TEST REPORT

Product Name : Tablet computer
Model Number : TAB201901
FCC ID : 2AUET-191813SRM

Prepared for : Badge Messenger Inc
Address : 11 Industrial Blvd. Sauk Rapids, MN 56379

Prepared by : EMTEK (DONGGUAN) CO., LTD.
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Report Number : ES200116039E3
Date(s) of Tests : January 16, 2020 to March 05, 2020
Date of issue : March 05, 2020

VERIFICATION OF COMPLIANCE

Applicant:	Badge Messenger Inc 11 Industrial Blvd. Sauk Rapids, MN 56379
Manufacturer:	Badge Messenger Inc 11 Industrial Blvd. Sauk Rapids, MN 56379
Product Description:	Tablet computer
Model Number:	TAB201901
Input Rating:	AC 120V/60Hz for adapter, DC 3.8V from battery

We hereby certify that:

The above equipment was tested by EMTEK(SHENZHEN) 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 : January 16, 2020 to March 05, 2020

Prepared by : Loren Luo /Editor

Reviewer : Tim Dong /Supervisor

Approved & Authorized Signer : Lisa Wang/Manager

Modified Information

Version	Summary	Revision Date	Report No.
Ver.1.0	Original Report	/	ES200116039E3

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APPENDIX I (PHOTOS OF EUT)(13PAGES)

1. General Information

1.1 Product Description

Characteristics	Description
Product Name	Tablet computer
Model number	TAB201901
Power Supply	AC 120V/60Hz for adapter, DC 3.8V from 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) 2422-2452MHz for 802.11n(HT40)
Number of Channels	11 for 20MHz bandwidth; 7 for 40MHz bandwidth
Transmit Power Max	802.11b: 8.65dBm 802.11g: 7.59 dBm 802.11n(HT20): 7.19Bm 802.11n(HT40): 5.98dBm
Antenna Type	PIFA Antenna
Antenna Gain	0 dBi

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.	Tablet computer	N/A	TAB201901	2AUET-191813SRM	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.
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; 802.11n (HT40): MCS0) were used for all test.

Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

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		

Frequency and Channel list for 802.11 n (HT40):

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
3	2422	5	2432	8	2447
4	2427	6	2437	9	2452
		7	2442		

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

Test Frequency and channel for 802.11 n (HT40):

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
3	2422	6	2437	9	2452

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	Pass
§15.247(d), §15.209	Radiated Emission	Pass
§15.247(d)	Antenna Port Emission	Pass
§15.247(b)&§15.203	Antenna Application	Pass

RELATED SUBMITTAL(S) / GRANT(S):

This submittal(s) (test report) is intended for FCC ID: 2AUET-191813SRM filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.
The system is compliance with Subpart B is authorized under a DOC procedure

5. Test Methodology

According to its specifications, the EUT must comply with the requirements of the following standards:
FCC 47 CFR Part 2, Subpart J
FCC 47 CFR Part 15, Subpart C
FCC KDB 558074 DTS D01 Meas. Guidance v05r02.
FCC KDB 662911 D01 Multiple Transmitter Output v01

6. Test Facility

Site Description

EMC Lab : Accredited by CNAS, 2016.10.24
The certificate is valid until 2022.10.28
The Laboratory has been assessed and proved to be in compliance with CNAS-CL01:2006 (identical to ISO/IEC 17025:2005)
The Certificate Registration Number is L2291.

Accredited by TUV Rheinland Shenzhen 2016.5.19
The Laboratory has been assessed according to the requirements ISO/IEC 17025.

Accredited by FCC, August 03, 2017
Designation Number: CN1204
Test Firm Registration Number: 882943

Accredited by Industry Canada, November 24, 2015
The Certificate Registration Number is 4480A.

Accredited by A2LA, July 31, 2017
The Certificate Number is 4321.01.

Name of Firm : EMTEK(SHENZHEN) CO., LTD.
Bldg 69, Majialong Industry Zone, Nanshan District, Shenzhen, Guangdong, China.

7. TEST SYSTEM UNCERTAINTY

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

Parameter	Uncertainty
Radio Frequency	±1x10^-5
Maximum Peak Output Power Test	±1.0dB
Conducted Emissions Test	±2.0dB
Radiated Emission Test	±2.0dB
Power Density	±2.0dB
Occupied Bandwidth Test	±1.0dB
Band Edge Test	±3dB
All emission, radiated	±3dB
Antenna Port Emission	±3dB
Temperature	±0.5℃
Humidity	±3%

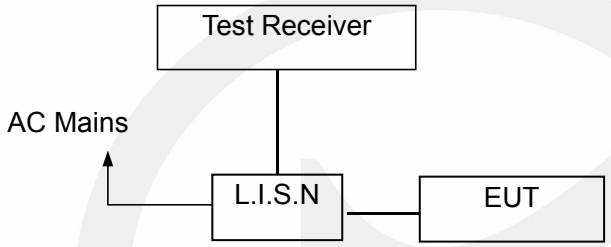
Measurement Uncertainty for a level of Confidence of 95%

8. Conducted Emissions Test

8.1 Measurement Procedure

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

8.2 Test SET-UP (Block Diagram of Configuration)



8.3 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**Last Cal.**	**Due date**
Test Receiver	Rohde & Schwarz	ESCS30	100018	05/23/2019	05/22/2020
L.I.S.N	Rohde & Schwarz	ENV216	100017	05/23/2019	05/22/2020
RF Switching Unit	CDS	RSU-M2	38401	05/23/2019	05/22/2020
Coaxial Cable	CDS	79254	46107086	05/23/2019	05/22/2020

8.4 Conducted Emission Limit

Conducted Emission

Frequency(MHz)	**Quasi-peak**	**Average**
0.15-0.5	66-56	56-46
0.5-5.0	56	46
5.0-30.0	60	50

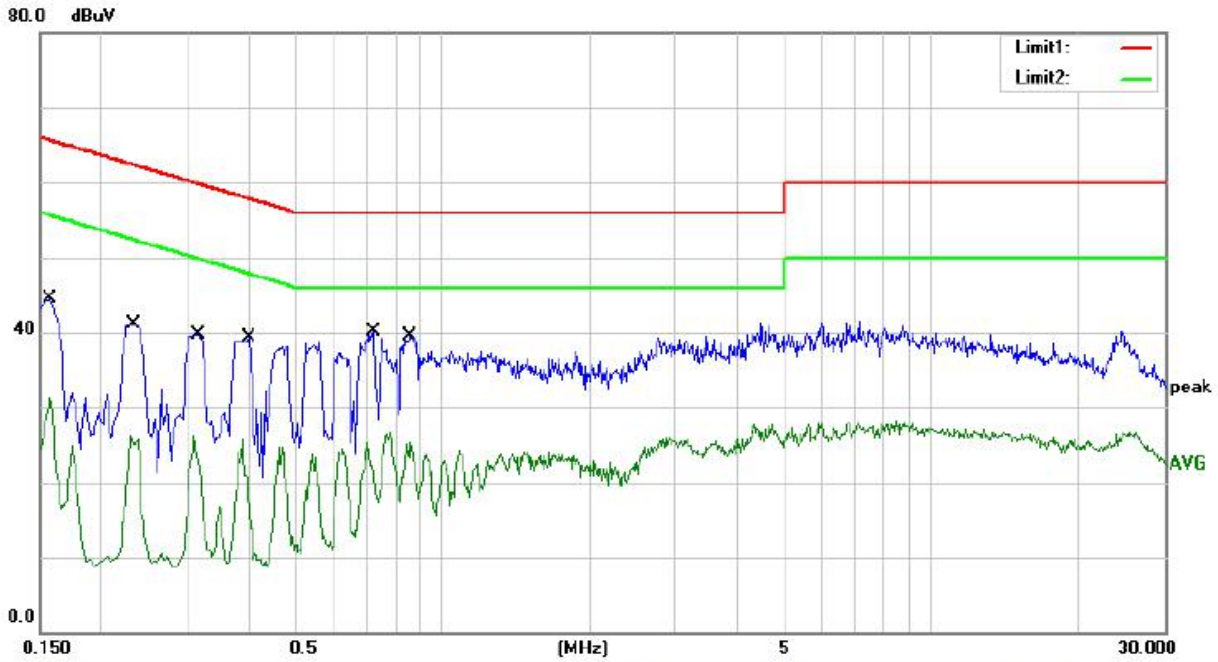
Note: 1. The lower limit shall apply at the transition frequencies
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

8.5 Measurement Result:

Operation Mode:	TX	Test Date :	February 25, 2020
Frequency Range:	0.15MHz~30MHz	Temperature :	28℃
Test Result:	PASS	Humidity :	65 %
Test By:	Loren		

Pass.
Conducted emission at both 120V & 240V, and emission at 120V represents the worst case. All the modulation modes were tested the data of the worst mode (GFSK TX 2402MHz) are recorded in the following pages and the others modulation methods do not exceed the limits.

Please refer to the following data.



Site site #1 Phase: N Temperature: 25

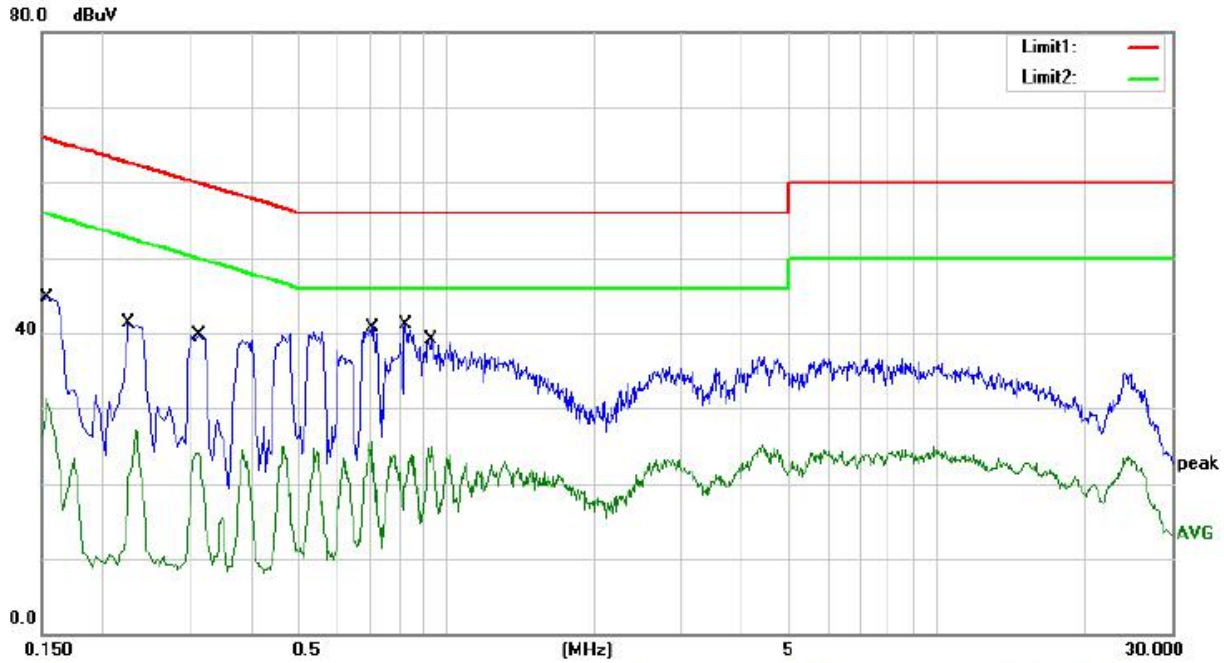
Limit: (CE)FCC PART 15 C_QP Power: AC 120V/60Hz Humidity: 55 %

Mode: TX 2412

Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1580	34.43	10.01	44.44	65.57	-21.13	QP	
2		0.1580	21.20	10.01	31.21	55.57	-24.36	AVG	
3		0.2340	31.13	10.05	41.18	62.31	-21.13	QP	
4		0.2340	16.27	10.05	26.32	52.31	-25.99	AVG	
5		0.3180	29.68	10.09	39.77	59.76	-19.99	QP	
6		0.3180	16.20	10.09	26.29	49.76	-23.47	AVG	
7		0.4020	29.14	10.13	39.27	57.81	-18.54	QP	
8		0.4020	15.50	10.13	25.63	47.81	-22.18	AVG	
9	*	0.7260	29.91	10.18	40.09	56.00	-15.91	QP	
10		0.7260	16.40	10.18	26.58	46.00	-19.42	AVG	
11		0.8580	29.34	10.18	39.52	56.00	-16.48	QP	
12		0.8580	15.12	10.18	25.30	46.00	-20.70	AVG	

*:Maximum data x:Over limit !:over margin Comment: Factor build in receiver. Operator: Lian



Site site #1 Phase: L1 Temperature: 25

Limit: (CE)FCC PART 15 C_QP Power: AC 120V/60Hz Humidity: 55 %

Mode: TX 2412

Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1540	34.68	10.01	44.69	65.78	-21.09	QP	
2		0.1540	21.26	10.01	31.27	55.78	-24.51	AVG	
3		0.2260	31.18	10.05	41.23	62.60	-21.37	QP	
4		0.2260	17.00	10.05	27.05	52.60	-25.55	AVG	
5		0.3140	29.66	10.09	39.75	59.86	-20.11	QP	
6		0.3140	14.06	10.09	24.15	49.86	-25.71	AVG	
7		0.7060	30.45	10.18	40.63	56.00	-15.37	QP	
8		0.7060	15.24	10.18	25.42	46.00	-20.58	AVG	
9	*	0.8300	30.86	10.18	41.04	56.00	-14.96	QP	
10		0.8300	13.80	10.18	23.98	46.00	-22.02	AVG	
11		0.9380	29.01	10.18	39.19	56.00	-16.81	QP	
12		0.9380	14.66	10.18	24.84	46.00	-21.16	AVG	

*:Maximum data x:Over limit !:over margin Comment: Factor build in receiver. Operator: Lian

8.6 Conducted Measurement Photos:

9. Radiated Emission Test

9.1 Measurement Procedure

1. 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.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measured was complete.

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

EMI Test Receiver	Setting
Attenuation	Auto
RBW	120KHz
VBW	300KHz
Detector	QP
Trace	Max hold

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

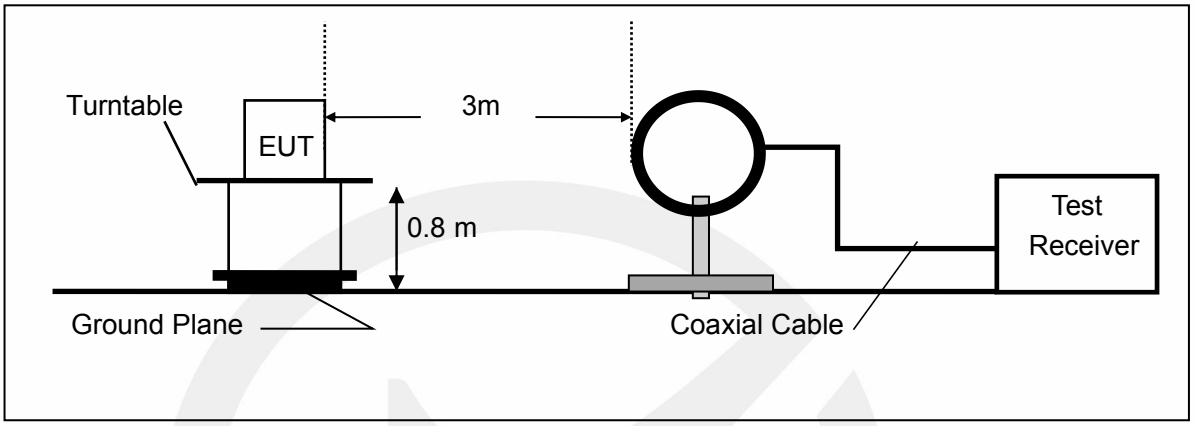
EMI Test Receiver	Setting
Attenuation	Auto
RBW	1MHz
VBW	3MHz
Detector	Peak
Trace	Max hold

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

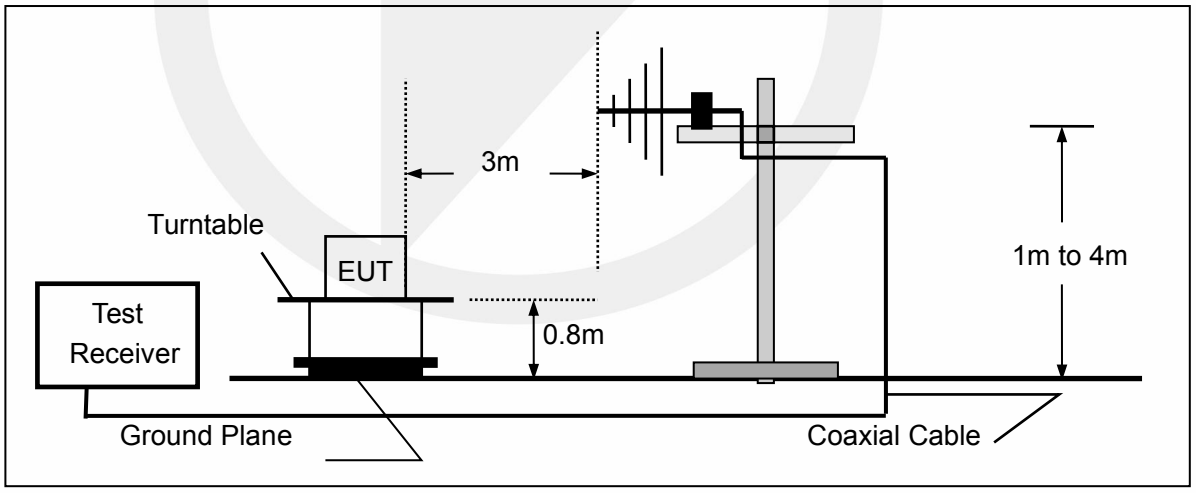
EMI Test Receiver	Setting
Attenuation	Auto
RBW	1MHz
VBW	10Hz
Detector	Peak
Trace	Max hold

9.2 Test SET-UP (Block Diagram of Configuration)

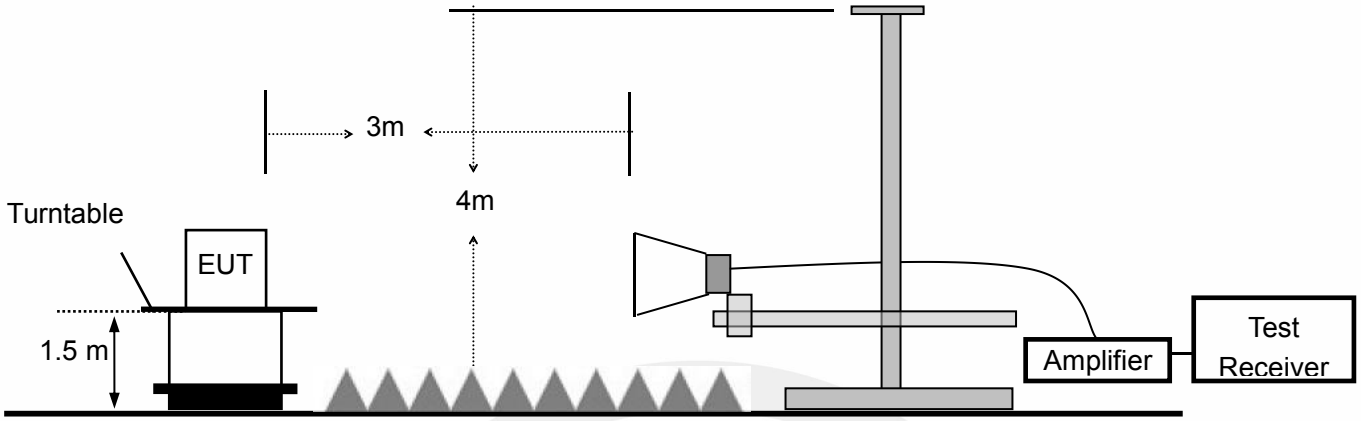
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



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



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



9.3 Measurement Equipment Used

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Test Receiver	Rohde & Schwarz	ESCI	1166.5950.03	05/23/2019	1 Year
2.	Bilog Antenna	Schwarzbeck	VULB9163	000141	05/23/2019	1 Year
3.	Power Amplifier	CDS	RSU-M352	818	05/23/2019	1 Year
4.	Power Amplifier	HP	8447F	OPT H64	05/23/2019	1 Year
5.	Color Monitor	SUNSPO	SP-140A	N/A	05/23/2019	1 Year
6.	Single Line Filter	JIANLI	XL-3	N/A	05/23/2019	1 Year
7.	Single Phase Power Line Filter	JIANLI	DL-2X100B	N/A	05/23/2019	1 Year
8.	3 Phase Power Line Filter	JIANLI	DL-4X100B	N/A	05/23/2019	1 Year
9.	DC Power Filter	JIANLI	DL-2X50B	N/A	05/23/2019	1 Year
10.	Cable	Schwarzbeck	PLF-100	549489	05/23/2019	1 Year
11.	Cable	Rosenberger	CIL02	A0783566	05/23/2019	1 Year
12.	Cable	Rosenberger	RG 233/U	525178	05/23/2019	1 Year
13.	Signal Analyzer	Rohde & Schwarz	FSV30	103040	05/23/2019	1 Year
14.	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-1272	05/23/2019	1 Year
15.	Power Amplifier	LUNAR EM	LNA1G18-40	J10100000081	05/23/2019	1 Year
16.	Cable	H+S	CBL-26	N/A	05/23/2019	1 Year
17.	Cable	H+S	CBL-26	N/A	05/23/2019	1 Year
18.	Cable	H+S	CBL-26	N/A	05/23/2019	1 Year

9.4 Radiated Emission Limit

The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table15.209(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

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 ξ 15.205, and the emissions located in restricted bands also comply with 15.209 limit.

9.5 Measurement Result

Below 30MHz:

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

Operation Mode:	TX Mode	Test Date :	February 25, 2020
Frequency Range:	9KHz~30MHz	Temperature :	28℃
Test Result:	PASS	Humidity :	60 %
Measured Distance:	3m	Test By:	Lian

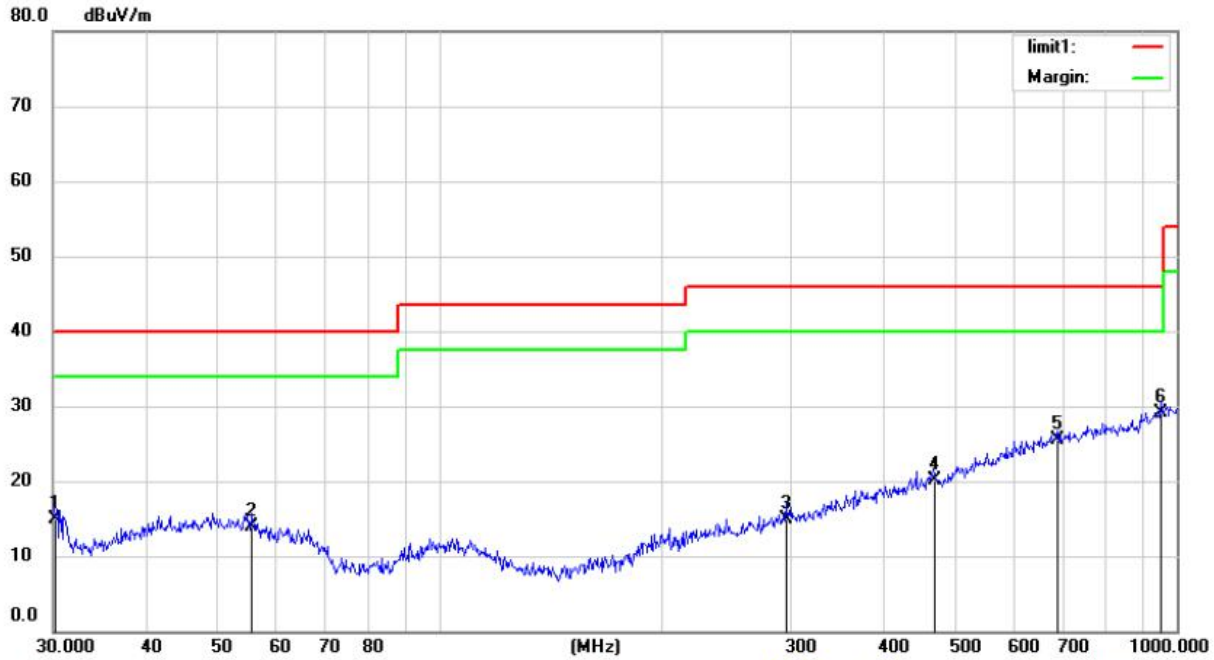
Freq. (MHz)	Ant.Pol. H/V	Emission Level (dBuV/m)	Limit 3m (dBuV/m)	Over (dB)
--	--	--	--	--

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 =40log(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 2462MHz) 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

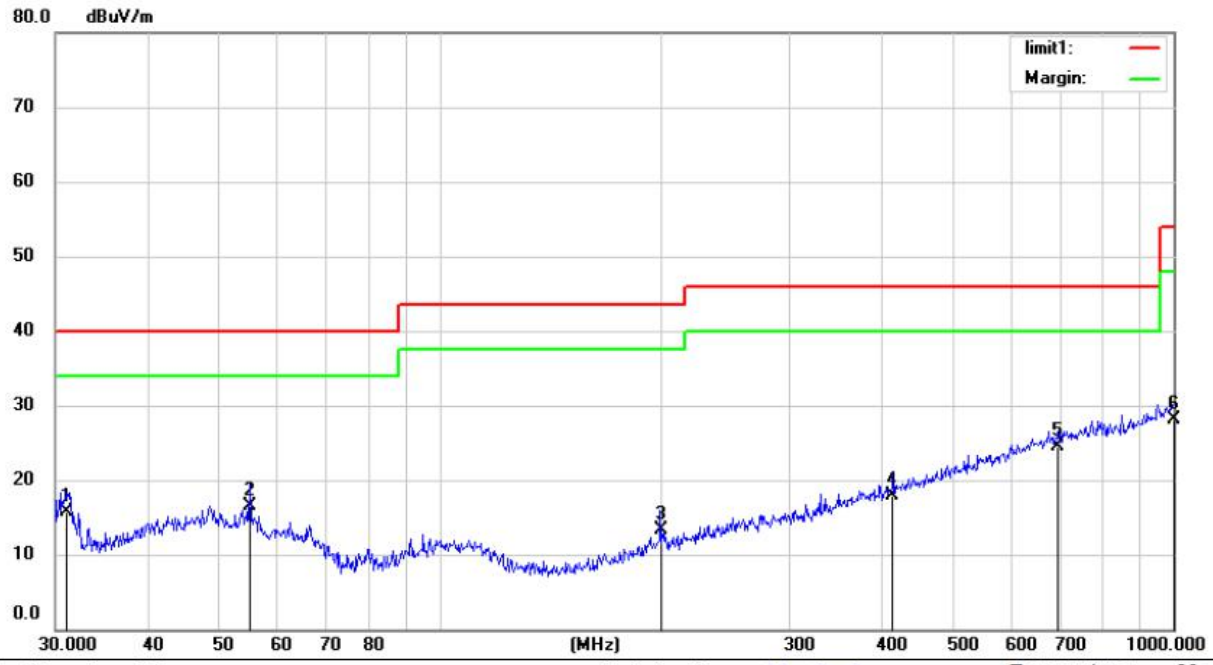
Limit: (RE)FCC PART 15 C 3m Power: DC 3.8V Humidity: 55 %

Mode: TX 2412

Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		30.1054	33.64	-18.78	14.86	40.00	-25.14	QP			
2		55.6094	29.84	-16.02	13.82	40.00	-26.18	QP			
3		295.1470	28.63	-13.79	14.84	46.00	-31.16	QP			
4		467.2350	29.84	-9.76	20.08	46.00	-25.92	QP			
5		689.5644	29.87	-4.46	25.41	46.00	-20.59	QP			
6	*	952.0937	29.57	-0.47	29.10	46.00	-16.90	QP			

*:Maximum data x:Over limit I:over margin Operator: Lian



Site Chamber #1 Polarization: ***Vertical*** Temperature: 26

Limit: (RE)FCC PART 15 C 3m Power: DC 3.8V Humidity: 55 %

Mode:TX 2412

Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		30.9620	34.58	-18.87	15.71	40.00	-24.29	QP			
2		55.2207	32.46	-15.97	16.49	40.00	-23.51	QP			
3		199.9856	30.47	-17.25	13.22	43.50	-30.28	QP			
4		414.7223	28.63	-10.65	17.98	46.00	-28.02	QP			
5	*	696.8567	28.74	-4.28	24.46	46.00	-21.54	QP			
6		1000.000	27.63	0.40	28.03	54.00	-25.97	QP			

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

Above 1000MHz:

Operation Mode: 802.11b Lowest
Test Voltage: DC 3.8V
Test Date : February 25, 2020
Test by: Lian

Freq.	Ant. Pol.	Reading Level(dBuV/m)		Correct Factor	Emission Level(dBuV/m)		Limit 3m		Margin(dB)	
(MHz)	H/V	PK	AV	dB	PK	AV	PK	AV	PK	AV
4824	V	96.82	75.51	-32.15	64.67	43.36	74	54	-9.33	-10.64
7236	V	95.75	75.77	-37.58	58.17	38.19	74	54	-15.83	-15.81
9648	V	91.99	74.19	-39.54	52.45	34.65	74	54	-21.55	-19.35
12060	V	94.95	76.57	-40.11	54.84	36.46	74	54	-19.16	-17.54
14472	V	97.31	72.03	-40.98	56.33	31.05	74	54	-17.67	-22.95
16884	V	96.28	73.04	-40.07	56.21	32.97	74	54	-17.79	-21.03
4824	H	93.50	72.47	-31.46	62.04	41.01	74	54	-11.96	-12.99
7236	H	96.41	76.85	-35.68	60.73	41.17	74	54	-13.27	-12.83
9648	H	97.73	70.73	-38.29	59.44	32.44	74	54	-14.56	-21.56
12060	H	91.59	74.33	-39.16	52.43	35.17	74	54	-21.57	-18.83
14472	H	93.39	74.97	-42.13	51.26	32.84	74	54	-22.74	-21.16
16884	H	98.81	76.16	-39.64	59.17	36.52	74	54	-14.83	-17.48

Operation Mode: 802.11b Middle
Test Voltage: DC 3.8V
Test Date : February 25, 2020
Test by: Loren

Freq.	Ant. Pol.	Reading Level(dBuV/m)		Correct Factor	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Margin(dB)	
(MHz)	H/V	PK	AV	dB	PK	AV	PK	AV	PK	AV
4874	V	97.90	73.73	-31.25	66.65	42.48	74	54	-7.35	-11.52
7311	V	98.30	75.28	-37.46	60.84	37.82	74	54	-13.16	-16.18
9748	V	92.70	75.41	-39.62	53.08	35.79	74	54	-20.92	-18.21
12185	V	93.67	70.94	-40.27	53.4	30.67	74	54	-20.60	-23.33
14622	V	95.46	70.30	-41.57	53.89	28.73	74	54	-20.11	-25.27
17059	V	94.73	70.80	-41.11	53.62	29.69	74	54	-20.38	-24.31
4874	H	98.28	70.80	-31.59	66.69	39.21	74	54	-7.31	-14.79
7311	H	93.79	73.67	-35.67	58.12	38	74	54	-15.88	-16.00
9748	H	97.10	71.50	-39.27	57.83	32.23	74	54	-16.17	-21.77
12185	H	94.22	72.06	-39.14	55.08	32.92	74	54	-18.92	-21.08
14622	H	97.94	74.98	-42.57	55.37	32.41	74	54	-18.63	-21.59
17059	H	93.13	71.17	-41.52	51.61	29.65	74	54	-22.39	-24.35

Operation Mode: 802.11b Highest

Test Voltage: DC 3.8V

Test Date : February 25, 2020

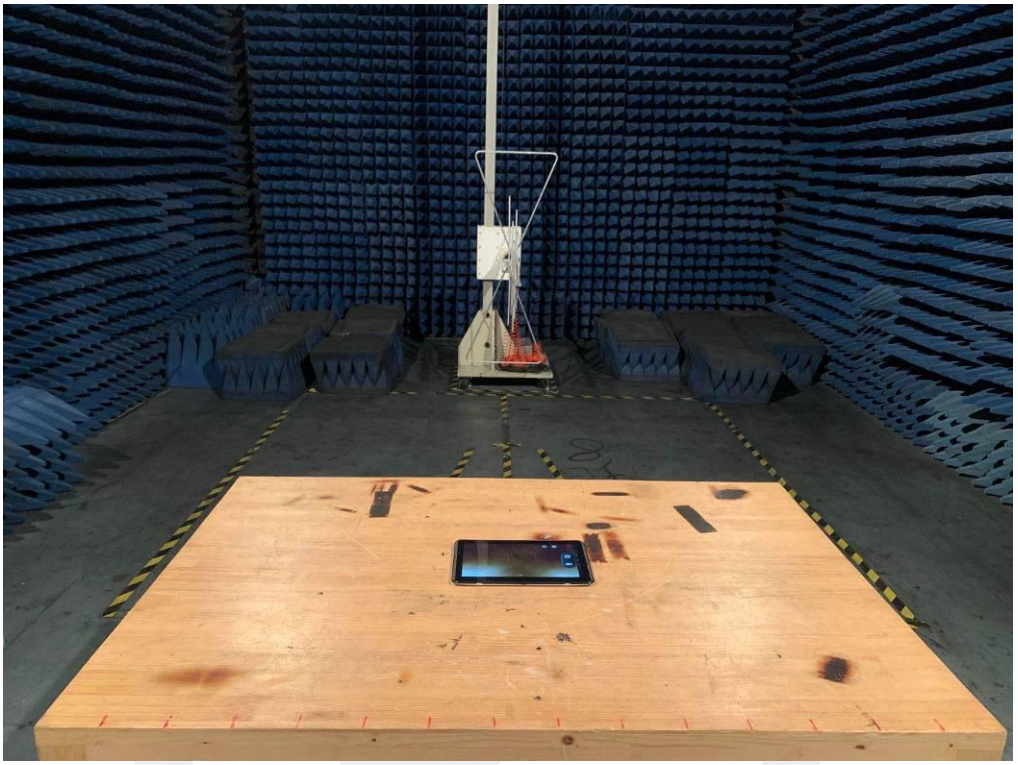
Test by: Loren

Freq.	Ant. Pol.	Reading Level(dBuV/m)		Correct Factor	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
(MHz)	H/V	PK	AV	dB	PK	AV	PK	AV	PK	AV
4924	V	95.02	73.10	-31.99	63.03	41.11	74	54	-10.97	-12.89
7386	V	97.83	76.18	-37.12	60.71	39.06	74	54	-13.29	-14.94
9848	V	95.15	76.90	-39.03	56.12	37.87	74	54	-17.88	-16.13
12310	V	97.85	74.98	-40.09	57.76	34.89	74	54	-16.24	-19.11
14772	V	92.78	72.52	-41.15	51.63	31.37	74	54	-22.37	-22.63
17234	V	93.44	74.74	-41.37	52.07	33.37	74	54	-21.93	-20.63
4924	H	94.12	75.23	-31.19	62.93	44.04	74	54	-11.07	-9.96
7386	H	97.62	73.70	-36.54	61.08	37.16	74	54	-12.92	-16.84
9848	H	91.72	71.72	-38.64	53.08	33.08	74	54	-20.92	-20.92
12310	H	95.23	70.66	-39.67	55.56	30.99	74	54	-18.44	-23.01
14772	H	94.86	73.21	-42.17	52.69	31.04	74	54	-21.31	-22.96
17234	H	95.10	72.03	-41.56	53.54	30.47	74	54	-20.46	-23.53

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

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.

9.6 Radiated Measurement Photos:



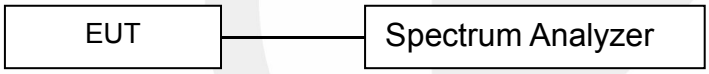
10. 6dB Bandwidth Test

10.1 Measurement Procedure

The EUT was operating in IEEE 802.11b, 802.11g, 802.11n(HT20), 802.11n(HT40) 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) ≥ 3 x 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.

10.2 Test SET-UP (Block Diagram of Configuration)



10.3 Measurement Equipment Used

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	FSV30	1321.3008K	05/23/2019	05/22/2020

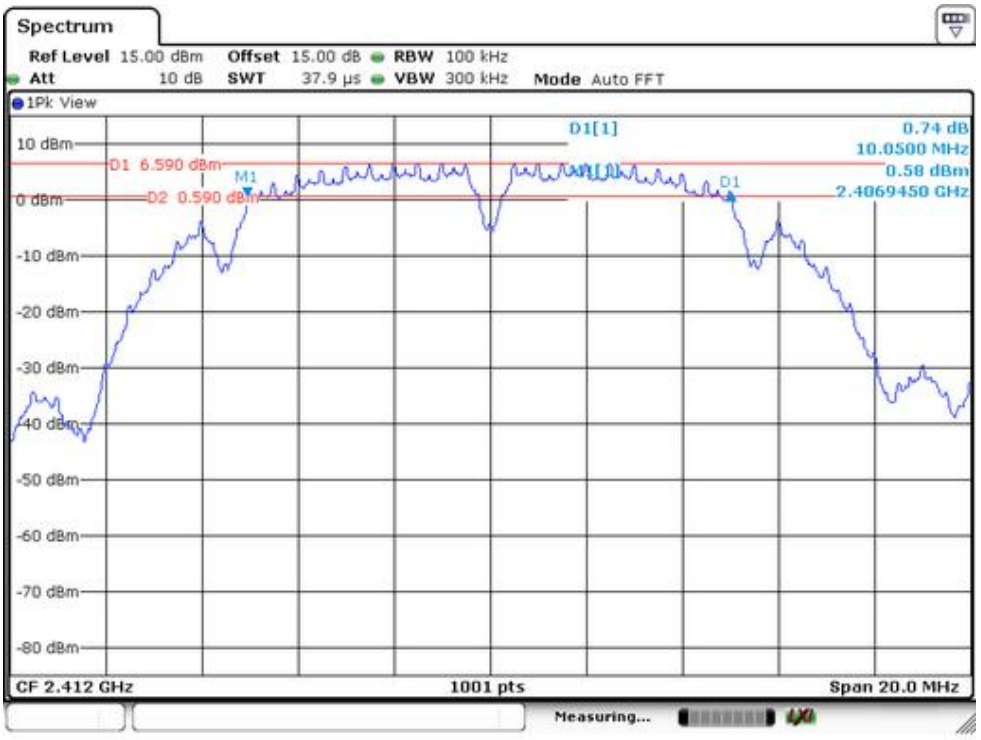
10.4 Measurement Results

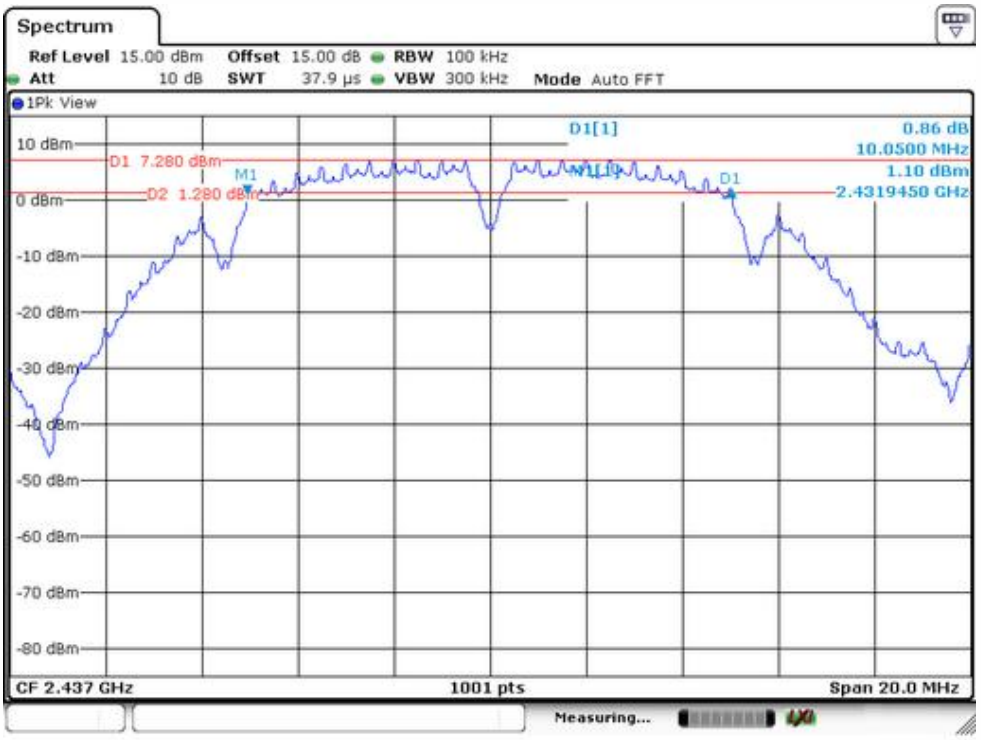
6 Bandwidth Test Data Chart:

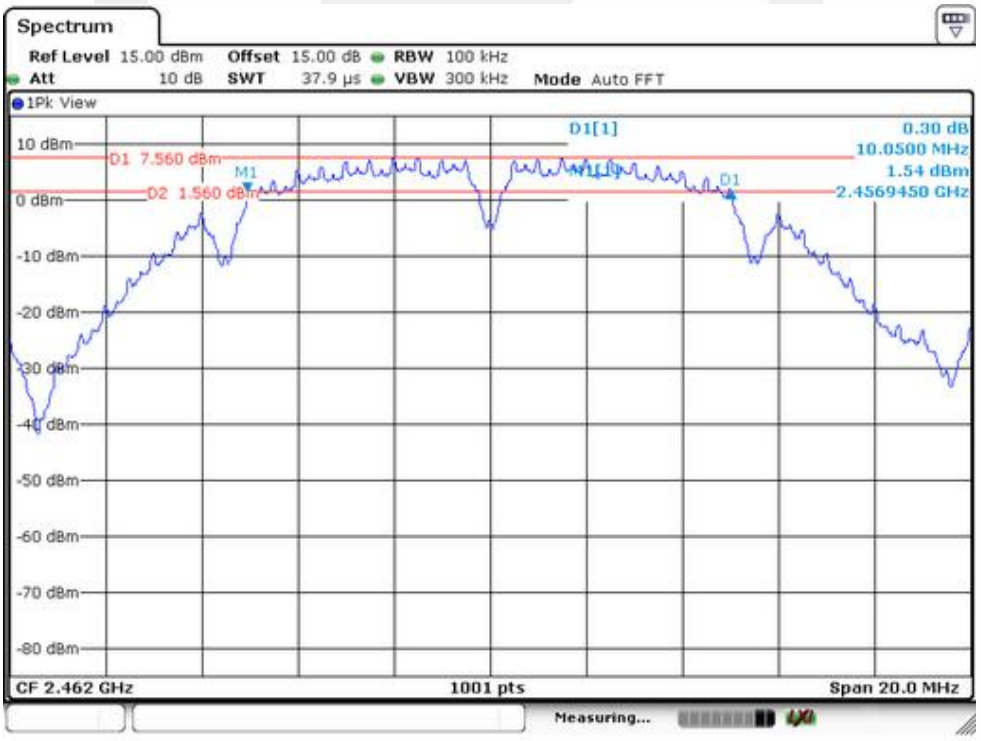
Refer to attached data chart.

Spectrum Detector:	PK	Test Date :	February 25, 2020
Test By:	Lian	Temperature :	28℃
Humidity :	60%		

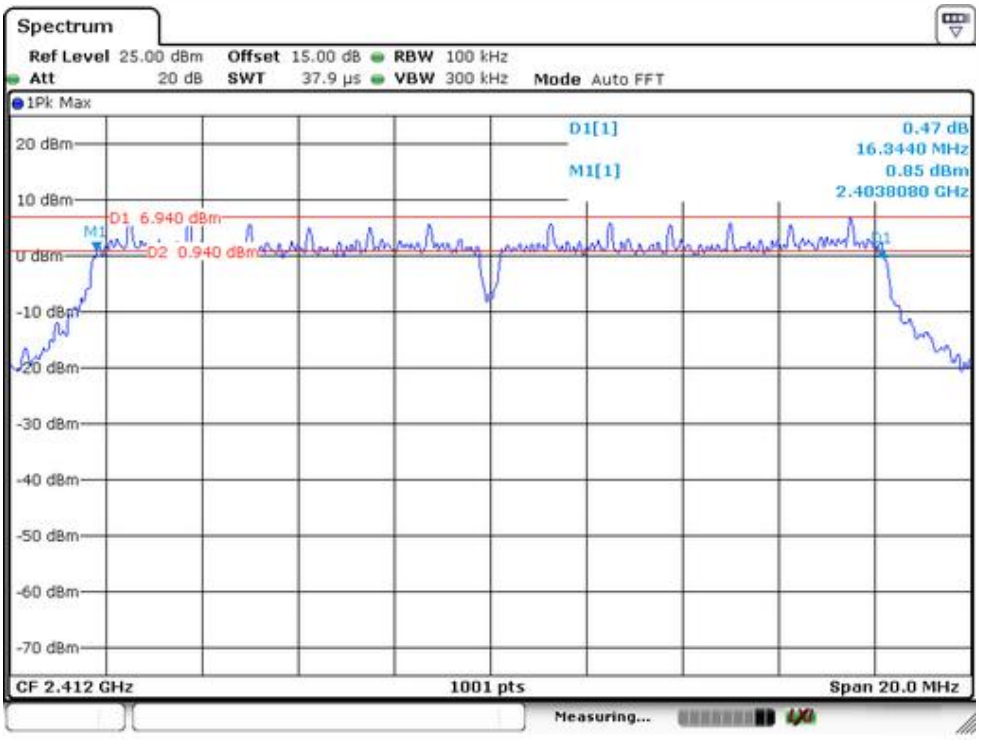
IEEE 802.11b			
Channel frequency (MHz)	Measurement level (KHz)	Required Limit (KHz)	Result
2412	10050	>500	Pass
2437	10050	>500	
2462	10050	>500	

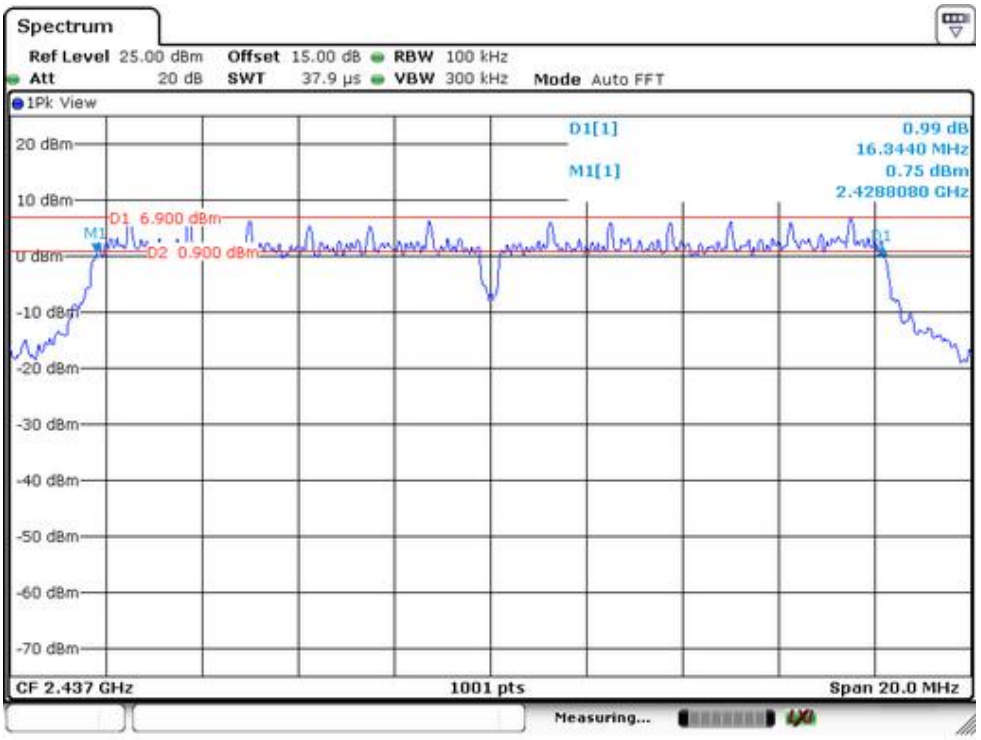


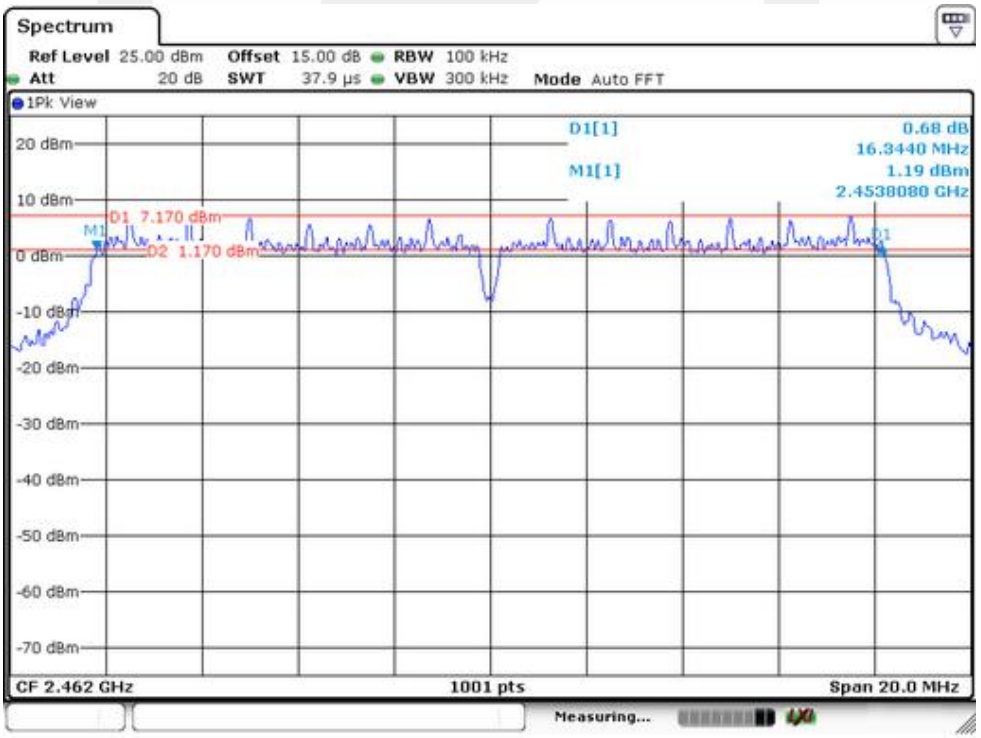

Spectrum
Ref Level 15.00 dBm Offset 15.00 dB RBW 100 kHz
Att 10 dB SWT 37.9 µs VBW 300 kHz Mode Auto FFT
1Pk View
D1[1]
0.86 dB
10.0500 MHz
1.10 dBm
2.4319450 GHz
D1 7.280 dBm
D2 1.280 dBm
M1
D1
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.437 GHz
1001 pts
Span 20.0 MHz
Measuring...


Spectrum
Ref Level 15.00 dBm Offset 15.00 dB RBW 100 kHz
Att 10 dB SWT 37.9 µs VBW 300 kHz Mode Auto FFT
1Pk View
D1[1]
0.30 dB
10.0500 MHz
1.54 dBm
2.4569450 GHz
D1 7.560 dBm
D2 1.560 dBm
M1
D1
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.462 GHz
1001 pts
Span 20.0 MHz
Measuring...

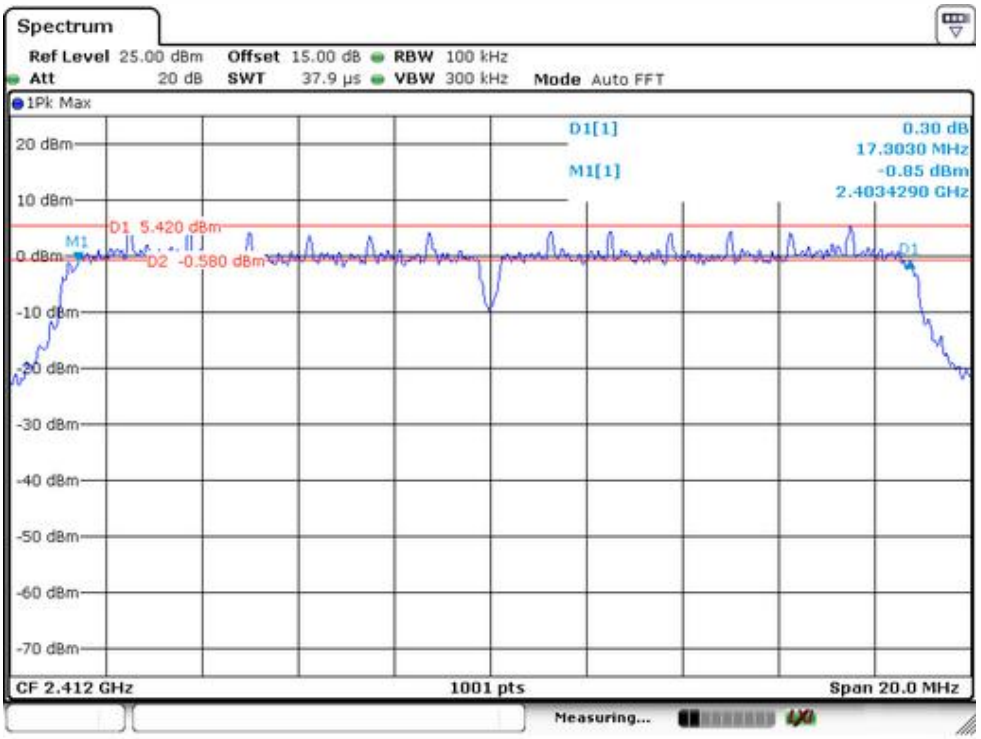
IEEE 802.11g			
Channel frequency (MHz)	Measurement level (KHz)	Required Limit (KHz)	Result
2412	16344	>500	Pass
2437	16344	>500	
2462	16344	>500	

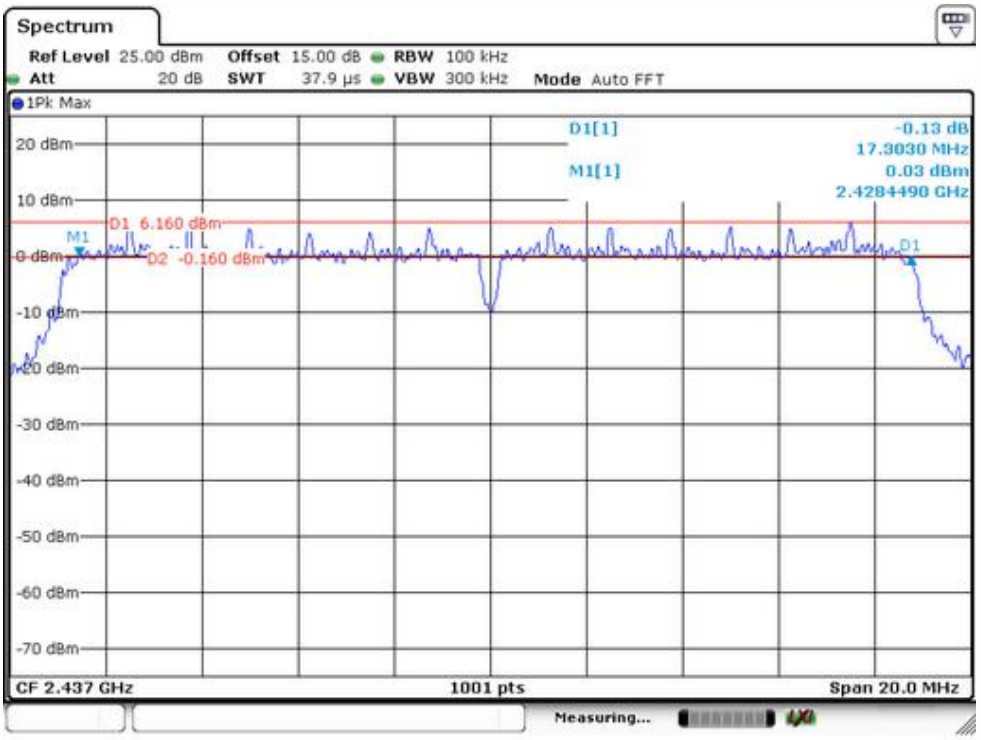


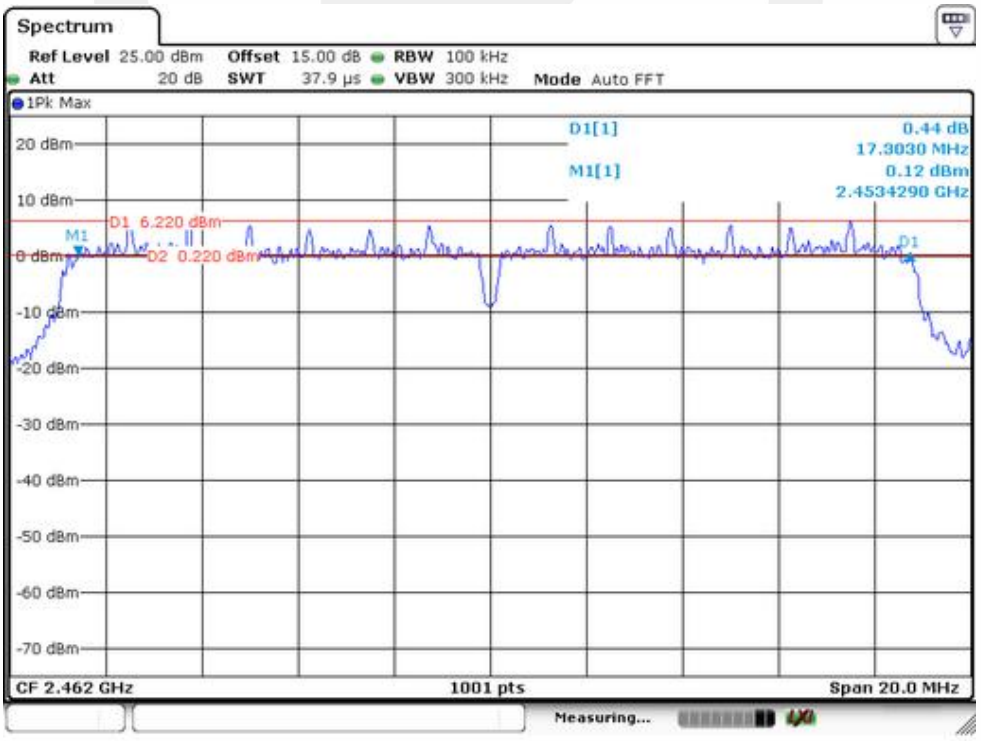

Spectrum
Ref Level 25.00 dBm Offset 15.00 dB RBW 100 kHz
Att 20 dB SWT 37.9 µs VBW 300 kHz Mode Auto FFT
1Pk View
D1[1] 0.99 dB
16.3440 MHz
M1[1] 0.75 dBm
2.4288080 GHz
D1 6.900 dBm
D2 0.900 dBm
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
CF 2.437 GHz
1001 pts
Span 20.0 MHz
Measuring...


Spectrum
Ref Level 25.00 dBm Offset 15.00 dB RBW 100 kHz
Att 20 dB SWT 37.9 µs VBW 300 kHz Mode Auto FFT
1Pk View
D1[1] 0.68 dB
16.3440 MHz
M1[1] 1.19 dBm
2.4538080 GHz
D1 7.170 dBm
D2 1.170 dBm
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
CF 2.462 GHz
1001 pts
Span 20.0 MHz
Measuring...

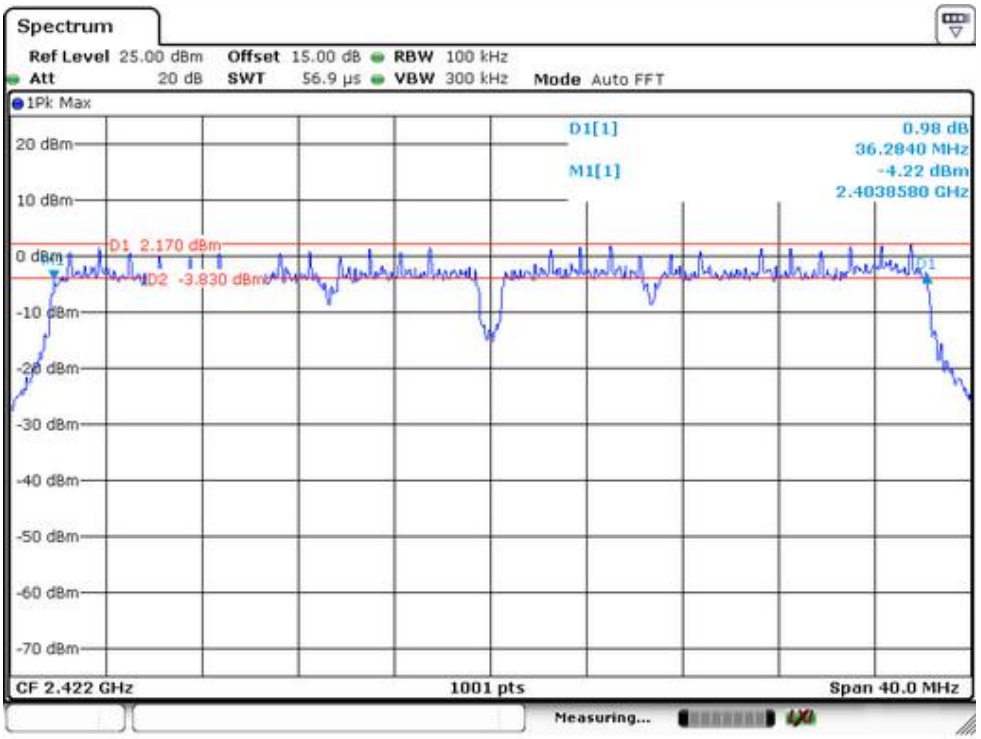
IEEE 802.11n(HT20)			
Channel frequency (MHz)	Measurement level (KHz)	Required Limit (KHz)	Result
2412	17303	>500	Pass
2437	17303	>500	
2462	17303	>500	

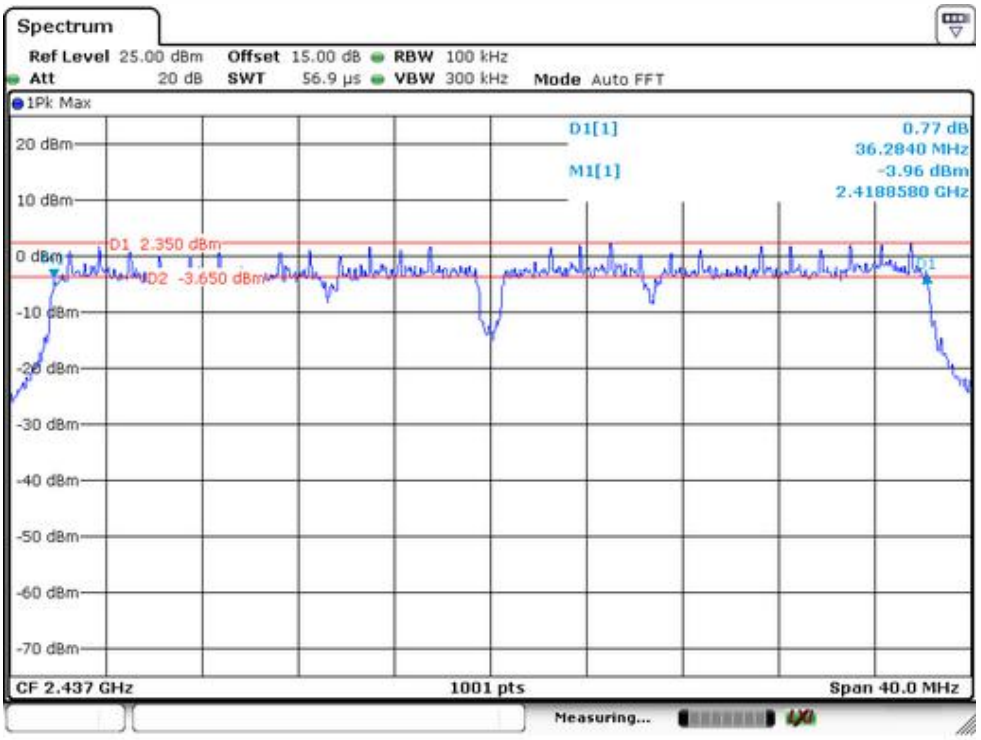


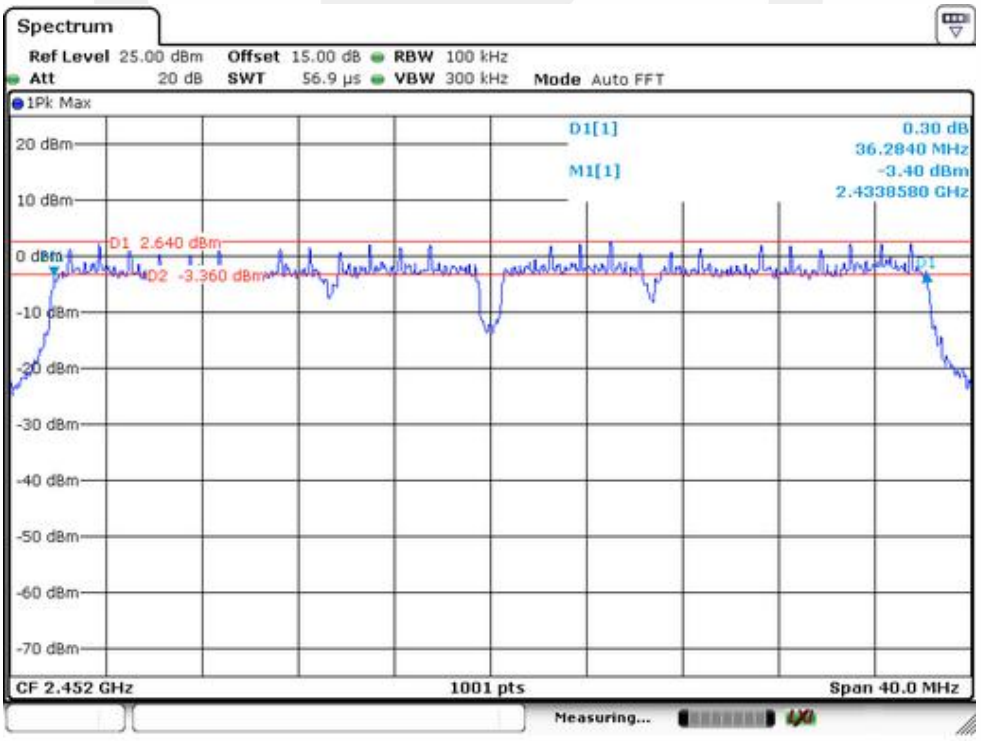

Spectrum
Ref Level 25.00 dBm Offset 15.00 dB RBW 100 kHz
Att 20 dB SWT 37.9 µs VBW 300 kHz Mode Auto FFT
1Pk Max
D1[1] -0.13 dB
17.3030 MHz
M1[1] 0.03 dBm
2.4284490 GHz
D1 6.160 dBm
D2 -0.160 dBm
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
CF 2.437 GHz
1001 pts
Span 20.0 MHz
Measuring...


Spectrum
Ref Level 25.00 dBm Offset 15.00 dB RBW 100 kHz
Att 20 dB SWT 37.9 µs VBW 300 kHz Mode Auto FFT
1Pk Max
D1[1] 0.44 dB
17.3030 MHz
M1[1] 0.12 dBm
2.4534290 GHz
D1 6.220 dBm
D2 0.220 dBm
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
CF 2.462 GHz
1001 pts
Span 20.0 MHz
Measuring...

IEEE 802.11n (HT40)			
Channel frequency (MHz)	Measurement level (KHz)	Required Limit (KHz)	Result
2422	36284	>500	Pass
2437	36284	>500	
2452	36284	>500	




Spectrum
Ref Level 25.00 dBm Offset 15.00 dB RBW 100 kHz
Att 20 dB SWT 56.9 µs VBW 300 kHz Mode Auto FFT
1Pk Max
D1[1] 0.77 dB
36.2840 MHz
M1[1] -3.96 dBm
2.4188580 GHz
D1 2.350 dBm
D2 -3.650 dBm
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
CF 2.437 GHz
1001 pts
Span 40.0 MHz
Measuring...


Spectrum
Ref Level 25.00 dBm Offset 15.00 dB RBW 100 kHz
Att 20 dB SWT 56.9 µs VBW 300 kHz Mode Auto FFT
1Pk Max
D1[1] 0.30 dB
36.2840 MHz
M1[1] -3.40 dBm
2.4338580 GHz
D1 2.640 dBm
D2 -3.360 dBm
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
CF 2.452 GHz
1001 pts
Span 40.0 MHz
Measuring...

11. Maximum Peak Output Power Test

11.1 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.

11.2 Test SET-UP (Block Diagram of Configuration)

11.3 Measurement Equipment Used

EQUIPMENT TYPE	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power meter	ML2495A	0824006	05/23/2019	05/22/2020
Power sensor	MA2411B	0738172	05/23/2019	05/22/2020

11.4 Peak Power output limit

The maximum peak conducted output power of the intentional radiator for systems using digital modulation in the 2400 - 2483.5 MHz bands shall not exceed: 1 Watt (30dBm).

11.5 Measurement Results

Spectrum Detector:	PK	Test Date :	February 25, 2020
Test By:	Loren	Temperature :	28℃
Test Result:	PASS	Humidity :	60%

Test Channel	Peak Output Power (dBm)				Limit(dBm)	Result
	802.11b	802.11g	802.11n(HT20)	802.11n(HT40)		
Lowest	8.65	7.59	7.14	5.98	30	Pass
Middle	8.59	7.52	7.11	5.67		
Highest	8.53	7.55	7.19	5.86		

12. Band Edge Test

12.1 Measurement Procedure

For Conducted Test

1. The testing follows FCC KDB Publication No. 558074 DTS D01 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 DTS D01 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 0.8 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
RBW	1MHz
VBW	3MHz
Detector	Peak
Trace	Max hold

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

EMI Test Receiver	Setting
Attenuation	Auto
RBW	1MHz
VBW	10Hz
Detector	Peak
Trace	Max hold

12.2 Test SET-UP (Block Diagram of Configuration)

EUT —— Spectrum Analyzer

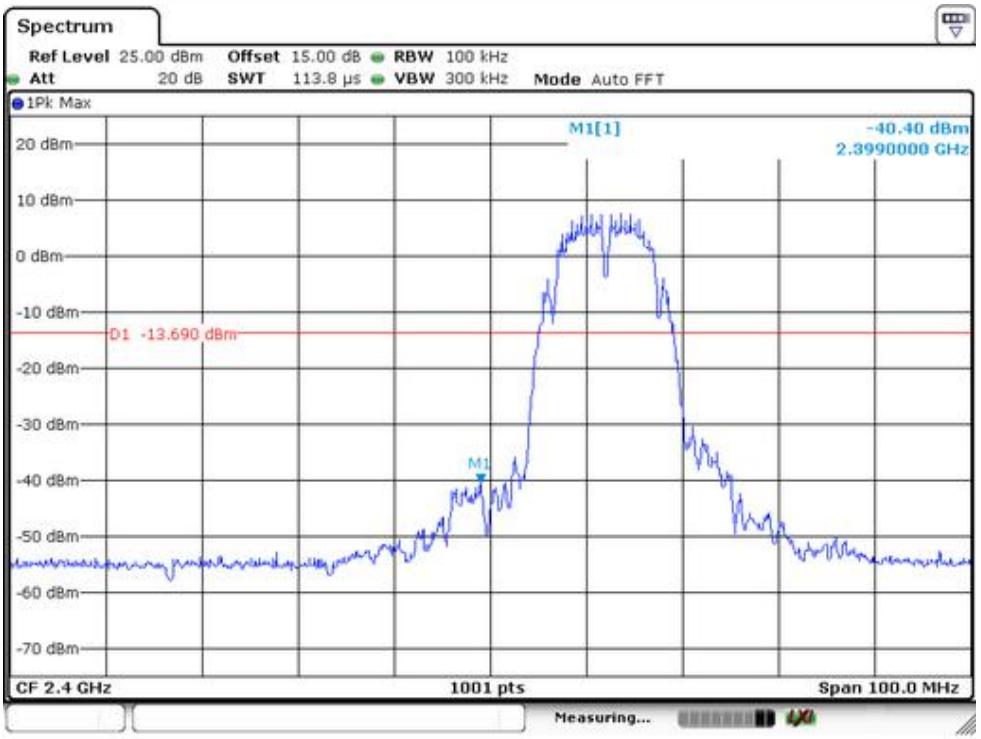
12.3 Measurement Equipment Used

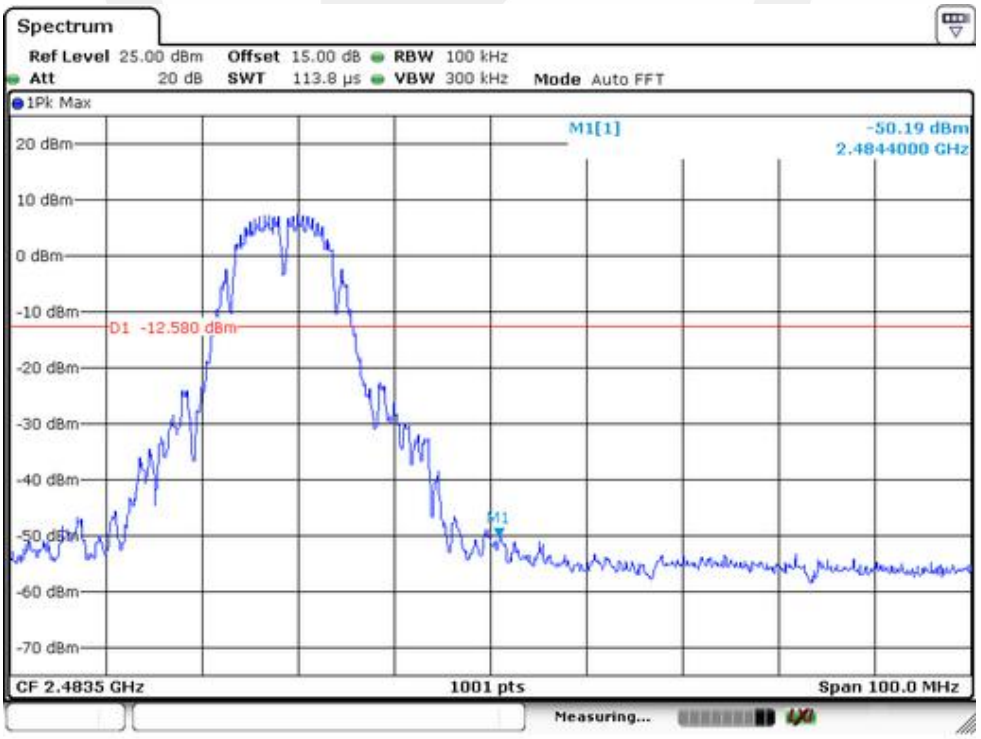
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	FSV30	1321.3008K	05/23/2019	05/22/2020

12.4 Measurement Results

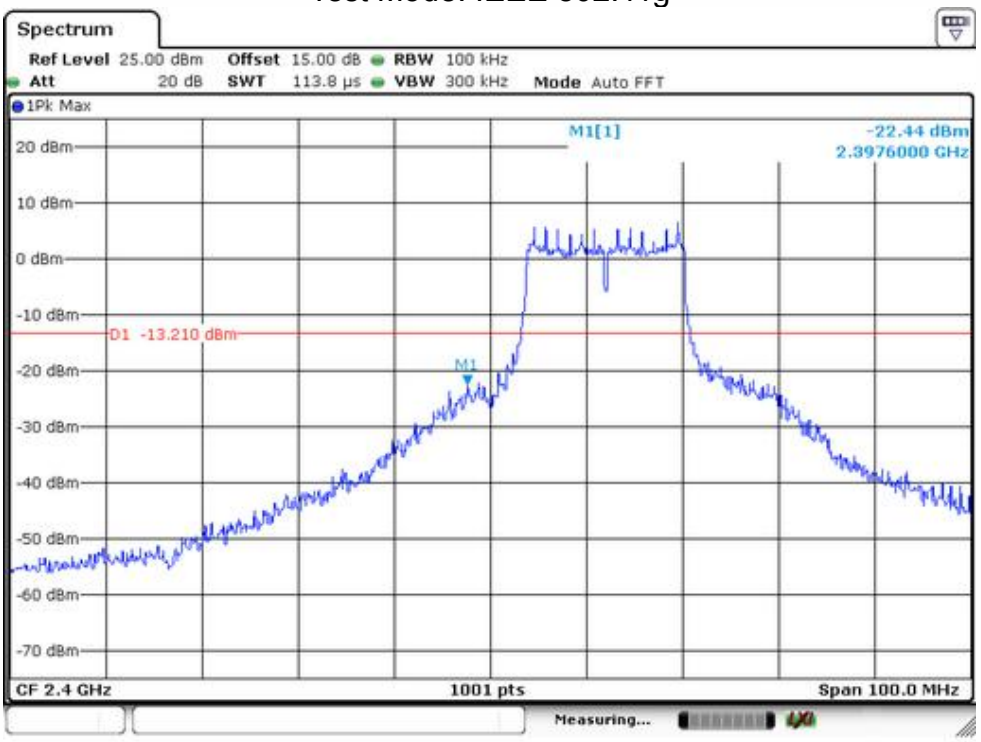
1. Conducted Test

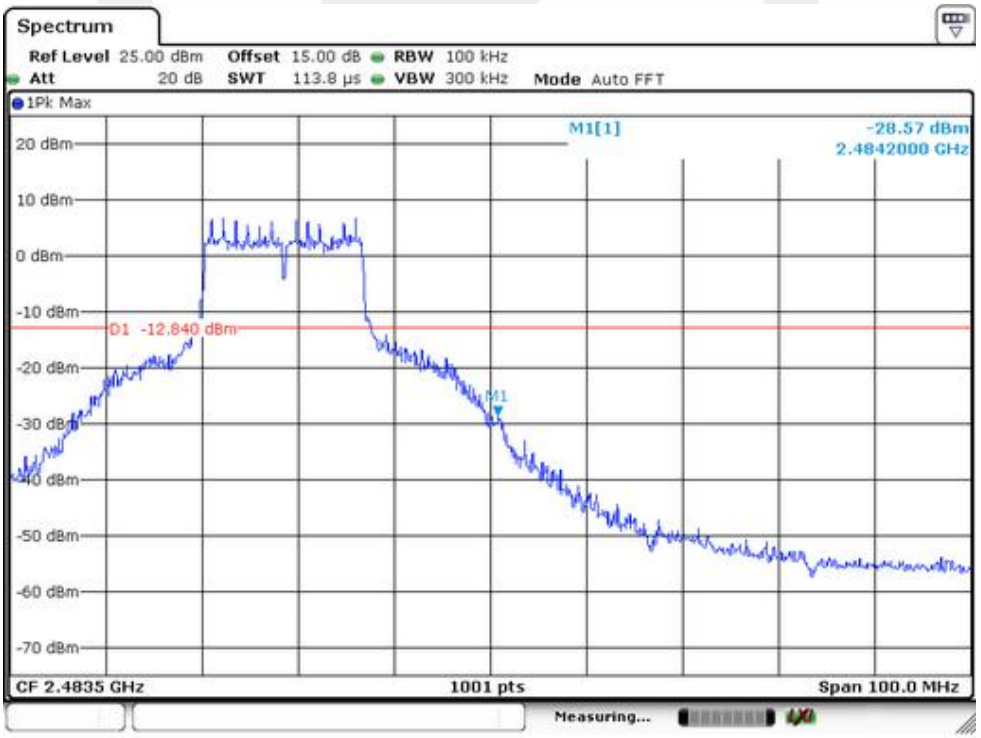
Test Mode: IEEE 802.11b



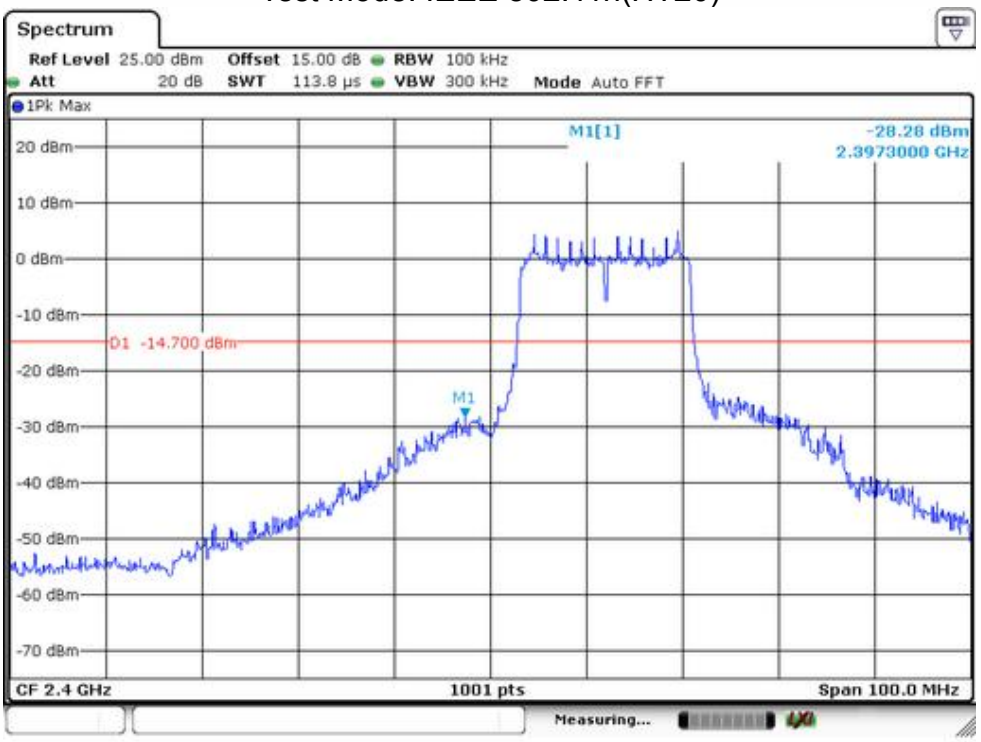


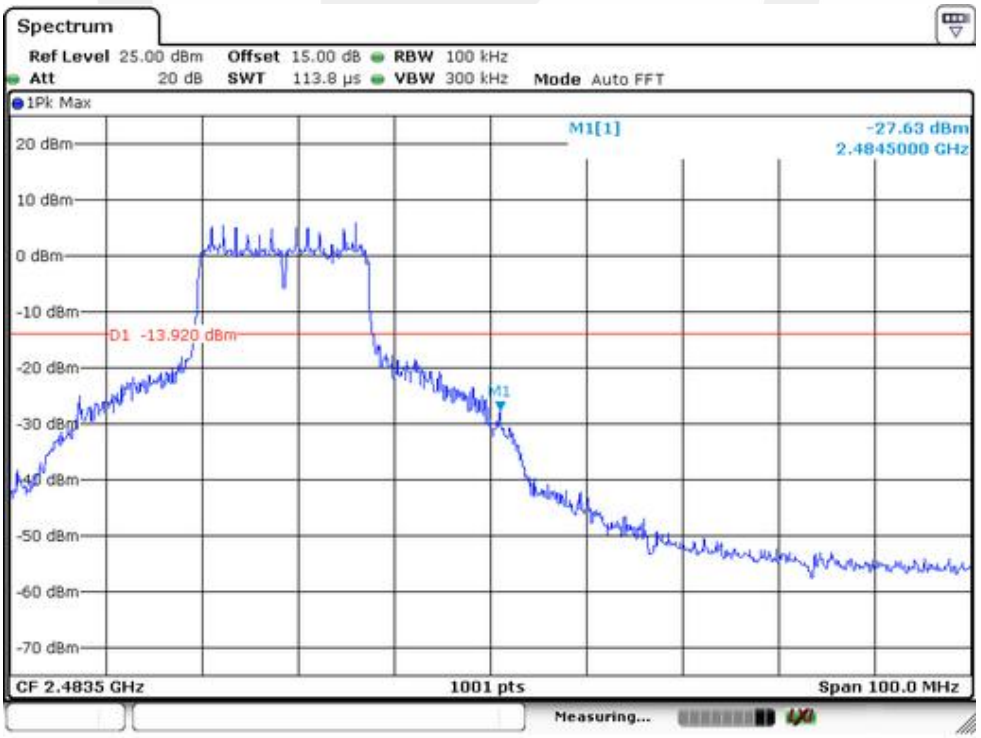
Test Mode: IEEE 802.11g



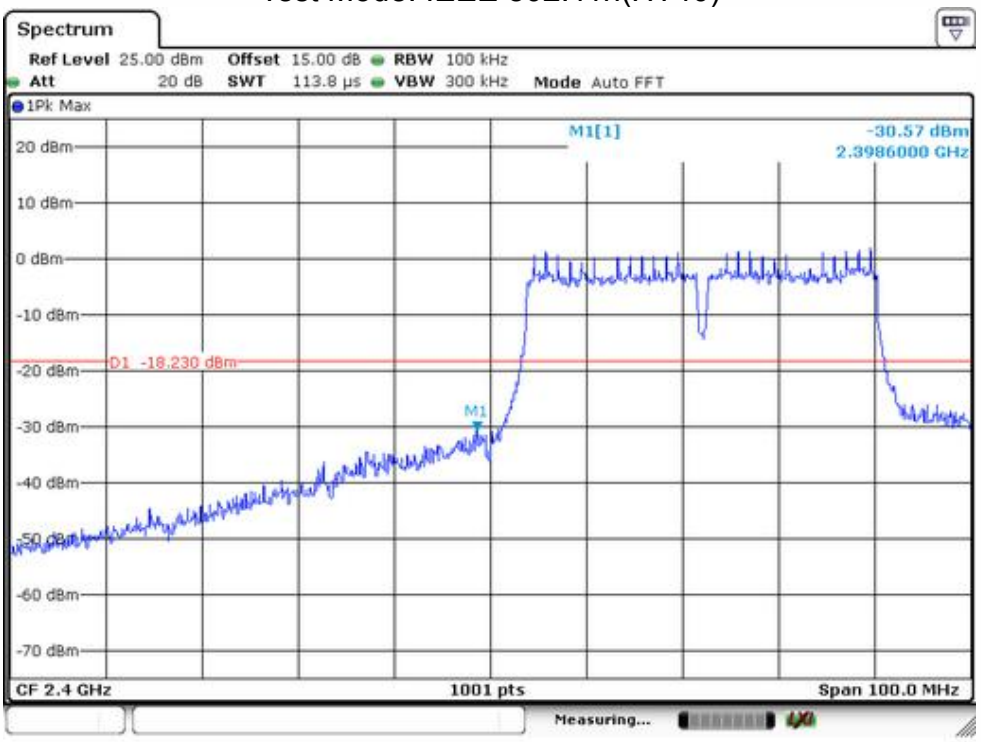


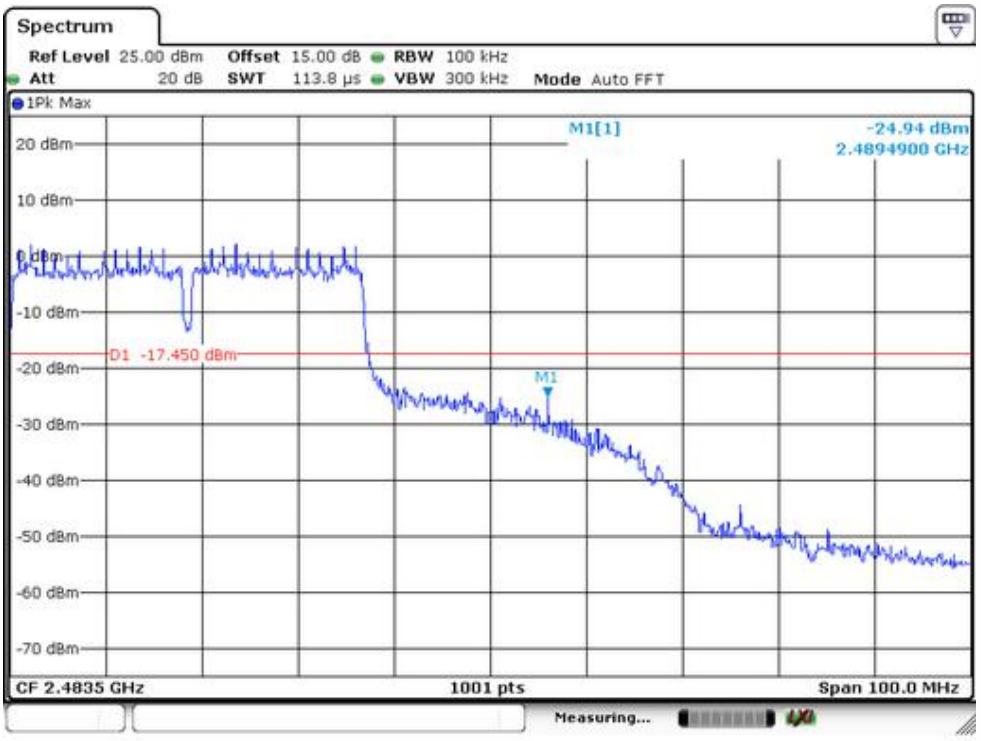
Test Mode: IEEE 802.11n(HT20)





Test Mode: IEEE 802.11n(HT40)





2. Radiated emission Test

Spectrum Detector:	PK/AV	Test Date :	February 25, 2020
Test By:	Loren	Temperature :	28 ℃
Humidity :	65 %		

IEEE 802.11b										
Freq.	Ant. Pol.	Reading Level(dBuV/m)		Correct Factor	Emission Level(dBuV/m)		Limit 3m		Margin(dB)	
(MHz)	H/V	PK	AV	dB	PK	AV	PK	AV	PK	AV
<2400	H	87.53	68.45	-26.3	61.23	42.15	74	54	-12.77	-11.85
<2400	V	86.75	66.29	-26.1	60.65	40.19	74	54	-13.35	-13.81
>2483.5	H	88.48	67.67	-26.3	62.18	41.37	74	54	-11.82	-12.63
>2483.5	V	85.78	65.34	-26.1	59.68	39.24	74	54	-14.32	-14.76

IEEE 802.11g										
Freq.	Ant. Pol.	Reading Level(dBuV/m)		Correct Factor	Emission Level(dBuV/m)		Limit 3m		Margin(dB)	
(MHz)	H/V	PK	AV	dB	PK	AV	PK	AV	PK	AV
<2400	H	88.64	68.85	-26.3	62.34	42.55	74	54	-11.66	-11.45
<2400	V	87.69	68.23	-26.1	61.59	42.13	74	54	-12.41	-11.87
>2483.5	H	86.87	67.98	-26.3	60.57	41.68	74	54	-13.43	-12.32
>2483.5	V	86.44	67.26	-26.1	60.34	41.16	74	54	-13.66	-12.84

IEEE 802.11n(HT20)										
Freq.	Ant. Pol.	Reading Level(dBuV/m)		Correct Factor	Emission Level(dBuV/m)		Limit 3m		Margin(dB)	
(MHz)	H/V	PK	AV	dB	PK	AV	PK	AV	PK	AV
<2400	H	88.63	69.97	-26.3	62.33	43.67	74	54	-11.67	-10.33
<2400	V	87.39	68.25	-26.1	61.29	42.15	74	54	-12.71	-11.85
>2483.5	H	89.87	68.57	-26.3	63.57	42.27	74	54	-10.43	-11.73
>2483.5	V	87.68	66.25	-26.1	61.58	40.15	74	54	-12.42	-13.85

IEEE 802.11n(HT40)										
Freq.	Ant. Pol.	Reading Level(dBuV/m)		Correct Factor	Emission Level(dBuV/m)		Limit 3m		Margin(dB)	
(MHz)	H/V	PK	AV	dB	PK	AV	PK	AV	PK	AV
<2400	H	89.64	68.87	-26.3	63.34	42.57	74	54	-10.66	-11.43
<2400	V	86.25	66.64	-26.1	60.15	40.54	74	54	-13.85	-13.46
>2483.5	H	88.88	68.61	-26.3	62.58	42.31	74	54	-11.42	-11.69
>2483.5	V	86.47	67.36	-26.1	60.37	41.26	74	54	-13.63	-12.74

13. Maxiumum Power Spectral Density

13.1 Test Equipment

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	FSV30	1321.3008K	05/23/2019	05/22/2020

13.2 Measuring Instruments and Setting

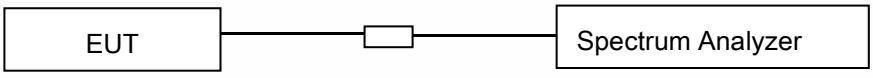
The following table is the setting of spectrum analyzer.

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

13.3 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=3KHz. Set the VBW=10KHz
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.

13.4 Block Diagram of Test Setup



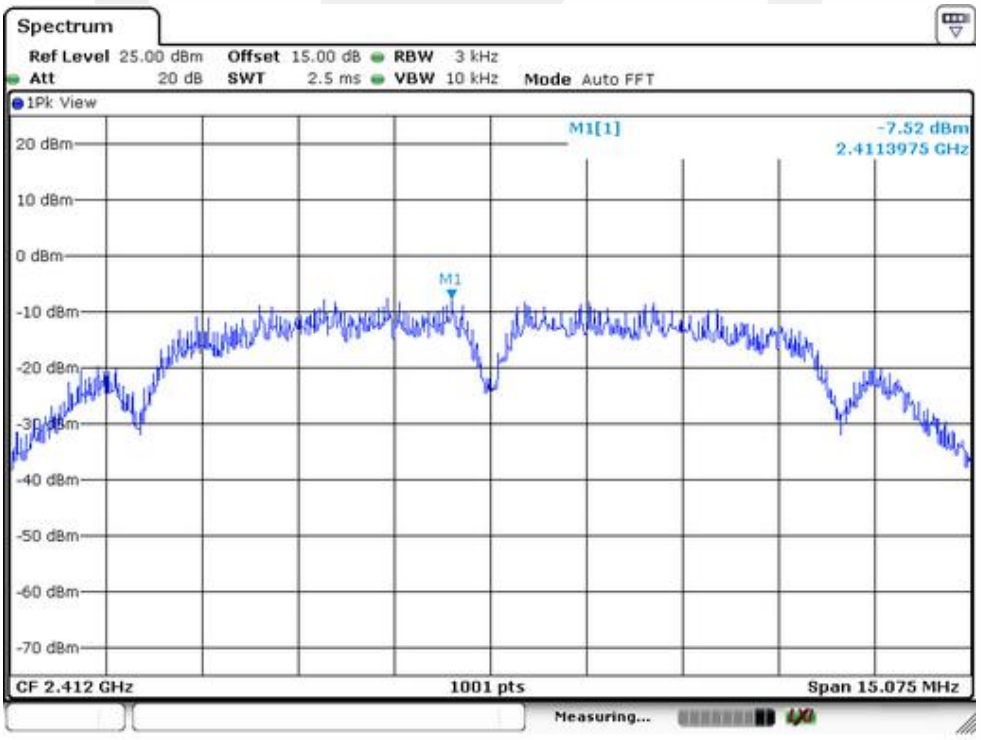
13.5Limit

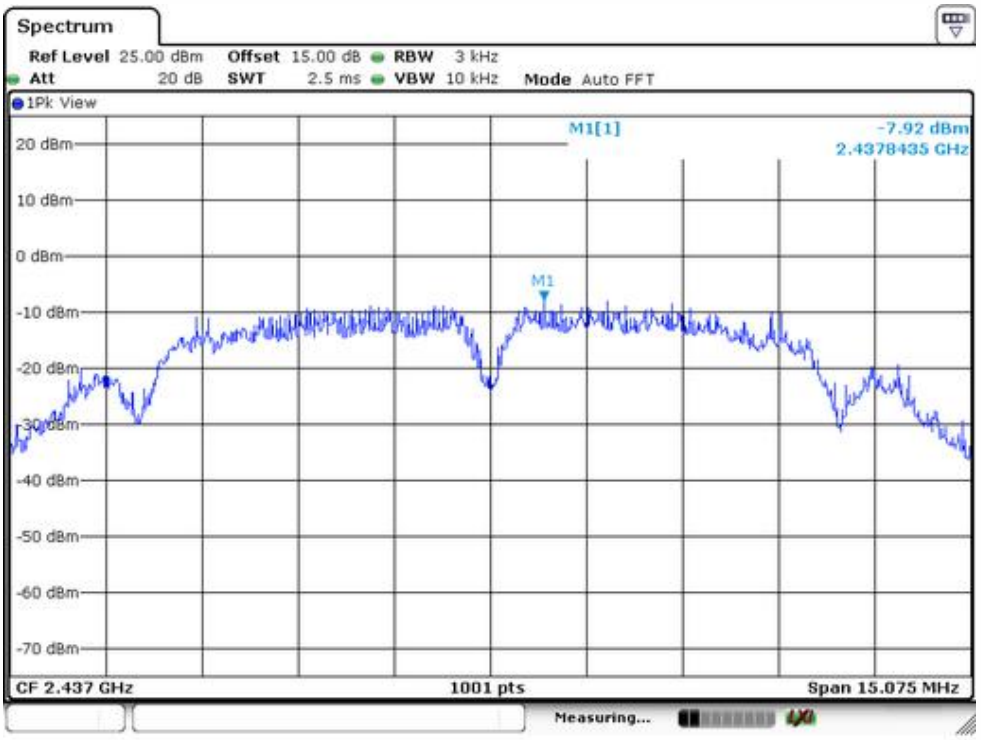
The transmitted power density averaged over any 1 second interval shall not be greater +8dBm in any 3 kHz bandwidth.

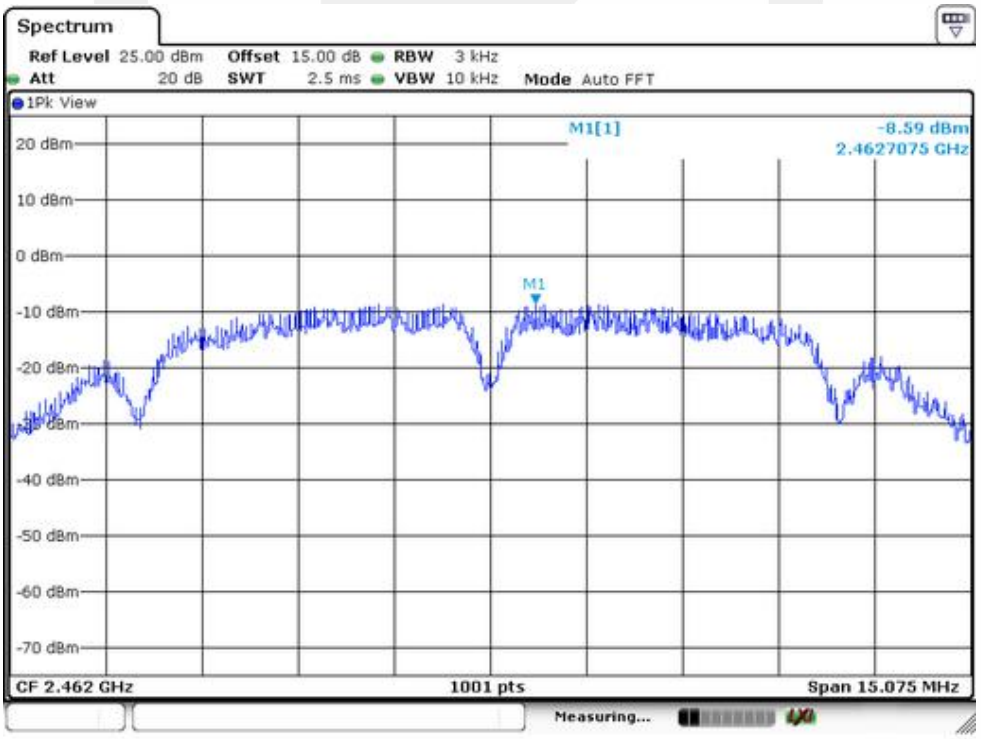
13.6Test Result

Spectrum Detector:	PK	Test Date :	February 25, 2020
Test By:	Loren	Temperature :	28℃
Humidity :	60%		

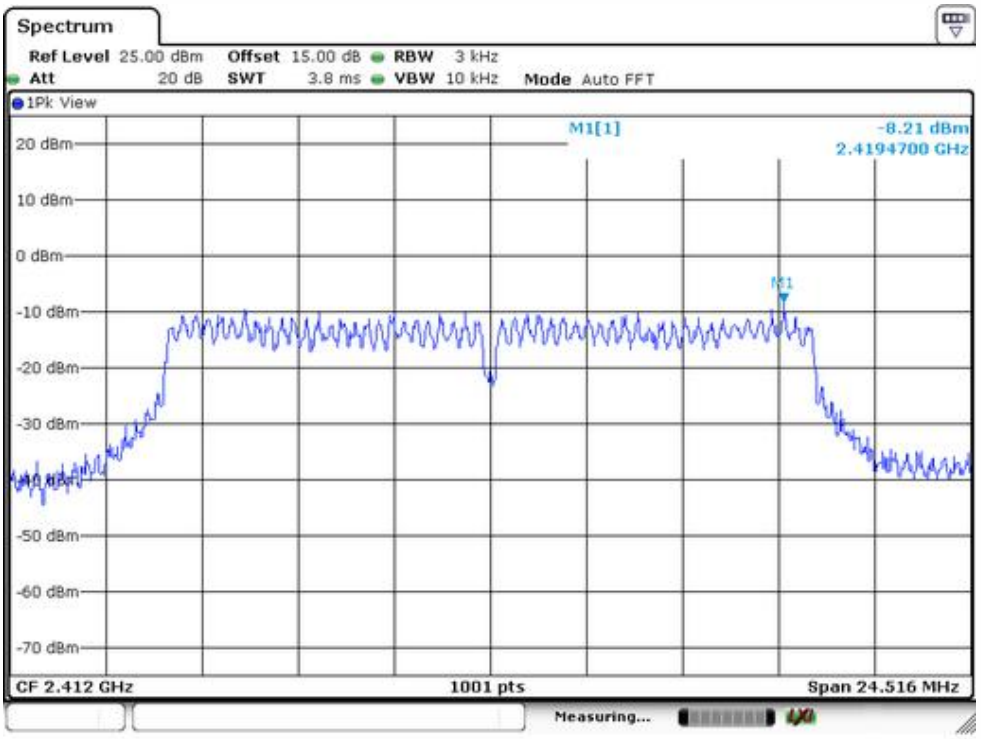
IEEE 802.11b			
Channel frequency (MHz)	Power Density (dBm/3kHz)	Power Density Limit (dBm/3kHz)	Result
2412	-7.52	8	Pass
2437	-7.92		
2462	-8.59		

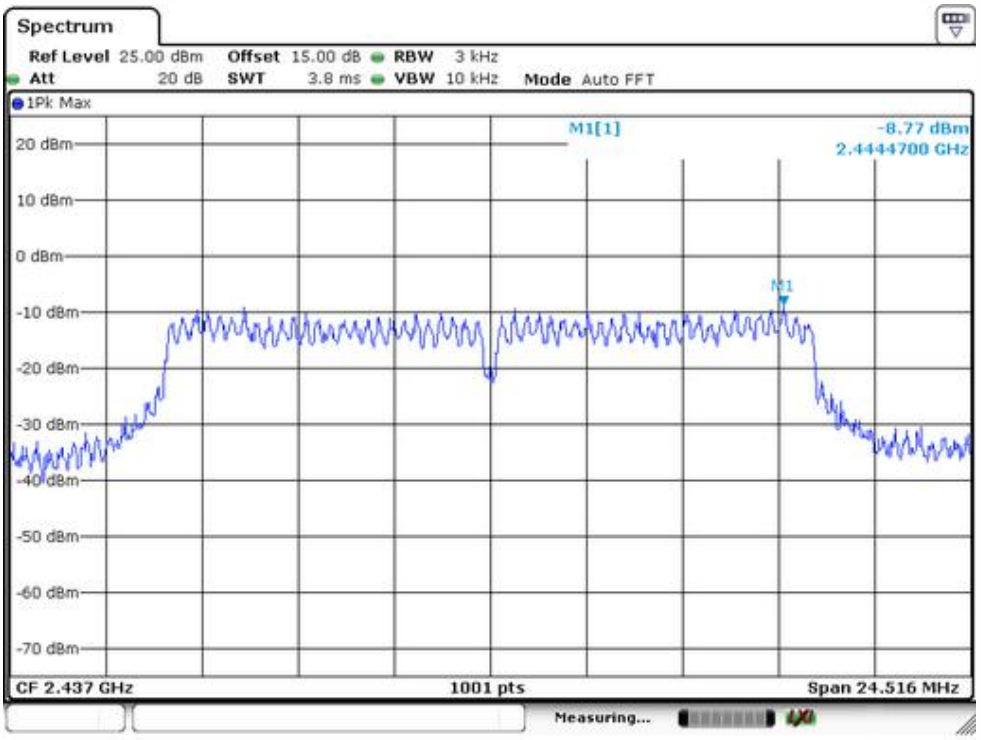


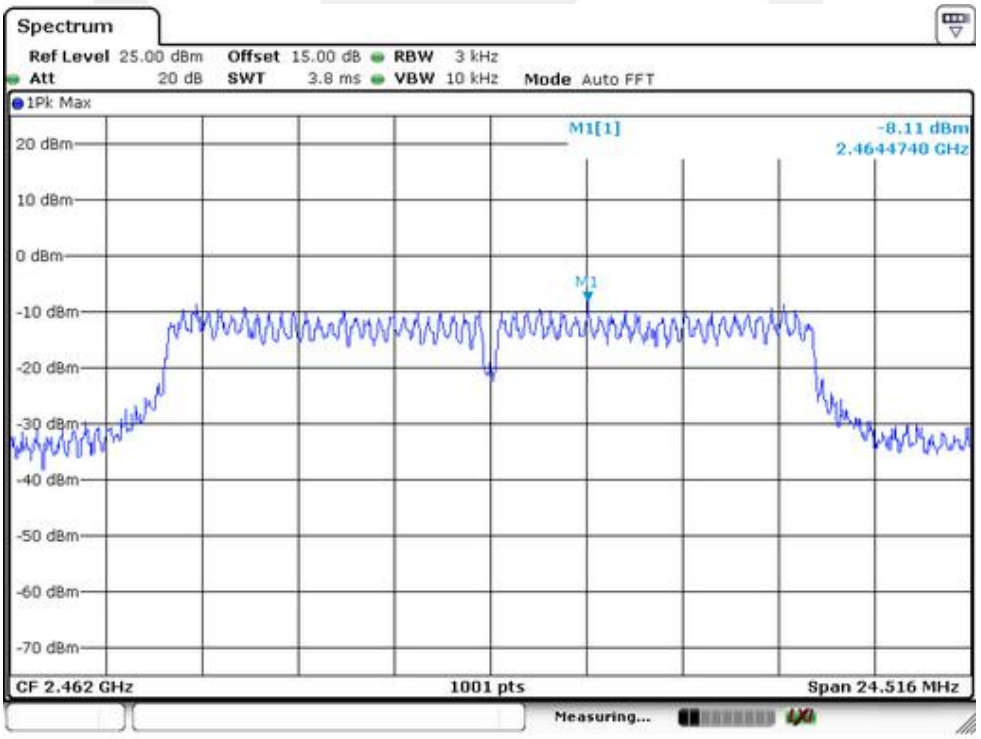

Spectrum
Ref Level 25.00 dBm Offset 15.00 dB RBW 3 kHz
Att 20 dB SWT 2.5 ms VBW 10 kHz Mode Auto FFT
1Pk View
M1[1] -7.92 dBm
2.4378435 GHz
M1
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
CF 2.437 GHz
1001 pts
Span 15.075 MHz
Measuring...


Spectrum
Ref Level 25.00 dBm Offset 15.00 dB RBW 3 kHz
Att 20 dB SWT 2.5 ms VBW 10 kHz Mode Auto FFT
1Pk View
M1[1] -8.59 dBm
2.4627075 GHz
M1
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
CF 2.462 GHz
1001 pts
Span 15.075 MHz
Measuring...

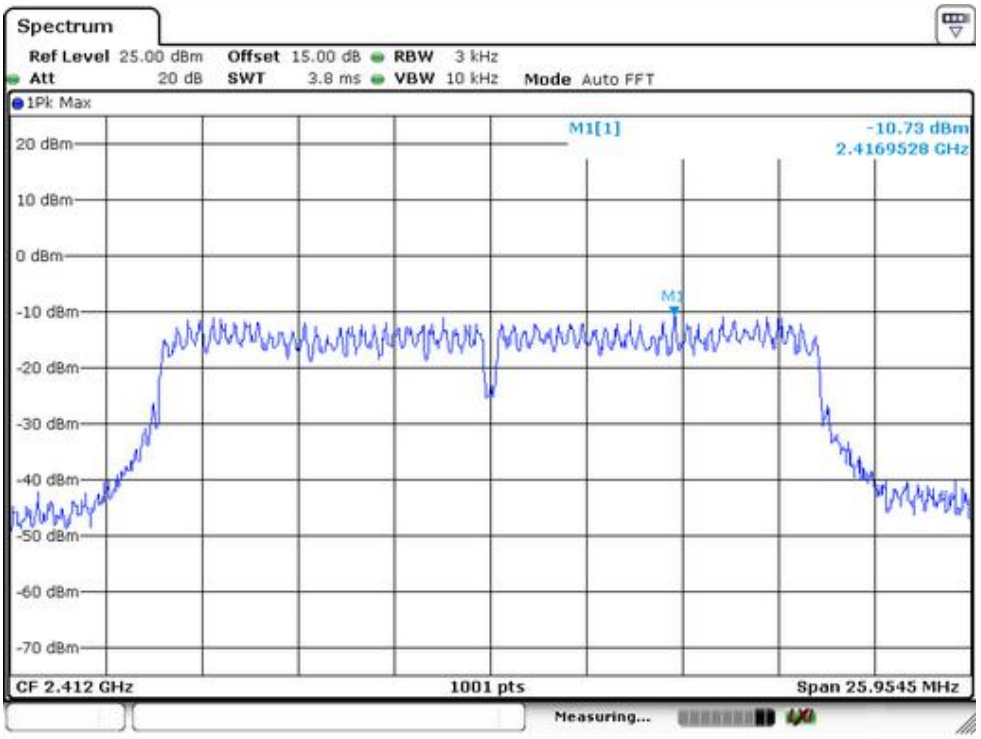
IEEE 802.11g			
Channel frequency (MHz)	Power Density (dBm/3kHz)	Power Density Limit (dBm/3kHz)	Result
2412	-8.21	8	Pass
2437	-8.77		
2462	-8.11		

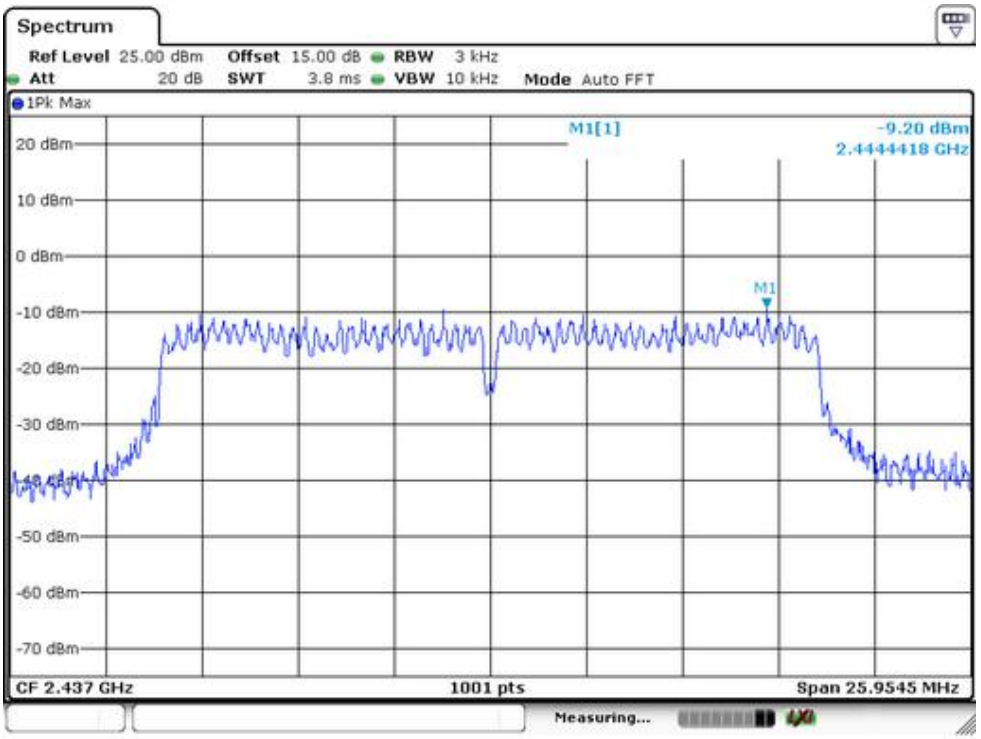


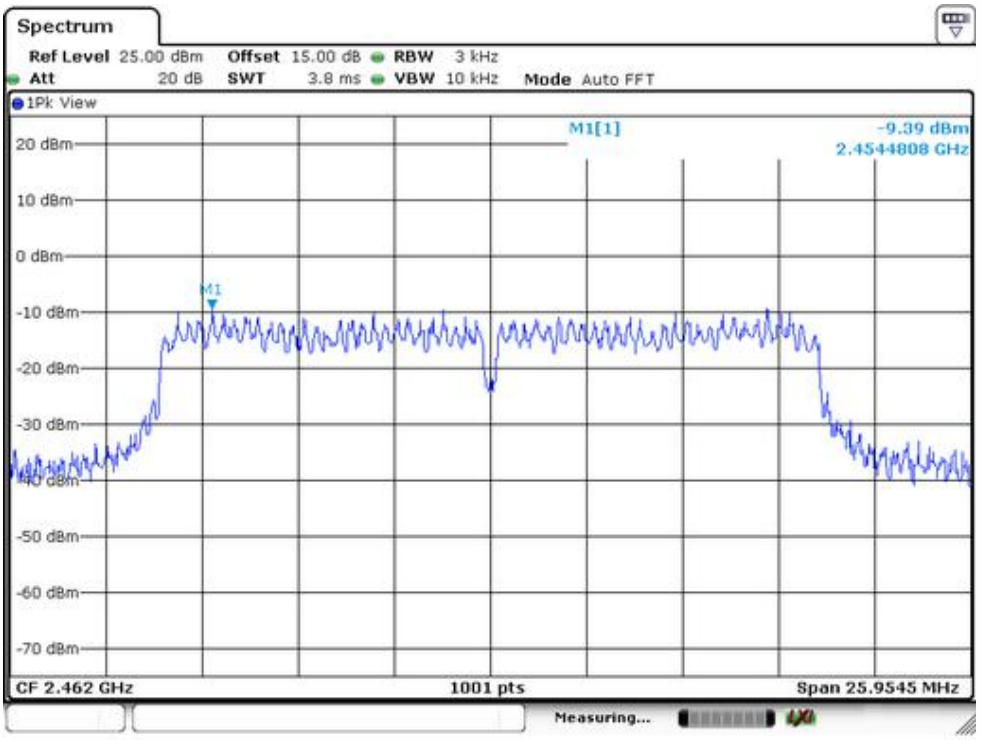

Spectrum
Ref Level 25.00 dBm Offset 15.00 dB RBW 3 kHz
Att 20 dB SWT 3.8 ms VBW 10 kHz Mode Auto FFT
1Pk Max
M1[1] -8.77 dBm
2.4444700 GHz
M1
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
CF 2.437 GHz
1001 pts
Span 24.516 MHz
Measuring...


Spectrum
Ref Level 25.00 dBm Offset 15.00 dB RBW 3 kHz
Att 20 dB SWT 3.8 ms VBW 10 kHz Mode Auto FFT
1Pk Max
M1[1] -8.11 dBm
2.4644740 GHz
M1
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
CF 2.462 GHz
1001 pts
Span 24.516 MHz
Measuring...

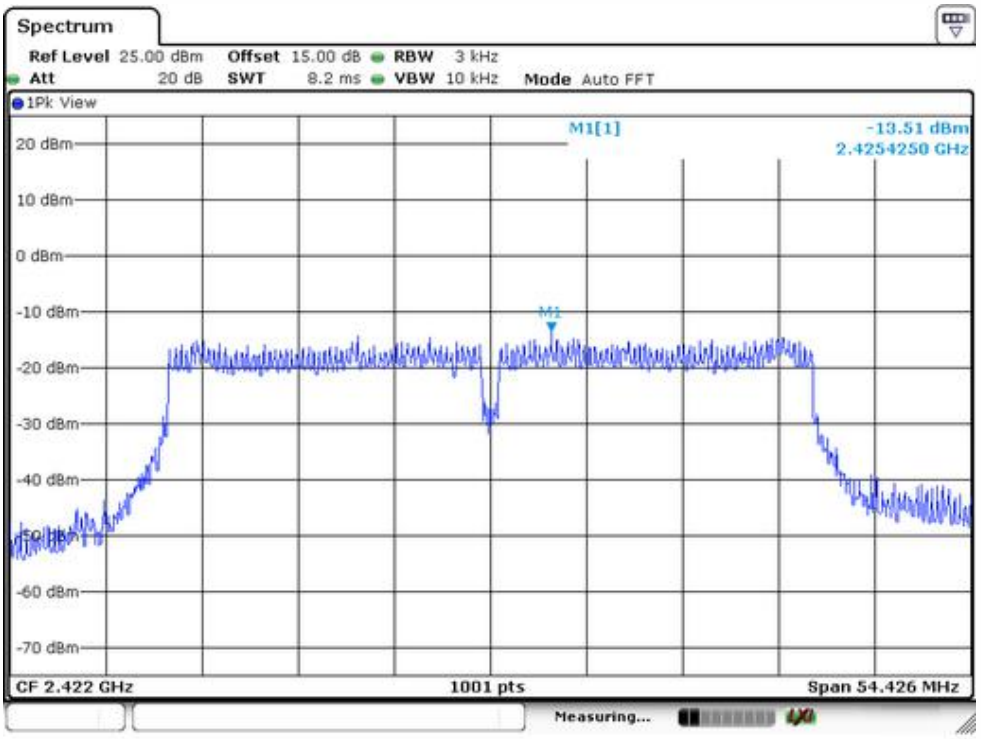
IEEE 802.11n(HT20)			
Channel frequency (MHz)	Measurement level (dBm)	Limit(dBm)	Result
2412	-10.73	8	Pass
2437	-9.20		
2462	-9.39		

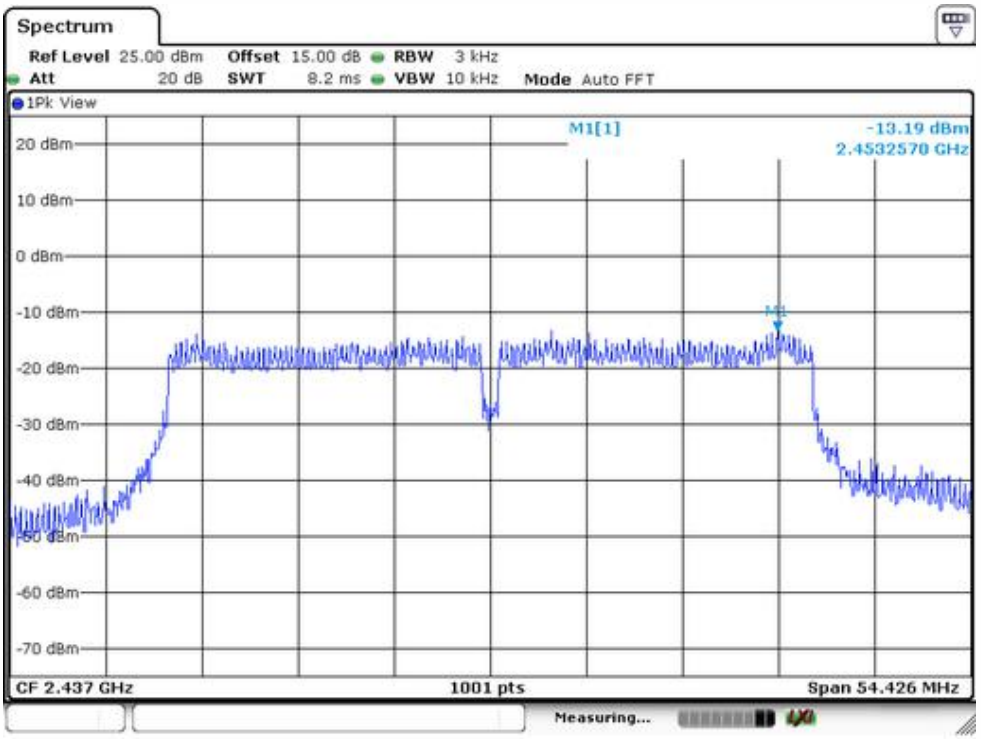


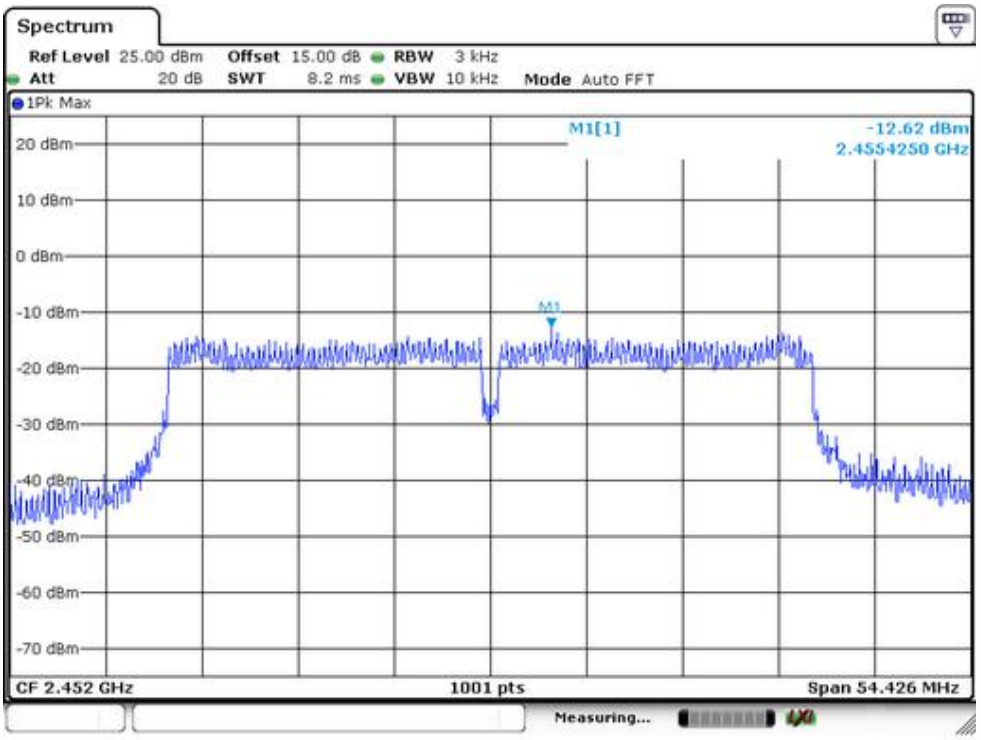

Spectrum
Ref Level 25.00 dBm Offset 15.00 dB RBW 3 kHz
Att 20 dB SWT 3.8 ms VBW 10 kHz Mode Auto FFT
1Pk Max
M1[1] -9.20 dBm
2.4444418 GHz
M1
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-50 dBm
-60 dBm
-70 dBm
CF 2.437 GHz
1001 pts
Span 25.9545 MHz
Measuring...


Spectrum
Ref Level 25.00 dBm Offset 15.00 dB RBW 3 kHz
Att 20 dB SWT 3.8 ms VBW 10 kHz Mode Auto FFT
1Pk View
M1[1] -9.39 dBm
2.4544808 GHz
M1
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-50 dBm
-60 dBm
-70 dBm
CF 2.462 GHz
1001 pts
Span 25.9545 MHz
Measuring...

IEEE 802.11n(HT40)			
Channel frequency (MHz)	Measurement level (dBm)	Limit(dBm)	Result
2422	-13.51	8	Pass
2437	-13.19		
2452	-12.62		




Spectrum
Ref Level 25.00 dBm Offset 15.00 dB RBW 3 kHz
Att 20 dB SWT 8.2 ms VBW 10 kHz Mode Auto FFT
1Pk View
M1[1] -13.19 dBm
2.4532570 GHz
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
CF 2.437 GHz
1001 pts
Span 54.426 MHz
Measuring...


Spectrum
Ref Level 25.00 dBm Offset 15.00 dB RBW 3 kHz
Att 20 dB SWT 8.2 ms VBW 10 kHz Mode Auto FFT
1Pk Max
M1[1] -12.62 dBm
2.4554250 GHz
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
CF 2.452 GHz
1001 pts
Span 54.426 MHz
Measuring...

14. Antenna Port Emission

14.1 Test Equipment

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	FSV30	1321.3008K	05/23/2019	05/22/2020

14.2 Measuring Instruments and Setting

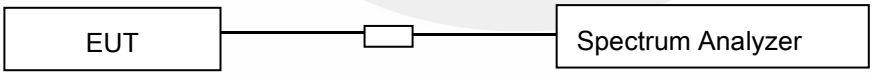
The following table is the setting of spectrum analyzer.

Spectrum analyzer	Setting
Attenuation	Auto
RBW	100kHz
VBW	300kHz
Detector	Peak
Trace	Max hold

14.3 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.

14.4 Block Diagram of Test setup

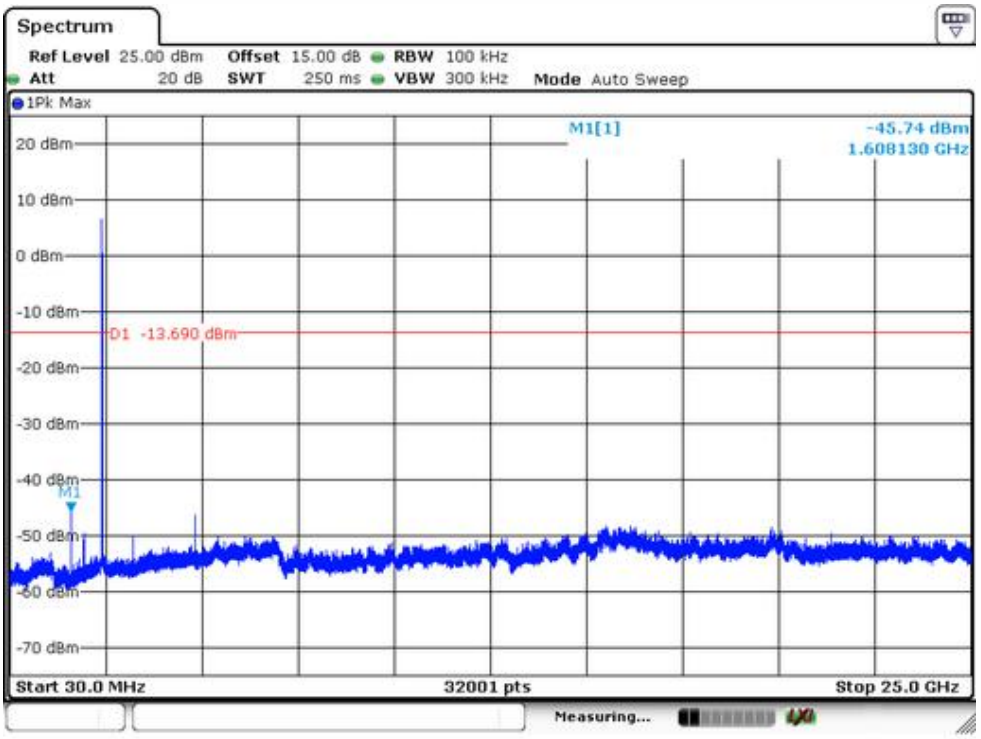


14.5 Test Result

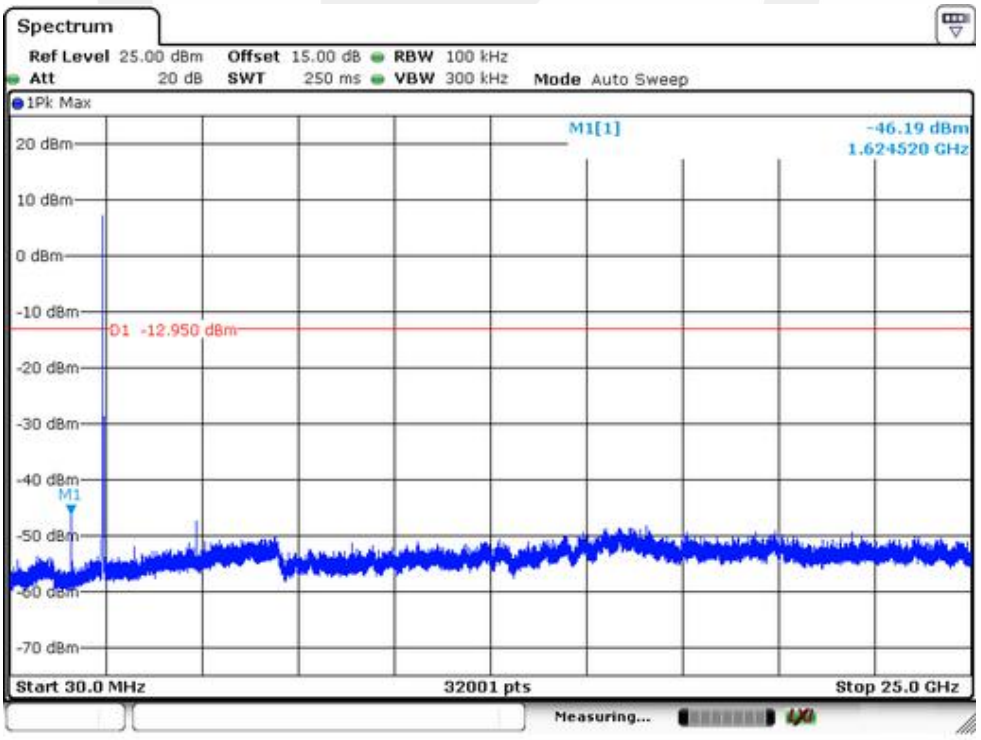
PASS.

Please refer to the following pages.

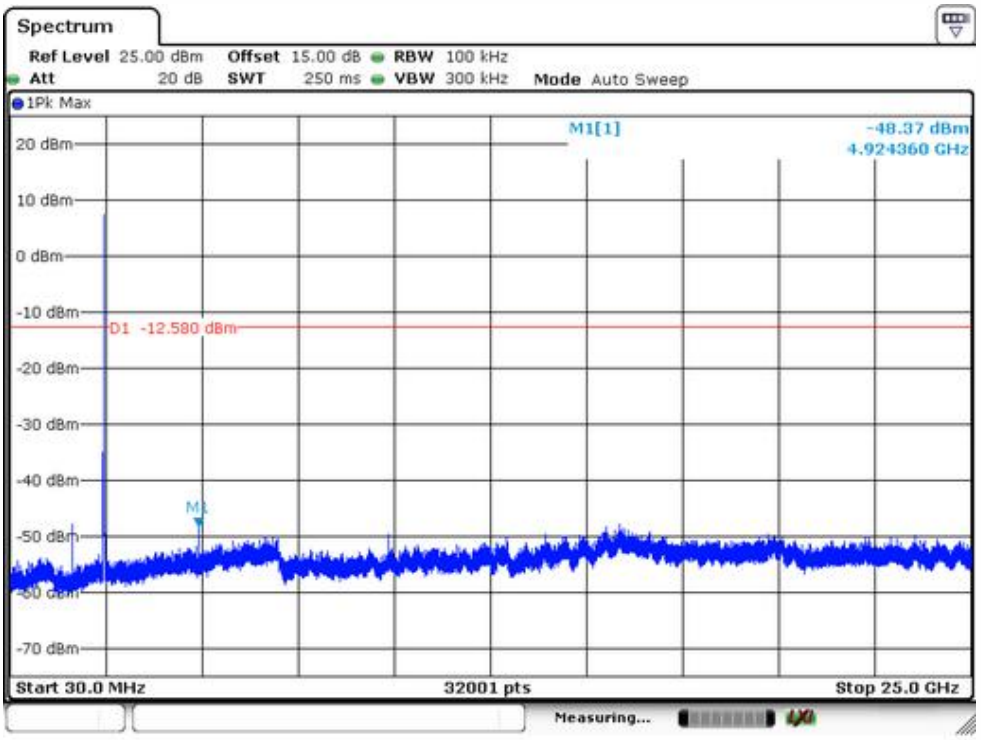
Test Mode: IEEE 802.11b



Lowest Channel

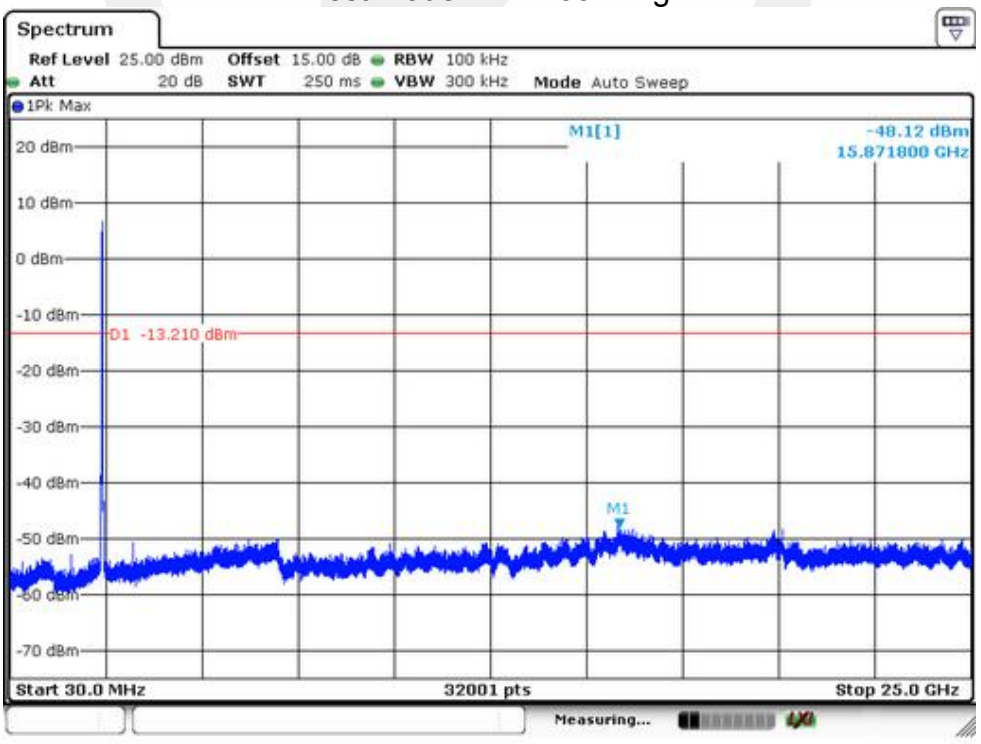


Middel Channel

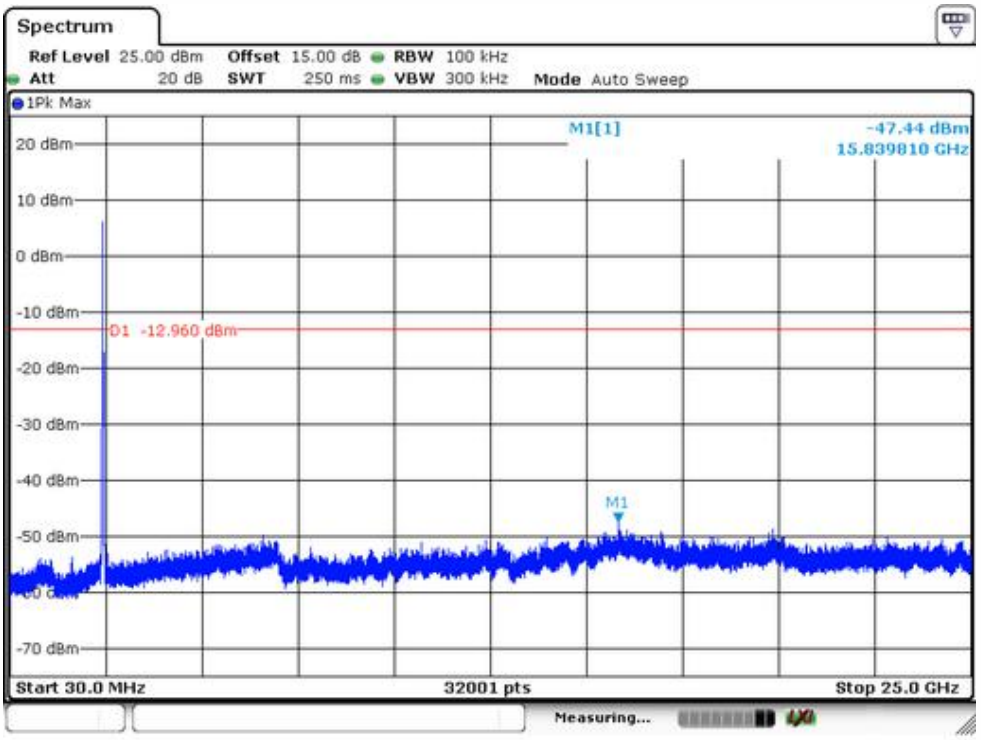


Highest Channel

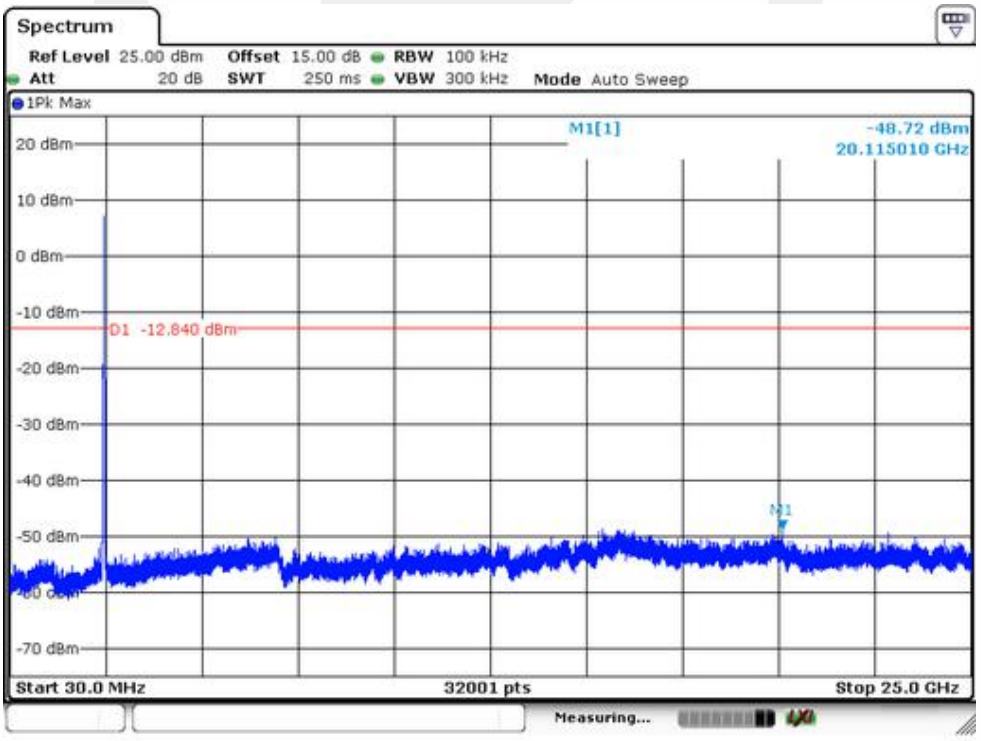
Test Mode: IEEE 802.11g



Lowest Channel

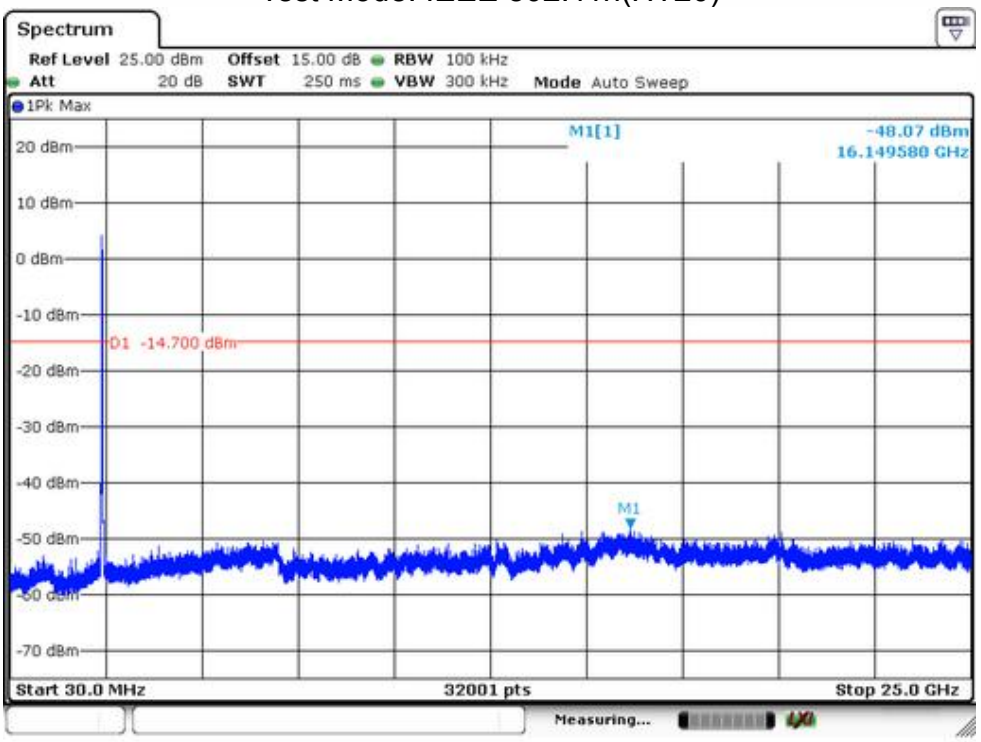


Middle Channel

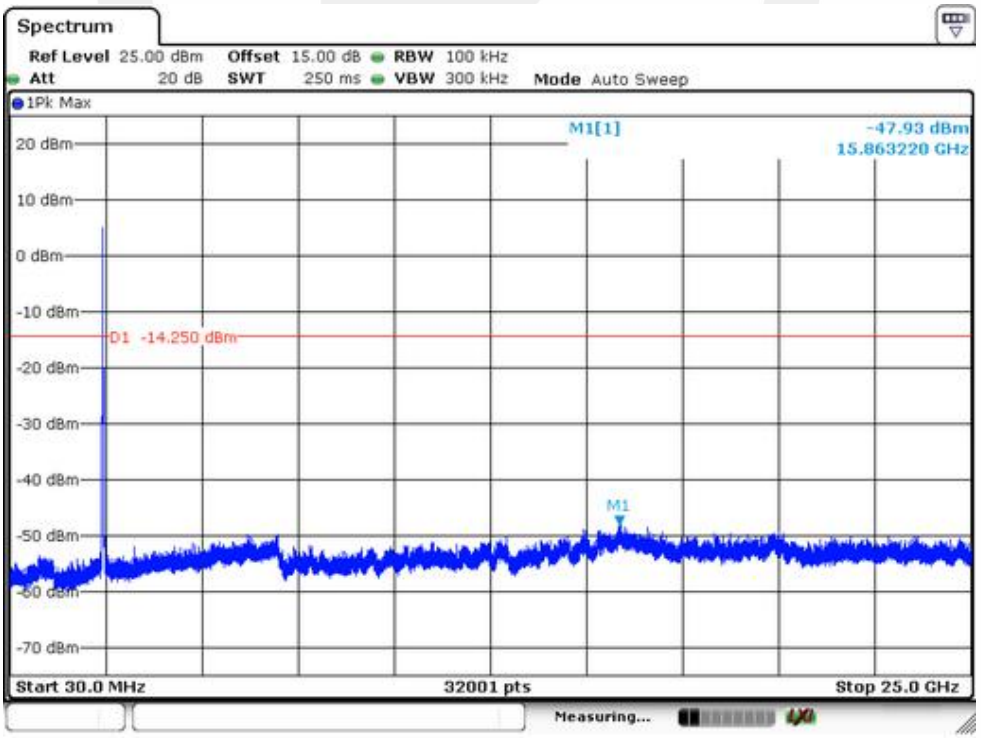


Highest Channel

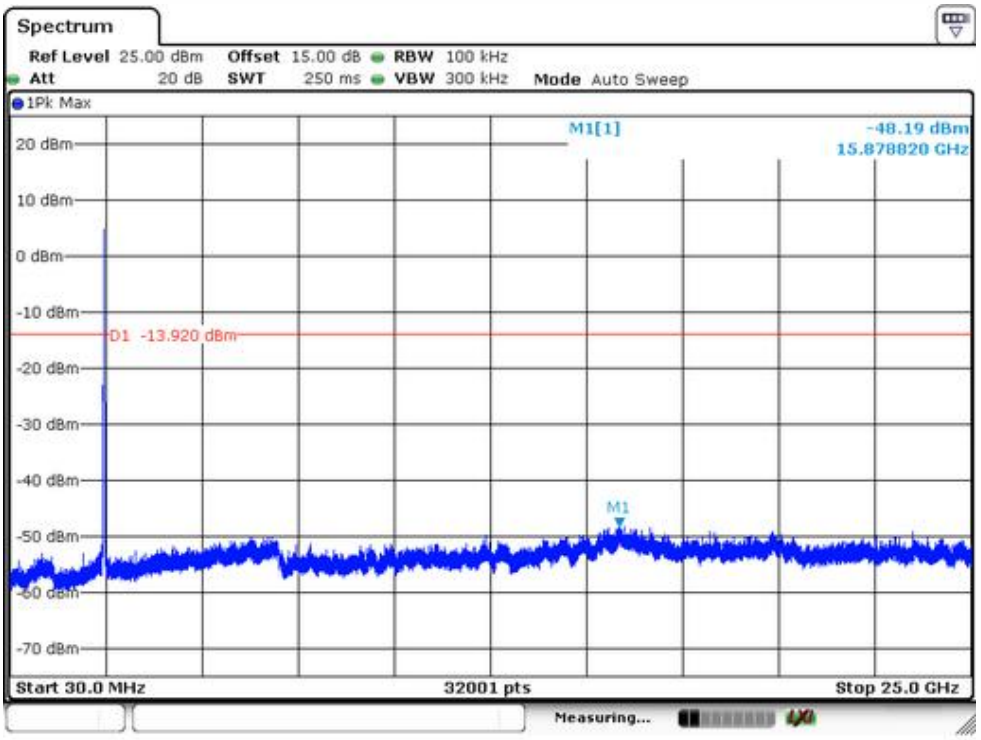
Test Mode: IEEE 802.11n(HT20)



Lowest Channel

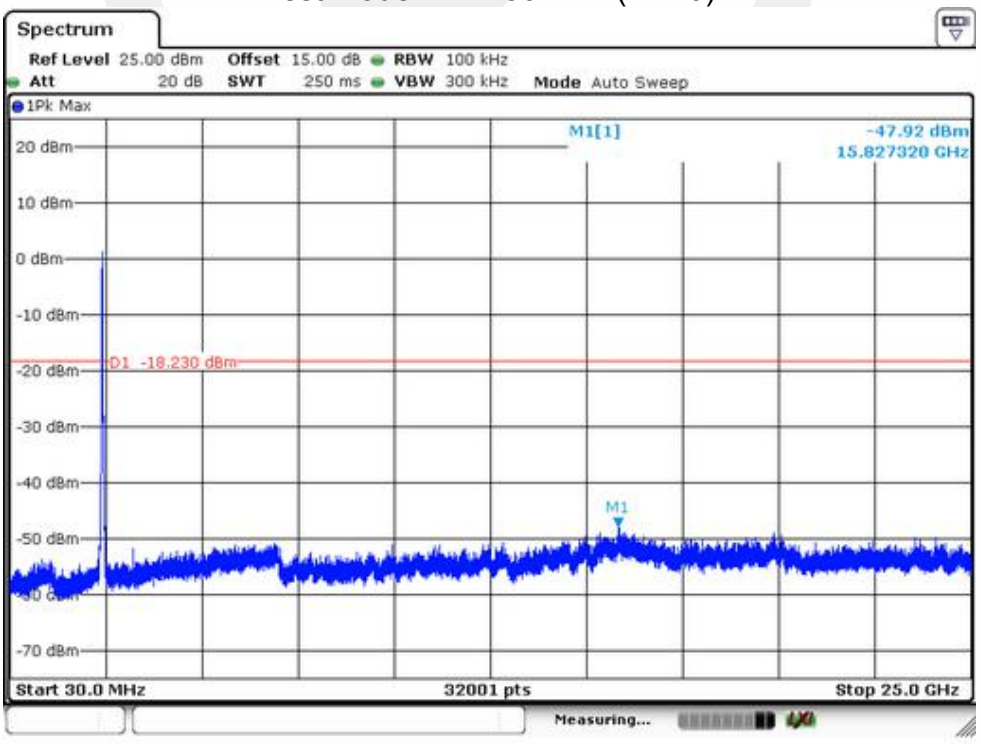


Middle Channel

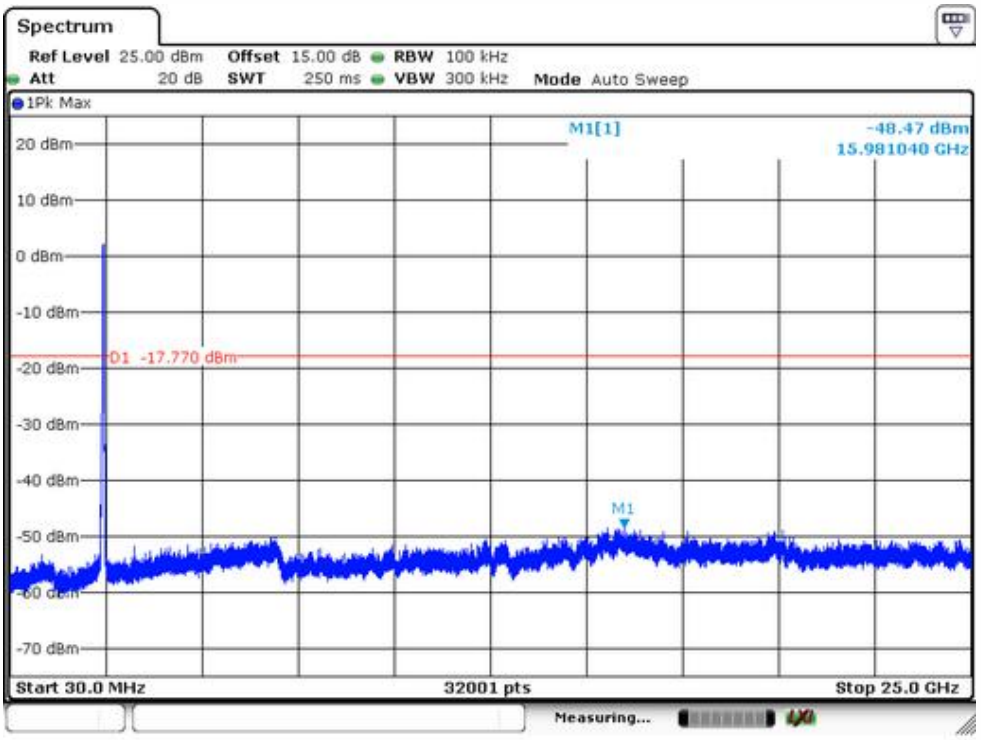


Highest Channel

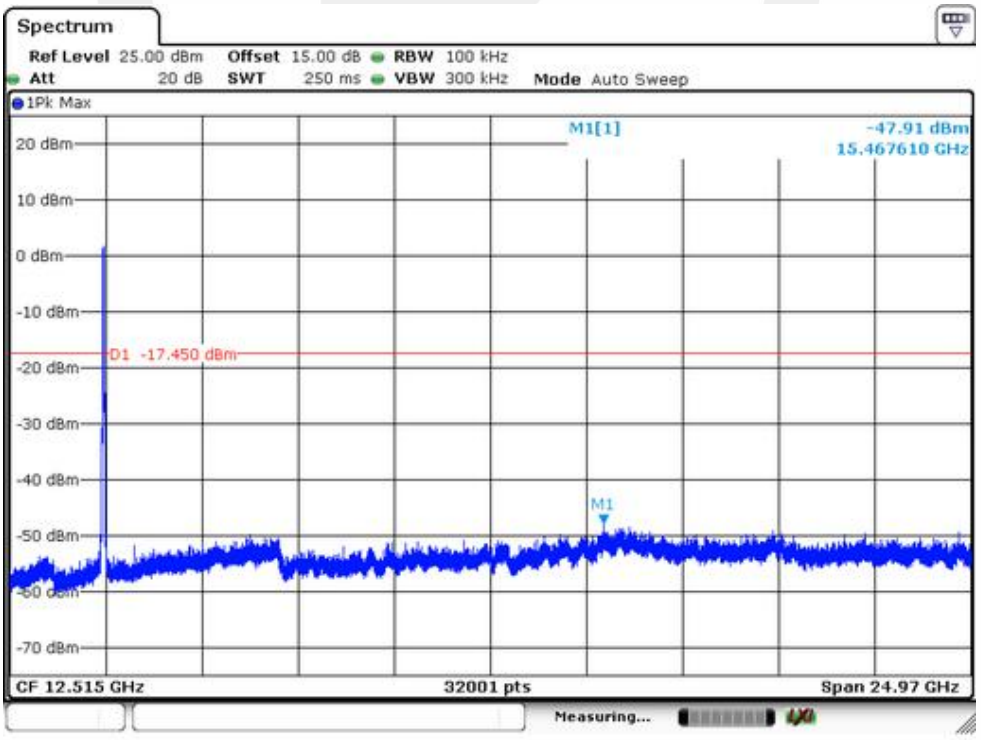
Test Mode: IEEE802.11n(HT40)



Lowest Channel



Middle Channel



Highest Channel

15. Antenna Application

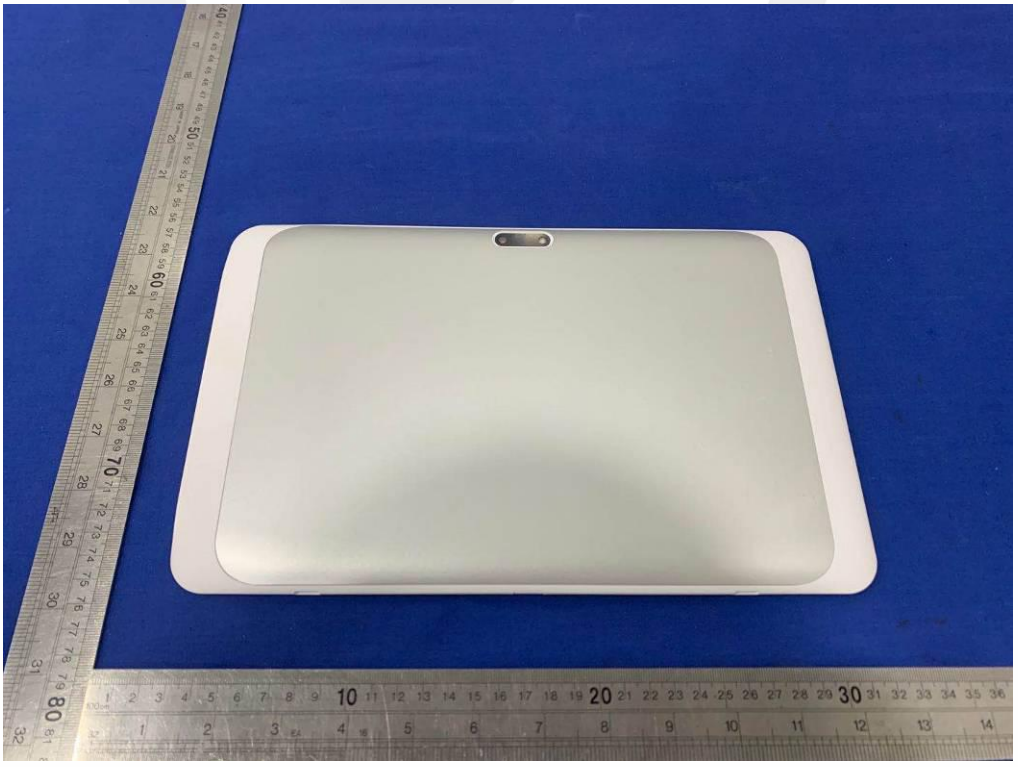
15.1 Antenna Requirement

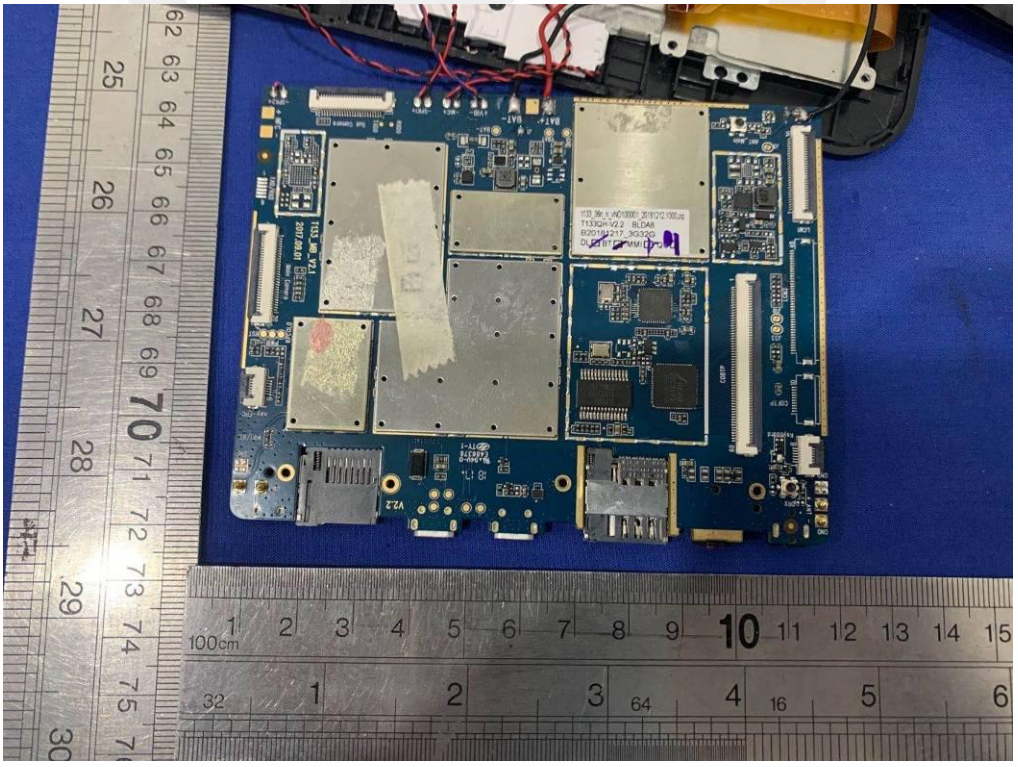
For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional 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.

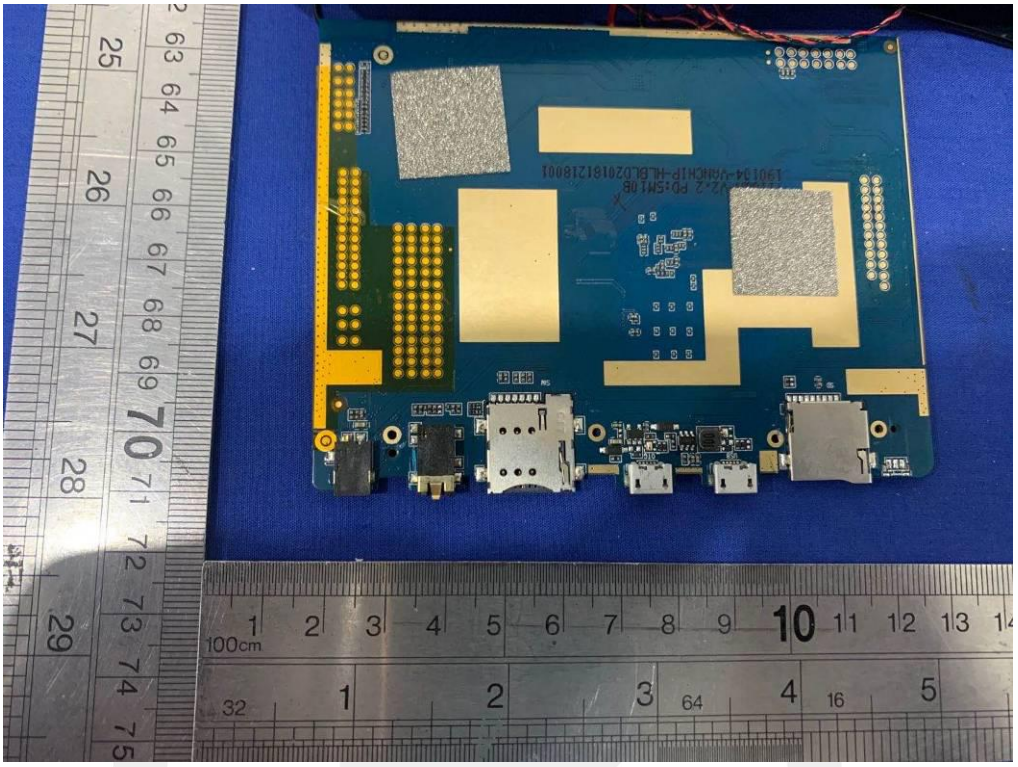
15.2 Result

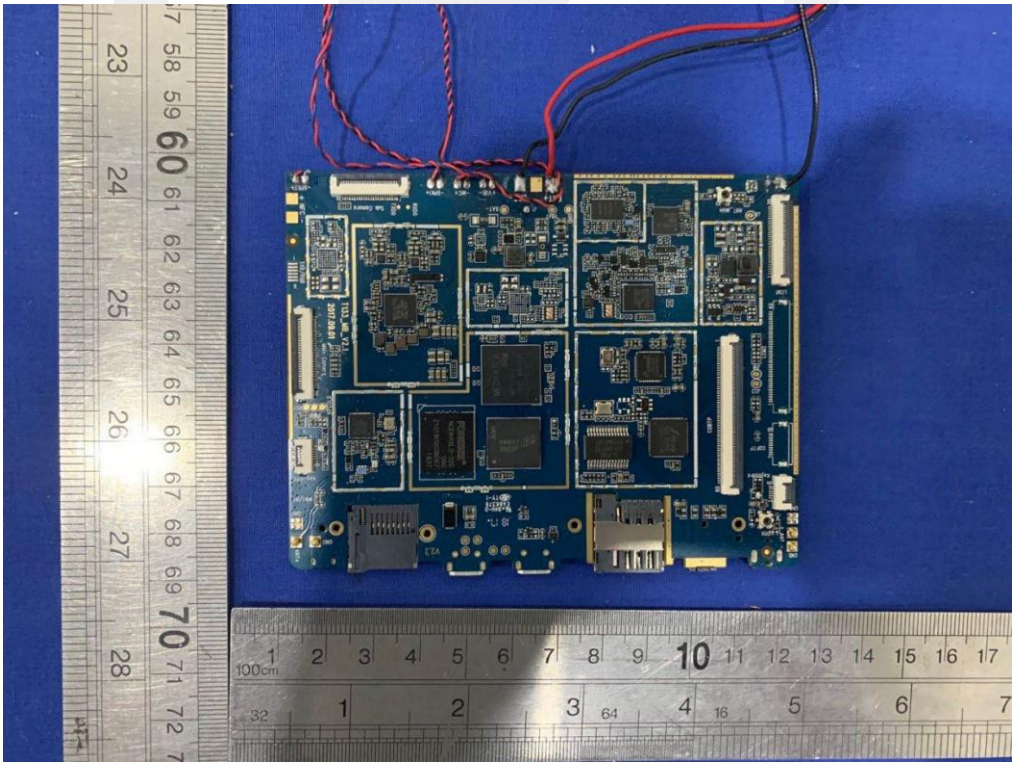
The EUT'S antenna, permanent attached antenna, is internal antenna. The antenna's gain is 0dBi and meets the requirement.

APPENDIX I
(PHOTOS OF EUT)









*** End of Report ***

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