

**ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT
INTENTIONAL RADIATOR CERTIFICATION TO
FCC PART 15 SUBPART C REQUIREMENT**

OF

WiFi Leak Sensor

Model No.: iSB02

FCC ID: EMOISB02

Trademark: iHome

Report No.: ED170807051E

Issue Date: July 11, 2017

Prepared for

**SDI Technologies Inc.
1299, Main Street, Rahway, NJ 07065, U.S.A.**

Prepared by

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EMTEK(DONGGUAN) CO., LTD.**

VERIFICATION OF COMPLIANCE

Applicant:	SDI Technologies Inc. 1299, Main Street, Rahway, NJ 07065, U.S.A.
Manufacturer:	SDI Technologies Inc. 1299, Main Street, Rahway, NJ 07065, U.S.A.
Factory :	Plastoform Electronics (Shenzhen) Company Limited. Building No. 16, 21 B Zone, The 1st Industrial Zone, Gonghe Community, Shajing Street, Baoan District Shenzhen Guangdong China.
Product Description:	WiFi Leak Sensor
Model Number:	iSB02

We hereby certify that:

The above equipment was tested by EMTEK(DONGGUAN) CO., LTD. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10-2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.247(2017).

Date of Test : July 03, 2017 to July 11, 2017

Abby Li

Prepared by : Abby Li/Editor

Tomas Yang

Reviewer : Tomas Yang/Supervisor

Approved & Authorized Signer : *Sam Lv*

Sam Lv/Manager

Modified Information

Version	Summary	Revision Date	Report No.
Ver.1.0	Original Report	/	ED170807051E

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1. General Information

1.1 Product Description

Characteristics	Description
Product Name	WiFi Leak Sensor
Model number	iSB02
Power Supply	DC 2*1.5V Battery
Modulation	802.11b: DSSS(DBPSK/DQPSK/CCK) 802.11g/n: OFDM(BPSK/QPSK/16QAM/64QAM)
Operating Frequency Range	2412-2462MHz for 802.11b/g/n(HT20)
Number of Channels	11 for 20MHz bandwidth
Transmit Power Max	802.11b: 15.68dBm 802.11g: 14.95 dBm 802.11n(HT20): 13.76dBm
Antenna Type	Internal antenna
Antenna Gain	1.8 dBi
Product Software Version	v05.02.09
Product Hardware version	VER01
Radio Software Version	v02.09 SDK 1.5.2
Radio Hardware version	DOIT - ESPF - B01

Note: for more details, please refer to the User's manual of the EUT.

2. System Test Configuration

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

2.3 Test Procedure

2.3.1 Conducted Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-Peak and average detector mode.

2.3.2 Radiated Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. Emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes according to the requirements in Section 13.1.4.1 of ANSI C63.10-2013.

2.4 Configuration of Tested System

Fig. 2-1 Configuration of Tested System



Table 2-1 Equipment Used in Tested System

Item	Equipment	Trademark	Model No.	FCC ID	Note
1.	WiFi Leak Sensor	iHome	iSB02	EMOISB02	EUT
2.	PC	DELL	OPTIRLEX 760	N/A	Support EUT

Note:

- (1) Unless otherwise denoted as EUT in 『Remark』 column, device(s) used in tested system is a support equipment.

3. Description of Test Modes

The EUT has been tested under its typical operating condition and new batteries(2*1.5V) for EUT tested alone . The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

Test of channel included the lowest and middle and highest frequency to perform the test, then record on this report.

Those data rates (802.11b: 1 Mbps; 802.11g: 6 Mbps; 802.11n (HT20) : MCS0) were used for all test.

Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting mode is programmed. EUT is connected by com port, and transmit the control instruction via test software(SecureCRT.v.6.7.1-kg).

For Radiated: The EUT's antenna was pre-tested under the following modes:

Test Mode	Description
Mode A	X-Y axis
Mode B	Y-Z axis
Mode C	X-Z axis

From the above modes, the worst case was found in Mode A. Therefore only the test data of the mode was recorded in this report.

Frequency and Channel list for 802.11 b/g/n (HT20):

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	5	2432	9	2452
2	2417	6	2437	10	2457
3	2422	7	2442	11	2462
4	2427	8	2447		

Test Frequency and Channel for 802.11 b/g/n (HT20):

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	6	2437	11	2462

The output power setting of EUT is set in the factory and followed the max. peak level in below

Operating Mode	Test Channel	output power
802.11b	1	16
	6	15
	11	16
802.11g	1	14
	6	15
	11	15
802.11n (HT20)	1	14
	6	14
	11	13

Operated Mode for Worst Duty cycle:

Test Signal Duty Cycle(x)	Average correction factor(db)
802.11b-100%	0
802.11g-100%	0
802.11n(HT20)-100%	0

4. Summary of Test Results

FCC Rules	Description Of Test	Result
§15.247(a)(2)	6dB bandwidth	Pass
§15.247(b)(3)	Max Peak output Power test	Pass
§15.247(e)	Power density	Pass
§15.247(d)	Band edge test	Pass
§15.207	AC Power Conducted Emission	N/A
§15.247(d), §15.209	Radiated Emission	Pass
§15.247(d)	Antenna Port Emission	Pass
§15.247(b)&§15.203	Antenna Application	Pass
Note: N/A is an abbreviation for Not Applicable. The power supply is from DC 2*1.5V battery, so the AC Power Conducted Emission is not Applicable.		

5. TEST SYSTEM UNCERTAINTY

The following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-5}$
Maximum Peak Output Power Test	$\pm 1.0\text{dB}$
Conducted Emissions Test	$\pm 2.0\text{dB}$
Radiated Emission Test	$\pm 2.0\text{dB}$
Power Density	$\pm 2.0\text{dB}$
Occupied Bandwidth Test	$\pm 1.0\text{dB}$
Band Edge Test	$\pm 3\text{dB}$
All emission, radiated	$\pm 3\text{dB}$
Antenna Port Emission	$\pm 3\text{dB}$
Temperature	$\pm 0.5^\circ\text{C}$
Humidity	$\pm 3\%$

Remark: The coverage Factor (k=2), and measurement Uncertainty for a level of Confidence of 95

6. Test Facility

Site Description

EMC Lab : Registered on FCC, July 06, 2016
The Certificate Number is 247565.

Registered on Industry Canada, January 13, 2017
The Certificate Number is 9444A.

Name of Firm : EMTEK(DONGGUAN) CO., LTD.
Site Location : No.281, Guantai Road, Nancheng District,
Dongguan, Guangdong, China

7. Radiated Emission Test

7.1 Measurement Procedure

1. The testing follows the guidelines in Spurious Radiated Emissions of ANSI C63.10-2013.
2. Below 1000MHz, The EUT was placed on a turn table which is 0.8m above ground plane. And above 1000MHz, The EUT was placed on a Styrofoam table which is 1.5m above ground plane.
3. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (From 1m to 4m) and turntable (from 0 degree to 360 degree) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
5. Set to the maximum power setting and enable the EUT transmit continuously.
6. Final measurement (Above 1GHz): The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The EMI Receiver set to peak and average mode and a resolution bandwidth of 1MHz. The measurement will be performed in horizontal and vertical polarization of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 degree to 360 degree in order to have the antenna inside the cone of radiation.
7. Test Procedure of measurement (For Above 1GHz):
 - 1) Monitor the frequency range at horizontal polarization and move the antenna over all sides of the EUT(if necessary move the EUT to another orthogonal axis).
 - 2) Change the antenna polarization and repeat 1) with vertical polarization.
 - 3) Make a hardcopy of the spectrum.
 - 4) Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
 - 5) Change the analyser mode to Clear/ Write and found the cone of emission.
 - 6) Rotate and move the EUT, so that the measuring distance can be enlarged to 3m and the antenna will be still inside the cone of emission.
 - 7) Measure the level of the detected frequency with the correct resolution bandwidth, with the antenna polarization and azimuth and the peak and average detector, which causes the maximum emission.
 - 8) Repeat steps 1) to 7) for the next antenna spot if the EUT is larger than the antenna beamwidth.

When spectrum scanned from 30MHz to 1GHz setting resolution bandwidth 120KHz and video bandwidth 300KHz:

EMI Test Receiver	Setting
Attenuation	Auto
RB	120KHz
VB	300KHz
Detector	QP
Trace	Max hold

When spectrum scanned above 1GHz setting resolution bandwidth 1MHz, video bandwidth 3MHz:

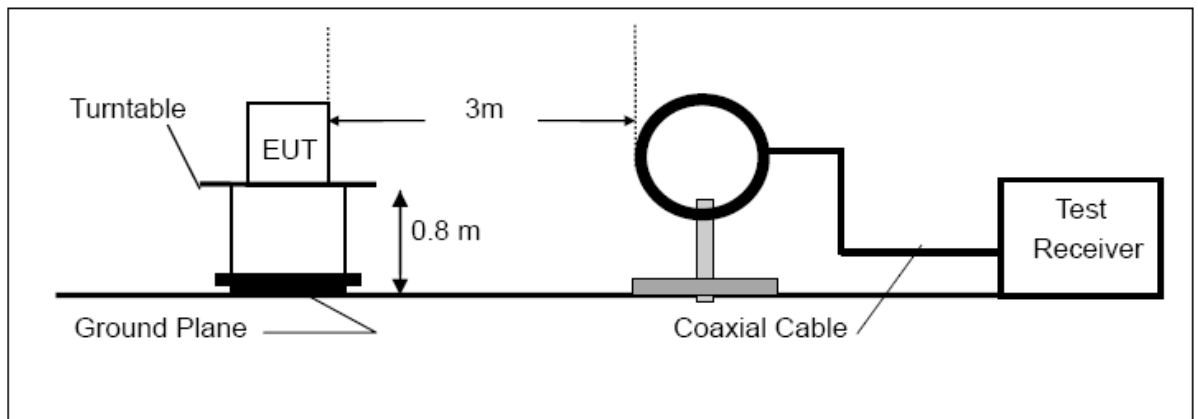
EMI Test Receiver	Setting
Attenuation	Auto
RB	1MHz
VB	3MHz
Detector	Peak
Trace	Max hold

When spectrum scanned above 1GHz setting resolution bandwidth 1MHz, video bandwidth 10Hz:

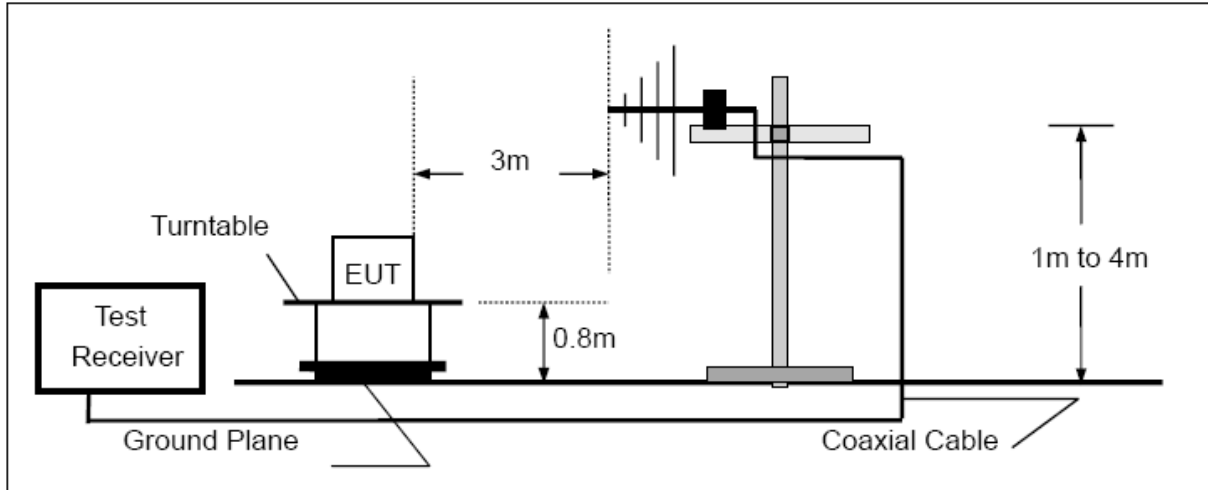
EMI Test Receiver	Setting
Attenuation	Auto
RB	1MHz
VB	10Hz
Detector	AVG
Trace	Max hold

7.2 Test SET-UP (Block Diagram of Configuration)

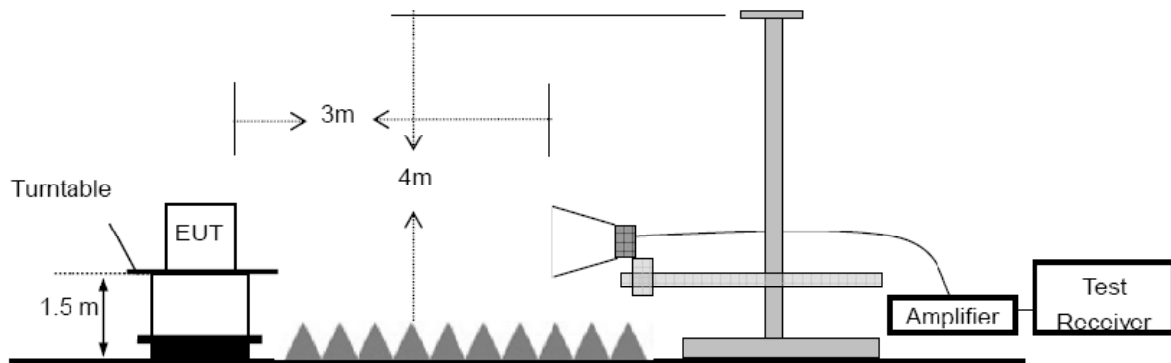
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(B) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(C) Radiated Emission Test Set-Up, Frequency above 1000MHz



7.3 Measurement Equipment Used

Item	Equipment	Manufacturer	Model No.	Serial No.	Characteristics	Last Cal.	Cal. Interval
1.	Test Receiver	Rohde & Schwarz	ESCI	1166.5950.0 3	9KHz-3GHz	05/16/2017	1 Year
2.	Loop Antenna	Schwarzbeck	FMZB 1519	012	9 KHz -30MHz	05/16/2017	1 Year
3.	Bilog Antenna	Schwarzbeck	VULB9163	000141	25MHz-2GHz	05/16/2017	1 Year
4.	Power Amplifier	CDS	RSU-M352	818	1MHz-1GHz	05/16/2017	1 Year
5.	Power Amplifier	HP	8447F	OPT H64	1GHz-26.5GHz	05/16/2017	1 Year
6.	Color Monitor	SUNSPO	SP-140A	N/A	--	05/16/2017	1 Year
7.	Single Line Filter	JIANLI	XL-3	N/A	--	05/16/2017	1 Year
8.	Single Phase Power Line Filter	JIANLI	DL-2X100B	N/A	--	05/16/2017	1 Year
9.	3 Phase Power Line Filter	JIANLI	DL-4X100B	N/A	--	05/16/2017	1 Year
10.	DC Power Filter	JIANLI	DL-2X50B	N/A	--	05/16/2017	1 Year
11.	Cable	Schwarzbeck	PLF-100	549489	9KHz-3GHz	05/16/2017	1 Year
12.	Cable	Rosenberger	CIL02	A0783566	9KHz-3GHz	05/16/2017	1 Year
13.	Cable	Rosenberger	RG 233/U	525178	9KHz-3GHz	05/16/2017	1 Year
14.	Signal Analyzer	Rohde & Schwarz	FSV30	103040	9KHz-40GHz	05/16/2017	1 Year
15.	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-1272	1GHz-18GHz	05/16/2017	1 Year
16.	Horn Antenna	Schwarzbeck	BBHA 9170	BBHA91703 99	18GHz -26.5GHz	05/16/2017	1 Year
17.	Power Amplifier	LUNAR EM	LNA1G18-4 0	J101000000 81	1GHz-26.5GHz	05/16/2017	1 Year
18.	Cable	H+S	CBL-26	N/A	1GHz-26.5GHz	05/16/2017	1 Year
19.	Cable	H+S	CBL-26	N/A	1GHz-26.5GHz	05/16/2017	1 Year
20.	Cable	H+S	CBL-26	N/A	1GHz-26.5GHz	05/16/2017	1 Year

7.4 Radiated Emission Limit

The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table 15.209(a):

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
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

15.205 Restricted bands of operation

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)

- Remark 1. Emission level in dBuV/m=20 log (uV/m)
 : 2. Measurement was performed at an antenna to the closed point of EUT distance of meters.
 3. Only spurious frequency is permitted to locate within the Restricted Bands specified in provision of § 15.205, and the emissions located in restricted bands also comply with 15.209 limit.

7.5 Measurement Result

Below 30MHz:

All the modulation modes were tested the data of the worst test mode are recorded in the following pages.

Operation Mode:	TX Mode	Test Date :	July 10, 2017
Frequency Range:	9KHz~30MHz	Temperature :	28°C
Test Result:	PASS	Humidity :	60 %
Measured Distance:	3m	Test By:	WOLF

Freq. (MHz)	Ant.Pol. H/V	Emission Level (dBuV/m)	Limit 3m (dBuV/m)	Over (dB)
--	--	--	--	--

Note: the amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

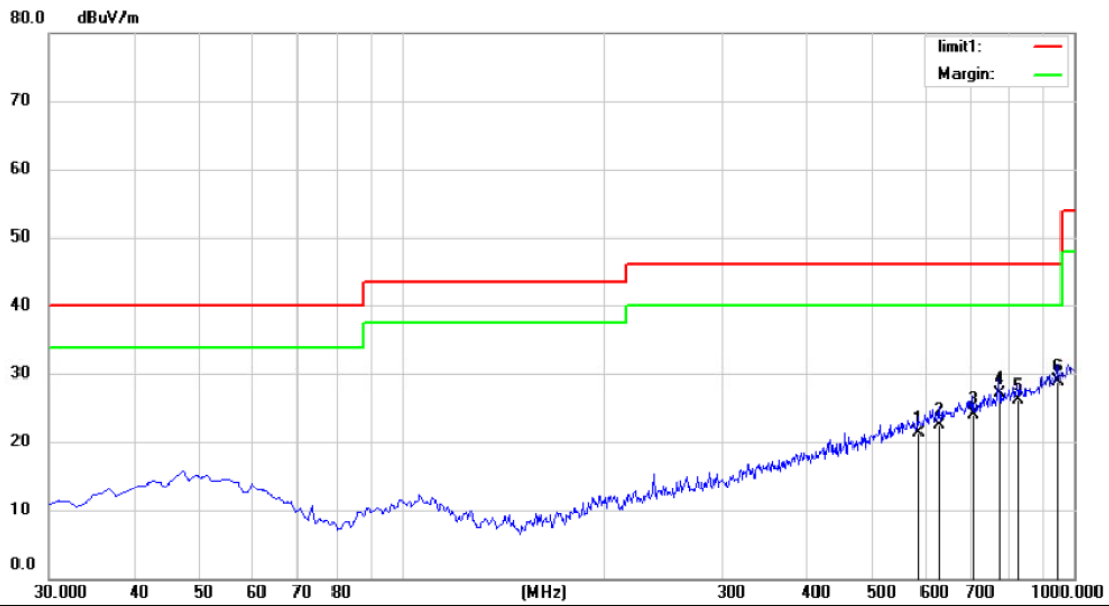
Distance extrapolation factor = $40\log(\text{Specific distance/ test distance})$ (dB);

Limit line=Specific limits(dBuV) + distance extrapolation factor.

Below 1000MHz:

All the modulation modes were tested the data of the worst mode (TX 802.11b) are recorded in the following pages and the others modulation methods do not exceed the limits.

Please refer to the following test plots:

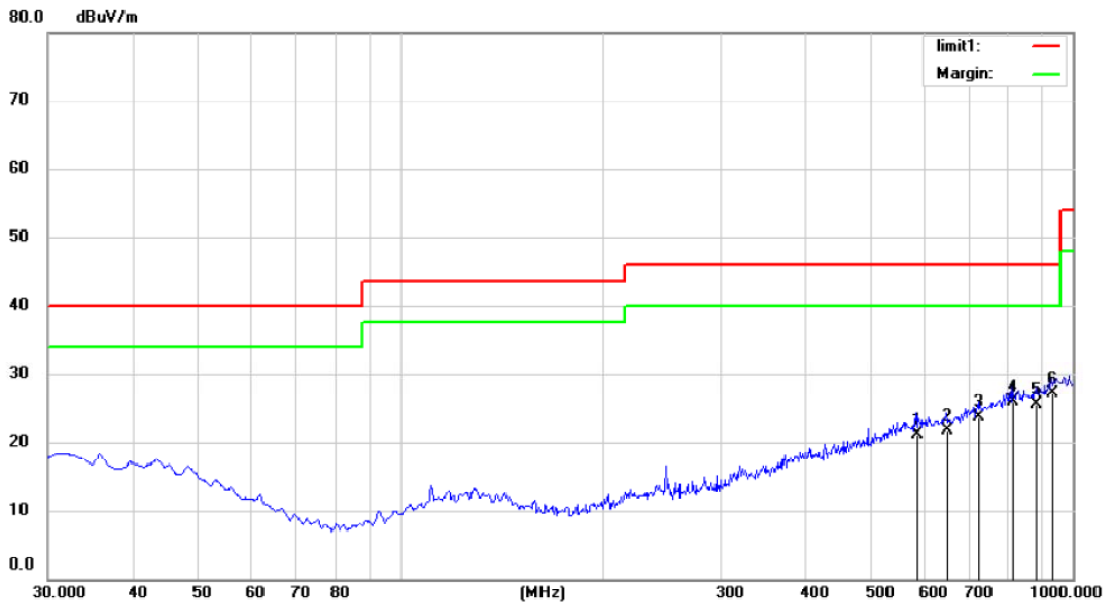


Site Chamber #1 Polarization: **Horizontal** Temperature: 26
 Limit: (RE)FCC PART 15 C 3m Power: Battery 2*1.5V Humidity: 55 %
 Mode:TX2412
 Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		588.7200	28.00	-6.66	21.34	46.00	-24.66	QP		
2		631.4000	28.20	-5.64	22.56	46.00	-23.44	QP		
3		708.0300	28.60	-4.42	24.18	46.00	-21.82	QP		
4		773.9900	30.10	-3.01	27.09	46.00	-18.91	QP		
5		825.4000	28.30	-2.19	26.11	46.00	-19.89	QP		
6	*	946.6500	28.20	0.66	28.86	46.00	-17.14	QP		

*:Maximum data x:Over limit !:over margin

Operator: washington

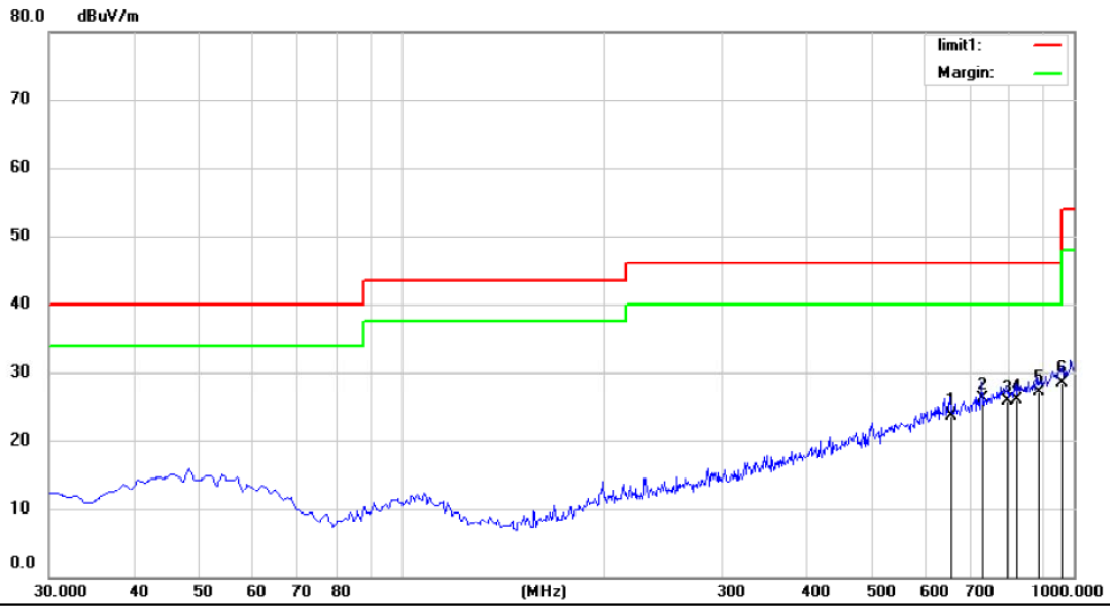


Site: Chamber #1 Polarization: **Vertical** Temperature: 26
 Limit: (RE)FCC PART 15 C 3m Power: Battery 2*1.5V Humidity: 55 %
 Mode: TX2412
 Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Antenna Height cm	Table Degree degree	Comment
1		586.7800	28.60	-7.57	21.03	46.00	-24.97	QP		
2		650.8000	28.50	-6.82	21.68	46.00	-24.32	QP		
3		724.5200	29.10	-5.31	23.79	46.00	-22.21	QP		
4		813.7600	29.10	-3.29	25.81	46.00	-20.19	QP		
5		883.6000	28.20	-2.77	25.43	46.00	-20.57	QP		
6	*	932.1000	28.10	-1.05	27.05	46.00	-18.95	QP		

*:Maximum data x:Over limit !:over margin

Operator: washington

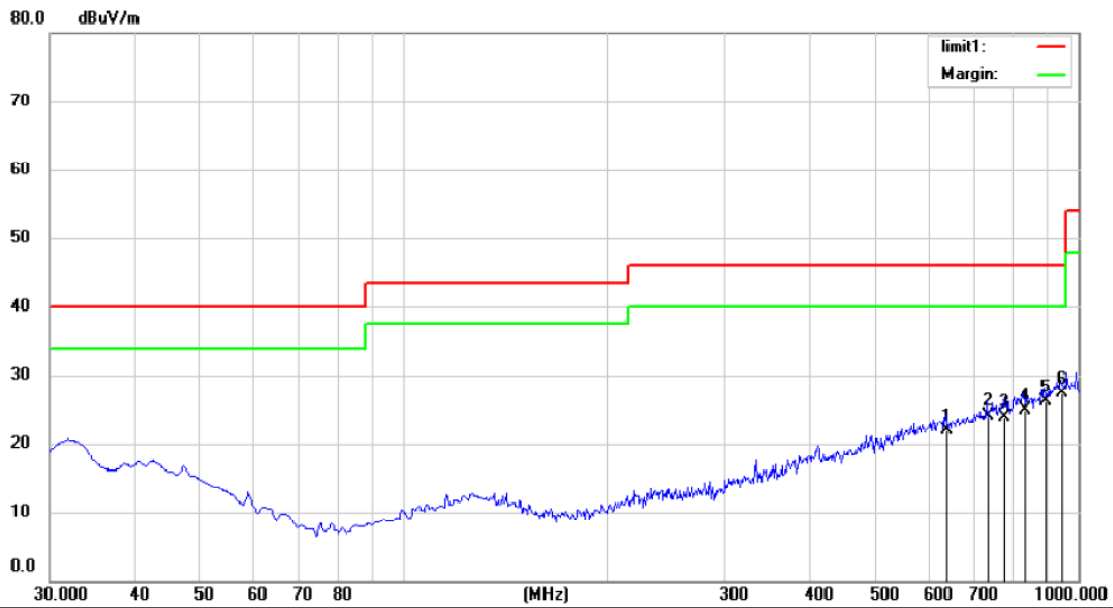


Site Chamber #1 Polarization: **Horizontal** Temperature: 26
 Limit: (RE)FCC PART 15 C 3m Power: Battery 2*1.5V Humidity: 55 %
 Mode:TX2437
 Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Antenna Height cm	Table Degree degree	Comment
1		654.6800	29.00	-5.28	23.72	46.00	-22.28	QP		
2		729.3700	30.10	-3.95	26.15	46.00	-19.85	QP		
3		794.3600	28.30	-2.60	25.70	46.00	-20.30	QP		
4		819.5800	28.20	-2.27	25.93	46.00	-20.07	QP		
5		885.5400	28.10	-1.05	27.05	46.00	-18.95	QP		
6	*	959.2600	27.50	0.92	28.42	46.00	-17.58	QP		

*:Maximum data x:Over limit !:over margin

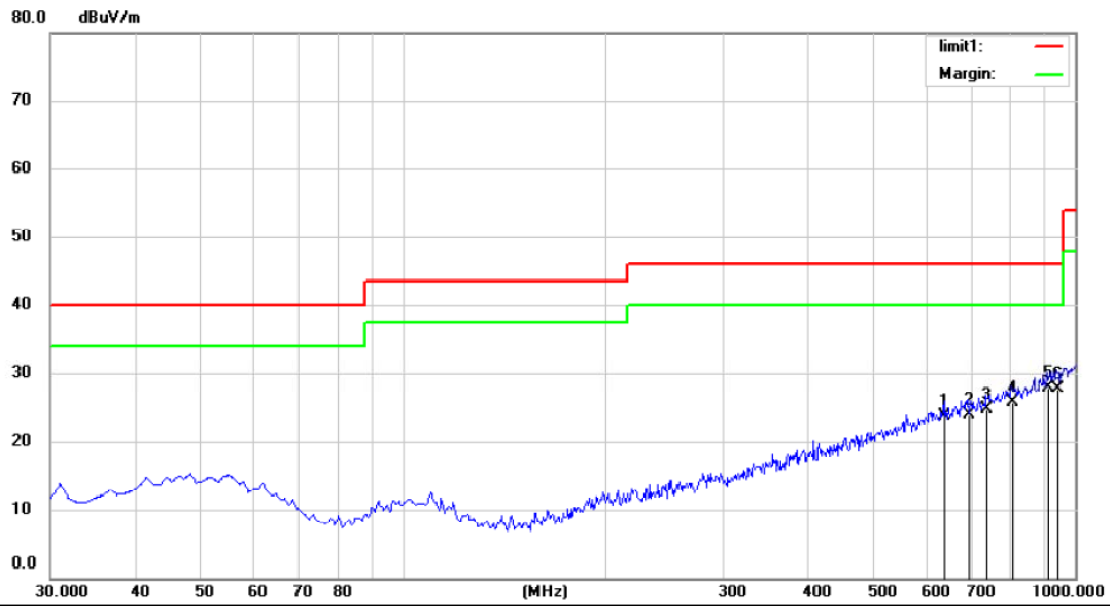
Operator: washington



Site Chamber #1 Polarization: **Vertical** Temperature: 26
 Limit: (RE)FCC PART 15 C 3m Power: Battery 2*1.5V Humidity: 55 %
 Mode:TX2437
 Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Antenna Height cm	Table Degree degree	Comment
1		636.2500	29.00	-7.00	22.00	46.00	-24.00	QP		
2		734.2200	29.10	-5.00	24.10	46.00	-21.90	QP		
3		778.8400	28.20	-4.35	23.85	46.00	-22.15	QP		
4		832.1900	28.10	-3.16	24.94	46.00	-21.06	QP		
5		891.3600	28.60	-2.57	26.03	46.00	-19.97	QP		
6	*	942.7700	28.20	-0.80	27.40	46.00	-18.60	QP		

*:Maximum data x:Over limit !:over margin Operator: washington

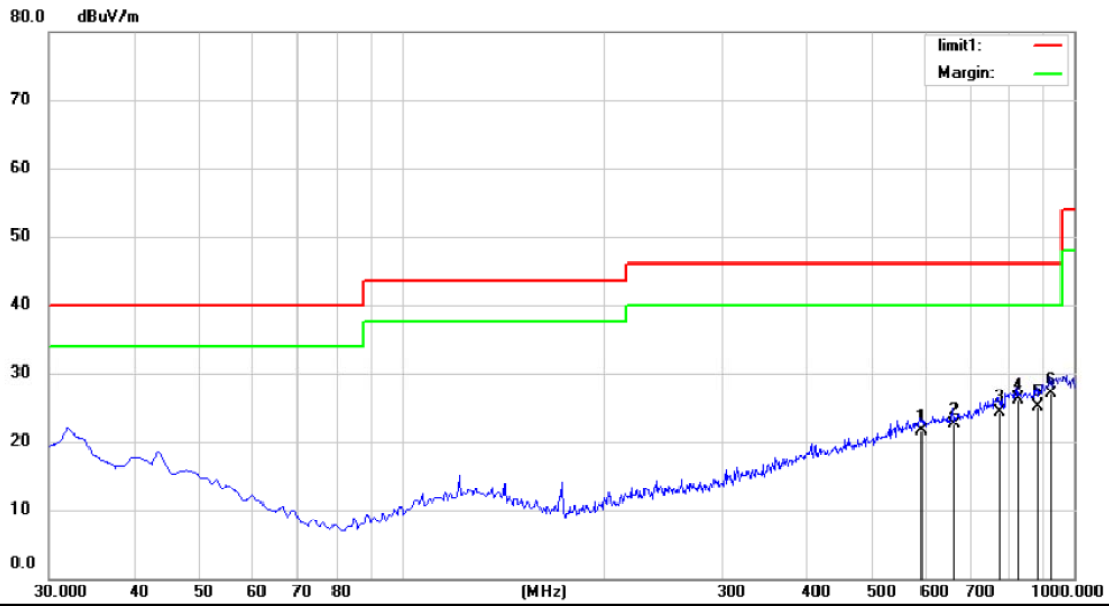


Site Chamber #1 Polarization: *Horizontal* Temperature: 26
 Limit: (RE)FCC PART 15 C 3m Power: Battery 2*1.5V Humidity: 55 %
 Mode:TX2462
 Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		640.1300	29.10	-5.49	23.61	46.00	-22.39	QP		
2		693.4800	28.50	-4.66	23.84	46.00	-22.16	QP		
3		739.0700	28.30	-3.65	24.65	46.00	-21.35	QP		
4		805.0300	28.20	-2.41	25.79	46.00	-20.21	QP		
5	*	912.7000	28.10	-0.27	27.83	46.00	-18.17	QP		
6		941.8000	27.20	0.51	27.71	46.00	-18.29	QP		

*:Maximum data x:Over limit !:over margin

Operator: washington



Site Chamber #1 Polarization: **Vertical** Temperature: 26
 Limit: (RE)FCC PART 15 C 3m Power: Battery 2*1.5V Humidity: 55 %
 Mode:TX2462
 Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		592.6000	29.00	-7.46	21.54	46.00	-24.46	QP		
2		662.4400	29.10	-6.68	22.42	46.00	-23.58	QP		
3		773.0200	28.60	-4.38	24.22	46.00	-21.78	QP		
4		827.3400	29.20	-3.13	26.07	46.00	-19.93	QP		
5		879.7200	28.00	-2.86	25.14	46.00	-20.86	QP		
6	*	924.3400	28.20	-1.22	26.98	46.00	-19.02	QP		

*:Maximum data x:Over limit !:over margin

Operator: washington

Above 1GHz:

All the modulation modes were tested the data of the worst mode (TX 802.11b) are recorded in the following pages and the others modulation methods do not exceed the limits. The frequency range from 1GHz to 25GHz is investigated.

Operation Mode: 802.11b Lowest Test Date : July 10, 2017
 Test Voltage: DC 2*1.5V Battery Test by: Andy

Freq. (MHz)	Ant. Pol. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
4824	V	65.34	45.1	74	54	-8.66	-8.9
7236	V	64.38	44.37	74	54	-9.62	-9.63
9648	V	62.73	43.62	74	54	-11.27	-10.38
12060	V	62.64	41.95	74	54	-11.36	-12.05
14472	V	61.46	40.34	74	54	-12.54	-13.66
16884	V	61.16	39.43	74	54	-12.84	-14.57
4824	H	64.36	44.52	74	54	-9.64	-9.48
7236	H	63.43	43.39	74	54	-10.57	-10.61
9648	H	62.85	42.37	74	54	-11.15	-11.63
12060	H	61.37	41.96	74	54	-12.63	-12.04
14472	H	59.3	39.76	74	54	-14.7	-14.24
16884	H	58.88	38.35	74	54	-15.12	-15.65

Operation Mode: 802.11b Middle Test Date : July 10, 2017
 Test Voltage: DC 2*1.5V Battery Test by: Andy

Freq. (MHz)	Ant. Pol. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
4874	V	63.43	43.99	74	54	-10.57	-10.01
7311	V	62.96	42.34	74	54	-11.04	-11.66
9688	V	61.37	41.96	74	54	-12.63	-12.04
12185	V	60.62	40.64	74	54	-13.38	-13.36
14622	V	59.82	39.73	74	54	-14.18	-14.27
17059	V	58.58	39.2	74	54	-15.42	-14.8
4874	H	64.22	42.69	74	54	-9.78	-11.31
7311	H	63.73	43.63	74	54	-10.27	-10.37
9688	H	62.91	42.16	74	54	-11.09	-11.84
12185	H	61.37	41.34	74	54	-12.63	-12.66
14622	H	60.76	40.95	74	54	-13.24	-13.05
17059	H	59.63	39.22	74	54	-14.37	-14.78

Operation Mode: 802.11b Highest

Test Date : July 10, 2017

Test Voltage: DC 2*1.5V Battery

Test by: Andy

Freq. (MHz)	Ant. Pol. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
4924	V	65.46	45.11	74	54	-8.54	-8.89
7386	V	63.76	43.85	74	54	-10.24	-10.15
9848	V	64.43	42.61	74	54	-9.57	-11.39
12310	V	63.61	41.37	74	54	-10.39	-12.63
14772	V	62.76	40.85	74	54	-11.24	-13.15
17234	V	61.86	39.16	74	54	-12.14	-14.84
4924	H	64.87	44.16	74	54	-9.13	-9.84
7386	H	63.52	43.76	74	54	-10.48	-10.24
9848	H	62.43	42.66	74	54	-11.57	-11.34
12310	H	61.82	41.85	74	54	-12.18	-12.15
14772	H	60.34	40.36	74	54	-13.66	-13.64
17234	H	59.62	39.88	74	54	-14.38	-14.12

All emissions not reported were more than 20dB below the specified limit or in the noise floor.

No others harmonics emissions are higher than 20 dB below the limits of 47 CFR Part 15.247.

- Note:**
- (1) All Readings are Peak Value and AV.
 - (2) Emission Level= Reading Level+Probe Factor +Cable Loss.
 - (3) 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.

8. 6dB Bandwidth Test

8.1 Measurement Procedure

The EUT was operating in IEEE 802.11b, 802.11g, 802.11n(HT20) mode or could be controlled its channel. Printed out the test result from the spectrum by hard copy function.

1. Set resolution bandwidth (RBW) = 100 kHz.
2. Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequency) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

8.2 Test SET-UP (Block Diagram of Configuration)



8.3 Measurement Equipment Used

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	Characteristics	LAST CAL.	CAL DUE.
Spectrum Analyzer	Rohde & Schwarz	FSV30	1321.3008K	10Hz-30GHz	5/16/2017	5/15/2018
Coaxial Cable	CDS	79254	46107086	10Hz-30GHz	5/16/2017	5/15/2018
Antenna Connector	ARTHUR-YANG	2244-N1TG1	N/A	10Hz-30GHz	5/16/2017	5/15/2018

Remark: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

8.4 Measurement Results

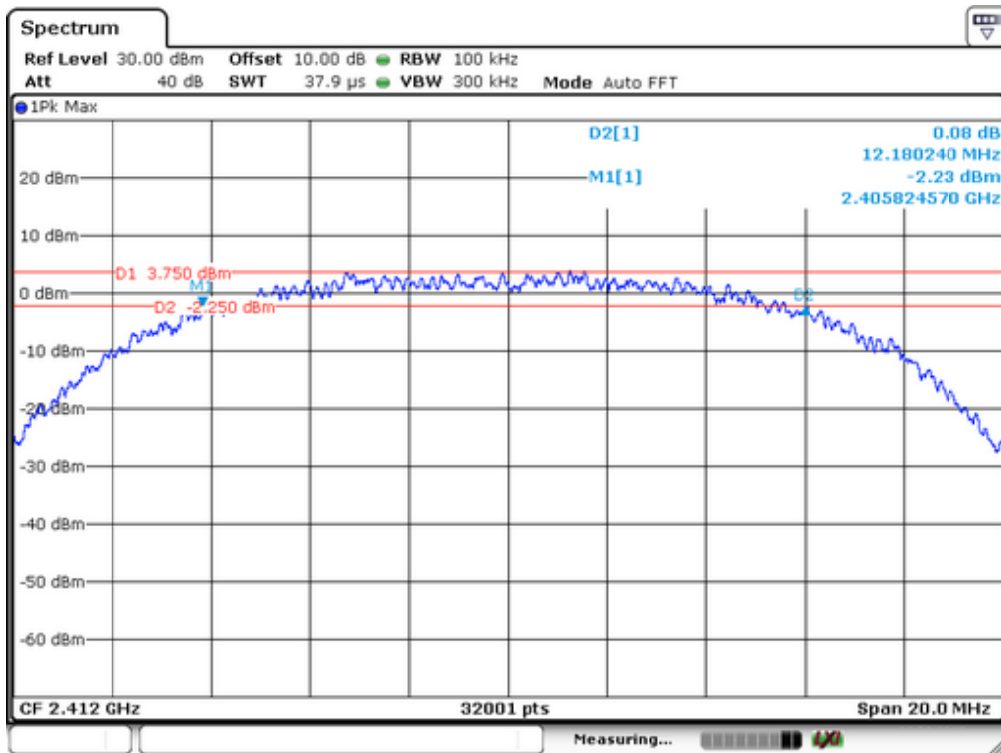
6 Bandwidth Test Data Chart:

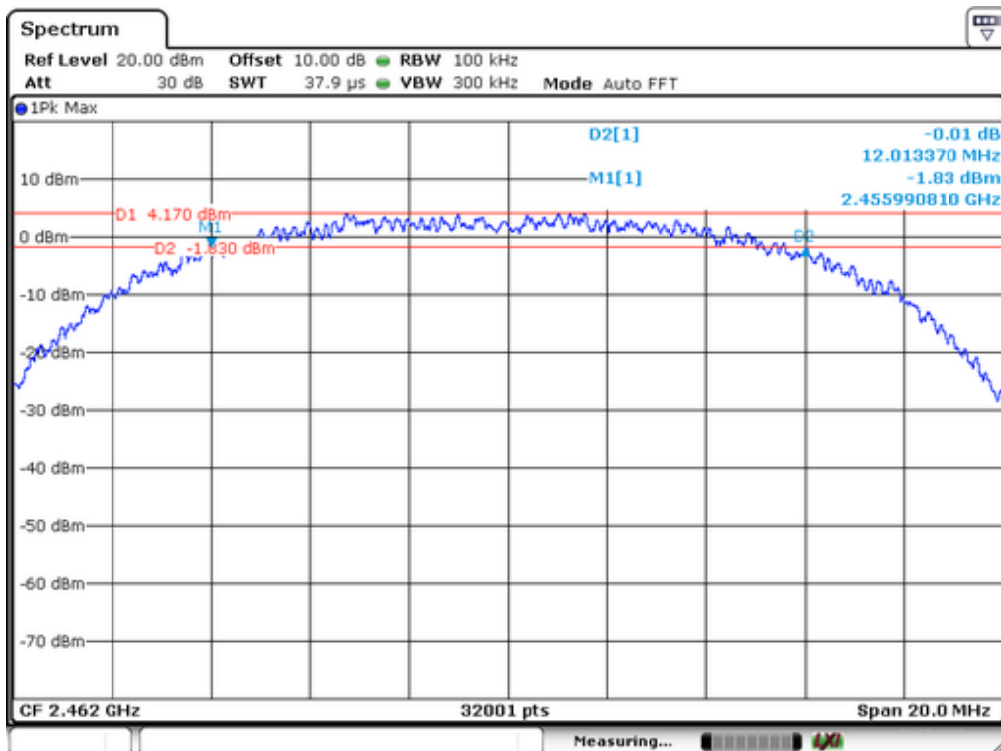
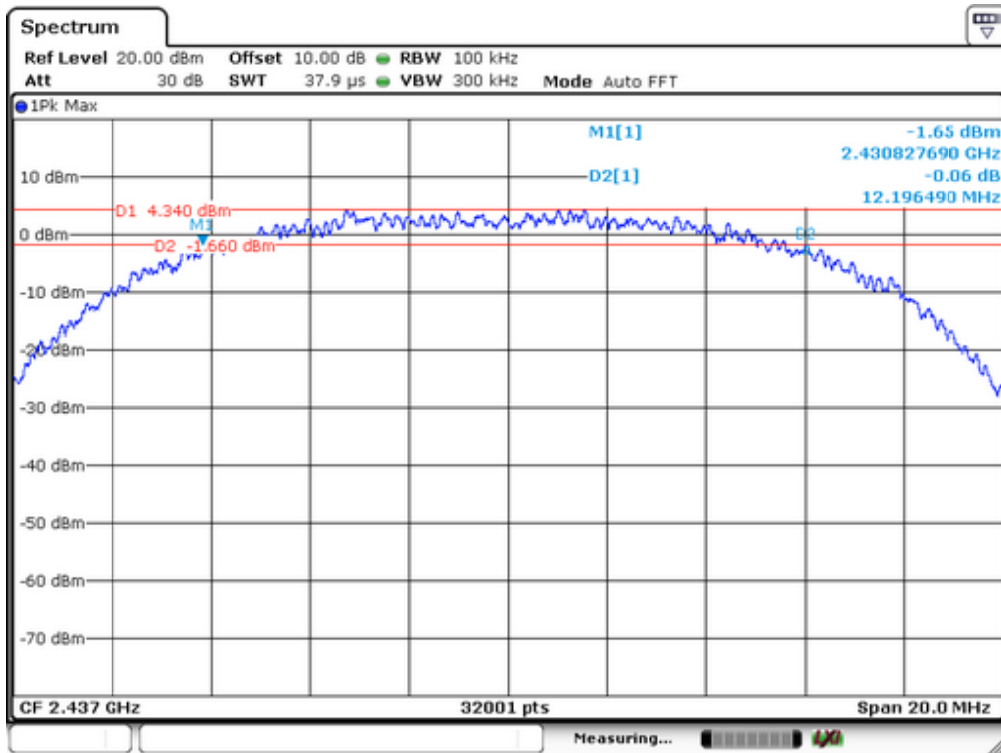
Refer to attached data chart.

Spectrum Detector: PK
 Test By: Andy
 Humidity : 60%

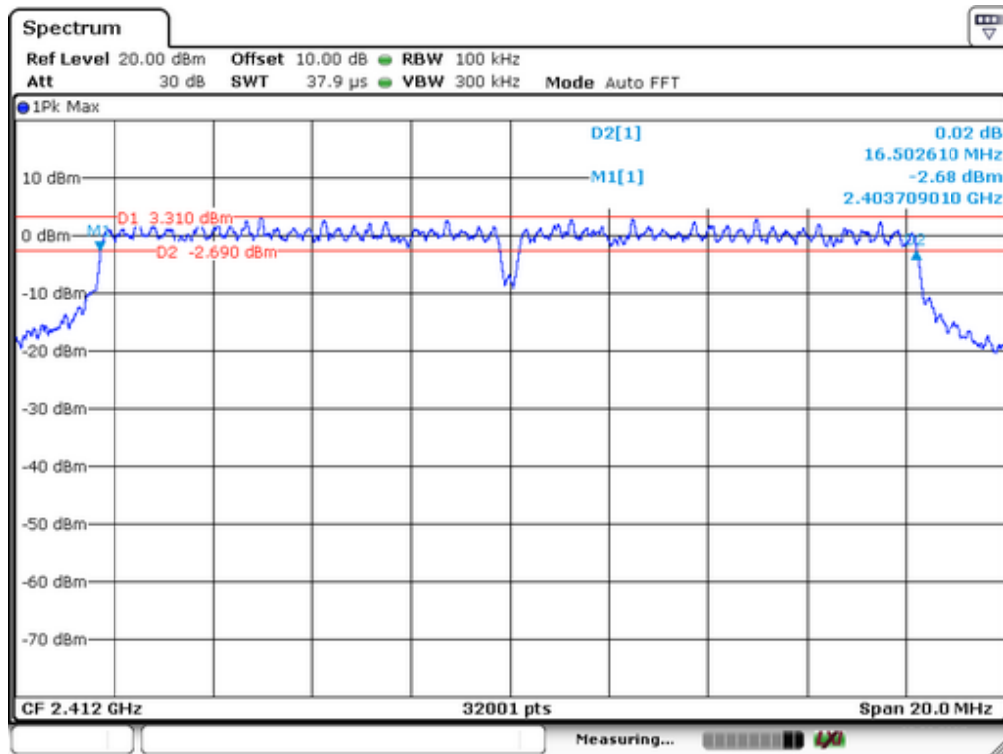
Test Date : July 10, 2017
 Temperature : 28°C

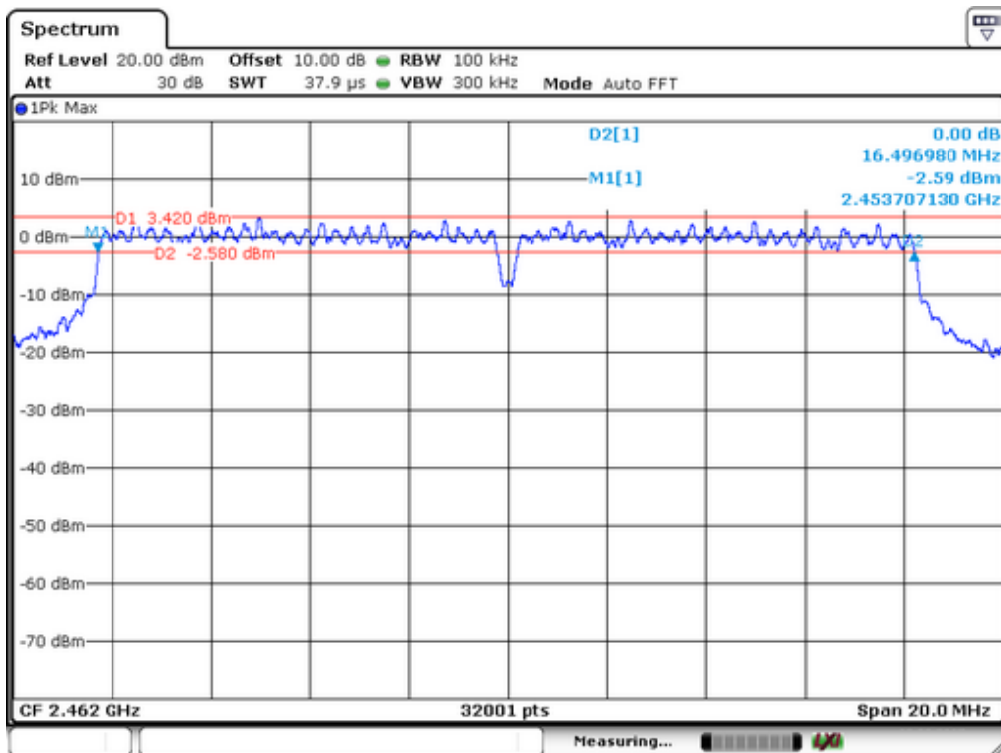
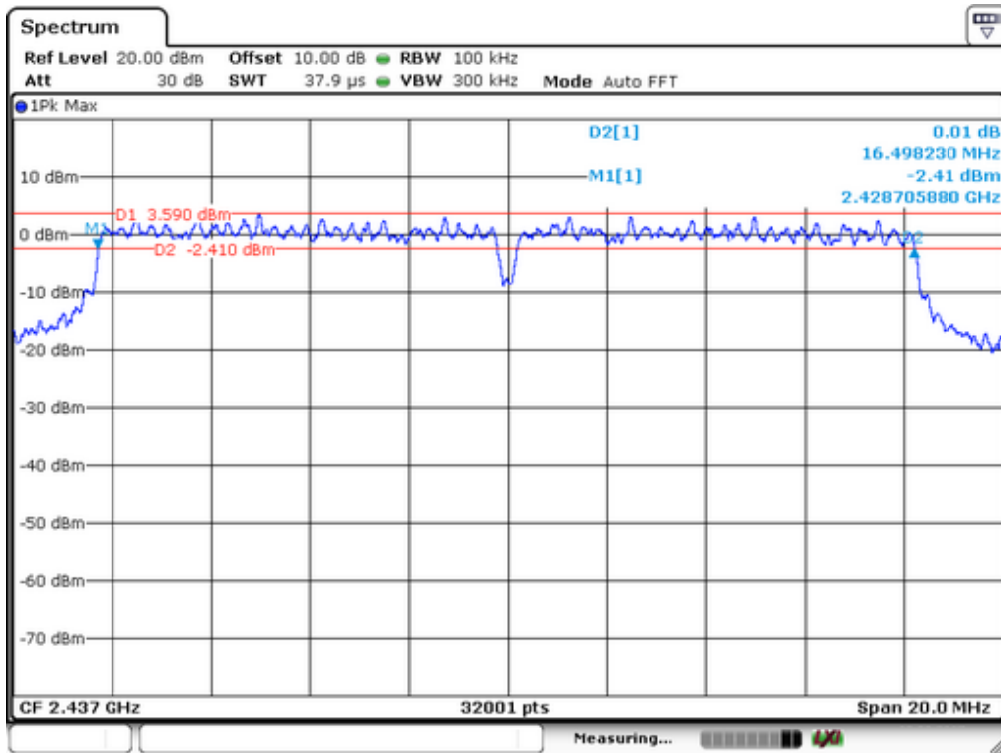
IEEE 802.11b			
Channel frequency (MHz)	Measurement level (KHz)	Required Limit (KHz)	Result
2412	12180	>500	Pass
2437	12196	>500	
2462	12013	>500	



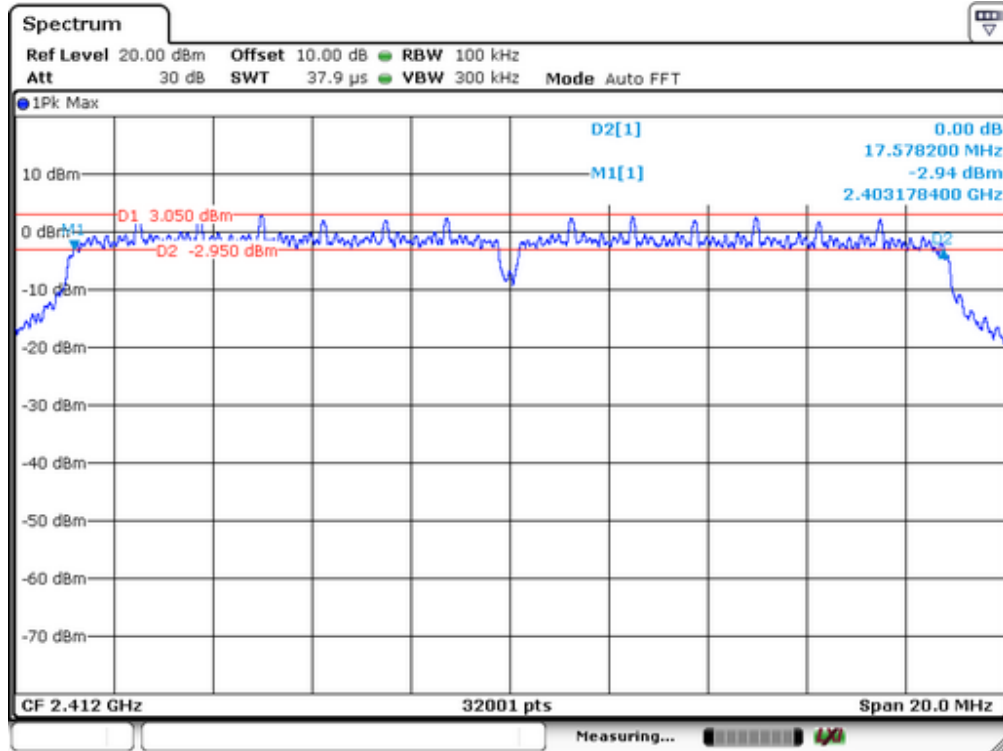


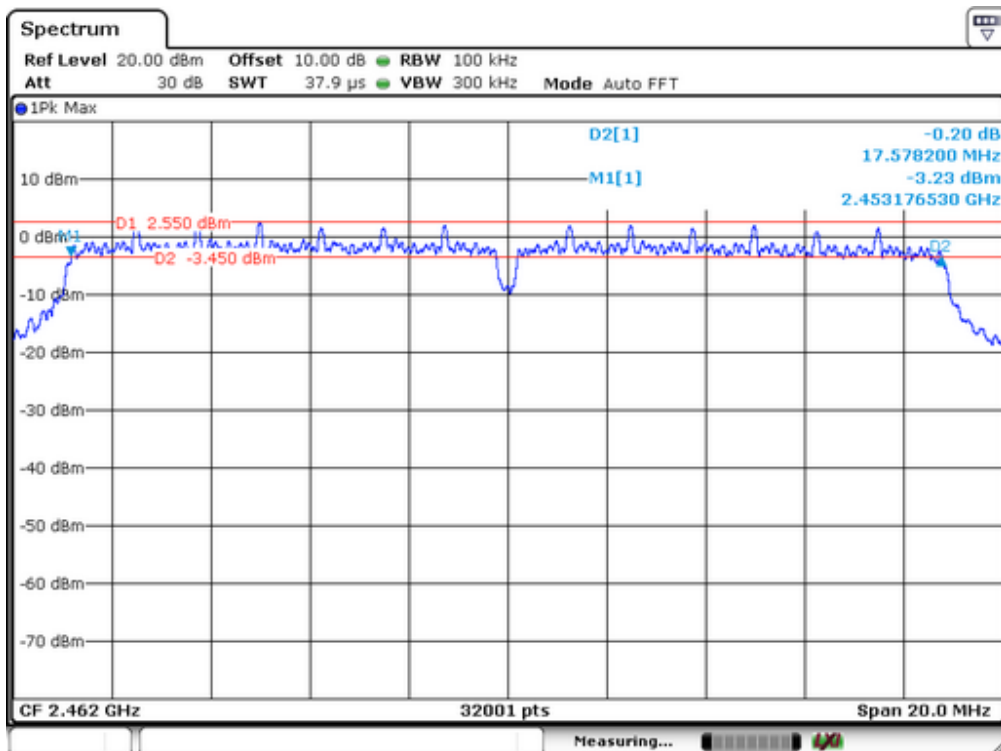
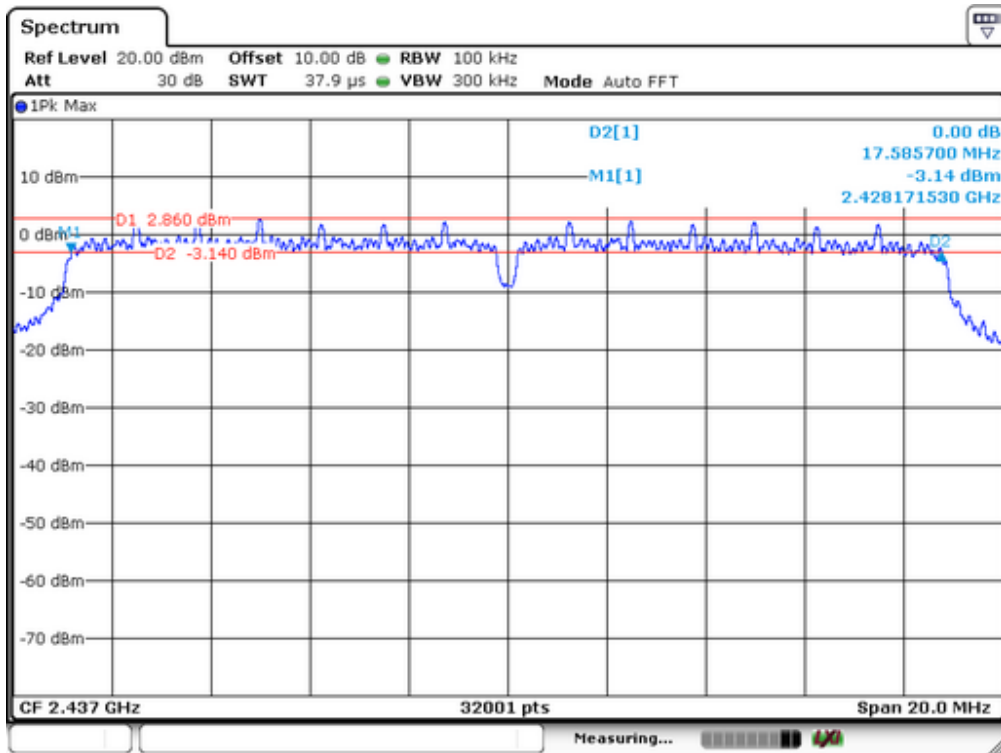
IEEE 802.11g			
Channel frequency (MHz)	Measurement level (KHz)	Required Limit (KHz)	Result
2412	16503	>500	Pass
2437	16498	>500	
2462	16497	>500	





IEEE 802.11n(HT20)			
Channel frequency (MHz)	Measurement level (KHz)	Required Limit (KHz)	Result
2412	17578	>500	Pass
2437	17586	>500	
2462	17578	>500	





9. Maximum Peak Output Power Test

9.1 Measurement Procedure

1. The testing follows the Measurement Procedure of FCC KDB No. 558074 DTS D01 Meas. Guidance v04.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power and record the results in the test report.

9.2 Test SET-UP (Block Diagram of Configuration)



9.3 Measurement Equipment Used

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	Characteristics	LAST CAL.	CAL DUE.
Power Meter	Theda	PS-X10-100	N/A	10Hz-30GHz	5/16/2017	5/15/2018
Coaxial Cable	CDS	79254	46107086	10Hz-30GHz	5/16/2017	5/15/2018
Antenna Connector	ARTHUR-YANG	2244-N1TG1	N/A	10Hz-30GHz	5/16/2017	5/15/2018

Remark: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

9.4 Peak Power output limit

The maximum peak power shall be less 1Watt.

9.5 Measurement Results

Spectrum Detector:	PK	Test Date :	July 10, 2017
Test By:	Andy	Temperature :	28°C
Test Result:	PASS	Humidity :	60%

Test Channel	Peak Output Power (dBm)			Limit(dBm)	Result
	802.11b	802.11g	802.11n(HT20)		
Lowest	15.68	14.34	13.62	30	Pass
Middle	14.95	14.95	13.76		
Highest	15.63	14.75	13.37		

10. Band Edge Test

10.1 Measurement Procedure

For Conducted Test

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. Measure and record the results in the test report.
5. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

For Radiated emission Test

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT was placed on a turntable with 1.5 meter above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.
6. For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
7. Repeat above procedures until all frequency measured were complete.

When spectrum scanned above 1GHz setting resolution bandwidth 1MHz, video bandwidth 3MHz.

EMI Test Receiver	Setting
Attenuation	Auto
RB	1MHz
VB	3MHz
Detector	Peak
Trace	Max hold

When spectrum scanned above 1GHz setting resolution bandwidth 1MHz, video

bandwidth 10Hz.

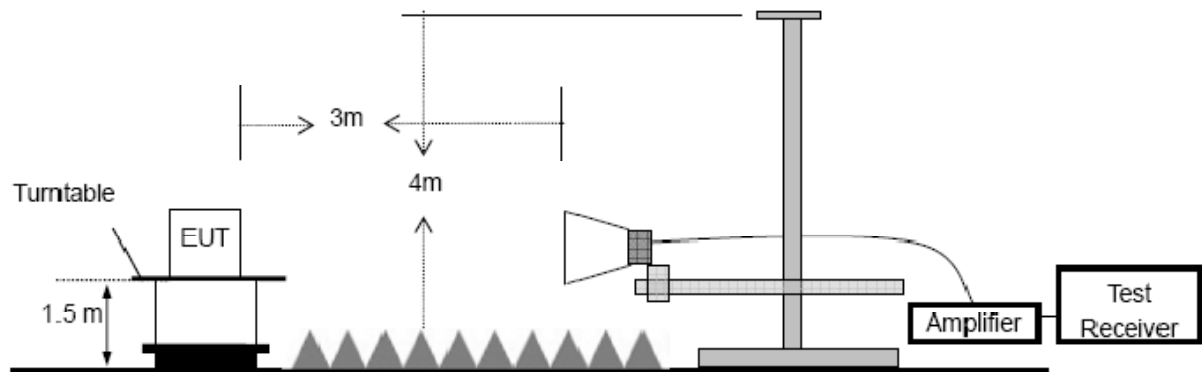
EMI Test Receiver	Setting
Attenuation	Auto
RB	1MHz
VB	10Hz
Detector	AVG
Trace	Max hold

10.2 Test SET-UP (Block Diagram of Configuration)

For Conducted Test



For Radiated emission Test



10.3 Measurement Equipment Used

For Conducted Test

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	Characteristics	LAST CAL.	CAL DUE.
Spectrum Analyzer	Rohde & Schwarz	FSV30	1321.3008K	10Hz-30GHz	05/16/2017	05/15/2018
Coaxial Cable	CDS	79254	46107086	10Hz-30GHz	05/16/2017	05/15/2018
Antenna Connector	ARTHUR-YANG	2244-N1TG1	N/A	10Hz-30GHz	05/16/2017	05/15/2018

Remark: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

For Radiated emission Test

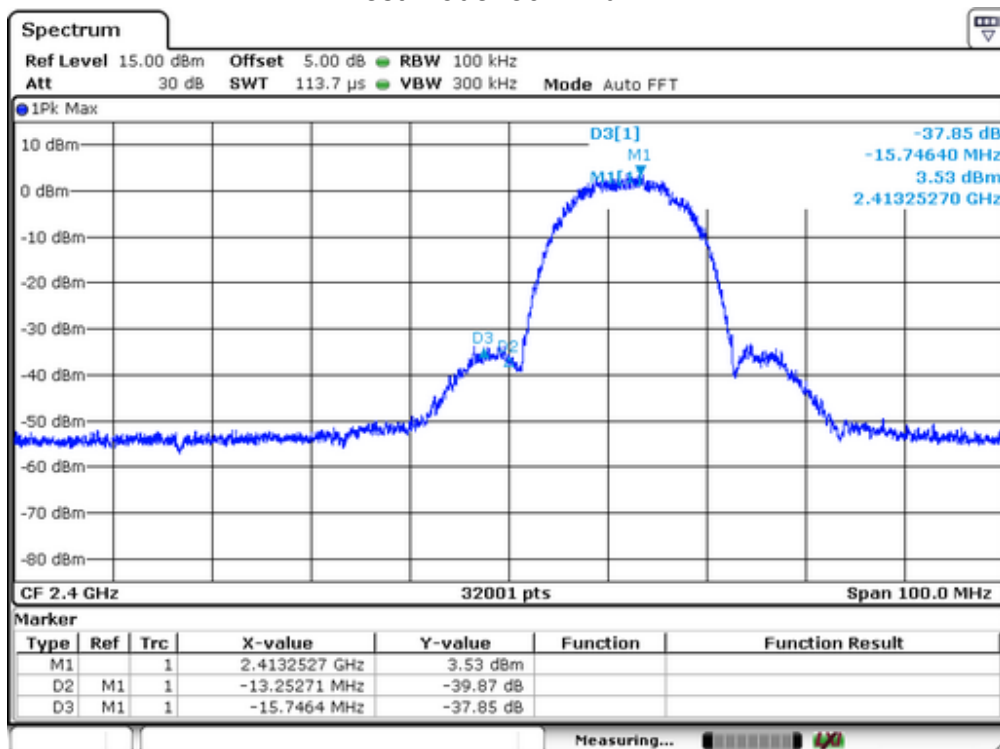
Item	Equipment	Manufacturer	Model No.	Serial No.	Characteristics	Last Cal.	Cal. Interval
1	Signal Analyzer	Rohde & Schwarz	FSV30	103040	9KHz-40GHz	05/16/2017	1 Year
2	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-1272	1GHz-18GHz	05/16/2017	1 Year
3	Power Amplifier	LUNAR EM	LNA1G18-40	J10100000081	1GHz-26.5GHz	05/16/2017	1 Year
4	Cable	H+S	CBL-26	N/A	1GHz-26.5GHz	05/16/2017	1 Year
5	Cable	H+S	CBL-26	N/A	1GHz-26.5GHz	05/16/2017	1 Year
6	Cable	H+S	CBL-26	N/A	1GHz-26.5GHz	05/16/2017	1Year

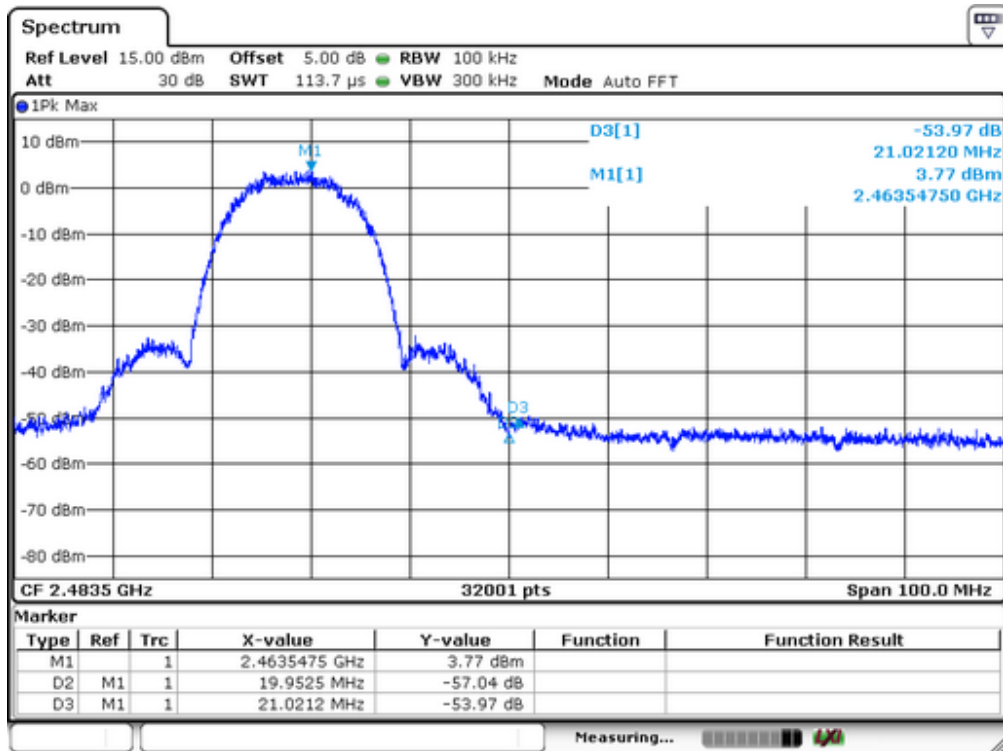
10.4 Measurement Results

1. Conducted Test

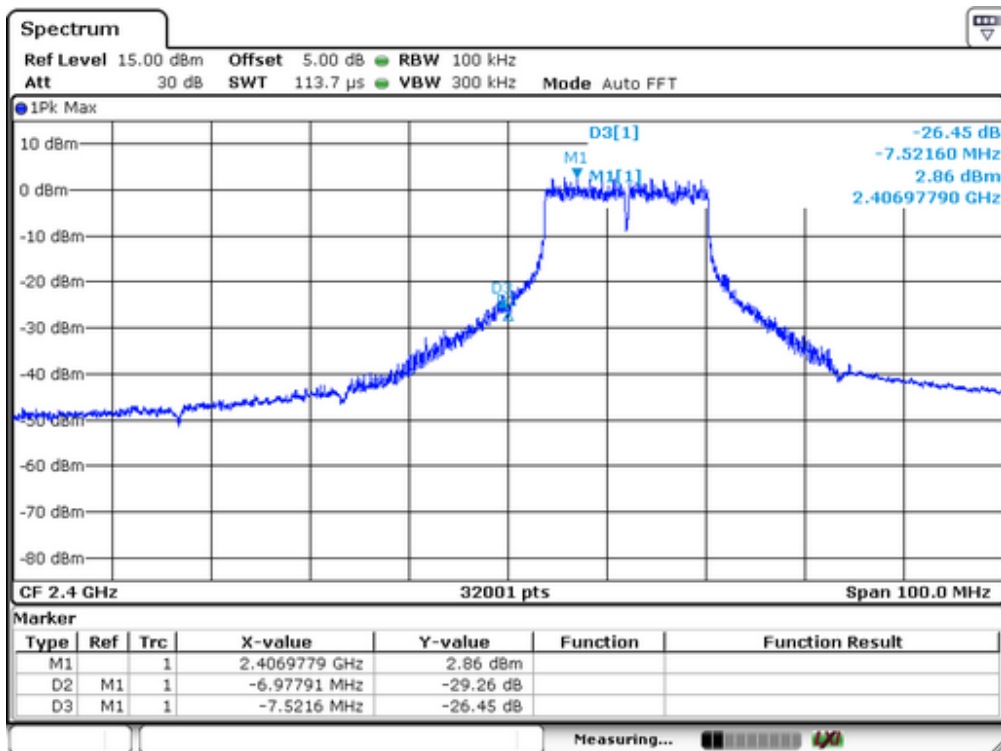
Please refer to the following pages.

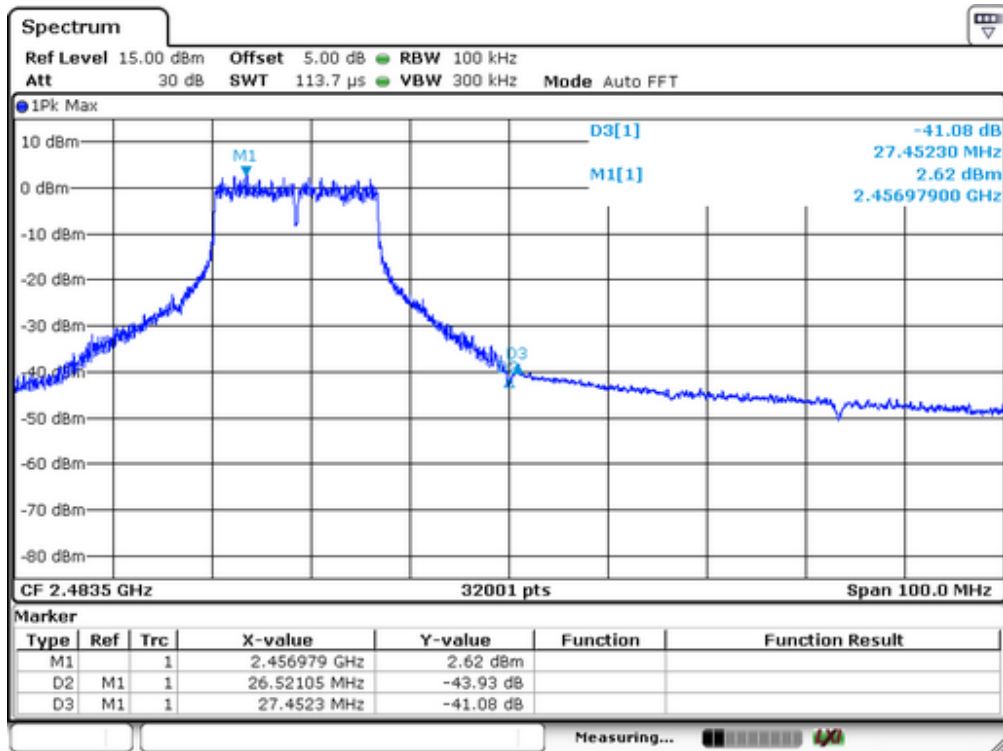
Test mode: 802.11b



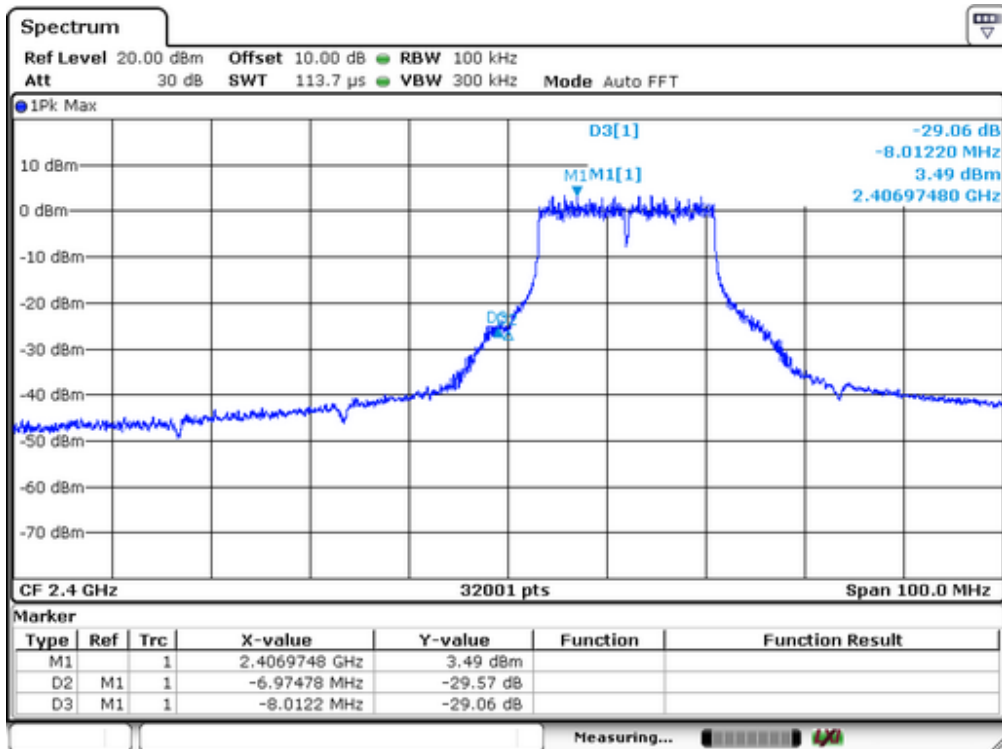


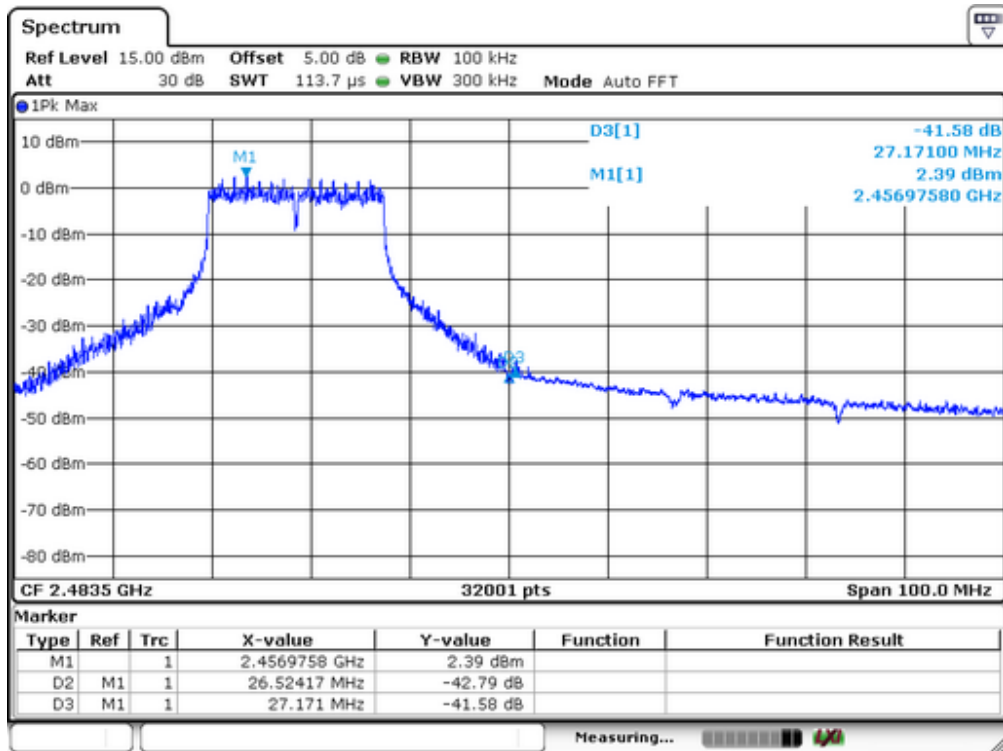
Test mode: 802.11g





Test mode: 802.11n(HT20)





2. Radiated emission Test

Spectrum Detector: PK/AV Test Date : July 10, 2017
 Test By: Andy Temperature : 28 °C
 Humidity : 65 %

IEEE 802.11b							
Frequency (MHz)	Antenna polarization (H/V)	Emission (dBuV/m)		Band edge Limit (dBuV/m)		Margin (dB)	
		PK	AV	PK	AV	PK	AV
2400	H	64.85	44.34	74	54	-9.15	-9.66
2400	V	61.05	41.02	74	54	-12.95	-12.98
2483.5	H	64.22	44.62	74	54	-9.78	-9.38
2483.5	V	60.36	40.36	74	54	-13.64	-13.64

IEEE 802.11g							
Frequency (MHz)	Antenna polarization	Emission (dBuV/m)		Band edge Limit (dBuV/m)		Margin (dB)	
	(H/V)	PK	AV	PK	AV	PK	AV
2400	H	63.64	43.85	74	54	-10.36	-10.15
2400	V	59.52	39.51	74	54	-14.48	-14.49
2483.5	H	63.67	43.61	74	54	-10.33	-10.39
2483.5	V	60.36	40.12	74	54	-13.64	-13.88

IEEE 802.11n(HT20)							
Frequency (MHz)	Antenna polarization	Emission (dBuV/m)		Band edge Limit (dBuV/m)		Margin (dB)	
	(H/V)	PK	AV	PK	AV	PK	AV
2400	H	64.85	44.37	74	54	-9.15	-9.63
2400	V	60.14	40.12	74	54	-13.86	-13.88
2483.5	H	65.75	44.95	74	54	-8.25	-9.05
2483.5	V	59.41	39.65	74	54	-14.59	-14.35

11. Power Density

11.1 Test Equipment

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	Characteristics	LAST CAL.	CAL DUE.
Spectrum Analyzer	Rohde & Schwarz	FSV30	1321.3008K	10Hz-30GHz	05/16/2017	05/15/2018
Coaxial Cable	CDS	79254	46107086	10Hz-30GHz	05/16/2017	05/15/2018
Antenna Connector	ARTHUR-YANG	2244-N1TG1	N/A	10Hz-30GHz	05/16/2017	05/15/2018

Remark: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

11.2 Measuring Instruments and Setting

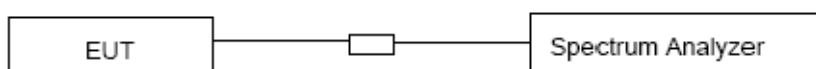
The following table is the setting of spectrum analyzer.

Spectrum analyzer	Setting
Attenuation	Auto
Span Frequency	Set the span to 1.5 times the DTS bandwidth.
RB	3kHz
VB	10KHz
Detector	Peak
Trace	Max hold
Sweep Time	Automatic

11.3 Test Procedures

- a. The transmitter output (antenna port) was connected to the spectrum analyzer.
- b. Set analyzer center frequency to DTS channel center frequency.
- c. Set the analyzer span to a minimum of 1.5 times the DTS bandwidth.
- d. Set the RBW \geq 3 kHz. Set the VBW \geq 3 x RBW.
- e. Detector = peak.
- f. Sweep time = auto couple.
- g. Trace mode = max hold.
- h. Allow trace to fully stabilize.
- i. Use the peak marker function to determine the maximum amplitude level.

11.4 Block Diagram of Test Setup



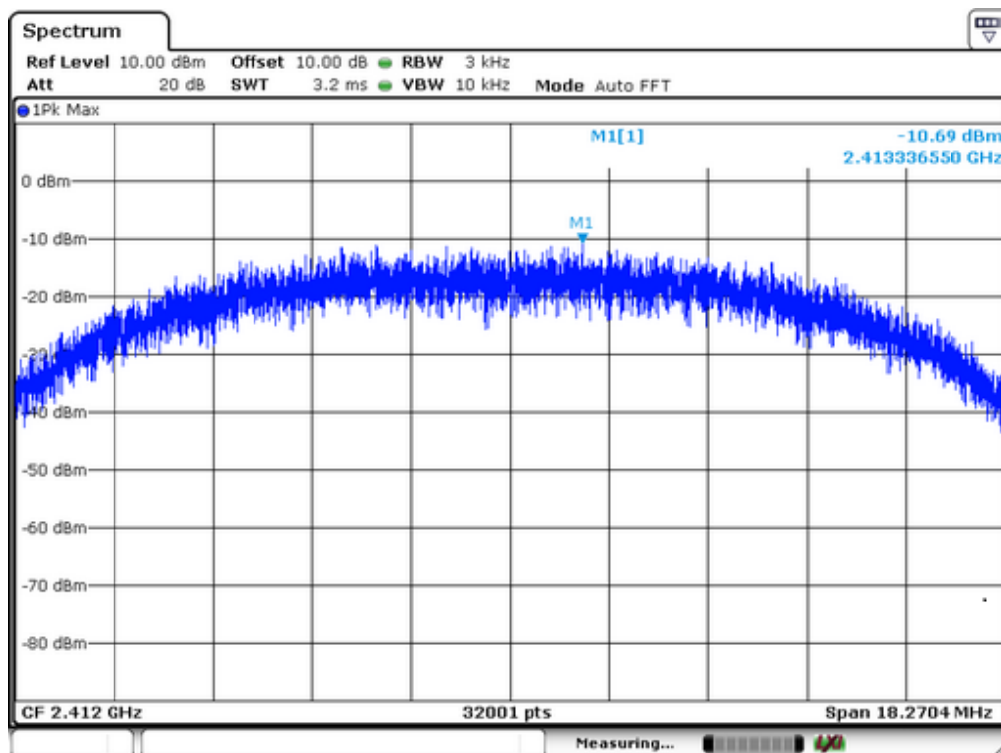
11.5 Limit

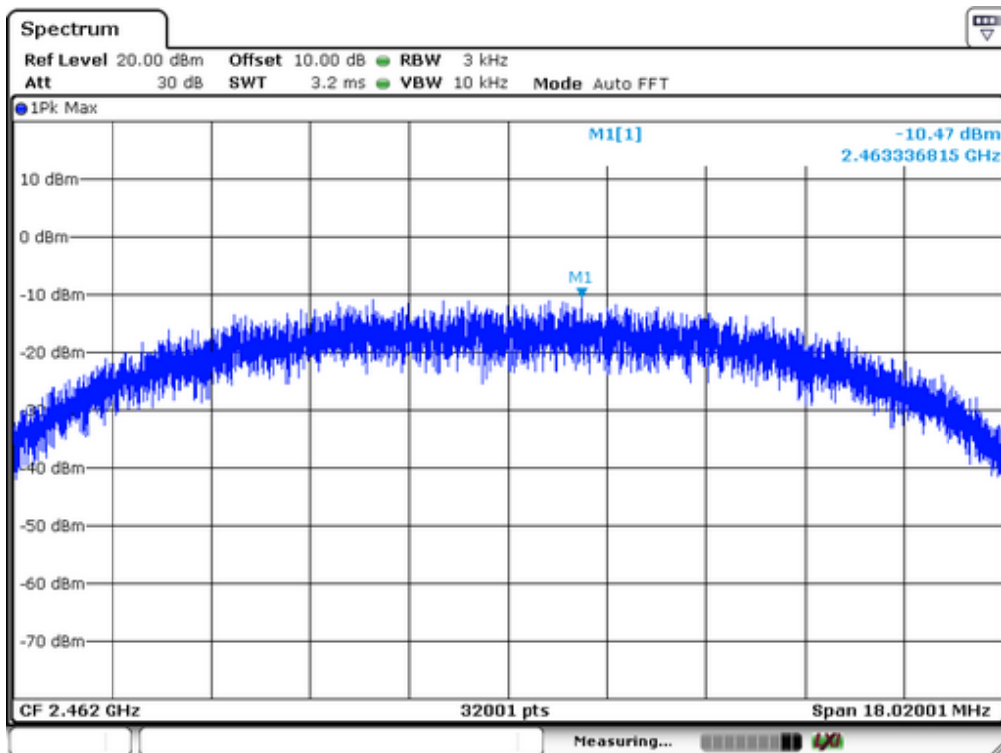
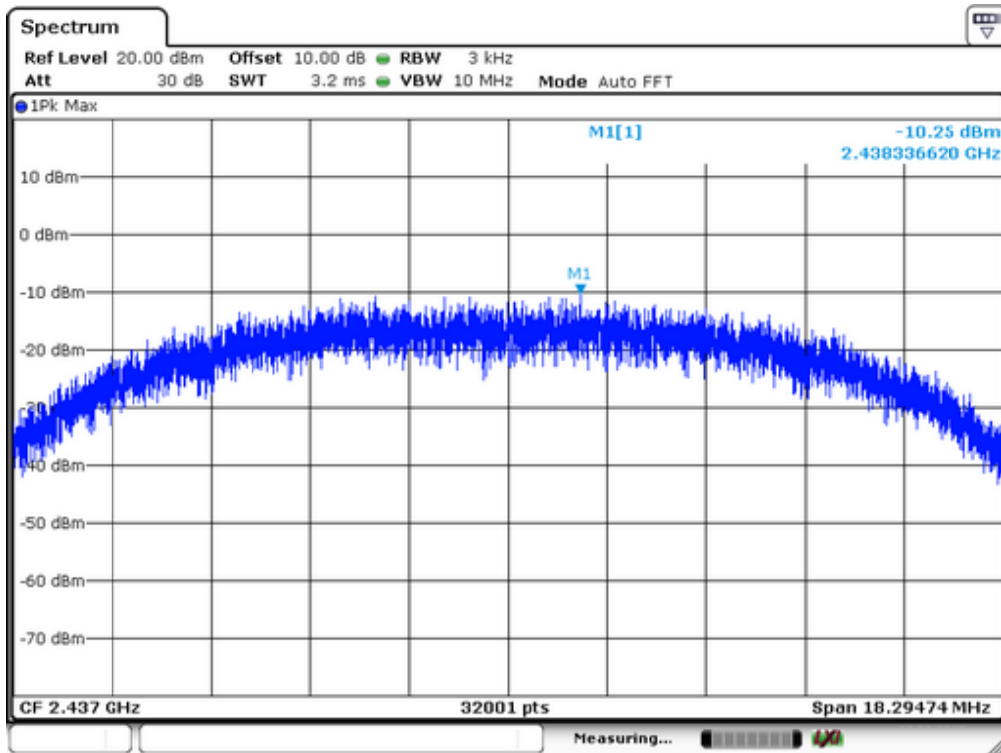
The transmitted power density averaged over any 1 second interval shall not be greater +8dBm in any 3 kHz bandwidth.

11.6 Test Result

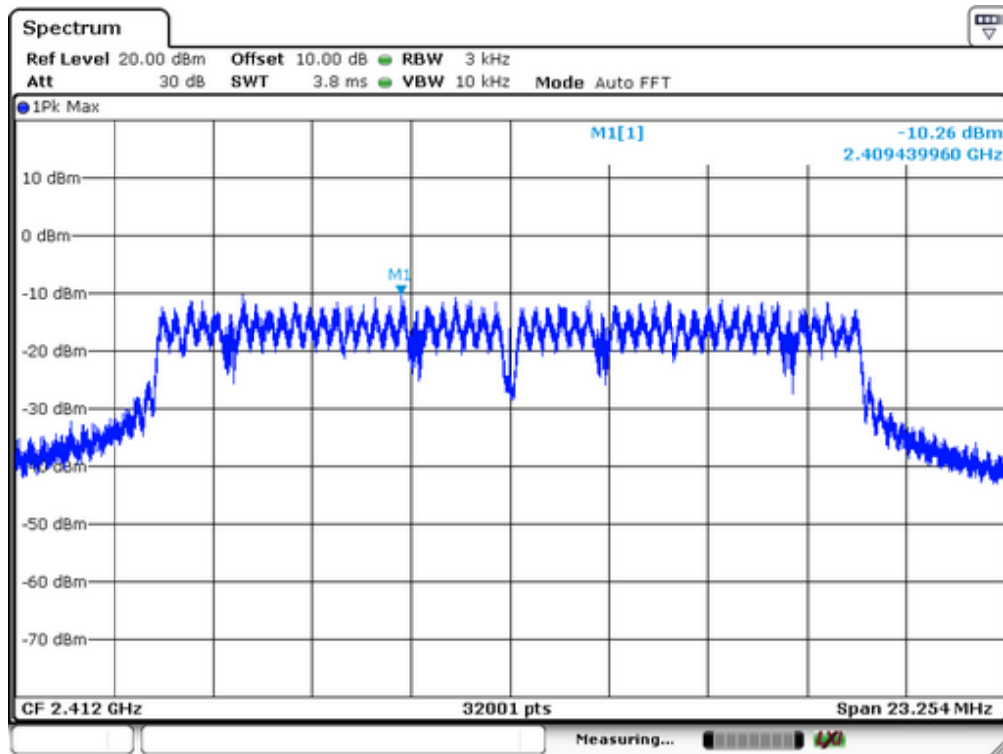
Spectrum Detector:	PK	Test Date :	July 10, 2017
Test By:	Andy	Temperature :	28°C
Test Result:	PASS	Humidity :	60%

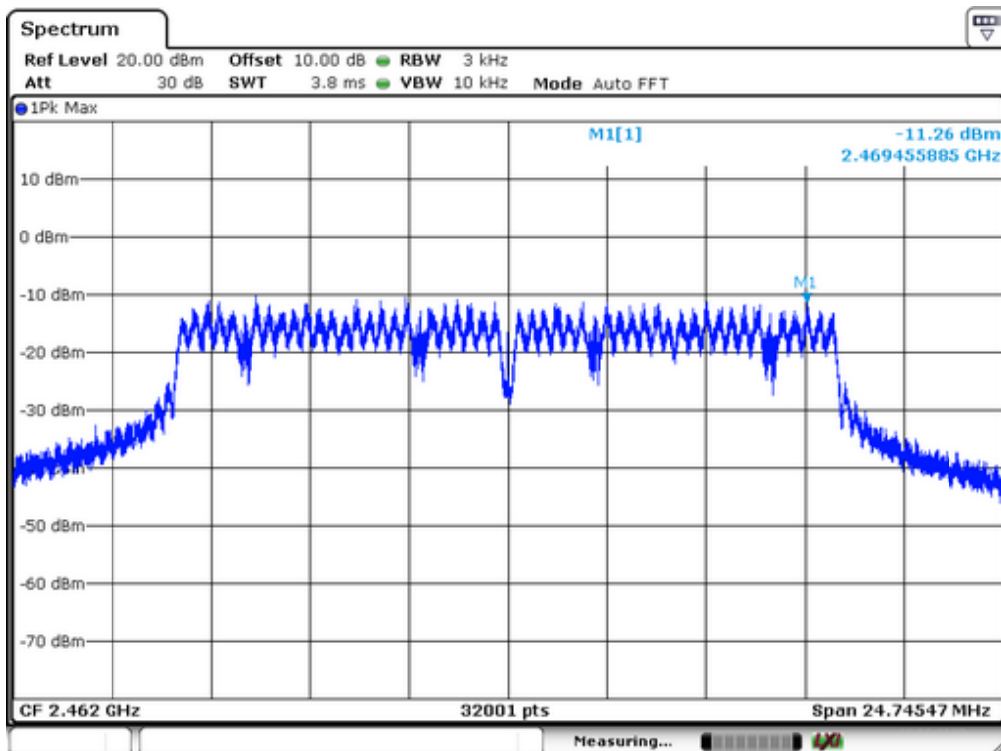
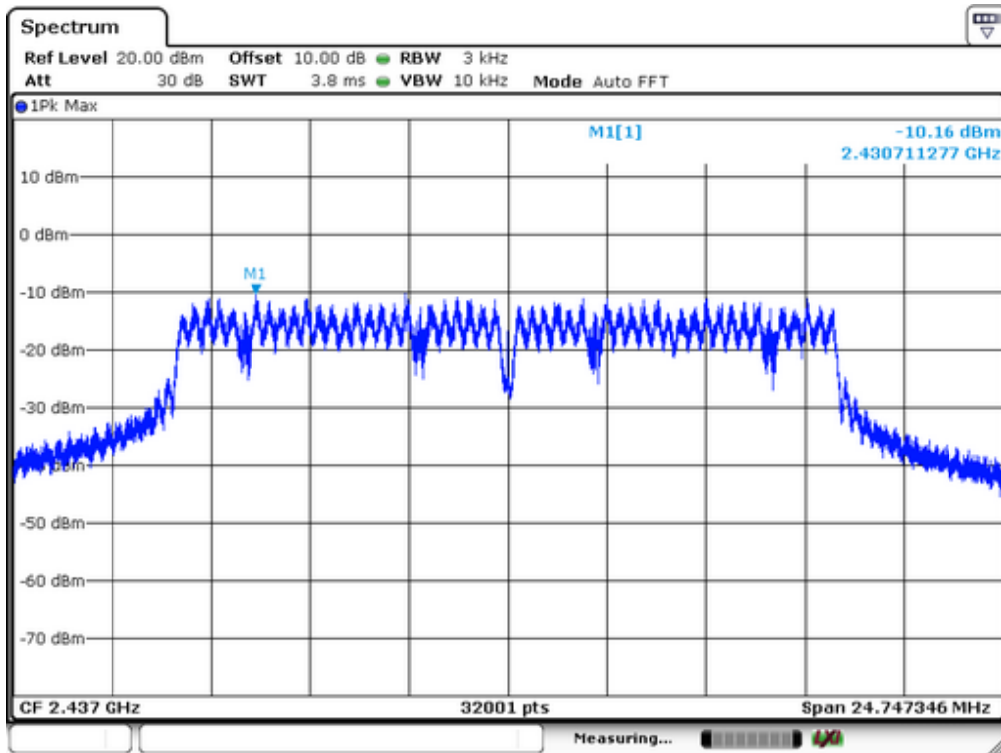
IEEE 802.11b			
Channel frequency (MHz)	Measurement level (dBm/3kHz)	Limit(dBm/3kHz)	Result
2412	-10.69	8	Pass
2437	-10.25		
2462	-10.47		



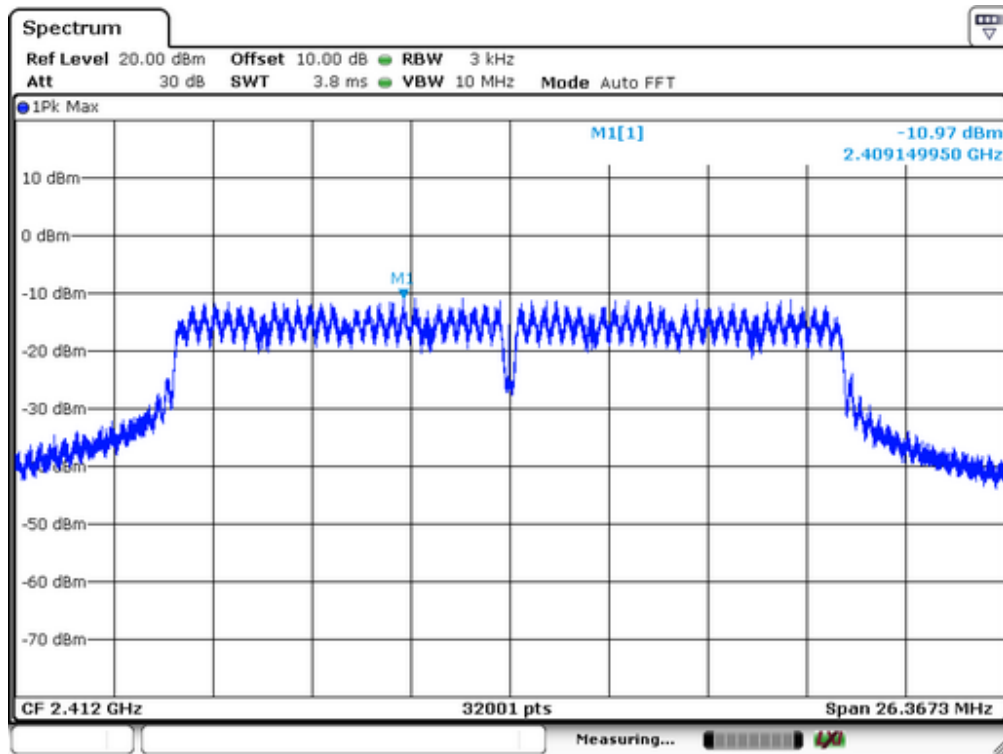


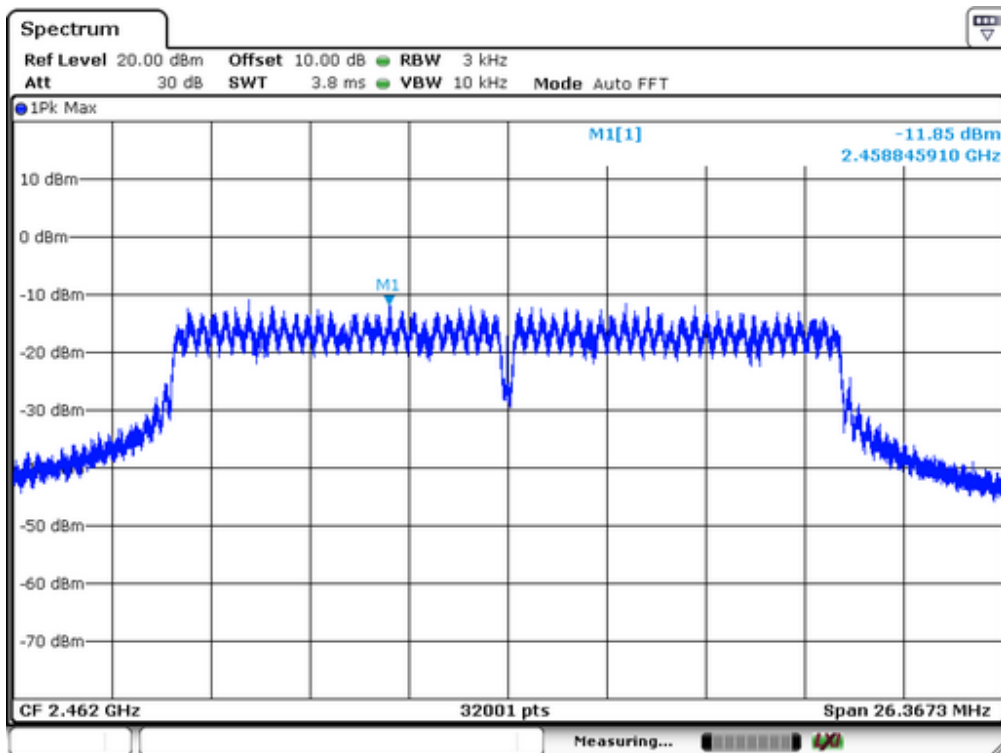
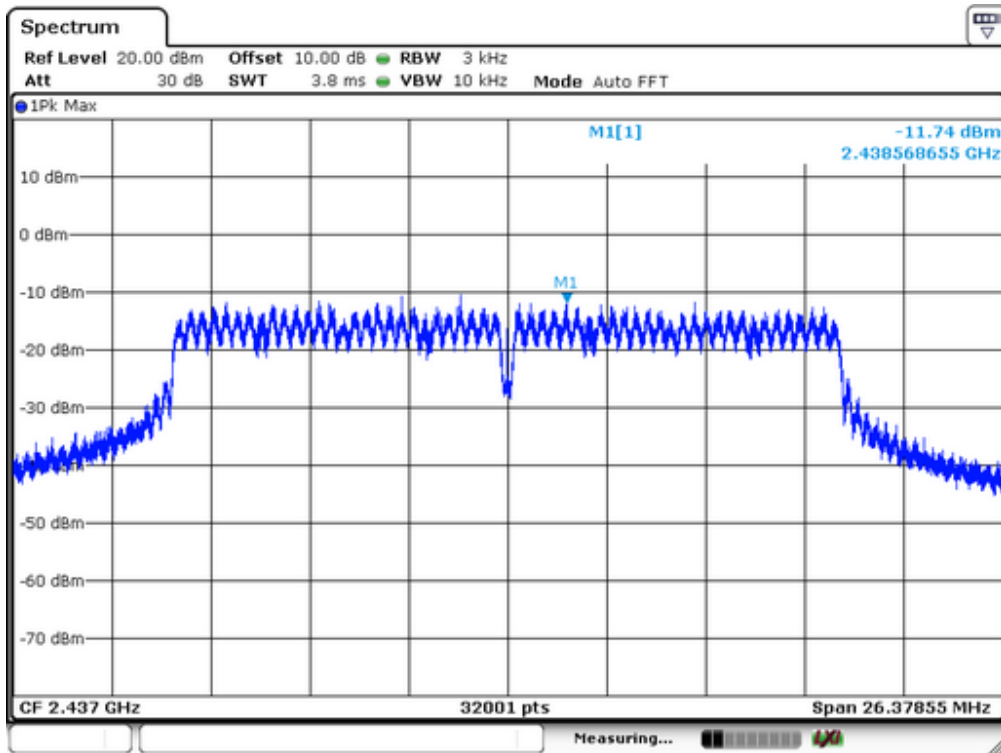
IEEE 802.11g			
Channel frequency (MHz)	Measurement level (dBm/3kHz)	Limit(dBm/3kHz)	Result
2412	-10.26	8	Pass
2437	-10.16		
2462	-11.26		





IEEE 802.11n(HT20)			
Channel frequency (MHz)	Measurement level (dBm/3kHz)	Limit(dBm/3kHz)	Result
2412	-10.97	8	Pass
2437	-11.74		
2462	-11.85		





12. Antenna Port Emission

12.1 Test Equipment

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	Characteristics	LAST CAL.	CAL DUE.
Spectrum Analyzer	Rohde & Schwarz	FSV30	1321.3008K	10Hz-30GHz	05/16/2017	05/15/2018
Coaxial Cable	CDS	79254	46107086	10Hz-30GHz	05/16/2017	05/15/2018
Antenna Connector	ARTHUR-YANG	2244-N1TG1	N/A	10Hz-30GHz	05/16/2017	05/15/2018

Remark: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

12.2 Measuring Instruments and Setting

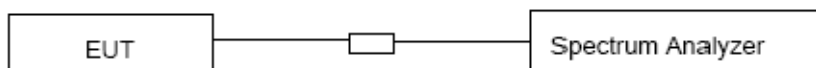
The following table is the setting of spectrum analyzer.

Spectrum analyzer	Setting
Attenuation	Auto
RB	100kHz
VB	300kHz
Detector	Peak
Trace	Max hold

12.3 Test Procedures

The conducted spurious emissions were measured conducted using a spectrum analyzer at low, Middle, and high channels, the limit was determined by attenuation 20dB of the RF peak power output.

12.4 Block Diagram of Test setup

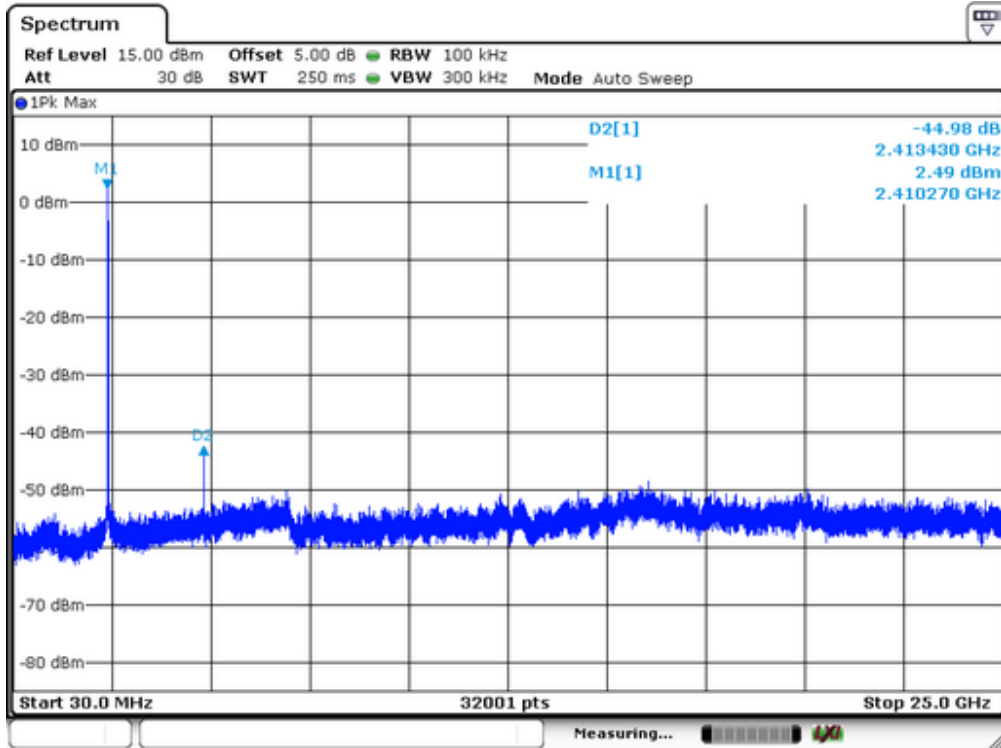


12.5 Test Result

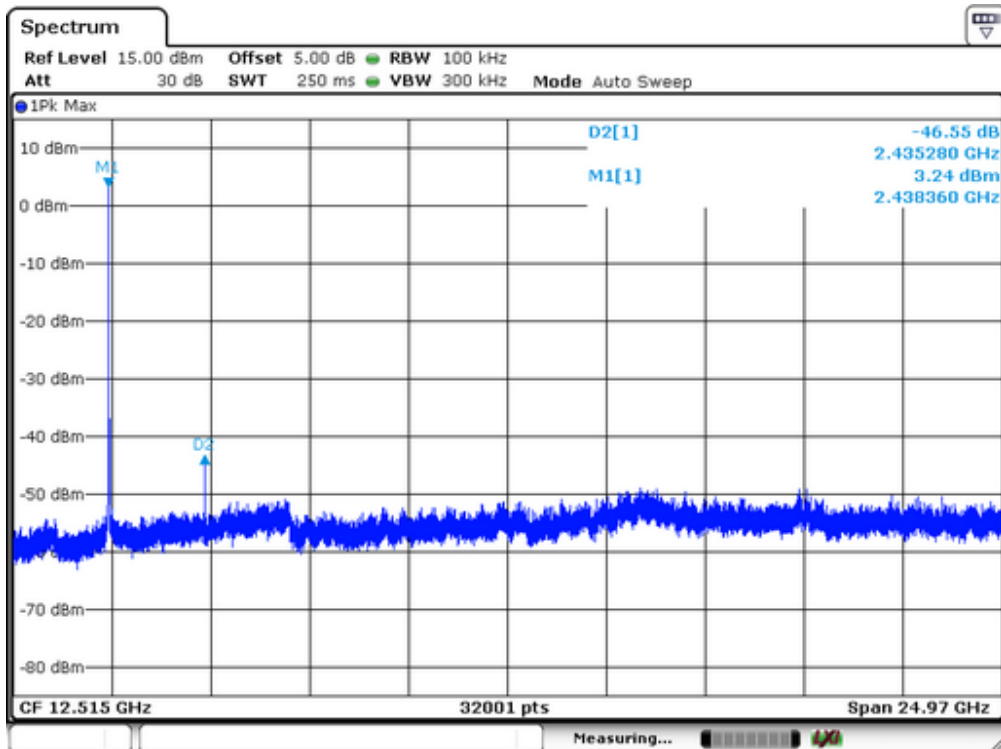
PASS.

Please refer to following pages.

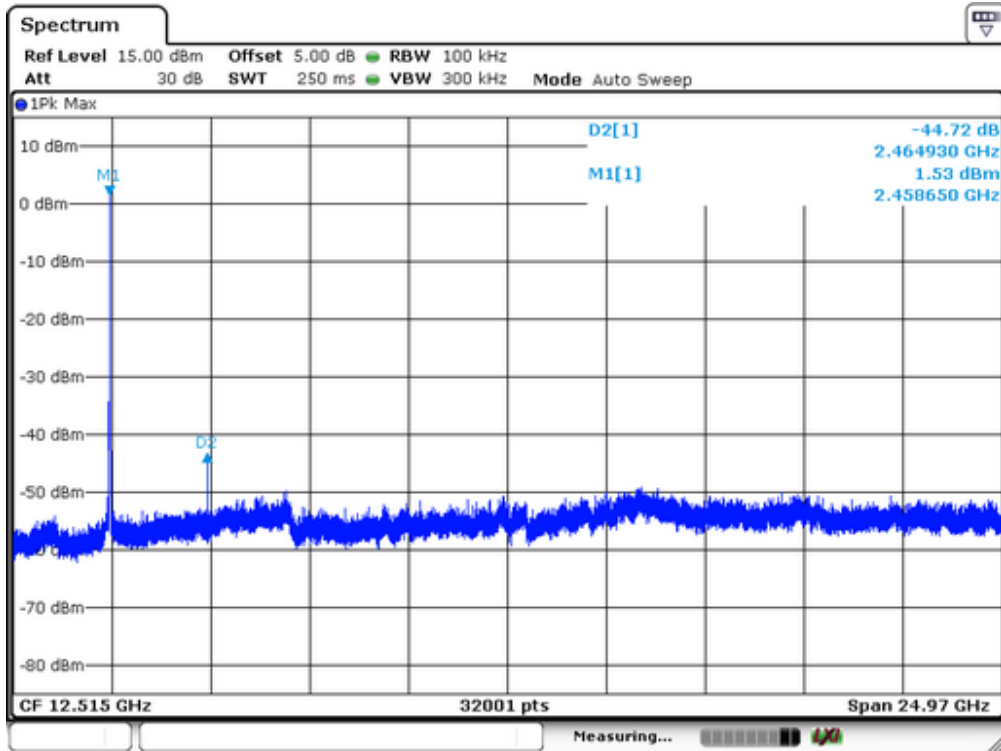
Test Mode: 802.11b



Lowest Channel

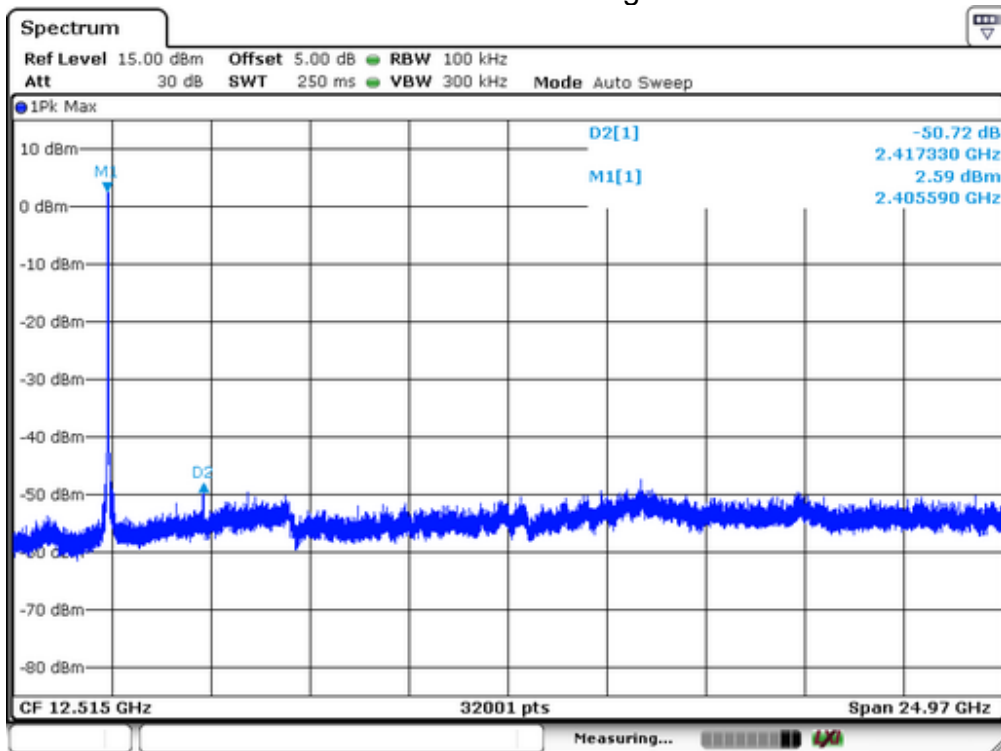


Middel Channel

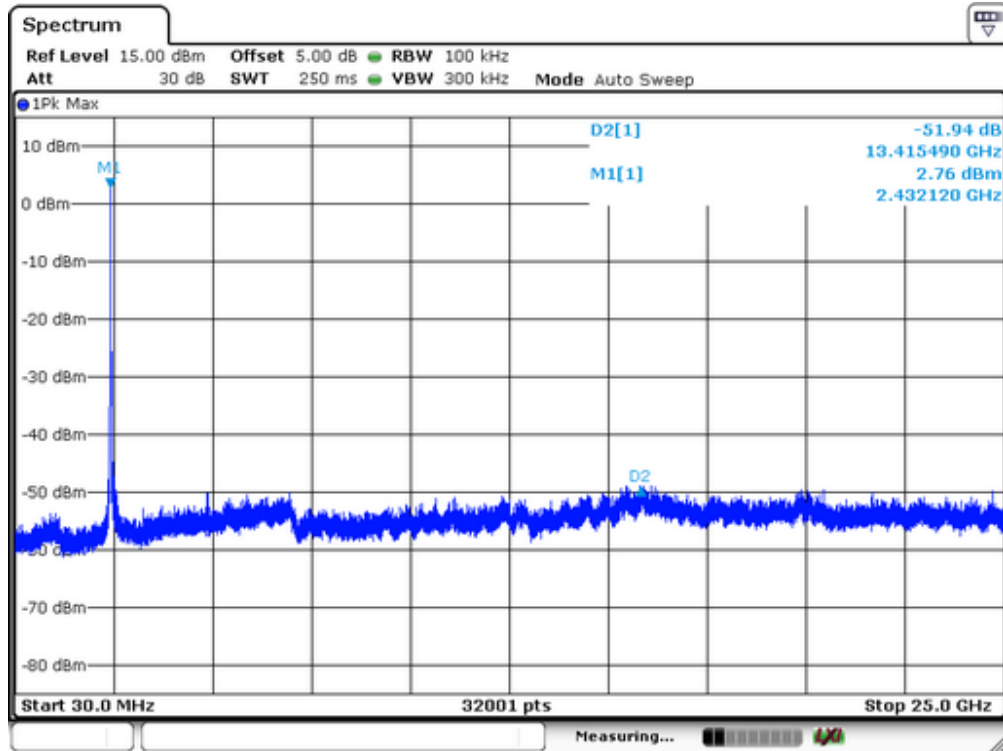


Highest Channel

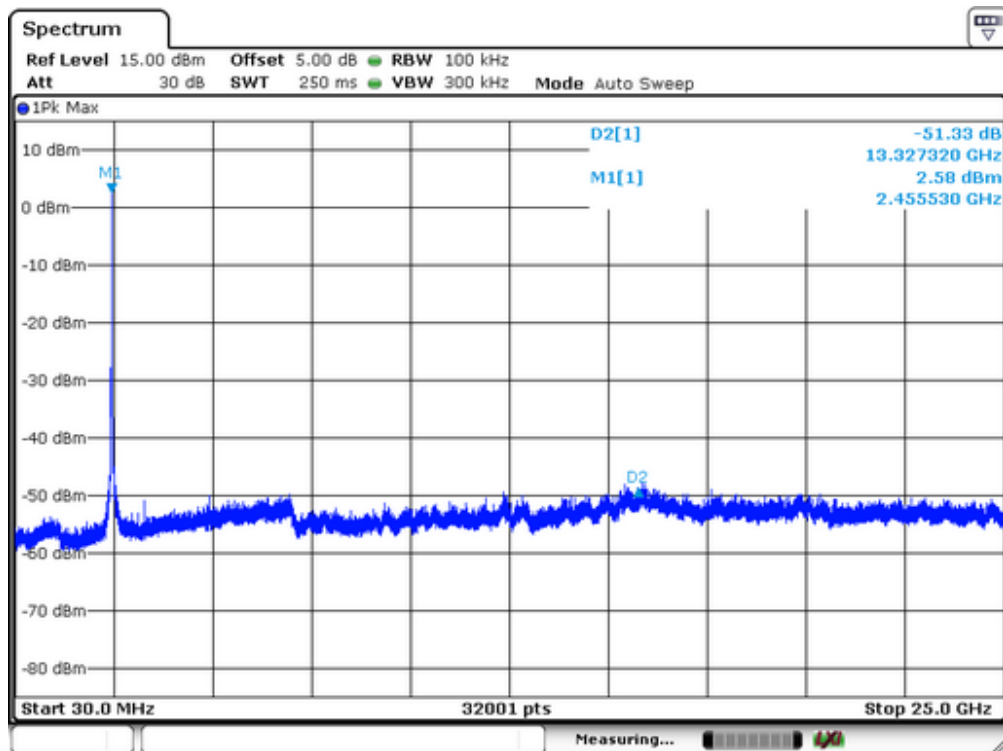
Test Mode: 802.11g



Lowest Channel

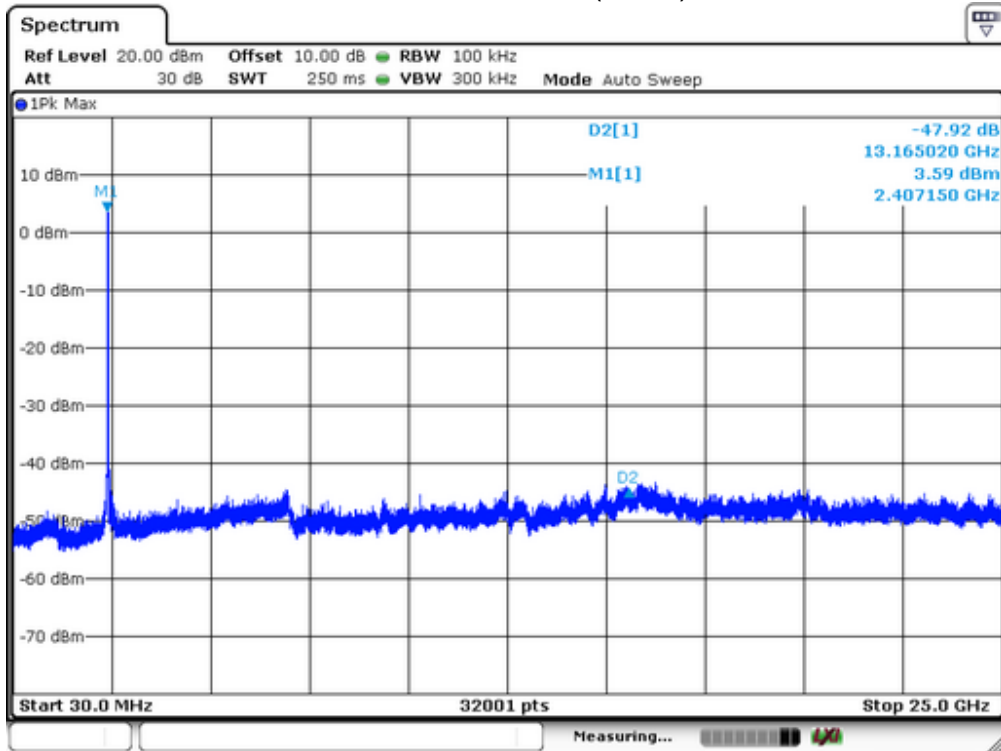


Middle Channel

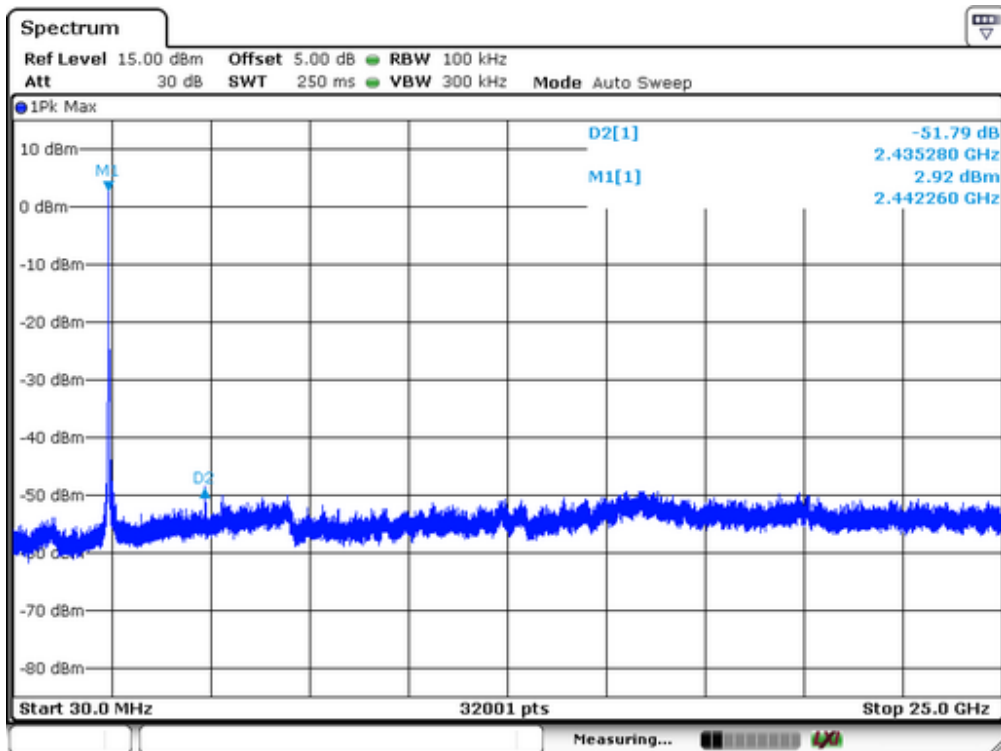


Highest Channel

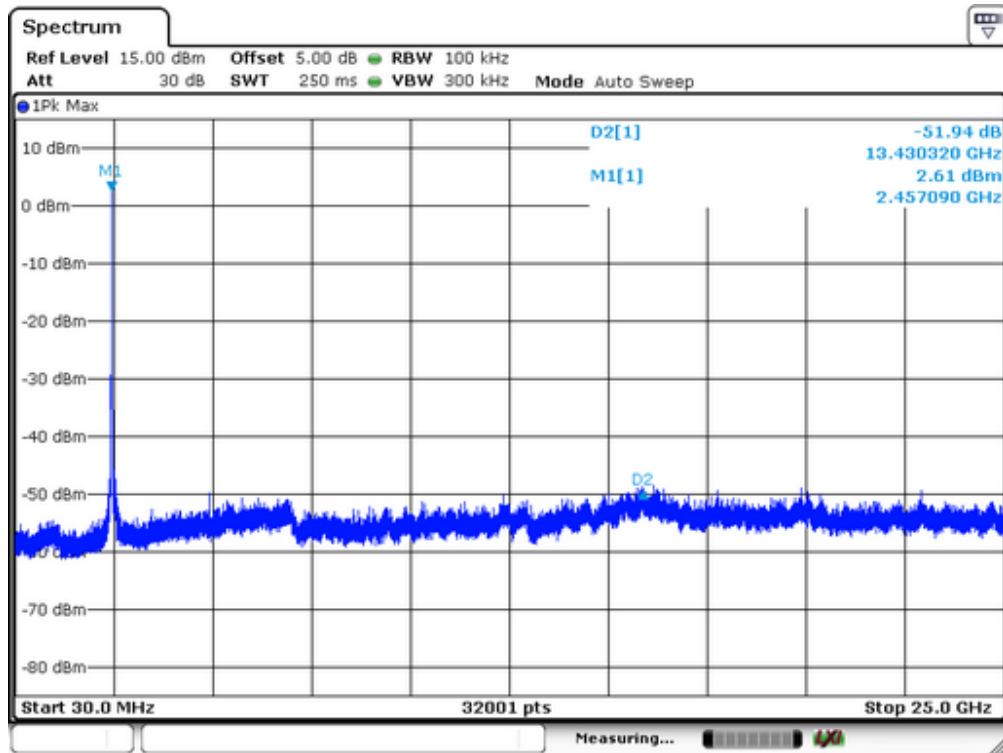
Test Mode: 802.11n(HT20)



Lowest Channel



Middle Channel



Highest Channel

13. Antenna Application

13.1 Antenna Requirement

For intentional device, according to FCC 47 CFR 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. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

13.2 Result

The EUT'S antenna is an internal PCB antenna. The antenna's gain is 1.8 dBi and meets the requirement.

14. Photos of EUT

Please refer to external photos and internal photos.