FCC REPORT

(Bluetooth)

Applicant:	YiHang Technologys Co.,Ltd.
Address of Applicant:	4/F, PuSheng Building, GaoXin 6th Road, Hi-Tech District, Xi'an, Shaanxi, P.R.C

Equipment Under Test (EUT)

Product Name:	GSM/WCDMA Multi-mode On-board equipment
Model No.:	TREQr-5
Trade mark:	OBC
FCC ID:	2AHEC-TREQR-5
Applicable standards:	FCC CFR Title 47 Part 15 Subpart C Section 15.247
Date of sample receipt:	17 Feb., 2016
Date of Test:	17 Feb., to 09 Mar., 2016
Date of report issued:	09 Mar., 2016
Test Result:	PASS *

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

Authorized Signature:

Bruce Zhang
Laboratory Manager

2 Version

Version No.	Date	Description
00	*09 Mar., 2016*	*Original*

Tested by:  ***Date:*** *09 Mar., 2016*

Test Engineer

Reviewed by:  ***Date:*** *09 Mar., 2016*

Project Engineer

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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	N/A
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:	YiHang Technologys Co.,Ltd.
Address of Applicant:	4/F, PuSheng Building, GaoXin 6th Road, Hi-Tech District, Xi'an, Shaanxi, P.R.C
Manufacturer:	YiHang Technologys Co.,Ltd.
Address of Manufacturer:	4/F, PuSheng Building, GaoXin 6th Road, Hi-Tech District, Xi'an, Shaanxi, P.R.C

5.2 General Description of E.U.T.

Product Name:	GSM/WCDMA Multi-mode On-board equipment
Model No.:	TREQr-5
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:	0.71 dBi
Power supply:	DC 12V

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 with worst case data rate.
Remark	GFSK (1 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.

5.4 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 Description of Support Units

Manufacturer	Description	Model	Serial Number	FCC ID/DoC
GS Japan	Lead-acid battery	55D26R-MFZ	8362810610	N/A

5.7 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 SAC	SAEMC	9(L)*6(W)* 6(H)	CCIS0001	08-23-2014	08-22-2017
2	BiConiLog Antenna	SCHWARZBECK	VULB9163	CCIS0005	03-28-2015	03-28-2016
3	Horn Antenna	SCHWARZBECK	BBHA9120D	CCIS0006	03-28-2015	03-28-2016
4	Pre-amplifier (10kHz-1.3GHz)	HP	8447D	CCIS0003	04-01-2015	03-31-2016
5	Pre-amplifier (1GHz-18GHz)	Compliance Direction Systems Inc.	PAP-1G18	CCIS0011	04-01-2015	03-31-2016
6	Pre-amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	04-01-2015	03-31-2016
7	Horn Antenna	ETS-LINDGREN	3160	GTS217	04-01-2015	03-31-2016
8	Spectrum analyzer 9k-30GHz	Rohde & Schwarz	FSP30	CCIS0023	03-28-2015	03-28-2016
9	EMI Test Receiver	Rohde & Schwarz	ESRP7	CCIS0167	03-28-2015	03-28-2016
10	Loop antenna	Laplace instrument	RF300	EMC0701	04-01-2015	03-31-2016

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	08-23-2014	08-22-2017
2	EMI Test Receiver	Rohde & Schwarz	ESCI	CCIS0002	03-28-2015	03-28-2016
3	LISN	CHASE	MN2050D	CCIS0074	03-28-2015	03-28-2016
4	Coaxial Cable	CCIS	N/A	CCIS0086	04-01-2015	03-31-2016
5	EMI Test Software	AUDIX	E3	N/A	N/A	N/A

6 Test results and Measurement Data

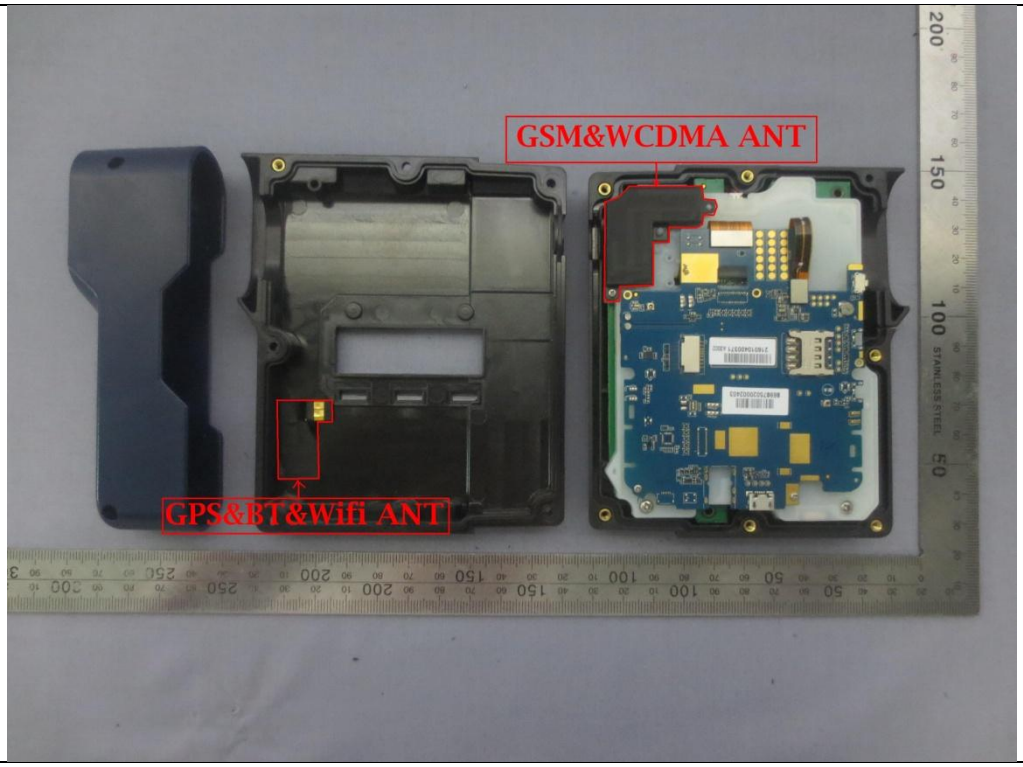
6.1 Antenna requirement

Standard requirement:	FCC Part 15 C Section 15.203 /247(c)

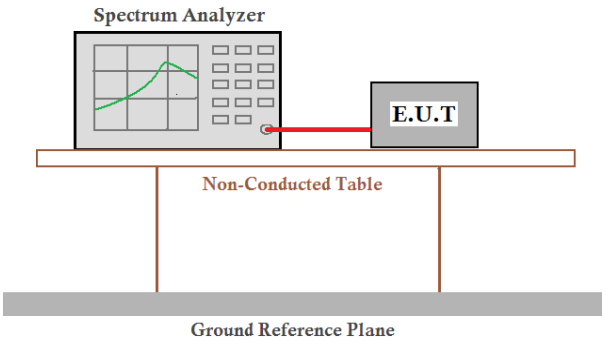
15.203 requirement:
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer 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 0.71 dBi.



6.2 Conducted Output Power

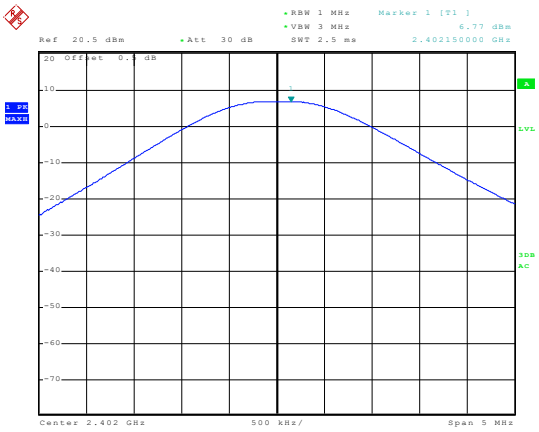
Test Requirement:	FCC Part 15 C Section 15.247 (b)(3)
Test Method:	ANSI C63.10:2009 and DA00-705
Receiver setup:	RBW=1MHz, VBW=3MHz, Detector=Peak (If 20dB BW ≤1 MHz) RBW=3MHz, VBW=10MHz, Detector=Peak (If 20dB BW > 1 MHz and < 3MHz)
Limit:	125 mW(21 dBm)
Test setup:	
Test Instruments:	Refer to section 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	6.77	21.00	Pass
Middle	6.95	21.00	Pass
Highest	6.36	21.00	Pass
π/4-DQPSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	6.74	21.00	Pass
Middle	6.95	21.00	Pass
Highest	6.28	21.00	Pass
8DPSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	7.19	21.00	Pass
Middle	7.38	21.00	Pass
Highest	6.74	21.00	Pass

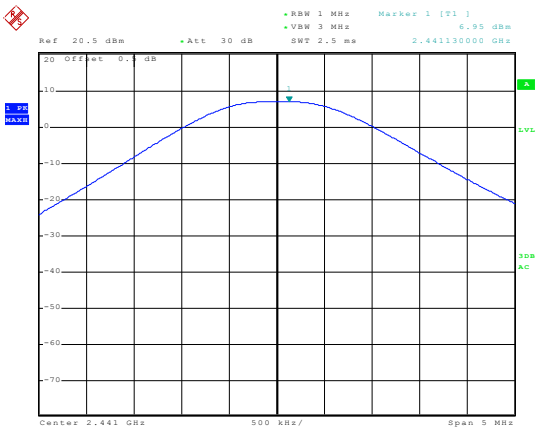
Test plot as follows:

Modulation mode: GFSK



Date: 24.FEB.2016 20:23:07

Lowest channel



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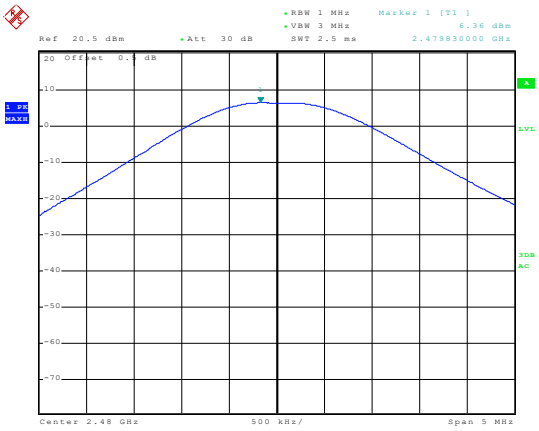
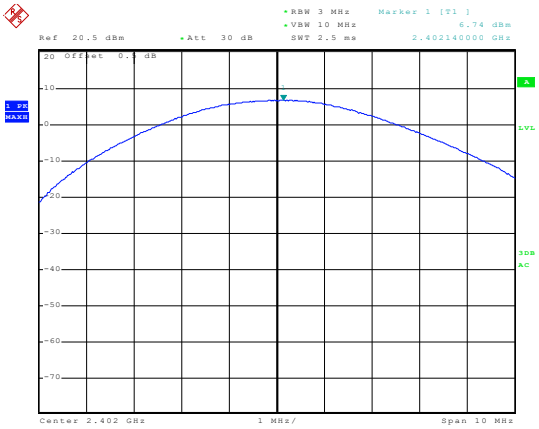
Middle channel



Date: 24.FEB.2016 20:24:17

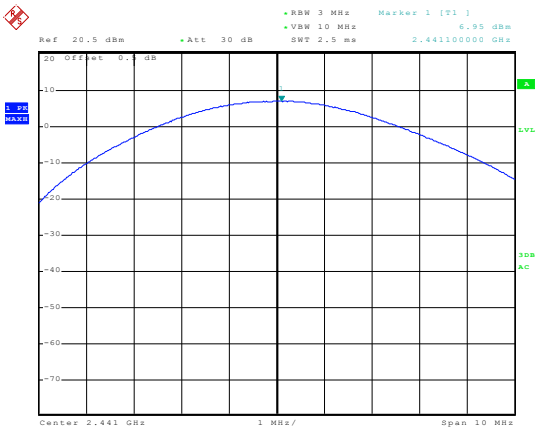
Highest channel

Modulation mode: π/4-DQPSK



Date: 24.FEB.2016 20:25:51

Lowest channel



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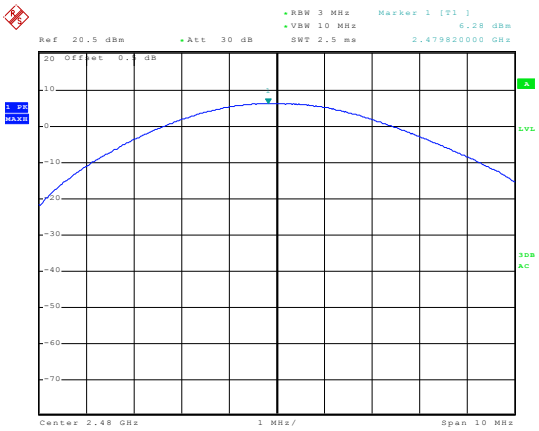
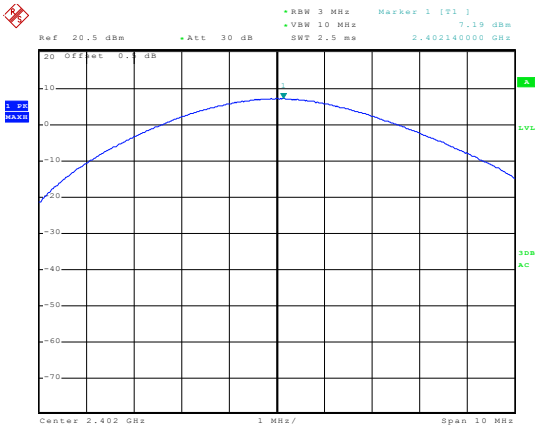
Middle channel



Date: 24.FEB.2016 20:24:53

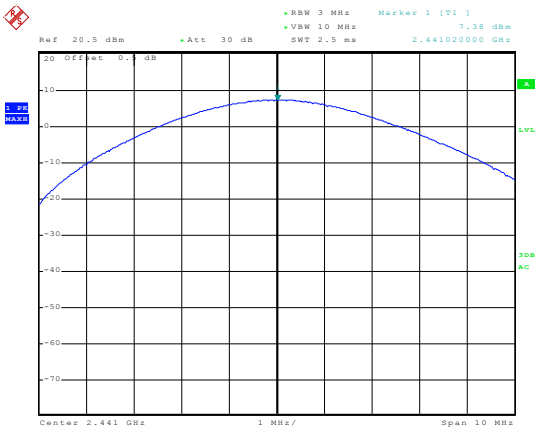
Highest channel

Modulation mode: 8DPSK



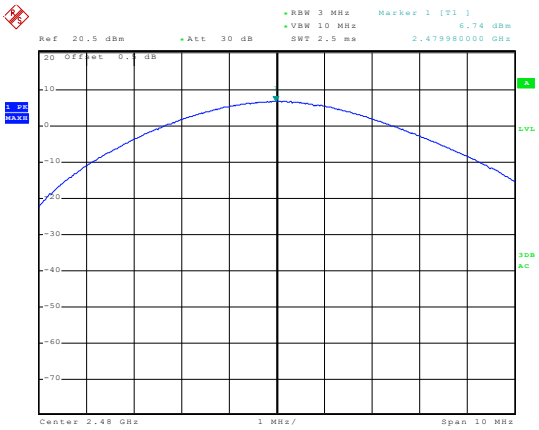
Date: 24.FEB.2016 20:26:14

Lowest channel



Date: 24.FEB.2016 20:26:36

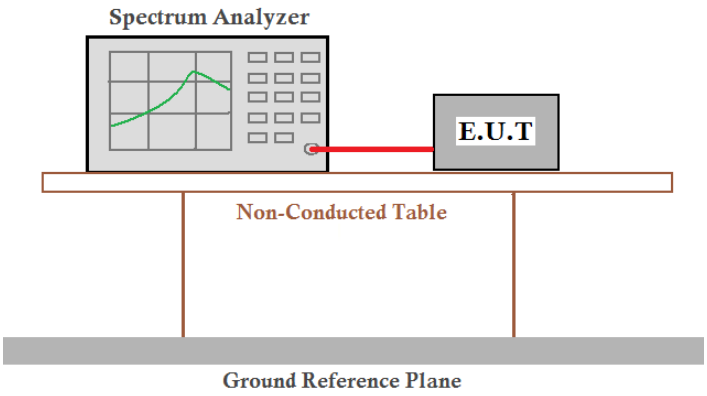
Middle channel



Date: 24.FEB.2016 20:27:27

Highest channel

6.3 20dB Occupy Bandwidth

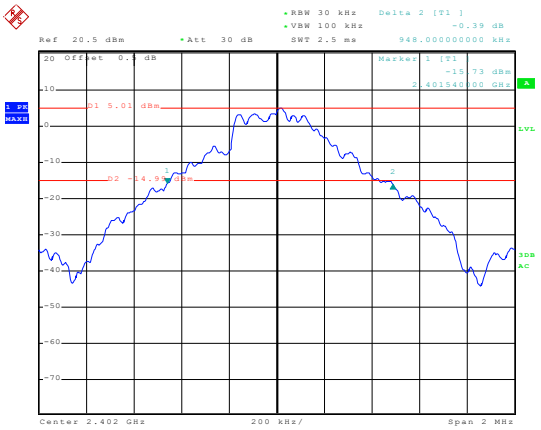
Test Requirement:	FCC Part 15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2009 and DA00-705
Receiver setup:	RBW=30 kHz, VBW=100 kHz, detector=Peak
Limit:	NA
Test setup:	
Test Instruments:	Refer to section 5.7 for details
Test mode:	Non-hopping mode
Test results:	Pass

Measurement Data

Test channel	20dB Occupy Bandwidth (kHz)		
	GFSK	π/4-DQPSK	8DPSK
Lowest	948	1276	1232
Middle	960	1276	1228
Highest	968	1300	1260

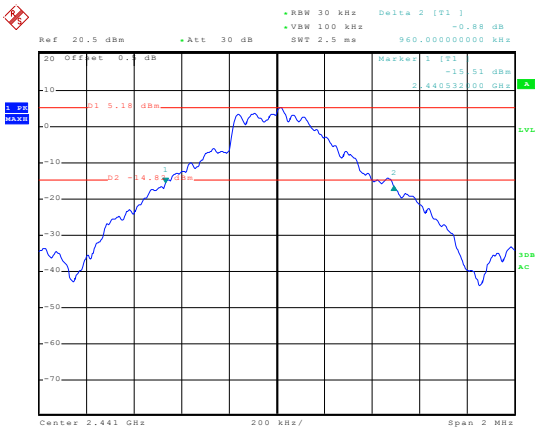
Test plot as follows:

Modulation mode: GFSK



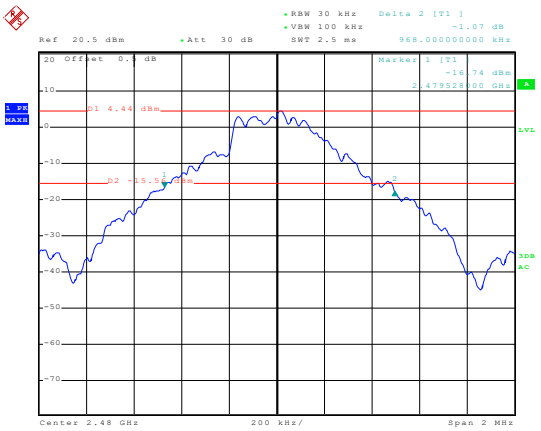
Date: 24.FEB.2016 20:30:20

Lowest channel



Date: 24.FEB.2016 20:31:32

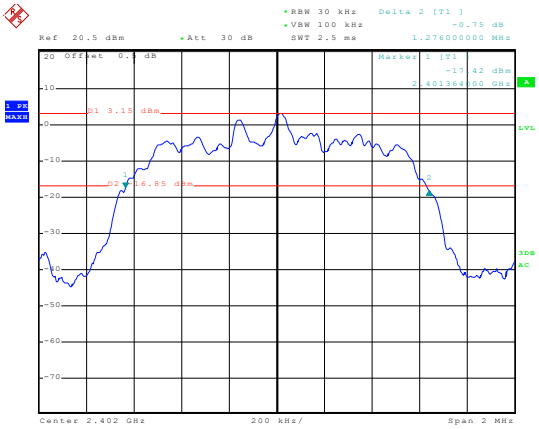
Middle channel



Date: 24.FEB.2016 20:32:54

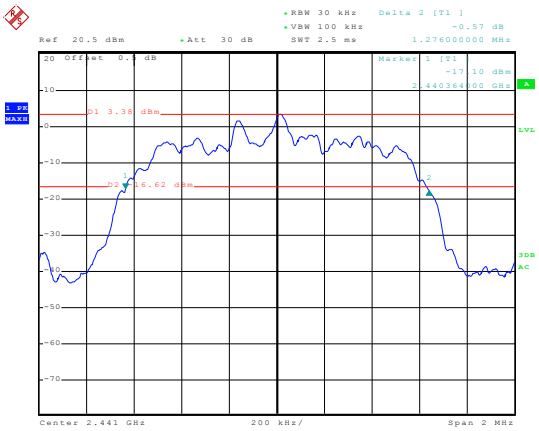
Highest channel

Modulation mode: π/4-DQPSK



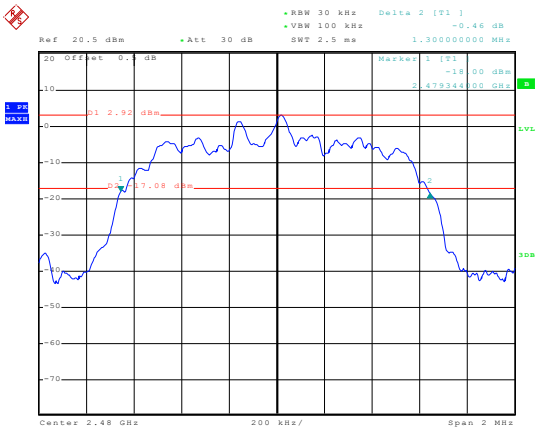
Date: 24.FEB.2016 20:36:16

Lowest channel



Date: 24.FEB.2016 20:35:24

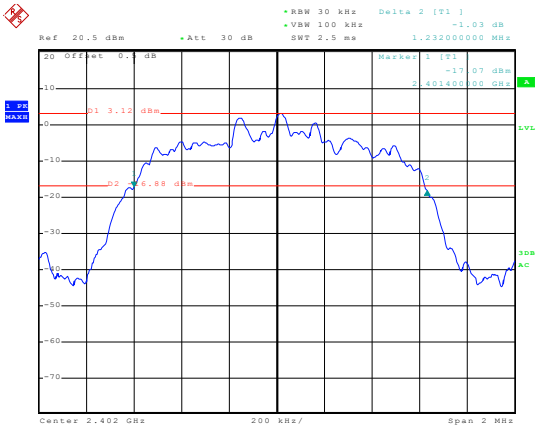
Middle channel



Date: 25.FEB.2016 18:00:37

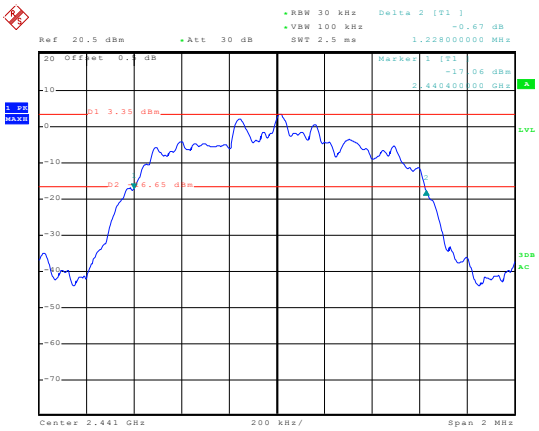
Highest channel

Modulation mode: 8DPSK



Date: 24.FEB.2016 20:37:35

Lowest channel



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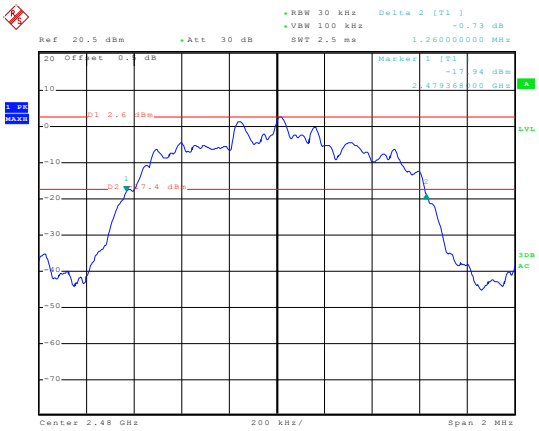
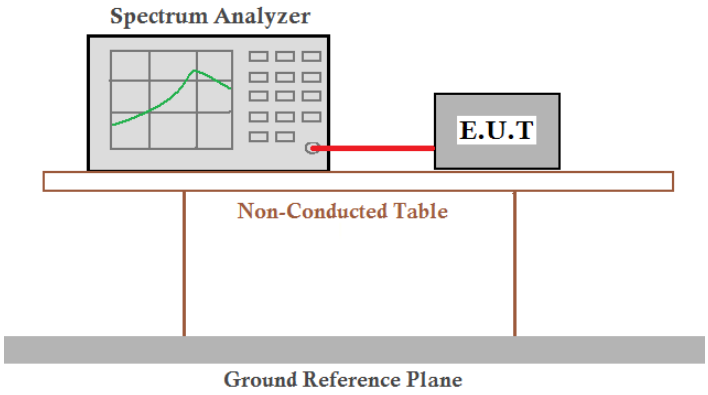
Middle channel



Date: 24.FEB.2016 20:39:59

Highest channel

6.4 Carrier Frequencies Separation

Test Requirement:	FCC Part 15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2009 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

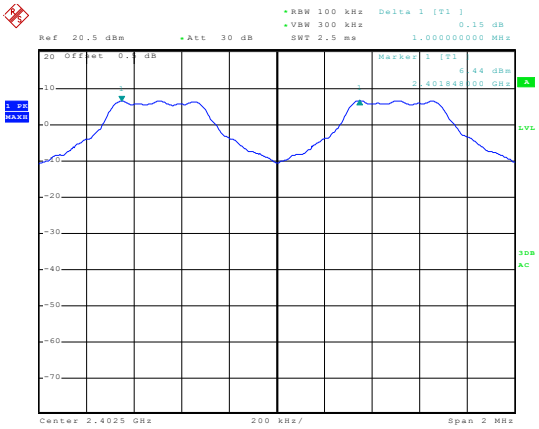
GFSK mode			
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Lowest	1000	645.33	Pass
Middle	1004	645.33	Pass
Highest	1004	645.33	Pass
π/4-DQPSK mode			
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Lowest	1004	866.67	Pass
Middle	1000	866.67	Pass
Highest	1004	866.67	Pass
8DPSK mode			
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Lowest	1004	840.00	Pass
Middle	1000	840.00	Pass
Highest	1000	840.00	Pass

Note: According to section 6.4

Mode	*20dB bandwidth (kHz) (worse case)*	*Limit (kHz) (Carrier Frequencies Separation)*
GFSK	*968*	*645.33*
π/4-DQPSK	*1300*	*866.67*
8DPSK	*1260*	*840.00*

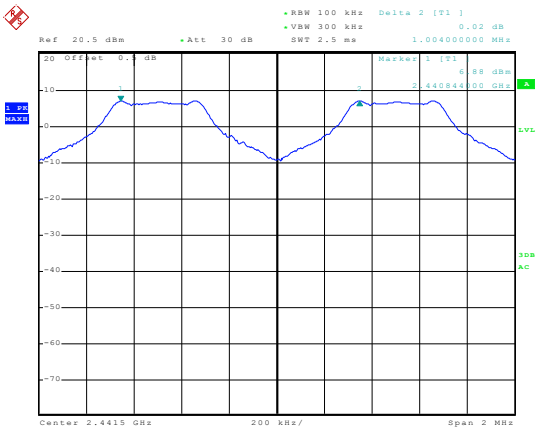
Test plot as follows:

Modulation mode: GFSK



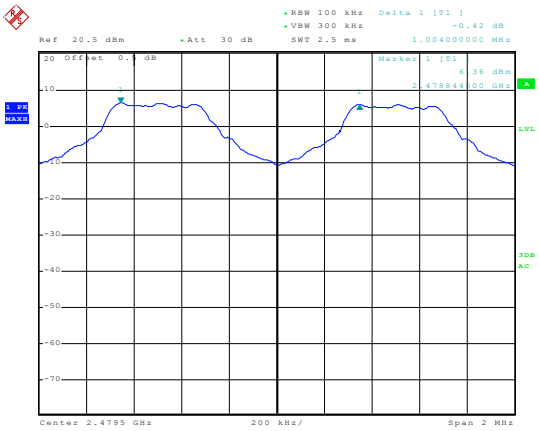
Date: 24.FEB.2016 21:31:53

Lowest channel



Date: 8.MAR.2016 14:46:13

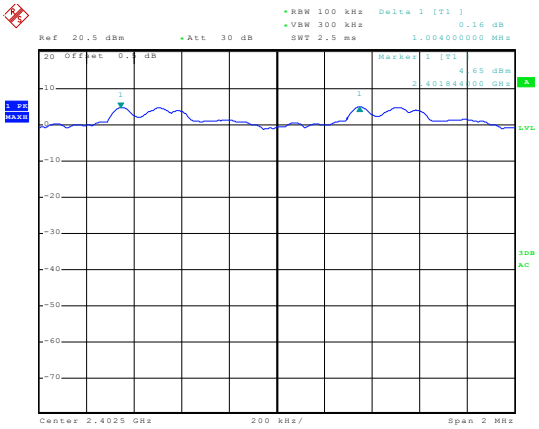
Middle channel



Date: 24.FEB.2016 21:33:47

Highest channel

Modulation mode: π/4-DQPSK



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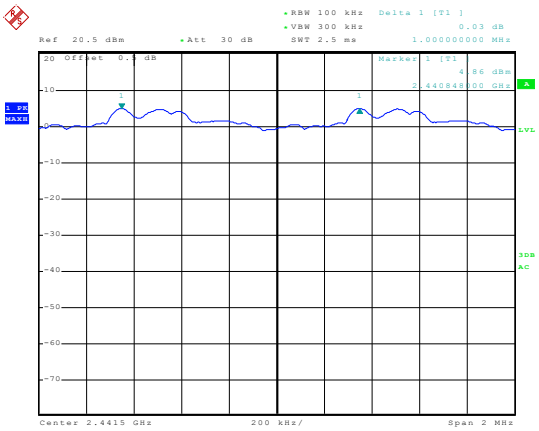
Lowest channel



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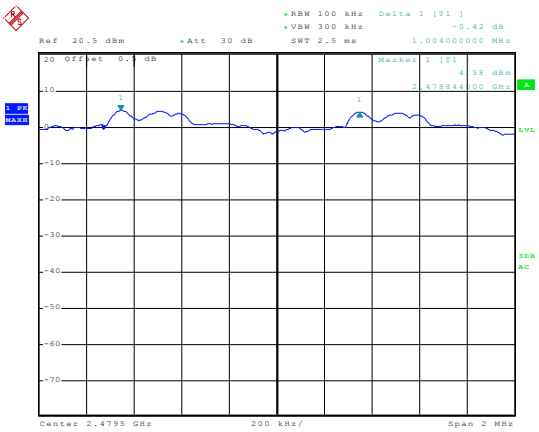
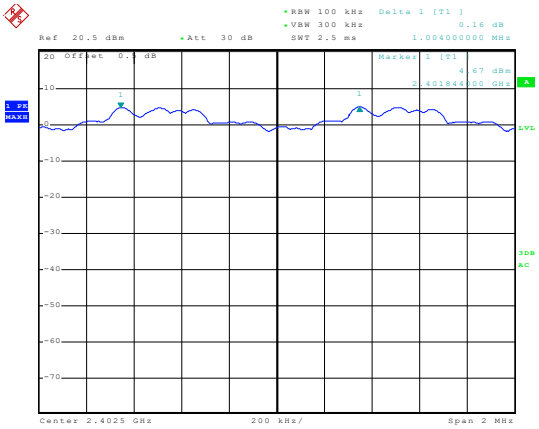
Middle channel



Date: 24.FEB.2016 21:37:11

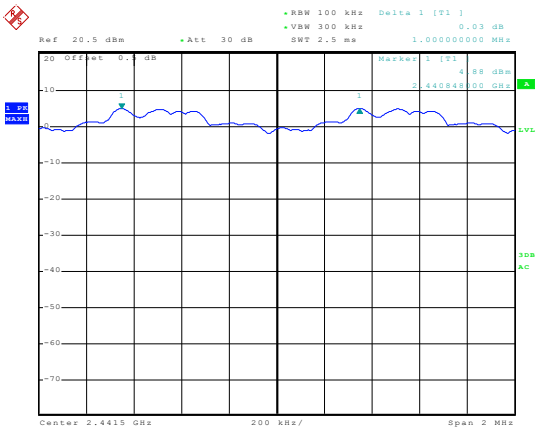
Highest channel

Modulation mode: 8DPSK



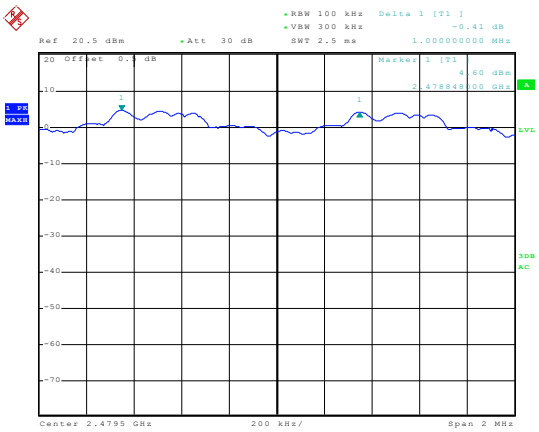
Date: 24.FEB.2016 21:38:12

Lowest channel



Date: 24.FEB.2016 21:39:39

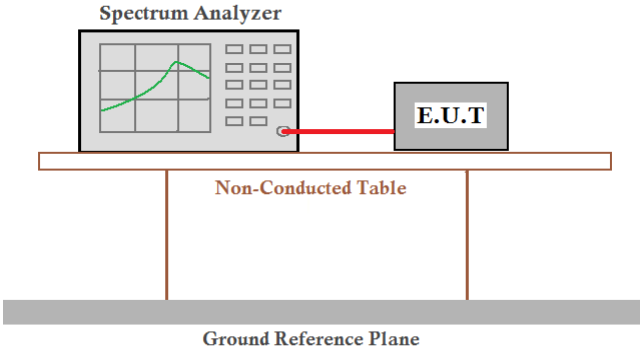
Middle channel



Date: 24.FEB.2016 21:41:04

Highest channel

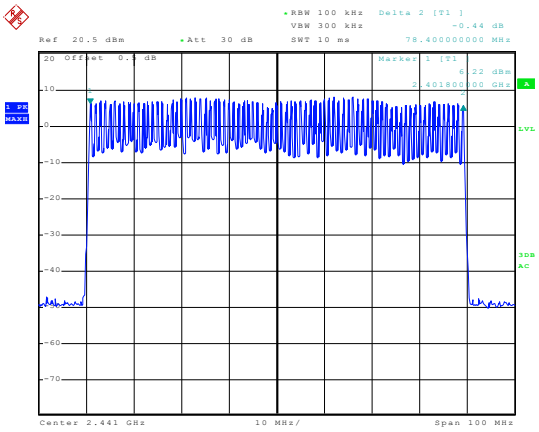
6.5 Hopping Channel Number

Test Requirement:	FCC Part 15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2009 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:

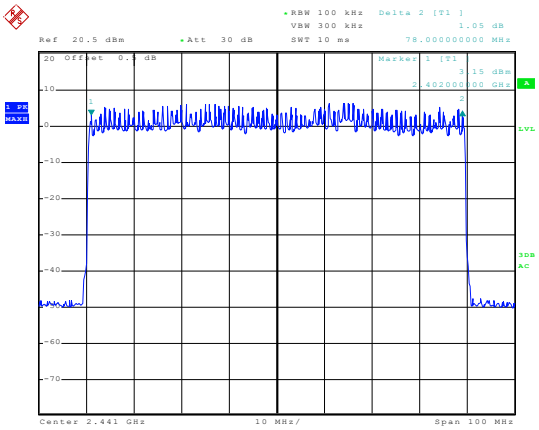
Mode	Hopping channel numbers	Limit	Result
GFSK, π/4-DQPSK, 8DPSK	79	15	Pass

GFSK



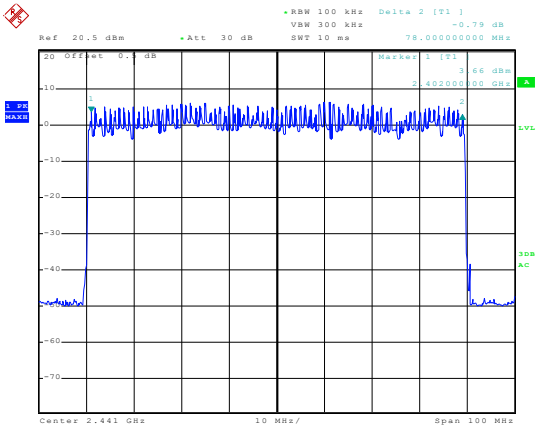
Date: 24.FEB.2016 21:51:02

π/4-DQPSK



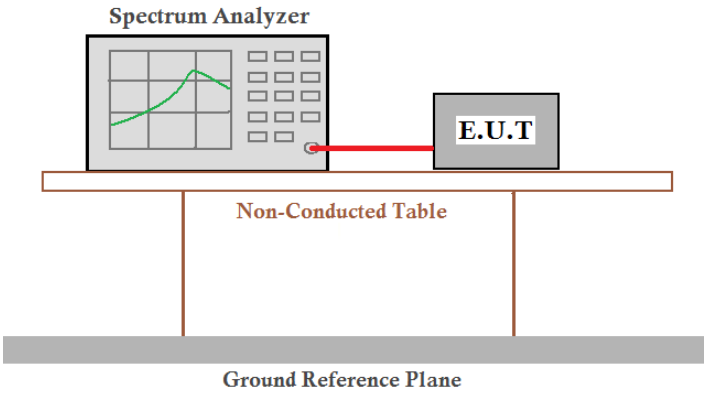
Date: 24.FEB.2016 21:52:44

8DPSK



Date: 24.FEB.2016 21:54:32

6.6 Dwell Time

Test Requirement:	FCC Part 15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2009 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	0.13120	0.4	Pass
	DH3	0.26880		
	DH5	0.31403		
π/4-DQPSK	2-DH1	0.13440	0.4	Pass
	2-DH3	0.26976		
	2-DH5	0.31232		
8DPSK	3-DH1	0.13760	0.4	Pass
	3-DH3	0.26976		
	3-DH5	0.31403		

For GFSK, π/4-DQPSK and 8DPSK:

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

DH1 time slot=0.410*(1600/ (2*79))*31.6=131.20ms

DH3 time slot=1.680*(1600/ (4*79))*31.6=268.8ms

DH5 time slot=2.944*(1600/ (6*79))*31.6=314.03ms

2-DH1 time slot=0.420*(1600/ (2*79))*31.6=134.4ms

2-DH3 time slot=1.686*(1600/ (4*79))*31.6=269.76ms

2-DH5 time slot=2.928*(1600/ (6*79))*31.6=312.32ms

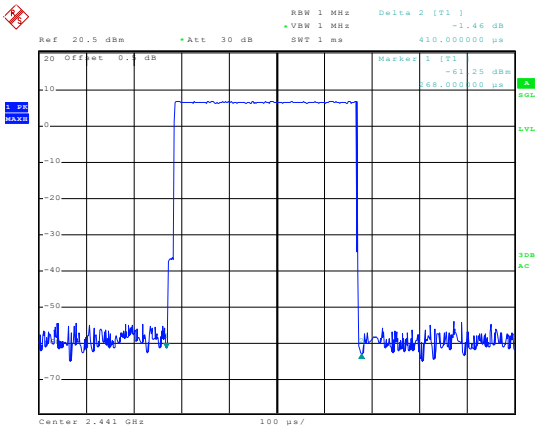
3-DH1 time slot=0.430*(1600/ (2*79))*31.6=137.60ms

3-DH3 time slot=1.686*(1600/ (4*79))*31.6=269.76ms

3-DH5 time slot=2.944*(1600/ (6*79))*31.6=314.03ms

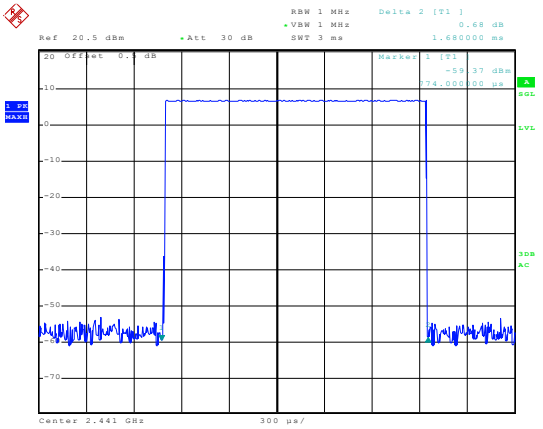
Test plot as follows:

Modulation mode: GFSK



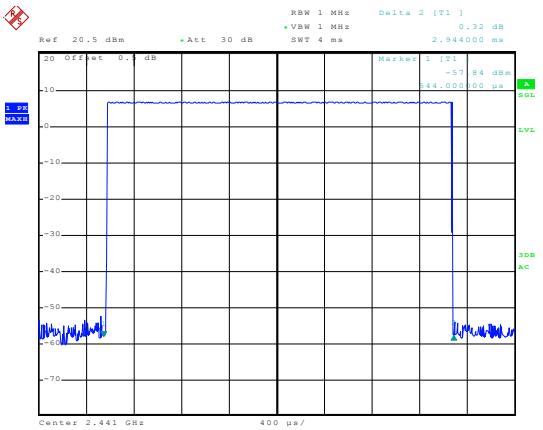
Date: 24.FEB.2016 21:42:38

DH1



Date: 24.FEB.2016 21:43:30

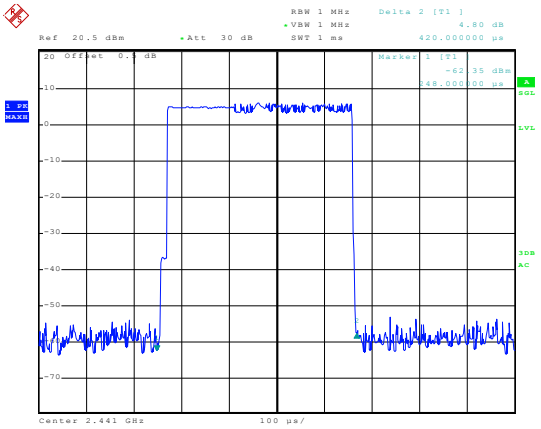
DH3



Date: 24.FEB.2016 21:44:21

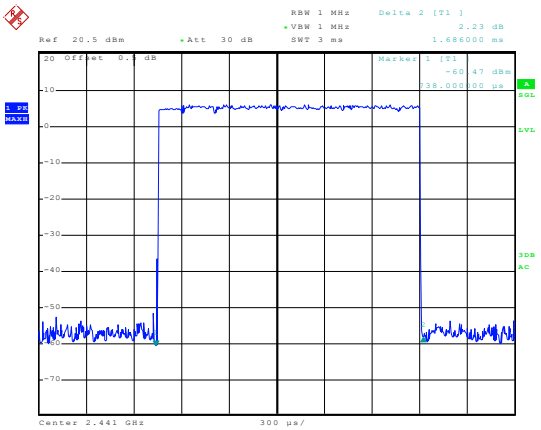
DH5

Modulation mode: π/4-DQPSK



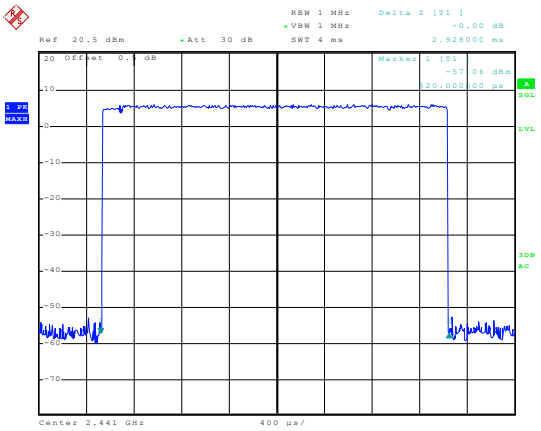
Date: 24.FEB.2016 21:44:56

2-DH1



Date: 24.FEB.2016 21:45:25

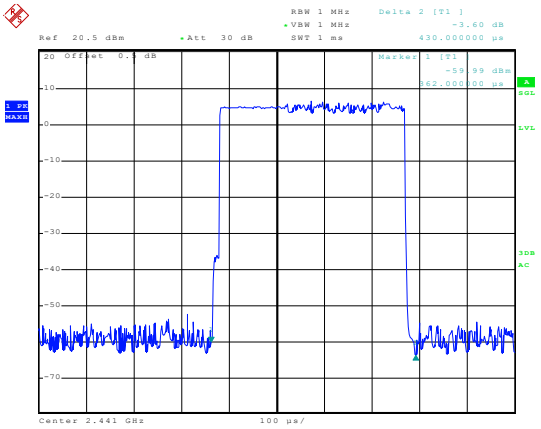
2-DH3



Date: 24.FEB.2016 21:46:03

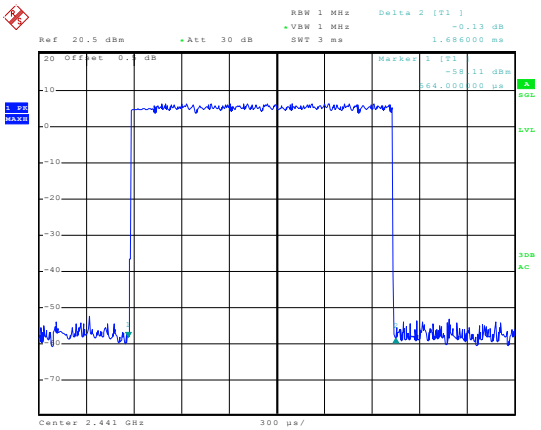
2-DH5

Modulation mode: 8DPSK



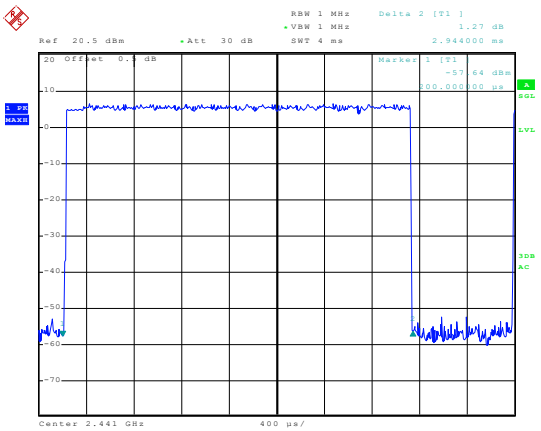
Date: 24.FEB.2016 21:47:25

3-DH1



Date: 24.FEB.2016 21:47:55

3-DH3



Date: 24.FEB.2016 21:48:23

3-DH5

6.7 Pseudorandom Frequency Hopping Sequence

Test Requirement:	FCC Part 15 C Section 15.247 (a)(1) requirement:

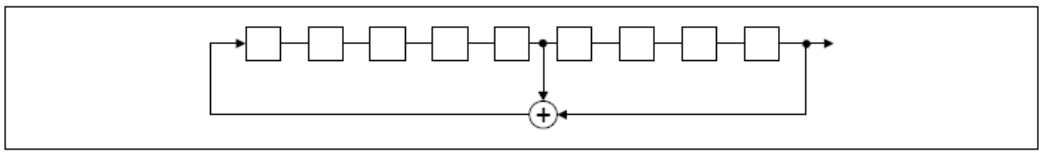
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

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

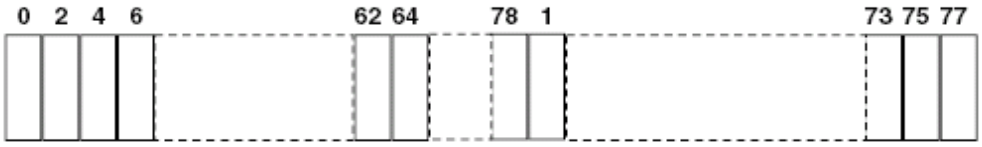
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized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

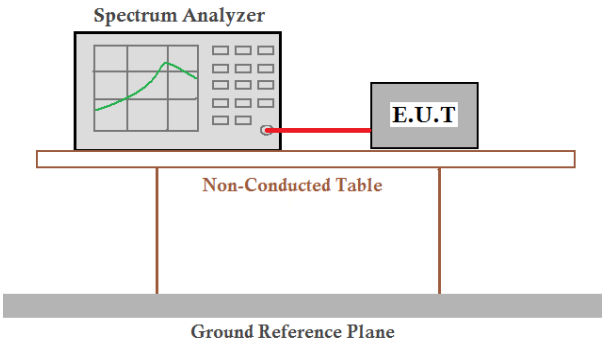


Each frequency used equally on the average by each transmitter.

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.

6.8 Band Edge

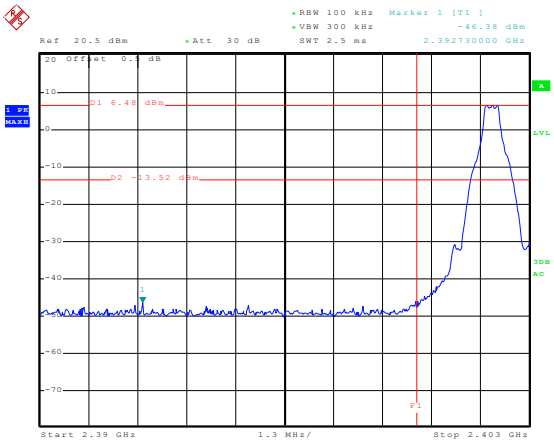
6.8.1 Conducted Emission Method

Test Requirement:	FCC Part 15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2009 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:

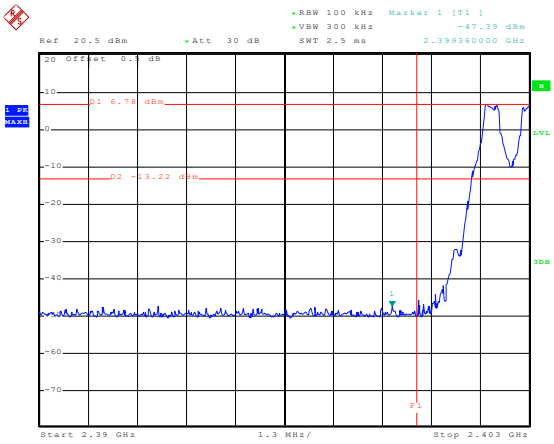
GFSK

Lowest Channel



Date: 24.FEB.2016 21:10:57

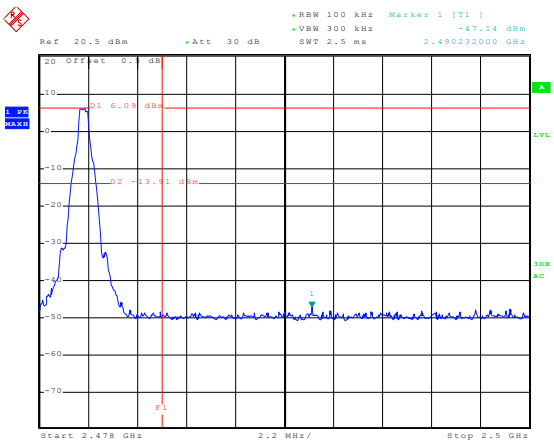
No-hopping mode



Date: 25.FEB.2016 18:03:30

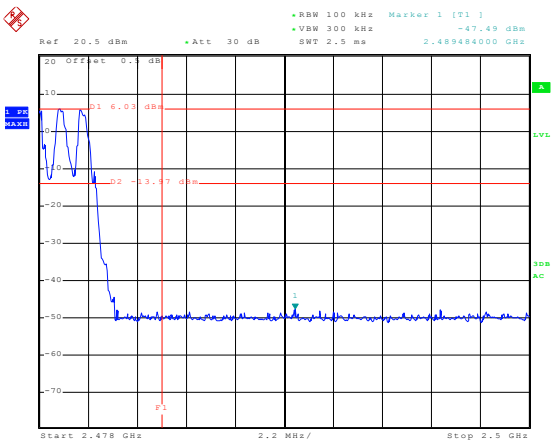
Hopping mode

Highest Channel



Date: 24.FEB.2016 21:22:02

No-hopping mode

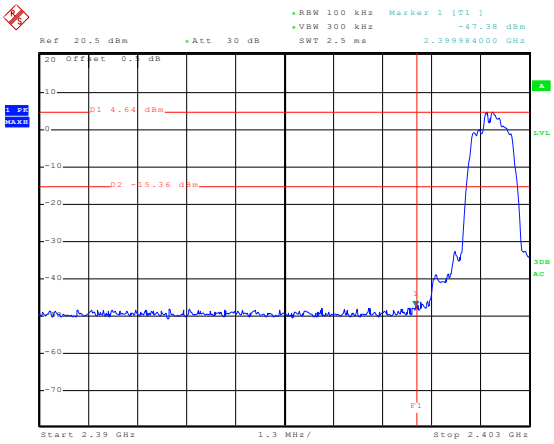


Date: 24.FEB.2016 21:22:56

Hopping mode

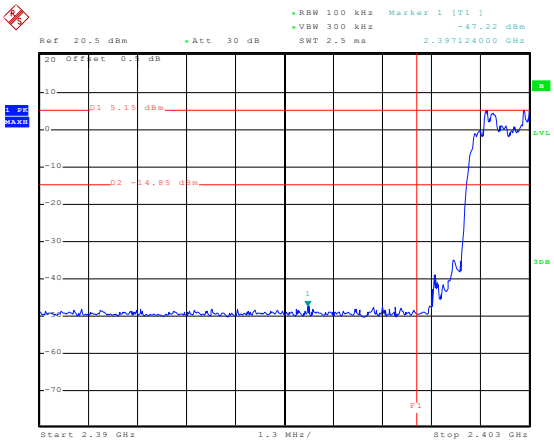
π/4-DQPSK

Lowest Channel



Date: 24.FEB.2016 21:15:14

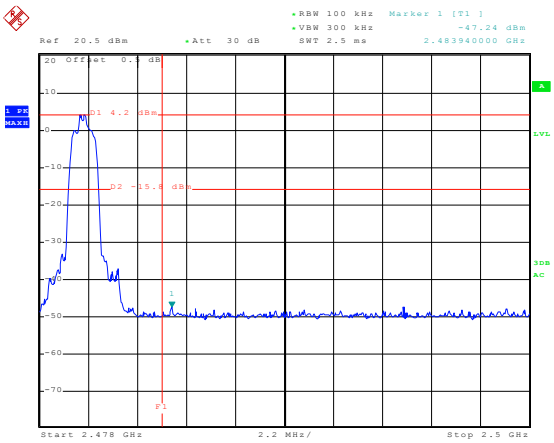
No-hopping mode



Date: 25.FEB.2016 18:06:38

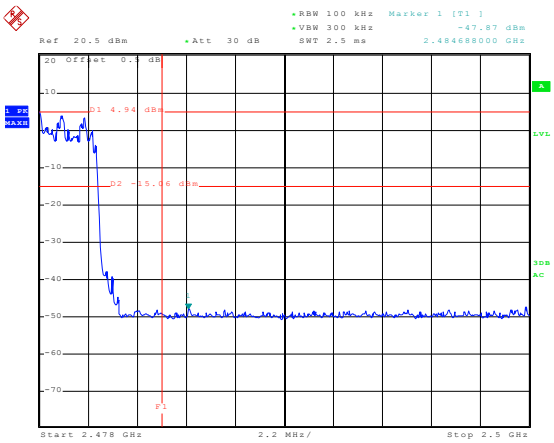
Hopping mode

Highest Channel



Date: 24.FEB.2016 21:20:18

No-hopping mode

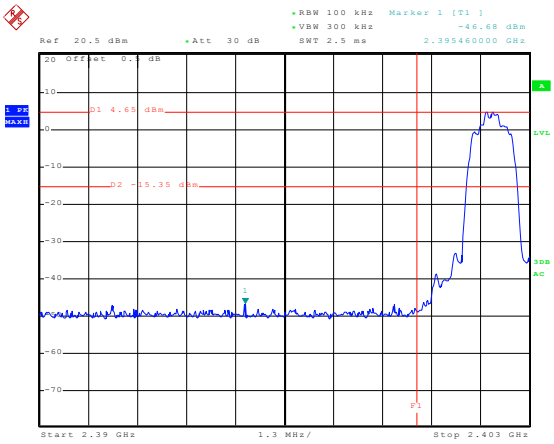


Date: 24.FEB.2016 21:24:56

Hopping mode

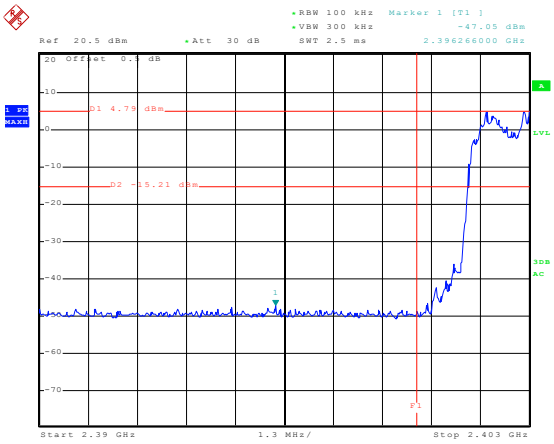
8DPSK

Lowest Channel



Date: 24.FEB.2016 21:17:16

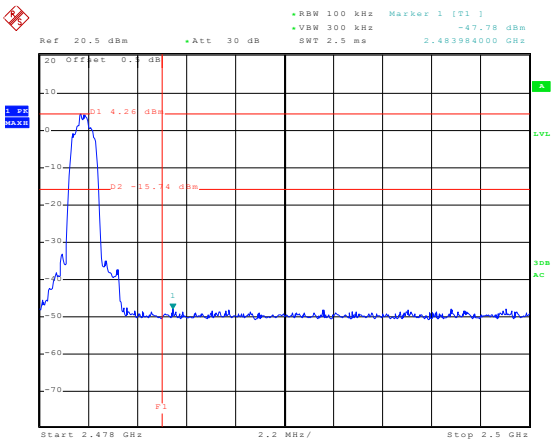
No-hopping mode



Date: 24.FEB.2016 21:27:32

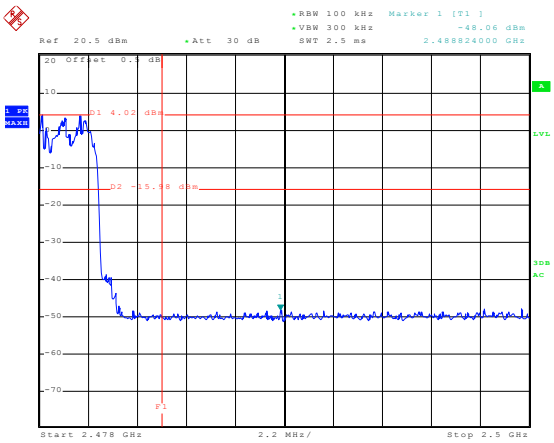
Hopping mode

Highest Channel



Date: 24.FEB.2016 21:18:45

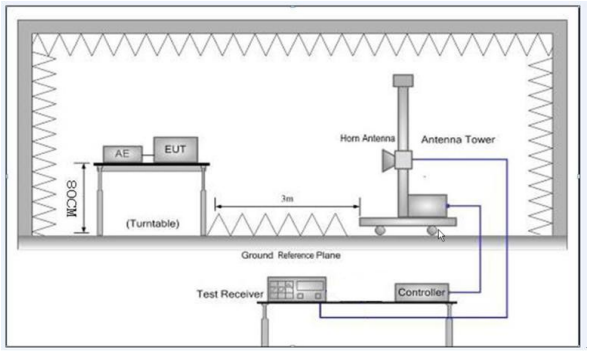
No-hopping mode



Date: 24.FEB.2016 21:25:56

Hopping mode

6.8.2 Radiated Emission Method

<table>
<tr><td>Test Requirement:</td><td>FCC Part 15 C Section 15.209 and 15.205</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10: 2009</td></tr>
<tr><td>Test Frequency Range:</td><td>2.3GHz to 2.5GHz</td></tr>
<tr><td>Test site:</td><td>Measurement Distance: 3m</td></tr>
<tr><td>Receiver setup:</td><td>
<table>
<tr><td>Frequency</td><td>Detector</td><td>RBW</td><td>VBW</td><td>Remark</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>Peak</td><td>1MHz</td><td>3MHz</td><td>Peak Value</td></tr>
<tr><td>RMS</td><td>1MHz</td><td>3MHz</td><td>Average Value</td></tr>
</table>
</td></tr>
<tr><td>Limit:</td><td>
<table>
<tr><td>Frequency</td><td>Limit (dBuV/m @3m)</td><td>Remark</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>54.00</td><td>Average Value</td></tr>
<tr><td>74.00</td><td>Peak Value</td></tr>
</table>
</td></tr>
<tr><td>Test setup:</td><td> 
</td></tr>
<tr><td>Test Procedure:</td><td>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.</td></tr>
<tr><td>Test Instruments:</td><td>Refer to section 5.7 for details</td></tr>
<tr><td>Test mode:</td><td>Non-hopping mode</td></tr>
<tr><td>Test results:</td><td>Passed</td></tr>
</table>

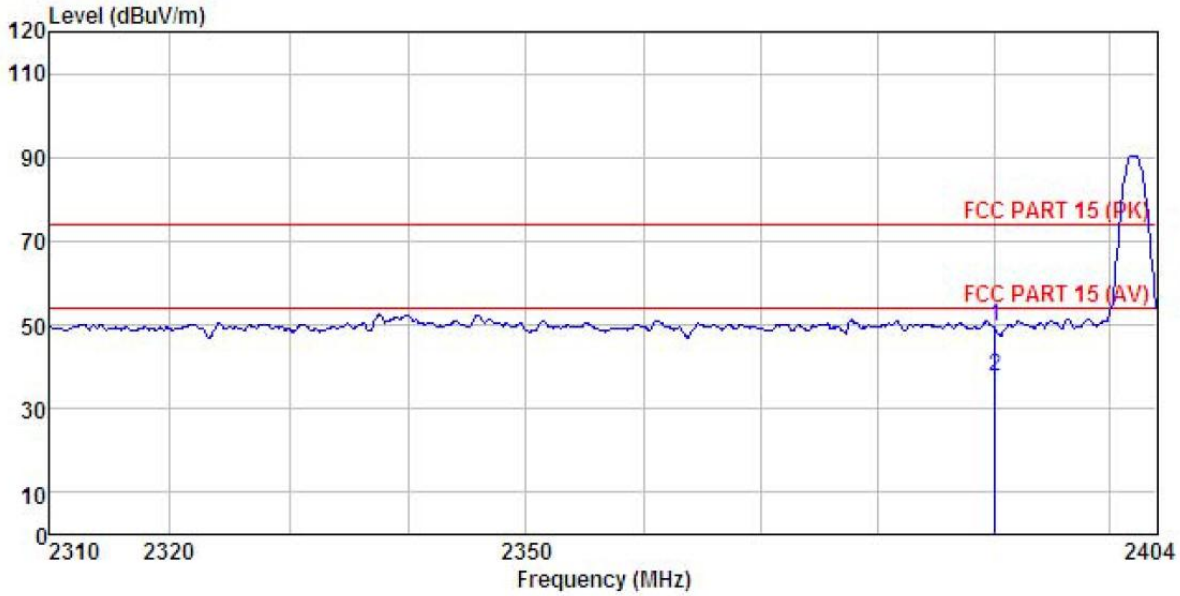
Remark:

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

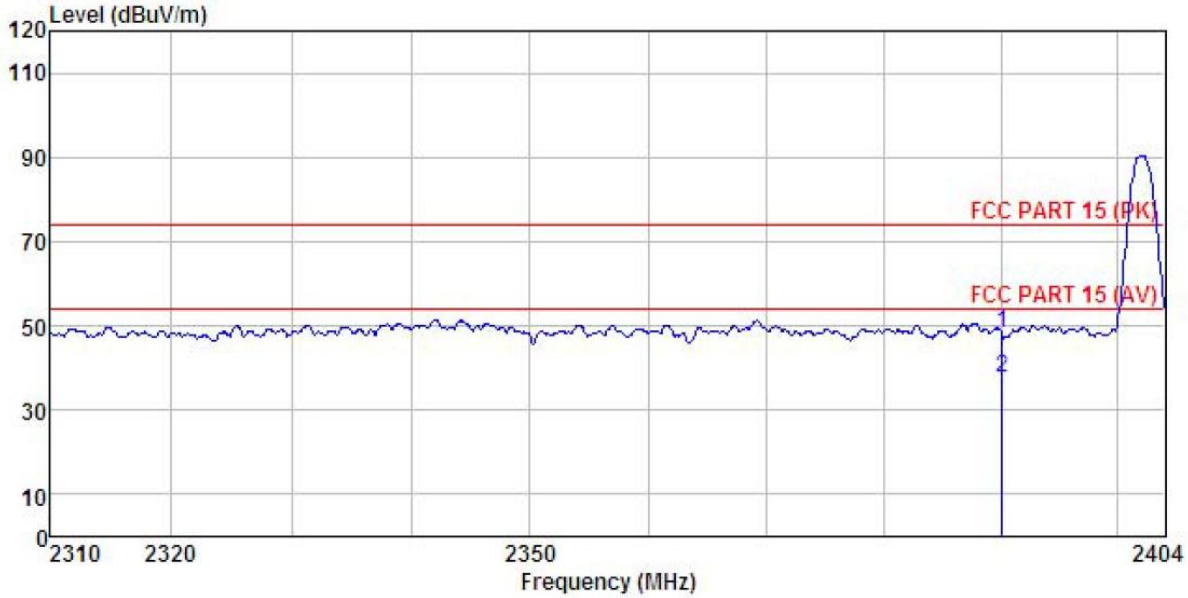
Horizontal:



Site : 3m chamber
Condition : FCC PART 15 (PK) 3m BBHA9120(1G18) HORIZONTAL
EUT : Vehicle Module
Model : TREQr-5
Test mode : DH1-L Mode
Power Rating : DC 12V
Environment : Temp:25.5℃ Huni:55%
Test Engineer: YT
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	19.29	23.68	6.63	0.00	49.60	74.00	-24.40	Peak
2	2390.000	7.25	23.68	6.63	0.00	37.56	54.00	-16.44	Average

Vertical:

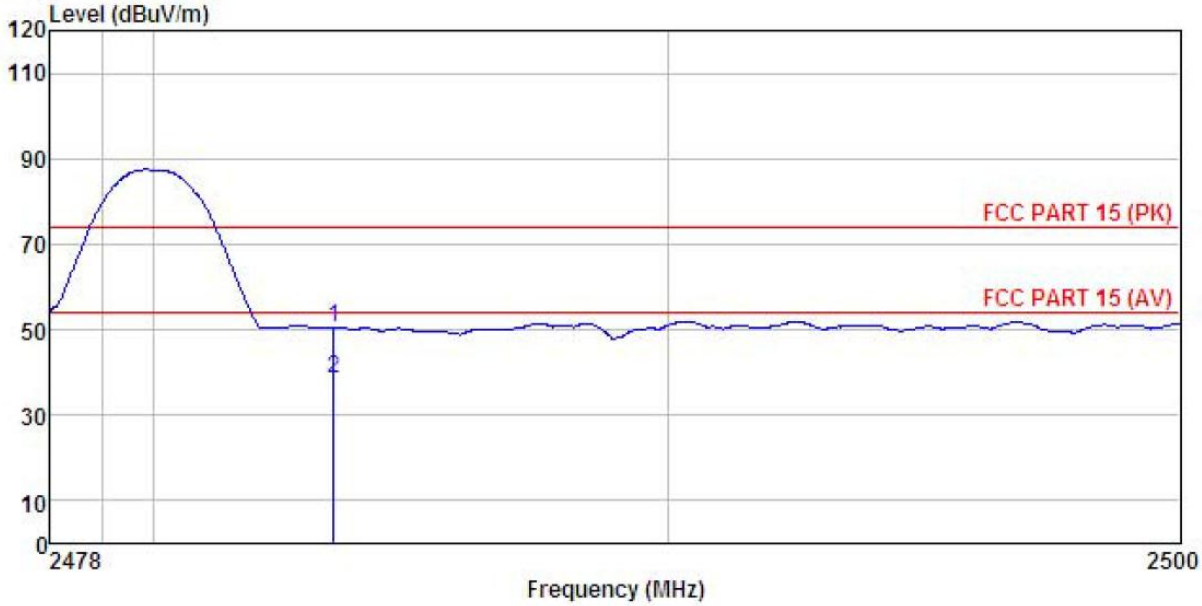


Site : 3m chamber
Condition : FCC PART 15 (PK) 3m BBHA9120(1G18) VERTICAL
EUT : Vehicle Module
Model : TREQr-5
Test mode : DH1-L Mode
Power Rating : DC 12V
Environment : Temp:25.5℃ Huni:55%
Test Engineer: YT
REMARK :

	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	17.80	23.68	6.63	0.00	48.11	74.00	-25.89	Peak
2	2390.000	7.26	23.68	6.63	0.00	37.57	54.00	-16.43	Average

Test channel: Highest

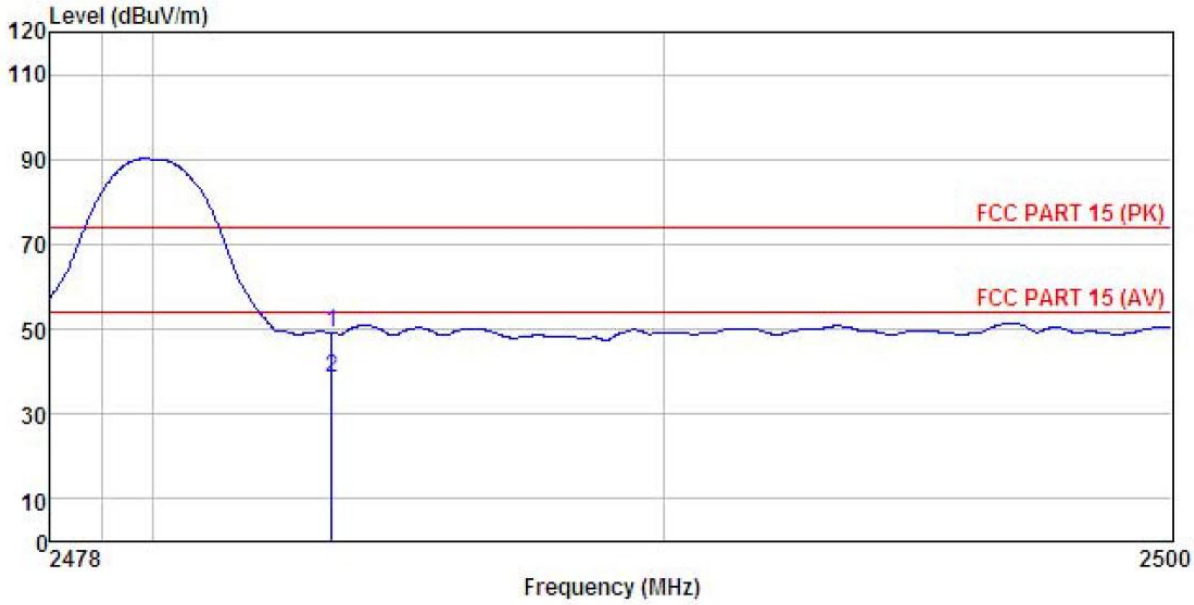
Horizontal:



Site : 3m chamber
Condition : FCC PART 15 (PK) 3m BBHA9120(1G18) HORIZONTAL
EUT : Vehicle Module
Model : TREQr-5
Test mode : DH1-H Mode
Power Rating : DC 12V
Environment : Temp:25.5℃ Huni:55%
Test Engineer: YT
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	2483.500	19.79	23.70	6.85	0.00	50.34	74.00	-23.66	Peak
2	2483.500	7.85	23.70	6.85	0.00	38.40	54.00	-15.60	Average

Vertical:



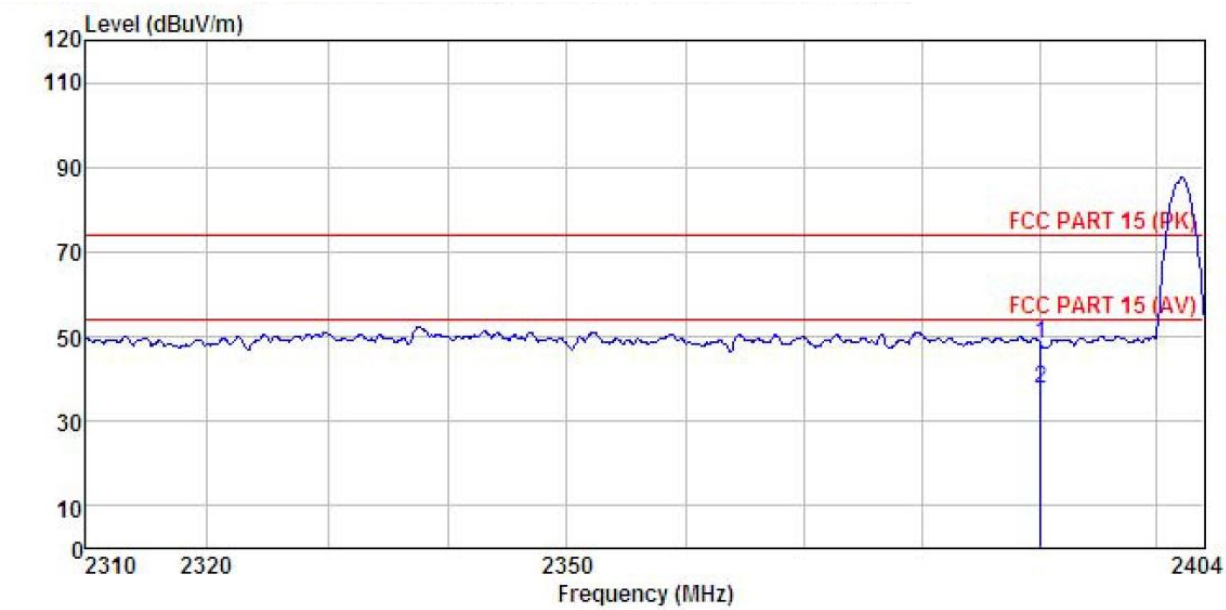
Site : 3m chamber
Condition : FCC PART 15 (PK) 3m BBHA9120(1G18) VERTICAL
EUT : Vehicle Module
Model : TREQr-5
Test mode : DH1-H Mode
Power Rating : DC 12V
Environment : Temp:25.5℃ Huni:55%
Test Engineer: YT
REMARK :

	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	18.64	23.70	6.85	0.00	49.19	74.00	-24.81	Peak
2	2483.500	7.84	23.70	6.85	0.00	38.39	54.00	-15.61	Average

π/4-DQPSK mode

Test channel: Lowest

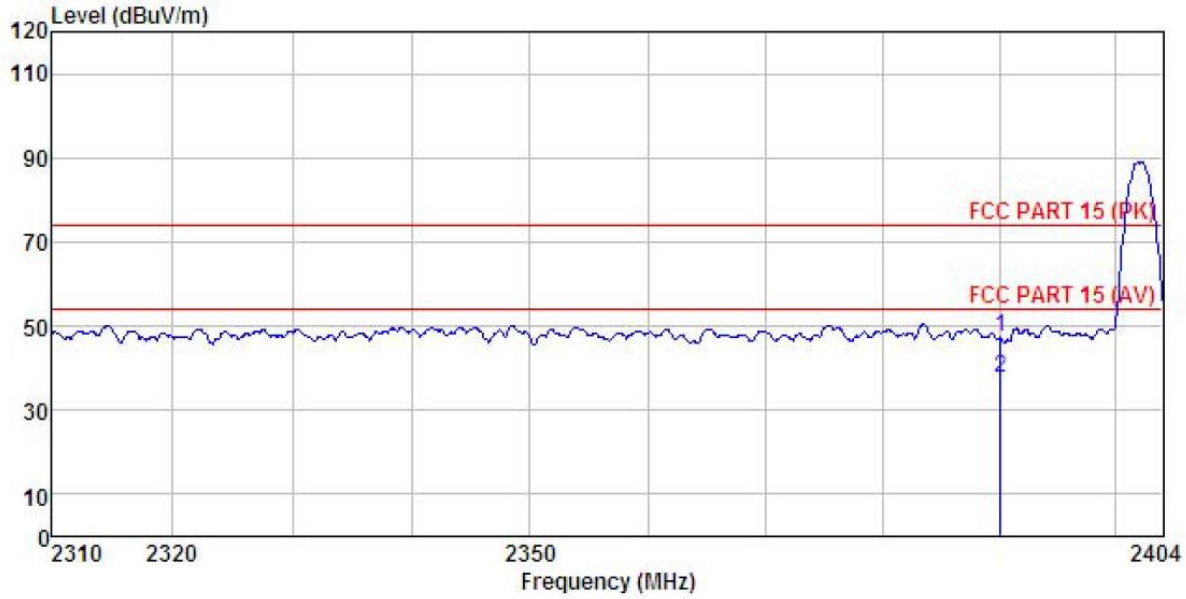
Horizontal:




```
Site          : 3m chamber
Condition     : FCC PART 15 (PK) 3m BBHA9120(1G18) HORIZONTAL
EUT           : Vehicle Module
Model         : TREQr-5
Test mode     : 2DH1-L Mode
Power Rating  : DC 12V
Environment   : Temp:25.5'C  Huni:55%
Test Engineer: YT
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	18.12	23.68	6.63	0.00	48.43	74.00	-25.57	Peak
2	2390.000	7.28	23.68	6.63	0.00	37.59	54.00	-16.41	Average

Vertical:

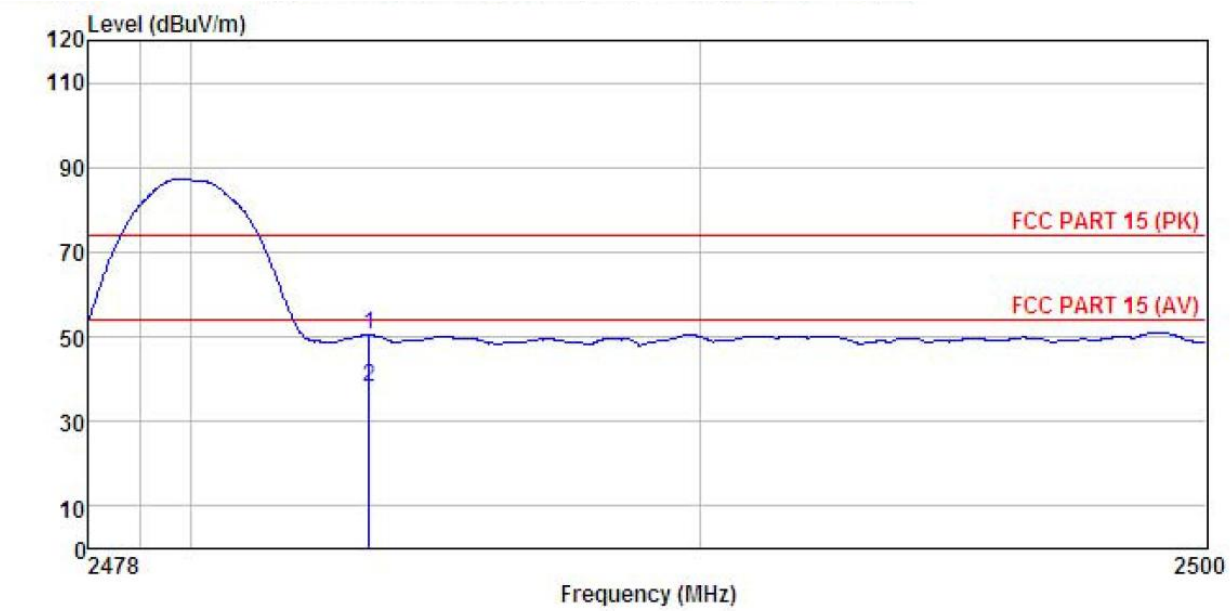


Site : 3m chamber
Condition : FCC PART 15 (PK) 3m BBHA9120(1G18) VERTICAL
EUT : Vehicle Module
Model : TREQr-5
Test mode : 2DH1-L Mode
Power Rating : DC 12V
Environment : Temp:25.5℃ Huni:55%
Test Engineer: YT
REMARK :

	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	16.98	23.68	6.63	0.00	47.29	74.00	-26.71	Peak
2	2390.000	7.25	23.68	6.63	0.00	37.56	54.00	-16.44	Average

Test channel: Highest

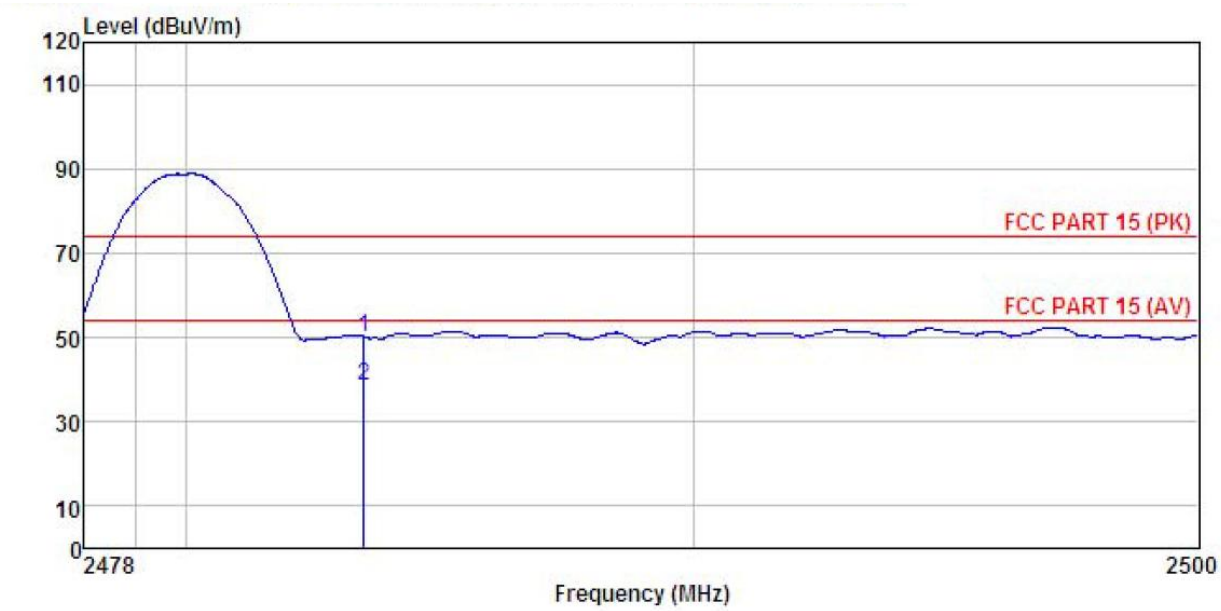
Horizontal:



Site : 3m chamber
Condition : FCC PART 15 (PK) 3m BBHA9120(1G18) HORIZONTAL
EUT : Vehicle Module
Model : TREQr-5
Test mode : 2DH1-H Mode
Power Rating : DC 12V
Environment : Temp:25.5℃ Huni:55%
Test Engineer: YT
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	2483.500	19.84	23.70	6.85	0.00	50.39	74.00	-23.61	Peak
2	2483.500	7.73	23.70	6.85	0.00	38.28	54.00	-15.72	Average

Vertical:



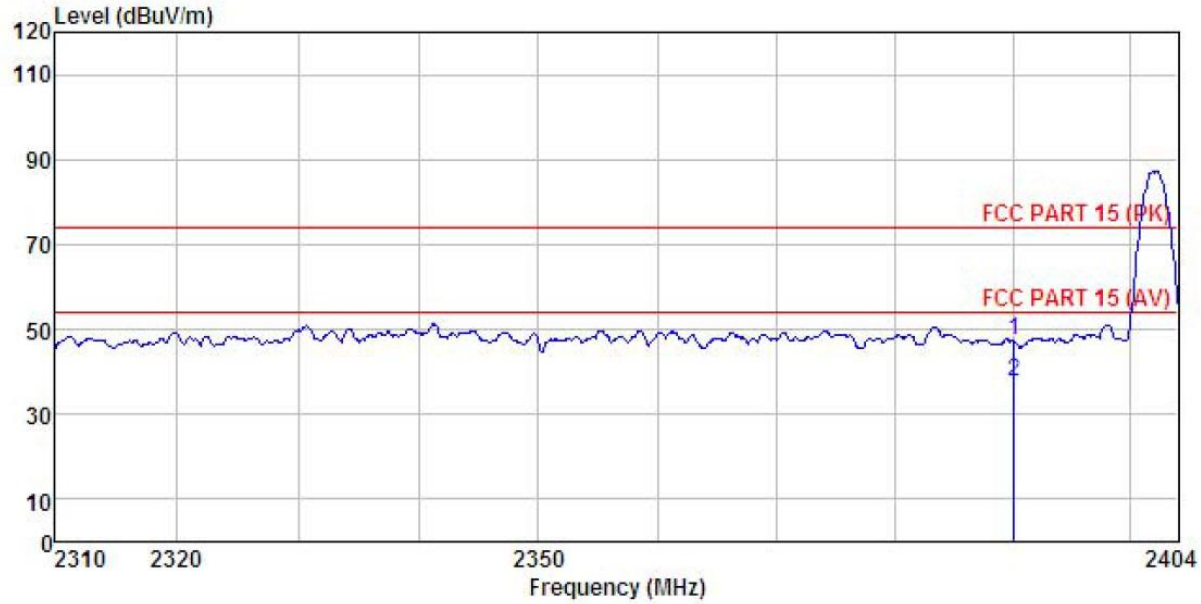
Site : 3m chamber
Condition : FCC PART 15 (PK) 3m BBHA9120(1G18) VERTICAL
EUT : Vehicle Module
Model : TREQr-5
Test mode : 2DH1-H Mode
Power Rating : DC 12V
Environment : Temp:25.5℃ Huni:55%
Test Engineer: YT
REMARK :

	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	2483.500	19.68	23.70	6.85	0.00	50.23	74.00	-23.77	Peak
2	2483.500	7.78	23.70	6.85	0.00	38.33	54.00	-15.67	Average

8DPSK mode

Test channel: Lowest

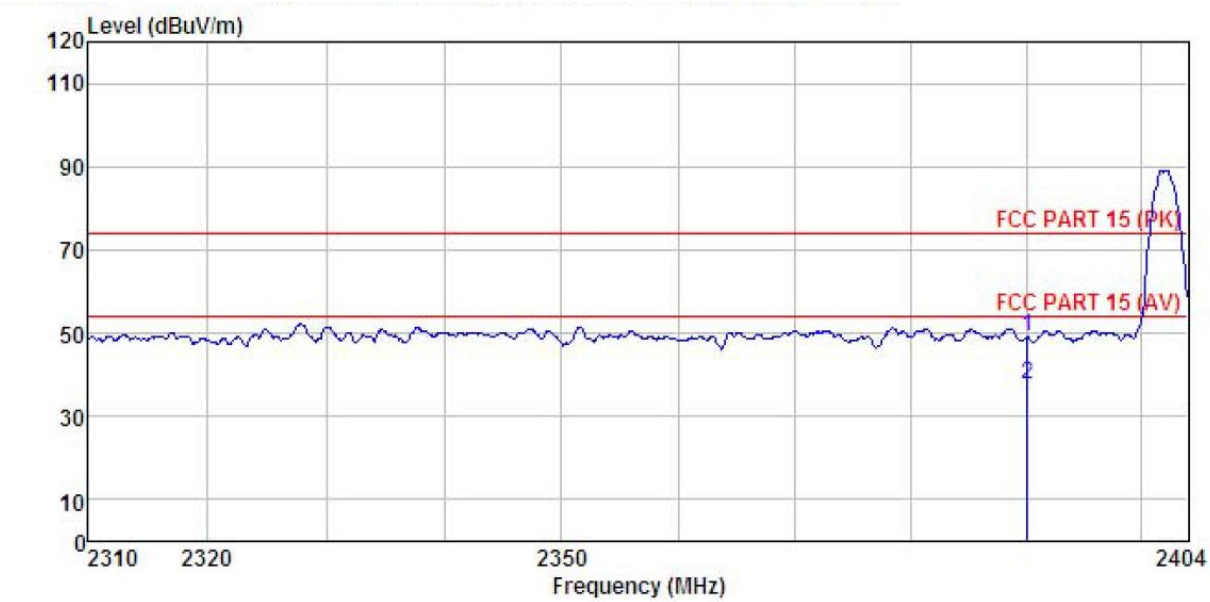
Horizontal:



Site : 3m chamber
Condition : FCC PART 15 (PK) 3m BBHA9120(1G18) HORIZONTAL
EUT : Vehicle Module
Model : TREQr-5
Test mode : 3DH1-L Mode
Power Rating : DC 12V
Environment : Temp:25.5'C Huni:55%
Test Engineer: YT
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	17.07	23.68	6.63	0.00	47.38	74.00	-26.62	Peak
2	2390.000	7.21	23.68	6.63	0.00	37.52	54.00	-16.48	Average

Vertical:

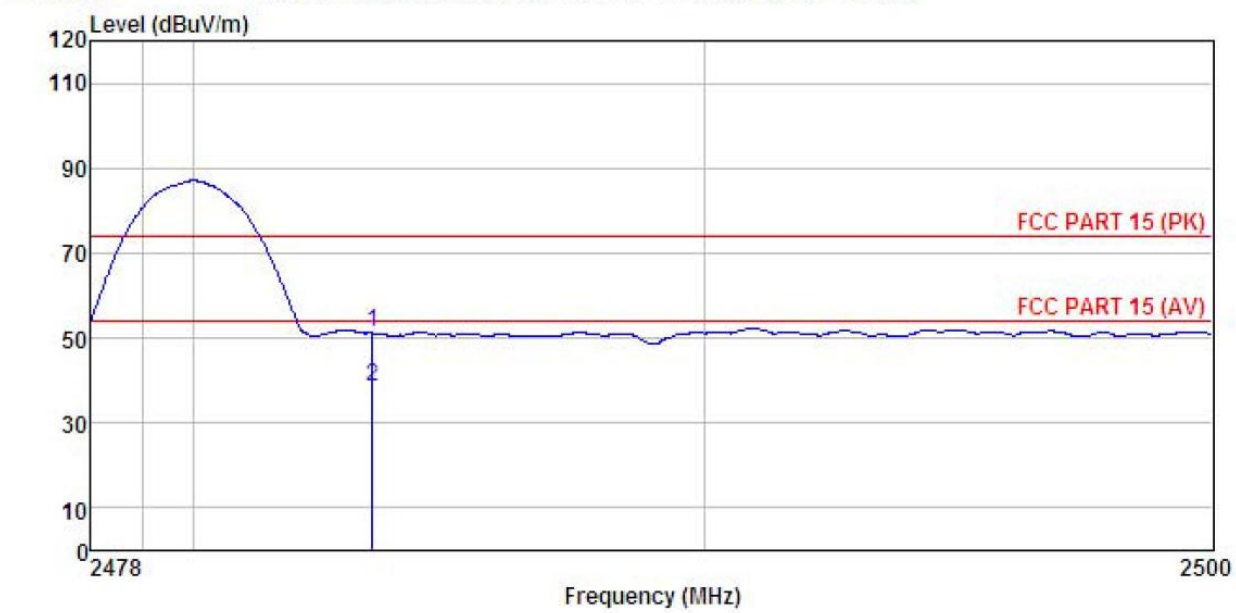


Site : 3m chamber
Condition : FCC PART 15 (PK) 3m BBHA9120(1G18) VERTICAL
EUT : Vehicle Module
Model : TREQr-5
Test mode : 3DH1-L Mode
Power Rating : DC 12V
Environment : Temp:25.5'C Huni:55%
Test Engineer: YT
REMARK :

	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	19.02	23.68	6.63	0.00	49.33	74.00	-24.67	Peak
2	2390.000	7.20	23.68	6.63	0.00	37.51	54.00	-16.49	Average

Test channel: Highest

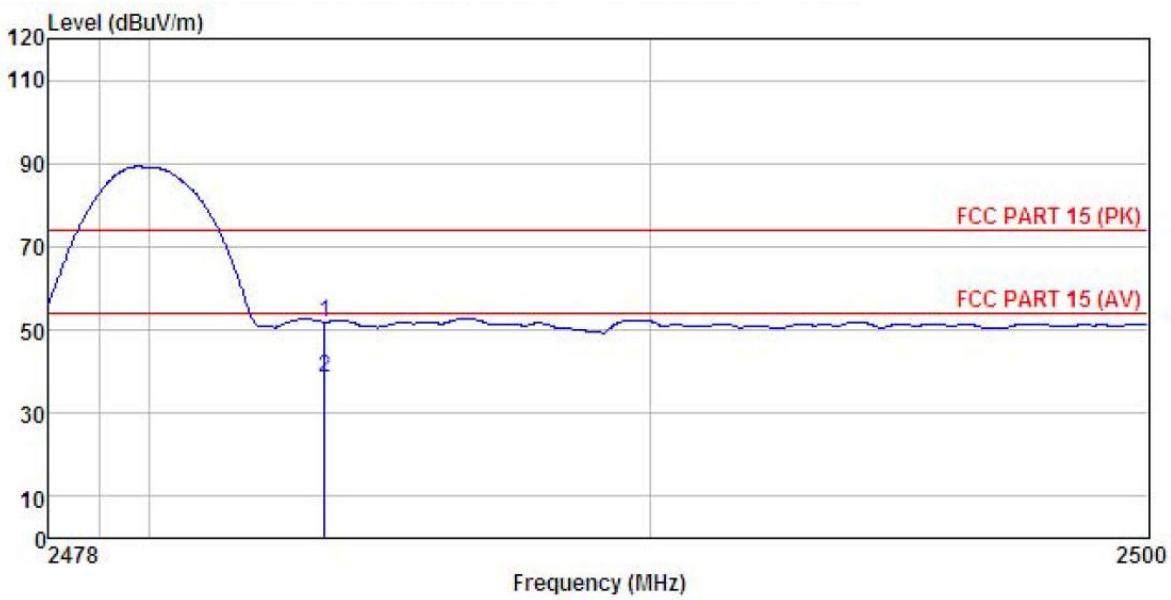
Horizontal:



Site : 3m chamber
Condition : FCC PART 15 (PK) 3m BBHA9120(1G18) HORIZONTAL
EUT : Vehicle Module
Model : TREQr-5
Test mode : 3DH1-H Mode
Power Rating : DC 12V
Environment : Temp:25.5℃ Huni:55%
Test Engineer: YT
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	2483.500	20.61	23.70	6.85	0.00	51.16	74.00	-22.84	Peak
2	2483.500	7.82	23.70	6.85	0.00	38.37	54.00	-15.63	Average

Vertical:

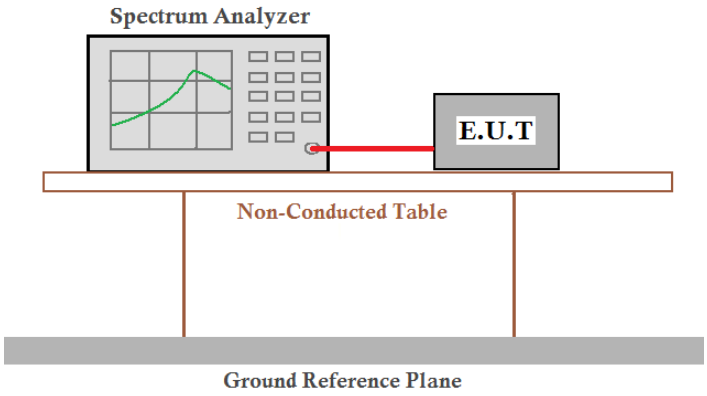


Site : 3m chamber
Condition : FCC PART 15 (PK) 3m BBHA9120(1G18) VERTICAL
EUT : Vehicle Module
Model : TREQr-5
Test mode : 3DH1-H Mode
Power Rating : DC 12V
Environment : Temp:25.5℃ Huni:55%
Test Engineer: YT
REMARK :

	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	21.18	23.70	6.85	0.00	51.73	74.00	-22.27	Peak
2	2483.500	7.83	23.70	6.85	0.00	38.38	54.00	-15.62	Average

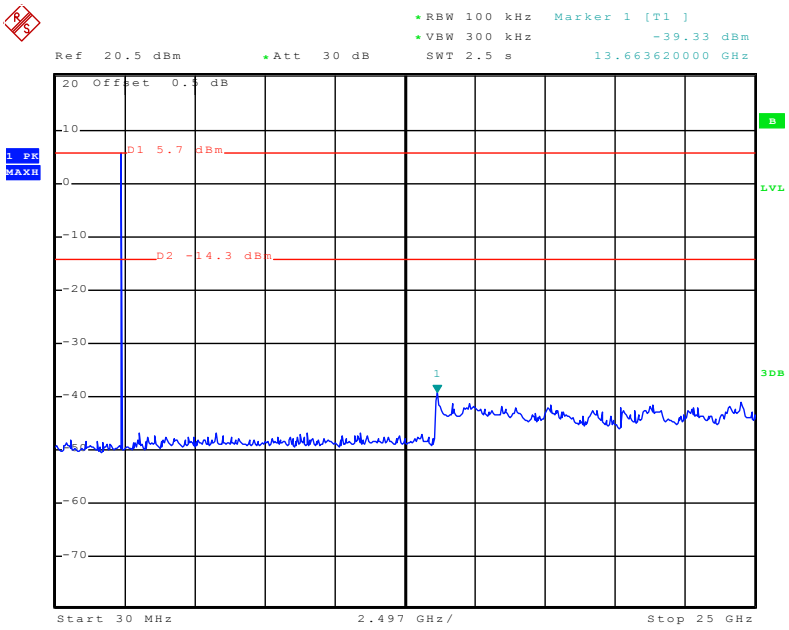
7 Spurious Emission

7.1.1 Conducted Emission Method

Test Requirement:	FCC Part 15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2009 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

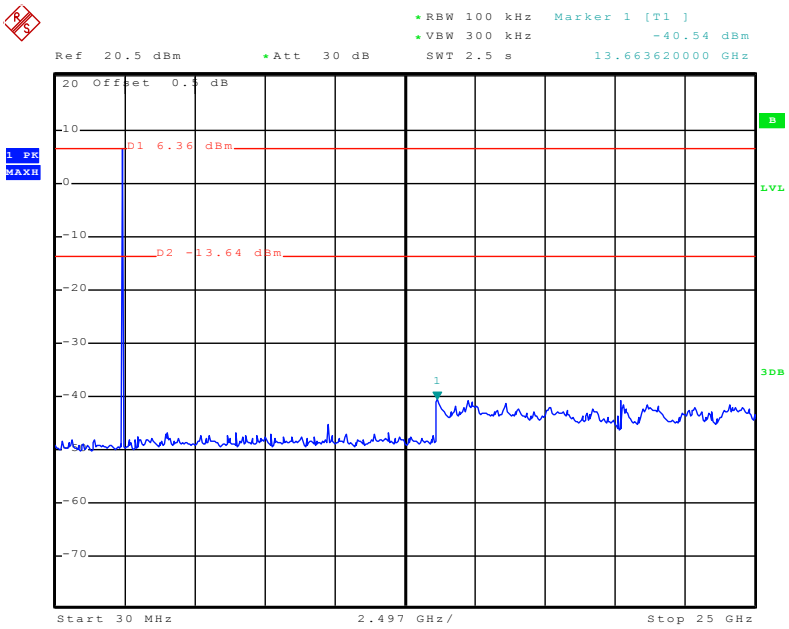
Lowest channel



Date: 25.FEB.2016 17:50:34

30MHz~25GHz

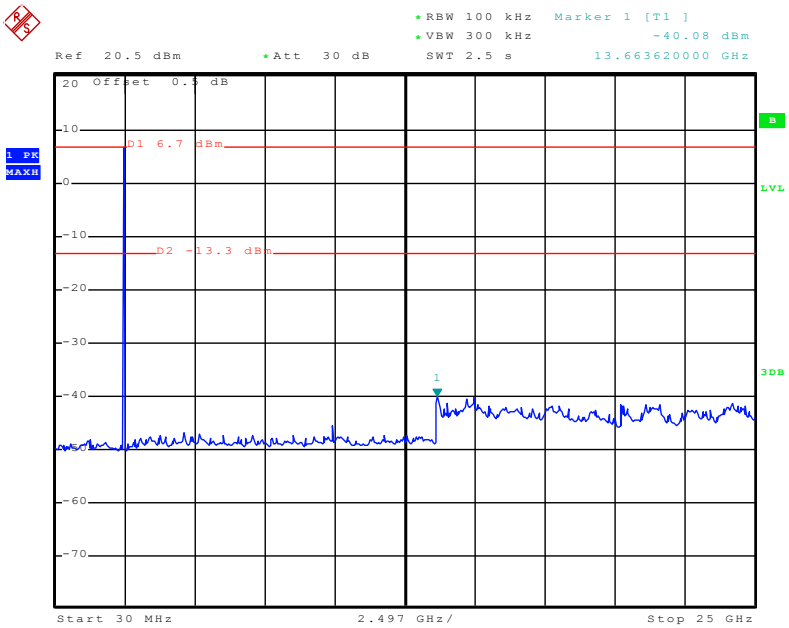
Middle channel



Date: 25.FEB.2016 17:51:36

30MHz~25GHz

Highest channel

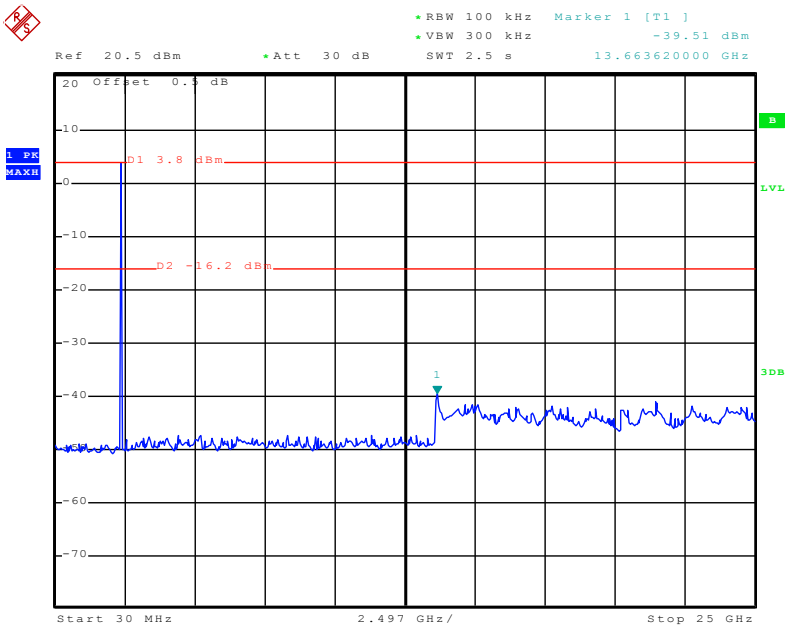


Date: 25.FEB.2016 17:52:48

30MHz~25GHz

π/4-DQPSK

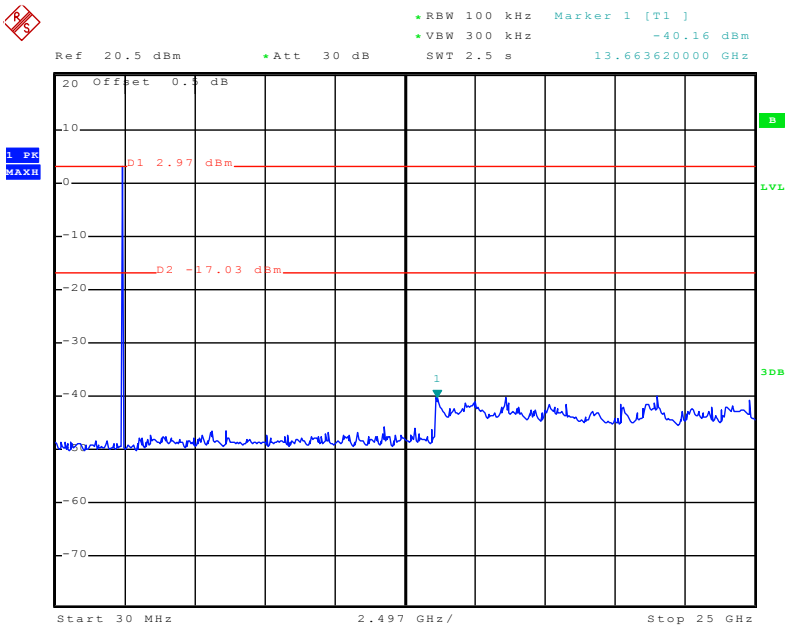
Lowest channel



Date: 25.FEB.2016 17:55:08

30MHz~25GHz

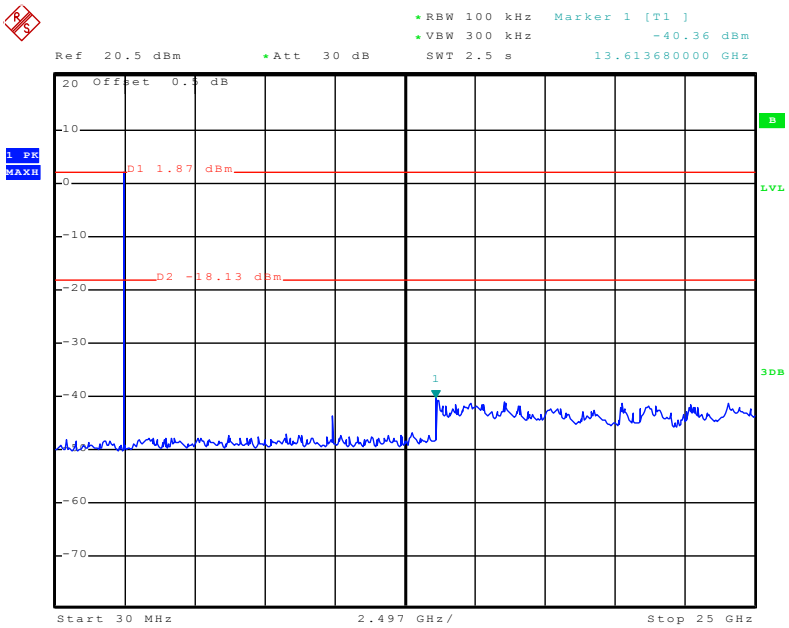
Middle channel



Date: 25.FEB.2016 17:54:39

30MHz~25GHz

Highest channel

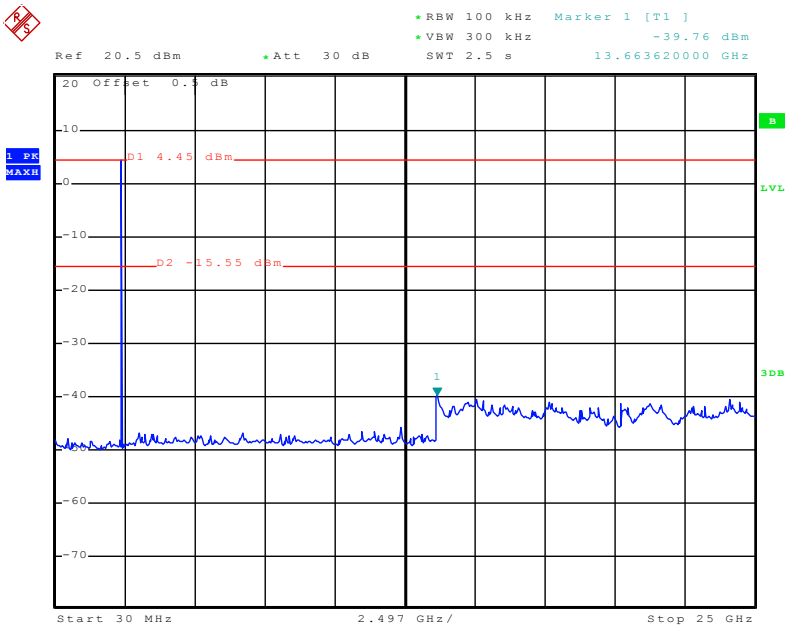


Date: 25.FEB.2016 17:53:39

30MHz~25GHz

8DPSK

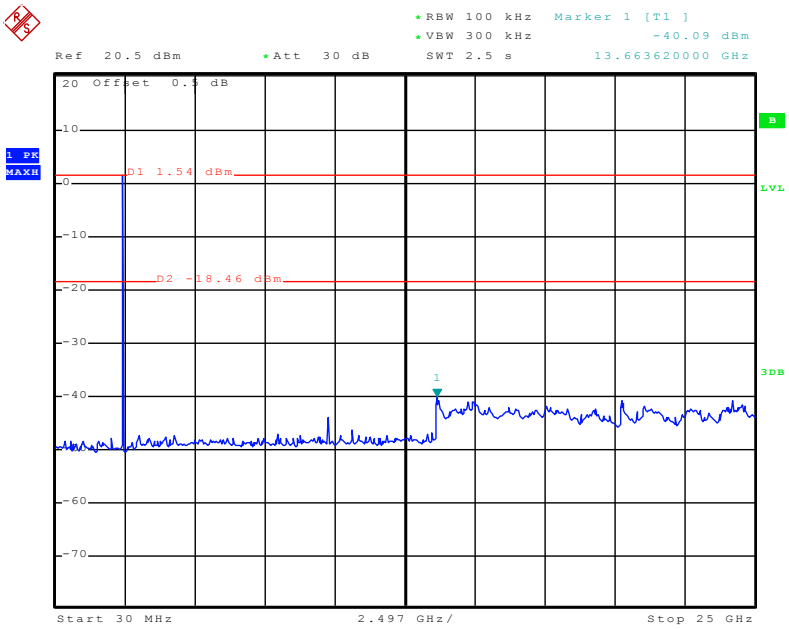
Lowest channel



Date: 25.FEB.2016 17:56:45

30MHz~25GHz

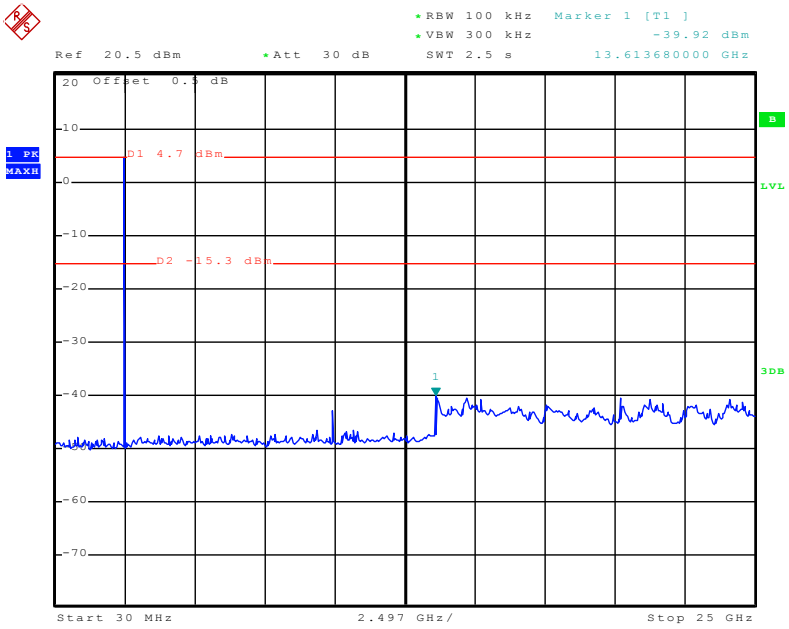
Middle channel



Date: 25.FEB.2016 17:57:54

30MHz~25GHz

Highest channel



30MHz~25GHz

7.1.2 Radiated Emission Method

Test Requirement:	FCC Part 15 C Section 15.209
Test Method:	ANSI C63.10: 2009
Test Frequency Range:	9 kHz to 25 GHz
Test site:	Measurement Distance: 3m

Receiver setup:

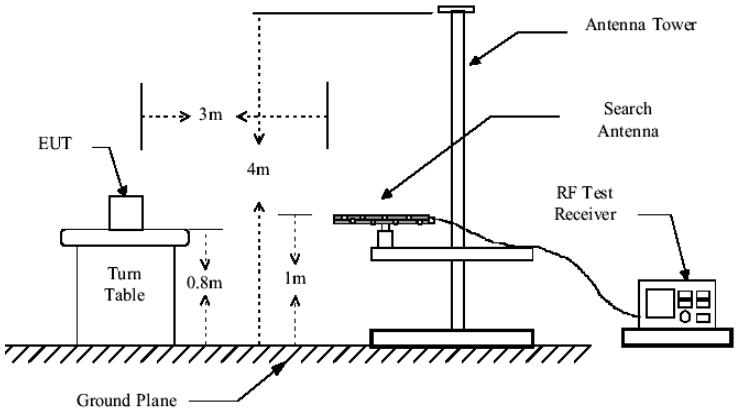
Frequency	Detector	RBW	VBW	Remark
30MHz-1GHz	Quasi-peak	120kHz	300kHz	Quasi-peak Value
Above 1GHz	Peak	1MHz	3MHz	Peak Value
	RMS	1MHz	3MHz	Average Value

Limit:

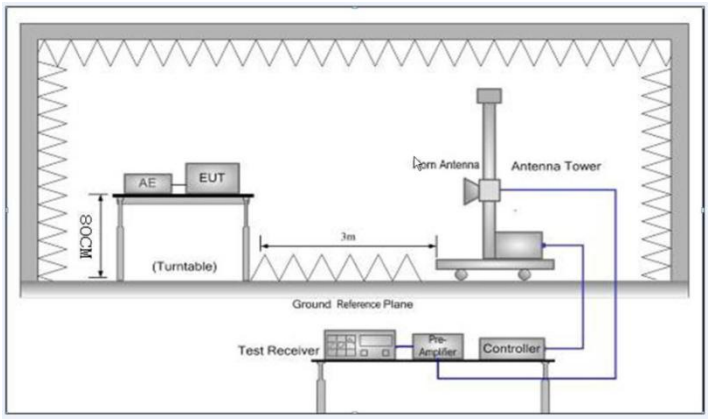
Frequency	Limit (dBuV/m @3m)	Remark
30MHz-88MHz	40.0	Quasi-peak Value
88MHz-216MHz	43.5	Quasi-peak Value
216MHz-960MHz	46.0	Quasi-peak Value
960MHz-1GHz	54.0	Quasi-peak Value
Above 1GHz	54.0	Average Value
	74.0	Peak Value

Test setup:

Below 1GHz



Above 1GHz



Test Procedure:	1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber. 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 Uncertainty:	±4.88 dB
Test Instruments:	Refer to section 5.7 for details
Test mode:	Non-hopping mode
Test results:	Pass

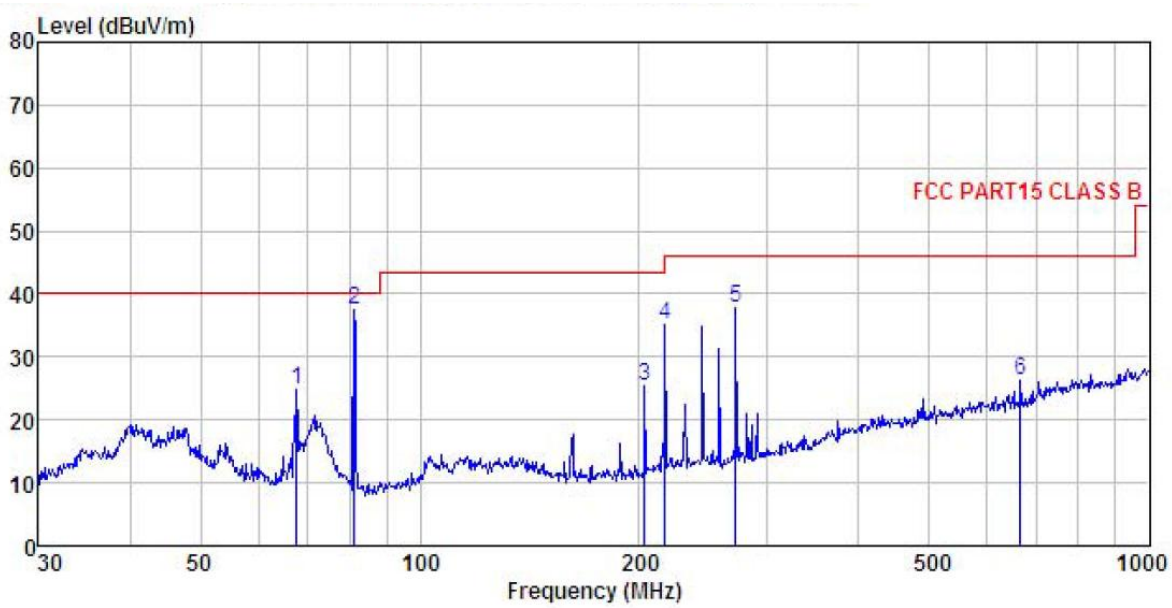
Remark:

1. *During the test, pre-scan the GFSK, π/4-DQPSK, 8DPSK modulation, and found the GFSK modulation is the worst case.*
2. *Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis is the worst case.*
3. *9 kHz to 30 MHz is noise floor, so only shows the data of above 30MHz in this report.*

Measurement data:

Below 1GHz

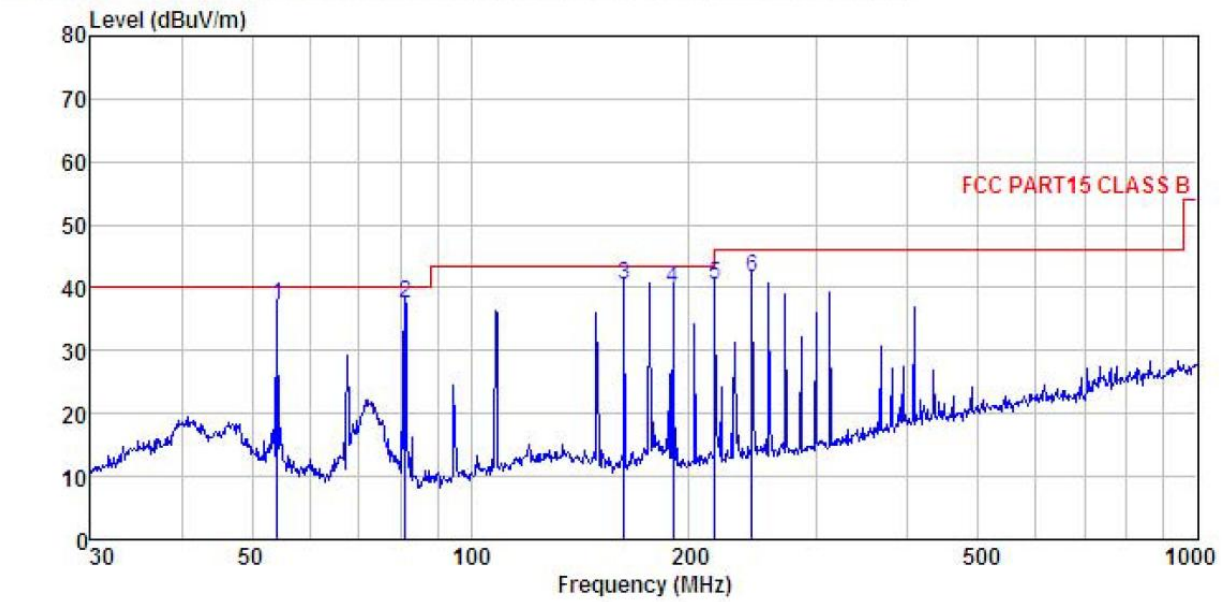
Vertical:



Site : 3m chamber
Condition : FCC PART15 CLASS B 3m VULB9163(30M3G) VERTICAL
EUT : Vehicle Module
Model : TREQr-5
Test mode : BT Mode
Power Rating : DC 12V
Environment : Temp:25.5'C Huni:55%
Test Engineer: YT
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	67.675	45.55	7.50	1.46	29.74	24.77	40.00	-15.23	QP
2	81.212	58.66	6.73	1.69	29.63	37.45	40.00	-2.55	QP
3	203.523	40.96	10.38	2.87	28.81	25.40	43.50	-18.10	QP
4	216.783	49.92	11.18	2.85	28.73	35.22	46.00	-10.78	QP
5	271.325	51.33	12.11	2.86	28.50	37.80	46.00	-8.20	QP
6	665.804	32.00	18.92	3.96	28.74	26.14	46.00	-19.86	QP

Horizontal:



Site : 3m chamber
Condition : FCC PART15 CLASS B 3m VULB9163(30M3G) HORIZONTAL
EUT : Vehicle Module
Model : TREQr-5
Test mode : BT Mode
Power Rating : DC 12V
Environment : Temp:25.5℃ Huni:55%
Test Engineer: YT
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	54.261	52.62	13.06	1.34	29.80	37.22	40.00	-2.78	QP
2	81.212	58.67	6.73	1.69	29.63	37.46	40.00	-2.54	QP
3	162.611	57.00	9.87	2.61	29.11	40.37	43.50	-3.13	QP
4	189.739	56.12	9.70	2.79	28.90	39.71	43.50	-3.79	QP
5	216.783	55.28	11.18	2.85	28.73	40.58	46.00	-5.42	QP
6	244.232	55.63	11.84	2.82	28.57	41.72	46.00	-4.28	QP

Above 1GHz:

Test channel:			Lowest		Level:		Peak	
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4804.00	46.05	35.99	10.57	40.24	52.37	74.00	-21.63	Vertical
4804.00	45.30	35.99	10.57	40.24	51.62	74.00	-22.38	Horizontal
Test channel:			Lowest		Level:		Average	
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4804.00	36.79	35.99	10.57	40.24	43.11	54.00	-10.89	Vertical
4804.00	35.67	35.99	10.57	40.24	41.99	54.00	-12.01	Horizontal

Test channel:			Middle		Level:		Peak	
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4882.00	44.63	36.38	10.66	40.15	51.52	74.00	-22.48	Vertical
4882.00	44.60	36.38	10.66	40.15	51.49	74.00	-22.51	Horizontal
Test channel:			Middle		Level:		Average	
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4882.00	34.67	36.38	10.66	40.15	41.56	54.00	-12.44	Vertical
4882.00	34.68	36.38	10.66	40.15	41.57	54.00	-12.43	Horizontal

Test channel:			Highest		Level:		Peak	
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4960.00	44.70	36.71	10.73	40.03	52.11	74.00	-21.89	Vertical
4960.00	45.39	36.71	10.73	40.03	52.80	74.00	-21.20	Horizontal
Test channel:			Highest		Level:		Average	
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4960.00	34.98	36.71	10.73	40.03	42.39	54.00	-11.61	Vertical
4960.00	35.15	36.71	10.73	40.03	42.56	54.00	-11.44	Horizontal

Remark:

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*