FCC PART 15.247

EMI MEASUREMENT AND TEST REPORT
For

IGEN TECH CO.,LTD

A1-405,Tian'an iPark,No.228 Linghu Avenue,New District,Wuxi,Jiangsu,China

FCC ID:2AEPWP1

Trade:

This Report Concerns: Original Report	Equipment Type: Smart Plug
Test Engineer:	Lisa Chen
Report No.:	BSL20150522-1
Receive EUT Date/Test Date:	May 05, 2015/ May 05- May 22, 2015
Reviewed By:	Mike moo
Prepared By:	**BSL Testing Co.,LTD.** NO. 24, ZH Park, Nantou, Shenzhen, 518000 China Tel: 86- 755-26508703 Fax: 86- 755-26508703

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1. GENERAL INFORMATION

1.1. Report information

1.1.1.This report is not a certificate of quality; it only applies to the sample of the specific product/equipment given at the time of its testing. The results are not used to indicate or imply that they are application to the similar items. In addition, such results must not be used to indicate or imply that BSL approves recommends or endorses the manufacture, supplier or use of such product/equipment, or that BSL in any way guarantees the later performance of the product/equipment.

1.1.2.The sample/s mentioned in this report is/are supplied by Applicant, BSL therefore assumes no responsibility for the accuracy of information on the brand name, model number, origin of manufacture or any information supplied.

1.1.3.Additional copies of the report are available to the Applicant at an additional fee. No third part can obtain a copy of this report through BSL, unless the applicant has authorized BSL in writing to do so.

Test Facility -
The test site used to collect the radiated data is located on the address of
BSL Testing Co.,LTD.
(FCC Registered Test Site Number: 191509) on
NO. 24, ZH Park, Nantou, Shenzhen, 518000 China
The Test Site is constructed and calibrated to meet the FCC requirements.

1.2. 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 %.

No.	Item	Uncertainty
1	Conducted Emission Test	+/-1.25dB
2	RF Power, Conducted	+/-0.20dB
3	Spurious emissions, conducted	+/-0.33dB
4	All emissions, radiated (<1G)	+/-3.47dB
5	All emissions, radiated (>1G)	+/-3.82dB
6	Temperature	+/-0.5°CdB
7	Humidity	+/-2%

2. PRODUCT DESCRIPTION

2.1. EUT Description

Applicant	:	IGEN TECH CO.,LTD
Address	:	A1-405,Tian'an iPark,No.228 Linghu Avenue,New District,Wuxi,Jiangsu,China
Manufacturer	:	IGEN TECH CO.,LTD
Address	:	A1-405,Tian'an iPark,No.228 Linghu Avenue,New District,Wuxi,Jiangsu,China
EUT Description	:	Smart Plug
Modulation	:	802.11b: DSSS(11/5.5/2/1Mbps) 802.11g: OFDM(54/48/36/24/18/12/9/6Mbps) 802.11n(20MHz): OFDM (up to 72.2 Mbps) software not supported n (40MHz). (disabled by software).
Wi-fi Frequency Band	:	IEEE 802.11b/g/n20:2412-2462MHz
Number of Channels	:	IEEE 802.11b/g/n20: 11 Channels.
Model Number	:	P1,P1(US)
Trade Name	:	Reco4life
Antenna gain	:	0dBi
Antenna type	:	chip antenna
Power supply	:	AC 120V/60Hz
Hardware version	:	Main PCB:MG-15A-NM-V1-140904,RF PCB:1413
Software version	:	V1
Serial Number	:	20150525

The series products, model name: P1,P1(US) have the same circuit diagram,PCB layout, software, RF Module, Features and functionality. The differences are the model name, so, we select P1 to test.

2.2. Block Diagram of EUT Configuration

Figure 1 EUT Setup

2.3. Support Equipment List

Table 2 Ancillary Equipment

Name	Model No	S/N	Manufacturer	Used (Y/N)

2.4. Test Conditions

Temperature: 23~25°C
Relative Humidity: 50~63 %

After the preliminary test, we found to emit the worst emissions and therefore had been tested under operating condition.

For 802.11b, 802.11g, and 802.11n-HT20 mode, 11 channels are provided to testing:

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

For 802.11b, 802.11g, 802.11n-HT20 mode, EUT was tested with Channel 1, 6 and 11.
IEEE 802.11b:1Mbps data rate were chosen for full testing.
IEEE 802.11g:6Mbps data rate were chosen for full testing.
IEEE 802.11n-HT20:6.5Mbps data rate were chosen for full testing.
The EUT configured to transmit continuously(duty cycle=100%,average correction factor=0).

the test procedure mentioned:KDB 558074 D01 DTS Meas Guidance v03r02.

3. TEST RESULTS SUMMARY

FCC 15 Subpart C,Paragraph 15.247 :2013

FCC Rules	Description of Test	Result
FCC§15.203	Antenna Requirement	Compliance
FCC§15.207 (a)	AC Line Conducted Emissions	Compliance
FCC§15.247(d)	Spurious Emissions at Antenna Port	Compliance
FCC§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
FCC§15.247 (a)(2)	6dB Bandwidth	Compliance
FCC§15.247(b)(3)	Maximum Peak Output Power	Compliance
FCC§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliance
FCC§15.247(e)	Power Spectral Density	Compliance

Modifications

No modification was made.

4. TEST EQUIPMENT USED

EQUIPMENT/FACILITIES	MANUFACTURER	MODEL	SERIAL NO.	DATE OF CAL.	CAL. INTERVAL
3m Semi-Anechoic Chamber	Chengyu Electron	9 (L)*6 (W)* 6 (H)	BSL086	Aug. 23 2014	1 Year
EMI Test Receiver	Rohde & Schwarz	ESCI3	BSL001	Sep. 28 2014	1 Year
BiConiLog Antenna	Rohde & Schwarz	HL562 (30MHz－3GHz)	BSL009	Sep. 28 2014	1 Year
Double -ridged waveguide horn	Rohde & Schwarz	BBHA9120D (1－18GHz)	BSL008	Aug. 27 2014	1 Year
Horn Antenna	AHS	SAS-574 (18GHz－40GHz)	BSL072	Dec. 28 2014	1 Year
Cable	PUTIANLE	BSL045	BSL045	Aug. 27 2014	1 Year
Cable	PUTIANLE	BSL046	BSL046	Aug. 27 2014	1 Year
Cable	PUTIANLE	BSL047	BSL047	Aug. 27 2014	1 Year
Amplifier(100kHz-40GHz)	R&S	SMR40	BSL007	Sep. 28 2014	1 Year
Band filter	Amindeon	82346	BSL049	Aug. 27 2014	1 Year
Active Loop Antenna	Schwarzbeck	FMZB1519 (9 kHz - 30 MHz)	BSL011	Sep. 28 2014	1 Year
Coaxial Switch	YUANFANG	TA218B	BSL004	Aug. 27 2014	1 Year
Spectrum analyzer	Rohde & Schwarz	FSP40	BSL049	Sep. 28 2014	1 Year
Shielding Room	zhongyu Electron	7.0(L)x3.0(W)x3.0(H)	BSL085	Sep. 28 2014	1 Year
EMI Test Receiver	R&S	ESPI	BSL002	Sep. 28 2014	1 Year
10dB Pulse Limita	R&S	BSL003	BSL003	Sep. 28 2014	1 Year
Coaxial Switch	PUTIANLE	TA218B	BSL004	Aug. 27 2014	1 Year
LISN	Rohde & Schwarz	ESH3-Y5	BSL005	Sep. 28 2014	1 Year
Coaxial Cable	PUTIANLE	BSL048	BSL048	Aug. 27 2014	1 Year
EMI TEST SOFTWARE	AUDIX	E3	N/A	N/A	N/A
Power Meter	R&S	NRVS	GTS216	Apr. 6, 2015	1 Year
Power Sensor	R&S	NRV-Z33	GTS220	Apr. 6, 2015	1 Year

the conducted measurements RF cable, NO antenna connector, Soldered to the transmitter part:

5. §15.203 - ANTENNA REQUIREMENT

5.1. Standard Applicable

According to § 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

a. Antenna must be permanently attached to the unit.
b. Antenna must use a unique type of connector to attach to the EUT.

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

And according to FCC 47 CFR section 15.247 (b), if the 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 6 dBi.

5.2. Antenna Connector Construction

The antenna used for this product is a chip antenna.The antenna is permanently attached. Refer to the product photo.

5.3. Result

Compliance

6. §15.207 - CONDUCTED EMISSIONS

6.1. Applicable Standard

The specification used was with the FCC Part 15.207 limits.

6.2. Test Procedure

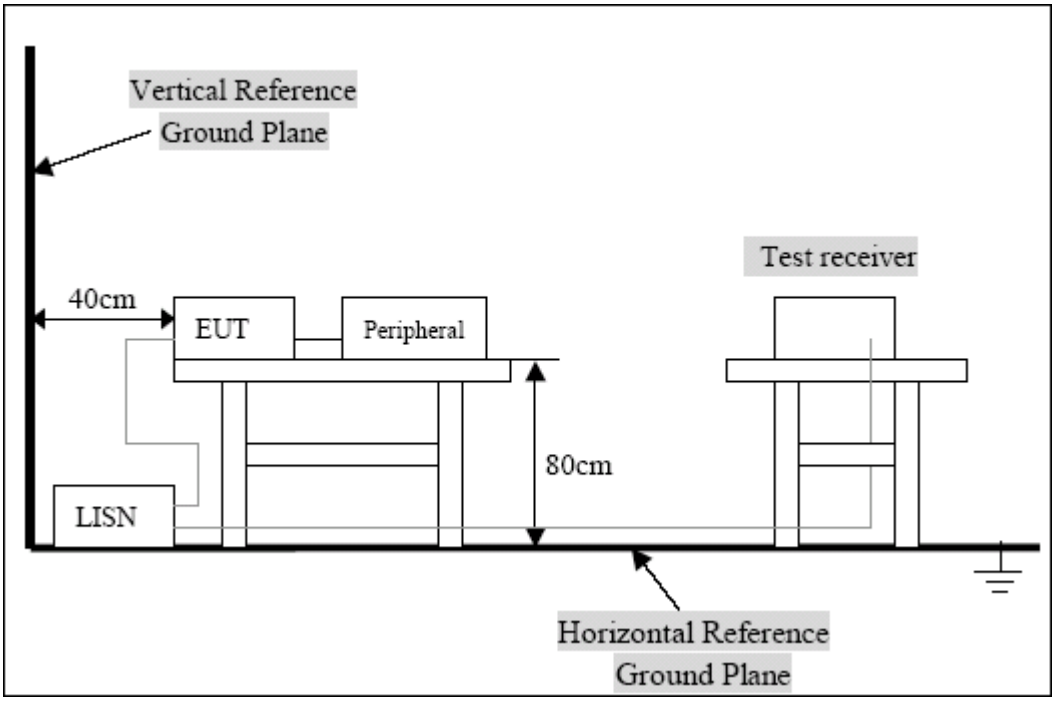
During the conducted emission test, the EUT was connected to the outlet of the LISN. Maximizing procedure was performed on the six (6) highest emissions of the EUT. All data was recorded in the Quasi-peak and average detection mode.

6.3. Conducted Power line Emission Limits

FCC Part 15 Paragraph 15.207 (dBuV)		
Frequency Range (MHz)	Class A QP/AV	Class B QP/AV
0.15-0.5	79/66	65-56/56-46
0.5-5.0	73/60	56-46
5.0-3.0	73/60	60-50

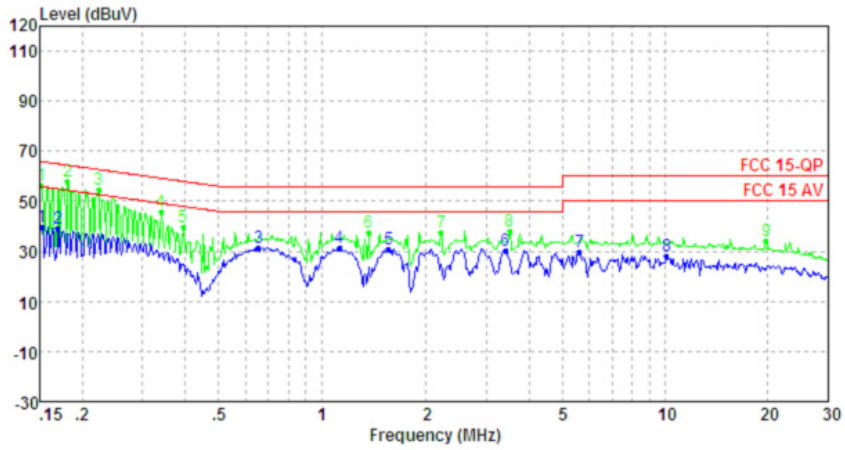
Note: In the above table, the tighter limit applies at the band edges.

6.4. Block Diagram of Test Setup



6.5. Conducted Power Line Test Result

PASS
test AC power (120V/60Hz)
The worst test mode: WiFi Tx 802.11b 2412MHz

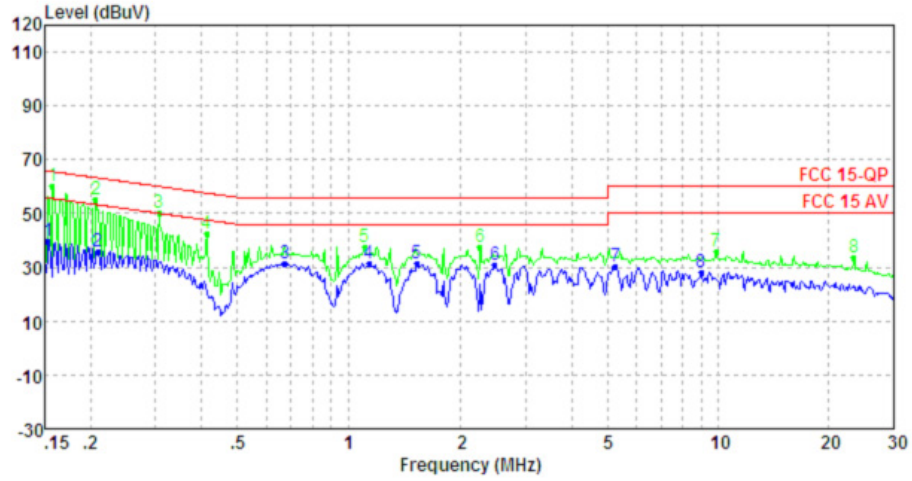


Condition:
: RBW:9.000KHz VBW:30.000KHz

	Freq	Level	Limit Line	Over Limit	Remark	Pol/Phase
	MHz	dBuV	dBuV	dB		
1	0.152	40.0	55.9	-15.9	Average	LINE
2	0.169	39.4	55.0	-15.6	Average	LINE
3	0.654	31.4	46.0	-14.6	Average	LINE
4	1.129	31.6	46.0	-14.4	Average	LINE
5	1.568	31.1	46.0	-14.9	Average	LINE
6	3.417	30.5	46.0	-15.5	Average	LINE
7	5.623	29.9	50.0	-20.1	Average	LINE
8	10.125	28.0	50.0	-22.0	Average	LINE

Condition:
: RBW:9.000KHz VBW:30.000KHz

	Freq	Level	Limit Line	Over Limit	Remark	Pol/Phase
	MHz	dBuV	dBuV	dB		
1	0.152	56.4	65.9	-9.5	QP	LINE
2	0.182	57.8	64.4	-6.6	QP	LINE
3	0.223	54.4	62.7	-8.3	QP	LINE
4	0.339	45.6	59.2	-13.6	QP	LINE
5	0.393	39.5	58.0	-18.5	QP	LINE
6	1.374	37.8	56.0	-18.2	QP	LINE
7	2.213	37.5	56.0	-18.5	QP	LINE
8	3.509	38.1	56.0	-17.9	QP	LINE
9	19.740	34.4	60.0	-25.6	QP	LINE



Condition:
: RBW:9.000KHz VBW:30.000KHz

	Freq	Level	Limit Line	Over Limit	Remark	Pol/Phase
	MHz	dBuV	dBuV	dB		
1	0.153	39.8	55.8	-16.0	Average	NEUTRAL
2	0.209	35.8	53.2	-17.4	Average	NEUTRAL
3	0.672	31.4	46.0	-14.6	Average	NEUTRAL
4 M	1.141	31.5	46.0	-14.5	Average	NEUTRAL
5	1.535	31.3	46.0	-14.7	Average	NEUTRAL
6	2.474	30.8	46.0	-15.2	Average	NEUTRAL
7	5.277	30.1	50.0	-19.9	Average	NEUTRAL
8	9.011	28.0	50.0	-22.0	Average	NEUTRAL

Condition:
: RBW:9.000KHz VBW:30.000KHz

	Freq	Level	Limit Line	Over Limit	Remark	Pol/Phase
	MHz	dBuV	dBuV	dB		
1	0.157	60.0	65.6	-5.6	QP	NEUTRAL
2	0.206	55.5	63.4	-7.9	QP	NEUTRAL
3	0.307	50.3	60.1	-9.8	QP	NEUTRAL
4	0.413	42.8	57.6	-14.8	QP	NEUTRAL
5	1.106	37.8	56.0	-18.2	QP	NEUTRAL
6	2.261	37.6	56.0	-18.4	QP	NEUTRAL
7	9.861	35.9	60.0	-24.1	QP	NEUTRAL
8	23.387	33.6	60.0	-26.4	QP	NEUTRAL

7. §15.209, §15.205, §15.247(D) - Spurious Emissions

7.1. Test Equipment

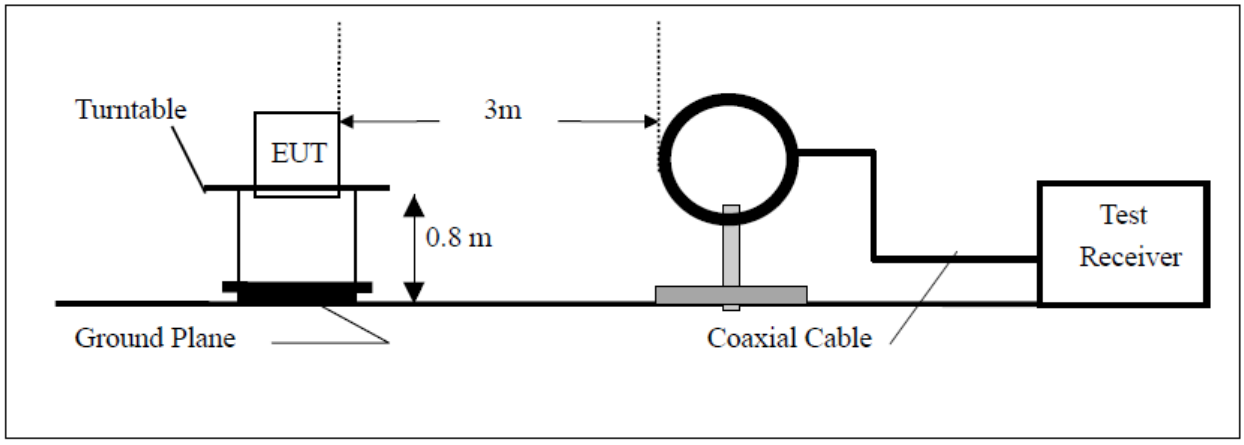
Please refer to section 5 this report.

7.2. Test Procedure

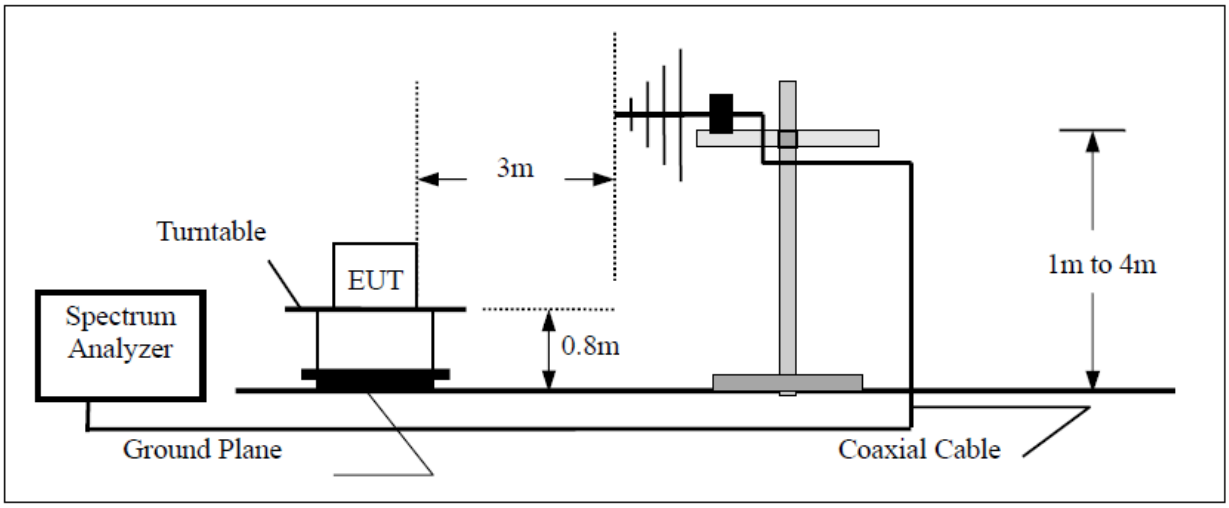
The EUT and its simulators are placed on a turntable, which is 0.8 meter high above ground. The turntable can rotate 360 degrees to determine the position of the maximum emission level. EUT is set 3.0 meters away from the receiving antenna, which is mounted on an antenna tower. The antenna can be moved up and down between 1.0 meter and 4 meters to find out the maximum emission level.
Calibrated Loop antenna is used as receiving antenna for frequencies below 30MHz, Calibrated Bilog antenna is used as receiving antenna for frequencies between 30 MHz and 1 GHz, Calibrated Horn antenna is used as receiving antenna for frequencies above 1000MHz. Both horizontal and vertical polarizations of the antenna are set on measurement. In order to find the maximum emission levels, all of the interface cables must be manipulated according to ANSI C63.4: 2003 on radiated emission measurement.
The bandwidth of test receiver is set at 9kHz in below 30MHz. and set at 120kHz in 30-1000MHz, and 1MHz in above 1000MHz.
The frequency range from 9kHz to 25GHz is checked.
The final measurement in band 9-90kHz, 110-490kHz and above 1000MHz is performed with Peak detector and Average detector. Except those frequency bands mention above, the final measurement for frequencies below 1000MHz is performed with Quasi Peak detector.
Through three orthogonal axes to determine which attitude and equipment arrangement produces the highest emission relative to the limit. And X direction is worst mode.

7.3. Radiated Test Setup

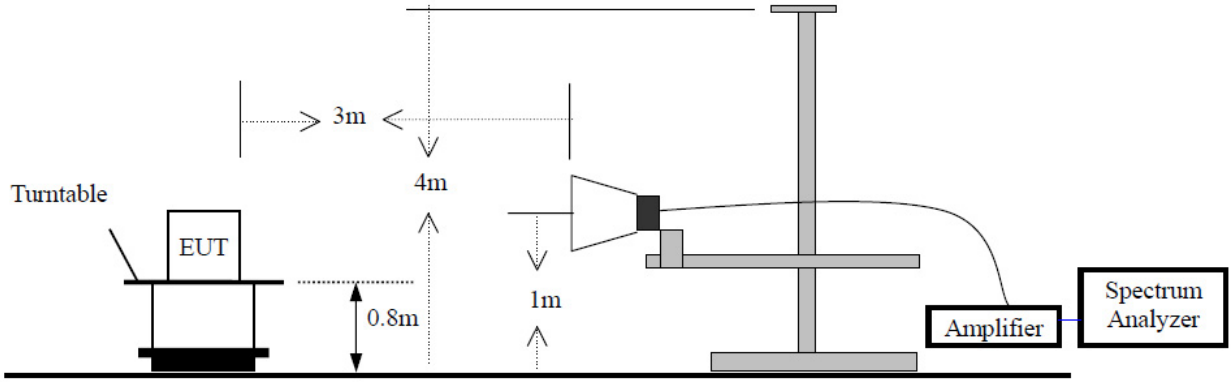
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



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



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



7.4. Radiated Emission Limit

Frequency (MHz)	Limit			
	Field Strength of Quasi-peak Value (microvolts/m)	Field Strength of Quasi-peak Value (dBμV/m)	Measurement distance (m)	The final measurement in band 9-90kHz, 110-490kHz and above 1000MHz is performed with Average detector. Except those frequency bands mention above, the final measurement for frequencies below 1000MHz is performed with Quasi Peak detector.
0.009 - 0.490	2400/F(kHz)	/	300	
0.490 - 1.705	24000/F(kHz)	/	30	
1.705-30	30	29.5	30	
30 - 88	100	40	3	
88 - 216	150	43.5	3	
216 - 960	200	46	3	
Above 960	500	54	3	

Note: (1) RF Voltage (dBuV)=20 log Voltage(uV)
(2) In the Above Table,the tighter limit applies at the band edges.
(3) Distaqnce refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

7.5. Radiated Emission Test Result

For below 9kHz-30MHz Spurious

Freq. (MHz)	Emission(dBuV/m) PK / AV	Limits(dBuV/m) PK / AV	Margin (dB)
-	-	-	-
-	-	-	-

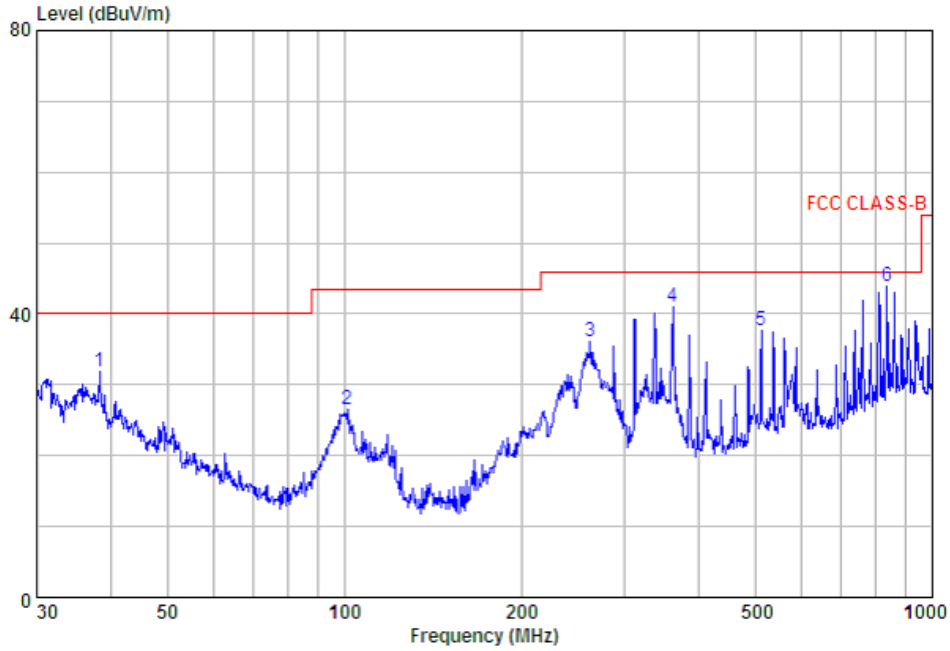
Note:

1. Emissions attenuated more than 20 dB below the permissible value are not reported.

For 30M-1000MHz Spurious

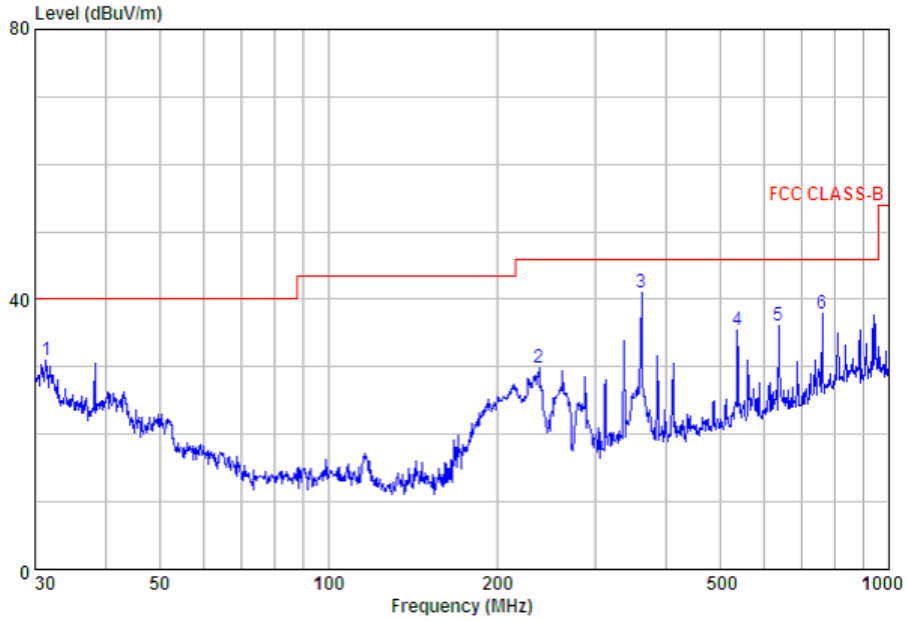
The worst test mode: WiFi Tx 802.11b 2412MHz

Corrected Factor = Antenna Factor + Cable Loss – Amplifier Gain



Condition : FCC CLASS-B 3m VERTICAL
: RBW:120.000KHz VBW:300.000KHz SWT:Auto

	Freq	Limit Line	Level	Over Limit	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB		
1	38.346	40.0	31.9	-8.1	QP	VERTICAL
2	101.289	43.5	26.6	-16.9	QP	VERTICAL
3	261.975	46.0	36.1	-9.9	QP	VERTICAL
4	361.714	46.0	41.0	-5.0	QP	VERTICAL
5	511.835	46.0	37.7	-8.3	QP	VERTICAL
6 max	836.244	46.0	43.8	-2.2	QP	VERTICAL



Condition : FCC CLASS-B 3m HORIZONTAL
: RBW:120.000KHz VBW:300.000KHz SWT:Auto

	Freq	Limit Line	Level	Over Limit	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB		
1	31.399	40.0	30.9	-9.1	QP	HORIZONTAL
2	237.476	46.0	29.8	-16.2	QP	HORIZONTAL
3 max	361.714	46.0	41.0	-5.0	QP	HORIZONTAL
4	535.707	46.0	35.4	-10.6	QP	HORIZONTAL
5	636.134	46.0	36.0	-10.0	QP	HORIZONTAL
6	760.704	46.0	38.0	-8.0	QP	HORIZONTAL

For 1000MHz-25000MHz Spurious

802.11b Mode:

Indicated		Detector (PK/Ave.)	Table Angle Degree	Antenna		Correction Factor			FCC Part 15.247/15.209			
Frequency (MHz)	S.A. Reading (dBμV)			Height (m)	Polar (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Comment
Low Channel (2412 MHz)												
7236	31.76	Ave.	300	1.1	H	39.0	5.22	26.64	49.34	54	4.66	harmonic
7236	28.78	Ave.	150	1.1	V	37.7	5.22	26.64	45.06	54	8.94	harmonic
4824	30.04	Ave.	185	1.2	H	36.6	4.3	26.75	44.19	54	9.81	harmonic
2389.7	32.28	Ave.	0	1.0	V	30.6	2.98	26.83	39.03	54	14.97	spurious
2389.4	29.1	Ave.	75	1.0	H	30.6	2.98	26.83	35.85	54	18.15	spurious
7236	38.06	PK	300	1.1	H	39.0	5.22	26.64	55.64	74	18.36	harmonic
2389.7	45.9	PK	0	1.0	V	30.6	2.98	26.83	52.65	74	21.35	spurious
4824	19.24	Ave.	285	1.0	V	35.4	4.3	26.75	32.19	54	21.81	harmonic
7236	35.91	PK	150	1.0	V	37.7	5.22	26.64	52.19	74	21.81	harmonic
2389.4	43.24	PK	75	1.0	H	30.6	2.98	26.83	49.99	74	24.01	spurious
4824	35.52	PK	185	1.2	H	36.6	4.3	26.75	49.67	74	24.33	harmonic
4824	30.05	PK	285	1.0	V	35.4	4.3	26.75	43	74	31	harmonic
Middle Channel (2437 MHz)												
7311	32.35	Ave.	300	1.2	H	39.0	5.09	26.64	49.8	54	4.2	harmonic
7311	28.38	Ave.	150	1.1	V	37.7	5.09	26.64	44.53	54	9.47	harmonic
4874	30.02	Ave.	185	1.2	H	36.6	4.36	26.75	44.23	54	9.77	harmonic
7311	38.63	PK	300	1.2	H	39.0	5.09	26.64	56.08	74	17.92	harmonic
7311	34.75	PK	150	1.1	V	37.7	5.09	26.64	50.9	74	23.1	harmonic
4874	16.87	Ave.	285	1.0	V	35.4	4.36	26.75	29.88	54	24.12	harmonic
4874	34.96	PK	185	1.2	H	36.6	4.36	26.75	49.17	74	24.83	harmonic
4874	30.16	PK	285	1.0	V	35.4	4.36	26.75	43.17	74	30.83	harmonic
High Channel (2462 MHz)												
7386	32.59	Ave.	310	1.2	H	39.0	5.02	26.64	49.97	54	4.03	harmonic
2500	39.31	Ave.	0	1.0	V	30.6	3.11	26.88	46.14	54	7.86	spurious
7386	29.37	Ave.	150	1.1	V	37.7	5.02	26.64	45.45	54	8.55	harmonic
4924	27.98	Ave.	185	1.2	H	36.6	4.40	26.75	42.23	54	11.77	harmonic
2483.5	29.41	Ave.	75	1.0	H	30.6	3.11	26.88	36.24	54	17.76	spurious
7386	38.49	PK	310	1.2	H	39.0	5.02	26.64	55.87	74	18.13	harmonic
2500	49.02	PK	0	1.0	V	30.6	3.11	26.88	55.85	74	18.15	spurious
7386	35.67	PK	150	1.1	V	37.7	5.02	26.64	51.75	74	22.25	harmonic
4924	16.45	Ave.	280	1.0	V	35.4	4.40	26.75	29.5	54	24.5	harmonic
2483.5	42.39	PK	75	1.0	H	30.6	3.11	26.88	49.22	74	24.78	spurious
4924	34.58	PK	185	1.2	H	36.6	4.40	26.75	48.83	74	25.17	harmonic
4924	29.88	PK	280	1.0	V	35.4	4.40	26.75	42.93	74	31.07	harmonic

802.11g Mode:

Indicated		Detector (PK/Ave)	Table Angle Degree	Antenna		Correction Factor			FCC Part 15.247/15.209			
Frequency (MHz)	S.A. Reading (dBμV)			Height (m)	Polar (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Comment
Low Channel (2412 MHz)												
2390	62.41	PK	0	1.0	V	30.6	2.98	26.83	69.16	74	4.84	spurious
2390	40.4	Ave.	0	1.0	V	30.6	2.98	26.83	47.15	54	6.85	spurious
2388.6	60.07	PK	73	1.0	H	30.6	2.98	26.83	66.82	74	7.18	spurious
2388.6	39.71	Ave.	73	1.0	H	30.6	2.98	26.83	46.46	54	7.54	spurious
7236	44.77	PK	300	1.1	H	39	5.22	26.64	62.35	74	11.65	harmonic
7236	24.42	Ave.	300	1.1	H	39	5.22	26.64	42	54	12	harmonic
7236	19.33	Ave.	150	1.1	V	37.7	5.22	26.64	35.61	54	18.39	harmonic
7236	37.36	PK	150	1.0	V	37.7	5.22	26.64	53.64	74	20.36	harmonic
4824	18.36	Ave.	130	1.5	H	36.6	4.3	26.75	32.51	54	21.49	harmonic
4824	17.05	Ave.	60	1.8	V	35.4	4.3	26.75	30	54	24	harmonic
4824	33.02	PK	130	1.5	H	36.6	4.3	26.75	47.17	74	26.83	harmonic
4824	29.57	PK	60	1.8	V	35.4	4.3	26.75	42.52	74	31.48	harmonic
Middle Channel (2437 MHz)												
7311	45.06	PK	300	1.2	H	39.0	5.09	26.64	62.51	74	11.49	harmonic
7311	24.71	Ave.	300	1.2	H	39.0	5.09	26.64	42.16	54	11.84	harmonic
7311	19.76	Ave.	150	1.2	V	37.7	5.09	26.64	35.91	54	18.09	harmonic
7311	39.74	PK	150	1.2	V	37.7	5.09	26.64	55.89	74	18.11	harmonic
4874	18.34	Ave.	185	1.2	H	36.6	4.36	26.75	32.55	54	21.45	harmonic
4874	16.53	Ave.	280	1.1	V	35.4	4.36	26.75	29.54	54	24.46	harmonic
4874	32.84	PK	185	1.2	H	36.6	4.36	26.75	47.05	74	26.95	harmonic
4874	29.96	PK	280	1.1	V	35.4	4.36	26.75	42.97	74	31.03	harmonic
High Channel (2462 MHz)												
2483.6	62.52	PK	0	1.0	V	30.6	3.11	26.88	69.35	74	4.65	spurious
2483.6	42.41	Ave.	0	1.0	V	30.6	3.11	26.88	49.24	54	4.76	spurious
2483.6	60.79	PK	73	1.0	H	30.6	3.11	26.88	67.62	74	6.38	spurious
2483.6	39.46	Ave.	73	1.0	H	30.6	3.11	26.88	46.29	54	7.71	spurious
7386	44.45	PK	300	1.1	H	39.0	5.02	26.64	61.83	74	12.17	harmonic
7386	23.38	Ave.	300	1.1	H	39.0	5.02	26.64	40.76	54	13.24	harmonic
7386	18.81	Ave.	150	1.1	V	37.7	5.02	26.64	34.89	54	19.11	harmonic
7386	37.62	PK	150	1.1	V	37.7	5.02	26.64	53.7	74	20.3	harmonic
4924	16.27	Ave.	185	1.2	H	36.6	4.40	26.75	30.52	54	23.48	harmonic
4924	16.54	Ave.	280	1.2	V	35.4	4.40	26.75	29.59	54	24.41	harmonic
4924	31.28	PK	185	1.2	H	36.6	4.40	26.75	45.53	74	28.47	harmonic
4924	30.04	PK	280	1.2	V	35.4	4.40	26.75	43.09	74	30.91	harmonic

802.11n-HT20 Mode:

Indicated		Detector (PK/Ave)	Table Angle Degree	Antenna		Correction Factor			FCC Part 15.247/15.209			
Frequency (MHz)	S.A. Reading (dBμV)			Height (m)	Polar (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Comment
Low Channel (2412 MHz)												
2389	62.42	PK	0	1.0	V	30.6	2.98	26.83	69.17	74	4.83	spurious
2390	59.2	PK	72	1.0	H	30.6	2.98	26.83	65.95	74	8.05	spurious
7236	45.06	PK	300	1.1	H	39.0	5.22	26.64	62.64	74	11.36	harmonic
2389	35.07	Ave.	0	1.0	V	30.6	2.98	26.83	41.82	54	12.18	spurious
7236	22.97	Ave.	300	1.1	H	39.0	5.22	26.64	40.55	54	13.45	harmonic
2390	32.59	Ave.	72	1.0	H	30.6	2.98	26.83	39.34	54	14.66	spurious
7236	19.03	Ave.	150	1.1	V	37.7	5.22	26.64	35.31	54	18.69	harmonic
7236	38.71	PK	150	1.0	V	37.7	5.22	26.64	54.99	74	19.01	harmonic
4824	16.33	Ave.	130	1.5	H	36.6	4.3	26.75	30.48	54	23.52	harmonic
4824	16.25	Ave.	60	1.8	V	35.4	4.3	26.75	29.2	54	24.8	harmonic
4824	33.72	PK	130	1.5	H	36.6	4.3	26.75	47.87	74	26.13	harmonic
4824	29.76	PK	60	1.8	V	35.4	4.3	26.75	42.71	74	31.29	harmonic
Middle Channel (2437 MHz)												
7311	45.15	PK	300	1.2	H	39.0	5.09	26.64	62.6	74	4.66	harmonic
7311	23.15	Ave.	300	1.2	H	39.0	5.09	26.64	40.6	54	6.66	harmonic
7311	19.1	Ave.	240	1.1	V	37.7	5.09	26.64	35.25	54	18.75	harmonic
7311	38.99	PK	240	1.1	V	37.7	5.09	26.64	55.14	74	18.86	harmonic
4874	16.37	Ave.	185	1.2	H	36.6	4.36	26.75	30.58	54	23.42	harmonic
4874	16.33	Ave.	280	1.1	V	35.4	4.36	26.75	29.34	54	24.66	harmonic
4874	33.78	PK	185	1.2	H	36.6	4.36	26.75	47.99	74	26.01	harmonic
4874	29.84	PK	280	1.1	V	35.4	4.36	26.75	42.85	74	31.15	harmonic
High Channel (2462 MHz)												
2483.5	62.27	PK	0	1.0	V	30.6	3.11	26.88	69.1	74	4.9	spurious
2483.5	58.82	PK	72	1.0	H	30.6	3.11	26.88	65.65	74	8.35	spurious
7386	45.04	PK	300	1.1	H	39.0	5.02	26.64	62.42	74	11.58	harmonic
2483.5	33.47	Ave.	0	1.0	V	30.6	3.11	26.88	40.3	54	13.7	spurious
7386	22.38	Ave.	300	1.1	H	39.0	5.02	26.64	39.76	54	14.24	harmonic
2483.5	31.91	Ave.	72	1.0	H	30.6	3.11	26.88	38.74	54	15.26	spurious
7386	18.84	Ave.	150	1.1	V	37.7	5.02	26.64	34.92	54	19.08	harmonic
7386	38.66	PK	150	1.1	V	37.7	5.02	26.64	54.74	74	19.26	harmonic
4924	16.35	Ave.	250	1.8	H	36.6	4.40	26.75	30.6	54	23.4	harmonic
4924	16.3	Ave.	60	1.8	V	35.4	4.40	26.75	29.35	54	24.65	harmonic
4924	33.73	PK	250	1.8	H	36.6	4.40	26.75	47.98	74	26.02	harmonic
4924	29.73	PK	60	1.8	V	35.4	4.40	26.75	42.78	74	31.22	harmonic

7.6. Conducted Emission Method

Please refer to section 5 this report.

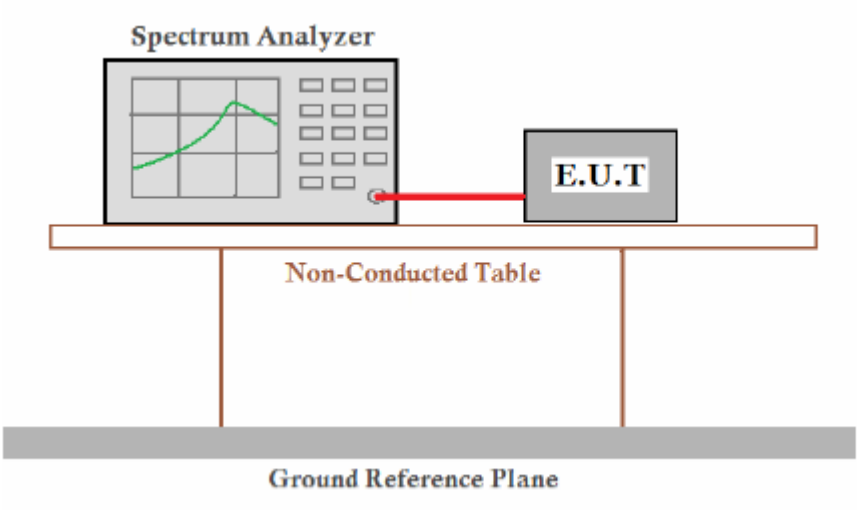
7.7. Test Requirement:

FCC Part15 C Section 15.247 (d)

7.8. Limit:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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.

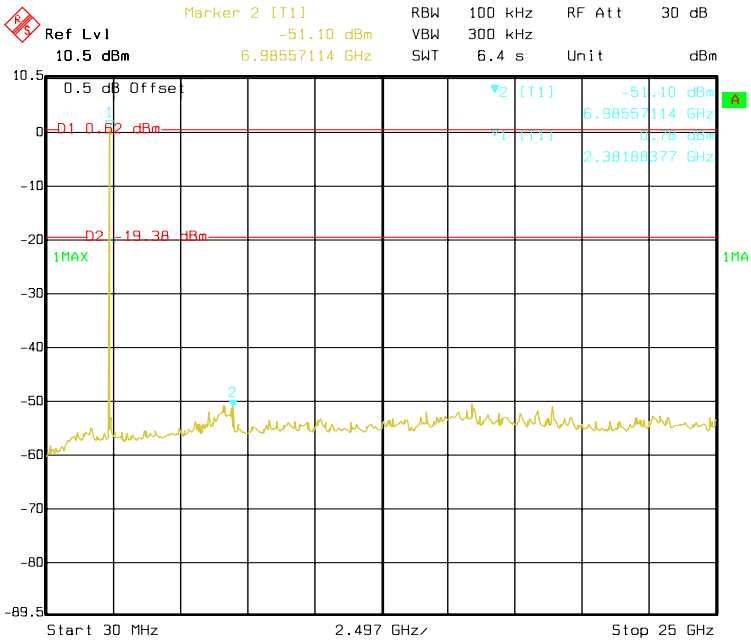
7.9. Test Setup



7.10.Test Result

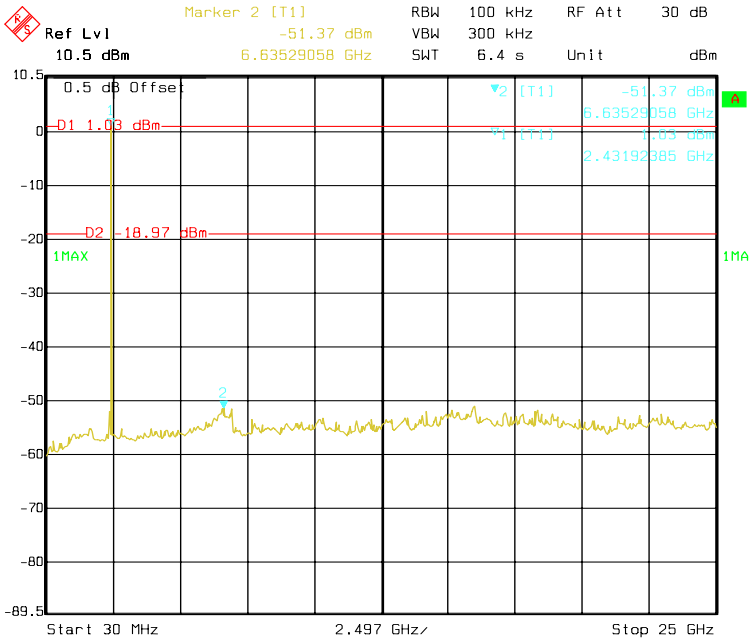
Test plot as follows:

802.11b Low Channel 2412 MHz
30MHz~25GHz



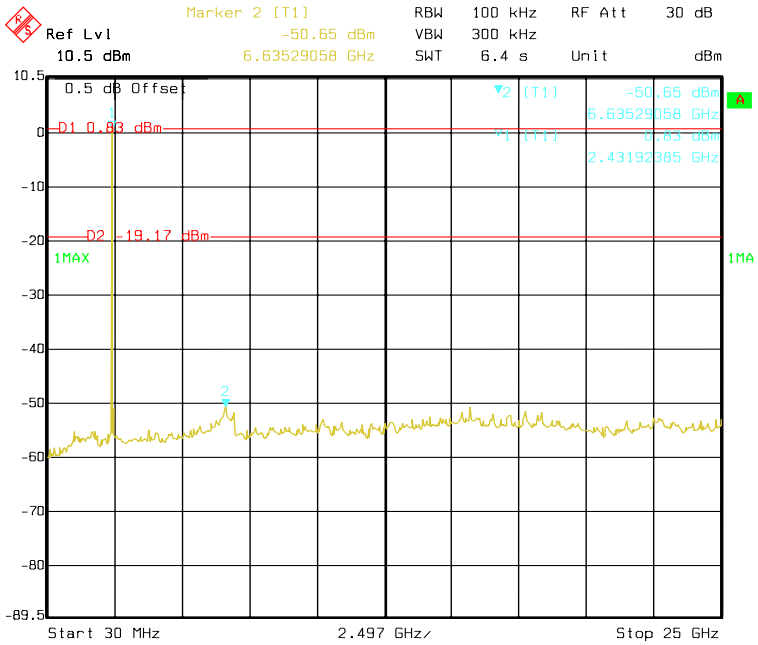
Note:Sweep points=250000pts

802.11b Middle Channel 2437 MHz
30MHz~25GHz



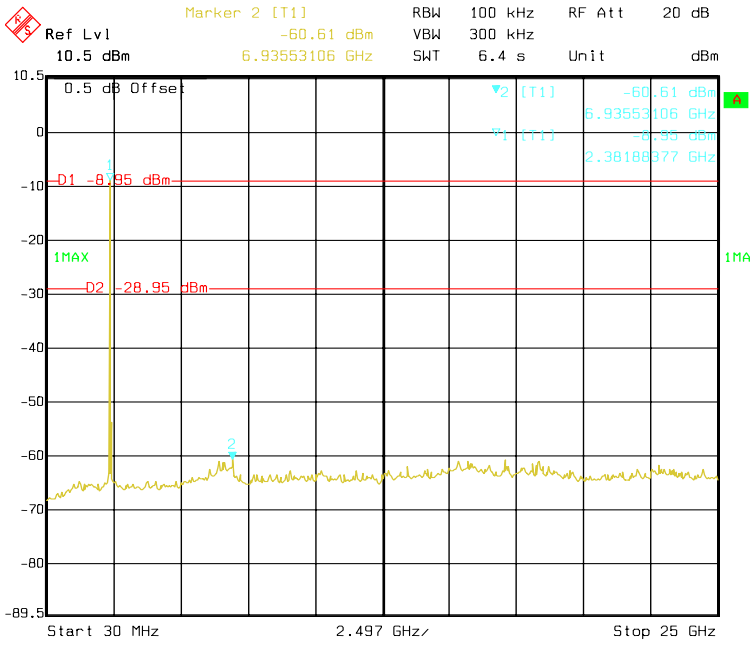
Note:Sweep points=250000pts

802.11b High channel 2462 MHz
30MHz~25GHz



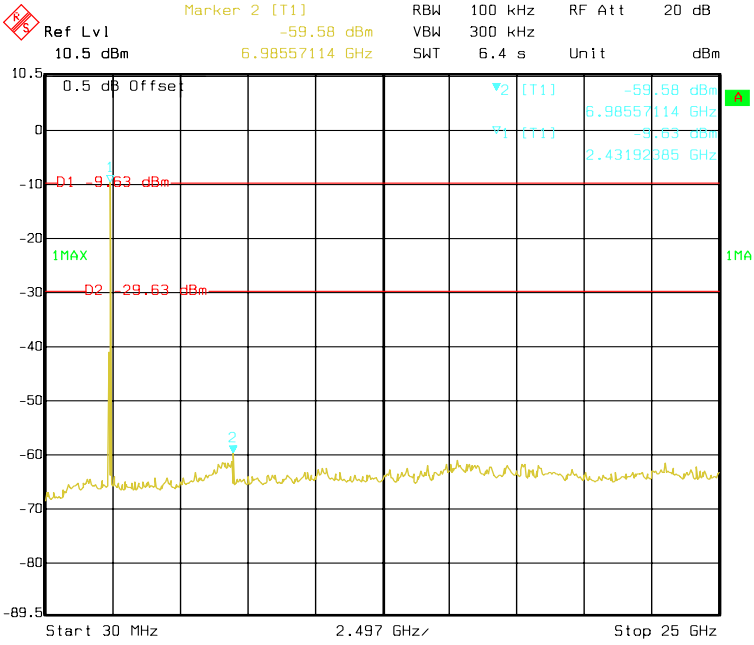
Note:Sweep points=250000pts

802.11g Low Channel 2412 MHz
30MHz~25GHz



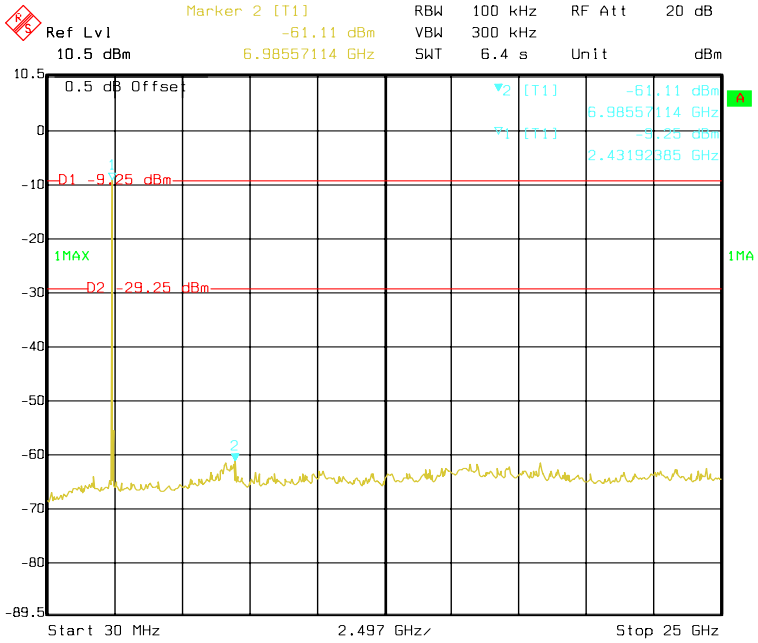
Note:Sweep points=250000pts

802.11g Middle Channel 2437 MHz
30MHz~25GHz



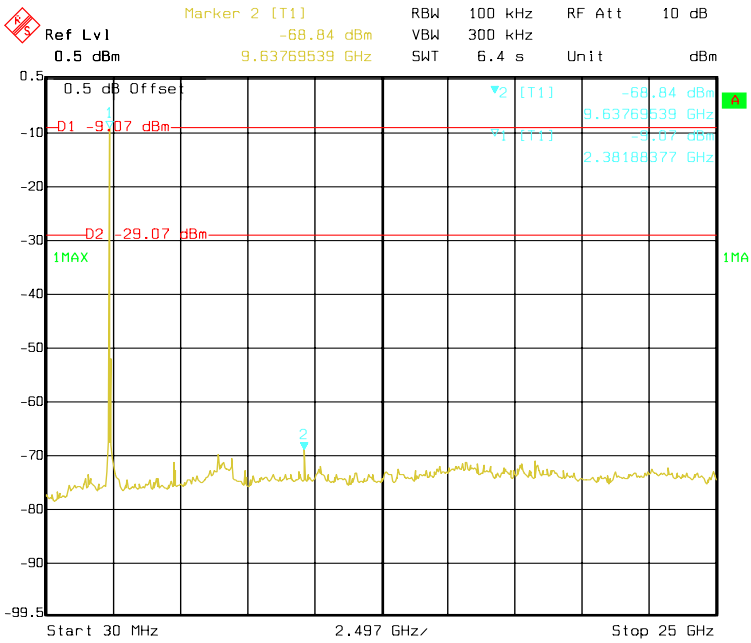
Note:Sweep points=250000pts

802.11g High channel 2462 MHz
30MHz~25GHz



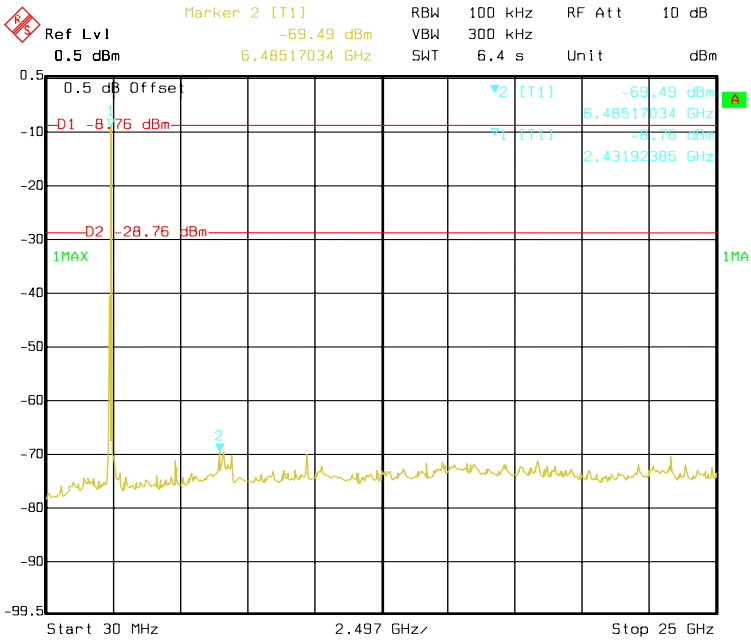
Note:Sweep points=250000pts

802.11n20 Low Channel 2412 MHz
30MHz~25GHz



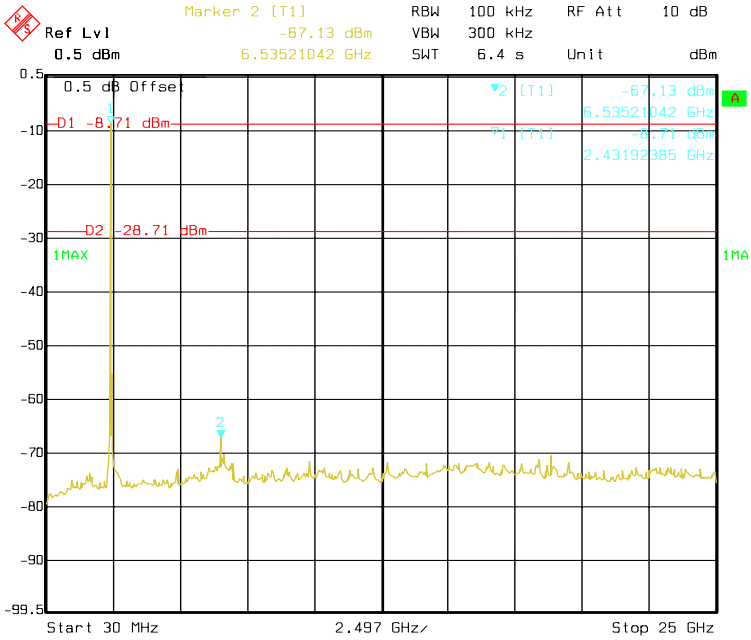
Note:Sweep points=250000pts

802.11n20 Middle Channel 2437 MHz
30MHz~25GHz



Note:Sweep points=250000pts

802.11n20 High channel 2462 MHz
30MHz~25GHz



Note:Sweep points=250000pts

8. §15.247(A) (2) – 6DB BANDWIDTH TESTING

8.1. Test Equipment

Please refer to Section 5 this report.

8.2. Test Procedure

1. Set EUT in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3.

802.11b mode :Set the spectrum analyzer as RBW=100KHz,VBW>=3RBW,Span=40MHz,Sweep=auto.
802.11g/n mode :Set the spectrum analyzer as BW=300KHz,VBW>=3RBW,Span=40MHz,Sweep=auto.

4. Mark the peak frequency and -6dB(upper and lower)frequency.
5. Repeat until all the rest channels are investigated.

8.3. Applicable Standard

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

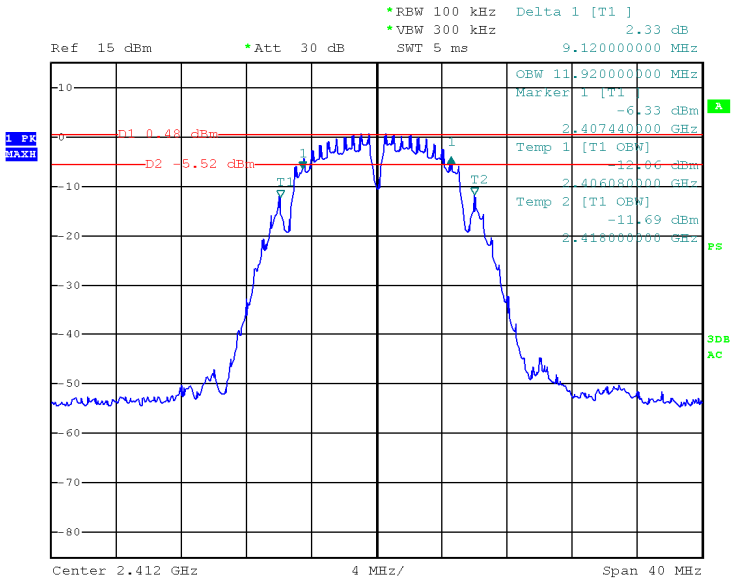
8.4. Test Result:Pass.

Please refer to the following tables

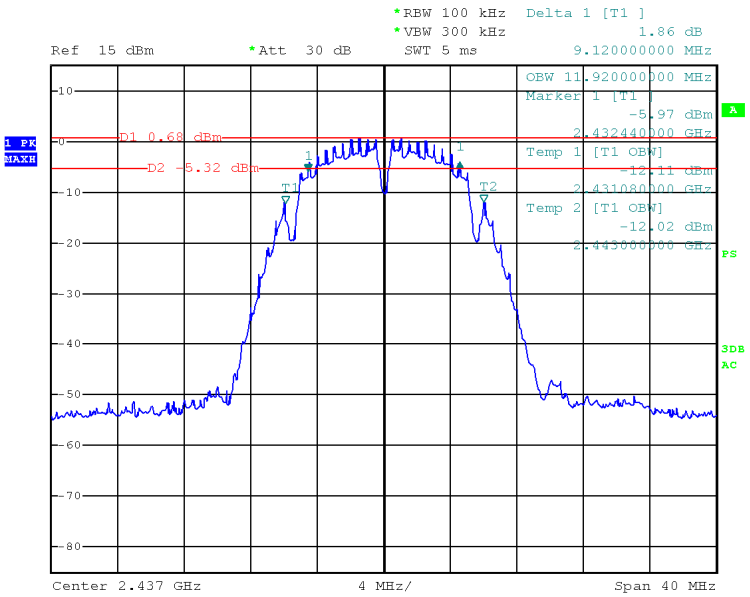
Channel	Channel Frequency (MHz)	Data Rate (Mbps)	6dB Emission Bandwidth (MHz)	FCC Part 15.247 Limit (kHz)
802.11b mode				
Low	2412	1	9.12	>500
Middle	2437	1	9.12	>500
High	2462	1	9.12	>500
802.11g mode				
Low	2412	6	16.64	>500
Middle	2437	6	16.64	>500
High	2462	6	16.64	>500
802.11n20 mode				
Low	2412	6.5	16.72	>500
Middle	2437	6.5	16.72	>500
High	2462	6.5	16.72	>500

802.11b Mode:

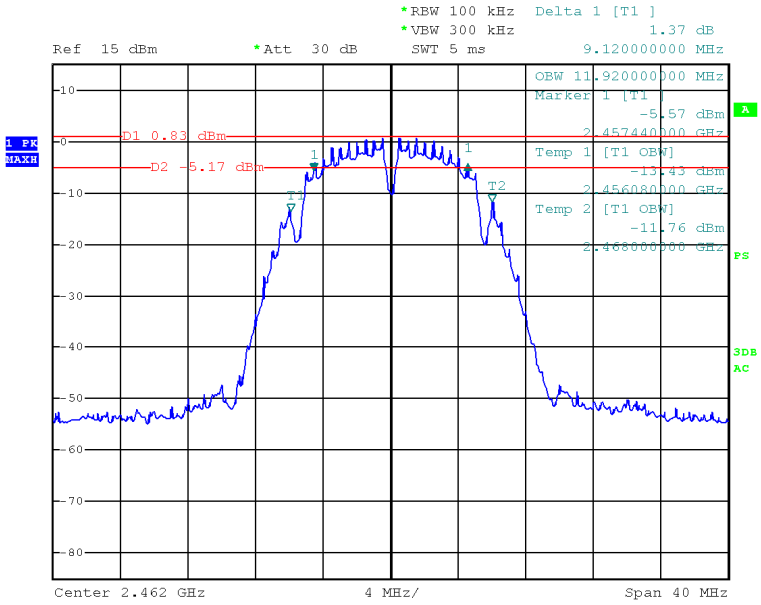
Low Channel
6dB Bandwidth



Middle Channel
6dB Bandwidth

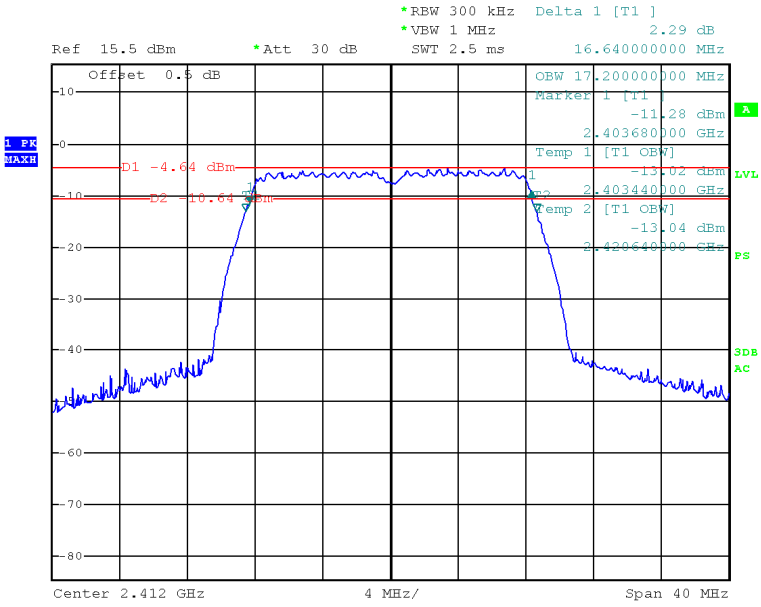


High Channel
6dB Bandwidth

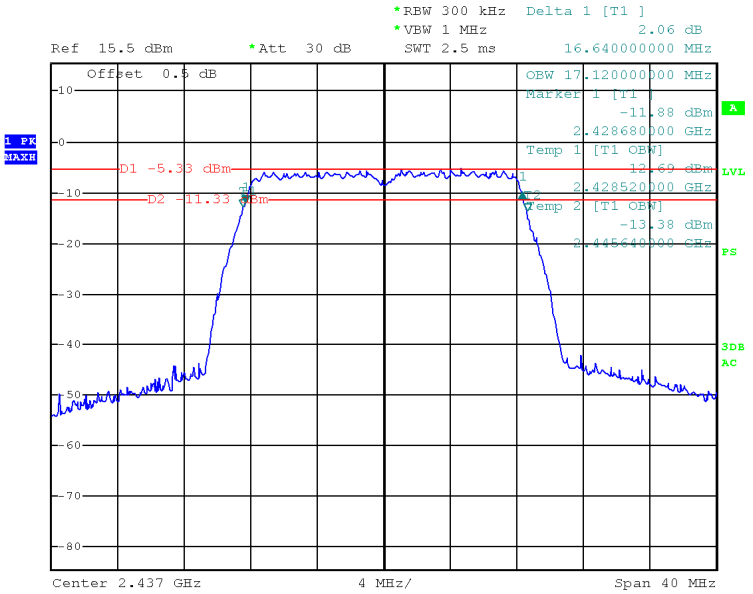


802.11g Mode:

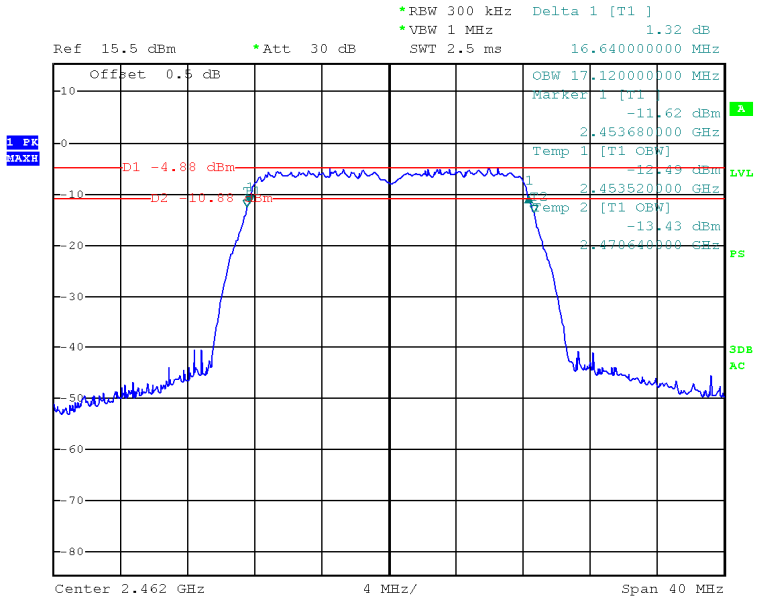
Low Channel
6dB Bandwidth



Middle Channel
6dB Bandwidth

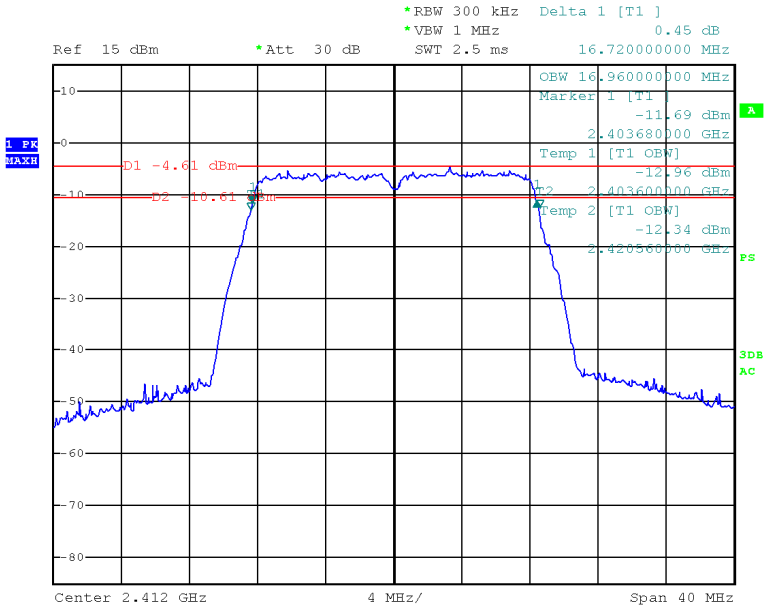


High Channel
6dB Bandwidth

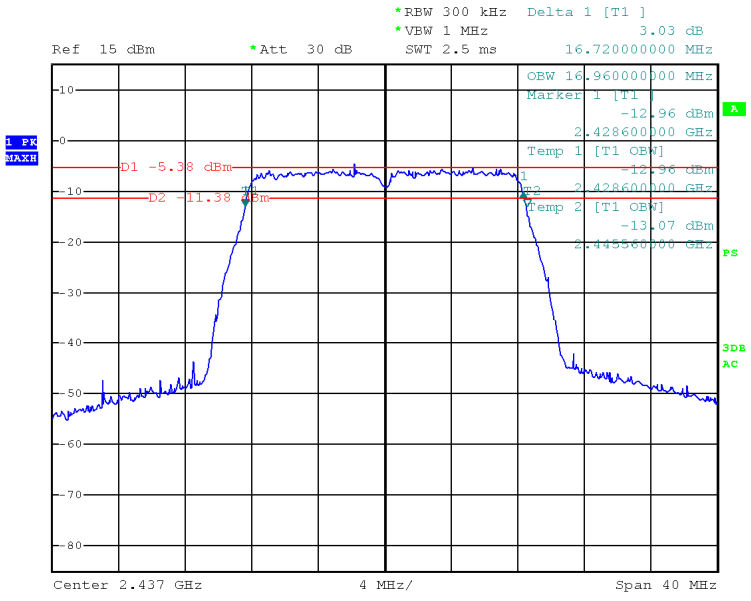


802.11n20 Mode:

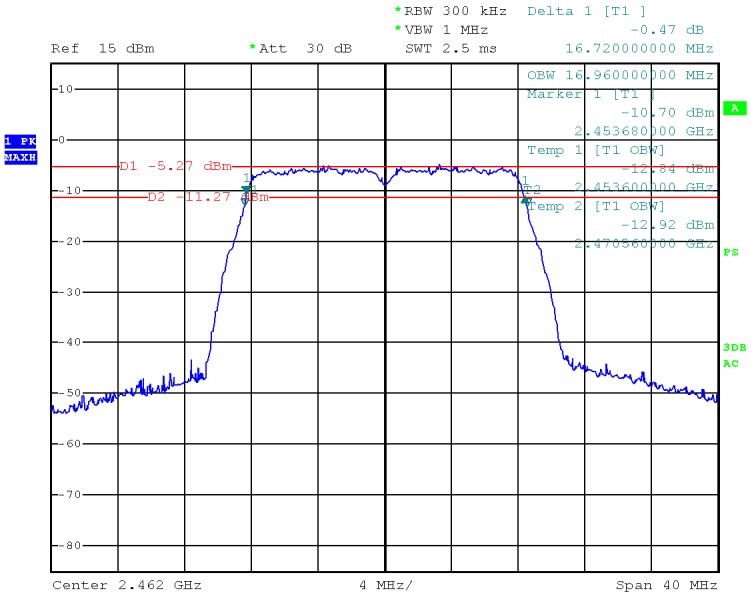
Low Channel
6dB Bandwidth



Middle Channel
6dB Bandwidth



High Channel
6dB Bandwidth



9. §15.247(B) (3) - Maximum Output Power

9.1. Test Equipment

Please refer to Section 4 this report.

9.2. Test Procedure

1. The EUT was directly connected to the PK power meter

9.3. Applicable Standard

According to §15.247(b) (3), for systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

9.4. Test Result

Pass

Channel	Frequency (MHz)	Data Rate (Mbps)	Reading PK Power (dBm)	Reading AV Power (dBm)	Limit (dBm)	Result
802.11b mode						
Low	2412	1	8.91	8.8	30	Pass
Middle	2437	1	9.14	9.03	30	Pass
High	2462	1	9.28	9.17	30	Pass
802.11g mode						
Low	2412	6	8.58	8.47	30	Pass
Middle	2437	6	8.87	8.76	30	Pass
High	2462	6	9.11	9	30	Pass
802.11n20 mode						
Low	2412	6.5	8.59	8.48	30	Pass
Middle	2437	6.5	8.9	8.79	30	Pass
High	2462	6.5	9.12	9.01	30	Pass

10. §15.247(D) – 100 KHZ Bandwidth of Frequency Band Edge

10.1.Test Equipment

Please refer to Section 4 this report.

10.2.Test Procedure

1, Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2, Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3, Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
Note: For Rdstricted Band
RBW=1MHz
VBW=1 MHz
4, Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5, Repeat above procedures until all measured frequencies were complete.

10.3.Applicable Standard

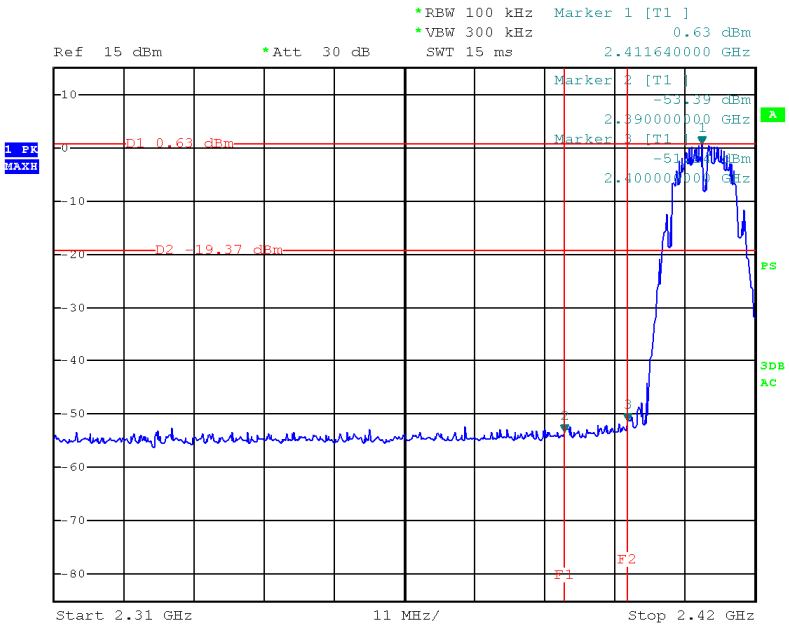
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

10.4.Test Result

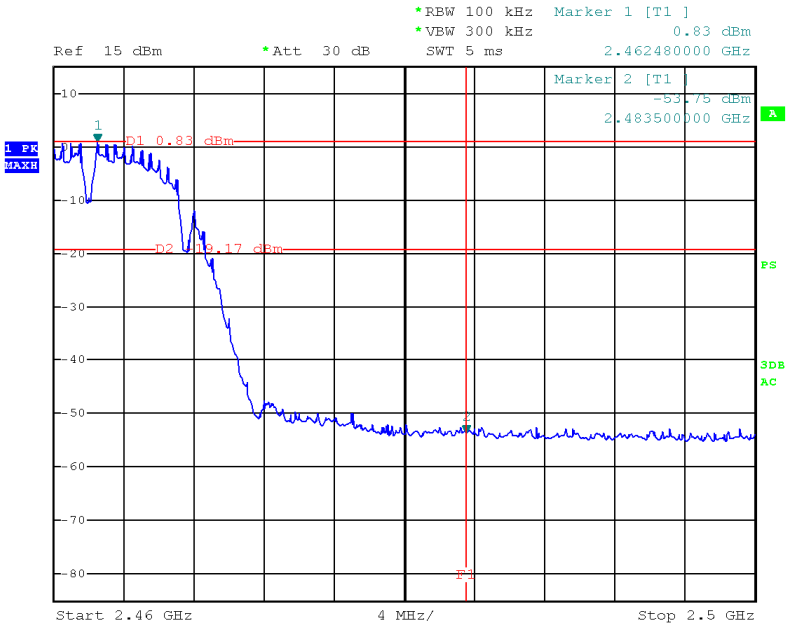
Pass

Please refer to following plots.

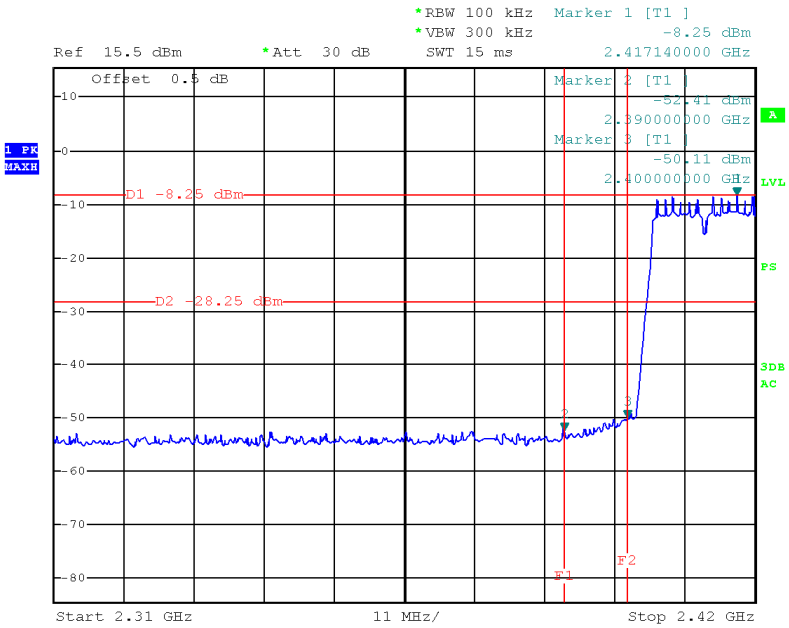
802.11b: Band Edge, Left Side Low Channel



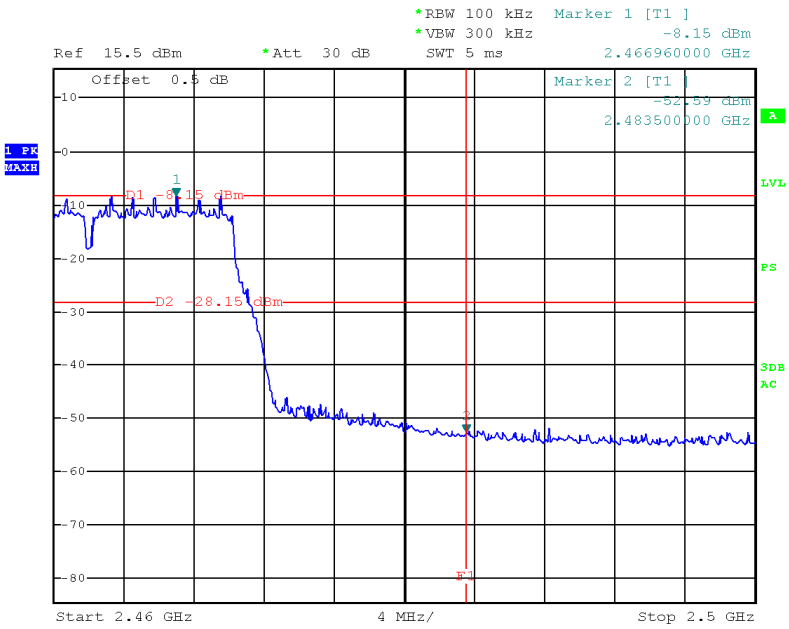
802.11b: Band Edge, Right Side High Channel



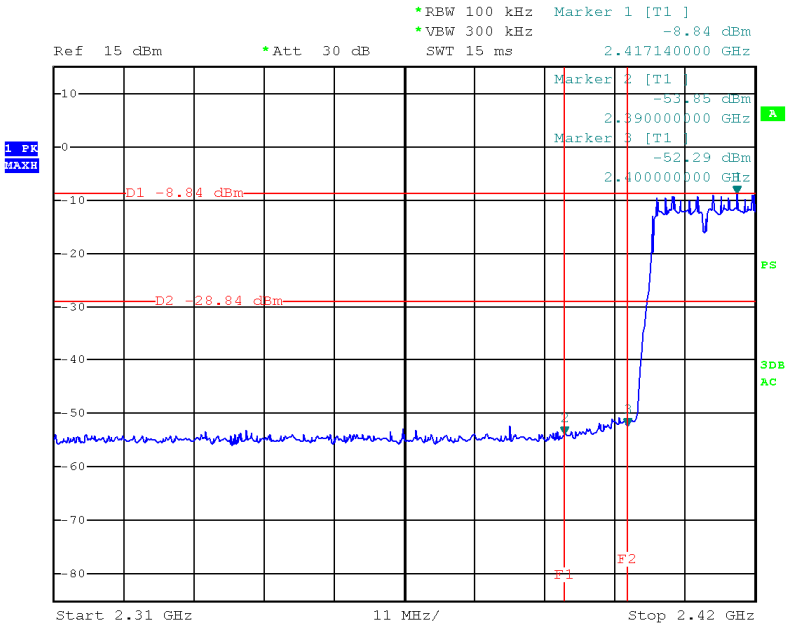
802.11g: Band Edge, Left Side Low Channel



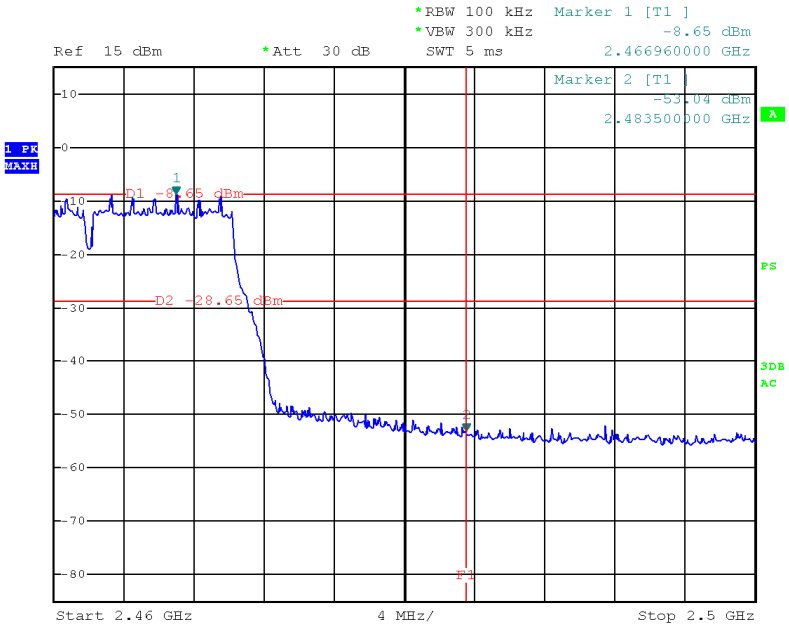
802.11g: Band Edge, Right Side High Channel



802.11n20: Band Edge, Left Side Low Channel



802.11n20: Band Edge, Right Side High Channel



11. §15.247(E) - Power Spectral Density

11.1. Test Equipment

Please refer to Section 4 this report.

11.2.Test Procedure

1.Connect EUT test port to spectrum analyzer
2. Set the EUT to transmit maximum output power at 2.4GHz.
3. Then set the EUT to transmit at high, middle and low frequency and measure the conducted Power Spectral Density.

11.3.Applicable Standard

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

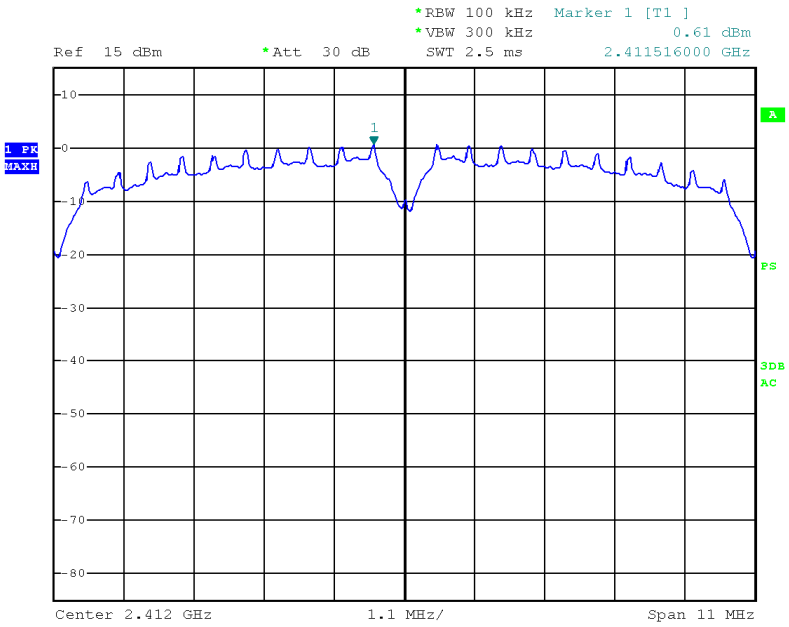
11.4.Test Result

PASS

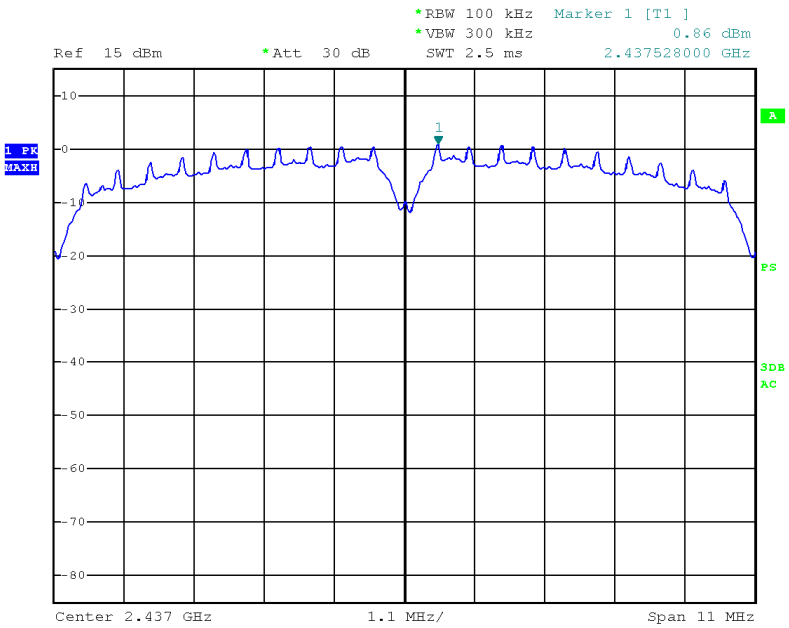
Channel	Frequency (MHz)	Data Rate (Mbps)	Correct Power spectral density (dBm/100kHz)	Limit (dBm/3kHz)	Result
802.11b mode					
Low	2412	1	0.61	≤8	Pass
Middle	2437	1	0.86	≤8	Pass
High	2462	1	0.71	≤8	Pass
802.11g mode					
Low	2412	6	-8.28	≤8	Pass
Middle	2437	6	-8.70	≤8	Pass
High	2462	6	-8.36	≤8	Pass
802.11n20 mode					
Low	2412	6.5	-8.78	≤8	Pass
Middle	2437	6.5	-8.67	≤8	Pass
High	2462	6.5	-8.57	≤8	Pass

Please refer to the following plots

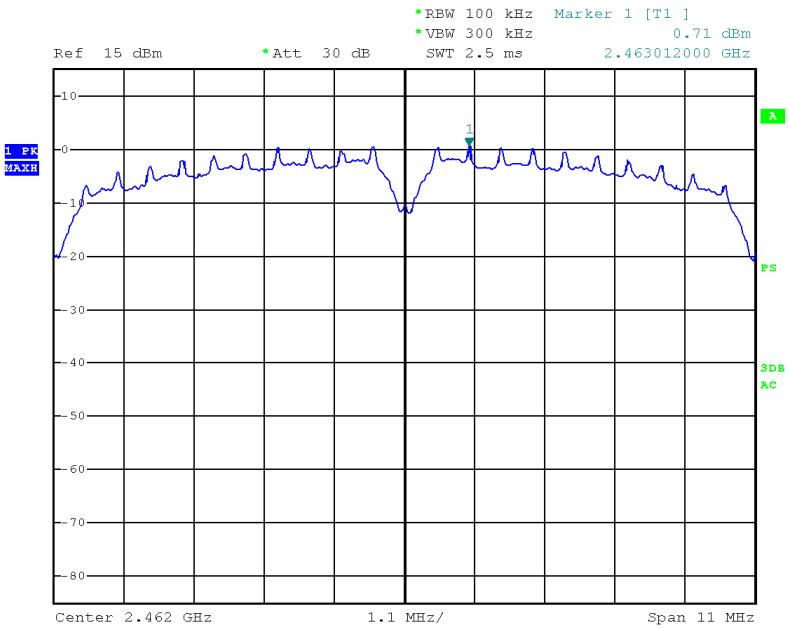
Power Spectral Density, 802.11b Low Channel



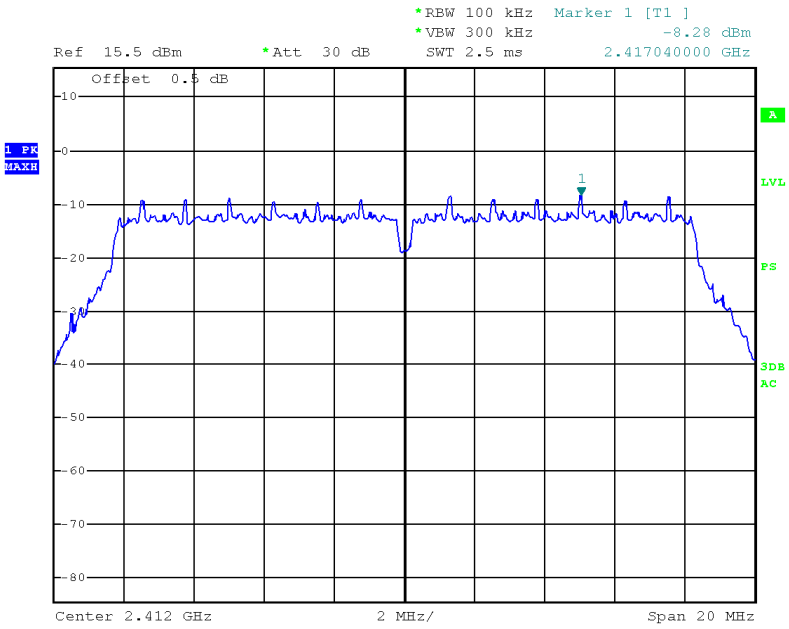
Power Spectral Density, 802.11b Middle Channel



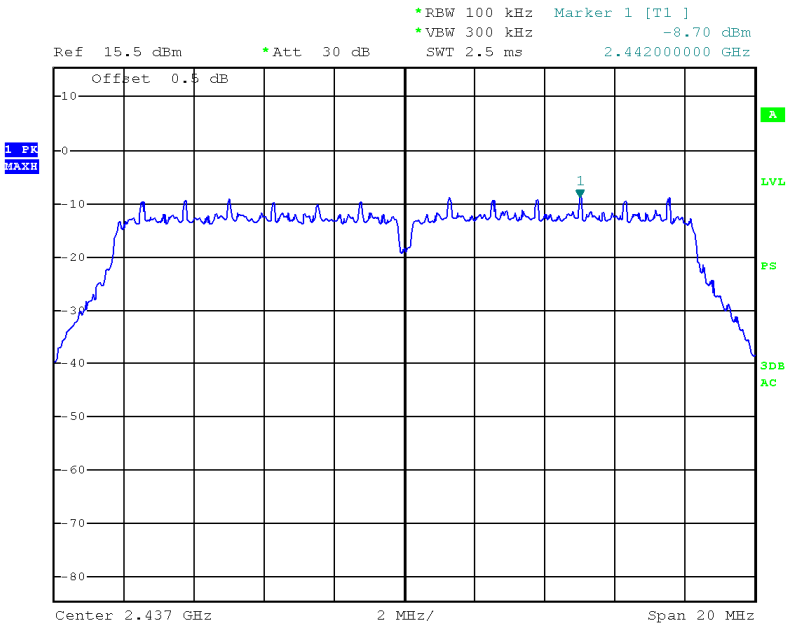
Power Spectral Density, 802.11b High Channel



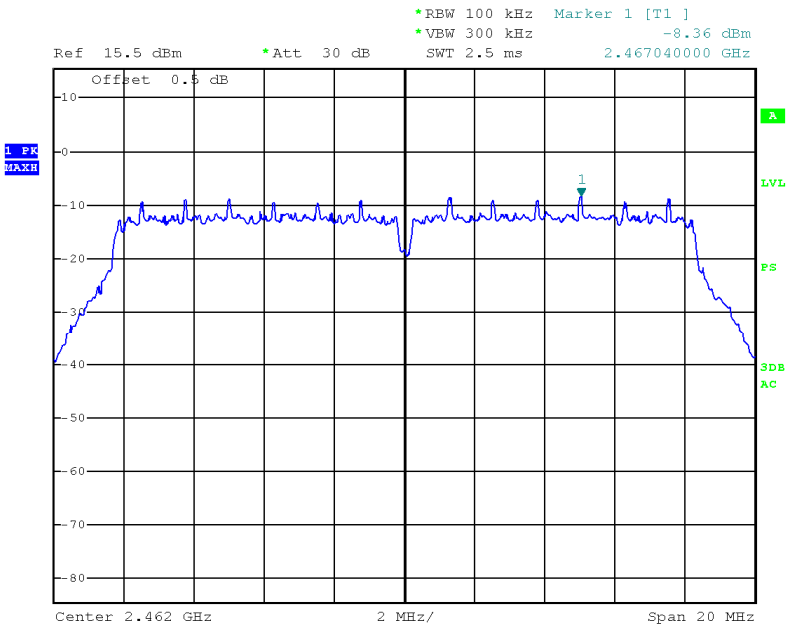
Power Spectral Density, 802.11g Low Channel



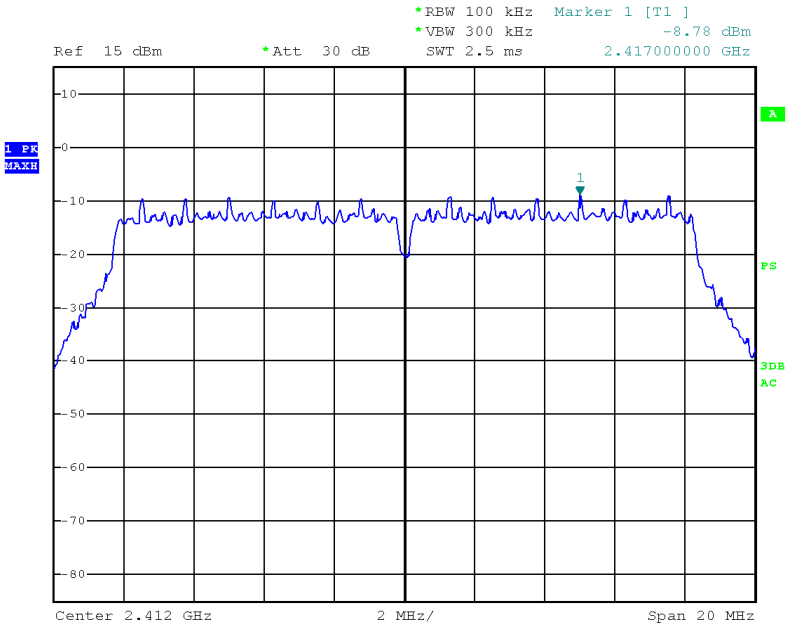
Power Spectral Density, 802.11g Middle Channel



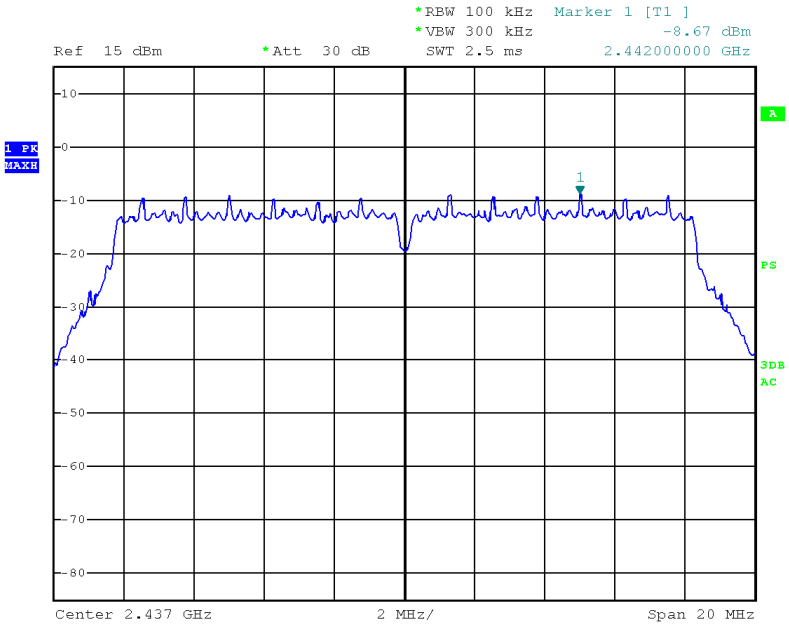
Power Spectral Density, 802.11g High Channel



Power Spectral Density, 802.11n20 Low Channel



Power Spectral Density, 802.11 n20 Middle Channel



Power Spectral Density, 802.11 n20 High Channel