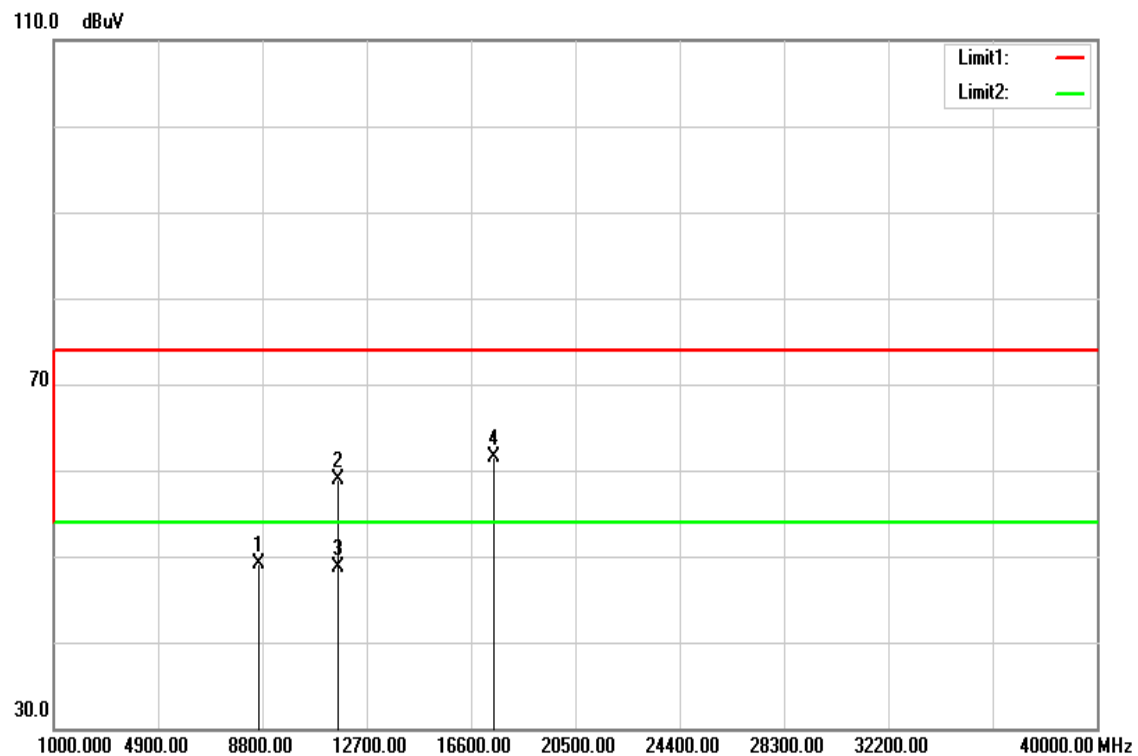
1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit.
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:** June 22, 2016
Temperature: 27°C **Tested by:** Dennis Li
Humidity: 53% RH **Polarity:** Ver. / Hor.

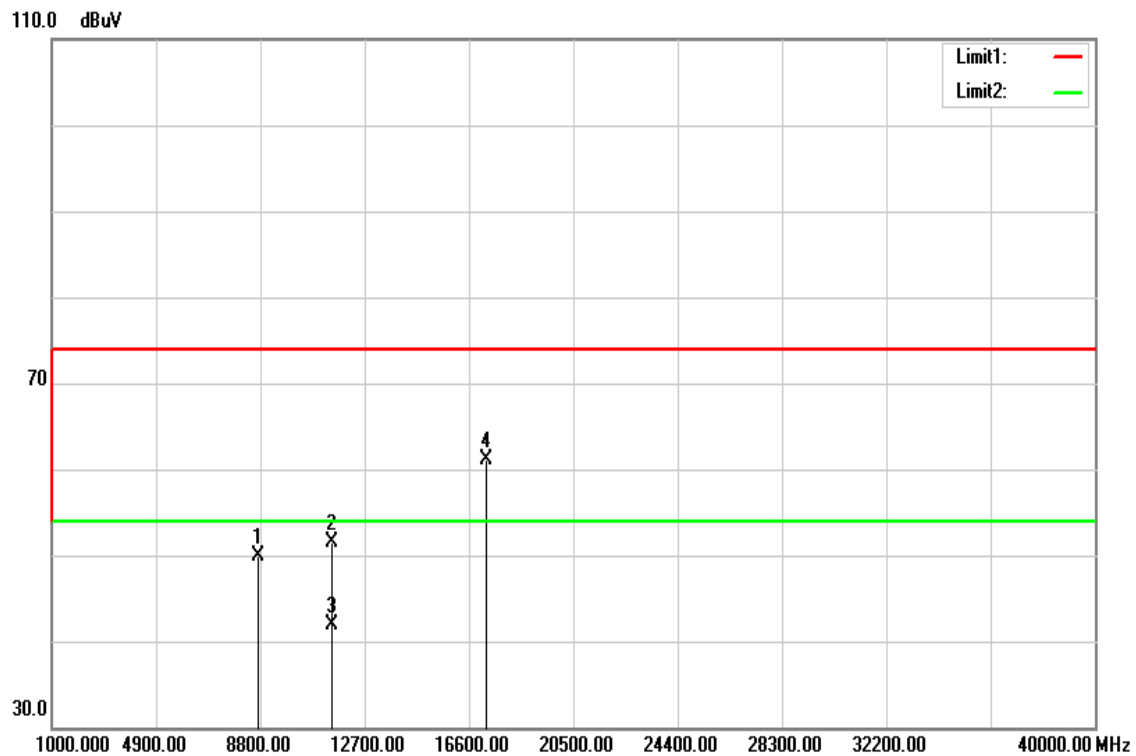
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
8766.000	35.53	13.76	49.29	74.00	-24.71	peak	V
11650.000	35.66	16.91	52.57	74.00	-21.43	peak	V
11650.000	25.78	16.91	42.69	54.00	-11.31	AVG	V
17475.000	34.55	26.22	60.77	74.00	-13.23	peak	V
N/A							
8692.000	35.28	13.73	49.01	74.00	-24.99	peak	H
11650.000	42.00	16.91	58.91	74.00	-15.09	peak	H
11650.000	31.89	16.91	48.80	54.00	-5.20	AVG	H
17475.000	35.29	26.22	61.51	74.00	-12.49	peak	H
N/A							

Remark:

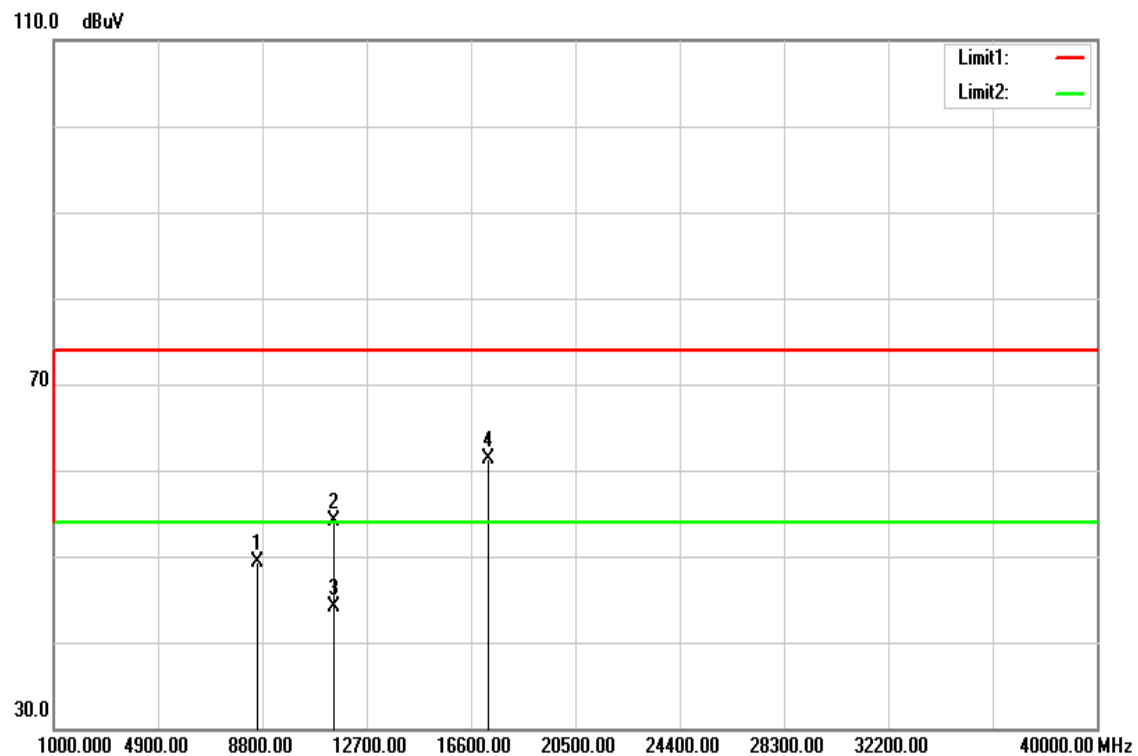
1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit.
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: June 22, 2016

Temperature: 27°C

Tested by: Dennis Li

Humidity: 53% RH

Polarity: Ver. / Hor.

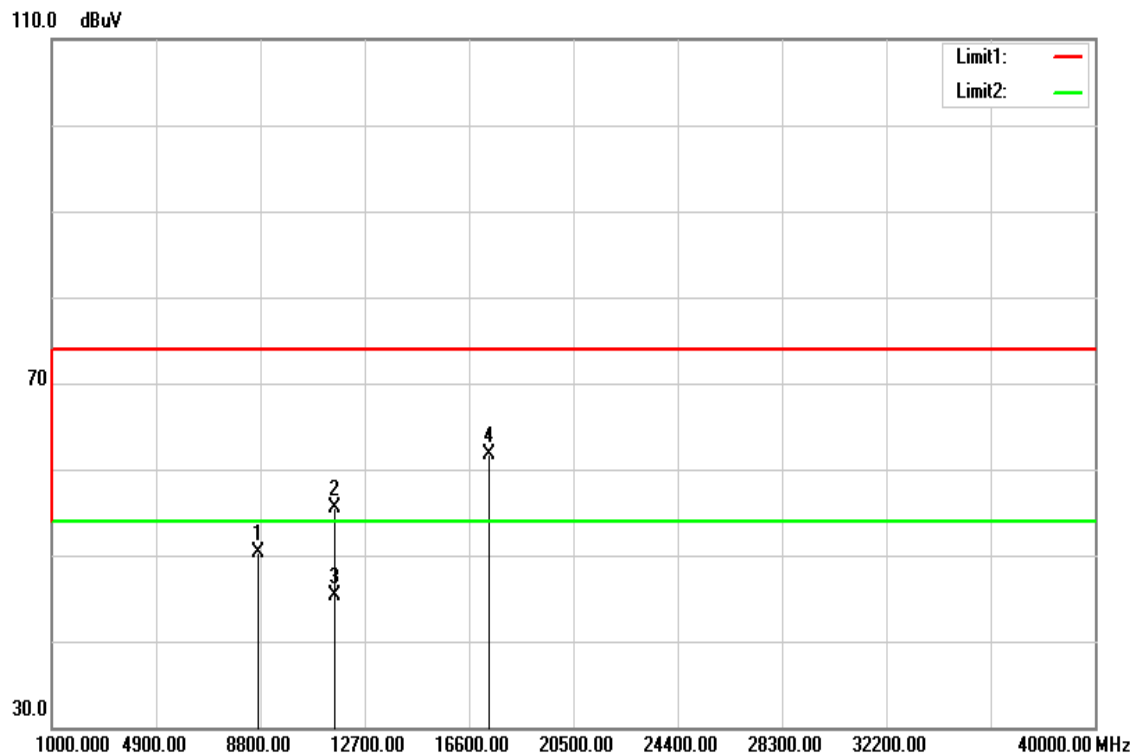
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
8744.000	36.07	13.75	49.82	74.00	-24.18	peak	V
11490.000	34.70	16.78	51.48	74.00	-22.52	peak	V
11490.000	25.21	16.78	41.99	54.00	-12.01	AVG	V
17235.000	35.77	25.28	61.05	74.00	-12.95	peak	V
N/A							
8631.000	35.60	13.70	49.30	74.00	-24.70	peak	H
11490.000	37.28	16.78	54.06	74.00	-19.94	peak	H
11490.000	27.37	16.78	44.15	54.00	-9.85	AVG	H
17235.000	36.11	25.28	61.39	74.00	-12.61	peak	H
N/A							

Remark:

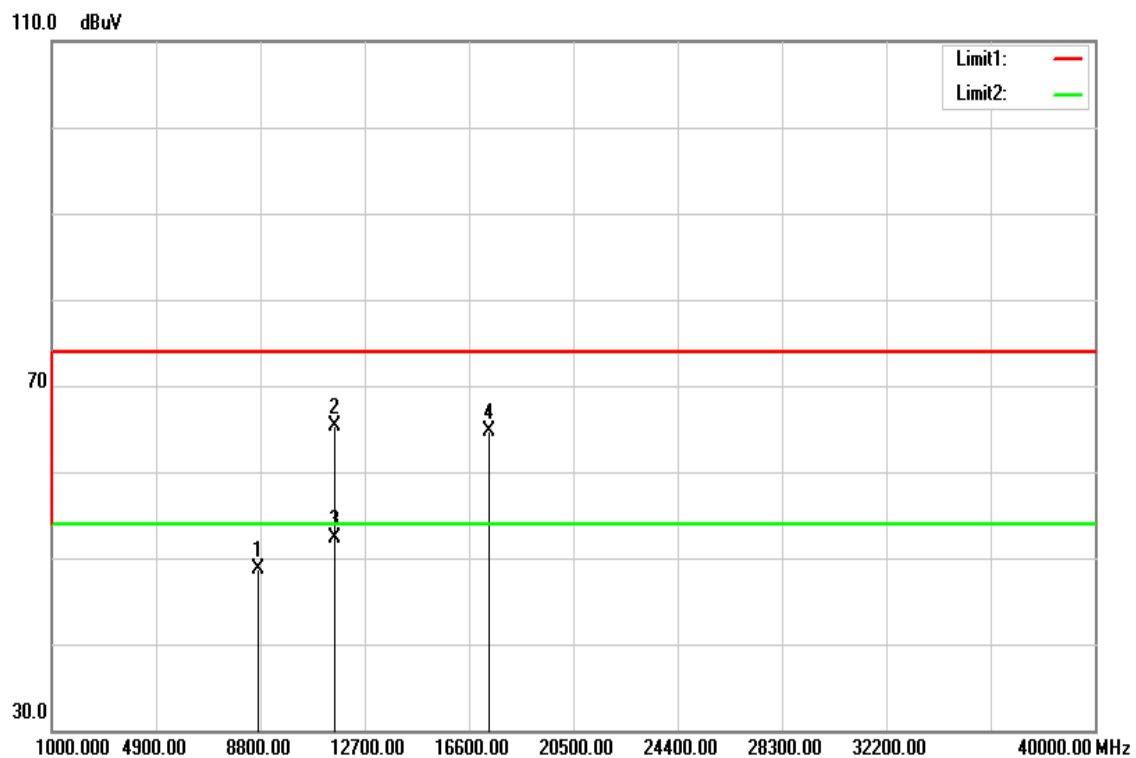
1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit 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: June 22, 2016

Temperature: 27°C

Tested by: Dennis Li

Humidity: 53% RH

Polarity: Ver. / Hor.

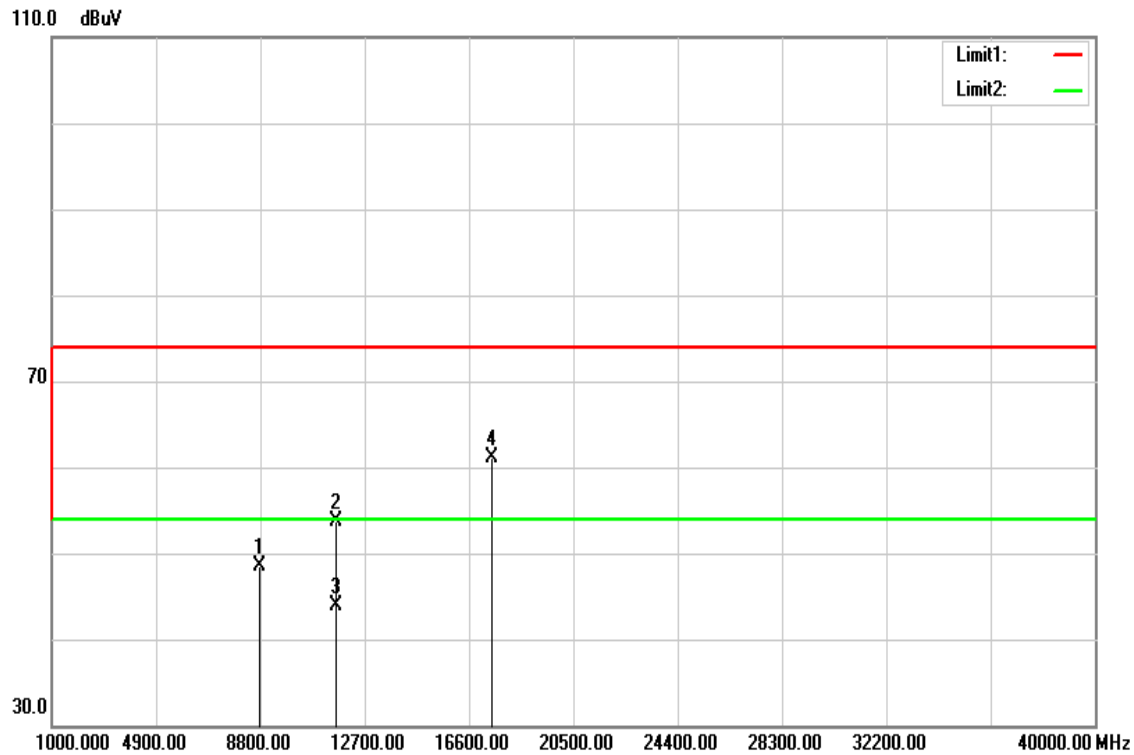
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
8746.000	36.46	13.75	50.21	74.00	-23.79	peak	V
11570.000	38.67	16.84	55.51	74.00	-18.49	peak	V
11570.000	28.49	16.84	45.33	54.00	-8.67	AVG	V
17355.000	35.98	25.75	61.73	74.00	-12.27	peak	V
N/A							
8744.000	34.88	13.75	48.63	74.00	-25.37	peak	H
11570.000	48.55	16.84	65.39	74.00	-8.61	peak	H
11570.000	35.51	16.84	52.35	54.00	-1.65	AVG	H
17355.000	38.97	25.75	64.72	74.00	-9.28	peak	H
N/A							

Remark:

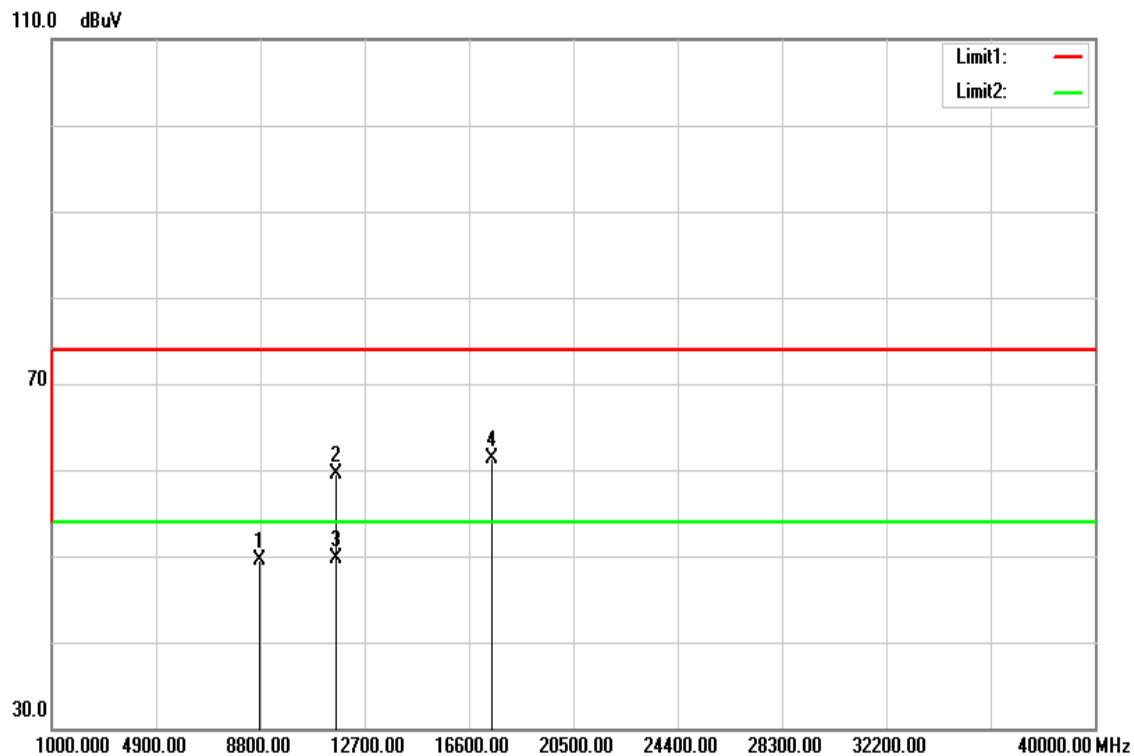
1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit 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: June 22, 2016

Temperature: 27°C

Tested by: Dennis Li

Humidity: 53% RH

Polarity: Ver. / Hor.

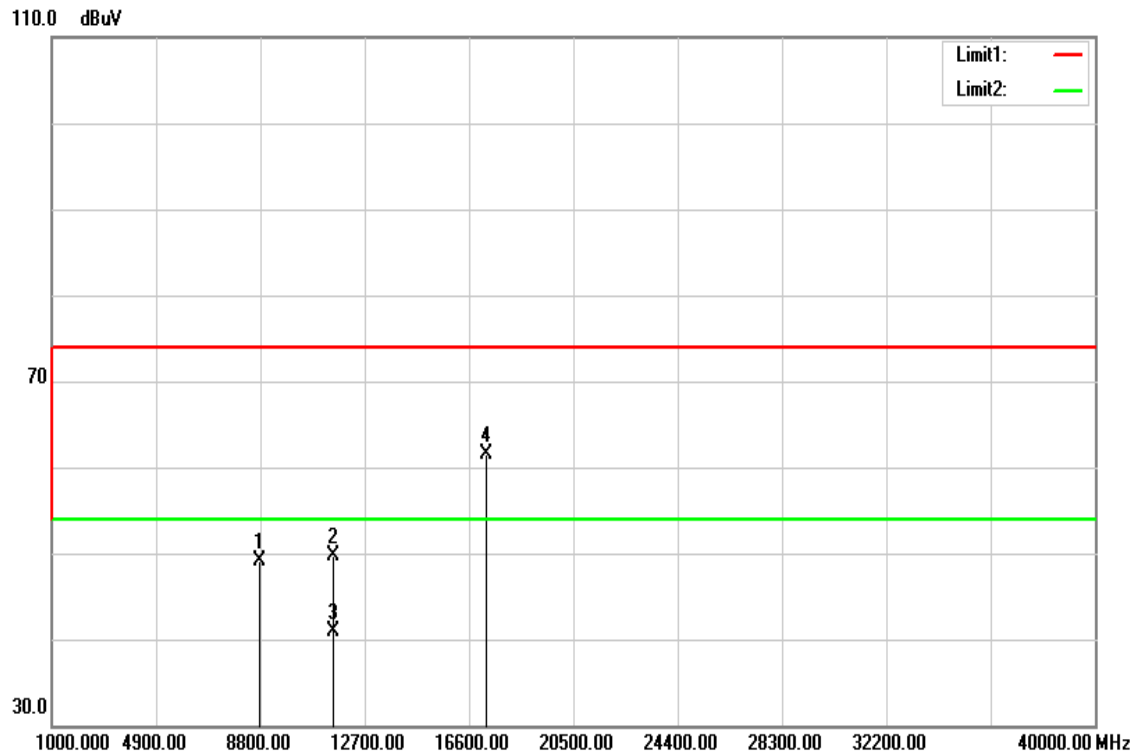
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
8755.000	34.83	13.76	48.59	74.00	-25.41	peak	V
11650.000	36.84	16.91	53.75	74.00	-20.25	peak	V
11650.000	26.96	16.91	43.87	54.00	-10.13	AVG	V
17475.000	34.92	26.22	61.14	74.00	-12.86	peak	V
N/A							
8766.000	35.83	13.76	49.59	74.00	-24.41	peak	H
11650.000	42.69	16.91	59.60	74.00	-14.40	peak	H
11650.000	32.87	16.91	49.78	54.00	-4.22	AVG	H
17475.000	35.16	26.22	61.38	74.00	-12.62	peak	H
N/A							

Remark:

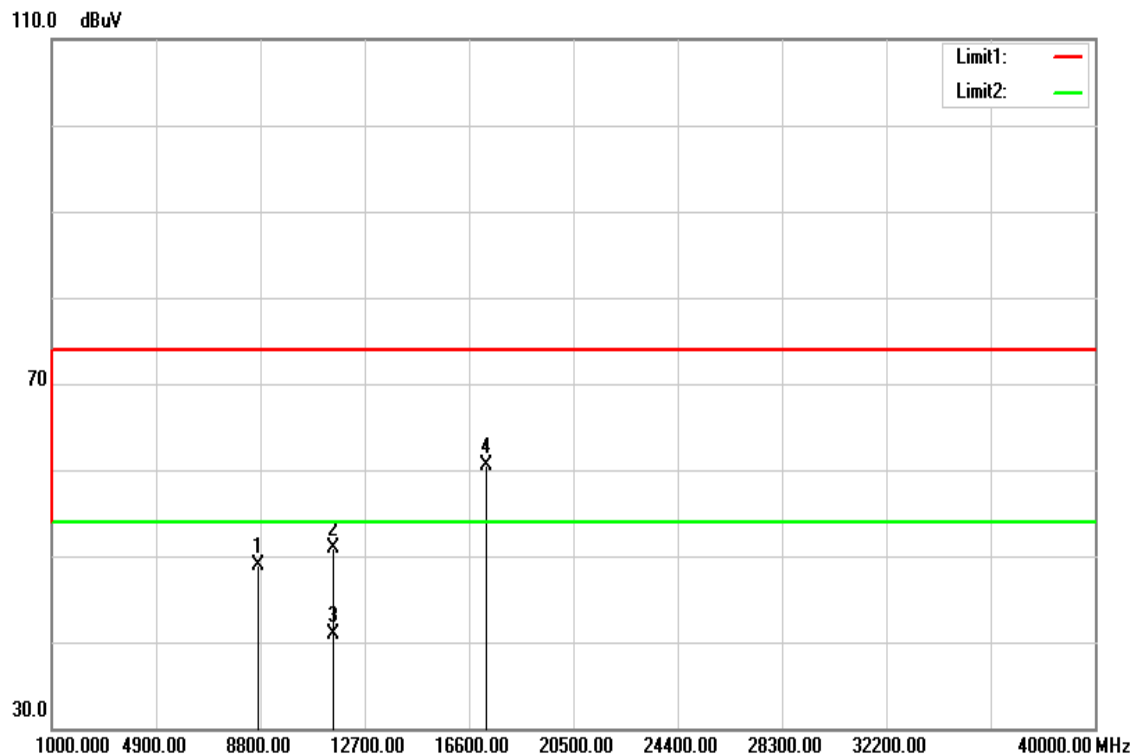
1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit 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: June 22, 2016

Temperature: 27°C

Tested by: Dennis Li

Humidity: 53% RH

Polarity: Ver. / Hor.

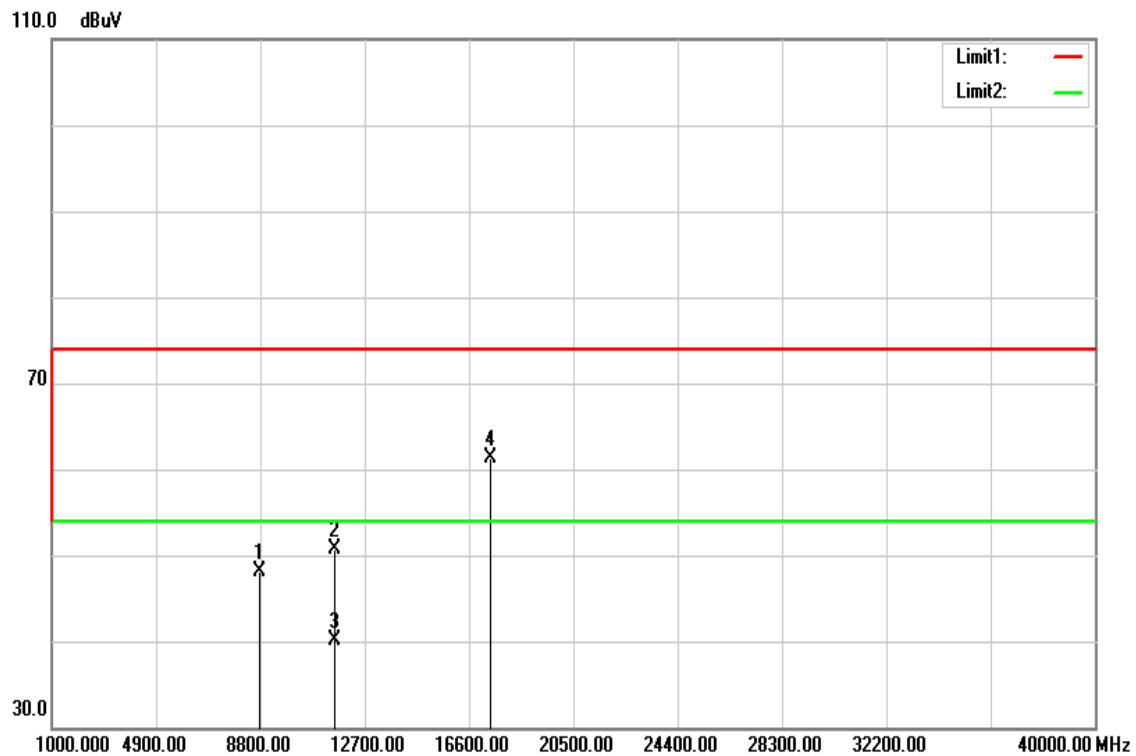
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
8792.000	35.24	13.77	49.01	74.00	-24.99	peak	V
11510.000	32.82	16.79	49.61	74.00	-24.39	peak	V
11510.000	24.09	16.79	40.88	54.00	-13.12	AVG	V
17265.000	36.13	25.40	61.53	74.00	-12.47	peak	V
N/A							
8712.000	35.18	13.74	48.92	74.00	-25.08	peak	H
11510.000	34.13	16.79	50.92	74.00	-23.08	peak	H
11510.000	24.19	16.79	40.98	54.00	-13.02	AVG	H
17265.000	35.09	25.40	60.49	74.00	-13.51	peak	H
N/A							

Remark:

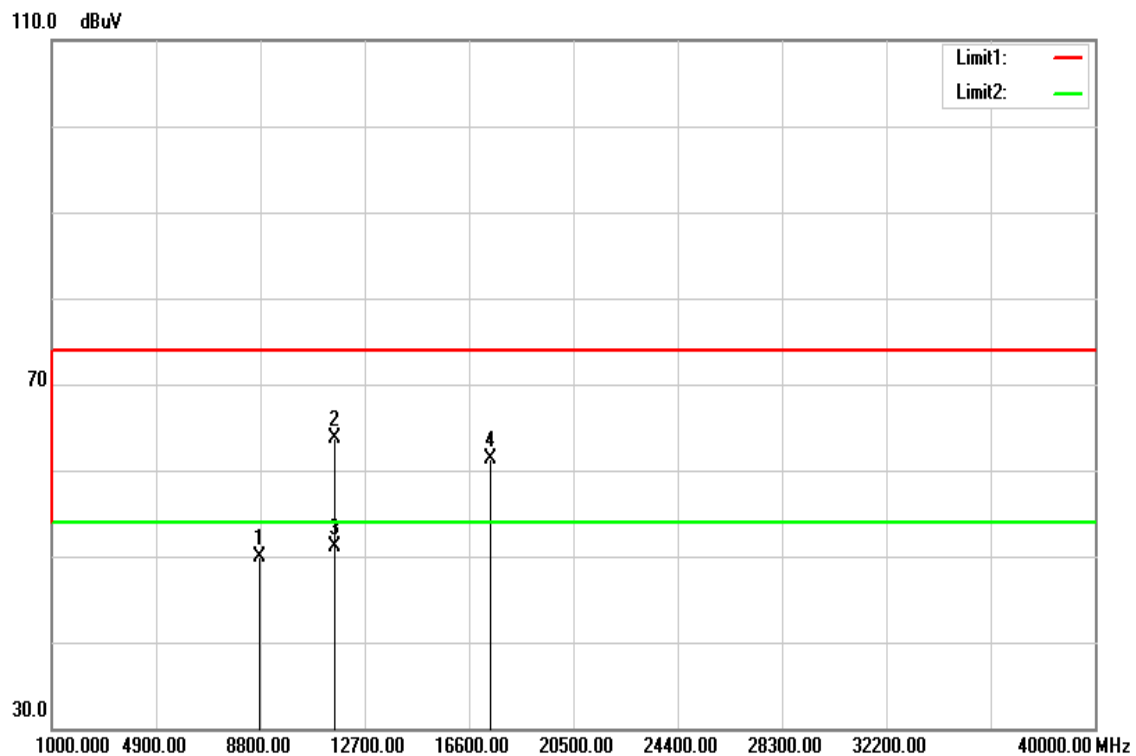
1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit 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: June 22, 2016

Temperature: 27°C

Tested by: Dennis Li

Humidity: 53% RH

Polarity: Ver. / Hor.

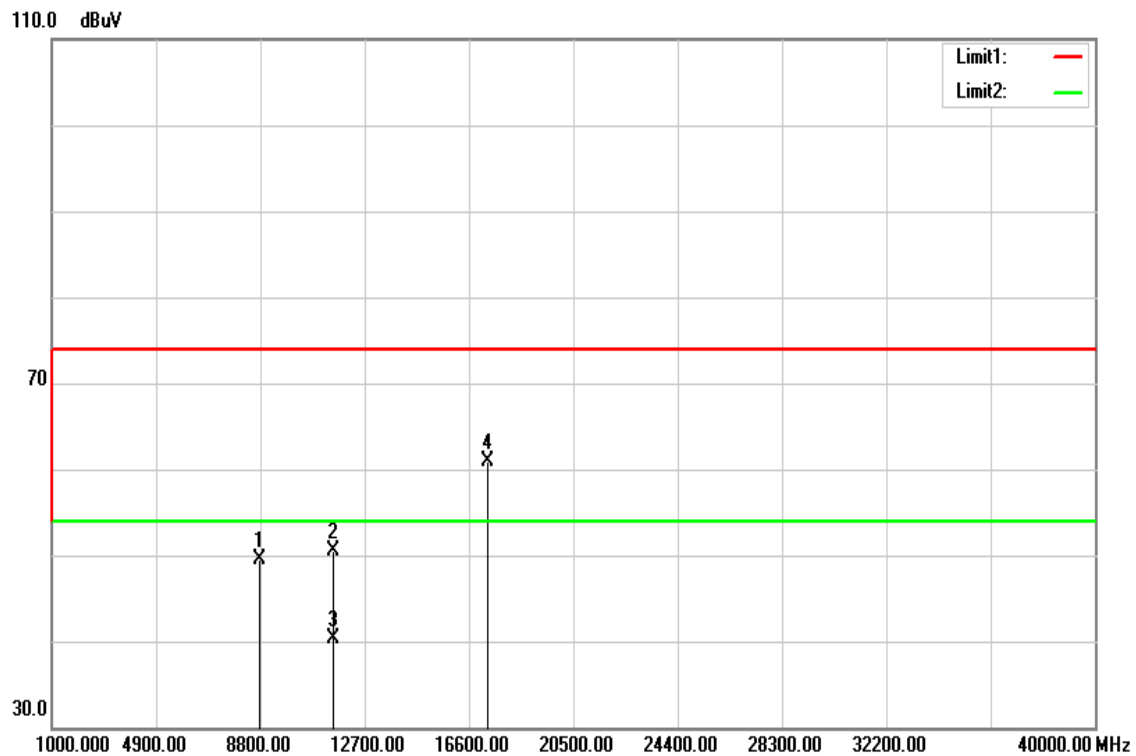
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
8755.000	34.38	13.76	48.14	74.00	-25.86	peak	V
11590.000	33.81	16.86	50.67	74.00	-23.33	peak	V
11590.000	23.27	16.86	40.13	54.00	-13.87	AVG	V
17385.000	35.43	25.87	61.30	74.00	-12.70	peak	V
N/A							
8774.000	36.17	13.77	49.94	74.00	-24.06	peak	H
11590.000	46.90	16.86	63.76	74.00	-10.24	peak	H
11590.000	34.32	16.86	51.18	54.00	-2.82	AVG	H
17385.000	35.34	25.87	61.21	74.00	-12.79	peak	H
N/A							

Remark:

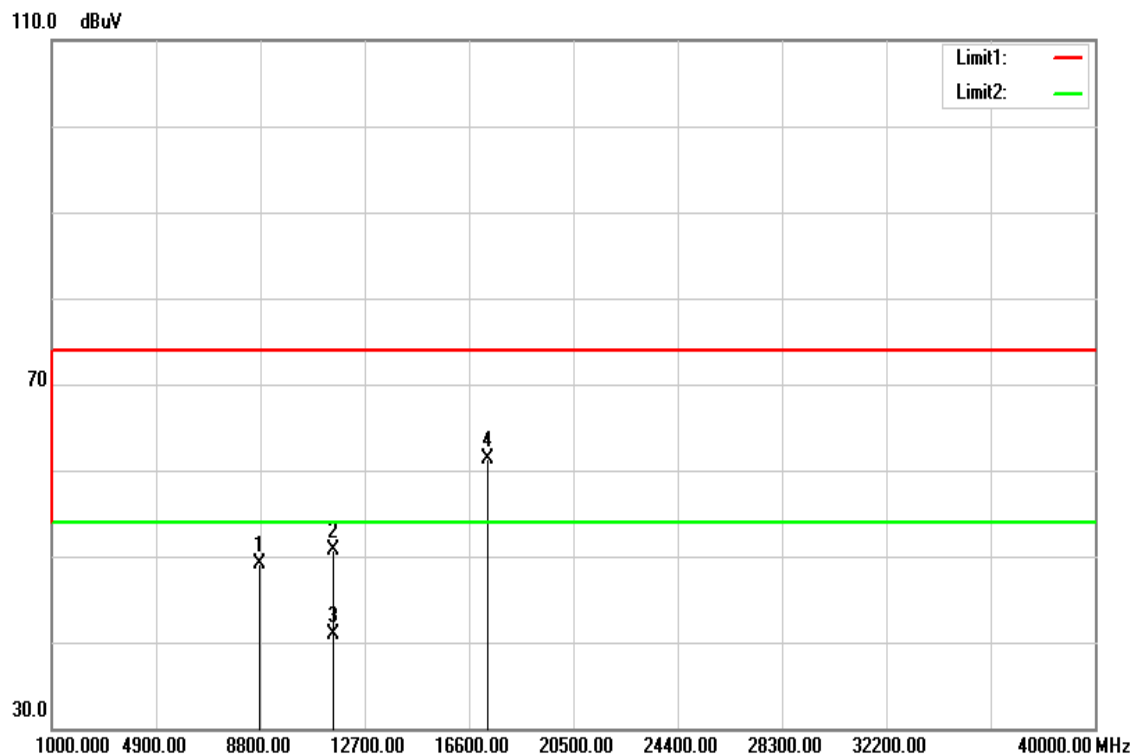
1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit 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

Temperature: 27°C

Humidity: 53% RH

Test Date: June 22, 2016

Tested by: Dennis Li

Polarity: Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
8799.000	35.72	13.78	49.50	74.00	-24.50	peak	V
11550.000	33.69	16.82	50.51	74.00	-23.49	peak	V
11550.000	23.46	16.82	40.28	54.00	-13.72	AVG	V
17325.000	35.18	25.63	60.81	74.00	-13.19	peak	V
N/A							
8756.000	35.31	13.76	49.07	74.00	-24.93	peak	H
11550.000	33.91	16.82	50.73	74.00	-23.27	peak	H
11550.000	24.14	16.82	40.96	54.00	-13.04	AVG	H
17325.000	35.66	25.63	61.29	74.00	-12.71	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 μ H/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 (dB μ V)	
	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:** July 6, 2016
Temperature: 24°C **Tested by:** Dennis Li
Humidity: 50% RH

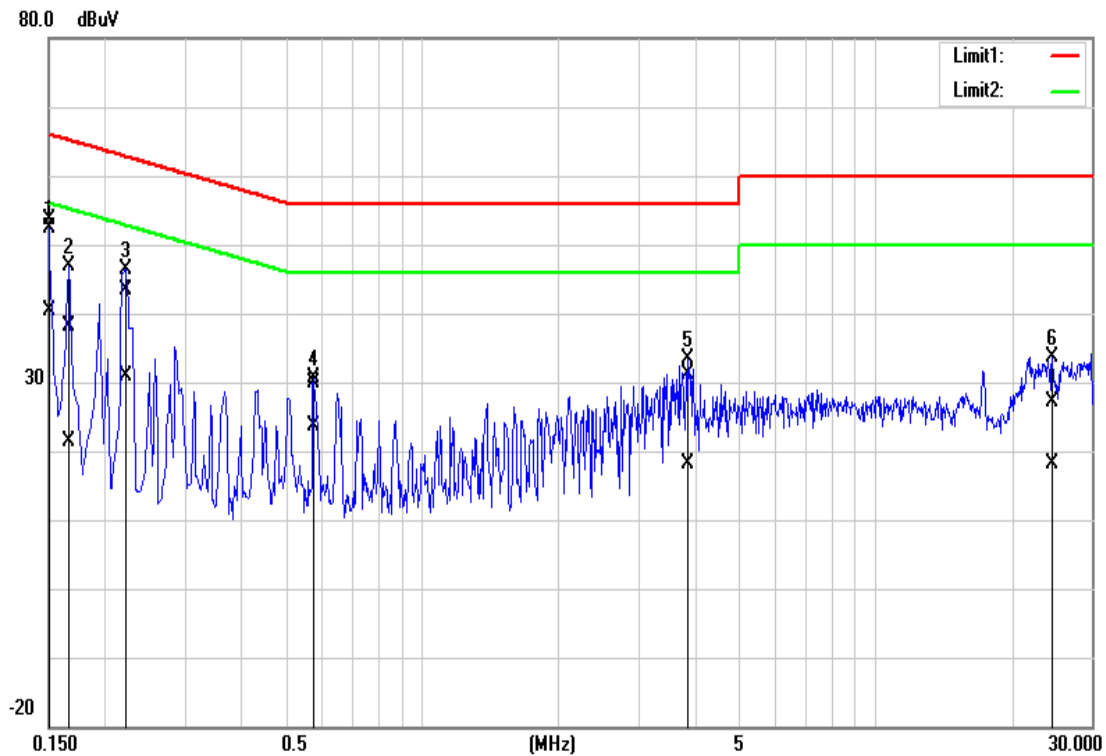
Freq. (MHz)	QP Reading (dBuV)	AV Reading (dBuV)	Corr. factor (dB/m)	QP Result (dBuV/m)	AV Result (dBuV/m)	QP Limit (dBuV)	AV Limit (dBuV)	QP Margin (dB)	AV Margin (dB)	Note
0.1500	43.90	30.72	9.71	53.61	40.43	66.00	56.00	-12.39	-15.57	L1
0.1660	28.46	11.57	9.71	38.17	21.28	65.16	55.16	-26.99	-33.88	L1
0.2220	33.57	21.20	9.70	43.27	30.90	62.74	52.74	-19.47	-21.84	L1
0.5780	20.18	13.94	9.70	29.88	23.64	56.00	46.00	-26.12	-22.36	L1
3.8780	21.39	8.34	9.74	31.13	18.08	56.00	46.00	-24.87	-27.92	L1
24.5540	17.31	8.34	9.83	27.14	18.17	60.00	50.00	-32.86	-31.83	L1
0.1700	27.84	9.88	9.78	37.62	19.66	64.96	54.96	-27.34	-35.30	L2
0.2220	33.94	22.10	9.77	43.71	31.87	62.74	52.74	-19.03	-20.87	L2
0.3700	22.19	13.24	9.76	31.95	23.00	58.50	48.50	-26.55	-25.50	L2
0.6580	20.91	15.78	9.76	30.67	25.54	56.00	46.00	-25.33	-20.46	L2
3.6620	16.40	2.97	9.82	26.22	12.79	56.00	46.00	-29.78	-33.21	L2
29.9220	19.39	11.12	10.38	29.77	21.50	60.00	50.00	-30.23	-28.50	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)

