

FCC PART 15.247 TEST REPORT

For

Wuxi Roidmi Information Technology Co., Ltd.

Layer4, Building C8, No. 1699, Huishan Avenue, Huishan Economic Development District, Wuxi City,
China

FCC ID: 2AIS7-2016Q3BFQ04RM

Report Type: Original Report	Product Type: Smart Car Charger 3S (Full Compatible Edition)
Test Engineer: Peter Jiang	<i>Peter Jiang</i>
Report Number: RKS161103002-00E	
Report Date: 2016-12-20	
Reviewed By: EMC Manager	Jesse Huang <i>Jesse Huang</i>
Prepared By:	Bay Area Compliance Laboratories Corp. (Kunshan) No.248 Chenghu Road, Kunshan, Jiangsu province, China Tel: +86-0512-86175000 Fax: +86-0512-88934268 www.baclcorp.com.cn

Note: This test report is prepared for the customer shown above and for the equipment described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp.

TABLE OF CONTENTS

GENERAL INFORMATION.....	4
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	4
OBJECTIVE	4
RELATED SUBMITTAL(S)/GRANT(S).....	4
TEST METHODOLOGY	4
TEST FACILITY	5
SYSTEM TEST CONFIGURATION.....	6
DESCRIPTION OF TEST CONFIGURATION	6
EUT EXERCISE SOFTWARE	6
SPECIAL ACCESSORIES.....	6
EQUIPMENT MODIFICATIONS	6
SUPPORT EQUIPMENT LIST AND DETAILS	6
EXTERNAL I/O CABLE.....	6
BLOCK DIAGRAM OF TEST SETUP	7
SUMMARY OF TEST RESULTS	8
FCC §15.247 (i), §1.1310& §2.1091 –MAXIMUM PERMISSIBLE EXPOSURE (MPE).....	9
APPLICABLE STANDARD	9
MEASUREMENT RESULT	9
FCC §15.203 – ANTENNA REQUIREMENT.....	10
APPLICABLE STANDARD	10
ANTENNA CONNECTOR CONSTRUCTION	10
FCC §15.205, §15.209 & §15.247(d) – RADIATED EMISSIONS.....	11
APPLICABLE STANDARD	11
MEASUREMENT UNCERTAINTY.....	11
EUT SETUP	11
EMI TEST RECEIVER & SPECTRUM ANALYZER SETUP	12
TEST PROCEDURE	12
CORRECTED AMPLITUDE & MARGIN CALCULATION	13
TEST EQUIPMENT LIST AND DETAILS.....	13
TEST RESULTS SUMMARY	13
TEST DATA	14
FCC §15.247(a) (1)-CHANNEL SEPARATION TEST	19
APPLICABLE STANDARD	19
TEST PROCEDURE	19
TEST EQUIPMENT LIST AND DETAILS.....	19
TEST DATA	19
FCC §15.247(a) (1) – 20 dB EMISSION BANDWIDTH.....	25
APPLICABLE STANDARD	25
TEST PROCEDURE	25
TEST EQUIPMENT LIST AND DETAILS.....	25
TEST DATA	25
FCC §15.247(a) (1) (iii)-QUANTITY OF HOPPING CHANNEL TEST	31
APPLICABLE STANDARD	31
TEST PROCEDURE	31
TEST EQUIPMENT LIST AND DETAILS.....	31
TEST DATA	31
FCC §15.247(a) (1) (iii) - TIME OF OCCUPANCY (DWELL TIME).....	34

APPLICABLE STANDARD	34
TEST PROCEDURE	34
TEST EQUIPMENT LIST AND DETAILS.....	34
TEST DATA	34
FCC §15.247(b) (1) - PEAK OUTPUT POWER MEASUREMENT	51
APPLICABLE STANDARD	51
TEST PROCEDURE	51
TEST EQUIPMENT LIST AND DETAILS.....	51
TEST DATA	51
FCC §15.247(d) - BAND EDGES TESTING	57
APPLICABLE STANDARD	57
TEST PROCEDURE	57
TEST EQUIPMENT LIST AND DETAILS.....	57
TEST DATA	57

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The Wuxi Roidmi Information Technology Co., Ltd.'s product, model number: BFQ04RM, trademark: ROIDMI (FCC ID: 2AIS7-2016Q3BFQ04RM) or the "EUT" in this report was a Smart Car Charger 3S (Full Compatible Edition), which was measured approximately: 26.5mm(L)×26.5mm(W)×61.5 mm(H), rated input voltage: DC 12-24V.

**All measurement and test data in this report was gathered from production sample serial number: 20161009009.*

(Assigned by BACL, Kunshan). The EUT was received on 2016-10-09.

Objective

This test report is prepared on behalf of Wuxi Roidmi Information Technology 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 compliance with FCC Part 15, Subpart C, section 15.203, 15.205, 15.209 and 15.247 rules.

Related Submittal(s)/Grant(s)

Part 15.239 DXX & Part 15.247 DTS submissions with FCC ID: 2AIS7-2016Q3BFQ04RM.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices and DA 00-705.

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

Measurement uncertainty with radiated emission is 5.87 dB for 30MHz-1GHz, and 4.84 dB for above 1GHz, 1.85dB for conducted measurement.

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu province, China.

Test site at Bay Area Compliance Laboratories Corp. (Kunshan) 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 November 06, 2014. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 815570. 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

Description of Test Configuration

The system was configured for testing in an engineering mode which was controlled by the software.

EUT Exercise Software

AppoTech RF Control Kit

GFSK: Power level : -4

Special Accessories

No special accessory.

Equipment Modifications

No modification was made to the EUT tested.

Support Equipment List and Details

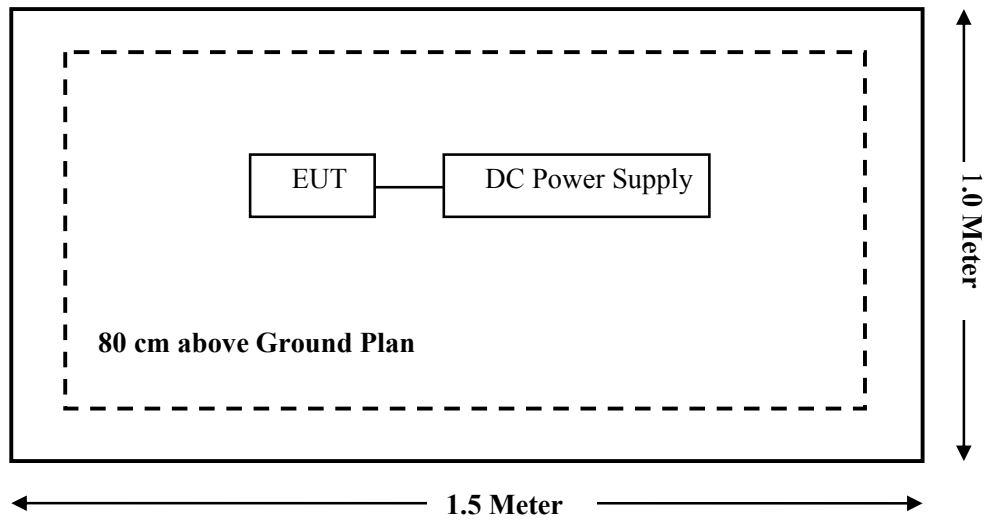
Manufacturer	Description	Model	Serial Number
BACL	Resistor	/	/
EAST	DC Power Supply	MCH-303D-II	14070562

External I/O Cable

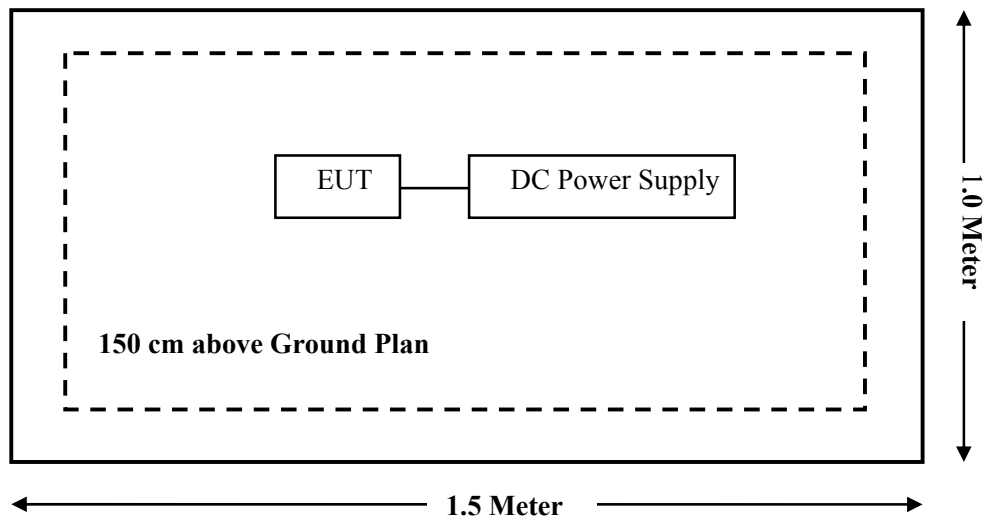
Cable Description	Length (m)	From Port	To
DC Cable	0.8	DC Power Supply	EUT
USB Cable	0.8	EUT	Resistor

Block Diagram of Test Setup

For Radiated Emissions (Below 1GHz):



For Radiated Emissions (Above 1GHz):



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (i), §1.1310 & §2.1091	MAXIMUM PERMISSIBLE EXPOSURE (MPE)	Compliance
§15.203	Antenna Requirement	Compliance
§15.207(a)	AC Line Conducted Emissions	Not applicable*
§15.205, §15.209 & §15.247(d)	Radiated Emissions	Compliance
§15.247(a)(1)	20 dB Emission 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

Note:

(1) Not Applicable – This device is used in vehicle.

(2) All of the tests are powered by DC12V and DC24V, only the worst case (DC 12V) was recorded.

FCC§15.247 (i), §1.1310& §2.1091 –MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 15.247(i) and subpart §1.1310, 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) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minutes)
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	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/cm²);

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);

Measurement Result

Worst case BDR(GFSK):

Model	Frequency (MHz)	Antenna Gain		Output Power		Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
		(dBi)	(numeric)	(dBm)	(mW)			
BDR (GFSK)	2402	3.0	2.00	-4.00	0.40	20	0.0002	1

Note: The target output power: -6 ± 2 dBm, which declared by the Manufacturer.

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

FCC §15.203 – ANTENNA REQUIREMENT

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 a ceramics antenna arrangement for Bluetooth, which the antenna gain is 3 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliance.

FCC §15.205, §15.209 & §15.247(d) – RADIATED EMISSIONS

Applicable Standard

FCC §15.205; §15.209; §15.247(d)

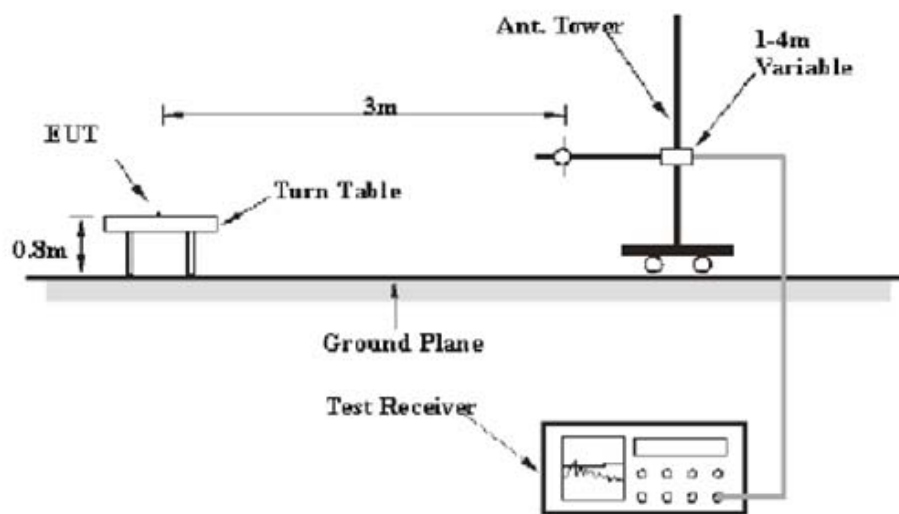
Measurement Uncertainty

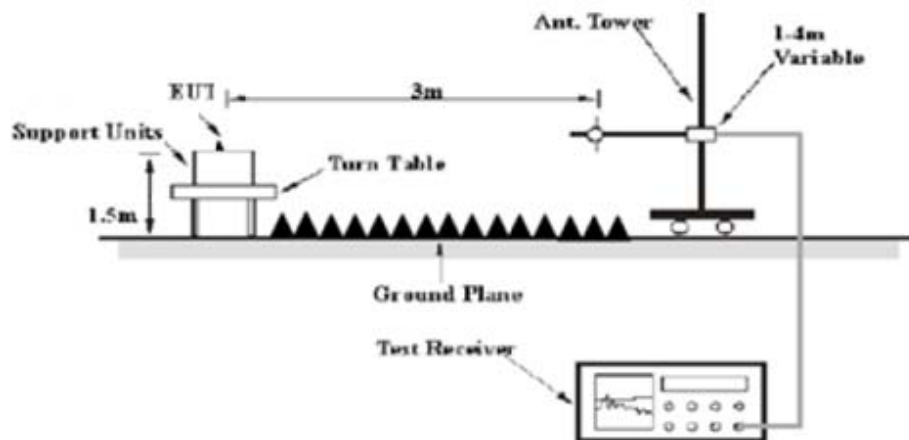
All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency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

Based on CISPR 16-4-2, the expanded combined standard uncertainty of radiation emissions at Bay Area Compliance Laboratories Corp. (Kunshan) is 5.91 dB for 30MHz-1GHz, and 4.92 dB for above 1GHz. And this uncertainty will not be taken into consideration for the test data recorded in the report.

EUT Setup

Below 1 GHz:



Above 1GHz:

The radiated emission tests were performed in the 3 meters, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209 and FCC 15.247 limits.

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:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30 MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1 MHz	3 MHz	/	PK
	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.

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

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 Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Sonoma Instrument	Amplifier	330	171377	2016-10-21	2017-10-21
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2016-11-12	2017-11-11
Sunol Sciences	Broadband Antenna	JB3	A090314-2	2016-01-09	2019-01-08
ETS	Horn Antenna	3115	6229	2016-11-07	2017-11-06
EMCO	Horn Antenna	3116	2516	2016-11-07	2019-11-06
Rohde & Schwarz	Signal Analyzer	FSIQ26	836131/009	2016-09-21	2017-09-21
Narda	Pre-amplifier	AFS42-00101800	2001270	2016-09-08	2017-09-08
DUCOMMUN	Pre-amplifier	ALN-22093530-01	990147	2016-09-17	2017-09-16
champrotek	Chamber	Chamber A	1#	/	/
R&S	Auto test Software	EMC32	V 09.10.0	2015-12-16	2016-12-15
BACL	RF cable	KS-LAB-012	KS-LAB-012	2015-12-16	2016-12-15
BACL	RF cable	KS-LAB-010	KS-LAB-010	2016-09-16	2017-09-15

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

Test Results Summary

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

Refer to CISPR16-4-2 and CISPR 16-4-1, the measured level complies with the limit if

$$L_m + U_{(L_m)} \leq L_{lim} + U_{cispr}$$

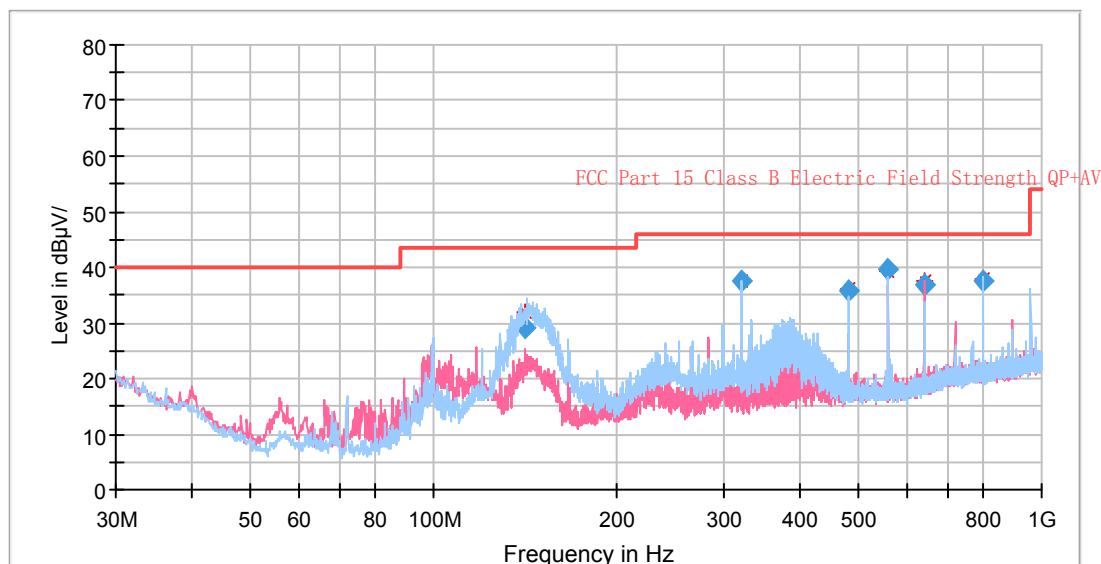
In BACL, $U_{(L_m)}$ is less than $+U_{cispr}$, if L_m is less than L_{lim} , it implies that the EUT complies with the limit.

Test Data**Environmental Conditions**

Temperature:	27 °C
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Peter Jiang on 2016-11-19.

EUT operation mode: Normal operation

30MHz-1GHz:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247/205/209	
	Reading	Detector		Height	Polar			Limit	Margin
	(dBμV)	(PK/QP/Ave.)		(cm)	(H/V)			(dB μV/m)	(dB)
141.745850	41.26	QP	329.0	199.0	H	-12.0	29.26	43.50	14.24
320.000300	47.40	QP	67.0	101.0	H	-10.0	37.40	46.00	8.60
479.987600	41.85	QP	86.0	101.0	H	-6.2	35.65	46.00	10.35
559.988250	44.78	QP	37.0	199.0	H	-5.3	39.48	46.00	6.52
640.006650	40.79	QP	297.0	101.0	V	-4.1	36.69	46.00	9.31
799.989150	39.14	QP	39.0	101.0	H	-1.7	37.44	46.00	8.56

EUT operation mode: Transmitting

1GHz -25 GHz: (Scanned with GFSK, $\pi/4$ -DQPSK, 8DPSK mode, and the worst case is GFSK mode)

Frequency	Receiver		Turntable	Rx Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/205/209	
	Reading	Detector		Height	Polar			Limit	Margin
(MHz)	(dB μ V)	(PK/QP/Ave.)	Degree	(cm)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
Low Channel (2402 MHz)									
2402.00	92.39	PK	52	232	V	-3.04	89.35	/	/
2402.00	83.69	Ave	52	232	V	-3.04	80.65	/	/
2402.00	91.46	PK	23	242	H	-3.04	88.42	/	/
2402.00	85.25	Ave	23	242	H	-3.04	82.21	/	/
2390.00	45.26	PK	292	119	V	-3.05	42.21	74.00	31.79
2390.00	32.22	Ave	292	119	V	-3.05	29.17	54.00	24.83
2400.00	46.29	PK	244	113	V	-3.00	43.29	74.00	30.71
2400.00	34.16	Ave	244	113	V	-3.00	31.16	54.00	22.84
1622.38	55.16	PK	57	124	H	-6.01	49.15	74.00	24.85
1622.38	50.64	Ave	57	124	H	-6.01	44.63	54.00	9.37
4804.00	47.28	PK	95	173	V	7.16	54.44	74.00	19.56
4804.00	36.21	Ave	95	173	V	7.16	43.37	54.00	10.63
7236.00	40.56	PK	326	113	H	16.00	56.56	74.00	17.44
7236.00	31.12	Ave	326	113	H	16.00	47.12	54.00	6.88
Frequency	Receiver		Turntable	Rx Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/205/209	
	Reading	Detector		Height	Polar			Limit	Margin
(MHz)	(dB μ V)	(PK/QP/Ave.)	Degree	(cm)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
Middle Channel (2441 MHz)									
2441.00	90.63	PK	63	211	V	-3.02	87.61	/	/
2441.00	84.66	Ave	63	211	V	-3.02	81.64	/	/
2441.00	91.15	PK	67	193	H	-3.02	88.13	/	/
2441.00	85.41	Ave	67	193	H	-3.02	82.39	/	/
1486.59	43.71	PK	257	134	V	-7.02	36.69	74.00	37.31
1486.59	32.12	Ave	257	134	V	-7.02	25.10	54.00	28.90
1702.61	42.73	PK	36	131	H	-5.41	37.32	74.00	36.68
1702.61	36.79	Ave	36	131	H	-5.41	31.38	54.00	22.62
4882.00	45.21	PK	290	224	V	7.28	52.49	74.00	21.51
4882.00	39.51	Ave	290	224	V	7.28	46.79	54.00	7.21
6669.14	39.47	PK	304	239	H	13.79	53.26	74.00	20.74
6669.14	32.72	Ave	304	239	H	13.79	46.51	54.00	7.49
7323.00	41.73	PK	42	109	H	16.38	58.11	74.00	15.89
7323.00	31.51	Ave	42	109	H	16.38	47.89	54.00	6.11

Frequency	Receiver		Turntable	Rx Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/205/209	
	Reading	Detector		Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave.)	Degree	(cm)	(H/V)	(dB)	(dBμV/m)	(dB μV/m)	(dB)
High Channel (2480MHz)									
2480.00	87.12	PK	79	137	V	-2.99	84.13	/	/
2480.00	84.94	Ave	79	137	V	-2.99	81.95	/	/
2480.00	90.48	PK	57	204	H	-2.99	87.49	/	/
2480.00	84.63	Ave	57	204	H	-2.99	81.64	/	/
2483.50	43.55	PK	300	206	V	-2.99	40.56	74.00	33.44
2483.50	30.28	Ave	300	206	V	-2.99	27.29	54.00	26.71
2577.64	43.11	PK	9	201	V	-2.52	40.59	74.00	33.41
2577.64	34.16	Ave	9	201	V	-2.52	31.64	54.00	22.36
4960.00	46.27	PK	226	180	H	7.40	53.67	74.00	20.33
4960.00	38.73	Ave	226	180	H	7.40	46.13	54.00	7.87
6681.00	23.72	PK	2	119	H	13.80	37.52	74.00	36.48
6681.00	22.14	Ave	2	119	H	13.80	35.94	54.00	18.06
7386.00	43.38	PK	146	211	H	16.65	60.03	74.00	13.97
7386.00	29.51	Ave	146	211	H	16.65	46.16	54.00	7.84

Note:

Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor

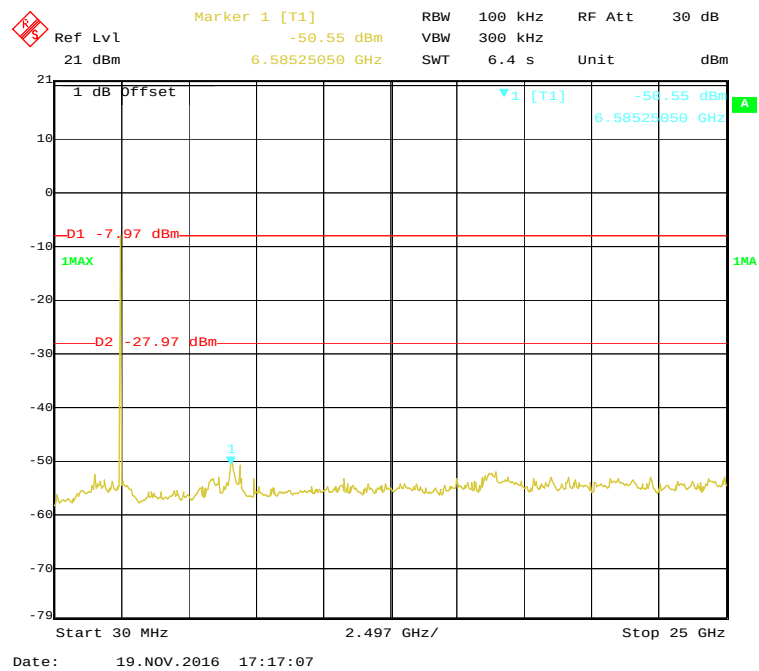
Corrected Amplitude = Corrected Factor + Reading

Margin = Limit - Corrected. Amplitude

Low Channel



High Channel



Note:

Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor

Corrected Amplitude = Corrected Factor + Reading

Margin = Limit - Corrected. Amplitude

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 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.

Test Procedure

1. Set the EUT in transmitting mode, maxhold the channel.
2. Set the adjacent channel of the EUT and maxhold another trace.
3. Measure the channel separation.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	836131/009	2016-09-21	2017-09-21
BACL	RF cable	KS-LAB-012	KS-LAB-012	2015-12-16	2016-12-15

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

Test Data**Environmental Conditions**

Temperature:	26 °C
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Peter Jiang on 2016-11-19

EUT operation mode: Transmitting

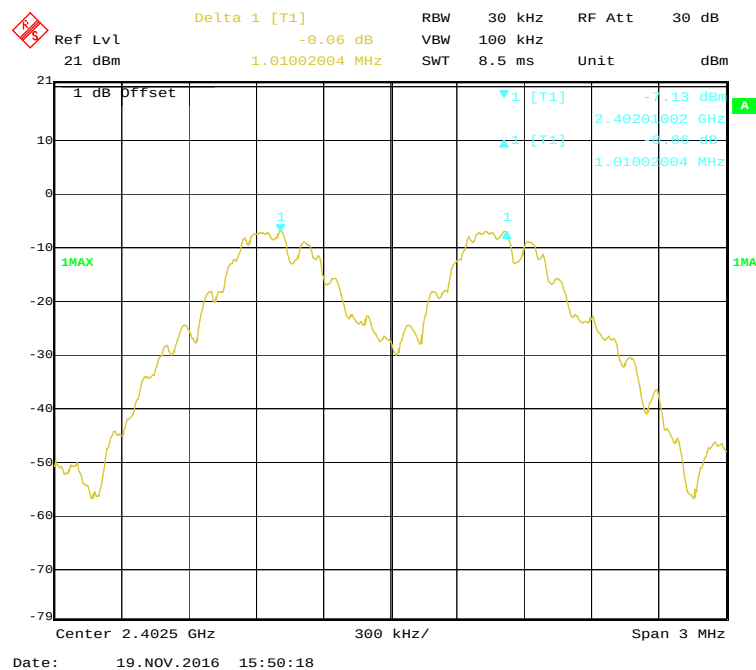
Test Result: Compliance.

Please refer to following tables and plots:

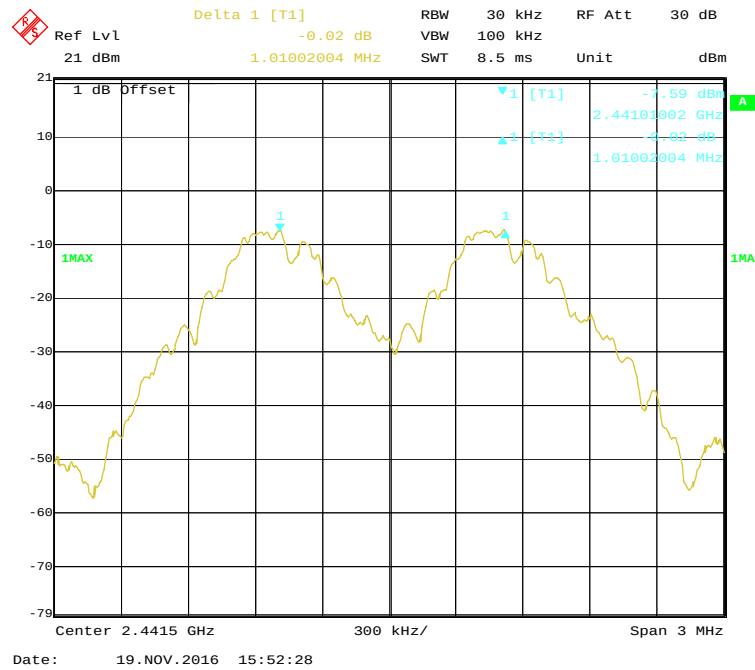
Mode	Channel	Frequency (MHz)	Channel Separation (MHz)	≥Limit (MHz)	Result
BDR (GFSK)	Low	2402	1.010	0.637	Pass
	Adjacent	2403			
	Middle	2441	1.010	0.637	Pass
	Adjacent	2442			
	High	2480	1.004	0.637	Pass
	Adjacent	2479			
EDR (π/4-DQPSK)	Low	2402	1.004	0.862	Pass
	Adjacent	2403			
	Middle	2441	1.004	0.862	Pass
	Adjacent	2442			
	High	2480	1.004	0.862	Pass
	Adjacent	2479			
EDR (8DPSK)	Low	2402	0.992	0.842	Pass
	Adjacent	2403			
	Middle	2441	1.004	0.838	Pass
	Adjacent	2442			
	High	2480	1.004	0.842	Pass
	Adjacent	2479			

Note: Limit = 20 dB bandwidth *2/3

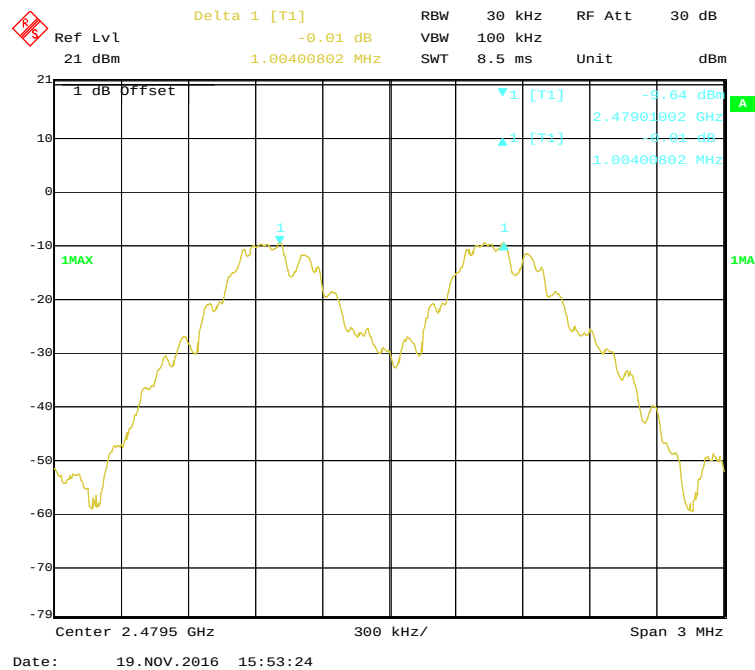
BDR (GFSK): Low Channel



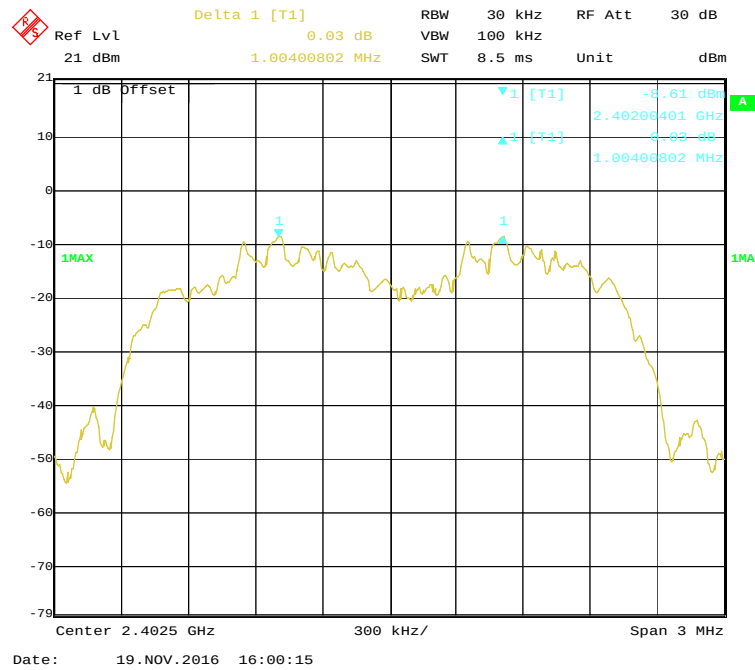
BDR (GFSK): Middle Channel



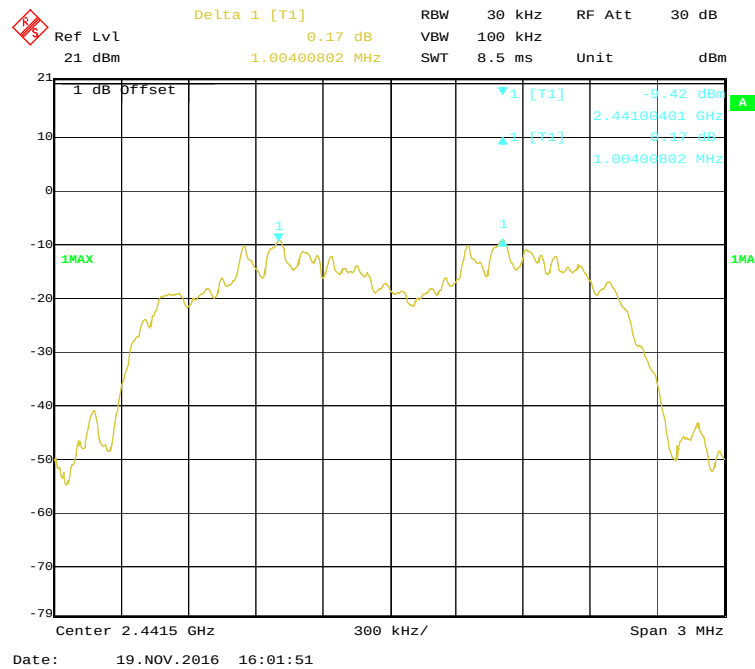
BDR (GFSK): High Channel

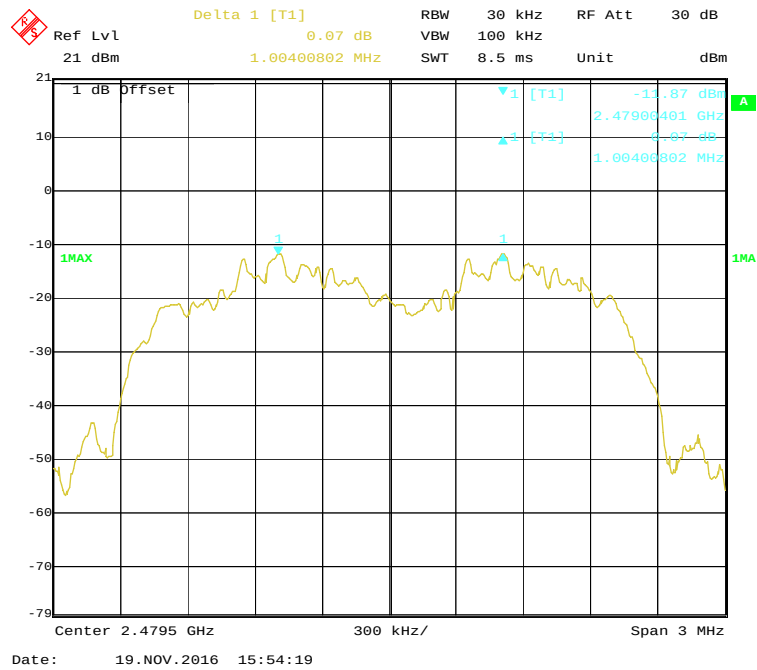
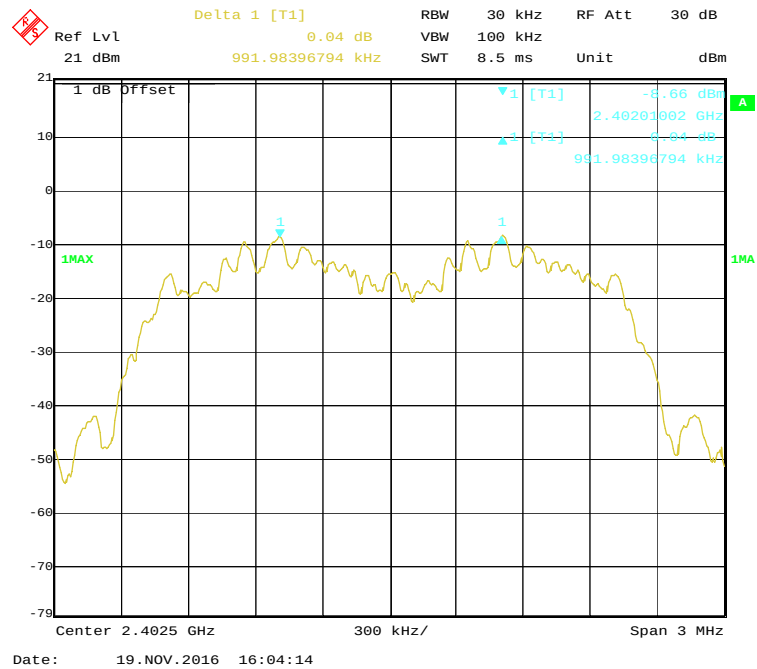


EDR ($\pi/4$ -DQPSK): Low Channel

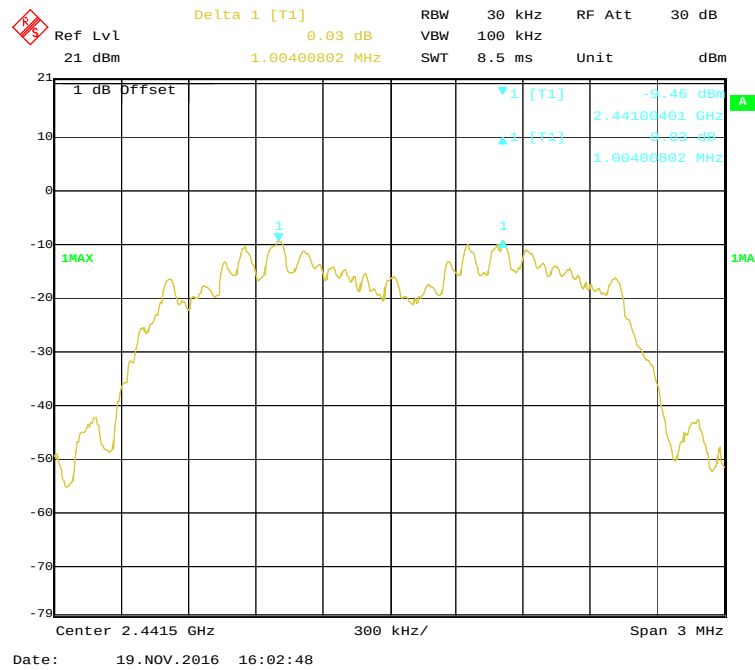


EDR ($\pi/4$ -DQPSK): Middle Channel

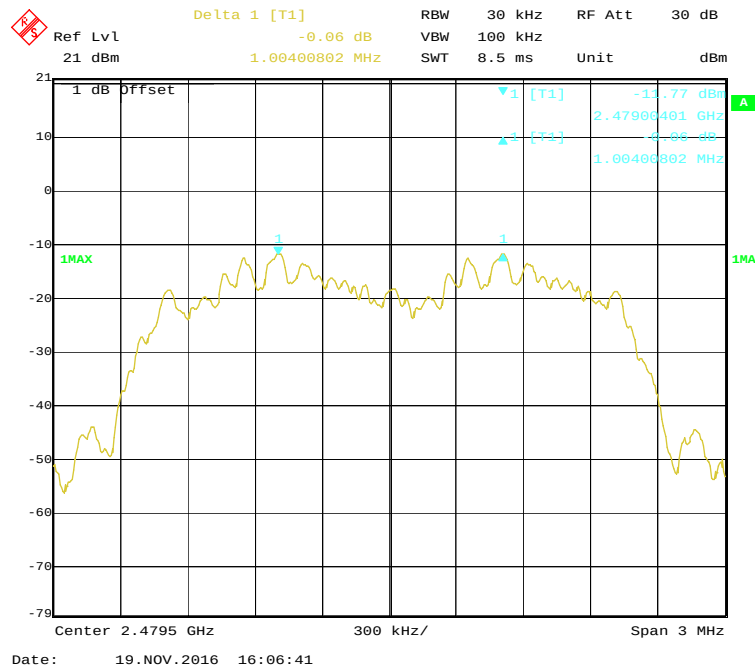


EDR ($\pi/4$ -DQPSK): High Channel**EDR (8DPSK): Low Channel**

EDR (8DPSK): Middle Channel



EDR (8DPSK): High Channel



FCC §15.247(a) (1) – 20 dB EMISSION BANDWIDTH**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 without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. 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	Signal Analyzer	FSIQ26	836131/009	2016-09-21	2017-09-21
BACL	RF cable	KS-LAB-012	KS-LAB-012	2015-12-16	2016-12-15

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

Test Data**Environmental Conditions**

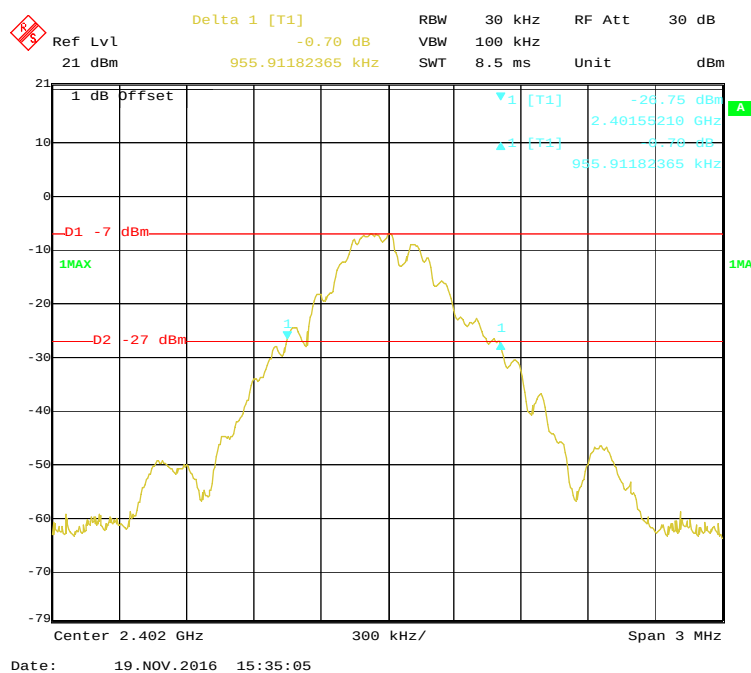
Temperature:	26 °C
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Peter Jiang on 2016-11-19.

EUT operation mode: Transmitting

Test Result: Compliance. Please refer to following tables and plots

Mode	Channel	Frequency (MHz)	20 dB Emission Bandwidth (MHz)
BDR (GFSK)	Low	2402	0.956
	Middle	2441	0.956
	High	2480	0.956
EDR ($\pi/4$-DQPSK)	Low	2402	1.293
	Middle	2441	1.293
	High	2480	1.293
EDR (8DPSK)	Low	2402	1.263
	Middle	2441	1.257
	High	2480	1.263

BDR (GFSK): Low Channel

Delta 1 [T1] -0.17 dB RBW 30 kHz RF Att 30 dB

Ref Lvl 21 dBm Unit dBm

1 dB Offset

1 [T1] -27.68 dBm 2.44055210 GHz

3 [T1] -27.47 dBm 995.91182365 kHz

D1 -7.6 dBm 1MAX

D2 -27.6 dBm 1

Center 2.441 GHz 300 kHz/ Span 3 MHz

Date: 19. NOV. 2016 15:39:05

Delta 1 [T1] -0.07 dB RBW 30 kHz RF Att 30 dB
 Ref Lvl 21 dBm VBW 100 kHz Unit dBm
 955.91182365 kHz SWT 8.5 ms

1 dB Offset

1 [T1] -29.55 dBm
 2.47955210 GHz
 1 [T1] -9.55 dBm
 955.91182365 kHz

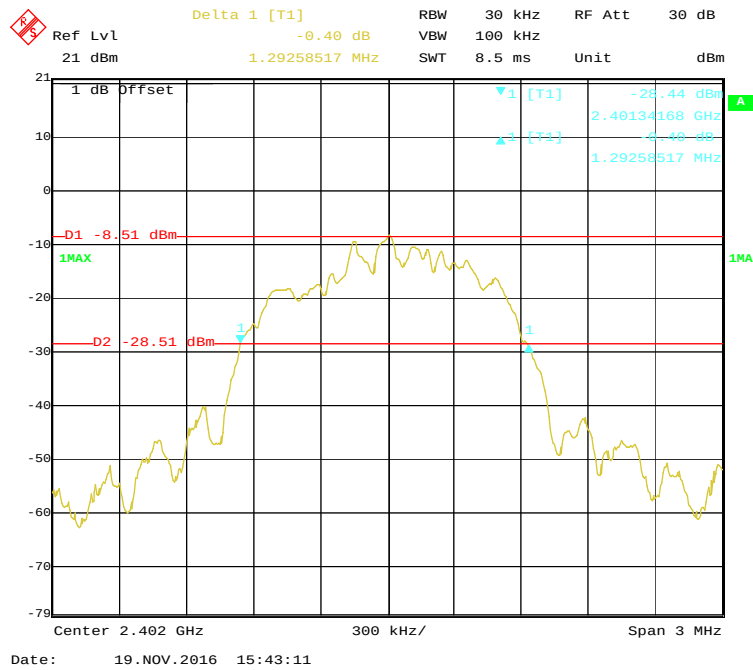
D1 -9.55 dBm
 1MAX

D2 -29.55 dBm
 1

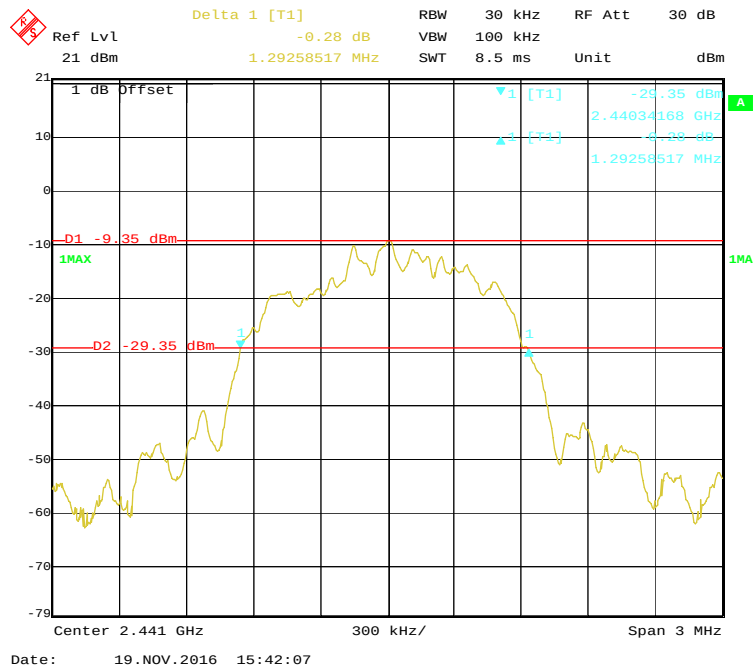
Center 2.48 GHz 300 kHz/ Span 3 MHz

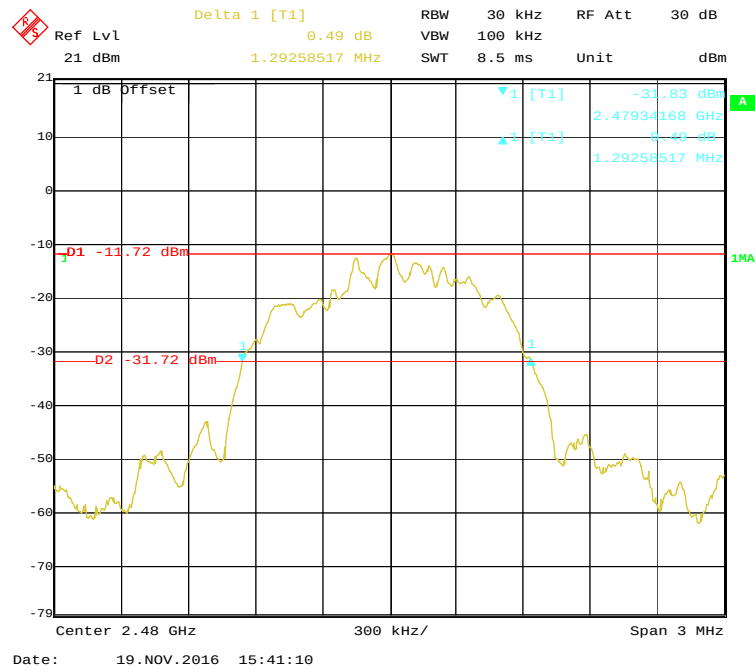
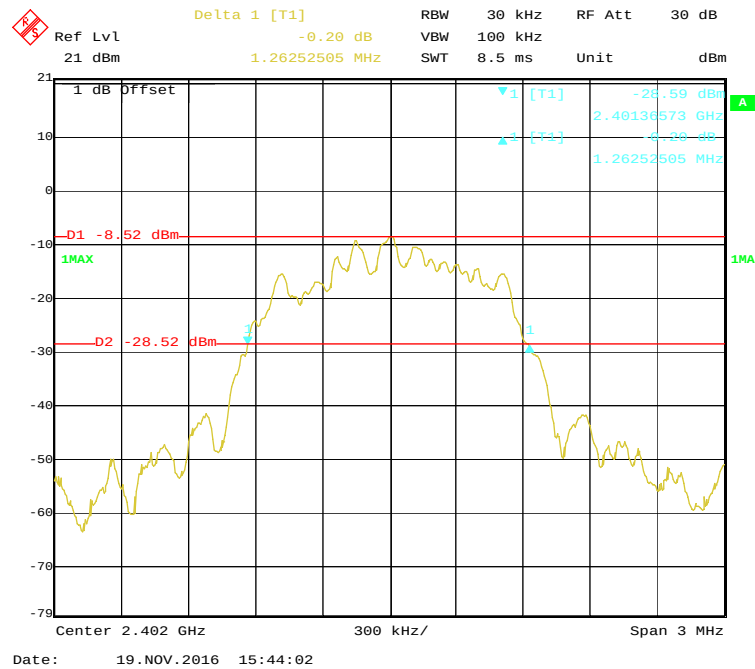
Date: 19. NOV. 2016 15:40:15

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

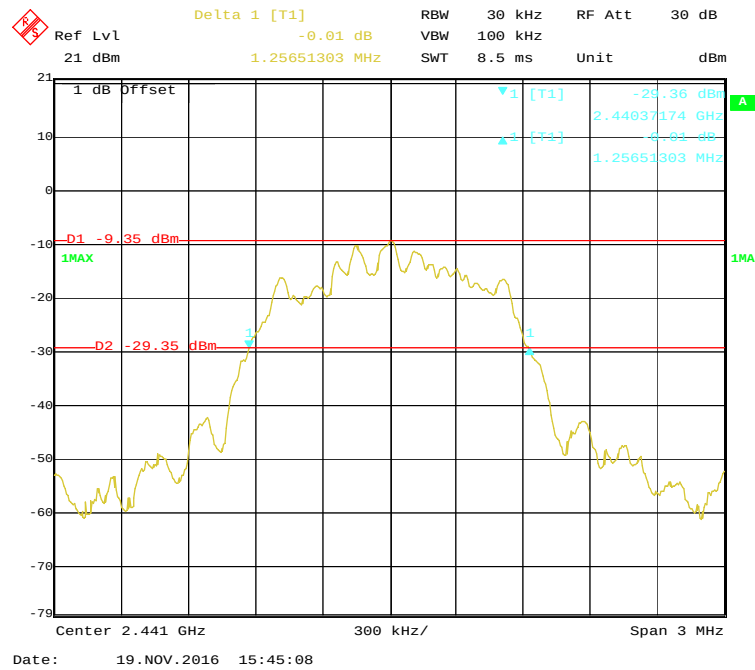


EDR($\pi/4$ -DQPSK): Middle Channel

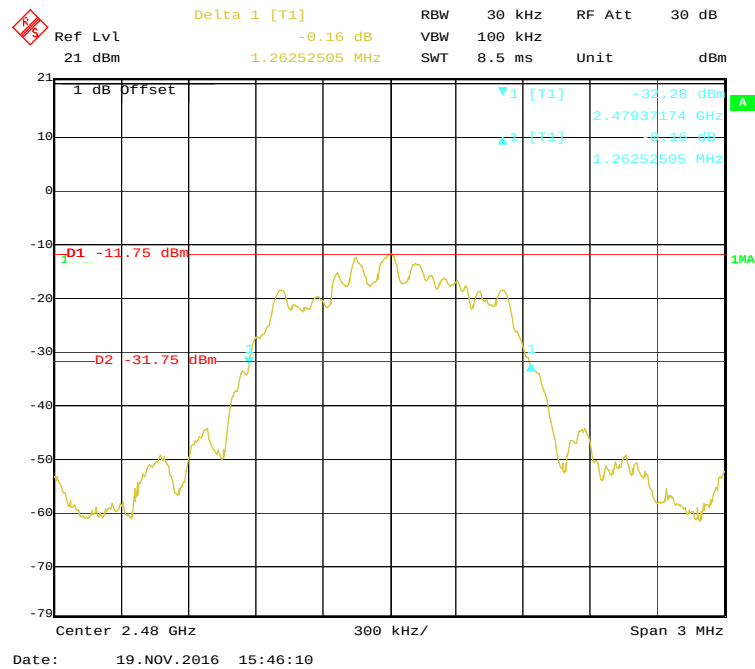


EDR ($\pi/4$ -DQPSK): High Channel**EDR (8DPSK): Low Channel**

EDR (8DPSK): Middle Channel



EDR (8DPSK): High Channel



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

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	836131/009	2016-09-21	2017-09-21
BACL	RF cable	KS-LAB-012	KS-LAB-012	2015-12-16	2016-12-15

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

Test Data**Environmental Conditions**

Temperature:	26 °C
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

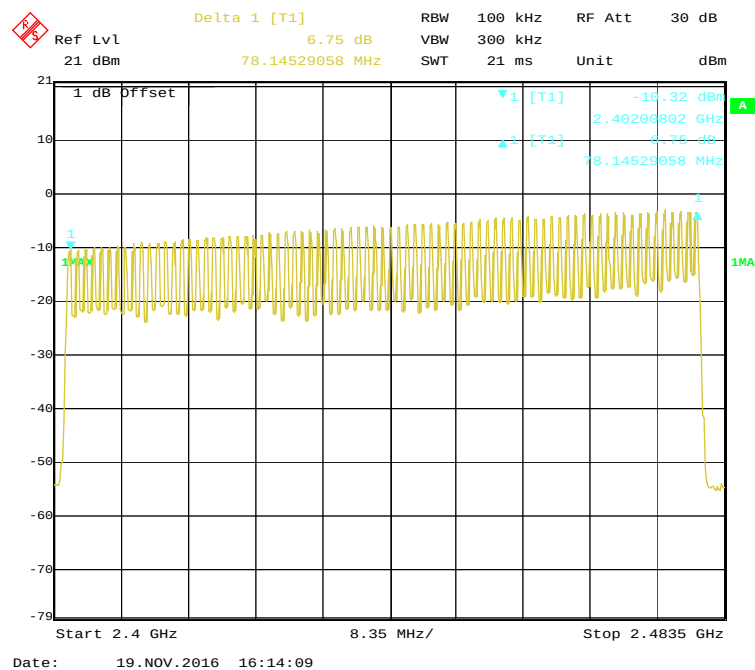
The testing was performed by Peter Jiang on 2016-11-19.

EUT operation mode: Transmitting

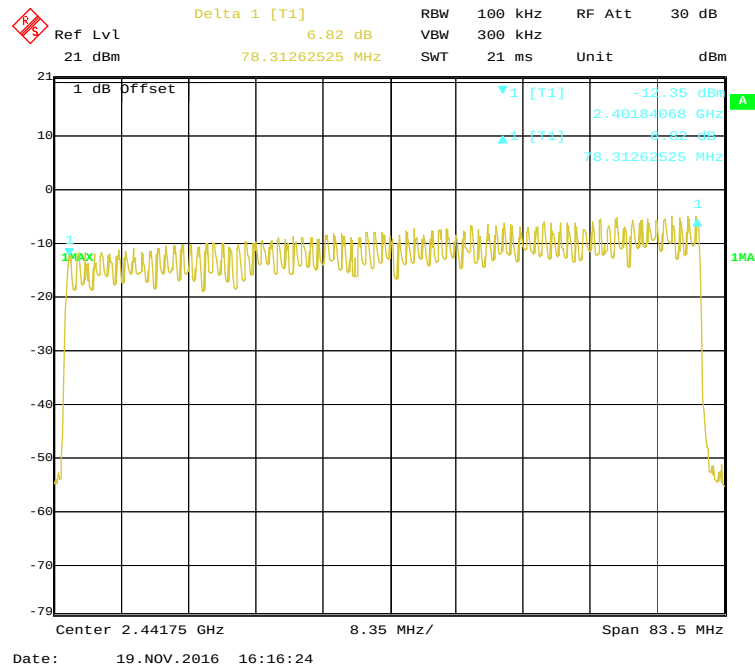
Test Result: Compliance. Please refer to following tables and plots

Mode	Frequency Range (MHz)	Number of Hopping Channel (CH)	Limit (CH)
BDR (GFSK)	2400-2483.5	79	≥15
EDR ($\pi/4$ -DQPSK)	2400-2483.5	79	≥15
EDR (8DPSK)	2400-2483.5	79	≥15

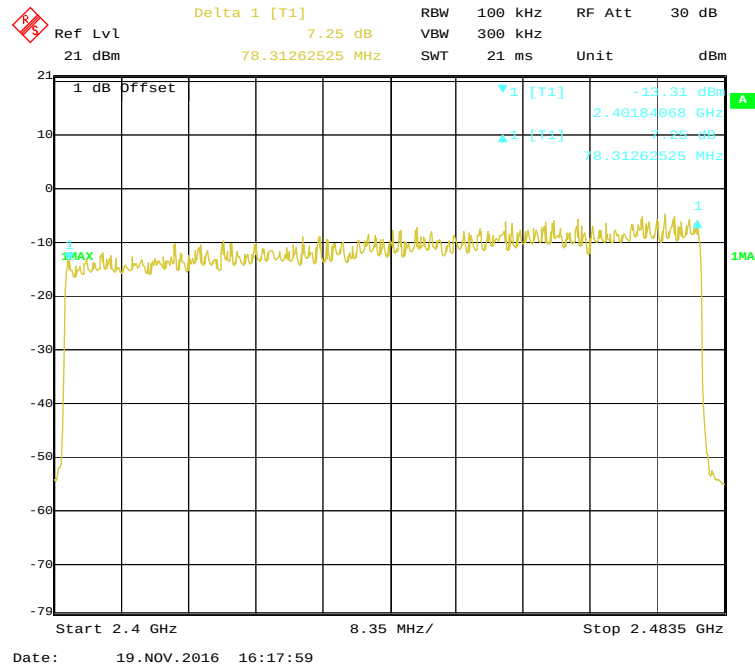
BDR (GFSK): Number of Hopping Channels



EDR ($\pi/4$ -DQPSK): Number of Hopping Channels



EDR (8DPSK): Number of Hopping Channels



FCC §15.247(a) (1) (iii) - TIME OF OCCUPANCY (DWEELL 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 X channel no. (s), the quantity of pulse was get from single sweep. In addition, the time of single pulses was tested.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	836131/009	2016-09-21	2017-09-21
BACL	RF cable	KS-LAB-012	KS-LAB-012	2015-12-16	2016-12-15

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

Test Data**Environmental Conditions**

Temperature:	26 °C
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Peter Jiang on 2016-11-19.

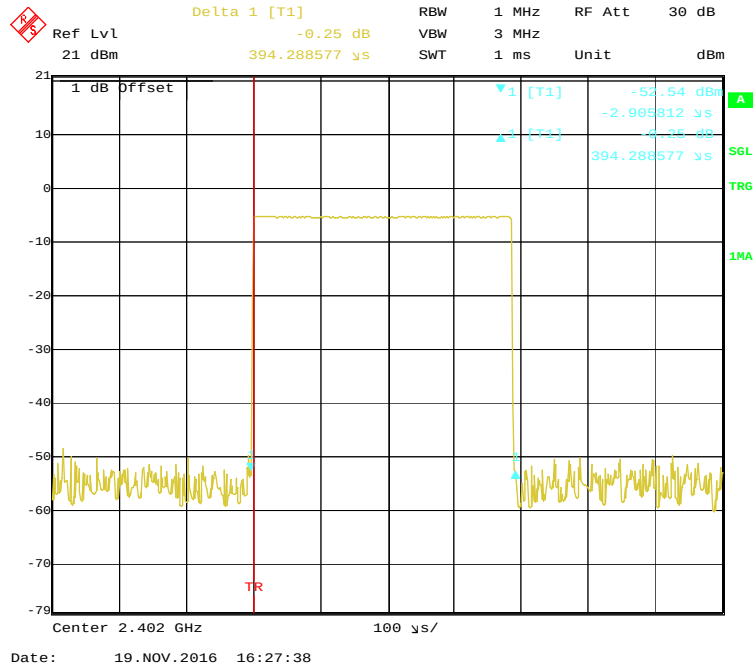
EUT operation mode: Transmitting

Test Result: Compliance. Please refer to following tables and plots

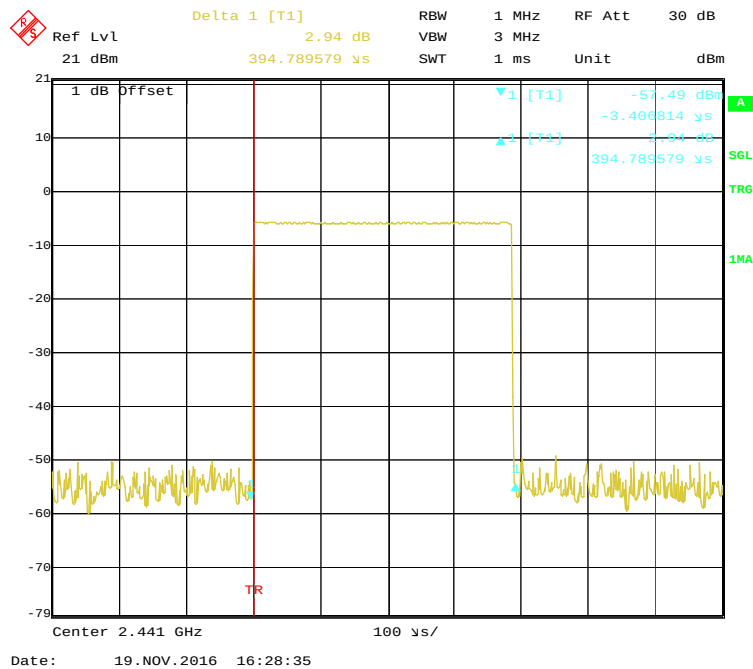
Mode		Channel	Pulse Width	Dwell Time	Limit	Result
			(ms)	(S)	(S)	
BDR (GFSK)	DH 1	Low	0.394	0.126	0.4	Pass
		Middle	0.395	0.126	0.4	Pass
		High	0.395	0.126	0.4	Pass
		Note: DH1:Dwell time = Pulse time*(1600/2/79)*31.6S				
	DH 3	Low	1.659	0.265	0.4	Pass
		Middle	1.659	0.265	0.4	Pass
		High	1.665	0.266	0.4	Pass
		Note: DH3:Dwell time = Pulse time*(1600/4/79)*31.6S				
	DH 5	Low	2.918	0.311	0.4	Pass
		Middle	2.918	0.311	0.4	Pass
		High	2.918	0.311	0.4	Pass
		Note: DH5:Dwell time = Pulse time*(1600/6/79)*31.6S				
EDR ($\pi/4$ -DQPSK)	DH 1	Low	0.431	0.138	0.4	Pass
		Middle	0.427	0.137	0.4	Pass
		High	0.433	0.139	0.4	Pass
		Note: DH1:Dwell time = Pulse time*(1600/2/79)*31.6S				
	DH 3	Low	1.689	0.270	0.4	Pass
		Middle	1.695	0.271	0.4	Pass
		High	1.689	0.270	0.4	Pass
		Note: DH3:Dwell time = Pulse time*(1600/4/79)*31.6S				
	DH 5	Low	2.942	0.314	0.4	Pass
		Middle	2.942	0.314	0.4	Pass
		High	2.942	0.314	0.4	Pass
		Note: DH5:Dwell time = Pulse time*(1600/6/79)*31.6S				
EDR (8DPSK)	DH 1	Low	0.431	0.138	0.4	Pass
		Middle	0.431	0.138	0.4	Pass
		High	0.433	0.139	0.4	Pass
		Note: DH1:Dwell time = Pulse time*(1600/2/79)*31.6S				
	DH 3	Low	1.689	0.270	0.4	Pass
		Middle	1.695	0.271	0.4	Pass
		High	1.695	0.271	0.4	Pass
		Note: DH3:Dwell time = Pulse time*(1600/4/79)*31.6S				
	DH 5	Low	2.950	0.315	0.4	Pass
		Middle	2.950	0.315	0.4	Pass
		High	2.950	0.315	0.4	Pass
		Note: DH5:Dwell time = Pulse time*(1600/6/79)*31.6S				

BDR (GFSK):

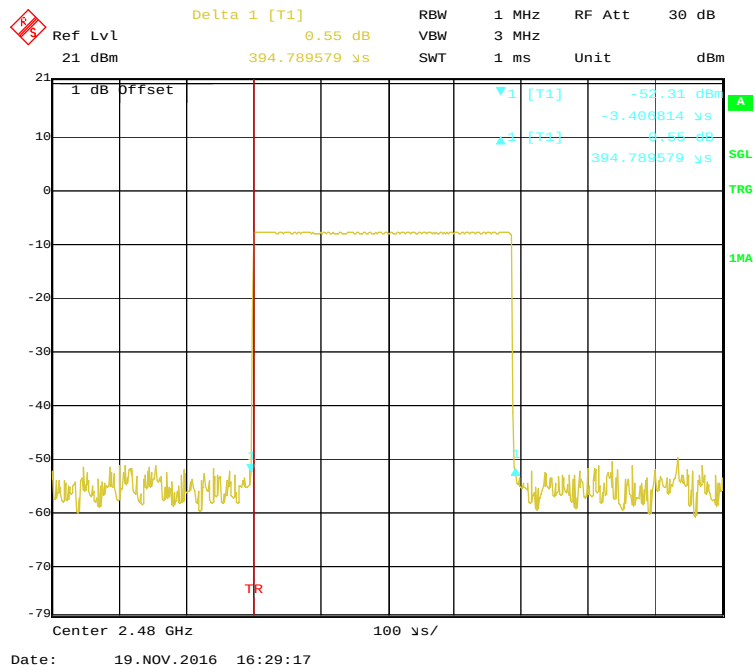
Pulse time, Low Channel, DH1



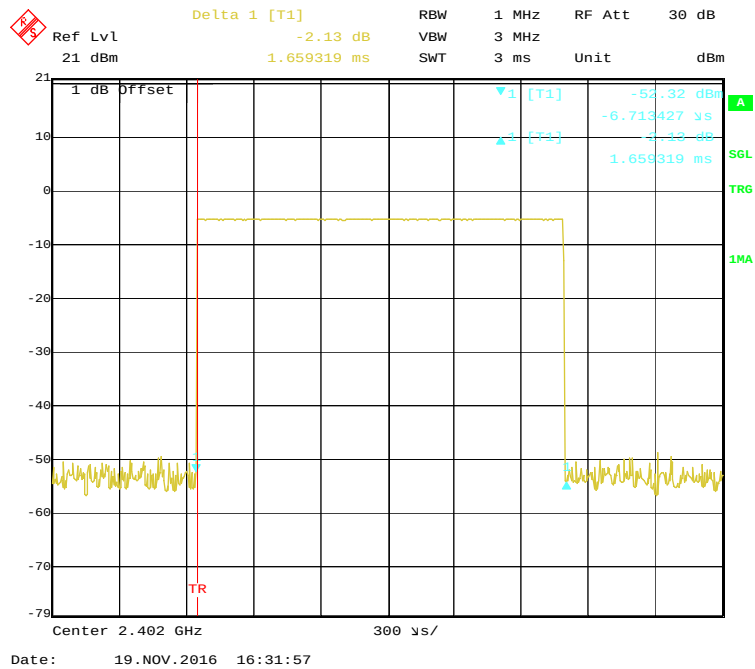
Pulse time, Middle Channel, DH1



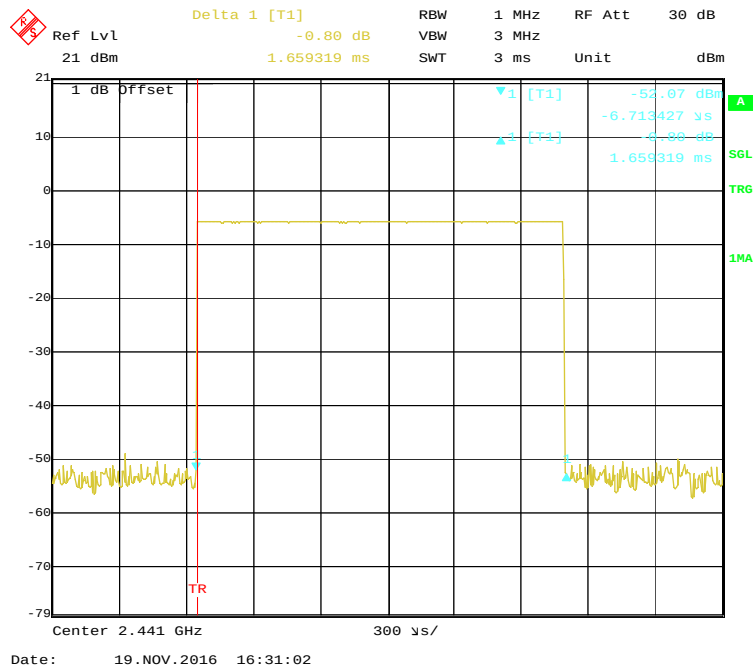
Pulse time, High Channel, DH1



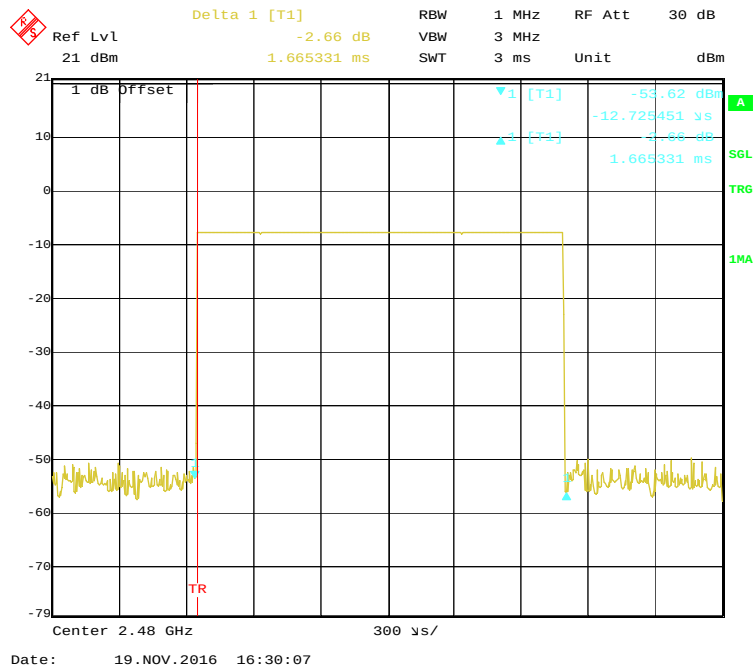
Pulse time, Low Channel, DH3



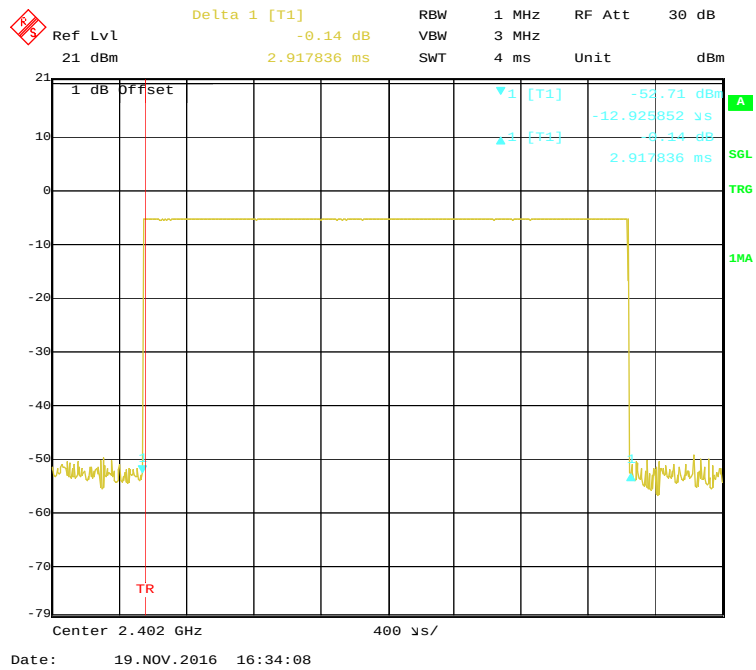
Pulse time, Middle Channel, DH3



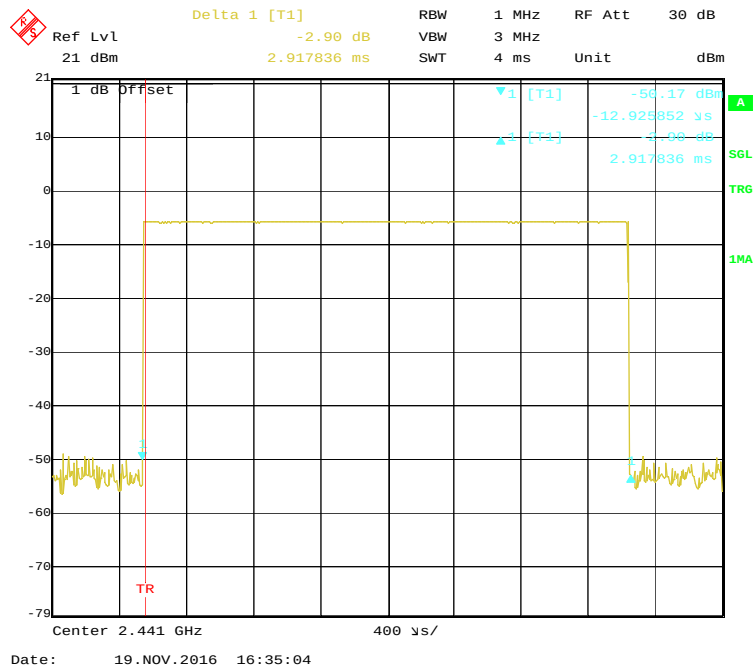
Pulse time, High Channel, DH3



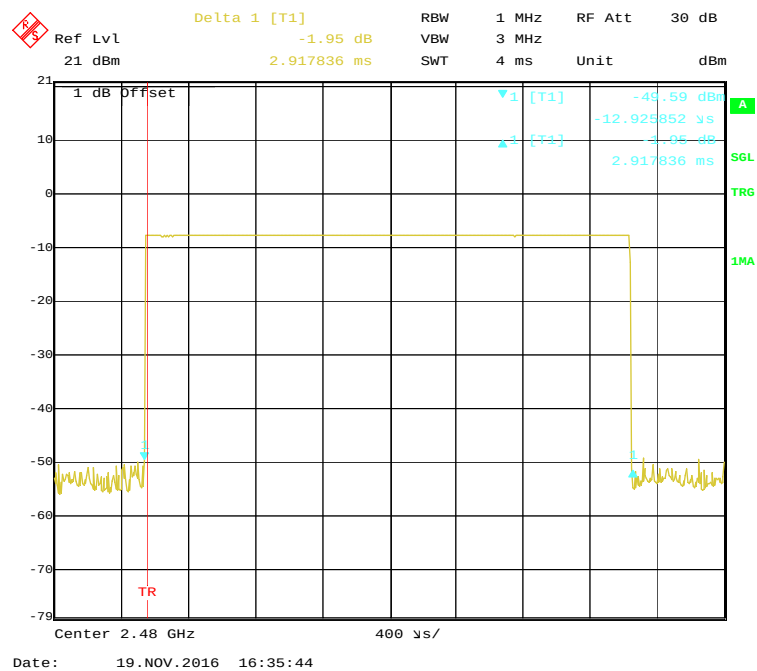
Pulse time, Low Channel, DH5



Pulse time, Middle Channel, DH5

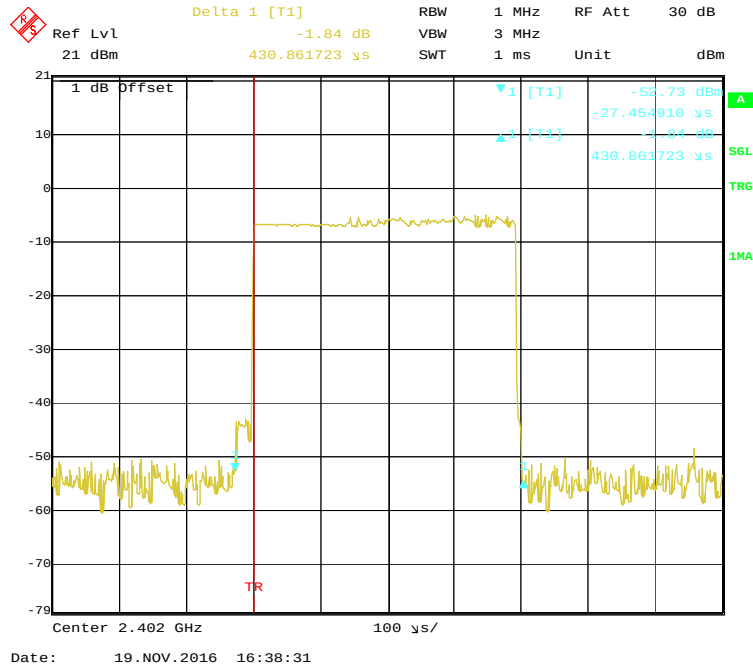


Pulse time, High Channel, DH5

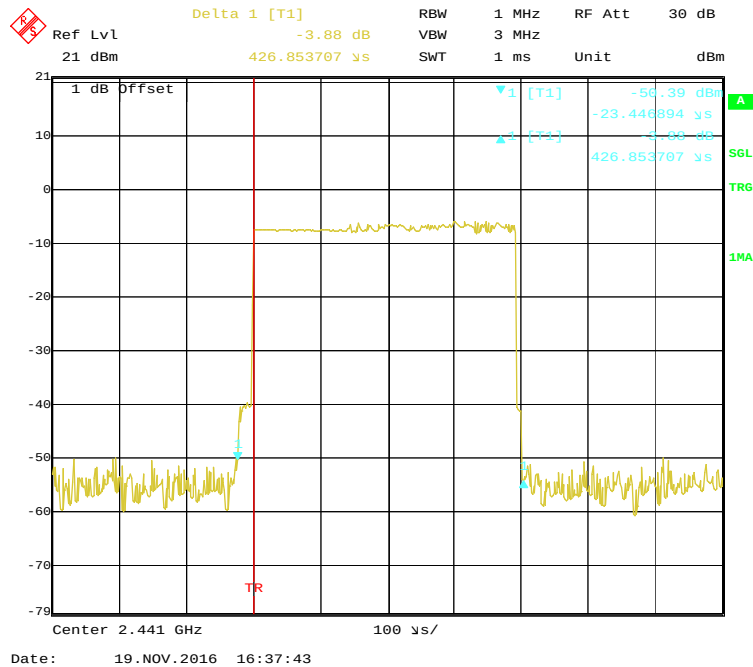


EDR ($\pi/4$ -DQPSK):

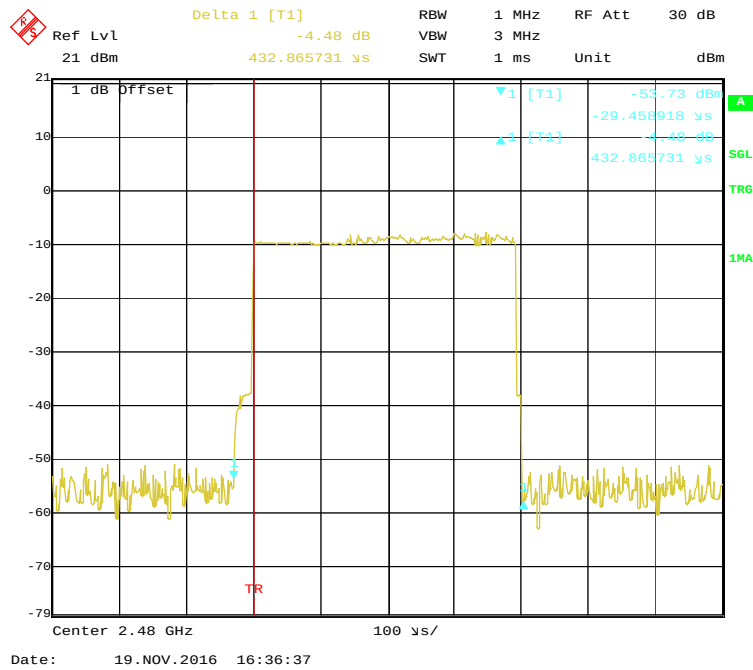
Pulse time, Low Channel, DH1



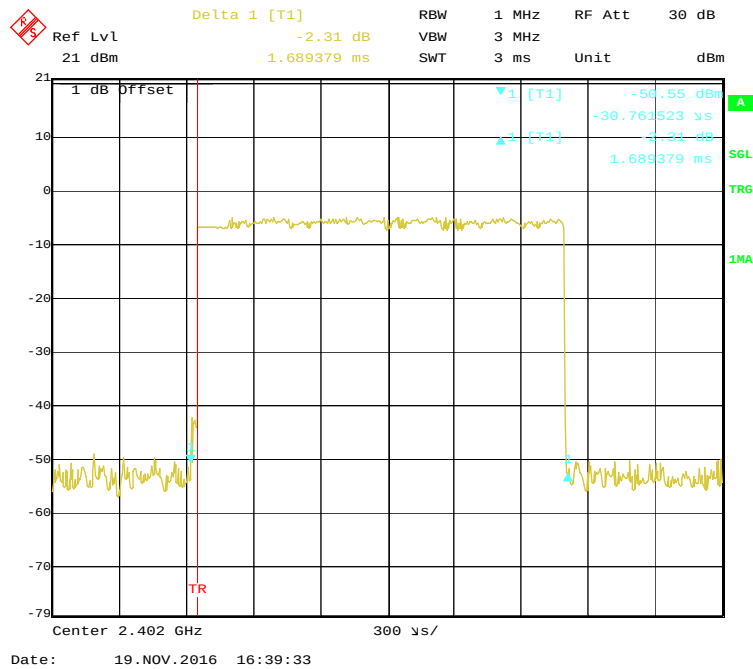
Pulse time, Middle Channel, DH1



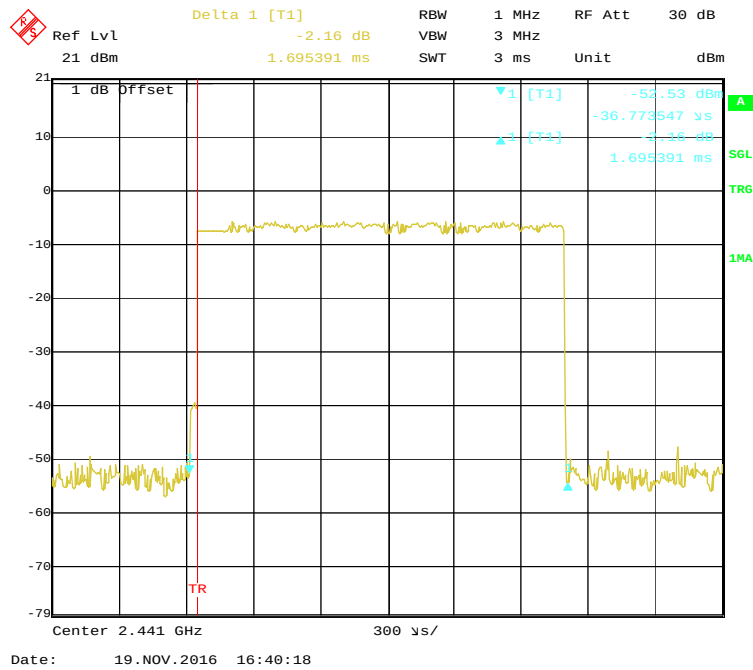
Pulse time, High Channel, DH1



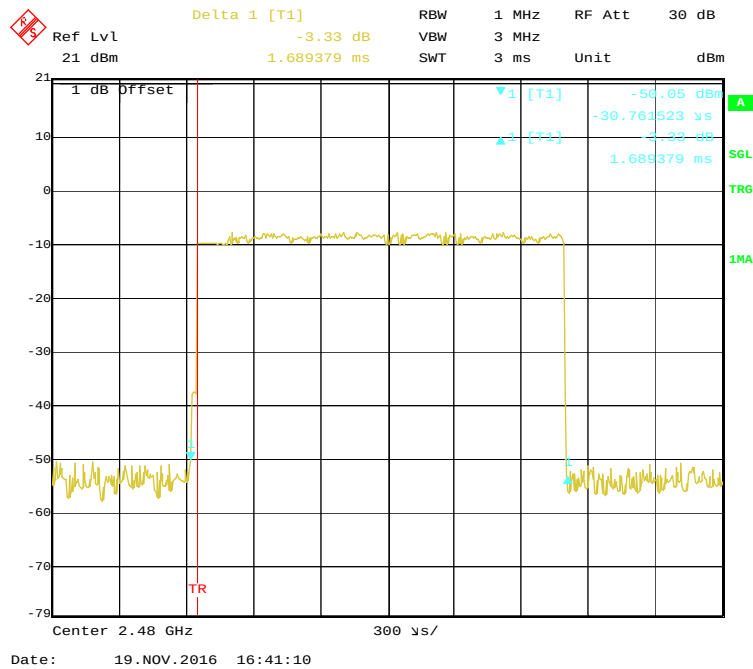
Pulse time, Low Channel, DH3



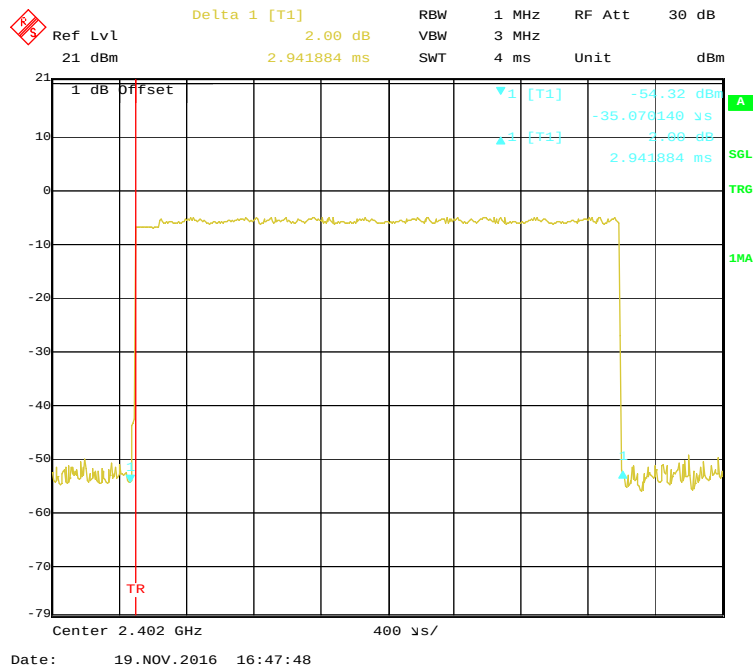
Pulse time, Middle Channel, DH3



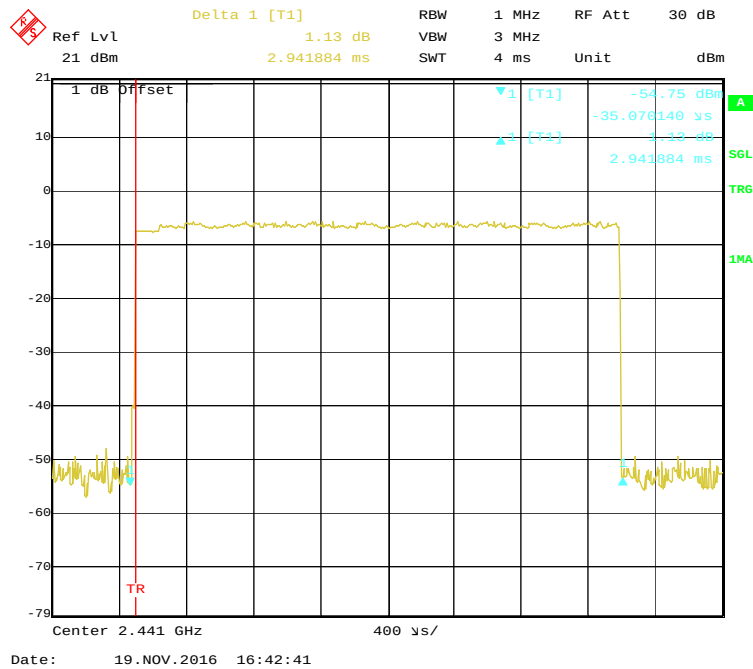
Pulse time, High Channel, DH3



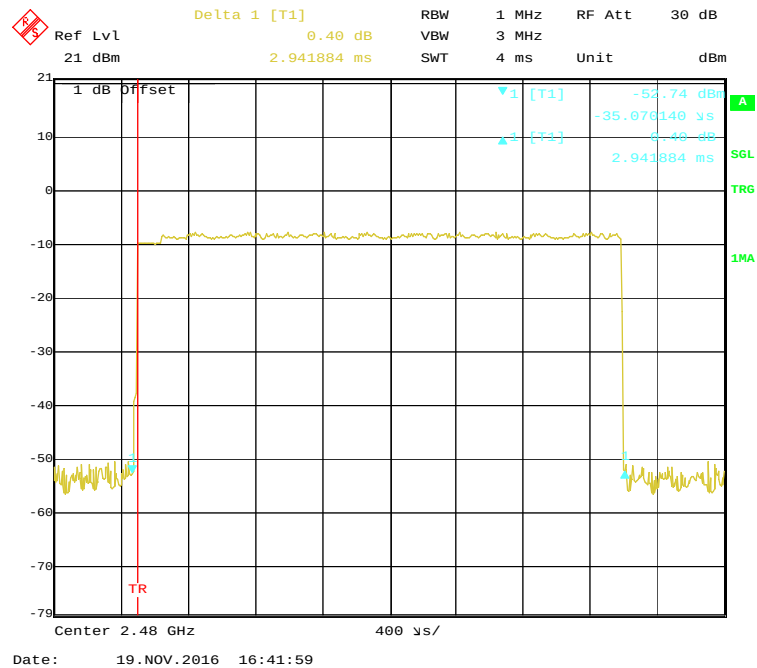
Pulse time, Low Channel, DH5



Pulse time, Middle Channel, DH5

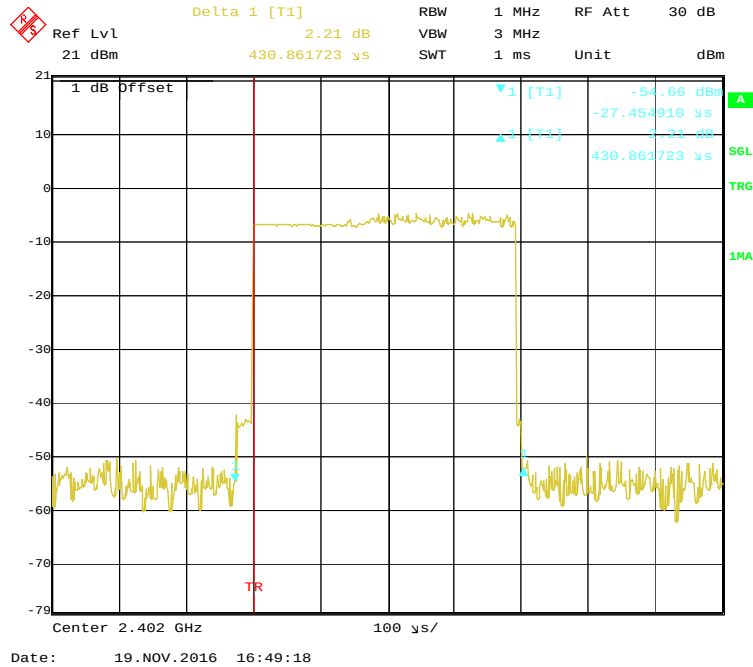


Pulse time, High Channel, DH5

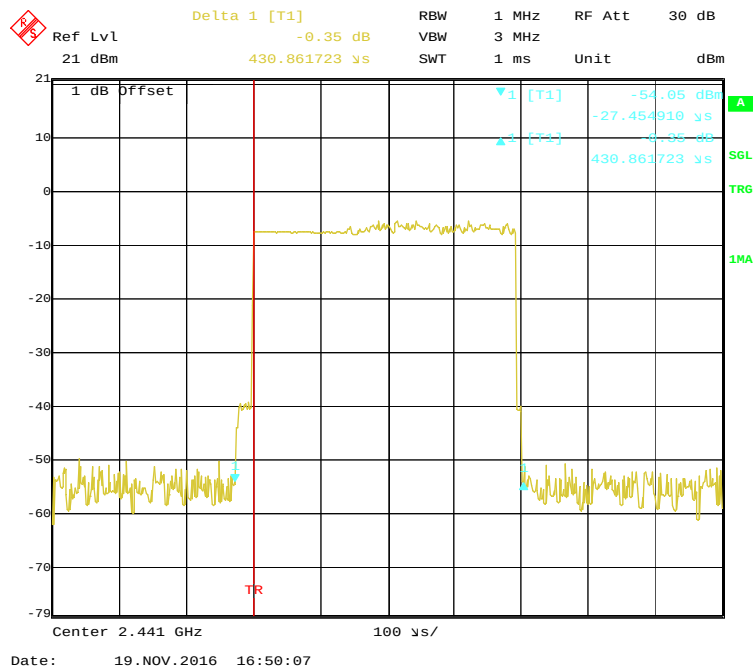


EDR (8DPSK):

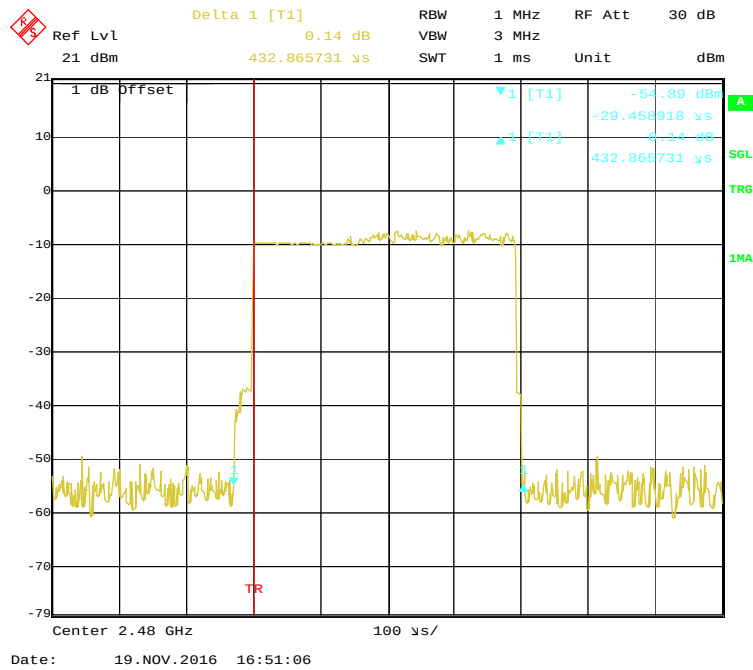
Pulse time, Low Channel, DH1



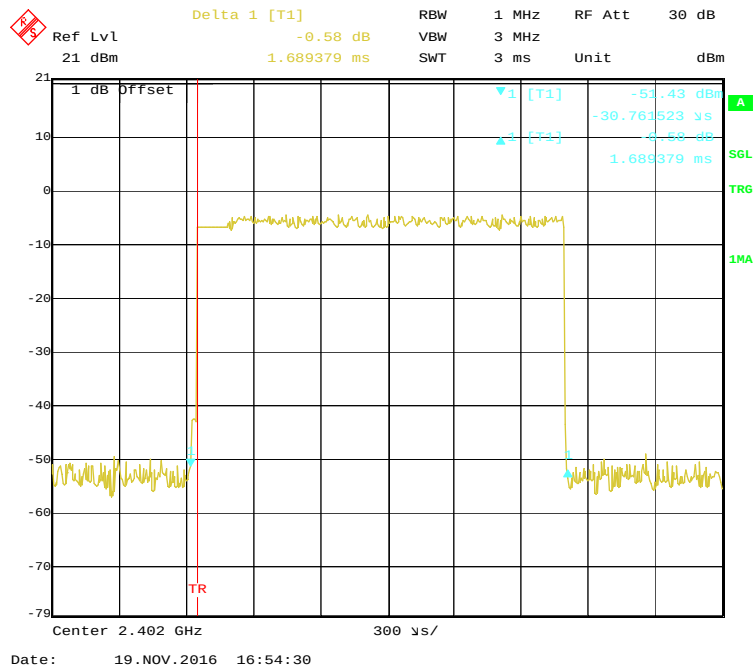
Pulse time, Middle Channel, DH1



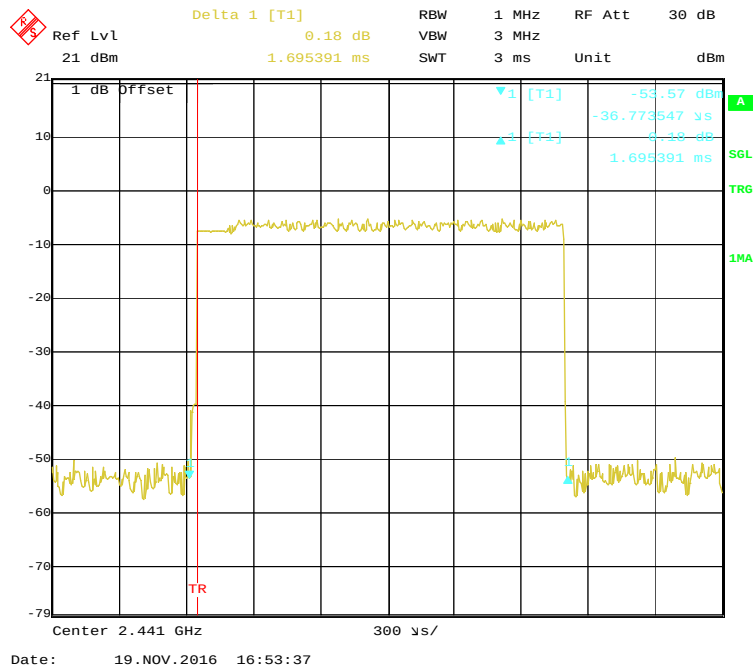
Pulse time, High Channel, DH1



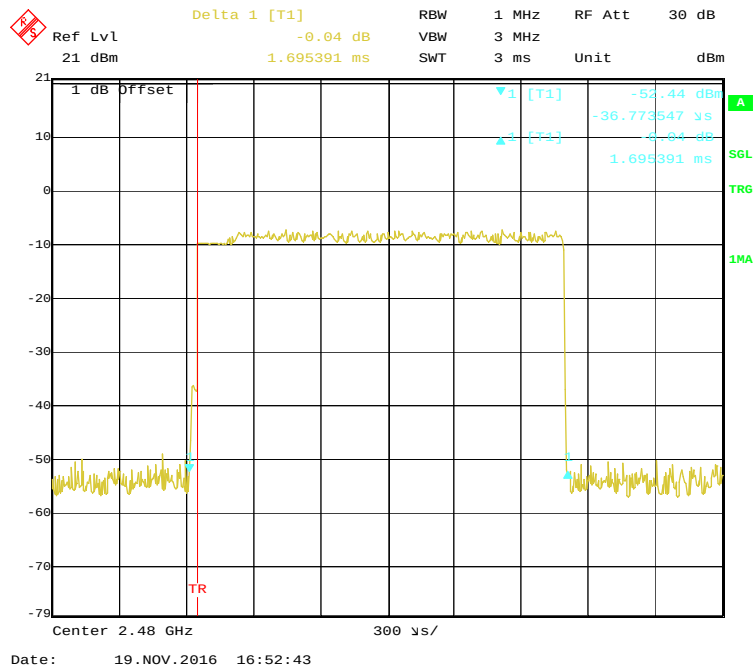
Pulse time, Low Channel, DH3



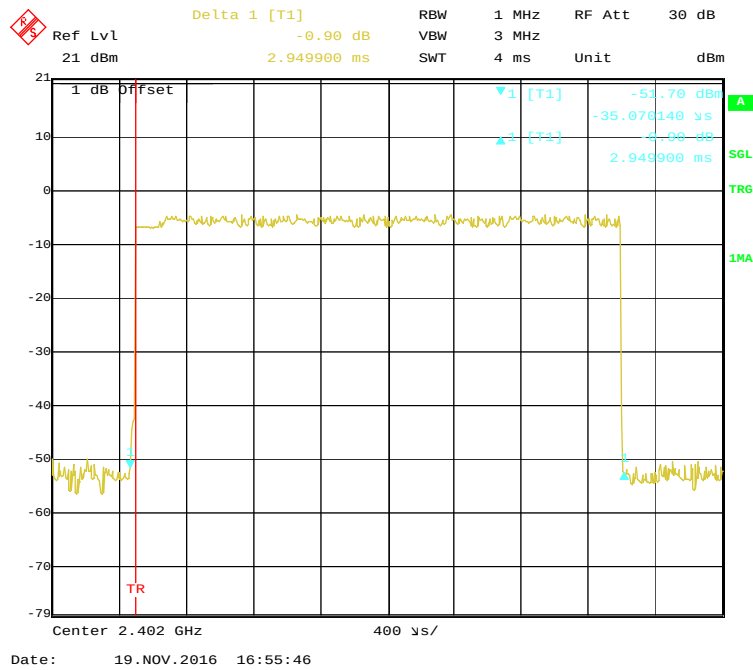
Pulse time, Middle Channel, DH3



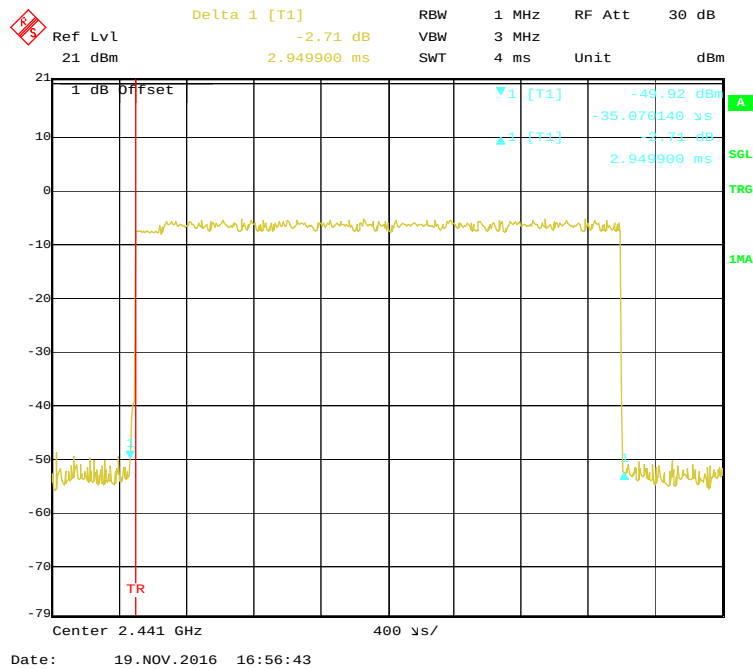
Pulse time, High Channel, DH3



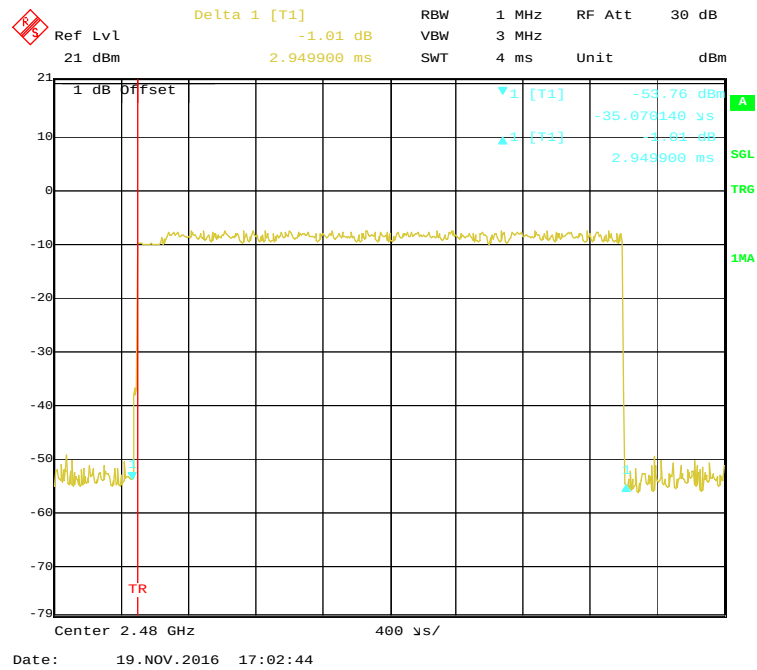
Pulse time, Low Channel, DH5



Pulse time, Middle Channel, DH5



Pulse time, High Channel, DH5



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. And 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 one test equipment.
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	Signal Analyzer	FSIQ26	836131/009	2016-09-21	2017-09-21
BACL	RF cable	KS-LAB-012	KS-LAB-012	2015-12-16	2016-12-15

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

Test Data**Environmental Conditions**

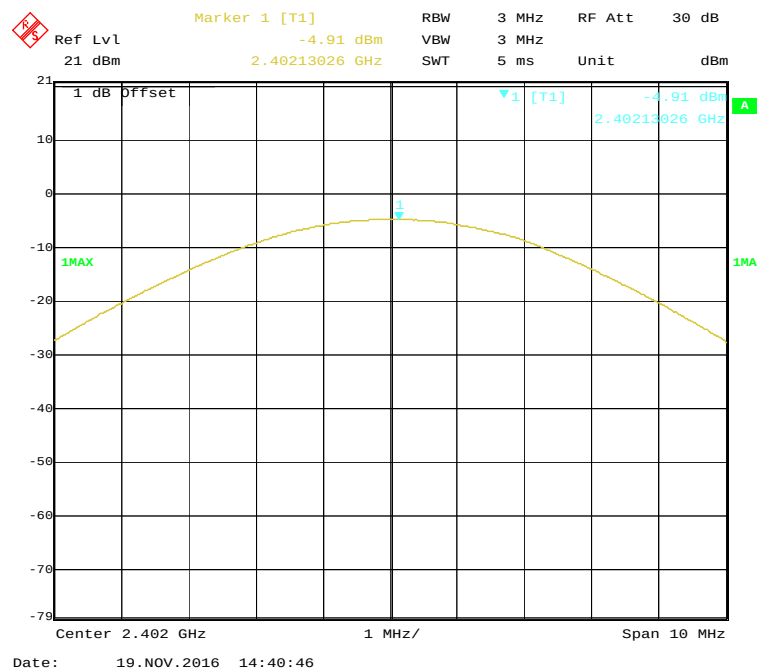
Temperature:	26 °C
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Peter Jiang on 2016-11-19.

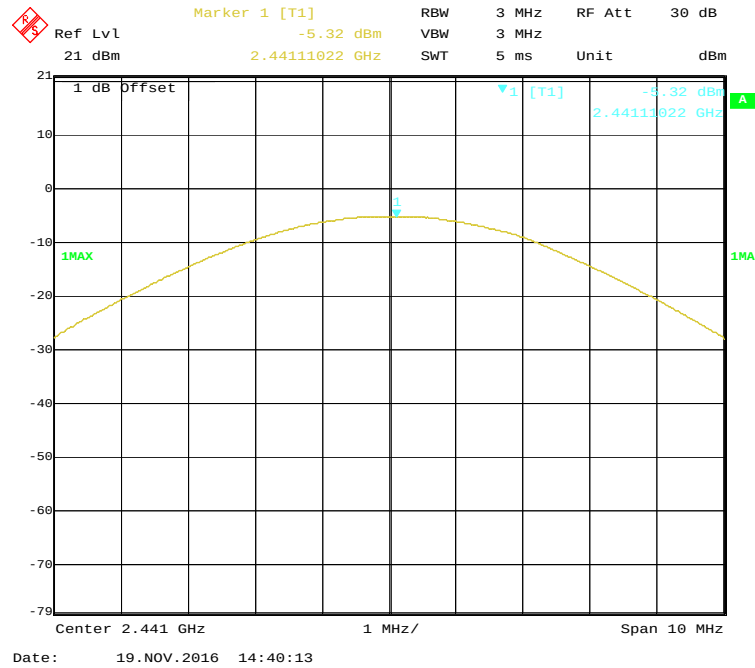
EUT operation mode: Transmitting

Test Result: Compliance. Please refer to following tables and plots

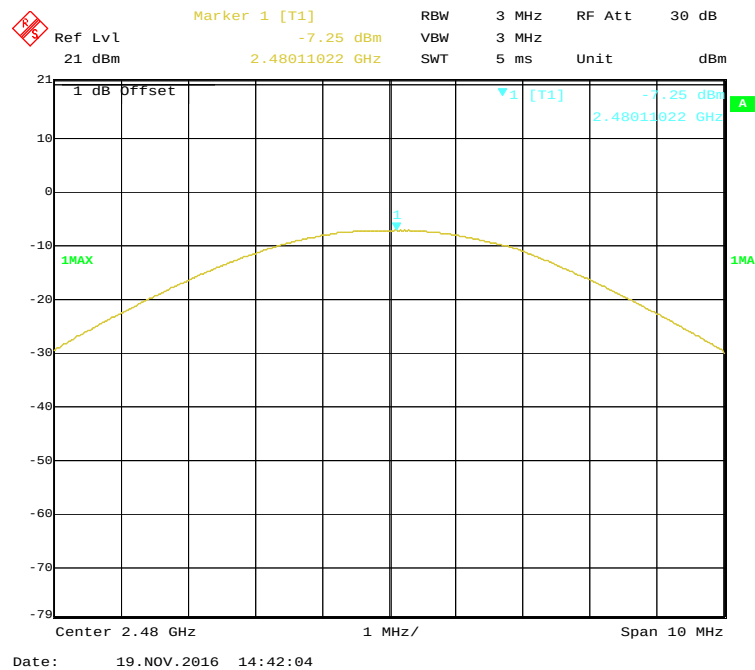
Mode	Channel	Frequency (MHz)	Output Power		Limit (mW)
			(dBm)	(mW)	
BDR (GFSK)	Low	2402	-4.91	0.32	1000
	Middle	2441	-5.32	0.29	1000
	High	2480	-7.25	0.19	1000
EDR ($\pi/4$-DQPSK)	Low	2402	-5.54	0.28	1000
	Middle	2441	-5.48	0.28	1000
	High	2480	-6.86	0.21	1000
EDR (8DPSK)	Low	2402	-4.97	0.32	1000
	Middle	2441	-6.10	0.25	1000
	High	2480	-6.50	0.22	1000

BDR (GFSK): Low Channel

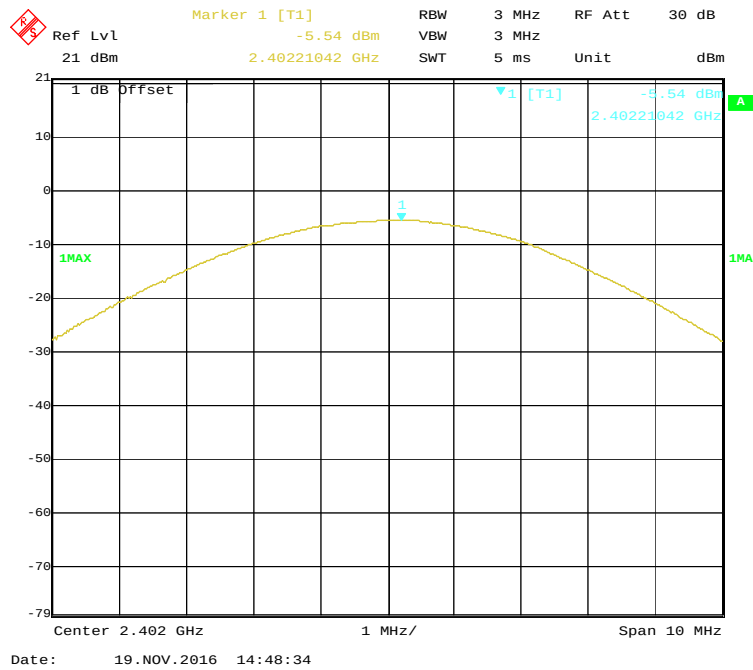
BDR (GFSK): Middle Channel



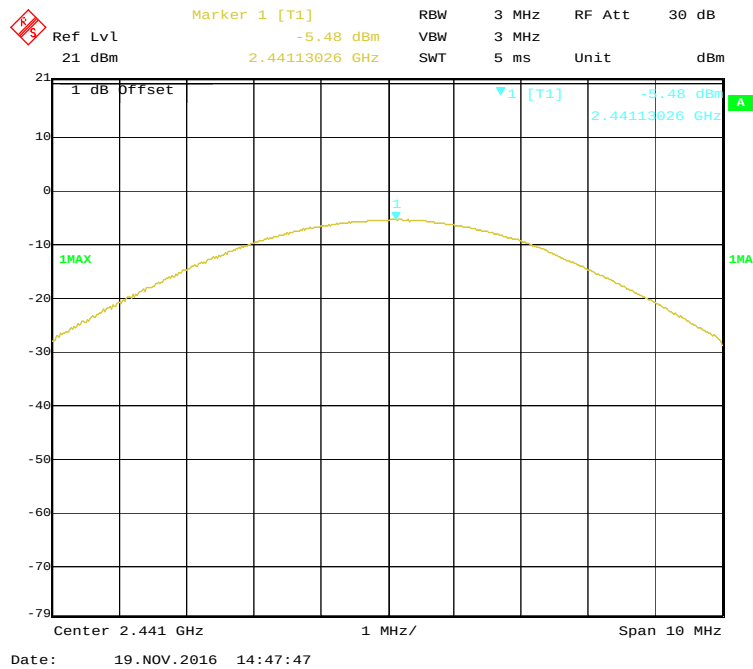
BDR (GFSK): High Channel



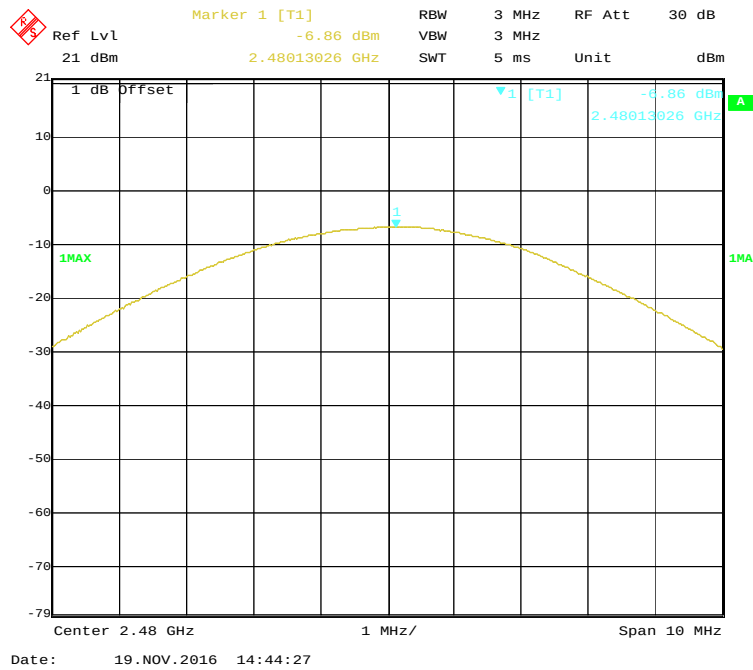
EDR ($\pi/4$ -DQPSK): Low Channel



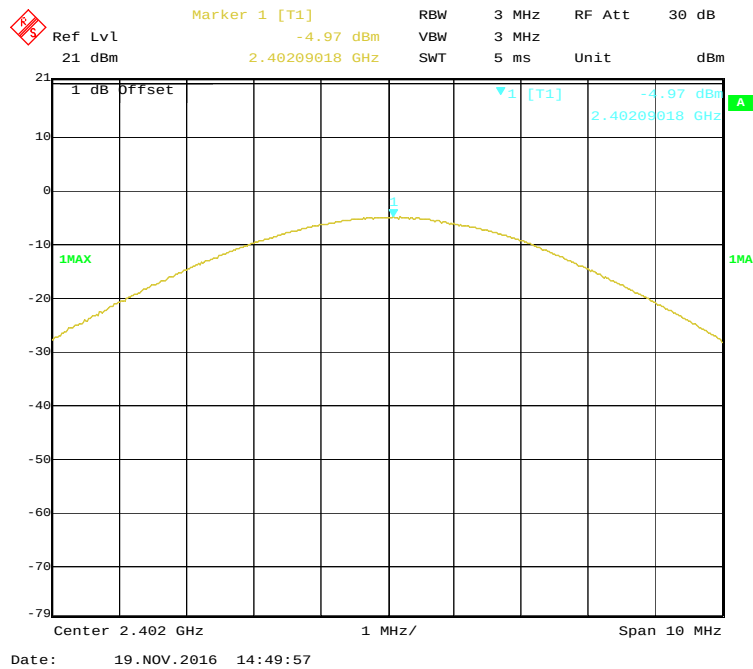
EDR ($\pi/4$ -DQPSK): Middle Channel



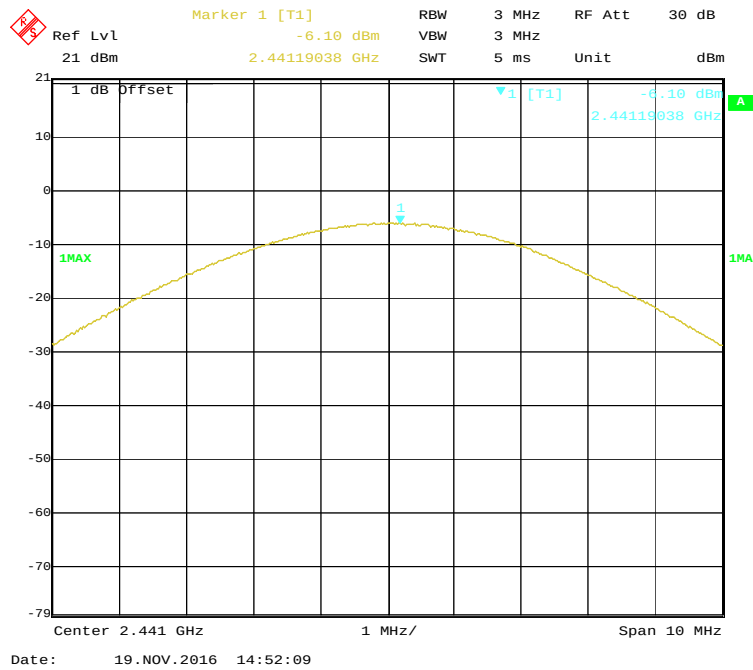
EDR ($\pi/4$ -DQPSK): High Channel



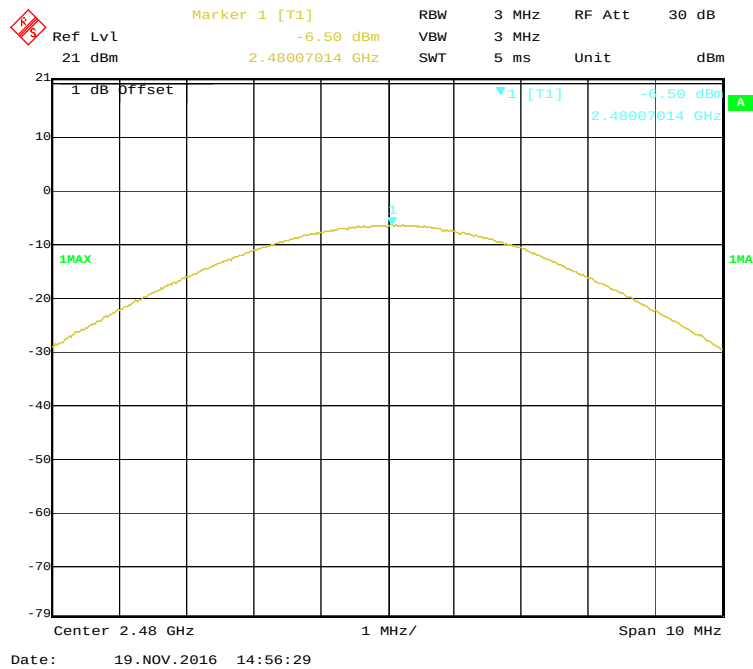
EDR (8DPSK): Low Channel



EDR (8DPSK): Middle Channel



EDR (8DPSK): High Channel



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 RBW 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	Signal Analyzer	FSIQ26	836131/009	2016-09-21	2017-09-21
BACL	RF cable	KS-LAB-012	KS-LAB-012	2015-12-16	2016-12-15

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	26 °C
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Peter Jiang on 2016-11-19.

Test Result: Compliance. Please refer to following plots.

Marker 1 [T1]
-53.38 dBm
2.39968938 GHz

Ref Lvl
21 dBm

RBW
100 kHz

VBW
300 kHz

SWT
5 ms

RF Att
30 dB

Unit
dBm

1 dB Offset

D1 -5.36 dBm

D2 -25.36 dBm

1MAX

Center 2.4 GHz

1 MHz/

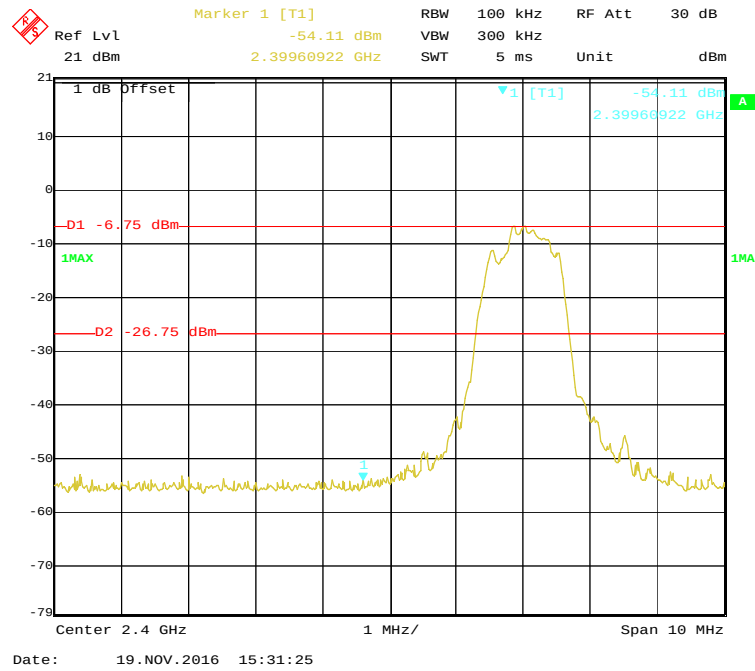
Span 10 MHz

Date: 19. NOV. 2016 15:27:32

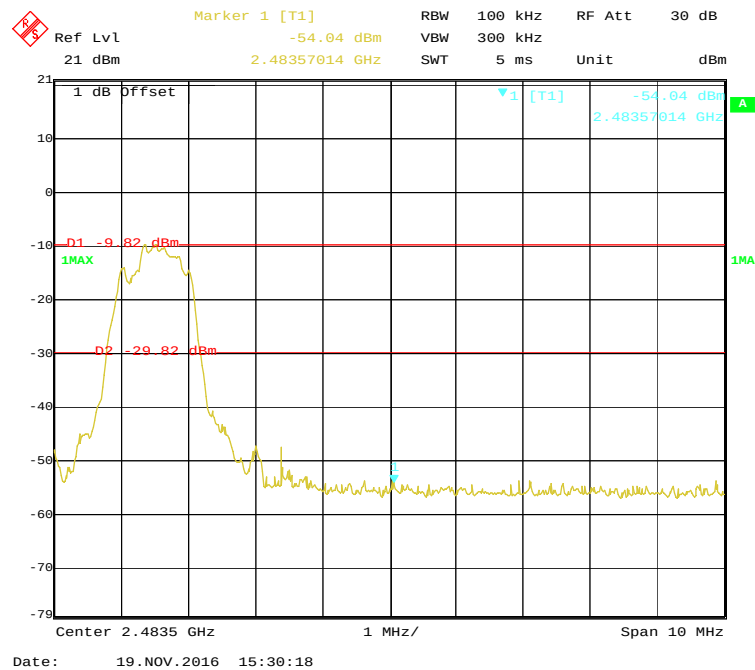
Ref Lvl 21 dBm
 Marker 1 [T1] -54.21 dBm
 RBW 100 kHz
 VBW 300 kHz
 SWT 5 ms
 Unit dBm

1 dB Offset
 -D1 -7.8 dBm
 1MAX
 -D2 -27.8 dBm
 -54.21 dBm
 2.48383066 GHz
 Center 2.4835 GHz
 1 MHz/
 Span 10 MHz
 Date: 19. NOV. 2016 15:28:55

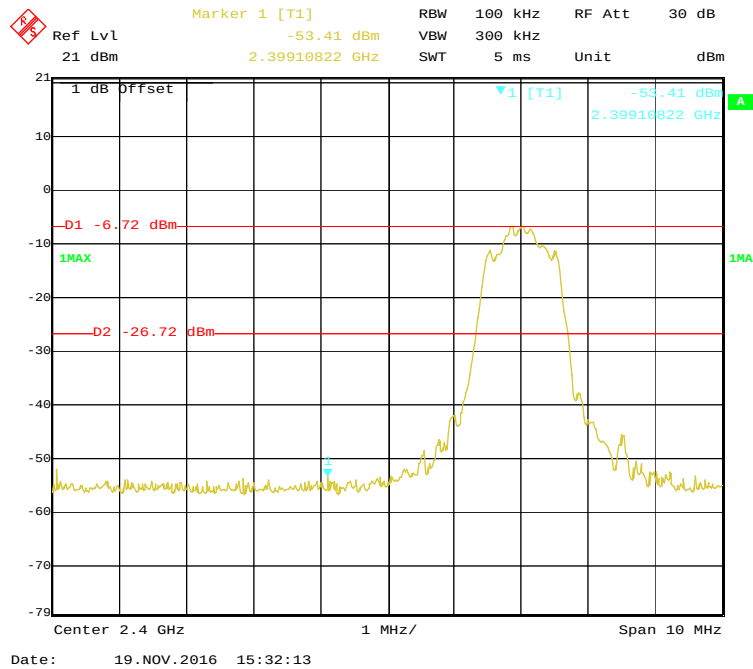
EDR ($\pi/4$ -DQPSK): Band Edge-Left Side



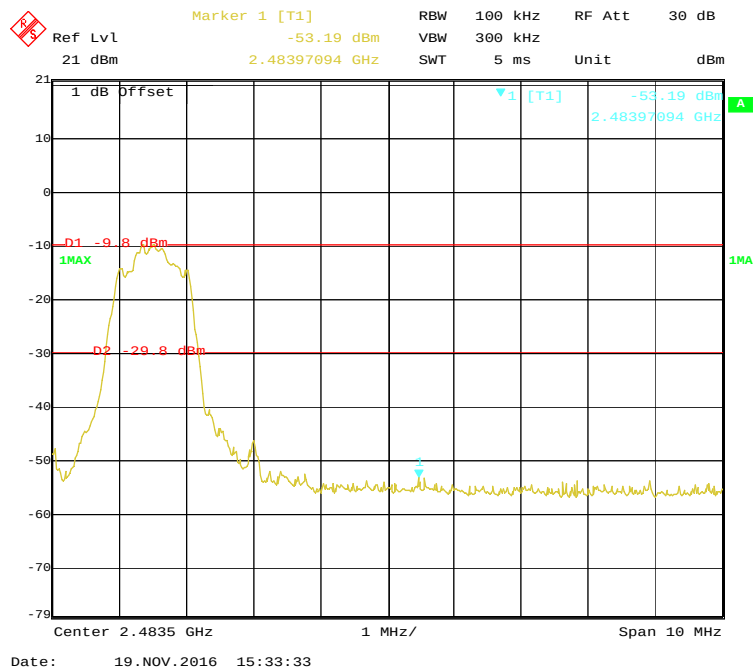
EDR ($\pi/4$ -DQPSK): Band Edge-Right Side



EDR (8DPSK): Band Edge-Left Side



BDR (8DPSK): Band Edge-Right Side



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