Shenzhen Global Test Service Co.,Ltd.
1F, Building No. 13A, Zhonghaixin Science and Technology City, No.12,6 Road, Ganli Industrial Park, Buji Street, Longgang District, Shenzhen, Guangdong

FCC PART 15 SUBPART C TEST REPORT

FCC PART 15.247

Report Reference No.....:	**GTSR15080020-EDR**
FCC ID..... :	**2AFQFYC01**
Compiled by (position+printed name+signature)..:	File administrators Jimmy Wang
Supervised by (position+printed name+signature)..:	Test Engineer Peter Xiao
Approved by (position+printed name+signature)..:	Manager Sam Wang
Date of issue.....:	Aug. 31, 2015
Representative Laboratory Name :	**Shenzhen Global Test Service Co.,Ltd.**
Address .....:	1F, Building No. 13A, Zhonghaixin Science and Technology City, No.12,6 Road, Ganli Industrial Park, Buji Street, Longgang District, Shenzhen, Guangdong
Testing Laboratory Name ..... :	**Shenzhen CTL Testing Technology Co., Ltd**
Address .....:	1/F.-A, Baisha Technology Park, No.3011, Shahexi Road, Nanshan District, Shenzhen, Guangdong, China
Applicant's name.....:	**Shenzhen FuJinYing Electronic Co.,Ltd**
Address .....:	4F-B, Block 3 of Fuda Industrial Park, No.68 YuanLing Ave, ShangWu Community, ShiYan Avenue, BaoAn District, Shenzhen city, GuangDong Prov, China
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 Global Test Service Co.,Ltd.
Master TRF.....:	Dated 2014-12

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Test item description .....:	Stick Computer
Trade Mark .....:	/
Manufacturer .....:	**Shenzhen FuJinYing Electronic Co.,Ltd**
Model/Type reference.....:	YC-01
Listed Models .....:	/
Modulation Type .....:	GFSK,Π/4DQPSK,8DPSK
Operation Frequency.....:	From 2402MHz to 2480MHz
EUT Type .....:	Production Unit
Rating .....:	DC 5.0V from Adapter AC 120V/60Hz
Result.....:	**PASS**

T E S T R E P O R T

Test Report No. :	GTSR15080020-EDR	Aug. 31, 2015 Date of issue

Equipment under Test	:	Stick Computer
Model /Type	:	YC-01
Listed Models	:	/
Applicant	:	**Shenzhen FuJinYing Electronic Co.,Ltd**
Address	:	4F-B, Block 3 of Fuda Industrial Park, No.68 YuanLing Ave, ShangWu Community, ShiYan Avenue, BaoAn District, Shenzhen city, GuangDong Prov, China
Manufacturer	:	**Shenzhen FuJinYing Electronic Co.,Ltd**
Address	:	4F-B, Block 3 of Fuda Industrial Park, No.68 YuanLing Ave, ShangWu Community, ShiYan Avenue, BaoAn District, Shenzhen city, GuangDong Prov, China

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.

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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
DA 00-705: Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems

2. SUMMARY

2.1. General Remarks

Date of receipt of test sample	:	Aug. 17, 2015
Testing commenced on	:	Aug. 17, 2015
Testing concluded on	:	Aug. 31, 2015

2.2. Product Description

The **Shenzhen FuJinYing Electronic Co.,Ltd**'s Model: YC-01 or the "EUT" as referred to in this report; more general information as follows, for more details, refer to the user's manual of the EUT.

Name of EUT	Stick Computer
Model Number	YC-01
FCC ID	2AFQFYC01
Antenna Type	Internal
WLAN FCC Operation frequency	IEEE 802.11b: 2412MHz—2462MHz IEEE 802.11g: 2412MHz—2462MHz IEEE 802.11n HT20: 2412MHz—2462MHz IEEE 802.11n HT40: 2422MHz—2452MHz
Bluetooth FCC Operation frequency	2402MHz-2480MHz
WLAN Modulation	IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK) IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n HT20: OFDM (64QAM, 16QAM, QPSK,BPSK) IEEE 802.11n HT40: OFDM (64QAM, 16QAM, QPSK,BPSK)
Bluetooth Modulation	GFSK (BT 4.0)/GFSK,8DPSK,π/4DQPSK(BT v2.1+EDR)
WLAN	Supported 802.11b/802.11g/802.11n HT20/802.11n HT40
Bluetooth	Supported BT4.0 and BT v2.1+EDR

2.3. Equipment Under Test

Power supply system utilised

Power supply voltage	:	○	230V / 50 Hz	○	120V / 60Hz
		○	12 V DC	○	24 V DC
		●	Other (specified in blank below)		

DC 5.0V from Adapter AC 120V/60Hz

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

This is a stick computer.

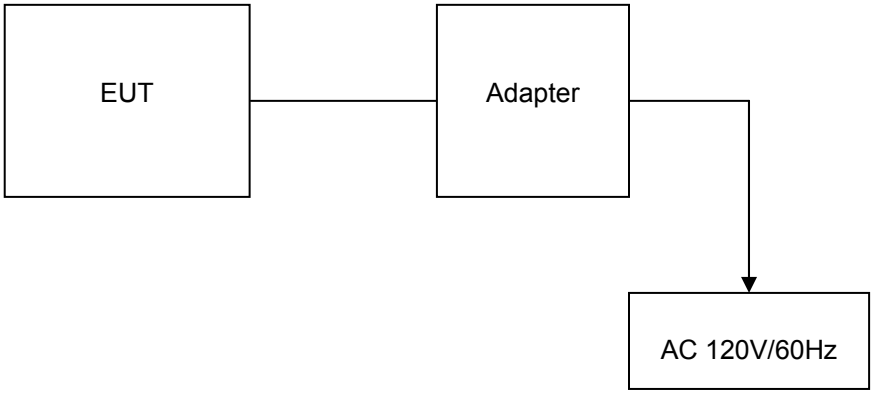
For more details, refer to the user's manual of the EUT.

2.5. EUT operation mode

The Applicant provides communication tools software to control the EUT for staying in continuous transmitting (Duty Cycle more than 98%) and receiving mode for testing .There are 79 channels provided to the EUT. Channel 00/39/78 was selected to test.

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		

2.6. Block Diagram of Test Setup



Adapter:

Model: HJ520
Input: 100-240V～50/60Hz 0.25A
Output: 5.0V DC 2A
Power Cable: 150cm
◇ Shielded ◆ Unshielded

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

This submittal(s) (test report) is intended for **FCC ID: 2AFQFYC01** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

2.8. Modifications

No modifications were implemented to meet testing criteria.

2.9. NOTE

1. The EUT is a stick computer with WLAN and Bluetooth function,The functions of the EUT listed as below:

	Test Standards	Reference Report
WLAN	FCC Part 15 Subpart C	GTSR15080020-WLAN
Bluetooth-EDR	FCC Part 15 Subpart C	GTSR15080020-EDR
Bluetooth-BLE	FCC Part 15 Subpart C	GTSR15080020- BLE
MPE	FCC Per 47 CFR 2.1093(d)	GTSR15080020-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

Shenzhen CTL Testing Technology Co., Ltd
1/F.-A, Baisha Technology Park, No.3011, Shahexi Road, Nanshan District, Shenzhen, Guangdong, China

3.2. Test Facility

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

FCC-Registration No.: 964637

Shenzhen Global Test 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 964637, Jul 24, 2015.

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. Summary of measurement results

Test Specification clause	Test case	Test Mode	Test Channel	Recorded In Report		Pass	Fail	NA	NP	Remark
§15.247(b)(4)	Antenna gain	GFSK	☒ Lowest ☒ Middle ☒ Highest	GFSK	☒ Lowest ☒ Middle ☒ Highest	☒	☐	☐	☐	complies
§15.247(e)	Power spectral density	-/-	-/-	-/-	-/-	☐	☐	☒	☐	Not applicable for FHSS
§15.247(a)(1)	Carrier Frequency separation	GFSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK 8DPSK	☒ Middle	☒ ☒	☐	☐	☐	complies
§15.247(a)(1)	Number of Hopping channels	GFSK 8DPSK	☒ Full	GFSK 8DPSK	☒ Full	☒ ☒	☐	☐	☐	complies
§15.247(a)(1)	Time of Occupancy (dwell time)	GFSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK 8DPSK	☒ Middle	☒ ☒	☐	☐	☐	complies
§15.247(a)(1)	Spectrum bandwidth of a FHSS system 20dB bandwidth	GFSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	☒ ☒	☐	☐	☐	complies
§15.247(b)(1)	Maximum output power	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK Π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	☒ ☒ ☒	☐	☐	☐	complies
§15.247(d)	Band edge compliance conducted	GFSK 8DPSK	☒ Lowest ☒ Highest	GFSK 8DPSK	☒ Lowest ☒ Highest	☒ ☒	☐	☐	☐	complies
§15.205	Band edge compliance radiated	GFSK 8DPSK	☒ Lowest ☒ Highest	GFSK	☒ Lowest ☒ Highest	☒	☐	☐	☐	complies
§15.247(d)	TX spurious emissions conducted	GFSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	☒ ☒	☐	☐	☐	complies
§15.247(d)	TX spurious emissions radiated	GFSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK	☒ Lowest ☒ Middle ☒ Highest	☒	☐	☐	☐	complies
§15.109	RX spurious emissions radiated	-/-	-/-	-/-	-/-	☒	☐	☐	☐	complies
§15.209(a)	TX spurious Emissions radiated < 30 MHz	GFSK	-/-	GFSK	-/-	☒	☐	☐	☐	complies
§15.107(a) §15.207	Conducted Emissions < 30 MHz	GFSK	-/-	GFSK	-/-	☒	☐	☐	☐	complies

Remark:
1. The measurement uncertainty is not included in the test result.
2. NA = Not Applicable; NP = Not Performed
3. We tested all test mode and recorded worst case in report
4. For π/4 QPSK its same modulation type with 8-DPSK, and based exploratory test, there is no significant difference of that two types test result, so except output power, all other items final test were only performed with the worse case 8-DPSK and GFSK.

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 Shenzhen CTL Testing Technology 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 Shenzhen CTL Testing Technology Co., Ltd laboratory is reported:

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	30~1000MHz	4.10 dB	(1)
Radiated Emission	1~18GHz	4.32 dB	(1)
Radiated Emission	18-40GHz	5.54 dB	(1)
Conducted Disturbance	0.15~30MHz	3.20 dB	(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

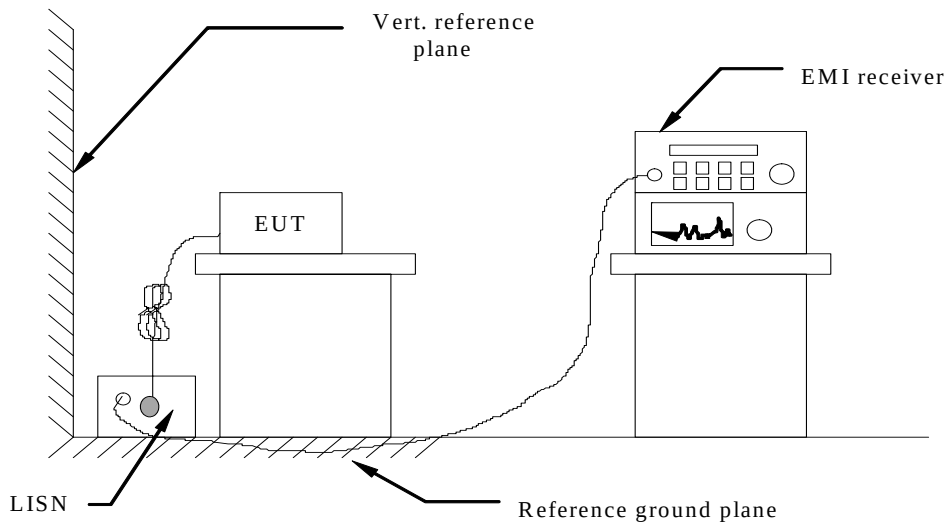
Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
LISN	R&S	ENV216	3560.6550.12	2015/06/02	2016/06/01
LISN	R&S	ESH2-Z5	860014/010	2015/06/02	2016/06/01
Bilog Antenna	Sunol Sciences Corp.	JB1	A061713	2015/06/02	2016/06/01
EMI Test Receiver	R&S	ESCI	103710	2015/06/02	2016/06/01
Spectrum Analyzer	Agilent	N9020A	MY41440676	2015/05/21	2016/05/20
Controller	EM Electronics	Controller EM 1000	N/A	2015/05/21	2016/05/20
Horn Antenna	Sunol Sciences Corp.	DRH-118	A062013	2015/05/19	2016/05/18
Active Loop Antenna	SCHWARZBEC K	FMZB1519	1519-037	2015/05/19	2016/05/18
Amplifier	Agilent	8349B	3008A02306	2015/05/19	2016/05/18
Amplifier	Agilent	8447D	2944A10176	2015/05/19	2016/05/18
Temperature/Humidi ty Meter	Gangxing	CTH-608	02	2015/05/20	2016/05/19
High-Pass Filter	K&L	9SH10-2700/X12750-O/O	N/A	2015/05/20	2016/05/19
High-Pass Filter	K&L	41H10-1375/U12750-O/O	N/A	2015/05/20	2016/05/19
RF Cable	HUBER+SUHNE R	RG214	N/A	2015/05/20	2016/05/19

Note: 1. 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.

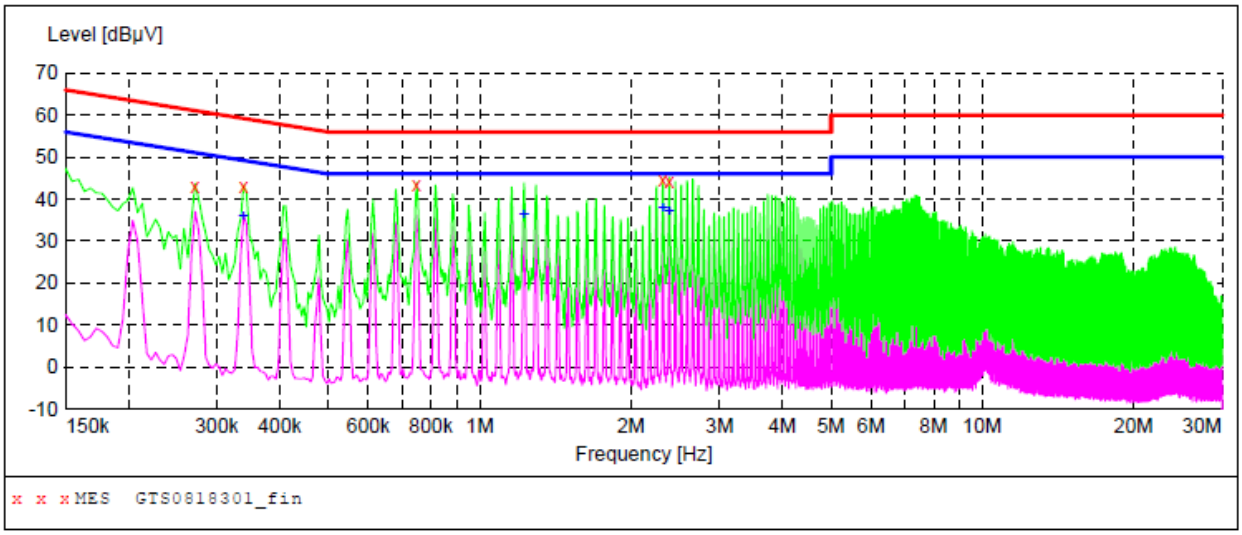
AC Power Conducted Emission Limit

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

Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50
* Decreases with the logarithm of the frequency.		

TEST RESULTS

Remark: We measured Conducted Emission at GFSK, π/4 DQPSK and 8DPSK mode and recorded worst case at GFSK mode.



MEASUREMENT RESULT: "GTS0818301_fin"

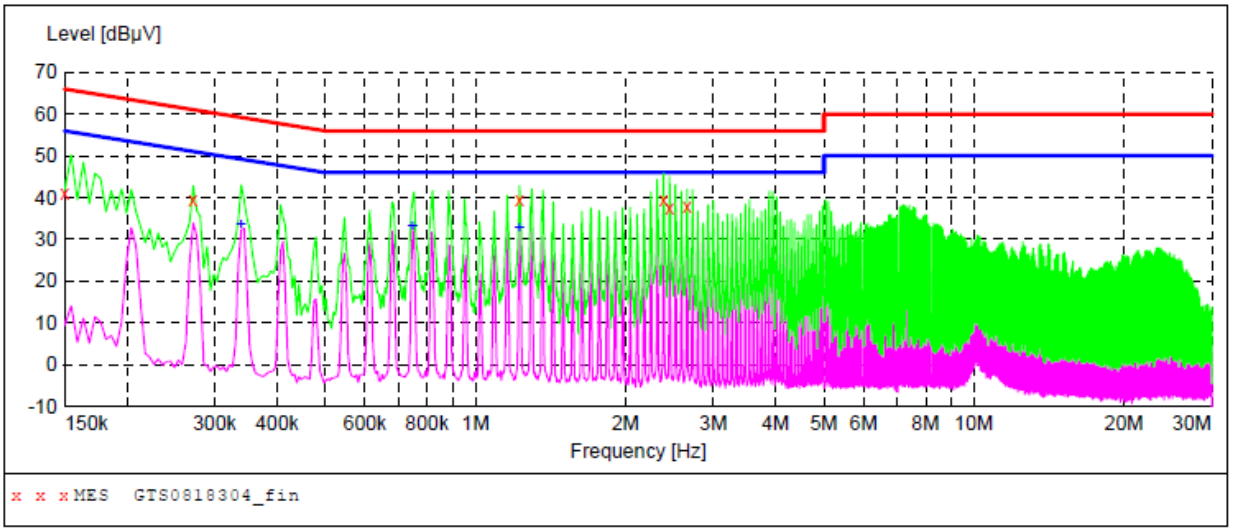
8/18/2015 6:27PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.271500	42.90	9.9	61	18.2	QP	L1	GND
0.339000	43.00	9.9	59	16.2	QP	L1	GND
0.748500	43.40	9.7	56	12.6	QP	L1	GND
2.314500	44.70	9.5	56	11.3	QP	L1	GND
2.382000	44.10	9.5	56	11.9	QP	L1	GND

MEASUREMENT RESULT: "GTS0818301_fin2"

8/18/2015 6:27PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.339000	36.10	9.9	49	13.1	AV	L1	GND
1.225500	36.20	9.6	46	9.8	AV	L1	GND
2.314500	38.00	9.5	46	8.0	AV	L1	GND
2.382000	37.20	9.5	46	8.8	AV	L1	GND



MEASUREMENT RESULT: "GTS0818304_fin"

8/18/2015 6:34PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.150000	41.10	10.1	66	24.9	QP	N	GND
0.271500	39.60	9.9	61	21.5	QP	N	GND
1.225500	39.30	9.6	56	16.7	QP	N	GND
2.386500	39.60	9.5	56	16.4	QP	N	GND
2.449500	37.50	9.5	56	18.5	QP	N	GND
2.656500	37.90	9.5	56	18.1	QP	N	GND

MEASUREMENT RESULT: "GTS0818304_fin2"

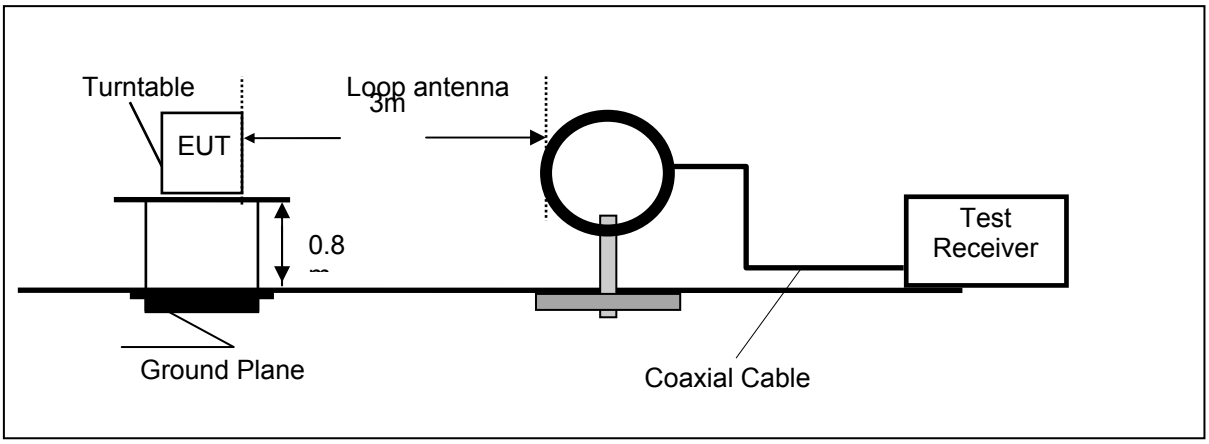
8/18/2015 6:34PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.339000	33.40	9.9	49	15.8	AV	N	GND
0.748500	33.00	9.7	46	13.0	AV	N	GND
1.225500	32.70	9.6	46	13.3	AV	N	GND

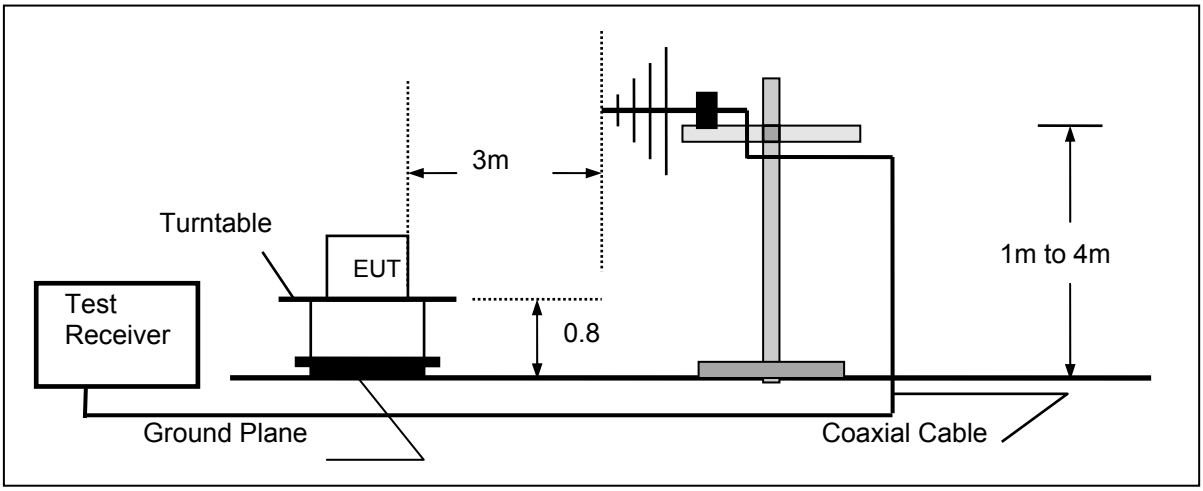
4.2. Radiated Emission

TEST CONFIGURATION

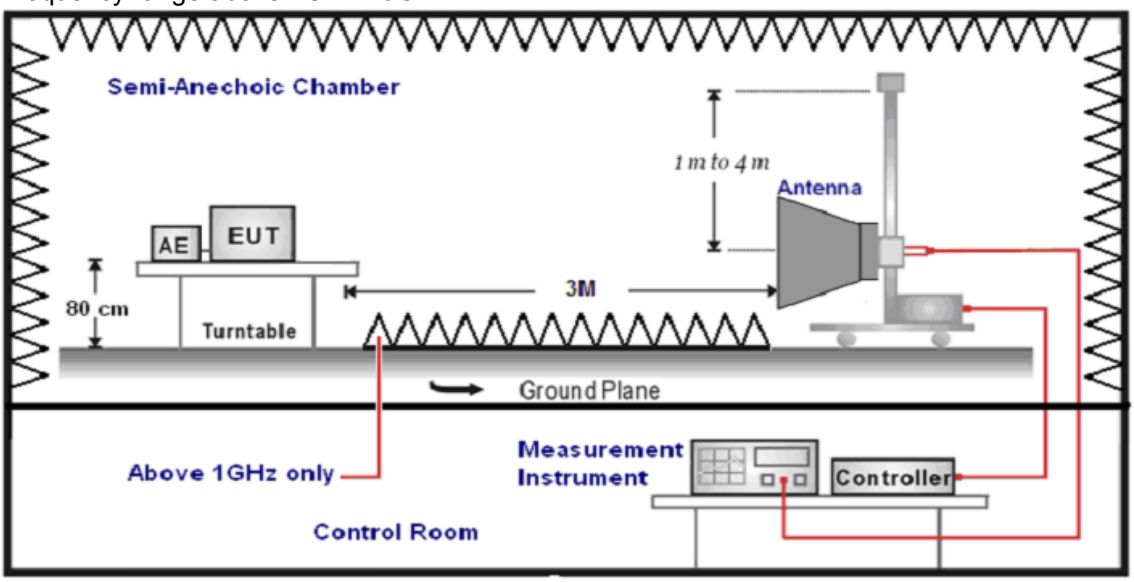
Frequency range 9 KHz – 30MHz



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 32.768KHz and maximum operation frequency was 2480MHz.so radiated emission test frequency band from 9KHz to 25GHz.
6. The distance between test antenna and EUT as following table states:

Test Frequency range	Test Antenna Type	Test Distance
9KHz-30MHz	Active Loop Antenna	3
30MHz-1GHz	Ultra-Broadband Antenna	3
1GHz-18GHz	Double Ridged Horn Antenna	3
18GHz-25GHz	Horn Anternna	1

7. Setting test receiver/spectrum as following table states:

Test Frequency range	Test Receiver/Spectrum Setting	Detector
9KHz-150KHz	RBW=200Hz/VBW=3KHz,Sweep time=Auto	QP
150KHz-30MHz	RBW=9KHz/VBW=100KHz,Sweep time=Auto	QP
30MHz-1GHz	RBW=120KHz/VBW=1000KHz,Sweep time=Auto	QP
1GHz-40GHz	Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto Average Value: RBW=1MHz/VBW=10Hz, Sweep time=Auto	Peak

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	

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 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

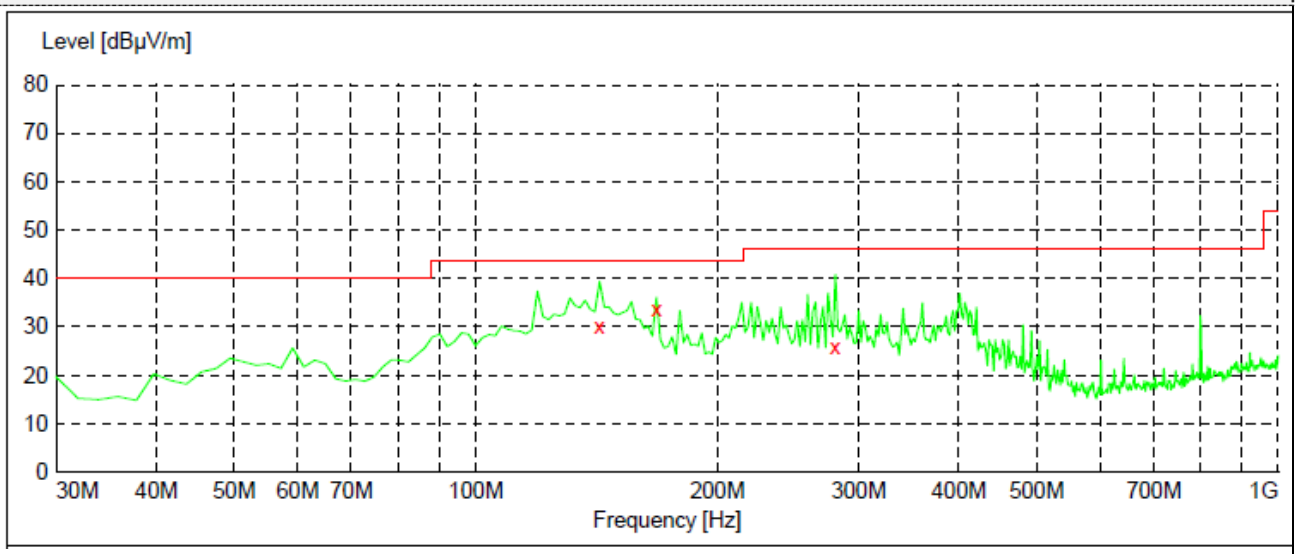
Remark: We measured Radiated Emission at GFSK, π/4 DQPSK and 8DPSK mode from 9 KHz to 25GHz and recorded worst case at GFSK mode.

For 9 KHz-30MHz

Frequency (MHz)	Corrected Reading (dBuV/m)@3m	FCC Limit (dBuV/m) @3m	Margin (dB)	Detector	Result
0.38	47.66	96.01	48.35	QP	PASS
1.55	54.26	63.80	9.54	QP	PASS
19.68	59.38	69.54	10.16	QP	PASS
24.62	42.36	69.54	27.18	QP	PASS

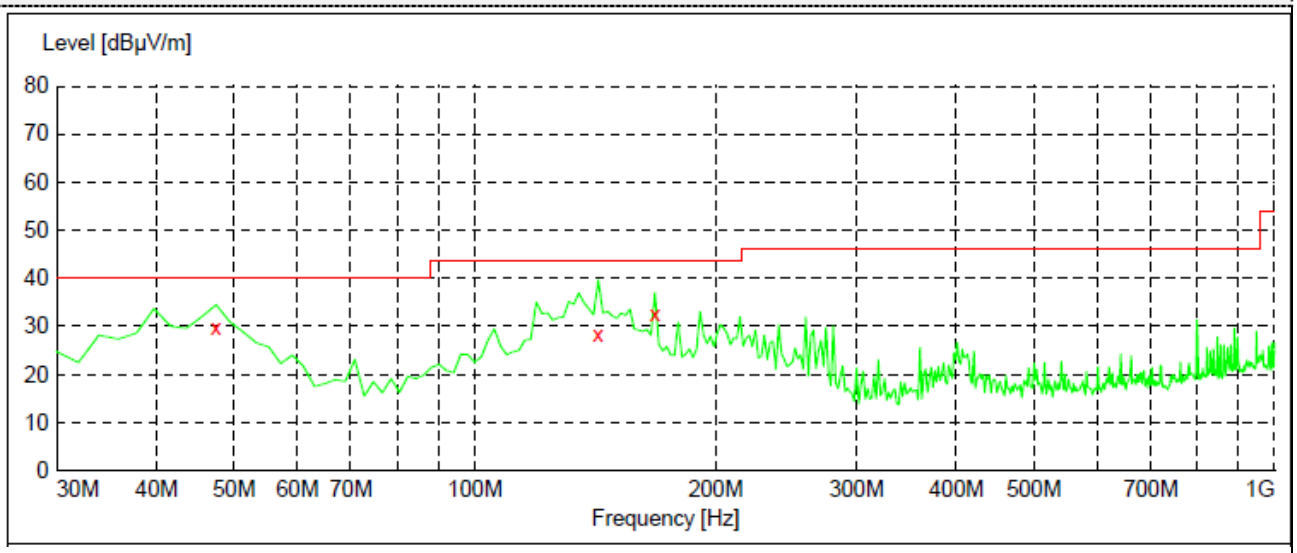
For 30MHz-1GHz

Horizontal



Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
142.745491	30.10	-21.4	43.5	13.4	QP	264.0	49.00	HORIZONTAL
168.016032	33.60	-23.3	43.5	9.9	QP	250.0	27.00	HORIZONTAL
280.761523	25.70	-18.4	46.0	20.3	QP	100.0	99.00	HORIZONTAL

Vertical



Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
47.494990	29.80	-19.0	40.0	10.2	QP	100.0	304.00	VERTICAL
142.745491	28.30	-21.4	43.5	15.2	QP	100.0	348.00	VERTICAL
168.016032	32.70	-23.3	43.5	10.8	QP	100.0	0.00	VERTICAL

For 1GHz to 25GHz

GFSK Mode (above 1GHz)

Frequency(MHz):				2402			Polarity:			HORIZONTAL		
No.	Frequency (MHz)	Emission 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	59.87	PK	74.00	14.13	1.00 H	110	57.97	31.42	6.98	36.5	1.90
1	4804.00	41.54	AV	54.00	12.46	1.00 H	110	39.64	31.42	6.98	36.5	1.90
2	7206.00	46.29	PK	74.00	27.71	1.00 H	55	35.69	37.03	8.87	35.3	10.60
2	7206.00	--	AV	--	--	--	--	--	--	--	--	--

Frequency(MHz):				2402			Polarity:			VERTICAL		
No.	Frequency (MHz)	Emission 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	58.51	PK	74.00	15.49	1.00 V	133	56.61	31.42	6.98	36.5	1.90
1	4804.00	40.25	AV	54.00	13.75	1.00 V	133	38.35	31.42	6.98	36.5	1.90
2	7206.00	48.65	PK	74.00	25.35	1.00 V	125	38.05	37.03	8.87	35.3	10.60
2	7206.00	--	AV	--	--	--	--	--	--	--	--	--

Frequency(MHz):				2440			Polarity:			HORIZONTAL		
No.	Frequency (MHz)	Emission 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	4882.00	57.12	PK	74.00	16.88	1.00 H	150	55.06	30.98	7.58	36.5	2.06
1	4882.00	43.26	AV	54.00	10.74	1.00 H	150	41.20	30.98	7.58	36.5	2.06
2	7323.00	42.65	PK	74.00	31.35	1.00 H	100	31.73	37.66	8.56	35.3	10.92
2	7323.00	--	AV	--	--	--	--	--	--	--	--	--

Frequency(MHz):				2440			Polarity:			VERTICAL		
No.	Frequency (MHz)	Emission 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	4882.00	60.25	PK	74.00	13.75	1.00 V	114	58.19	30.98	7.58	36.5	2.06
1	4882.00	45.26	AV	54.00	8.74	1.00 V	114	43.20	30.98	7.58	36.5	2.06
2	7323.00	48.62	PK	74.00	25.38	1.00 V	120	37.70	37.66	8.56	35.3	10.92
2	7323.00	--	AV	--	--	--	--	--	--	--	--	--

Frequency(MHz):				2480			Polarity:			HORIZONTAL		
No.	Frequency (MHz)	Emission 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	57.63	PK	74.00	16.37	1.00 H	133	54.56	31.47	7.80	36.2	3.07
1	4960.00	42.21	AV	54.00	11.79	1.00 H	133	39.14	31.47	7.80	36.2	3.07
2	7340.00	45.41	PK	74.00	28.59	1.00 H	250	33.67	38.32	8.72	35.3	11.74
2	7340.00	--	AV	--	--	--	--	--	--	--	--	--

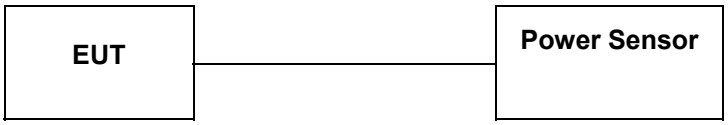
Frequency(MHz):				2480			Polarity:			VERTICAL		
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier	Correction Factor (dB/m)
1	4960.00	59.63	PK	74.00	14.37	1.00 V	255	56.56	31.47	7.80	-36.2	3.07
1	4960.00	39.22	AV	54.00	14.78	1.00 V	255	36.15	31.47	7.80	-36.2	3.07
2	7340.00	46.11	PK	74.00	27.89	1.00 V	150	34.37	38.32	8.72	-35.3	11.74
2	7340.00	--	AV	--	--	--	--	--	--	--	--	--

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. Margin value = Limit value- Emission level.
4. -- Mean the PK detector measured value is below average limit.
5. The other emission levels were very low against the limit.

4.3. Maximum Peak Output Power

TEST CONFIGURATION



TEST PROCEDURE

According to ANSI C63.10:2009 Maximum peak conducted output power for HFSS devices:
The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the HFSS bandwidth and shall utilize a fast-responding diode detector.

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.

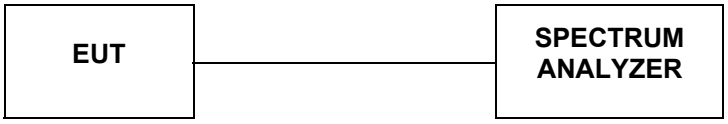
TEST RESULTS

Type	Channel	Output power (dBm)	Limit (dBm)	Result
GFSK	00	1.91	30	Pass
	39	1.89		
	78	2.23		
π/4DQPSK	00	1.25	21	Pass
	39	1.31		
	78	1.68		
8DPSK	00	1.35	21	Pass
	39	1.31		
	78	1.16		

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

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

Modulation	Channel	20dB bandwidth (MHz)	Result
GFSK	CH00	0.864	Pass
	CH39	0.862	
	CH78	0.863	
8DSPSK	CH00	1.259	
	CH39	1.258	
	CH78	1.260	

GFSK Modulation

CH00

CH39

CH78

8DSPSK Modulation

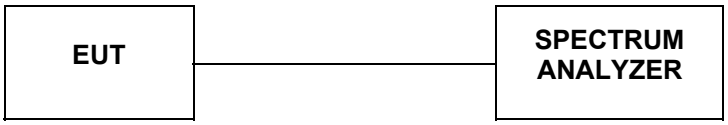
CH00

CH39

CH78

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

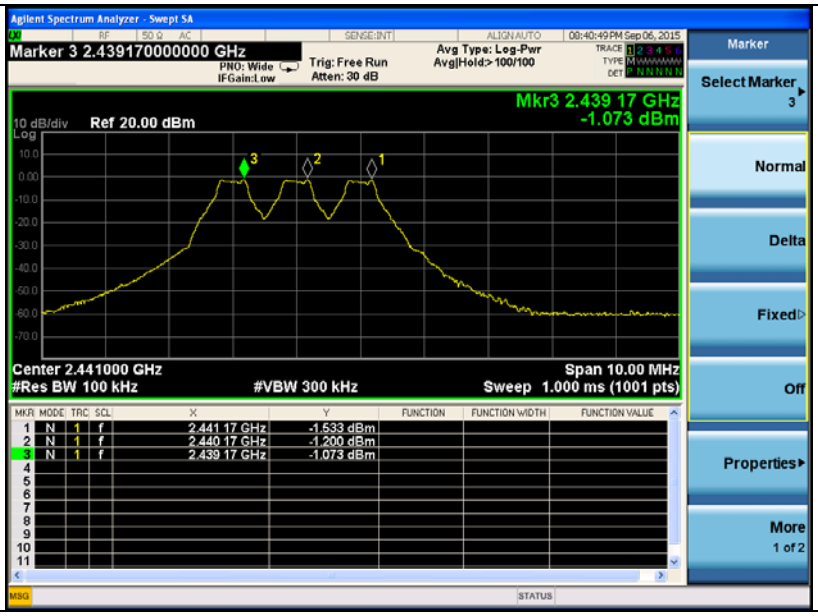
According to 15.247(a)(1),frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25KHz or the 2/3*20dB bandwidth of the hopping channel, whichever is greater.

TEST RESULTS

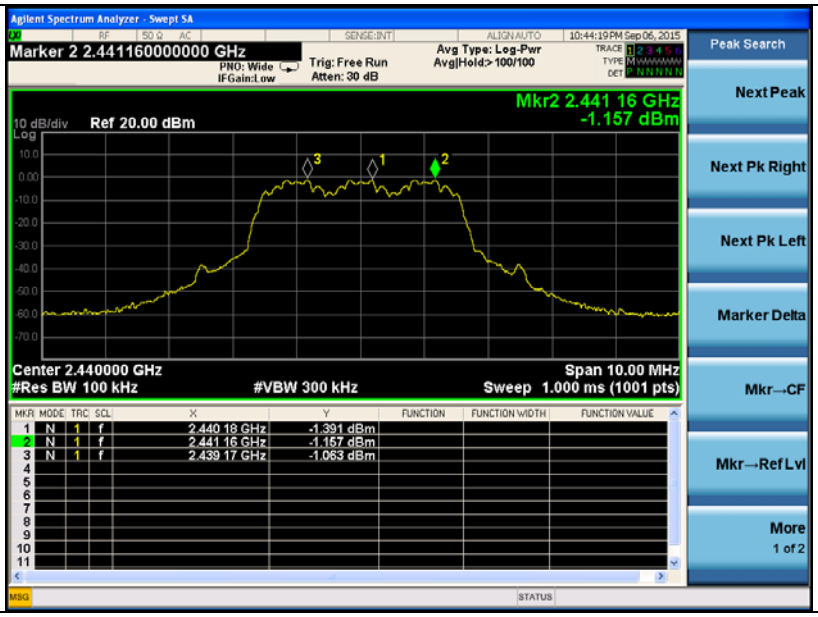
4.5.1 GFSK Test Mode

Modulation	Channel	Channel Separation (MHz)	Limit(MHz)	Result
GFSK	CH38	1.000	25KHz or 2/3*20dB bandwidth	Pass
	CH39			
8DPSK	CH38	1.000	25KHz or 2/3*20dB bandwidth	Pass
	CH39			

Remark: We have tested all mode at high, middle and low channel, and recorded worst case at middle


Agilent Spectrum Analyzer - Swept SA
Marker 3 2.439170000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
08:40:49 PM Sep 06, 2015
Mkr3 2.439 17 GHz
-1.073 dBm
10 dB/div
Ref 20.00 dBm
Center 2.441000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 10.00 MHz
Sweep 1.000 ms (1001 pts)
1 N 1 f 2.441 17 GHz -1.533 dBm
2 N 1 f 2.440 17 GHz -1.200 dBm
3 N 1 f 2.439 17 GHz -1.073 dBm
Marker
Select Marker 3
Normal
Delta
Fixed
Off
Properties
More 1 of 2

GFSK


Agilent Spectrum Analyzer - Swept SA
Marker 2 2.441160000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
10:44:19 PM Sep 06, 2015
Mkr2 2.441 16 GHz
-1.157 dBm
10 dB/div
Ref 20.00 dBm
Center 2.440000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 10.00 MHz
Sweep 1.000 ms (1001 pts)
1 N 1 f 2.440 18 GHz -1.391 dBm
2 N 1 f 2.441 16 GHz -1.157 dBm
3 N 1 f 2.439 17 GHz -1.063 dBm
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More 1 of 2

8DPSK

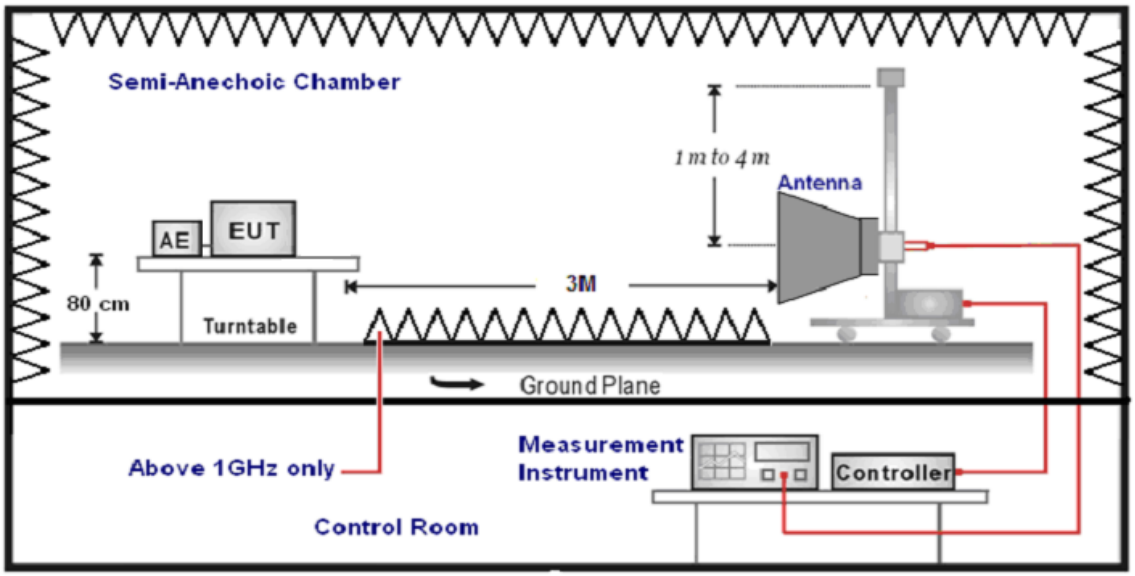
4.6. Band Edge Compliance of RF Emission

TEST REQUIREMENT

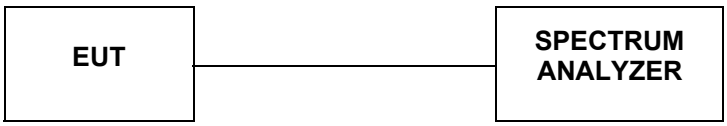
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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 CONFIGURATION

For Radiated



For Conducted



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 distance between test antenna and EUT was 3 meter:
6. Setting test receiver/spectrum as following table states:

Test Frequency range	Test Receiver/Spectrum Setting	Detector
1GHz-40GHz	Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto Average Value: RBW=1MHz/VBW=10Hz, Sweep time=Auto	Peak

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

4.6.1 For Radiated Bandedge Measurement

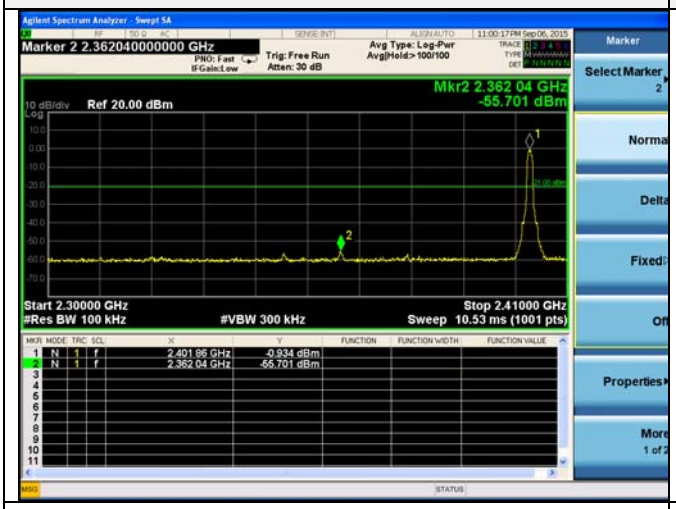
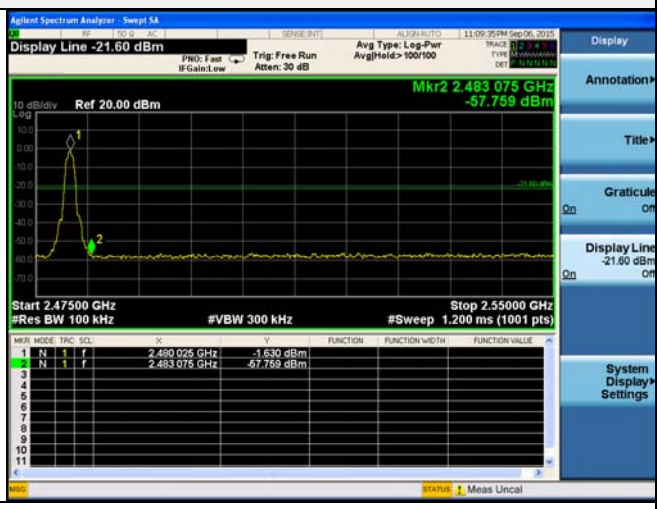
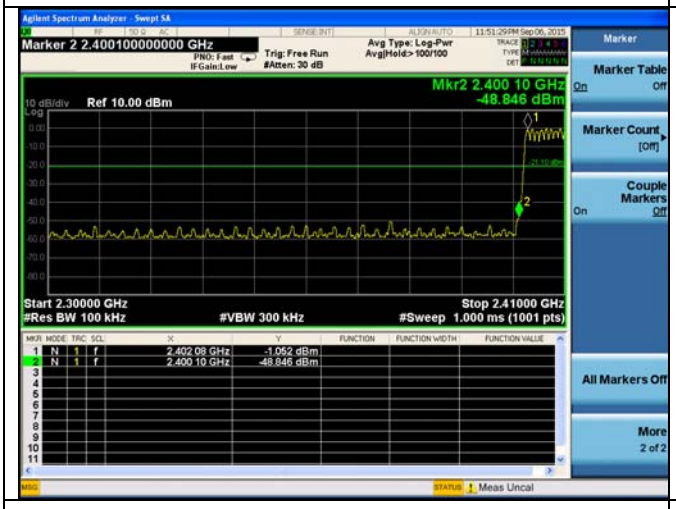
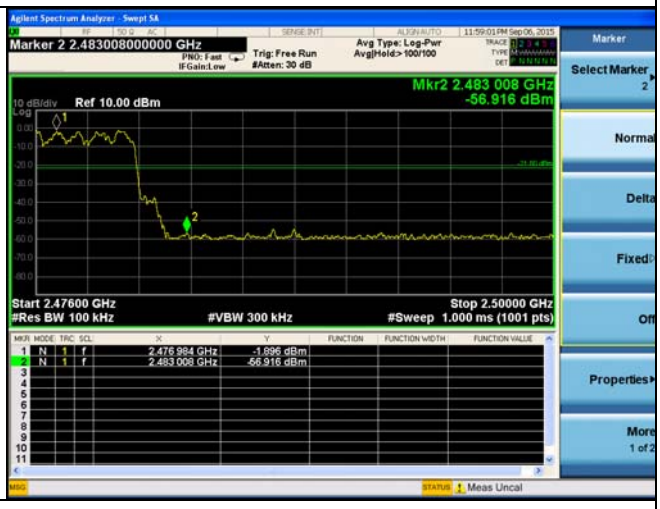
Remark: we tested radiated bandedge at both hopping and no-hopping modes,recorded worst case at no-hopping mode

Test Mode:		GFSK			Polarization:		Horizontal		
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)	Detector
1	2390.00	36.83	3.32	27.49	36.12	42.11	74.00	37.17	Peak
2	2401.94	90.26	3.32	27.49	36.12	95.57	74.00	-16.26	Peak
3	2390.00	23.84	3.32	27.49	36.12	29.12	54.00	30.16	Average
4	2402.13	79.62	3.32	27.49	36.12	84.93	54.00	-25.62	Average
5	2479.83	89.56	3.88	27.45	36.55	94.78	74.00	-15.56	Peak
6	2483.50	48.94	3.88	27.45	36.55	54.16	74.00	25.06	Peak
7	2480.01	76.40	3.88	27.45	36.55	81.62	54.00	-22.40	Average
8	2483.50	36.10	3.88	27.45	36.55	41.32	54.00	17.90	Average
Test Mode:		**GFSK**			**Polarization:**		**Vertical**		
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)	Detector
1	2390.00	35.93	3.32	27.49	36.12	41.21	74.00	38.07	Peak
2	2401.94	93.23	3.32	27.49	36.12	98.54	74.00	-19.23	Peak
3	2390.00	24.01	3.32	27.49	36.12	29.29	54.00	29.99	Average
4	2402.13	79.79	3.32	27.49	36.12	85.10	54.00	-25.79	Average
5	2479.92	91.40	3.88	27.45	36.55	96.62	74.00	-17.40	Peak
6	2483.50	51.59	3.88	27.45	36.55	56.81	74.00	22.41	Peak
7	2480.01	78.60	3.88	27.45	36.55	83.82	54.00	-24.60	Average
8	2483.50	37.93	3.88	27.45	36.55	43.15	54.00	16.07	Average

4.6.2 For Conducted Bandedge Measurement

GFSK

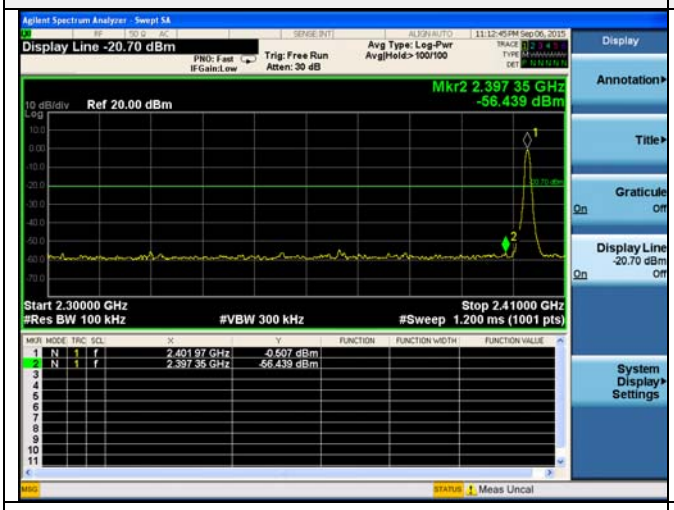
Frequency (MHz)	Delta Peak to Band emission (dBc)	Hoping Mode	Limit (dBc)	Verdict
2400.00	-54.77	OFF	-20	PASS
2400.00	-52.84	ON	-20	PASS
2483.50	-56.15	OFF	-20	PASS
2483.50	-55.14	ON	-20	PASS

2402	2480
	
Hoping Off	Hoping Off
	
Hoping On	Hoping On

8DPSK

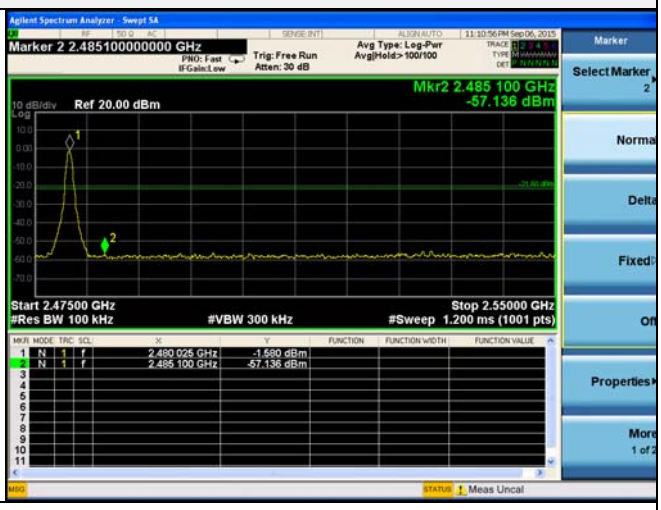
Frequency (MHz)	Delta Peak to Band emission (dBc)	Hoping Mode	Limit (dBc)	Verdict
2400.00	-55.87	OFF	-20	PASS
2400.00	-55.68	ON	-20	PASS
2483.50	-55.47	OFF	-20	PASS
2483.50	-53.78	ON	-20	PASS

2402

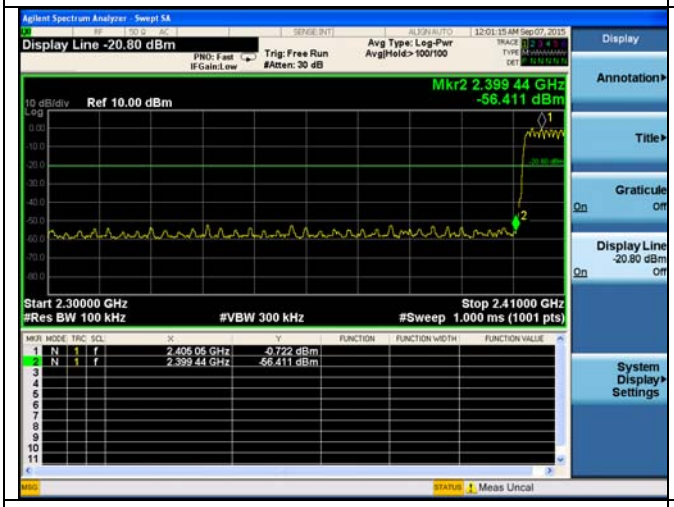


Hoping Off

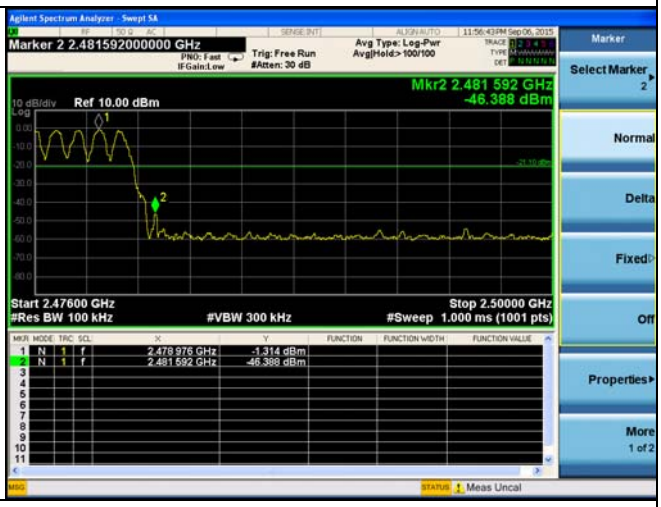
2480



Hoping Off



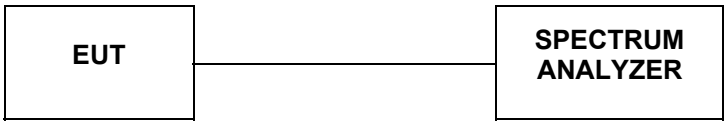
Hoping On



Hoping On

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 VBW= 300KHz to measure the peak field strength , and mwasure frequeny range from 9KHz to 25GHz.

LIMIT

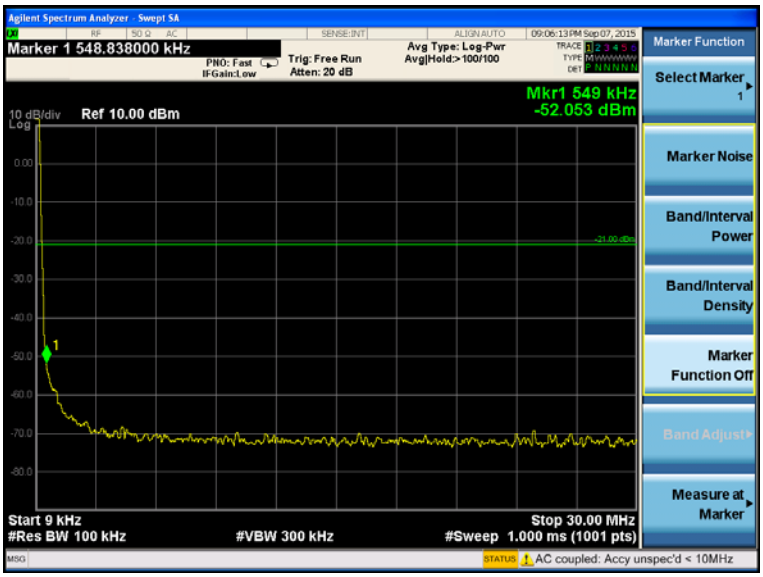
1. Below -20dB of the highest emission level in operating band.
2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

TEST RESULTS

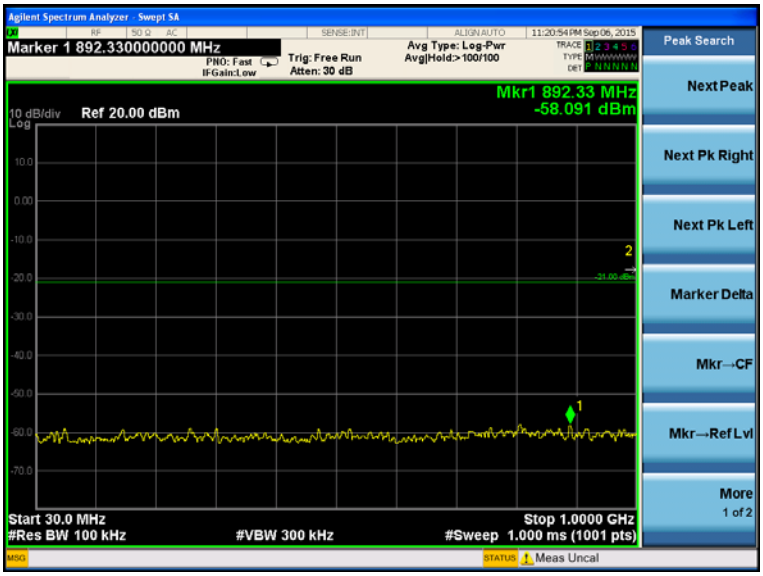
Remark: The measurement frequency range is from 9KHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and bandege measurement data.

Test Mode:	GFSK	Test channel :	00

Channel 00

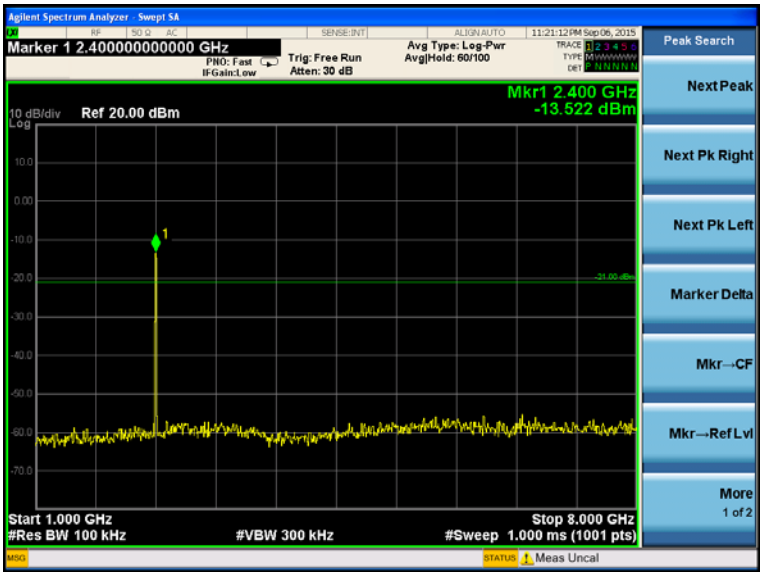


9KHz~30MHz

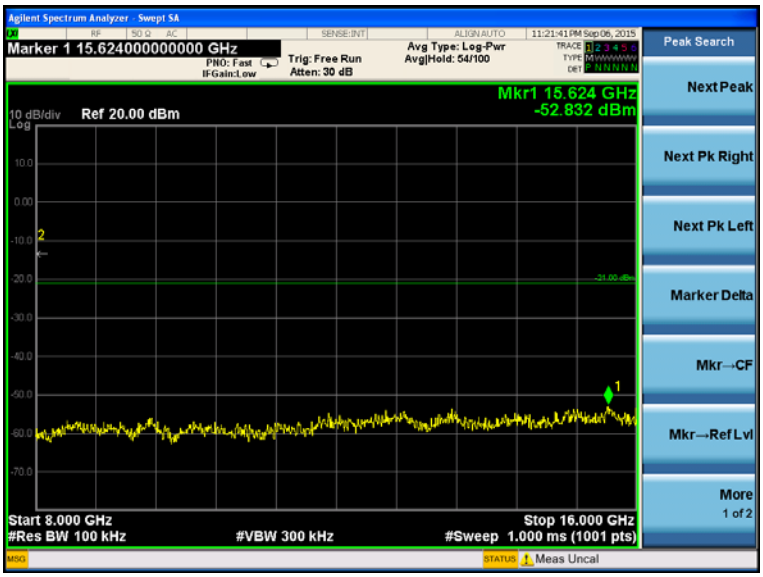


30M Hz~1GHz

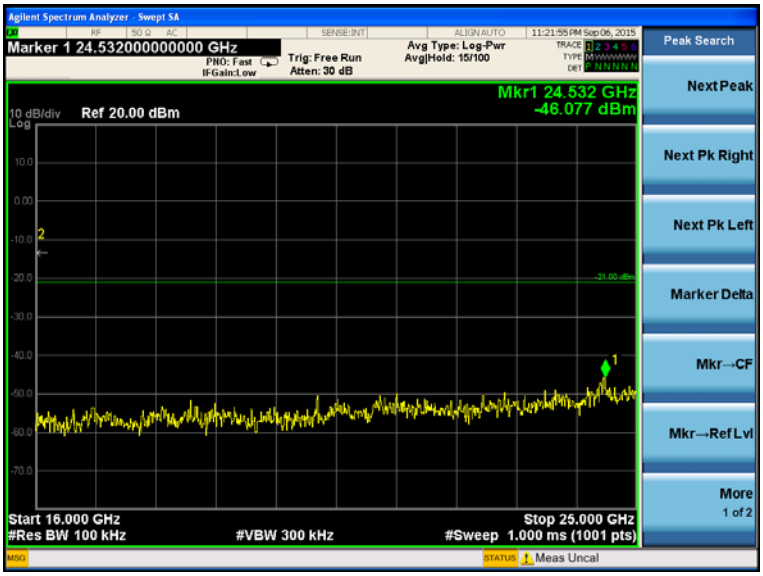
Test Mode:	GFSK	Test channel :	00



1GHz~8GHz



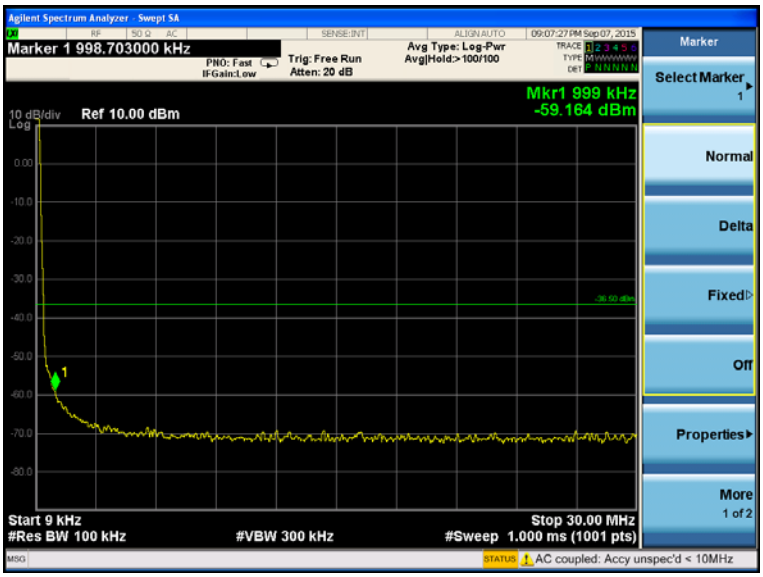
8GHz~16GHz



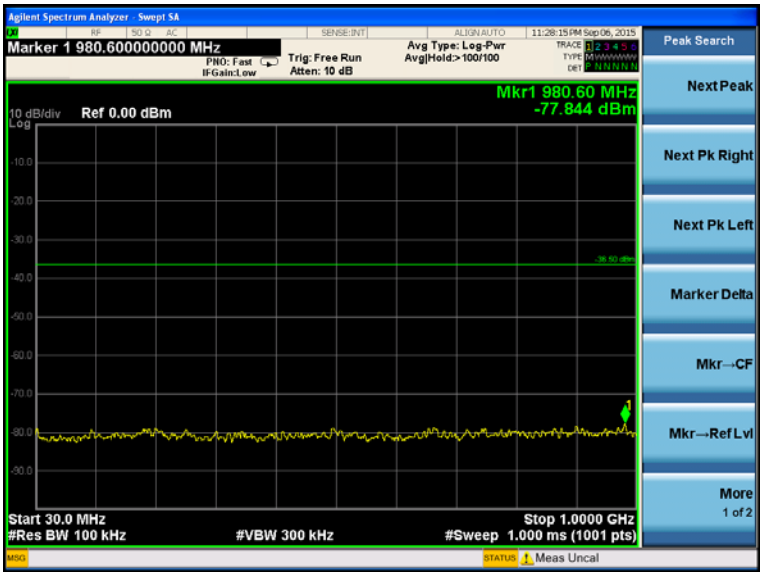
16GHz~25GHz

Test Mode:	GFSK	Test channel :	39

Channel 39

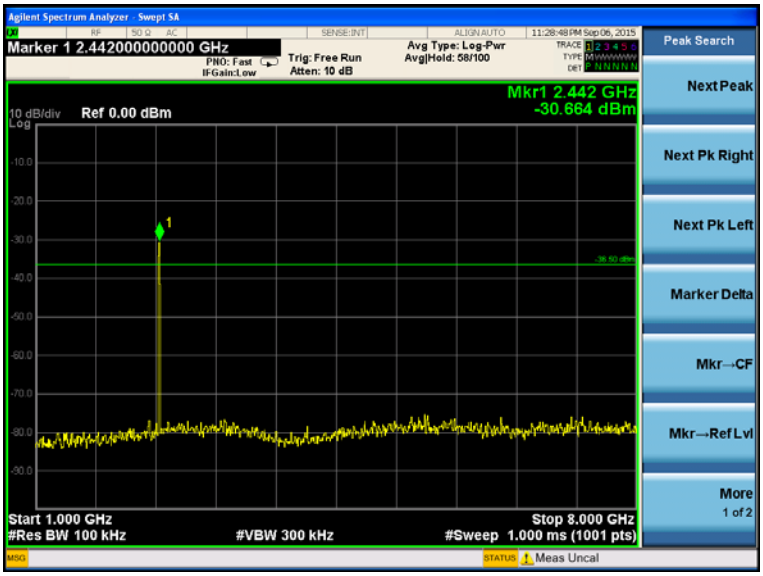


9KHz~30MHz

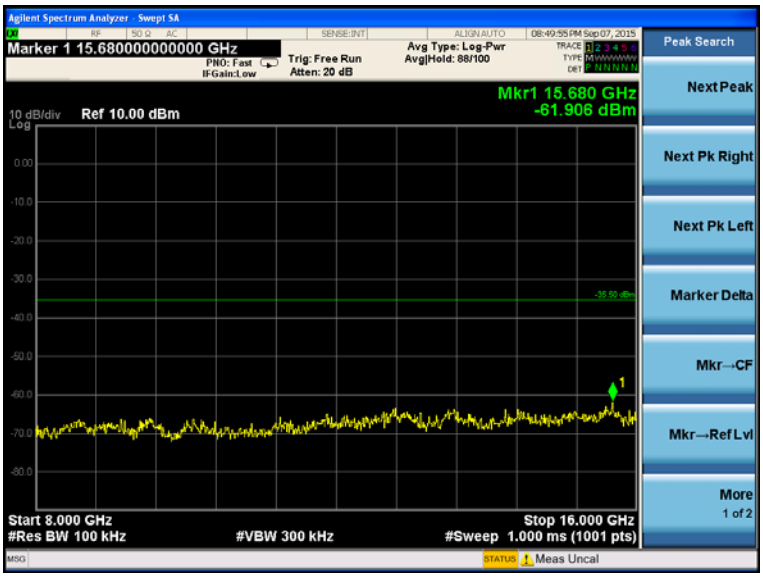


30M Hz~1GHz

Test Mode:	GFSK	Test channel :	39



1GHz~8GHz

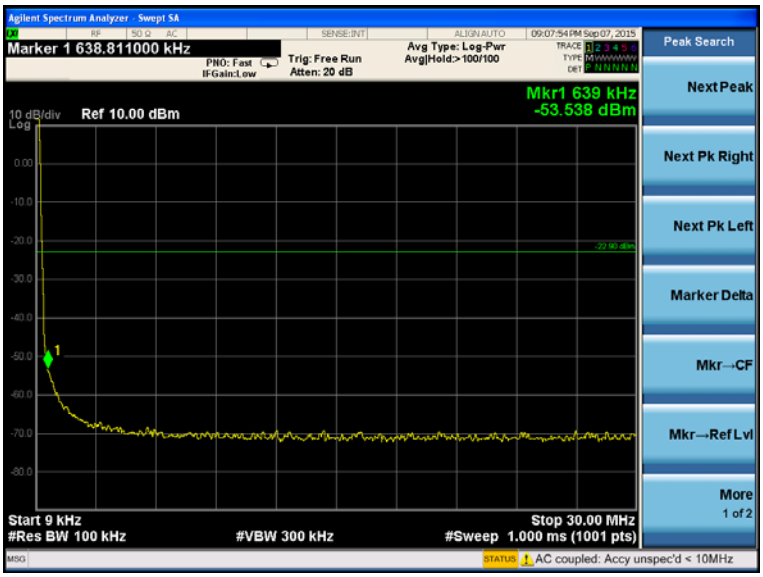


8GHz~16GHz

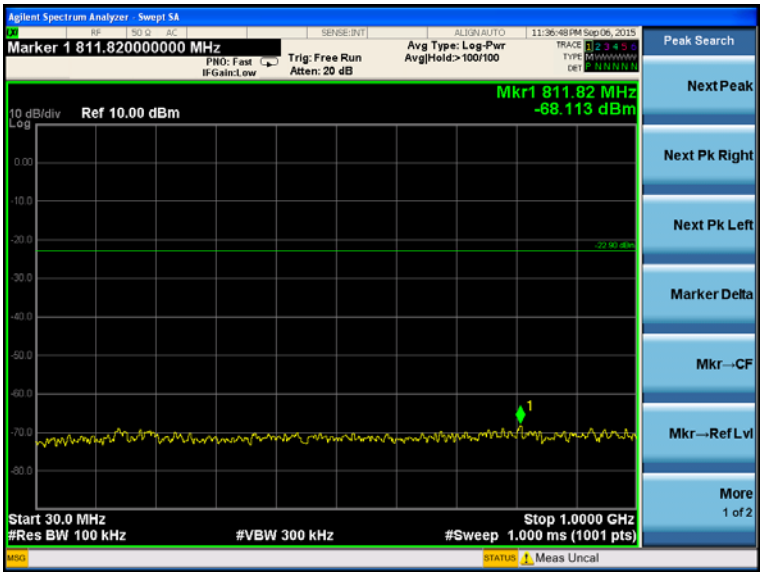
16GHz~25GHz

Test Mode:	GFSK	Test channel :	78

Channel 78

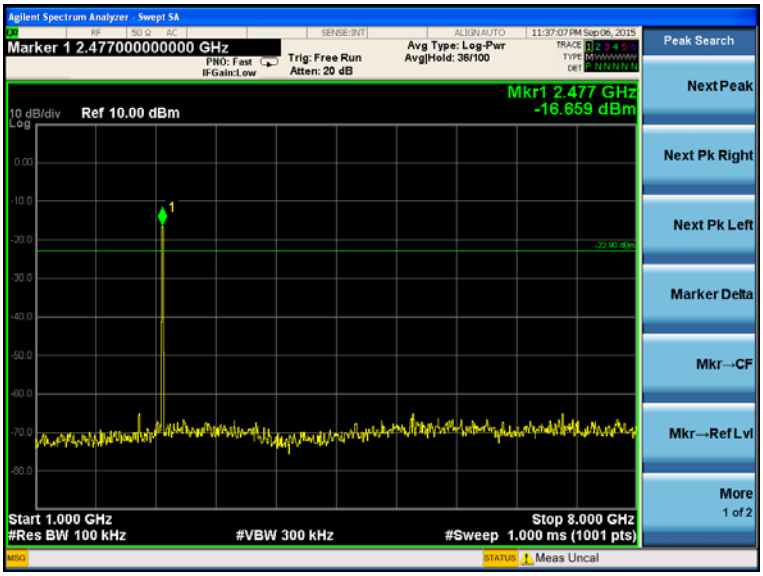


9KHz~30MHz

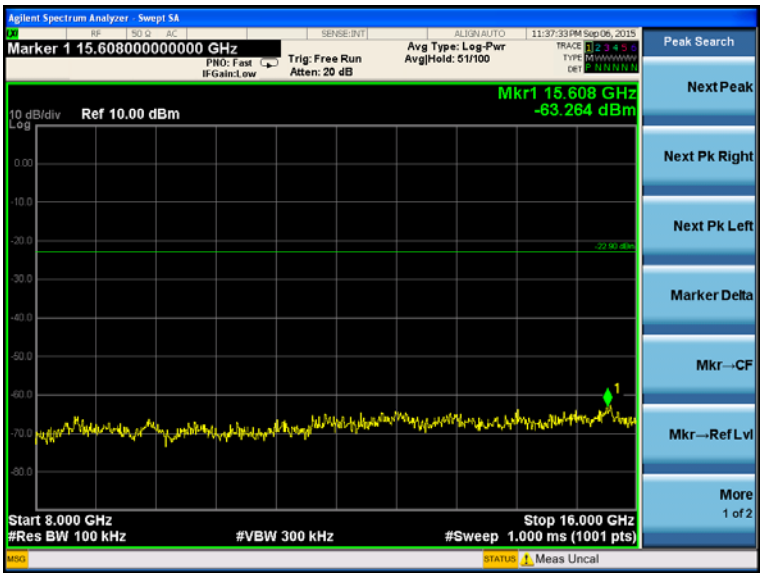


30M Hz~1GHz

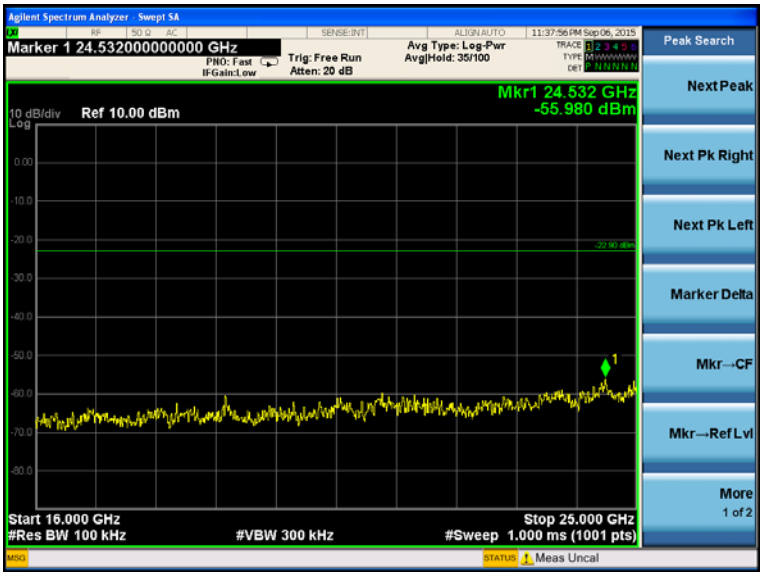
Test Mode:	GFSK	Test channel :	78



1GHz~8GHz



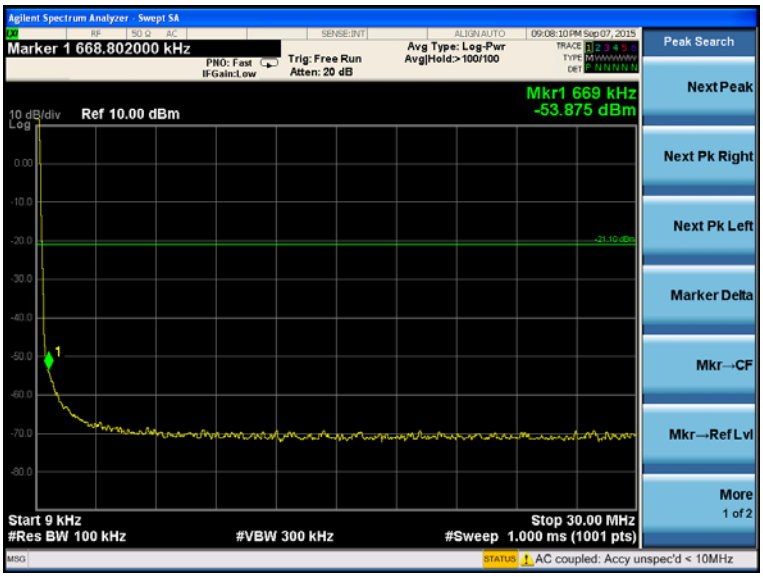
8GHz~16GHz



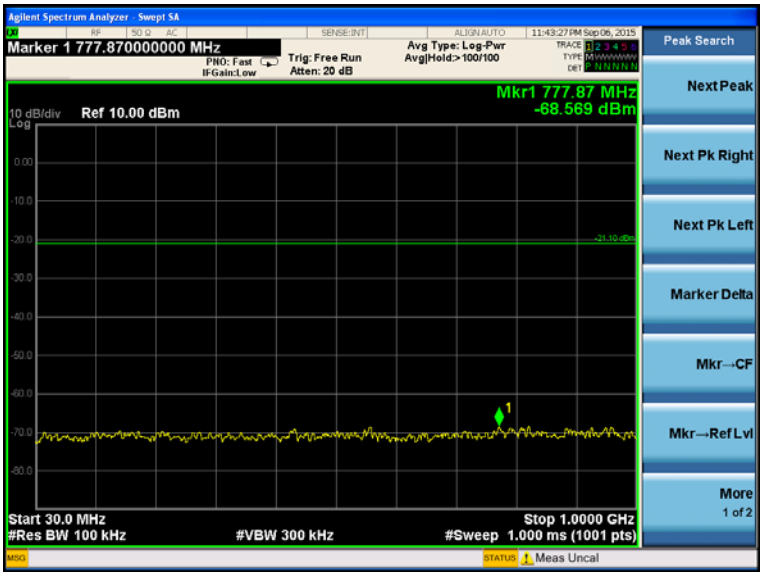
16GHz~25GHz

Test Mode:	8DPSK	Test channel :	00

Channel 00

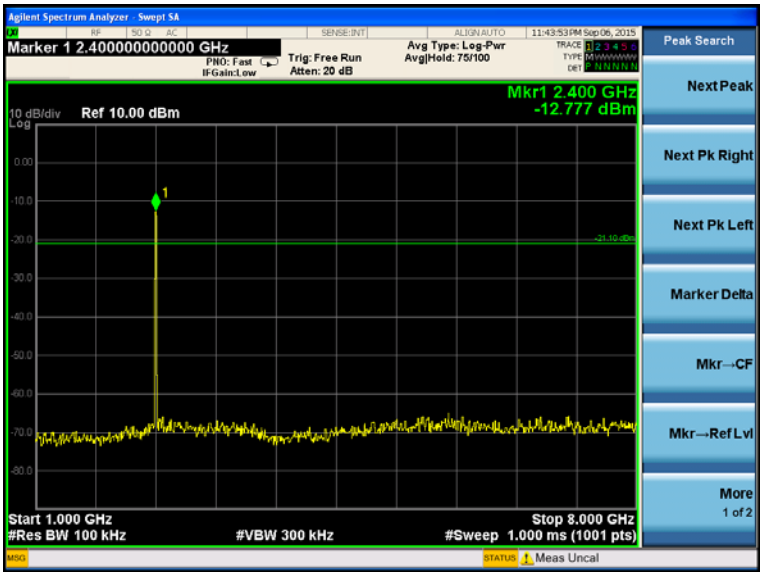


9KHz~30MHz

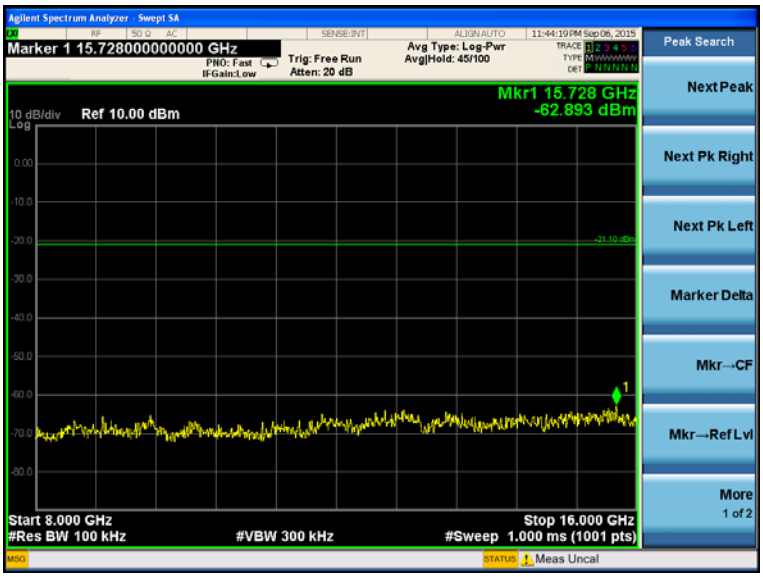


30M Hz~1GHz

Test Mode:	8DPSK	Test channel :	00



1GHz~8GHz

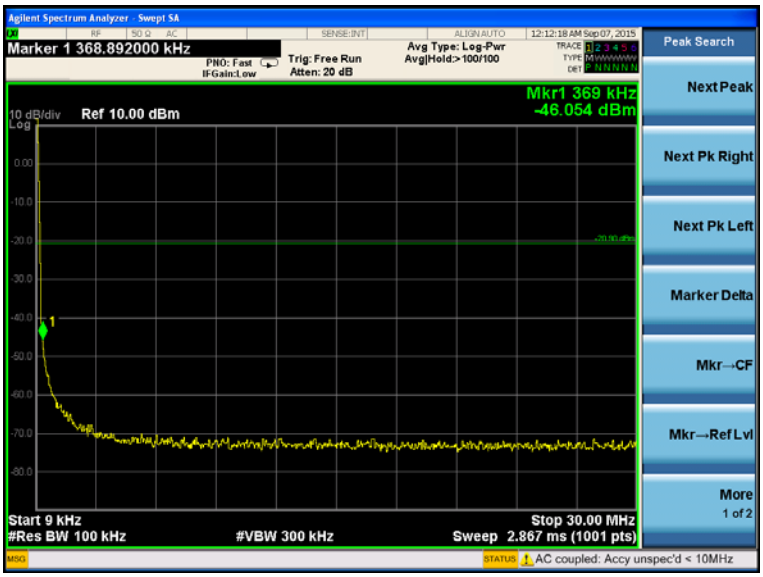


8GHz~16GHz

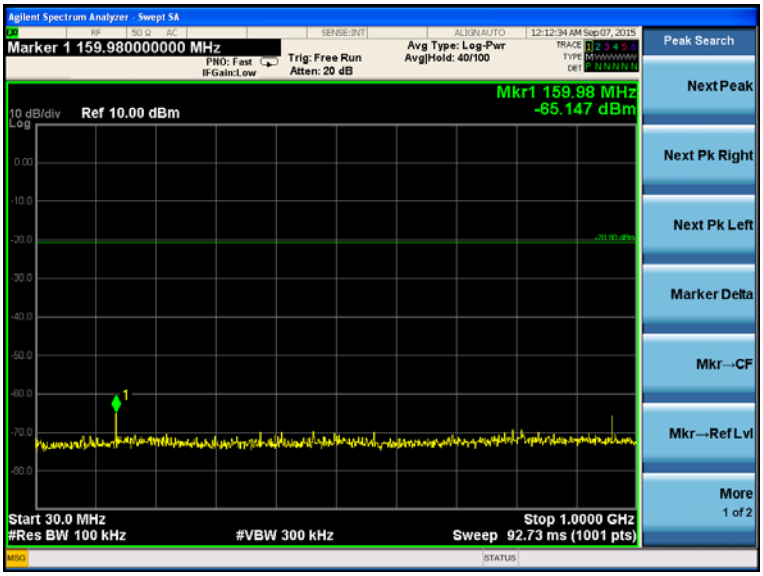
16GHz~25GHz

Test Mode:	8DPSK	Test channel :	39

Channel 39

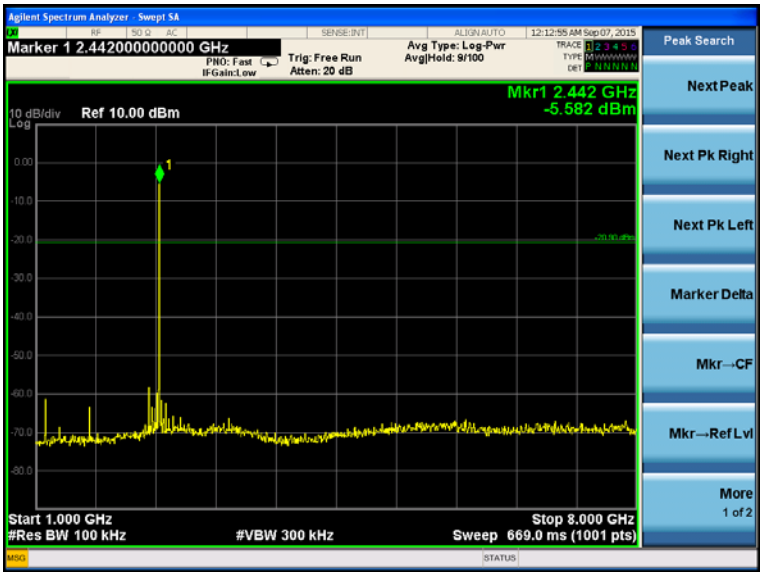


9KHz~30MHz



30M Hz~1GHz

Test Mode:	8DPSK	Test channel :	39



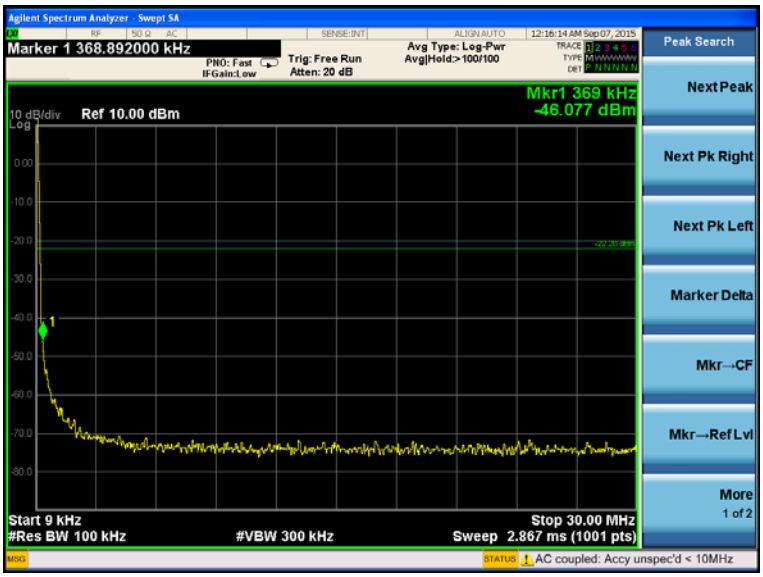
1GHz~8GHz

8GHz~16GHz

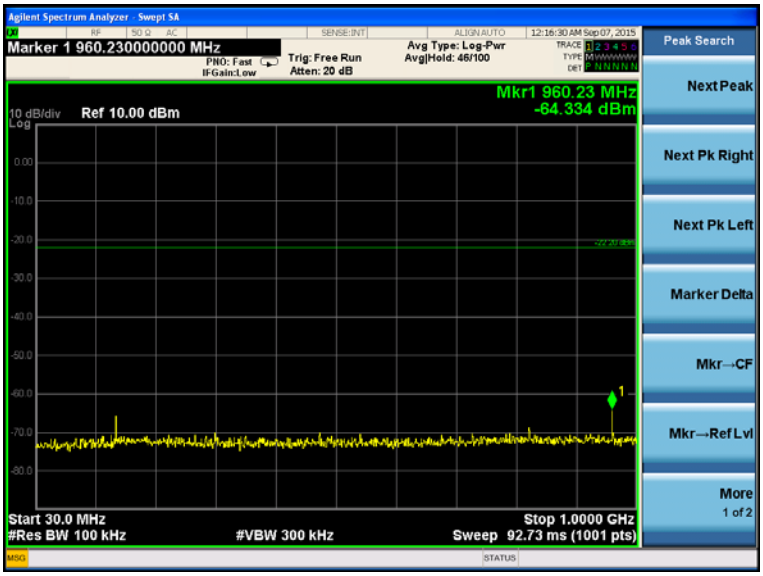
16GHz~25GHz

Test Mode:	8DPSK	Test channel :	78

Channel 78

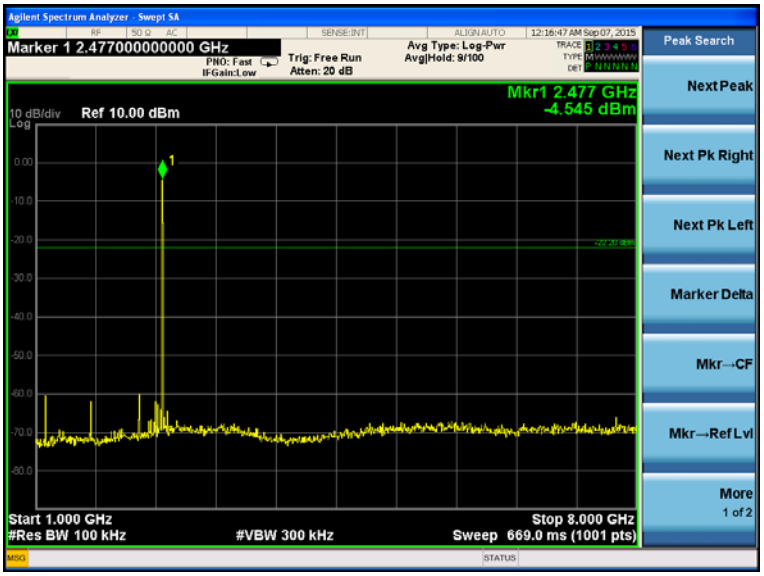


9KHz~30MHz



30M Hz~1GHz

Test Mode:	8DPSK	Test channel :	78



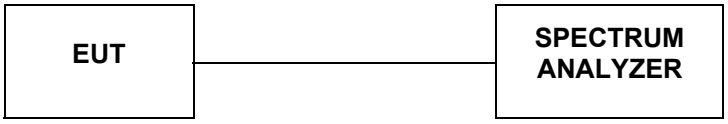
1GHz~8GHz

8GHz~16GHz

16GHz~25GHz

4.8. Number of hopping frequency

TEST CONFIGURATION



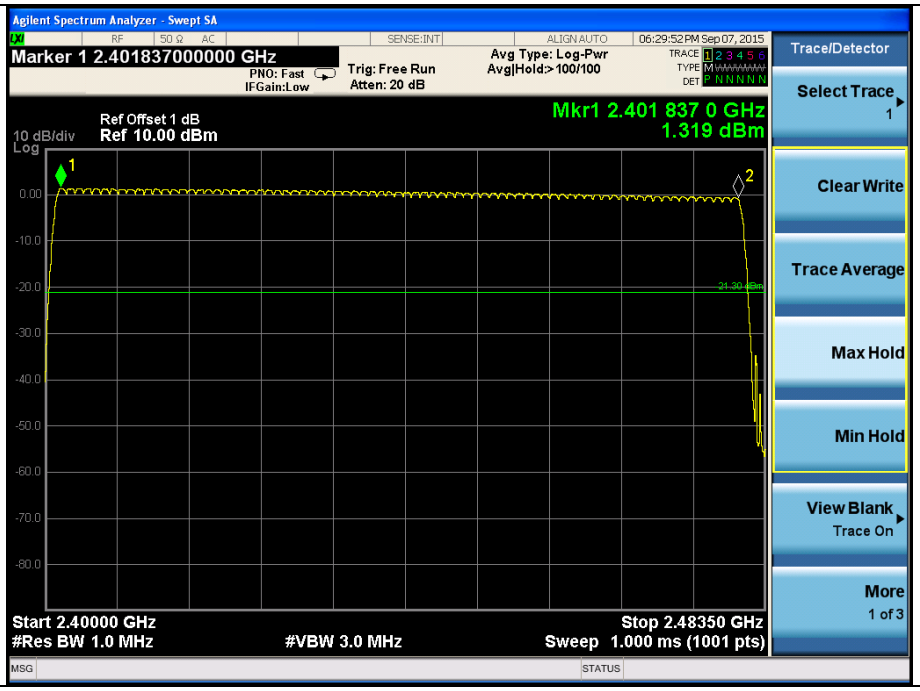
TEST PROCEDURE

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.

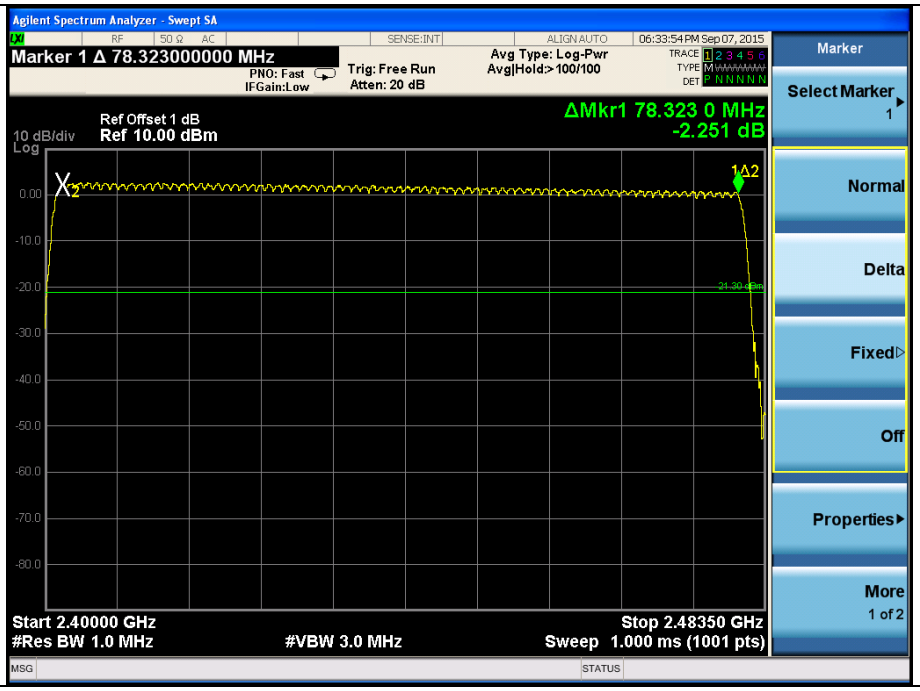
LIMIT

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

Modulation	Number of Hopping Channel	Limit	Result
GFSK	79	≥15	Pass
8DPSK	79		



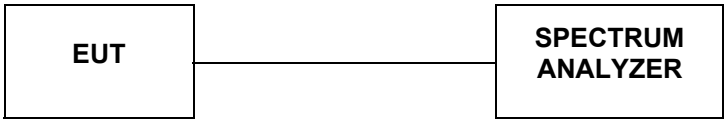
GFSK Modulation



8DPSK Modulation

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.

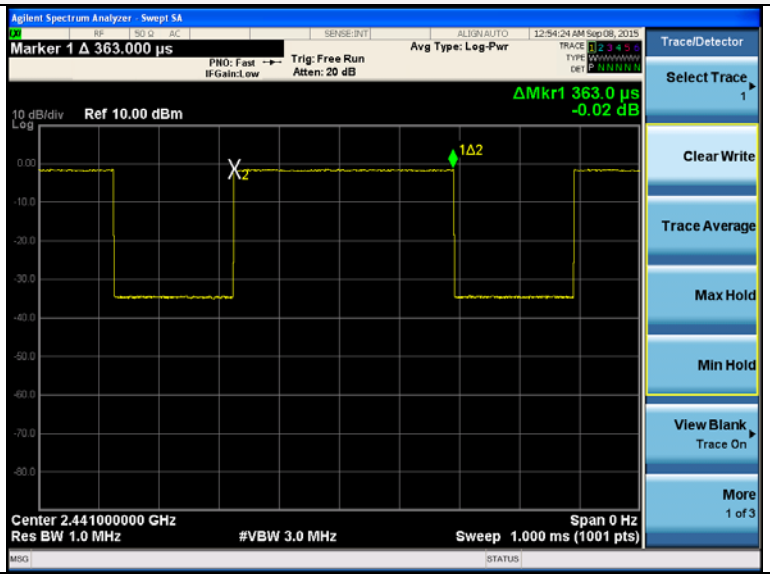
TEST RESULTS

Modulation	Packet	Pulse time (ms)	Dwell time (second)	Limit (second)	Result
GFSK	DH1	0.363	0.116	0.40	Pass
	DH3	1.615	0.258		
	DH5	2.865	0.305		
8DSPSK	3-DH1	0.383	0.122	0.40	Pass
	3-DH3	1.635	0.262		
	3-DH5	2.885	0.307		

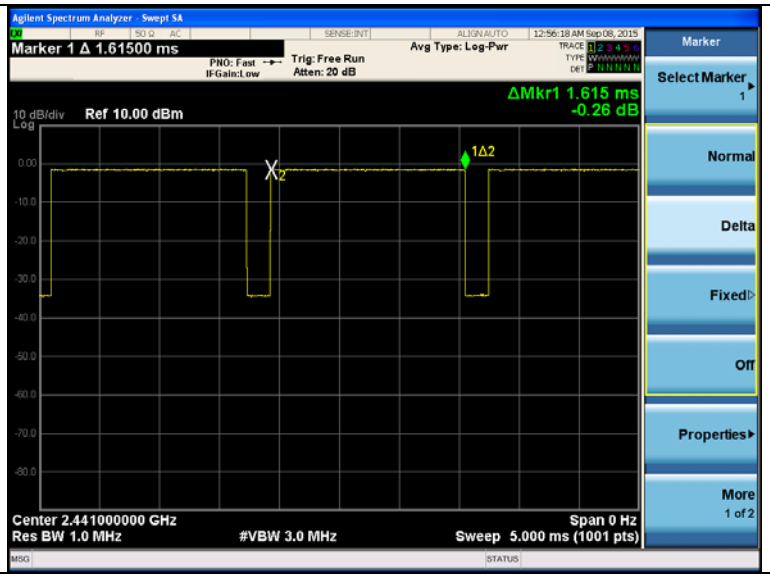
Note:

1. We have tested all mode at high,middle and low channel,and recoreded worst case at middle channel.
2. Dwell time=Pulse time (ms) × (1600 ÷ 2 ÷ 79) ×31.6 Second for DH1, 2-DH1, 3-DH1
   Dwell time=Pulse time (ms) × (1600 ÷ 4 ÷ 79) ×31.6 Second for DH3, 2-DH3, 3-DH3
   Dwell time=Pulse time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second for DH5, 2-DH5, 3-DH5

GFSK Modulation



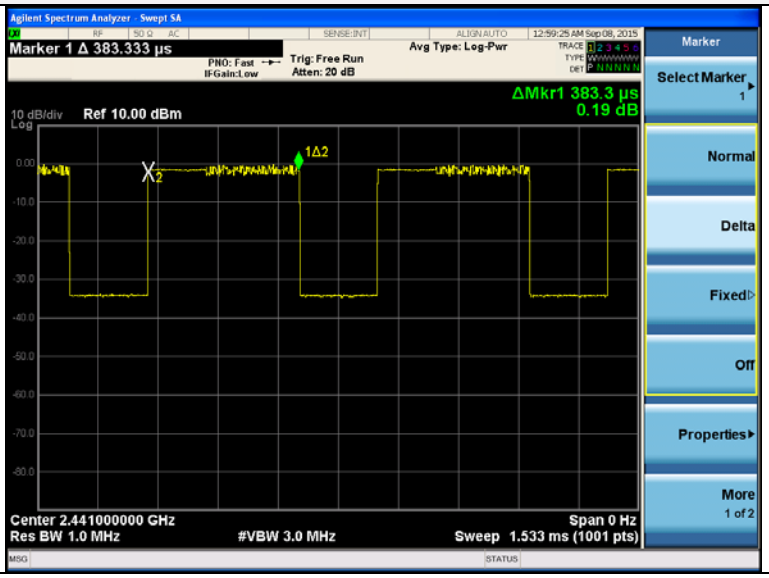
DH1



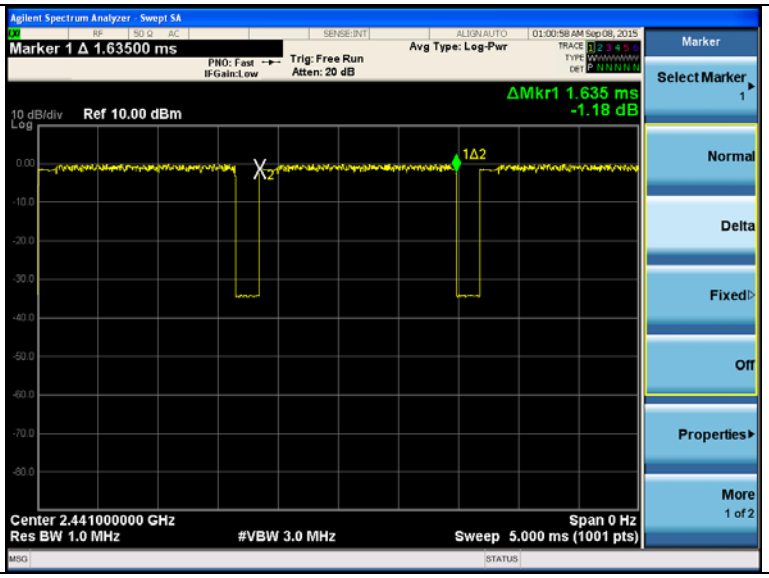
DH3

DH5

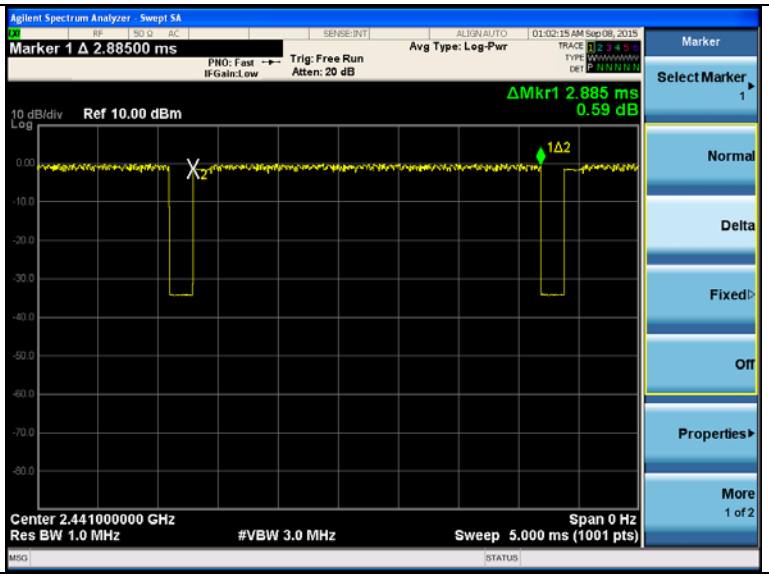
8DSPSK Modulation



3-DH1



3-DH3



3-DH5

4.10. Pseudorandom Frequency Hopping Sequence

TEST APPLICABLE

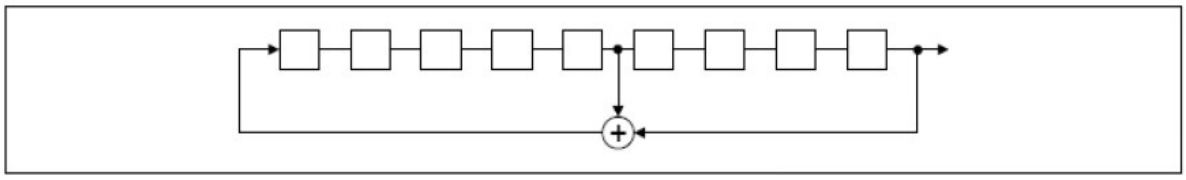
For 47 CFR Part 15C section 15.247 (a)(1) requirement:

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

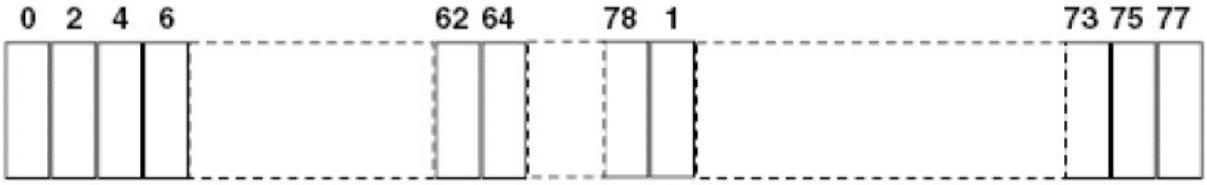
The pseudorandom frequency hopping sequence may be generated in a nice-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage.And the result is fed back to the input of the frist stage.The sequence begins with the frist one of 9 consecutive ones,for example:the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

Measurement

The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module.For normal BT devices, the GFSK mode is used.

Measurement parameters

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1MHz
Video bandwidth:	3MHz
Trace-Mode:	Max hold

Limits

Antenna Gain	6 dBi

Results

T_{nom}	V_{nom}	Lowest Channel 2402 MHz	Middle Channel 2441 MHz	Highest Channel 2480 MHz
Conducted power [dBm] Measured with GFSK modulation		1.91	1.89	2.23
Radiated power [dBm] Measured with GFSK modulation		0.21	0.42	0.61
Gain [dBi] Calculated		1.70	1.47	1.62
Measurement uncertainty		± 0.6 dB (cond.) / ± 4.32 dB (rad.)		

5. Test Setup Photos of the EUT

6. External and Internal Photos of the EUT

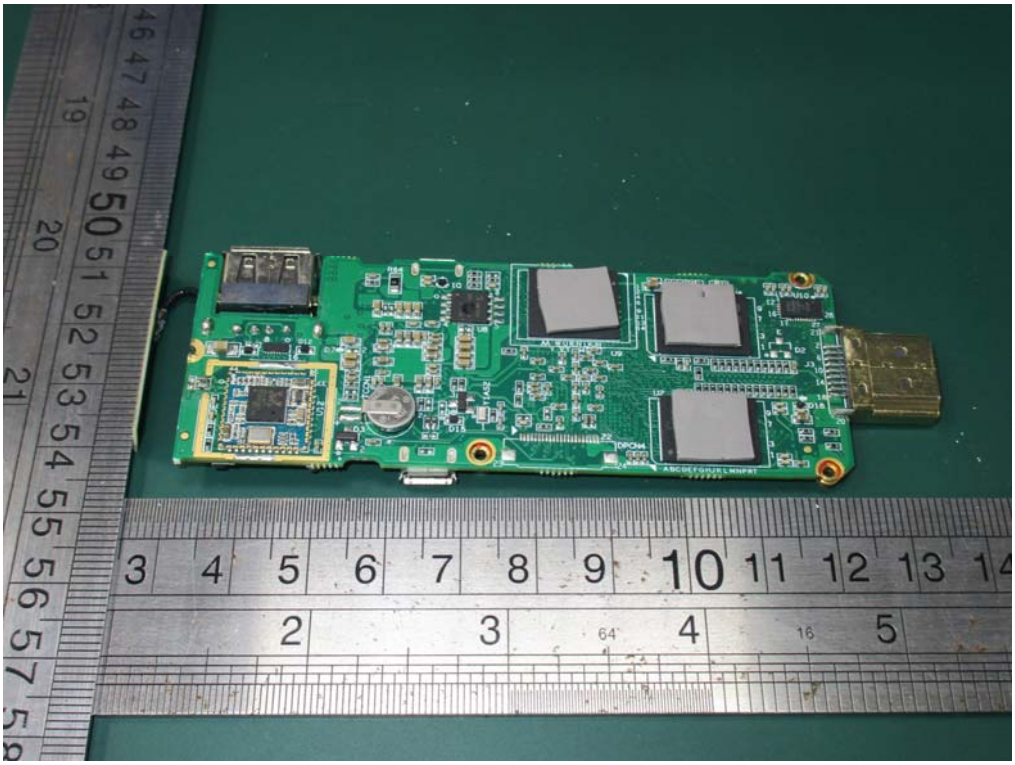
External Photos

intel
inside

RED rock Stick Computer

HJ
TRAVEL ADAPTER
MODEL:HJ620
INPUT:100-240Vac
50/60Hz 0.25A Max
OUTPUT:5V 2000mA
MADE IN CHINA

Internal Photos



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