

# ELECTROMAGNETIC EMISSION COMPLIANCE REPORT FOR LOW-POWER, NON-LICENSED TRANSMITTER

**Test Report No.** : W159R-D006  
**AGR No.** : A158A-013  
**Applicant** : BLUEBIRD INC.  
**Address** : (Dogok-dong, SEI Tower 13,14)39, Eonjuro30-gil, Gangnam-gu, Seoul, South Korea  
**Manufacturer** : BLUEBIRD INC.  
**Address** : (Dogok-dong, SEI Tower 13,14)39, Eonjuro30-gil, Gangnam-gu, Seoul, South Korea  
**Type of Equipment** : Mobile Payment Terminal  
**FCC ID.** : SS4MT280  
**Model Name** : MT280  
**Serial number** : N/A  
**Total page of Report** : 68 pages (including this page)  
**Date of Incoming** : August 03, 2015  
**Date of issue** : September 07, 2015

## SUMMARY

The equipment complies with the regulation; *FCC PART 15 SUBPART C Section 15.247*

This test report only contains the result of a single test of the sample supplied for the examination.

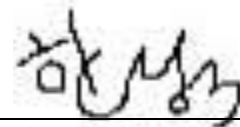
It is not a generally valid assessment of the features of the respective products of the mass-production.

Reviewed by:



Jae-Ho, Lee / Chief Engineer  
ONETECH Corp.

Approved by:



Sung-Ik, Han / Managing Director  
ONETECH Corp.

## CONTENTS

	PAGE
<b>1. VERIFICATION OF COMPLIANCE .....</b>	<b>5</b>
<b>2. TEST SUMMARY .....</b>	<b>6</b>
<b>2.1 TEST ITEMS AND RESULTS .....</b>	<b>6</b>
<b>2.2 ADDITIONS, DEVIATIONS, EXCLUSIONS FROM STANDARDS .....</b>	<b>6</b>
<b>2.3 RELATED SUBMITTAL(S) / GRANT(S) .....</b>	<b>6</b>
<b>2.4 PURPOSE OF THE TEST .....</b>	<b>6</b>
<b>2.5 TEST METHODOLOGY .....</b>	<b>6</b>
<b>2.6 TEST FACILITY .....</b>	<b>6</b>
<b>3. GENERAL INFORMATION .....</b>	<b>7</b>
<b>3.1 PRODUCT DESCRIPTION .....</b>	<b>7</b>
<b>3.2 ALTERNATIVE TYPE(S)/MODEL(S); ALSO COVERED BY THIS TEST REPORT .....</b>	<b>8</b>
<b>4. EUT MODIFICATIONS .....</b>	<b>8</b>
<b>5. SYSTEM TEST CONFIGURATION .....</b>	<b>9</b>
<b>5.1 JUSTIFICATION .....</b>	<b>9</b>
<b>5.3 MODE OF OPERATION DURING THE TEST .....</b>	<b>9</b>
<b>5.4 CONFIGURATION OF TEST SYSTEM .....</b>	<b>10</b>
<b>5.5 ANTENNA REQUIREMENT .....</b>	<b>10</b>
<b>6. PRELIMINARY TEST .....</b>	<b>11</b>
<b>6.1 AC POWER LINE CONDUCTED EMISSIONS TESTS .....</b>	<b>11</b>
<b>6.2 GENERAL RADIATED EMISSIONS TESTS .....</b>	<b>11</b>
<b>7. WLAN .....</b>	<b>12</b>
<b>7.1 MIMIMUM 6 DB BANDWIDTH .....</b>	<b>12</b>
<b>7.1.1 Operating environment .....</b>	<b>12</b>
<b>7.1.2 Test set-up .....</b>	<b>12</b>
<b>7.1.3 Test equipment used .....</b>	<b>12</b>
<b>7.1.4 Test data for 802.11b .....</b>	<b>13</b>
<b>7.1.5 Test data for 802.11g .....</b>	<b>15</b>
<b>7.1.6 Test data for 802.11n_HT20 .....</b>	<b>17</b>
<b>7.2 MAXIMUM PEAK OUTPUT POWER .....</b>	<b>19</b>
<b>7.2.1 Operating environment .....</b>	<b>19</b>
<b>7.2.2 Test set-up .....</b>	<b>19</b>

7.2.3 Test equipment used.....	19
7.2.4 Test data for 802.11b .....	20
7.2.5 Test data for 802.11g .....	22
7.2.6 Test data for 802.11n_HT20.....	24
<b>7.3 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND .....</b>	<b>26</b>
7.3.1 Operating environment.....	26
7.3.2 Test set-up for conducted measurement.....	26
7.3.3 Test set-up for radiated measurement.....	26
7.3.4 Test equipment used.....	26
7.3.5 Test data for conducted emission .....	27
<b>7.4 PEAK POWER SPECTRUL DENSITY .....</b>	<b>48</b>
7.4.1 Operating environment.....	48
7.4.2 Test set-up .....	48
7.4.3 Test equipment used.....	48
7.4.4 Test data for 802.11b .....	49
7.4.5 Test data for 802.11g .....	51
7.4.6 Test data for 802.11n_HT20.....	53
<b>7.5 RADIATED EMISSION TEST.....</b>	<b>55</b>
7.5.1 Operating environment.....	55
7.5.2 Test set-up .....	55
7.5.3 Test equipment used.....	55
7.5.4 Test data for 802.11b .....	56
7.5.5 Test data for 802.11g .....	58
7.5.6 Test data for 802.11n_HT20.....	60
<b>7.6 CONDUCTED EMISSION TEST .....</b>	<b>62</b>
7.6.1 Operating environment.....	62
7.6.2 Test set-up .....	62
7.6.3 Test equipment used.....	62
7.6.4 Test data for 802.11b .....	63
7.6.5 Test data for 802.11g .....	65
7.6.6 Test data for 802.11n_HT20.....	67

### Revision History

Issued Report No.	Issued Date	Revisions	Effect Section
W159R-D006	September 07, 2015	Initial Issue	All

## 1. VERIFICATION OF COMPLIANCE

Applicant : BLUEBIRD INC.  
 Address : (Dogok-dong, SEI Tower 13,14)39, Eonjuro30-gil, Gangnam-gu, Seoul, South Korea  
 Contact Person : Jae ho, Lee / Assistant Manager  
 Telephone No. : +82-70-7730-8210  
 FCC ID : SS4MT280  
 Model Name : MT280  
 Serial Number : N/A  
 Date : September 07, 2015

EQUIPMENT CLASS	DTS-Digital Transmission System
EQUIPMENT DESCRIPTION	Mobile Payment Terminal
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	ANSI C63.10: 2013
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Certification
EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)	FCC PART 15 SUBPART C Section 15.247
Modifications on the Equipment to Achieve Compliance	None
Final Test was Conducted On	3 m Semi Anechoic Chamber

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

## 2. TEST SUMMARY

### 2.1 Test items and results

SECTION	TEST ITEMS	RESULTS
15.247 (a) (2)	Minimum 6 dB Bandwidth	Met the Limit / PASS
15.247 (b) (3)	Maximum Peak Conducted Output Power	Met the Limit / PASS
15.247 (d)	100 kHz Bandwidth Outside the Frequency Band	Met the Limit / PASS
15.247 (d)	Radiated Emission which fall in the Restricted Band	Met the Limit / PASS
15.247 (e)	Peak Power Spectral Density	Met the Limit / PASS
15.209	Radiated Emission Limits	Met the Limit / PASS
15.207	Conducted Limits	Met the Limit / PASS
15.203	Antenna Requirement	Met requirement / PASS

### 2.2 Additions, deviations, exclusions from standards

No additions, deviations or exclusions have been made from standard.

### 2.3 Related Submittal(s) / Grant(s)

Original submittal only

### 2.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in FCC PART 15 SUBPART C Section 15.247

### 2.5 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10: 2013. Radiated testing was performed at a distance of 3 m from EUT to the antenna.

### 2.6 Test Facility

The Onetech Corp. has been designated to perform equipment testing in compliance with ISO/IEC 17025.

The Electromagnetic compatibility measurement facilities are located at 301-14, Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do, 464-862 Korea.

-. Site Filing:

VCCI (Voluntary Control Council for Interference) – Registration No. R-4112/ C-4617/ G-666/ T-1842 IC (Industry Canada) – Registration No. Site# 3736-3

-. Site Accreditation:

KOLAS (Korea Laboratory Accreditation Scheme) - Accreditation No. 85

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

### 3. GENERAL INFORMATION

#### 3.1 Product Description

The BLUEBIRD INC., Model MT280 (referred to as the EUT in this report) is a Mobile Payment Terminal. Product specification information described herein was obtained from product data sheet or user’s manual.

DEVICE TYPE	Mobile Payment Terminal
OPERATING FREQUENCY	802.11b/g/n(HT20): 2 412 MHz ~ 2 462 MHz
MAX. RF OUTPUT POWER	802.11b: 14.01 dBm
	802.11g: 9.59 dBm
	802.11n(HT20): 9.37 dBm
MODULATION TYPE	802.11b: DSSS Modulation(DBPSK/DQPSK/CCK) 802.11g/n(HT20): OFDM Modulation(BPSK/QPSK/16QAM/64QAM)
ANTENNA TYPE	PCB Antenna
ANTENNA GAIN	-0.67 dBi
List of each Osc. or crystal Freq.(Freq. >= 1 MHz)	24 MHz, 2.5 MHz, 1.25 MHz, 32.768 kHz

**3.2 Alternative type(s)/model(s); also covered by this test report.**

-. None

**4. EUT MODIFICATIONS**

-. None



## 5. SYSTEM TEST CONFIGURATION

### 5.1 Justification

This device was configured for testing in a typical way as a normal customer is supposed to be used. During the test, the following components were installed inside of the EUT.

DEVICE TYPE	MANUFACTURER	MODEL/PART NUMBER	FCC ID
KEY BOARD	N/A	PCB-MT280-KEY-REV0.2	N/A
MAIN BOARD	N/A	PCB-MT280-MAIN-REV0.2	N/A
TERMINAL BOARD	N/A	PCB-MT280-TERMINAL-REV0.2	N/A
LCD	N/A	N/A	N/A
LOWER BOARD	N/A	N/A	N/A
UPPER BOARD	N/A	N/A	N/A
Battery	N/A	N/A	N/A
Print	N/A	P2VS41504401136	N/A
BT Antenna	N/A	N/A	N/A
GSM Module	N/A	N/A	N/A
MSR	N/A	N/A	N/A
NFC Antenna	N/A	N/A	N/A
WCDMA Antenna	N/A	MT760_main antenna_GSM/WCDMA	N/A
WLAN Antenna	N/A	MT280_WLAN ant_FPCB_Rev.01	N/A

### 5.2 Peripheral equipment

Defined as equipment needed for correct operation of the EUT, but not considered as tested:

Model	Manufacturer	Description	Connected to
MT280	BLUEBIRD INC.	Mobile Payment Terminal (EUT)	Adapter
PSAC30U-090	Phihong(Dong guan) Electronics Co.,Ltd.	Adapter	EUT

### 5.3 Mode of operation during the test

For the testing, software used to control the EUT for staying in continuous transmitting mode is programmed.

The worse case data rate for each modulation is determined in 11 Mbps for IEEE 802.11b, 6 Mbps for IEEE 802.11g, and 6.5 Mbps for HT20.

## 5.4 Configuration of Test System

**Line Conducted Test:** The EUT was connected to USB and the power of USB was connected to Notebook PC. All supporting equipments were connected to another LISN. Preliminary Power line Conducted Emission test was performed by using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions.

**Radiated Emission Test:** Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions. Final radiated emission tests were conducted at 3 meter open area test site. The turntable was rotated through 360 degrees and the EUT was tested by positioned three orthogonal planes to obtain the highest reading on the field strength meter. Once maximum reading was determined, the search antenna was raised and lowered in both vertical and horizontal polarization.

## 5.5 Antenna Requirement

For intentional device, according to section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

### Antenna Construction:

The transmitter antenna of the EUT is WLAN PCB antenna, so no consideration of replacement by the user.

## 6. PRELIMINARY TEST

### 6.1 AC Power line Conducted Emissions Tests

During Preliminary Test, the following operating mode was investigated.

Operation Mode	The Worse operating condition (Please check one only)
Transmitting Mode	X

### 6.2 General Radiated Emissions Tests

During Preliminary Test, the following operating mode was investigated.

Operation Mode	The Worse operating condition (Please check one only)
Transmitting Mode	X

## 7. WLAN

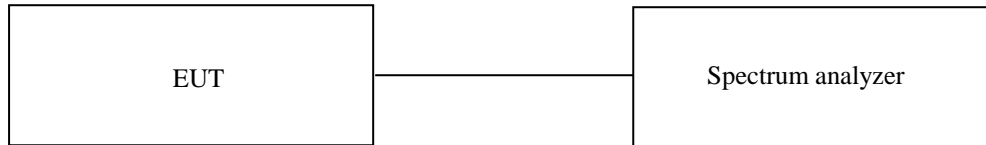
### 7.1 MINIMUM 6 dB BANDWIDTH

#### 7.1.1 Operating environment

Temperature : 23 °C  
 Relative humidity : 53 % R.H.

#### 7.1.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz, and peak detection was used. The 6 dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 6 dB.



#### 7.1.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - FSV40	Rohde & Schwarz	Signal Analyzer	101009	Jul. 22, 2015 (1Y)

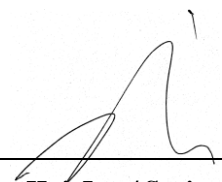
All test equipment used is calibrated on a regular basis.

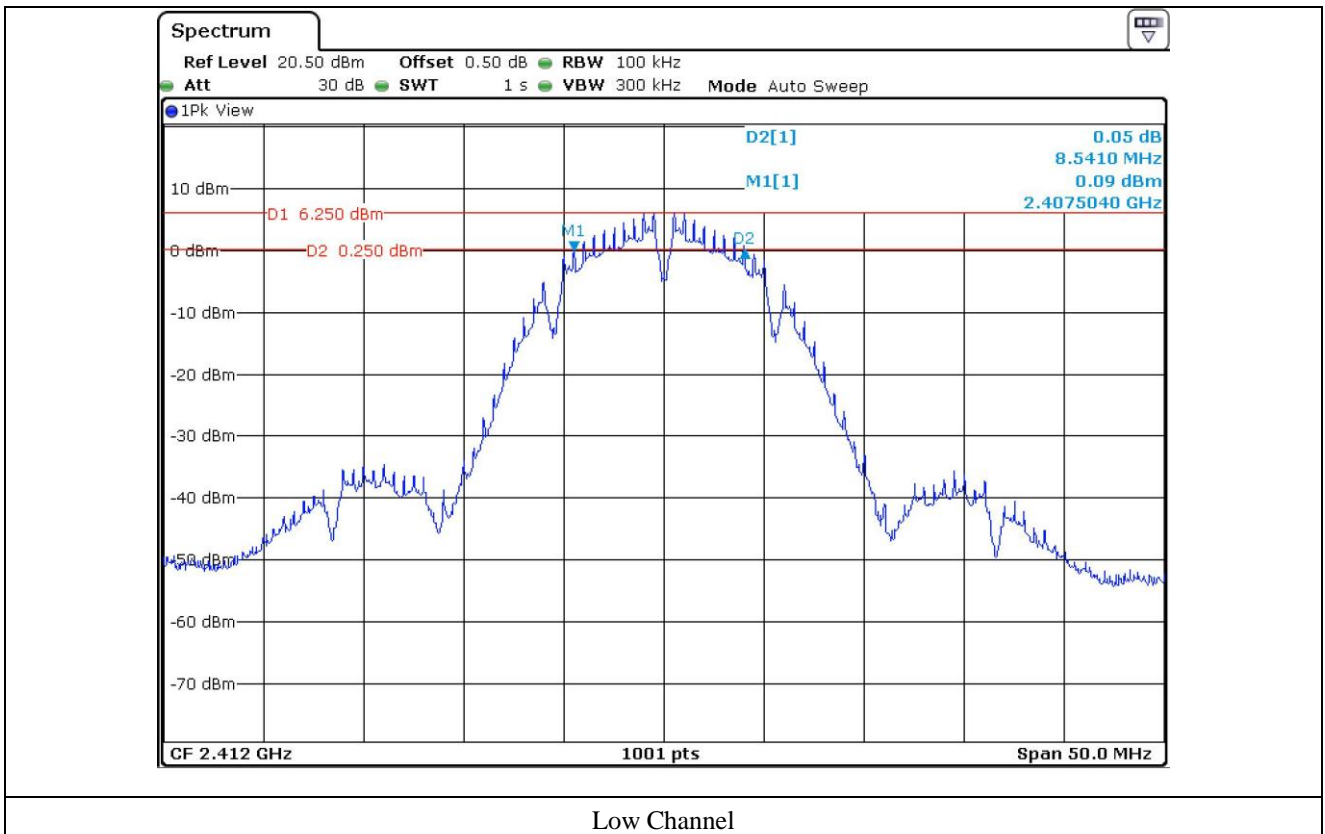
**7.1.4 Test data for 802.11b**

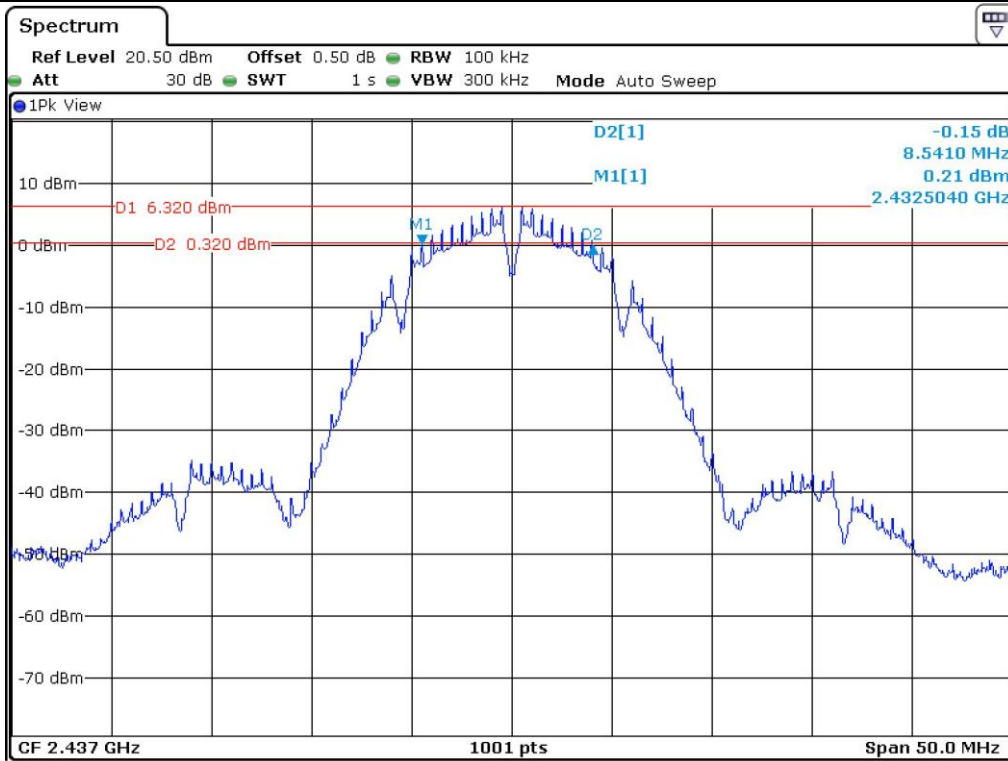
- Test Date : August 21, 2015
- Test Result : Pass

CHANNEL	FREQUENCY(MHz)	MEASURED VALUE (MHz)	LIMIT(MHz)	Margin(MHz)
Low	2412	8.54	0.5	8.04
Middle	2437	8.54	0.5	8.04
High	2462	8.54	0.5	8.04

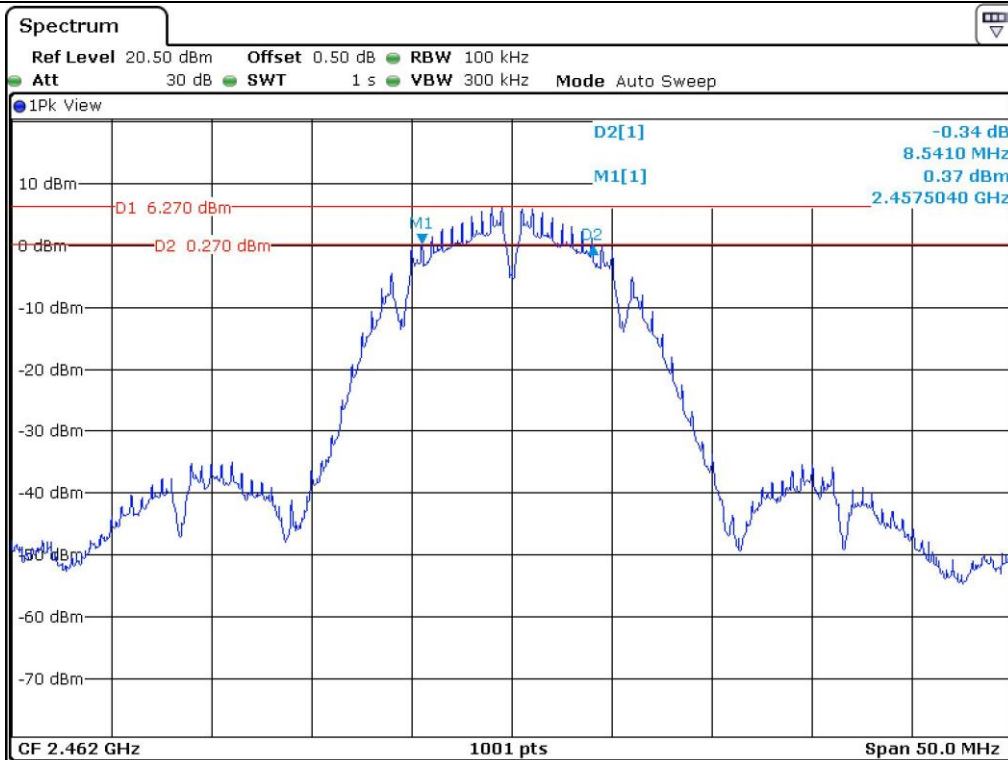
Remark. Margin = Measured Value - Limit

  
 \_\_\_\_\_  
**Tested by: Jun-Hui, Lee / Senior Engineer**





Middle Channel



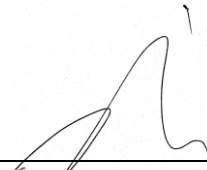
High Channel

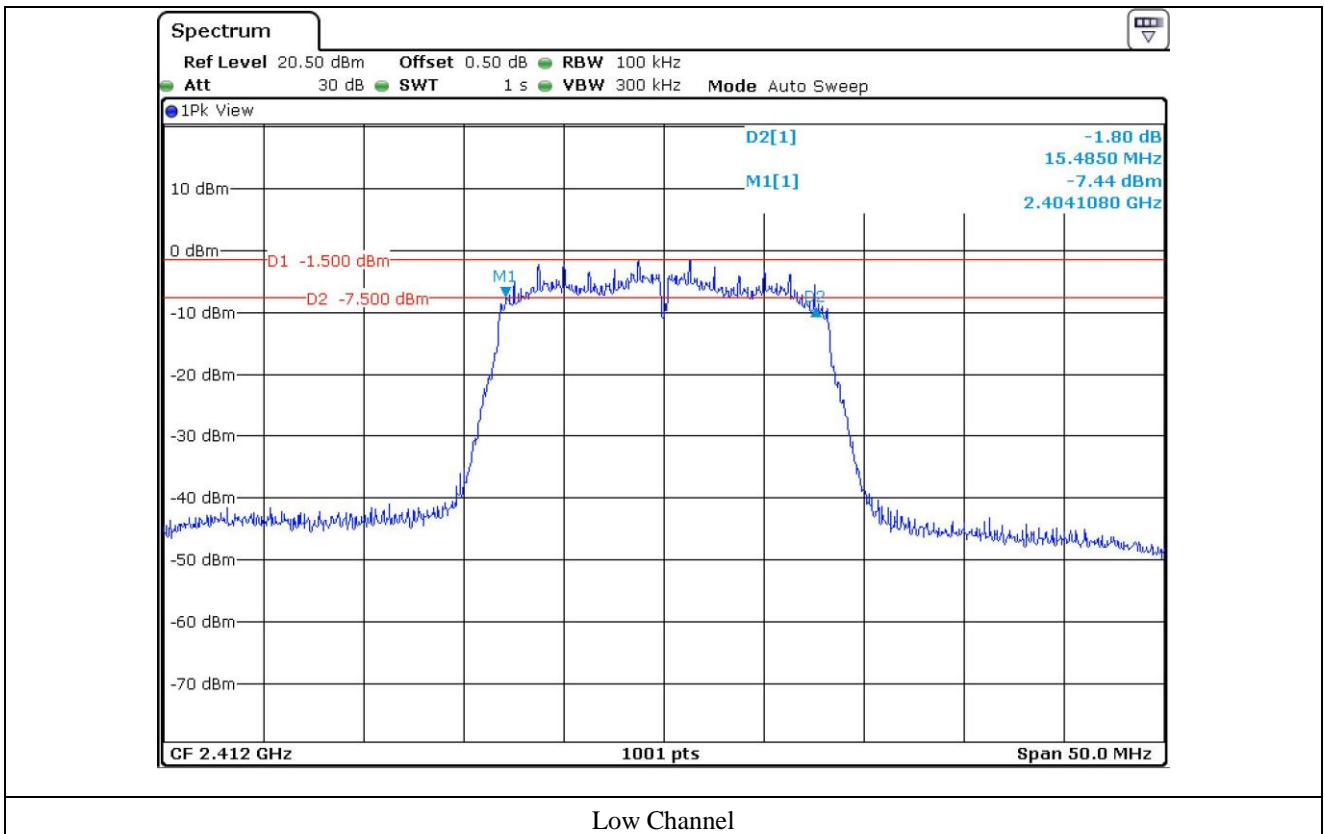
**7.1.5 Test data for 802.11g**

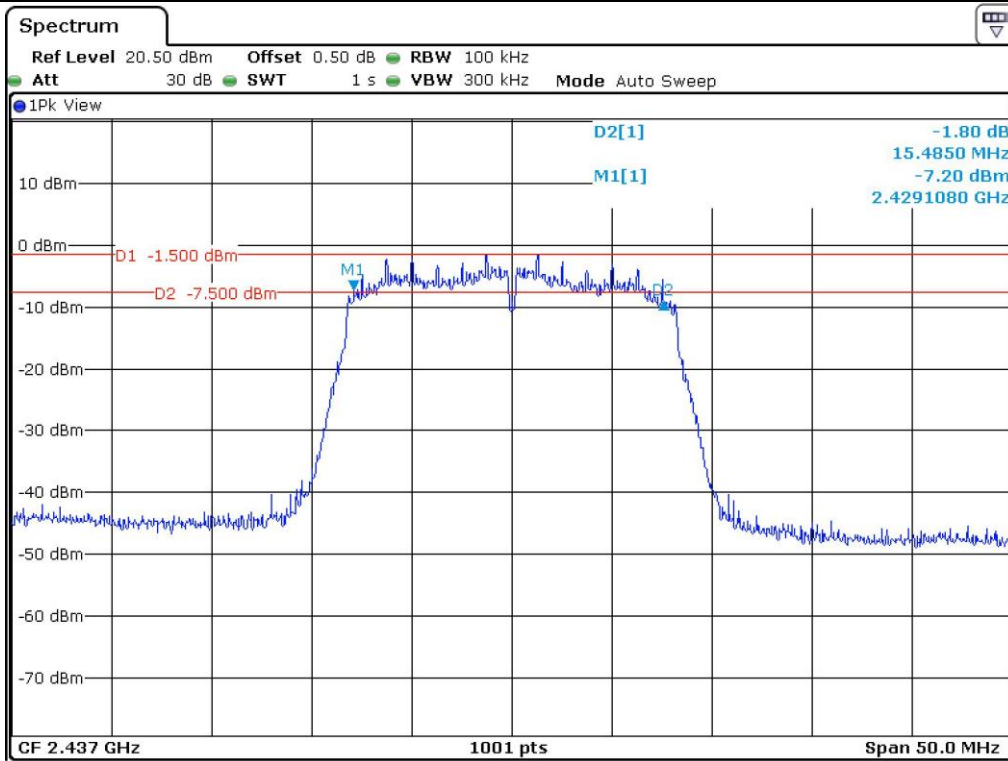
- Test Date : August 21, 2015
- Test Result : Pass

CHANNEL	FREQUENCY(MHz)	MEASURED VALUE (MHz)	LIMIT(MHz)	Margin(MHz)
Low	2412	15.49	0.5	14.99
Middle	2437	15.49	0.5	14.99
High	2462	15.49	0.5	14.99

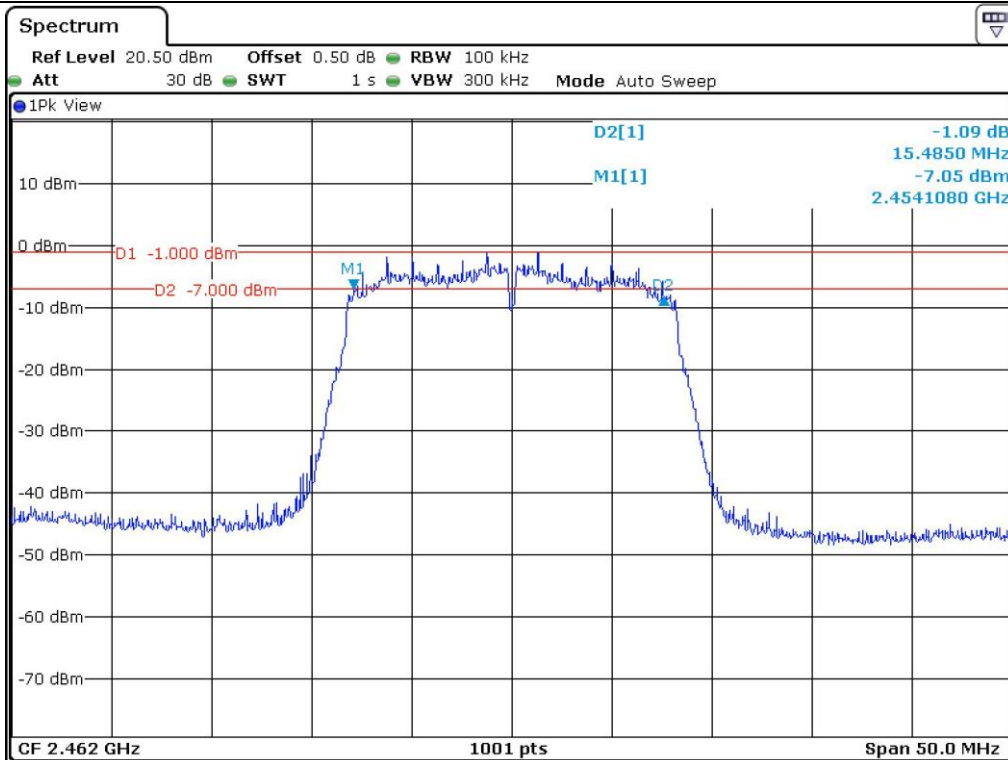
Remark. Margin = Measured Value - Limit

  
 \_\_\_\_\_  
**Tested by: Jun-Hui, Lee / Senior Engineer**





Middle Channel



High Channel




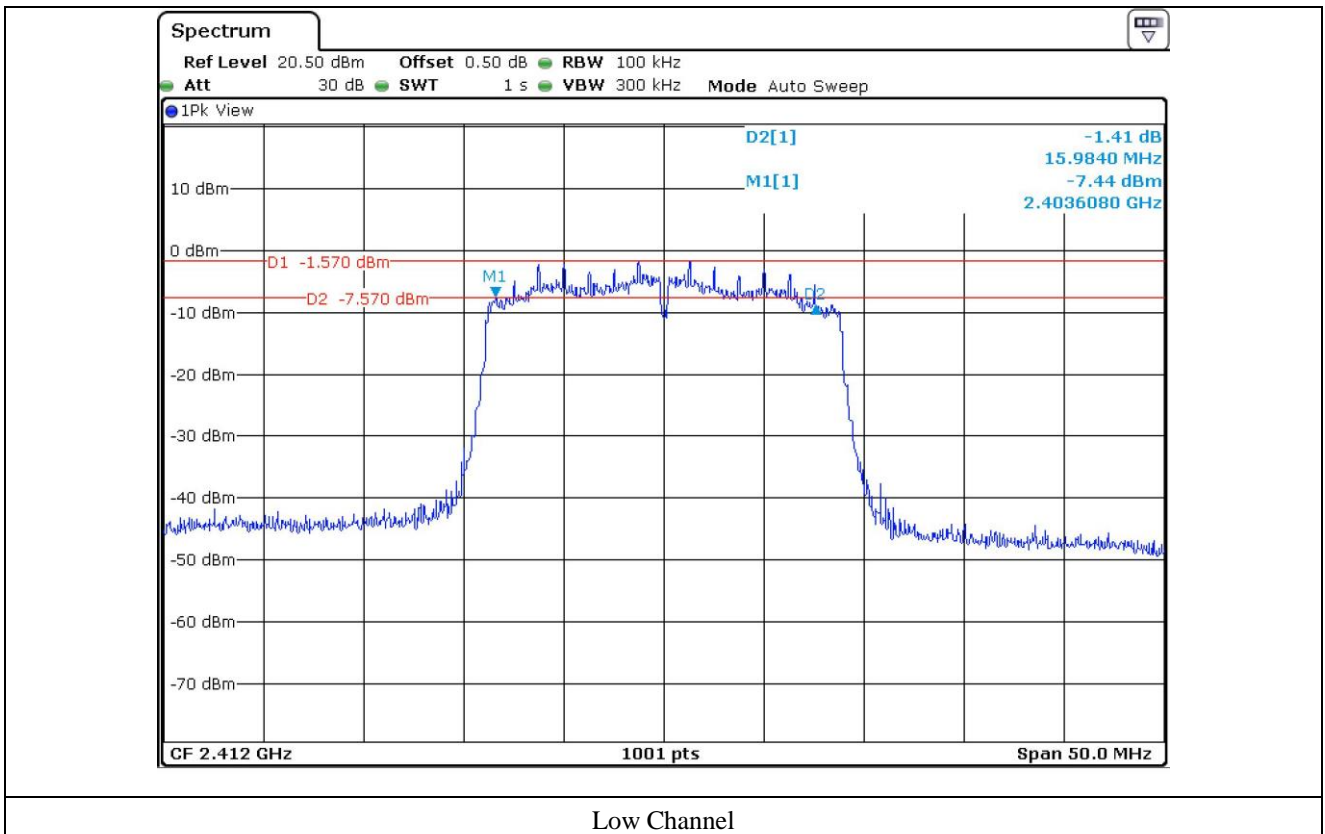
**7.1.6 Test data for 802.11n\_HT20**

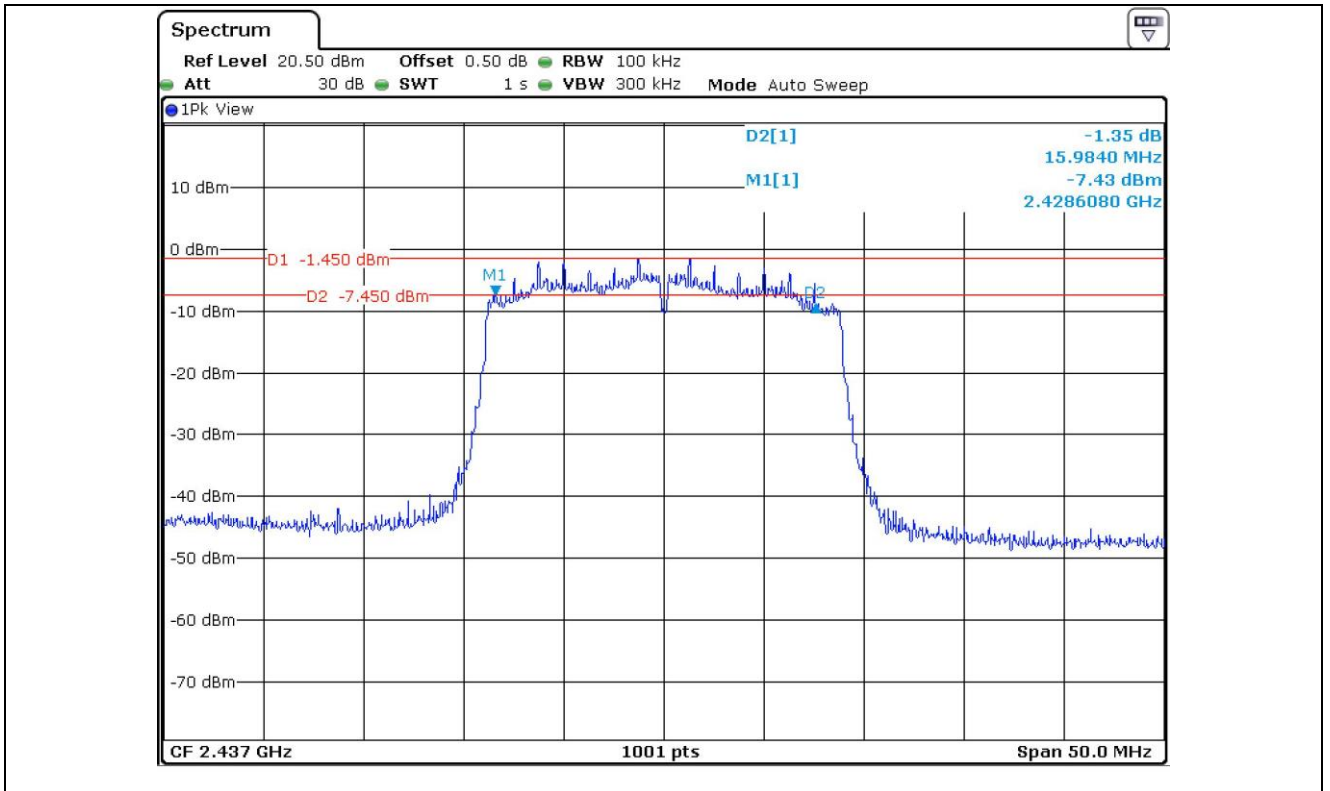
- Test Date : August 21, 2015
- Test Result : Pass

CHANNEL	FREQUENCY(MHz)	MEASURED VALUE (MHz)	LIMIT(MHz)	Margin(MHz)
Low	2412	15.98	0.5	15.48
Middle	2437	15.98	0.5	15.48
High	2462	15.98	0.5	15.48

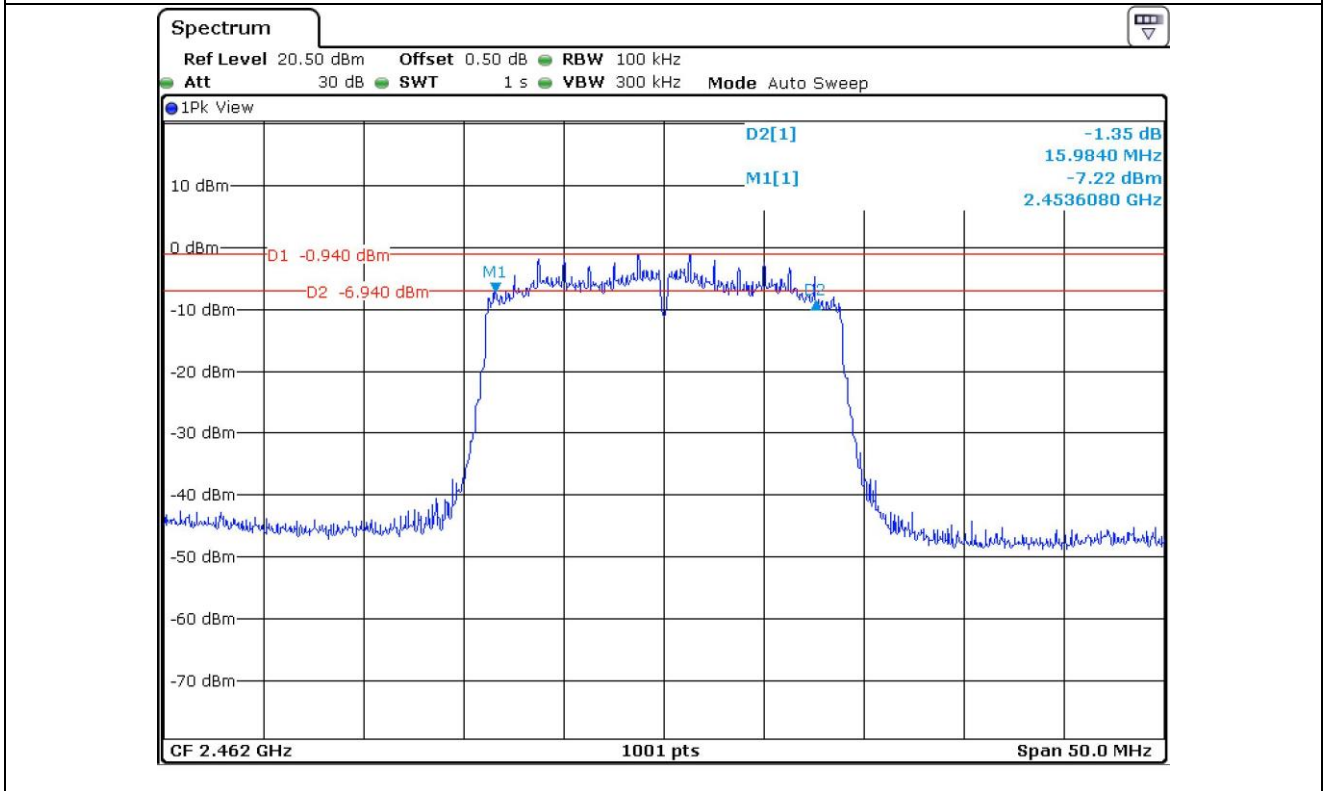
Remark. Margin = Measured Value - Limit

  
 \_\_\_\_\_  
**Tested by: Jun-Hui, Lee / Senior Engineer**





Middle Channel



High Channel

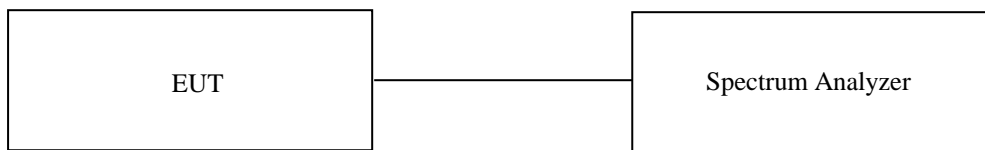
## 7.2 MAXIMUM PEAK OUTPUT POWER

### 7.2.1 Operating environment

Temperature : 23 °C  
 Relative humidity : 53 % R.H.

### 7.2.2 Test set-up

The maximum peak output power was measured with the spectrum analyzer connected to the antenna output of the EUT. The spectrum analyzer's internal channel power integration function is used to integrate the power over a bandwidth greater than or equal to the 99 % bandwidth. The EUT was operating in transmit mode at the appropriate center frequency.



### 7.2.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - FSV40	Rohde & Schwarz	Signal Analyzer	101009	Jul. 22, 2015 (1Y)

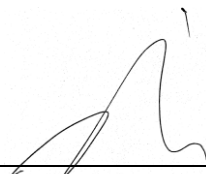
All test equipment used is calibrated on a regular basis.

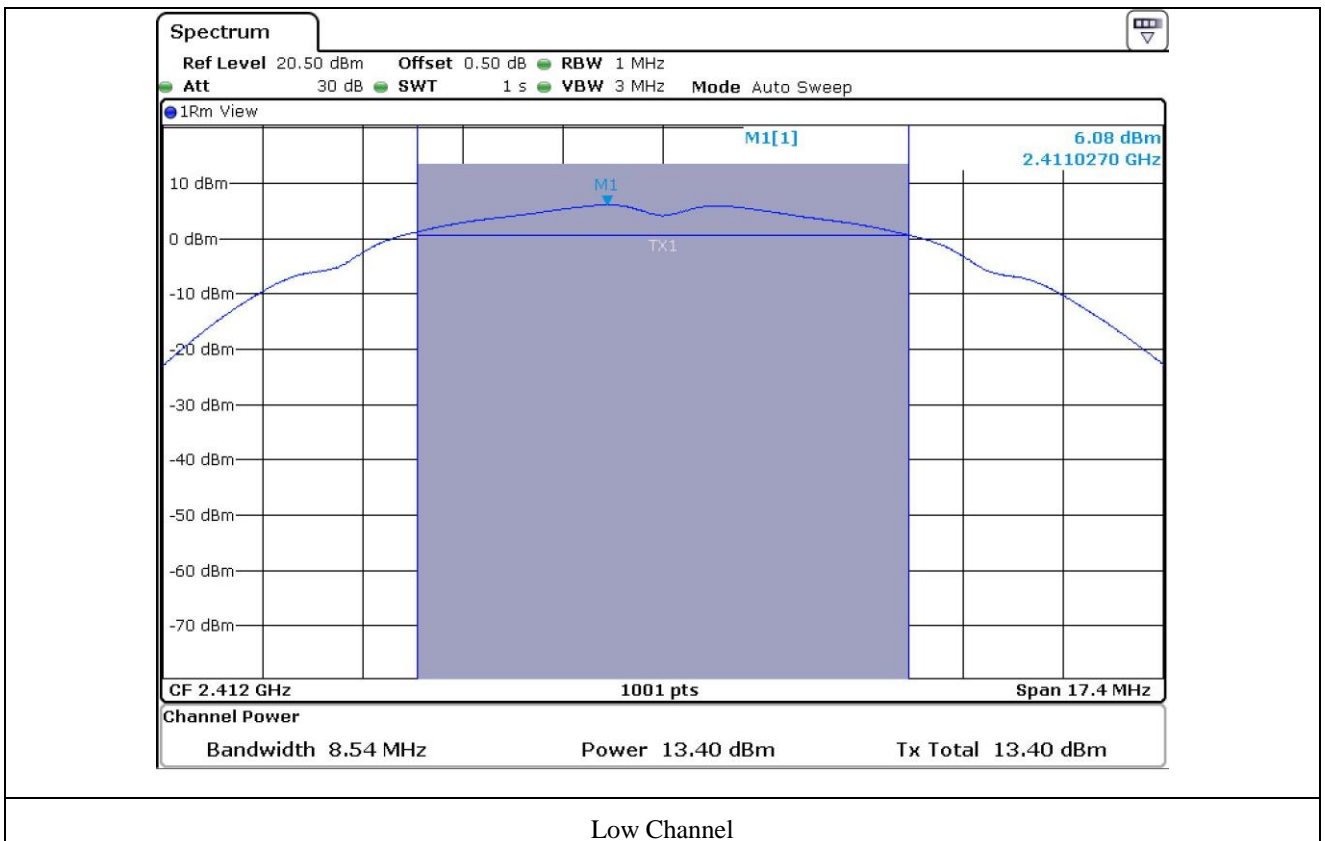
**7.2.4 Test data for 802.11b**

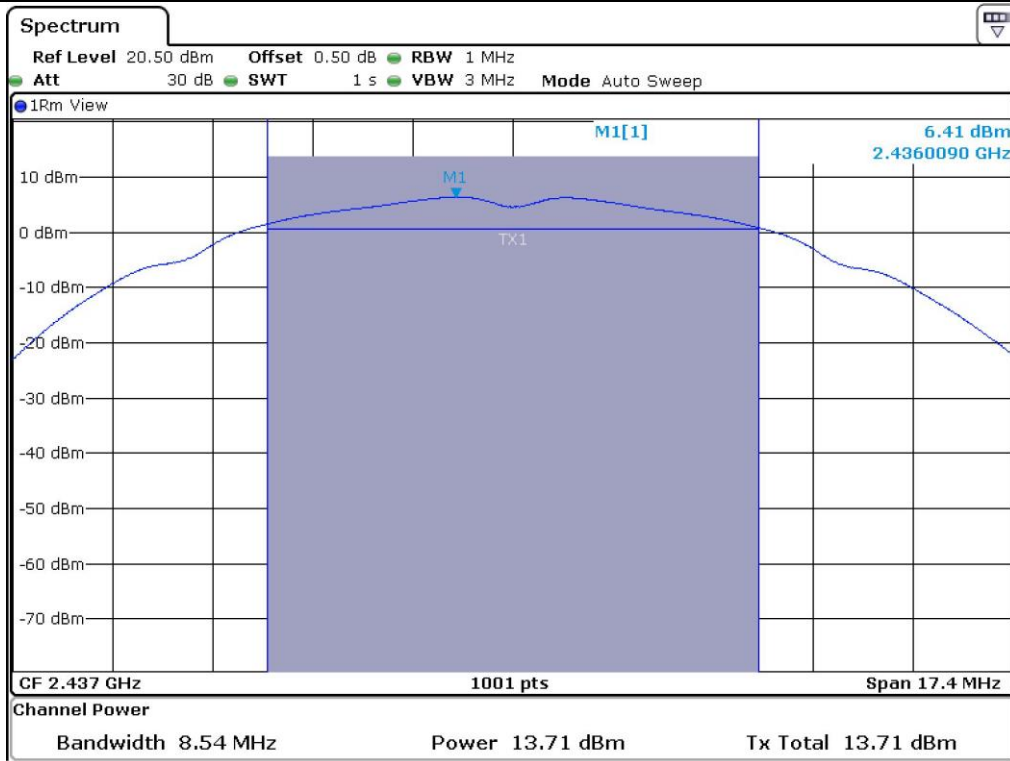
- Test Date : August 21, 2015
- Test Result : Pass

CHANNEL	FREQUENCY (MHz)	DTS (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2412	8.54	13.40	30	16.60
MIDDLE	2437	8.54	13.71	30	16.29
HIGH	2462	8.54	14.01	30	15.99

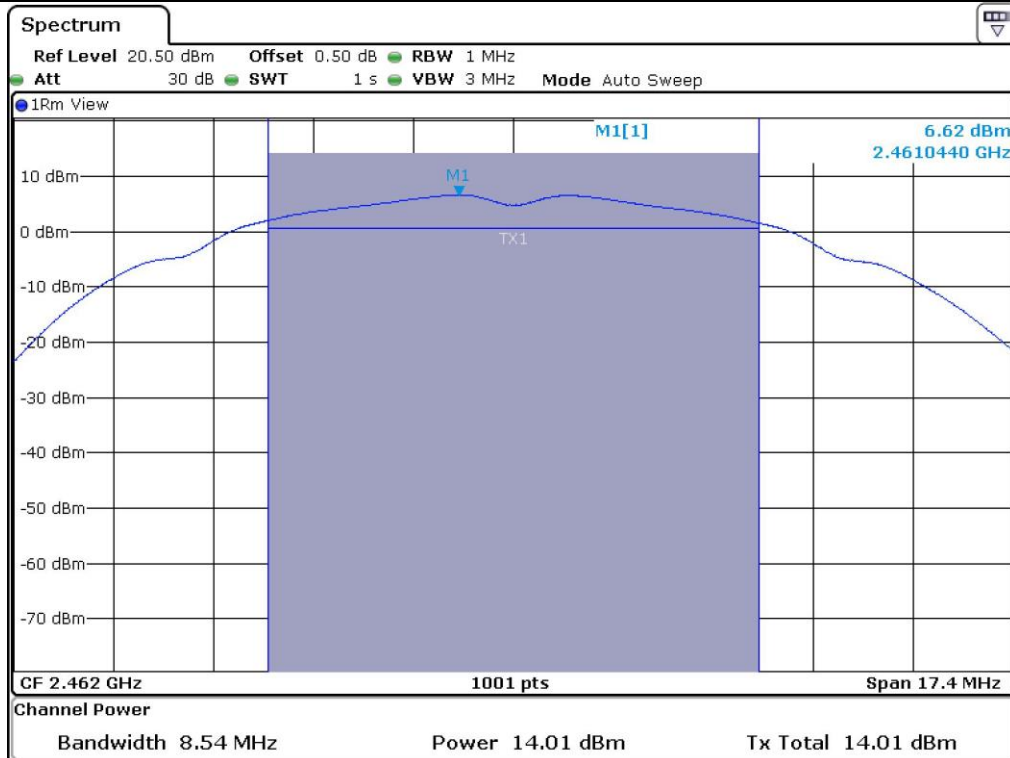
Remark. Margin = Limit – Measured Value (=Receiver Reading + Cable Loss)

  
 \_\_\_\_\_  
**Tested by: Jun-Hui, Lee / Senior Engineer**





Middle Channel



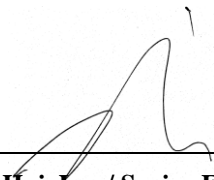
High Channel

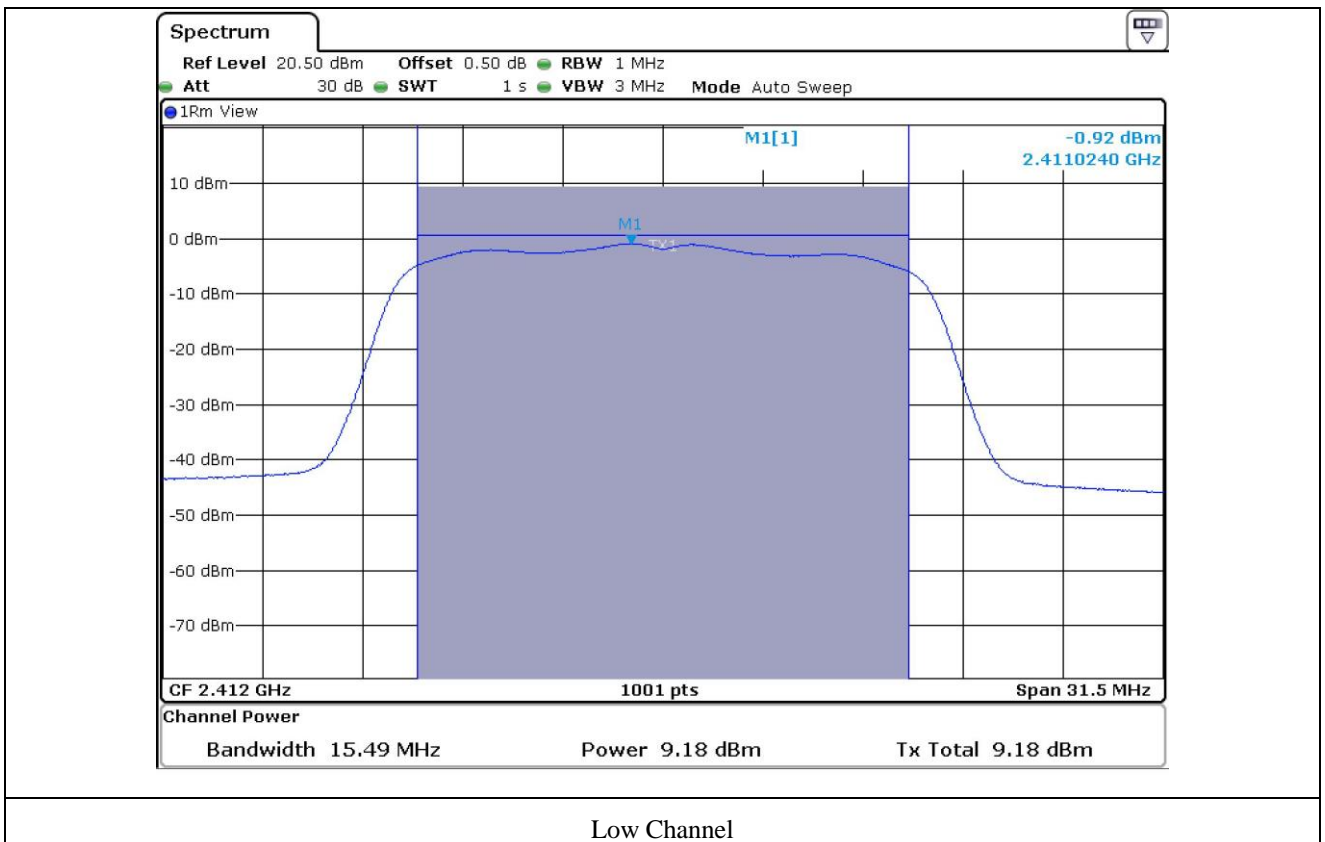
**7.2.5 Test data for 802.11g**

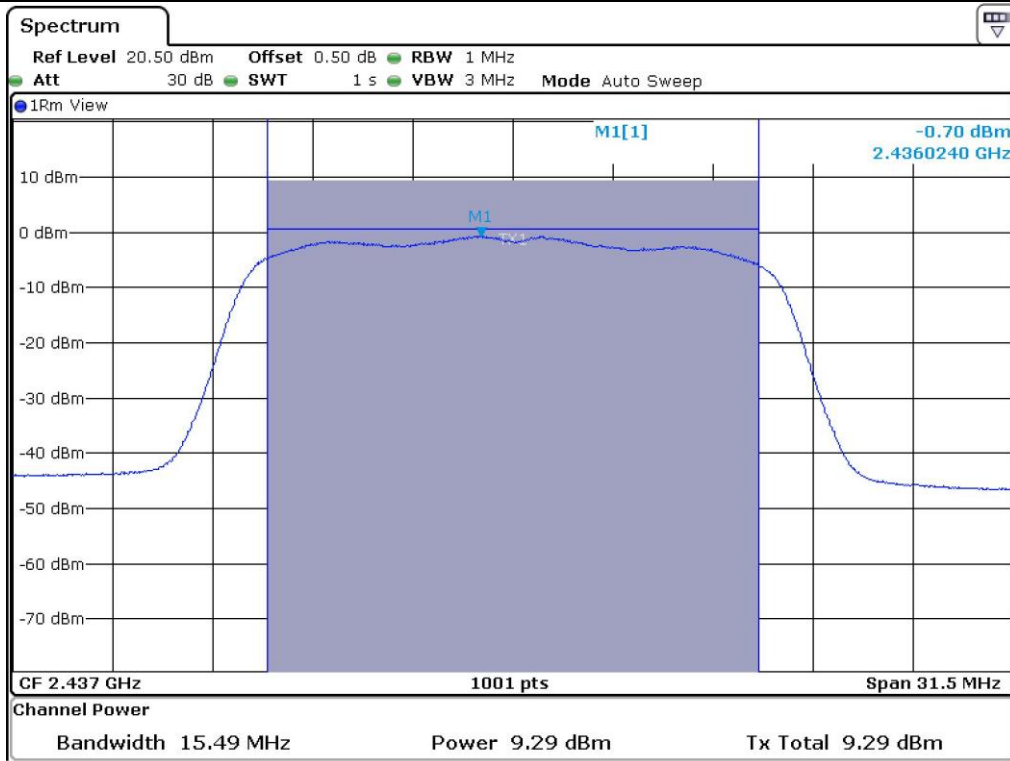
- Test Date : August 21, 2015
- Test Result : Pass

CHANNEL	FREQUENCY (MHz)	DTS (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2412	15.49	9.18	30	20.82
MIDDLE	2437	15.49	9.29	30	20.71
HIGH	2462	15.49	9.59	30	20.41

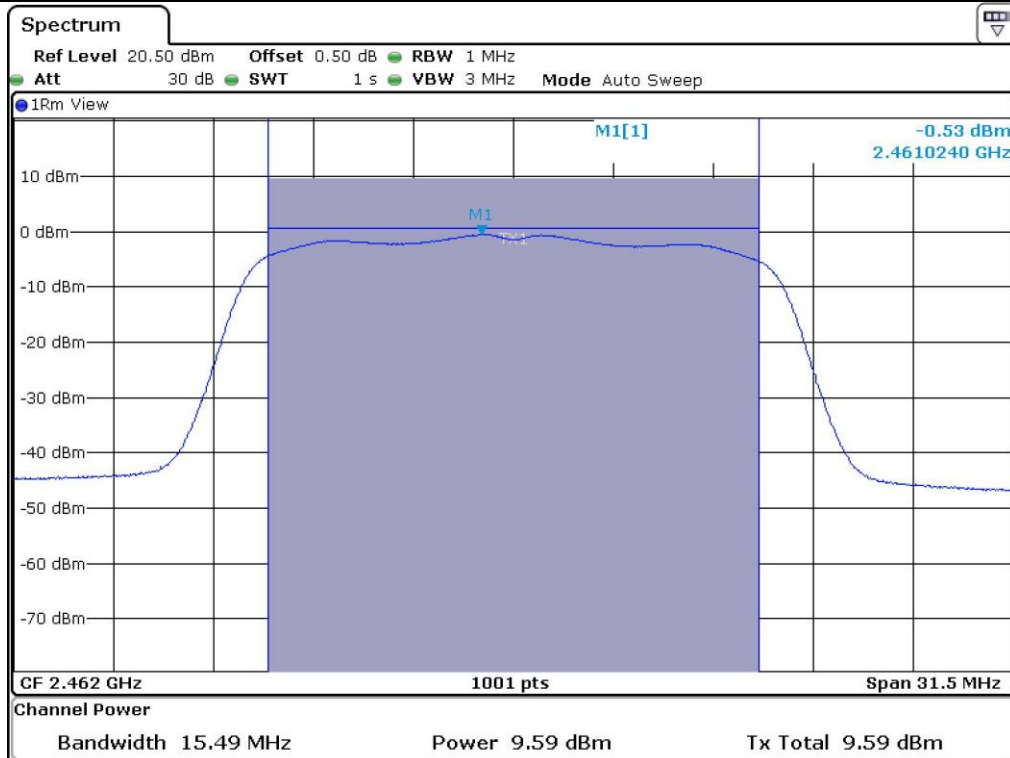
Remark. Margin = Limit – Measured Value (=Receiver Reading + Cable Loss)

  
 \_\_\_\_\_  
**Tested by: Jun-Hui, Lee / Senior Engineer**





Middle Channel



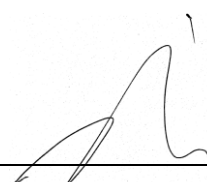
High Channel

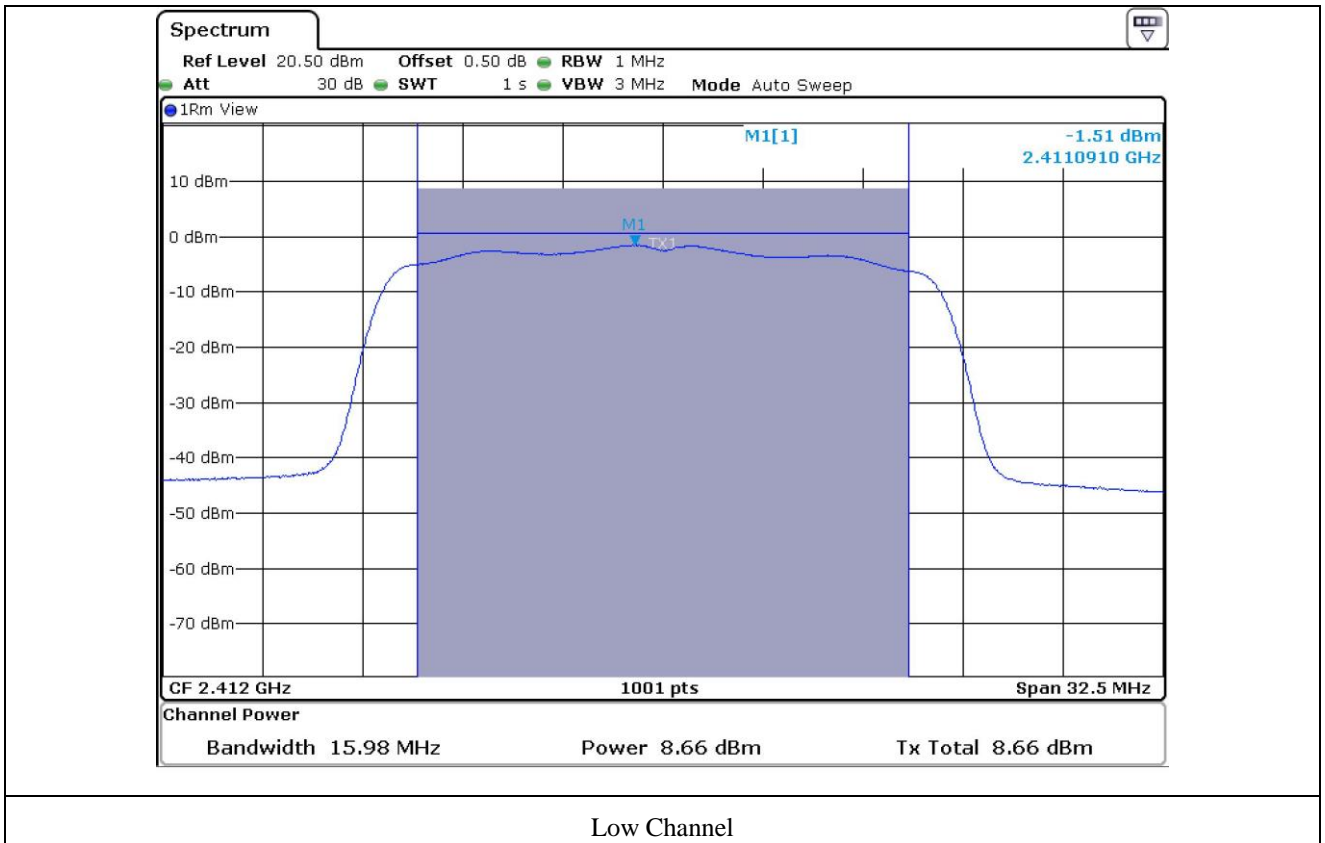
**7.2.6 Test data for 802.11n\_HT20**

- Test Date : August 21, 2015
- Test Result : Pass

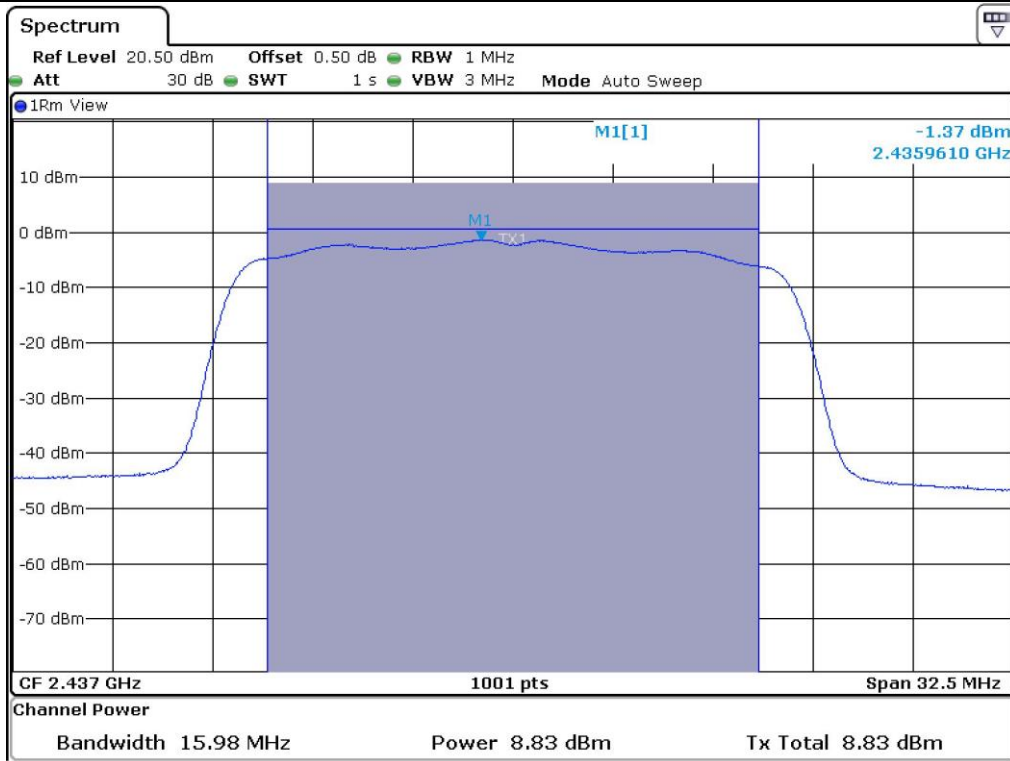
CHANNEL	FREQUENCY (MHz)	DTS (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2412	15.98	8.66	30	21.34
MIDDLE	2437	15.98	8.83	30	21.17
HIGH	2462	15.98	9.37	30	20.63

Remark. Margin = Limit – Measured Value (=Receiver Reading + Cable Loss)

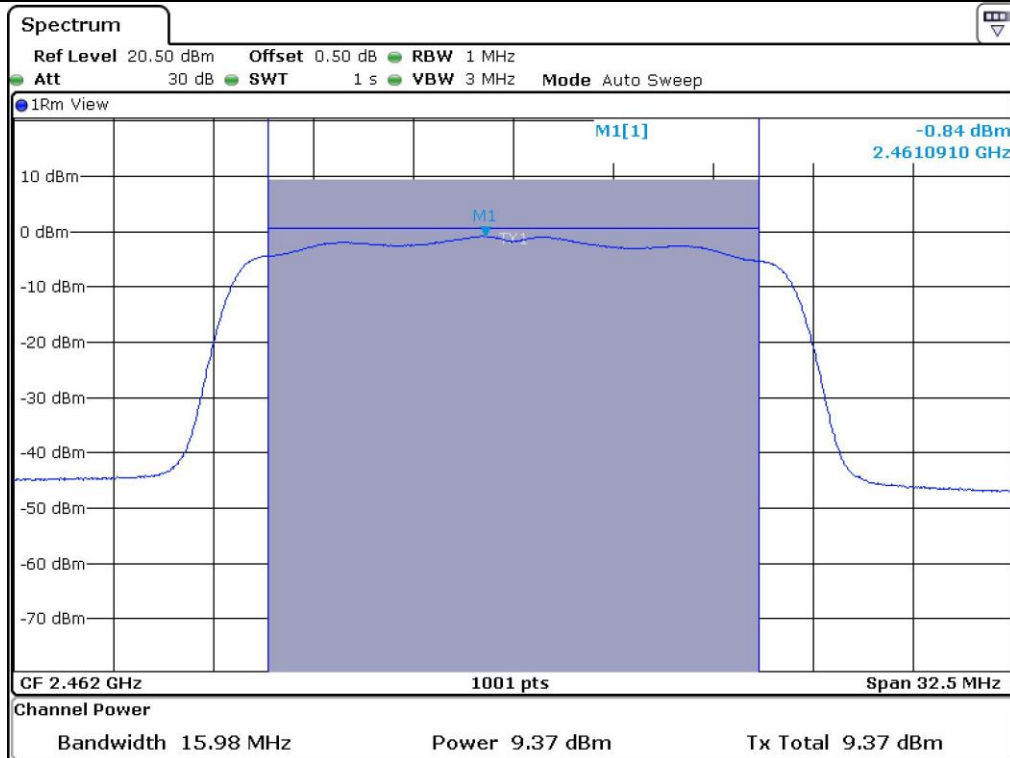
  
 \_\_\_\_\_  
**Tested by: Jun-Hui, Lee / Senior Engineer**







Middle Channel



High Channel

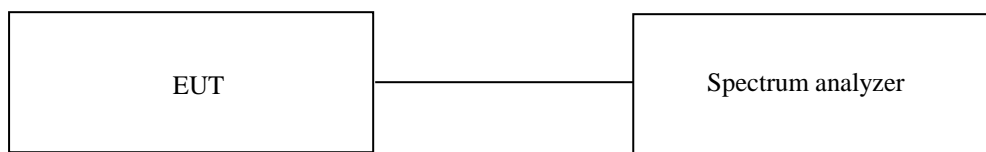
### 7.3 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

#### 7.3.1 Operating environment

Temperature : 22 °C  
 Relative humidity : 49 % R.H.

#### 7.3.2 Test set-up for conducted measurement

The antenna output of the EUT was connected to the spectrum analyzer. The resolution and video bandwidth is set to 100 kHz, and peak detection was used.



#### 7.3.3 Test set-up for radiated measurement

The radiated emissions measurements were performed on the 3 m, open-field test site. The EUT was placed on a non-conductive turntable above the ground plane.

The frequency spectrum from 30 MHz to 26.5 GHz was scanned and maximum emission levels at each frequency recorded. The system was rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for horizontal and vertical polarization of the receiving antenna.

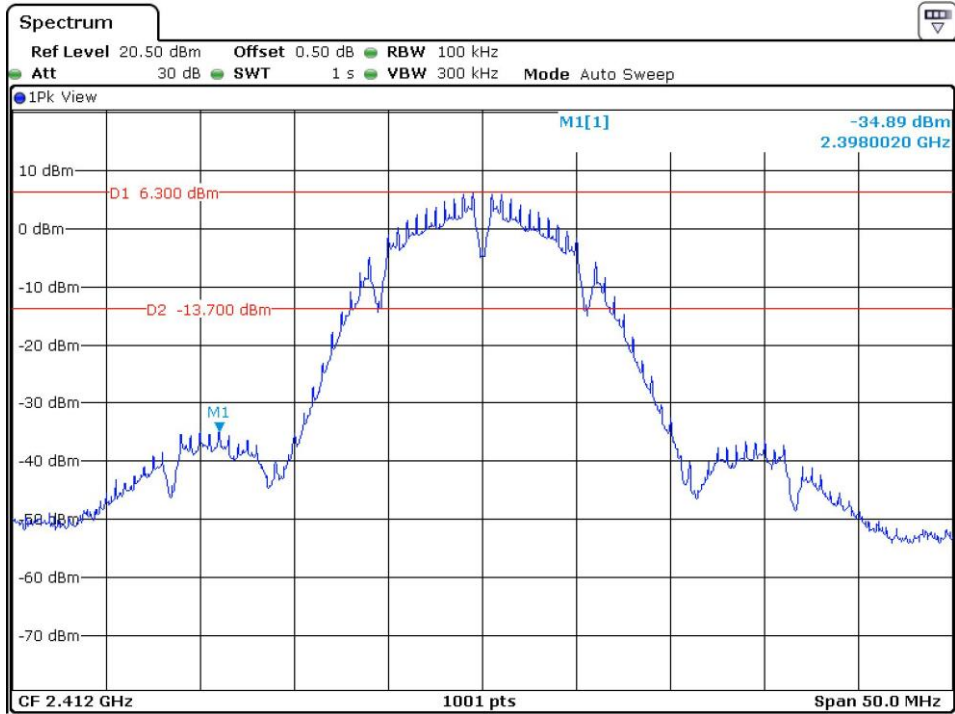
#### 7.3.4 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
■ - FSV40	Rohde & Schwarz	Signal Analyzer	101009	Jul. 22, 2015 (1Y)
■ - ESU	Rohde & Schwarz	EMI Test Receiver	100261	Apr. 29, 2015 (1Y)
■ - 310N	Sonoma Instrument	Pre-Amplifier	312544	Apr. 29, 2015 (1Y)
■ - SCU-18	Rohde & Schwarz	Pre-Amplifier	10041	Nov. 03, 2014 (1Y)
■ - DT3000	Innco System	Turn Table	930611	N/A
■ - MA4000-EP	Innco System	Antenna Master	3320611	N/A
■ - VULB9163	Schwarzbeck	TRILOG Broadband Antenna	9163-421	Jul. 10, 2014 (2Y)
■ - BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D295	Aug. 31, 2015 (2Y)
■ - BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170178	Aug. 31, 2015 (2Y)

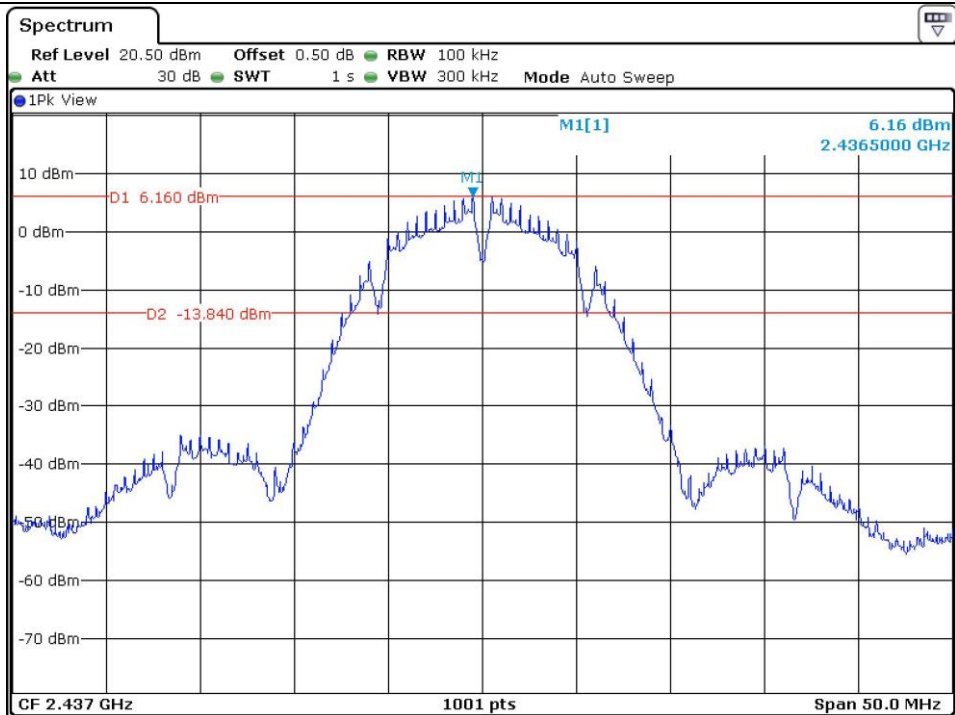
All test equipment used is calibrated on a regular basis.

7.3.5 Test data for conducted emission

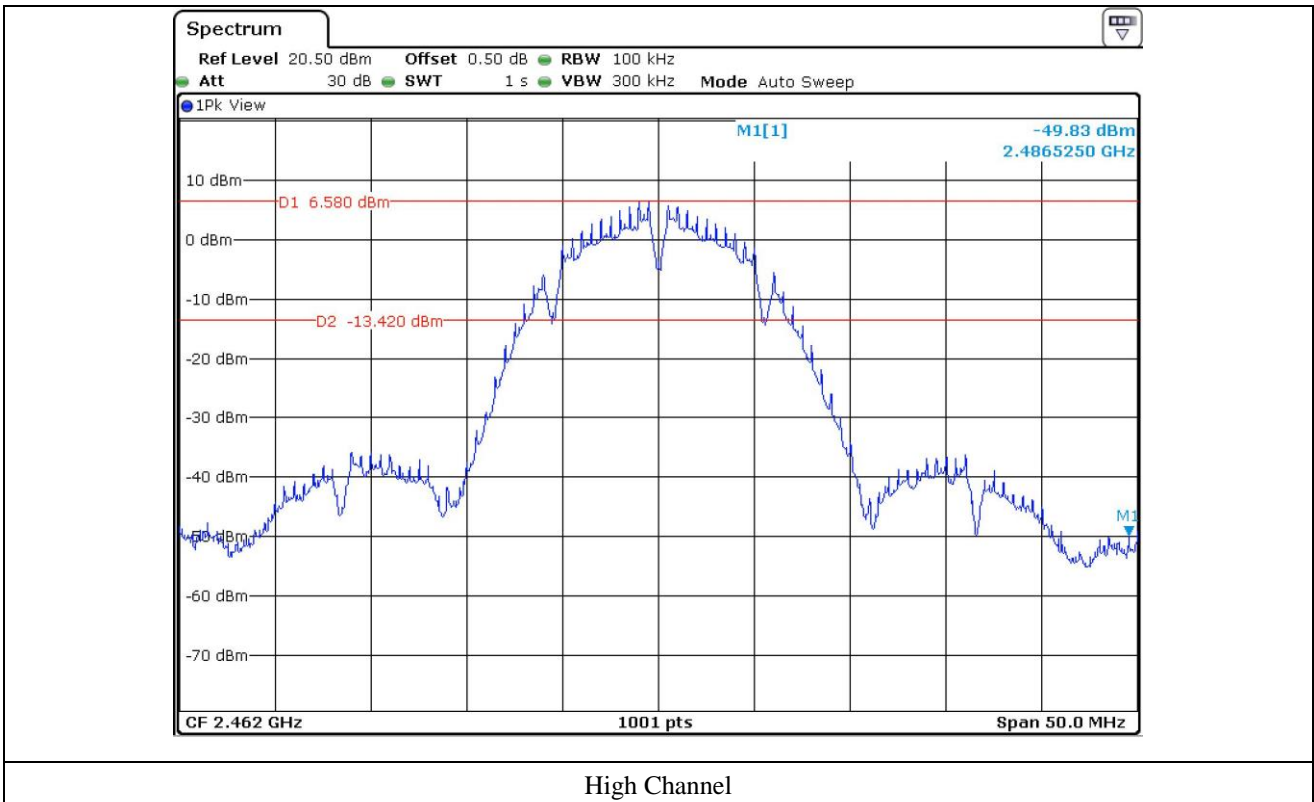
7.3.5.1 Test data for 802.11b



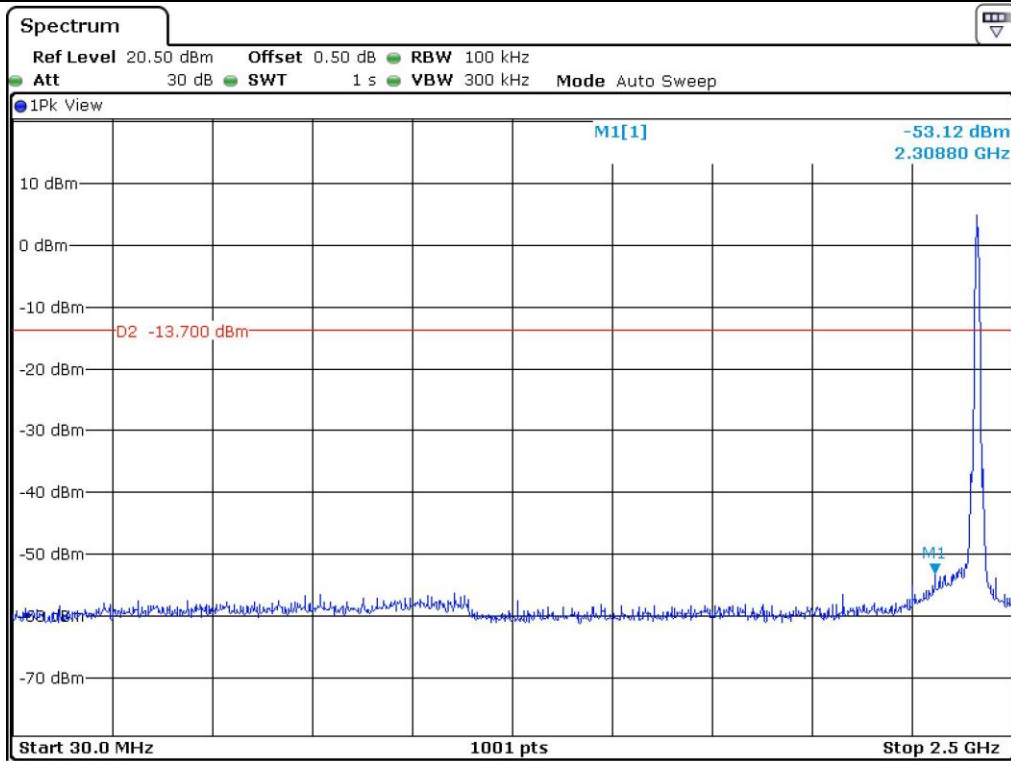
Low Channel



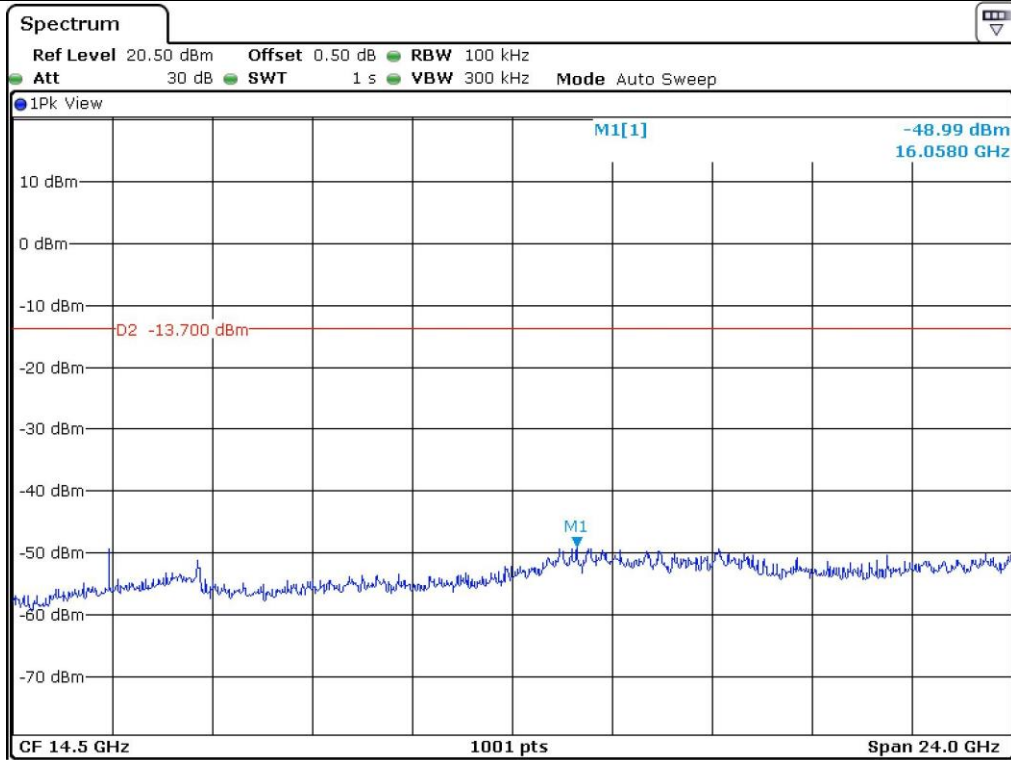
Middle Channel



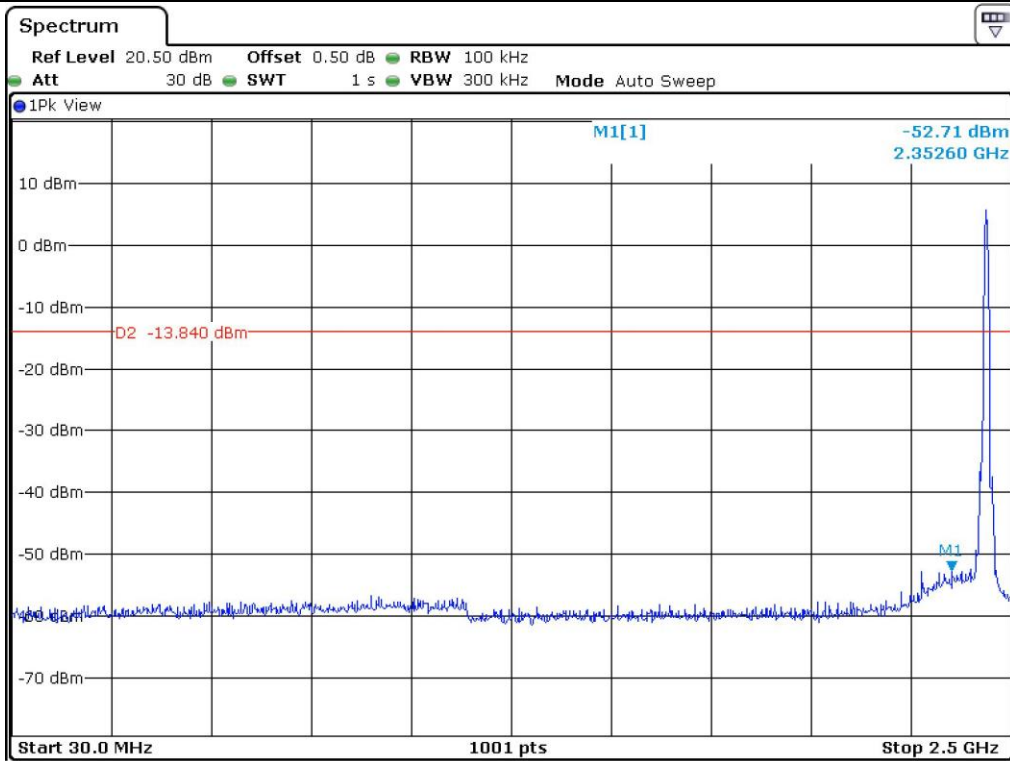
High Channel



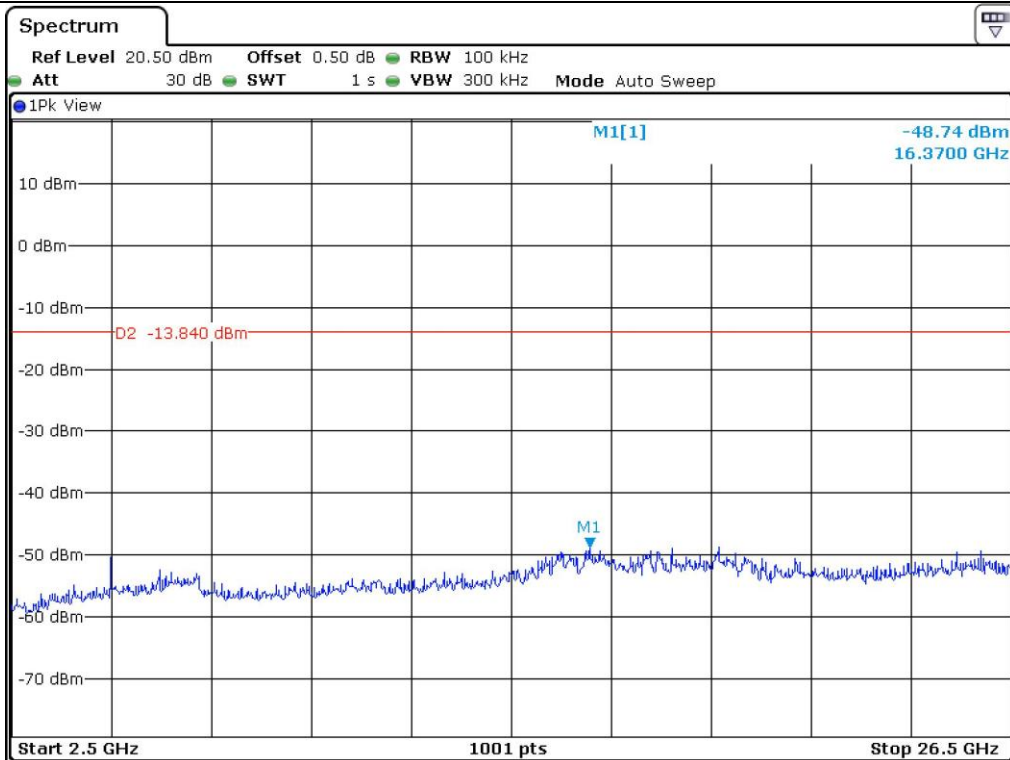
Low Channel



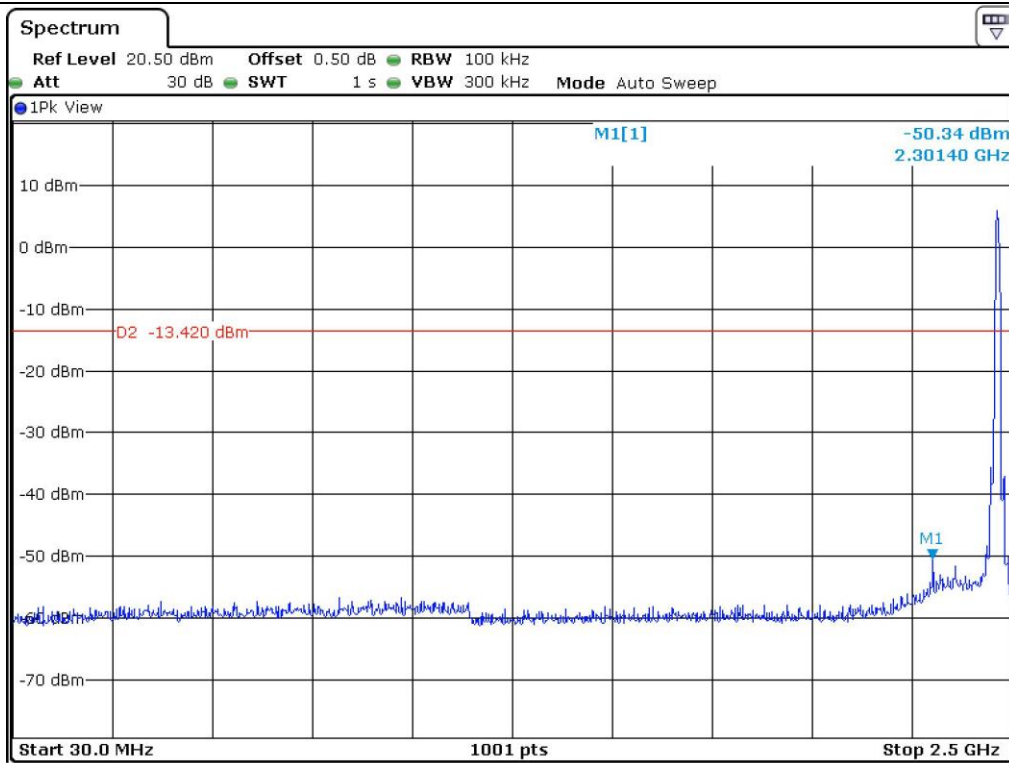
Low Channel



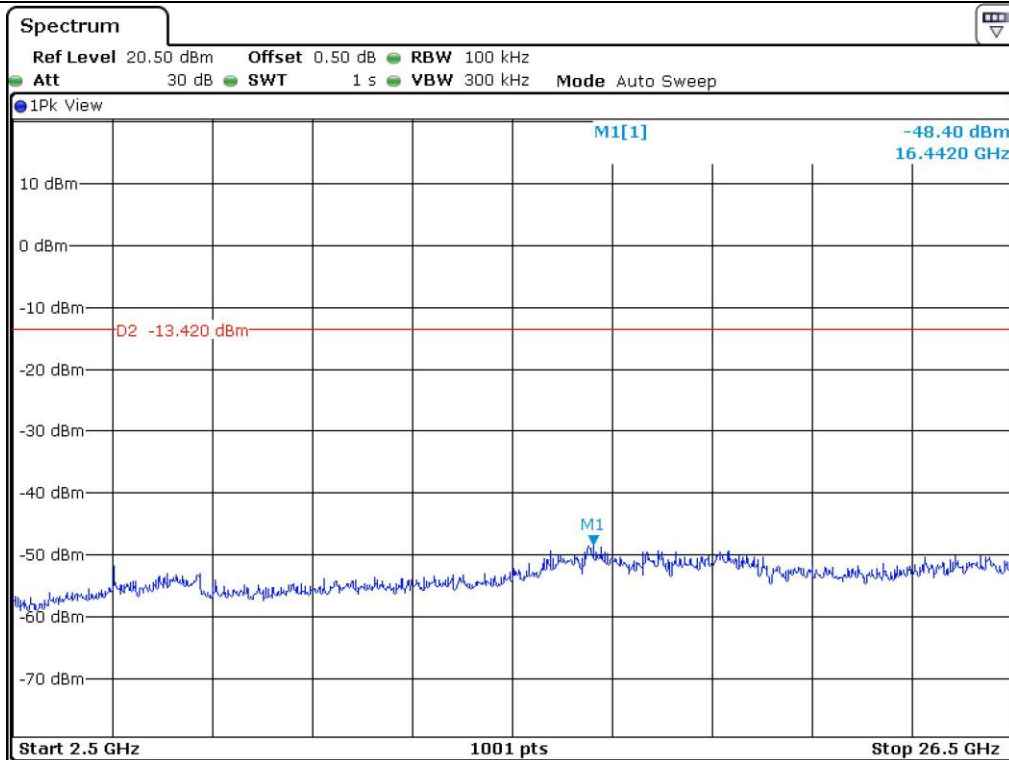
Middle Channel



Middle Channel

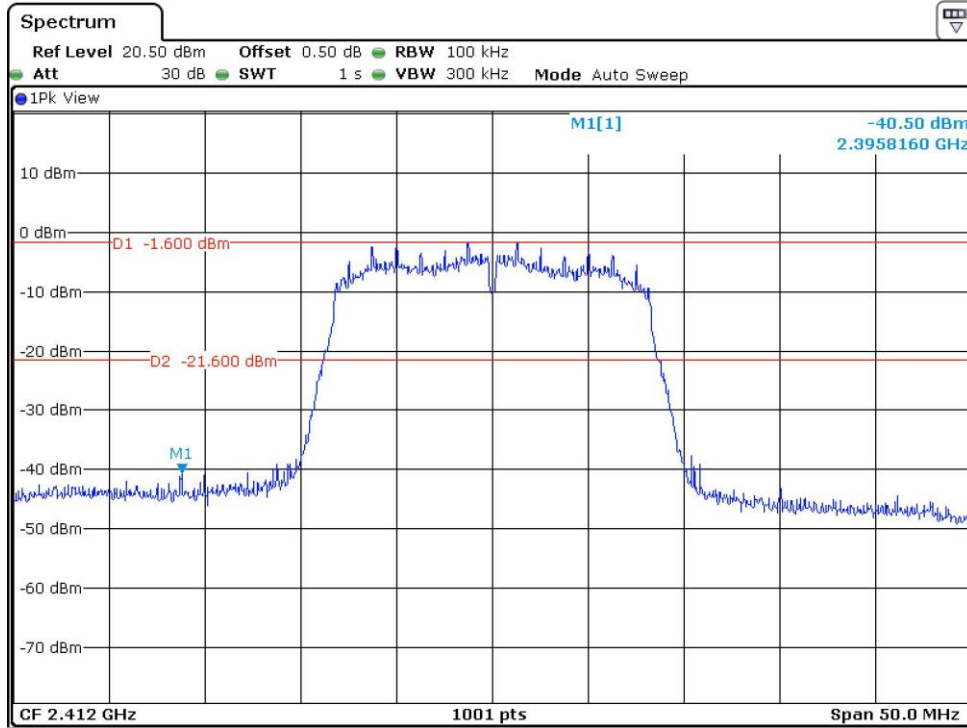


High Channel

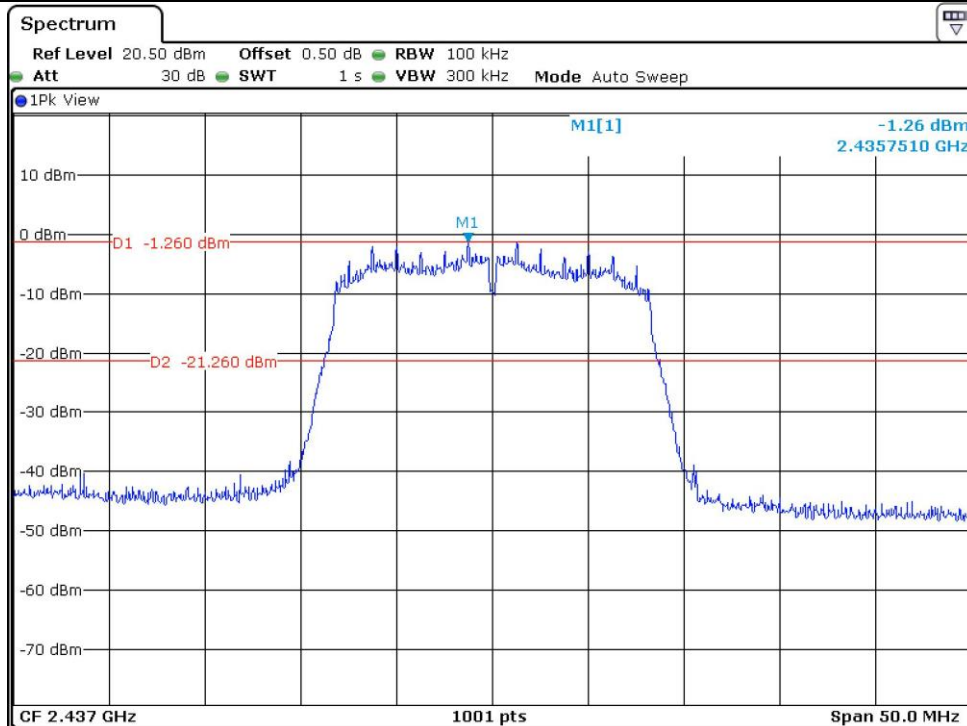


High Channel

7.3.5.2 Test data for 802.11g

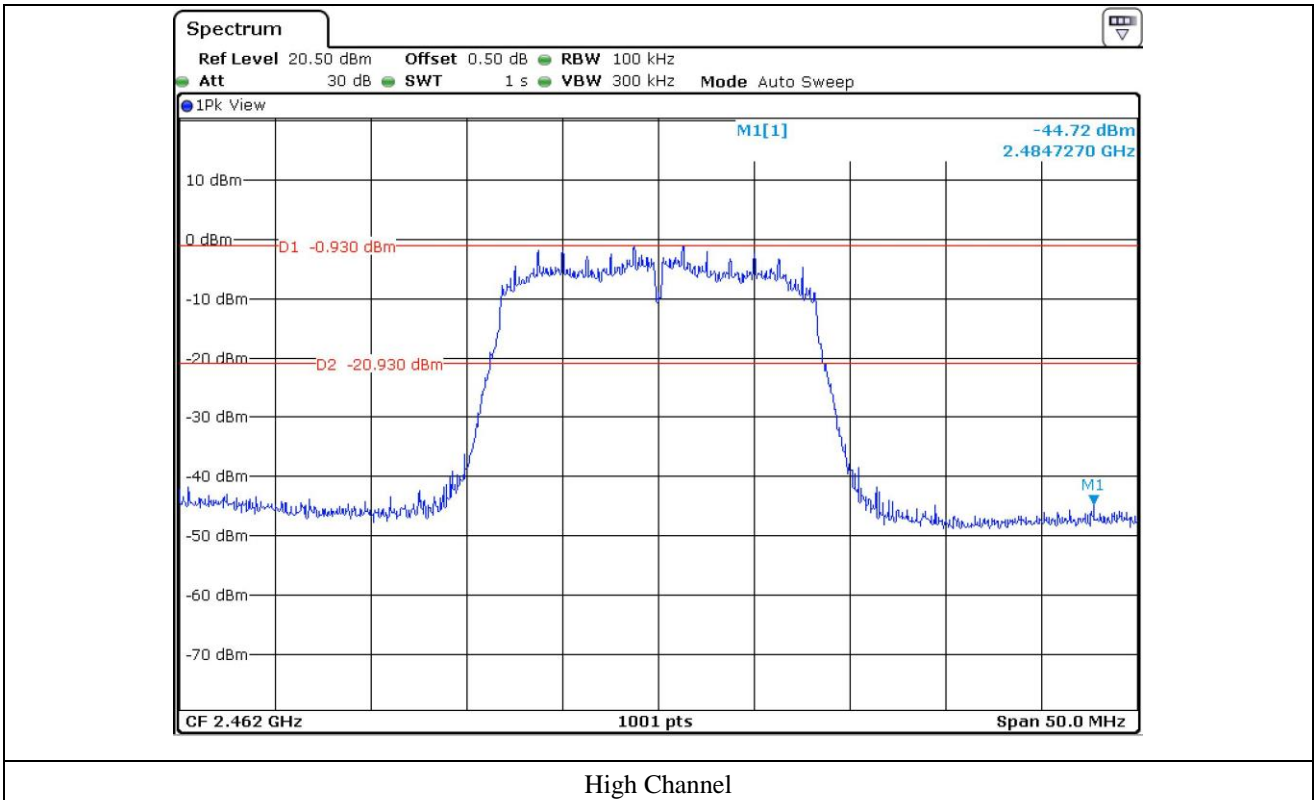


Low Channel

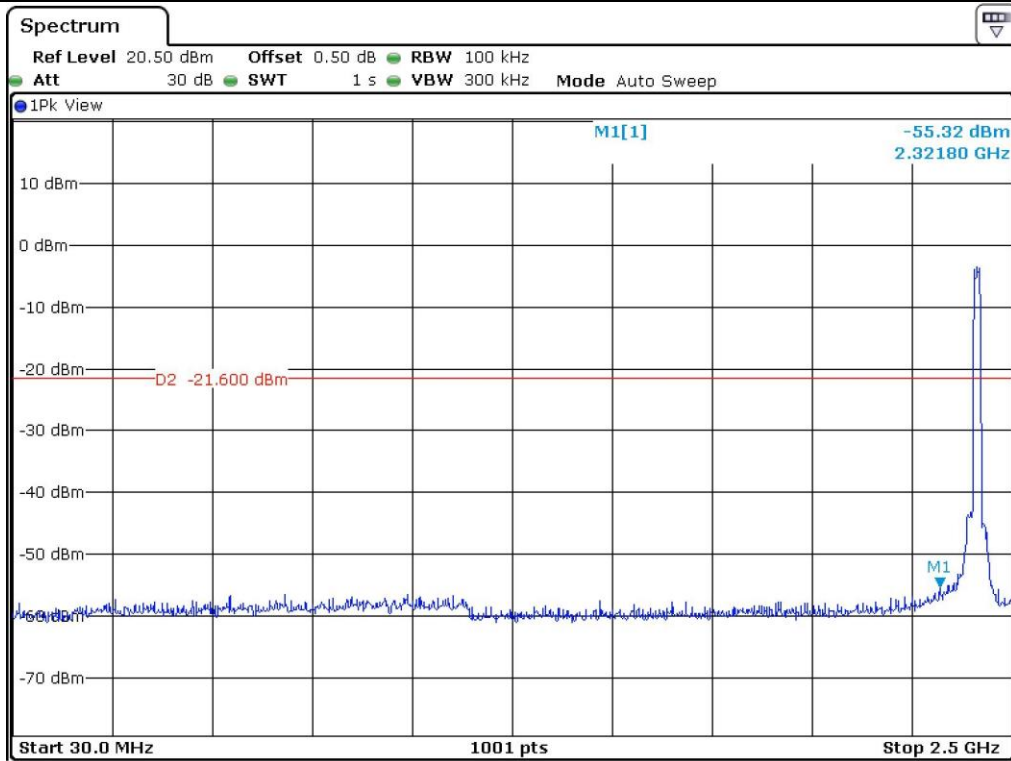


Middle Channel

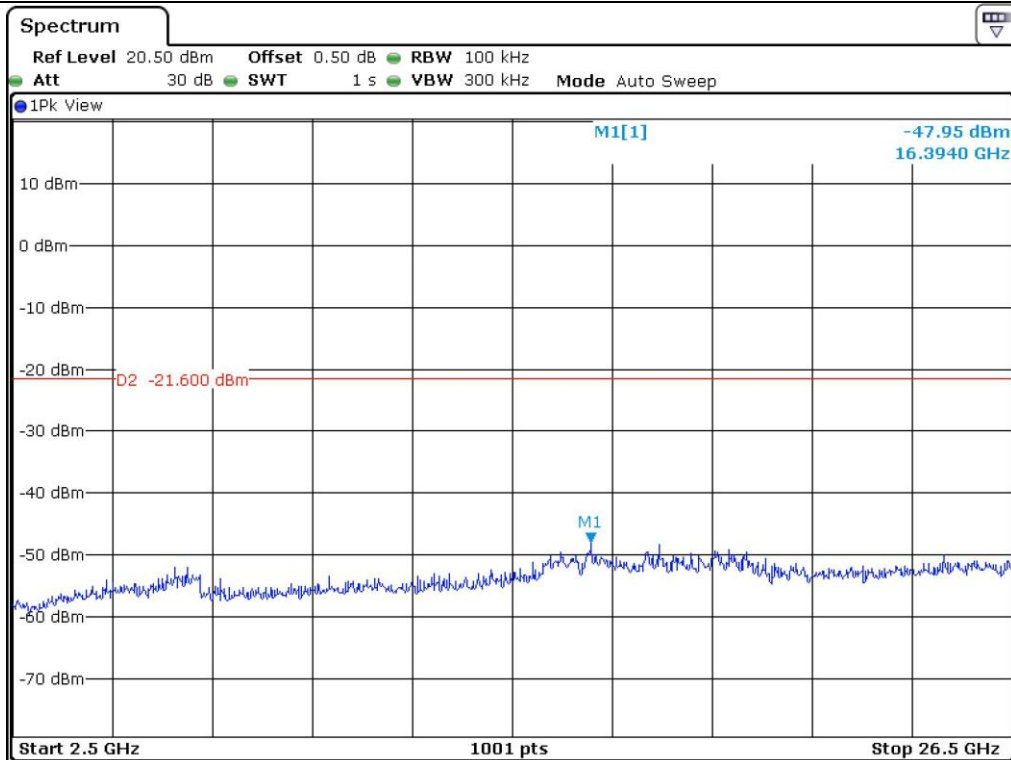




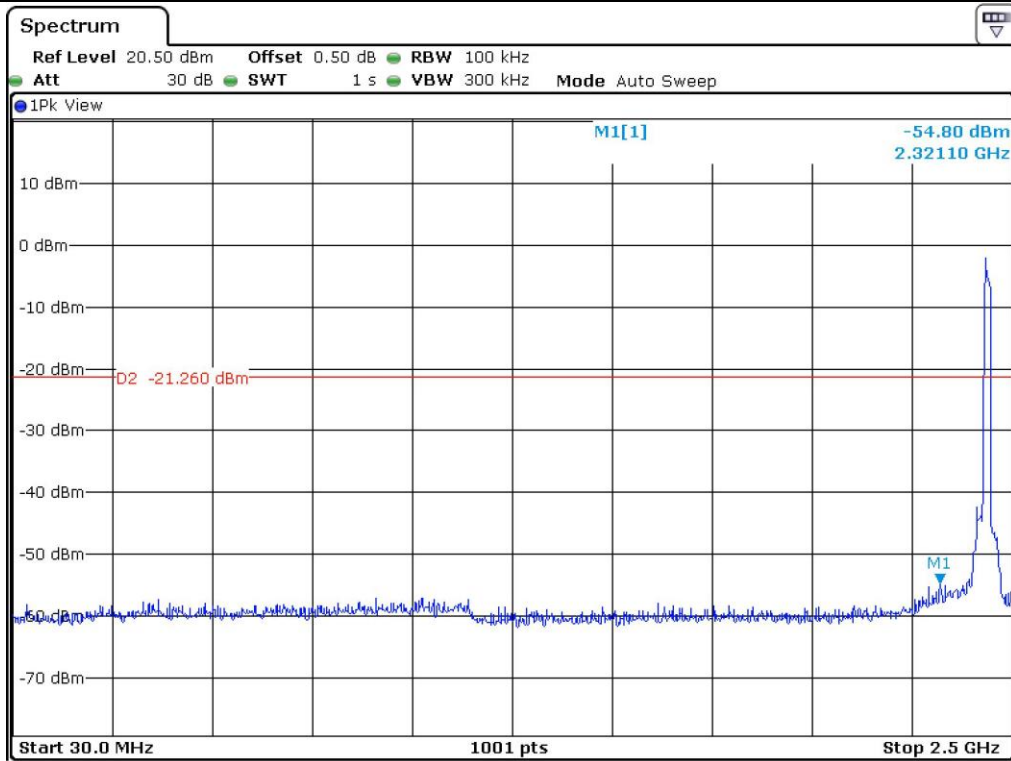
High Channel



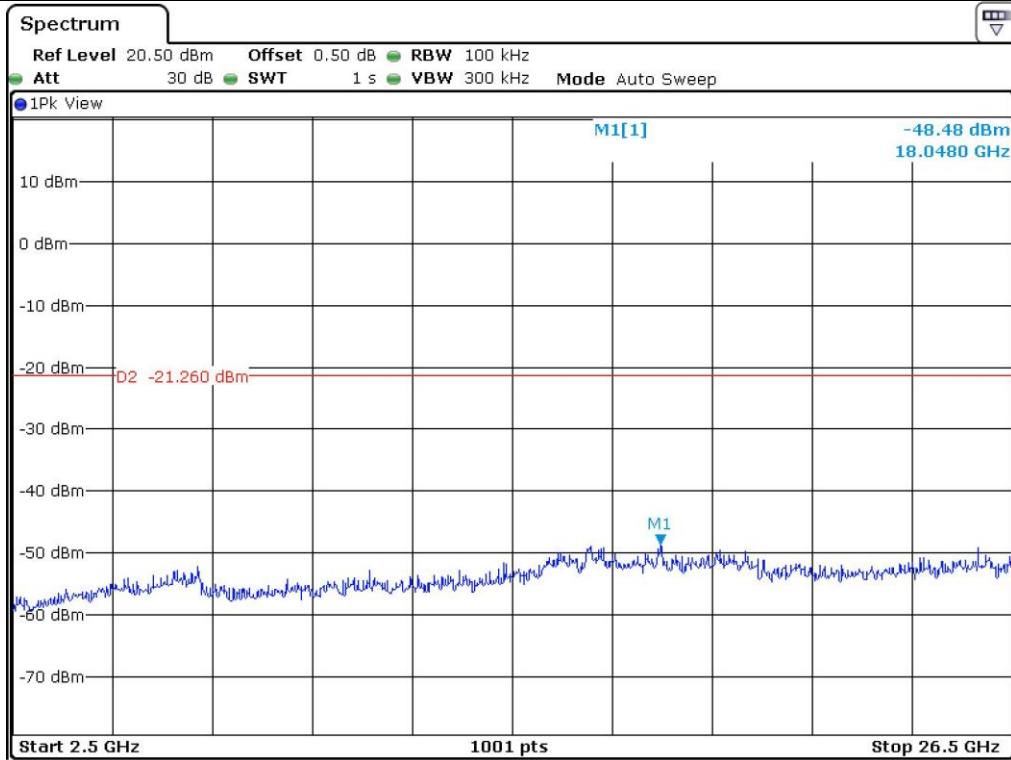
Low Channel



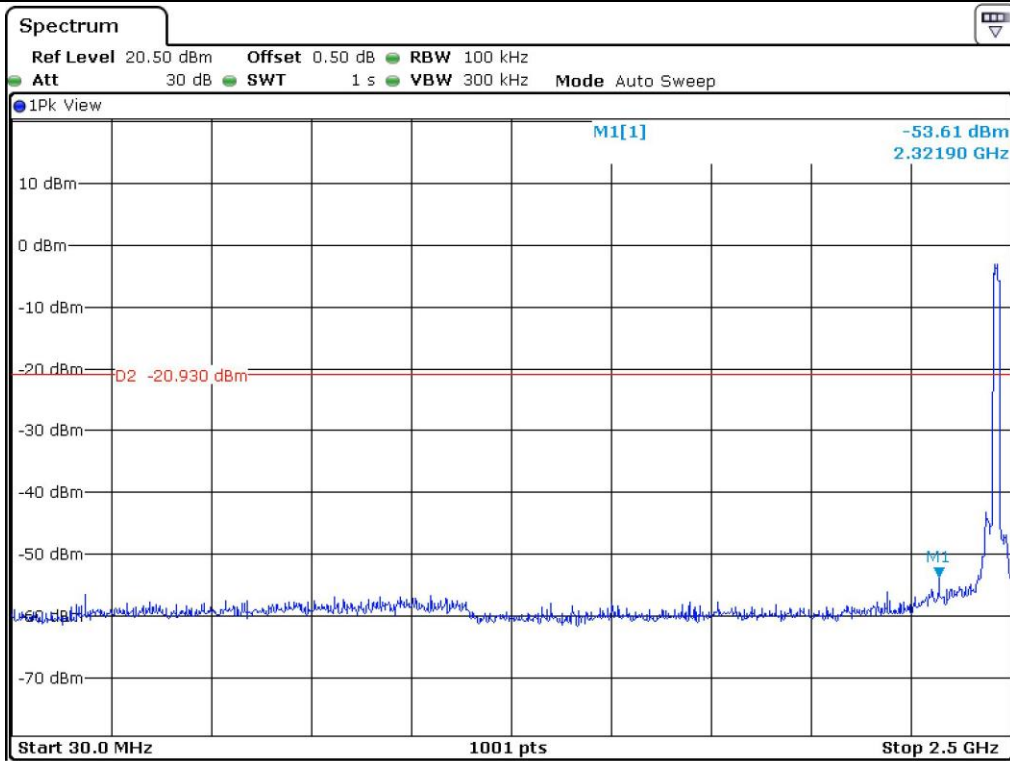
Low Channel



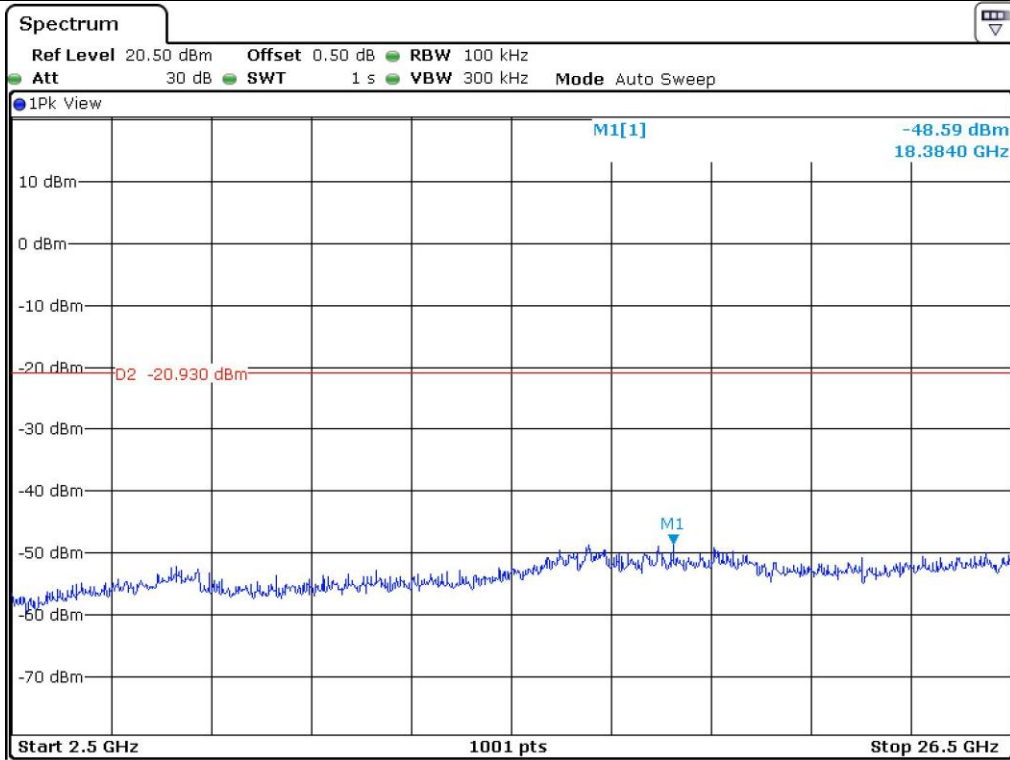
Middle Channel



Middle Channel

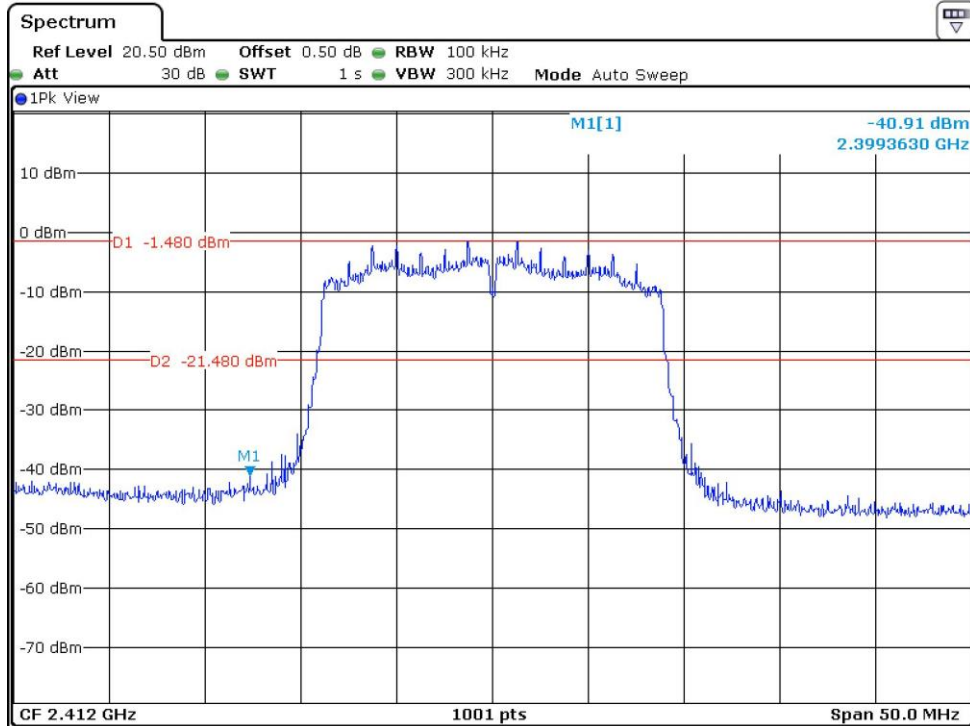


High Channel

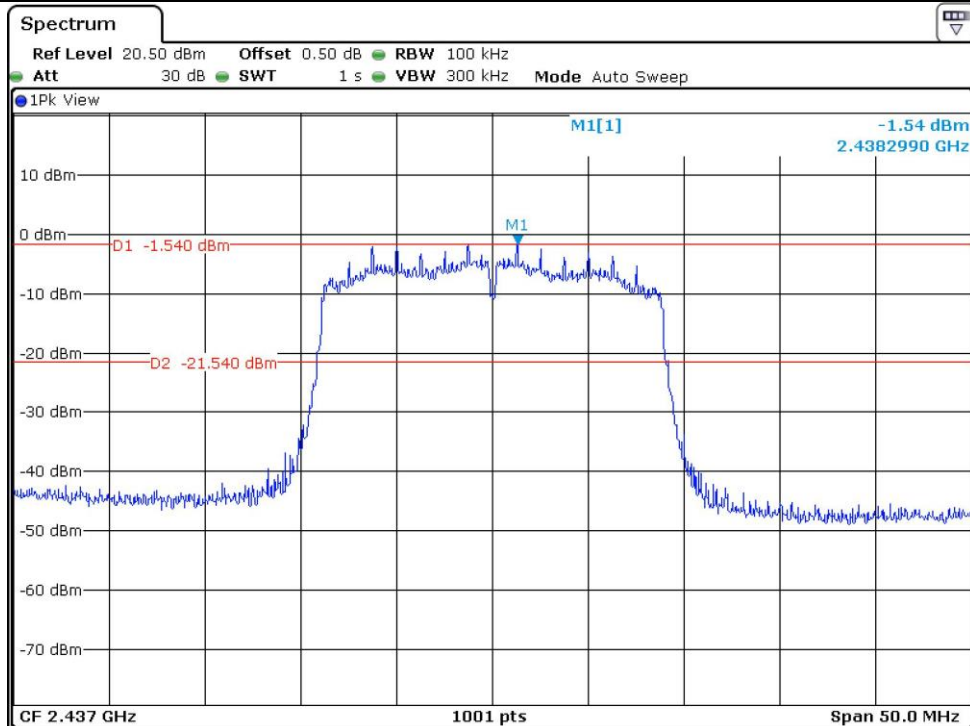


High Channel

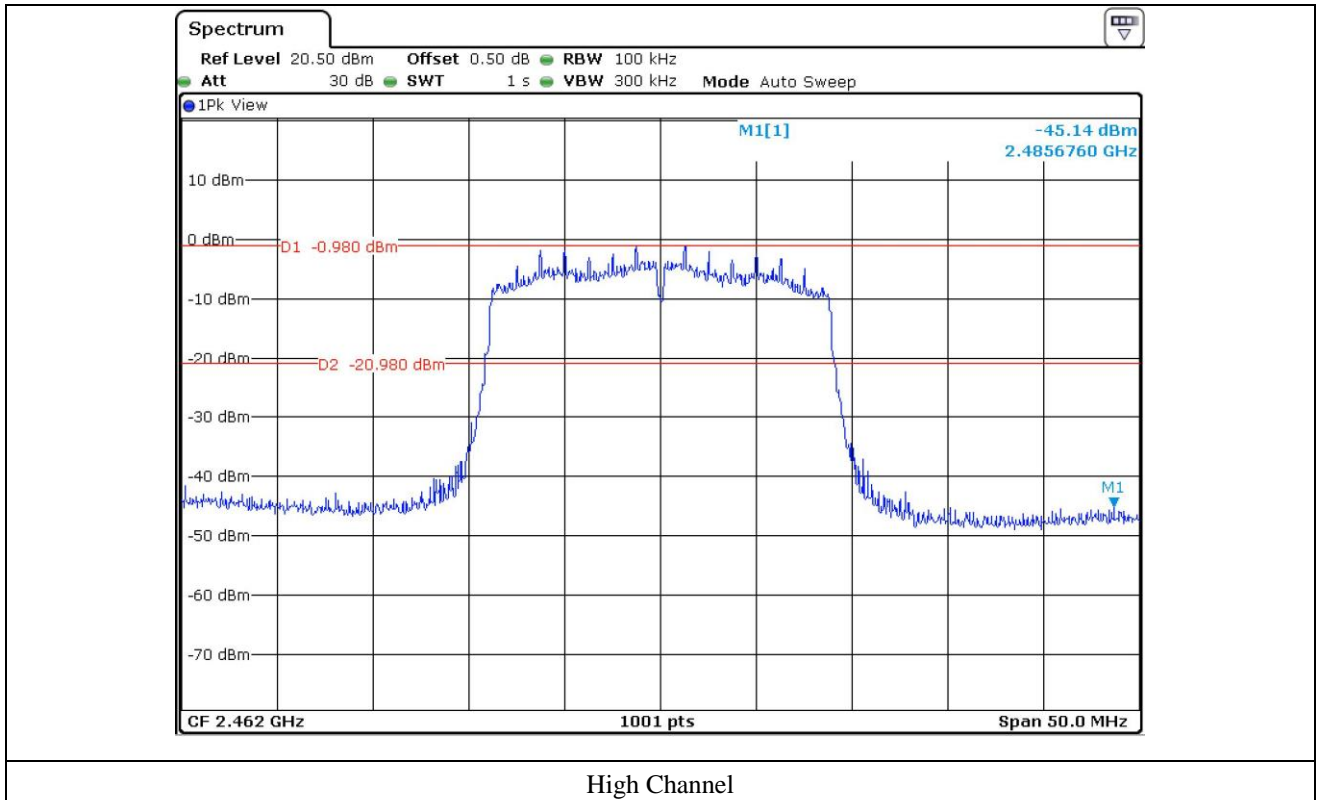
7.3.5.3 Test data for 802.11n\_HT20

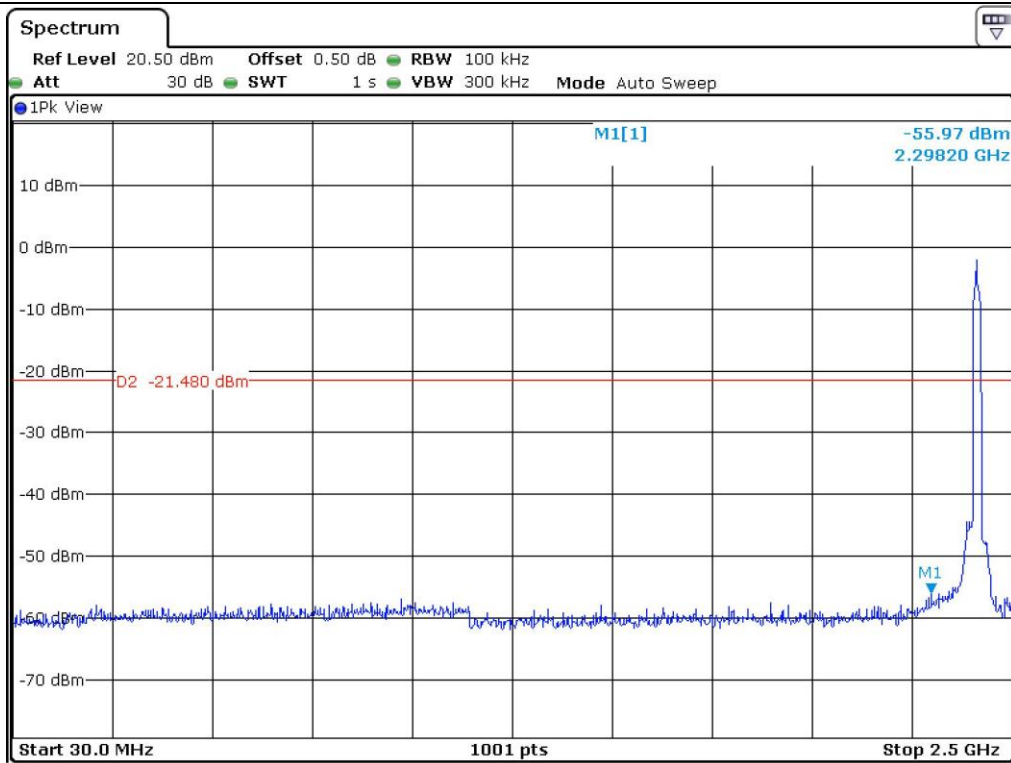


Low Channel

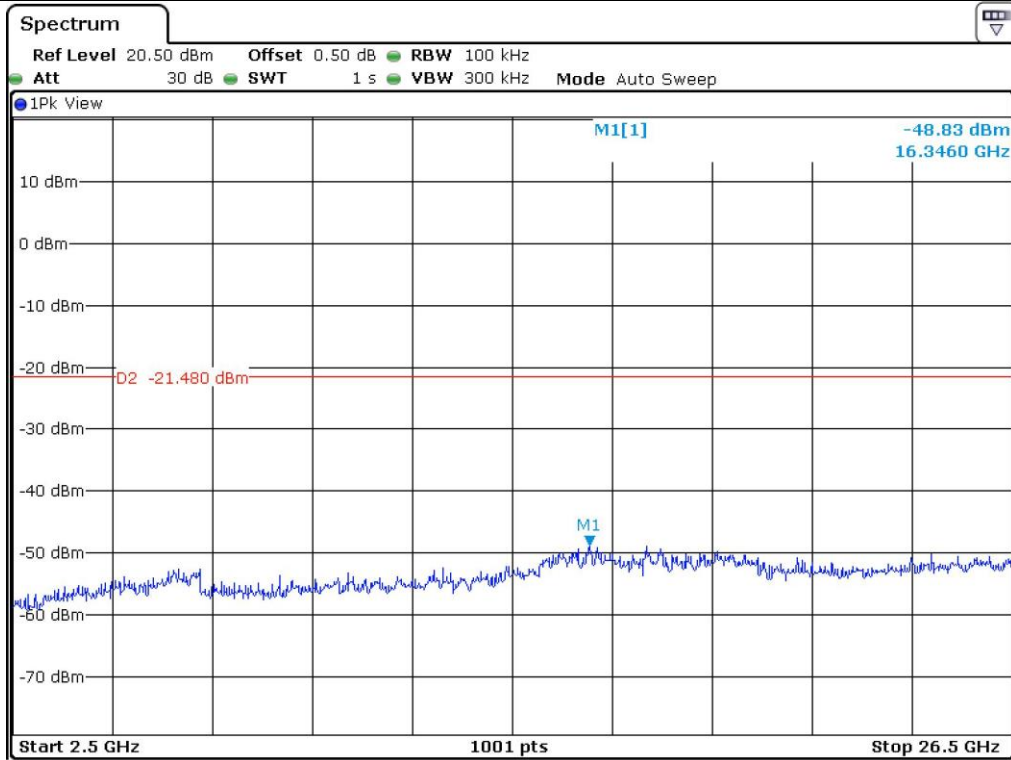


Middle Channel

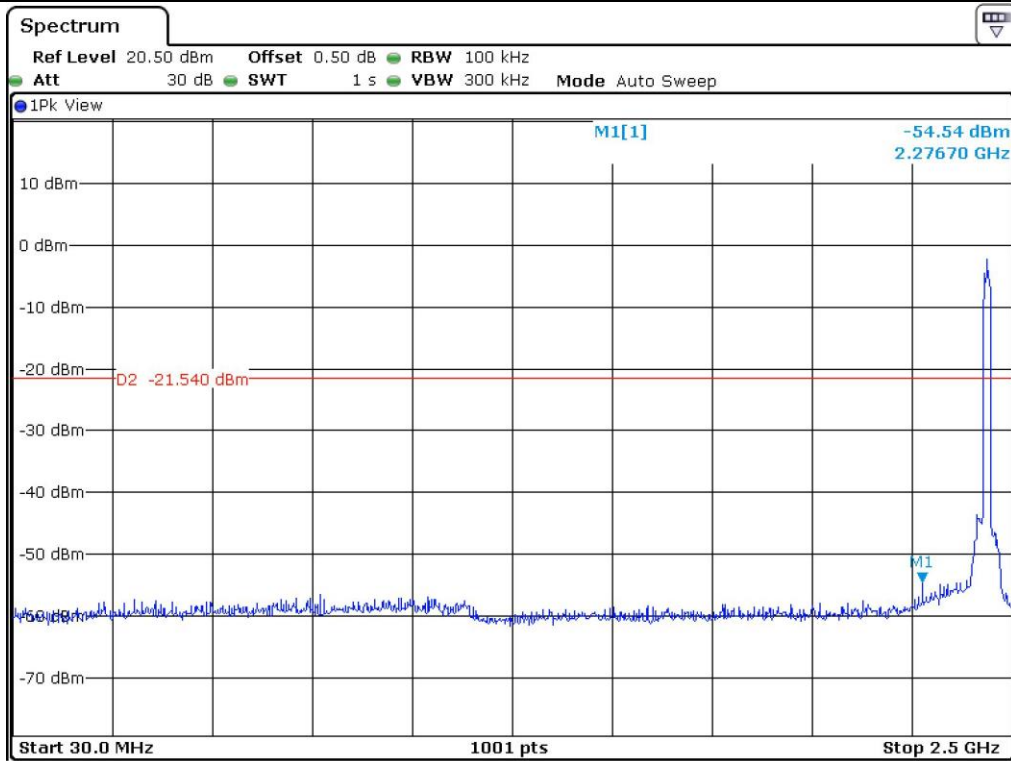




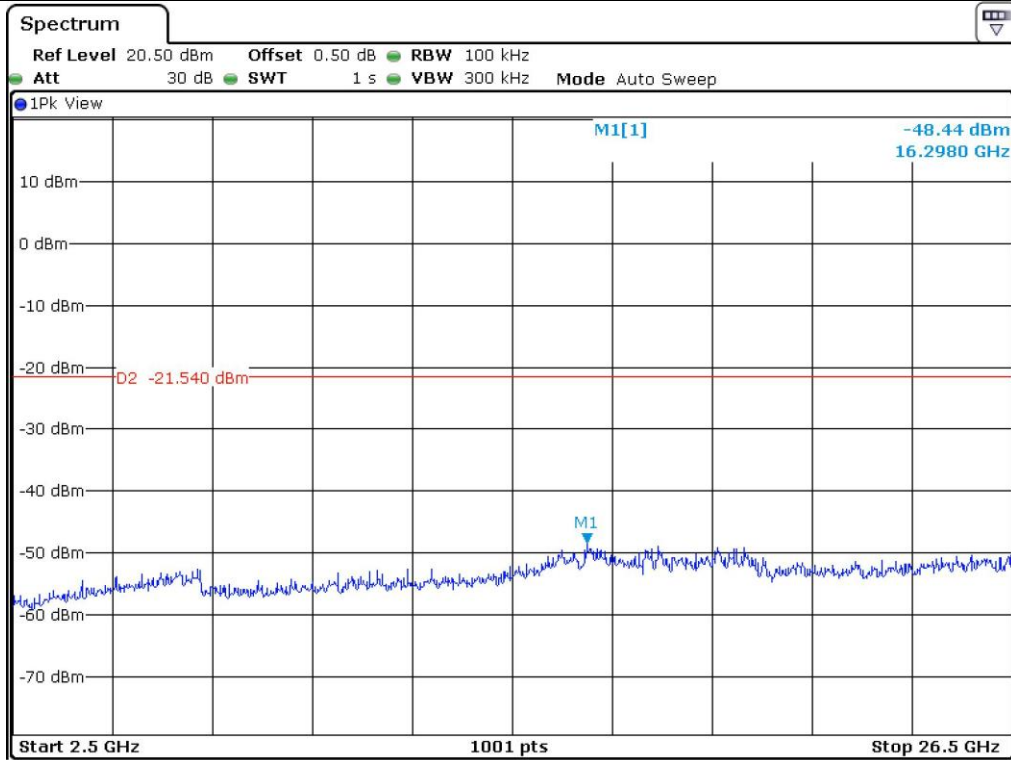
Low Channel



Low Channel

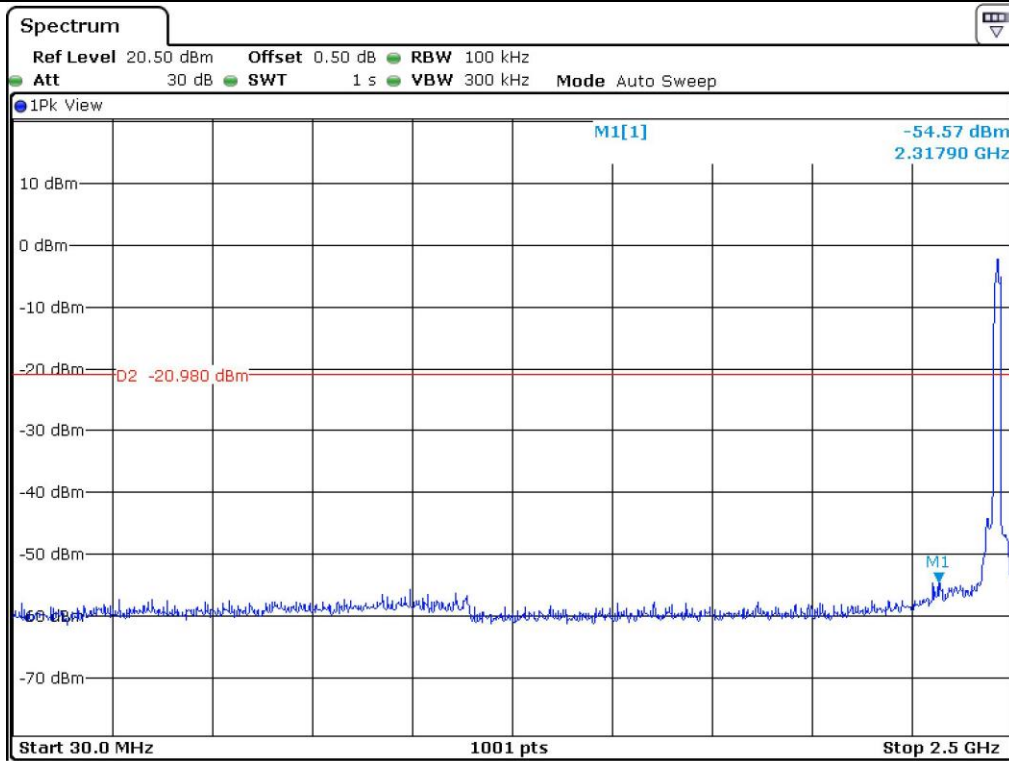


Middle Channel

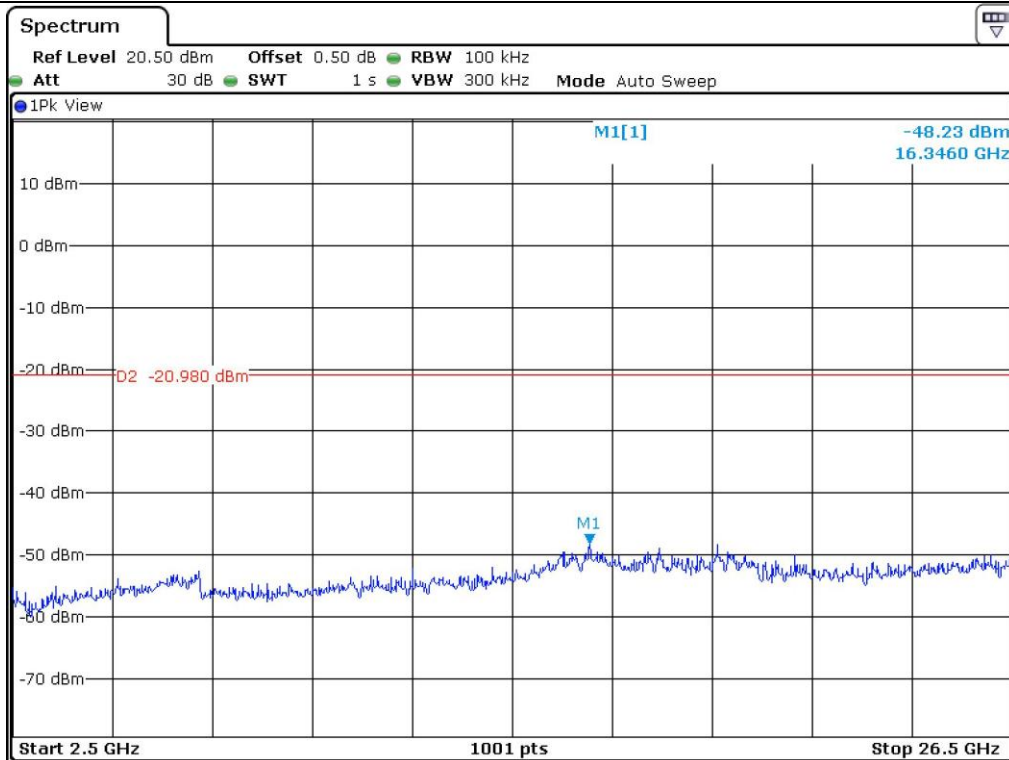


Middle Channel





High Channel



High Channel