

**FCC 47 CFR PART 15 SUBPART E &  
INDUSTRY CANADA RSS-247**

**TEST REPORT**

**For**

**Wi-Fi (11a/b/g/n 2Tx2R)+BT (V4.1LE) USB Combo Module**

**Model:**

**WCBN4515R, WCBN4515R(Ext), WCBN4515R(Emb)**

**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: October 3, 2016**



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**Revision History**

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	October 3, 2016	Initial Issue	ALL	Doris Chu
01	December 10, 2016	1. Add remark for Part 15.203	P.5	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

**Manufacturer:** LITE-ON TECHNOLOGY (Changzhou) CO., LTD  
 A9 Building, No.88 Yanghu Road, Wujin Hi-Tech Industrial  
 Development Zone, Changzhou City,  
 Jiangsu Province 213100 China

**Equipment Under Test:** Wi-Fi (11a/b/g/n 2Tx2R)+BT (V4.1LE) USB Combo Module

**Model Number:** WCBN4515R, WCBN4515R(Ext), WCBN4515R(Emb)

**Trade Name:** LITE-ON

**Date of Test:** September 8 ~ 26, 2016

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
FCC 47 CFR Part 15 Subpart E & Industry Canada RSS-247 Issue 1	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:





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Sam Chuang  
 Manager  
 Compliance Certification Services Inc.

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Dennis Li  
 Engineer  
 Compliance Certification Services Inc.

## 2. EUT DESCRIPTION

<b>Product</b>	Wi-Fi (11a/b/g/n 2Tx2R)+BT (V4.1LE) USB Combo Module
<b>Model Number</b>	WCBN4515R, WCBN4515R(Ext), WCBN4515R(Emb)
<b>Trade Name</b>	LITE-ON
<b>Model Discrepancy</b>	WCBN4515R : PCB Antenna WCBN4515R(Ext) : WiFi PCB Antenna, BT PIFA Antenna WCBN4515R(Emb) : PCB Antenna
<b>Received Date</b>	September 5, 2016
<b>Power supply</b>	Power form host device.
<b>Frequency Range</b>	IEEE 802.11a / IEEE 802.11n HT 20 MHz: 5745 ~ 5825 MHz IEEE 802.11n HT 40 MHz: 5755 ~ 5795 MHz
<b>Transmit Power</b>	IEEE 802.11a mode: 15.45 dBm IEEE 802.11n HT 20 MHz mode: 19.27 dBm IEEE 802.11n HT 40 MHz mode: 16.24 dBm
<b>Number of Channels</b>	IEEE 802.11a mode: 5 Channels IEEE 802.11n HT 20 MHz mode: 5 Channels IEEE 802.11n HT 40 MHz mode: 2 Channels
<b>Antenna Specification</b>	PIFA Antenna Ant1: Gain: 1.88dBi Ant2: Gain: -0.17dBi
<b>Product SW/HW version</b>	3.3.0 / V00
<b>Radio SW version</b>	3.3.0
<b>Radio HW version</b>	V00

**Remark:**

1. The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.
2. The device is restricted to transmit in the band 5600 ~ 5650 MHz
3. Antenna was meets the rule of Part 15.203 Antenna requirement.

<b>Antenna Category</b>	<input checked="" type="checkbox"/> Integral: antenna permanently attached <input type="checkbox"/> External dedicated antennas <input type="checkbox"/> External Unique antenna connector
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### 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 v01r03, IC RSS-247, IC RSS-Gen.

#### 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 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
<sup>1</sup> 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	( <sup>2</sup> )
13.36 - 13.41	322 - 335.4		

<sup>1</sup> Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

<sup>2</sup> 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.

### 3.3 DESCRIPTION OF TEST MODES

The EUT (model: WCBN4515R) 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.

#### 3.3.1 The worst mode of measurement

AC Conducted Emission	
<b>Test Condition</b>	<b>AC Power line conducted emission for line and neutral</b>
<b>Voltage/Hz</b>	120V/60Hz
<b>Test Mode</b>	<b>Mode 1: Printed Antenna (EUT via USB link NB)</b>
<b>Worst Mode</b>	<input checked="" type="checkbox"/> <b>Mode 1</b> <input type="checkbox"/> <b>Mode 2</b> <input type="checkbox"/> <b>Mode 3</b> <input type="checkbox"/> <b>Mode 4</b>

Remark: The worst mode was record in this test report.

Radiated Emission Measurement	
<b>Test Condition</b>	<b>Band edge, Emission for Unwanted and Fundamental</b>
<b>Voltage/Hz</b>	120V/60Hz
<b>Test Mode</b>	<b>Mode 1: Printed Antenna (EUT via USB link NB)</b>
<b>Worst Mode</b>	<input checked="" type="checkbox"/> <b>Mode 1</b> <input type="checkbox"/> <b>Mode 2</b> <input type="checkbox"/> <b>Mode 3</b> <input type="checkbox"/> <b>Mode 4</b>
<b>Position</b>	<input type="checkbox"/> Placed in fixed position. <input type="checkbox"/> Placed in fixed position at X-Plane (E2-Plane) <input checked="" type="checkbox"/> Placed in fixed position at Y-Plane (E1-Plane) <input type="checkbox"/> Placed in fixed position at Z-Plane (H-Plane)

Remark:

1. The worst mode was record in this test report.
2. The EUT pre-scanned in three axis ,X, Y, Z and two polarity, Horizontal and Vertical for radiated measurement. The worst case (Y-Plane and Vertical) were recorded in this report.

### 3.4 THE WORST CASE POWER SETTING PARAMETER

#### IEEE 802.11a mode / 5745 ~ 5825MHz

Channel	Frequency (MHz)	RF power setting in TEST SW
Low	5745	1F
Mid	5785	1F
High	5825	1F

#### 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	1E	1C
Mid	5785	22	1F
High	5825	23	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	1D	1A
High	5795	22	1F



## 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

RF Conducted 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 # B					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
LISN	SCHWARZBECK	NSLK 8127	8127-541	11/23/15	11/22/16
Receiver	R&S	ESCI	101073	08/20/16	08/19/17
Software	CCS-3A1-CE				

**Remark:**

1. Each piece of equipment is scheduled for calibration once a year and Precision Dipole is scheduled for calibration once three years.
2. N.C.R. = No Calibration Request.

### 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, Chungshen 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
2	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

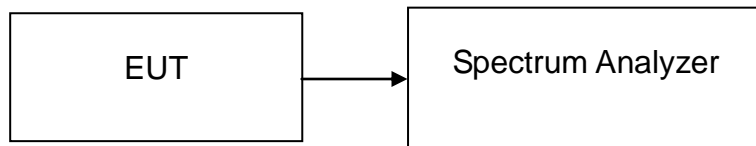
**Remark:**

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 RSS-247 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.

#### Limit

For reporting purposes only.

## **TEST RESULTS**

### **Test Data**

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

Channel	Frequency (MHz)	99%Bandwidth (MHz)
Low	5745	16.9753
Mid	5785	16.9319
High	5825	16.9319

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

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5745	17.9305
Mid	5785	18.0173
High	5825	17.9305

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

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5745	17.8002
Mid	5785	17.8002
High	5825	17.7568

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

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5755	36.9319
High	5795	36.8162

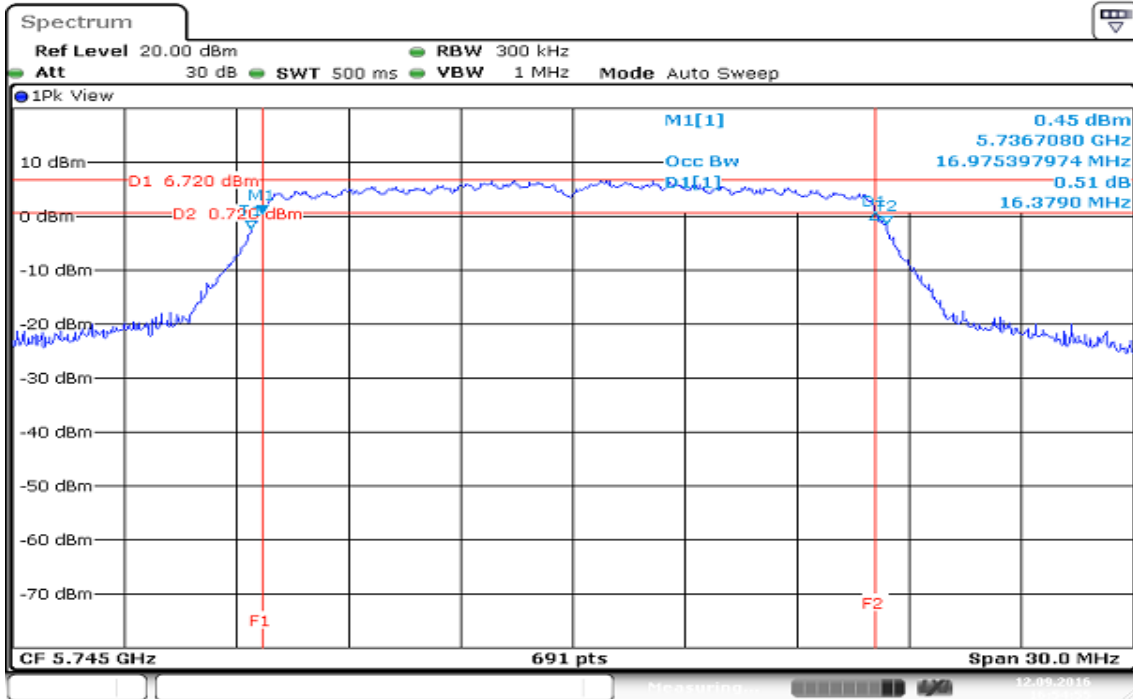
**Test mode: IEEE 802.11n HT 40 MHz mode / Chain 1**

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5755	36.7004
High	5795	36.5846

**Test Plot**

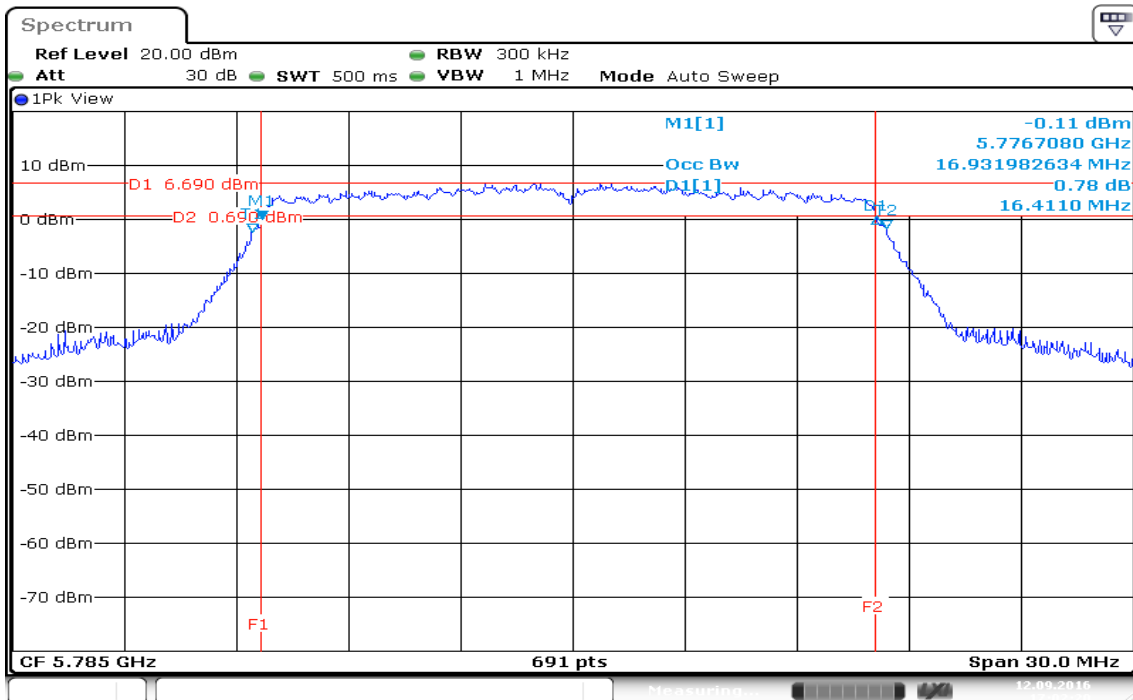
**IEEE 802.11a mode / 5745 ~ 5825MHz**

**99% Bandwidth (CH Low)**



Date: 12 SEP 2016 16:54:56

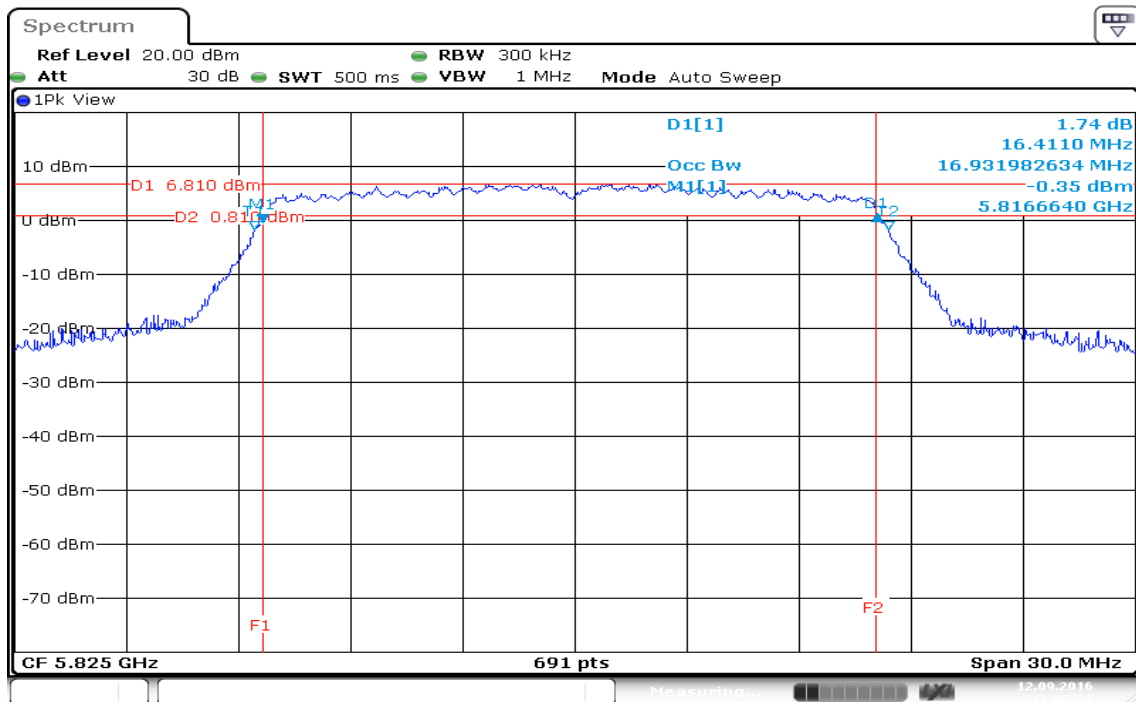
**99% Bandwidth (CH Mid)**



Date: 12 SEP 2016 17:02:20



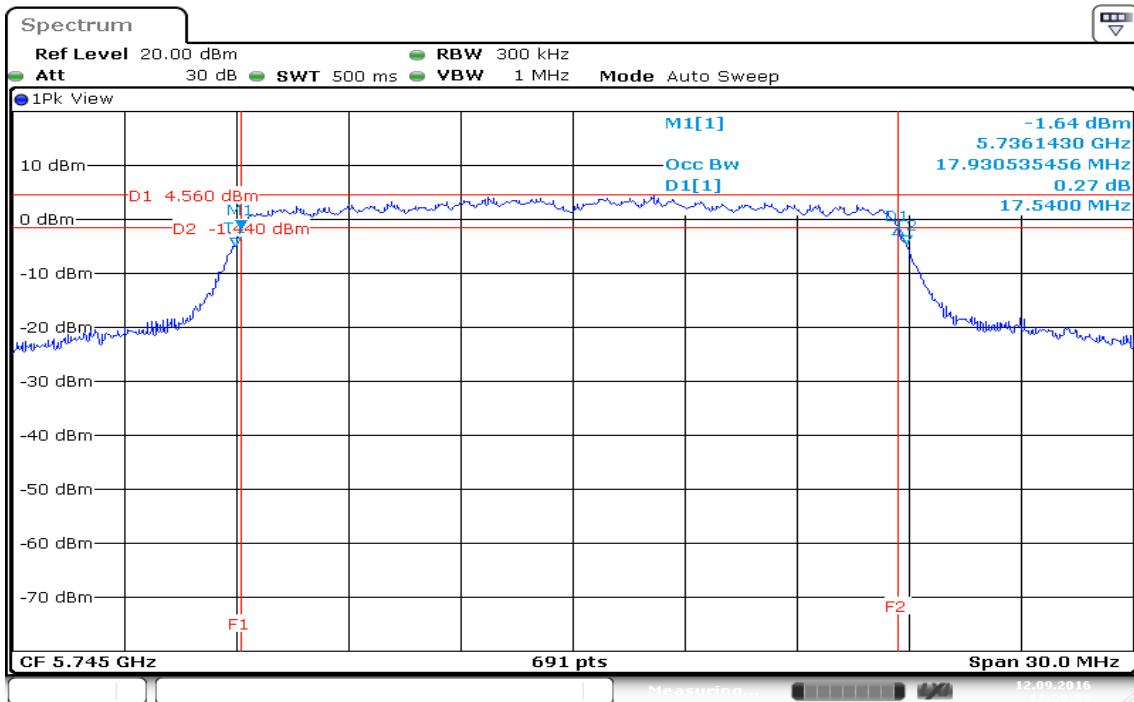
### 99% Bandwidth (CH High)



Date: 12.SEP.2016 17:05:33

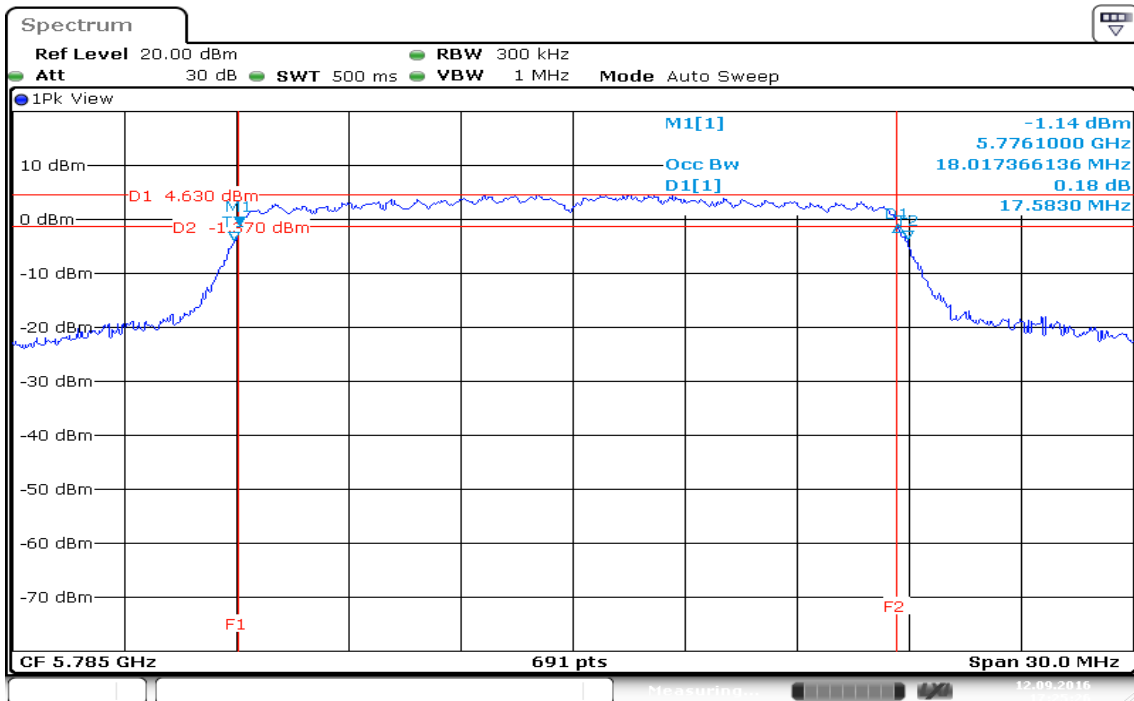
**IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz / Chain 0**

**99% Bandwidth (CH Low)**



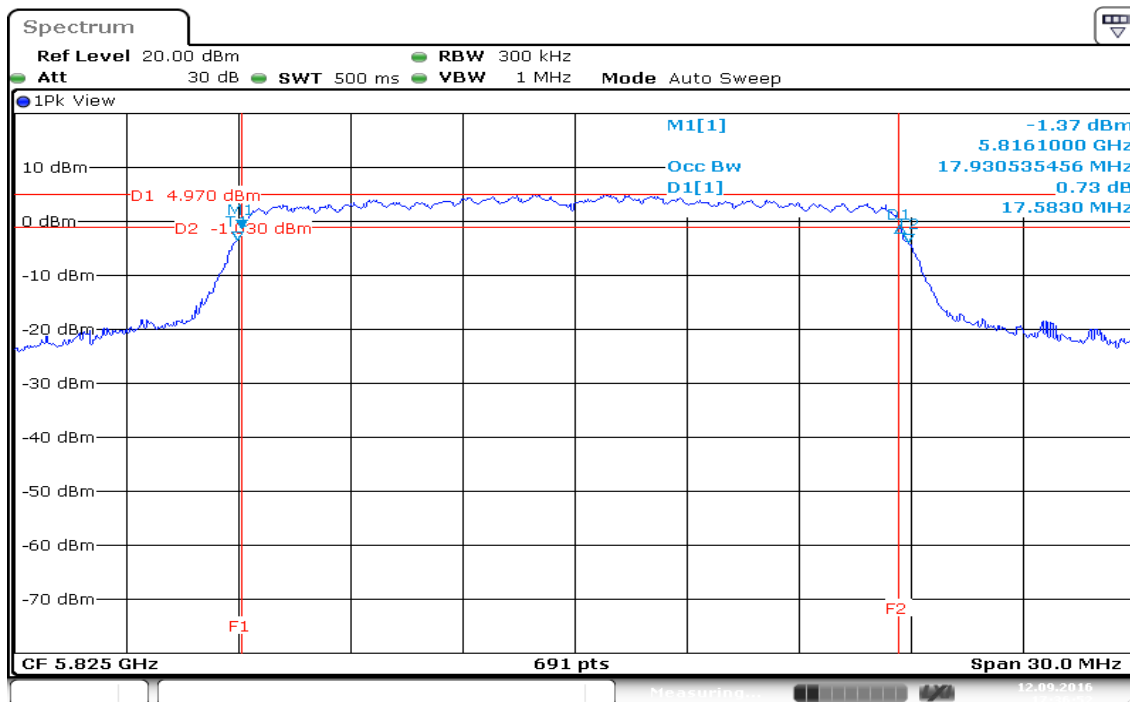
Date: 12 SEP 2016 17:20:55

**99% Bandwidth (CH Mid)**



Date: 12 SEP 2016 17:25:26

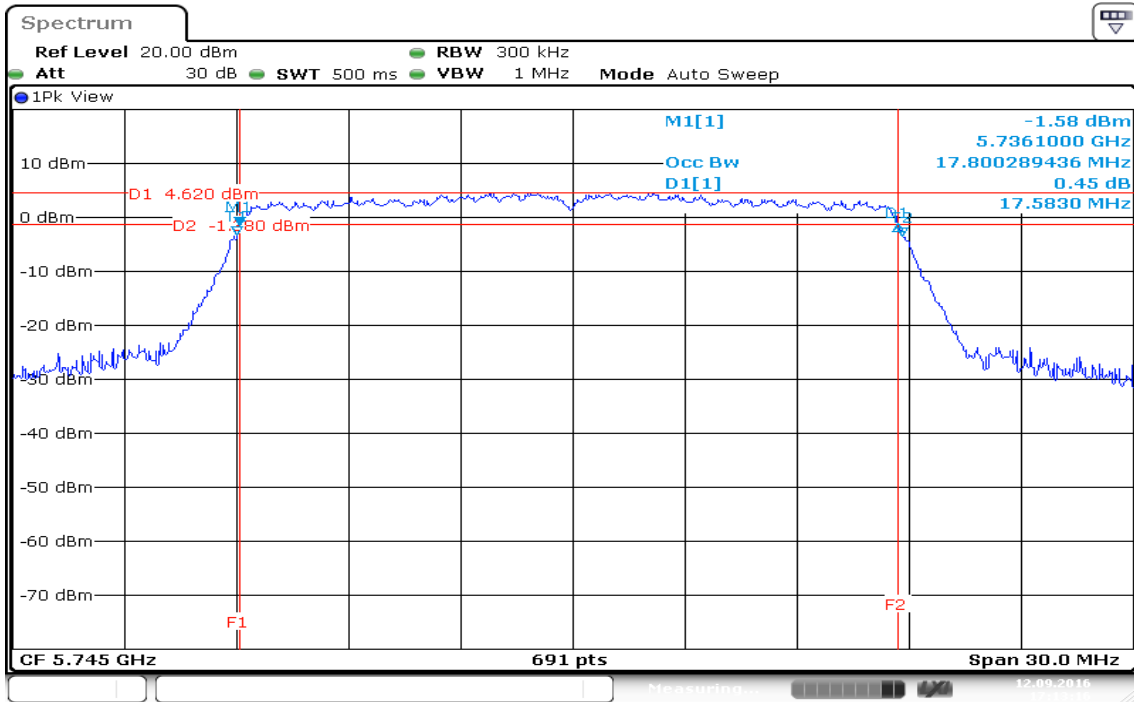
### 99% Bandwidth (CH High)



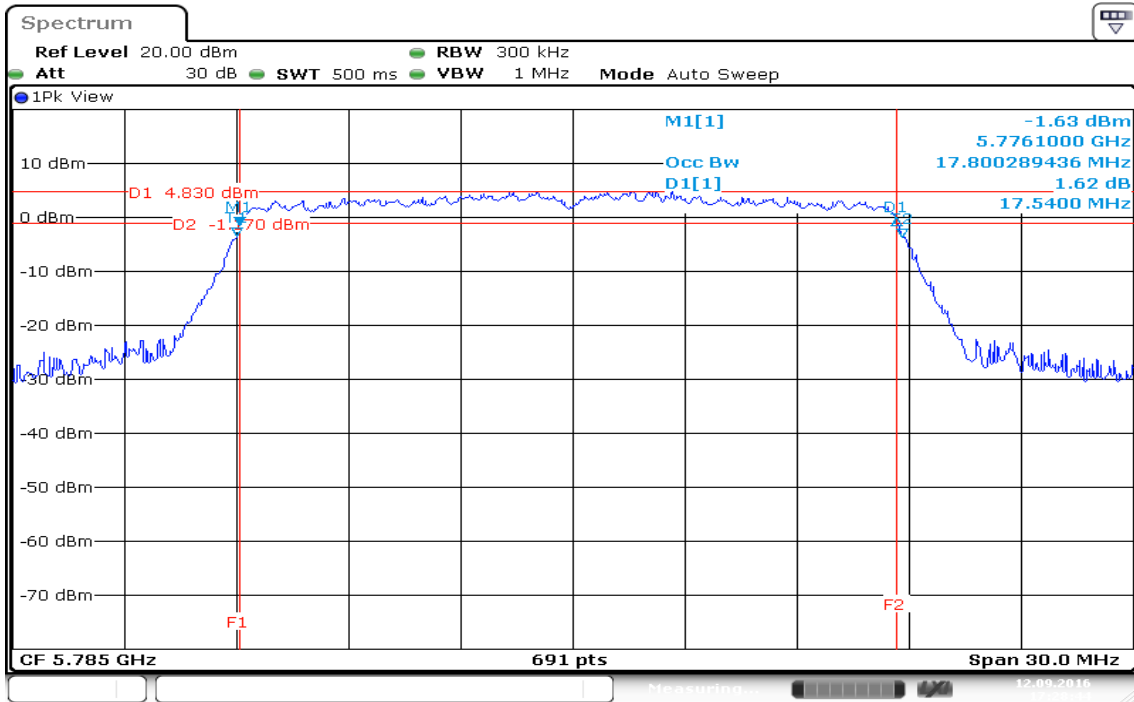
Date: 12.SEP.2016 17:36:52

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

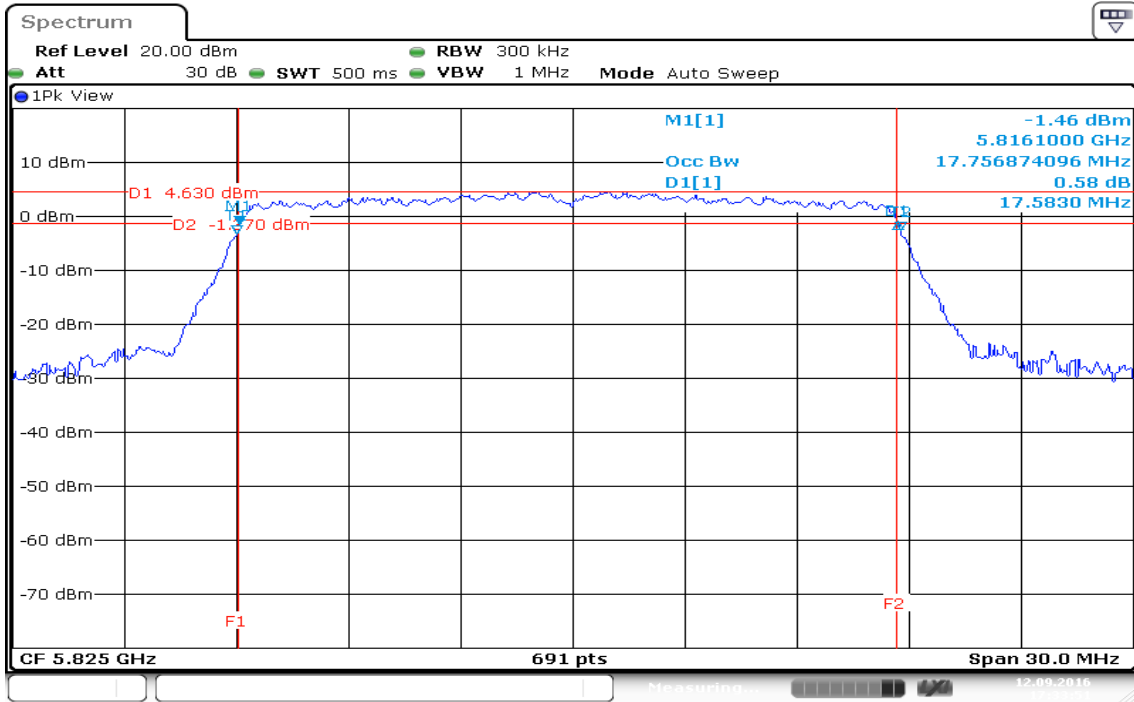
**99% Bandwidth (CH Low)**



**99% Bandwidth (CH Mid)**



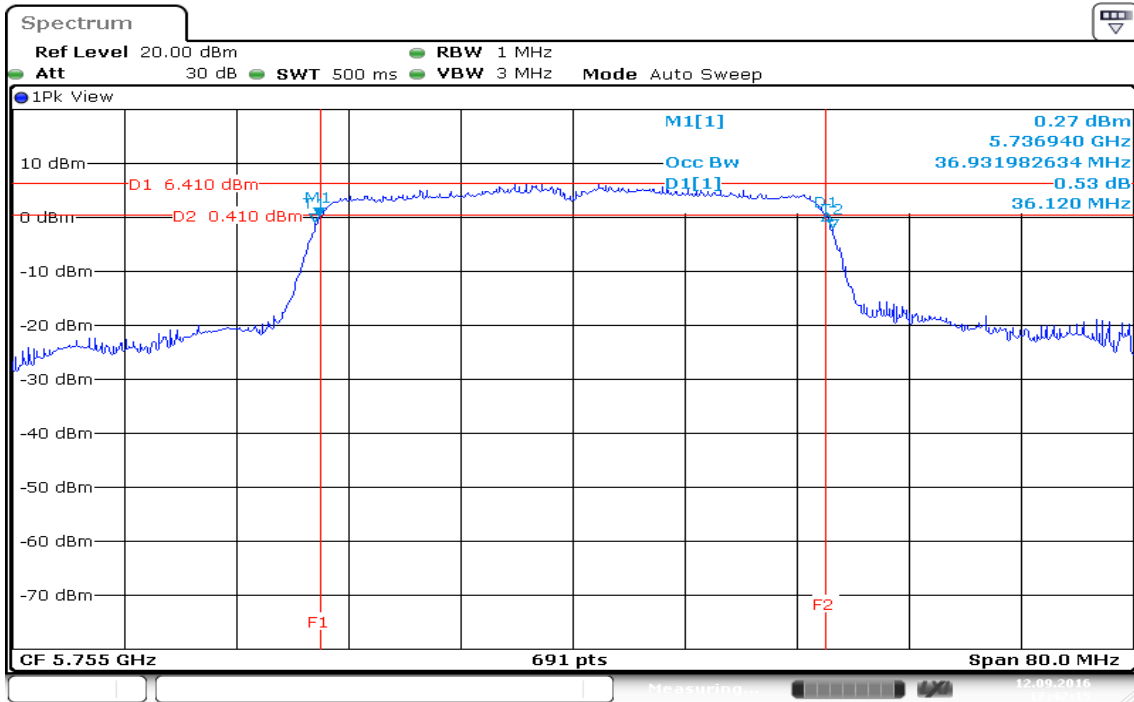
### 99% Bandwidth (CH High)



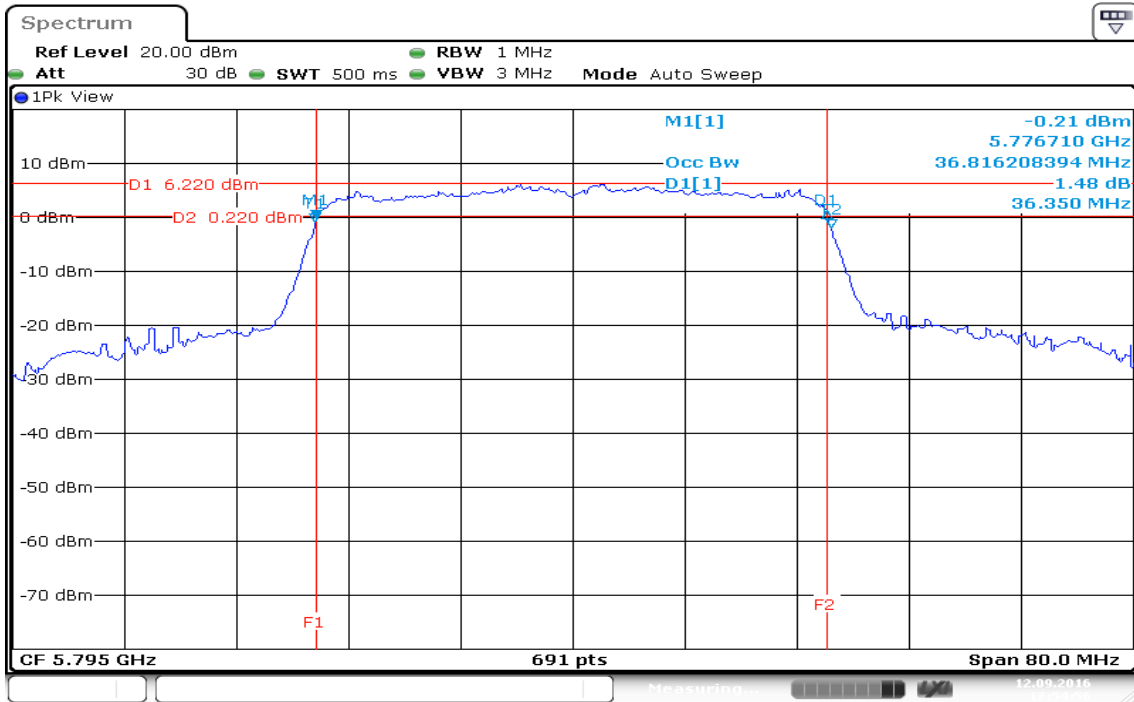
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**IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz / Chain 0**

**99% Bandwidth (CH Low)**

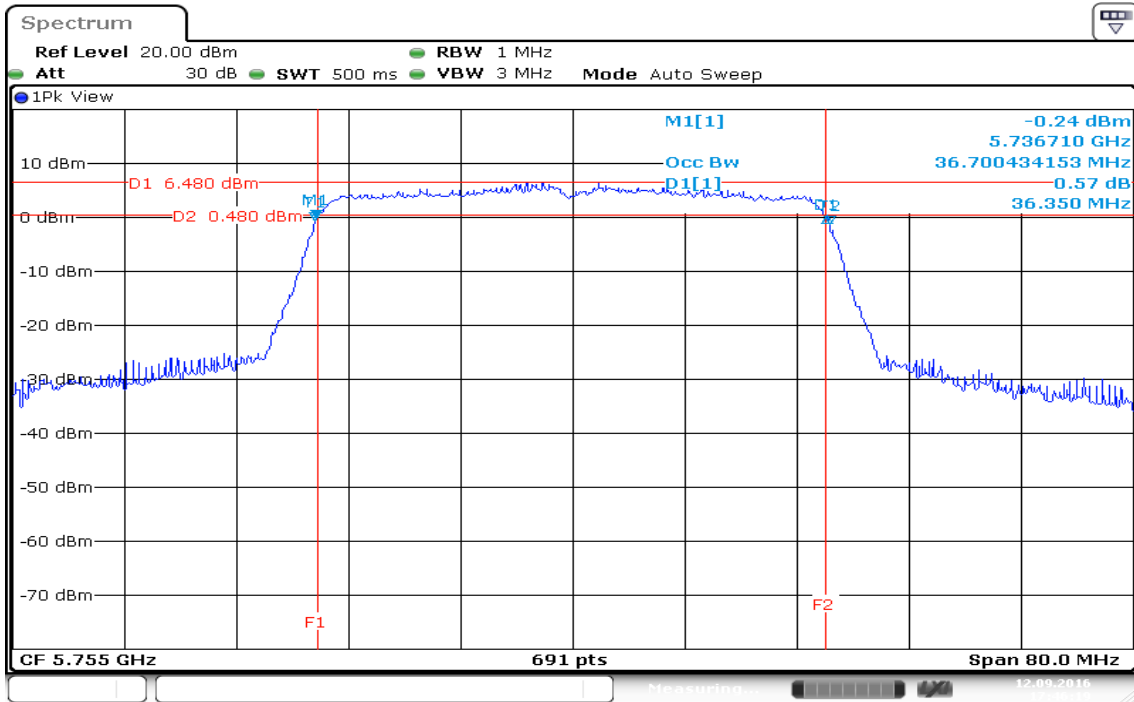


**99% Bandwidth (CH High)**

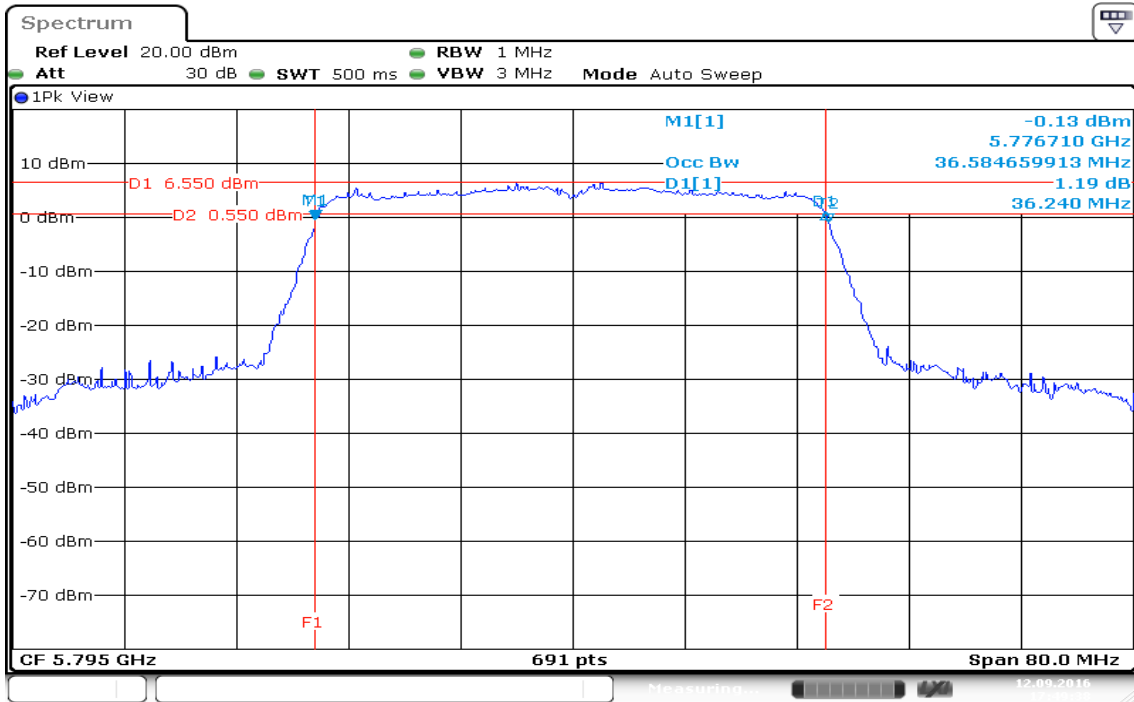


**IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz / Chain 1**

**99% Bandwidth (CH Low)**



**99% Bandwidth (CH High)**

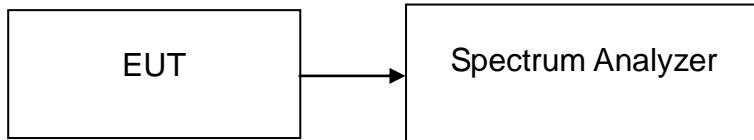


## 7.2 6DB BANDWIDTH

### LIMIT

According to §15.407 & RSS-247§, systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 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=300KHz for 802.11a, 802.11n HT20; 1MHz for 802.11n HT40 = VBW = 3\*RBW, 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	16.3790	>500	PASS
Mid	5785	16.4110		PASS
High	5825	16.4110		PASS

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

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (kHz)	Result
Low	5745	17.5400	>500	PASS
Mid	5785	17.5830		PASS
High	5825	17.5830		PASS

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

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (kHz)	Result
Low	5745	17.5830	>500	PASS
Mid	5785	17.5400		PASS
High	5825	17.5830		PASS

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

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (kHz)	Result
Low	5755	36.1200	>500	PASS
High	5795	36.3500		PASS

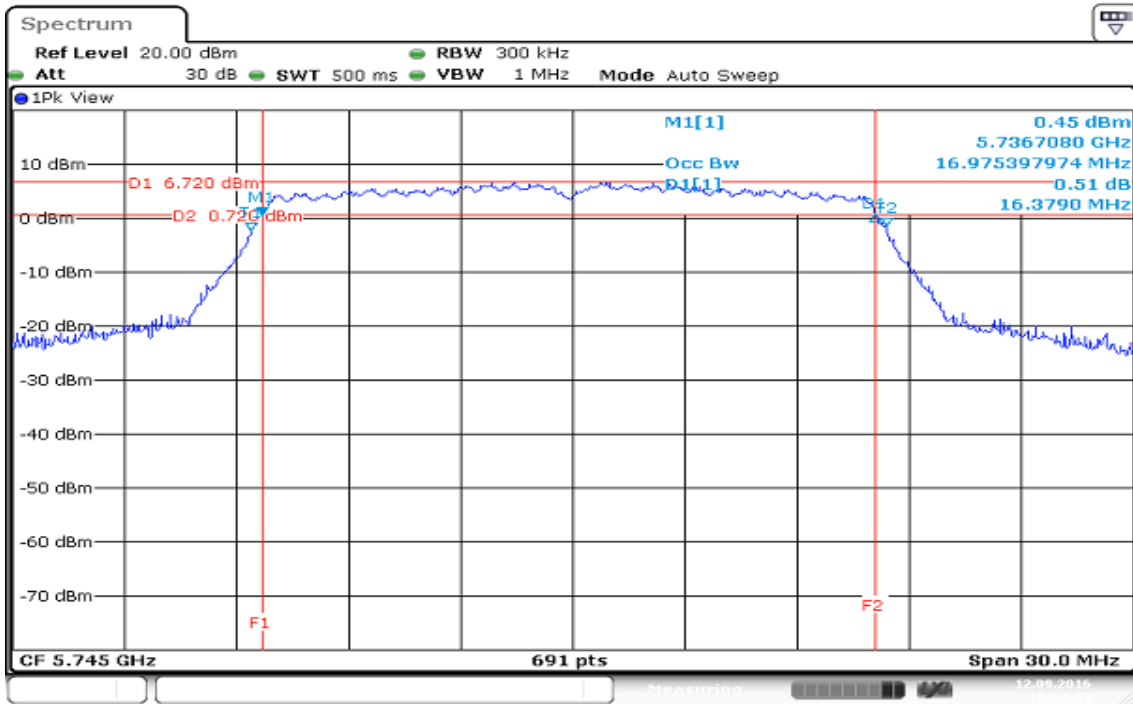
**Test mode: IEEE 802.11n HT 40 MHz mode / Chain 1**

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (kHz)	Result
Low	5755	36.3500	>500	PASS
High	5795	36.2400		PASS

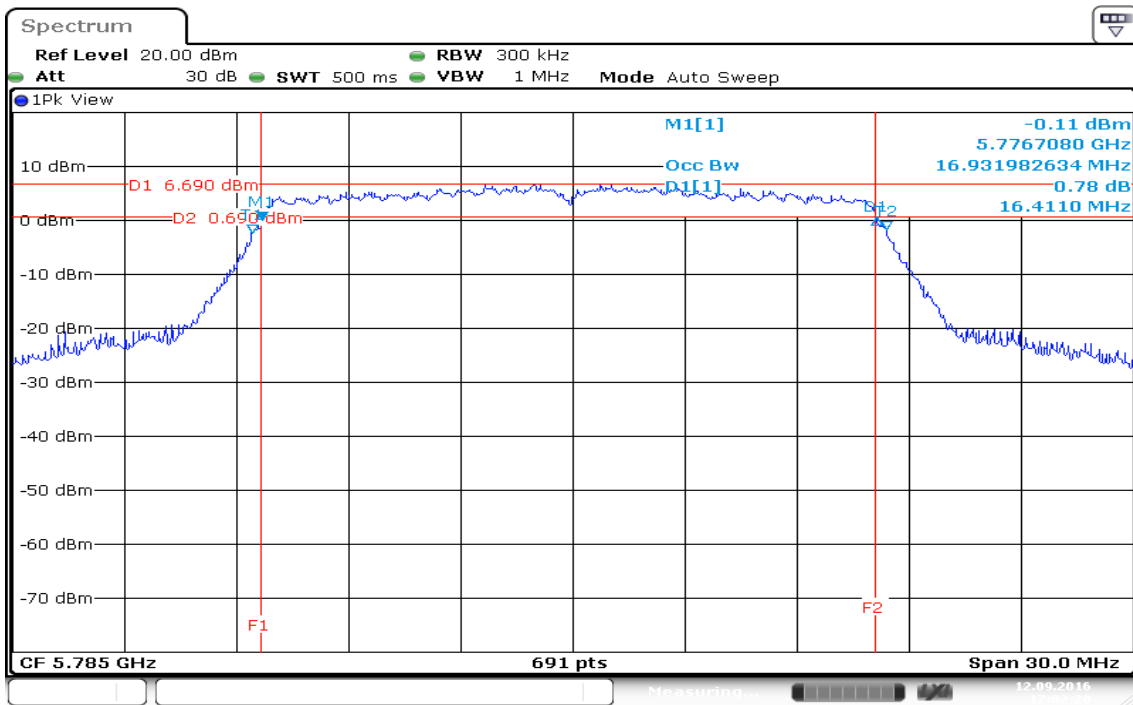
**Test Plot**

**IEEE 802.11a mode / 5745 ~ 5825MHz**

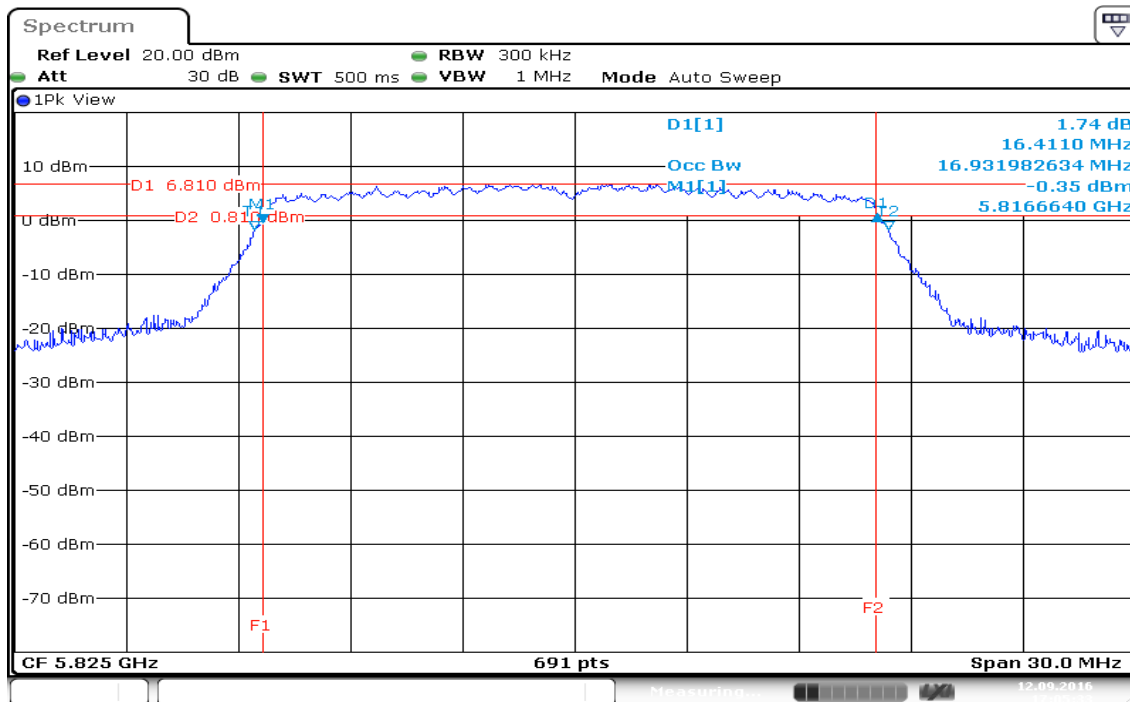
**6dB Bandwidth (CH Low)**



**6dB Bandwidth (CH Mid)**

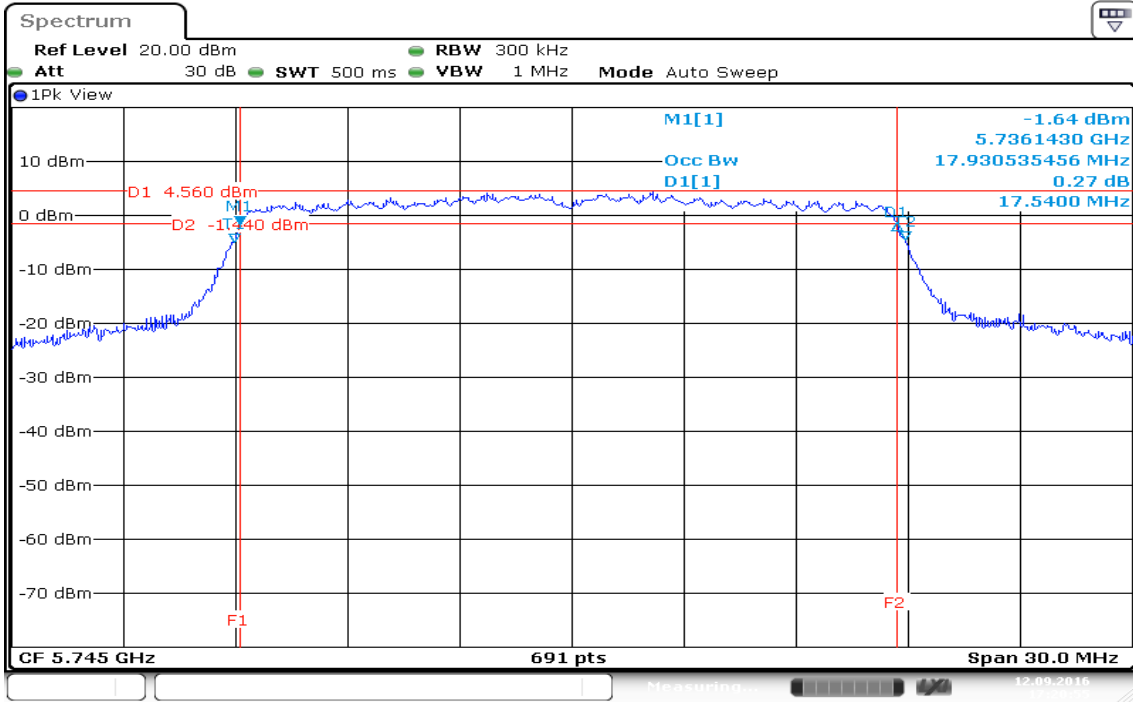


### 6dB Bandwidth (CH High)

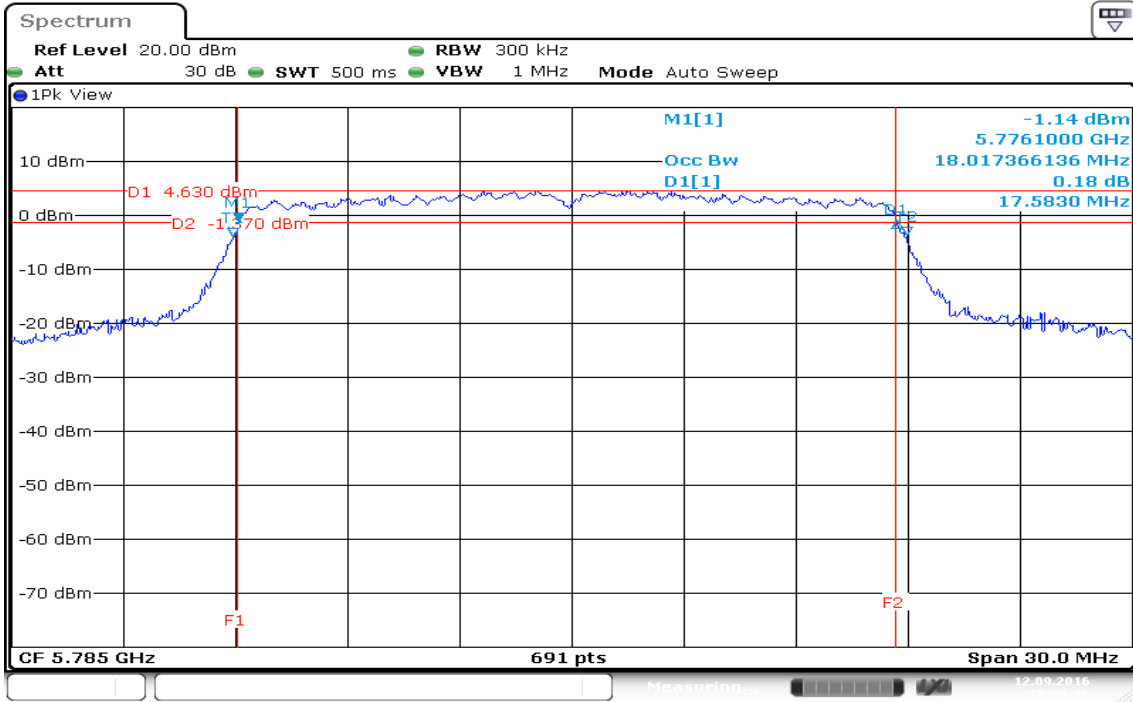


**IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz / Chain 0**

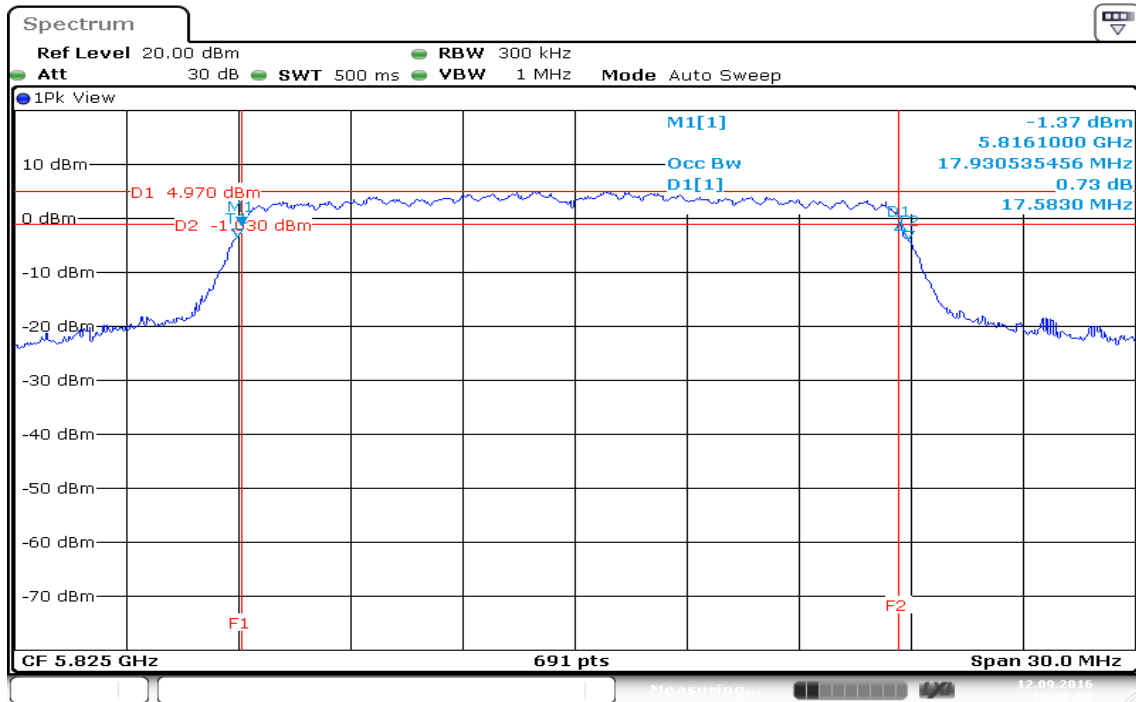
**6dB Bandwidth (CH Low)**



**6dB Bandwidth (CH Mid)**



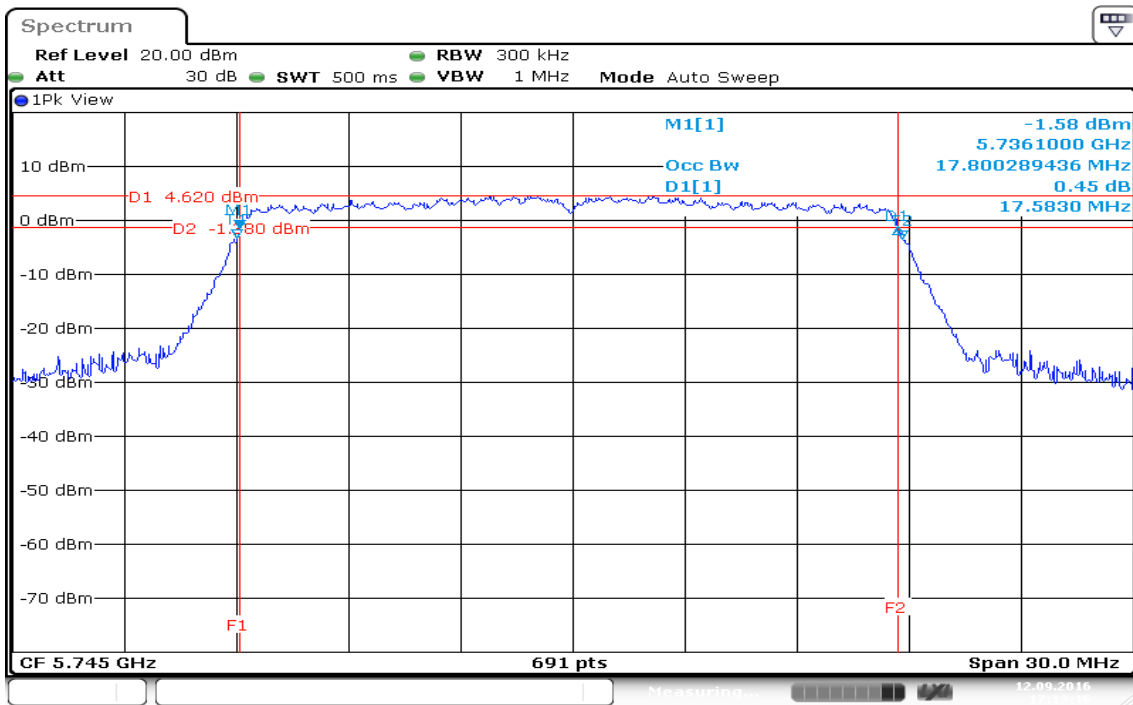
### 6dB Bandwidth (CH High)



Date: 12.SEP.2016 17:36:52

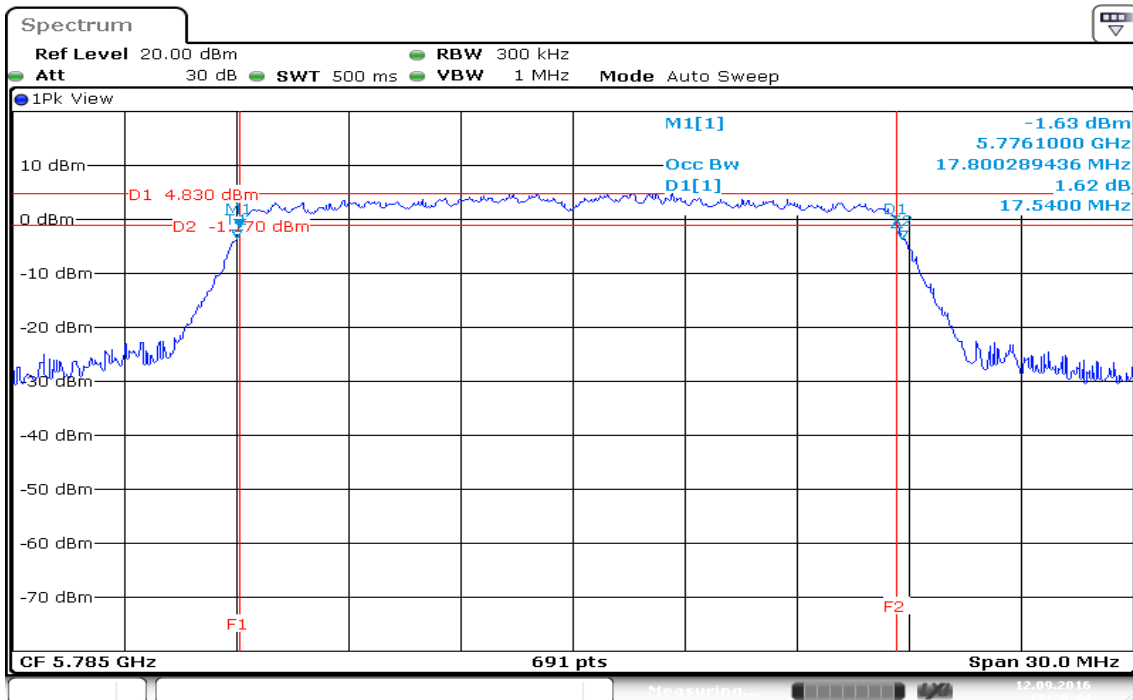
**IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz / Chain 1**

**6dB Bandwidth (CH Low)**



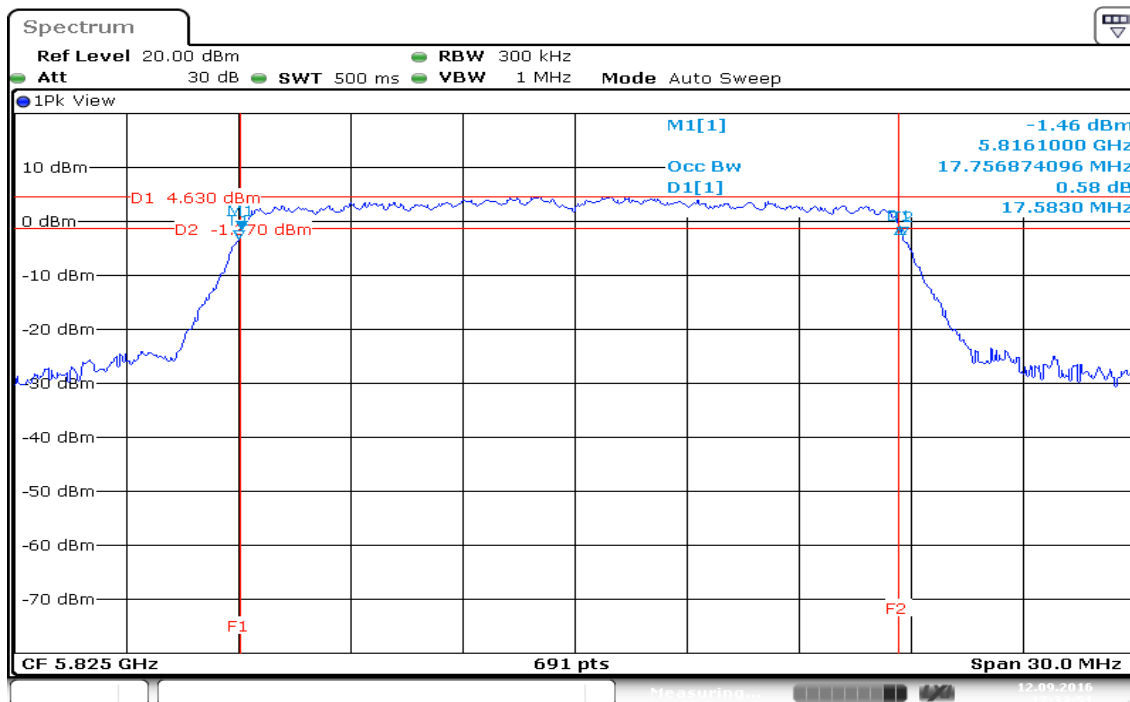
Date: 12 SEP 2016 17:13:16

**6dB Bandwidth (CH Mid)**



Date: 12 SEP 2016 17:28:44

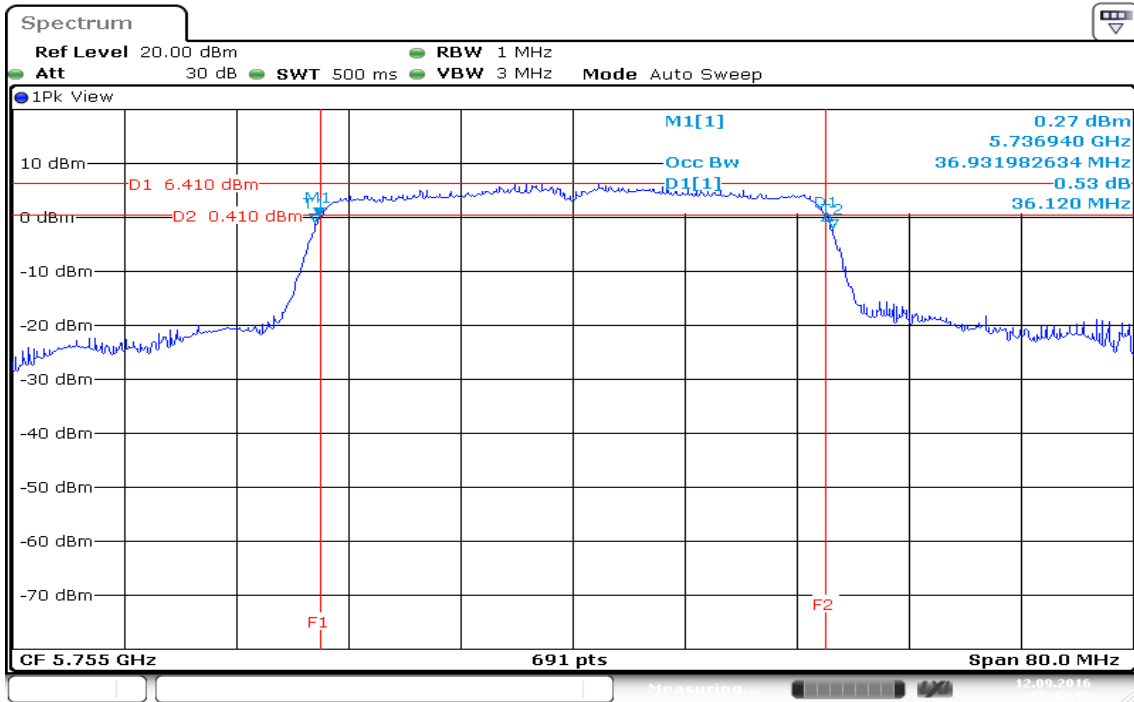
### 6dB Bandwidth (CH High)



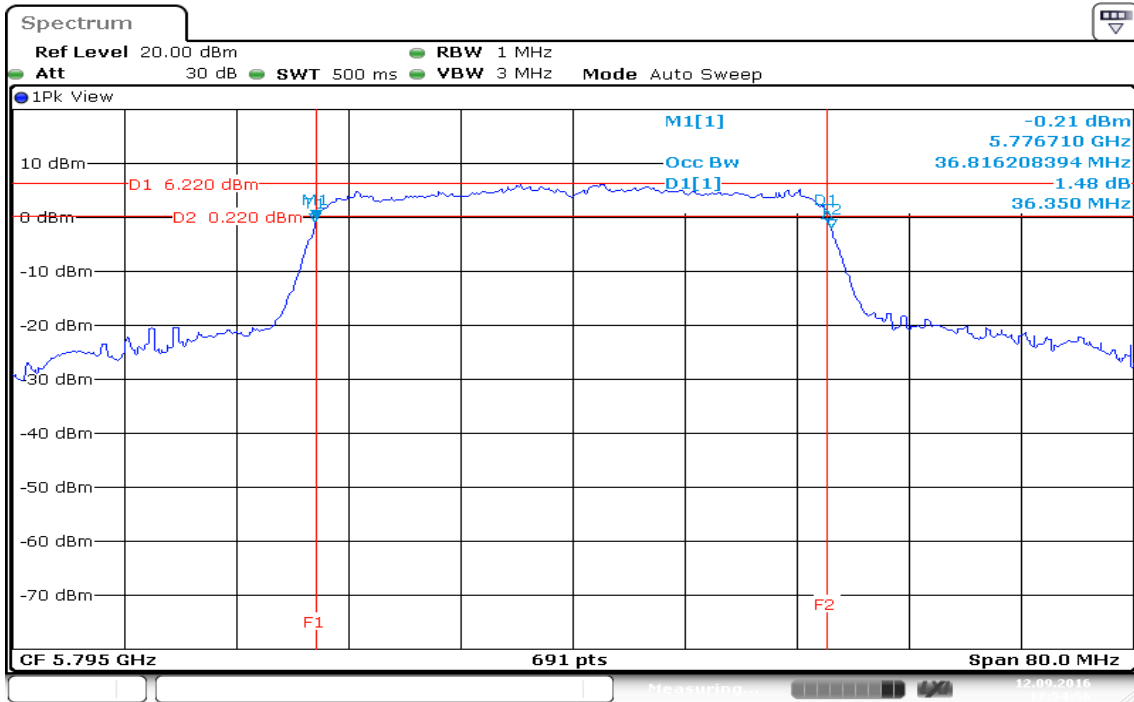
Date: 12 SEP 2016 17:33:51

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

**6dB Bandwidth (CH Low)**



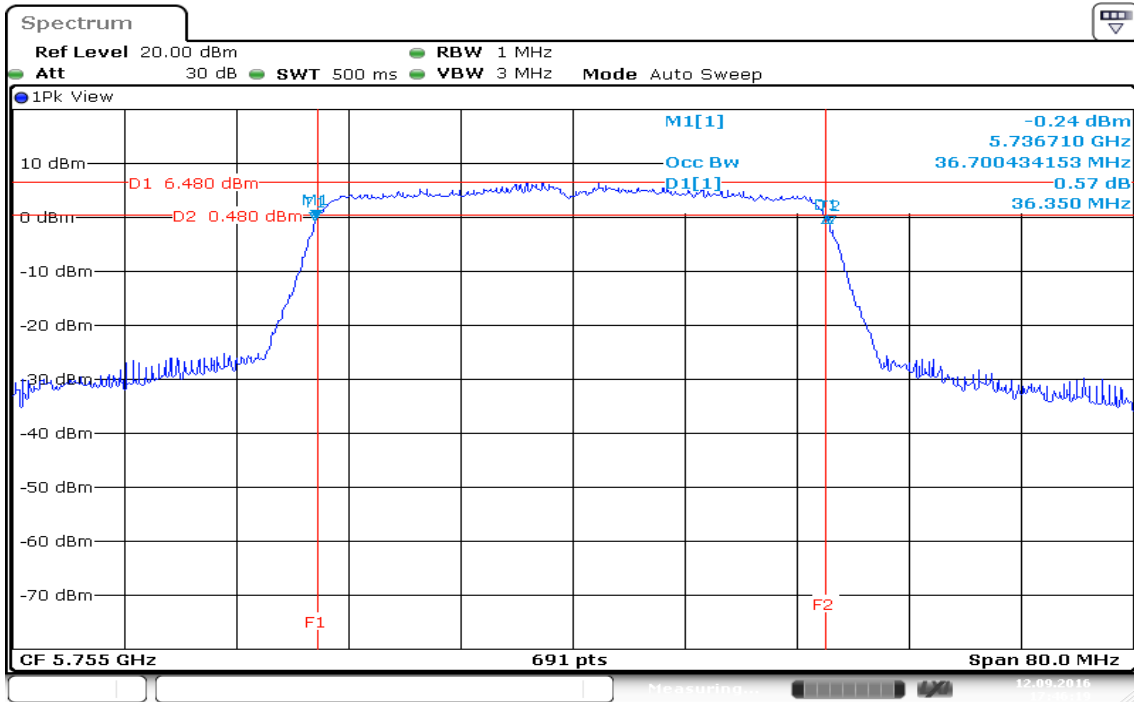
**6dB Bandwidth (CH High)**



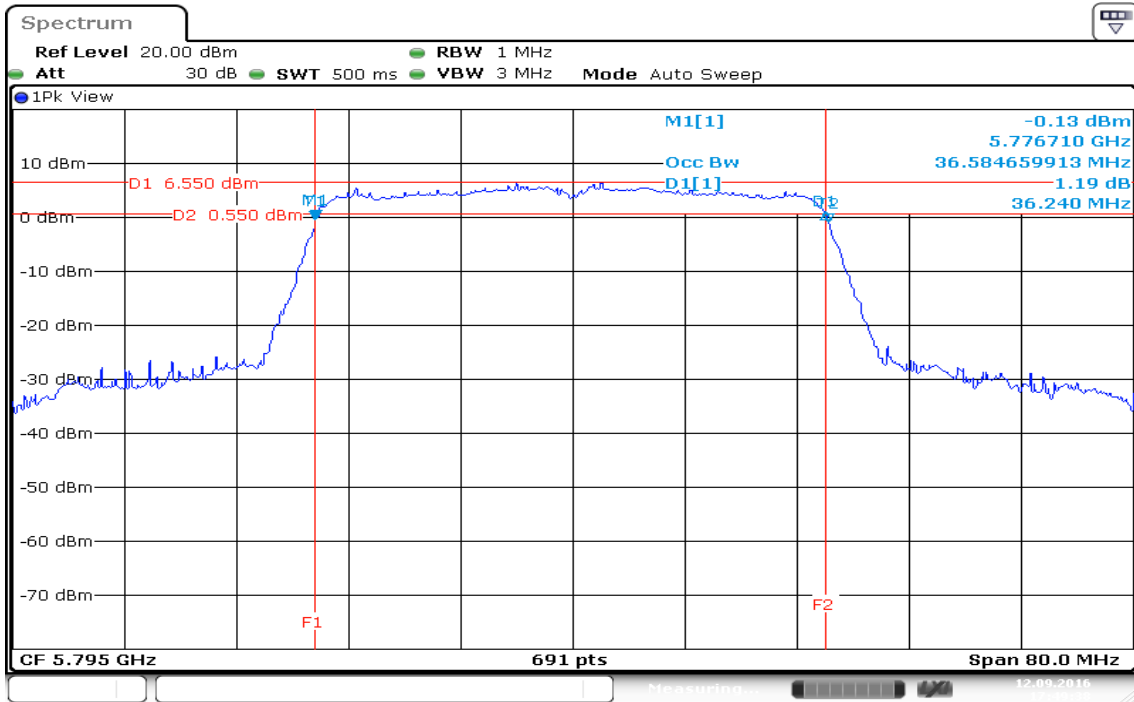


**IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz / Chain 1**

**6dB Bandwidth (CH Low)**



**6dB Bandwidth (CH High)**



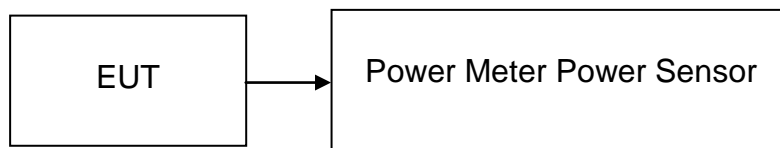
## 7.3 MAXIMUM CONDUCTED OUTPUT POWER

### 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 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz: 1 Watt.
2. According to RSS-247 §, for systems employing digital modulation techniques operating in the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz, the maximum peak conducted output power shall not exceed 1 W.

### 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	<b>*15.45</b>	0.0351	30.00
Mid	5785	15.38	0.0345	30.00
High	5825	15.41	0.0348	30.00

**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	12.78	13.33	16.59	0.0456	30.00
Mid	5785	15.6	15.68	19.16	0.0824	30.00
High	5825	15.81	15.69	<b>*19.27</b>	0.0845	30.00

**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	9.81	9.76	13.75	0.0237	30.00
High	5795	12.15	12.41	<b>*16.24</b>	0.0421	30.00

**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

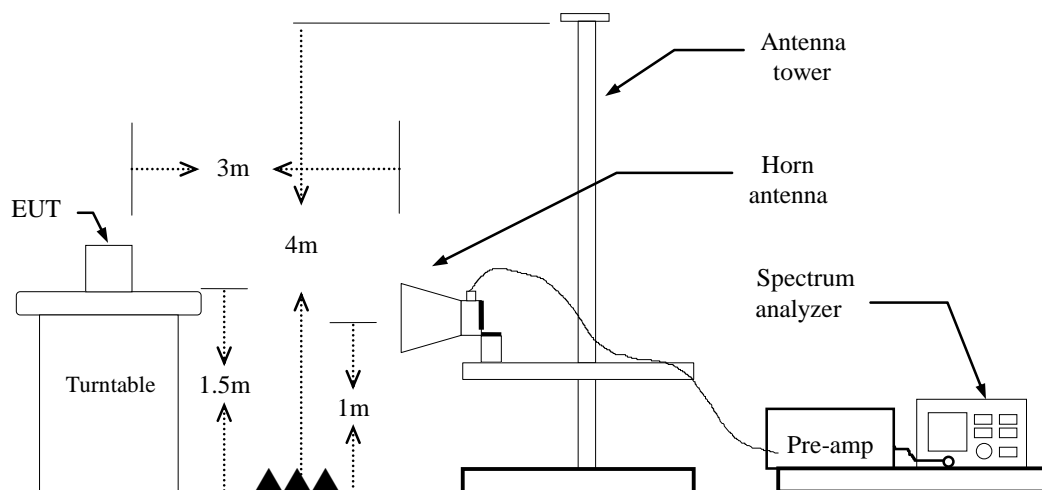
### LIMIT

According Part 15.407(b)(4)(i)

For transmitters operating in the 5.725-5.85 GHz band:

All emissions shall be limited to a level of  $-27$  dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

### Test Configuration

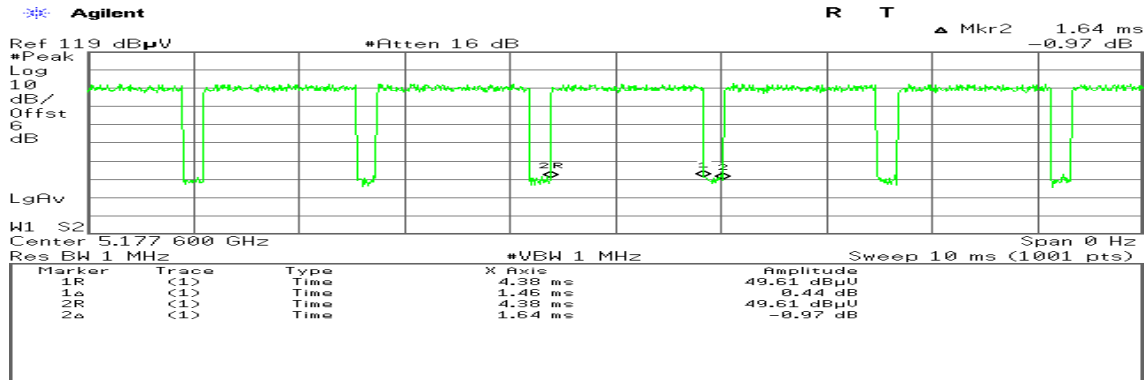


## **TEST PROCEDURE**

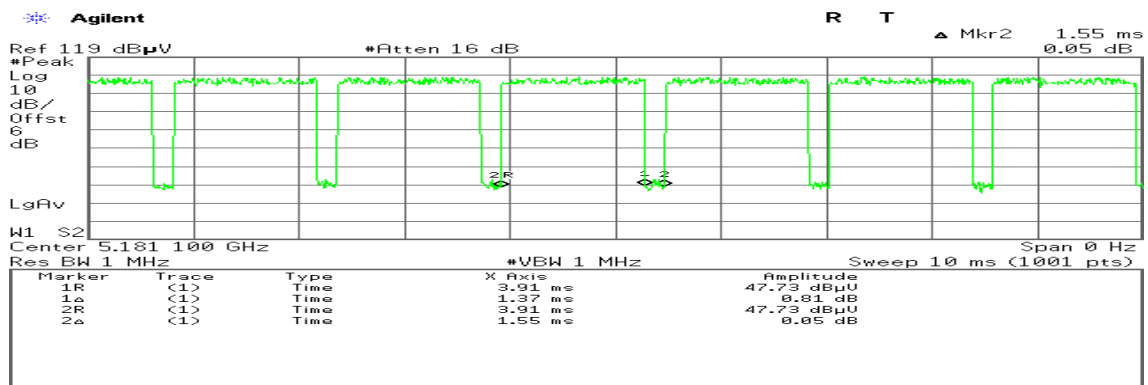
1. The EUT is placed on a turntable, which is 1.5m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the 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:** =89%, VBW=750Hz  
**IEEE 802.11n HT 20 MHz mode:** =88%, VBW=750Hz  
**IEEE 802.11n HT 40 MHz mode:** =79%, VBW=1.5KHz
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

**Duty Cycle:**

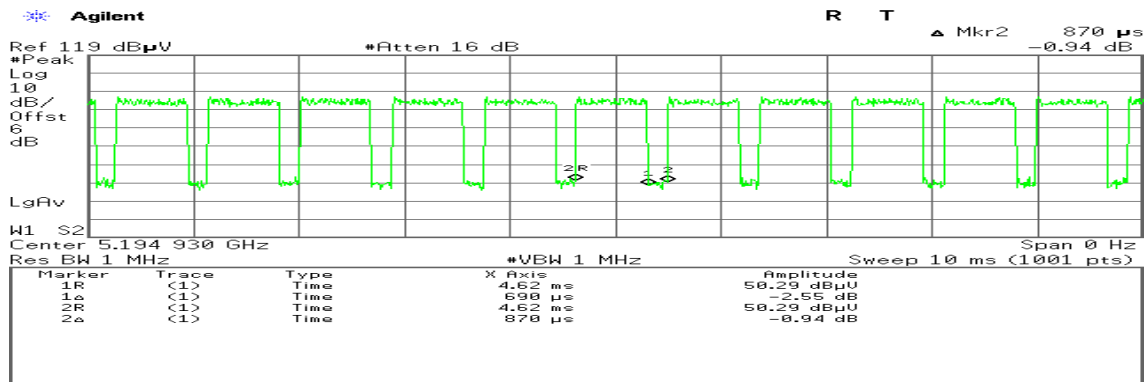
**IEEE 802.11a mode:**



**IEEE 802.11n HT 20 MHz mode:**



**IEEE 802.11n HT 40 MHz mode:**

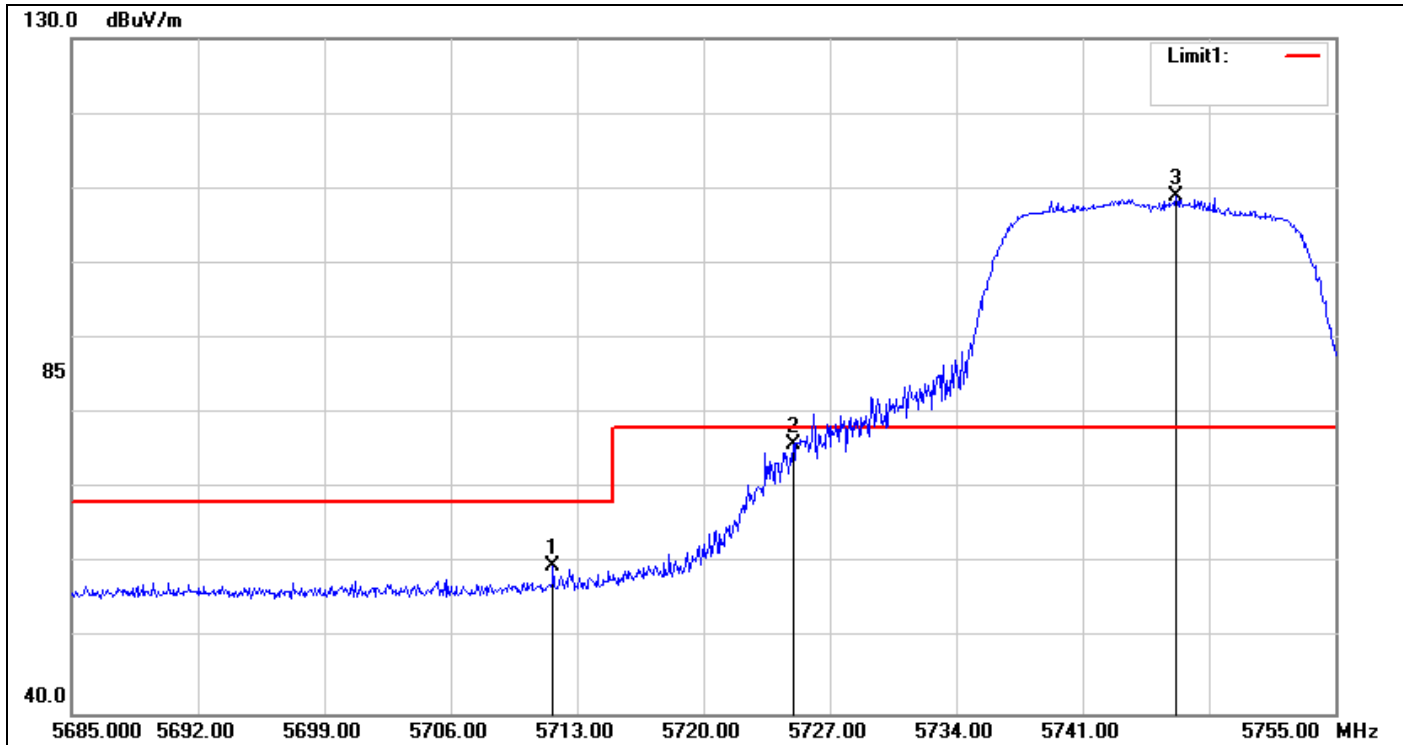


**TEST RESULTS**

Refer to attach spectrum analyzer data chart.

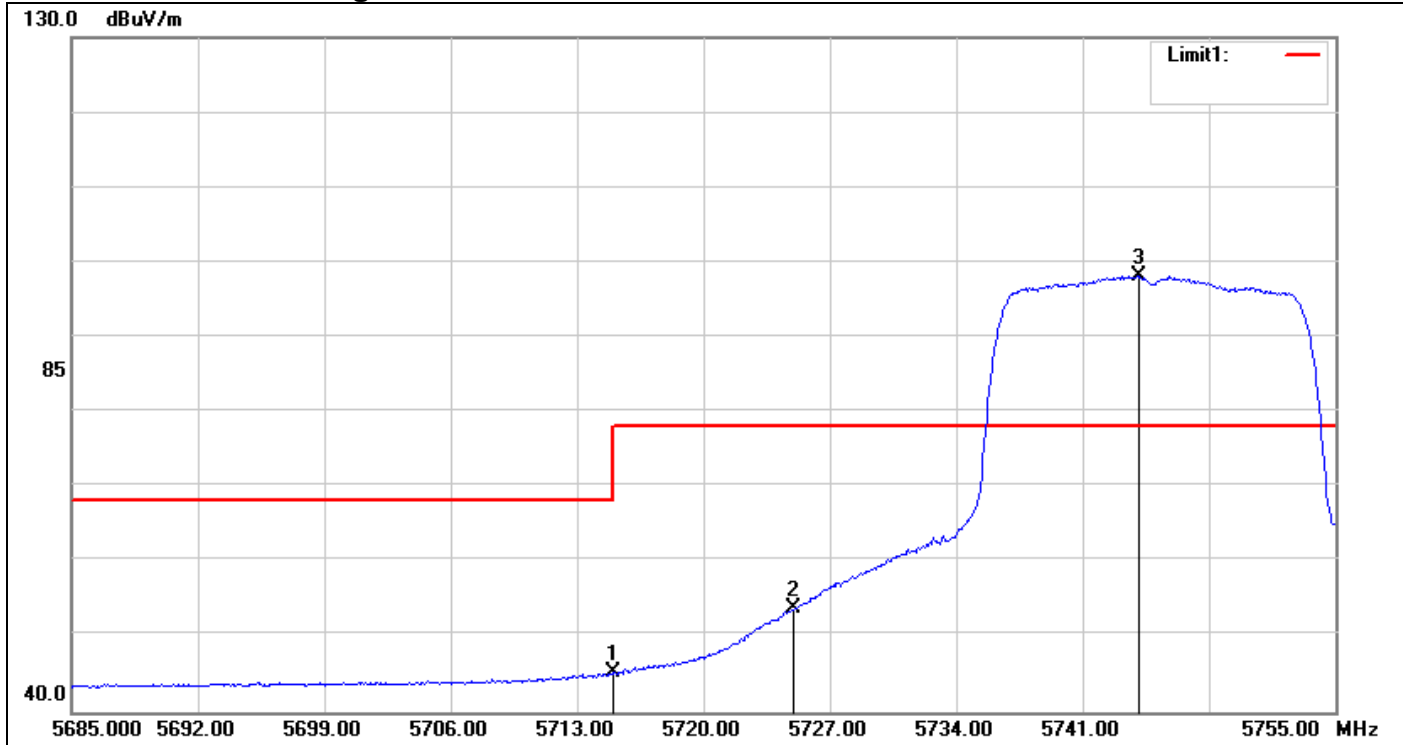
**IEEE 802.11a Mode / CH Low**

**Detector mode: Peak**



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5711.670	53.54	6.15	59.69	68.20	-8.51	peak
2	5724.970	69.62	6.21	75.83	78.20	-2.37	peak
3	5746.180	102.74	6.30	109.04	-	-	peak

**Detector mode: Average**

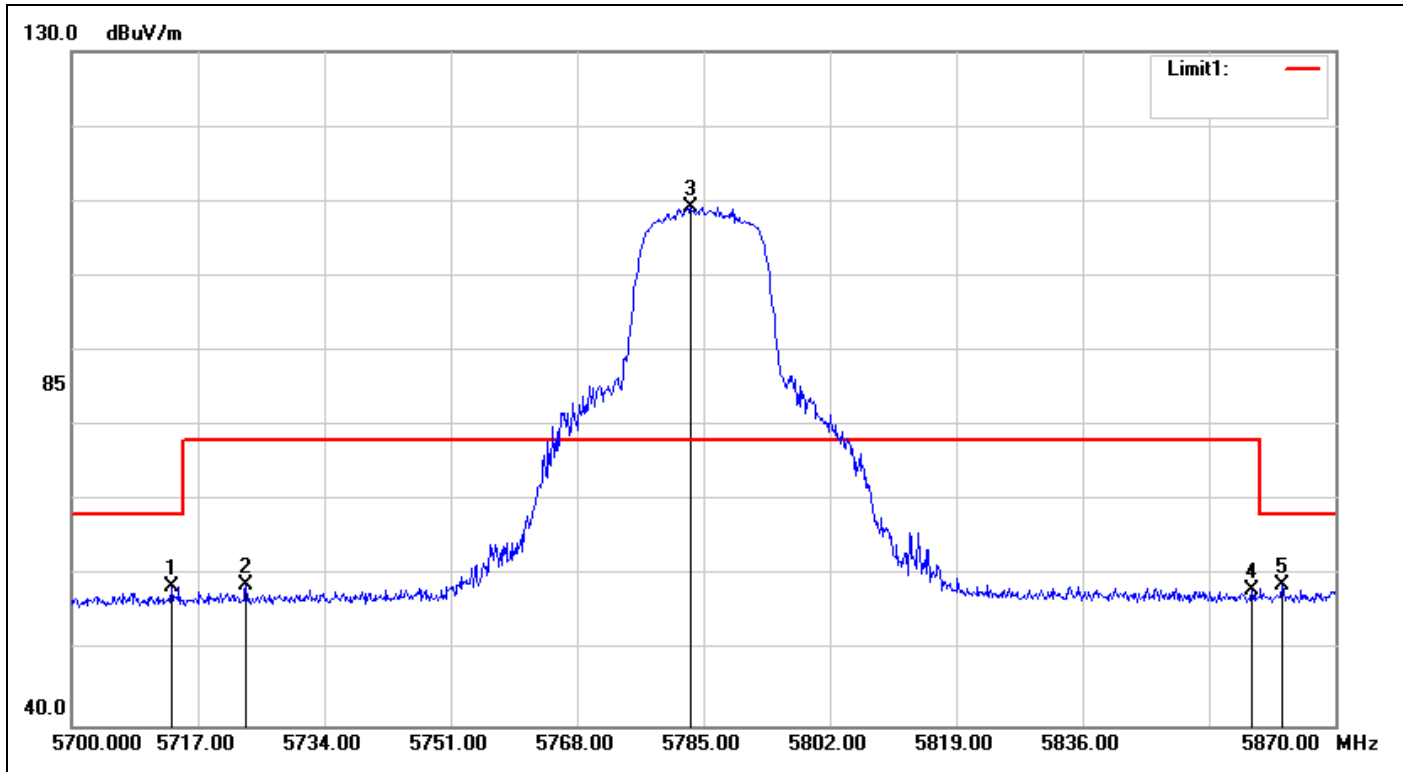


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5714.960	39.03	6.17	45.20	68.20	-23.00	AVG
2	5725.000	47.73	6.21	53.94	78.20	-24.26	AVG
3	5744.080	91.95	6.29	98.24	-	-	AVG



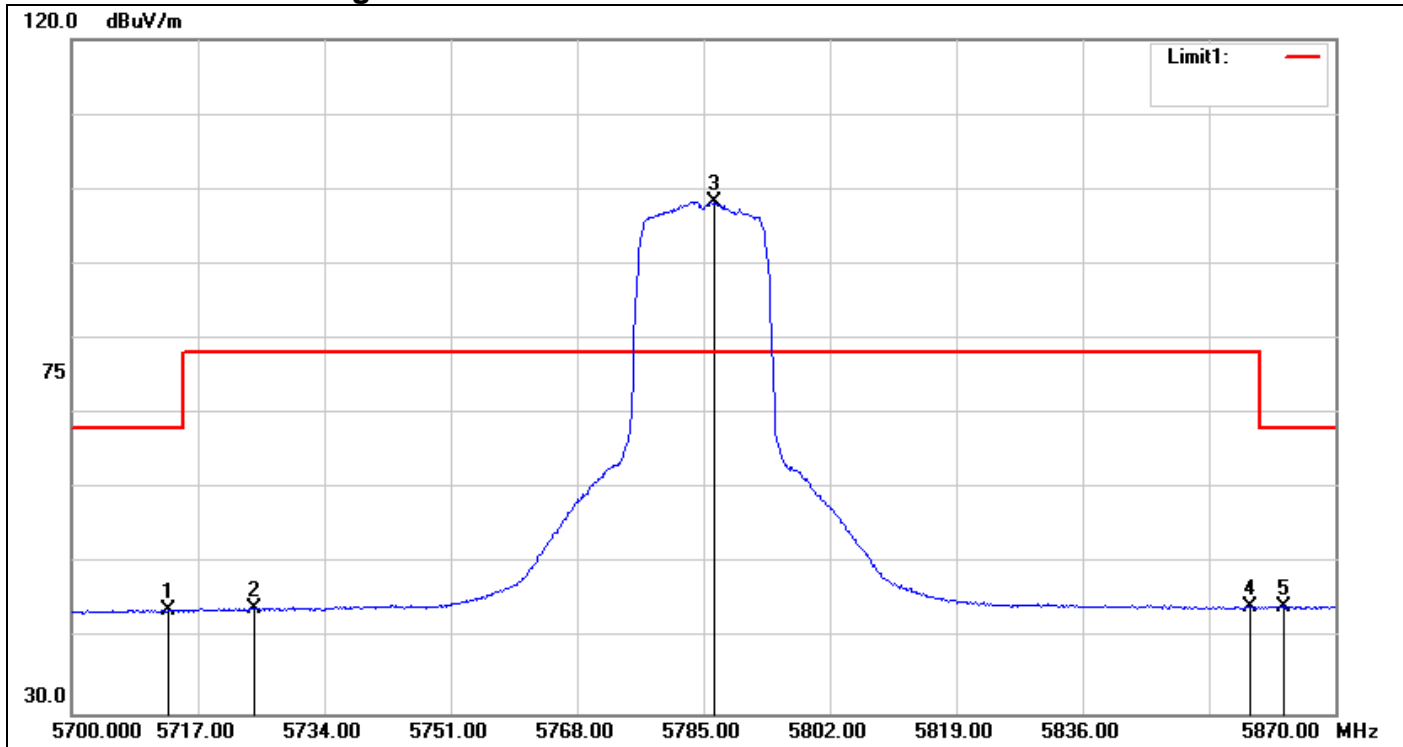
**IEEE 802.11a Mode / CH Mid**

**Detector mode: Peak**



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5713.430	52.37	6.16	58.53	68.20	-9.67	peak
2	5723.460	52.64	6.20	58.84	78.20	-19.36	peak
3	5783.300	102.69	6.46	109.15	-	-	peak
4	5858.780	51.35	6.78	58.13	78.20	-20.07	peak
5	5862.860	51.90	6.80	58.70	68.20	-9.50	peak

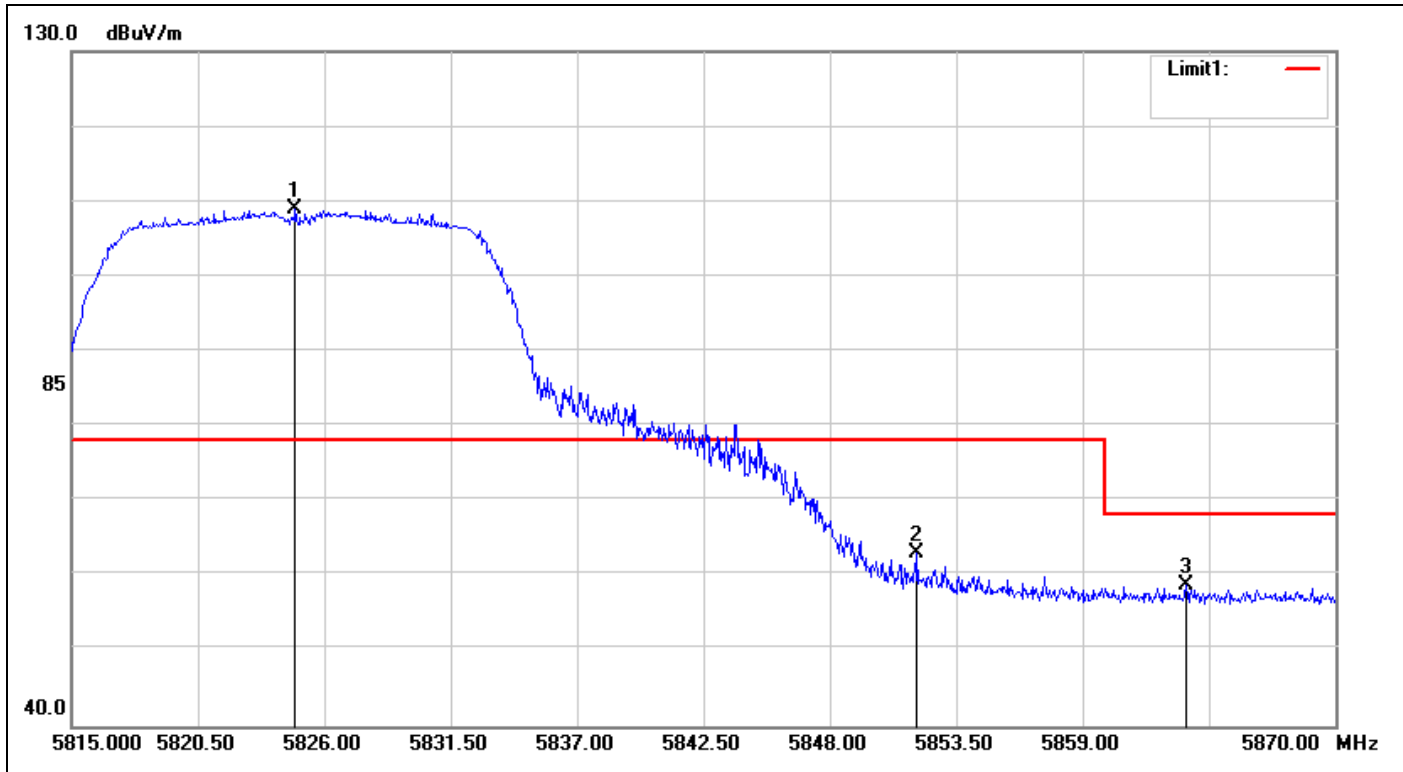
**Detector mode: Average**



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5713.090	37.75	6.16	43.91	68.20	-24.29	AVG
2	5724.480	37.92	6.21	44.13	78.20	-34.07	AVG
3	5786.360	91.81	6.47	98.28	-	-	AVG
4	5858.440	37.56	6.78	44.34	78.20	-33.86	AVG
5	5863.030	37.60	6.80	44.40	68.20	-23.80	AVG

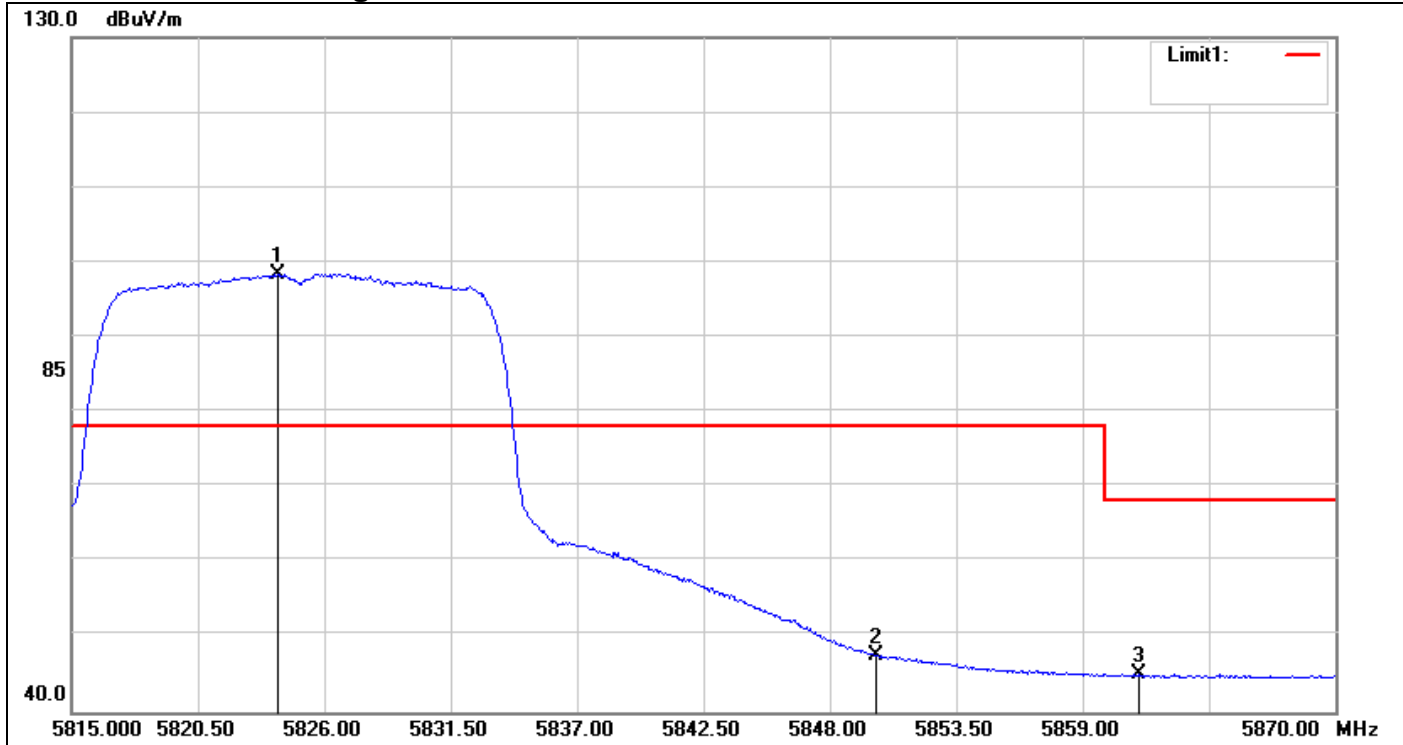
**IEEE 802.11a Mode / CH High**

**Detector mode: Peak**



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5824.735	102.23	6.63	108.86	-	-	peak
2	5851.795	56.42	6.75	63.17	78.20	-15.03	peak
3	5863.510	52.03	6.80	58.83	68.20	-9.37	peak

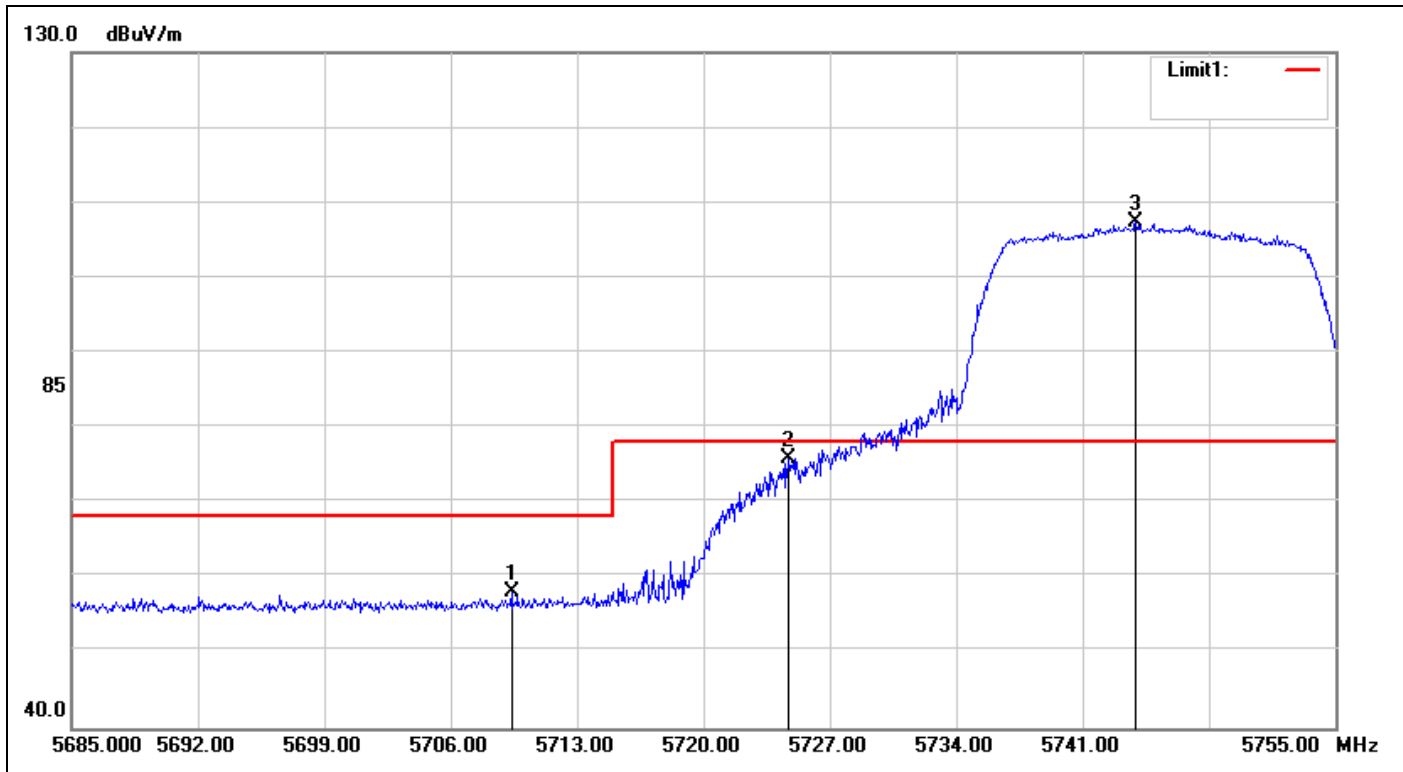
**Detector mode: Average**



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5823.965	91.86	6.63	98.49	-	-	AVG
2	5850.000	40.85	6.74	47.59	78.20	-30.61	AVG
3	5861.475	38.31	6.79	45.10	68.20	-23.10	AVG

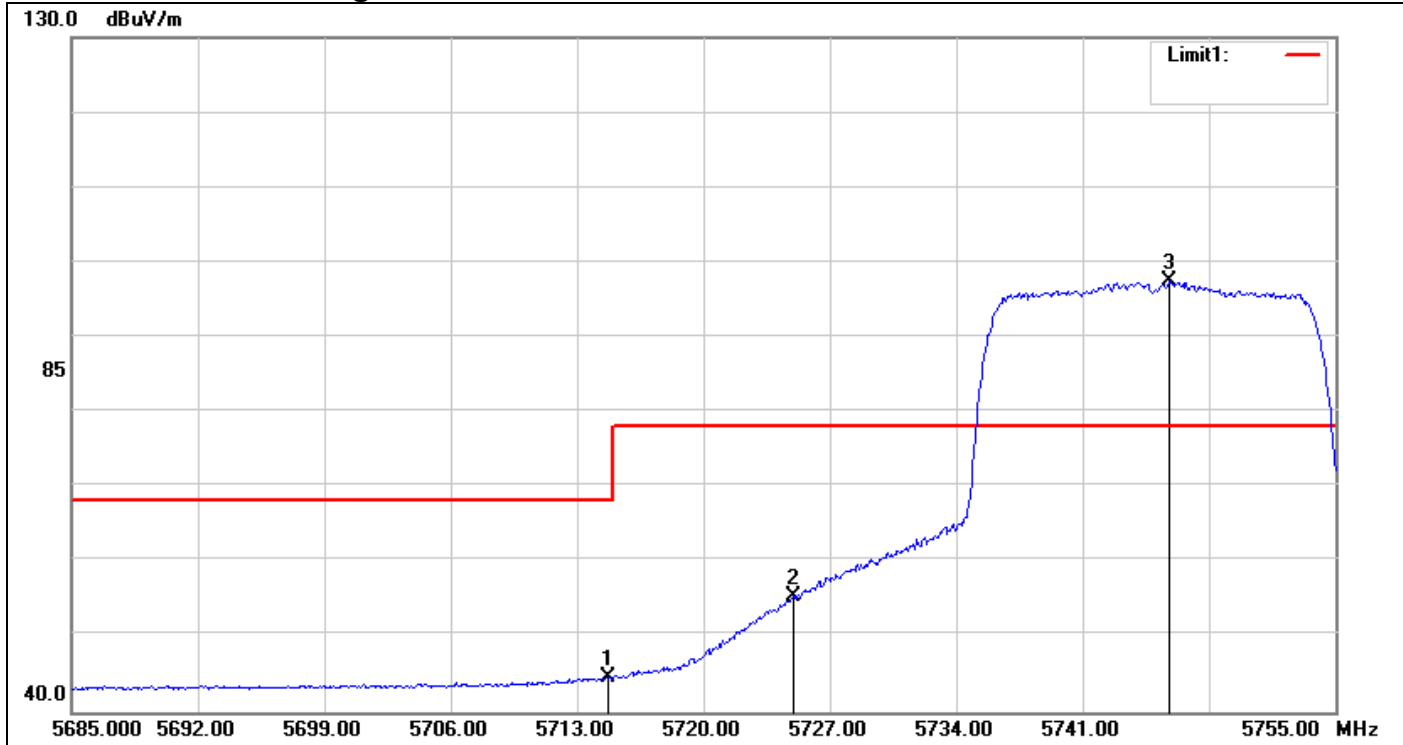
**IEEE 802.11n HT 20 MHz Mode / CH Low**

**Detector mode: Peak**



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5709.360	51.97	6.14	58.11	68.20	-10.09	peak
2	5724.690	69.75	6.21	75.96	78.20	-2.24	peak
3	5743.940	100.99	6.29	107.28	-	-	peak

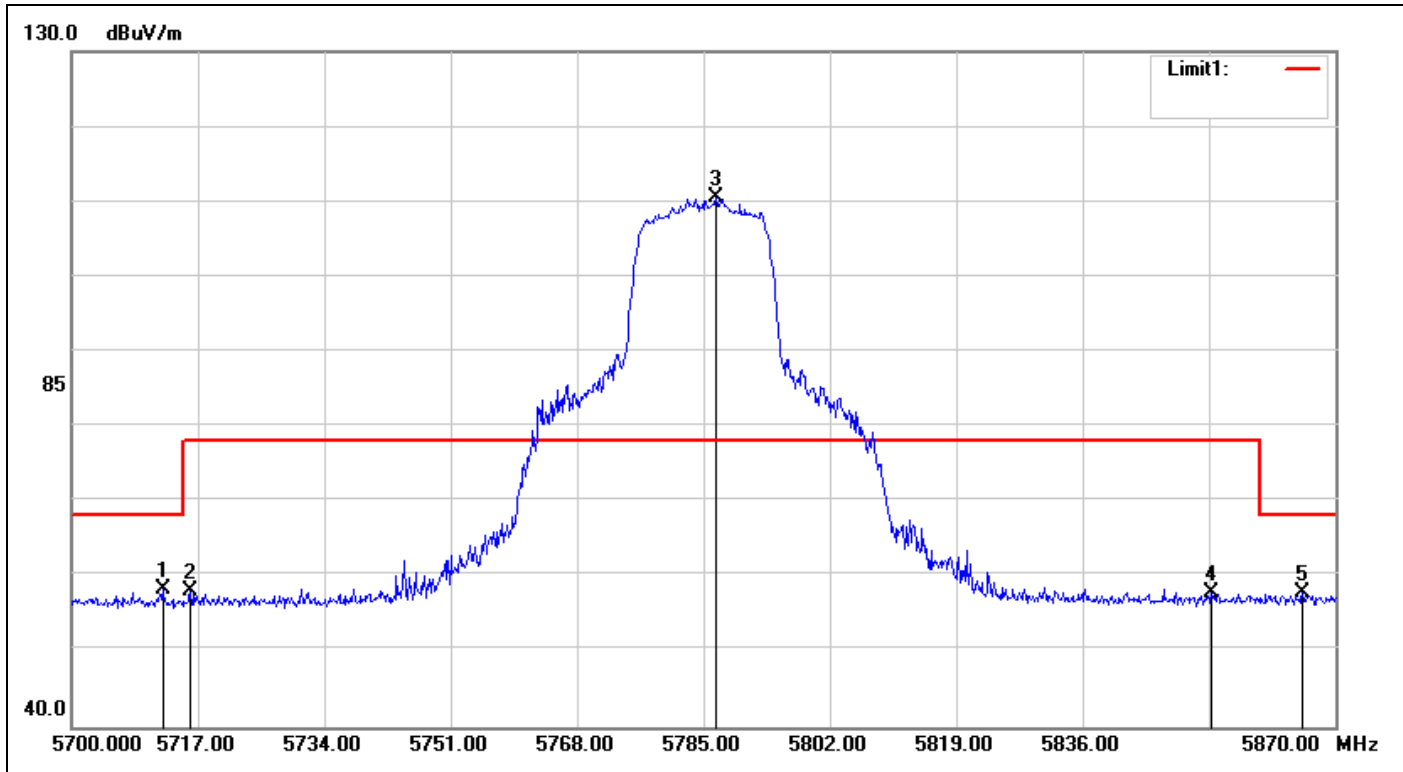
**Detector mode: Average**



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5714.750	38.52	6.16	44.68	68.20	-23.52	AVG
2	5724.970	49.17	6.21	55.38	78.20	-22.82	AVG
3	5745.830	91.16	6.30	97.46	-	-	AVG

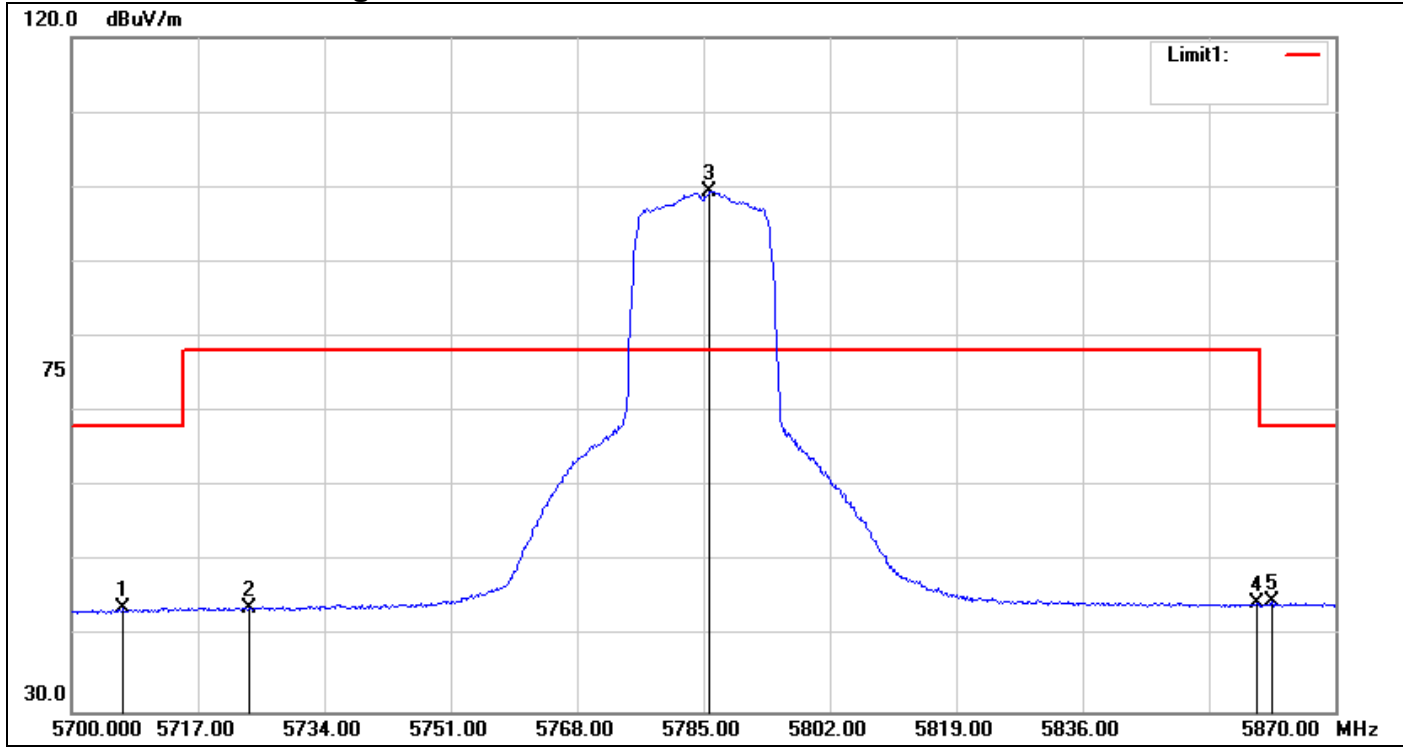
**IEEE 802.11n HT 20 MHz Mode / CH Mid**

**Detector mode: Peak**



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5712.240	52.21	6.15	58.36	68.20	-9.84	peak
2	5715.980	51.90	6.17	58.07	78.20	-20.13	peak
3	5786.700	104.04	6.47	110.51	-	-	peak
4	5853.340	51.08	6.76	57.84	78.20	-20.36	peak
5	5865.580	50.98	6.81	57.79	68.20	-10.41	peak

**Detector mode: Average**

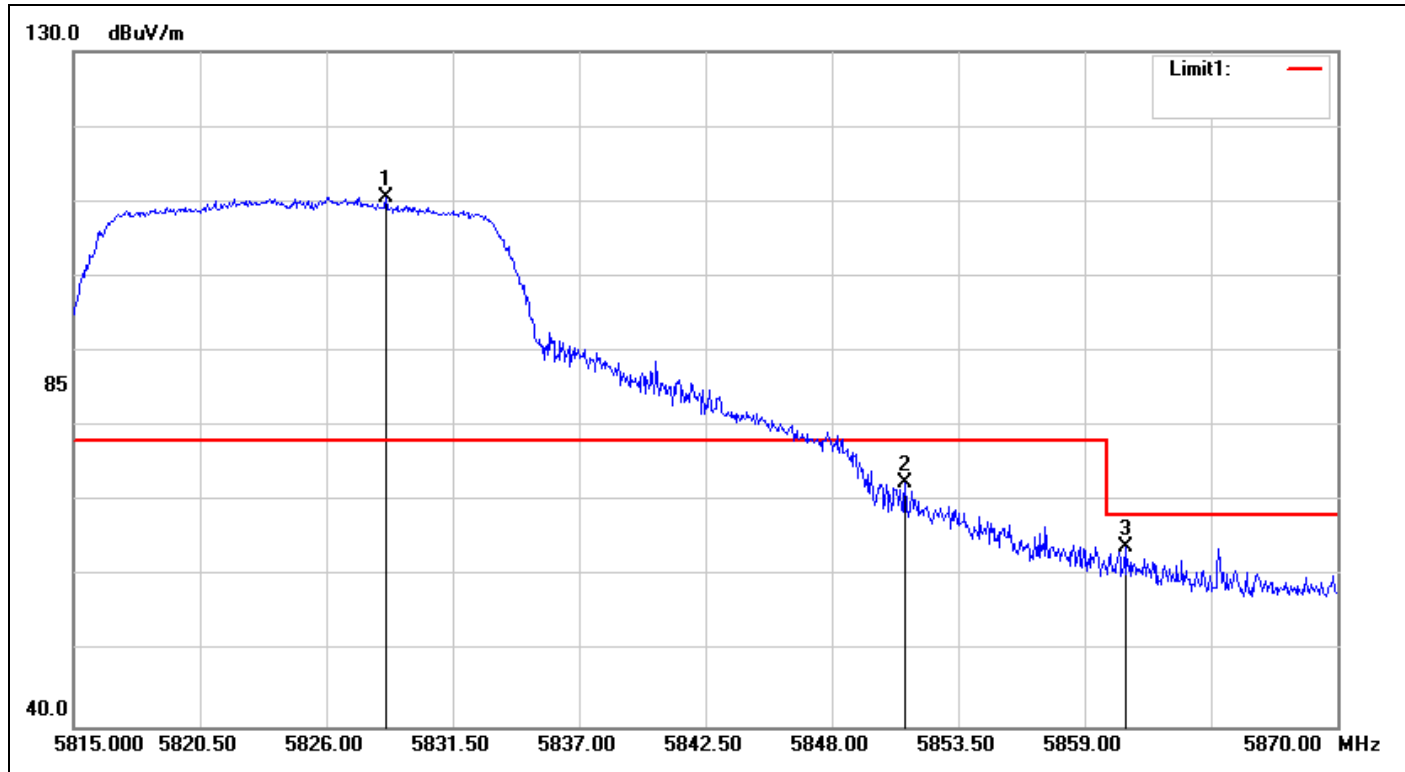


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5706.970	37.74	6.13	43.87	68.20	-24.33	AVG
2	5723.800	37.73	6.20	43.93	78.20	-34.27	AVG
3	5785.850	93.00	6.47	99.47	-	-	AVG
4	5859.460	37.63	6.78	44.41	78.20	-33.79	AVG
5	5861.500	37.99	6.79	44.78	68.20	-23.42	AVG



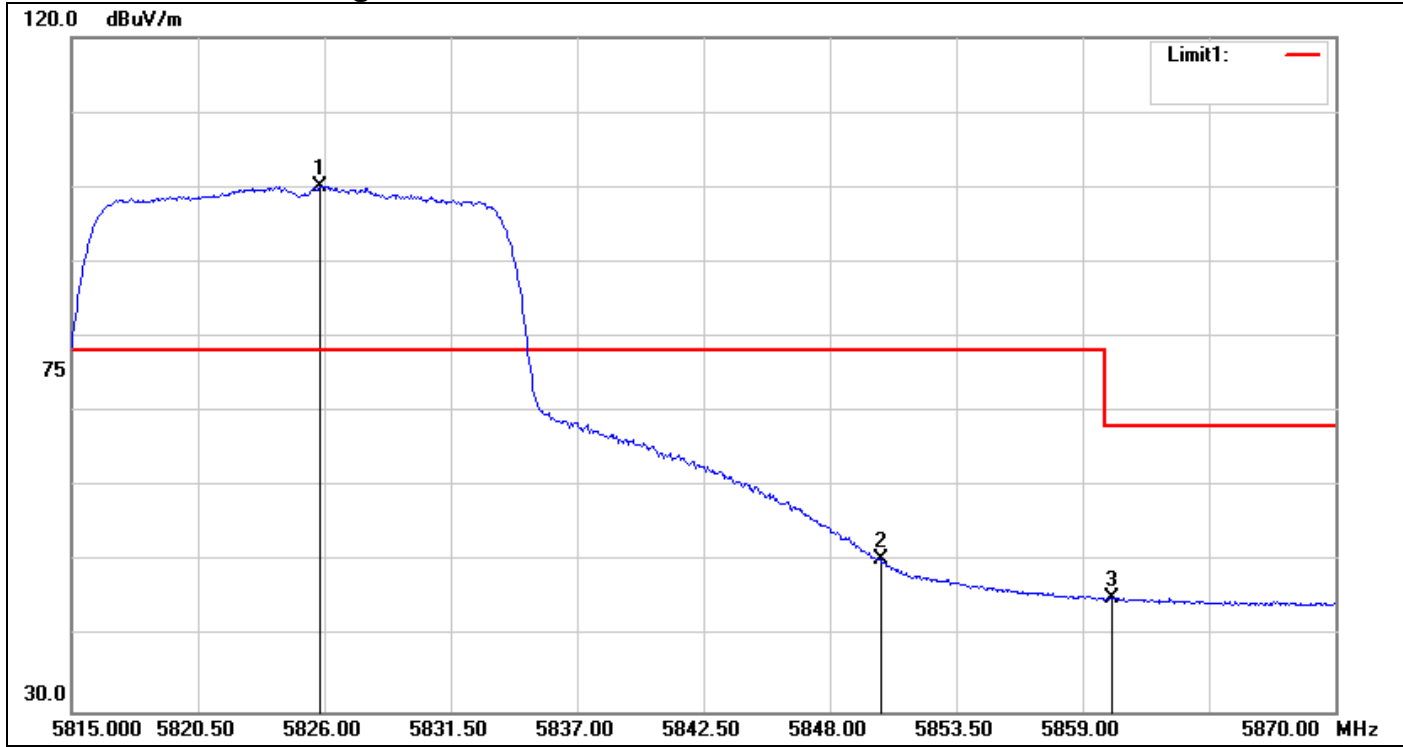
**IEEE 802.11n HT 20 MHz Mode / CH High**

**Detector mode: Peak**



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5828.585	103.94	6.65	110.59	-	-	peak
2	5851.190	65.71	6.75	72.46	78.20	-5.74	peak
3	5860.760	57.08	6.79	63.87	68.20	-4.33	peak

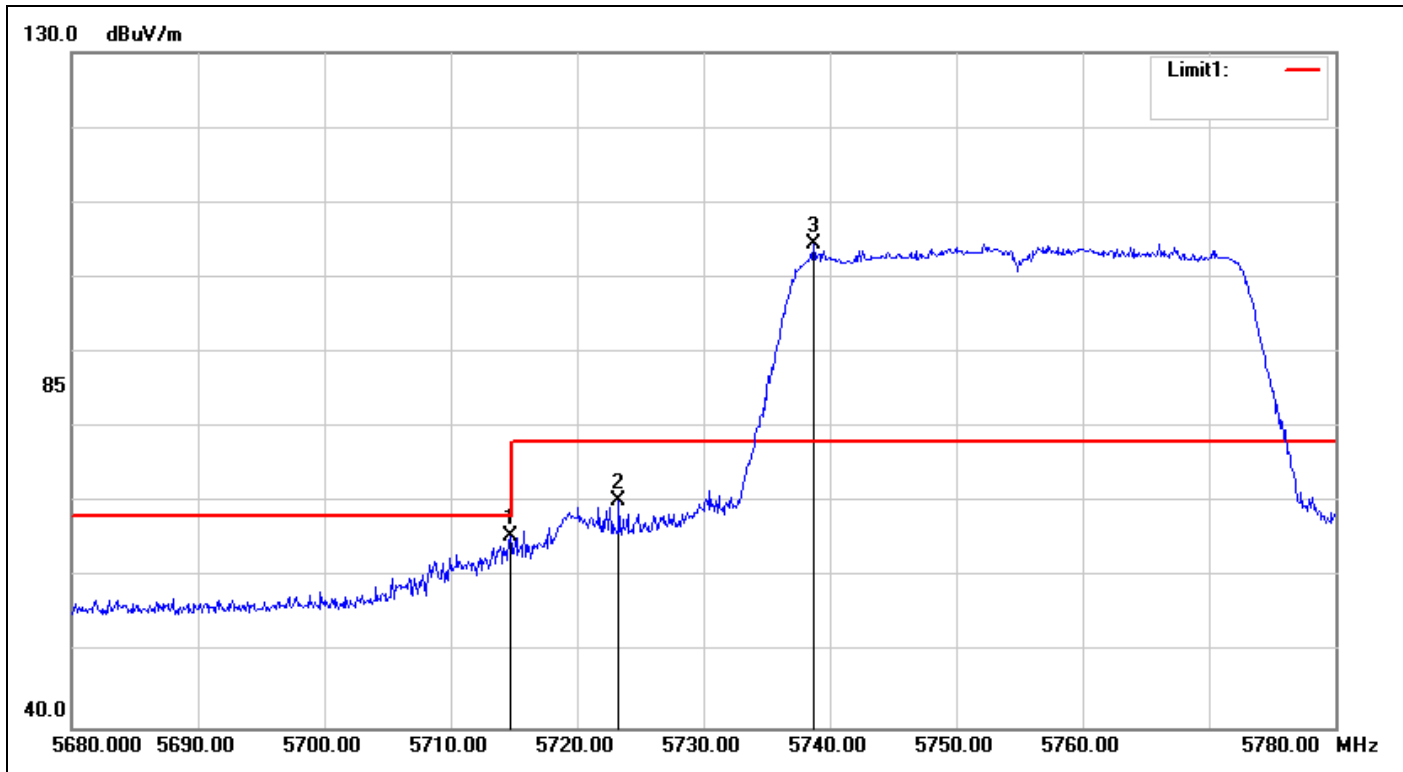
**Detector mode: Average**



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5825.835	93.48	6.64	100.12	-	-	AVG
2	5850.200	43.69	6.74	50.43	78.20	-27.77	AVG
3	5860.265	38.41	6.78	45.19	68.20	-23.01	AVG

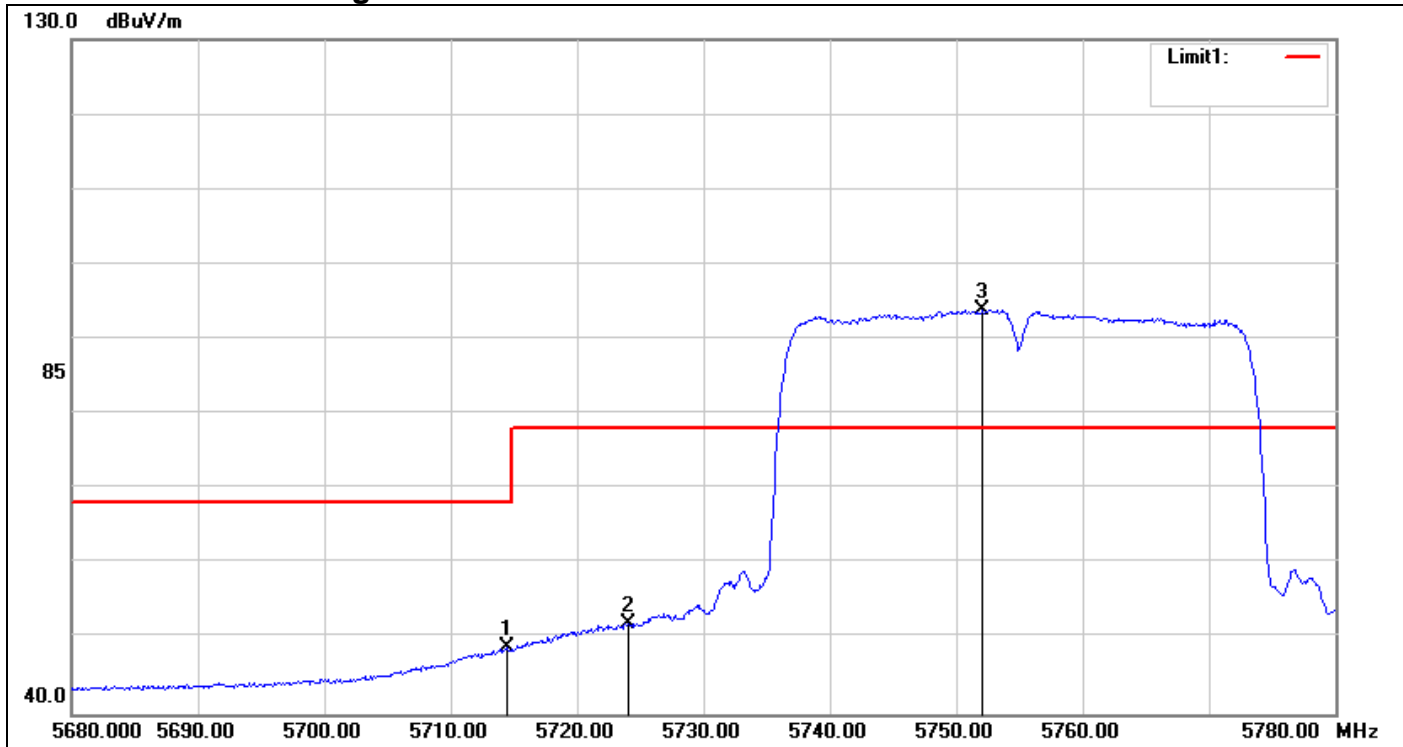
**IEEE 802.11n HT 40 MHz Mode / CH Low**

**Detector mode: Peak**



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5714.700	59.27	6.16	65.43	68.20	-2.77	peak
2	5723.300	64.10	6.20	70.30	78.20	-7.90	peak
3	5738.700	98.29	6.27	104.56	-	-	peak

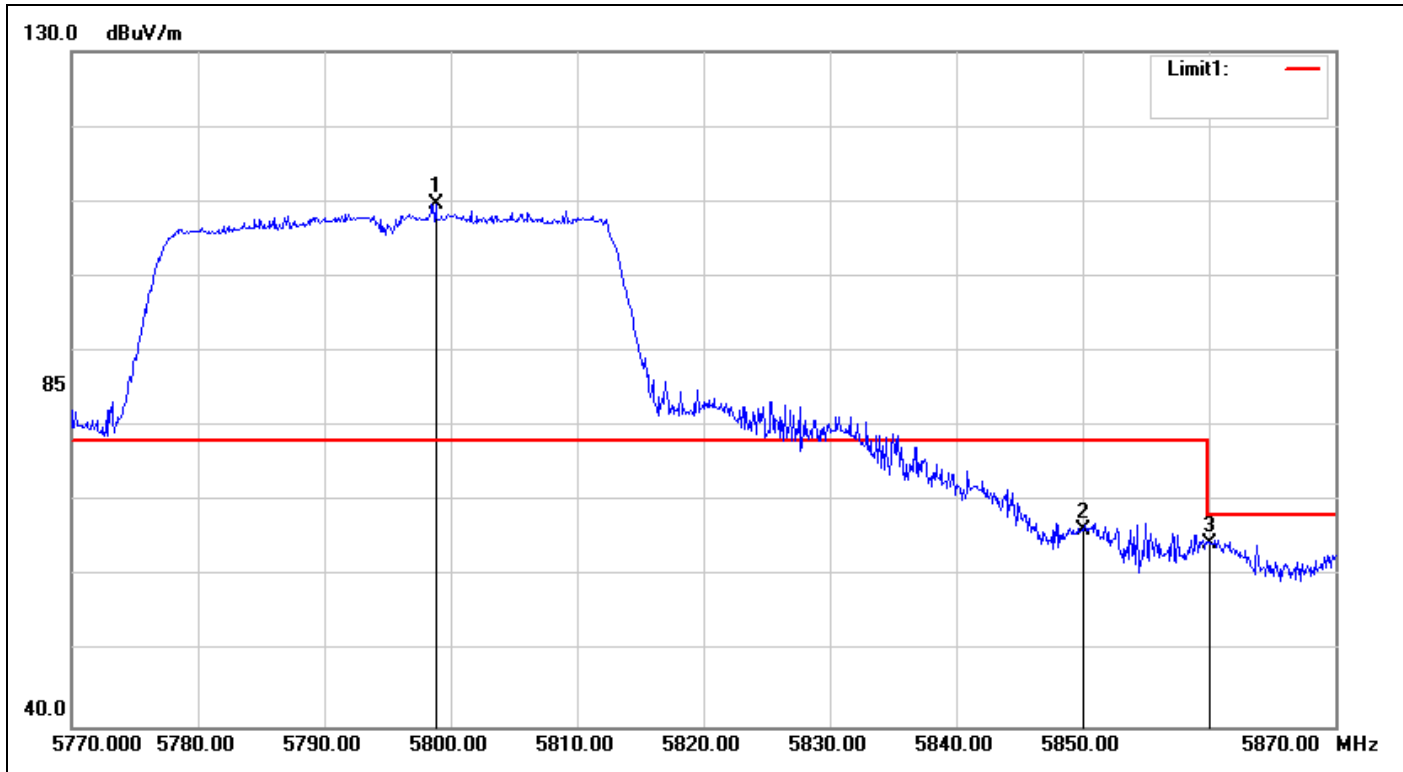
**Detector mode: Average**



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5714.500	42.79	6.16	48.95	68.20	-19.25	AVG
2	5724.000	45.91	6.20	52.11	78.20	-26.09	AVG
3	5752.100	87.51	6.32	93.83	-	-	AVG

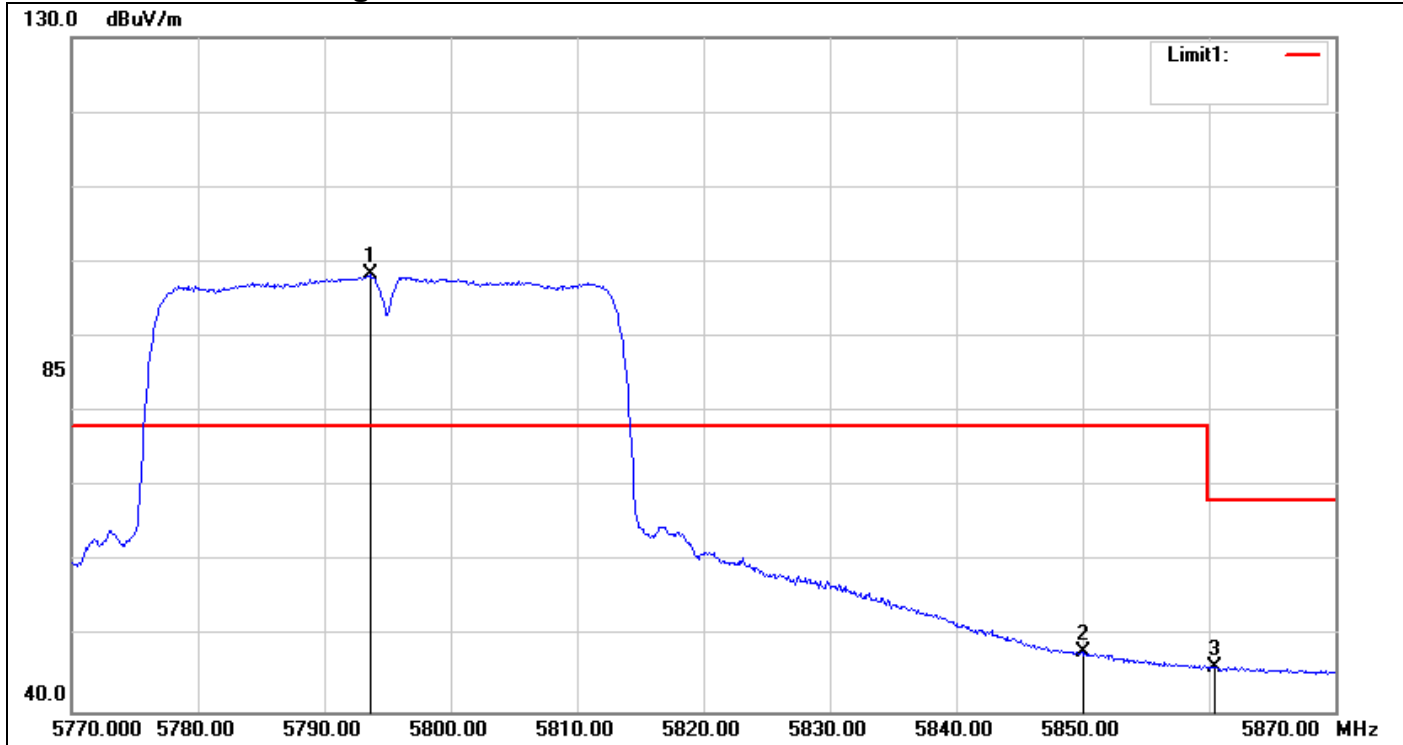
**IEEE 802.11n HT 40 MHz Mode / CH High**

**Detector mode: Peak**



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5798.800	103.14	6.52	109.66	-	-	peak
2	5850.000	59.56	6.74	66.30	78.20	-11.90	peak
3	5860.000	57.54	6.78	64.32	68.20	-3.88	peak

**Detector mode: Average**



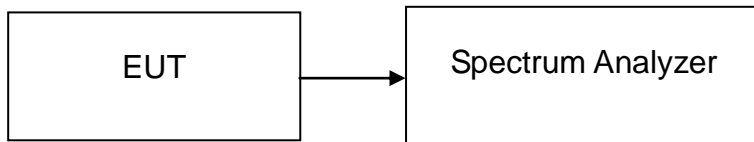
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5793.600	91.83	6.50	98.33	-	-	AVG
2	5850.000	41.21	6.74	47.95	78.20	-30.25	AVG
3	5860.500	39.26	6.79	46.05	68.20	-22.15	AVG

## 7.5 PEAK POWER SPECTRAL DENSITY

### LIMIT

1. According to §15.407 & RSS-247 §, 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=2MHz
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	10.87	30.00	PASS
Mid	5785	11.03		PASS
High	5825	10.86		PASS

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

Channel	Frequency (MHz)	Chain 0 PPSSD (dBm)	Chain 1 PPSSD (dBm)	PPSD (dBm)	Limit (dBm)	Result
Low	5745	7.29	8.27	10.82	30.00	PASS
Mid	5785	8.91	9.18	12.06		PASS
High	5825	9.18	9.27	12.24		PASS

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

Channel	Frequency (MHz)	Chain 0 PPSSD (dBm)	Chain 1 PPSSD (dBm)	PPSD (dBm)	Limit (dBm)	Result
Low	5755	2.83	2.47	5.66	30.00	PASS
High	5795	5.20	5.09	8.16		PASS

**Remark:**

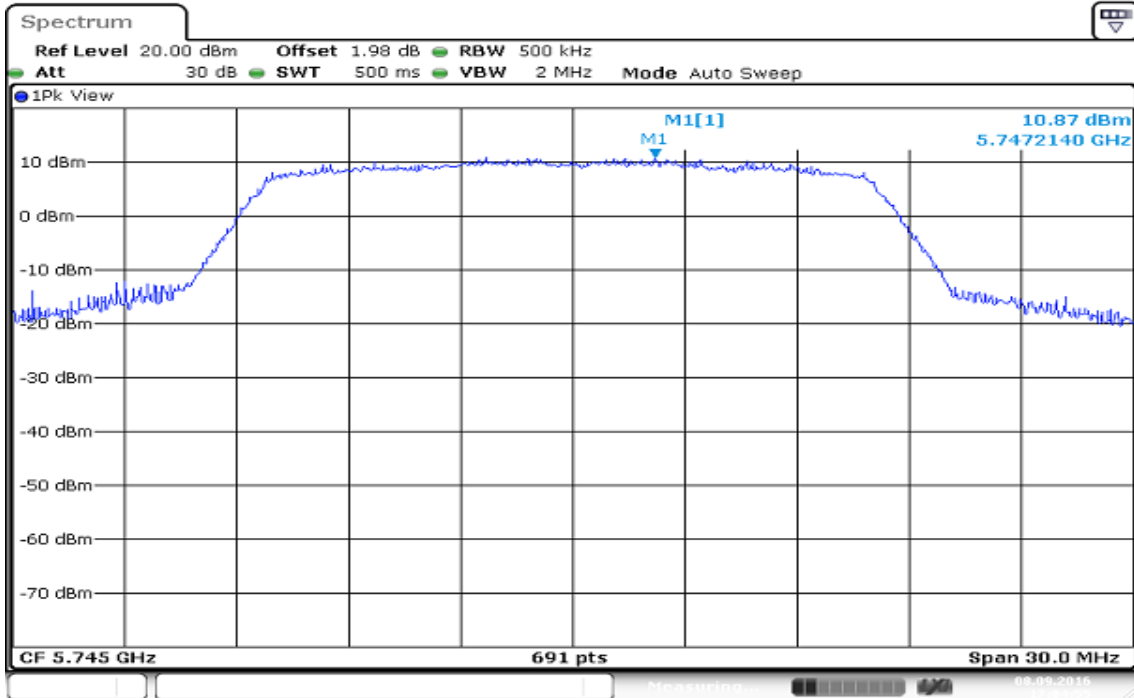
1. Total PPSSD (dBm) = 10\*LOG(10^(Chain 0 PPSSD / 10)+10^(Chain 1 PPSSD / 10))



**Test Plot**

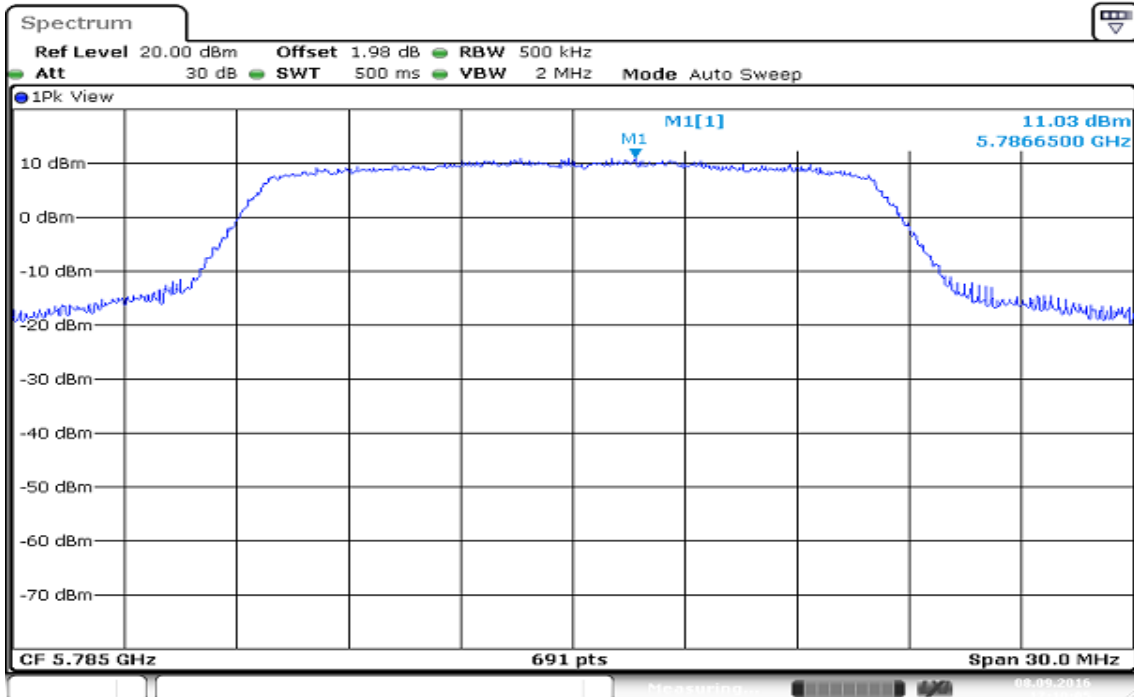
**IEEE 802.11a MHz mode / 5745 ~ 5825MHz**

**PPSD (CH Low)**



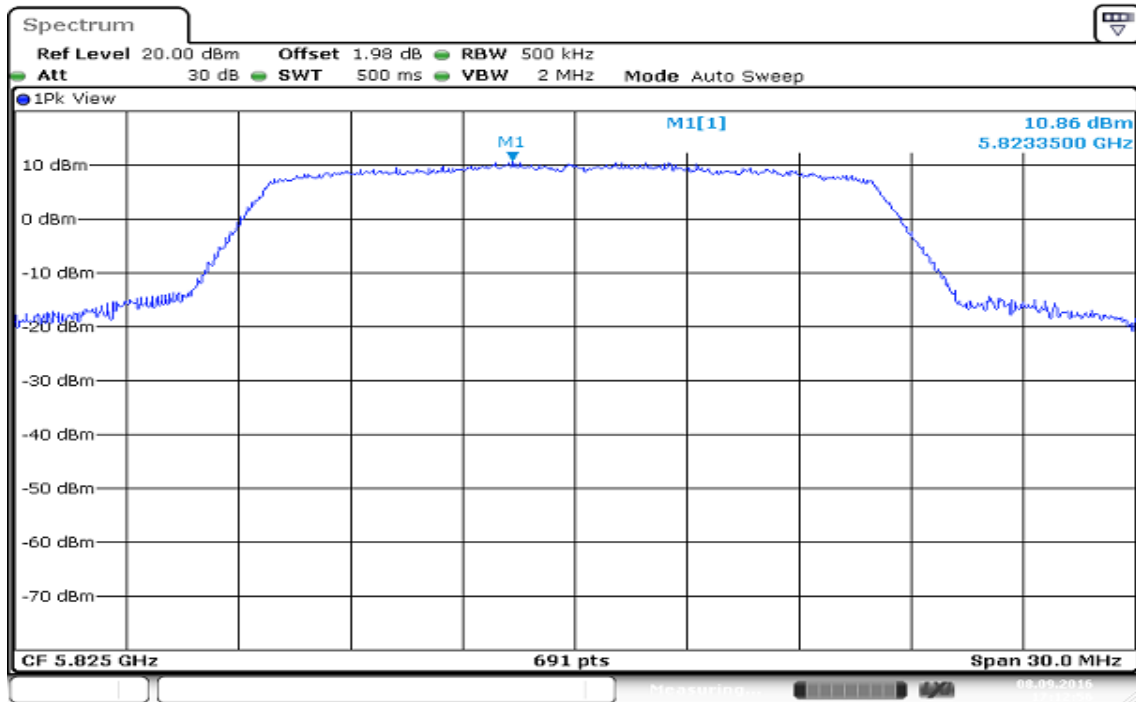
Date: 8 SEP 2016 17:04:56

**PPSD (CH Mid)**



Date: 8 SEP 2016 17:10:06

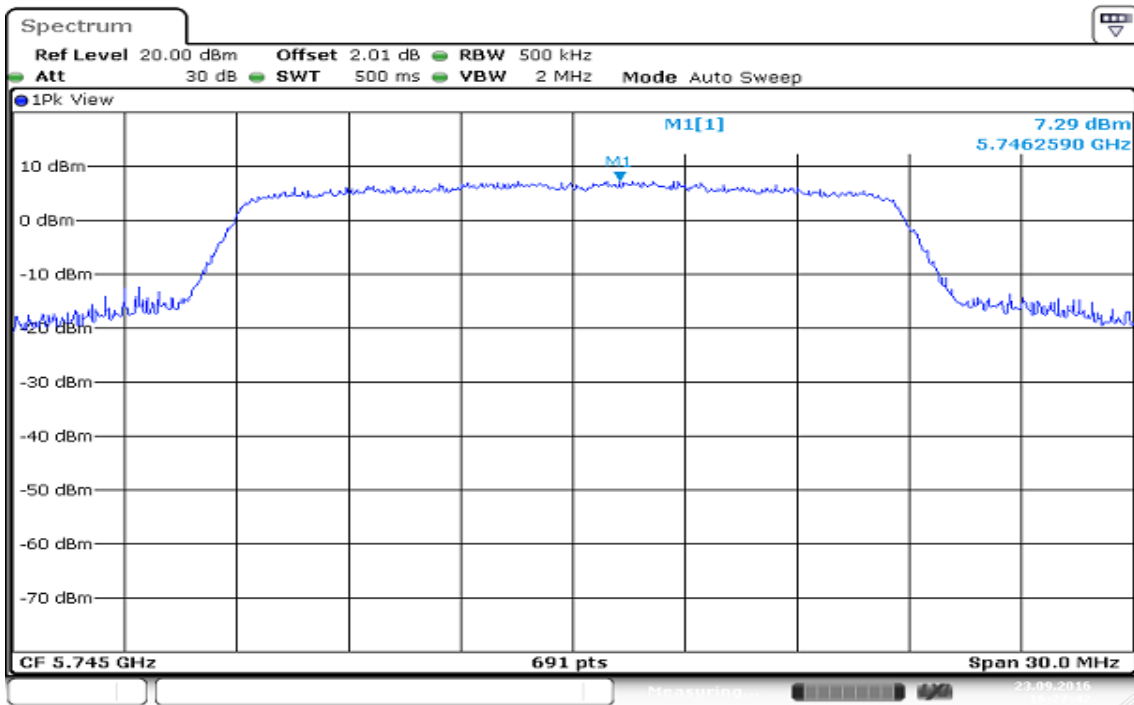
### PPSD (CH High)



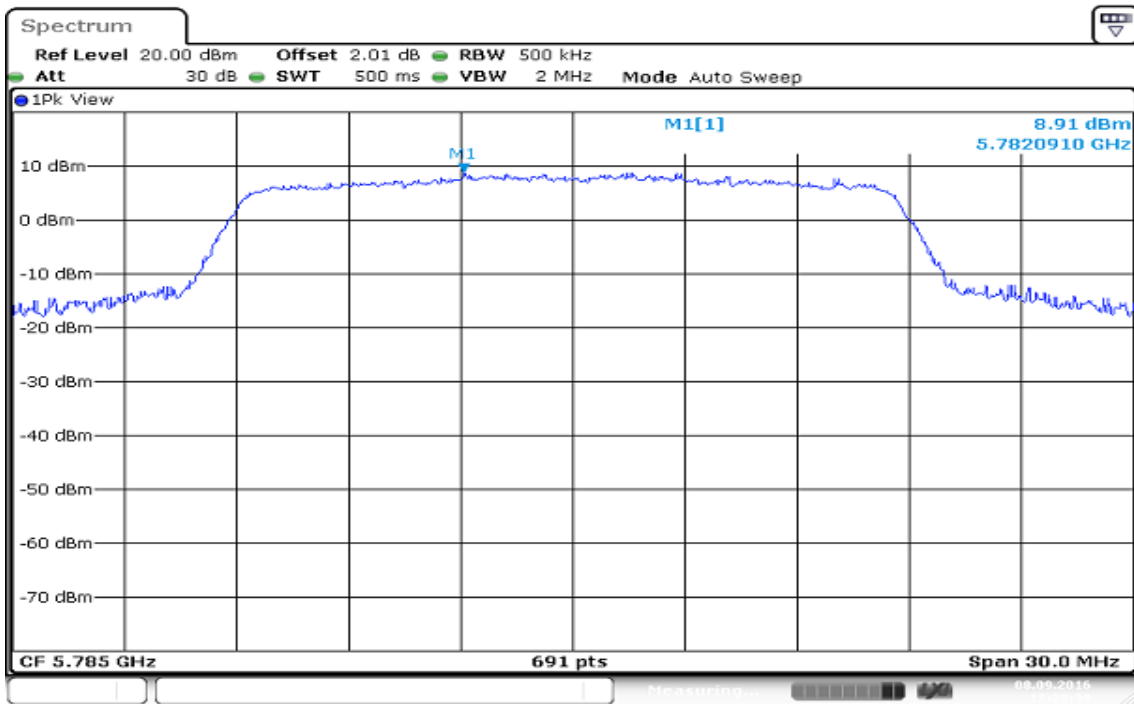
Date: 8 SEP 2016 17:12:56

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

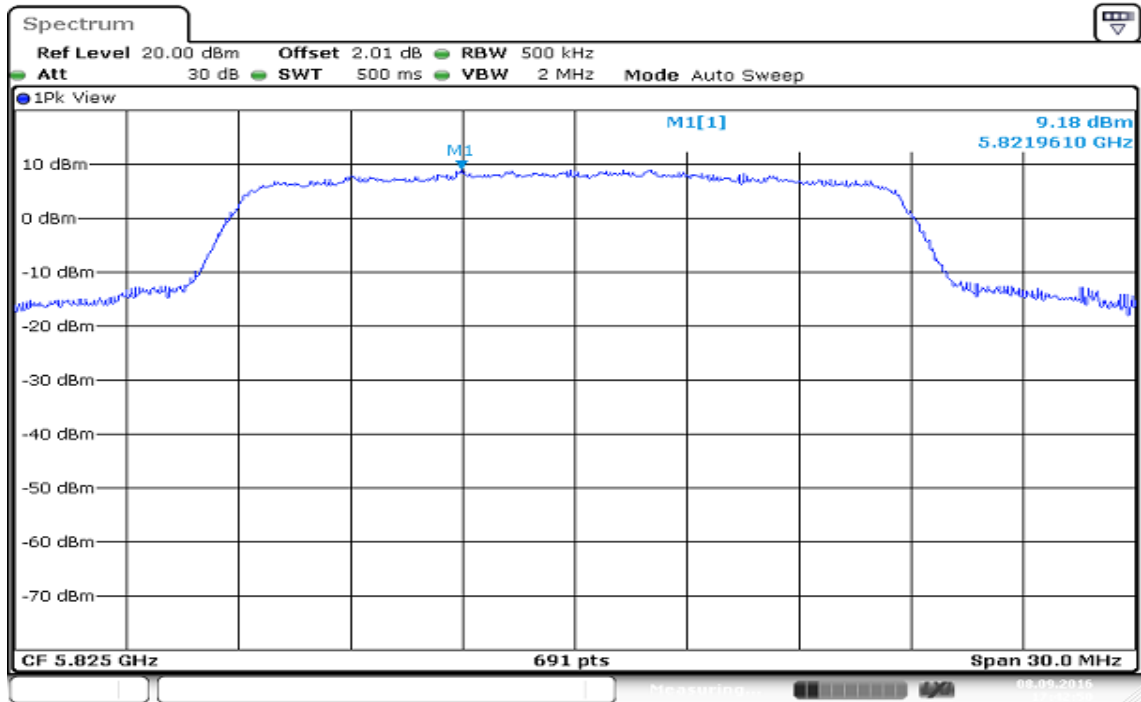
**PPSD (CH Low)**



**PPSD (CH Mid)**



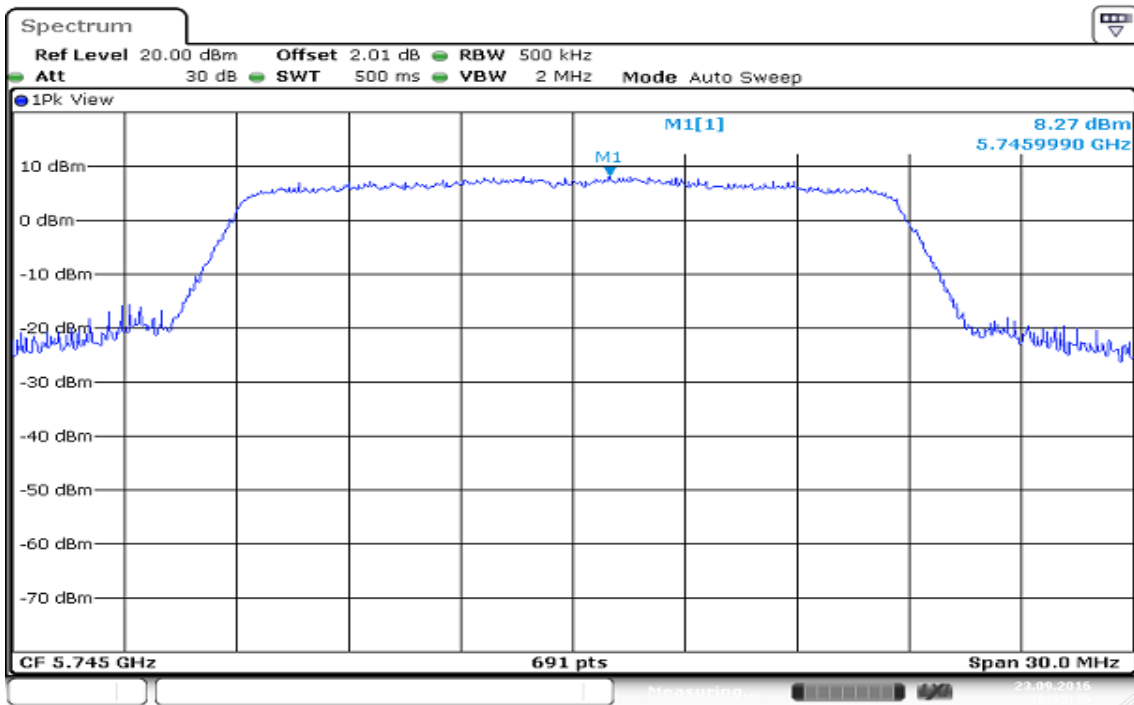
### PPSD (CH High)



Date: 8 SEP 2016 17:42:51

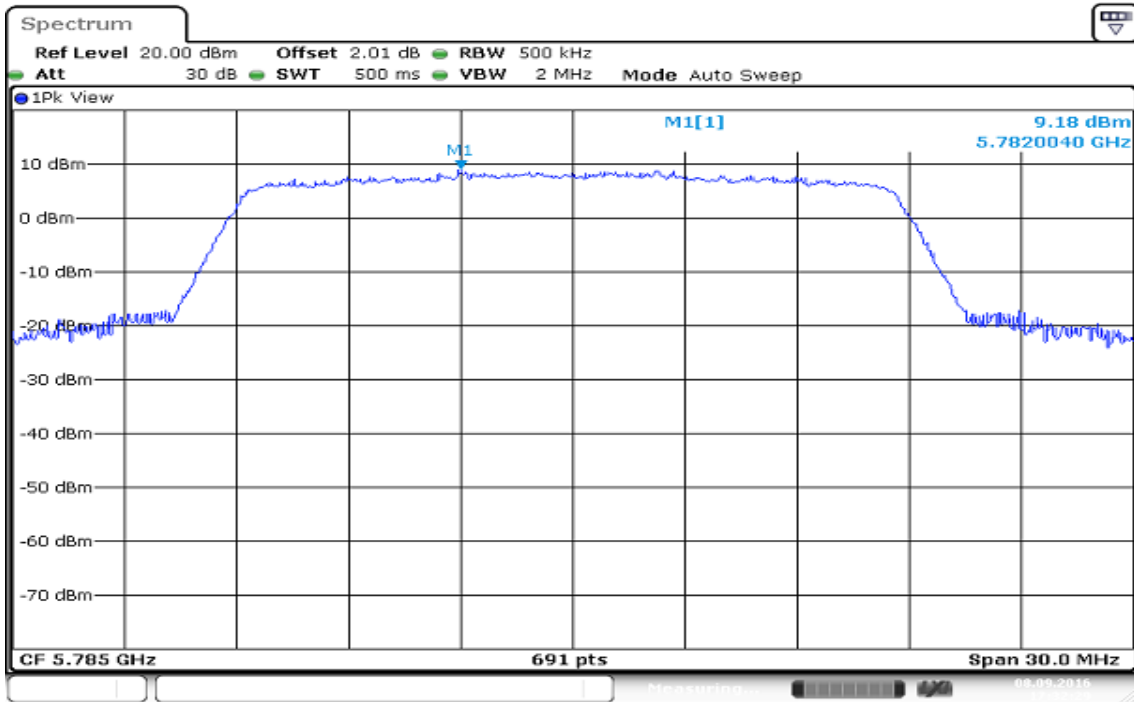
**IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz / Chain 1**

**PPSD (CH Low)**



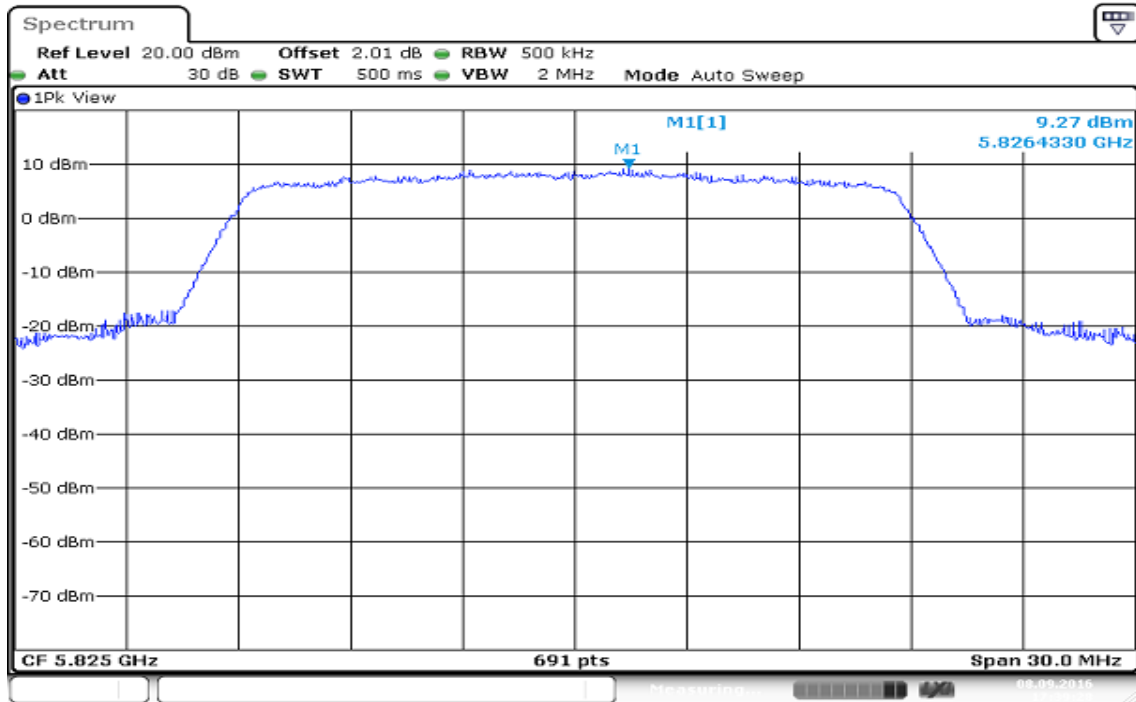
Date: 23.SEP.2016 16:35:36

**PPSD (CH Mid)**



Date: 8.SEP.2016 17:32:29

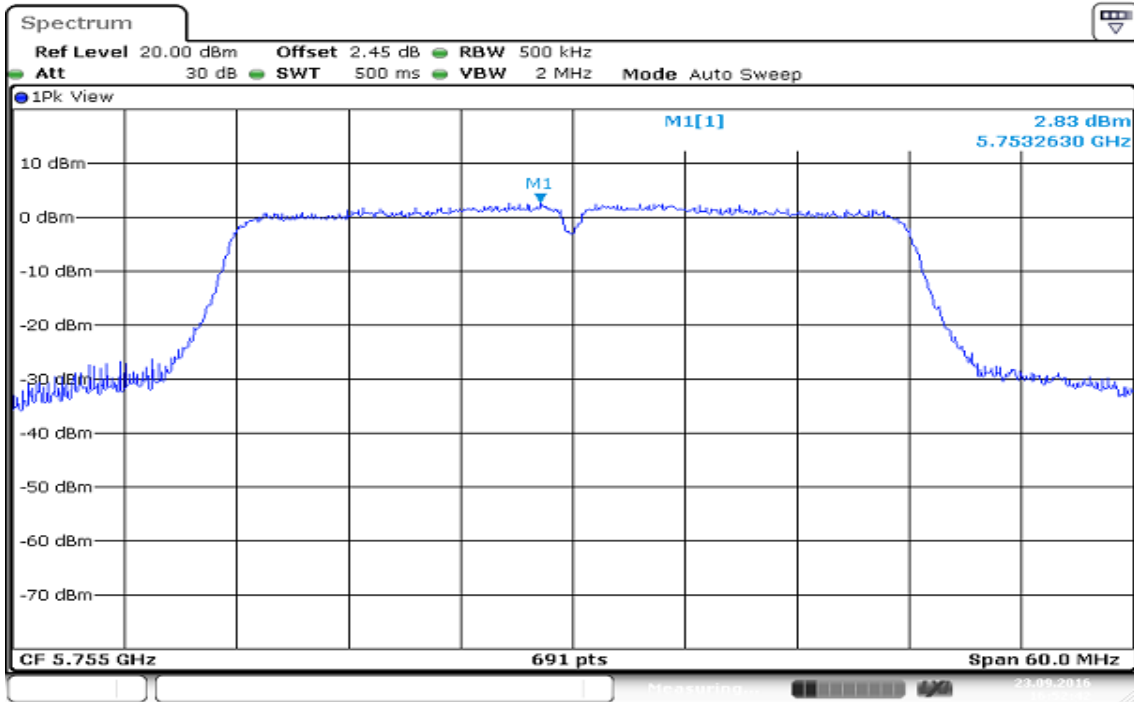
### PPSD (CH High)



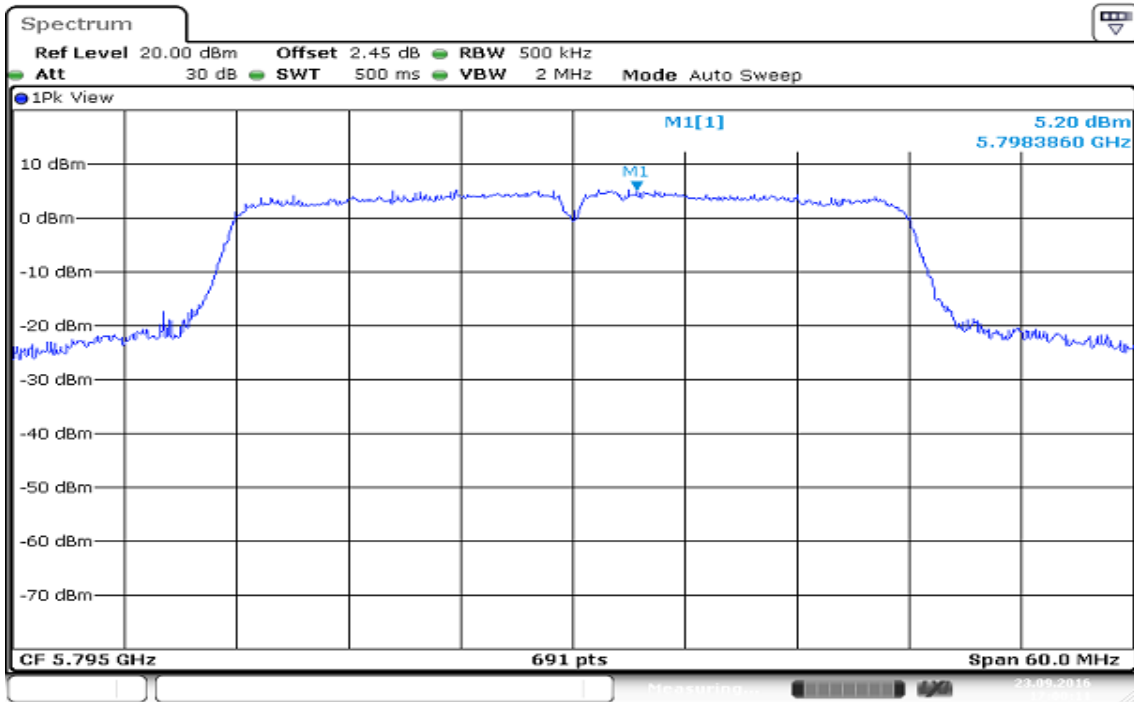
Date: 8 SEP 2016 17:29:28

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

**PPSD (CH Low)**

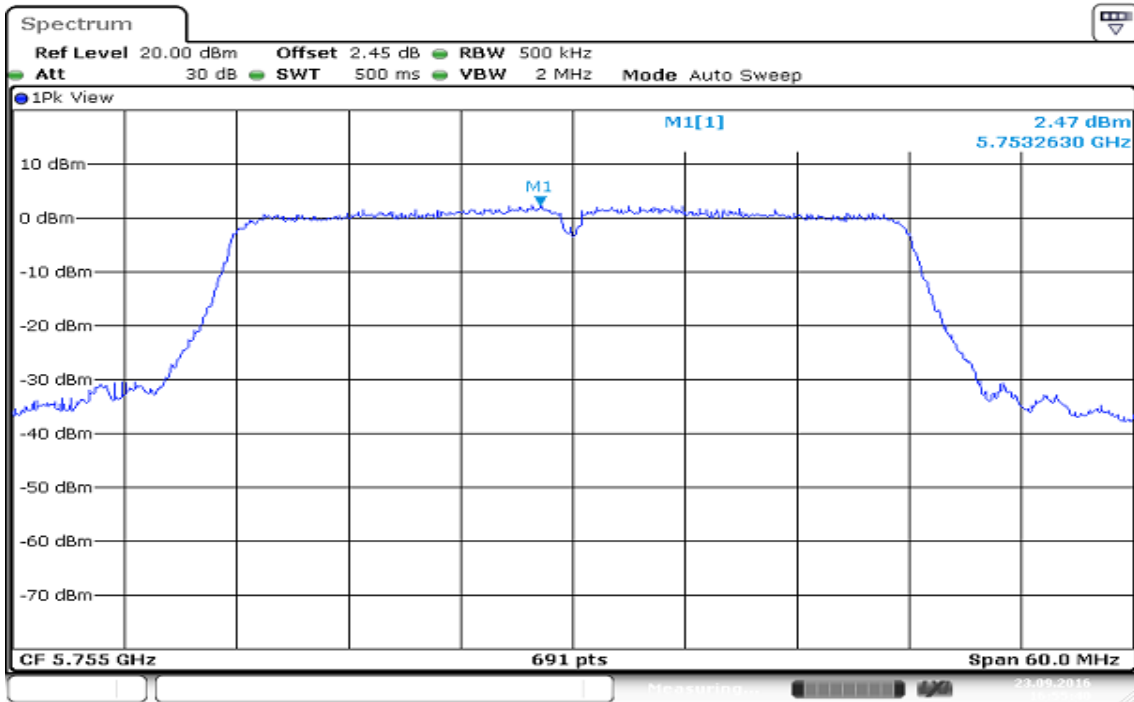


**PPSD (CH High)**



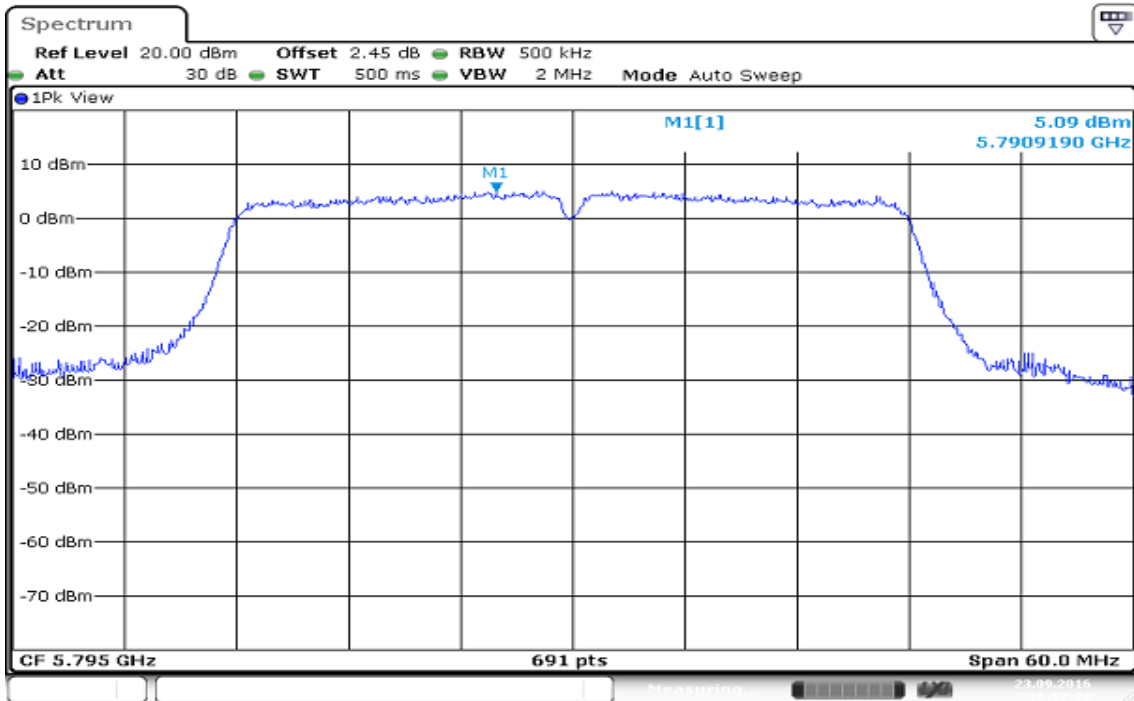
**IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz / Chain 1**

**PPSD (CH Low)**



Date: 23.SEP.2016 16:55:40

**PPSD (CH High)**



Date: 23.SEP.2016 16:58:32



## 7.6 RADIATED EMISSIONS

### LIMIT

All spurious emissions shall comply with the limits of §15.209(a) and RSS-Gen Table 2 & Table 4.

### RSS-Gen Table 2 & Table 4: General Field Strength Limits for Transmitters and Receivers at Frequencies Above 30 MHz <sup>(Note)</sup>

Frequency (MHz)	Field Strength microvolts/m at 3 metres (watts, e.i.r.p.)	
	Transmitters	Receivers
30-88	100 (3 nW)	100 (3 nW)
88-216	150 (6.8 nW)	150 (6.8 nW)
216-960	200 (12 nW)	200 (12 nW)
Above 960	500 (75 nW)	500 (75 nW)

**Note:** \*Measurements for compliance with limits in the above table may be performed at distances other than 3 metres, in accordance with Section 6.5.

Transmitting devices are not permitted in Table 1 bands or, unless stated otherwise, in TV bands (54-72 MHz, 76-88 MHz, 174-216 MHz, 470-608 MHz and 614-806 MHz).

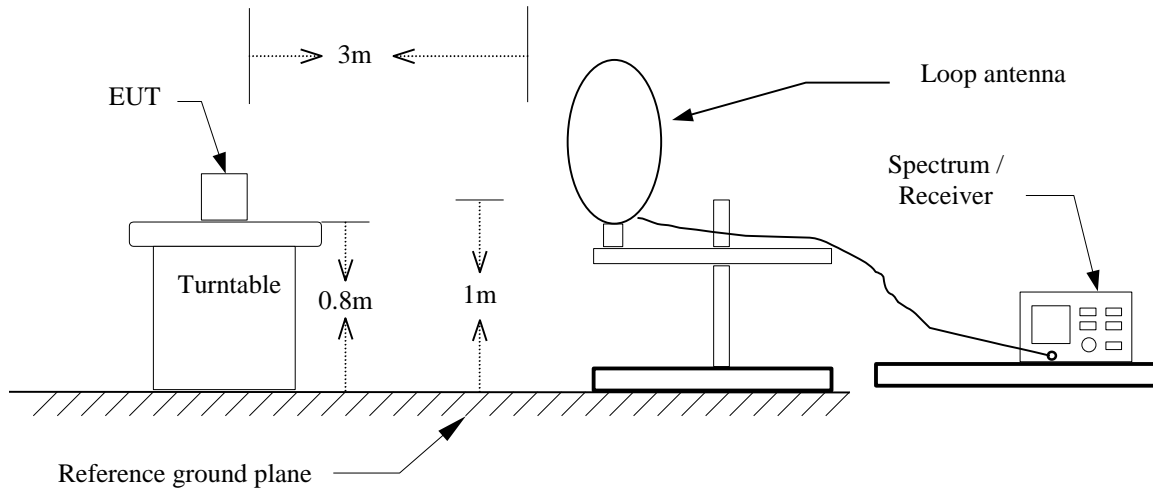
### RSS-Gen Table 5: General Field Strength Limits for Transmitters at Frequencies Below 30 MHz (Transmit)

Frequency	Field Strength (microvolts/m)	Magnetic H-Field (microamperes/m)	Measurement Distance (metres)
9-490 kHz	2,400/F (F in kHz)	2,400/377F (F in kHz)	300
490-1,705 kHz	24,000/F (F in kHz)	24,000/377F (F in kHz)	30
1.705-30 MHz	30	N/A	30

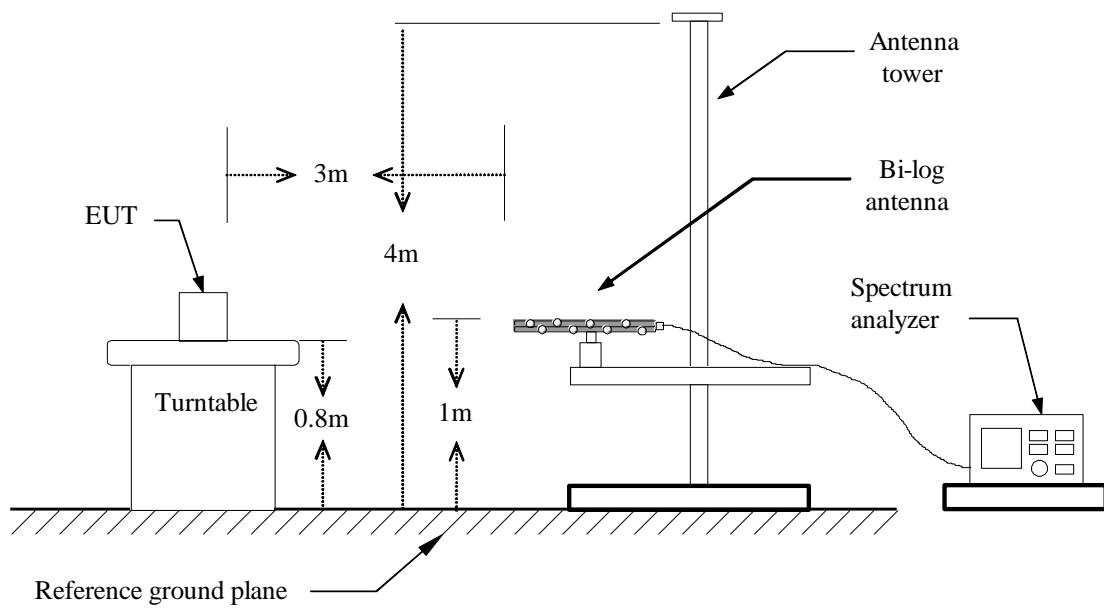
**Note:** The emission limits for the bands 9-90 kHz and 110-490 kHz are based on measurements employing an average detector.

**Test Configuration**

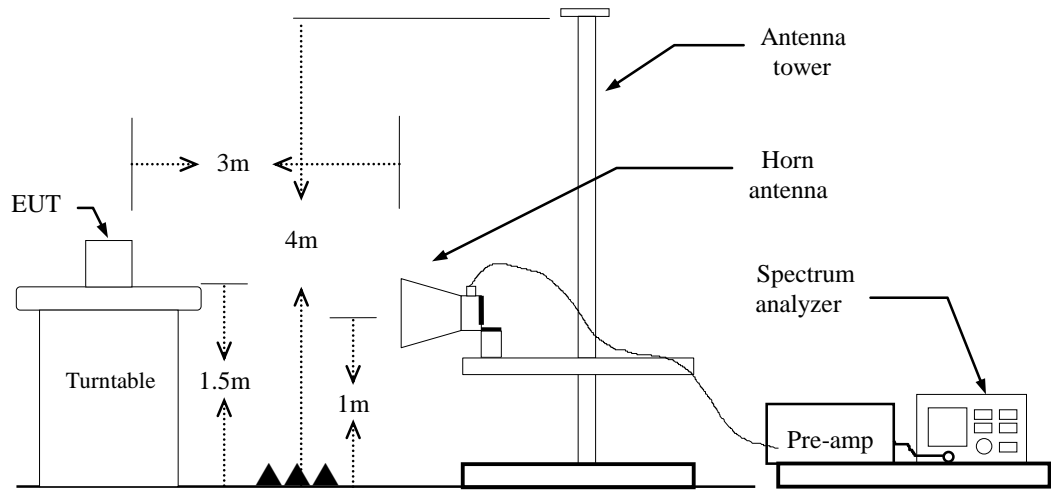
**9kHz ~ 30MHz**



**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:** =89%, VBW=750Hz

**IEEE 802.11n HT 20 MHz mode:** =88%, VBW=750Hz

**IEEE 802.11n HT 40 MHz mode:** =79%, VBW=1.5KHz

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

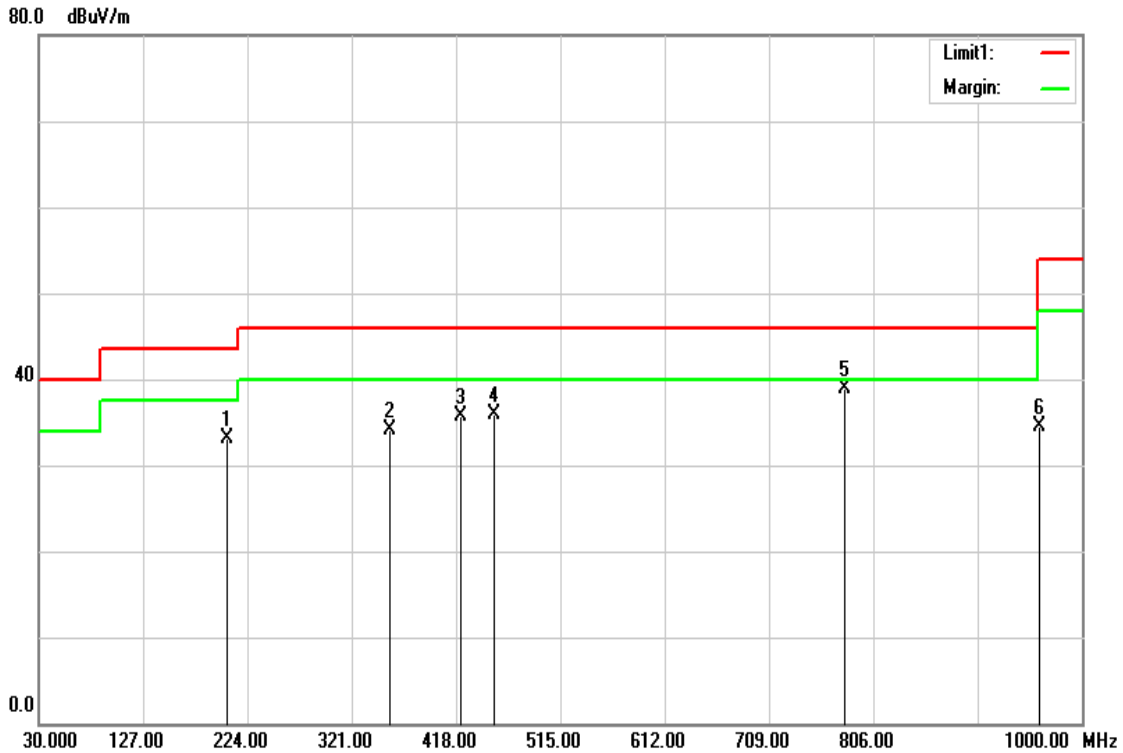
**Test Date:** September 13, 2016

**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)
205.5700	49.12	-15.94	33.18	43.50	-10.32	peak	V
356.8900	46.74	-12.73	34.01	46.00	-11.99	peak	V
421.8800	46.74	-11.04	35.70	46.00	-10.30	peak	V
452.9200	46.08	-10.13	35.95	46.00	-10.05	QP	V
779.8100	43.62	-4.67	38.95	46.00	-7.05	peak	V
960.2300	36.70	-2.23	34.47	54.00	-19.53	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

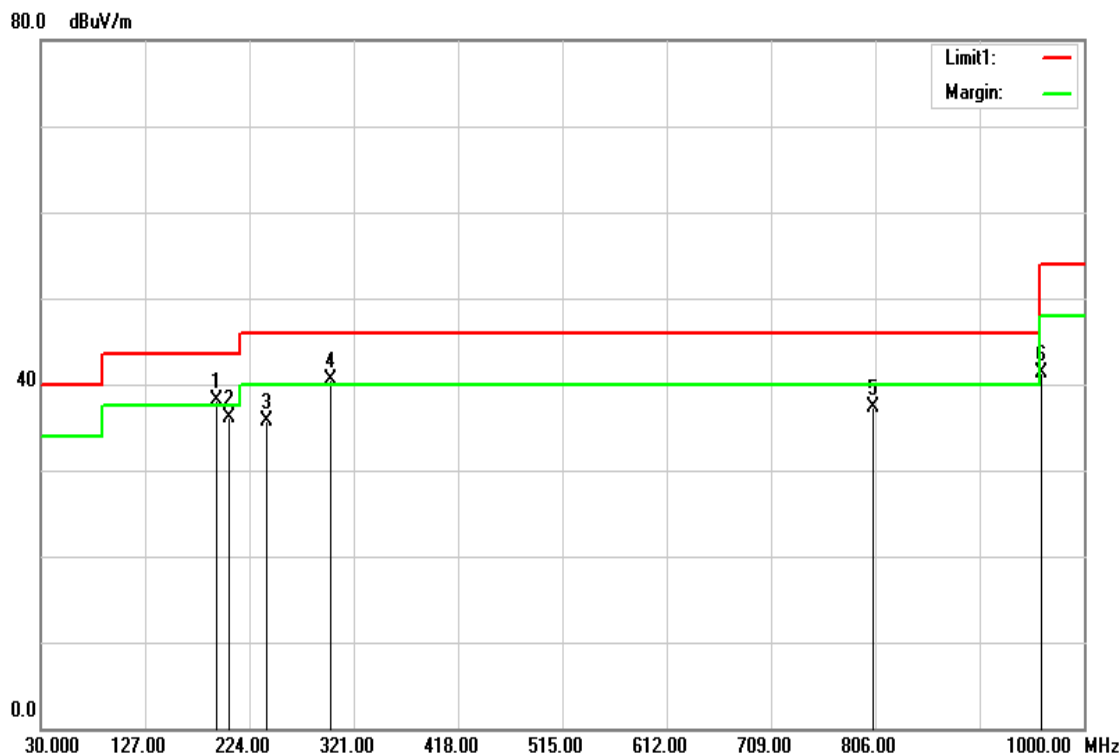
**Test Date:** September 13, 2016

**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)
193.9300	54.27	-16.09	38.18	43.50	-5.32	QP	H
205.5700	52.12	-15.94	36.18	43.50	-7.32	QP	H
239.5200	52.18	-16.52	35.66	46.00	-10.34	QP	H
299.6600	54.78	-14.25	40.53	46.00	-5.47	QP	H
804.0600	41.74	-4.44	37.30	46.00	-8.70	QP	H
960.2300	43.45	-2.23	41.22	54.00	-12.78	peak	H

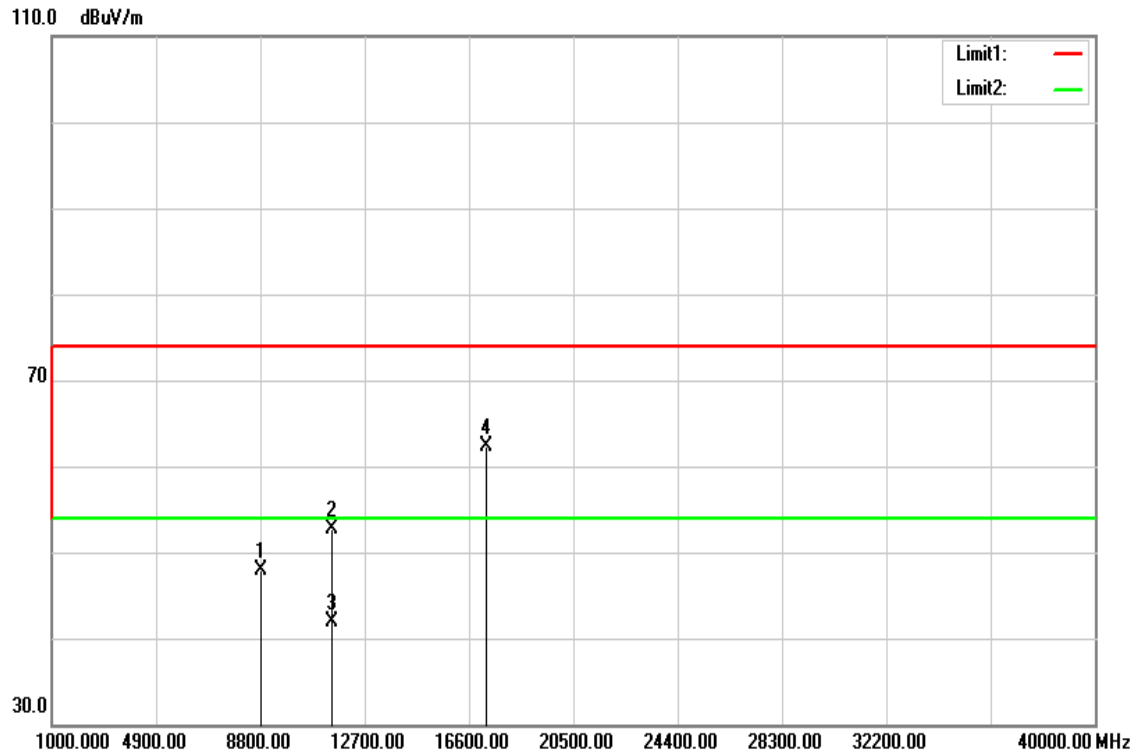
**Remark:**

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).

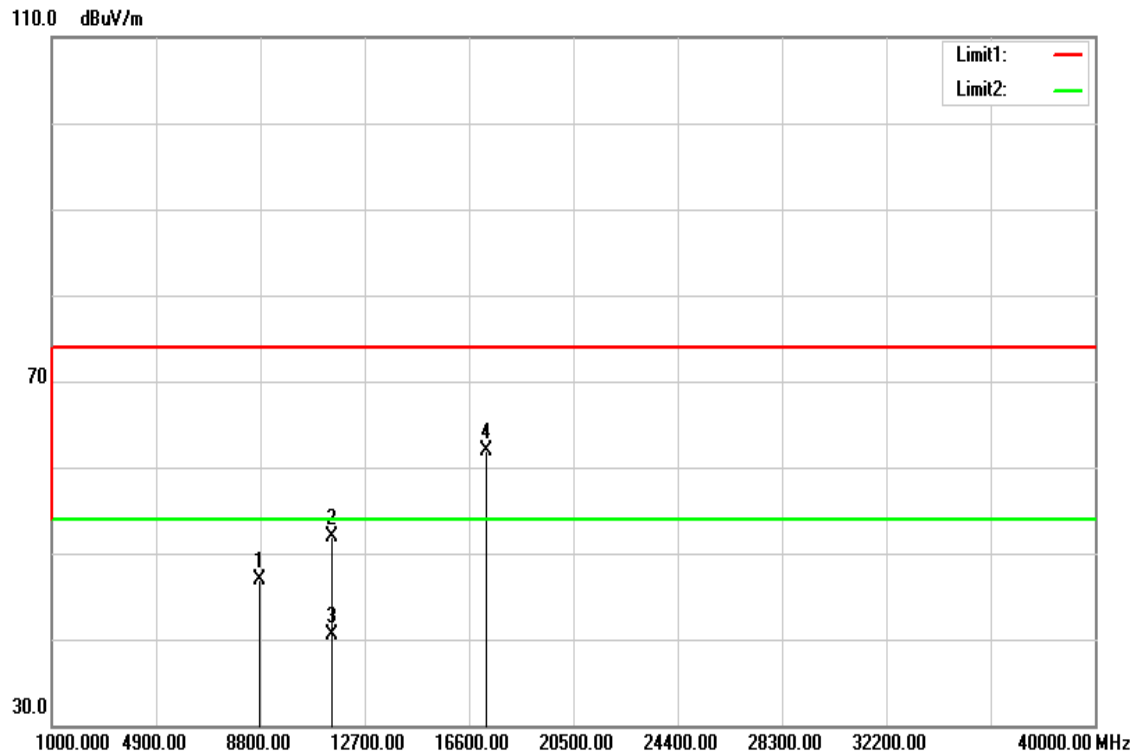
**Above 1 GHz**

**TX / IEEE 802.11a mode / CH Low**

**Polarity: Vertical**



**Polarity: Horizontal**



**Operation Mode:** TX / IEEE 802.11a mode / CH Low

**Test Date:** September 8, 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)
8850.000	33.56	14.34	47.90	74.00	-26.10	peak	V
11490.000	35.25	17.43	52.68	74.00	-21.32	peak	V
11490.000	24.42	17.43	41.85	54.00	-12.15	AVG	V
17235.000	34.16	28.09	62.25	74.00	-11.75	peak	V
N/A							
8760.000	32.62	14.23	46.85	74.00	-27.15	peak	H
11490.000	34.47	17.43	51.90	74.00	-22.10	peak	H
11490.000	23.11	17.43	40.54	54.00	-13.46	AVG	H
17235.000	33.79	28.09	61.88	74.00	-12.12	peak	H
N/A							

**Remark:**

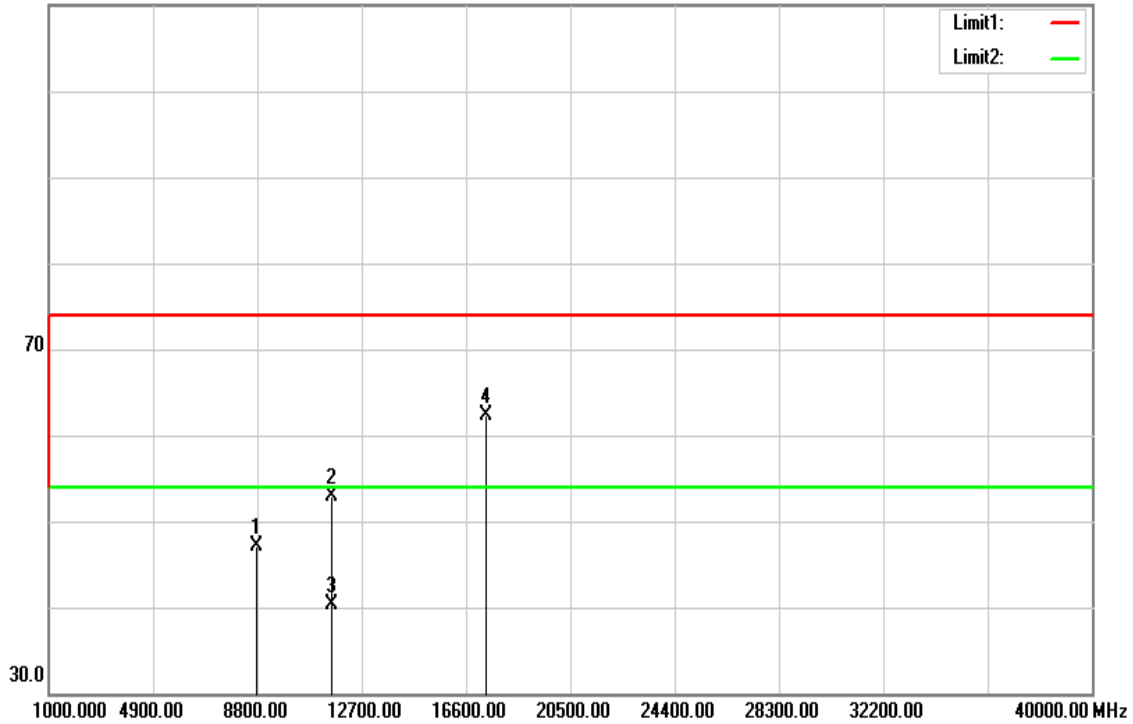
1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit.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

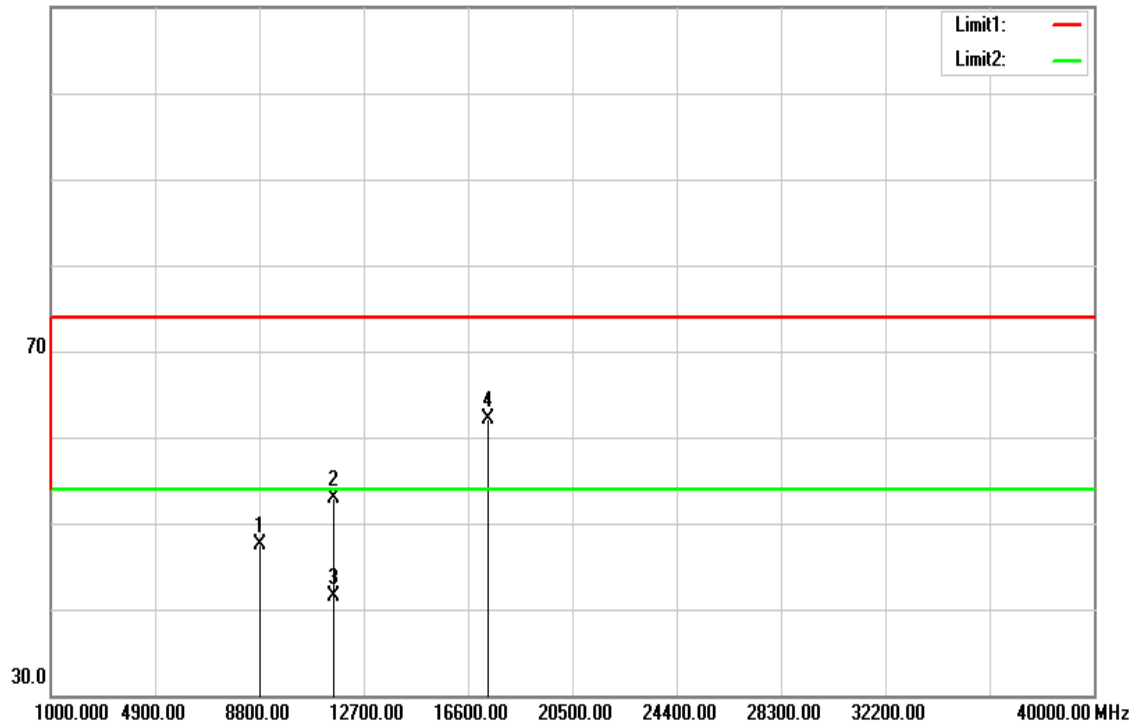
**Polarity: Vertical**

110.0 dBuV/m



**Polarity: Horizontal**

110.0 dBuV/m



**Operation Mode:** TX / IEEE 802.11a mode / CH Mid

**Test Date:** September 8, 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	32.97	14.21	47.18	74.00	-26.82	peak	V
11570.000	35.39	17.44	52.83	74.00	-21.17	peak	V
11570.000	22.93	17.44	40.37	54.00	-13.63	AVG	V
17355.000	33.64	28.63	62.27	74.00	-11.73	peak	V
N/A							
8820.000	33.15	14.30	47.45	74.00	-26.55	peak	H
11570.000	35.44	17.44	52.88	74.00	-21.12	peak	H
11570.000	24.04	17.44	41.48	54.00	-12.52	AVG	H
17355.000	33.41	28.63	62.04	74.00	-11.96	peak	H
N/A							

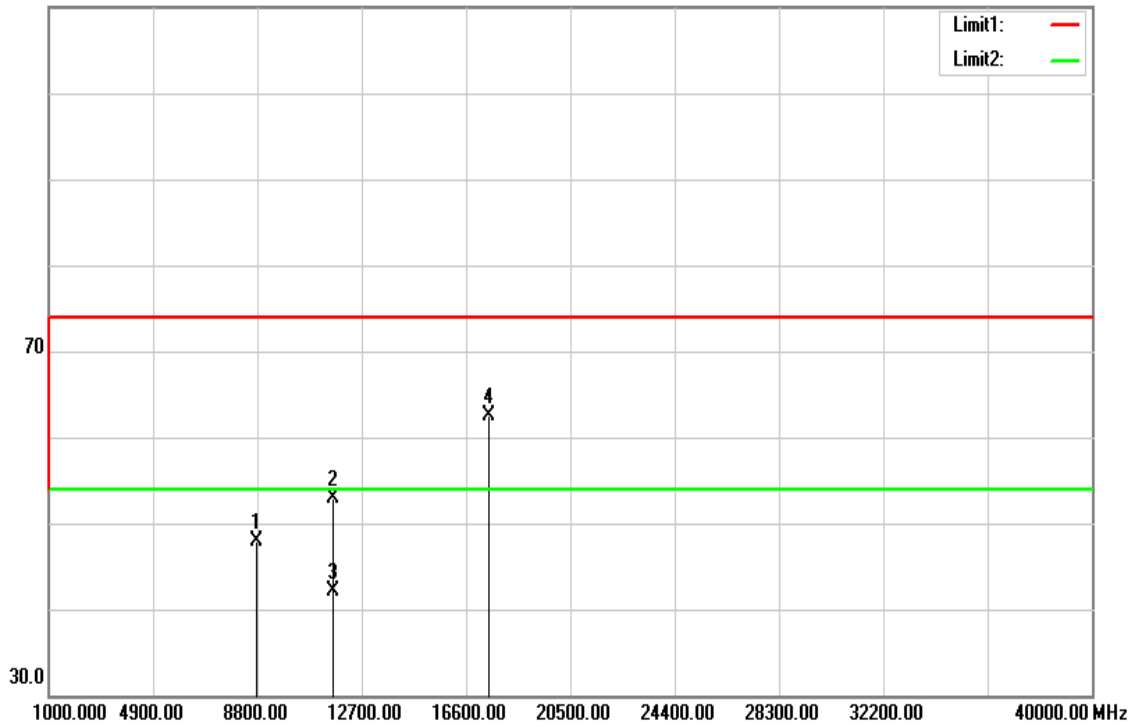
**Remark:**

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**

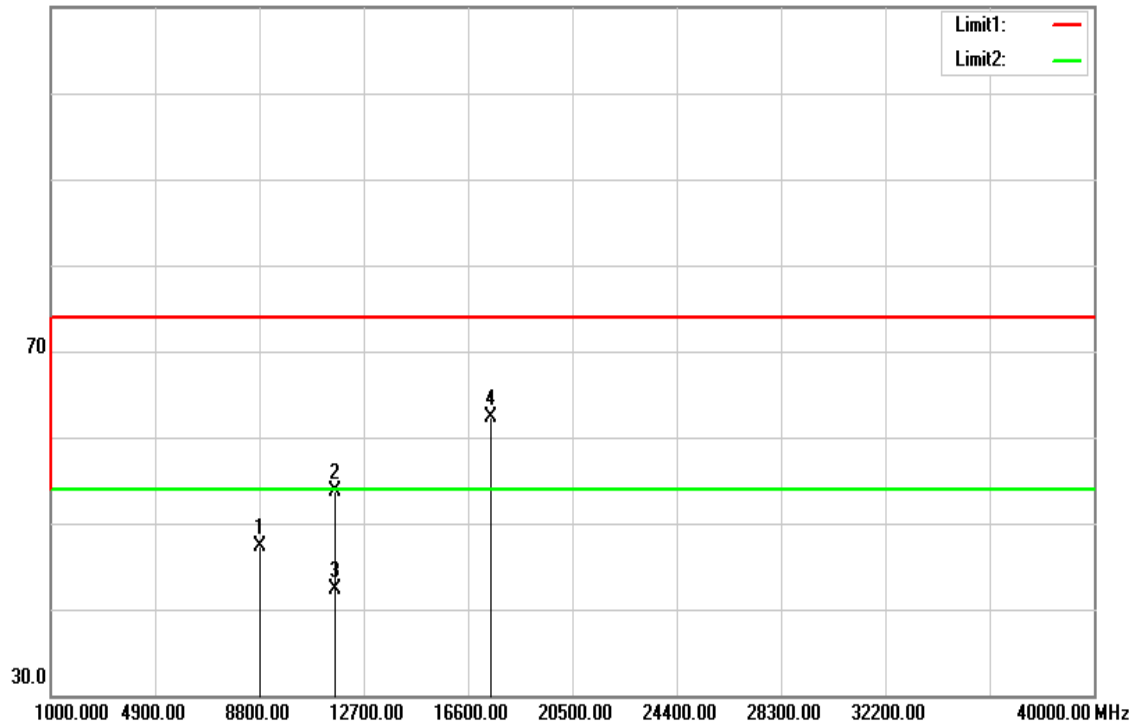
**Polarity: Vertical**

110.0 dBuV/m



**Polarity: Horizontal**

110.0 dBuV/m



**Operation Mode:** TX / IEEE 802.11a mode / CH High

**Test Date:** September 8, 2016

**Temperature:** 27°C

**Tested by:** Dennis Li

**Humidity:** 53% RH

**Polarity:** Ver. / Hor.

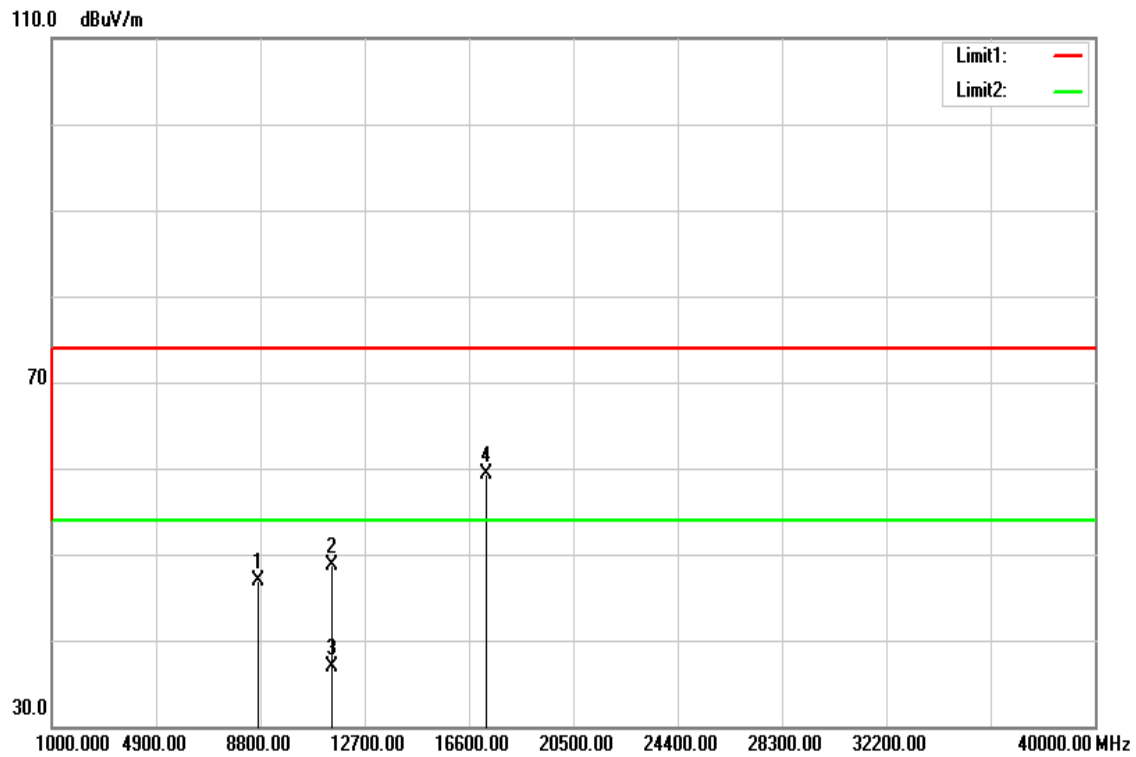
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
8750.000	33.63	14.21	47.84	74.00	-26.16	peak	V
11650.000	35.53	17.45	52.98	74.00	-21.02	peak	V
11650.000	24.70	17.45	42.15	54.00	-11.85	AVG	V
17475.000	33.41	29.18	62.59	74.00	-11.41	peak	V
N/A							
8850.000	32.90	14.34	47.24	74.00	-26.76	peak	H
11650.000	36.30	17.45	53.75	74.00	-20.25	peak	H
11650.000	24.83	17.45	42.28	54.00	-11.72	AVG	H
17475.000	33.15	29.18	62.33	74.00	-11.67	peak	H
N/A							

**Remark:**

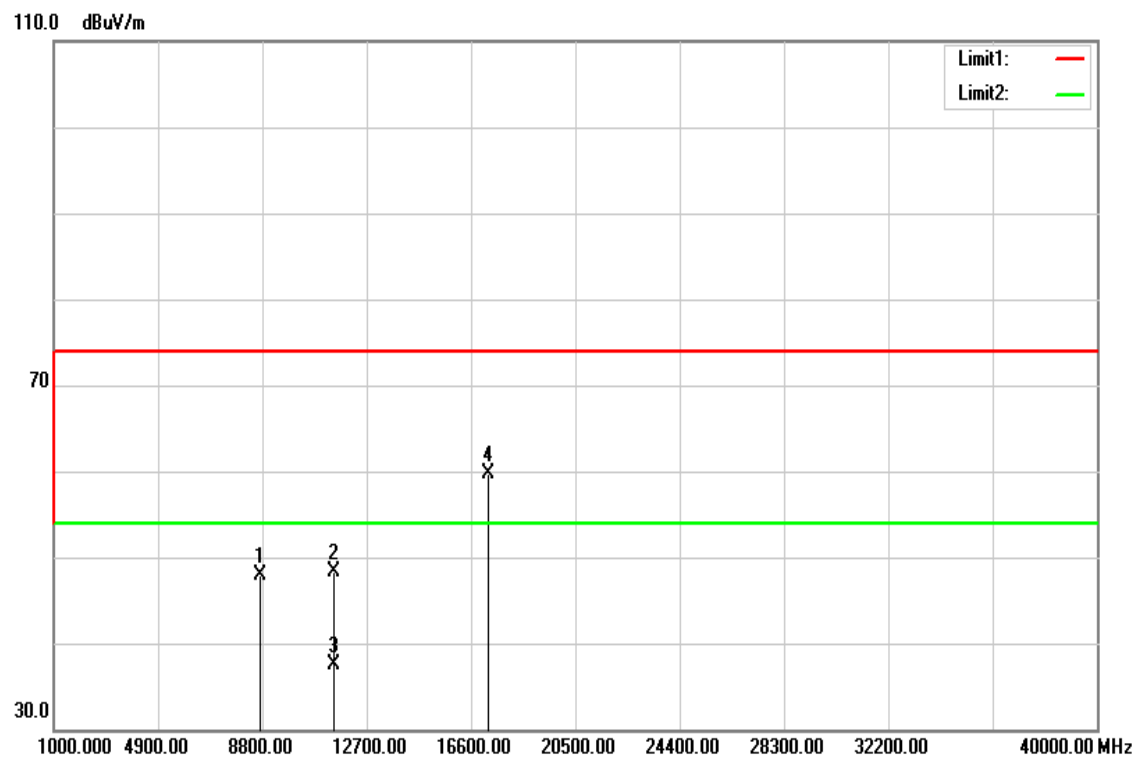
1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average 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 14, 2016

**Temperature:** 27°C

**Tested by:**Dennis Li

**Humidity:** 53% RH

**Polarity:** Ver. / Hor.

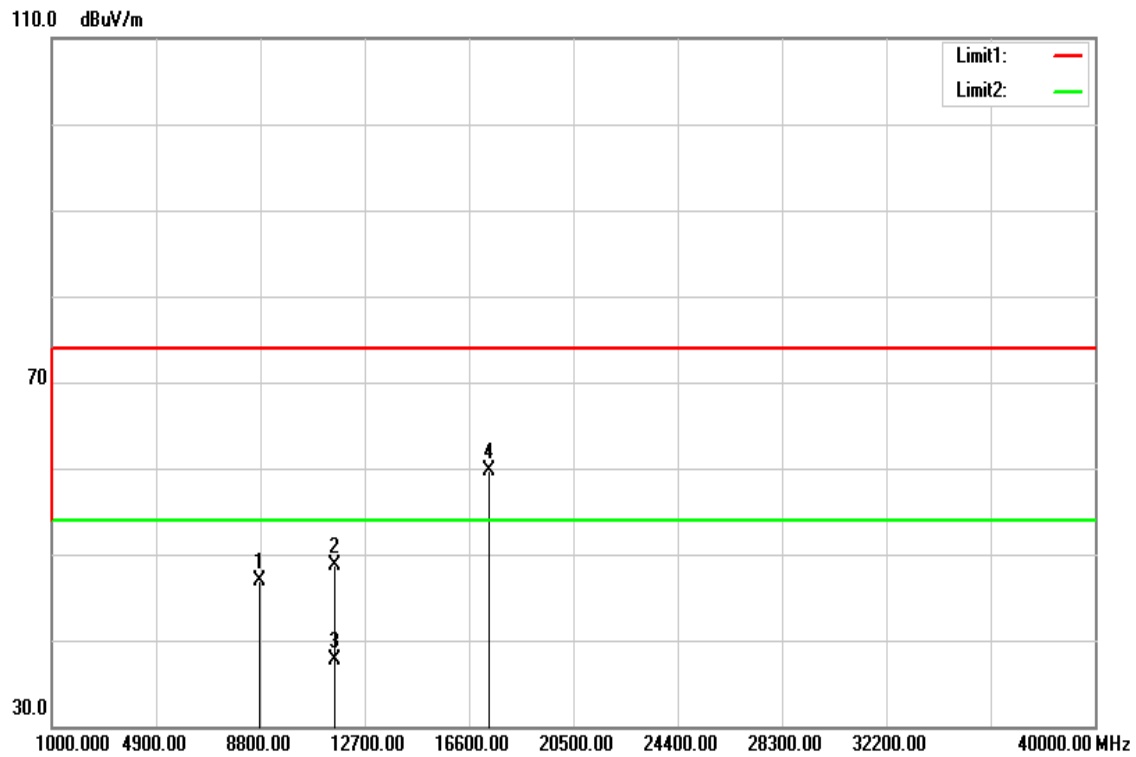
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
8700.000	33.17	13.73	46.90	74.00	-27.10	peak	V
11490.000	31.84	16.78	48.62	74.00	-25.38	peak	V
11490.000	20.22	16.78	37.00	54.00	-17.00	AVG	V
17235.000	34.03	25.28	59.31	74.00	-14.69	peak	V
N/A							
8700.000	34.14	13.73	47.87	74.00	-26.13	peak	H
11490.000	31.52	16.78	48.30	74.00	-25.70	peak	H
11490.000	20.65	16.78	37.43	54.00	-16.57	AVG	H
17235.000	34.38	25.28	59.66	74.00	-14.34	peak	H
N/A							

**Remark:**

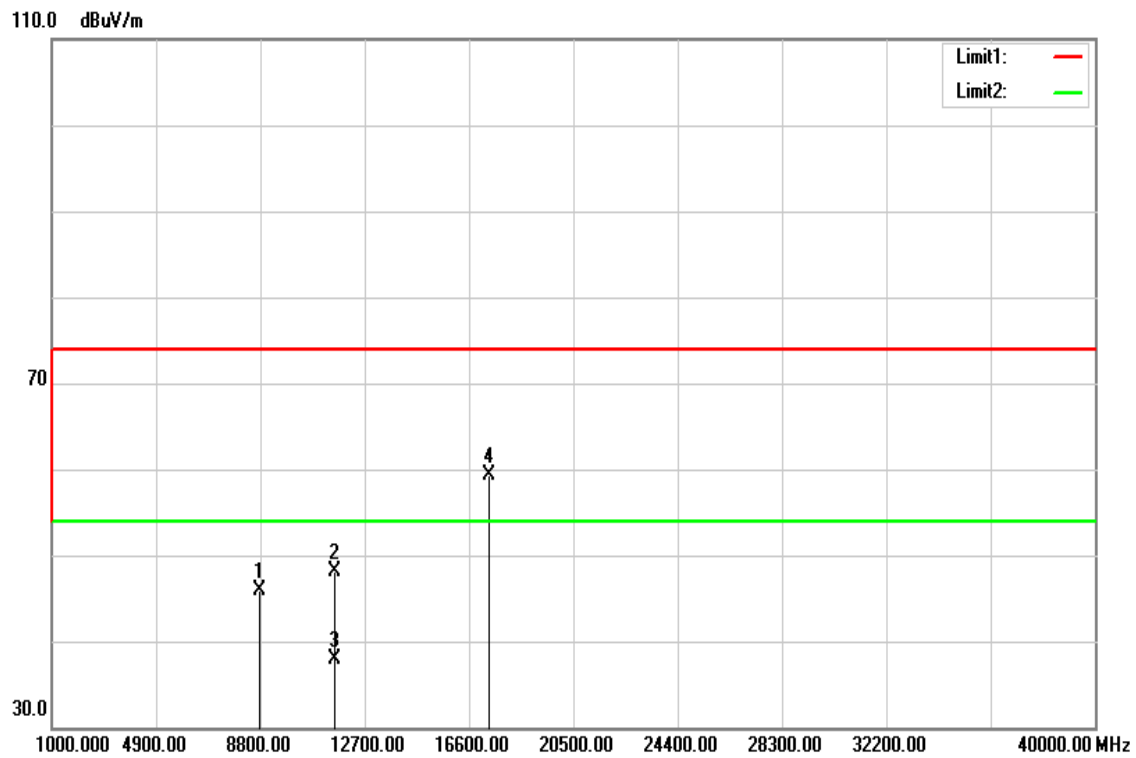
1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average 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 14, 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	33.12	13.75	46.87	74.00	-27.13	peak	V
11570.000	31.91	16.84	48.75	74.00	-25.25	peak	V
11570.000	20.76	16.84	37.60	54.00	-16.40	AVG	V
17355.000	34.01	25.75	59.76	74.00	-14.24	peak	V
N/A							
8750.000	32.08	13.75	45.83	74.00	-28.17	peak	H
11570.000	31.19	16.84	48.03	74.00	-25.97	peak	H
11570.000	20.98	16.84	37.82	54.00	-16.18	AVG	H
17355.000	33.50	25.75	59.25	74.00	-14.75	peak	H
N/A							

**Remark:**

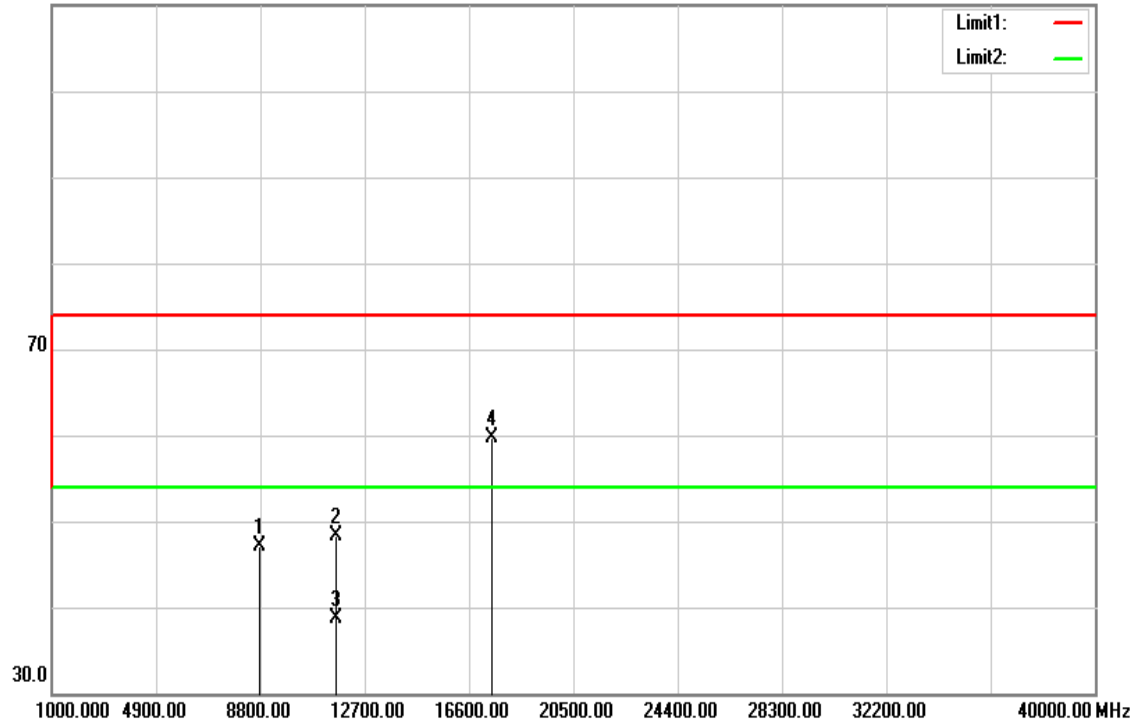
1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average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

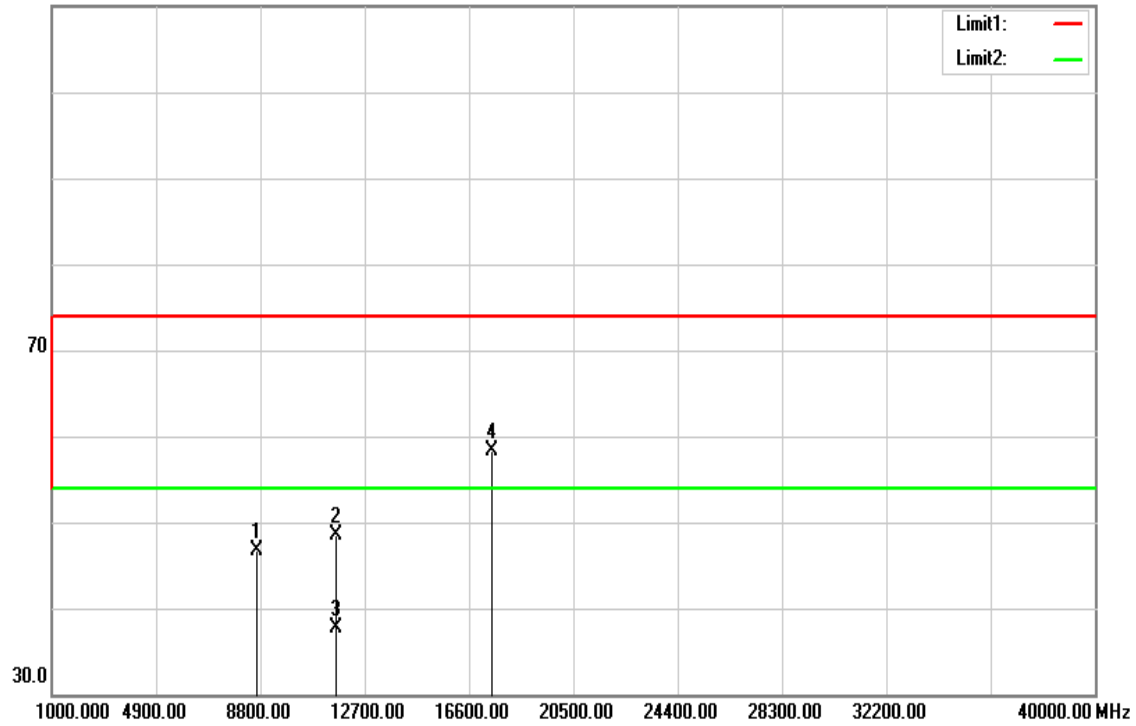
**Polarity: Vertical**

110.0 dBuV/m



**Polarity: Horizontal**

110.0 dBuV/m



**Operation Mode:**TX / IEEE 802.11n HT 20 MHz mode / CH High **Test Date:** September 14, 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	33.40	13.76	47.16	74.00	-26.84	peak	V
11650.000	31.40	16.91	48.31	74.00	-25.69	peak	V
11650.000	21.80	16.91	38.71	54.00	-15.29	AVG	V
17475.000	33.45	26.22	59.67	74.00	-14.33	peak	V
N/A							
8650.000	32.99	13.71	46.70	74.00	-27.30	peak	H
11650.000	31.58	16.91	48.49	74.00	-25.51	peak	H
11650.000	20.87	16.91	37.78	54.00	-16.22	AVG	H
17475.000	32.17	26.22	58.39	74.00	-15.61	peak	H
N/A							

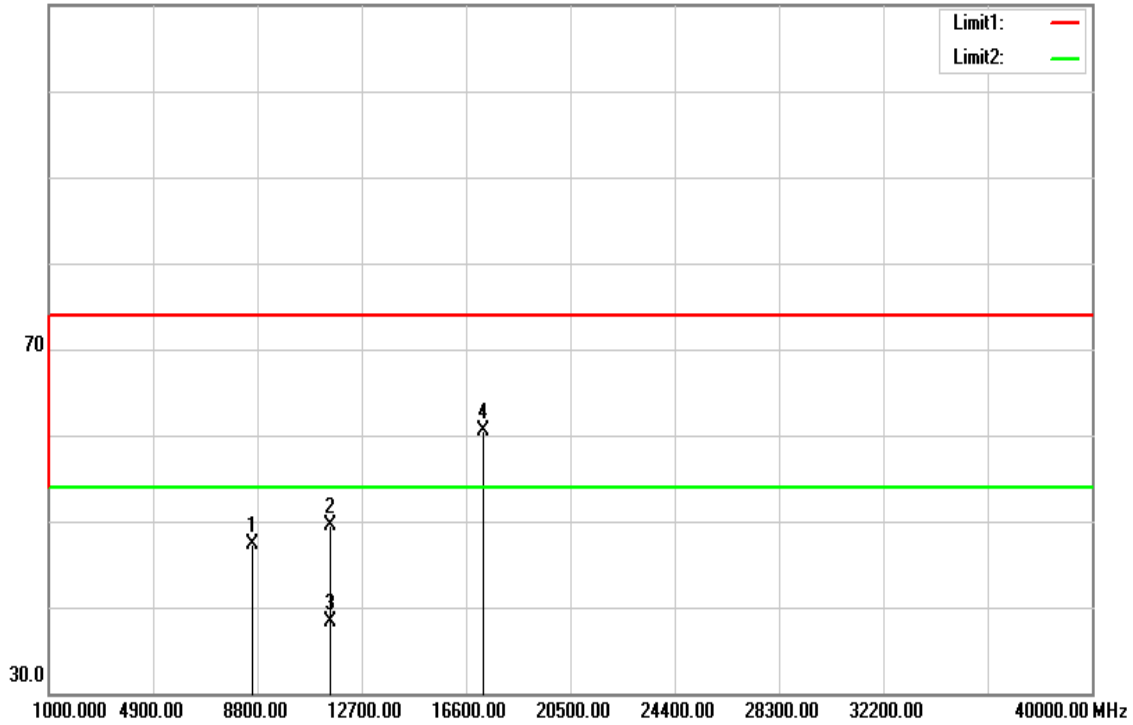
**Remark:**

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 40 MHz mode / CH Low**

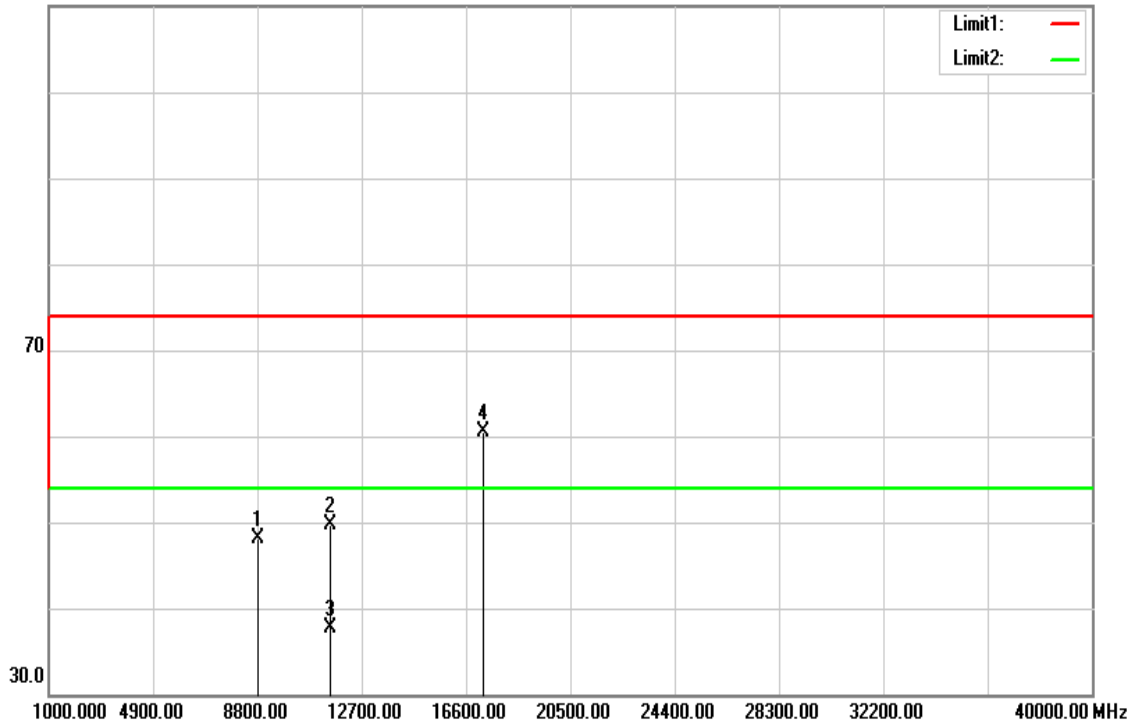
**Polarity: Vertical**

110.0 dBuV/m



**Polarity: Horizontal**

110.0 dBuV/m



**Operation Mode:**TX / IEEE 802.11n HT 40 MHz mode / CH Low **Test Date:** September 14, 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)
8600.000	33.68	13.69	47.37	74.00	-26.63	peak	V
11510.000	32.71	16.79	49.50	74.00	-24.50	peak	V
11510.000	21.57	16.79	38.36	54.00	-15.64	AVG	V
17265.000	35.06	25.40	60.46	74.00	-13.54	peak	V
N/A							
8800.000	34.35	13.78	48.13	74.00	-25.87	peak	H
11510.000	32.98	16.79	49.77	74.00	-24.23	peak	H
11510.000	20.85	16.79	37.64	54.00	-16.36	AVG	H
17265.000	35.19	25.40	60.59	74.00	-13.41	peak	H
N/A							

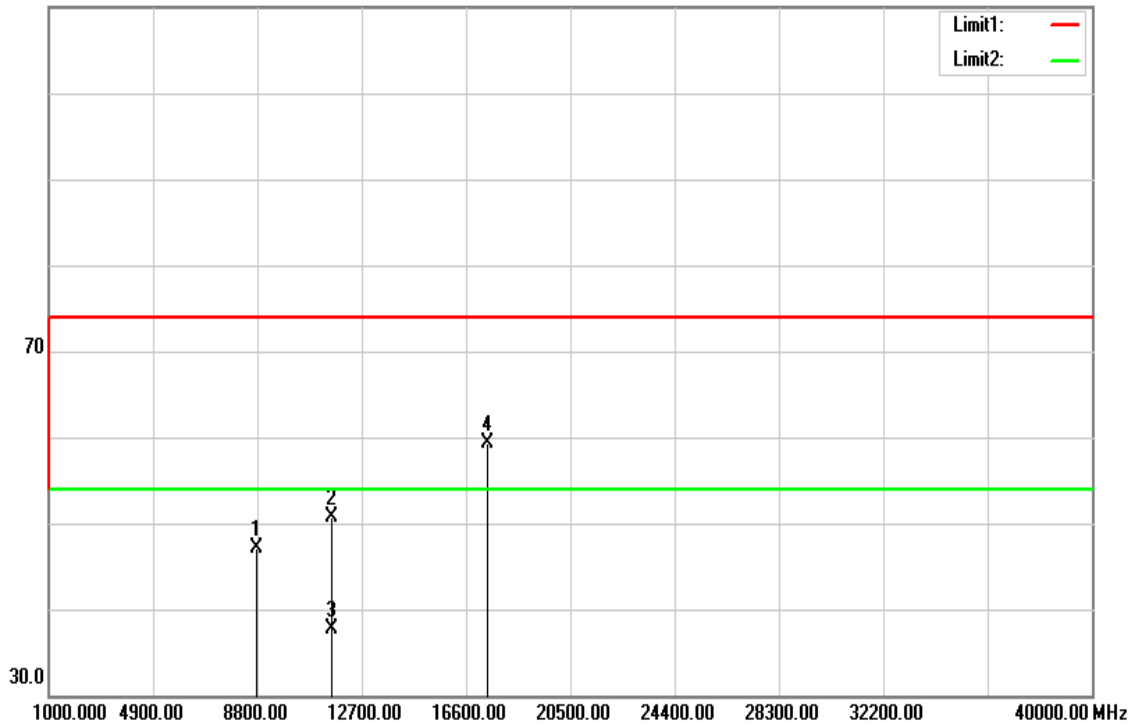
**Remark:**

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**

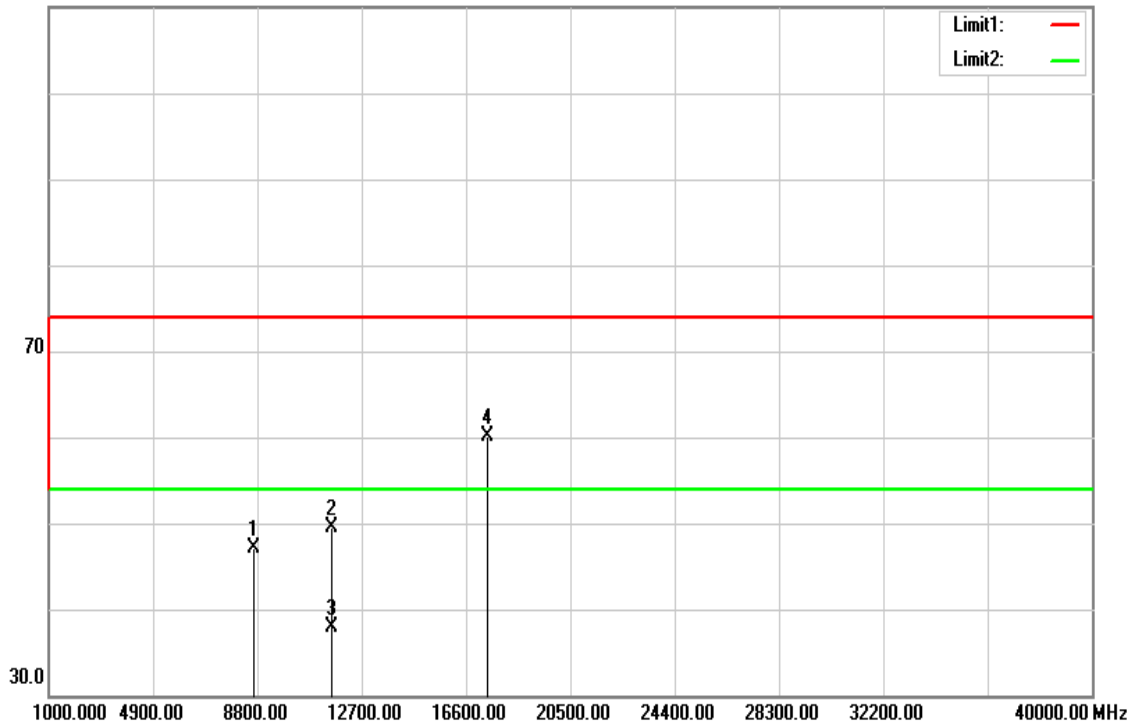
**Polarity: Vertical**

110.0 dBuV/m



**Polarity: Horizontal**

110.0 dBuV/m



**Operation Mode:**TX / IEEE 802.11n HT 40 MHz mode / CH High **Test Date:** September 14, 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	33.44	13.75	47.19	74.00	-26.81	peak	V
11590.000	33.76	16.86	50.62	74.00	-23.38	peak	V
11590.000	20.83	16.86	37.69	54.00	-16.31	AVG	V
17385.000	33.43	25.87	59.30	74.00	-14.70	peak	V
N/A							
8650.000	33.46	13.71	47.17	74.00	-26.83	peak	H
11590.000	32.58	16.86	49.44	74.00	-24.56	peak	H
11590.000	21.09	16.86	37.95	54.00	-16.05	AVG	H
17385.000	34.21	25.87	60.08	74.00	-13.92	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) & RSS-Gen §8.8, 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  $\mu$ 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)	Conducted limit (dB $\mu$ V)	
	Quasi-peak	Average
0.15 to 0.5	66 to 56*	56 to 46*
0.5 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

### Test Data

**Operation Mode:** Normal Link                      **Test Date:** September 26, 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
0.1660	41.08	39.51	9.69	50.77	49.20	65.15	55.16	-14.38	-5.96	L1
0.2980	34.85	32.58	9.68	44.53	42.26	60.30	50.30	-15.77	-8.04	L1
1.7340	29.09	27.55	9.96	39.05	37.51	56.00	46.00	-16.95	-8.49	L1
3.8140	32.88	30.28	9.82	42.70	40.10	56.00	46.00	-13.30	-5.90	L1
6.0140	33.71	30.78	9.86	43.57	40.64	60.00	50.00	-16.43	-9.36	L1
9.1340	36.41	34.53	9.92	46.33	44.45	60.00	50.00	-13.67	-5.55	L1
0.1700	40.98	38.48	9.64	50.62	48.12	64.96	54.96	-14.34	-6.84	L2
0.1900	39.24	37.88	9.64	48.88	47.52	64.03	54.04	-15.15	-6.48	L2
0.2980	36.91	34.87	9.64	46.55	44.51	60.30	50.30	-13.75	-5.79	L2
1.7780	29.02	27.44	9.89	38.91	37.33	56.00	46.00	-17.09	-8.67	L2
8.9020	35.95	33.74	9.89	45.84	43.63	60.00	50.00	-14.16	-6.37	L2
9.6500	35.69	33.94	9.91	45.60	43.85	60.00	50.00	-14.40	-6.15	L2

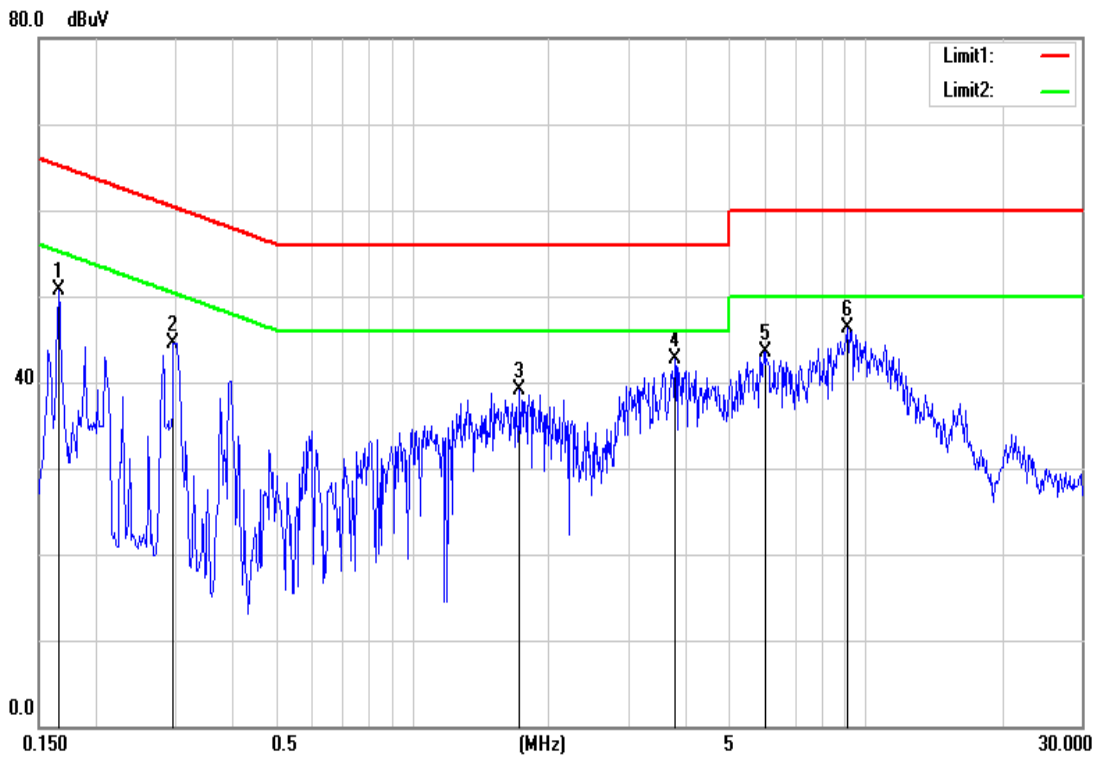
### **Remark:**

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 to 30MHz was 10kHz; the IF bandwidth of Test Receiver between 0.15MHz to 30MHz was 9kHz;*
4. *L1 = Line One (Live Line) / L2 = Line Two (Neutral Line)*

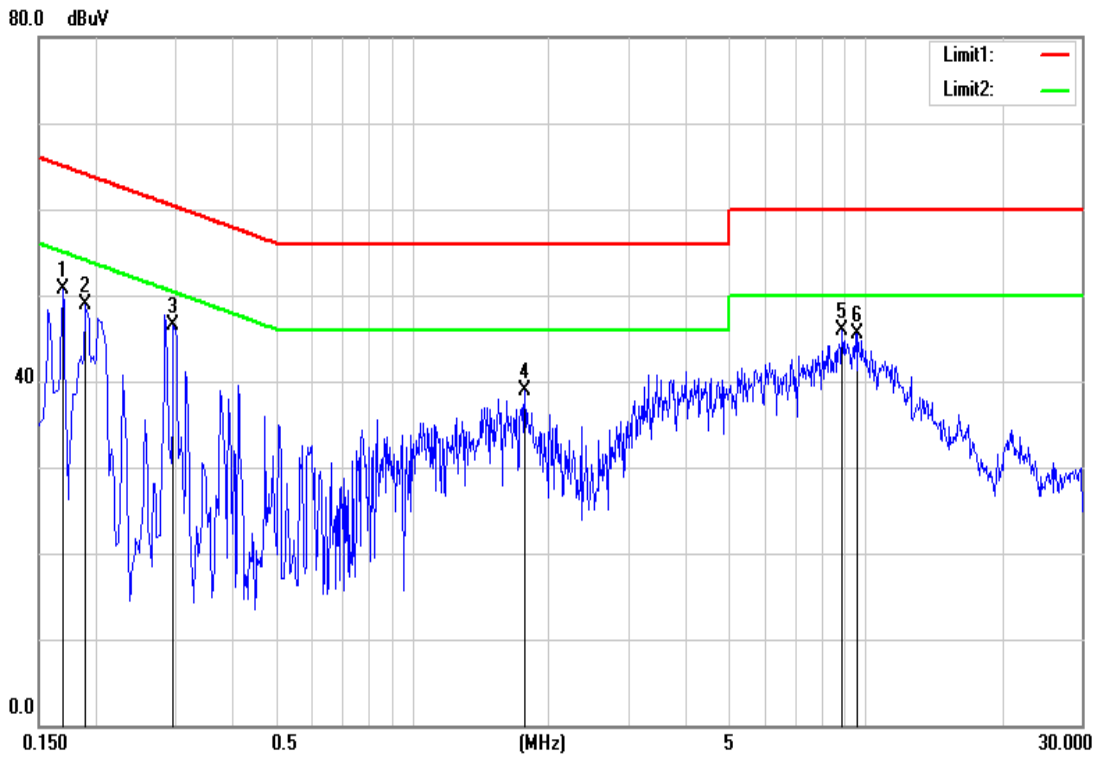


**Test Plots**

**Conducted emissions (Line 1)**



**Conducted emissions (Line 2)**

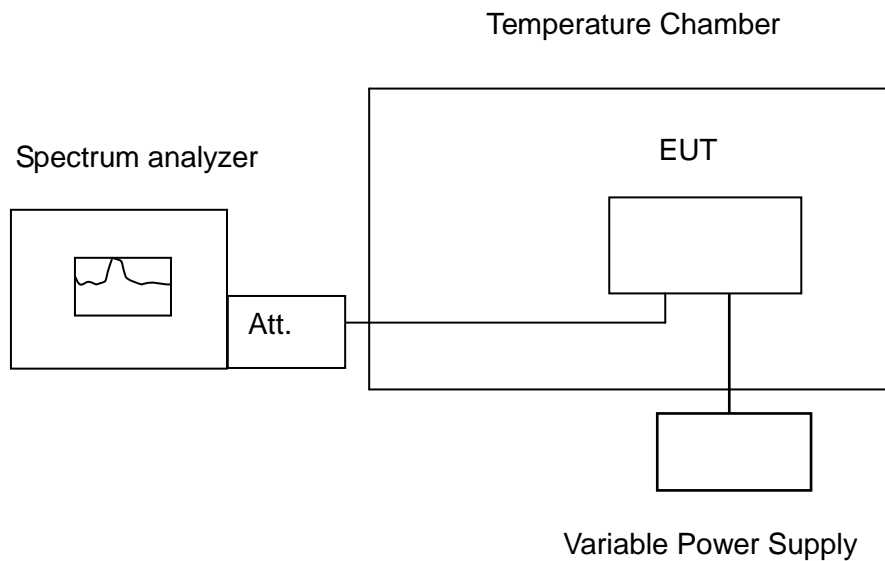


## 7.8 FREQUENCY STABILITY

### LIMIT

According to §15.407(g) & RSS-247, manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the operational description.

### Test Configuration



**Remark:** Measurement setup for testing on Antenna connector

**TEST PROCEDURE**

The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 20°C operating frequency as reference frequency. Turn EUT off and set the chamber temperature to -20°C. After the temperature stabilized for approximately 30 minutes recorded the frequency. Repeat step measure with 10°C increased per stage until the highest temperature of +50°C reached.

**TEST RESULTS**

*No non-compliance noted.*

Operating Frequency: 5785 MHz				
Environment Temperature (°C)	Voltage (V)	Measured Frequency (MHz)	Limit (20ppm)	Test Result
50	5	5784.928364	-12.383060	Pass
40	5	5784.925275	-12.917027	Pass
30	5	5784.923751	-13.180467	Pass
20	5	5784.918873	-14.023682	Pass
10	5	5784.920486	-13.744857	Pass
0	5	5784.949737	-8.688505	Pass
-10	5	5784.970183	-5.154192	Pass
-20	5	5784.984152	-2.739499	Pass

Operating Frequency: 5785 MHz				
Environment Temperature (°C)	Voltage (V)	Measured Frequency (MHz)	Limit (20ppm)	Test Result
20	4.5	5784.916437	-14.444771	Pass
	5	5784.918873	-14.023682	Pass
	5.5	5784.919674	-13.885220	Pass