

FCC TEST REPORT

FCC ID : S7GICB103BU
Applicant : DONG GUAN WANG NIU DUN WELLCOM ELECTRONICS FACTORY
Address : Xia Wu Lane, WangLian Hamlet, WangNiuDun Town, DongGuan City, GuangDong Province, China
Manufacturer : DONG GUAN WELLCOM ELECTRONICS COMPANY LIMITED
Address : NANYU INDUSTRIAL PARK,NANCHANG ROAD,WANGNIUDUN TOWN,DONGGUAN CITY,CHINA
Equipment Under Test (EUT) :
Product Name : Bluetooth Clock Radio
Model No. : ICB103BU, ICB103P, ICB103B
Standards : FCC CFR47 Part 15 Section 15.247:2012
Date of Test : July 04~25, 2013
Date of Issue : Augsut 06, 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.

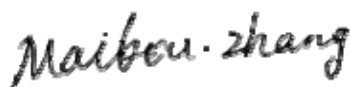
Prepared By:**Waltek Services (Shenzhen) Co., Ltd.**

Address: 1/F., Fukangtai Building, West Baima Road, Songgang Street, Baoan District, Shenzhen, Guangdong, China

Testing location: 1/F., Fukangtai Building, West Baima Road, Songgang Street, Baoan District, Shenzhen, Guangdong, China

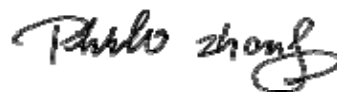
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Compiled by:



Maikou Zhang / Project Engineer

Approved by:



Philo Zhong / Manager

2 Test Summary

Test Items	Test Requirement	Result
Spurious Radiated Emissions	15.205(a) 15.209 15.247(d)	PASS
Band edge Emissions	15.247(d)	PASS
Spurious RF Conducted Emissions from out of band	15.247(d)	PASS
Duty Cycle	15.35	PASS
Conducted Emissions	15.207	PASS
20dB Bandwidth	15.215c 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	: Bluetooth Clock Radio
Model No.	: ICB103BU, ICB103P, ICB103B
Model Description	: Only the appearance is different.
Operation Frequency	: 2402MHz ~ 2480MHz, 79 channels in total, separated by 1MHz
Type of Modulation	: GFSK, Pi/4DQPSK, 8DPSK
Oscillator	: Crystal 16MHz for RF Module
Antenna installation	: PCB Printed Antenna

4.2 Details of E.U.T.

Technical Data	: (1)DC 3V powered by battery (DC 1.5V*2, Size"AAA") (2)DC 5V, 2A powered by adapter (Adapter Input: 100-240V~50/60Hz, 0.5A)
Adapter	: Manufacturer: MING DATA, M/N:CP0520

4.3 Description of Support Units

No.	Equipment	Manufacturer	Model No.	Serial No.
1.	IPOD	Apple	A1367	-

4.4 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.

4.5 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 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

5.2 Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-6}$
Bandwidth	$\pm 1.5 \times 10^{-6}$
RF Power	± 1.0 dB
RF Power Density	± 2.2 dB
Temperature	± 1 °C
DC Source	$\pm 0.05\%$
Radiated Emissions test	± 5.03 dB (Bilog antenna 30M~1000MHz)
	± 4.74 dB (Horn antenna 1000M~25000MHz)
Conducted Spurious Emissions test	± 3.64 dB (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: 26 °C

Humidity: 50 % RH

Atmospheric Pressure: 1010 mbar

EUT Operation:

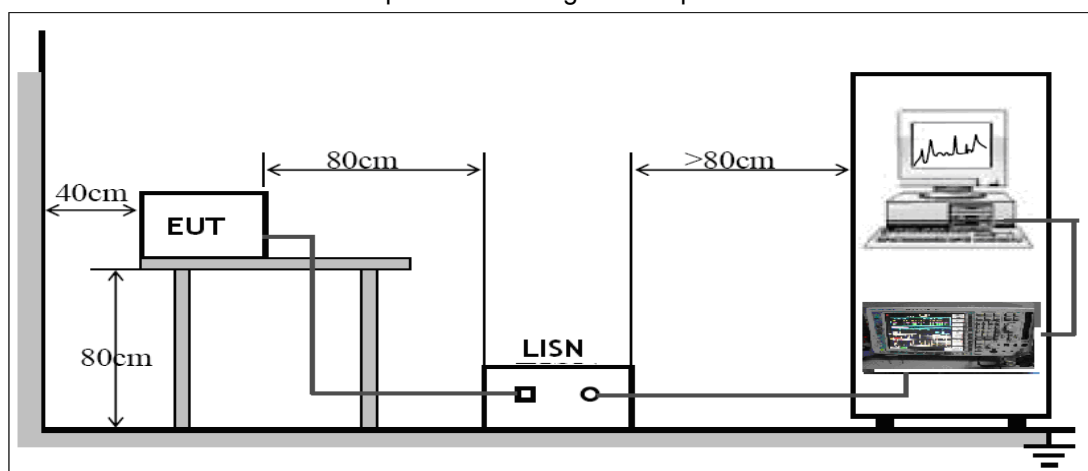
The EUT was tested in AUX in with discharging, FM (87.6MHz/ 98MHz/ 107.9MHz) with USB charging and bluetooth linking with USB charging mode. The worst mode were shown in the report.

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

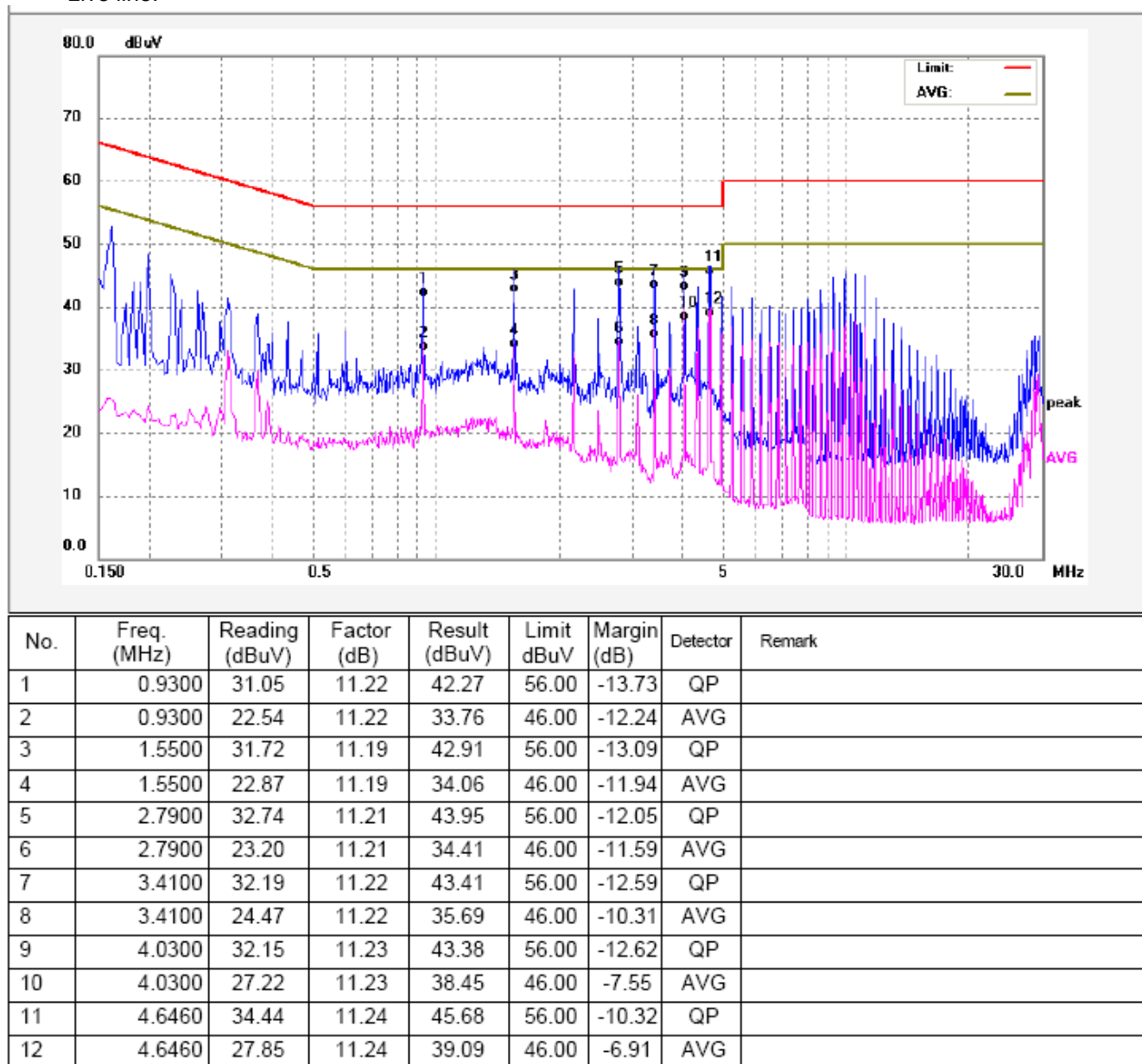


6.3 Conducted Emission Test Result

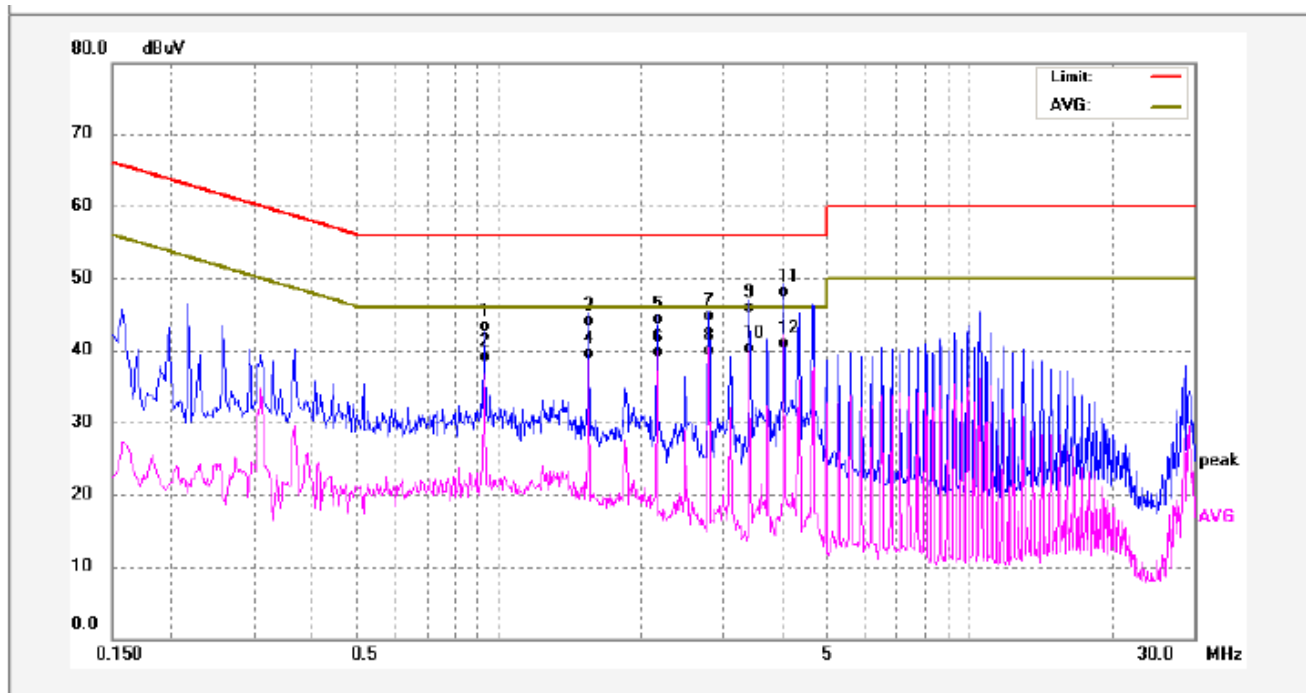
An initial pre-scan was performed on the live and neutral lines.

Test Mode: FM (98MHz) with USB charging Mode

Live line:



Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Remark
1	0.9300	32.15	11.22	43.37	56.00	-12.63	QP	
2	0.9300	27.98	11.22	39.20	46.00	-6.80	AVG	
3	1.5500	32.83	11.19	44.02	56.00	-11.98	QP	
4	1.5500	28.40	11.19	39.59	46.00	-6.41	AVG	
5	2.1700	33.02	11.20	44.22	56.00	-11.78	QP	
6	2.1700	28.49	11.20	39.69	46.00	-6.31	AVG	
7	2.7900	33.59	11.21	44.80	56.00	-11.20	QP	
8	2.7900	28.67	11.21	39.88	46.00	-6.12	AVG	
9	3.4100	34.74	11.22	45.96	56.00	-10.04	QP	
10	3.4100	29.08	11.22	40.30	46.00	-5.70	AVG	
11	4.0300	36.81	11.23	48.04	56.00	-7.96	QP	
12	4.0300	29.74	11.23	40.97	46.00	-5.03	AVG	

7 Radiated 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

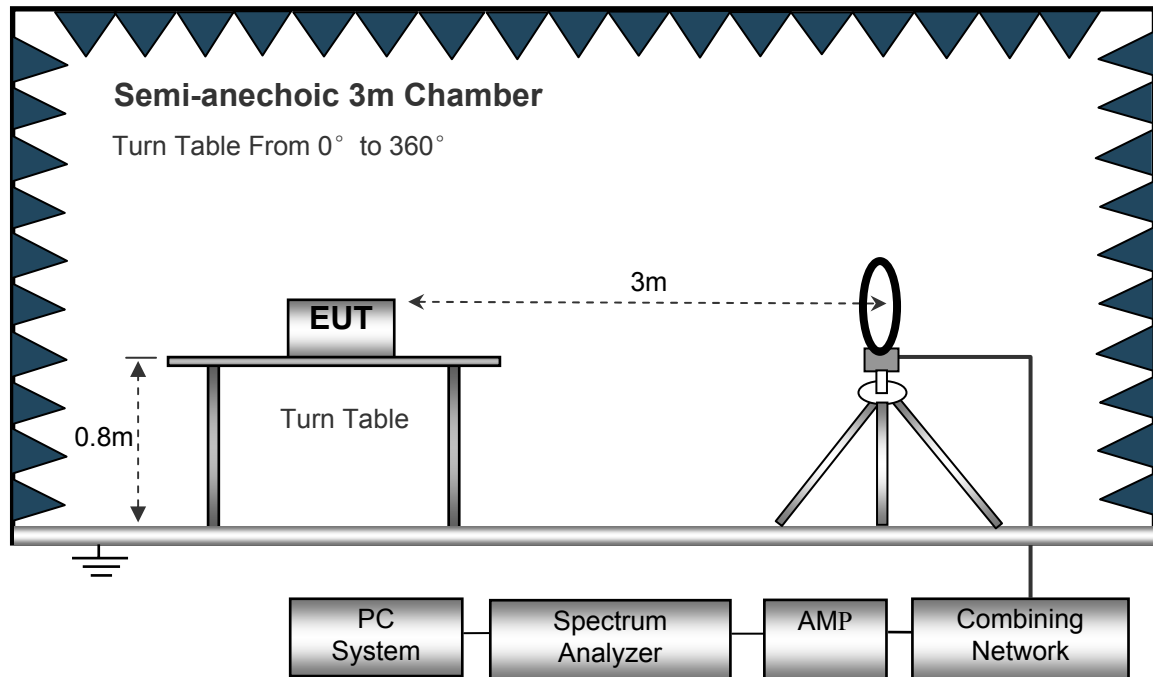
EUT Operation:

- (1) The pre-test was tested in battery supply and adapter supply, and the worst is adapter supply.
- (2) The EUT was tested in AUX in with discharging, FM (88.7MHz/ 98MHz/ 107.9MHz) with USB charging and bluetooth linking with USB charging mode. The worst mode were shown in the report.

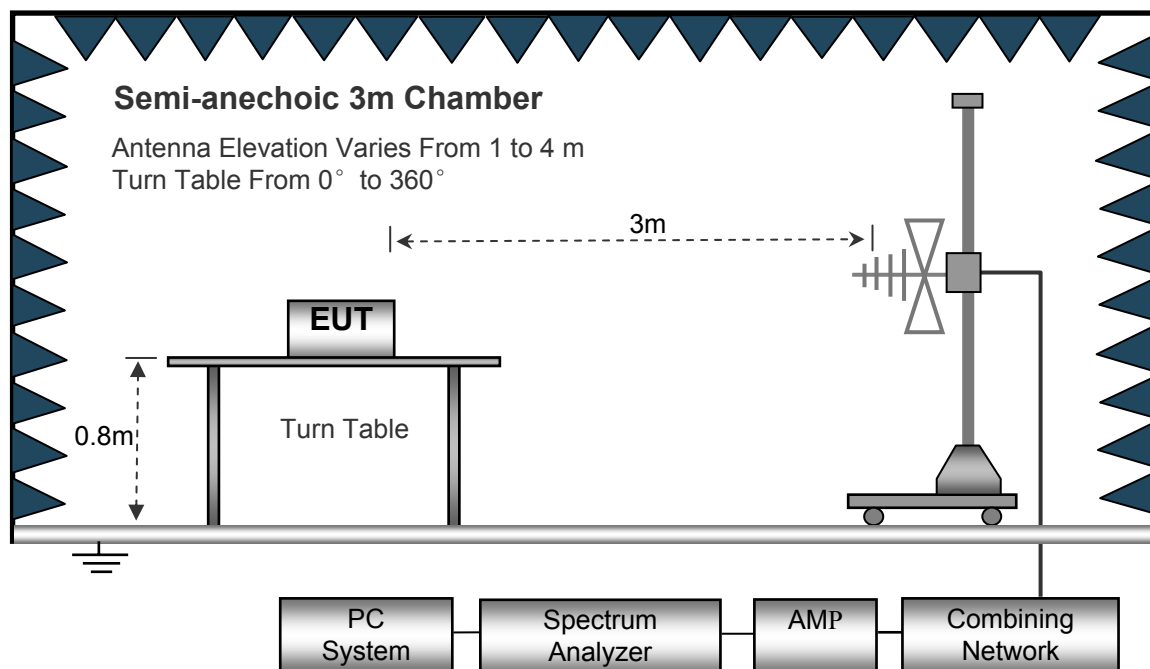
7.2 Test Setup

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

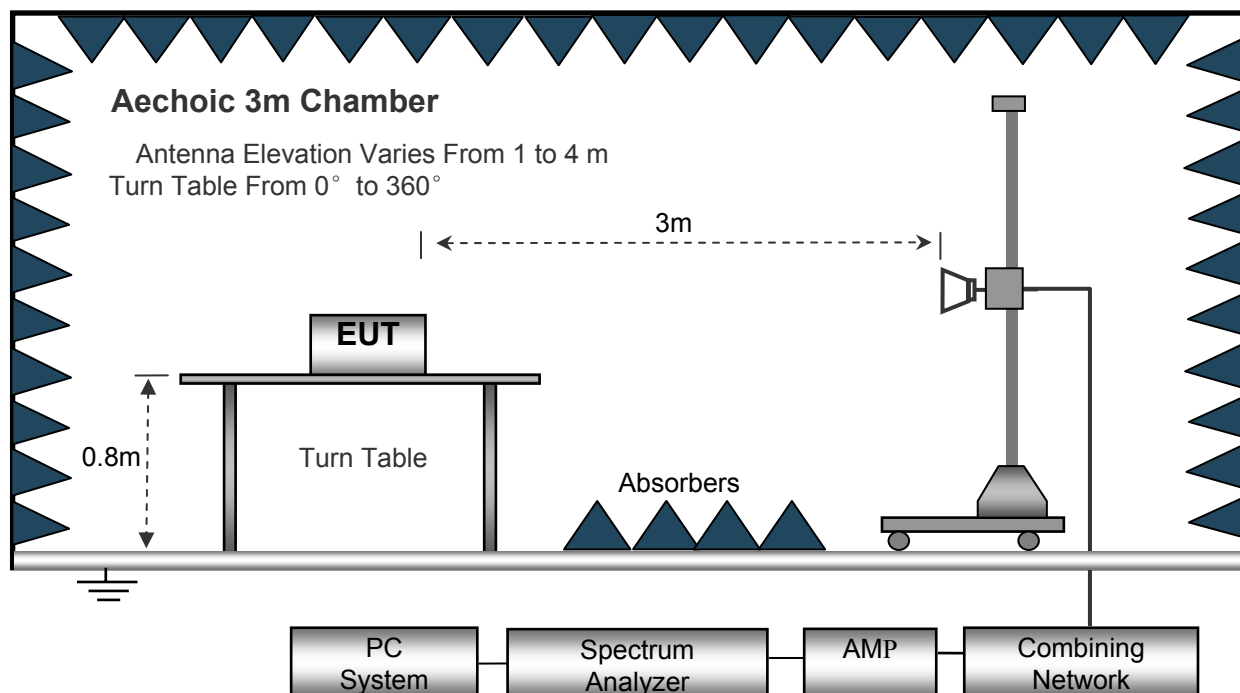
The test setup for emission measurement below 30MHz.



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

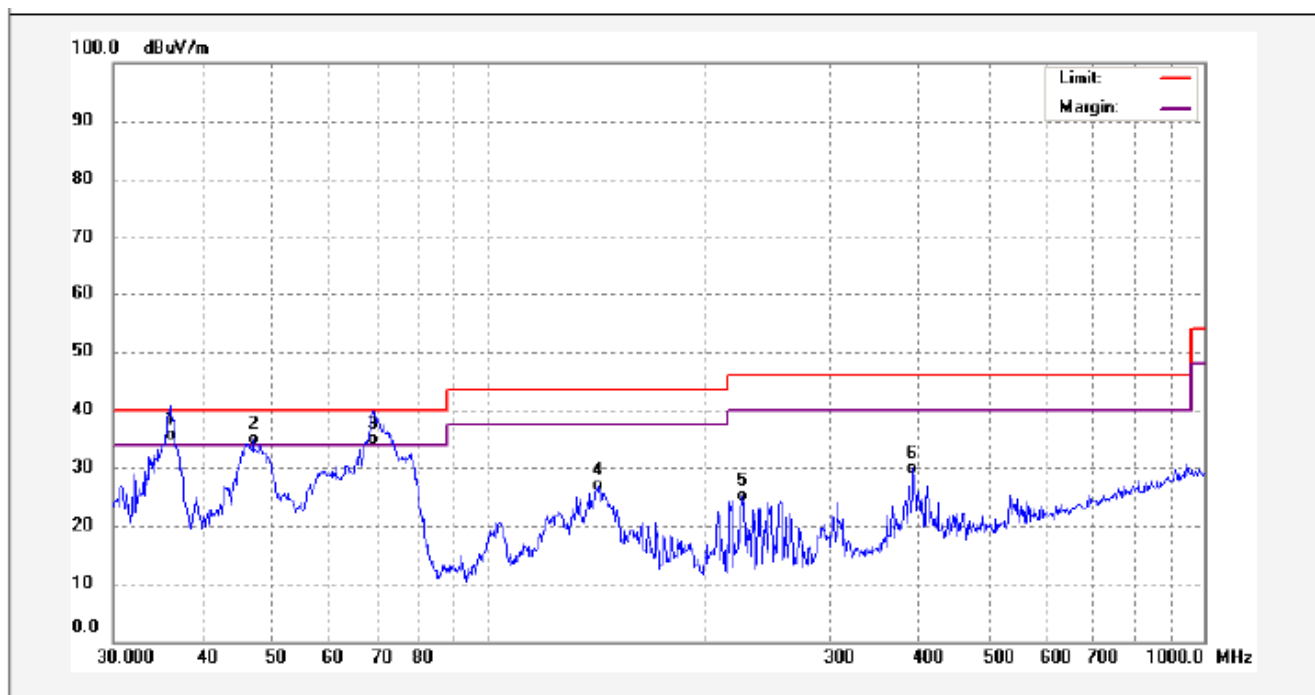
Test Frequency :Below 30MHz

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

Test Frequency : 30MHz ~ 1000MHz

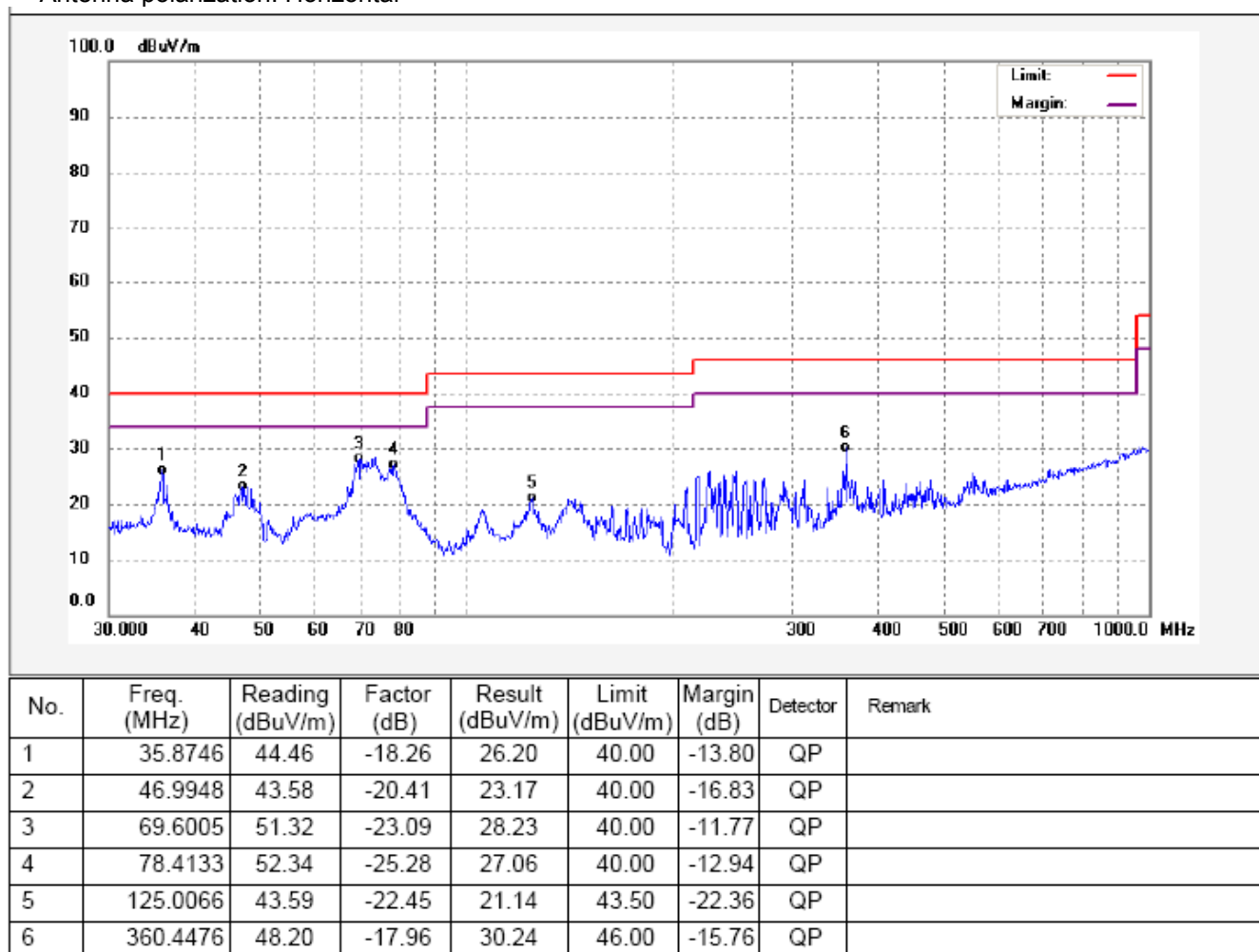
Test mode: Bluetooth linking with charging mode

Antenna polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	36.0007	55.70	-20.15	35.55	40.00	-4.45	QP	
2	46.9948	57.38	-22.47	34.91	40.00	-5.09	QP	
3	69.1141	57.98	-23.22	34.76	40.00	-5.24	QP	
4	142.8243	48.28	-21.31	26.97	43.50	-16.53	QP	
5	226.8936	47.65	-22.64	25.01	46.00	-20.99	QP	
6	392.0951	46.75	-16.97	29.78	46.00	-16.22	QP	

Antenna polarization: Horizontal



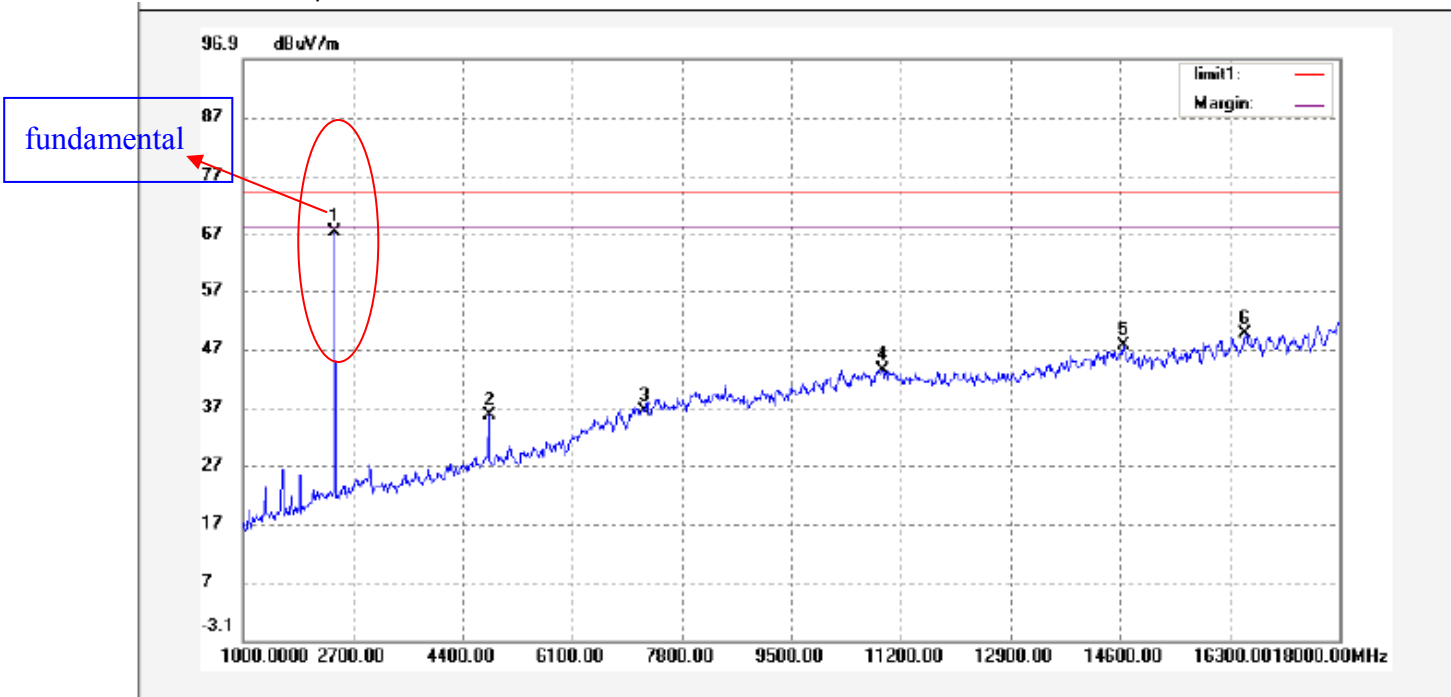
Test Frequency: 1GHz ~ 18GHz (Battery Supply)

All the modulation modes were tested, the data of the worst mode (GFSK) were recorded in the following pages.

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

Test mode: transmitting at lower channel

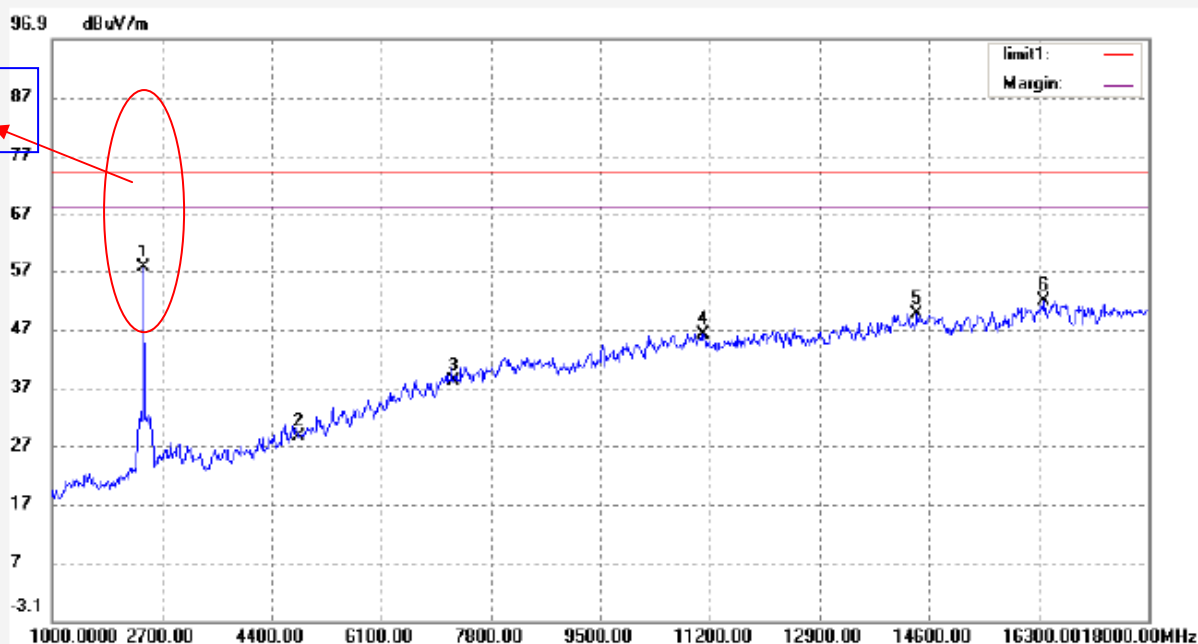
Antenna polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2402.000	82.89	-15.59	67.30	74.00	-6.70	peak	
2	4804.000	47.45	-11.97	35.48	74.00	-38.52	peak	
3	7206.000	43.61	-7.21	36.40	74.00	-37.60	peak	
4	10911.000	46.87	-3.51	43.36	74.00	-30.64	peak	
5	14651.000	47.06	0.37	47.43	74.00	-26.57	peak	
6	16538.000	51.29	-1.75	49.54	74.00	-24.46	peak	

No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
2	4804.000	-9	26.48	54.00	-27.52	AV	
3	7206.000	-9	27.4	54.00	-26.6	AV	
4	10911.000	-9	34.36	54.00	-19.64	AV	
5	14651.000	-9	38.43	54.00	-15.57	AV	
6	16538.000	-9	40.54	54.00	-13.46	AV	

Antenna polarization: Horizontal

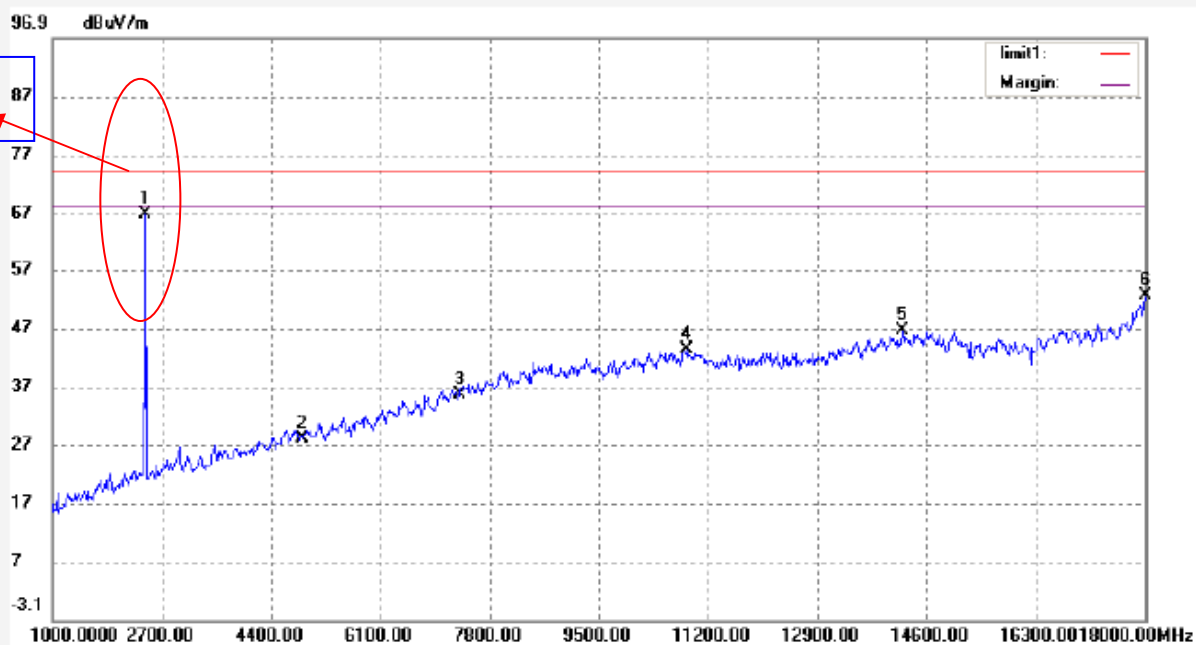


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2402.000	73.02	-15.58	57.44	74.00	-16.56	peak	
2	4804.000	40.57	-11.97	28.60	74.00	-45.40	peak	
3	7206.000	45.30	-7.21	38.09	74.00	-35.91	peak	
4	11098.000	49.89	-3.78	46.11	74.00	-27.89	peak	
5	14413.000	49.18	0.41	49.59	74.00	-24.41	peak	
6	16385.000	54.11	-2.34	51.77	74.00	-22.23	peak	

No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
2	4804.000	-9	19.6	54.00	-34.4	AV	
3	7206.000	-9	29.09	54.00	-24.91	AV	
4	11098.000	-9	37.11	54.00	-16.89	AV	
5	14413.000	-9	40.59	54.00	-13.41	AV	
6	16385.000	-9	42.77	54.00	-11.23	AV	

Test mode: transmitting at middle channel

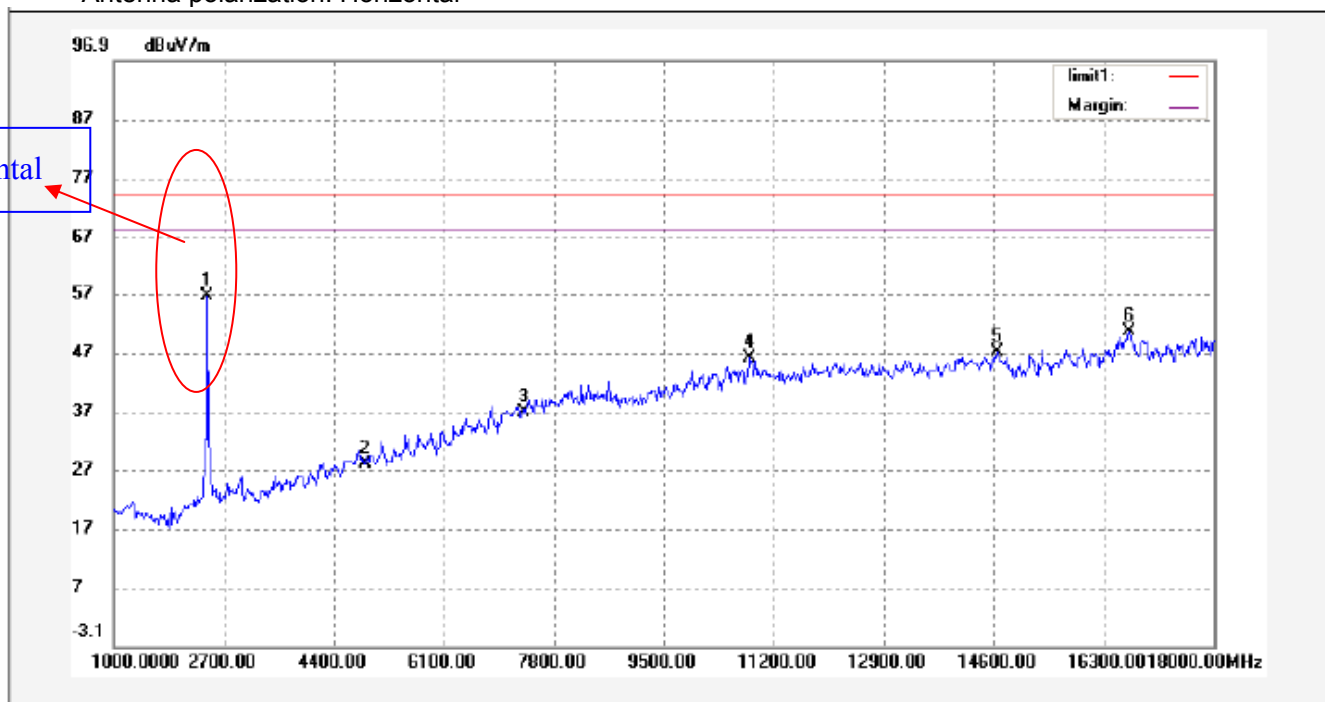
Antenna polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2441.000	82.46	-15.70	66.76	74.00	-7.24	peak	
2	4882.000	39.95	-11.92	28.03	74.00	-45.97	peak	
3	7323.000	42.61	-7.13	35.48	74.00	-38.52	peak	
4	10877.000	46.75	-3.58	43.17	74.00	-30.83	peak	
5	14226.000	46.47	-0.01	46.46	74.00	-27.54	peak	
6	18000.000	45.39	7.08	52.47	74.00	-21.53	peak	

No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
2	4882.000	-9	19.03	54.00	-34.97	AV	
3	7323.000	-9	26.48	54.00	-27.52	AV	
4	10877.000	-9	34.17	54.00	-19.83	AV	
5	14226.000	-9	37.46	54.00	-16.54	AV	
6	18000.000	-9	43.47	54.00	-10.53	AV	

Antenna polarization: Horizontal

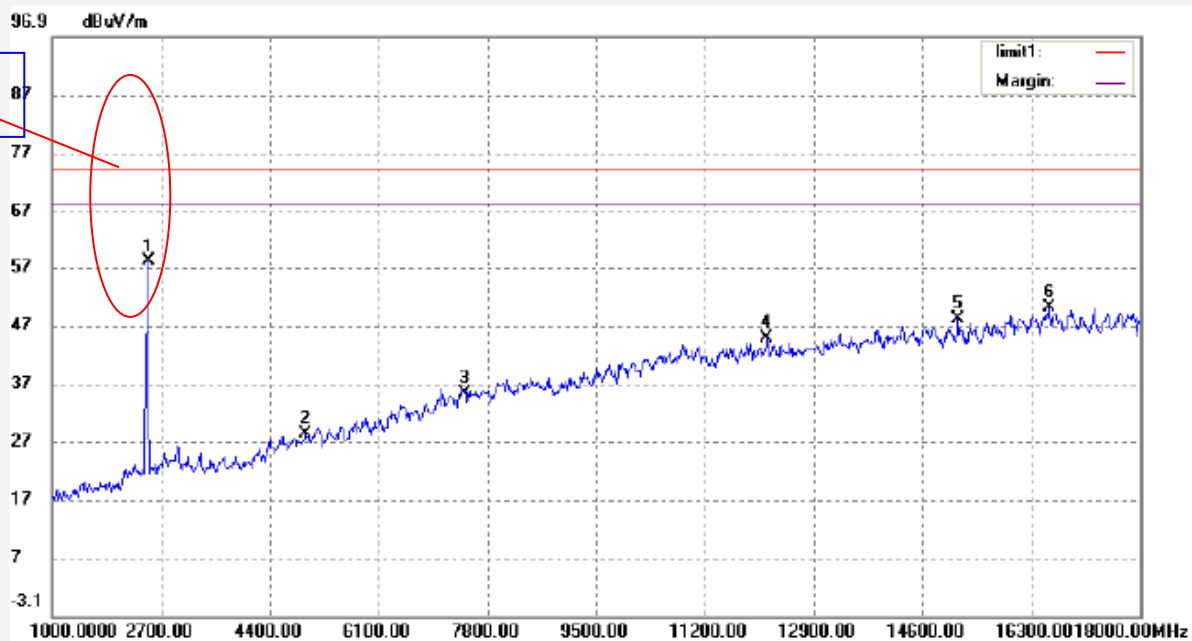


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2441.000	72.22	-15.70	56.52	74.00	-17.48	peak	
2	4882.000	39.87	-11.92	27.95	74.00	-46.05	peak	
3	7323.000	43.91	-7.13	36.78	74.00	-37.22	peak	
4	10826.000	49.67	-3.74	45.93	74.00	-28.07	peak	
5	14651.000	46.58	0.37	46.95	74.00	-27.05	peak	
6	16691.000	51.41	-0.89	50.52	74.00	-23.48	peak	

No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
2	4882.000	-9	18.95	54.00	-35.05	AV	
3	7323.000	-9	27.78	54.00	-26.22	AV	
4	10826.000	-9	36.93	54.00	-17.07	AV	
5	14651.000	-9	37.95	54.00	-16.05	AV	
6	16691.000	-9	41.52	54.00	-12.48	AV	

Test mode: transmitting at upper channel

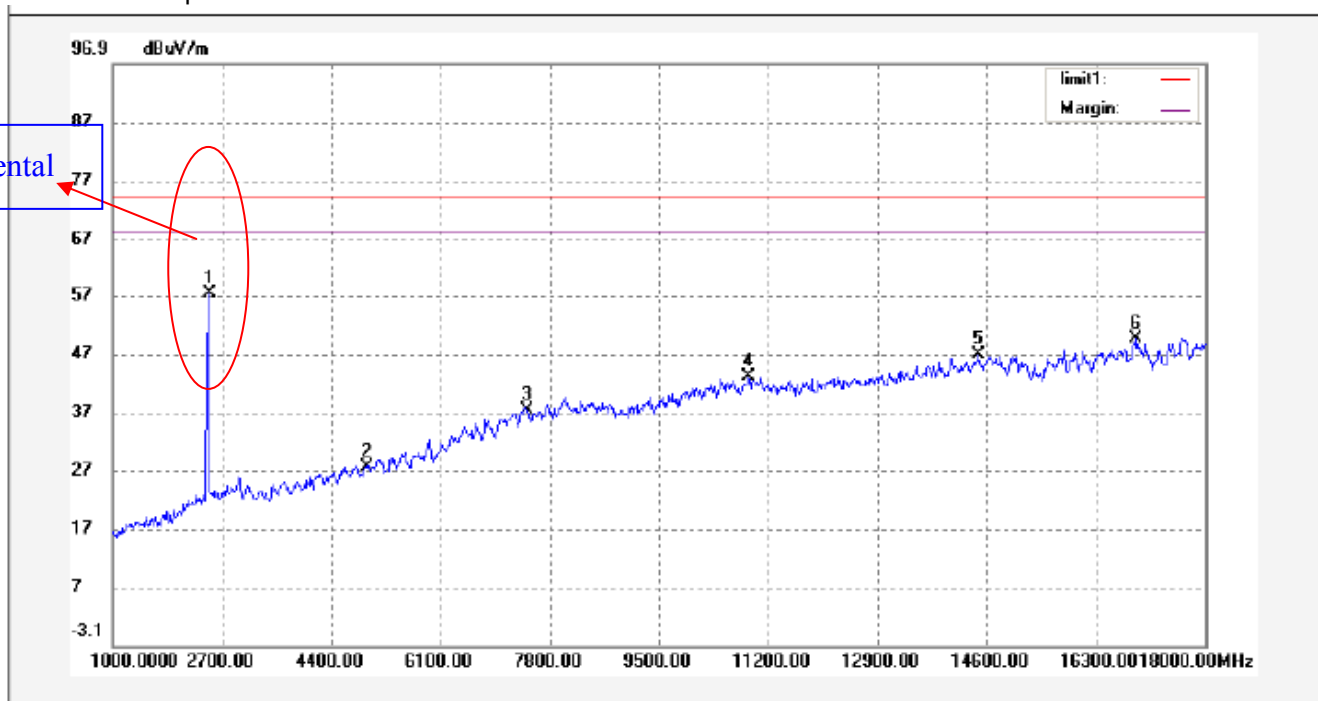
Antenna polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2480.000	73.73	-15.68	58.05	74.00	-15.95	peak	
2	4960.000	40.16	-11.77	28.39	74.00	-45.61	peak	
3	7440.000	42.26	-6.93	35.33	74.00	-38.67	peak	
4	12169.000	49.25	-4.39	44.86	74.00	-29.14	peak	
5	15161.000	49.78	-1.73	48.05	74.00	-25.95	peak	
6	16572.000	51.65	-1.56	50.09	74.00	-23.91	peak	

No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
2	4960.000	-9	19.39	54.00	-34.61	AV	
3	7440.000	-9	26.33	54.00	-27.67	AV	
4	12169.000	-9	35.86	54.00	-18.14	AV	
5	15161.000	-9	39.05	54.00	-14.95	AV	
6	16572.000	-9	41.09	54.00	-12.91	AV	

Antenna polarization: Horizontal

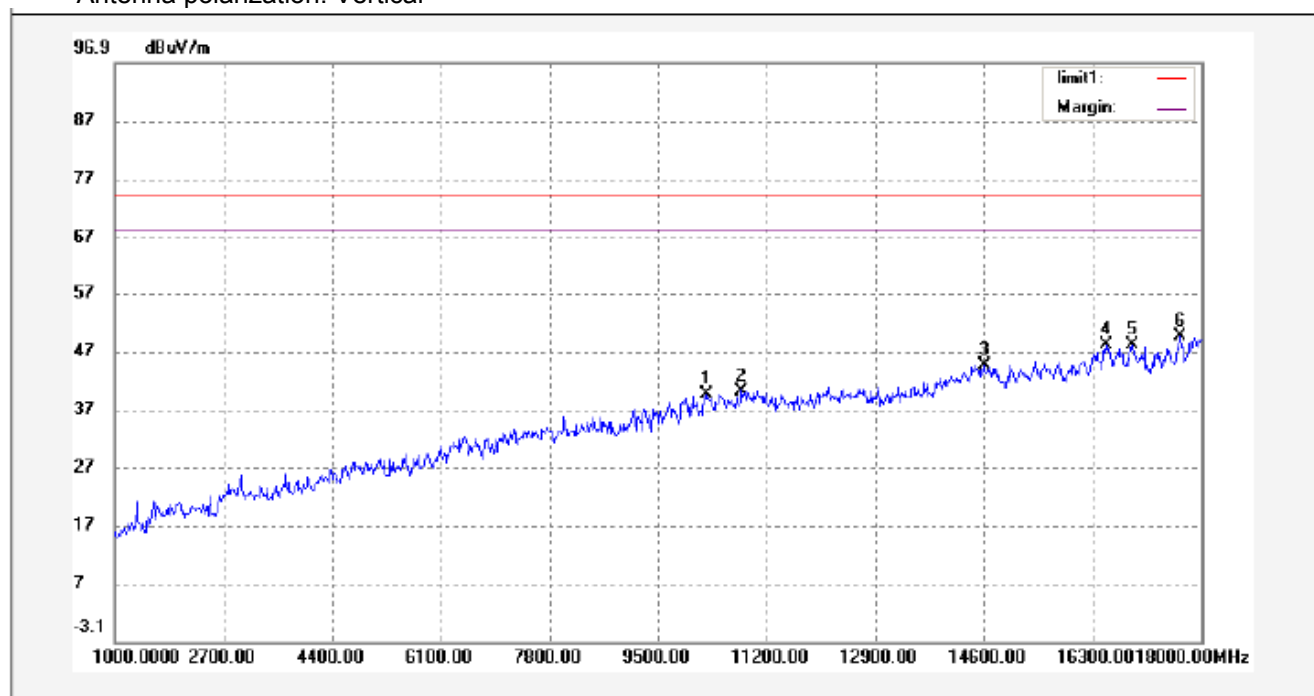


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2480.000	72.87	-15.68	57.19	74.00	-16.81	peak	
2	4960.000	39.30	-11.77	27.53	74.00	-46.47	peak	
3	7440.000	44.14	-6.93	37.21	74.00	-36.79	peak	
4	10894.000	46.69	-3.54	43.15	74.00	-30.85	peak	
5	14481.000	46.17	0.53	46.70	74.00	-27.30	peak	
6	16929.000	49.24	0.24	49.48	74.00	-24.52	peak	

No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
2	4960.000	-9	18.53	54.00	-35.47	AV	
3	7440.000	-9	28.21	54.00	-25.79	AV	
4	10894.000	-9	34.15	54.00	-19.85	AV	
5	14481.000	-9	37.7	54.00	-16.3	AV	
6	16929.000	-9	40.48	54.00	-13.52	AV	

Test mode: receiving whole band

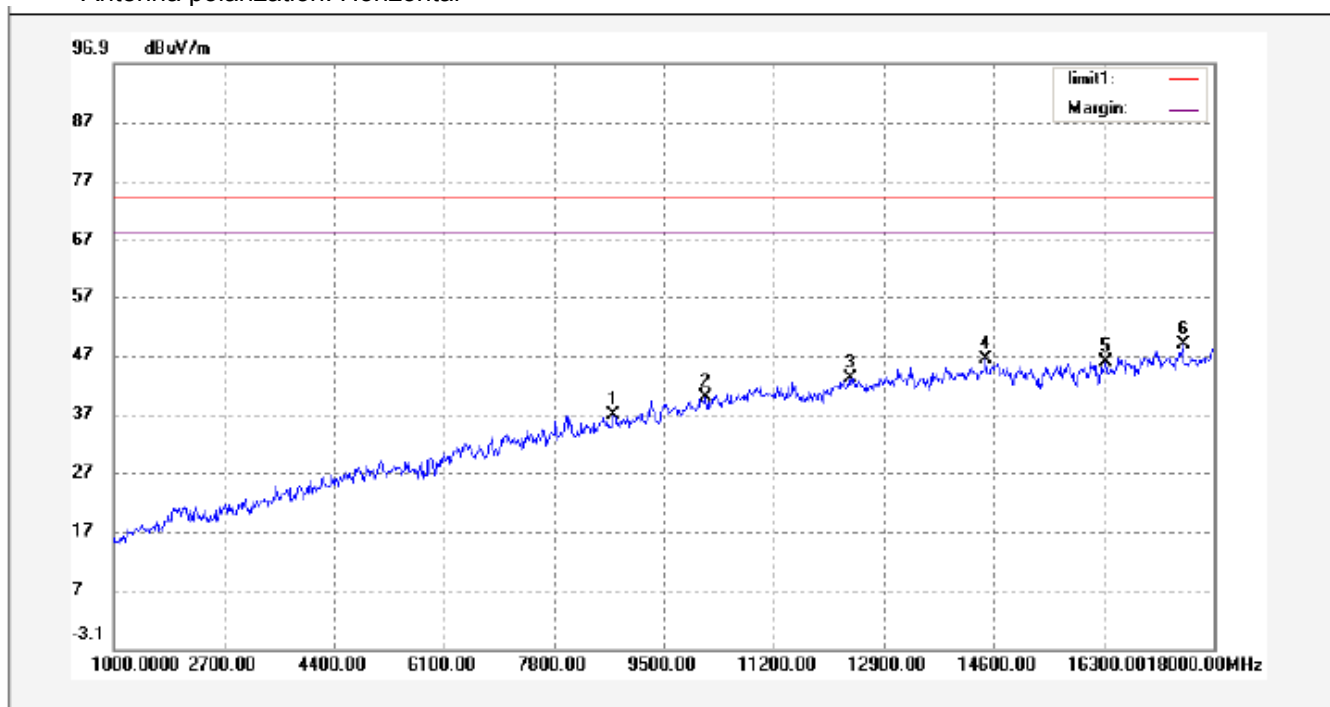
Antenna polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	10248.000	44.35	-4.80	39.55	74.00	-34.45	peak	
2	10809.000	43.94	-3.79	40.15	74.00	-33.85	peak	
3	14600.000	44.15	0.43	44.58	74.00	-29.42	peak	
4	16504.000	49.85	-1.94	47.91	74.00	-26.09	peak	
5	16929.000	47.70	0.24	47.94	74.00	-26.06	peak	
6	17660.000	46.32	3.32	49.64	74.00	-24.36	peak	

No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	10248.000	-9	30.55	54.00	-23.45	AV	
2	10809.000	-9	31.15	54.00	-22.85	AV	
3	14600.000	-9	35.58	54.00	-18.42	AV	
4	16504.000	-9	38.91	54.00	-15.09	AV	
5	16929.000	-9	38.94	54.00	-15.06	AV	
6	17660.000	-9	40.64	54.00	-13.36	AV	

Antenna polarization: Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	8718.000	43.94	-7.10	36.84	74.00	-37.16	peak	
2	10146.000	44.92	-5.03	39.89	74.00	-34.11	peak	
3	12390.000	47.93	-4.82	43.11	74.00	-30.89	peak	
4	14481.000	45.83	0.53	46.36	74.00	-27.64	peak	
5	16334.000	48.38	-2.53	45.85	74.00	-28.15	peak	
6	17524.000	46.18	2.52	48.70	74.00	-25.30	peak	

No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	8718.000	-9	27.84	54.00	-26.16	AV	
2	10146.000	-9	30.89	54.00	-23.11	AV	
3	12390.000	-9	34.11	54.00	-19.89	AV	
4	14481.000	-9	37.36	54.00	-16.64	AV	
5	16334.000	-9	36.85	54.00	-17.15	AV	
6	17524.000	-9	39.7	54.00	-14.3	AV	

Test Frequency :Above 18GHz

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

8 Spurious RF Conducted Emissions from out of band

Test Requirement: FCC Part 15.247(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

Test Method: DA 00-705

Test Status: TX mode

8.1 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 to span from the lowest frequency generated in the device up to and including the tenth harmonic of the highest fundamental frequency.
3. Set RBW = 100kHz and VBW = 100kHz.Sweep =auto.
4. mark the worst point and record.

8.2 Test Result

Test Frequency: Below 30MHz

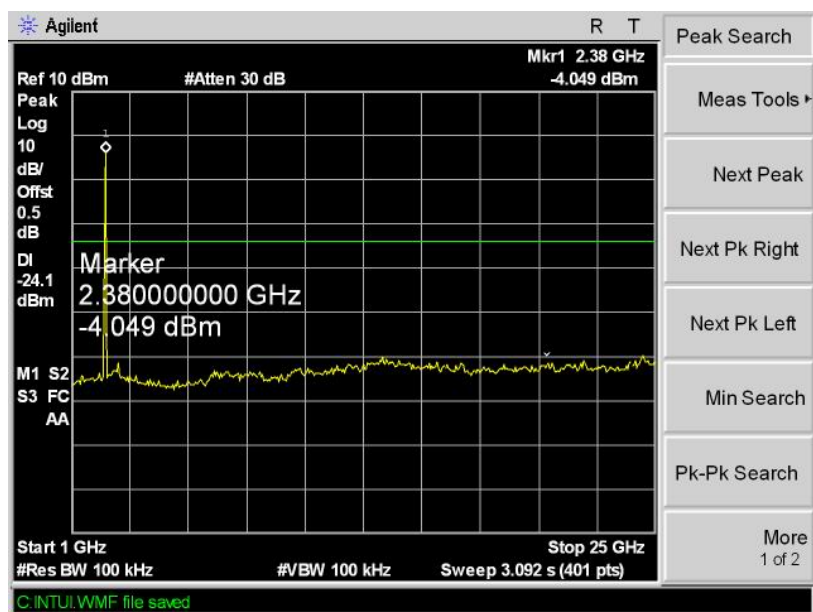
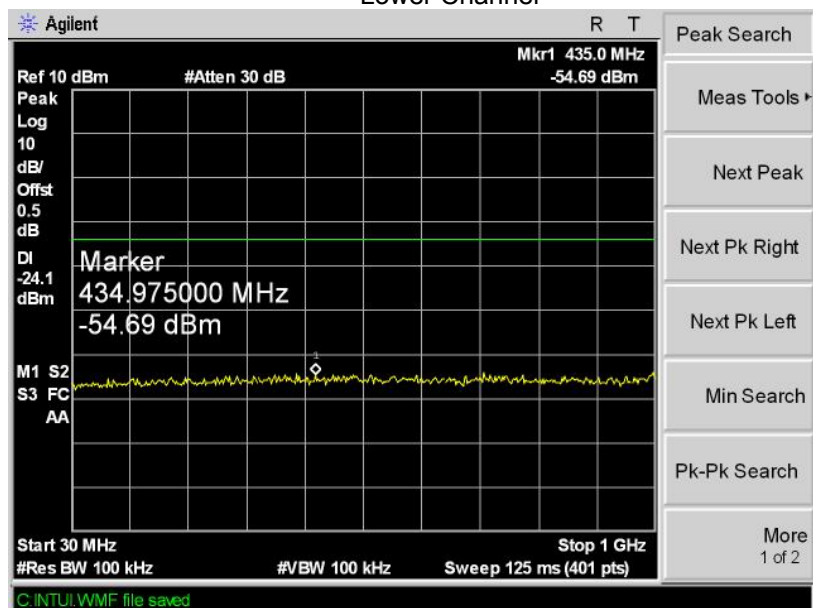
Remark: For emissions below 30MHz,no emission higher than background level, so the data does not show in the report.

Test Frequency: 30MHz ~ 25GHz

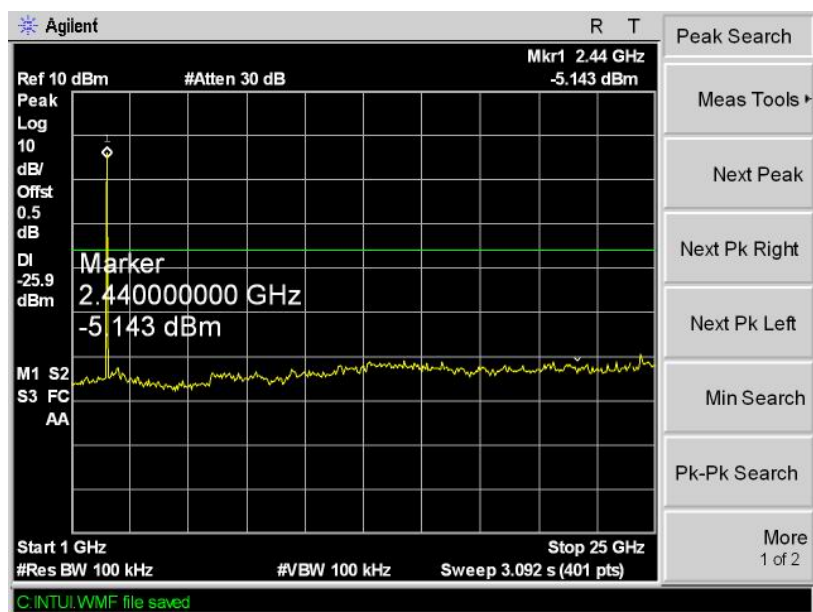
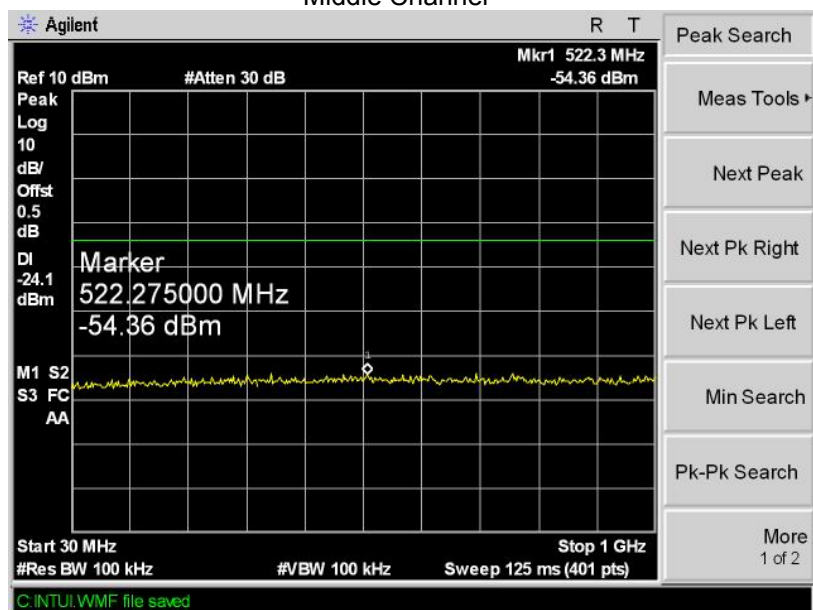
Test result plots shown as follows:

Modulation:GFSK

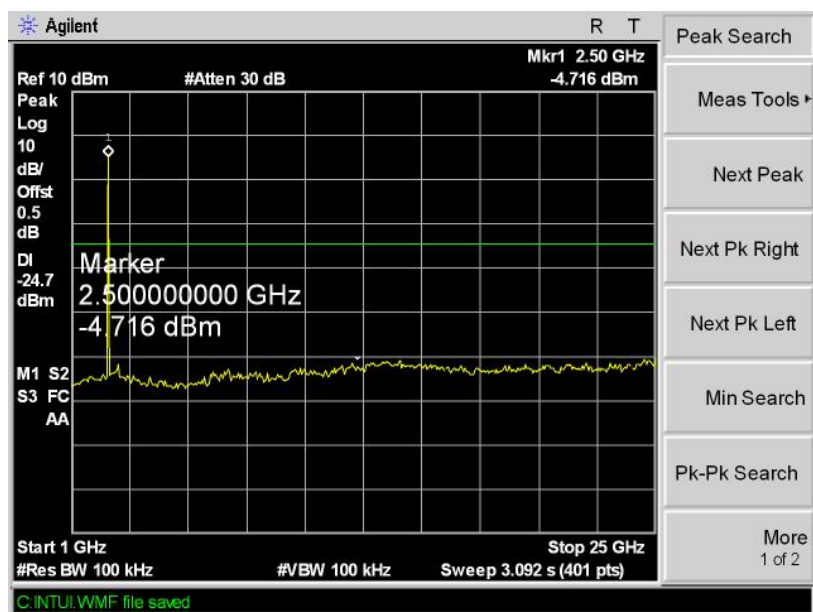
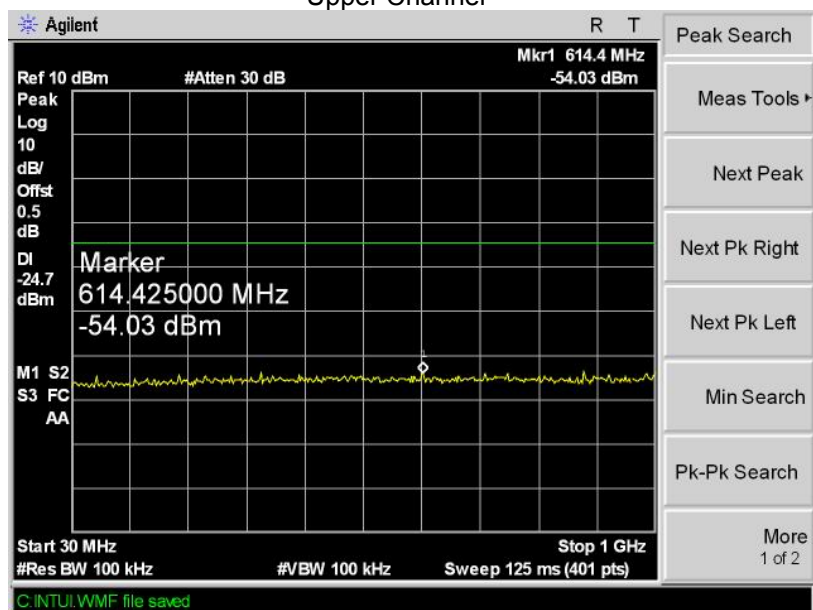
Lower Channel



Middle Channel

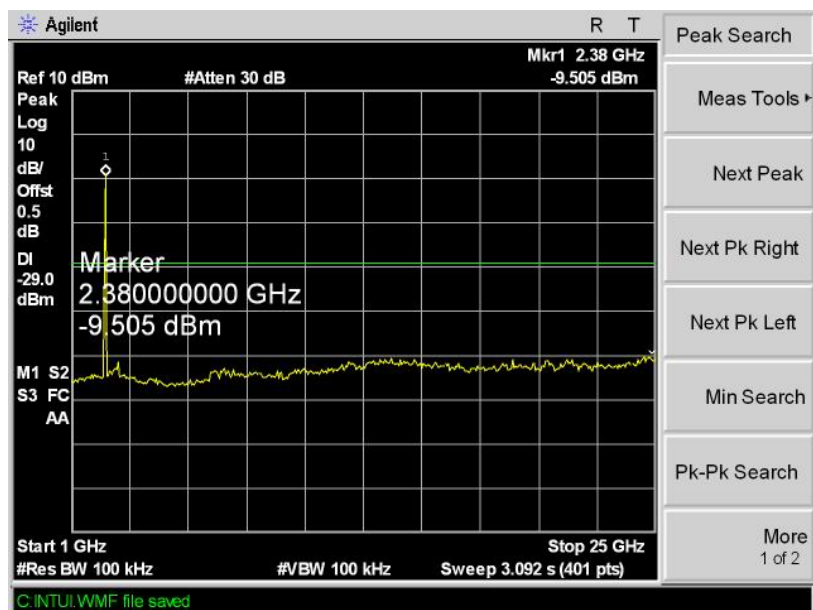
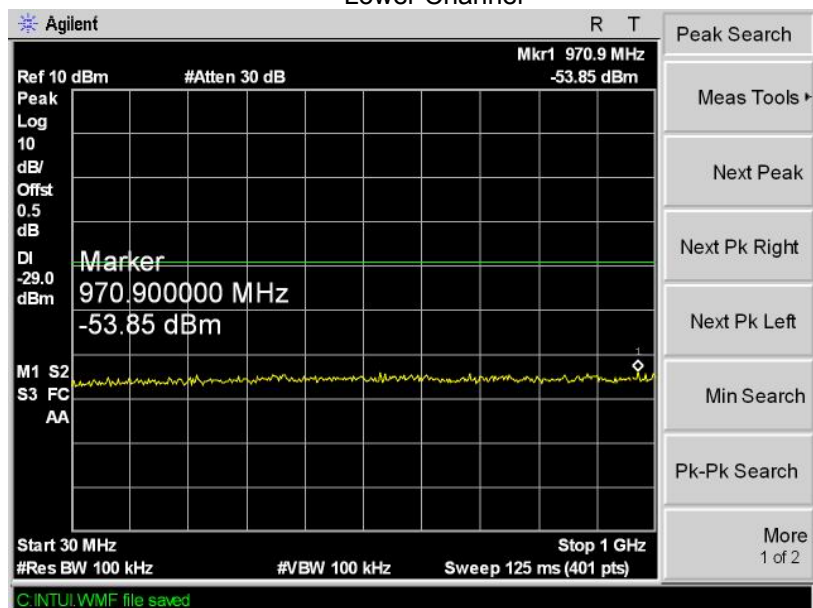


Upper Channel

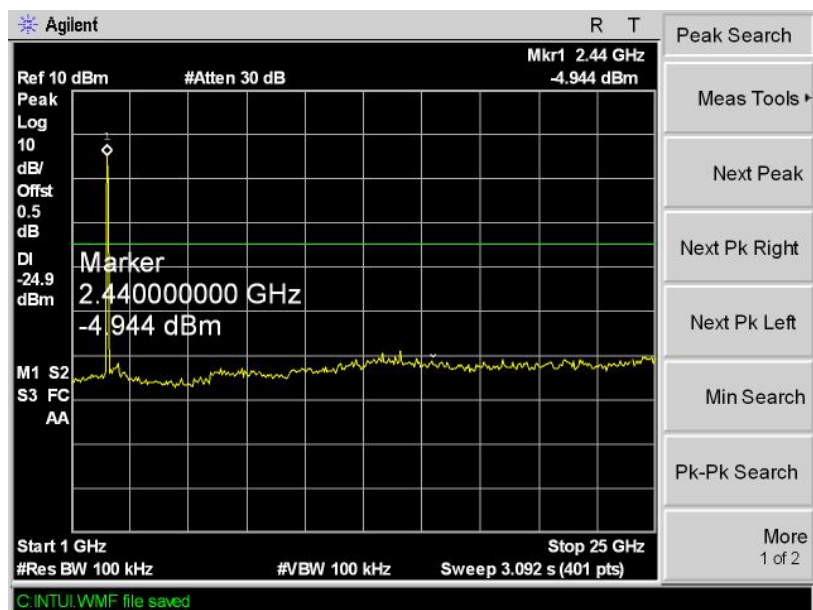
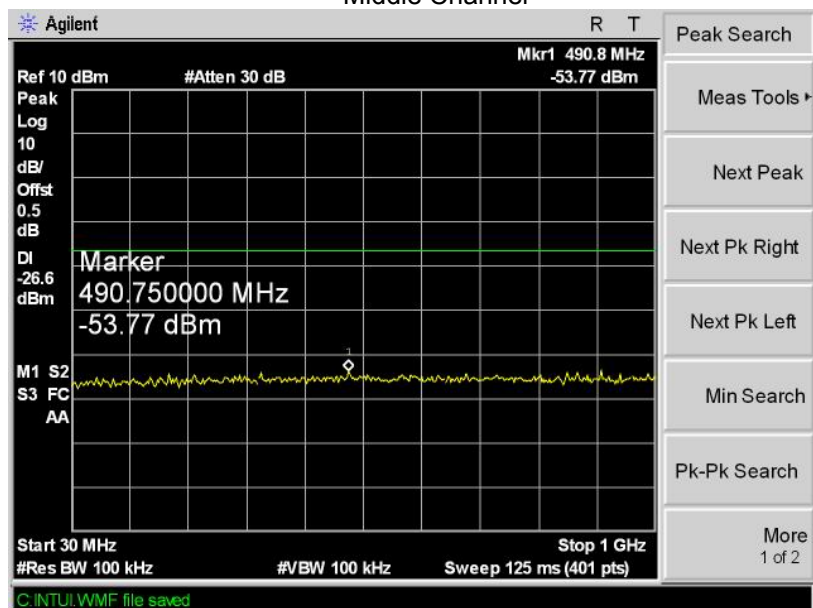


Modulation: Pi/4DQPSK

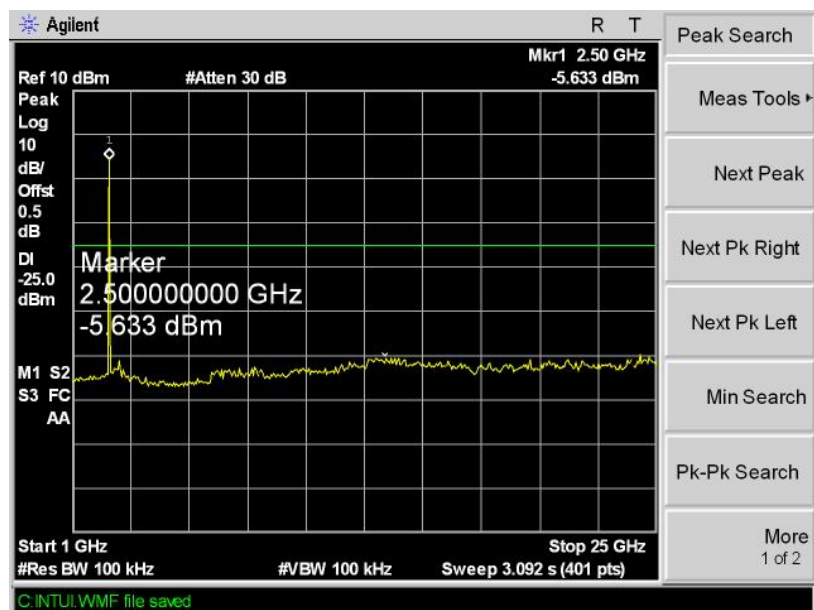
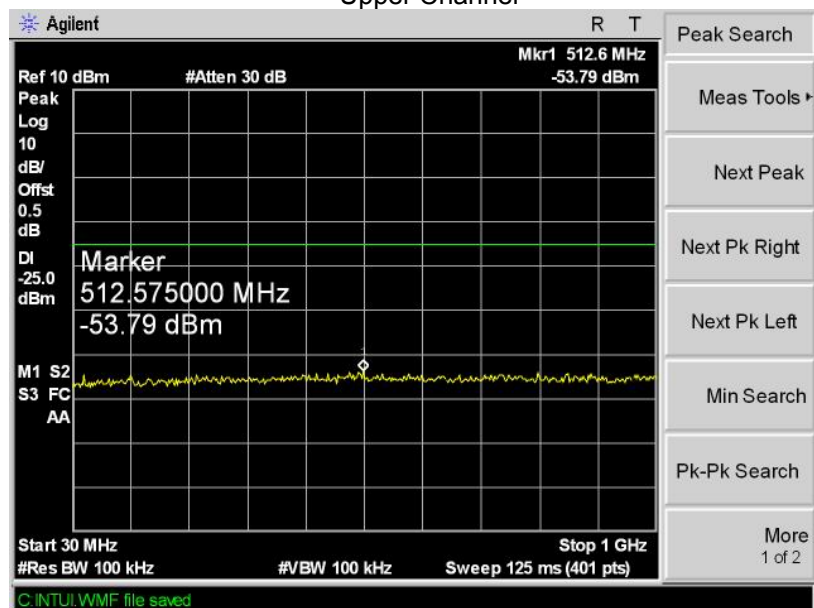
Lower Channel



Middle Channel

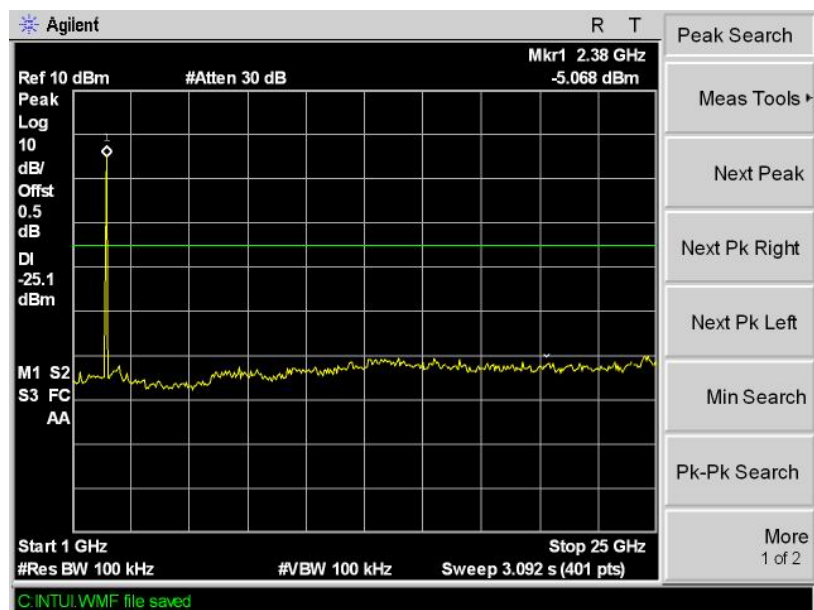
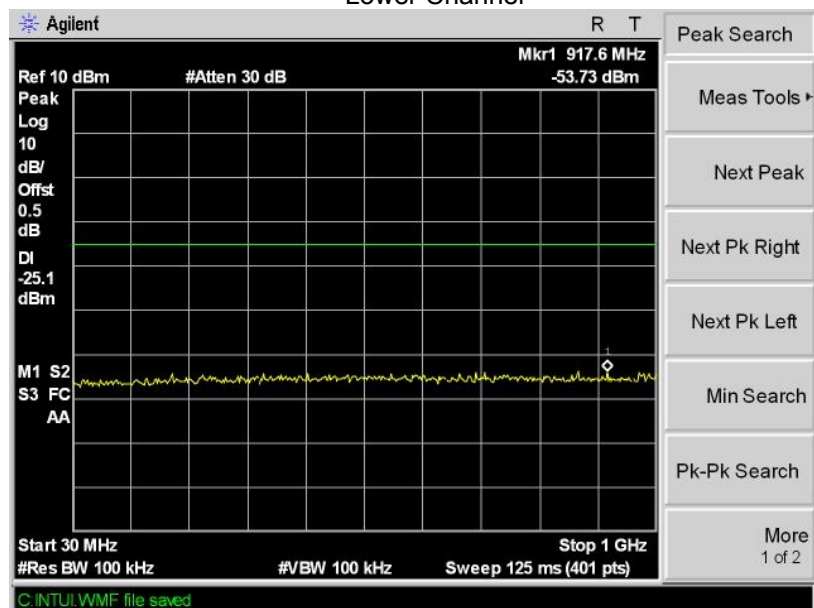


Upper Channel

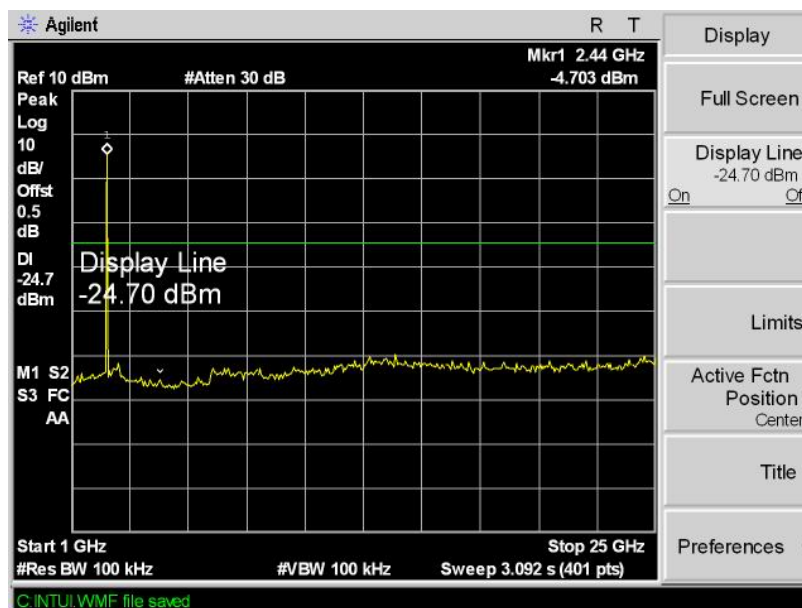
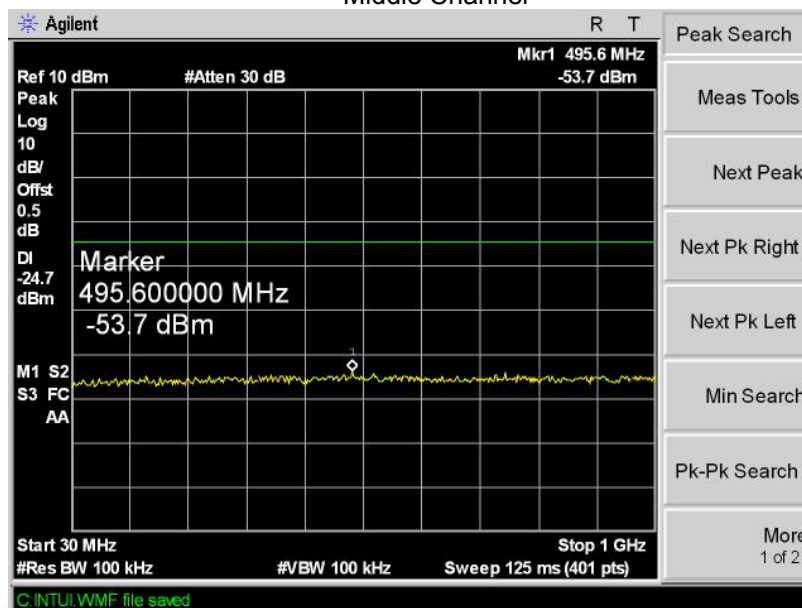


Modulation: 8DPSK

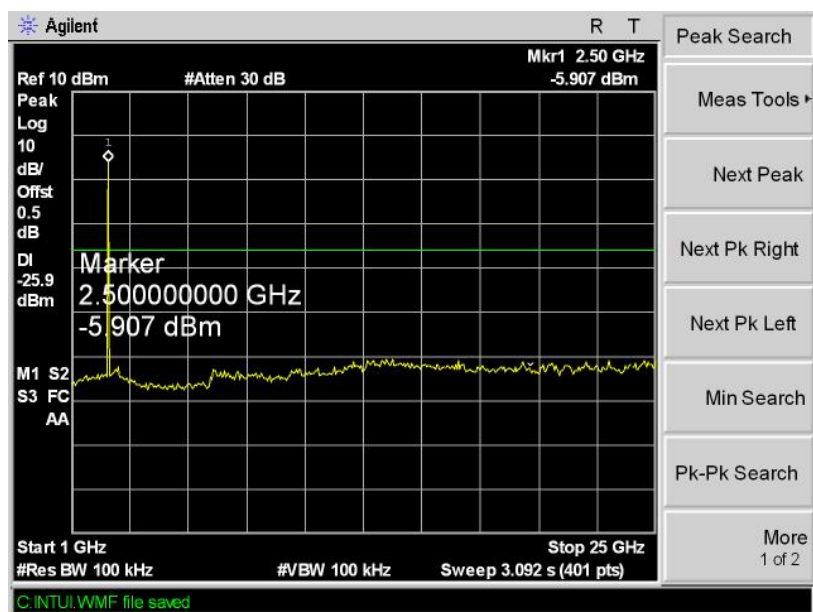
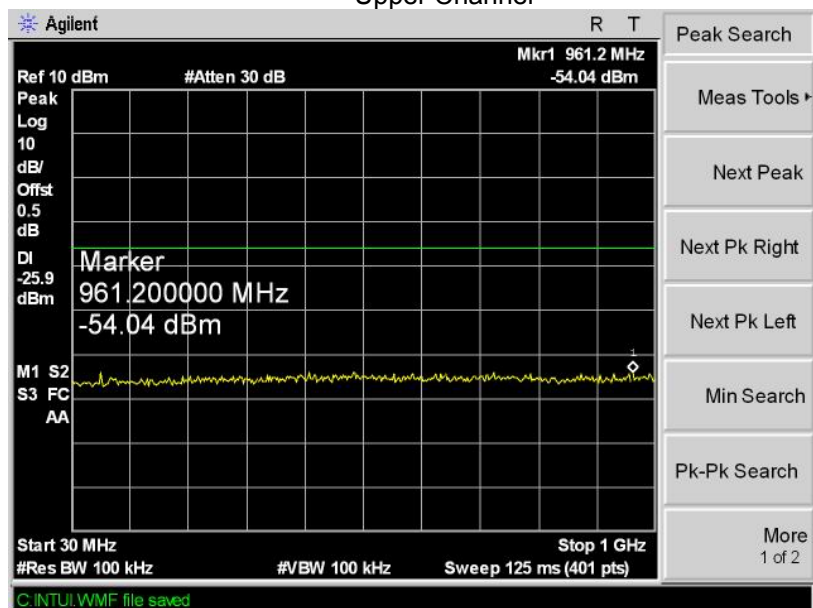
Lower Channel



Middle Channel



Upper Channel



9 Duty Cycle

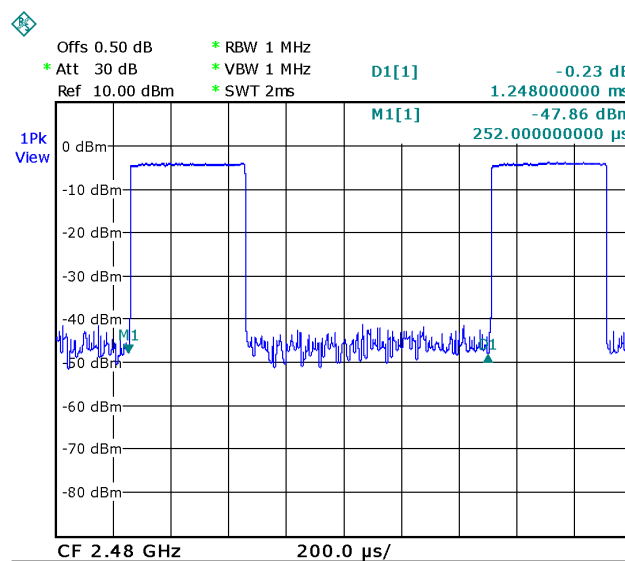
Test Requirement: FCC Part 15.35
Test Method: ANSI C63.4:2003
Test Status: TX mode.

9.1 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 = 100 kHz, VBW = 100 kHz, Span = 0 Hz, Adjacent sweep time.

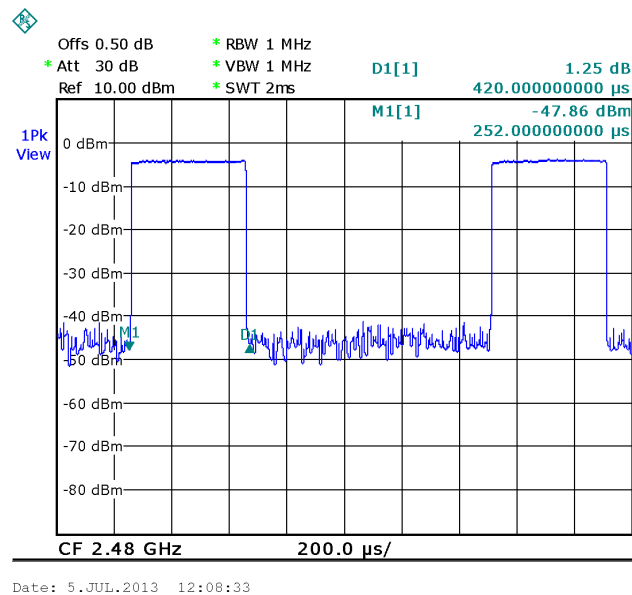
9.2 Test Result

(a) transmission period is 1.248ms



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(b) Single pulse time is 0.420ms



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 = 0.420 ms

The EUT's work period : $T = T_{ON} + T_{OFF}$ = transmission period = 1.248 ms

The EUT's duty cycle : $D = T_{on} / T = 0.420 / 1.248 * 100\% = 33.6\%$

Duty Cycle Correction Factor(dB) = $20 * \log_{10}(\text{Duty Cycle}) = 20 * \log_{10}(33.6\%)$
 = -9dB

10 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
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

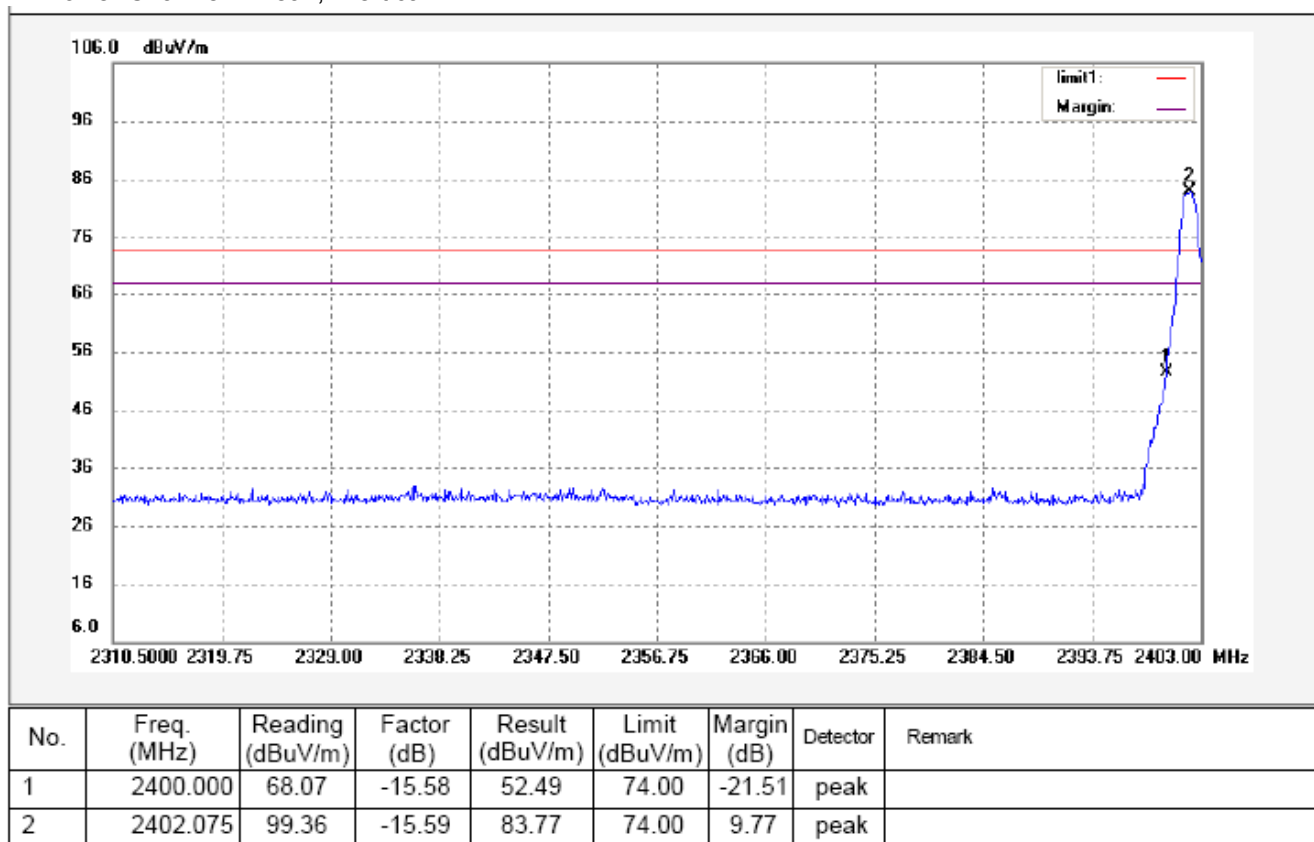
10.1 Test Procedure

1. The EUT was placed on a turntable which is 0.8m above ground plane
2. Measurement Distance is 3m
3. 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 = AVG
Trace = max hold
4. Test mode: Continuous transmitting(the worst mode)

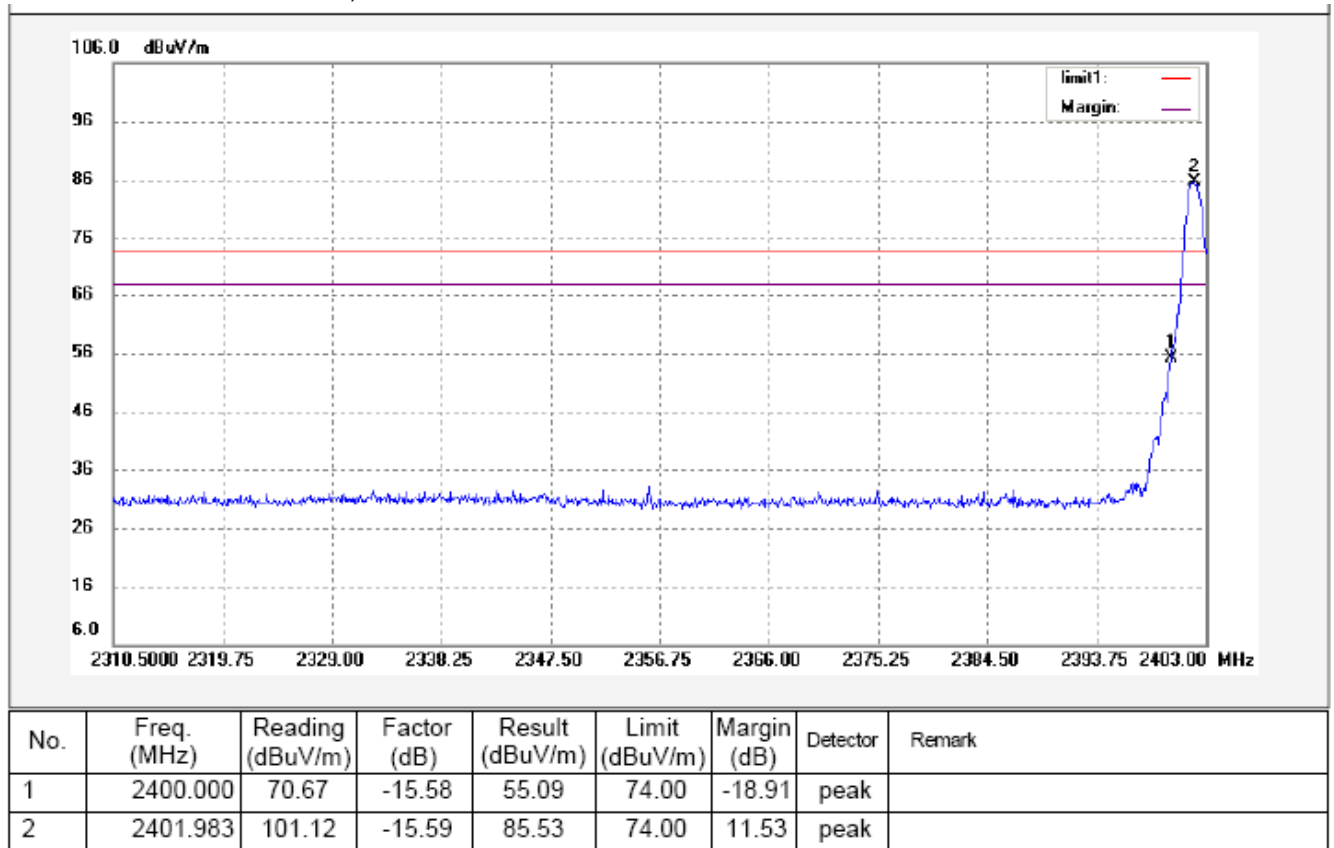
10.2 Test Result:

Lower Channel – Peak, Vertical



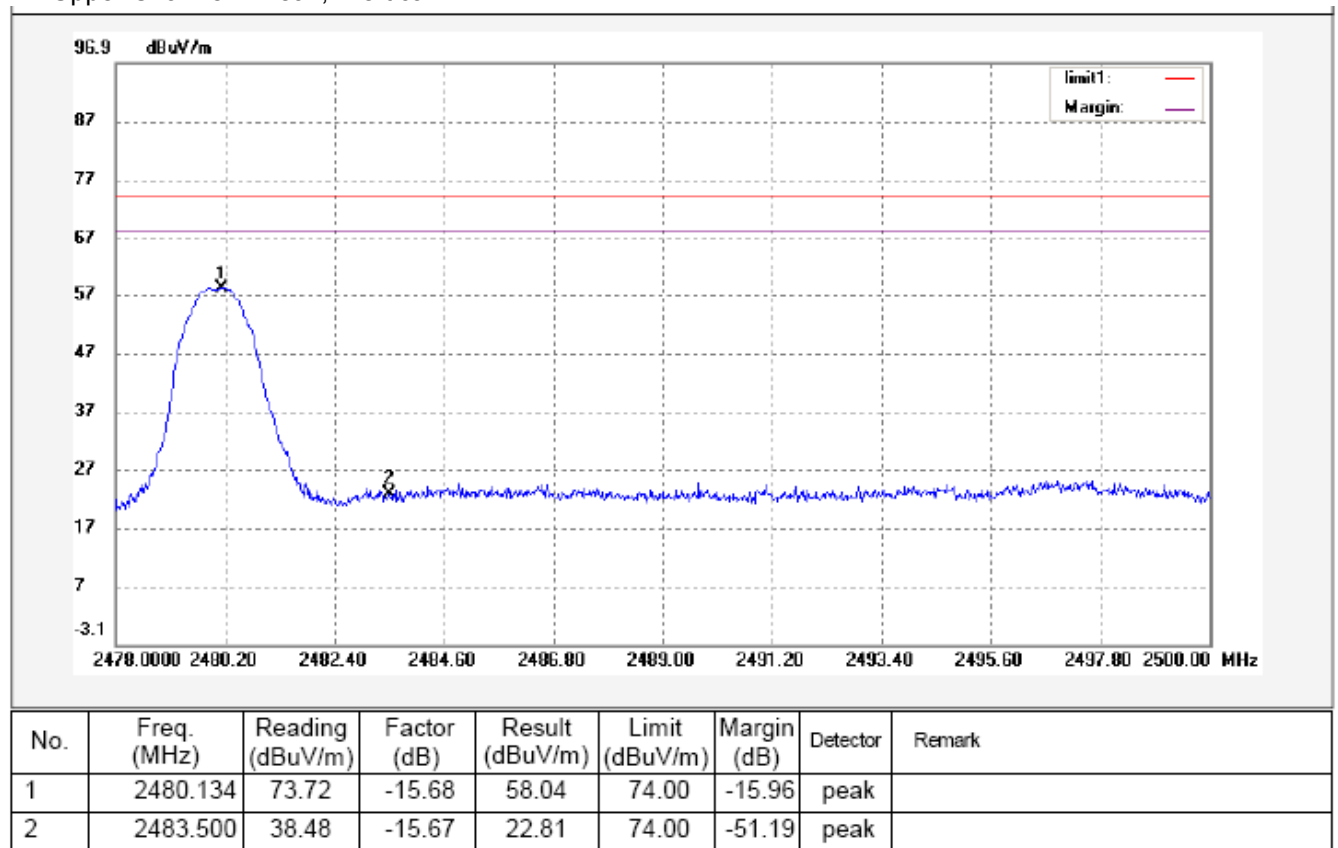
No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2400.000	-9	43.49	54.00	-10.51	AV	

Lower Channel – Peak, Horizontal



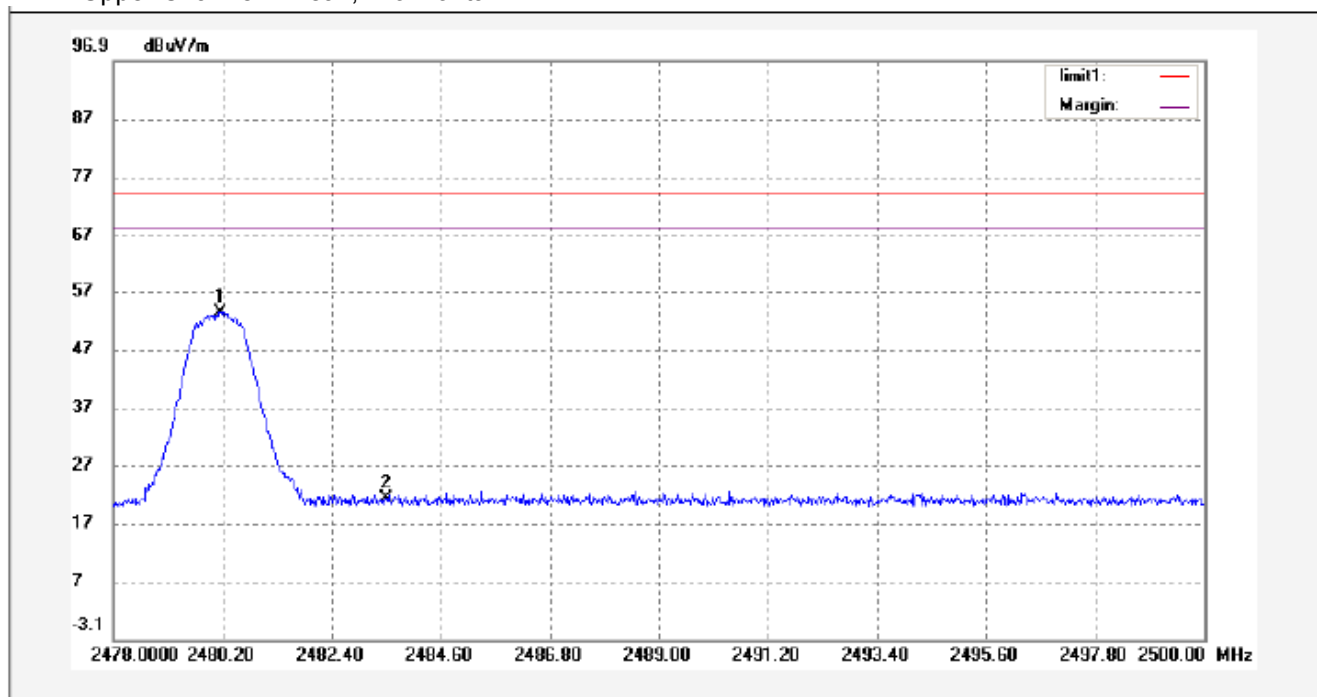
No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2400.000	-9	46.09	54.00	-7.91	AV	

Upper Channel – Peak, Vertical



No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
2	2483.500	-9	13.81	54.00	-40.19	AV	

Upper Channel – Peak, Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2480.156	69.08	-15.68	53.40	74.00	-20.60	peak	
2	2483.500	37.00	-15.67	21.33	74.00	-52.67	peak	

No.	Freq. (MHz)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
2	2483.500	-9	12.33	54.00	-41.67	AV	

11 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.

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 = 100kHz, VBW = 100kHz

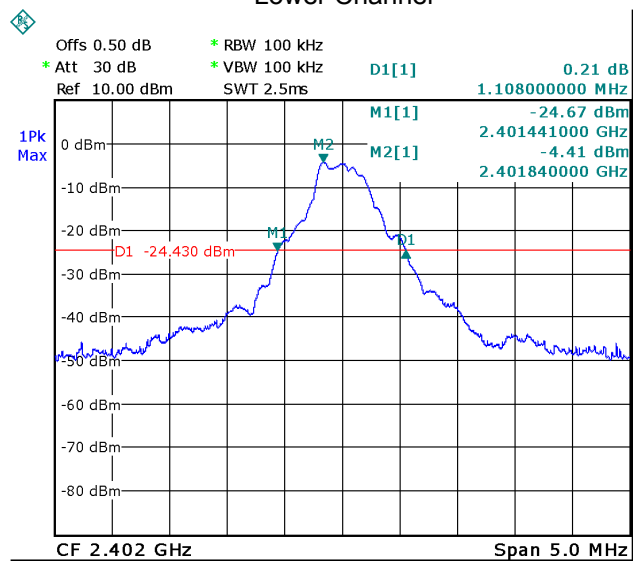
11.2 Test Result:

Modulation	Test Channel	Bandwidth(MHz)
GFSK	Lower	1.108
	Middle	1.108
	Upper	1.118
Pi/4DQPSK	Lower	1.337
	Middle	1.337
	Upper	1.327
8DPSK	Lower	1.307
	Middle	1.307
	Upper	1.307

Test result plot as follows:

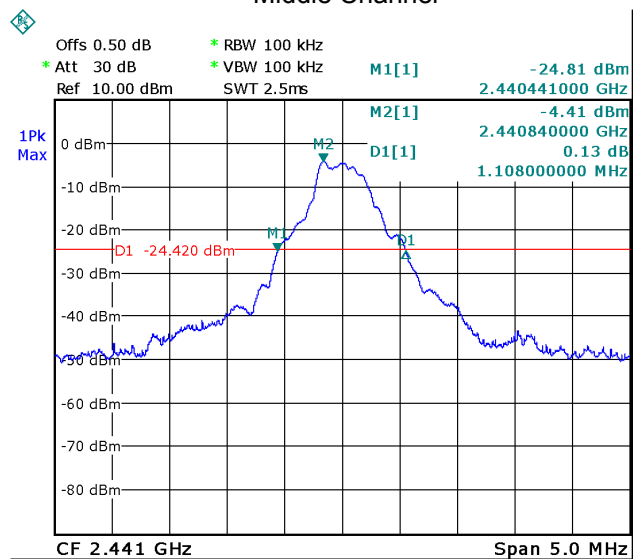
Modulation:GFSK

Lower Channel

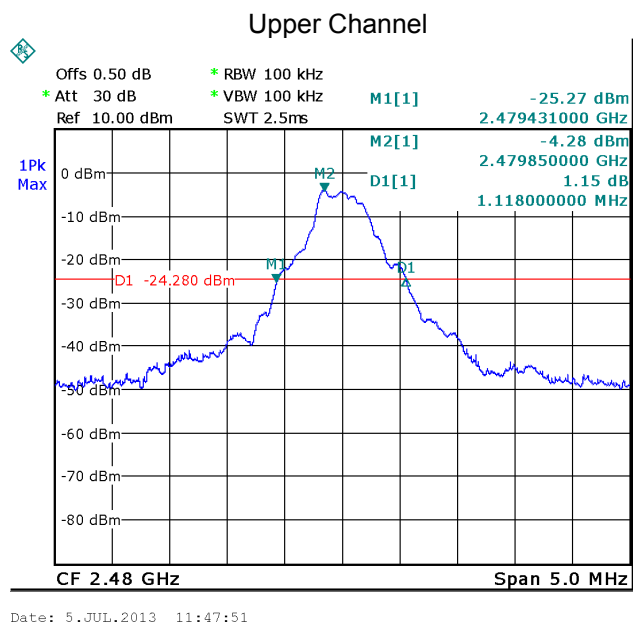


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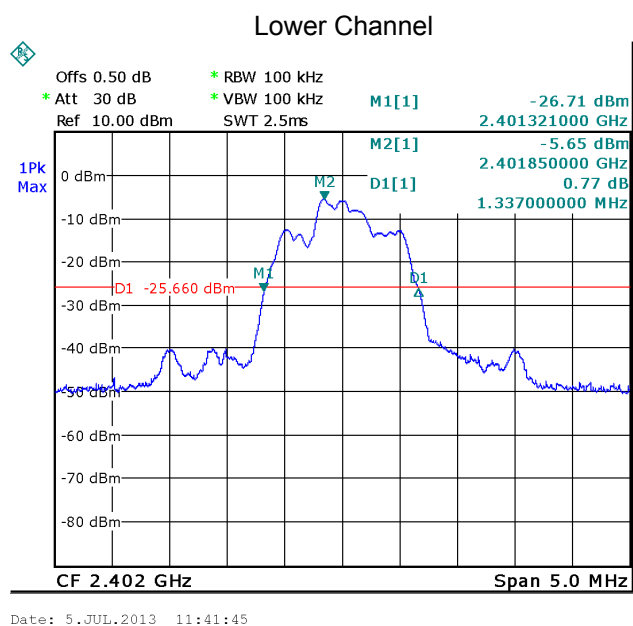
Middle Channel



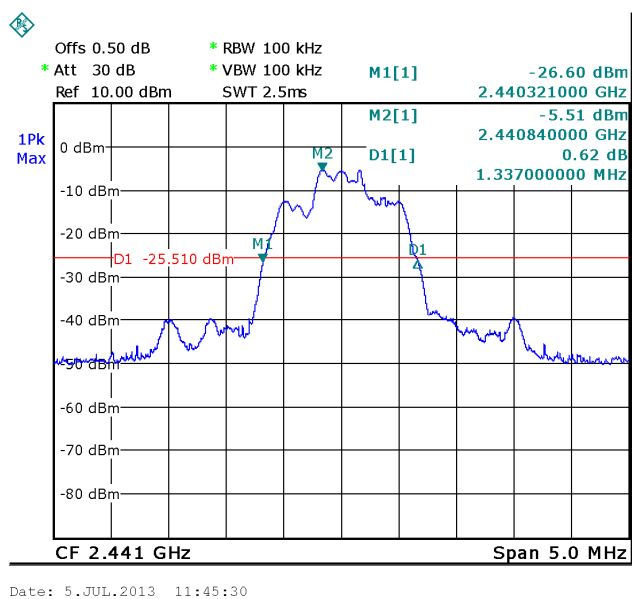
Date: 5.JUL.2013 11:46:38



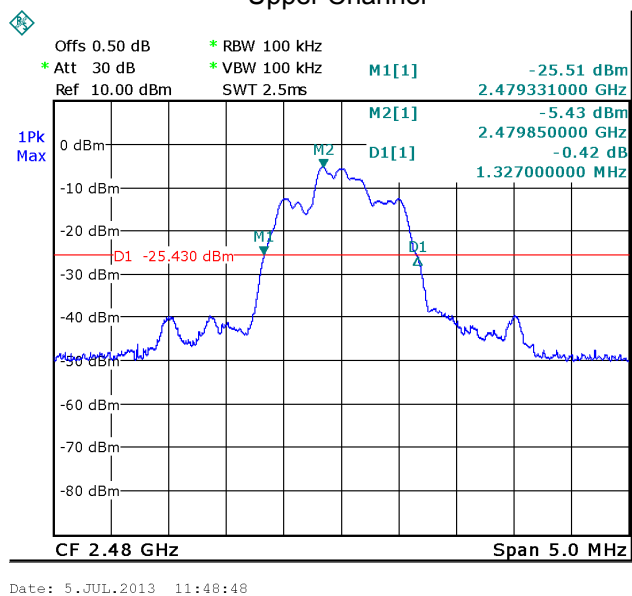
Modulation: Pi/4DQPSK



Middle Channel

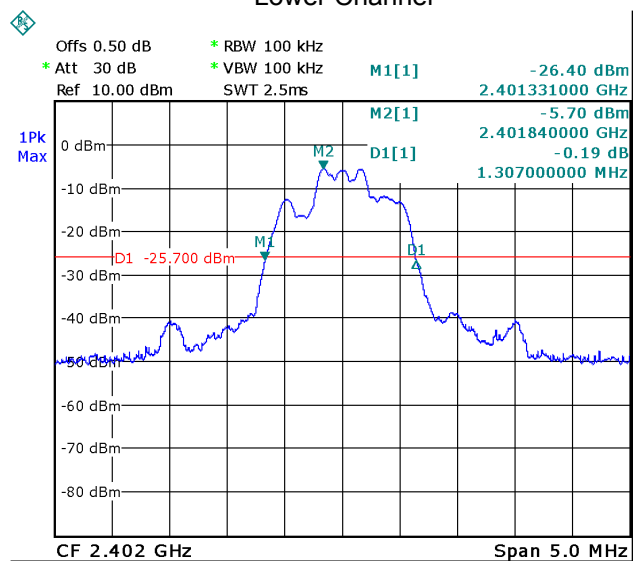


Upper Channel



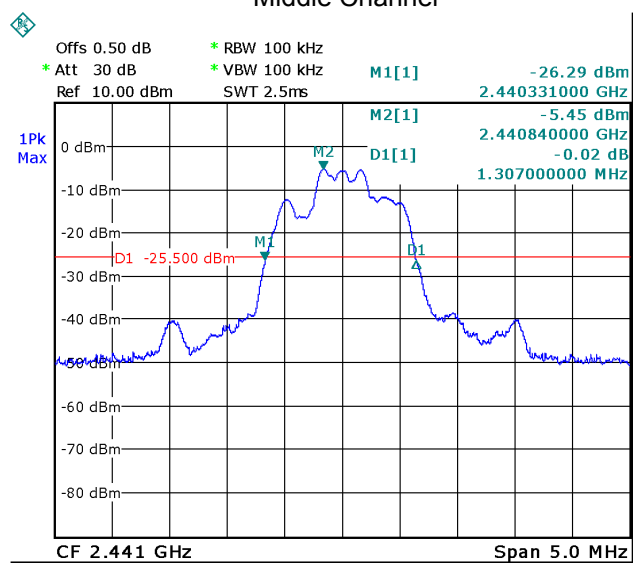
Modulation: 8DPSK

Lower Channel

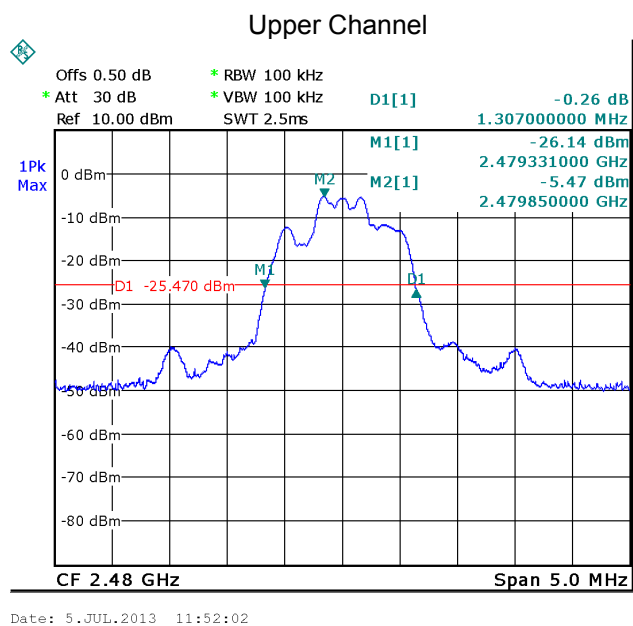


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Middle Channel



Date: 5.JUL.2013 11:43:48



12 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 1watts (30 dBm) limit applies.
Test mode:	Test in fixing frequency transmitting 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 = 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.

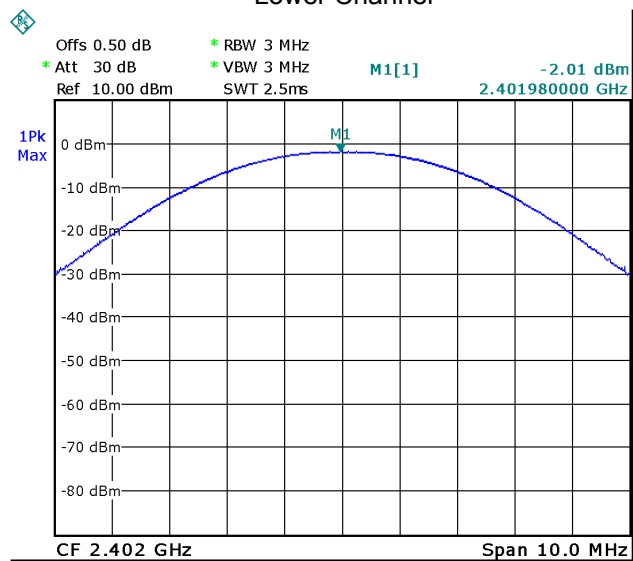
12.2 Test Result:

Modulation	Test Channel	Output Power (dBm)	Limit (dBm)
GFSK	Lower	-2.01	30
	Middle	-1.95	30
	Upper	-1.85	30
Pi/4DQPSK	Lower	-3.20	30
	Middle	-3.11	30
	Upper	-2.97	30
8DPSK	Lower	-3.02	30
	Middle	-2.95	30
	Upper	-2.85	30

Test result plot as follows:

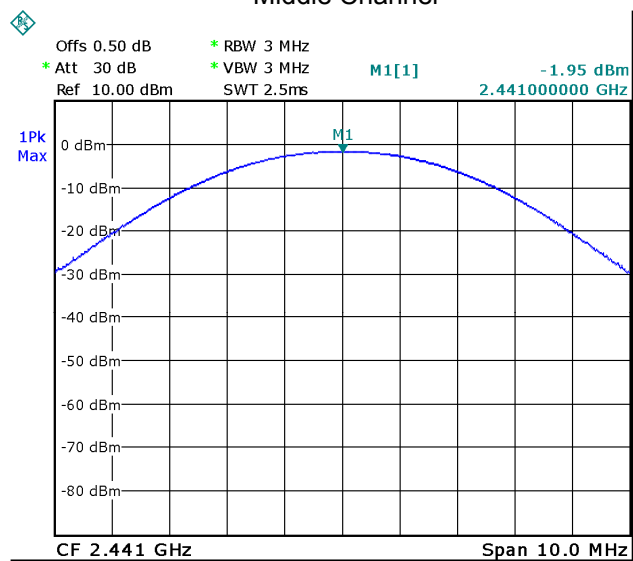
Modulation:GFSK

Lower Channel

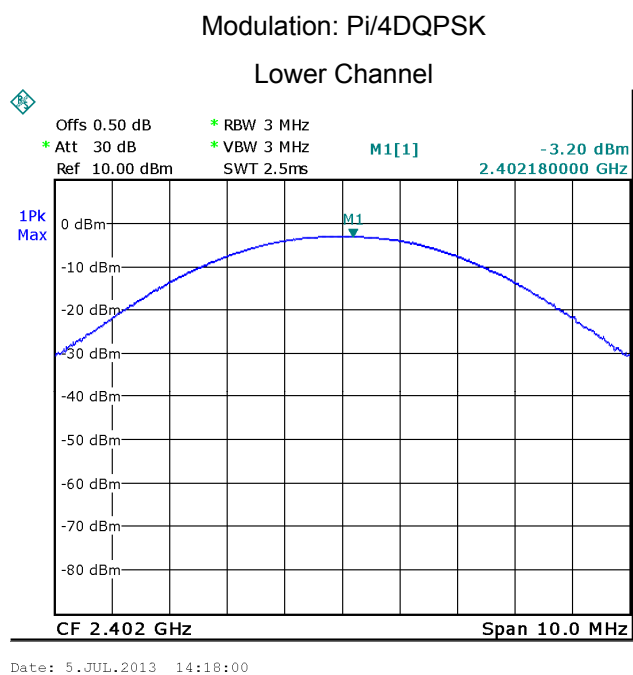
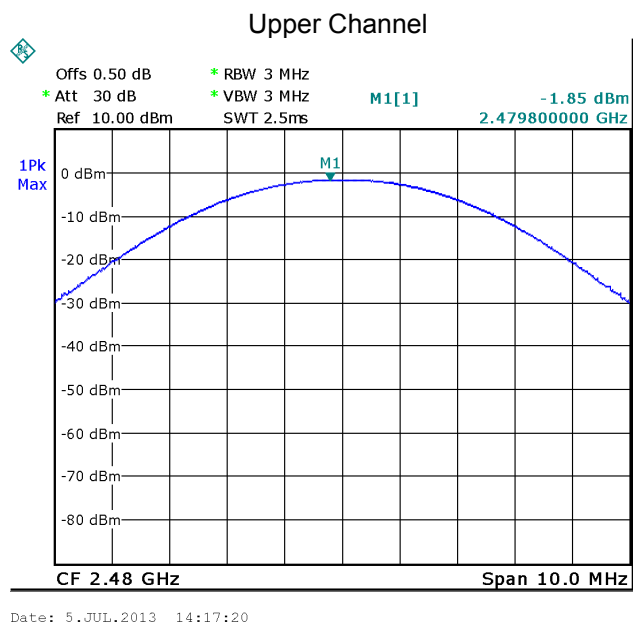


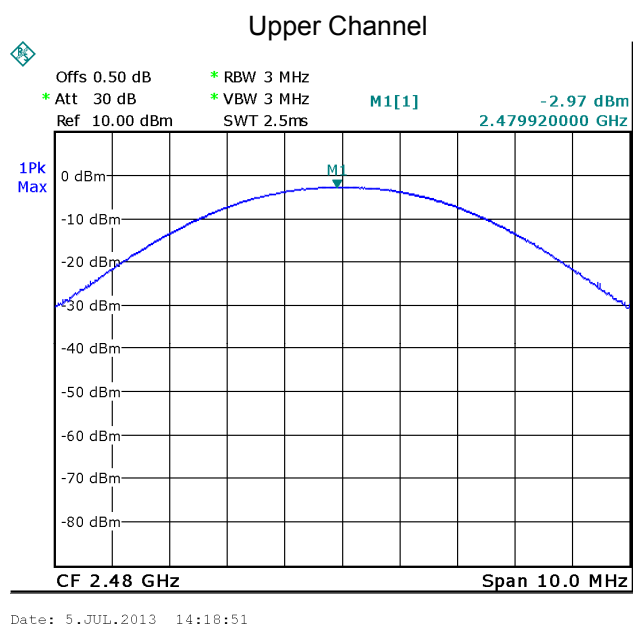
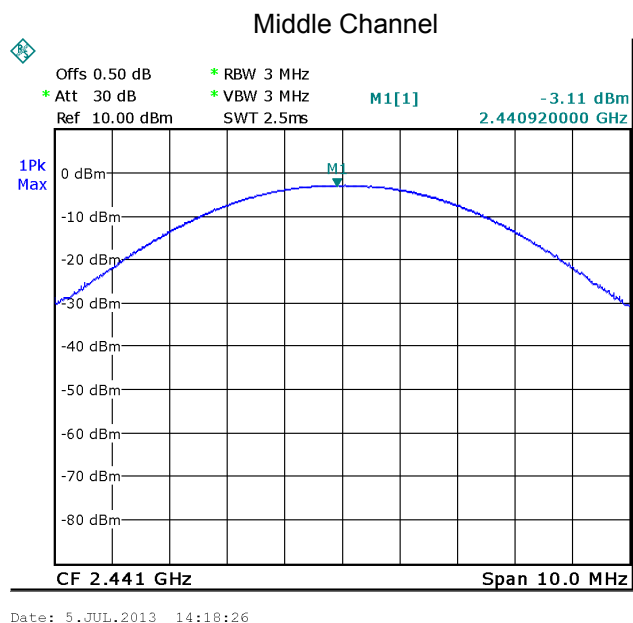
Date: 5.JUL.2013 14:15:31

Middle Channel



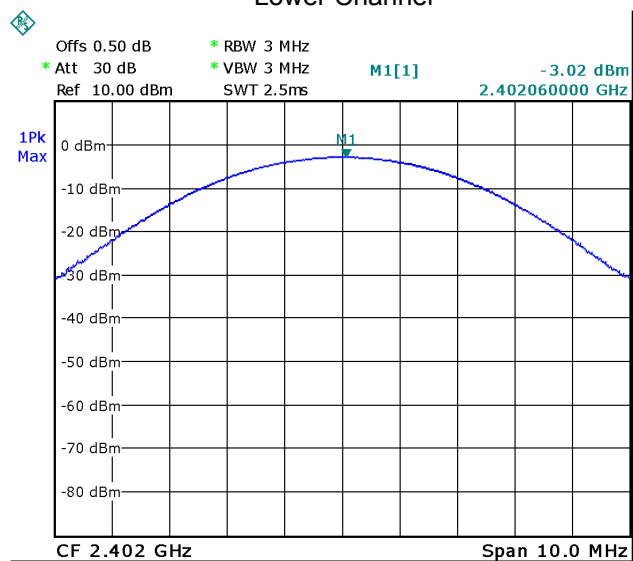
Date: 5.JUL.2013 14:16:42





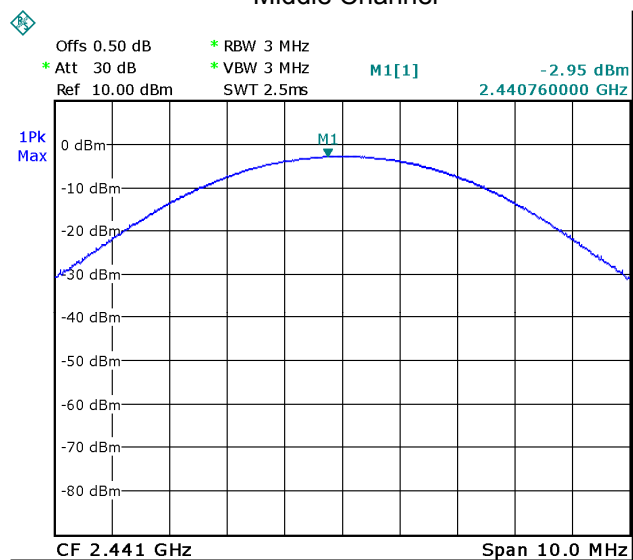
Modulation: 8DPSK

Lower Channel



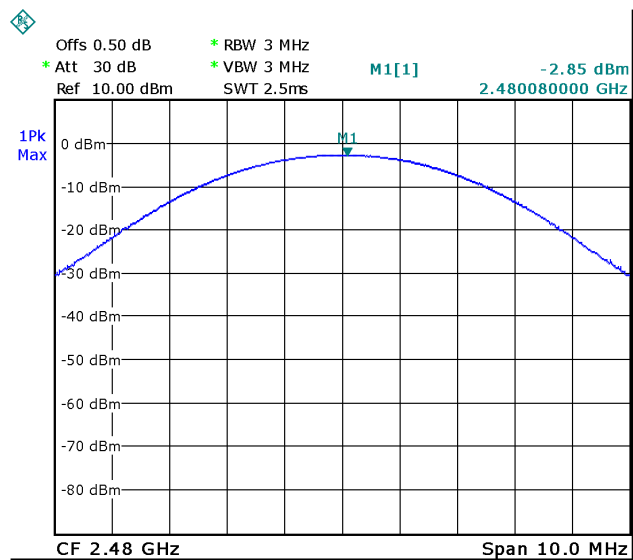
Date: 5.JUL.2013 14:19:22

Middle Channel



Date: 5.JUL.2013 14:19:40

Upper Channel



Date: 5.JUL.2013 14:19:56

13 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.

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 = 100KHz. VBW = 100KHz , Span = 6MHz. 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.

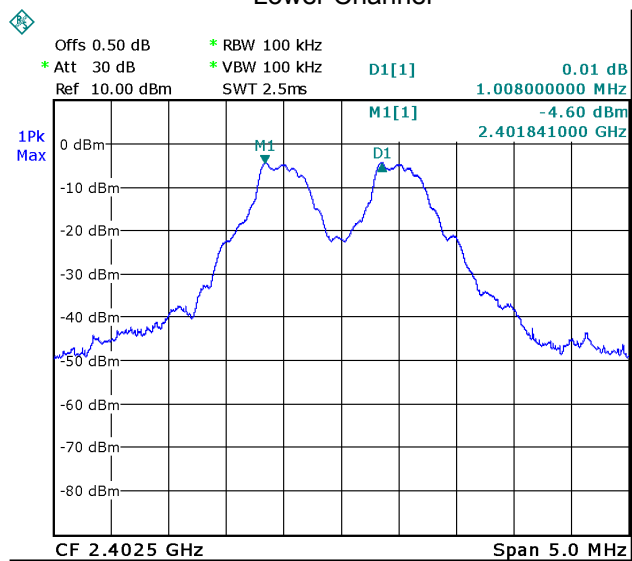
13.2 Test Result:

Modulation	Test Channel	Separation (MHz)
GFSK	Lower	1.008
	Middle	0.998
	Upper	1.008
Pi/4DQPSK	Lower	1.008
	Middle	1.008
	Upper	1.008
8DPSK	Lower	1.008
	Middle	1.008
	Upper	1.008

Test result plot as follows:

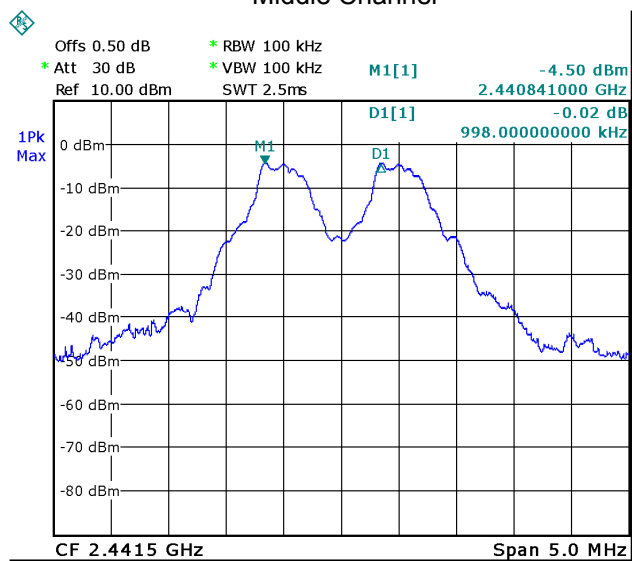
Modulation:GFSK

Lower Channel



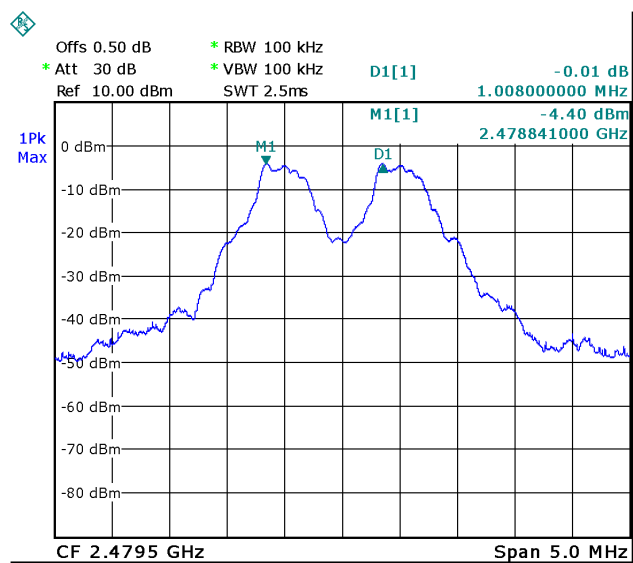
Date: 5.JUL.2013 11:56:30

Middle Channel



Date: 5.JUL.2013 11:59:45

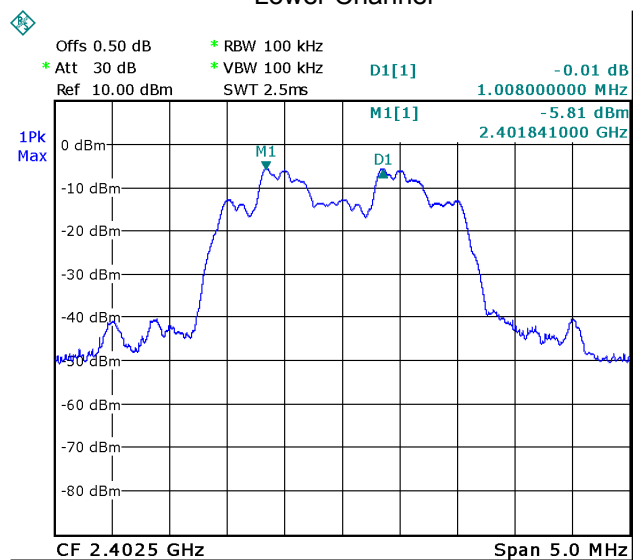
Upper Channel



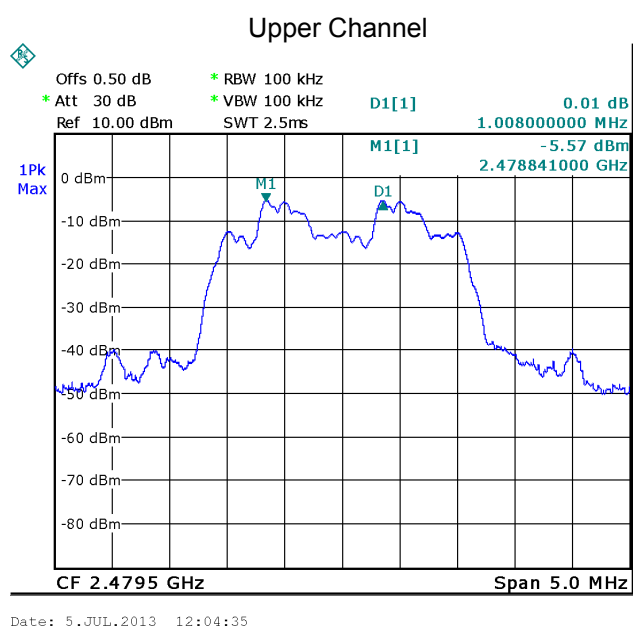
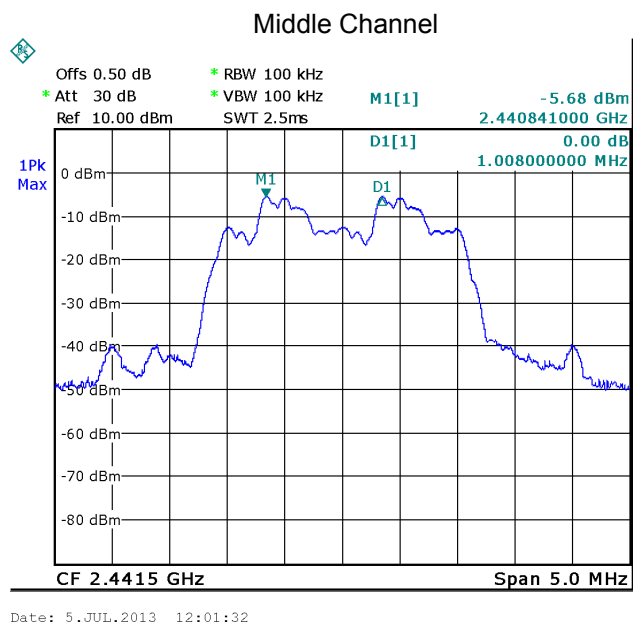
Date: 5.JUL.2013 12:03:39

Modulation: Pi/4DQPSK

Lower Channel

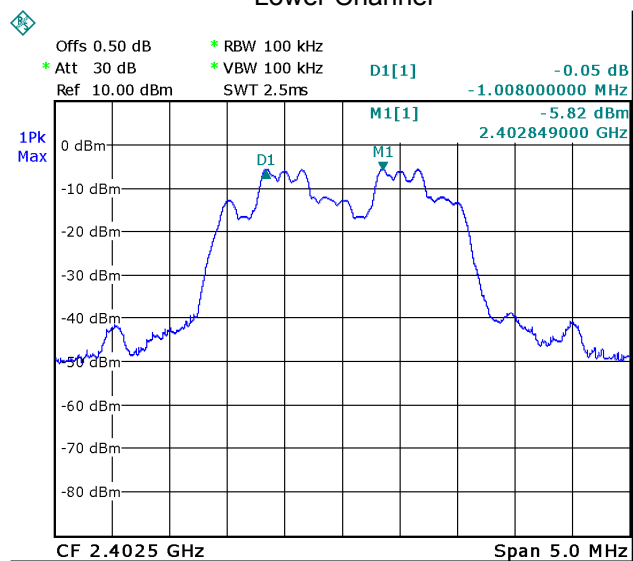


Date: 5.JUL.2013 11:57:20

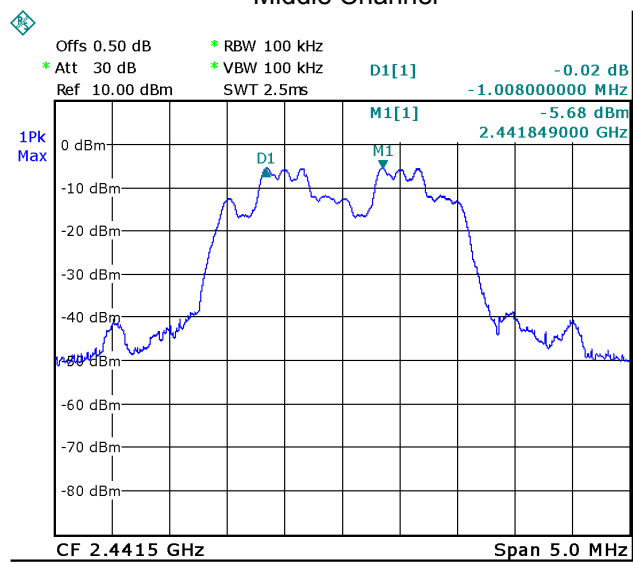


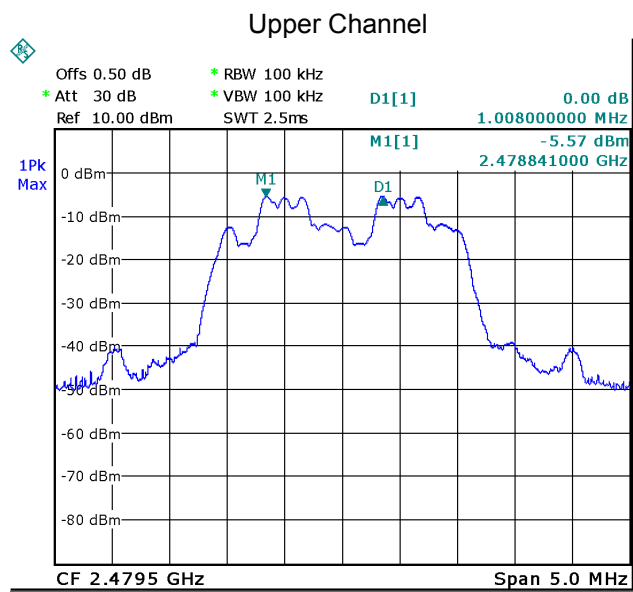
Modulation: 8DPSK

Lower Channel



Middle Channel





Date: 5.JUL.2013 12:05:36

14 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.

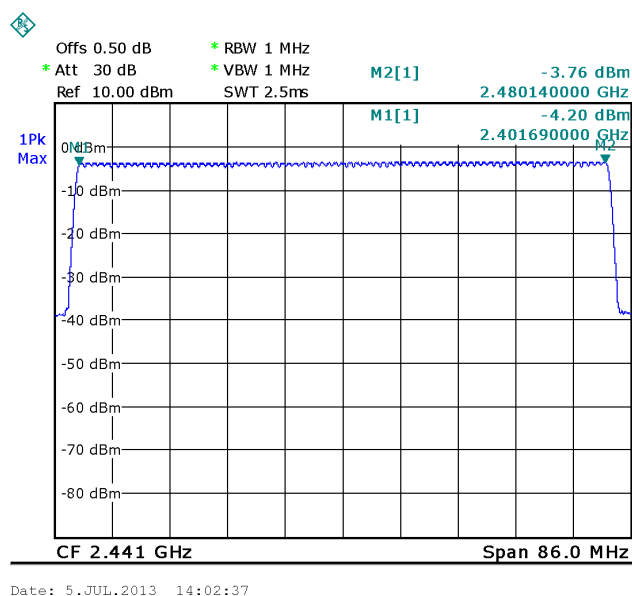
14.1 Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set 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: Centre Frequency = 2.441GHz, Span = 86MHz. Sweep=auto;

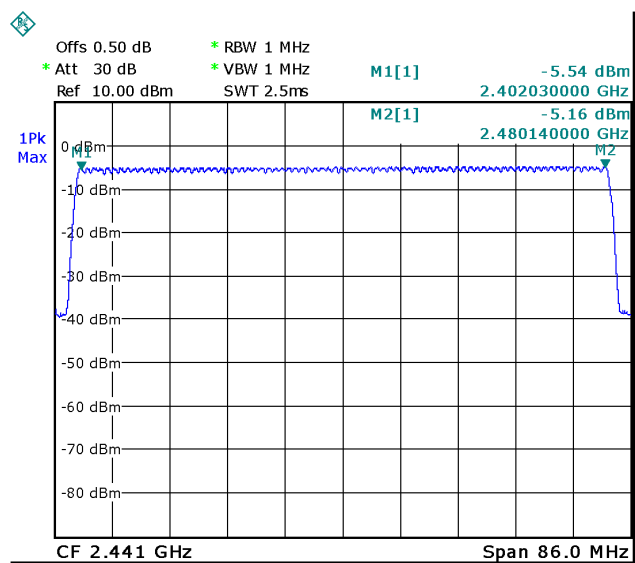
14.2 Test Result:

Total Channels are 79 Channels.

Modulation: GFSK

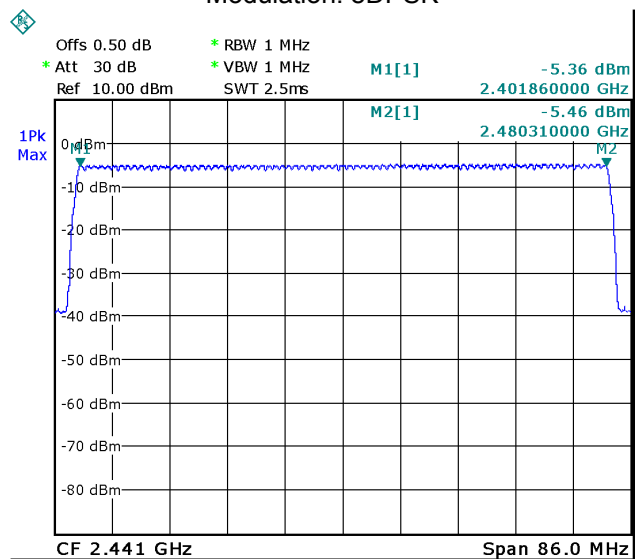


Modulation: Pi/4DQPSK



Date: 5.JUL.2013 14:05:58

Modulation: 8DPSK



Date: 5.JUL.2013 14:08:02

15 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.

15.1 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. centred on a hopping channel;
- 3.Set RBW = 1MHz and VBW = 3MHz. 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).

15.2 Test Result:

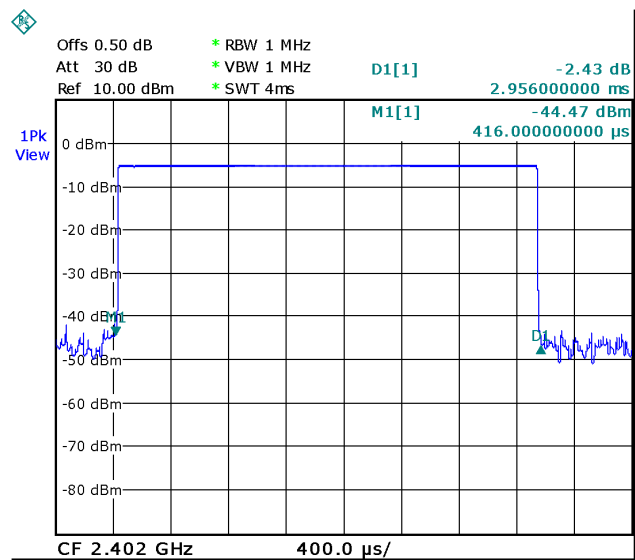
Mode	Hopping Channel Number	Hops Over Occupancy Time(hops)	Package Transfer Time(msec)	Dwell Time (sec)	Limits (sec)	Pass/Fail
Normal	79	106.67	2.956	0.315	0.4	Pass
AFH	20	53.34	2.956	0.158	0.4	Pass

Remark:

1. In normal mode, hopping rate is 1600hops/s with 6 slots in 79 hopping channels. With channel hopping rate $(1600 / 6 / 79)$ in Occupancy Time Limit (0.4×79) (s), Hops Over Occupancy Time comes to $(1600 / 6 / 79) \times (0.4 \times 79) = 106.67$ hops.
2. In AFH mode, hopping rate is 800hops/s with 6 slots in 20 hopping channels. With channel hopping rate $(800 / 6 / 20)$ in Occupancy Time Limit (0.4×20) (s), Hops Over Occupancy Time comes to $(800 / 6 / 20) \times (0.4 \times 20) = 53.34$ hops.
3. Dwell Time(s) = Hops Over Occupancy Time (hops) x Package Transfer Time

Measurement Plot

Data Packet:DH5



Date: 04.JUN.2013 09:46:00

16 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 PCB printed antenna, fulfill the requirement of this section.

17 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).

17.1 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:

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

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.

17.2 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)
0.653	0.219	5	10

Remark:Duty factor is 33.4%,refer to section 9 for more details.

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

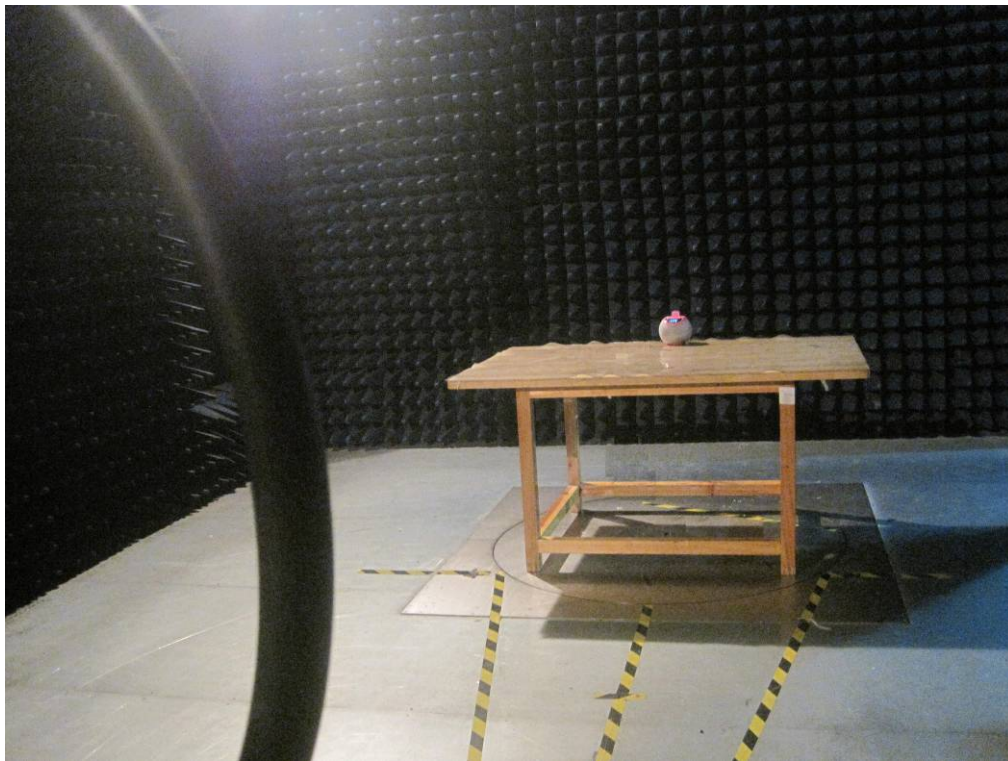
18 Photographs – Test Setup

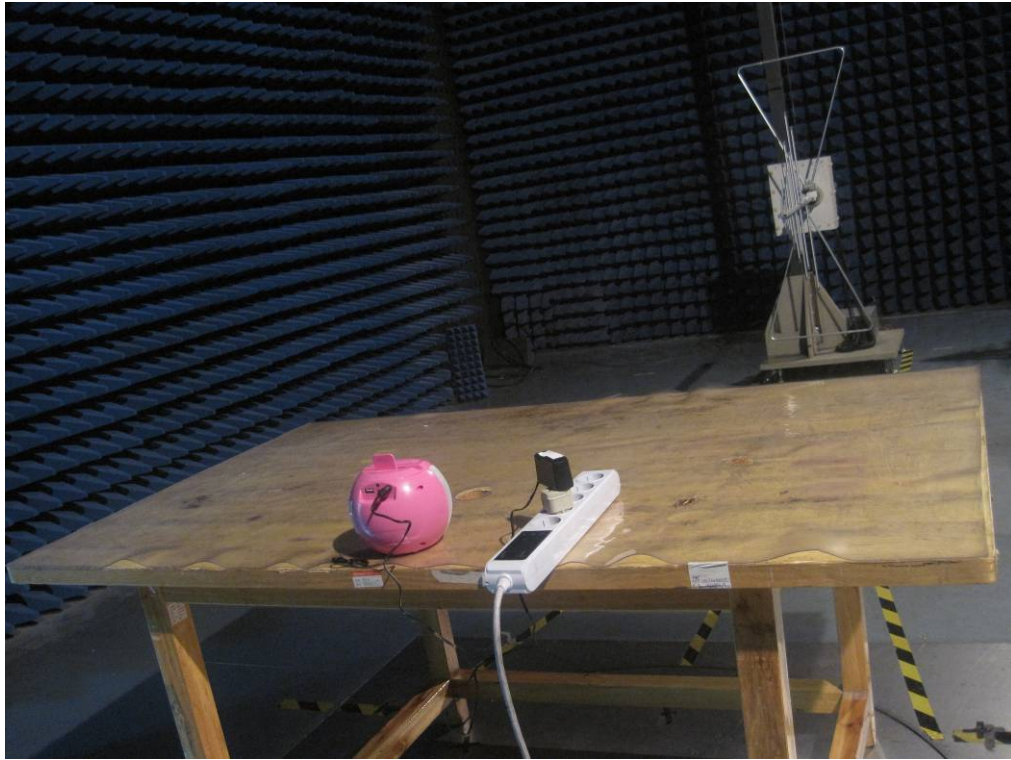
18.1 Conducted Emissions



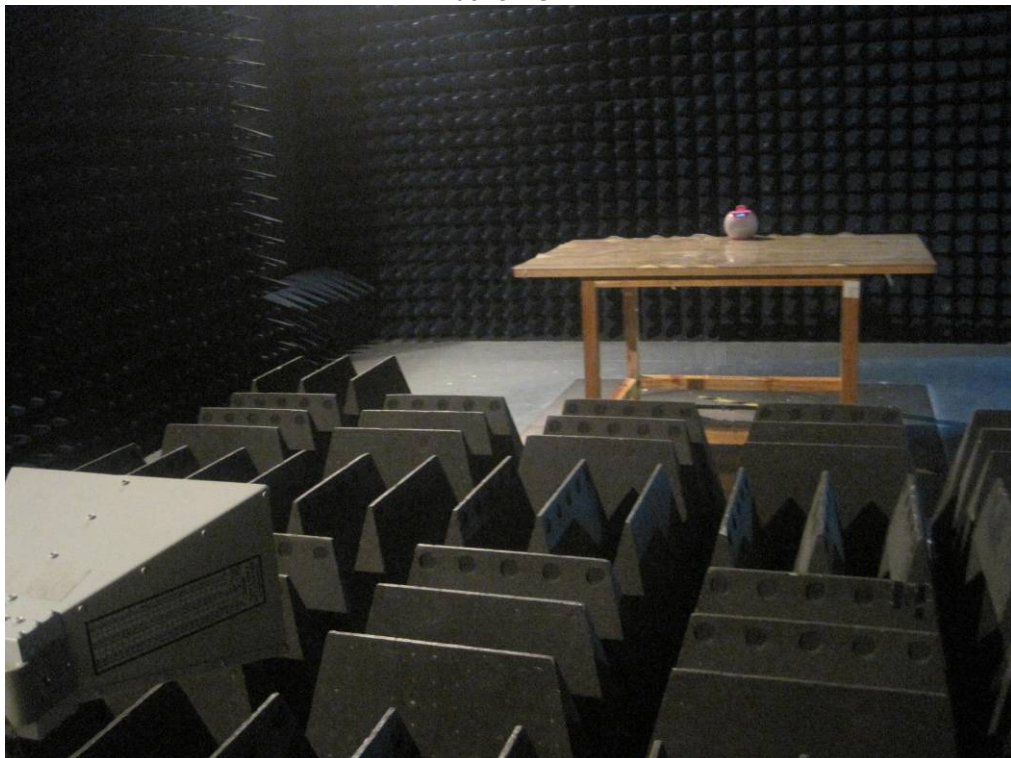
18.2 Radiated Emissions

Below 30MHz





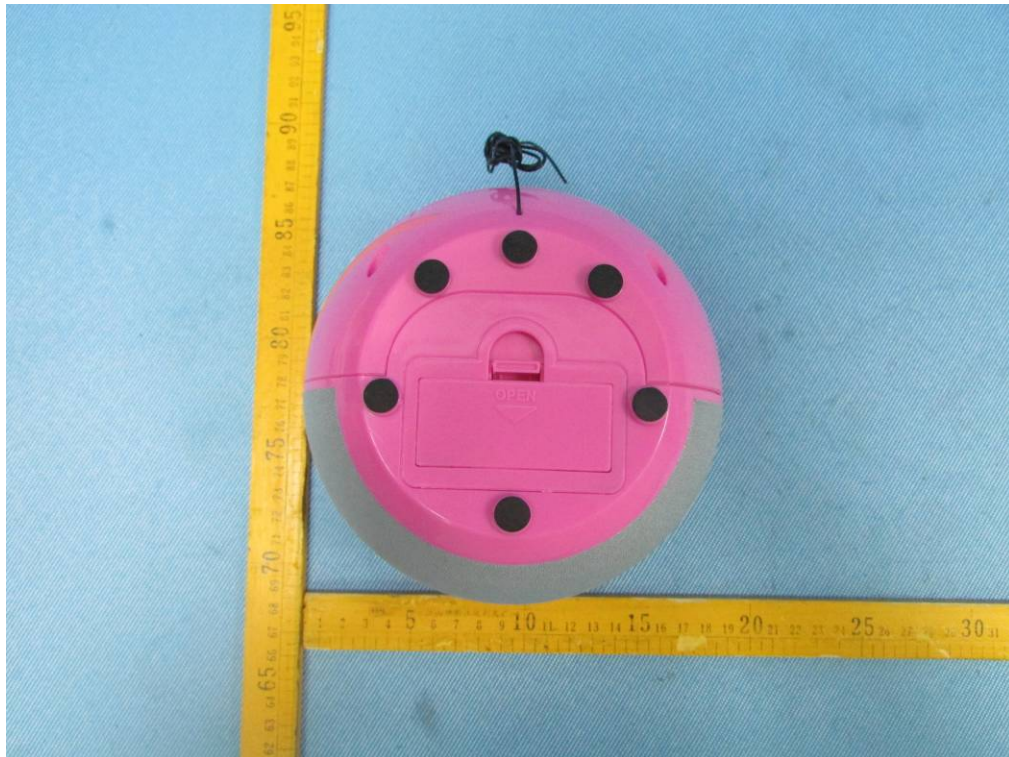
Above 1GHz



19 Photographs - Constructional Details

19.1 EUT – External View

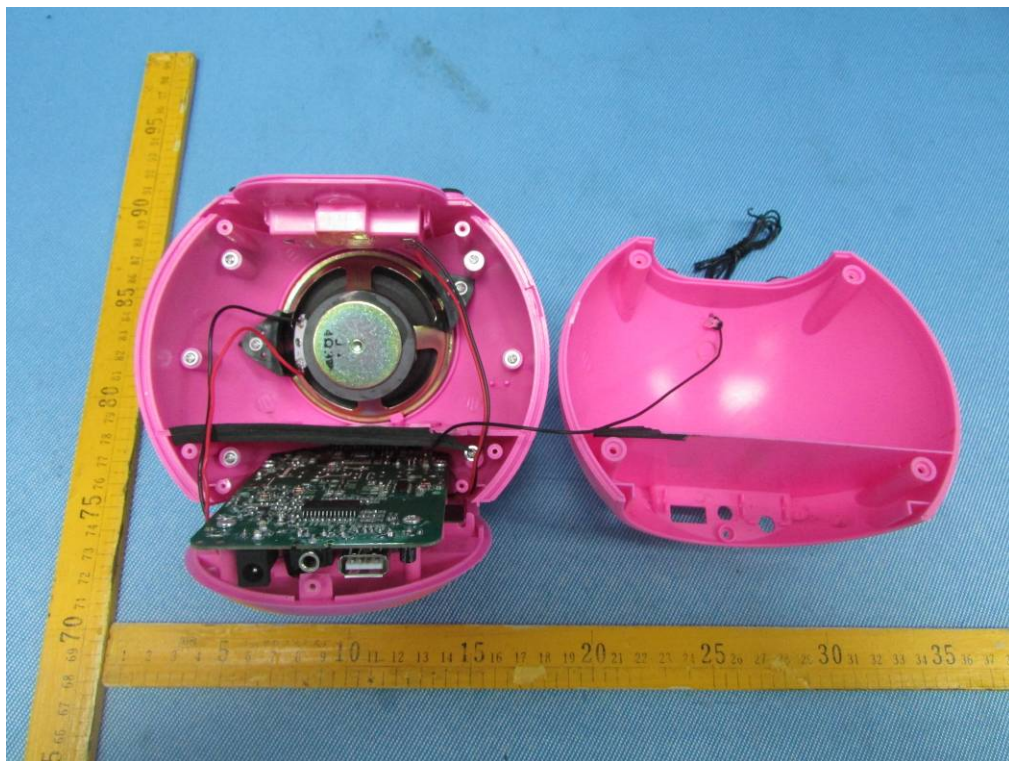


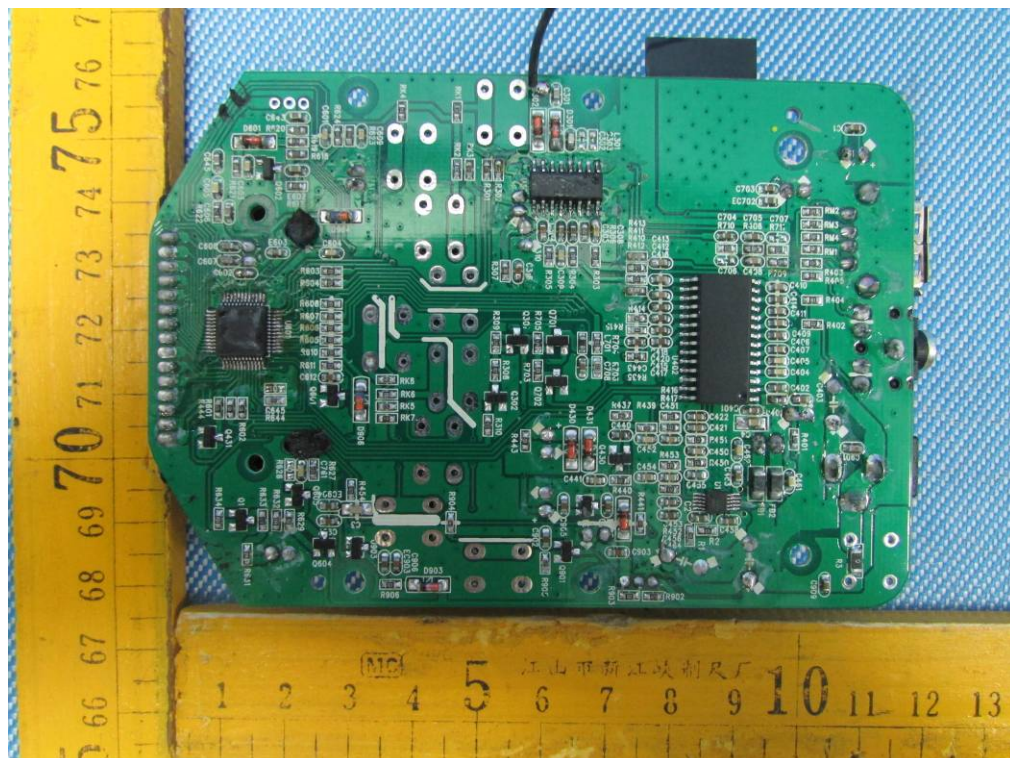
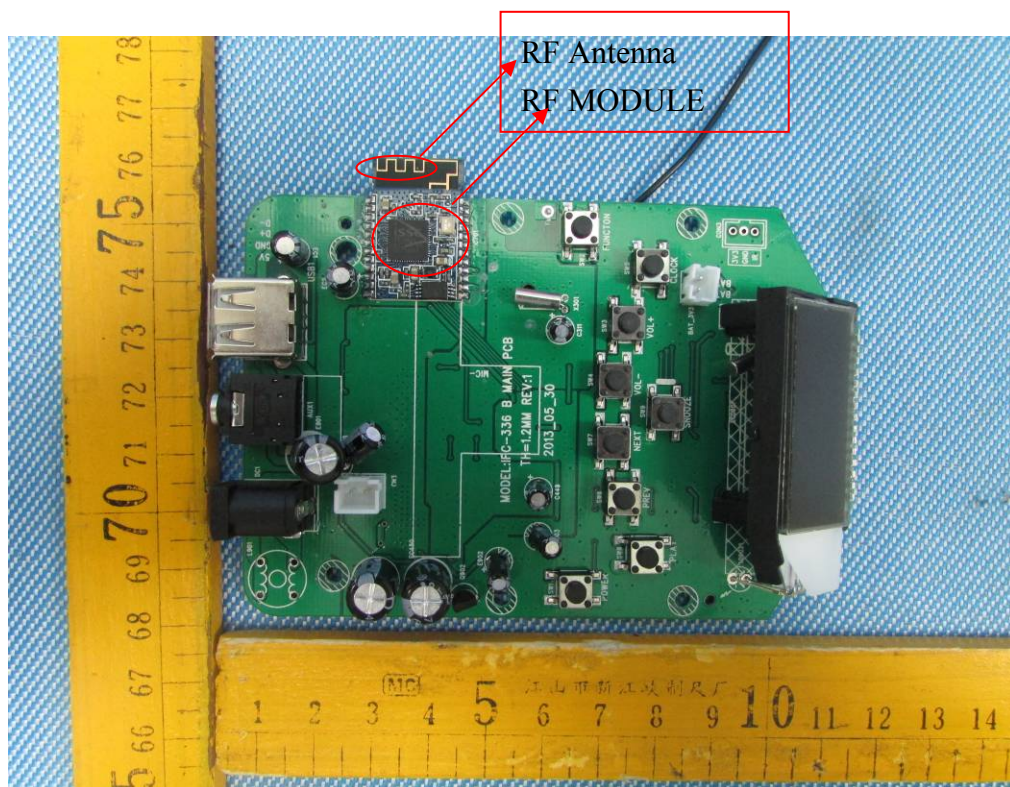




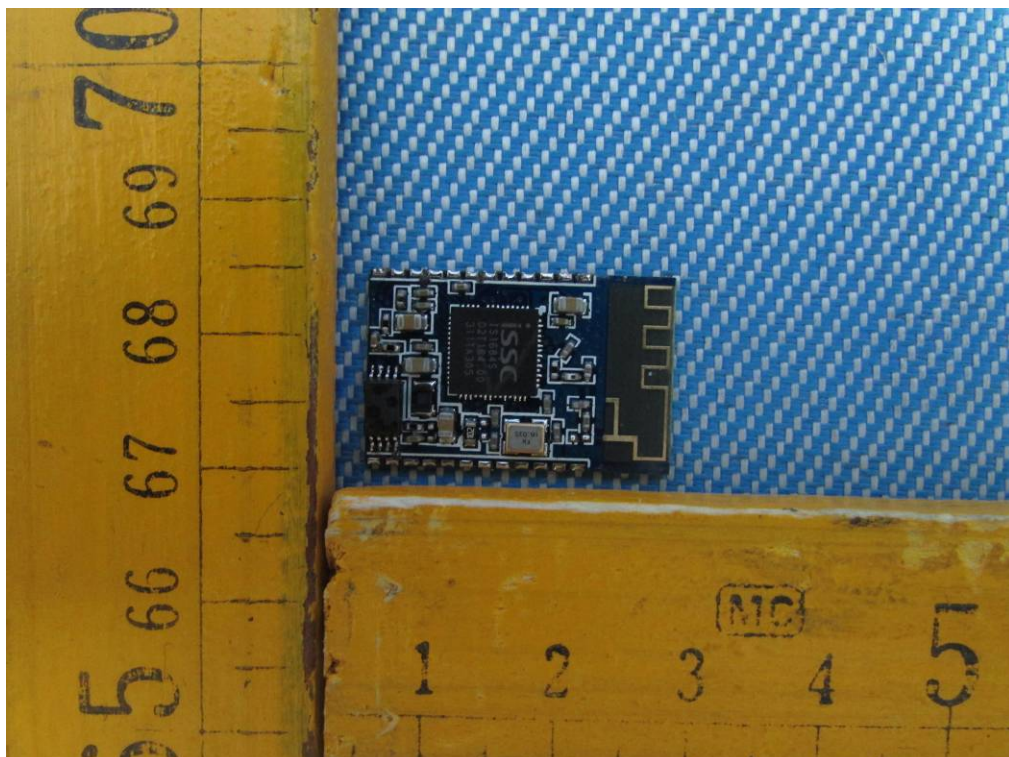
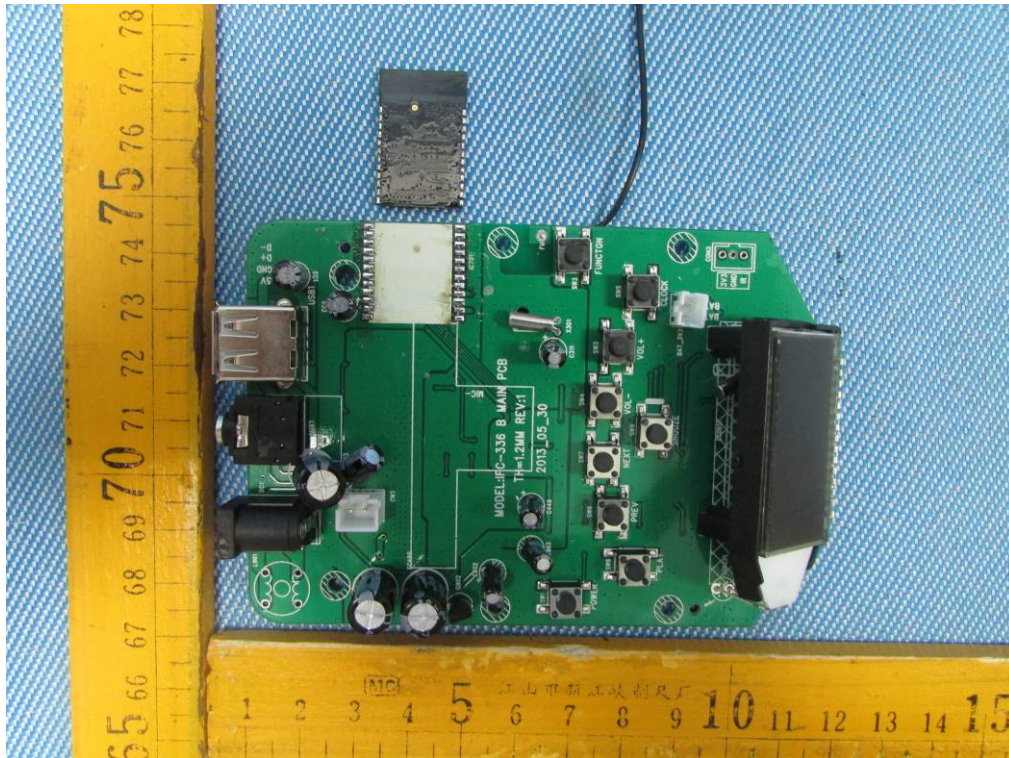


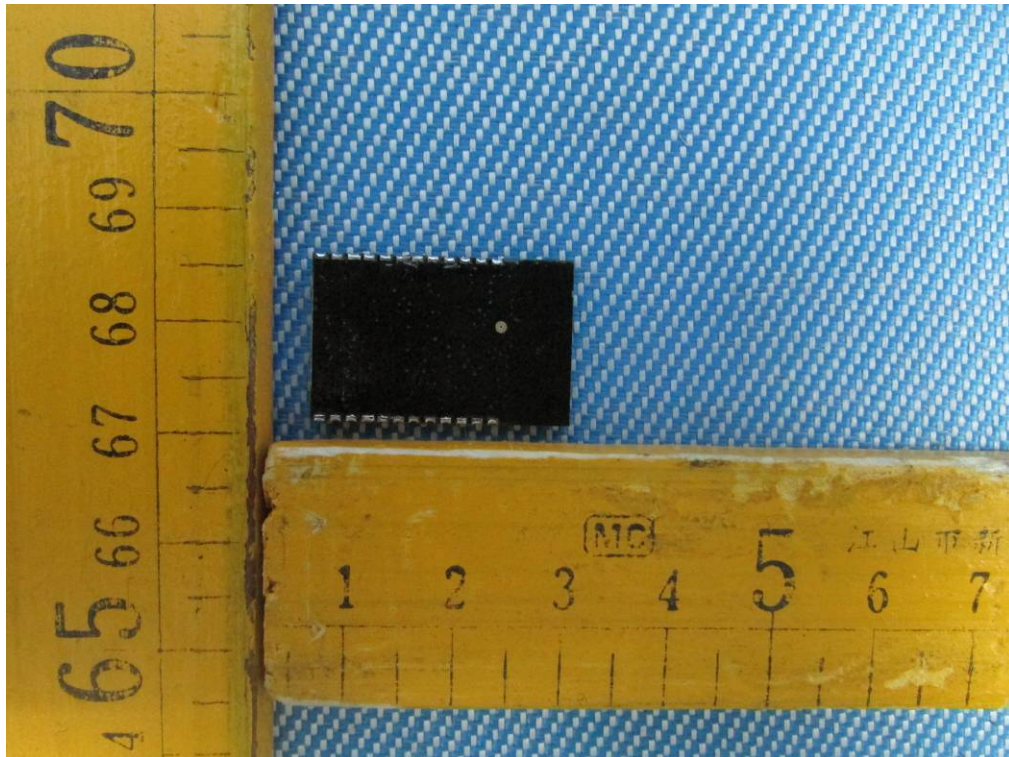
19.2 EUT – Internal View





19.3 EUT-RF Module View





=End of test report==