FCC PART 15 SUBPART C TEST REPORT

FCC PART 15.247

Report Reference No.....:	**A1407096032-RW**
FCC ID..... :	**2ACP7-MJ28X0**
Compiled by (position+printed name+signature)..:	File administrators Tony Li
Supervised by (position+printed name+signature)..:	Technique principal Robin Fang
Approved by (position+printed name+signature)..:	Manager James Wu
Date of issue.....:	July,26 2014
Representative Laboratory Name ....:	Shenzhen CTL Electron Technology Co., Ltd.
Address .....:	A0402, Block 1, Kefa Industrial District, Huanguan Nan Rd, Xintian community, Guanlan, Baoan, Shenzhen, China
Testing Laboratory Name.....:	Dongguan Dongdian Testing Service Co.,Ltd
Address .....:	No.17, Zongbu Road 2, Songshan Lake Sci&Tech, Industry Park, Dongguan City, Guangdong Province, China
Applicant's name.....:	**HuiZhou Minjie Technology Co.,LTD**
Address .....:	Qingchun Industrial District Chengjing Huizhou City
Test specification .....**:**	
Standard .....:	**FCC Part 15.247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz**
TRF Originator.....:	Shenzhen CTL Electron Technology Co., Ltd.
Master TRF.....:	Dated 2012-06

Test item description .....:	Wireless barcode scanner
Trade Mark .....:	Minjie
Model/Type reference.....:	MJ2810
Listed Models .....:	MJ2820,MJ2830,MJ2850,MJ2860,MJ2870,MJ2880,MJ2890
Manufacturer .....:	**HuiZhou Minjie Technology Co.,LTD**
Modulation Type.....:	GFSK
Operation Frequency.....:	From 2402MHz to 2480MHz
Rating .....:	DC 3.7V
Result.....:	**PASS**

T E S T R E P O R T

Test Report No. :	A1407096032-RW	July,26 2014 Date of issue

Equipment under Test	:	Wireless barcode scanner
Model /Type	:	MJ2810
Listed Models	:	MJ2820,MJ2830,MJ2850,MJ2860,MJ2870,MJ2880,MJ2890
Applicant	:	**HuiZhou Minjie Technology Co.,LTD**
Address	:	Qingchun Industrial District Chengjing Huizhou City
Manufacturer	:	**HuiZhou Minjie Technology Co.,LTD**
Address	:	Qingchun Industrial District Chengjing Huizhou City

Test Result:	**PASS**

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Contents

1. TEST STANDARDS

The tests were performed according to following standards:

FCC Rules Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.
ANSI C63.10-2009: American National Standard for Testing Unlicensed Wireless Devices

2. SUMMARY

2.1. General Remarks

Date of receipt of test sample	:	July 15, 2014
Testing commenced on	:	July 15, 2014
Testing concluded on	:	July 25, 2014

2.2. Equipment Under Test

Power supply system utilised

Power supply voltage	:	○	120V / 60 Hz	○	115V / 60Hz
		○	12 V DC	○	24 V DC
		●	Other (specified in blank below)		

Battery:3.7 V

2.3. Short description of the Equipment under Test (EUT)

2.4GHz (Wireless barcode scanner (M/N: MJ2810))

For more details, refer to the user's manual of the EUT.

2.4. EUT operation mode

The EUT has been tested under typical operating condition. The Applicant provides communication tools software to control the EUT for staying in continous transmitting and receiving mode for testing. There are 79 channels of EUT, and the test carried out at the lowest channel, middle channel and highest channel .

Channel	Frequency(MHz)	Channel	Frequency(MHz)
00	**2402**	40	2442
01	2403	41	2443
02	2404	42	2444
03	2405	43	2445
04	2406	44	2446
05	2407	45	2447
06	2408	46	2448
07	2409	47	2449
08	2410	48	2450
09	2411	49	2451
10	2412	50	2452
11	2413	51	2453
12	2414	52	2454
13	2415	53	2455
14	2416	54	2456
15	2417	55	2457
16	2418	56	2458
17	2419	57	2459
18	2420	58	2460
19	2421	59	2461
20	2422	60	2462
21	2423	61	2463
22	2424	62	2464
23	2425	63	2465

24	2426	64	2466
25	2427	65	2467
26	2428	66	2468
27	2429	67	2469
28	2430	68	2470
29	2431	69	2471
30	2432	70	2472
31	2433	71	2473
32	2434	72	2474
33	2435	73	2475
34	2436	74	2476
35	2437	75	2477
36	2438	76	2478
37	2439	77	2479
38	2440	**78**	**2480**
39	**2441**		

2.5. Block Diagram of Test Setup

2.6. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for **FCC ID: 2ACP7-MJ28X0** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

2.7. Modifications

No modifications were implemented to meet testing criteria.

2.8. NOTE

1. The EUT is a Wireless barcode scanner with Bluetooth function,The functions of the EUT listed as below:

	Test Standards	Reference Report
Bluetooth	FCC Part 15 Subpart C	A1407096032-RW
RF Exposure	FCC Per 47 CFR 2.1093(d)	A1407096032-MPE

2. The frequency bands used in this EUT are listed as follows:

Frequency Band(MHz)	2400-2483.5	5150-5350	5470-5725	5725-5850
EUT	√	—	—	—

3. TEST ENVIRONMENT

3.1. Address of the test laboratory

Dongguan Dongdian Testing Service Co.,Ltd

No.17, Zongbu Road 2, Songshan Lake Sci&Tech, Industry Park, Dongguan City, Guangdong Province, China

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 (2003) and CISPR Publication 22.

3.2. Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

IC Registration No.: 10288A-1

The 3m alternate test site of Dongguan Dongdian Testing Service Co.,Ltd EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration No.: 10288A-1 on Mar, 2012.

FCC-Registration No.: 270092

Dongguan Dongdian Testing Service 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 270092, Mar 06, 2012.

3.3. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15-35 ° C
Humidity:	30-60 %
Atmospheric pressure:	950-1050mbar

3.4. Test Description

FCC PART 15 15.247		
FCC Part 15.207	AC Power Conducted Emission	PASS
FCC Part 15.247(a)(1)(i)	20dB Bandwidth	PASS
FCC Part 15.247(d)	Spurious RF Conducted Emission	PASS
FCC Part 15.247(b)	Maximum Peak Output Power	PASS
FCC Part 15.247(b)	Pseudorandom Frequency Hopping Sequence	PASS
FCC Part 15.247(a)(1)(iii)	Number of hopping frequency& Time of Occupancy	PASS
FCC Part 15.247(a)(1)	Frequency Separation	PASS
FCC Part 15.109/ 15.205/ 15.209	Radiated Emissions	PASS
FCC Part 15.247(d)	Band Edge Compliance of RF Emission	PASS
FCC Part 15.203/15.247 (b)	Antenna Requirement	PASS
FCC Part1.1307 (b)	MPE Evaluation	PASS

Remark: The measurement uncertainty is not included in the test result.

3.5. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Dongguan Dongdian Testing Service Co.,Ltd quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Dongguan Dongdian Testing Service Co.,Ltd laboratory is reported:

Test Items	Measurement Uncertainty	Notes
Transmitter power conducted	0.57 dB	(1)
Transmitter power Radiated	2.20 dB	(1)
Conducted spurious emission 9KHz-40 GHz	1.60 dB	(1)
Radiated spurious emission 9KHz-40 GHz	2.20 dB	(1)
Conducted Emission 9KHz-30MHz	3.39 dB	(1)
Radiated Emission 30~1000MHz	4.24 dB	(1)
Radiated Emissio 1~18GHz	5.16 dB	(1)
Radiated Emissio 18-40GHz	5.54 dB	(1)
Occupied Bandwidth	---------	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

3.6. Equipments Used during the Test

Radiated Emission					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Ultra-Broadband Antenna	ShwarzBeck	VULB9163	462	2013/11/26
2	EMI TEST RECEIVER	Rohde&Schwarz	ESU8	100316	2013/11/13
3	EMI TEST Software	Audix	E3	N/A	N/A
4	Horn Anternna	EMCO	3116	00060095	2013/11/16
5	Pre-Amplifer	Rohde&Schwarz	SCU-01	10049	2013/11/26
6	Pre-Amplifer	A.H.	PAM0-0118	360	2013/11/16
7	Pre-Amplifer	A.H.	PAM-1840VH	562	2013/11/16
8	Double Ridged Horn Antenna	Rohde&Schwarz	HF907	100265	2013/11/16
9	Active Loop Antenna	Schwarz beck	FMZB1519	0.38	2013/11/16
10	Loop Antenna	Rohde&Schwarz	HFH2-Z2	100020	2013/10/28
11	TURNTABLE	MATURO	TT2.0	----	N/A
12	ANTENNA MAST	MATURO	TAM-4.0-P	----	N/A
13	Spectrum	R&S	FSU26	1166.1660.26	2013/11/26

Maximum Peak Output Power / 20dB Bandwidth / Number of hopping frequency& Time of Occupancy / Band Edge Compliance of RF Emission / Spurious RF Conducted Emission/ Frequency Separation					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Power Sensor	Rohde&Schwarz	NRP-Z21	102638	2013/10/26
2	Power Sensor	Rohde&Schwarz	NRP-Z21	102639	2013/10/26
3	Spectrum Analyzer	R&S	FSU26	1166.1660.26	2013/11/26
4	Spectrum Analyzer	Aglient	E4407B	MY44210775	2013/11/13

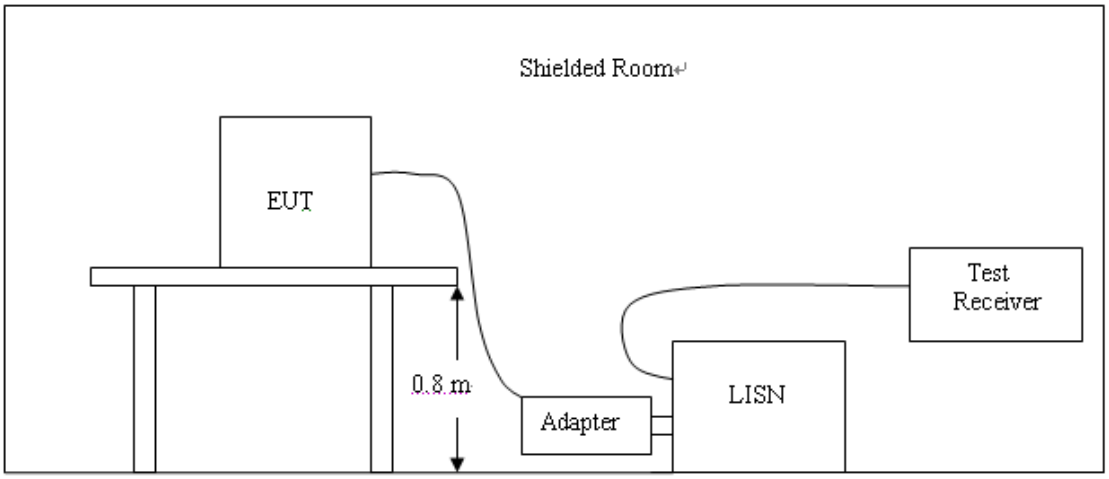
AC Power Conducted Emission					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Artificial Mains	Rohde&Schwarz	ENV216	100316	2013/11/26
2	EMI Test Receiver	Rohde&Schwarz	ESU8	100316	2013/11/13
3	Pulse Limiter	Rohde&Schwarz	ESH3-Z2	101242	2013/11/26
4	EMI Test Software	Rohde&Schwarz	ES-K1 V1.71	N/A	N/A

The Cal.Interval was one year

4. TEST CONDITIONS AND RESULTS

4.1. AC Power Conducted Emission

TEST CONFIGURATION



TEST PROCEDURE

1 The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10-2009.
2 Support equipment, if needed, was placed as per ANSI C63.10-2009
3 All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10-2009
4 The EUT received DC5V power from PC, the adapter of PC received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5 All support equipments received AC power from a second LISN, if any.
6 The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7 Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
8 During the above scans, the emissions were maximized by cable manipulation.

AC Power Conducted Emission Limit

For intentional device, according to § 15.207(a) AC Power Conducted Emission Limits is as following：

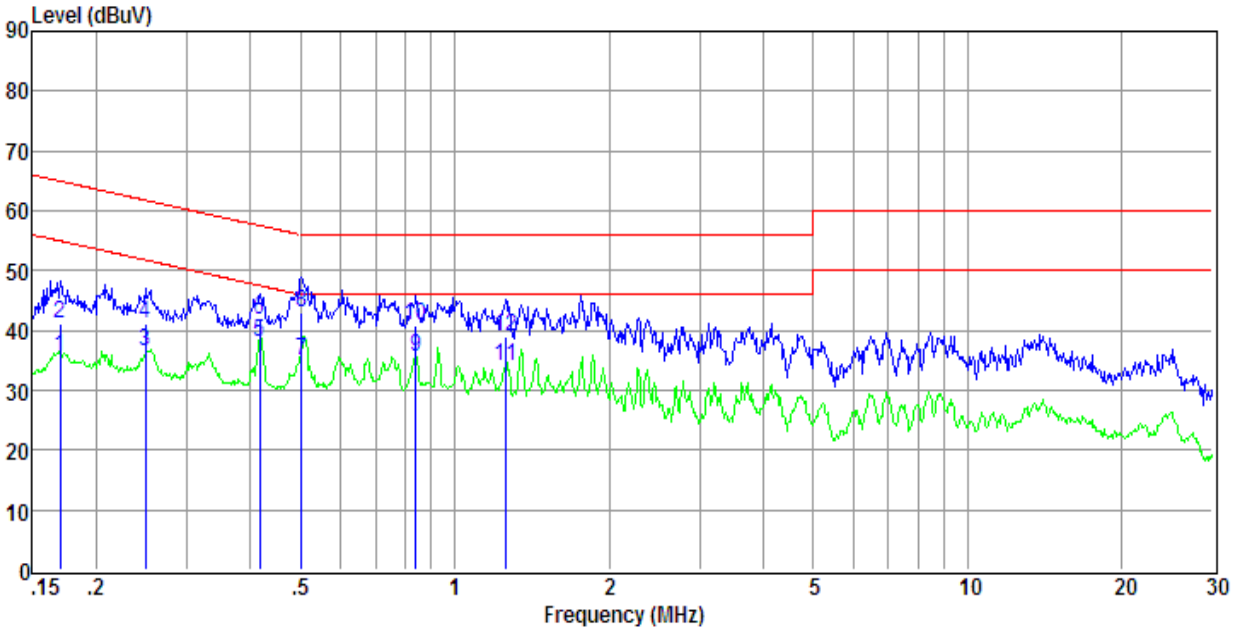
Frequency (MHz)	Maximum RF Line Voltage (dBμV)			
	CLASS A		CLASS B	
	Q.P.	Ave.	Q.P.	Ave.
0.15 - 0.50	79	66	66-56*	56-46*
0.50 - 5.00	73	60	56	46
5.00 - 30.0	73	60	60	50

* Decreasing linearly with the logarithm of the frequency

TEST RESULTS

*Note:*We tested Conducted Emission at both TX and RX mode of GFSK from 0.15KHz to 30MHz and recorded the worst case data at GFSK TX mode.

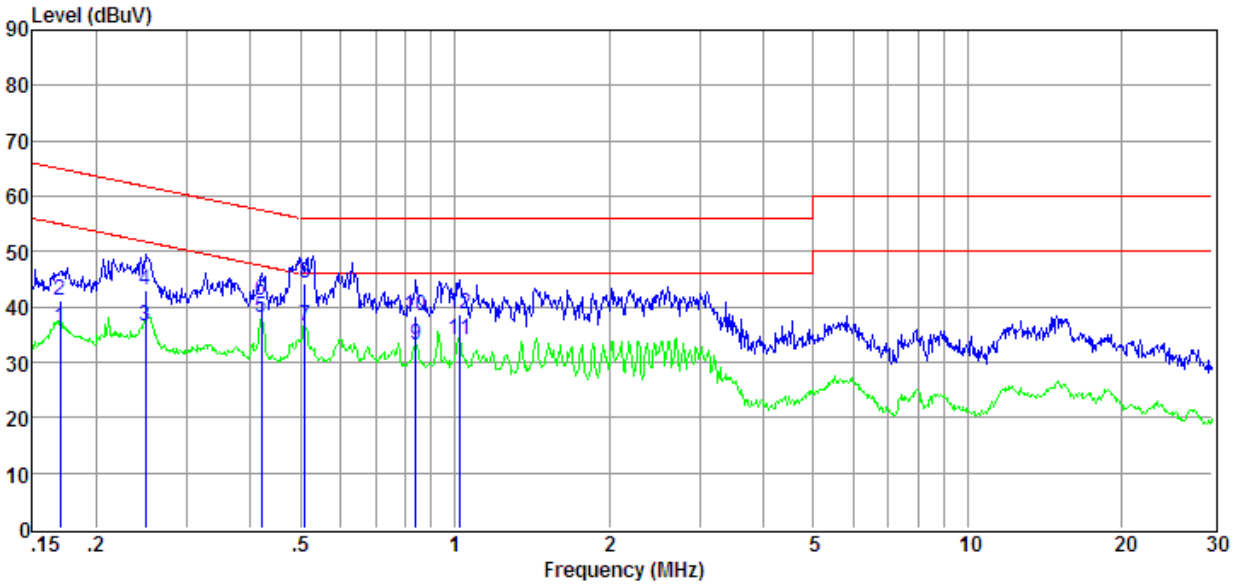
Line



Item (Mark)	Freq (MHz)	Read Level (dBµV)	LISN Factor (dB)	Cable Loss (dB)	Pulse Limiter Factor (dB)	Result Level (dBµV)	Limit Line (dBµV)	Over Limit (dB)	Detector	Phase
1	0.17	16.09	9.61	0.01	9.84	35.55	54.94	-19.39	Average	LINE
2	0.17	21.82	9.61	0.01	9.84	41.28	64.94	-23.66	QP	LINE
3	0.25	16.94	9.62	0.02	9.85	36.43	51.78	-15.35	Average	LINE
4	0.25	21.80	9.62	0.02	9.85	41.29	61.78	-20.49	QP	LINE
5	0.42	18.47	9.63	0.03	9.86	37.99	47.51	-9.52	Average	LINE
6	0.42	22.16	9.63	0.03	9.86	41.68	57.51	-15.83	QP	LINE
7	0.50	15.53	9.63	0.03	9.87	35.06	46.00	-10.94	Average	LINE
8	0.50	23.54	9.63	0.03	9.87	43.07	56.00	-12.93	QP	LINE
9	0.84	16.13	9.62	0.07	9.86	35.68	46.00	-10.32	Average	LINE
10	0.84	21.17	9.62	0.07	9.86	40.72	56.00	-15.28	QP	LINE
11	1.26	14.52	9.62	0.05	9.87	34.06	46.00	-11.94	Average	LINE
12	1.26	19.38	9.62	0.05	9.87	38.92	56.00	-17.08	QP	LINE

Note: 1. Result Level = Read Level +LISN Factor + Pulse Limiter Factor + Cable loss
2. If QP Result comply with AV limit, AV Result is deemed to comply with AV limit
3. Test setup: RBW: 200Hz(9kHz—150kHz) , 9kHz(150kHz—30MHz), Step size:4kHz, Scan time: auto

Neutral



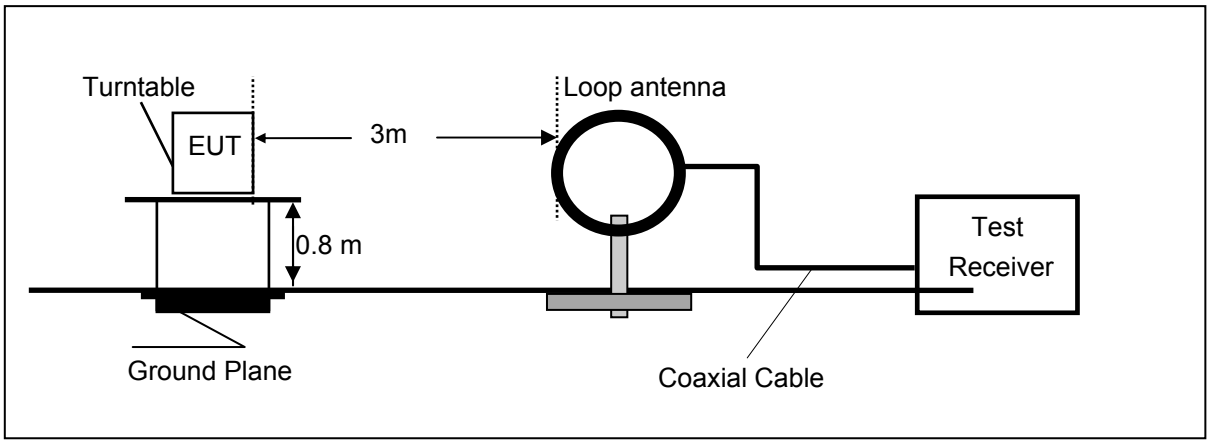
Item (Mark)	Freq (MHz)	Read Level (dBµV)	LISN Factor (dB)	Cable Loss (dB)	Pulse Limiter Factor (dB)	Result Level (dBµV)	Limit Line (dBµV)	Over Limit (dB)	Detector	Phase
1	0.17	16.60	9.60	0.01	9.84	36.05	54.94	-18.89	Average	NEUTRAL
2	0.17	21.66	9.60	0.01	9.84	41.11	64.94	-23.83	QP	NEUTRAL
3	0.25	17.04	9.59	0.02	9.85	36.50	51.78	-15.28	Average	NEUTRAL
4	0.25	23.55	9.59	0.02	9.85	43.01	61.78	-18.77	QP	NEUTRAL
5	0.42	18.69	9.61	0.03	9.86	38.19	47.46	-9.27	Average	NEUTRAL
6	0.42	21.72	9.61	0.03	9.86	41.22	57.46	-16.24	QP	NEUTRAL
7	0.51	17.13	9.61	0.03	9.87	36.64	46.00	-9.36	Average	NEUTRAL
8	0.51	24.59	9.61	0.03	9.87	44.10	56.00	-11.90	QP	NEUTRAL
9	0.84	13.65	9.61	0.07	9.86	33.19	46.00	-12.81	Average	NEUTRAL
10	0.84	18.77	9.61	0.07	9.86	38.31	56.00	-17.69	QP	NEUTRAL
11	1.02	14.41	9.60	0.04	9.87	33.92	46.00	-12.08	Average	NEUTRAL
12	1.02	19.30	9.60	0.04	9.87	38.81	56.00	-17.19	QP	NEUTRAL

Note: 1. Result Level = Read Level +LISN Factor + Pulse Limiter Factor + Cable loss
2. If QP Result comply with AV limit, AV Result is deemed to comply with AV limit
3. Test setup: RBW: 200Hz(9kHz—150kHz) , 9kHz(150kHz—30MHz), Step size:4kHz, Scan time: auto

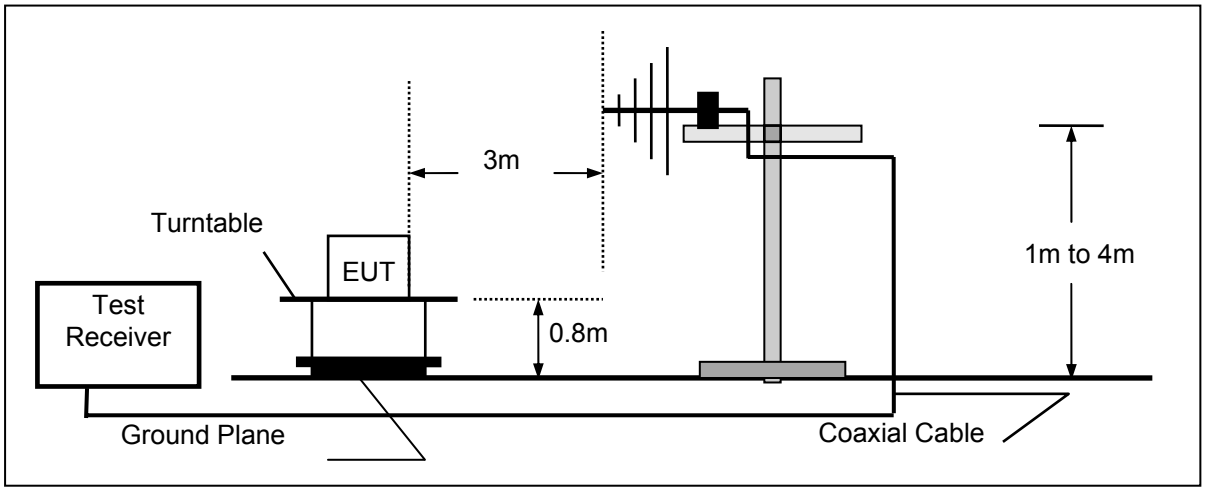
4.2. Radiated Emission

TEST CONFIGURATION

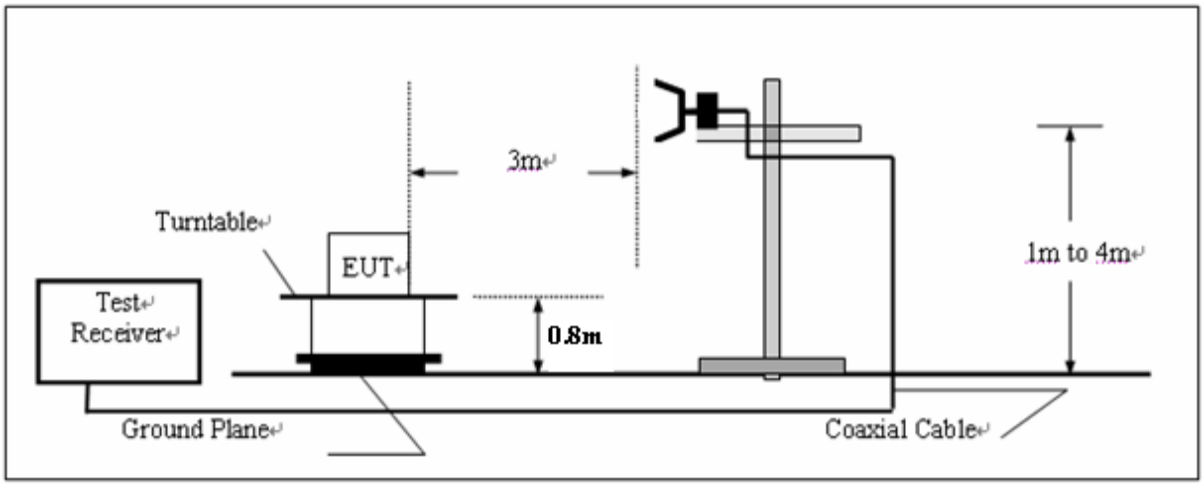
Frequency range 9KHz – 30MHz



Frequency range 30MHz – 1000MHz



Frequency range above 1GHz-25GHz



TEST PROCEDURE

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0℃ to 360℃ to acquire the highest emissions from EUT
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

4. Repeat above procedures until all frequency measurements have been completed.
5. The EUT minimum operation frequency was 22.184MHz and maximum operation frequency was 2480MHz.so radiated emission test frequency band from 9KHz to 25GHz.

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL - AG

Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

For example

Frequency (MHz)	FS (dBμV/m)	RA (dBμV/m)	AF (dB)	CL (dB)	AG (dB)	Transd (dB)
300.00	40	58.1	12.2	1.6	31.90	-18.1

Transd=AF +CL-AG

RADIATION LIMIT

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission from intentional radiators at a distance of 3 meters shall not exceed the following table. According to § 15.247(d), in any 100kHz bandwidth outside the frequency band in which the EUT is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the100kHz bandwidth within the band that contains the highest level of desired power.

The frequency spectrum above 1 GHz for Transmitter was investigated. All emission not reported are much lower than the prescribed limits. Set the RBW=1MHz,VBW=3MHz for Peak Detector while the RBW=1MHz,VBW=10Hz for Average Detector,Readings are both peak and average values. The pre-test have done for the EUT in three axes and found the worst emission at position shown in test setup photos.

Frequency (MHz)	Distance (Meters)	Radiated (dBμV/m)	Radiated (μV/m)
0.009-0.49	3	20log(2400/F(KHz))+40log(300/3)	2400/F(KHz)
0.49-1.705	3	20log(24000/F(KHz))+ 40log(30/3)	24000/F(KHz)
1.705-30	3	20log(30)+ 40log(30/3)	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

TEST RESULTS

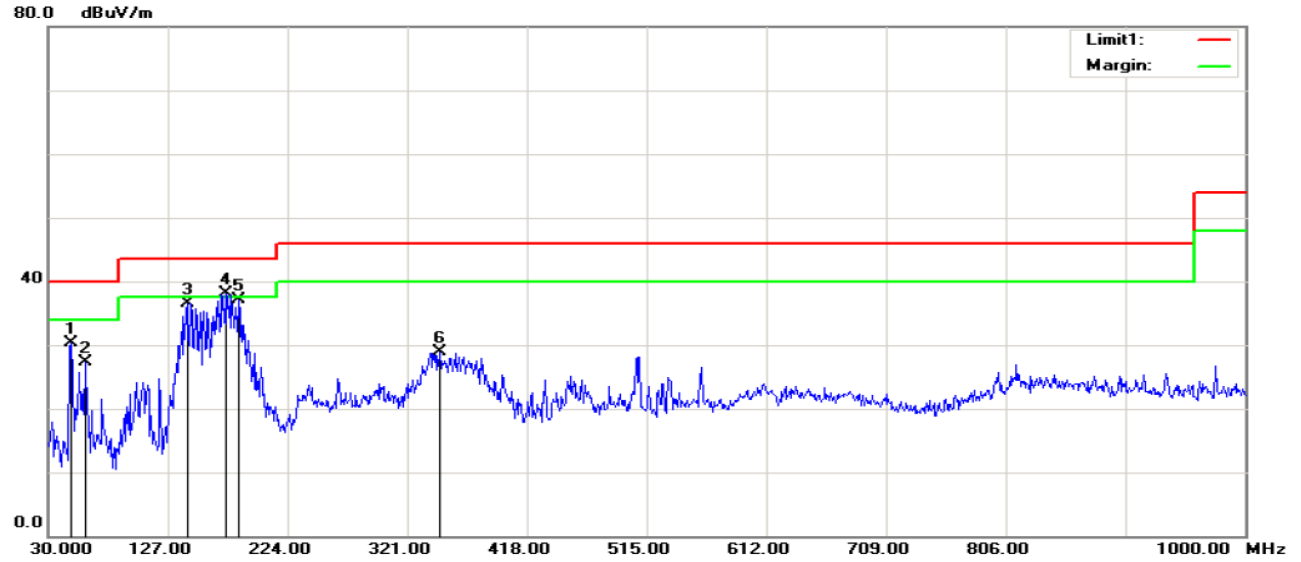
Remark: 1. We tested three positions and recorded worst case.

For 9KHz to 30MHz

Frequency (MHz)	Corrected Reading (dBμV/m)@3m	FCC Limit (dBμV/m) @3m	Margin (dB)	Detector	Result
12.00	40.55	69.54	28.99	QP	PASS
26.00	44.34	69.54	25.20	QP	PASS

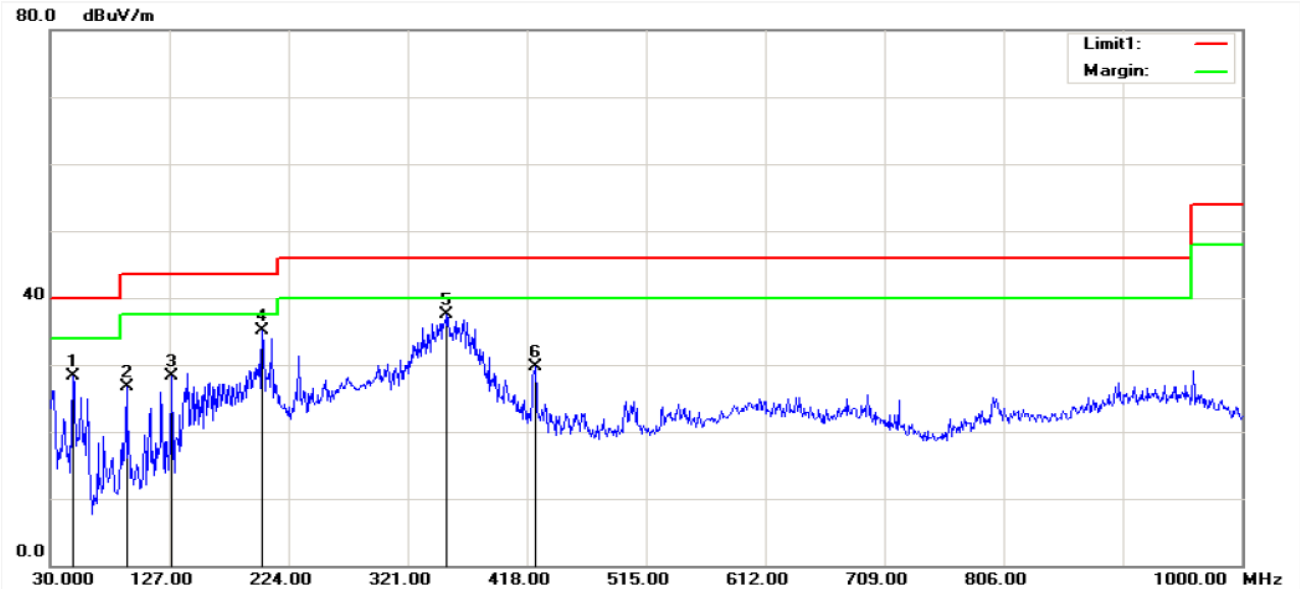
For 30MHz to 1000MHz

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (deg.)	Height (cm)	Remark
1	48.4300	42.49	-12.24	30.25	40.00	-9.75			QP
2	60.0700	40.79	-13.43	27.36	40.00	-12.64			QP
3	143.4900	40.23	-3.66	36.57	43.50	-6.93			QP
4*	173.5600	44.07	-5.93	38.14	43.50	-5.36			QP
5	184.2300	43.50	-6.36	37.14	43.50	-6.36			QP
6	347.1900	35.76	-6.89	28.87	46.00	-17.13			QP

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (deg.)	Height (cm)	Remark
1	48.4300	42.20	-13.92	28.28	40.00	-11.72			QP
2	92.0800	37.81	-11.16	26.65	43.50	-16.85			QP
3	128.9400	40.36	-12.08	28.28	43.50	-15.22			QP
4*	202.6600	44.50	-9.47	35.03	43.50	-8.47			QP
5	353.0100	42.43	-5.01	37.42	46.00	-8.58			QP
6	424.7900	35.60	-5.88	29.72	46.00	-16.28			QP

For 1GHz to 25GHz

Low Channel @ Channel 00 @ 2402 MHz

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M												
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier	Correction Factor (dB/m)
1	4804.00	58.01	PK	74.00	15.99	1.00	236	55.93	31.58	7.00	36.5	2.08
2	4804.00	45.64	AV	54.00	8.36	1.00	236	43.56	31.58	7.00	36.5	2.08
3	7206.00	56.16	PK	74.00	17.84	1.00	147	45.50	37.06	8.90	35.3	10.66
4	7206.00	46.34	AV	54.00	7.66	1.00	147	35.68	37.06	8.90	35.3	10.66

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M												
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier	Correction Factor (dB/m)
1	4804.00	58.34	PK	74.00	15.66	1.00	111	56.26	31.58	7.00	36.5	2.08
2	4804.00	46.46	AV	54.00	7.54	1.00	111	44.38	31.58	7.00	36.5	2.08
3	7206.00	57.33	PK	74.00	16.67	1.00	340	46.67	37.06	8.90	35.3	10.66
4	7206.00	47.03	AV	54.00	6.97	1.00	340	36.37	37.06	8.90	35.3	10.66

Middle Channel @ Channel 39 @ 2441 MHz

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M												
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier	Correction Factor (dB/m)
1	4880.00	58.92	PK	74.00	15.08	1.00	85	56.78	31.04	7.60	36.5	2.14
2	4880.00	45.67	AV	54.00	8.33	1.00	85	43.53	31.04	7.60	36.5	2.14
3	7320.00	56.94	PK	74.00	17.06	1.00	124	45.80	37.84	8.60	35.3	11.14
4	7320.00	46.26	AV	54.00	7.74	1.00	124	34.79	37.84	8.60	35.3	11.47

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M												
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier	Correction Factor (dB/m)
1	4880.00	59.04	PK	74.00	14.96	1.00	250	56.90	31.04	7.60	36.5	2.14
2	4880.00	46.70	AV	54.00	7.30	1.00	250	44.56	31.04	7.60	36.5	2.14
3	7320.00	57.33	PK	74.00	16.67	1.00	197	46.19	37.84	8.60	35.3	11.14
4	7320.00	46.82	AV	54.00	7.18	1.00	197	35.35	37.84	8.60	35.3	11.47

High Channel @ Channel 78 @ 2480 MHz

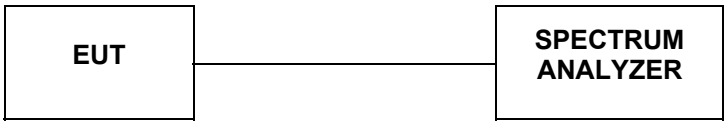
ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M												
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier	Correction Factor (dB/m)
1	4960.00	59.18	PK	74.00	14.82	1.00	222	56.75	31.63	7.00	36.2	2.43
2	4960.00	45.88	AV	54.00	8.12	1.00	222	43.45	31.63	7.00	36.2	2.43
3	7340.00	57.56	PK	74.00	16.44	1.00	167	45.96	38.40	8.50	35.3	11.60
4	7340.00	46.71	AV	54.00	7.29	1.00	167	35.11	38.40	8.50	35.3	11.60

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M												
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier	Correction Factor (dB/m)
1	4960.00	59.67	PK	74.00	14.33	1.00	5	57.24	31.63	7.00	-36.2	2.43
2	4960.00	45.93	AV	54.00	8.07	1.00	5	43.50	31.63	7.00	-36.2	2.43
3	7340.00	58.55	PK	74.00	15.45	1.00	246	46.95	38.40	8.50	-35.3	11.60
4	7340.00	46.92	AV	54.00	7.08	1.00	246	35.32	38.40	8.50	35.3	11.60

REMARKS: 1. Emission level (dBuV/m) =Raw Value (dBuV) + Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
3. The other emission levels were very low against the limit.
4. Margin value = Limit value- Emission level.
5. The average measurement was not performed when the peak measured data under the limit of average detection.

4.3. Maximum Peak Output Power

TEST CONFIGURATION



TEST PROCEDURE

According to ANSI C63.10:2009 Maximum peak conducted output power for HFSS devices:
1. Set the RBW =2MHz.
2. Set VBW=10MHz
3. Set span=10MHz
4. Sweep time = auto couple
5. Detector = peak
6. Trace mode = max hold
7. Allow trace to fully stabilize
8. Use peak marker function to determine the peak amplitude level

LIMIT

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.

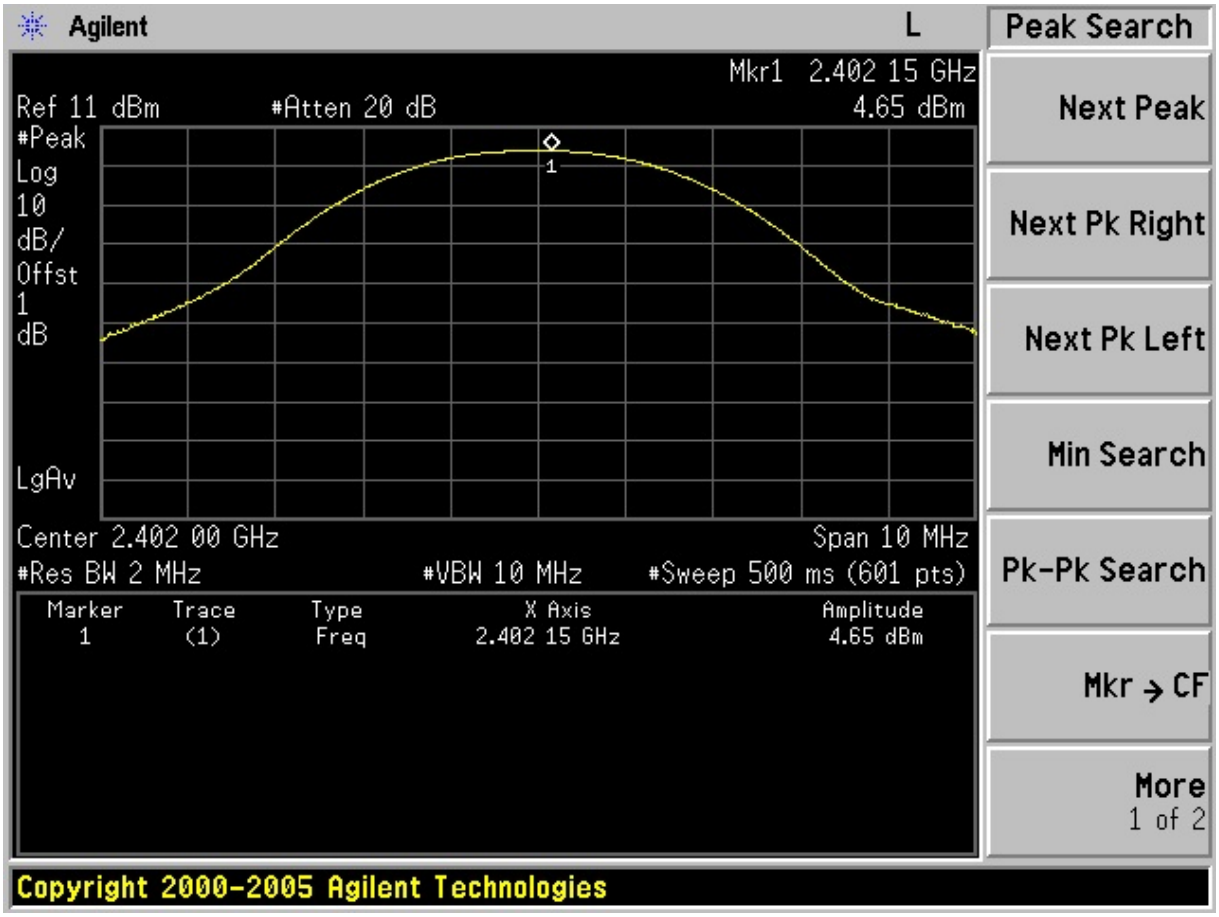
TEST RESULTS

A. Test Verdict

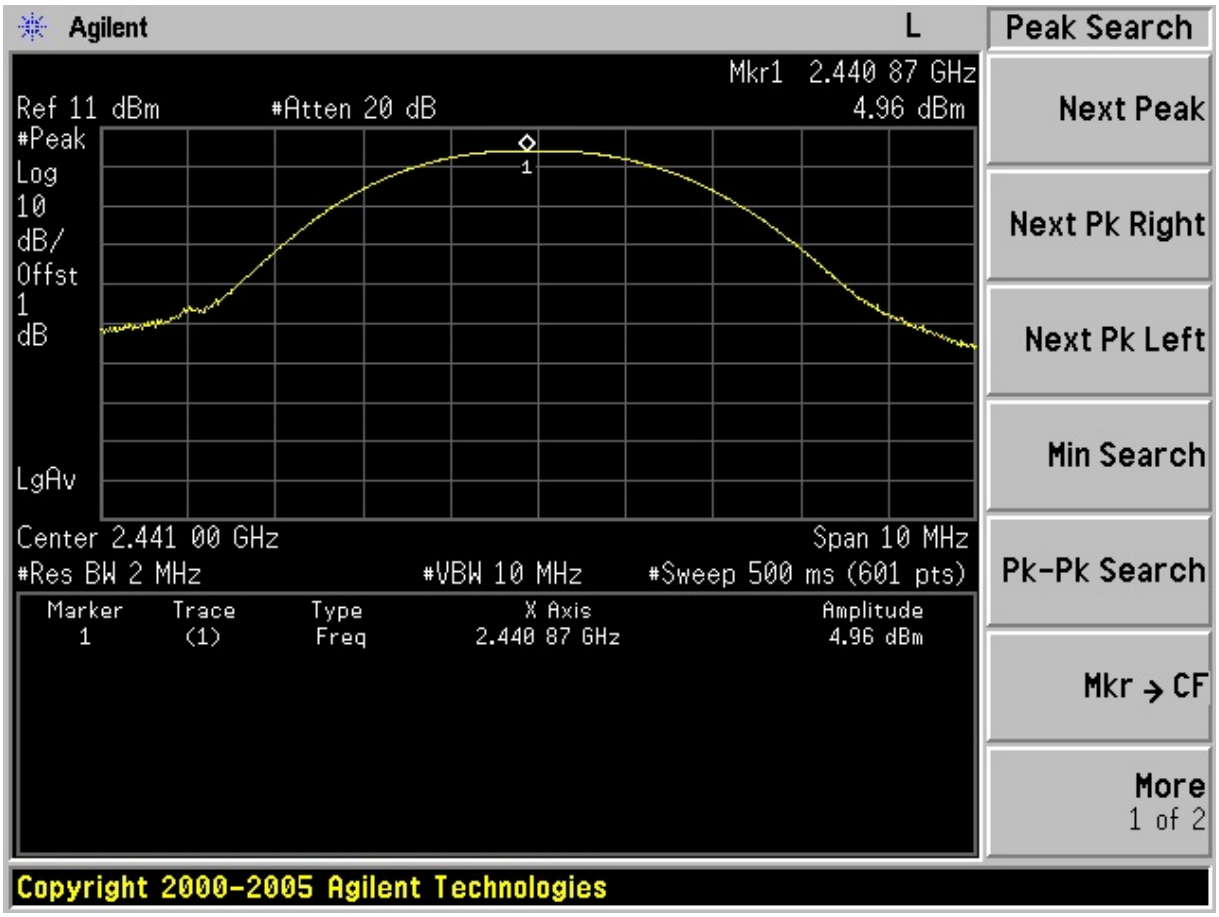
Channel	Frequency (MHz)	Measured Output Peak Power (dBm)	Refer to Plot	Limits (dBm)	Verdict
00	2402	4.65	Plot 4.3.1 A	30	PASS
39	2441	4.96	Plot 4.3.1 B	30	PASS
78	2480	4.63	Plot 4.3.1 C	30	PASS

Note: 1.The test results including the cable lose.

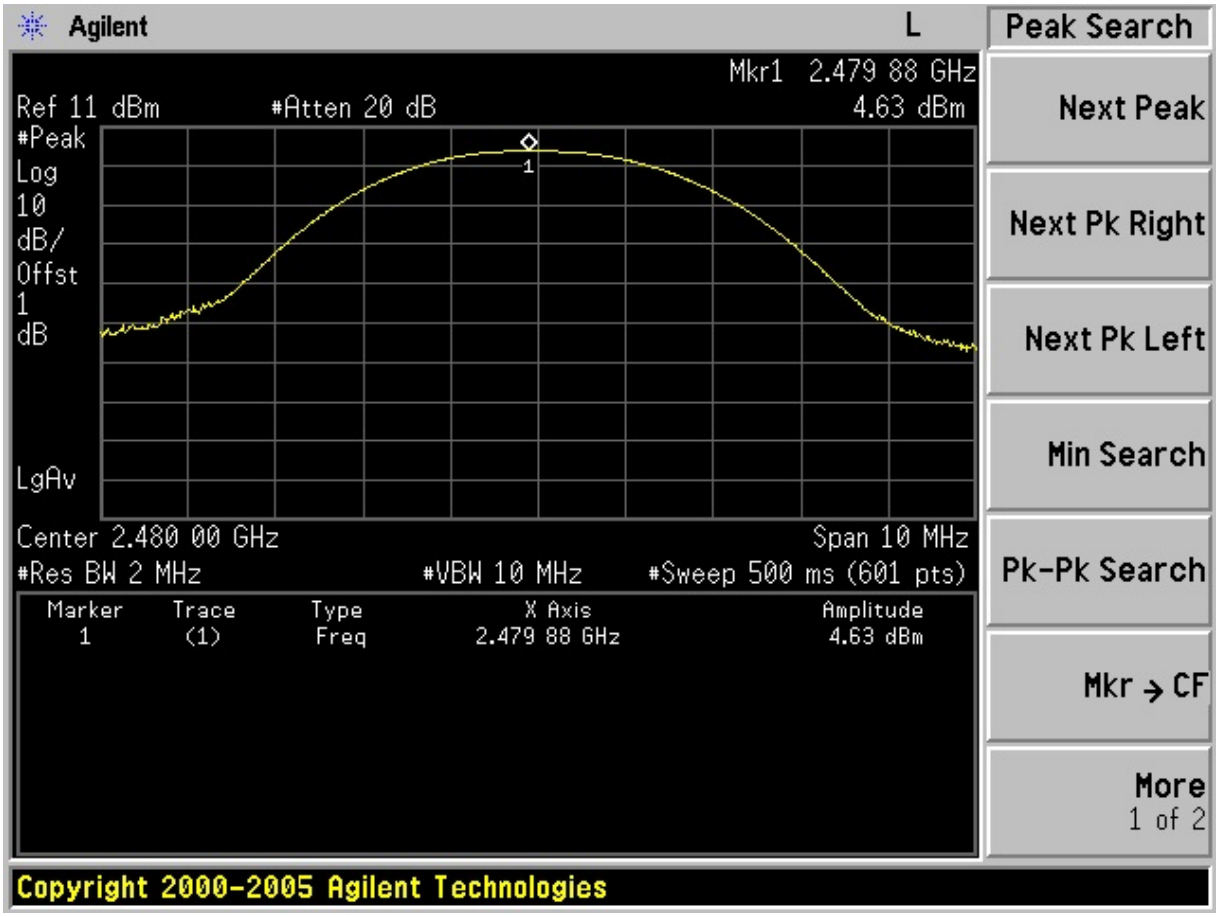
B. Test Plots



(Plot 4.3.1 A: Channel 00: 2402MHz @ GFSK)



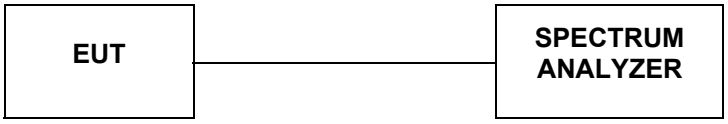
(Plot 4.3.1 B: Channel 39: 2441MHz @ GFSK)



(Plot 4.3.1 C: Channel 78: 2480MHz @ GFSK)

4.4. 20dB Bandwidth

TEST CONFIGURATION



TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with RBW=30 KHz and VBW=100KHz.
The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

LIMIT

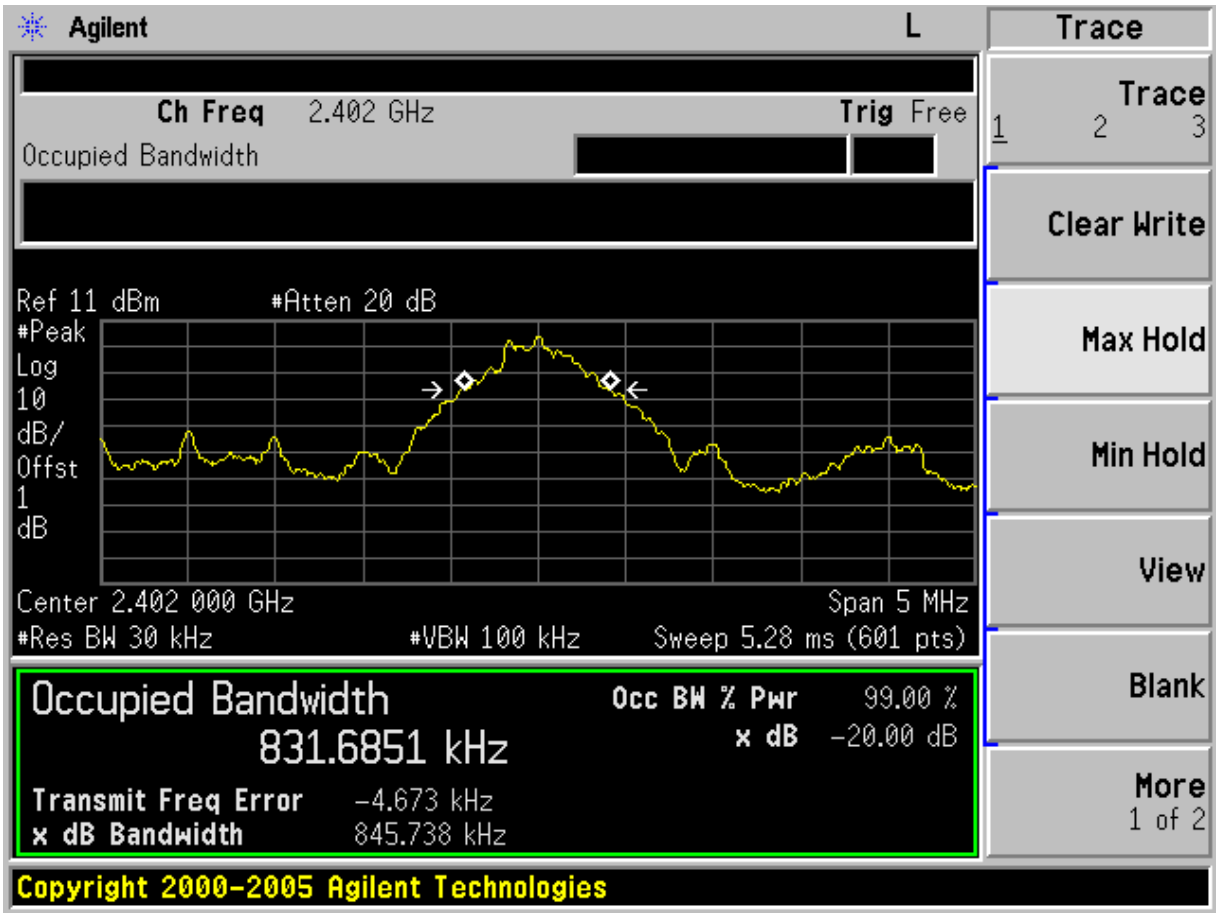
For frequency hopping systems operating in the 2400MHz-2483.5MHz no limit for 20dB bandwith.

TEST RESULTS

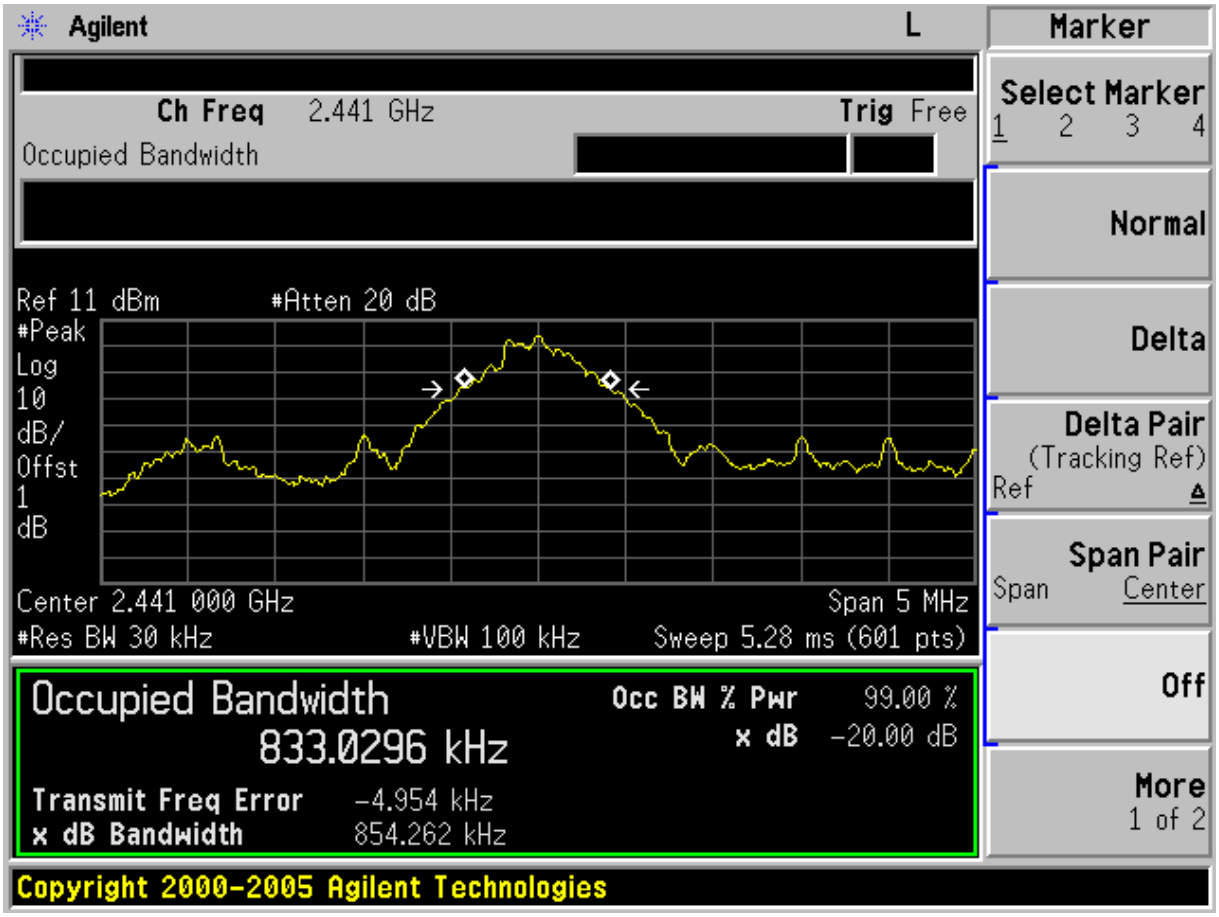
A. Test Verdict

Channel	Frequency (MHz)	20dB Bandwidth (KHz)	Refer to Plot	Limits (MHz)	Verdict
00	2402	845.738	Plot 4.4.1 A	/	PASS
39	2441	854.262	Plot 4.4.1 B	/	PASS
78	2480	846.124	Plot 4.4.1 C	/	PASS

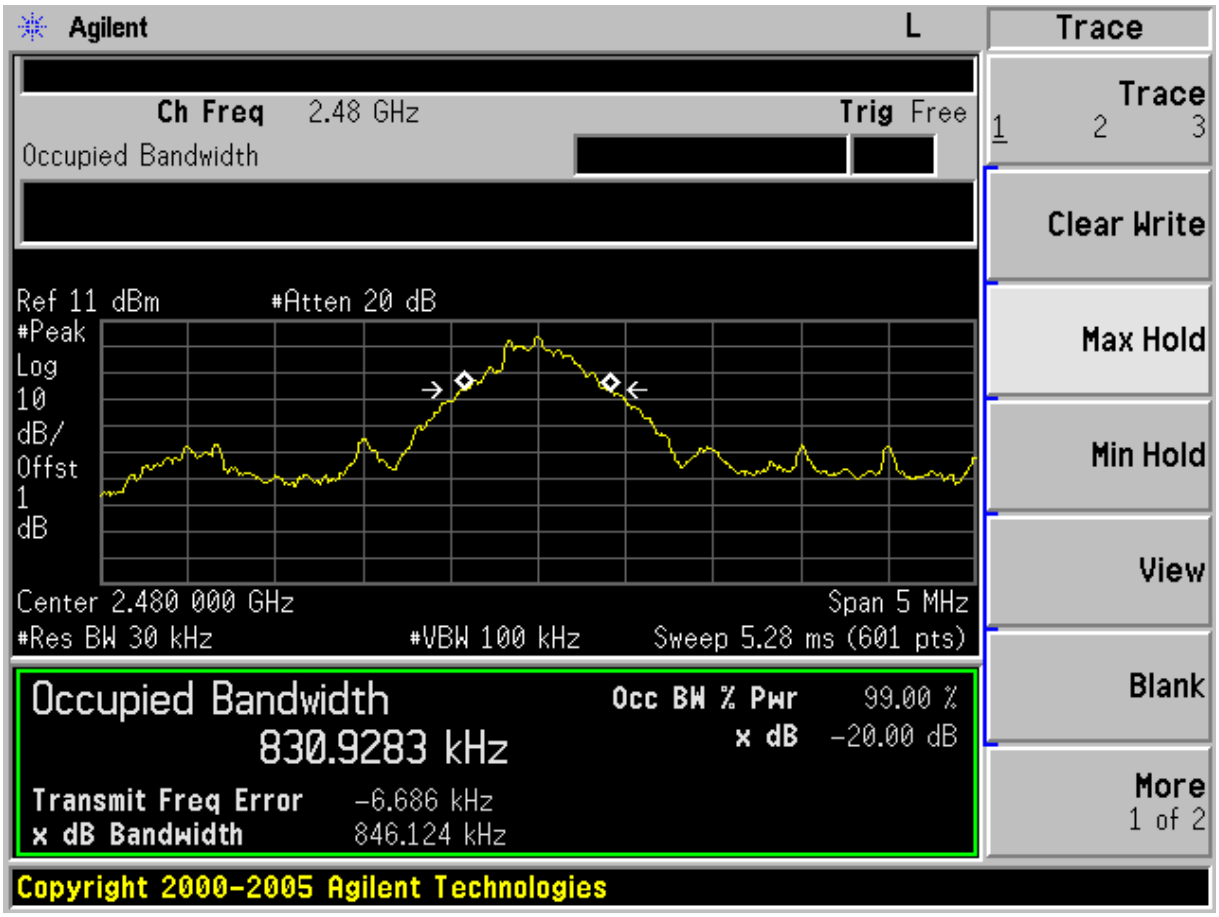
B. Test Plots



(Plot 4.4.1 A: Channel 00: 2402MHz @ GFSK)



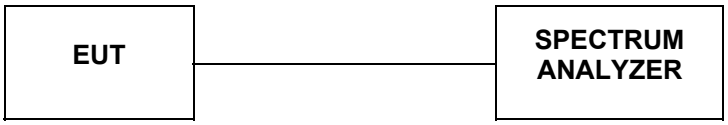
(Plot 4.4.1 B: Channel 39: 2441MHz @ GFSK)



(Plot 4.4.1 C: Channel 78: 2480MHz @ GFSK)

4.5. Frequency Separation

TEST CONFIGURATION



TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with RBW=30 KHz and VBW=100KHz.

LIMIT

According to 15.247(a)(1),frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25KHz or the 2/3*20dB bandwidth of the hopping channel, whichever is greater.

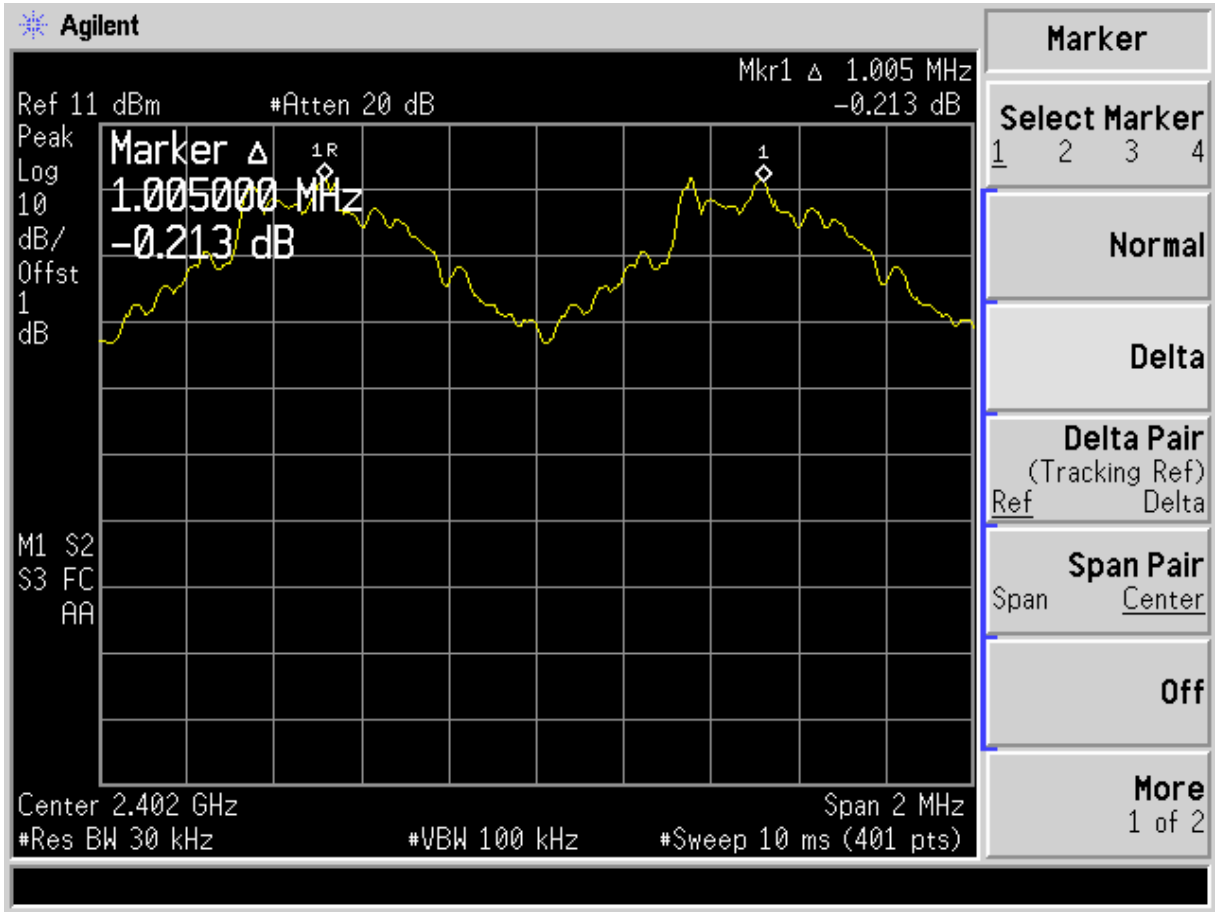
TEST RESULTS

A. Test Verdict

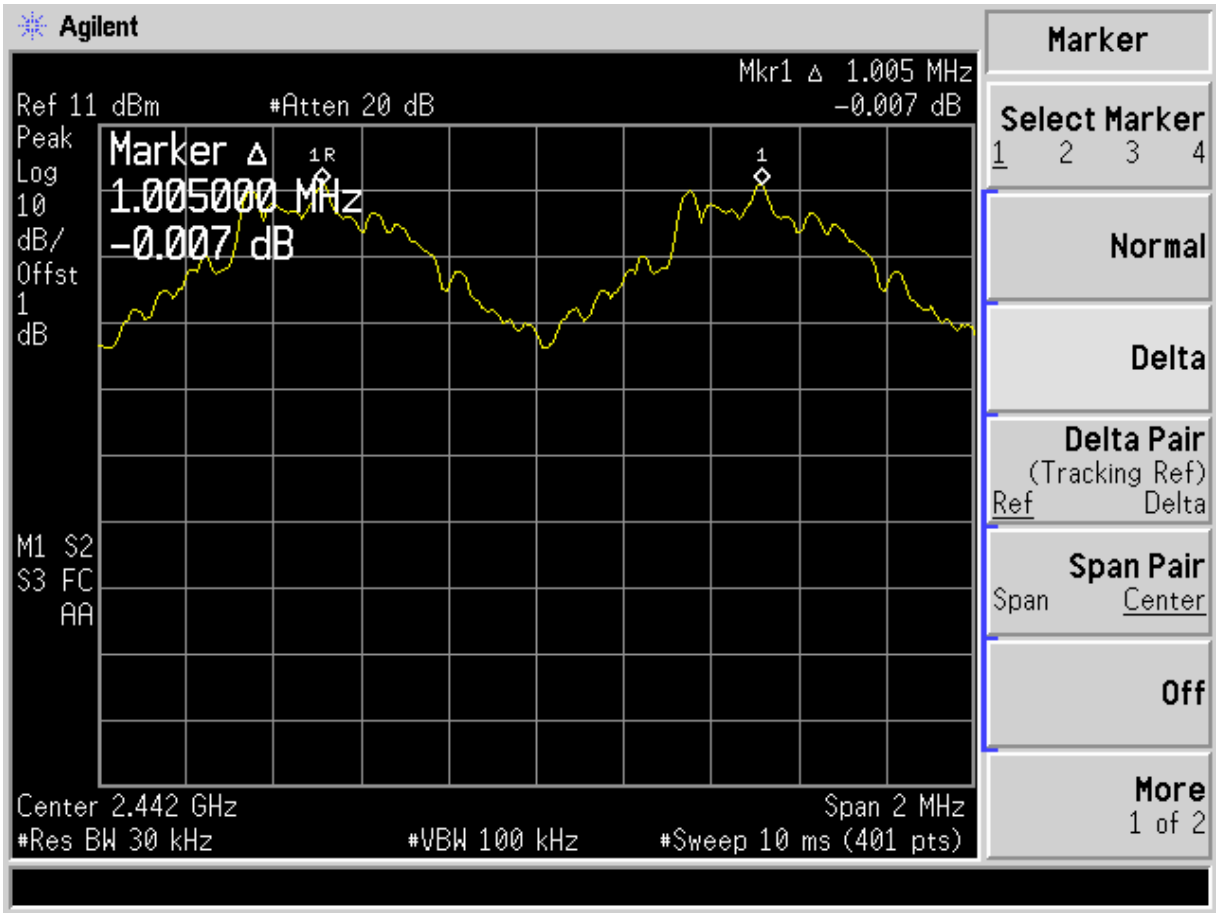
Channel	Frequency (MHz)	Channel Separation (MHz)	Refer to Plot	Limits (KHz)	Verdict
00	2402	1.005	Plot 4.5.1 A	25KHz or 2/3*20dB bandwidth	PASS
01	2403				
38	2440	1.005	Plot 4.5.1 B	25KHz or 2/3*20dB bandwidth	PASS
39	2441				
77	2479	1.005	Plot 4.5.1 C	25KHz or 2/3*20dB bandwidth	PASS
78	2480				

Note: 1.The test results including the cable lose.

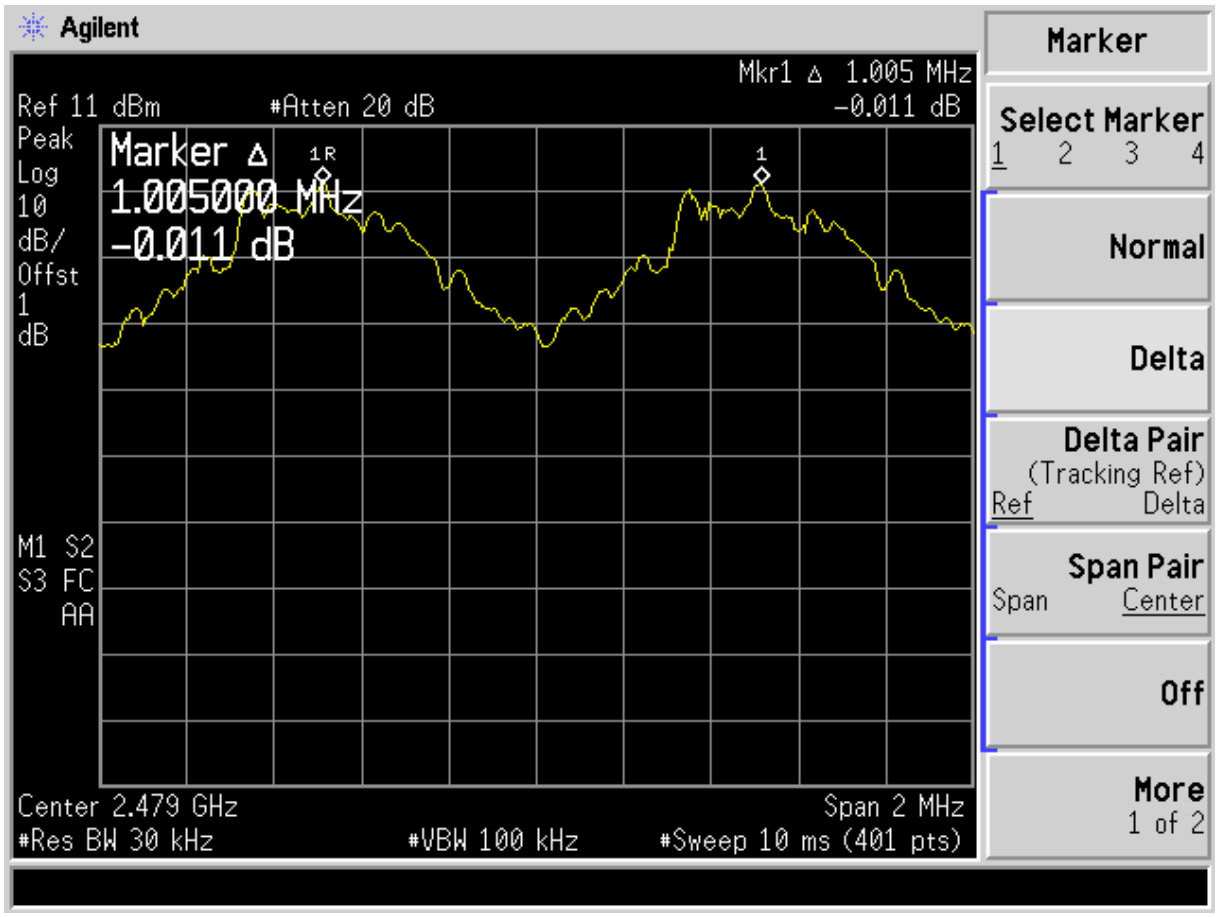
B. Test Plots



(Plot 4.5.1 A: Channel 00: 2402MHz @ GFSK)



(Plot 4.5.1 B: Channel 39: 2441MHz @ GFSK)



(Plot 4.5.1 C: Channel 78: 2480MHz @ GFSK)

4.6. Band Edge Compliance of RF Emission

TEST REQUIREMENT

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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

TEST PROCEDURE

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge, for Radiated emissions restricted band RBW=1MHz, VBW=3MHz for Peak dector while RBW=1MHz,VBW=10Hz for Average dector.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

LIMIT

Below -20dB of the highest emission level in operating band.
Radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)

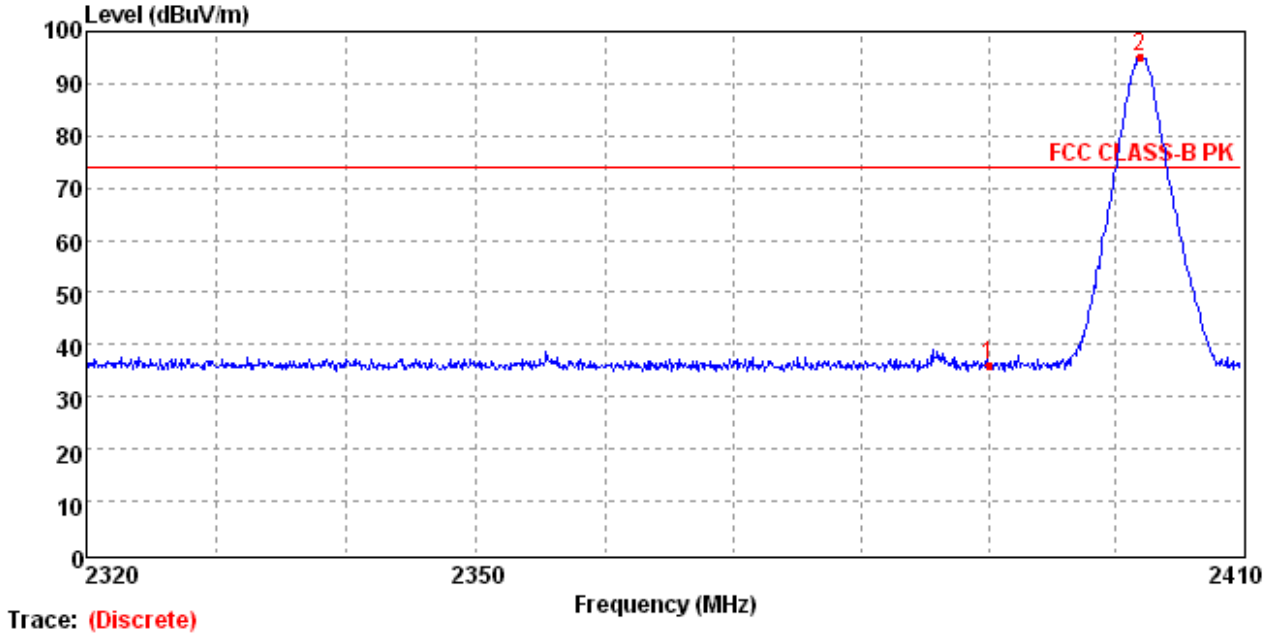
TEST RESULTS

Remark: we measured all conditions(DH1,DH3,DH5) and recorded worst case at DH1

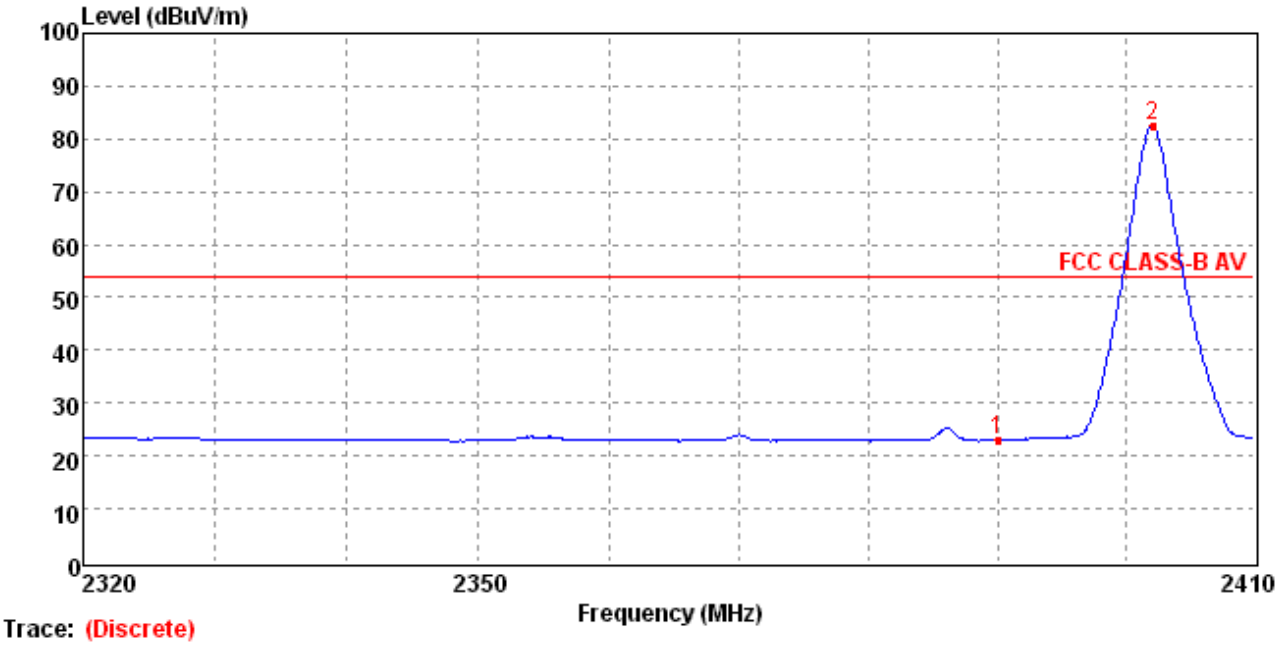
4.5.1 For Radiated Bandedge Measurement

Remark: we tested radiated bandedge at both hopping and no-hopping modes,recorded worst case at no-hopping mode

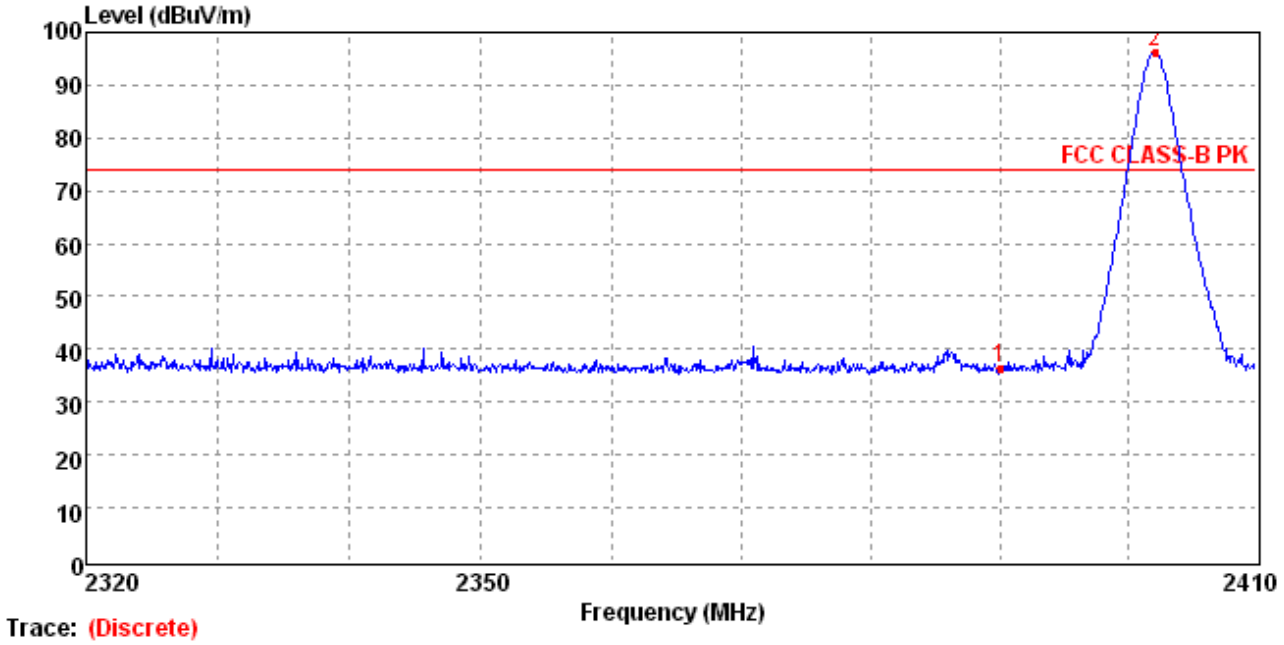
4.5.1.1 GFSK Test Mode



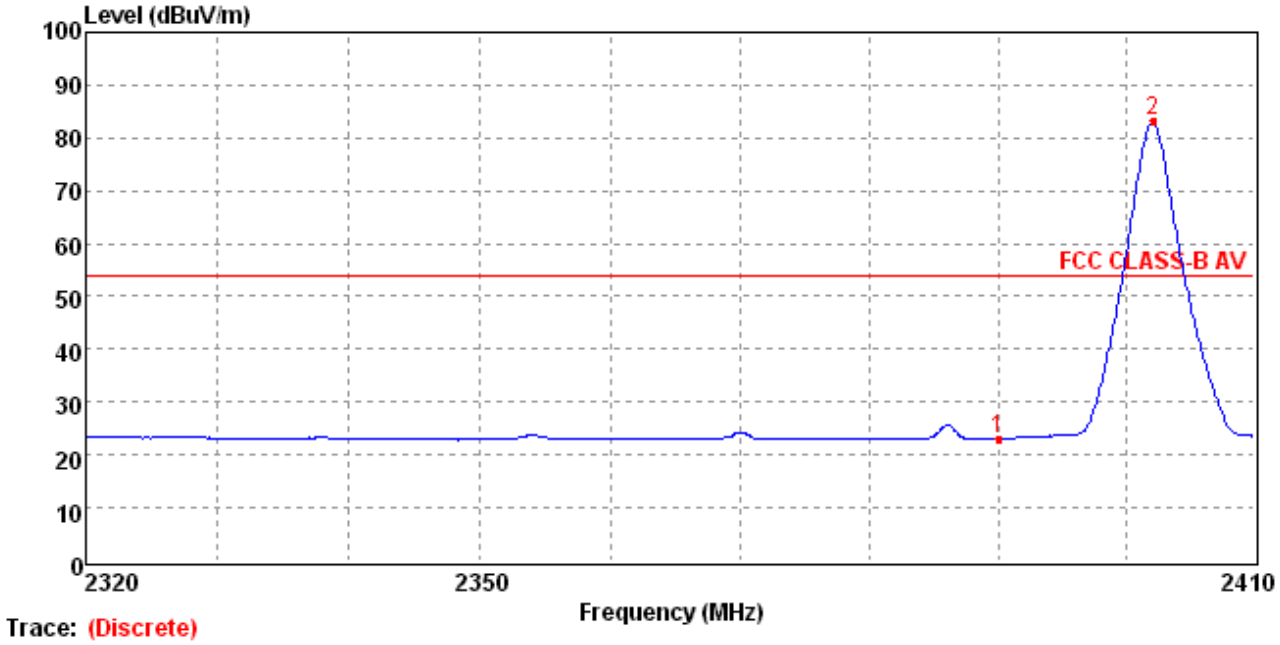
Mark	Frequency (MHz)	Level (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Reading Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Polarization	Detector
1	2390.00	37.22	3.32	27.49	36.12	42.53	74.00	36.38	Hor	Peak
2	**2402.03**	**96.88**	**3.32**	**27.49**	**36.12**	**102.91**	**74.00**	**-22.88**	**Hor**	**Peak**



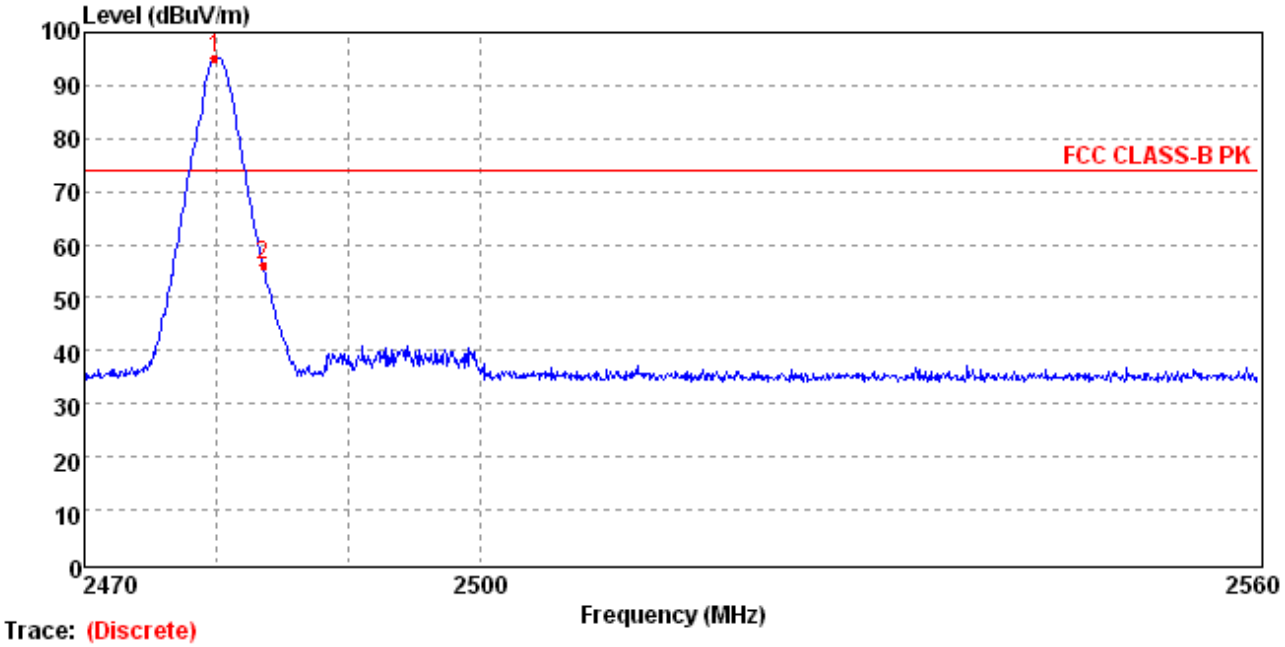
Mark	Frequency (MHz)	Level (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Reading Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Polarization	Detector
1	2390.00	23.77	3.32	27.49	36.12	29.08	54.00	50.23	Hor	Average
2	**2402.00**	**83.45**	**3.32**	**27.49**	**36.12**	**88.76**	**54.00**	**-9.45**	**Hor**	Average



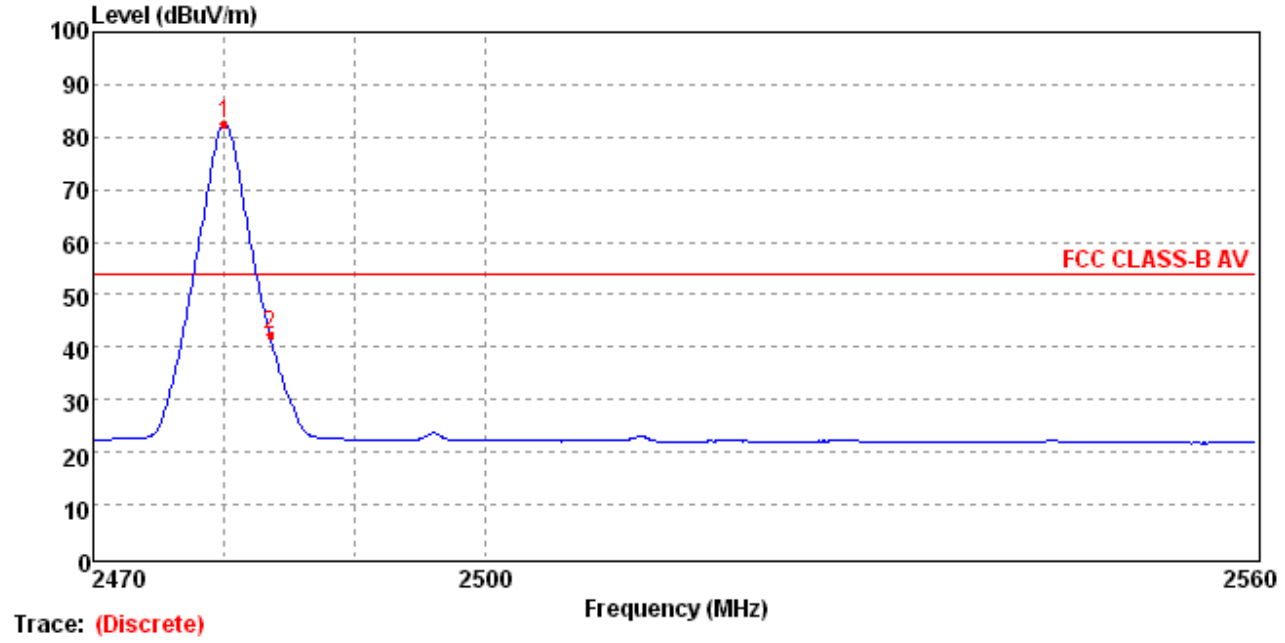
Mark	Frequency (MHz)	Level (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Reading Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Polarization	Detector
1	2390.00	37.61	3.32	27.49	36.12	42.92	74.00	36.39	Ver	Peak
2	**2402.35**	**97.12**	**3.32**	**27.49**	**36.12**	**102.43**	**74.00**	**-23.12**	**Ver**	**Peak**



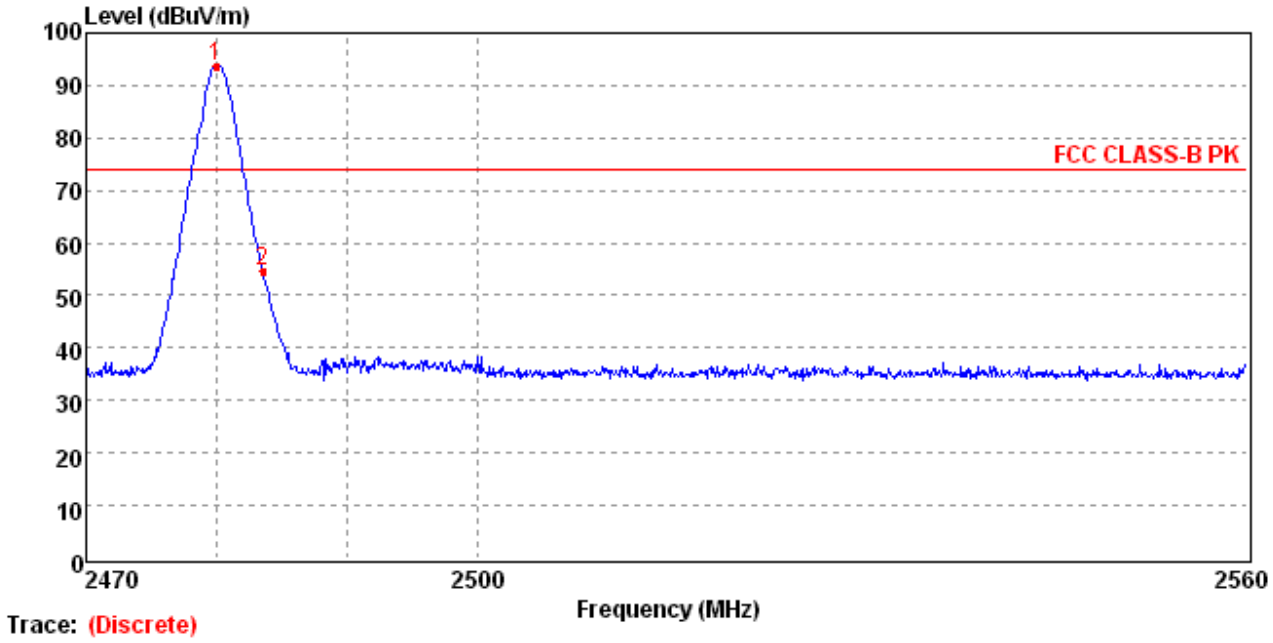
Mark	Frequency (MHz)	Level (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Reading Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Polarization	Detector
1	2390.00	23.97	3.32	27.49	36.12	29.28	54.00	50.03	Ver	Average
2	**2401.98**	**84.11**	**3.32**	**27.49**	**36.12**	**89.42**	**54.00**	**-10.11**	**Ver**	**Average**



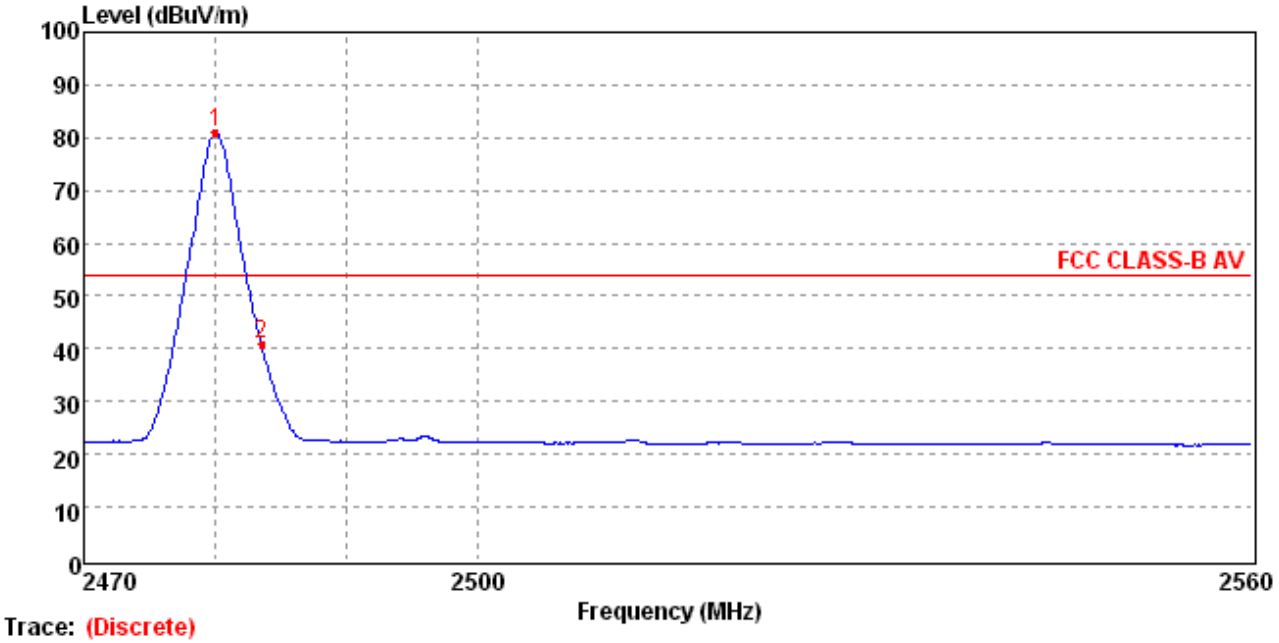
Mark	Frequency (MHz)	Level (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Reading Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Polarization	Detector
1	**2480.16**	**96.64**	**3.88**	**27.45**	**36.55**	**101.86**	**74.00**	**-22.64**	**Hor**	**Peak**
2	2483.50	57.85	3.88	27.45	36.55	63.07	74.00	16.15	Hor	Peak



Mark	Frequency (MHz)	Level (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Reading Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Polarization	Detector
1	**2480.08**	**82.97**	**3.88**	**27.45**	**36.55**	**88.19**	**54.00**	**-8.97**	**Hor**	**Average**
2	2483.50	43.04	3.88	27.45	36.55	48.26	54.00	30.96	Hor	Average



Mark	Frequency (MHz)	Level (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Reading Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Polarization	Detector
1	**2479.89**	**94.71**	**3.88**	**27.45**	**36.55**	**99.93**	**74.00**	**-20.71**	**Ver**	**Peak**
2	2483.50	55.66	3.88	27.45	36.55	60.88	74.00	18.34	Ver	Peak



Mark	Frequency (MHz)	Level (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Reading Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Polarization	Detector
1	**2480.00**	**80.24**	**3.88**	**27.45**	**36.55**	**85.46**	**54.00**	**-6.24**	**Ver**	**Average**
2	2483.50	41.33	3.88	27.45	36.55	46.55	54.00	32.67	Ver	Average

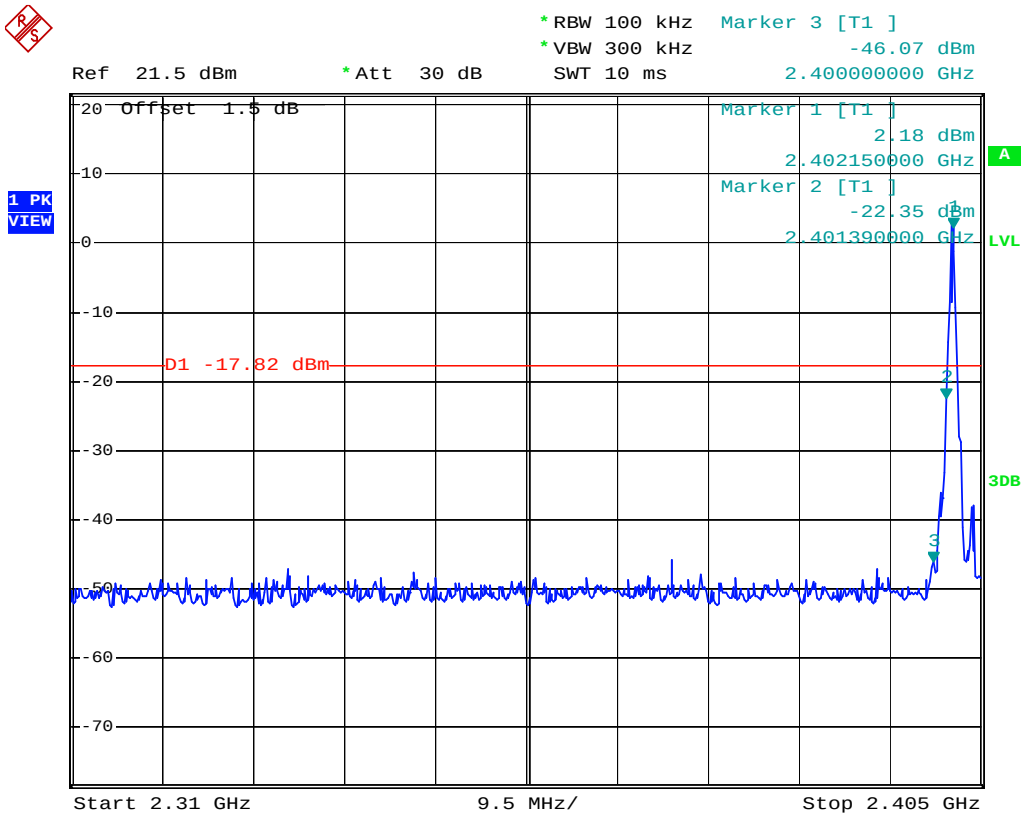
4.5.2 For Conducted Bandedge Measurement

4.5.2.1 GFSK Test Mode

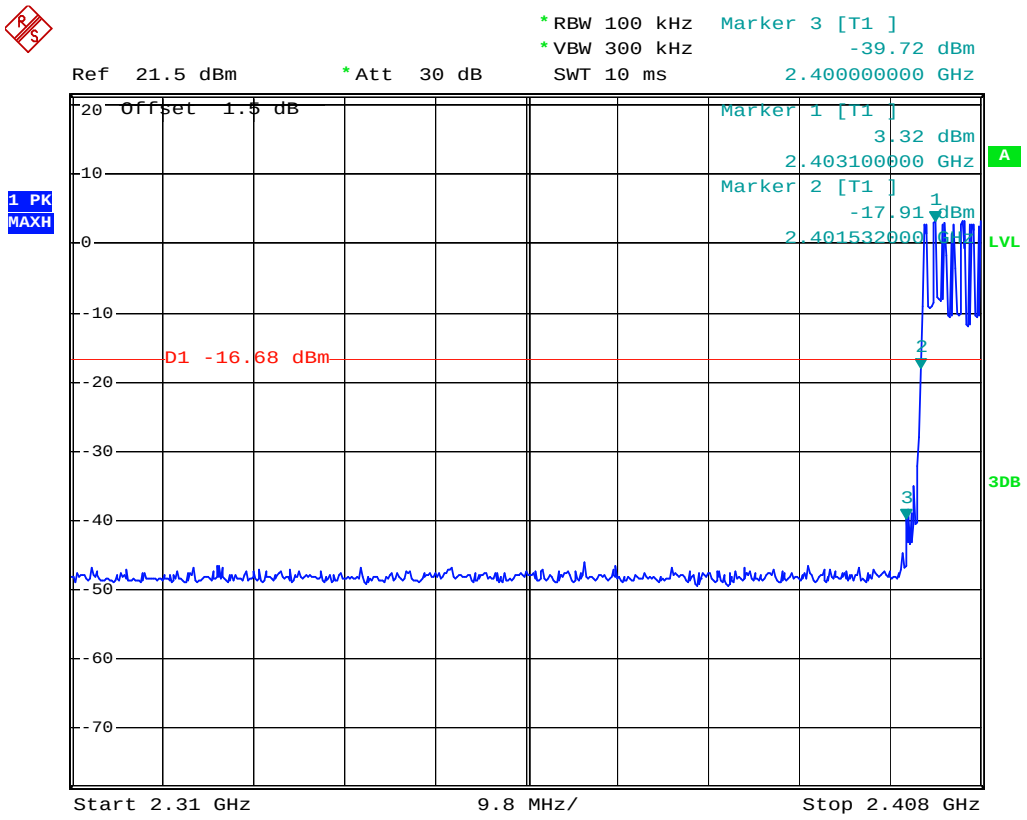
A. Test Verdict

Frequency (MHz)	Delta Peak to Band emission (dBc)	Hoping Mode	Detector	Limit (dBc)	Refer to Plot	Verdict
2400.00	48.25	OFF	Peak	20	Plot 4.6.2.1 A	PASS
2400.00	43.04	ON	Peak	20	Plot 4.6.2.1 B	PASS
2483.50	46.60	OFF	Peak	20	Plot 4.6.2.1 C	PASS
2483.50	47.45	ON	Peak	20	Plot 4.6.2.1 D	PASS

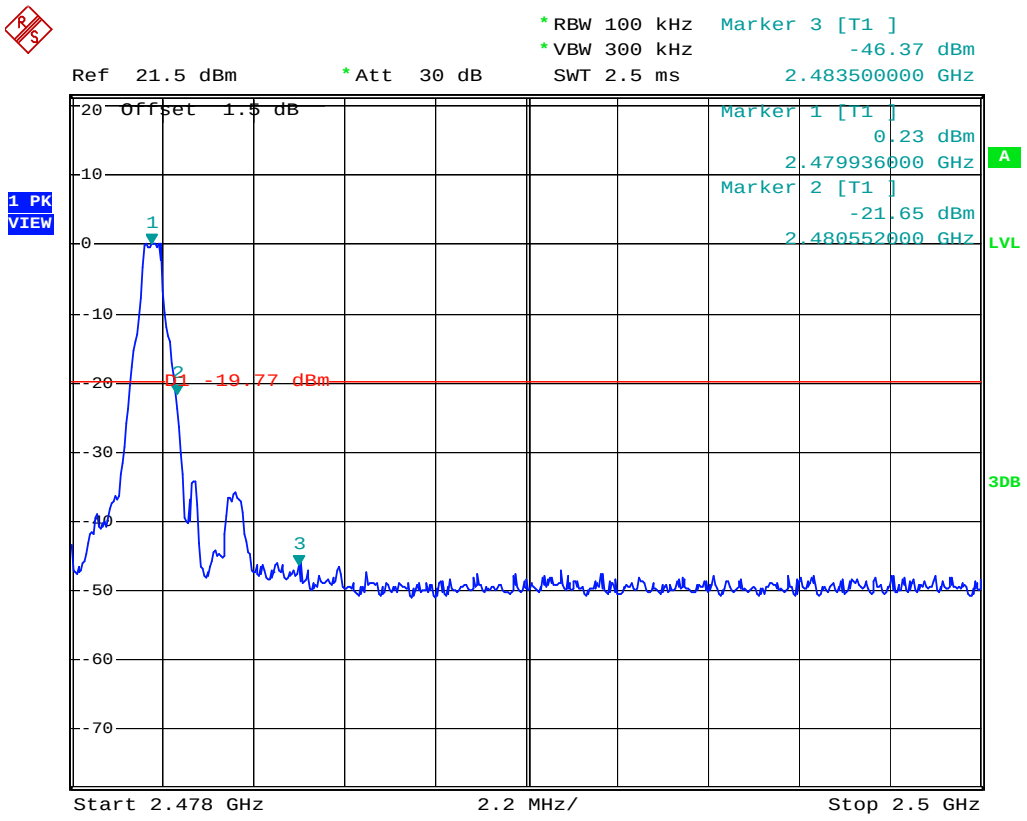
B. Test Plots



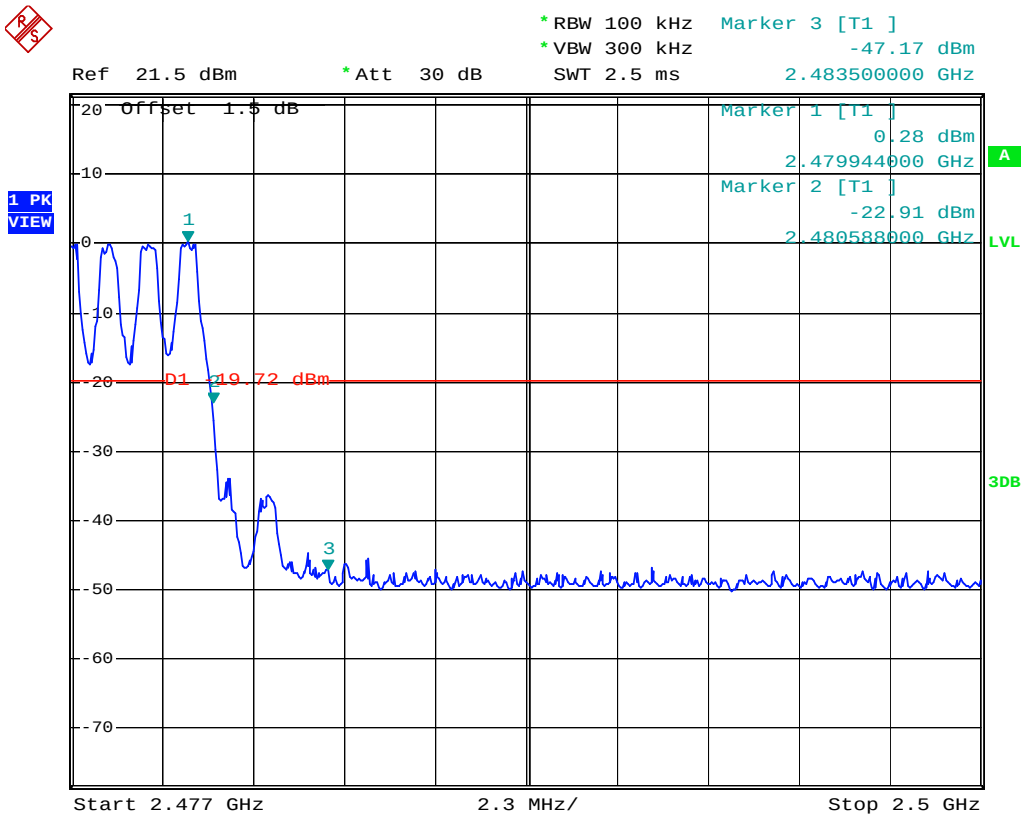
(Plot 4.6.2.1 A: Channel 00: 2402MHz @ GFSK)



(Plot 4.6.2.1 B: Hopping Mode @ GFSK)



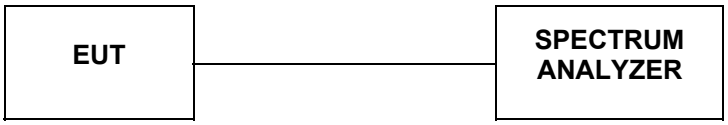
(Plot 4.6.2.1 C: Channel 78: 2480MHz @ GFSK)



(Plot 4.6.2.1 D: Hopping Mode @ GFSK)

4.7. Spurious RF Conducted Emission

TEST CONFIGURATION



TEST PROCEDURE

The Spurious RF conducted emissions compliance of RF radiated emission should be measured by following the guidance in ANSI C63.10-2009 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization etc. Set RBW=100kHz and VBM= 300KHz to measure the peak field strength , and mwasure frequeny range from 30MHz to 25GHz.

LIMIT

1. Below -20dB of the highest emission level in operating band.
2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

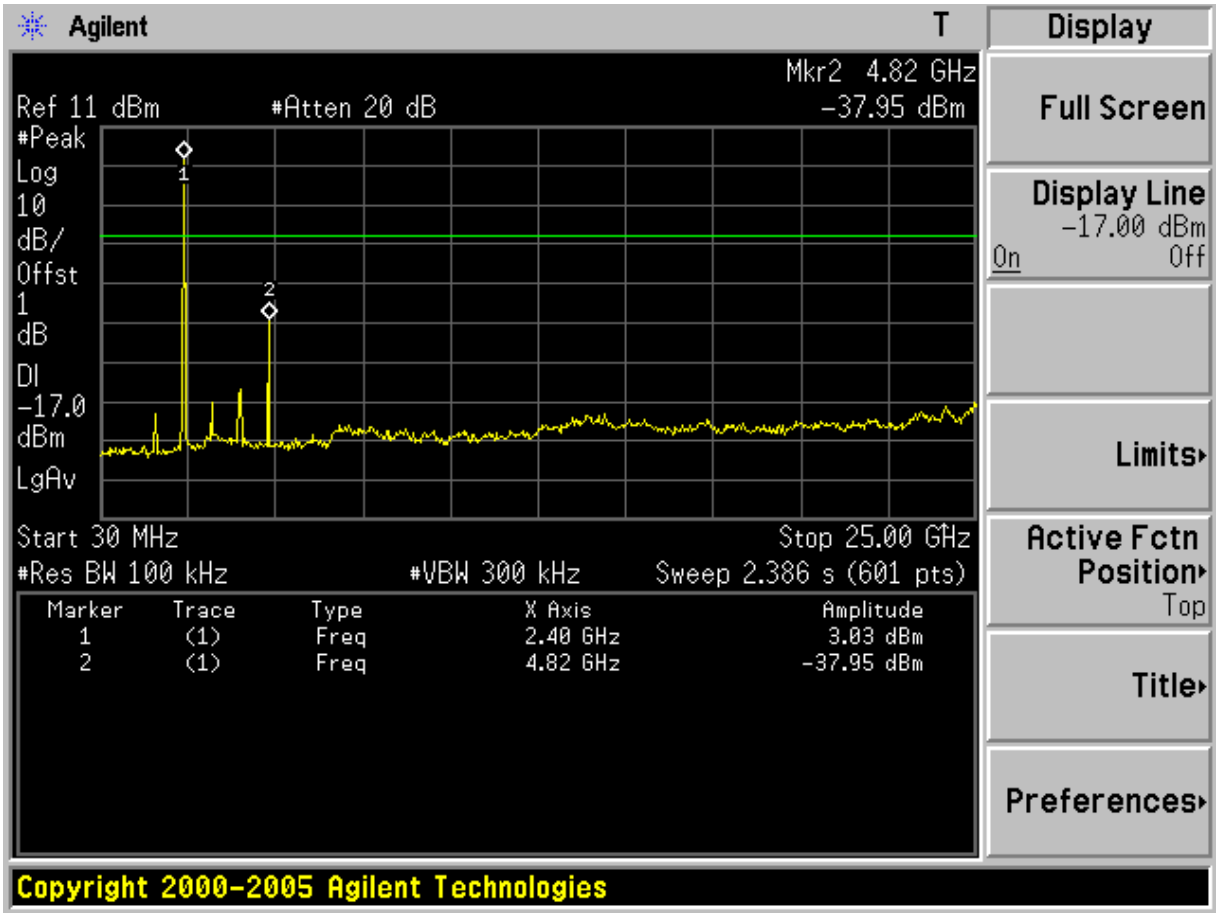
TEST RESULTS

Remark: The measurement frequency range is from 30MHz to the 10^{th} harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and bandege measurement data.

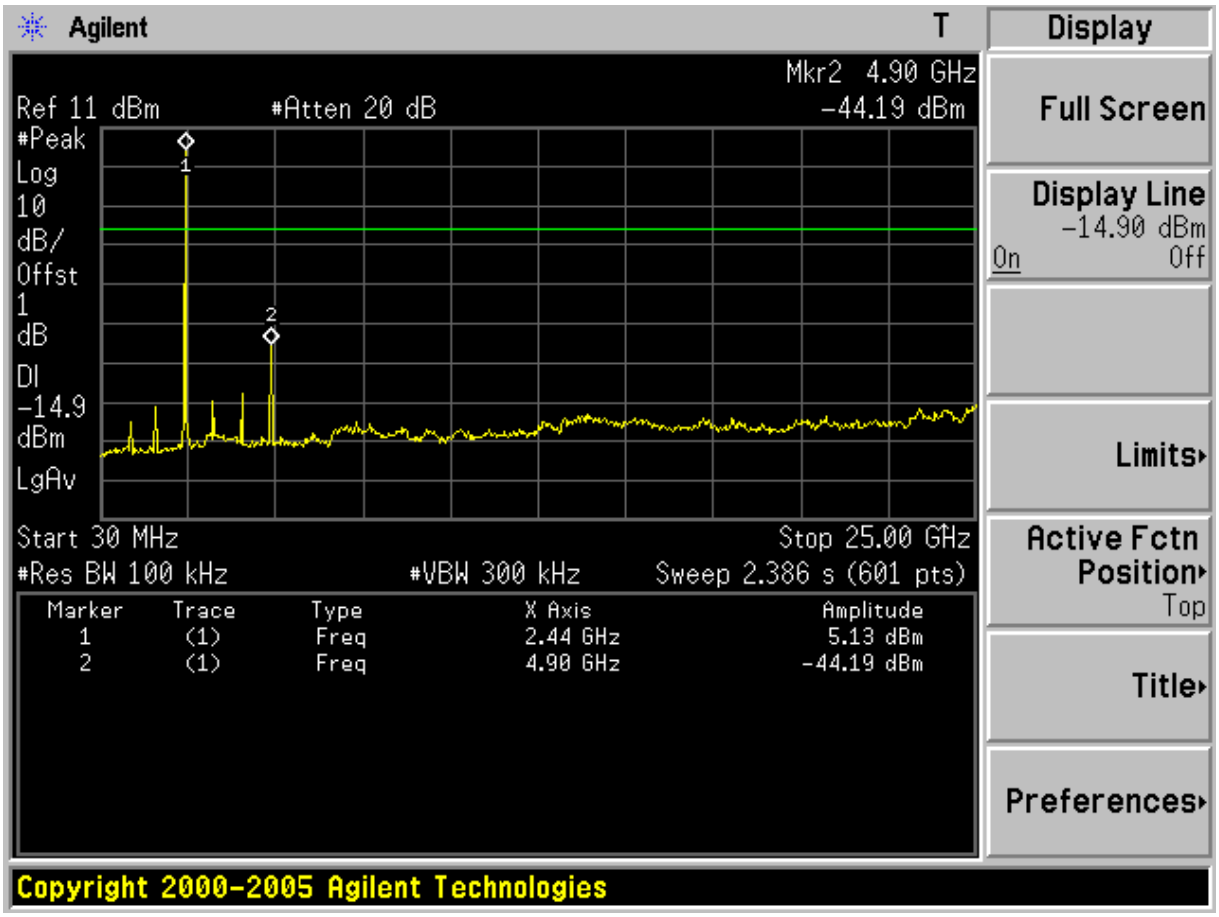
A. Test Verdict

Channel	Frequency (MHz)	Frequency Range	Refer to Plot	Limit (dBc)	Verdict
00	2402	30MHz-25GHz	Plot 4.7.1 A1	-20	PASS
39	2441	30MHz-25GHz	Plot 4.7.1 B1	-20	PASS
78	2480	30MHz-25GHz	Plot 4.7.1 C1	-20	PASS

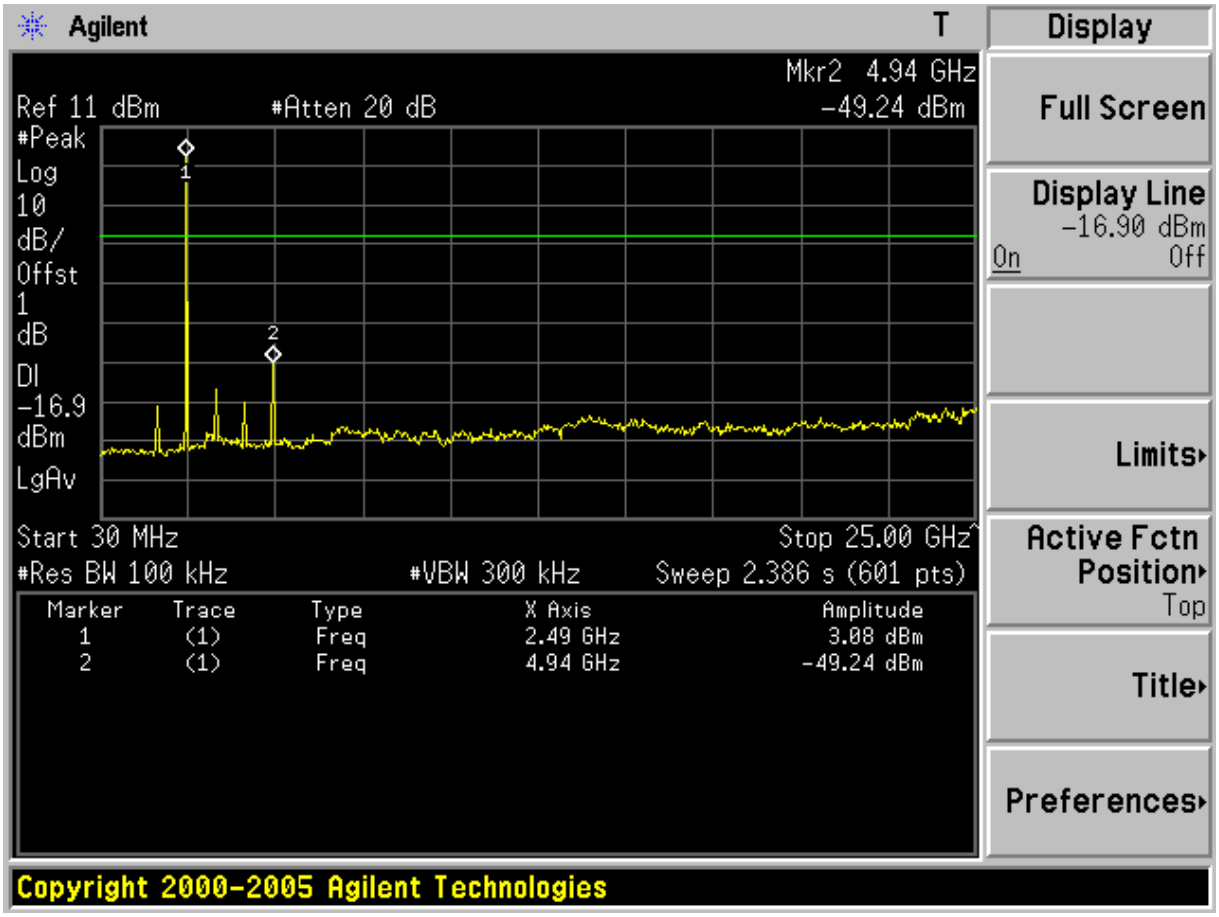
B. Test Plots



(Plot 4.7.1 A1: Channel 00: 2402MHz @ GFSK)



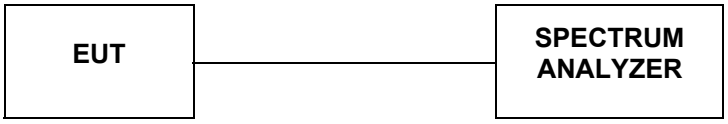
(Plot 4.7.1 B1: Channel 39: 2441MHz @ GFSK)



(Plot 4.7.1 C1: Channel 78: 2480MHz @ GFSK)

4.8. Number of hopping frequency

TEST CONFIGURATION



TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator.Set spectrum analyzer start 2400MHz to 2483.5MHz with RBW=30 KHz and VBW=100KHz.

LIMIT

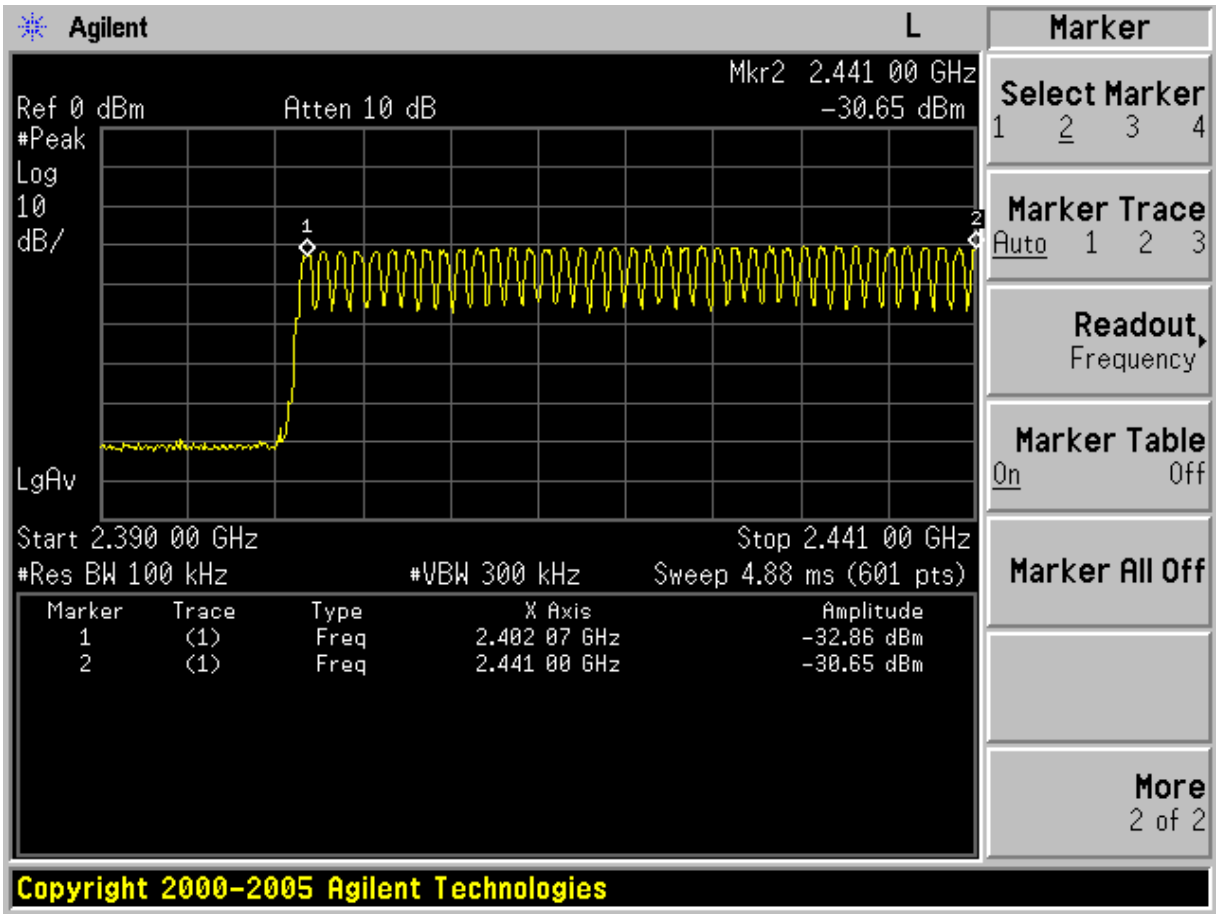
Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

4.7.1 GFSK Test Mode

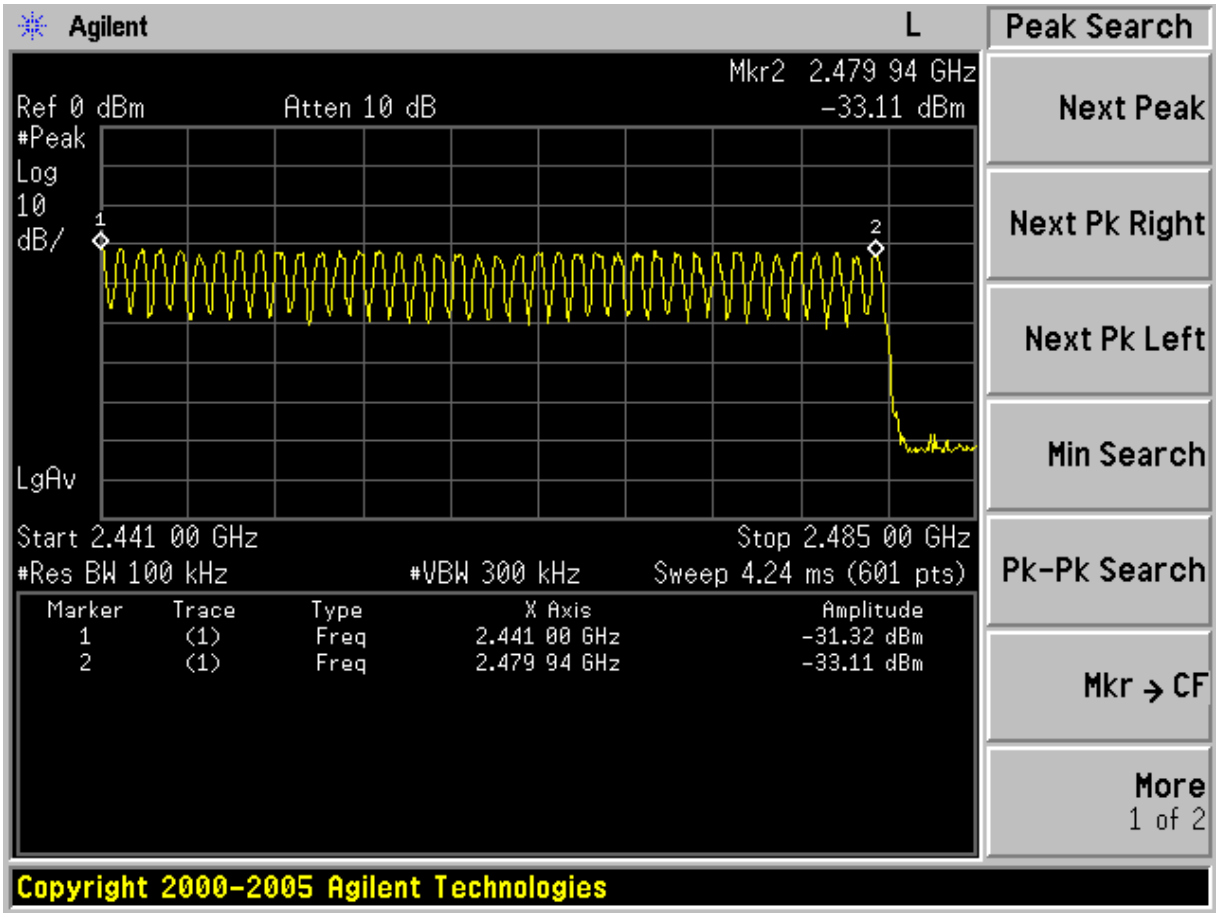
A. Test Verdict

Hopping Channel Frequency Range (MHz)	Number of Hopping Channel	Refer to Plot	Limit	Verdict
2400-2483.5	79	Plot 4.7.1 A1 Plot 4.7.1 A2	≥15	PASS

B. Test Plots



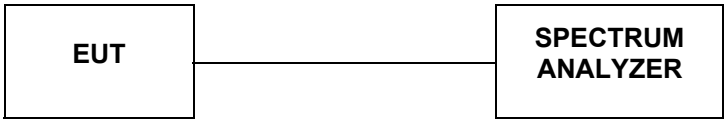
(Plot 4.7.1 A1: @ GFSK)



(Plot 4.7.1 A2: @ GFSK)

4.9. Time Of Occupancy(Dwell Time)

TEST CONFIGURATION



TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. Set center frequency of spectrum analyzer=operating frequency with RBW=1MHz and VBW=3MHz,Span=0Hz.

LIMIT

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a pe-riod of 0.4 seconds multiplied by the number of hopping channels employed.

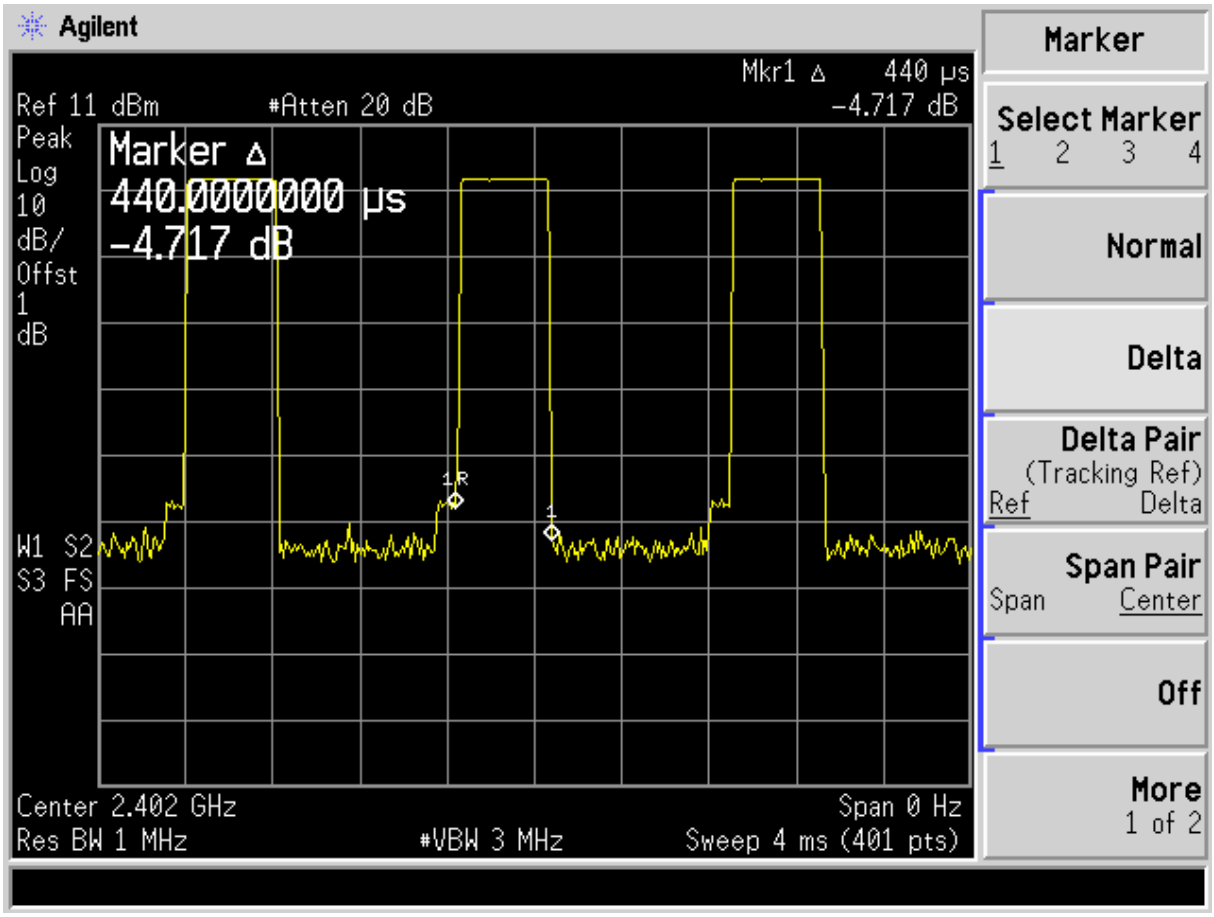
TEST RESULTS

4.8.1 GFSK Test Mode

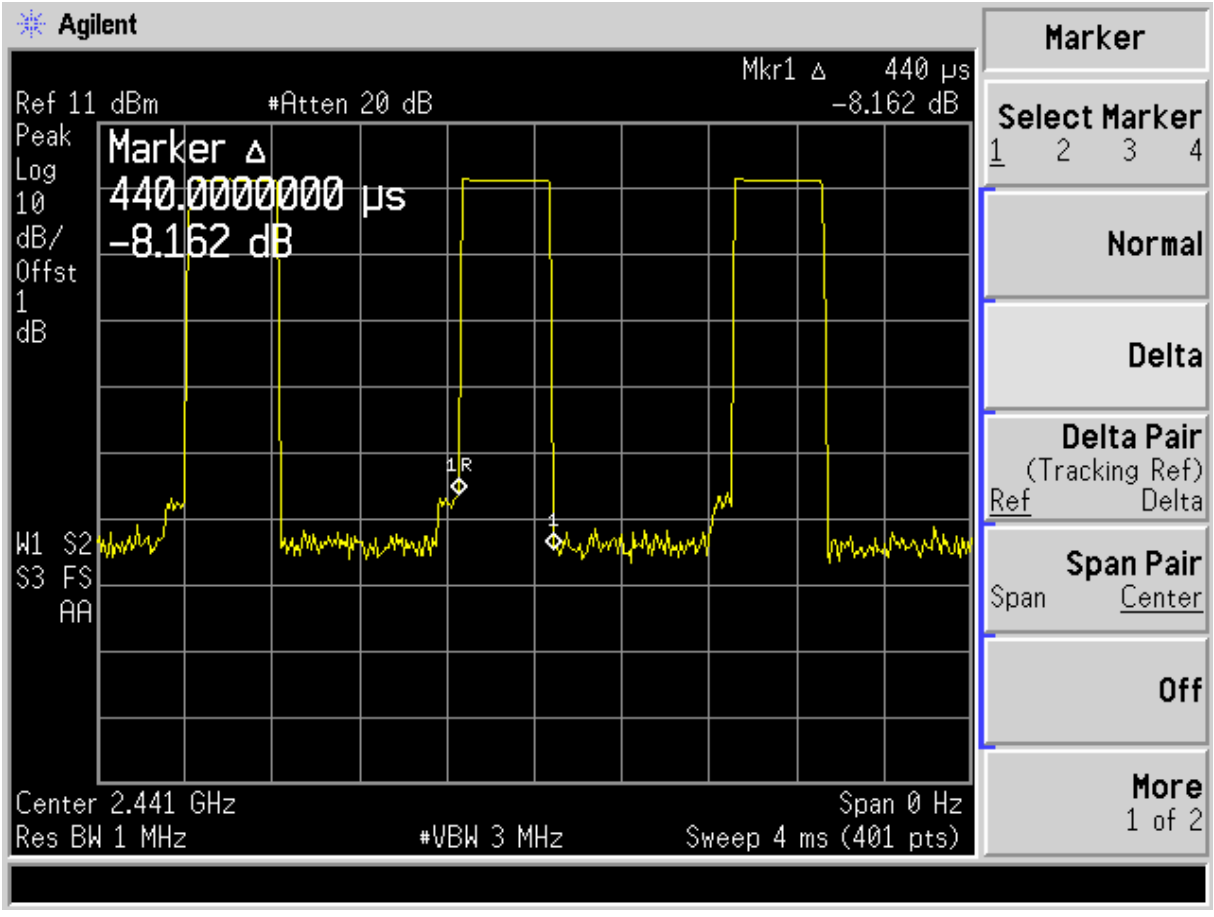
A. Test Verdict

Mode	Frequency (MHz)	Pulse Width (ms)	Dwell Time (S)	Limit (S)	Refer to Plot	Verdict
DH 1	2402	0.440	0.1408	0.4	Plot 4.9.1 A1	PASS
	2441	0.440	0.1408	0.4	Plot 4.9.1 A2	PASS
	2480	0.440	0.1408	0.4	Plot 4.9.1 A3	PASS
	Note: Dwell time=Pulse time (ms) × (1600 ÷ 2 ÷ 79) ×31.6 Second					
DH 3	2402	1.7125	0.2740	0.4	Plot 4.9.1 B1	PASS
	2441	1.7000	0.2720	0.4	Plot 4.9.1 B2	PASS
	2480	1.7000	0.2720	0.4	Plot 4.9.1 B3	PASS
	Note: Dwell time=Pulse time (ms) × (1600 ÷ 4 ÷ 79) ×31.6 Second					
DH 5	2402	2.975	0.3173	0.4	Plot 4.9.1 C1	PASS
	2441	2.975	0.3173	0.4	Plot 4.9.1 C2	PASS
	2480	2.975	0.3173	0.4	Plot 4.9.1 C3	PASS
	Note: Dwell time=Pulse Time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second					

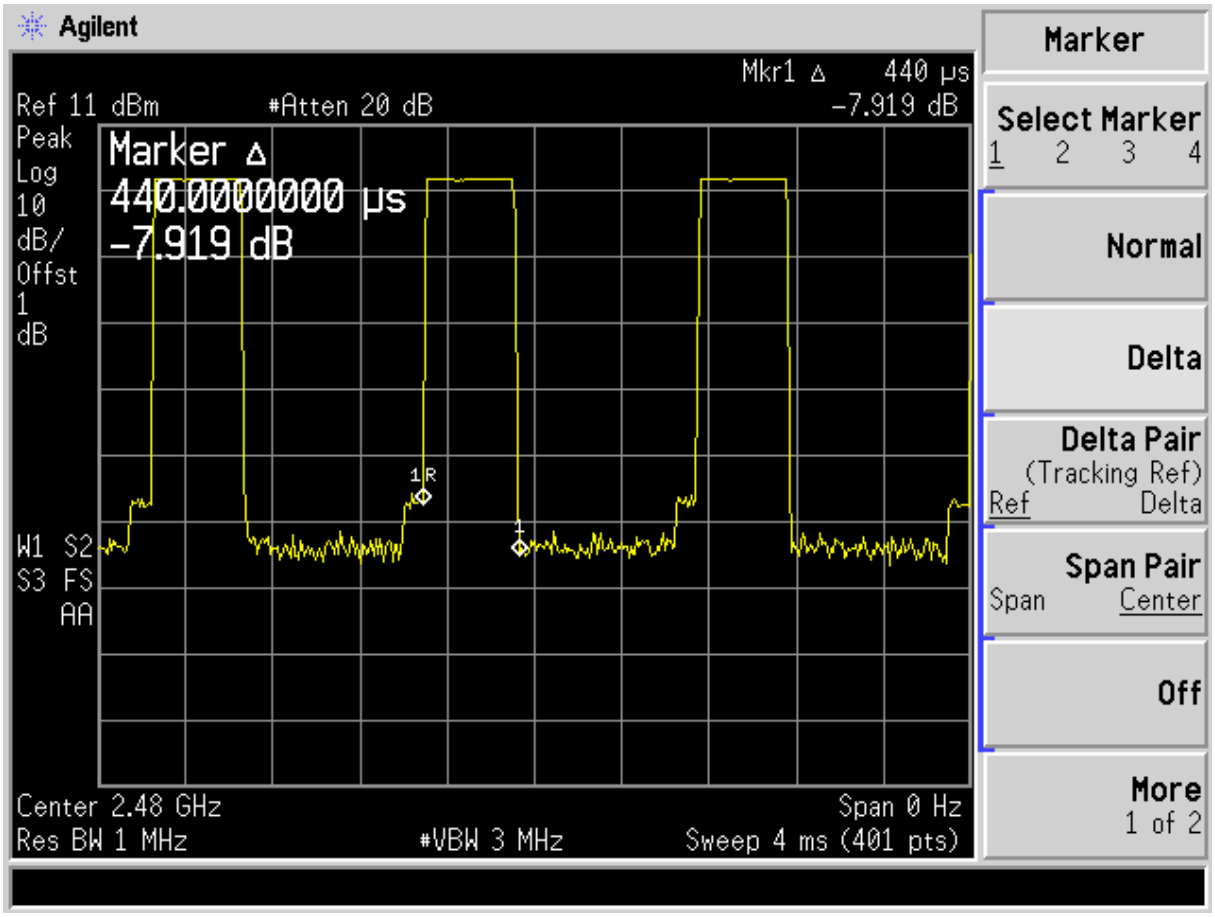
B. Test Plots



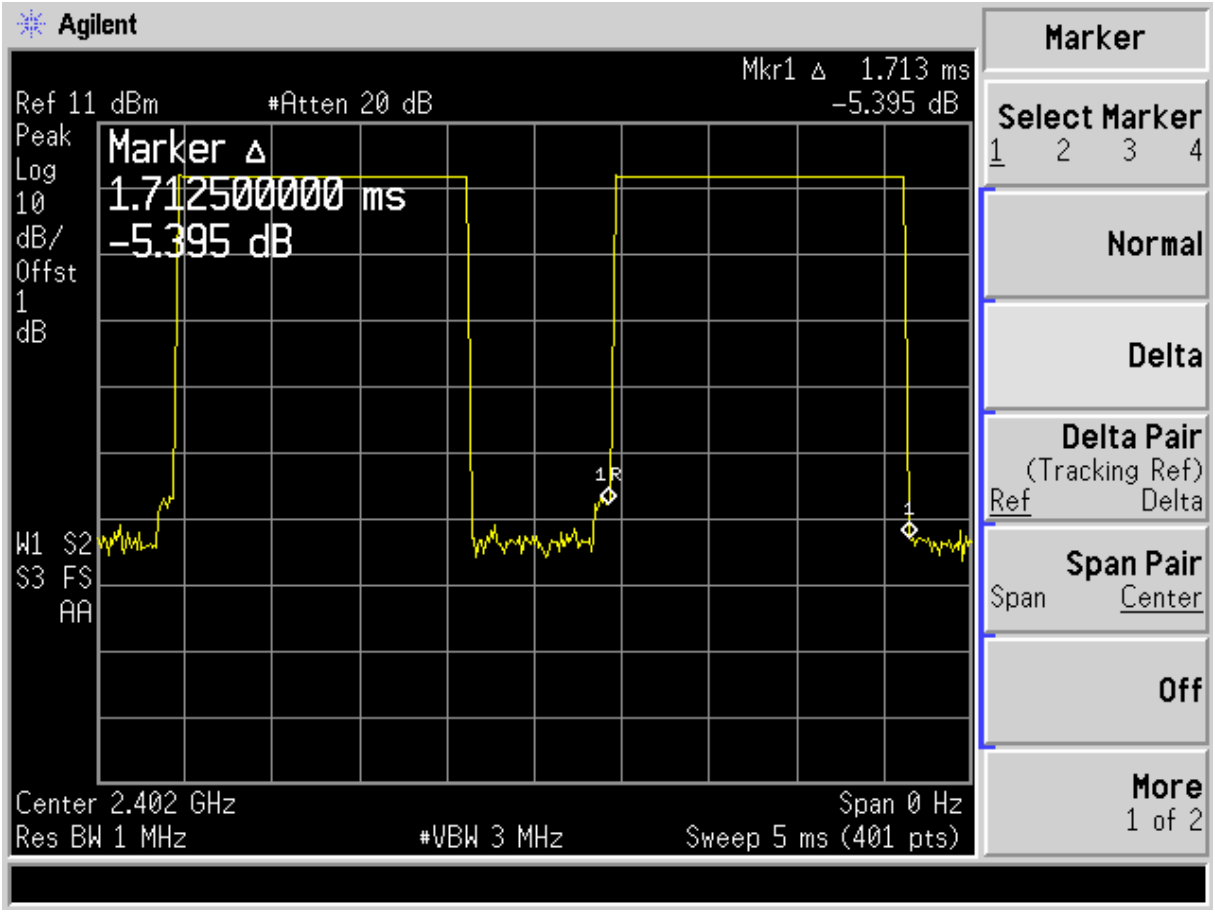
(Plot 4.9.1.A1: Channel 00: 2402MHz @ GFSK @ DH1)



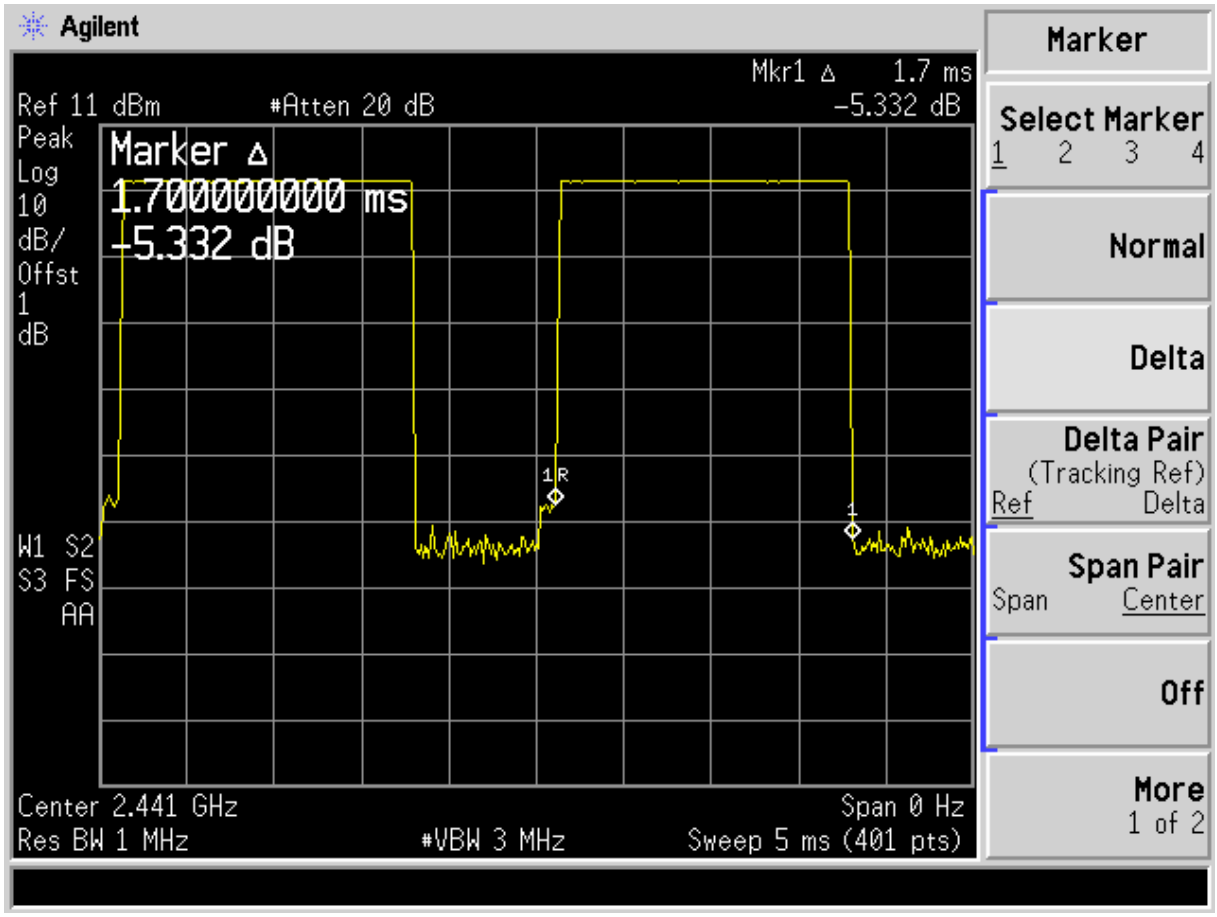
(Plot 4.9.1.A2: Channel 39: 2441MHz @ GFSK @ DH1)



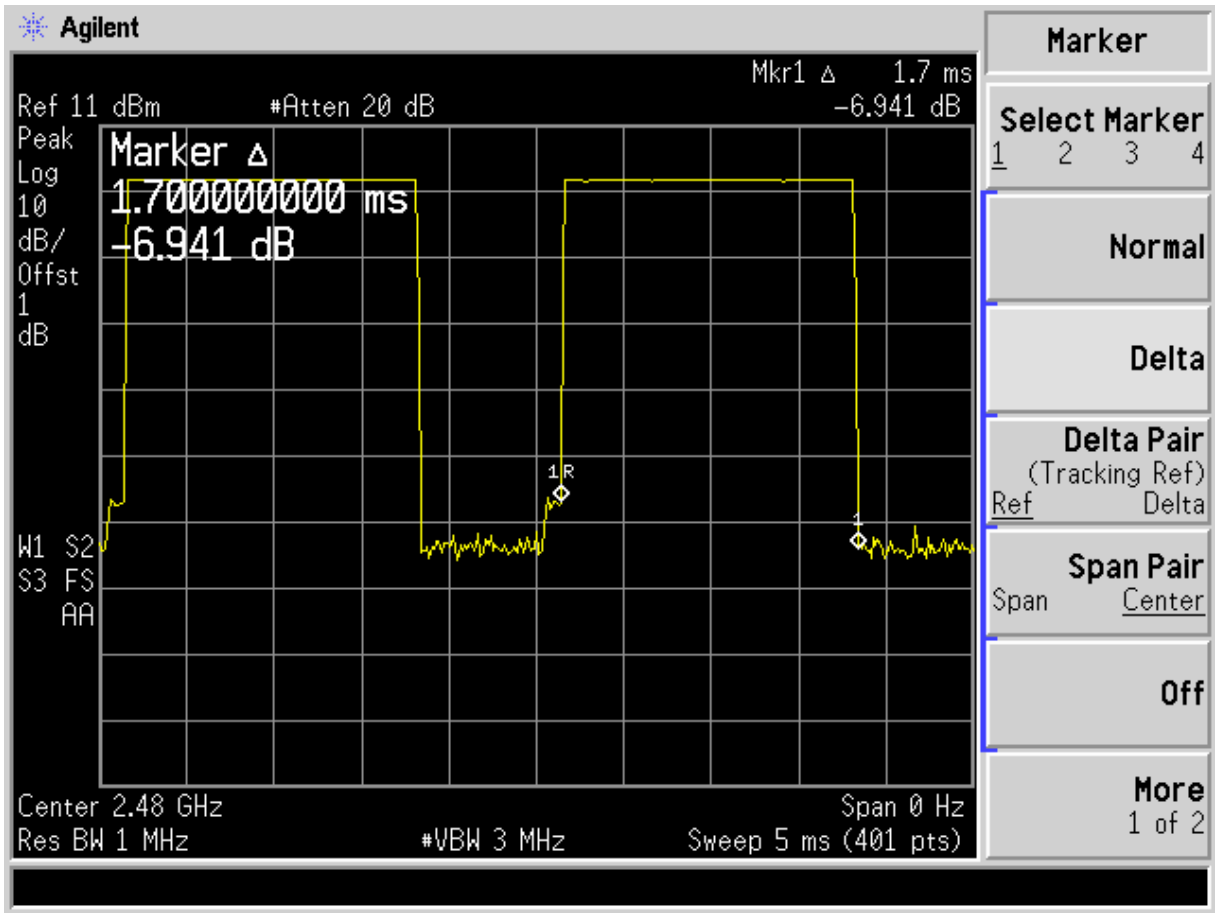
(Plot 4.9.1.A3: Channel 78: 2480MHz @ GFSK @ DH1)



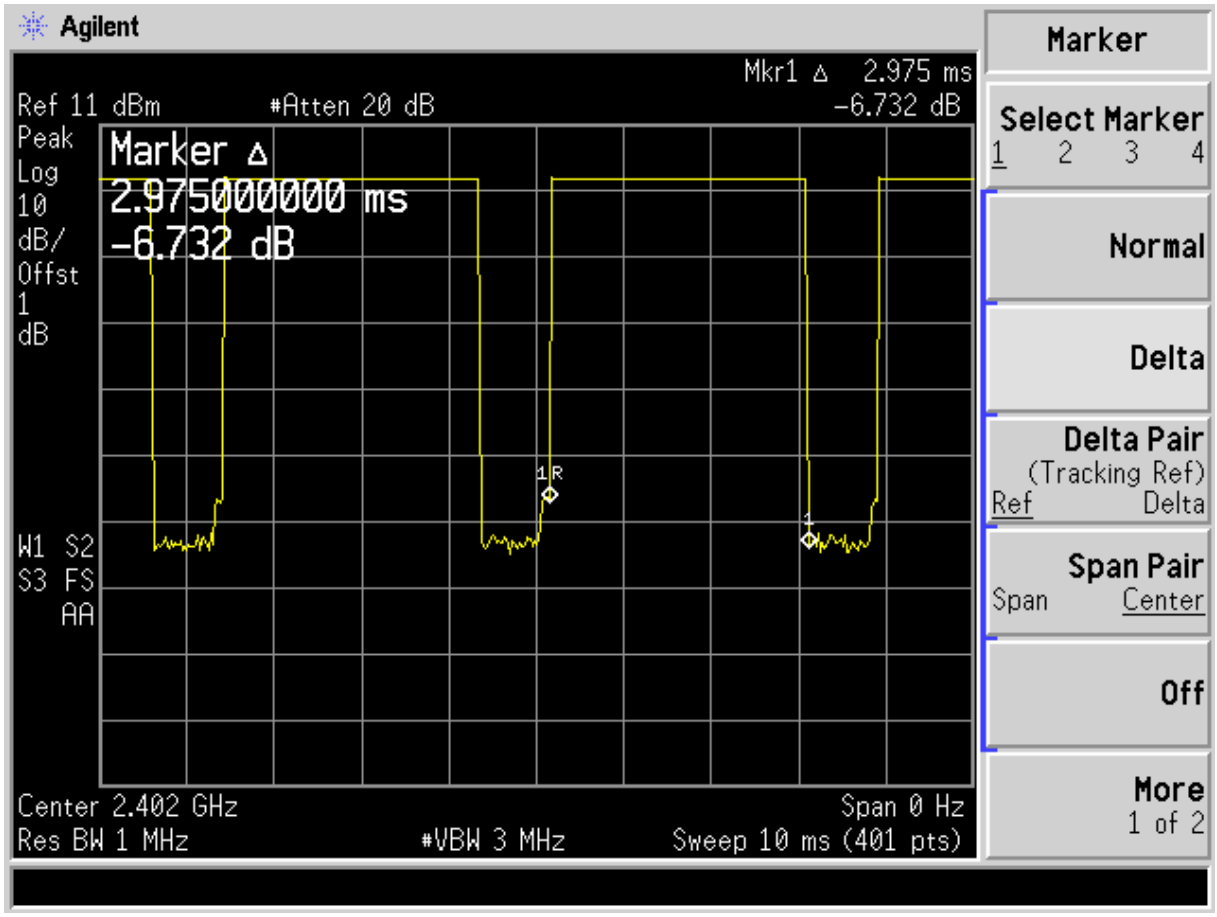
(Plot 4.9.1.B1: Channel 00: 2402MHz @ GFSK @ DH3)



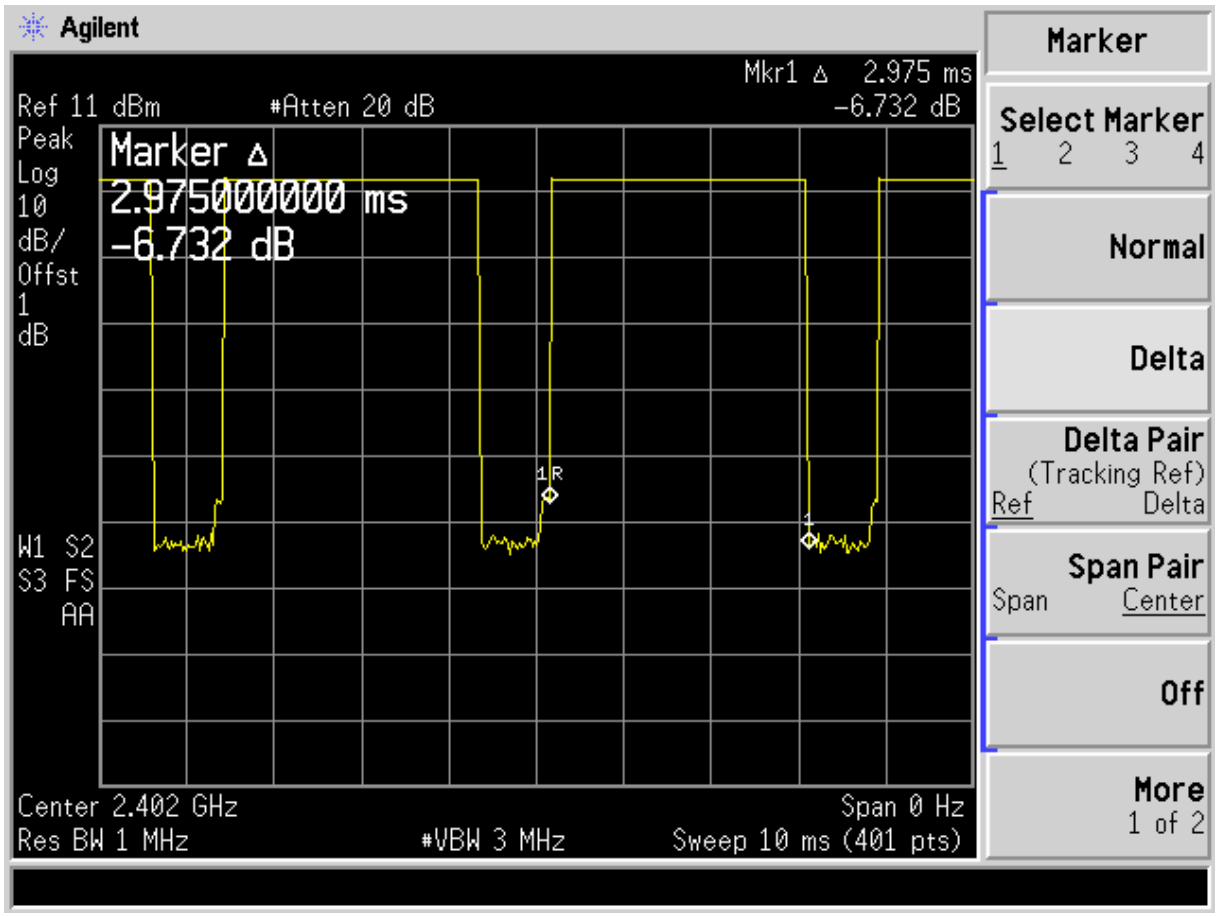
(Plot 4.9.1.B2: Channel 39: 2441MHz @ GFSK @ DH3)



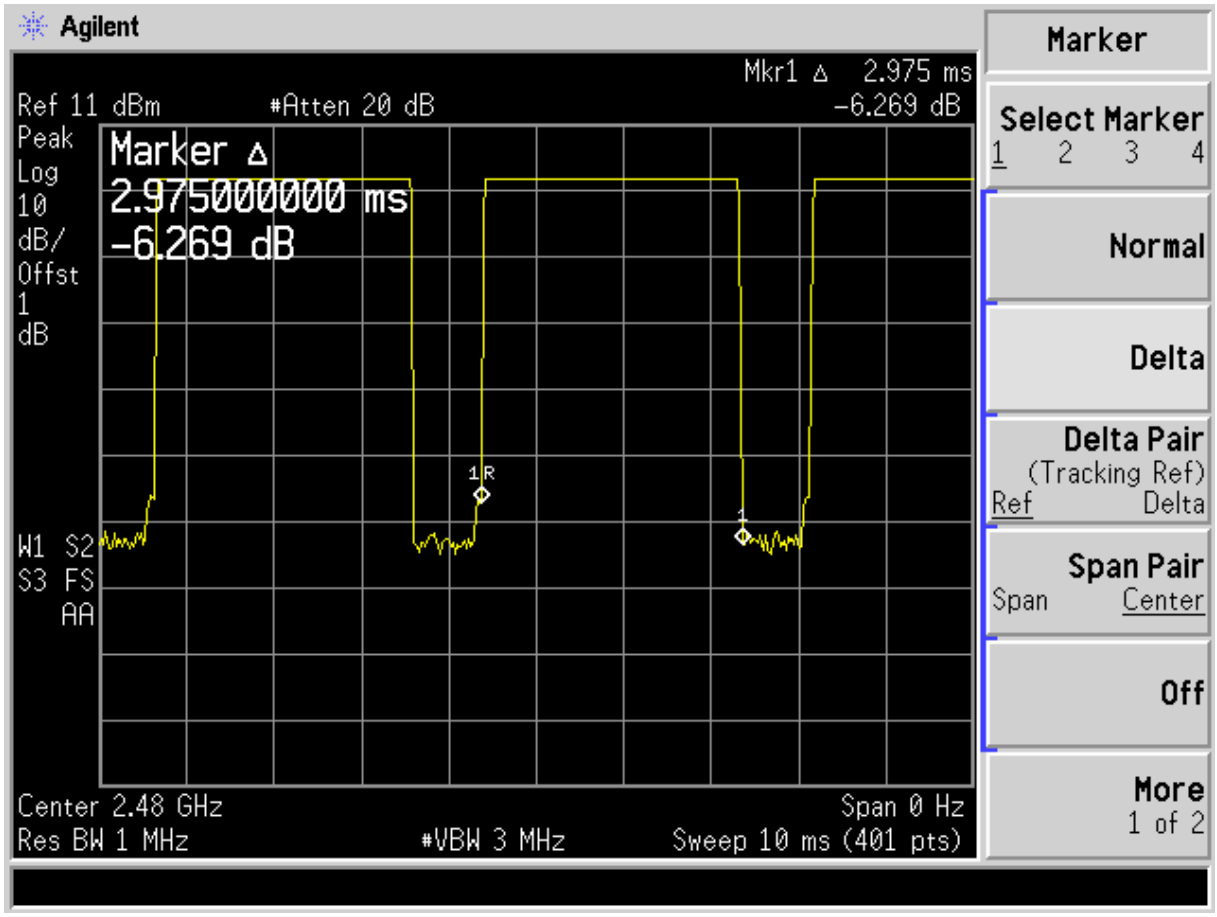
(Plot 4.9.1.B3: Channel 78: 2480MHz @ GFSK @ DH3)



(Plot 4.9.1.C1: Channel 00: 2402MHz @ GFSK @ DH5)



(Plot 4.9.1.C2: Channel 39: 2441MHz @ GFSK @ DH5)



(Plot 4.9.1.C3: Channel 78: 2480MHz @ GFSK @ DH5)

4.10. Pseudorandom Frequency Hopping Sequence

TEST APPLICABLE

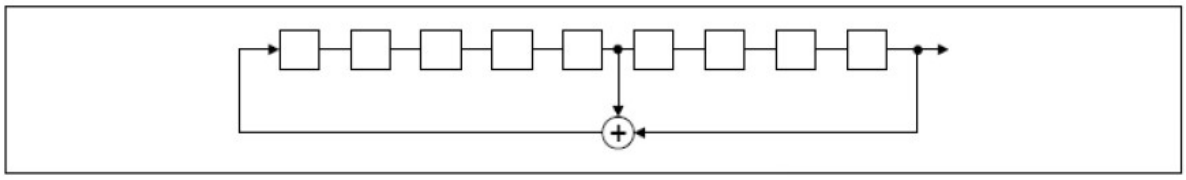
For 47 CFR Part 15C section 15.247 (a)(1) requirement:

Frequency hopping systems shall have hopping channel carrier fre-quencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hop-ping channel, whichever is greater. Al-ternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier fre-quencies 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 125 mW. The system shall hop to chan-nel frequencies that are selected at the system hopping rate from a pseudo ran-domly ordered list of hopping fre-quencies. Each frequency must be used equally on the average by each trans-mitter. The system receivers shall have input bandwidths that match the hop-ping channel bandwidths of their cor-responding transmitters and shall shift frequencies in synchronization with the transmitted signals.

EUT Pseudorandom Frequency Hopping Sequence Requirement

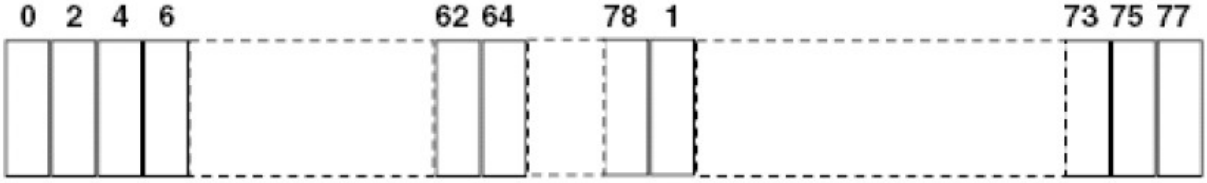
The pseudorandom frequency hopping sequence may be generated in a nice-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage.And the result is fed back to the input of the frist stage.The sequence begins with the frist one of 9 consecutive ones,for example:the shift register is initialized with nine ones.

- Number of shift register stages:9
- Length of pseudo-random sequence:29-1=511 bits
- Longest sequence of zeros:8(non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An explame of pseudorandom frequency hopping sequence as follows:



Each frequency used equally one the average by each transmitter.
The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitter and shift frequencies in synchronization with the transmitted signals.

4.11. Antenna Requirement

Standard Applicable

For intentional device, according to FCC 47 CFR Section 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.

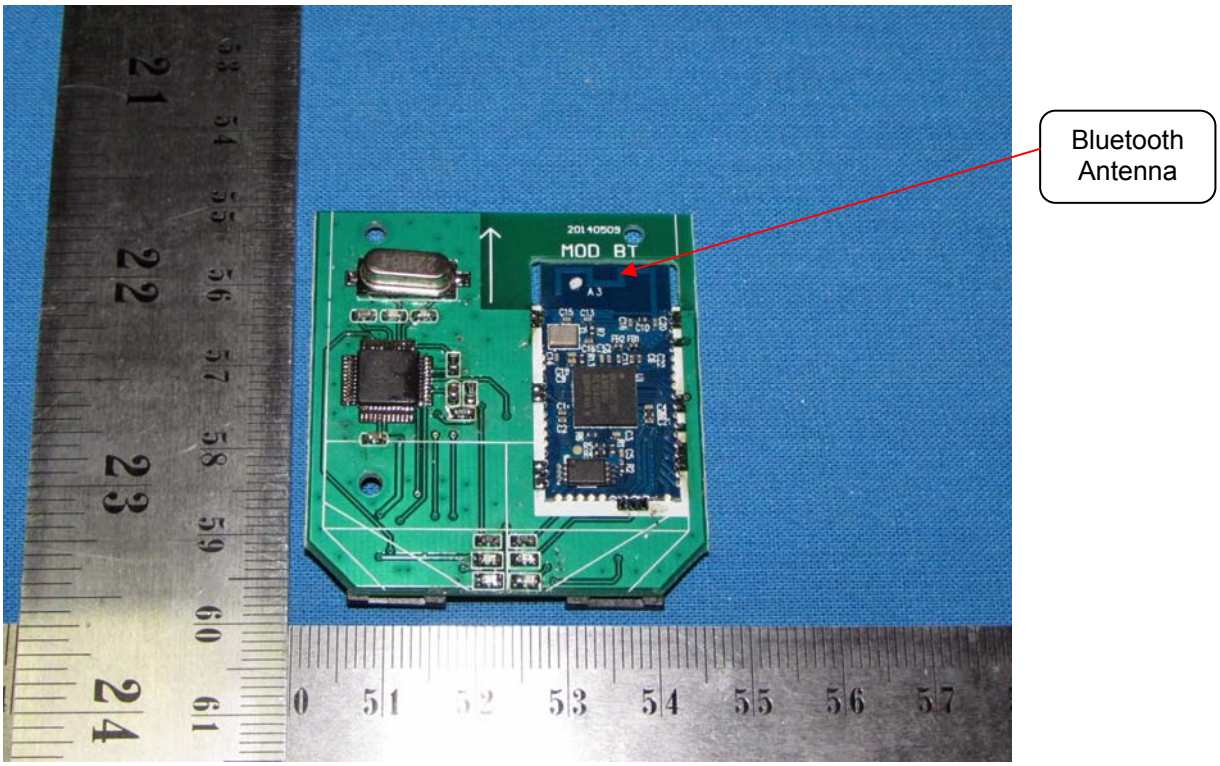
And according to FCC 47 CFR Section 15.247 (c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

Refer to statement below for compliance.

The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

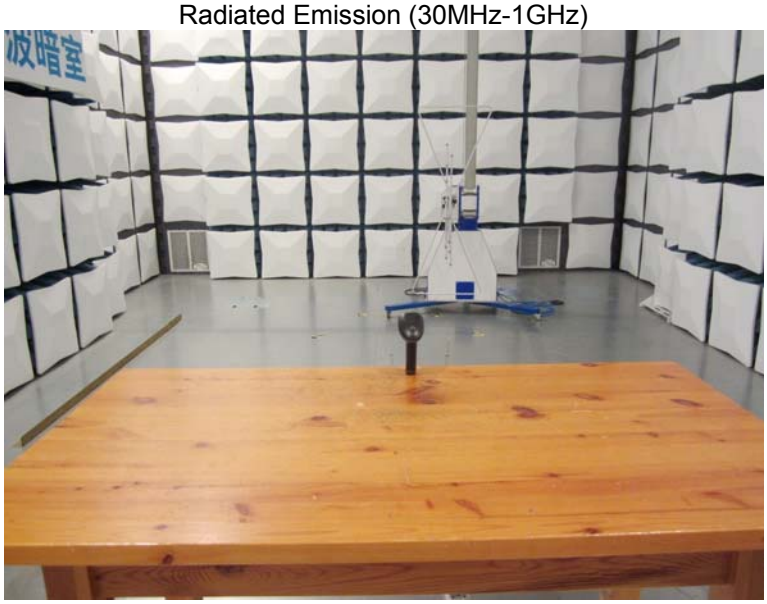
Antenna Connected Construction

The maximum gain of bluetooth antenna was 0.00 dBi.

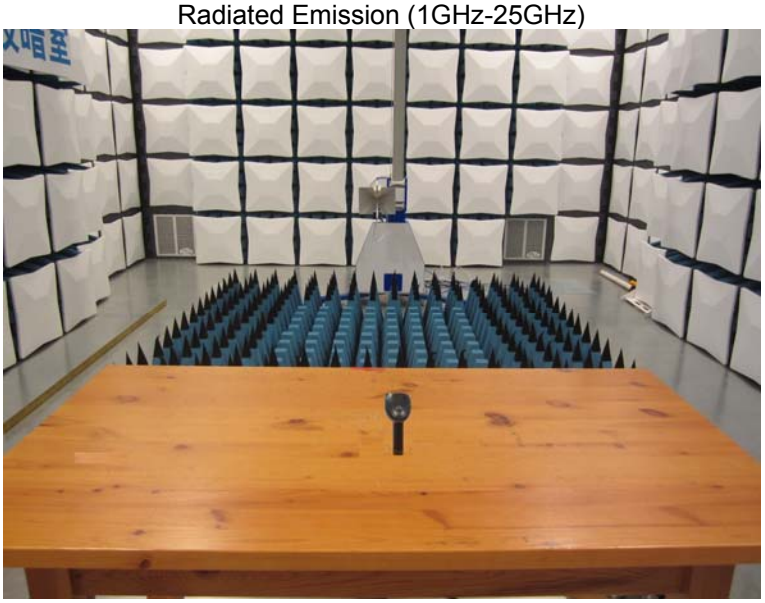


5. Test Setup Photos of the EUT

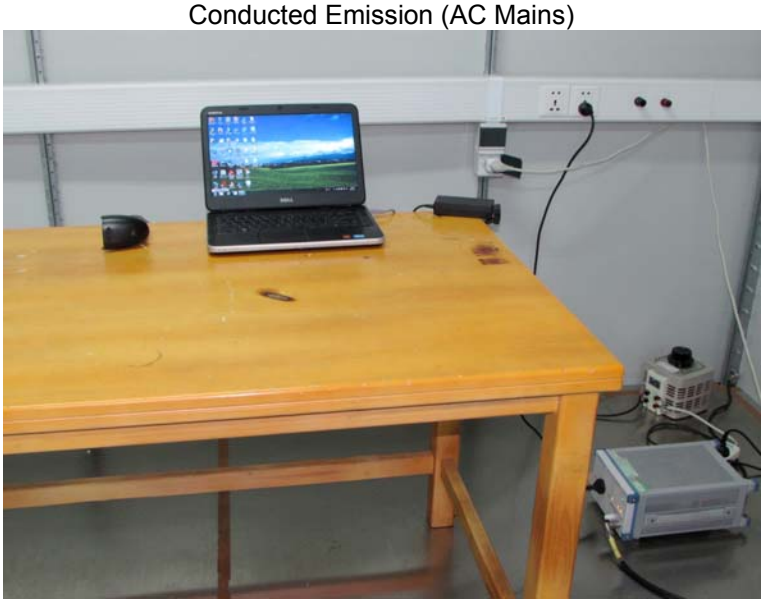
Radiated Emission (30MHz-1GHz)



Radiated Emission (1GHz-25GHz)

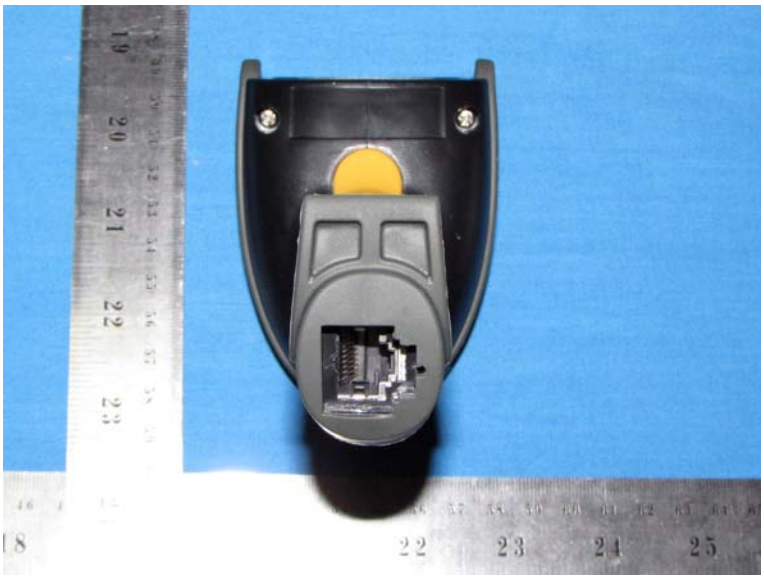


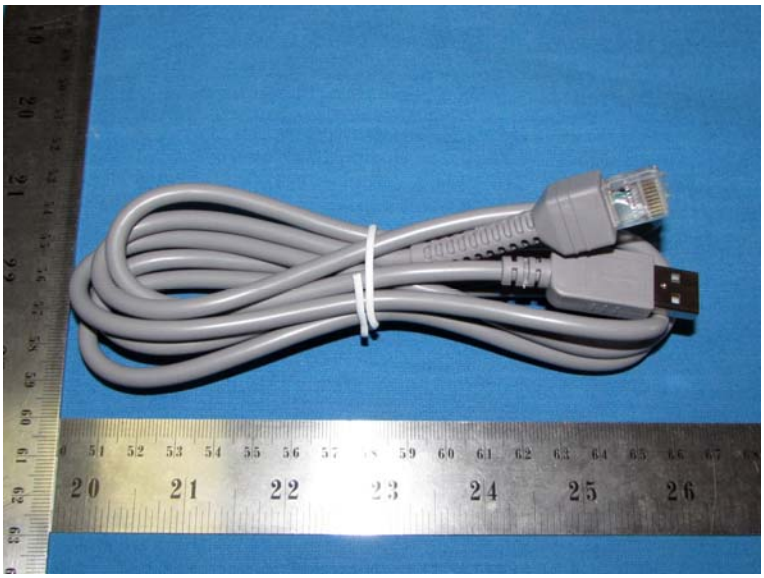
Conducted Emission (AC Mains)



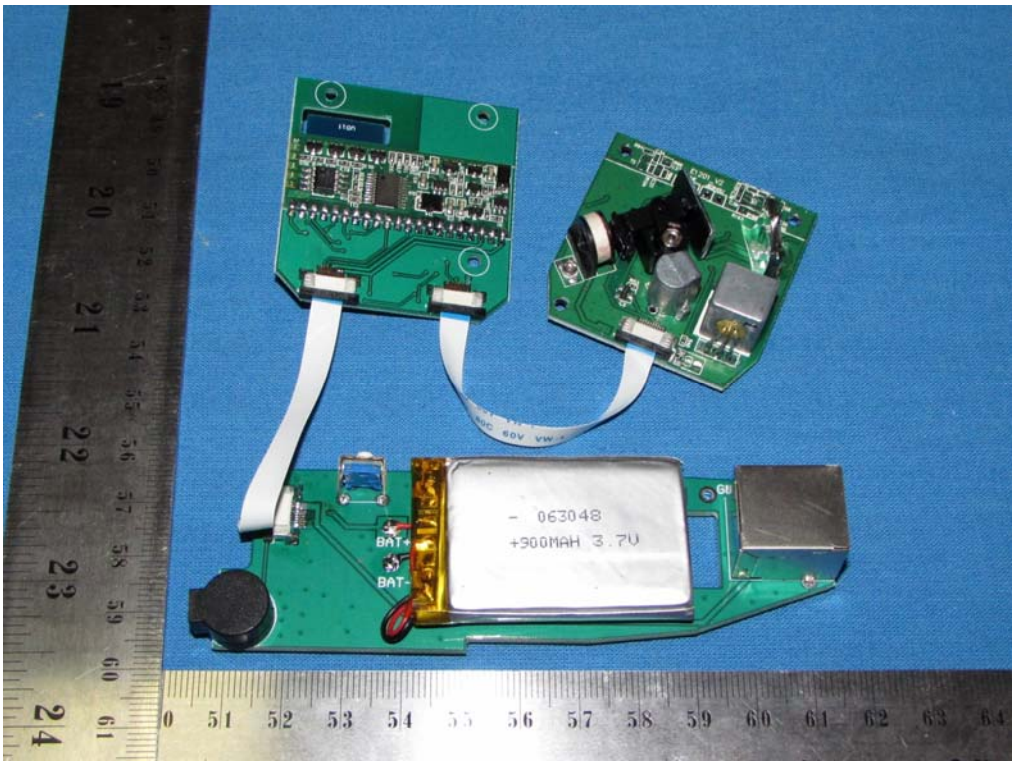
6. External and Internal Photos of the EUT

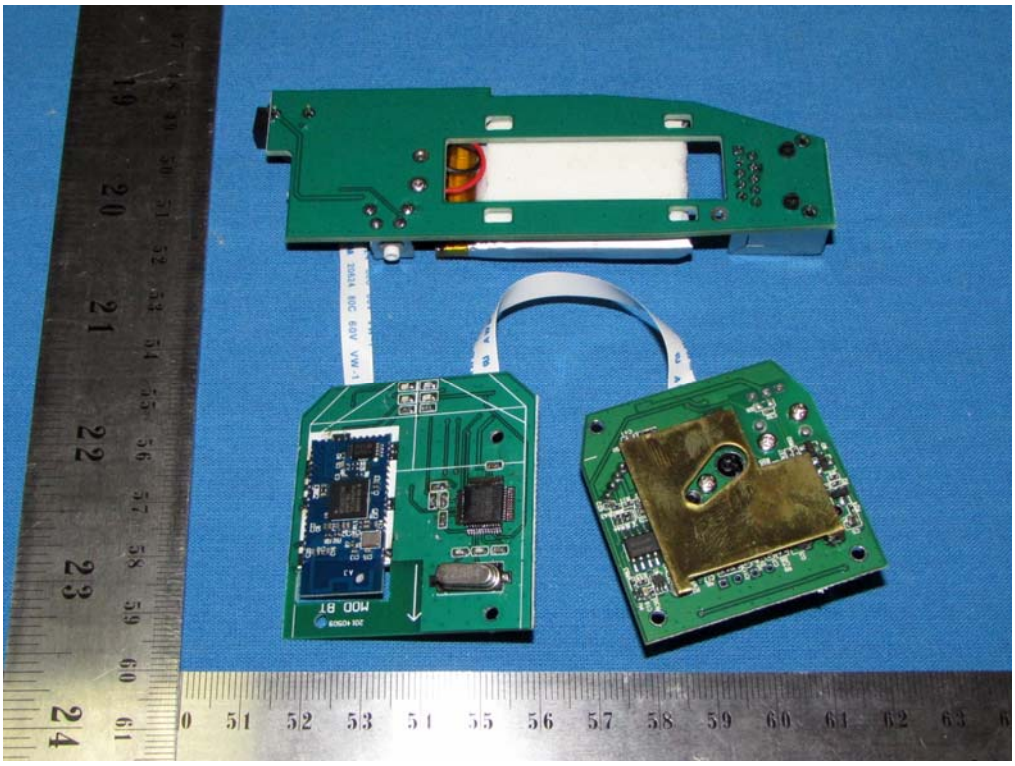
External Photos

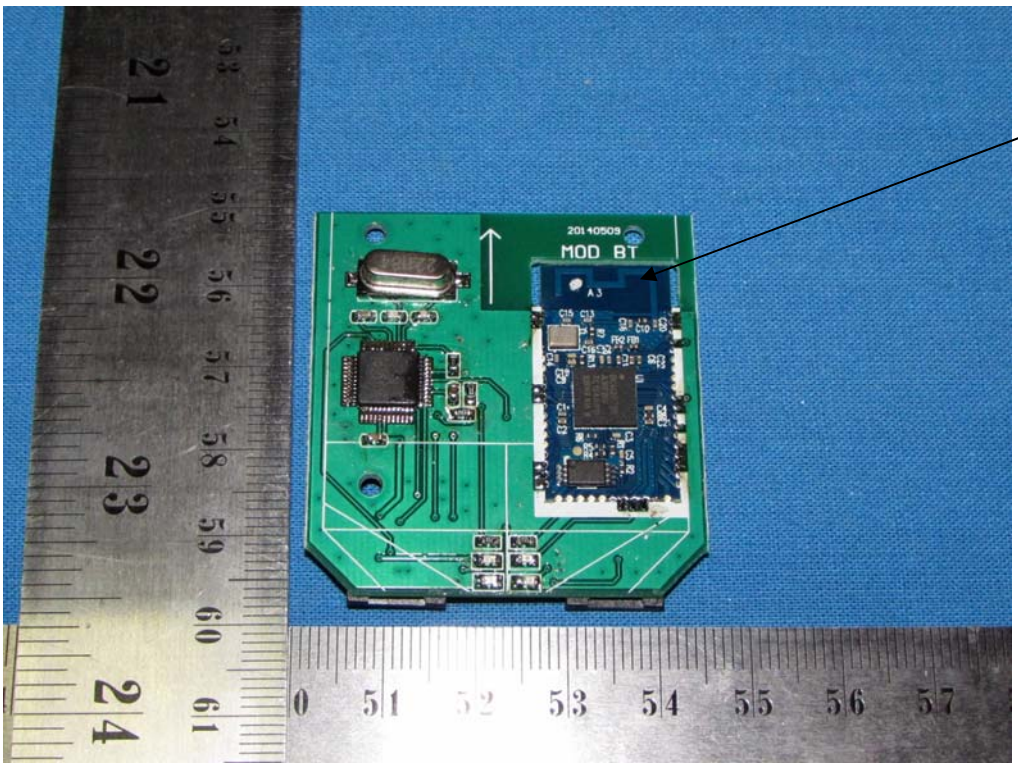


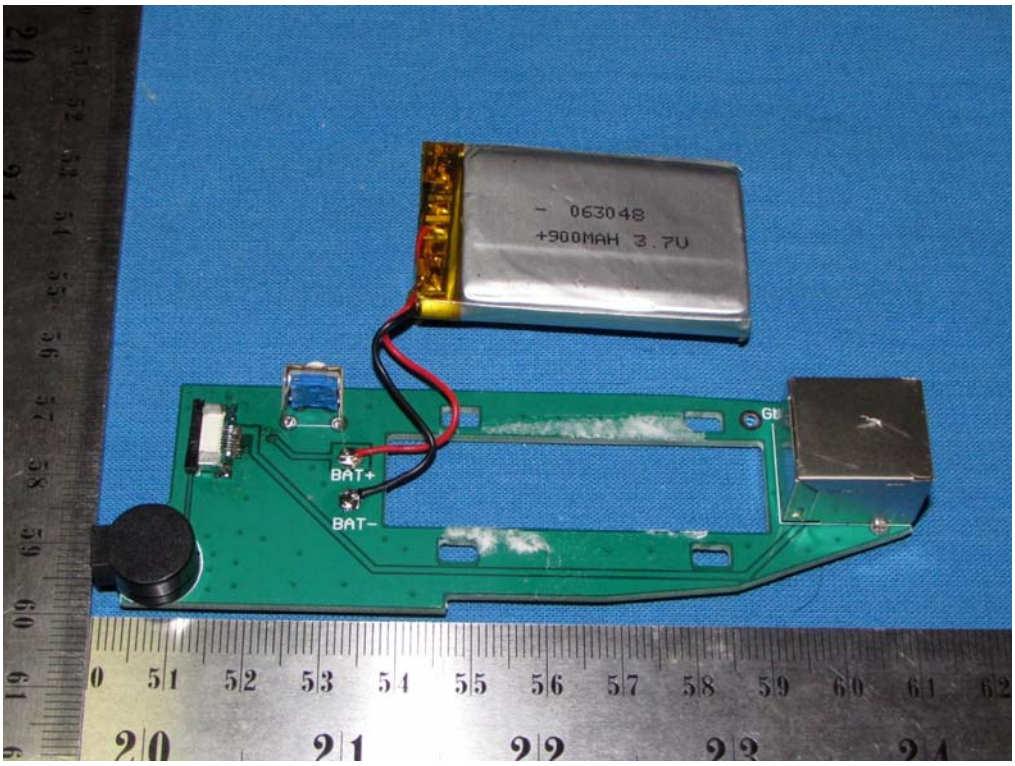


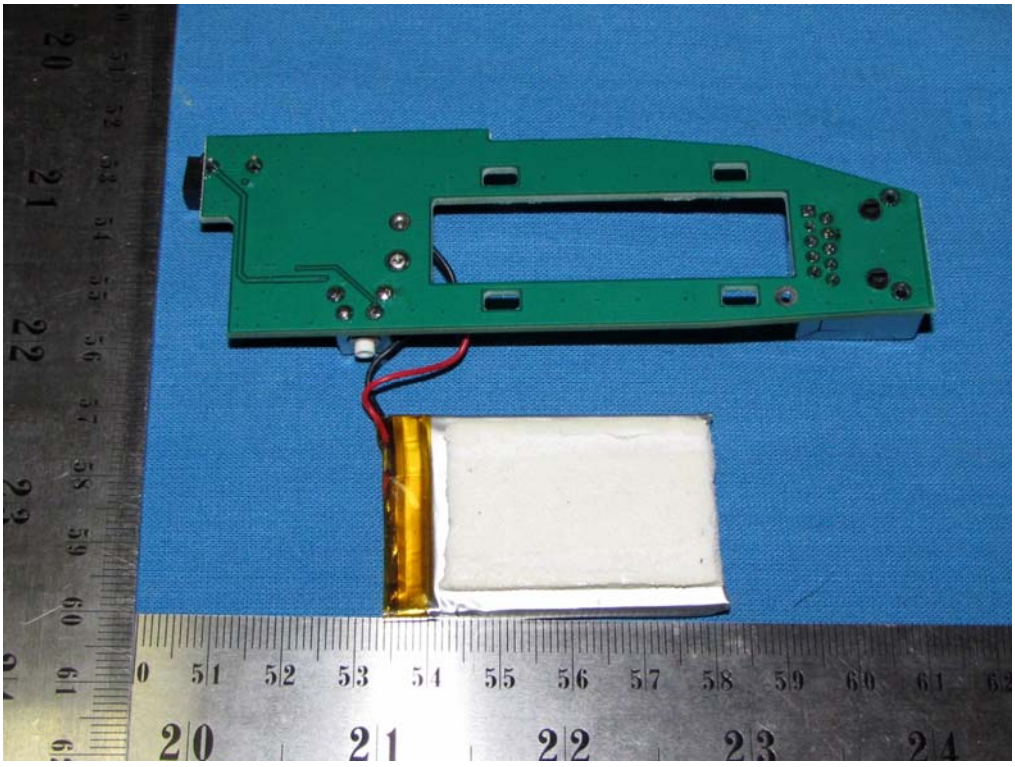
Internal Photos

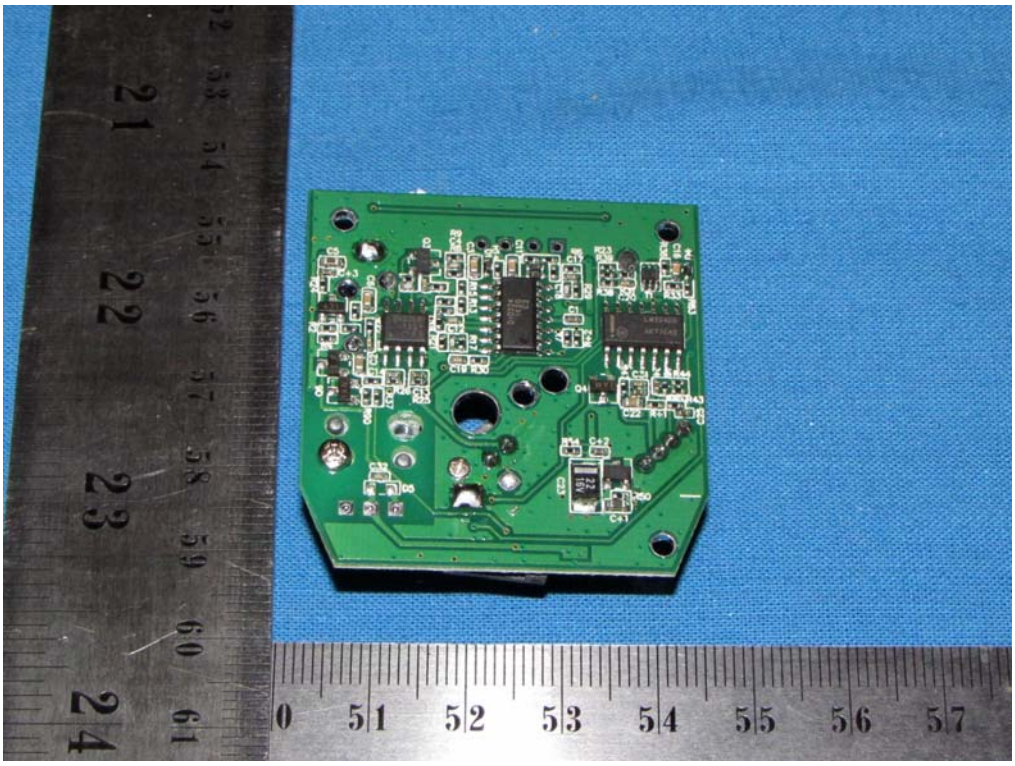


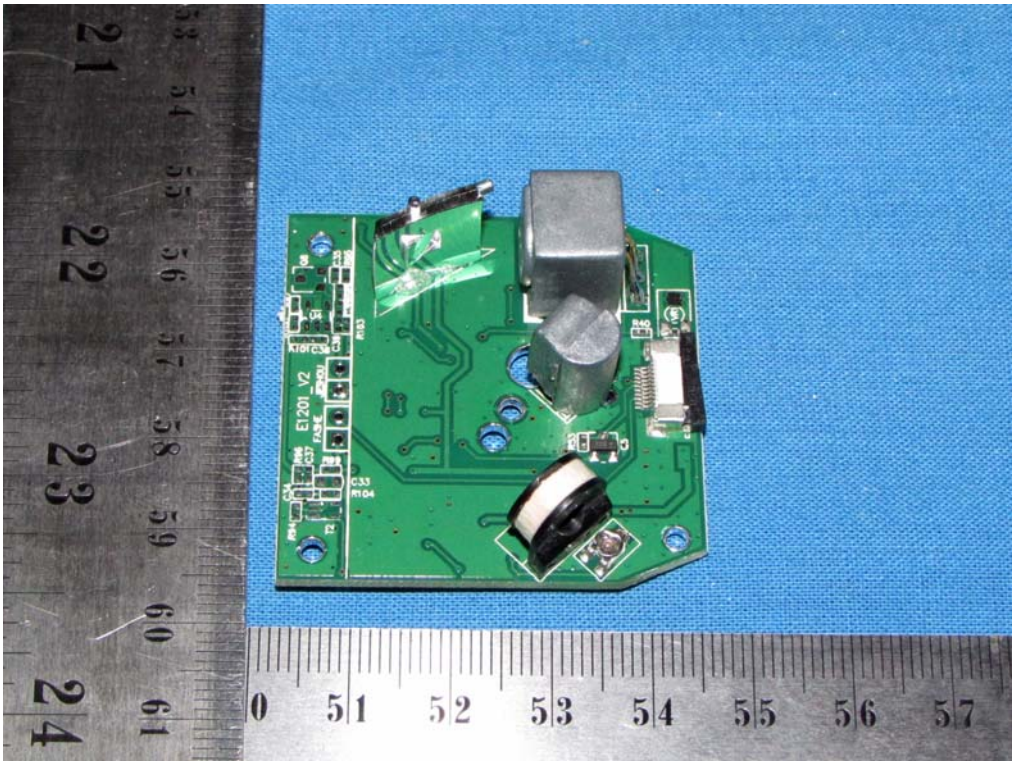


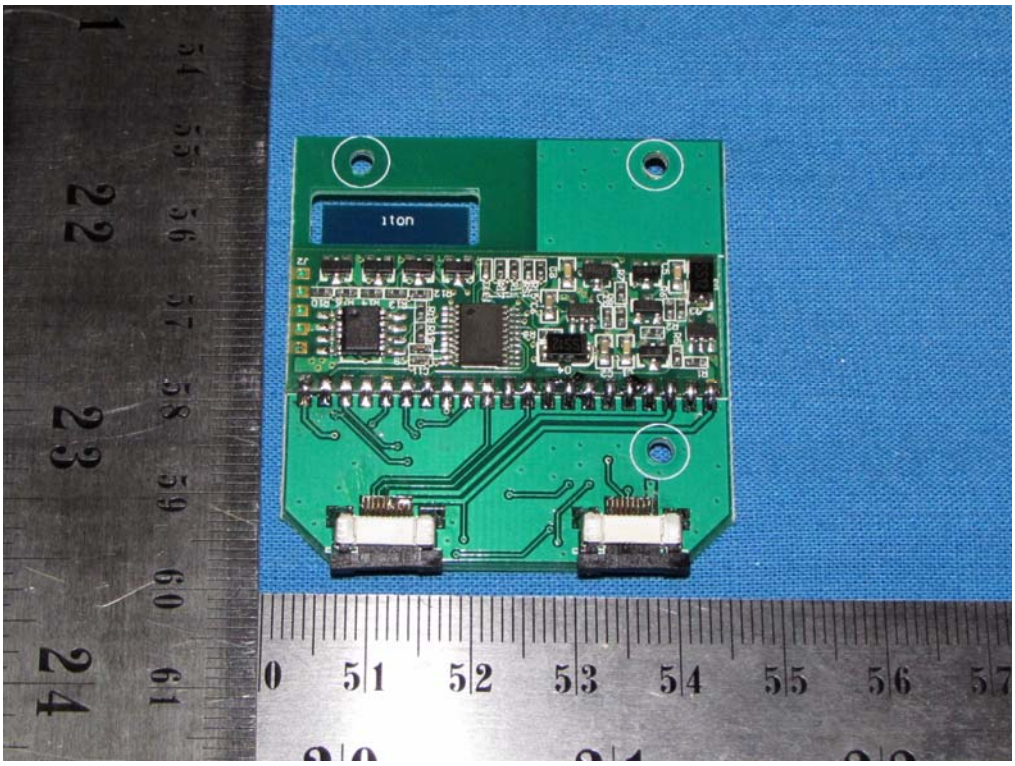

BT
Antenna
20140509
MOD BT
A3

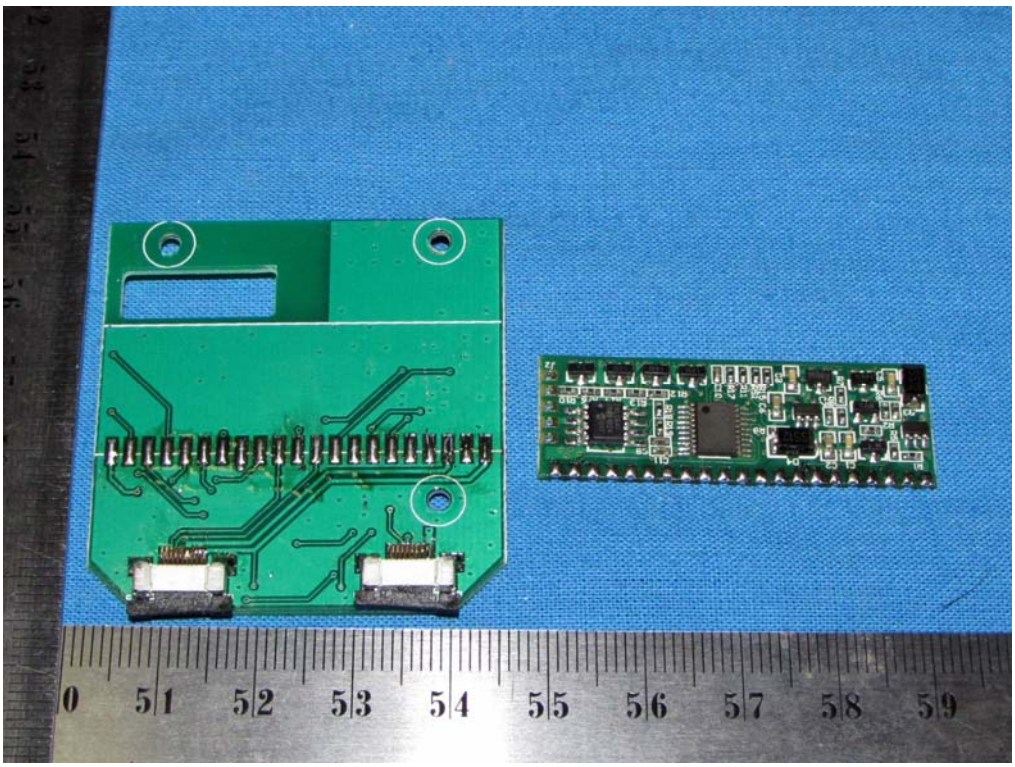

063048
+900MAH 3.7V
BAT+
BAT-

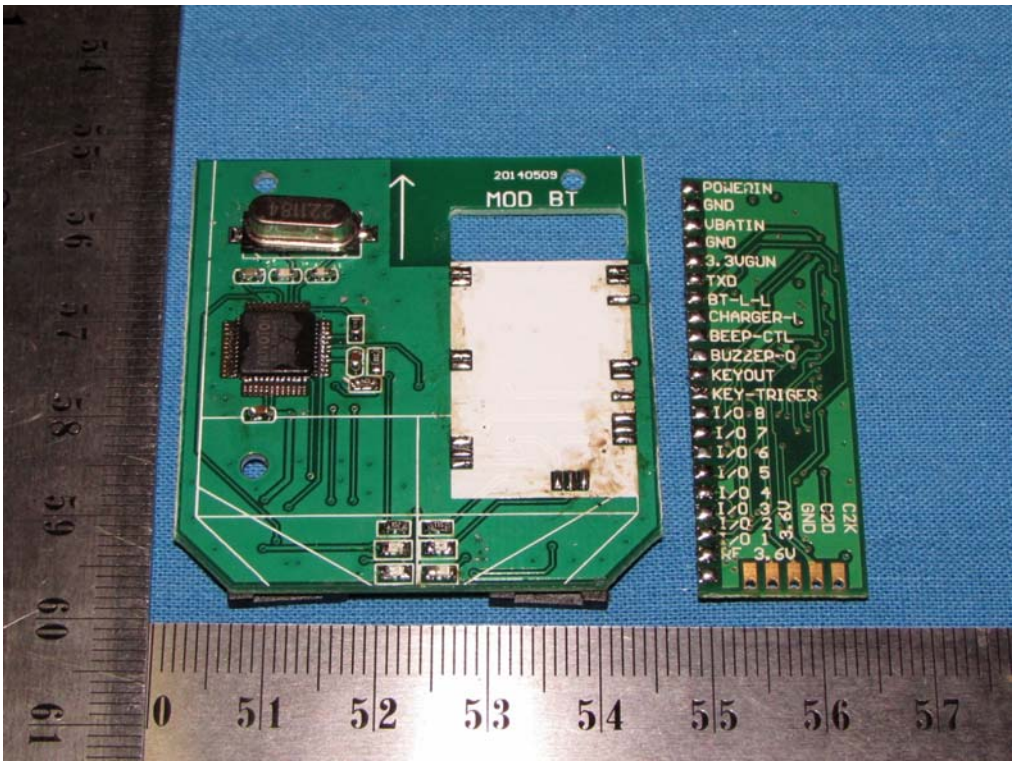





E1201_V2






20140509
MOD BT
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VBATIN
GND
3.3VGUN
TXD
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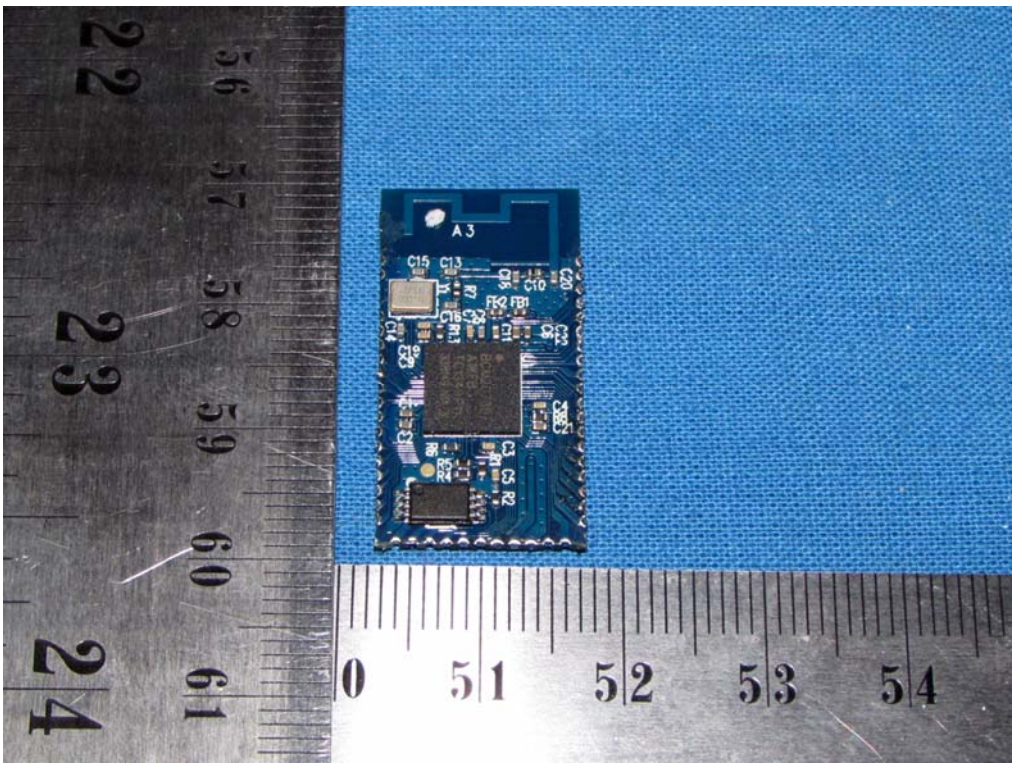
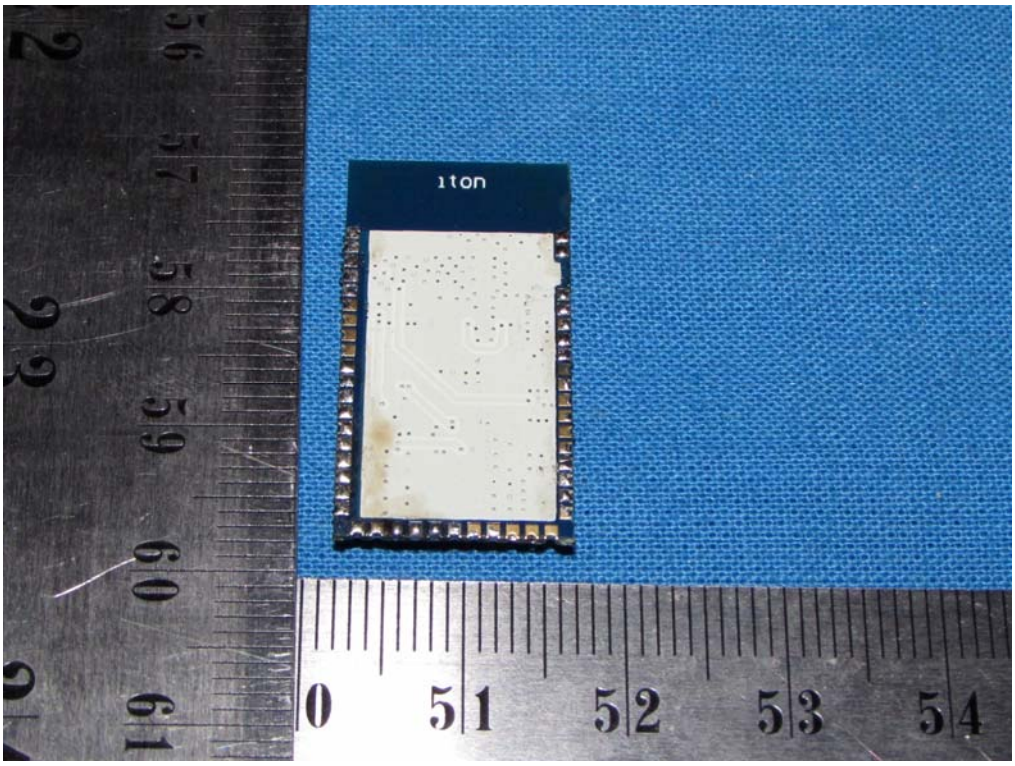
CHARGER-L
BEEP-CTL
BUZZER-O
KEYOUT
KEY-TRIGER
I/O 8
I/O 7
I/O 6
I/O 5
I/O 4
I/O 3
I/O 2
I/O 1
RF 3.6V
3.6V
GND
C2D
C2K


A3



.....End of Report.....