

**FCC 47 CFR PART 15 SUBPART E &  
INDUSTRY CANADA RSS-247  
(Class II Permissive Change)**

**TEST REPORT**

**For**

**802.11a/b/g/n/ac WLAN + Bluetooth PCI-E NGFF 2230 Card**

**Model: BCM94350ZAE**

**Trade Name: Broadcom**

*Issued to*

**Broadcom Corporation  
190 Mathilda Avenue, Sunnyvale, CA 94086**

*Issued by*

**Compliance Certification Services Inc.  
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Issued Date: August 6, 2015**



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**Revision History**

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	August 6, 2015	Initial Issue	ALL	Kelly Cheng

## TABLE OF CONTENTS

<b>1. TEST RESULT CERTIFICATION.....</b>	<b>4</b>
<b>2. EUT DESCRIPTION.....</b>	<b>5</b>
<b>3. TEST METHODOLOGY.....</b>	<b>6</b>
3.1    EUT CONFIGURATION.....	6
3.2    EUT EXERCISE.....	6
3.3    GENERAL TEST PROCEDURES.....	6
3.4    FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS .....	7
3.5    DESCRIPTION OF TEST MODES.....	8
<b>4. INSTRUMENT CALIBRATION.....</b>	<b>9</b>
4.1    MEASURING INSTRUMENT CALIBRATION .....	9
4.2    MEASUREMENT EQUIPMENT USED .....	9
4.3    MEASUREMENT UNCERTAINTY .....	9
<b>5. FACILITIES AND ACCREDITATIONS.....</b>	<b>10</b>
5.1    FACILITIES.....	10
5.2    LABORATORY ACCREDITATIONS AND LISTING .....	10
5.3    TABLE OF ACCREDITATIONS AND LISTINGS.....	11
<b>6. SETUP OF EQUIPMENT UNDER TEST.....</b>	<b>12</b>
6.1    SETUP CONFIGURATION OF EUT .....	12
6.2    SUPPORT EQUIPMENT .....	12
<b>7. RSS-247 REQUIREMENTS .....</b>	<b>13</b>
7.1    MAXIMUM CONDUCTED OUTPUT POWER .....	13
7.2    BAND EDGES MEASUREMENT .....	15
7.3    RADIATED EMISSIONS .....	24
7.4    POWERLINE CONDUCTED EMISSIONS .....	60
<b>APPENDIX II PHOTOGRAPHS OF TEST SETUP.....</b>	<b>61</b>
<b>APPENDIX 1 - PHOTOGRAPHS OF EUT</b>	

## 1. TEST RESULT CERTIFICATION

**Applicant:** Broadcom Corporation  
190 Mathilda Avenue, Sunnyvale, CA 94086

**Manufacturer:** Broadcom Corporation  
190 Mathilda Avenue, Sunnyvale, CA 94086

**Equipment Under Test:** 802.11a/b/g/n/ac WLAN + Bluetooth PCI-E NGFF 2230 Card

**Trade Name:** Broadcom

**Model:** BCM94350ZAE

**Date of Test:** July 29 ~ August 4, 2015

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



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Miller Lee  
Manager  
Compliance Certification Services Inc.

Reviewed by



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Angel Cheng  
Section Manager  
Compliance Certification Services Inc.

## 2. EUT DESCRIPTION

<b>Product</b>	802.11a/b/g/n/ac WLAN + Bluetooth PCI-E NGFF 2230 Card		
<b>Trade Name</b>	Broadcom		
<b>Model Number</b>	BCM94350ZAE		
<b>Model Discrepancy</b>	N/A		
<b>Power Supply</b>	Powered from host device		
<b>Received Date</b>	July 22, 2015		
<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 IEEE 802.11ac VHT 80 mode: 5775MHz		
<b>Transmit Power</b>	IEEE 802.11a mode: 17.66 dBm IEEE 802.11n HT 20 MHz mode: 17.66 dBm IEEE 802.11n HT 40 MHz mode: 17.62 dBm IEEE 802.11ac VHT 80 MHz mode: 17.16 dBm		
<b>Modulation Technique &amp; Transmit Data Rate</b>	IEEE 802.11a: OFDM (54, 48, 36, 24, 18, 12, 9, 6 Mbps) IEEE 802.11n HT 20 MHz mode: OFDM (6.5, 7.2, 13, 14.4, 14.44, 19.5, 21.7, 26, 28.89, 28.9, 39, 43.3, 43.33 52, 57.78, 57.8, 58.5, 65.0, 72.2, 78, 86.67, 104, 115.56, 117, 130, 144.44 Mbps) IEEE 802.11n HT 40 MHz mode: OFDM (13.5, 15, 27, 30, 40.5, 45, 54, 60, 81, 90, 108, 120, 121.5, 135, 150, 162, 180, 216, 240, 243, 270, 300 Mbps) IEEE 802.11ac VHT 80 mode: OFDM (29.3, 58.5, 87.8, 117, 175.5, 234, 263.3, 292.5, 351, 390, 468, 526.5, 585, 702, 780 Mbps)		
<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 IEEE 802.11ac VHT 80 mode: 1 Channels		
<b>Antenna Specification</b>	1. High-Tek Electronics Co., Ltd PIFA Antenna P/N : 025.900CR.0001 (Main) / 2.48 dBi (Worse) 025.900CR.0001 (Aux) / 1.70 dBi 2. Wistron Neweb Corporation PIFA Antenna P/N : 025.900CR.0011 (Main) / -4.39 dBi 025.900CR.0011 (Aux) / -3.04 dBi		
<b>Host Brand</b>	Lenovo	<b>Host Model Name</b>	Flex 3-1570
			Flex 3-1535
			Flex 3-1580
<b>Class II Permissive Change</b>	Adding the portable platforms Flex 3-1570, Flex 3-1535, Flex 3-1580, The host have the same antenna type as originally approved with lower gains.		

**Remark:**

1. The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.
2. This submittal(s) (test report) is intended for FCC&IC ID: **QDS-BRCM1087** & **4324A-BRCM1087** filing to comply with FCC Part 15C, Section 15.207, 15.209 and IC RSS-247 & RSS-GEN.
3. Choosing the maximum antenna gain for the test

### **3. TEST METHODOLOGY**

The tests documented in this report were performed in accordance with ANSI C63.10: 2009 and FCC CFR 47 Part 15.207, 15.209, 15.247.

The tests documented in this report were performed in accordance with IC RSS-247, IC RSS-Gen and ANSI C63.10:2013.

This submittal(s) (test report) is intended for IC Certification with Industry Canada RSS-247.

#### **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**

The EUT is placed on the turntable, which is positioned at 0.8 m above the ground plane. According to the requirements in ANSI C63.10: 2013 for IC, ANSI C63.10: 2009 for FCC, 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 for IC, ANSI C63.10: 2009 for FCC.

### 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
<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.

### **3.5 DESCRIPTION OF TEST MODES**

The EUT (model: BCM94350ZAE) 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: The EUT has Notebook mode, Flat mode, Tent mode, Stand mode, Tablet X, Y and Z axis modes. The worst emission was found in Tablet X axis mode and the worst case was recorded.

## 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.

Wugu 966 Chamber A				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	US42510268	09/18/2015
EMI Test Receiver	R&S	ESCI	100064	06/04/2016
Bilog Antenna	Sunol Sciences	JB3	A030105	08/19/2015
Horn Antenna	EMCO	3117	00055165	01/26/2016
Horn Antenna	EMCO	3116	26370	12/25/2015
Turn Table	CCS	CC-T-1F	N/A	N.C.R
Antenna Tower	CCS	CC-A-1F	N/A	N.C.R
Controller	CCS	CC-C-1F	N/A	N.C.R
Pre-Amplifier	MITEQ	1652-3000	1490939	08/09/2016
Pre-Amplifier	EMC	EMC 01265	4035	06/04/2016
Pre-Amplifier	MITEQ	AMF-6F-260400-40-8P	985646	12/25/2015
Coaxial Cable	Huber+Suhner	102	29212/2	12/25/2015
Coaxial Cable	Huber+Suhner	102	29406/2	12/25/2015
Test S/W	EZ-EMC (CCS-3A1RE)			

### 4.3 MEASUREMENT UNCERTAINTY

PARAMETER	UNCERTAINTY
Powerline Conducted Emission	N/A
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 for IC, ANSI C63.10: 2009 for FCC 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	 Testing Laboratory 1309
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 II for the actual connections between EUT and support equipment.

### 6.2 SUPPORT EQUIPMENT

No.	Device Type	Brand	Model	Series No.	FCC ID	Data Cable	Power Cord
1	Notebook PC	Lenovo	Flex 3-1580	N/A	FCC DOC	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

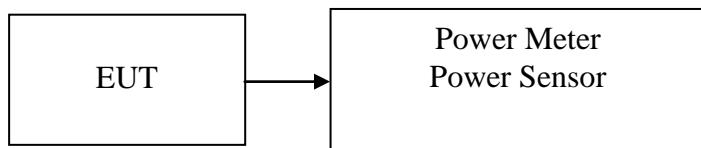
### 7.1 MAXIMUM CONDUCTED OUTPUT POWER

#### 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)	Chain 0 Output Power (dBm)	Chain 1 Output Power (dBm)	Total Maximum Conducted Output Power (dBm)	Limit (dBm)
149	5745	14.40	14.80	17.61	30
157	5785	14.60	14.70	*17.66	30
165	5825	14.30	14.70	17.51	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)	Total Maximum Conducted Output Power (dBm)	Limit (dBm)
149	5745	14.50	14.40	17.46	30
153	5765	14.20	14.80	17.52	30
157	5785	14.40	14.70	17.56	30
165	5825	14.60	14.70	*17.66	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)	Total Maximum Conducted Output Power (dBm)	Limit (dBm)
151	5755	14.30	14.90	*17.62	30
159	5795	14.40	14.80	17.61	30

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

Channel	Frequency (MHz)	Chain 0 Output Power (dBm)	Chain 1 Output Power (dBm)	Total Maximum Conducted Output Power (dBm)	Limit (dBm)
155	5775	14.10	14.20	*17.16	30

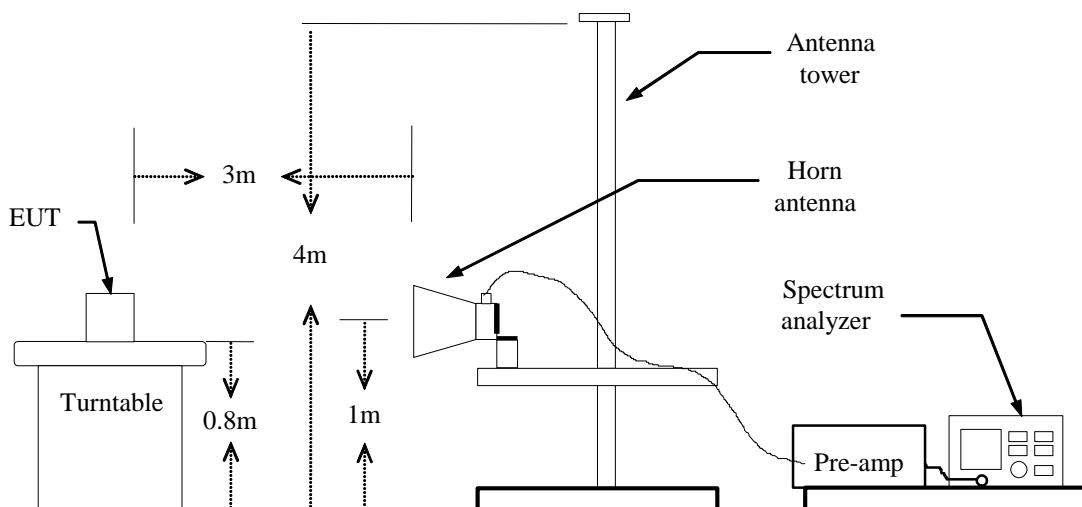
**Remark:** Total Output Power (w) = Chain 0 (10^(Output Power /10)/1000)+ Chain 1 (10^(Output Power /10)/1000)

## 7.2 BAND EDGES MEASUREMENT

### LIMIT

According to §15.407 & RSS-247 §, 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.

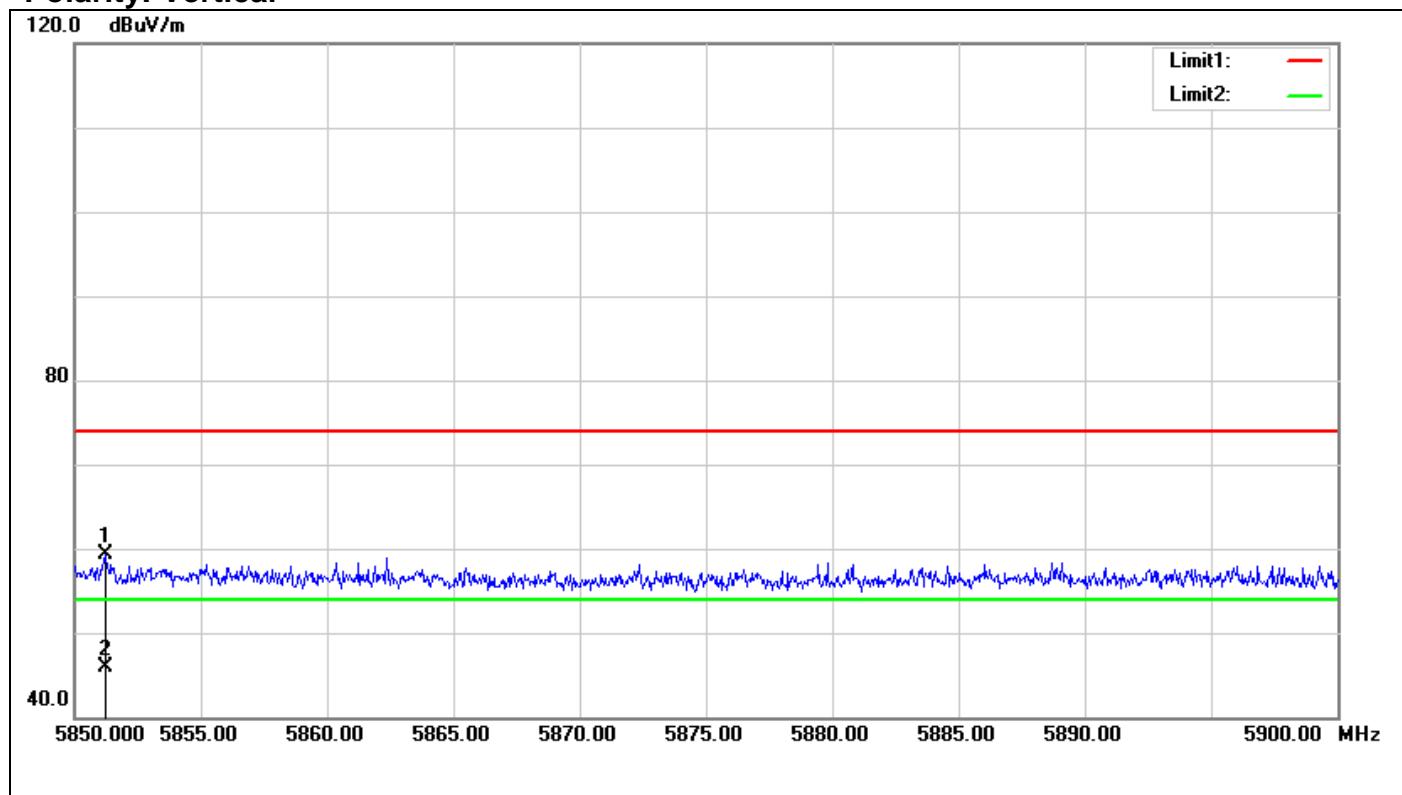
**IEEE 802.11a mode:** = 95%, VBW= 510Hz  
**IEEE 802.11n HT 20 MHz mode:** = 95%, VBW= 560Hz  
**IEEE 802.11n HT 40 MHz mode:** = 92%, VBW= 1.1KHz  
**IEEE 802.11ac VHT 80 MHz mode:** = 95%, VBW= 2.2KHz
5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

### TEST RESULTS

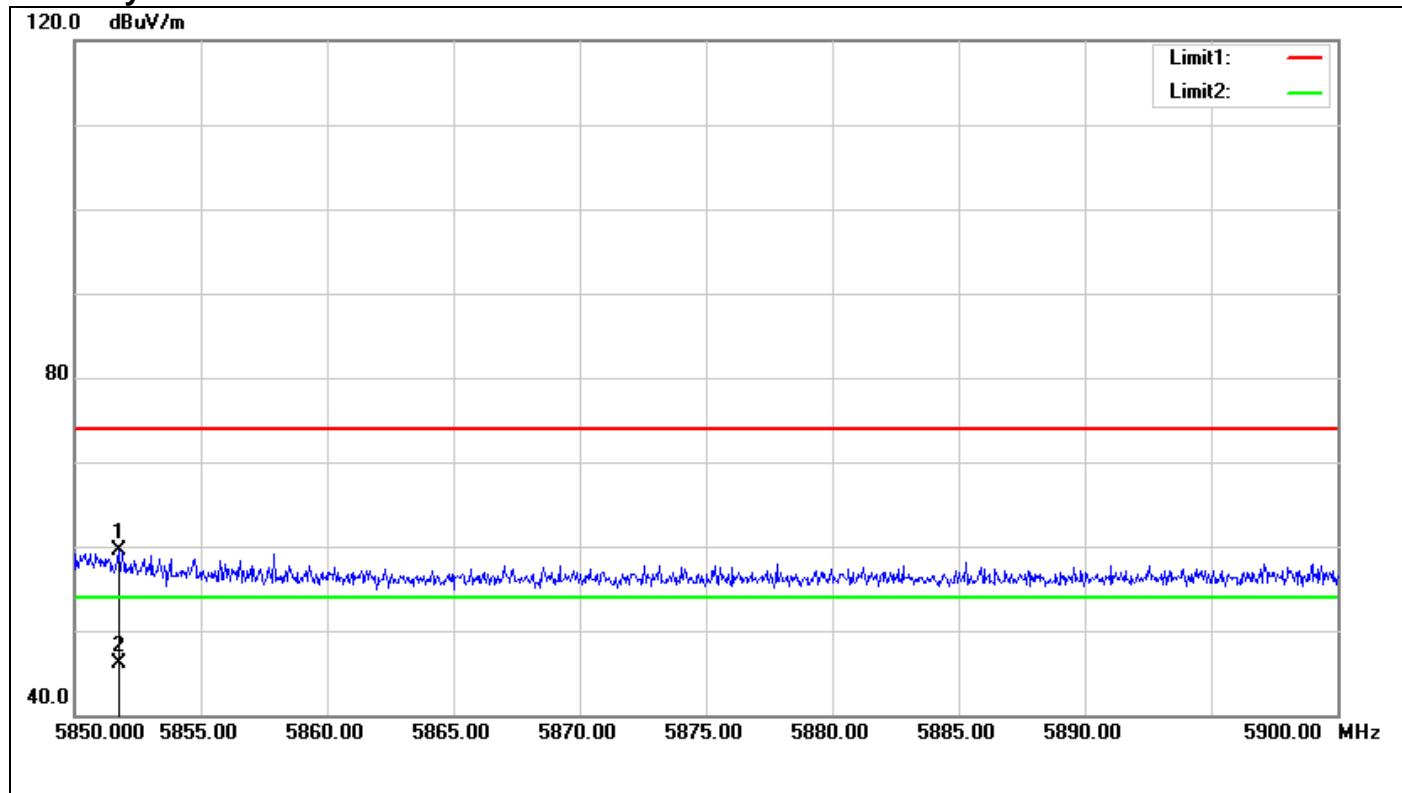
Refer to attach spectrum analyzer data chart.

## Band Edges (IEEE 802.11a mode / CH 5825 MHz)

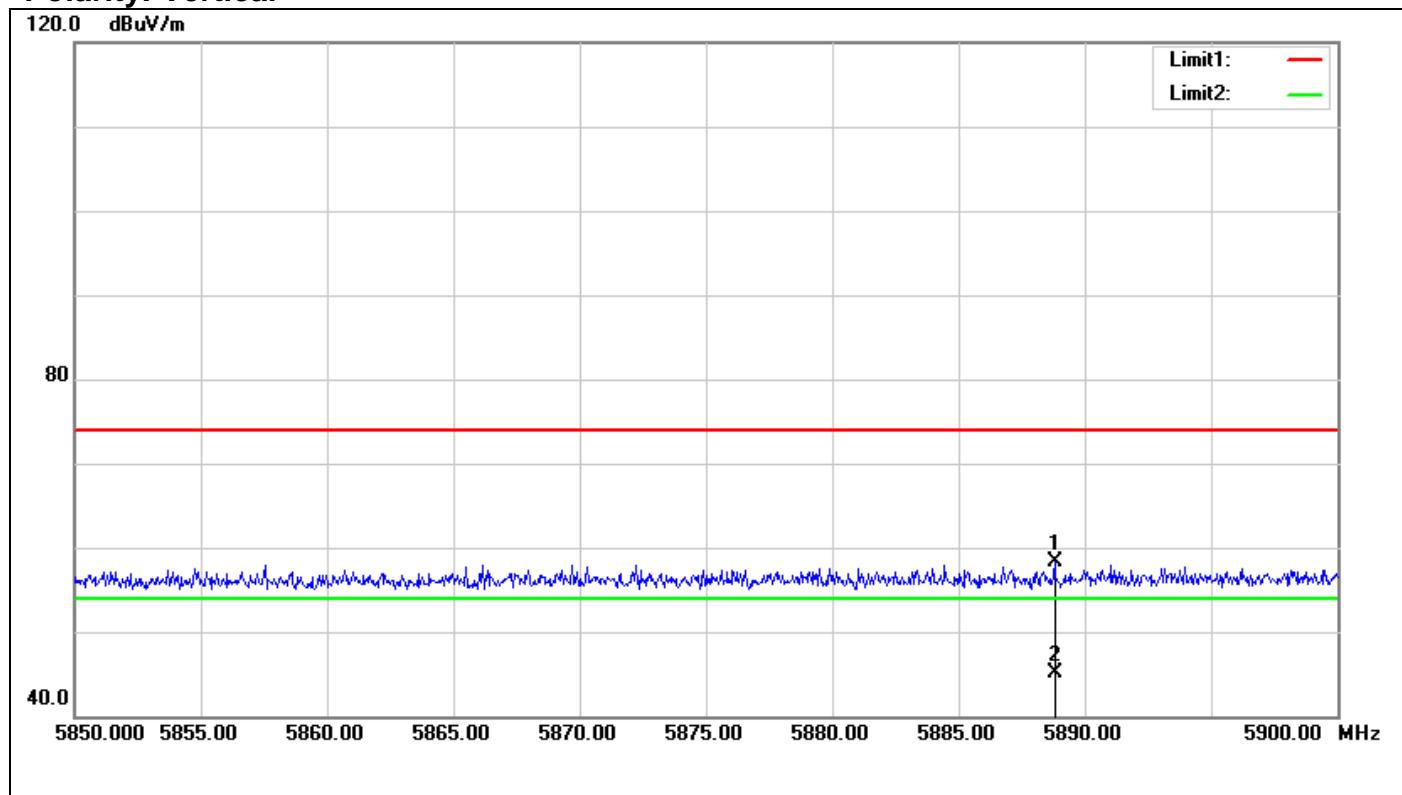
## Polarity: Vertical



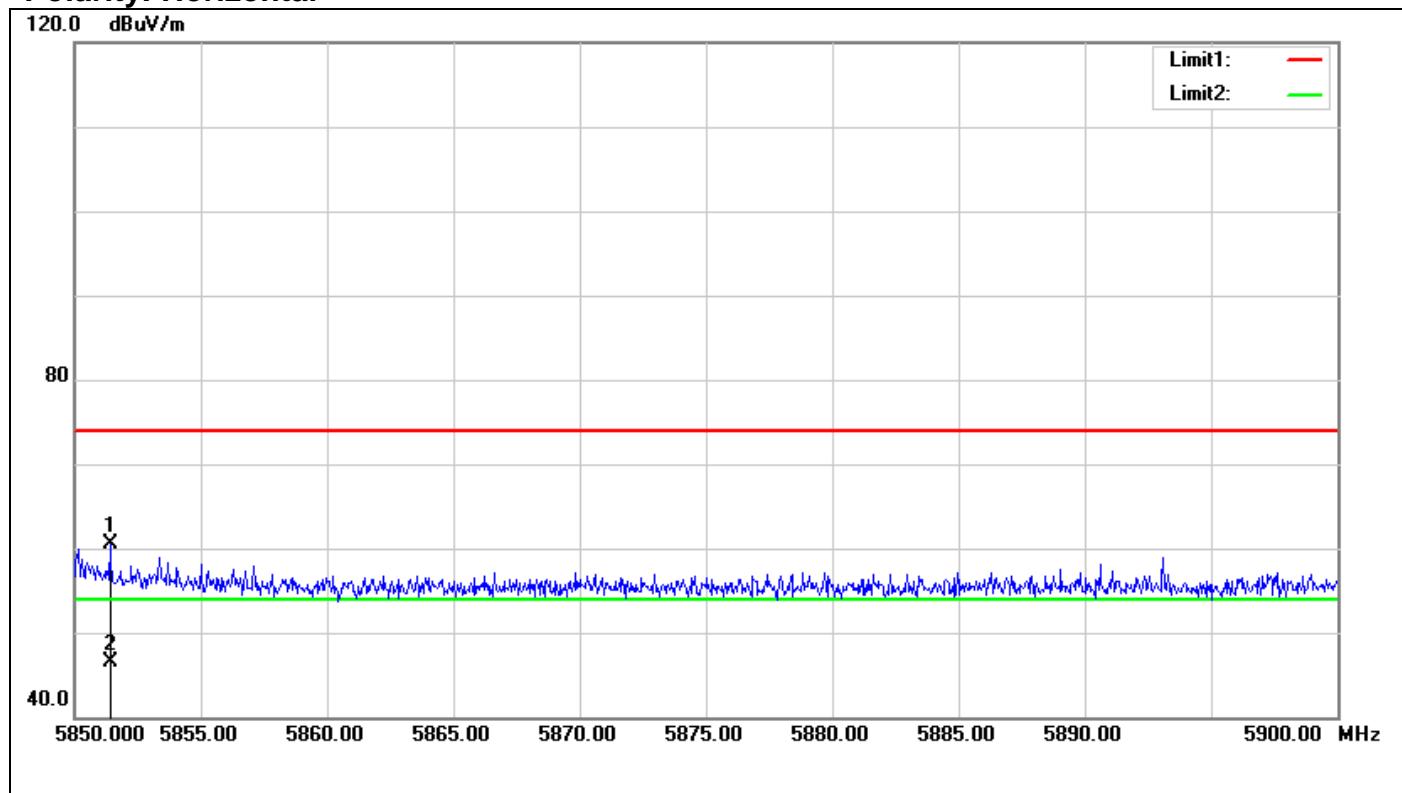
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	5851.200	52.55	6.75	59.30	74.00	-14.70	100	258	peak
2	5851.200	39.11	6.75	45.86	54.00	-8.14	100	258	AVG

**Polarity: Horizontal**

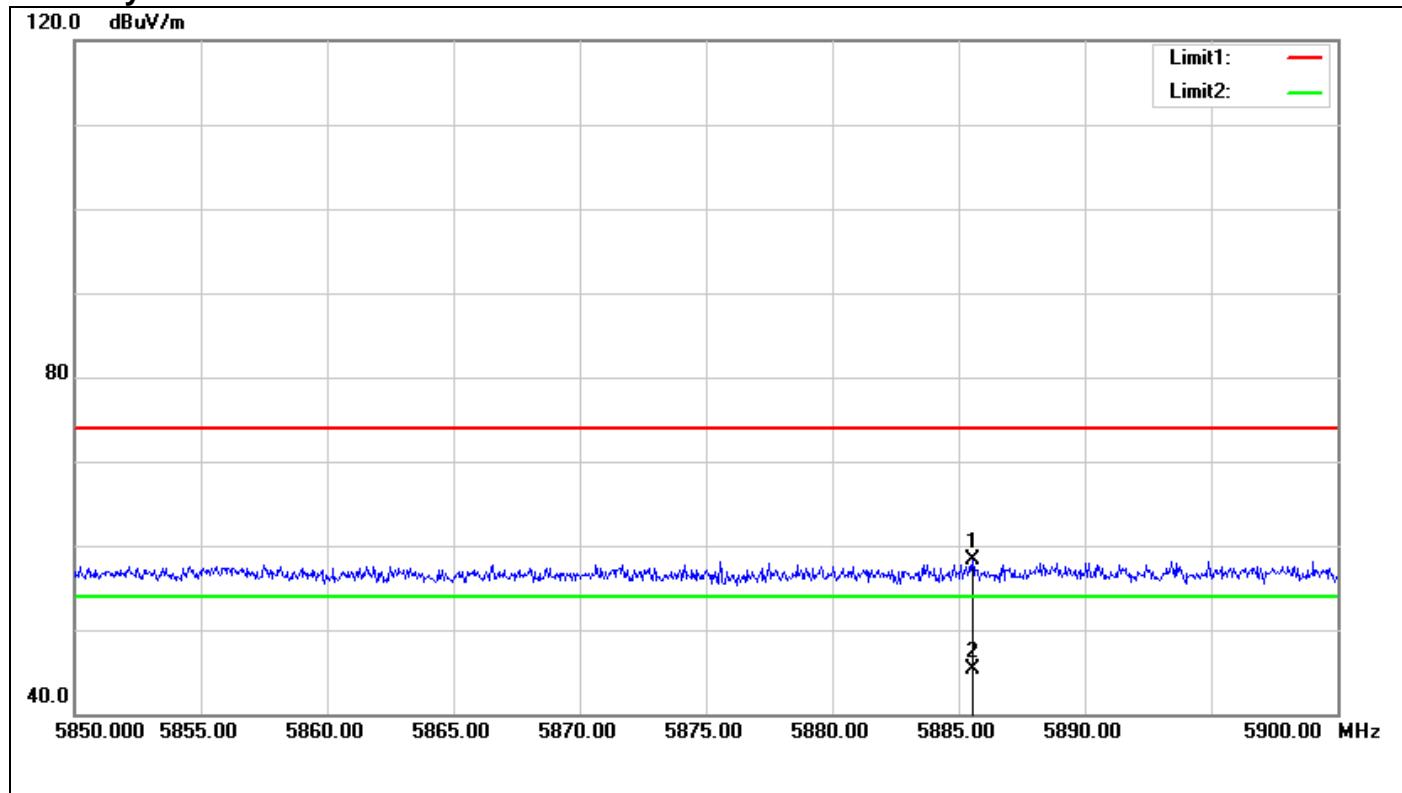
No.	Frequency	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(°)	
1	5851.750	52.77	6.75	59.52	74.00	-14.48	100	359	peak
2	5851.750	39.37	6.75	46.12	54.00	-7.88	100	359	AVG

**Band Edges (IEEE 802.11n HT 20 MHz mode / CH 5825 MHz)****Polarity: Vertical**

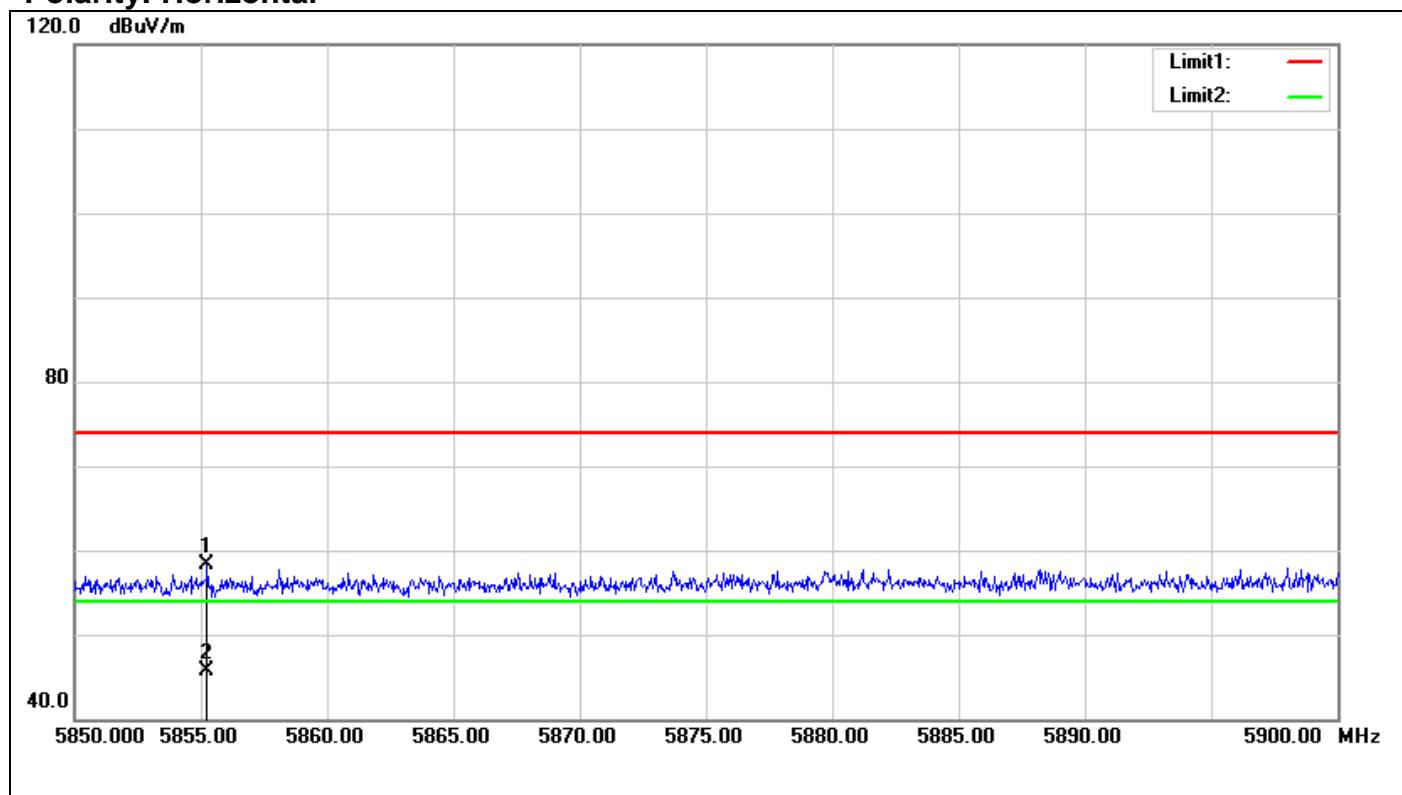
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	5888.800	51.40	6.91	58.31	74.00	-15.69	100	122	peak
2	5888.800	38.15	6.91	45.06	54.00	-8.94	100	122	AVG

**Polarity: Horizontal**

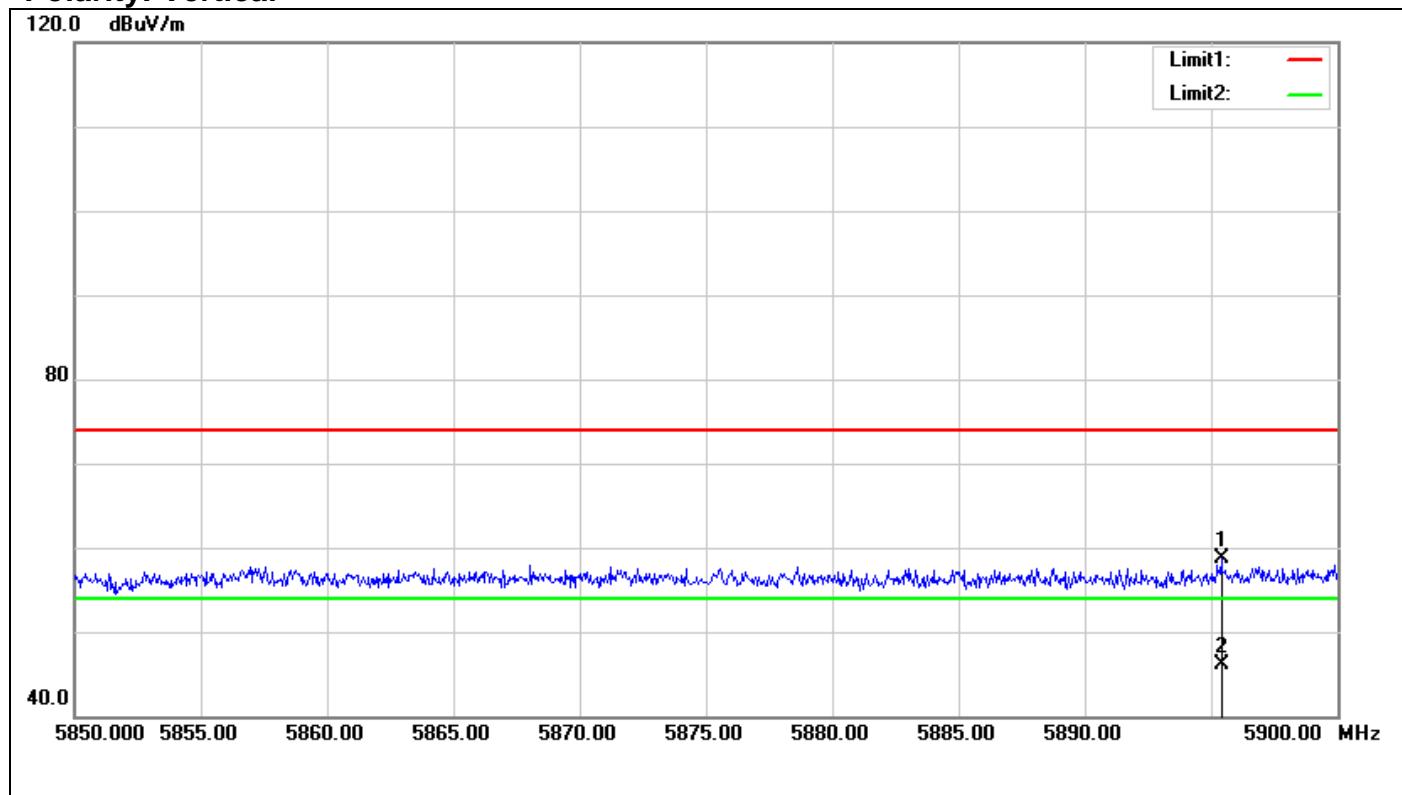
No.	Frequency	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(°)	
1	5851.400	53.72	6.75	60.47	74.00	-13.53	100	203	peak
2	5851.400	39.77	6.75	46.52	54.00	-7.48	100	203	AVG

**Band Edges (IEEE 802.11n HT 40 MHz mode / CH 5795 MHz)****Polarity: Vertical**

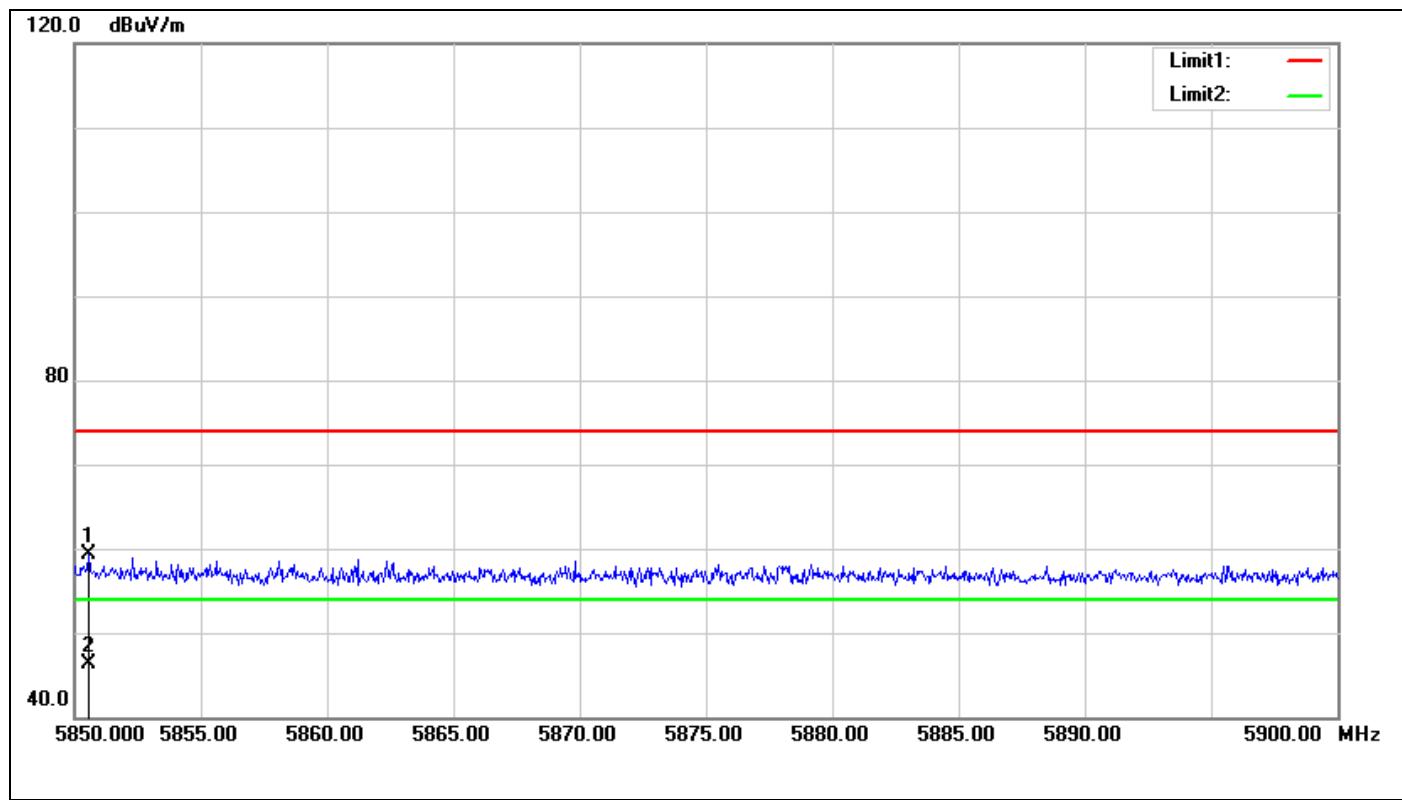
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	5885.550	51.49	6.89	58.38	74.00	-15.62	100	142	peak
2	5885.550	38.32	6.89	45.21	54.00	-8.79	100	142	AVG

**Polarity: Horizontal**

No.	Frequency	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(°)	
1	5855.250	51.63	6.76	58.39	74.00	-15.61	100	133	peak
2	5855.250	39.00	6.76	45.76	54.00	-8.24	100	133	AVG

**Band Edges (IEEE 802.11ac VHT 80 MHz mode / CH 5775 MHz)****Polarity: Vertical**

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	5895.400	51.79	6.93	58.72	74.00	-15.28	100	339	peak
2	5895.400	39.14	6.93	46.07	54.00	-7.93	100	339	AVG

**Polarity: Horizontal**

No.	Frequency	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(°)	
1	5850.550	52.47	6.74	59.21	74.00	-14.79	100	353	peak
2	5850.550	39.63	6.74	46.37	54.00	-7.63	100	353	AVG

## 7.3 RADIATED EMISSIONS

### LIMIT

All spurious emissions shall comply with the limits of §15.209(a) and RSS-Gen Table 2 & Table 5.

#### RSS-Gen Table 2 & Table 5: General Field Strength Limits for Transmitters and Receivers at Frequencies Above 30 MHz (Note)

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)

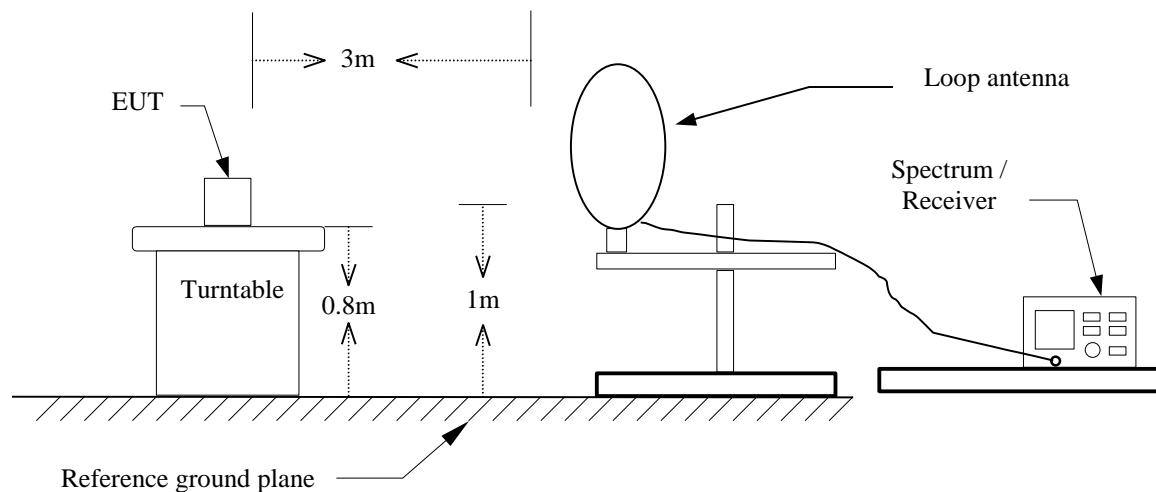
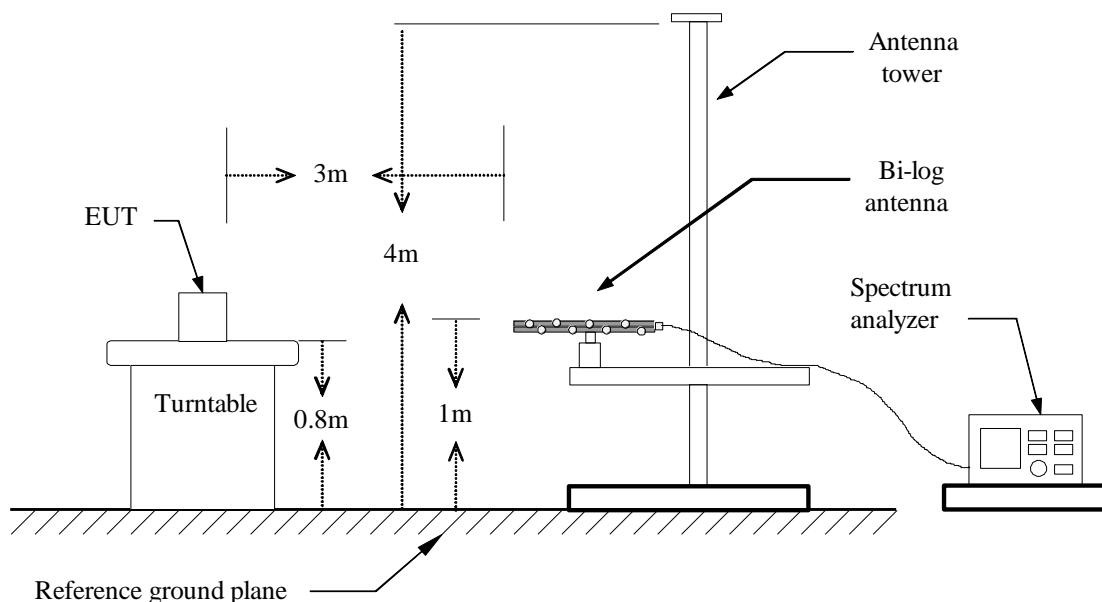
**Note:** \*Measurements for compliance with limits in the above table may be performed at distances other than 3 metres, in accordance with Section 7.2.7.

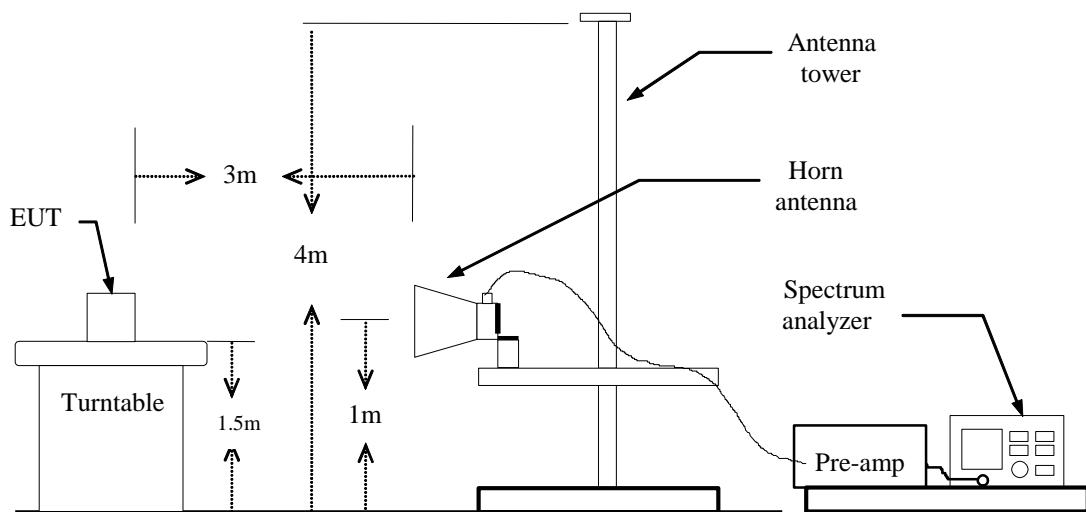
Transmitting devices are not permitted in Table 1 bands or, unless stated otherwise, in TV bands (54-72 MHz, 76-88 MHz, 174-216 MHz, 470-608 MHz and 614-806 MHz).

#### RSS-Gen Table 6: 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)	3000
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, which is 1.5m 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.

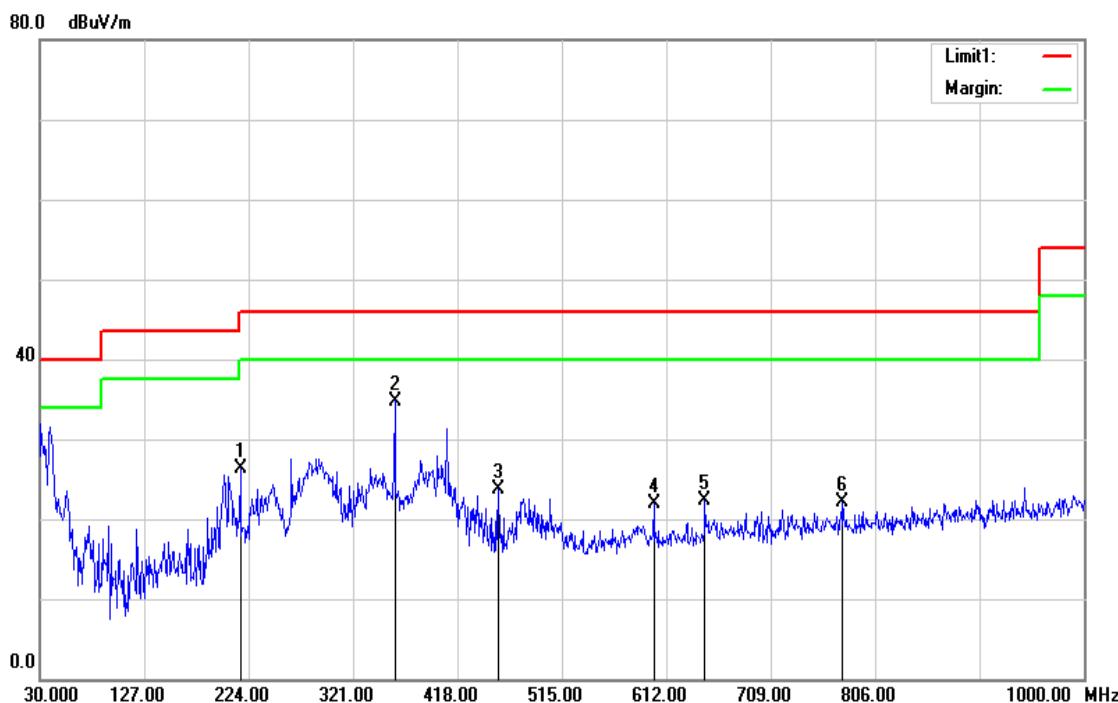
**IEEE 802.11a mode:** = 95%, VBW= 510Hz

**IEEE 802.11n HT 20 MHz mode:** = 95%, VBW= 560Hz

**IEEE 802.11n HT 40 MHz mode:** = 92%, VBW= 1.1KHz

**IEEE 802.11ac VHT 80 MHz mode:** = 95%, VBW= 2.2KHz

7. Repeat above procedures until the measurements for all frequencies are complete.

**Below 1 GHz****Operation Mode:** Normal Link**Test Date:** July 29, 2015**Temperature:** 27°C**Tested by:** Jason Lu**Humidity:** 53% RH**Polarity:** Ver.

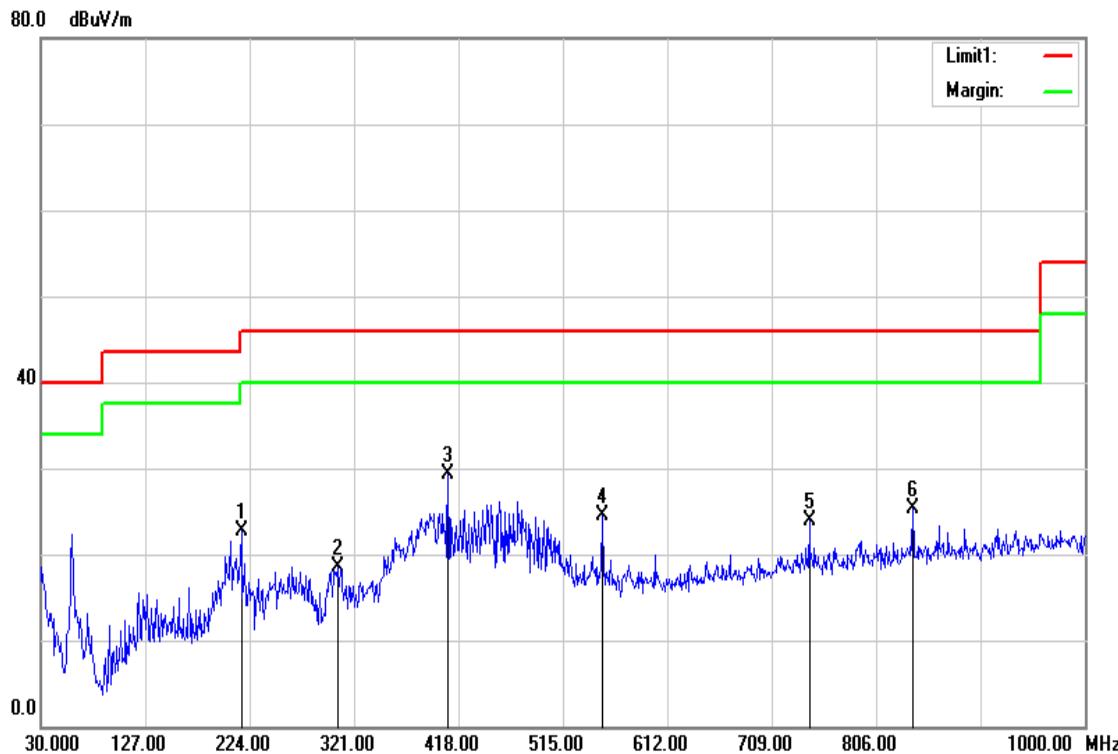
Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
216.2400	42.91	-16.69	26.22	46.00	-19.78	peak	V
359.8000	47.46	-12.66	34.80	46.00	-11.20	peak	V
455.8300	33.73	-10.08	23.65	46.00	-22.35	peak	V
600.3600	29.56	-7.75	21.81	46.00	-24.19	peak	V
647.8900	28.92	-6.62	22.30	46.00	-23.70	peak	V
775.9300	26.74	-4.70	22.04	46.00	-23.96	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  
**Temperature:** 27°C  
**Humidity:** 53% RH

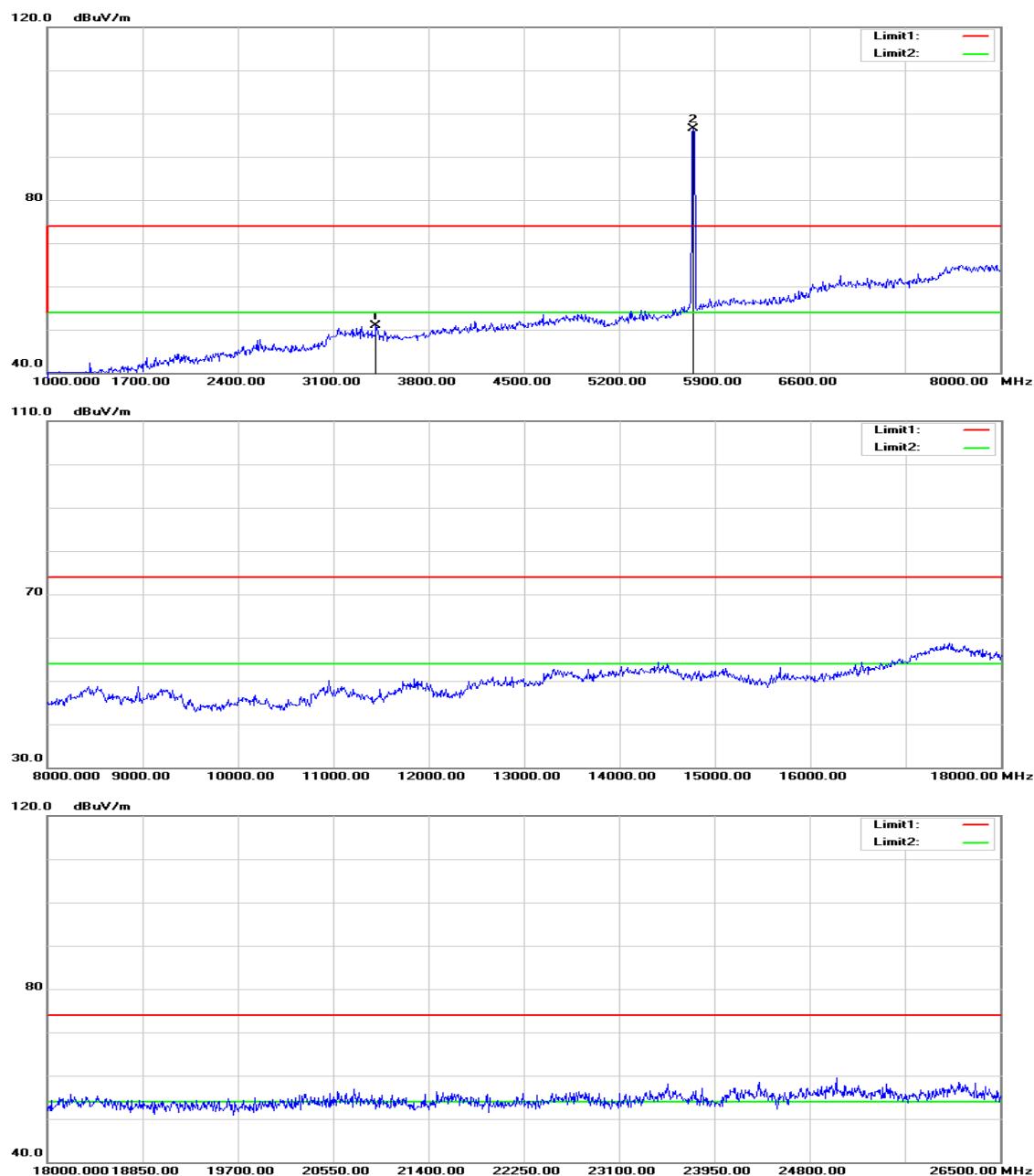
**Test Date:** July 29, 2015  
**Tested by:** Jason Lu  
**Polarity:** Hor.

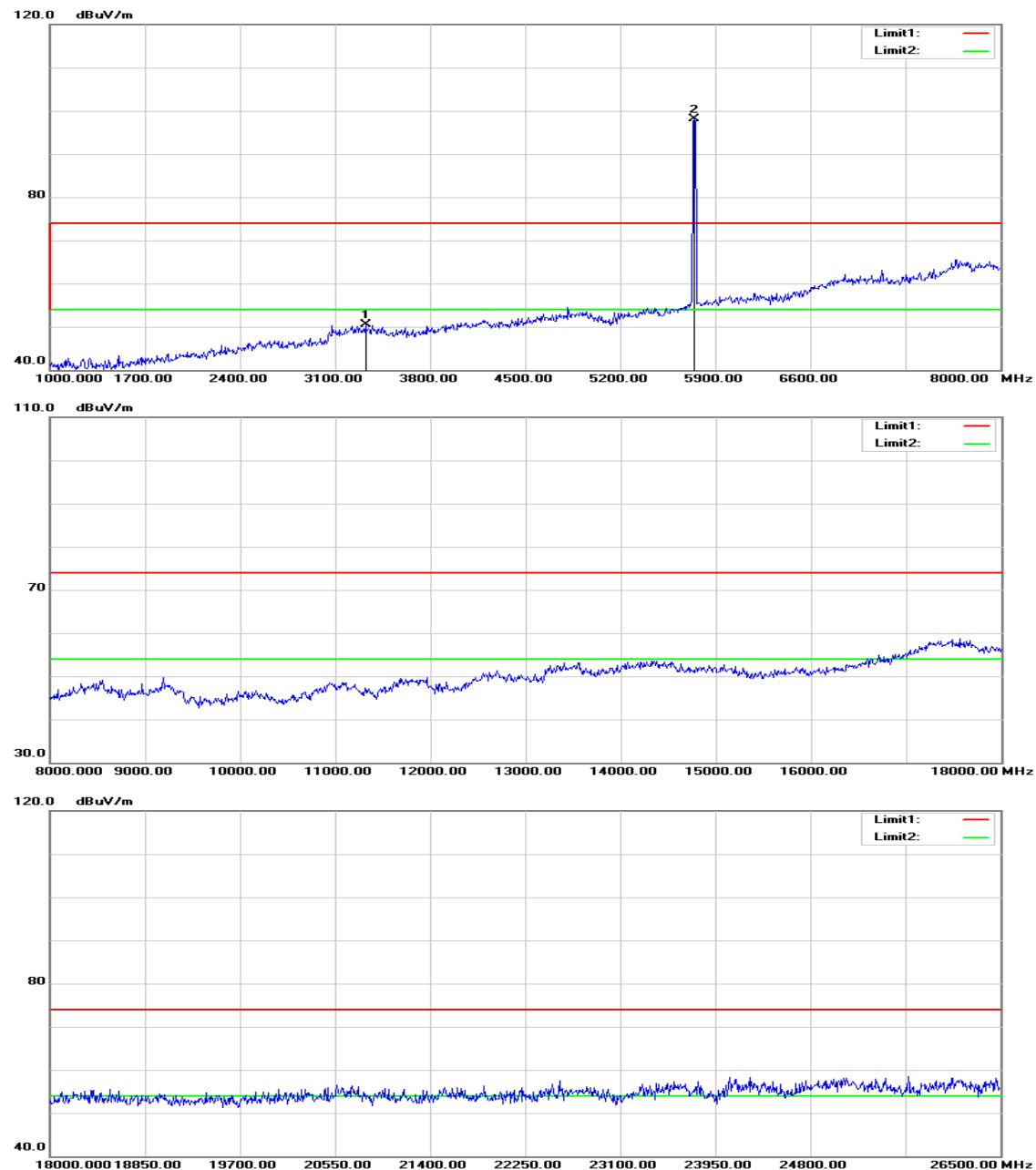


Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
216.2400	39.43	-16.69	22.74	46.00	-23.26	peak	H
305.4800	32.54	-14.09	18.45	46.00	-27.55	peak	H
408.3000	40.70	-11.45	29.25	46.00	-16.75	peak	H
551.8600	32.98	-8.46	24.52	46.00	-21.48	peak	H
743.9200	29.01	-5.06	23.95	46.00	-22.05	peak	H
839.9500	29.17	-3.92	25.25	46.00	-20.75	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:** August 2, 2015

**Temperature:** 27°C

**Tested by:** Jason Lu

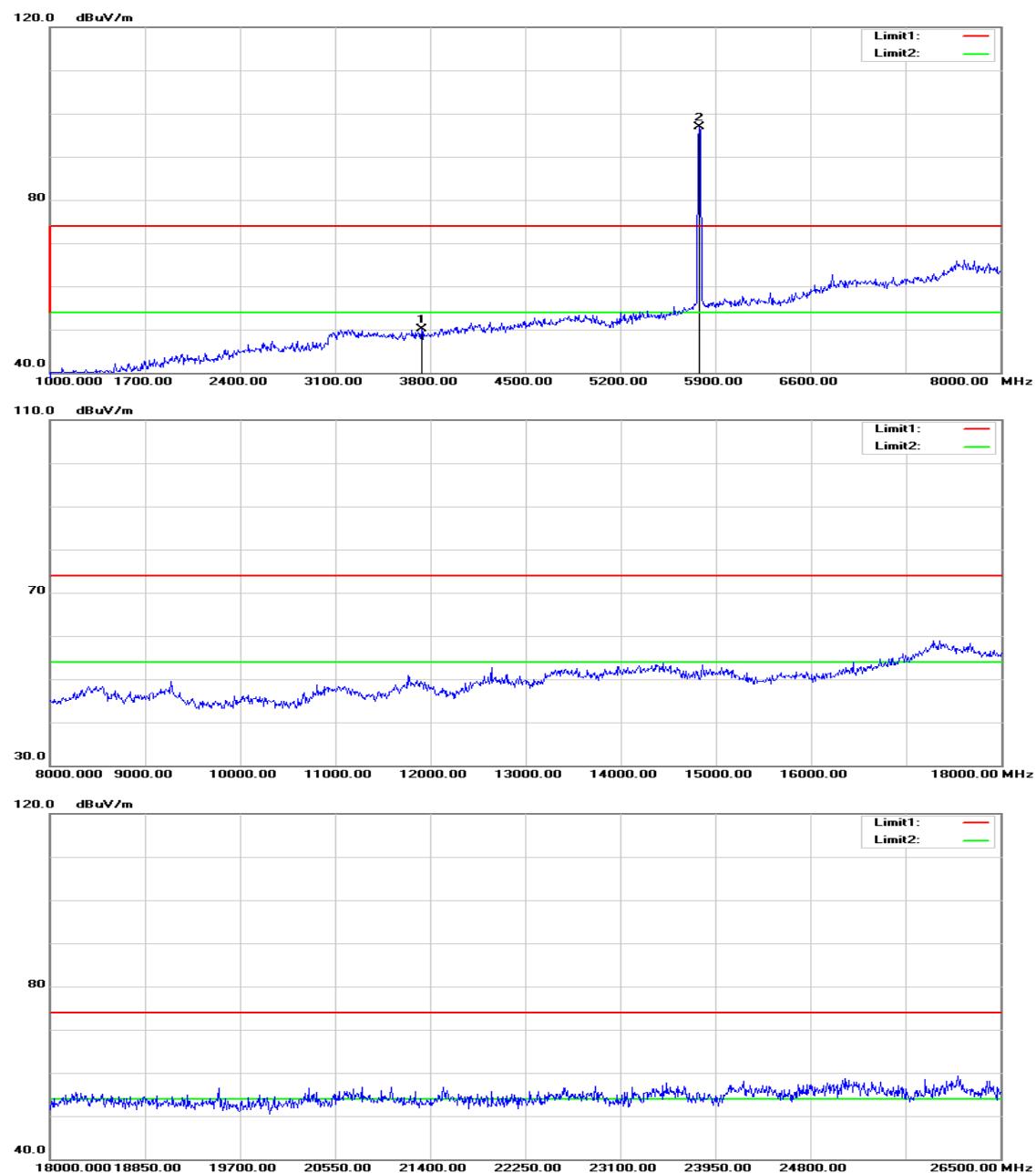
**Humidity:** 53% RH

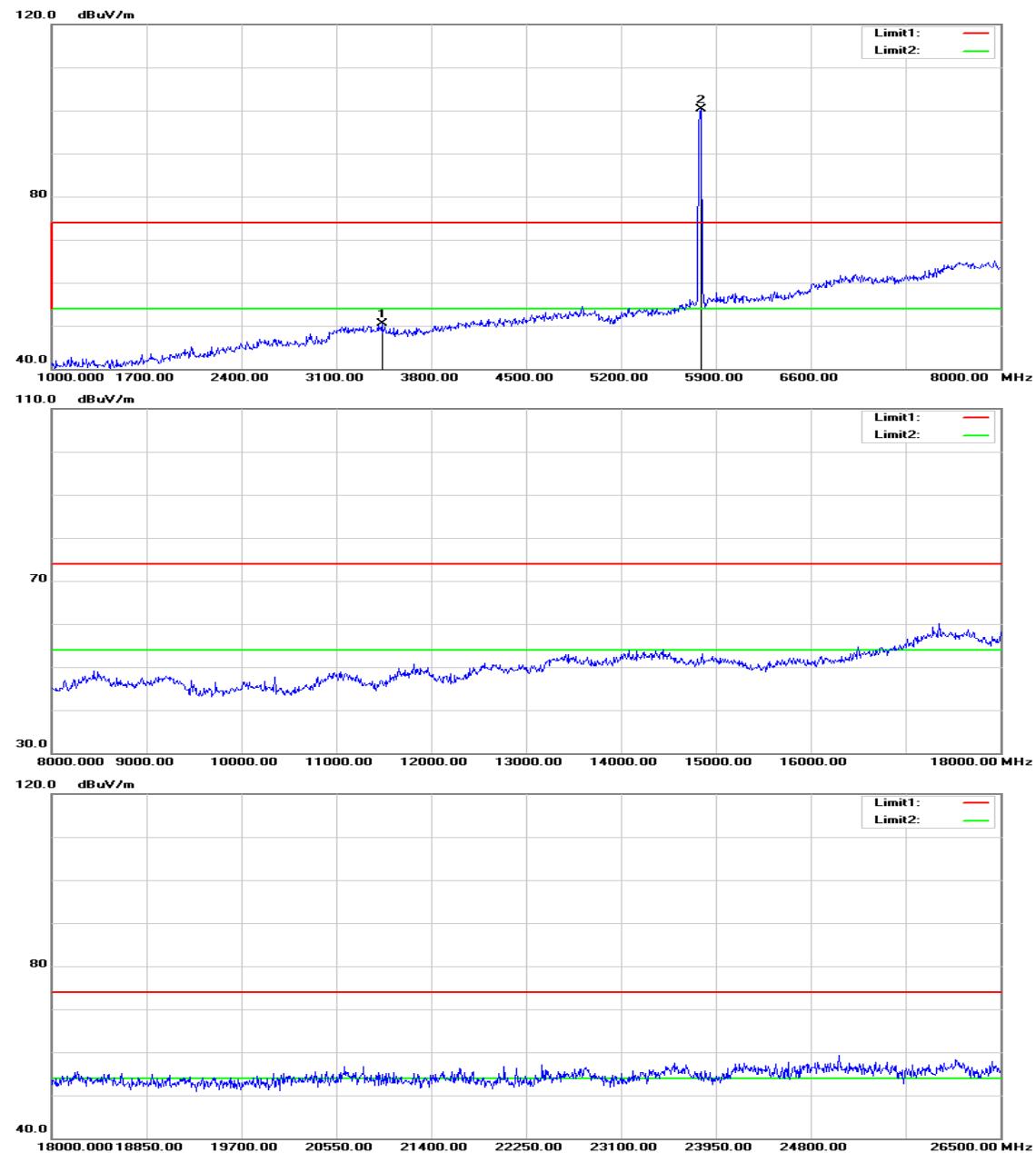
**Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
3415.000	52.09	-1.11	50.98	74.00	-23.02	peak	V
N/A							
3324.000	51.79	-1.33	50.46	74.00	-23.54	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:** August 2, 2015

**Temperature:** 27°C

**Tested by:** Jason Lu

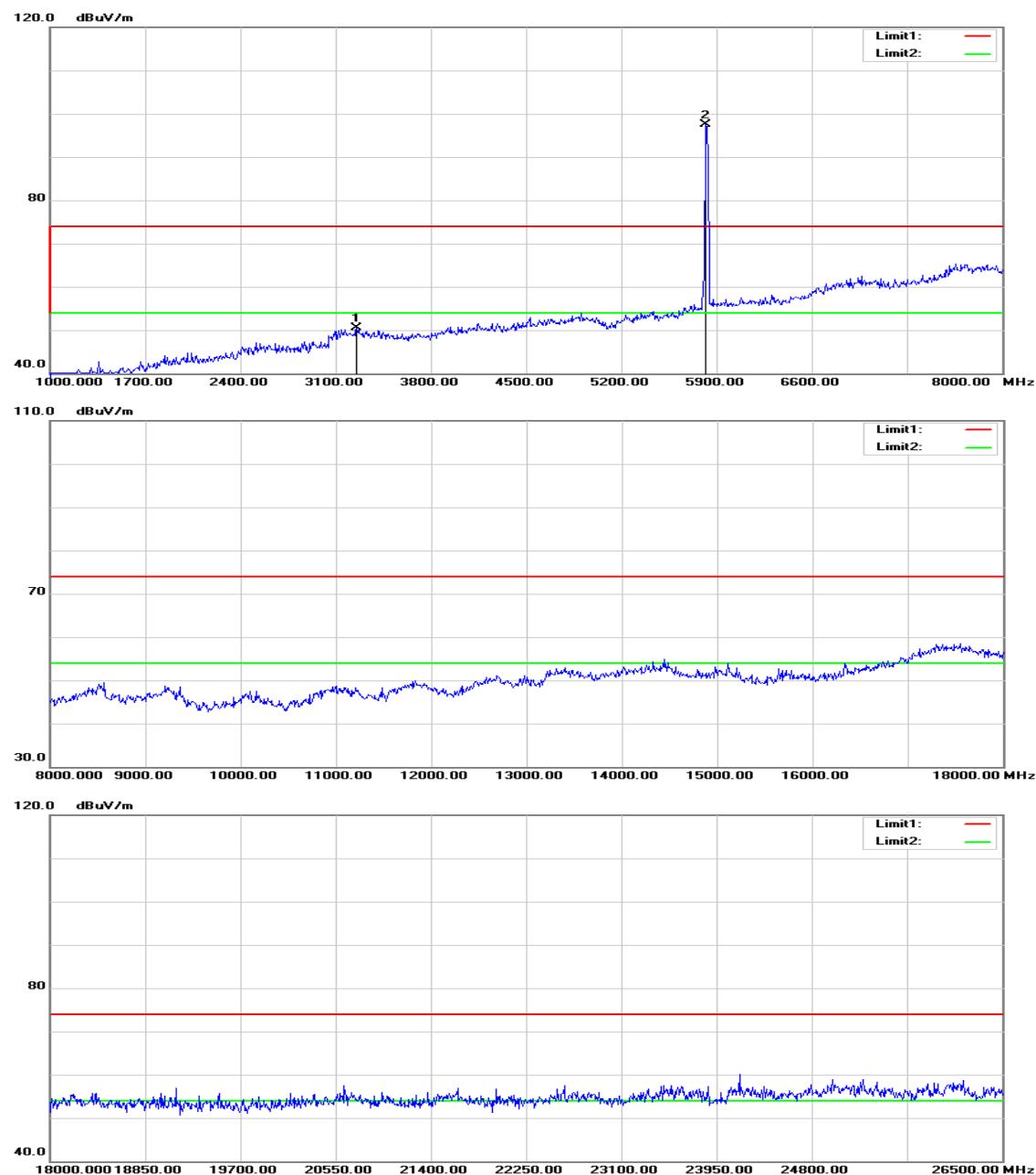
**Humidity:** 53% RH

**Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
3737.000	50.00	0.10	50.10	74.00	-23.90	peak	V
N/A							
3436.000	51.47	-1.06	50.41	74.00	-23.59	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:** August 2, 2015

**Temperature:** 27°C

**Tested by:** Jason Lu

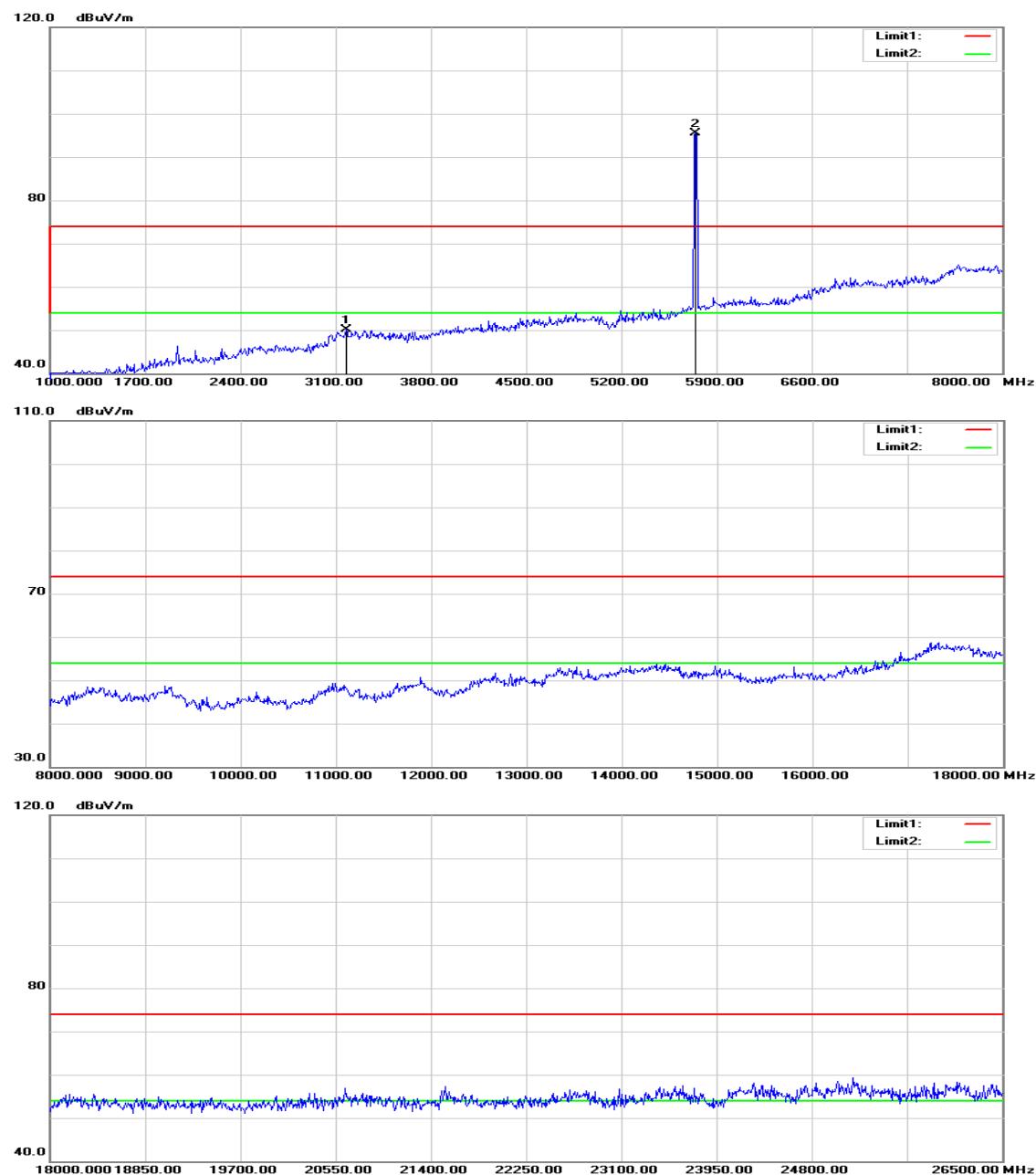
**Humidity:** 53% RH

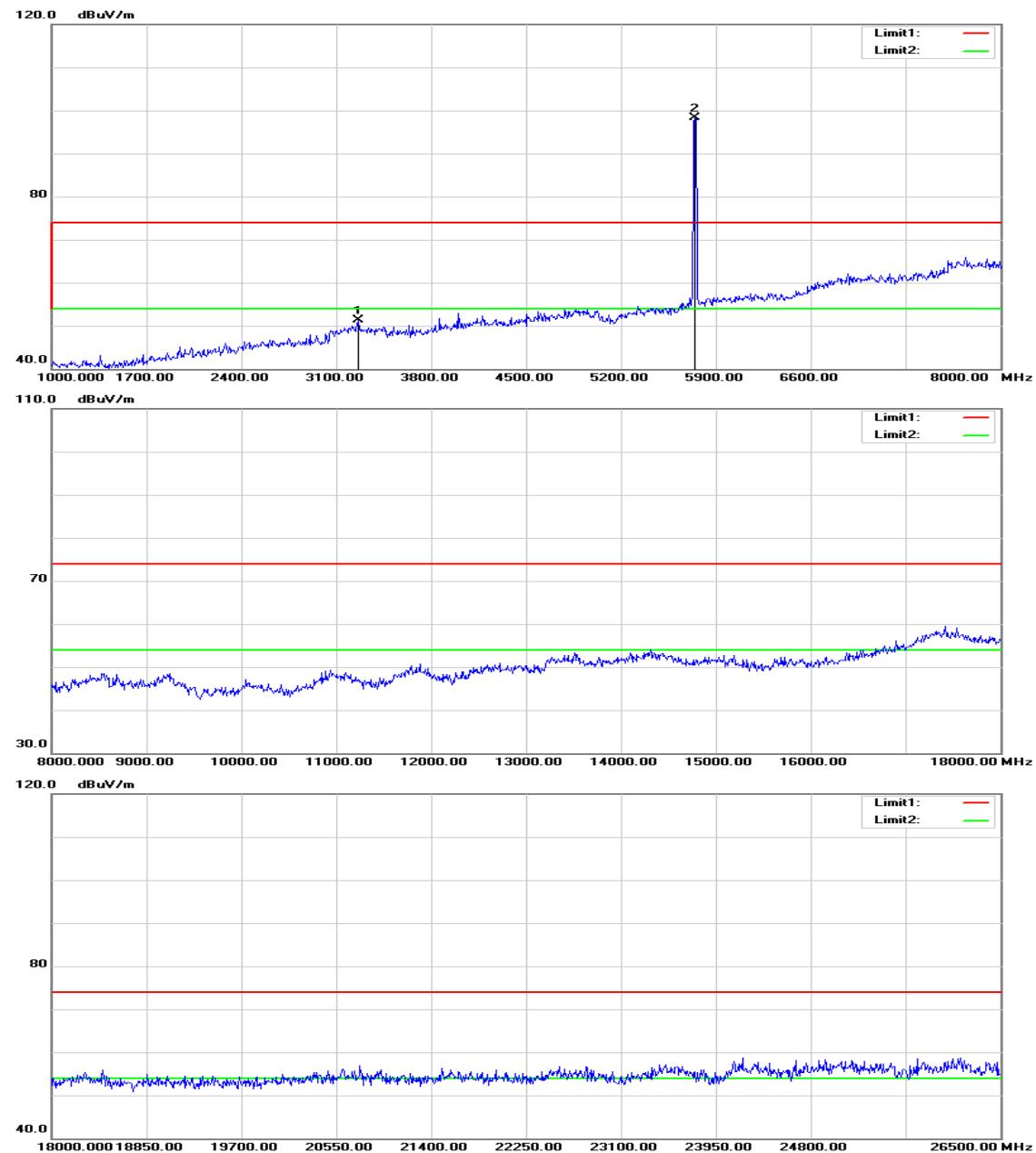
**Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
3254.000	52.04	-1.50	50.54	74.00	-23.46	peak	V
N/A							
3261.000	51.98	-1.48	50.50	74.00	-23.50	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 / 5745 MHz****Polarity: Vertical**

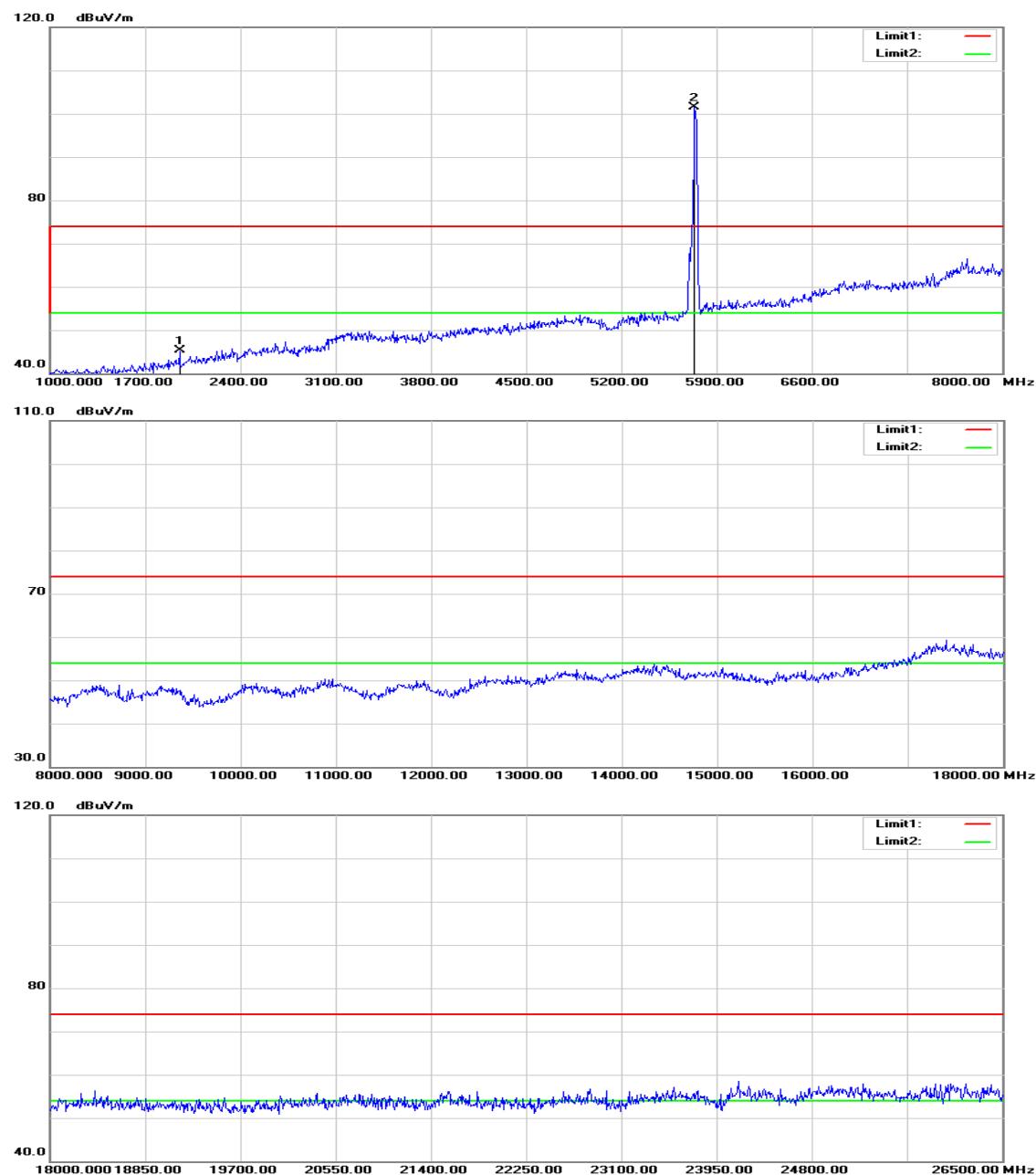
**Polarity: Horizontal**

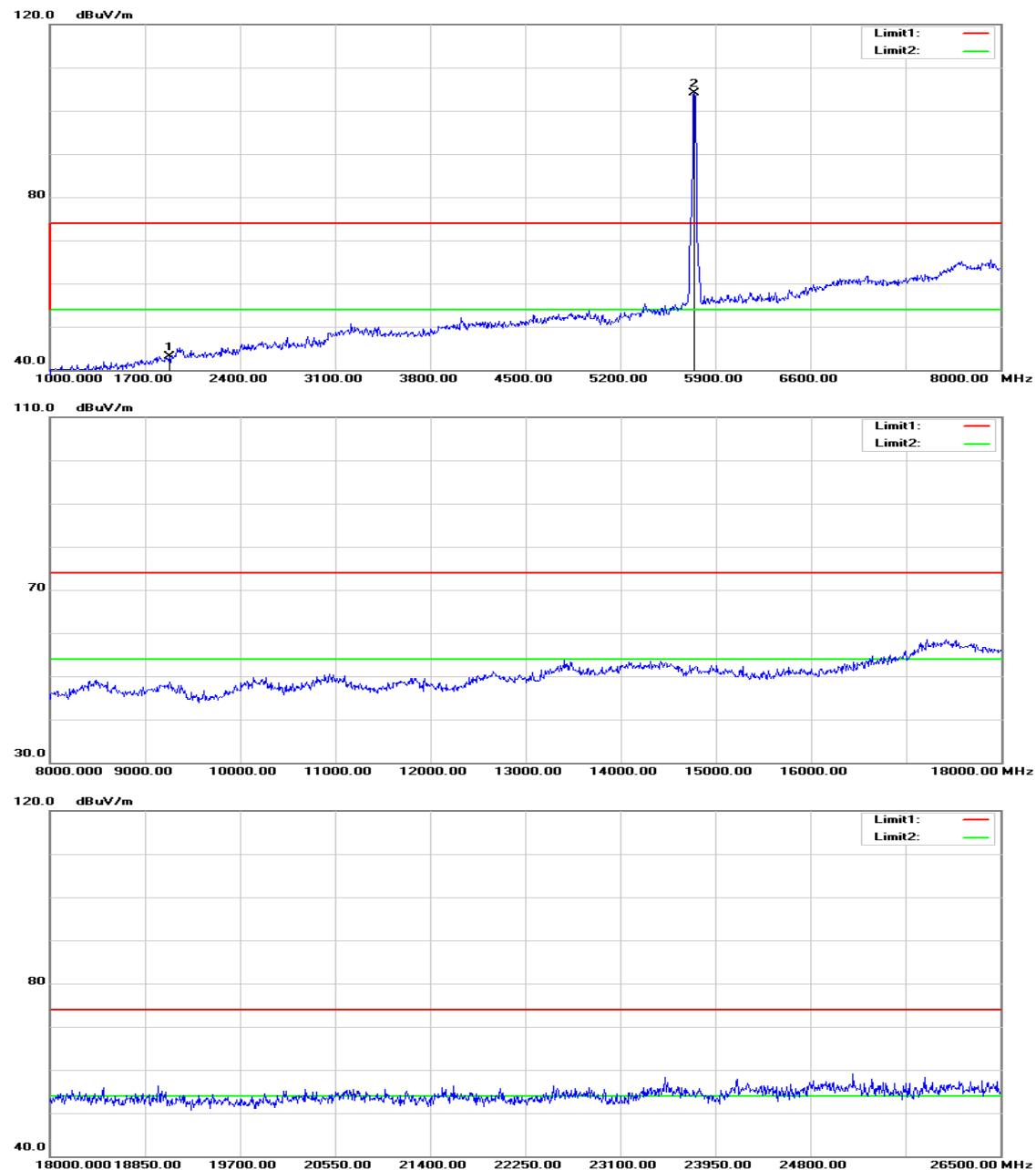
**Operation Mode:** TX / IEEE 802.11n HT 20 MHz mode / 5745MHz**Test Date:** August 2, 2015**Temperature:** 27°C**Tested by:** Jason Lu**Humidity:** 53% RH**Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
3177.000	51.71	-1.69	50.02	74.00	-23.98	peak	V
N/A							
3261.000	52.79	-1.48	51.31	74.00	-22.69	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 / 5765 MHz****Polarity: Vertical**

**Polarity: Horizontal**

**Operation Mode:** TX / IEEE 802.11n HT 20 MHz mode / 5765MHz

**Test Date:** August 4, 2015

**Temperature:** 27°C

**Tested by:** Jason Lu

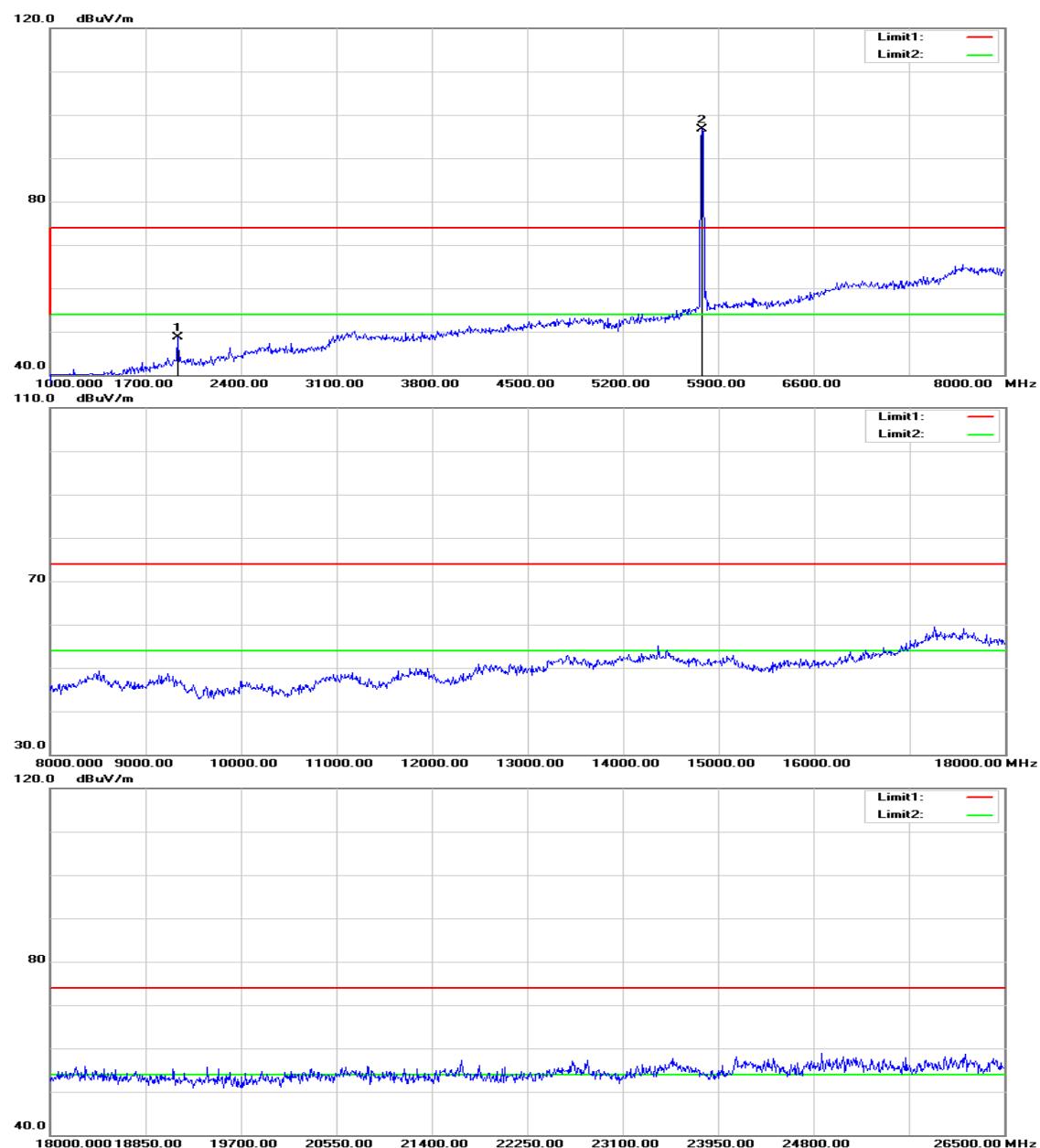
**Humidity:** 53% RH

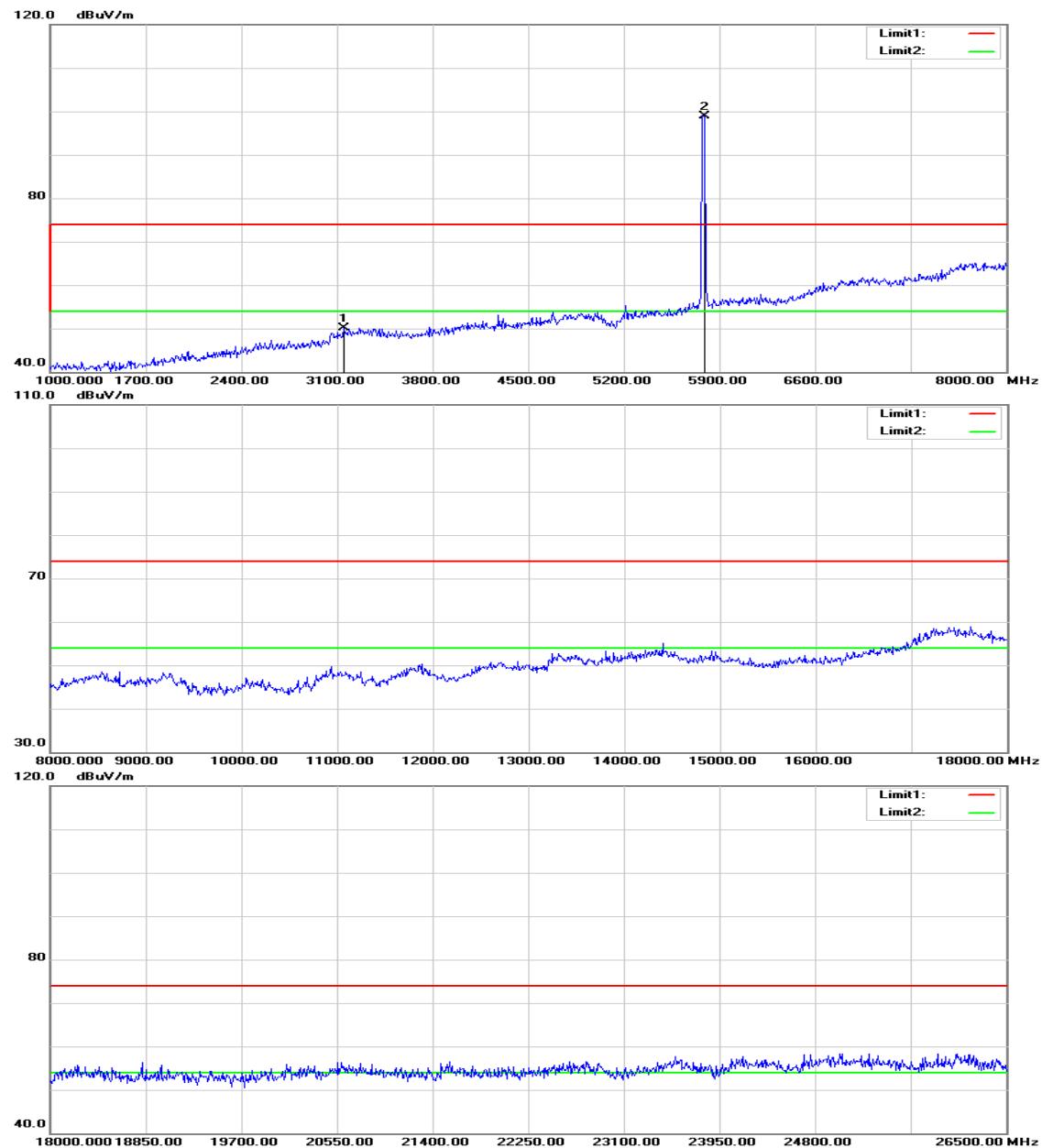
**Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
1952.000	50.33	-5.13	45.20	74.00	-28.80	peak	V
N/A							
1882.000	48.65	-5.51	43.14	74.00	-30.86	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 / 5785 MHz****Polarity: Vertical**

**Polarity: Horizontal**

**Operation Mode:** TX / IEEE 802.11n HT 20 MHz mode / 5785MHz

**Test Date:** August 2, 2015

**Temperature:** 27°C

**Tested by:** Jason Lu

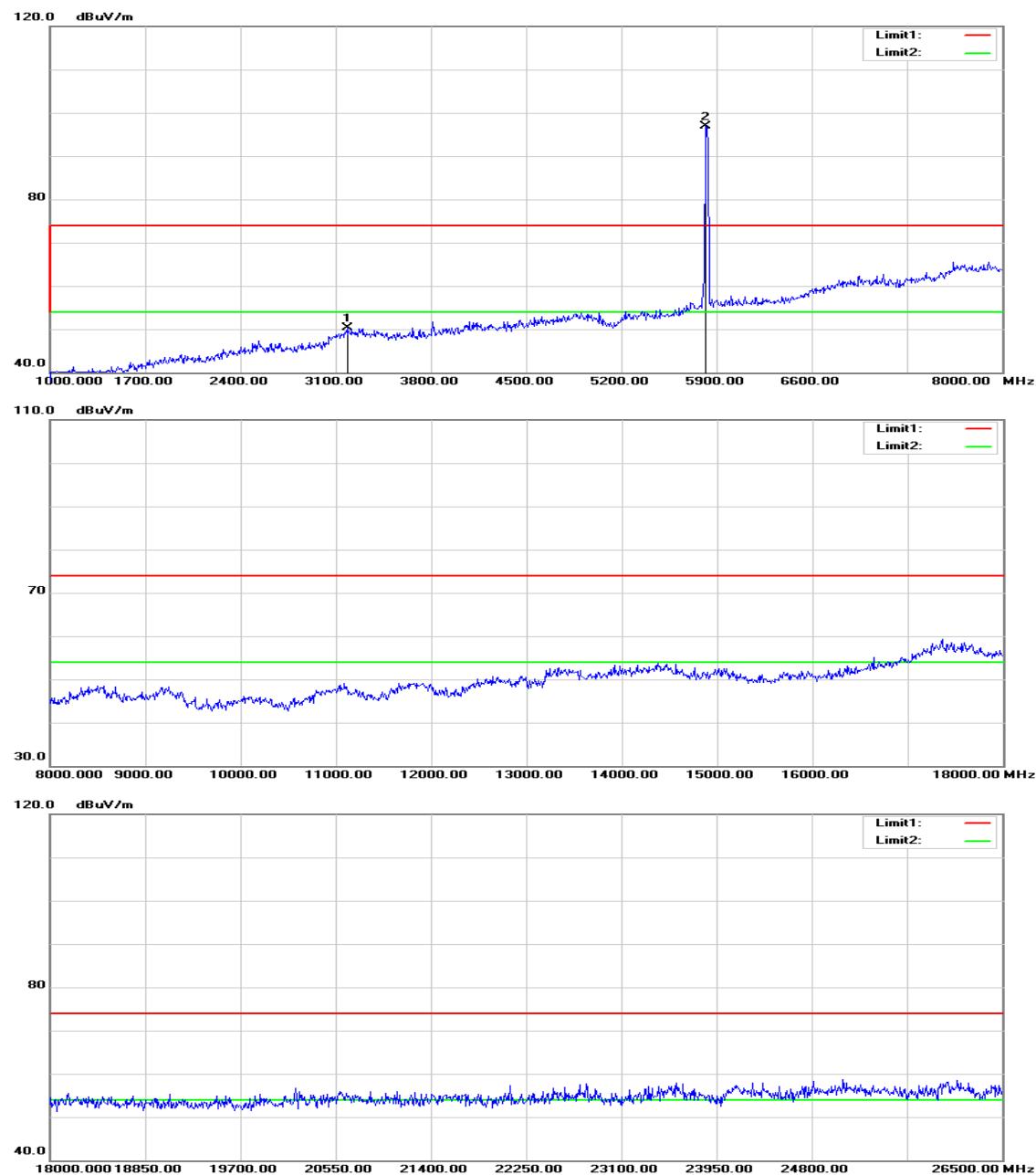
**Humidity:** 53% RH

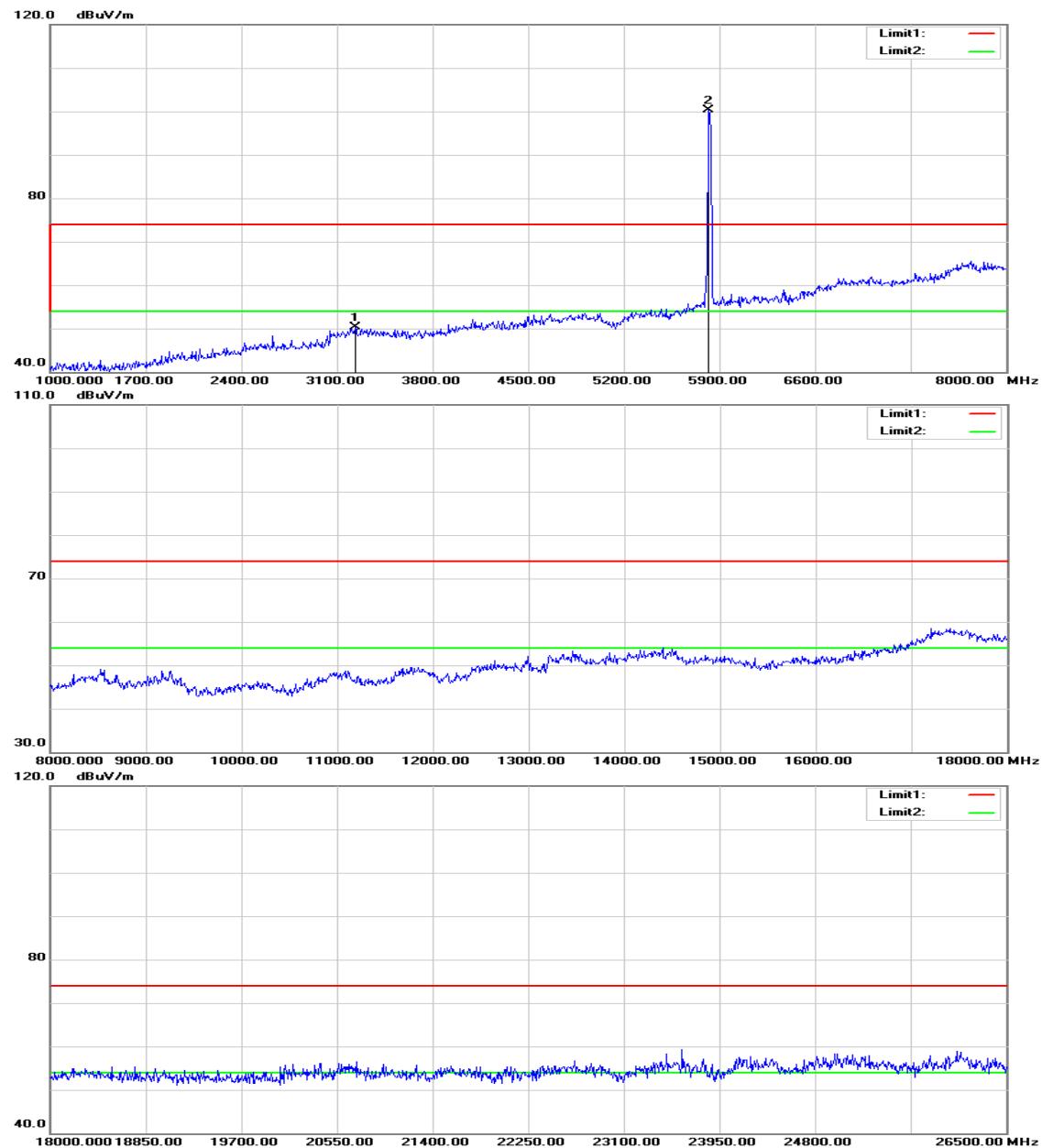
**Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
1938.000	53.92	-5.21	48.71	74.00	-25.29	peak	V
N/A							
3149.000	51.86	-1.75	50.11	74.00	-23.89	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 / 5825MHz****Polarity: Vertical**

**Polarity: Horizontal**

**Operation Mode:** TX / IEEE 802.11n HT 20 MHz mode / 5825MHz

**Test Date:** August 2, 2015

**Temperature:** 27°C

**Tested by:** Jason Lu

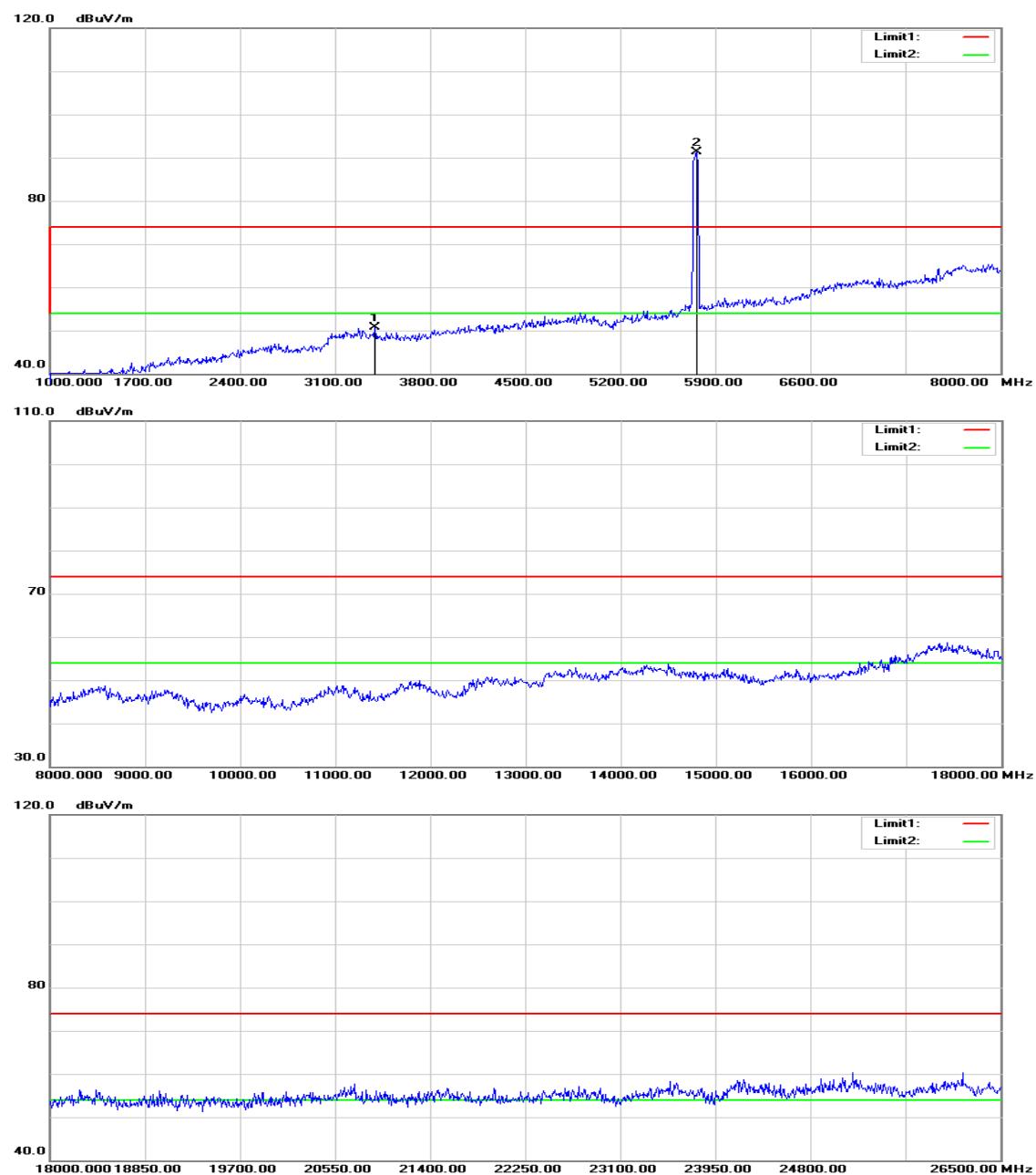
**Humidity:** 53% RH

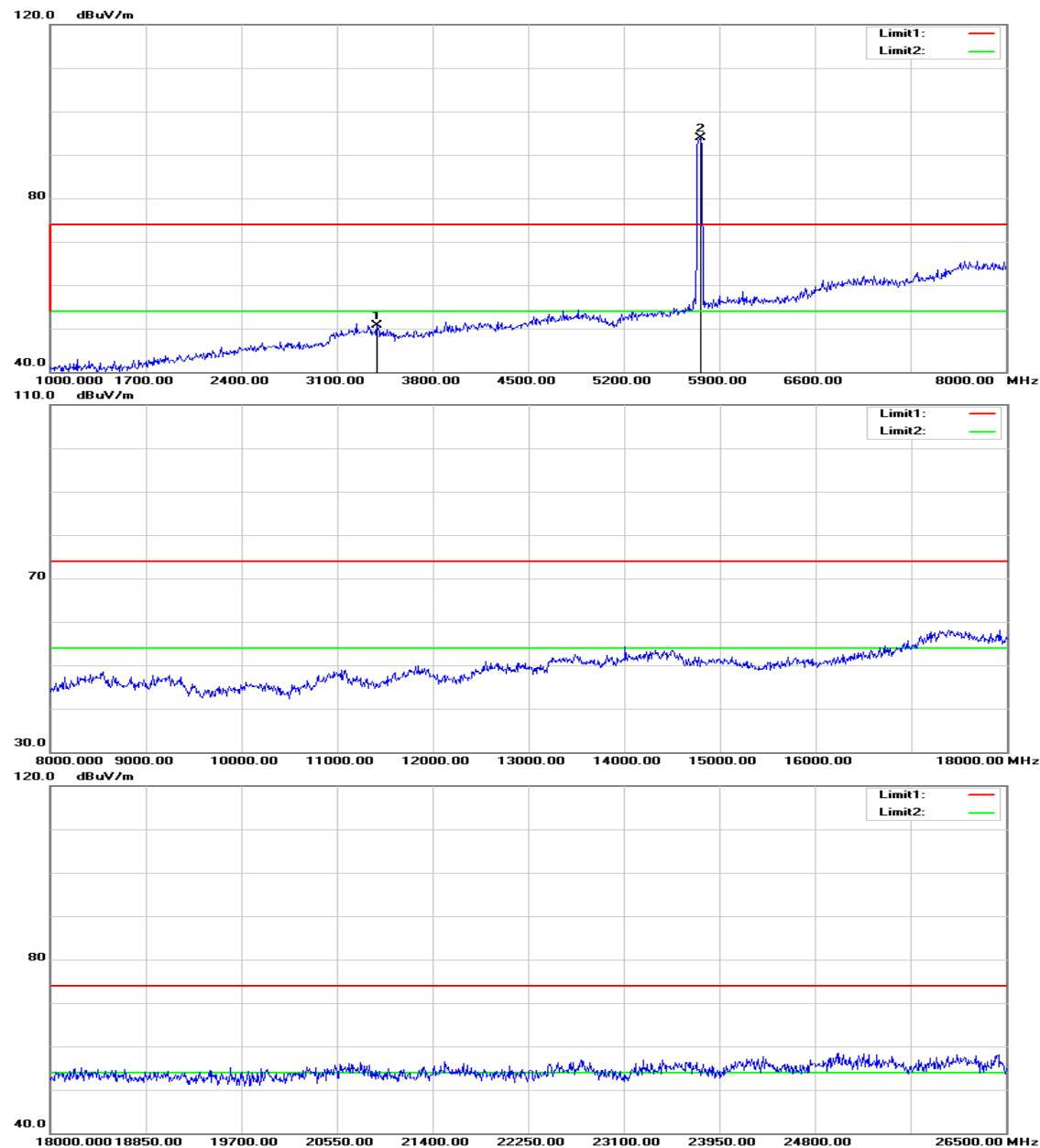
**Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
3184.000	52.01	-1.67	50.34	74.00	-23.66	peak	V
N/A							
3233.000	51.85	-1.55	50.30	74.00	-23.70	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:** August 3, 2015

**Temperature:** 27°C

**Tested by:** Jason Lu

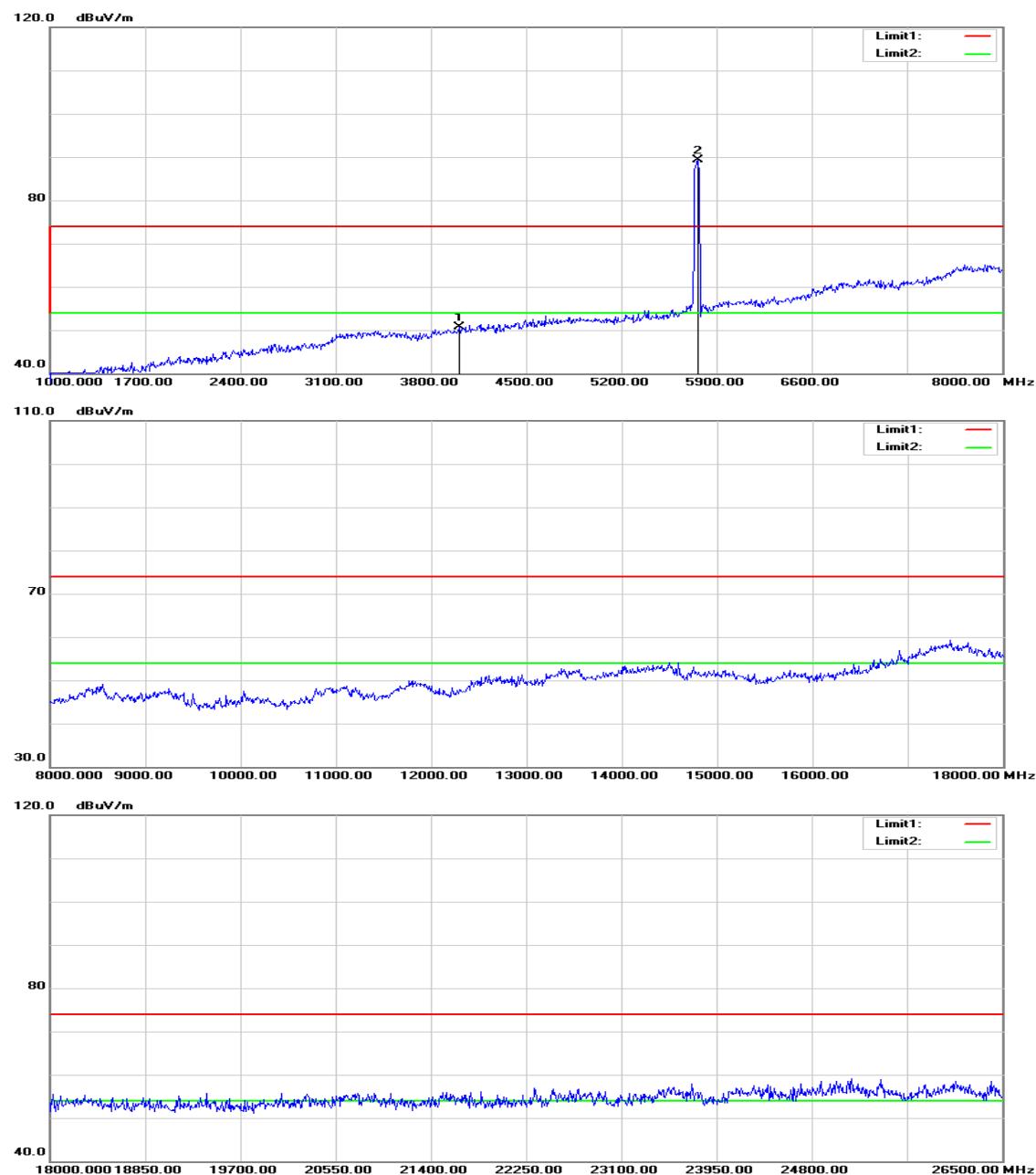
**Humidity:** 53% RH

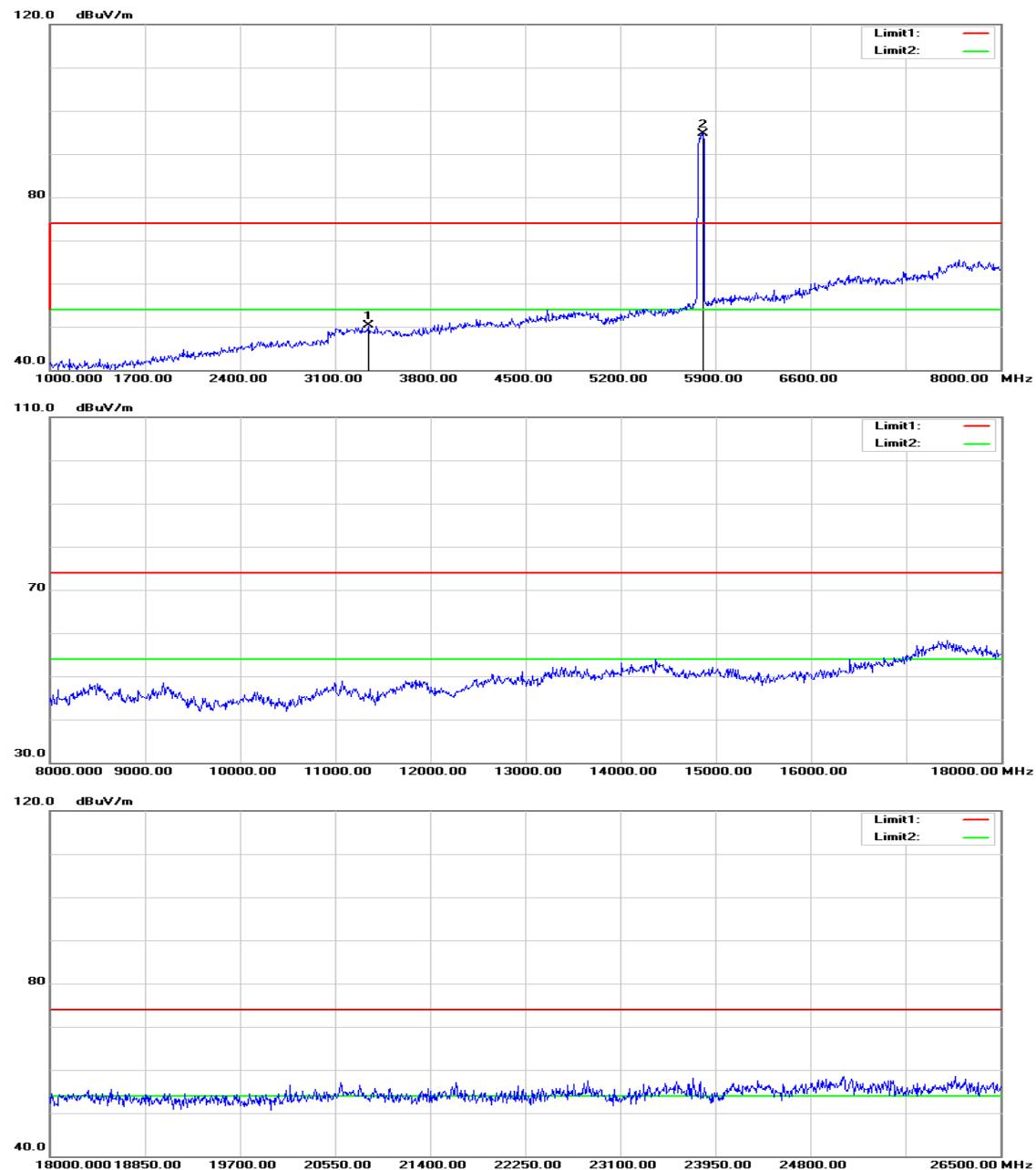
**Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
3394.000	51.87	-1.16	50.71	74.00	-23.29	peak	V
N/A							
3394.000	51.80	-1.16	50.64	74.00	-23.36	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:** August 3, 2015

**Temperature:** 27°C

**Tested by:** Jason Lu

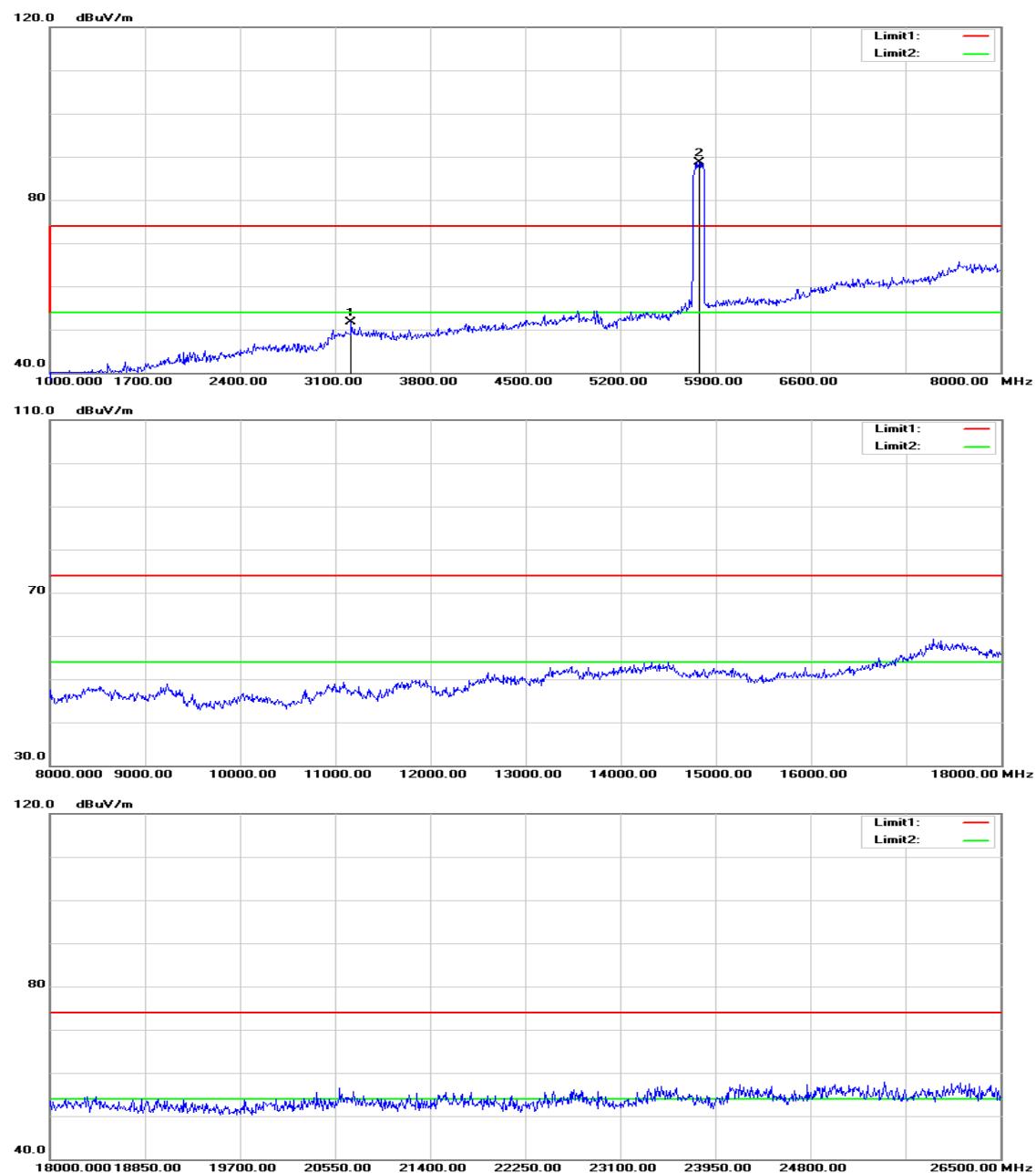
**Humidity:** 53% RH

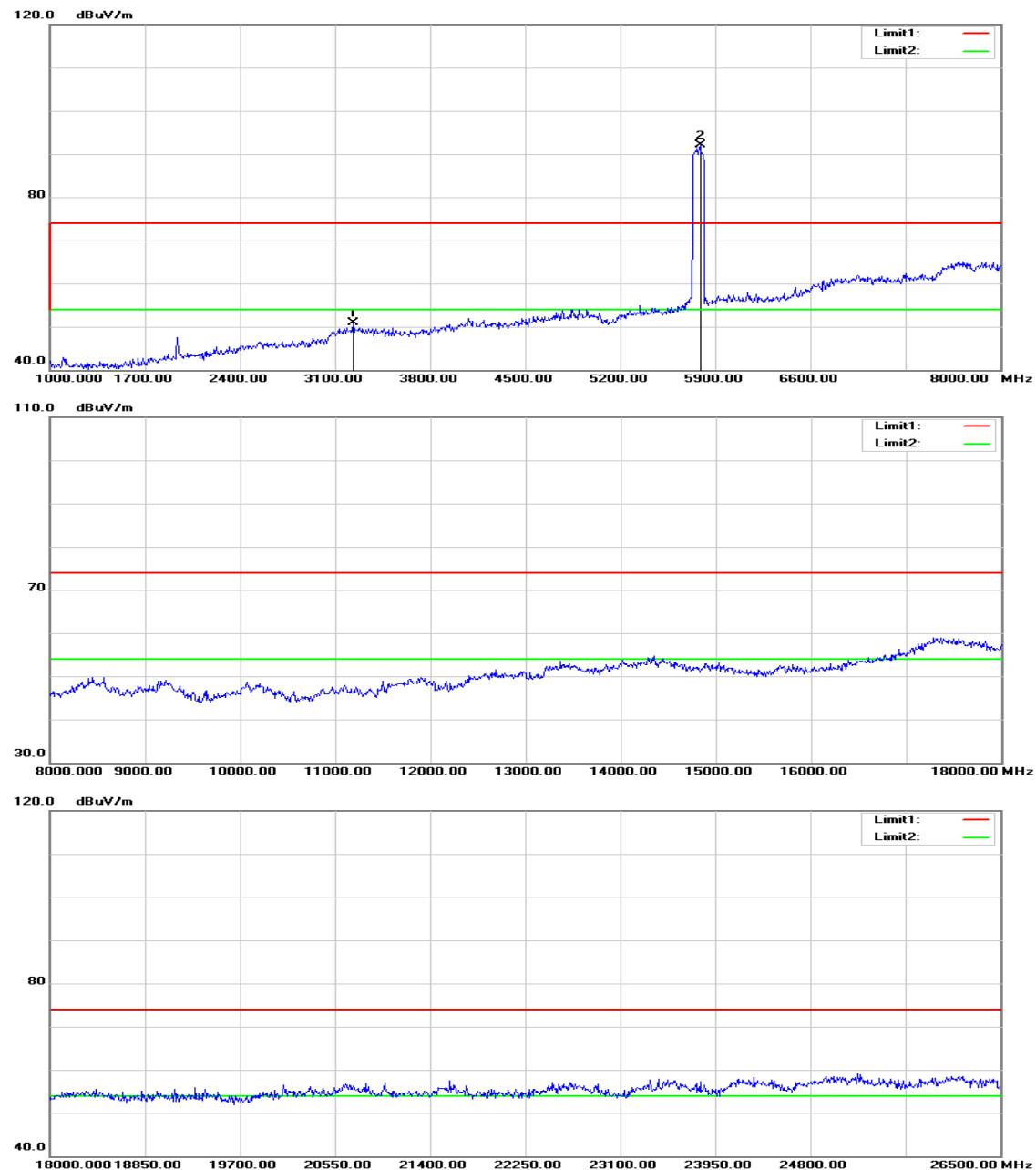
**Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
4010.000	49.45	1.27	50.72	74.00	-23.28	peak	V
N/A							
3345.000	51.48	-1.28	50.20	74.00	-23.80	peak	H
N/A							

**Remark:**

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

**Tx / IEEE 802.11ac VHT 80 MHz mode / CH Mid****Polarity: Vertical**

**Polarity: Horizontal**

**Operation Mode:** Tx / IEEE 802.11ac VHT 80 MHz mode / CH Mid      **Test Date:** August 3, 2015

**Temperature:** 27°C      **Tested by:** Jason Lu

**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)
3219.000	53.22	-1.58	51.64	74.00	-22.36	peak	V
N/A							
3233.000	52.44	-1.55	50.89	74.00	-23.11	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).

## 7.4 POWERLINE CONDUCTED EMISSIONS

### LIMIT

According to §15.207(a) & RSS-Gen §7.2.4, except when the requirements applicable to a given device state otherwise, for any licence-exempt radiocommunication device equipped to operate from the public utility AC power supply, either directly or indirectly, the radio frequency voltage that is conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in Table 2. The tighter limit applies at the frequency range boundaries.

The conducted emissions shall be measured with a 50 ohm/50 microhenry line impedance stabilization network.

### **RSS-Gen Table 2 – AC Power Lines Conducted Emission Limits**

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

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

*Not applicable, because EUT not connect to AC Main Source direct.*