

# FCC RADIO TEST REPORT

## FCC ID: 2AML4-CAM1080

**Product:** Battery Camera Hub  
**Trade Name:** Momentum  
**Model Name:** MOCAMOUT1080-01  
**Serial Model:** N/A  
**Report No.:** UNIA20061216FR-01

### Prepared for

Apollo Tech USA Inc.  
Tech USA Inc. 8608 Utica Ave #220, Rancho Cucamonga, California,  
United States

### Prepared by

Shenzhen United Testing Technology Co., Ltd.  
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Community, Xixiang Str, Bao'an District, Shenzhen, China

## TEST RESULT CERTIFICATION

**Applicant's name**..... : Apollo Tech USA Inc.  
**Address**..... : Tech USA Inc. 8608 Utica Ave #220, Rancho Cucamonga,  
California, United States  
**Manufacture's Name**..... : Apollo Tech USA Inc.  
**Address**..... : Tech USA Inc. 8608 Utica Ave #220, Rancho Cucamonga,  
California, United States

### Product description

**Product name**..... : Battery Camera Hub  
**Trade Mark**..... : Momentum  
**Model and/or type reference** .. : MOCAMOUT1080-01  
**Standards**..... : FCC Rules and Regulations Part 15 Subpart C Section 15.247  
ANSI C63.10: 2013

This device described above has been tested by Shenzhen United Testing Technology Co., Ltd., and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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**Date of Test**..... :  
**Date (s) of performance of tests**..... : Jun. 06 ~ 18, 2020  
**Date of Issue**..... : Jun. 19, 2020  
**Test Result**..... : Pass

Test by:

*Bob Liao*

Bob liao/Engineer

Reviewer:

*Kahn Yang*

Kahn yang/Supervisor

Approved & Authorized Signer:

*Liuze*

Liuze/Manager

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## 1. TEST SUMMARY

### TEST PROCEDURES AND RESULTS

DESCRIPTION OF TEST	RESULT
CONDUCTED EMISSIONS TEST	COMPLIANT
RADIATED EMISSION TEST	COMPLIANT
BAND EDGE	COMPLIANT
OCCUPIED BANDWIDTH MEASUREMENT	COMPLIANT
POWER SPECTRAL DENSITY	COMPLIANT
PEAK OUTPUT POWER	COMPLIANT
OUT OF BAND EMISSIONS	COMPLIANT
ANTENNA REQUIREMENT	COMPLIANT

### 1.1 TEST FACILITY

Test Firm : Shenzhen United Testing Technology Co., Ltd.  
 Address : 2F, Annex Bldg, Jiahuangyuan Tech Park, #365 Baotian 1 Rd, Tiegang Community, Xixiang Str, Bao'an District, Shenzhen, China

The testing quality ability of our laboratory meet with "Quality Law of People's Republic of China" Clause 19. The testing quality system of our laboratory meets with ISO/IEC-17025 requirements, which is approved by CNAS. This approval result is accepted by MRA of APLAC.

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

CNAS-LAB Code: L6494

The EMC Laboratory has been assessed and in compliance with CNAS-CL01 accreditation criteria for testing Laboratories (identical to ISO/IEC 17025:2017 General Requirements) for the Competence of testing Laboratories.

Designation Number: CN1227

Test Firm Registration Number: 674885

The EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications commission. The acceptance letter from the FCC is maintained in our files.

### 1.2 MEASUREMENT UNCERTAINTY

#### Measurement Uncertainty

Conducted Emission Expanded Uncertainty	=	2.23dB, k=2
Radiated emission expanded uncertainty(9kHz-30MHz)	=	3.08dB, k=2
Radiated emission expanded uncertainty(30MHz-1000MHz)	=	4.42dB, k=2
Radiated emission expanded uncertainty(Above 1GHz)	=	4.06dB, k=2



## 2. GENERAL INFORMATION

### 2.1 GENERAL DESCRIPTION OF EUT

Equipment	Battery Camera Hub
Trade Mark	Momentum
Model Name	MOCAMOUT1080-01
Sample ID	UNIA20061216FR-1#
Serial No.	N/A
Model Difference	N/A
FCC ID	2AML4-CAM1080
Antenna Type	Internal Antenna
Antenna Gain	3.5dBi
Frequency Range	802.11b/g/n20: 2412~2462 MHz 802.11n40:2422-2452 MHz
Number of Channels	802.11b/g/n20: 11CH 802.11n40:7CH
Modulation Type	DSSS, OFDM
Power Source	DC 5V/2A from Adapter
Adapter	
Manufacturer	SHENZHEN TIANYIN ELECTRONICS CO LTD
M/N	TPA-46050200UU
Input	100-240V~ 50/60Hz 0.3A
Output	DC 5V/2000mA

### 2.2 Carrier Frequency of Channels

Channel List for 802.11b/g/n(20MHz/40MHz)							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
01	2412	04	2427	07	2442	10	2457
02	2417	05	2432	08	2447	11	2462
03	2422	06	2437	09	2452		

### 2.3 Operation of EUT during testing

#### Operating Mode

The mode is used: Transmitting mode for 802.11b/g/n (20MHz)/ n(40MHz)

Low Channel: 2412MHz/2422MHz

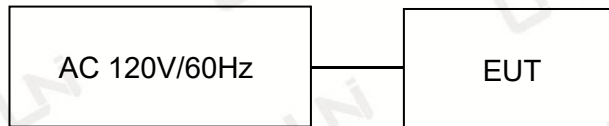
Middle Channel: 2437MHz

High Channel: 2462MHz/2452MHz

Test SW Version:SSCOM3.2

### 2.4 DESCRIPTION OF TEST SETUP

Operation of EUT during Conducted testing:



Operation of EUT during Radiation testing:

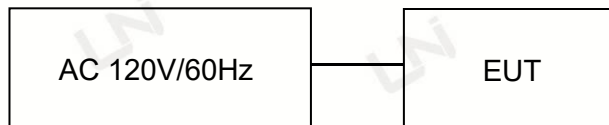


Table for auxiliary equipment:

Equipment Description	Manufacturer	Model	Calibration Due Date
N/A	N/A	N/A	N/A

2.5 MEASUREMENT INSTRUMENTS LIST

Item	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
<b>CONDUCTED EMISSIONS TEST</b>					
1	AMN	Schwarzbeck	NNLK8121	8121370	2020.9.6
2	AMN	ETS	3810/2	00020199	2020.9.6
3	EMI TEST RECEIVER	Rohde&Schwarz	ESCI	101210	2020.9.6
4	AAN	TESEQ	T8-Cat6	38888	2020.9.6
<b>RADIATED EMISSION TEST</b>					
1	Horn Antenna	Sunol	DRH-118	A101415	2020.9.6
2	BicoNILog Antenna	Sunol	JB1 Antenna	A090215	2020.9.6
3	PREAMP	HP	8449B	3008A00160	2020.9.6
4	PREAMP	HP	8447D	2944A07999	2020.9.6
5	EMI TEST RECEIVER	Rohde&Schwarz	ESR3	101891	2020.9.6
6	VECTOR Signal Generator	Rohde&Schwarz	SMU200A	101521	2020.9.6
7	Signal Generator	Agilent	E4421B	MY4335105	2020.9.6
8	MXA Signal Analyzer	Agilent	N9020A	MY50510140	2020.9.6
9	MXA Signal Analyzer	Agilent	N9020A	MY51110104	2020.9.6
10	ANT Tower&Turn table Controller	Champro	EM 1000	60764	2020.9.6
11	Anechoic Chamber	Taihe Maorui	9m*6m*6m	966A0001	2020.9.6
12	Shielding Room	Taihe Maorui	6.4m*4m*3m	643A0001	2020.9.6
13	RF Power sensor	DARE	RPR3006W	15I00041SNO88	2020.9.6
14	RF Power sensor	DARE	RPR3006W	15I00041SNO89	2020.9.6
15	RF power divider	Anritsu	K241B	992289	2020.9.6
16	Wideband radio communication tester	Rohde&Schwarz	CMW500	154987	2020.9.6
17	Biconical antenna	Schwarzbeck	VHA 9103	91032360	2020.9.6
18	Biconical antenna	Schwarzbeck	VHA 9103	91032361	2020.9.6
19	Broadband Hybrid Antennas	Schwarzbeck	VULB9163	VULB9163#958	2020.9.6
20	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-1680	2020.9.6
21	Active Receive Loop Antenna	Schwarzbeck	FMZB 1919B	00023	2020.9.6
22	Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170651	2020.9.6
23	Microwave Broadband Pre-amplifier	Schwarzbeck	BBV 9721	100472	2020.9.6
24	Active Loop Antenna	Com-Power	AL-130R	10160009	2020.9.6
25	Power Meter	KEYSIGHT	N1911A	MY50520168	2020.9.6
26	Frequency Meter	VICTOR	VC2000	997406086	2020.9.6
27	DC Power Source	HYELEC	HY5020E	055161818	2020.9.6
<b>Test software</b>					
1	E3	Audix	6.101223a	N/A	N/A



### 3. CONDUCTED EMISSIONS TEST

#### 3.1 Conducted Power Line Emission Limit

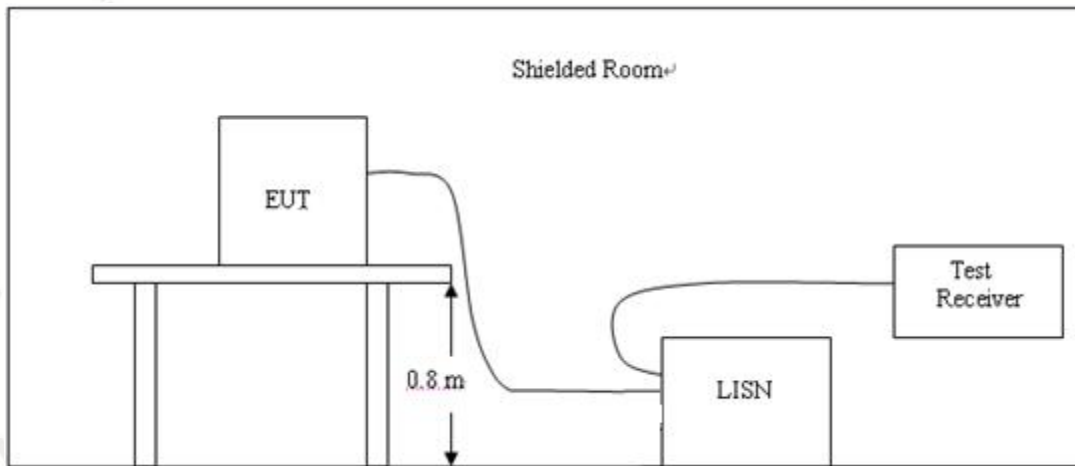
For unintentional device, according to § 15.107(a) Line Conducted Emission Limits is as following

Frequency (MHz)	Maximum RF Line Voltage(dBμV)			
	CLASS A		CLASS B	
	Q.P.	Ave.	Q.P.	Ave.
0.15~0.50	79	66	66~56*	56~46*
0.50~5.00	73	60	56	46
5.00~30.0	73	60	60	50

\* Decreasing linearly with the logarithm of the frequency

For intentional device, according to §15.207(a) Line Conducted Emission Limit is same as above table.

#### 3.2 Test Setup



#### 3.3 Test Procedure

- 1, The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. A wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10.
- 2, Support equipment, if needed, was placed as per ANSI C63.10.
- 3, All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
- 4, If a EUT received DC power from the USB Port of Notebook PC, the PC's adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
- 5, All support equipments received AC power from a second LISN, if any.
- 6, The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
- 7, Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.

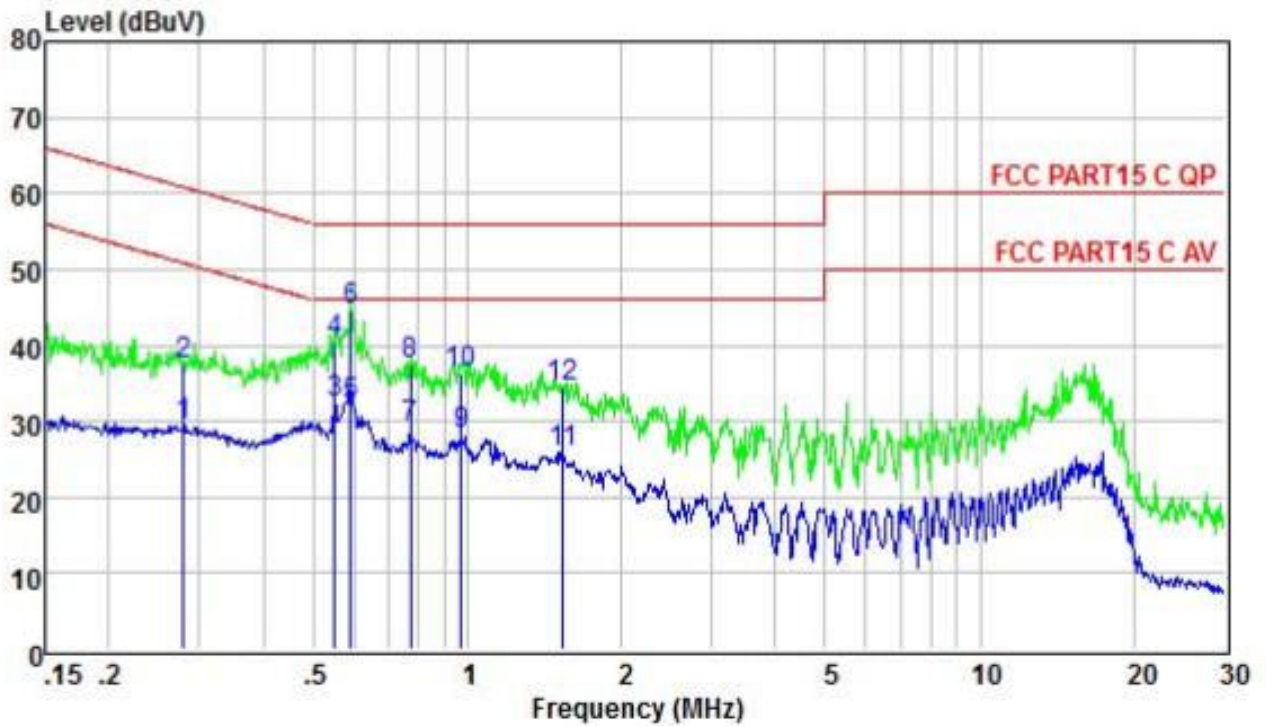
#### 3.4 Test Result

Pass

Remark:

1. All modes were tested at AC 120V and 240V, only the worst result of AC 120V was reported.
2. All modes were tested at Low, Middle, and High channel, only the worst result of 802.11b Low Channel was reported as below:

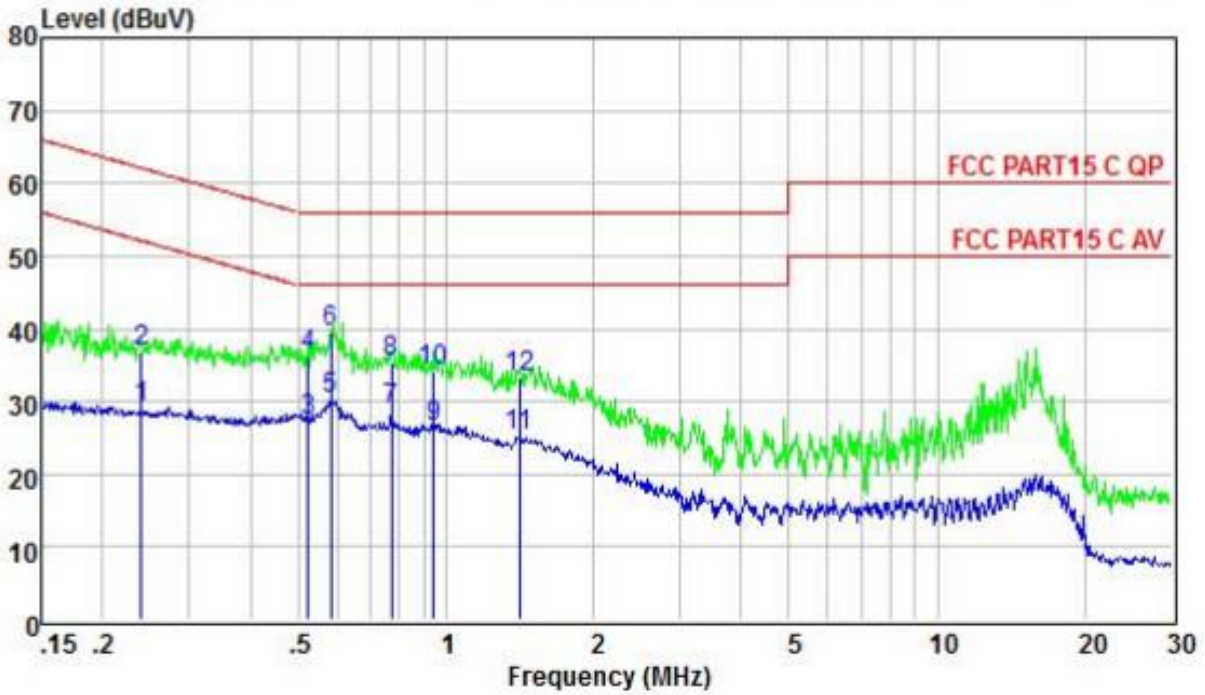
Temperature:	24°C	Relative Humidity:	48%
Test Date:	Jun. 09, 2020	Pressure:	1010hPa
Test Voltage:	120V/60Hz	Phase:	Line
Test Mode:	Transmitting mode of 802.11b 2412MHz		



	Read Freq	Read Level	LISN Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	
1	0.28	19.89	9.62	29.51	50.85	-21.34	Average
2	0.28	27.88	9.62	37.50	60.85	-23.35	QP
3	0.55	22.78	9.67	32.45	46.00	-13.55	Average
4	0.55	30.68	9.67	40.35	56.00	-15.65	QP
5	0.59	22.38	9.66	32.04	46.00	-13.96	Average
6	0.59	34.99	9.66	44.65	56.00	-11.35	QP
7	0.78	19.50	9.63	29.13	46.00	-16.87	Average
8	0.78	27.86	9.63	37.49	56.00	-18.51	QP
9	0.97	18.66	9.61	28.27	46.00	-17.73	Average
10	0.97	26.55	9.61	36.16	56.00	-19.84	QP
11	1.54	16.36	9.60	25.96	46.00	-20.04	Average
12	1.54	24.90	9.60	34.50	56.00	-21.50	QP

Remark: Factor = Insertion Loss + Cable Loss, Result = Reading + Factor, Margin = Result – Limit.

Temperature:	24°C	Relative Humidity:	48%
Test Date:	Jun. 09, 2020	Pressure:	1010hPa
Test Voltage:	120V/60Hz	Phase:	Neutral
Test Mode:	Transmitting mode of 802.11b 2412MHz		



	Read Freq	Read Level	LISN Factor	Limit Level	Over Limit	Remark
	MHz	dBuV	dB	dBuV	dB	
1	0.24	19.50	9.53	29.03	52.08	-23.05 Average
2	0.24	27.27	9.53	36.80	62.08	-25.28 QP
3	0.52	17.79	9.63	27.42	46.00	-18.58 Average
4	0.52	26.63	9.63	36.26	56.00	-19.74 QP
5	0.58	20.73	9.63	30.36	46.00	-15.64 Average
6	0.58	29.87	9.63	39.50	56.00	-16.50 QP
7	0.78	19.11	9.63	28.74	46.00	-17.26 Average
8	0.78	25.63	9.63	35.26	56.00	-20.74 QP
9	0.94	16.79	9.63	26.42	46.00	-19.58 Average
10	0.94	24.63	9.63	34.26	56.00	-21.74 QP
11	1.41	15.58	9.60	25.18	46.00	-20.82 Average
12	1.41	23.60	9.60	33.20	56.00	-22.80 QP

Remark: Factor = Insertion Loss + Cable Loss, Result = Reading + Factor, Margin = Result – Limit.



## 4. RADIATED EMISSION TEST

### 4.1 Radiation Limit

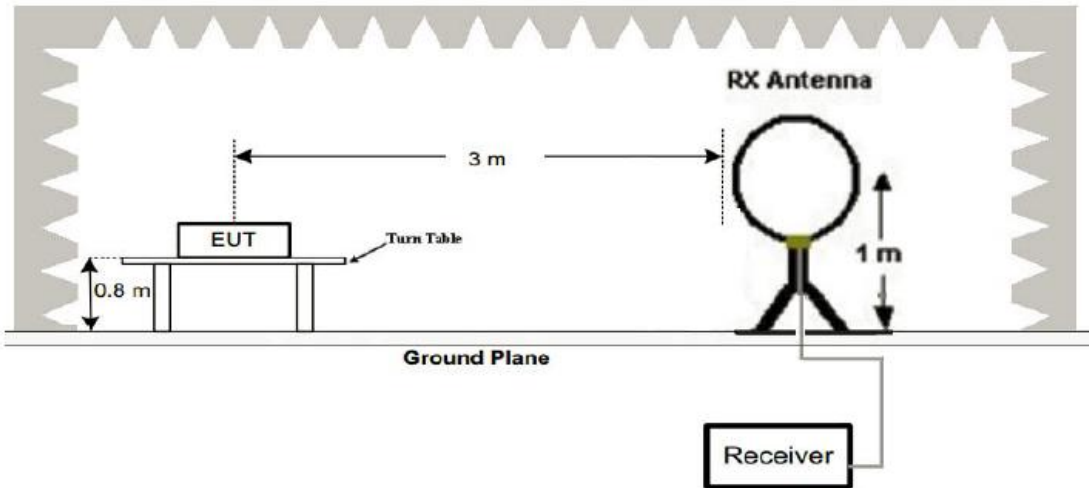
For unintentional device, according to § 15.109(a), except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency (MHz)	Distance (Meters)	Radiated (dB $\mu$ V/m)	Radiated ( $\mu$ V/m)
30-88	3	40	100
88-216	3	43.5	150
216-960	3	46	200
Above 960	3	54	500

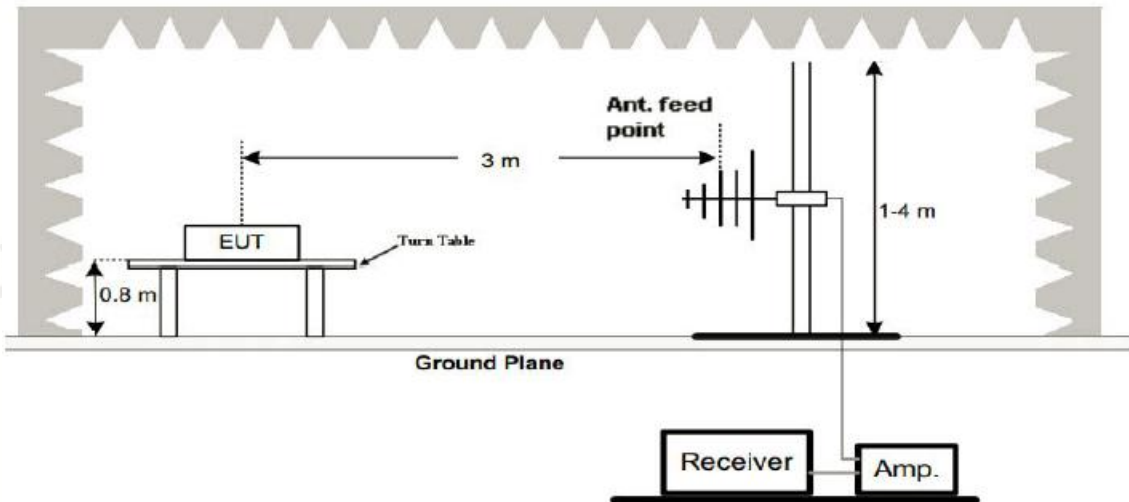
For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the above table.

### 4.2 Test Setup

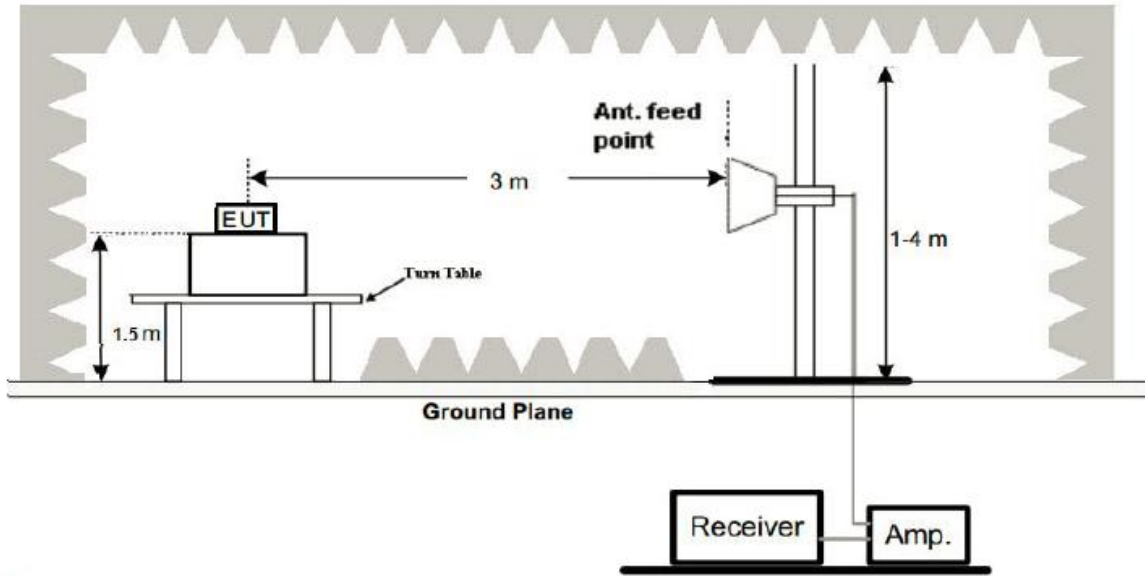
#### 1. Radiated Emission Test-Up Frequency Below 30MHz



#### 2. Radiated Emission Test-Up Frequency 30MHz~1GHz



### 3. Radiated Emission Test-Up Frequency Above 1GHz



#### 4.3 Test Procedure

1. Below 1GHz measurement the EUT is placed on turntable which is 0.8m above ground plane. And above 1GHz measurement EUT was placed on low permittivity and low tangent turn table which is 1.5m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The test frequency range from 9KHz to 25GHz per FCC PART 15.33(a).
8. The distance between test antenna and EUT as following table states:

Test Frequency range	Test Antenna Type	Test Distance
9KHz-30MHz	Active Loop Antenna	3
30MHz-1GHz	Bilog Antenna	3
1GHz-18GHz	Horn Antenna	3
18GHz-25GHz	Horn Antenna	1

**Note:**

For battery operated equipment, the equipment tests shall be performed using a new battery.

#### 4.4 Test Result

**PASS**

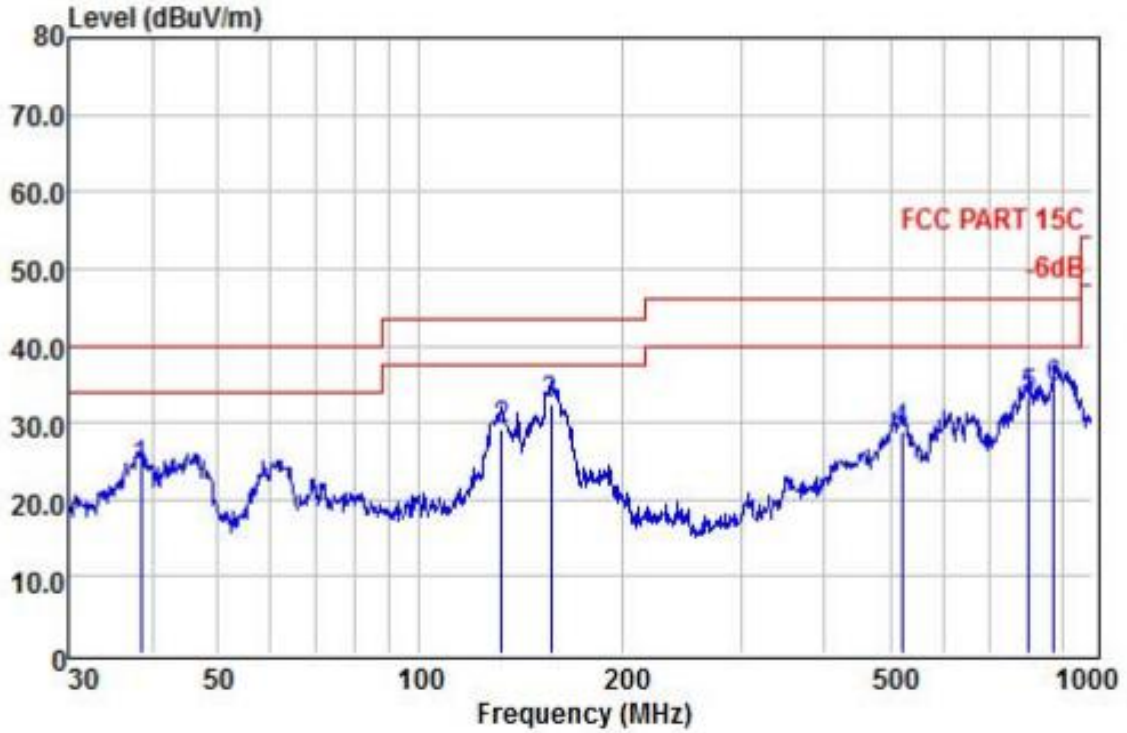
Remark:

1. All modes of 802.11b/g/n20 were test at Low, Middle, and High channel, only the worst result of 802.11b Low Channel was reported for below 1GHz test.
2. By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that "Z axis" position was the worst, and test data recorded in this report.



Below 1GHz Test Results:

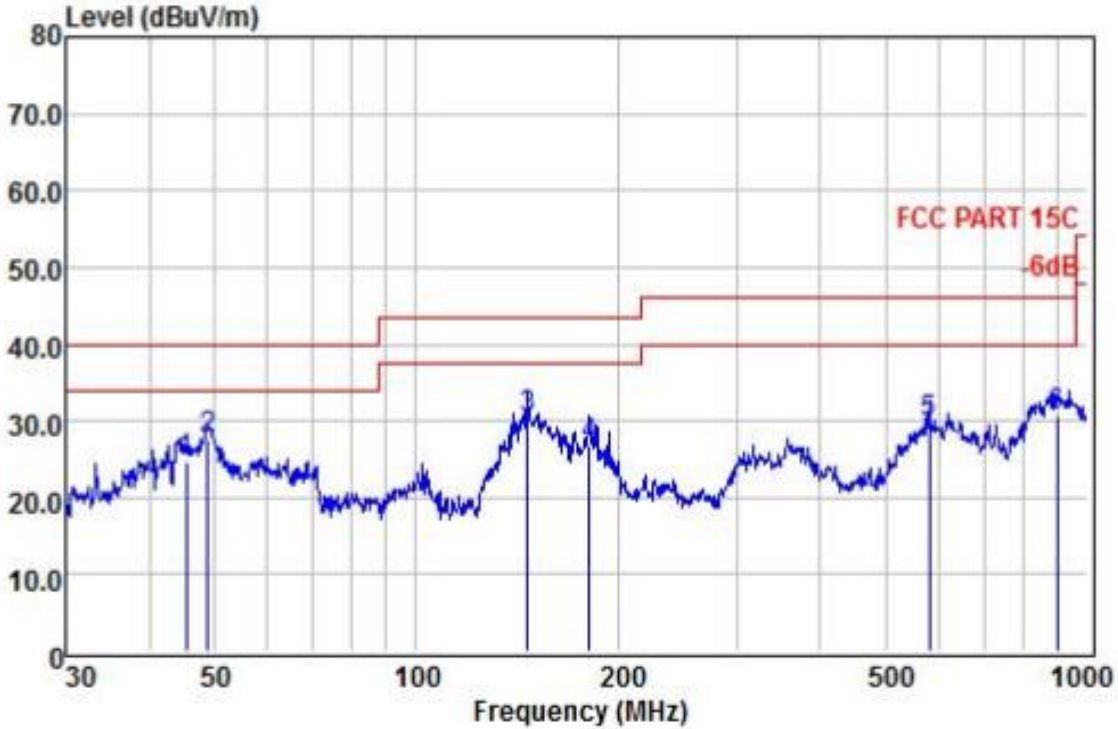
Temperature:	22°C	Relative Humidity:	48%
Test Date:	Jun. 09, 2020	Pressure:	1010hPa
Test Voltage:	120V/60Hz	Polarization:	Horizontal
Test Mode:	Transmitting mode of 802.11b 2412MHz		



	Read	Antenna	Cable	Limit	Over		
Freq	Level	Factor	Loss	Line	Limit	Remark	
MHz	dBuV	dB/m	dB	dBuV/m	dBuV/m	dB	
1	38.48	10.72	13.30	0.16	24.18	40.00	-15.82 QP
2	132.22	14.74	14.15	0.22	29.11	43.50	-14.39 QP
3	156.46	16.49	15.62	0.23	32.34	43.50	-11.16 QP
4	520.89	10.74	16.83	1.17	28.74	46.00	-17.26 QP
5	804.60	10.75	21.28	1.41	33.44	46.00	-12.56 QP
6	878.32	10.61	22.23	1.58	34.42	46.00	-11.58 QP

Remark: Absolute Level = Reading Level + Factor, Margin = Absolute Level – Limit  
 Factor = Ant. Factor + Cable Loss – Pre-amplifier

Temperature:	22°C	Relative Humidity:	48%
Test Date:	Jun. 09, 2020	Pressure:	1010hPa
Test Voltage:	120V/60Hz	Polarization:	Vertical
Test Mode:	Transmitting mode of 802.11b 2412MHz		



	Read	Antenna	Cable	Limit	Over	
Freq	Level	Factor	Loss	Line	Limit	Remark
MHz	dBuV	dB/m	dB	dBuV/m	dBuV/m	dB
1	45.38	11.42	13.22	0.12	24.76	40.00 -15.24 QP
2	48.84	14.54	13.05	0.12	27.71	40.00 -12.29 QP
3	146.37	14.86	15.37	0.23	30.46	43.50 -13.04 QP
4	181.28	13.79	12.61	0.24	26.64	43.50 -16.86 QP
5	580.70	11.19	17.38	1.14	29.71	46.00 -16.29 QP
6	900.15	6.54	22.50	1.63	30.67	46.00 -15.33 QP

Remark: Absolute Level = Reading Level + Factor, Margin = Absolute Level – Limit  
 Factor = Ant. Factor + Cable Loss – Pre-amplifier

Remark:

- (1) Measuring frequencies from 9 KHz to the 1 GHz, Radiated emission test from 9KHz to 30MHz was verified, and no any emission was found except system noise floor.
- (2) \* denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
- (3) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.

Above 1 GHz Test Results:

CH Low of 802.11b Mode (2412MHz)

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4824	63.53	-3.64	59.89	74	-14.11	PK
4824	51.29	-3.64	47.65	54	-6.35	AV
7236	62.59	-0.95	61.64	74	-12.36	PK
7236	47.11	-0.95	46.16	54	-7.84	AV

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4824	64.24	-3.64	60.6	74	-13.4	PK
4824	50.24	-3.64	46.6	54	-7.4	AV
7236	63.14	-0.95	62.19	74	-11.81	PK
7236	46.38	-0.95	45.43	54	-8.57	AV

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit

CH Middle of 802.11b Mode (2437MHz)

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4874	64.24	-3.64	60.6	74	-13.4	PK
4874	50.24	-3.64	46.6	54	-7.4	AV
7311	63.14	-0.95	62.19	74	-11.81	PK
7311	46.38	-0.95	45.43	54	-8.57	AV

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4874	61.27	-3.51	57.76	74	-16.24	PK
4874	50.23	-3.51	46.72	54	-7.28	AV
7311	54.37	-0.82	53.55	74	-20.45	PK
7311	49.62	-0.82	48.8	54	-5.2	AV

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit



CH High of 802.11b Mode (2462MHz)

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4924	61.53	-3.43	58.1	74	-15.9	PK
4924	53.27	-3.43	49.84	54	-4.16	AV
7386	54.16	-0.75	53.41	74	-20.59	PK
7386	44.39	-0.75	43.64	54	-10.36	AV

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4924	60.38	-3.43	56.95	74	-17.05	PK
4924	47.59	-3.43	44.16	54	-9.84	AV
7386	58.63	-0.75	57.88	74	-16.12	PK
7386	43.96	-0.75	43.21	54	-10.79	AV

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit

Remark:

- (1) Measuring frequencies from 1 GHz to the 25 GHz.
- (2) "F" denotes fundamental frequency; "H" denotes spurious frequency. "E" denotes band edge frequency.
- (3) \* denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
- (4) Data of measurement within this frequency range shown "---" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for peak measurement with peak detector at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 10Hz for Average measurement with peak detection at frequency above 1GHz.
- (6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.



CH Low of 802.11g Mode (2412MHz)

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4824	61.35	-3.64	57.71	74	-16.29	PK
4824	52.37	-3.64	48.73	54	-5.27	AV
7236	54.19	-0.95	53.24	74	-20.76	PK
7236	48.26	-0.95	47.31	54	-6.69	AV

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4824	64.33	-3.64	60.69	74	-13.31	PK
4824	51.28	-3.64	47.64	54	-6.36	AV
7236	59.34	-0.95	58.39	74	-15.61	PK
7236	47.36	-0.95	46.41	54	-7.59	AV

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit

CH Middle of 802.11g Mode (2437MHz)

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4874	61.35	-3.51	57.84	74	-16.16	PK
4874	48.23	-3.51	44.72	54	-9.28	AV
7311	56.39	-0.82	55.57	74	-18.43	PK
7311	48.51	-0.82	47.69	54	-6.31	AV

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4874	64.53	-3.51	61.02	74	-12.98	PK
4874	47.51	-3.51	44	54	-10	AV
7311	53.24	-0.82	52.42	74	-21.58	PK
7311	47.16	-0.82	46.34	54	-7.66	AV

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit

CH High of 802.11g Mode (2462MHz)

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4924	57.49	-3.43	54.06	74	-19.94	PK
4924	46.39	-3.43	42.96	54	-11.04	AV
7386	56.28	-0.75	55.53	74	-18.47	PK
7386	47.29	-0.75	46.54	54	-7.46	AV

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4924	62.33	-3.43	58.9	74	-15.1	PK
4924	53.13	-3.43	49.7	54	-4.3	AV
7386	56.34	-0.75	55.59	74	-18.41	PK
7386	43.21	-0.75	42.46	54	-11.54	AV

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit

Remark:

- (1) Measuring frequencies from 1 GHz to the 25 GHz.
- (2) "F" denotes fundamental frequency; "H" denotes spurious frequency. "E" denotes band edge frequency.
- (3) \* denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
- (4) Data of measurement within this frequency range shown "---" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for peak measurement with peak detector at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 10Hz for Average measurement with peak detection at frequency above 1GHz.
- (6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.

CH Low of 802.11n/H20 Mode (2412MHz)

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4824	62.34	-3.64	58.7	74	-15.3	PK
4824	51.36	-3.64	47.72	54	-6.28	AV
7236	56.39	-0.95	55.44	74	-18.56	PK
7236	47.29	-0.95	46.34	54	-7.66	AV

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4824	62.53	-3.64	58.89	74	-15.11	PK
4824	51.23	-3.64	47.59	54	-6.41	AV
7236	57.49	-0.95	56.54	74	-17.46	PK
7236	48.29	-0.95	47.34	54	-6.66	AV

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit

CH Middle of 802.11n/H20 Mode (2437MHz)

Horizontal:

Frequency (MHz)	Reading Result (dB $\mu$ V)	Factor (dB)	Emission Level (dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Margin (dB)	Detector Type
4874	62.38	-3.51	58.87	74	-15.13	PK
4874	47.29	-3.51	43.78	54	-10.22	AV
7311	59.36	-0.82	58.54	74	-15.46	PK
7311	47.35	-0.82	46.53	54	-7.47	AV

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit

Vertical:

Frequency (MHz)	Reading Result (dB $\mu$ V)	Factor (dB)	Emission Level (dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Margin (dB)	Detector Type
4874	61.25	-3.51	57.74	74	-16.26	PK
4874	52.34	-3.51	48.83	54	-5.17	AV
7311	57.49	-0.82	56.67	74	-17.33	PK
7311	49.66	-0.82	48.84	54	-5.16	AV

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit



CH High of 802.11n/H20 Mode (2462MHz)

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4924	62.38	-3.43	58.95	74	-15.05	PK
4924	52.46	-3.43	49.03	54	-4.97	AV
7386	55.39	-0.75	54.64	74	-19.36	PK
7386	50.31	-0.75	49.56	54	-4.44	AV

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4924	63.46	-3.43	60.03	74	-13.97	PK
4924	49.67	-3.43	46.24	54	-7.76	AV
7386	58.63	-0.75	57.88	74	-16.12	PK
7386	47.68	-0.75	46.93	54	-7.07	AV

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit

Remark:

- (1) Measuring frequencies from 1 GHz to the 25 GHz.
- (2) "F" denotes fundamental frequency; "H" denotes spurious frequency. "E" denotes band edge frequency.
- (3) \* denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
- (4) Data of measurement within this frequency range shown "---" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for peak measurement with peak detector at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 10Hz for Average measurement with peak detection at frequency above 1GHz.
- (6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.

CH Low of 802.11n/H40 Mode (2422MHz)

Horizontal:

Frequency (MHz)	Reading Result (dB $\mu$ V)	Factor (dB)	Emission Level (dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Margin (dB)	Detector Type
4844	65.39	-3.64	61.75	74	-12.25	PK
4844	48.69	-3.64	45.05	54	-8.95	AV
7266	57.49	-0.95	56.54	74	-17.46	PK
7266	49.68	-0.95	48.73	54	-5.27	AV

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit

Vertical:

Frequency (MHz)	Reading Result (dB $\mu$ V)	Factor (dB)	Emission Level (dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Margin (dB)	Detector Type
4844	62.36	-3.64	58.72	74	-15.28	PK
4844	52.13	-3.64	48.49	54	-5.51	AV
7266	62.53	-0.95	61.58	74	-12.42	PK
7266	49.21	-0.95	48.26	54	-5.74	AV

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit

CH Middle of 802.11n/H40 Mode (2437MHz)

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4874	62.38	-3.51	58.87	74	-15.13	PK
4874	51.36	-3.51	47.85	54	-6.15	AV
7311	60.98	-0.82	60.16	74	-13.84	PK
7311	49.68	-0.82	48.86	54	-5.14	AV

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4874	62.35	-3.51	58.84	74	-15.16	PK
4874	53.42	-3.51	49.91	54	-4.09	AV
7311	56.38	-0.82	55.56	74	-18.44	PK
7311	49.16	-0.82	48.34	54	-5.66	AV

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit

CH High of 802.11n/H40 Mode (2452MHz)

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4904	63.47	-3.43	60.04	74	-13.96	PK
4904	54.29	-3.43	50.86	54	-3.14	AV
7356	55.43	-0.75	54.68	74	-19.32	PK
7356	49.68	-0.75	48.93	54	-5.07	AV

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4904	63.54	-3.43	60.11	74	-13.89	PK
4904	51.26	-3.43	47.83	54	-6.17	AV
7356	63.54	-0.75	62.79	74	-11.21	PK
7356	48.26	-0.75	47.51	54	-6.49	AV

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit

Remark:

- (1) Measuring frequencies from 1 GHz to the 25 GHz.
- (2) "F" denotes fundamental frequency; "H" denotes spurious frequency. "E" denotes band edge frequency.
- (3) \* denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
- (4) Data of measurement within this frequency range shown "---" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for peak measurement with peak detector at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 10Hz for Average measurement with peak detection at frequency above 1GHz.
- (6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.

## 5. BAND EDGE

### 5.1 Limits

FCC PART 15.247 Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

### 5.2 Test Procedure

The band edge compliance of RF radiated emission should be measured by following the guidance in ANSI C63.10 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization etc. Set RBW to 1MHz and VBM to 3MHz to measure the peak field strength and set RBW to 1MHz and VBW to 10kHz to measure the average radiated field strength. The conducted RF band edge was measured by using a spectrum analyzer. Set span wide enough to capture the highest in-band emission and the emission at the band edge. Set RBW to 100 KHz and VBW to 300 KHz, to measure the conducted peak band edge.

### 5.3 Test Result

PASS

We tested at 802.11b/802.11g/802.11n HT20/802.11n HT40 mode at the antenna single and recored the worst data 802.11b mode in report.



Horizontal:

Frequency (MHz)	Reading Result (dB $\mu$ V)	Factor (dB)	Emission Level (dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Margin (dB)	Detector Type
2310	57.86	-5.81	52.05	74	-21.95	PK
2310	49.63	-5.81	43.82	54	-10.18	AV
2390	63.51	-5.84	57.67	74	-16.33	PK
2390	52.49	-5.84	46.65	54	-7.35	AV
2400	63.49	-5.84	57.65	74	-16.35	PK
2400	51.28	-5.84	45.44	54	-8.56	AV

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

Vertical:

Frequency (MHz)	Reading Result (dB $\mu$ V)	Factor (dB)	Emission Level (dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Margin (dB)	Detector Type
2310	57.49	-5.81	51.68	74	-22.32	PK
2310	53.26	-5.81	47.45	54	-6.55	AV
2390	63.51	-5.84	57.67	74	-16.33	PK
2390	51.27	-5.84	45.43	54	-8.57	AV
2400	63.42	-5.84	57.58	74	-16.42	PK
2400	52.19	-5.84	46.35	54	-7.65	AV

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

Horizontal :

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2483.5	67.49	-5.54	61.95	74	-12.05	PK
2483.5	52.69	-5.54	47.15	54	-6.85	AV
2500	56.34	-5.72	50.62	74	-23.38	PK
2500	51.27	-5.72	45.55	54	-8.45	AV

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

Vertical:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2483.5	66.53	-5.54	60.99	74	-13.01	PK
2483.5	53.42	-5.54	47.88	54	-6.12	AV
2500	57.49	-5.72	51.77	74	-22.23	PK
2500	51.46	-5.72	45.74	54	-8.26	AV

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

## 6. OCCUPIED BANDWIDTH MEASUREMENT

### 6.1 Test Limit

FCC Part15(15.247), Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(a)(2)	Bandwidth	$\geq 500\text{KHz}$ (6dB bandwidth)	2400-2483.5	PASS

### 6.2 Test Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set EUT as normal operation.
3. Based on FCC Part15 C Section 15.247: RBW=100KHz, VBW=300KHz.
4. The useful radiated emission from the EUT was detected by the spectrum analyzer with peak detector.

### 6.3 Measurement Equipment Used

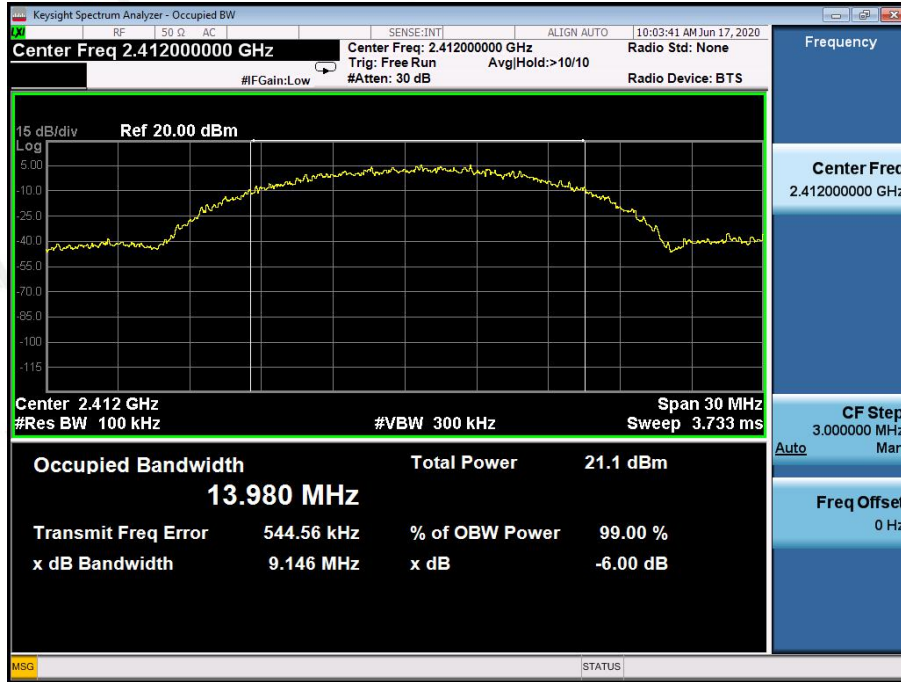
Same as Radiated Emission Measurement

### 6.4 Test Result

PASS

TX 802.11b Mode			
Frequency (MHz)	6dB Bandwidth (MHz)	Channel Separation (MHz)	Result
2412	9.146	>=500KHz	PASS
2437	9.145	>=500KHz	PASS
2462	9.138	>=500KHz	PASS

CH: 2412MHz



CH: 2437MHz



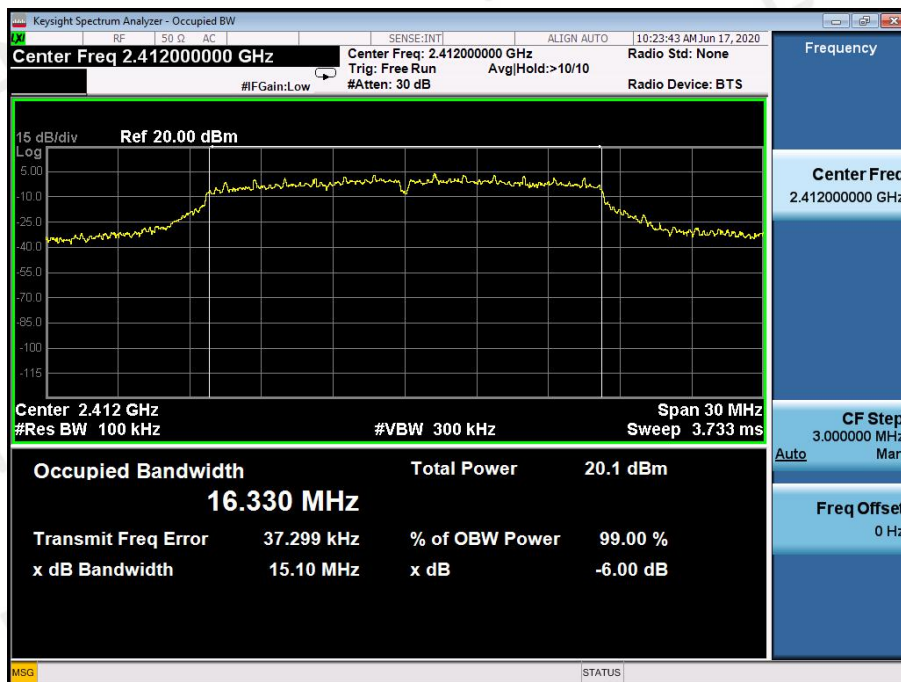


CH: 2462MHz

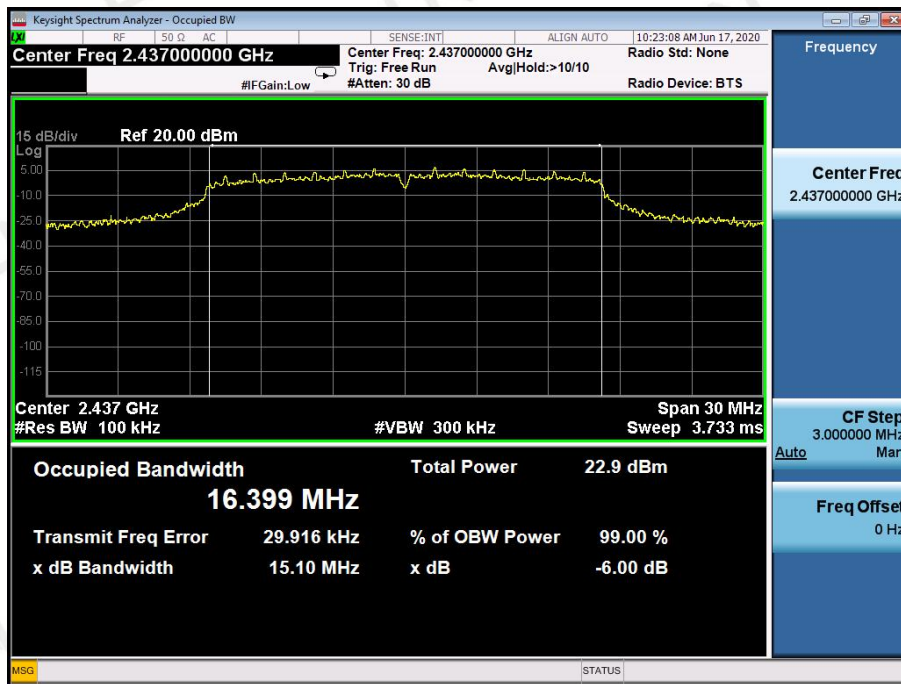


TX 802.11g Mode			
Frequency (MHz)	6dB Bandwidth (MHz)	Channel Separation (MHz)	Result
2412	15.10	>=500KHz	PASS
2437	15.10	>=500KHz	PASS
2462	15.10	>=500KHz	PASS

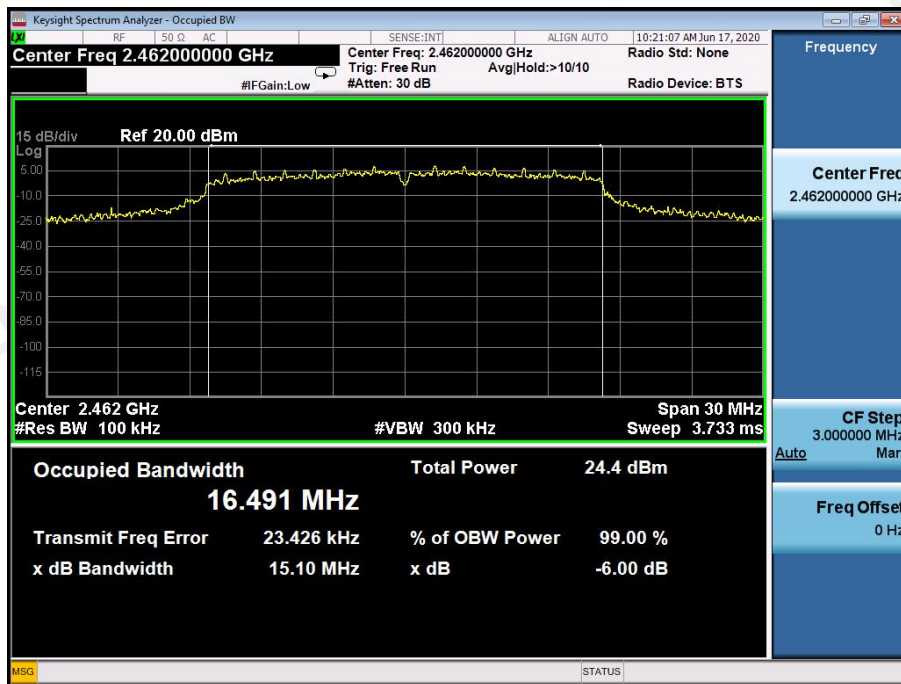
CH: 2412MHz



CH: 2437MHz

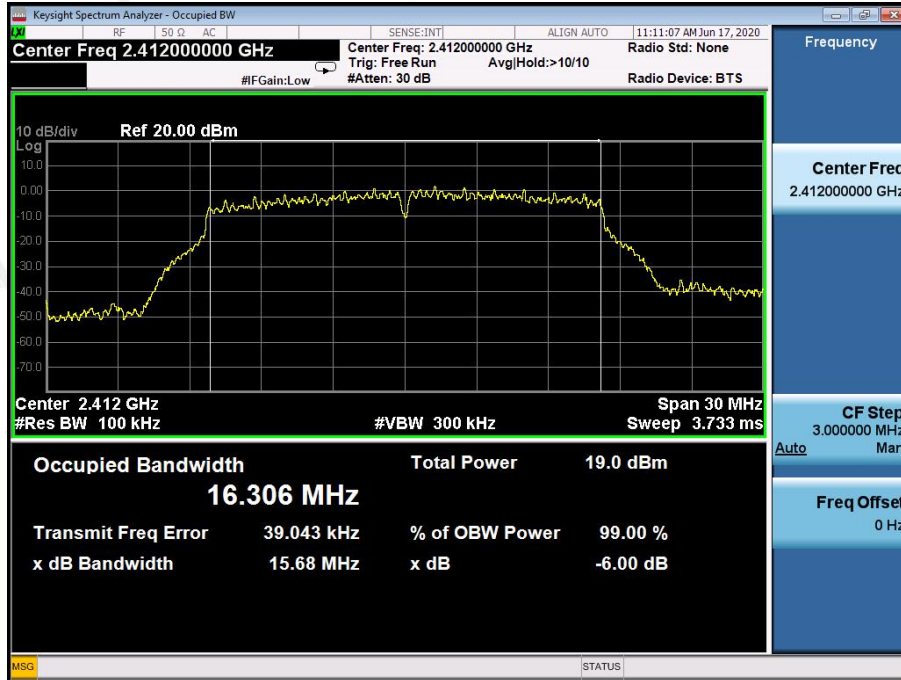


CH: 2462MHz

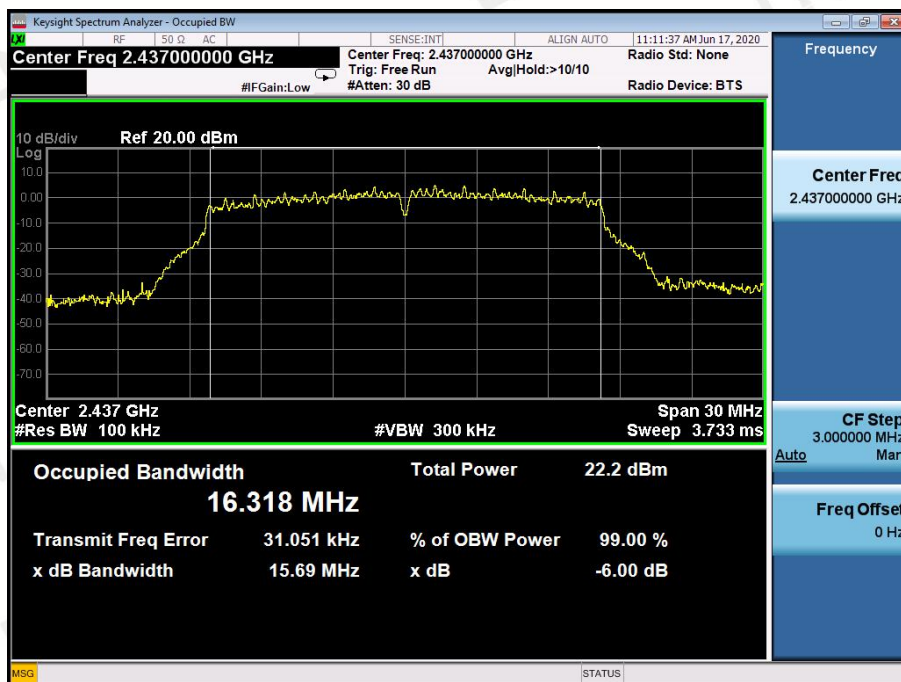


TX 802.11n/HT20 Mode			
Frequency (MHz)	6dB Bandwidth (MHz)	Channel Separation (MHz)	Result
2412	15.68	>=500KHz	PASS
2437	15.69	>=500KHz	PASS
2462	15.68	>=500KHz	PASS

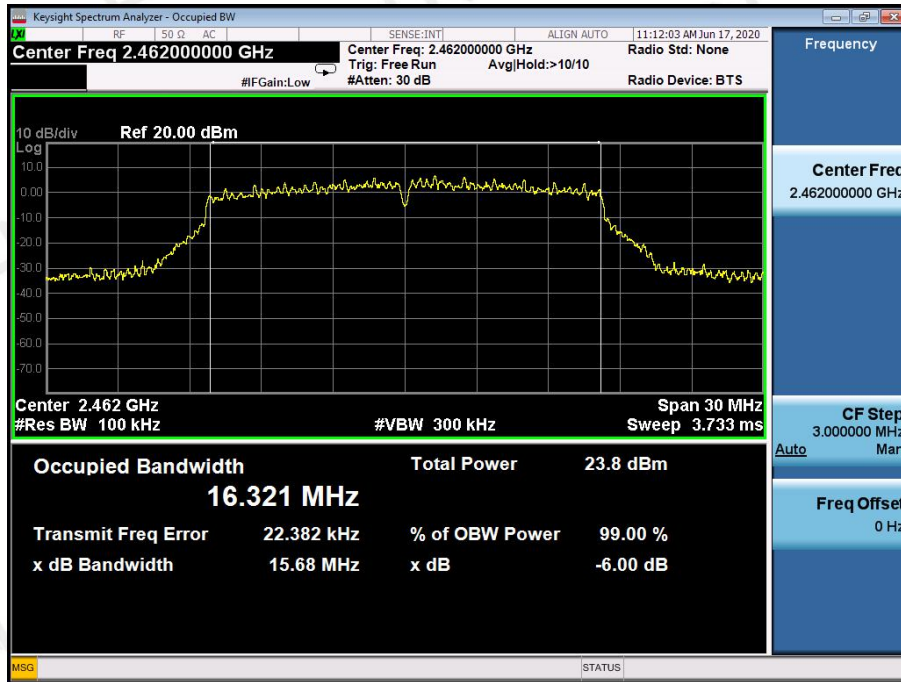
CH: 2412MHz



CH: 2437MHz

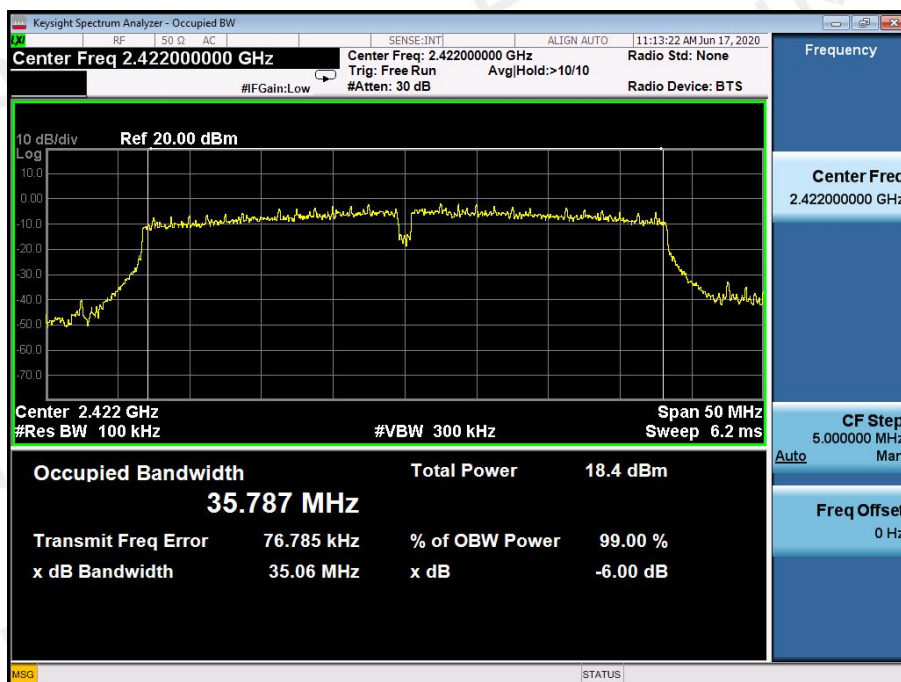


CH: 2462MHz



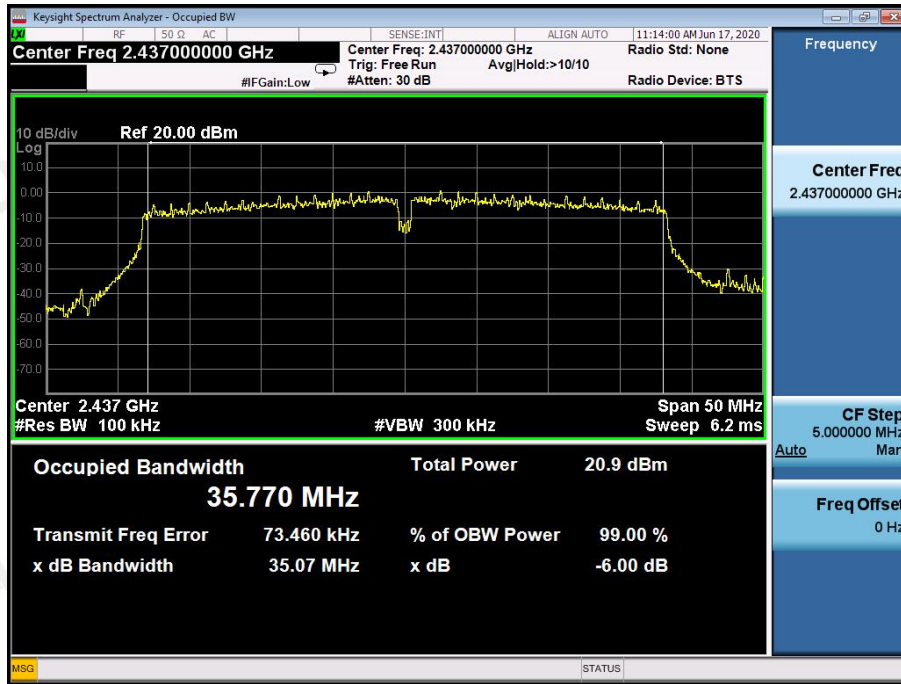
TX 802.11n/HT40 Mode			
Frequency (MHz)	6dB Bandwidth (MHz)	Channel Separation (MHz)	Result
2422	36.06	>=500KHz	PASS
2437	36.07	>=500KHz	PASS
2452	36.07	>=500KHz	PASS

CH: 2422MHz

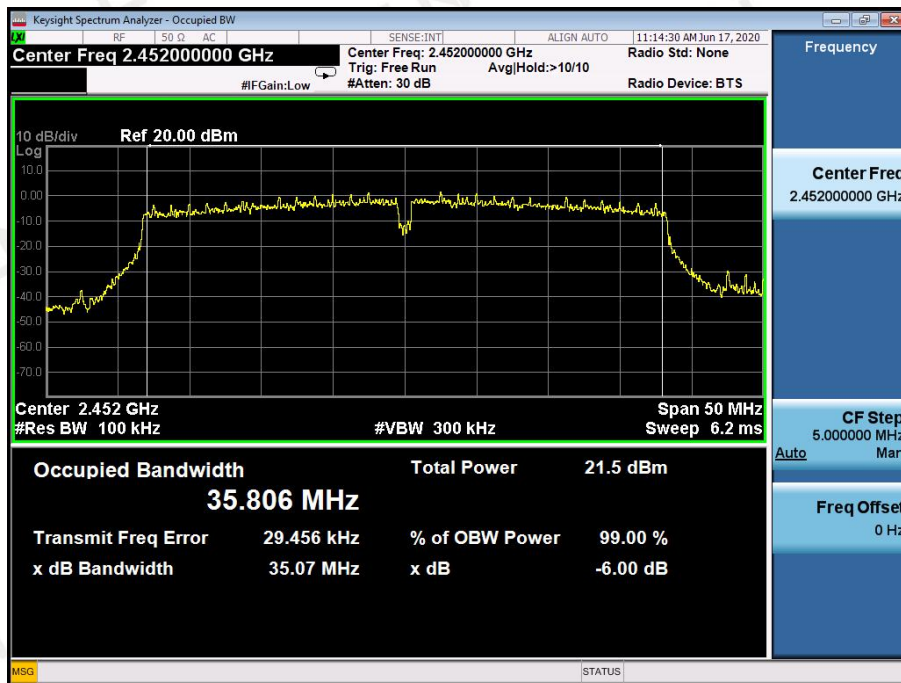




CH: 2437MHz



CH: 2452MHz



## 7. POWER SPECTRAL DENSITY TEST

### 7.1 Test Limit

FCC Part15(15.247), Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247	Power Spectral Density	8 dBm (in any 3KHz)	2400-2483.5	PASS

### 7.2 Test Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set EUT as normal operation.
3. Based on FCC Part15 C Section 15.247: RBW=3KHz, VBW=10KHz.
4. The useful radiated emission from the EUT was detected by the spectrum analyzer with peak detector.

### 7.3 Measurement Equipment Used

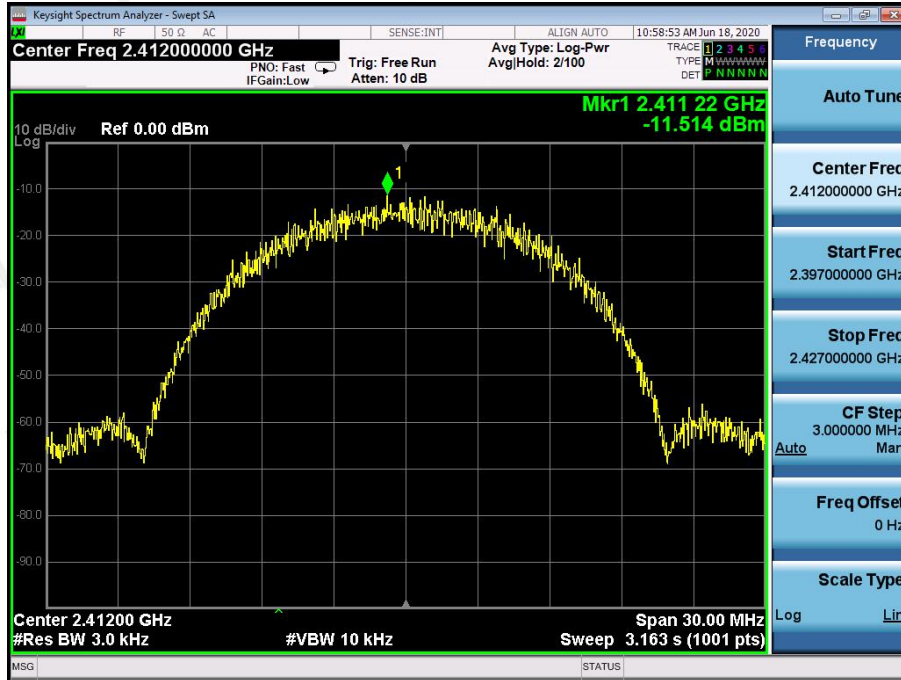
Same as Radiated Emission Measurement

### 7.4 Test Result

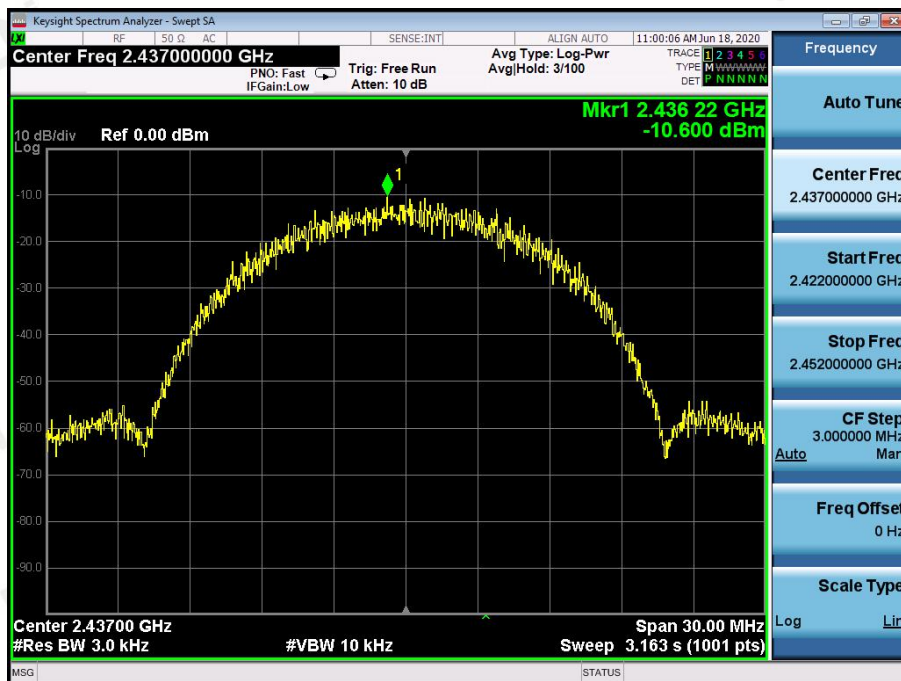
PASS

TX 802.11b Mode			
Frequency (MHz)	Power Density (dBm/3KHz)	Limit (dBm/3KHz)	Result
2412	-11.514	8	PASS
2437	-10.600	8	PASS
2462	-11.000	8	PASS

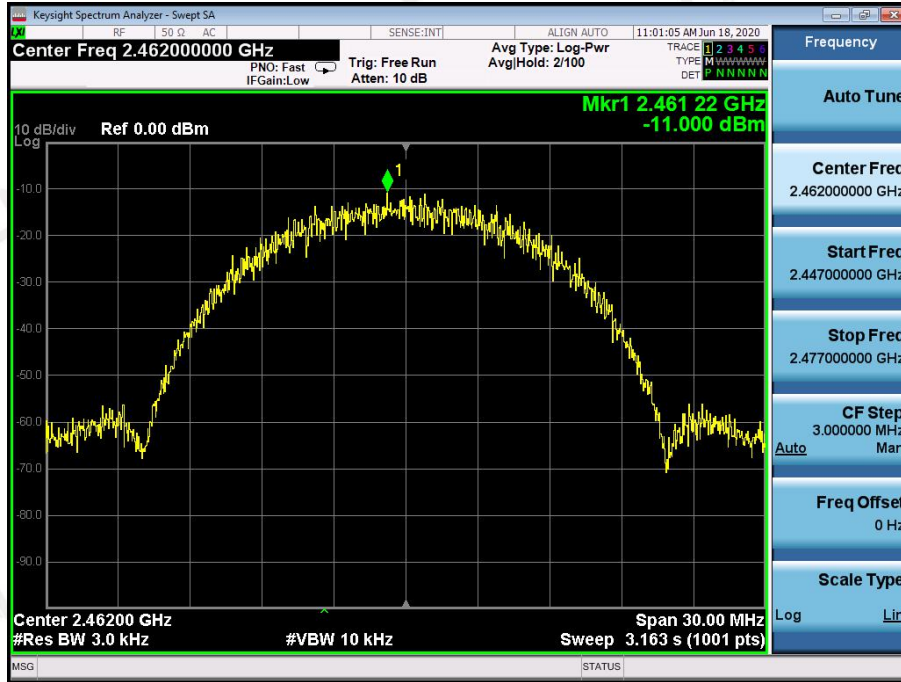
CH: 2412MHz



CH: 2437MHz

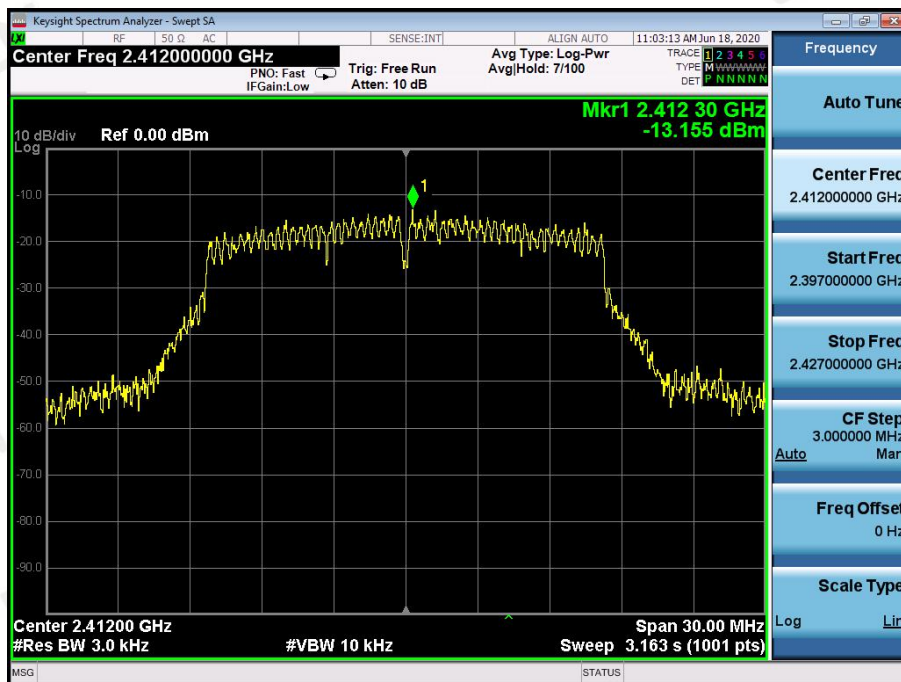


CH: 2462MHz



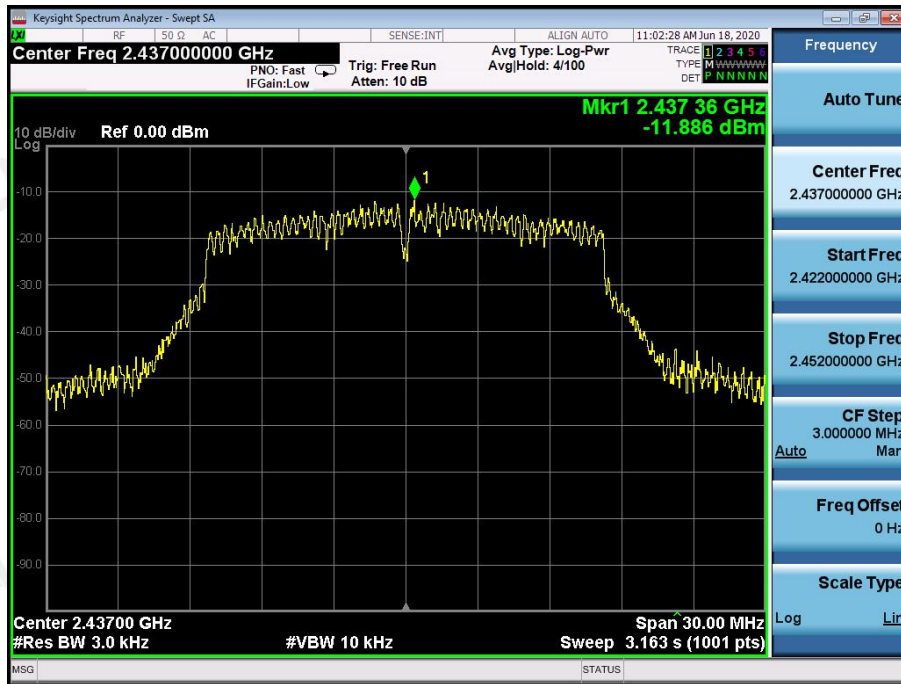
TX 802.11g Mode			
Frequency (MHz)	Power Density (dBm/3KHz)	Limit (dBm/3KHz)	Result
2412	-13.155	8	PASS
2437	-11.886	8	PASS
2462	-11.198	8	PASS

CH: 2412MHz

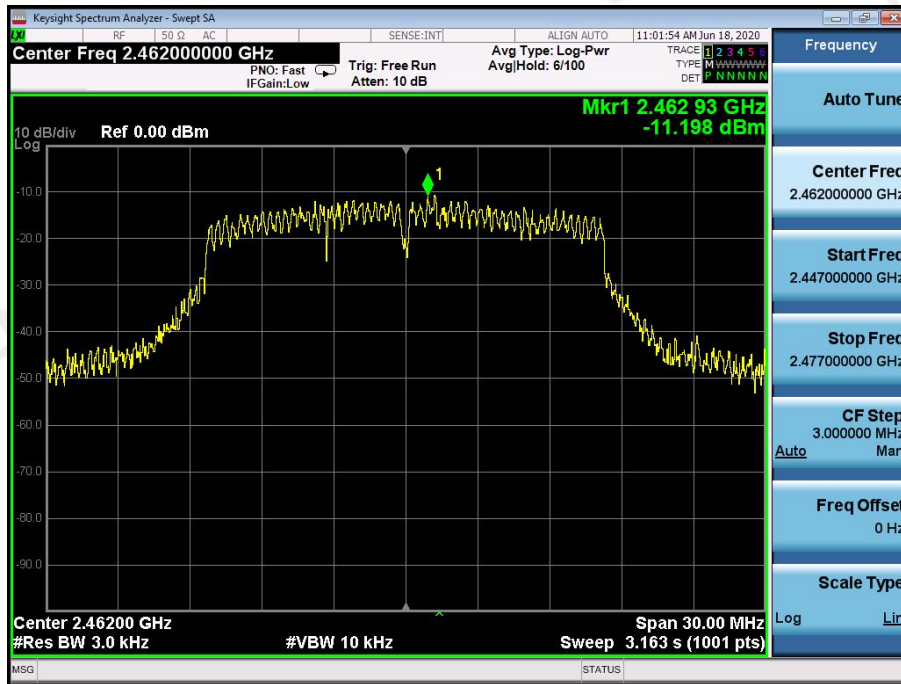




CH: 2437MHz

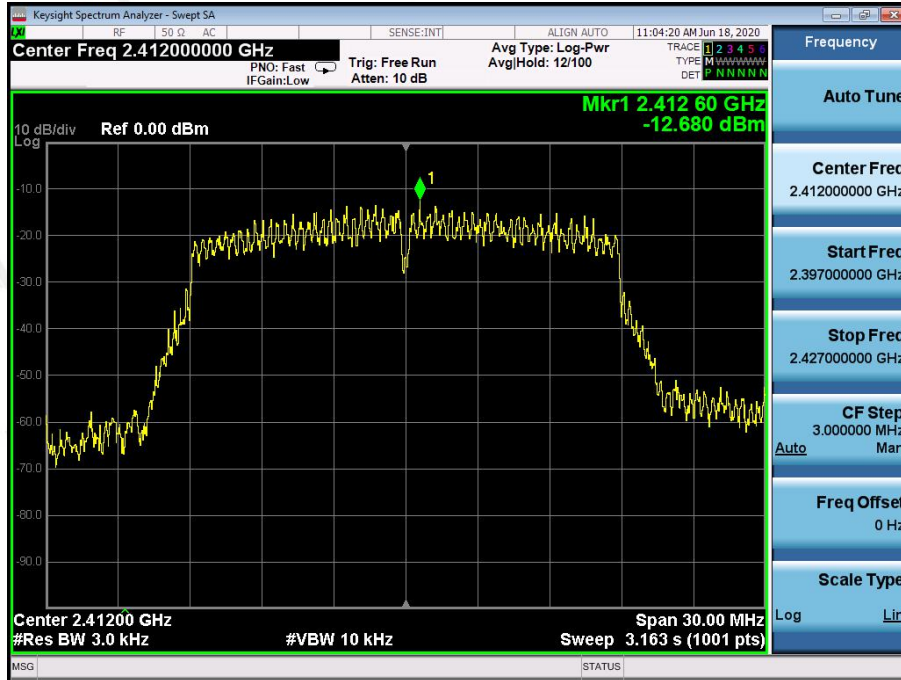


CH: 2462MHz

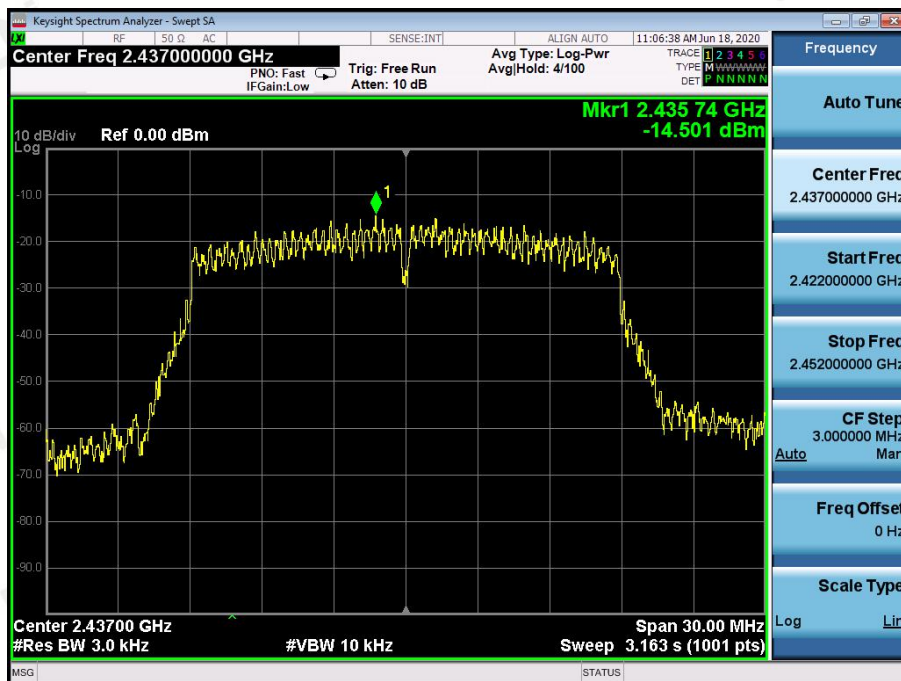


TX 802.11n/HT20 Mode			
Frequency (MHz)	Power Density (dBm/3KHz)	Limit (dBm/3KHz)	Result
2412	-12.680	8	PASS
2437	-14.501	8	PASS
2462	-11.106	8	PASS

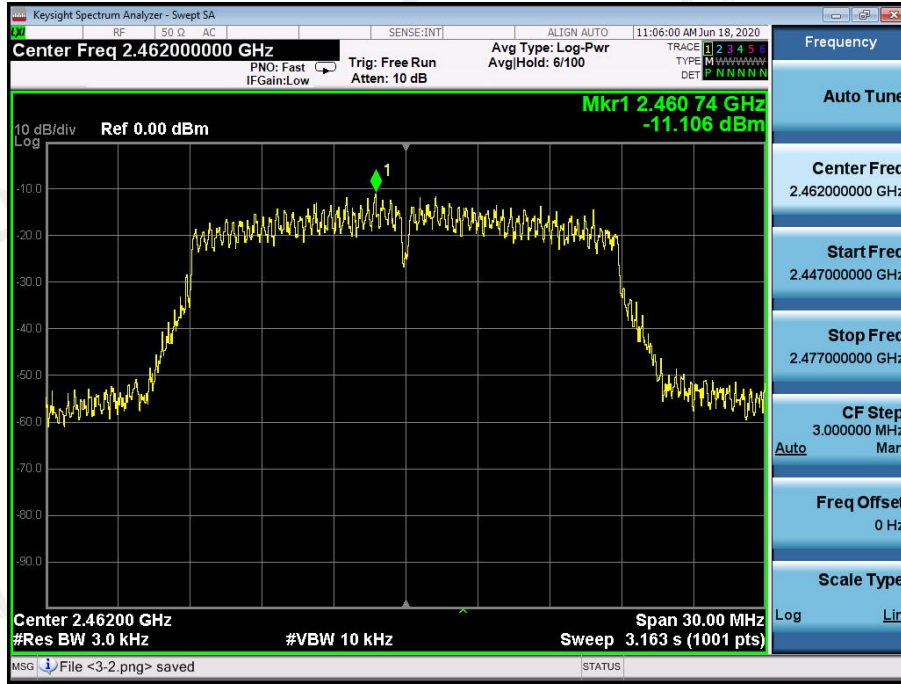
CH: 2412MHz



CH: 2437MHz

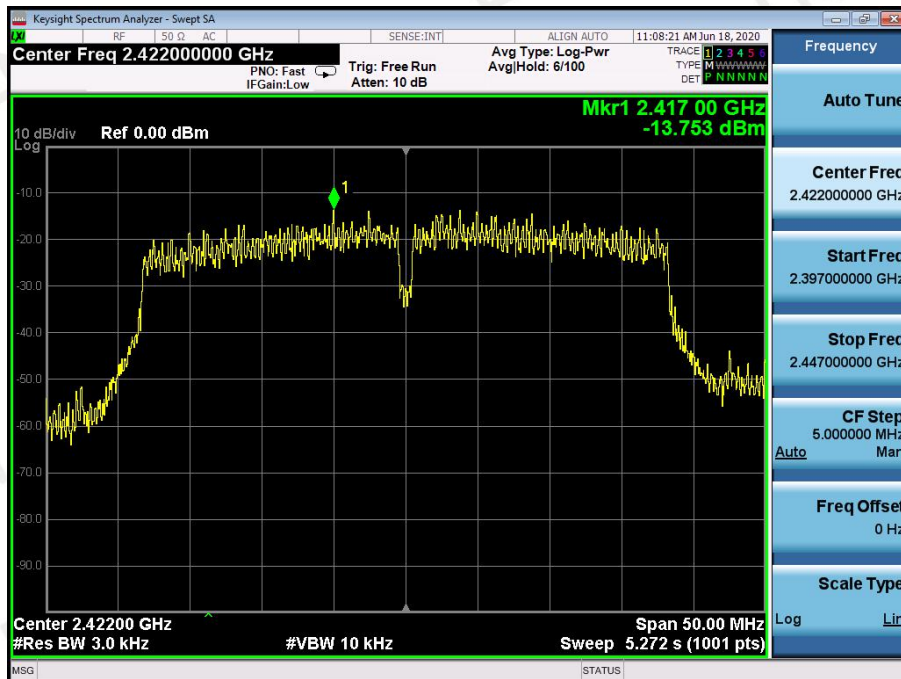


CH: 2462MHz

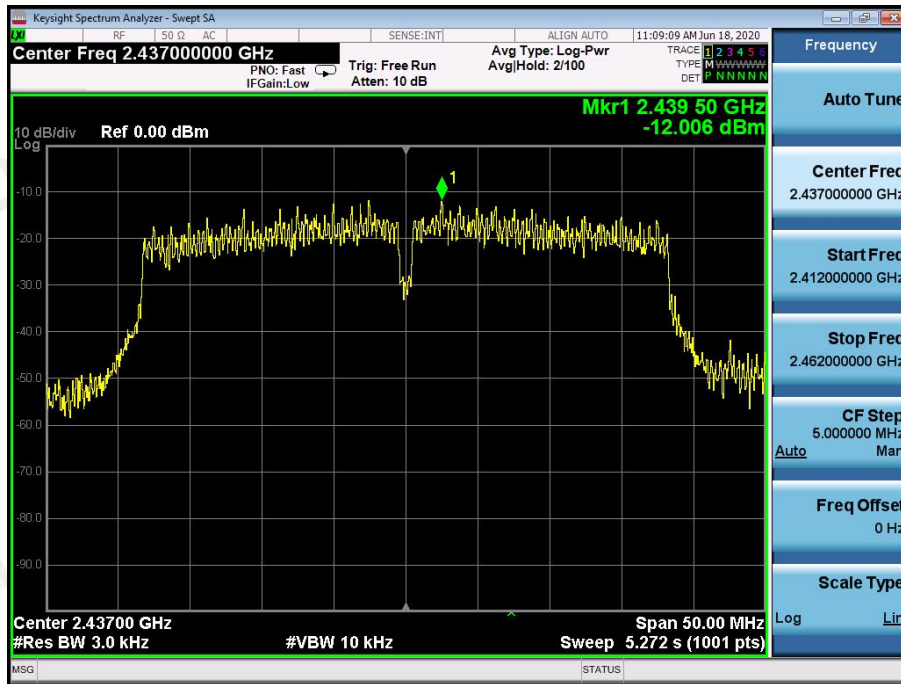


TX 802.11n/HT40 Mode			
Frequency (MHz)	Power Density (dBm/3KHz)	Limit (dBm/3KHz)	Result
2422	-13.753	8	PASS
2437	-12.006	8	PASS
2452	-12.112	8	PASS

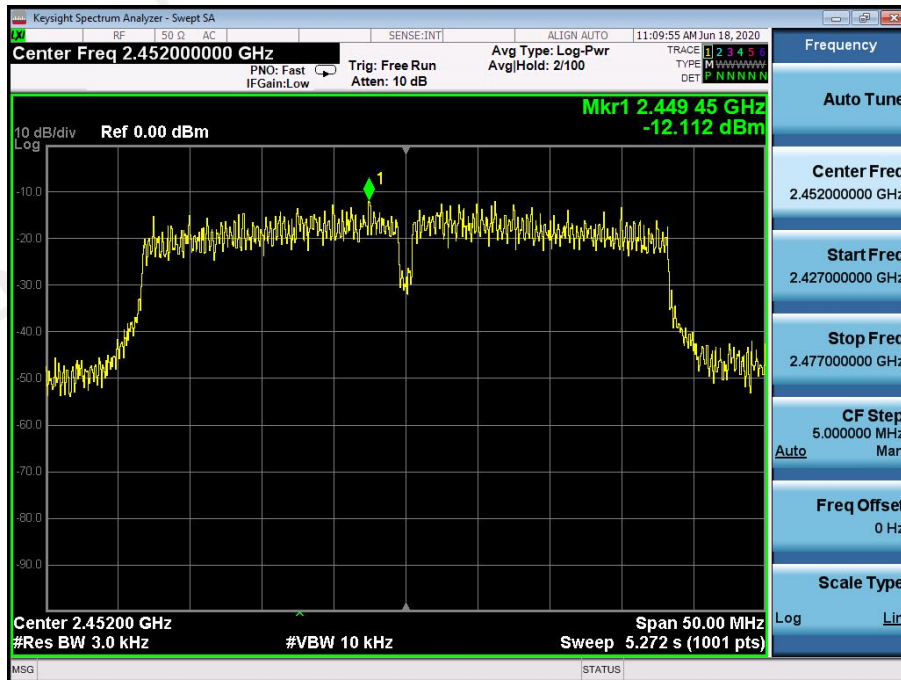
CH: 2422MHz



CH: 2437MHz



CH: 2452MHz





## 8. PEAK OUTPUT POWER TEST

### 8.1 Test Limit

FCC Part15(15.247), Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(b)(3)	Peak Output Power	1 watt or 30dBm	2400-2483.5	PASS

### 8.2 Test Procedure

1. The EUT was directly connected to the Power meter.

### 8.3 Measurement Equipment Used

Same as Radiated Emission Measurement

### 8.4 Test Result

PASS

All the test modes completed for test.

TX 802.11b Mode			
Test Channel	Frequency (MHz)	Maximum Peak Conducted Output Power (dBm)	LIMIT (dBm)
CH01	2412	<b>12.047</b>	30
CH06	2437	11.309	30
CH11	2462	11.357	30
TX 802.11g Mode			
CH01	2412	11.694	30
CH06	2437	11.436	30
CH11	2462	12.036	30
TX 802.11n20 Mode			
CH01	2412	11.245	30
CH06	2437	10.986	30
CH11	2462	10.364	30
TX 802.11n40 Mode			
CH03	2422	10.675	30
CH06	2437	9.486	30
CH09	2452	9.036	30

Note:

- 1) Measured output power at difference data rate for each mode and recorded worst case for each mode.
- 2). Test results including cable loss.

## 9. OUT OF BAND EMISSIONS TEST

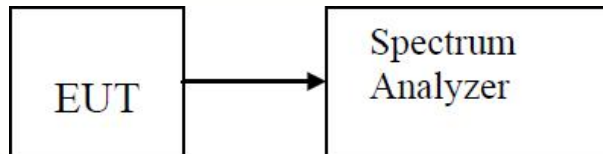
### 9.1 Test Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

### 9.2 Test Procedure

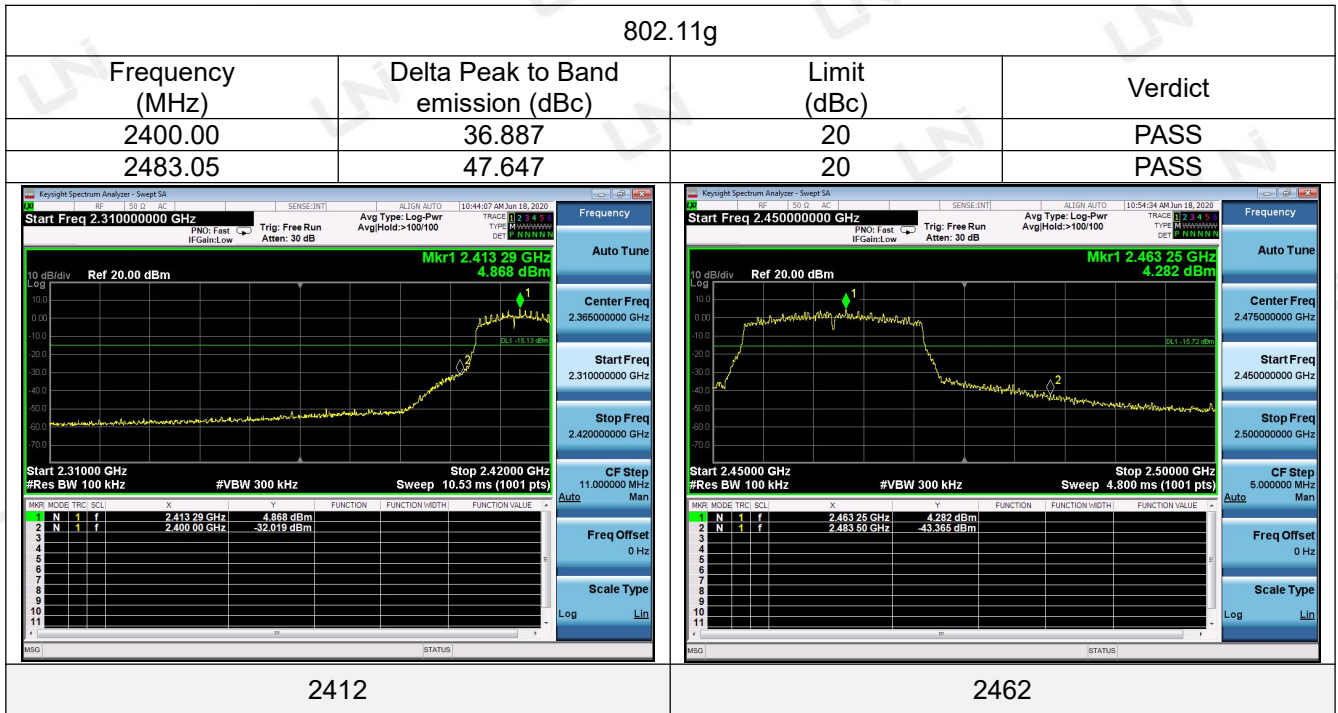
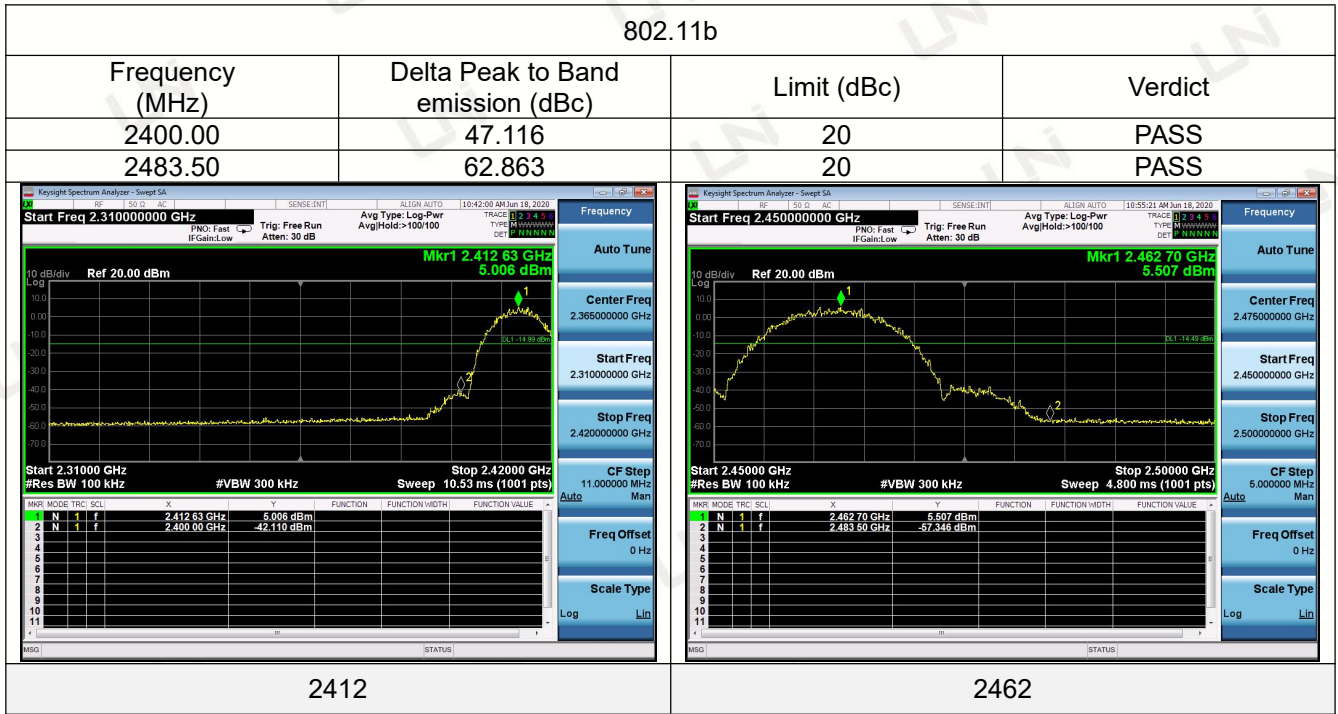
1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set EUT as TX operation and connect directly to the spectrum analyzer.
3. Based on FCC Part15 C Section 15.247: RBW=100KHz, VBW=300KHz.
4. Set detected by the spectrum analyzer with peak detector.

### 9.3 Test Setup



### 9.4 Test Result

PASS



802.11n HT20

Frequency (MHz)	Delta Peak to Band emission (dBc)	Limit (dBc)	Verdict
2400.00	37.426	20	PASS
2483.50	47.672	20	PASS

	2412
	2462

802.11n HT40

Frequency (MHz)	Delta Peak to Band emission (dBc)	Limit (dBc)	Verdict
2400.00	45.687	20	PASS
2483.50	41.526	20	PASS

	2422
	2452