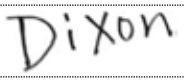
FCC PART 15 SUBPART C TEST REPORT

FCC PART 15.247

Report Reference No..... :	**MWR1411000403**	
FCC ID..... :	**RQQHLT-E425**	
Compiled by (position+printed name+signature)..:	File administrators Martin Ao	
Supervised by (position+printed name+signature)..:	Test Engineer Martin Ao	
Approved by (position+printed name+signature)..:	Manager Dixon Hao	
Date of issue.....:	Nov 19, 2014	
Representative Laboratory Name. :	**Maxwell International Co., Ltd.**	
Address..... :	Room 509, Hongfa Center Building, Baoan District, Shenzhen, Guangdong, China	
Testing Laboratory Name.....:	**Shenzhen CTL Testing Technology Co., Ltd.**	
Address..... :	Floor 1-A, Baisha Technology Park, No. 3011, Shahexi Road, Nanshan,Shenzhen,China	
Applicant's name.....:	**HYUNDAI CORPORATION**	
Address..... :	140-2, Kye-dong, Chongro-ku, Seoul, South Korea	
Test specification.....:		
Standard.....:	**FCC Part 15.247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz**	
TRF Originator.....:	Maxwell International Co., Ltd.	
Master TRF.....:	Dated 2011-05	

Test item description.....:	Mobile Phone
Trade Mark.....:	HYUNDAI
Manufacturer.....:	**WASAM TECHNOLOGY (SHEN ZHEN) CO.,LTD.**
Model/Type reference.....:	E425
Listed Models .....:	E420
Modulation Type.....:	GFSK,8DPSK,π/4DQPSK
Operation Frequency.....:	From 2402MHz to 2480MHz
Rating.....:	DC 3.70V
Hardware version.....:	DR315 V0.1
Software version .....:	S11P_HS_W412_HYUNDAI_B24859_2014-10-22_64P8_32P8_FWVGA_W25[D]_GpsL_DC_FL_GS_LED_170552
Result.....:	**PASS**

TEST REPORT

Test Report No. :	MWR1411000403	Nov 19, 2014 Date of issue

Equipment under Test	:	Mobile Phone
Model /Type	:	E425
Listed Models	:	E420
Applicant	:	**HYUNDAI CORPORATION**
Address	:	140-2, Kye-dong, Chongro-ku, Seoul, South Korea
Manufacturer	:	**WASAM TECHNOLOGY (SHEN ZHEN) CO.,LTD.**
Address	:	B,F Building, (Hengqiang Industrial Park), Bogang Taifeng Industrial Zone, Shajing Town, Bao'an District, Shenzhen, 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.

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	:	Oct 10, 2014
Testing commenced on	:	Oct 11, 2014
Testing concluded on	:	Nov 17, 2014

2.2. Product Description

The **HYUNDAI CORPORATION**'s Model: E425 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	Mobile Phone
Model Number	E425
FCC ID	RQQHLT-E425
Modilation Type	GMSK for GSM/GPRS;QPSK for WCDMA
Antenna Type	Internal
GSM/EDGE/GPRS	Supported GPRS
Extreme temp. Tolerance	-30°C to +50°C
Extreme vol. Limits	3.40VDC to 4.20VDC (nominal: 3.70VDC)
GSM Operation Frequency Band	GSM 850MHz/ PCS 1900MHz
GSM Release Version	R99
GPRS operation mode	Class B
GPRS Multislot Class	12
EGPRS Multislot Class	Only support downlink mode

2.3. 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)		

DC 3.70V

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

E425 is subscriber equipment in the WCDMA/GSM system. The HSPA/UMTS frequency band is Band II, Band IV; The GSM/GPRS/EDGE (EDGE downlink only) frequency band includes GSM850 and GSM900 and DCS1800 and PCS1900, but only Band II and Band V and GSM850 and PCS1900 bands test data included in this report. The Mobile Phone implements such functions as RF signal receiving/transmitting, HSPA/UMTS and GSM/GPRS/EDGE protocol processing, voice, video MMS service, GPS and WIFI etc. Externally it provides micro SD card interface, earphone port (to provide voice service) and SIM card interface. It also provides Bluetooth module to synchronize data between a PC and the phone, or to use the built-in modem of the phone to access the Internet with a PC, or to exchange data with other Bluetooth devices.

NOTE: Unless otherwise noted in the report, the functional boards installed in the units shall be selected from the below list, but not means all the functional boards listed below shall be installed in one unit.

2.5. EUT operation mode

The EUT has been tested under typical operating condition. There are EDR (Enhanced Data Rate) and BDR

(Basic Data Rate)mode.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**		

2.6. Internal Identification of AE used during the test

AE ID*	Description
AE1	Charger

AE1

Model：E425

INPUT: 100-300V 50/60HZ 0.15A

OUTPUT: 5.0VDC=====500mAh

*AE ID: is used to identify the test sample in the lab internally.

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

This submittal(s) (test report) is intended for **FCC ID: RQQHLT-E425** 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.

3. TEST ENVIRONMENT

3.1. Address of the test laboratory

Shenzhen CTL Testing Technology Co., Ltd.
Floor 1-A, Baisha Technology Park, No. 3011, Shahexi Road, Nanshan, Shenzhen,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:

FCC-Registration No.: 970318

Shenzhen CTL Testing Technology Co., Ltd. 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 970318, Dec 19, 2013

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 Conditions

Test Case	Test Conditions	
	Configuration	Description
20dB Emission Bandwidth (EBW)	Meas. Method	ANSI C63.10:2009
	Test Environment	NTNV
	EUT Conf.	TM1_DH5_Ch00,TM1_DH5_Ch39,TM1_DH5_Ch78,TM2_2DH5_Ch00,TM2_2DH5_Ch39,TM2_2DH5_Ch78,TM3_3DH5_Ch00,TM3_3DH5_Ch39,TM3_3DH5_Ch78, TM4_DH5_Ch00,TM4_DH5_Ch19,TM4_DH5_Ch39.
Carrier Frequency Separation	Meas. Method	ANSI C63.10:2009
	Test Environment	NTNV
	EUT Conf.	TM1_DH5_Hop,TM2_2DH5_Hop,TM3_3DH5_Hop,
Number of Hopping Channel	Meas. Method	ANSI C63.10:2009
	Test Environment	NTNV
	EUT Conf.	TM1_DH5_Hop,TM2_2DH5_Hop,TM3_3DH5_Hop,
Time of Occupancy (Dwell Time)	Meas. Method	ANSI C63.10:2009
	Test Environment	NTNV
	EUT Conf.	TM1_DH5_Ch39,TM2_2DH5_Ch39,TM3_3DH5_Ch39.
Maximum Peak Conducted Output Power	Meas. Method	ANSI C63.10:2009
	Test Environment	NTNV
	EUT Conf.	TM1_DH3_Ch00,TM1_DH3_Ch39,TM1_DH3_Ch78,TM2_2DH3_Ch00,TM2_2DH3_Ch39,TM2_2DH3_Ch78,TM3_3DH3_Ch00,TM3_3DH3_Ch39,TM3_3DH3_Ch78, TM4_DH3_Ch00,TM4_DH3_Ch19,TM4_DH3_Ch39.
Bandedge spurious emission (Conducted)	Meas. Method	ANSI C63.10:2009
	Test Environment	NTNV
	EUT Conf.	TM1_DH3_Ch00,TM1_DH3_Ch78,TM2_2DH3_Ch00,TM2_2DH3_Ch78, TM3_3DH3_Ch00,TM3_3DH3_Ch78. TM4_DH3_Ch00,TM4_DH3_Ch39.
Conducted RF Spurious	Meas. Method	ANSI C63.10:2009

Emission	Test Environment	NTNV
	EUT Conf.	TM1_DH5_Ch00, TM1_DH5_Ch39, TM1_DH5_Ch78, TM2_2DH5_Ch00, TM2_2DH5_Ch39, TM2_2DH5_Ch78, TM3_3DH5_Ch00, TM3_3DH5_Ch39, TM3_3DH5_Ch78. TM4_DH5_Ch00,TM4_DH5_Ch19,TM4_DH5_Ch39.
Radiated Emissions in the Restricted Bands	Meas. Method	ANSI C63.10:2009 30 MHz to 1 GHz: Pre: RBW=100kHz; VBW=300kHz; Det. = Peak. Final: RBW=120kHz; Det. = CISPR Quasi-Peak. 1 GHz to 26.5GHz: Average: RBW=1 MHz; VBW= 10Hz; Det. = Peak; Sweep-time= Auto; Trace = Single. Peak: RBW=1 MHz; VBW= 3 MHz; Det. = Peak; Sweep-time= Auto; Trace≥ MaxHold * 100.
	Test Environment	NTNV
	EUT Conf.	30 MHz-1GHz TM1_DH5_Ch00 (Worst Conf.).
		1-18 GHz: TM1_DH5_Ch00, TM1_DH5_Ch39, TM1_DH5_Ch78, (Worst Conf.).

Test Case	Test Conditions	
	Configuration	Description
AC Power Line Conducted Emissions	Measurement Method	AC mains conducted.
	Test Environment	NTNV
	EUT Configuration	TM1_DH5_Ch39. (Worst Conf.).

Note: For Radiated Emissions, By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that “Z axis” position was the worst, then the final test was executed the worst condition and test data were recorded in this report.

3.5. 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

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

3.6. 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. is reported:

Test Items	Measurement Uncertainty	Notes
Frequency stability	25 Hz	(1)
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-12.75 GHz	2.20 dB	(1)
Conducted Emission 9KHz-30MHz	3.39 dB	(1)
Radiated Emission 9KHz-30MHz	2.88 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)
Emission Mask	---------	(1)
Modulation Characteristic	---------	(1)
Transmitter Frequency Behavior	---------	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

3.7. Equipments Used during the Test

AC Power Conducted Emission					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Artificial Mains	Rohde&Schwarz	ENV216	101316	2014/07/02
2	EMI Test Receiver	Rohde&Schwarz	ESCI3	103710	2014/07/02
3	Pulse Limiter	Com-Power	LIT-153	53226	2014/07/01
4	EMI Test Software	Rohde&Schwarz	ES-K1 V1.71	N/A	N/A
5	RF Cable4	/	Cable000001	/	2014/07/06

Radiated Emission					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Bilog Antenna	Sunol Sciences Corp.	JB1	A061713	2014/07/12
2	EMI TEST Receivcer	Rohde&Schwarz	ESCI3	103710	2014/07/02
3	EMI TEST Software	Audix	E3	N/A	N/A
4	EMI TEST Software	Rohde&Schwarz	ESK1	N/A	N/A
5	HORN ANTENNA	Sunol Sciences Corp.	DRH-118	A062013	2014/07/12
6	Amplifer	HP	8447D	3113A07663	2014/10/26
7	Preamplifier	HP	8349B	3155A00882	2014/07/03
8	Amplifer	Compliance Direction systems	PAP1-4060	129	2014/07/03
9	Loop Antenna	Rohde&Schwarz	HFH2-Z2	100020	2014/06/29
10	TURNTABLE	MATURO	TT2.0	----	N/A
11	ANTENNA MAST	MATURO	TAM-4.0-P	----	N/A
12	Horn Antenna	SCHWARZBECK	BBHA9170	25849	2014/06/21
13	Spectrum Analyzer	Rohde&Schwarz	FSU26	201148	2014/07/02
14	RF Cable 5	/	Cable000005	/	2014/07/06
15	RF Cable 6	/	Cable000006	/	2014/07/06

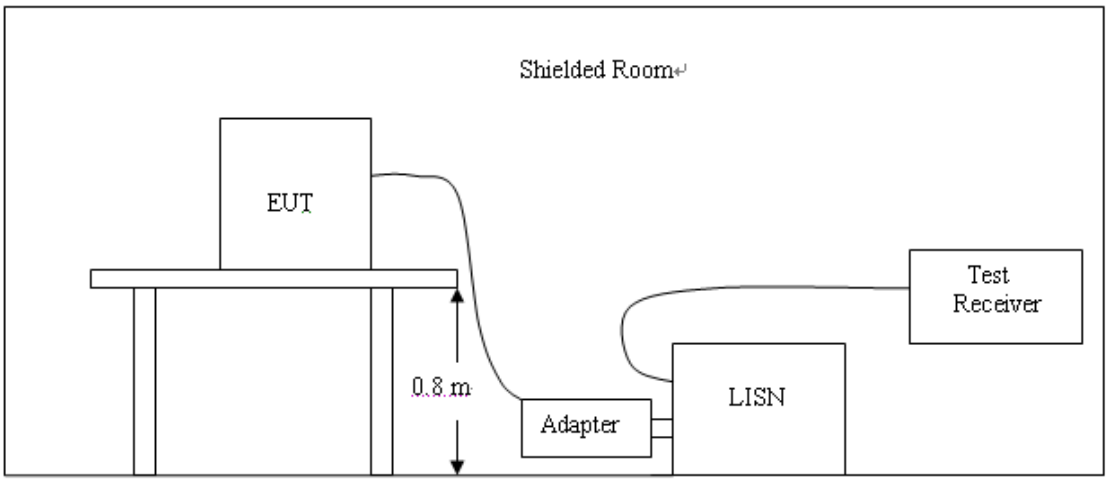
Maximum Peak Output Power / Power Spectral Density / 6dB Bandwidth / Band Edge Compliance of RF Emission / Spurious RF Conducted Emission					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Spectrum Analyzer	Rohde&Schwarz	FSU26	201148	2014/07/02
2	Power Sensor	Rohde&Schwarz	NRR-Z81	256697	2014/07/02
3	MXA Signal Analyzer	Agilent	N9020A	MY53420615	2014/05/12
4	RF Cable1	/	Cable000001	/	2014/07/06

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 the adapter, the adapter 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：

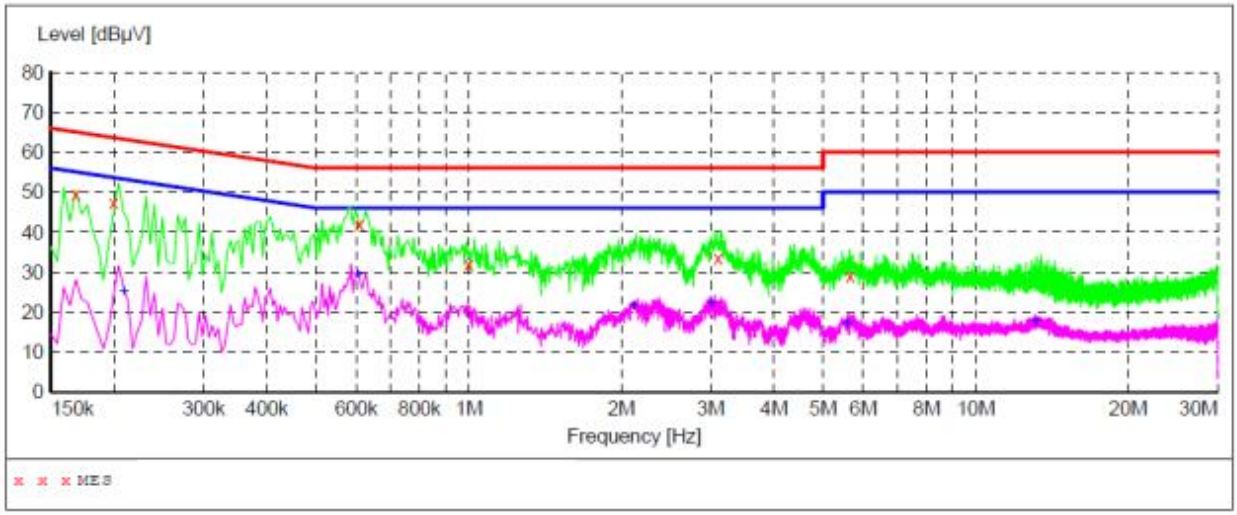
Frequency (MHz)	Maximum RF Line Voltage (dBμV)			
	CLASS A		CLASS B	
	Q.P.	Ave.	Q.P.	Ave.
0.15 - 0.50	79	66	66-56*	56-46*
0.50 - 5.00	73	60	56	46
5.00 - 30.0	73	60	60	50

* Decreasing linearly with the logarithm of the frequency

TEST RESULTS

Note: We tested Conducted Emission of GFSK, π/4 DQPSK and 8DPSK mode from 0.15 KHz to 30MHz (DH1, DH3 and DH5) and all channels (low, middle and high), recorded the worst case data at GFSK DH5 middle channel.

SCAN TABLE: "Voltage (9K-30M) FIN"
Short Description: 150K-30M Voltage



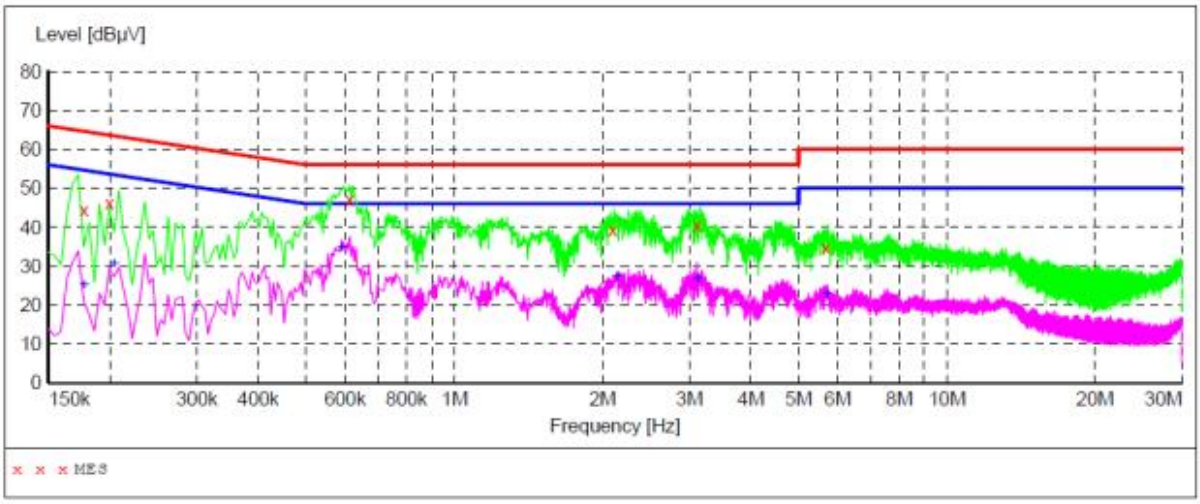
MEASUREMENT RESULT:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.168000	49.50	10.3	65.1	15.6	QP	N	GND
0.199500	47.30	10.4	63.6	16.3	QP	N	GND
0.609000	41.80	10.3	56.0	14.2	QP	N	GND
1.000500	32.10	10.3	56.0	23.9	QP	N	GND
3.102000	33.60	10.3	56.0	22.4	QP	N	GND
5.653500	29.00	10.3	60.0	31.0	QP	N	GND

MEASUREMENT RESULT:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.208500	25.20	10.4	53.3	28.1	AV	N	GND
0.604500	29.20	10.3	46.0	16.8	AV	N	GND
2.112000	21.40	10.3	46.0	24.6	AV	N	GND
3.016500	22.00	10.3	46.0	24.0	AV	N	GND
5.568000	17.10	10.3	50.0	32.9	AV	N	GND
13.114500	17.50	10.7	50.0	32.5	AV	N	GND

SCAN TABLE: "Voltage (9K-30M)FIN"
Short Description: 150K-30M Voltage



MEASUREMENT RESULT:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.177000	44.30	10.3	64.6	20.3	QP	L1	GND
0.199500	46.20	10.4	63.6	17.4	QP	L1	GND
0.613500	47.20	10.3	56.0	8.8	QP	L1	GND
2.098500	39.10	10.3	56.0	16.9	QP	L1	GND
3.115500	40.40	10.3	56.0	15.6	QP	L1	GND
5.694000	34.90	10.3	60.0	25.1	QP	L1	GND

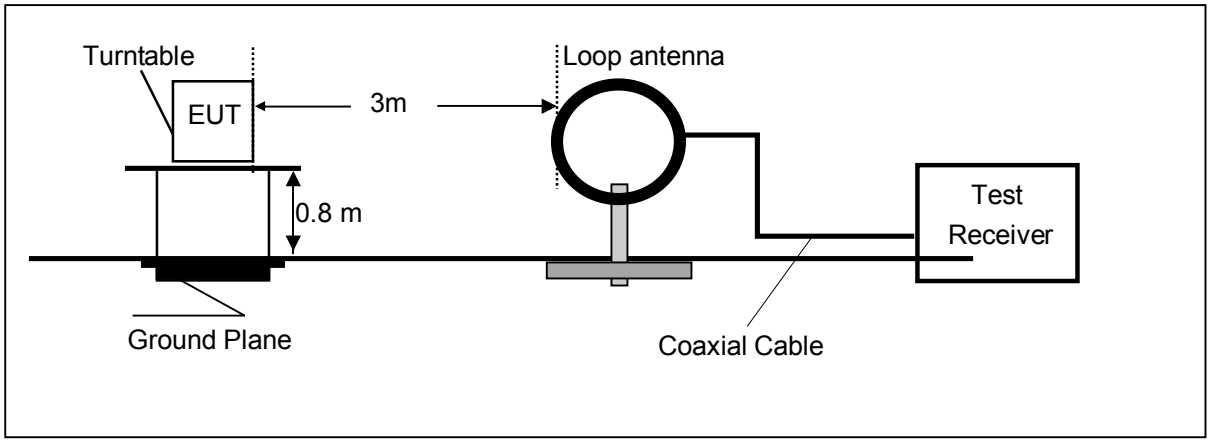
MEASUREMENT RESULT:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.177000	25.00	10.3	54.6	29.6	AV	L1	GND
0.204000	30.50	10.4	53.4	22.9	AV	L1	GND
0.591000	34.70	10.3	46.0	11.3	AV	L1	GND
2.139000	27.10	10.3	46.0	18.9	AV	L1	GND
3.111000	26.60	10.3	46.0	19.4	AV	L1	GND
5.712000	22.80	10.3	50.0	27.2	AV	L1	GND

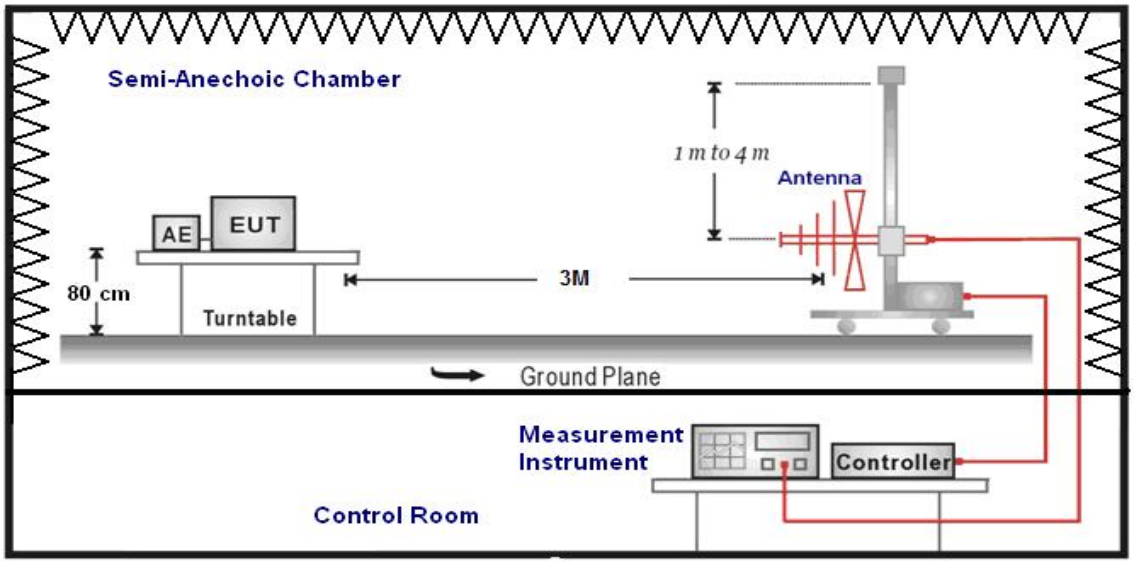
4.2. Radiated Emission

TEST CONFIGURATION

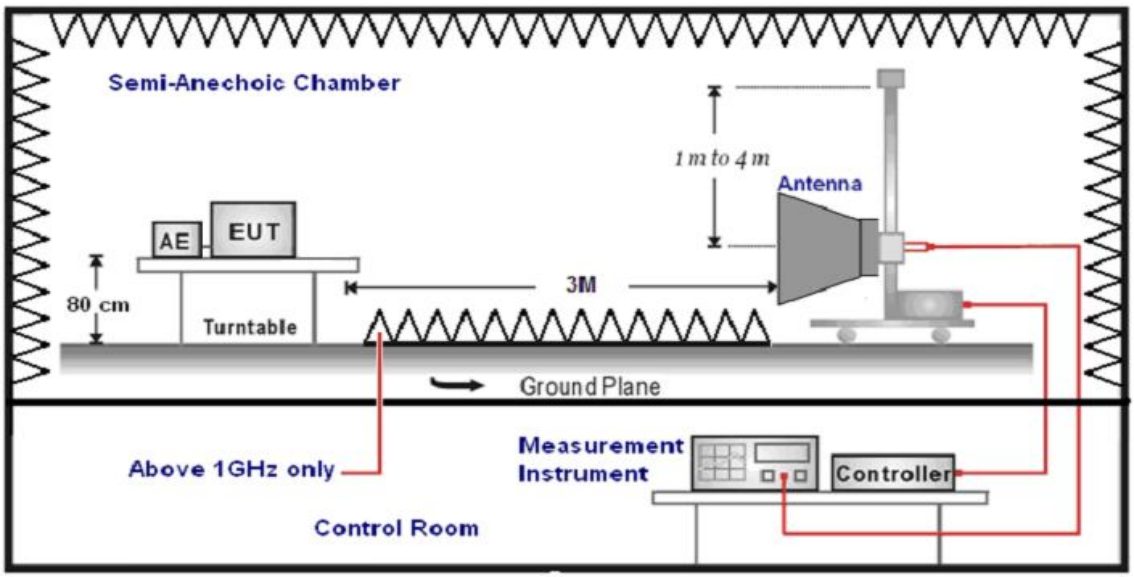
Frequency range 9KHz – 30MHz



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 32.768kHz 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	300	20log(2400/F(KHz))+80	2400/F(KHz)
0.49-1.705	30	20log(24000/F(KHz))+40	24000/F(KHz)
1.705-30	30	20log(30)+40	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. The radiated measurement are performed the each channel (low/mid/high) at all Packet type (DH1, DH3 and DH5) also for difference modulation type (GFSK, 8DPSK and π/4 DQPSK), recorded worst case at GFSK_DH5_Low channel (Channel 00) for below 1GHz and GFSK_DH5_Low channel (Channel 00), GFSK_DH5_Middle channel (Channel 39), GFSK_DH5_High channel (Channel 78).
2. ULTRA-BROADBAND ANTENNA for the radiation emission test below 1G.

3. HORN ANTENNA for the radiation emission test above 1G.
4. We tested both battery powered and powered by adapter charging mode at three orientate ones, recorded worst case at powered by adapter charging mode.
5. "---" means not recorded as emission levels lower than limit.

For 9KHz to 30MHz

Frequency (MHz)	Corrected Reading (dBμV/m)@3m	FCC Limit (dBμV/m) @3m	Margin (dB)	Detector	Result
12.00	44.61	69.54	24.93	QP	PASS
24.00	42.42	69.54	27.12	QP	PASS

For 30MHz to 1000MHz

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin Limit (dB)	Polarization
34.86	49.30	15.82	0.61	32.06	33.67	40.00	6.33	Vertical
113.34	47.75	14.15	1.31	31.83	31.38	43.50	12.12	Vertical
234.16	43.95	14.88	2.04	32.16	28.71	46.00	17.29	Vertical
742.29	38.68	22.34	4.24	31.25	34.01	46.00	11.99	Vertical
34.27	48.11	15.80	0.60	32.06	32.45	40.00	7.55	Horizontal
96.45	47.3	16.02	1.16	31.75	32.73	43.50	10.77	Horizontal
147.39	52.47	11.27	1.55	31.97	33.32	43.50	10.18	Horizontal
239.14	41.40	15.06	2.06	32.16	26.36	46.00	19.64	Horizontal

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	55.63	PK	74.00	18.37	1.00	125	53.55	31.58	7.00	36.5	2.08
2	4804.00	40.71	AV	54.00	13.29	1.00	125	38.63	31.58	7.00	36.5	2.08
3	7206.00	57.78	PK	74.00	16.22	1.00	313	47.12	37.06	8.90	35.3	10.66
4	7206.00	39.89	AV	54.00	14.11	1.00	313	29.23	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	53.91	PK	74.00	20.09	1.00	23	51.83	31.58	7.00	36.5	2.08
2	4804.00	38.50	AV	54.00	15.50	1.00	23	36.42	31.58	7.00	36.5	2.08
3	7206.00	56.08	PK	74.00	17.92	1.00	179	45.42	37.06	8.90	35.3	10.66
4	7206.00	38.29	AV	54.00	15.71	1.00	179	27.63	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	4882.00	56.44	PK	74.00	17.56	1.00	267	54.30	31.04	7.60	36.5	2.14
2	4882.00	41.22	AV	54.00	12.78	1.00	267	39.08	31.04	7.60	36.5	2.14
3	7323.00	58.33	PK	74.00	15.67	1.00	222	47.19	37.84	8.60	35.3	11.14
4	7323.00	40.13	AV	54.00	13.87	1.00	222	28.99	37.84	8.60	35.3	11.14

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	4882.00	54.22	PK	74.00	19.78	1.00	188	52.08	31.04	7.60	36.5	2.14
2	4882.00	39.38	AV	54.00	14.62	1.00	188	37.24	31.04	7.60	36.5	2.14
3	7323.00	56.26	PK	74.00	17.74	1.00	343	45.12	37.84	8.60	35.3	11.14
4	7323.00	38.39	AV	54.00	15.61	1.00	343	27.25	37.84	8.60	35.3	11.14

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	56.02	PK	74.00	17.98	1.00	177	53.59	31.63	7.00	36.2	2.43
2	4960.00	40.93	AV	54.00	13.07	1.00	177	38.50	31.63	7.00	36.2	2.43
3	7340.00	58.79	PK	74.00	15.21	1.00	142	47.19	38.40	8.50	35.3	11.60
4	7340.00	40.41	AV	54.00	13.59	1.00	142	28.81	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	54.46	PK	74.00	19.54	1.00	108	52.03	31.63	7.00	-36.2	2.43
2	4960.00	39.55	AV	54.00	14.45	1.00	108	37.12	31.63	7.00	-36.2	2.43
3	7340.00	57.14	PK	74.00	16.86	1.00	129	45.54	38.40	8.50	-35.3	11.60
4	7340.00	38.59	AV	54.00	15.41	1.00	129	26.99	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:Connent antenna port into power meter and reading Peak values.

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

Remark: We test maximum peak output power at difference Packet Type (DH1, DH3 and DH5), recorded worst case at DH3

4.3.1 GFSK Test Mode

A. Test Verdict

Channel	Frequency (MHz)	Measured Output Peak Power (dBm)	Limits (dBm)	Verdict
00	2402	1.87	30	PASS
39	2441	2.36	30	PASS
78	2480	2.36	30	PASS

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

4.3.2 π/4 DQPSK Test Mode

A. Test Verdict

Channel	Frequency (MHz)	Measured Output Peak Power (dBm)	Limits (dBm)	Verdict
00	2402	1.34	21	PASS
39	2441	1.61	21	PASS
78	2480	1.61	21	PASS

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

4.3.3 8DPSK Test Mode

A. Test Verdict

Channel	Frequency (MHz)	Measured Output Peak Power (dBm)	Limits (dBm)	Verdict
00	2402	1.33	21	PASS
39	2441	1.53	21	PASS
78	2480	1.58	21	PASS

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

4.4.1 GFSK Test Mode

A. Test Verdict

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot	Limits (MHz)	Verdict
00	2402	0.8258	Plot 4.4.1 A	/	PASS
39	2441	0.8171	Plot 4.4.1 B	/	PASS
78	2480	0.8029	Plot 4.4.1 C	/	PASS

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

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)

4.4.2 8DPSK Test Mode

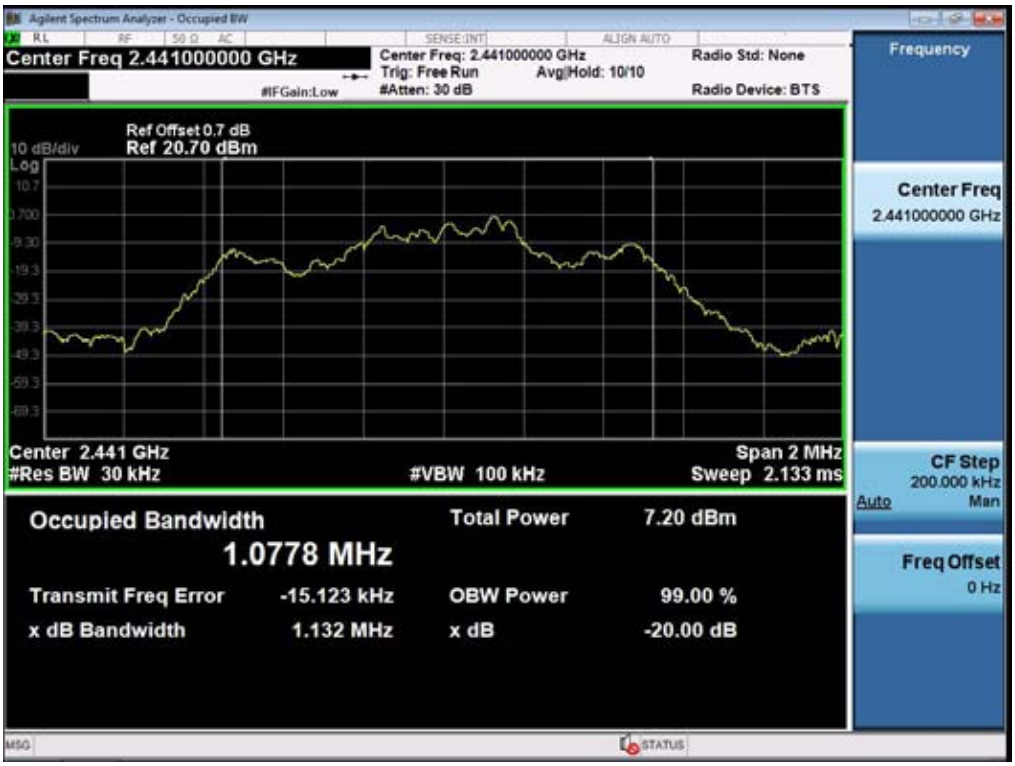
A. Test Verdict

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot	Limits (MHz)	Verdict
00	2402	1.1260	Plot 4.4.2 A	/	PASS
39	2441	1.1320	Plot 4.4.2 B	/	PASS
78	2480	1.1370	Plot 4.4.2 C	/	PASS

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

B. Test Plots

(Plot 4.4.2 A: Channel 00: 2402MHz @ 8DPSK)



(Plot 4.4.2 B: Channel 39: 2441MHz @ 8DPSK)

(Plot 4.4.2 C: Channel 78: 2480MHz @ 8DPSK)

4.4.3 π/4DQPSKTest Mode

A. Test Verdict

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot	Limits (MHz)	Verdict
00	2402	1.1410	Plot 4.4.3 A	/	PASS
39	2441	1.1400	Plot 4.4.3 B	/	PASS
78	2480	1.1330	Plot 4.4.3 C	/	PASS

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

B. Test Plots

(Plot 4.4.3 A: Channel 00: 2402MHz @ π/4DQPSK)

(Plot 4.4.3 B: Channel 39: 2441MHz @π/4DQPSK)

(Plot 4.4.3 C: Channel 78: 2480MHz @π/4DQPSK)

4.5. Band Edge

Applicable Standard

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.
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.

TEST RESULTS

Remark: 1. We test Band Edge at difference Packet Type (DH1, DH3 and DH5), recorded worst case at DH5.
2. “---” means not recorded as emission levels lower than limit.

4.5.1 For Radiated Bandedge Measurement

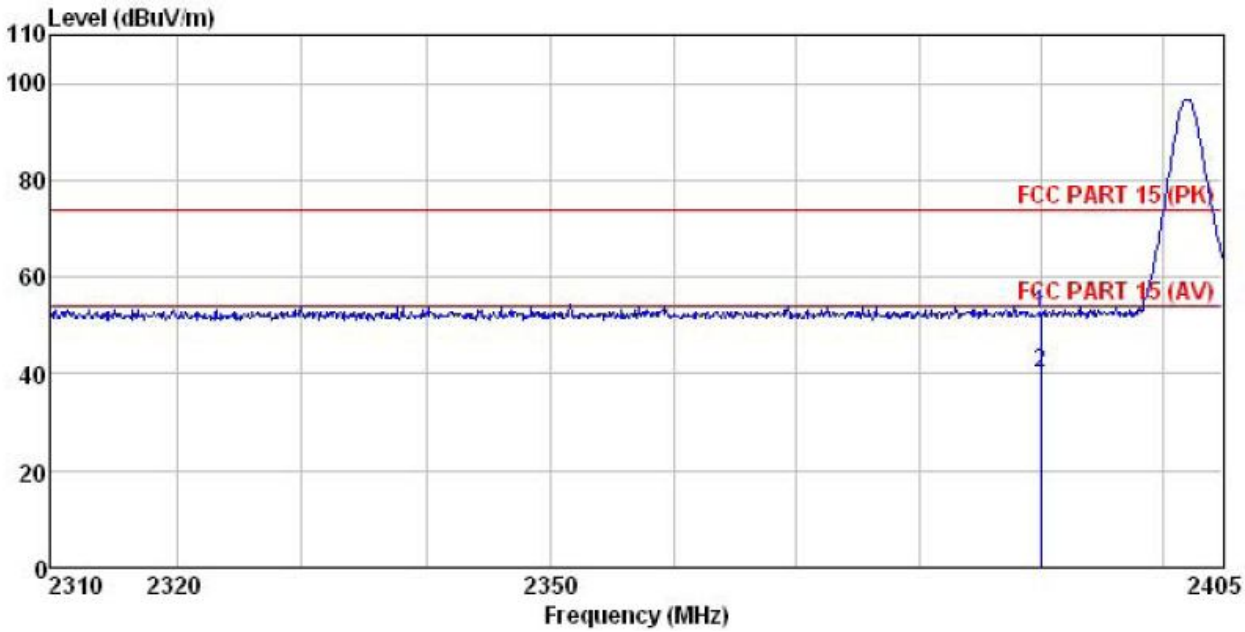
Remark: we tested radiated bandedge at both hopping and no-hopping modes, recorded worst case at no-hopping mode

We test all case and recorded the worst data at TM1-DH5

4.5.1.1 GFSK Test Mode

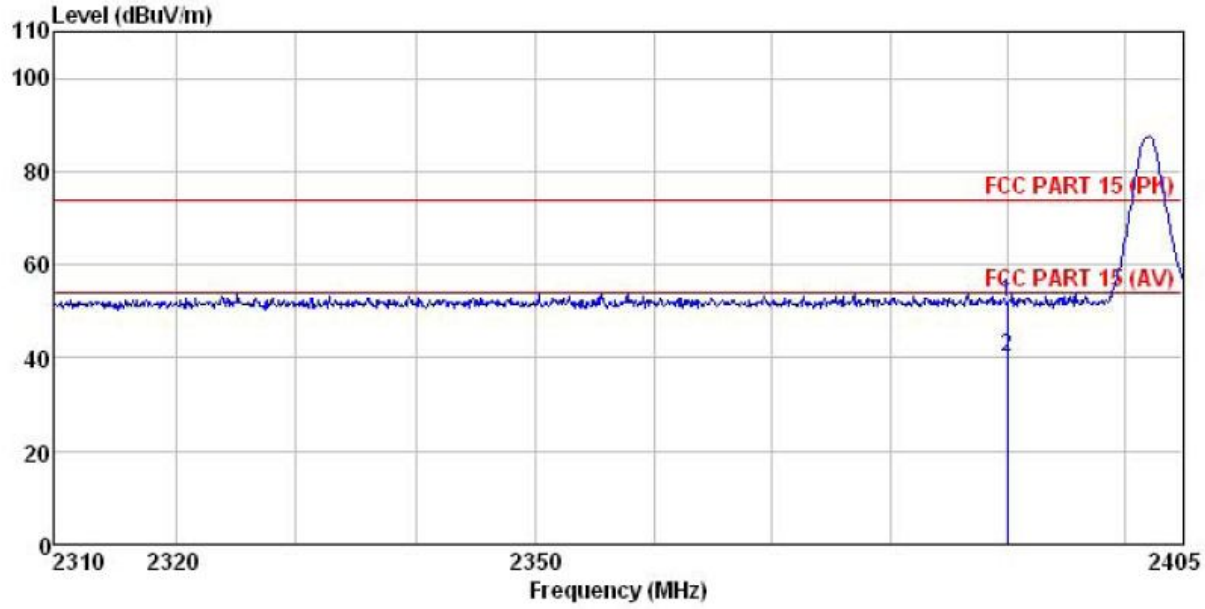
Low Channel

HORIZONTAL:



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	2390.000	19.20	27.58	5.67	0.00	52.45	74.00	-21.55	Peak
2	2390.000	6.95	27.58	5.67	0.00	40.20	54.00	-13.80	Average

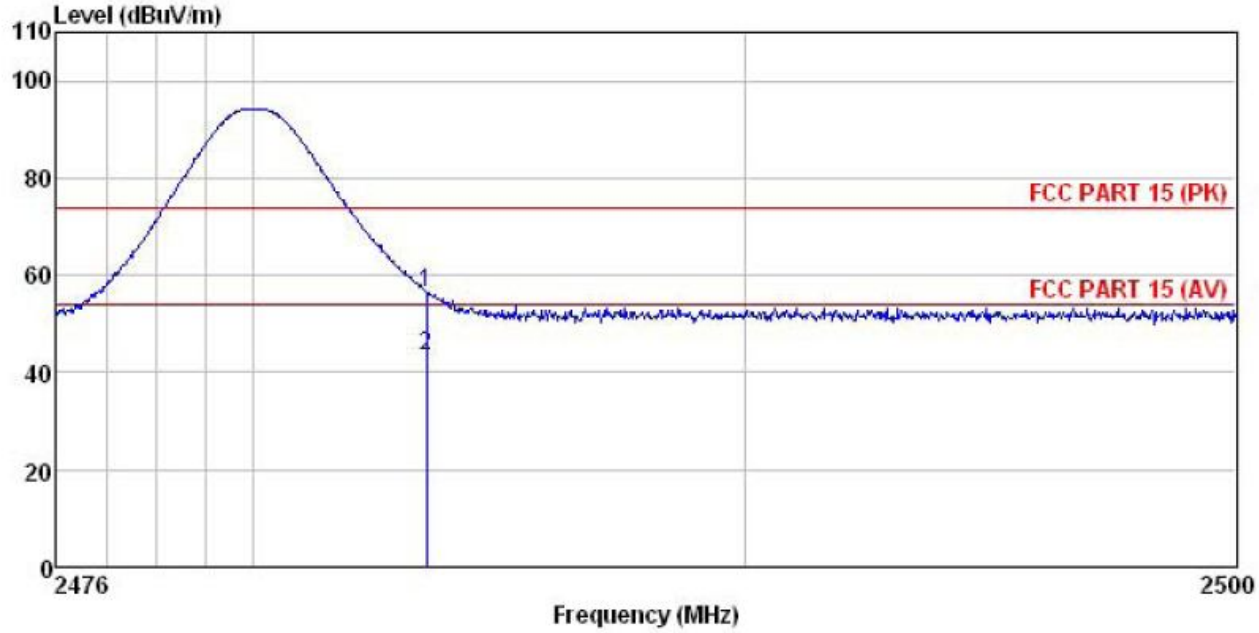
VERTICAL:



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	2390.000	18.59	27.58	5.67	0.00	51.84	74.00	-22.16	Peak
2	2390.000	7.02	27.58	5.67	0.00	40.27	54.00	-13.73	Average

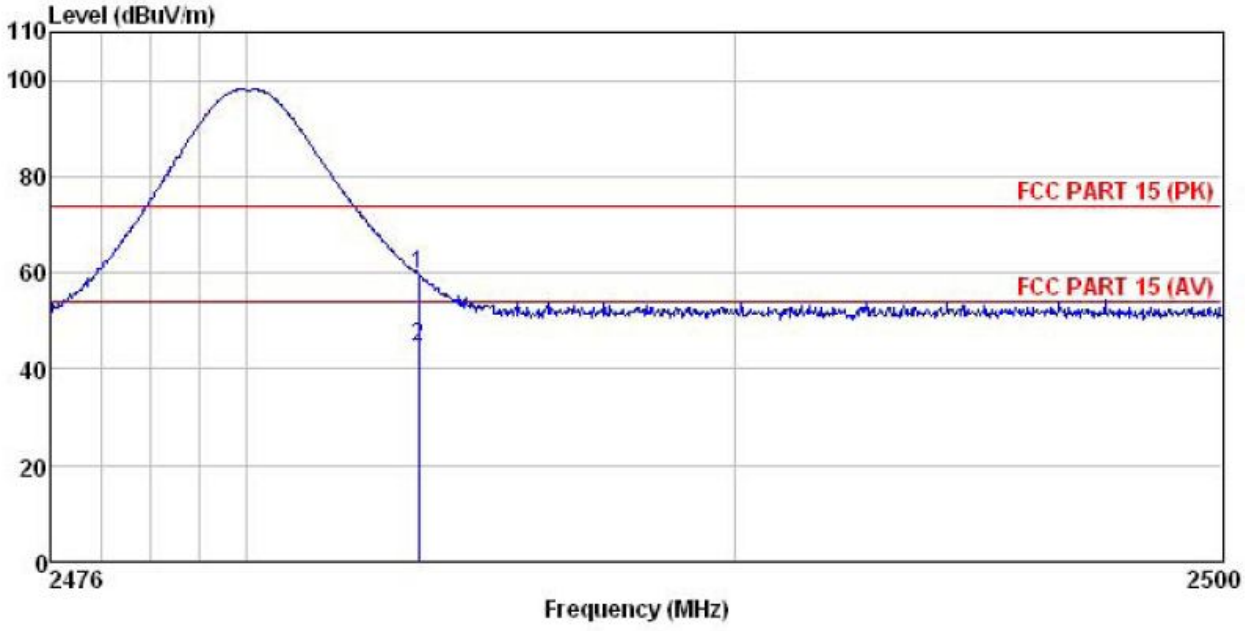
High Channel

HORIZONTAL:



	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	2483.500	23.35	27.52	5.70	0.00	56.57	74.00	-17.43	Peak
2	2483.500	10.23	27.52	5.70	0.00	43.45	54.00	-10.55	Average

VERTICAL:

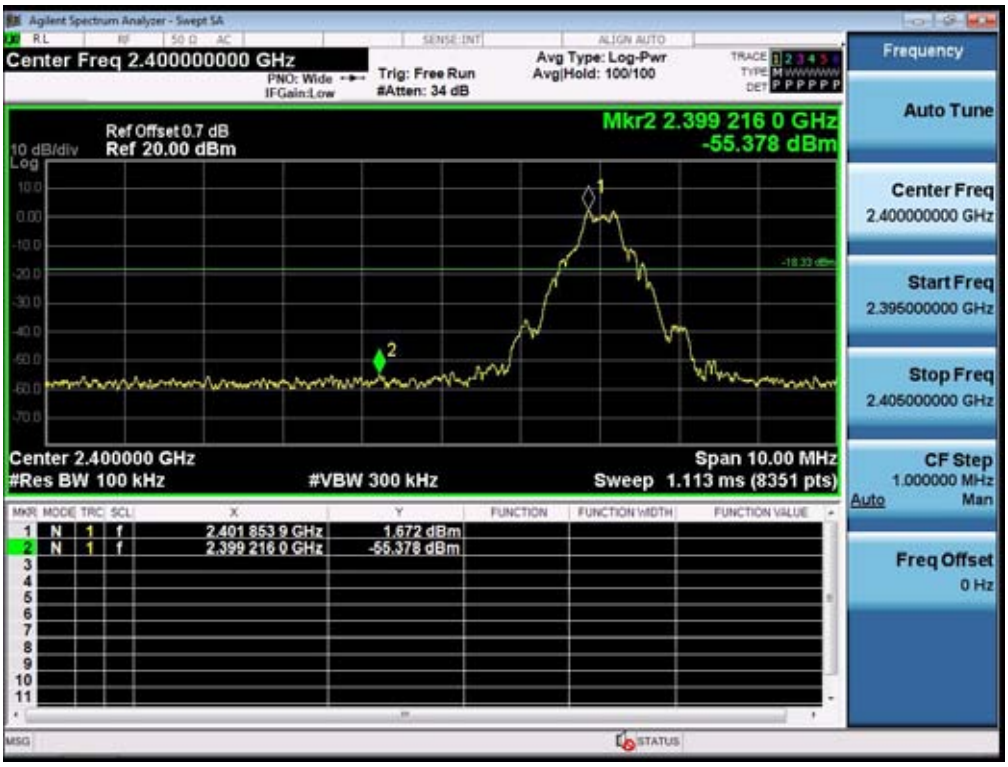


	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	2483.511	26.55	27.52	5.70	0.00	59.77	74.00	-14.23	Peak
2	2483.511	11.32	27.52	5.70	0.00	44.54	54.00	-9.46	Average

4.5.2 For Conducted Bandedge Measurement

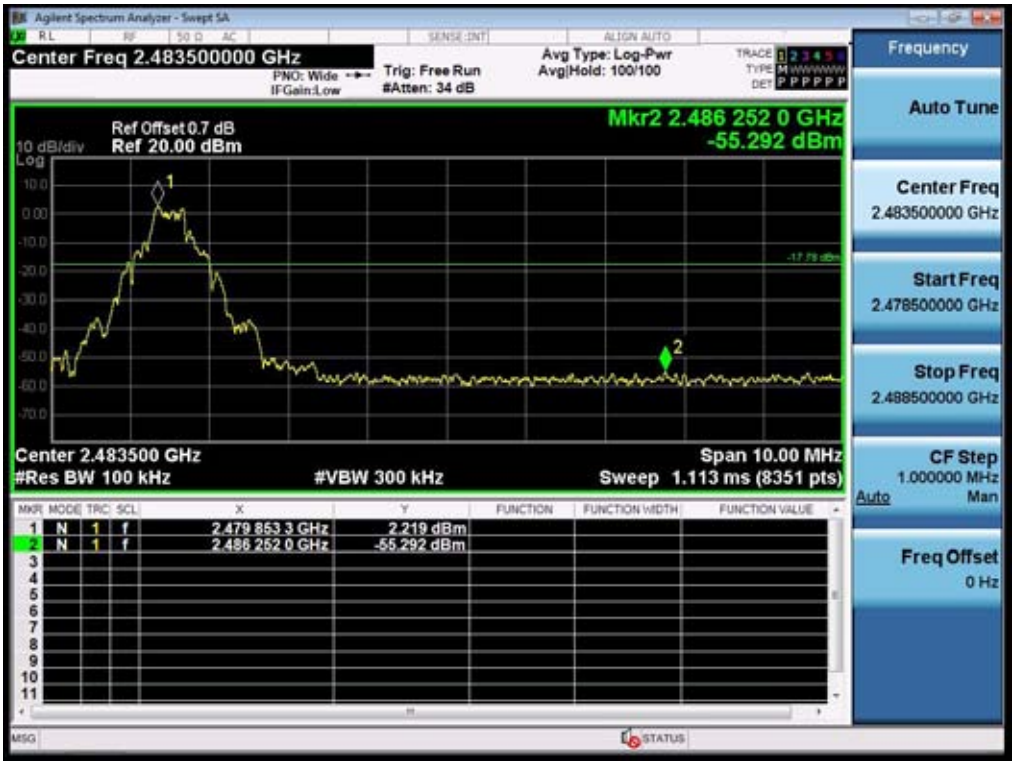
4.5.2.1 GFSK Test Mode

A. Test Plots



(Plot 4.5.2.1 A: Channel 00: 2402MHz @ GFSK)

(Plot 4.5.2.1 B: Hopping Mode @ GFSK)



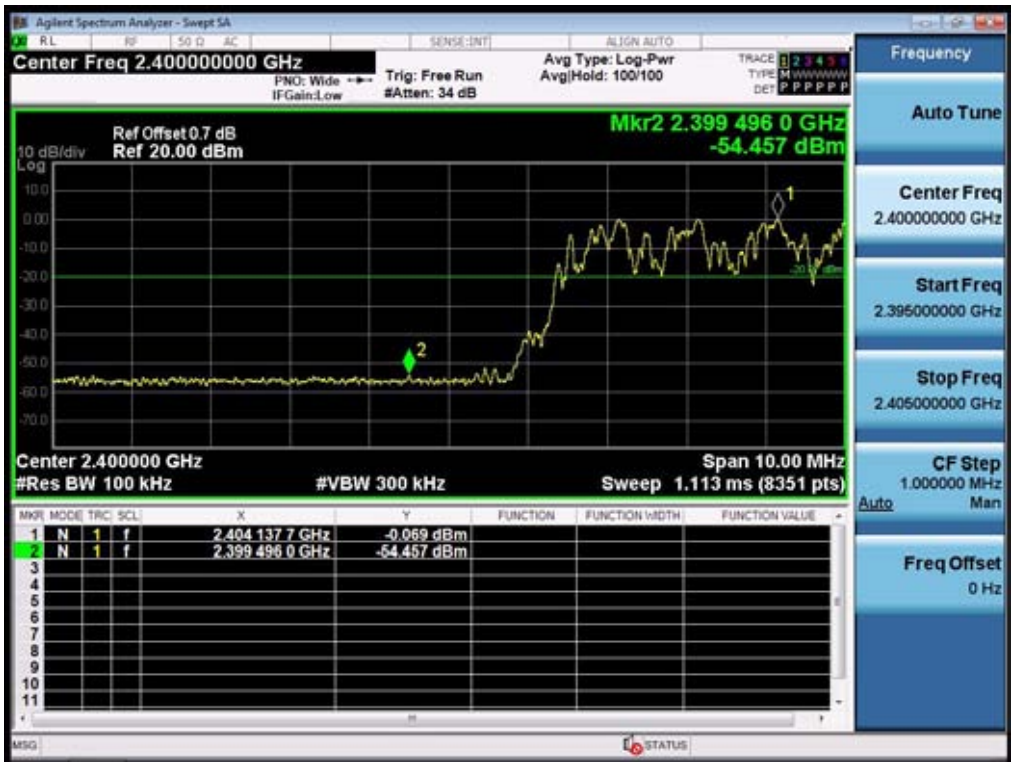
(Plot 4.5.2.1 C: Channel 78: 2480MHz @ GFSK)

(Plot 4.5.2.1 D: Hopping Mode @ GFSK)

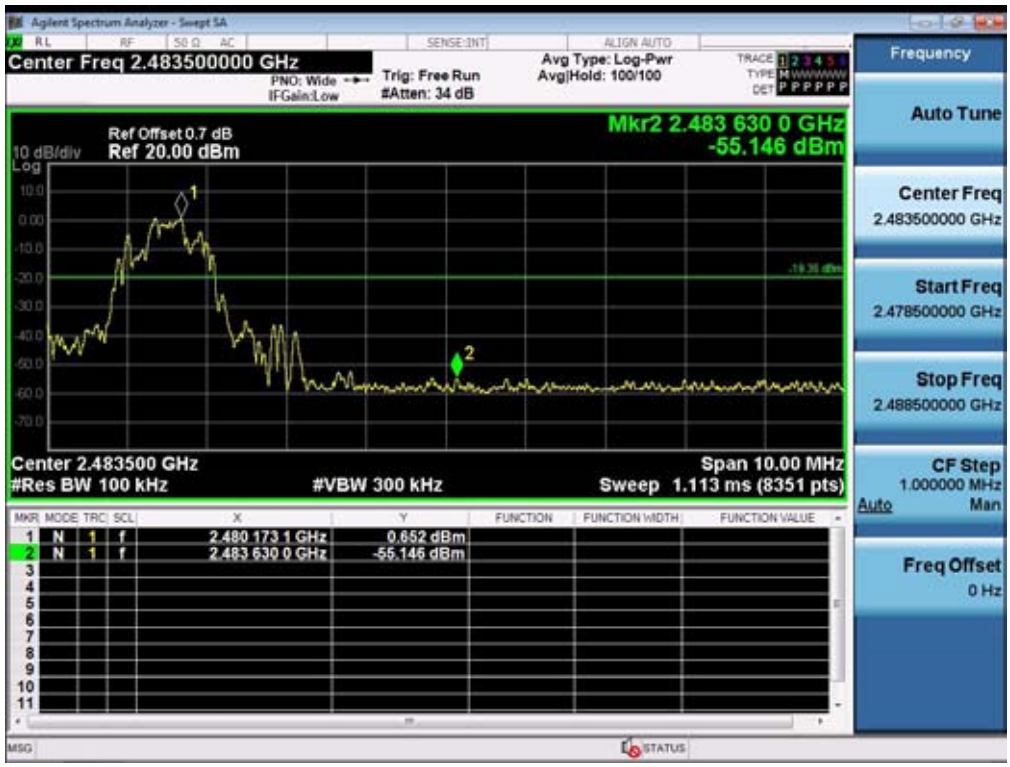
4.5.2.2 8DPSK Test Mode

A. Test Plots

(Plot 4.5.2.2 A: Channel 00: 2402MHz @ 8DPSK)



(Plot 4.5.2.2 B: Hopping Mode @ 8DPSK)



(Plot 4.5.2.2 C: Channel 78: 2480MHz @ 8DPSK)

(Plot 4.5.2.2 D: Hopping Mode @ 8DPSK)

4.5.2.3 π/4DQPSK Test Mode

A. Test Plots

(Plot 4.5.2.3 A: Channel 00: 2402MHz @ π/4DQPSK)

(Plot 4.5.2.3 B: Hopping Mode @π/4DQPSK)

(Plot 4.5.2.3 C: Channel 78: 2480MHz @ π/4DQPSK)

(Plot 4.5.2.3 D: Hopping Mode @π/4DQPSK)

4.6. 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

Remark: 1. We test Frequency Separation at difference Packet Type (DH1, DH3 and DH5) and all test channels, recorded worst case at DH5 and middle channel.

4.6.1 GFSK Test Mode

A. Test Verdict

Channel	Frequency (MHz)	Channel Separation (MHz)	Refer to Plot	Limits (MHz)	Verdict
38	2440	1.000	Plot 4.6.1 A	0.8702	PASS
39	2441				

B. Test Plots

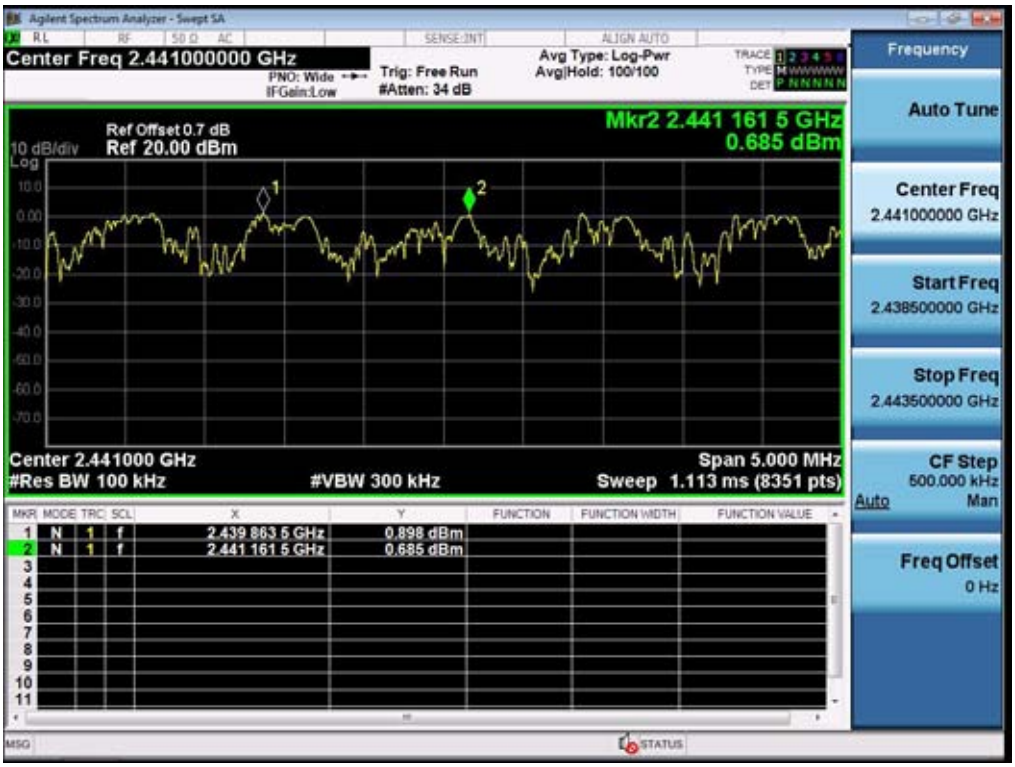
(Plot 4.6.1 A: Channel 39: 2441MHz @ GFSK)

4.6.2 8DPSK Test Mode

A. Test Verdict

Channel	Frequency (MHz)	Channel Separation (MHz)	Refer to Plot	Limits (MHz)	Verdict
38	2440	1.298	Plot 4.6.2 A	0.84936	PASS
39	2441				

B. Test Plots



(Plot 4.6.2 A: Channel 39: 2441MHz @ 8DPSK)

4.6.3 π/4DQPSK Test Mode

A. Test Verdict

Channel	Frequency (MHz)	Channel Separation (MHz)	Refer to Plot	Limits (MHz)	Verdict
38	2440	1..0855	Plot 4.6.3 A	0.84936	PASS
39	2441				

B. Test Plots

(Plot 4.6.3 A: Channel 39: 2441MHz @ π/4DQPSK)

4.7. 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=100 KHz and VBW=300KHz.

LIMIT

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

TEST RESULTS

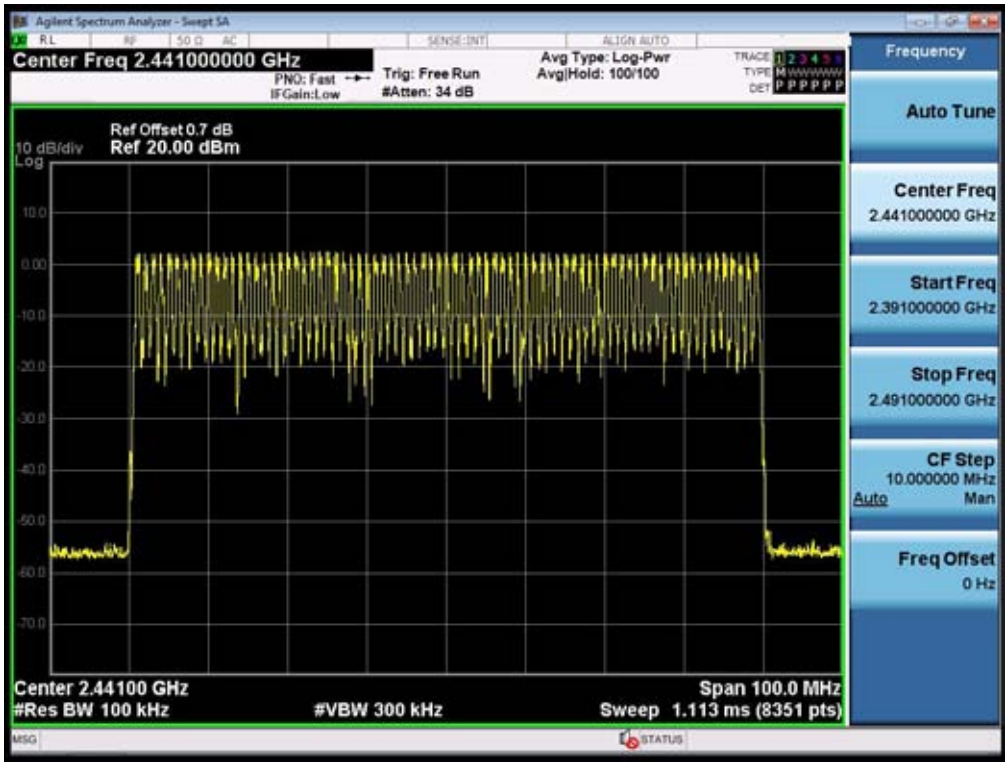
Remark: 1. We test Frequency Separation at difference Packet Type (DH1, DH3 and DH5), recorded worst case at DH5.

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	≥15	PASS

B. Test Plots



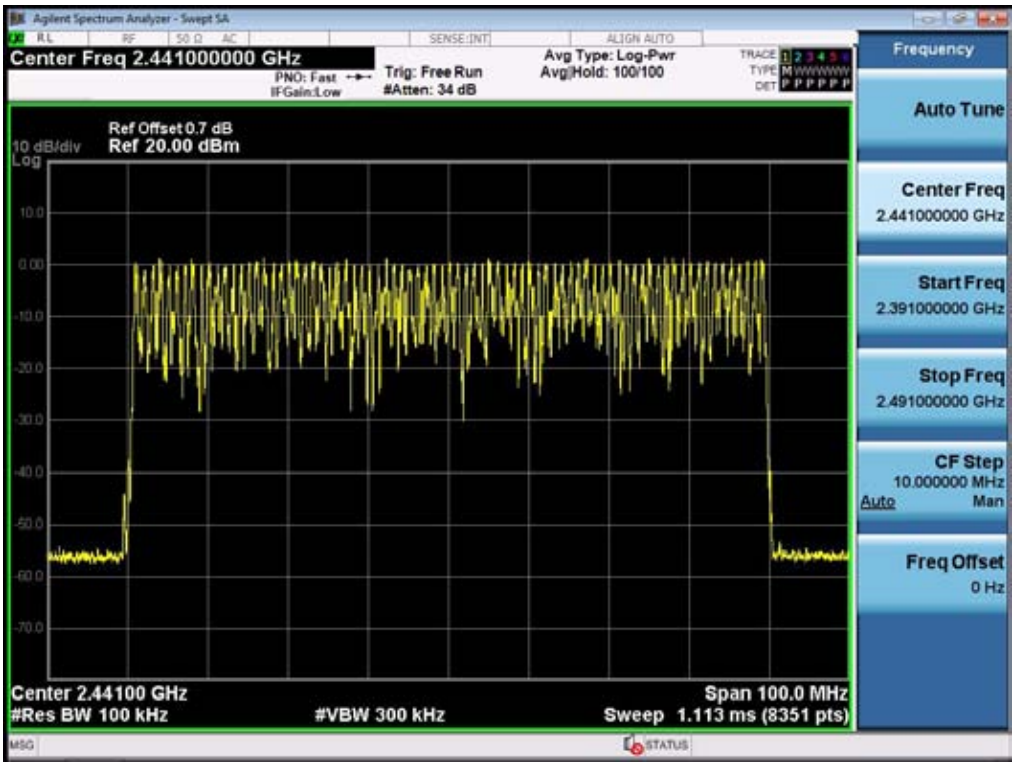
(Plot 4.7.1 A1: @ GFSK)

4.7.2 8DPSK Test Mode

A. Test Verdict

Hopping Channel Frequency Range (MHz)	Number of Hopping Channel	Refer to Plot	Limit	Verdict
2400-2483.5	79	Plot 4.7.2 A1	≥15	PASS

B. Test Plots



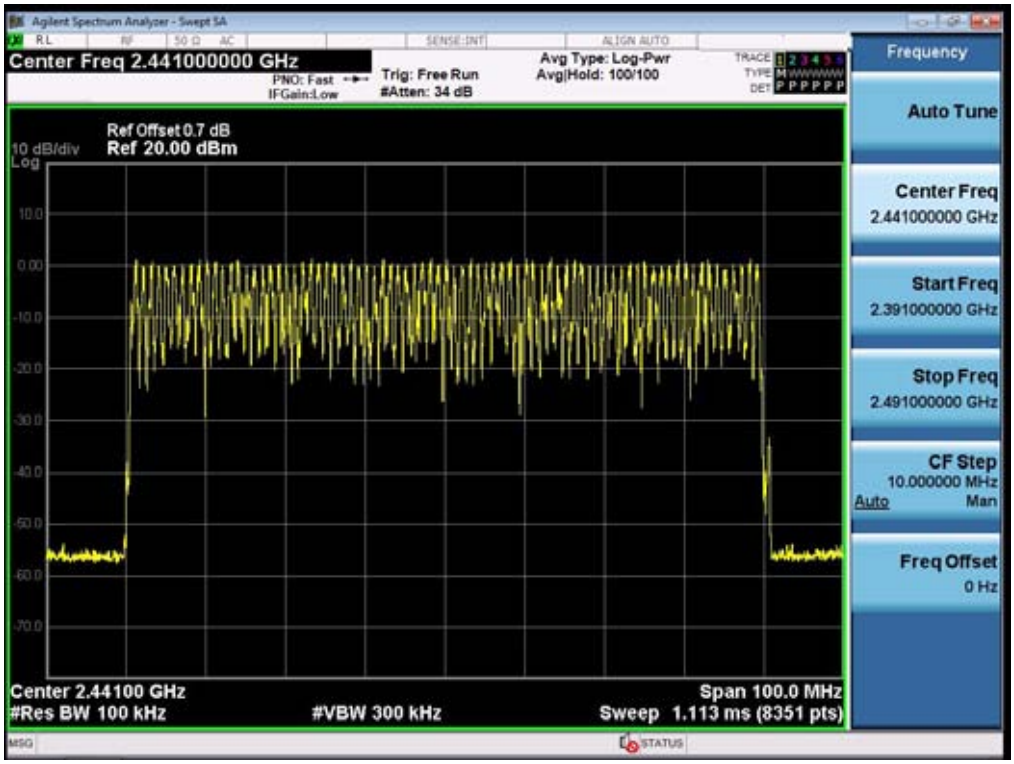
(Plot 4.7.2 A1: @ 8DPSK)

4.7.3 π/4DQPSK Test Mode

A. Test Verdict

Hopping Channel Frequency Range (MHz)	Number of Hopping Channel	Refer to Plot	Limit	Verdict
2400-2483.5	79	Plot 4.7.3 A1	≥15	PASS

B. Test Plots



(Plot 4.7.3 A1: @ π/4DQPSK)

4.8. 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

The Dwell Time=Burst Width*Total Hops. The detailed calculations are showed as follows:
The duration for dwell time calculation:0.4[s]*hopping number=0.4[s]*79[ch]=31.6[s*ch];
The burst width [ms/hop/ch], which is directly measured, refers to the duration on one channel hop.
The hops per second for all channels: The selected EUT Conf uses a slot type of 5-Tx&1-Rx and a hopping rate of 1600 [ch*hop/s] for all channels. So the final hopping rate for all channels is 1600/6=266.67 [ch*hop/s]
The hops per second on one channel: 266.67 [ch*hops/s]/79 [ch]=3.38 [hop/s];
The total hops for all channels within the dwell time calculation duration: 3.38 [hop/s]*31.6[s*ch]=106.67 [hop*ch];
The dwell time for all channels hopping: 106.67 [hop*ch]*Burst Width [ms/hop/ch].

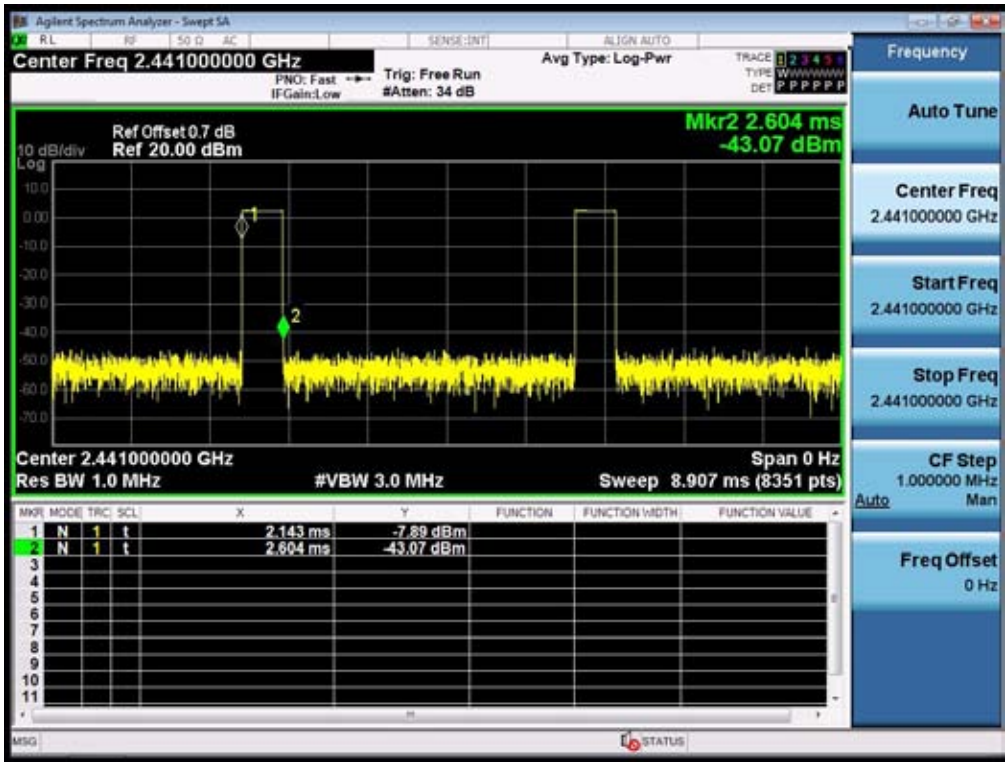
Remark: 1. We test Frequency Separation at all test channels, recorded worst case at middle channel.

4.8.1 GFSK/8DPSK/ pi/4DQPSK Test Mode

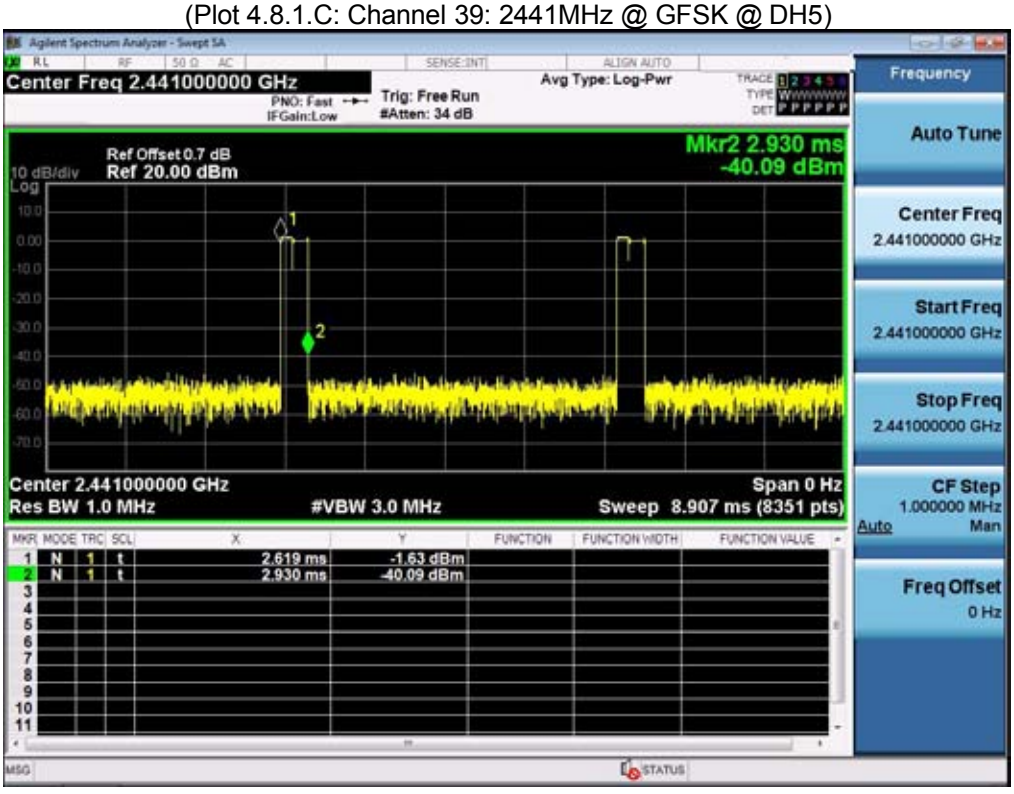
A. Test Verdict

Mode	Frequency (MHz)	Pulse Width (ms)	Dwell Time (S)	Limit (S)	Refer to Plot	Verdict
DH5	2441	3.000	0.04917	0.4	Plot 4.8.1 A	PASS
	Note: Dwell time=Pulse time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second					
2DH5	2441	2.995	0.03317	0.4	Plot 4.8.1 B	PASS
	Note: Dwell time=Pulse time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second					
3DH5	2441	3.000	0.02741	0.4	Plot 4.8.1 C	PASS
	Note: Dwell time=Pulse Time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second					

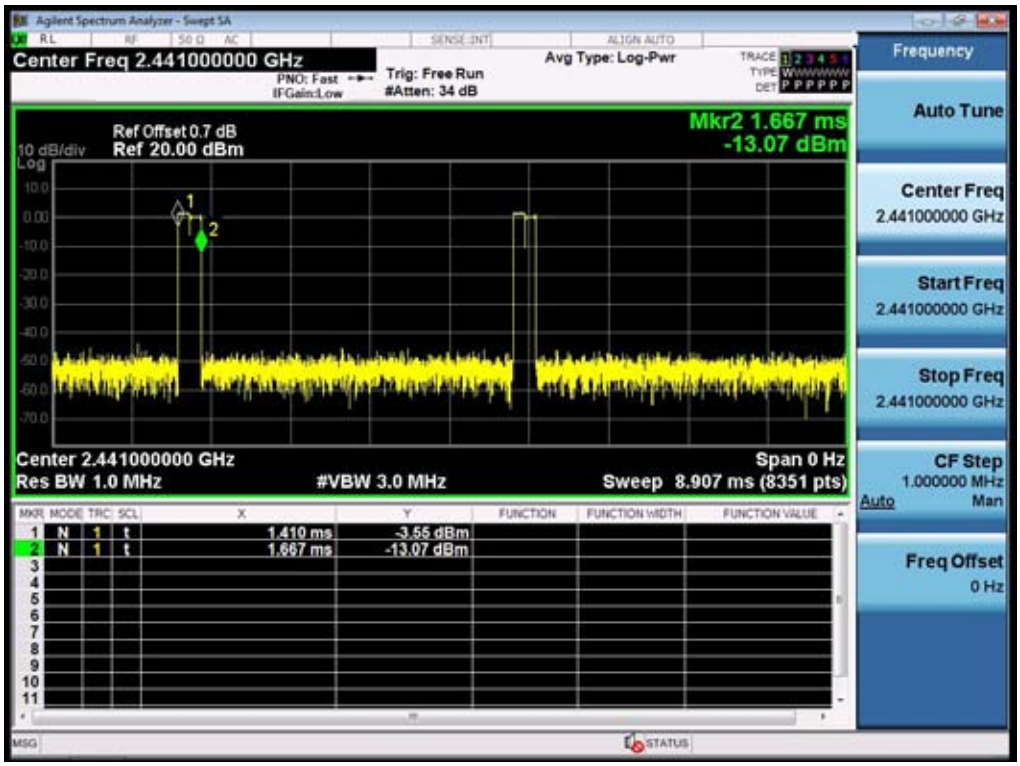
B. Test Plots



(Plot 4.8.1.C: Channel 39: 2441MHz @ GFSK @ DH5)



(Plot 4.8.2.C: Channel 39: 2441MHz @ 8DPSK @ DH5)



(Plot 4.8.3.C: Channel 39: 2441MHz @ π/4DQPSK @ DH5)

4.9. 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 measurement frequency range from 9KHz to 26.5GHz.

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: 1. We test Frequency Separation at difference Packet Type (DH1, DH3 and DH5), recorded worst case at DH3.

4.9.1 GFSK Test Mode

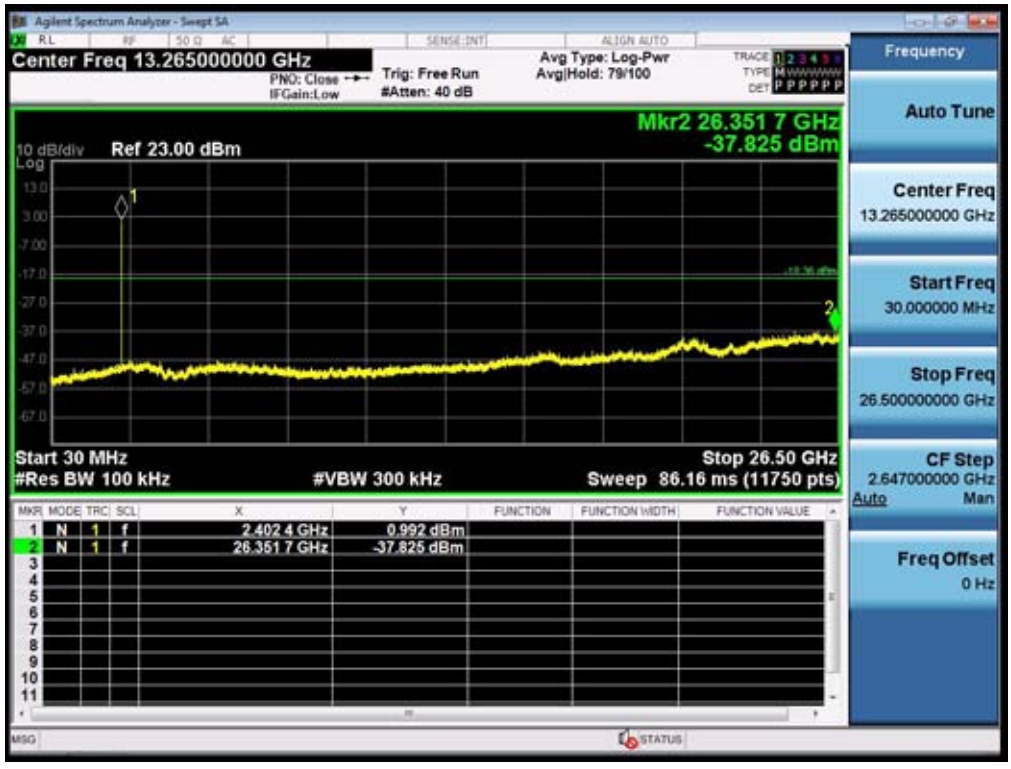
A. Test Verdict

Channel	Frequency (MHz)	Frequency Range	Refer to Plot	Limit (dBc)	Verdict
00	2402	2.402 GHz	Plot 4.9.1 A1	---	PASS
		30MHz-26GHz	Plot 4.9.1 A2	-20	PASS
39	2441	2.441 GHz	Plot 4.9.1 B1	---	PASS
		30MHz-26GHz	Plot 4.9.1 B2	-20	PASS
78	2480	2.480 GHz	Plot 4.9.1 C1	---	PASS
		30MHz-26GHz	Plot 4.9.1 C2	-20	PASS

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

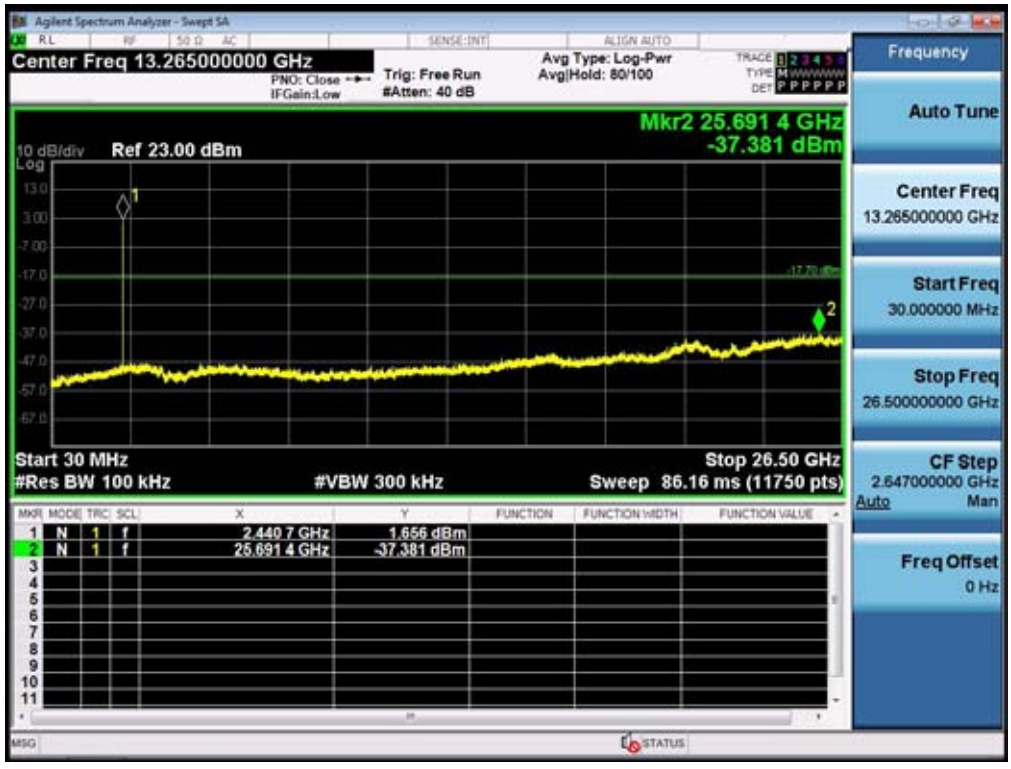
B. Test Plots

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



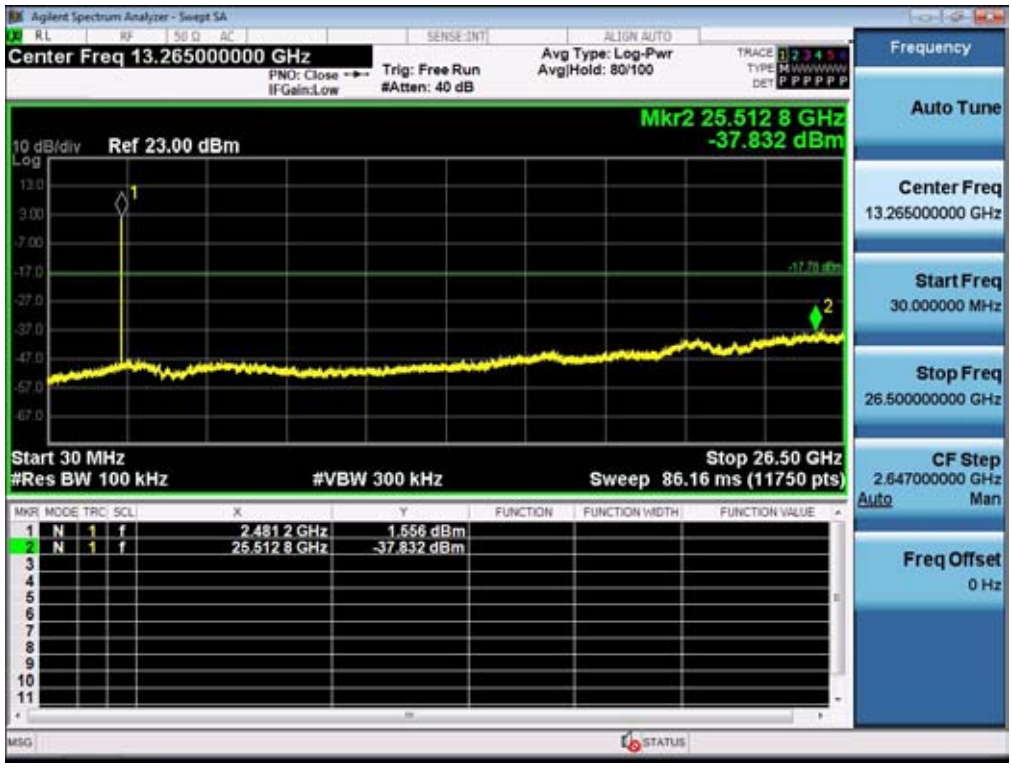
(Plot 4.9.1 A2: Channel 00: 2402MHz @ GFSK)

(Plot 4.9.1 B1: Channel 39: 2441MHz @ GFSK)



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

(Plot 4.9.1 C1: Channel 78: 2480MHz @ GFSK)



(Plot 4.9.1 C2: Channel 78: 2480MHz @ GFSK)

4.9.2 π/4DQPSK Test Mode

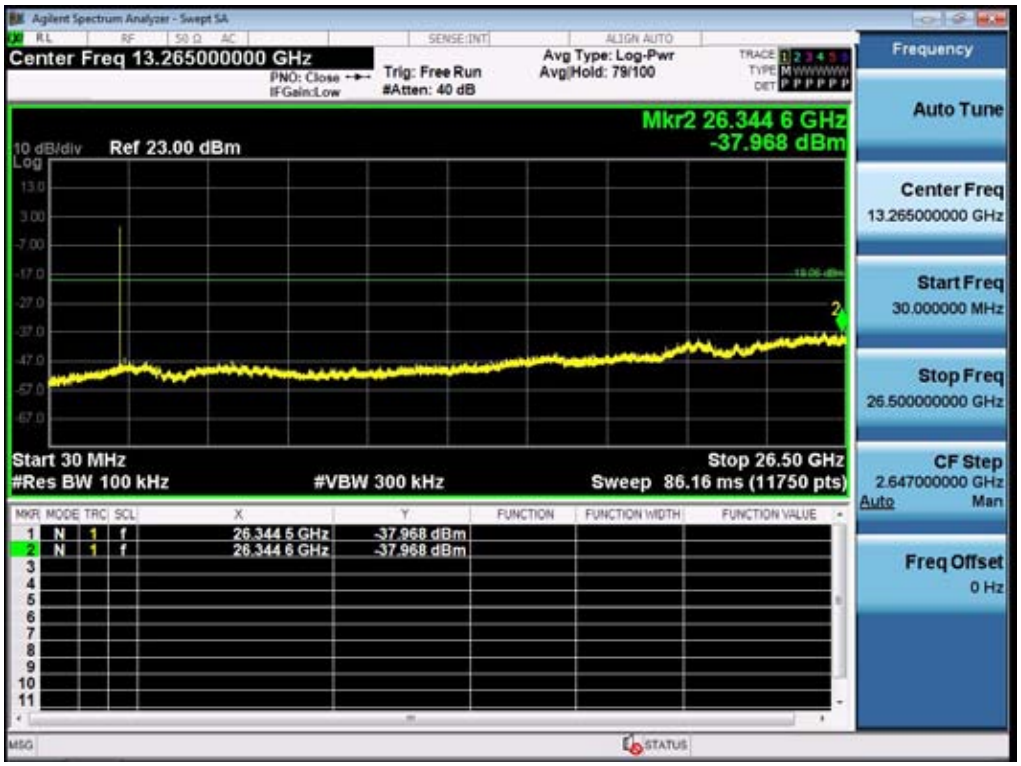
A. Test Verdict

Channel	Frequency (MHz)	Frequency Range	Refer to Plot	Limit (dBc)	Verdict
00	2402	2.402 GHz	Plot 4.9.2 A1	---	PASS
		30MHz-26GHz	Plot 4.9.2 A3	-20	PASS
39	2441	2.441 GHz	Plot 4.9.2 B1	---	PASS
		30MHz-26GHz	Plot 4.9.2 B2	-20	PASS
78	2480	2.480 GHz	Plot 4.9.2 C1	---	PASS
		30MHz-26GHz	Plot 4.9.2 C2	-20	PASS

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

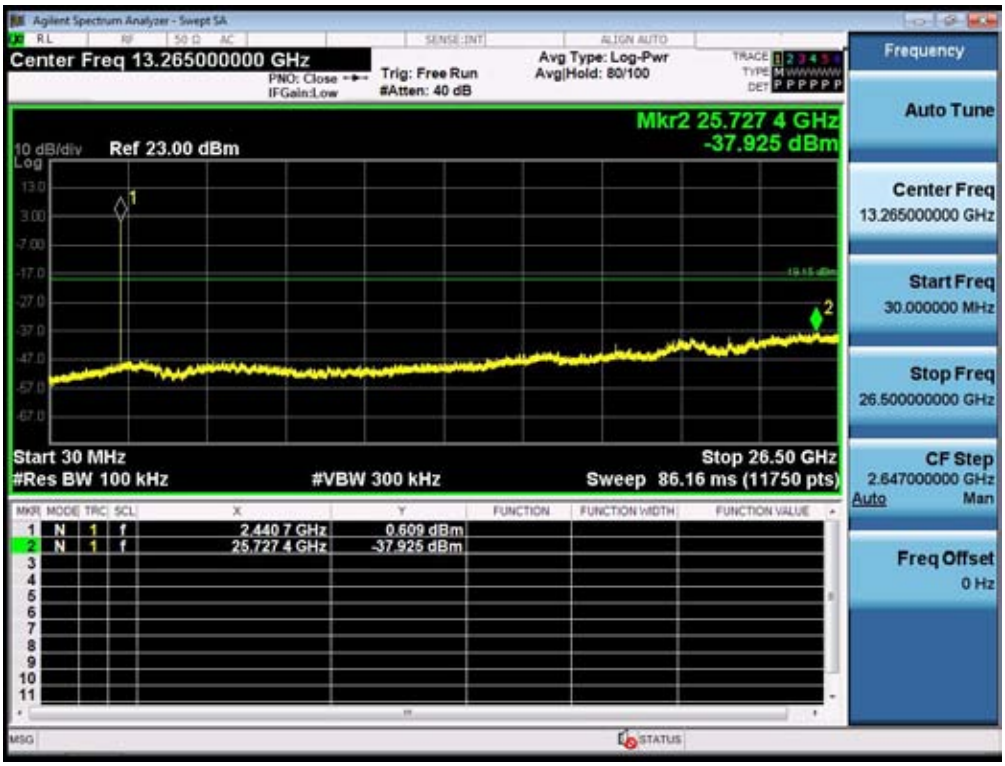
B. Test Plots

(Plot 4.9.2 A1: Channel 00: 2402MHz @ π/4DQPSK)



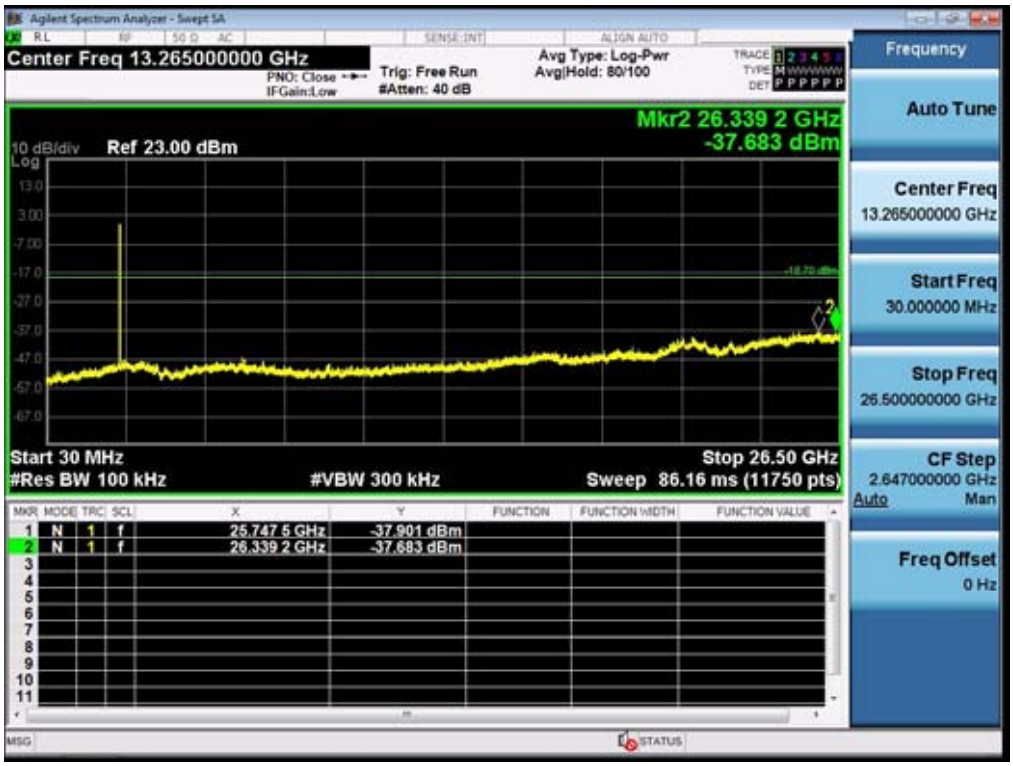
(Plot 4.9.2 A2: Channel 00: 2402MHz @ π/4DQPSK)

(Plot 4.9.2 B1: Channel 39: 2441MHz @ π/4DQPSK)



(Plot 4.9.2 B2: Channel 39: 2441MHz @ π/4DQPSK)

(Plot 4.9.2 C1: Channel 78: 2480MHz @ π/4DQPSK)



(Plot 4.9.2 C2: Channel 78: 2480MHz @ π/4DQPSK)

4.9.3 8DPSK Test Mode

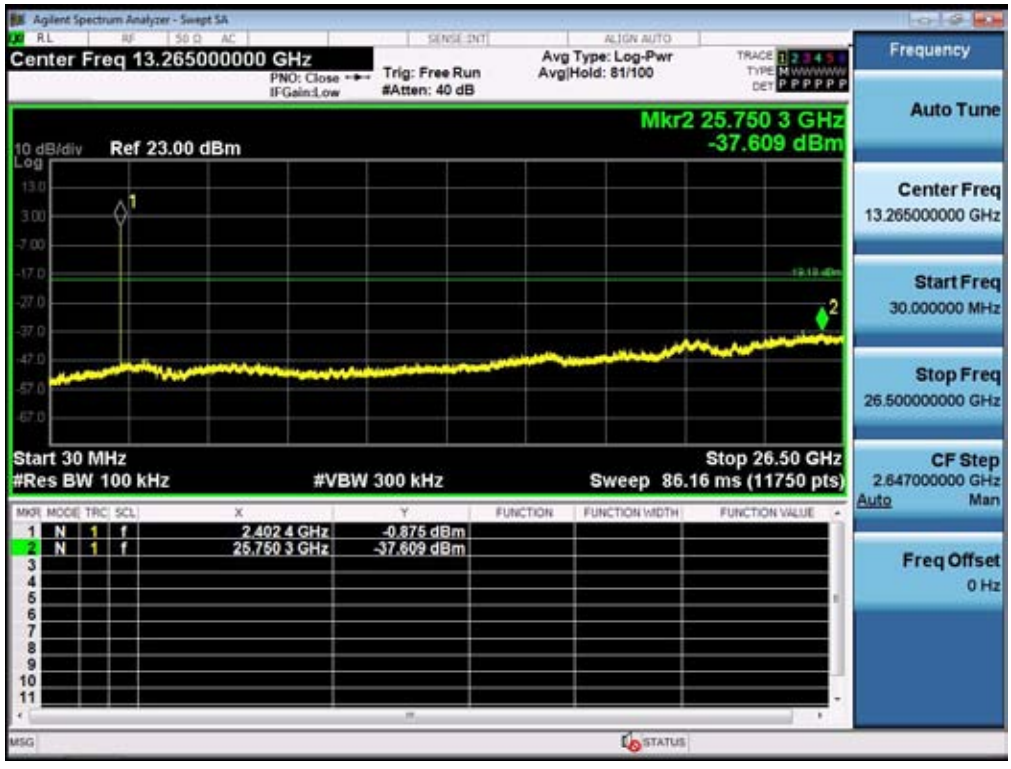
A. Test Verdict

Channel	Frequency (MHz)	Frequency Range	Refer to Plot	Limit (dBc)	Verdict
00	2402	2.402 GHz	Plot 4.9.3 A1	---	PASS
		30MHz-26GHz	Plot 4.9.3 A2	-20	PASS
39	2441	2.441 GHz	Plot 4.9.3 B1	---	PASS
		30MHz-26GHz	Plot 4.9.3 B2	-20	PASS
78	2480	2.480 GHz	Plot 4.9.3 C1	---	PASS
		30MHz-26GHz	Plot 4.9.3 C2	-20	PASS

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

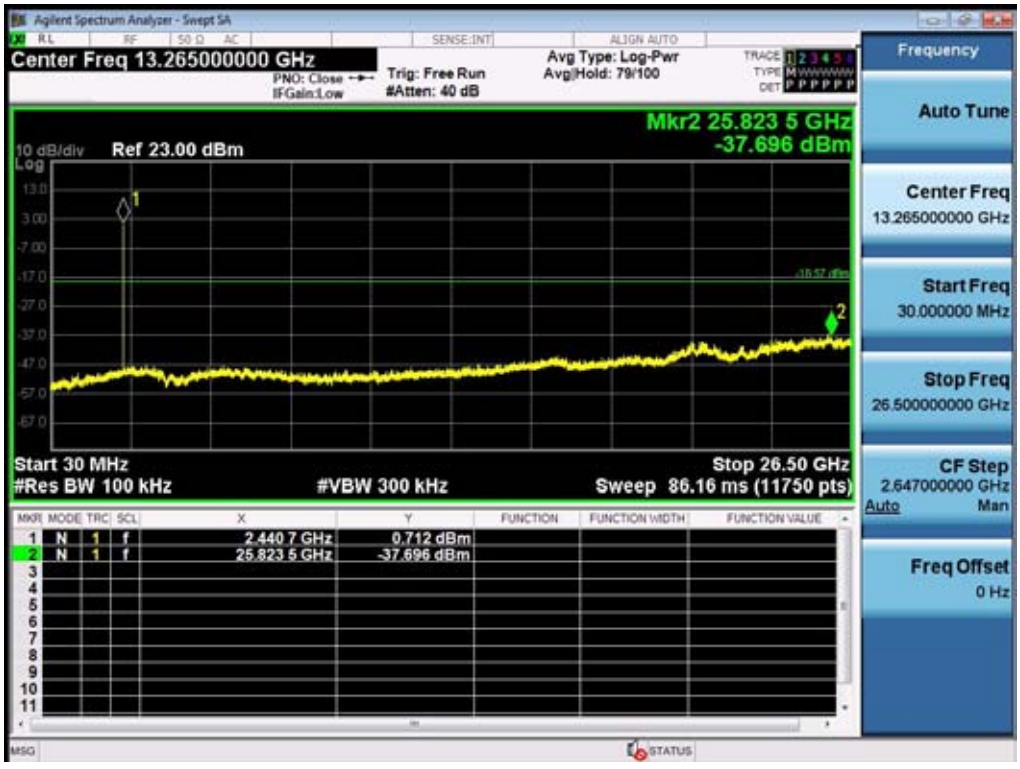
B. Test Plots

(Plot 4.9.3 A1: Channel 00: 2402MHz @ 8DPSK)



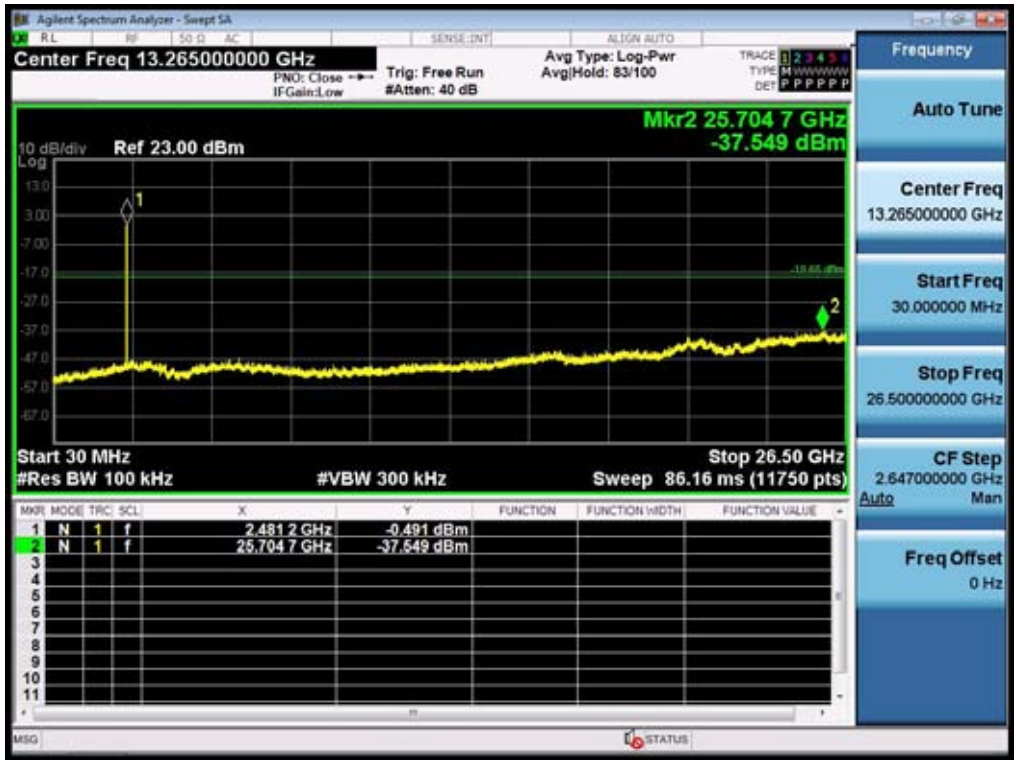
(Plot 4.9.3 A2: Channel 00: 2402MHz @ 8DPSK)

(Plot 4.9.3 B1: Channel 39: 2441MHz @ 8DPSK)



(Plot 4.9.3 B2: Channel 39: 2441MHz @ 8DPSK)

(Plot 4.9.3 C1: Channel 78: 2480MHz @ 8DPSK)



(Plot 4.9.3 C2: Channel 78: 2480MHz @ 8DPSK)

4.10. Pseudorandom Frequency Hopping Sequence

TEST APPLICABLE

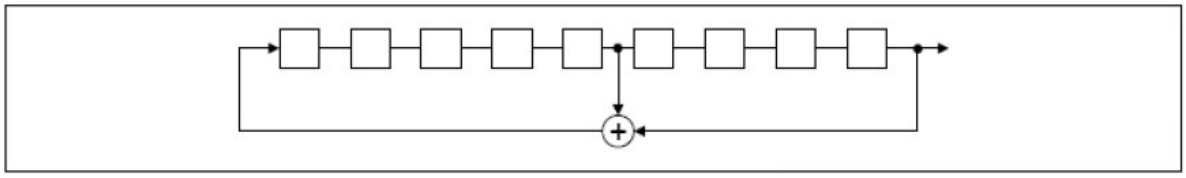
For 47 CFR Part 15C section 15.247 (a)(1) requirement:

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

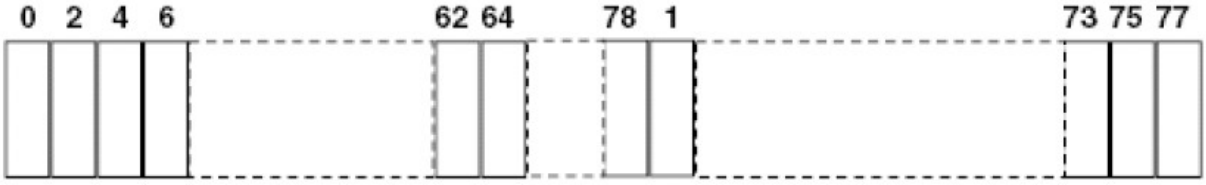
The pseudorandom frequency hopping sequence may be generated in a nice-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage.And the result is fed back to the input of the frist stage.The sequence begins with the frist one of 9 consecutive ones,for example:the 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 WLAN and Bluetooth sharing same antenna and the maximum antenna gain of BT uesed was 0.00 dBi.

5. Test Setup Photos of the EUT

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