



Report No.SH16100058W02

FCC RF TEST REPORT

Issued to

Shanghai MXCHIP Information Technology Co., Ltd

For

Embedded WiFi module

Model Name : EMW3166-P,
EMW3166-E,
EMW3166-B
Trade Name : MXCHIP
Brand Name : MXCHIP
Standard : 47 CFR Part 15, Subpart C
ANSI C63.10-2013
FCC ID : P53-EMW3166
Test date : Nov.7,2016 to Nov.8,2016
Issue date : Nov.10,2016



Shanghai Skylabs Co., Ltd.

Tested by Wu Hongfei

Approved by Shi Han

Review by Xiao Dong Wei

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**Change History**

Issue	Date	Reason for change
1.0	Nov.10,2016	First edition



1. General Information

1.1 Applicant

Shanghai MXCHIP Information Technology Co., Ltd

9thFloor,No.5,Lane2145JinshaJiangRoad,Putuo District,ShangHai (200333)

1.2 Manufacturer

Shanghai MXCHIP Information Technology Co., Ltd

9thFloor,No.5,Lane2145JinshaJiangRoad,Putuo District,ShangHai (200333)

1.3 Description of EUT

EUT Name..... : Embedded WiFi module
Model Name..... : EMW3166-P,EMW3166-E, EMW3166-B
Brand Name..... : MXCHIP
Trade Name..... : MXCHIP
Hardware Version..... : EMW3166 V1.0
Software Version..... : EMW3166 V2.1 921600
Modulation Type..... : DSSS (802.11b), OFDM (802.11g/n)
Frequency Range..... : 2.412GHz - 2.462GHz(at interval of 5 MHz)
Channel Number..... : 11
Antenna Type..... : PCB / External Antenna/ PIFA Antenna
Antenna Gain..... : 2 dBi /2 dBi /2 dBi

Antenna details:

NO.	Model	Type	Gain	frequency
1	EMW3166-P	PCB Antenna	2dBi	2400-2500
2	EMW3166-E	External Antenna	2dBi	2400-2500
3	EMW3166-B	PIFA-Antenna	2dBi	2400-2500

NOTE 1:

*The EUT is WIFI Module operating at 2.4GHz ISM band; it supports 802.11b, 802.11g, 802.11n and they are all tested in this report. The frequencies allocated is $F \text{ (MHz)} = 2412 + 5 * (n - 1)$ ($1 \leq n \leq 11$). The lowest, middle, highest channel numbers of the EUT used and tested in this report are separately 1(2412MHz), 6 (2437MHz) and 11 (2462MHz). The sample EMW3166-P,EMW3166-E, EMW3166-B is same module except for equipped different antenna as show in above table.*

NOTE 2:

For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacture.



2. Facilities and Accreditations

2.1 Test Facility

Shanghai Skylabs Co., Ltd. is a third party testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L6644. A 9*6*6(m) full/semi-anechoic chamber was used for the radiated emissions test.

FCC Registration number:196218

2.2 Environmental Conditions

Ambient temperature: 15~35°C

Relative humidity: 30~60%

Atmosphere pressure: 86-106kPa

2.3 Measurement Uncertainty

The uncertainty is calculated using the methods suggested in the "Guide to the Expression of Uncertainty in Measurement" (GUM) published by ISO.

Uncertainty of Conducted Emission: $\pm 1.76\text{dB}$

Uncertainty of Radiated Emission: $\pm 3.16\text{dB}$



2.4 List of Equipments Used

Description	Manufacturer	Model	Serial No.	Cal.Date	Cal. Due
Spectrum Analyzer	R&S	FSU26	200880	2016.2.25	1year
Power Splitter	Weinschel	1506A	NW521	(n.a.)	(n.a.)
Power Splitter	Mini-Circuits	ZFRSC-183-S+	765001016	(n.a.)	(n.a.)
Attenuator 1	Resnet	10dB	(n.a.)	(n.a.)	(n.a.)
Attenuator 2	Resnet	3dB	(n.a.)	(n.a.)	(n.a.)
Full/Semi-Anechoic Chamber	CHENGYU	9.2×6.25×6.15m	SAR	2016.4.11	3year
EMI Test Receiver	R&S	ESCI7	100787	2016.2.25	1year
LISN	TESEQ	NNB 51	33285	2016.2.25	1year
Personal Computer	HP	6300P	CNG24296YW	(n.a.)	(n.a.)
Test Antenna-Horn	Schwarzbeck	BBHA9170	BBHA91970171	2016.9.21	1year
Test Antenna-Horn	Schwarzbeck	BBHA 9120D	9120D-1033	2016.7.24	1year
Test Antenna-Log	Schwarzbeck	VULB 9163	9163-561	2016.9.24	1year
Test Antenna-Loop	Schwarzbeck	FMZB 1519	1519-025	2016.9.21	1year
Power supplier	NF	ES2000S	9087735	2016.10.17	1year

NOTE:

Equipments listed above have been calibrated and are in the period of validation.

Supporting Accessories

Description	Manufacturer	Model	Serial No.
Laptop	ACER	Aspire 4376ZG	LXPFY0C004 935291221601
Laptop Adapter	LITEON	PA-1650-22	9801016502
RF Cable	(n.a.)	0~18GHz	(n.a.)
RF Cable	(n.a.)	0~25GHz	(n.a.)
Test Clamp	MX	EMW3165	(n.a.)



3. Test Standards and Results

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

FCC Part 15 Subpart C §15.247

ANSI C63.10-2013

April 2016KDB558074

NOTE:

(1)All test items were verified and recorded according to the standards and without any deviation during the test.

(2)This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart C (WIFI, 2.4GHz ISM band radiators),recorded in a separate test report.

Test items and the results are as bellow:

No.	FCC Rules	Description	Result
1	15.203	Antenna Requirement	Pass
2	15.247(b)	Peak Output power	Pass
3	15.247(a)	20dB Bandwidth	Pass
4	15.247(d)	Conducted Spurious Emission	Pass
5	15.247(d)	Band Edge	Pass
6	15.207	Conducted Emission	Pass
7	15.247(d) 15.209	Radiated Emission	Pass
8	15.247(e)	Power Spectral Density (PSD)	Pass



4. Test Conditions Setting

4.1 Test Mode

Conduct Emission EUT model number:EMW3166-P

Radiation Emission EUTs model number: EMW3166-P, EMW3166-E, EMW3166-B

Software Configuration:

1. Open "driver" folder, compile the exact file, such as "2G_Tx_11b_CCK1.bat".
2. Correct to the actual Serial Number, set channel number and power class etc.

```
1 wl --serial 25 down .
2 wl --serial 25 mpc 0
3 wl --serial 25 up
4 wl --serial 25 country ALL
5 wl --serial 25 scansuppress 1
6 wl --serial 25 channel 1
7 wl --serial 25 band b
8 wl --serial 25 rate 1
9 wl --serial 25 txpwr1 -1
0 wl --serial 25 txpwr1 -0 -q 60
1 wl --serial 25 pkteng_start 00:11:22:33:44:55 tx 20 1025 0
2 pause
3 wl --serial 25 pkteng_stop tx
```

3. Save and run "2G_Tx_11b_CCK1.bat"
4. Repeat the procedure swift to other mode and data rate.
5. The module does not work if the cable and laptop removed during the test.

With the software which was provide by applicant he EUT could be set to continuous transmit mode (duty cycle $\geq 98\%$) with a certain modulation scheme and data rate on a certain frequency. The software WL was installed on a laptop PC, which was connected to the Test Clamp with a USB cable.

Setting table of output power:

Frequency (MHz)	Setting Value		
	802.11b	802.11g	802.11n
2412	-1	-1	-1
2437	-1	-1	-1
2462	-1	-1	-1

NOTE:

"-1" mains applicant's default configure about output power.

Modulation technology	Modulation Type	Transfer Rate (Mbps)
DSSS (802.11b)	DBPSK	1
	DQPSK	2
	CCK	5.5/ 11
OFDM (802.11g)	BPSK	6 / 9



	QPSK	12 / 18
	16QAM	24 / 36
	64QAM	48 / 54
OFDM (802.11n-20MHz)	BPSK	6.5
	QPSK	13/19.5
	16QAM	26/39
	64QAM	52/58.5/65/72

Preliminary tests were performed in different data rate in above table to find the worst radiated emission. The worst data were recorded in this report according to below table.

Mode	Data Rate (Mbps)	Channel	Frequency (MHz)
IEEE 802.11b	11	1	2412
	11	6	2437
	11	11	2462
IEEE 802.11g	54	1	2412
	54	6	2437
	54	11	2462
IEEE 802.11n, HT20	65	1	2412
	65	6	2437
	65	11	2462

Note1: While testing transmitting mode of EUT, the internal modulation and continuously transmission was applied.

The lowest, middle and highest channel were tested as representatives. For 802.11b/g/n (HT20)----- lowest, 2412MHz; middle, 2437MHz; highest, 2462MHz.

Note2: According to exploratory test, EUT has the maximum PK output power in above data rate, so those data rate were chosen to perform all the tests as representative:



5. 47 CFR Part 15C

5.1 Antenna requirement

5.1.1 Applicable standard

According to FCC 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by 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.

5.1.2 Result: Compliant

For EUT with PCB antenna, it has a permanently and irreplaceable attached antenna. Please refer to the EUT internal and external photos.

For EUT with external antenna, has an IPEX connector, only professional users can access to and obtain materials and equipments to install of an external antenna. Please refer to the EUT internal and external photos.

For EUT with PIFA antenna, the PIFA Antenna was soldred to the module via calbe Please refer to the EUT internal and external photos.



6. Test Result

6.1 Peak Output Power

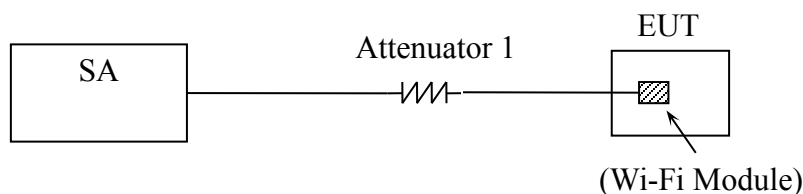
6.1.1 Requirement

According to FCC section 15.247(b)(3), For systems using digital modulation in the 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz bands: The maximum peak conducted output power of the intentional radiator shall not exceed 1 Watt.

6.1.2 Test Description

The measured output power was calculated by the reading of the spectrum analyzer (SA) and calibration.

A. Test Setup:



The EUT (Equipment under the test) is coupled to the SA; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading, all test result in SA.

6.1.3 Test Result

The lowest, middle and highest channels are selected to perform testing to verify the conducted RF output peak power of the Module.(Duty cycle > 98%).

A. Test Verdict:

Mode	Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
			dBm	W	dBm	W	
802.11b	1	2412	18.21	0.06622	30	1	Pass
	6	2437	19.82	0.09594			Pass
	11	2462	19.86	0.09683			Pass
802.11g	1	2412	22.81	0.19099			Pass
	6	2437	21.90	0.15488			Pass
	11	2462	21.61	0.14488			Pass
802.11n (20MHz)	1	2412	22.65	0.18408			Pass
	6	2437	22.01	0.15885			Pass
	11	2462	21.90	0.15488			Pass



6.2 Average Power

6.2.1 Requirement

None; for reporting purposes only.

6.2.2 Test Description

Refer to 6.1.2.

6.2.3 Test Results

Mode	Channel	Frequency (MHz)	Measured Output Average Power	
			dBm	W
802.11b	1	2412	15.35	0.034277
	6	2437	15.44	0.034995
	11	2462	15.31	0.033963
802.11g	1	2412	12.49	0.017742
	6	2437	12.43	0.017498
	11	2462	12.25	0.016788
802.11n (20MHz)	1	2412	11.32	0.013552
	6	2437	11.09	0.012853
	11	2462	11.92	0.015560

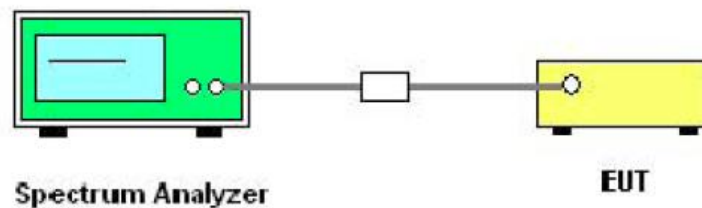


6.3 6dB & 20dB Bandwidth

6.3.1 Requirement

According to FCC section 15.247(a) (2), 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.

6.3.2 Test Description



6.3.3 Test Result

The lowest, middle and highest channels are selected to perform testing to record the 6 dB bandwidth of the Module.

A. Test Verdict:

802.11b Test mode

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Refer to plot	20dB Bandwidth (MHz)	Refer to plot	Limit (KHz)	Result
1	2412	7.852	Plot A1	13.982	Plot A2	≥ 500	Pass
6	2437	7.572	Plot B1	13.661	Plot B2	≥ 500	Pass
11	2462	7.828	Plot C1	13.998	Plot C2	≥ 500	Pass

802.11g Test mode

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Refer to plot	20dB Bandwidth (MHz)	Refer to plot	Limit (KHz)	Result
1	2412	15.745	Plot D1	17.508	Plot D2	≥ 500	Pass
6	2437	16.266	Plot E1	17.467	Plot E2	≥ 500	Pass
11	2462	15.801	Plot F1	17.604	Plot F2	≥ 500	Pass

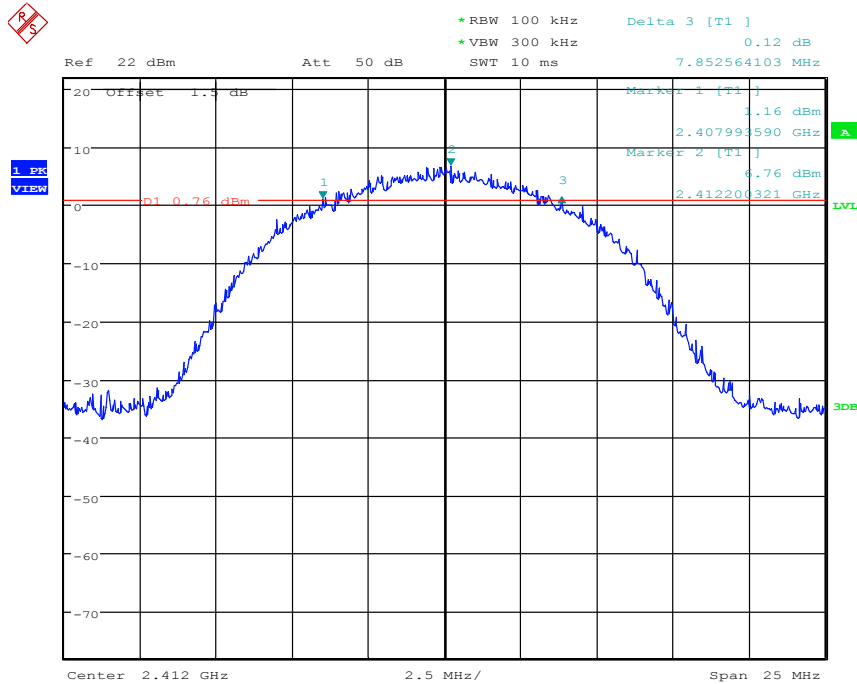
802.11n (20MHz) Test mode

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Refer to plot	20dB Bandwidth (MHz)	Refer to plot	Limit (KHz)	Result
1	2412	17.267	Plot G1	18.229	Plot G2	≥ 500	Pass



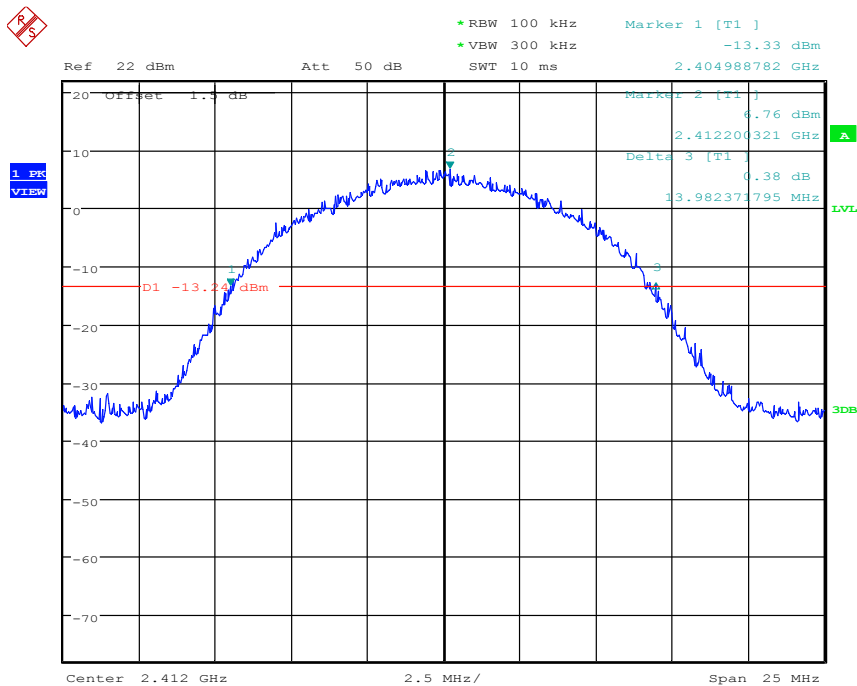
6	2437	16.947	Plot H1	18.149	Plot H2	≥ 500	Pass
11	2462	16.402	Plot I1	18.205	Plot I2	≥ 500	Pass

B. Test Plots:



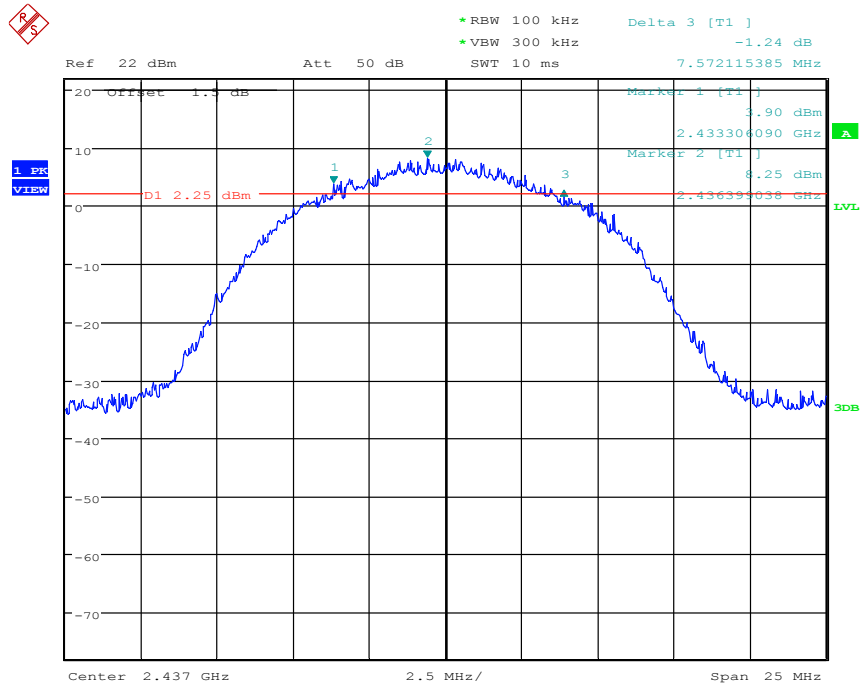
Date: 7.NOV.2016 17:46:16

Plot A1



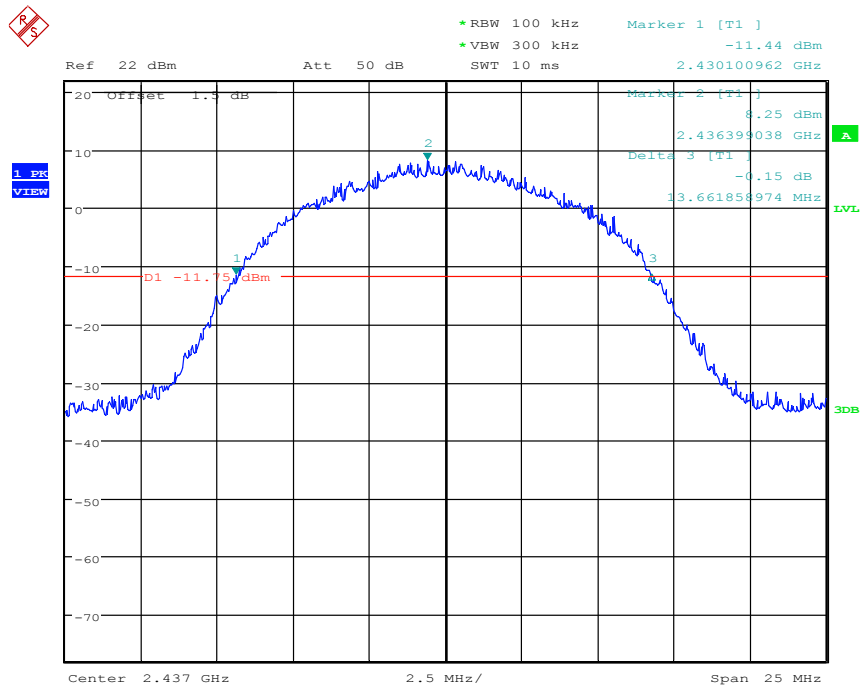
Date: 7.NOV.2016 17:47:09

Plot A2



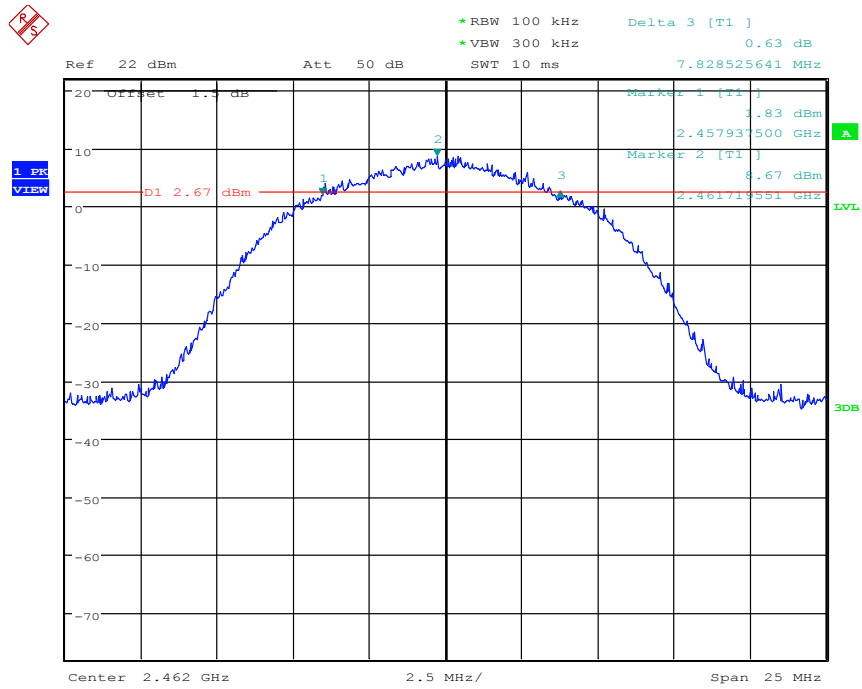
Date: 7.NOV.2016 17:55:21

Plot B1



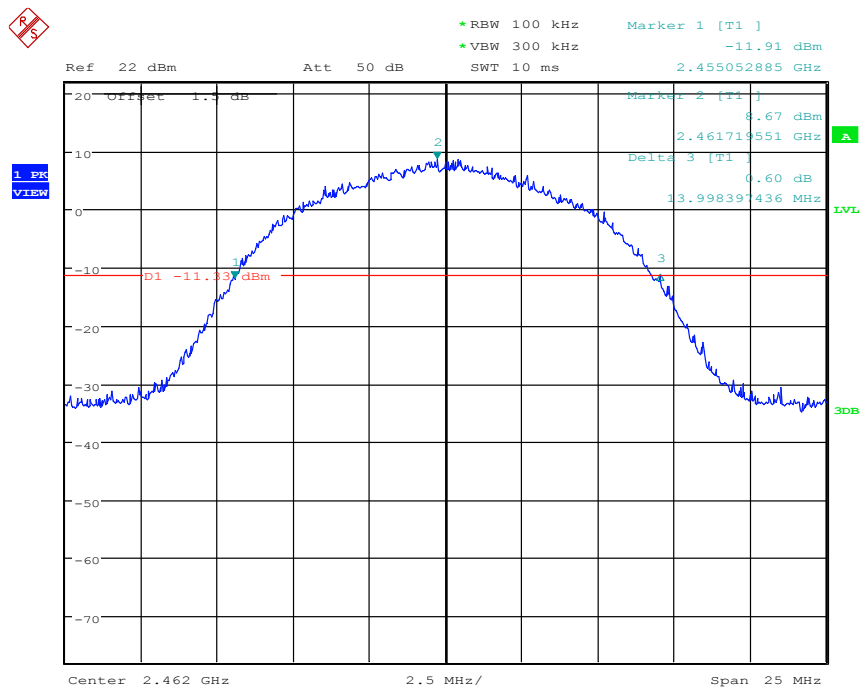
Date: 7.NOV.2016 17:55:57

Plot B2



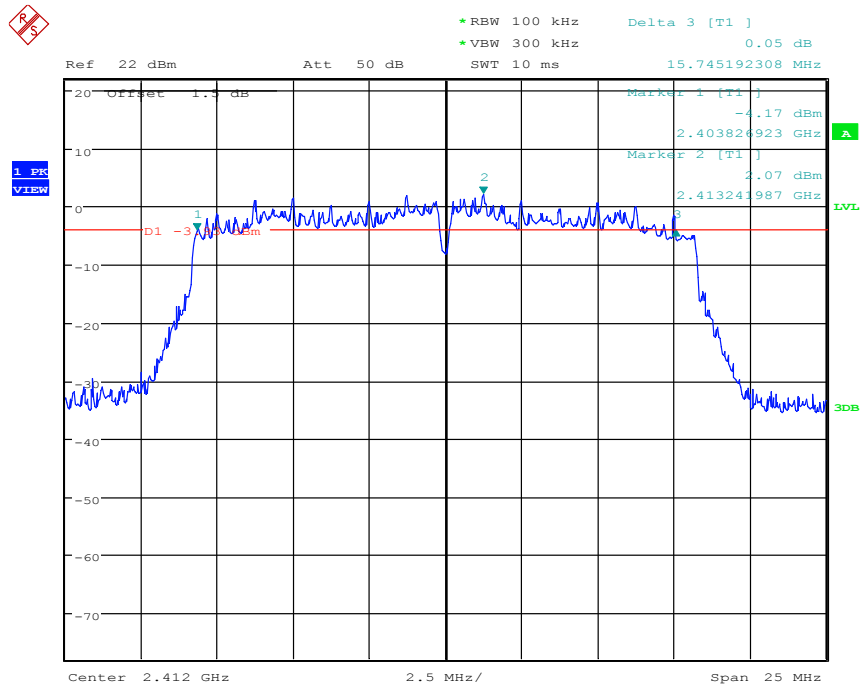
Date: 7.NOV.2016 18:19:00

Plot C1



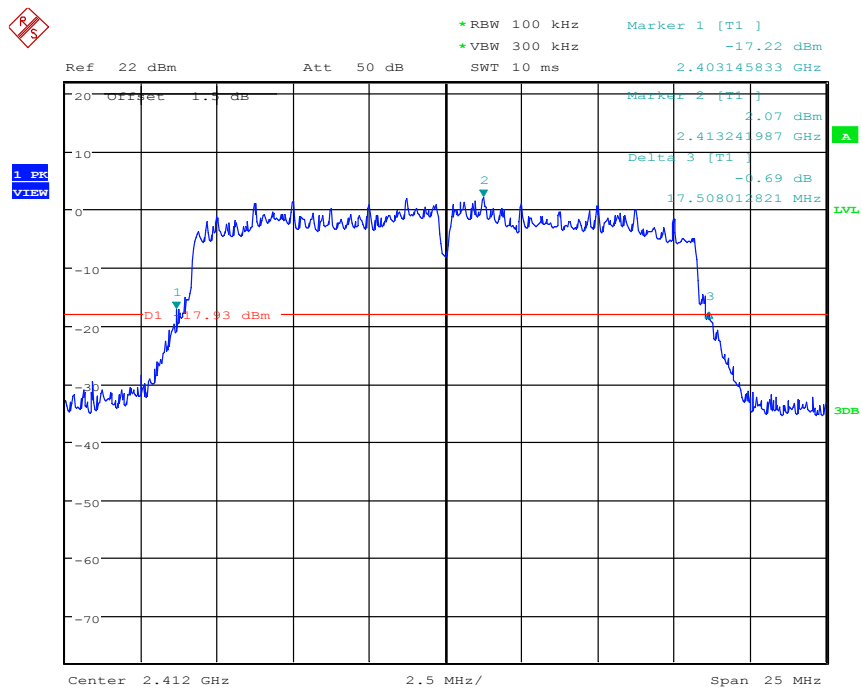
Date: 7.NOV.2016 18:19:51

Plot C2



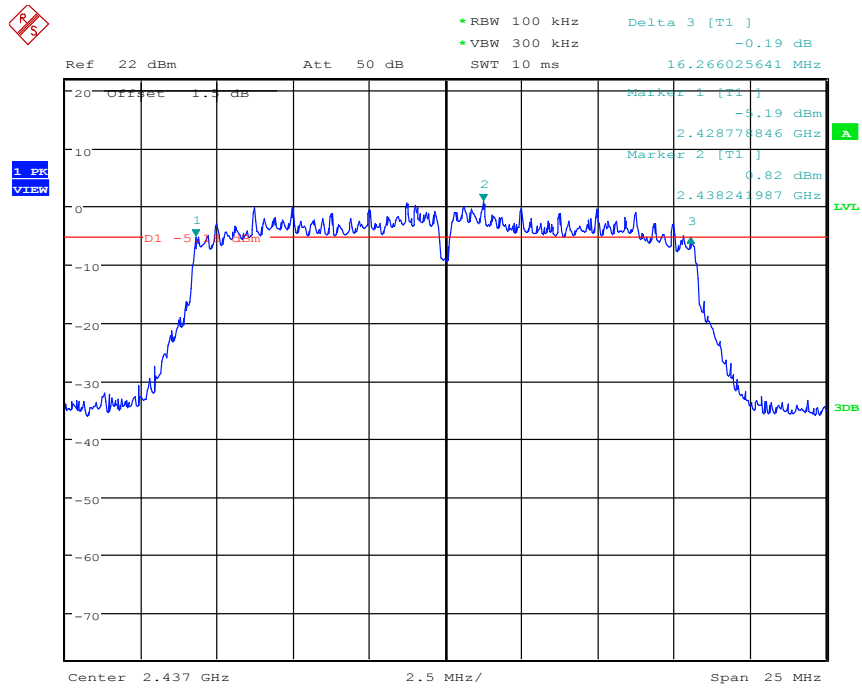
Date: 7.NOV.2016 17:48:05

Plot D1



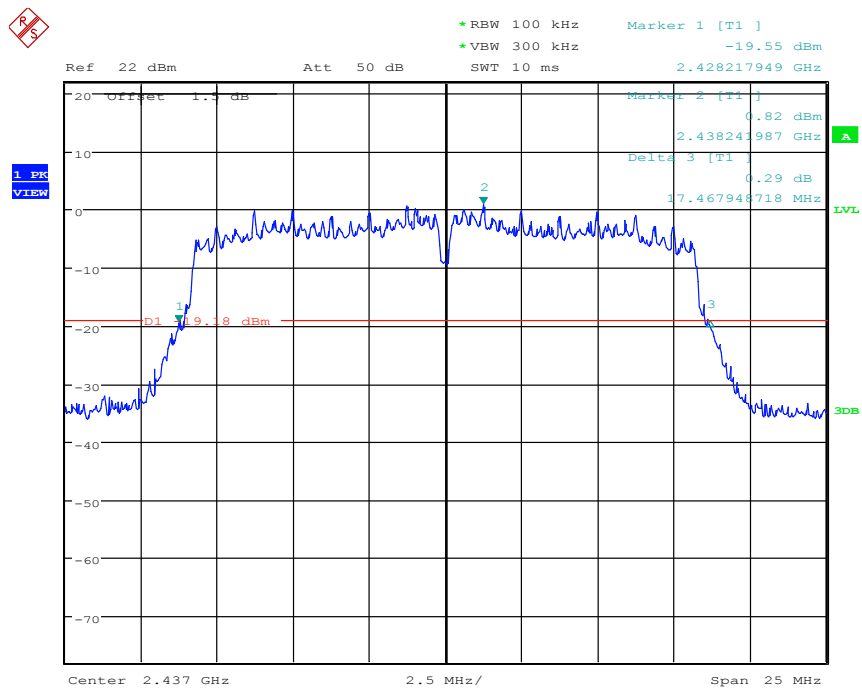
Date: 7.NOV.2016 17:48:36

Plot D2



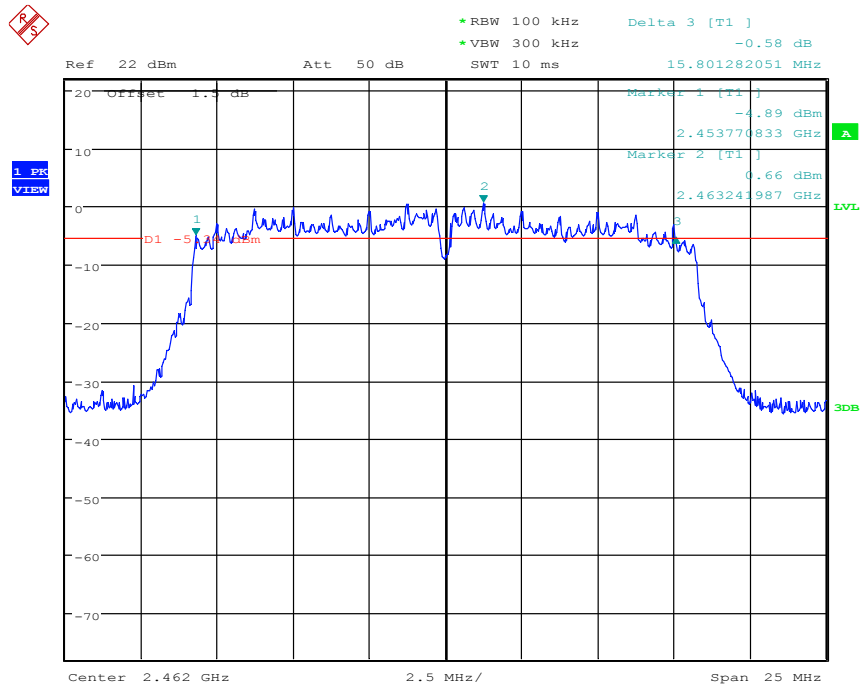
Date: 7.NOV.2016 17:57:06

Plot E1



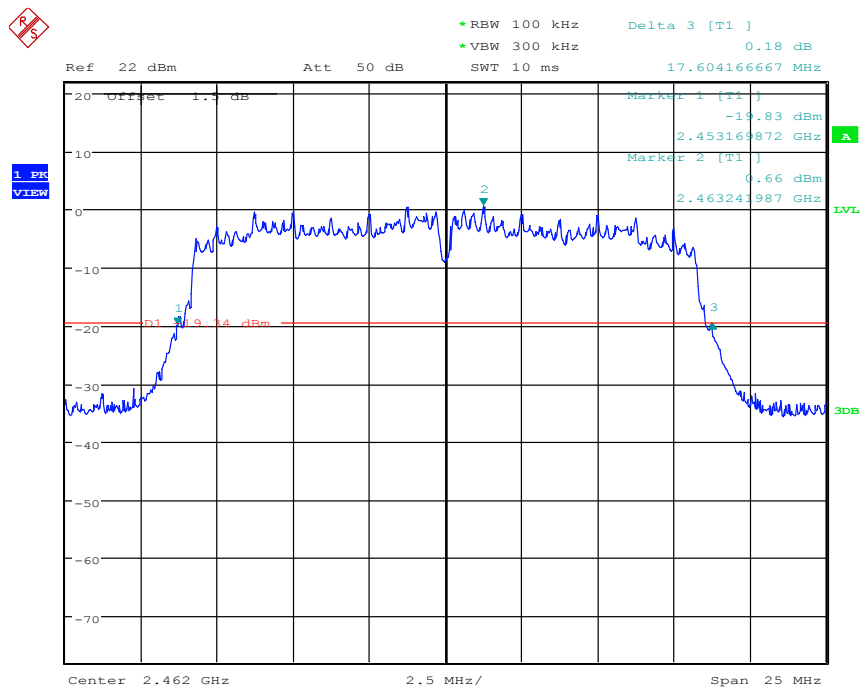
Date: 7.NOV.2016 17:57:39

Plot E2



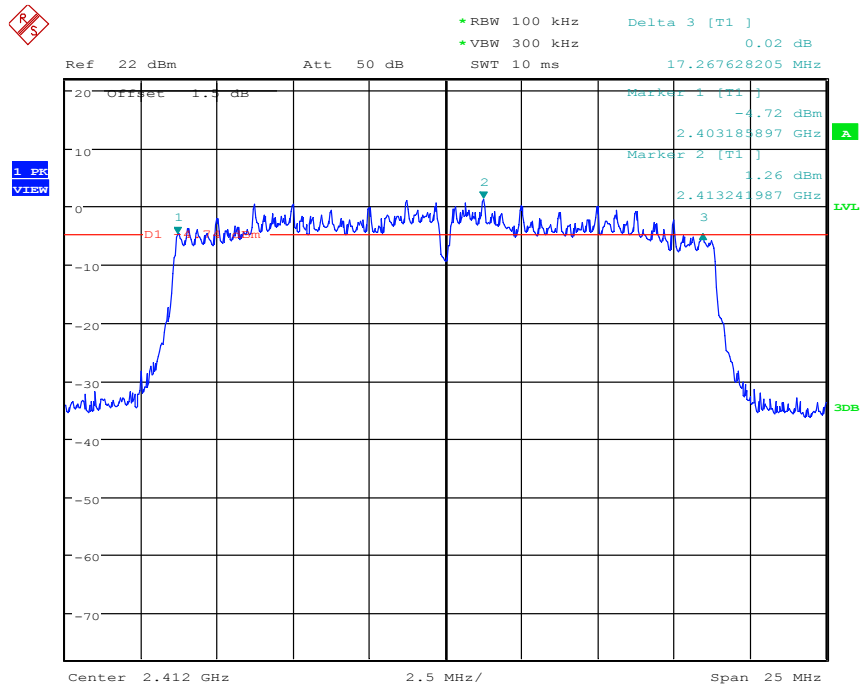
Date: 7.NOV.2016 18:21:51

Plot F1



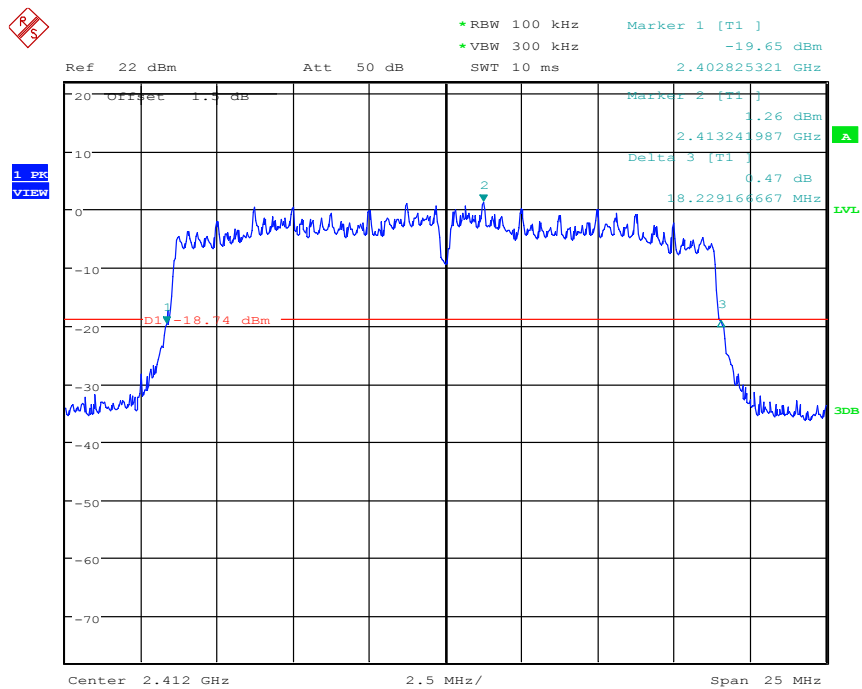
Date: 7.NOV.2016 18:22:24

Plot F2



Date: 7.NOV.2016 17:53:15

Plot G1

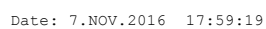


Date: 7.NOV.2016 17:53:58

Plot G2



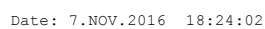
Plot H1



Plot H2



Plot I1



Plot I2

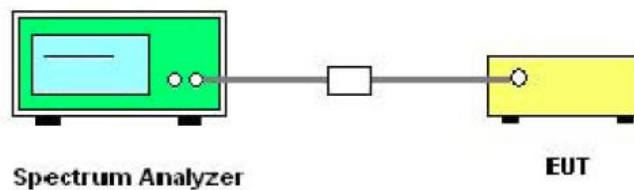


6.4 Conducted Spurious Emissions

6.4.1 Requirement

According to FCC section 15.247(d), in any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

6.4.2 Test Description



6.4.3 Test Result

The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions.

A. Test Verdict:

802.11b Test mode

Channel	Frequency (MHz)	Measured max out of band emission(dBm)	Refer to plot	Limit(dBm)		Result
				Carrier level	Calculated 20dBc limit	
1	2412	-31.72	Plot A	5.02	-14.98	Pass
6	2437	-31.56	Plot B	7.14	-12.86	Pass
11	2462	-31.46	Plot C	7.39	-12.61	Pass

802.11g Test mode

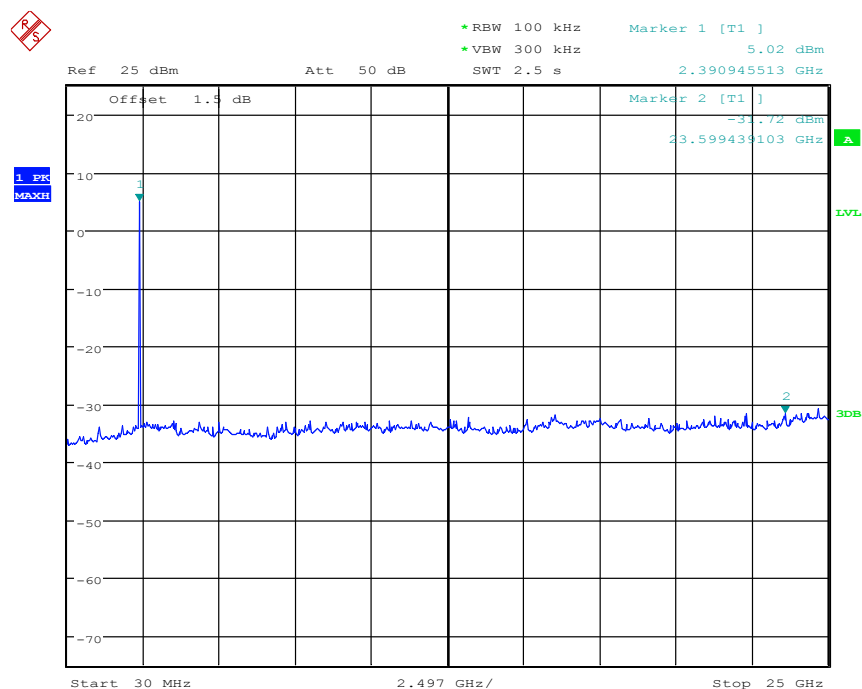
Channel	Frequency (MHz)	Measured max out of band emission(dBm)	Refer to plot	Limit(dBm)		Result
				Carrier level	Calculated 20dBc limit	
1	2412	-31.33	Plot D	1.18	-18.82	Pass
6	2437	-32.00	Plot E	0.32	-19.68	Pass
11	2462	-31.28	Plot F	-0.28	-20.28	Pass

802.11n (20MHz) Test mode



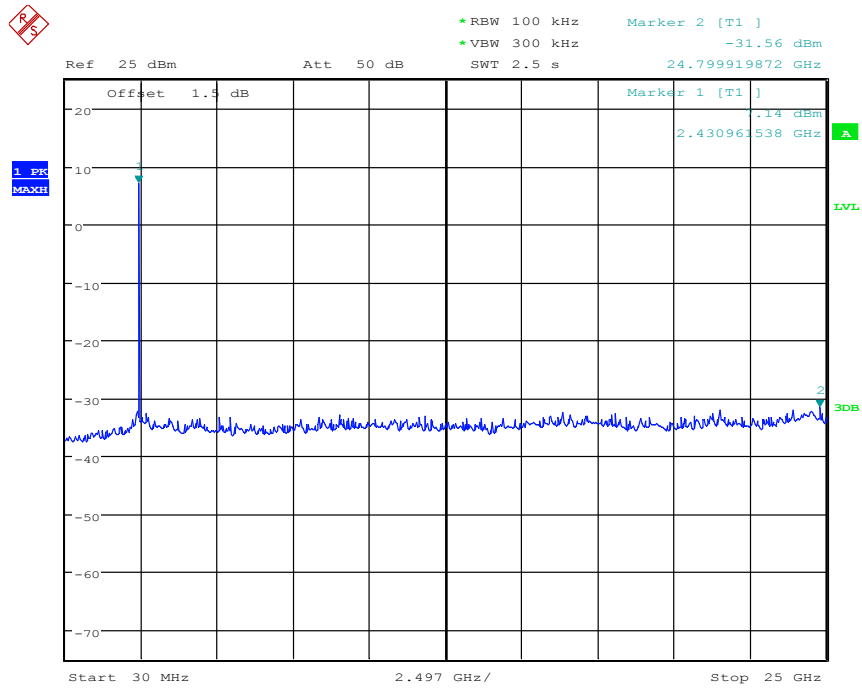
Channel	Frequency (MHz)	Measured max out of band emission(dBm)	Refer to plot	Limit(dBm)		Result
				Carrier level	Calculated 20dBc limit	
1	2412	-31.30	Plot G	-0.49	-20.49	Pass
6	2437	-31.45	Plot H	0.90	-19.10	Pass
11	2462	-32.32	Plot I	0.30	-19.70	Pass

B. Test Plot:



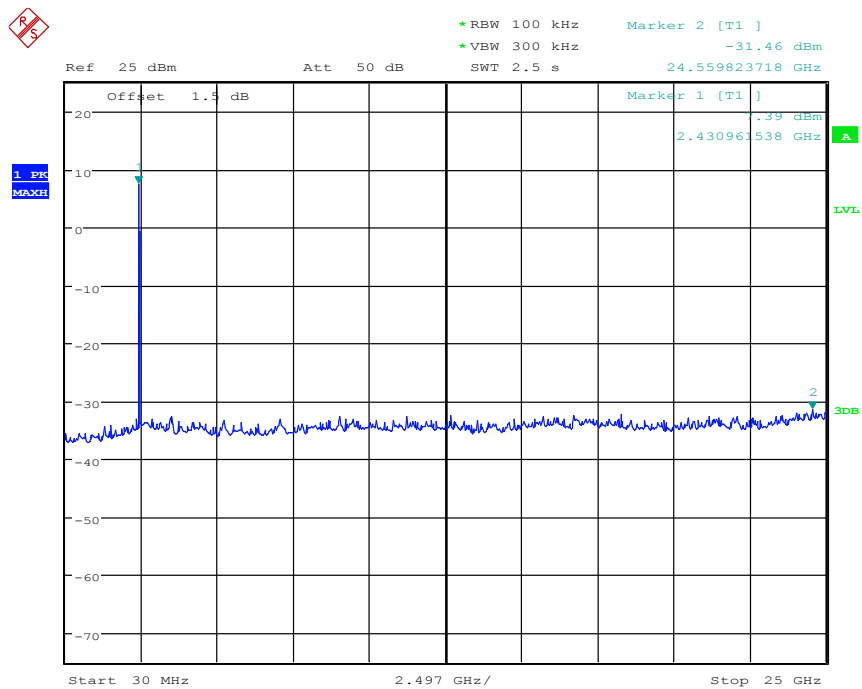
Date: 7.NOV.2016 18:48:19

Plot A



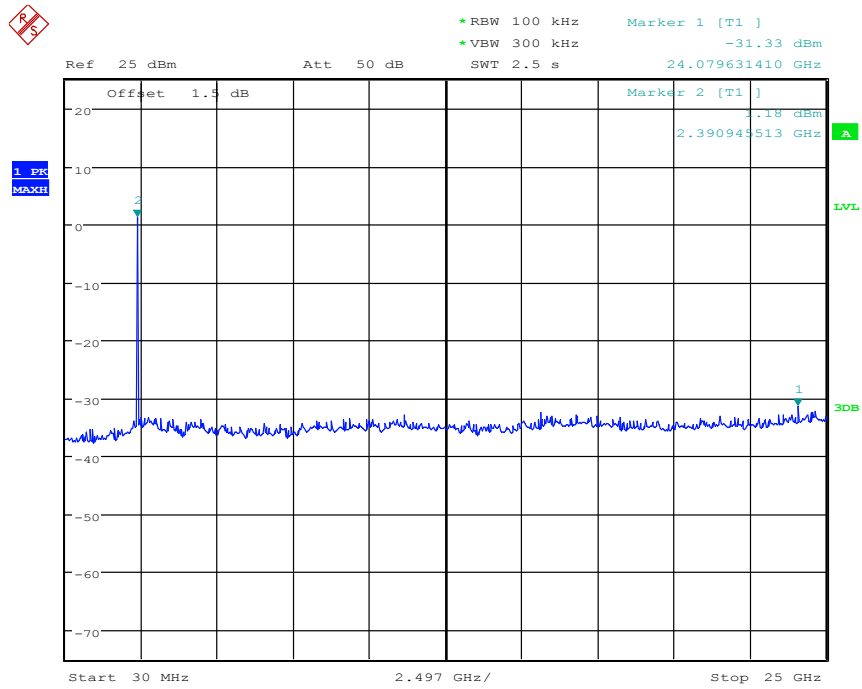
Date: 7.NOV.2016 18:49:26

Plot B



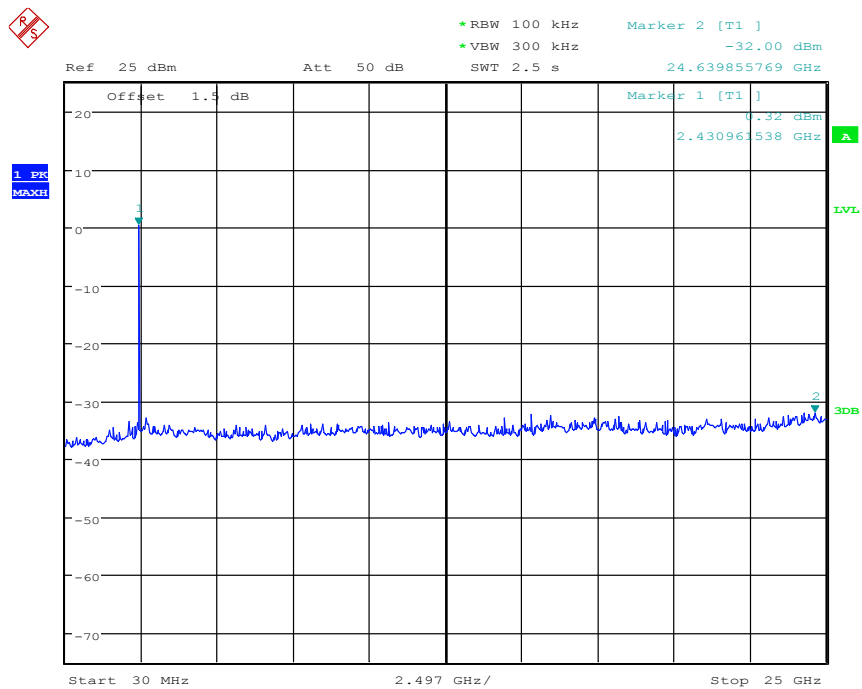
Date: 7.NOV.2016 19:07:25

Plot C



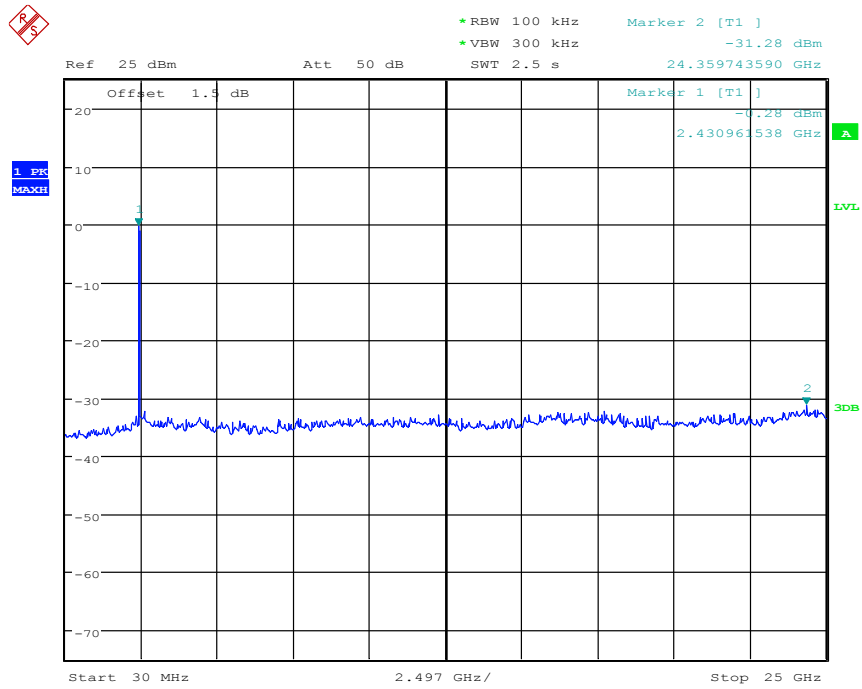
Date: 7.NOV.2016 19:08:03

Plot D



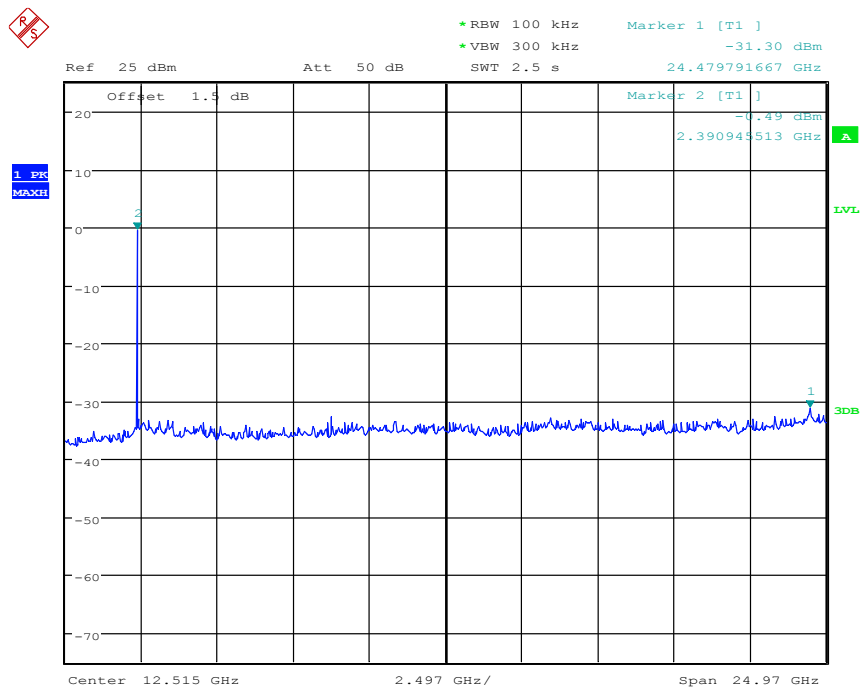
Date: 7.NOV.2016 19:08:44

Plot E



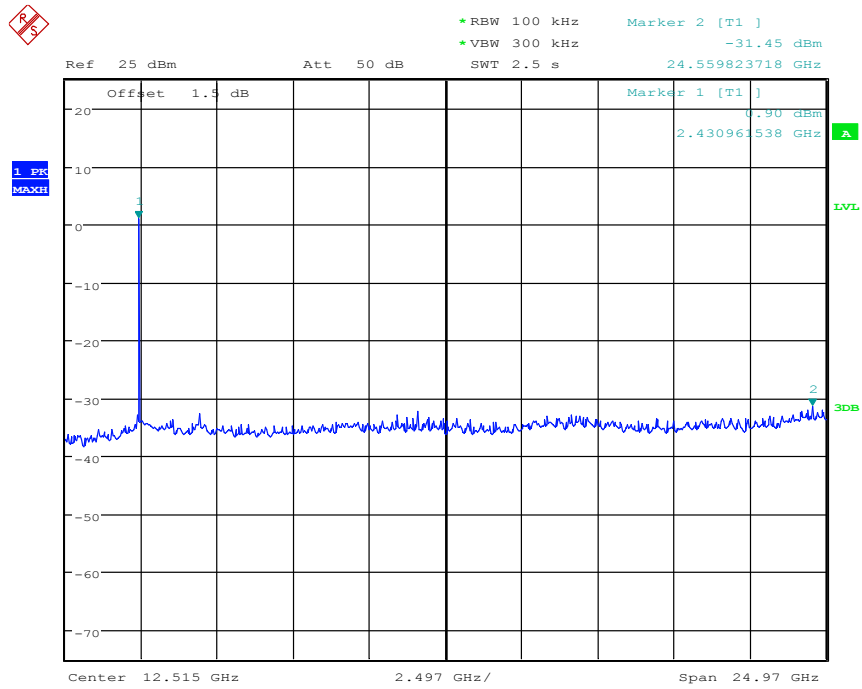
Date: 7.NOV.2016 19:10:13

Plot F



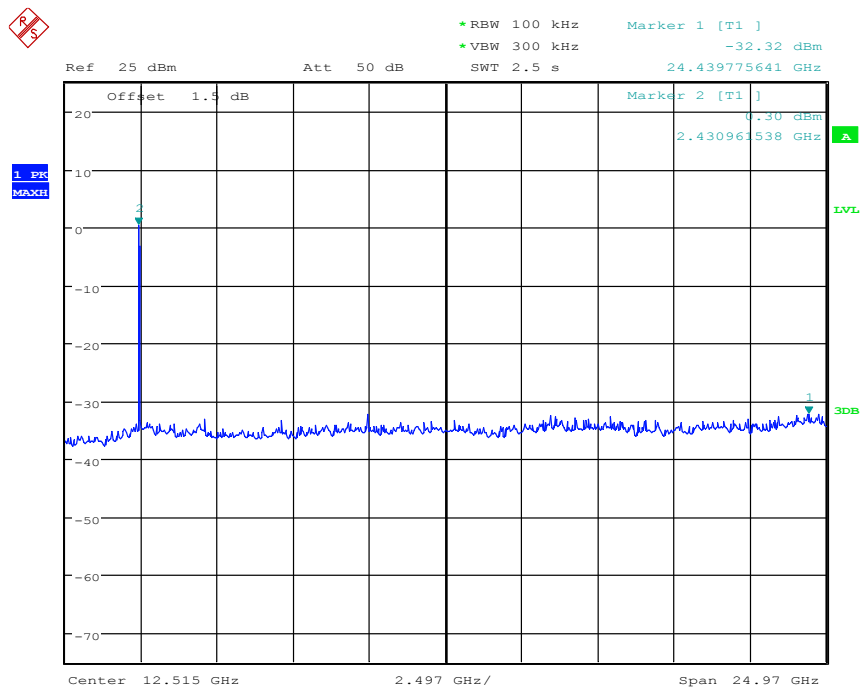
Date: 7.NOV.2016 19:11:00

Plot G



Date: 7.NOV.2016 19:11:41

Plot H



Date: 7.NOV.2016 19:12:24

Plot I

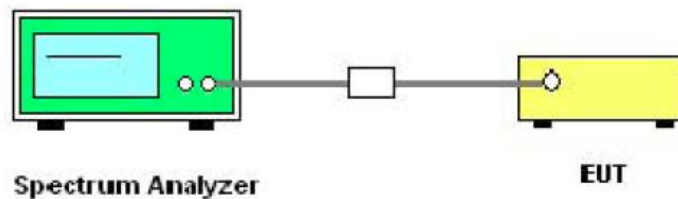


6.5 Power Spectral Density (PSD)

6.5.1 Requirement

According to FCC section 15.247(e), the same method of determining the conducted output power shall be used to determine the power spectral density. If a peak output power is measured, then a peak power spectral density measurement is required. If an average output power is measured, then an average power spectral density measurement should be used

6.5.2 Test Description



6.5.3 Test Result

A. Test Verdict

802.11b Test mode

Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	Refer to plot	Limit (dBm/3kHz)	Result
1	2412	-7.66	Plot A	8	Pass
6	2437	-7.13	Plot B	8	Pass
11	2462	-6.95	Plot C	8	Pass

802.11g Test mode

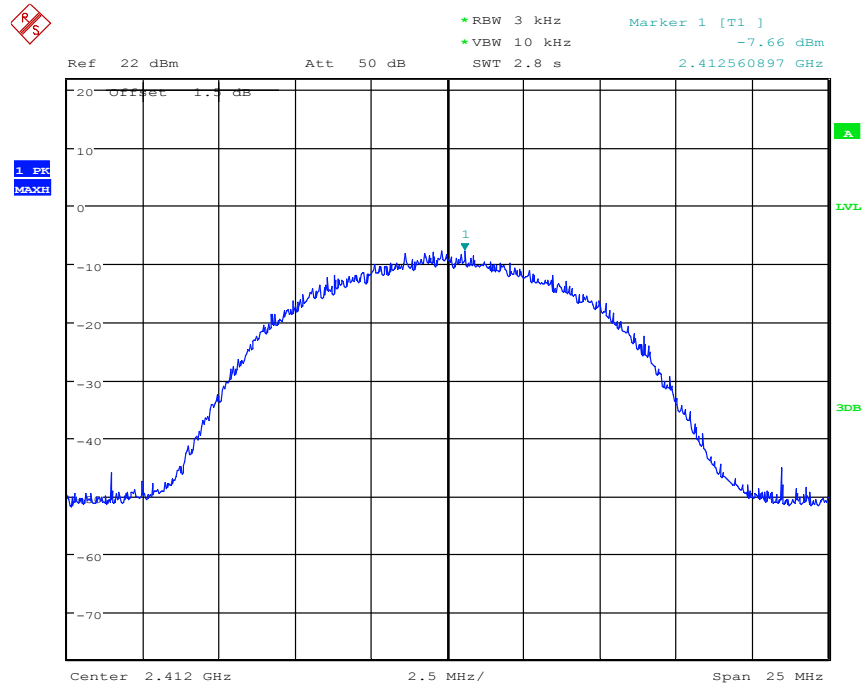
Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	Refer to plot	Limit (dBm/3kHz)	Result
1	2412	-11.40	Plot D	8	Pass
6	2437	-14.33	Plot E	8	Pass
11	2462	-14.14	Plot F	8	Pass

802.11n (20MHz) Test mode

Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	Refer to plot	Limit (dBm/3kHz)	Result
1	2412	-13.01	Plot G	8	Pass
6	2437	-13.65	Plot H	8	Pass
11	2462	-13.86	Plot I	8	Pass

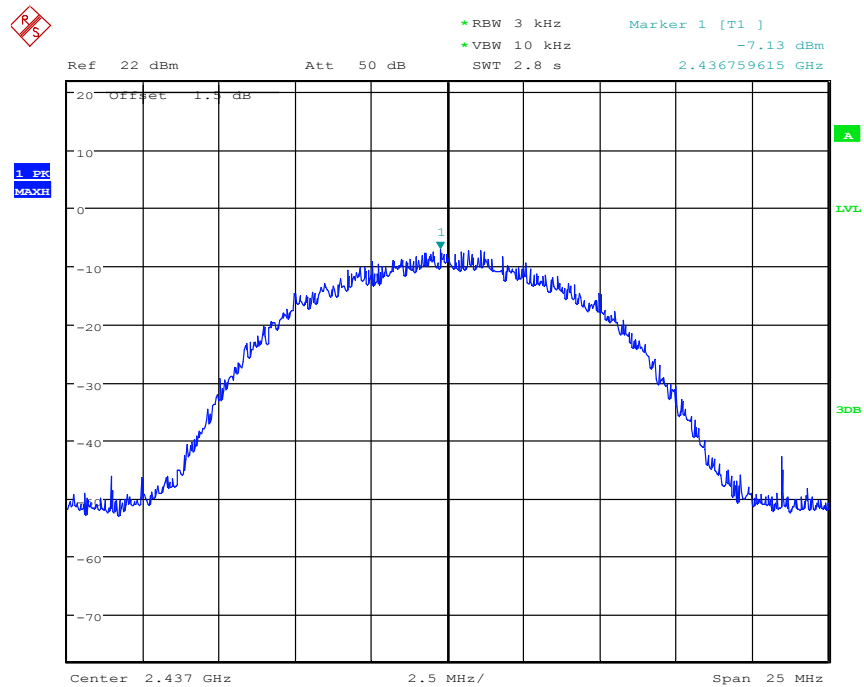


B. Test Plot



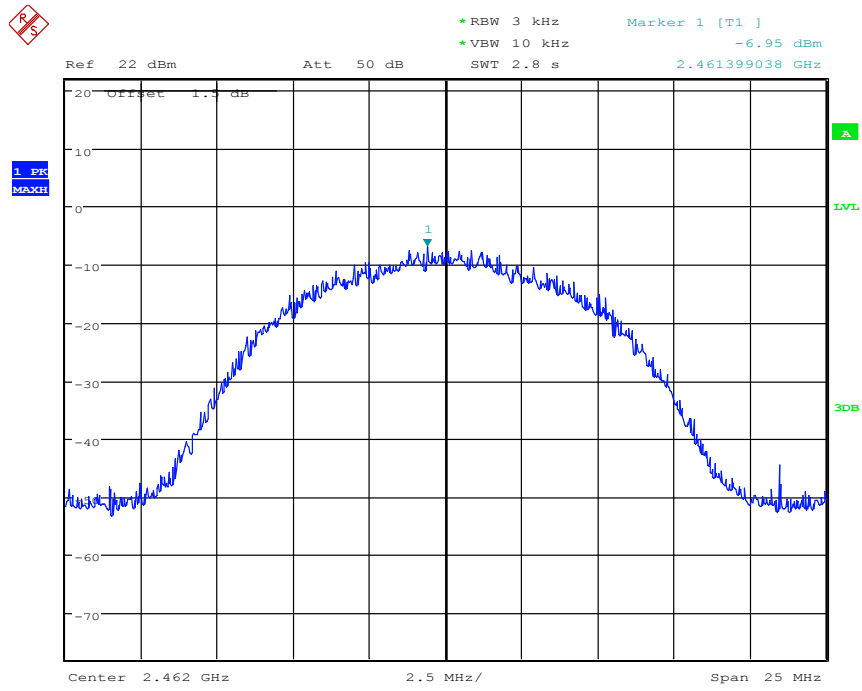
Date: 7.NOV.2016 18:32:04

Plot A



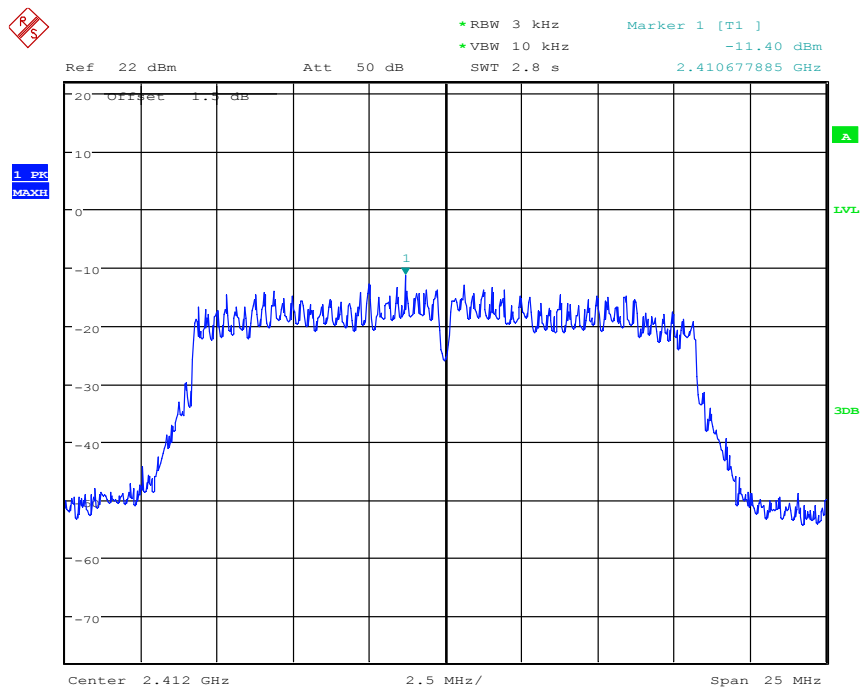
Date: 7.NOV.2016 18:33:59

Plot B



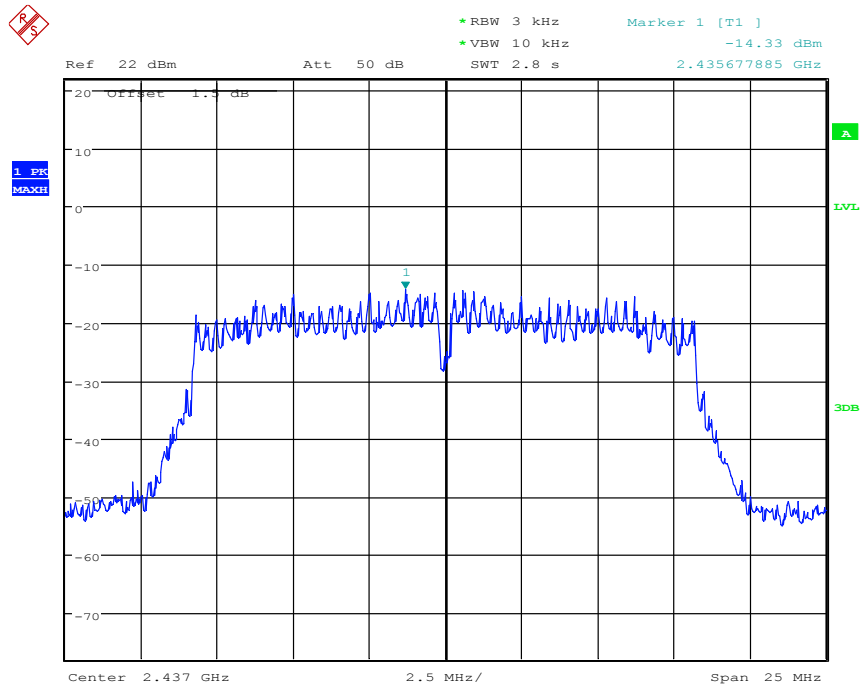
Date: 7.NOV.2016 18:35:58

Plot C



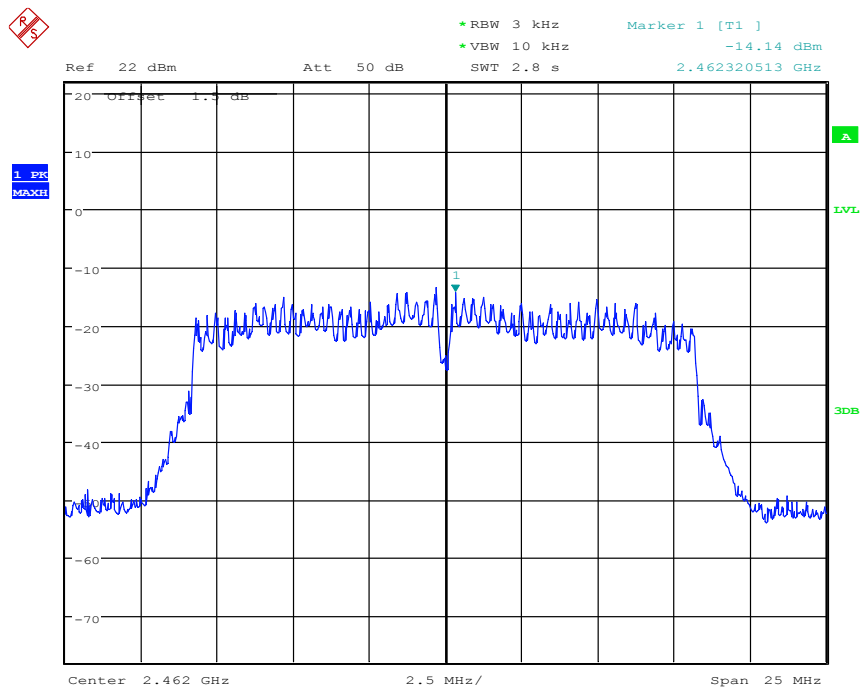
Date: 7.NOV.2016 18:32:43

Plot D



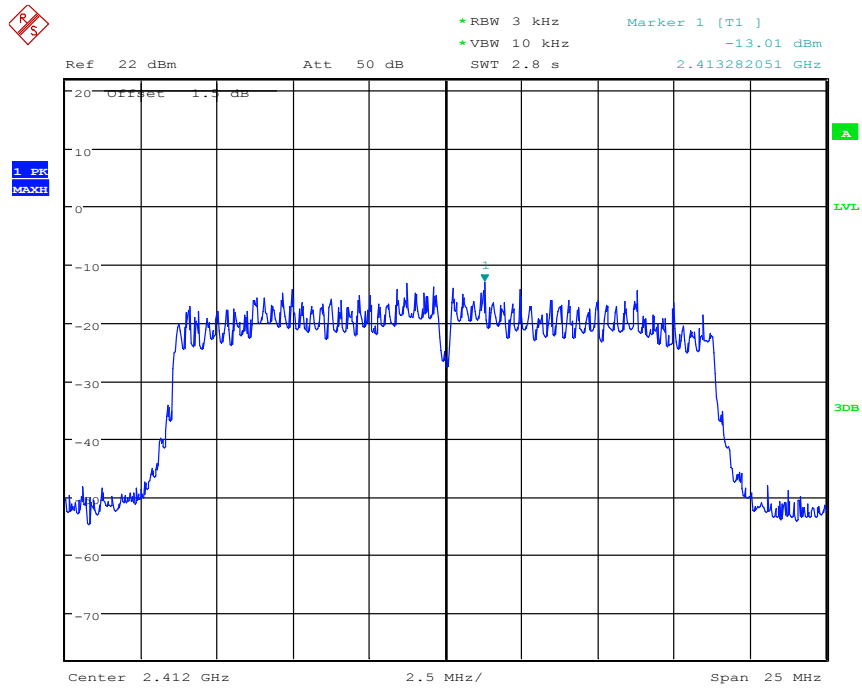
Date: 7.NOV.2016 18:34:33

Plot E



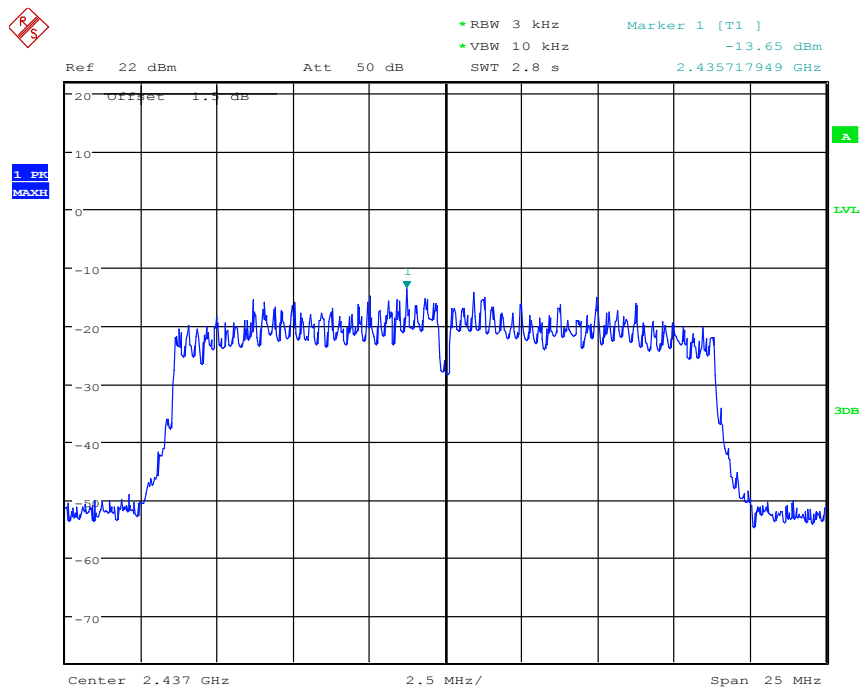
Date: 7.NOV.2016 18:44:05

Plot F



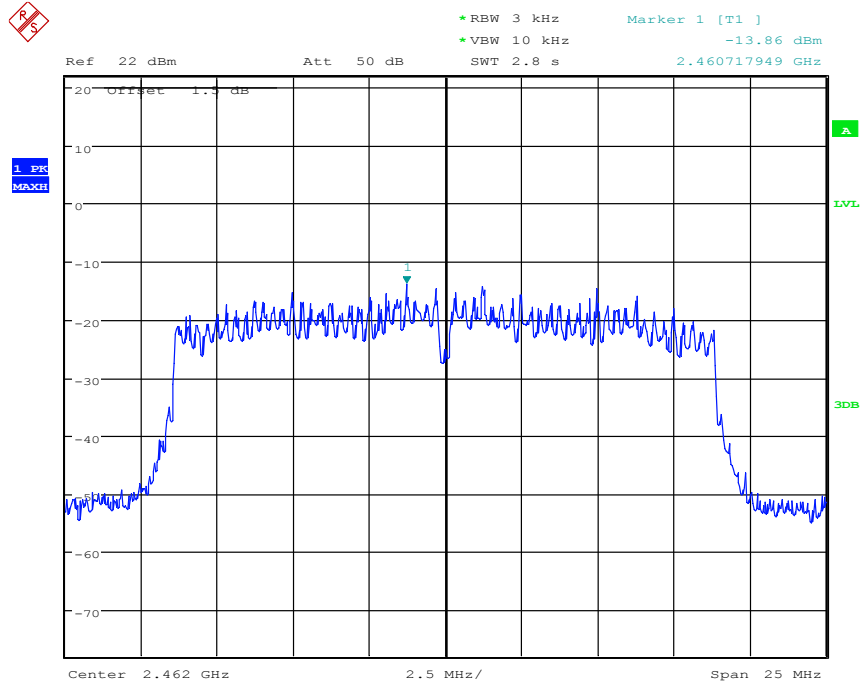
Date: 7.NOV.2016 18:33:23

Plot G



Date: 7.NOV.2016 18:35:18

Plot H



Date: 7.NOV.2016 18:44:47

Plot I

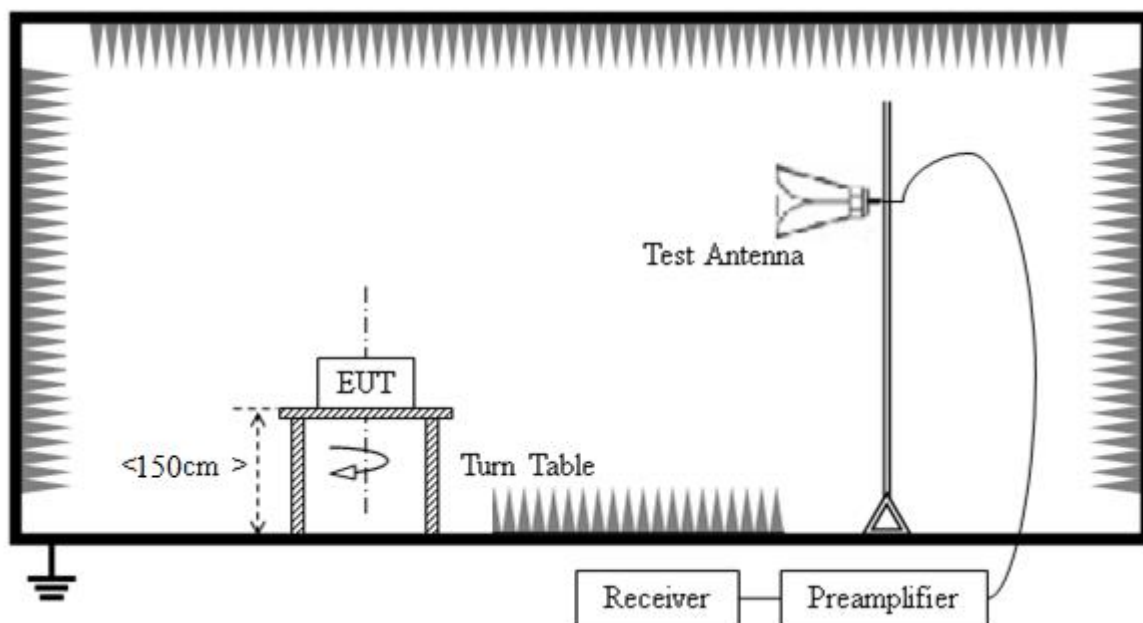


6.6 Band Edge

6.6.1 Requirement

According to FCC section 15.247(d), in any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, , 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).

6.6.2 Test Description



The Module is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading.

For the Test Antenna:

Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength.

Testing procedure according to FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r05: 13.3.1

- Set analyzer center frequency to 2360 MHz or 2470 MHz frequency.
- Set the span =100 MHz.
- Set the RBW to: 100 KHz .
- Set the VBW to: 300 KHz.
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level.



6.6.3 Test Result

The lowest and highest channels are tested to verify the Restricted Frequency Bands.

Note: Restricted Frequency Bands were performed when antenna was at vertical and horizontal polarity, and only the worse test condition (vertical) was recorded in this test report.

The lowest and highest channels are tested to verify the Restricted Frequency Bands

A.Test Verdict (for PCB Antenna)

802.11b Test mode

Ch	Frequency (MHz)	Detector PK/AV	Max. Emission (dBuV/m)	Limit (dBuV/m)	Plot	Result
1	2388.35	PK	36.27	74	Plot A1	Pass
1	2386.91	AV	30.41	54		Pass
11	2495.36	PK	35.40	74	Plot B1	Pass
11	2483.55	AV	29.92	54		Pass

802.11g Test mode

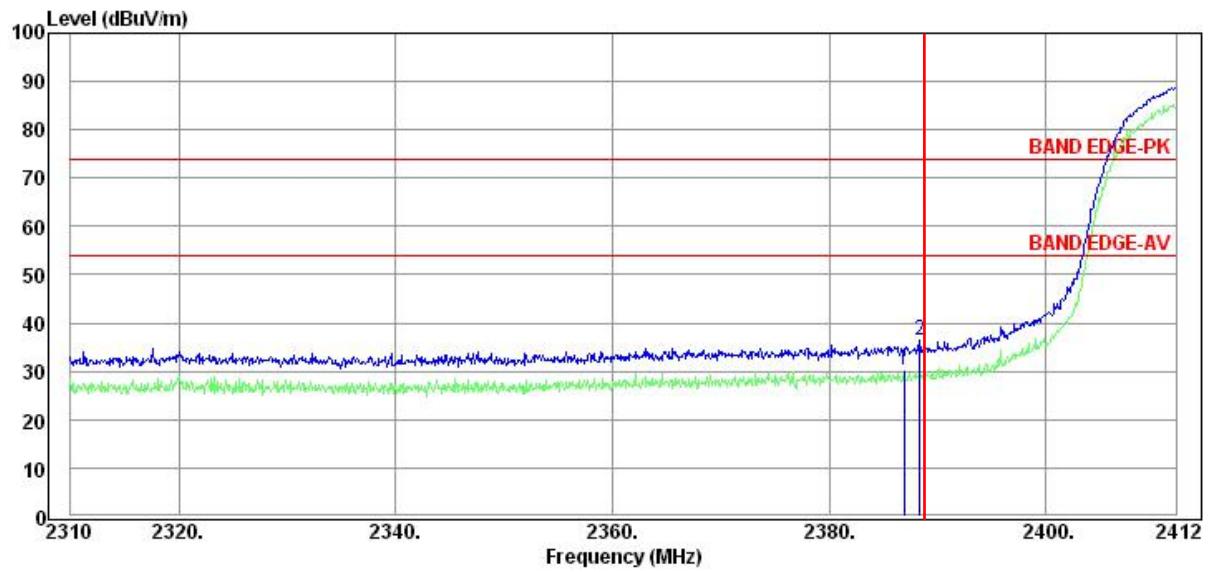
Ch	Frequency (MHz)	Detector PK/AV	Max. Emission (dBuV/m)	Limit (dBuV/m)	Plot	Result
1	2388.95	PK	42.54	74	Plot C1	Pass
1	2389.46	AV	35.82	54		Pass
11	2483.85	PK	38.73	74	Plot D1	Pass
11	2484.27	AV	31.33	54		Pass

802.11n (20MHz) Test mode

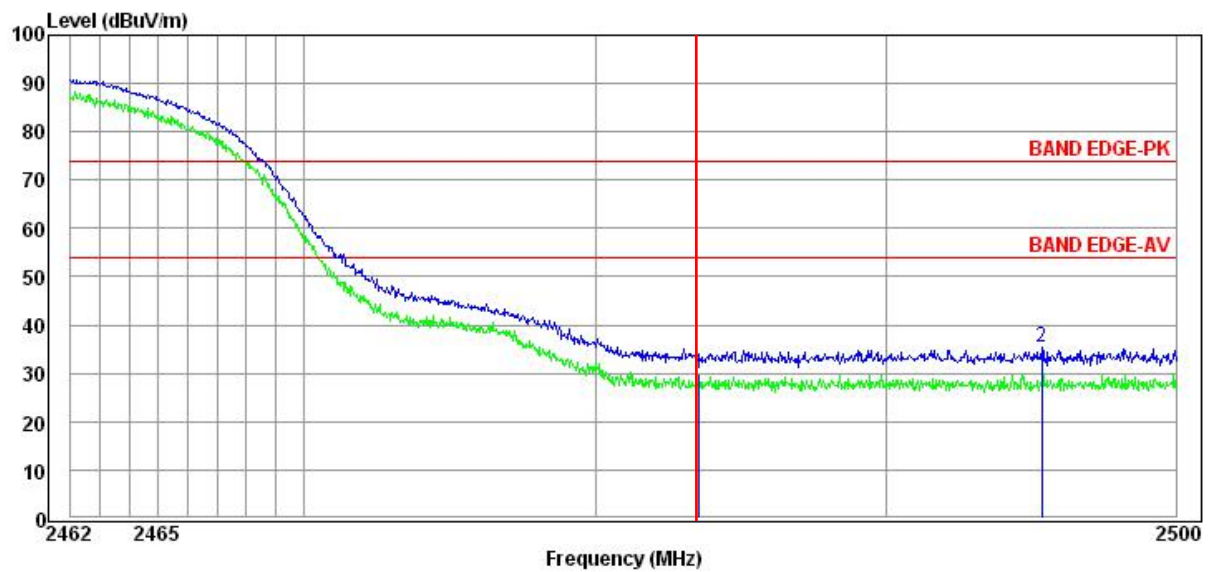
Ch	Frequency (MHz)	Detector PK/AV	Max. Emission (dBuV/m)	Limit (dBuV/m)	Plot	Result
1	2387.62	PK	42.64	74	Plot E1	Pass
1	2389.46	AV	33.67	54		Pass
11	2483.89	PK	37.78	74	Plot F1	Pass
11	2484.08	AV	31.81	54		Pass



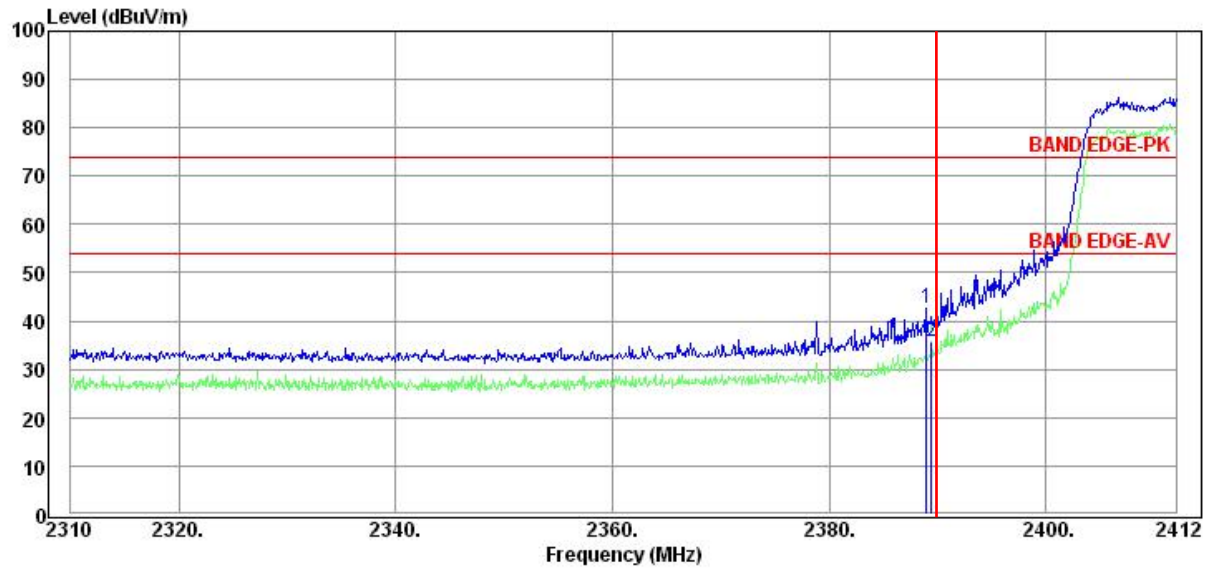
Test Plot



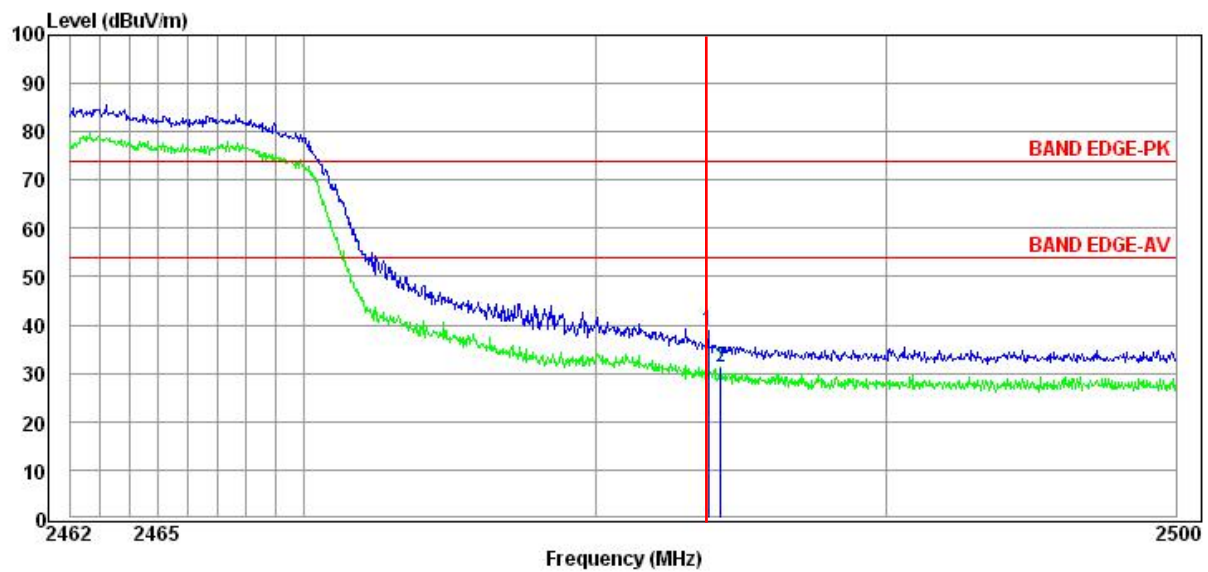
Plot A1



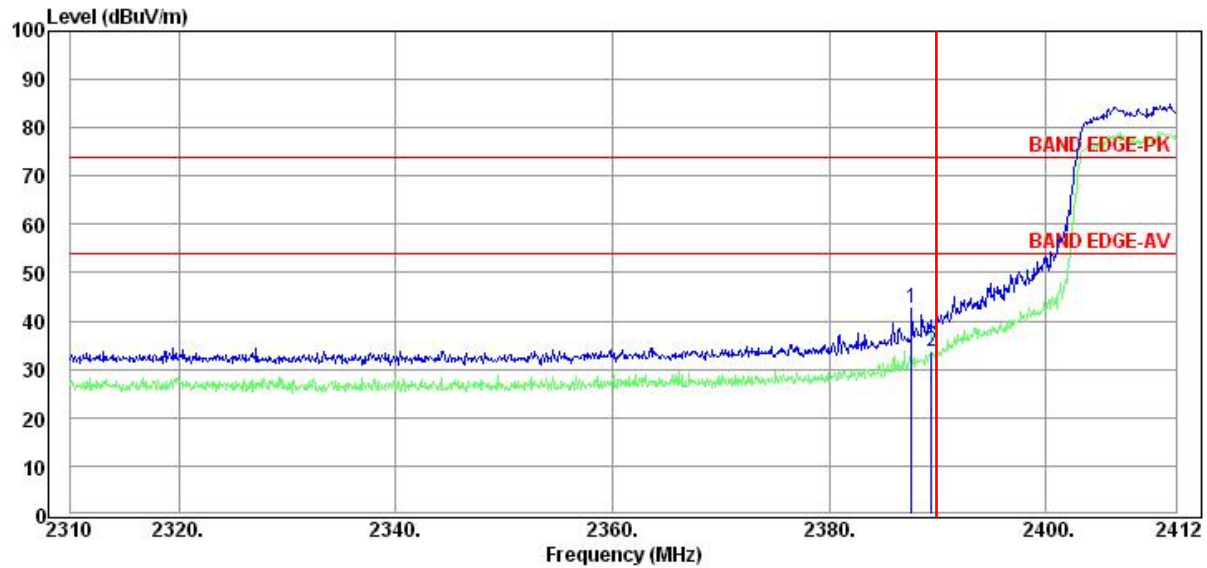
Plot B1



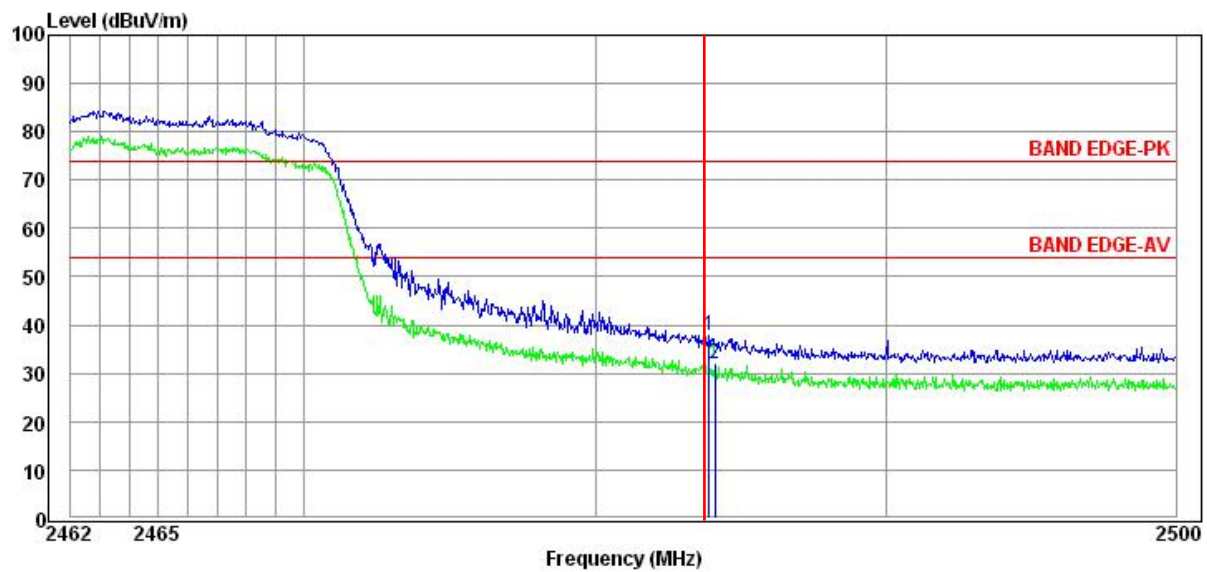
Plot C1



Plot D1



Plot E1



Plot F1

B. Test Verdict (for PFIA Antenna)

802.11b Test mode

Ch	Frequency (MHz)	Detector PK/AV	Max. Emission (dBuV/m)	Limit (dBuV/m)	Plot	Result
1	2386.09	PK	43.49	74	Plot A2	Pass
1	2386.19	AV	38.35	54		Pass
11	2488.22	PK	45.28	74	Plot B2	Pass
11	2483.51	AV	40.75	54		Pass



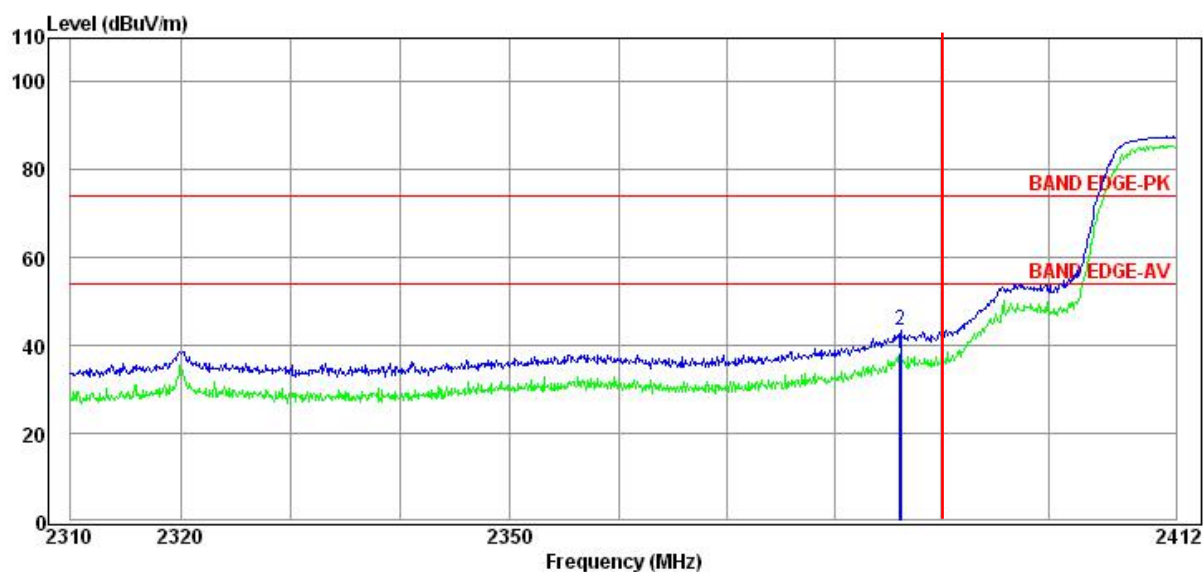
802.11g Test mode

Ch	Frequency (MHz)	Detector PK/AV	Max. Emission (dBuV/m)	Limit (dBuV/m)	Plot	Result
1	2389.59	PK	55.65	74	Plot C2	Pass
1	2389.59	AV	48.55	54		Pass
11	2484.05	PK	50.96	74	Plot D2	Pass
11	2483.67	AV	43.51	54		Pass

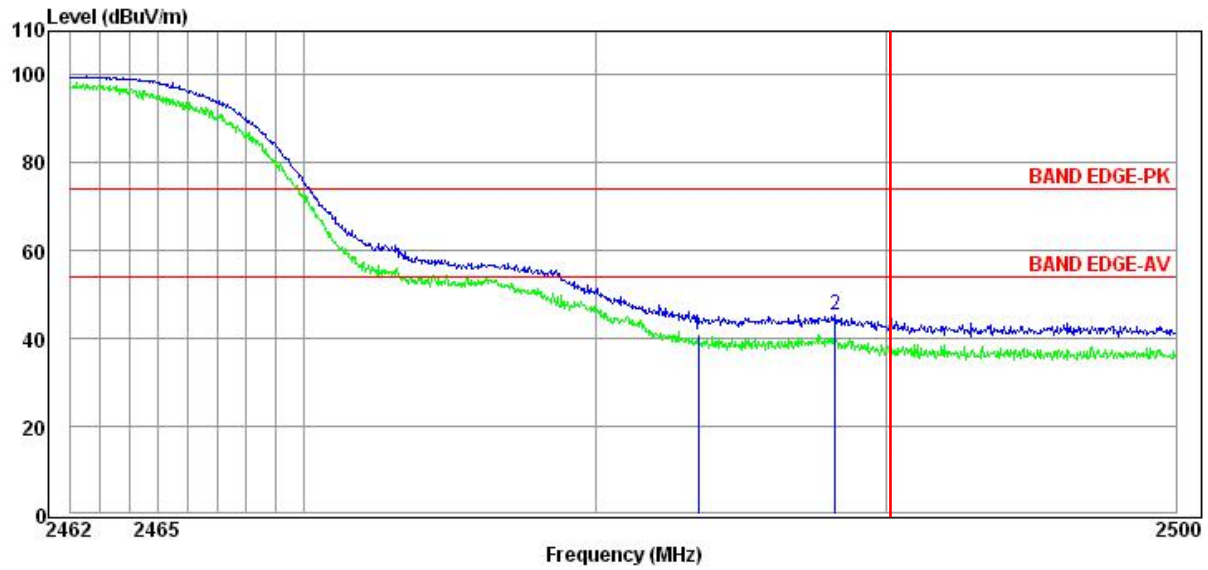
802.11n (20MHz) Test mode

Ch	Frequency (MHz)	Detector PK/AV	Max. Emission (dBuV/m)	Limit (dBuV/m)	Plot	Result
1	2389.80	PK	55.97	74	Plot E2	Pass
1	2389.49	AV	47.82	54		Pass
11	2483.48	PK	50.77	74	Plot F2	Pass
11	2484.27	AV	43.55	54		Pass

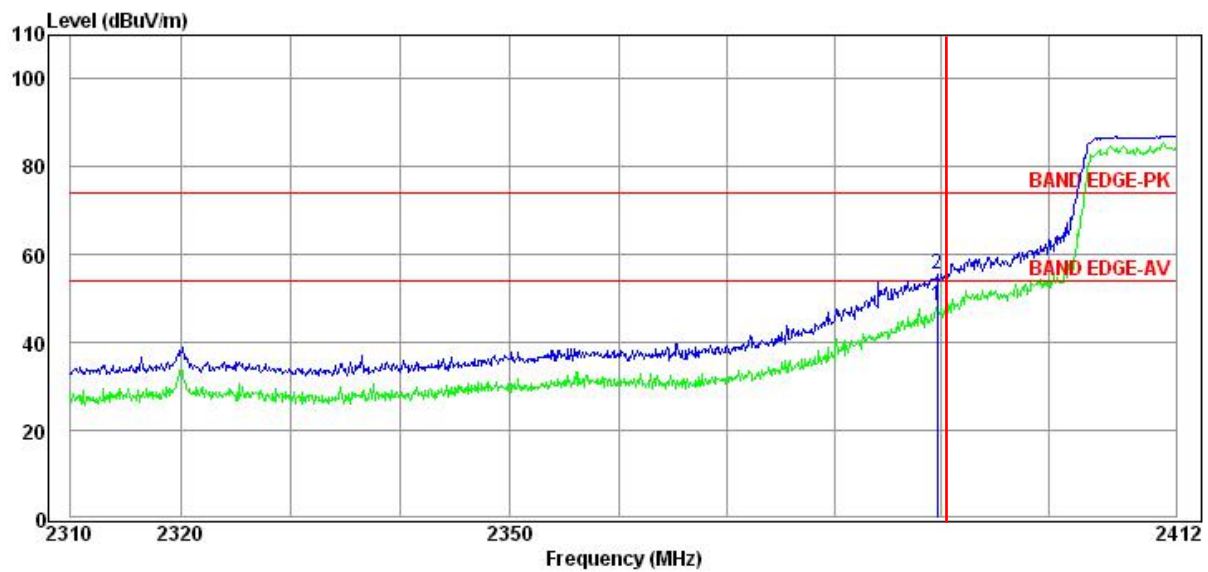
Test Plot



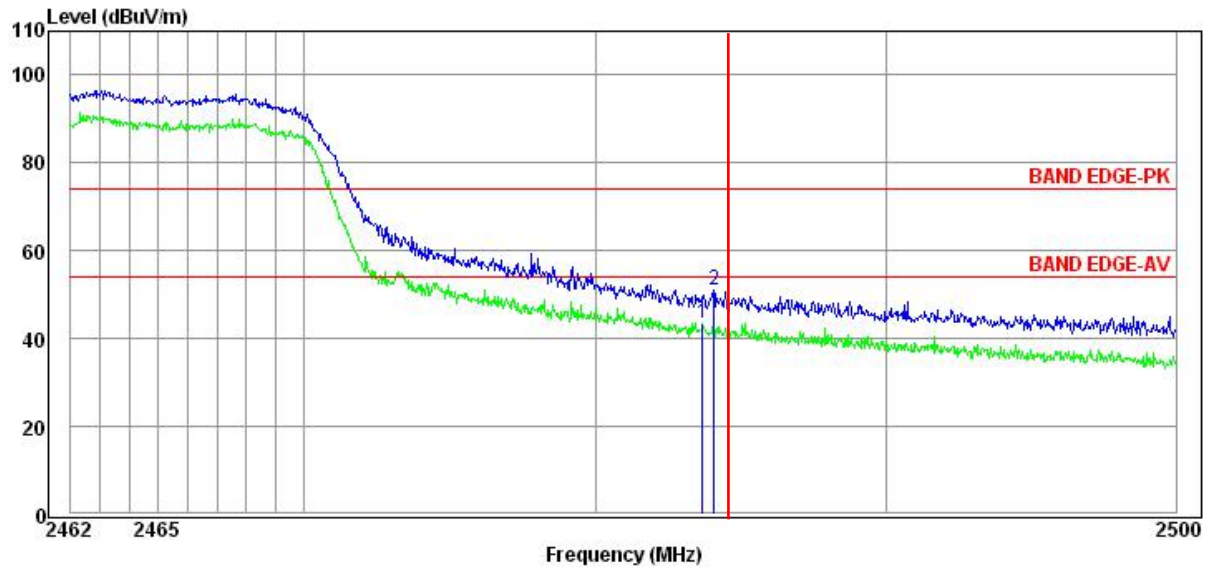
Plot A2



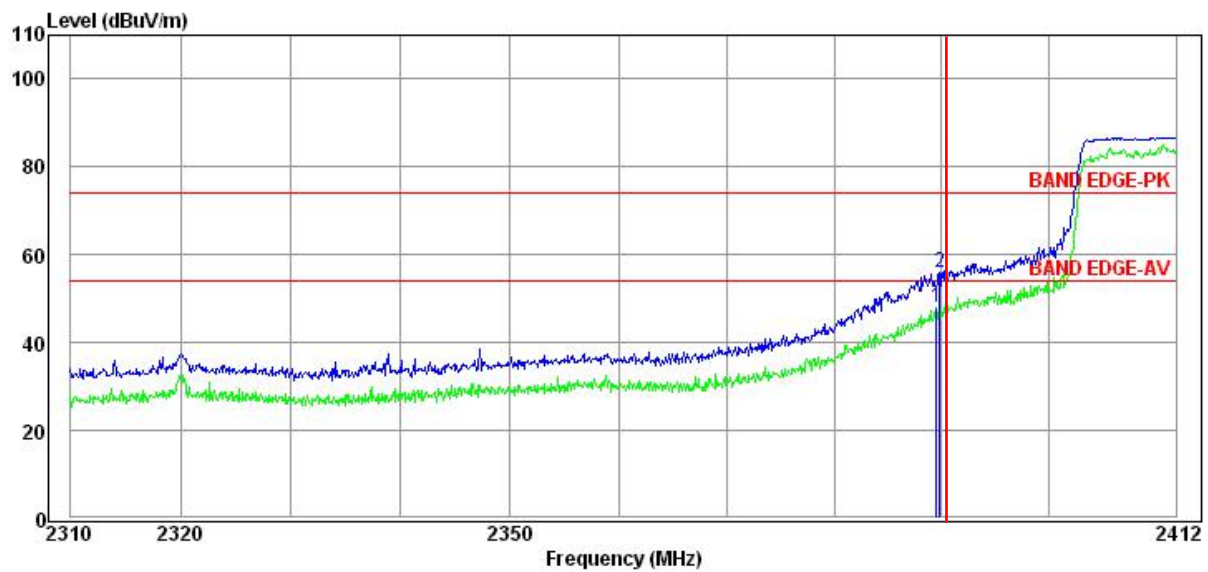
Plot B2



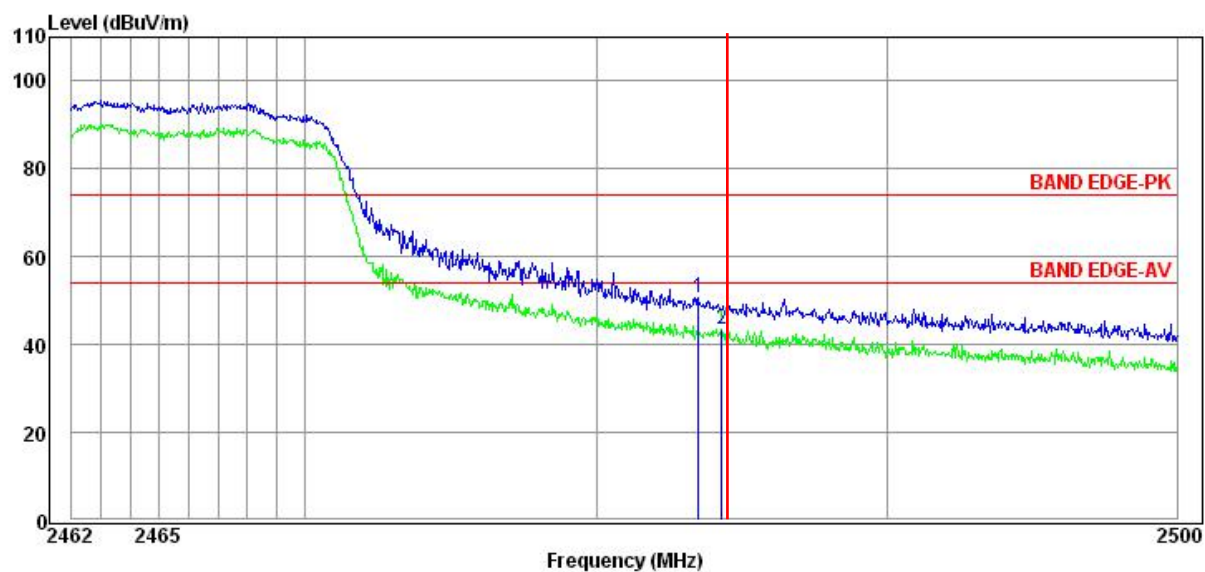
Plot C2



Plot D2



Plot E2



Plot F2

C.Test Verdict (for External Antenna)

802.11b Test mode

Ch	Frequency (MHz)	Detector PK/AV	Max. Emission (dBuV/m)	Limit (dBuV/m)	Plot	Result
1	2313.10	PK	57.37	74	Plot A3	Pass
1	2327.23	AV	49.46	54		Pass
11	2499.66	PK	52.07	74	Plot B3	Pass
11	2494.99	AV	46.56	54		Pass

802.11g Test mode

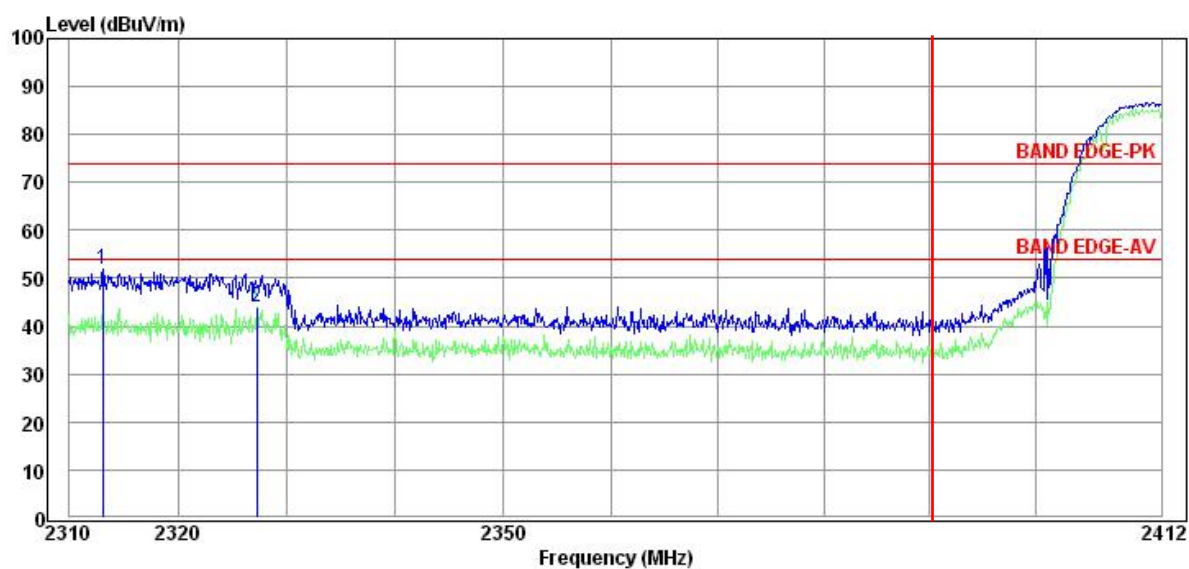
Ch	Frequency (MHz)	Detector PK/AV	Max. Emission (dBuV/m)	Limit (dBuV/m)	Plot	Result
1	2312.10	PK	57.32	74	Plot C3	Pass
1	2328.14	AV	50.25	54		Pass
11	2496.52	PK	51.87	74	Plot D3	Pass
11	2497.32	AV	46.18	54		Pass



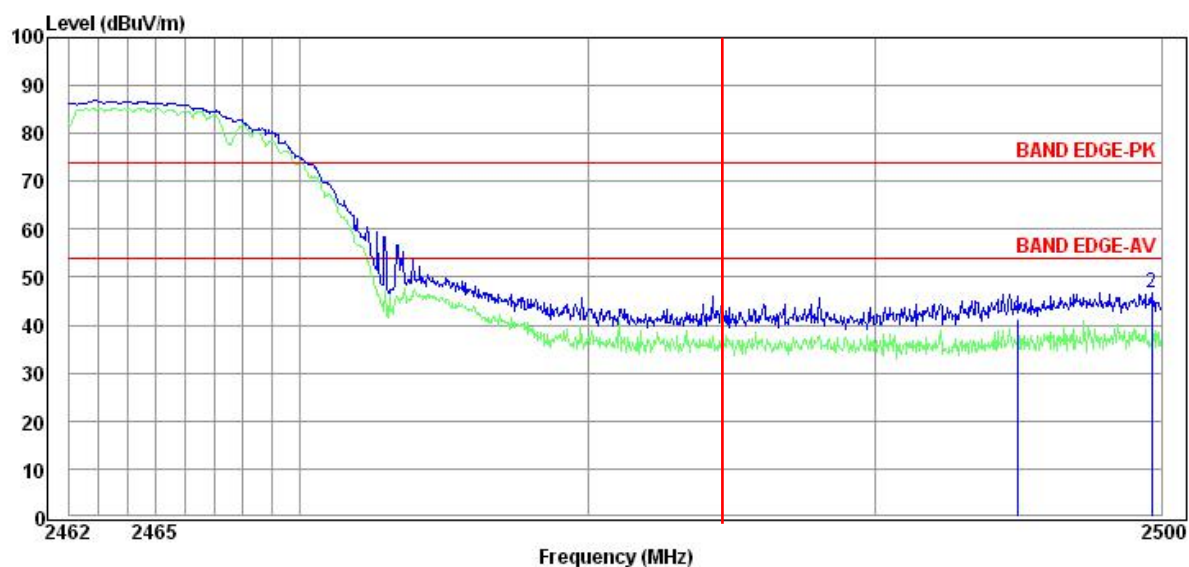
802.11n (20MHz) Test mode

Ch	Frequency (MHz)	Detector PK/AV	Max. Emission (dBuV/m)	Limit (dBuV/m)	Plot	Result
1	2312.50	PK	56.77	74	Plot E3	Pass
1	2322.61	AV	49.11	54		Pass
11	2498.28	PK	52.09	74	Plot F3	Pass
11	2490.79	AV	46.18	54		Pass

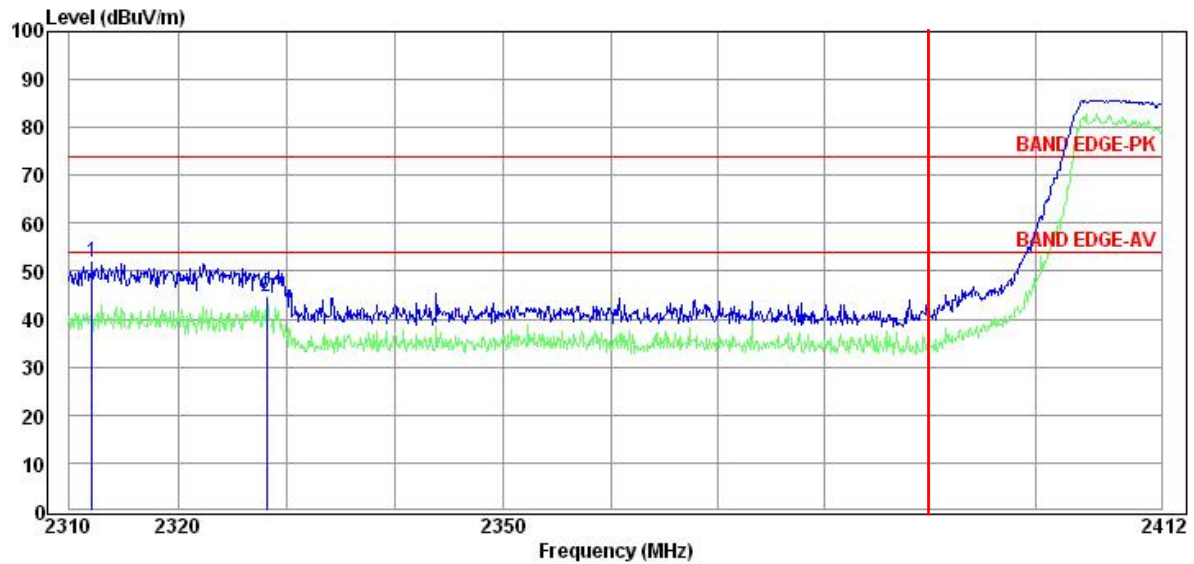
Test Plot



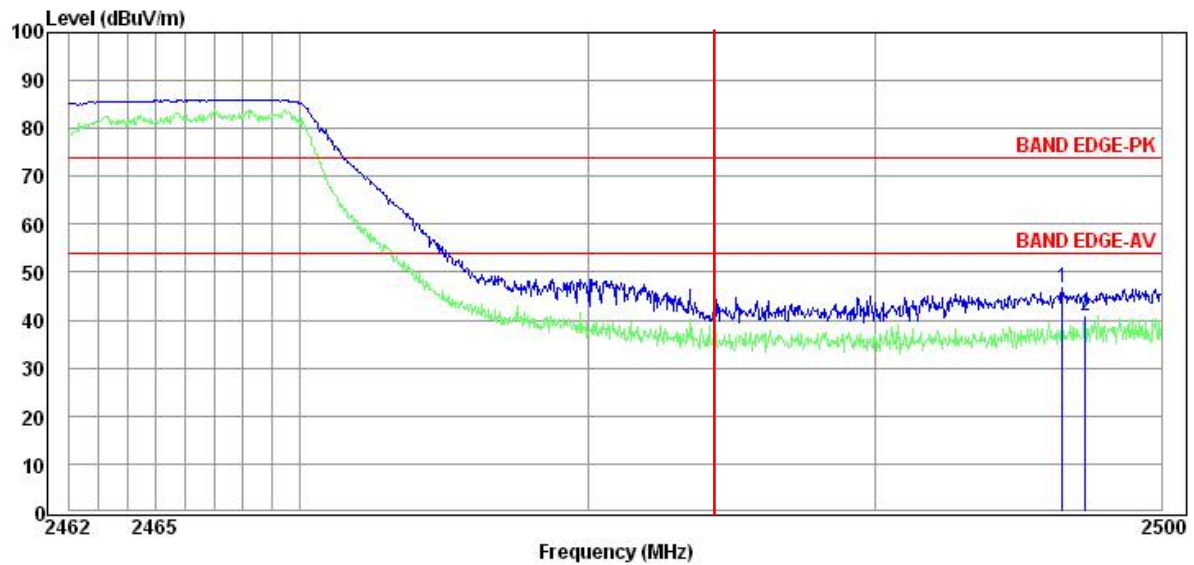
Plot A3



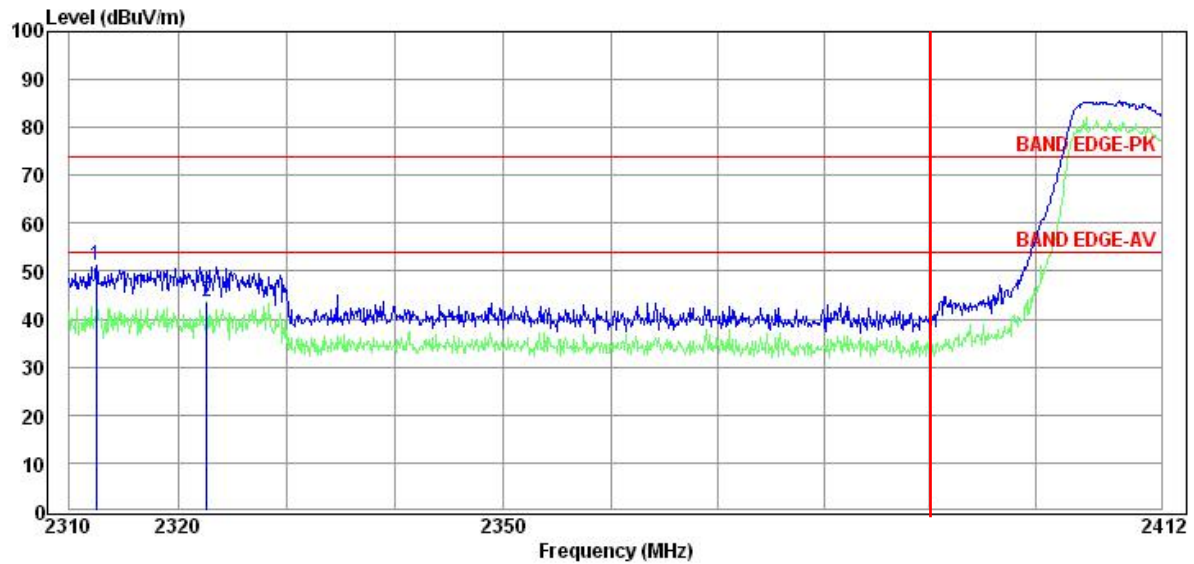
Plot B3



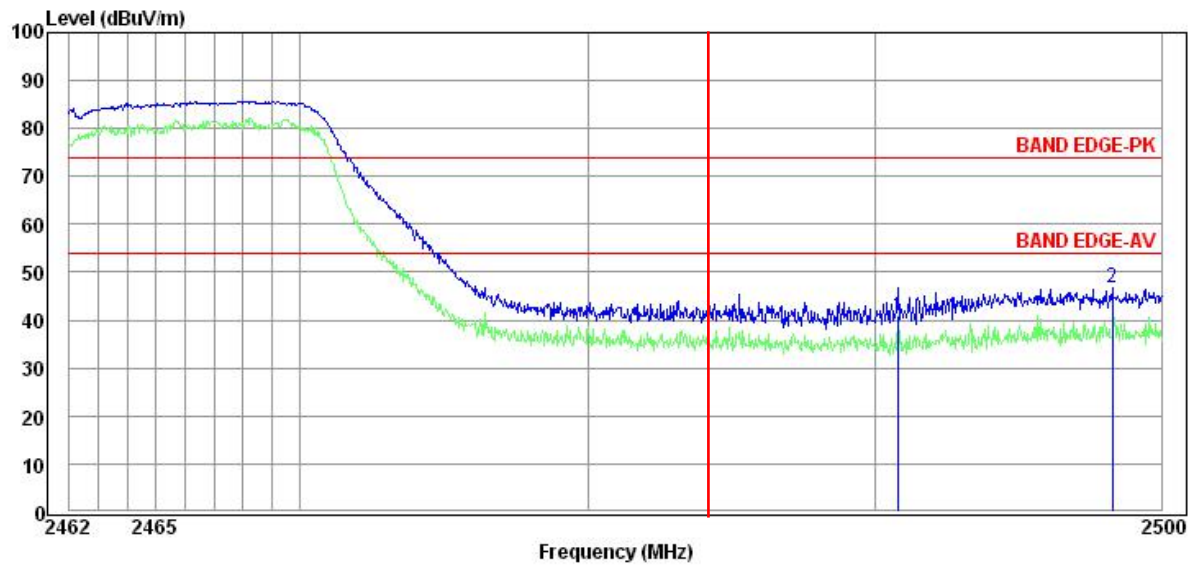
Plot C3



Plot D3



Plot E3



Plot F3



6.7 Conducted Emission

6.7.1 Requirement

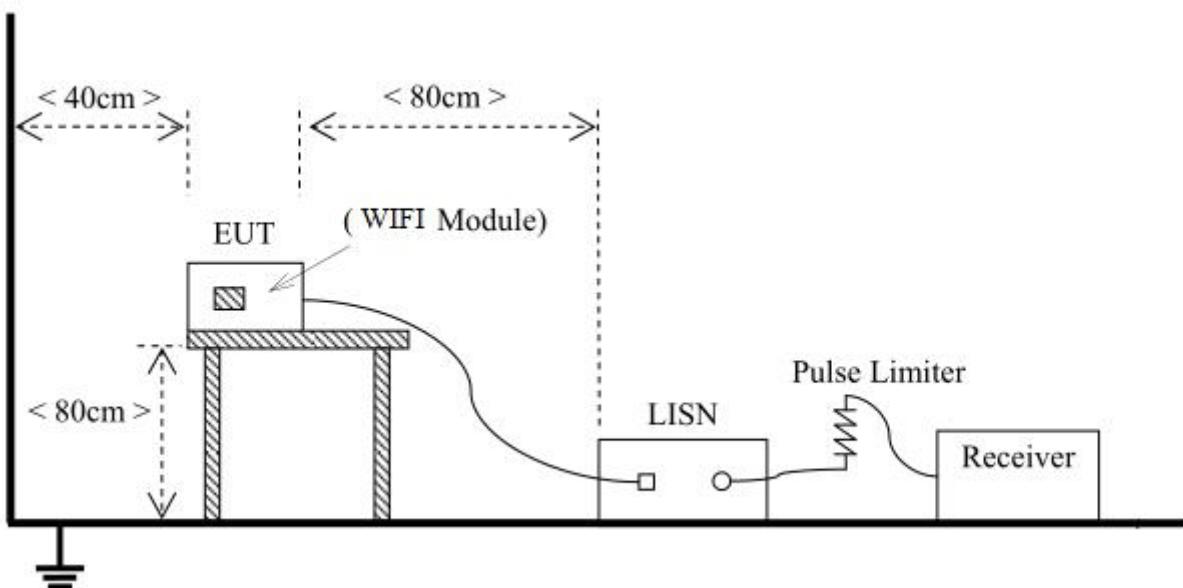
According to FCC section 15.207, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 Ω line impedance stabilization network(LISN).

Frequency range (MHz)	Conducted Limit (dB μ V)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

NOTE:

- (a) The lower limit shall apply at the band edges.
- (b) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

6.7.2 Test Description



The EUT was placed upon a non-metallic table 0.8m above the horizontal metal reference ground plane. EUT was connected to LISN and LISN was connected to reference Ground Plane. EUT was 80cm from LISN. Power supplier is setting to 120V/60Hz. The set-up and test methods were according to ANSI C63.10:2013

EUT is connected to Computer via USB data cable, the EUT was set by software in continuous Transmitting condition,during the measurement, the EUT exchanged data with computer.

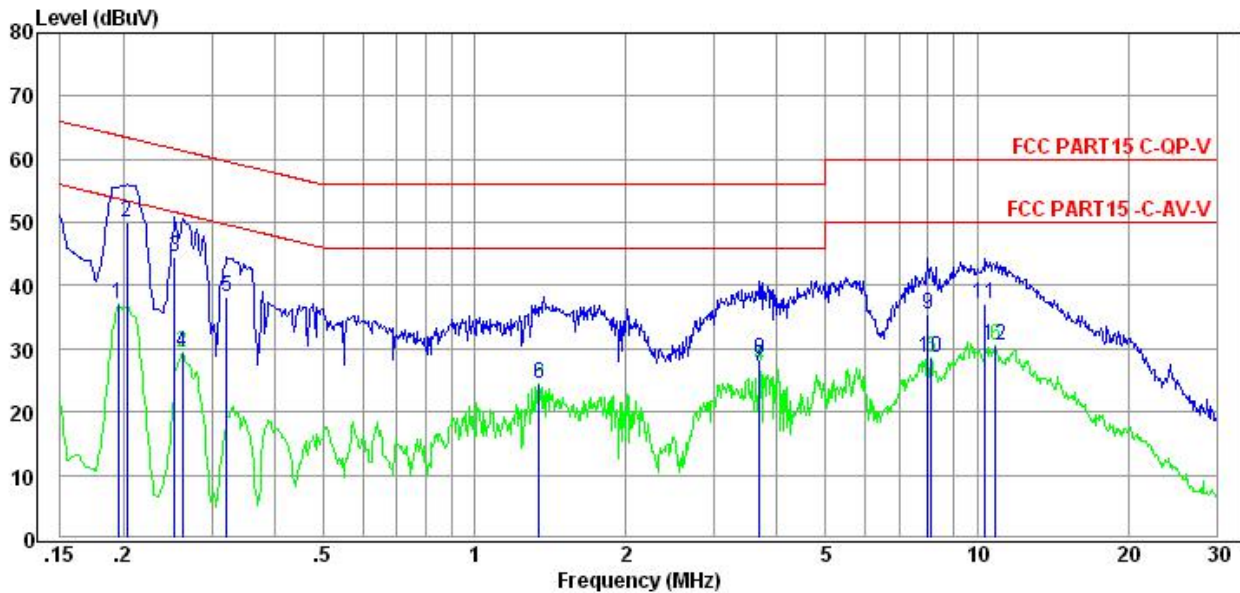
802.11g Channel 1 was identified as the worst case condition when data rate is set to 54Mbps. The worst data were recorded in this section.



6.7.3 Test result

Test Result of “L” line-120V/60Hz:

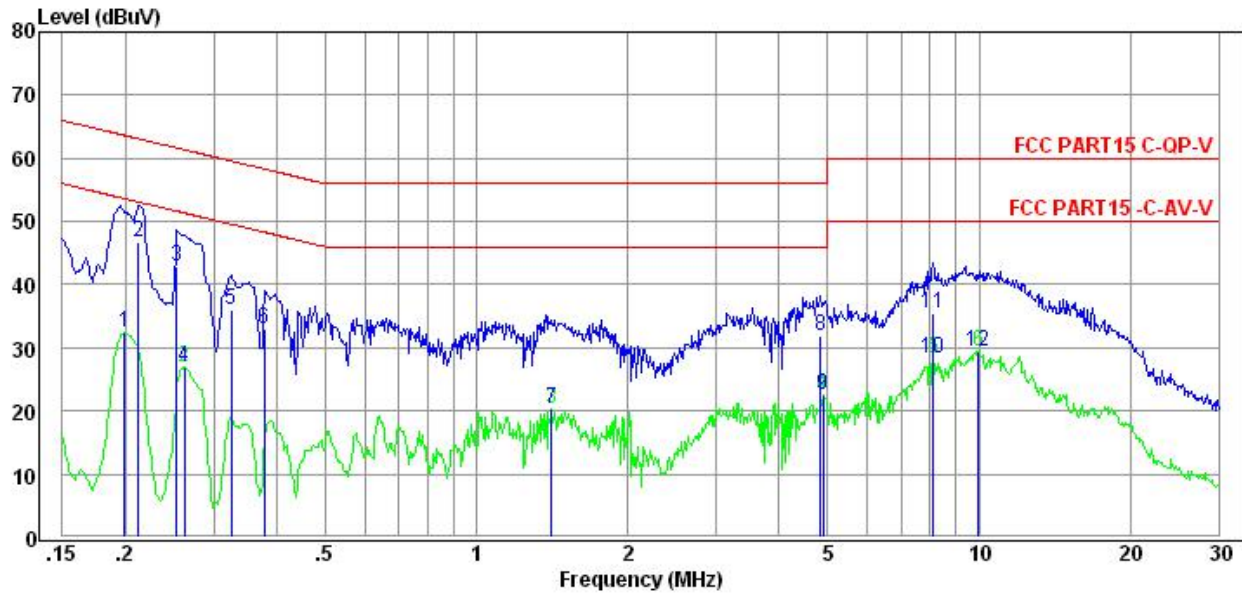
No.	Frequency MHz	Level dB μ V	Detector	Limit dB μ V	Margin dB
1	0.20	37.11	Average	53.80	16.69
2	0.20	50.01	QP	63.45	13.44
3	0.25	44.40	QP	61.64	17.24
4	0.26	29.34	Average	51.34	22.00
5	0.32	38.34	QP	59.66	21.32
6	1.35	24.41	Average	46.00	21.59
7	3.70	27.26	Average	46.00	18.74
8	3.70	28.38	QP	56.00	27.62
9	7.98	35.46	QP	60.00	24.54
10	8.11	28.64	Average	50.00	21.36
11	10.40	37.11	QP	60.00	22.89
12	10.91	30.49	Average	50.00	19.51





Test Result of “N” line-120V/60Hz:

No.	Frequency MHz	Level dB μ V	Detector	Limit dB μ V	Margin dB
1	0.20	32.51	Average	53.62	21.11
2	0.21	46.80	QP	63.10	16.30
3	0.25	42.96	QP	61.64	18.68
4	0.26	26.90	Average	51.34	24.44
5	0.33	35.98	QP	59.57	23.59
6	0.38	32.92	QP	58.30	25.38
7	1.41	20.35	Average	46.00	25.65
8	4.85	31.97	QP	56.00	24.03
9	4.90	22.53	Average	46.00	23.47
10	8.11	28.28	Average	50.00	21.72
11	8.11	35.49	QP	60.00	24.51
12	9.97	29.53	Average	50.00	20.47





6.8 Radiated Emission

6.8.1 Requirement

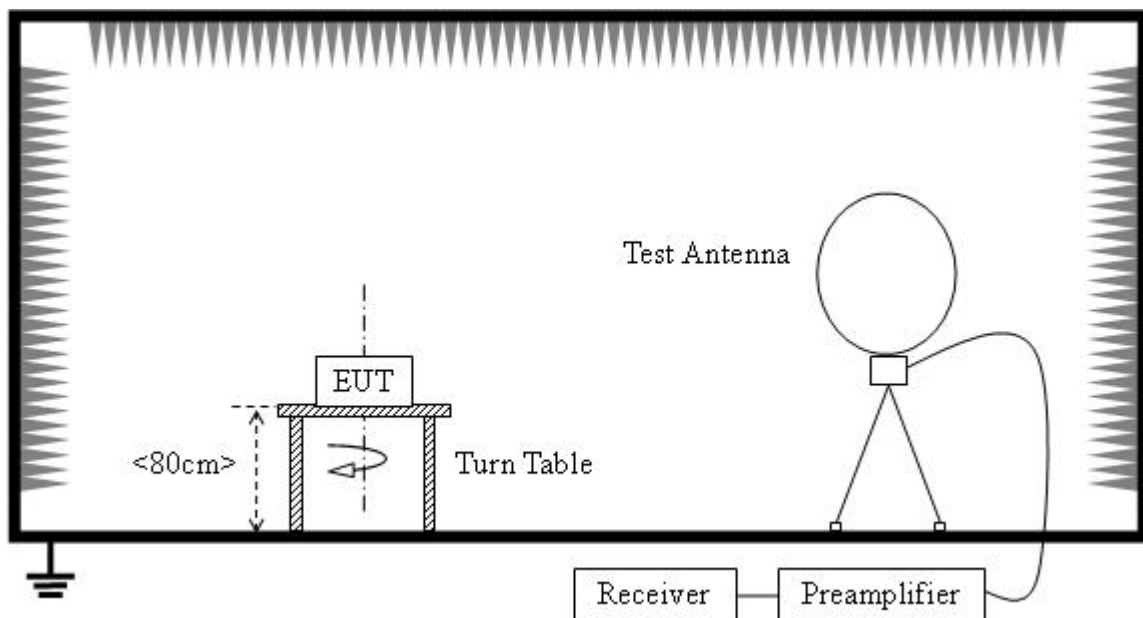
According to FCC section 15.247(c), radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

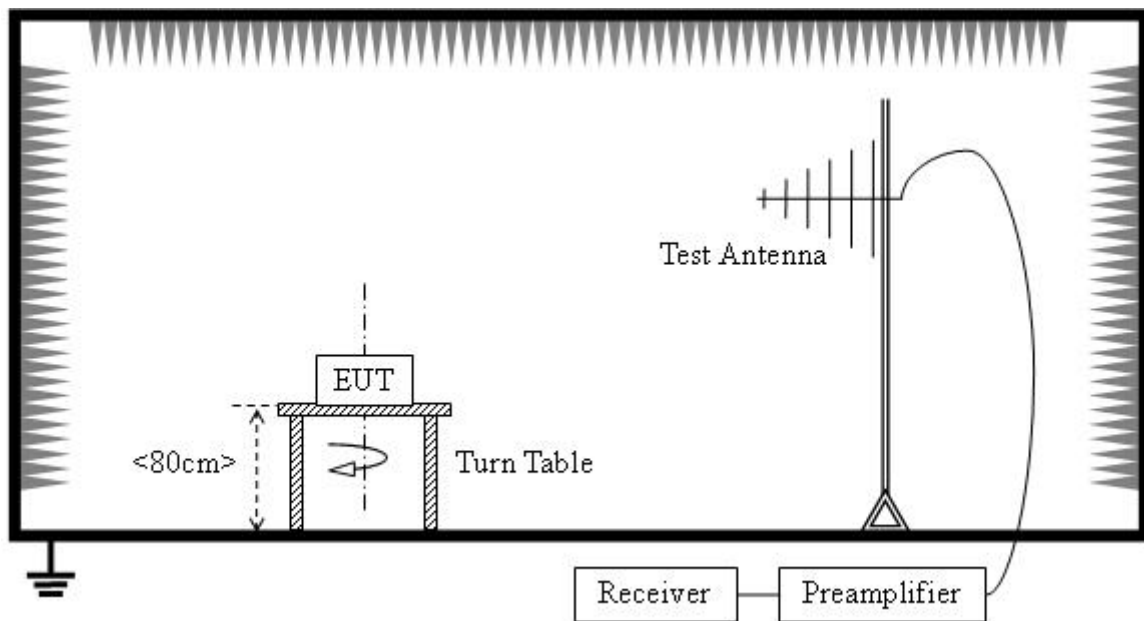
Frequency (MHz)	Field Strength ($\mu\text{V/m}$)	Measurement Distance (m)	Limit(dB $\mu\text{V/m}$)	Detector
0.009-0.490	2400/F(kHz)	300	/	/
0.490-1.705	24000/F(kHz)	30	/	/
1.705-30	30	30	/	/
30 - 88	100	3	40	QP
88 - 216	150	3	43.5	QP
216 - 960	200	3	46	QP
960 - 1000	500	3	54	QP
Above 1000	500	3	54	AV

In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), also should comply with the radiated emission limits specified in Section 15.209(a)(above table)

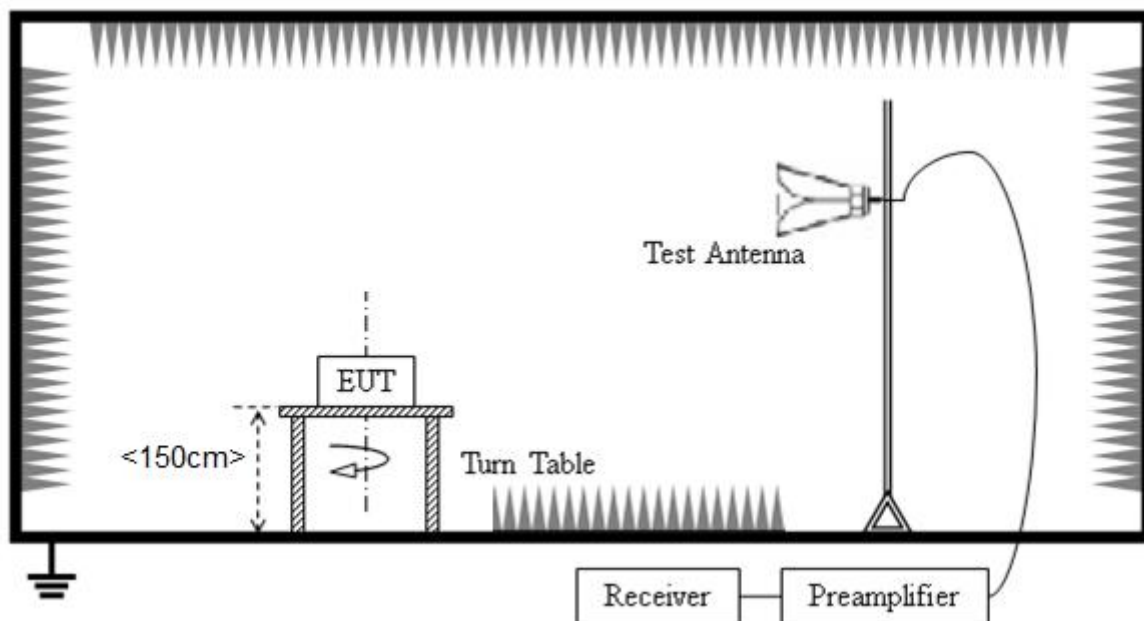
6.8.2 Test setup



Radiated Emissions Below 30MHz



Radiated Emissions 30-1000MHz



Radiated Emissions above 1000MHz

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4dB according to the standards: ANSI C63.10-2013. Below 1GHz, the EUT was set-up on insulator 80cm above the Ground Plane. Above 1GHz, the EUT was set-up on insulator 150cm above the Ground Plane. The set-up and test methods were according to ANSI C63.10

The Wifi Module is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading. During the measurement, the Wifi Module is activated and controlled by the software WL, and is set to operate under transmitting at maximum power.

For the Test Antenna: In the frequency range above 30MHz, Bi-Log Test Antenna (30MHz to 1GHz)



and Horn Test Antenna (above 1GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength, the azimuth range of turntable was 0o to 360o, the receive antenna has two polarizations horizontal and vertical. When doing measurements above 1GHz, the EUT was placed within the 3dB beam width range of the horn antenna, and the EUT was tested in 3 orthogonal positions as recommended in ANSI C63.10 for Radiated Emissions and the worst-case data was presented.

Receiver Setting:

(9-150kHz): RBW=200Hz, VBW=1kHz, Detector: PK, Max Hold.

(0.15-30MHz): RBW=9kHz, VBW=30kHz, Detector: PK, Max Hold.

(30MHz-1GHz): RBW=120kHz, VBW=300kHz, Detector: QK, Max Hold.

(Above 1GHz): RBW=1MHz, VBW=3MHz, Detector: AV, Max Hold.

6.8.3 Test Result

A. Test Result for 9kHz~30MHz

Frequency (MHz)	Level (dBuV)	Over Limit (dB)	Limit Line (dBuV)	Remark
--	--	20	--	See Note

Note:

- The amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value has no need to be reported.*
- Distance extrapolation factor = $40 \log (\text{specific distance} / \text{test distance})$ (dB);*
- Limit line = specific limits (dBuV) + distance extrapolation factor.*

B. Test Result for (PCB Antenna)above 30MHz ~ 10th Harmonic

Frequency (MHz)	Level (dBuV)	Limit Line (dBuV)	Margin (dB)	Antenna Polarization	Detector
47.99	30.35	40.00	9.65	Horizontal	QP
191.75	31.04	43.50	12.46	Horizontal	QP
239.99	39.43	46.00	6.57	Horizontal	QP
336.04	43.19	46.00	2.81	Horizontal	QP
400.43	39.88	46.00	6.12	Horizontal	QP
625.08	39.92	46.00	6.08	Horizontal	QP
47.99	29.62	40.00	10.38	Vertical	QP
49.71	30.11	40.00	9.89	Vertical	QP
239.99	35.47	46.00	10.53	Vertical	QP
336.04	37.15	46.00	8.85	Vertical	QP
400.43	39.80	46.00	6.20	Vertical	QP
625.08	39.74	46.0	6.26	Vertical	QP



Frequency (MHz)	Level (dBuV)	Limit Line (dBuV)	Margin (dB)	Antenna Polarization	Detector
1055.22	31.20	74.00	42.80	Horizontal	Peak
1152.06	24.20	54.00	29.80	Horizontal	Average
1152.06	34.44	74.00	39.56	Horizontal	Peak
1294.36	22.03	54.00	31.97	Horizontal	Average
1593.38	21.38	54.00	32.62	Horizontal	Average
1593.38	35.30	74.00	38.70	Horizontal	Peak
2126.19	33.73	74.00	40.27	Horizontal	Peak
2130.00	20.77	54.00	33.23	Horizontal	Average
2410.31	47.39	54.00	6.61	Horizontal	Average
2410.31	58.75	74.00	15.25	Horizontal	Peak
3620.03	26.84	54.00	27.16	Horizontal	Average
3620.03	41.00	74.00	33.00	Horizontal	Peak
1055.22	20.45	54.00	33.55	Vertical	Average
1152.06	20.96	54.00	33.04	Vertical	Average
1198.38	32.44	74.00	41.56	Vertical	Peak
1593.38	40.68	74.00	33.32	Vertical	Peak
1596.24	24.30	54.00	29.70	Vertical	Average
1786.99	35.37	74.00	38.63	Vertical	Peak
2126.19	21.34	54.00	32.66	Vertical	Average
2126.19	35.19	74.00	38.81	Vertical	Peak
2410.31	46.96	54.00	7.04	Vertical	Average
2410.31	58.16	74.00	15.84	Vertical	Peak
3620.03	24.74	54.00	29.26	Vertical	Average
3620.03	38.13	74.00	35.87	Vertical	Peak

C. Test Result for (External Antenna)above 30MHz ~ 10th Harmonic

Frequency (MHz)	Level (dBuV)	Limit Line (dBuV)	Margin (dB)	Antenna Polarization	Detector
47.99	29.67	40.00	10.33	Horizontal	QP
192.42	38.41	43.50	5.09	Horizontal	QP
239.99	38.29	46.00	7.71	Horizontal	QP
336.04	41.44	46.00	4.56	Horizontal	QP
721.73	41.40	46.00	4.60	Horizontal	QP
47.99	35.14	40.00	4.86	Vertical	QP
239.99	38.32	46.00	7.68	Vertical	QP
336.04	41.61	46.00	4.39	Vertical	QP
432.55	39.20	46.00	6.80	Vertical	QP
625.08	36.94	46.00	9.06	Vertical	QP



Frequency (MHz)	Level (dBuV)	Limit Line (dBuV)	Margin (dB)	Antenna Polarization	Detector
1055.22	23.15	54.00	30.85	Horizontal	Average
1152.06	22.63	54.00	31.37	Horizontal	Average
1152.06	32.43	74.00	41.57	Horizontal	Peak
1702.59	39.00	74.00	35.00	Horizontal	Peak
1878.92	25.45	54.00	28.55	Horizontal	Average
1878.92	43.43	74.00	30.57	Horizontal	Peak
3620.03	24.85	54.00	29.15	Horizontal	Average
3620.03	38.05	74.00	35.95	Horizontal	Peak
4839.20	51.96	54.00	2.04	Horizontal	Average
4839.20	69.98	74.00	4.02	Horizontal	Peak
1060.91	32.26	74.00	41.74	Vertical	Peak
1103.57	20.93	54.00	33.07	Vertical	Average
1593.38	23.47	54.00	30.53	Vertical	Average
1593.38	39.89	74.00	34.11	Vertical	Peak
2130.00	36.40	74.00	37.60	Vertical	Peak
2160.75	23.10	54.00	30.90	Vertical	Average
3620.03	24.61	54.00	29.39	Vertical	Average
3620.03	37.67	74.00	36.33	Vertical	Peak
4830.53	49.90	54.00	4.10	Vertical	Average
4830.53	63.51	74.00	10.49	Vertical	Peak

D. Test Result for (PIFA Antenna)above 30MHz ~ 10th Harmonic

Frequency (MHz)	Level (dBuV)	Limit Line (dBuV)	Margin (dB)	Antenna Polarization	Detector
47.99	31.48	40.00	8.52	Horizontal	QP
143.83	34.82	43.50	8.68	Horizontal	QP
336.04	41.63	46.00	4.37	Horizontal	QP
400.43	40.22	46.00	5.78	Horizontal	QP
721.73	41.93	46.00	4.07	Horizontal	QP
47.99	37.06	40.00	2.94	Vertical	QP
239.99	38.63	46.00	7.37	Vertical	QP
336.04	37.32	46.00	8.68	Vertical	QP
400.43	42.69	46.00	3.31	Vertical	QP
721.73	36.34	46.00	9.66	Vertical	QP



Frequency (MHz)	Level (dBuV)	Limit Line (dBuV)	Margin (dB)	Antenna Polarization	Detector
1055.22	22.65	54.00	31.35	Horizontal	Average
1152.06	23.36	54.00	30.64	Horizontal	Average
1198.38	33.41	74.00	40.59	Horizontal	Peak
1438.68	32.99	74.00	41.01	Horizontal	Peak
2000.53	22.28	54.00	31.72	Horizontal	Average
2000.53	37.05	74.00	36.95	Horizontal	Peak
3620.03	25.75	54.00	28.25	Horizontal	Average
3620.03	39.93	74.00	34.07	Horizontal	Peak
5006.77	27.17	54.00	26.83	Horizontal	Average
5033.76	39.69	74.00	34.31	Horizontal	Peak
1055.22	21.59	54.00	54.00	Vertical	Average
1103.57	21.26	54.00	54.00	Vertical	Average
1198.38	31.04	74.00	74.00	Vertical	Peak
1593.38	24.49	54.00	54.00	Vertical	Average
1593.38	40.58	74.00	74.00	Vertical	Peak
2126.19	22.51	54.00	54.00	Vertical	Average
2126.19	36.15	74.00	74.00	Vertical	Peak
2659.93	34.85	74.00	74.00	Vertical	Peak
3620.03	26.51	54.00	54.00	Vertical	Average
3620.03	39.80	74.00	74.00	Vertical	Peak
4997.81	27.31	54.00	54.00	Vertical	Average
4997.81	39.44	74.00	74.00	Vertical	Peak

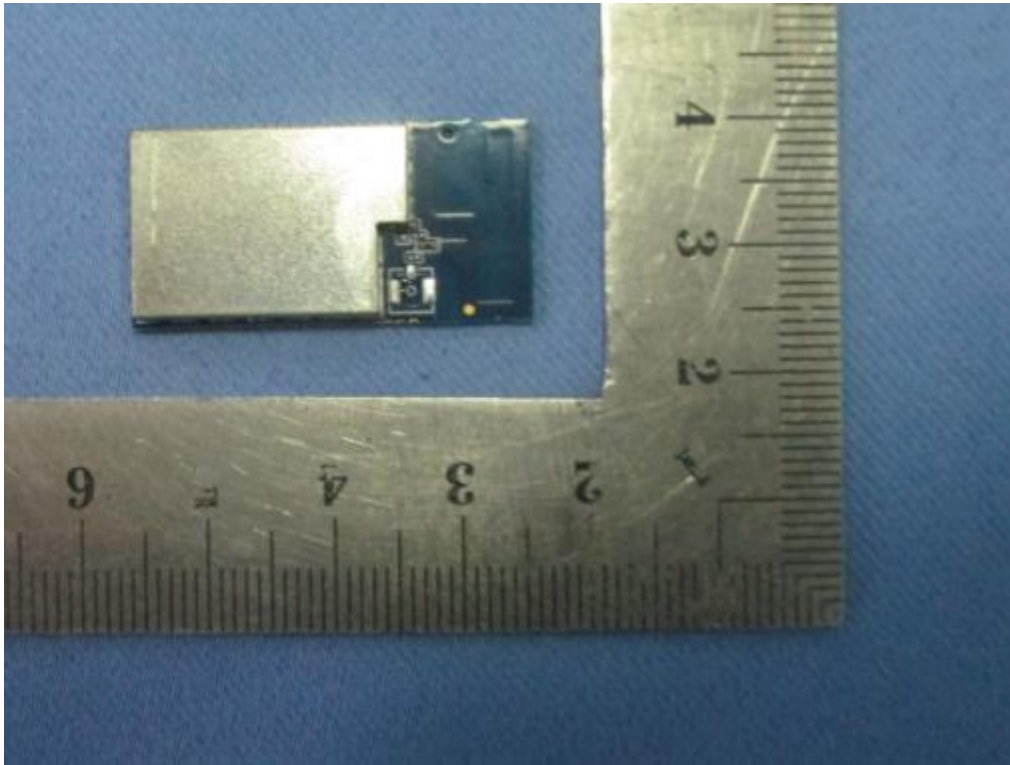
Note:

1. The worst case (802.11g Channel 1:2412MHz) is recorded in the section.

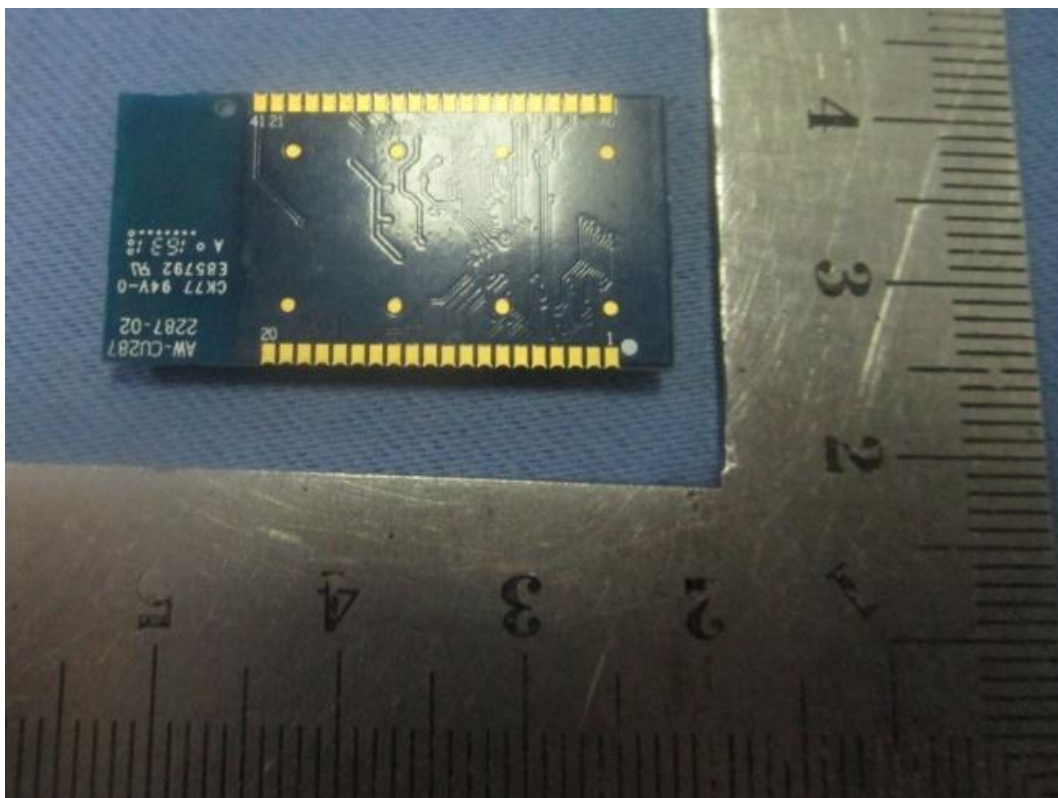


Annex A Photos of the EUT

EMW3081-P

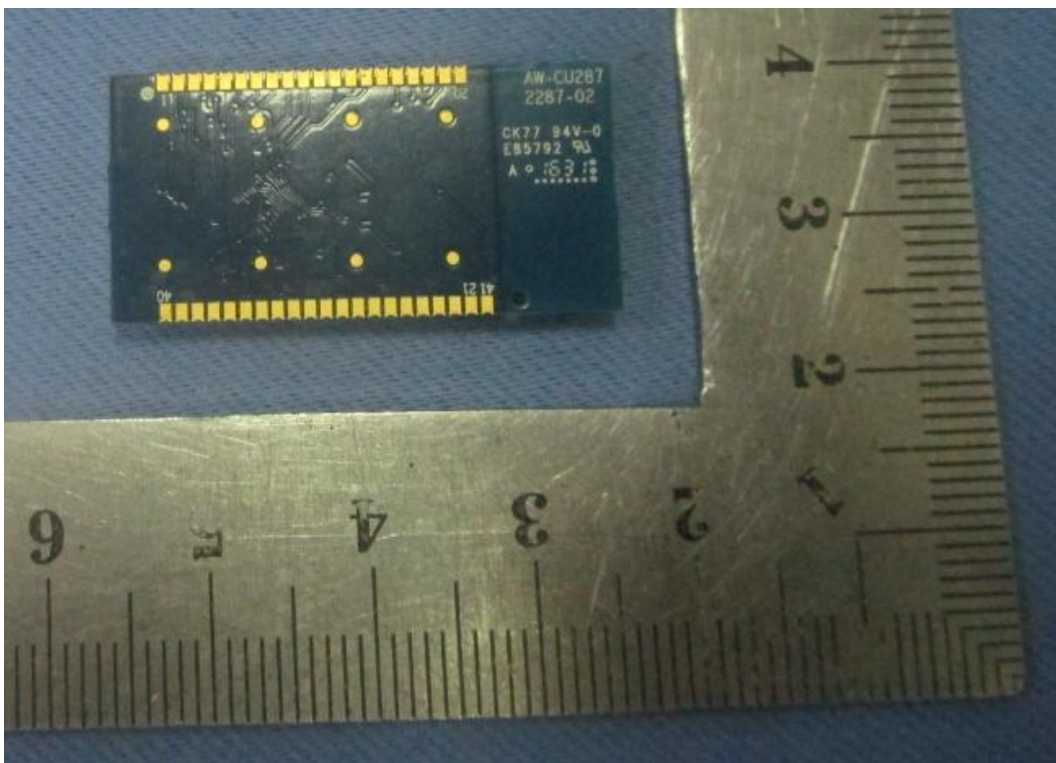
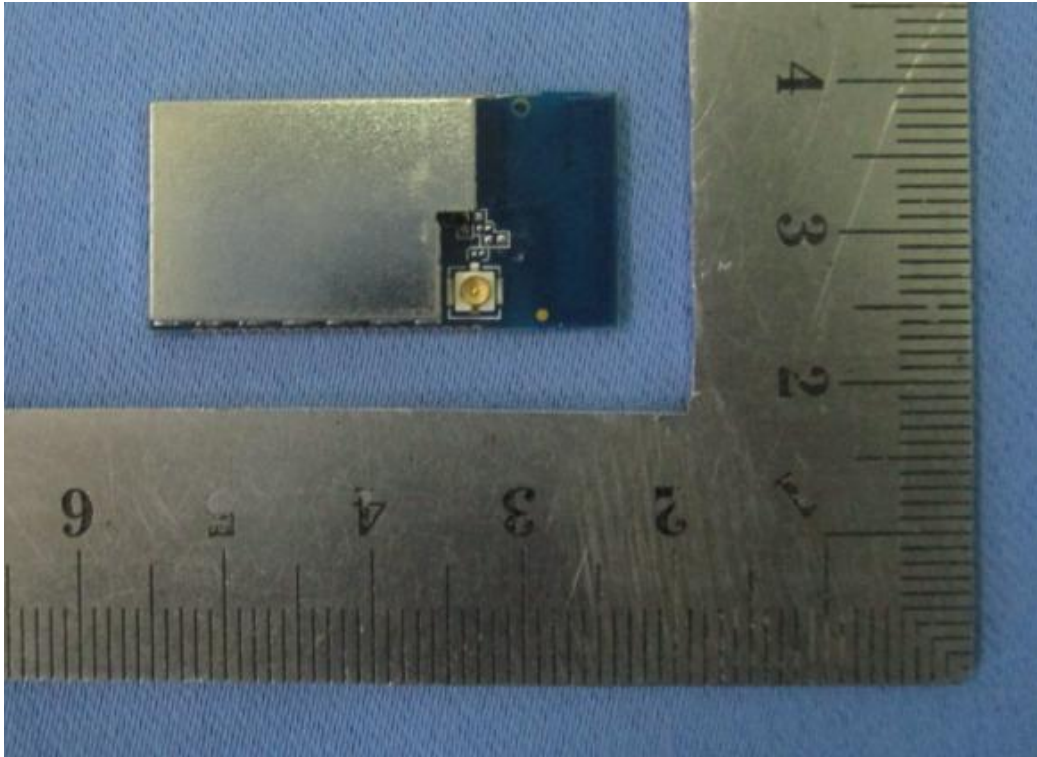


EMW3081-P



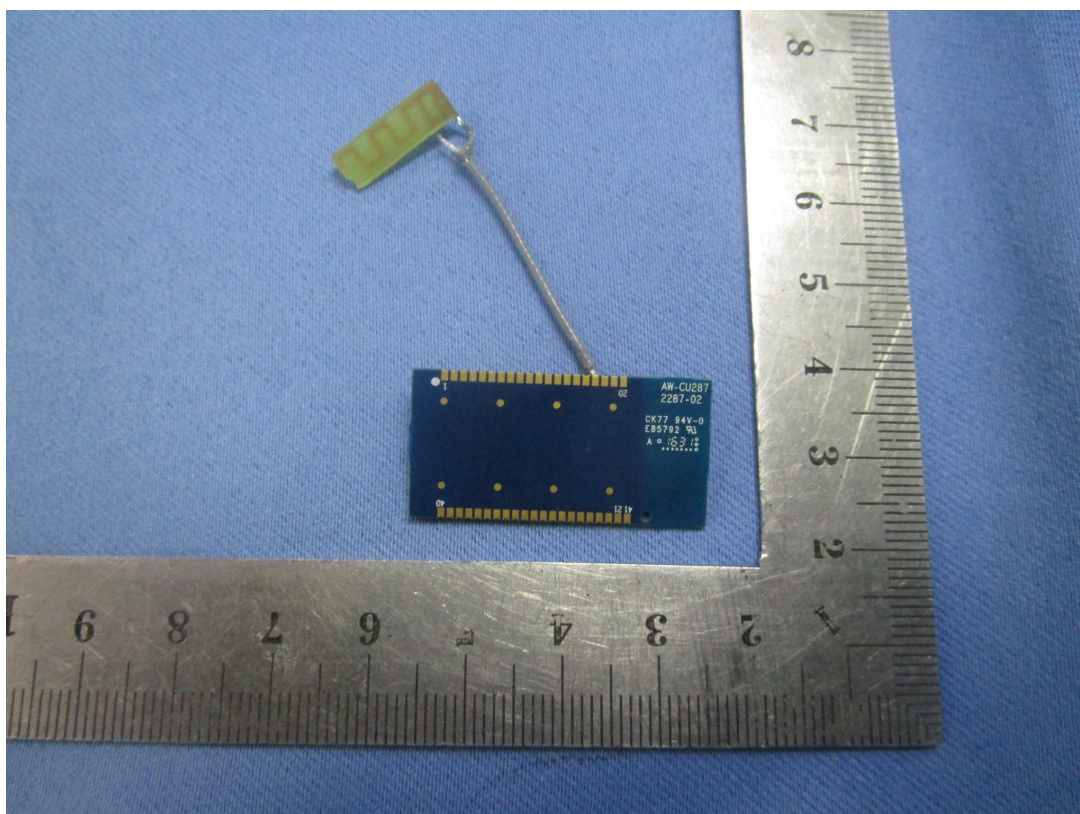
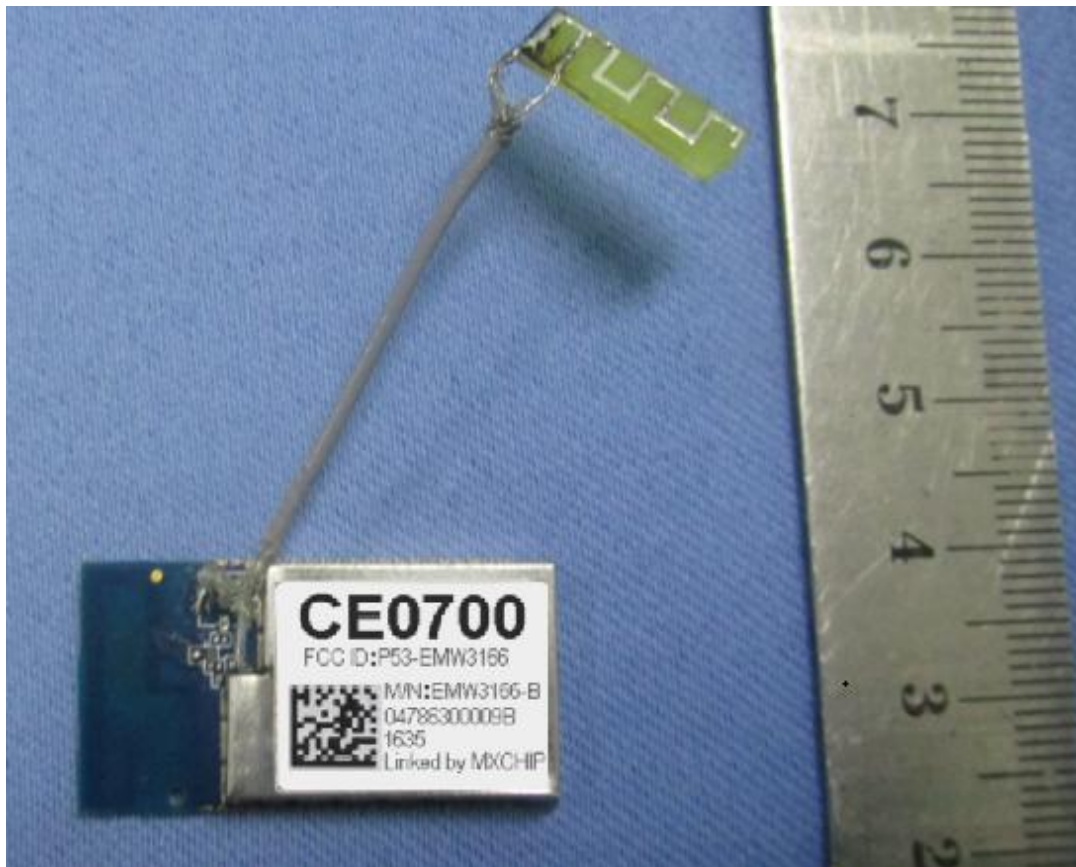


EMW3081-E





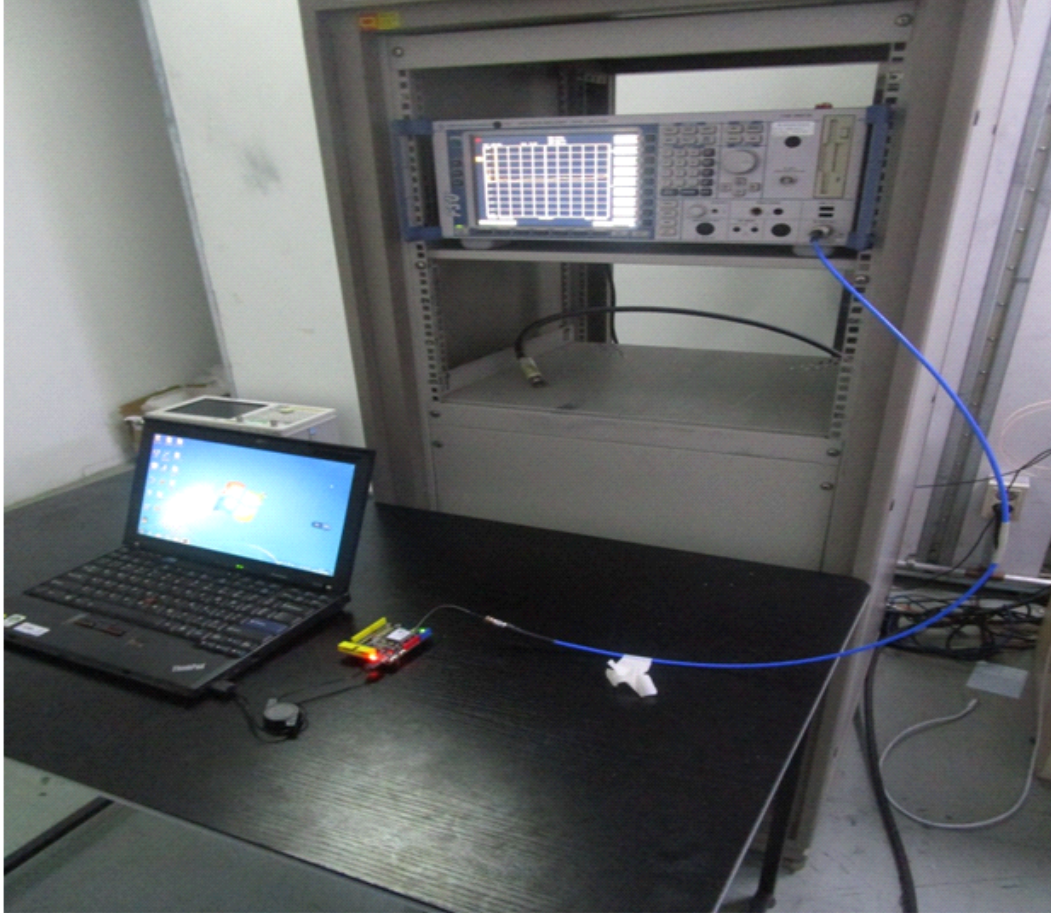
EMW3081-B





Annex B Photos of Setup

1. RF



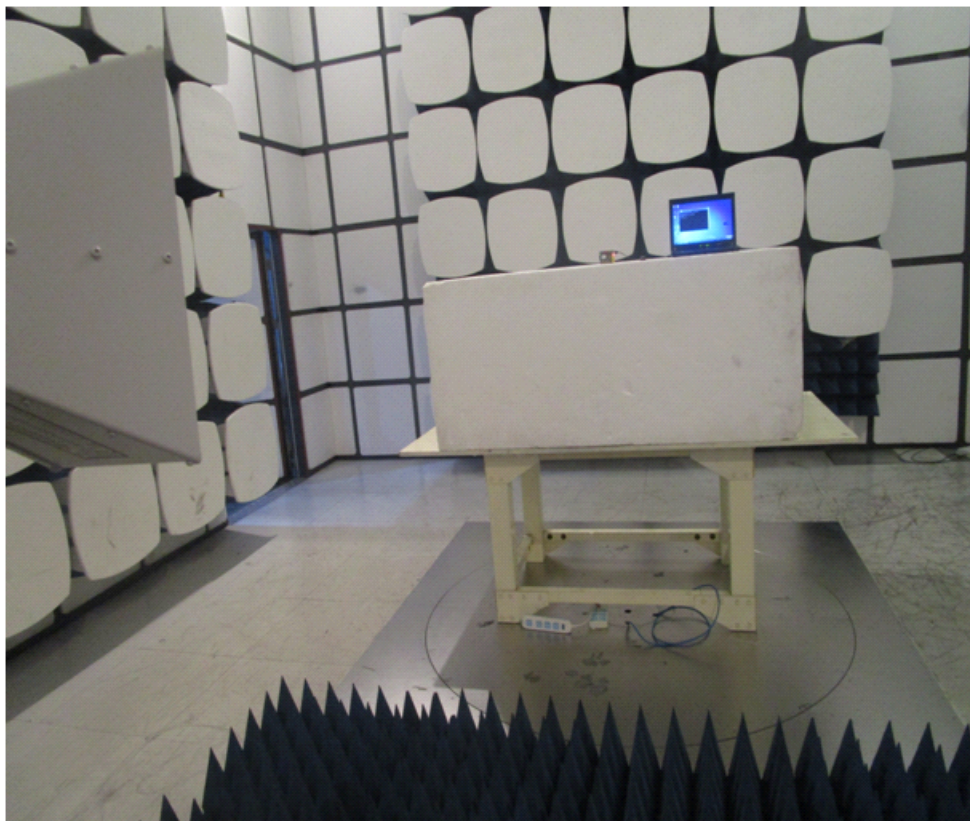
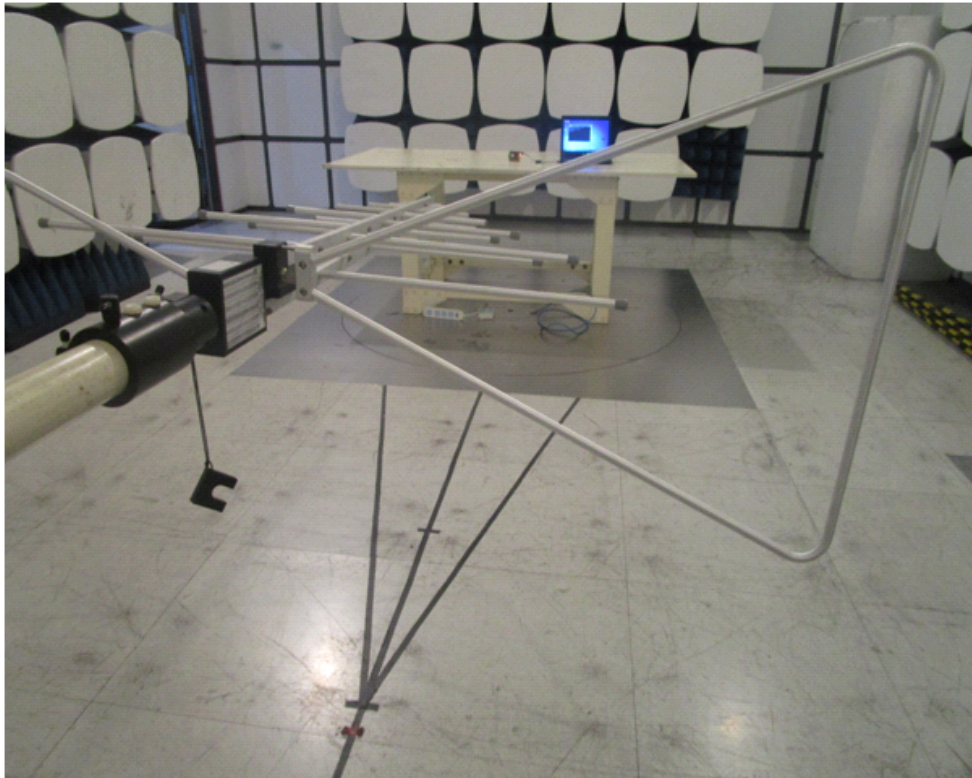


2. Conducted Emission





3. Radiated Emission





** END OF REPORT **