TCT 通测检测 TESTING CENTRE TECHNOLOGY

Report No.: TCT150119E022

FCC REPORT

Applicant:	Eurotec
Address of Applicant:	1000 South Euclid Street, La Habra, California 90631 USA

Equipment Under Test (EUT)

Product Name:	Digital Amplifier with Receiver
Model No.:	81-5102
Trade mark:	**SoundShaker**
FCC ID:	2AD3X81-5102
Applicable standards:	FCC CFR Title 47 Part 15 Subpart C Section 15.247
Date of sample receipt:	Jan. 19, 2015
Date of Test:	Jan. 19 – Feb. 04, 2015
Date of report issued:	Feb. 05, 2015
Test Result :	PASS *

* In the configuration tested, the EUT complied with the standards specified above.

2 Version

Version No.	Date	Description
00	*Feb. 05, 2015*	*Original*

Prepared by: _____ ***Date:*** ***Feb. 05, 2015***

Report Clerk

Reviewed by: _____ ***Date:*** ***Feb. 05, 2015***

EMC Manager

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4 Test Summary

Test Item	Section in CFR 47	Result
Antenna Requirement	15.203/15.247 (c)	Pass
AC Power Line Conducted Emission	15.207	Pass
Conducted Peak Output Power	15.247 (b)(1)	Pass
20dB Occupied Bandwidth	15.247 (a)(1)	Pass
Carrier Frequencies Separation	15.247 (a)(1)	Pass
Hopping Channel Number	15.247 (a)(1)	Pass
Dwell Time	15.247 (a)(1)	Pass
Radiated Emission	15.205/15.209	Pass
Band Edge	15.247(d)	Pass

Pass: The EUT complies with the essential requirements in the standard.

5 General Information

5.1 Client Information

Applicant:	Eurotec
Address of Applicant:	1000 South Euclid Street, La Habra, California 90631 USA
Manufacturer:	Eurotec
Address of Manufacturer:	1000 South Euclid Street, La Habra, California 90631 USA

5.2 General Description of E.U.T.

Product Name:	Digital Amplifier with Receiver
Model No.:	81-5102
Trade mark:	**SoundShaker**
Operation Frequency:	2402MHz~2480MHz
Transfer rate:	1/2/3 Mbits/s
Number of channel:	79
Modulation type:	GFSK, π/4-DQPSK, 8DPSK
Modulation technology:	FHSS
Antenna Type:	Internal Antenna
Antenna gain:	0dBi
Power supply:	From Adapter
AC adapter:	Input: AC100-240V, 50/60Hz Output: DC15V, 6A

Operation Frequency each of channel for GFSK, π/4-DQPSK, 8DPSK							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
0	2402MHz	20	2422MHz	40	2442MHz	60	2462MHz
1	2403MHz	21	2423MHz	41	2443MHz	61	2463MHz
2	2404MHz	22	2424MHz	42	2444MHz	62	2464MHz
3	2405MHz	23	2425MHz	43	2445MHz	63	2465MHz
4	2406MHz	24	2426MHz	44	2446MHz	64	2466MHz
5	2407MHz	25	2427MHz	45	2447MHz	65	2467MHz
6	2408MHz	26	2428MHz	46	2448MHz	66	2468MHz
7	2409MHz	27	2429MHz	47	2449MHz	67	2469MHz
8	2410MHz	28	2430MHz	48	2450MHz	68	2470MHz
9	2411MHz	29	2431MHz	49	2451MHz	69	2471MHz
10	2412MHz	30	2432MHz	50	2452MHz	70	2472MHz
11	2413MHz	31	2433MHz	51	2453MHz	71	2473MHz
12	2414MHz	32	2434MHz	52	2454MHz	72	2474MHz
13	2415MHz	33	2435MHz	53	2455MHz	73	2475MHz
14	2416MHz	34	2436MHz	54	2456MHz	74	2476MHz
15	2417MHz	35	2437MHz	55	2457MHz	75	2477MHz
16	2418MHz	36	2438MHz	56	2458MHz	76	2478MHz
17	2419MHz	37	2439MHz	57	2459MHz	77	2479MHz
18	2420MHz	38	2440MHz	58	2460MHz	78	2480MHz
19	2421MHz	39	2441MHz	59	2461MHz		
Remark: Channel 0, 39 &78 selected for GFSK, π/4-DQPSK and 8DPSK.							

5.3 Measuremet uncertainty

The reported uncertainty of measurement y ± U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2,providing a level of confidence of approximately 95 %.

No.	Item	Uncertainty
1	Conducted Emission	±3.28dB
2	RF power,conducted	±0.12dB
3	Spurious emissions,conducted	±0.11dB
4	All emissions,radiated(<1G)	±4.88dB
5	All emissions,radiated(>1G)	±4.88dB
6	Temperature	±0.5°C
7	Humidity	±2%

5.4 Test mode

Transmitting mode:	Keep the EUT in transmitting mode with worst case data rate.
Remark	8DPSK (3 Mbps) is the worst case mode.

The sample was placed 0.8m above the ground plane of 3m chamber*. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working with a fresh battery, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.

5.5 Laboratory Facility

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

● **FCC - Registration No.: 572331**

Shenzhen TCT Testing Technology Co., Ltd., Shenzhen EMC Laboratory: Shenzhen Tongce Testing Lab

The 3m Semi-anechoic chamber has been registered and fully described in a report with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.

● **IC - Registration No.: 10668A-1**

The 3m Semi-anechoic chamber of Shenzhen TCT Testing Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing

● **CNAS - Registration No.: CNAS L6165**

Shenzhen TCT Testing Technology Co., Ltd. is accredited to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration laboratories for the competence of testing. The Registration No. is CNAS L6165.

5.6 Laboratory Location

Shenzhen Tongce Testing Lab
Address: 1F, Leinuo Watch Building, Fuyong Town, Baoan Dist, Shenzhen, China
Tel: 13410377511
Fax: --

5.7 Description of Support Units

Manufacturer	Description	Model	S/N	FCC ID/DoC
ATEC	Speaker	AT81-2887	N/A	N/A

5.8 Test Instruments list

Radiated Emission:						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Cal. Date (mm-dd-yy)**	**Cal. Due date (mm-dd-yy)**
1	ESPI Test Receiver	ROHDE&SCHWARZ	ESVD	100008	Sep.17, 2014	Sep.16, 2015
2	Spectrum Analyzer	ROHDE&SCHWARZ	FSEM	848597/001	Sep.17, 2014	Sep.16, 2015
3	Spectrum Analyzer	ROHDE&SCHWARZ	FSU3	1166.1660.03	Sep.17, 2014	Sep.16, 2015
4	Pre-amplifier	EM Electronics Corporation CO.,LTD	EM30265	07032613	Sep.17, 2014	Sep.16, 2015
5	Pre-amplifier	HP	8447D	2727A05017	Sep.17, 2014	Sep.16, 2015
6	Loop antenna	ZHINAN	ZN30900A	12024	Dec.15, 2014	Dec.14, 2015
7	Broadband Antenna	Schwarzbeck	VULB9163	340	Sep.17, 2014	Sep.16, 2015
8	Horn Antenna	Schwarzbeck	BBHA 9120D	631	Sep.17, 2014	Sep.16, 2015
9	Loop antenna	ZHINAN	ZN30900A	12024	Dec.15, 2014	Dec.14, 2015
10	Coax cable	TCT	N/A	N/A	Sep.14, 2014	Sep.15, 2015
11	Coax cable	TCT	N/A	N/A	Sep.14, 2014	Sep.15, 2015
12	Coax cable	TCT	N/A	N/A	Sep.14, 2014	Sep.15, 2015
13	Coax cable	TCT	N/A	N/A	Sep.14, 2014	Sep.15, 2015
14	EMI Test Software	Shurple Technology	EZ-EMC	N/A	N/A	N/A

Conducted Emission:						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Cal. Date (mm-dd-yy)**	**Cal. Due date (mm-dd-yy)**
1	EMI Test Receiver	R&S	ESCS30	100139	Sep.17, 2014	Sep.16, 2015
2	LISN-1	AFJ	LS16C	16010947251	Sep.17, 2014	Sep.16, 2015
3	LISN-2	Schwarzbeck	NSLK 8126	8126453	Sep.17, 2014	Sep.16, 2015
4	Coax cable	TCT	N/A	164080	Sep.17, 2014	Sep.16, 2015
5	EMI Test Software	Shurple Technology	EZ-EMC	N/A	N/A	N/A

Conducted method test:						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Cal. Date (mm-dd-yy)**	**Cal. Due date (mm-dd-yy)**
1	Spectrum Analyzer	ROHDE&SCHWARZ	FSU3	200054	Sep.17, 2014	Sep.16, 2015
2	Spectrum Analyzer	Agilent	N9020A	MY49100060	Oct. 22, 2014	Oct. 23, 2015
3	X-series USB Peak and Average Power Sensor	Agilent	U2042XA	MY54080020	Jan. 20, 2014	Jan. 19, 2015

4	Power Meter	Agilent	E4416A	MY45101555	Sep.17, 2014	Sep.16, 2015

6 Test results and Measurement Data

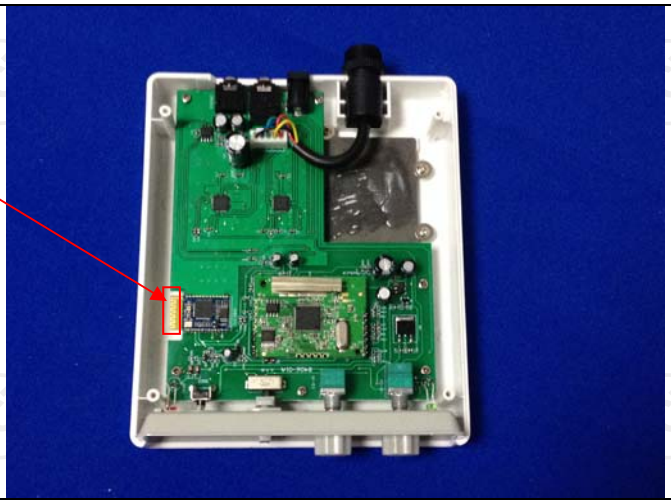
6.1 Antenna requirement:

Standard requirement:	FCC Part15 C Section 15.203 /247(c)

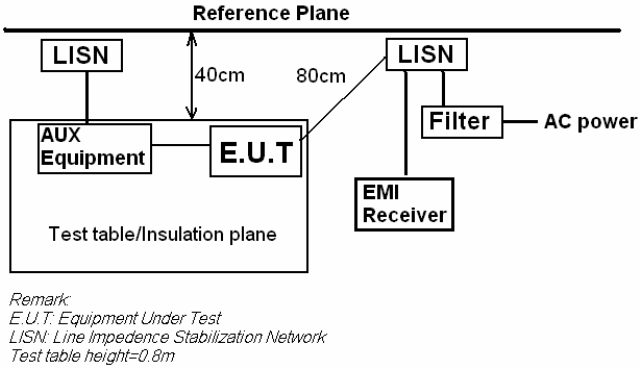
15.203 requirement:
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.
15.247(c) (1)(i) requirement:
(i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

E.U.T Antenna:	

The Bluetooth antenna is an internal PCB antenna which permanently attached, and the best case gain of the antenna is 2 dBi.

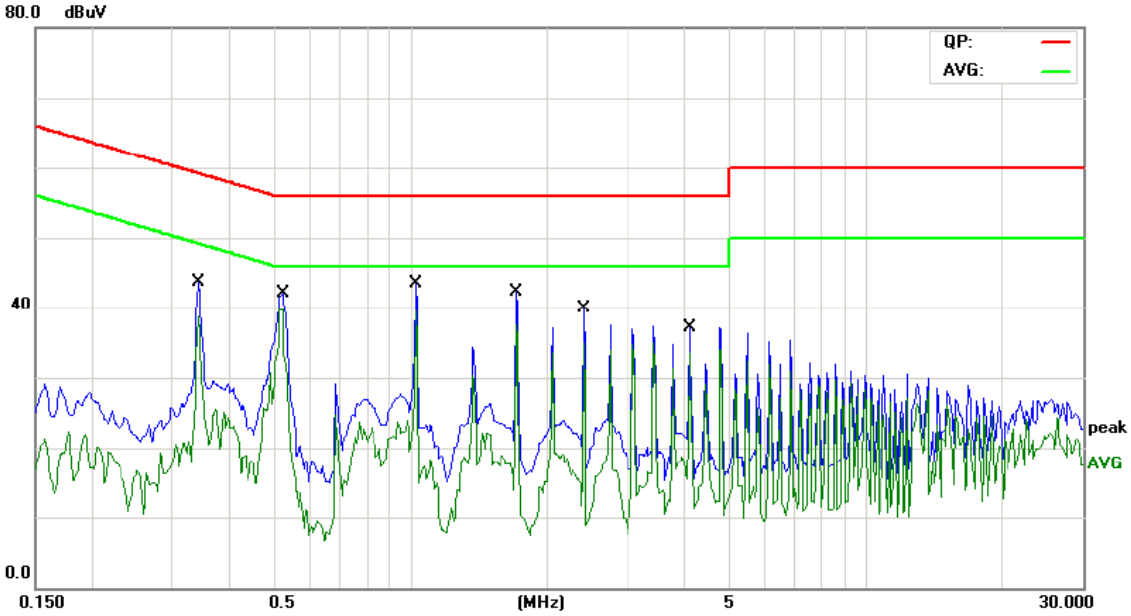


6.2 Conducted Emissions

Test Requirement:	FCC Part15 C Section 15.207
Test Method:	ANSI C63.4:2003
Test Frequency Range:	150 kHz to 30 MHz
Class / Severity:	Class B
Receiver setup:	RBW=9 kHz, VBW=30 kHz, Sweep time=auto
Limit:	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 setup:	 *Remark:* *E.U.T: Equipment Under Test* *LISN: Line Impedence Stabilization Network* *Test table height=0.8m*
Test procedure:	1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment. 2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs). 3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4: 2003 on conducted measurement.
Test Instruments:	Refer to section 5.7 for details
Test mode:	Bluetooth (Continuous transmitting) mode
Test results:	Pass

Measurement Data

Conducted Emission on Line Terminal of the power line (150 kHz to 30MHz)

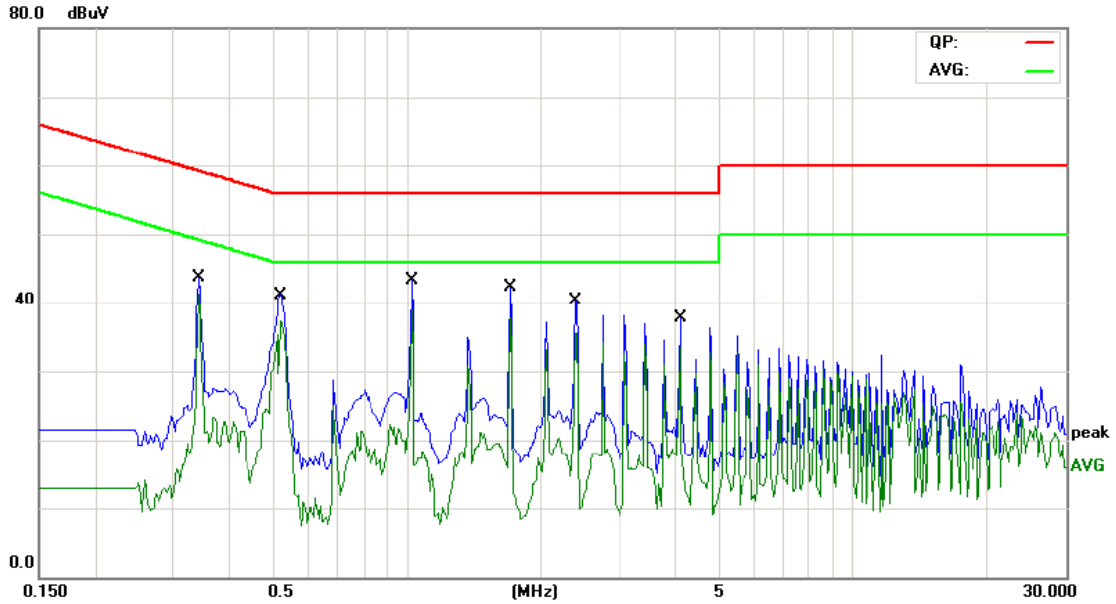


Site Chamber #1 Phase: *L1* Temperature: 28 (C)

Limit: FCC PART15 Conduction(QP) Power: AC 120V/60Hz Humidity: 52 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.3414	31.29	11.39	42.68	59.17	-16.49	QP	
2		0.3414	27.52	11.39	38.91	49.17	-10.26	AVG	
3		0.5250	29.34	11.29	40.63	56.00	-15.37	QP	
4		0.5250	23.51	11.29	34.80	46.00	-11.20	AVG	
5		1.0289	31.41	11.18	42.59	56.00	-13.41	QP	
6	*	1.0289	28.10	11.18	39.28	46.00	-6.72	AVG	
7		1.7125	29.74	11.52	41.26	56.00	-14.74	QP	
8		1.7125	26.08	11.52	37.60	46.00	-8.40	AVG	
9		2.4000	27.37	11.53	38.90	56.00	-17.10	QP	
10		2.4000	23.97	11.53	35.50	46.00	-10.50	AVG	
11		4.1133	25.40	10.93	36.33	56.00	-19.67	QP	
12		4.1133	22.88	10.93	33.81	46.00	-12.19	AVG	

Conducted Emission on Neutral Terminal of the power line (150 kHz to 30MHz)



Site Chamber #1 Phase: N Temperature: 28 (C)

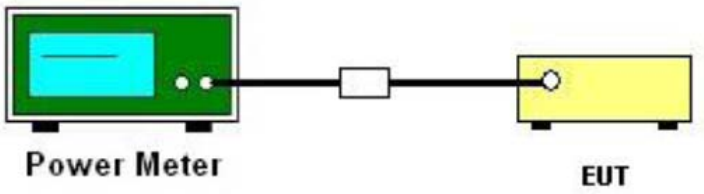
Limit: FCC PART15 Conduction(QP) Power: AC 120V/60Hz Humidity: 52 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.3414	31.25	11.41	42.66	59.17	-16.51	QP	
2		0.3414	27.66	11.41	39.07	49.17	-10.10	AVG	
3		0.5211	28.55	11.30	39.85	56.00	-16.15	QP	
4		0.5211	24.03	11.30	35.33	46.00	-10.67	AVG	
5		1.0289	31.17	11.19	42.36	56.00	-13.64	QP	
6	*	1.0289	27.82	11.19	39.01	46.00	-6.99	AVG	
7		1.7125	29.68	11.53	41.21	56.00	-14.79	QP	
8		1.7125	26.30	11.53	37.83	46.00	-8.17	AVG	
9		2.3961	26.75	11.54	38.29	56.00	-17.71	QP	
10		2.3961	23.37	11.54	34.91	46.00	-11.09	AVG	
11		4.1094	24.96	10.94	35.90	56.00	-20.10	QP	
12		4.1094	20.79	10.94	31.73	46.00	-14.27	AVG	

Notes:

1. An initial pre-scan was performed on the line and neutral terminal of the power line with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level =Receiver Read level + Correct Factor
4. * is meaning the worst frequency has been tested in the frequency range 150 kHz to 30MHz.

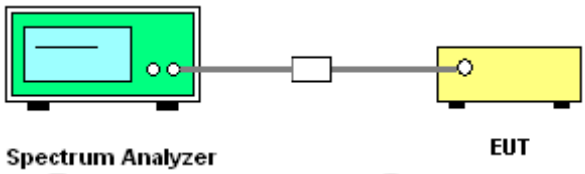
6.3 Conducted Output Power

Test Requirement:	FCC Part15 C Section 15.247 (b)(3)
Test Method:	ANSI C63.4:2003 and DA00-705
Limit:	Section 15.247 (b) The maximum peak conducted output power of the intentional radiator shall not exceed the following: (1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band 0.125 watts.
Test setup:	
Test Instruments:	Refer to section 5.7 for details
Test mode:	Non-hopping mode
Test procedure:	1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines. 2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement. 3. Set to the maximum power setting and enable the EUT transmit continuously. 4. Measure the conducted output power with cable loss and record the results in the test report. 5. Measure and record the results in the test report.
Test results:	Pass

Measurement Data

GFSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	1.25	21.00	Pass
Middle	-0.68	21.00	Pass
Highest	-0.33	21.00	Pass
π/4-DQPSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	1.52	21.00	Pass
Middle	0.85	21.00	Pass
Highest	0.96	21.00	Pass
8DPSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	1.35	21.00	Pass
Middle	1.42	21.00	Pass
Highest	1.68	21.00	Pass

6.4 20dB Occupy Bandwidth

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.4:2003 and DA00-705
Limit:	NA
Test setup:	
Test Instruments:	Refer to section 5.7 for details
Test mode:	Non-hopping mode
	1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines. 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement. 3. Set to the maximum power setting and enable the EUT transmit continuously. 4. Use the following spectrum analyzer settings for 20dB Bandwidth measurement. Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel; RBW ≥ 1% of the 20 dB bandwidth; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold. 5. Measure and record the results in the test report.
Test results:	Pass

Measurement Data

Test channel	20dB Occupy Bandwidth (kHz)		
	GFSK	π/4-DQPSK	8DPSK
Lowest	920.00	1210.00	1210.00
Middle	920.00	1242.50	1210.00
Highest	920.00	1230.00	1210.00

Test plot as follows:

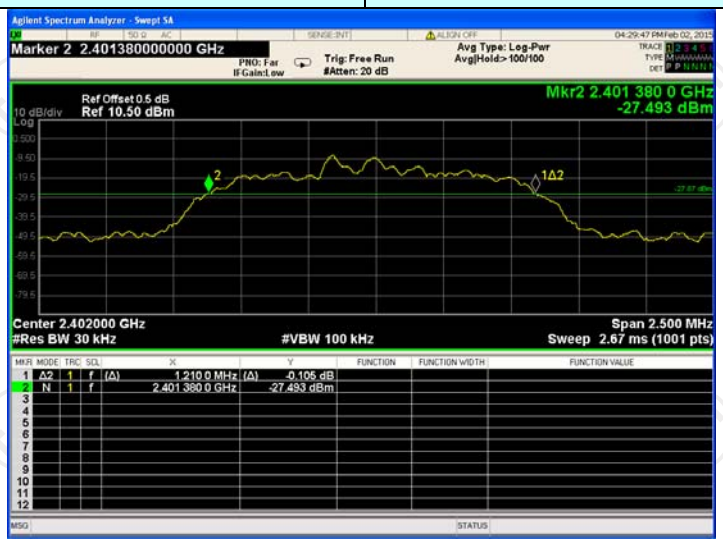
Modulation mode:	GFSK

Lowest channel

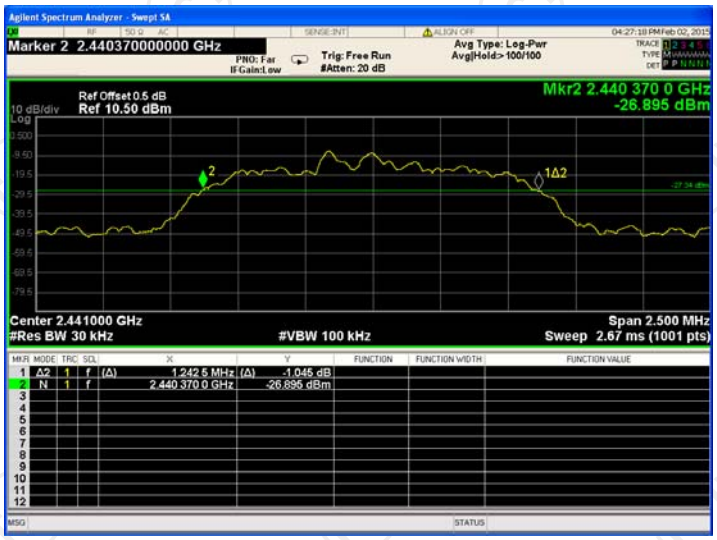
Middle channel

Highest channel

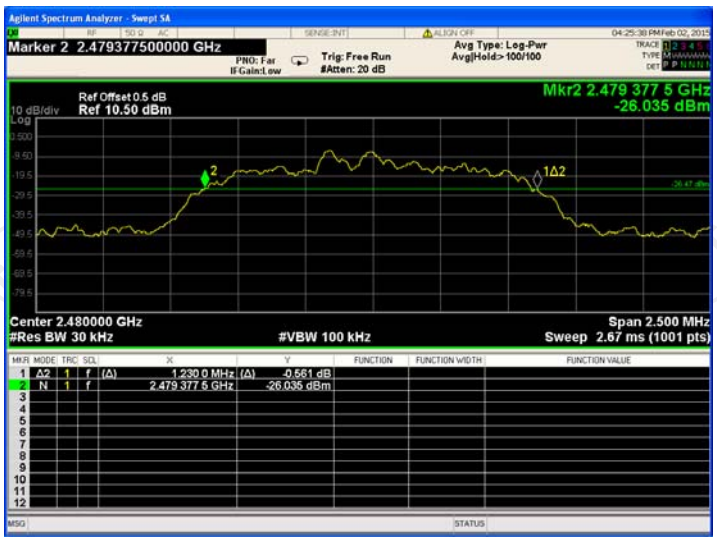
Modulation mode:	π/4-DQPSK



Lowest channel



Middle channel



Highest channel

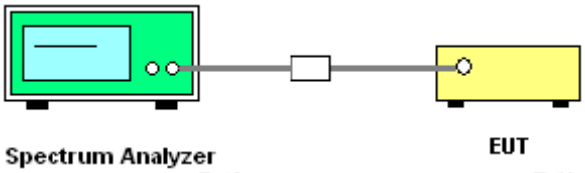
Modulation mode:	8DPSK

Lowest channel

Middle channel

Highest channel

6.5 Carrier Frequencies Separation

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.4:2003 and DA00-705
Limit:	Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.
Test setup:	
Test Instruments:	Refer to section 5.7 for details
Test mode:	Hopping mode
	1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines. 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement. 3. Set to the maximum power setting and enable the EUT transmit continuously. 4. Enable the EUT hopping function. 5. Use the following spectrum analyzer settings: Span = wide enough to capture the peaks of two adjacent channels; RBW ≥ 1% of the span; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold. 6. Measure and record the results in the test report.
Test results:	Pass

Measurement Data

GFSK mode			
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Lowest	1022	613.33	Pass
Middle	1000	613.33	Pass
Highest	1000	613.33	Pass
π/4-DQPSK mode			
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Lowest	1000	828.00	Pass
Middle	1000	828.00	Pass
Highest	1000	828.00	Pass
8DPSK mode			
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Lowest	1000	806.67	Pass
Middle	1000	806.67	Pass
Highest	1000	806.67	Pass

Note: According to section 6.4

Mode	*20dB bandwidth (kHz) (worse case)*	*Limit (kHz) (Carrier Frequencies Separation)*
GFSK	*920*	*613.33*
π/4-DQPSK	*1242*	*828.00*
8DPSK	*1210*	*806.67*

Test plot as follows:

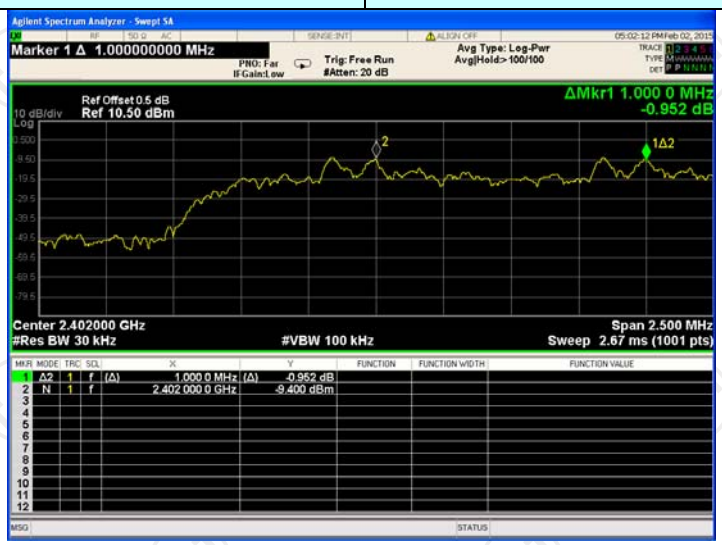
Modulation mode:	GFSK

Lowest channel

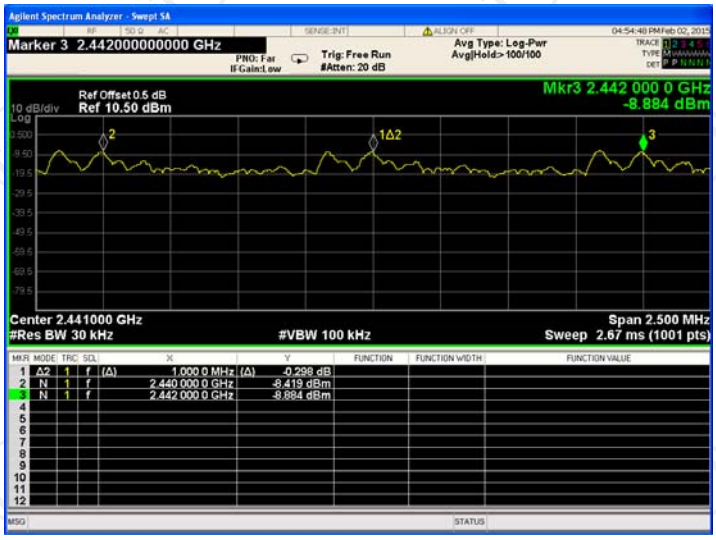
Middle channel

Highest channel

Modulation mode:	π/4-DQPSK



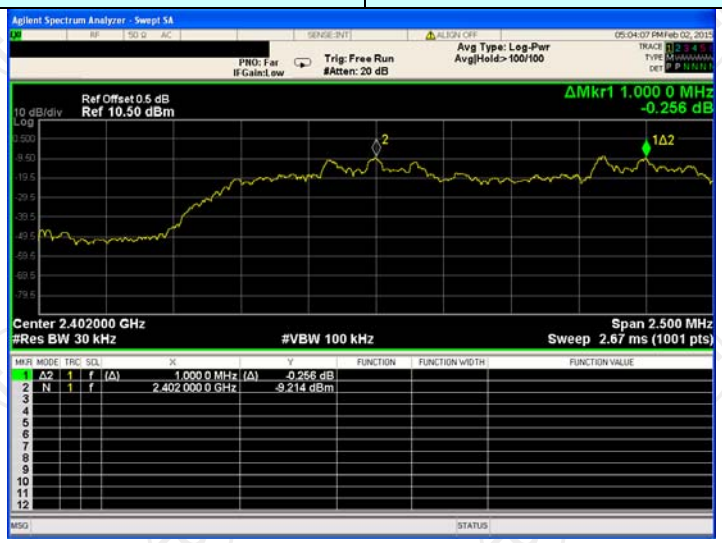
Lowest channel



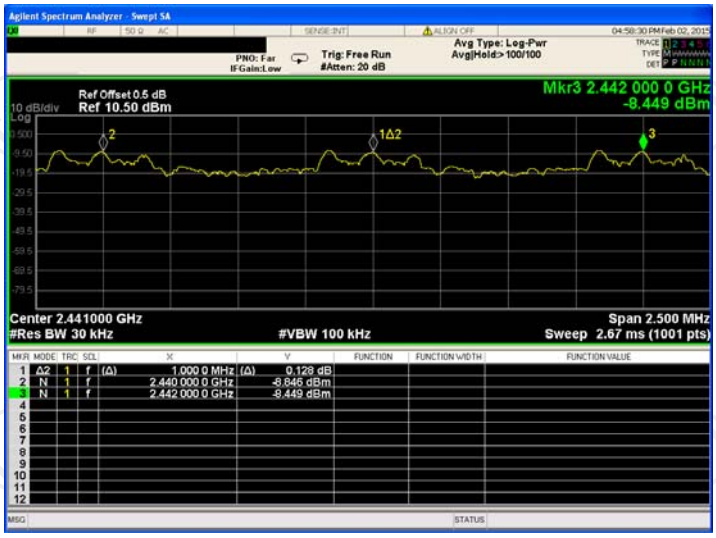
Middle channel

Highest channel

Modulation mode:	8DPSK



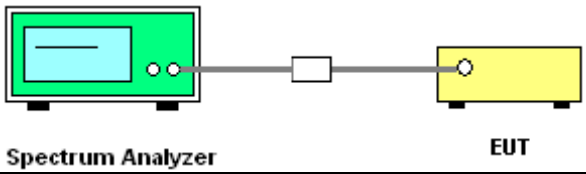
Lowest channel



Middle channel

Highest channel

6.6 Hopping Channel Number

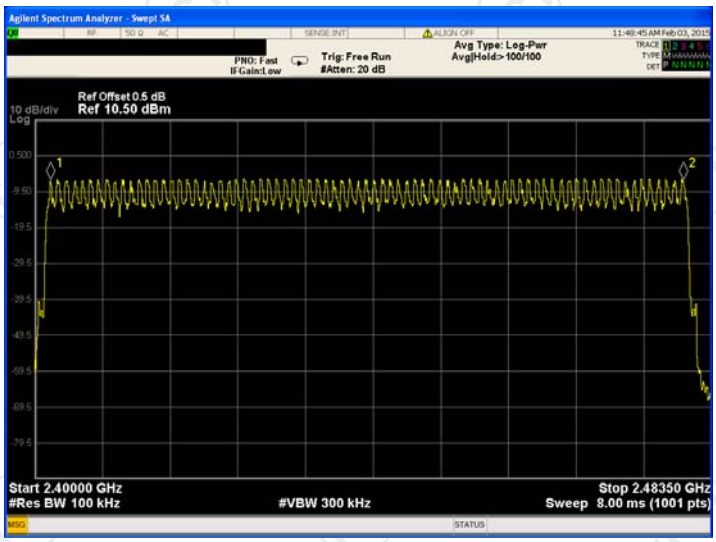
Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.4:2003 and DA00-705
Limit:	Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.
Test setup:	
Test Instruments:	Refer to section 5.7 for details
Test mode:	Hopping mode
	1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines. 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement. 3. Set to the maximum power setting and enable the EUT transmit continuously. 4. Enable the EUT hopping function. 5. Use the following spectrum analyzer settings: Span = the frequency band of operation; RBW ≥1% of the span; VBW≥RBW; Sweep = auto; Detector function = peak; Trace = max hold. 6. The number of hopping frequency used is defined as the number of total channel. 7. Record the measurement data derived from spectrum analyzer.
Test results:	Pass

Measurement Data:

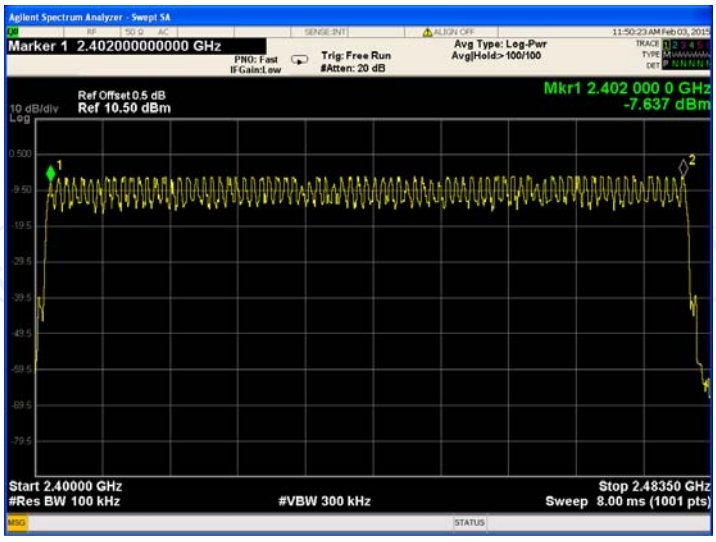
Mode	Hopping channel numbers	Limit	Result
GFSK, π/4-DQPSK, 8DPSK	79	15	Pass

GFSK

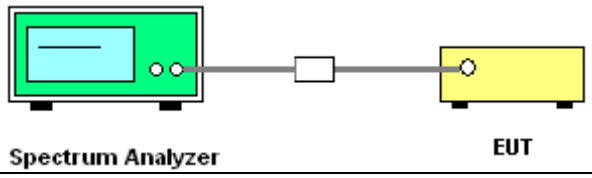
π/4-DQPSK



8DPSK



6.7 Dwell Time

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.4:2003 and KDB DA00-705
Limit:	The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.
Test setup:	
Test Instruments:	Refer to section 5.7 for details
Test mode:	Hopping mode
	1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines. 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement. 3. Set to the maximum power setting and enable the EUT transmit continuously. 4. Enable the EUT hopping function. 5. Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel; RBW = 1 MHz; VBW≥RBW; Sweep = as necessary to capture the entire dwell time per hopping channel; Detector function = peak; Trace = max hold. 6. Measure and record the results in the test report.
Test results:	Pass

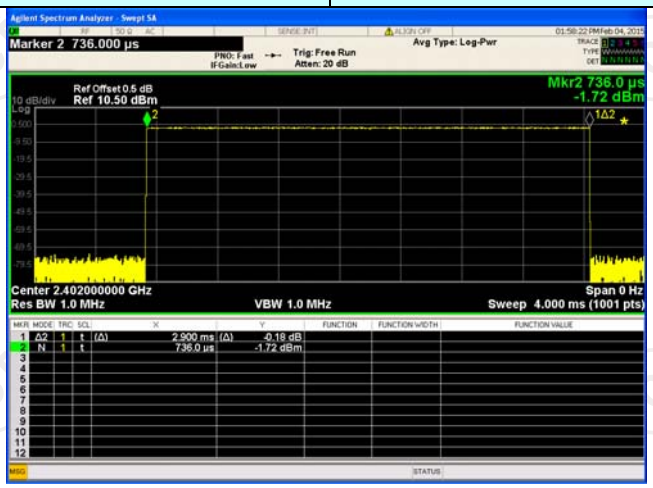
Measurement Data (Worst case)

Mode	Packet	Hops Over Occupancy Time(hops)	Package Transfer Time (msec)	Dwell time (second)	Limit (second)	Result
GFSK	DH5	106.67	2.90	0.31	0.4	Pass
π/4-DQPSK	2-DH5	106.67	2.91	0.31	0.4	Pass
8DPSK	3-DH5	106.67	2.90	0.31	0.4	Pass

Remark: 1. In normal mode, hopping rate is 1600 hops/s with 6 slots in 79 hopping channels.
With channel hopping rate (1600 / 6 / 79) in Occupancy Time Limit (0.4 x 79) (s),
Hops Over Occupancy Time comes to (1600 / 6 / 79) x (0.4 x 79) = 106.67 hops
2. Dwell Time(s) = Hops Over Occupancy Time (hops) x Package Transfer Time

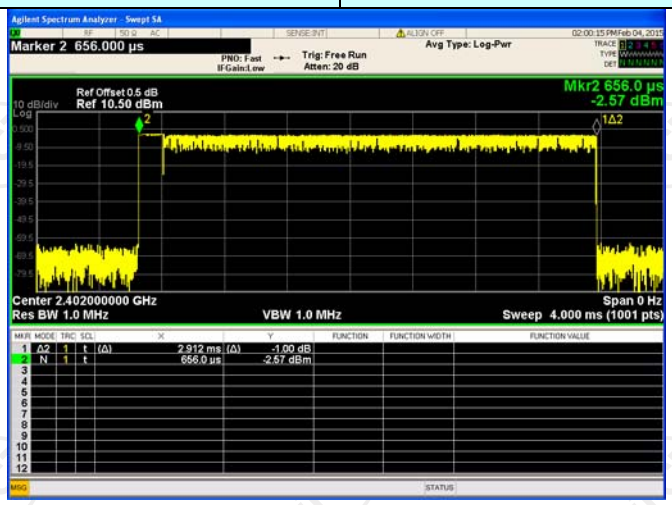
Test plot Package Transfer Time:

Modulation mode:	GFSK



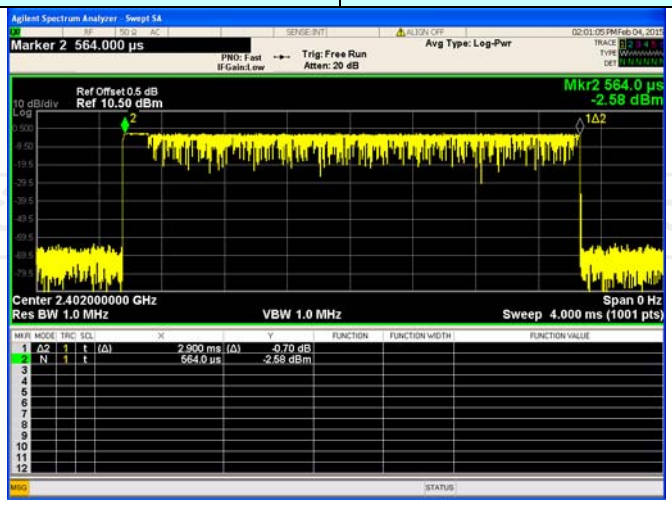
DH5

Modulation mode:	π/4-DQPSK



2-DH5

Modulation mode:	8DPSK



3-DH5

6.8 Pseudorandom Frequency Hopping Sequence

Test Requirement:	FCC Part15 C Section 15.247 (a)(1) requirement:

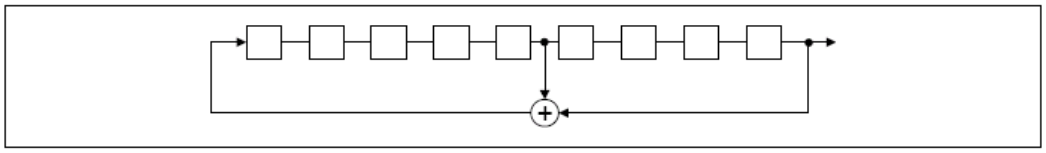
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Alternatively. Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

EUT Pseudorandom Frequency Hopping Sequence

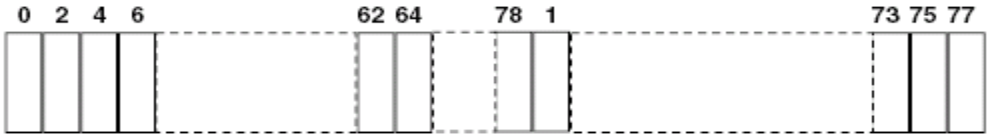
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized with nine ones.

- *Number of shift register stages: 9*
- *Length of pseudo-random sequence: 2^9 -1 = 511 bits*
- *Longest sequence of zeros: 8 (non-inverted signal)*



Linear Feedback Shift Register for Generation of the PRBS sequence

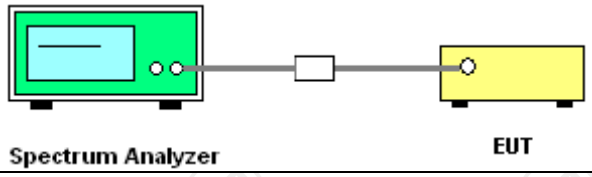
An example of Pseudorandom Frequency Hopping Sequence as follow:



Each frequency used equally on the average by each transmitter.

The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

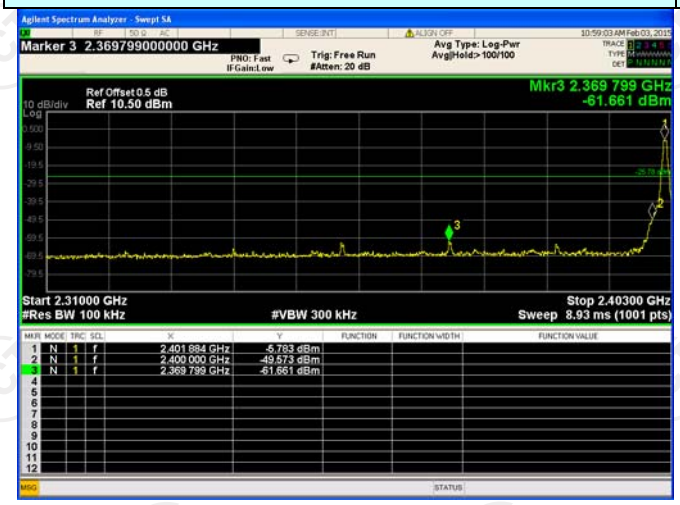
6.9 Conducted Band Edge Measurement

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.4:2003 and DA00-705
Limit:	In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.
Test setup:	
Test Instruments:	Refer to section 5.7 for details
Test mode:	Non-hopping mode and hopping mode
Test procedure:	1. The testing follows the guidelines in Band-edge Compliance of RF Conducted Emissions of FCC Public Notice DA 00-705 Measurement Guidelines. 2. Set to the maximum power setting and enable the EUT transmit continuously. 3. Set RBW = 100kHz（≥1% span=10MHz), VBW = 300kHz（≥RBW). Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100kHz RBW. The attenuation shall be 30 dB instead of 20 dB when RMS conducted output power procedure is used. 4. Enable hopping function of the EUT and then repeat step 2. and 3. 5. Measure and record the results in the test report.
Test results:	Pass

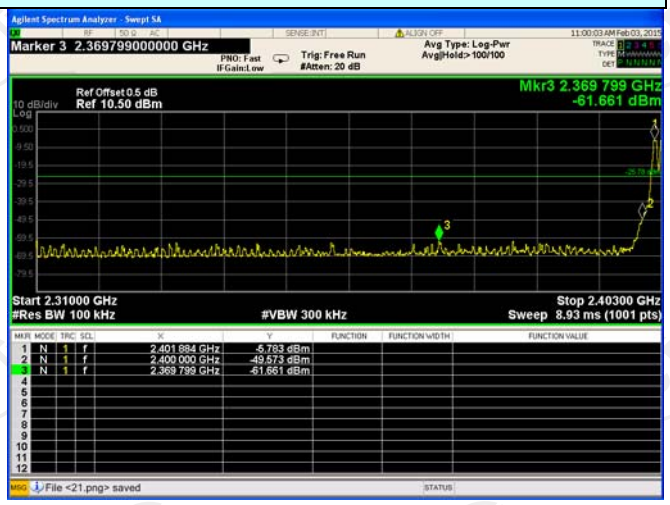
Test plot as follows:

GFSK

Test channel:	Lowest channel

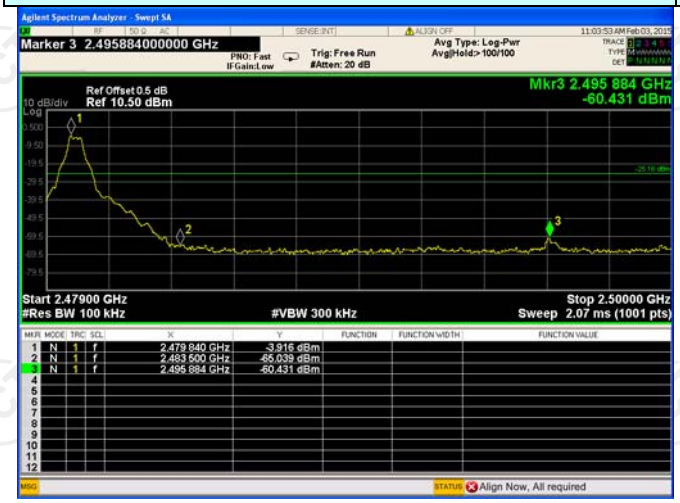


No-hopping mode

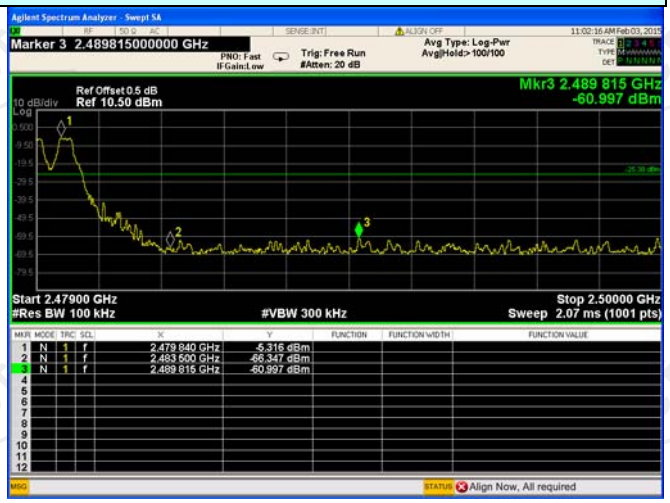


Hopping mode

Test channel:	Highest channel



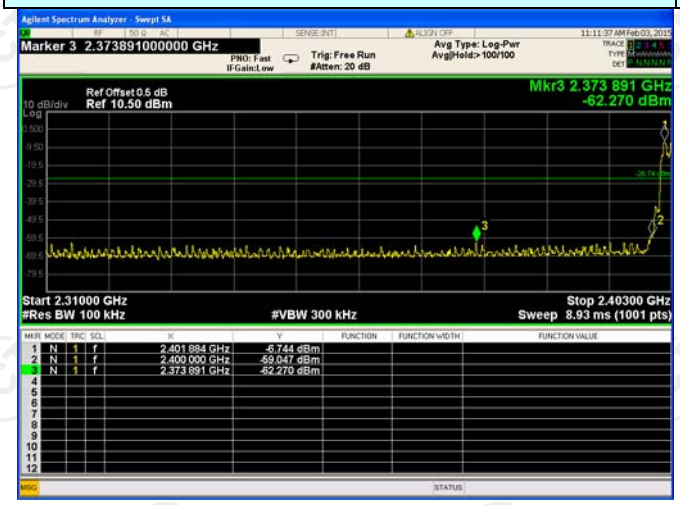
No-hopping mode



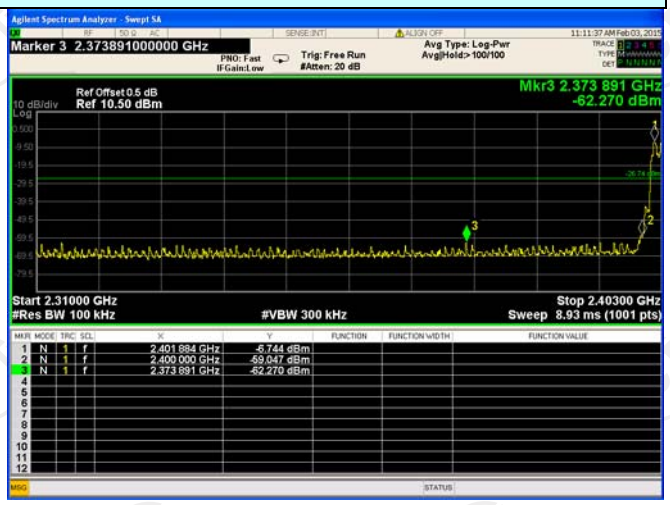
Hopping mode

π/4-DQPSK

Test channel:	Lowest channel

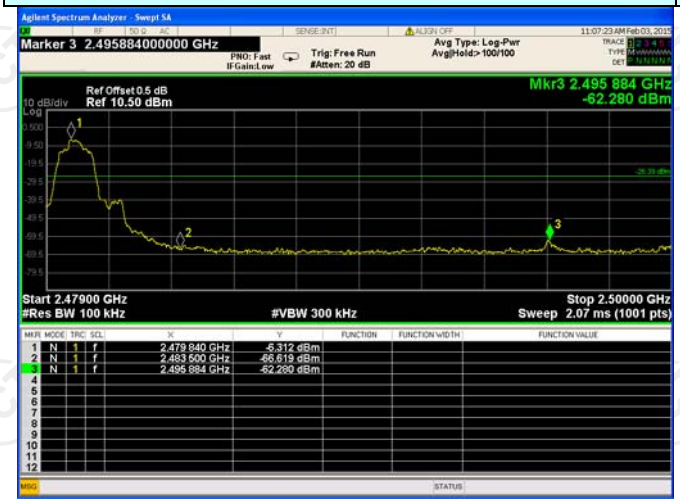


No-hopping mode

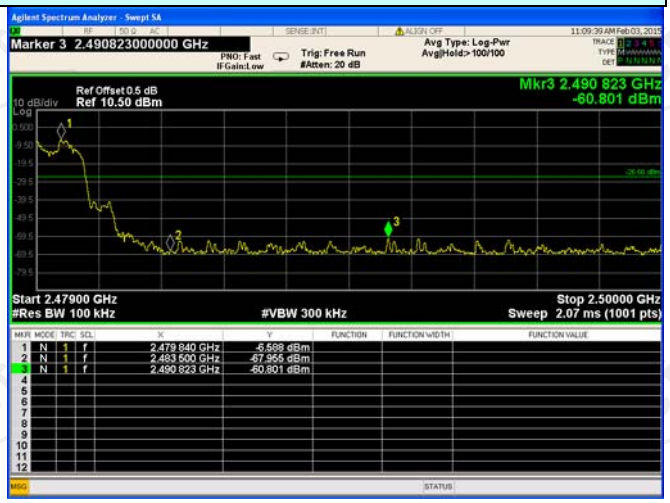


Hopping mode

Test channel:	Highest channel



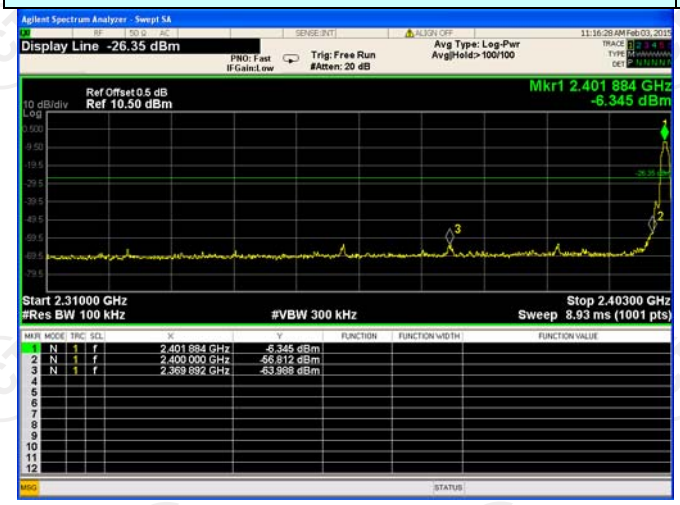
No-hopping mode



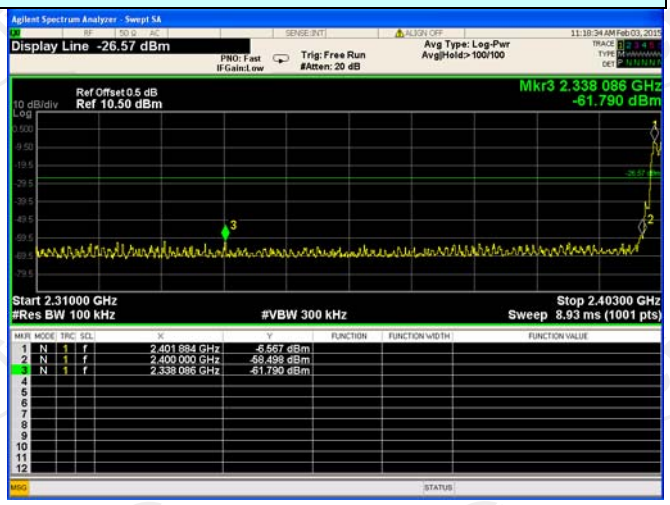
Hopping mode

8DPSK

Test channel:	Lowest channel

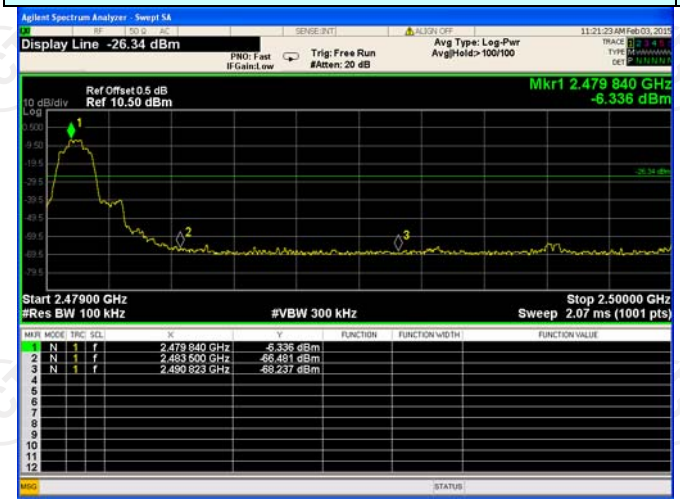


No-hopping mode

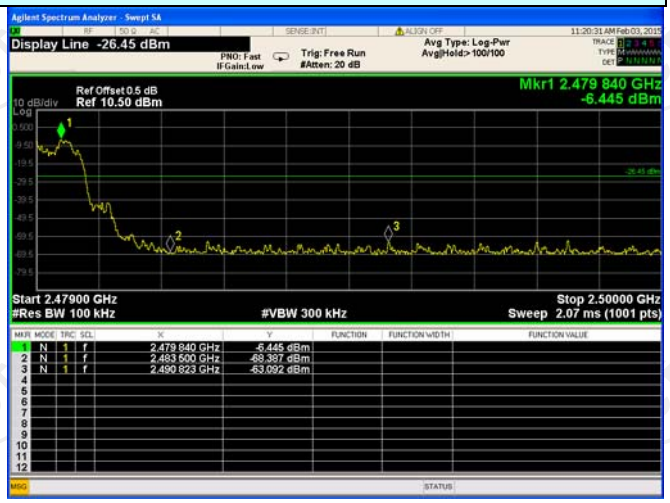


Hopping mode

Test channel:	Highest channel

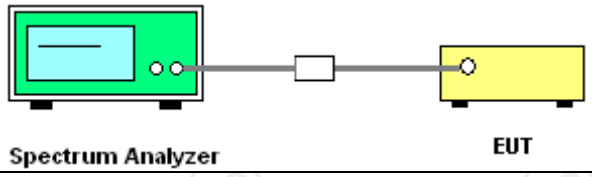


No-hopping mode



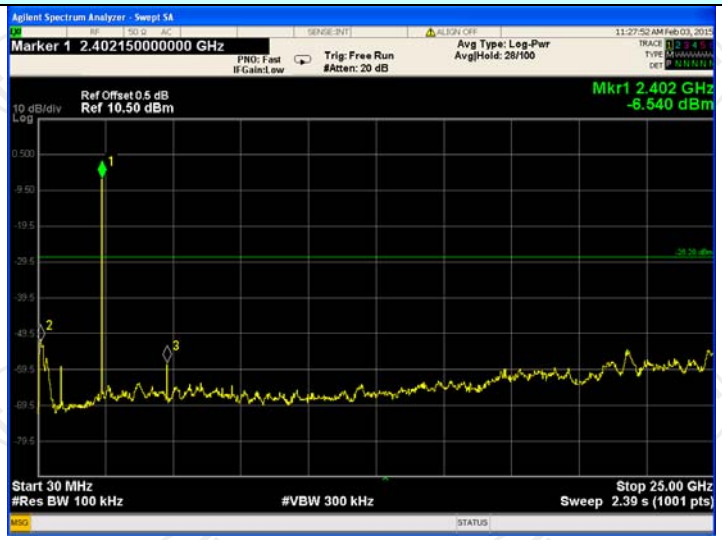
Hopping mode

6.10 Conducted Spurious Emission Measurement

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.4:2003 and DA00-705
Limit:	In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.
Test setup:	
Test Instruments:	Refer to section 5.7 for details
Test mode:	Non-hopping mode
	1. The testing follows the guidelines in Spurious RF Conducted Emissions of FCC Public Notice DA 00-705 Measurement Guidelines 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement. 3. Set to the maximum power setting and enable the EUT transmit continuously. 4. Set RBW = 100 kHz, VBW = 300kHz, scan up through 10th harmonic. All harmonics / spurs must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW. 5. Measure and record the results in the test report. 6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
Test results:	Pass

GFSK

Lowest channel

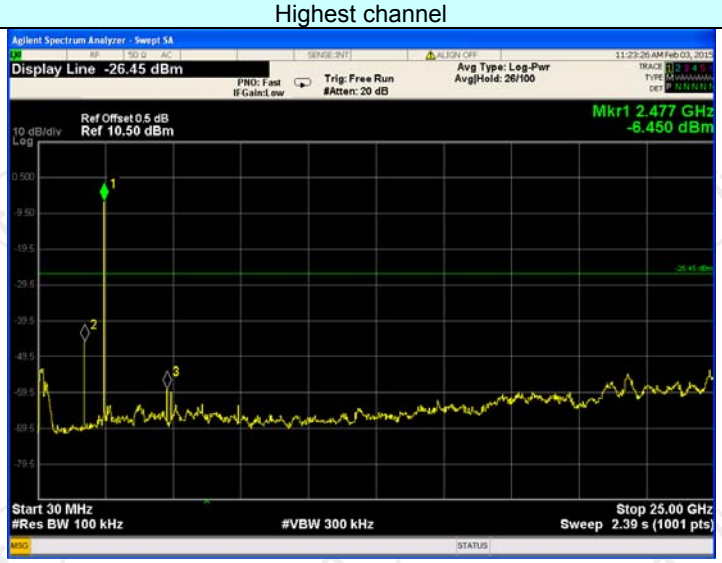


30MHz~25GHz

Middle channel

30MHz~25GHz

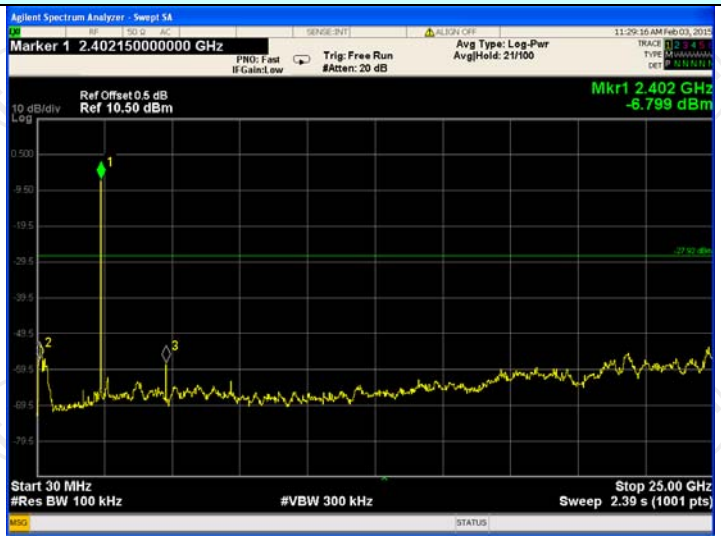
Highest channel



30MHz~25GHz

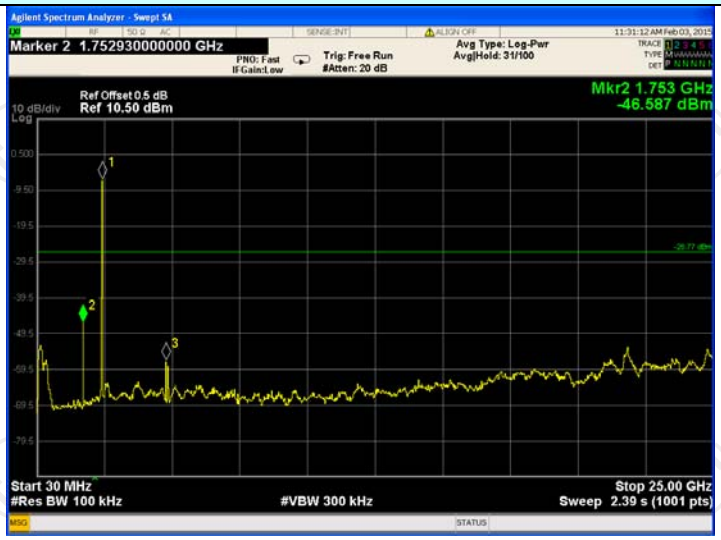
π/4-DQPSK

Lowest channel



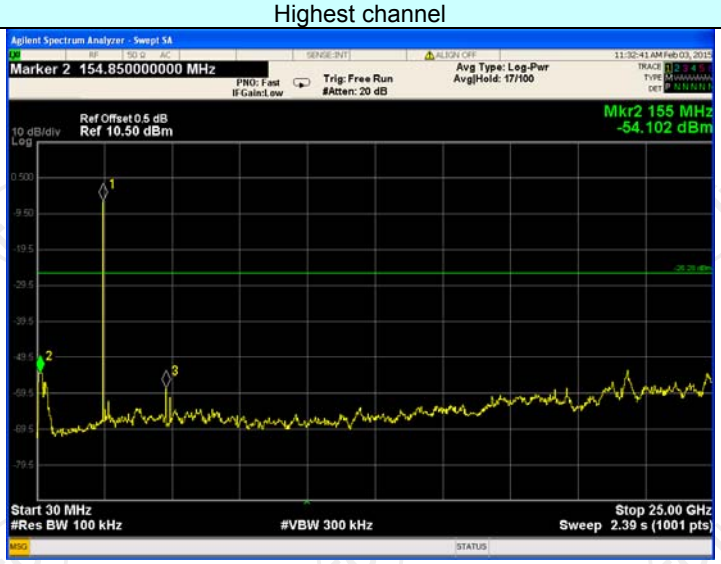
30MHz~25GHz

Middle channel



30MHz~25GHz

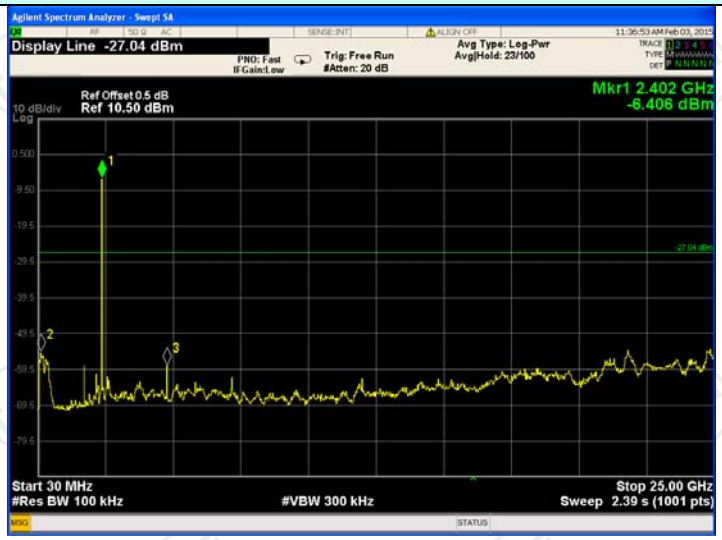
Highest channel



30MHz~25GHz

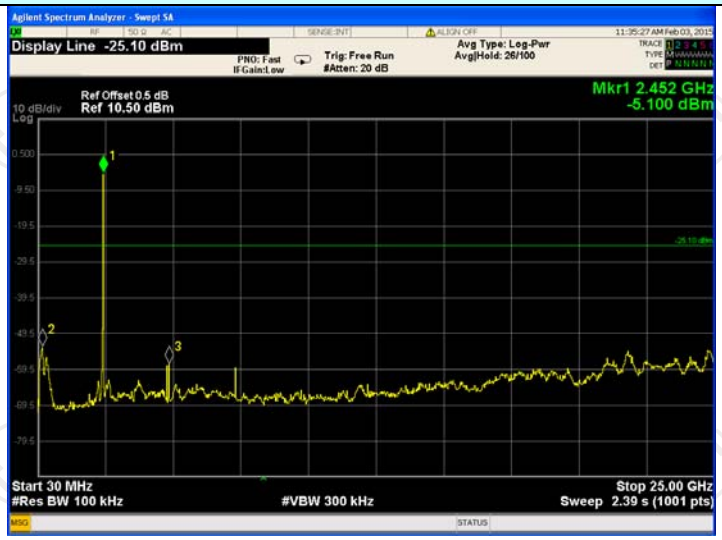
8DPSK

Lowest channel



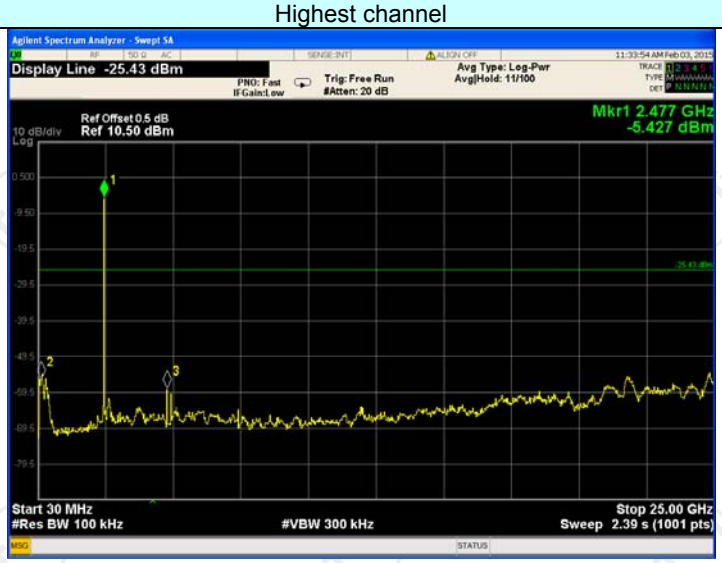
30MHz~25GHz

Middle channel



30MHz~25GHz

Highest channel



30MHz~25GHz

6.11 Radiated Spurious Emission Measurement

Test Requirement:	FCC Part15 C Section 15.209
Test Method:	ANSI C63.4: 2003
Test Frequency Range:	9 kHz to 25 GHz
Test site:	Measurement Distance: 3m

Receiver setup:

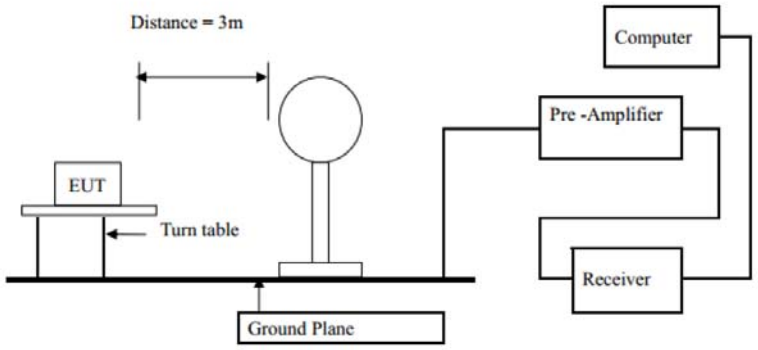
Frequency	Detector	RBW	VBW	Remark
30MHz-1GHz	Quasi-peak	120kHz	300kHz	Quasi-peak Value
Above 1GHz	Peak	1MHz	3MHz	Peak Value
	Peak	1MHz	10Hz	Average Value

Limit:

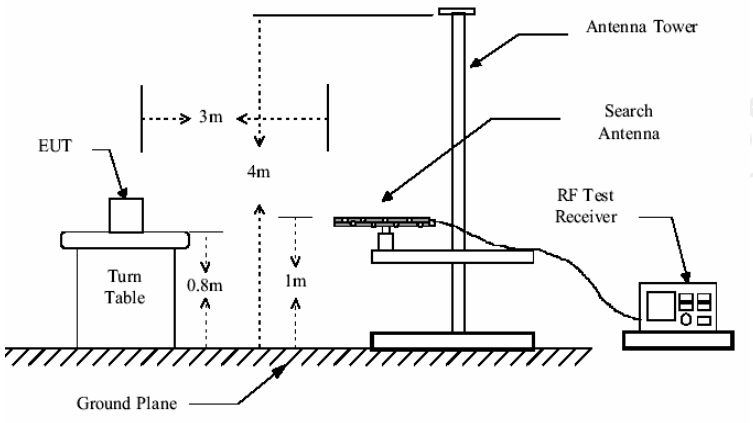
Frequency	Limit (dBuV/m @3m)	Remark
30MHz-88MHz	40.0	Quasi-peak Value
88MHz-216MHz	43.5	Quasi-peak Value
216MHz-960MHz	46.0	Quasi-peak Value
960MHz-1GHz	54.0	Quasi-peak Value
Above 1GHz	54.0	Average Value
	74.0	Peak Value

Test setup:

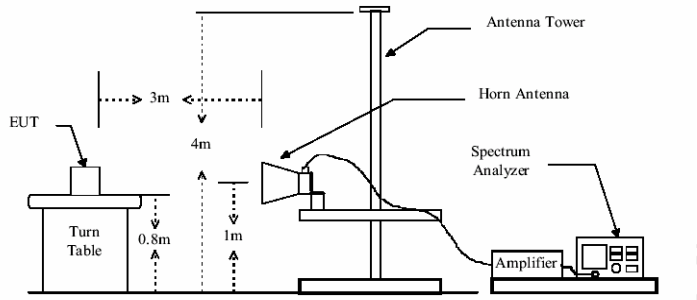
For radiated emissions below 30MHz



30MHz to 1GHz



Above 1GHz

	
Test Procedure:	1. The testing follows the guidelines in Spurious Radiated Emissions of FCC Public Notice DA 00-705 Measurement Guidelines. 2. The EUT was placed on a turntable with 0.8 meter above ground. 3. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower. 4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines. 5. Set to the maximum power setting and enable the EUT transmit continuously. 6. Use the following spectrum analyzer settings: (1) Span shall wide enough to fully capture the emission being measured; (2) Set RBW=100 kHz for f < 1 GHz, RBW=1MHz for f>1GHz ; VBW≥RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak (3) For average measurement: use duty cycle correction factor method per 15.35(c). Duty cycle = On time/100 milliseconds On time = N1*L1+N2*L2+...+Nn-1*LNn-1+Nn*Ln Where N1 is number of type 1 pulses, L1 is length of type 1 pulses, etc. Average Emission Level = Peak Emission Level + 20*log(Duty cycle) 7. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
Test Instruments:	Refer to section 5.7 for details
Test mode:	Non-hopping mode
Test results:	Pass

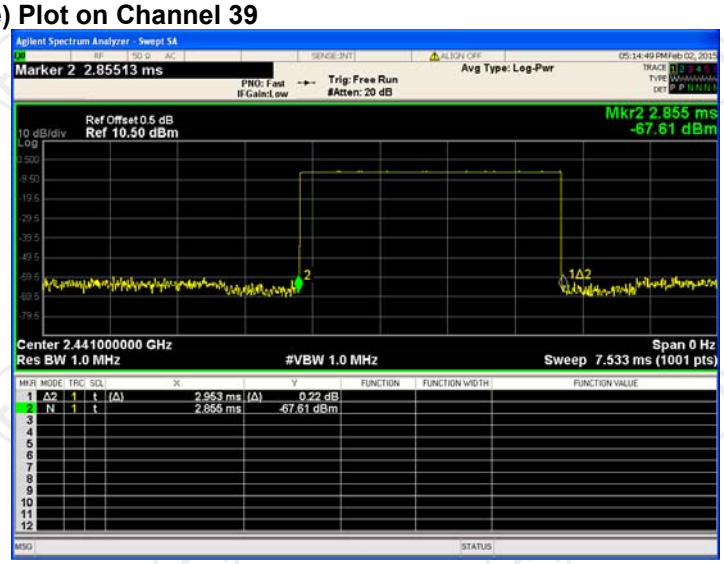
Remark:

1. Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis is the worst case.
2. 9 kHz to 30 MHz is noise floor, so only shows the data of above 30MHz in this report.

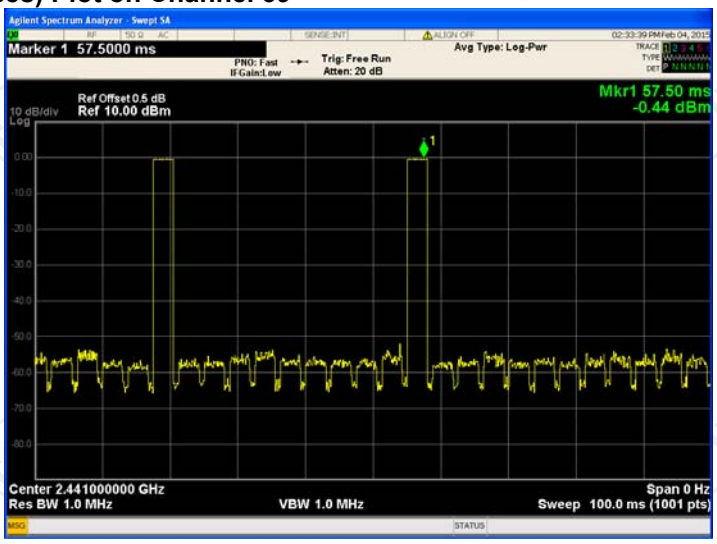
Measurement data:

Duty cycle correction factor for average measurement

DH5 on time (One Pulse) Plot on Channel 39



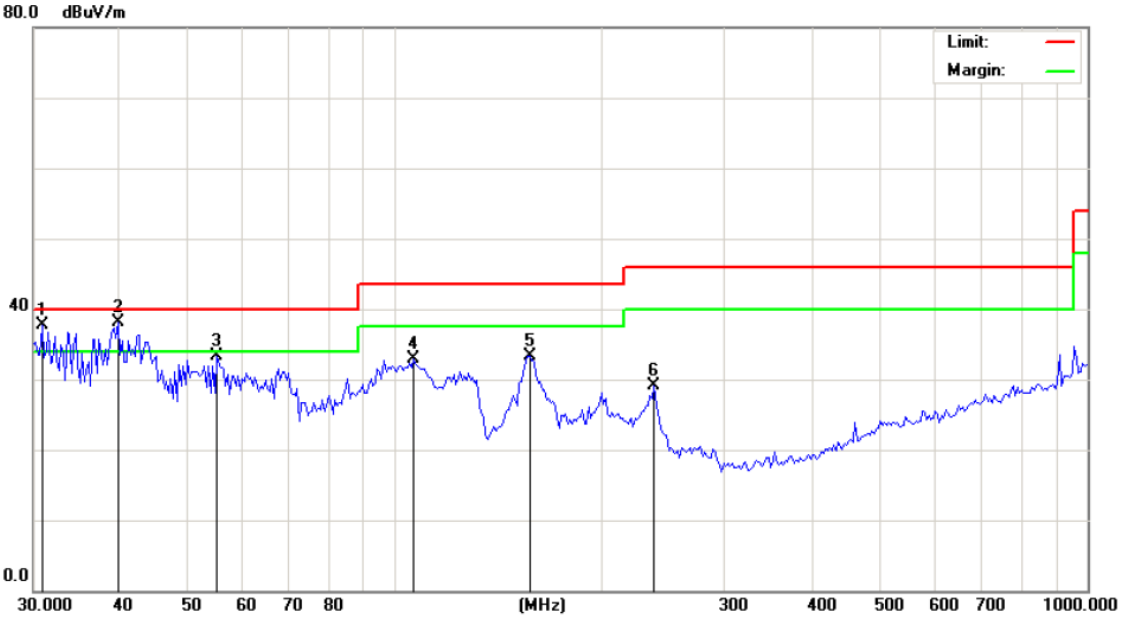
DH5 on time (Count Pulses) Plot on Channel 39



Note:
1. Worst case Duty cycle = on time/100 milliseconds =2 * 2.95/ 100 = 0.059
2. Worst case Duty cycle correction factor = 20*log (Duty cycle) = -24.58dB
3. DH5 has the highest duty cycle worst case and is reported.
4. The average levels were calculated from the peak level corrected with duty cycle correction factor (-24.58dB) derived from 20log (dwell time/100ms). This correction is only for signals that hop with the fundamental signal, such as band-edge and harmonic. Other spurious signals that are independent of the hopping signal would not use this correction.

Below 1GHz

Vertical:



Site

Polarization: *Vertical*

Temperature: 27

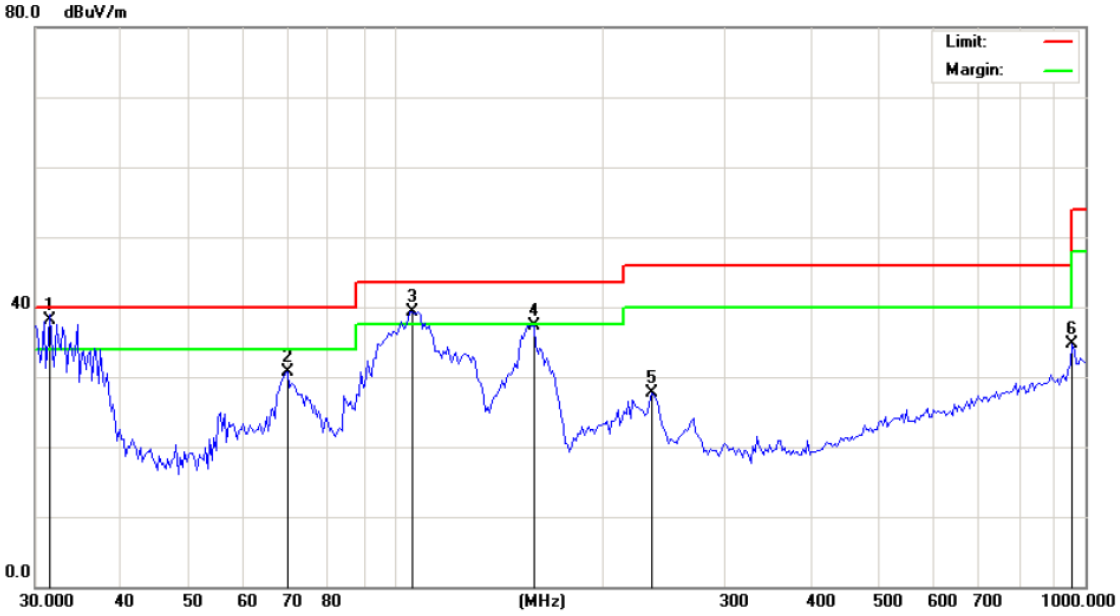
Limit: FCC Part 15B Class B RE_3 m

Power: AC 230V/50Hz

Humidity: 50 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1	!	30.8552	51.33	-13.61	37.72	40.00	-2.28	QP		0	
2	*	39.7371	50.65	-12.50	38.15	40.00	-1.85	QP		0	
3		55.2883	45.72	-12.45	33.27	40.00	-6.73	peak		0	
4		106.2812	44.62	-11.79	32.83	43.50	-10.67	peak		0	
5		156.4260	47.99	-14.71	33.28	43.50	-10.22	peak		0	
6		236.7928	39.44	-10.42	29.02	46.00	-16.98	peak		0	

Horizontal:



Site

Limit: FCC Part 15B Class B RE_3 m

Polarization: *Horizontal*

Power: AC 230V/50Hz

Temperature: 27

Humidity: 50 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1	*	31.5126	51.60	-13.53	38.07	40.00	-1.93	QP		0	
2		69.7180	47.12	-16.39	30.73	40.00	-9.27	peak		0	
3	!	105.5370	51.13	-11.74	39.39	43.50	-4.11	peak		0	
4		158.6400	51.89	-14.56	37.33	43.50	-6.17	peak		0	
5		235.1346	38.25	-10.47	27.78	46.00	-18.22	peak		0	
6		958.7135	30.06	4.66	34.72	46.00	-11.28	peak		0	

Above 1GHz:

Modulation Type: 8DPSK

Low channel: 2402 MHz									
Freq. (MHz)	Ant. Pol. H/V	Peak reading (dBuV)	AV reading (dBuV)	Correction Factor (dB)	Emission Level		Peak limit (dBuV/m)	AV limit (dBuV/m)	Margin (dB)
					Peak (dBuV/m)	AV (dBuV/m)			
1288.00	H	50.85	---	-4.20	46.65	---	74	54	-7.35
4804.00	H	48.46	---	-3.94	44.52	---	74	54	-9.48
7206.00	H	45.26	---	0.52	45.78	---	74	54	-8.22
---	H	---	---	---	---	---	---	---	---
---	H	---	---	---	---	---	---	---	---
1254.00	V	49.32	---	-4.25	45.07	---	74	54	-8.93
4804.00	V	50.65	---	-3.94	46.71	---	74	54	-7.29
7206.00	V	46.74	---	0.59	47.33	---	74	54	-6.67
---	V	---	---	---	---	---	---	---	---
---	V	---	---	---	---	---	---	---	---

Middle channel: 2441 MHz									
Freq. (MHz)	Ant. Pol. H/V	Peak reading (dBuV)	AV reading (dBuV)	Correction Factor (dB)	Emission Level		Peak limit (dBuV/m)	AV limit (dBuV/m)	Margin (dB)
					Peak (dBuV/m)	AV (dBuV/m)			
1236.72	H	46.31	---	-4.20	42.11	---	74	54	-11.89
4882.00	H	52.74	---	-3.98	48.76	---	74	54	-5.24
7323.00	H	45.59	---	0.56	46.15	---	74	54	-7.85
---	H	---	---	---	---	---	---	---	---
---	H	---	---	---	---	---	---	---	---
1236.72	V	47.36	---	-4.25	43.11	---	74	54	-10.89
4882.00	V	51.47	---	-3.98	47.49	---	74	54	-6.51
7323.00	V	46.89	---	0.57	47.46	---	74	54	-6.54
---	V	---	---	---	---	---	---	---	---

High channel: 2480 MHz									
Freq. (MHz)	Ant. Pol. H/V	Peak reading (dBuV)	AV reading (dBuV)	Correction Factor (dB)	Emission Level		Peak limit (dBuV/m)	AV limit (dBuV/m)	Margin (dB)
					Peak (dBuV/m)	AV (dBuV/m)			
1295.82	H	46.32	---	-4.20	42.12	---	74	54	-11.88
4960.00	H	50.82	---	-3.98	46.84	---	74	54	-7.16
7440.00	H	45.35	---	0.52	45.87	---	74	54	-8.13
---	H	---	---	---	---	---	---	---	---
---	H	---	---	---	---	---	---	---	---
1295.82	V	47.48	---	-4.25	44.32	---	74	54	-9.68
4960.00	V	52.34	---	-3.98	46.15	---	74	54	-7.85
7440.00	V	47.21	---	0.57	45.78	---	74	54	-8.22
---	V	---	---	---	---	---	---	---	---
---	V	---	---	---	---	---	---	---	---

Remark:

1. Emission Level=Peak Reading + Correction Factor; Correction Factor= Antenna Factor + Cable loss – Pre-amplifier
2. Margin (dB) = Emission Level (Peak) (dBuV/m)-Average limit (dBuV/m)
3. The emission levels of other frequencies are very lower than the limit and not show in test report.
4. Measurements were conducted from 1 GHz to the 10th harmonic of highest fundamental frequency.
5. Data of measurement shown "---"in the above table mean that the reading of emissions is attenuated more than 20 dB below the limits or the field strength is too small to be measured.

------End of report------