

FCC TEST REPORT

FCC ID : 2AAWUTL800US
Applicant : AVC Technology (International) Limited
Address : 6/F Enterprise Square Three, 39 Wang Chiu Road, Kowloon Bay, Hong Kong.
Manufacturer : SHENZHEN SUNLIGHT TECHNOLOGY CO.,LTD
Address : Block B, Xinshidai gongrong Industrial Park, Shihuan RD, Shilong, Shiyuan street, Baoan, Shenzhen,China
Equipment Under Test (EUT) :
Product Name : Lumen bulb
Model No. : TL800US
Standards : FCC CFR47 Part 15 Section 15.247:2012
Date of Test : June 06~July 17, 2013
Date of Issue : August 07, 2013

Test Result : **PASS**

Remark:

* The sample described above has been tested to be in compliance with the requirements of ANSI C63.4:2003. The test results have been reviewed and comply with the rules listed above and found to meet their essential requirements.

The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company.

The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

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2 Test Summary

Test Items	Test Requirement	Result
Radiated Spurious Emissions	15.205(a) 15.209 15.247(d)	PASS
Duty Cycle	15.35	PASS
Band edge	15.247(d) 15.205(a)	PASS
Conduct Emission	15.207	PASS
20dB Bandwidth	15.247(a)(1)	PASS
Maximum Peak Output Power	15.247(b)(1)	PASS
Frequency Separation	15.247(a)(1)	PASS
Number of Hopping Frequency	15.247(a)(1)(iii)	PASS
Dwell time	15.247(a)(1)(iii)	PASS
Maximum Permissible Exposure (Exposure of Humans to RF Fields)	1.1307(b)(1)	PASS

3 Contents

	Page
1 COVER PAGE	1
2 TEST SUMMARY	2
3 CONTENTS	3
4 GENERAL INFORMATION	5
4.1 GENERAL DESCRIPTION OF E.U.T.....	5
4.2 DETAILS OF E.U.T.....	5
4.3 CHANNEL LIST.....	5
4.4 TEST MODE.....	5
4.5 TEST FACILITY.....	6
4.6 TEST LOCATION.....	6
5 EQUIPMENT USED DURING TEST	7
5.1 EQUIPMENTS LIST.....	7
5.2 MEASUREMENT UNCERTAINTY.....	7
5.3 TEST EQUIPMENT CALIBRATION.....	7
6 CONDUCTED EMISSION	8
6.1 E.U.T. OPERATION.....	8
6.2 EUT SETUP.....	8
6.3 CONDUCTED EMISSION TEST RESULT.....	9
7 RADIATED SPURIOUS EMISSIONS	11
7.1 EUT OPERATION :.....	11
7.2 TEST SETUP.....	12
7.3 SPECTRUM ANALYZER SETUP.....	13
7.4 TEST PROCEDURE.....	14
7.5 CORRECTED AMPLITUDE & MARGIN CALCULATION.....	14
7.6 SUMMARY OF TEST RESULTS.....	15
8 DUTY CYCLE	23
8.1 TEST PROCEDURE.....	23
8.2 TEST RESULT.....	23
9 BAND EDGE MEASUREMENT	25
9.1 TEST RESULT:.....	26
10 20 DB BANDWIDTH MEASUREMENT	32
10.1 TEST PROCEDURE:.....	32
10.2 TEST RESULT:.....	32
11 MAXIMUM PEAK OUTPUT POWER	34
11.1 TEST PROCEDURE:.....	34
11.2 TEST RESULT:.....	34
12 HOPPING CHANNEL SEPARATION	37
12.1 TEST PROCEDURE:.....	37
12.2 TEST RESULT:.....	37
13 NUMBER OF HOPPING FREQUENCY	40
13.1 TEST PROCEDURE:.....	40
13.2 TEST RESULT:.....	40
14 DWELL TIME	41

14.1	TEST PROCEDURE:.....	41
14.2	TEST RESULT:.....	41
15	ANTENNA REQUIREMENT.....	45
16	RF EXPOSURE.....	46
16.1	REQUIMENTS:	46
16.2	TEST RESULT.....	46
17	PHOTOGRAPHS – TEST SETUP	47
17.1	PHOTOGRAPH – RADIATION SPURIOUS EMISSION TEST SETUP.....	47
17.2	PHOTOGRAPH – CONDUCTED EMISSION TEST SETUP.....	48
18	PHOTOGRAPHS - CONSTRUCTIONAL DETAILS.....	49
18.1	EXTERNAL VIEW.....	49
18.2	EUT - INTERNAL VIEW.....	51

4 General Information

4.1 General Description of E.U.T.

Product Name	: Lumen bulb
Model No.	: TL800US
Operation Frequency	: 2402MHz ~ 2480MHz, 79 channels in total
Type of Modulation	: GFSK
Oscillator	: Crystal 32MHz for RF module, Crystal 32.768KHz for MCU
Antenna installation	: PCB Printed Antenna
Antenna Gain	: 0 dBi

4.2 Details of E.U.T.

Technical Data	: AC100-240V, 50/60Hz, 7W
Adapter	: N/A

4.3 Channel List

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
1	2402	2	2403	3	2404	4	2405
5	2406	6	2407	7	2408	8	2409
9	2410	10	2411	11	2412	12	2413
13	2414	14	2415	15	2416	16	2417
17	2418	18	2419	19	2420	20	2421
21	2422	22	2423	23	2424	24	2425
25	2426	26	2427	27	2428	28	2429
29	2430	30	2431	31	2432	32	2433
33	2434	34	2435	35	2436	36	2437
37	2438	38	2439	39	2440	40	2441
41	2442	42	2443	43	2444	44	2445
45	2446	46	2447	47	2448	48	2449
49	2450	50	2451	51	2452	52	2453
53	2454	54	2455	55	2456	56	2457
57	2458	58	2459	59	2460	60	2461
61	2462	62	2463	63	2464	64	2465
65	2466	66	2467	67	2468	68	2469
69	2470	70	2471	71	2472	72	2473
73	2474	74	2475	75	2476	76	2477
77	2478	78	2479	79	2480	-	-

4.4 Test Mode

Test Item	Test Mode
Conducted Emissions	Normal linking
Radiated Emissions	Normal linking

4.5 Test Facility

The test facility has a test site registered with the following organizations:

- **IC – Registration No.: 7760A**

Waltek Services(Shenzhen) Co., Ltd. has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files.

Registration 7760A, July 12, 2012.

- **FCC – Registration No.: 880581**

Waltek Services(Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 880581, May 26, 2011.

4.6 Test Location

All the tests were performed at:

Waltek Services(Shenzhen) Co., Ltd. at 1/F, Fukangtai Building, West Baima Rd., Songgang Street, Baoan District, Shenzhen, China

5 Equipment Used during Test

5.1 Equipments List

Conducted Emissions						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMI Test Receiver	R&S	ESCI	100947	Aug. 13,2012	Aug. 12,2013
2.	LISN	R&S	ENV216	101215	Aug. 13,2012	Aug. 12,2013
3.	Cable	Top	TYPE16(3.5M)	-	Aug.14,2012	Aug. 13,2013
3m Semi-anechoic Chamber for Radiation Emissions						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMC Analyzer	Agilent	E7405A	MY45114943	Aug. 13,2012	Aug. 12,2013
2.	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	Aug. 13,2012	Aug. 12,2013
3.	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	Apr. 20,2013	Apr. 19,2014
4.	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	Apr. 20,2013	Apr. 19,2014
5.	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	399	Aug. 13,2012	Aug. 12,2013
6.	Broadband Preampfier	COMPLIANCE DIRECTION	PAP-1G18	2004	Apr.07,2013	Apr.06,2014
7.	Broadband Preampfier	SCHWARZBECK	BBV 9718	9718-148	Aug. 13,2012	Aug. 12,2013
8.	Cable	Top	EWO2014-7	-	Apr. 20,2013	Apr. 19,2014
9.	Cable	Top	TYPE16(13M)	-	Aug. 13,2012	Aug. 12,2013
10.	DC POWER SUPPLY	LWDQGS	PS-303D		Aug. 13,2012	Aug. 12,2013
11.	Humidity Chamber	GTH-225-40-1P	IAA061213		May. 15, 2013	May. 14, 2014
12.	Spectrum Analyzer	ROHDE & SCHWARZ	FSL6		Sep. 21, 2012	Sep. 20, 2013

5.2 Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-6}$
RF Power	± 1.0 dB
RF Power Density	± 2.2 dB
Radiated Spurious Emissions test	± 5.03 dB (Bilog antenna 30M~1000MHz)
	± 4.74 dB (Horn antenna 1000M~25000MHz)
Conducted Spurious Emissions test	± 3.64 dB (AC mains 150KHz~30MHz)

5.3 Test Equipment Calibration

All the test equipments used are valid and calibrated by CEPREI Certification Body that address is No.110 Dongguan Zhuang RD. Guangzhou, P.R.China.

6 Conducted Emission

Test Requirement:	FCC CFR 47 Part 15 Section 15.207
Test Method:	ANSI C63.4:2003
Test Result:	PASS
Frequency Range:	150kHz to 30MHz
Class:	Class B
Limit:	66-56 dB μ V between 0.15MHz & 0.5MHz 56 dB μ V between 0.5MHz & 5MHz 60 dB μ V between 5MHz & 30MHz
Detector:	Peak for pre-scan (9kHz Resolution Bandwidth) Quasi-Peak & Average if maximised peak within 6dB of Average Limit

6.1 E.U.T. Operation

Operating Environment:

Temperature: 25.5 °C

Humidity: 51 % RH

Atmospheric Pressure: 1009 mbar

EUT Operation:

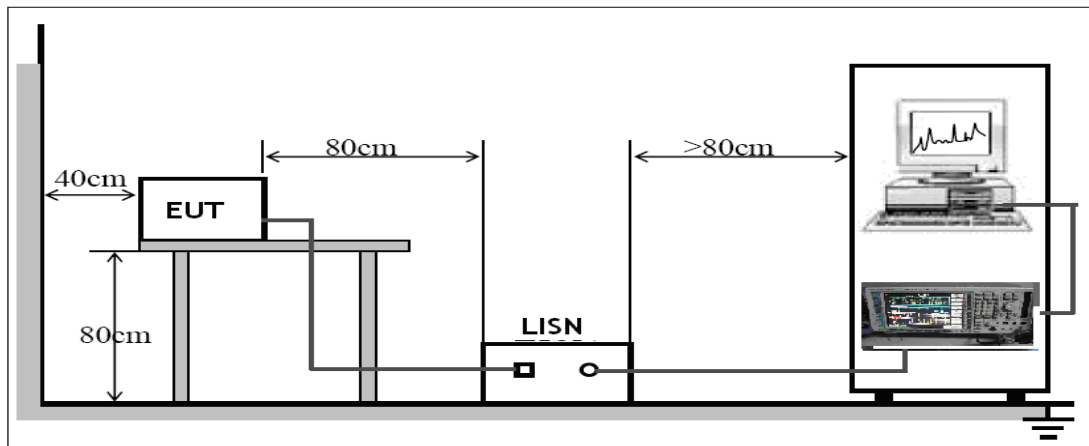
The test was performed in normal linking mode, the test data were shown in the report.

The EUT was tested according to ANSI C63.4:2003. The frequency spectrum from 150kHz to 30MHz was investigated.

The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

6.2 EUT Setup

The EUT was placed on the test table in shielding room.

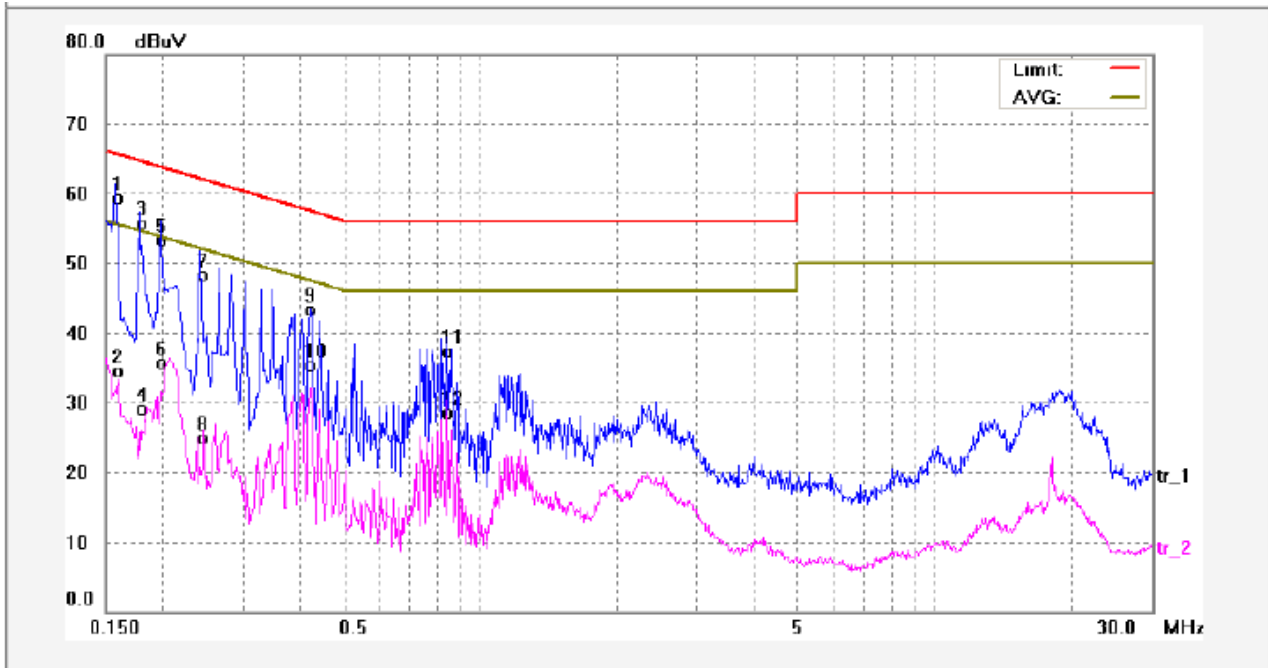


6.3 Conducted Emission Test Result

An initial pre-scan was performed on the live and neutral lines.

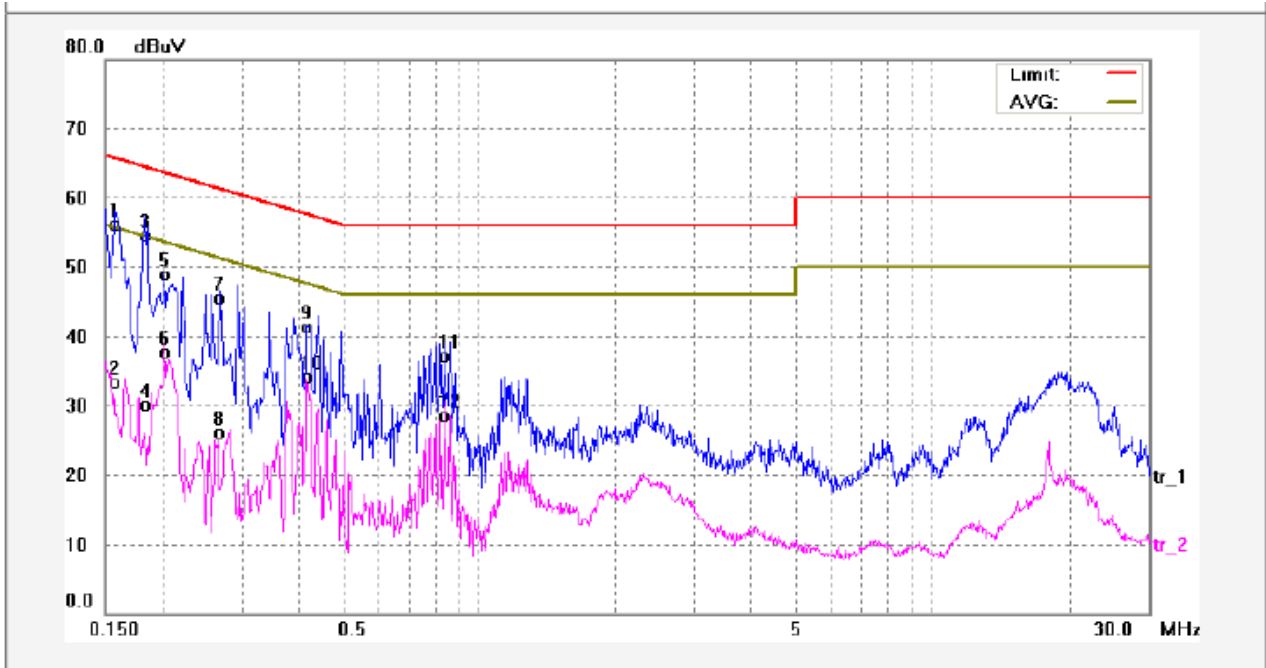
Test mode: normal linking mode

Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1580	48.69	9.81	58.50	65.56	-7.06	QP	
2	0.1580	23.89	9.81	33.70	55.56	-21.86	AVG	
3	0.1780	45.08	9.82	54.90	64.57	-9.67	QP	
4	0.1780	18.41	9.82	28.23	54.57	-26.34	AVG	
5	0.1980	42.70	9.84	52.54	63.69	-11.15	QP	
6	0.1980	25.12	9.84	34.96	53.69	-18.73	AVG	
7	0.2420	37.75	9.85	47.60	62.02	-14.42	QP	
8	0.2420	14.35	9.85	24.20	52.02	-27.82	AVG	
9	0.4220	32.61	9.91	42.52	57.41	-14.89	QP	
10	0.4220	24.61	9.91	34.52	47.41	-12.89	AVG	
11	0.8460	26.44	9.97	36.41	56.00	-19.59	QP	
12	0.8460	17.66	9.97	27.63	46.00	-18.37	AVG	

Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1580	45.55	9.81	55.36	65.56	-10.20	QP	
2	0.1580	22.73	9.81	32.54	55.56	-23.02	AVG	
3	0.1844	43.82	9.83	53.65	64.28	-10.63	QP	
4	0.1844	19.41	9.83	29.24	54.28	-25.04	AVG	
5	0.2040	38.35	9.84	48.19	63.44	-15.25	QP	
6	0.2040	27.16	9.84	37.00	53.44	-16.44	AVG	
7	0.2700	34.81	9.86	44.67	61.12	-16.45	QP	
8	0.2700	15.42	9.86	25.28	51.12	-25.84	AVG	
9	0.4180	30.60	9.91	40.51	57.49	-16.98	QP	
10	0.4180	23.48	9.91	33.39	47.49	-14.10	AVG	
11	0.8420	26.33	9.97	36.30	56.00	-19.70	QP	
12	0.8420	17.83	9.97	27.80	46.00	-18.20	AVG	

7 Radiated Spurious Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method: DA 00-705

Test Result: PASS

Measurement Distance: 3m

Limit:

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Dist	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	2400/F(kHz)	300	10000 * 2400/F(kHz)	$20\log^{(2400/F(kHz))} + 80$
0.490 ~ 1.705	24000/F(kHz)	30	100 * 24000/F(kHz)	$20\log^{(24000/F(kHz))} + 40$
1.705 ~ 30	30	30	100 * 30	$20\log^{(30)} + 40$
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

7.1 EUT Operation :

Operating Environment:

Temperature: 25.5 °C

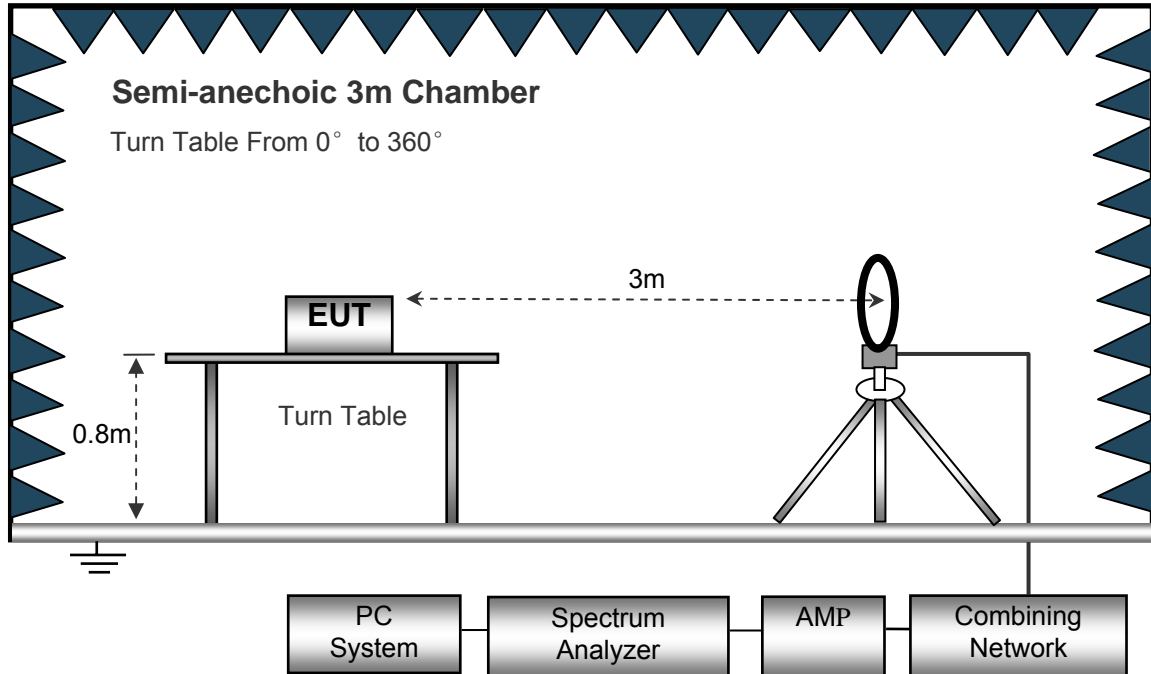
Humidity: 51 % RH

Atmospheric Pressure: 1011 mbar

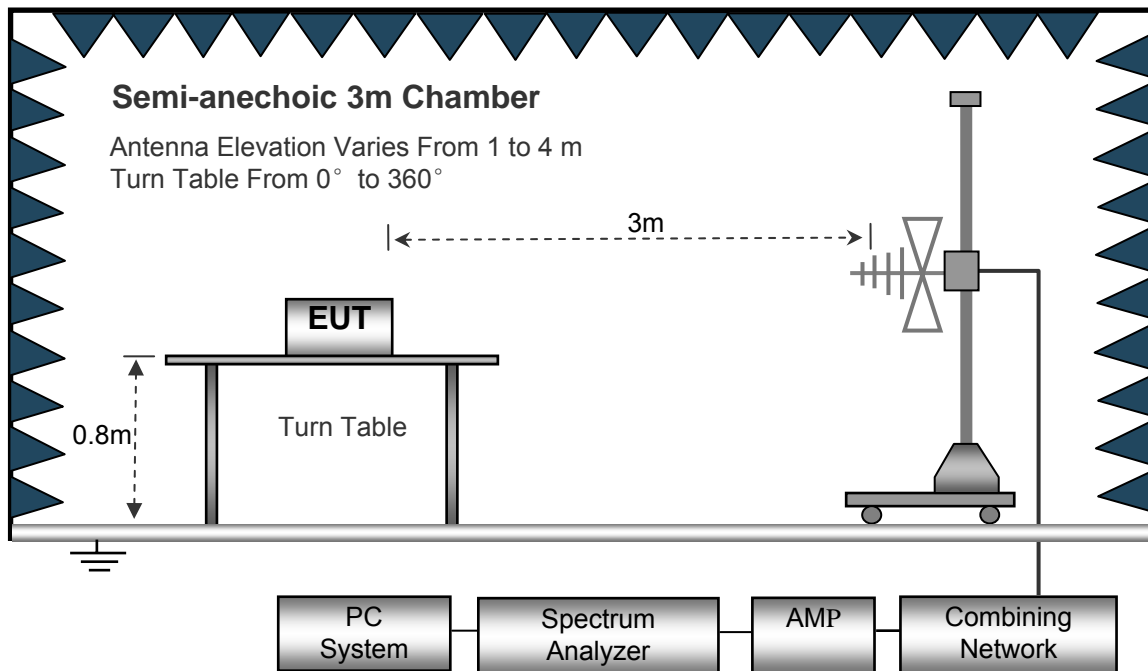
7.2 Test Setup

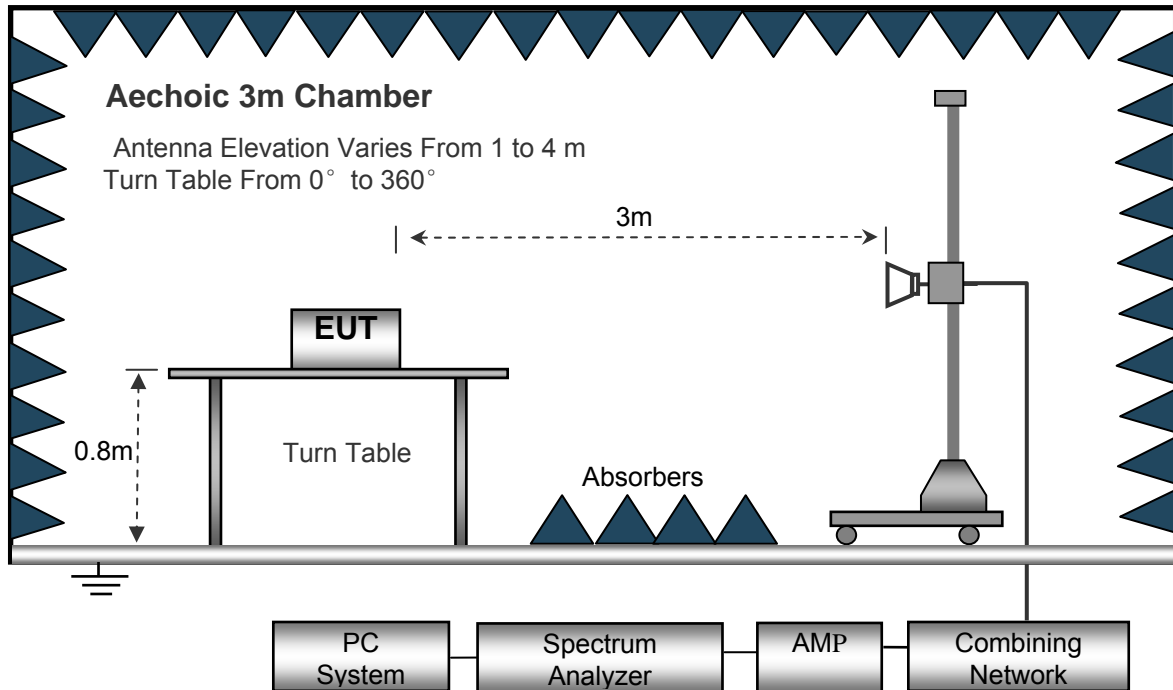
The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.4: 2003.

The test setup for emission measurement below 30MHz.



The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.**7.3 Spectrum Analyzer Setup**

According to FCC Part15 Rules, the system was tested 9kHz to 25000MHz.

Below 30MHz

Sweep SpeedAuto
 IF Bandwidth10KHz
 Video Bandwidth10KHz
 Resolution Bandwidth10KHz

30MHz ~ 1GHz

Sweep SpeedAuto
 IF Bandwidth120 KHz
 Video Bandwidth100KHz
 Quasi-Peak Adapter Bandwidth120 KHz
 Quasi-Peak Adapter ModeNormal
 Resolution Bandwidth100KHz

Above 1GHz

Sweep SpeedAuto
 IF Bandwidth120 KHz
 Video Bandwidth3MHz
 Quasi-Peak Adapter Bandwidth120 KHz
 Quasi-Peak Adapter ModeNormal
 Resolution Bandwidth1MHz

7.4 Test Procedure

1. The EUT is placed on a turntable, which is 0.8m 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 moved from 1m to 4m to find out the maximum 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 radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.

7.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The "Margin" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{Limit}$$

7.6 Summary of Test Results

Test Frequency :Below 30MHz

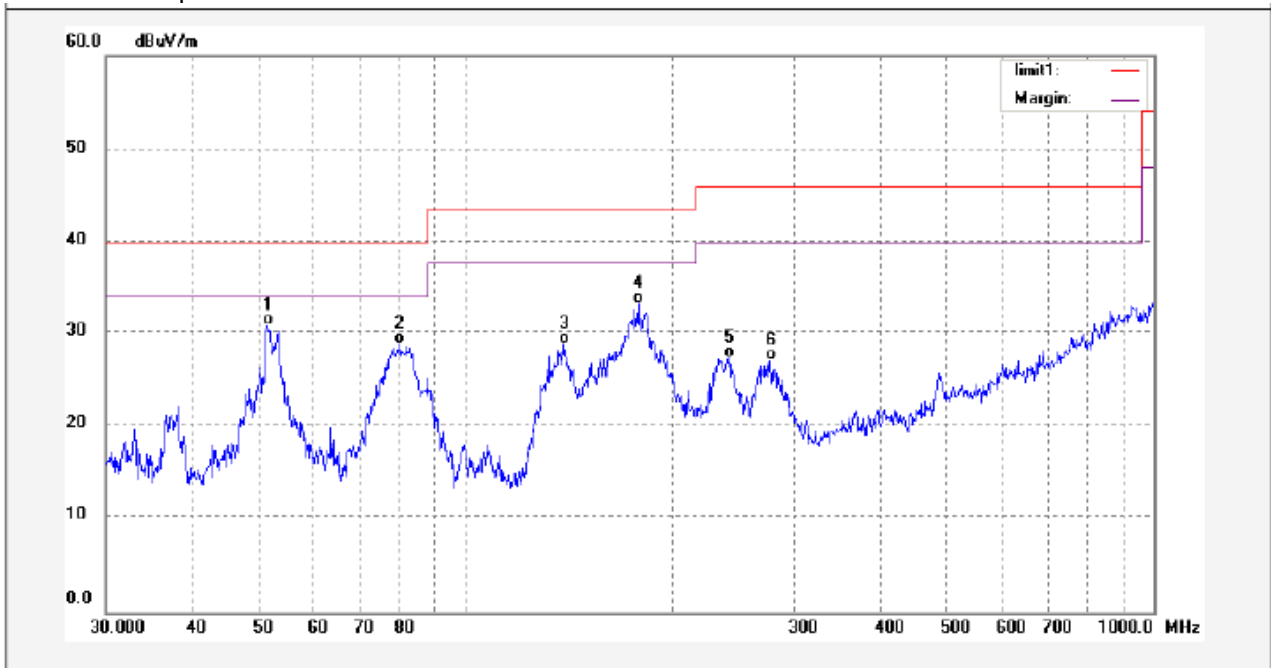
The measurements were more than 20 dB below the limit and not reported.

Test Frequency : 30MHz ~ 1000MHz

Remark: the EUT was pretested at the high, middle and low channel, and the worse case was the low Channel, so the data show was the low channel only.

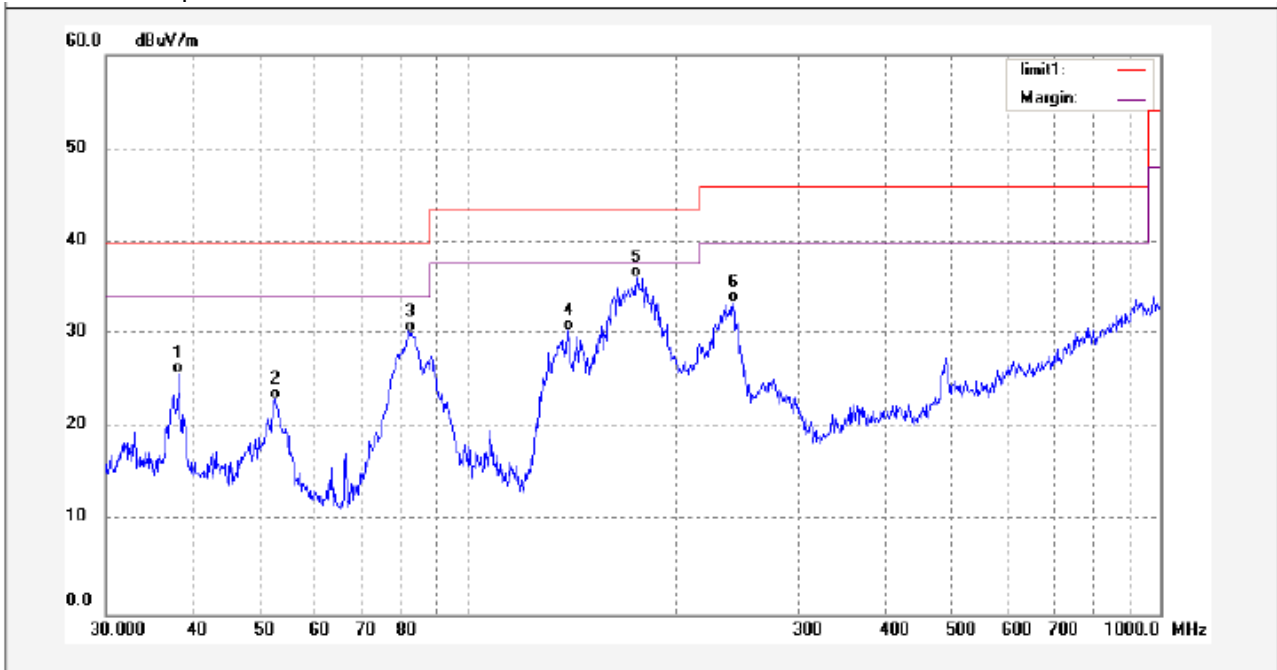
Test mode: Normal Linking

Antenna polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	51.5365	16.20	14.60	30.80	40.00	-9.20	QP	
2	80.2383	19.64	9.24	28.88	40.00	-11.12	QP	
3	138.8120	17.22	11.70	28.92	43.50	-14.58	QP	
4	178.1426	20.59	12.57	33.16	43.50	-10.34	QP	
5	241.8377	12.57	14.74	27.31	46.00	-18.69	QP	
6	277.3546	10.78	16.23	27.01	46.00	-18.99	QP	

Antenna polarization: Horizontal



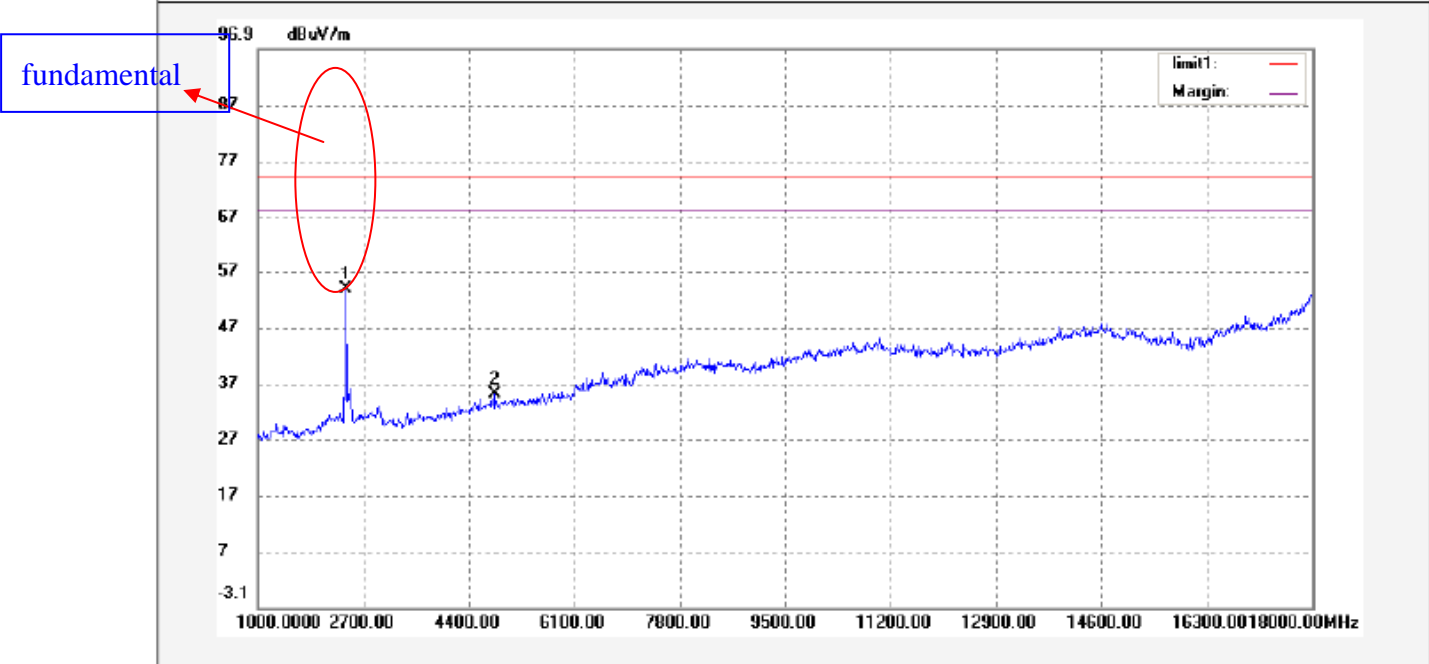
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	38.2305	9.06	16.67	25.73	40.00	-14.27	QP	
2	52.6345	8.59	14.44	23.03	40.00	-16.97	QP	
3	82.2363	20.71	9.59	30.30	40.00	-9.70	QP	
4	139.3006	18.78	11.65	30.43	43.50	-13.07	QP	
5	175.0404	23.88	12.23	36.11	43.50	-7.39	QP	
6	241.8377	18.63	14.74	33.37	46.00	-12.63	QP	

Test Frequency: 1GHz ~ 18GHz

AV = Peak +20Log₁₀(duty cycle) =PK+(-9)=PK-9 [refer to section 8 for more detail]

Test Channel: TX2402MHz

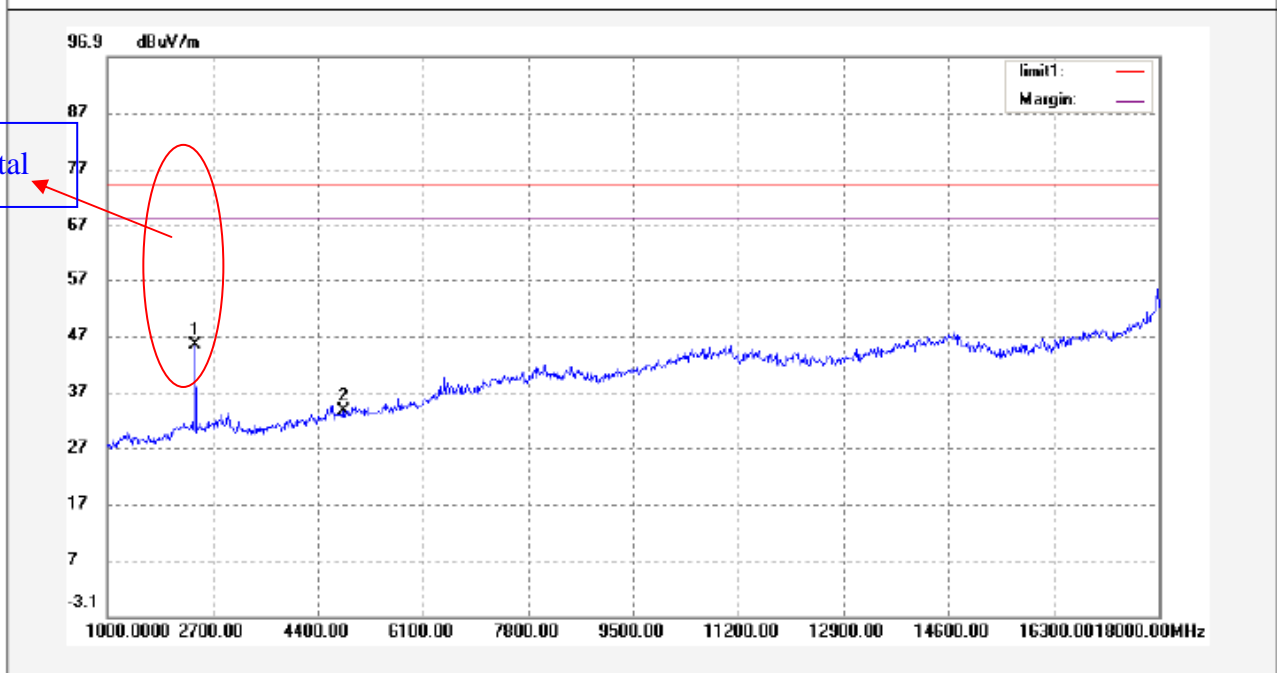
Antenna polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2402.000	69.39	-15.58	53.81	74.00	-20.19	peak	
2	4804.000	46.99	-11.97	35.02	74.00	-38.98	peak	

No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2402.000	-9	44.81	54	-9.19	AV	
2	4804.000	-9	26.02	54	-27.98	AV	

Antenna polarization: Horizontal



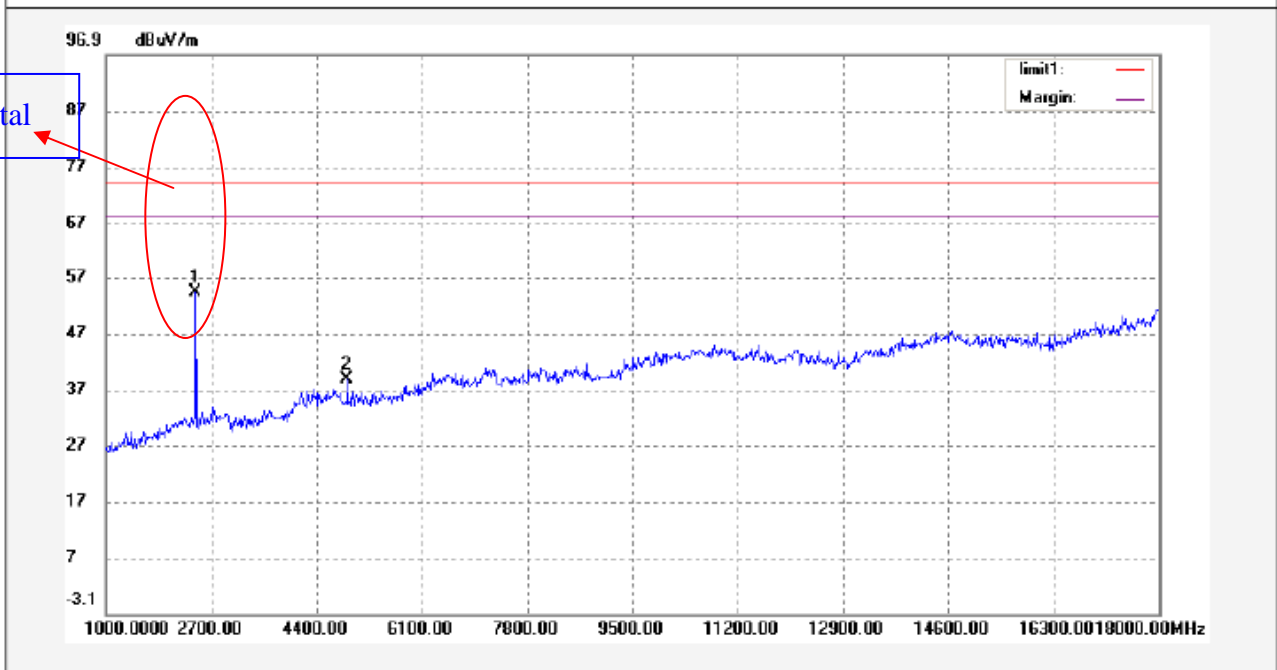
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2402.000	60.87	-15.58	45.29	74.00	-28.71	peak	
2	4804.000	45.38	-11.97	33.41	74.00	-40.59	peak	

No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2402.000	-9	36.29	54	-17.71	AV	
2	4804.000	-9	24.41	54	-29.59	AV	

Test Frequency: 1GHz ~ 18GHz

Test Channel: TX2440MHz

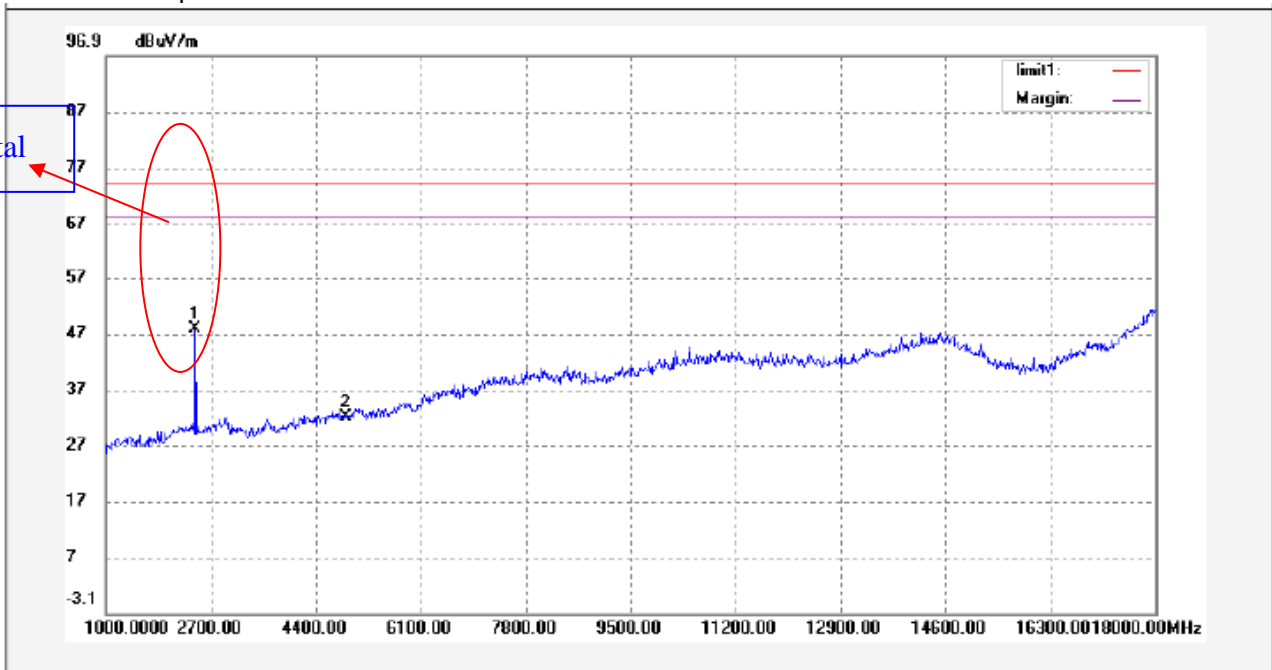
Antenna polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2441.000	69.96	-15.70	54.26	74.00	-19.74	peak	
2	4882.000	50.81	-11.92	38.89	74.00	-35.11	peak	

No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2441.000	-9	45.26	54	-8.74	AV	
2	4882.000	-9	29.89	54	-24.11	AV	

Antenna polarization: Horizontal

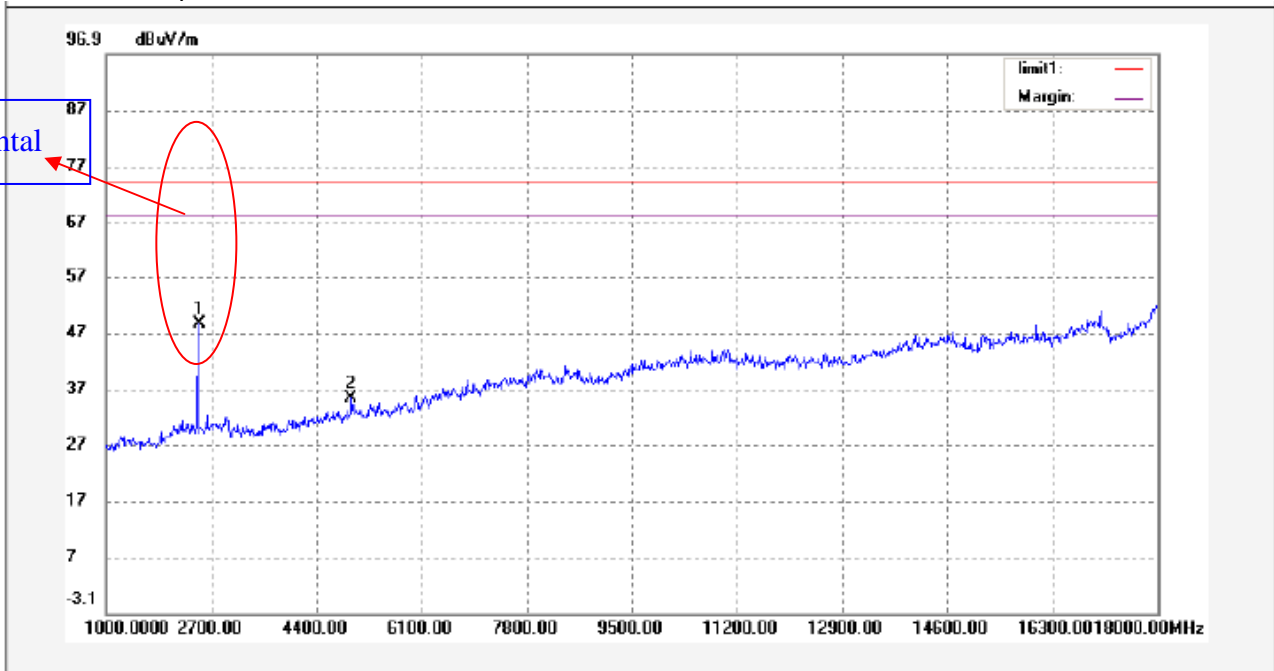


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2441.000	63.48	-15.70	47.78	74.00	-26.22	peak	
2	4882.000	43.97	-11.92	32.05	74.00	-41.95	peak	

No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2441.000	-9	38.78	54	-15.22	AV	
2	4882.000	-9	23.05	54	-30.95	AV	

Test Channel: TX2480MHz

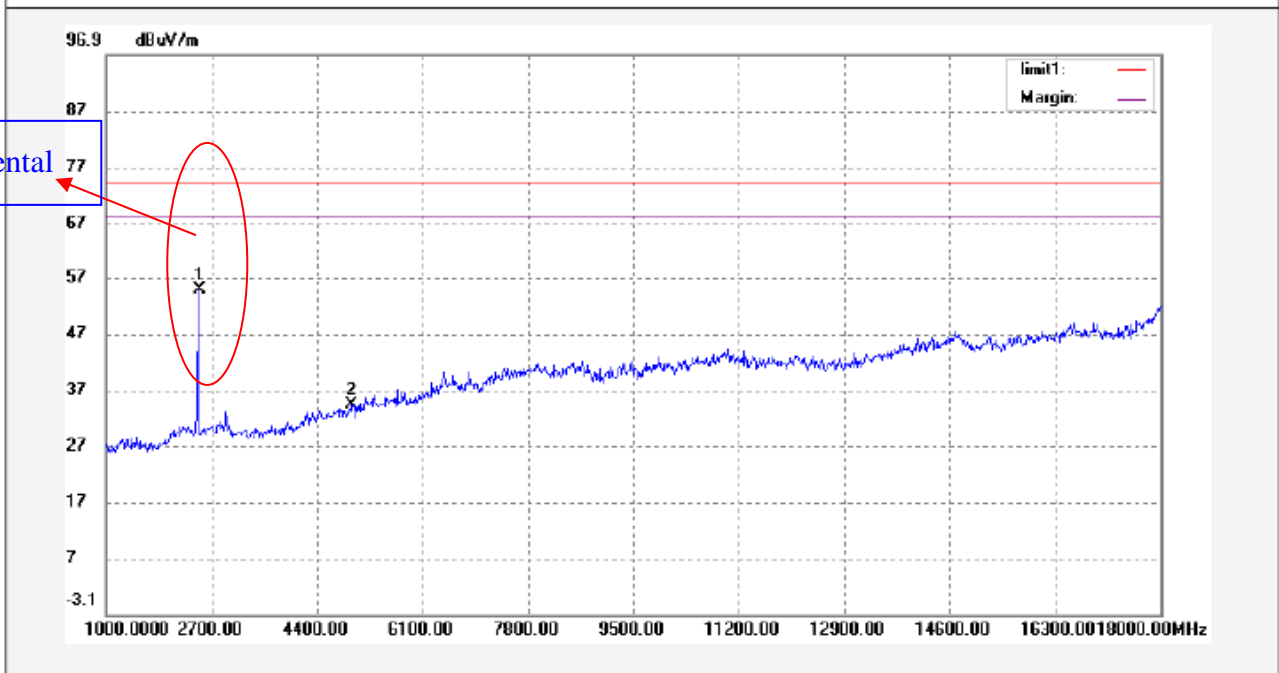
Antenna polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2480.000	64.32	-15.68	48.64	74.00	-25.36	peak	
2	4960.000	47.14	-11.77	35.37	74.00	-38.63	peak	

No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2480.000	-9	39.64	54	-14.36	AV	
2	4960.000	-9	26.37	54	-27.63	AV	

Antenna polarization: Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2480.000	70.49	-15.68	54.81	74.00	-19.19	peak	
2	4960.000	46.11	-11.77	34.34	74.00	-39.66	peak	

No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2480.000	-9	45.81	54	-8.19	AV	
2	4960.000	-9	25.34	54	-28.66	AV	

Test Frequency :Above 18GHz

The measurements were more than 20 dB below the limit and not reported

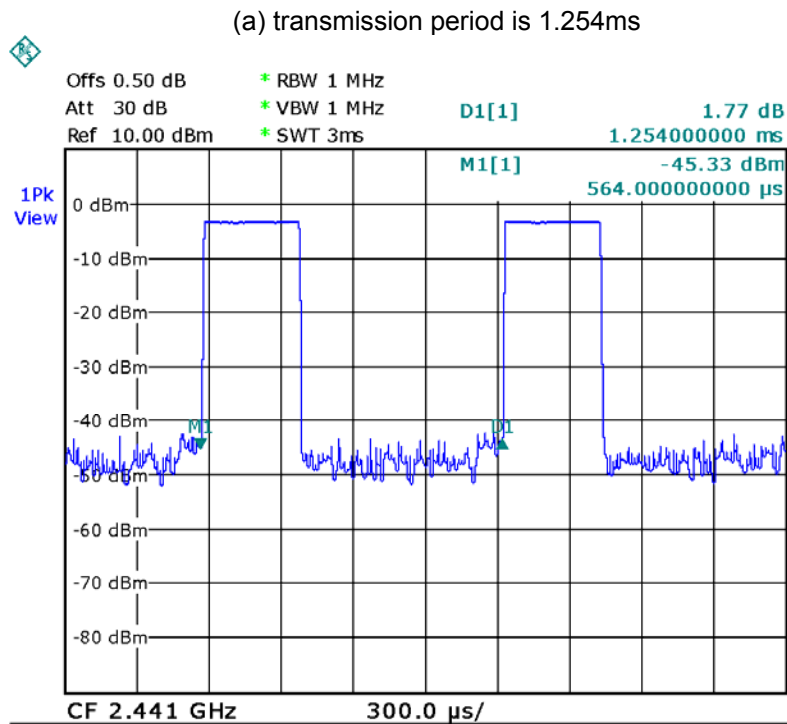
8 Duty Cycle

Test Requirement: FCC Part 15.35
Test Method: ANSI C63.4:2003
Test Status: TX mode.

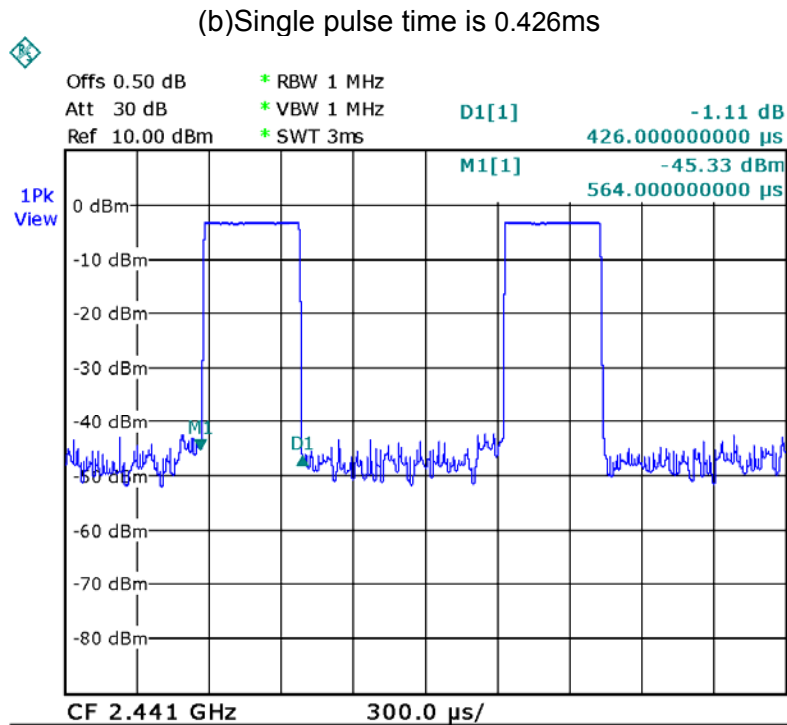
8.1 Test Procedure

1. The EUT was placed on a turntable which is 0.8m above ground plane
2. Set EUT as normal working mode
3. Set SPA center frequency = fundamental frequency, RBW = 1000 kHz, VBW = 1000 kHz, Span = 0 Hz, Adjacent sweep time.

8.2 Test Result



Date: 15.JUN.2013 17:12:18



Date: 15.JUN.2013 17:12:04

The EUT is auto. operation for transmitter, it is declared by the manufacturer as a duty cycle ratio of less than 100%.

The EUT's work time : T_{on} = pulse time = 0.426 ms

The EUT's work period : $T = T_{ON} + T_{OFF}$ = transmission period = 1.254 ms

The EUT's duty cycle : $D = T_{on} / T = 0.426 / 1.254 * 100\% = 34\%$

Duty Cycle Correction Factor(dB) = $20 * \log_{10}(\text{Duty Cycle}) = 20 * \log_{10}(34\%)$

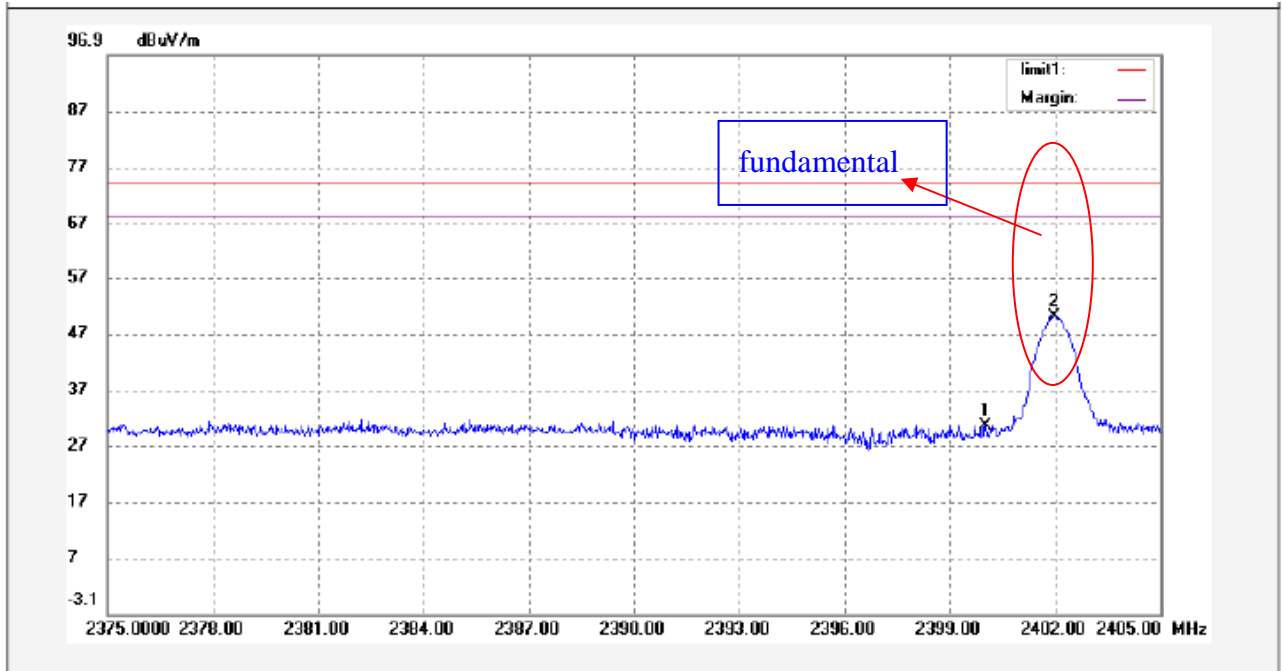
= -9dB

9 Band Edge Measurement

Test Requirement:	Section 15.247(d) In addition, radiated emissions which fall in the restricted bands. as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).
Test Method:	DA 00-705
Measurement Distance:	3m
Limit:	40.0 dBuV/m between 30MHz & 88MHz; 43.5 dBuV/m between 88MHz & 216MHz; 46.0 dBuV/m between 216MHz & 960MHz; 54.0 dBuV/m above 960MHz. 74.0 dBuV/m for peak above 1GHz 54.0 dBuV/m for AVG above 1GHz
Detector:	For Peak value: RBW = 1 MHz for $f \geq 1$ GHz VBW \geq RBW; Sweep = auto Detector function = peak Trace = max hold For AVG value: RBW = 1 MHz for $f \geq 1$ GHz VBW = 10Hz; Sweep = auto Detector function d= AVG Trace = max hold
Test Mode:	continuous transmitting

9.1 Test Result:

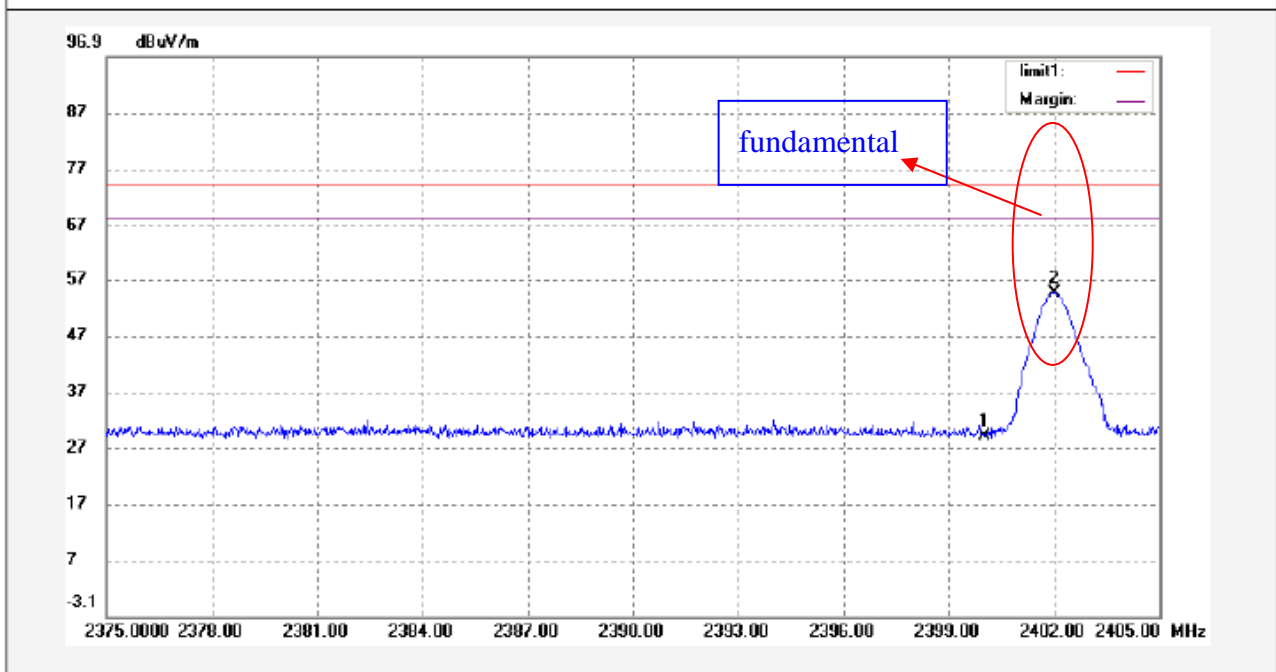
Lower Channel –Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2400.000	46.18	-15.58	30.60	74.00	-43.40	peak	
2	2401.970	65.49	-15.58	49.91	74.00	-24.09	peak	

No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2400.000	-9	21.60	54	-32.40	AV	
2	2401.970	-9	40.91	54	-13.09	AV	

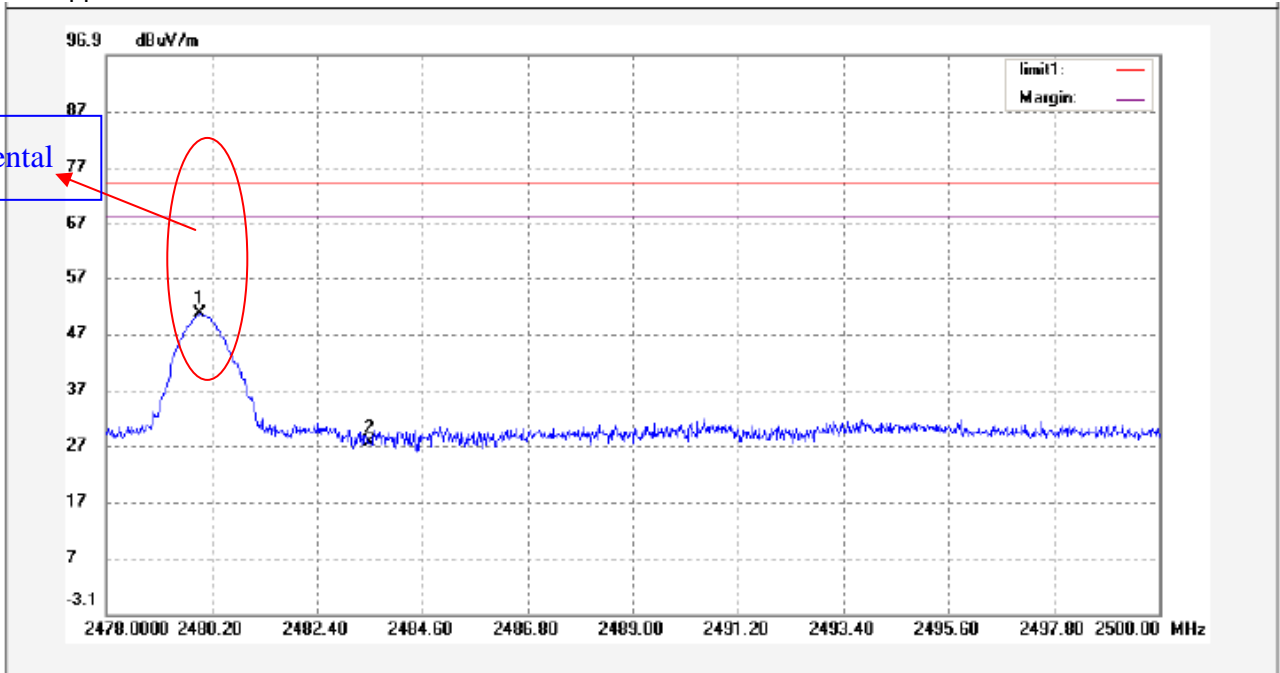
Lower Channel –Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2400.000	44.67	-15.58	29.09	74.00	-44.91	peak	
2	2402.000	70.17	-15.58	54.59	74.00	-19.41	peak	

No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2400.000	-9	20.09	54	-33.91	AV	
2	2402.000	-9	45.59	54	-8.41	AV	

Upper Channel – Vertical

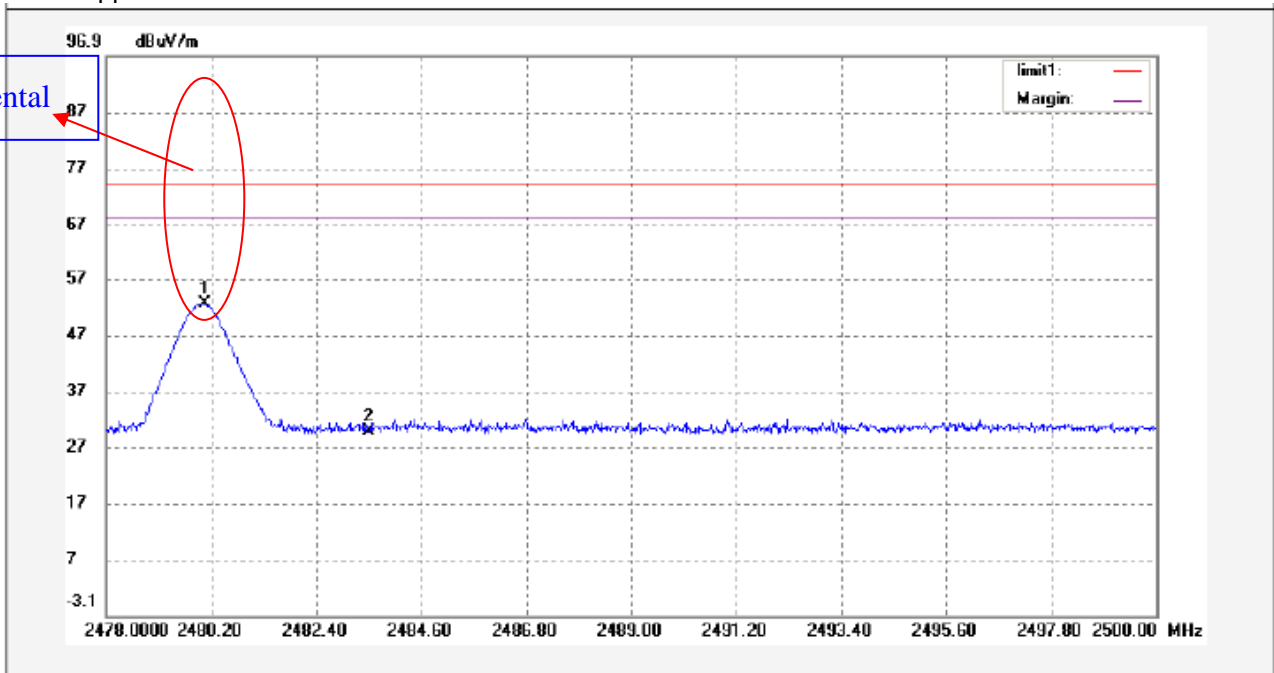


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2479.958	66.16	-15.68	50.48	74.00	-23.52	peak	
2	2483.500	43.10	-15.67	27.43	74.00	-46.57	peak	

No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2479.958	-9	41.48	54	-12.52	AV	
2	2483.500	-9	18.43	54	-35.57	AV	

Upper Channel –Horizontal

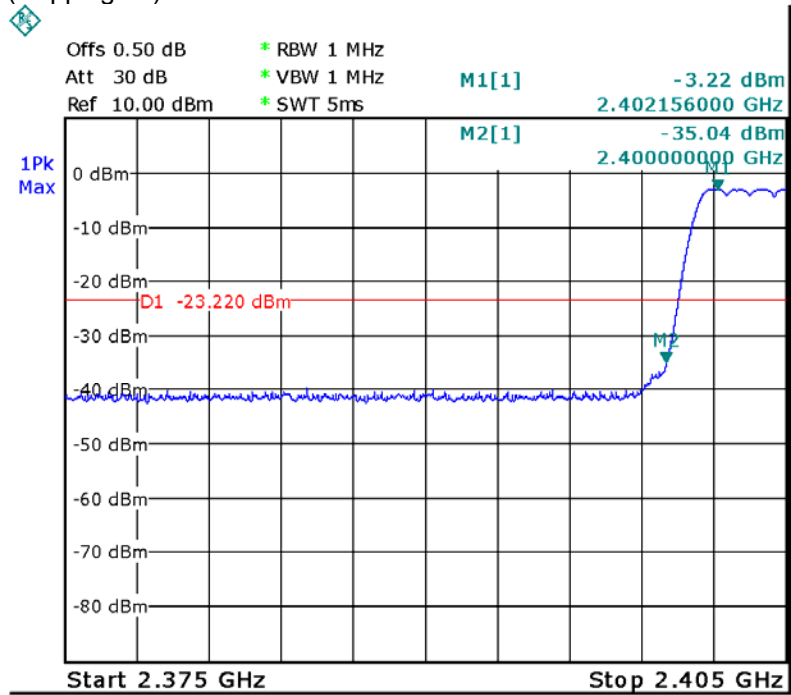
fundamental



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2480.068	68.32	-15.68	52.64	74.00	-21.36	peak	
2	2483.500	45.50	-15.67	29.83	74.00	-44.17	peak	

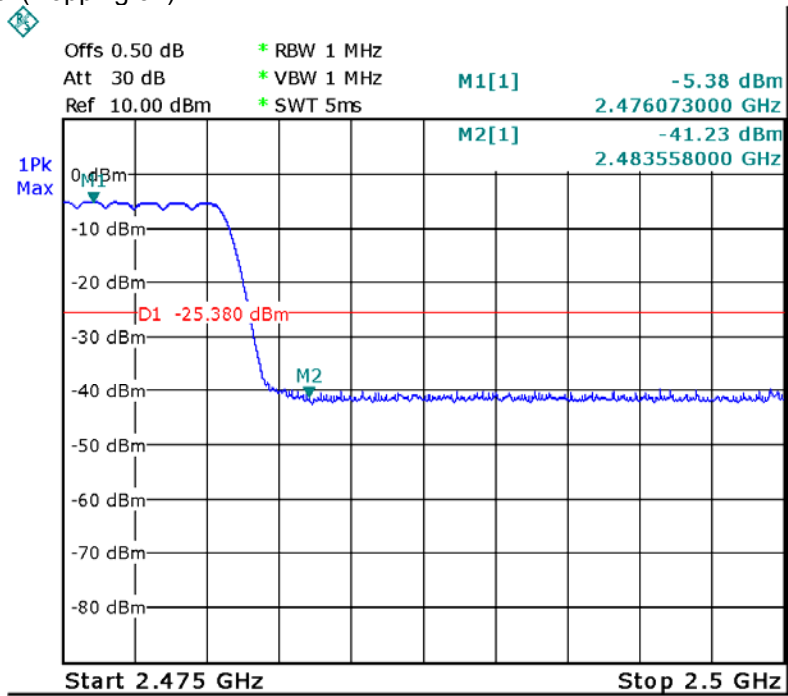
No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2479.958	-9	43.64	54	-10.36	AV	
2	2483.500	-9	20.83	54	-33.17	AV	

Lower Channel (Hopping on)



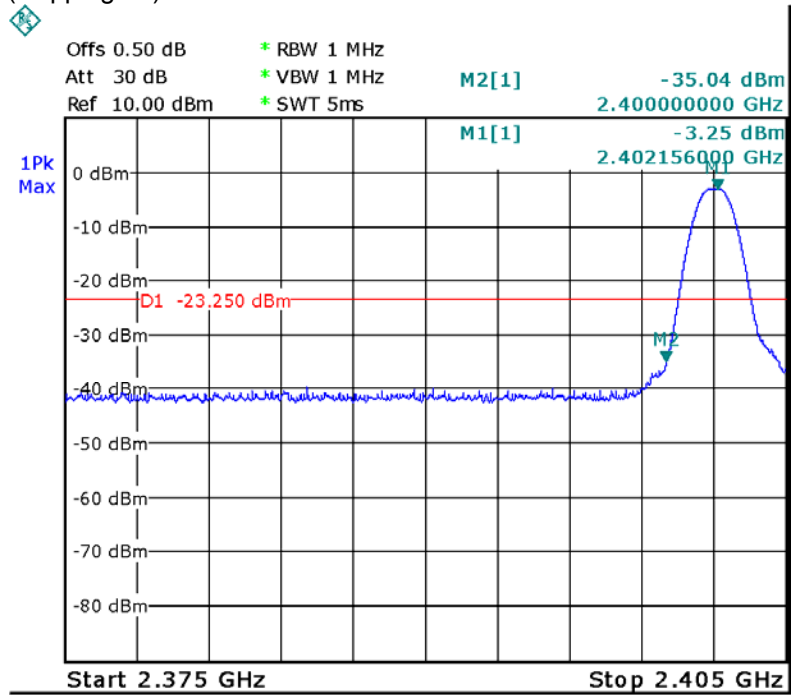
Date: 15.JUN.2013 17:19:40

Upper Channel (Hopping on)



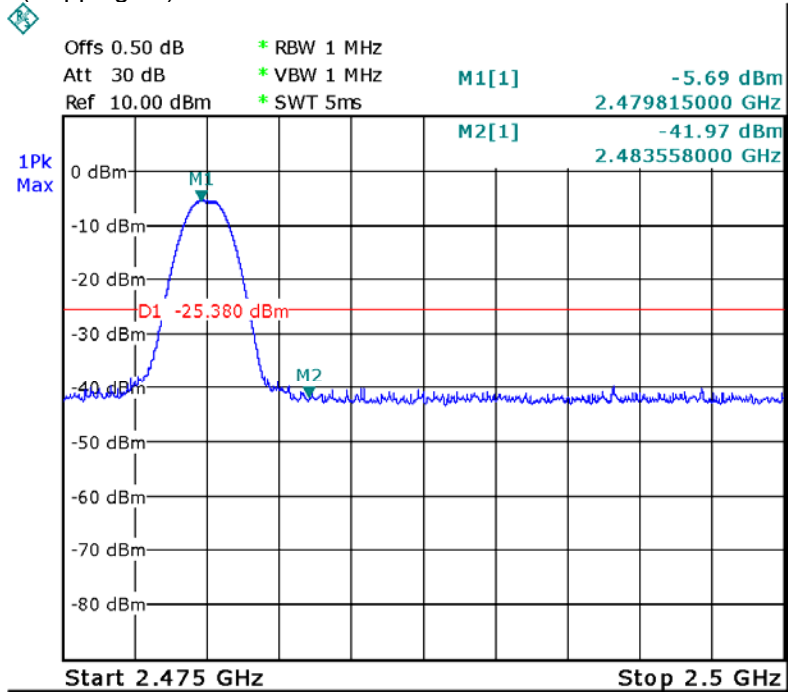
Date: 15.JUN.2013 17:21:32

Lower Channel (Hopping off)



Date: 15.JUN.2013 17:19:03

Upper Channel (Hopping off)



Date: 15.JUN.2013 17:21:49

10 20 dB Bandwidth Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.247
 Test Method: DA 00-705
 Test Mode: Test in fixing operating frequency at low, Middle, high channel.

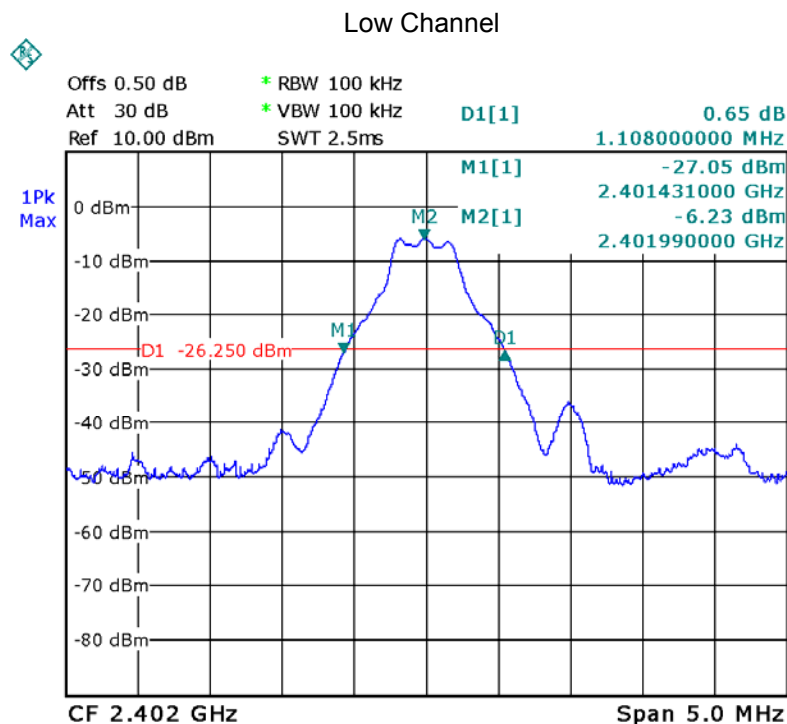
10.1 Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 100kHz

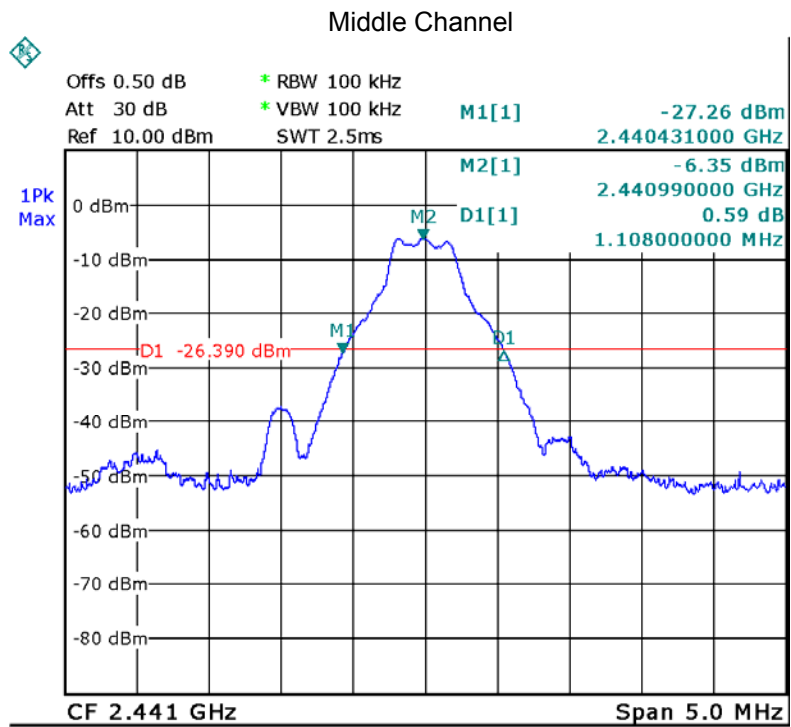
10.2 Test Result:

Test Channel	Bandwidth
Low	1.108MHz
Middle	1.108MHz
High	1.108MHz

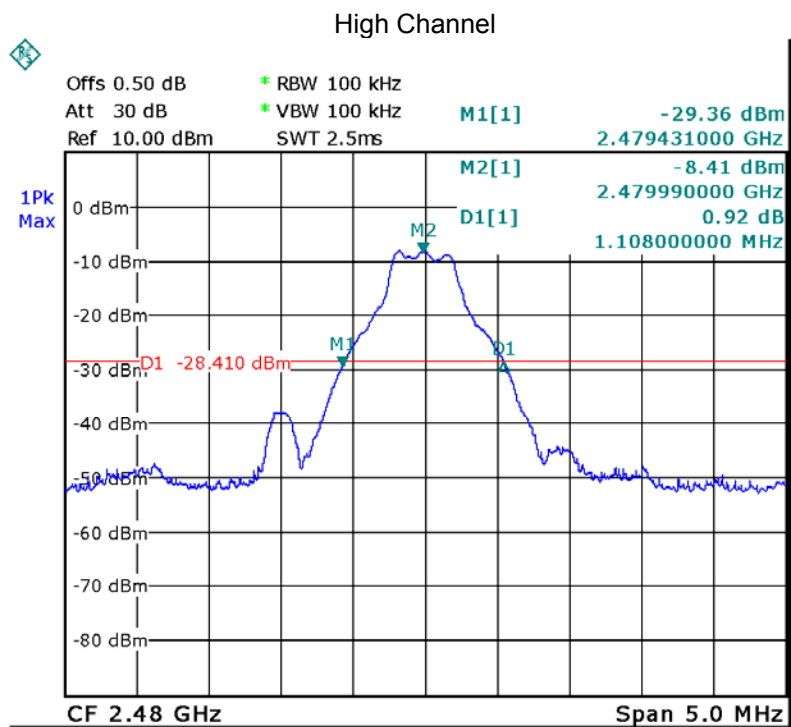
Test result plot as follows:



Date: 15.JUN.2013 16:54:02



Date: 15.JUN.2013 16:54:59



Date: 15.JUN.2013 16:55:57

11 Maximum Peak Output Power

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	DA 00-705
Test Limit:	Regulation 15.247 (b)(1), For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts. Refer to the result "Number of Hopping Frequency" of this document. The 0.125watts (20.97 dBm) limit applies.
Test mode:	Test in fixing frequency transmitting mode.

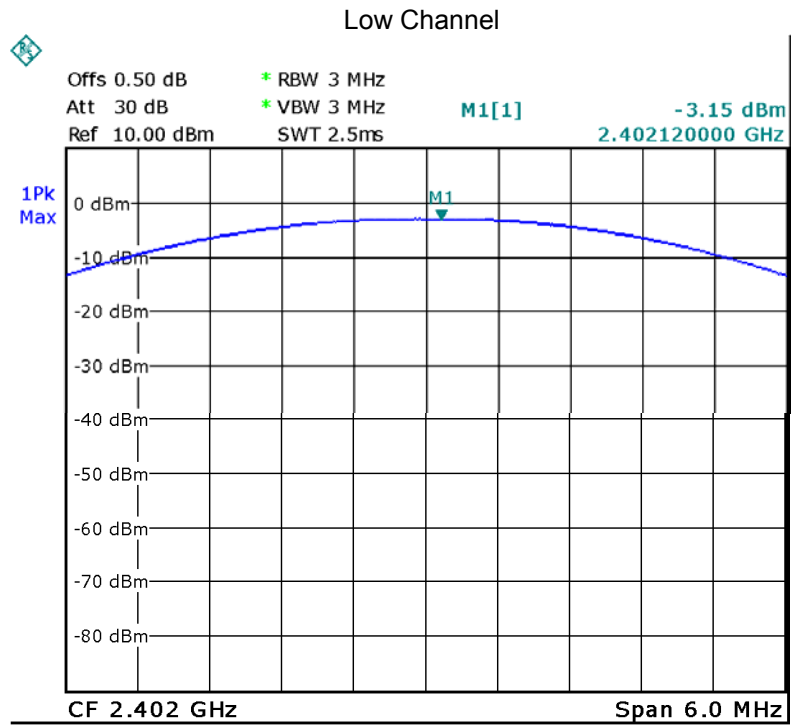
11.1 Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 3 MHz. VBW = 3 MHz. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

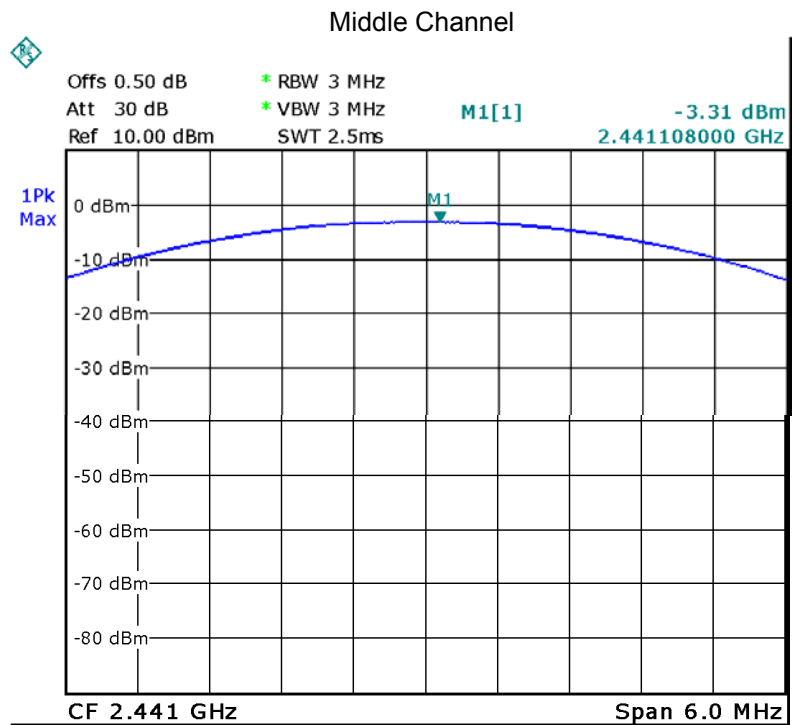
11.2 Test Result:

Test Channel	Output Power (dBm)	Limit (dBm)
Low	-3.15	20.97
Middle	-3.31	20.97
High	-5.56	20.97

Test result plot as follows:

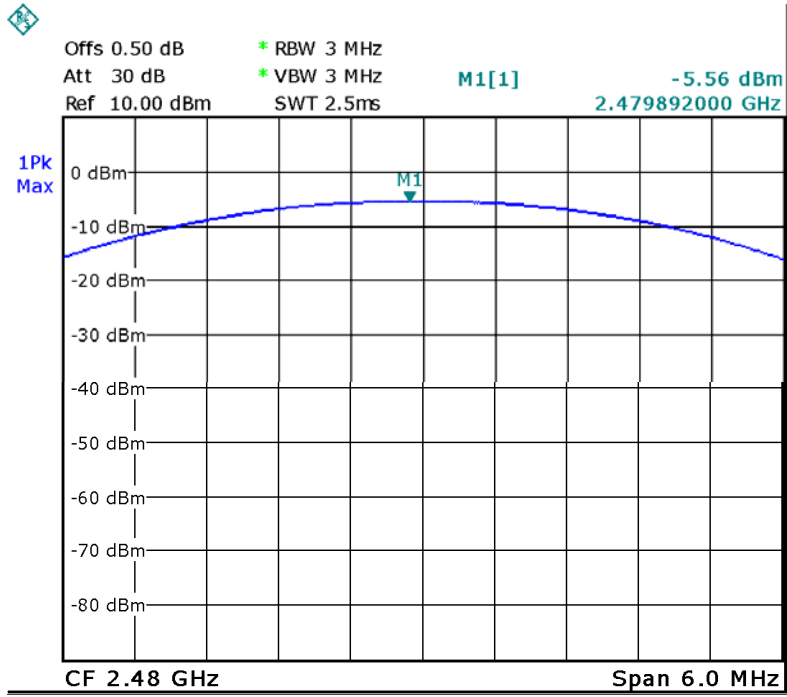


Date: 15.JUN.2013 17:00:36



Date: 15.JUN.2013 17:01:18

High Channel



Date: 15.JUN.2013 17:01:48

12 Hopping Channel Separation

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: DA 00-705

Test Limit: Regulation 15.247(a)(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 1W.

Test Mode: Test in hopping transmitting operating mode.

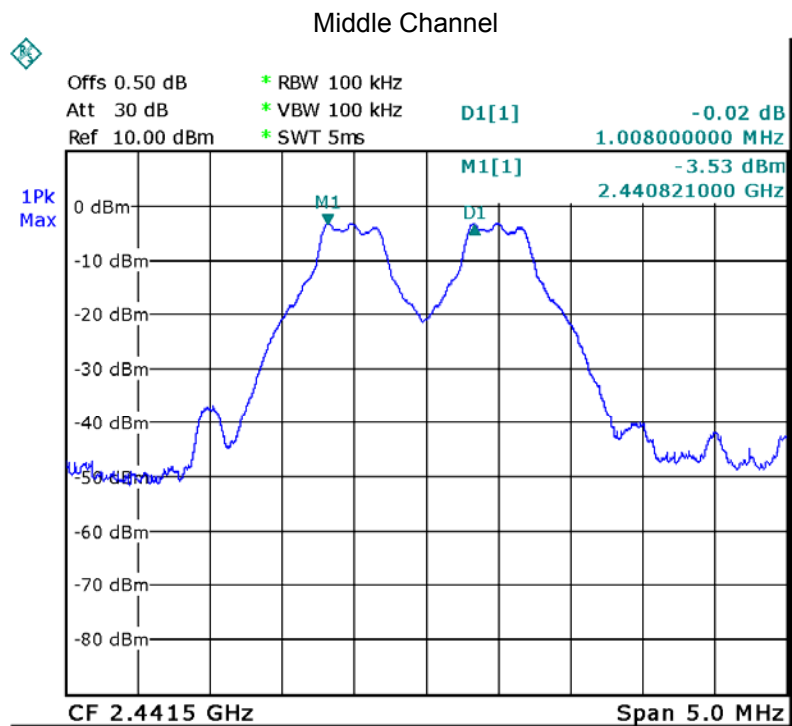
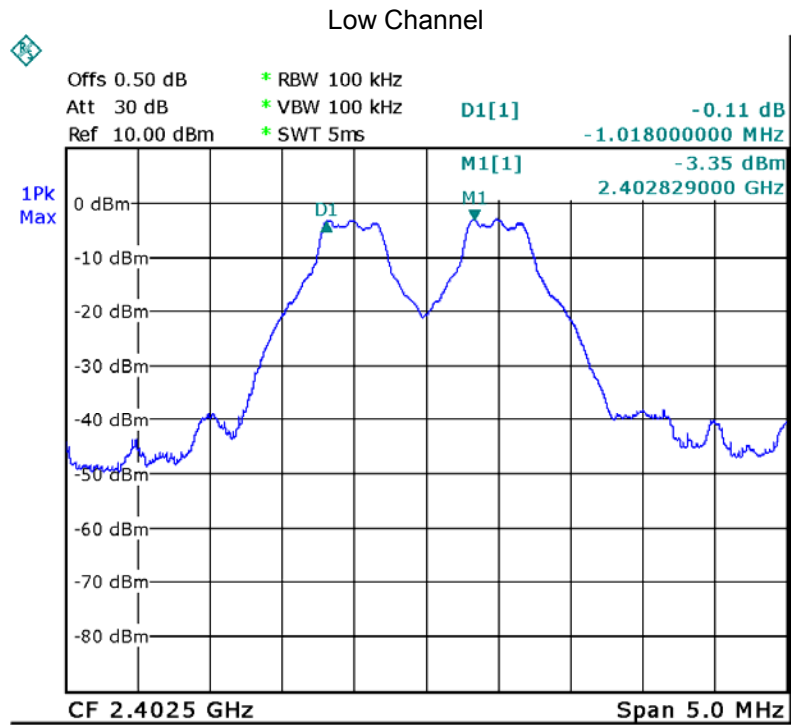
12.1 Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 100kHz. VBW = 100kHz , Span = 4MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.

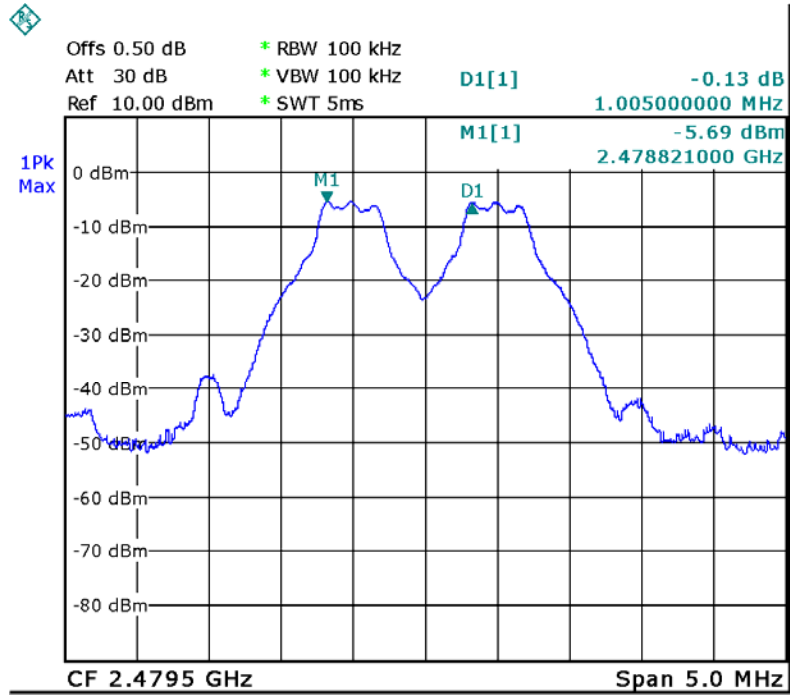
12.2 Test Result:

Test Channel	Separation (MHz)	Result
Low	1.018	PASS
Middle	1.008	PASS
High	1.005	PASS

Test result plot as follows:



High Channel



Date: 15.JUN.2013 17:17:11

13 Number of Hopping Frequency

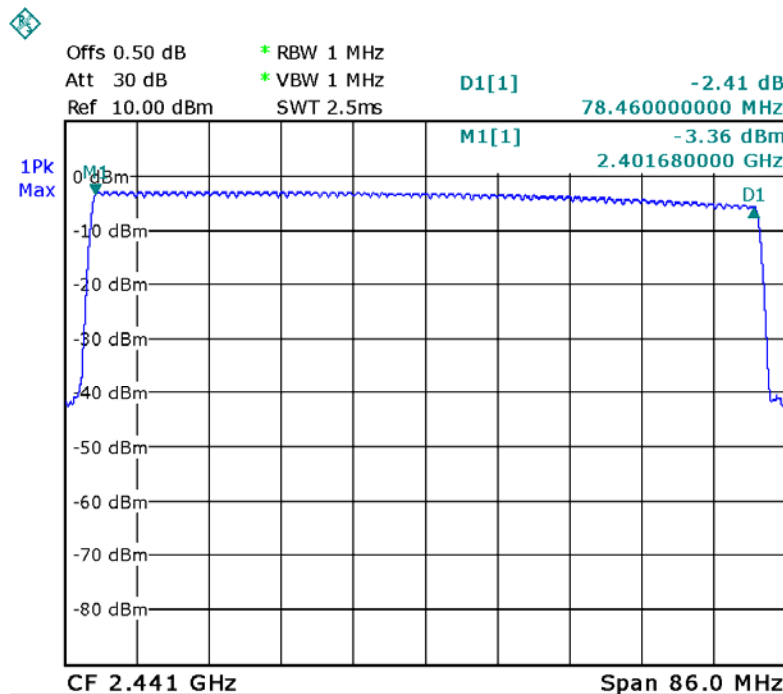
Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	DA 00-705
Test Limit:	Regulation 15.247 (a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.
Test Mode:	Test in hopping transmitting operating mode.

13.1 Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 1MHz. VBW = 1MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.
4. Set the spectrum analyzer: Start Frequency = 2.4GHz, Stop Frequency = 2.483GHz. Sweep=auto;

13.2 Test Result:

Total Channels are 79 Channels.



Date: 15.JUN.2013 17:03:20

14 Dwell Time

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	DA 00-705
Test Limit:	Regulation 15.247(a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.
Test Mode:	Test in hopping transmitting operating mode.

14.1 Test Procedure:

- 1.Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
- 2.Set spectrum analyzer span = 0. centered on a hopping channel;
- 3.Set RBW = 1MHz and VBW = 1MHz.Sweep = as necessary to capture the entire dwell time per hopping channel.
- 4.Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g.. data rate. modulation format. etc.). repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

14.2 Test Result:

The test period: $T = 0.4(s) * 79 = 31.6 (s)$

So, the Dwell Time can be calculated as follows:

Low channel: Dwell Time = $51 (\text{times}) / 5(s) * 0.424(\text{ms}) * 31.6(s) = 0.137(s)$

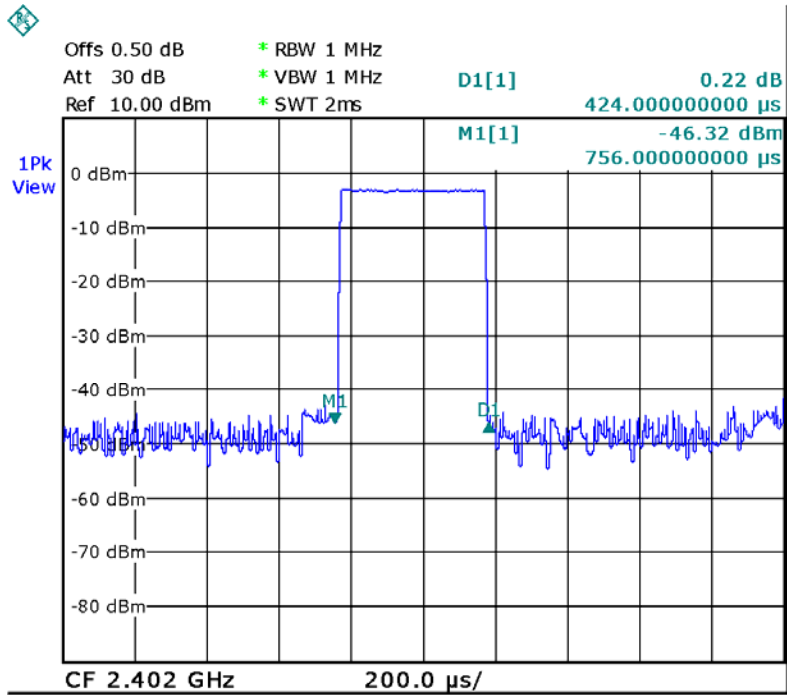
Middle channel: Dwell Time = $50(\text{times}) / 5(s) * 0.420(\text{ms}) * 31.6(s) = 0.133(s)$

High channel: Dwell Time = $51(\text{times}) / 5(s) * 0.424(\text{ms}) * 31.6(s) = 0.137(s)$

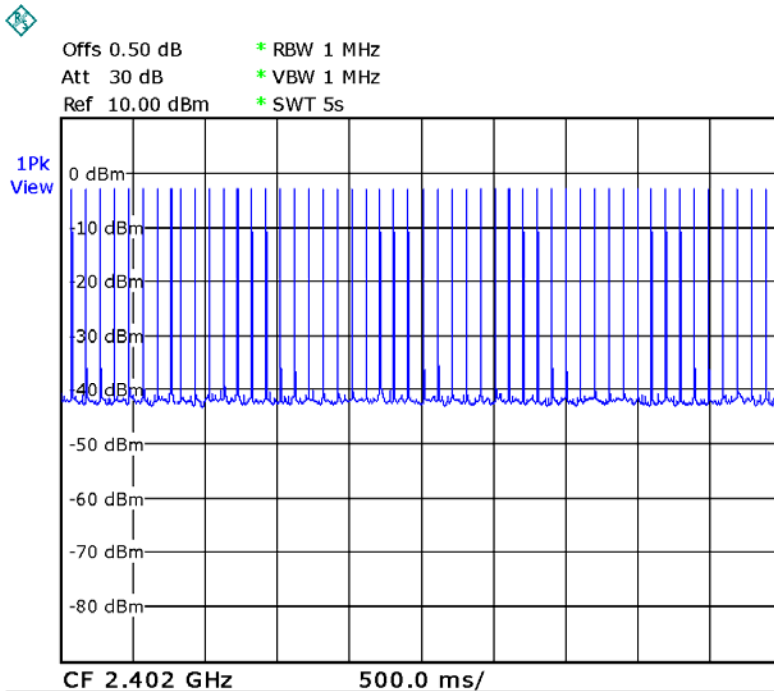
Note : Mkr Delta is once pulse time.

Frequency	Mkr Delta(ms)	Dwell Time(s)	Limits(s)	Result
2402 MHz	0.424	0.137	0.400	Pass
2440 MHz	0.420	0.133	0.400	Pass
2478 MHz	0.424	0.137	0.400	Pass

Low Channel

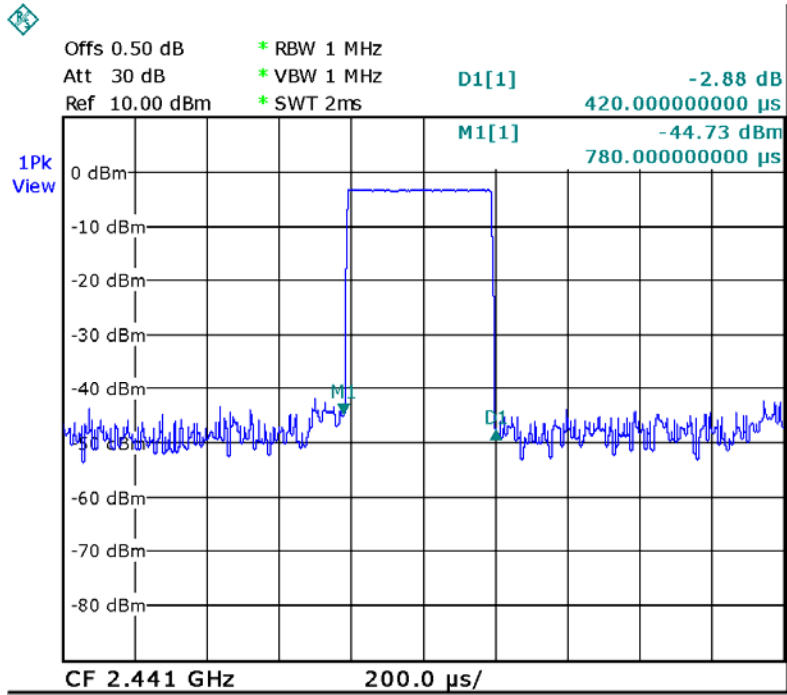


Date: 15.JUN.2013 17:06:55

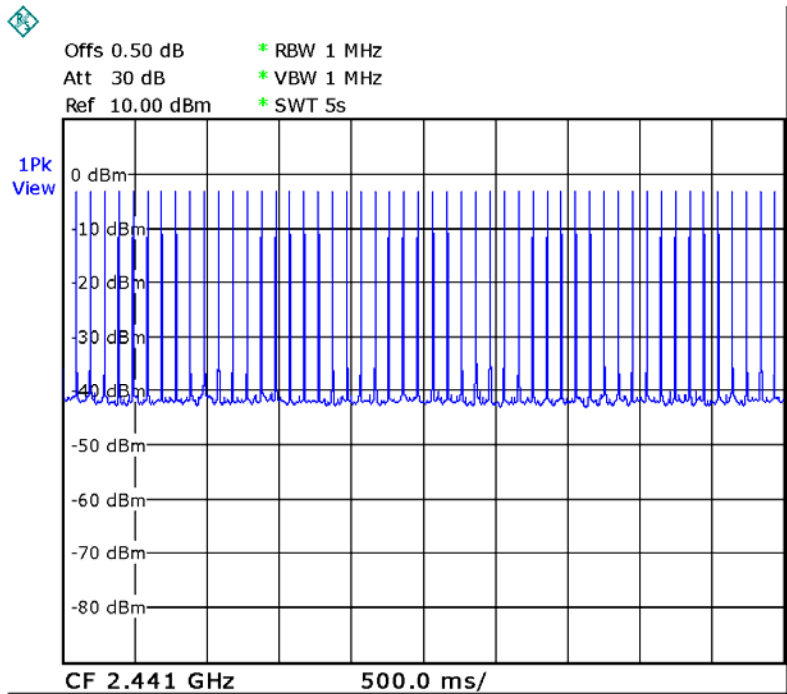


Date: 15.JUN.2013 17:05:54

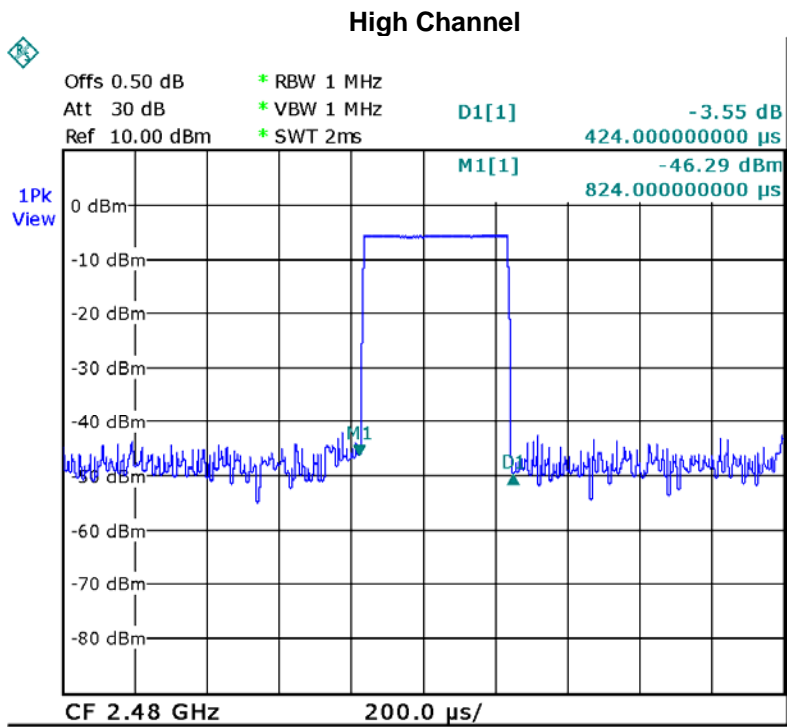
Middle Channel



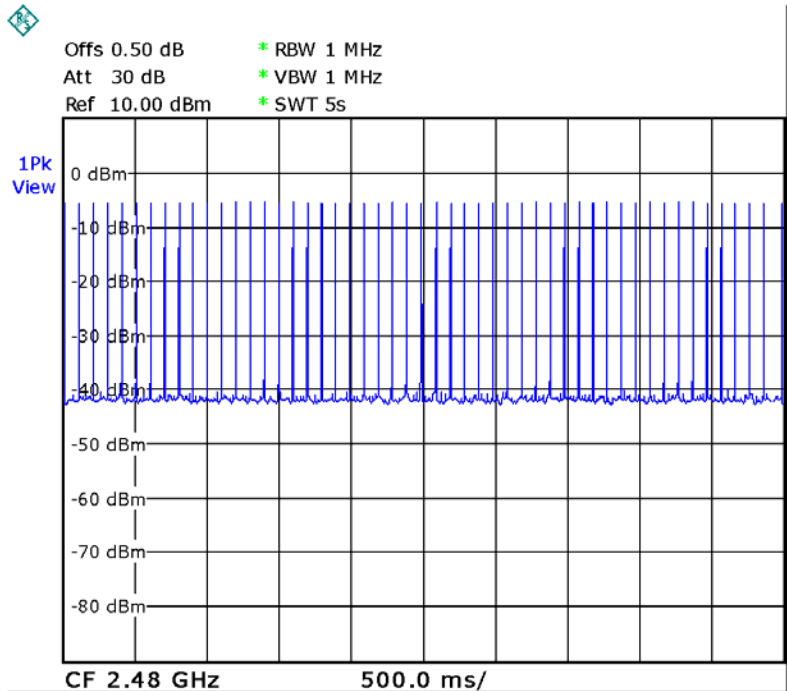
Date: 15.JUN.2013 17:08:37



Date: 15.JUN.2013 17:07:36



Date: 15.JUN.2013 17:09:32



Date: 15.JUN.2013 17:10:01

15 Antenna Requirement

According to the FCC Part 15 Paragraph 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. This product has a permanent antenna, fulfill the requirement of this section.

16 RF Exposure

Test Requirement:	FCC Part 1.1307
Test Method	KDB 447498 D01 General RF Exposure Guidance v05
Test Mode:	The EUT work in test mode(Tx).

16.1 Requirments:

1) The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$ for 1-g SAR and ≤ 7.5 for 10-g extremity SAR where

1. $f(\text{GHz})$ is the RF channel transmit frequency in GHz
2. Power and distance are rounded to the nearest mW and mm before calculation
3. The result is rounded to one decimal place for comparison

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

16.2 Test Result

Conducted Peak power(mW)	Source-based time-averaged maximum conducted output power(mW)	Minimum test separation distance required for the exposure conditions (mm)	SAR Test Exclusion Thresholds(mW)
0.484	0.165	5	10

Remark:Duty factor is 34%,refer to section 8 for more details.

Calculation formula: Source-based time-averaged maximum conducted output power(mW)
 =Conducted peak power(mW)*Duty factor

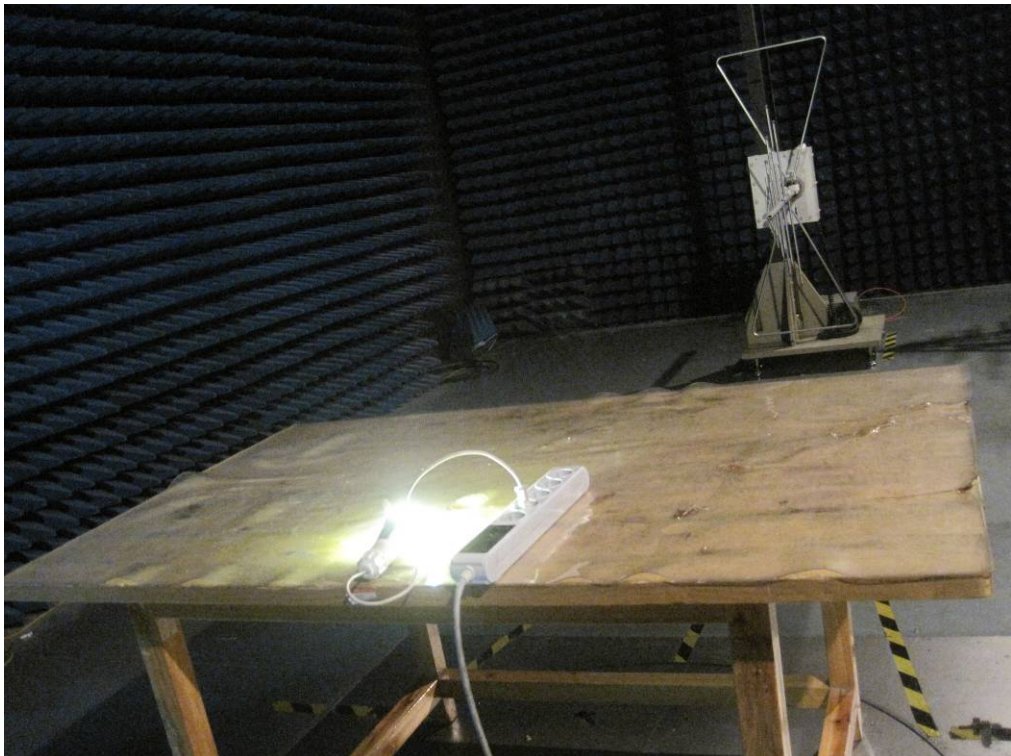
17 Photographs – Test Setup

17.1 Photograph – Radiation Spurious Emission Test Setup

Below 30MHz



30MHz-1GHz



Above 1GHz



17.2 Photograph – Conducted Emission Test Setup



18 Photographs - Constructional Details

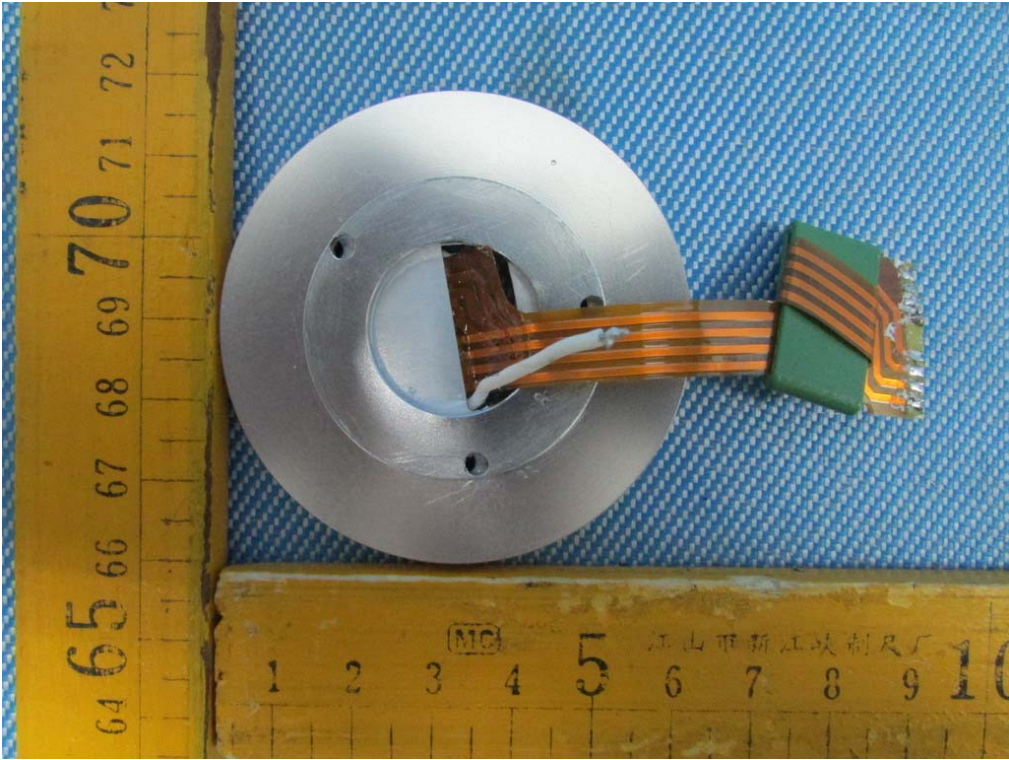
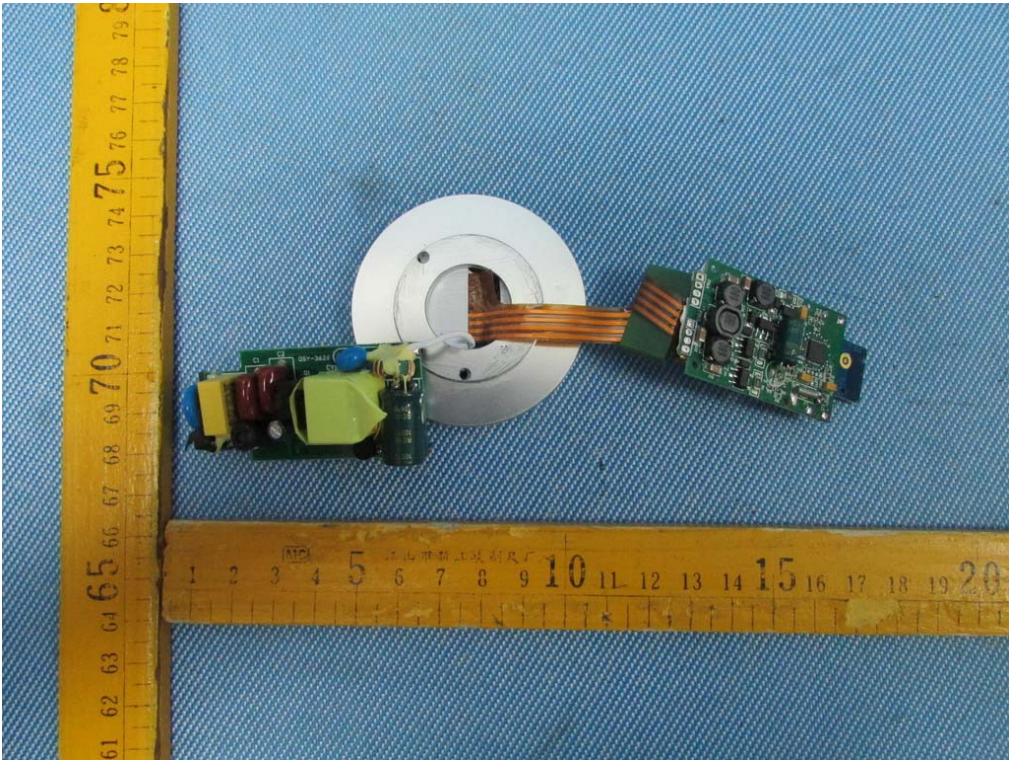
18.1 External View

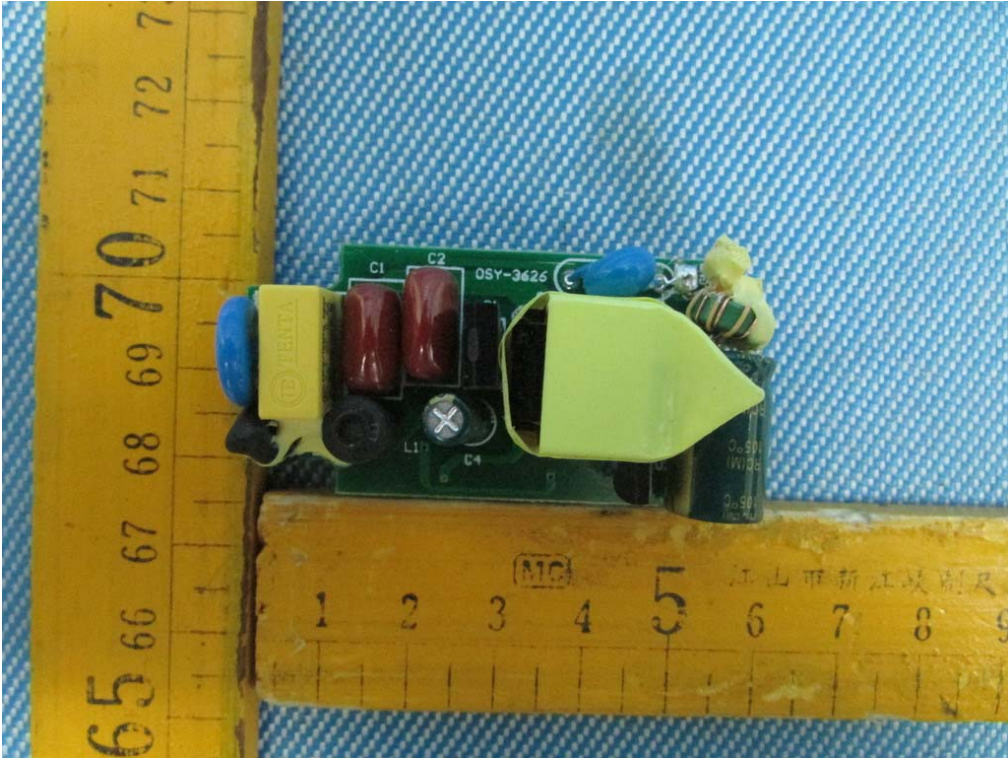


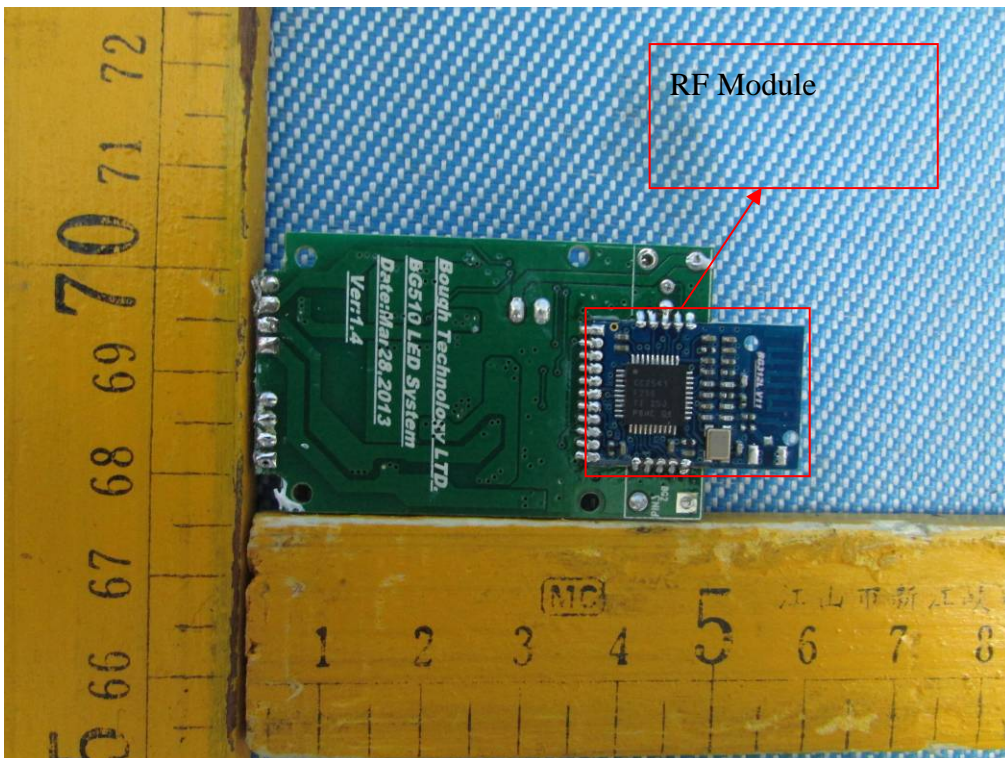
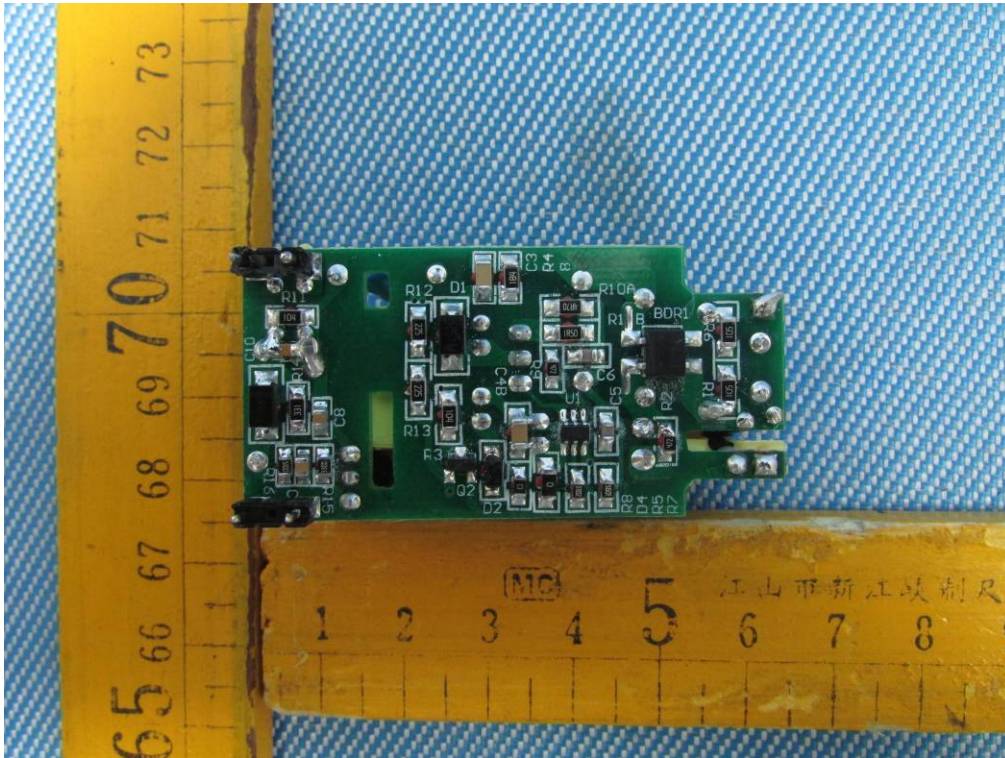


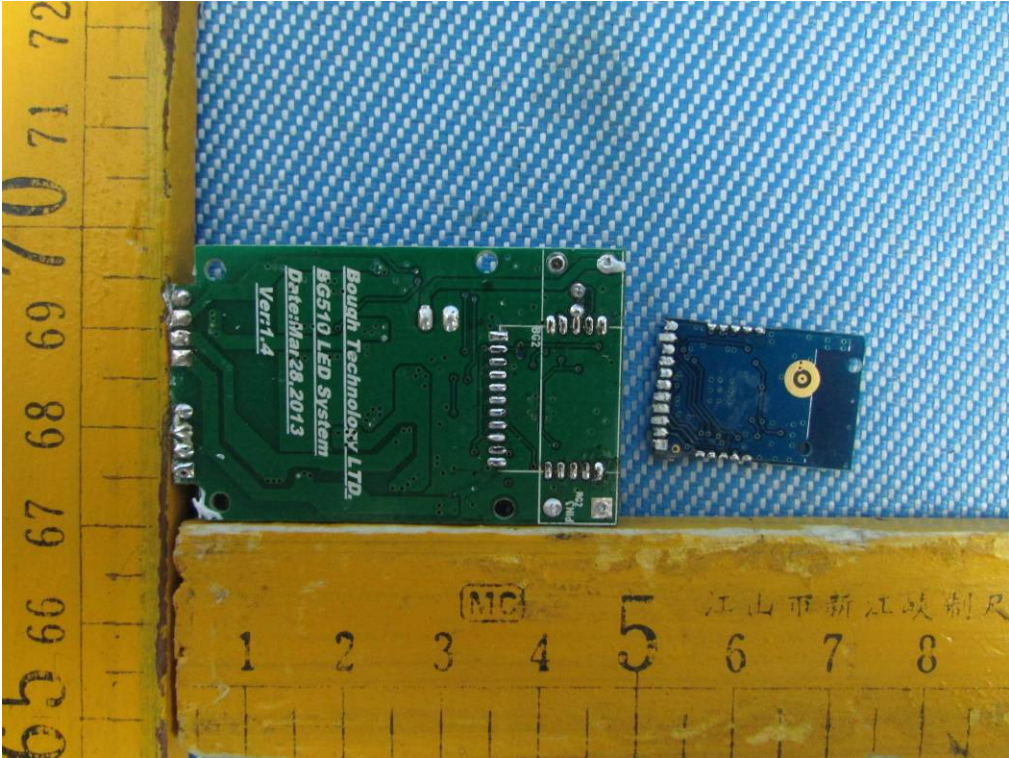
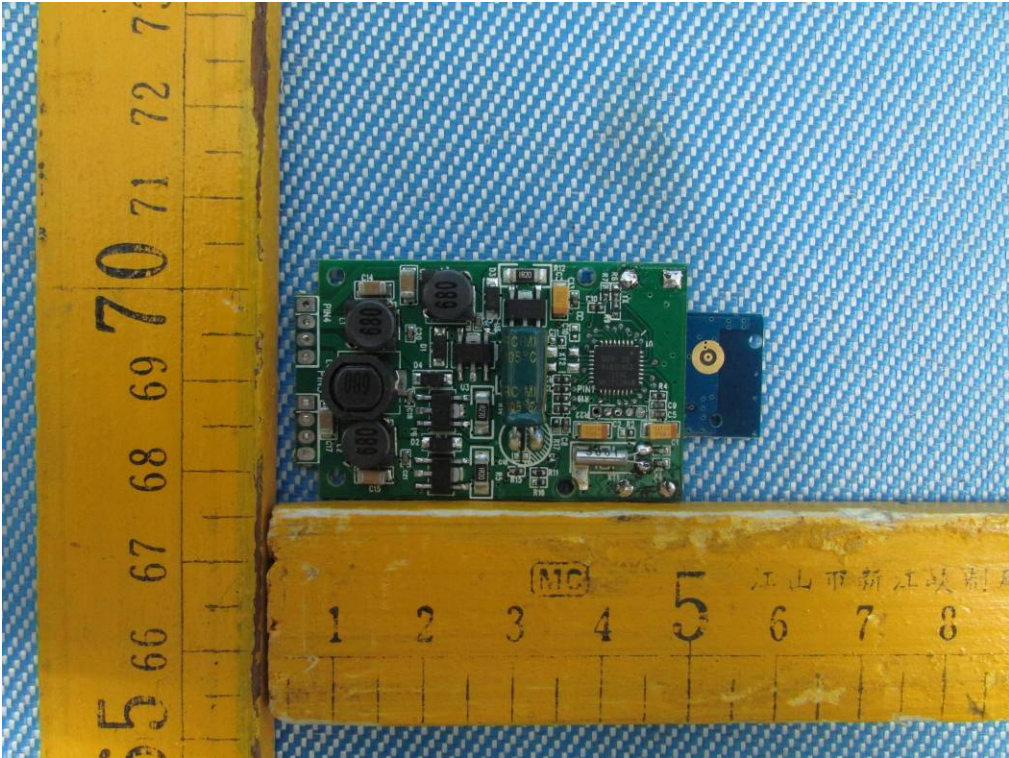
18.2 EUT - Internal View

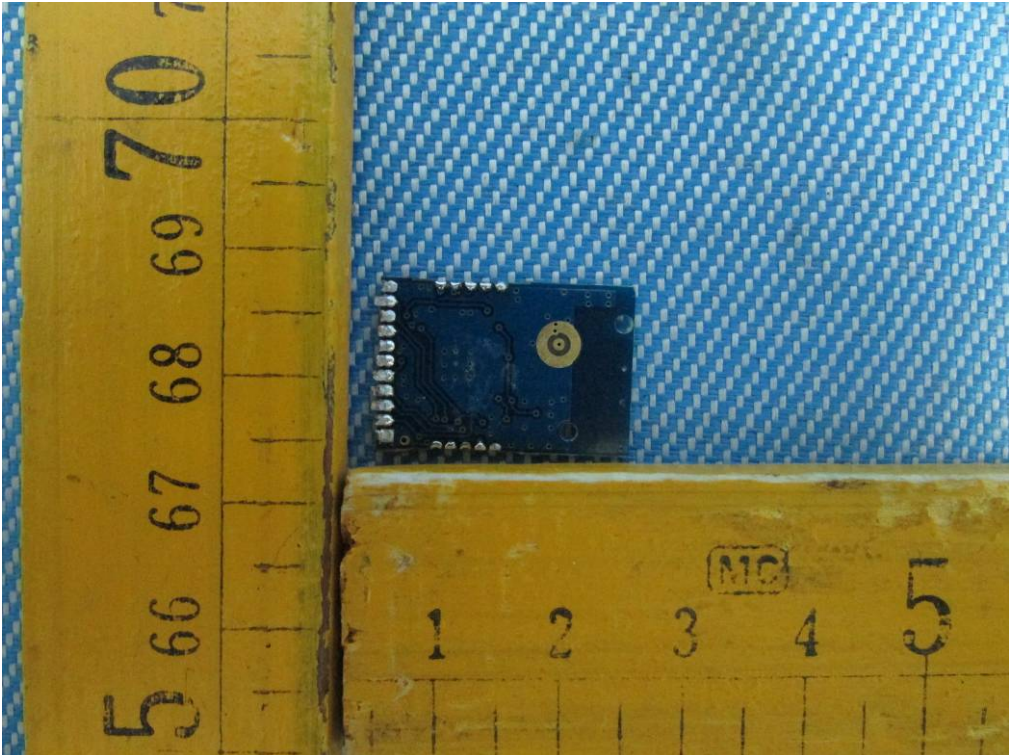
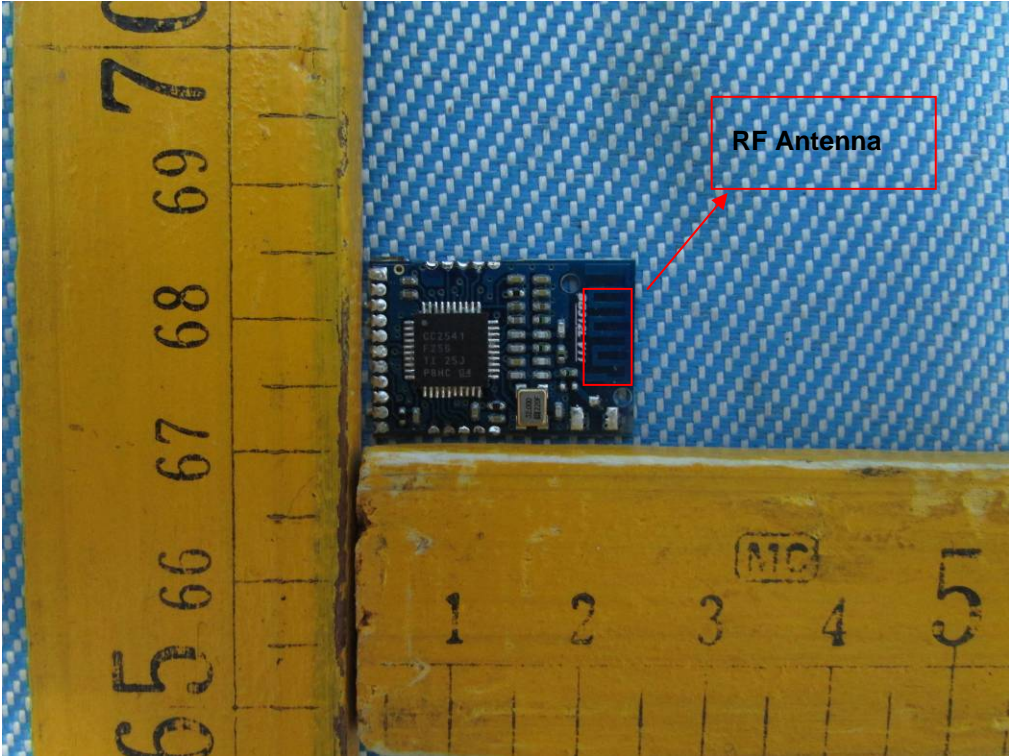












=End of report=