

FCC TEST REPORT

FCC ID : 2AAKGRCWBS30-1R
Applicant : Sky Success Asia Limited.
Address : Unit1, 8/F, Wah Yiu Industrial Centre, 30-32 Au Pui Wan Street, Fo Tan, NT,H.K.
Manufacturer : The same as above
Address : The same as above
Equipment Under Test (EUT) :
Product Name : 2.4G Wireless Digital Security Camera System
Model No. : RCWBS30-1R (Receiver)
Standards : FCC CFR47 Part 15 Section 15.247:2012
Date of Test : July 17~22, 2013
Date of Issue : September 09, 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.

Prepared By:

Waltek Services (Shenzhen) Co., Ltd.

1/F, Fukangtai Building, West Baima Rd., Songgang Street, Baoan District,

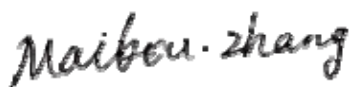
Shenzhen 518105, China

Tel: +86-755-83551033

Fax: +86-755-83552400

Compiled by:

Approved by:



Maikou Zhang / Project Engineer



Philo Zhong / Manager

2 Test Summary

Test Items	Test Requirement	Result
Radiated Spurious Emissions	15.205(a) 15.209 15.247(d)	PASS
Conducted Emissions	15.207(a)	PASS
Duty Cycle	15.35	PASS
Band edge	15.247(d) 15.205(a)	PASS
Conduct Emission	15.207	N/A
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

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4 General Information

4.1 General Description of E.U.T.

Product Name	: 2.4G Wireless Digital Security Camera System
Model No.	: RCWBS30-1R (Receiver)
Operation Frequency	: 2408 MHz ~ 2468 MHz, 16 Channels in total
Type of Modulation	: GFSK
Antenna installation	: Integrated Antenna
Antenna Gain	: 2 dBi

4.2 Details of E.U.T.

Technical Data	: DC12V (Receiver)
Adapter	: N/A

4.3 Channel List

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
1	2408	2	2412	3	2416	4	2420
5	2424	6	2428	7	2432	8	2436
9	2440	10	2444	11	2448	12	2452
13	2456	14	2460	15	2464	16	2468

4.4 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Test mode	Lower channel	Middle channel	Upper channel
Transmitting	MHz	MHz	MHz
Receiving	2408MHz	2440MHz	2468MHz

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	101155	Aug. 13,2012	Aug. 12,2013
2.	LISN	SCHWARZBECK	NSLK 8128	8128-289	Aug. 13,2012	Aug. 12,2013
3.	Cable	LARGE	RF300	EW02014-3	Aug.14,2012	Aug. 13,2013
3m Semi-anechoic Chamber for Radiation Emissions						
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 Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	Apr.07,2013	Apr.06,2014
7.	Broadband Preamplifier	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
Auxiliary equipment						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	Adapter	GOE	GS2U	--	--	--

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)

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

2.1 E.U.T. Operation

Operating Environment:

Temperature: 26 °C

Humidity: 50 % RH

Atmospheric Pressure: 1010 mbar

EUT Operation:

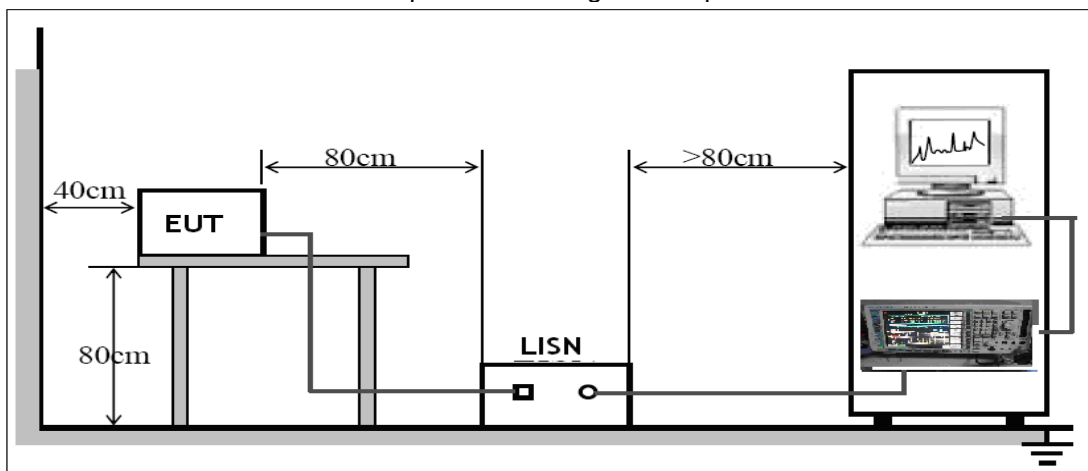
The EUT was tested in RF mode with Adapter(The adapter is Auxiliary equipment).

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.

2.2 EUT Setup

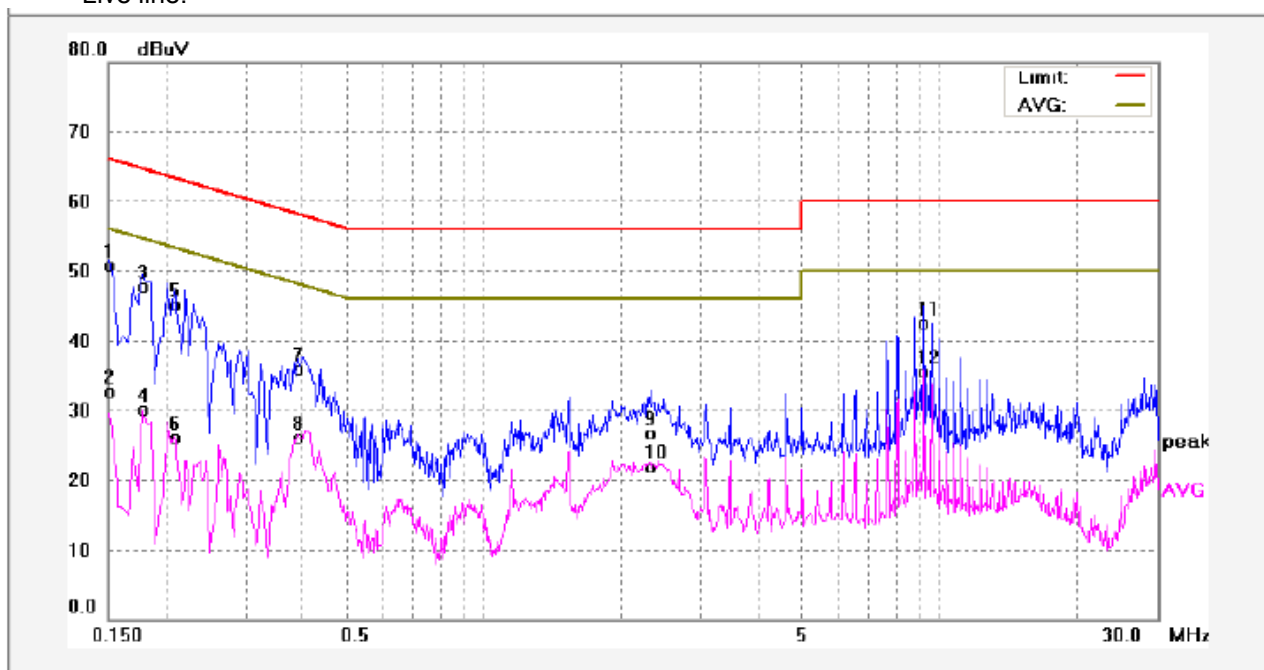
The conducted emission tests were performed using the setup accordance with the ANSI C63.4:2003.



2.3 Conducted Emission Test Result

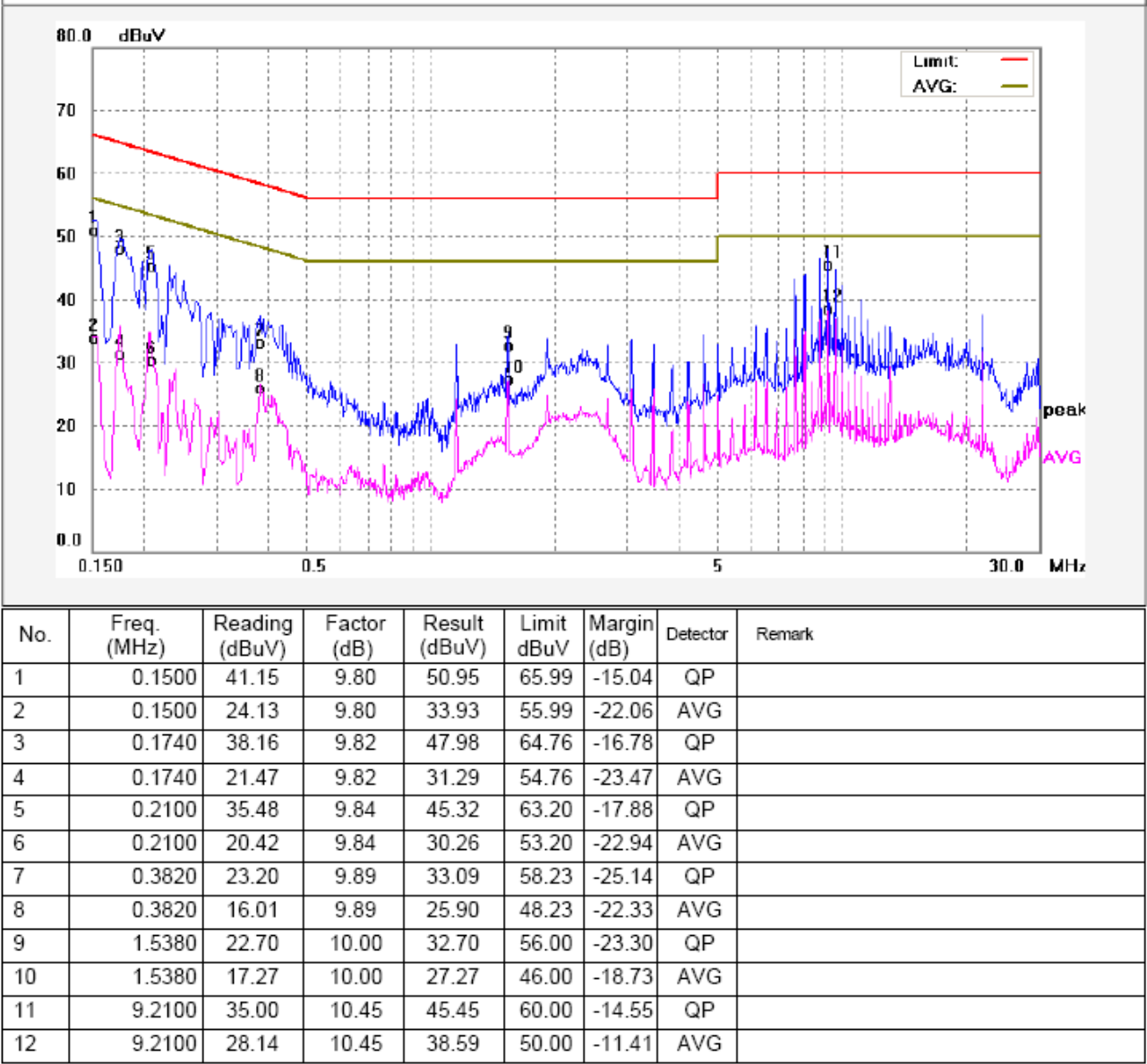
An initial pre-scan was performed on the live and neutral lines.

Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1500	40.93	9.80	50.73	65.99	-15.26	QP	
2	0.1500	22.85	9.80	32.65	55.99	-23.34	AVG	
3	0.1780	37.98	9.82	47.80	64.57	-16.77	QP	
4	0.1780	20.23	9.82	30.05	54.57	-24.52	AVG	
5	0.2100	35.34	9.84	45.18	63.20	-18.02	QP	
6	0.2100	16.35	9.84	26.19	53.20	-27.01	AVG	
7	0.3980	25.97	9.90	35.87	57.89	-22.02	QP	
8	0.3980	16.29	9.90	26.19	47.89	-21.70	AVG	
9	2.3100	16.70	10.01	26.71	56.00	-29.29	QP	
10	2.3100	11.88	10.01	21.89	46.00	-24.11	AVG	
11	9.2100	32.08	10.45	42.53	60.00	-17.47	QP	
12	9.2100	25.06	10.45	35.51	50.00	-14.49	AVG	

Neutral line:



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

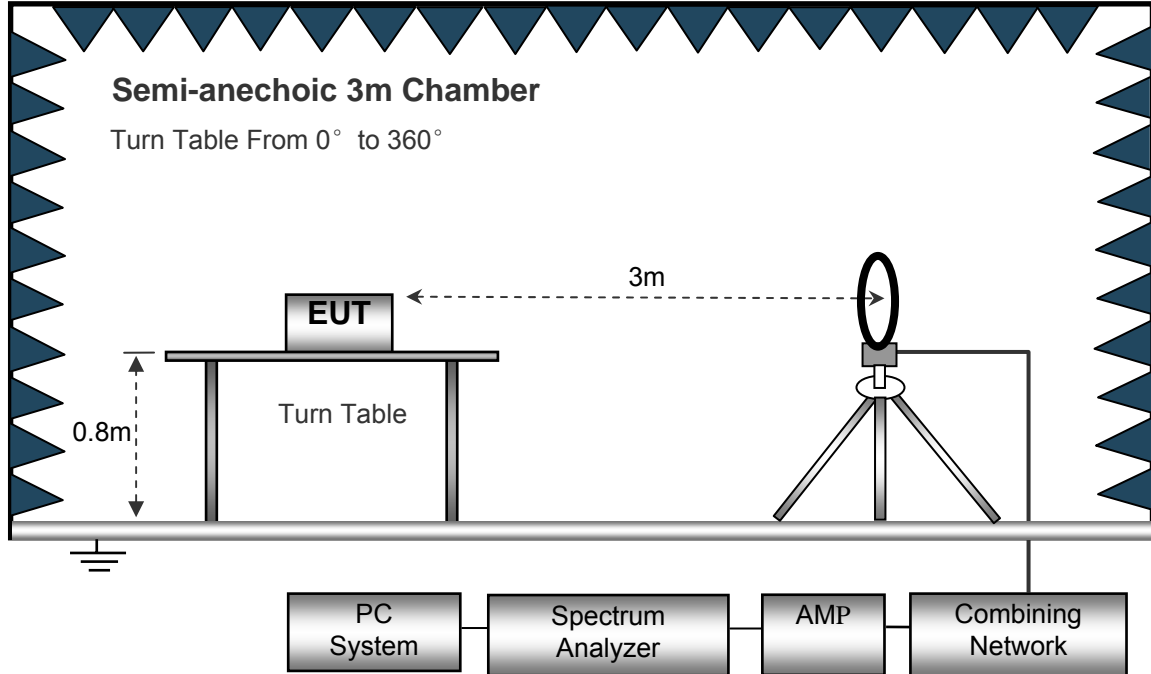
Humidity: 51 % RH

Atmospheric Pressure: 1008 mbar

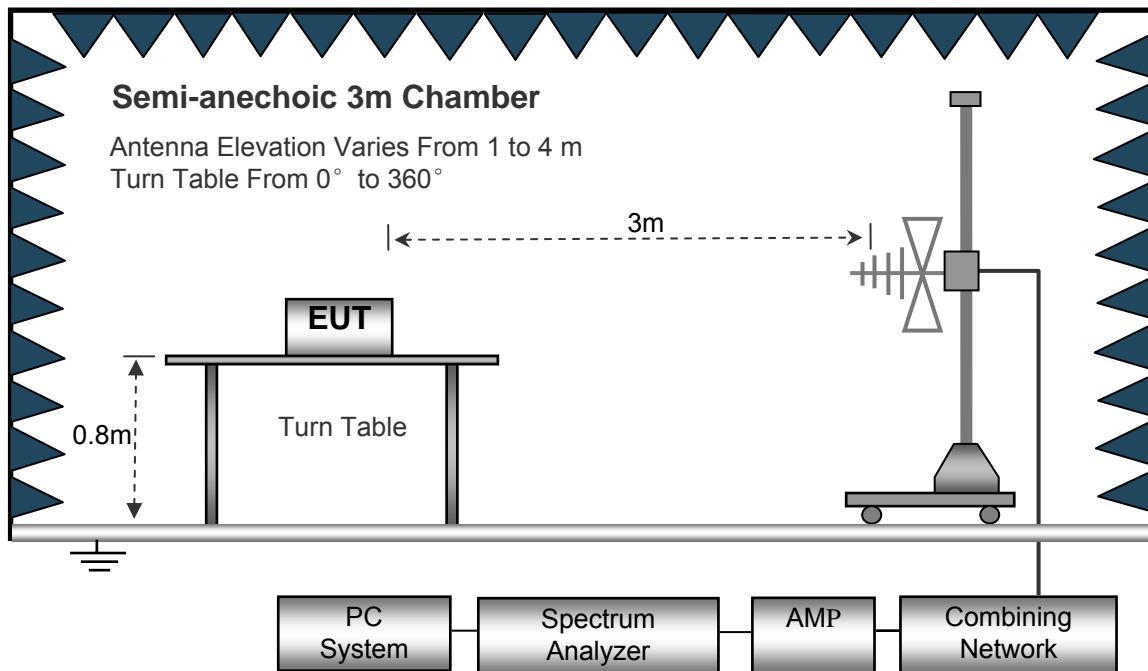
7.2 Test Setup

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

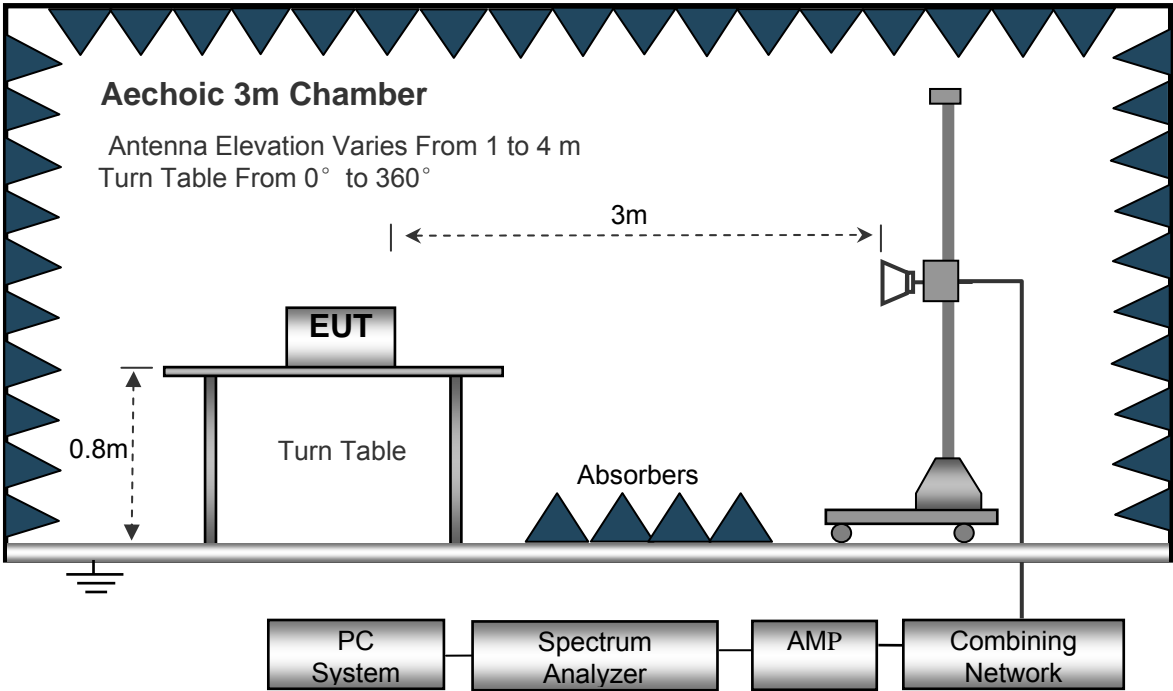
The test setup for emission measurement below 30MHz.



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

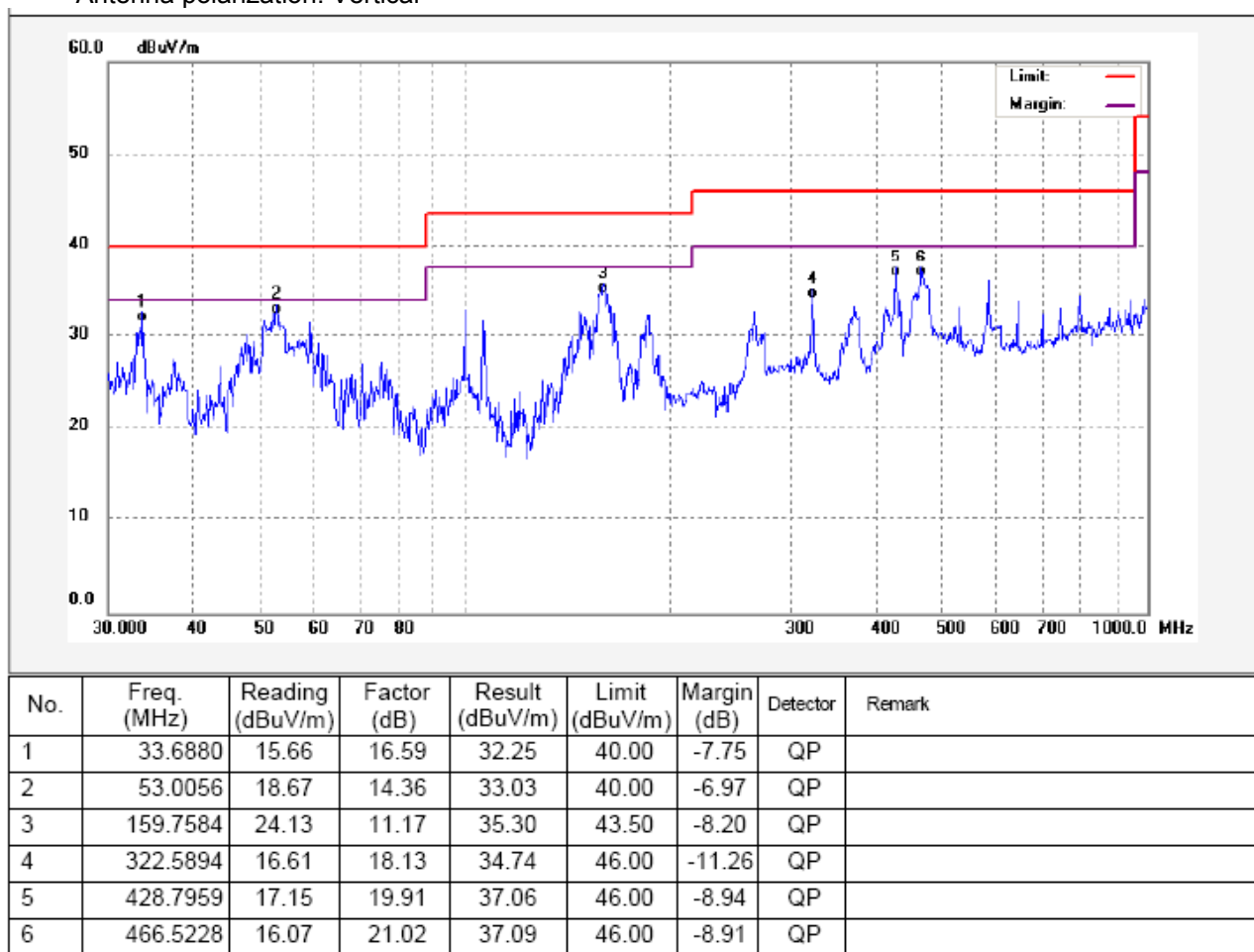
The measurements were more than 20 dB below the limit and not reported.

Test Frequency : 30MHz ~ 1000MHz

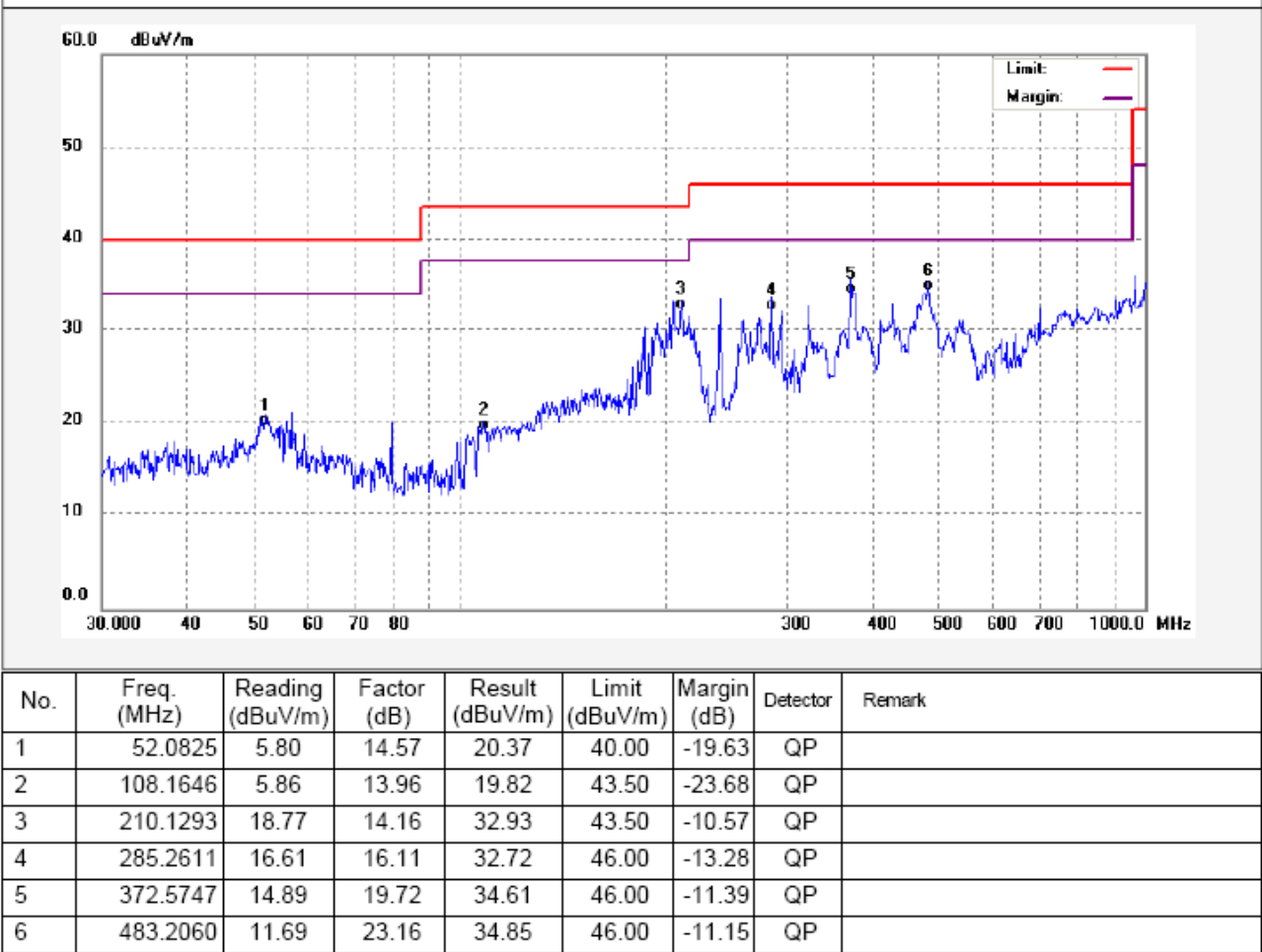
Test mode : continuous transmitting mode

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.

Antenna polarization: Vertical



Antenna polarization: Horizontal



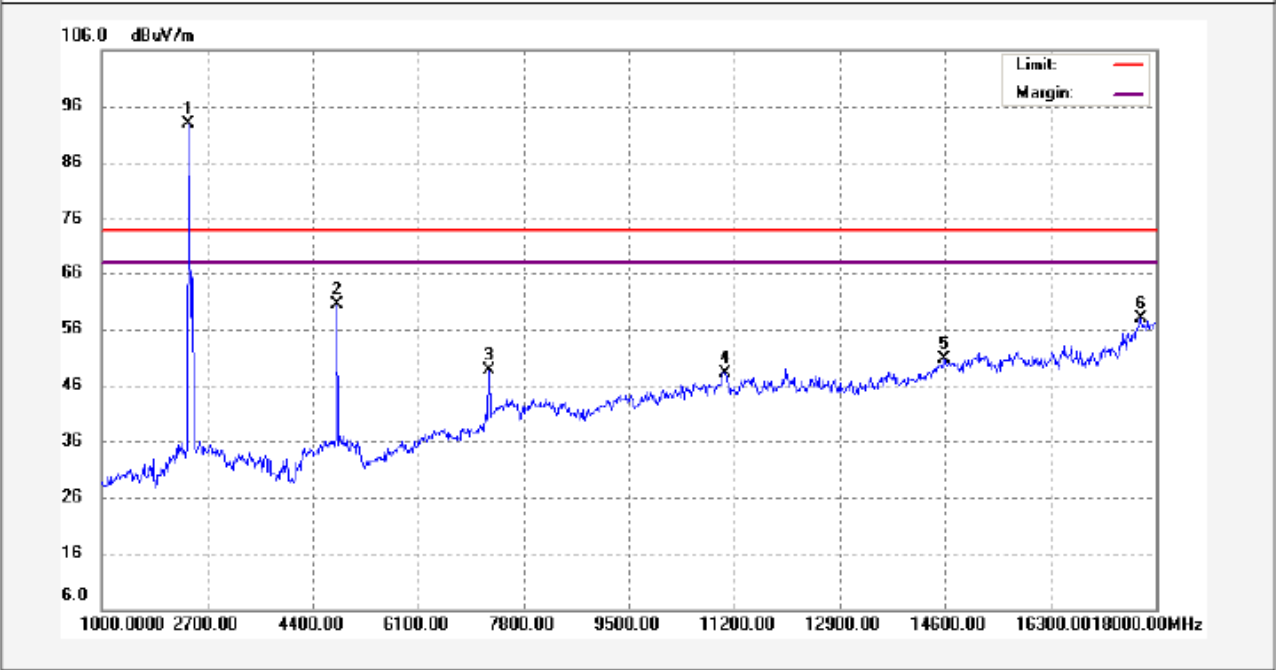
Test Frequency: 1GHz ~ 18GHz

Test Mode : continuous transmitting mode

AV = Peak +20Log₁₀(duty cycle) =PK+(-14)=PK-14 [refer to section 8 for more detail]

Test Channel: TX 2408MHz

Antenna polarization: Vertical

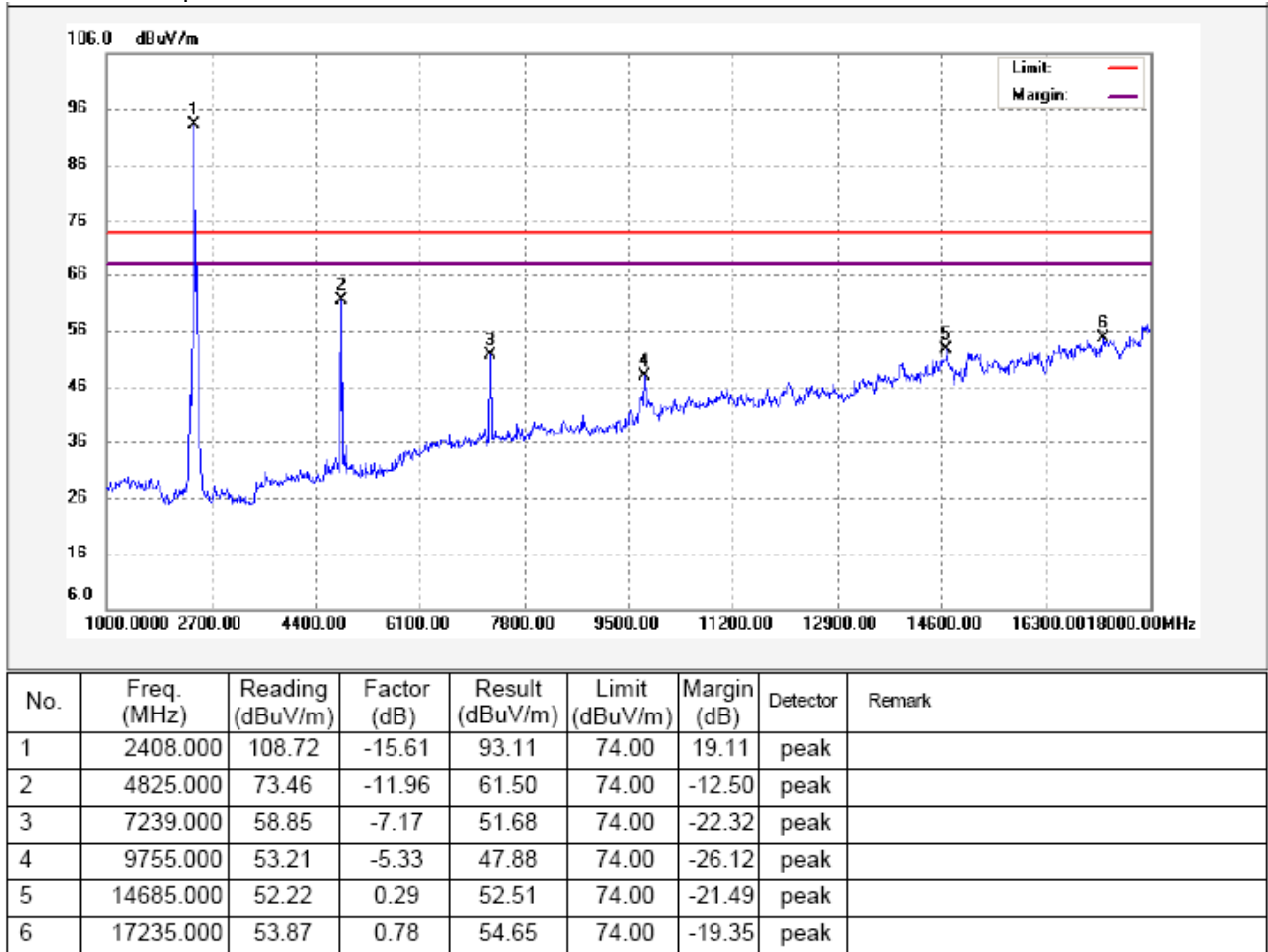


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2408.000	108.58	-15.60	92.98	74.00	18.98	peak	
2	4791.000	72.49	-11.99	60.50	74.00	-13.50	peak	
3	7239.000	55.73	-7.17	48.56	74.00	-25.44	peak	
4	11047.000	51.83	-3.64	48.19	74.00	-25.81	peak	
5	14583.000	50.22	0.46	50.68	74.00	-23.32	peak	
6	17762.000	53.80	4.12	57.92	74.00	-16.08	peak	

Remark: the marker 1 is the fundamental

No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
2	4791.000	-14	46.50	54	-7.50	AV	
3	7239.000	-14	34.56	54	-19.44	AV	
4	11047.000	-14	34.19	54	-19.81	AV	
5	14583.000	-14	36.68	54	-17.32	AV	
6	17762.000	-14	43.92	54	-10.08	AV	

Antenna polarization: Horizontal

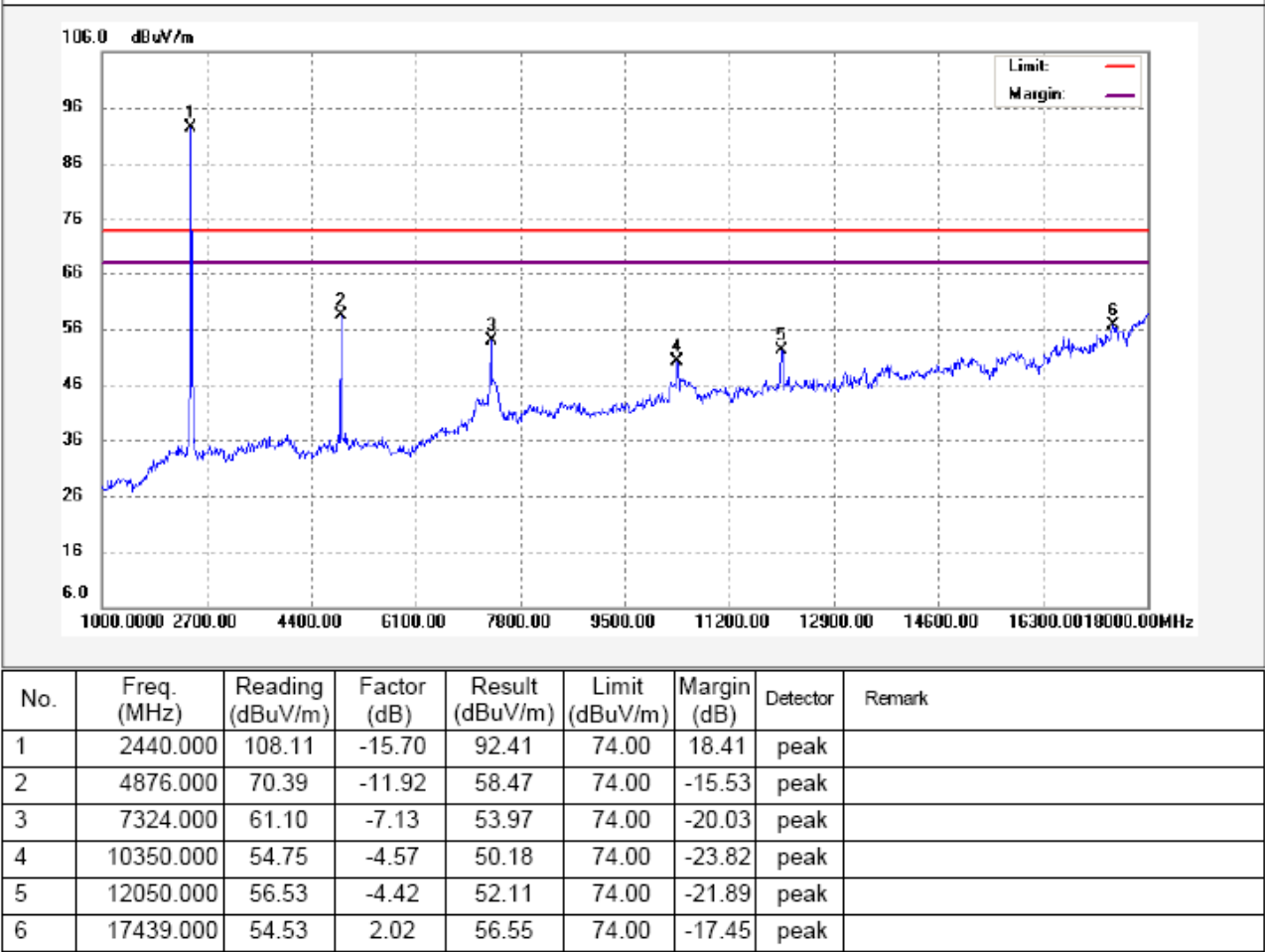


Remark: the marker 1 is the fundamental

No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
2	4825.000	-14	47.50	54	-6.50	AV	
3	7239.000	-14	37.68	54	-16.32	AV	
4	9755.000	-14	33.88	54	-20.12	AV	
5	14685.000	-14	38.51	54	-15.49	AV	
6	17235.000	-14	40.65	54	-13.35	AV	

Test Channel: TX 2440MHz

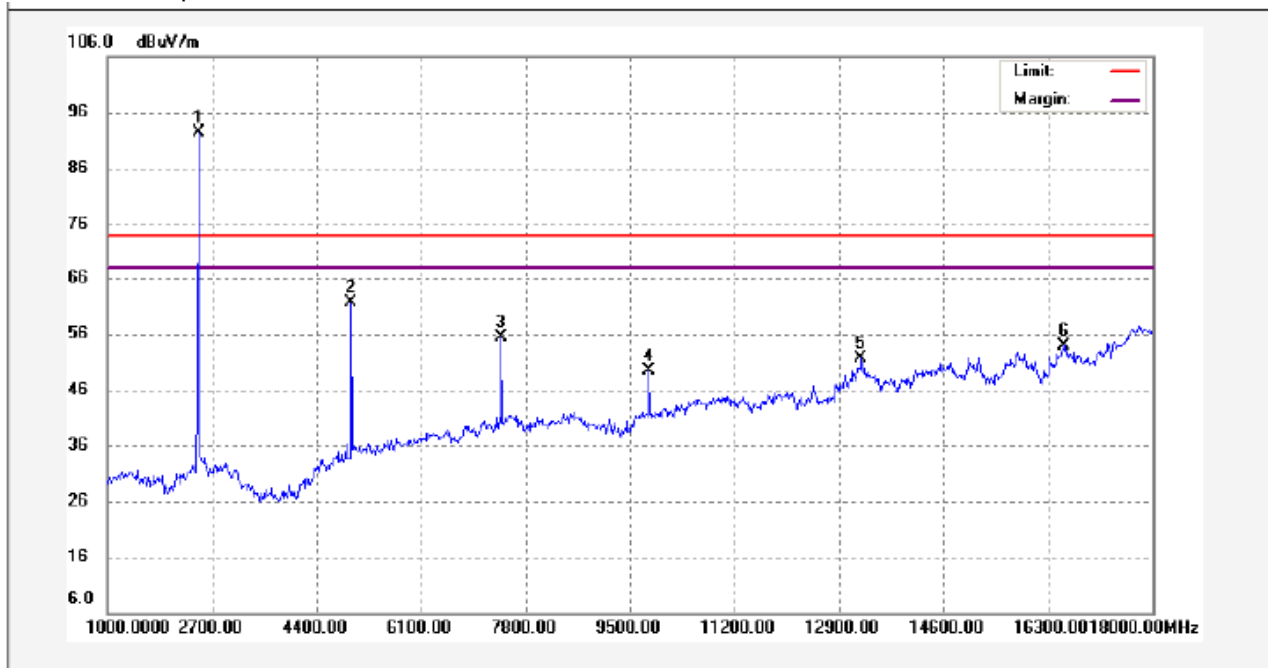
Antenna polarization: Vertical



Remark: the marker 1 is the fundamental

No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
2	4876.000	-14	44.47	54	-9.53	AV	
3	7324.000	-14	39.97	54	-14.03	AV	
4	10350.000	-14	36.18	54	-17.82	AV	
5	12050.000	-14	38.11	54	-15.89	AV	
6	17439.000	-14	42.55	54	-11.45	AV	

Antenna polarization: Horizontal



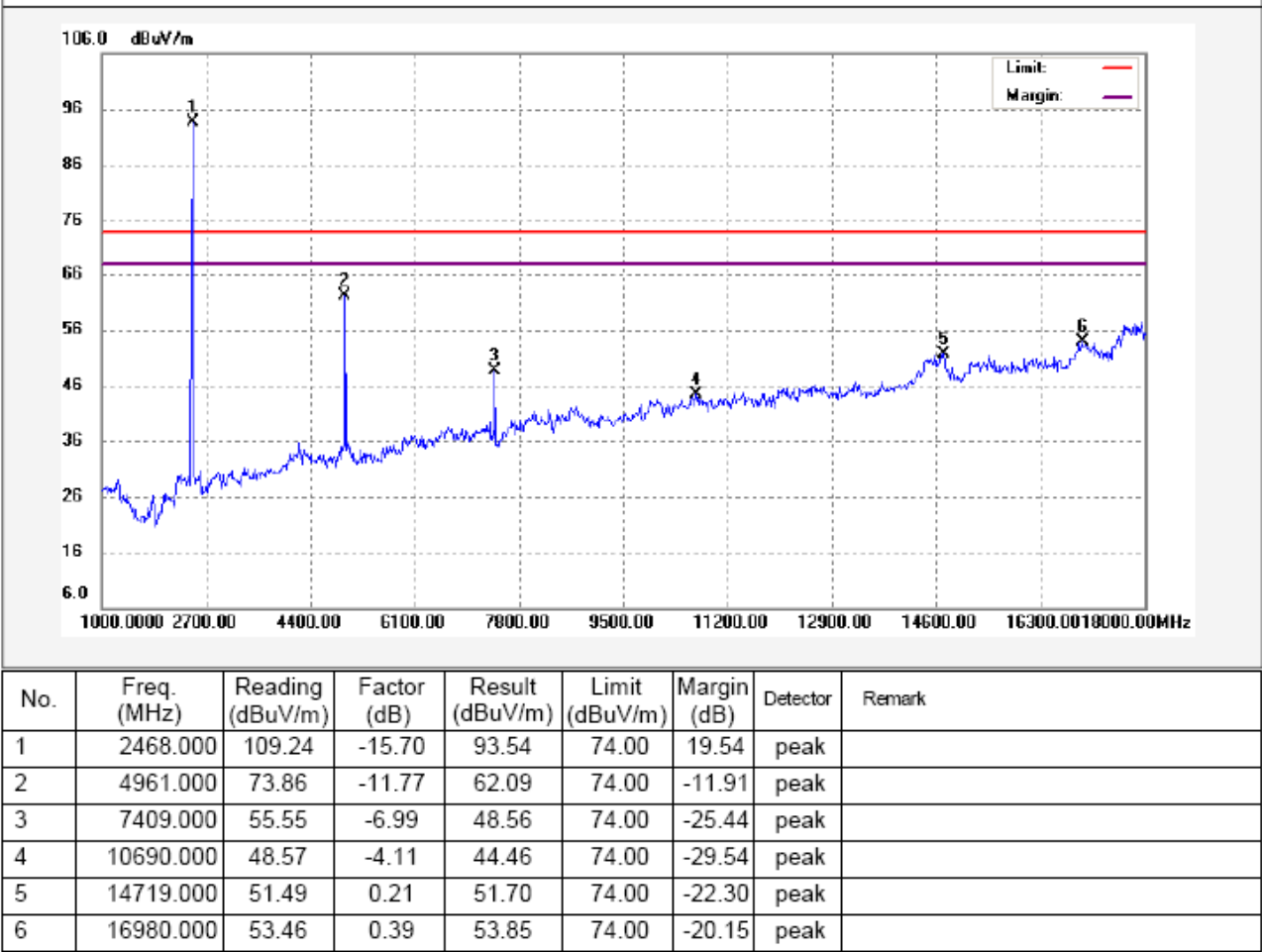
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2468.000	108.17	-15.70	92.47	74.00	18.47	peak	
2	4961.000	73.36	-11.77	61.59	74.00	-12.41	peak	
3	7409.000	62.25	-6.99	55.26	74.00	-18.74	peak	
4	9806.000	54.46	-5.18	49.28	74.00	-24.72	peak	
5	13257.000	54.67	-3.04	51.63	74.00	-22.37	peak	
6	16555.000	55.46	-1.67	53.79	74.00	-20.21	peak	

Remark: the marker 1 is the fundamental

No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
2	4961.000	-14	47.59	54	-6.41	AV	
3	7409.000	-14	41.26	54	-12.74	AV	
4	9806.000	-14	35.28	54	-18.72	AV	
5	13257.000	-14	37.63	54	-16.37	AV	
6	16555.000	-14	39.79	54	-14.21	AV	

Test Channel: TX 2468MHz

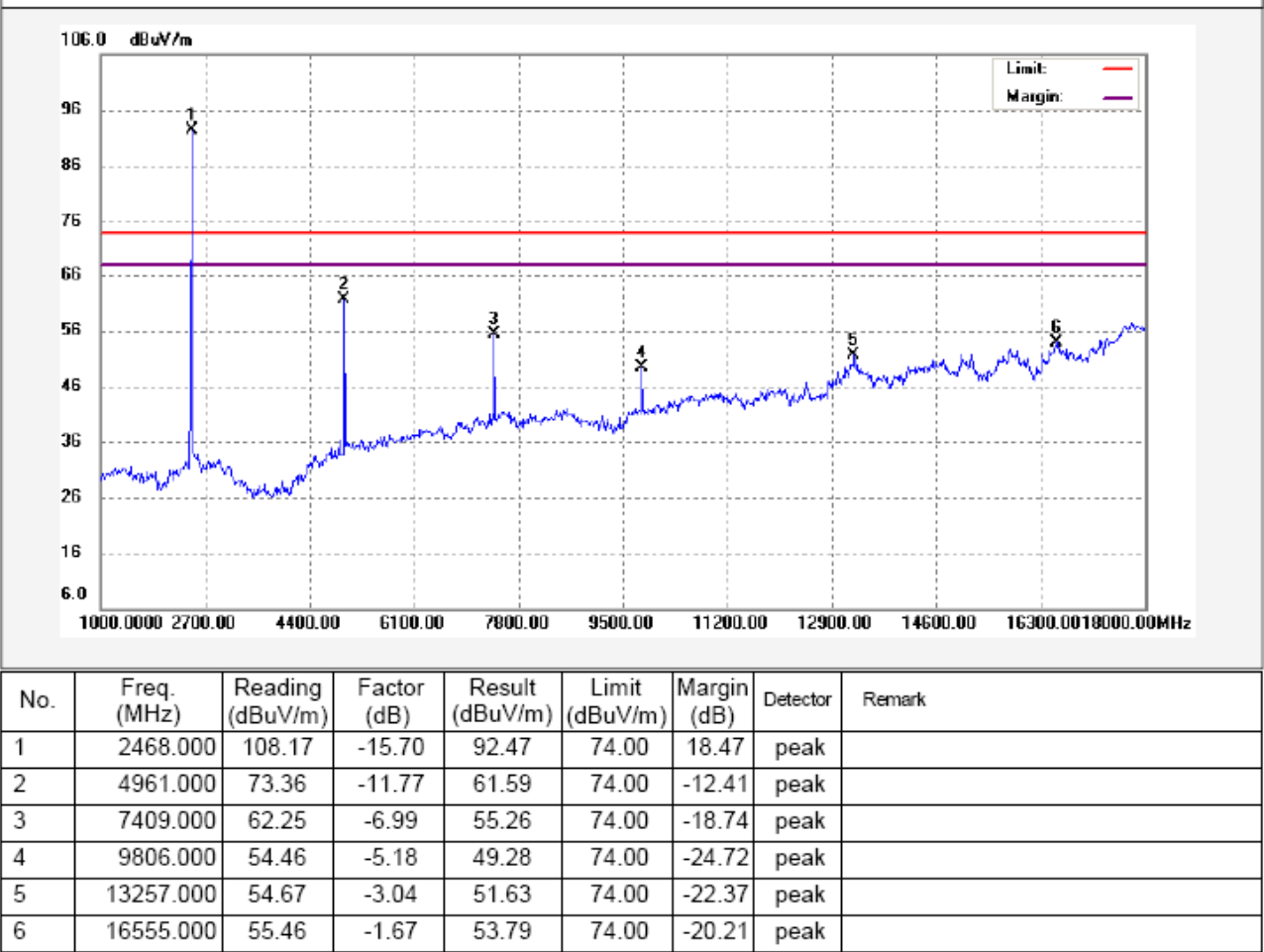
Antenna polarization: Vertical



Remark: the marker 1 is the fundamental

No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
2	4961.000	-14	48.09	54	-5.91	AV	
3	7409.000	-14	34.56	54	-19.44	AV	
4	10690.000	-14	30.46	54	-23.54	AV	
5	14719.000	-14	37.7	54	-16.3	AV	
6	16980.000	-14	39.85	54	-14.15	AV	

Antenna polarization: Horizontal



Remark: the marker 1 is the fundamental

No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
2	4961.000	-14	47.59	54	-6.41	AV	
3	7409.000	-14	41.26	54	-12.74	AV	
4	9806.000	-14	35.28	54	-18.72	AV	
5	13257.000	-14	37.63	54	-16.37	AV	
6	16555.000	-14	39.79	54	-14.21	AV	

Test Frequency :Above 18GHz

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

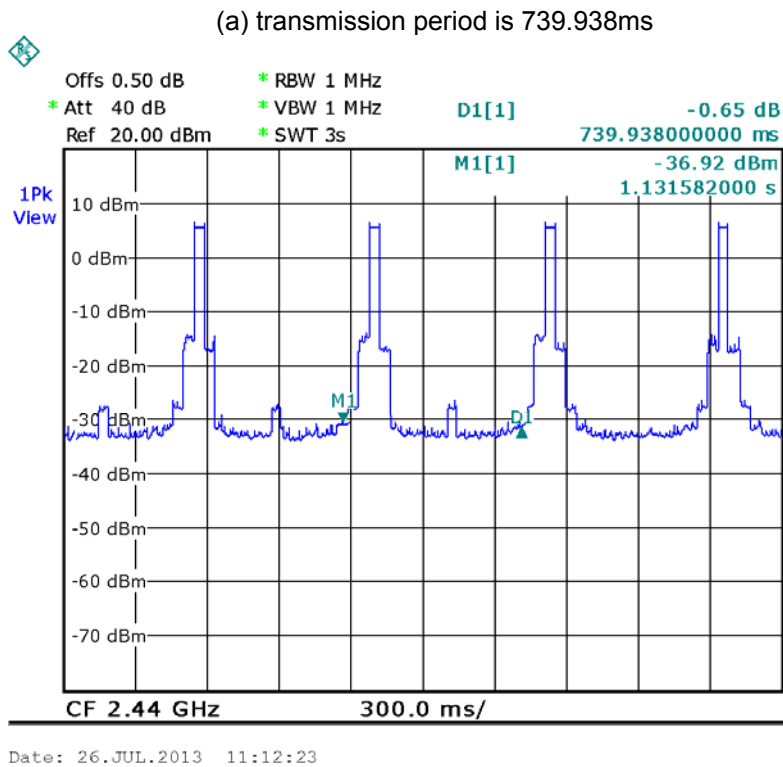
8 Duty Cycle

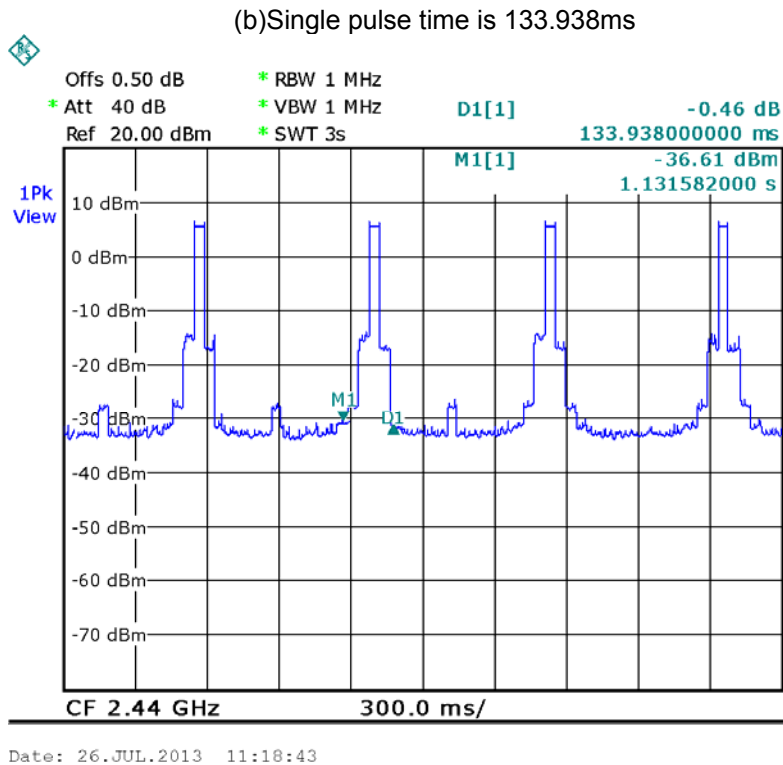
Test Requirement: FCC Part 15.35
Test Mothed: ANSI C63.4:2003
Test Status: TX mode.

8.1 Test Procedure

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

8.2 Test Result





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 = 133.938 ms

The EUT's work period : $T = T_{ON} + T_{OFF}$ = transmission period = 739.938 ms

The EUT's duty cycle : $D = T_{on} / T = 133.938 / 739.938 * 100\% = 18\%$

Duty Cycle Correction Factor(dB) = $20 * \log_{10}(\text{Duty Cycle}) = 20 * \log_{10}(18\%)$

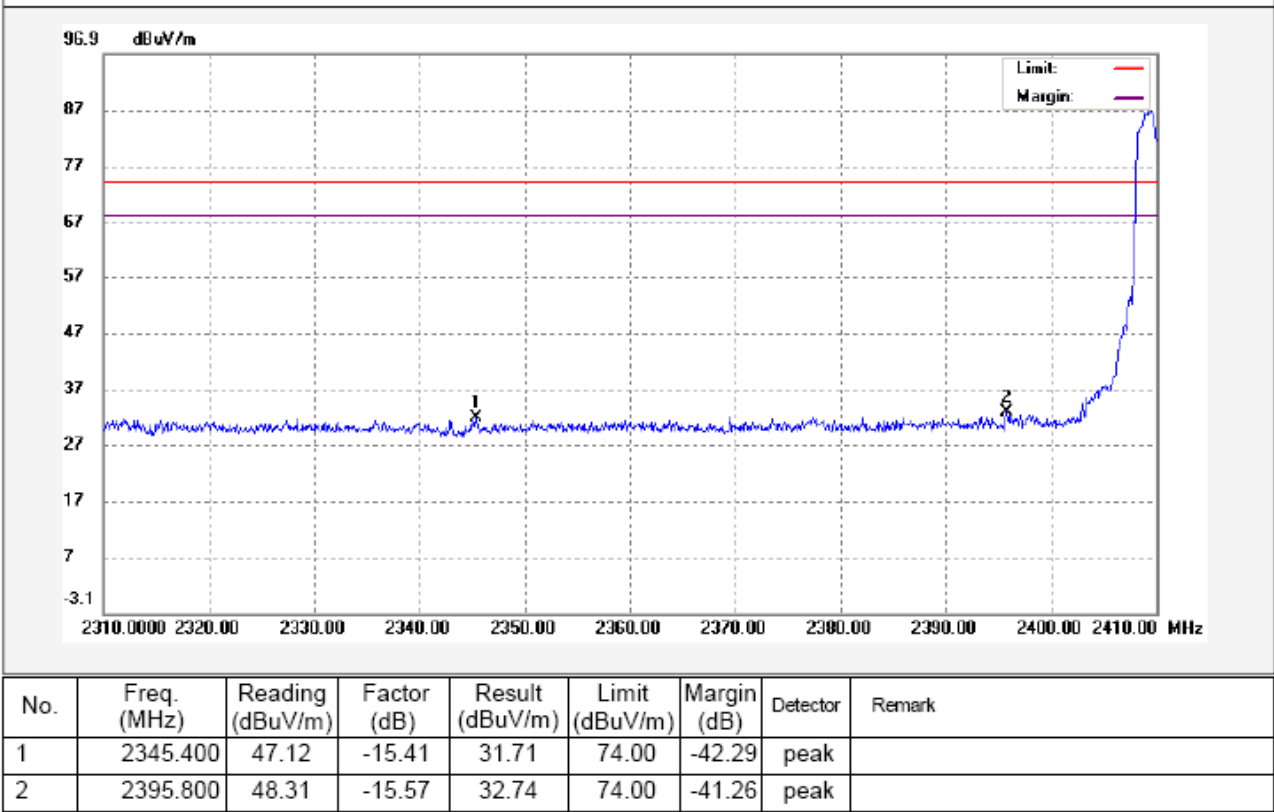
= -14dB

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

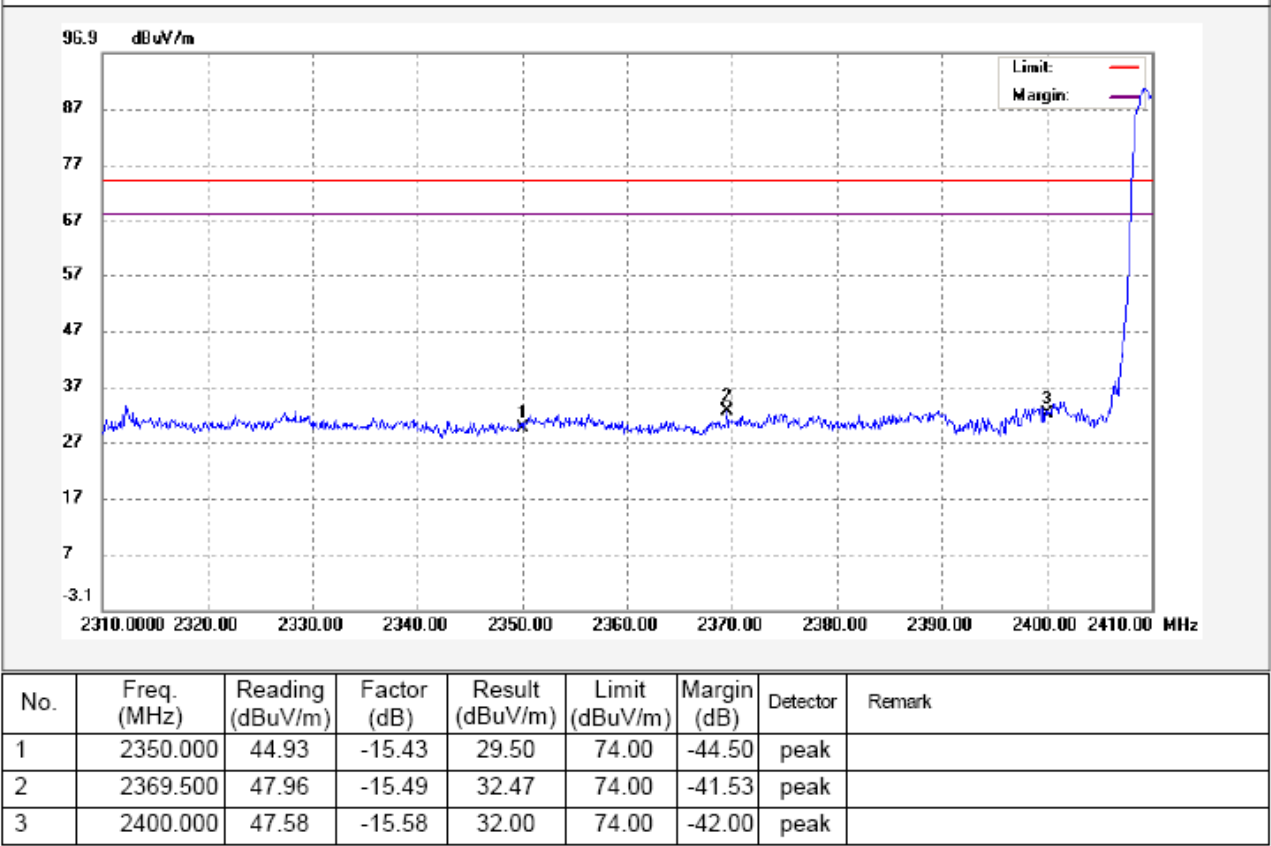
9.1 Test Result:

Lower Channel –Vertical



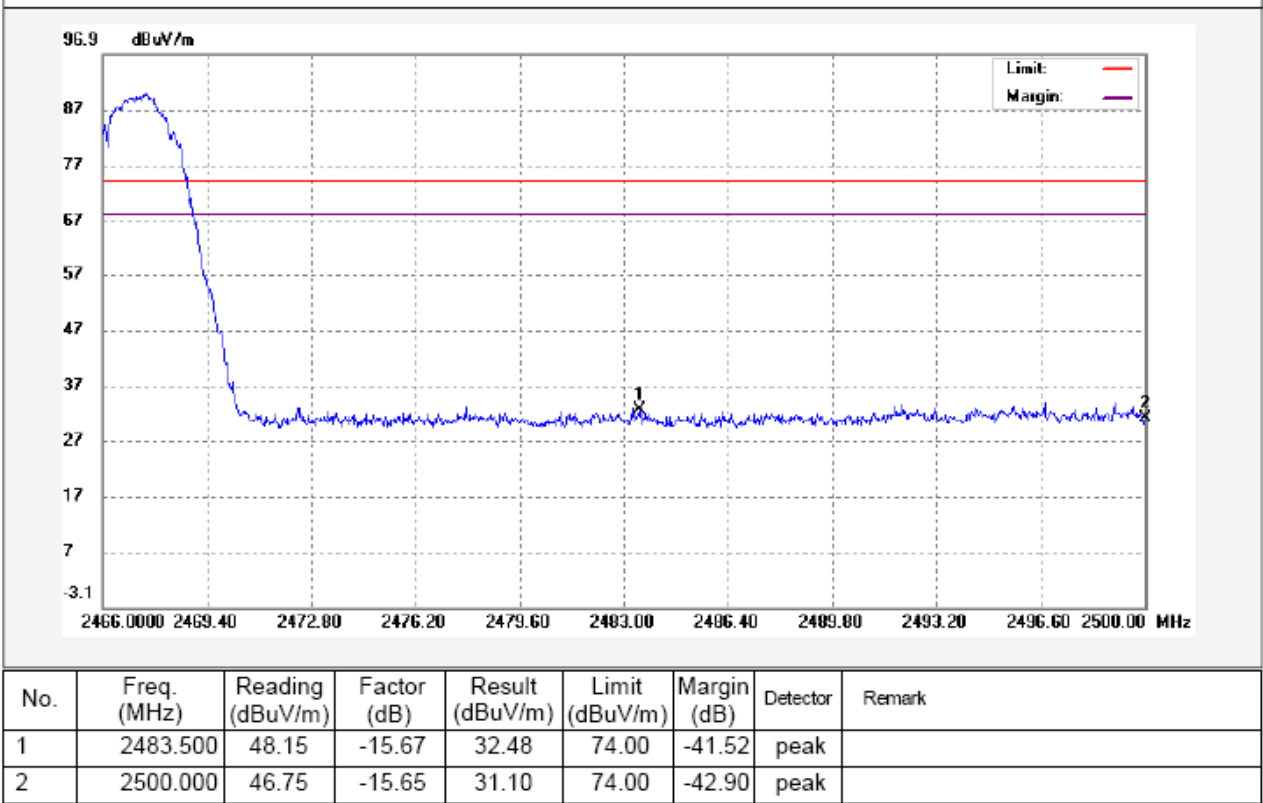
No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2345.400	-14	17.71	54	-36.29	AV	
2	2395.000	-14	18.74	54	-35.26	AV	

Lower Channel –Horizontal



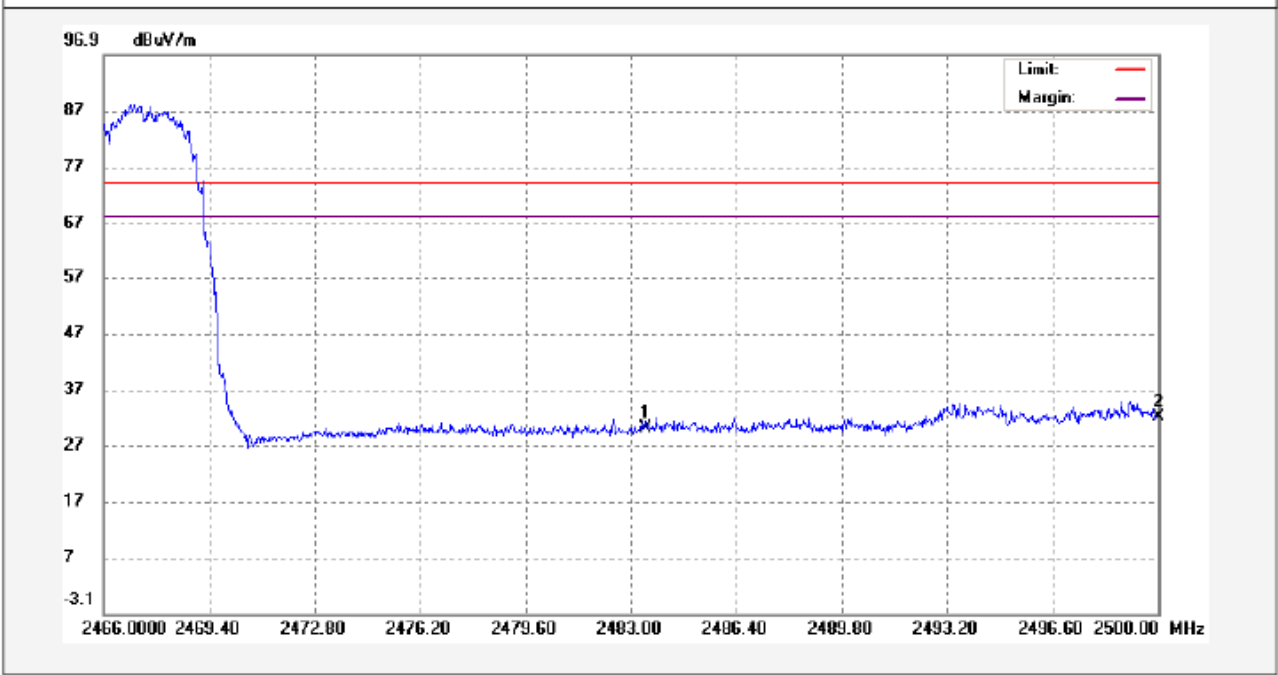
No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	235.000	-14	15.50	54	-38.50	AV	
2	2369.500	-14	18.47	54	-35.53	AV	
3.	2400.000	-14	18.00	54	-36.00	AV	

Upper Channel – Vertical



No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2483.500	-14	18.48	54	-35.52	AV	
2	2500.000	-14	17.10	54	-36.9	AV	

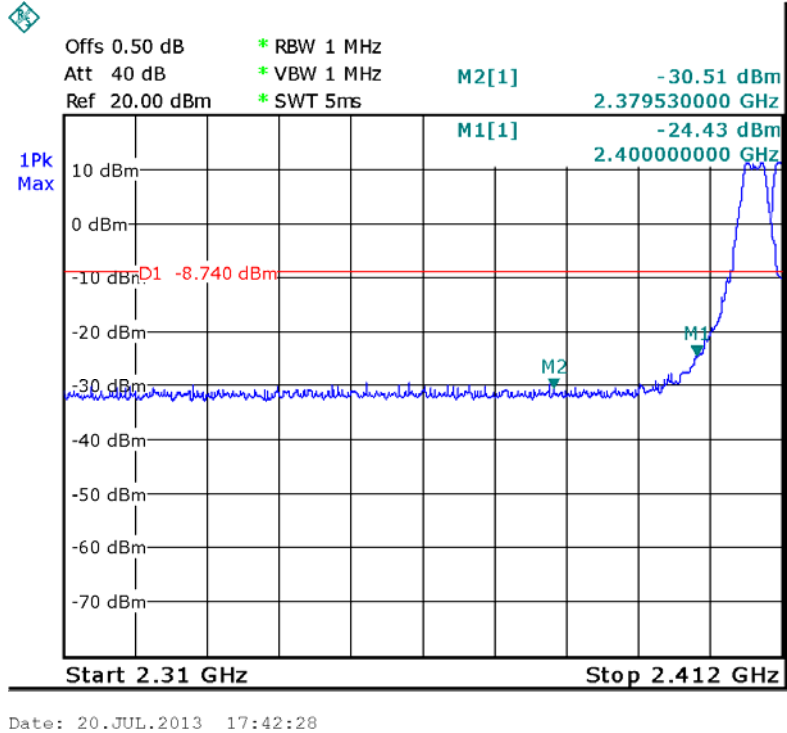
Upper Channel –Horizontal



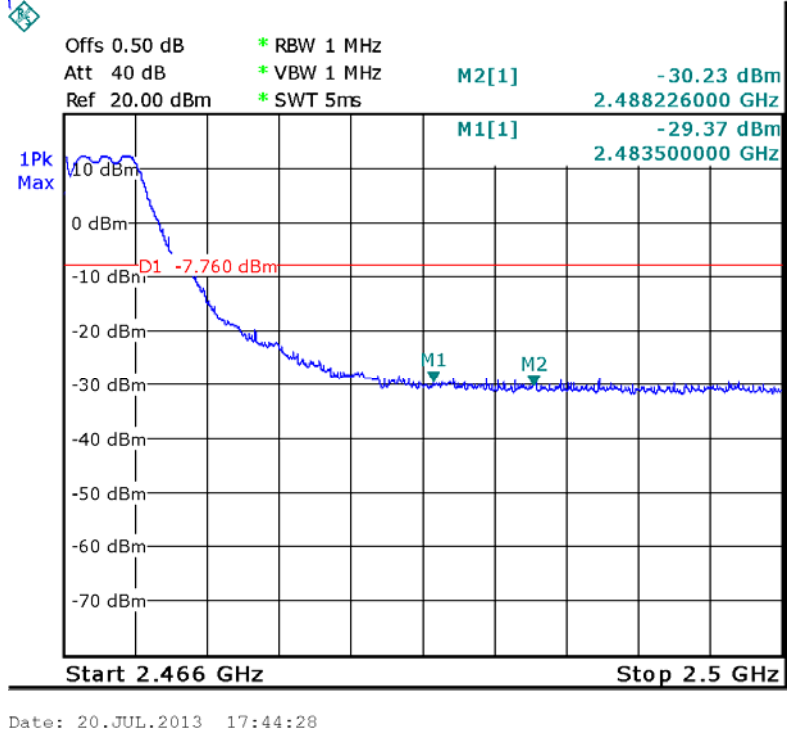
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2483.500	45.77	-15.67	30.10	74.00	-43.90	peak	
2	2500.000	47.73	-15.65	32.08	74.00	-41.92	peak	

No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2483.500	-14	16.1	54	-37.9	AV	
2	2500.000	-14	18.08	54	-35.92	AV	

Test mode: Hopping on
Lower Channel – Peak

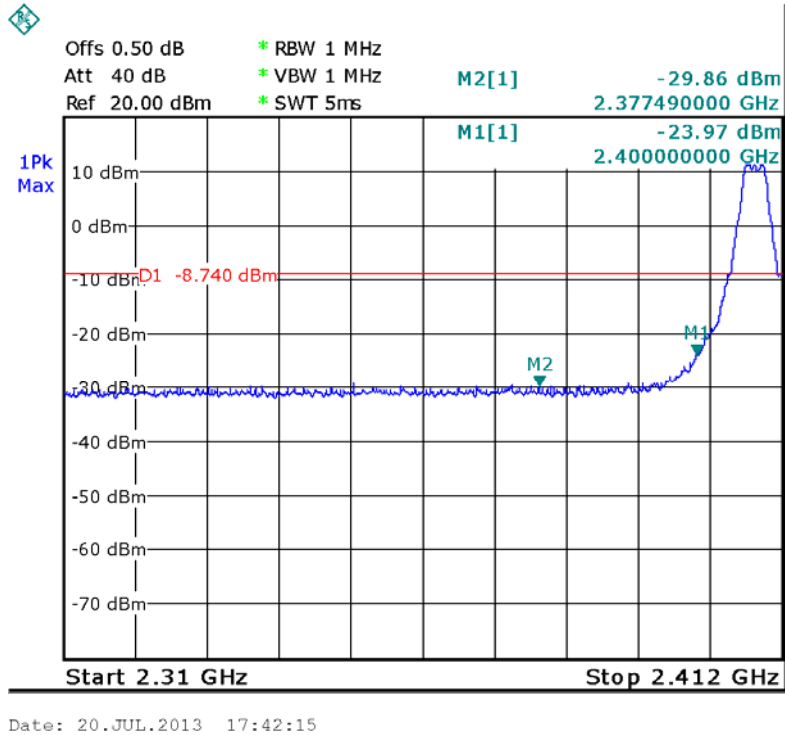


Upper Channel – Peak

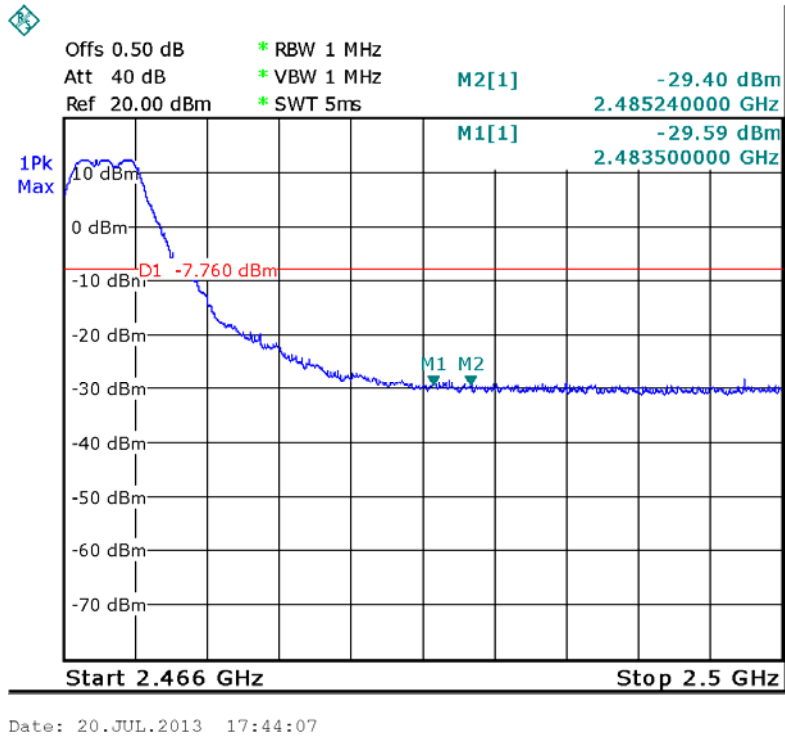


Test mode: Hopping off

Lower Channel – Peak



Upper Channel – Peak



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.

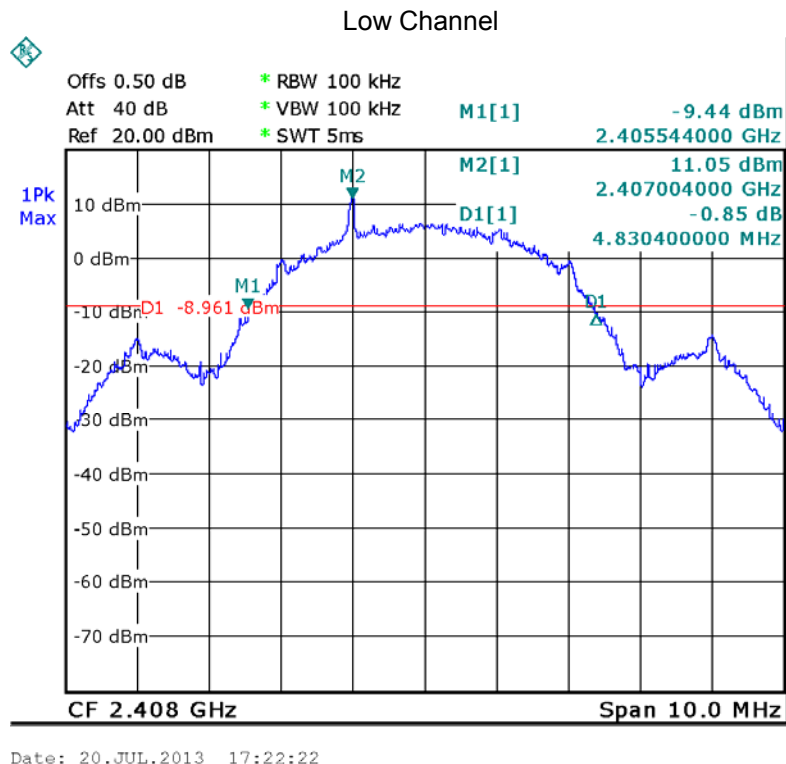
10.1 Test Procedure:

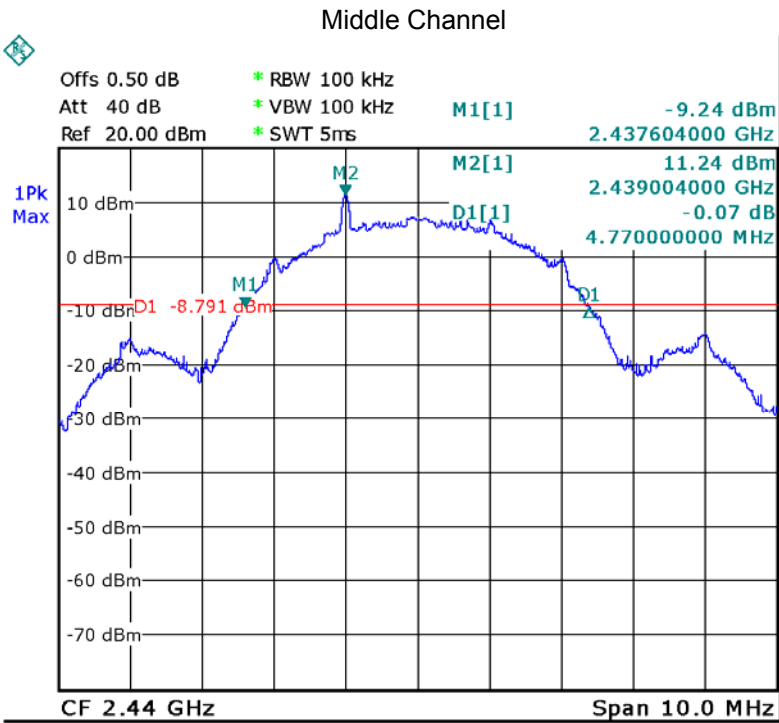
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 100kHz

10.2 Test Result:

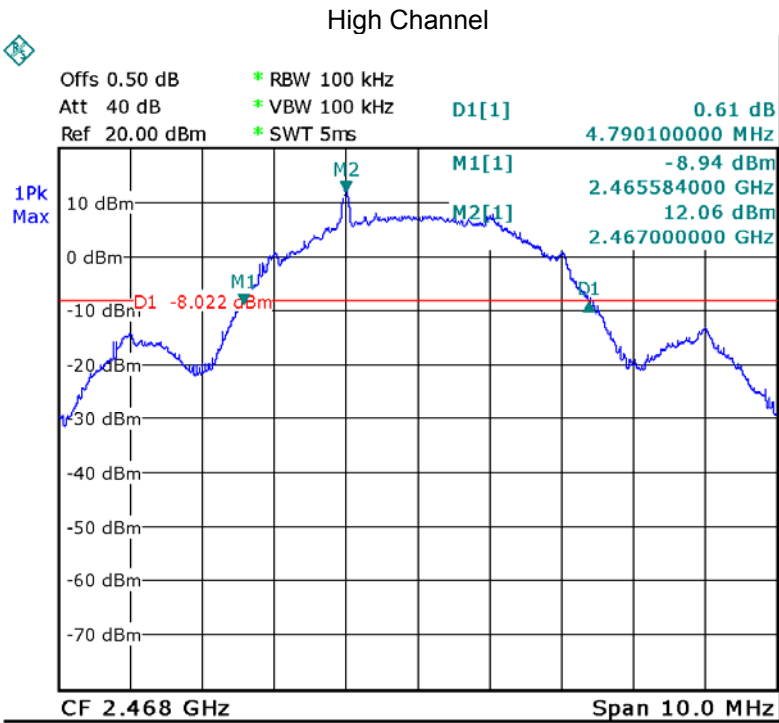
Test Channel	Bandwidth
Low	4.830
Middle	4.770
High	4.790

Test result plot as follows:





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Date: 20.JUL.2013 17:13:17

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.

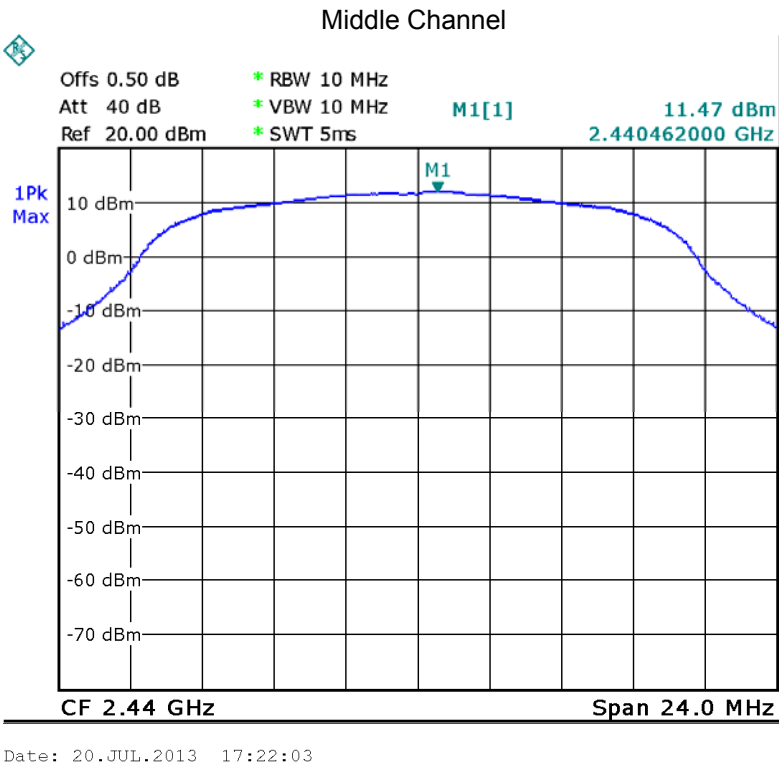
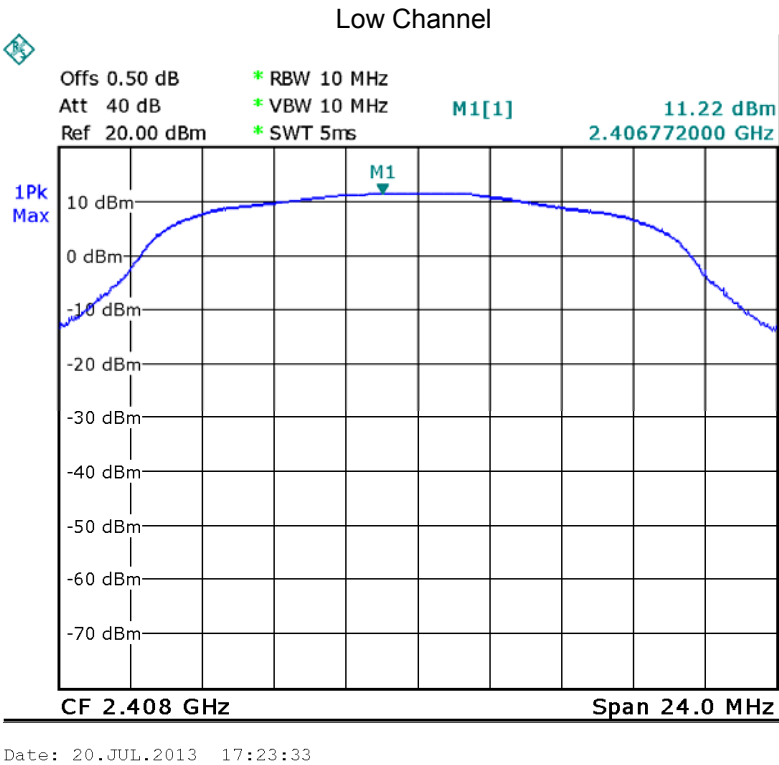
11.1 Test Procedure:

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 = 10MHz. VBW = 10MHz. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

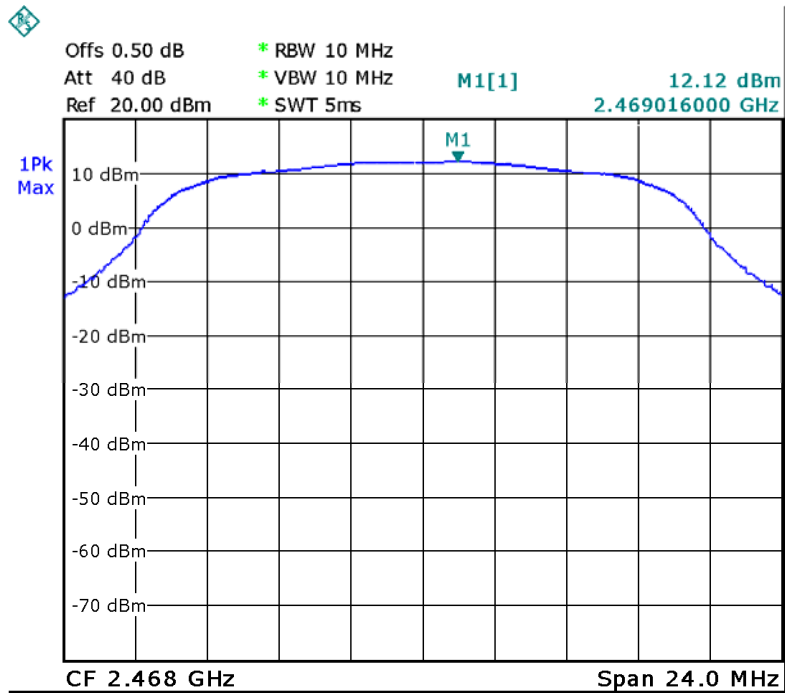
11.2 Test Result:

Test Channel	Output Power (dBm)	Limit (dBm)
Low	11.22	20.97
Middle	11.47	20.97
High	12.12	20.97

Test result plot as follows:



High Channel



Date: 20.JUL.2013 17:27:37

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.

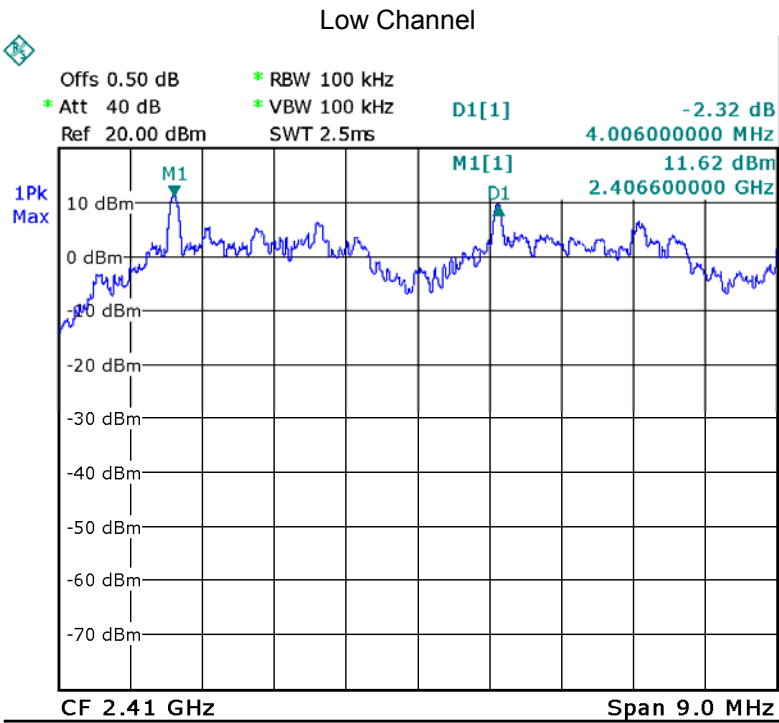
12.1 Test Procedure:

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.

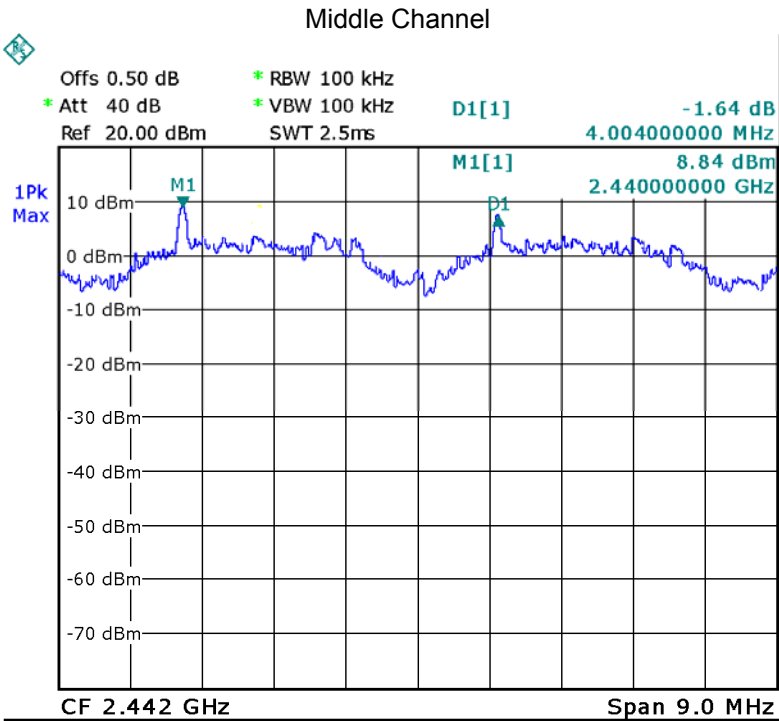
12.2 Test Result:

Test Channel	Separation (MHz)	Result
Low	4.006	PASS
Middle	4.004	PASS
High	4.003	PASS

Test result plot as follows:

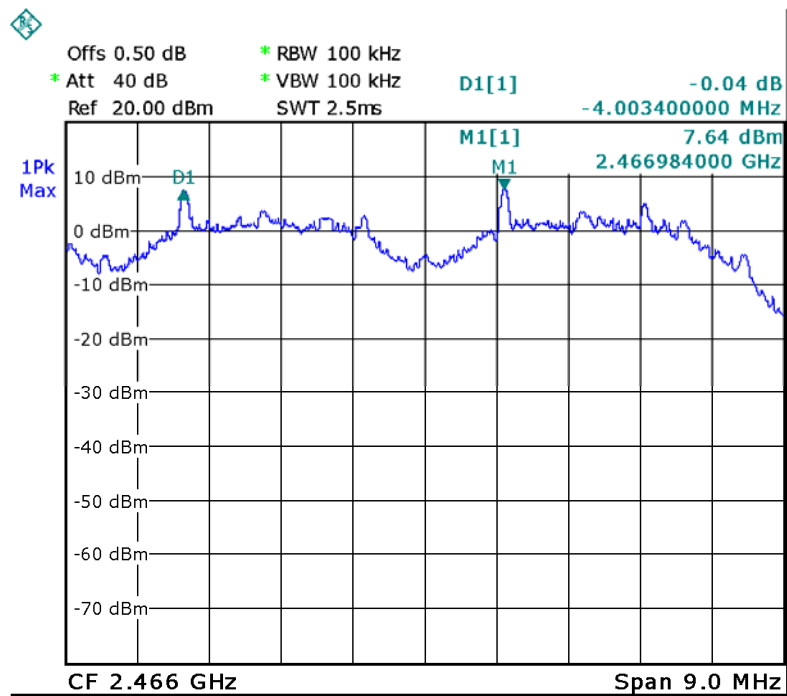


Date: 26.JUL.2013 14:55:51



Date: 26.JUL.2013 14:54:13

High Channel



Date: 26.JUL.2013 14:56:06

13 Number of Hopping Frequency

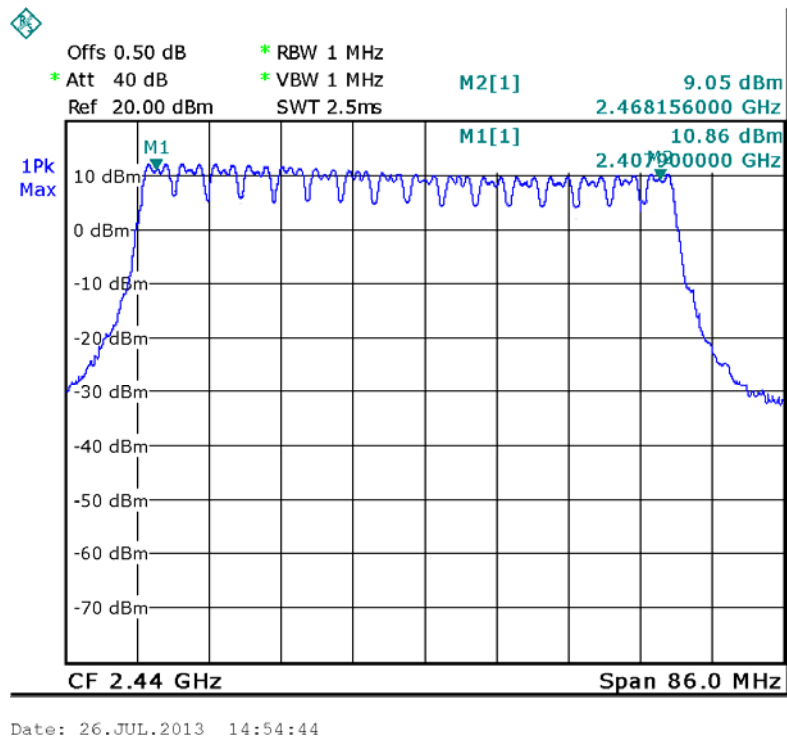
Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	DA 00-705
Test Limit:	Regulation 15.247 (a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.
Test Mode:	Test in hopping transmitting operating mode.

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 16 Channels.



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: $T = 0.4(s) * 16 = 6.4 (s)$

So, the Dwell Time can be calculated as follows:

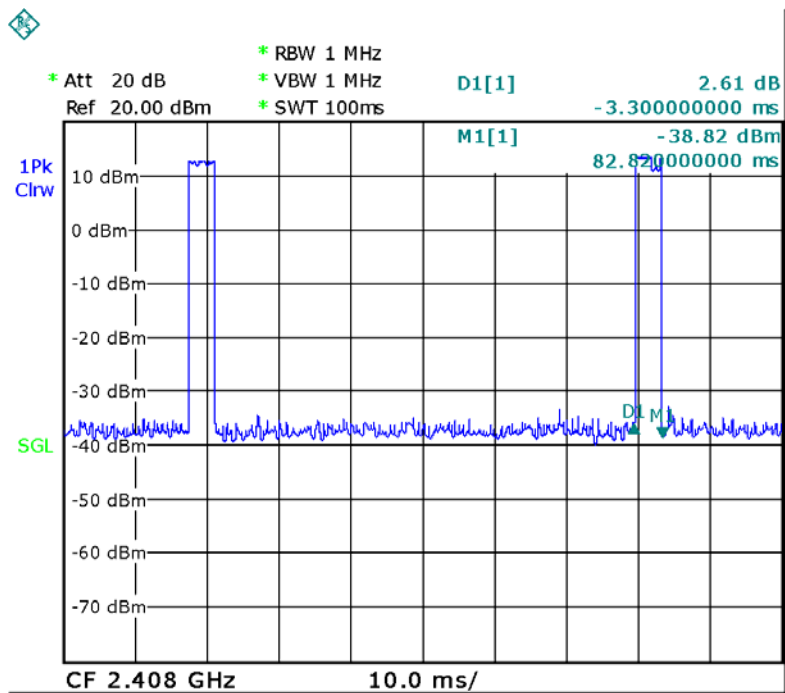
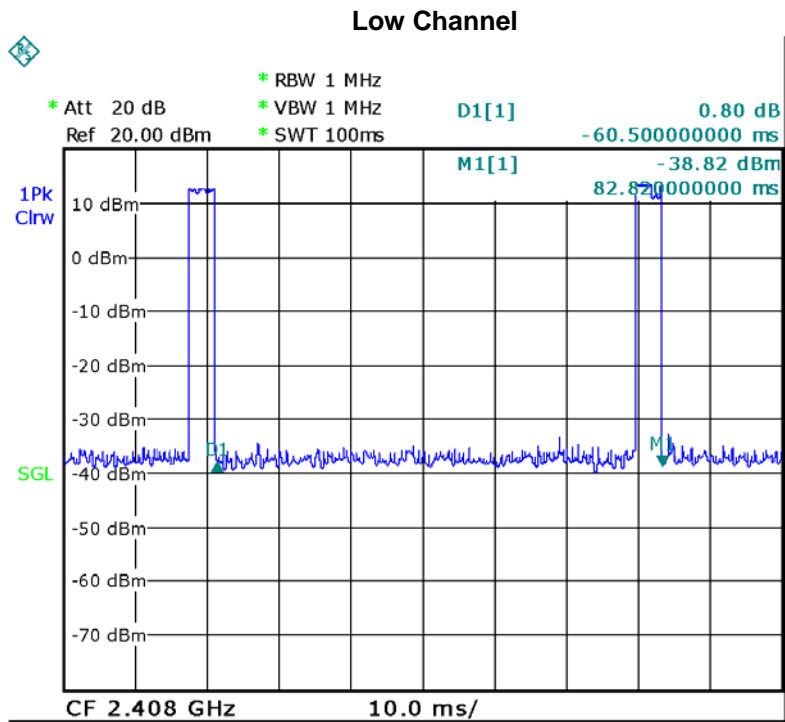
Low channel: Dwell Time = $1(\text{times})/0.061(s)*3.30(\text{ms})*6.4(s)=0.346(s)$

Middle channel: Dwell Time = $1(\text{times})/0.062(s)*3.30(\text{ms})*6.4(s)=0.340(s)$

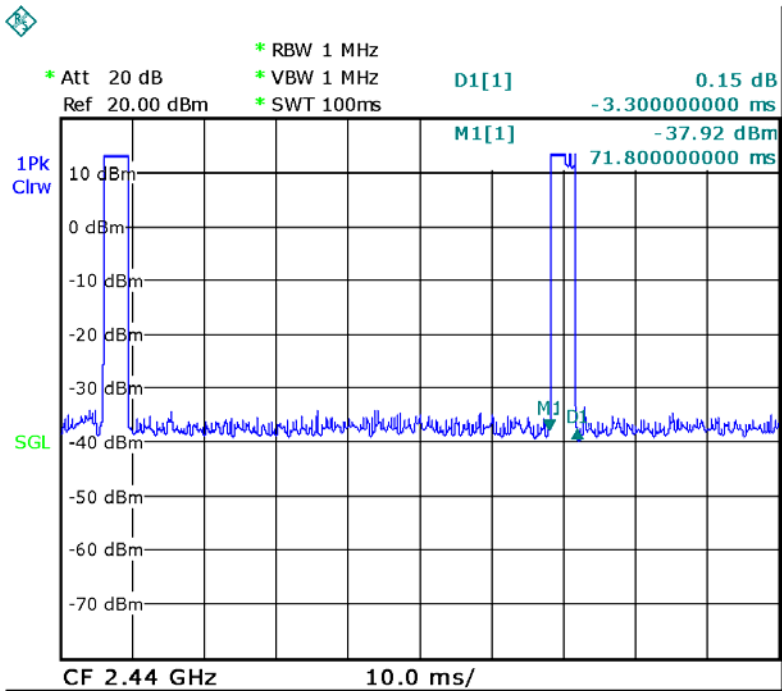
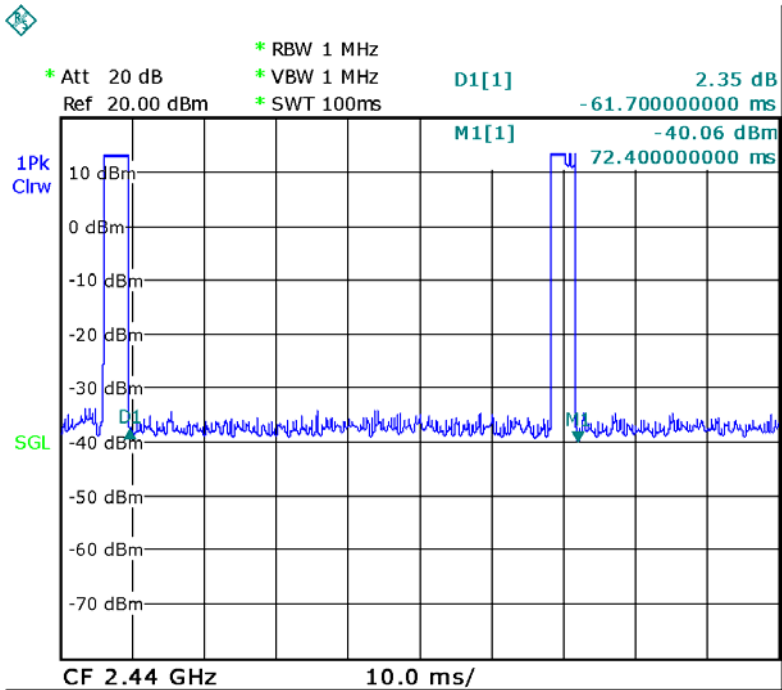
High channel: Dwell Time = $1(\text{times})/0.062(s)*3.30(\text{ms})*6.4(s)=0.340(s)$

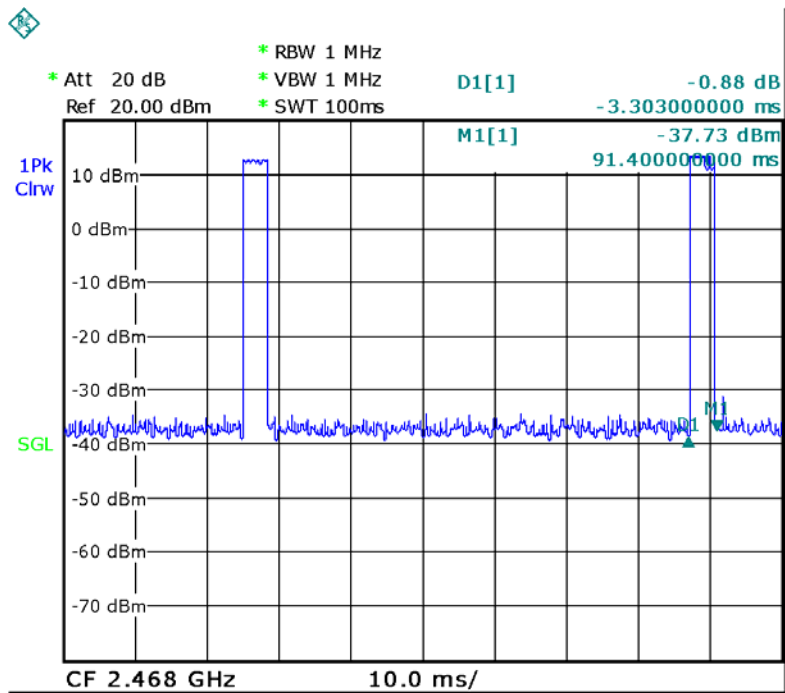
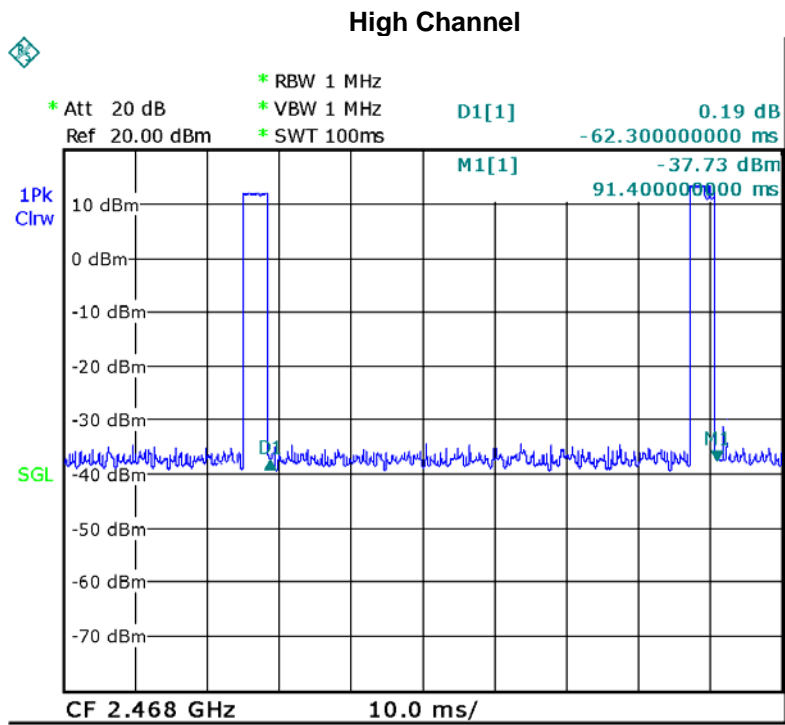
Note : Mkr Delta is once pulse time.

Frequency	Mkr Delta(ms)	Dwell Time(s)	Limits(s)	Result
2408 MHz	3.30	0.346	0.400	Pass
2440 MHz	3.30	0.340	0.400	Pass
2468 MHz	3.30	0.340	0.400	Pass



Middle Channel





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 detachable antenna with RP SMA connector (The whorl is nonstandard , it only apply to this model), fulfill the requirement of this section.

16 RF Exposure

Test Requirement: FCC Part 1.1307

Test Mode: The EUT work in test mode(Tx).

16.1 Requirements:

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2 m normally can be maintained between the user and the device.

16.2 The procedures / limit

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842 / f	4.89 / f	(900 / f)*	6
30-300	61.4	0.163	1.0	6
300-1500			F/300	6
1500-100,000			5	6

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

Note: f = frequency in MHz ; *Plane-wave equivalent power density

16.3 MPE Calculation Method

$$E \text{ (V/m)} = \frac{\sqrt{30 \times P \times G}}{d} \quad \text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

E = Electric field (V/m)

P = Peak RF output power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$

From the peak EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained

Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
1.585	12.12	16.293	0.005	1

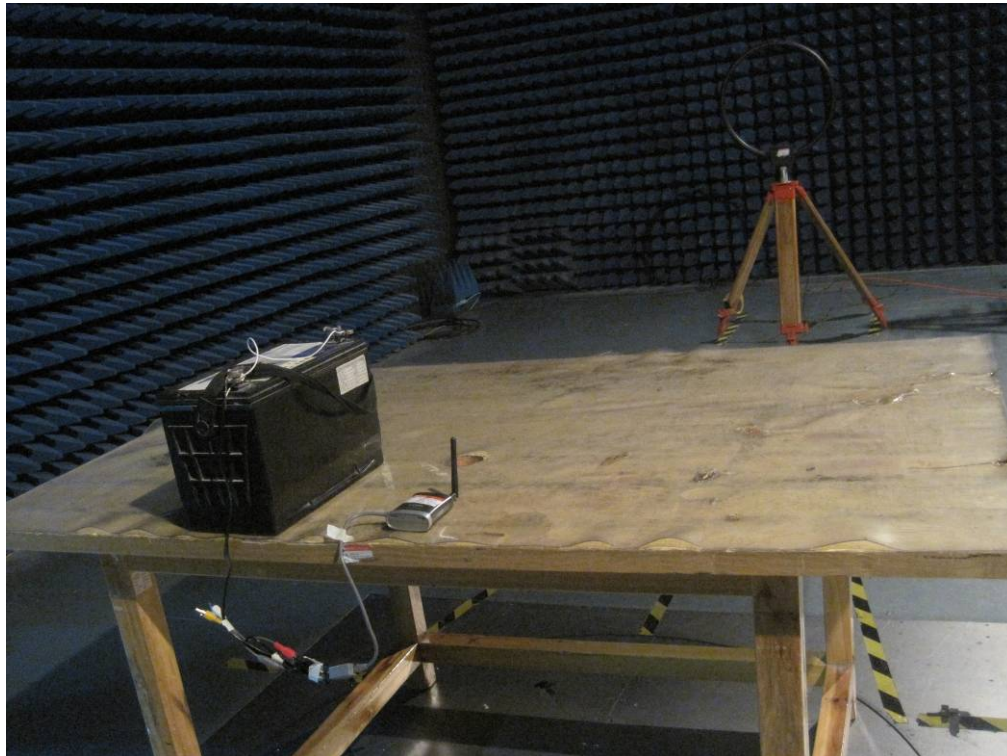
17 Photographs – Test Setup

17.1 Conducted Emissions

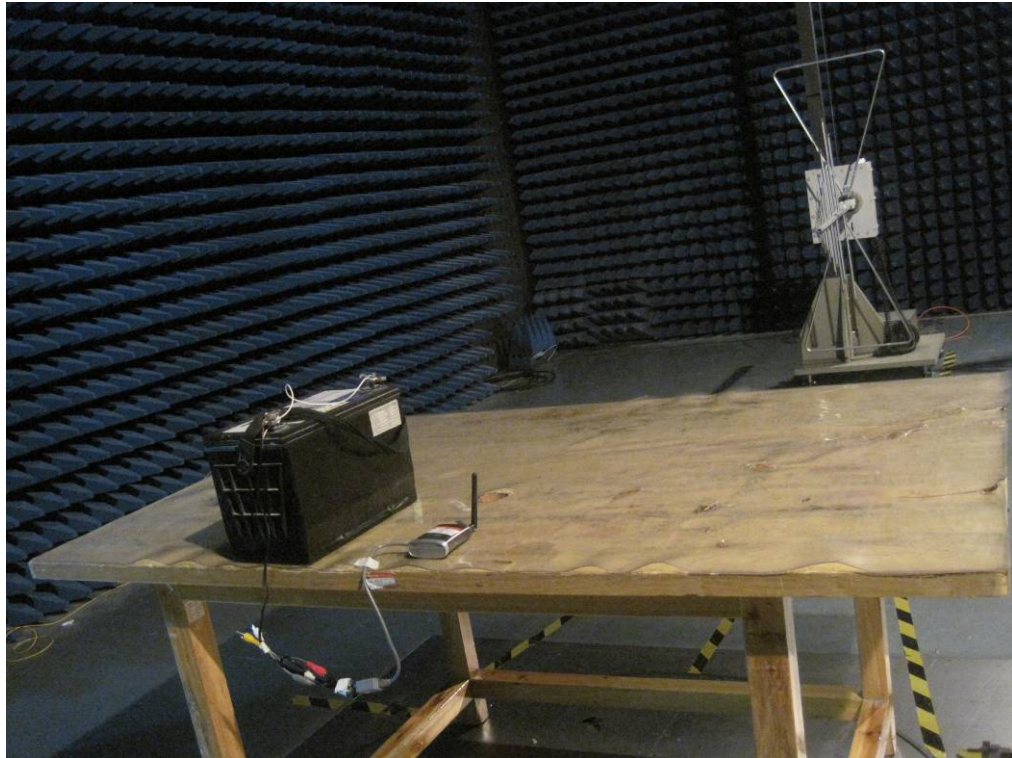


17.2 Photograph – Radiation Spurious Emission Test Setup

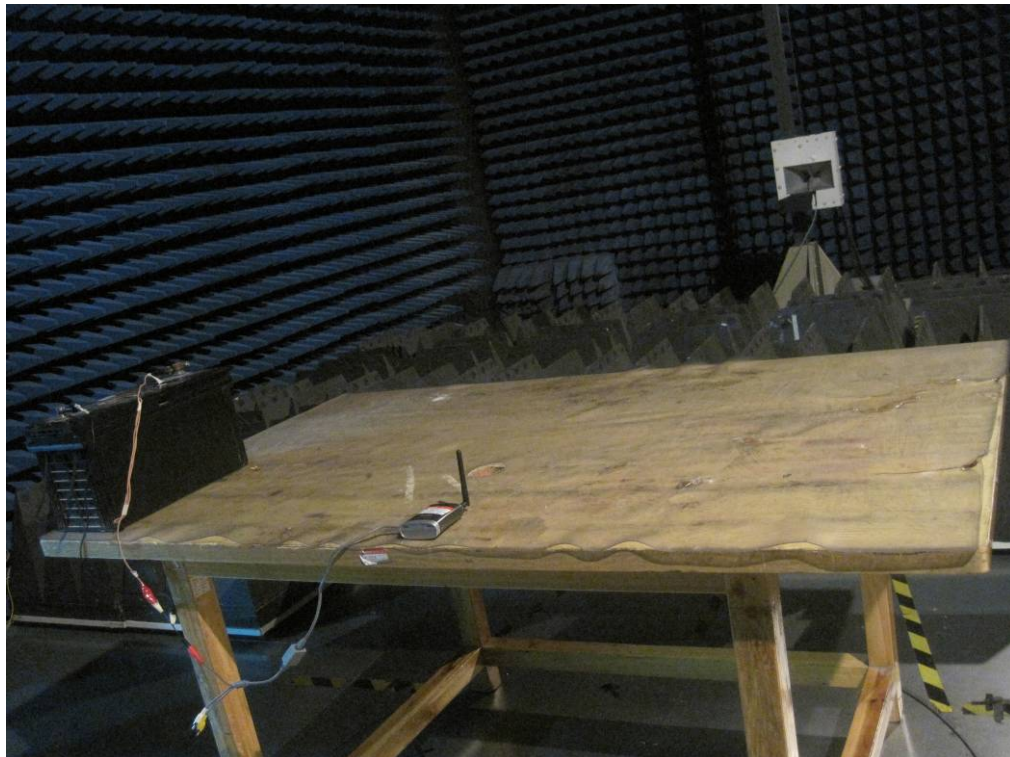
Below 30MHz



30MHz-1GHz



Above 1GHz



18 Photographs - Constructional Details

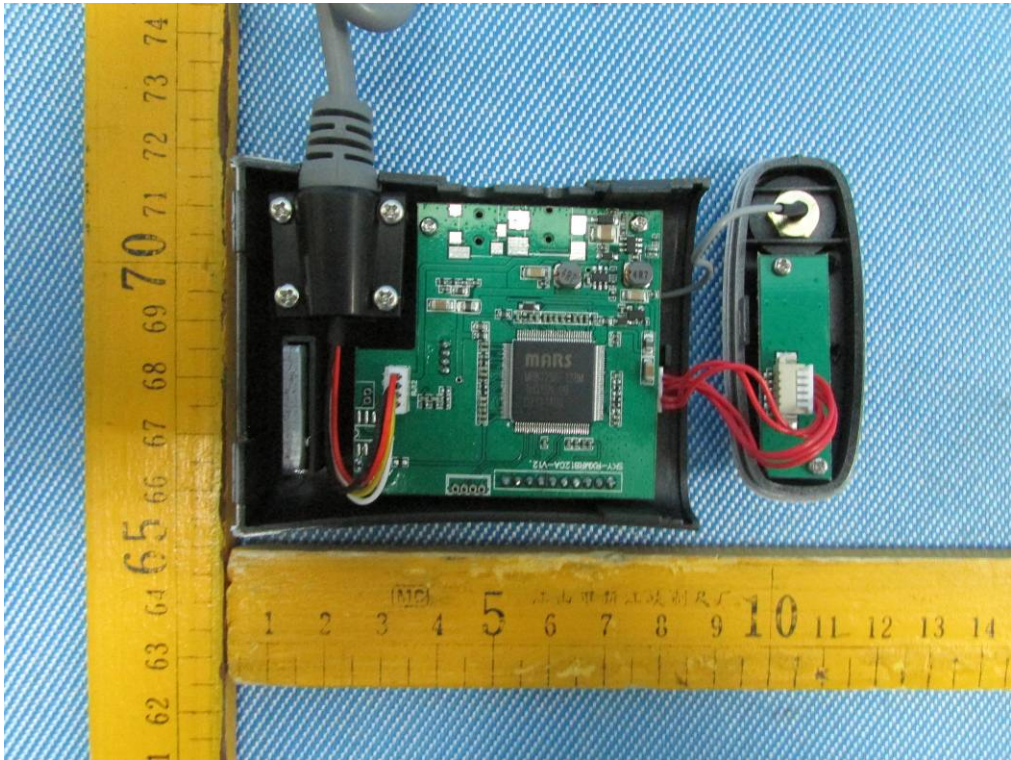
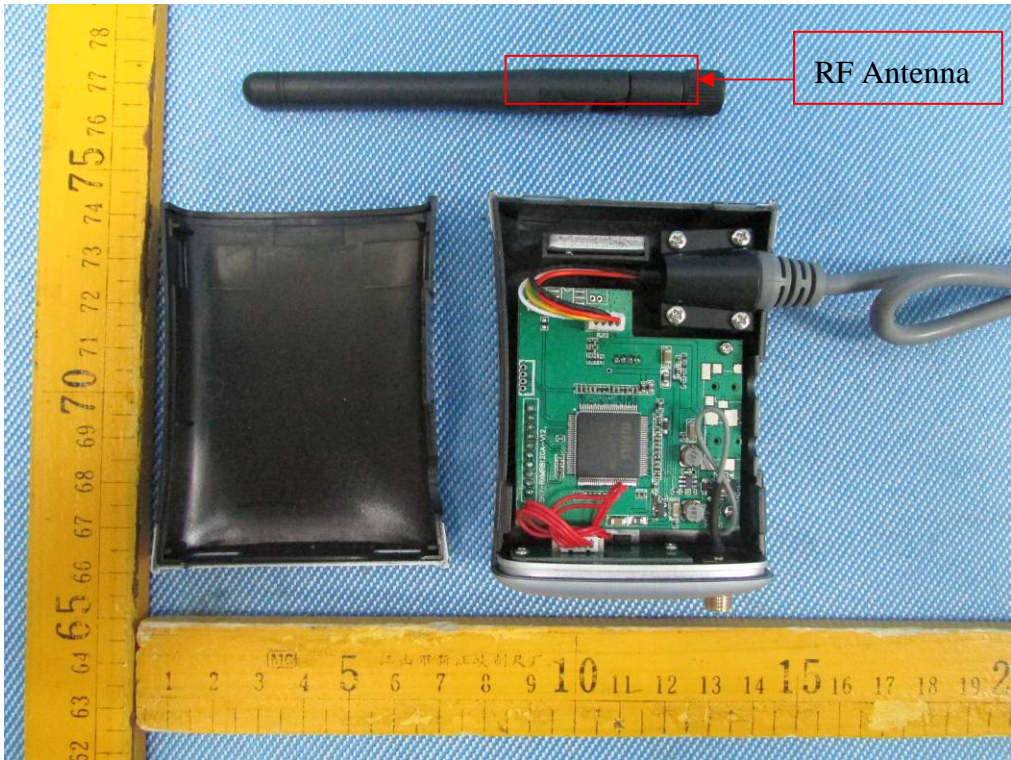
18.1 External View

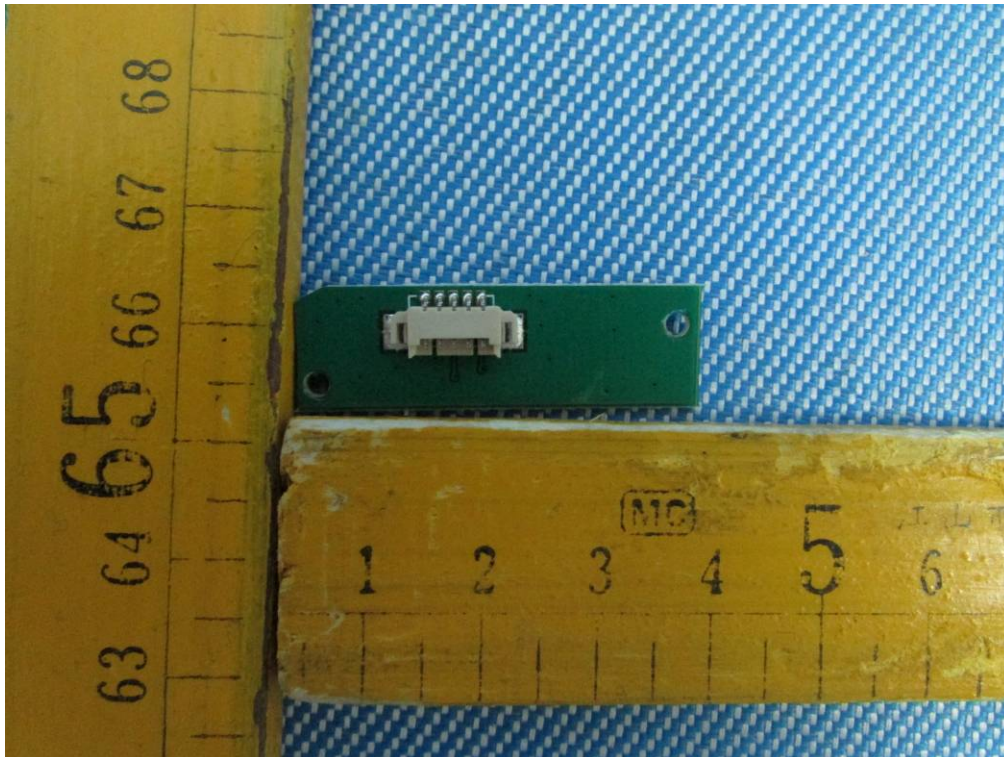
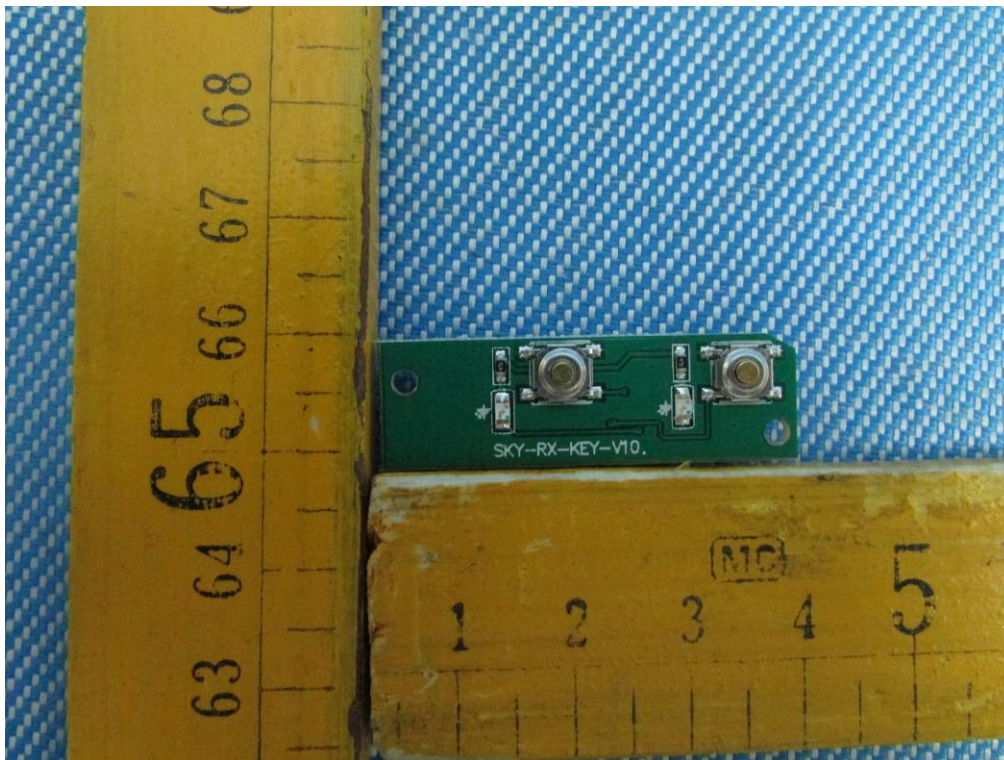


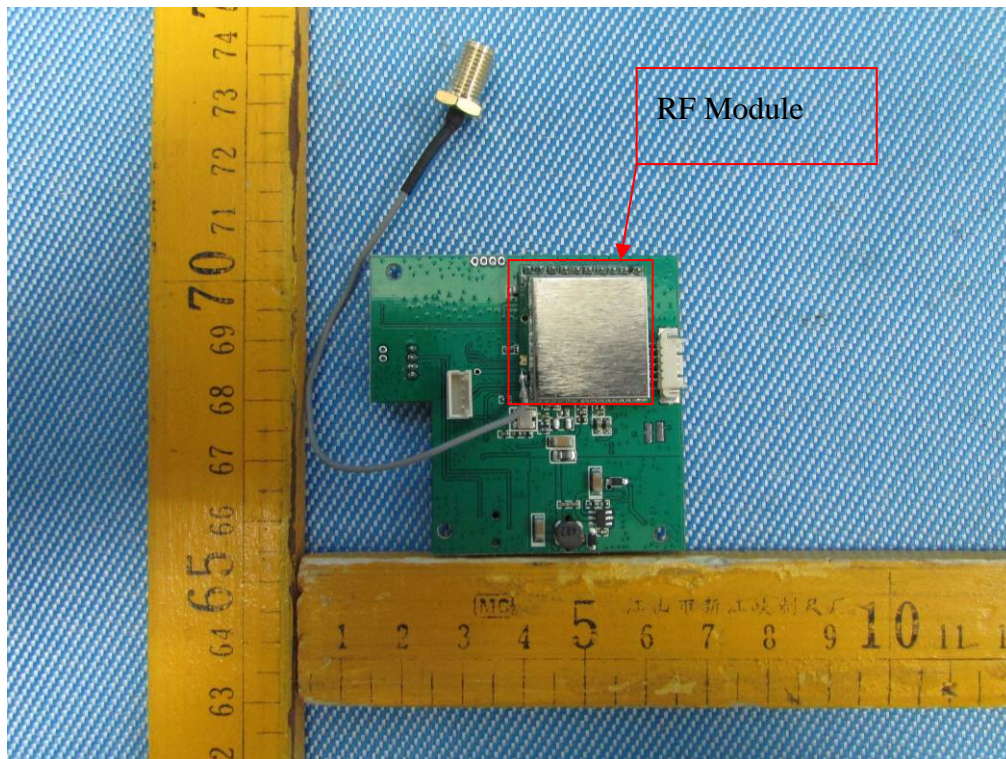
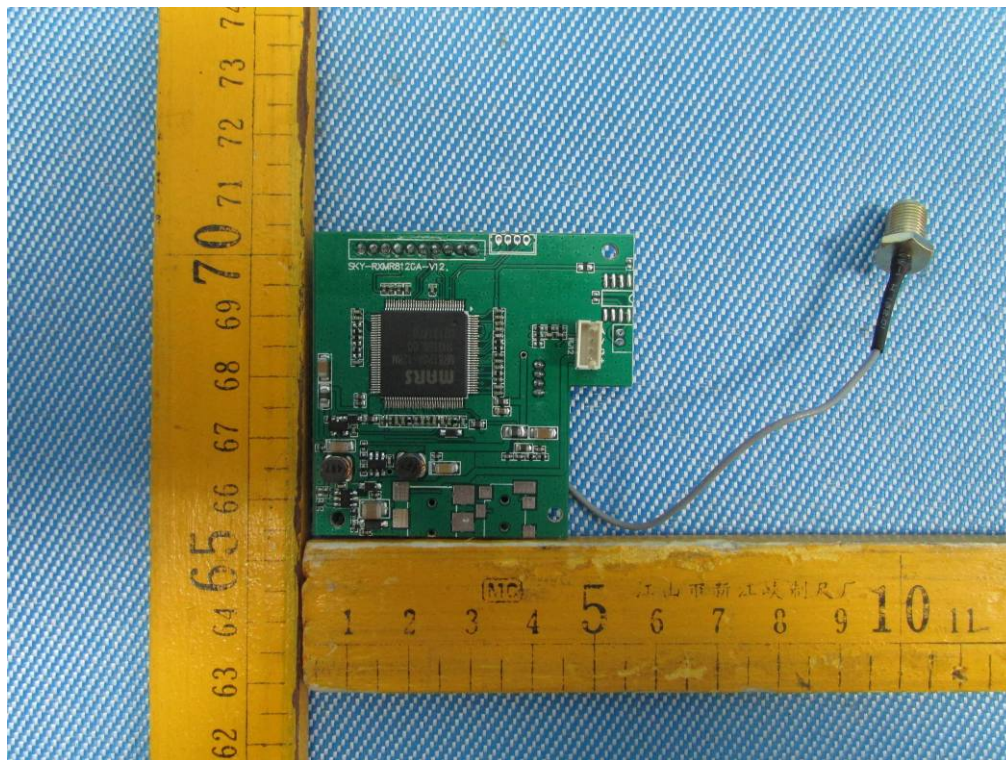


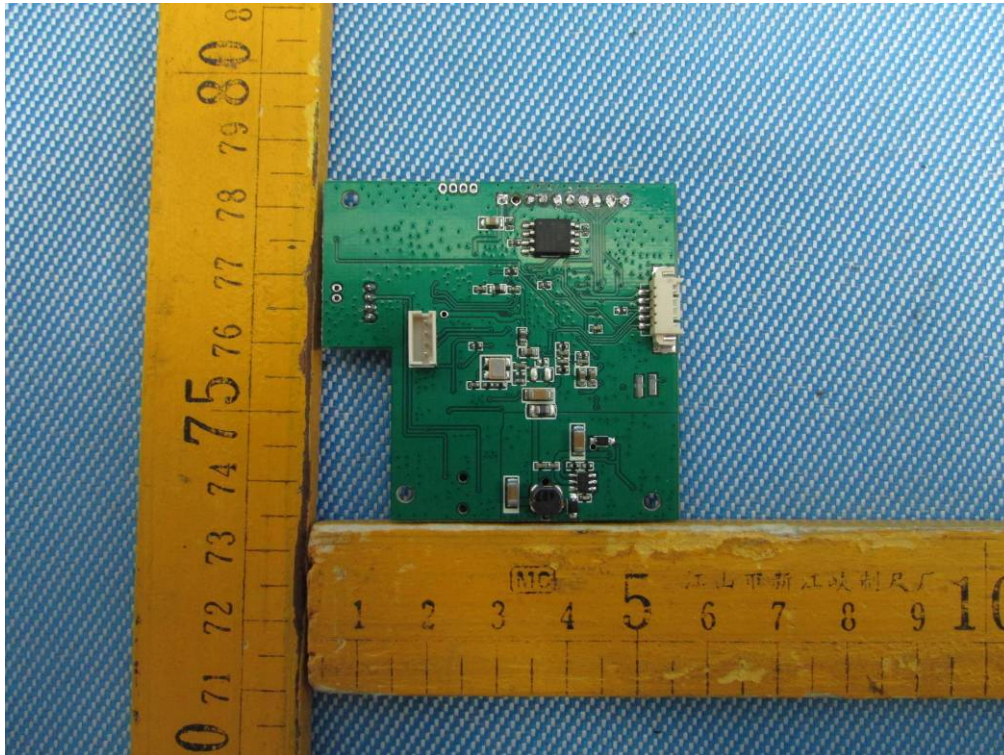


18.2 EUT – Open View

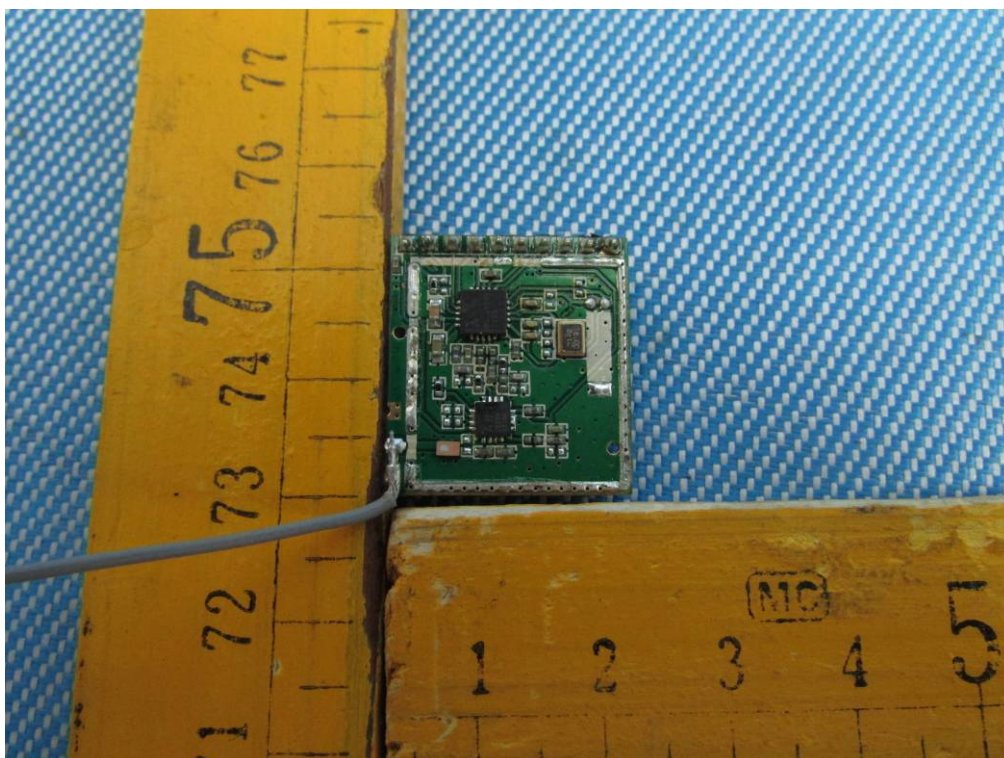


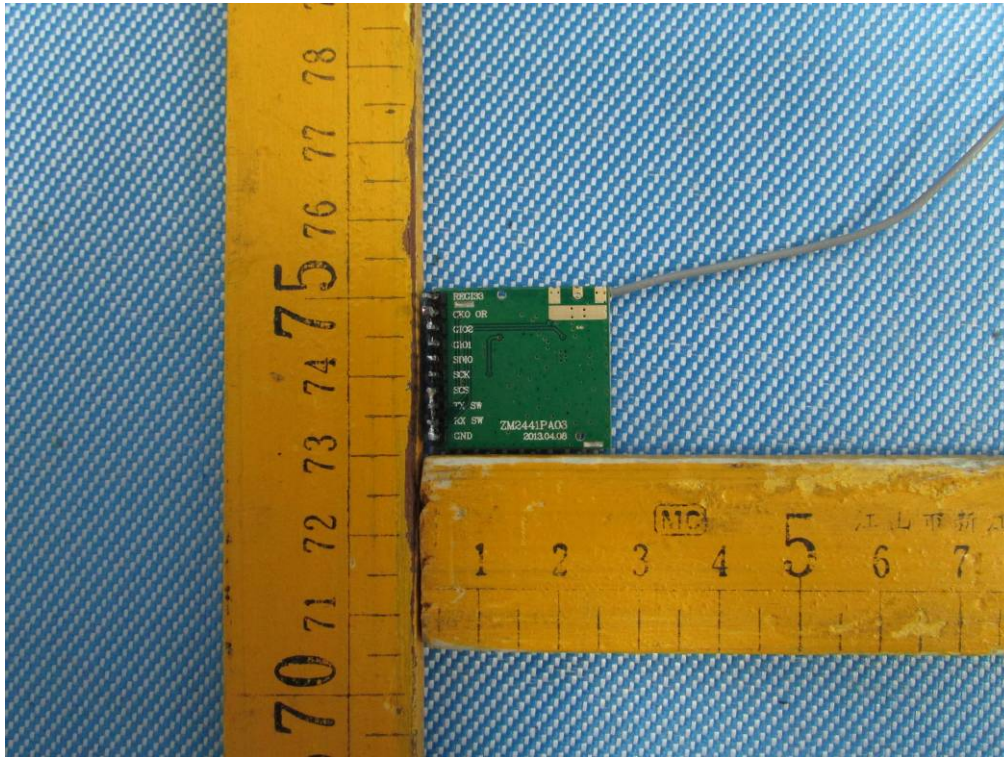






18.3 RF module - View





18.4 RF Antenna - View





=End of report=