FCC PART 15.247
TEST REPORT

For

Suga Electronics Limited

22/F.,Tower B, Billion Centre, 1 Wang Kwong Road, Kowloon Bay, Kowloon, Hong Kong

FCC ID: VZFSWBGFSA0

Report Type:	**Product Type:**
Original Report	3-in-1 Wifi/Bluetooth/GPS Combo Module

Test Engineer:	August He
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Reviewed By:	Jimmy Xiao RF Engineer
Prepared By:	Bay Area Compliance Laboratories Corp. (Shenzhen) 6/F, the 3rd Phase of WanLi Industrial Building ShiHua Road, FuTian Free Trade Zone Shenzhen, Guangdong, China Tel: +86-755-33320018 Fax: +86-755-33320008 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.

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Suga Electronics Limited*'s product, model number: *SWBGFSA-0 (FCC ID: VZFSWBGFSA0)* or the "EUT" in this report is a *3-in-1 Wifi/Bluetooth/GPS combo module,* which was measured approximately: 2.5 cm (L) x 2.0 cm (W) x 0.2 cm (H), rated with input voltage: DC 3.3V.

** All measurement and test data in this report was gathered from production sample serial number: 00000000000 (Assigned by Applicant). The EUT supplied by the applicant was received on 2014-03-27.*

Objective

This test report is prepared on behalf of *Suga Electronics Limited* 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, 15.207, 15.209 and 15.247 rules.

Related Submittal(s)/Grant(s)

FCC Part 15.247 DTS submission with FCC ID: VZFSWBGFSA0.

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 at Bay Area Compliance Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement uncertainty with radiated emission is 5.91 dB for 30MHz-1GHz, and 4.92 dB for above 1GHz, 1.95dB for conducted measurement.

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone Shenzhen, Guangdong, China.

Test site at Bay Area Compliance Laboratories Corp. (Shenzhen) 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 December 06, 2010. 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.: 382179. 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 EUT supports BT 2.1+EDR, 3.0+HS, and which was configured for testing with test software.

EUT Exercise Software

MTK6611-LabTool-BT-non-Link-mode-V1.6

Special Accessories

No special accessory.

Equipment Modifications

No modification was made to the EUT tested.

Support Equipment List and Details

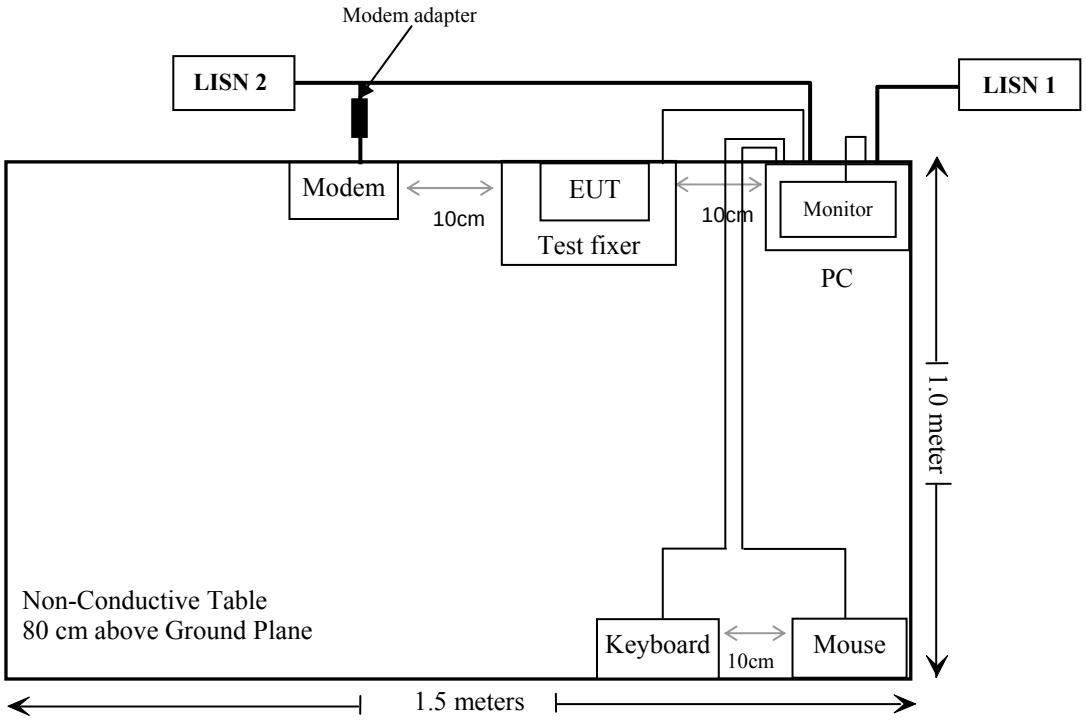
Manufacturer	Description	Model	Serial Number
DELL	PC	VOSTRO 220S	127BP2X
DELL	LCD Monitor	E178WFPC	CN-OWY564-64180-7C4-2SQH
DELL	Keyboard	L100	CNORH656658907BL05DC
DELL	Mouse	MOC5UO	G1900NKD
SAST	Modem	AEM-2100	0293
Suga	Test fixture	/	/

External I/O Cable

Cable Description	Length (m)	From/Port	To
Shielding Detachable USB Cable	1.5	Host PC	Mouse
Shielding Detachable Serial Cable	1.2	Host PC	Modem
Shielding Detachable K/B Cable	1.5	Host PC	Keyboard
Shielding Detachable VGA Cable	1.5	Host PC	LCD Monitor
Unshielding Detachable USB Cable	1.0	Test Fixer	PC
Unshielding Detachable RS232 Cable	1.5	Test Fixer	PC

Block Diagram of Test Setup

For conducted emission



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (i), §1.1307 (b)(1), §2.1091	Maximum Permissible exposure (MPE)	Compliance
§15.203	Antenna Requirement	Compliance
§15.207(a)	AC Line Conducted Emissions	Compliance
§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

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), 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

Limits for General Population/Uncontrolled Exposure

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

Result

Calculated Formulary:

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

S = power density (in appropriate units, e.g. mW/cm^2)
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)

Frequency (MHz)	Antenna Gain		Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
	(dBi)	(numeric)	(dBm)	(mW)			
2441	0	1	10.12	10.28	20	0.002	1.0

Note: To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

Result: Compliance

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 ceramic antenna arrangement for BT, which was permanently attached and the gain was 0 dBi, fulfill the requirement of this section. Please refer to the internal photos.

Result: Compliance.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC §15.207(a)

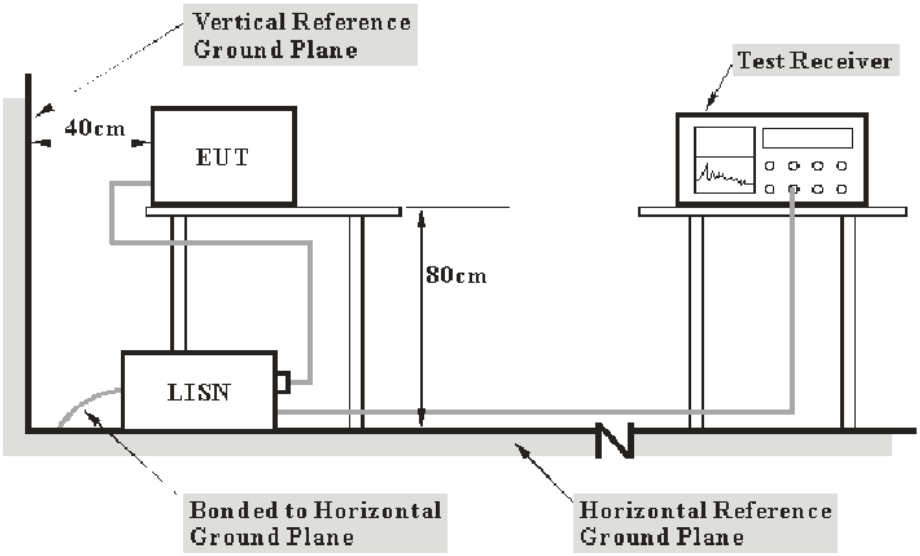
Measurement Uncertainty

Input quantities to be considered for conducted disturbance measurements maybe receiver reading, attenuation of the connection between LISN and receiver, LISN voltage division factor, LISN VDF frequency interpolation and receiver related input quantities, etc.

Based on CISPR 16-4-2:2011, the expended combined standard uncertainty of conducted disturbance test at Bay Area Compliance Laboratories Corp. (Shenzhen) is shown as below. And the uncertainty will not be taken into consideration for the test data recorded in the report.

Port	Expanded Measurement uncertainty
AC Mains	3.26 dB (k=2, 95% level of confidence)
CAT 3	3.70 dB (k=2, 95% level of confidence)
CAT 5	3.86 dB (k=2, 95% level of confidence)
CAT 6	4.64 dB (k=2, 95% level of confidence)

EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The measurement procedure of EUT setup is according with ANSI C63.4-2009. The related limit was specified in FCC Part 15.207.

The spacing between the peripherals was 10 cm.

The PC was connected to a 120 VAC/60 Hz power source.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

During the conducted emission test, the PC was connected to the outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All final data was recorded in the Quasi-peak and average detection mode.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCS30	100176	2013-06-17	2014-06-17
Rohde & Schwarz	LISN	ENV216	3560.6650.12-101613-Yb	2013-05-07	2014-05-07
Rohde & Schwarz	LISN	ESH2-Z5	892107/021	2013-08-22	2014-08-22
Rohde & Schwarz	Transient Limiter	ESH3Z2	DE25985	2013-10-15	2014-10-15
Rohde & Schwarz	CE Test software	EMC 32	V8.53	--	--

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

Corrected Factor & Margin Calculation

The Corrected factor is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

Correction Factor = LISN VDF + Cable Loss + Transient Limiter Attenuation

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

Margin = Limit – Corrected Amplitude

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207, the worst margin reading as below:

11.0 dB at **14.601770 MHz** in the **Neutral** conducted mode

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

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

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

Test Data

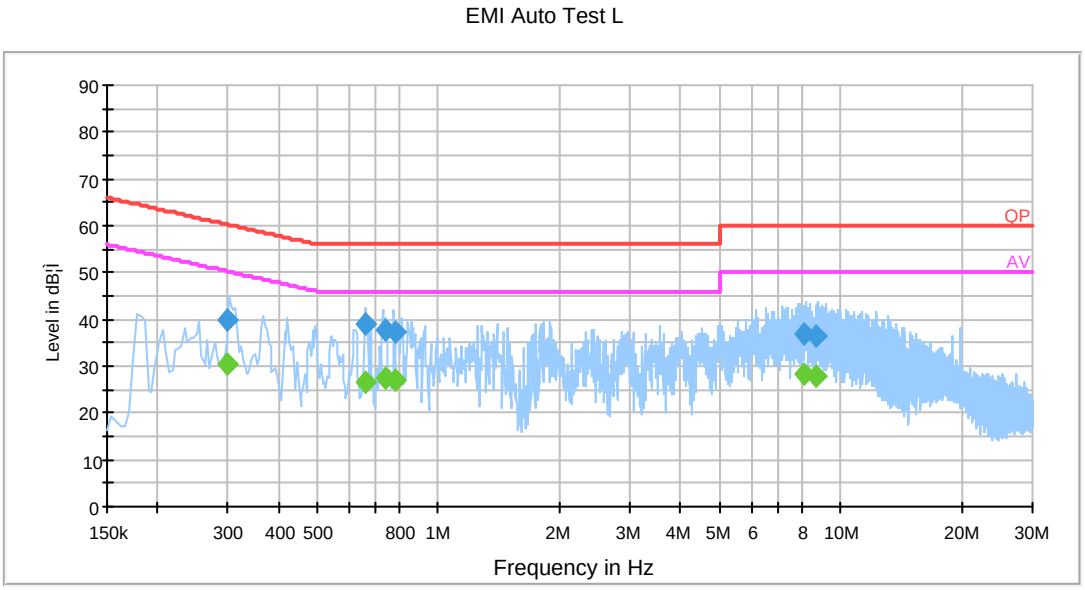
Environmental Conditions

Temperature:	24 ℃
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by August He on 2014-04-10.

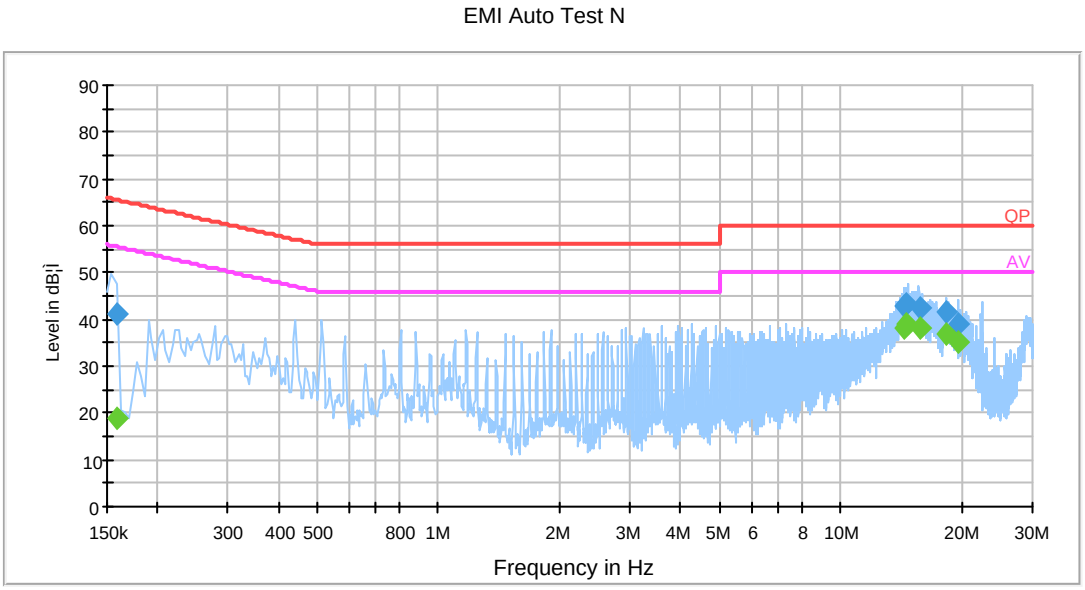
EUT operation mode: Transmitting

AC 120V/60 Hz, Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.297470	39.8	19.4	60.3	20.5	QP
0.297470	30.6	19.4	50.3	19.7	Ave.
0.660130	38.9	19.6	56.0	17.1	QP
0.660130	26.6	19.6	46.0	19.4	Ave.
0.735050	37.7	19.6	56.0	18.3	QP
0.735050	27.4	19.6	46.0	18.6	Ave.
0.778390	37.5	19.5	56.0	18.5	QP
0.778390	26.9	19.5	46.0	19.1	Ave.
8.087390	37.0	19.7	60.0	23.0	QP
8.087390	28.4	19.7	50.0	21.6	Ave.
8.714810	36.5	19.7	60.0	23.5	QP
8.714810	27.7	19.7	50.0	22.3	Ave.

AC 120V/60 Hz, Neutral



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.158500	41.3	19.6	65.5	24.2	QP
0.158500	18.8	19.6	55.5	36.7	Ave.
14.427210	42.9	19.9	60.0	17.1	QP
14.427210	38.2	19.9	50.0	11.8	Ave.
14.601770	43.4	19.9	60.0	16.6	QP
14.601770	39.0	19.9	50.0	11.0	Ave.
15.747110	42.3	19.9	60.0	17.7	QP
15.747110	38.0	19.9	50.0	12.0	Ave.
18.242510	41.4	20.0	60.0	18.6	QP
18.242510	37.0	20.0	50.0	13.0	Ave.
19.710350	39.0	20.0	60.0	21.0	QP
19.710350	35.0	20.0	50.0	15.0	Ave.

Note:
1) Correction Factor =LISN VDF (Voltage Division Factor) + Cable Loss + Transient Limiter Attenuation
2) Corrected Amplitude = Reading + Correction Factor
3) Margin = Limit – Corrected Amplitude

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

Applicable Standard

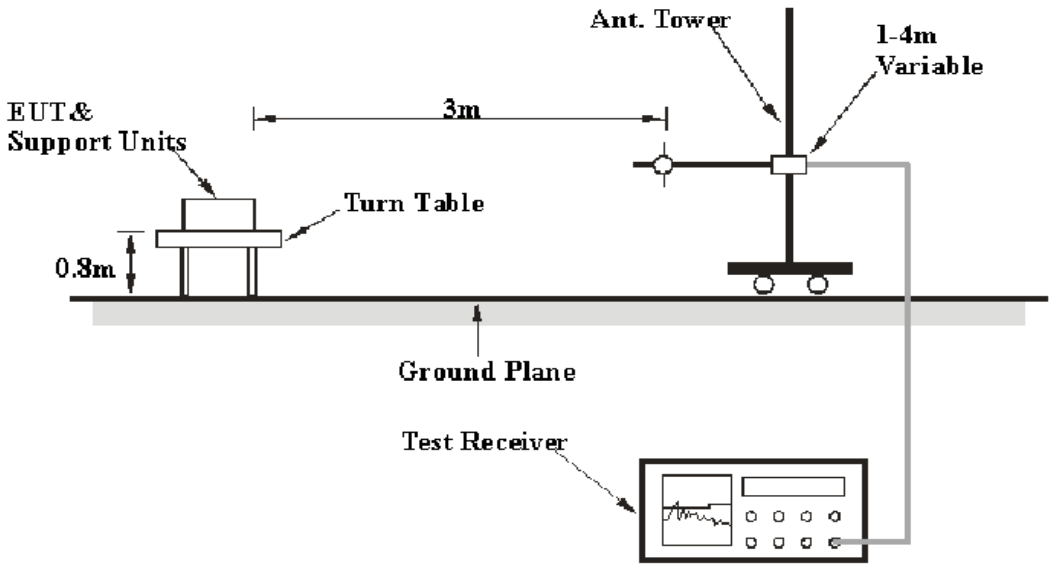
FCC §15.205; §15.209; §15.247(d)

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 16-4-2:2011, the expended combined standard uncertainty of radiation emissions at Bay Area Compliance Laboratories Corp. (Shenzhen) 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



The radiated emission tests were performed in the 3 meters, 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.

The spacing between the peripherals was 10 cm.

The PC was connected to a 120 VAC/60 Hz power source.

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 the final data was recorded in Quasi-peak detection mode for 30MHz - 1GHz, peak and Average detection modes for 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:

Corrected Amplitude = Meter Reading + Antenna Factor + Cable Loss - 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:

Margin = Limit – Corrected Amplitude

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
HP	Amplifier	8447E	1937A01046	2013-09-30	2014-09-30
Rohde & Schwarz	EMI Test Receiver	ESCI	101122	2013-09-25	2014-09-25
Sunol Sciences	Broadband Antenna	JB1	A040904-2	2011-11-28	2014-11-27
Mini	Amplifier	ZVA-183-S+	5969001149	2014-04-03	2015-04-03
A.H. System	Horn Antenna	SAS-200/571	135	2012-02-11	2015-02-10
DUCOMMUN	Pre-amplifier	ALN-22093530-01	991373-01	2013-08-03	2014-08-03
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2013-11-12	2014-11-12
the electro-Mechanics Co.	Horn Antenna	3116	9510-2270	2013-10-14	2016-10-13
R&S	Auto test Software	EMC32	V9.10	--	--

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) 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, the worst margin reading as below:

13.67 dB at **9764.0 MHz** in the **Horizontal** polarization

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

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

in BACL., $U_{(Lm)}$ 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:	23 ℃
Relative Humidity:	54 %
ATM Pressure:	101.0 kPa

The testing was performed by August He on 2014-04-08.

EUT operation mode: Transmitting

30 MHz -25 GHz: (*Scan with GFSK, π/4-DQPSK, 8-DPSK, the worst case is BDR Mode (GFSK)*)

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247/205/209	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
Low Channel (2402 MHz)									
754.3	31.62	QP	272	1.5	H	-6.1	25.52	46	20.48
2402.0	92.98	PK	125	2.1	H	5.48	98.46	/	/
2402.0	81.34	Ave.	125	2.1	H	5.48	86.82	/	/
2402.0	94.92	PK	4	2.1	V	5.48	100.4	/	/
2402.0	83.54	Ave.	4	2.1	V	5.48	89.02	/	/
2389.1	42.82	PK	273	2.5	H	5.48	48.30	74	25.70
2389.1	26.41	Ave.	273	2.5	H	5.48	31.89	54	22.11
2499.5	38.95	PK	188	1.3	H	7.21	46.16	74	27.84
2499.5	31.80	Ave.	188	1.3	H	7.21	39.01	54	14.99
2485.4	40.84	PK	233	1.4	V	7.21	48.05	74	25.95
2485.4	25.59	Ave.	233	1.4	V	7.21	32.80	54	21.20
4804.0	36.87	PK	355	1.2	V	12.44	49.31	74	24.69
4804.0	23.35	Ave.	355	1.2	V	12.44	35.79	54	18.21
7206.0	35.06	PK	85	1.3	H	17.06	52.12	74	21.88
7206.0	20.83	Ave.	85	1.3	H	17.06	37.89	54	16.11
9608.0	34.73	PK	187	1.5	V	19.28	54.01	74	19.99
9608.0	19.37	Ave.	187	1.5	V	19.28	38.65	54	15.35
Middle Channel (2441 MHz)									
754.3	31.30	QP	36	1.8	V	-6.1	25.20	46	20.80
2441.0	90.91	PK	163	2.2	H	6.13	97.04	/	/
2441.0	85.19	Ave.	163	2.2	H	6.13	91.32	/	/
2441.0	89.95	PK	45	1.2	V	6.13	96.08	/	/
2441.0	84.40	Ave.	45	1.2	V	6.13	90.53	/	/
2366.9	37.64	PK	40	2.0	V	5.48	43.12	74	30.88
2366.9	26.56	Ave.	40	2.0	V	5.48	32.04	54	21.96
2488.1	44.60	PK	2	2.4	H	7.21	51.81	74	22.19
2488.1	28.45	Ave.	2	2.4	H	7.21	35.66	54	18.34
2497.1	40.18	PK	294	1.2	H	7.21	47.39	74	26.61
2497.1	24.09	Ave.	294	1.2	H	7.21	31.30	54	22.70
4882.0	36.25	PK	163	2.3	H	12.4	48.65	74	25.35
4882.0	23.93	Ave.	163	2.3	H	12.4	36.33	54	17.67
7323.0	35.88	PK	344	1.6	V	16.49	52.37	74	21.63
7323.0	21.67	Ave.	344	1.6	V	16.49	38.16	54	15.84
9764.0	34.90	PK	64	1.2	H	19.4	54.30	74	19.70
9764.0	20.93	Ave.	64	1.2	H	19.4	40.33	54	13.67

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247/205/209	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
High Channel (2480 MHz)									
754.3	30.59	QP	56	1.1	V	-6.1	24.49	46	21.51
2480.0	90.56	PK	64	2.5	H	7.21	97.77	/	/
2480.0	79.68	Ave.	64	2.5	H	7.21	86.89	/	/
2480.0	91.72	PK	29	1.5	V	7.21	98.93	/	/
2480.0	80.25	Ave.	29	1.5	V	7.21	87.46	/	/
2377.5	38.47	PK	184	1.6	H	5.48	43.95	74	30.05
2377.5	24.08	Ave.	184	1.6	H	5.48	29.56	54	24.44
2483.5	50.29	PK	274	1.9	H	7.21	57.50	74	16.50
2483.5	30.98	Ave.	274	1.9	H	7.21	38.19	54	15.81
2499.6	41.63	PK	166	2.3	V	7.21	48.84	74	25.16
2499.6	33.03	Ave.	166	2.3	V	7.21	40.24	54	13.76
4960.0	35.49	PK	257	2.2	V	12.5	47.99	74	26.01
4960.0	22.17	Ave.	257	2.2	V	12.5	34.67	54	19.33
7440.0	34.86	PK	296	1.3	V	15.9	50.76	74	23.24
7440.0	21.95	Ave.	296	1.3	V	15.9	37.85	54	16.15
9920.0	34.75	PK	244	1.6	H	19.39	54.14	74	19.86
9920.0	19.40	Ave.	244	1.6	H	19.39	38.79	54	15.21

Note:
Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor
Corrected Amplitude = Corrected Factor + Reading
Margin = Limit - Corrected. Amplitude

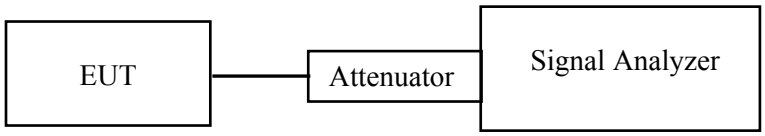
FCC §15.247(a) (1)-CHANNEL SEPARATION TEST

Applicable Standard

Frequency hopping systems shall have hoping 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
R&S	Signal Analyzer	FSIQ26	837405/023	2013-05-31	2014-05-31

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) 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:	24 ℃
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by August He on 2014-04-10.

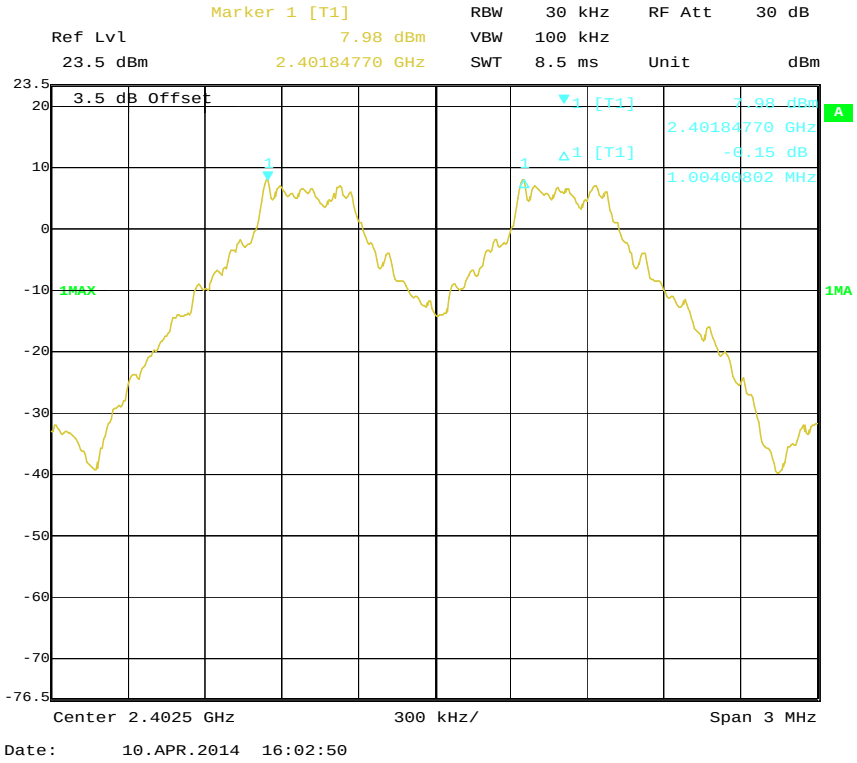
EUT operation mode: Transmitting

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

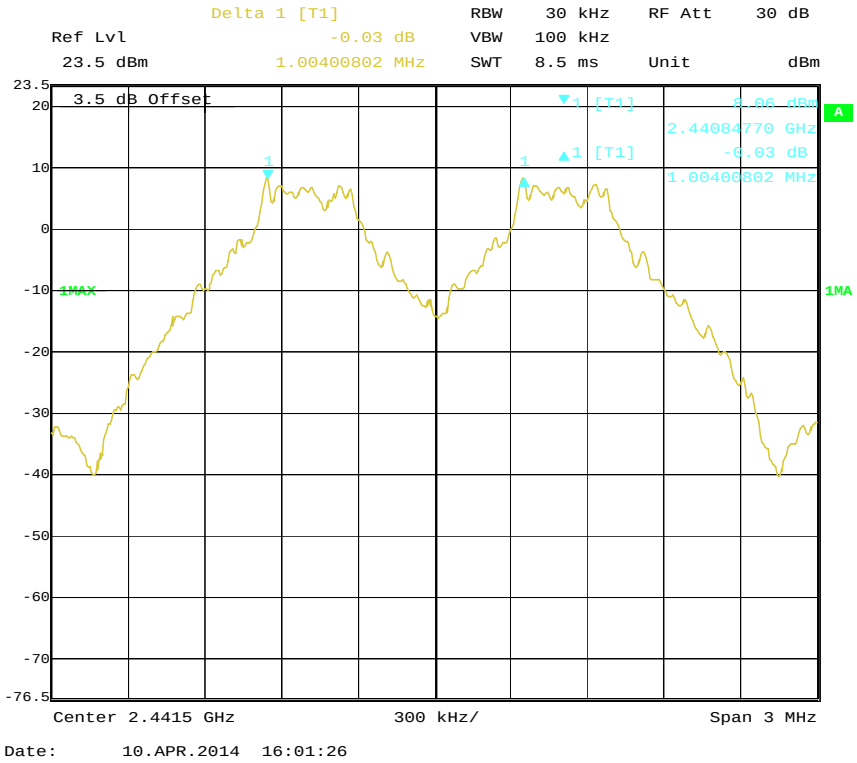
Mode	Channel	Frequency (MHz)	Channel Separation (MHz)	≥Limit (MHz)	Result
BDR (GFSK)	Low	2402	1.004	0.625	Pass
	Adjacent	2403			
	Middle	2441	1.004	0.625	Pass
	Adjacent	2442			
	High	2480	1.004	0.627	Pass
	Adjacent	2479			
EDR (π/4-DQPSK)	Low	2402	1.004	0.828	Pass
	Adjacent	2403			
	Middle	2441	1.004	0.828	Pass
	Adjacent	2442			
	High	2480	1.004	0.823	Pass
	Adjacent	2479			
EDR (8DPSK)	Low	2402	1.004	0.823	Pass
	Adjacent	2403			
	Middle	2441	1.004	0.823	Pass
	Adjacent	2442			
	High	2480	1.004	0.831	Pass
	Adjacent	2479			

Note: Limit = 20 dB bandwidth *2/3

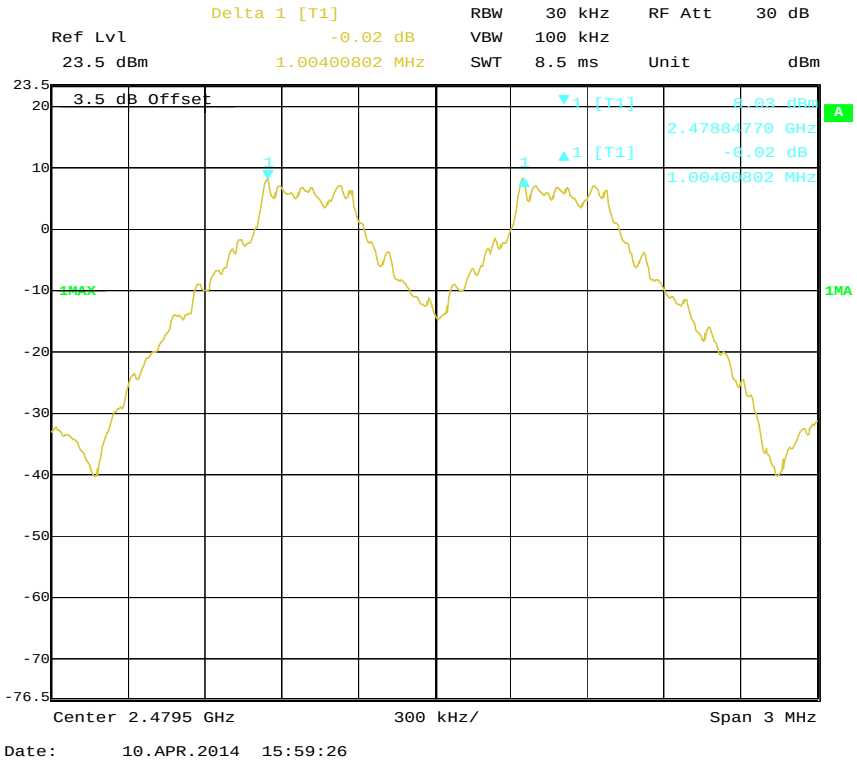
BDR (GFSK): Low Channel



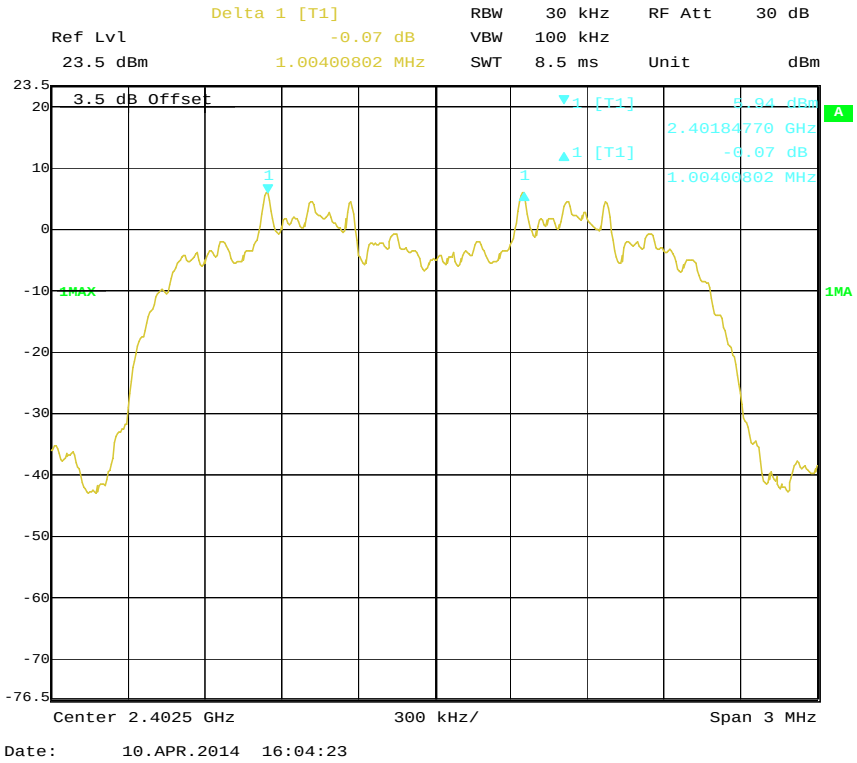
BDR (GFSK): Middle Channel



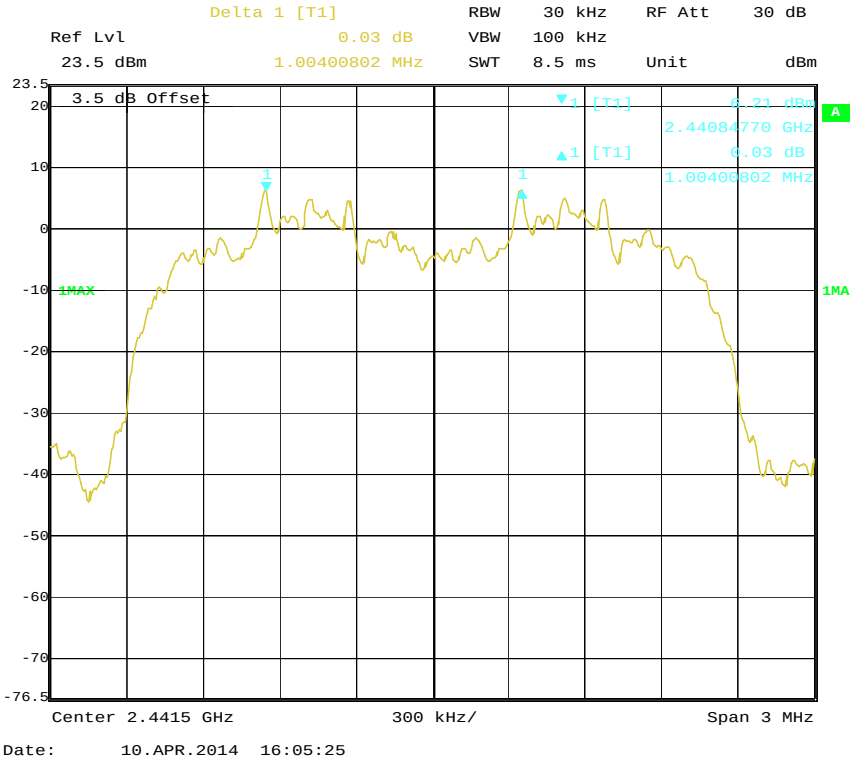
BDR (GFSK): High Channel



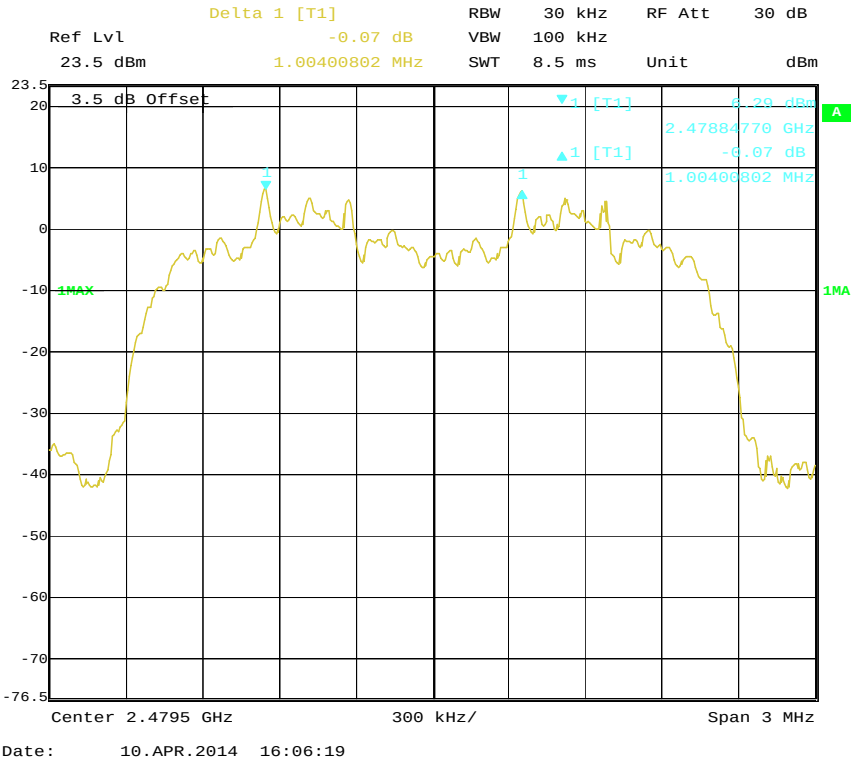
EDR (π/4-DQPSK): Low Channel



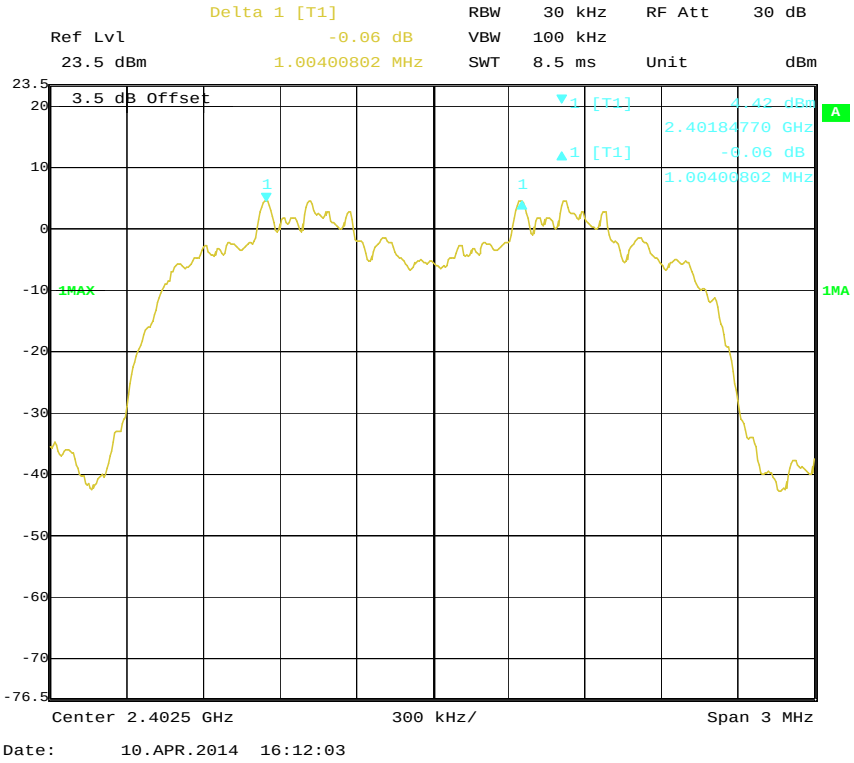
EDR (π/4-DQPSK): Middle Channel



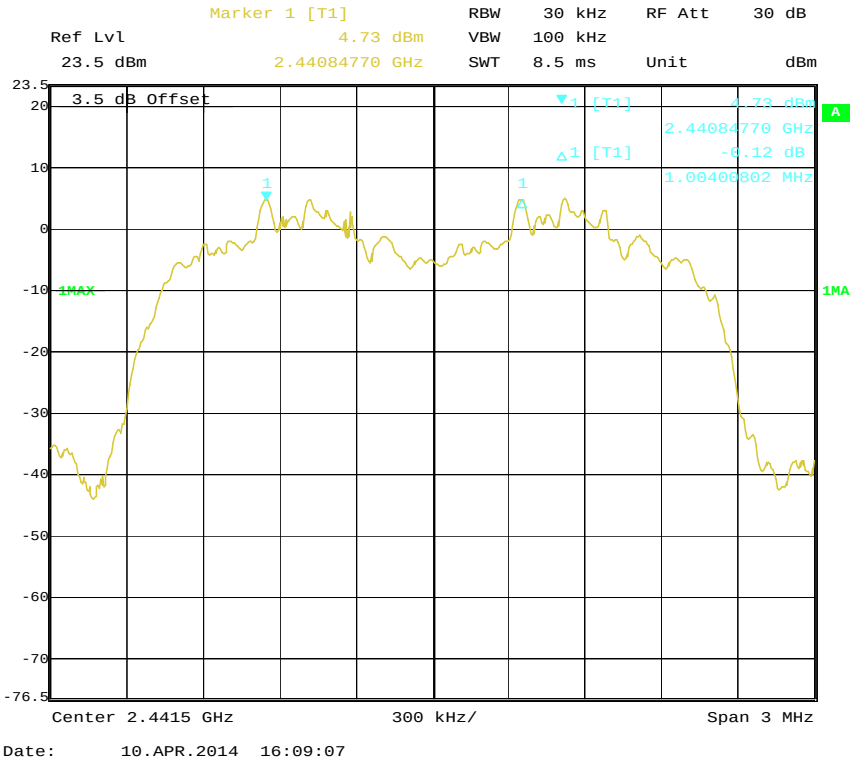
EDR (π/4-DQPSK): High Channel



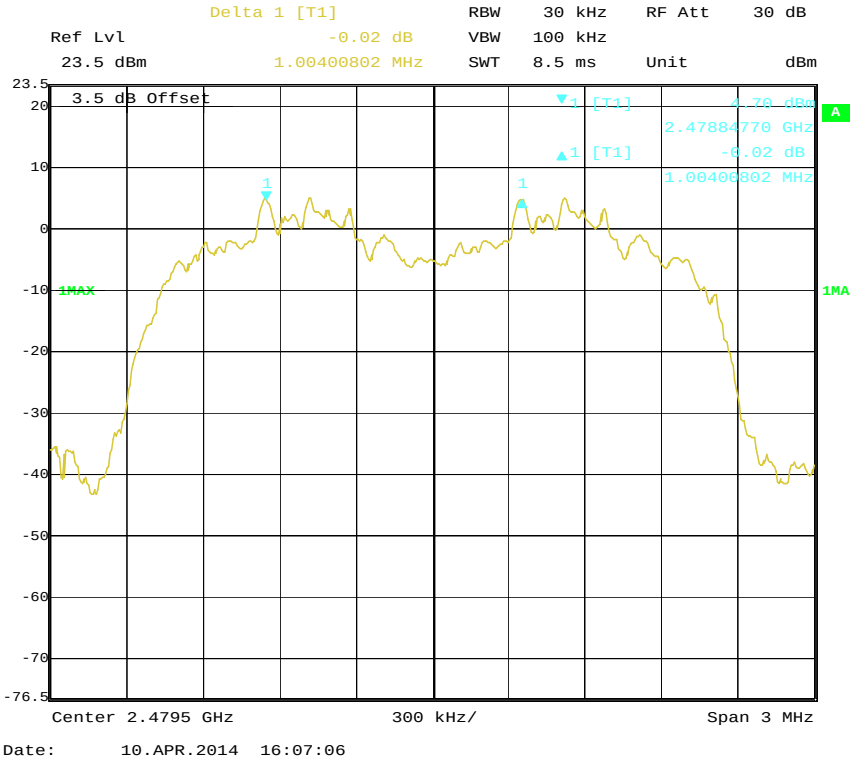
EDR (8DPSK): Low Channel



EDR (8DPSK): Middle Channel



EDR (8DPSK): High Channel



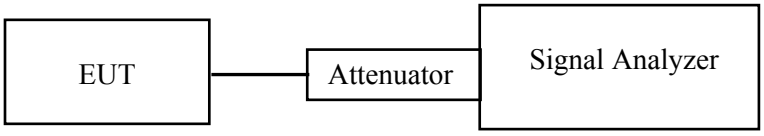
FCC §15.247(a) (1) – 20 dB EMISSION BANDWIDTH

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
R&S	Signal Analyzer	FSIQ26	837405/023	2013-05-31	2014-05-31

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) 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:	24 ℃
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

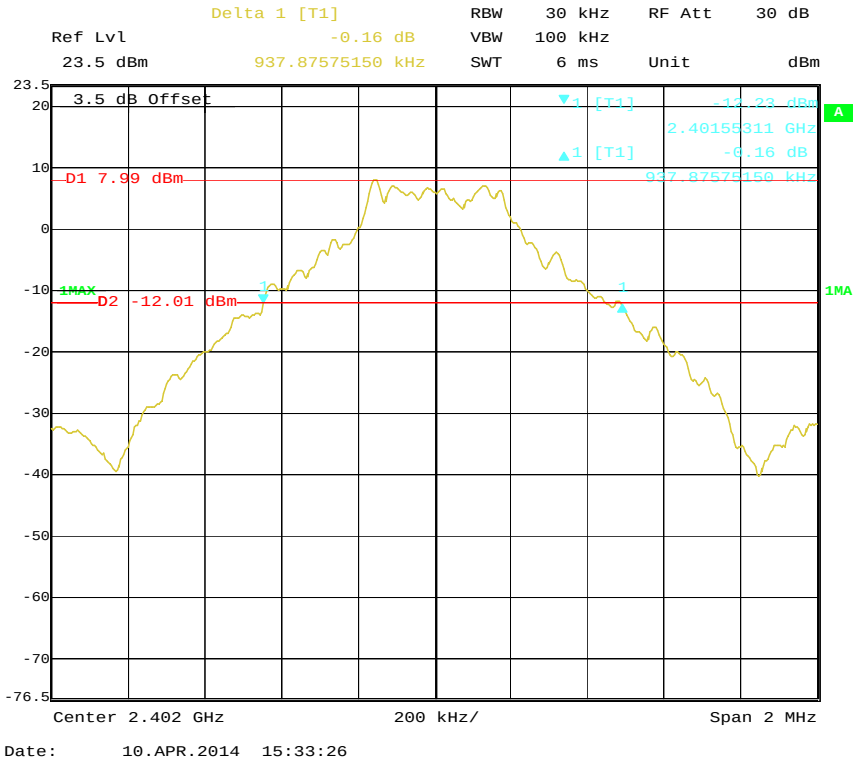
The testing was performed by August He on 2014-04-10.

EUT operation mode: Transmitting

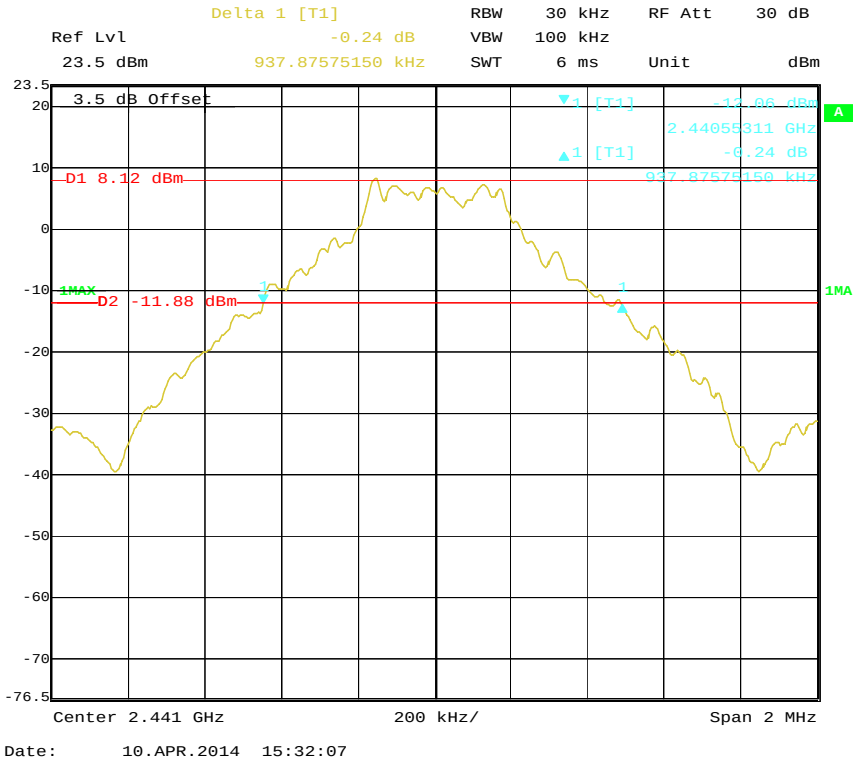
Test Result: Compliance. Please refer to following tables and plots

Mode	Channel	Frequency (MHz)	20 dB Emission Bandwidth (MHz)
BDR (GFSK)	Low	2402	0.938
	Middle	2441	0.938
	High	2480	0.941
EDR (π/4-DQPSK)	Low	2402	1.242
	Middle	2441	1.242
	High	2480	1.234
EDR (8DPSK)	Low	2402	1.234
	Middle	2441	1.234
	High	2480	1.246

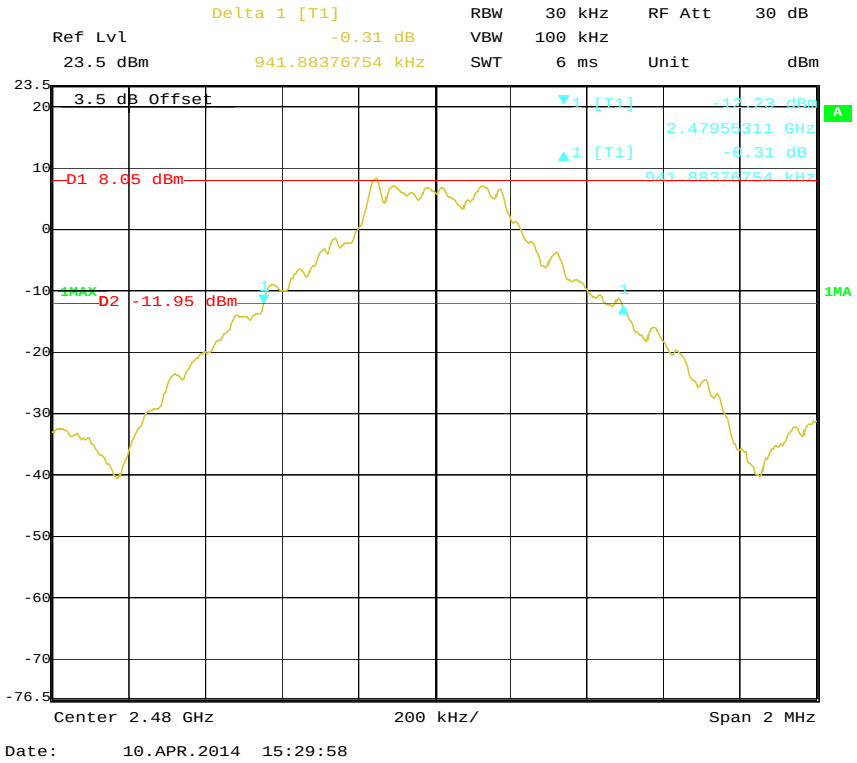
BDR (GFSK): Low Channel



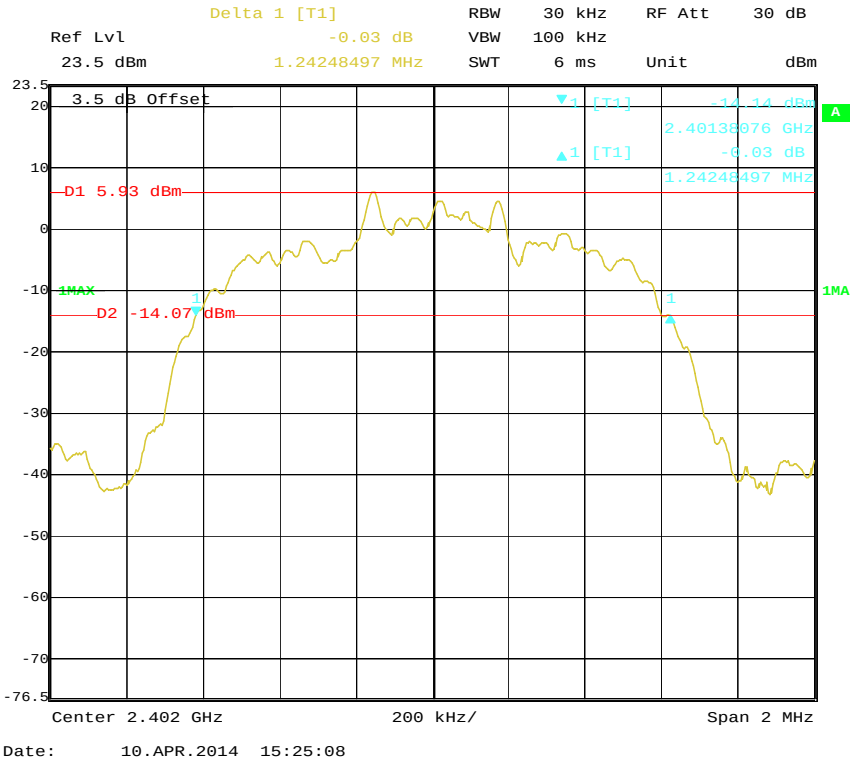
BDR (GFSK): Middle Channel



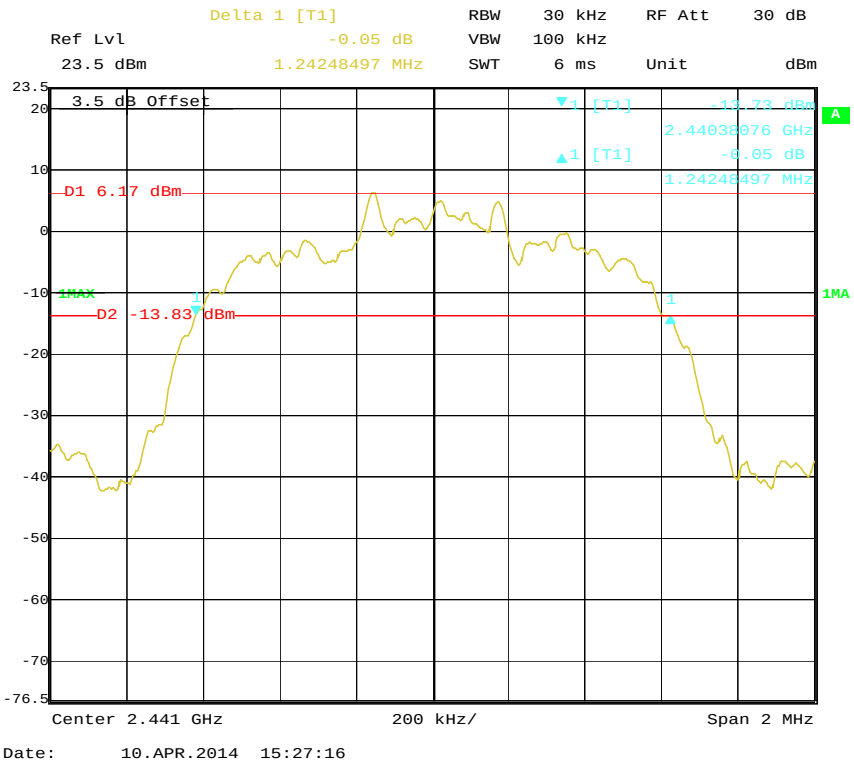
BDR (GFSK): High Channel



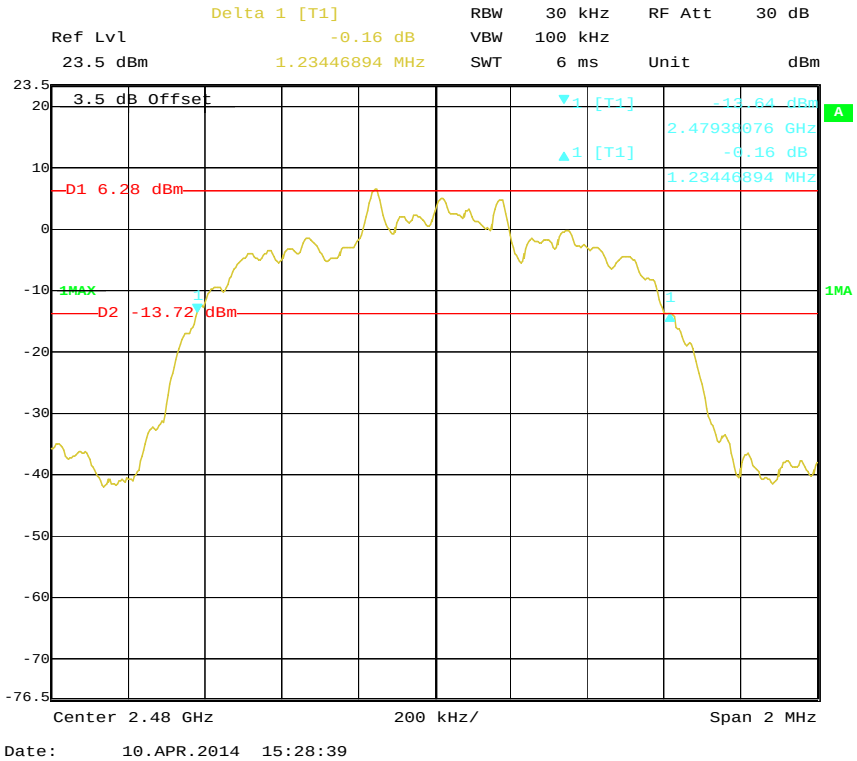
EDR (π/4-DQPSK): Low Channel



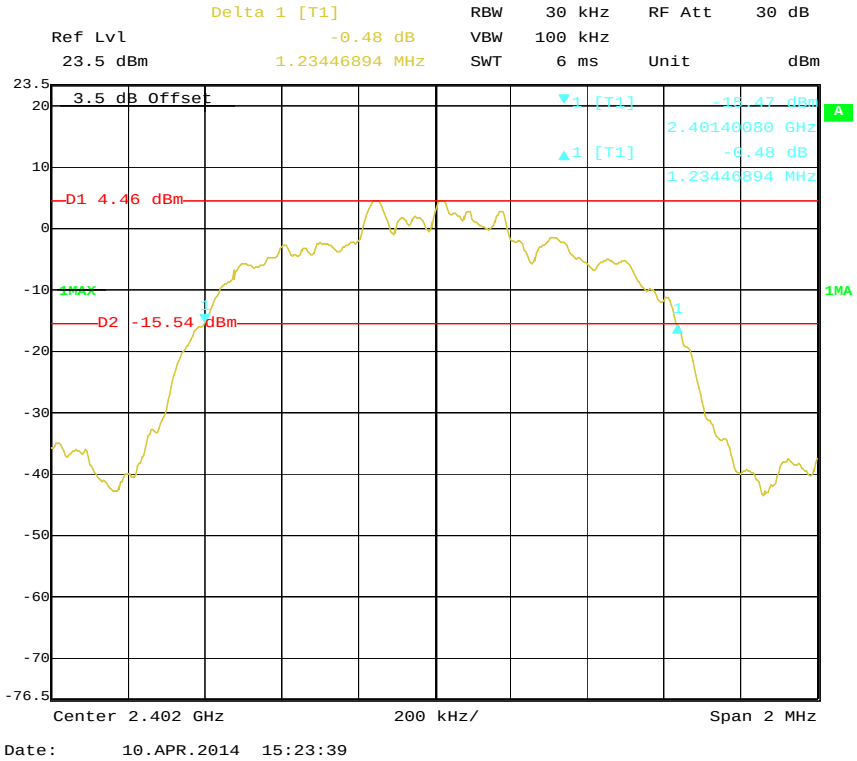
EDR (π/4-DQPSK): Middle Channel



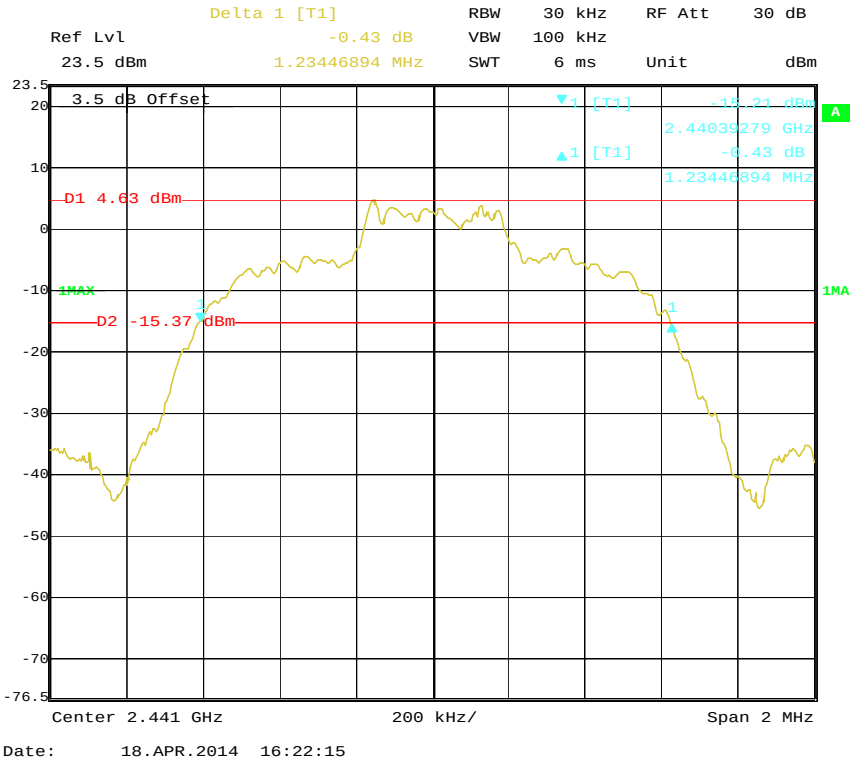
EDR (π/4-DQPSK): High Channel



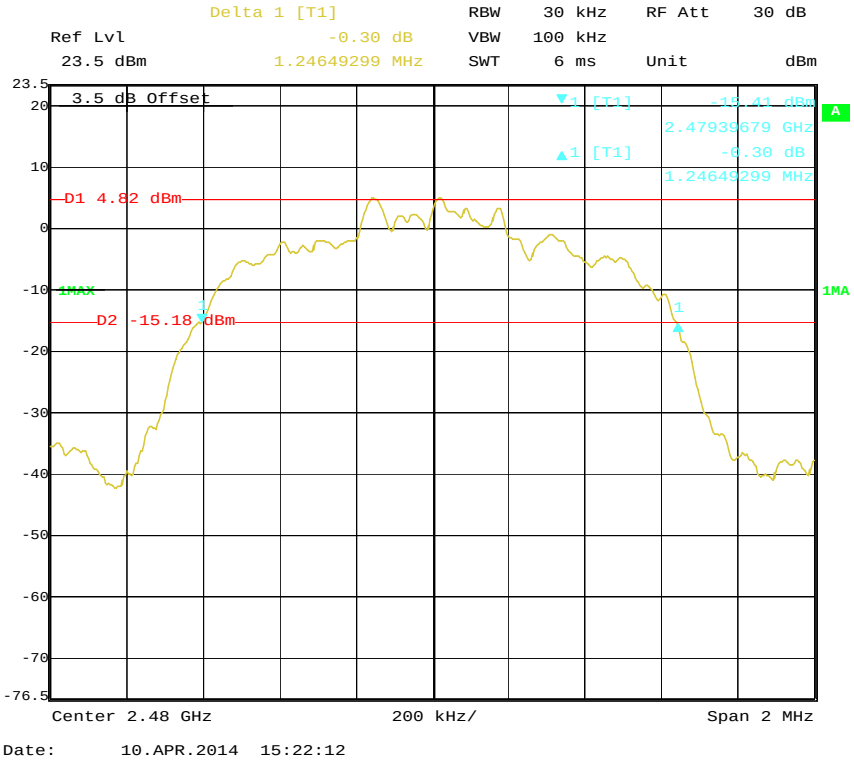
EDR (8DPSK): Low Channel



EDR (8DPSK): Middle Channel



EDR (8DPSK): High Channel



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

Applicable Standard

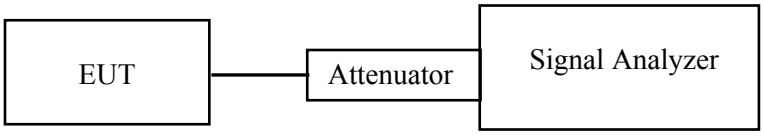
Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress 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
R&S	Signal Analyzer	FSIQ26	837405/023	2013-05-31	2014-05-31

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) 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:	24 ℃
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

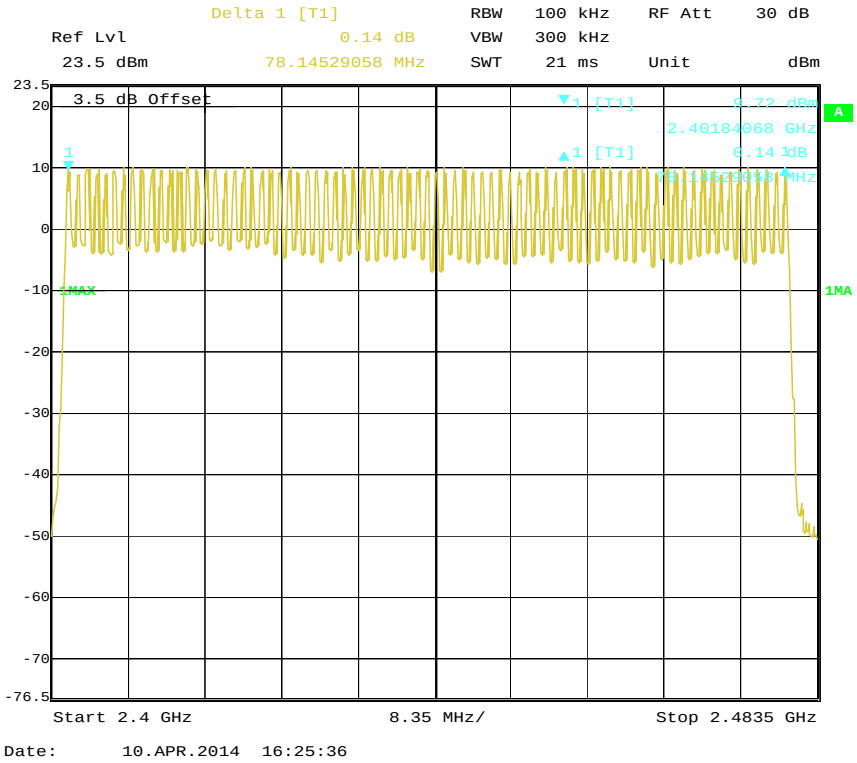
The testing was performed by August He on 2014-04-10.

EUT operation mode: Transmitting

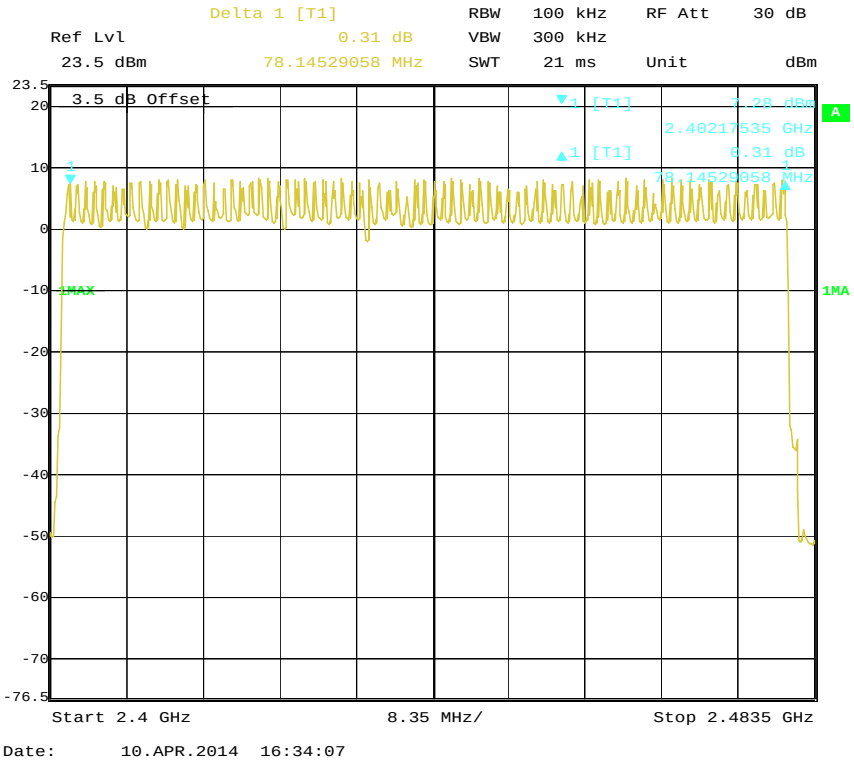
Test Result: Compliance. Please refer to following tables and plots

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

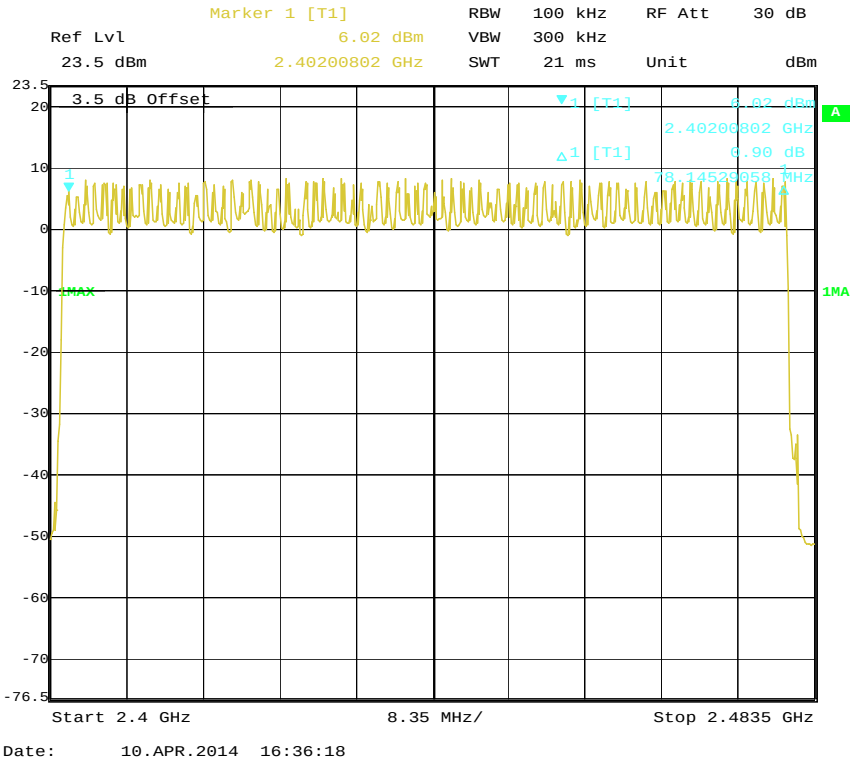
BDR (GFSK): Number of Hopping Channels



EDR (π/4-DQPSK): Number of Hopping Channels



EDR (8DPSK): Number of Hopping Channels



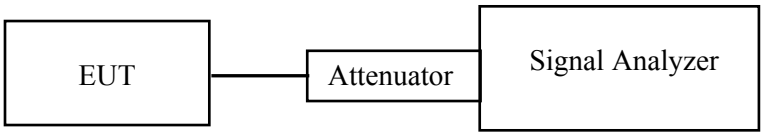
FCC §15.247(a) (1) (iii) - TIME OF OCCUPANCY (DWELL TIME)

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 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
R&S	Signal Analyzer	FSIQ26	837405/023	2013-05-31	2014-05-31

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) 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:	24 ℃
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by August He on 2014-04-10.

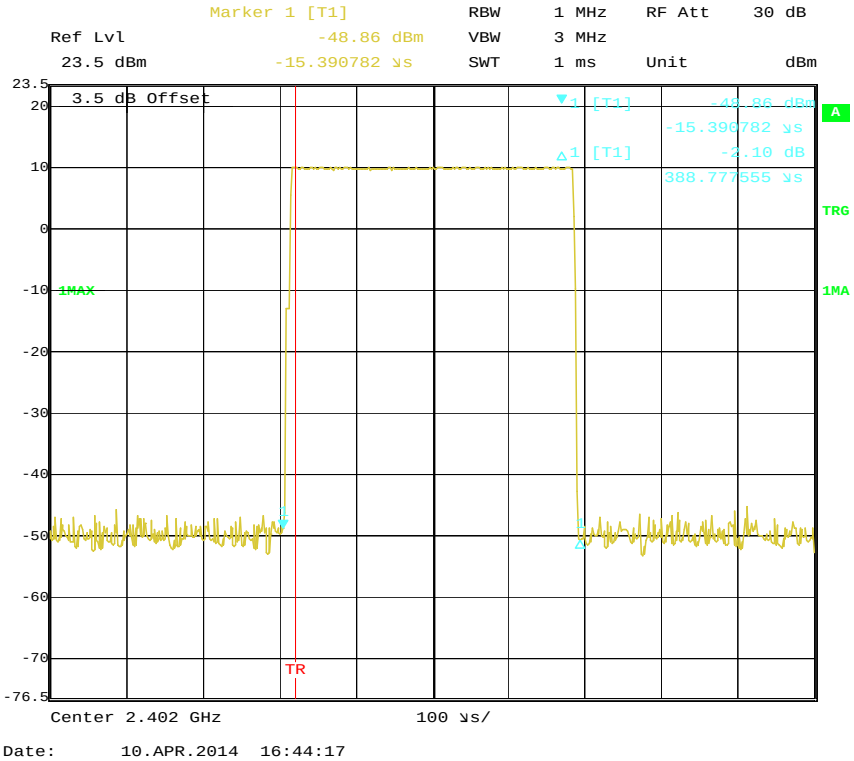
EUT operation mode: Transmitting

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

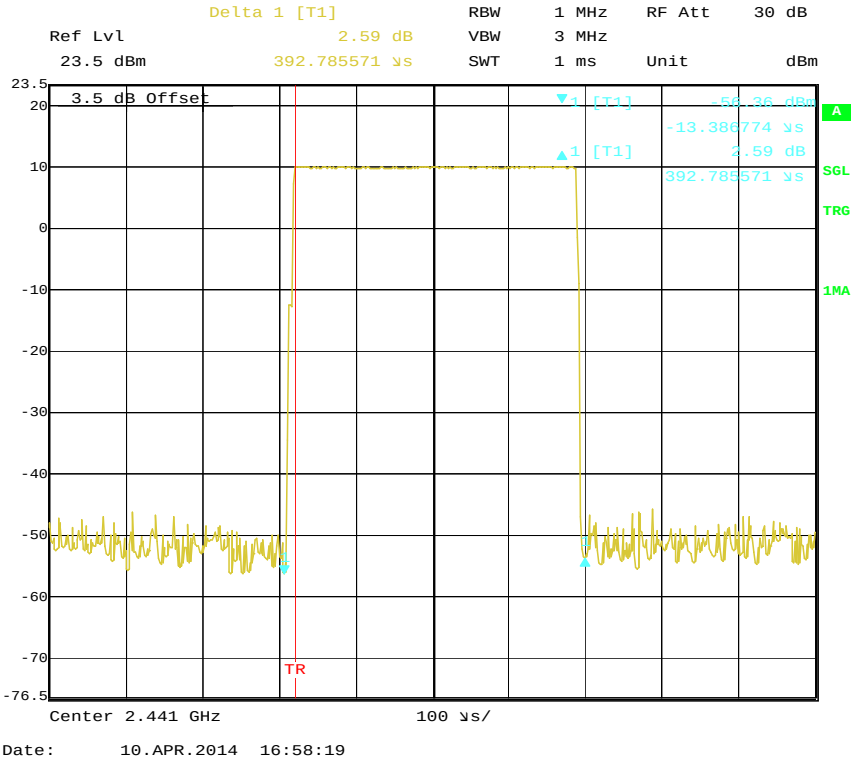
Mode		Channel	Pulse Width (ms)	Dwell Time (S)	Limit (S)	Result
BDR (GFSK)	DH 1	Low	0.389	0.124	0.4	Pass
		Middle	0.393	0.126	0.4	Pass
		High	0.391	0.125	0.4	Pass
		Note: DH1:Dwell time = Pulse time*(1600/2/79)*31.6S				
	DH 3	Low	1.669	0.267	0.4	Pass
		Middle	1.669	0.267	0.4	Pass
		High	1.669	0.267	0.4	Pass
		Note: DH3:Dwell time = Pulse time*(1600/4/79)*31.6S				
	DH 5	Low	2.926	0.312	0.4	Pass
		Middle	2.934	0.313	0.4	Pass
		High	2.942	0.314	0.4	Pass
		Note: DH5:Dwell time = Pulse time*(1600/6/79)*31.6S				
EDR (π/4-DQPSK)	DH 1	Low	0.393	0.126	0.4	Pass
		Middle	0.397	0.127	0.4	Pass
		High	0.399	0.128	0.4	Pass
		Note: 2DH1:Dwell time = Pulse time*(1600/2/79)*31.6S				
	DH 3	Low	1.675	0.268	0.4	Pass
		Middle	1.669	0.267	0.4	Pass
		High	1.657	0.265	0.4	Pass
		Note: 2DH3:Dwell time = Pulse time*(1600/4/79)*31.6S				
	DH 5	Low	2.918	0.311	0.4	Pass
		Middle	2.934	0.313	0.4	Pass
		High	2.910	0.310	0.4	Pass
		Note: 2DH5:Dwell time = Pulse time*(1600/6/79)*31.6S				
EDR (8DPSK)	DH 1	Low	0.393	0.126	0.4	Pass
		Middle	0.397	0.127	0.4	Pass
		High	0.395	0.126	0.4	Pass
		Note: 3DH1:Dwell time = Pulse time*(1600/2/79)*31.6S				
	DH 3	Low	1.681	0.269	0.4	Pass
		Middle	1.669	0.267	0.4	Pass
		High	1.657	0.265	0.4	Pass
		Note: 3DH3:Dwell time = Pulse time*(1600/4/79)*31.6S				
	DH 5	Low	2.934	0.313	0.4	Pass
		Middle	2.935	0.314	0.4	Pass
		High	2.918	0.311	0.4	Pass
		Note: 3DH5:Dwell time = Pulse time*(1600/6/79)*31.6S				

BDR (GFSK):

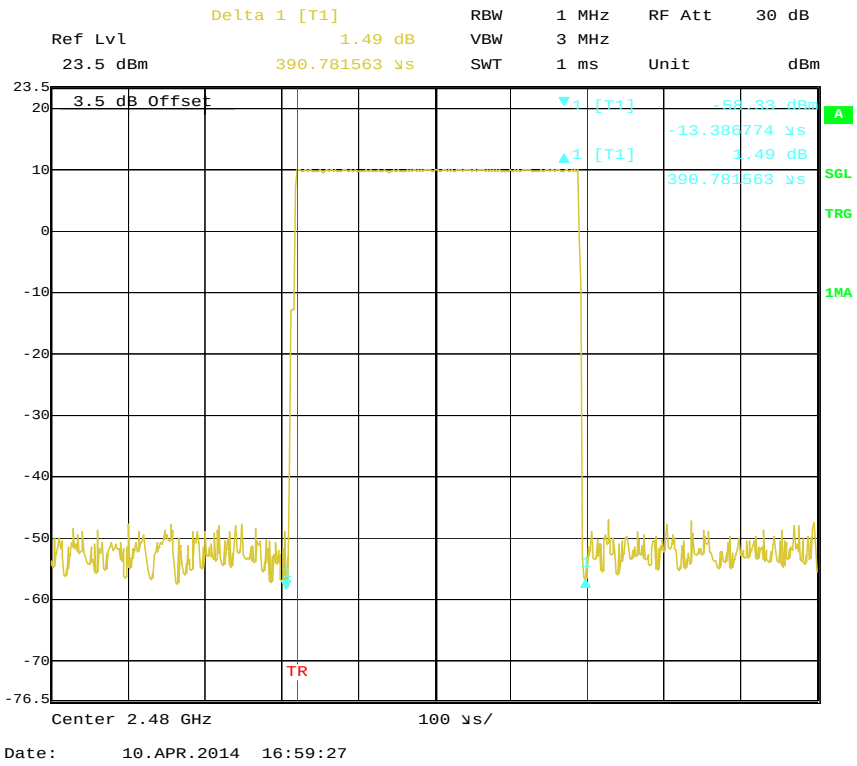
Pulse time, Low Channel, DH1



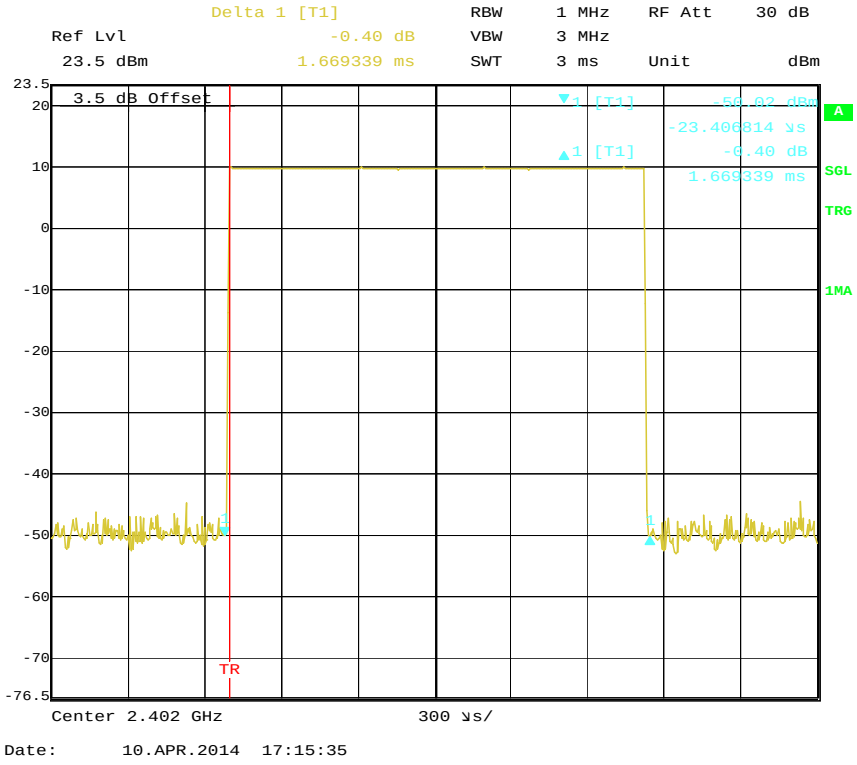
Pulse time, Middle Channel, DH1



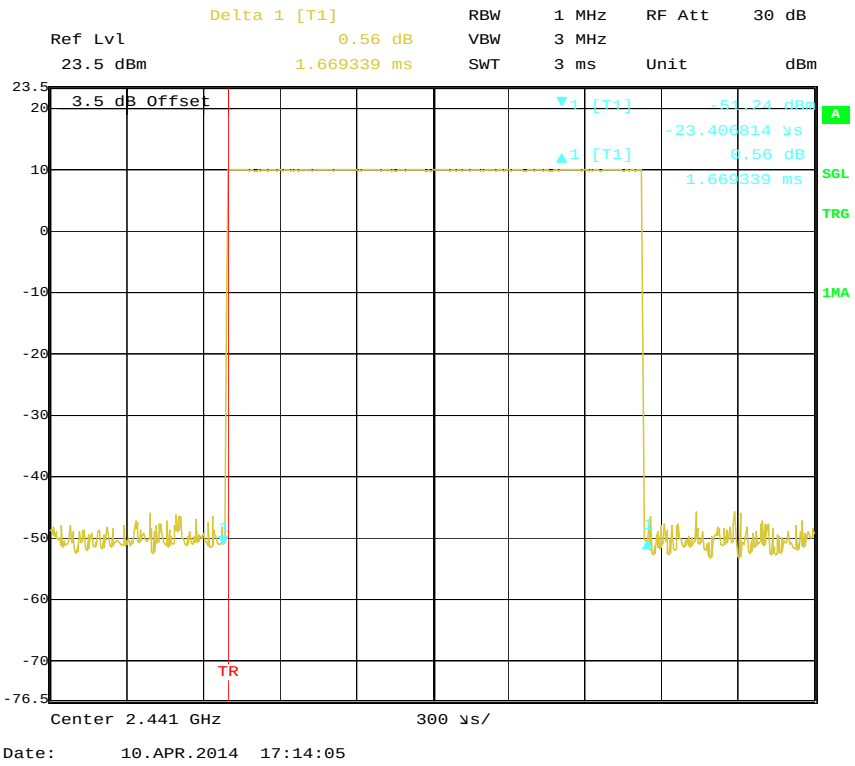
Pulse time, High Channel, DH1



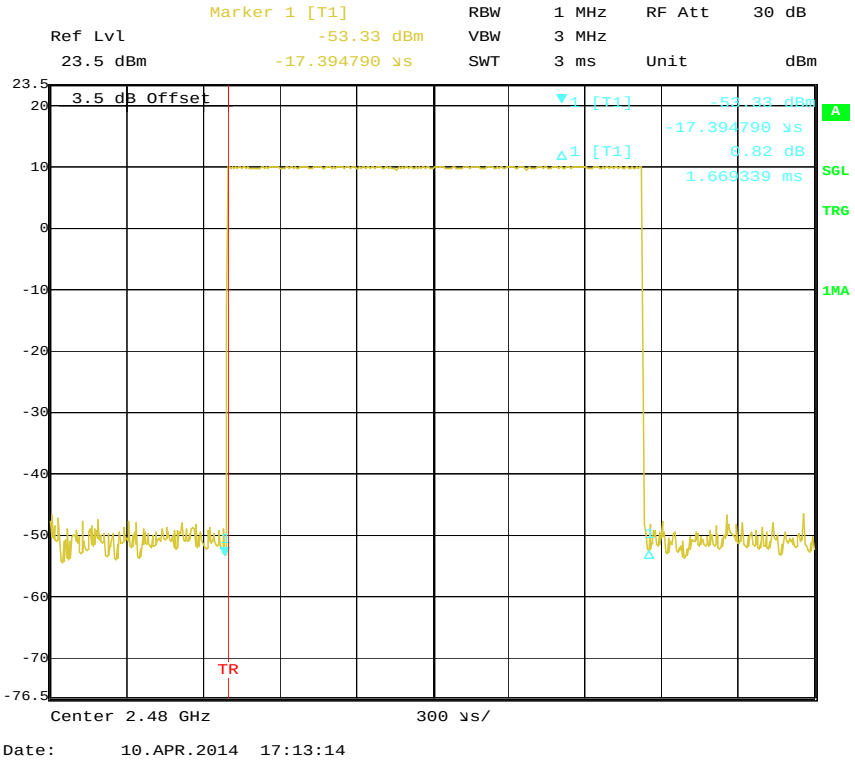
Pulse time, Low Channel, DH3



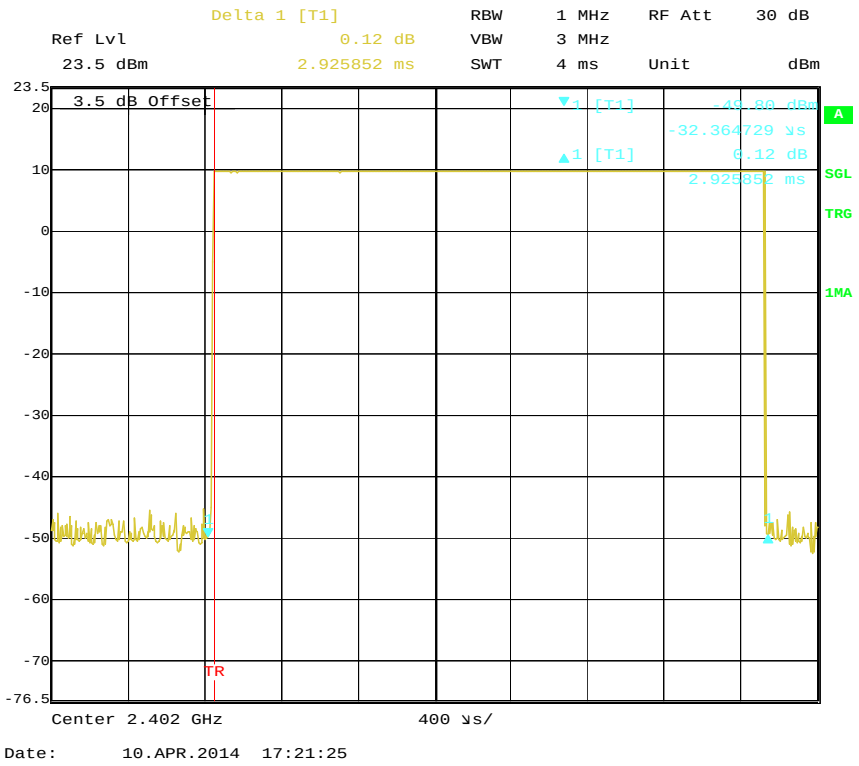
Pulse time, Middle Channel, DH3



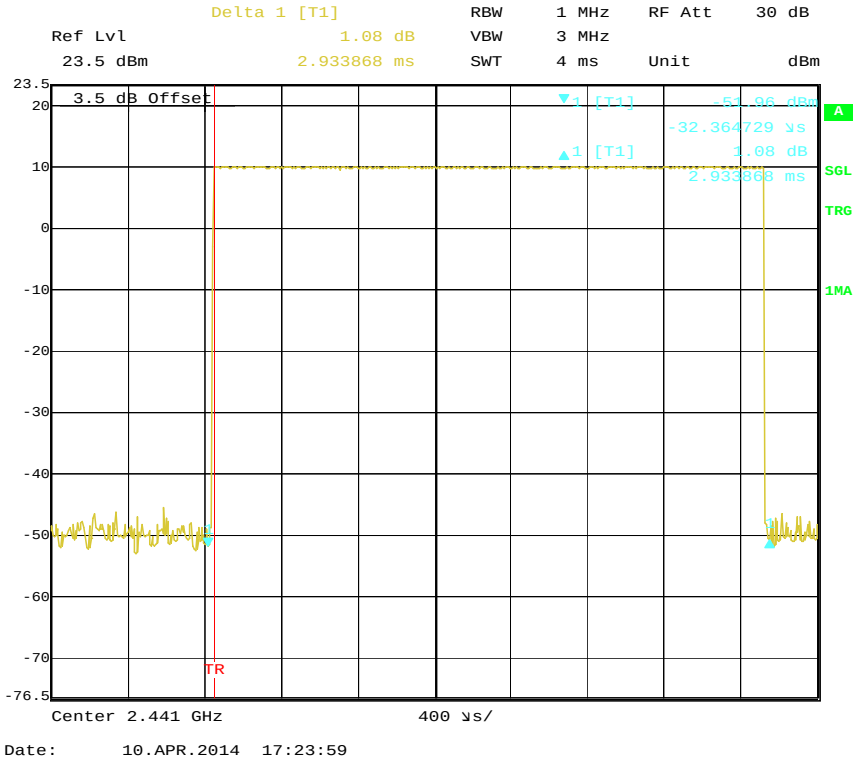
Pulse time, High Channel, DH3



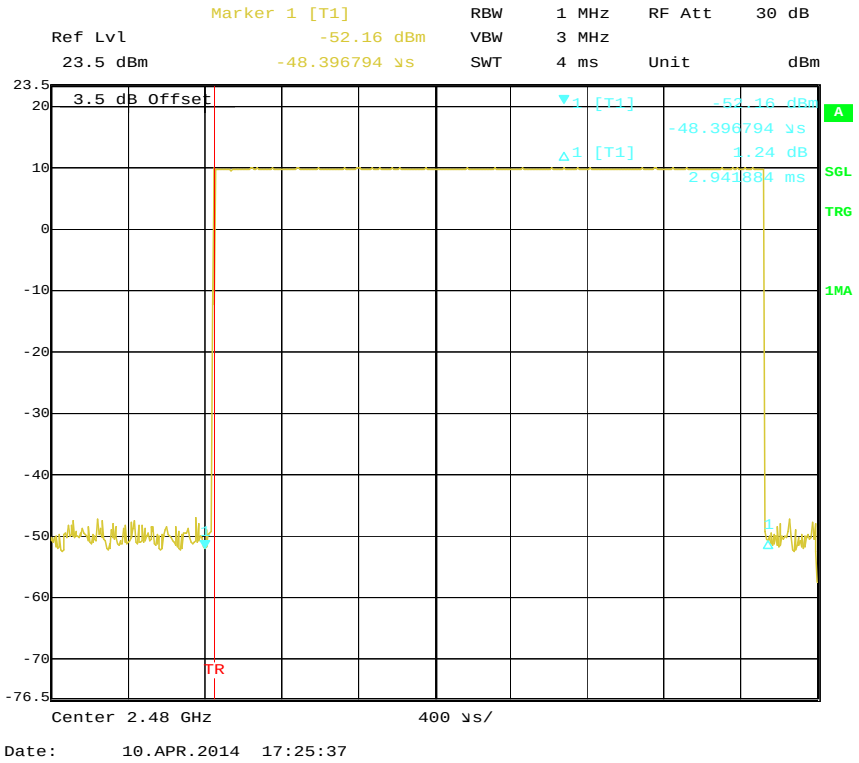
Pulse time, Low Channel, DH5



Pulse time, Middle Channel, DH5

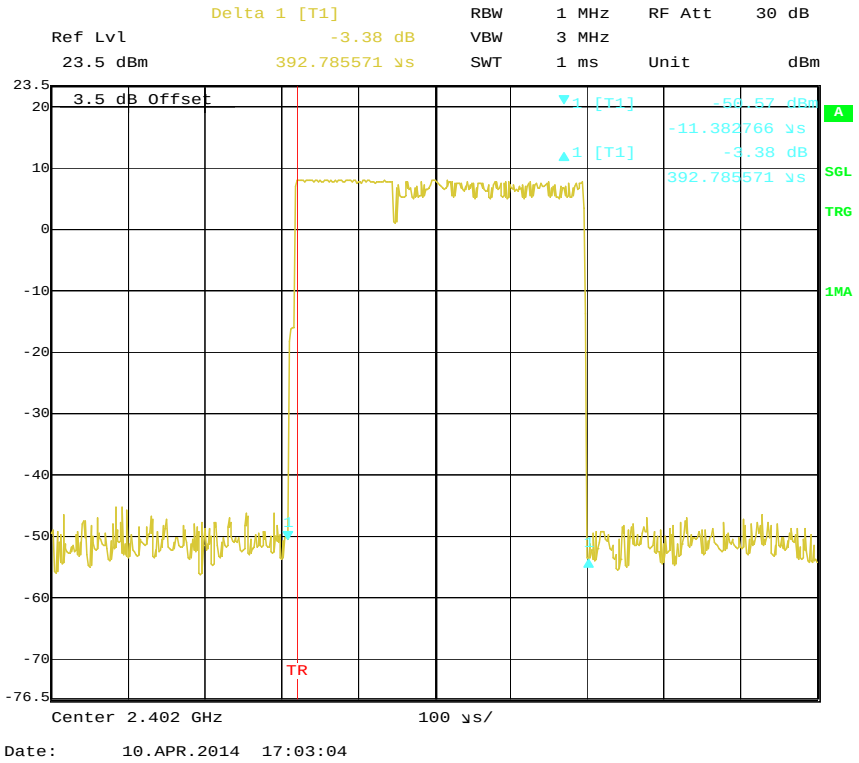


Pulse time, High Channel, DH5

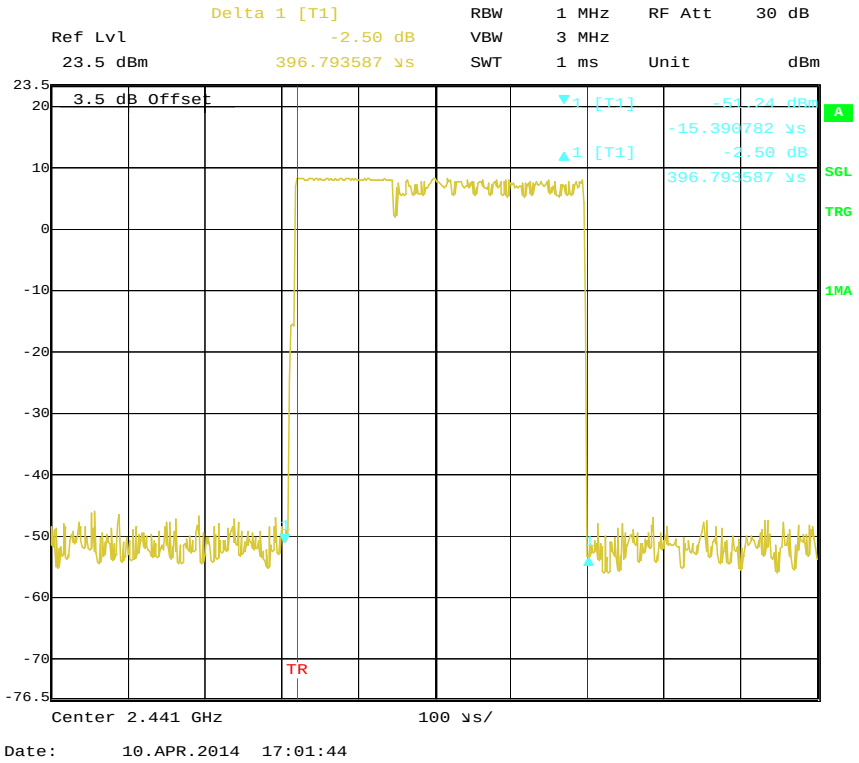


EDR (π/4-DQPSK):

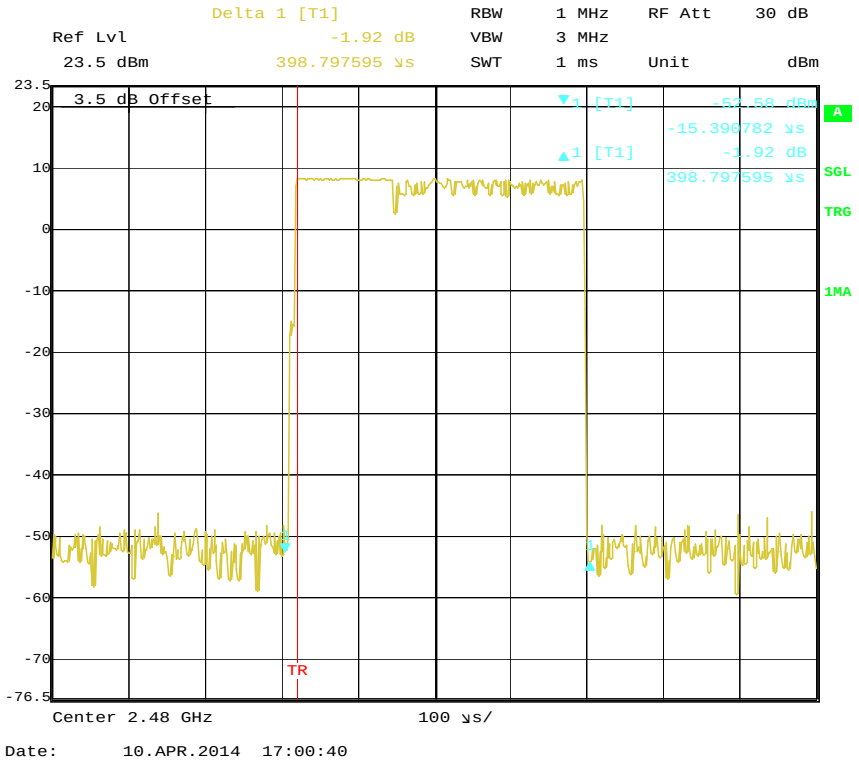
Pulse time, Low Channel, 2DH1



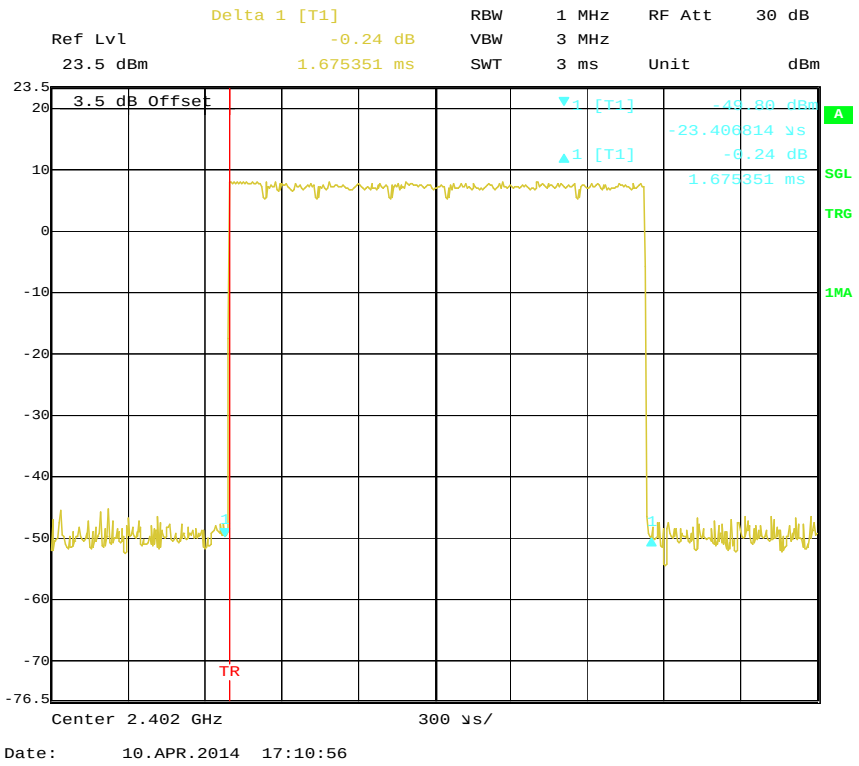
Pulse time, Middle Channel, 2DH1



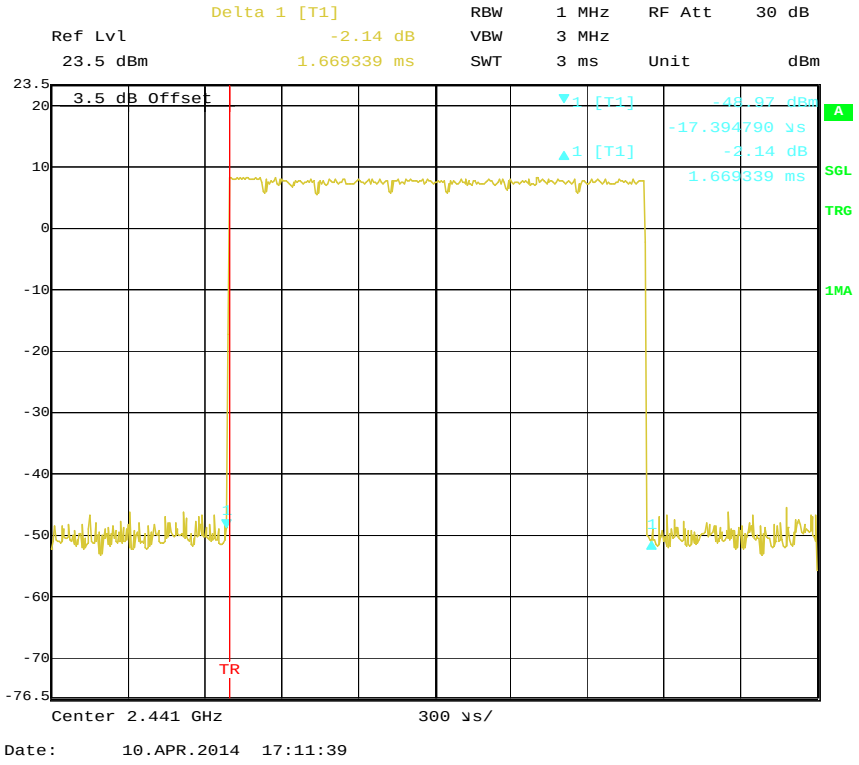
Pulse time, High Channel, 2DH1



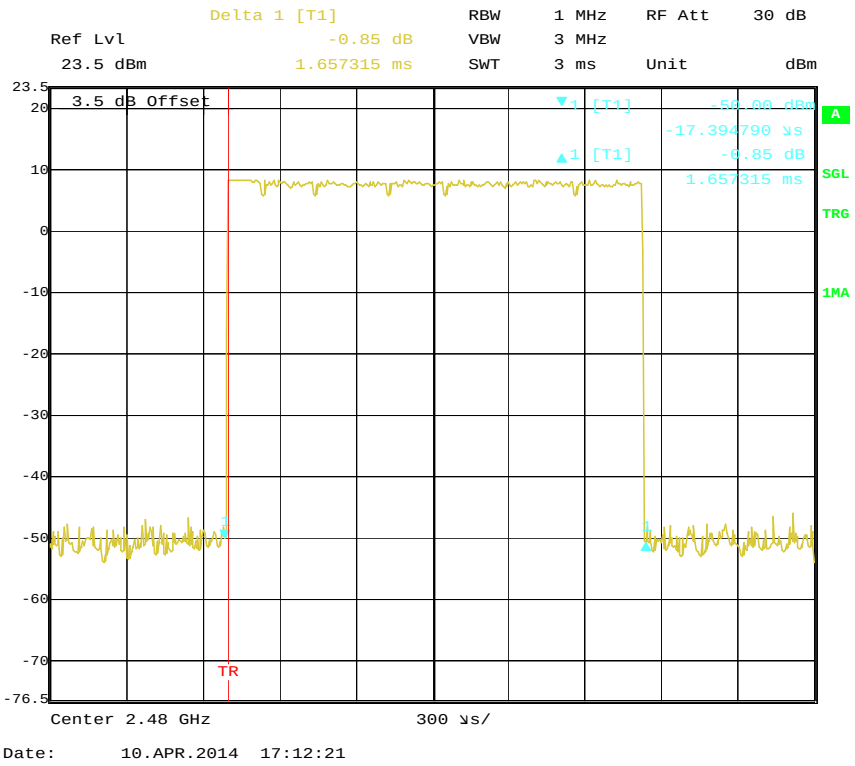
Pulse time, Low Channel, 2DH3



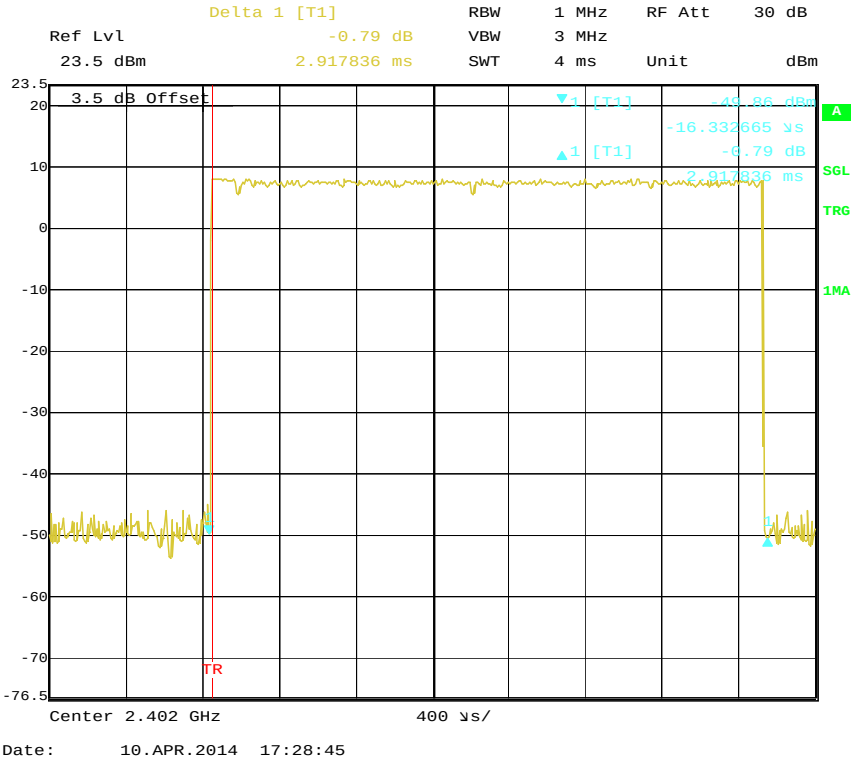
Pulse time, Middle Channel, 2DH3



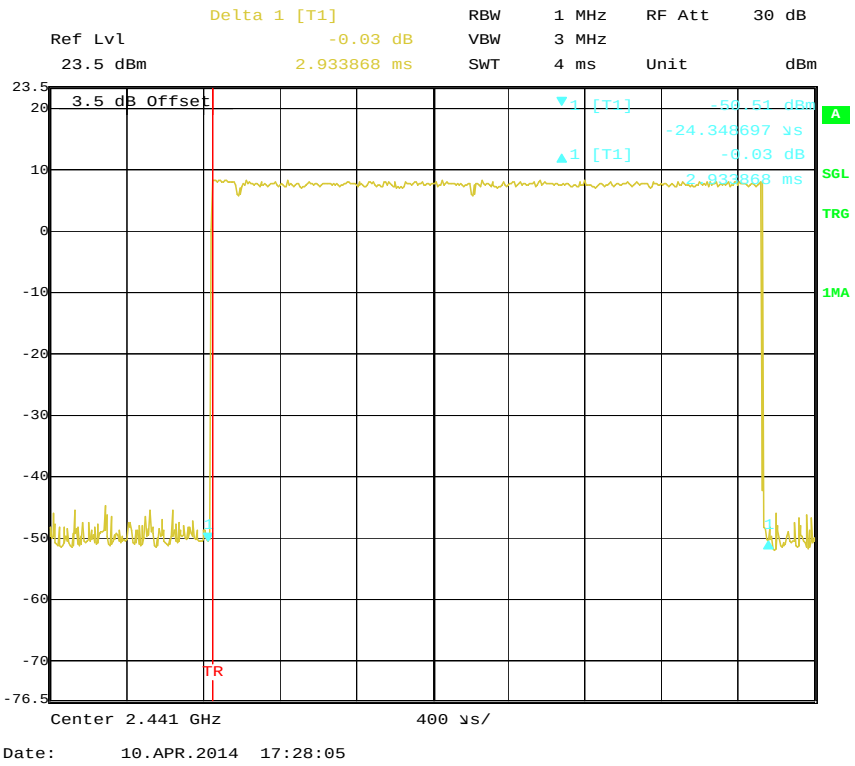
Pulse time, High Channel, 2DH3



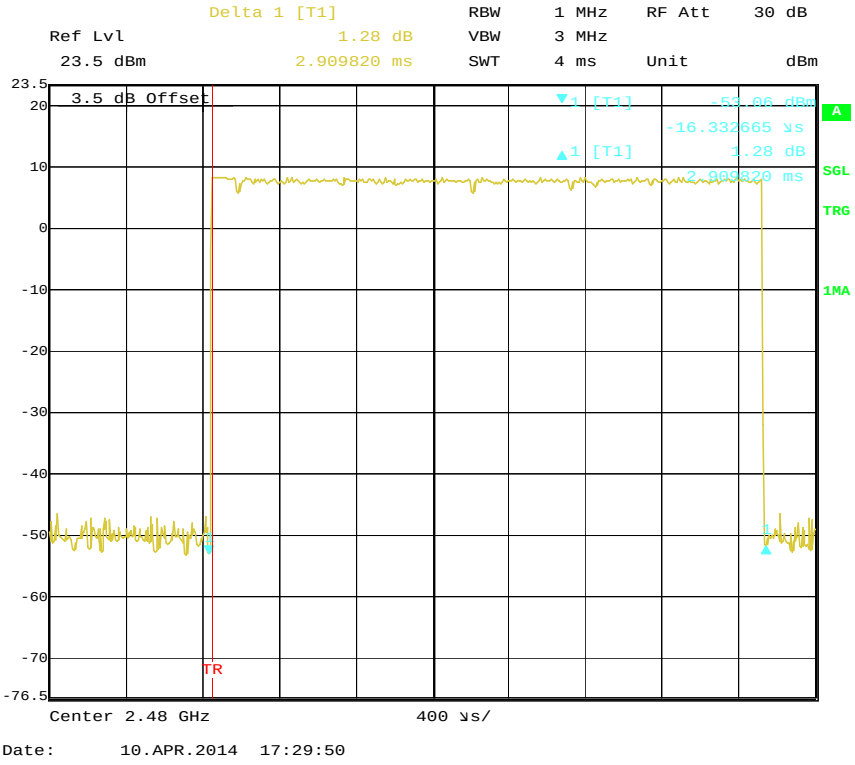
Pulse time, Low Channel, 2DH5



Pulse time, Middle Channel, 2DH5

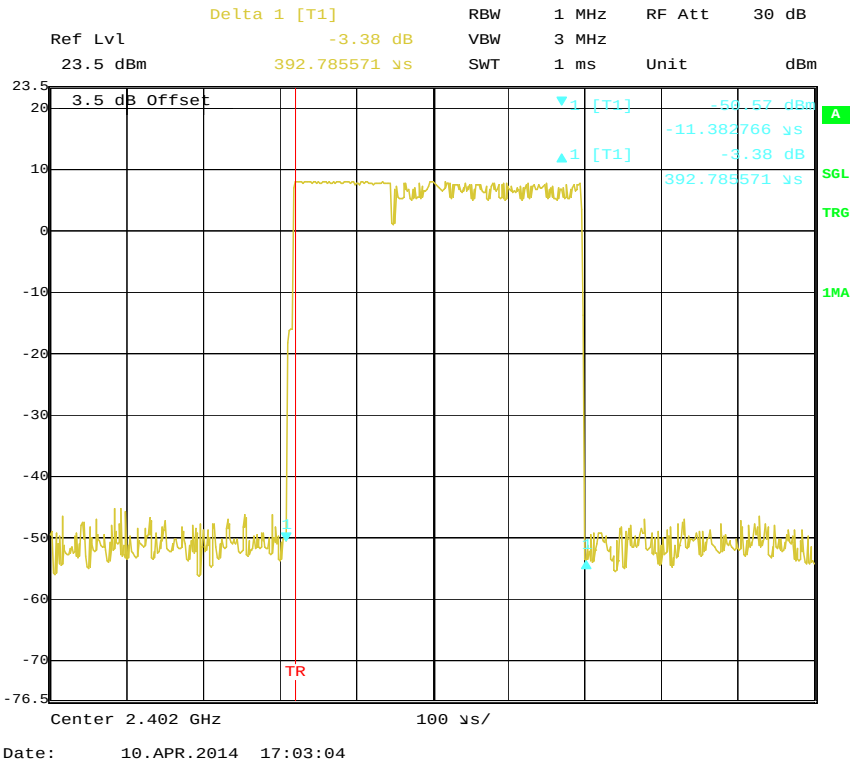


Pulse time, High Channel, 2DH5

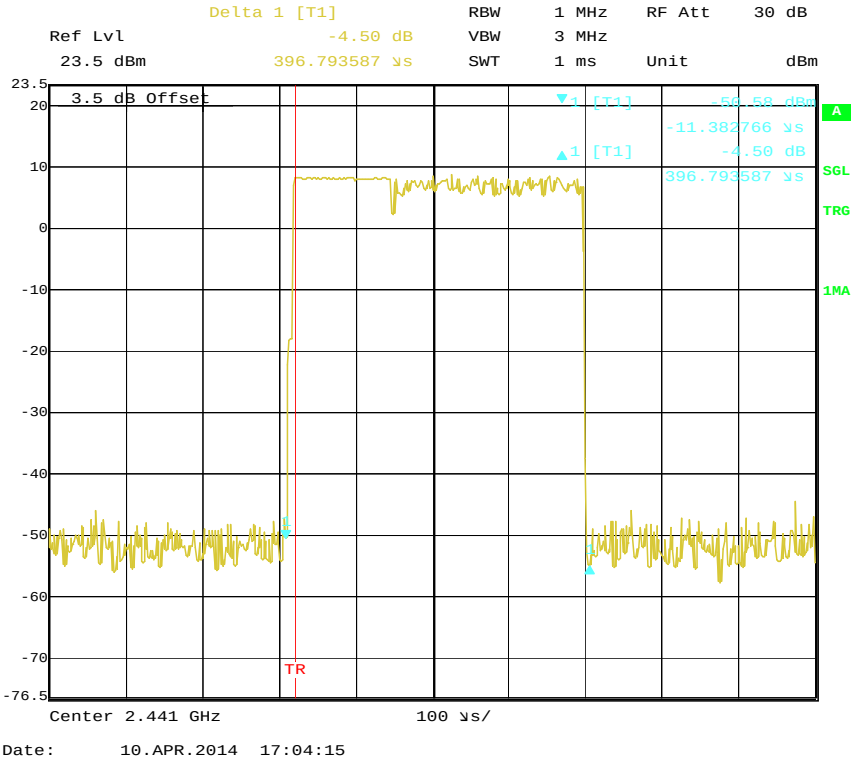


EDR (8DPSK):

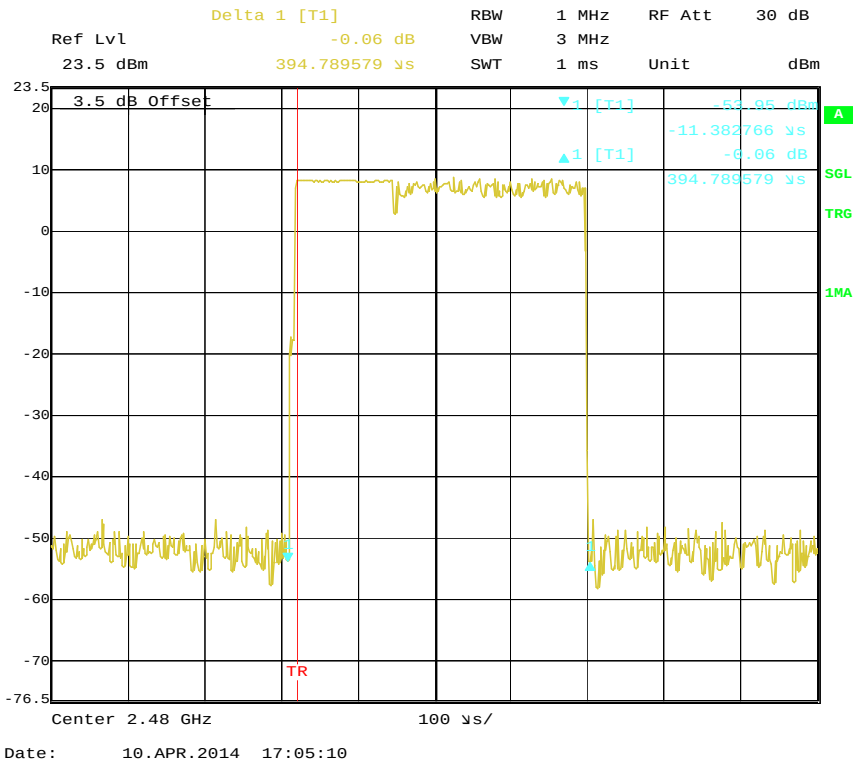
Pulse time, Low Channel, 3DH1



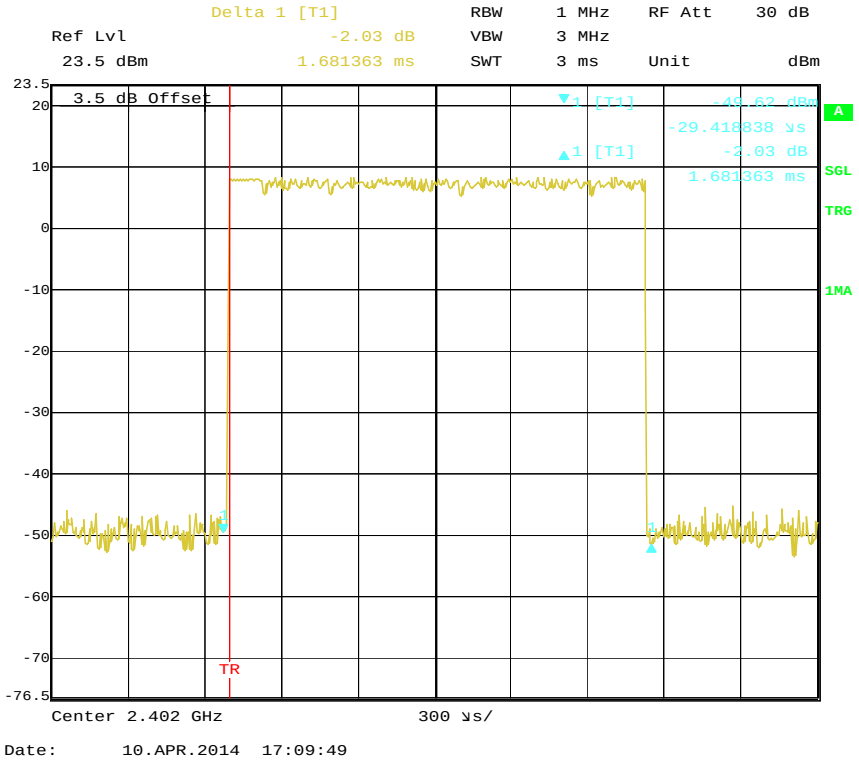
Pulse time, Middle Channel, 3DH1



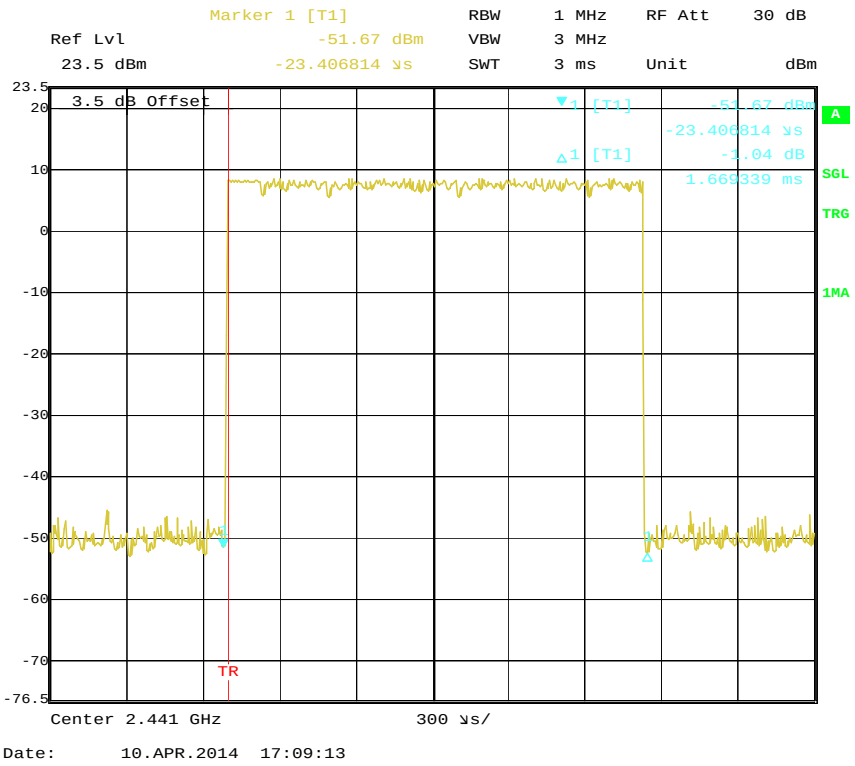
Pulse time, High Channel, 3DH1



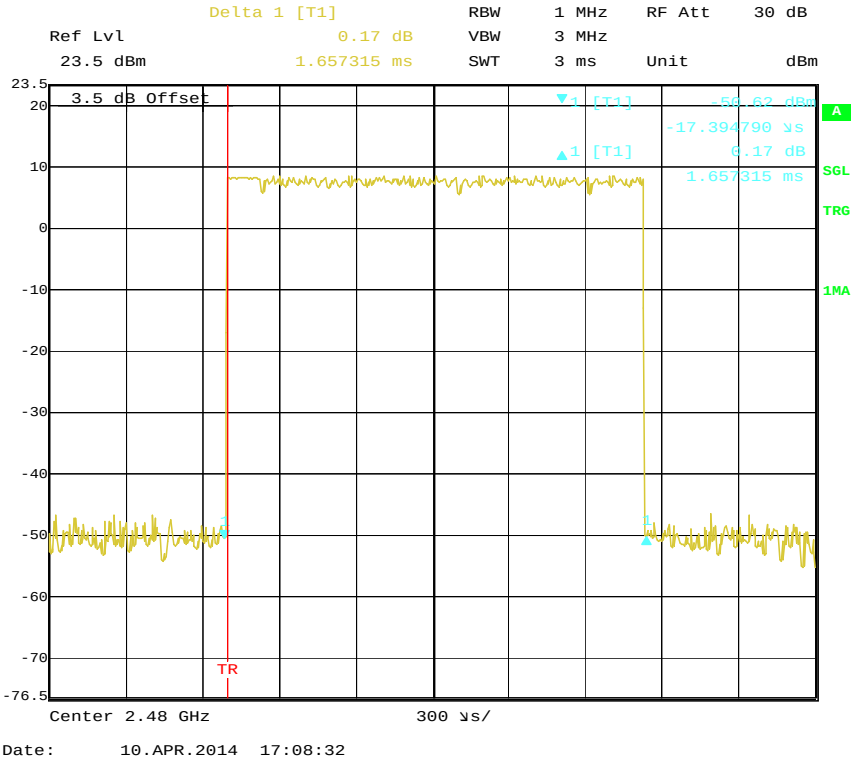
Pulse time, Low Channel, 3DH3



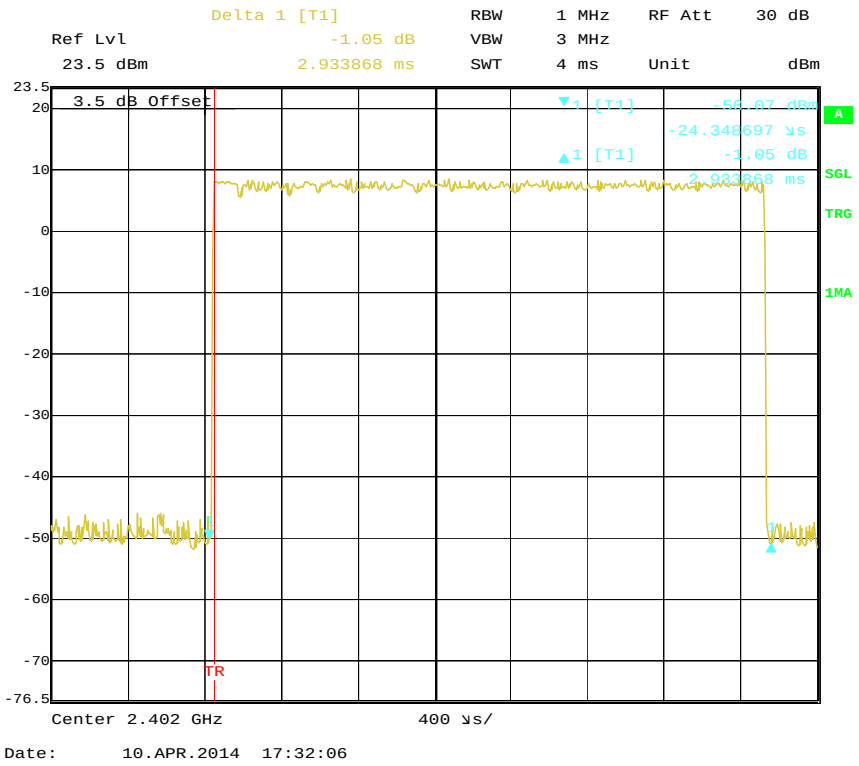
Pulse time, Middle Channel, 3DH3



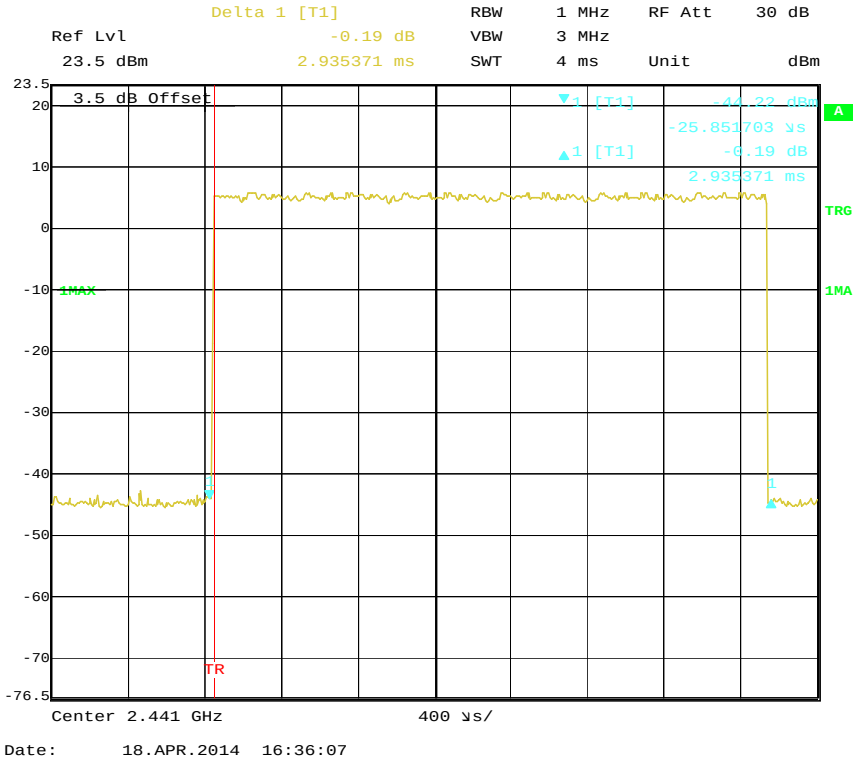
Pulse time, High Channel, 3DH3



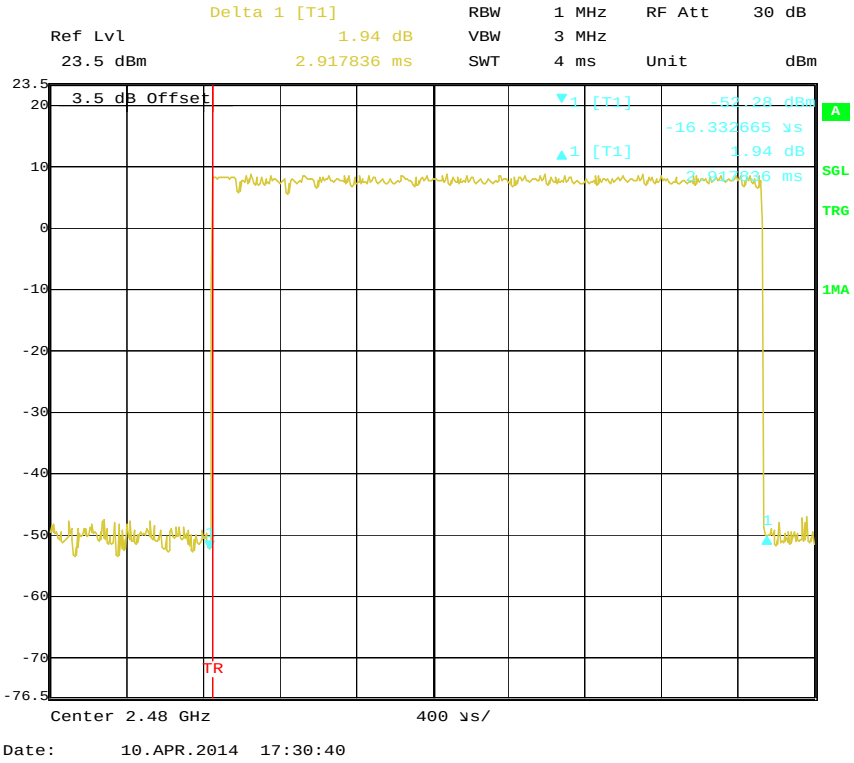
Pulse time, Low Channel, 3DH5



Pulse time, Middle Channel, 3DH5



Pulse time, High Channel, 3DH5



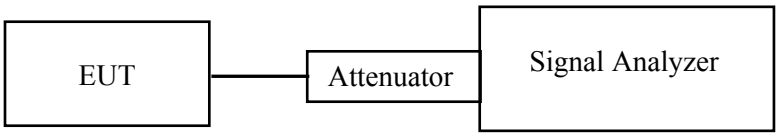
FCC §15.247(b) (1) - PEAK OUTPUT POWER MEASUREMENT

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
R&S	Signal Analyzer	FSIQ26	837405/023	2013-05-31	2014-05-31

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) 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:	24 ℃
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

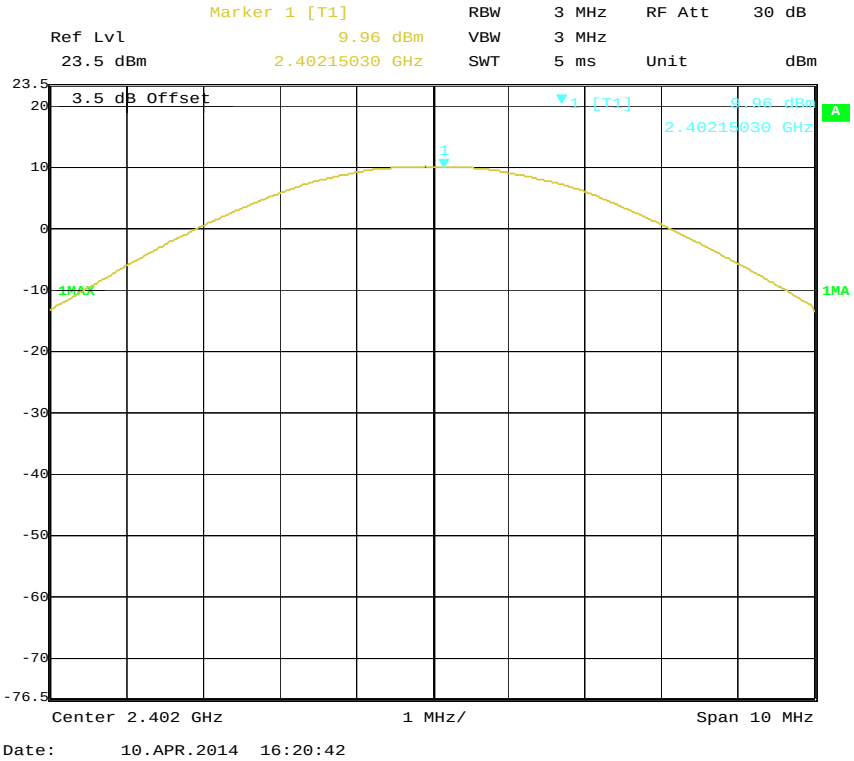
The testing was performed by August He on 2014-04-10.

EUT operation mode: Transmitting

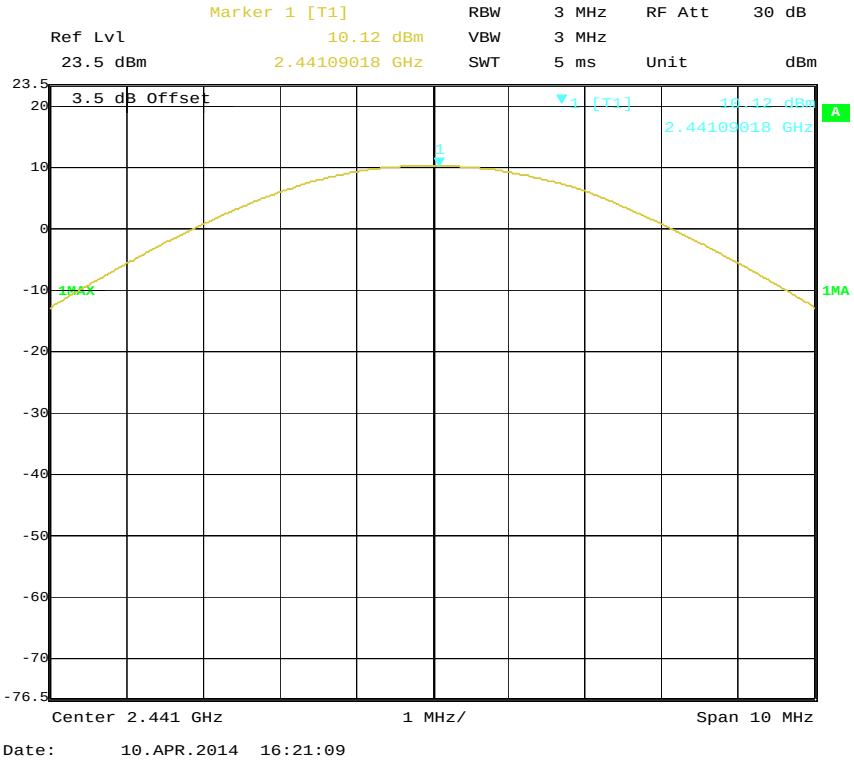
Test Result: Compliance. Please refer to following tables and plots

Mode	Channel	Frequency (MHz)	Conducted Output Power		Limit (mW)
			(dBm)	(mW)	
BDR (GFSK)	Low	2402	9.96	9.91	1000
	Middle	2441	10.12	10.28	1000
	High	2480	10.02	10.05	1000
EDR (π/4-DQPSK)	Low	2402	8.59	7.23	1000
	Middle	2441	8.84	7.66	1000
	High	2480	8.83	7.64	1000
EDR (8DPSK)	Low	2402	8.84	7.67	1000
	Middle	2441	9.13	8.19	1000
	High	2480	9.14	8.20	1000

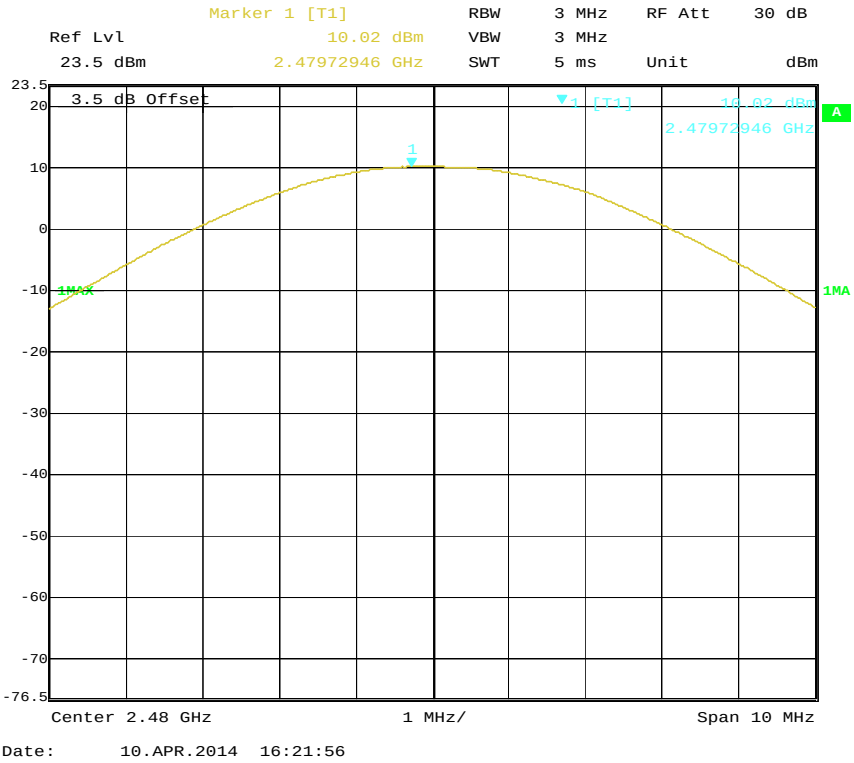
BDR (GFSK): Low Channel



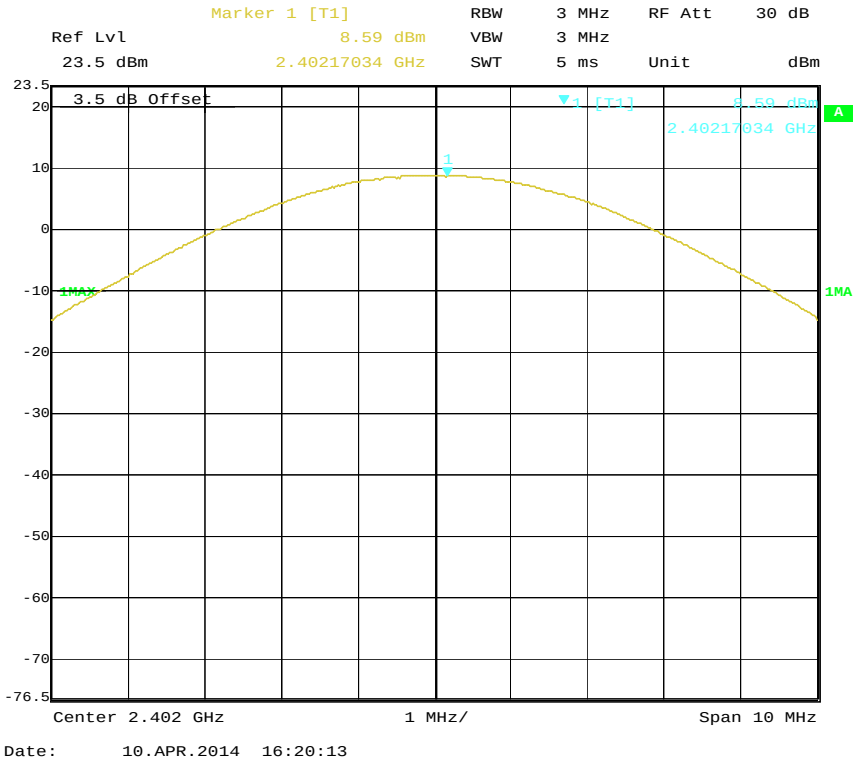
BDR (GFSK): Middle Channel



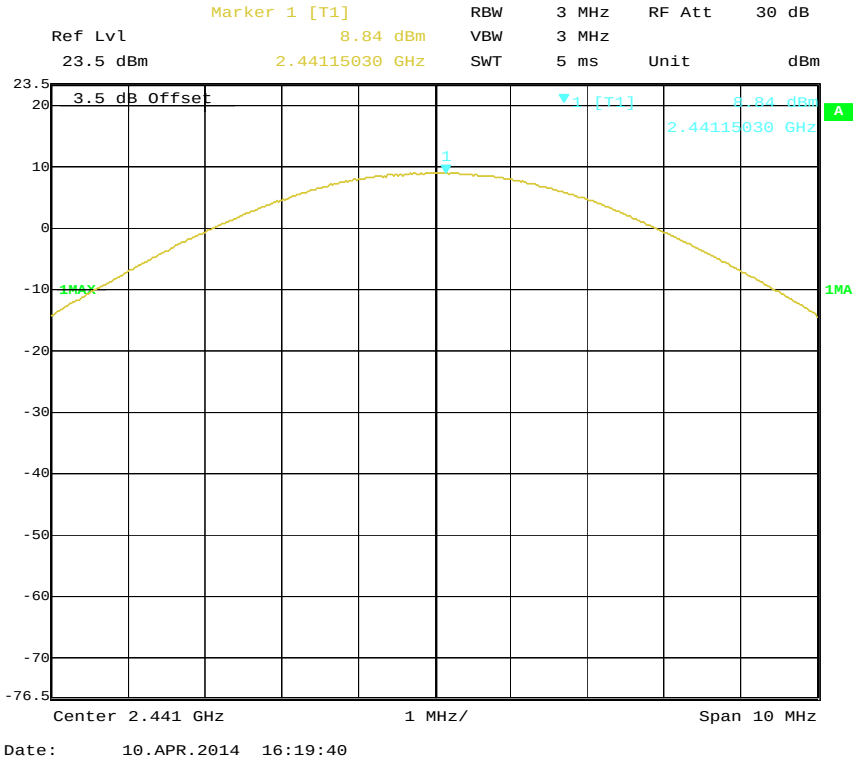
BDR (GFSK): High Channel



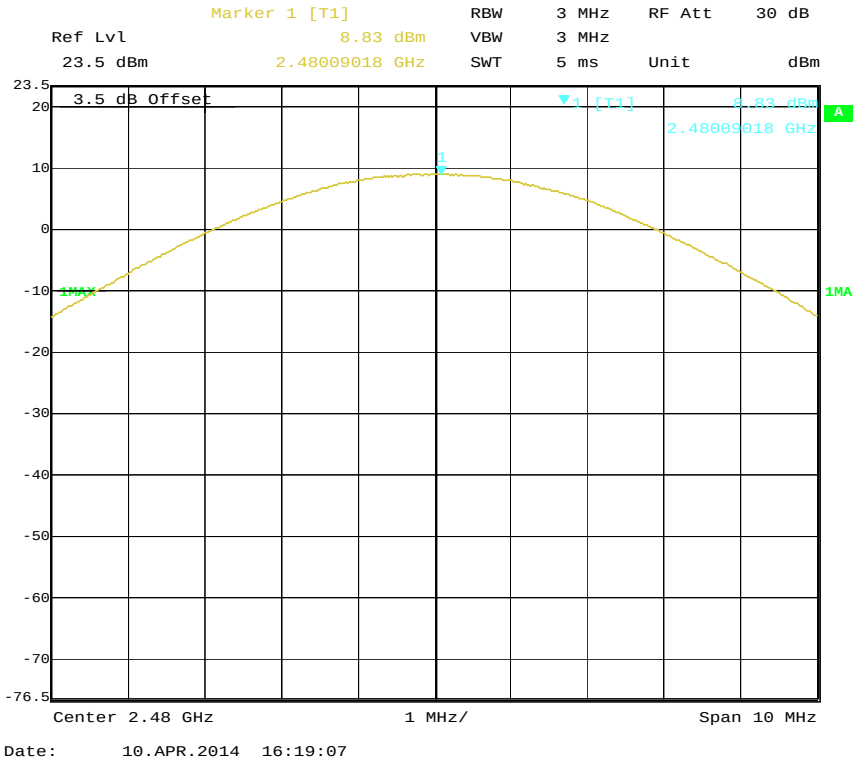
EDR(π/4-DQPSK): Low Channel



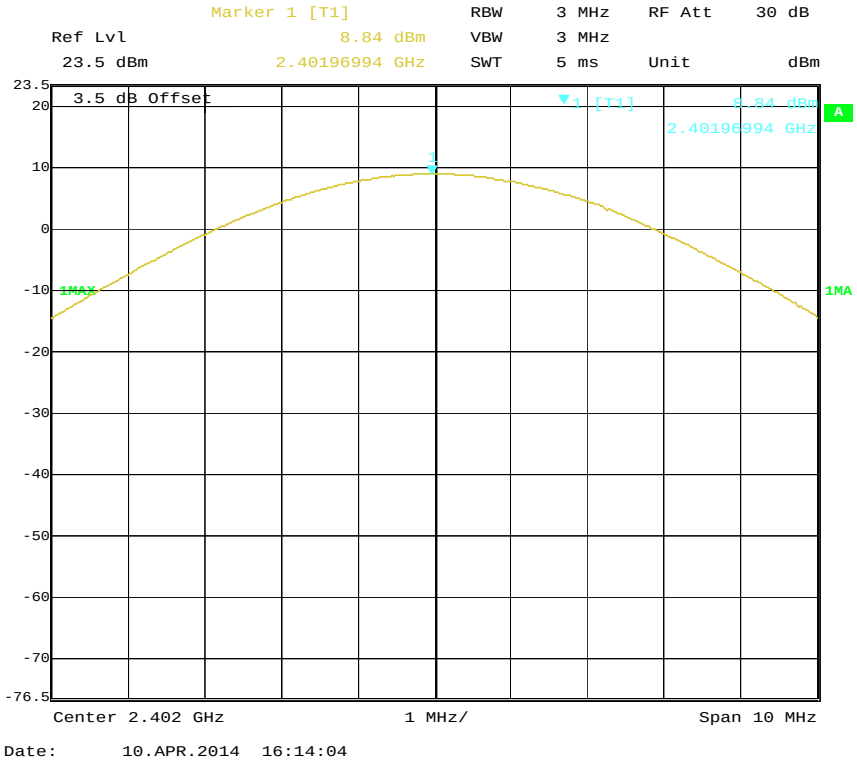
EDR(π/4-DQPSK): Middle Channel



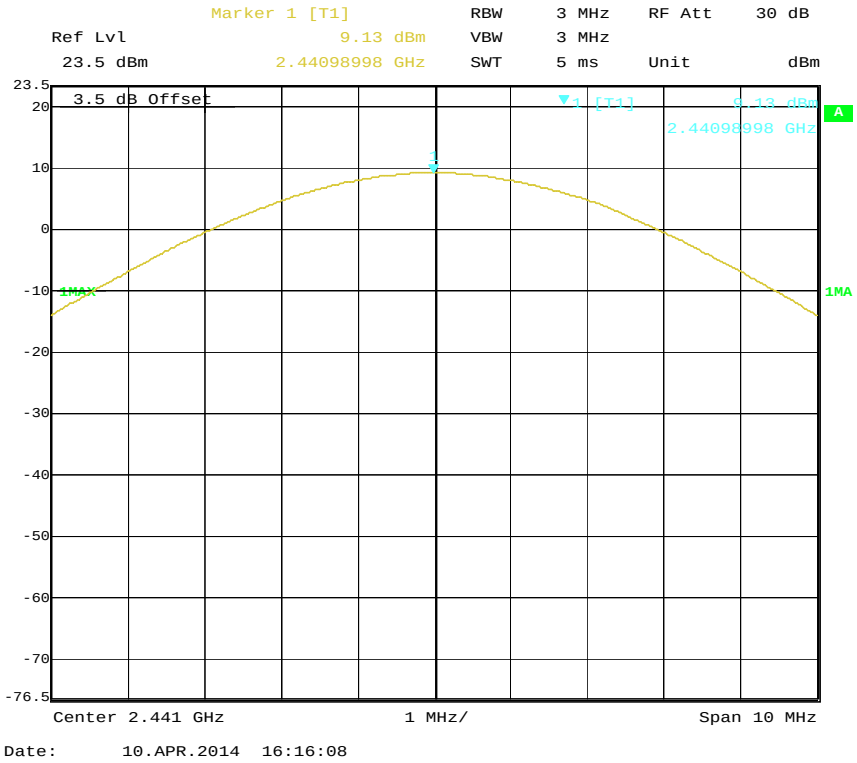
EDR(π/4-DQPSK): High Channel



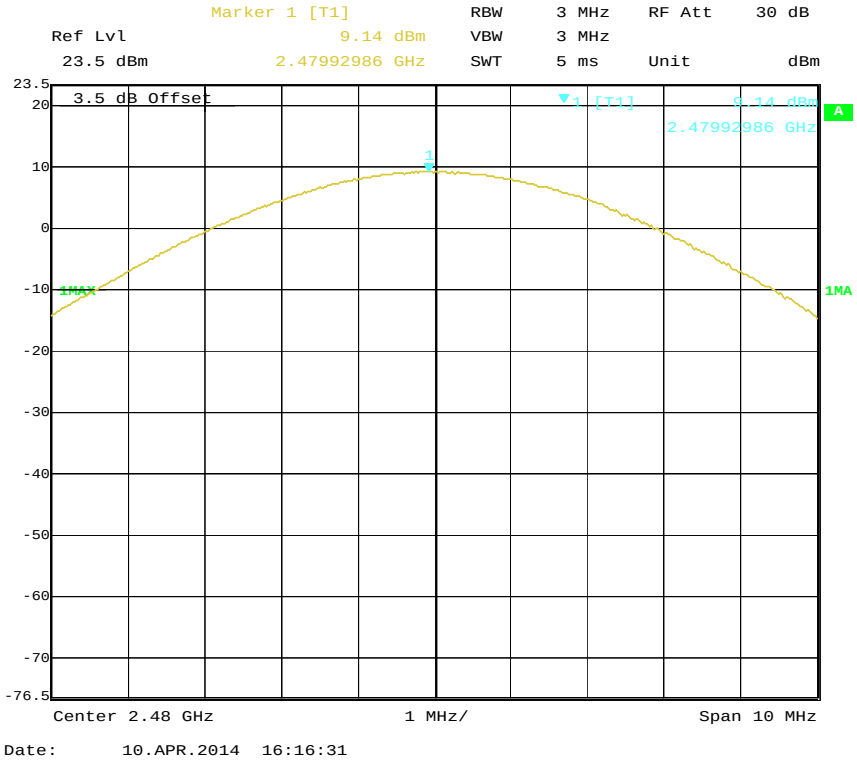
EDR(8DPSK): Low Channel



EDR(8DPSK): Middle Channel



EDR(8DPSK): High Channel



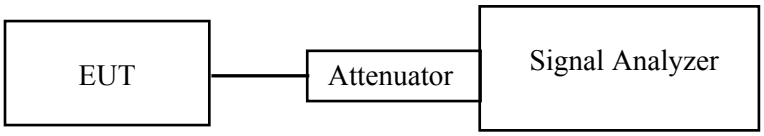
FCC §15.247(d) - BAND EDGES TESTING

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
R&S	Signal Analyzer	FSIQ26	837405/023	2013-05-31	2014-05-31

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) 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

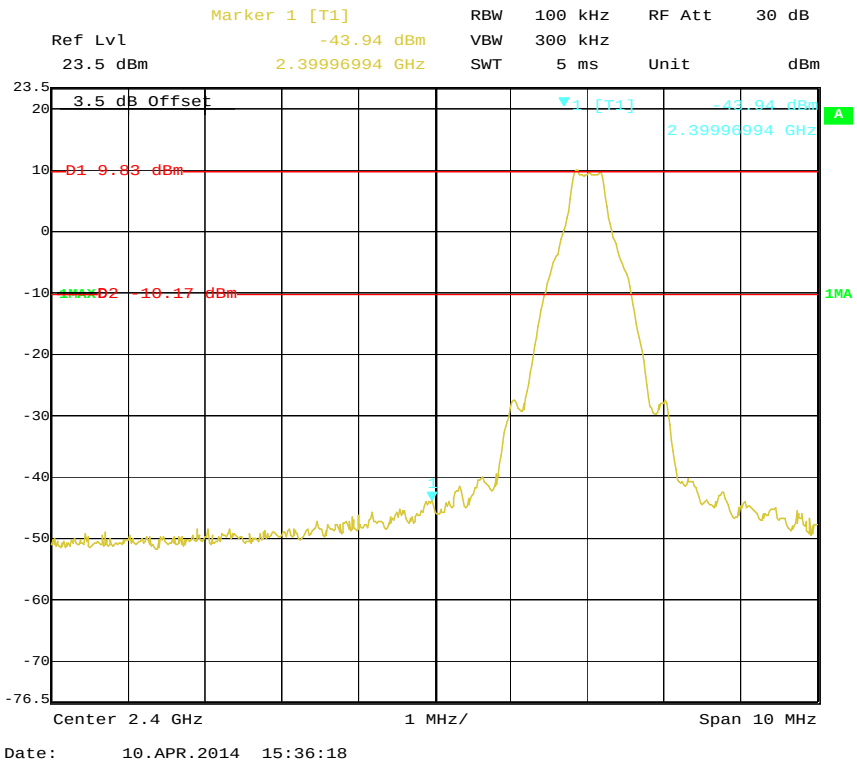
Temperature:	24 ℃
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by August He on 2014-04-10 to 2014-04-12.

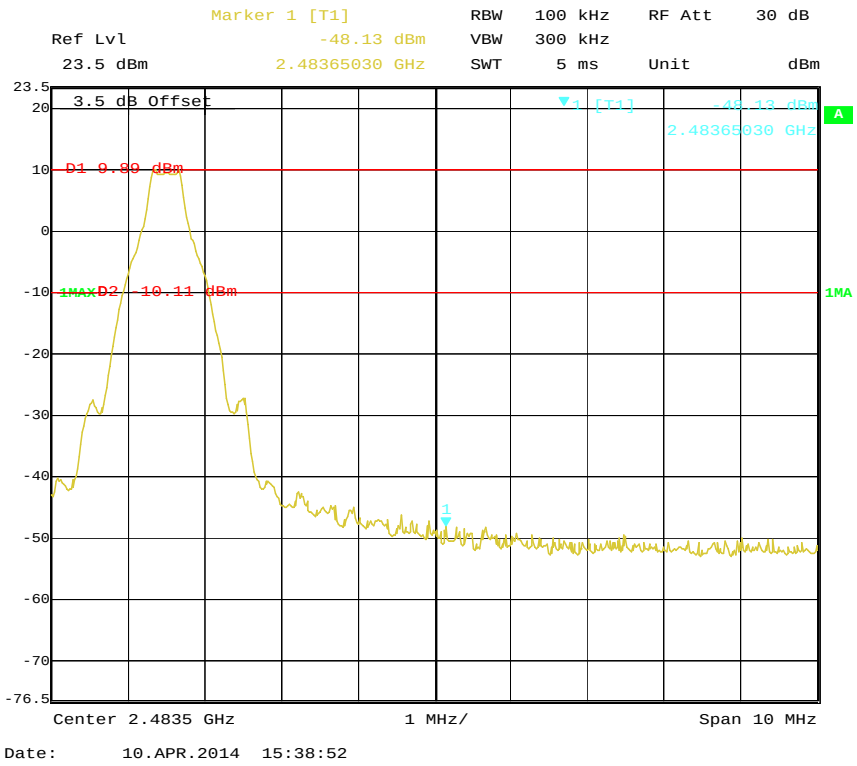
EUT operation mode: Transmitting

Test Result: Compliance. Please refer to following plots.

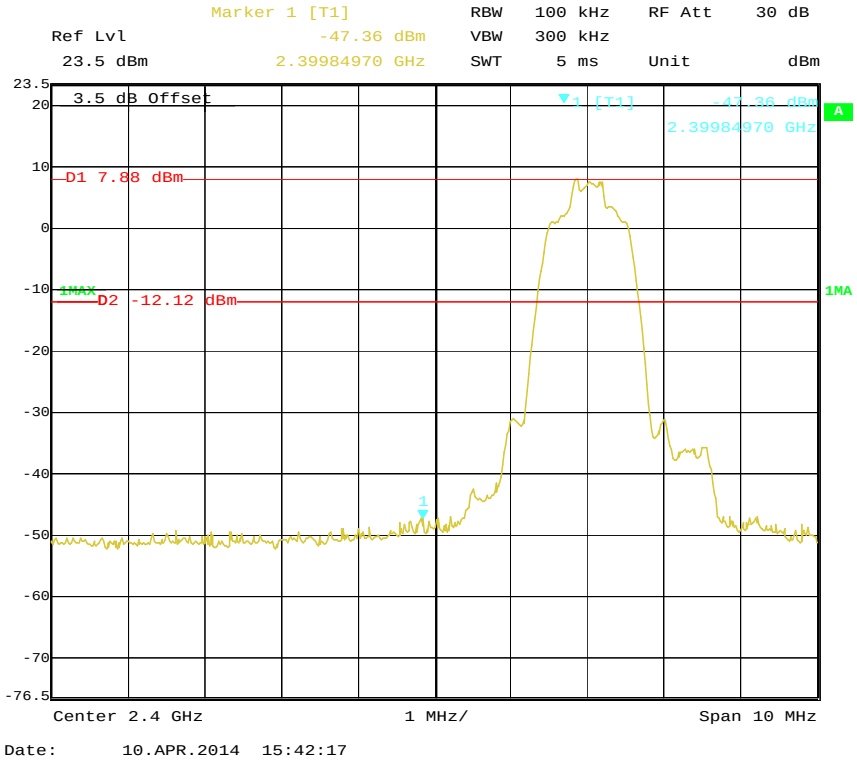
BDR (GFSK): Band Edge-Left Side



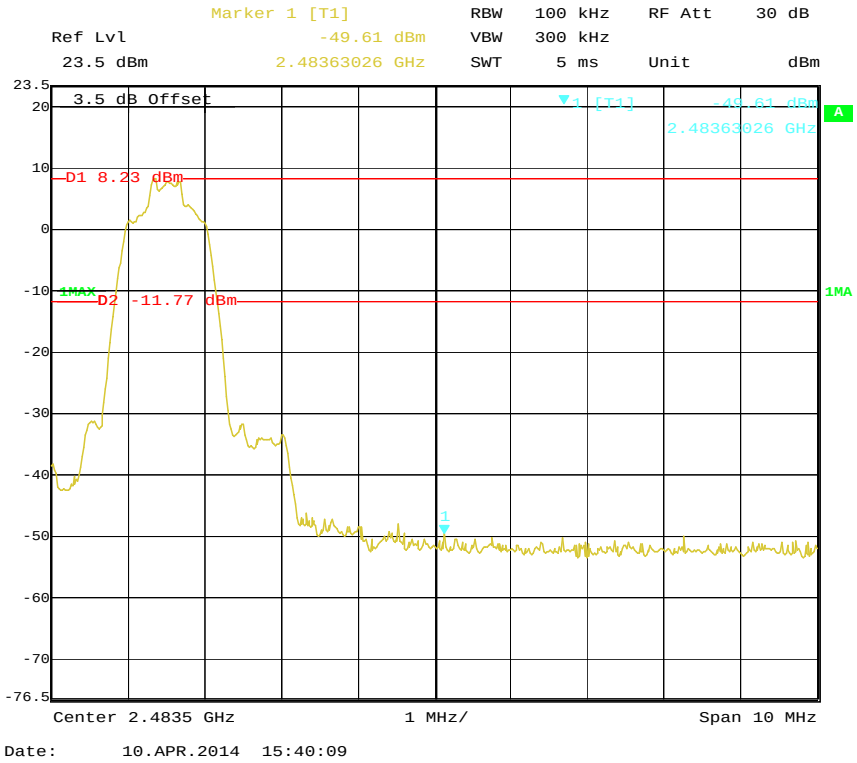
BDR (GFSK): Band Edge-Right Side



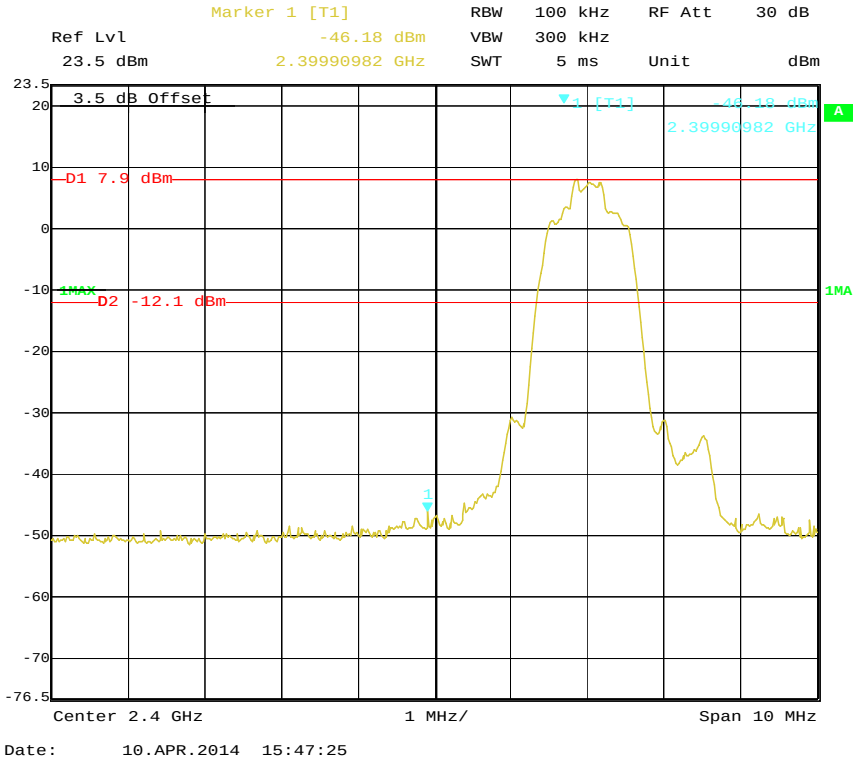
EDR (π/4-DQPSK): Band Edge-Left Side



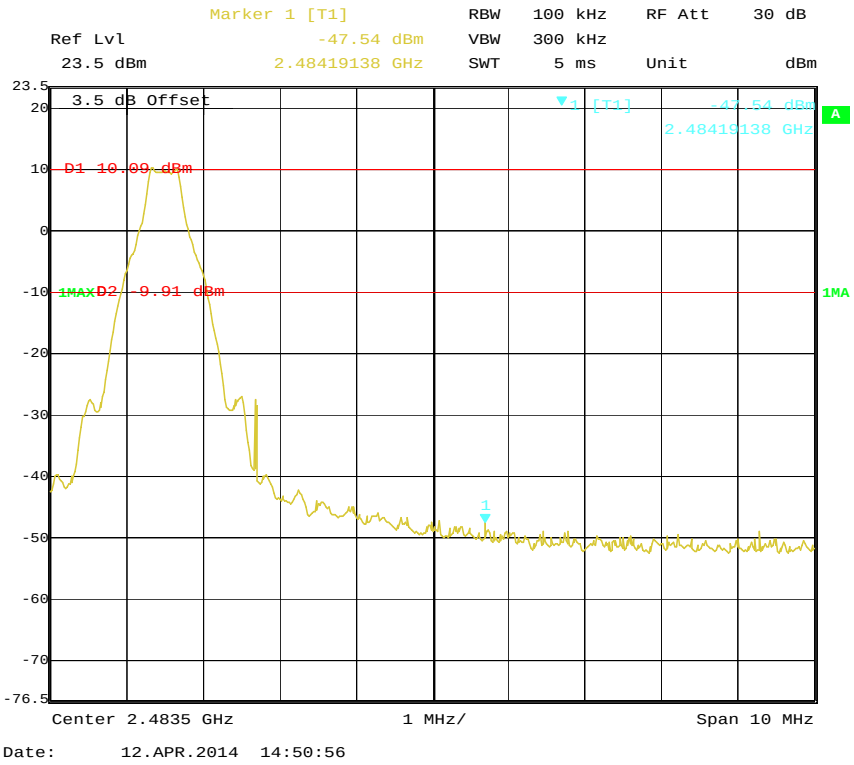
EDR (π/4-DQPSK): Band Edge-Right Side



EDR (8DPSK): Band Edge-Left Side



BDR (8DPSK): Band Edge-Right Side



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