

FCC TEST REPORT

FCC ID : SJ8-UBRC13
Applicant : RDI Technology (Shenzhen) Co., Ltd.
Address : Building C1 Xintang Industrial Park, East Baishixia, Fuyong, Baoan, Shenzhen, China
Manufacturer : The same as above
Address : The same as above
Equipment Under Test (EUT) :
Product Name : Wireless Camera
Model No. : UBRC13
Standards : FCC CFR47 Part 15 Section 15.247:2010
Date of Test : April 24~29, 2013
Date of Issue : May 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:

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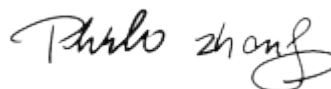
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Compiled by:



Zero Zhou / Project Engineer

Approved by:



Philo Zhong / Manager

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

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4 General Information

4.1 General Description of E.U.T.

Product Name	: Wireless Camera
Model No.	: UBRC13
Operation Frequency	: 2402MHz ~ 2480MHz, 40 channels in total
Type of Modulation	: GFSK
Oscillator	: Crystal 27MHz for CPU,16MHz for RF module
Antenna installation	: Integrated Antenna
Antenna Gain	: 2 dBi

4.2 Details of E.U.T.

Technical Data	: (1) DC 3.7V, 1000mAh powered by battery (2)DC 5V, 1A powered by adapter
Adapter	: Manufacturer:Csec, M/N:CS6D050100FUF

4.3 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.

4.4 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

4.5 Test Mode

Test Item	Test Mode
Conducted Emissions	Normal linking(adapter)
Radiated Emissions	Normal linking(adapter)
	Normal linking(battery)

4.6 Channel List

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
1	2402	2	2404	3	2406	4	2408
5	2410	6	2412	7	2414	8	2416
9	2418	10	2420	11	2422	12	2424
13	2426	14	2428	15	2430	16	2432
17	2434	18	2436	19	2438	20	2440
21	2442	22	2444	23	2446	24	2448
25	2450	26	2452	27	2454	28	2456
29	2458	30	2460	31	2462	32	2464
33	2466	34	2468	35	2470	36	2472
37	2474	38	2476	39	2478	40	2480

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 (Test Frequency: 1GHz ~6GHz)						
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
4.	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	Aug. 13,2012	Aug. 12,2013
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.	10m Coaxial Cable with N- plug	SCHWARZBECK	AK 9515 H	-	Aug. 13,2012	Aug. 12,2013
3m Semi-anechoic Chamber for Radiation(TDK) (Test Frequency: 32.768kHz ~1GHz)						
Item	Equipment	Manufacturer	Model No.	Serial No	Last Calibration Date	Calibration Due Date
1	Test Receiver	R&S	ESCI	101296	Aug.09,2012	Aug.08,2013
2	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	Aug. 13,2012	Aug. 12,2013
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	Aug.11,2012	Aug.0,2013
4	Amplifier	Compliance pirection systems inc	PAP-0203	22024	Apr.07,2013	Apr.06,2014
5	Cable	HUBER+SUHNE R	CBL2	525178	Sep.15,2012	Sep.14,2013

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: 1016 mbar

EUT Operation:

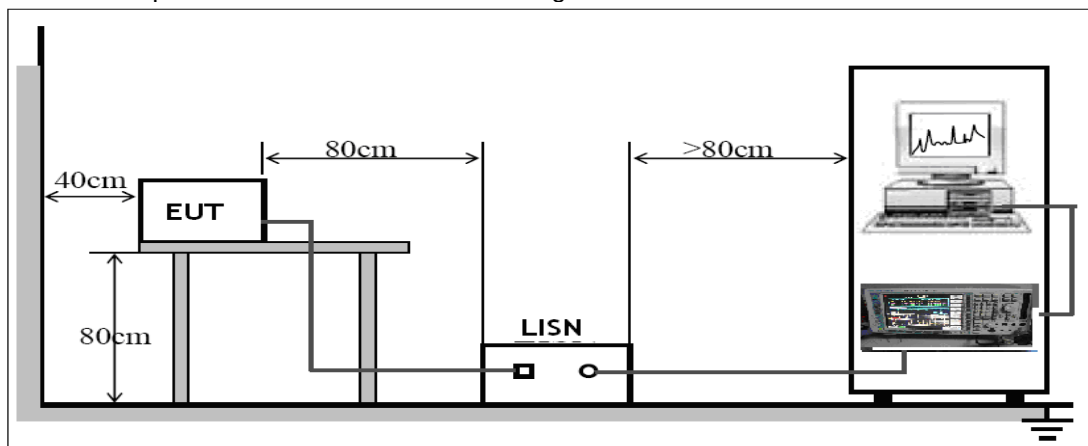
The test was performed in normal link mode, the test data were shown in the report.

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

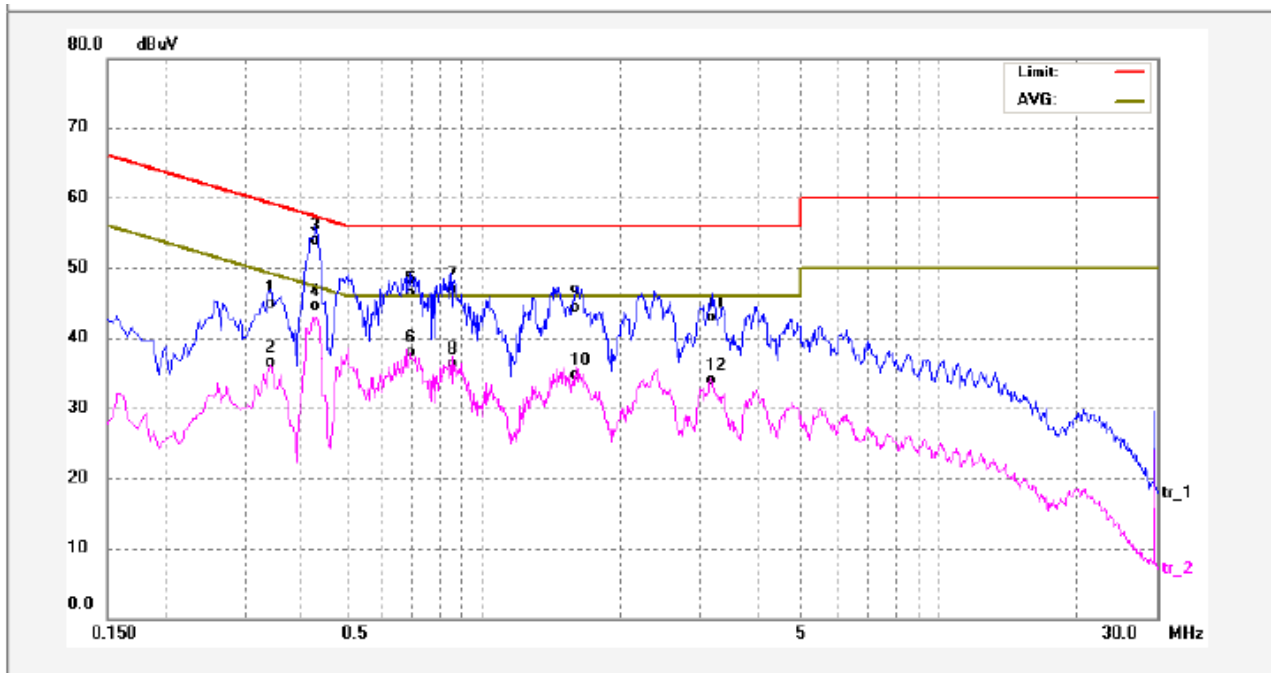
The EUT was placed on the test table in shielding room.



6.3 Conducted Emission Test Result

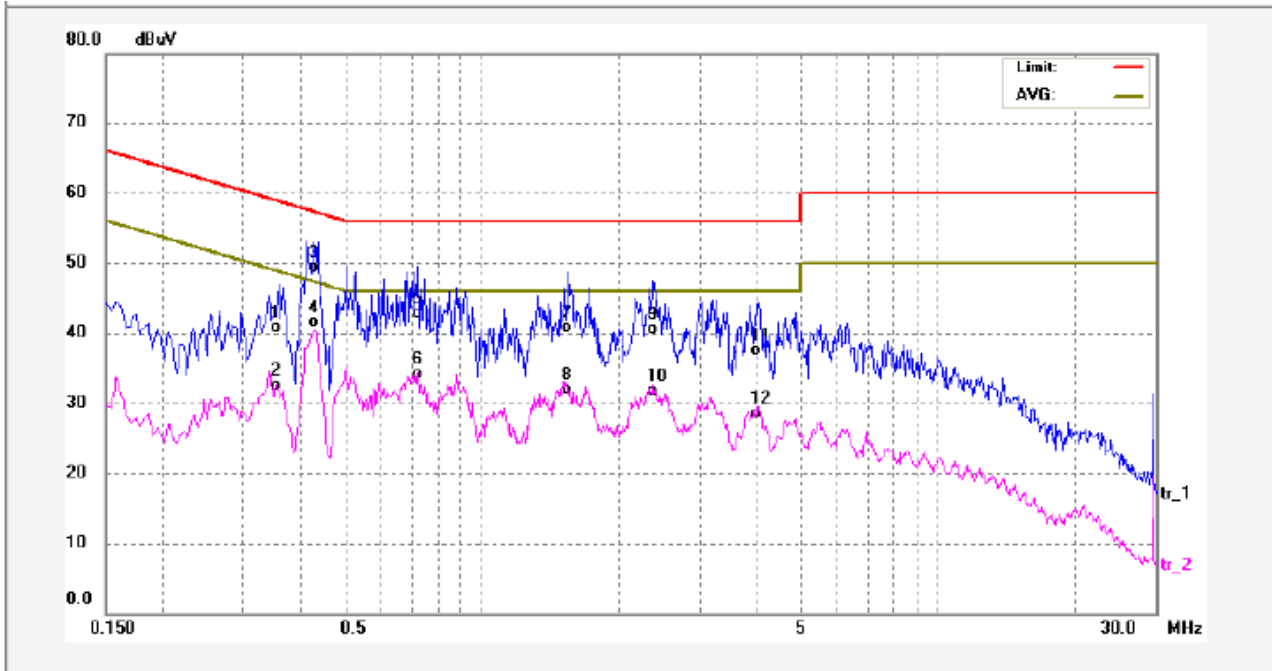
An initial pre-scan was performed on the live and neutral lines.

Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.3420	32.72	11.30	44.02	59.15	-15.13	QP	
2	0.3420	24.32	11.30	35.62	49.15	-13.53	AVG	
3	0.4300	41.88	11.31	53.19	57.25	-4.06	QP	
4	0.4300	32.32	11.31	43.63	47.25	-3.62	AVG	
5	0.6900	34.12	11.34	45.46	56.00	-10.54	QP	
6	0.6900	25.82	11.34	37.16	46.00	-8.84	AVG	
7	0.8500	34.90	11.26	46.16	56.00	-9.84	QP	
8	0.8500	24.31	11.26	35.57	46.00	-10.43	AVG	
9	1.6100	32.40	11.19	43.59	56.00	-12.41	QP	
10	1.6100	22.73	11.19	33.92	46.00	-12.08	AVG	
11	3.1820	30.87	11.22	42.09	56.00	-13.91	QP	
12	3.1820	21.80	11.22	33.02	46.00	-12.98	AVG	

Neutral line:



No.	Freq. (MHz)	Reading (dBμV)	Factor (dB)	Result (dBμV)	Limit dBμV	Margin (dB)	Detector	Remark
1	0.3580	28.63	11.31	39.94	58.77	-18.83	QP	
2	0.3580	20.34	11.31	31.65	48.77	-17.12	AVG	
3	0.4300	37.25	11.31	48.56	57.25	-8.69	QP	
4	0.4300	29.33	11.31	40.64	47.25	-6.61	AVG	
5	0.7260	30.51	11.33	41.84	56.00	-14.16	QP	
6	0.7260	21.89	11.33	33.22	46.00	-12.78	AVG	
7	1.5540	28.73	11.19	39.92	56.00	-16.08	QP	
8	1.5540	19.86	11.19	31.05	46.00	-14.95	AVG	
9	2.3780	28.41	11.20	39.61	56.00	-16.39	QP	
10	2.3780	19.64	11.20	30.84	46.00	-15.16	AVG	
11	4.0580	25.43	11.23	36.66	56.00	-19.34	QP	
12	4.0580	16.55	11.23	27.78	46.00	-18.22	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	$10000 * 2400/F(\text{kHz})$	$20\log^{(2400/F(\text{kHz}))} + 80$
0.490 ~ 1.705	24000/F(kHz)	30	$100 * 24000/F(\text{kHz})$	$20\log^{(24000/F(\text{kHz}))} + 40$
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

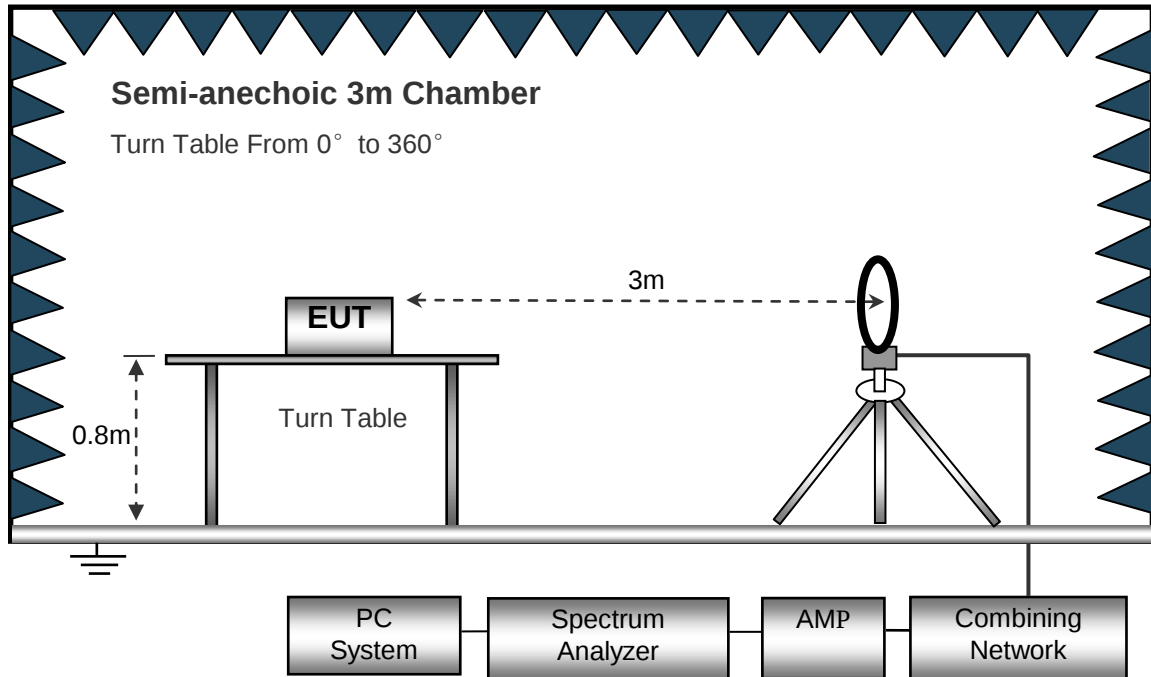
Humidity: 51 % RH

Atmospheric Pressure: 1010 mbar

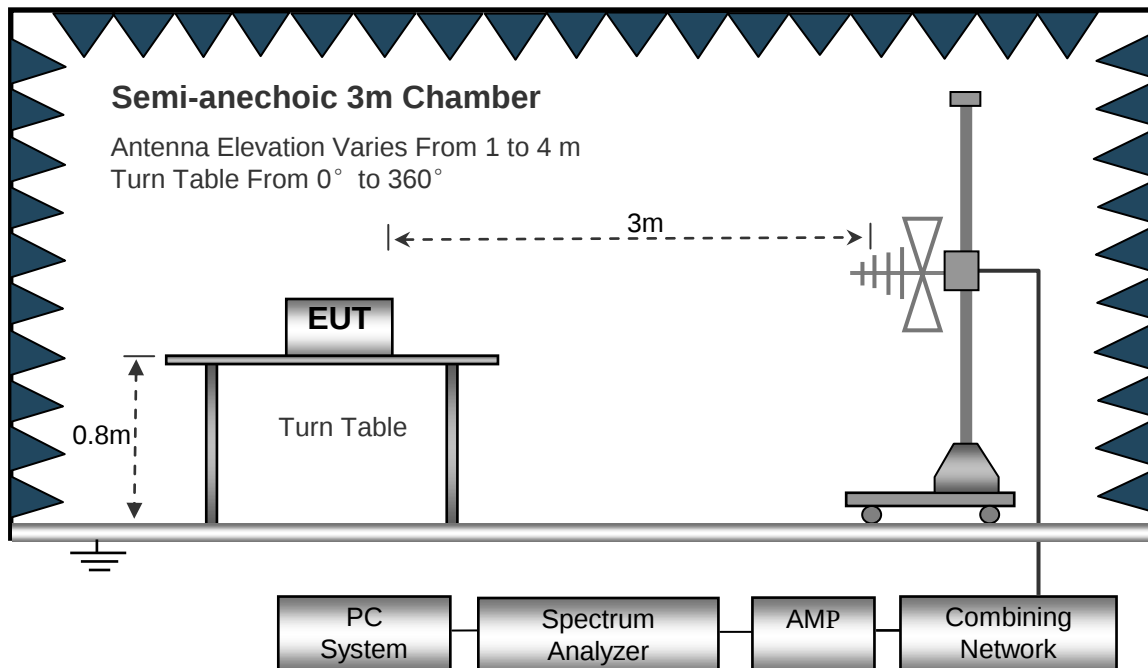
7.2 Test Setup

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

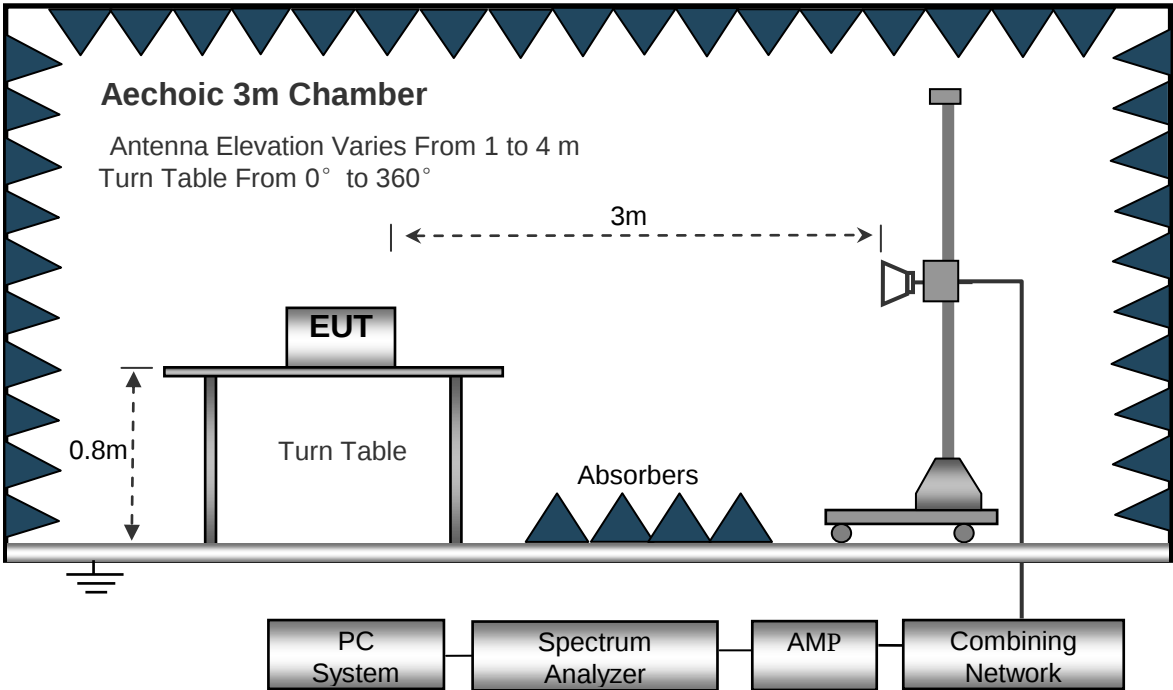
The test setup for emission measurement below 30MHz.



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 16MHz to 25000MHz.

Below 30MHz

Sweep Speed.....Auto
IF Bandwidth10KHz
Video Bandwidth10KHz
Resolution Bandwidth10KHz

30MHz ~ 1GHz

Sweep Speed.....Auto
IF Bandwidth120 KHz
Video Bandwidth100KHz
Quasi-Peak Adapter Bandwidth.....120 KHz
Quasi-Peak Adapter ModeNormal
Resolution Bandwidth100KHz

Above 1GHz

Sweep Speed.....Auto
IF Bandwidth120 KHz
Video Bandwidth3MHz
Quasi-Peak Adapter Bandwidth.....120 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

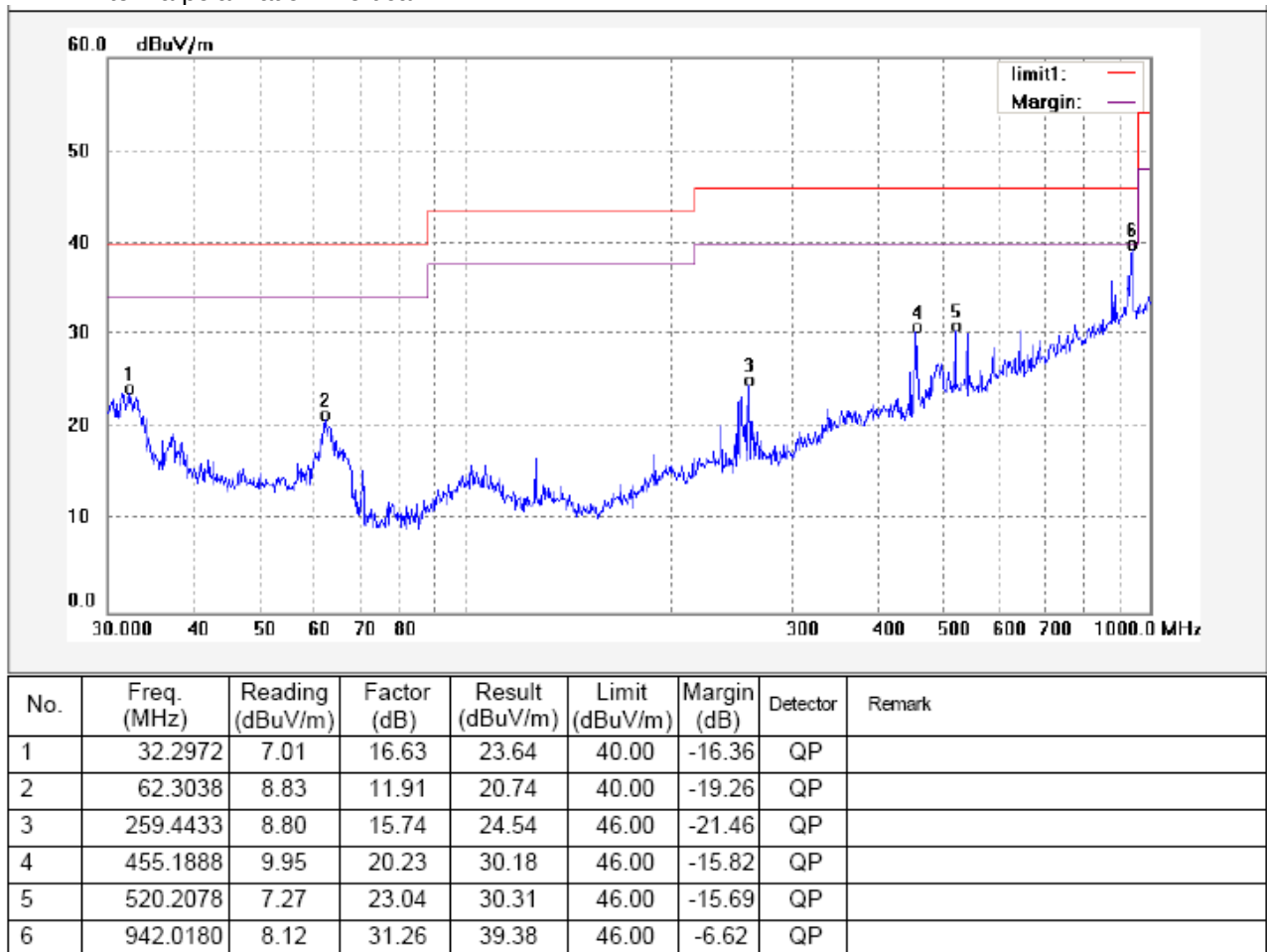
After pretest,we found no higher emission than background level, the data does not been shown in the test report.

Test Frequency : 30MHz ~ 1000MHz

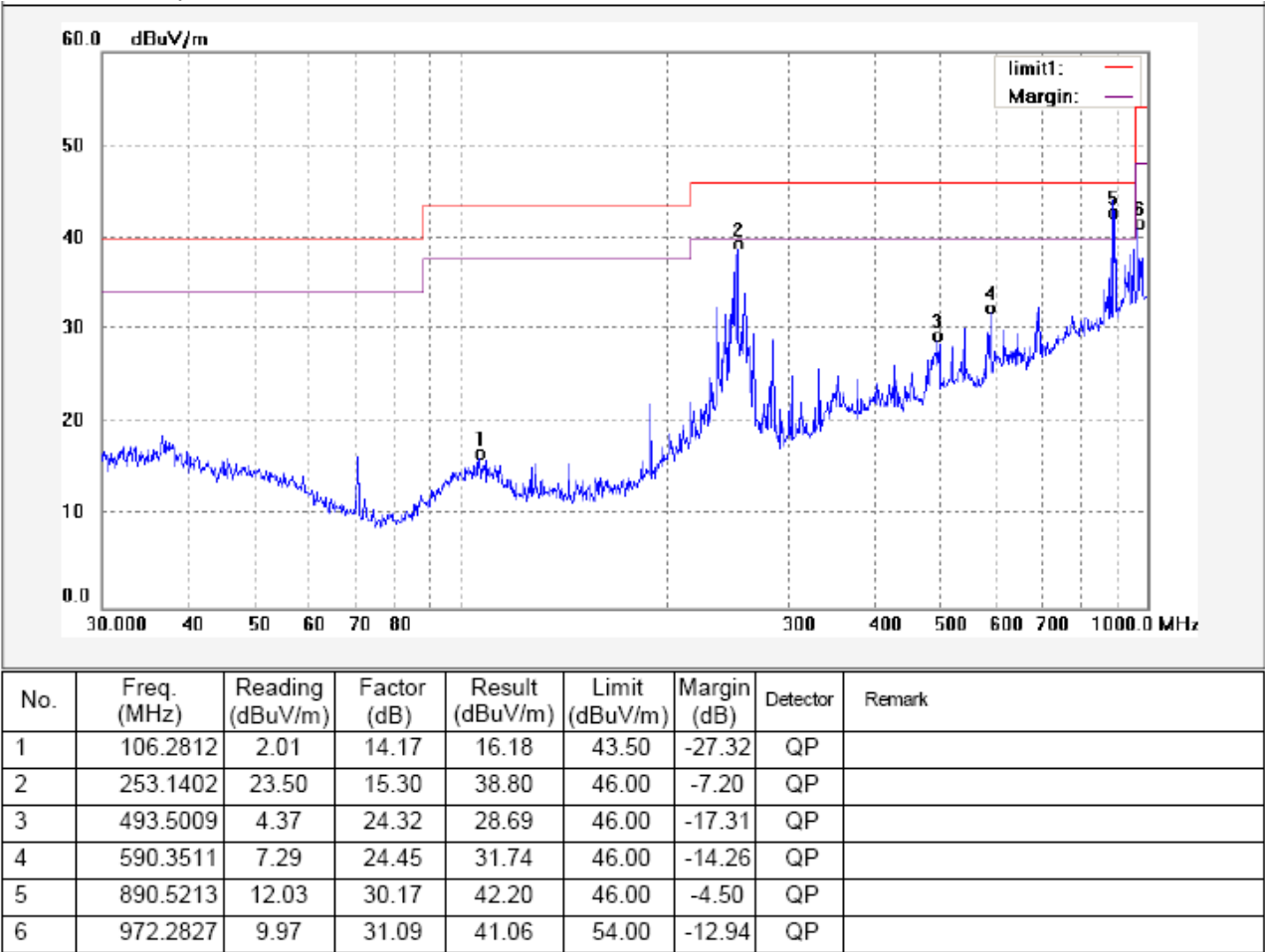
Remark: the EUT was pretested at the high, middle and low channel, and the worse case was the low Channel, so the data show was the low channel only.

Test mode: Normal Link(adapter)

Antenna polarization: Vertical

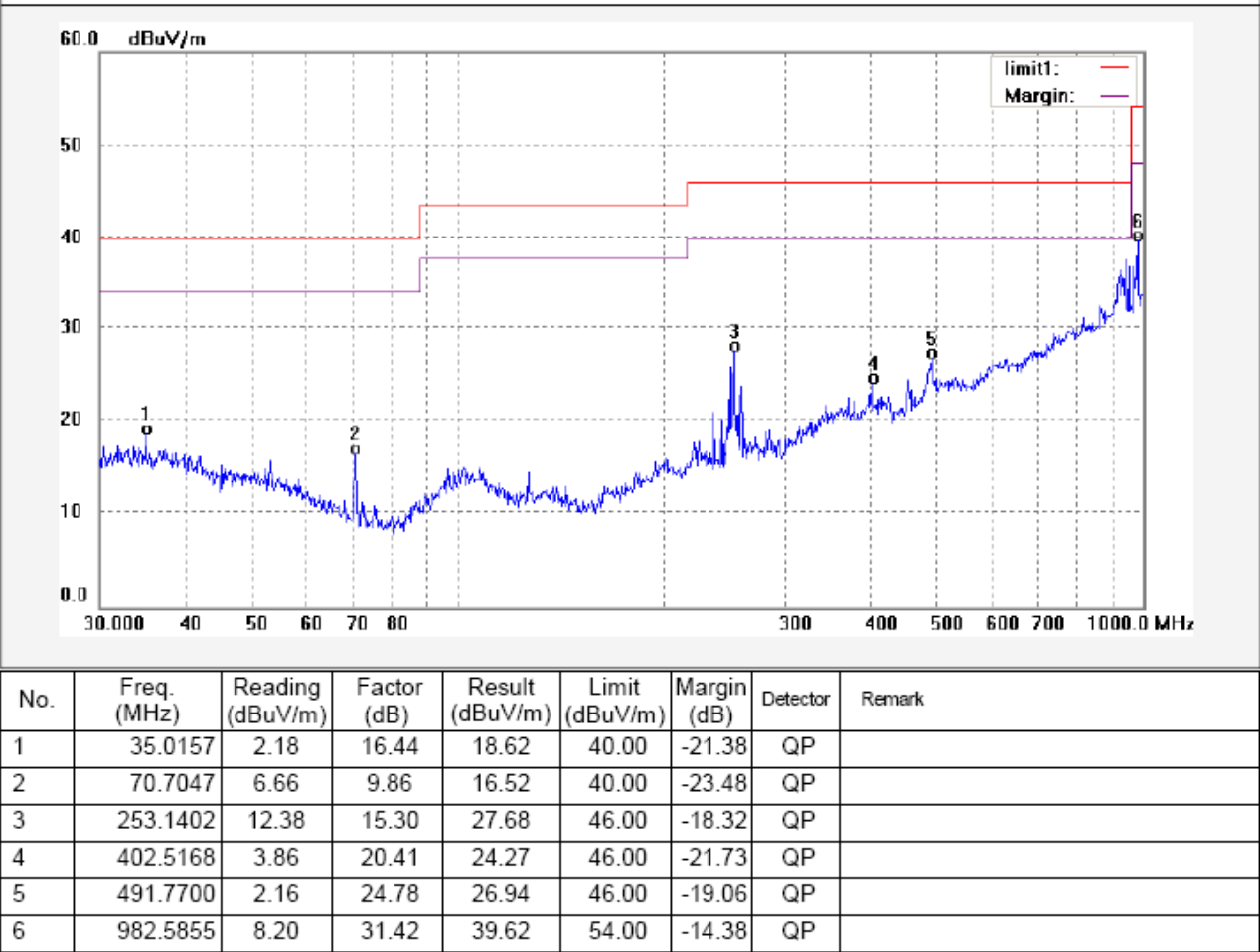


Antenna polarization: Horizontal

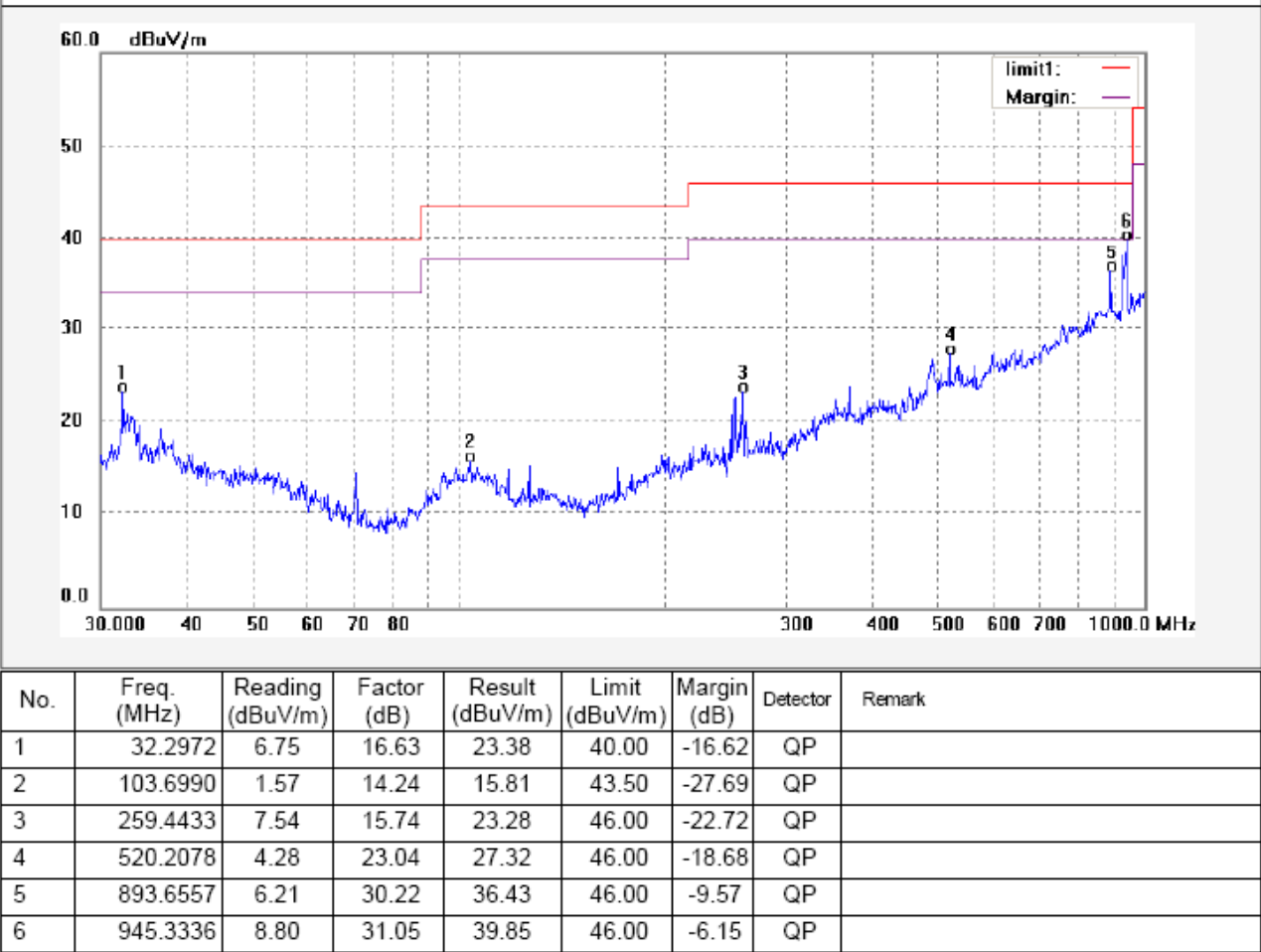


Test mode: Normal Link(battery)

Antenna polarization: Vertical



Antenna polarization: Horizontal

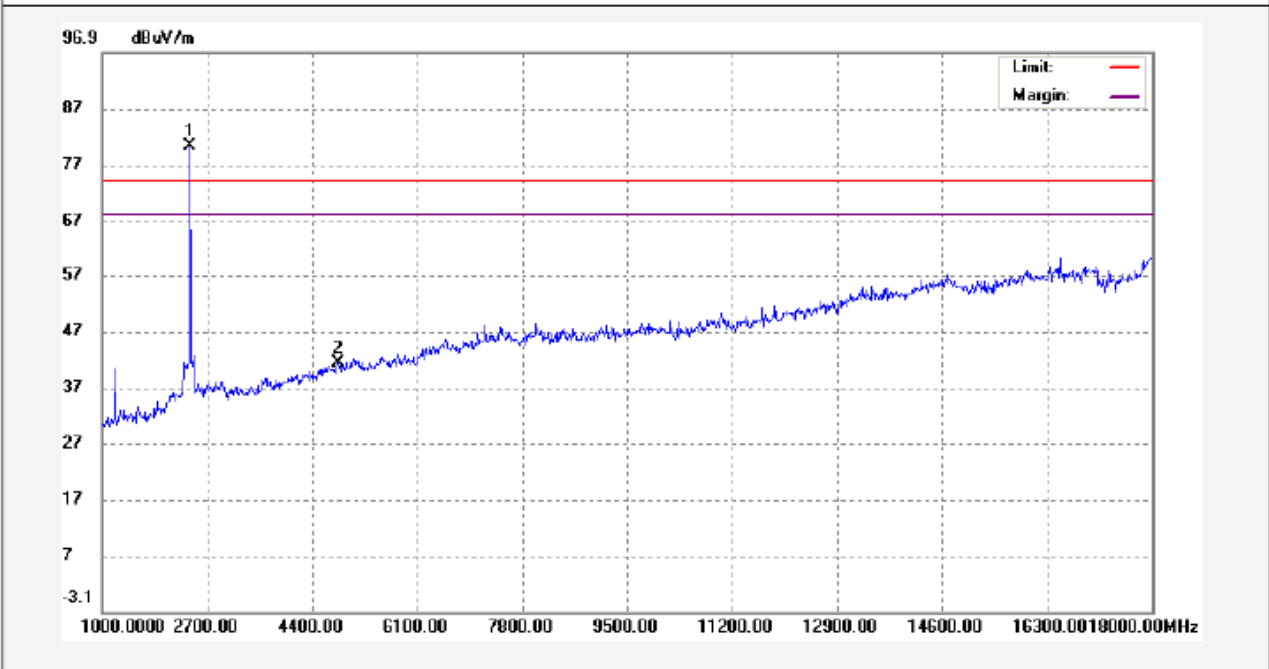


Test Frequency: 1GHz ~ 18GHz

AV = Peak +20Log₁₀(duty cycle) =PK+(-12)=PK-12 [refer to section 8 for more detail]

Test channel: TX2402MHz(Battery Operation)

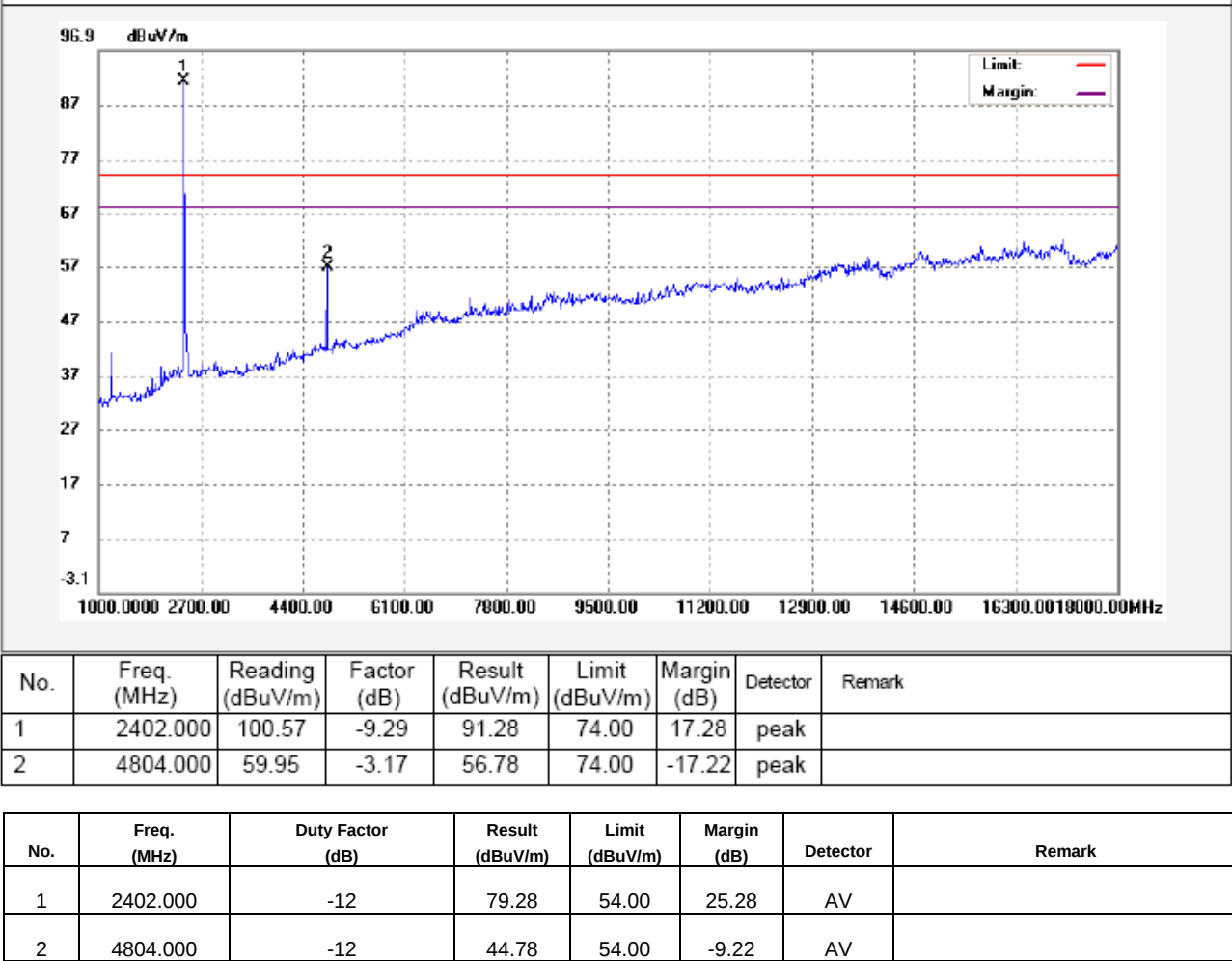
Antenna polarization: Vertical



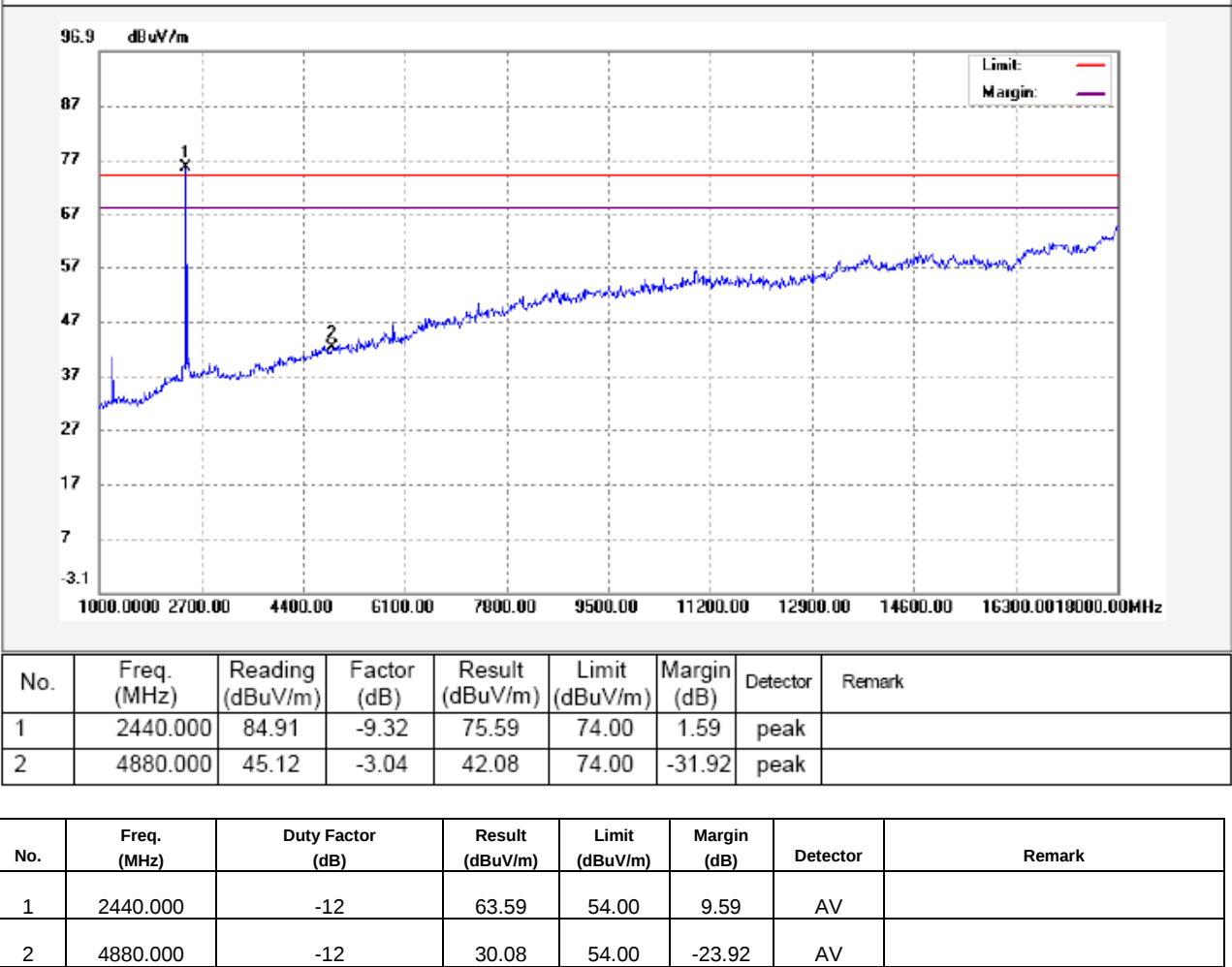
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2402.000	89.49	-9.28	80.21	74.00	6.21	peak	
2	4804.000	44.48	-3.17	41.31	74.00	-32.69	peak	

No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2402.000	-12	68.21	54.00	14.21	AV	
2	4804.000	-12	29.31	54.00	-24.69	AV	

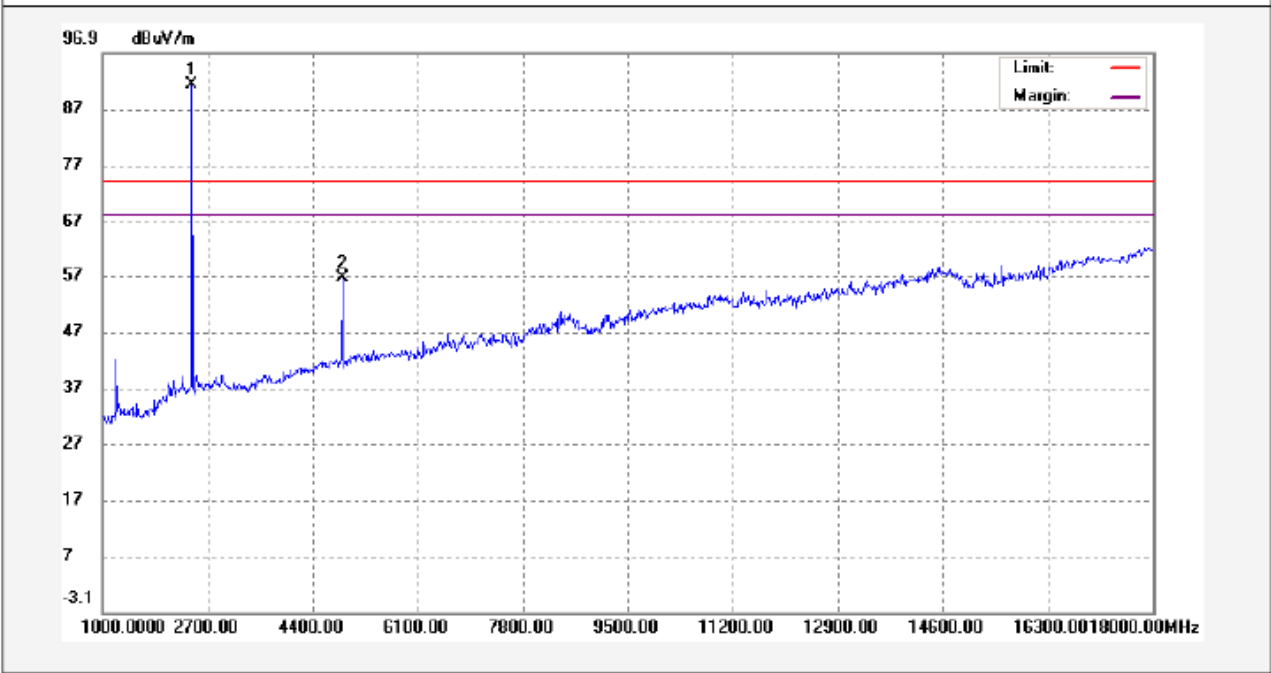
Antenna polarization: Horizontal



Test Frequency: 1GHz ~ 18GHz
Test channel: TX2440MHz(Battery Operation)
Antenna polarization: Vertical



Antenna polarization: Horizontal

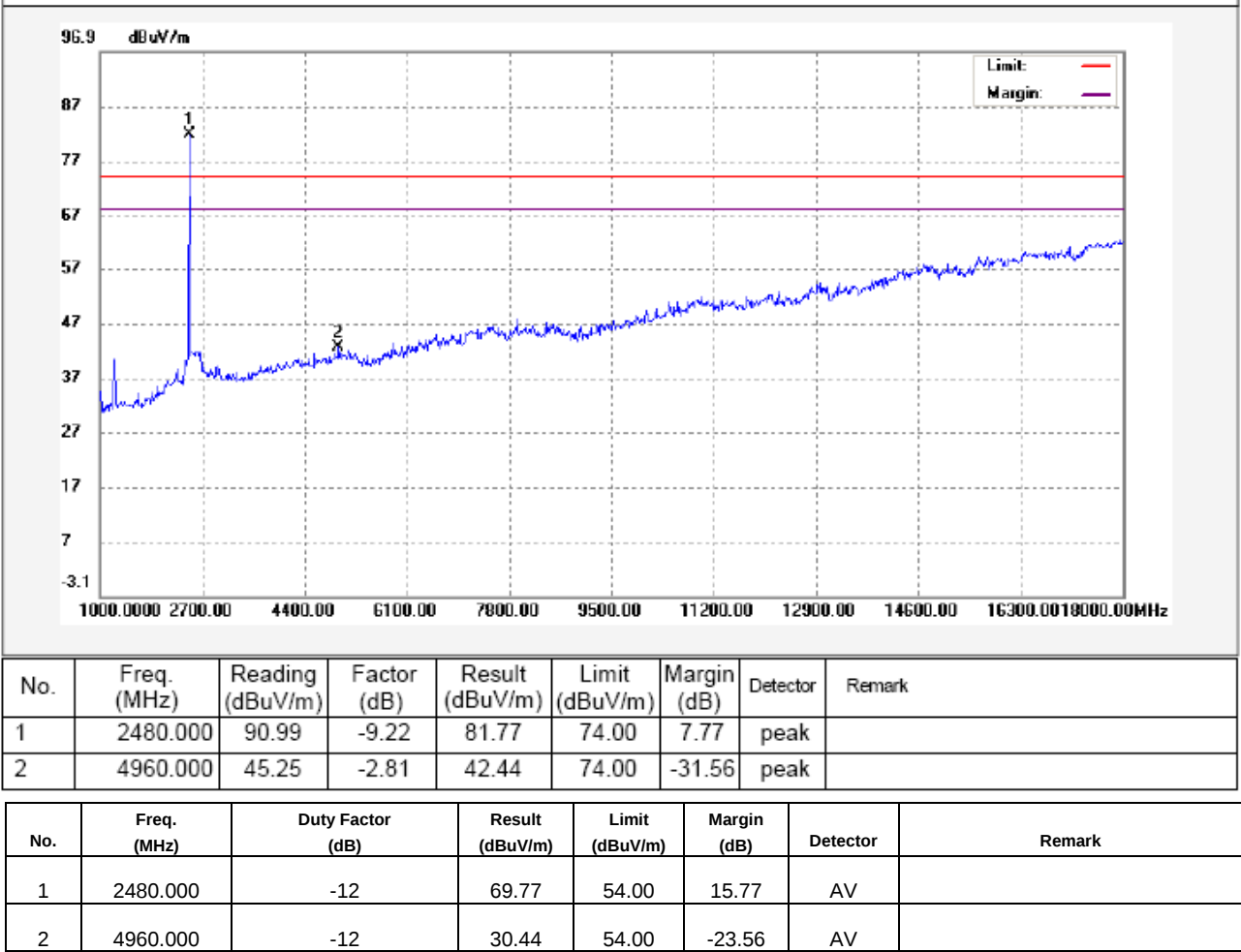


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2440.000	100.60	-9.32	91.28	74.00	17.28	peak	
2	4880.000	59.64	-3.04	56.60	74.00	-17.40	peak	

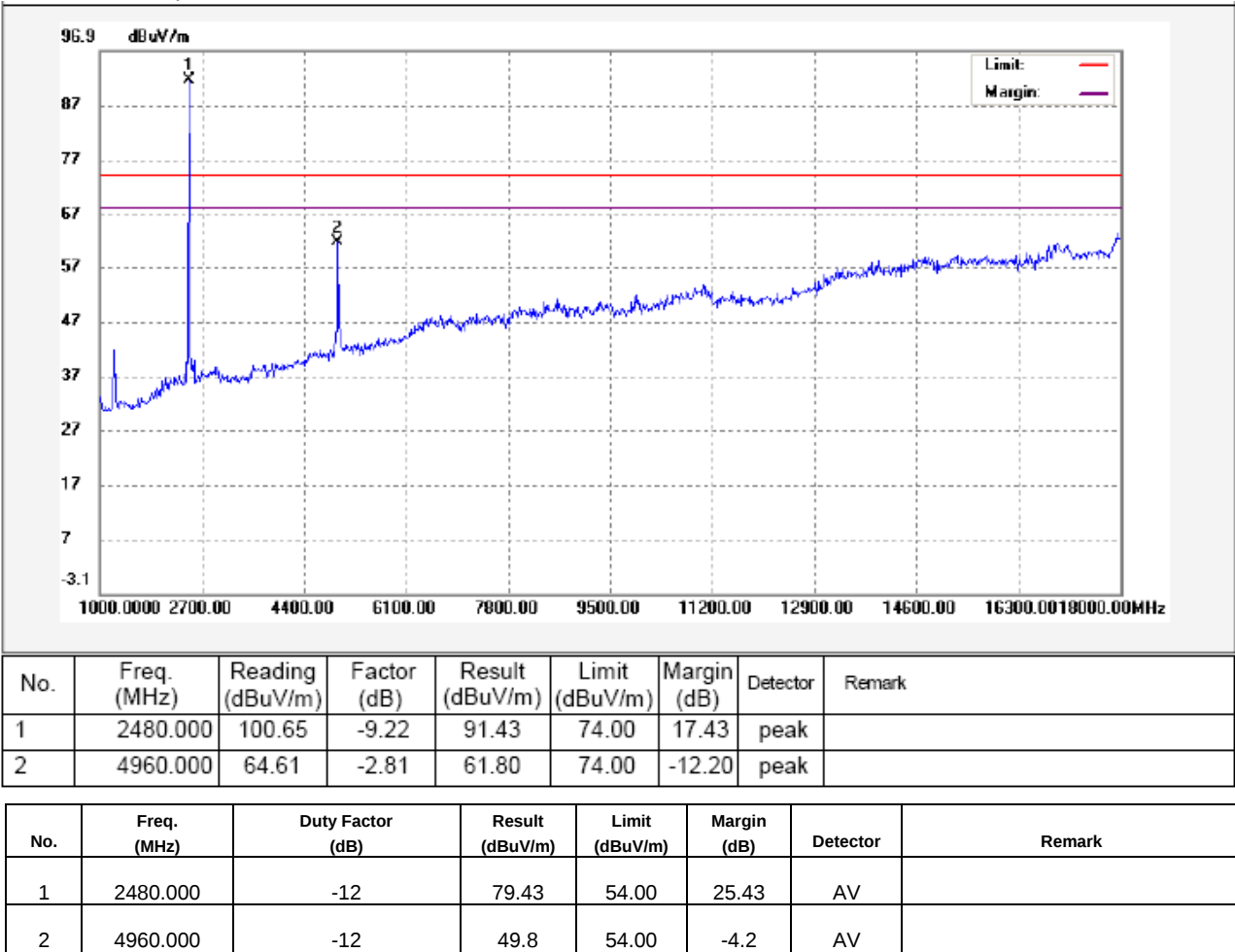
No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2440.000	-12	79.28	54.00	25.28	AV	
2	4880.000	-12	44.6	54.00	-9.4	AV	

Test channel: TX2480MHz(Battery Operation)

Antenna polarization: Vertical



Antenna polarization: Horizontal



Test Frequency :Above 18GHz

After pretest,we found no higher emission than background level, the data does not been shown in the test report.

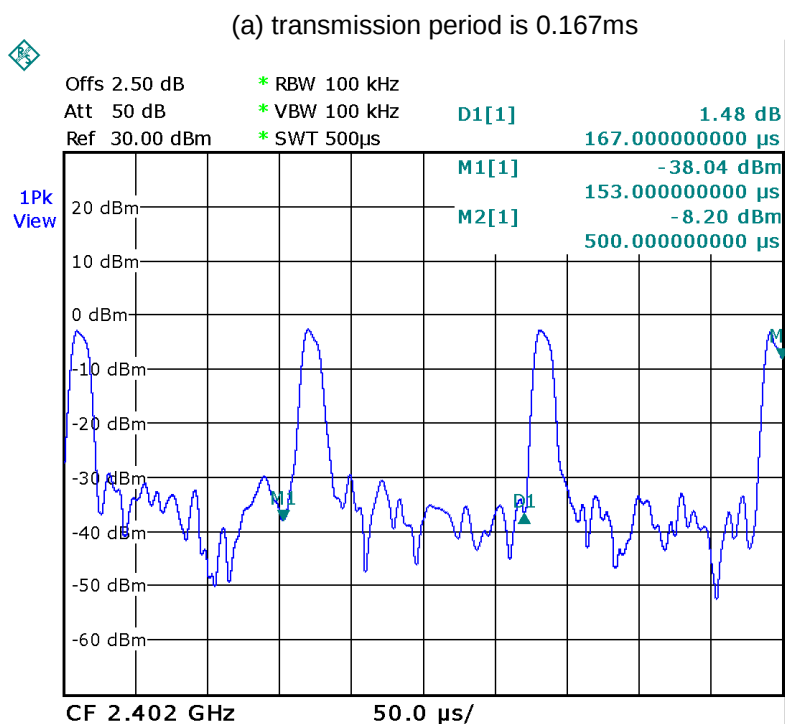
8 Duty Cycle

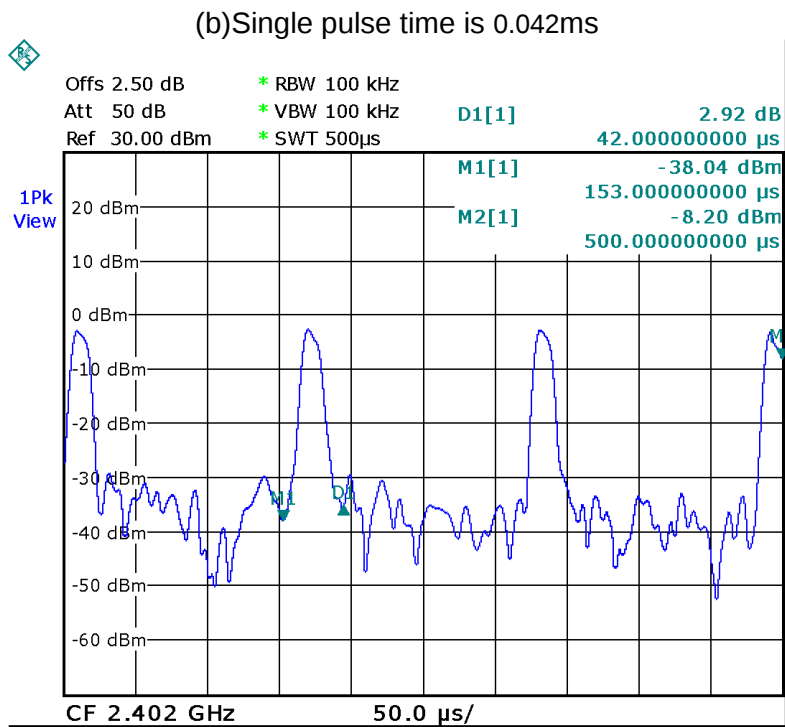
Test Requirement: FCC Part 15.35
Test Mothed: ANSI C63.4:2003
Test Status: TX mode.

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 = 100 kHz, VBW = 100 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 = 0.042 ms

The EUT's work period : $T = T_{ON} + T_{OFF}$ = transmission period = 0.167 ms

The EUT's duty cycle : $D = T_{on} / T = 0.042 / 0.167 * 100\% = 25.15\%$

Duty Cycle Correction Factor(dB) = $20 * \log_{10}(\text{Duty Cycle}) = 20 * \log_{10}(25.15\%)$

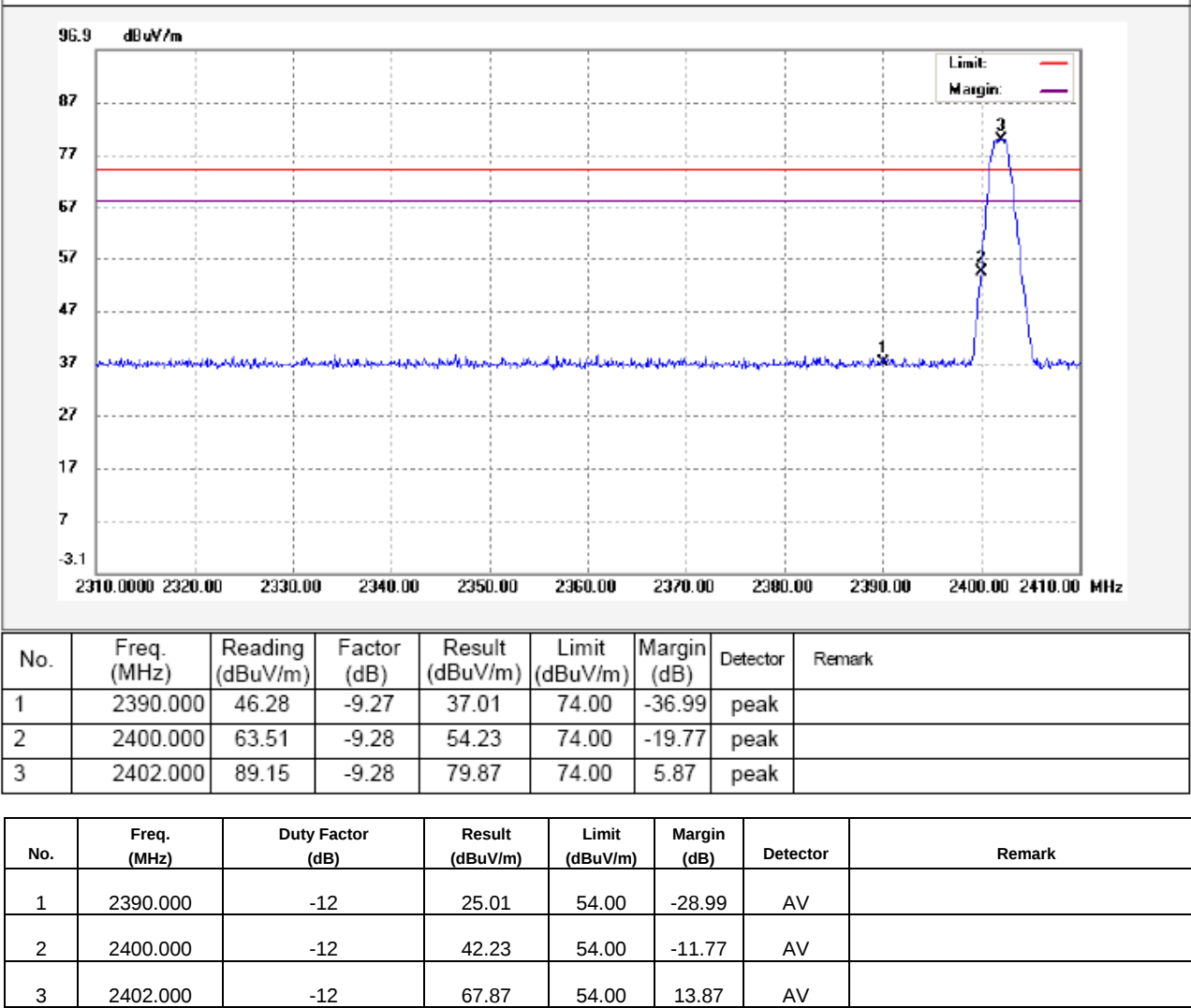
= -12dB

9 Band Edge Measurement

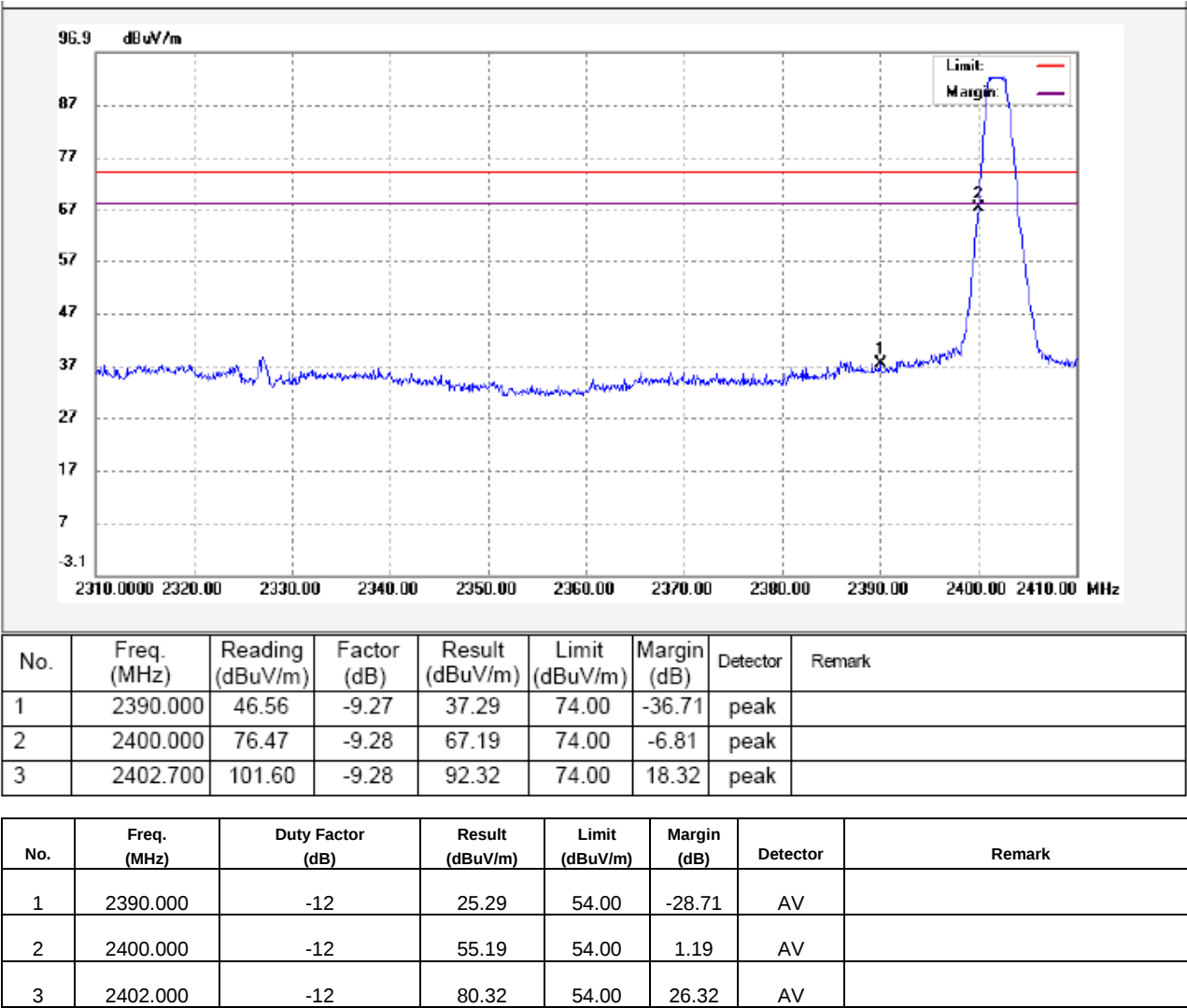
Test Requirement:	Section 15.247(d) In addition, radiated emissions which fall in the restricted bands. as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).
Test Method:	DA 00-705
Measurement Distance:	3m
Limit:	40.0 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:

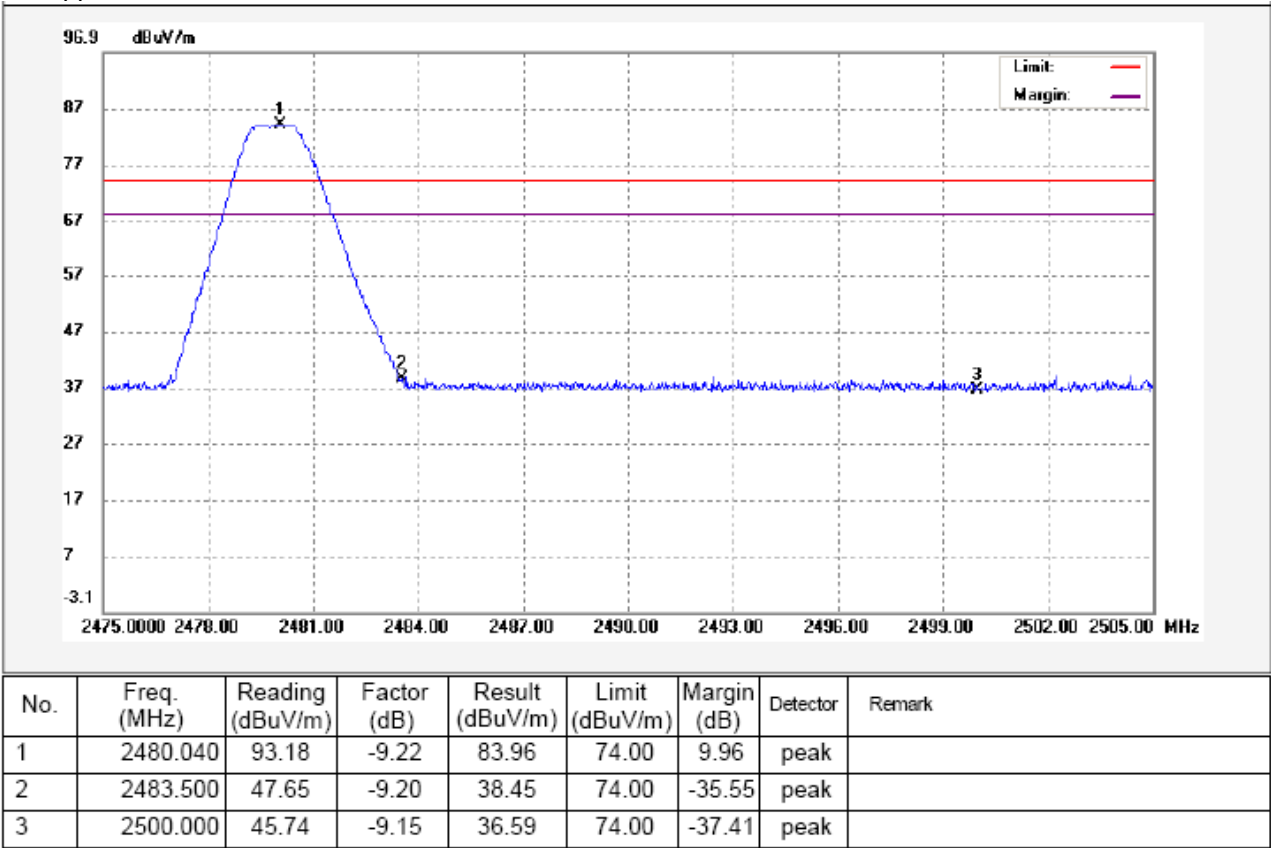
Lower Channel – Peak, Vertical



Lower Channel – Peak, Horizontal

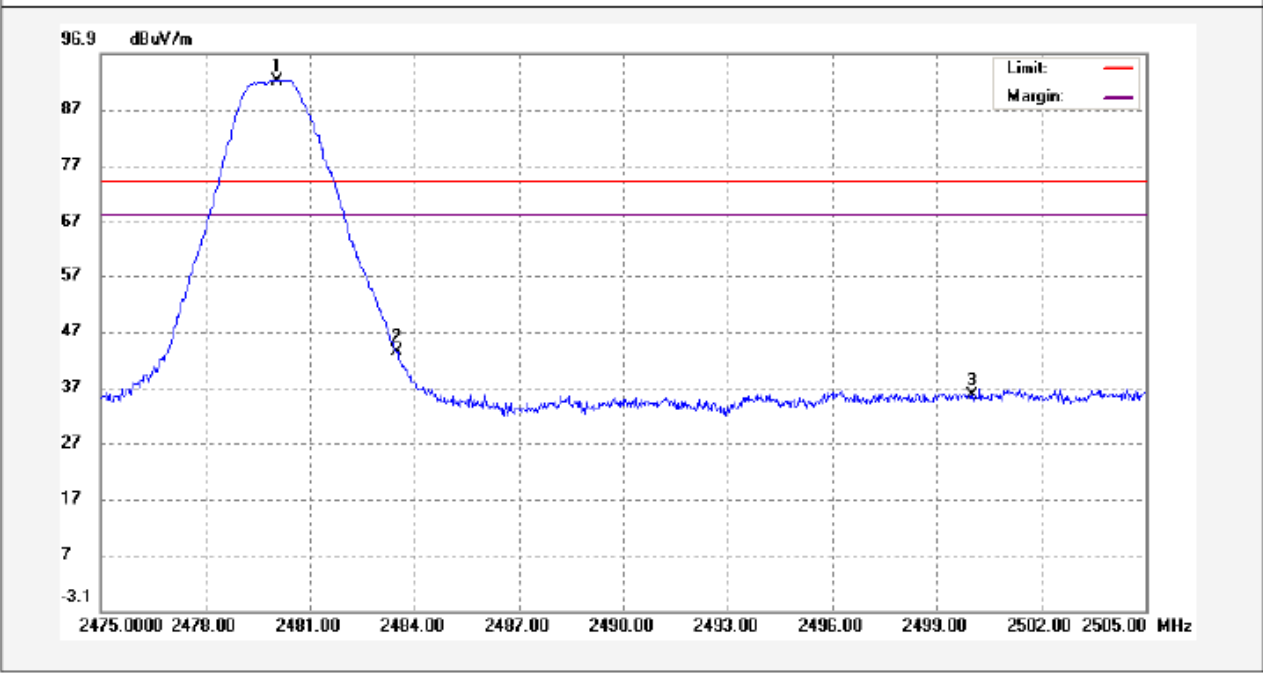


Upper Channel – Peak, Vertical



No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2480.040	-12	71.96	54.00	17.96	AV	
2	2483.500	-12	26.45	54.00	-27.55	AV	
3	2500.00	-12	24.59	54.00	-29.41	AV	

Upper Channel – Peak, Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2480.040	101.33	-9.22	92.11	74.00	18.11	peak	
2	2483.500	52.49	-9.20	43.29	74.00	-30.71	peak	
3	2500.000	44.75	-9.15	35.60	74.00	-38.40	peak	

No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2480.040	-12	80.11	54.00	26.11	AV	
2	2483.500	-12	31.29	54.00	-22.71	AV	
3	2500.000	-12	23.6	54.00	-30.4	AV	

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.

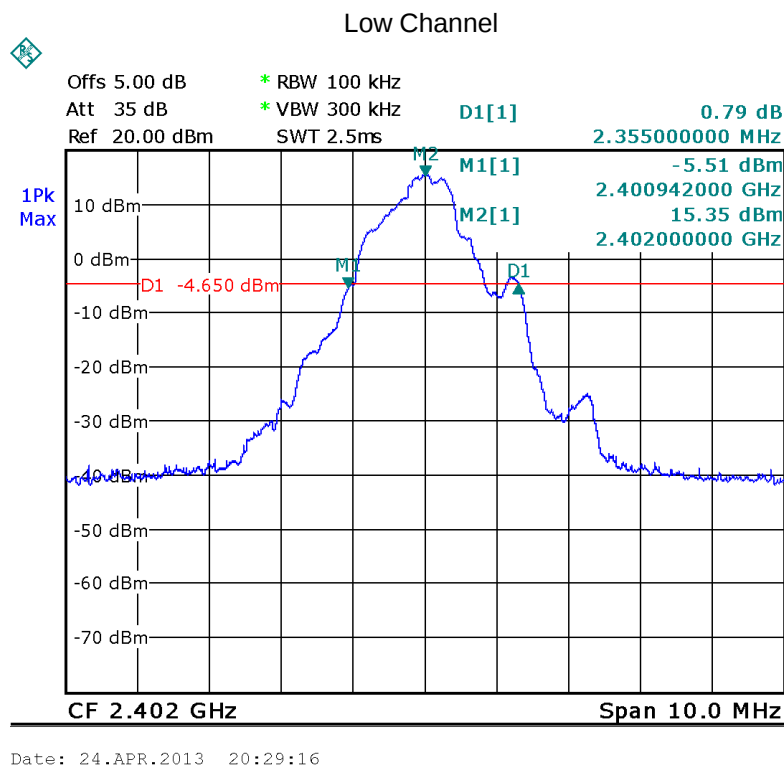
10.1 Test Procedure:

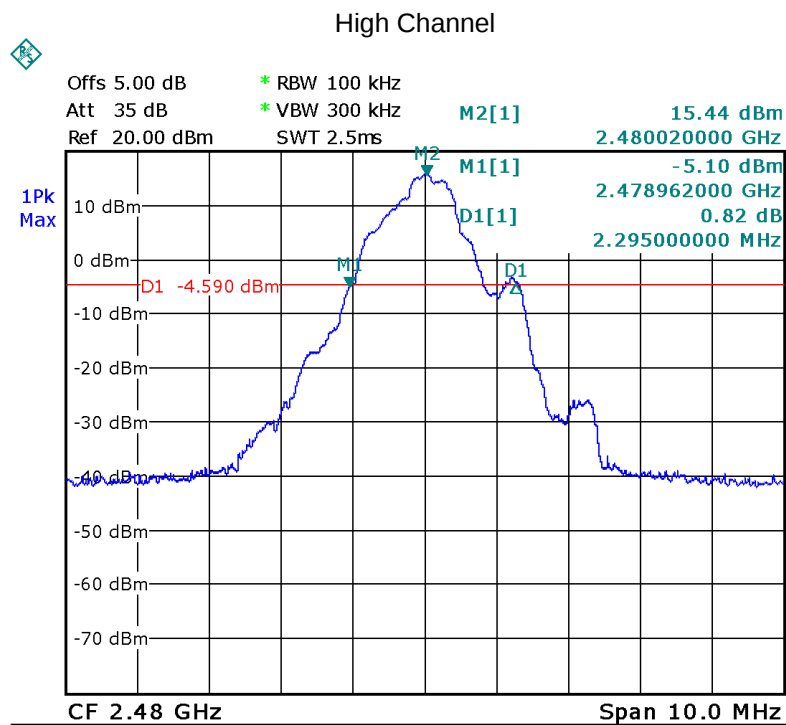
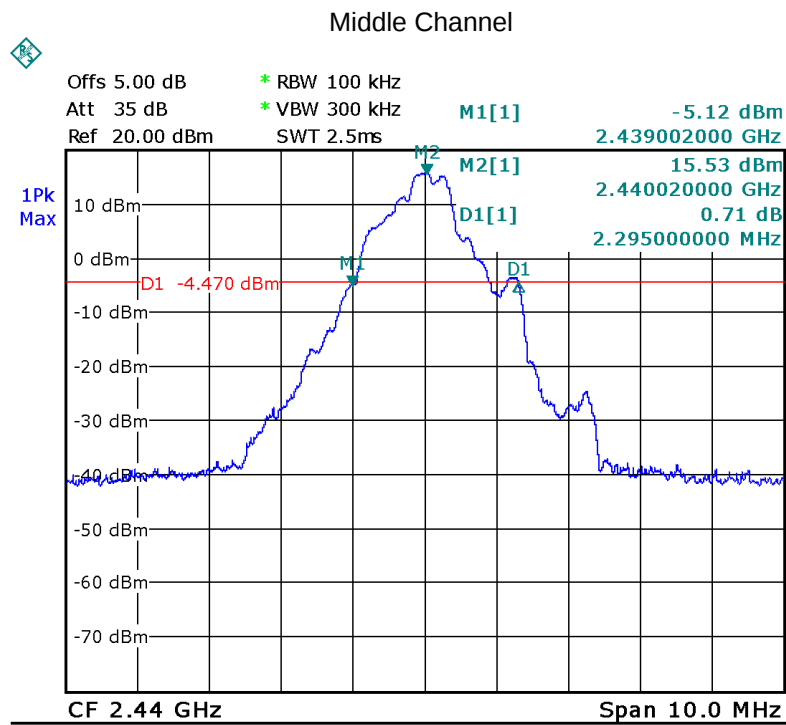
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 100kHz

10.2 Test Result:

Test Channel	Bandwidth
Low	2.355MHz
Middle	2.295MHz
High	2.295MHz

Test result plot as follows:





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.

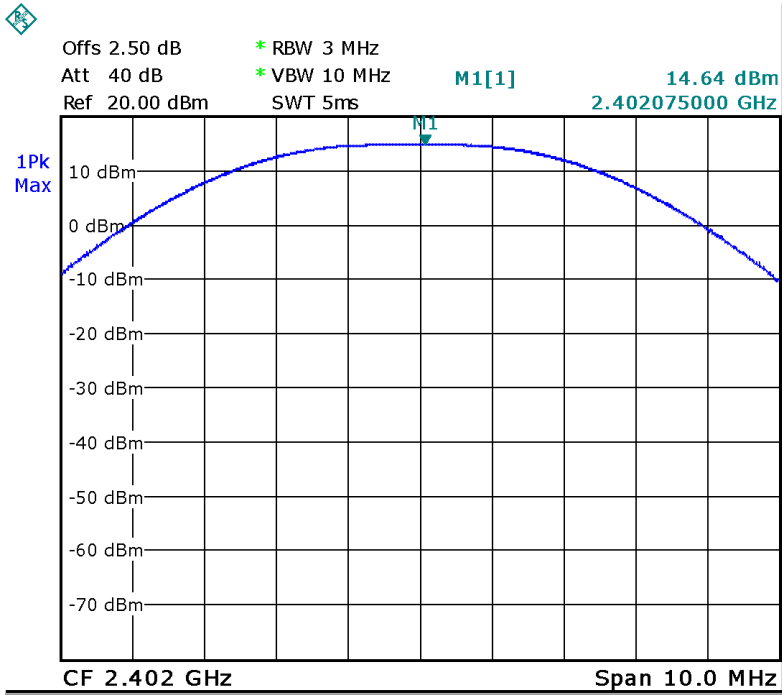
11.1 Test Procedure:

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.

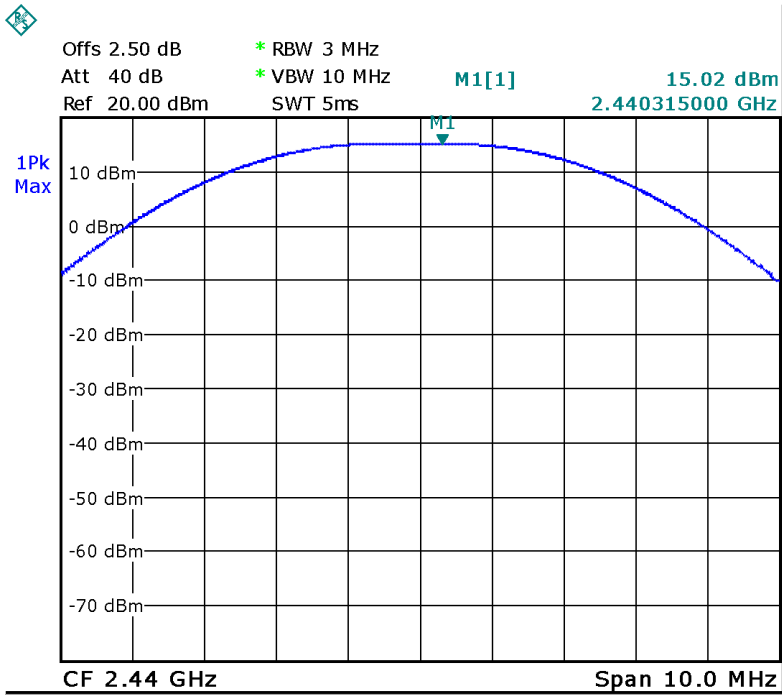
11.2 Test Result:

Test Channel	Output Power (dBm)	Limit (dBm)
Low	14.64	20.97
Middle	15.02	20.97
High	16.07	20.97

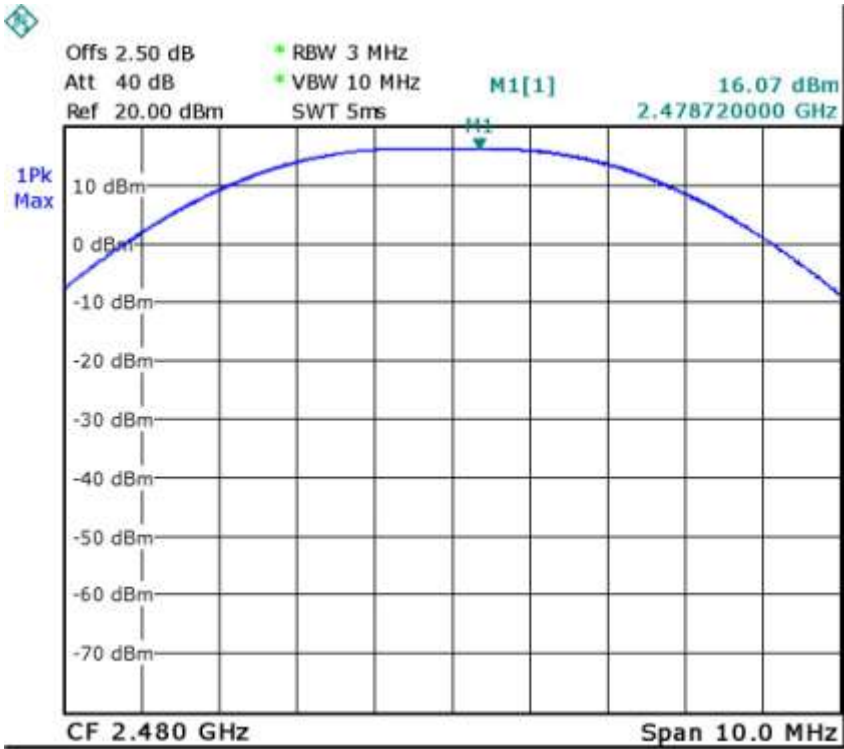
Low Channel



Middle Channel



High Channel



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:

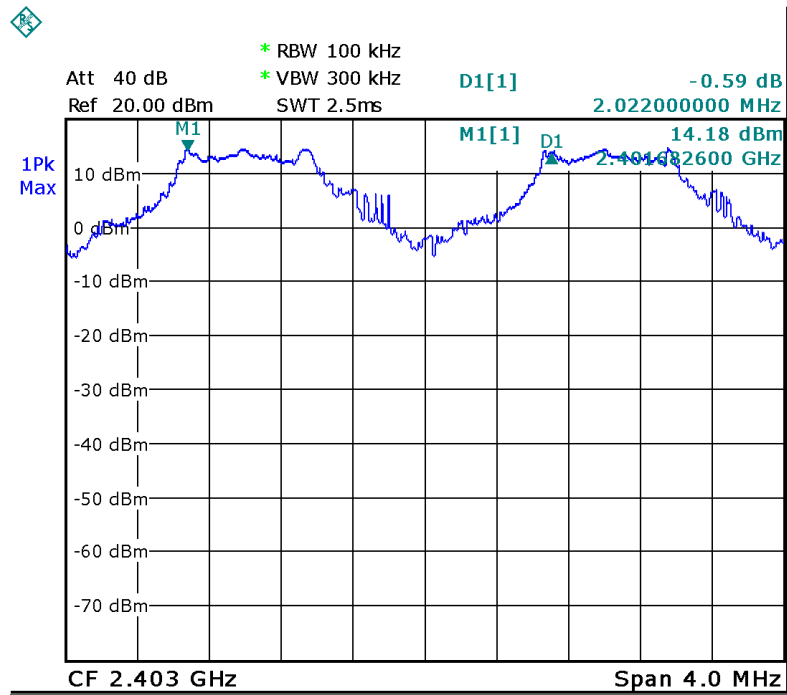
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 100kHz. VBW = 300kHz , Span = 4MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to 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	2.022	PASS
Middle	2.004	PASS
High	2.020	PASS

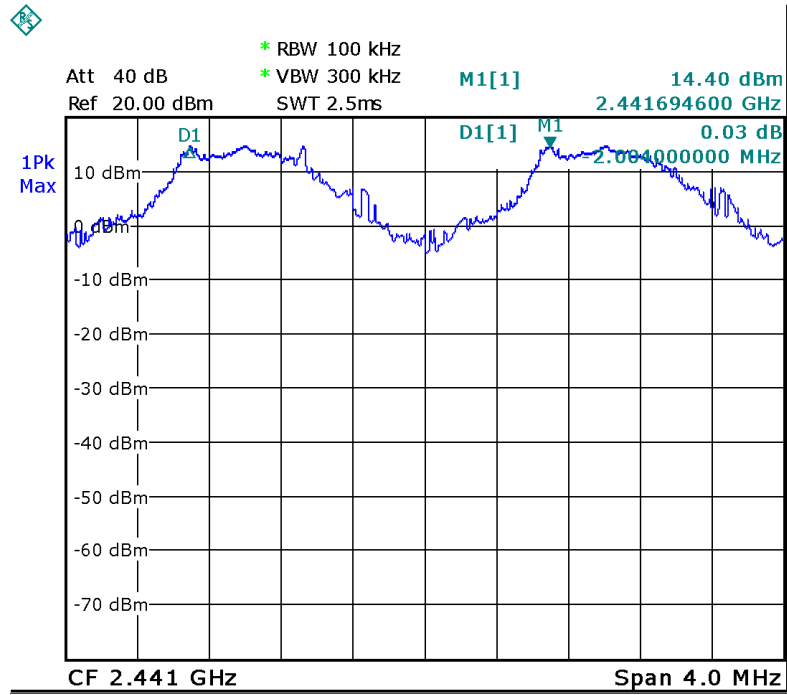
Test result plot as follows:

Low Channel



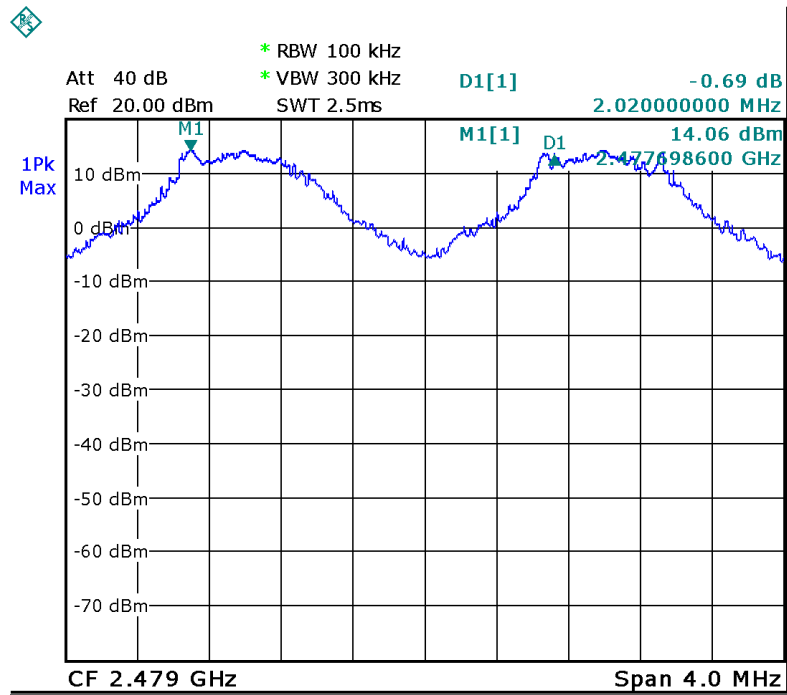
Date: 25.APR.2013 23:04:03

Middle Channel



Date: 25.APR.2013 23:25:03

High Channel



Date: 25.APR.2013 23:33:13

13 Number of Hopping Frequency

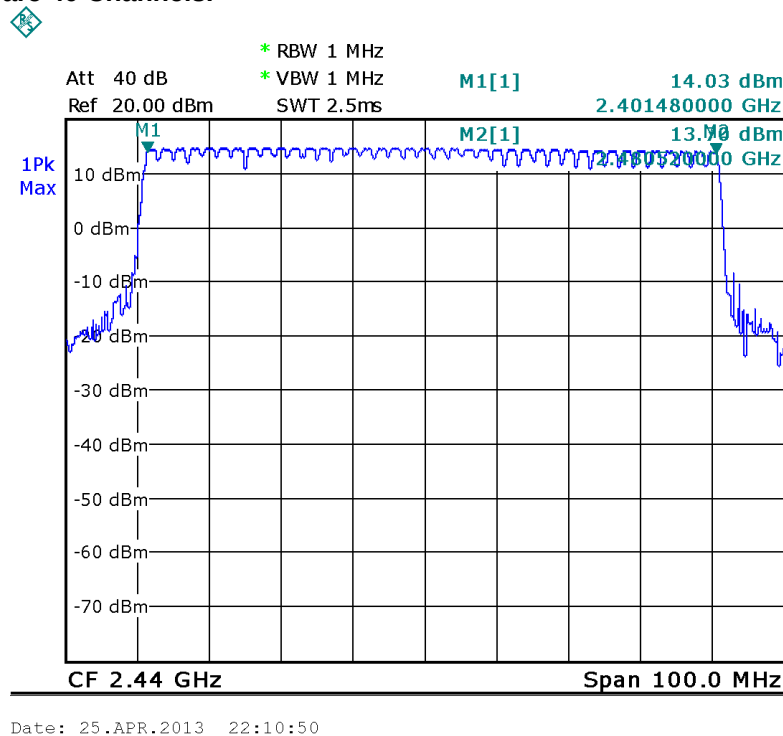
Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	DA 00-705
Test Limit:	Regulation 15.247 (a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.
Test Mode:	Test in hopping transmitting operating mode.

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 40 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: $T = 0.4(s) * 40 = 16 (s)$

So, the Dwell Time can be calculated as follows:

Low channel: slot time= $12(\text{times})/1(s)*0.210(\text{ms})*16(s)=0.040(s)$

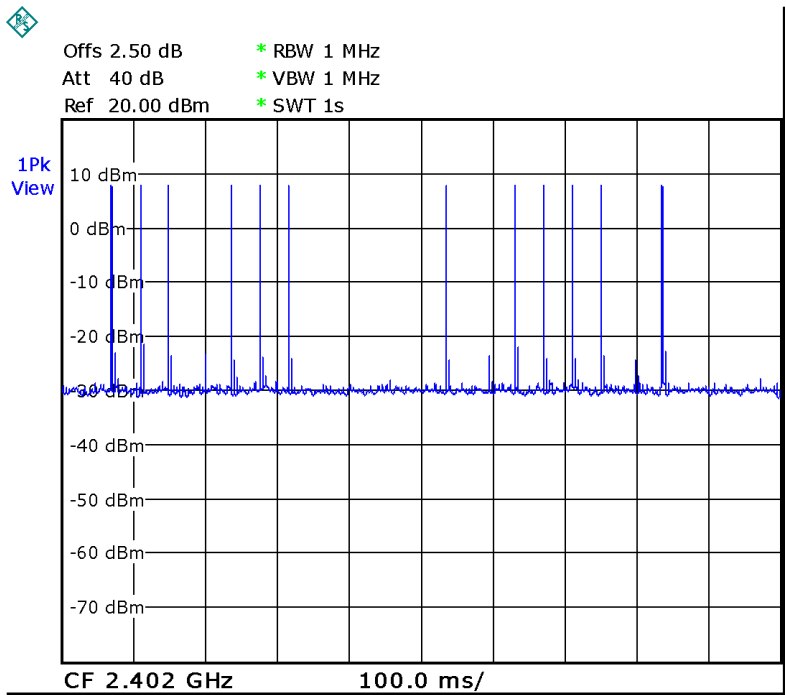
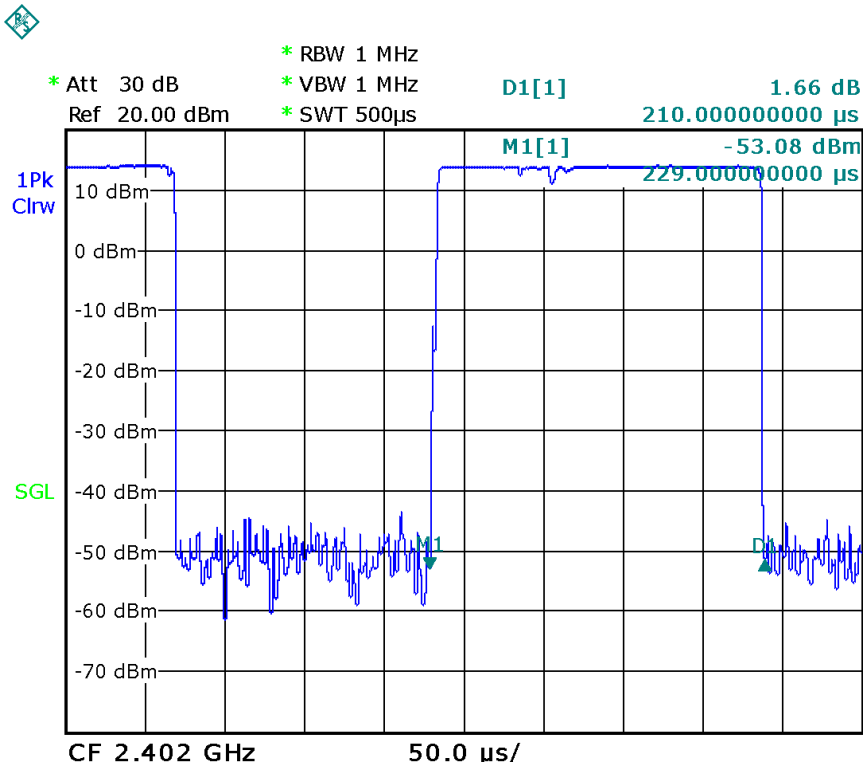
Middle channel: slot time= $15(\text{times})/1(s)*0.209(\text{ms})*16(s)=0.050(s)$

High channel: slot time= $15(\text{times})/1(s)*0.212(\text{ms})*16(s)=0.051(s)$

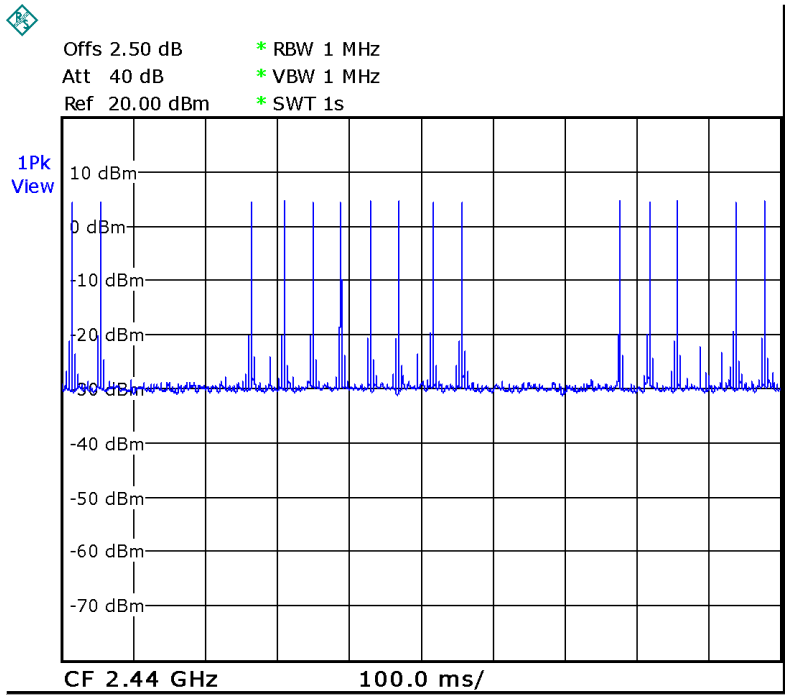
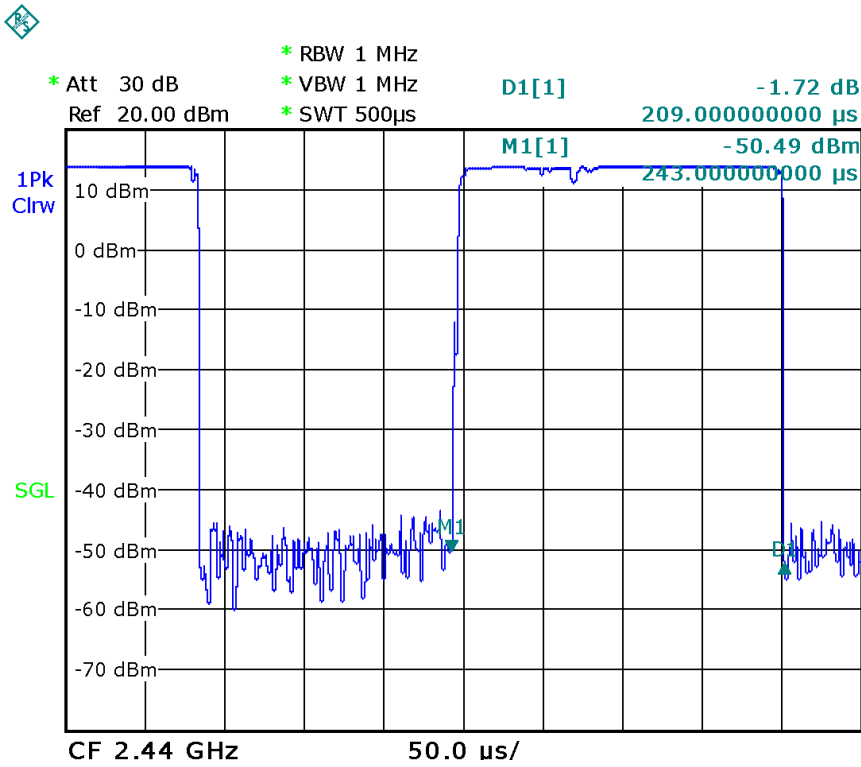
Note : Mkr Delta is once pulse time.

Frequency	Mkr Delta(ms)	Dwell Time(s)	Limits(s)	Result
2402 MHz	0.210	0.040	0.400	Pass
2440 MHz	0.209	0.050	0.400	Pass
2480 MHz	0.212	0.051	0.400	Pass

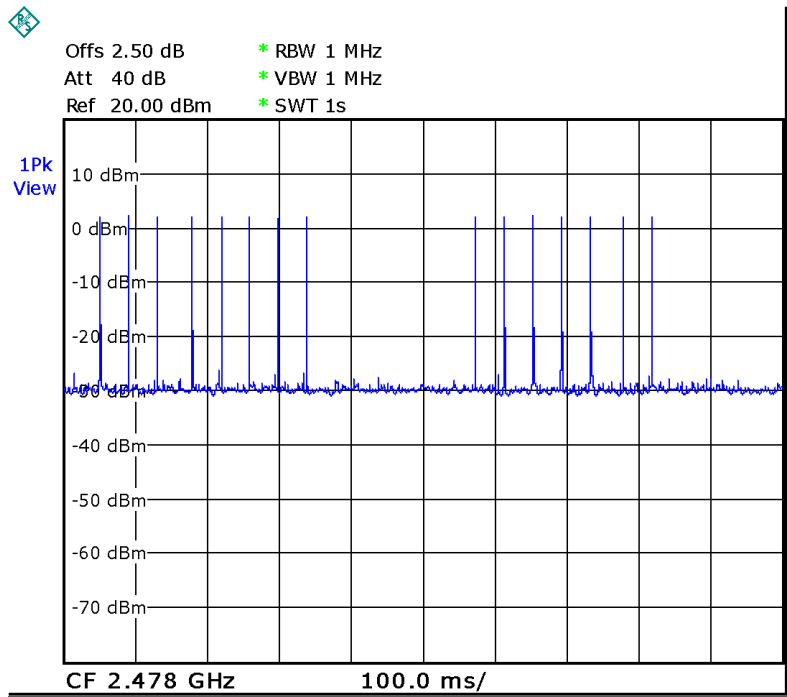
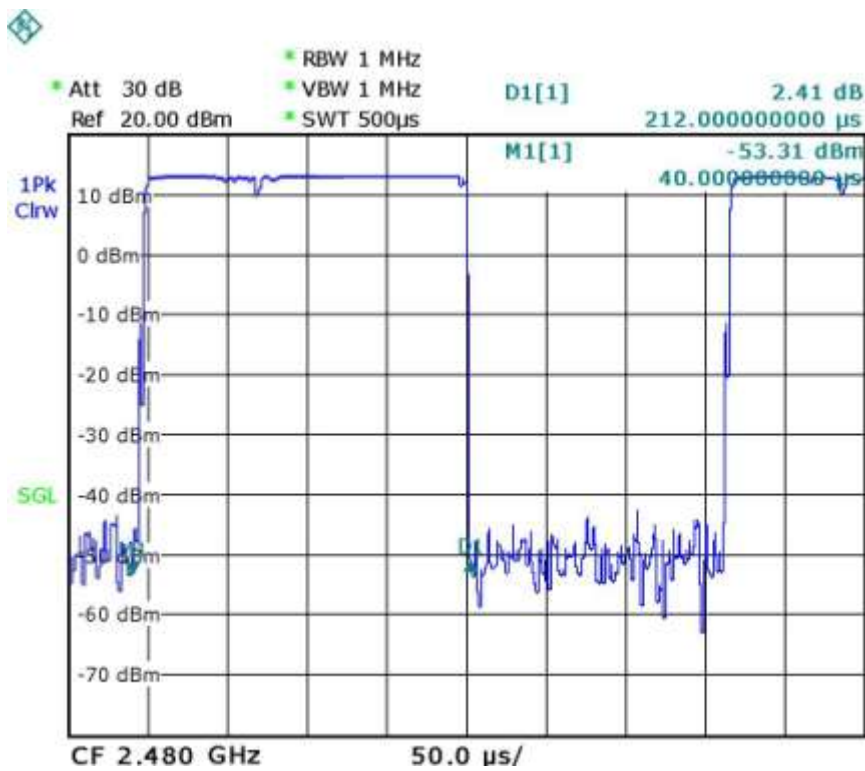
Low Channel



Middle Channel



High 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 permanent antenna, 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

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

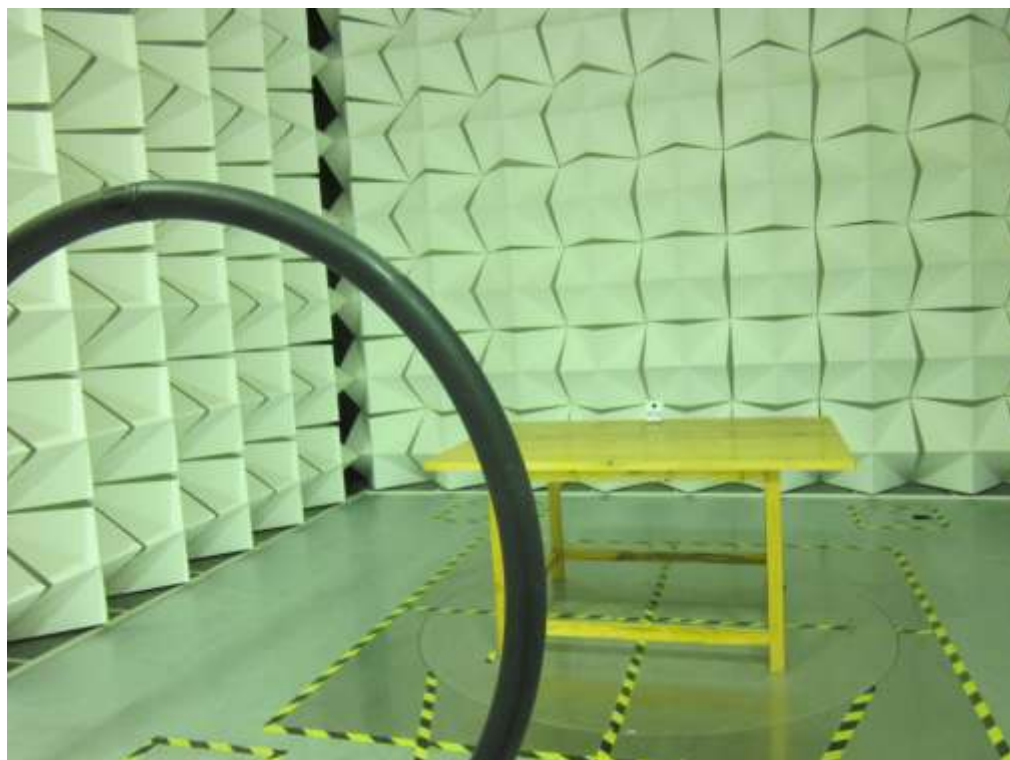
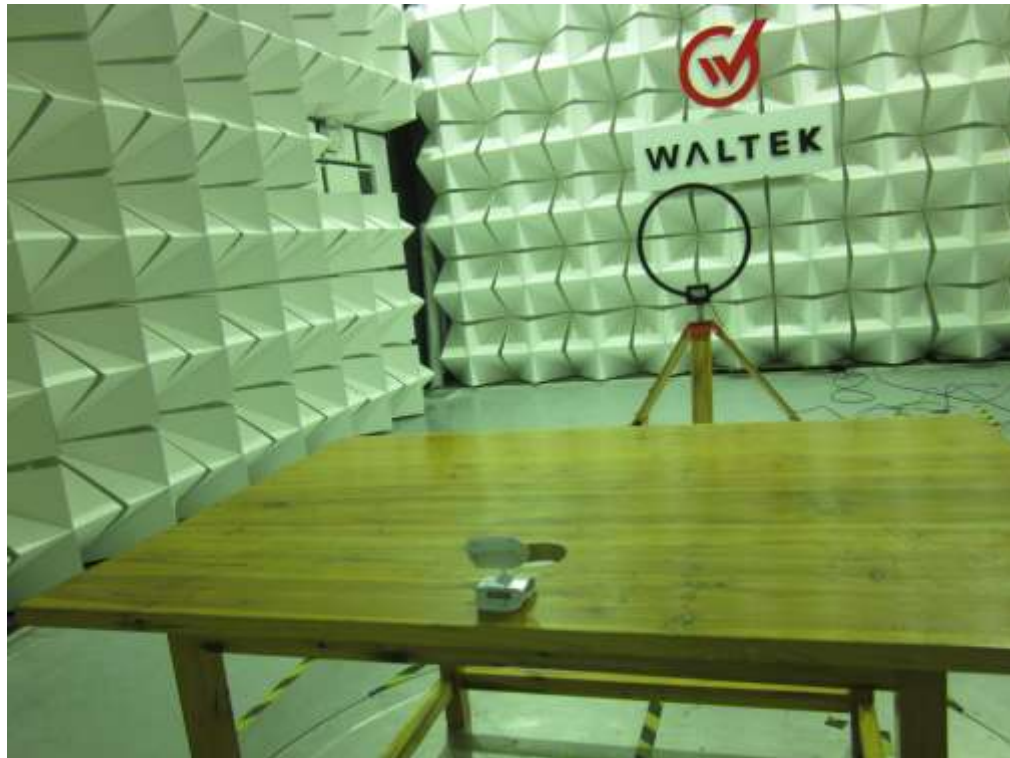
From the peak EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained

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	16.07	40.46	0.013	1

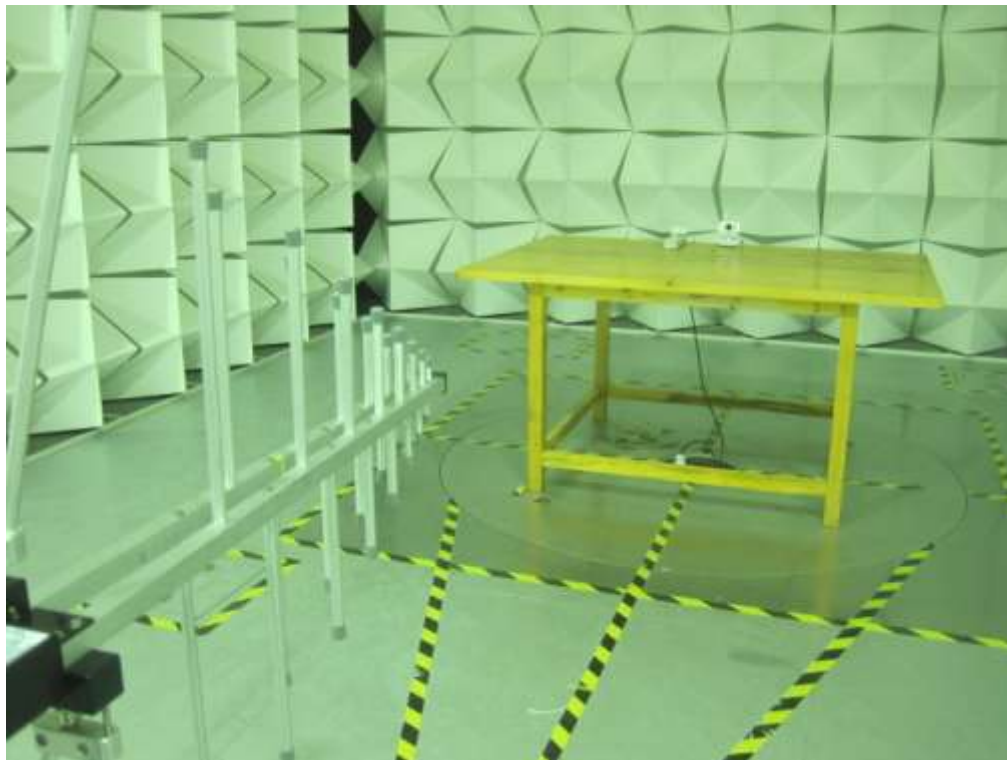
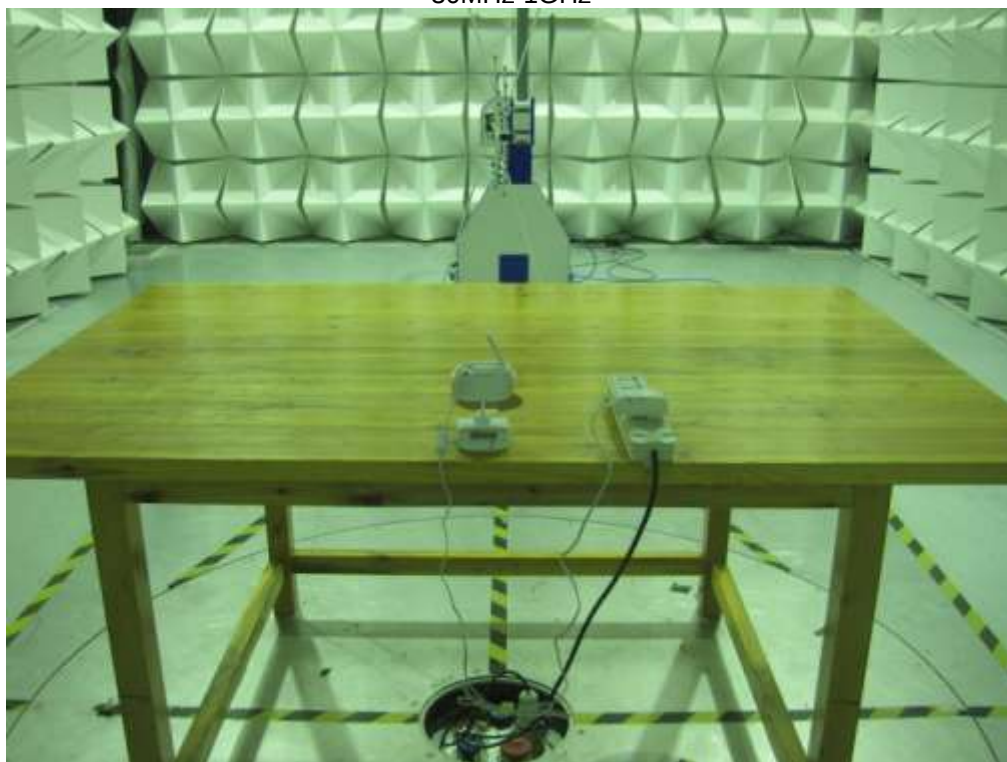
17 Photographs – Test Setup

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

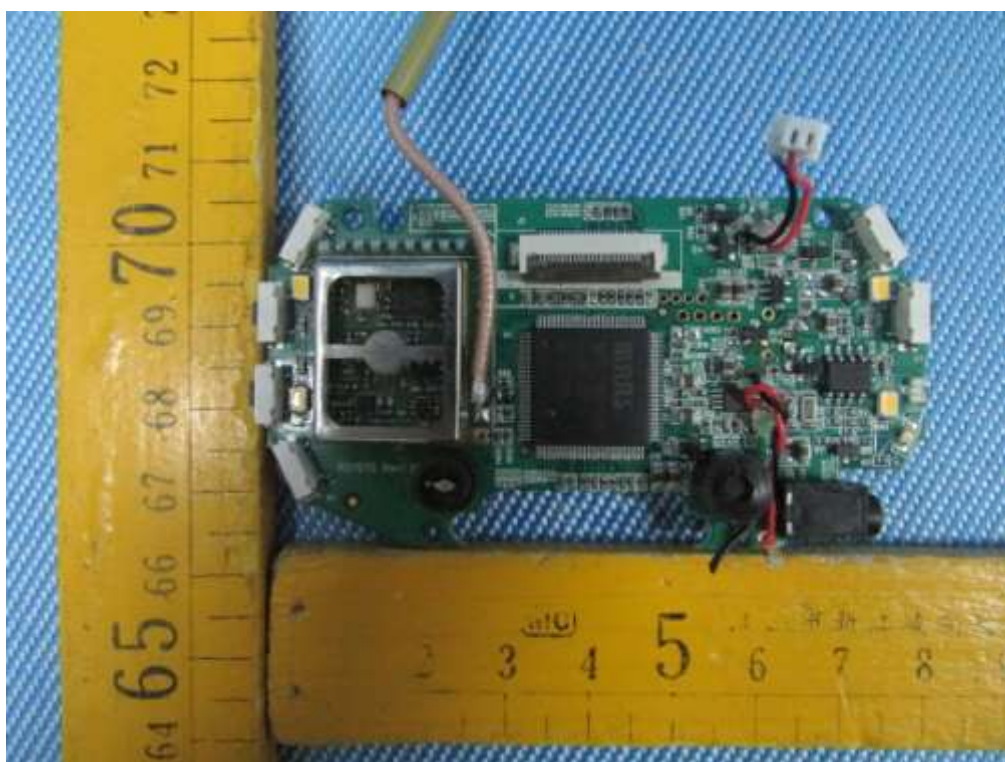
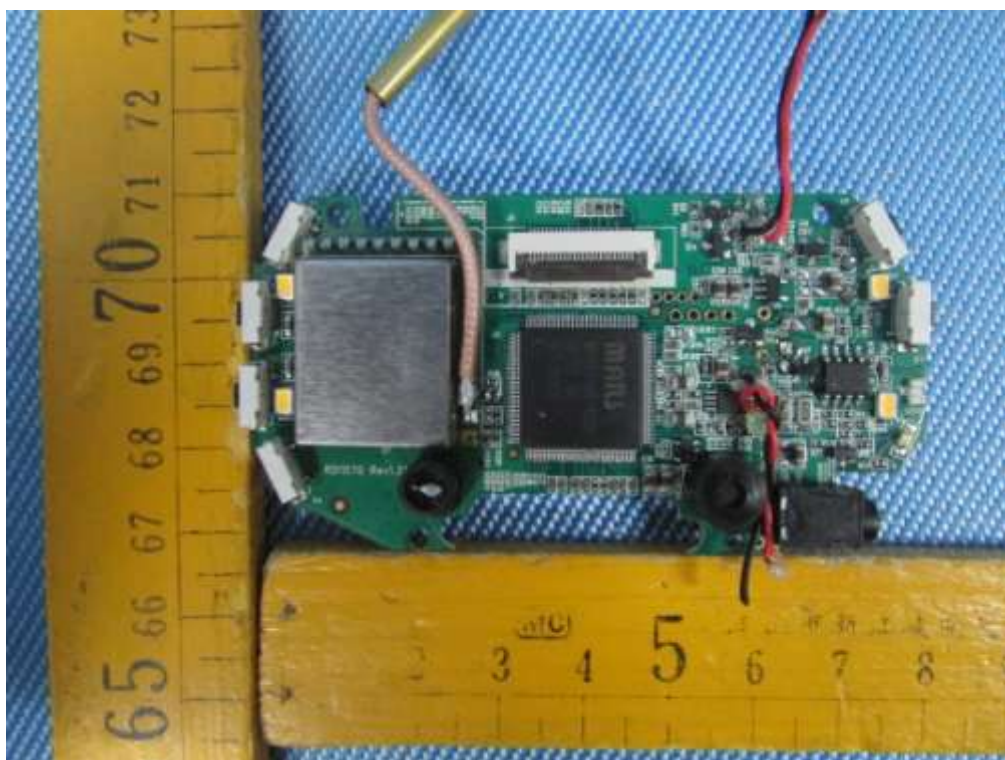


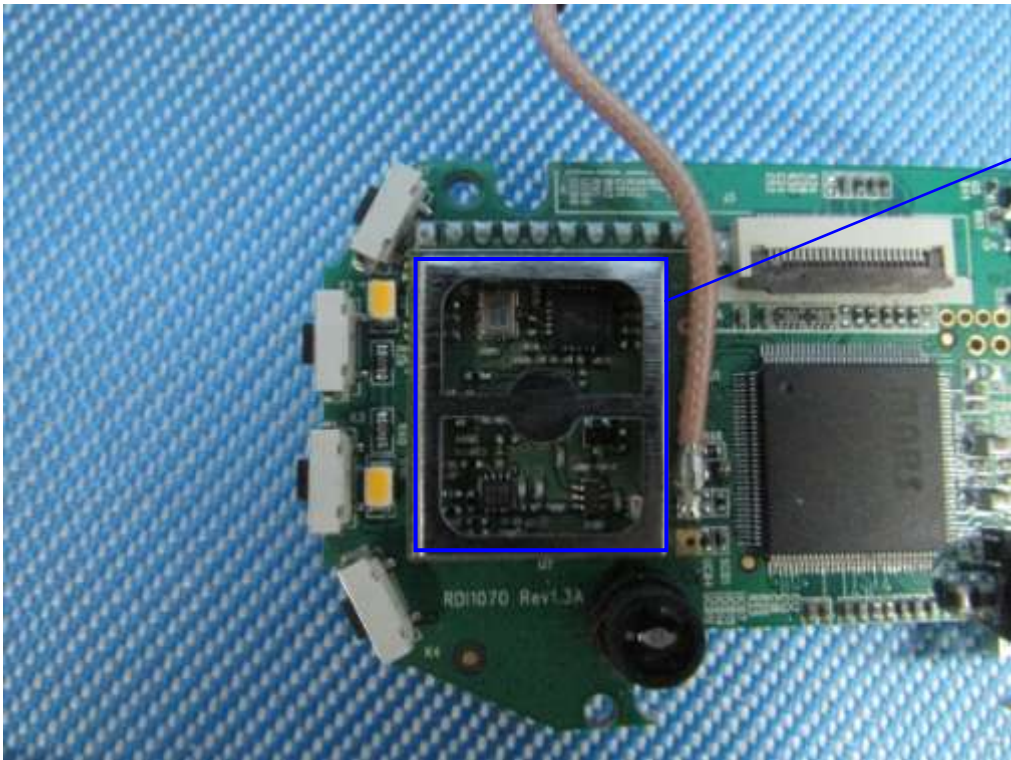


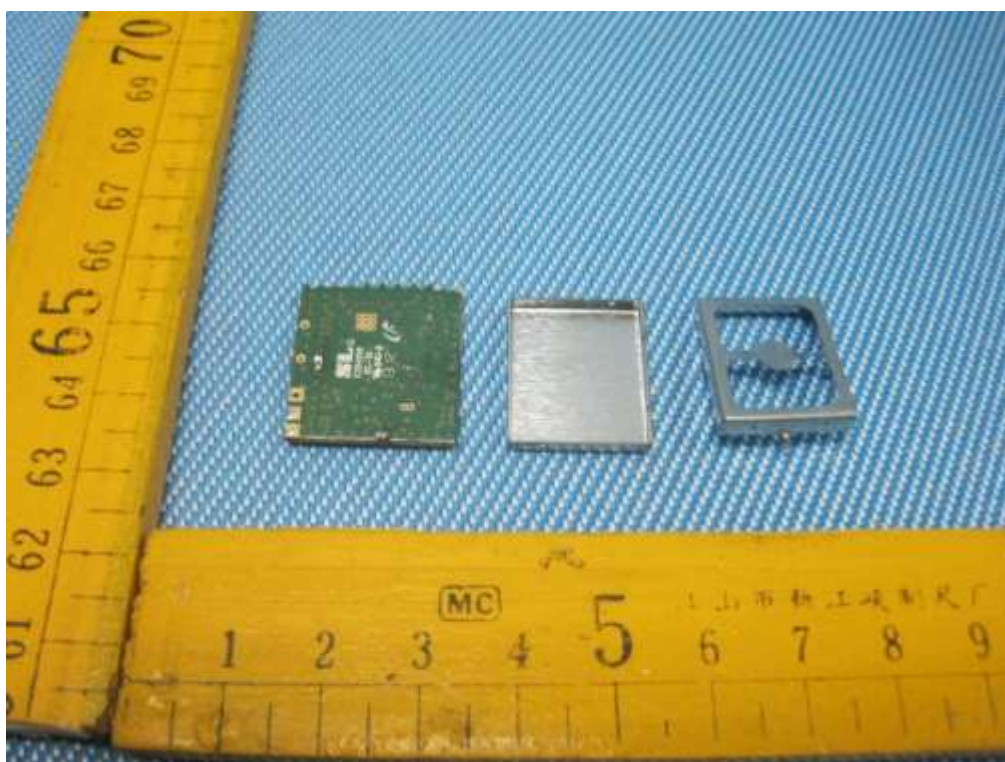
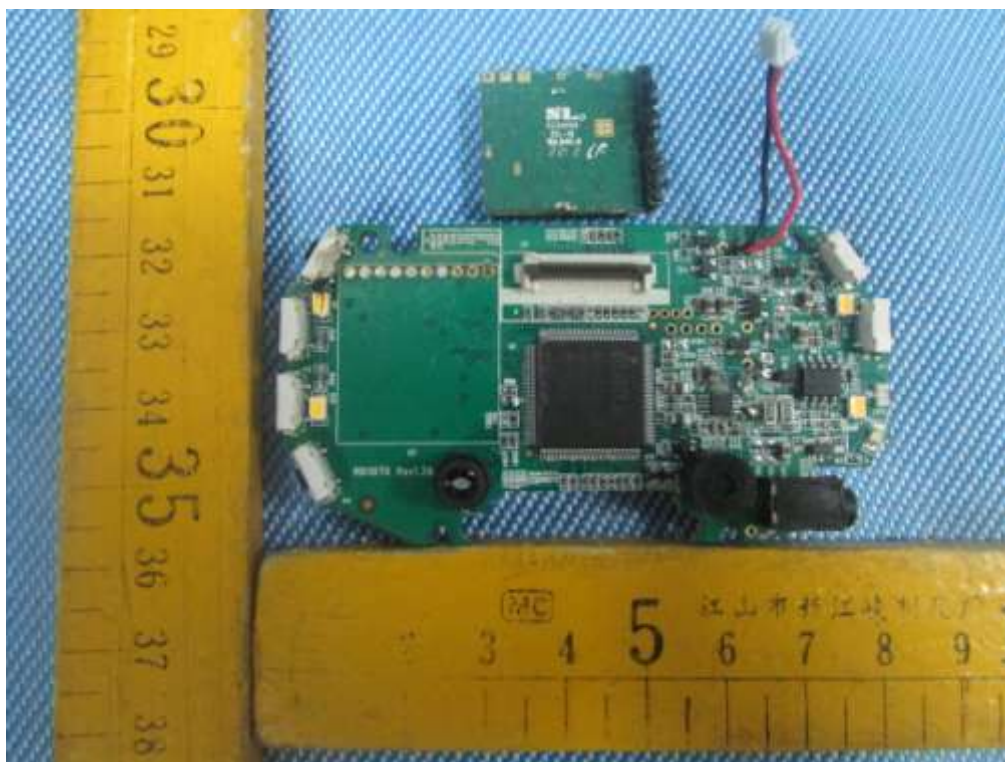


18.2 EUT - Internal View











19 FCC Label

FCC Label Sample for model: UBRC13

FCC ID: SJ8-UBRC13

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

FCC Label Location for model: UBRC13

The Label must not be a stick-on paper. The Label on these products must be permanently affixed to the product and readily visible at the time of purchase and must last the expected lifetime of the equipment not be readily detachable.



=End of report=