

# FCC PART 15.247

## TEST REPORT

For

### Zhongshan K-mate General Electronics Co., Ltd

Fuwan Industrial Zone, Fuwan South Road, Sunwen East Road, East District, Zhongshan, China

**FCC ID: WAD-BTC020**

<b>Report Type:</b> Original Report	<b>Product Type:</b> Bluetooth FM Transmitter
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<b>Report Number:</b> R1DG121204002-00	
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Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Dongguan).

## TABLE OF CONTENTS

<b>GENERAL INFORMATION.....</b>	<b>4</b>
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT).....	4
OBJECTIVE .....	4
RELATED SUBMITTAL(S)/GRANT(S).....	4
TEST METHODOLOGY .....	4
TEST FACILITY .....	5
<b>SYSTEM TEST CONFIGURATION.....</b>	<b>6</b>
DESCRIPTION OF TEST CONFIGURATION .....	6
EUT EXERCISE SOFTWARE .....	6
EQUIPMENT MODIFICATIONS .....	6
SUPPORT EQUIPMENT LIST AND DETAILS .....	6
EXTERNAL I/O CABLE.....	6
BLOCK DIAGRAM OF TEST SETUP .....	7
<b>SUMMARY OF TEST RESULTS .....</b>	<b>8</b>
<b>FCC §15.247 (i) &amp; §1.1307 (b) (1) &amp; §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE).....</b>	<b>9</b>
APPLICABLE STANDARD .....	9
<b>FCC §15.203 - ANTENNA REQUIREMENT.....</b>	<b>10</b>
APPLICABLE STANDARD .....	10
ANTENNA CONNECTOR CONSTRUCTION .....	10
<b>FCC §15.209, §15.205 &amp; §15.247(d) - SPURIOUS EMISSIONS.....</b>	<b>11</b>
APPLICABLE STANDARD .....	11
MEASUREMENT UNCERTAINTY .....	11
EUT SETUP .....	11
EMI TEST RECEIVER & SPECTRUM ANALYZER SETUP .....	12
TEST PROCEDURE .....	12
TEST EQUIPMENT LIST AND DETAILS.....	12
CORRECTED AMPLITUDE & MARGIN CALCULATION .....	13
TEST RESULTS SUMMARY .....	13
TEST DATA .....	13
<b>FCC §15.247(a) (1) - CHANNEL SEPARATION TEST .....</b>	<b>22</b>
APPLICABLE STANDARD .....	22
TEST EQUIPMENT LIST AND DETAILS.....	22
TEST PROCEDURE .....	22
TEST DATA .....	22
<b>FCC §15.247(a) (1) – 20 dB BANDWIDTH TESTING.....</b>	<b>29</b>
APPLICABLE STANDARD .....	29
TEST PROCEDURE .....	29
TEST EQUIPMENT LIST AND DETAILS.....	29
TEST DATA .....	29
<b>FCC §15.247(a) (1) (iii) - QUANTITY OF HOPPING CHANNEL TEST .....</b>	<b>36</b>
APPLICABLE STANDARD .....	36
TEST PROCEDURE .....	36
TEST EQUIPMENT LIST AND DETAILS.....	36

TEST DATA .....36

**FCC §15.247(a) (1) (iii) - TIME OF OCCUPANCY (DWELL TIME).....40**

    APPLICABLE STANDARD .....40

    TEST PROCEDURE .....40

    TEST EQUIPMENT LIST AND DETAILS.....40

    TEST DATA .....40

**FCC §15.247(b) (1) - PEAK OUTPUT POWER MEASUREMENT .....56**

    APPLICABLE STANDARD .....56

    TEST PROCEDURE .....56

    TEST EQUIPMENT LIST AND DETAILS.....56

    TEST DATA .....56

**FCC §15.247(d) - BAND EDGES TESTING .....62**

    APPLICABLE STANDARD .....62

    TEST PROCEDURE .....62

    TEST EQUIPMENT LIST AND DETAILS.....62

    TEST DATA .....62

## GENERAL INFORMATION

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### Product Description for Equipment under Test (EUT)

The Zhongshan K-mate General Electronics Co., Ltd.'s product, model number: *BTC020* (FCC ID: *WAD-BTC020*) or ("EUT") in this report is a *Bluetooth FM Transmitter*, which was measured approximately: 9.0 cm (L) x 6.5 cm (W) x 20.5 cm (H), rated input voltage: DC 12.0V-24.0V from battery.

*\* All measurement and test data in this report was gathered from production sample serial number: 121204002 (Assigned by BACL, Dongguan). The EUT was received on 2012-12-05.*

### Objective

This report is prepared on behalf of *Zhongshan K-mate General Electronics Co., Ltd.* in accordance with Part 2, Subpart J, Part 15, Subparts A, B and C of the Federal Communication Commissions rules

The tests were performed in order to determine the Bluetooth of EUT compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

### Related Submittal(s)/Grant(s)

FCC Part 15C DXX submissions with FCC ID: *WAD-BTC020* for FM transmitter.

### Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2009, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Dongguan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

The uncertainty of any RF tests which use conducted method measurement is  $\pm 0.96$  dB, the uncertainty of any radiation on emissions measurement is  $\pm 4.0$  dB

## **Test Facility**

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industrial Zone, Tangxia, Dongguan, Guangdong, China

Test site at Bay Area Compliance Laboratories Corp. (Dongguan) has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 02, 2012. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2009.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 273710. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

## SYSTEM TEST CONFIGURATION

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### Description of Test Configuration

The system was configured for testing in an engineering mode, which was provided by manufacturer.

### EUT Exercise Software

CSR Bluesuite 2.5.0 was performed in the test, which was provided by manufacturer.

### Equipment Modifications

No modification was made to the EUT tested.

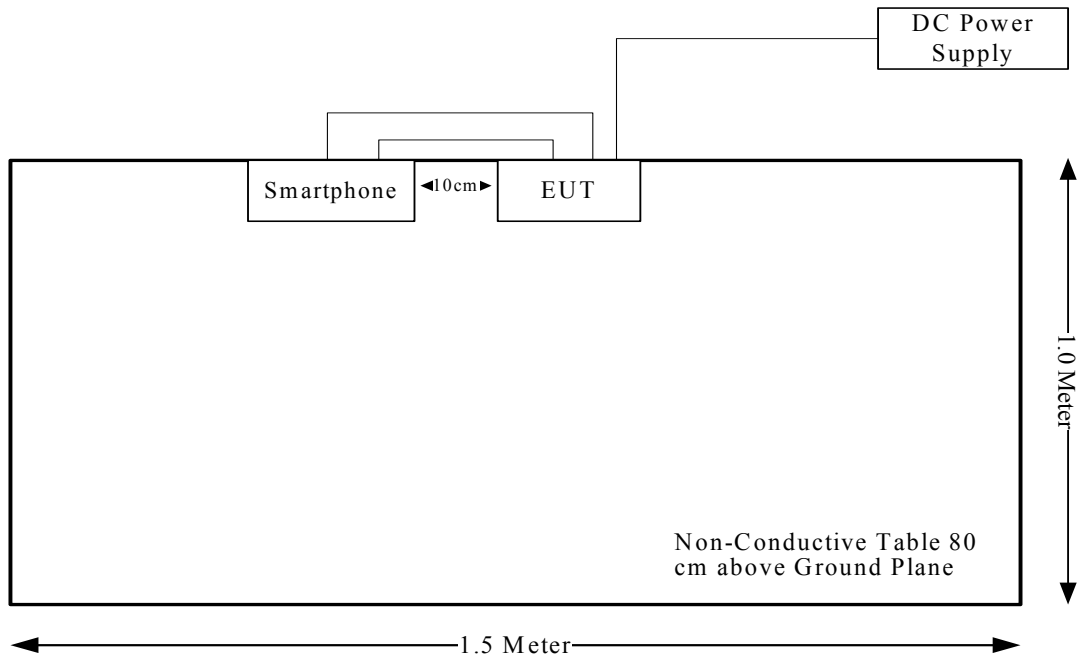
### Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Hisense	Smartphone	HS-U909	N/A

### External I/O Cable

Cable Description	Length (m)	From Port	To
Shielded Detachable USB cable	1.2	EUT	Smartphone
Shielded Detachable Audio cable	0.9	EUT	Smartphone

**Block Diagram of Test Setup**



## SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (i), §2.1091	Maximum Permissible exposure (MPE)	Compliance
§15.203	Antenna Requirement	Compliance
§15.207 (a)	Conducted Emissions	Not Applicable*
§15.205, §15.209, §15.247(d)	Radiated Emissions	Compliance
§15.247 (a)(1)	20 dB Bandwidth	Compliance
§15.247(a)(1)	Channel Separation Test	Compliance
§15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	Compliance
§15.247(a)(1)(iii)	Quantity of hopping channel Test	Compliance
§15.247(b)(1)	Peak Output Power Measurement	Compliance
§15.247(d)	Band Edges	Compliance

Not Applicable\*: the EUT was powered by DC battery from vehicle.



**FCC §15.247 (i) & §1.1307 (b) (1) & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)**

**Applicable Standard**

According to subpart 15.247(i) and subpart §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission’s guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

<b>(B) Limits for General Population/Uncontrolled Exposure</b>				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	Averaging Time (minutes)
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f <sup>2</sup> )	30
30–300	27.5	0.073	0.2	30
300–1500	/	/	f/1500	30
1500–100,000	/	/	1.0	30

f = frequency in MHz; \* = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

**Calculated Formulary:**

Predication of MPE limit at a given distance

$S = PG/4\pi R^2$  = power density (in appropriate units, e.g. mW/cm<sup>2</sup>);

P = power input to the antenna (in appropriate units, e.g., mW);

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

**Calculated Data:**

Mode	Frequency (MHz)	Antenna Gain		Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )
		(dBi)	(numeric)	(dBm)	(mW)			
BDR(GFSK)	2480	0	1	2.17	1.65	20	0.0003	1.0
EDR( $\pi/4$ -DQPSK)	2480	0	1	0.72	1.18	20	0.0002	1.0
EDR(8DPSK)	2441	0	1	1.24	1.33	20	0.0003	1.0

**Result:** The device meet FCC MPE at 20 cm distance

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## **FCC §15.203 - ANTENNA REQUIREMENT**

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### **Applicable Standard**

According to FCC § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. 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.

### **Antenna Connector Construction**

The EUT has an internal printed antenna permanently soldering on the printed circuit boards, which complied with 15.203, the maximum gain is 0 dBi, please refer to the internal photos.

**Result:** Compliance.

## FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

### Applicable Standard

FCC §15.247 (d); §15.209; §15.205;

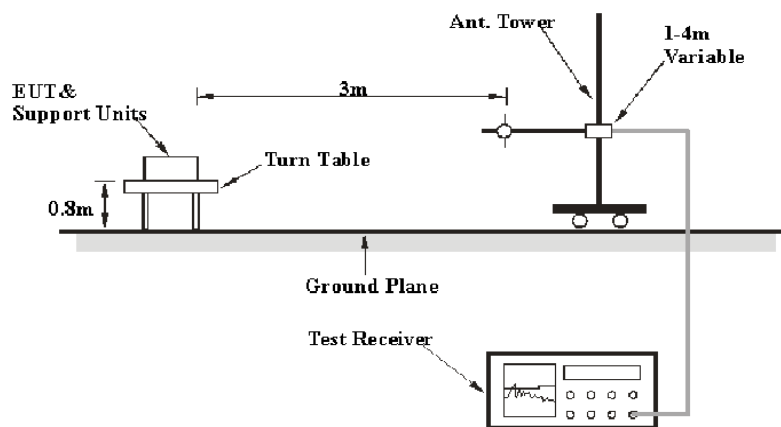
### Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

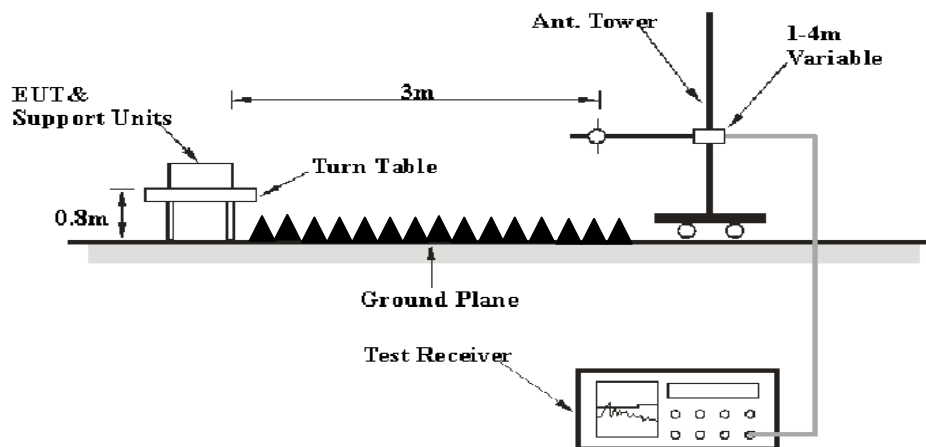
Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at Bay Area Compliance Laboratories Corp. (Dongguan) is 4.0 dB(k=2, 95% level of confidence), and the uncertainty will not be taken into consideration for all the test data recorded in the report.

### EUT Setup

#### Below 1GHz:



#### Above 1GHz:



The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.4-2009. The specification used was the FCC 15.209, and FCC 15.247 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

### EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

<i>Frequency Range</i>	<i>RBW</i>	<i>Video BW</i>	<i>Detector</i>
30 MHz – 1000 MHz	100 kHz	300 kHz	QP
1000 MHz – 25 GHz	1 MHz	3 MHz	PK
1000 MHz – 25 GHz	1 MHz	10 Hz	Ave.

### Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz - 1 GHz, peak and Average detection modes for frequencies above 1 GHz.

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	100035	2012-05-14	2013-05-13
Sunol Sciences	Hybrid Antennas	JB3	A060611-1	2011-09-06	2013-09-05
HP	Pre-amplifier	8447E	2434A02181	2012-10-08	2013-10-07
R&S	Spectrum Analyzer	FSEM 30	DE31388	2012-03-15	2013-03-14
ETS-LINDGREN	Horn Antenna	3115	000 527 35	2012-09-06	2014-09-05
PICOSECOND	Amplifier	5828	2708	N/A	N/A

## Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

## Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Subpart C, and section 15.205, 15.209 and 15.247, with the worst margin reading of:

**3.13 dB at 9764 MHz in the Vertical polarization**

## Test Data

### Environmental Conditions

Temperature:	22.8°C
Relative Humidity:	54%
ATM Pressure:	100.9kPa

*The testing was performed by Leon Chen on 2012-12-10.*

*Test Mode: Transmitting*

*BDR (GFSK):*

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBµV/m)	FCC 15.247	
	Reading (dBµV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB)				Limit (dBµV/m)	Margin (dB)
Low Channel: 2402(MHz)									
2402	40.7	AV	H	25.65	3.90	8.48	61.77	N/A	N/A
2402	67.42	PK	H	25.65	3.90	8.48	88.49	N/A	N/A
2402	43.21	AV	V	25.65	3.90	8.48	64.28	N/A	N/A
2402	73.31	PK	V	25.65	3.90	8.48	94.38	N/A	N/A
9608	15.68	AV	V	32.96	8.75	6.77	50.62	54.00	3.38*
7206	16.45	AV	H	34.09	6.50	7.02	50.02	54.00	3.98*
9608	33.21	PK	V	32.96	8.75	6.77	68.15	74.00	5.85
4804	18.63	AV	V	30.59	4.67	7.38	46.51	54.00	7.49
7206	31.43	PK	H	34.09	6.50	7.02	65.00	74.00	9.00
4804	34.36	PK	V	30.59	4.67	7.38	62.24	74.00	11.76
287.64	38.5	QP	H	13.88	2.04	21.51	32.91	46.00	13.09
1958.63	16.54	AV	V	24.52	3.53	9.09	35.50	54.00	18.50
2390	14.56	AV	V	25.61	3.84	8.55	35.46	54.00	18.54
1958.63	31.25	PK	V	24.52	3.53	9.09	50.21	74.00	23.79
2390	26.32	PK	V	25.61	3.84	8.55	47.22	74.00	26.78
Middle Channel: 2441(MHz)									
2441	40.26	AV	H	25.75	3.99	8.32	61.68	N/A	N/A
2441	66.13	PK	H	25.75	3.99	8.32	88.55	N/A	N/A
2441	43.07	AV	V	25.75	3.99	8.32	64.49	N/A	N/A
2441	72.2	PK	V	25.75	3.99	8.32	93.62	N/A	N/A
9764	15.57	AV	V	33.33	8.58	6.61	50.87	54.00	3.13*
7323	16.46	AV	H	34.38	6.72	7.05	50.51	54.00	3.49*
9764	34.23	PK	V	33.33	8.58	6.61	69.53	74.00	4.47
4882	19.54	AV	V	30.79	4.75	7.31	47.77	54.00	6.23
7323	31.06	PK	H	34.38	6.72	7.05	65.11	74.00	8.89
4882	35.36	PK	V	30.79	4.75	7.31	63.59	74.00	10.41
324.21	38.4	QP	H	14.60	2.16	21.58	33.58	46.00	12.42
2036.26	16.75	AV	V	24.69	3.67	9.06	36.05	54.00	17.95
1526.89	17.05	AV	H	23.65	3.04	9.52	34.22	54.00	19.78
2036.26	31.57	PK	V	24.69	3.67	9.06	50.87	74.00	23.13
1526.89	32.23	PK	H	23.65	3.04	9.52	49.40	74.00	24.60
High Channel: 2480(MHz)									
2480	39.2	AV	H	25.85	3.82	8.17	60.70	N/A	N/A
2480	64.97	PK	H	25.85	3.82	8.17	86.47	N/A	N/A
2480	43.49	AV	V	25.85	3.82	8.17	64.99	N/A	N/A
2480	72.49	PK	V	25.85	3.82	8.17	93.99	N/A	N/A
7440	16.47	AV	H	34.66	6.95	7.28	50.80	54.00	3.20*
9920	15.52	AV	V	33.71	8.41	7.29	50.35	54.00	3.65*
9920	33.47	PK	V	33.71	8.41	7.29	68.30	74.00	5.70
4960	19.74	AV	V	31.00	4.70	7.23	48.21	54.00	5.79
7440	30.14	PK	H	34.66	6.95	7.28	64.47	74.00	9.53
4960	35.96	PK	V	31.00	4.70	7.23	64.43	74.00	9.57
338.12	38.4	QP	H	14.79	2.19	21.62	33.76	46.00	12.24
2483.5	15.63	AV	V	25.86	3.80	8.10	37.19	54.00	16.81
1268.67	16.57	AV	V	23.00	2.65	9.41	32.81	54.00	21.19
2483.5	28.75	PK	V	25.86	3.80	8.10	50.31	74.00	23.69
1268.67	31.62	PK	V	23.00	2.65	9.41	47.86	74.00	26.14

\*Within measurement uncertainty!

EDR ( $\pi/4$ -DQPSK):

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dB $\mu$ V/m)	FCC 15.247	
	Reading (dB $\mu$ V)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB)				Limit (dB $\mu$ V/m)	Margin (dB)
Low Channel: 2402(MHz)									
2402	40.52	AV	H	25.65	3.90	8.48	61.59	N/A	N/A
2402	67.24	PK	H	25.65	3.90	8.48	88.31	N/A	N/A
2402	43.56	AV	V	25.65	3.90	8.48	64.63	N/A	N/A
2402	74.05	PK	V	25.65	3.90	8.48	95.12	N/A	N/A
9608	15.57	AV	V	32.96	8.75	6.77	50.51	54.00	3.49*
7206	16.74	AV	H	34.09	6.50	7.02	50.31	54.00	3.69*
9608	33.36	PK	V	32.96	8.75	6.77	68.30	74.00	5.70
4804	18.95	AV	V	30.59	4.67	7.38	46.83	54.00	7.17
7206	31.25	PK	H	34.09	6.50	7.02	64.82	74.00	9.18
4804	34.68	PK	V	30.59	4.67	7.38	62.56	74.00	11.44
286.14	36.4	QP	H	13.83	2.05	21.51	30.77	46.00	15.23
2390	14.93	AV	V	25.61	3.84	8.55	35.83	54.00	18.17
1624.52	16.87	AV	V	23.85	3.18	9.09	34.81	54.00	19.19
1624.52	32.04	PK	V	23.85	3.18	9.09	49.98	74.00	24.02
2390	26.85	PK	V	25.61	3.84	8.55	47.75	74.00	26.25
Middle Channel: 2441(MHz)									
2441	41.21	AV	H	25.75	3.99	8.32	62.63	N/A	N/A
2441	66.58	PK	H	25.75	3.99	8.32	88.00	N/A	N/A
2441	43.24	AV	V	25.75	3.99	8.32	64.66	N/A	N/A
2441	73.05	PK	V	25.75	3.99	8.32	94.47	N/A	N/A
7323	16.75	AV	H	34.38	6.72	7.05	50.80	54.00	3.20*
9764	15.35	AV	V	33.33	8.58	6.61	50.65	54.00	3.35*
9764	34.42	PK	V	33.33	8.58	6.61	69.72	74.00	4.28
4882	19.63	AV	V	30.79	4.75	7.31	47.86	54.00	6.14
7323	31.26	PK	H	34.38	6.72	7.05	65.31	74.00	8.69
4882	34.87	PK	V	30.79	4.75	7.31	63.10	74.00	10.90
305.21	37.8	QP	H	14.22	2.16	21.53	32.65	46.00	13.35
1962.09	16.72	AV	V	24.52	3.53	9.06	35.71	54.00	18.29
1436.74	16.51	AV	H	23.44	2.85	9.52	33.28	54.00	20.72
1962.09	31.53	PK	V	24.52	3.53	9.06	50.52	74.00	23.48
1436.74	31.53	PK	H	23.44	2.85	9.52	48.30	74.00	25.70
High Channel: 2480(MHz)									
2480	40.21	AV	H	25.85	3.82	8.17	61.71	N/A	N/A
2480	65.41	PK	H	25.85	3.82	8.17	86.91	N/A	N/A
2480	43.42	AV	V	25.85	3.82	8.17	64.92	N/A	N/A
2480	72.89	PK	V	25.85	3.82	8.17	94.39	N/A	N/A
7440	16.42	AV	H	34.66	6.95	7.28	50.75	54.00	3.25*
9920	12.48	AV	V	36.71	8.41	7.29	50.31	54.00	3.69*
9920	31.06	PK	V	36.71	8.41	7.29	68.89	74.00	5.11
4960	19.86	AV	V	31.00	4.70	7.23	48.33	54.00	5.67
7440	30.35	PK	H	34.66	6.95	7.28	64.68	74.00	9.32
4960	36.02	PK	V	31.00	4.70	7.23	64.49	74.00	9.51
387.95	39.1	QP	H	15.87	2.38	21.74	35.61	46.00	10.39
2483.5	15.43	AV	V	25.86	3.80	8.10	36.99	54.00	17.01
1326.74	16.37	AV	V	23.15	2.75	9.41	32.86	54.00	21.14
2483.5	28.76	PK	V	25.86	3.80	8.10	50.32	74.00	23.68
1326.74	31.53	PK	V	23.15	2.75	9.41	48.02	74.00	25.98

\*Within measurement uncertainty!

EDR (8DPSK):

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBµV/m)	FCC 15.247	
	Reading (dBµV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB)				Limit (dBµV/m)	Margin (dB)
Low Channel: 2402(MHz)									
2402	41.01	AV	H	25.65	3.90	8.48	62.08	N/A	N/A
2402	67.14	PK	H	25.65	3.90	8.48	88.21	N/A	N/A
2402	43.42	AV	V	25.65	3.90	8.48	64.49	N/A	N/A
2402	73.75	PK	V	25.65	3.90	8.48	94.82	N/A	N/A
7206	16.75	AV	H	34.09	6.50	7.02	50.32	54.00	3.68*
9608	15.34	AV	V	32.96	8.75	6.77	50.28	54.00	3.72*
9608	34.05	PK	V	32.96	8.75	6.77	68.99	74.00	5.01
4804	18.41	AV	V	30.59	4.67	7.38	46.29	54.00	7.71
7206	31.65	PK	H	34.09	6.50	7.02	65.22	74.00	8.78
4804	34.26	PK	V	30.59	4.67	7.38	62.14	74.00	11.86
326.42	37.5	QP	H	14.63	2.16	21.59	32.70	46.00	13.30
2390	14.25	AV	V	25.61	3.84	8.55	35.15	54.00	18.85
1756.32	16.17	AV	V	24.11	3.37	9.09	34.56	54.00	19.44
1756.32	30.21	PK	V	24.11	3.37	9.09	48.60	74.00	25.40
2390	26.53	PK	V	25.61	3.84	8.55	47.43	74.00	26.57
Middle Channel: 2441(MHz)									
2441	41.52	AV	H	25.75	3.99	8.32	62.94	N/A	N/A
2441	67.43	PK	H	25.75	3.99	8.32	88.85	N/A	N/A
2441	43.36	AV	V	25.75	3.99	8.32	64.78	N/A	N/A
2441	72.85	PK	V	25.75	3.99	8.32	94.27	N/A	N/A
9764	15.43	AV	V	33.33	8.58	6.61	50.73	54.00	3.27*
7323	16.42	AV	H	34.38	6.72	7.05	50.47	54.00	3.53*
9764	33.32	PK	V	33.33	8.58	6.61	68.62	74.00	5.38
4882	19.63	AV	V	30.79	4.75	7.31	47.86	54.00	6.14
7323	31.36	PK	H	34.38	6.72	7.05	65.41	74.00	8.59
4882	35.76	PK	V	30.79	4.75	7.31	63.99	74.00	10.01
295.38	37.98	QP	H	13.95	2.08	21.52	32.49	46.00	13.51
2124.35	18.75	AV	V	24.92	3.67	9.06	38.28	54.00	15.72
1426.57	16.68	AV	H	23.41	2.84	9.52	33.41	54.00	20.59
2124.35	32.26	PK	V	24.92	3.67	9.06	51.79	74.00	22.21
1426.57	31.24	PK	H	23.41	2.84	9.52	47.97	74.00	26.03
High Channel: 2480(MHz)									
2480	39.2	AV	H	25.85	3.82	8.17	60.70	N/A	N/A
2480	64.97	PK	H	25.85	3.82	8.17	86.47	N/A	N/A
2480	43.49	AV	V	25.85	3.82	8.17	64.99	N/A	N/A
2480	72.49	PK	V	25.85	3.82	8.17	93.99	N/A	N/A
7440	16.47	AV	H	34.66	6.95	7.28	50.80	54.00	3.20*
9920	15.52	AV	V	33.71	8.41	7.29	50.35	54.00	3.65*
9920	33.47	PK	V	33.71	8.41	7.29	68.30	74.00	5.70
4960	19.74	AV	V	31.00	4.70	7.23	48.21	54.00	5.79
7440	30.14	PK	H	34.66	6.95	7.28	64.47	74.00	9.53
4960	35.96	PK	V	31.00	4.70	7.23	64.43	74.00	9.57
315.56	39.26	QP	H	14.43	2.19	21.56	34.32	46.00	11.68
2483.5	15.63	AV	V	25.86	3.80	8.10	37.19	54.00	16.81
1268.67	16.57	AV	V	23.00	2.65	9.41	32.81	54.00	21.19
2483.5	28.75	PK	V	25.86	3.80	8.10	50.31	74.00	23.69
1268.67	31.62	PK	V	23.00	2.65	9.41	47.86	74.00	26.14

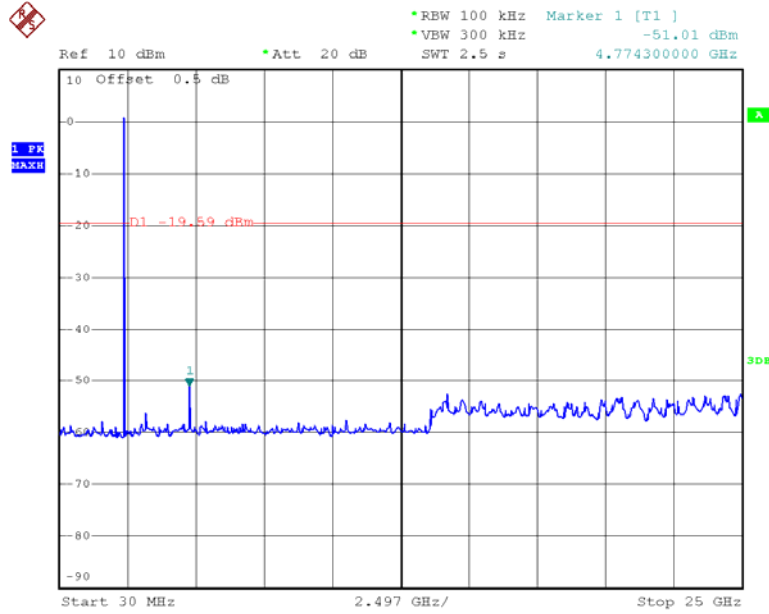
\*Within measurement uncertainty!



### Conducted Spurious Emissions at Antenna Port

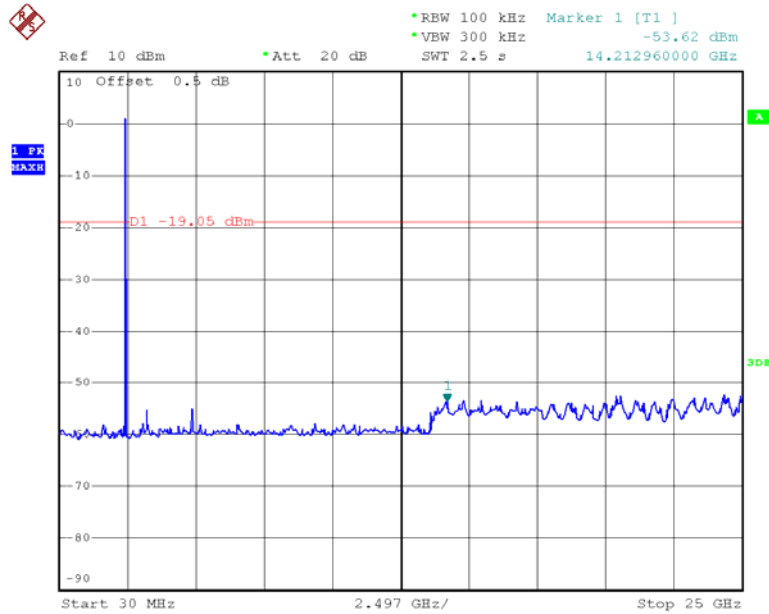
BDR- GFSK:

#### Low Channel



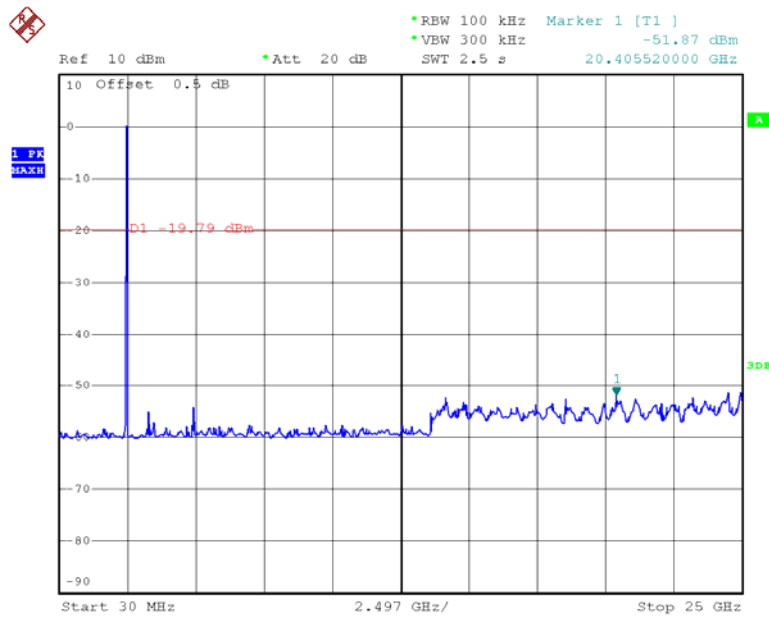
Date: 10.DEC.2012 11:31:55

#### Middle Channel



Date: 10.DEC.2012 11:32:50

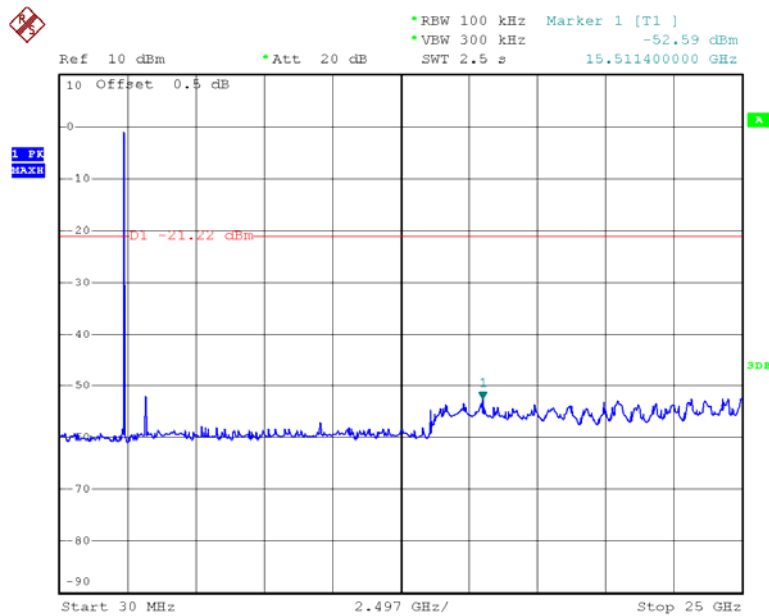
### High Channel



Date: 10.DEC.2012 11:34:11

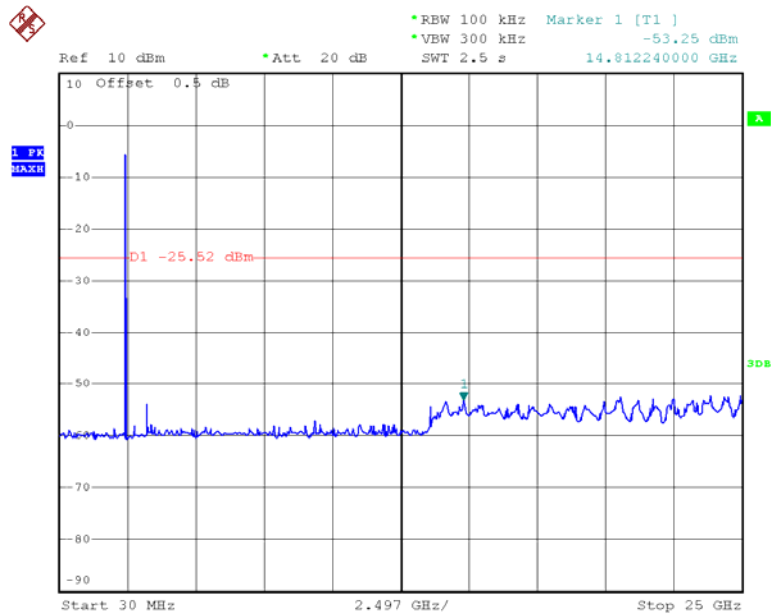
### EDR- $\pi/4$ -DQPSK:

### Low Channel



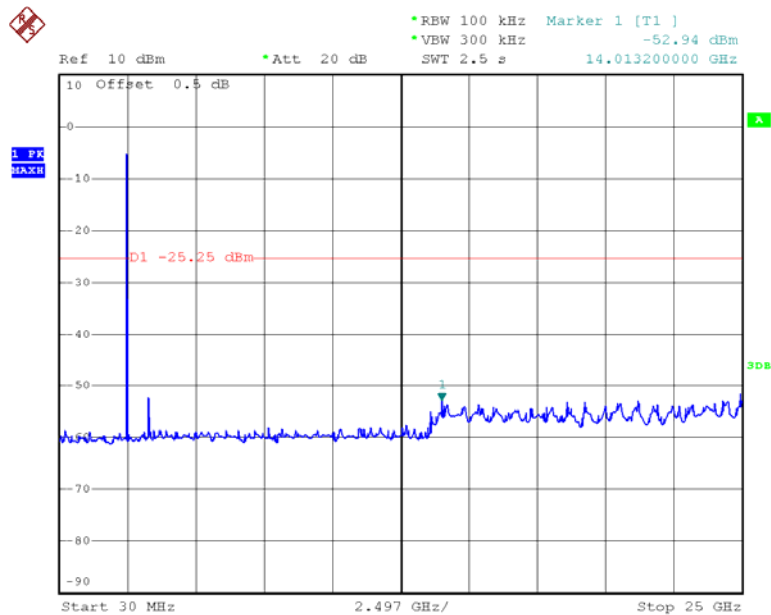
Date: 10.DEC.2012 13:42:46

### Middle Channel



Date: 10.DEC.2012 13:41:39

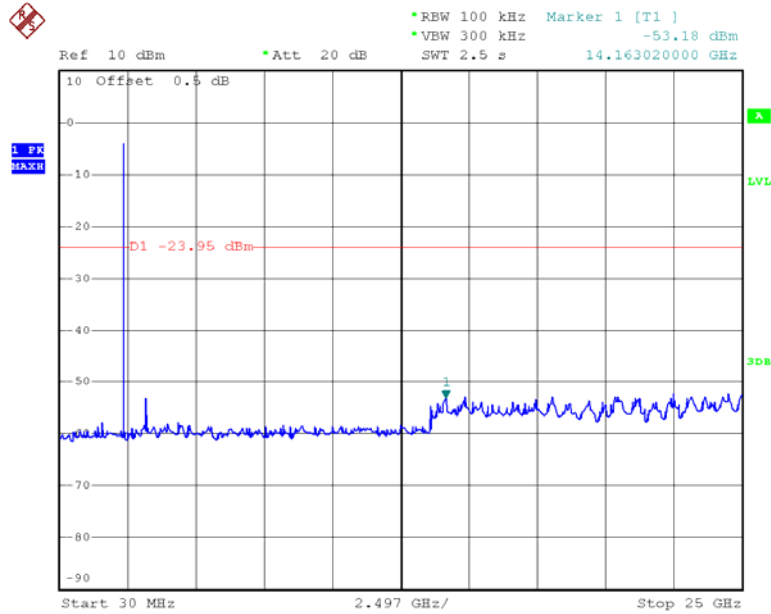
### High Channel



Date: 10.DEC.2012 13:40:44

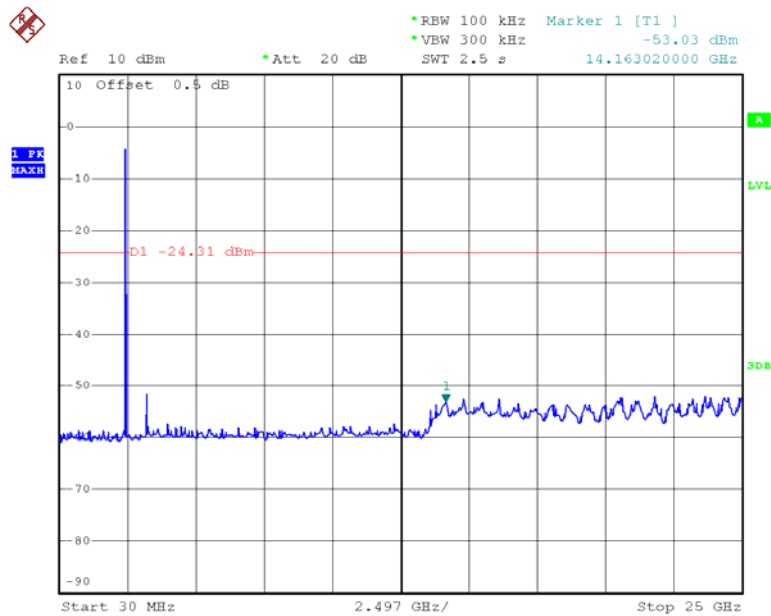
**EDR-8DPSK:**

**Low Channel**



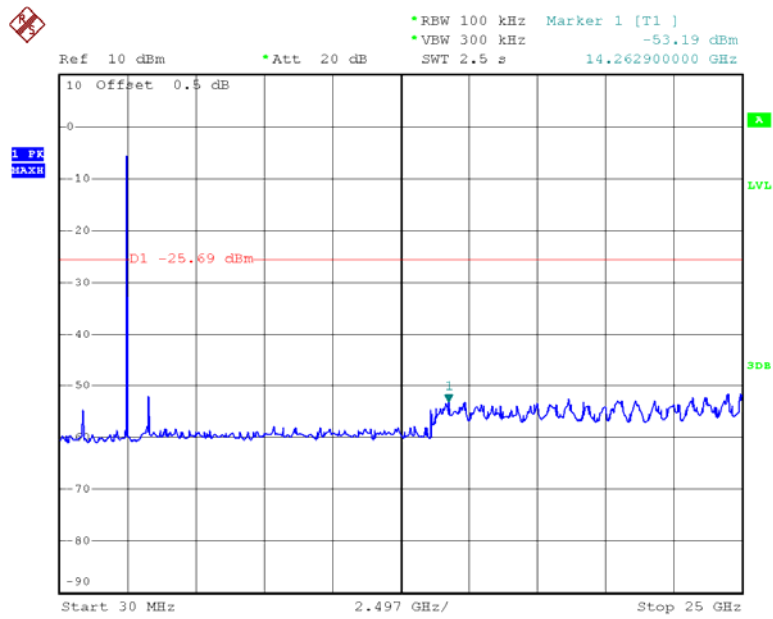
Date: 10.DEC.2012 14:11:58

**Middle Channel**



Date: 10.DEC.2012 14:11:05

### High Channel



Date: 10.DEC.2012 14:09:54

## FCC §15.247(a) (1) - CHANNEL SEPARATION TEST

### Applicable Standard

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.50 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater provided the systems operate with an output power no greater than 125 mW.

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Spectrum Analyzer	FSP38	100478	2012-5-14	2013-5-13

### Test Procedure

1. Set the EUT in transmitting mode, spectrum Bandwidth was set at 100 kHz, maxhold the channel.
2. Set the adjacent channel of the EUT maxhold another trace
3. Measure the channel separation.

### Test Data

#### Environmental Conditions

<b>Temperature:</b>	22.8 °C
<b>Relative Humidity:</b>	54 %
<b>ATM Pressure:</b>	100.9kPa

\* The testing was performed by Leon Chen on 2012-12-10.

**Test Result:** Compliance.

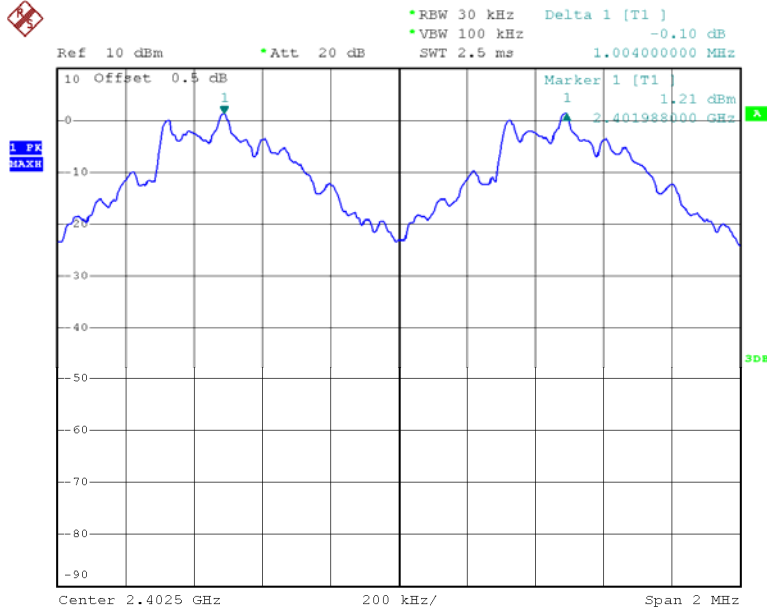
Please refer to following tables and plots

Test Mode: Transmitting

Mode	Channel	Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)	Result
BDR Mode (GFSK)	Low	2402	1.004	0.61	Pass
	Adjacent	2403			
	Middle	2441	1.004	0.61	Pass
	Adjacent	2442			
	High	2480	1.004	0.61	Pass
	Adjacent	2479			
EDR Mode ( $\pi/4$ -DQPSK)	Low	2402	1.004	0.82	Pass
	Adjacent	2403			
	Middle	2441	1.008	0.81	Pass
	Adjacent	2442			
	High	2480	1.004	0.81	Pass
	Adjacent	2479			
EDR Mode (8DPSK)	Low	2402	1.004	0.84	Pass
	Adjacent	2403			
	Middle	2441	1.004	0.84	Pass
	Adjacent	2442			
	High	2480	1.008	0.84	Pass
	Adjacent	2479			

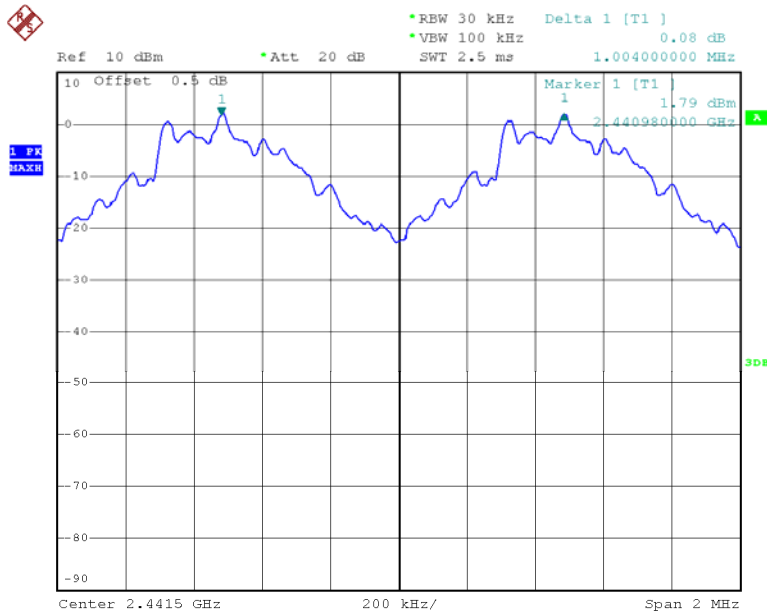
**BDR- GFSK:**

**Low Channel**



Date: 10.DEC.2012 11:37:06

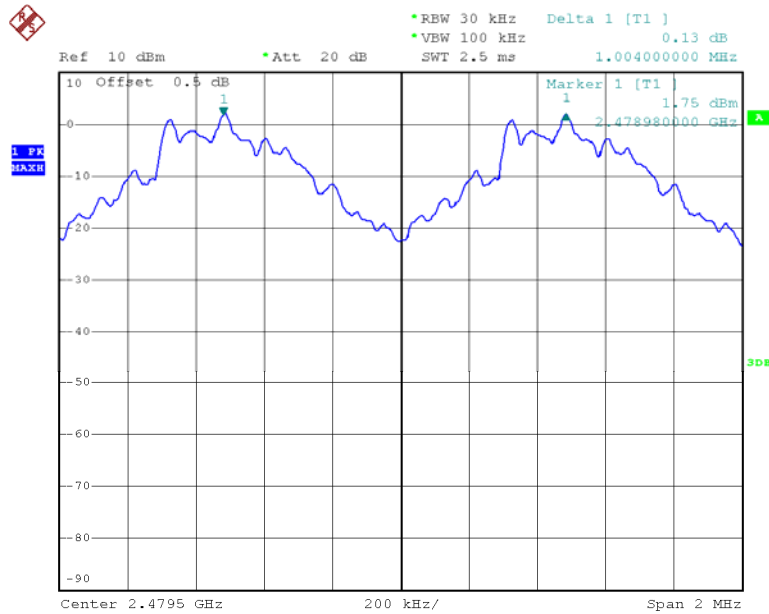
**Middle Channel**



Date: 10.DEC.2012 11:36:19



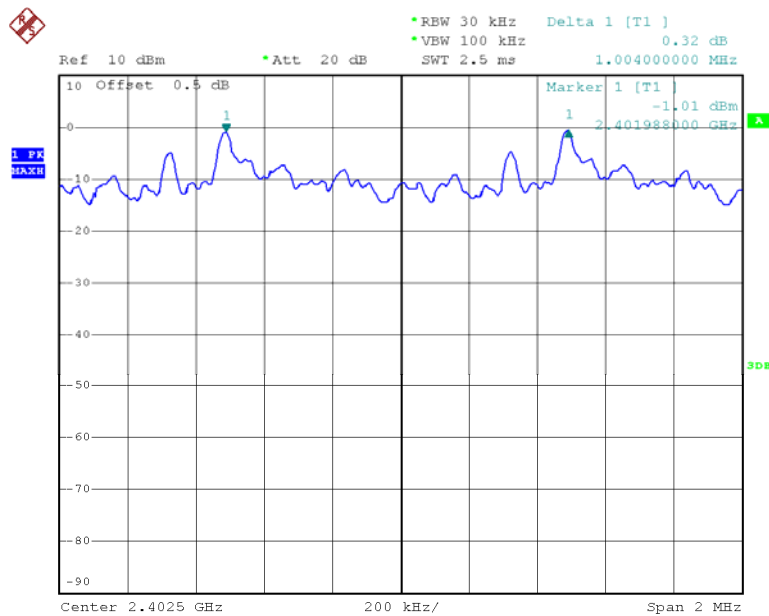
### High Channel



Date: 10.DEC.2012 11:35:35

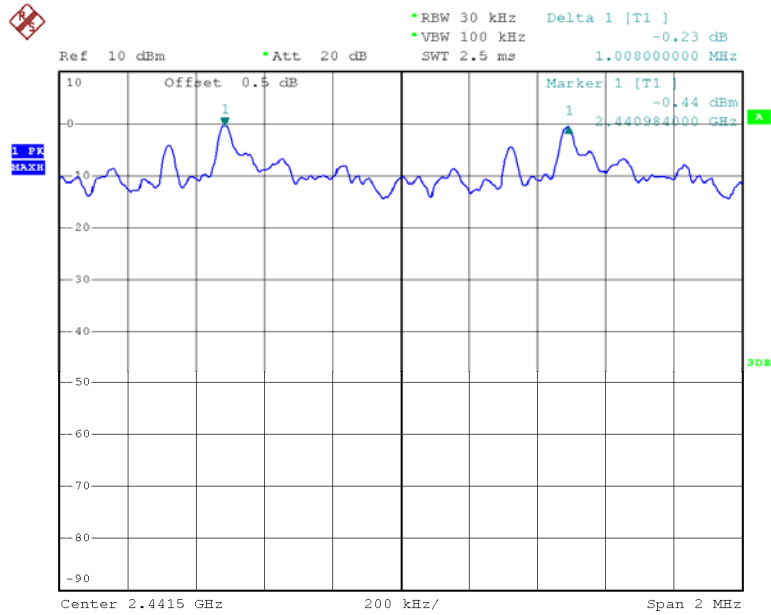
### EDR Mode ( $\pi/4$ -DQPSK):

### Low Channel



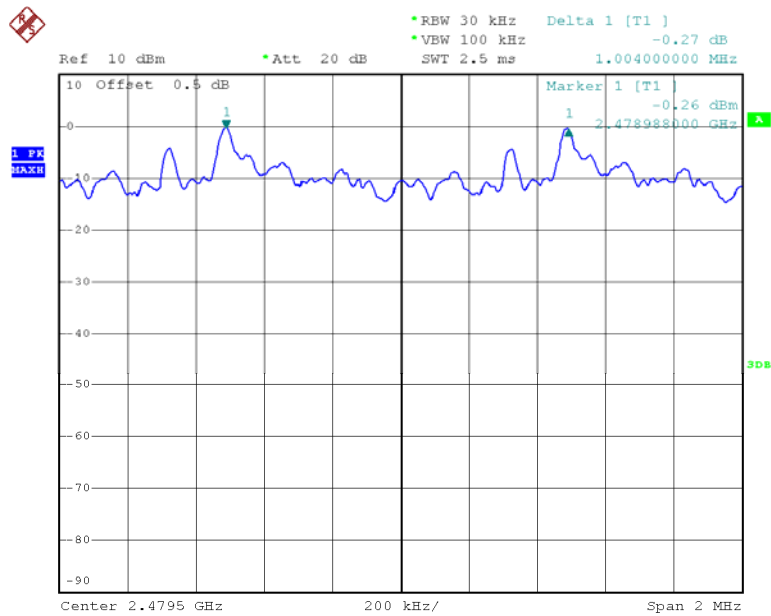
Date: 10.DEC.2012 11:51:37

### Middle Channel



Date: 10.DEC.2012 11:51:01

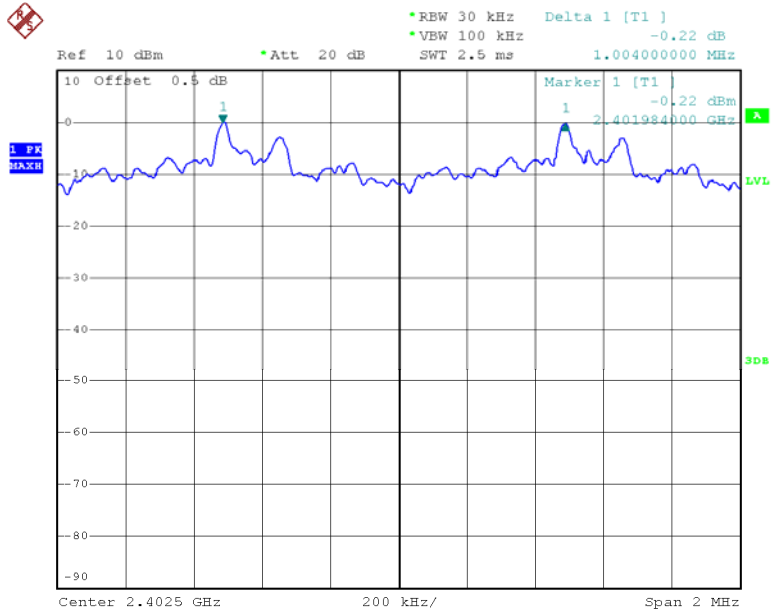
### High Channel



Date: 10.DEC.2012 11:50:21

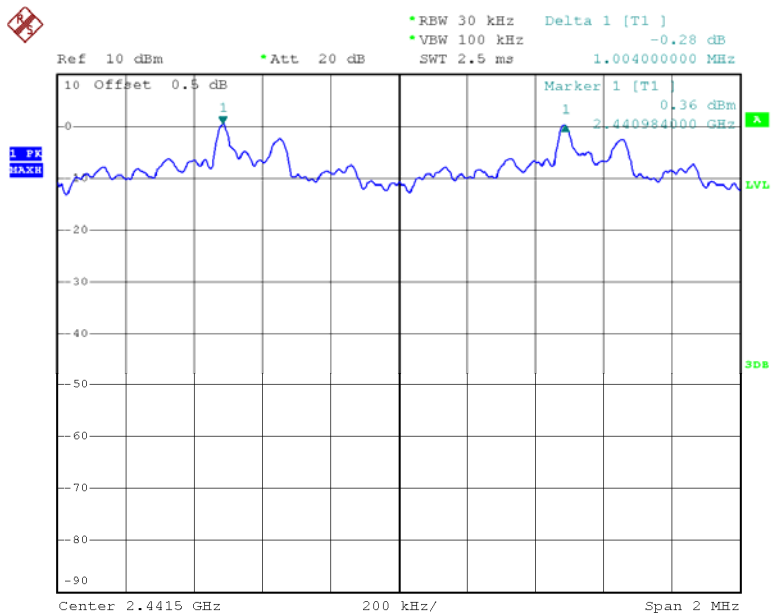
**EDR Mode (8DPSK):**

**Low Channel**



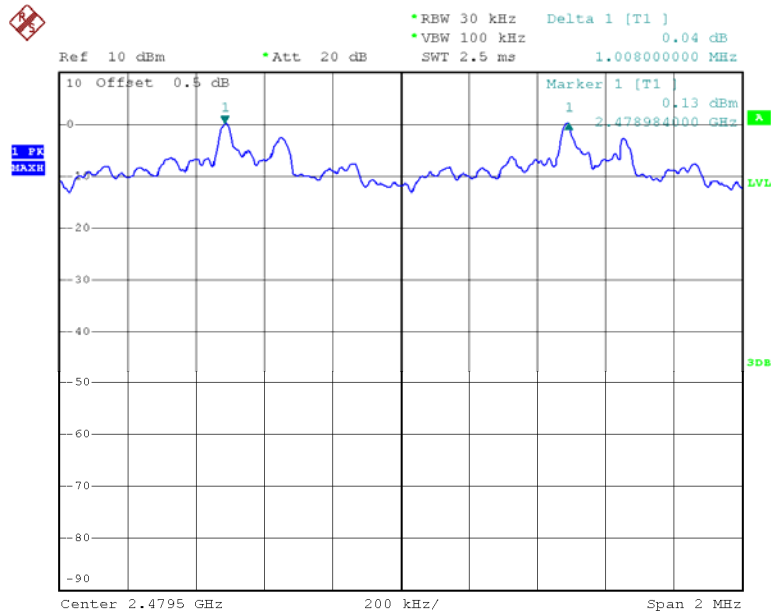
Date: 10.DEC.2012 14:00:57

**Middle Channel**



Date: 10.DEC.2012 14:01:38

### High Channel



Date: 10.DEC.2012 14:02:14

## FCC §15.247(a) (1) – 20 dB BANDWIDTH TESTING

### Applicable Standard

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.

### Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on the test table without connection to measurement instrument. Turn on the EUT. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Spectrum Analyzer	FSP38	100478	2012-5-14	2013-5-13

### Test Data

#### Environmental Conditions

<b>Temperature:</b>	22.8 °C
<b>Relative Humidity:</b>	54 %
<b>ATM Pressure:</b>	100.9kPa

\* The testing was performed by Leon Chen on 2012-12-10.

**Test Result:** Compliance.

Please refer to following tables and plots

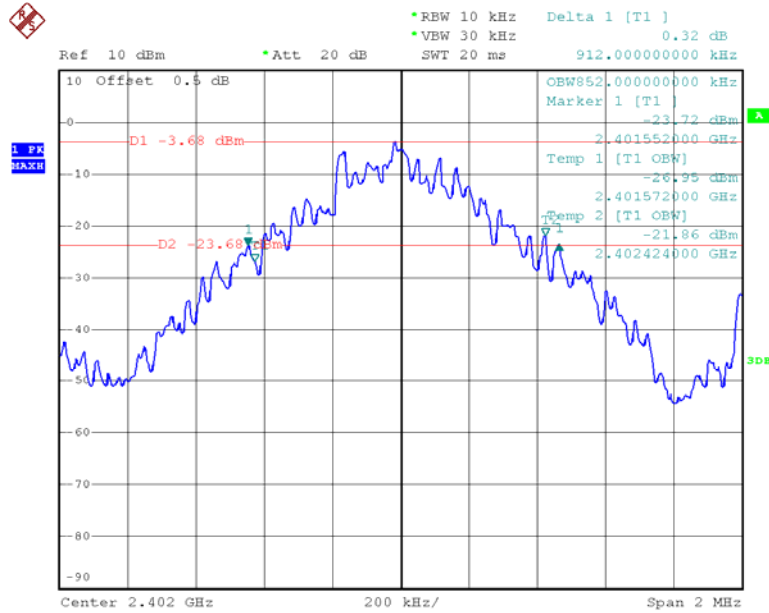
*Test Mode: Transmitting*

Mode	Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
BDR Mode (GFSK)	Low	2402	0.912
	Middle	2441	0.920
	High	2480	0.916
EDR Mode ( $\pi/4$ -DQPSK)	Low	2402	1.224
	Middle	2441	1.220
	High	2480	1.220
EDR Mode (8DPSK)	Low	2402	1.264
	Middle	2441	1.264
	High	2480	1.264

Please refer to the following plots.

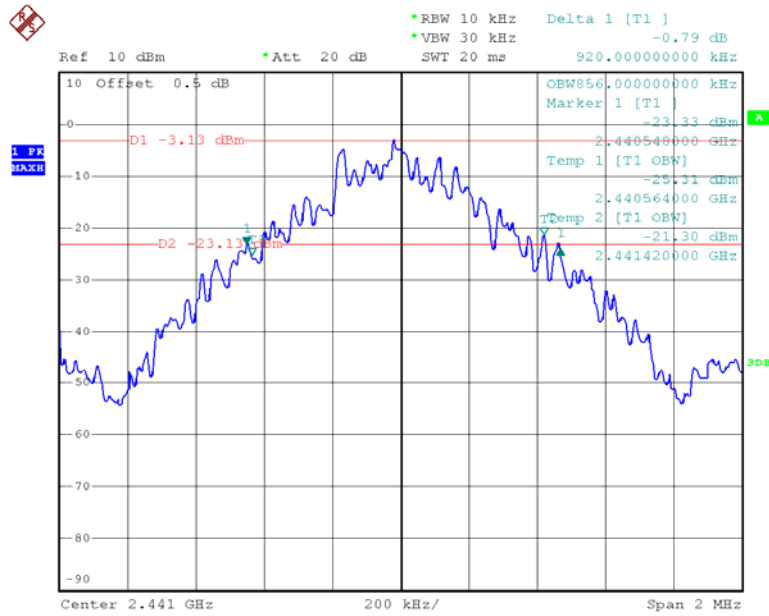
**BDR Mode (GFSK):**

**Low Channel**



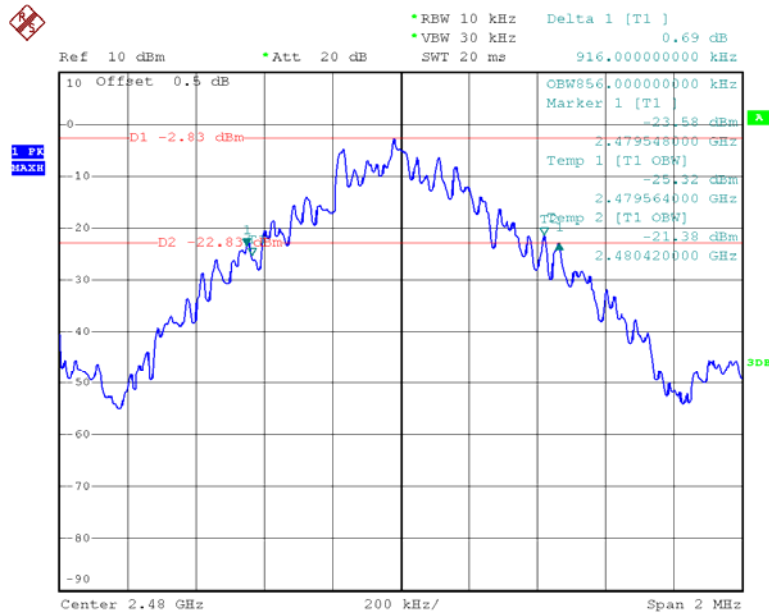
Date: 10.DEC.2012 11:18:08

**Middle Channel**



Date: 10.DEC.2012 11:26:01

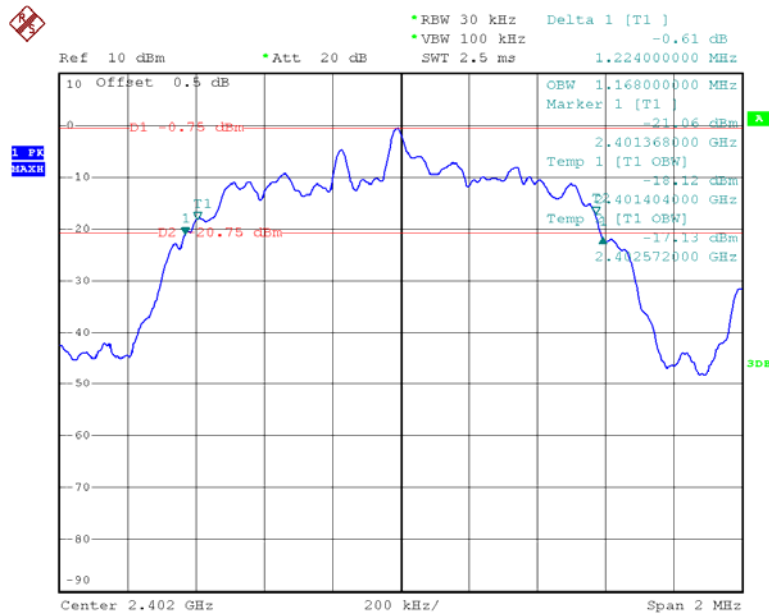
### High Channel



Date: 10.DEC.2012 11:27:36

### EDR Mode ( $\pi/4$ -DQPSK):

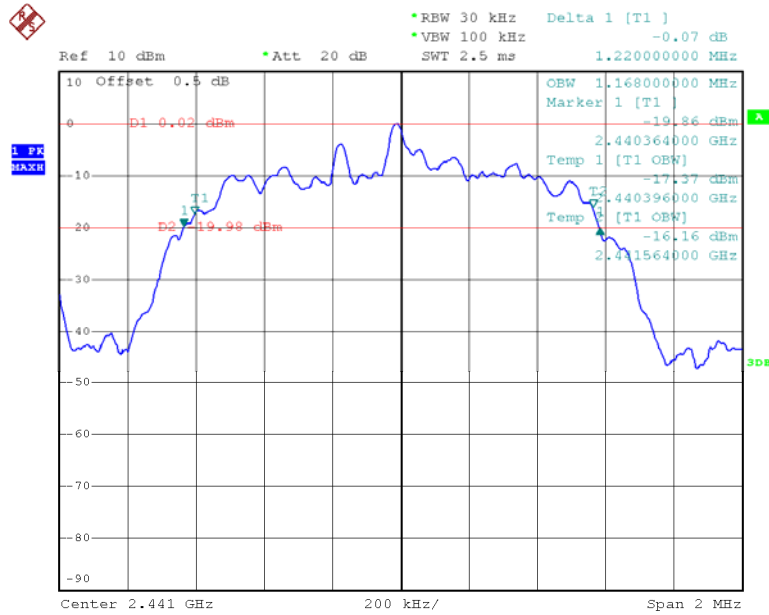
### Low Channel



Date: 10.DEC.2012 13:33:20

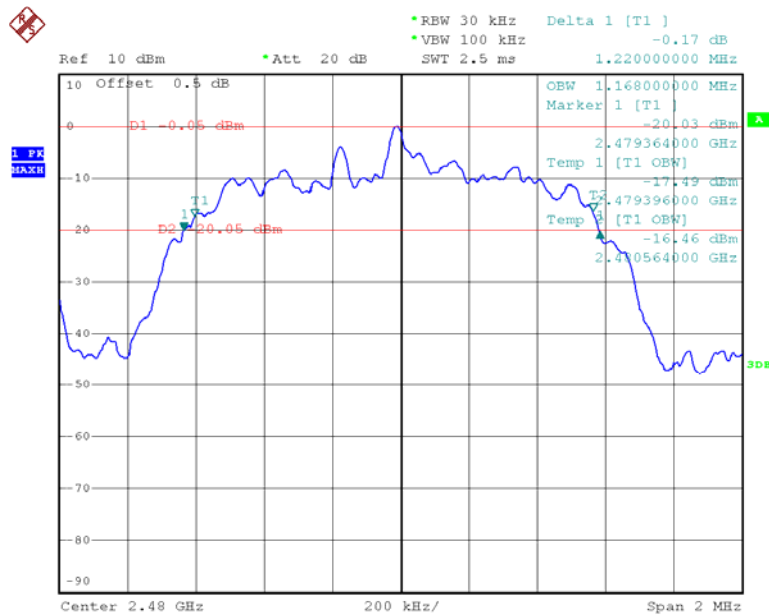


### Middle Channel



Date: 10.DEC.2012 13:35:00

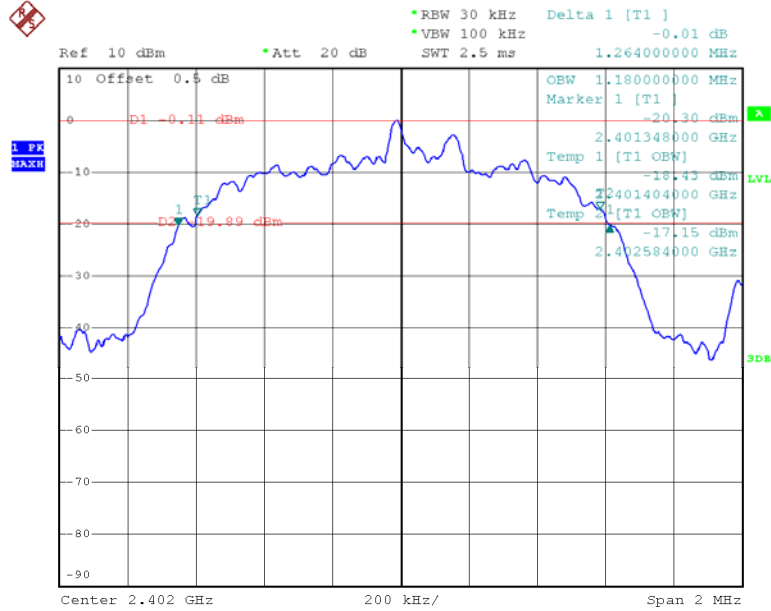
### High Channel



Date: 10.DEC.2012 13:36:53

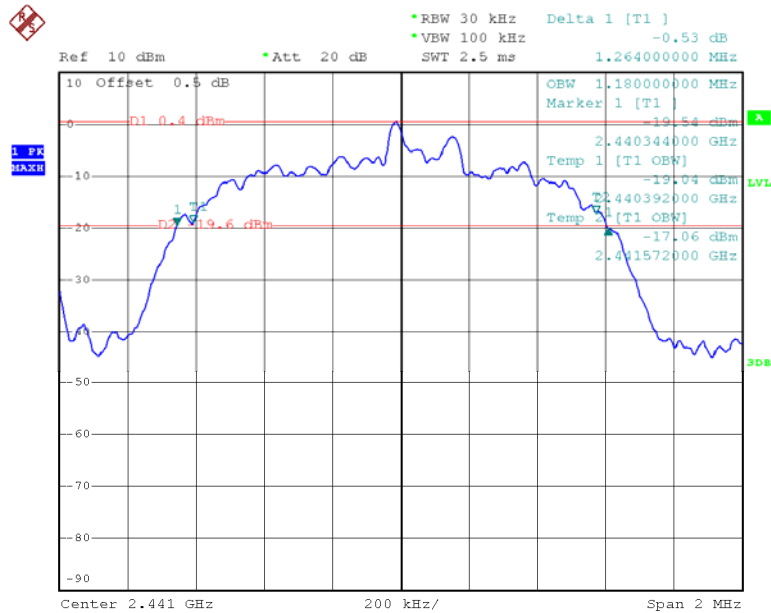
**EDR Mode (8DPSK):**

**Low Channel**



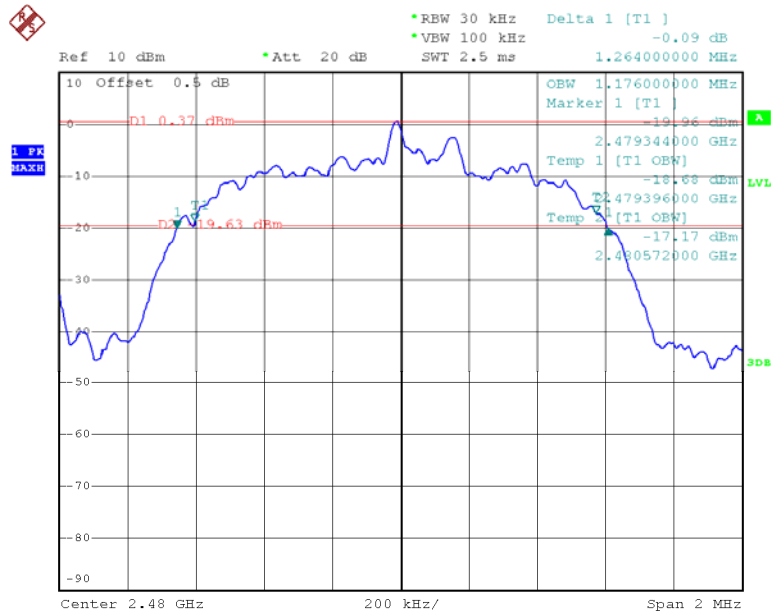
Date: 10.DEC.2012 13:59:45

**Middle Channel**



Date: 10.DEC.2012 13:58:22

### High Channel



Date: 10.DEC.2012 13:56:57

## **FCC §15.247(a) (1) (iii) - QUANTITY OF HOPPING CHANNEL TEST**

### **Applicable Standard**

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

### **Test Procedure**

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Set the EUT in hopping mode from first channel to last.
3. By using the Max-Hold function record the Quantity of the channel.

### **Test Equipment List and Details**

<b>Manufacturer</b>	<b>Description</b>	<b>Model</b>	<b>Serial Number</b>	<b>Calibration Date</b>	<b>Calibration Due Date</b>
Rohde & Schwarz	Spectrum Analyzer	FSP38	100478	2012-5-14	2013-5-13

### **Test Data**

#### **Environmental Conditions**

<b>Temperature:</b>	22.8 °C
<b>Relative Humidity:</b>	54 %
<b>ATM Pressure:</b>	100.9kPa

\* The testing was performed by Leon Chen on 2012-12-10.

**Test Result:** Compliance.

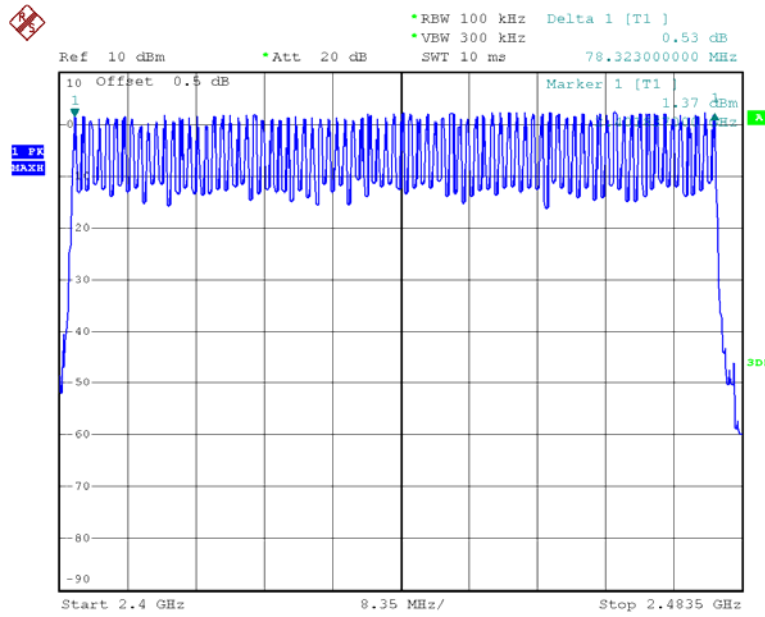
Please refer to following tables and plots

Test Mode: Transmitting

**BDR Mode (GFSK):**

Frequency Range (MHz)	Number of Hopping Channel	Limit
2400-2483.5	79	≥15

**Number of Hopping Channels**

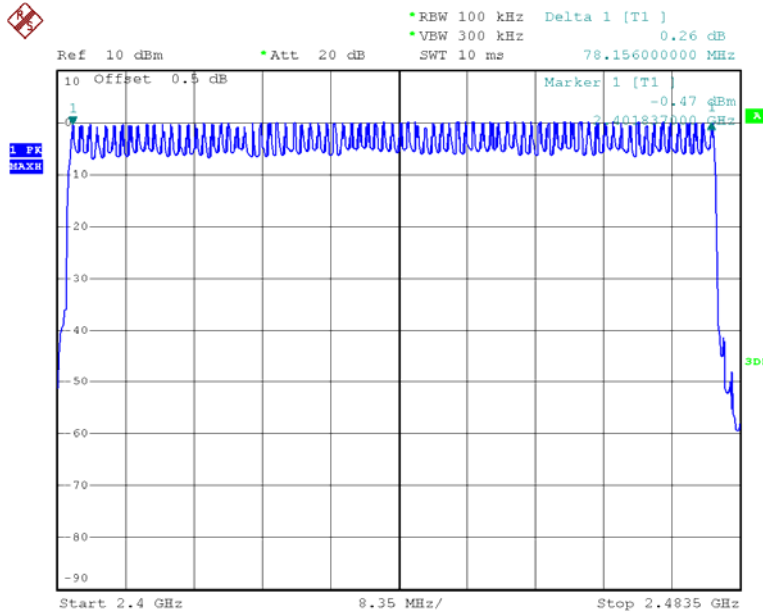


Date: 10.DEC.2012 11:40:39

**EDR Mode ( $\pi/4$ -DQPSK):**

Frequency Range (MHz)	Number of Hopping Channel	Limit
2400-2483.5	79	$\geq 15$

**Number of Hopping Channels**

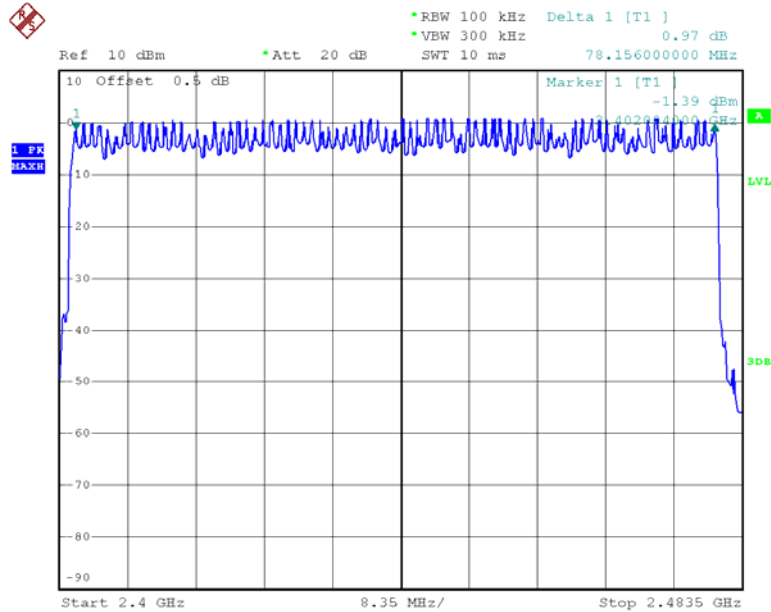


Date: 10.DEC.2012 11:46:36

**EDR Mode (8DPSK):**

Frequency Range (MHz)	Number of Hopping Channel	Limit
2400-2483.5	79	≥ 15

**Number of Hopping Channels**



Date: 10.DEC.2012 13:52:11

## **FCC §15.247(a) (1) (iii) - TIME OF OCCUPANCY (DWELL TIME)**

### **Applicable Standard**

Frequency hopping systems in the 2400-2483.5 MHz shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

### **Test Procedure**

The EUT was worked in channel hopping; Spectrum SPAN was set as 0. Sweep was set as 0.4 \* channel no. (s), the quantity of pulse was get from single sweep. In addition, the time of single pulses was tested.

Dwell Time= time slot length \* hope rate/ number of hopping channels \* 31.6s  
Hop rate=1600/s

### **Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Spectrum Analyzer	FSP38	100478	2012-5-14	2013-5-13

### **Test Data**

#### **Environmental Conditions**

<b>Temperature:</b>	22.8 °C
<b>Relative Humidity:</b>	54 %
<b>ATM Pressure:</b>	100.9kPa

\* The testing was performed by Leon Chen on 2012-12-10.

**Test Result:** Compliance.

Please refer to following tables and plots



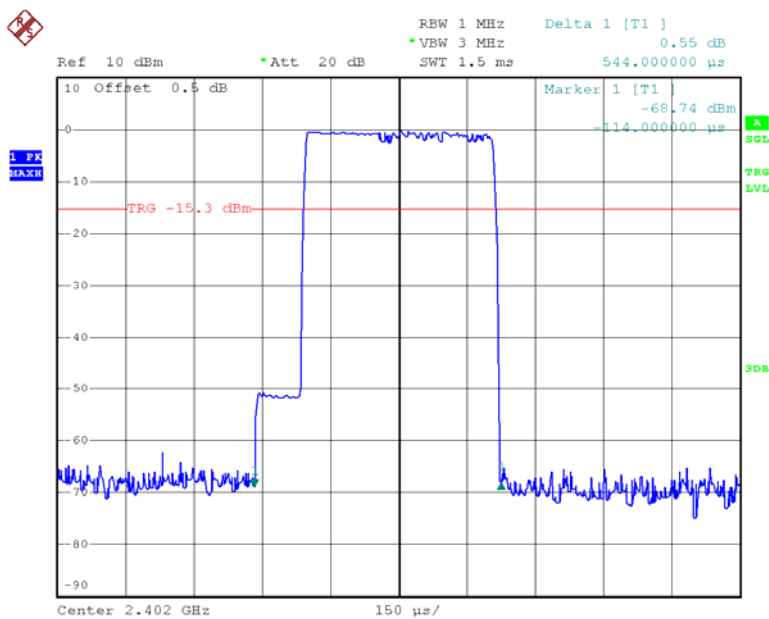
Test Mode: Transmitting

**BDR Mode (GFSK)**

Mode	Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
<b>DH1</b>	Low	0.544	0.174	0.4	Pass
	Middle	0.544	0.174	0.4	Pass
	High	0.544	0.174	0.4	Pass
	Note: Dwell time=Pulse time (ms) × (1600/2/79) ×31.6 s				
<b>DH3</b>	Low	1.824	0.292	0.4	Pass
	Middle	1.834	0.293	0.4	Pass
	High	1.824	0.292	0.4	Pass
	Note: Dwell time=Pulse time (ms) × (1600/4/79) ×31.6 s				
<b>DH5</b>	Low	3.078	0.328	0.4	Pass
	Middle	3.110	0.332	0.4	Pass
	High	3.078	0.328	0.4	Pass
	Note: Dwell time=Pulse time (ms) × (1600/6/79) ×31.6 s				

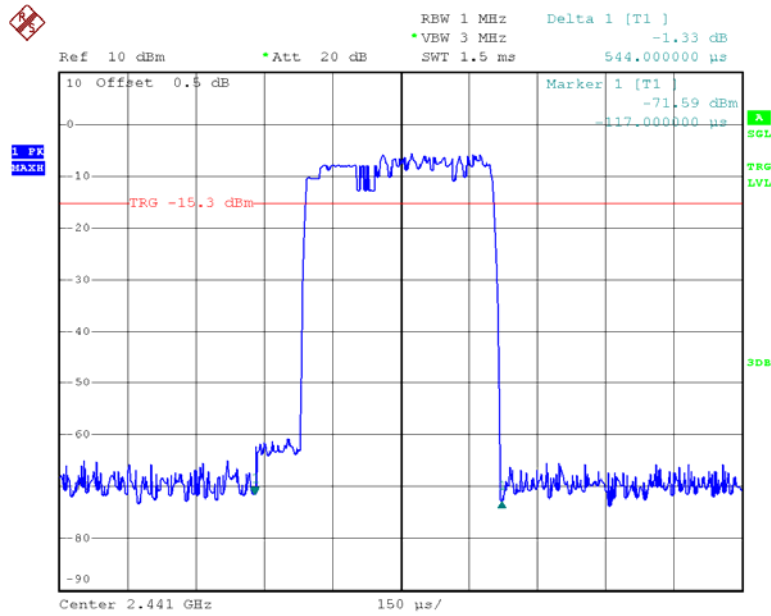
**DH1:**

**Low Channel**



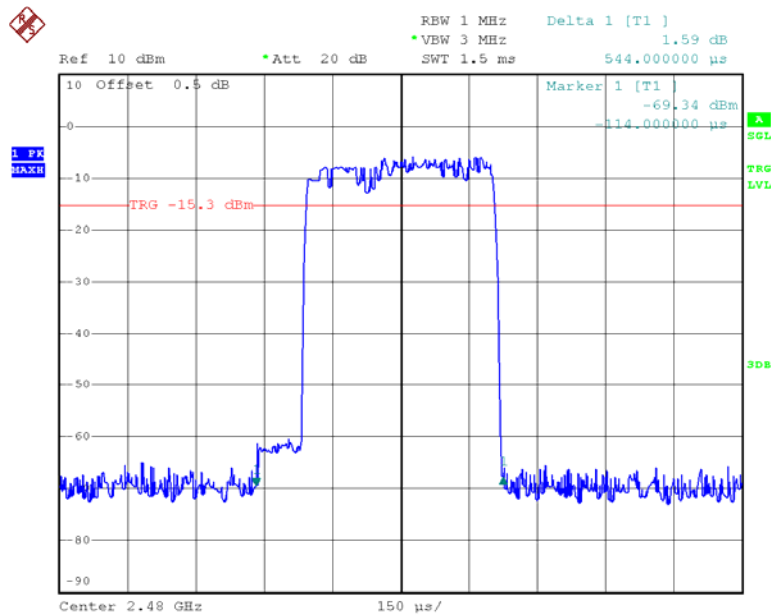
Date: 10.DEC.2012 14:25:32

### Middle Channel



Date: 10.DEC.2012 14:26:38

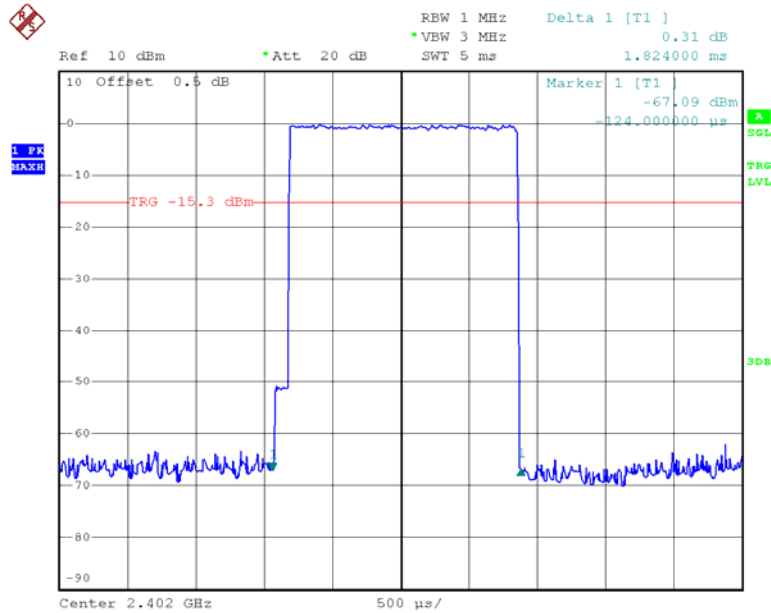
### High Channel



Date: 10.DEC.2012 14:27:44

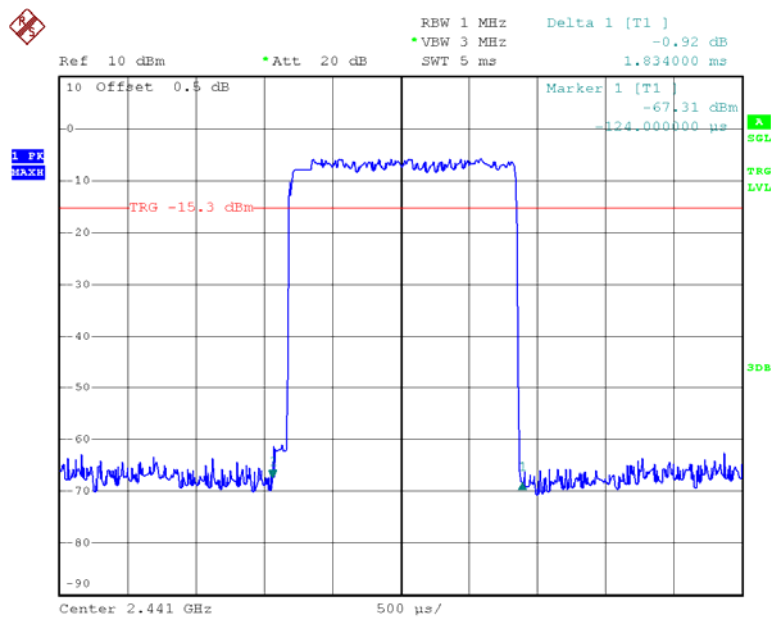
**DH3:**

**Low Channel**



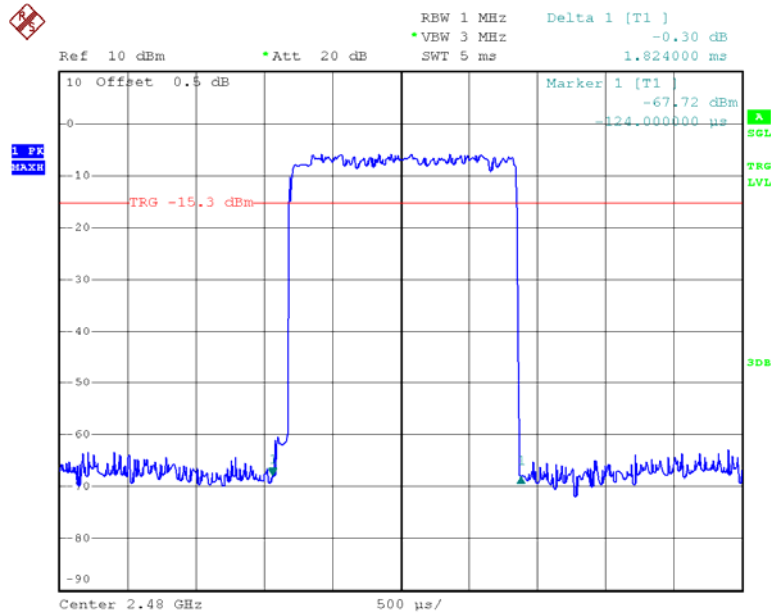
Date: 10.DEC.2012 14:32:40

**Middle Channel**



Date: 10.DEC.2012 14:31:22

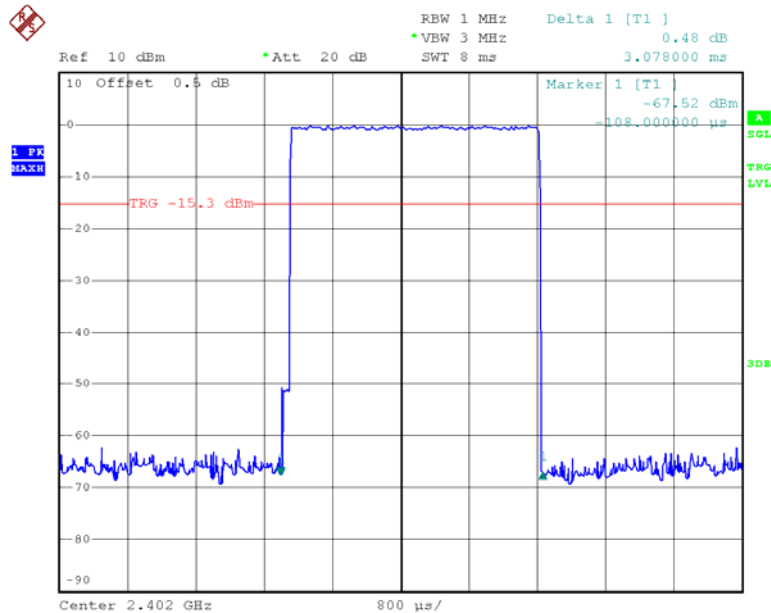
### High Channel



Date: 10.DEC.2012 14:29:59

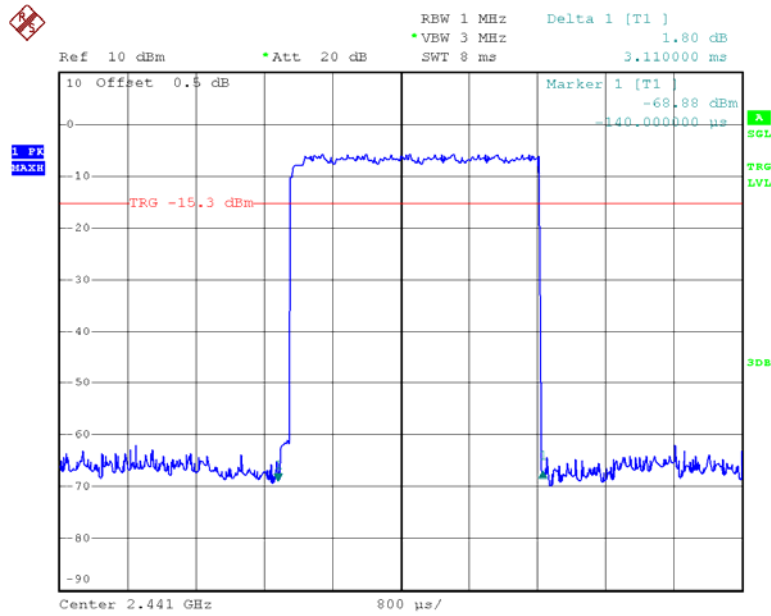
DH5:

### Low Channel



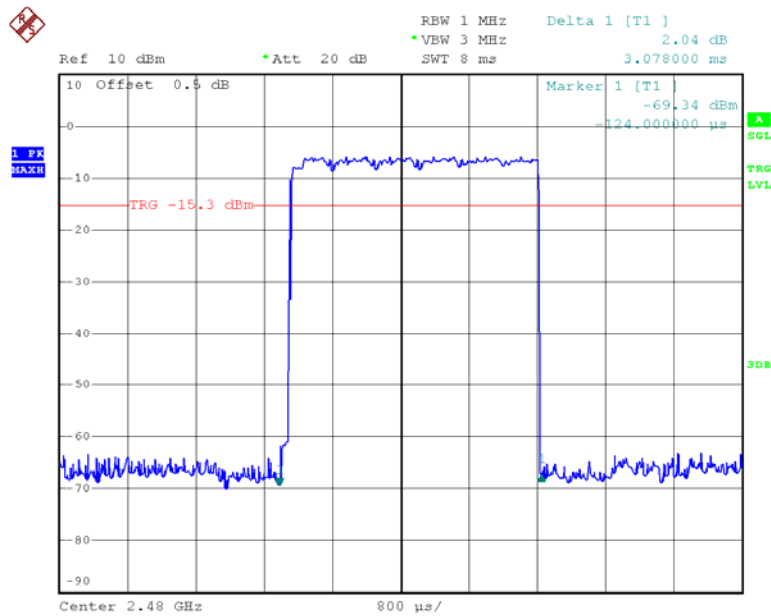
Date: 10.DEC.2012 14:34:42

### Middle Channel



Date: 10.DEC.2012 14:35:49

### High Channel



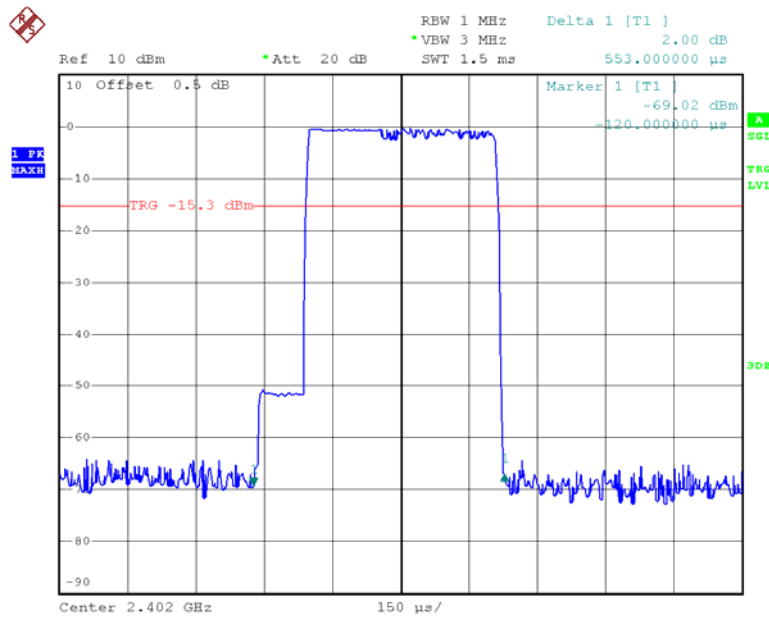
Date: 10.DEC.2012 14:36:51

**EDR Mode ( $\pi/4$ -DQPSK):**

Mode	Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
<i>DH1</i>	Low	0.553	0.177	0.4	Pass
	Middle	0.547	0.175	0.4	Pass
	High	0.544	0.174	0.4	Pass
	Note: Dwell time=Pulse time (ms) $\times$ (1600/2/79) $\times$ 31.6 s				
<i>DH3</i>	Low	1.814	0.290	0.4	Pass
	Middle	1.814	0.290	0.4	Pass
	High	1.844	0.295	0.4	Pass
	Note: Dwell time=Pulse time (ms) $\times$ (1600/4/79) $\times$ 31.6 s				
<i>DH5</i>	Low	3.110	0.332	0.4	Pass
	Middle	3.094	0.330	0.4	Pass
	High	3.078	0.328	0.4	Pass
	Note: Dwell time=Pulse time (ms) $\times$ (1600/6/79) $\times$ 31.6 s				

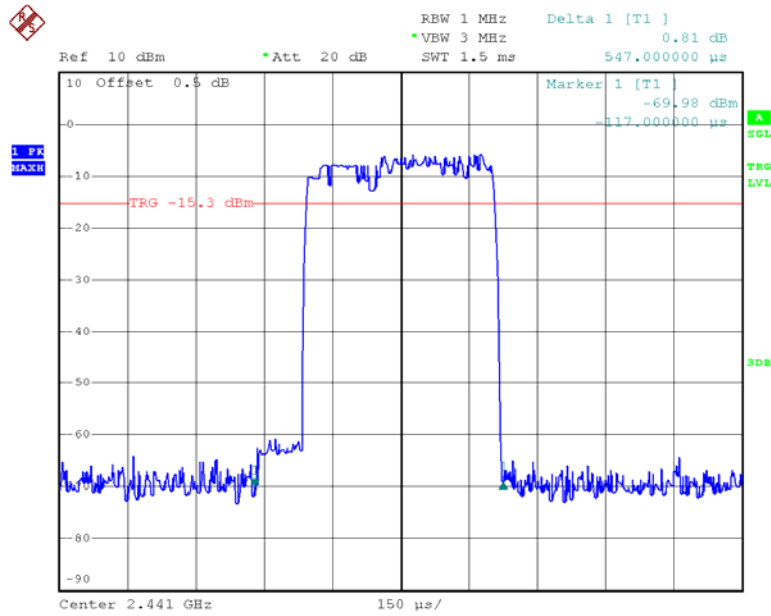
**DH1:**

**Low Channel**



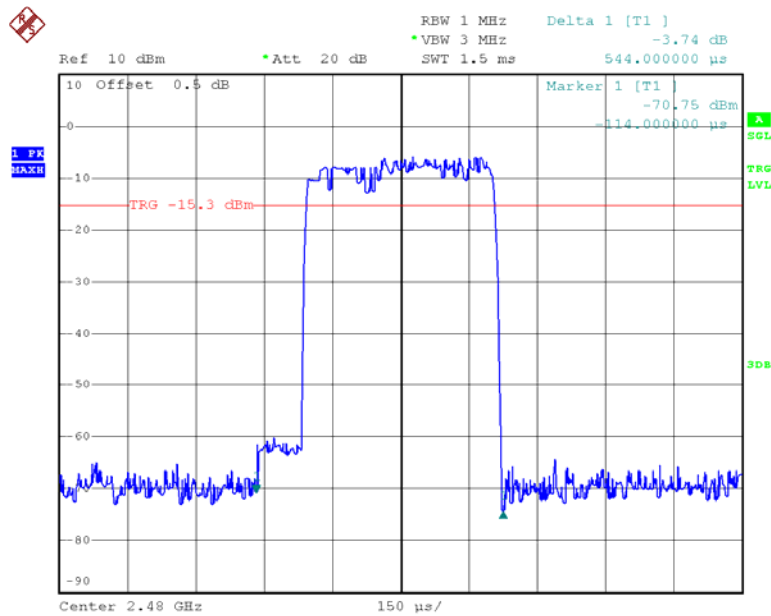
Date: 10.DEC.2012 14:25:51

### Middle Channel



Date: 10.DEC.2012 14:27:07

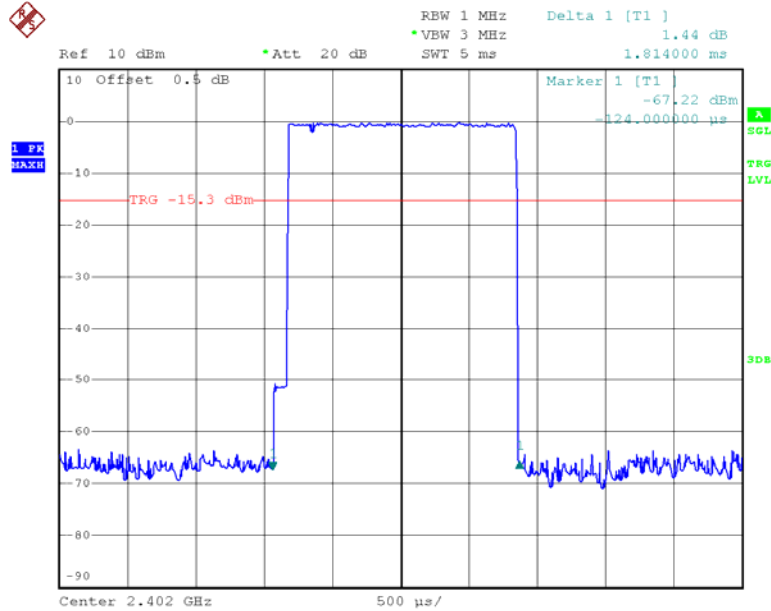
### High Channel



Date: 10.DEC.2012 14:28:15

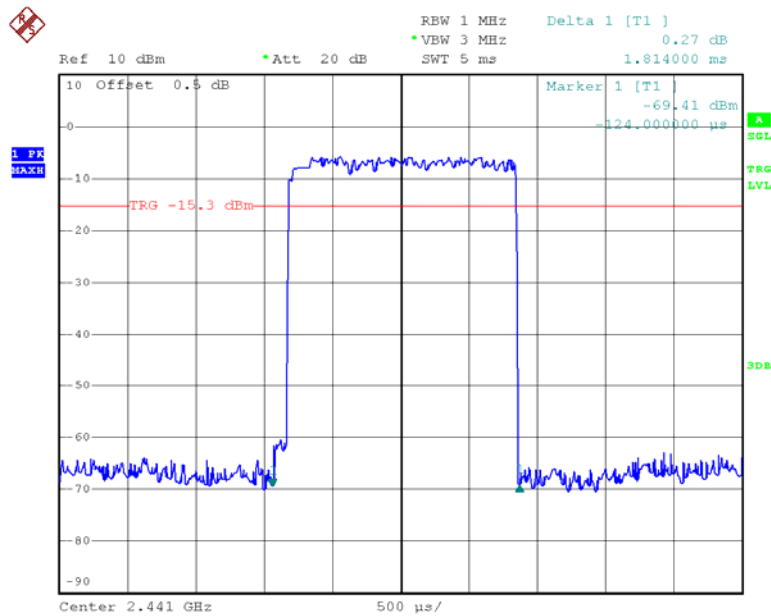
**DH3:**

**Low Channel**



Date: 10.DEC.2012 14:32:59

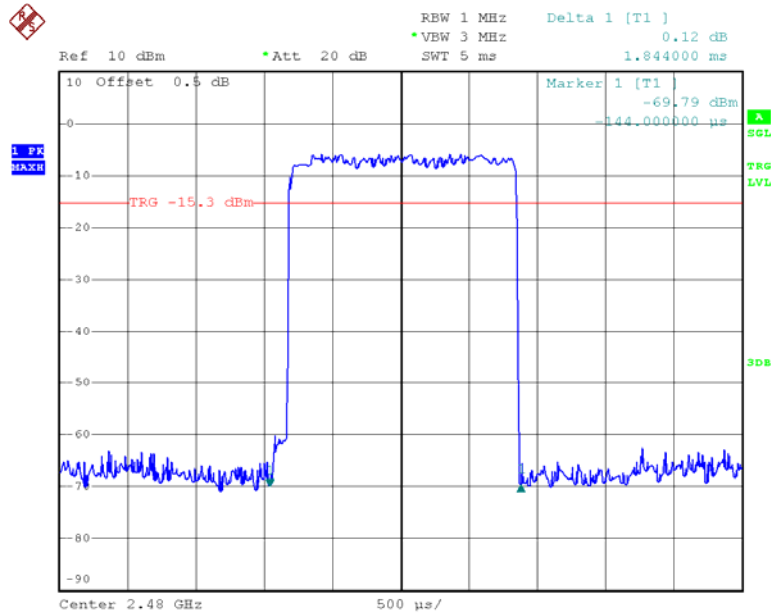
**Middle Channel**



Date: 10.DEC.2012 14:31:57



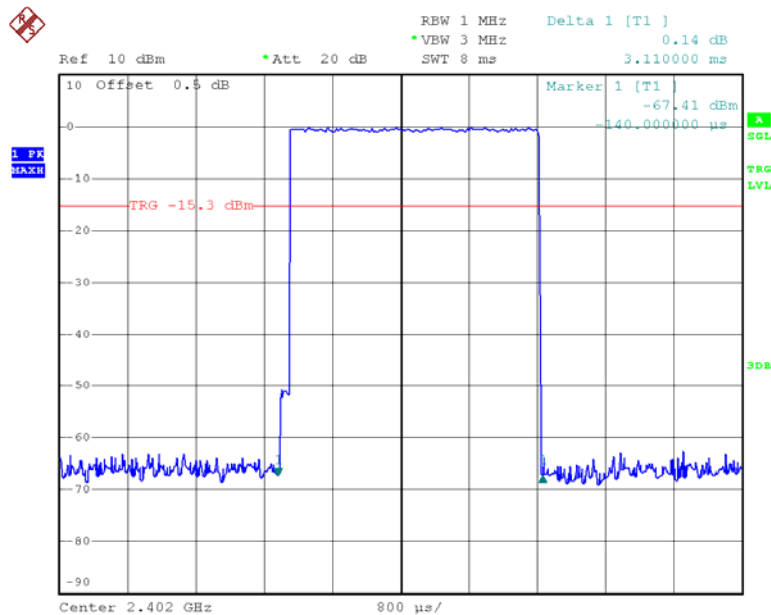
### High Channel



Date: 10.DEC.2012 14:30:12

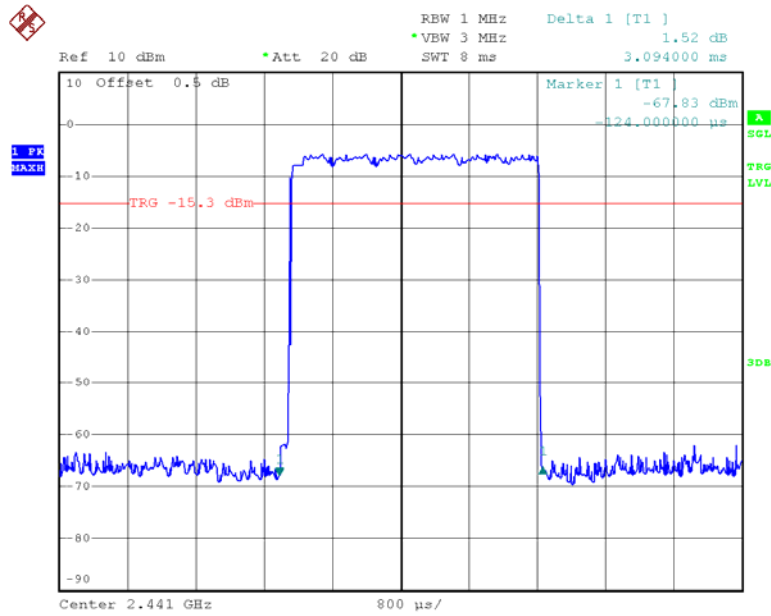
**DH5:**

### Low Channel



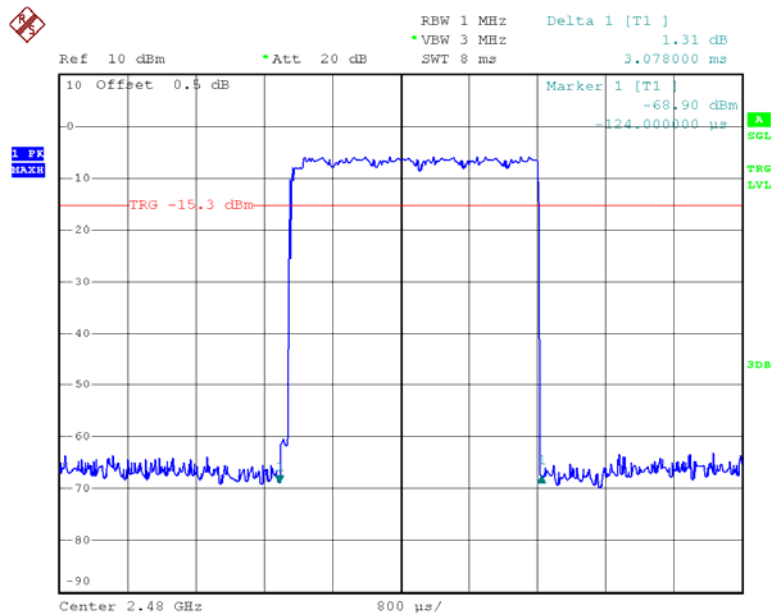
Date: 10.DEC.2012 14:34:56

### Middle Channel



Date: 10.DEC.2012 14:36:04

### High Channel



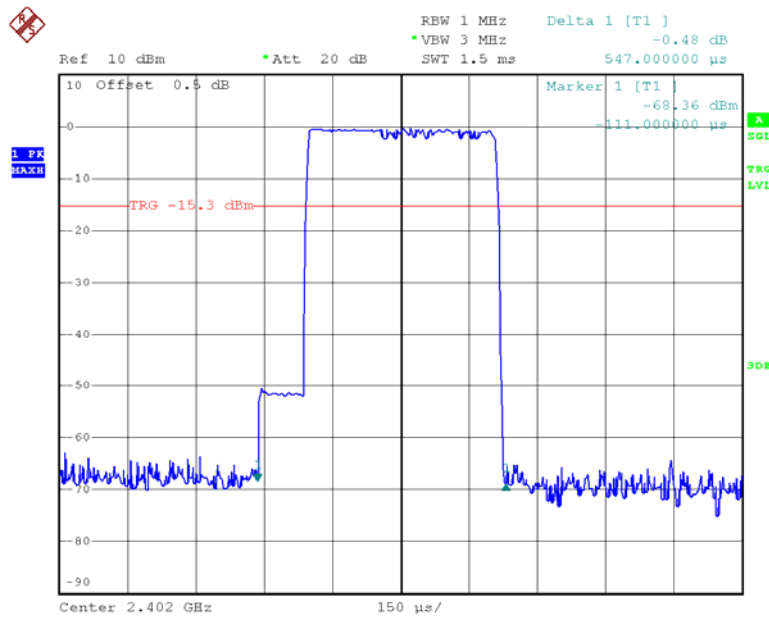
Date: 10.DEC.2012 14:37:04

**EDR Mode (8DPSK):**

Mode	Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
<i>DH1</i>	Low	0.547	0.175	0.4	Pass
	Middle	0.544	0.174	0.4	Pass
	High	0.547	0.175	0.4	Pass
	Note: Dwell time=Pulse time (ms) × (1600/2/79) ×31.6 s				
<i>DH3</i>	Low	1.834	0.293	0.4	Pass
	Middle	1.814	0.290	0.4	Pass
	High	1.814	0.290	0.4	Pass
	Note: Dwell time=Pulse time (ms) × (1600/4/79) ×31.6 s				
<i>DH5</i>	Low	3.142	0.335	0.4	Pass
	Middle	3.094	0.330	0.4	Pass
	High	3.078	0.328	0.4	Pass
	Note: Dwell time=Pulse time (ms) × (1600/6/79) ×31.6 s				

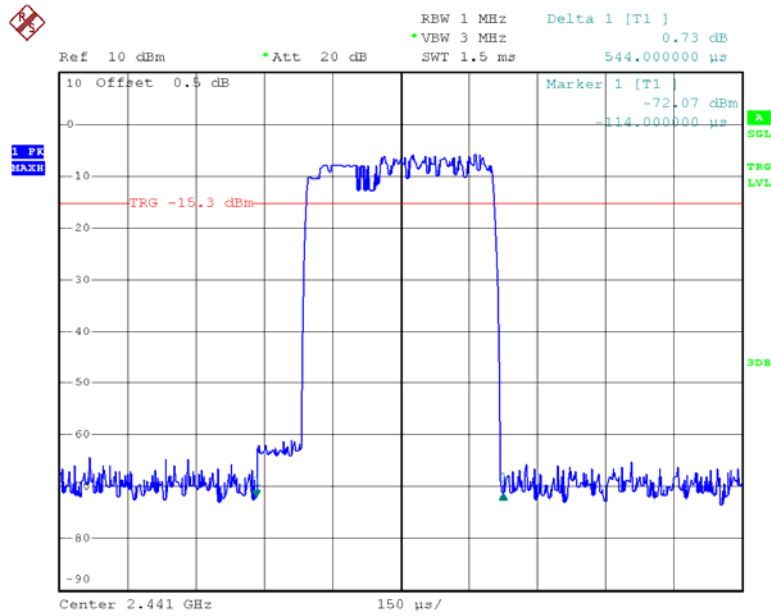
**DH1:**

**Low Channel**



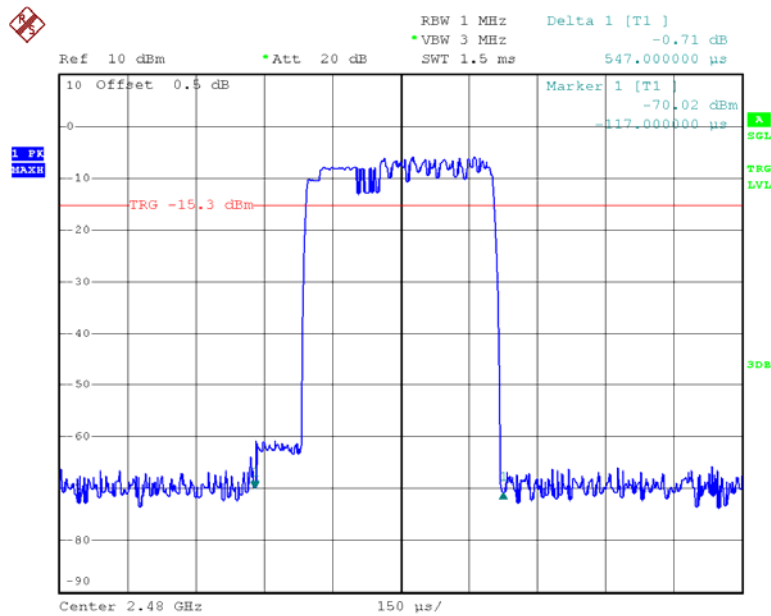
Date: 10.DEC.2012 14:25:16

### Middle Channel



Date: 10.DEC.2012 14:26:24

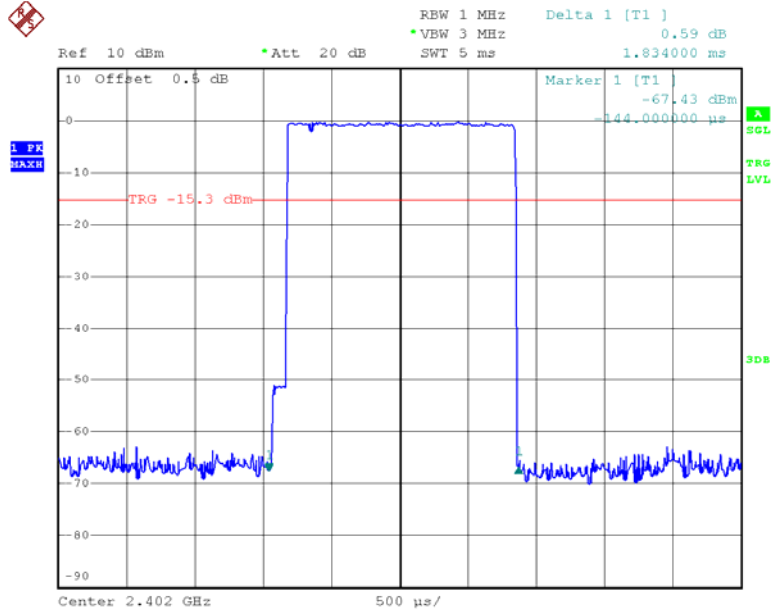
### High Channel



Date: 10.DEC.2012 14:27:31

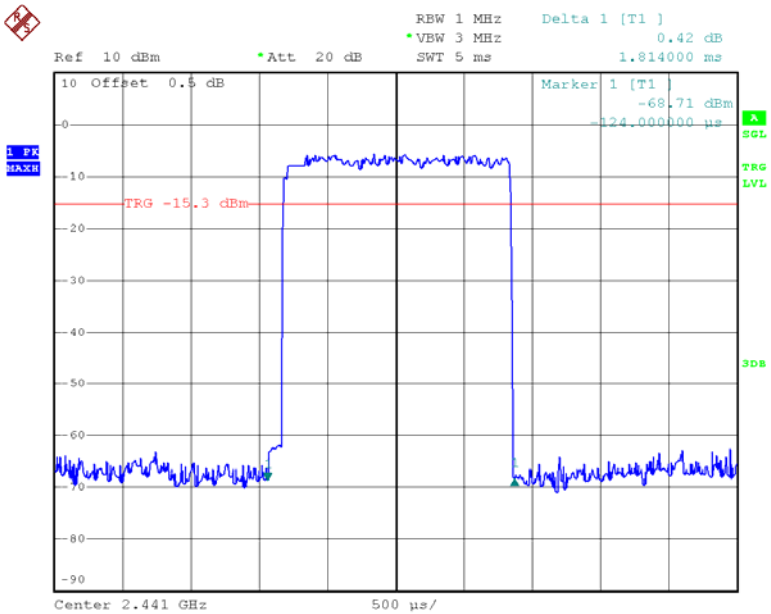
DH3:

### Low Channel



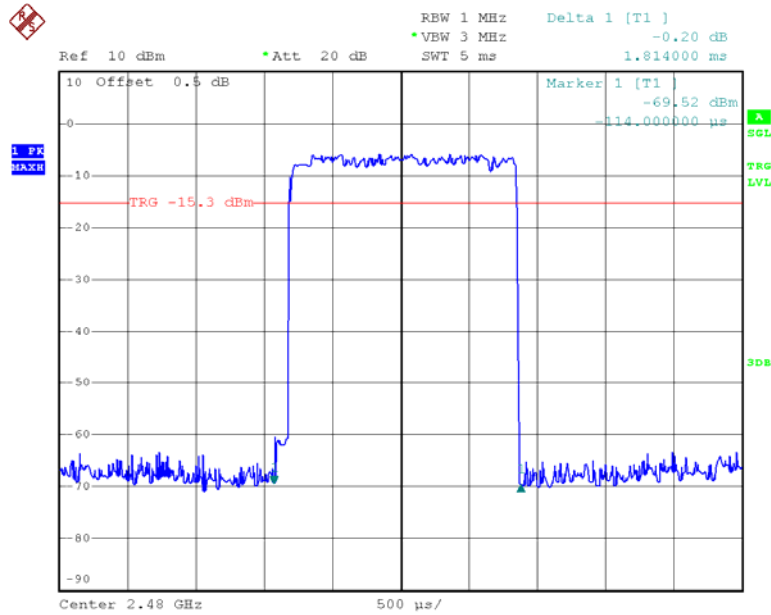
Date: 10.DEC.2012 14:32:23

### Middle Channel



Date: 10.DEC.2012 14:30:51

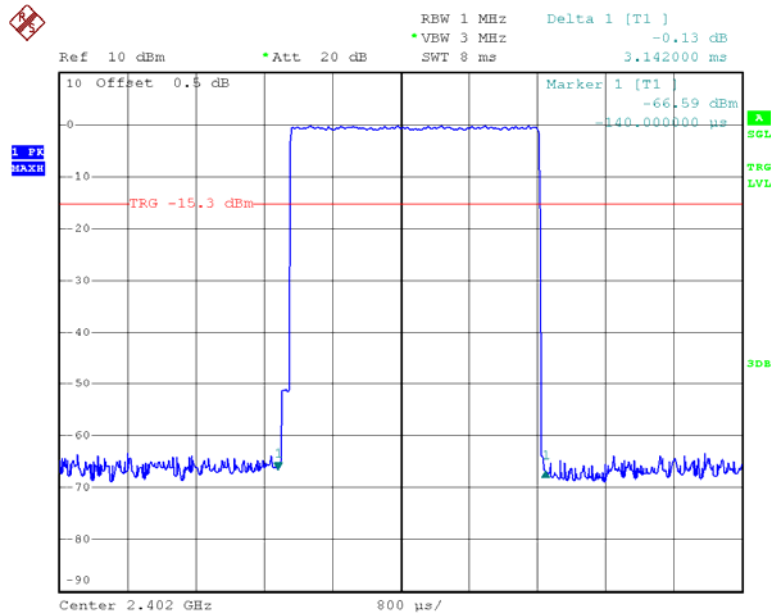
### High Channel



Date: 10.DEC.2012 14:29:27

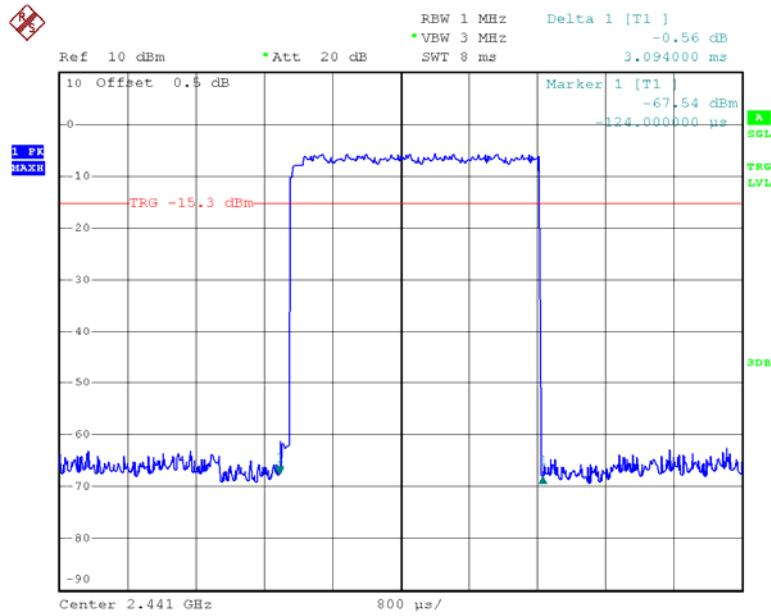
DH5:

### Low Channel



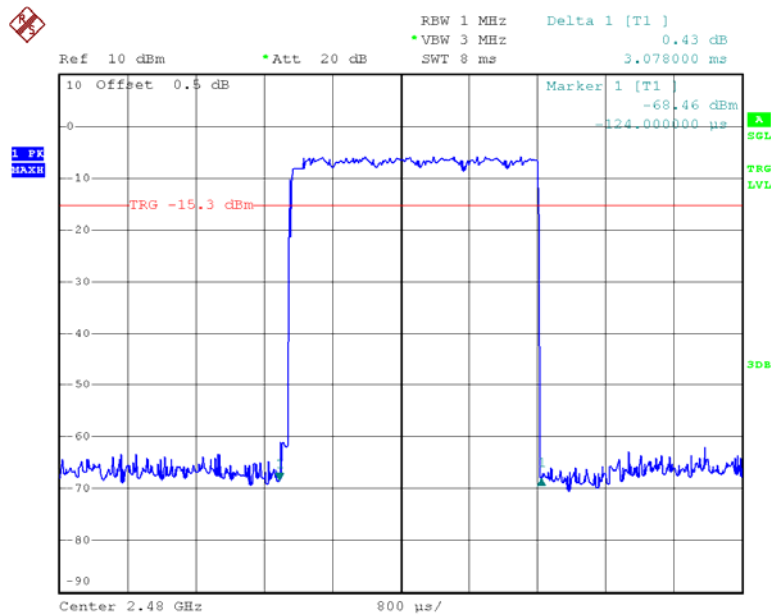
Date: 10.DEC.2012 14:34:21

### Middle Channel



Date: 10.DEC.2012 14:35:34

### High Channel



Date: 10.DEC.2012 14:36:31

**FCC §15.247(b) (1) - PEAK OUTPUT POWER MEASUREMENT**

**Applicable Standard**

According to §15.247(b) (1), for frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts

**Test Procedure**

1. Place the EUT on a bench and set in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to an EMI test receiver.
3. Add a correction factor to the display.

**Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Spectrum Analyzer	FSP38	100478	2012-5-14	2013-5-13

**Test Data**

**Environmental Conditions**

<b>Temperature:</b>	22.8 °C
<b>Relative Humidity:</b>	54 %
<b>ATM Pressure:</b>	100.9kPa

*\* The testing was performed by Leon Chen on 2012-12-10.*

**Test Result:** Compliance.



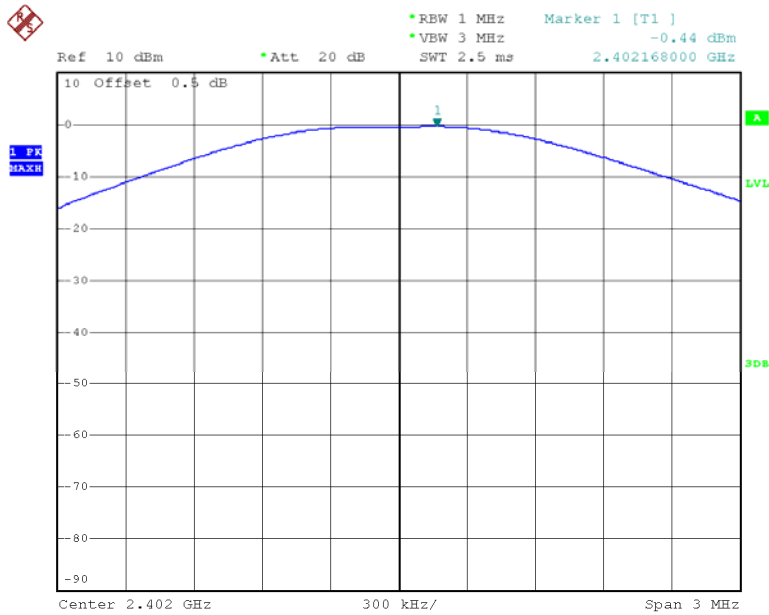
Test Mode: Transmitting

Mode	Channel	Frequency (MHz)	Output power (dBm)	Limit (dBm)
BDR Mode (GFSK)	Low	2402	-0.44	30
	Middle	2441	2.09	30
	High	2480	2.17	30
EDR Mode ( $\pi/4$ -DQPSK)	Low	2402	0.23	30
	Middle	2441	0.54	30
	High	2480	0.72	30
EDR Mode(8DPSK)	Low	2402	0.60	30
	Middle	2441	1.24	30
	High	2480	1.15	30

Note: The data above was tested in conducted mode.

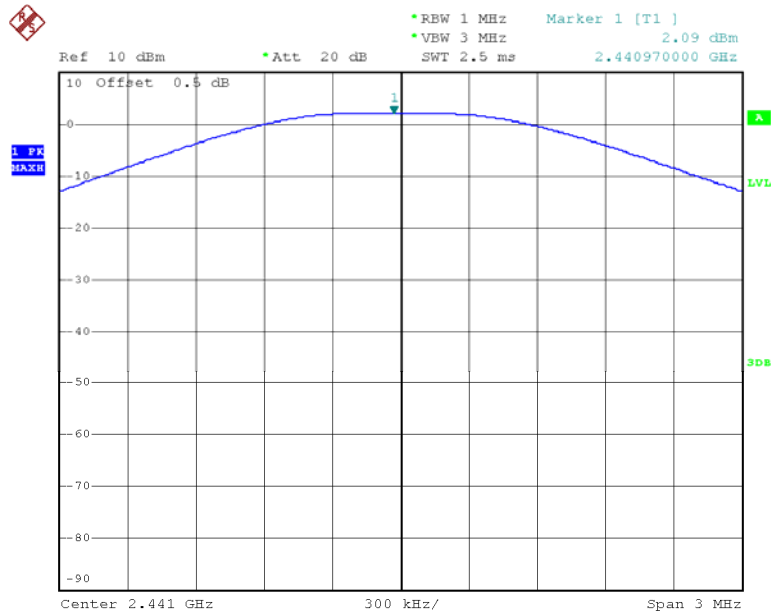
**BDR Mode (GFSK):**

**Output Power, Low**



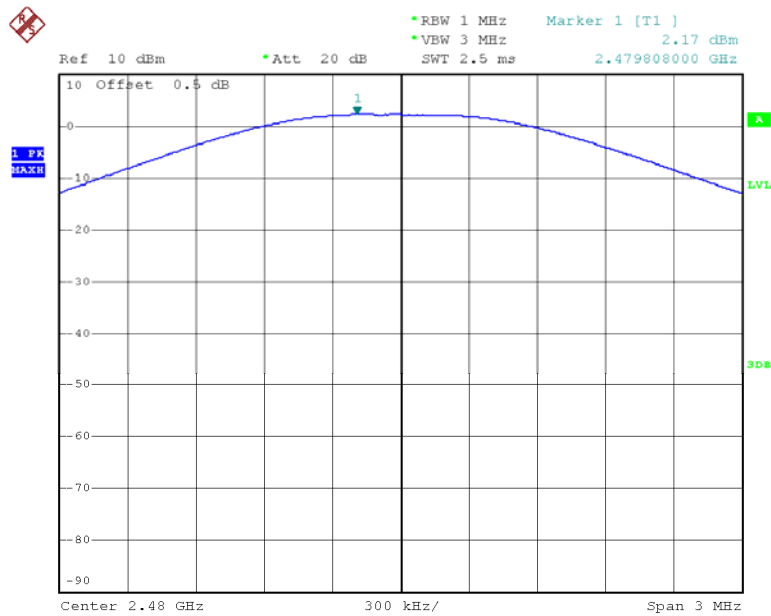
Date: 10.DEC.2012 14:14:04

### Output Power, Middle



Date: 10.DEC.2012 14:14:30

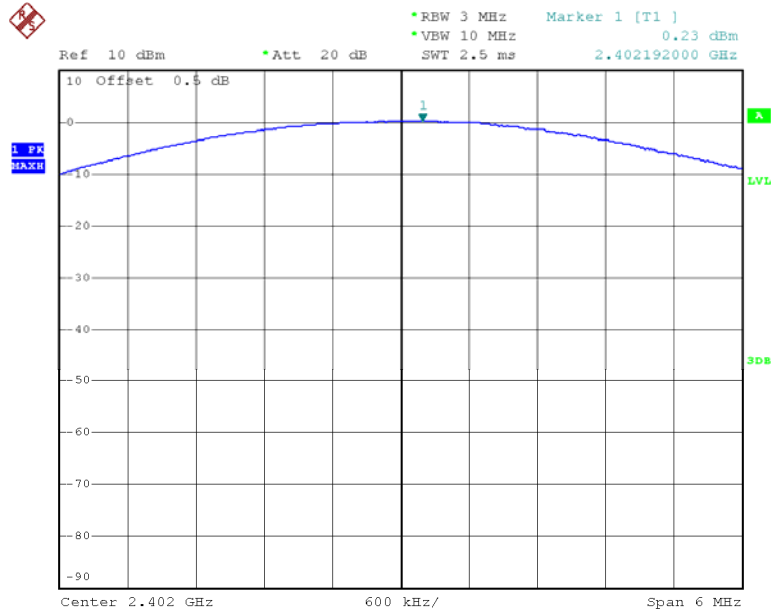
### Output Power, High



Date: 10.DEC.2012 14:15:28

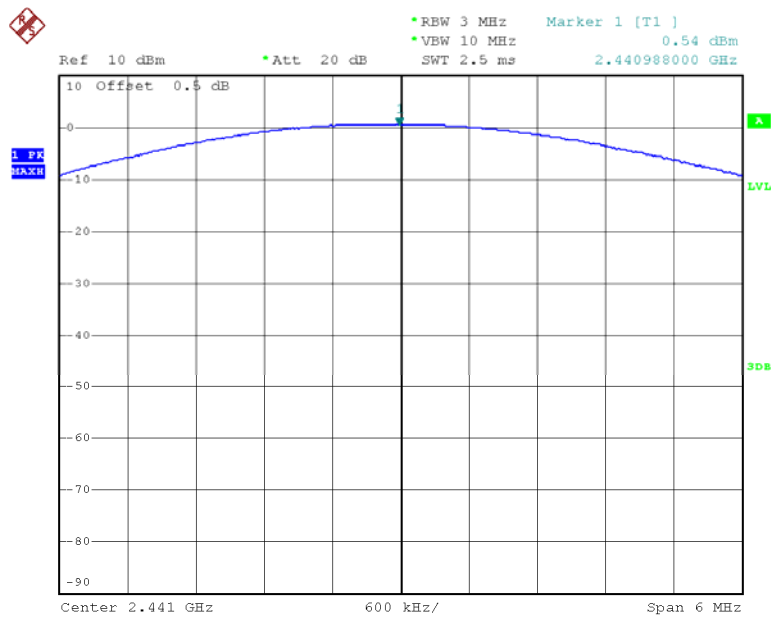
**EDR Mode ( $\pi/4$ -DQPSK):**

**Output Power, Low**



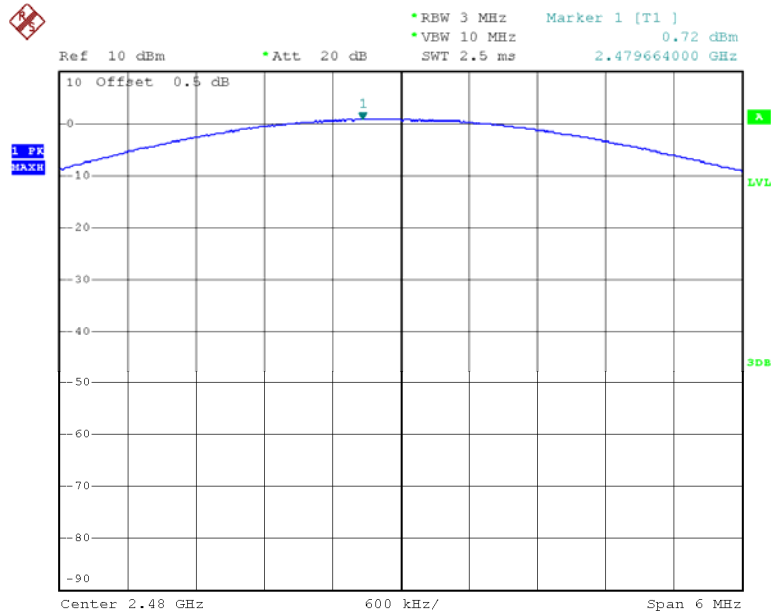
Date: 10.DEC.2012 14:22:22

**Output Power, Middle**



Date: 10.DEC.2012 14:22:37

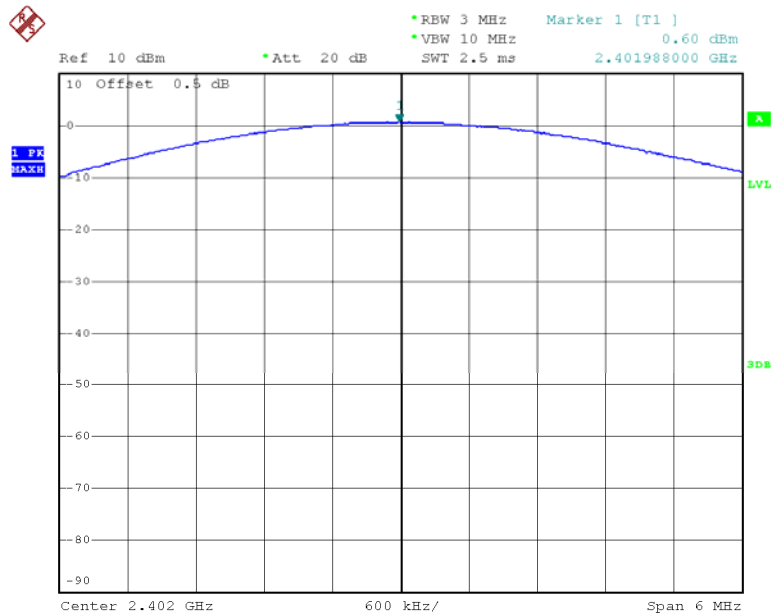
### Output Power, High



Date: 10.DEC.2012 14:22:56

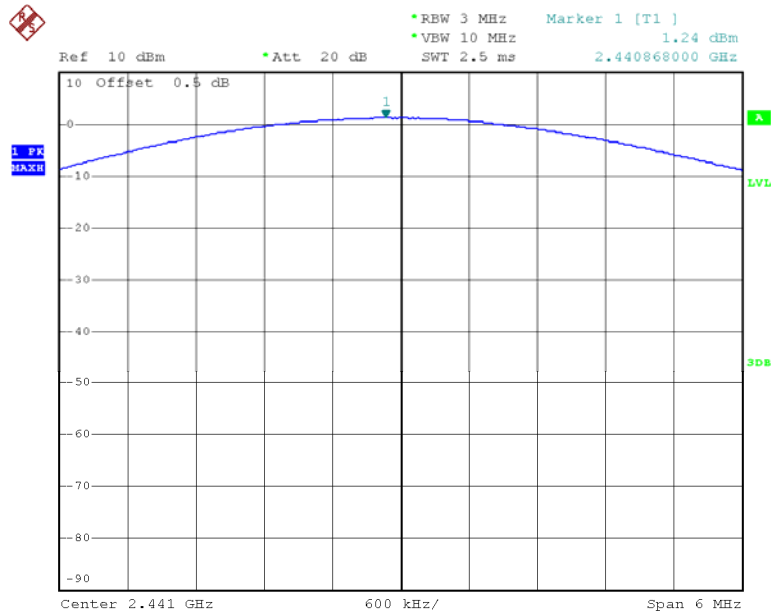
### EDR Mode (8DPSK):

### Output Power, Low



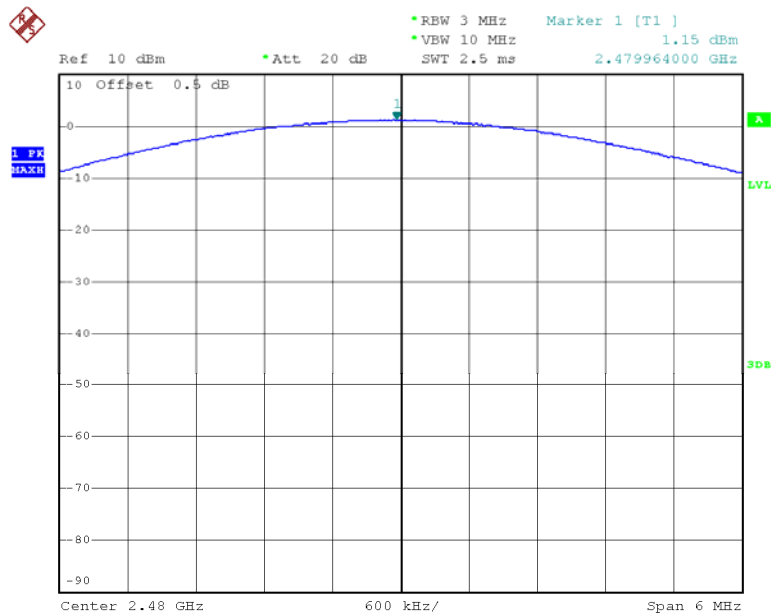
Date: 10.DEC.2012 13:53:42

### Output Power, Middle



Date: 10.DEC.2012 13:54:11

### Output Power, High



Date: 10.DEC.2012 13:55:23

## FCC §15.247(d) - BAND EDGES TESTING

### Applicable Standard

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

### Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Spectrum Analyzer	FSP38	100478	2012-5-14	2013-5-13

### Test Data

#### Environmental Conditions

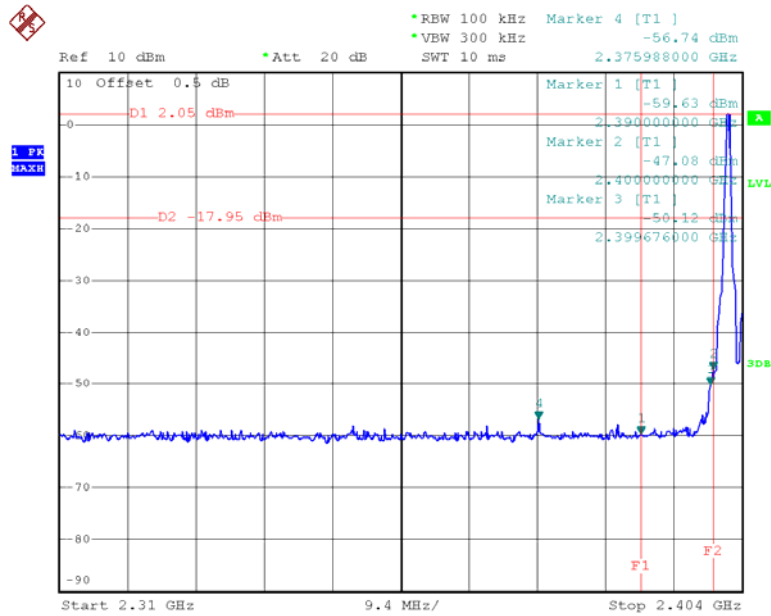
Temperature:	22.8 °C
Relative Humidity:	54 %
ATM Pressure:	100.9kPa

\* The testing was performed by Leon Chen on 2012-12-10.

**Test Result: Compliance**

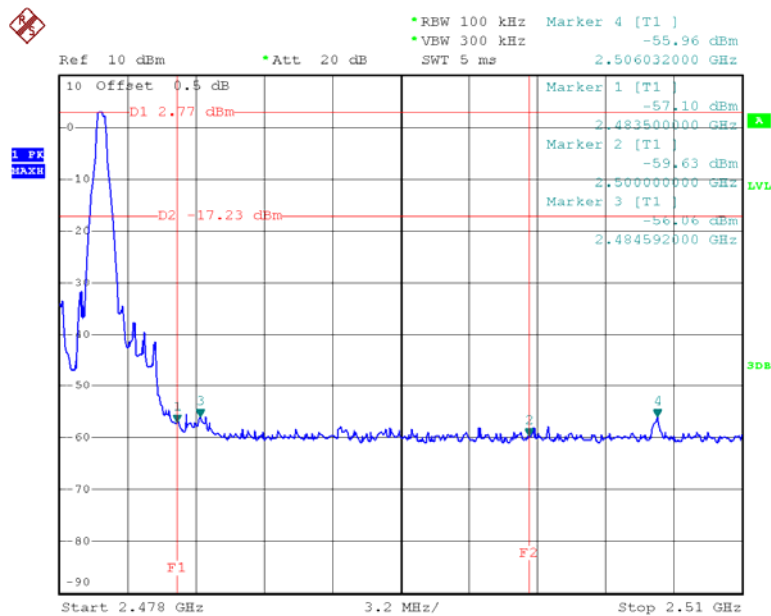
**BDR Mode (GFSK):**

**Band Edge, Left Side**



Date: 10.DEC.2012 14:17:54

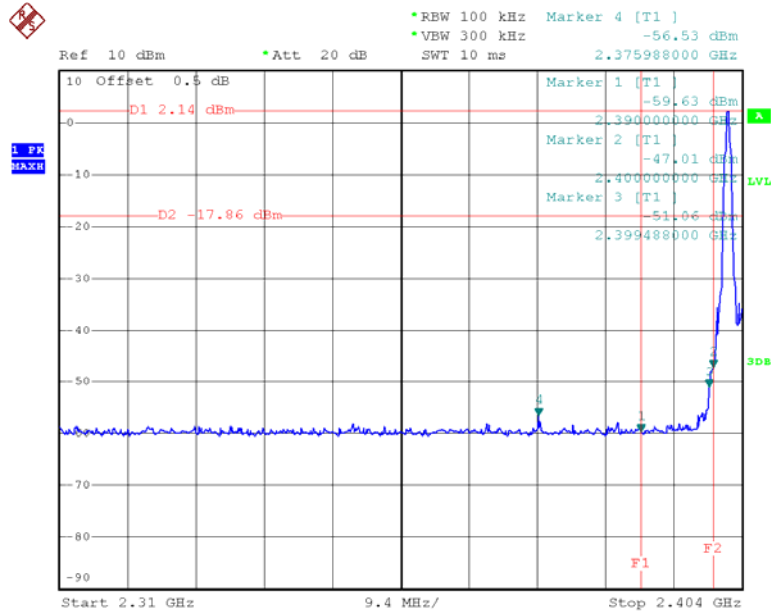
**Band Edge, Right Side**



Date: 10.DEC.2012 14:16:49

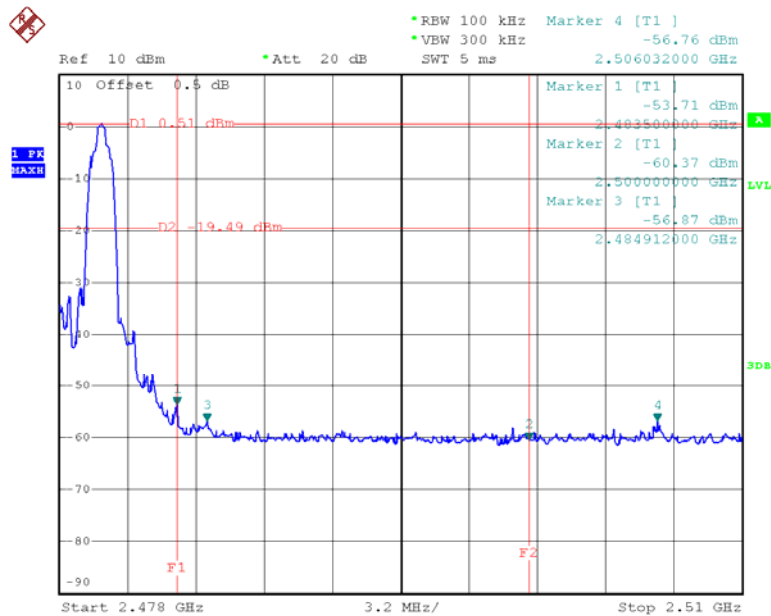
**EDR Mode ( $\pi/4$ -DQPSK):**

**Band Edge, Left Side**



Date: 10.DEC.2012 14:19:34

**Band Edge, Right Side**

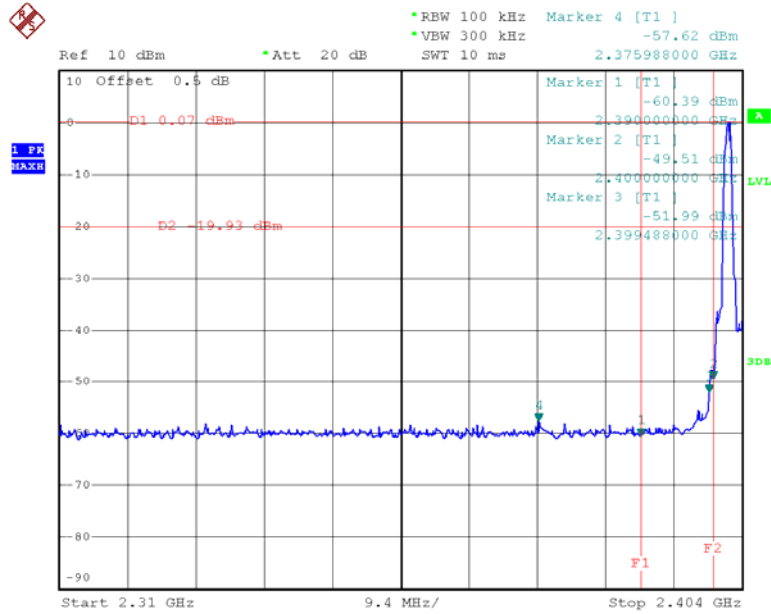


Date: 10.DEC.2012 14:20:44



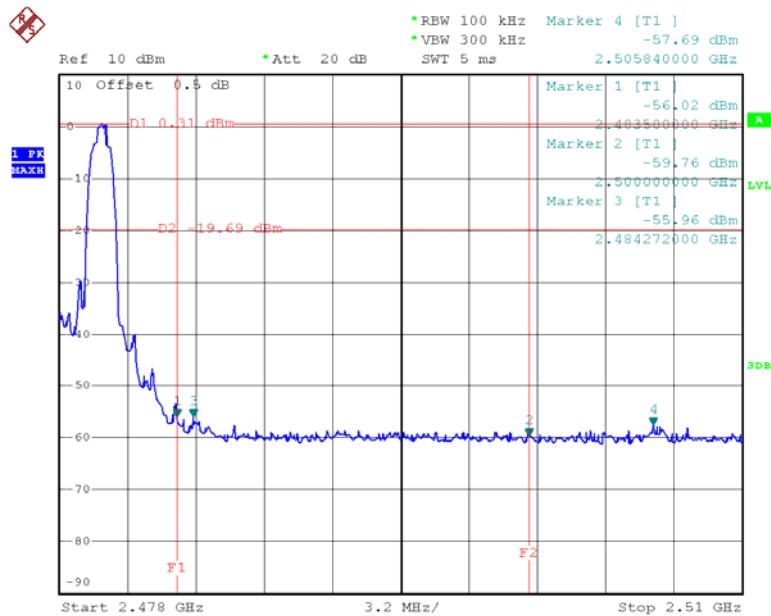
**EDR Mode (8DPSK):**

**Band Edge, Left Side**



Date: 10.DEC.2012 14:07:30

**Band Edge, Right Side**



Date: 10.DEC.2012 14:08:53

\*\*\*\*\* END OF REPORT \*\*\*\*\*