



## TEST REPORT

### FCC PART 15 SUBPART C 15.247

**Test report  
On Behalf of  
E-Song Digital Limited  
For  
WIFI Sensor**

**Model No.: IPM SQUARE, EPM002**

**FCC ID: 2AGEVEPM002**

**Prepared for : E-Song Digital Limited  
8/F, Building 2nd, Langkou Huaming Industrial Area, Langkou Community,  
Dalang, Longhua New District, Shenzhen City.**

**Prepared By : Shenzhen HUAK Testing Technology Co., Ltd.  
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Bao'an District, Shenzhen City, China**

**Date of Test: Oct. 23, 2018~ Oct. 30, 2018**

**Date of Report: Oct. 30, 2018**

**Report Number: HK1810301406E**

**TEST RESULT CERTIFICATION****Applicant's name** .....: E-Song Digital Limited

Address .....: 8/F, Building 2nd, Langkou Huaming Industrial Area, Langkou Community, Dalang, Longhua New District, Shenzhen City.

**Manufacturer's Name** .....: E-Song Digital Limited

Address .....: 8/F, Building 2nd, Langkou Huaming Industrial Area, Langkou Community, Dalang, Longhua New District, Shenzhen City.

**Product description**

Trade Mark: IPM Square

Product name .....: WIFI Sensor

Model and/or type reference ...: IPM SQUARE, EPM002

Difference description All the same except for the model name

**Standards** .....: **47 CFR FCC Part 15 Subpart C 15.247**

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**Date of Test** .....

Date (s) of performance of tests .....: Oct. 23, 2018~ Oct. 30, 2018

Date of Issue .....: Oct. 30, 2018

Test Result .....: **Pass**Testing Engineer : 

(Gary Qian)

Technical Manager : 

(Eden Hu)

Authorized Signatory : 

(Jason Zhou)



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## 1. SUMMARY

### 1.1 TEST STANDARDS

The tests were performed according to following standards:

[FCC Rules Part 15.247](#): Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

[ANSI C63.10:2013](#) : American National Standard for Testing Unlicensed Wireless Devices

[KDB558074 D01 15.247 Meas Guidance v05](#): Guidance for compliance measurements on Digital transmission system, frequency hopping spread spectrum system, and hybrid system devices operating under section 15.247 of the FCC rules.

### 1.2 TEST DESCRIPTION

FCC RULES	DESCRIPTION OF TEST	RESULT
§15.247	Output Power	Compliant
§15.247	6 dB Bandwidth	Compliant
§15.247	Conducted Spurious Emission	Compliant
§15.247	Maximum Conducted Output Power SPECTRAL Density	Compliant
§15.209	Radiated Emission	Compliant
§15.247	Band Edges	Compliant
§15.207	Line Conduction Emission	N/A

NOTE: N/A stands for not applicable.



## 1.3 TEST FACILITY

### 1.3.1 Address of the test laboratory

Shenzhen HUAK Testing Technology Co., Ltd.

Add.:1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Heping Community, Fuhai Street, Bao'an District, Shenzhen, China

There is one 3m semi-anechoic chamber and two line conducted labs for final test. The Test Sites meet the requirements in documents ANSI C63.4 and CISPR 32/EN 55032 requirements.

### 1.3.2 Laboratory accreditation

The test facility is recognized, certified, or accredited by the following organizations:

#### **IC Registration No.: 21210**

The 3m alternate test site of Shenzhen HUAK Testing Technology Co., Ltd. EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration No.: 21210 on May 24, 2016.

#### **FCC Registration No.: CN1229**

Test Firm Registration Number : 616276

## 1.4 STATEMENT OF THE MEASUREMENT UNCERTAINTY

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 "Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements" and is documented in the Shenzhen HUAK Testing Technology Co., Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for HUAK laboratory is reported:

Test	Measurement Uncertainty	Notes
Transmitter power conducted	±0.57 dB	(1)
Transmitter power Radiated	±2.20 dB	(1)
Conducted spurious emission 9KHz-40 GHz	±2.20 dB	(1)
Occupied Bandwidth	±0.01ppm	(1)
Radiated Emission 30~1000MHz	±4.10dB	(1)
Radiated Emission Above 1GHz	±4.32dB	(1)
Conducted Disturbance 0.15~30MHz	±3.20dB	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.



## 2.GENERAL INFORMATION

### 2.1 ENVIRONMENTAL CONDITIONS

During the measurement the environmental conditions were within the listed ranges:

Normal Temperature:	25°C
Relative Humidity:	55 %
Air Pressure:	101 kPa

### 2.2 GENERAL DESCRIPTION OF EUT

Product Name:	WIFI Sensor
Model/Type reference:	IPM SQUARE
Power supply:	DC 3V by Battery
Modulation	DSSS(DBPSK/DQPSK/CCK);OFDM(BPSK/QPSK/16-QAM/64-QAM)
Supported modes	802.11 b/g/n20
Operation Frequency	2.412 GHz~2.462GHz
Channel number:	11
Antenna type:	Fixed Antenna
Antenna gain:	0.3dBi
Hardware Version:	Verer:1.02
Software Version:	V1.0

Note: For more details, refer to the user's manual of the EUT.

### 2.3 DESCRIPTION OF TEST MODES AND TEST FREQUENCY

Frequency Band	Channel Number	Frequency
2400~2483.5MHZ	1	2412 MHZ
	2	2417 MHZ
	3	2422 MHZ
	4	2427 MHZ
	5	2432 MHZ
	6	2437 MHZ
	7	2442 MHZ
	8	2447 MHZ
	9	2452 MHZ
	10	2457 MHZ
	11	2462 MHZ

Note: For 20MHZ bandwidth system use Channel 1 to Channel 11



NO.	TEST MODE DESCRIPTION
1	Low channel TX
2	Middle channel TX
3	High channel TX
4	Normal operating

**Note:**  
Transmit by 802.11b with Date rate (1/2/5.5/11)  
Transmit by 802.11g with Date rate (6/9/12/18/24/36/48/54)  
Transmit by 802.11n (20MHz) with Date rate (6.5/13/19.5/26/39/52/58.5/65)

**Note:**

1. The EUT has been set to operate continuously on the lowest, middle and highest operation frequency individually, and the eut is operating at its maximum duty cycle>or equal 98%
2. All modes under which configure applicable have been tested and the worst mode test data recording in the test report, if no other mode data.
3. For Radiated Emission, 3axis were chosen for testing for each applicable mode.

**2.4 RELATED SUBMITTAL(S) / GRANT (S)**

This submittal(s) (test report) is intended to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

**2.5 MODIFICATIONS**

No modifications were implemented to meet testing criteria.

**2.6. IEEE 802.11N MODULATION SCHEME**

MCS Index	Nss	Modulation	R	NBPSC	NCBPS		NDBPS		Data rate(Mbps)	
					20MHz	40MHz	20MHz	40MHz	20MHz	40MHz
0	1	BPSK	1/2	1	52	108	26	54	6.5	13.5
1	1	QPSK	1/2	2	104	216	52	108	13.0	27.0
2	1	QPSK	3/4	2	104	216	78	162	19.5	40.5
3	1	16-QAM	1/2	4	208	432	104	216	26.0	54.0
4	1	16-QAM	3/4	4	208	432	156	324	39.0	81.0
5	1	64-QAM	2/3	6	312	648	208	432	52.0	108.0
6	1	64-QAM	3/4	6	312	648	234	489	58.5	121.5
7	1	64-QAM	5/6	6	312	648	260	540	65.0	135.0



Symbol	Explanation
NSS	Number of spatial streams
R	Code rate
NBPSC	Number of coded bits per single carrier
NCBPS	Number of coded bits per symbol
NDBPS	Number of data bits per symbol
GI	Guard interval

## 2.7 EQUIPMENT USED

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	L.I.S.N. Artificial Mains Network	R&S	ENV216	HKE-002	Dec. 28, 2017	1 Year
2.	Receiver	R&S	ESCI 7	HKE-010	Dec. 28, 2017	1 Year
3.	RF automatic control unit	Tonscend	JS0806-2	HKE-060	Dec. 28, 2017	1 Year
4.	Horn Antenna	Schewarzbeck	BBHA 9170	HKE-090	Dec. 28, 2017	1 Year
5.	Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 28, 2017	1 Year
6.	Preamplifier	Schwarzbeck	BBV 9743	HKE-006	Dec. 28, 2017	1 Year
7.	EMI Test Receiver	Rohde & Schwarz	ESCI 7	HKE-010	Dec. 28, 2017	1 Year
8.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	HKE-012	Dec. 28, 2017	1 Year
9.	Loop Antenna	Schwarzbeck	FMZB 1519 B	HKE-014	Dec. 28, 2017	1 Year
10.	Horn Antenna	Schwarzbeck	9120D	HKE-013	Dec. 28, 2017	1 Year
11.	Pre-amplifier	EMCI	EMC051845 SE	HKE-015	Dec. 28, 2017	1 Year
12.	Pre-amplifier	Agilent	83051A	HKE-016	Dec. 28, 2017	1 Year
13.	EMI Test Software EZ-EMC	Tonscend	JS1120-B Version	HKE-083	Dec. 28, 2017	N/A
14.	Power Sensor	Agilent	E9300A	HKE-086	Dec. 28, 2017	1 Year
15.	Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 28, 2017	1 Year
16.	Signal generator	Agilent	N5182A	HKE-029	Dec. 28, 2017	1 Year
17.	Signal Generator	Agilent	83630A	HKE-028	Dec. 28, 2017	1 Year
18.	Shielded room	Shiel Hong	4*3*3	HKE-039	Dec. 28, 2017	3 Year

The calibration interval was one year



### 3. OUTPUT POWER

#### 3.1. MEASUREMENT PROCEDURE

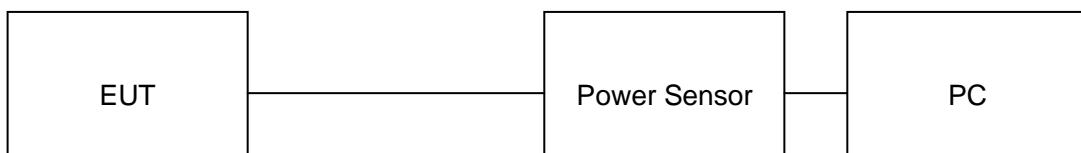
For average power test:

1. Connect EUT RF output port to power sensor through an RF attenuator.
2. Connect the power sensor to the PC.
3. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
4. Record the maximum power from the software.

**Note :** The EUT was tested according to ANSI C63.10 (2013) for compliance to FCC 47CFR 15.247 requirements.

#### 3.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

##### AVERAGE POWER SETUP





### 3.3. LIMITS AND MEASUREMENT RESULT

<b>TEST ITEM</b>	OUTPUT POWER		
<b>TEST MODE</b>	802.11b with data rate 1		

Frequency (GHz)	Average Power (dBm)	Applicable Limits (dBm)	Pass or Fail
2.412	9.64	30	Pass
2.437	9.52	30	Pass
2.462	9.38	30	Pass

<b>TEST ITEM</b>	OUTPUT POWER		
<b>TEST MODE</b>	802.11g with data rate 6		

Frequency (GHz)	Average Power (dBm)	Applicable Limits (dBm)	Pass or Fail
2.412	8.54	30	Pass
2.437	8.62	30	Pass
2.462	8.71	30	Pass

<b>TEST ITEM</b>	OUTPUT POWER		
<b>TEST MODE</b>	802.11n 20 with data rate 6.5		

Frequency (GHz)	Average Power (dBm)	Applicable Limits (dBm)	Pass or Fail
2.412	7.54	30	Pass
2.437	7.68	30	Pass
2.462	7.28	30	Pass



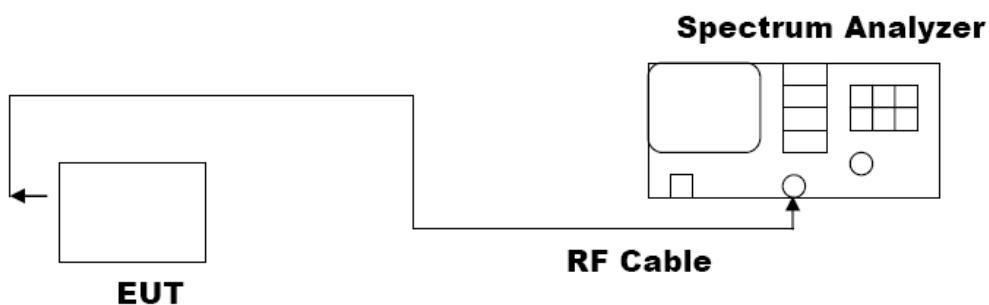
## 4. 6 DB BANDWIDTH

### 4.1. MEASUREMENT PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
3. Set SPA Centre Frequency = Operation Frequency, RBW= 100 KHz, VBW $\geqslant$ 3 $\times$ RBW.
4. Set SPA Trace 1 Max hold, then View.

**Note:** The EUT was tested according to ANSI C63.10 (2013) for compliance to FCC 47CFR 15.247 requirements.

### 4.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)





#### 4.3. LIMITS AND MEASUREMENT RESULTS

TEST ITEM	6DB BANDWIDTH	
TEST MODE	802.11b with data rate 11	

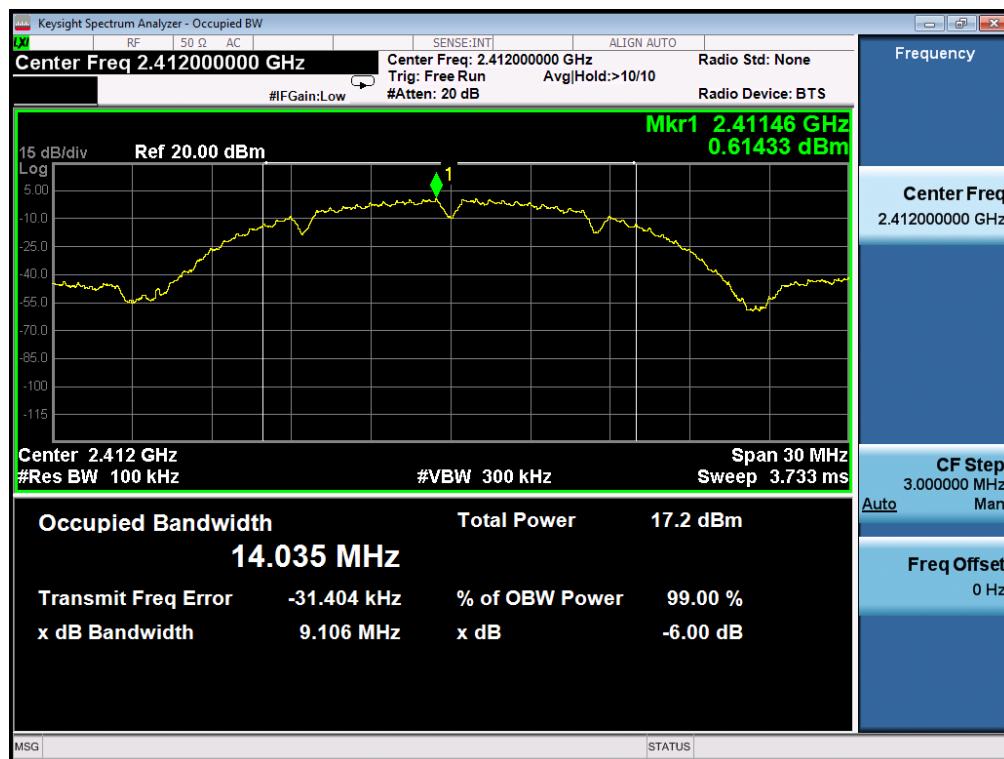
LIMITS AND MEASUREMENT RESULT			
Applicable Limits	Applicable Limits		
	Test Data (MHz)	Criteria	
>500KHZ	Low Channel	9.106	PASS
	Middle Channel	9.121	PASS
	High Channel	9.146	PASS

TEST ITEM	6DB BANDWIDTH	
TEST MODE	802.11g with data rate 54	

LIMITS AND MEASUREMENT RESULT			
Applicable Limits	Applicable Limits		
	Test Data (MHz)	Criteria	
>500KHZ	Low Channel	15.10	PASS
	Middle Channel	15.10	PASS
	High Channel	15.10	PASS

TEST ITEM	6DB BANDWIDTH	
TEST MODE	802.11n 20 with data rate 65	

LIMITS AND MEASUREMENT RESULT			
Applicable Limits	Applicable Limits		
	Test Data (MHz)	Criteria	
>500KHZ	Low Channel	15.10	PASS
	Middle Channel	15.10	PASS
	High Channel	15.09	PASS

**802.11b TEST RESULT****TEST PLOT OF BANDWIDTH FOR LOW CHANNEL****TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL**

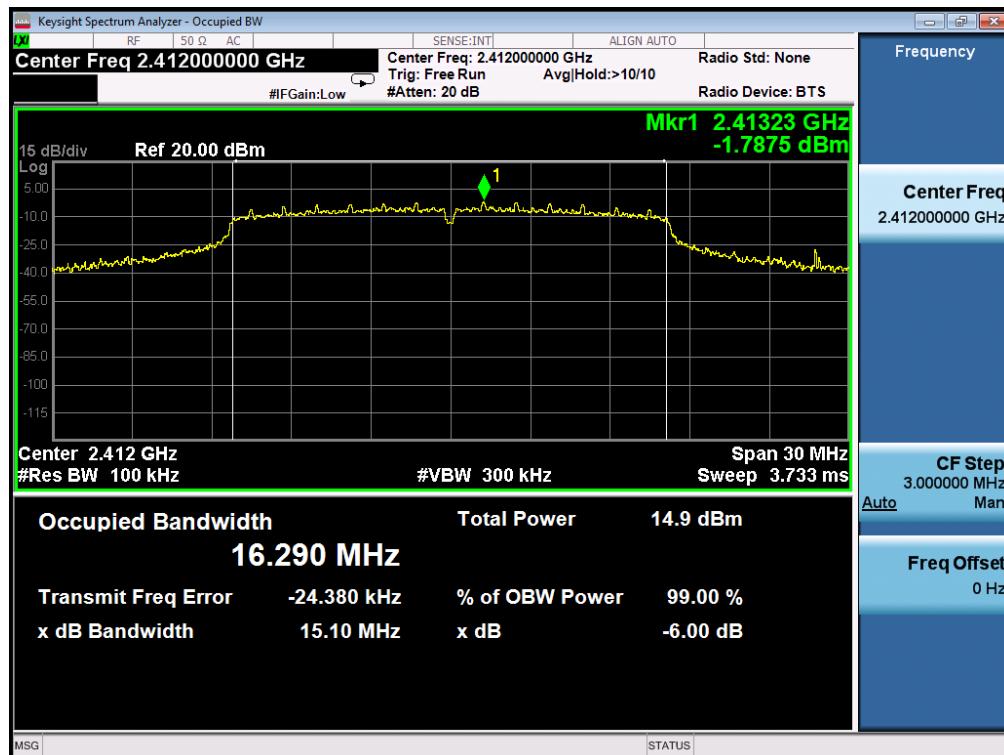


## TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



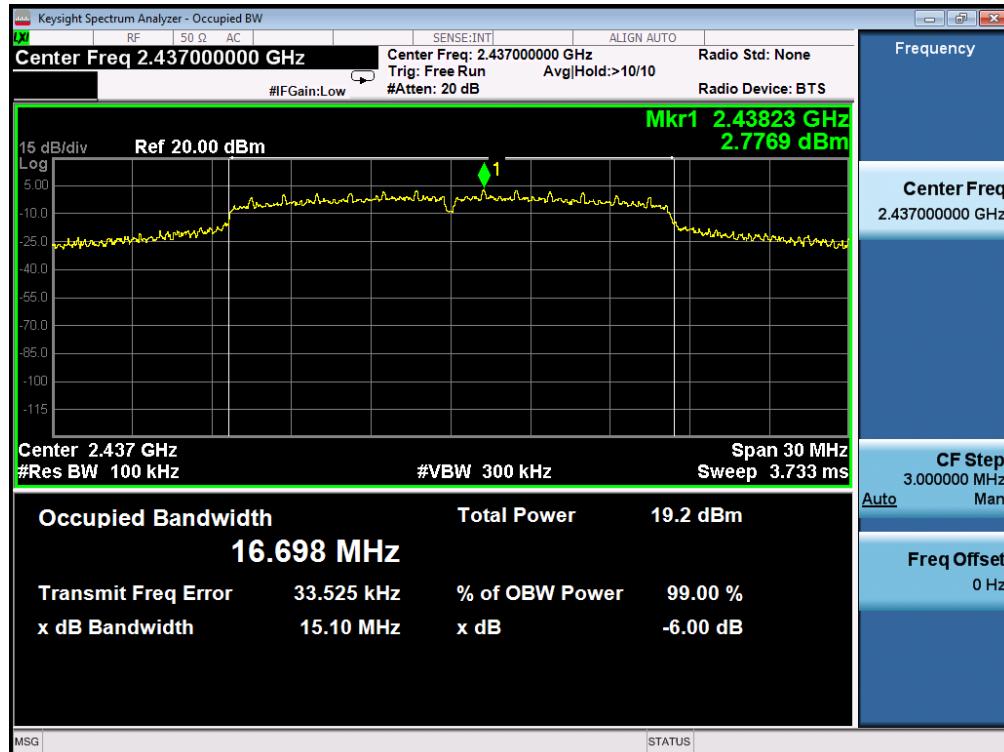
## 802.11g TEST RESULT

## TEST PLOT OF BANDWIDTH FOR LOW CHANNEL

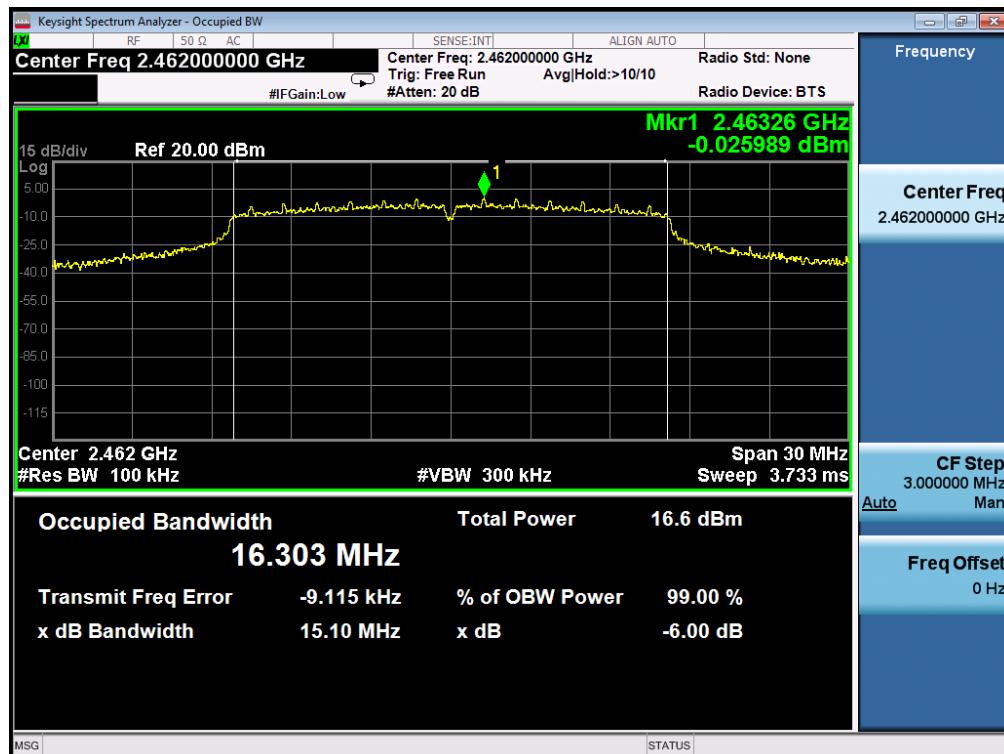




## TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL



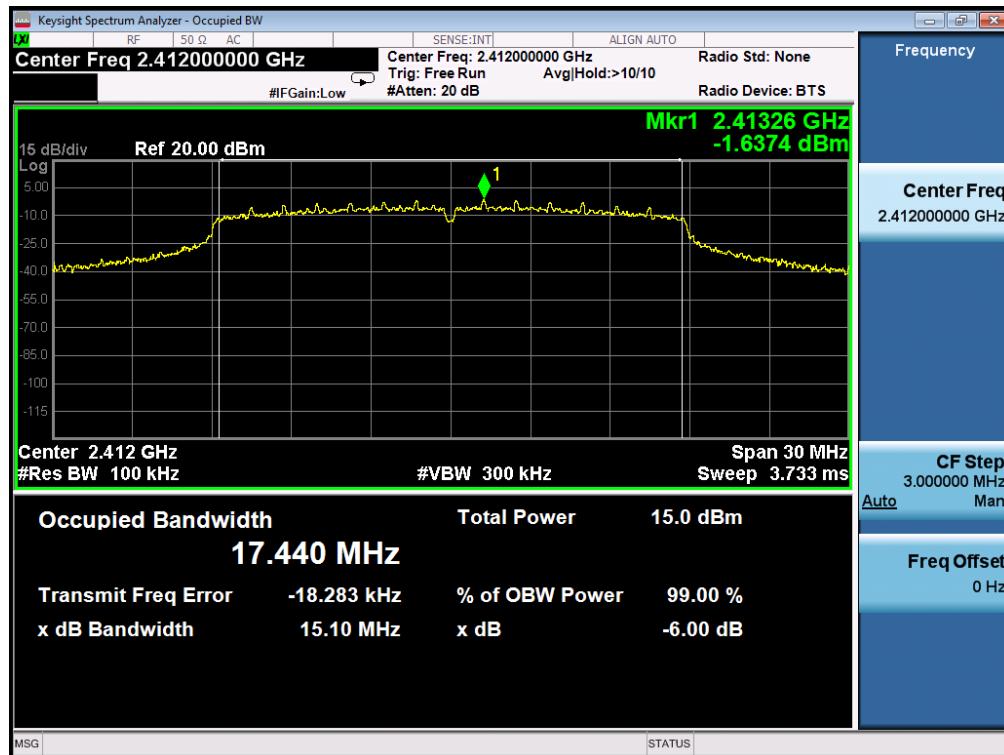
## TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



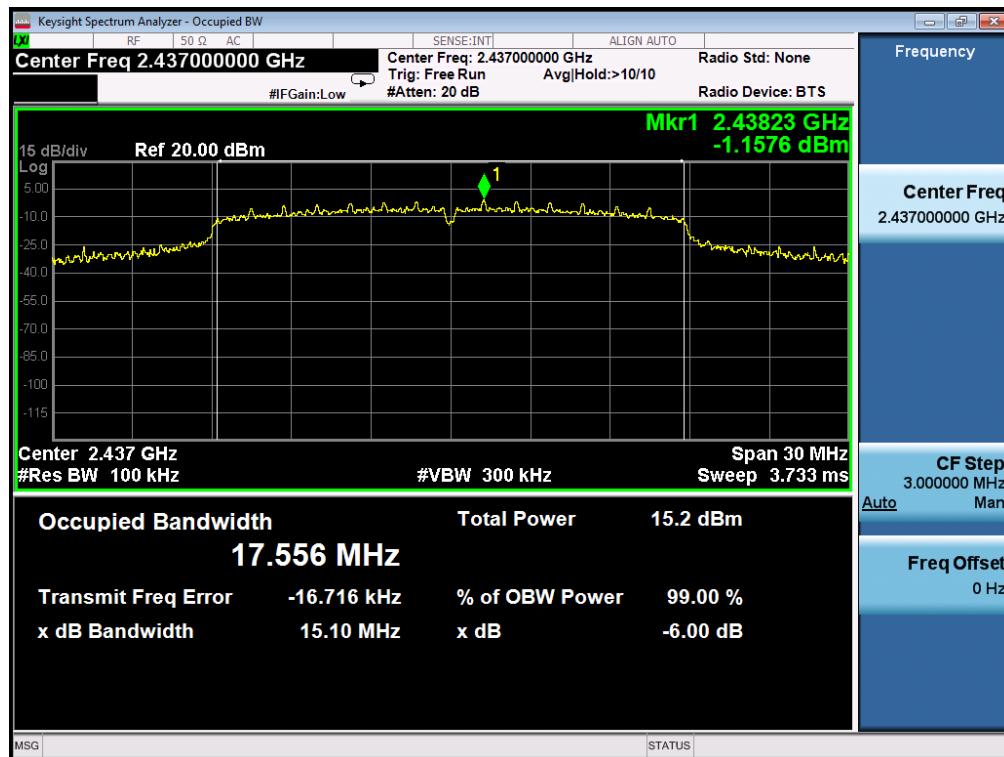


## 802.11n (20) TEST RESULT

### TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



### TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL





## TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL





## 5. CONDUCTED SPURIOUS EMISSION

### 5.1. MEASUREMENT PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
3. Set SPA Trace 1 Max hold, then View.

**Note:** The EUT was tested according to ANSI C63.10 (2013) for compliance to FCC 47CFR 15.247 requirements. Owing to satisfy the requirements of the number of measurement points, we set the RBW=1MHz, VBW>RBW, scan up through 10th harmonic, and consider the tested results as the worst case, if the tested results conform to the requirement, we can deem that the real tested results(set the RBW=100KHz, VBW>RBW) are conform to the requirement.

### 5.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

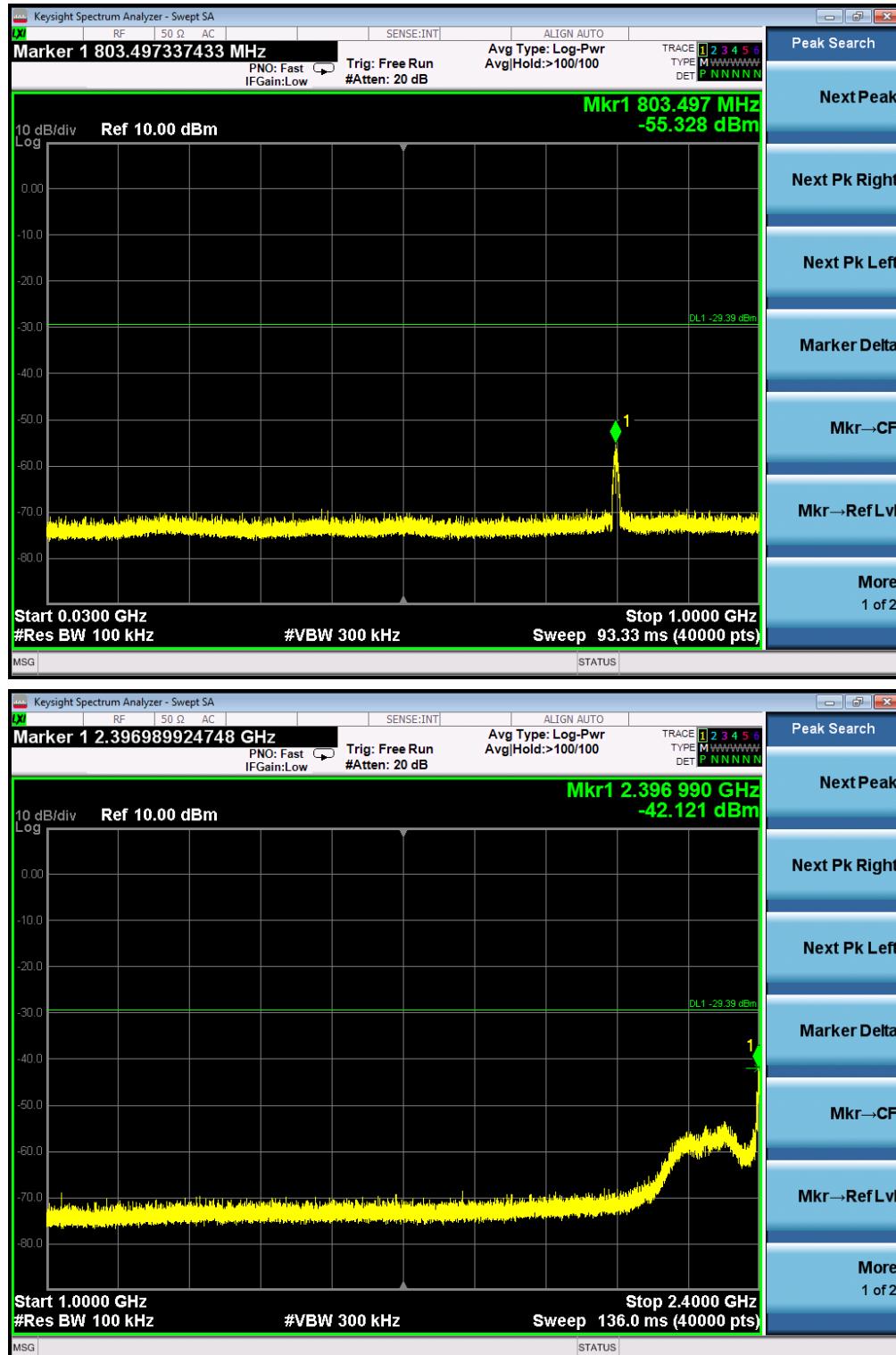
The same as described in section 4.2.

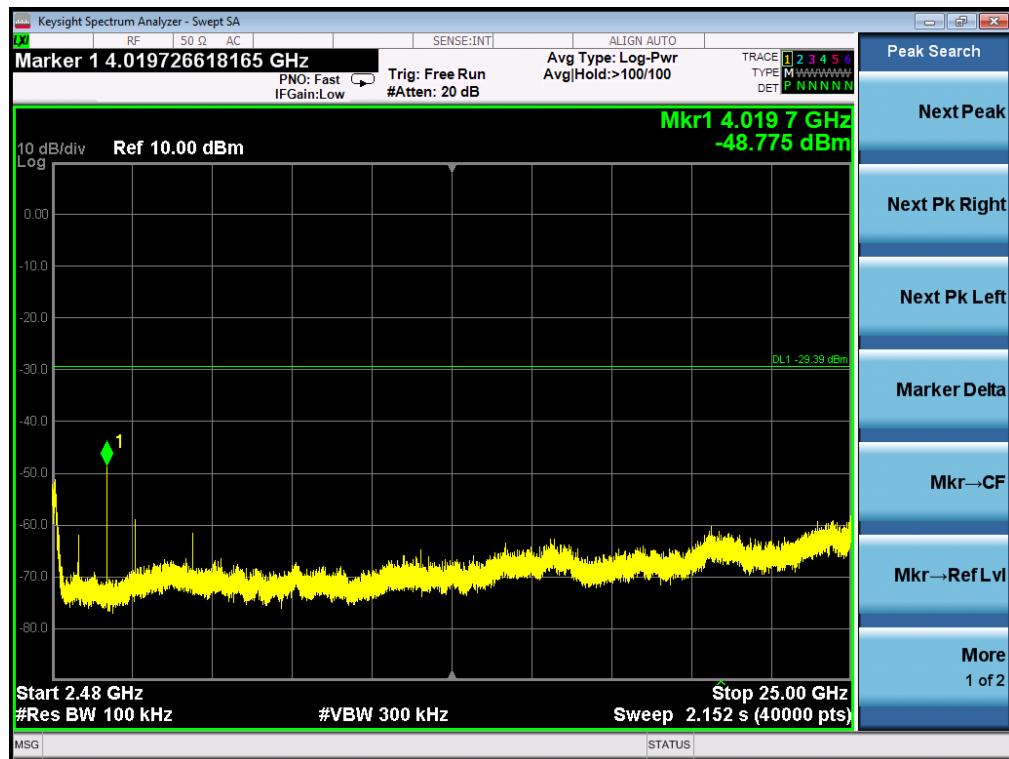
### 5.3. LIMITS AND MEASUREMENT RESULT

LIMITS AND MEASUREMENT RESULT		
Applicable Limits	Measurement Result	
	Test Data	Criteria
In any 100 KHz Bandwidth Outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produce by the intentional radiator shall be at least 30 dB below that in 100KHz bandwidth within the band that contains the highest level of the desired power. In addition, radiation 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))	At least -30dBc than the limit Specified on the BOTTOM Channel	PASS
	At least -30dBc than the limit Specified on the TOP Channel	PASS

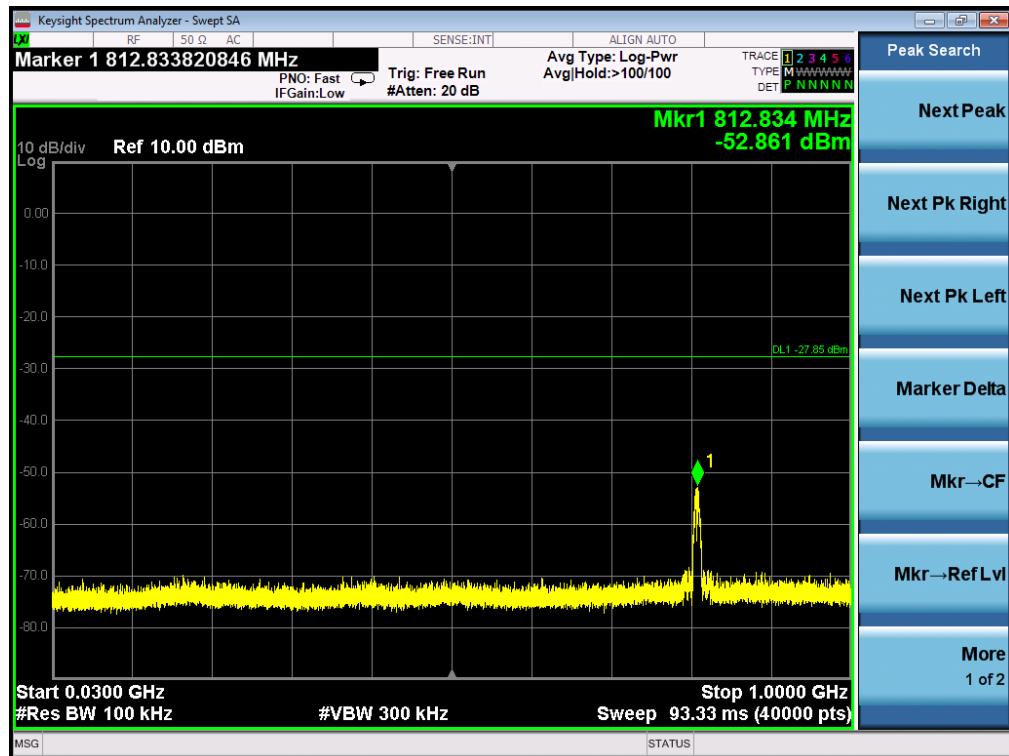


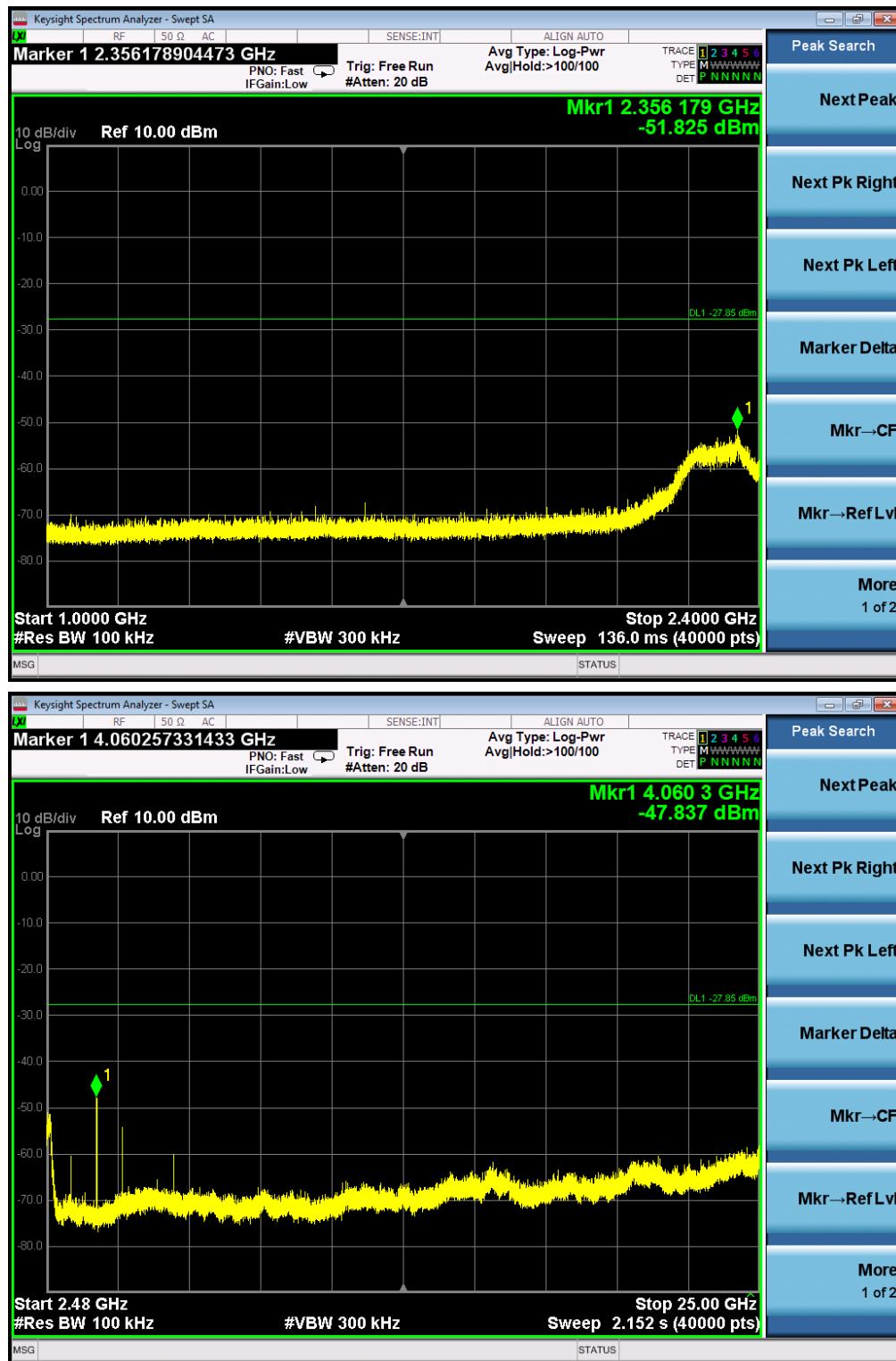
TEST PLOT OF OUT OF BAND EMISSIONS WITH THE WORST CASE  
OF 802.11b FOR MODULATION IN LOW CHANNEL





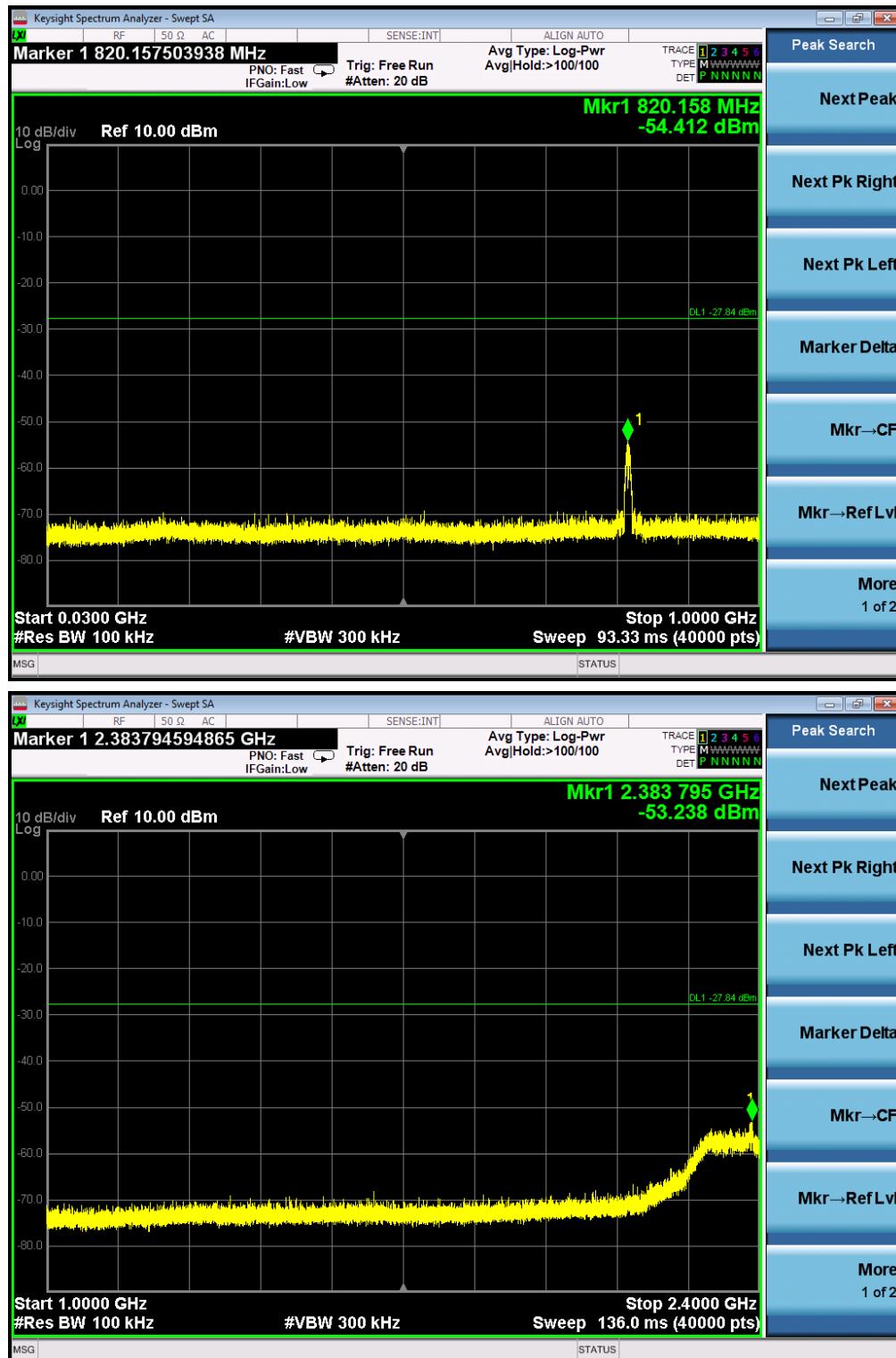
TEST PLOT OF OUT OF BAND EMISSIONS THE WORST CASE  
OF 802.11b FOR MODULATION IN MIDDLE CHANNEL

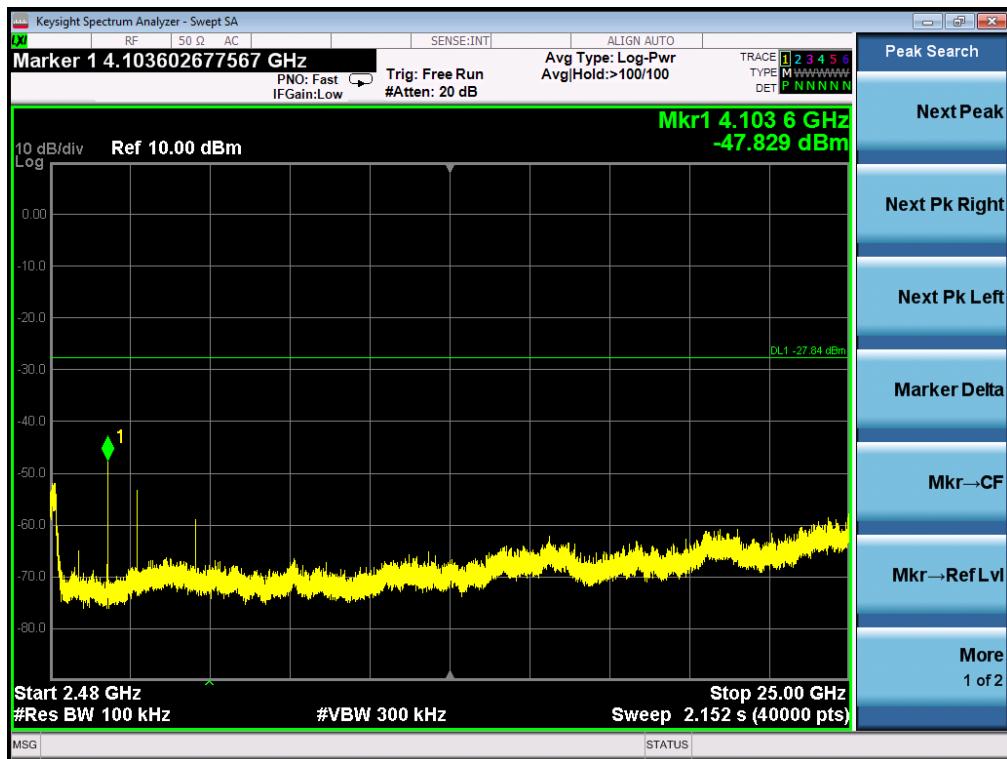




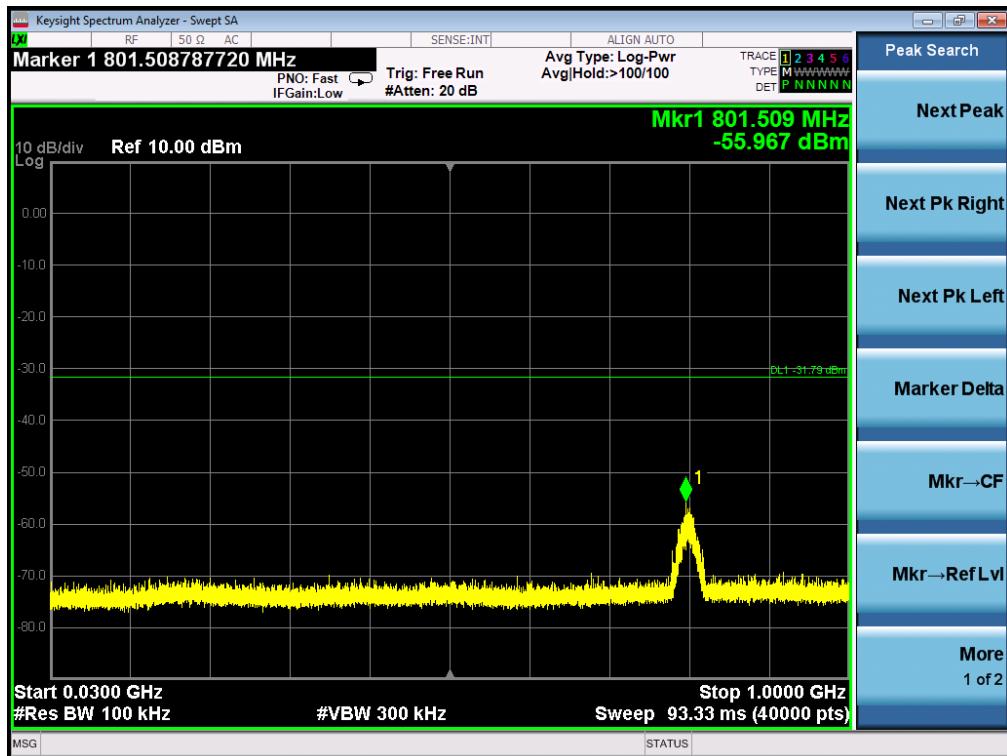


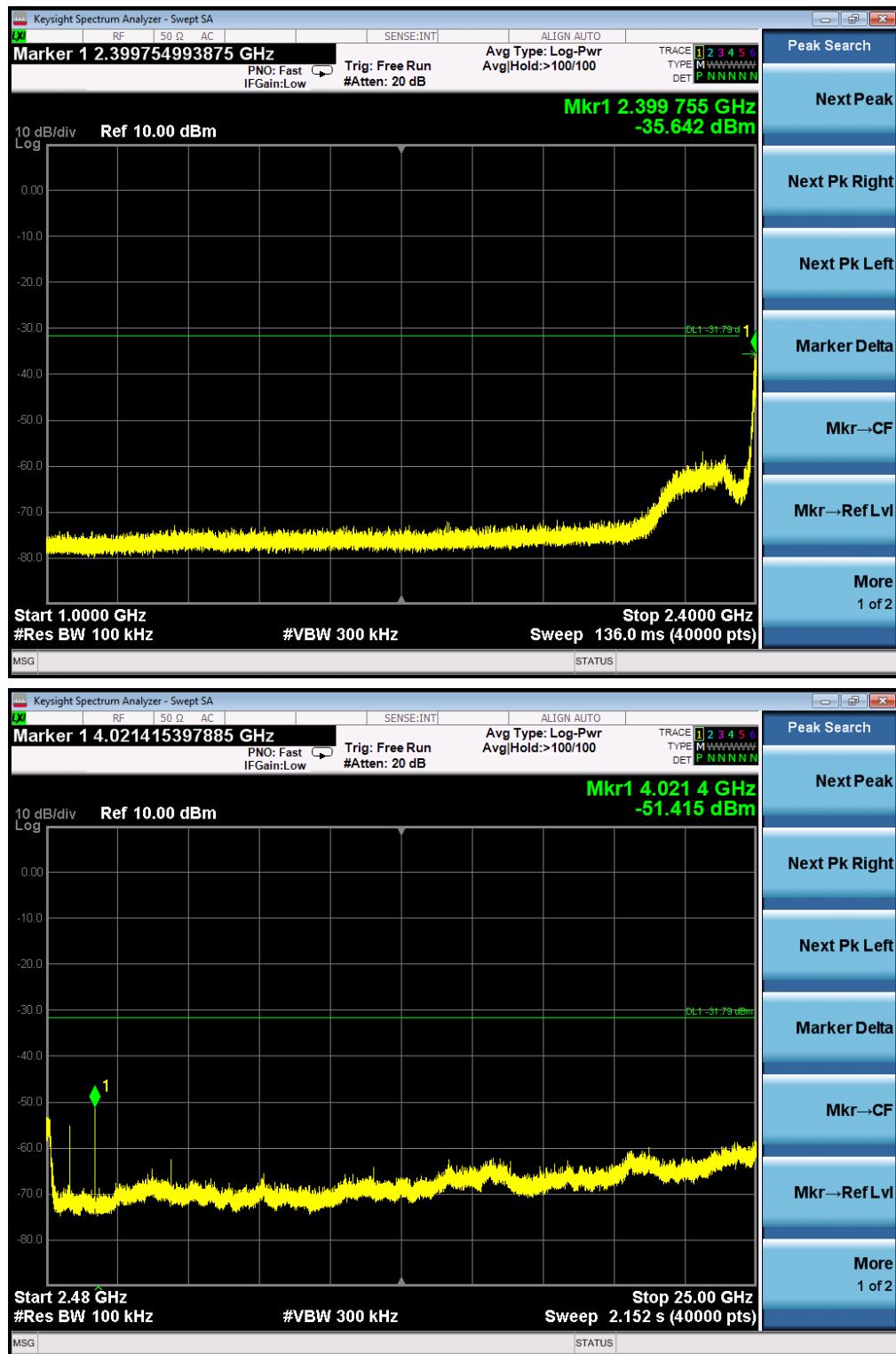
TEST PLOT OF OUT OF BAND EMISSIONS THE WORST CASE  
OF 802.11b FOR MODULATION IN HIGH CHANNEL





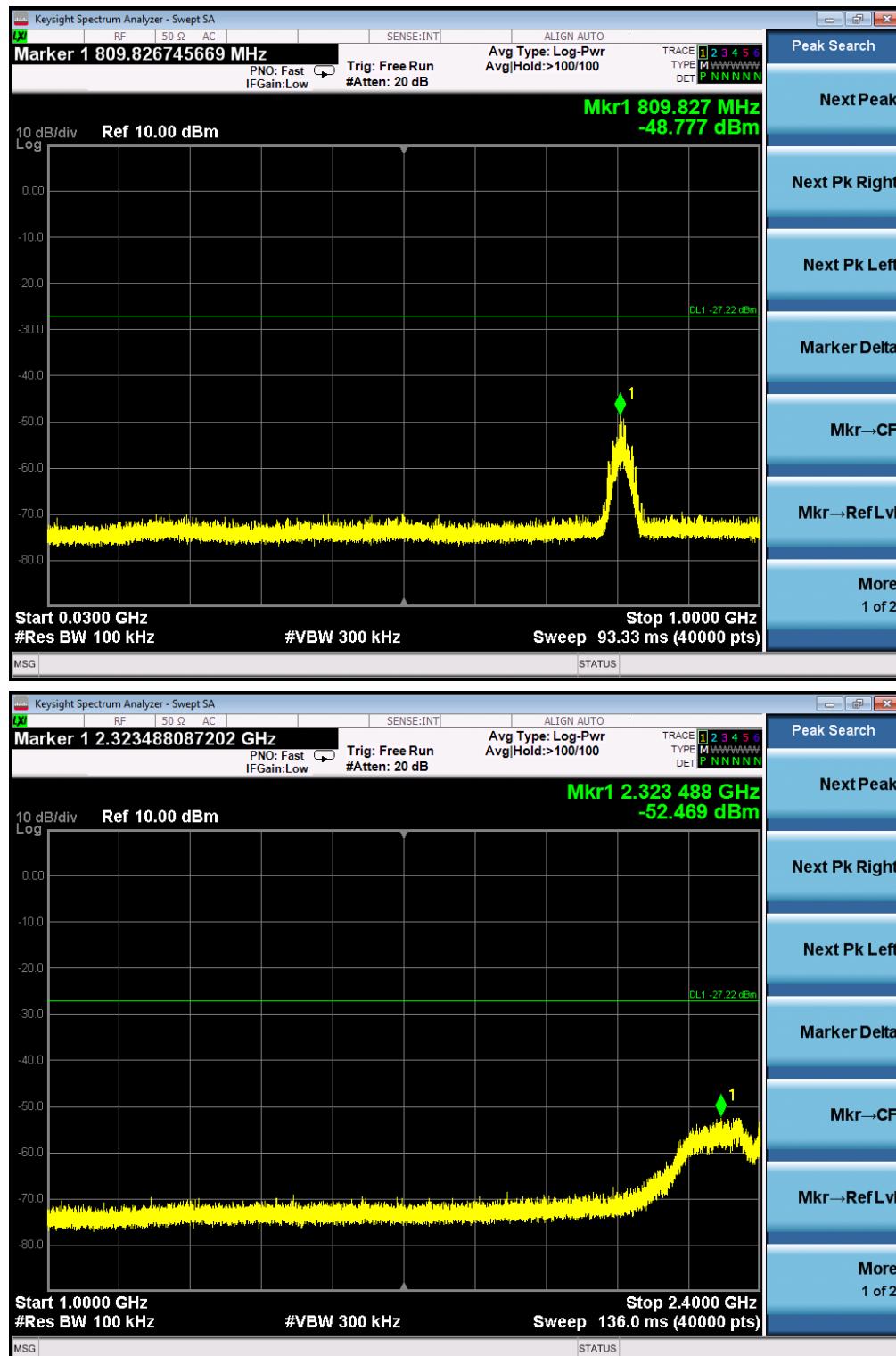
TEST PLOT OF OUT OF BAND EMISSIONS WITH THE WORST CASE  
OF 802.11g FOR MODULATION IN LOW CHANNEL

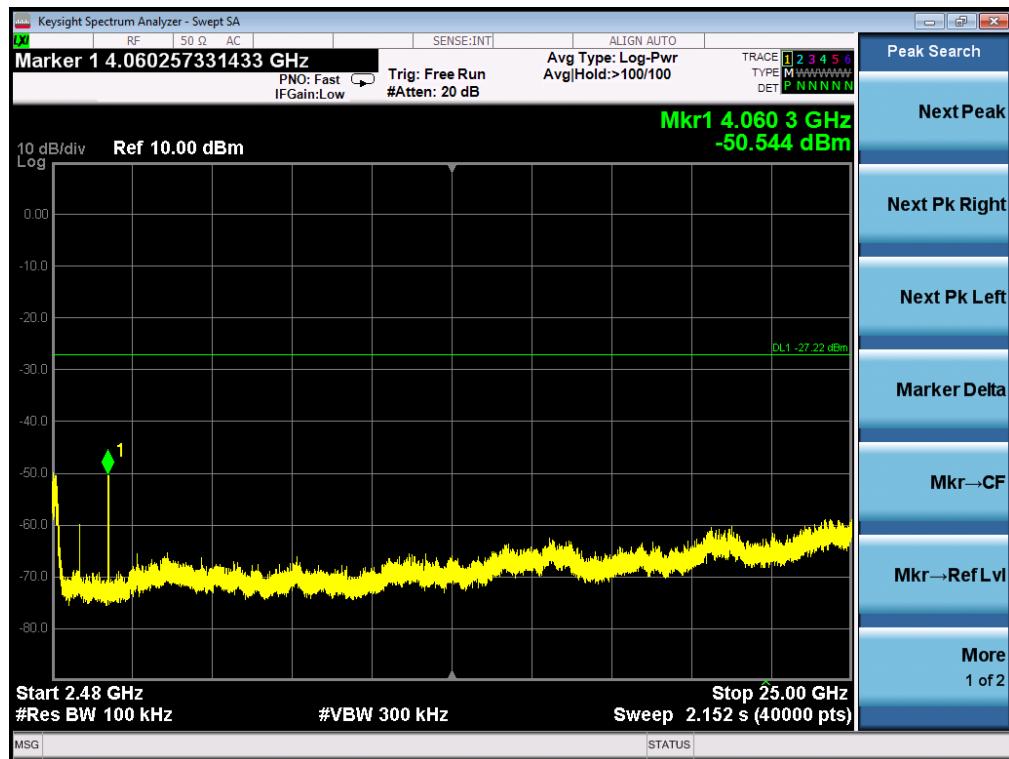




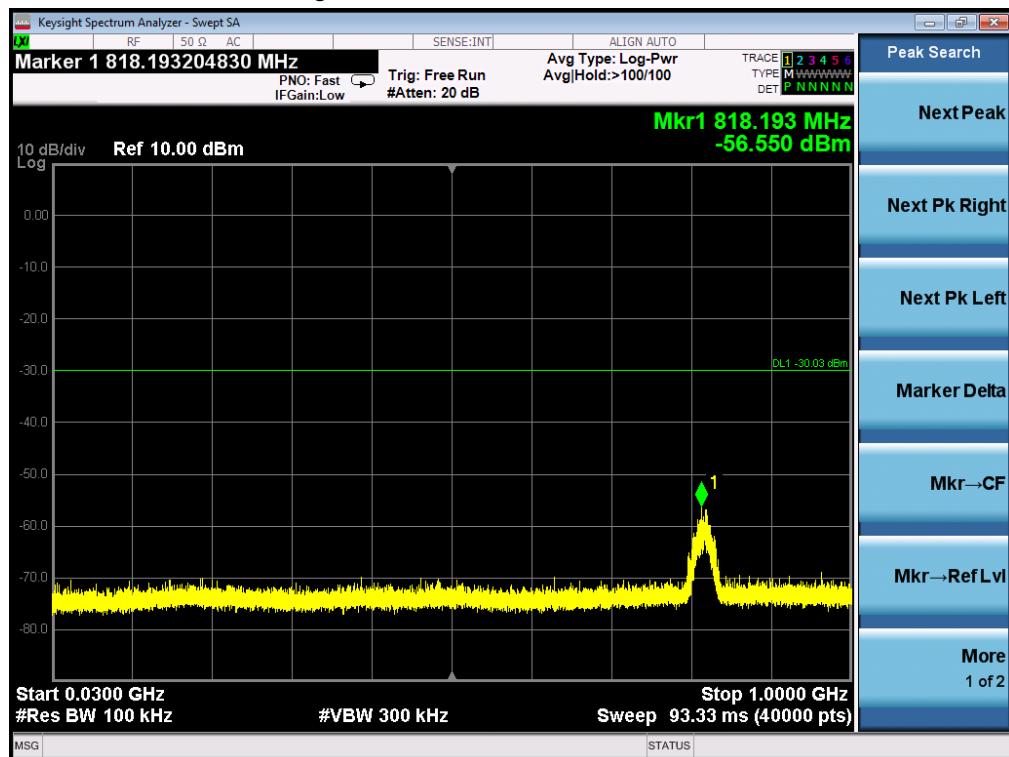


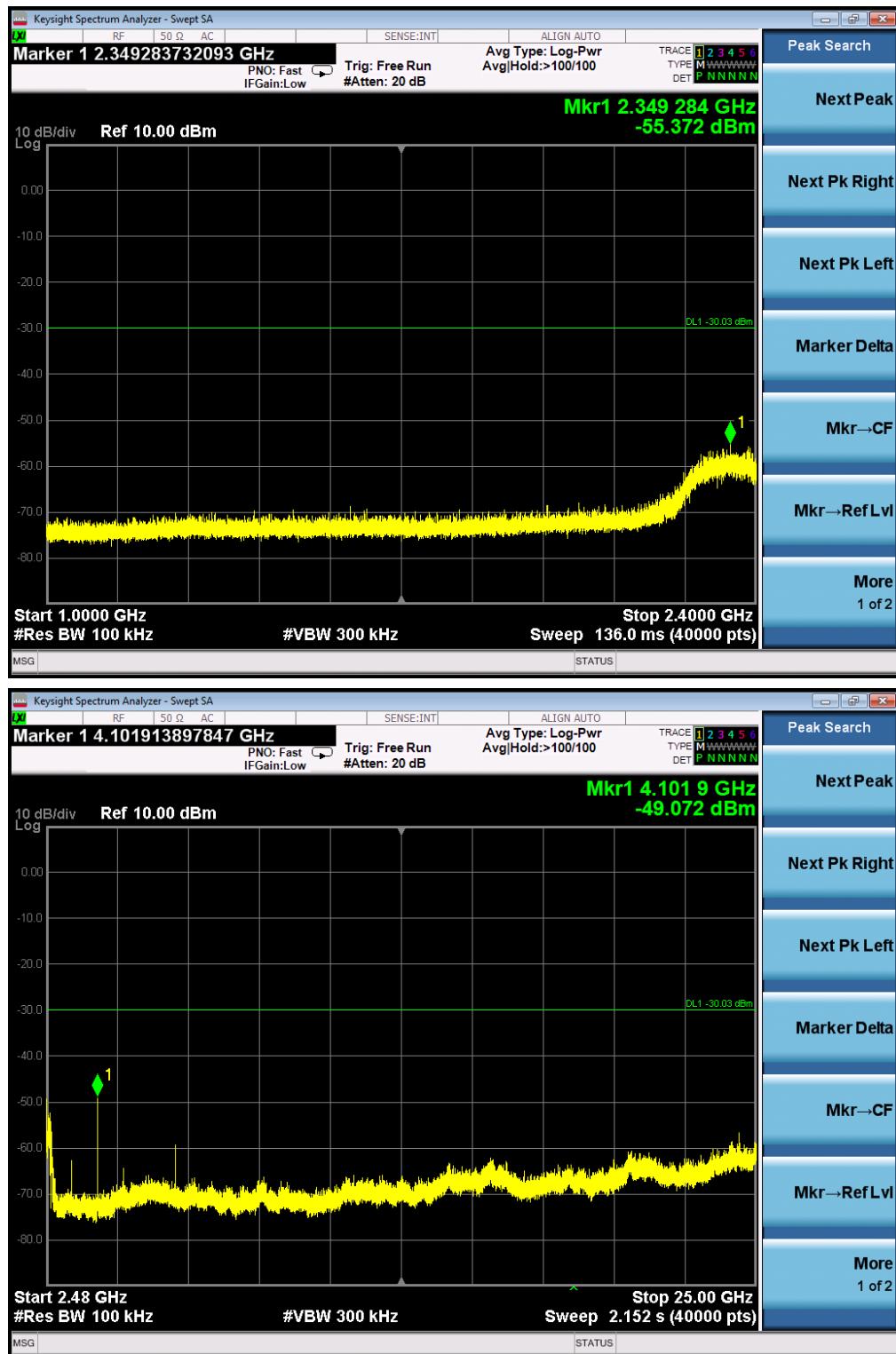
### TEST PLOT OF OUT OF BAND EMISSIONS THE WORST CASE OF 802.11g FOR MODULATION IN MIDDLE CHANNEL





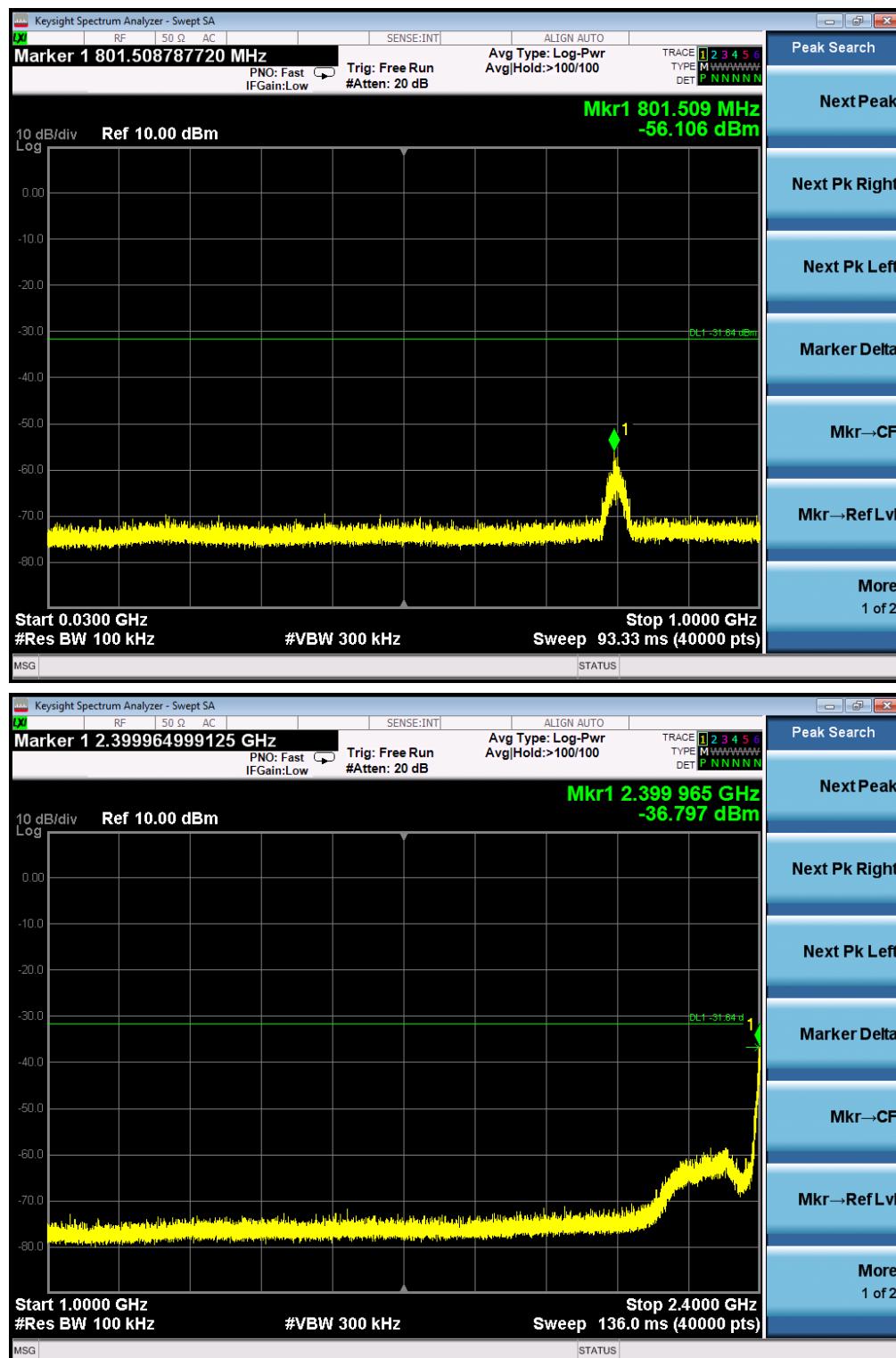
TEST PLOT OF OUT OF BAND EMISSIONS THE WORST CASE  
OF 802.11g FOR MODULATION IN HIGH CHANNEL

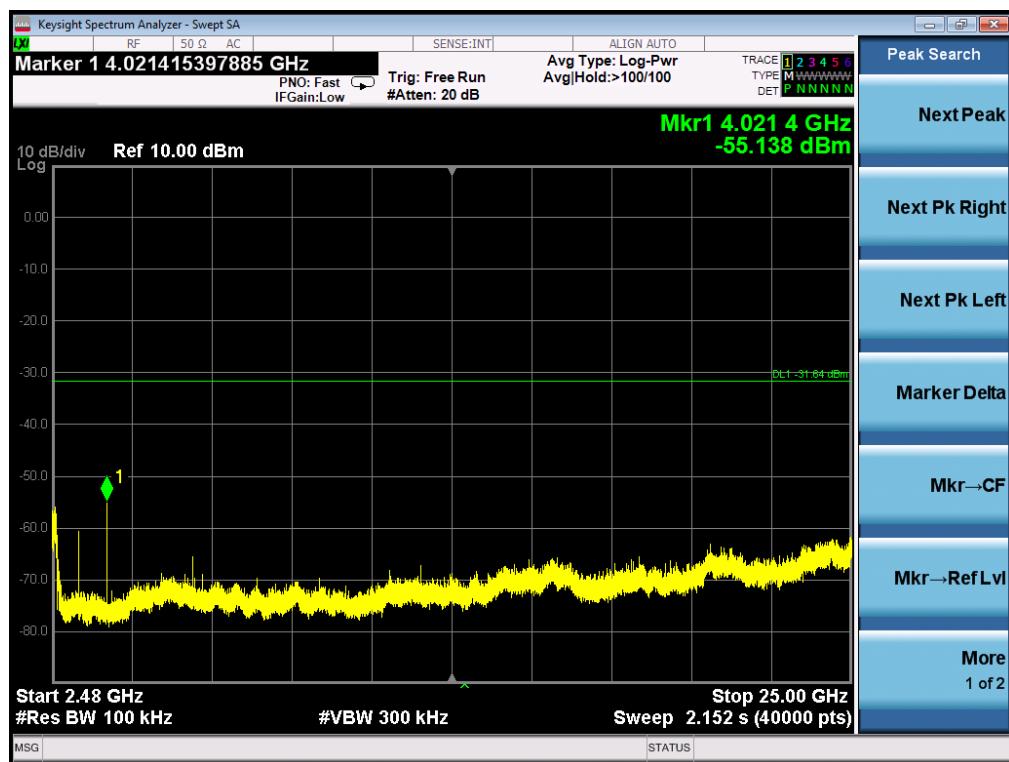




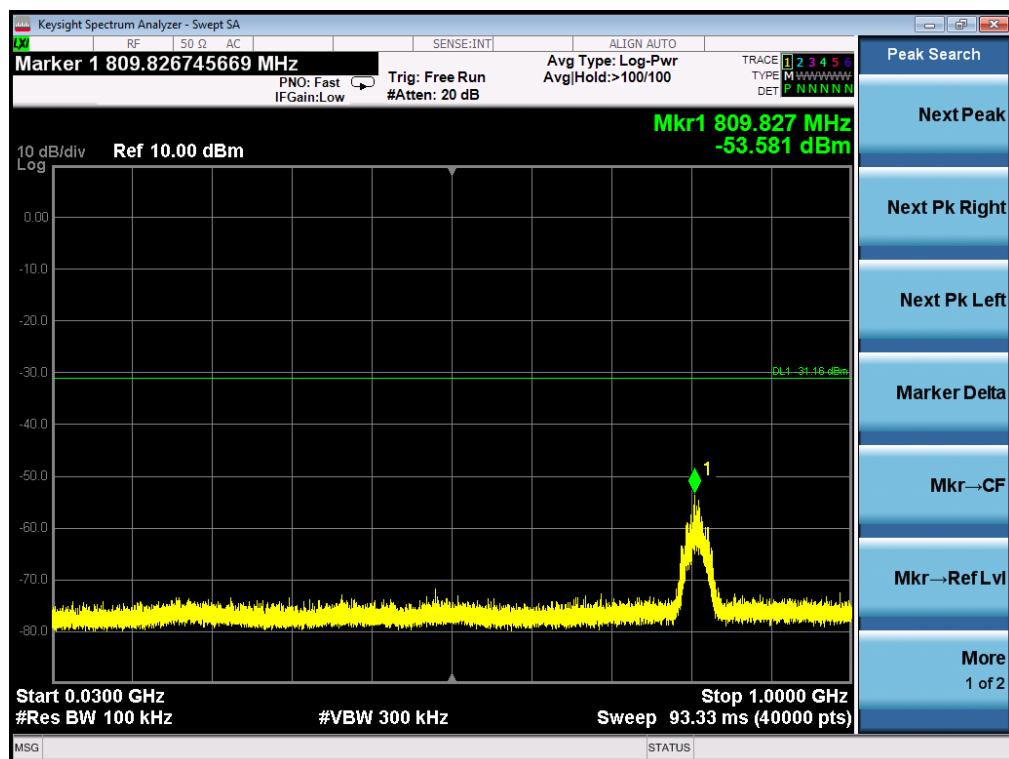


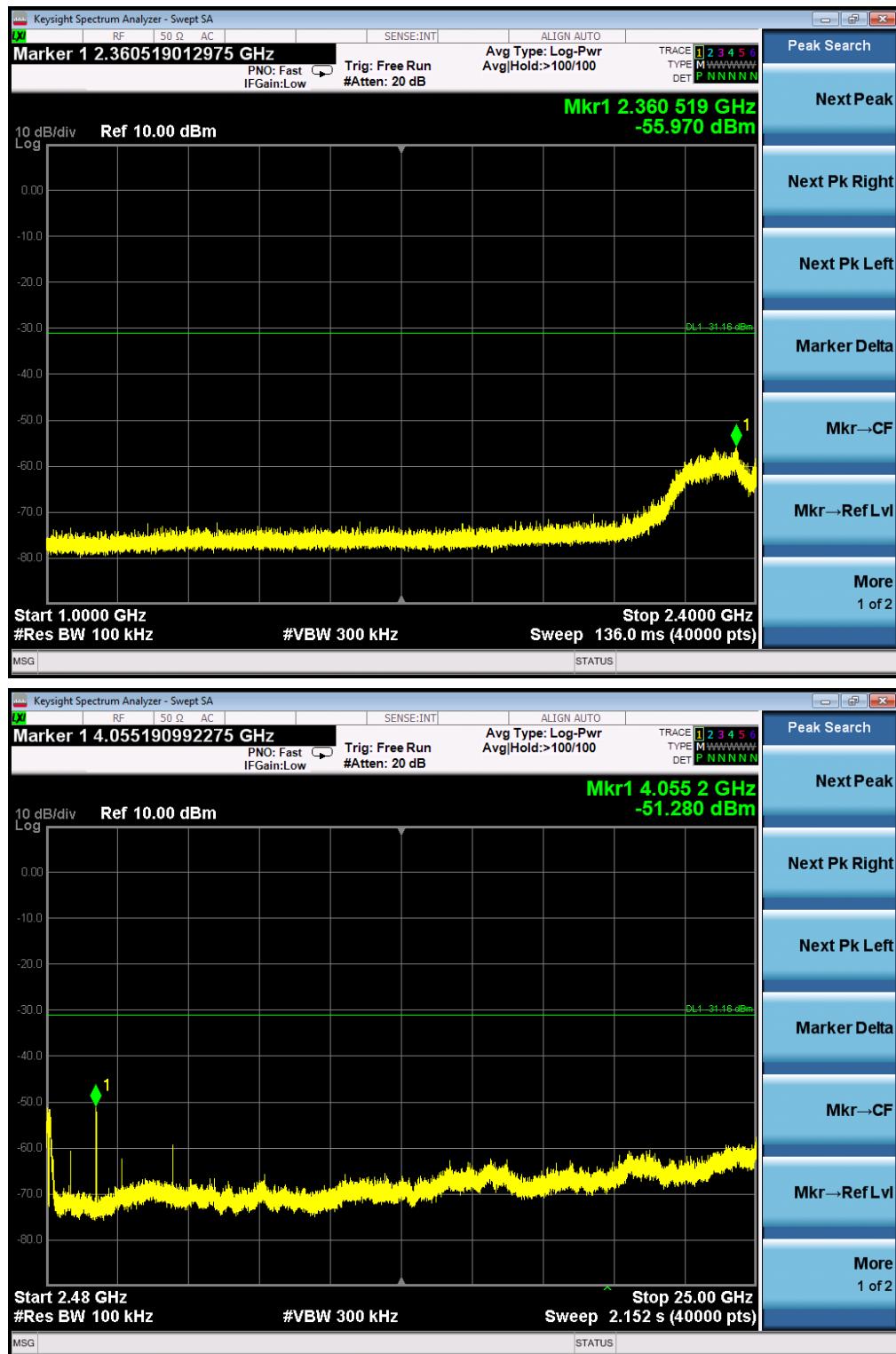
TEST PLOT OF OUT OF BAND EMISSIONS WITH THE WORST CASE  
OF 802.11n20 FOR MODULATION IN LOW CHANNEL





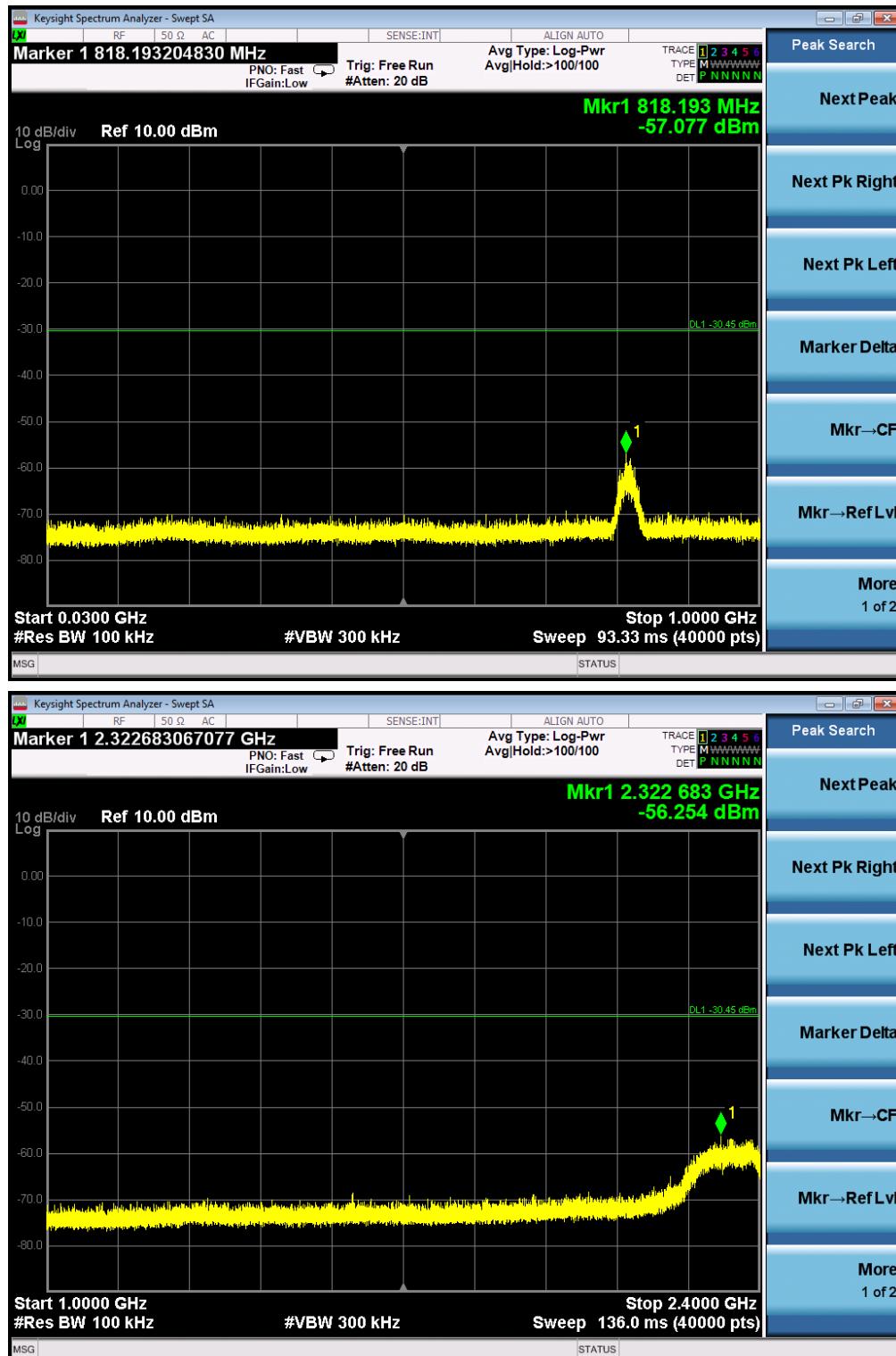
TEST PLOT OF OUT OF BAND EMISSIONS THE WORST CASE  
OF 802.11n20 FOR MODULATION IN MIDDLE CHANNEL

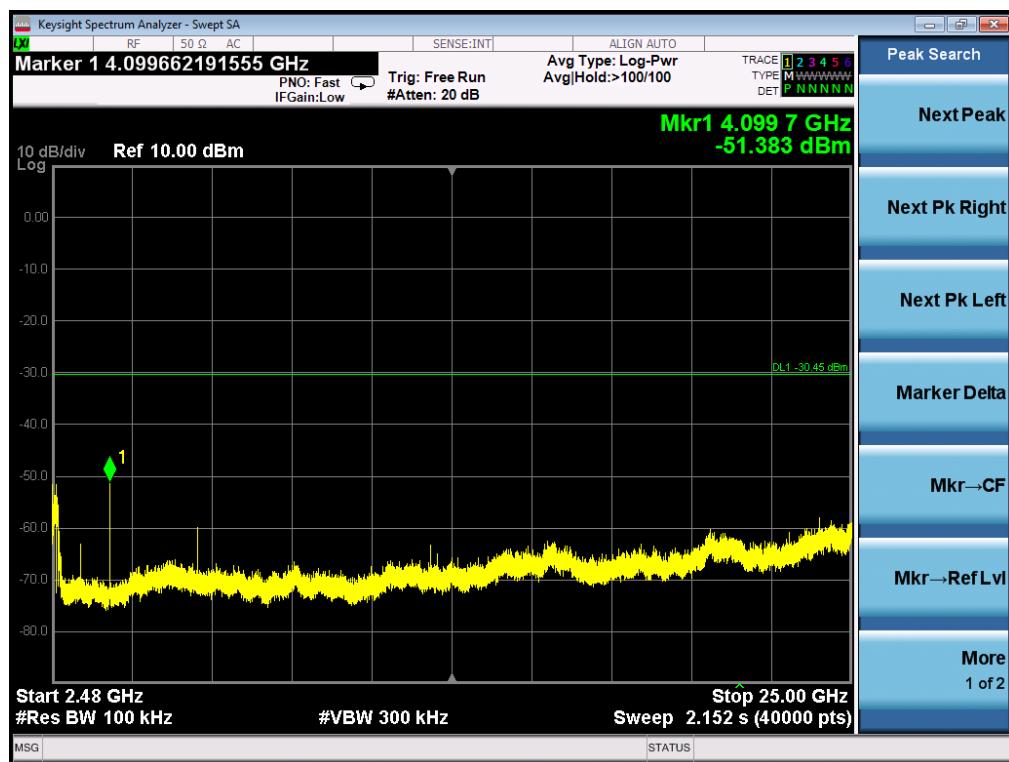






TEST PLOT OF OUT OF BAND EMISSIONS THE WORST CASE  
OF 802.11n20 FOR MODULATION IN HIGH CHANNEL







## 6. MAXIMUM CONDUCTED OUTPUT POWER SPECTRAL DENSITY

### 6.1 MEASUREMENT PROCEDURE

- (1). Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
- (2). Set the EUT Work on the top, the middle and the bottom operation frequency individually.
- (3). Set SPA Trace 1 Max hold, then View.

Note: The method of AVGPSD-1 in the ANSI C63.10 (2013) item 11.10 was used in this testing.

### 6.2 TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

Refer To Section 4.2.

### 6.3 LIMITS AND MEASUREMENT RESULT

TEST ITEM	POWER SPECTRAL DENSITY		
TEST MODE	802.11b with data rate 1		

Channel No.	Power density (dBm/20kHz)	Limit (dBm/3kHz)	Result
Low Channel	-4.644	8	Pass
Middle Channel	-3.039	8	Pass
High Channel	-2.996	8	Pass

TEST ITEM	POWER SPECTRAL DENSITY		
TEST MODE	802.11g with data rate 6		

Channel No.	Power density (dBm/20kHz)	Limit (dBm/3kHz)	Result
Low Channel	-7.901	8	Pass
Middle Channel	-3.276	8	Pass
High Channel	-7.048	8	Pass

TEST ITEM	POWER SPECTRAL DENSITY		
TEST MODE	802.11n 20 with data rate 6.5		

Channel No.	Power density (dBm/20kHz)	Limit (dBm/3kHz)	Result
Low Channel	-7.633	8	Pass
Middle Channel	-5.015	8	Pass
High Channel	-6.554	8	Pass

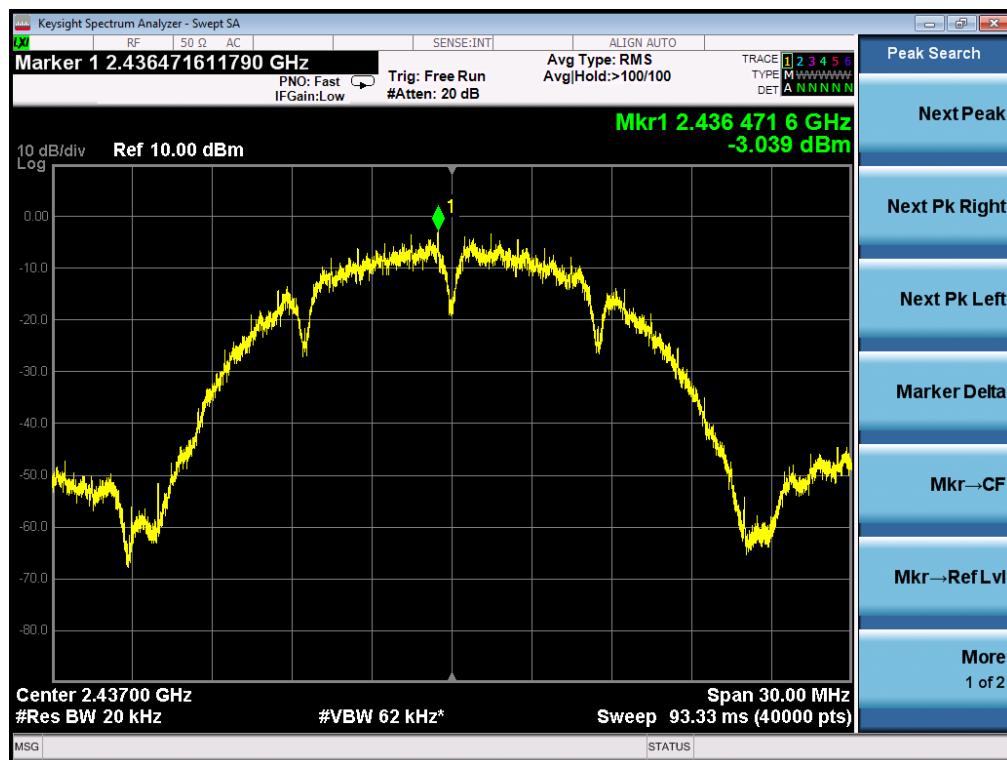


## 802.11b TEST RESULT

### TEST PLOT OF SPECTRAL DENSITY FOR LOW CHANNEL

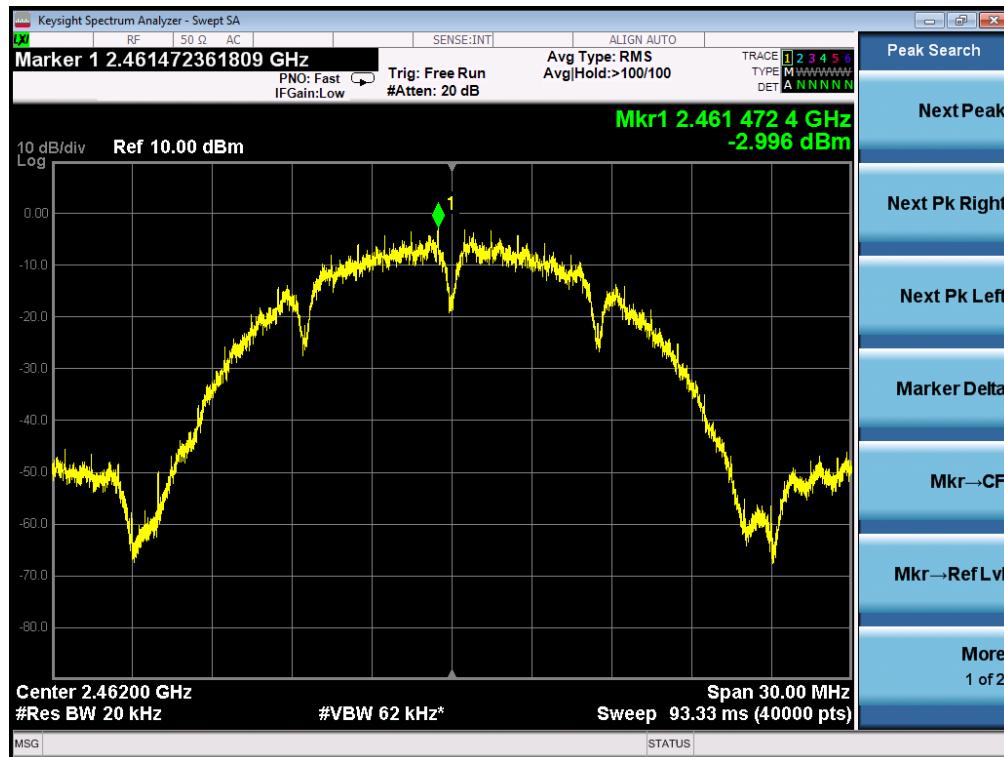


### TEST PLOT OF SPECTRAL DENSITY FOR MIDDLE CHANNEL



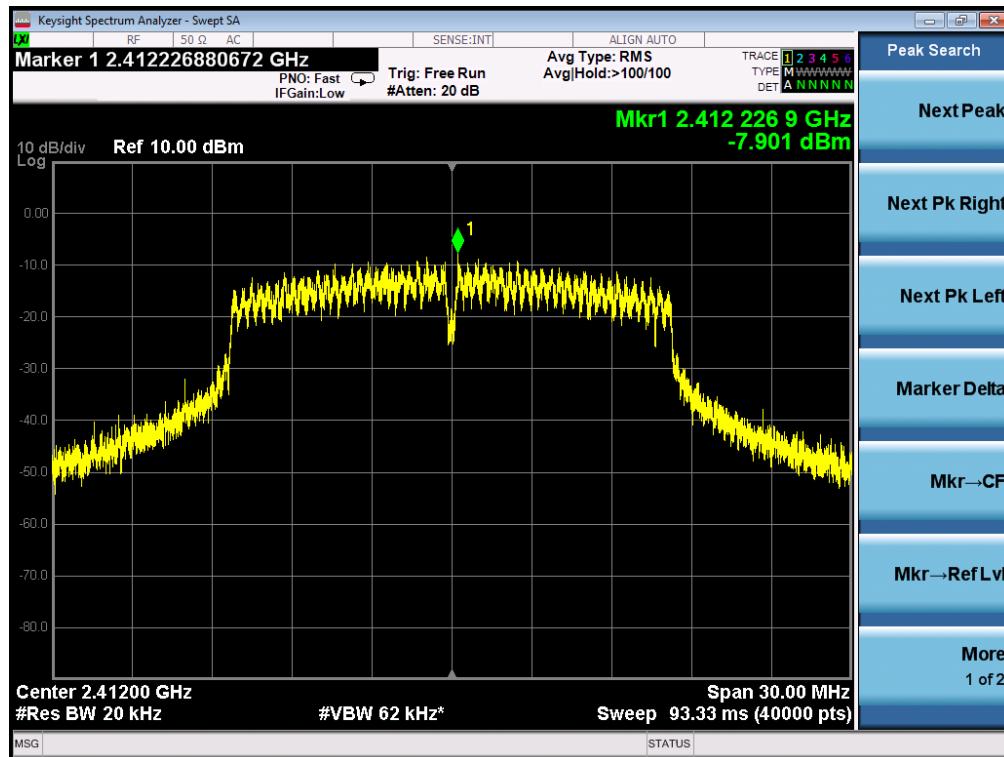


## TEST PLOT OF SPECTRAL DENSITY FOR HIGH CHANNEL



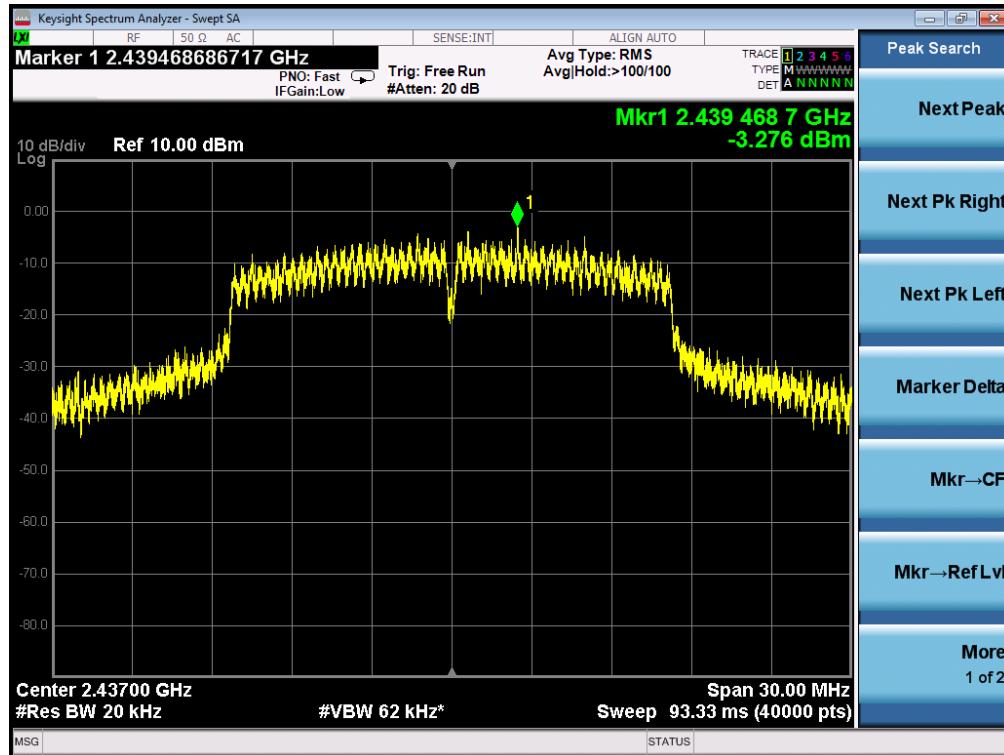
## 802.11g TEST RESULT

## TEST PLOT OF SPECTRAL DENSITY FOR LOW CHANNEL

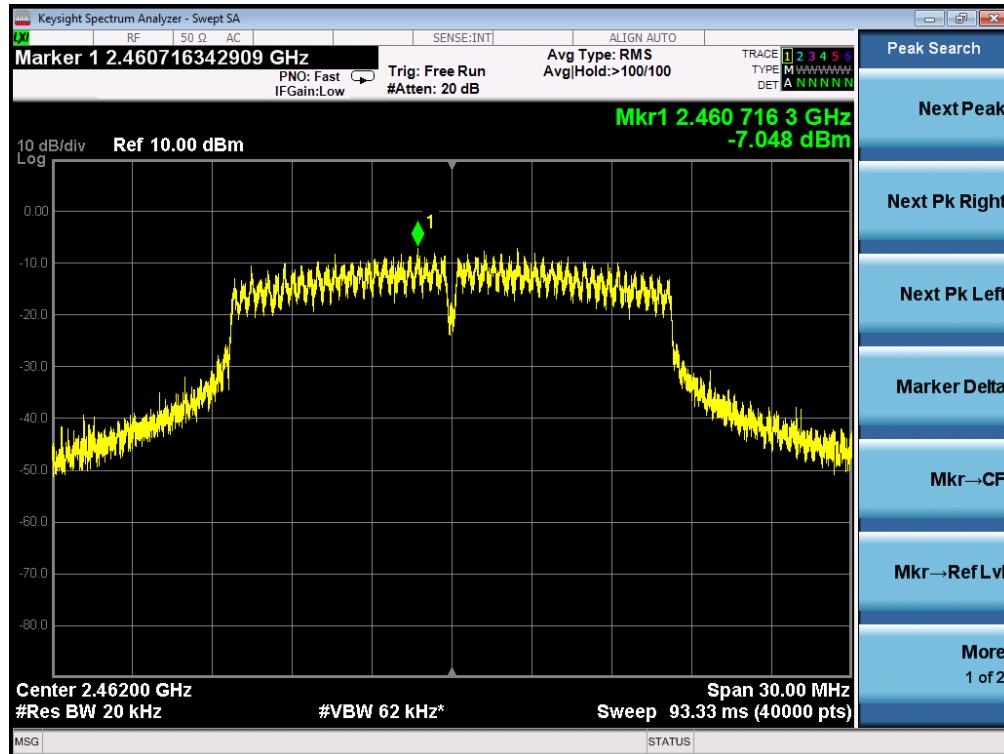




## TEST PLOT OF SPECTRAL DENSITY FOR MIDDLE CHANNEL



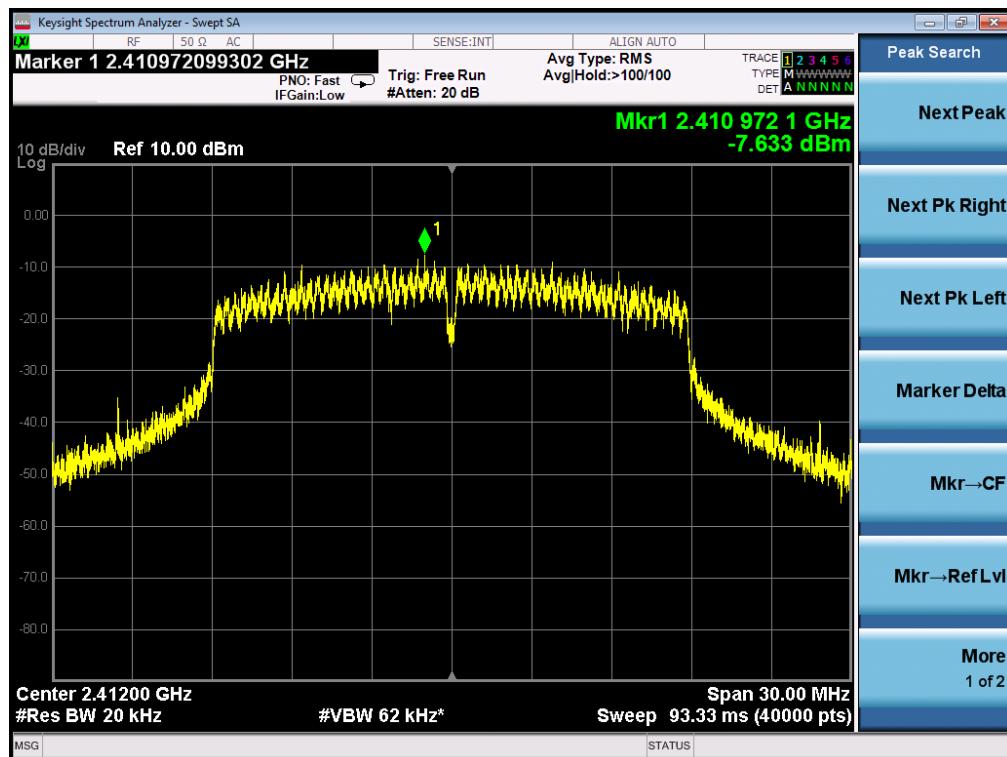
## TEST PLOT OF SPECTRAL DENSITY FOR HIGH CHANNEL



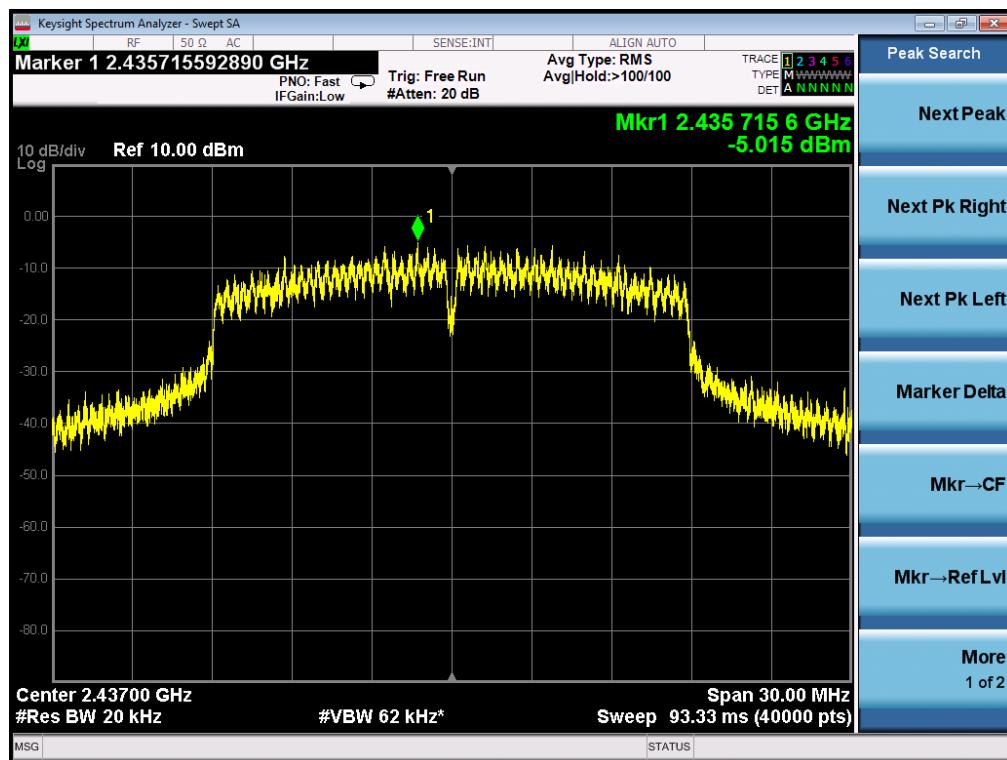


## 802.11n 20 TEST RESULT

### TEST PLOT OF SPECTRAL DENSITY FOR LOW CHANNEL

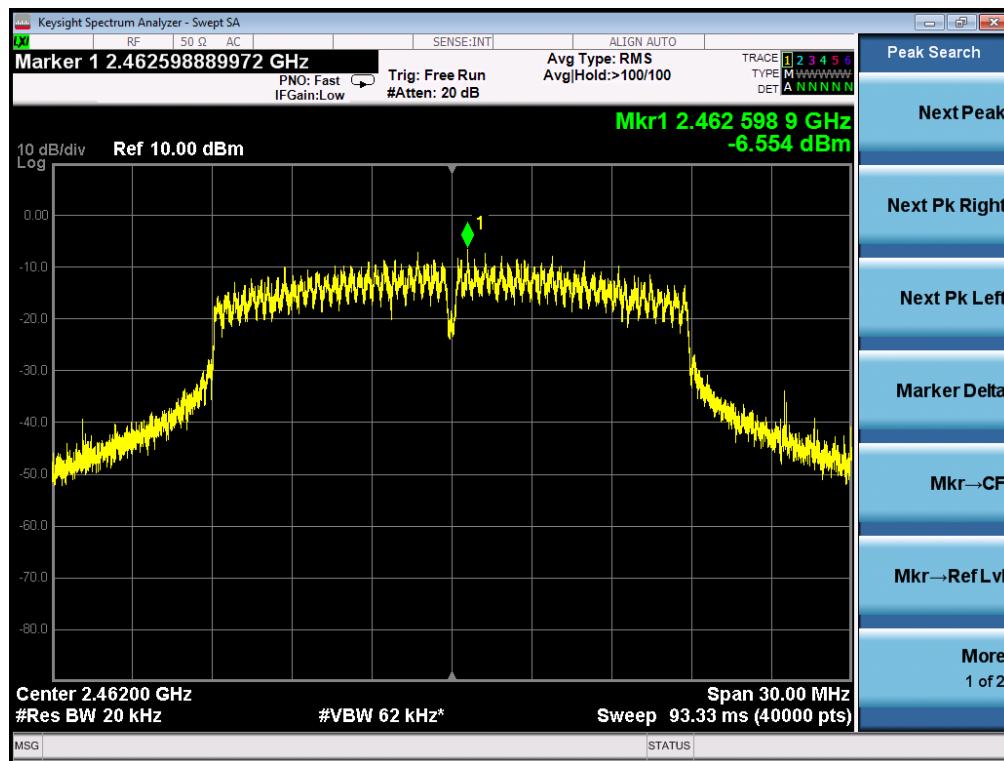


### TEST PLOT OF SPECTRAL DENSITY FOR MIDDLE CHANNEL





## TEST PLOT OF SPECTRAL DENSITY FOR HIGH CHANNEL





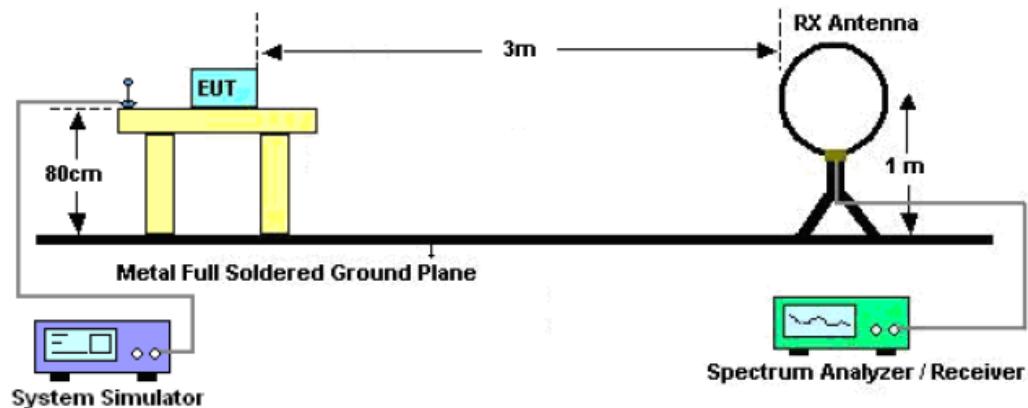
## 7. RADIATED EMISSION

### 7.1. MEASUREMENT PROCEDURE

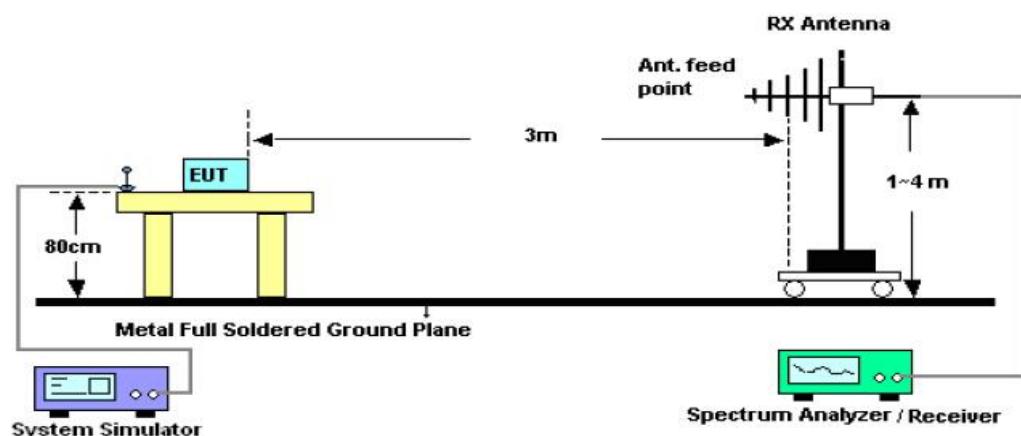
1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz RBW and 3MHz VBW for peak reading. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High - Low scan is not required in this case.

## 7.2. TEST SETUP

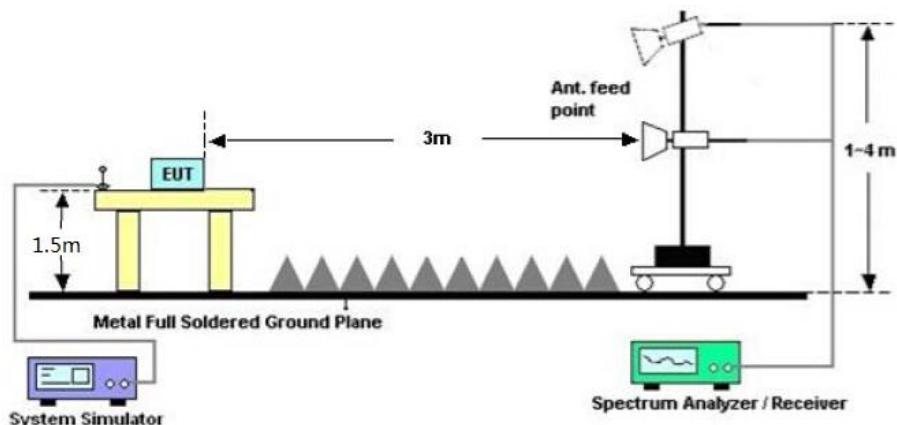
Radiated Emission Test-Setup Frequency Below 30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



RADIATED EMISSION TEST SETUP ABOVE 1000MHz





### 7.3. LIMITS AND MEASUREMENT RESULT

15.209(a) Limit in the below table has to be followed

<b>Frequencies (MHz)</b>	<b>Field Strength (micorvolts/meter)</b>	<b>Measurement Distance (meters)</b>
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

Note: All modes were tested For restricted band radiated emission,  
the test records reported below are the worst result compared to other modes.

### 7.4. TEST RESULT

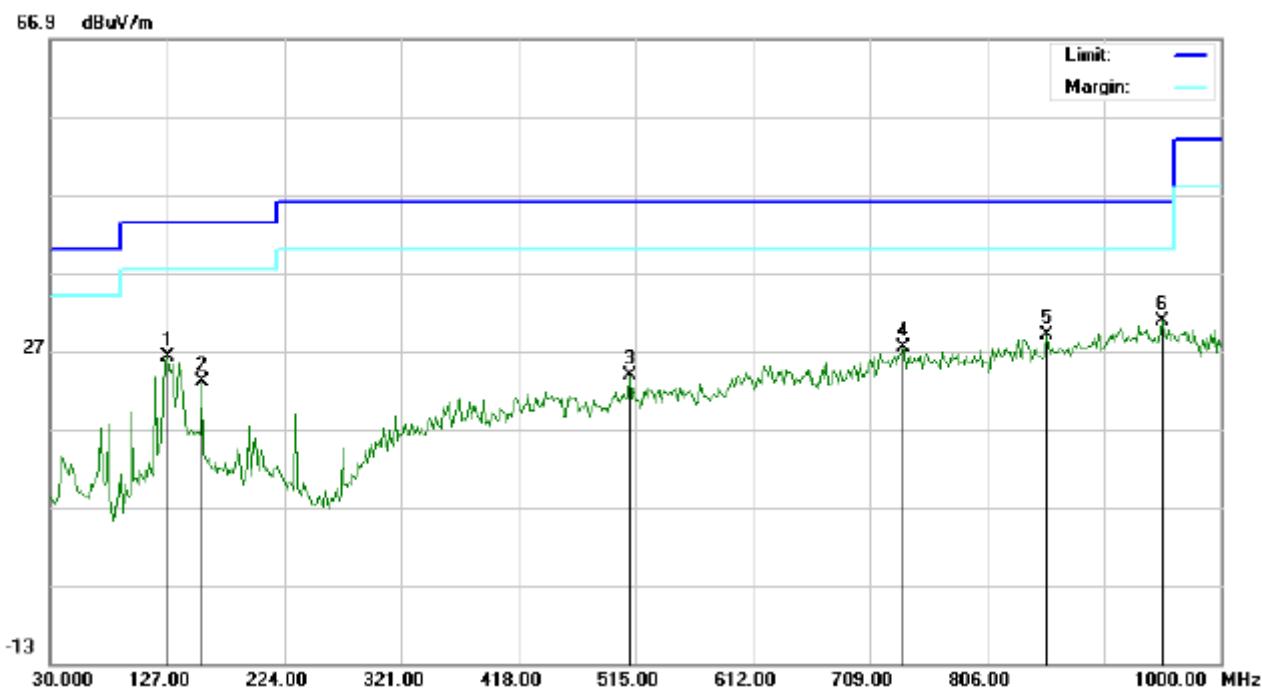
#### RADIATED EMISSION BELOW 30MHZ

No emission found between lowest internal used/generated frequencies to 30MHz.



## RADIATED EMISSION BELOW 1GHZ

<b>EUT</b>	WIFI Sensor	<b>Model Name</b>	IPM SQUARE
<b>Temperature</b>	25°C	<b>Relative Humidity</b>	55.4%
<b>Pressure</b>	960hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	802.11b with date rate 1 2412MHZ	<b>Antenna</b>	Horizontal

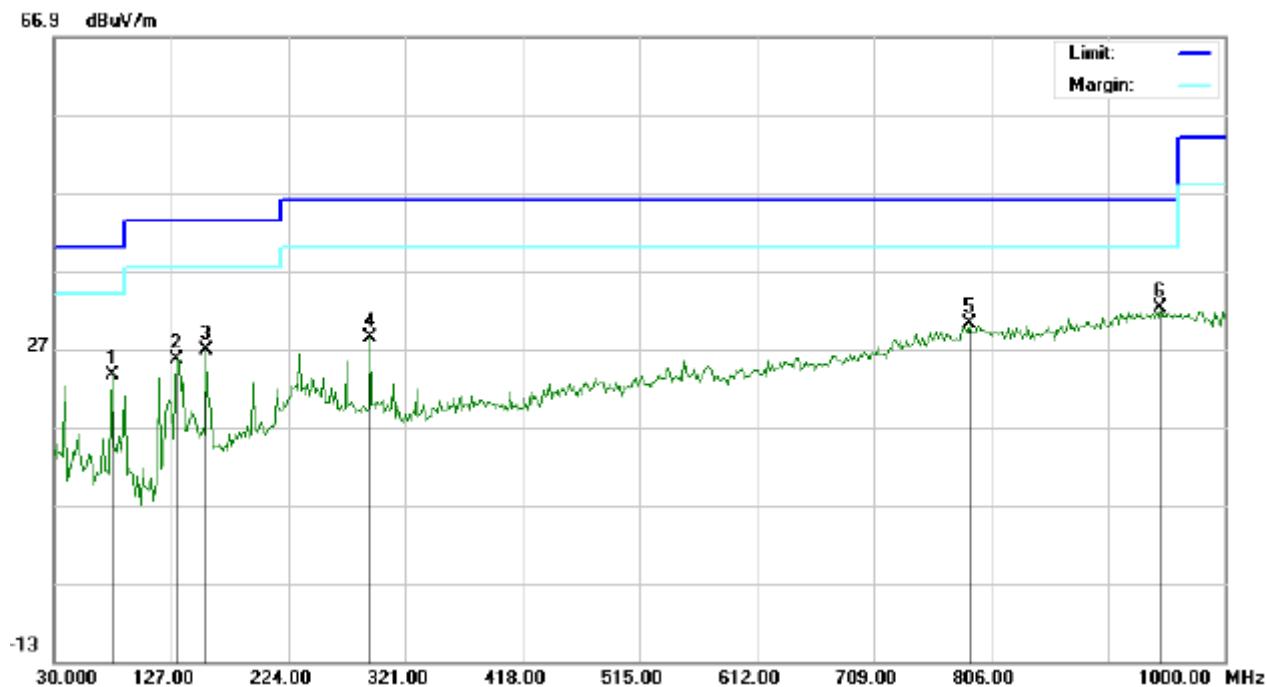


No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over	Detector	Comment
			Level	Factor	ment				
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB		
1	127.0000	127.00	17.09	9.13	26.22	43.50	-17.28	peak	
2	156.0999	156.0999	11.69	11.28	22.97	43.50	-20.53	peak	
3	510.1499	510.1499	2.35	21.40	23.75	46.00	-22.25	peak	
4	736.4832	736.4832	1.14	26.25	27.39	46.00	-18.61	peak	
5	856.1167	856.1167	1.49	27.47	28.96	46.00	-17.04	peak	
6	*	951.5000	0.77	29.99	30.76	46.00	-15.24	peak	

**RESULT: PASS**



<b>EUT</b>	WIFI Sensor	<b>Model Name</b>	IPM SQUARE
<b>Temperature</b>	25°C	<b>Relative Humidity</b>	55.4%
<b>Pressure</b>	960hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	802.11b with date rate 1 2412MHZ	<b>Antenna</b>	Vertical



No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over	Detector	Comment
			Level	Factor	ment				
1		78.5000	21.36	2.17	23.53	40.00	-16.47	peak	
2		131.8499	13.81	11.80	25.61	43.50	-17.89	peak	
3		156.0999	11.49	15.30	26.79	43.50	-16.71	peak	
4		291.8999	13.33	15.17	28.50	46.00	-17.50	peak	
5		788.2166	3.05	27.16	30.21	46.00	-15.79	peak	
6	*	946.6499	2.29	29.91	32.20	46.00	-13.80	peak	

## RESULT: PASS

**Note:** 1. Factor=Antenna Factor + Cable loss, Margin=Measurement-Limit.  
2. The "Factor" value can be calculated automatically by software of measurement system.  
3. All test modes had been pre-tested. The 802.11b at low channel is the worst case and recorded in the report.



## RADIATED EMISSION ABOVE 1GHZ

<b>EUT</b>	WIFI Sensor	<b>Model Name</b>	IPM SQUARE
<b>Temperature</b>	25°C	<b>Relative Humidity</b>	55.4%
<b>Pressure</b>	960hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	802.11b with date rate 1 2412MHZ	<b>Antenna</b>	Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dB $\mu$ V)	(dB)	(dB $\mu$ V/m)	(dB $\mu$ V/m)	(dB)	
4824.097	45.11	3.72	48.83	74	-25.17	peak
4824.118	41.23	3.72	44.95	54	-9.05	AVG
7236.055	42.52	8.15	50.67	74	-23.33	peak
7236.057	40.67	8.15	48.82	54	-5.18	AVG

Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

<b>EUT</b>	WIFI Sensor	<b>Model Name</b>	IPM SQUARE
<b>Temperature</b>	25°C	<b>Relative Humidity</b>	55.4%
<b>Pressure</b>	960hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	802.11b with date rate 1 2412MHZ	<b>Antenna</b>	Vertical

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dB $\mu$ V)	(dB)	(dB $\mu$ V/m)	(dB $\mu$ V/m)	(dB)	
4824.106	44.88	3.72	48.6	74	-25.4	peak
4824.049	41.31	3.72	45.03	54	-8.97	AVG
7236.096	43.89	8.15	52.04	74	-21.96	peak
7236.066	35.75	8.15	43.9	54	-10.1	AVG

Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.



<b>EUT</b>	WIFI Sensor	<b>Model Name</b>	IPM SQUARE
<b>Temperature</b>	25°C	<b>Relative Humidity</b>	55.4%
<b>Pressure</b>	960hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	802.11b with date rate 1 2437MHZ	<b>Antenna</b>	Horizontal

Frequency (MHz)	Meter Reading (dB $\mu$ V)	Factor (dB)	Emission Level (dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Margin (dB)	Value Type
4874.022	45.89	3.75	49.64	74	-24.36	peak
4874.030	42.63	3.75	46.38	54	-7.62	AVG
7311.090	44.12	8.16	52.28	74	-21.72	peak
7311.113	40.67	8.16	48.83	54	-5.17	AVG

Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

<b>EUT</b>	WIFI Sensor	<b>Model Name</b>	IPM SQUARE
<b>Temperature</b>	25°C	<b>Relative Humidity</b>	55.4%
<b>Pressure</b>	960hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	802.11b with date rate 1 2437MHZ	<b>Antenna</b>	Vertical

Frequency (MHz)	Meter Reading (dB $\mu$ V)	Factor (dB)	Emission Level (dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Margin (dB)	Value Type
4874.044	44.83	3.75	48.58	74	-25.42	peak
4874.100	42.64	3.75	46.39	54	-7.61	AVG
7311.118	43.34	8.16	51.5	74	-22.5	peak
7311.053	40.51	8.16	48.67	54	-5.33	AVG

Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.



<b>EUT</b>	WIFI Sensor	<b>Model Name</b>	IPM SQUARE
<b>Temperature</b>	25°C	<b>Relative Humidity</b>	55.4%
<b>Pressure</b>	960hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	802.11b with date rate 1 2462MHZ	<b>Antenna</b>	Horizontal

Frequency (MHz)	Meter Reading (dB $\mu$ V)	Factor (dB)	Emission Level (dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Margin (dB)	Value Type
4924.093	46.41	3.81	50.22	74	-23.78	peak
4924.058	41.53	3.81	45.34	54	-8.66	AVG
7386.058	44.26	8.19	52.45	74	-21.55	peak
7386.041	40.74	8.19	48.93	54	-5.07	AVG

Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

<b>EUT</b>	WIFI Sensor	<b>Model Name</b>	IPM SQUARE
<b>Temperature</b>	25°C	<b>Relative Humidity</b>	55.4%
<b>Pressure</b>	960hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	802.11b with date rate 1 2462MHZ	<b>Antenna</b>	Vertical

Frequency (MHz)	Meter Reading (dB $\mu$ V)	Factor (dB)	Emission Level (dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Margin (dB)	Value Type
4924.052	45.71	3.81	49.52	74	-24.48	peak
4924.068	42.16	3.81	45.97	54	-8.03	AVG
7386.053	43.86	8.19	52.05	74	-21.95	peak
7386.108	40.33	8.19	48.52	54	-5.48	AVG

Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

**RESULT: PASS****Note:**

Other emissions from 1G to 25 GHz are considered as ambient noise. No recording in the test report.

Factor = Antenna Factor + Cable loss - Amplifier gain, Over=Measure-Limit.

The “Factor” value can be calculated automatically by software of measurement system.

All test modes had been pre-tested. The 802.11b mode is the worst case and recorded in the report.



## 8. BAND EDGE EMISSION

### 8.1. MEASUREMENT PROCEDURE

Radiated restricted band edge measurements

The radiated restricted band edge measurements are measured with an EMI test receiver connected to the receive antenna while the EUT is transmitting

### 8.2. TEST SET-UP

same as 7.2

**Note:**

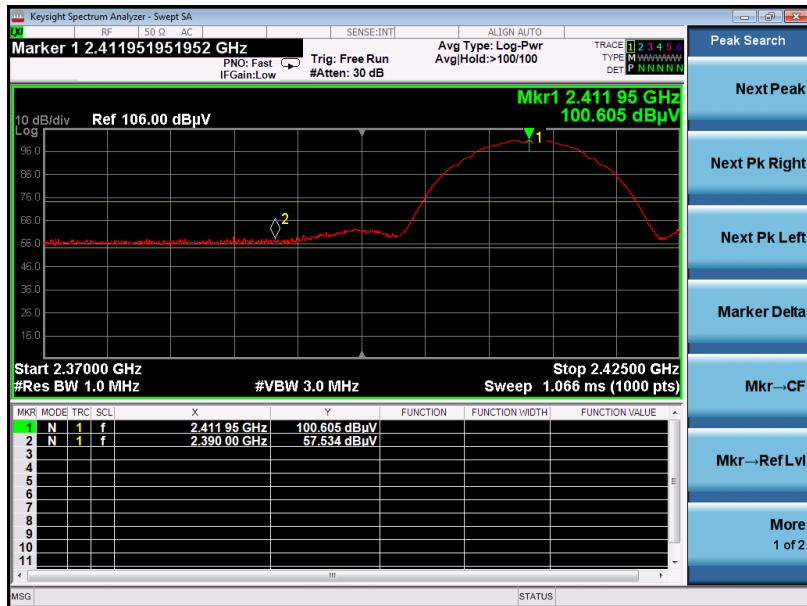
1. Factor=Antenna Factor + Cable loss - Amplifier gain. Field Strength=Factor + Reading level
2. The factor had been edited in the “Input Correction” of the Spectrum Analyzer. So the Amplitude of test plots is equal to Reading level plus the Factor in dB. Use the A dB( $\mu$ V) to represent the Amplitude. Use the F dB( $\mu$ V/m) to represent the Field Strength. So A=F.



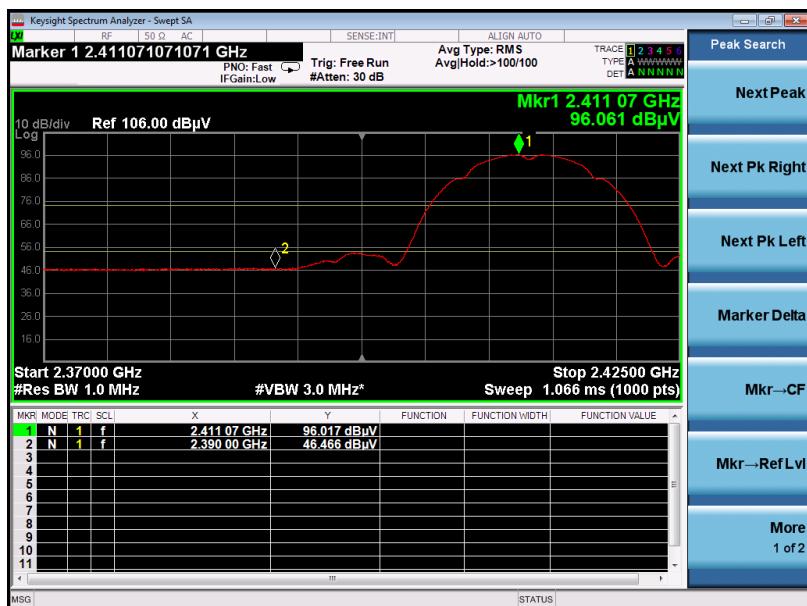
### 8.3. TEST RESULT

<b>EUT</b>	WIFI Sensor	<b>Model Name</b>	IPM SQUARE
<b>Temperature</b>	25°C	<b>Relative Humidity</b>	55.4%
<b>Pressure</b>	960hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	802.11b with data rate 1 2412MHZ	<b>Antenna</b>	Horizontal

PK



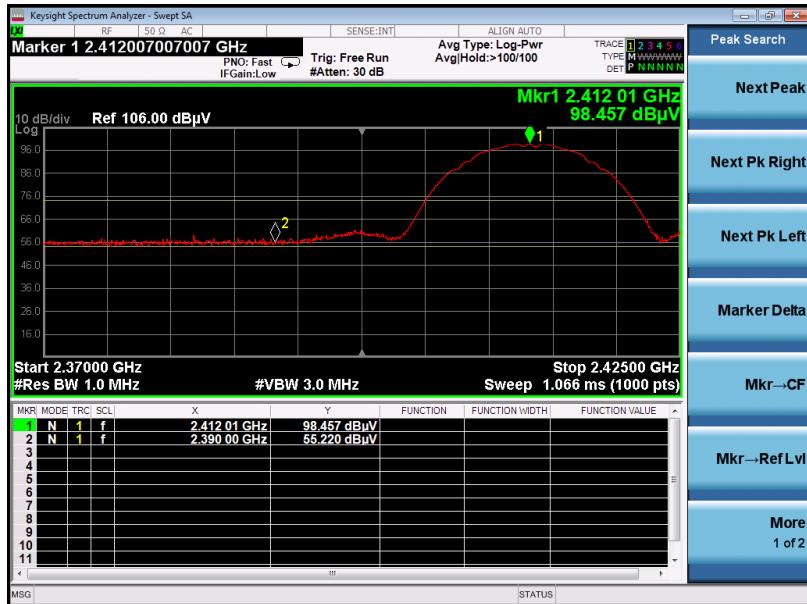
AV

**RESULT: PASS**



<b>EUT</b>	WIFI Sensor	<b>Model Name</b>	IPM SQUARE
<b>Temperature</b>	25°C	<b>Relative Humidity</b>	55.4%
<b>Pressure</b>	960hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	802.11b with data rate 1 2412MHz	<b>Antenna</b>	Vertical

PK



AV

**RESULT: PASS**



<b>EUT</b>	WIFI Sensor	<b>Model Name</b>	IPM SQUARE
<b>Temperature</b>	25°C	<b>Relative Humidity</b>	55.4%
<b>Pressure</b>	960hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	802.11b with data rate 1 2462MHz	<b>Antenna</b>	Horizontal

PK



AV

**RESULT: PASS**



<b>EUT</b>	WIFI Sensor	<b>Model Name</b>	IPM SQUARE
<b>Temperature</b>	25°C	<b>Relative Humidity</b>	55.4%
<b>Pressure</b>	960hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	802.11b with data rate 1 2462MHz	<b>Antenna</b>	Vertical

PK



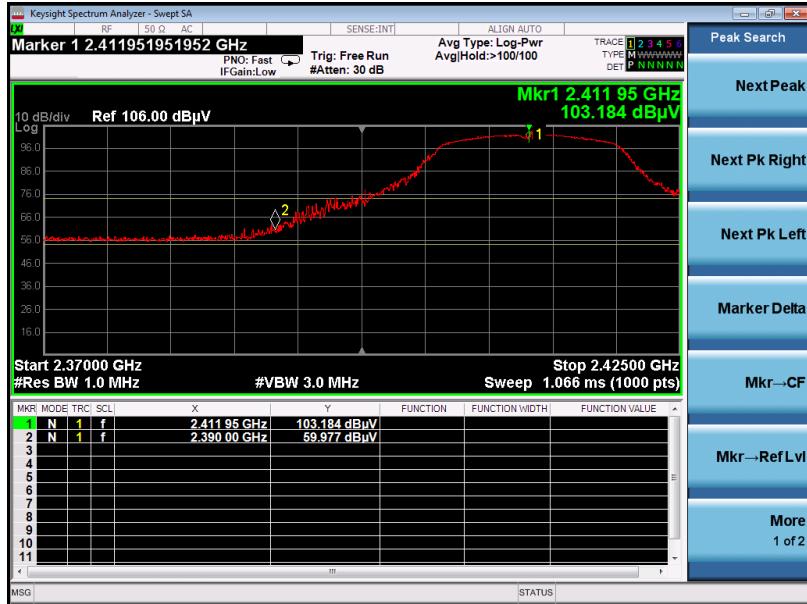
AV

**RESULT: PASS**

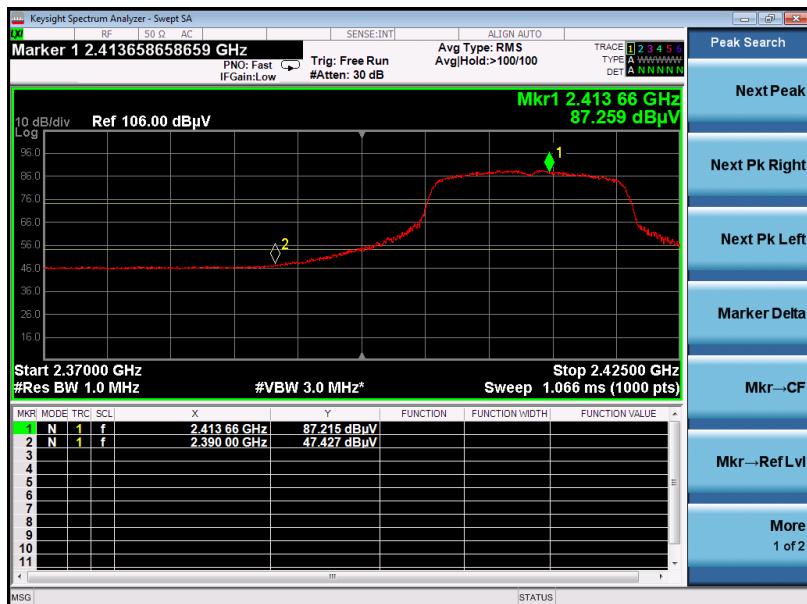


<b>EUT</b>	WIFI Sensor	<b>Model Name</b>	IPM SQUARE
<b>Temperature</b>	25°C	<b>Relative Humidity</b>	55.4%
<b>Pressure</b>	960hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	802.11g with data rate 6 2412MHz	<b>Antenna</b>	Horizontal

PK



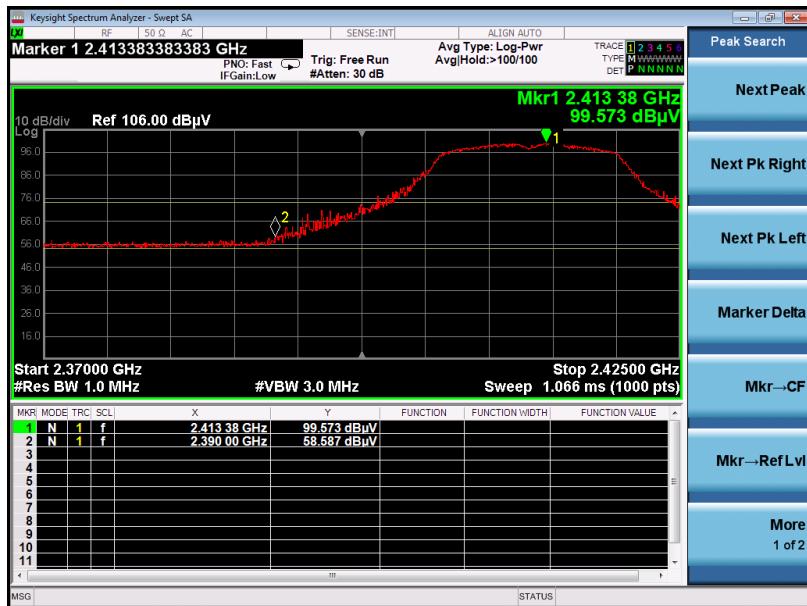
AV

**RESULT: PASS**

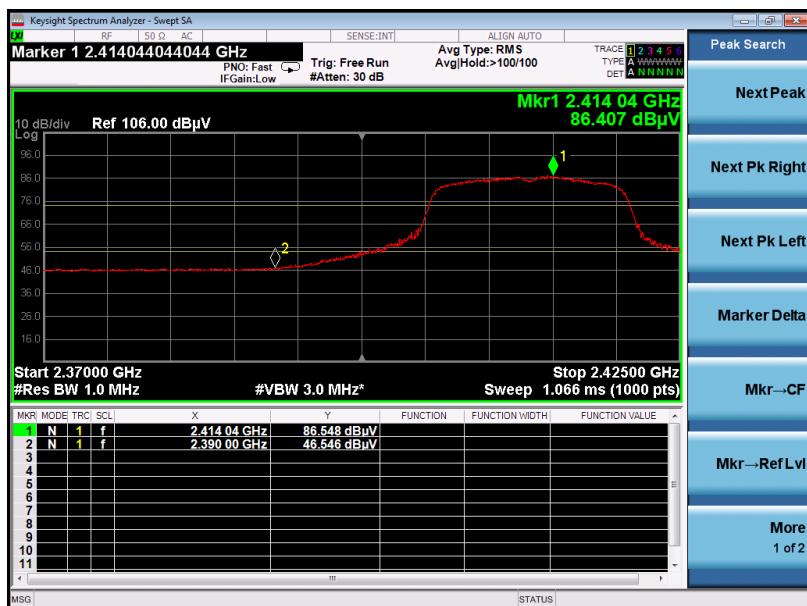


<b>EUT</b>	WIFI Sensor	<b>Model Name</b>	IPM SQUARE
<b>Temperature</b>	25°C	<b>Relative Humidity</b>	55.4%
<b>Pressure</b>	960hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	802.11g with data rate 6 2412MHz	<b>Antenna</b>	Vertical

PK



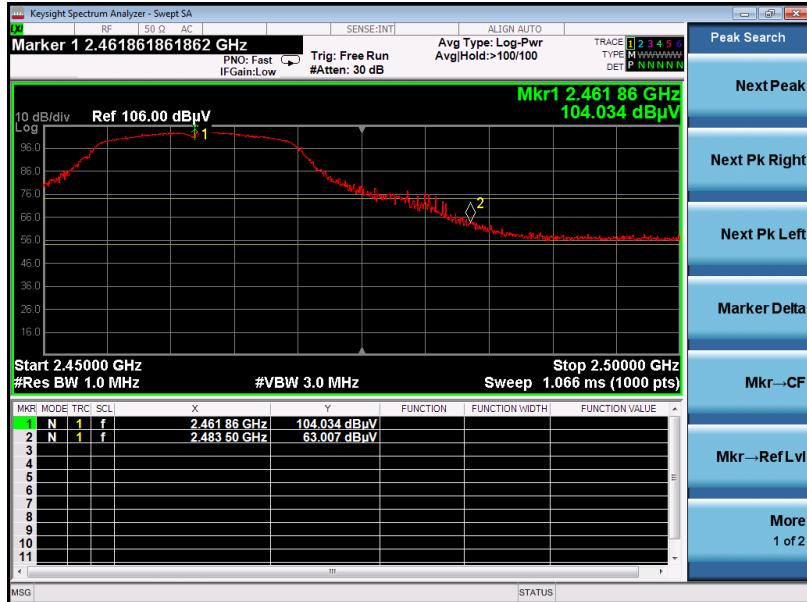
AV

**RESULT: PASS**



<b>EUT</b>	WIFI Sensor	<b>Model Name</b>	IPM SQUARE
<b>Temperature</b>	25°C	<b>Relative Humidity</b>	55.4%
<b>Pressure</b>	960hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	802.11g with data rate 6 2462MHz	<b>Antenna</b>	Horizontal

PK



AV

**RESULT: PASS**



<b>EUT</b>	WIFI Sensor	<b>Model Name</b>	IPM SQUARE
<b>Temperature</b>	25°C	<b>Relative Humidity</b>	55.4%
<b>Pressure</b>	960hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	802.11g with data rate 6 2462MHz	<b>Antenna</b>	Vertical

PK



AV

**RESULT: PASS**



<b>EUT</b>	WIFI Sensor	<b>Model Name</b>	IPM SQUARE
<b>Temperature</b>	25°C	<b>Relative Humidity</b>	55.4%
<b>Pressure</b>	960hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	802.11n 20 with data rate 6.5 2412MHZ	<b>Antenna</b>	Horizontal

PK



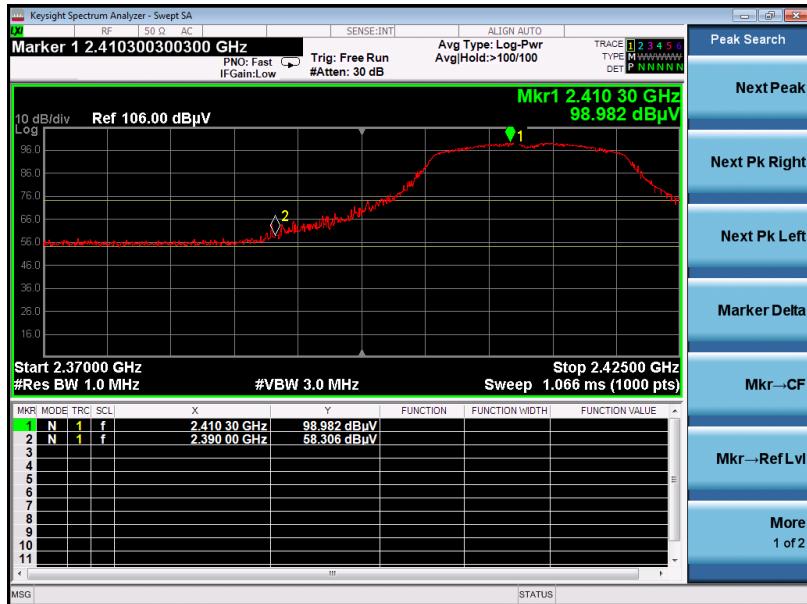
AV

**RESULT: PASS**



<b>EUT</b>	WIFI Sensor	<b>Model Name</b>	IPM SQUARE
<b>Temperature</b>	25°C	<b>Relative Humidity</b>	55.4%
<b>Pressure</b>	960hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	802.11n 20 with data rate 6.5 2412MHZ	<b>Antenna</b>	Vertical

PK



AV

**RESULT: PASS**



<b>EUT</b>	WIFI Sensor	<b>Model Name</b>	IPM SQUARE
<b>Temperature</b>	25°C	<b>Relative Humidity</b>	55.4%
<b>Pressure</b>	960hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	802.11n 20 with data rate 6.5 2462MHz	<b>Antenna</b>	Horizontal

PK



AV

**RESULT: PASS**



<b>EUT</b>	WIFI Sensor	<b>Model Name</b>	IPM SQUARE
<b>Temperature</b>	25°C	<b>Relative Humidity</b>	55.4%
<b>Pressure</b>	960hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	802.11n 20 with data rate 6.5 2462MHz	<b>Antenna</b>	Vertical

PK



AV

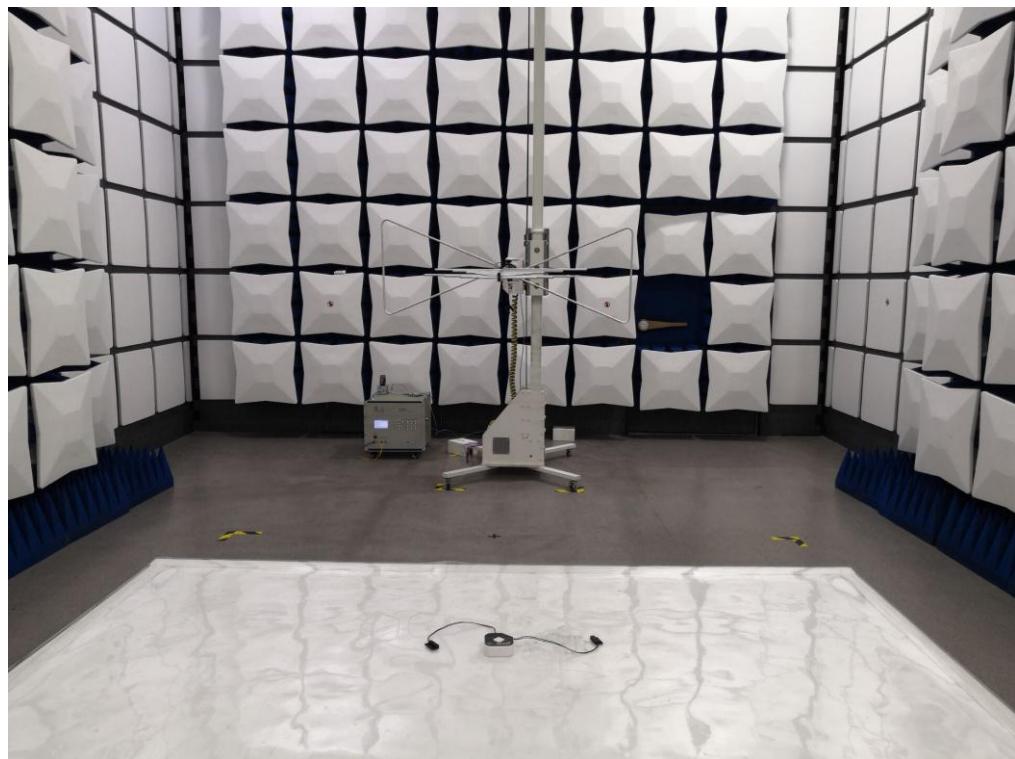


RESULT: PASS

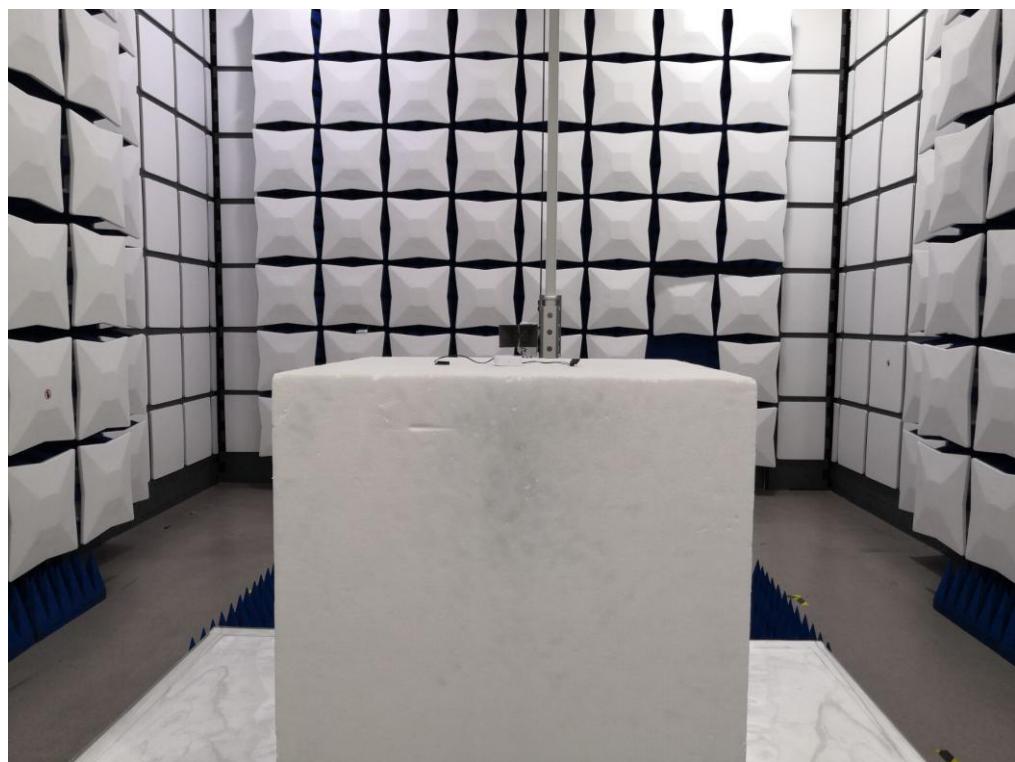


## APPENDIX A: PHOTOGRAPHS OF TEST SETUP

### FCC RADIATED EMISSION TEST SETUP BELOW 1GHZ



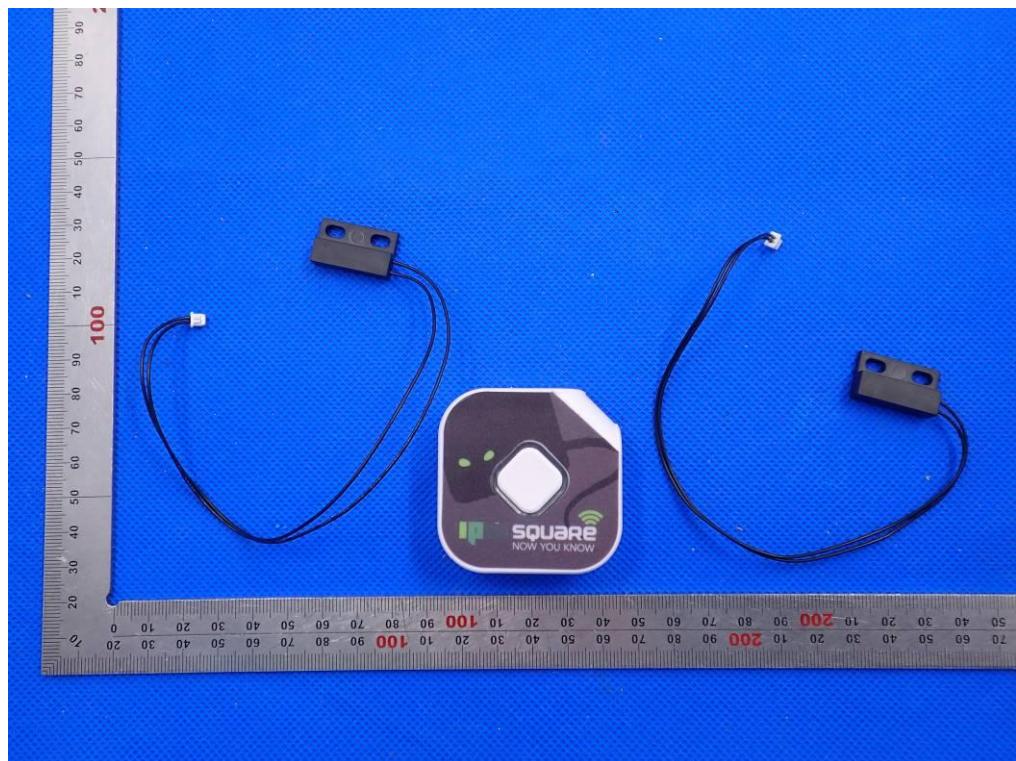
FCC RADIATED EMISSION TEST SETUP ABOVE 1GHZ





## APPENDIX B: PHOTOGRAPHS OF EUT

### ALL VIEW OF EUT



TOP VIEW OF EUT

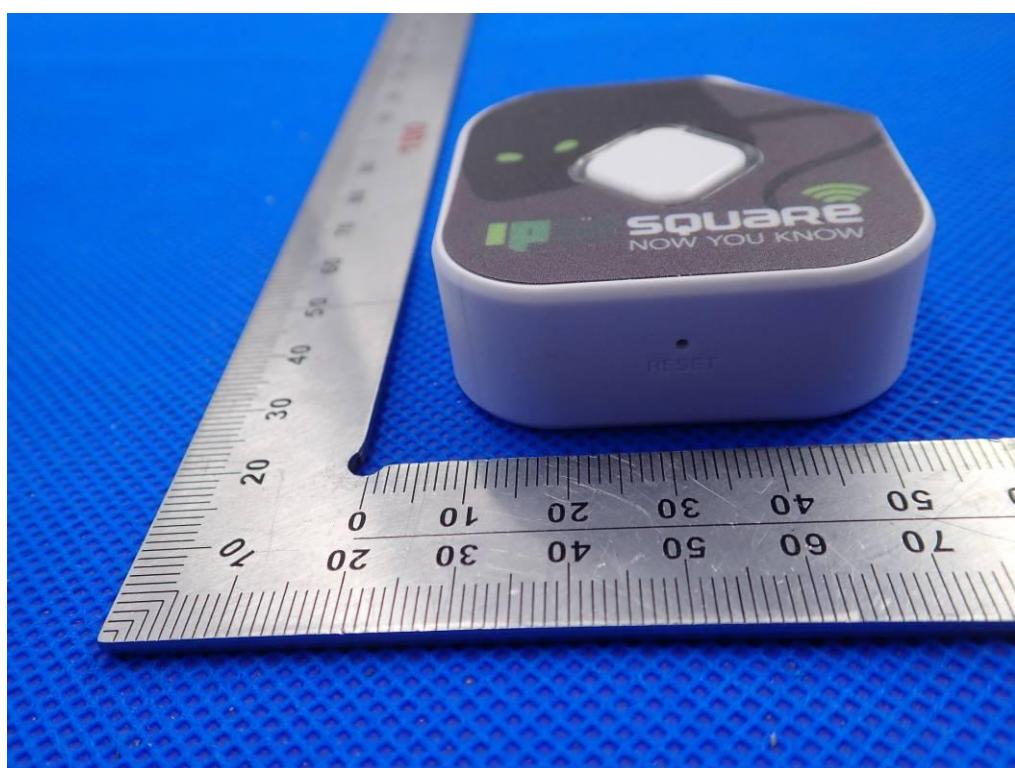




BOTTOM VIEW OF EUT



FRONT VIEW OF EUT

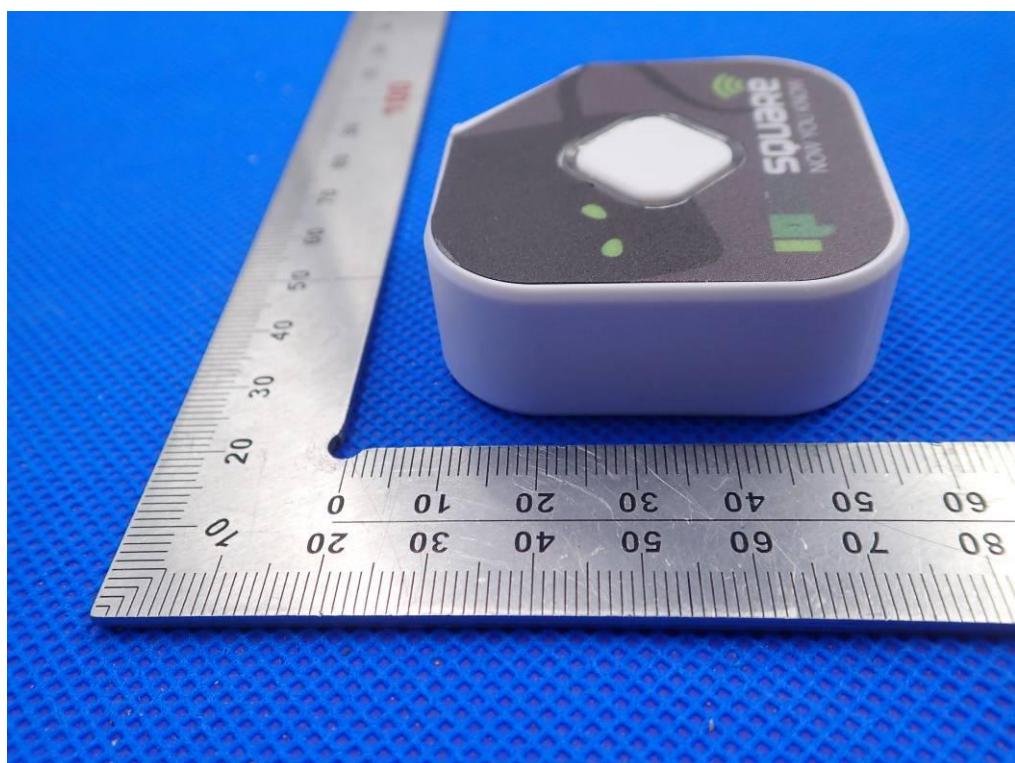




BACK VIEW OF EUT

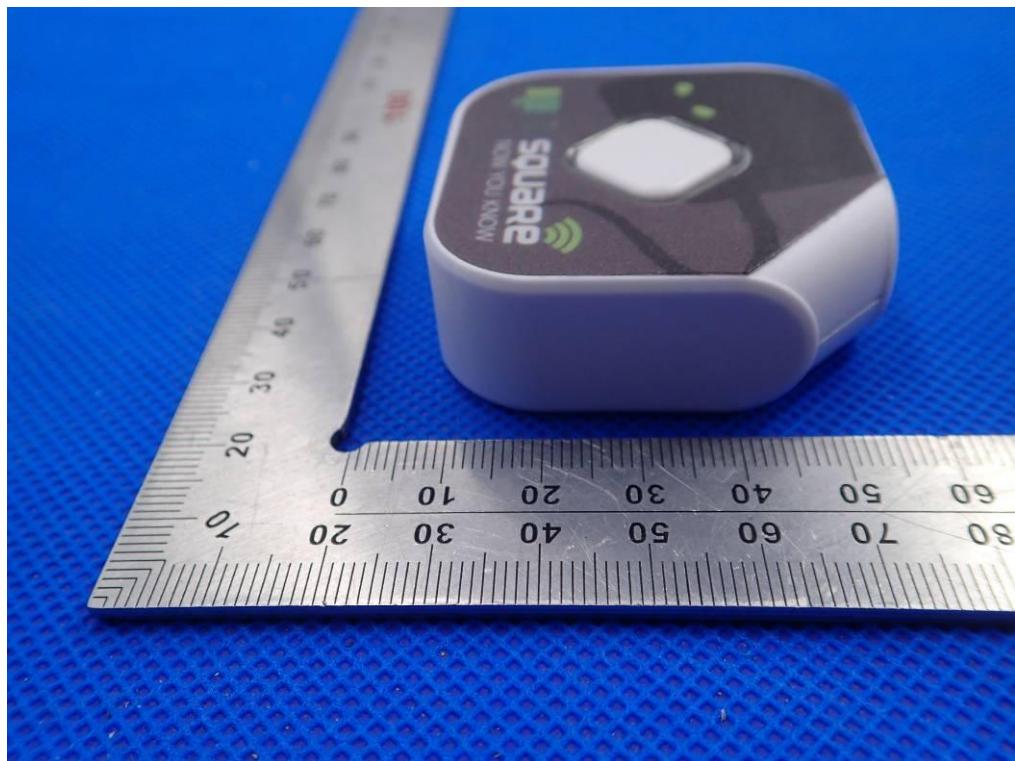


LEFT VIEW OF EUT

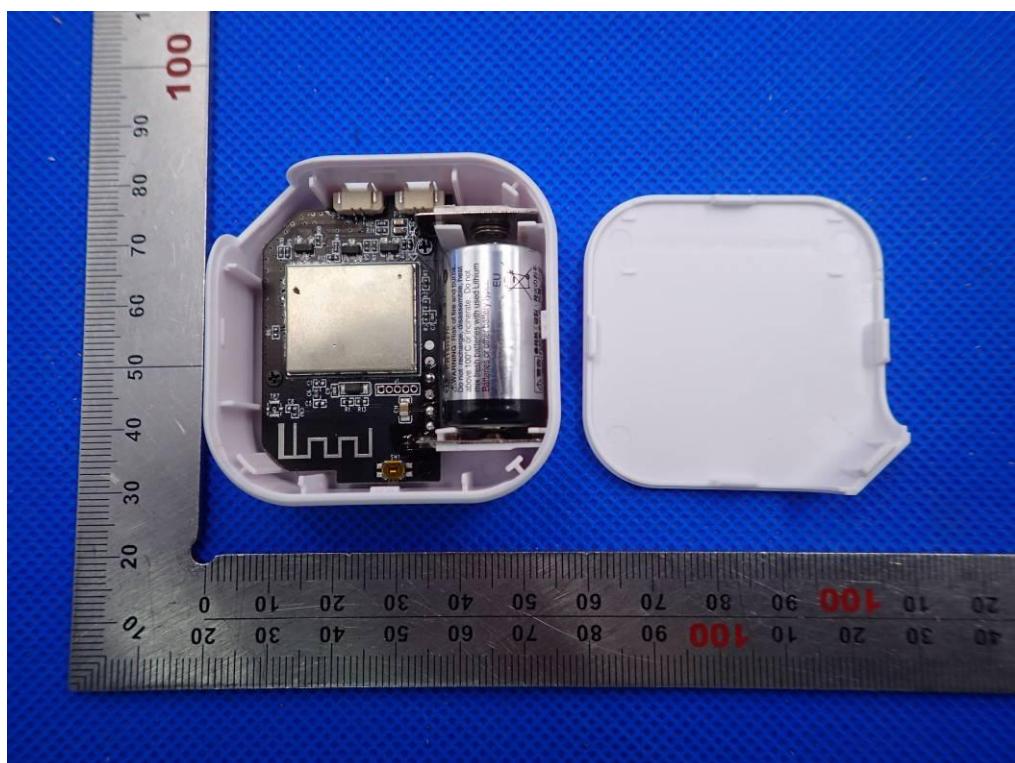




RIGHT VIEW OF EUT

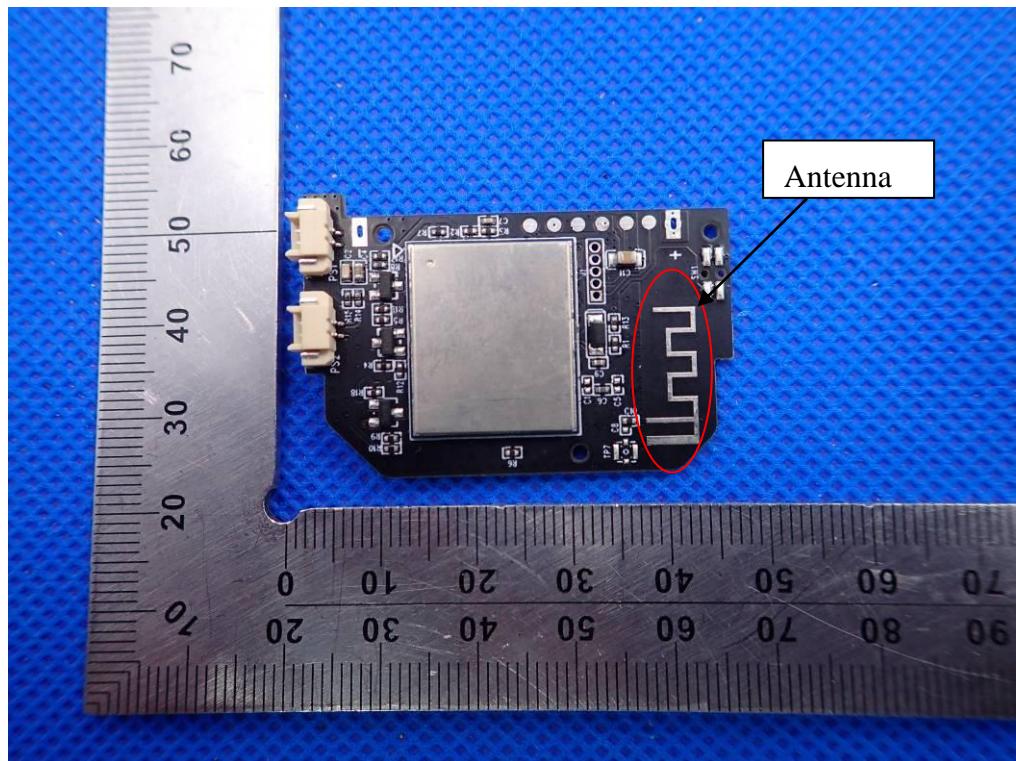


OPEN VIEW OF EUT 1

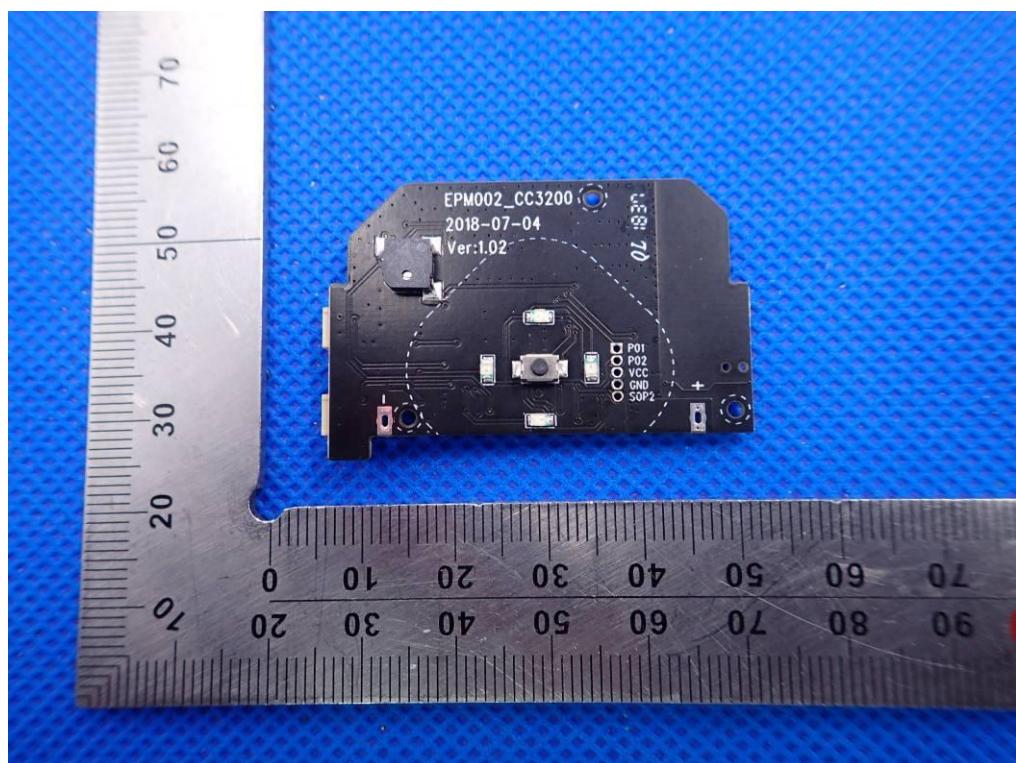




## INTERNAL VIEW OF EUT-1

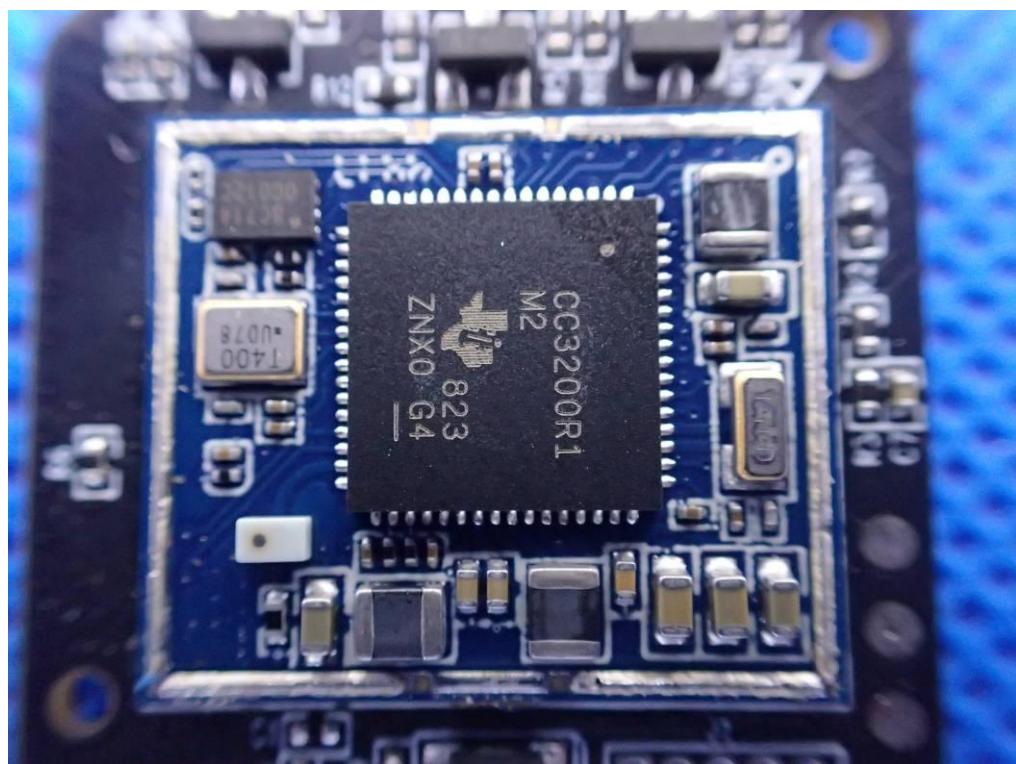


## INTERNAL VIEW OF EUT-2





INTERNAL VIEW OF EUT-3



---END OF REPORT---