FCC REPORT

Applicant:	REACH Tech (Xiamen) Co., Ltd.
Address of Applicant:	RM.303,#18,Guanri Road, Software Park II, Xiamen,361008, China
Equipment Under Test (EUT)	
Product Name:	MID
Model No.:	EQ823R
FCC ID:	Z5JREACH-EQ823R
Applicable standards:	FCC CFR Title 47 Part 15 Subpart C Section 15.247
Date of sample receipt:	12 Mar., 2014
Date of Test:	21 Mar., to 03 Apr., 2014
Date of report issued:	08 Apr., 2014
Test Result:	PASS *

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

Authorized Signature:

Bruce Zhang
Laboratory Manager

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product and does not permit the use of the CCIS product certification mark. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

This report may only be reproduced and distributed in full. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards.

This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

2 Version

Version No.	Date	Description
00	*08 Apr.,2014*	*Original*

Prepared by: Sera Xiang ***Date:*** *08 Apr.,2014*

Report Clerk

Reviewed by: Vincent Chen ***Date:*** *08 Apr.,2014*

Project Engineer

3 Contents

Page

1 COVER PAGE 1
2 VERSION 2
3 CONTENTS 3
4 TEST SUMMARY 4
5 GENERAL INFORMATION 5
5.1 CLIENT INFORMATION 5
5.2 GENERAL DESCRIPTION OF E.U.T. 5
5.3 TEST MODE 7
5.4 LABORATORY FACILITY 7
5.5 LABORATORY LOCATION 7
5.6 TEST INSTRUMENTS LIST 8
6 TEST RESULTS AND MEASUREMENT DATA 9
6.1 ANTENNA REQUIREMENT 9
6.2 CONDUCTED EMISSIONS 10
6.3 CONDUCTED OUTPUT POWER 13
6.4 20DB OCCUPY BANDWIDTH 17
6.5 CARRIER FREQUENCIES SEPARATION 21
6.6 HOPPING CHANNEL NUMBER 26
6.7 DWELL TIME 28
6.8 PSEUDORANDOM FREQUENCY HOPPING SEQUENCE 32
6.9 BAND EDGE 33
6.9.1 Conducted Emission Method 33
6.9.2 Radiated Emission Method 37
6.10 SPURIOUS EMISSION 50
6.10.1 Conducted Emission Method 50
6.10.2 Radiated Emission Method 54
7 TEST SETUP PHOTO 76
8 EUT CONSTRUCTIONAL DETAILS 77

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:	REACH Tech (Xiamen) Co., Ltd.
Address of Applicant:	RM.303,#18,Guanri Road, Software Park II, Xiamen,361008, China
Manufacturer:	REACH Tech (Xiamen) Co., Ltd.
Address of Manufacturer:	RM.303,#18,Guanri Road, Software Park II, Xiamen,361008,China
Factory:	REACH Tech (Xiamen) Co., Ltd.
Address of Factory:	5/F,#51,Wanghai Road, Software Park II,Xiamen,361008, China

5.2 General Description of E.U.T.

Product Name:	MID
Model No.:	EQ823R
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:	-3.55 dBi
AC adapter:	Model:SKL-5WU-U050-0700 Input:100-240V AC,50/60Hz 0.15A Output:5.0V DC 700mA
Power supply:	Rechargeable Li-ion Battery DC3.7V,4800mAh

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 Test mode

Transmitting mode:	Keep the EUT in transmitting 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.

5.4 Laboratory Facility

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

- **FCC - Registration No.: 817957**

Shenzhen Zhongjian Nanfang Testing Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in out files. Registration 817957, February 27, 2012.

- **IC - Registration No.: 10106A-1**

The 3m Semi-anechoic chamber of Shenzhen Zhongjian Nanfang Testing Co., Ltd. has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 10106A-1.

- **CNAS - Registration No.: CNAS L6048**

Shenzhen Zhongjian Nanfang Testing 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 L6048.

5.5 Laboratory Location

Shenzhen Zhongjian Nanfang Testing Co., Ltd.
Address: No.B-C, 1/F., Building 2, Laodong No.2 Industrial Park, Xixiang Road,
Bao'an District, Shenzhen, Guangdong, China
Tel: +86-755-23118282
Fax: +86-755-23116366

5.6 Test Instruments list

Radiated Emission:

Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
1	3m Semi- Anechoic Chamber	SAEMC	9(L)*6(W)* 6(H)	CCIS0001	June 09 2013	June 08 2014
2	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	CCIS0005	May 25 2013	May 24 2014
3	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	BBHA9120D	CCIS0006	May 25 2013	May 24 2014
4	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
5	Coaxial Cable	CCIS	N/A	CCIS0016	Feb. 01 2014	Feb. 31 2015
6	Coaxial Cable	CCIS	N/A	CCIS0017	Feb. 01 2014	Feb. 31 2015
7	Coaxial cable	CCIS	N/A	CCIS0018	Feb. 01 2014	Feb. 31 2015
8	Coaxial Cable	CCIS	N/A	CCIS0019	Feb. 01 2014	Feb. 31 2015
9	Coaxial Cable	CCIS	N/A	CCIS0087	Feb. 01 2014	Feb. 31 2015
10	Amplifier(10kHz-1.3GHz)	HP	8447D	CCIS0003	Feb. 01 2014	Feb. 31 2015
11	Amplifier(1GHz-18GHz)	Compliance Direction Systems Inc.	PAP-1G18	CCIS0011	June 09 2013	June 08 2014
12	Pre-amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	Feb. 01 2014	Feb. 31 2015
13	Horn Antenna	ETS-LINDGREN	3160	GTS217	Feb. 30 2014	Feb. 29 2015
14	Printer	HP	HP LaserJet P1007	N/A	N/A	N/A
15	Positioning Controller	UC	UC3000	CCIS0015	N/A	N/A
16	Spectrum analyzer 9k-30GHz	Rohde & Schwarz	FSP	CCIS0023	May. 25 2013	May. 24 2014
17	EMI Test Receiver	Rohde & Schwarz	ESPI	CCIS0022	Feb 01 2014	Feb. 31 2015
18	Loop antenna	Laplace instrument	RF300	EMC0701	Aug. 12 2013	Aug. 11 2014
19	Universal radio communication tester	Rhode & Schwarz	CMU200	CCIS0069	May. 25 2013	May. 24 2014
20	Signal Analyzer	Rohde & Schwarz	FSIQ3	CCIS0088	May. 25 2013	May. 24 2014

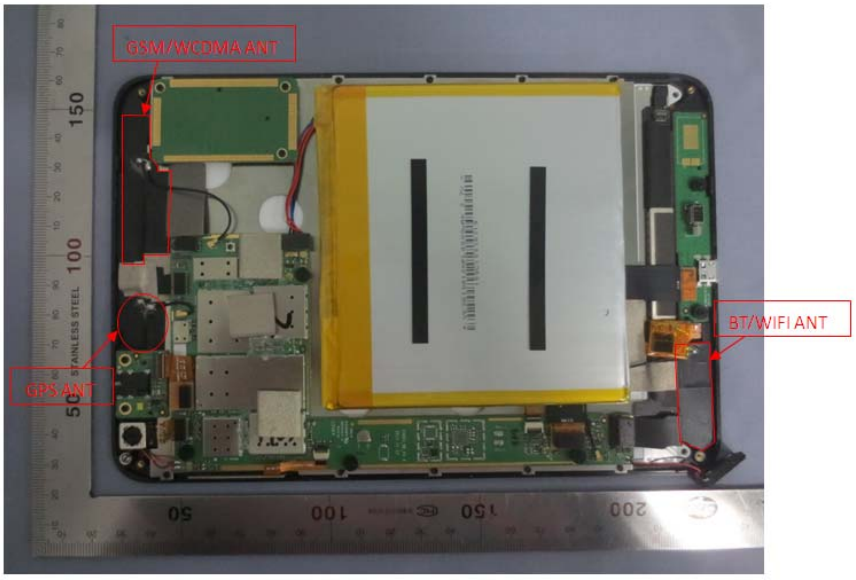
Conducted Emission:

Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
1	Shielding Room	ZhongShuo Electron	11.0(L)x4.0(W)x3.0(H)	CCIS0061	June 09 2013	June 08 2014
2	EMI Test Receiver	Rohde & Schwarz	ESCI	CCIS0002	May 25 2013	May 24 2014
3	LISN	CHASE	MN2050D	CCIS0074	Feb 01 2014	Feb. 31 2015
4	Coaxial Cable	CCIS	N/A	CCIS0086	Feb. 01 2014	Feb. 31 2015
5	EMI Test Software	AUDIX	E3	N/A	N/A	N/A

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 integral antenna which permanently attached, and the best case gain of the antenna is -3.55 dBi.	



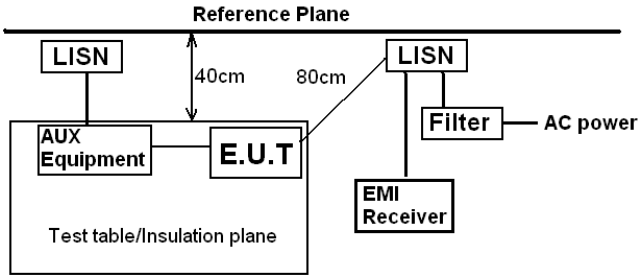
6.2 Conducted Emissions

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

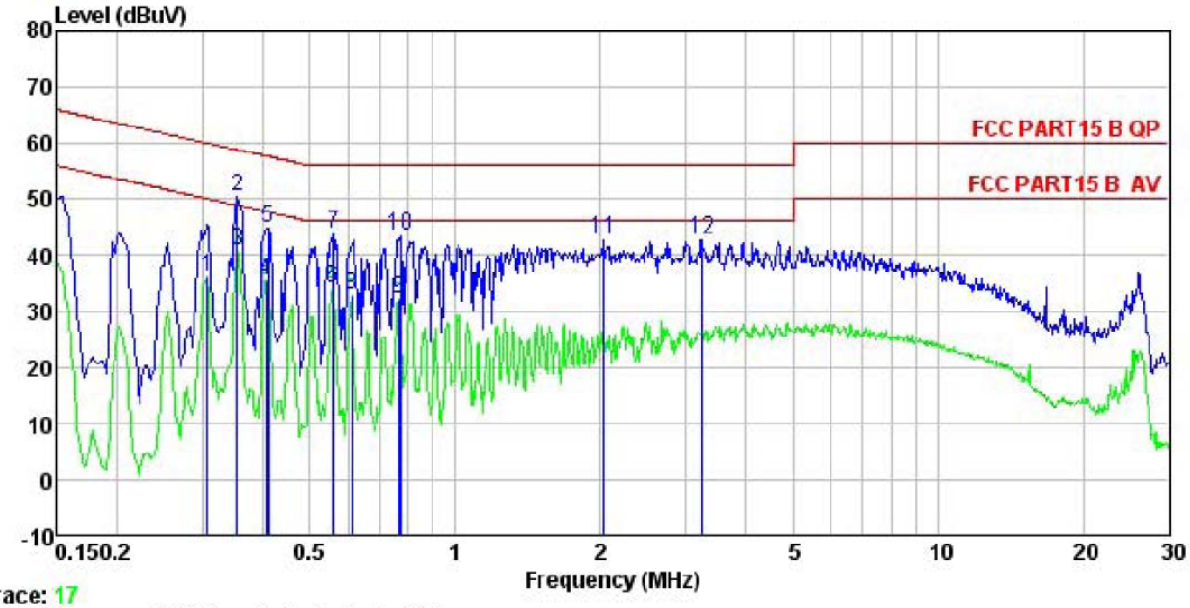
Test procedure:

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

Line:

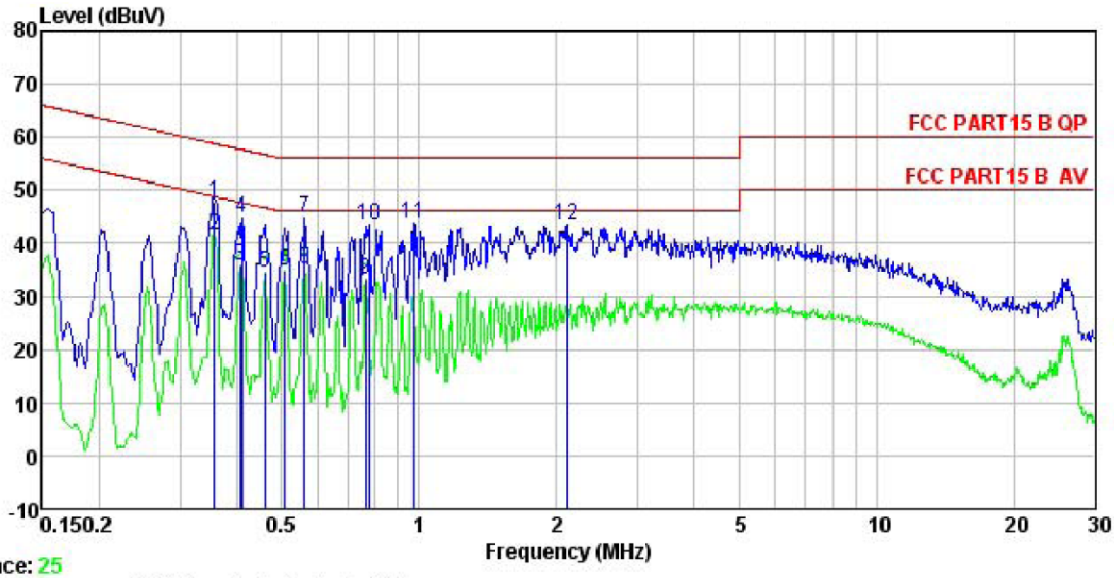


Trace: 17

Site : CCIS Conducted test Site
Condition : FCC PART15 B QP LISN LINE
Job No. : 108RF
EUT : MID
Model : EQ823R
Test Mode : BT Mode
Power Rating : AC 120V/60Hz
Environment : Temp: 23 ℃ Huni:56% Atmos:101KPa
Test Engineer: Vincent
Remark :

	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.307	25.24	0.26	10.74	36.24	50.06	-13.82	Average
2	0.354	39.39	0.27	10.73	50.39	58.87	-8.48	QP
3	0.354	29.85	0.27	10.73	40.85	48.87	-8.02	Average
4	0.406	24.40	0.28	10.72	35.40	47.73	-12.33	Average
5	0.410	33.74	0.28	10.72	44.74	57.64	-12.90	QP
6	0.558	23.28	0.27	10.77	34.32	46.00	-11.68	Average
7	0.561	32.74	0.27	10.77	43.78	56.00	-12.22	QP
8	0.611	21.90	0.25	10.77	32.92	46.00	-13.08	Average
9	0.763	21.23	0.23	10.80	32.26	46.00	-13.74	Average
10	0.771	32.40	0.23	10.80	43.43	56.00	-12.57	QP
11	2.033	31.43	0.26	10.96	42.65	56.00	-13.35	QP
12	3.241	31.72	0.27	10.91	42.90	56.00	-13.10	QP

Neutral:



Trace: 25

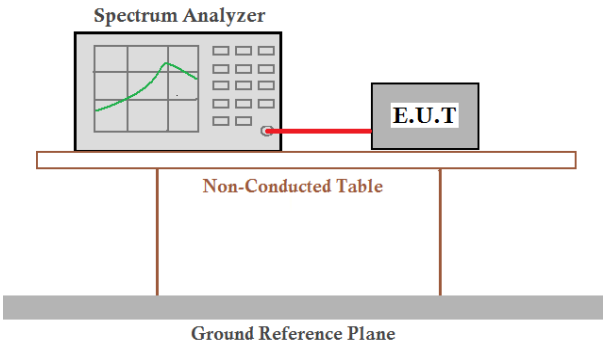
Site : CCIS Conducted test Site
Condition : FCC PART15 B QP LISN NEUTRAL
Job No. : 108RF
EUT : MID
Model : EQ823R
Test Mode : BT Mode
Power Rating : AC 120V/60Hz
Environment : Temp: 23 ℃ Huni:56% Atmos:101KPa
Test Engineer: Vincent
Remark :

	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.358	36.90	0.25	10.73	47.88	58.78	-10.90	QP
2	0.358	30.54	0.25	10.73	41.52	48.78	-7.26	Average
3	0.406	24.76	0.25	10.72	35.73	47.73	-12.00	Average
4	0.410	33.76	0.25	10.72	44.73	57.64	-12.91	QP
5	0.459	23.61	0.28	10.75	34.64	46.71	-12.07	Average
6	0.510	23.70	0.28	10.76	34.74	46.00	-11.26	Average
7	0.561	33.66	0.25	10.77	44.68	56.00	-11.32	QP
8	0.561	24.25	0.25	10.77	35.27	46.00	-10.73	Average
9	0.763	22.14	0.19	10.80	33.13	46.00	-12.87	Average
10	0.775	32.46	0.19	10.80	43.45	56.00	-12.55	QP
11	0.968	32.63	0.22	10.86	43.71	56.00	-12.29	QP
12	2.099	32.10	0.29	10.96	43.35	56.00	-12.65	QP

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level =Receiver Read level + LISN Factor + Cable Loss

6.3 Conducted Output Power

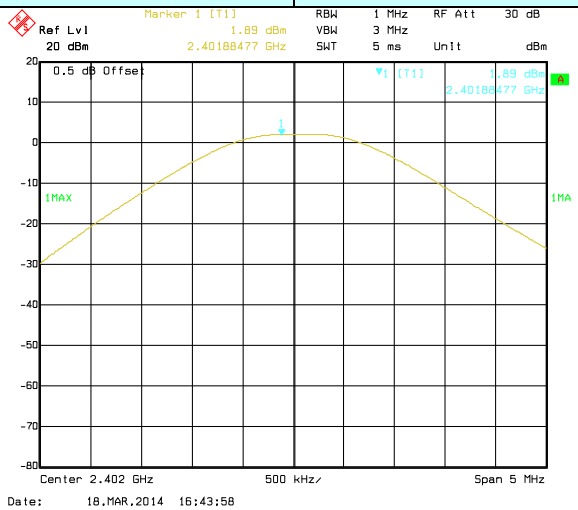
Test Requirement:	FCC Part15 C Section 15.247 (b)(3)
Test Method:	ANSI C63.4:2003 and DA00-705
Receiver setup:	RBW=1MHz, VBW=3MHz, Detector=Peak (If 20dB BW ≤1 MHz) RBW=3MHz, VBW=10MHz, Detector=Peak (If 20dB BW > 1 MHz and < 3MHz)
Limit:	125 mW(21 dBm)
Test setup:	
Test Instruments:	Refer to section 5.7 for details
Test mode:	Non-hopping mode
Test results:	Pass

Measurement Data

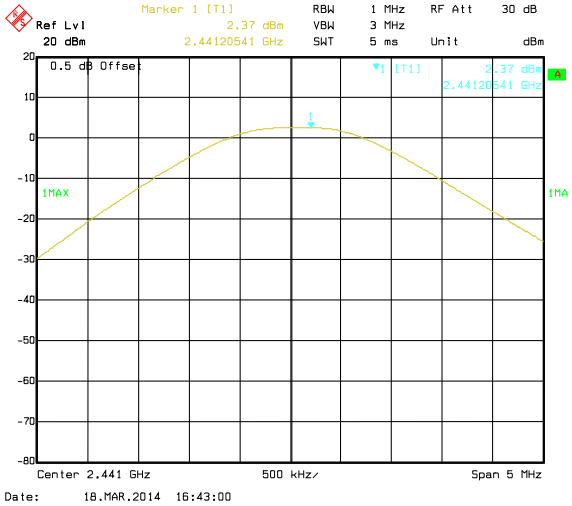
GFSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	1.89	21.00	Pass
Middle	2.37	21.00	Pass
Highest	2.72	21.00	Pass
π/4-DQPSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	2.85	21.00	Pass
Middle	3.21	21.00	Pass
Highest	3.69	21.00	Pass
8DPSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	3.21	21.00	Pass
Middle	3.57	21.00	Pass
Highest	3.82	21.00	Pass

Test plot as follows:

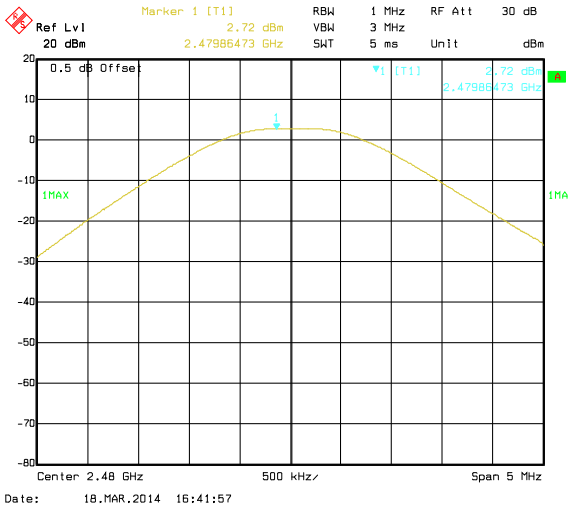
Modulation mode:	GFSK



Lowest channel

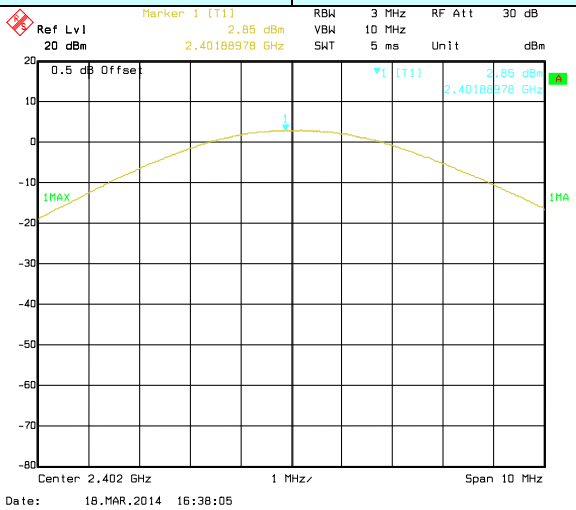


Middle channel

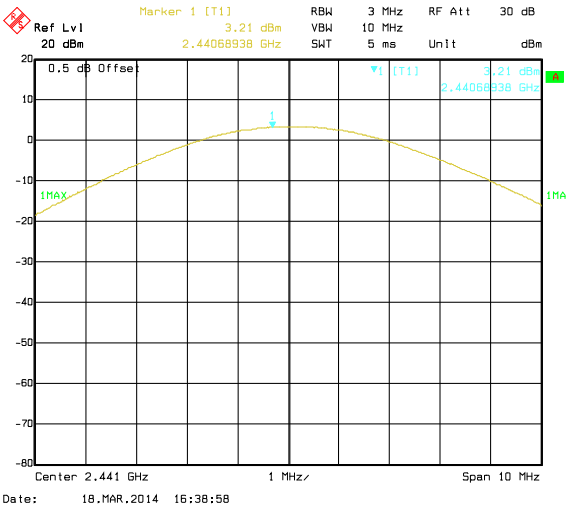


Highest channel

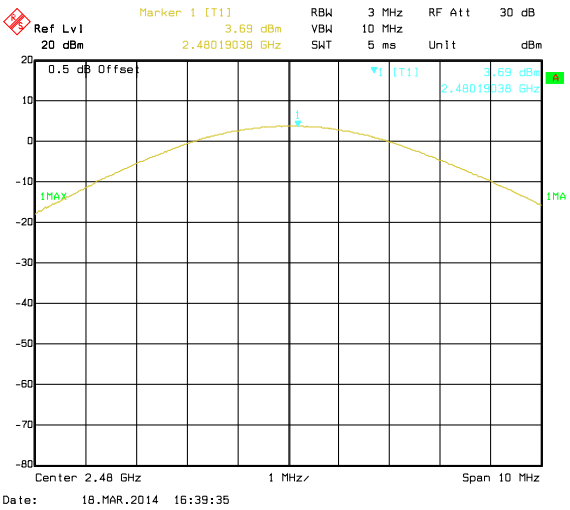
Modulation mode:	π/4-DQPSK



Lowest channel

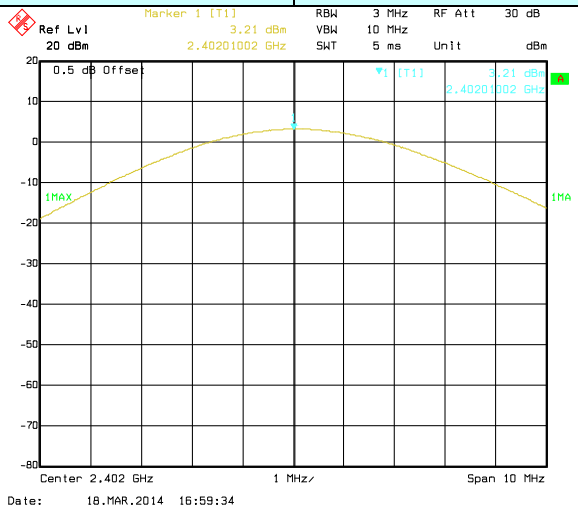


Middle channel

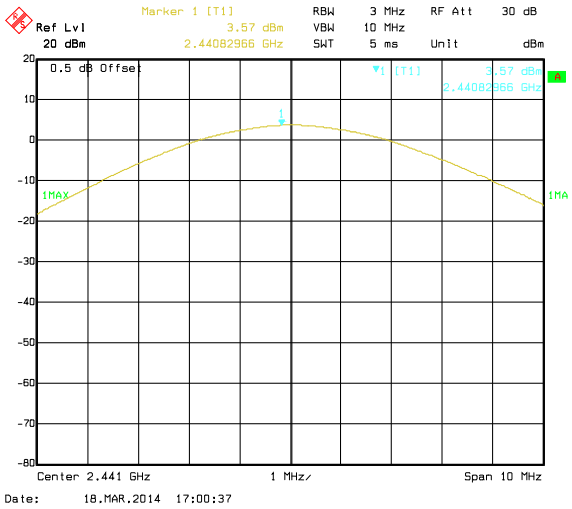


Highest channel

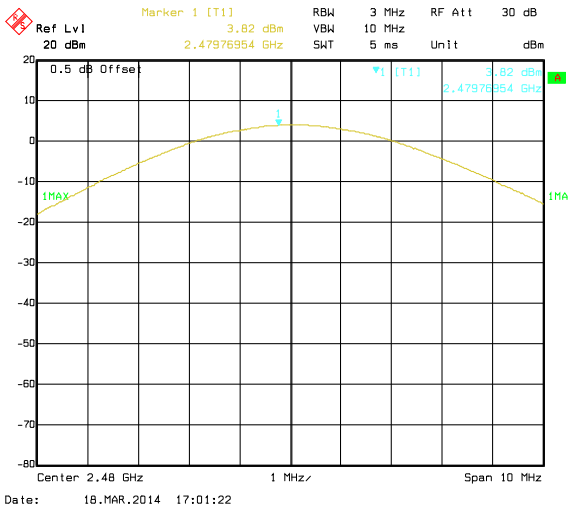
Modulation mode:	8DPSK



Lowest channel

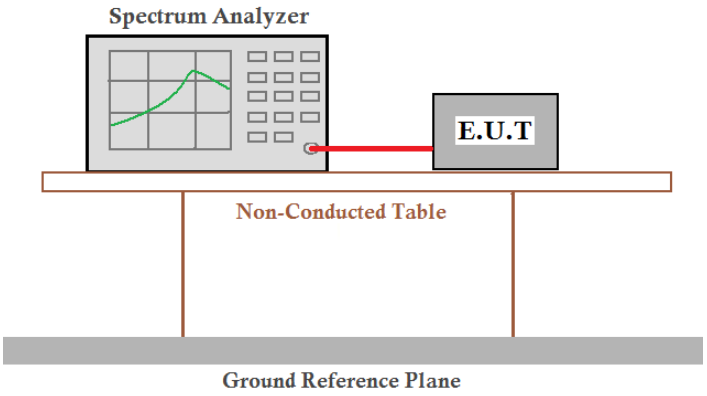


Middle channel



Highest channel

6.4 20dB Occupy Bandwidth

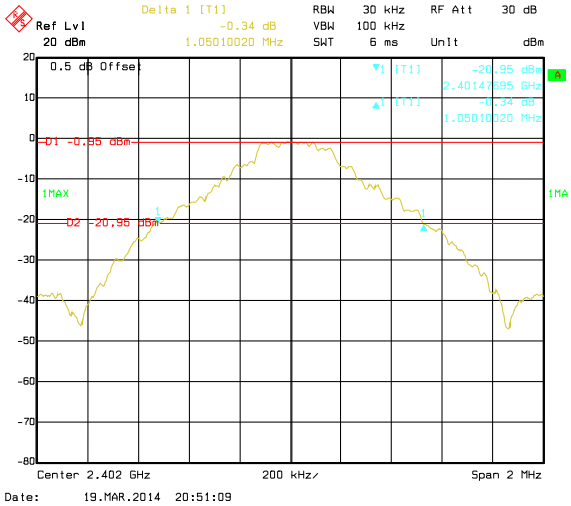
Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.4:2003 and DA00-705
Receiver setup:	RBW=30 kHz, VBW=100 kHz, detector=Peak
Limit:	NA
Test setup:	
Test Instruments:	Refer to section 5.7 for details
Test mode:	Non-hopping mode
Test results:	Pass

Measurement Data

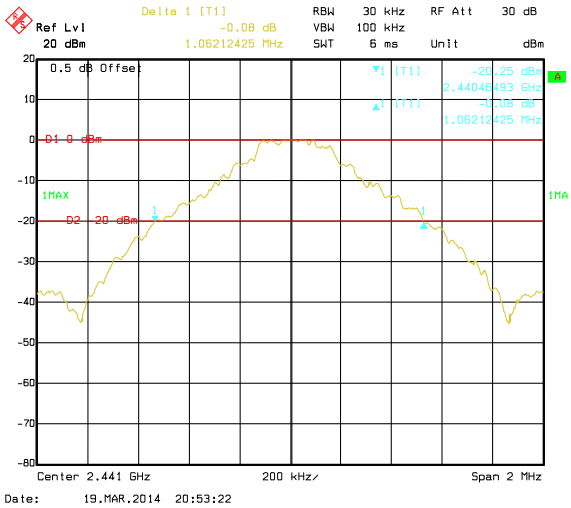
Test channel	20dB Occupy Bandwidth (kHz)		
	GFSK	π/4-DQPSK	8DPSK
Lowest	1050.10	1402.81	1342.69
Middle	1062.12	1370.74	1350.70
Highest	1054.11	1402.81	1346.69

Test plot as follows:

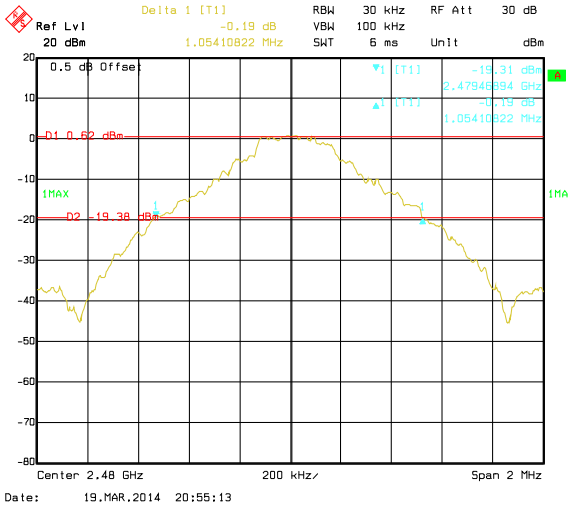
Modulation mode:	GFSK



Lowest channel

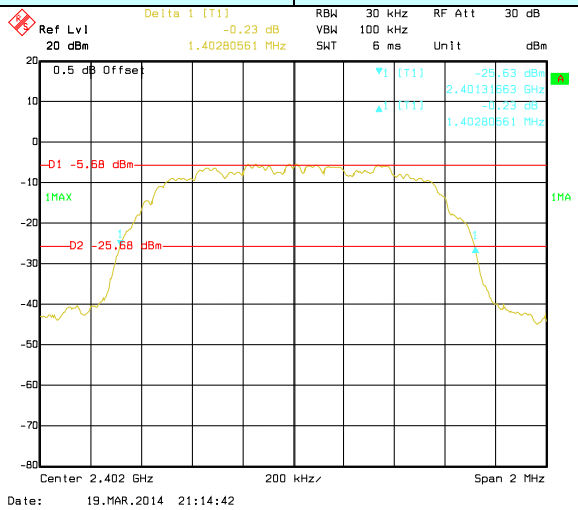


Middle channel

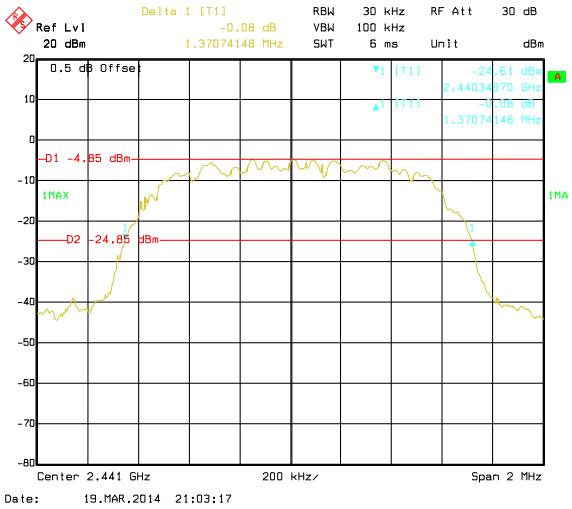


Highest channel

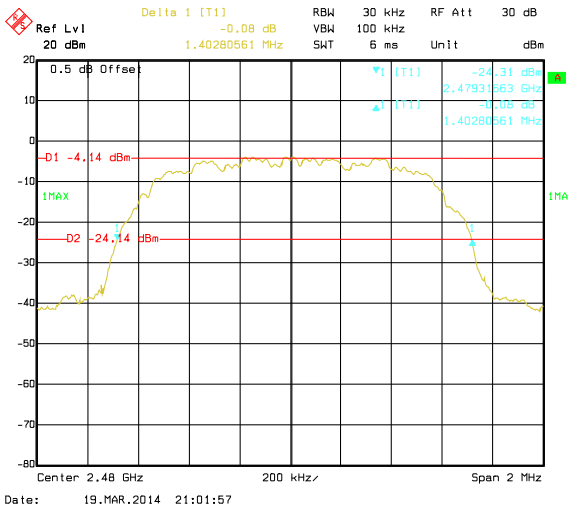
Modulation mode:	π/4-DQPSK



Lowest channel

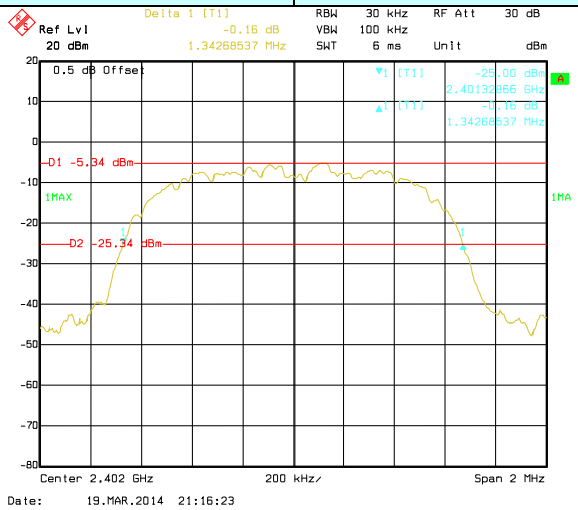


Middle channel

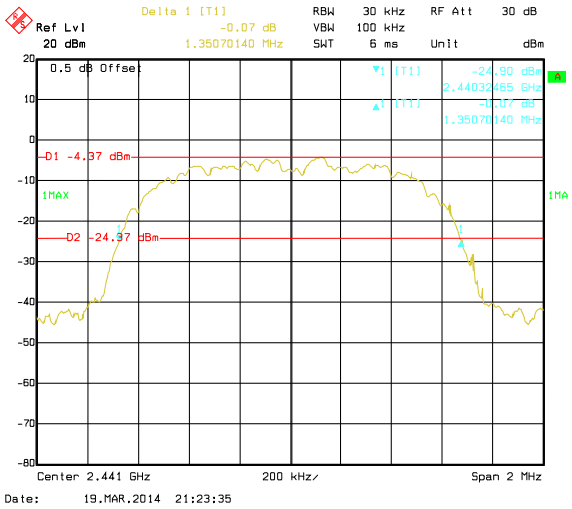


Highest channel

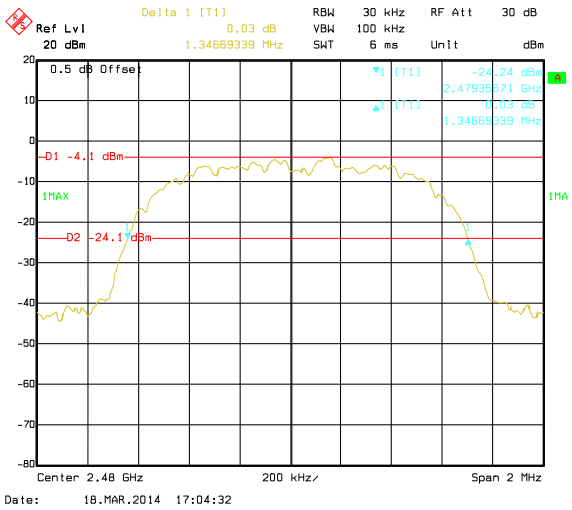
Modulation mode:	8DPSK



Lowest channel

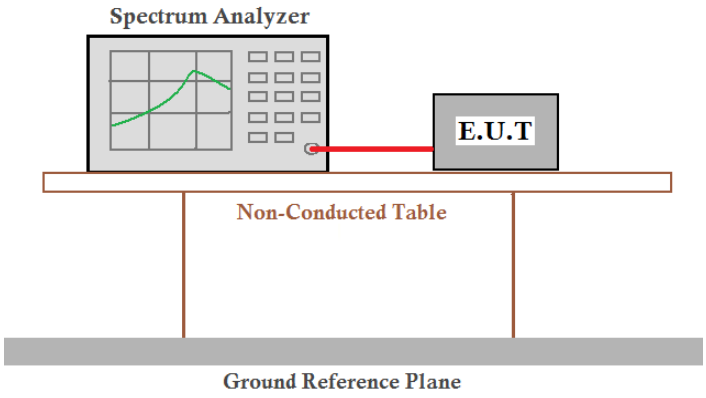


Middle channel



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
Receiver setup:	RBW=100 kHz, VBW=300 kHz, detector=Peak
Limit:	0.025MHz or 2/3 of the 20dB bandwidth (whichever is greater)
Test setup:	
Test Instruments:	Refer to section 5.7 for details
Test mode:	Hopping mode
Test results:	Pass

Measurement Data

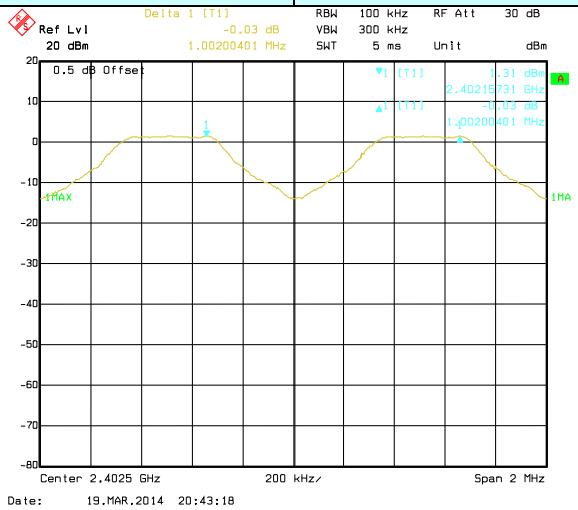
GFSK mode			
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Lowest	1002	*708.08*	Pass
Middle	1118	*708.08*	Pass
Highest	1046	*708.08*	Pass
π/4-DQPSK mode			
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Lowest	1006	*935.21*	Pass
Middle	1002	*935.21*	Pass
Highest	1002	*935.21*	Pass
8DPSK mode			
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Lowest	1042	*900.47*	Pass
Middle	1034	*900.47*	Pass
Highest	1006	*900.47*	Pass

Note: According to section 6.4

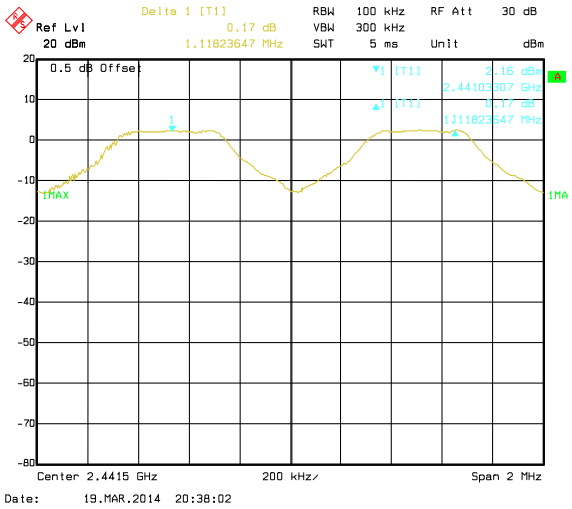
Mode	*20dB bandwidth (kHz) (worse case)*	*Limit (kHz) (Carrier Frequencies Separation)*
GFSK	*1062.12*	*708.08*
π/4-DQPSK	*1402.81*	*935.21*
8DPSK	*1350.70*	*900.47*

Test plot as follows:

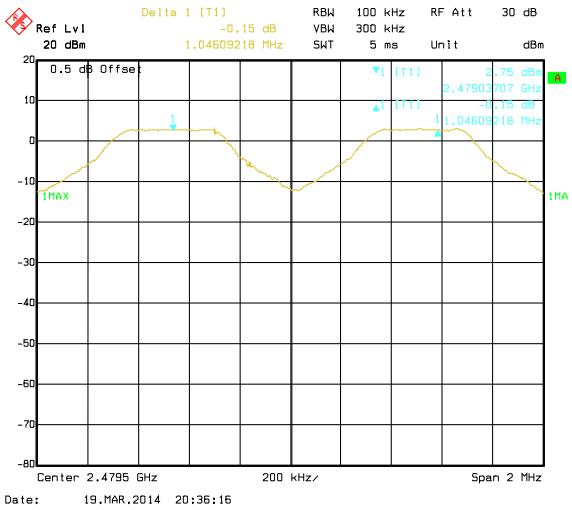
Modulation mode:	GFSK



Lowest channel

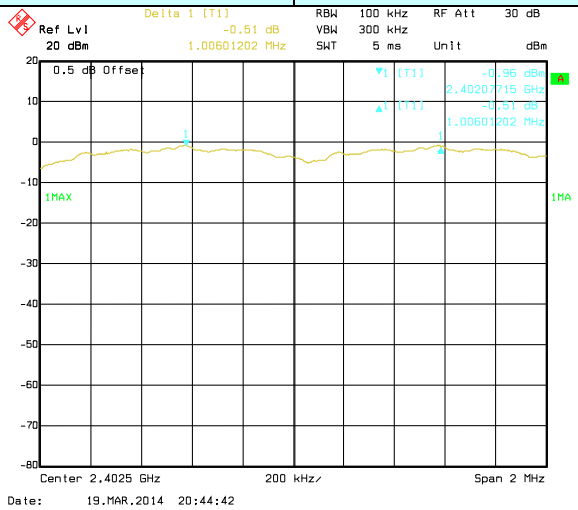


Middle channel

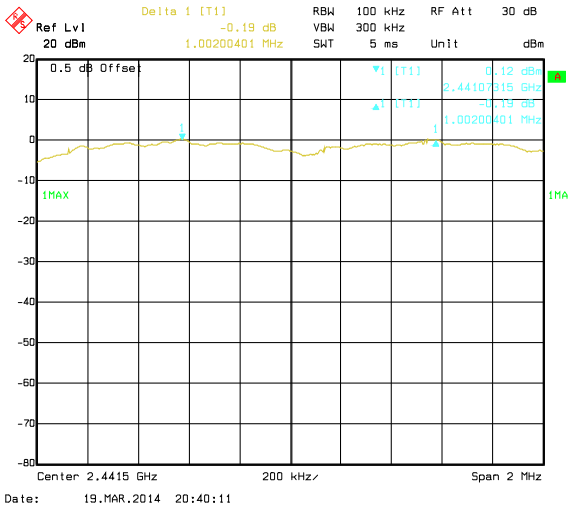


Highest channel

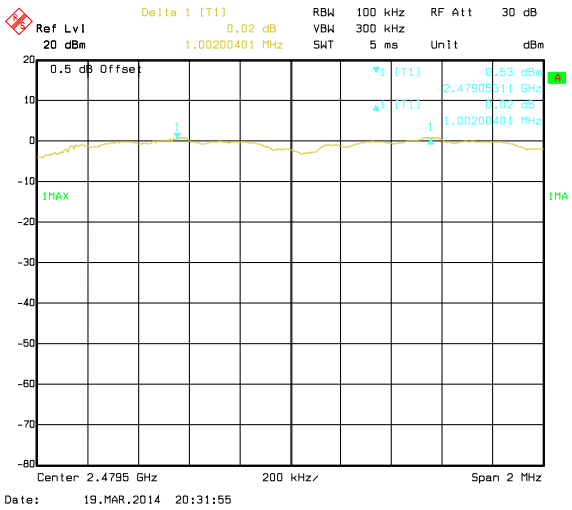
Modulation mode:	π/4-DQPSK



Lowest channel

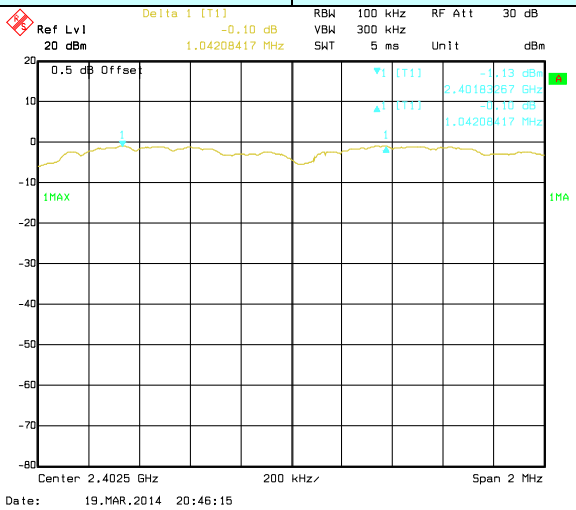


Middle channel

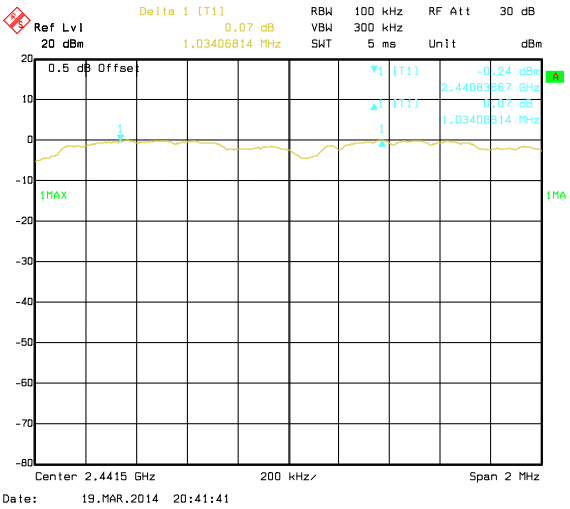


Highest channel

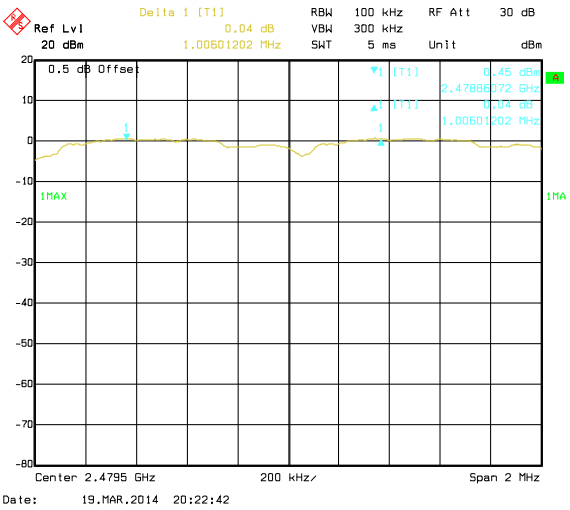
Modulation mode:	8DPSK



Lowest channel

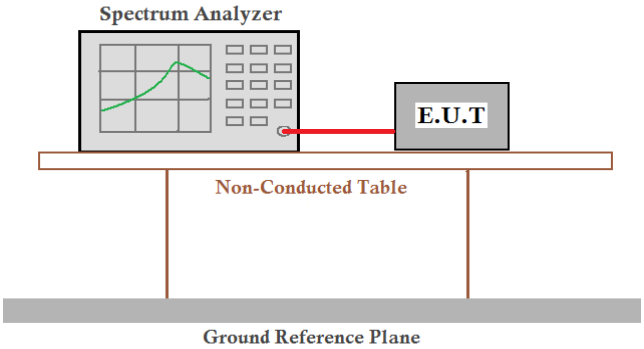


Middle channel



Highest channel

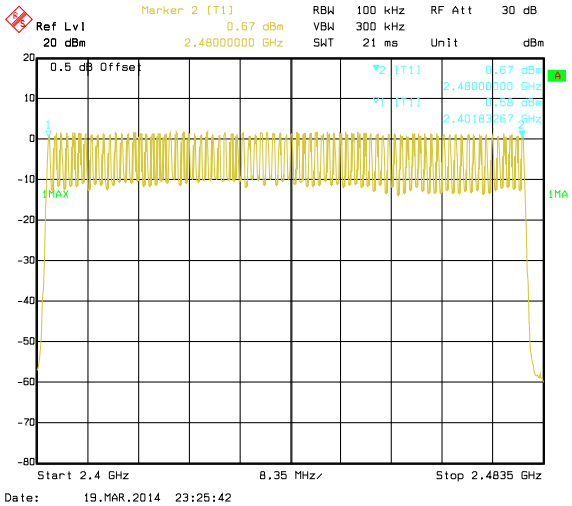
6.6 Hopping Channel Number

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.4:2003 and DA00-705
Receiver setup:	RBW=100 kHz, VBW=300 kHz, Frequency range=2400MHz-2483.5MHz, Detector=Peak
Limit:	15 channels
Test setup:	
Test Instruments:	Refer to section 5.7 for details
Test mode:	Hopping mode
Test results:	Pass

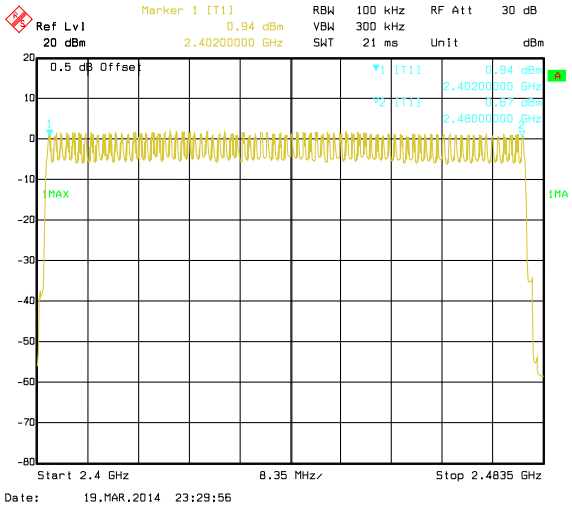
Measurement Data:

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

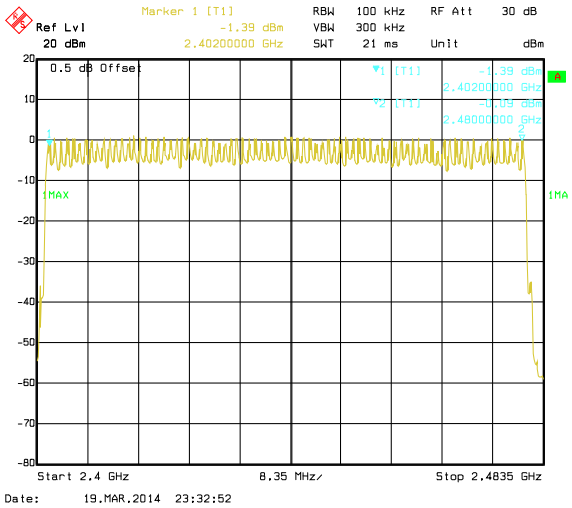
GFSK



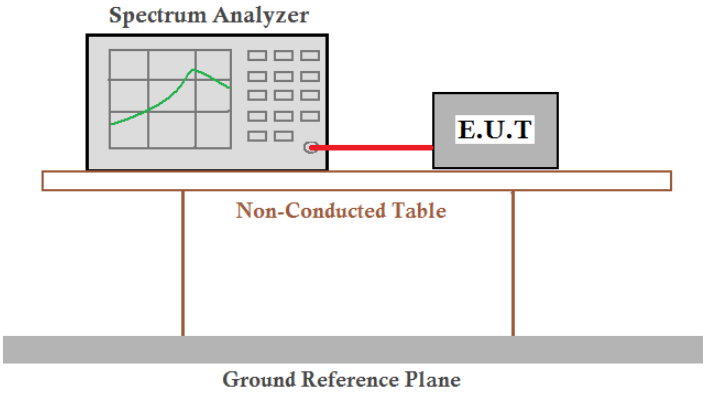
π/4-DQPSK



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
Receiver setup:	RBW=1 MHz, VBW=1 MHz, Span=0 Hz, Detector=Peak
Limit:	0.4 Second
Test setup:	
Test Instruments:	Refer to section 5.7 for details
Test mode:	Hopping mode
Test results:	Pass

Measurement Data (Worse case)

Mode	Packet	Dwell time (second)	Limit (second)	Result
GFSK	DH1	0.1315	0.4	Pass
	DH3	0.2712		
	DH5	0.3228		
π /4-DQPSK	2-DH1	0.1296	0.4	Pass
	2-DH3	0. 2712		
	2-DH5	0.3113		
8DPSK	3-DH1	0.1309	0.4	Pass
	3-DH3	0. 2683		
	3-DH5	0. 3162		

For GFSK, π/4-DQPSK and 8DPSK:

The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s

DH1 time slot=0.411*(1600/ (2*79))*31.6=131.52ms

DH3 time slot=1.695*(1600/ (4*79))*31.6=271.2ms

DH5 time slot=3.026(1600/ (6*79))*31.6=322.77ms

2-DH1 time slot=0.405*(1600/ (2*79))*31.6=129.6ms

2-DH3 time slot=1.659*(1600/ (4*79))*31.6=271.2ms

2-DH5 time slot=2.918(1600/ (6*79))*31.6=311.25ms

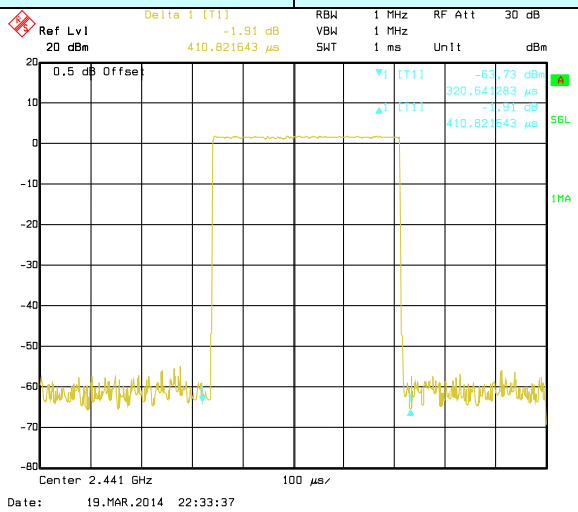
3-DH1 time slot=0.409*(1600/ (2*79))*31.6=130.88ms

3-DH3 time slot=1.677*(1600/ (4*79))*31.6=268.32ms

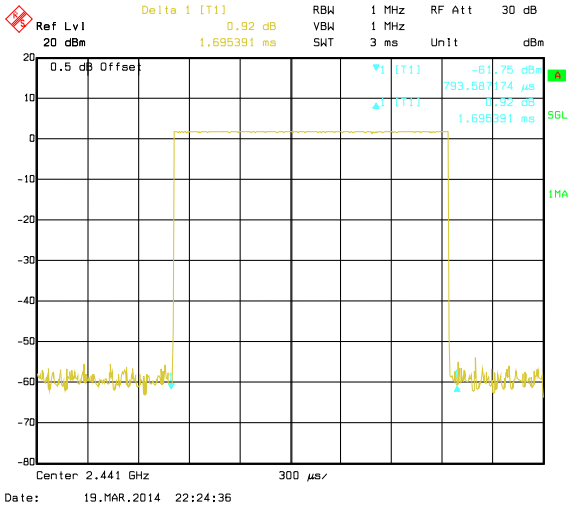
3-DH5 time slot=2.964(1600/ (6*79))*31.6=316.16ms

Test plot as follows:

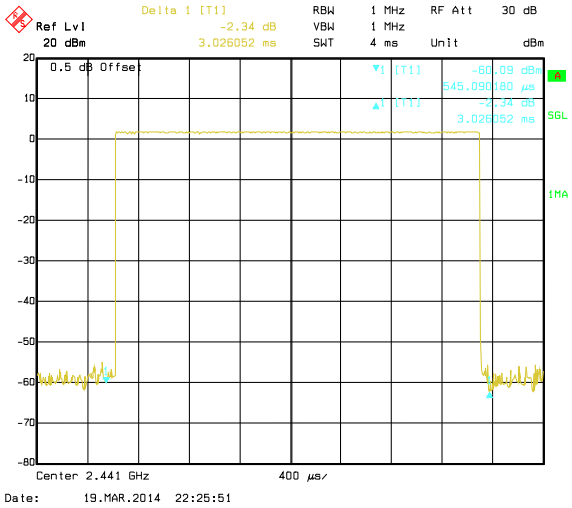
Modulation mode:	GFSK



DH1

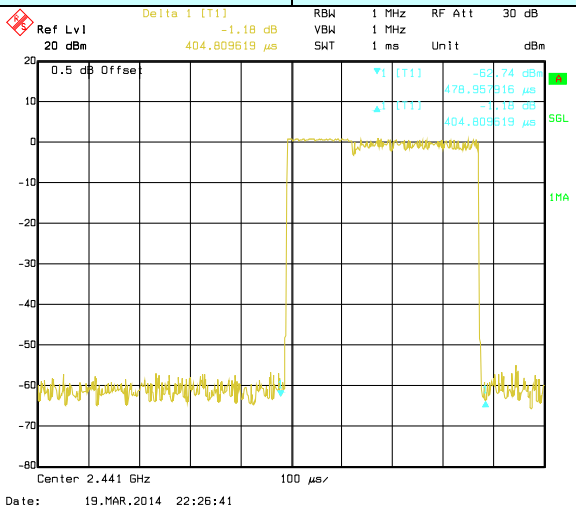


DH3

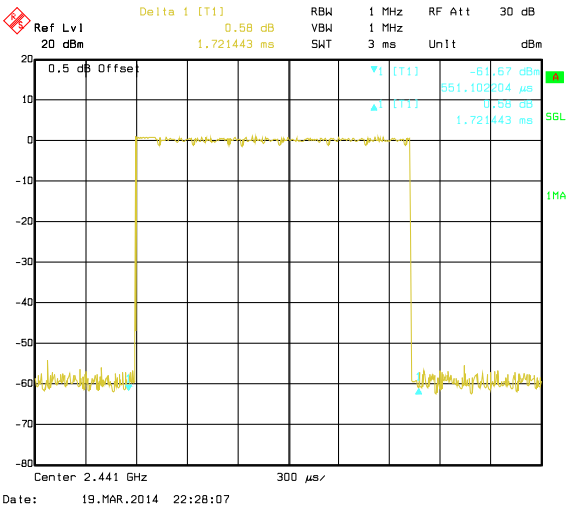


DH5

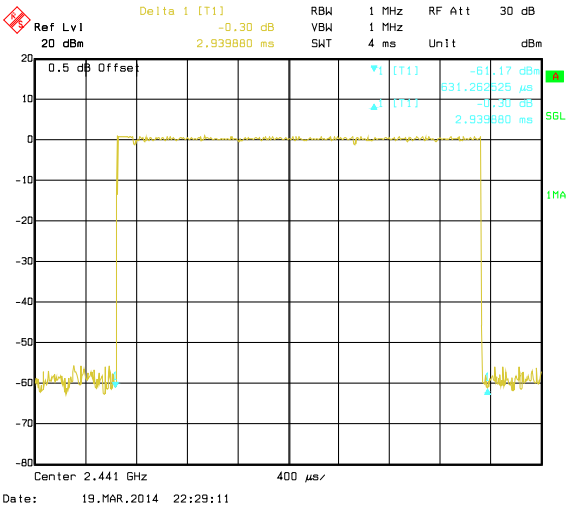
Modulation mode:	π/4-DQPSK



2-DH1

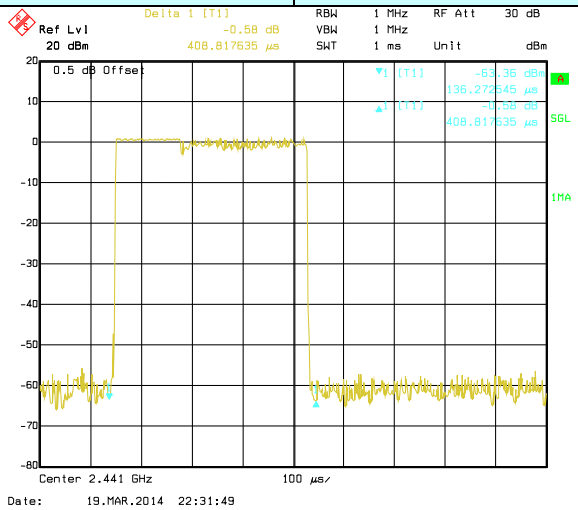


2-DH3

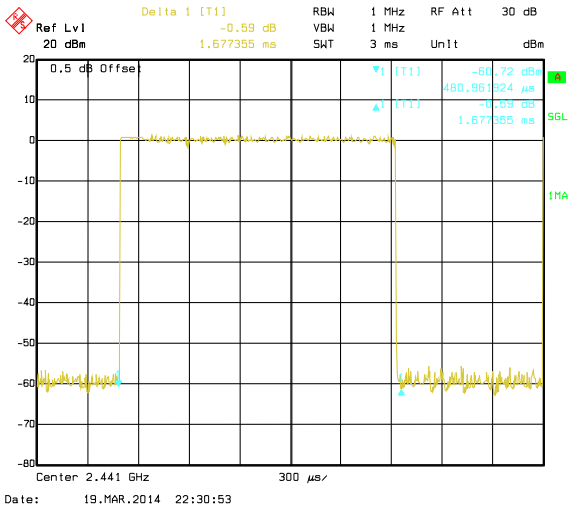


2-DH5

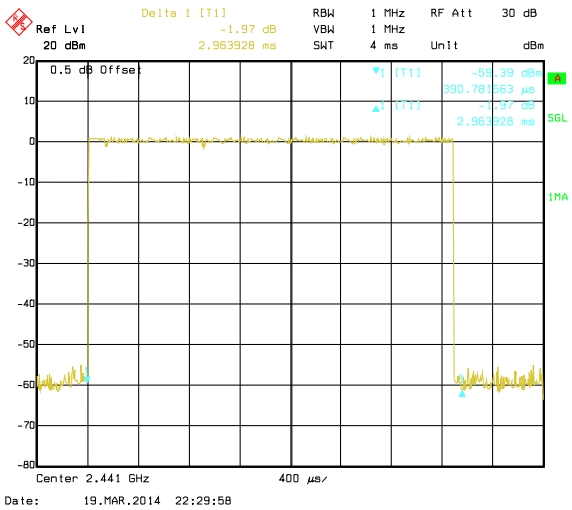
Modulation mode:	8DPSK



3-DH1



3-DH3



3-DH5

6.8 Pseudorandom Frequency Hopping Sequence

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

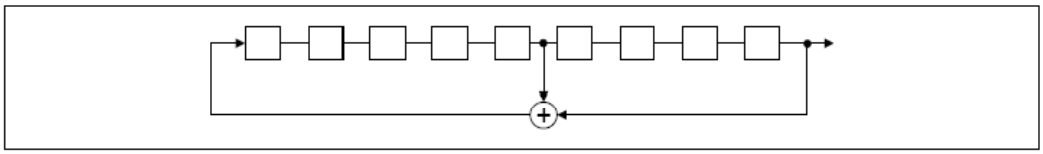
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

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

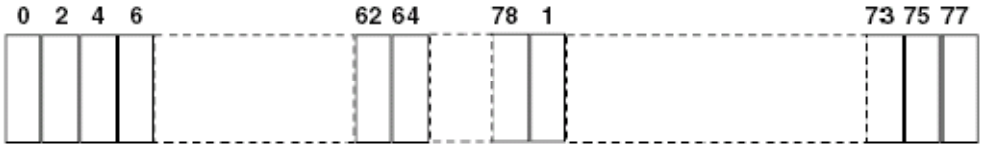
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized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

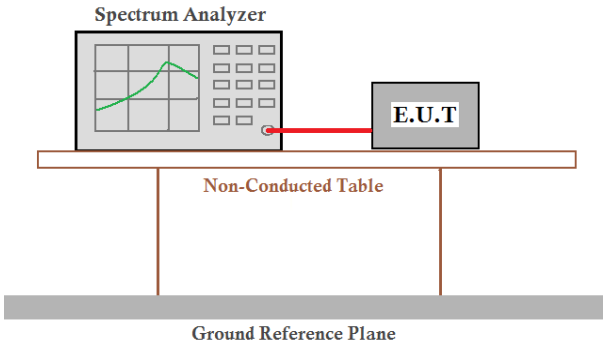


Each frequency used equally on the average by each transmitter.

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 Band Edge

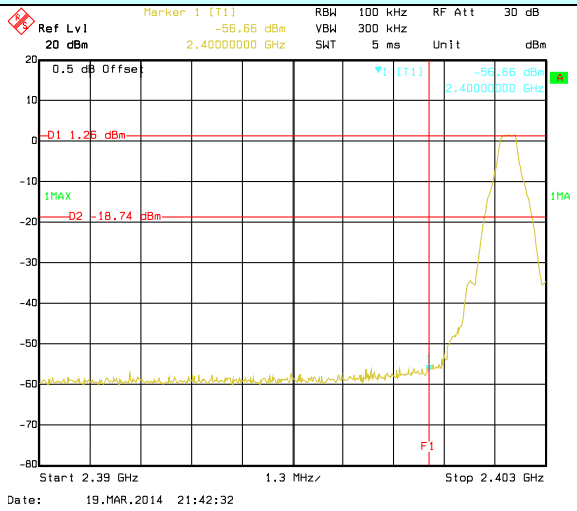
6.9.1 Conducted Emission Method

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.4:2003 and DA00-705
Receiver setup:	RBW=100 kHz, VBW=300 kHz, Detector=Peak
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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.
Test setup:	
Test Instruments:	Refer to section 5.7 for details
Test mode:	Non-hopping mode and hopping mode
Test results:	Pass

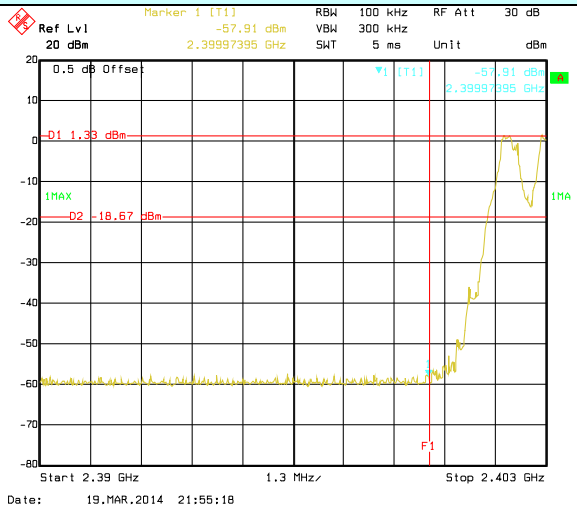
Test plot as follows:

GFSK

Test channel:	Lowest channel

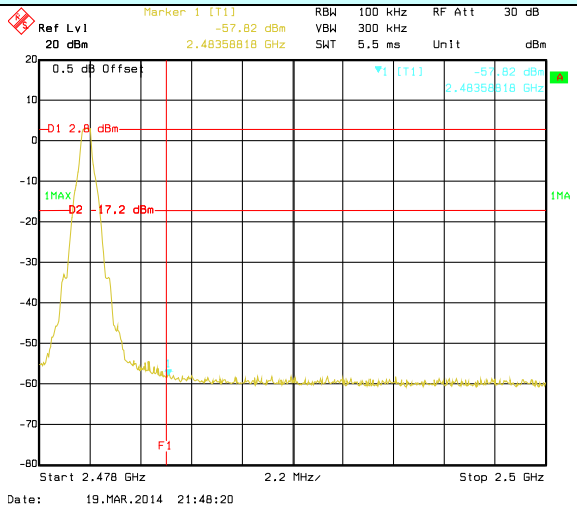


No-hopping mode

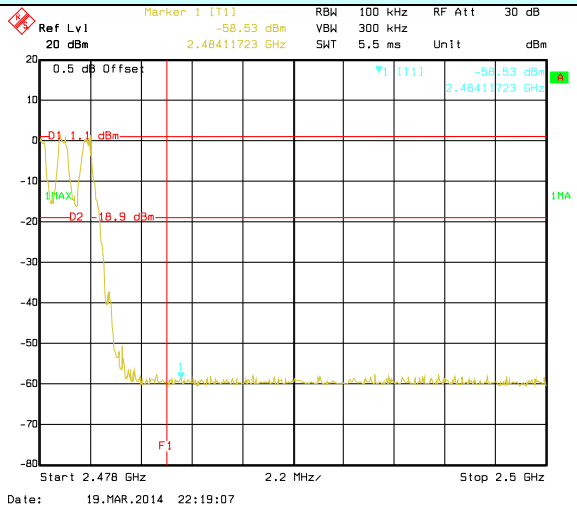


Hopping mode

Test channel:	Highest channel

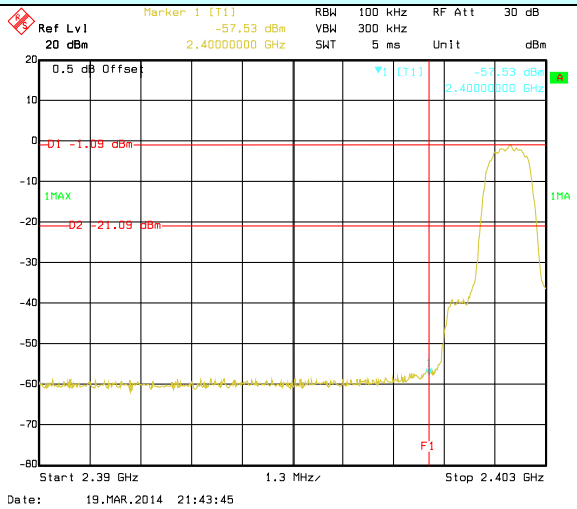
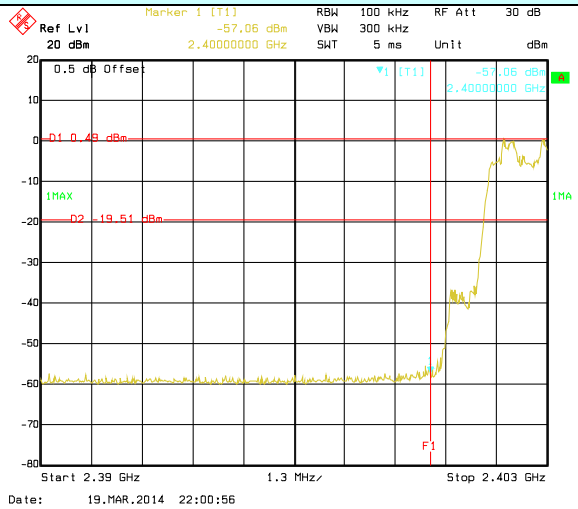


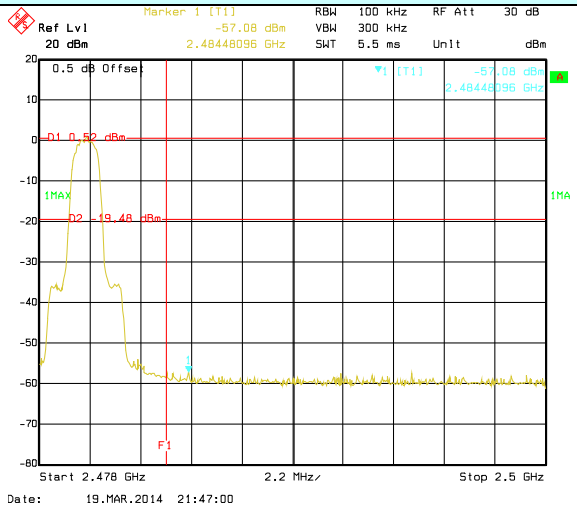
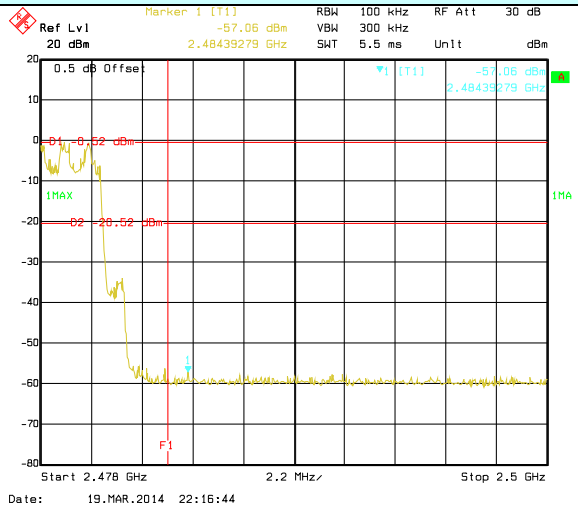
No-hopping mode



Hopping mode

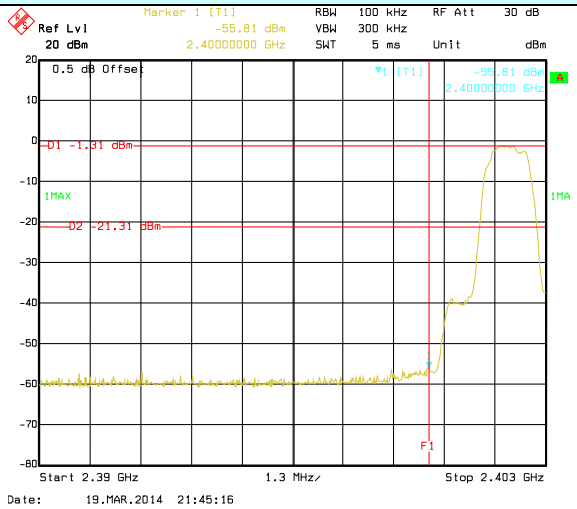
π/4-DQPSK

Test channel:	Lowest channel
	
No-hopping mode	Hopping mode

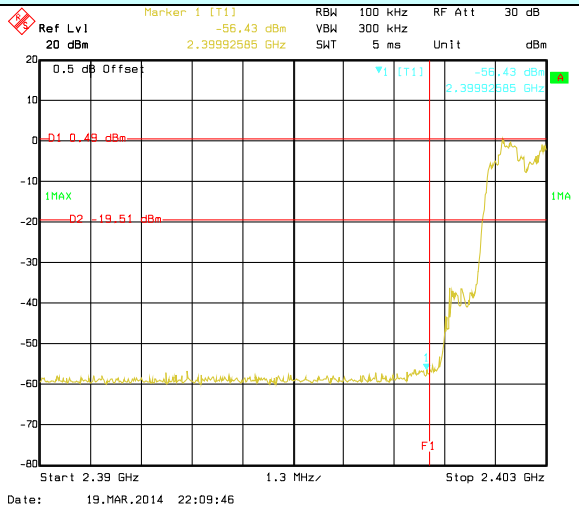
Test channel:	Highest channel
	
No-hopping mode	Hopping mode

8DPSK

Test channel:	Lowest channel

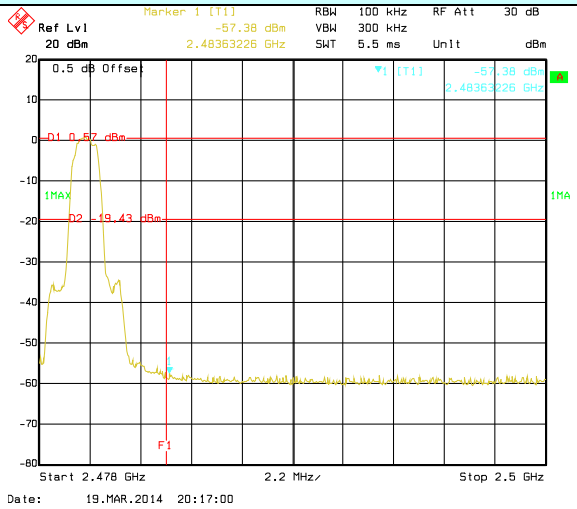


No-hopping mode

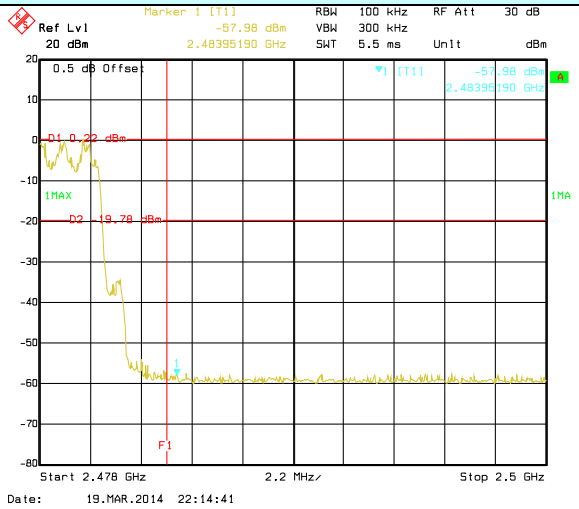


Hopping mode

Test channel:	Highest channel



No-hopping mode



Hopping mode

6.9.2 Radiated Emission Method

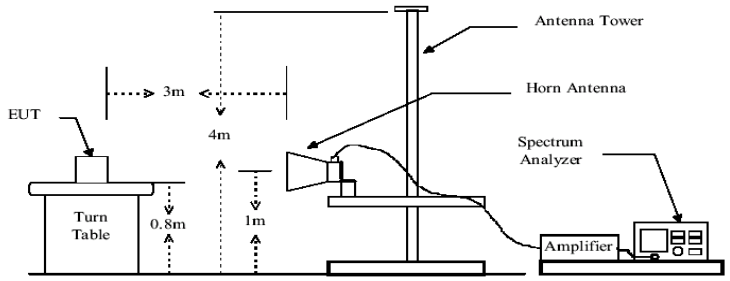
Test Requirement:	FCC Part15 C Section 15.209 and 15.205
Test Method:	ANSI C63.4: 2003
Test Frequency Range:	2.3GHz to 2.5GHz
Test site:	Measurement Distance: 3m
Receiver setup:	

Frequency	Detector	RBW	VBW	Remark
Above 1GHz	Peak	1MHz	3MHz	Peak Value
	Peak	1MHz	10Hz	Average Value

Limit:

Frequency	Limit (dBuV/m @3m)	Remark
Above 1GHz	54.00	Average Value
	74.00	Peak Value

Test setup:



Test Procedure:

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

Test Instruments:	Refer to section 5.7 for details
Test mode:	Non-hopping mode
Test results:	Passed

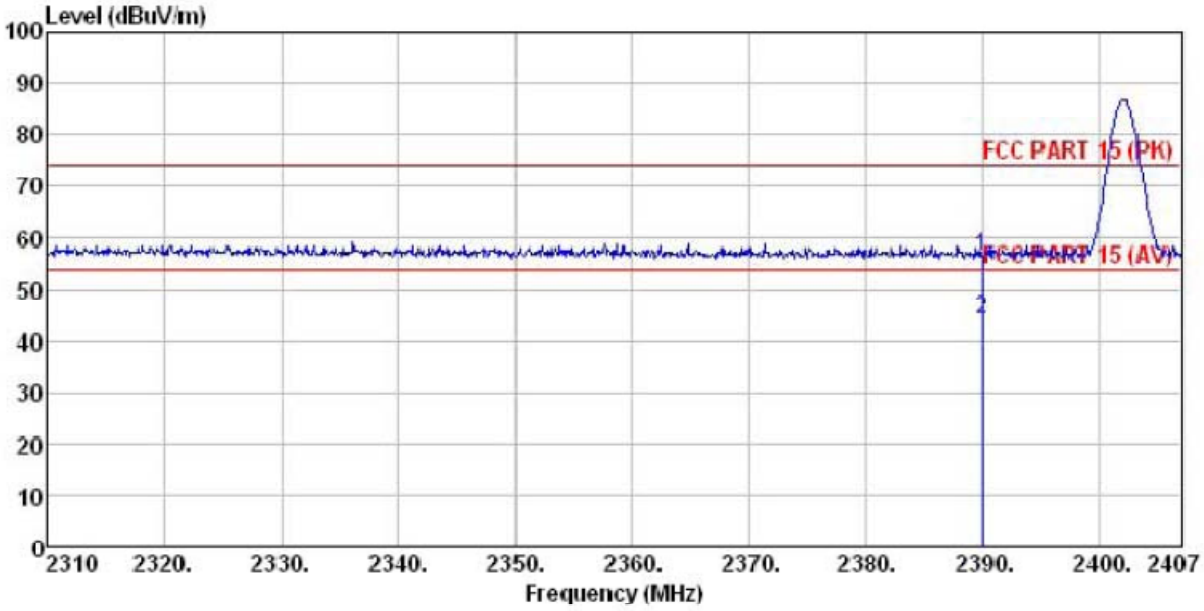
Remark:

1. *During the test, pre-scan the GFSK, π/4-DQPSK, 8DPSK, and all data were shown in report.*
2. *Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis is the worst case.*

GFSK mode

Test channel: Lowest

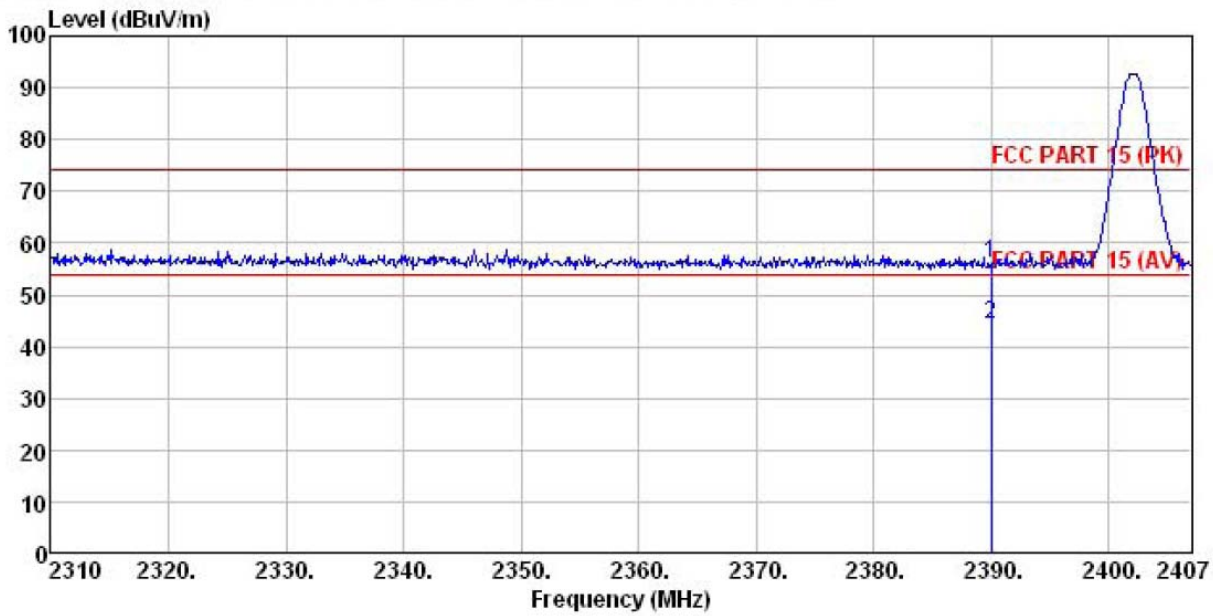
Horizontal:



Site : 3m chamber
Condition : FCC PART 15 (PK) 3m BBHA9120(1G18) HORIZONTAL
EUT : MID
Model : EQ823R
Test mode : BT DH1-L MODE
Power Rating : AC120V/60Hz
Environment : Temp:25.5℃ Huni:55%
Test Engineer: Vincent
REMARK :

	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	23.37	27.58	5.67	0.00	56.62	74.00	-17.38	Peak
2	2390.000	11.06	27.58	5.67	0.00	44.31	54.00	-9.69	Average

Vertical:

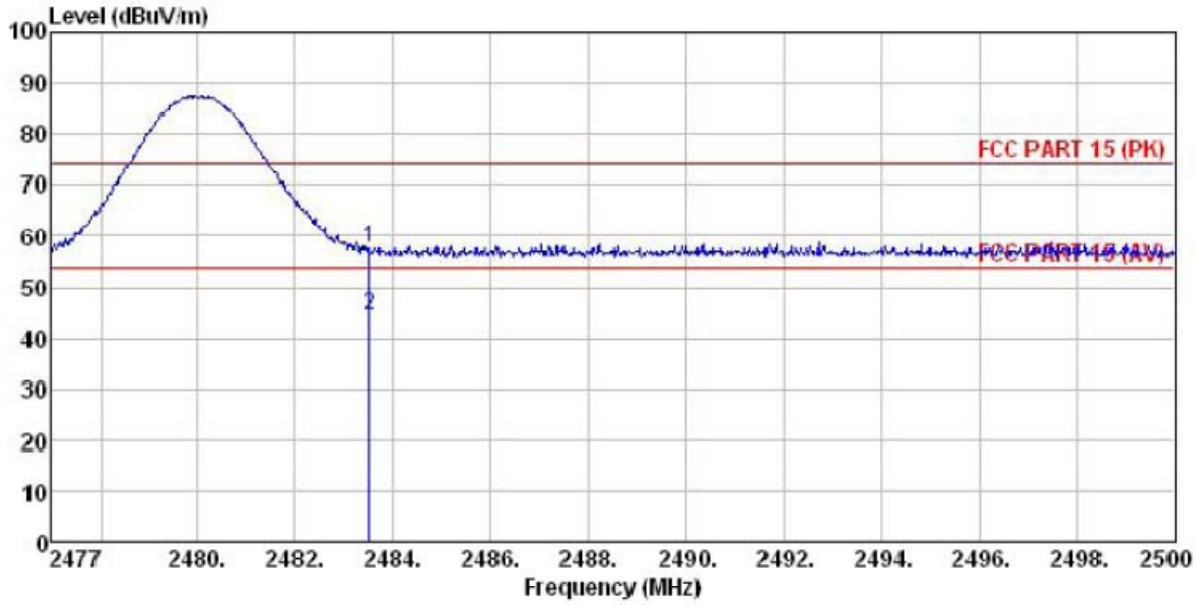


Site : 3m chamber
Condition : FCC PART 15 (PK) 3m BBHA9120(1G18) VERTICAL
EUT : MID
Model : EQ823R
Test mode : BT DH1-L MODE
Power Rating : AC120V/60Hz
Environment : Temp:25.5℃ Huni:55%
Test Engineer: Vincent
REMARK :

	Freq	ReadAntenna Level	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	22.91	27.58	5.67	0.00	56.16	74.00	-17.84	Peak
2	2390.000	11.14	27.58	5.67	0.00	44.39	54.00	-9.61	Average

Test channel: Highest

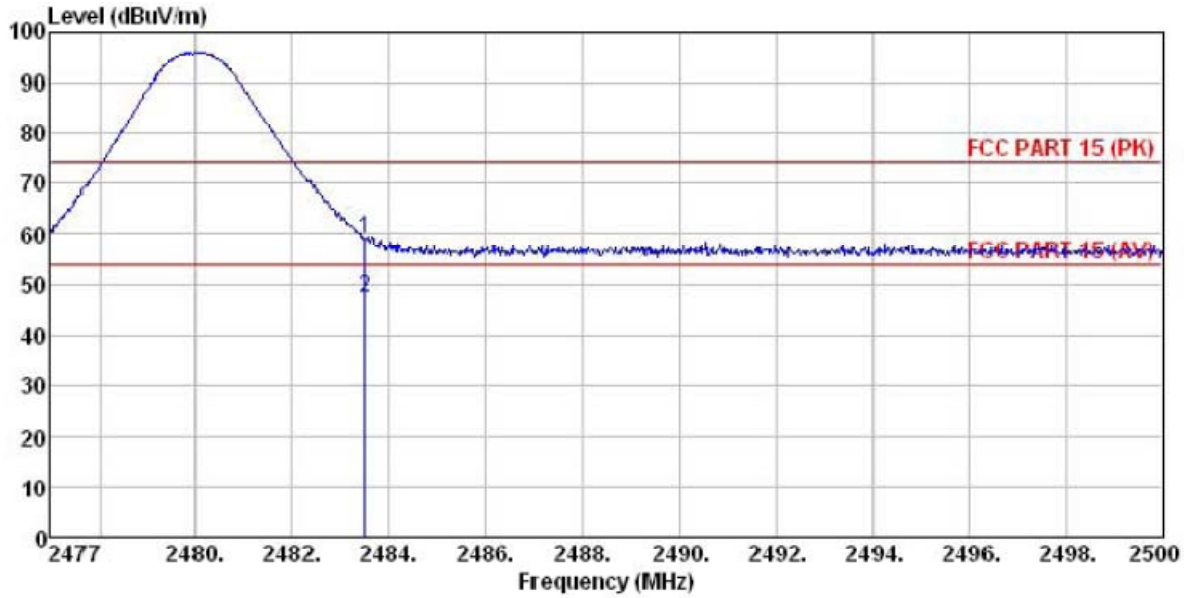
Horizontal:



Site : 3m chamber
Condition : FCC PART 15 (PK) 3m BBHA9120(1G18) HORIZONTAL
EUT : MID
Model : EQ823R
Test mode : BT DH1-H MODE
Power Rating : AC120V/60Hz
Environment : Temp:25.5℃ Huni:55%
Test Engineer: Vincent
REMARK :

	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	24.33	27.52	5.70	0.00	57.55	74.00	-16.45	Peak
2	2483.500	10.94	27.52	5.70	0.00	44.16	54.00	-9.84	Average

Vertical:



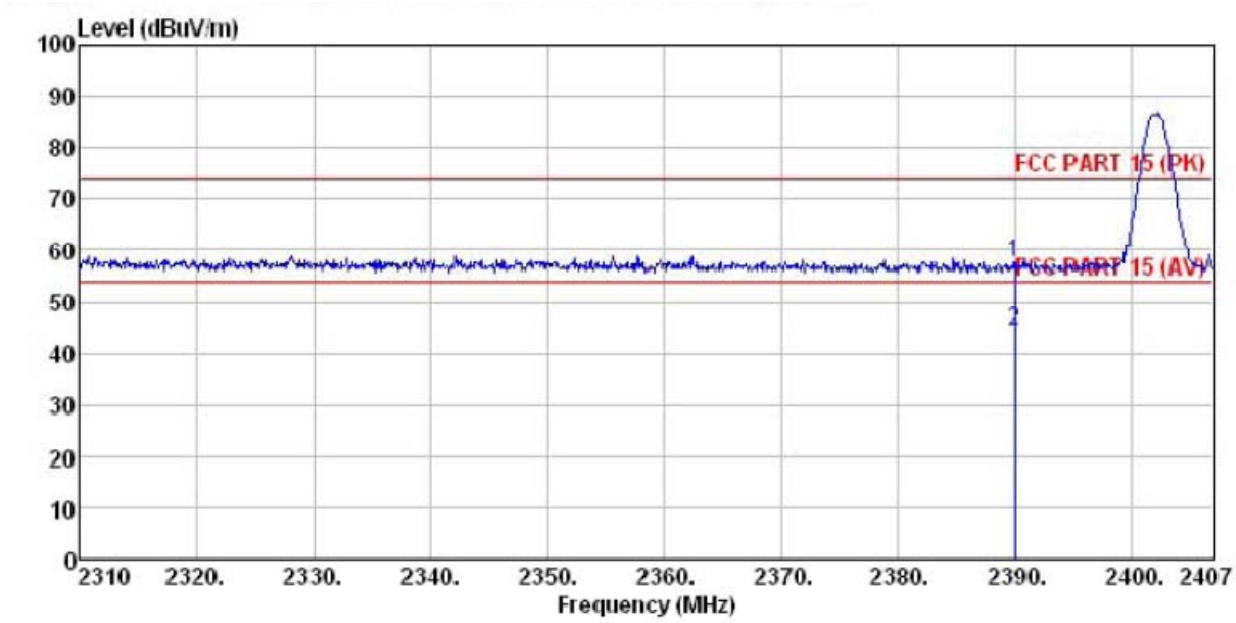
Site : 3m chamber
Condition : FCC PART 15 (PK) 3m BBHA9120(1G18) VERTICAL
EUT : MID
Model : EQ823R
Test mode : BT DH1-H MODE
Power Rating : AC120V/60Hz
Environment : Temp:25.5℃ Huni:55%
Test Engineer: Vincent
REMARK :

	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	25.90	27.52	5.70	0.00	59.12	74.00	-14.88	Peak
2	2483.500	14.10	27.52	5.70	0.00	47.32	54.00	-6.68	Average

π/4-DQPSK mode

Test channel: Lowest

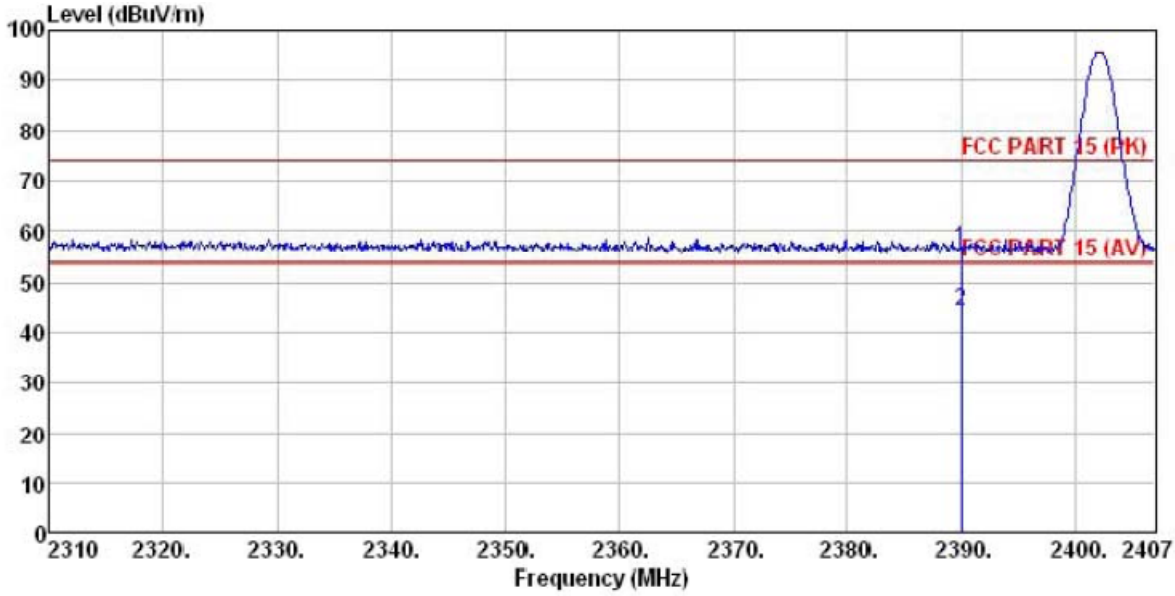
Horizontal:



Site : 3m chamber
Condition : FCC PART 15 (PK) 3m BBHA9120(1G18) HORIZONTAL
EUT : MID
Model : EQ823R
Test mode : BT 2DH1-L MODE
Power Rating : AC120V/60Hz
Environment : Temp:25.5'C Huni:55%
Test Engineer: Vincent
REMARK :

	Freq	ReadLevel	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	24.42	27.58	5.67	0.00	57.67	74.00	-16.33	Peak
2	2390.000	11.11	27.58	5.67	0.00	44.36	54.00	-9.64	Average

Vertical:

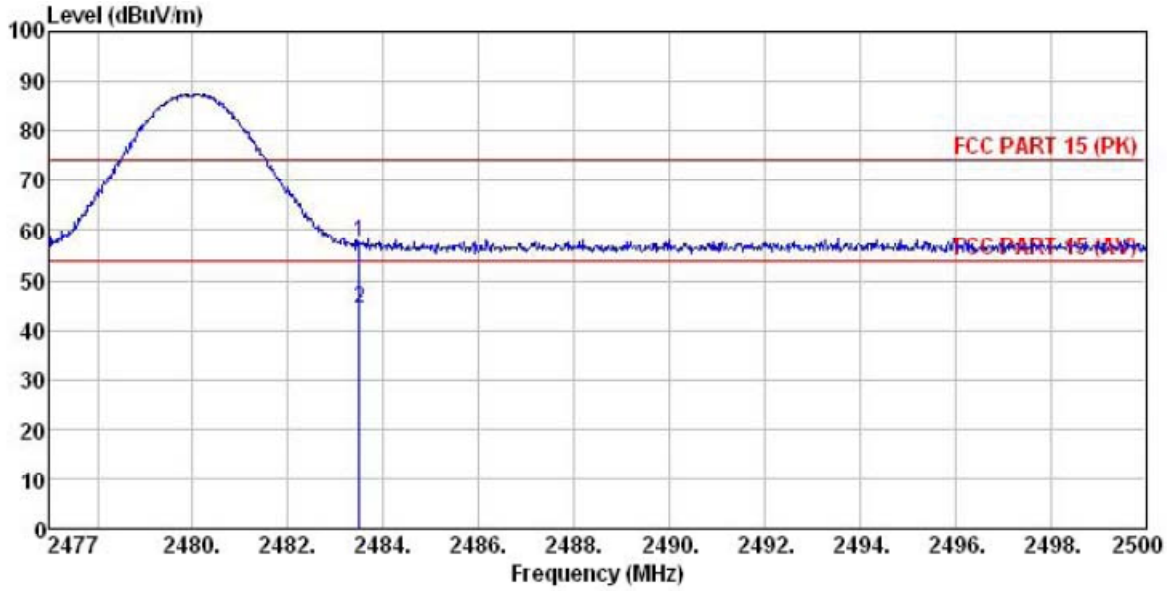


Site : 3m chamber
Condition : FCC PART 15 (PK) 3m BBHA9120(1G18) VERTICAL
EUT : MID
Model : EQ823R
Test mode : BT 2DH1-L MODE
Power Rating : AC120V/60Hz
Environment : Temp:25.5℃ Huni:55%
Test Engineer: Vincent
REMARK :

	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	23.31	27.58	5.67	0.00	56.56	74.00	-17.44	Peak
2	2390.000	11.15	27.58	5.67	0.00	44.40	54.00	-9.60	Average

Test channel: Highest

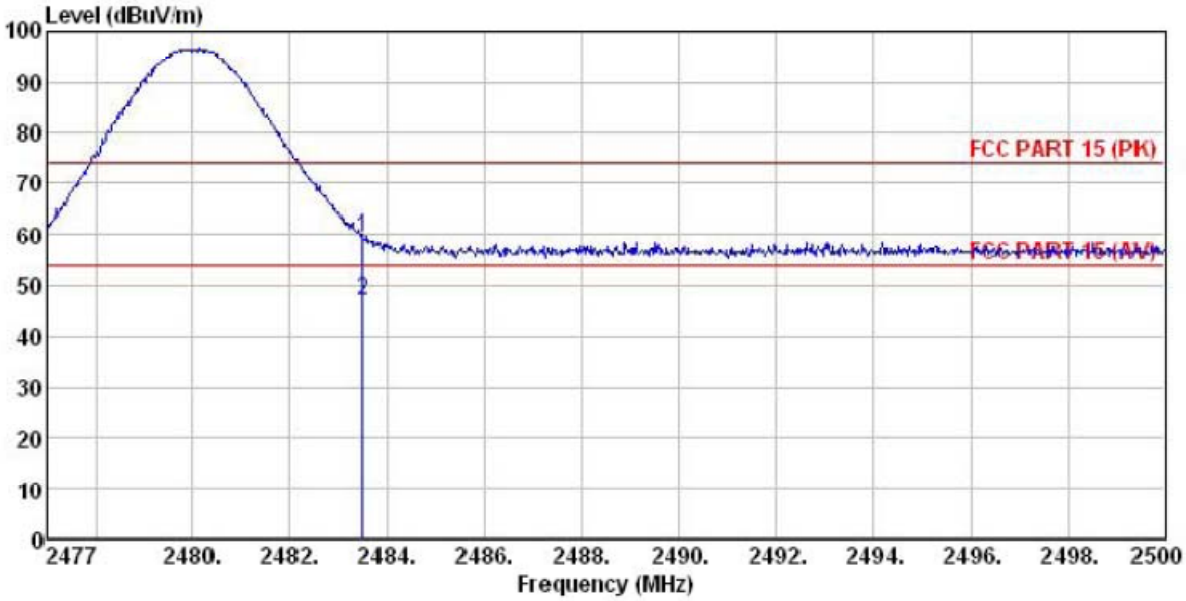
Horizontal:



Site : 3m chamber
Condition : FCC PART 15 (PK) 3m BBHA9120(1G18) HORIZONTAL
EUT : MID
Model : EQ823R
Test mode : BT 2DH1-H MODE
Power Rating : AC120V/60Hz
Environment : Temp:25.5℃ Huni:55%
Test Engineer: Vincent
REMARK :

	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	24.41	27.52	5.70	0.00	57.63	74.00	-16.37	Peak
2	2483.500	11.11	27.52	5.70	0.00	44.33	54.00	-9.67	Average

Vertical:



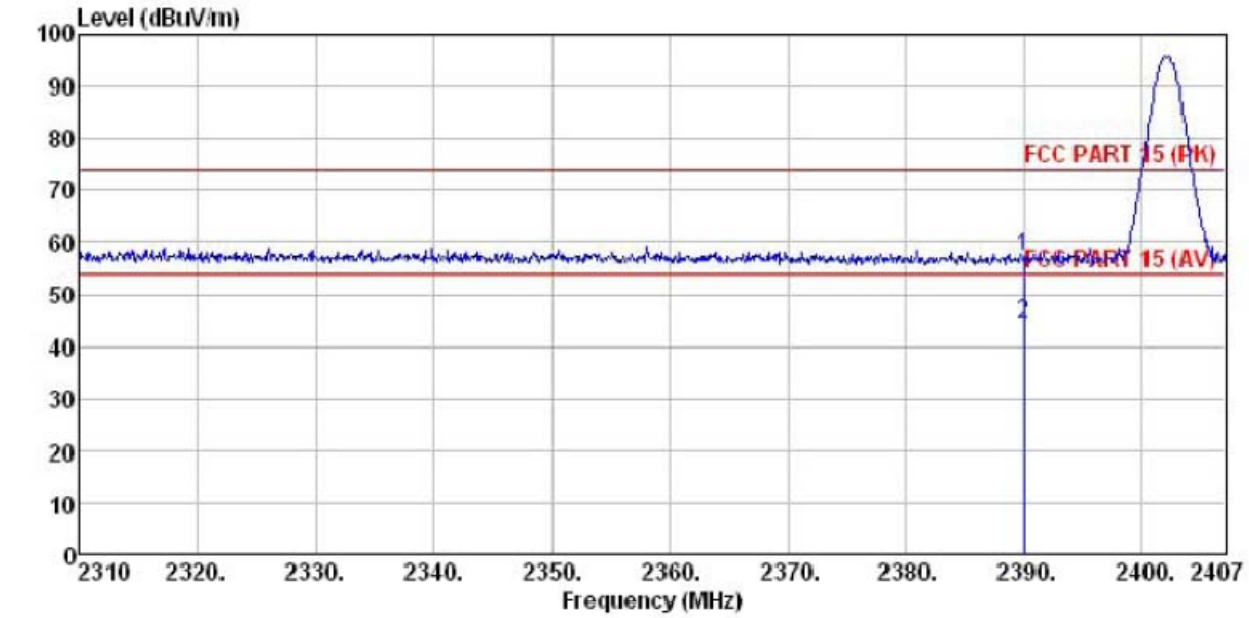
Site : 3m chamber
Condition : FCC PART 15 (PK) 3m BBHA9120(1G18) VERTICAL
EUT : MID
Model : EQ823R
Test mode : BT 2DH1-H MODE
Power Rating : AC120V/60Hz
Environment : Temp:25.5℃ Huni:55%
Test Engineer: Vincent
REMARK :

	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	26.24	27.52	5.70	0.00	59.46	74.00	-14.54	Peak
2	2483.500	13.62	27.52	5.70	0.00	46.84	54.00	-7.16	Average

8DPSK mode

Test channel: Lowest

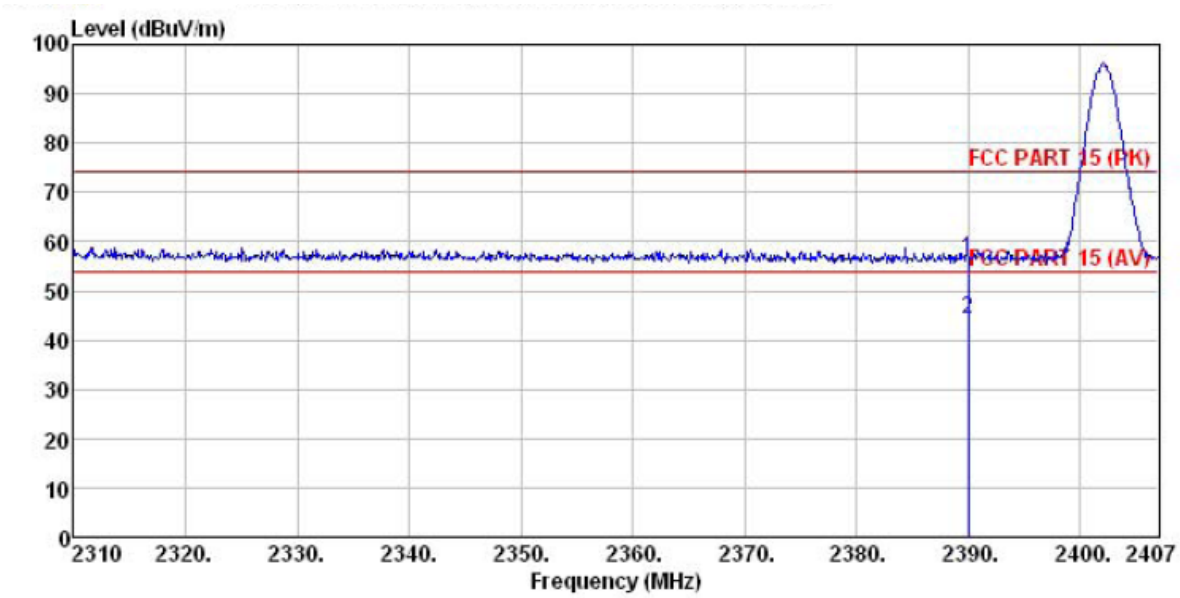
Horizontal:



Site : 3m chamber
Condition : FCC PART 15 (PK) 3m BBHA9120(1G18) HORIZONTAL
EUT : MID
Model : EQ823R
Test mode : BT 3DH1-L MODE
Power Rating : AC120V/60Hz
Environment : Temp:25.5℃ Huni:55%
Test Engineer: Vincent
REMARK :

	Freq	ReadAntenna 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	23.78	27.58	5.67	0.00	57.03	74.00	-16.97	Peak
2	2390.000	11.12	27.58	5.67	0.00	44.37	54.00	-9.63	Average

Vertical:

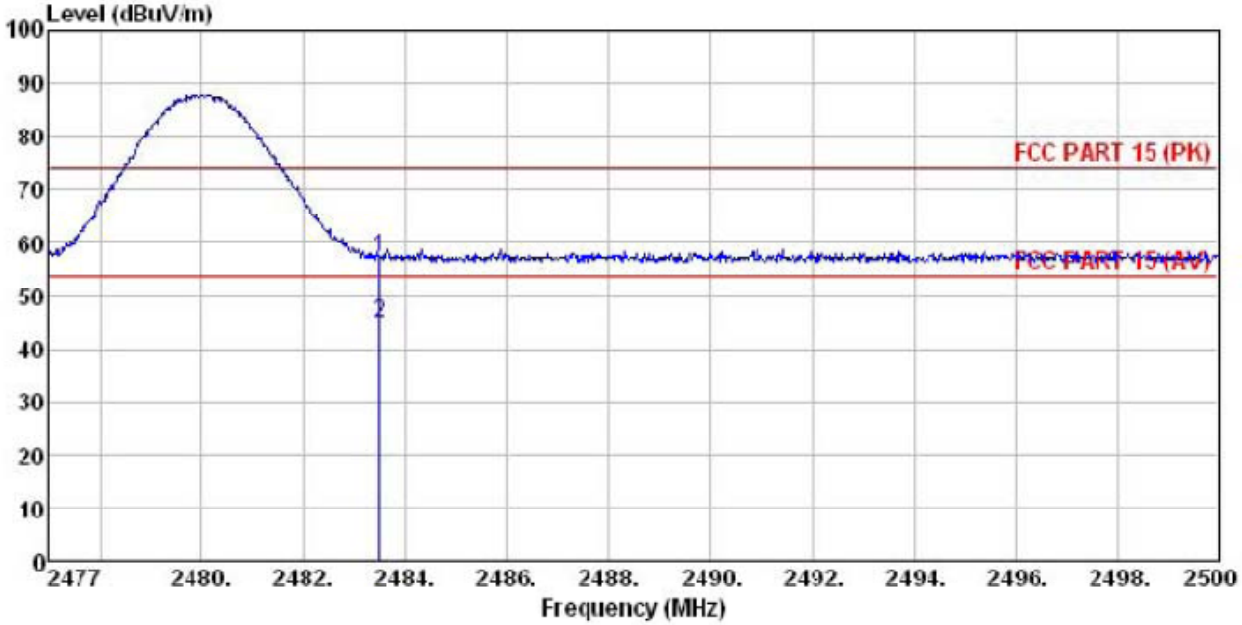


Site : 3m chamber
Condition : FCC PART 15 (PK) 3m BBHA9120(1G18) VERTICAL
EUT : MID
Model : EQ823R
Test mode : BT 3DH1-L MODE
Power Rating : AC120V/60Hz
Environment : Temp:25.5℃ Huni:55%
Test Engineer: Vincent
REMARK :

	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	23.13	27.58	5.67	0.00	56.38	74.00	-17.62	Peak
2	2390.000	11.16	27.58	5.67	0.00	44.41	54.00	-9.59	Average

Test channel: Highest

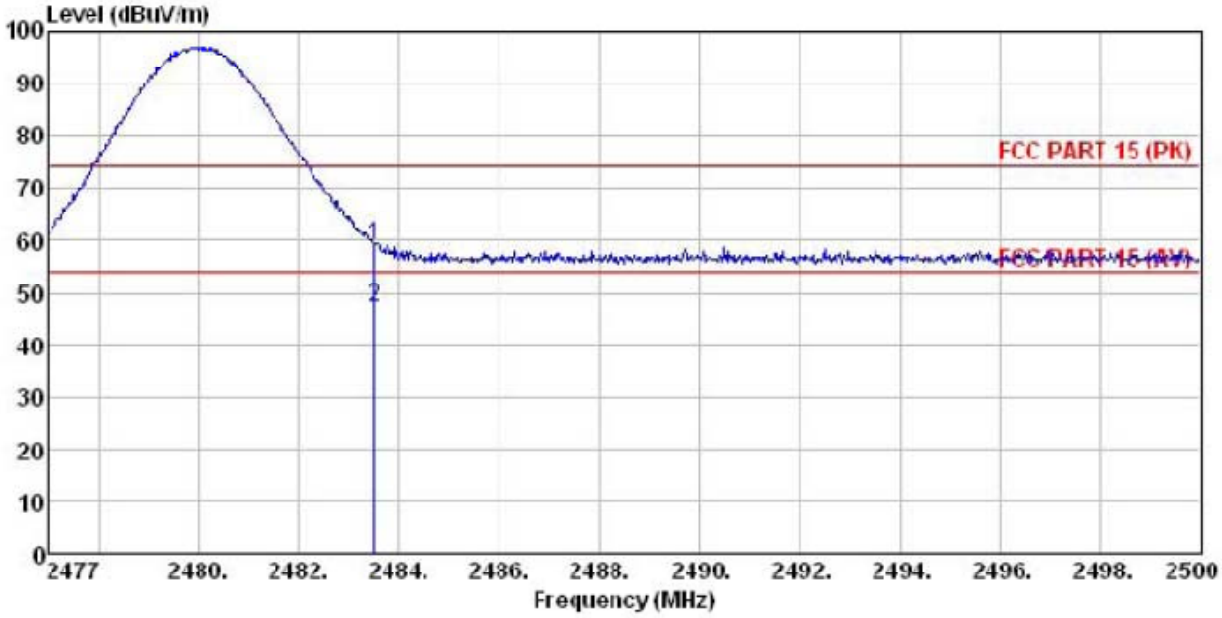
Horizontal:



Site : 3m chamber
Condition : FCC PART 15 (PK) 3m BBHA9120(1G18) HORIZONTAL
EUT : MID
Model : EQ823R
Test mode : BT 3DH1-H MODE
Power Rating : AC120V/60Hz
Environment : Temp:25.5℃ Huni:55%
Test Engineer: Vincent
REMARK :

	Freq	ReadLevel	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	24.14	27.52	5.70	0.00	57.36	74.00	-16.64	Peak
2	2483.500	11.29	27.52	5.70	0.00	44.51	54.00	-9.49	Average

Vertical:

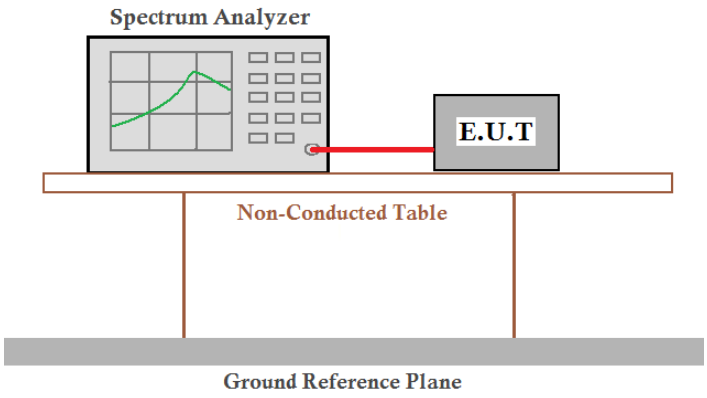


Site : 3m chamber
Condition : FCC PART 15 (PK) 3m BBHA9120(1G18) VERTICAL
EUT : MID
Model : EQ823R
Test mode : BT 3DH1-H MODE
Power Rating : AC120V/60Hz
Environment : Temp:25.5℃ Huni:55%
Test Engineer: Vincent
REMARK :

	Freq	ReadLevel	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	25.91	27.52	5.70	0.00	59.13	74.00	-14.87	Peak
2	2483.500	13.86	27.52	5.70	0.00	47.08	54.00	-6.92	Average

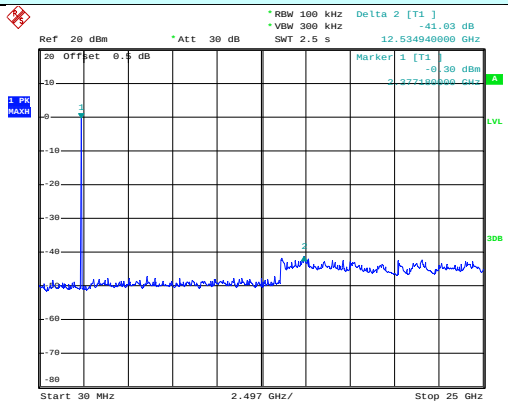
6.10 Spurious Emission

6.10.1 Conducted Emission Method

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 frequency band in which the spread spectrum 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.
Test setup:	
Test Instruments:	Refer to section 5.7 for details
Test mode:	Non-hopping mode
Test results:	Pass

GFSK

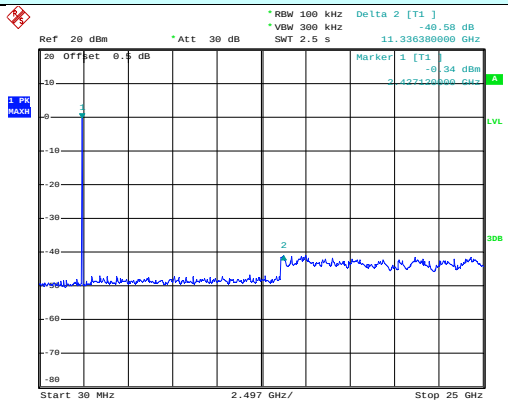
Lowest channel



Date: 19.MAR.2014 23:13:28

30MHz~25GHz

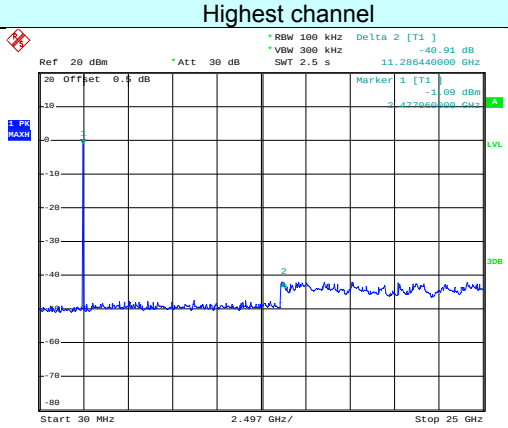
Middle channel



Date: 19.MAR.2014 23:12:31

30MHz~25GHz

Highest channel

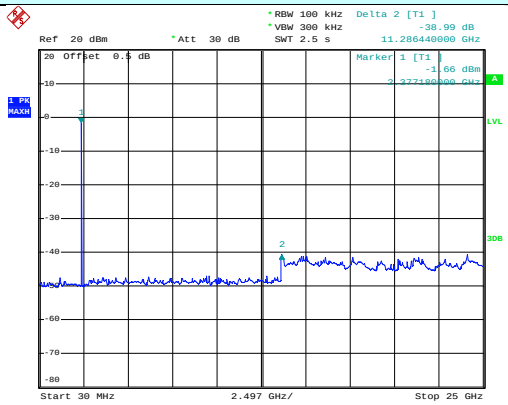


Date: 19.MAR.2014 23:13:07

30MHz~25GHz

π/4-DQPSK

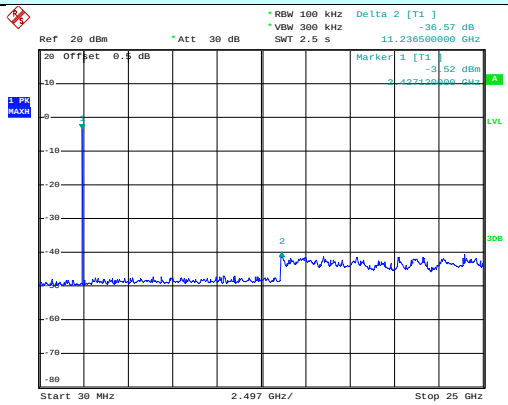
Lowest channel



Date: 19.MAR.2014 23:15:11

30MHz~25GHz

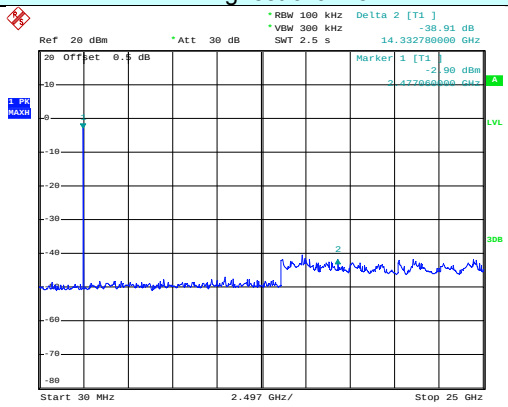
Middle channel



Date: 19.MAR.2014 23:17:55

30MHz~25GHz

Highest channel

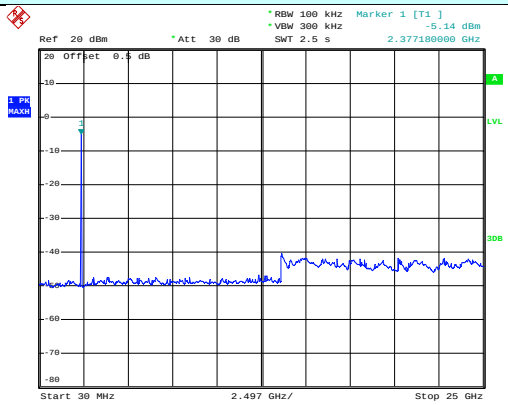


Date: 19.MAR.2014 23:18:28

30MHz~25GHz

8DPSK

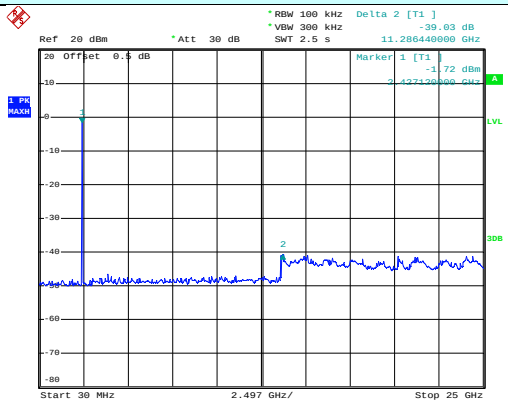
Lowest channel



Date: 19.MAR.2014 23:23:00

30MHz~25GHz

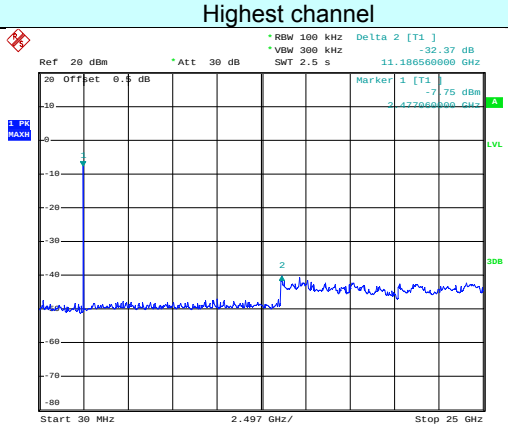
Middle channel



Date: 19.MAR.2014 23:21:31

30MHz~25GHz

Highest channel



Date: 19.MAR.2014 23:19:11

30MHz~25GHz