FCC RADIO TEST REPORT

FCC ID: 2AV4U-1117246

Product Name： Lockdown smart plug

Trade Mark： lockdown

Main Model： 1117246

Additional Model： N/A

Report No.： UNIA20042506ER-01

Prepared for

Battenfeld Technologies Inc.

1800 North Route Z Columbia, Missouri, 65202, United States

Prepared by

Shenzhen United Testing Technology Co., Ltd.

2F, Annex Bldg, Jiahuangyuan Tech Park, #365 Baotian 1 Rd, Tiegang Community, Xixiang Str, Bao'an District, Shenzhen, China

TEST RESULT CERTIFICATION

Applicant.....: Battenfeld Technologies Inc.

Address .....: 1800 North Route Z Columbia, Missouri, 65202, United States

Manufacturer.....: Shenzhen Lampow Electronics Co., Ltd.

Address .....: 11th, A Building,Quanju Industrial Park, Jiangshi Road, Gongming, Shenzhen China

Product description

Product Name.....: Lockdown smart plug

Trade Mark .....: lockdown

Model Name .....: 1117246

Test Methods.....: 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.....: Apr. 25, 2020 ~ May 20, 2020

Date of Issue .....: May 20, 2020

Test Result.....: Pass

Prepared by: Bob Liao

Bob liao/Editor

Reviewer: Kahn Yang

Kahn yang/Supervisor

Approved & Authorized Signer: liuze

Liuze/Manager

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1 TEST SUMMARY

1.1 TEST PROCEDURES AND RESULTS

ITEM	STANGARD	RESULT
CONDUCTED EMISSION	FCC Part 15.207	COMPLIANT
RADIATED EMISSION	FCC Part 15.209(a)	COMPLIANT
OCCUPIED BANDWIDTH	FCC Part 15.247(a)(2)	COMPLIANT
POWER SPECTRAL DENSITY	FCC Part 15.247(e)	COMPLIANT
PEAK OUTPUT POWER	FCC Part 15.247(b)	COMPLIANT
OUT OF BAND EMISSIONS	FCC Part 15.247(d)	COMPLIANT
CONDUCTED SPURIOUS EMISSION	FCC Part 15.247(d)	COMPLIANT
ANTENNA REQUIREMENT	FCC Part 15.203	COMPLIANT

1.2 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. This approval result is accepted by MRA of APLAC.

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

A2LA Certificate Number: 4747.01
The EMC Laboratory has been accredited by A2LA, and in compliance with ISO/IEC 17025:2017 General Requirements for testing Laboratories.

FCC Registration Number: 674885
The EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications commission.

IC Registration Number: 21947
The EMC Laboratory has been registered and fully described in a report filed with the (IC) Industry Canada.

1.3 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement y ± U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k = 2, providing a level of confidence of approximately 95%.

A. Conducted Measurement:

Test Site	Method	Measurement Frequency Range	U, (dB)	NOTE
UNI	ANSI	9kHz ~ 150kHz	2.96	
		150kHz ~ 30MHz	2.44	

B. Radiated Measurement:

Test Site	Method	Measurement Frequency Range	U, (dB)	NOTE
UNI	ANSI	9kHz ~ 30MHz	2.50	
		30MHz ~ 1000MHz	4.80	
		1000MHz ~ 6000MHz	4.13	

2 GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

Product Name:	Lockdown smart plug
Trade Mark:	lockdown
Main Model:	1117246
Additional Model:	N/A
Model Difference:	N/A
FCC ID:	2AV4U-1117246
Operation Frequency:	802.11b/g/n20: 2412~2462 MHz
Number of Channels:	802.11b/g/n20: 11CH
Modulation Type:	CCK, OFDM, DBPSK, DAPSK
Antenna Type:	PCB Antenna
Antenna Gain:	0dBi
Battery:	N/A
Adapter:	N/A
Power Source:	AC 120(240)V/60Hz

2.2 CARRIER FREQUENCY OF CHANNELS

Channel List for 802.11b/g/n(20MHz)							
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		

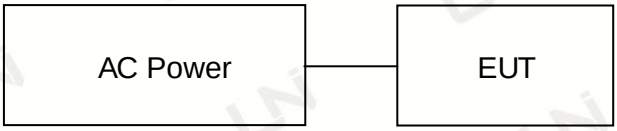
2.3 TEST MODE

The EUT was programmed to be in continuously transmitting mode.

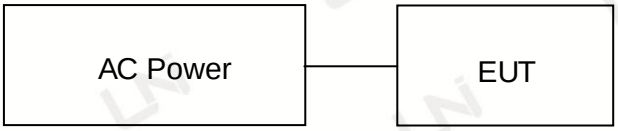
Channel List for 802.11b/g/n(20MHz)		
Test Channel	EUT Channel	Test Frequency (MHz)
Low	CH01	2412
Middle	CH06	2437
High	CH11	2462

2.4 TEST SETUP

Operation of EUT during Conducted testing:



Operation of EUT during Radiation and Above1GHz Radiation testing:



2.5 DESCRIPTION TEST PERIPHERAL AND EUT PERIPHERAL

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Mfr/Brand	Model/Type No.	Note
E-1	Lockdown smart plug	lockdown	1117246	EUT

Item	Shielded Type	Ferrite Core	Length	Note

Note:

1. The support equipment was authorized by Declaration of Confirmation.
2. For detachable type I/O cable should be specified the length in cm in『Length』column.
3. “YES” is means “shielded” “with core”; “NO” is means “unshielded” “without core”.

2.6 MEASUREMENT INSTRUMENTS LIST

Item	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
Conduction Emissions Measurement					
1	Conducted Emission Test Software	EZ-EMC	Ver.CCS-3A1-CE	N/A	N/A
2	AMN	Schwarzbeck	NNLK8121	8121370	2020.10.15
3	AMN	ETS	3810/2	00020199	2020.10.15
4	AAN	TESEQ	T8-Cat6	38888	2020.10.15
5	Pulse Limiter	CYBRTEK	EM5010	E115010056	2021.05.25
6	EMI Test Receiver	Rohde&Schwarz	ESCI	101210	2020.10.15
Radiated Emissions Measurement					
1	Radiated Emission Test Software	EZ-EMC	Ver.CCS-03A1	N/A	N/A
2	Horn Antenna	Sunol	DRH-118	A101415	2020.10.08
3	Broadband Hybrid Antenna	Sunol	JB1	A090215	2022.03.01
4	PREAMP	HP	8449B	3008A00160	2020.10.21
5	PREAMP	HP	8447D	2944A07999	2021.05.25
6	EMI TEST RECEIVER	Rohde&Schwarz	ESR3	101891	2020.10.15
7	VECTOR Signal Generator	Rohde&Schwarz	SMU200A	101521	2020.10.15
8	Signal Generator	Agilent	E4421B	MY4335105	2020.10.15
9	MXA Signal Analyzer	Agilent	N9020A	MY50510140	2020.10.15
10	MXA Signal Analyzer	Keysight	N9020A	MY51110104	2020.10.15
11	RF Power sensor	DARE	RPR3006W	15I00041SNO88	2021.05.25
12	RF Power sensor	DARE	RPR3006W	15I00041SNO89	2021.05.25
13	RF power divider	Anritsu	K241B	992289	2020.10.28
14	Wideband radio communication tester	Rohde&Schwarz	CMW500	154987	2020.11.19
15	Active Loop Antenna	Com-Power	AL-130R	10160009	2021.05.25
16	Broadband Hybrid Antennas	Schwarzbeck	VULB9163	VULB9163#958	2021.05.25
17	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-1680	2021.05.25
18	Horn Antenna	A-INFOMW	LB-180400-KF	J211060660	2020.10.23
19	Microwave Broadband Preamplifier	Schwarzbeck	BBV 9721	100472	2021.05.25
20	Signal Generator	Agilent	N5183A	MY47420153	2021.05.25
21	Spctrum Analyzer	Rohde&Schwarz	FSP 40	100501	2021.05.25
22	Power Meter	KEYSIGHT	N1911A	MY50520168	2021.05.25
23	Frequency Meter	VICTOR	VC2000	997406086	2021.05.25
24	DC Power Source	HYELEC	HY5020E	055161818	2021.05.25

3 CONDUCTED EMISSION

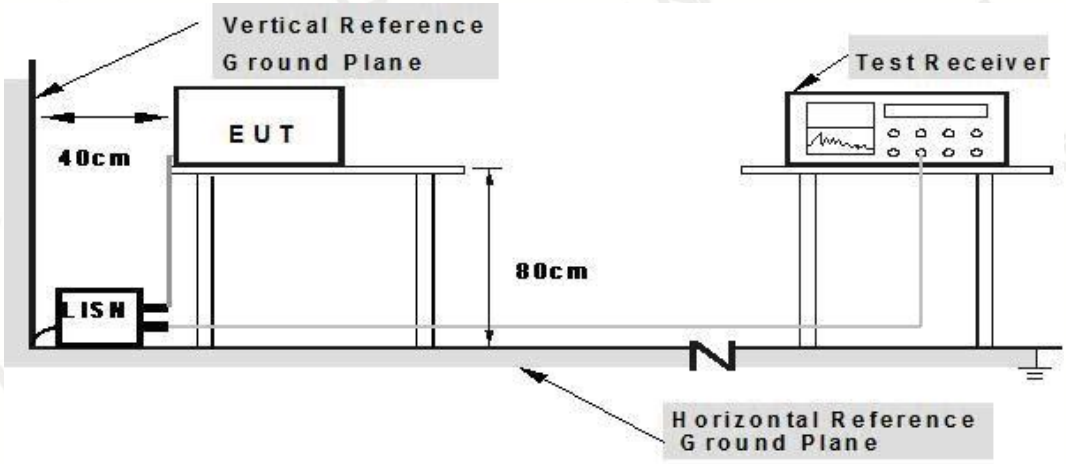
3.1 TEST LIMIT

For unintentional device, according to § 15.207(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



Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

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. The EUT is placed on 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.

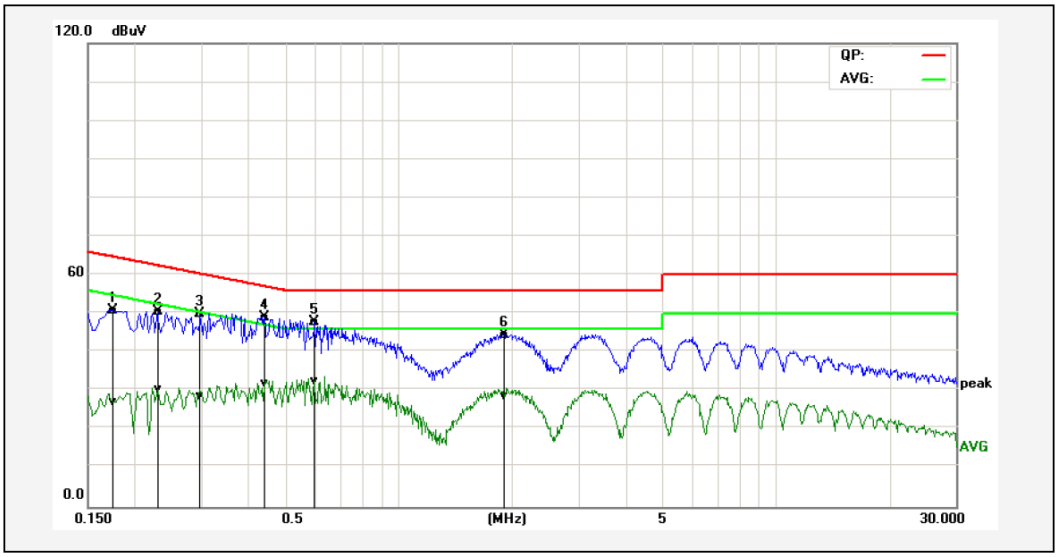
3.4 TEST RESULT

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 test at Low, Middle, and High channel, only the worst result of 802.11b Low Channel was reported.

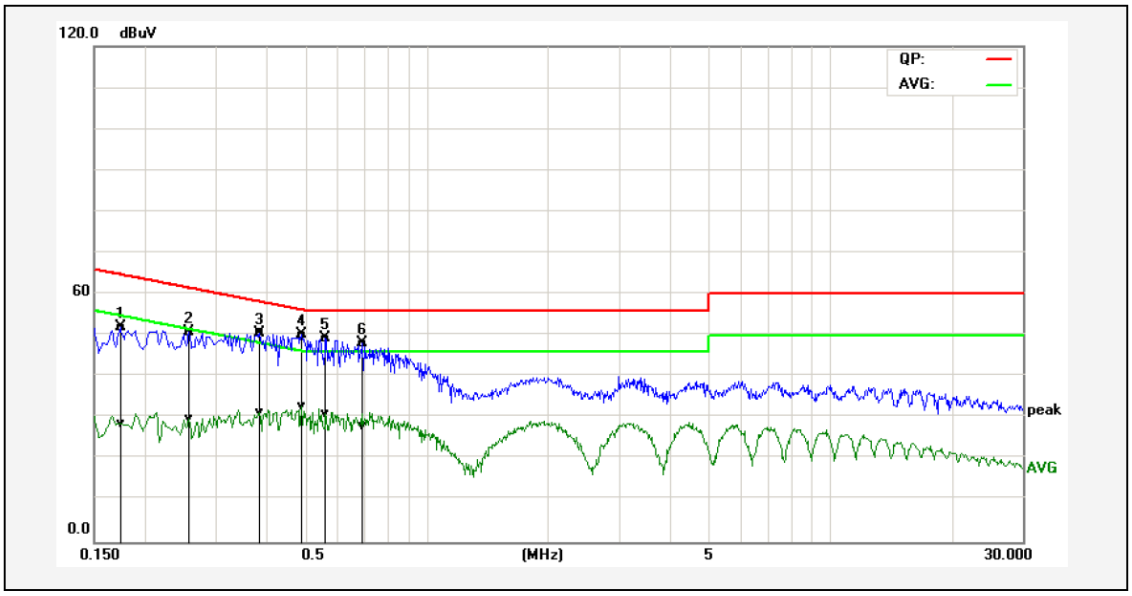
Temperature:	24℃	Relative Humidity:	48%
Test Date:	Apr. 28, 2020	Pressure:	1010hPa
Test Voltage:	AC 120V, 60Hz	Phase:	Line
Test Mode:	Transmitting mode of 802.11b 2412MHz		



No.	Frequency (MHz)	QuasiPeak reading (dBuV)	Average reading (dBuV)	Correction factor (dB)	QuasiPeak result (dBuV)	Average result (dBuV)	QuasiPeak limit (dBuV)	Average limit (dBuV)	QuasiPeak margin (dB)	Average margin (dB)	Remark
1P	0.1740	41.35	17.47	9.57	50.92	27.04	64.77	54.77	-13.85	-27.73	Pass
2P	0.2300	40.99	20.66	9.65	50.64	30.31	62.45	52.45	-11.81	-22.14	Pass
3P	0.2980	40.16	18.98	9.68	49.84	28.66	60.30	50.30	-10.46	-21.64	Pass
4*	0.4420	39.36	22.19	9.69	49.05	31.88	57.02	47.02	-7.97	-15.14	Pass
5P	0.5980	38.05	22.86	9.69	47.74	32.55	56.00	46.00	-8.26	-13.45	Pass
6P	1.9020	34.82	18.94	9.79	44.61	28.73	56.00	46.00	-11.39	-17.27	Pass

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

Temperature:	24℃	Relative Humidity:	48%
Test Date:	Apr. 28, 2020	Pressure:	1010hPa
Test Voltage:	AC 120V, 60Hz	Phase:	Neutral
Test Mode:	Transmitting mode of 802.11b 2412MHz		



No.	Frequency (MHz)	QuasiPeak reading (dBuV)	Average reading (dBuV)	Correction factor (dB)	QuasiPeak result (dBuV)	Average result (dBuV)	QuasiPeak limit (dBuV)	Average limit (dBuV)	QuasiPeak margin (dB)	Average margin (dB)	Remark
1P	0.1740	42.37	19.21	9.57	51.94	28.78	64.76	54.77	-12.82	-25.99	Pass
2P	0.2580	41.05	20.06	9.68	50.73	29.74	61.49	51.50	-10.76	-21.76	Pass
3P	0.3860	40.98	21.67	9.72	50.70	31.39	58.15	48.15	-7.45	-16.76	Pass
4*	0.4900	40.51	23.09	9.68	50.19	32.77	56.17	46.17	-5.98	-13.40	Pass
5P	0.5620	39.52	21.45	9.69	49.21	31.14	56.00	46.00	-6.79	-14.86	Pass
6P	0.6940	38.31	18.23	9.71	48.02	27.94	56.00	46.00	-7.98	-18.06	Pass

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

4 RADIATED EMISSION

4.1 TEST LIMIT

For unintentional device, according to §15.209(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	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
0.009MHz-0.490MHz	2400/F (kHz)	-	Quasi-peak	300
0.490MHz-1.705MHz	24000/F (kHz)	-	Quasi-peak	30
1.705MHz-30MHz	30	-	Quasi-peak	30
30MHz-88MHz	100	40.0	Quasi-peak	3
88MHz-216MHz	150	43.5	Quasi-peak	3
216MHz-960MHz	200	46.0	Quasi-peak	3
960MHz-1GHz	500	54.0	Quasi-peak	3
Above 1GHz	500	54.0	Average	3
		74.0	Peak	3

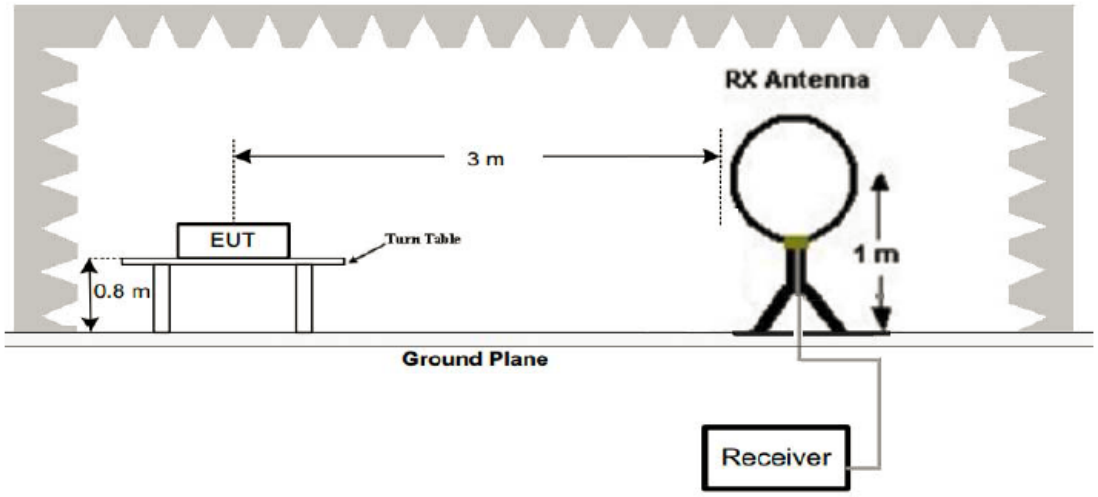
Limit calculation and transfer to 3m distance as showed in the following table:

Frequency (MHz)	Limit (dBuV/m)	Distance (m)
0.009-0.490	20log(2400/F(KHz))+40log(300/3)	3
0.490-1.705	20log(24000/F(KHz))+40log(30/3)	3
1.705-30.0	69.5	3
30-88	40.0	3
88-216	43.5	3
216-960	46.0	3
Above 960	54.0	3

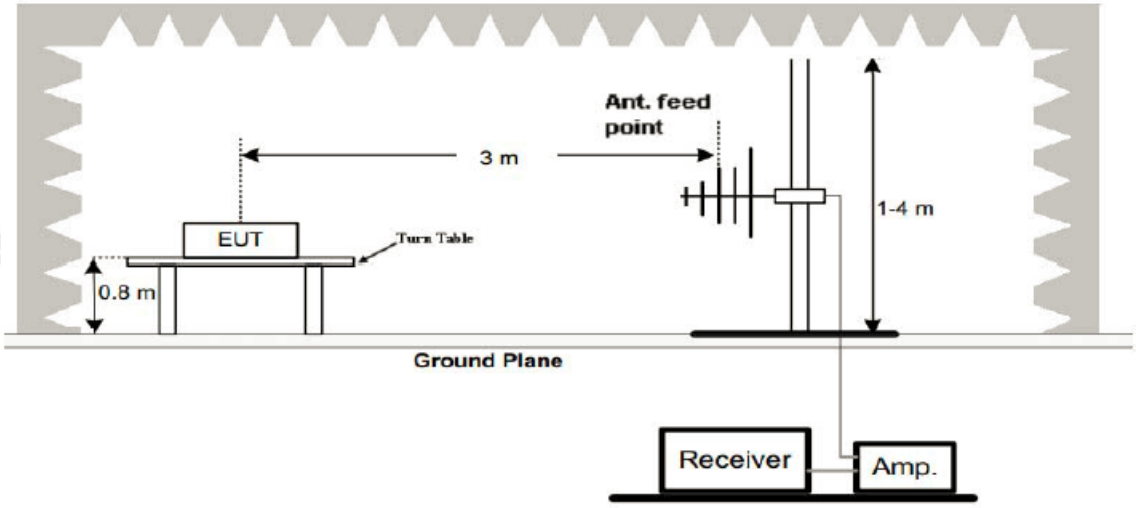
For intentional device, according to §15.209(a), the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the above table.

4.2 TEST SETUP

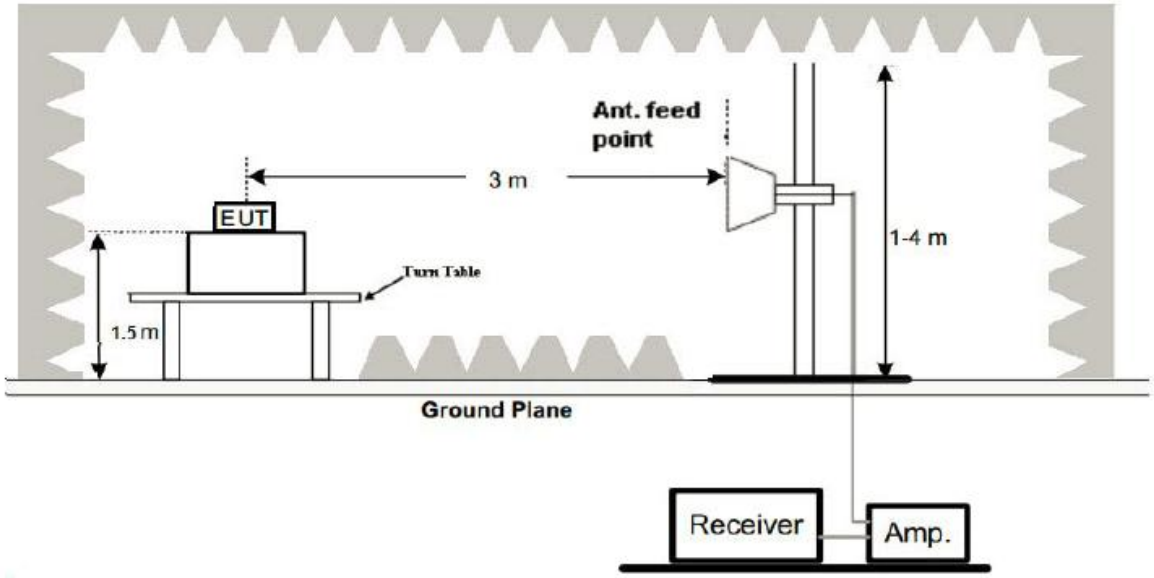
1. Radiated Emission Test-Up Frequency Below 30MHz



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).

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

4.4 TEST RESULT

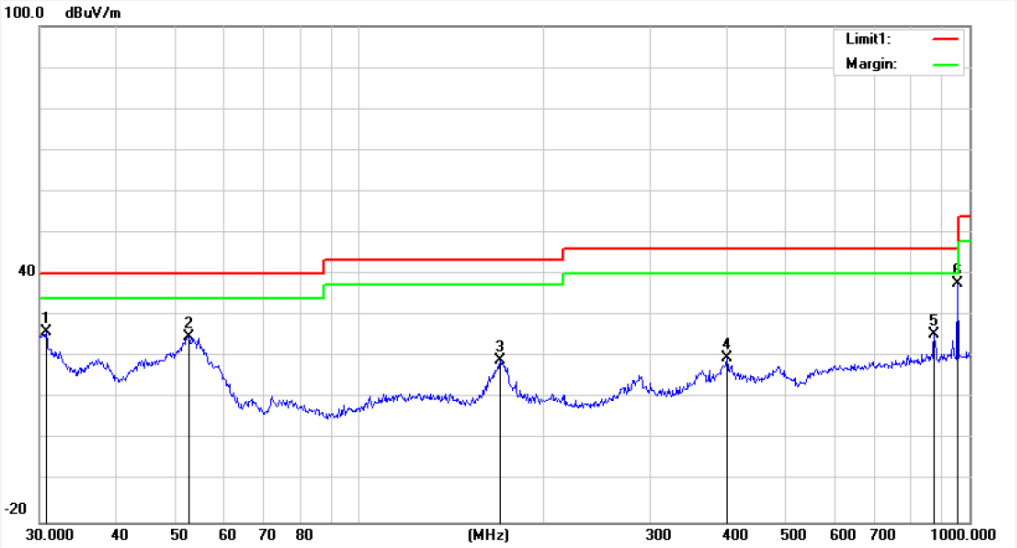
PASS

Remark:

1. All modes 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 “X axis” position was the worst, and test data recorded in this report.

Below 1GHz Test Results:

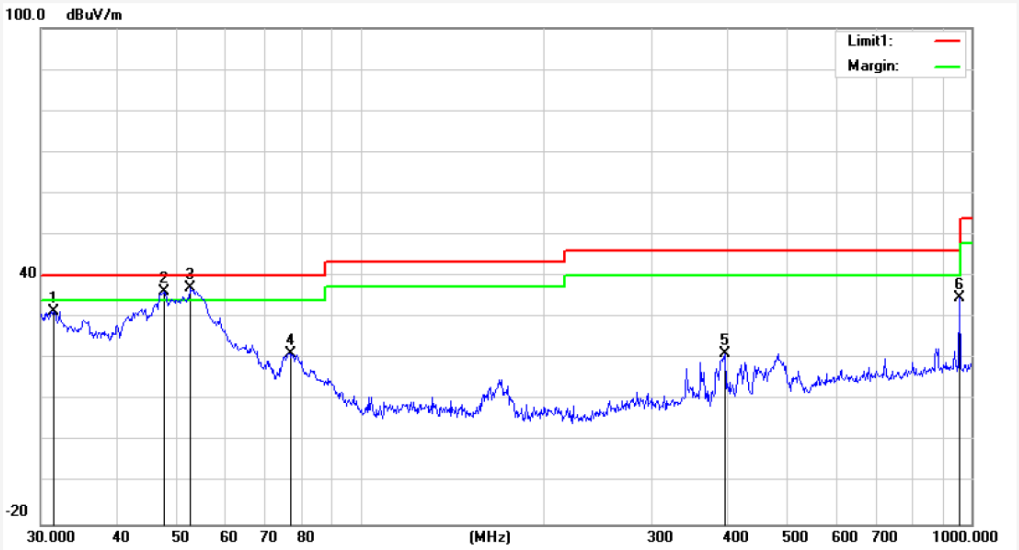
Temperature:	24℃	Relative Humidity:	48%
Test Date:	Apr. 28, 2020	Pressure:	1010hPa
Test Voltage:	AC 120V, 60Hz	Phase:	Horizontal
Test Mode:	Transmitting mode of 802.11b 2412MHz		



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (deg.)	Height (cm)	Remark
1	30.7455	33.75	-7.73	26.02	40.00	-13.98	60	100	peak
2	52.5753	45.80	-20.90	24.90	40.00	-15.10	90	100	peak
3	170.1948	36.30	-17.28	19.02	43.50	-24.48	150	100	peak
4	400.4319	32.49	-12.85	19.64	46.00	-26.36	200	100	peak
5	875.2470	32.34	-6.82	25.52	46.00	-20.48	30	100	peak
6*	955.4381	43.79	-6.10	37.69	46.00	-8.31	280	100	peak

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

Temperature:	24℃	Relative Humidity:	48%
Test Date:	Apr. 28, 2020	Pressure:	1010hPa
Test Voltage:	AC 120V, 60Hz	Phase:	Vertical
Test Mode:	Transmitting mode of 802.11b 2412MHz		



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (deg.)	Height (cm)	Remark
1	31.5095	39.86	-8.33	31.53	40.00	-8.47	80	100	peak
2!	47.8260	55.92	-19.63	36.29	40.00	-3.71	90	100	peak
3*	52.7600	58.17	-20.92	37.25	40.00	-2.75	220	100	peak
4	76.7808	42.86	-21.48	21.38	40.00	-18.62	50	100	peak
5	394.8545	34.21	-13.08	21.13	46.00	-24.87	100	100	peak
6	955.4381	40.75	-6.10	34.65	46.00	-11.35	120	100	peak

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 30MHzwas verified, and no any emission was found except system noise floor, emission are more than 20dB below the limit form 9kHz to 30MHz
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:

CH01 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	61.56	-3.64	57.92	74	-16.08	PK
4824	50.46	-3.64	46.82	54	-7.18	AV
7236	56.98	-0.95	56.03	74	-17.97	PK
7236	46.83	-0.95	45.88	54	-8.12	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	61.16	-3.64	57.52	74	-16.48	PK
4824	50.30	-3.64	46.66	54	-7.34	AV
7236	57.10	-0.95	56.15	74	-17.85	PK
7236	46.84	-0.95	45.89	54	-8.11	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit						

CH06 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	60.95	-3.51	57.44	74	-16.56	PK
4874	50.23	-3.51	46.72	54	-7.28	AV
7311	57.02	-0.82	56.20	74	-17.80	PK
7311	46.59	-0.82	45.77	54	-8.23	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	61.20	-3.51	57.69	74	-16.31	PK
4874	50.18	-3.51	46.67	54	-7.33	AV
7311	56.75	-0.82	55.93	74	-18.07	PK
7311	46.55	-0.82	45.73	54	-8.27	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit						

CH11 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	61.14	-3.43	57.71	74	-16.29	PK
4924	49.96	-3.43	46.53	54	-7.47	AV
7386	56.81	-0.75	56.06	74	-17.94	PK
7386	46.74	-0.75	45.99	54	-8.01	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	60.95	-3.43	57.52	74	-16.48	PK
4924	50.11	-3.43	46.68	54	-7.32	AV
7386	57.20	-0.75	56.45	74	-17.55	PK
7386	46.63	-0.75	45.88	54	-8.12	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit						

CH01 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	60.85	-3.64	57.21	74	-16.79	PK
4824	48.78	-3.64	45.14	54	-8.86	AV
7236	57.57	-0.95	56.62	74	-17.38	PK
7236	45.67	-0.95	44.72	54	-9.28	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	61.04	-3.64	57.40	74	-16.60	PK
4824	48.85	-3.64	45.21	54	-8.79	AV
7236	57.62	-0.95	56.67	74	-17.33	PK
7236	45.70	-0.95	44.75	54	-9.25	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit						

CH06 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	60.79	-3.51	57.28	74	-16.72	PK
4874	48.74	-3.51	45.23	54	-8.77	AV
7311	57.60	-0.82	56.78	74	-17.22	PK
7311	45.70	-0.82	44.88	54	-9.12	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	60.80	-3.51	57.29	74	-16.71	PK
4874	49.10	-3.51	45.59	54	-8.41	AV
7311	56.86	-0.82	56.04	74	-17.96	PK
7311	45.56	-0.82	44.74	54	-9.26	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit						

CH11 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	61.10	-3.43	57.67	74	-16.33	PK
4924	48.70	-3.43	45.27	54	-8.73	AV
7386	56.84	-0.75	56.09	74	-17.91	PK
7386	45.72	-0.75	44.97	54	-9.03	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	61.02	-3.43	57.59	74	-16.41	PK
4924	48.90	-3.43	45.47	54	-8.53	AV
7386	56.92	-0.75	56.17	74	-17.83	PK
7386	46.20	-0.75	45.45	54	-8.55	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit						

CH01 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	60.44	-3.64	56.80	74	-17.20	PK
4824	48.55	-3.64	44.91	54	-9.09	AV
7236	56.77	-0.95	55.82	74	-18.18	PK
7236	44.97	-0.95	44.02	54	-9.98	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	60.38	-3.64	56.74	74	-17.26	PK
4824	48.27	-3.64	44.63	54	-9.37	AV
7236	56.80	-0.95	55.85	74	-18.15	PK
7236	45.20	-0.95	44.25	54	-9.75	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit						

CH06 of 802.11n/H20 Mode (2437MHz):

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4874	60.50	-3.51	56.99	74	-17.01	PK
4874	48.00	-3.51	44.49	54	-9.51	AV
7311	56.80	-0.82	55.98	74	-18.02	PK
7311	44.90	-0.82	44.08	54	-9.92	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	60.30	-3.51	56.79	74	-17.21	PK
4874	48.10	-3.51	44.59	54	-9.41	AV
7311	56.82	-0.82	56.00	74	-18.00	PK
7311	45.10	-0.82	44.28	54	-9.72	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit						

CH11 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	60.33	-3.43	56.90	74	-17.10	PK
4924	47.84	-3.43	44.41	54	-9.59	AV
7386	56.75	-0.75	56.00	74	-18.00	PK
7386	44.80	-0.75	44.05	54	-9.95	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	60.20	-3.43	56.77	74	-17.23	PK
4924	47.63	-3.43	44.20	54	-9.80	AV
7386	56.70	-0.75	55.95	74	-18.05	PK
7386	44.76	-0.75	44.01	54	-9.99	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. The emissions are attenuated more than 20dB below the permissible limits are not recorded in the report.
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.
7. All modes of operation were investigated and the worst-case emissions are reported.

CH01 of 802.11b Mode (2412MHz)

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2310	56.73	-5.81	50.92	74	-23.08	PK
2310	/	-5.81	/	54	/	AV
2390	65.11	-5.84	59.27	74	-14.73	PK
2390	47.60	-5.84	41.76	54	-12.24	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
2310	55.97	-5.81	50.16	74	-23.84	PK
2310	/	-5.81	/	54	/	AV
2390	64.75	-5.84	58.91	74	-15.09	PK
2390	47.77	-5.84	41.93	54	-12.07	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit						

CH11 of 802.11b Mode (2462MHz)

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2483.5	57.00	-5.65	51.35	74	-22.65	PK
2483.5	/	-5.65	/	54	/	AV
2500	57.10	-5.72	51.38	74	-22.62	PK
2500	/	-5.72	/	54	/	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
2483.5	56.82	-5.65	51.17	74	-22.83	PK
2483.5	/	-5.65	/	54	/	AV
2500	56.99	-5.72	51.27	74	-22.73	PK
2500	/	-5.72	/	54	/	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit						

CH01 of 802.11g Mode (2412MHz)

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2310	56.88	-5.81	51.07	74	-22.93	PK
2310	/	-5.81	/	54	/	AV
2390	65.27	-5.84	59.43	74	-14.57	PK
2390	47.75	-5.84	41.91	54	-12.09	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
2310	57.05	-5.81	51.24	74	-22.76	PK
2310	/	-5.81	/	54	/	AV
2390	65.14	-5.84	59.30	74	-14.70	PK
2390	47.83	-5.84	41.99	54	-12.01	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit						

CH11 of 802.11g Mode (2462MHz)

Horizontal:

Frequency (MHz)	Reading Result (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2483.5	56.60	-5.65	50.95	74	-23.05	PK
2483.5	/	-5.65	/	54	/	AV
2500	57.71	-5.72	51.99	74	-22.01	PK
2500	/	-5.72	/	54	/	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
2483.5	56.20	-5.65	50.55	74	-23.45	PK
2483.5	/	-5.65	/	54	/	AV
2500	57.48	-5.72	51.76	74	-22.24	PK
2500	/	-5.72	/	54	/	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit						

CH01 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
2310	57.24	-5.81	51.43	74	-22.57	PK
2310	/	-5.81	/	54	/	AV
2390	65.10	-5.84	59.26	74	-14.74	PK
2390	47.22	-5.84	41.38	54	-12.62	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
2310	57.44	-5.81	51.63	74	-22.37	PK
2310	/	-5.81	/	54	/	AV
2390	64.74	-5.84	58.90	74	-15.10	PK
2390	47.38	-5.84	41.54	54	-12.46	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit						

CH11 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
2483.5	57.17	-5.65	51.52	74	-22.48	PK
2483.5	/	-5.65	/	54	/	AV
2500	56.82	-5.72	51.10	74	-22.90	PK
2500	/	-5.72	/	54	/	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
2483.5	57.10	-5.65	51.45	74	-22.55	PK
2483.5	/	-5.65	/	54	/	AV
2500	57.17	-5.72	51.45	74	-22.55	PK
2500	/	-5.72	/	54	/	AV
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit						

5 OCCUPIED BANDWIDTH

5.1 TEST LIMIT

FCC Part15(15.247), Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(a)(2)	Bandwidth	>= 500KHz (6dB bandwidth)	2400-2483.5	PASS

5.2 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.

5.3 EQUIPMENT USED

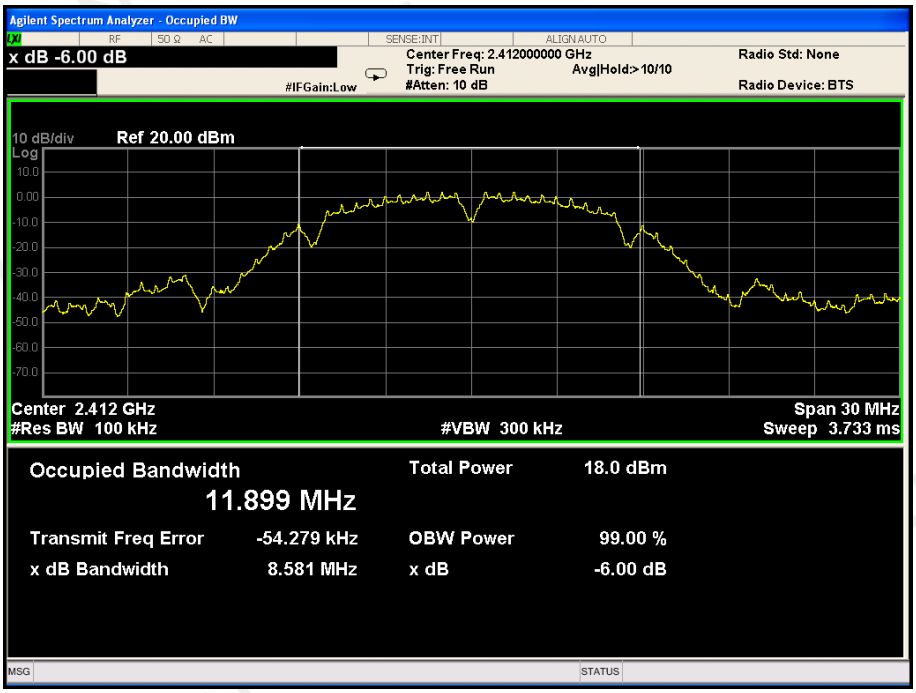
Same as Radiated Emission Measurement.

5.4 TEST RESULT

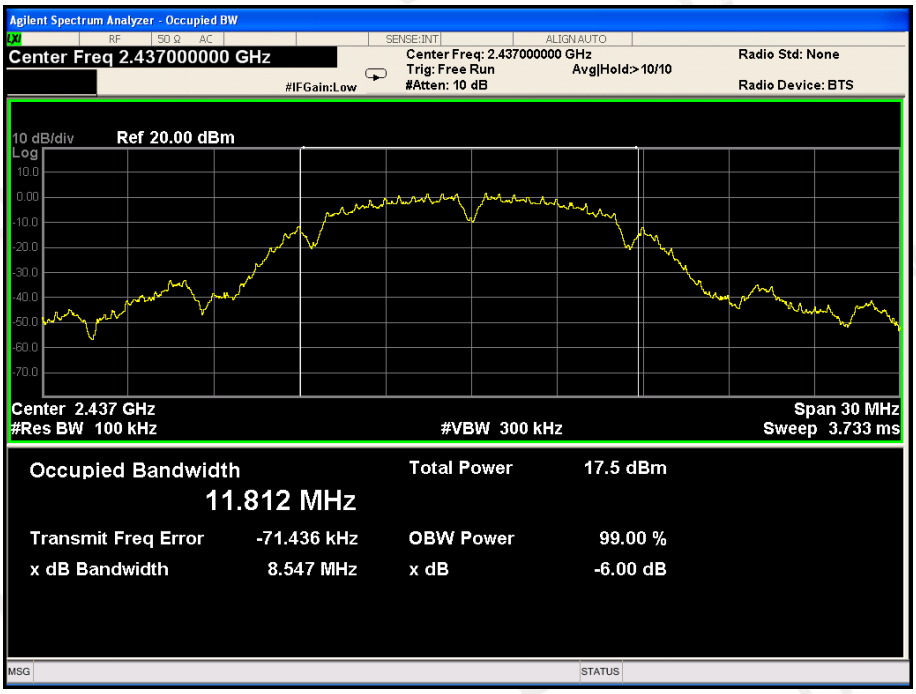
PASS

TX 802.11b Mode			
Frequency (MHz)	6dB Bandwidth (MHz)	Channel Separation (kHz)	Result
2412	8.581	>=500	PASS
2437	8.547	>=500	PASS
2462	8.069	>=500	PASS

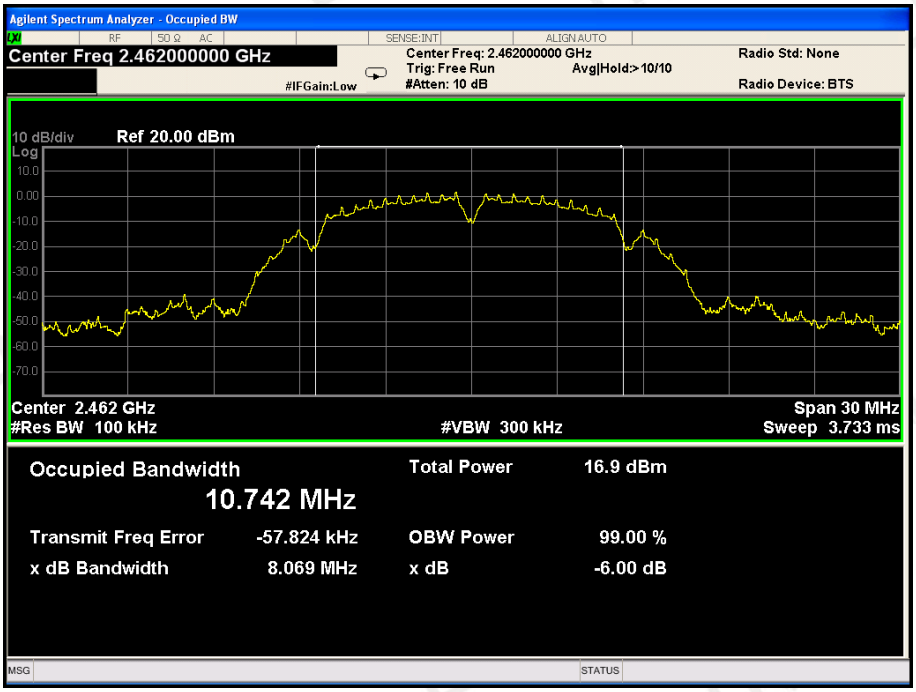
CH01: 2412MHz



CH06: 2437MHz

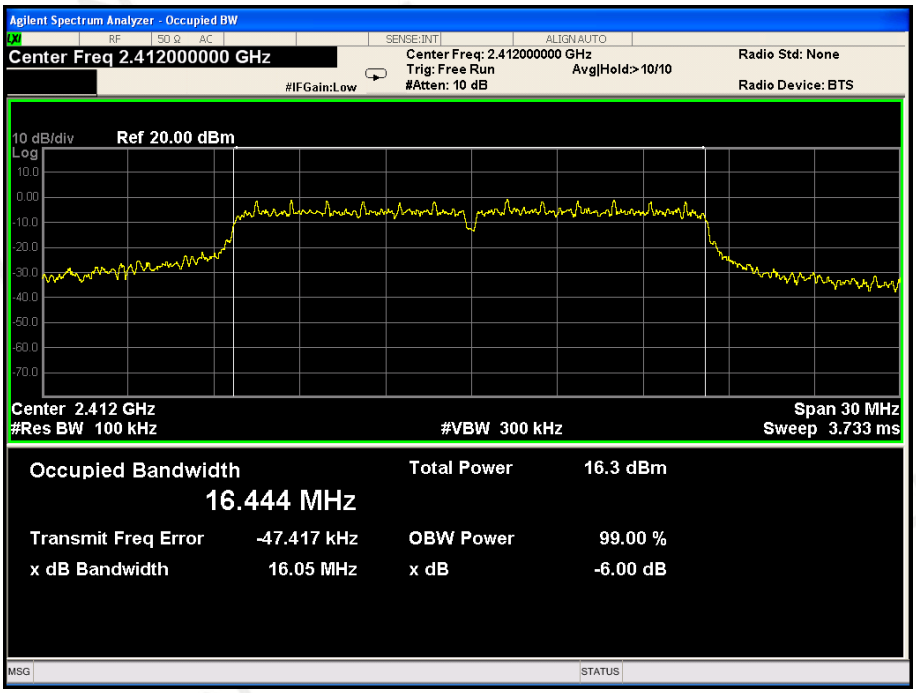


CH11: 2462MHz

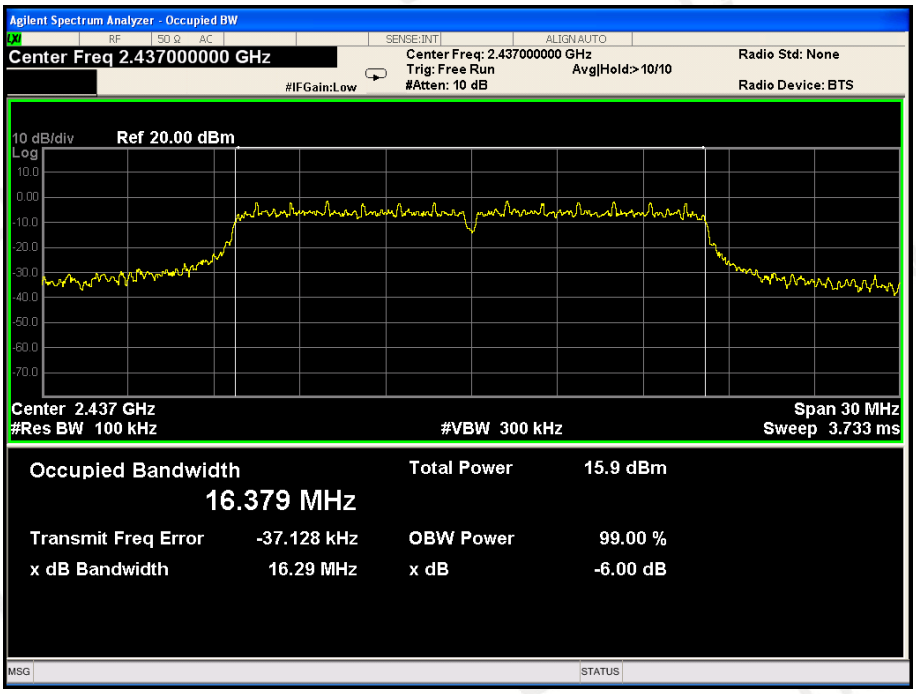


TX 802.11g Mode			
Frequency (MHz)	6dB Bandwidth (MHz)	Channel Separation (kHz)	Result
2412	16.05	>=500	PASS
2437	16.29	>=500	PASS
2462	16.29	>=500	PASS

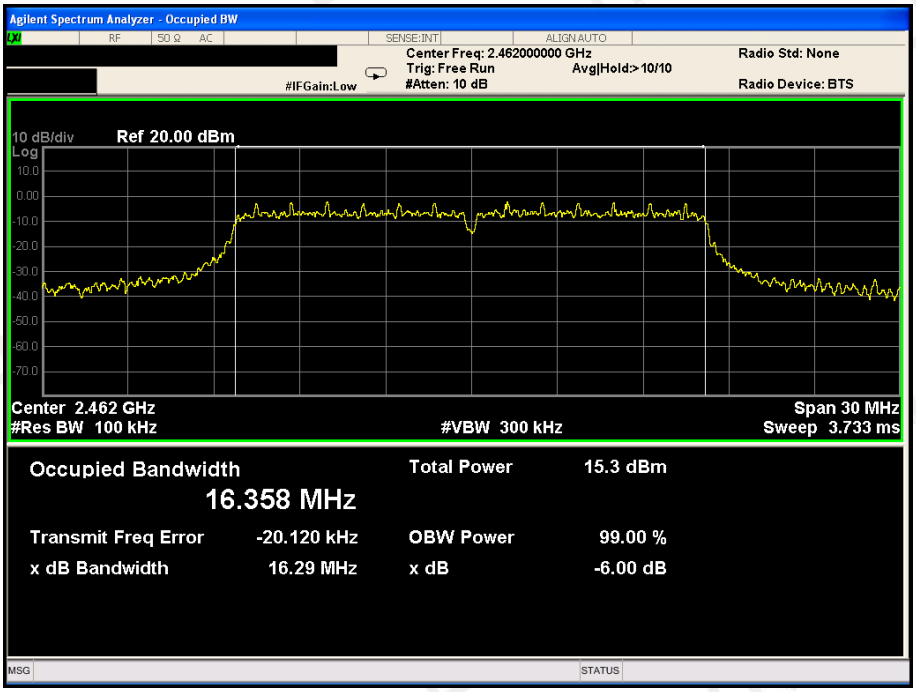
CH01: 2412MHz



CH06: 2437MHz

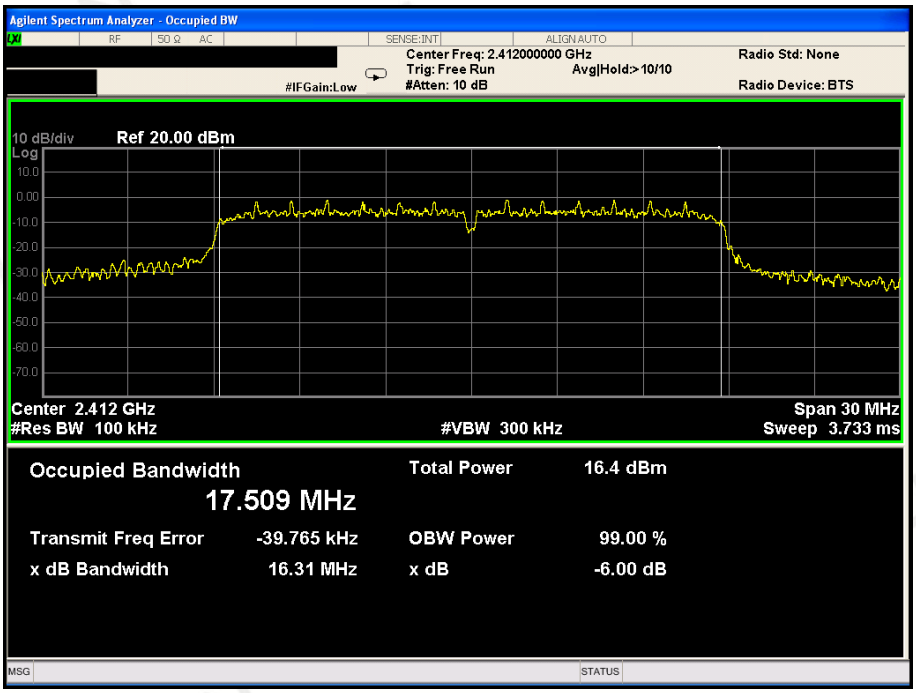


CH11: 2462MHz

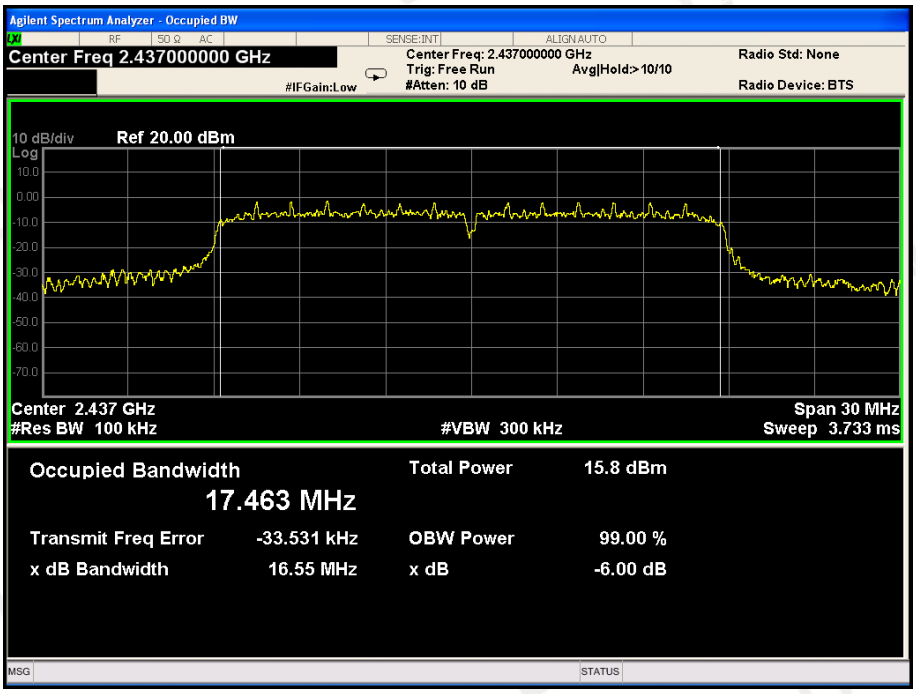


TX 802.11n/HT20 Mode			
Frequency (MHz)	6dB Bandwidth (MHz)	Channel Separation (kHz)	Result
2412	16.31	>=500	PASS
2437	16.55	>=500	PASS
2462	16.54	>=500	PASS

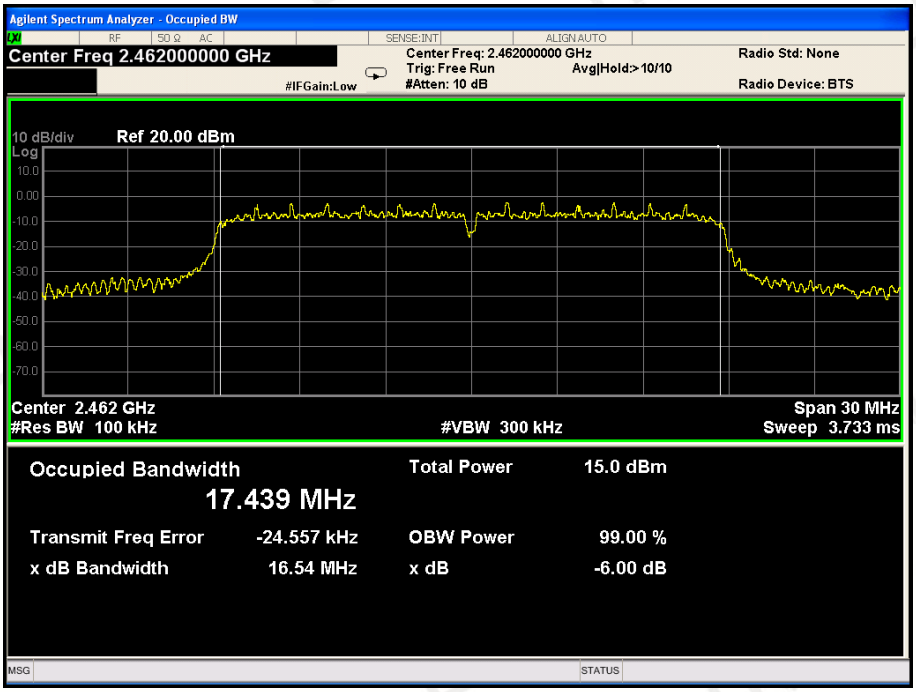
CH01: 2412MHz



CH06: 2437MHz



CH11: 2462MHz



6 POWER SPECTRAL DENSITY

6.1 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

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=3kHz, VBW=10kHz.
4. The useful radiated emission from the EUT was detected by the spectrum analyzer with peak detector.

6.3 EQUIPMENT USED

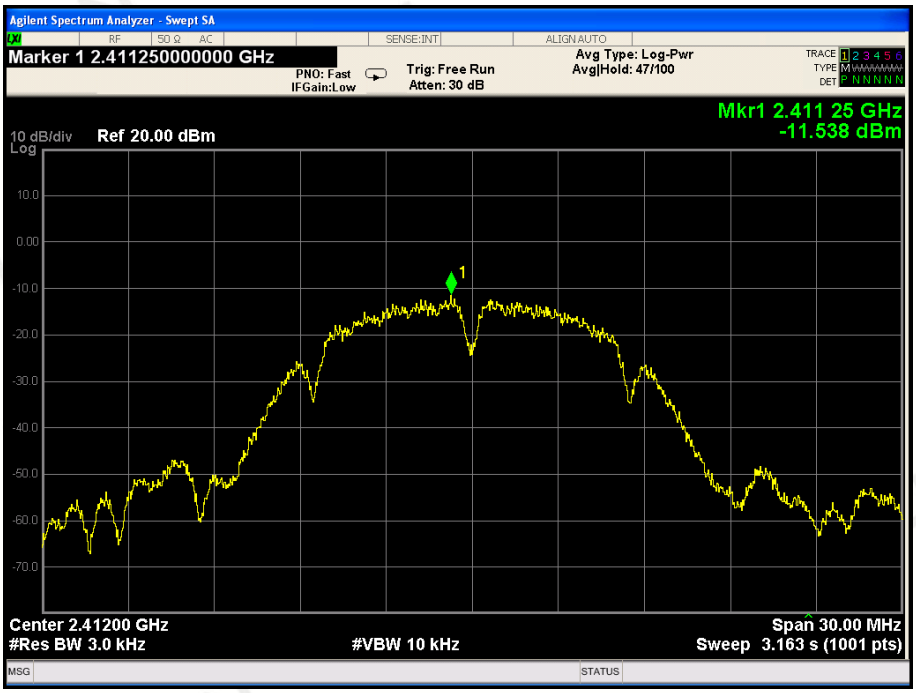
Same as Radiated Emission Measurement.

6.4 TEST RESULT

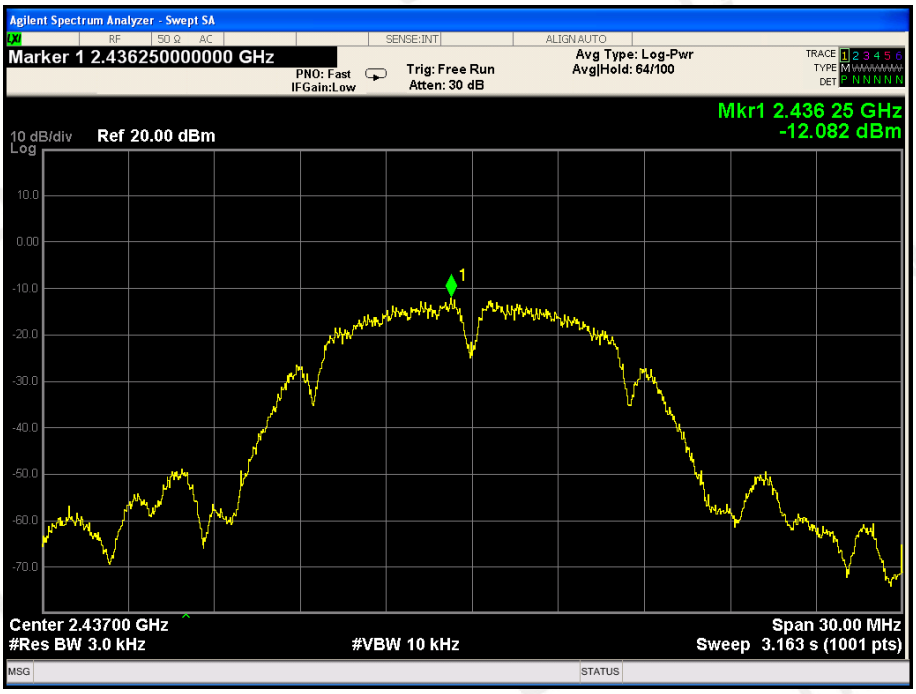
PASS

TX 802.11b Mode			
Frequency (MHz)	Power Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
2412	-11.538	8	PASS
2437	-12.082	8	PASS
2462	-12.453	8	PASS

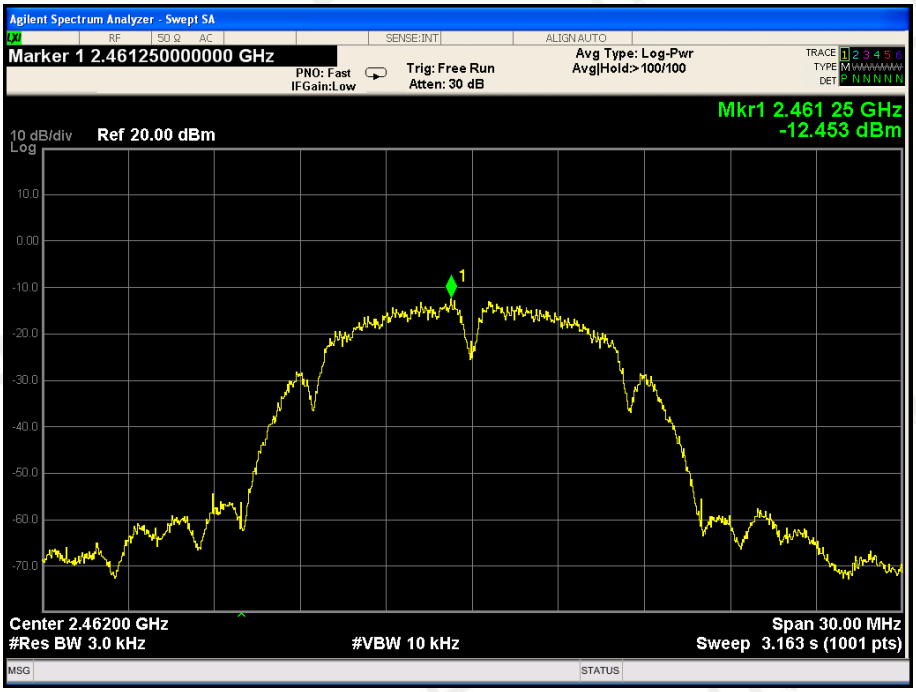
CH01: 2412MHz



CH06: 2437MHz

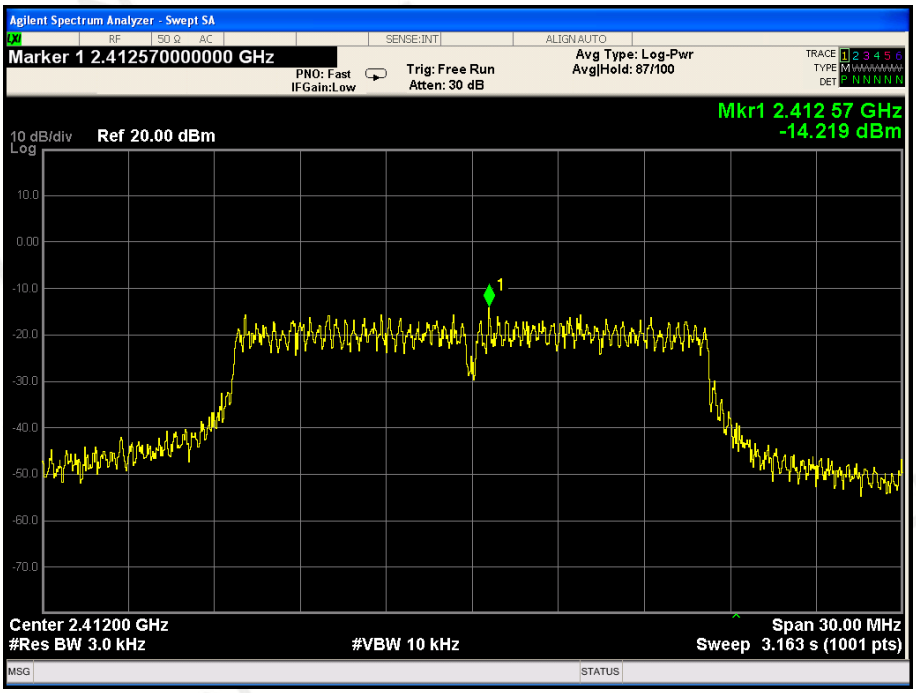


CH11: 2462MHz

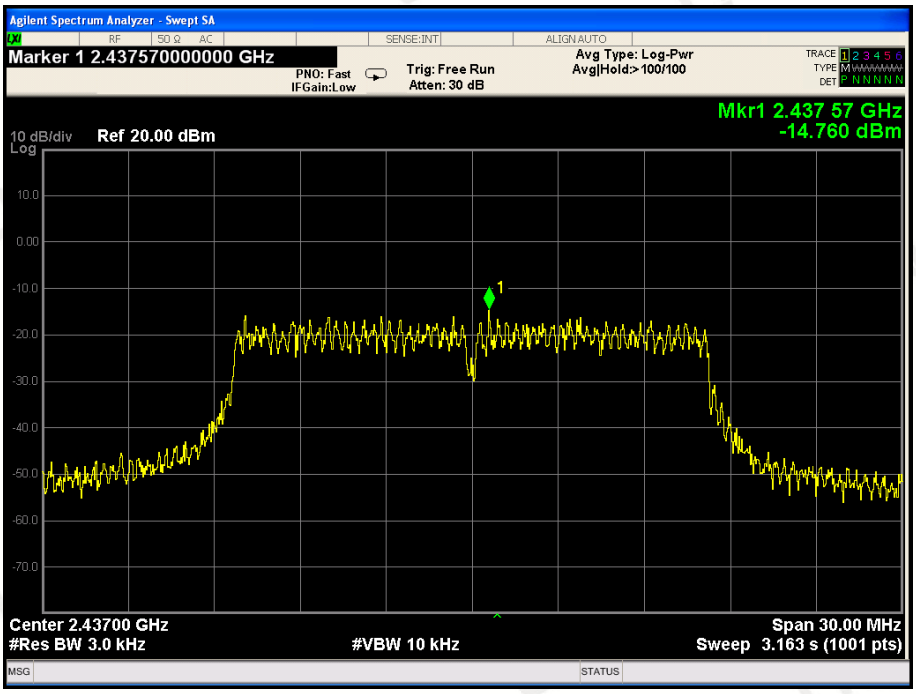


TX 802.11g Mode			
Frequency (MHz)	Power Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
2412	-14.219	8	PASS
2437	-14.760	8	PASS
2462	-15.454	8	PASS

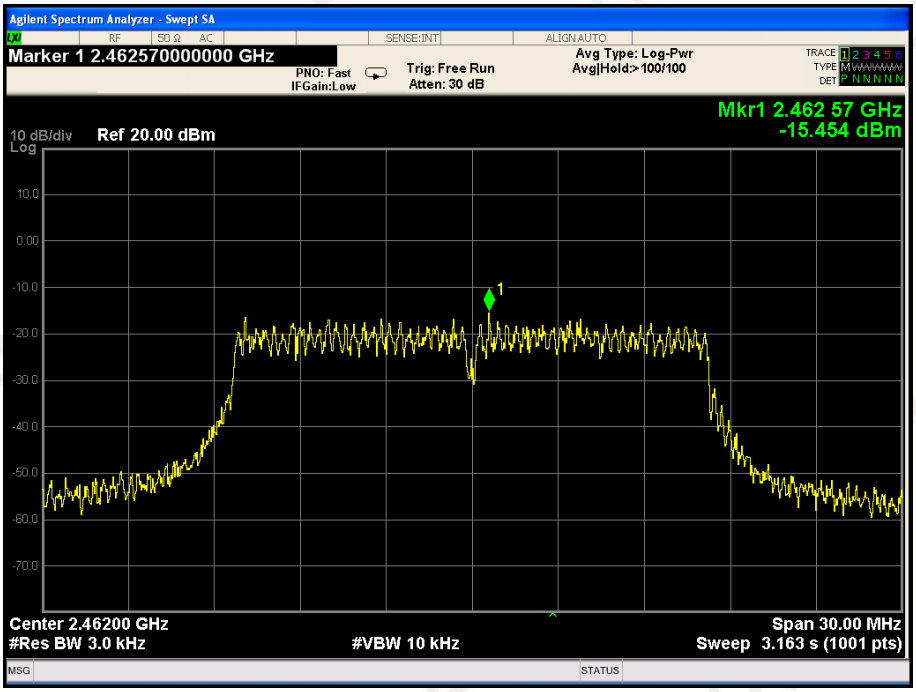
CH01: 2412MHz



CH06: 2437MHz

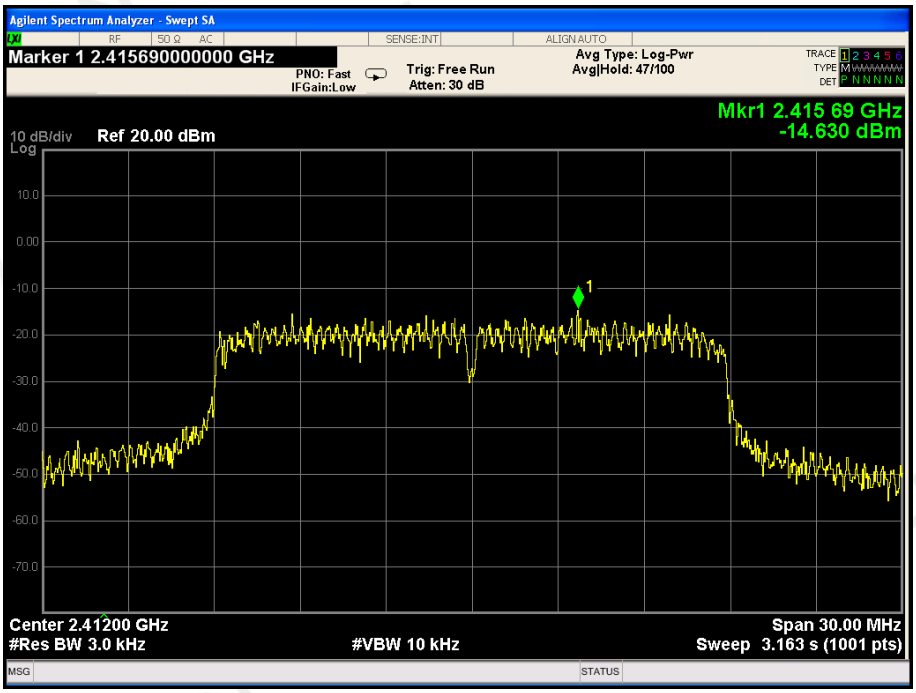


CH11: 2462MHz

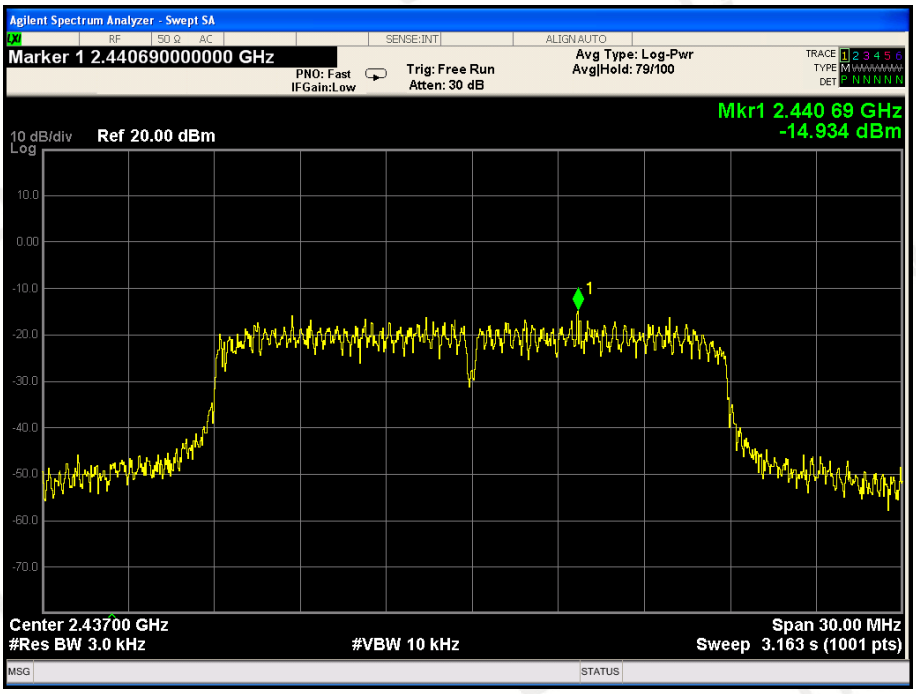


TX 802.11n/HT20 Mode			
Frequency (MHz)	Power Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
2412	-14.630	8	PASS
2437	-14.934	8	PASS
2462	-15.709	8	PASS

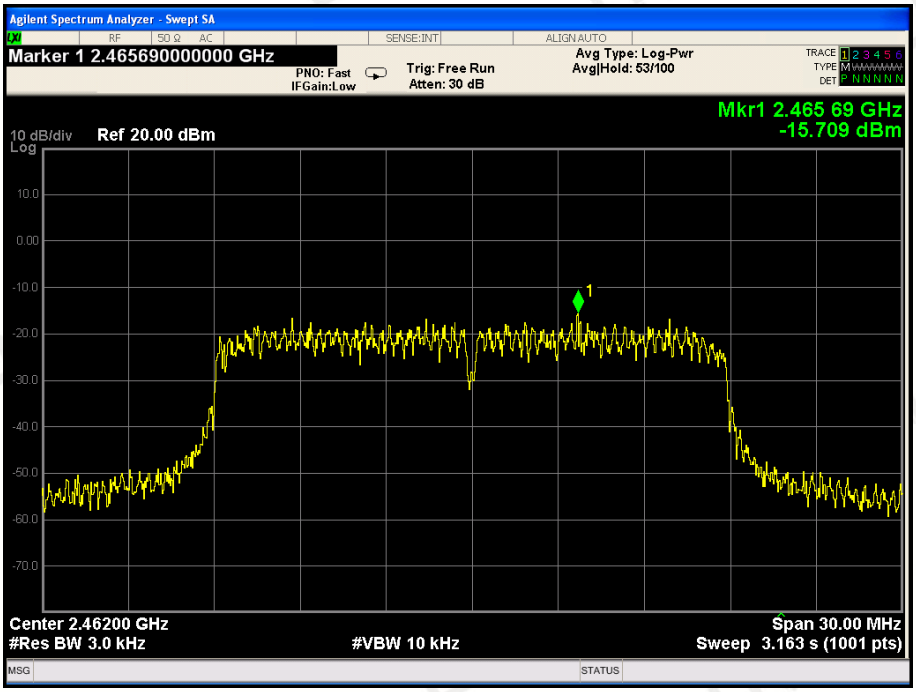
CH01: 2412MHz



CH06: 2437MHz



CH11: 2462MHz



7 PEAK OUTPUT POWER

7.1 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

7.2 TEST PROCEDURE

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. The EUT was directly connected to the Power meter.

7.3 EQUIPMENT USED

Same as Radiated Emission Measurement.

7.4 TEST RESULT

PASS

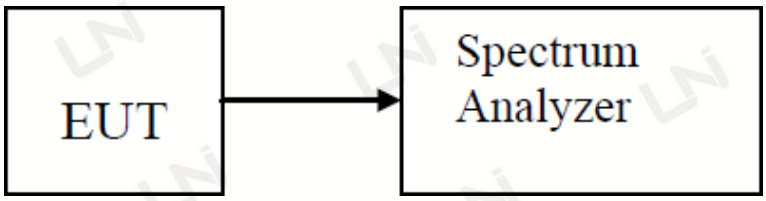
Test Mode	Frequency (MHz)	Maximum Peak Conducted Output Power (dBm)	LIMIT (dBm)
802.11b	2412	11.86	30
	2437	11.55	30
	2462	11.20	30
802.11g	2412	11.27	30
	2437	11.11	30
	2462	10.96	30
802.11n/HT20	2412	11.07	30
	2437	10.90	30
	2462	10.85	30

8 OUT OF BAND EMISSIONS

8.1 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.

8.2 TEST SETUP



8.3 TEST PROCEDURE

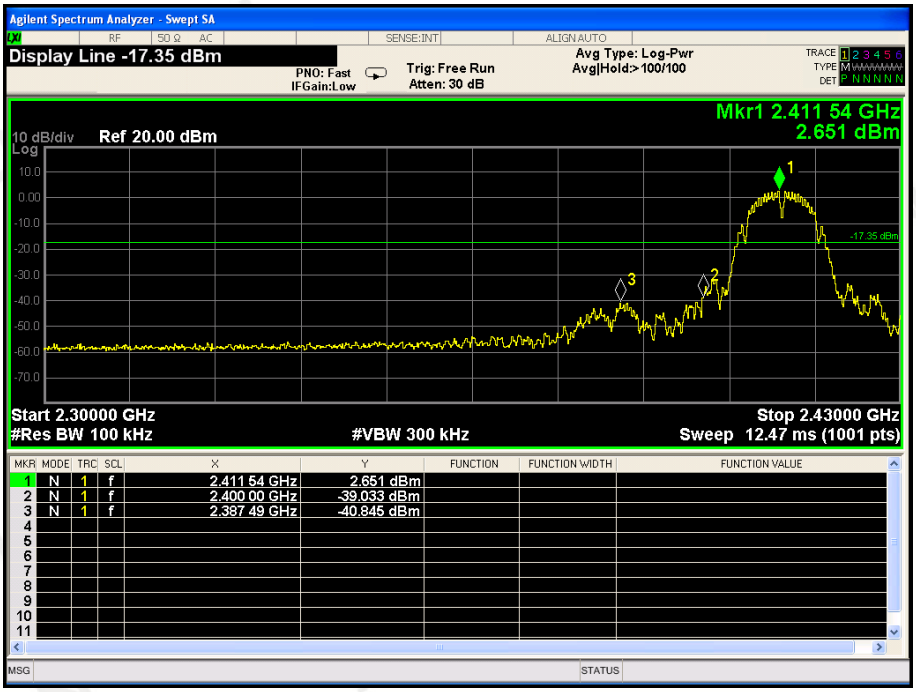
1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set EUT as TX operation and connect directly to the spectrum analyzer.
3. Based on FCC Part15 C Section 15.247: RBW=100kHz, VBW=300kHz.
4. Set detected by the spectrum analyzer with peak detector.

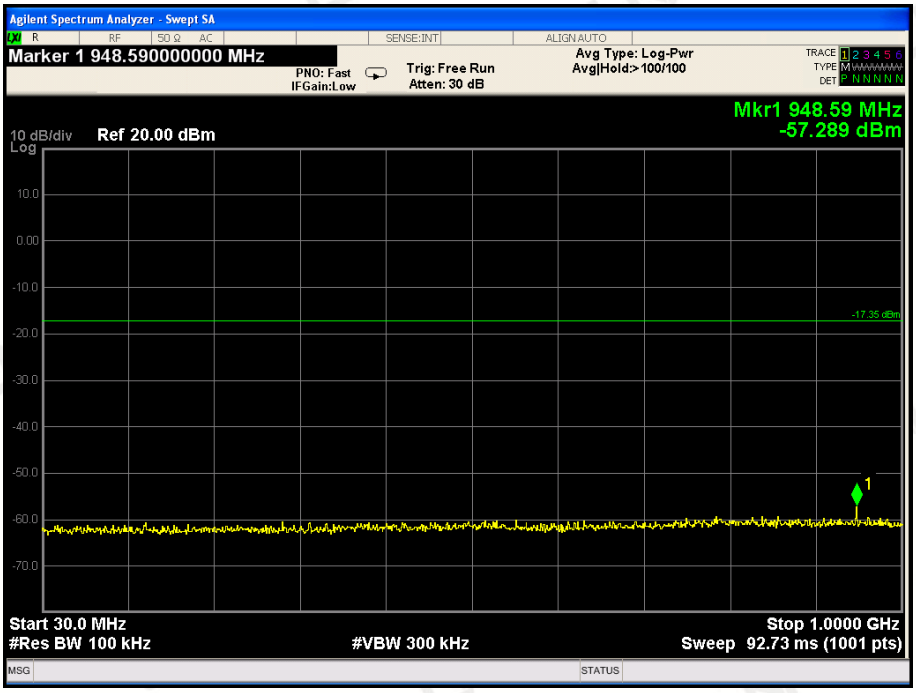
8.4 TEST RESULT

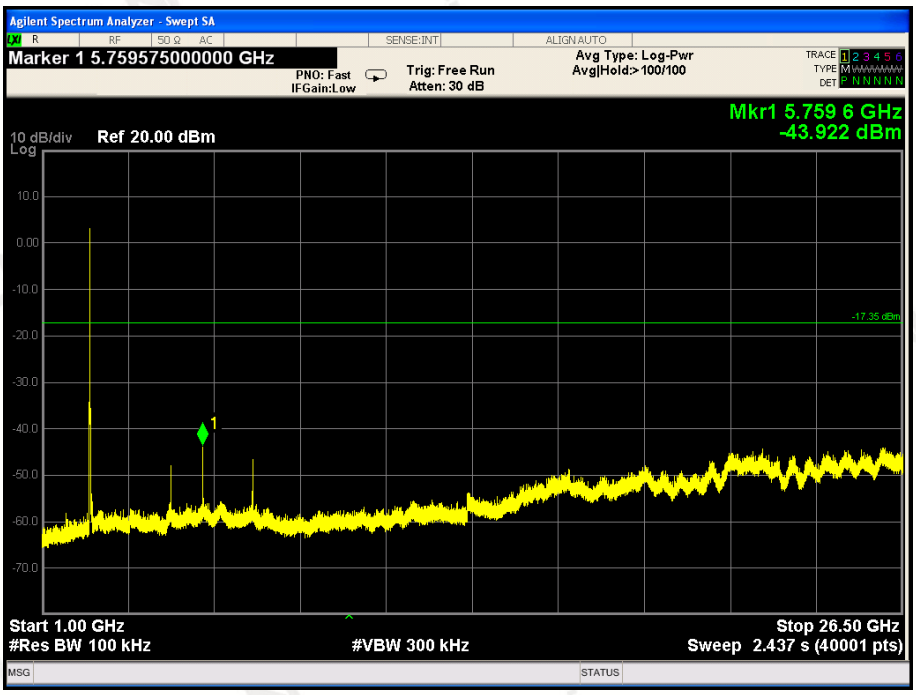
PASS

TX 802.11b Mode:

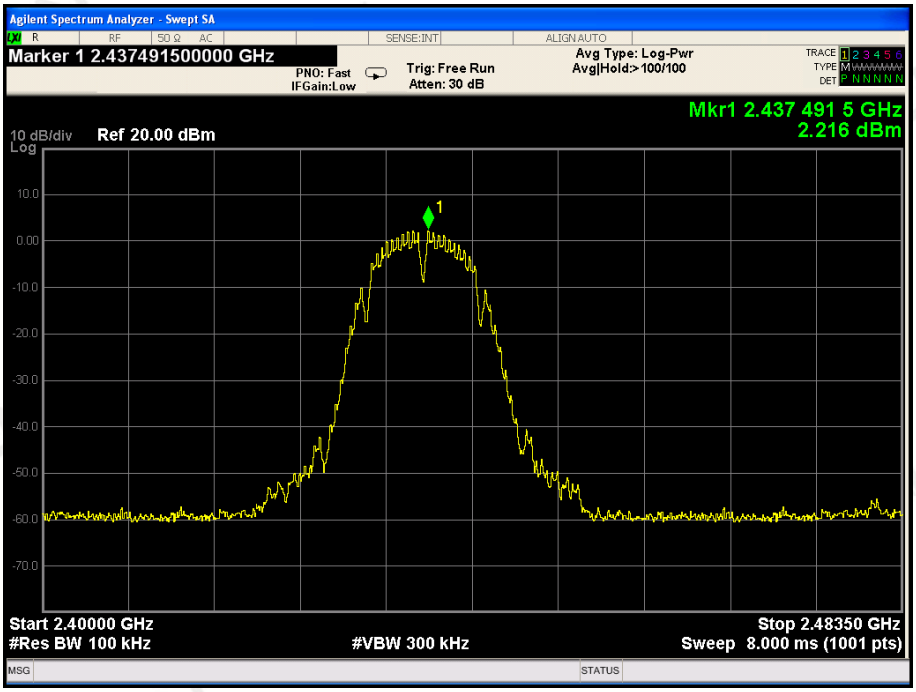
CH01: 2412MHz

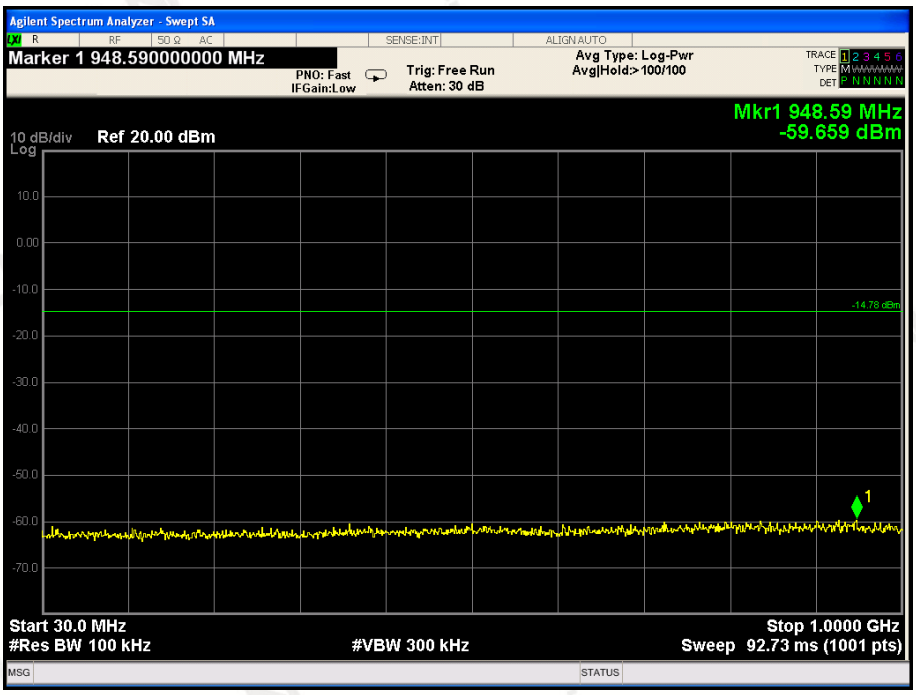


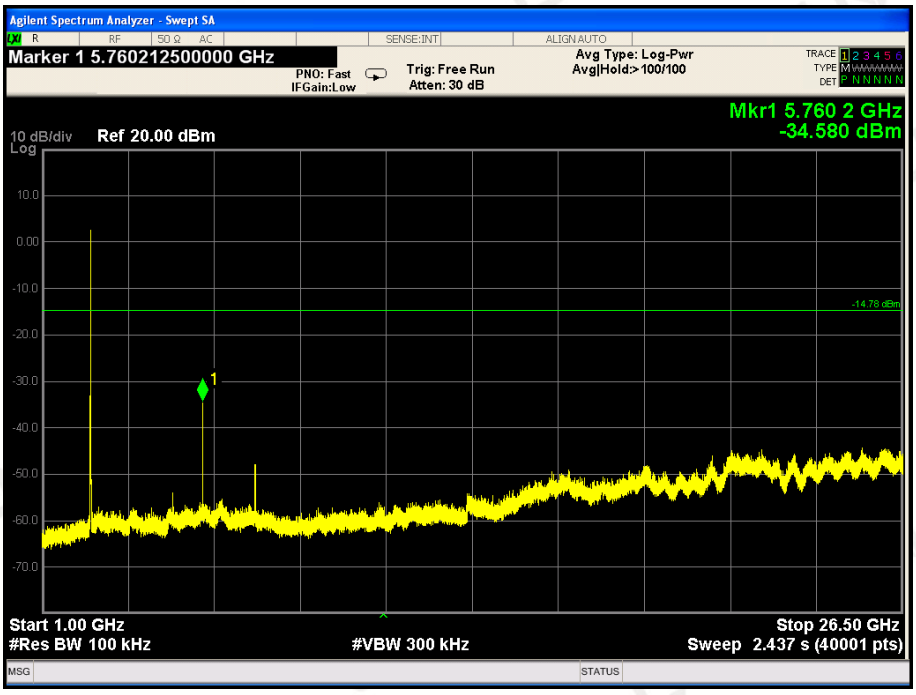




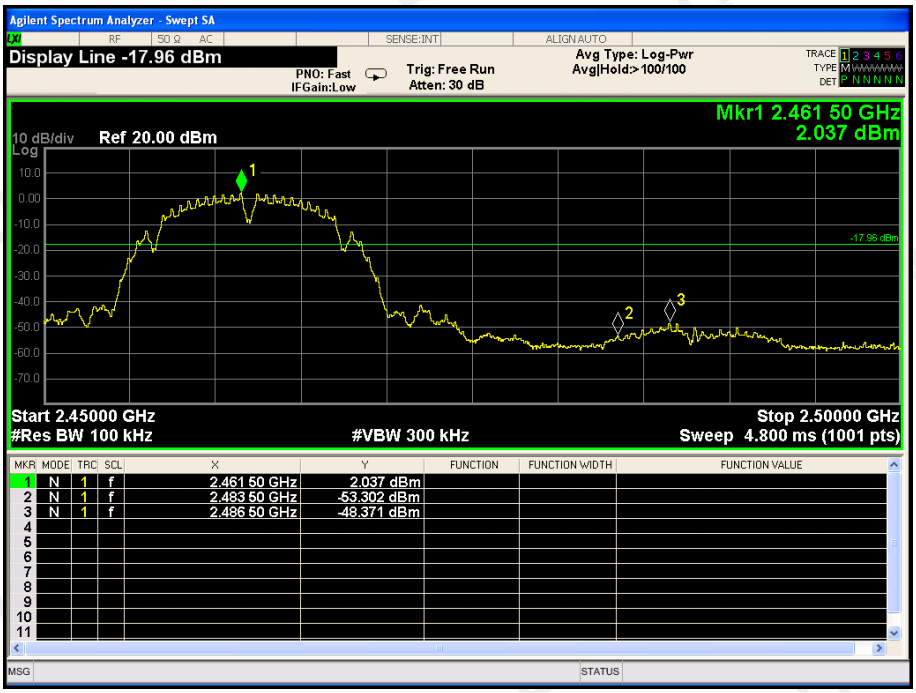
CH06: 2437MHz

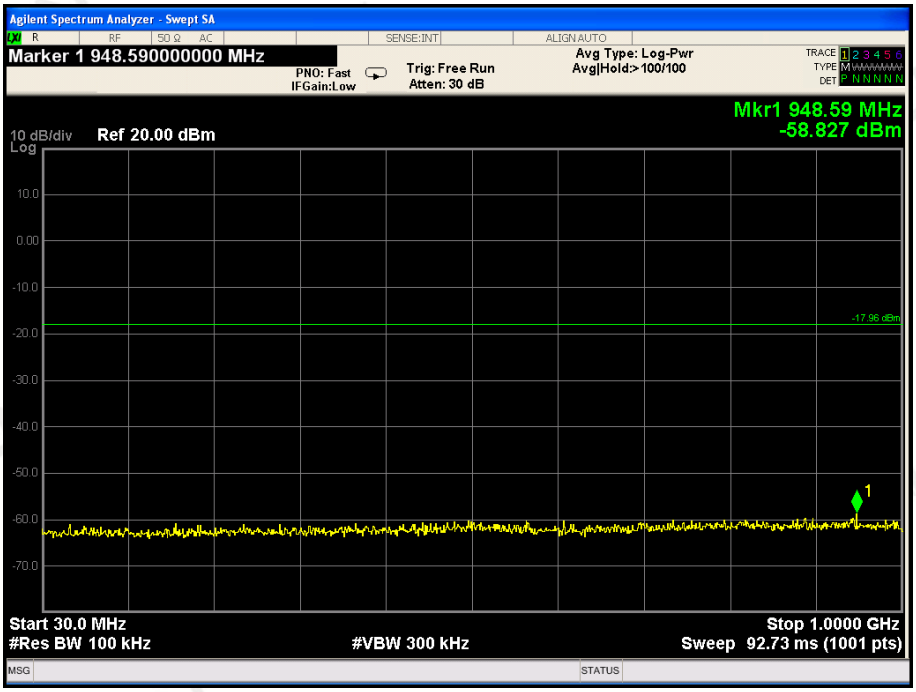


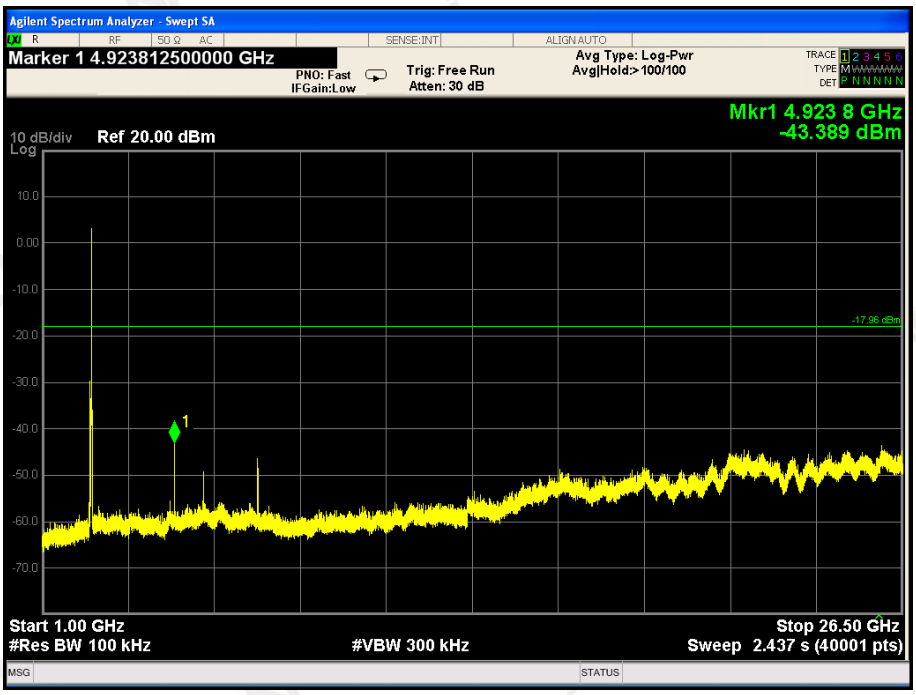

Agilent Spectrum Analyzer - Swept SA
Marker 1 948.590000000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 948.59 MHz
-59.659 dBm
10 dB/div
Log
Ref 20.00 dBm
-14.78 dBm
Start 30.0 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 1.0000 GHz
Sweep 92.73 ms (1001 pts)


Agilent Spectrum Analyzer - Swept SA
Marker 1 5.760212500000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 5.760 2 GHz
-34.580 dBm
10 dB/div
Log
Ref 20.00 dBm
-14.78 dBm
Start 1.00 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 26.50 GHz
Sweep 2.437 s (40001 pts)

CH11: 2462MHz

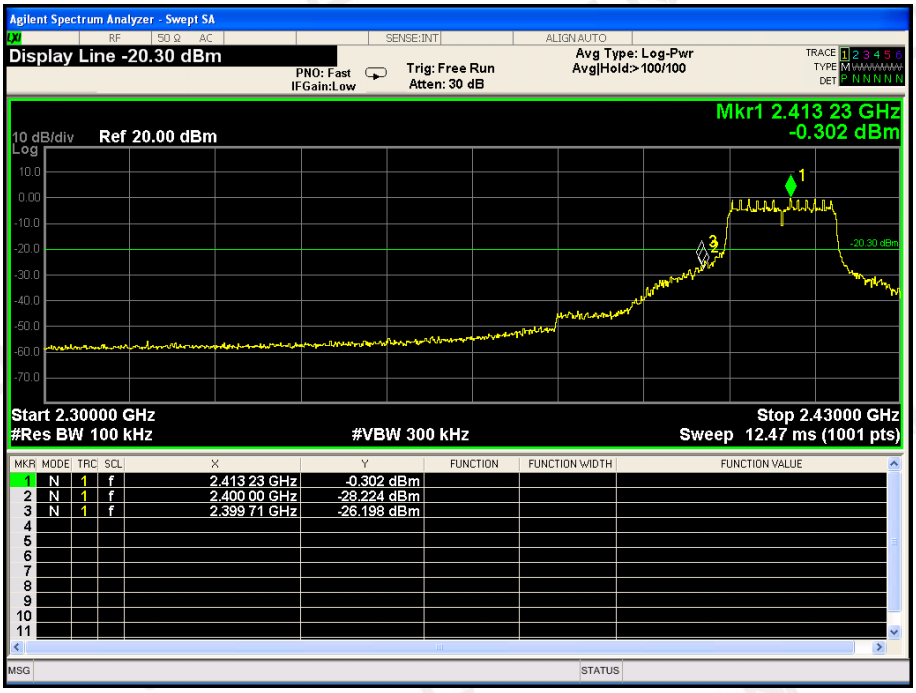


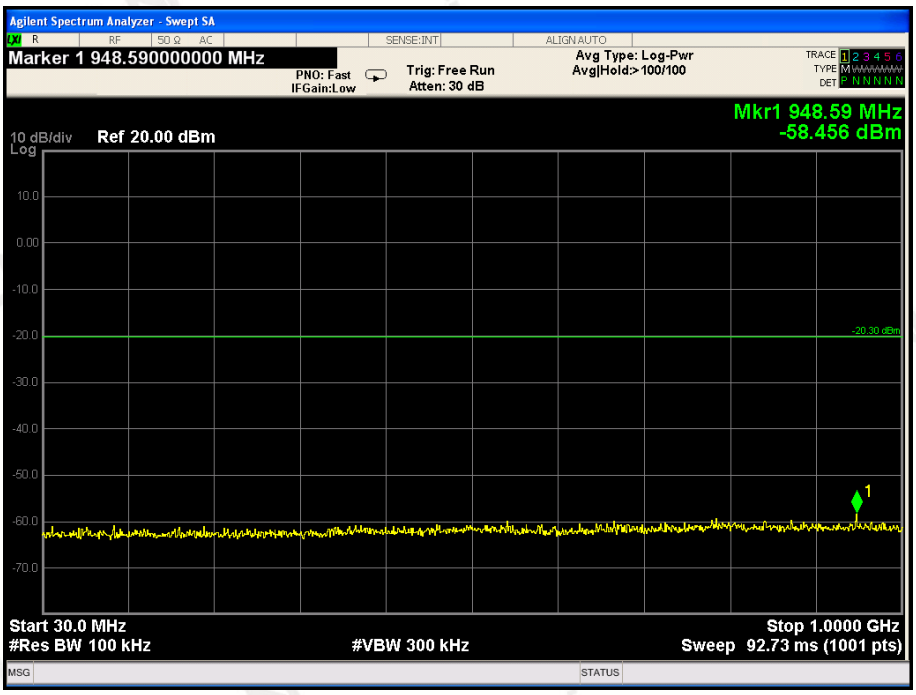


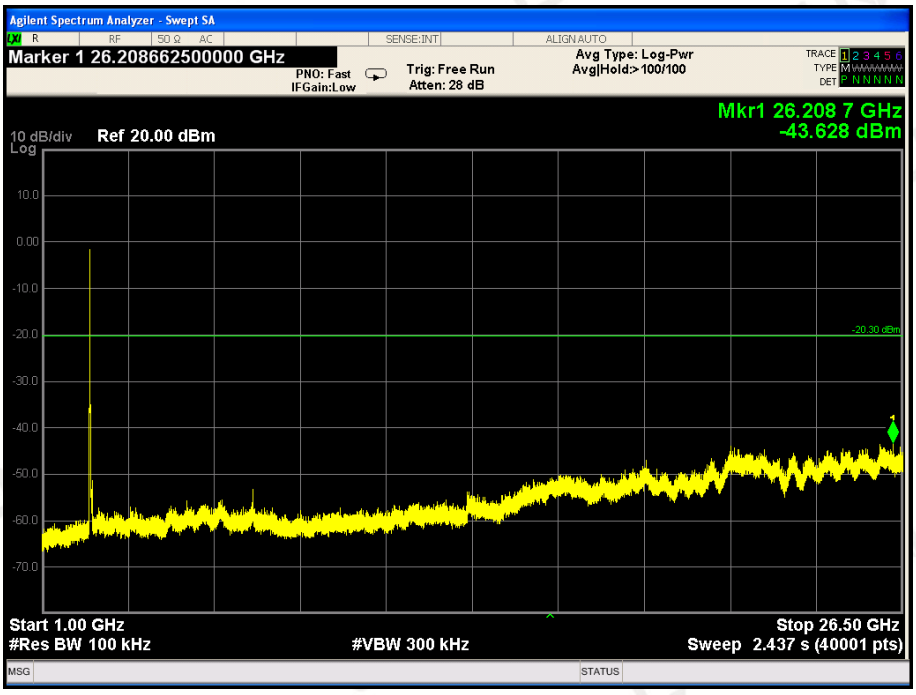


TX 802.11g Mode:

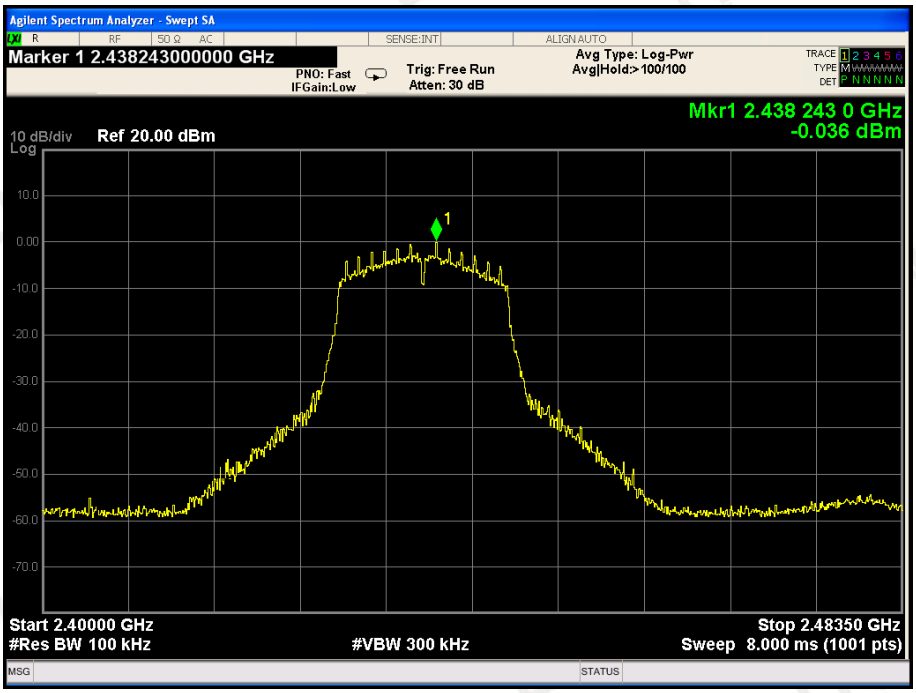
CH01: 2412MHz

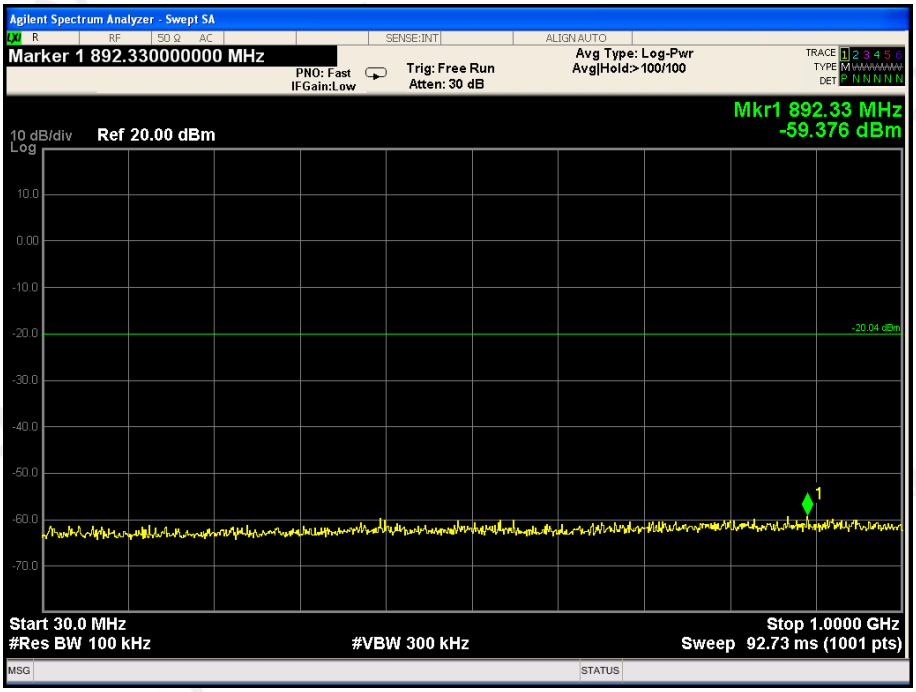


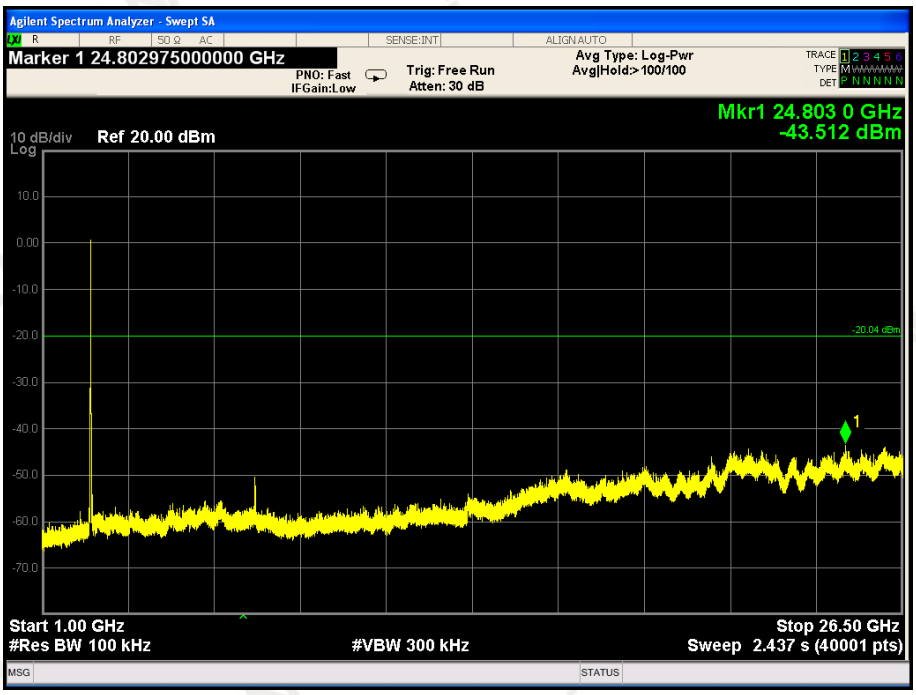

Agilent Spectrum Analyzer - Swept SA
Marker 1 948.590000000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 948.59 MHz
-58.456 dBm
10 dB/div
Ref 20.00 dBm
-20.30 dBm
Start 30.0 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 1.0000 GHz
Sweep 92.73 ms (1001 pts)


Agilent Spectrum Analyzer - Swept SA
Marker 1 26.208662500000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 28 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 26.208 7 GHz
-43.628 dBm
10 dB/div
Ref 20.00 dBm
-20.30 dBm
Start 1.00 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 26.50 GHz
Sweep 2.437 s (40001 pts)

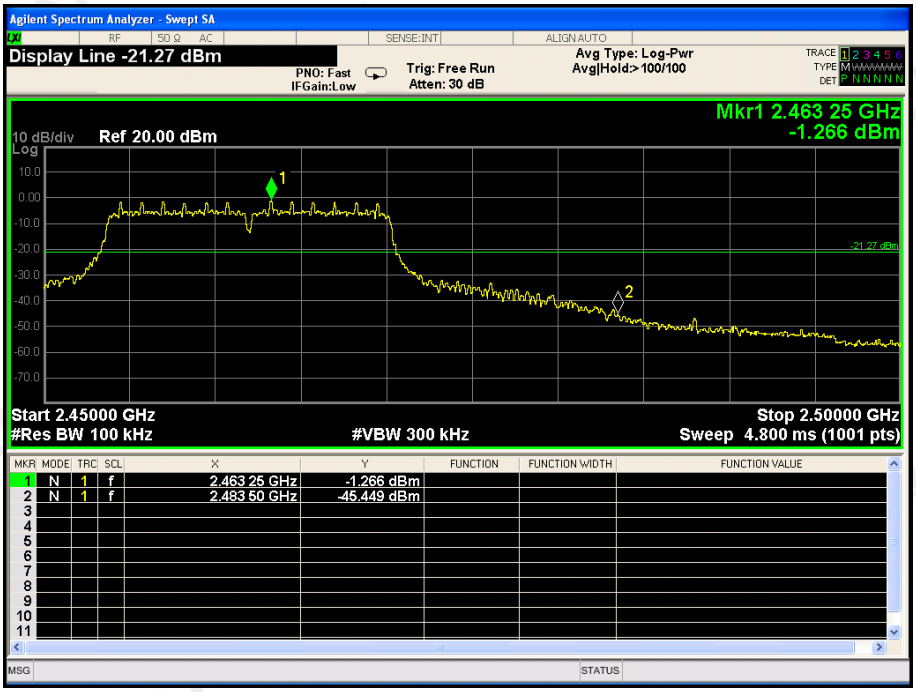
CH06: 2437MHz

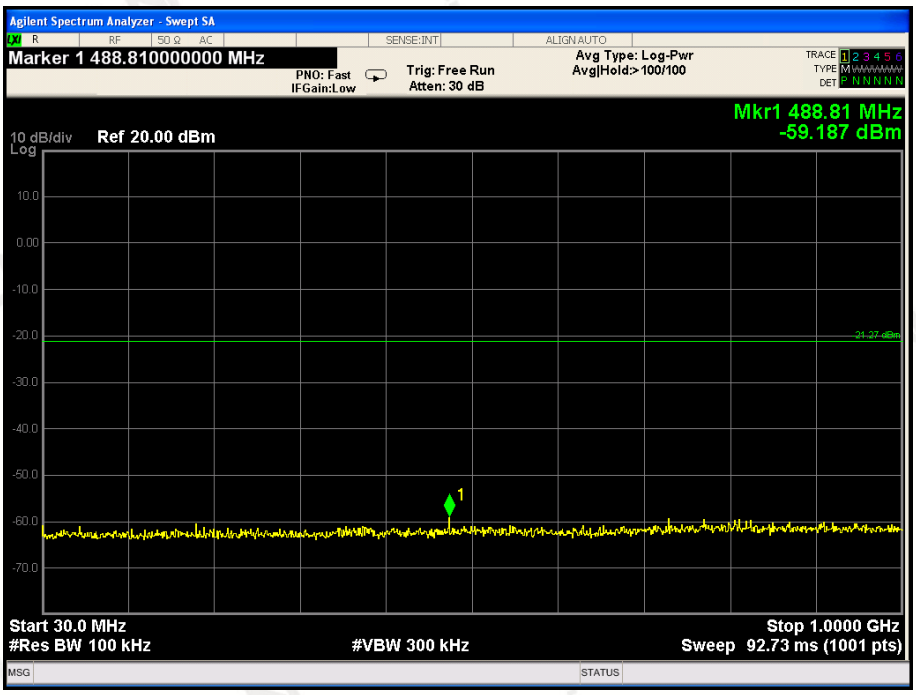


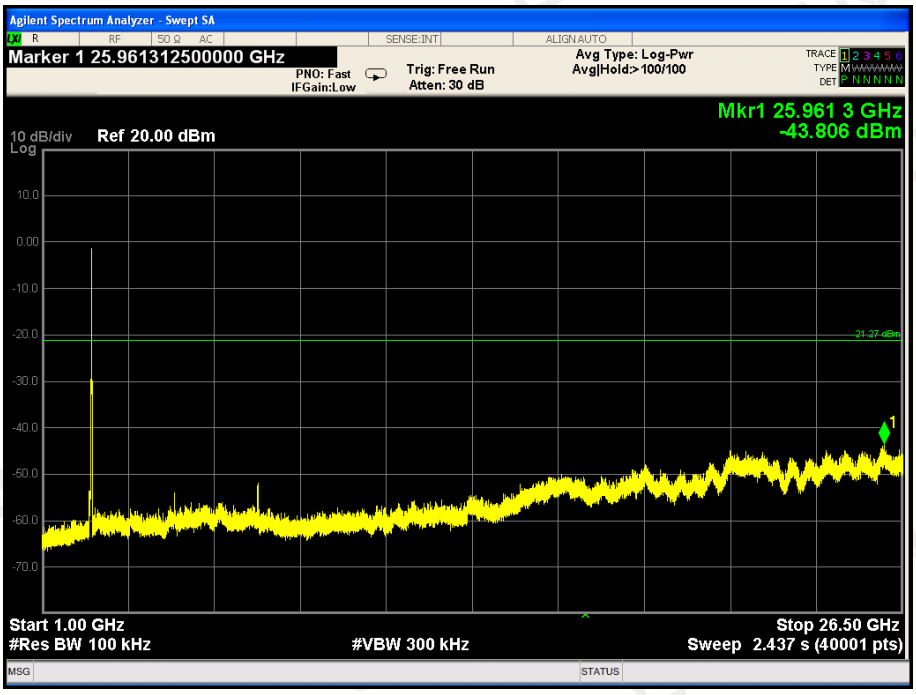




CH11: 2462MHz

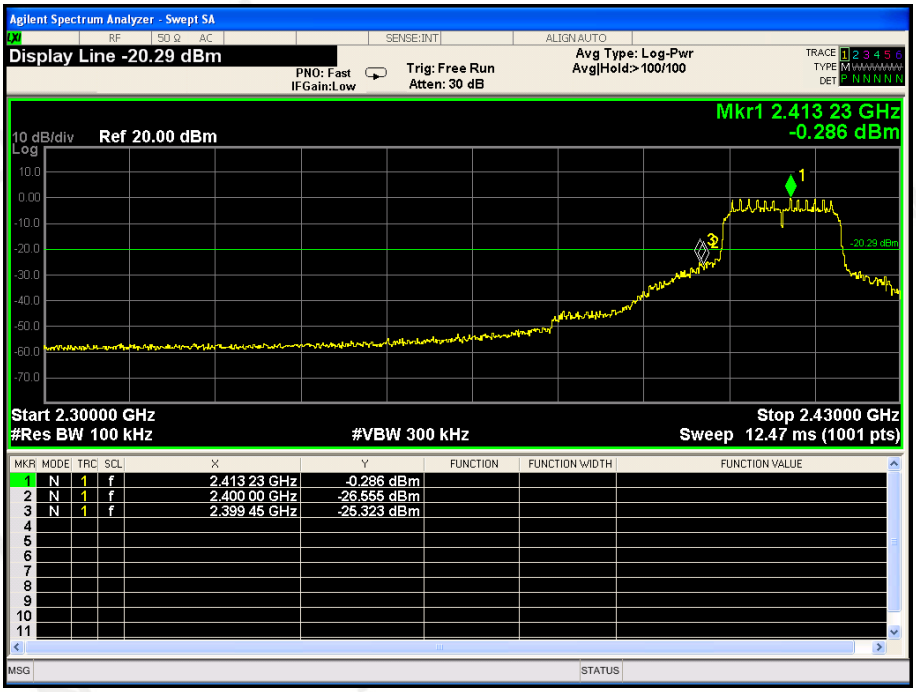


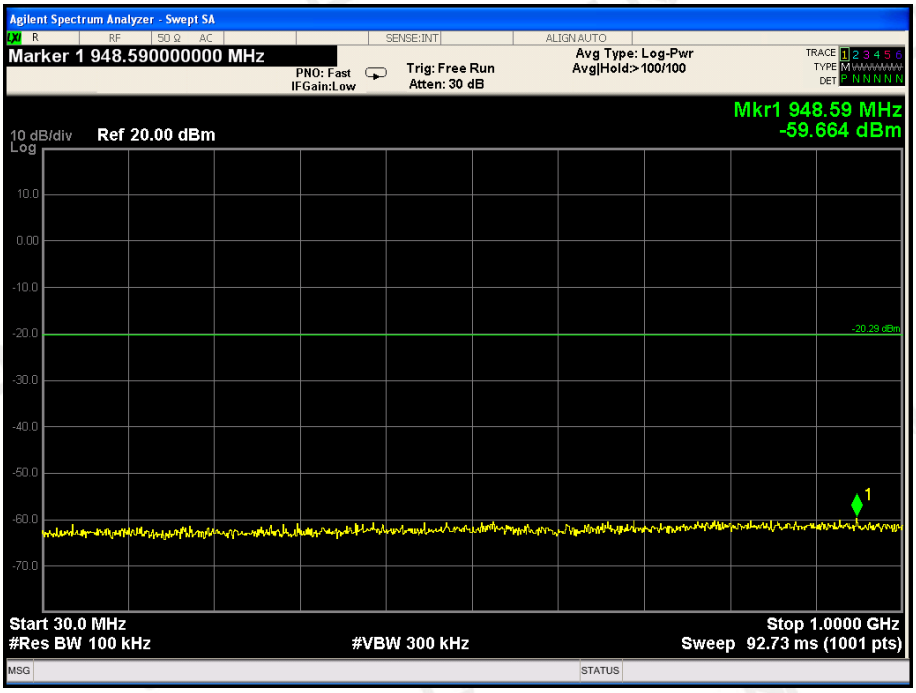

Agilent Spectrum Analyzer - Swept SA
Marker 1 488.810000000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 488.81 MHz
-59.187 dBm
10 dB/div
Log
Ref 20.00 dBm
Start 30.0 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 1.0000 GHz
Sweep 92.73 ms (1001 pts)

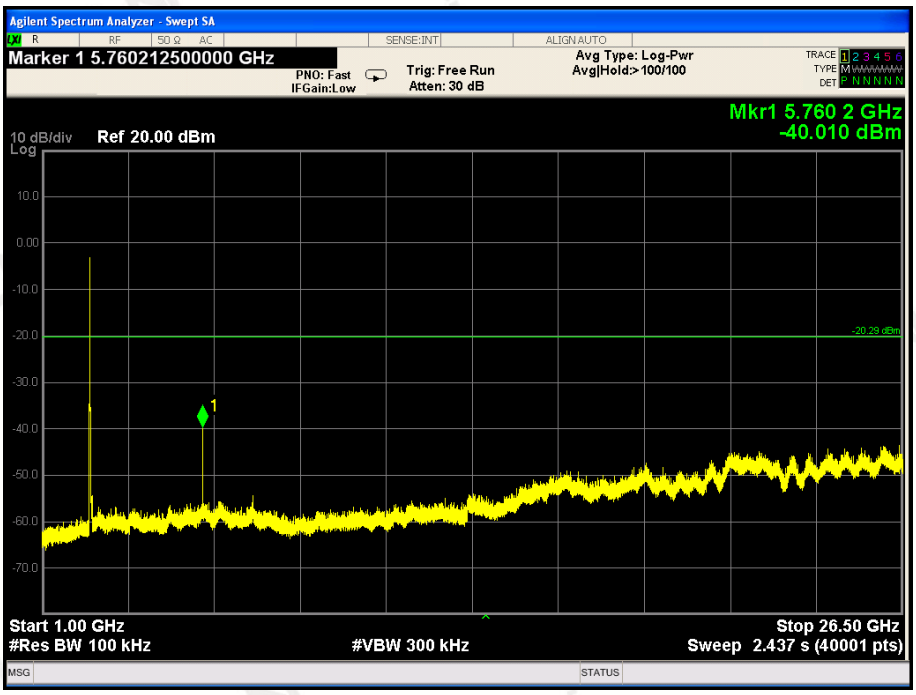

Agilent Spectrum Analyzer - Swept SA
Marker 1 25.961312500000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 25.961 3 GHz
-43.806 dBm
10 dB/div
Log
Ref 20.00 dBm
Start 1.00 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 26.50 GHz
Sweep 2.437 s (40001 pts)

TX 802.11n/HT20 Mode:

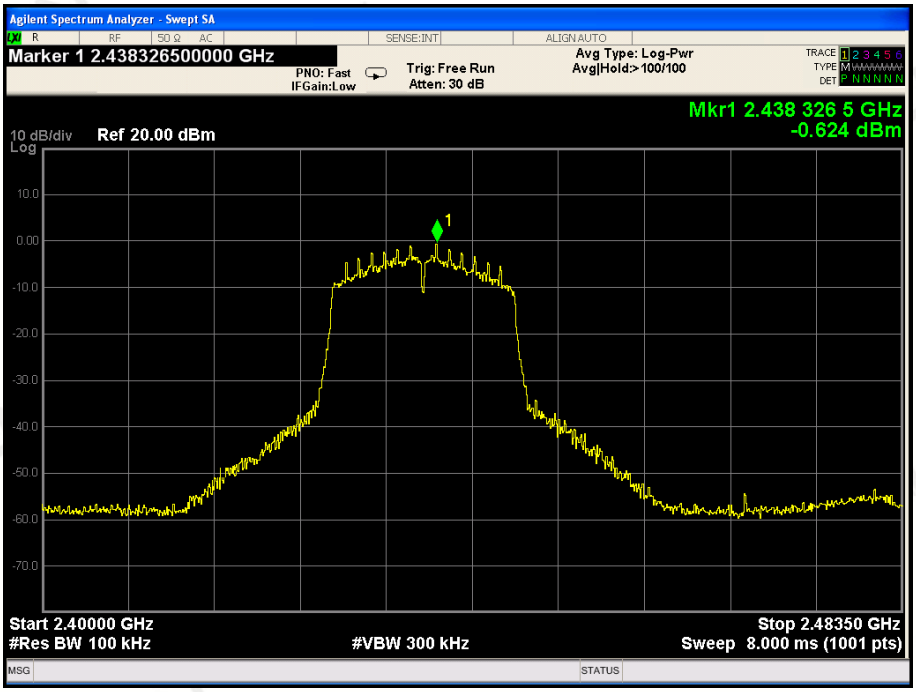
CH01: 2412MHz

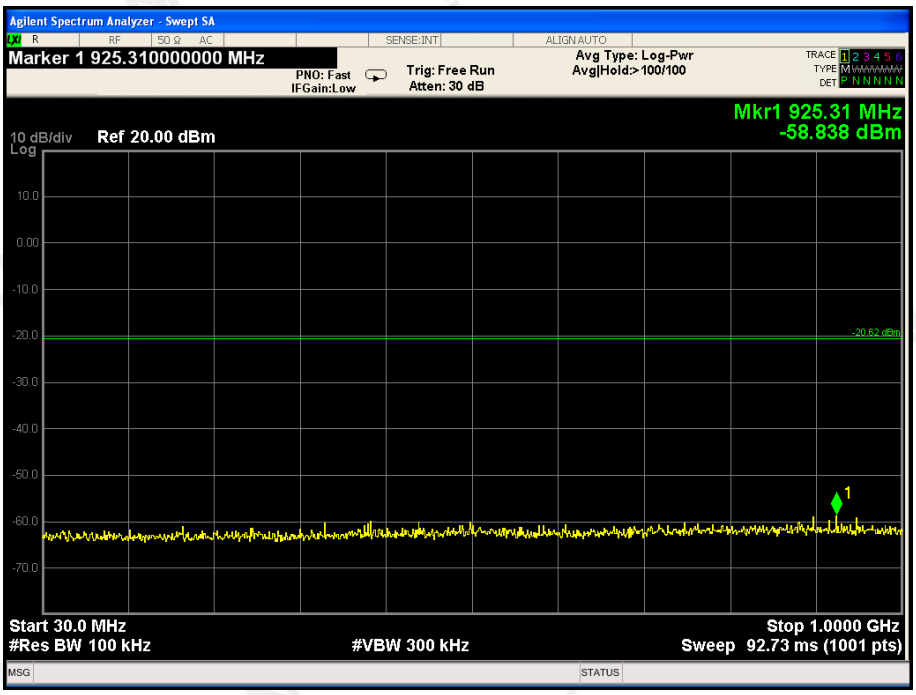


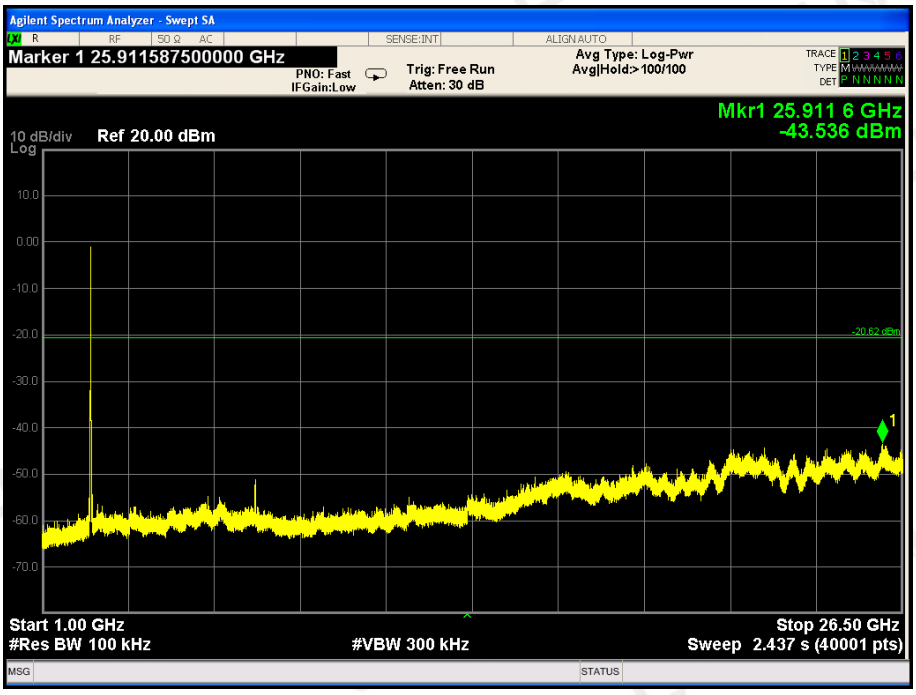




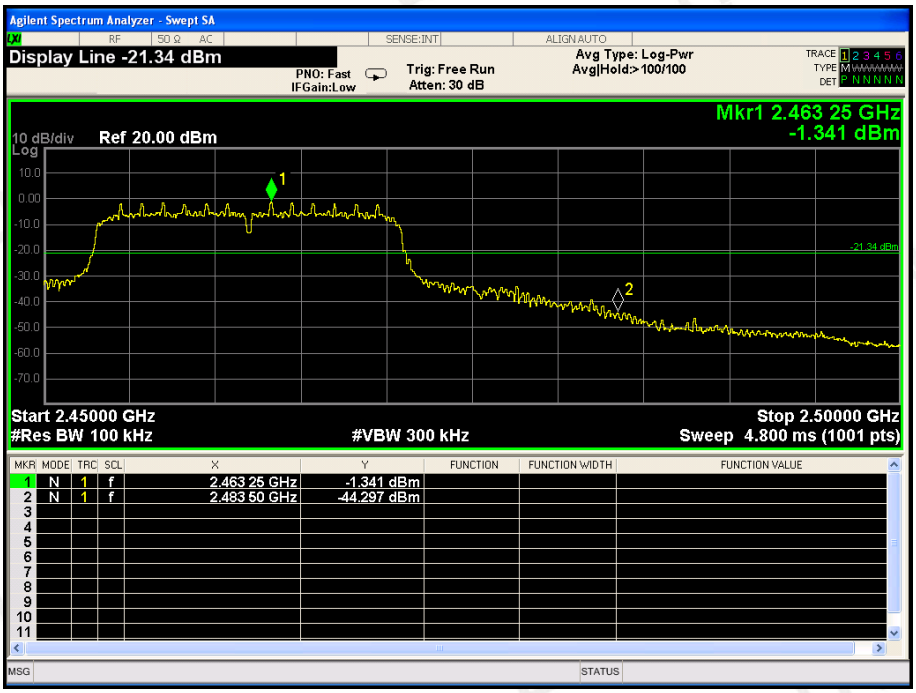
CH06: 2437MHz

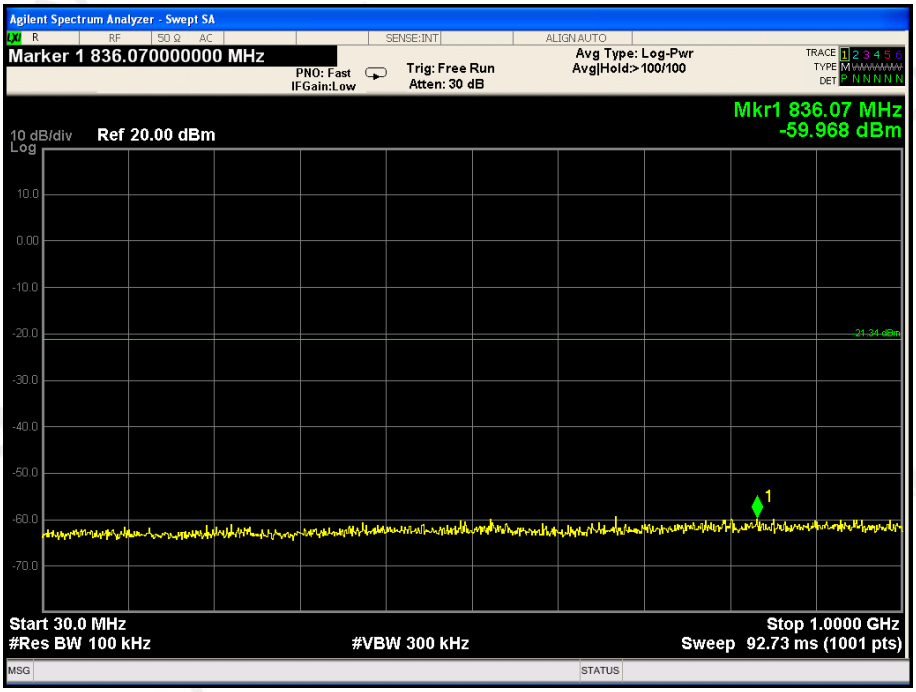


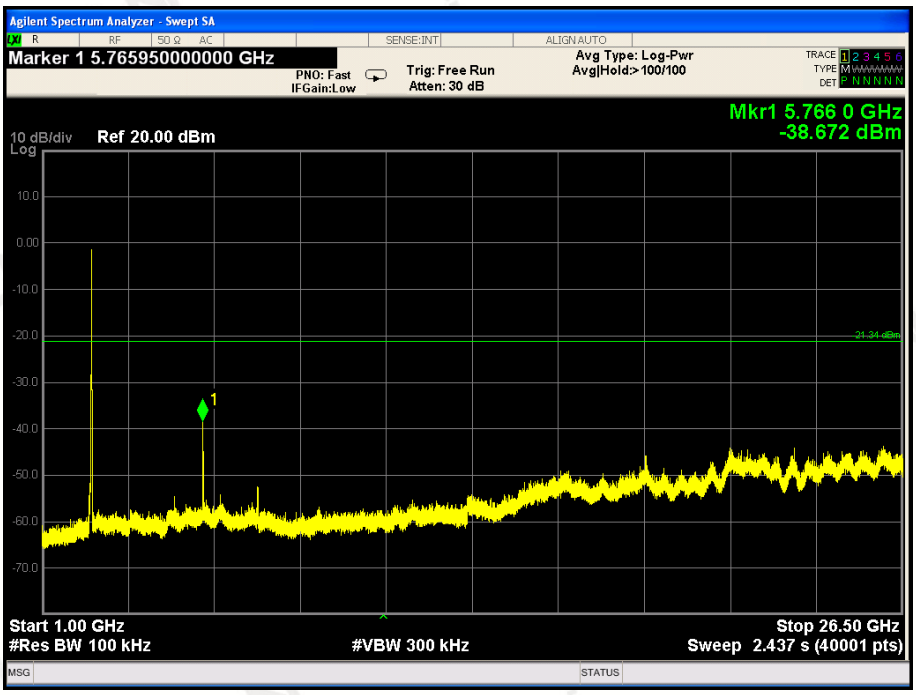

Agilent Spectrum Analyzer - Swept SA
Marker 1 925.310000000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 925.31 MHz
-58.838 dBm
10 dB/div
Log
Ref 20.00 dBm
-20.62 dBm
Start 30.0 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 1.0000 GHz
Sweep 92.73 ms (1001 pts)


Agilent Spectrum Analyzer - Swept SA
Marker 1 25.911587500000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 25.911 6 GHz
-43.536 dBm
10 dB/div
Log
Ref 20.00 dBm
-20.62 dBm
Start 1.00 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 26.50 GHz
Sweep 2.437 s (40001 pts)

CH11: 2462MHz





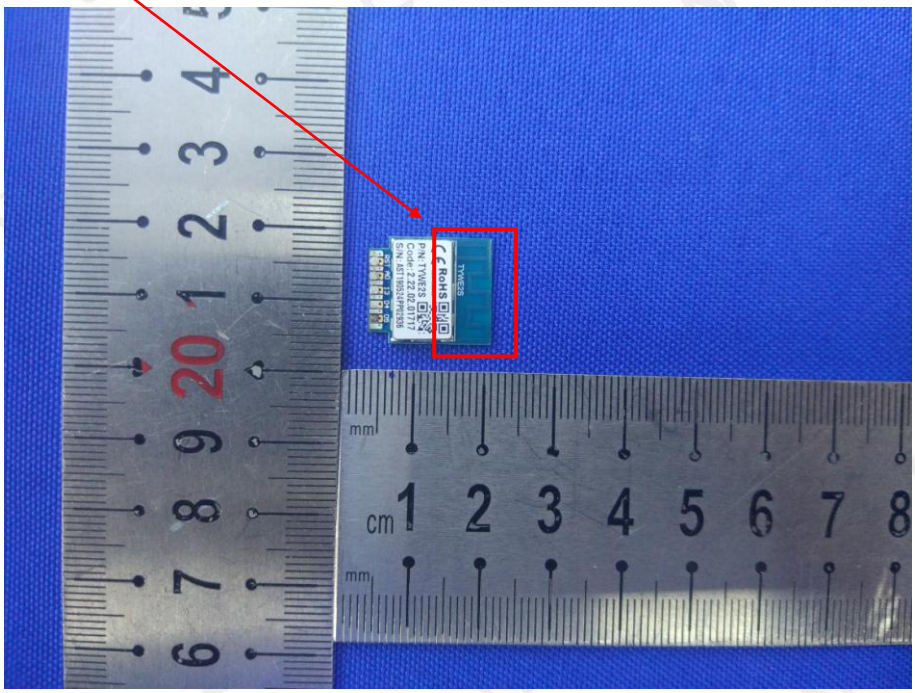

Agilent Spectrum Analyzer - Swept SA
Marker 1 5.765950000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 5.766 0 GHz
-38.672 dBm
10 dB/div
Log
Ref 20.00 dBm
21.34 dBm
Start 1.00 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 26.50 GHz
Sweep 2.437 s (40001 pts)

9 ANTENNA REQUIREMENT

Standard Applicable:
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.

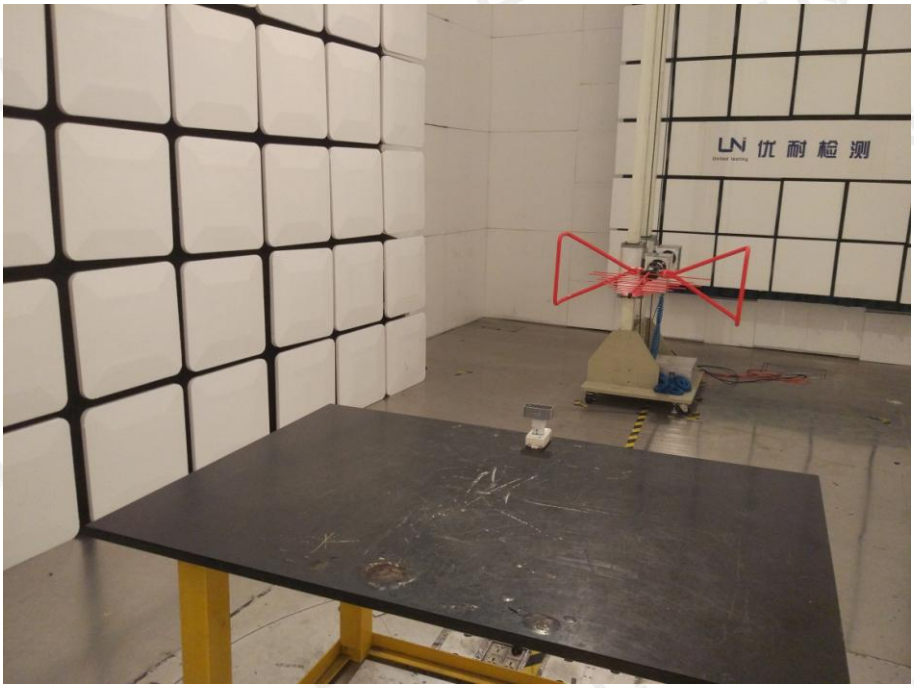
Antenna Connected Construction
The antenna used in this product is a PCB Antenna, The directional gains of antenna used for transmitting is 0dBi.

ANTENNA:

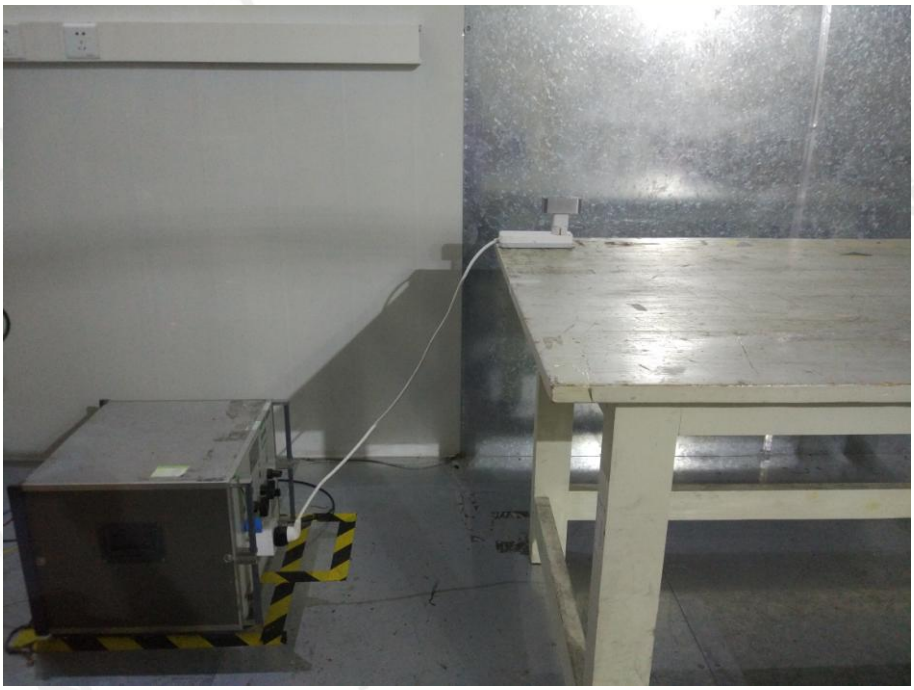


10 PHOTO OF TEST

10.1 RADIATED EMISSION



10.2 CONDUCTED EMISSION



End of Report