FCC PART 15.247

TEST REPORT

For

Hantat Technology Ltd.

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FCC ID: V3NHB098

Report Type:	**Product Type:**
Original Report	Bluetooth Speaker

Report Number:	RDG160829801-00A
Report Date:	2016-09-30
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Hantat Technology Ltd.*'s product, model number: *HB098 (FCC ID: V3NHB098)* (the "EUT") in this report was a *Bluetooth Speaker,* which was measured approximately: 10.2 cm (L) x 9.7 cm (W) x 5.5 cm (H), rated input voltage: DC3.7V from rechargeable Li-ion battery or DC5V from USB port .

All measurement and test data in this report was gathered from production sample serial number: 160829801 (Assigned by BACL, Dongguan). The EUT was received on 2016-08-29.

Objective

This report is prepared on behalf of *Hantat Technology Ltd.* in accordance with Part 2, Subpart J, Part 15, Subparts A, B and C of the Federal Communications Commission's rules

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

Related Submittal(s)/Grant(s)

FCC Part 15.247 DTS submissions with FCC ID: V3NHB098.

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.

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Dongguan).

Test Facility

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

Test site at Bay Area Compliance Laboratories Corp. (Dongguan) has been fully described in reports submitted to the Federal Communications Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 06, 2015.

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

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in engineering mode.

EUT Exercise Software

The software 'RDA Bluetooth Debug Tool' was used during testing; the system configured maximum output power as default setting. The software is only for changing channel and modes.

Equipment Modifications

No modification was made to the EUT.

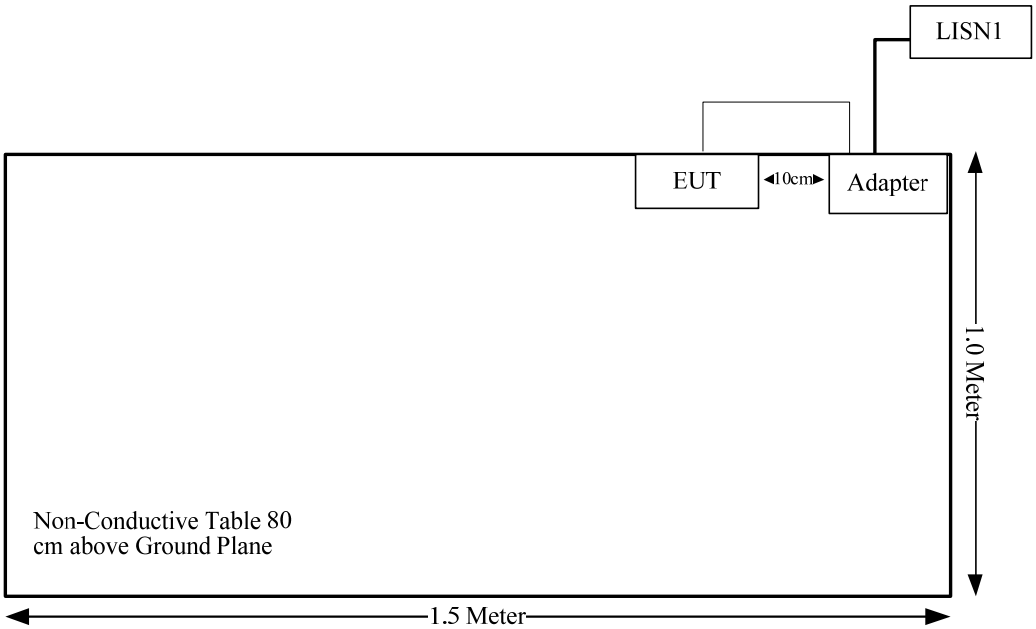
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Lenovo	Adapter	C-P44	N/A

External Cable

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
Charge Cable	No	No	0.54	Adapter	EUT

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
FCC §15.247 (i) & §1.1310 & §2.1093	RF Exposure	Compliance
§15.203	Antenna Requirement	Compliance
§15.207 (a)	Conducted Emissions	Compliance
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
§15.247 (a)(1)	20 dB Bandwidth	Compliance
§15.247(a)(1)	Channel Separation Test	Compliance
§15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	Compliance
§15.247(a)(1)(iii)	Quantity of hopping channel Test	Compliance
§15.247(b)(1)	Peak Output Power Measurement	Compliance
§15.247(d)	Band Edges	Compliance

Test Time:2016-09-01~2016-09-29.

FCC §15.247 (i) & §1.1310 & §2.1093- RF EXPOSURE

Applicable Standard

According to§15.247(i) and §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to KDB447498 D01 General RF Exposure Guidance v06

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

- f(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm according to 5) in section 4.1 is applied to determine SAR test exclusion.

Measurement Result

The tune-up power is 6.5 dBm (4.47 mW).
[(max. power of channel, mW)/(min. test separation distance, mm)][√f(GHz)]
= 4.47/5*(√2.480) = 1.4 < 3.0

So the stand-alone SAR evaluation is not necessary.

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 one integral antenna arrangement for buletooth and the antenna gain is 0dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliance.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207

Measurement Uncertainty

Compliance or non- compliance with a disturbance limit shall be determined in the following manner:

If U_{lab} is less than or equal to U_{cispr} of Table 1, then:
- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non - compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

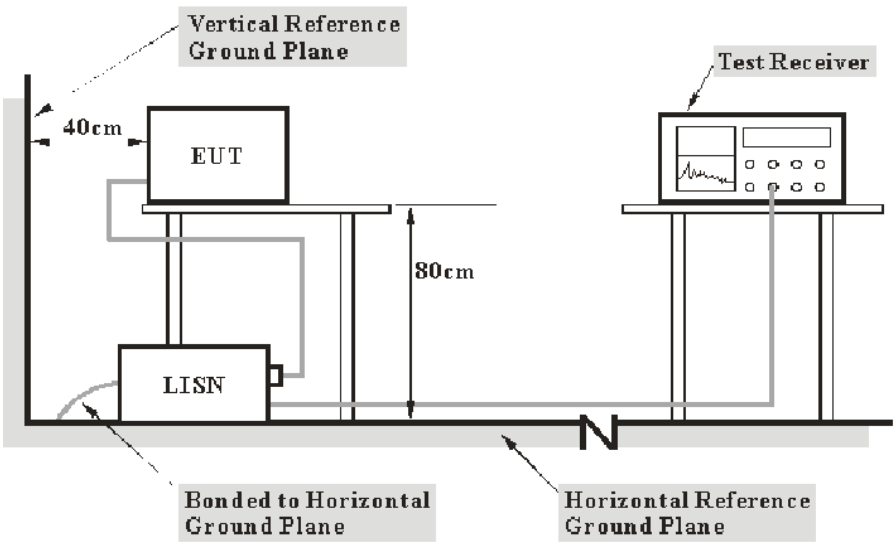
If U_{lab} is greater than U_{cispr} of Table 1, then:
- compliance is deemed to occur if no measured disturbance level, increased by ($U_{lab} - U_{cispr}$), exceeds the disturbance limit;
- non - compliance is deemed to occur if any measured disturbance level, increased by ($U_{lab} - U_{cispr}$), exceeds the disturbance limit.

Based on CISPR 16-4-2: 2011, measurement uncertainty of conducted disturbance at mains port using AMN at Bay Area Compliance Laboratories Corp. (Dongguan) is 3.12 dB (150 kHz to 30 MHz).

Table 1 – Values of U_{cispr}

Measurement	U_{cispr}
Conducted disturbance at mains port using AMN (150 kHz to 30 MHz)	3.4 dB

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 setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The spacing between the peripherals was 10 cm.

The adapter 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 adapter was connected to the outlet of the first LISN.

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

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

Corrected Amplitude & Margin Calculation

The basic equation is as follows:

$V_C = V_R + A_C + VDF$

Herein,
V_C: corrected voltage amplitude
V_R: reading voltage amplitude
A_c: attenuation caused by cable loss
VDF: voltage division factor of AMN or ISN

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of 7dB means the emission is 7dB below the maximum 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
R&S	EMI Test Receiver	ESCS 30	830245/006	2015-10-20	2016-10-20
R&S	L.I.S.N	ESH2-Z5	892107/021	2016-06-09	2017-06-09
R&S	Two-line V-network	ENV 216	3560.6550.12	2015-11-26	2016-11-25
N/A	Coaxial Cable	1.8m	N/A	2016-05-06	2017-05-06
R&S	Test Software	EMC32	Version8.53.0	N/A	N/A

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed in accordance to NVLAP requirements, 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 Part 15.207.

Test Data

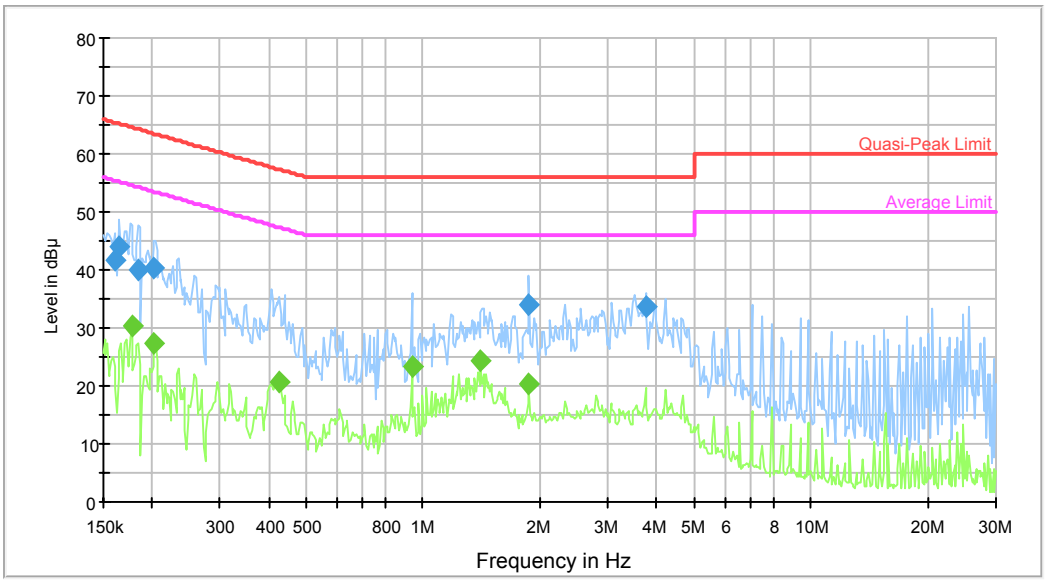
Environmental Conditions

Temperature:	28.4°C
Relative Humidity:	55%
ATM Pressure:	100 kPa

The testing was performed by Gavin Xu on 2016-09-07.

Test Mode: Transmitting

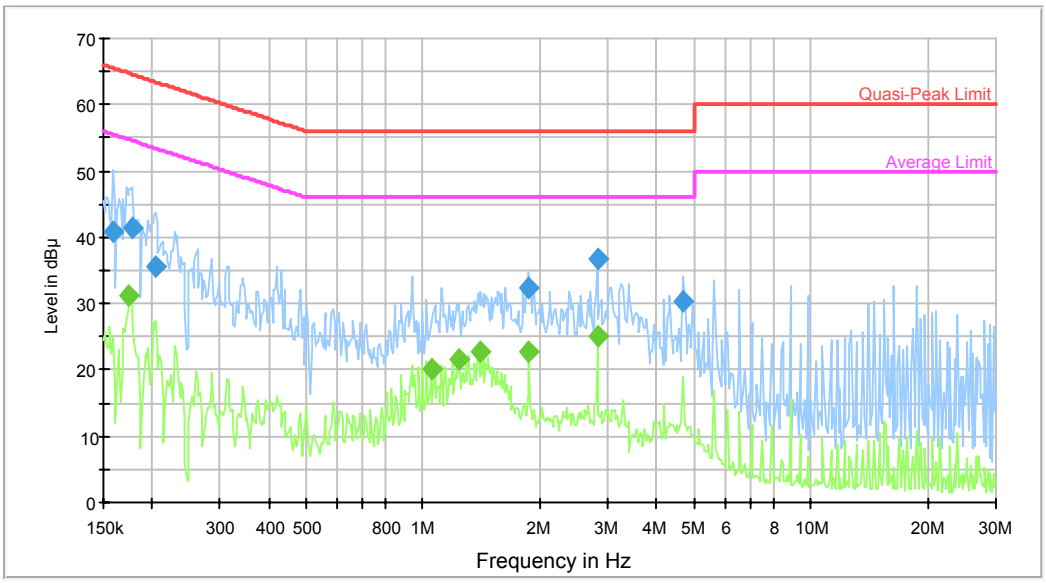
AC120 V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.159873	41.6	9.000	L1	9.7	23.9	65.5	Compliance
0.165051	43.9	9.000	L1	9.7	21.3	65.2	Compliance
0.184529	39.9	9.000	L1	9.7	24.4	64.3	Compliance
0.203045	40.2	9.000	L1	9.6	23.3	63.5	Compliance
1.875341	34.1	9.000	L1	9.7	21.9	56.0	Compliance
3.750995	33.7	9.000	L1	9.7	22.3	56.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.177322	30.2	9.000	L1	9.7	24.4	54.6	Compliance
0.203045	27.3	9.000	L1	9.6	26.2	53.5	Compliance
0.426011	20.8	9.000	L1	9.7	26.5	47.3	Compliance
0.937592	23.2	9.000	L1	9.7	22.8	46.0	Compliance
1.407671	24.2	9.000	L1	9.7	21.8	46.0	Compliance
1.875341	20.2	9.000	L1	9.7	25.8	46.0	Compliance

AC120 V, 60 Hz, Neutral:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.158604	40.7	9.000	N	9.6	24.8	65.5	Compliance
0.177322	41.3	9.000	N	9.6	23.3	64.6	Compliance
0.204669	35.6	9.000	N	9.6	27.8	63.4	Compliance
1.875341	32.5	9.000	N	9.7	23.5	56.0	Compliance
2.815577	36.9	9.000	N	9.7	19.1	56.0	Compliance
4.688581	30.2	9.000	N	9.7	25.8	56.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.174519	31.3	9.000	N	9.6	23.4	54.7	Compliance
1.048242	20.0	9.000	N	9.7	26.0	46.0	Compliance
1.239175	21.6	9.000	N	9.7	24.4	46.0	Compliance
1.407671	22.6	9.000	N	9.7	23.4	46.0	Compliance
1.875341	22.6	9.000	N	9.7	23.4	46.0	Compliance
2.815577	25.2	9.000	N	9.7	20.8	46.0	Compliance

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

Applicable Standard

FCC §15.247 (d); §15.209; §15.205;

Measurement Uncertainty

Compliance or non- compliance with a disturbance limit shall be determined in the following manner:

If U_{lab} is less than or equal to U_{cispr} of Table 1, then:
- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non - compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

If U_{lab} is greater than U_{cispr} of Table 1, then:
- compliance is deemed to occur if no measured disturbance level, increased by ($U_{lab} - U_{cispr}$), exceeds the disturbance limit;
- non - compliance is deemed to occur if any measured disturbance level, increased by ($U_{lab} - U_{cispr}$), exceeds the disturbance limit.

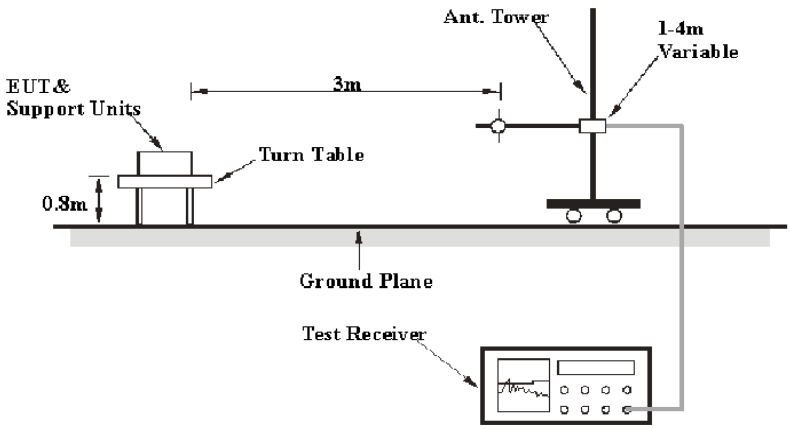
Based on CISPR 16-4-2: 2011, measurement uncertainty of radiated emission at a distance of 3m at Bay Area Compliance Laboratories Corp. (Dongguan) is: 30M~200MHz: 4.58 dB for Horizontal, 4.59 dB for Vertical; 200M~1GHz: 4.83 dB for Horizontal, 5.85 dB for Vertical; 1G~6GHz: 4.45 dB, 6G~18GHz: 5.23 dB

Table 1 – Values of U_{cispr}

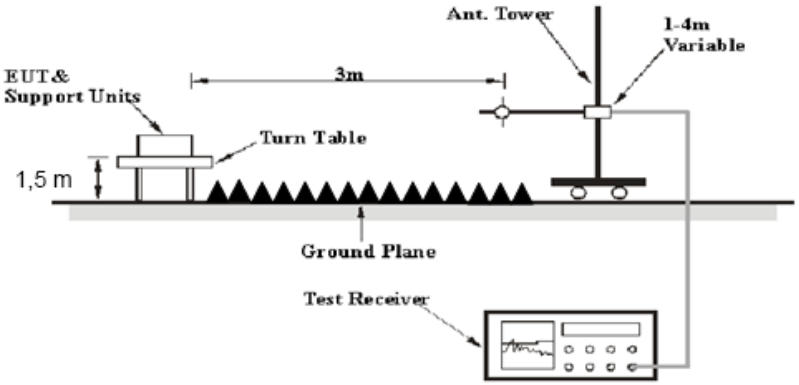
Measurement	U_{cispr}
Radiated disturbance (electric field strength at an OATS or in a SAC) (30 MHz to 1000 MHz)	6.3 dB
Radiated disturbance (electric field strength in a FAR) (1 GHz to 6 GHz)	5.2 dB
Radiated disturbance (electric field strength in a FAR) (6 GHz to 18 GHz)	5.5 dB

EUT Setup

Below 1GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.10-2013. 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.

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	120 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz	/	AV

Test Procedure

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

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCI	100224	2016-08-03	2017-08-02
Sunol Sciences	Antenna	JB3	A060611-3	2014-11-06	2017-11-05
HP	Amplifier	8447E	2434A02181	2016-09-01	2017-09-01
Agilent	Spectrum Analyzer	E4440A	SG43360054	2015-11-23	2016-11-22
ETS-Lindgren	Horn Antenna	3115	9808-5557	2015-09-06	2018-09-06
Mini-Circuit	Amplifier	ZVA-213-S+	054201245	2016-02-19	2017-02-18
R&S	Spectrum Analyzer	FSP 38	100478	2015-11-23	2016-11-22
Ducommun Technolagies	Horn Antenna	ARH-4223-02	1007726-01 1304	2014-06-16	2017-06-15
Quinstar	Amplifier	QLW-18405536-JO	15964001001	2016-09-06	2017-09-06
N/A	Coaxial Cable	14m	N/A	2016-05-06	2017-05-06
N/A	Coaxial Cable	8m	N/A	2016-05-06	2017-05-06

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

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 Results Summary

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

Test Data

Environmental Conditions

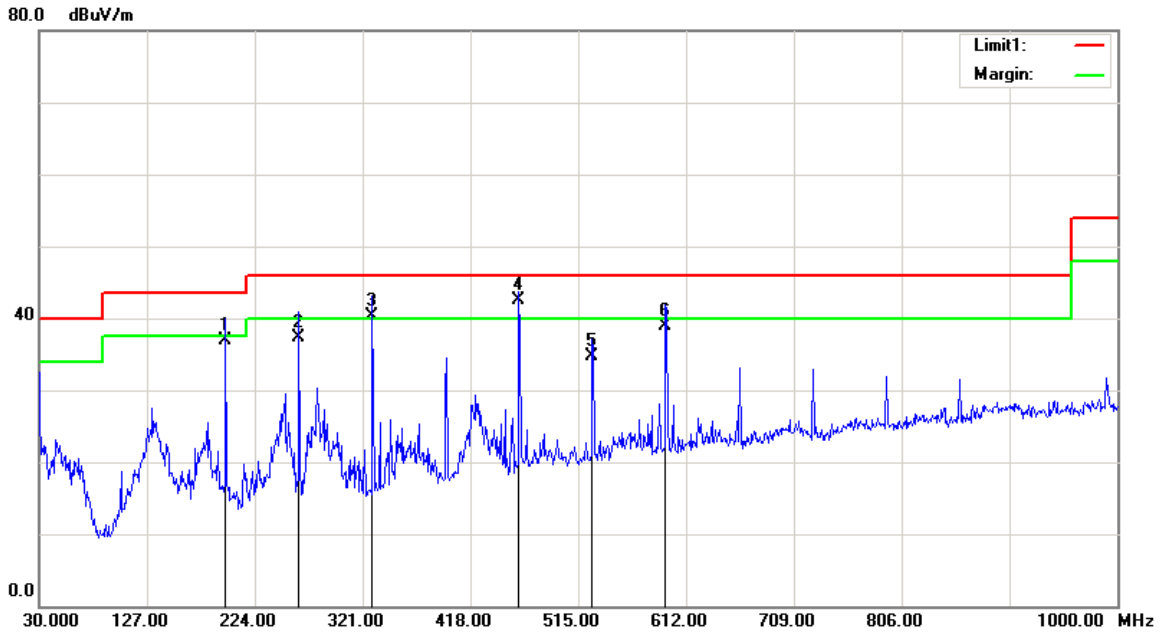
Temperature:	28.8°C
Relative Humidity:	63 %
ATM Pressure:	100.4kPa

** The testing was performed by Gavin Xu on 2016-09-29.*

Test Mode: Transmitting

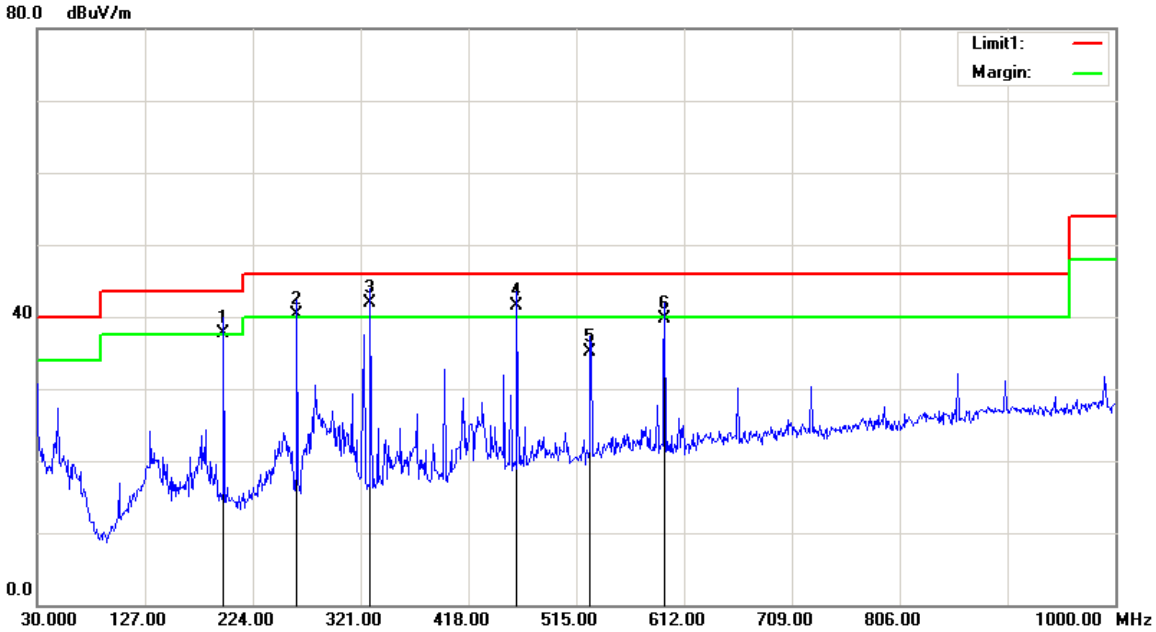
Below 1GHz

Horizontal:



Frequency (MHz)	Receiver Reading (dBuV)	Detector (PK/QP/Ave)	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
197.8100	44.66	QP	-7.76	36.90	43.50	6.60
263.7700	43.97	QP	-6.57	37.40	46.00	8.60
329.7300	45.77	QP	-5.47	40.30	46.00	5.70
461.6500	44.57	QP	-2.07	42.50	46.00	3.50
527.6100	35.78	QP	-1.08	34.70	46.00	11.30
593.5700	39.17	QP	-0.27	38.90	46.00	7.10

Vertical:



Frequency (MHz)	Receiver Reading (dBuV)	Detector (PK/QP/Ave)	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
197.8100	45.56	QP	-7.76	37.80	43.50	5.70
263.7700	46.87	QP	-6.57	40.30	46.00	5.70
329.7300	47.37	QP	-5.47	41.90	46.00	4.10
461.6500	43.57	QP	-2.07	41.50	46.00	4.50
527.6100	36.28	QP	-1.08	35.20	46.00	10.80
594.5400	40.05	QP	-0.25	39.80	46.00	6.20

Above 1GHz

BDR Mode (GFSK):

Frequency	Receiver		Rx Antenna		Cable	Amplifier	Corrected	FCC 15.247	
(MHz)	Reading (dBμV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB)	loss (dB)	Gain (dB)	Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Low Channel: 2402 MHz									
2402	64.8	PK	H	25.65	3.66	0.00	94.11	N/A	N/A
2402	64.12	AV	H	25.65	3.66	0.00	93.43	N/A	N/A
2402	65.74	PK	V	25.65	3.66	0.00	95.05	N/A	N/A
2402	65.2	AV	V	25.65	3.66	0.00	94.51	N/A	N/A
2390	25.19	PK	V	25.61	3.63	0.00	54.43	74.00	19.57
2390	11.84	AV	V	25.61	3.63	0.00	41.08	54.00	12.92
4804	37.42	PK	V	30.59	5.06	27.41	45.66	74.00	28.34
4804	30.62	AV	V	30.59	5.06	27.41	38.86	54.00	15.14
7206	32.64	PK	V	34.09	6.61	25.91	47.43	74.00	26.57
7206	25.41	AV	V	34.09	6.61	25.91	40.20	54.00	13.80
3846	34.26	PK	V	29.56	4.62	27.34	41.10	74.00	32.90
3846	28.72	AV	V	29.56	4.62	27.34	35.56	54.00	18.44
Middle Channel: 2441 MHz									
2441	67.92	PK	H	25.75	3.76	0.00	97.43	N/A	N/A
2441	66.37	AV	H	25.75	3.76	0.00	95.88	N/A	N/A
2441	68.7	PK	V	25.75	3.76	0.00	98.21	N/A	N/A
2441	67.54	AV	V	25.75	3.76	0.00	97.05	N/A	N/A
4882	39.06	PK	V	30.79	5.19	27.42	47.62	74.00	26.38
4882	31.57	AV	V	30.79	5.19	27.42	40.13	54.00	13.87
7323	33.69	PK	V	34.38	6.75	25.88	48.94	74.00	25.06
7323	26.42	AV	V	34.38	6.75	25.88	41.67	54.00	12.33
2945	33.75	PK	V	27.06	6.54	27.54	39.81	74.00	34.19
2945	26.94	AV	V	27.06	6.54	27.54	33.00	54.00	21.00
3846	34.85	PK	V	29.56	4.62	27.34	41.69	74.00	32.31
3846	27.61	AV	V	29.56	4.62	27.34	34.45	54.00	19.55
High Channel: 2480 MHz									
2480	70.02	PK	H	25.85	3.68	0.00	99.55	N/A	N/A
2480	69.53	AV	H	25.85	3.68	0.00	99.06	N/A	N/A
2480	70.29	PK	V	25.85	3.68	0.00	99.82	N/A	N/A
2480	69.59	AV	V	25.85	3.68	0.00	99.12	N/A	N/A
2483.5	26.54	PK	V	25.86	3.67	0.00	56.07	74.00	17.93
2483.5	12.49	AV	V	25.86	3.67	0.00	42.02	54.00	11.98
4960	41.36	PK	V	31.00	5.34	27.43	50.27	74.00	23.73
4960	35.16	AV	V	31.00	5.34	27.43	44.07	54.00	9.93
7440	35.64	PK	V	34.66	6.89	25.97	51.22	74.00	22.78
7440	27.68	AV	V	34.66	6.89	25.97	43.26	54.00	10.74
3846	33.06	PK	V	29.56	4.62	27.34	39.90	74.00	34.10
3846	26.47	AV	V	29.56	4.62	27.34	33.31	54.00	20.69

EDR Mode (π/4-DQPSK):

Frequency	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	FCC 15.247	
(MHz)	Reading (dBμV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB)				Limit (dBμV/m)	Margin (dB)
Low Channel: 2402 MHz									
2402	65.37	PK	H	25.65	3.66	0.00	94.68	N/A	N/A
2402	61.51	AV	H	25.65	3.66	0.00	90.82	N/A	N/A
2402	66.96	PK	V	25.65	3.66	0.00	96.27	N/A	N/A
2402	63.07	AV	V	25.65	3.66	0.00	92.38	N/A	N/A
2390	24.52	PK	V	25.61	3.63	0.00	53.76	74.00	20.24
2390	11.62	AV	V	25.61	3.63	0.00	40.86	54.00	13.14
4804	37.37	PK	V	30.59	5.06	27.41	45.61	74.00	28.39
4804	30.17	AV	V	30.59	5.06	27.41	38.41	54.00	15.59
7206	33.05	PK	V	34.09	6.61	25.91	47.84	74.00	26.16
7206	25.42	AV	V	34.09	6.61	25.91	40.21	54.00	13.79
3050	34.31	PK	V	27.36	6.64	27.49	40.82	74.00	33.18
3050	29.51	AV	V	27.36	6.64	27.49	36.02	54.00	17.98
Middle Channel: 2441 MHz									
2441	67.58	PK	H	25.75	3.76	0.00	97.09	N/A	N/A
2441	65.27	AV	H	25.75	3.76	0.00	94.78	N/A	N/A
2441	68.66	PK	V	25.75	3.76	0.00	98.17	N/A	N/A
2441	66.93	AV	V	25.75	3.76	0.00	96.44	N/A	N/A
4882	39.06	PK	V	30.79	5.19	27.42	47.62	74.00	26.38
4882	31.57	AV	V	30.79	5.19	27.42	40.13	54.00	13.87
7323	33.69	PK	V	34.38	6.75	25.88	48.94	74.00	25.06
7323	26.42	AV	V	34.38	6.75	25.88	41.67	54.00	12.33
2845	33.75	PK	V	26.80	5.36	27.55	38.36	74.00	35.64
2845	26.94	AV	V	26.80	5.36	27.55	31.55	54.00	22.45
3050	34.85	PK	V	27.36	6.64	27.49	41.36	74.00	32.64
3050	27.61	AV	V	27.36	6.64	27.49	34.12	54.00	19.88
High Channel: 2480 MHz									
2480	70.81	PK	H	25.85	3.68	0.00	100.34	N/A	N/A
2480	67.43	AV	H	25.85	3.68	0.00	96.96	N/A	N/A
2480	71.06	PK	V	25.85	3.68	0.00	100.59	N/A	N/A
2480	67.67	AV	V	25.85	3.68	0.00	97.20	N/A	N/A
2483.5	26.91	PK	V	25.86	3.67	0.00	56.44	74.00	17.56
2483.5	13.05	AV	V	25.86	3.67	0.00	42.58	54.00	11.42
4960	41.36	PK	V	31.00	5.34	27.43	50.27	74.00	23.73
4960	35.16	AV	V	31.00	5.34	27.43	44.07	54.00	9.93
7440	35.64	PK	V	34.66	6.89	25.97	51.22	74.00	22.78
7440	27.68	AV	V	34.66	6.89	25.97	43.26	54.00	10.74
3050	33.06	PK	V	27.36	6.64	27.49	39.57	74.00	34.43
3050	26.47	AV	V	27.36	6.64	27.49	32.98	54.00	21.02

EDR Mode (8-DPSK):

Frequency	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	FCC 15.247	
(MHz)	Reading (dBμV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB)				Limit (dBμV/m)	Margin (dB)
Low Channel: 2402 MHz									
2402	66.01	PK	H	25.65	3.66	0.00	95.32	N/A	N/A
2402	61.29	AV	H	25.65	3.66	0.00	90.60	N/A	N/A
2402	67.37	PK	V	25.65	3.66	0.00	96.68	N/A	N/A
2402	62.94	AV	V	25.65	3.66	0.00	92.25	N/A	N/A
2390	25.13	PK	V	25.61	3.63	0.00	54.37	74.00	19.63
2390	11.58	AV	V	25.61	3.63	0.00	40.82	54.00	13.18
4804	37.66	PK	V	30.59	5.06	27.41	45.90	74.00	28.10
4804	30.32	AV	V	30.59	5.06	27.41	38.56	54.00	15.44
7206	33.5	PK	V	34.09	6.61	25.91	48.29	74.00	25.71
7206	25.77	AV	V	34.09	6.61	25.91	40.56	54.00	13.44
3110	35.11	PK	V	27.55	6.87	27.44	42.09	74.00	31.91
3110	28.97	AV	V	27.55	6.87	27.44	35.95	54.00	18.05
Middle Channel: 2441 MHz									
2441	68.68	PK	H	25.75	3.76	0.00	98.19	N/A	N/A
2441	65.32	AV	H	25.75	3.76	0.00	94.83	N/A	N/A
2441	69.54	PK	V	25.75	3.76	0.00	99.05	N/A	N/A
2441	66.04	AV	V	25.75	3.76	0.00	95.55	N/A	N/A
4882	39.06	PK	V	30.79	5.19	27.42	47.62	74.00	26.38
4882	31.57	AV	V	30.79	5.19	27.42	40.13	54.00	13.87
7323	33.69	PK	V	34.38	6.75	25.88	48.94	74.00	25.06
7323	26.42	AV	V	34.38	6.75	25.88	41.67	54.00	12.33
3110	33.75	PK	V	27.55	6.87	27.44	40.73	74.00	33.27
3110	26.94	AV	V	27.55	6.87	27.44	33.92	54.00	20.08
3520	34.85	PK	V	28.84	4.51	27.24	40.96	74.00	33.04
3520	27.61	AV	V	28.84	4.51	27.24	33.72	54.00	20.28
High Channel: 2480 MHz									
2480	71.08	PK	H	25.85	3.68	0.00	100.61	N/A	N/A
2480	67.19	AV	H	25.85	3.68	0.00	96.72	N/A	N/A
2480	71.45	PK	V	25.85	3.68	0.00	100.98	N/A	N/A
2480	67.31	AV	V	25.85	3.68	0.00	96.84	N/A	N/A
2483.5	26.2	PK	V	25.86	3.67	0.00	55.73	74.00	18.27
2483.5	12.72	AV	V	25.86	3.67	0.00	42.25	54.00	11.75
4960	41.36	PK	V	31.00	5.34	27.43	50.27	74.00	23.73
4960	35.16	AV	V	31.00	5.34	27.43	44.07	54.00	9.93
7440	35.64	PK	V	34.66	6.89	25.97	51.22	74.00	22.78
7440	27.68	AV	V	34.66	6.89	25.97	43.26	54.00	10.74
3110	33.06	PK	V	27.55	6.87	27.44	40.04	74.00	33.96
3110	26.47	AV	V	27.55	6.87	27.44	33.45	54.00	20.55

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2015-11-23	2016-11-22
N/A	Coaxial Cable	0.1m	N/A	2016-05-06	2017-05-06
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	2016-05-06	2017-05-06

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

Test Procedure

1. Set the EUT in transmitting mode, spectrum Bandwidth was set at 30 kHz, maxhold the channel.
2. Set the adjacent channel of the EUT maxhold another trace.
3. Measure the channel separation.

Test Data

Environmental Conditions

Temperature:	28.1°C
Relative Humidity:	42 %
ATM Pressure:	99.8kPa

** The testing was performed by Gavin Xu on 2016-09-01.*

Test Result: Compliance.

Please refer to following tables and plots

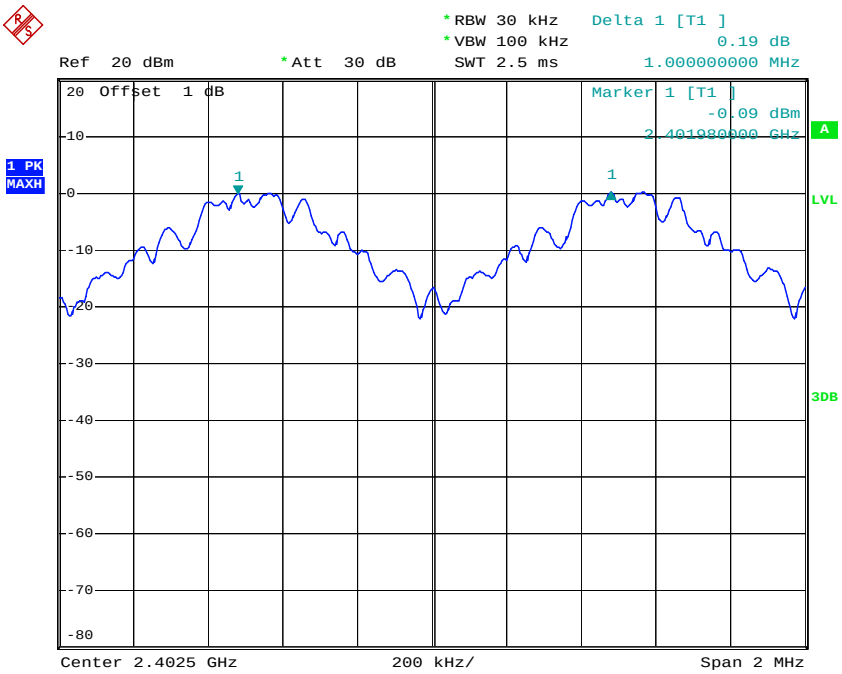
Test Mode: Transmitting

Mode	Channel	Frequency	Channel Separation	Limit	Result
		MHz	MHz	MHz	
BDR (GFSK)	Low	2402	1.000	0.693	Compliance
	Middle	2441	1.000	0.693	
	High	2480	1.004	0.693	
EDR (π/4-DQPSK)	Low	2402	1.000	0.893	Compliance
	Middle	2441	1.004	0.893	
	High	2480	1.000	0.893	
EDR (8DPSK)	Low	2402	1.000	0.907	Compliance
	Middle	2441	1.004	0.913	
	High	2480	1.000	0.913	

Note: Limit= (2/3)×20dB bandwidth

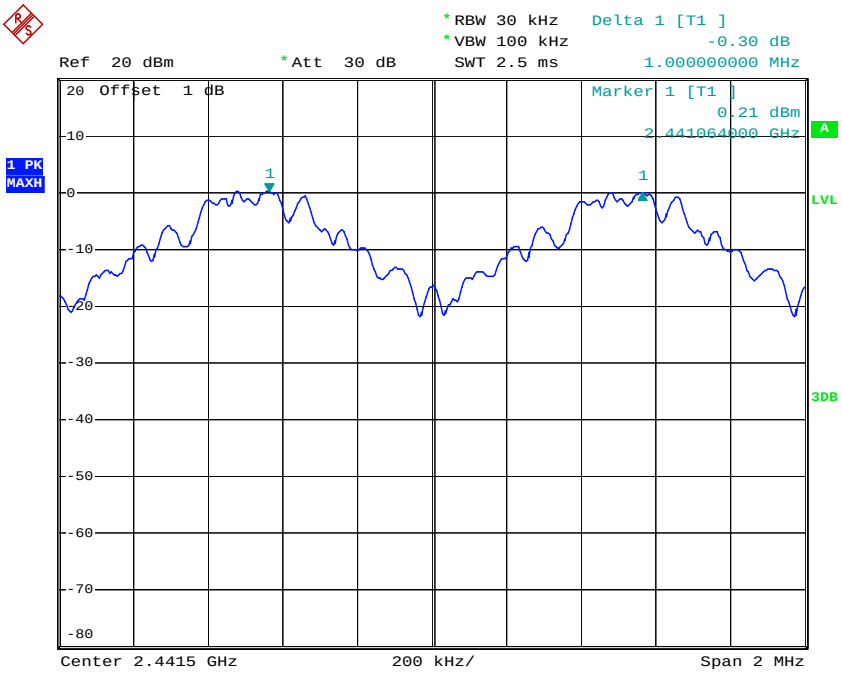
BDR Mode (GFSK):

Low Channel



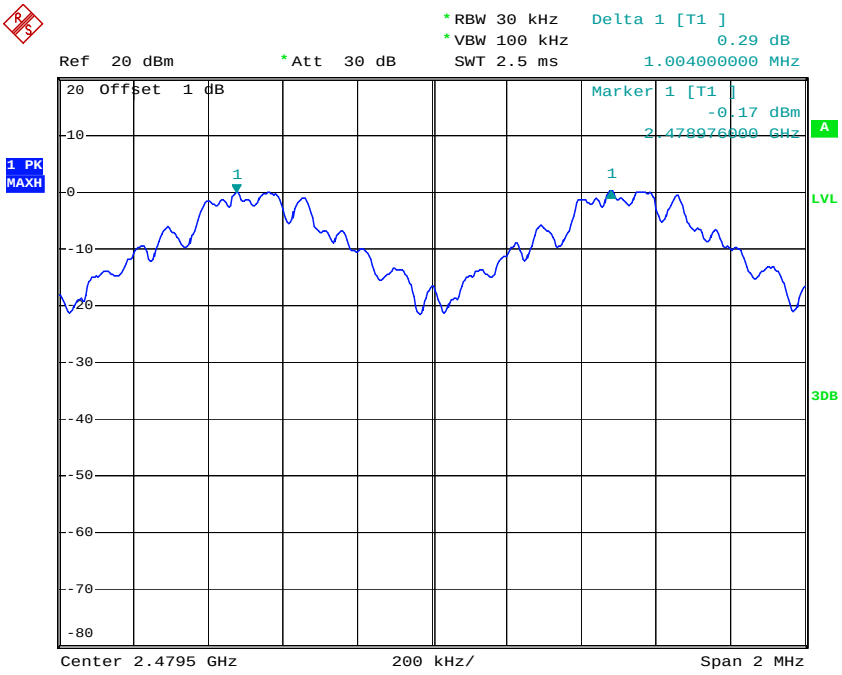
Date: 1.SEP.2016 21:55:29

Middle Channel



Date: 1.SEP.2016 21:54:27

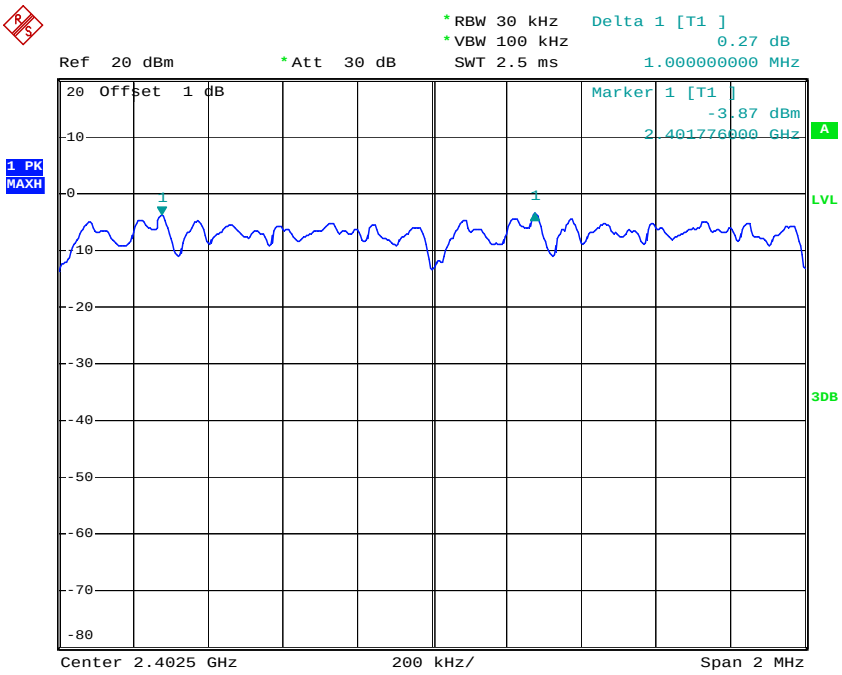
High Channel



Date: 1.SEP.2016 21:53:05

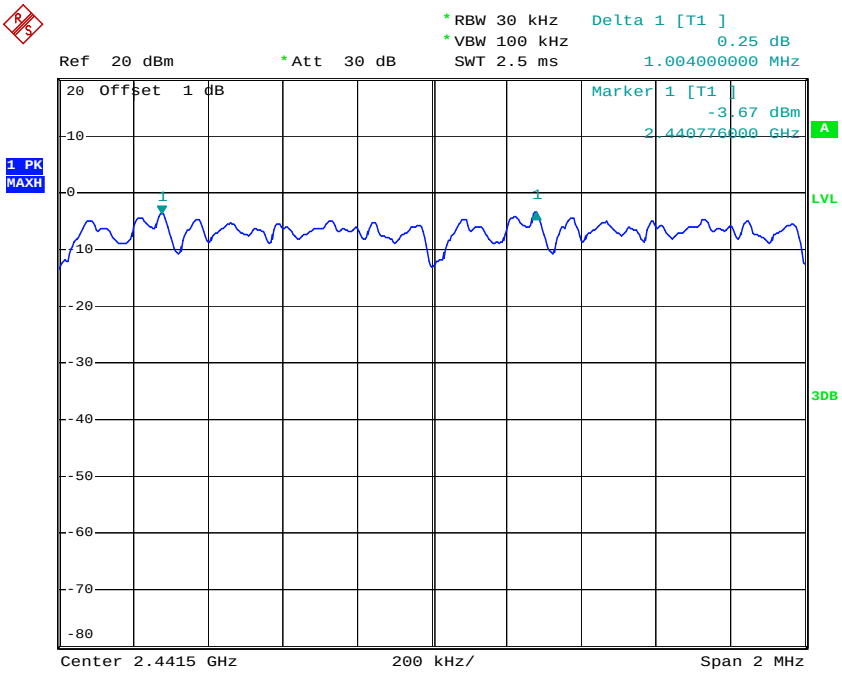
EDR Mode (π/4-DQPSK):

Low Channel



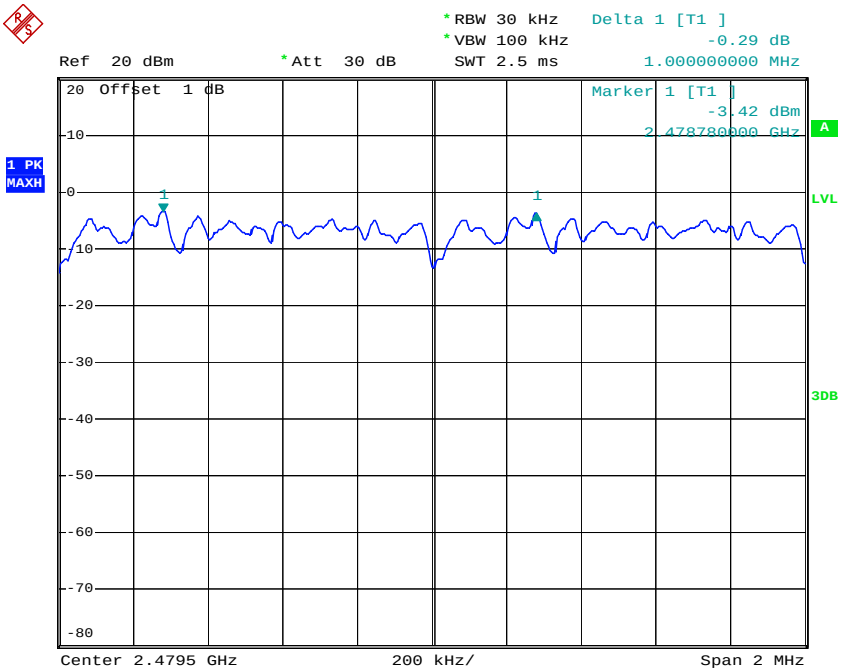
Date: 1.SEP.2016 21:47:32

Middle Channel



Date: 1.SEP.2016 21:48:50

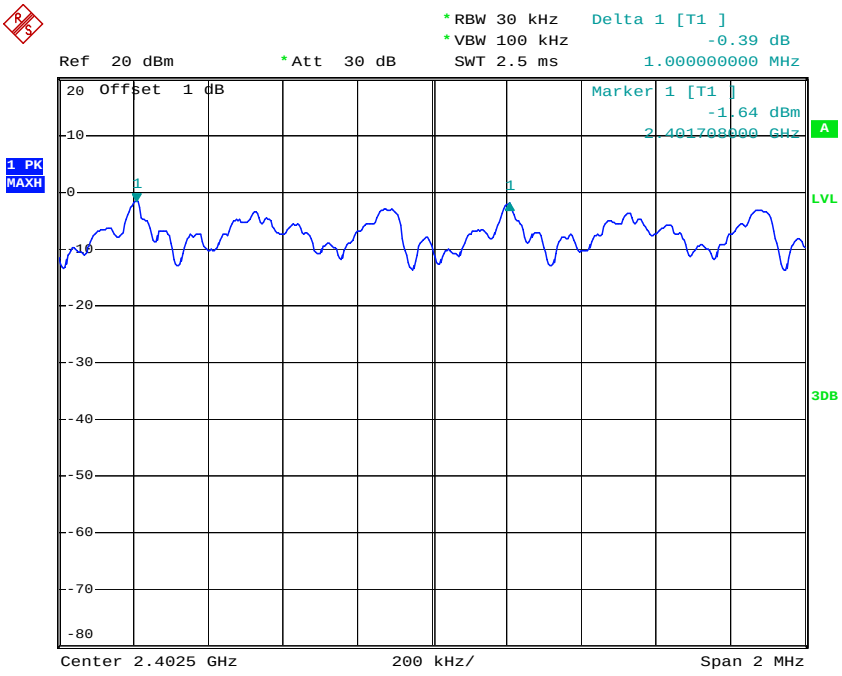
High Channel



Date: 1.SEP.2016 21:50:34

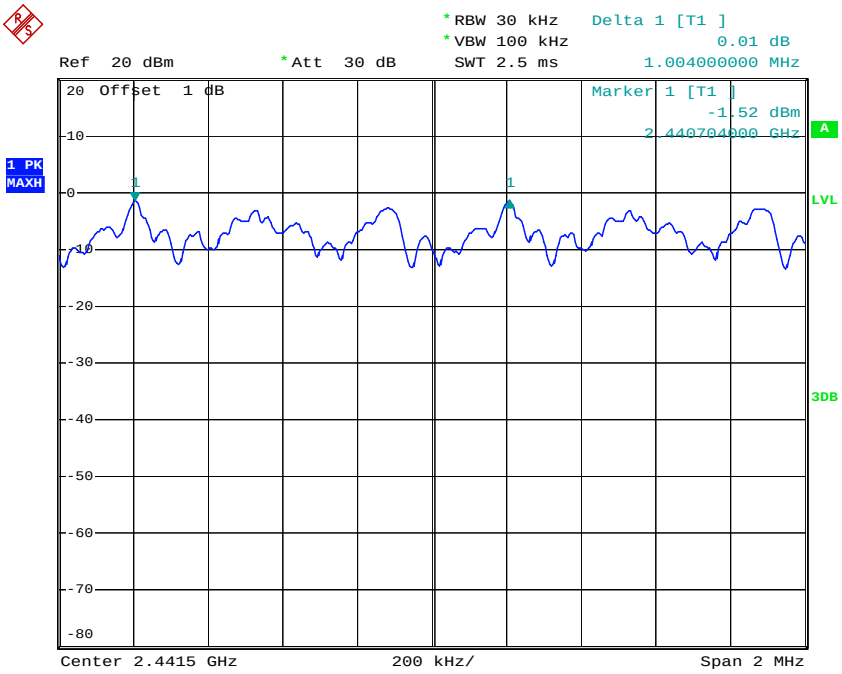
EDR Mode (8-DPSK):

Low Channel



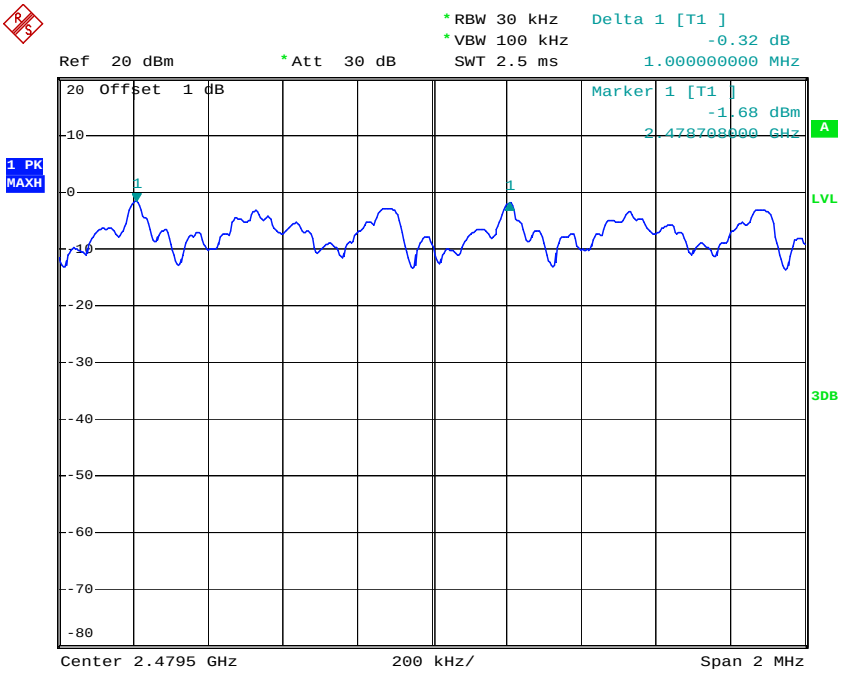
Date: 1.SEP.2016 21:44:56

Middle Channel



Date: 1.SEP.2016 21:42:29

High Channel



Date: 1.SEP.2016 21:41:22

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

Applicable Standard

Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Test Procedure

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2015-11-23	2016-11-22
N/A	Coaxial Cable	0.1m	N/A	2016-05-06	2017-05-06
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	2016-05-06	2017-05-06

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

Test Data

Environmental Conditions

Temperature:	28.1°C
Relative Humidity:	42 %
ATM Pressure:	99.8 kPa

** The testing was performed by Gavin Xu on 2016-09-01.*

Test Result: Compliance.

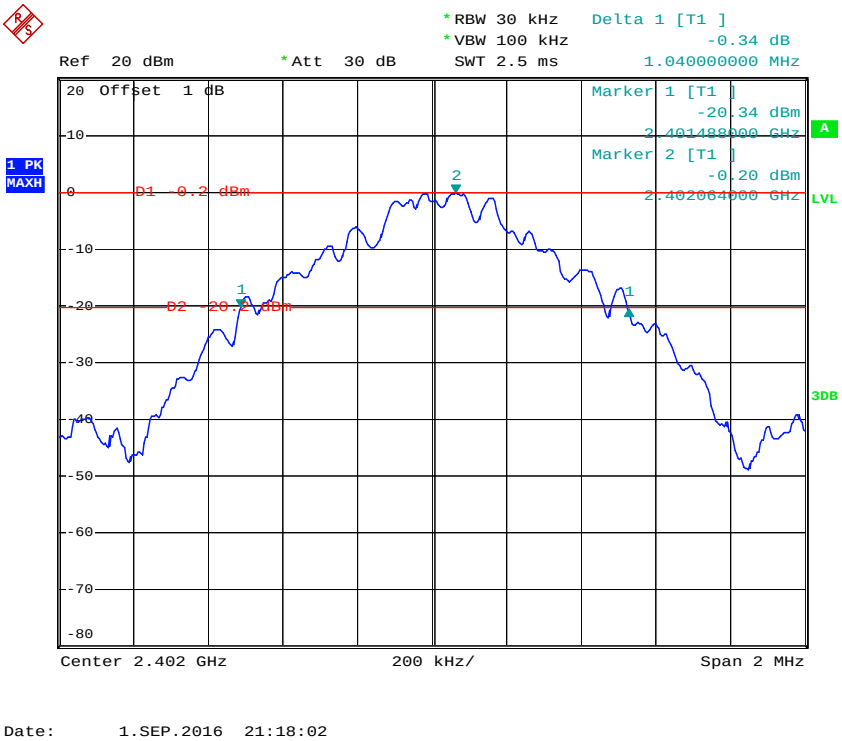
Please refer to following tables and plots

Test Mode: Transmitting

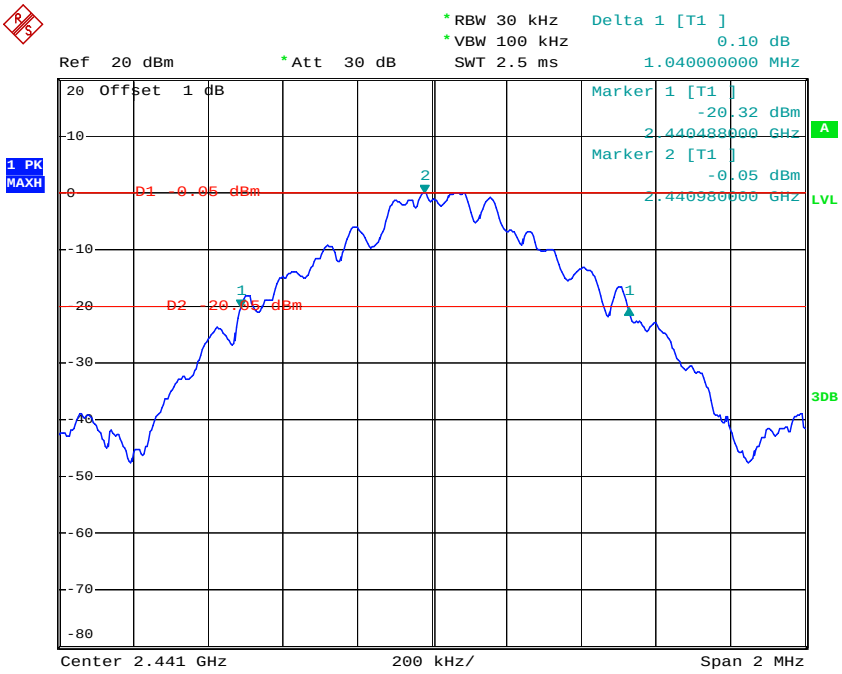
Mode	Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
BDR Mode (GFSK)	Low	2402	1.04
	Middle	2441	1.04
	High	2480	1.04
EDR Mode (π/4-DQPSK):	Low	2402	1.34
	Middle	2441	1.34
	High	2480	1.34
EDR Mode (8-DPSK):	Low	2402	1.36
	Middle	2441	1.37
	High	2480	1.37

BDR Mode (GFSK):

Low Channel

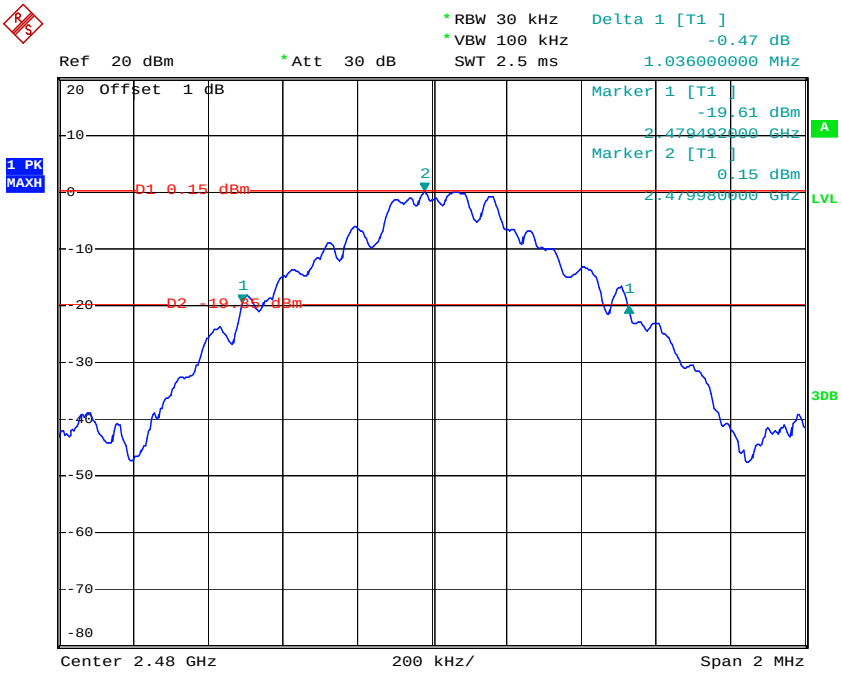


Middle Channel



Date: 1.SEP.2016 21:20:31

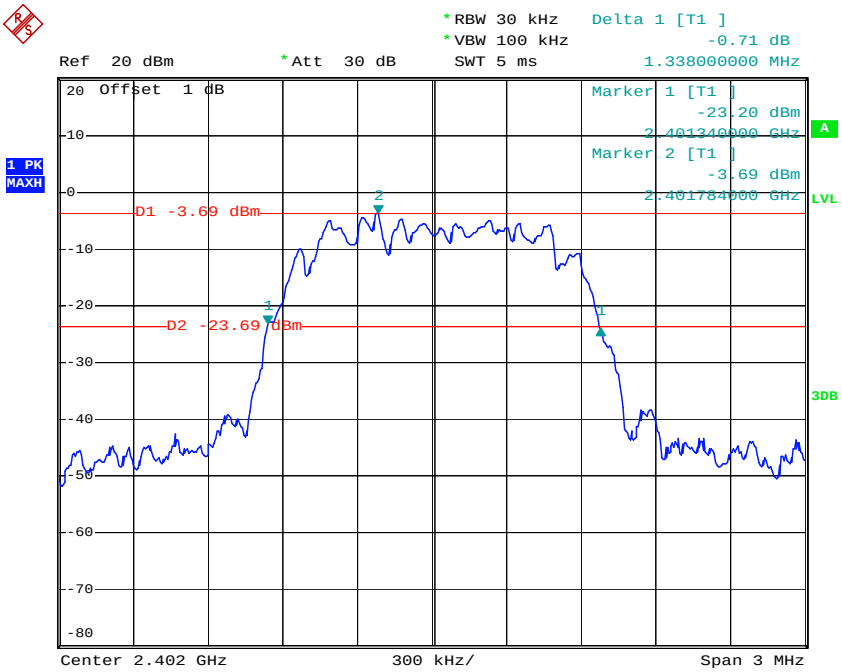
High Channel



Date: 1.SEP.2016 21:22:34

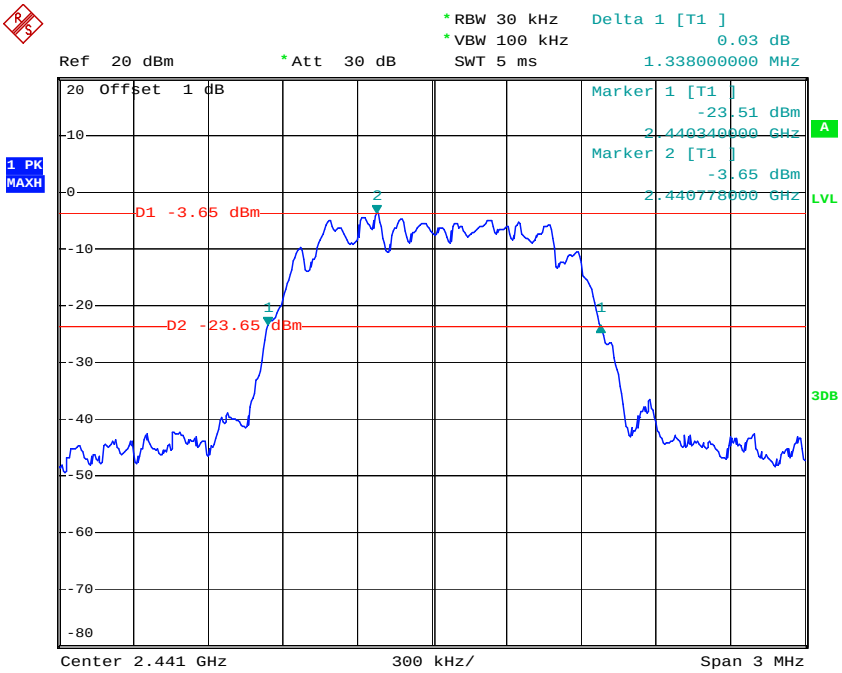
EDR Mode (π/4-DQPSK):

Low Channel



Date: 1.SEP.2016 21:32:21

Middle Channel



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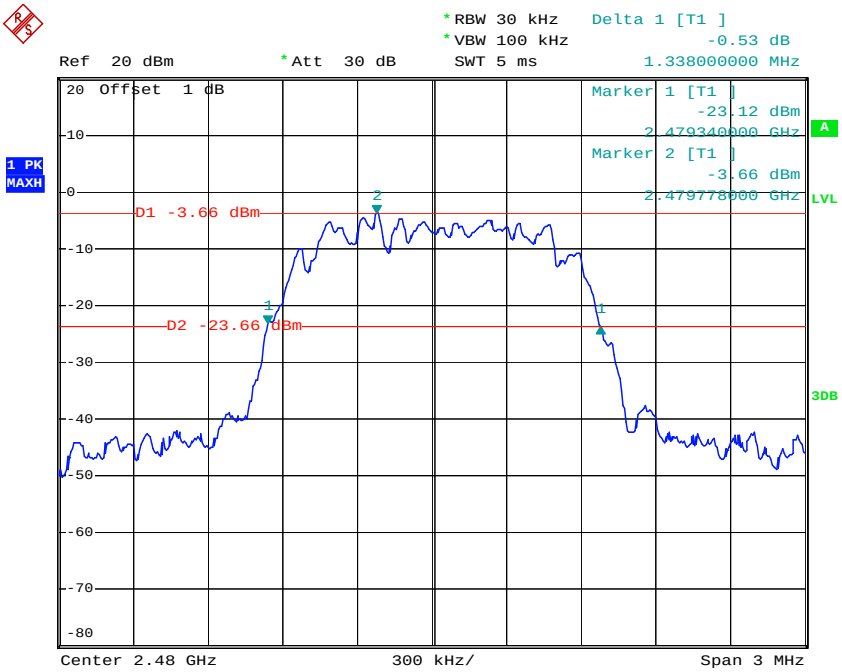
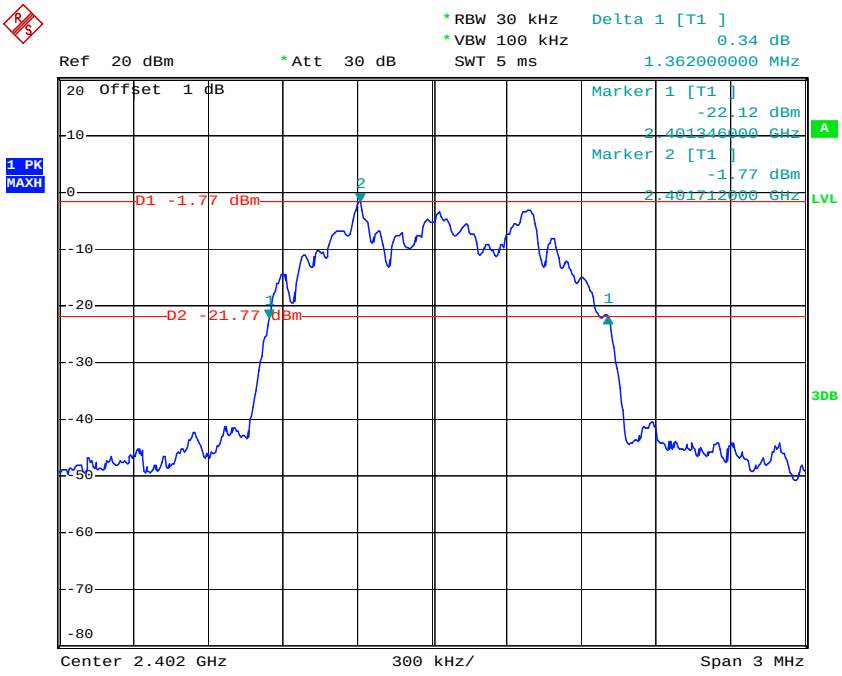
High Channel



Date: 1.SEP.2016 21:28:56

EDR Mode (8-DPSK):

Low Channel



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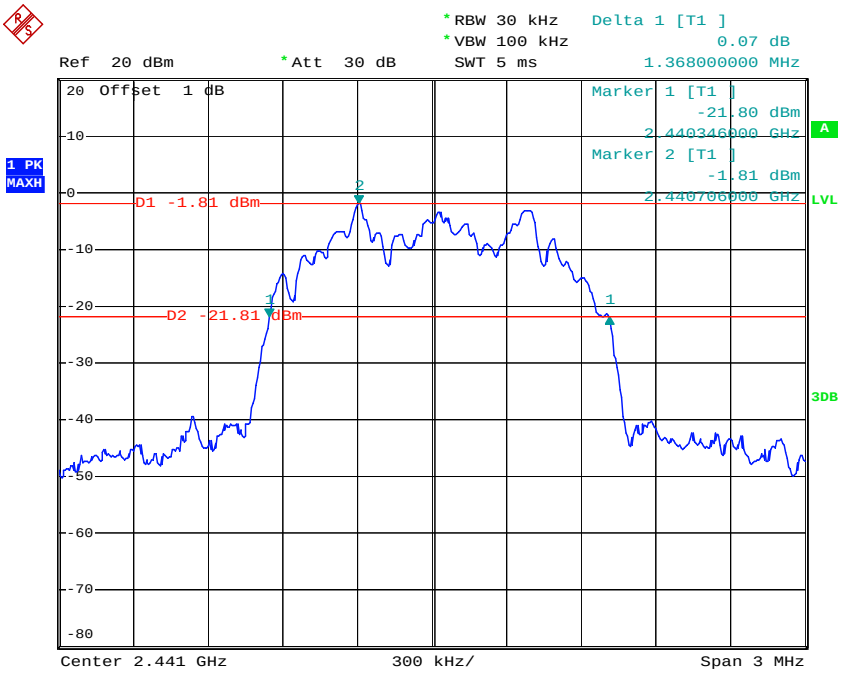
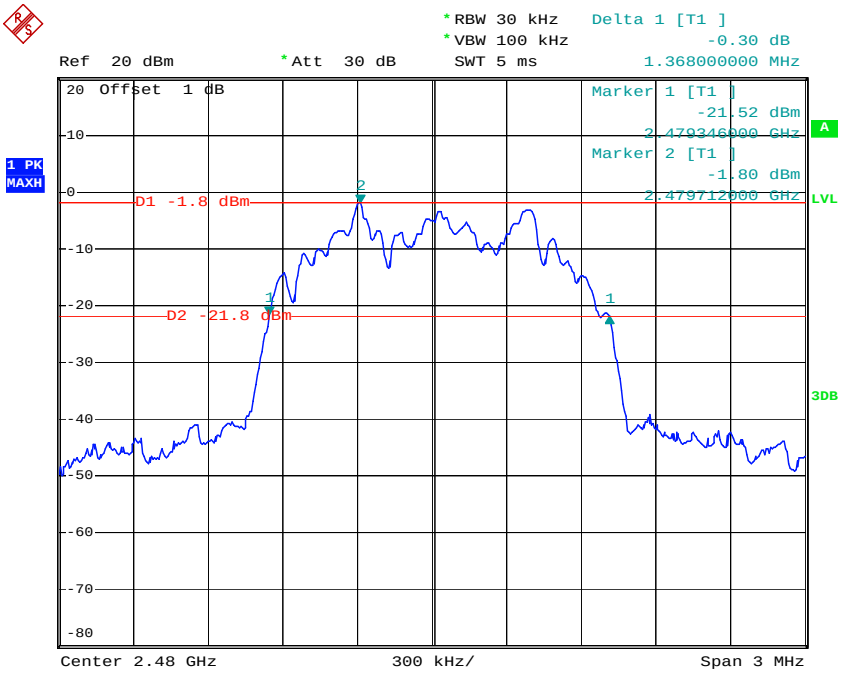
Middle Channel



Date: 1.SEP.2016 21:36:29

High Channel



Date: 1.SEP.2016 21:38:55

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	Spectrum Analyzer	FSP 38	100478	2015-11-23	2016-11-22
N/A	Coaxial Cable	0.1m	N/A	2016-05-06	2017-05-06
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	2016-05-06	2017-05-06

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

Test Data

Environmental Conditions

Temperature:	28.1°C
Relative Humidity:	42 %
ATM Pressure:	99.8 kPa

** The testing was performed by Gavin Xu on 2016-09-01*

Test Result: Compliance.

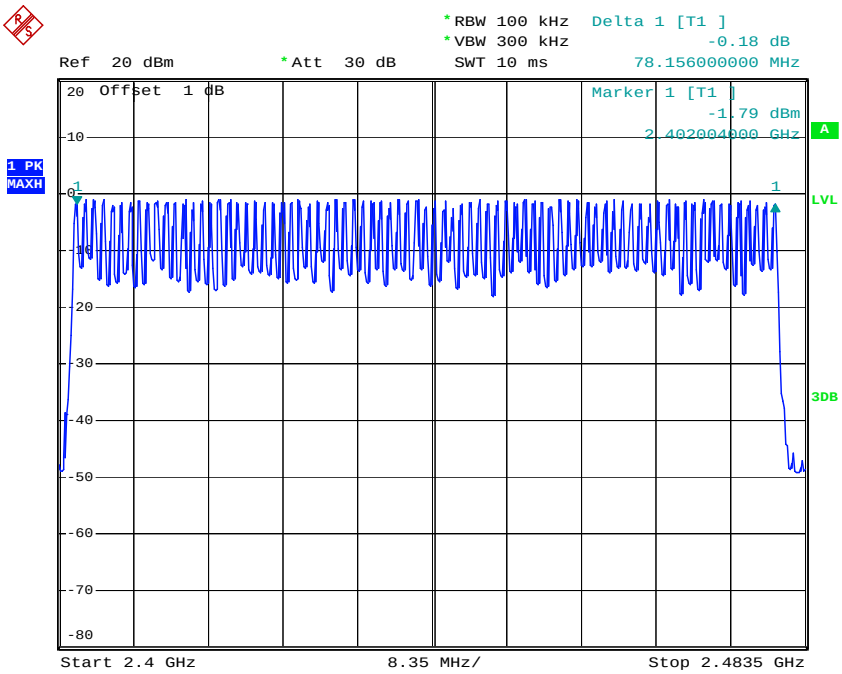
Please refer to following tables and plots

Test Mode: Transmitting

BDR Mode (GFSK):

Frequency Range (MHz)	Number of Hopping Channel	Limit
2400-2483.5	79	⩾75

Number of Hopping Channels

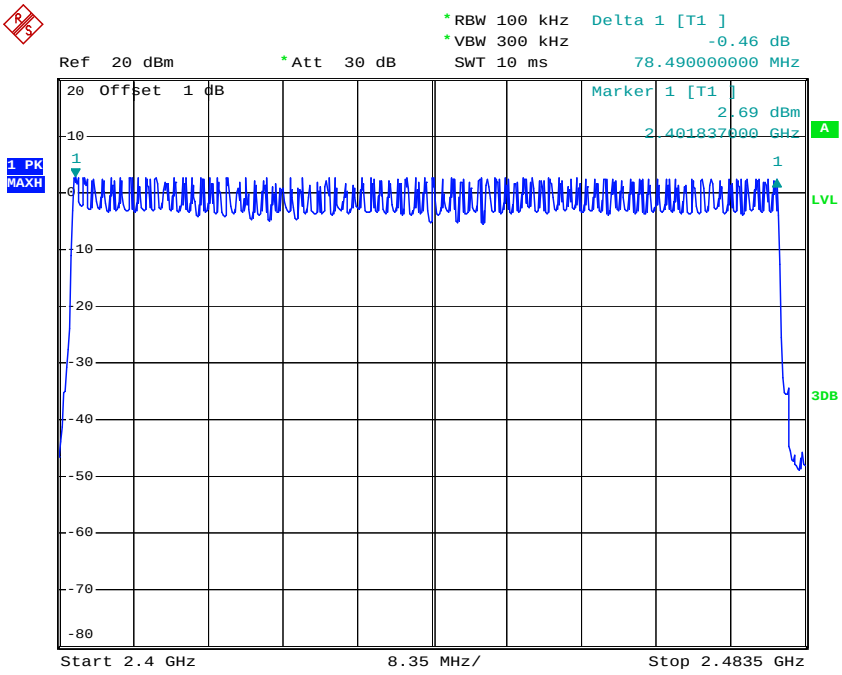


Date: 1.SEP.2016 22:00:41

EDR Mode (π/4-DQPSK):

Frequency Range (MHz)	Number of Hopping Channel	Limit
2400-2483.5	79	⩾75

Number of Hopping Channels

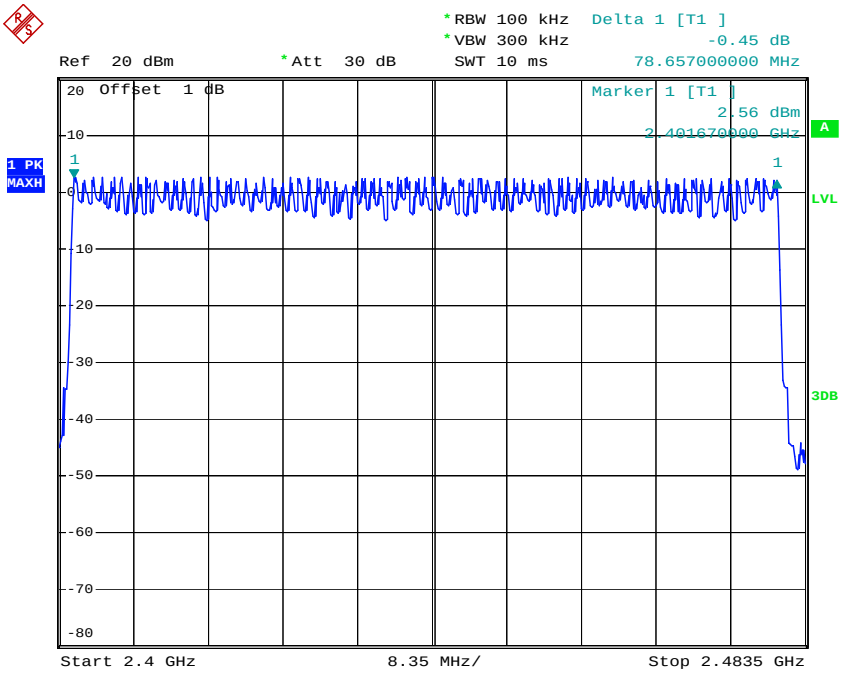


Date: 1.SEP.2016 22:13:06

EDR Mode (8-DPSK):

Frequency Range (MHz)	Number of Hopping Channel	Limit
2400-2483.5	79	⩾75

Number of Hopping Channels



Date: 1.SEP.2016 22:37:09

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

Applicable Standard

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

Test Procedure

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

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2015-11-23	2016-11-22
N/A	Coaxial Cable	0.1m	N/A	2016-05-06	2017-05-06
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	2016-05-06	2017-05-06

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

Test Data

Environmental Conditions

Temperature:	28.1°C
Relative Humidity:	42 %
ATM Pressure:	99.8 kPa

** The testing was performed by Gavin Xu on 2016-09-01.*

Test Result: Compliance.

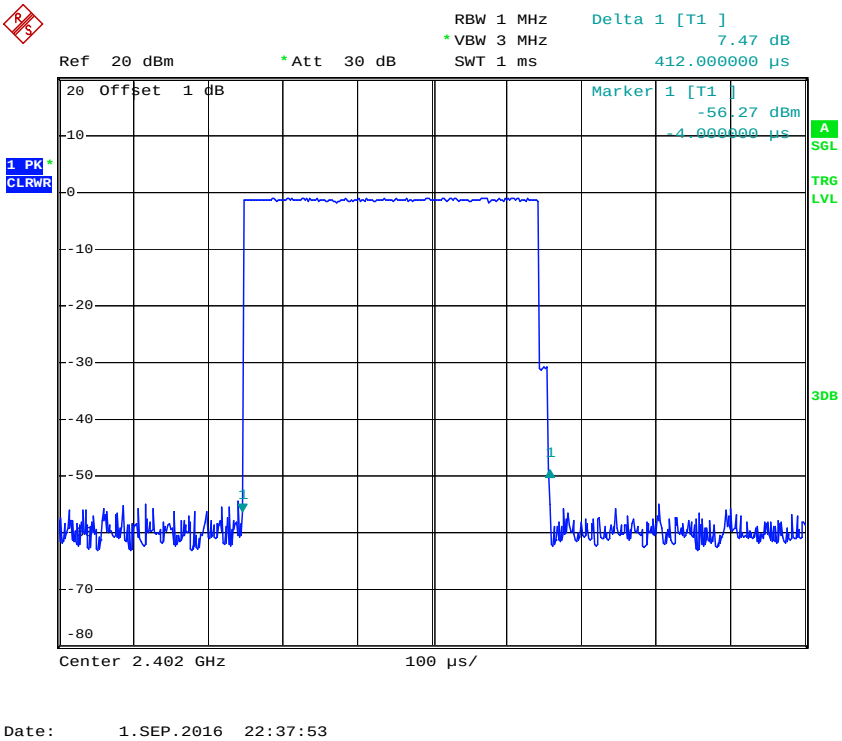
Please refer to following tables and plots

Test Mode: Transmitting

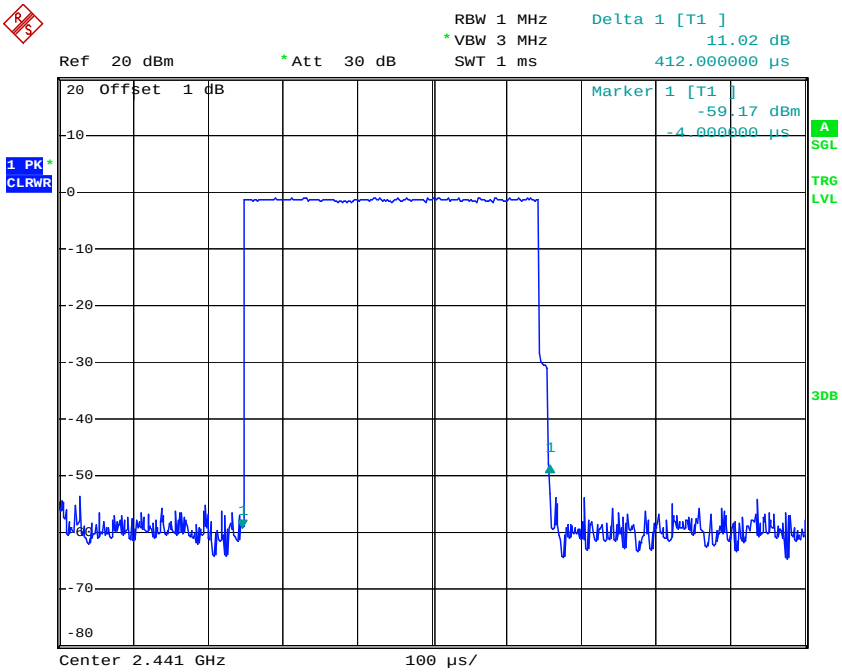
BDR Mode (GFSK):

Mode	Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
DH1	Low	0.412	0.132	0.4	Compliance
	Middle	0.412	0.132	0.4	Compliance
	High	0.412	0.132	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/2/79) ×31.6 s				
DH3	Low	1.686	0.270	0.4	Compliance
	Middle	1.680	0.269	0.4	Compliance
	High	1.686	0.270	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/4/79) ×31.6 s				
DH5	Low	2.940	0.314	0.4	Compliance
	Middle	2.940	0.314	0.4	Compliance
	High	2.940	0.314	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/6/79) ×31.6 s				

DH1: Low Channel

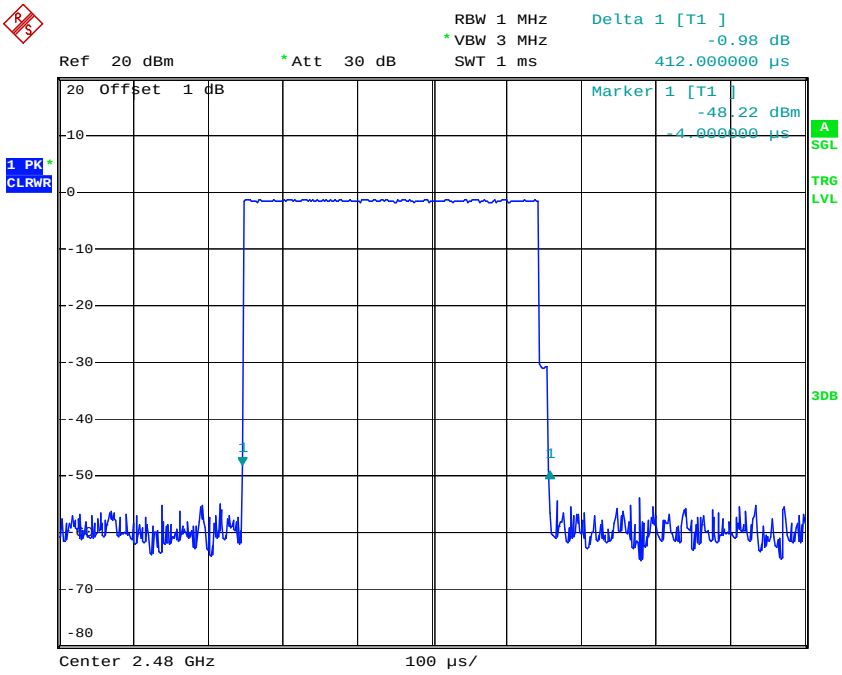


DH1: Middle Channel



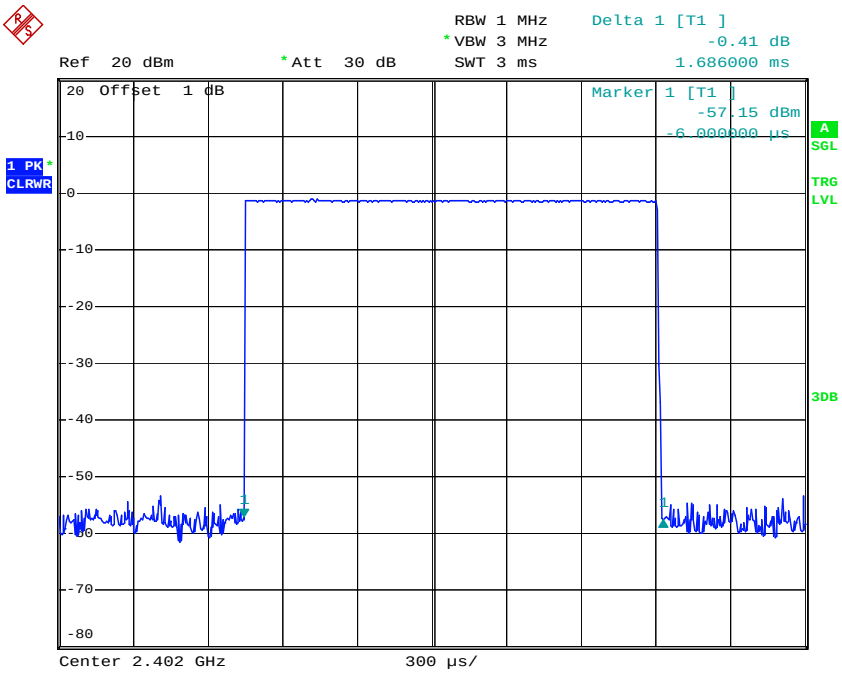
Date: 1.SEP.2016 22:38:05

DH1: High Channel



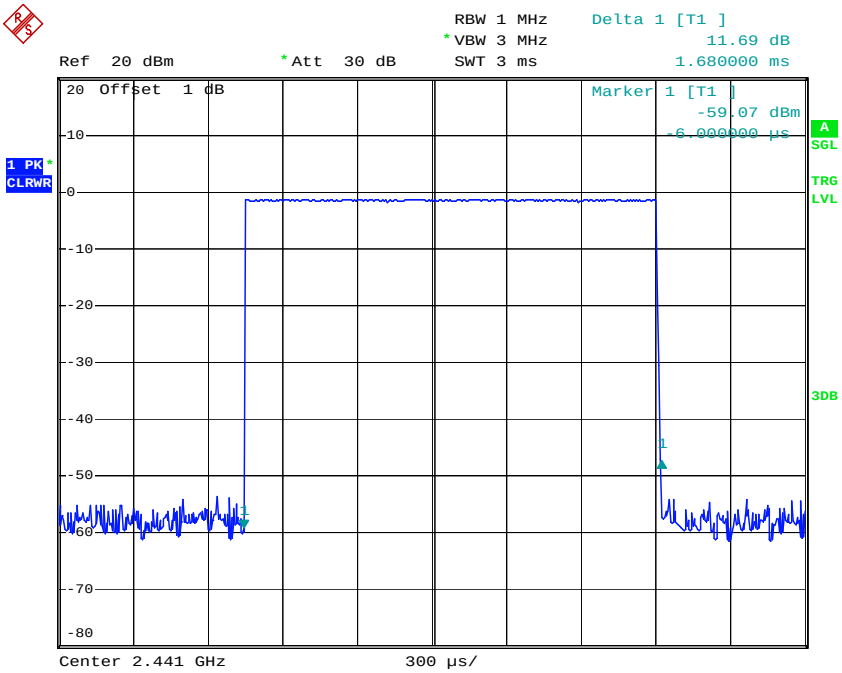
Date: 1.SEP.2016 22:38:21

DH3: Low Channel



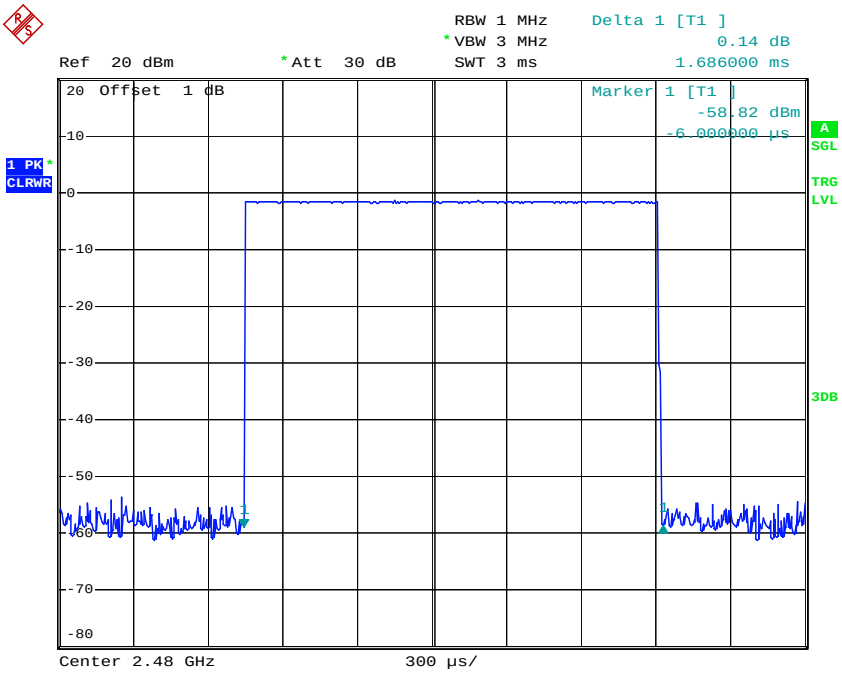
Date: 1.SEP.2016 22:39:25

DH3: Middle Channel



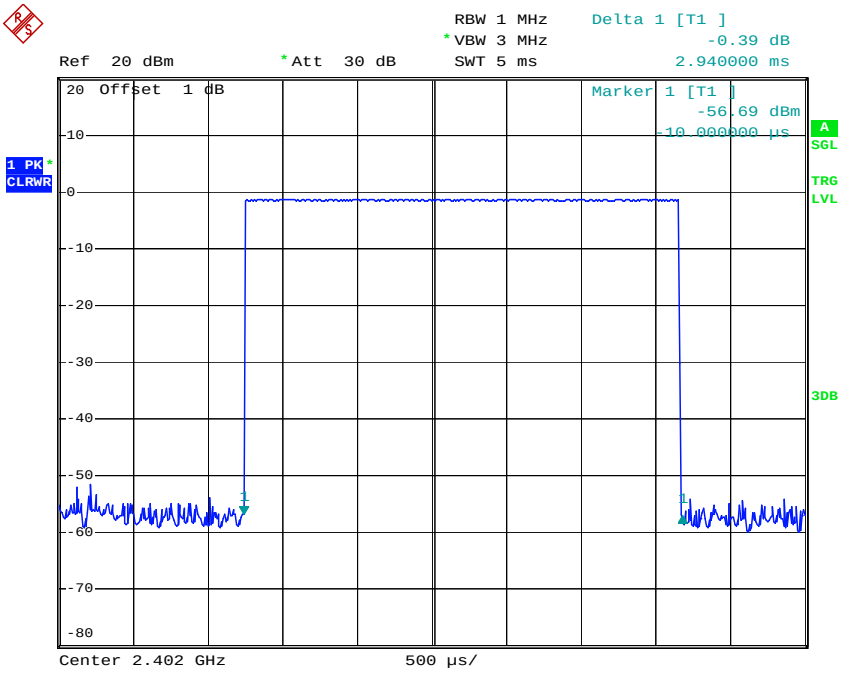
Date: 1.SEP.2016 22:39:38

DH3: High Channel



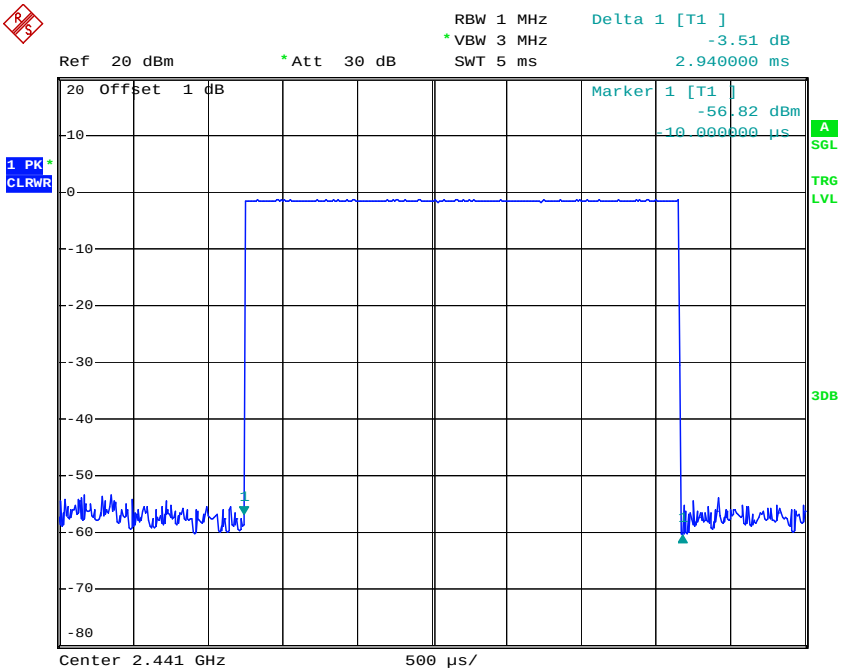
Date: 1.SEP.2016 22:39:50

DH5: Low Channel



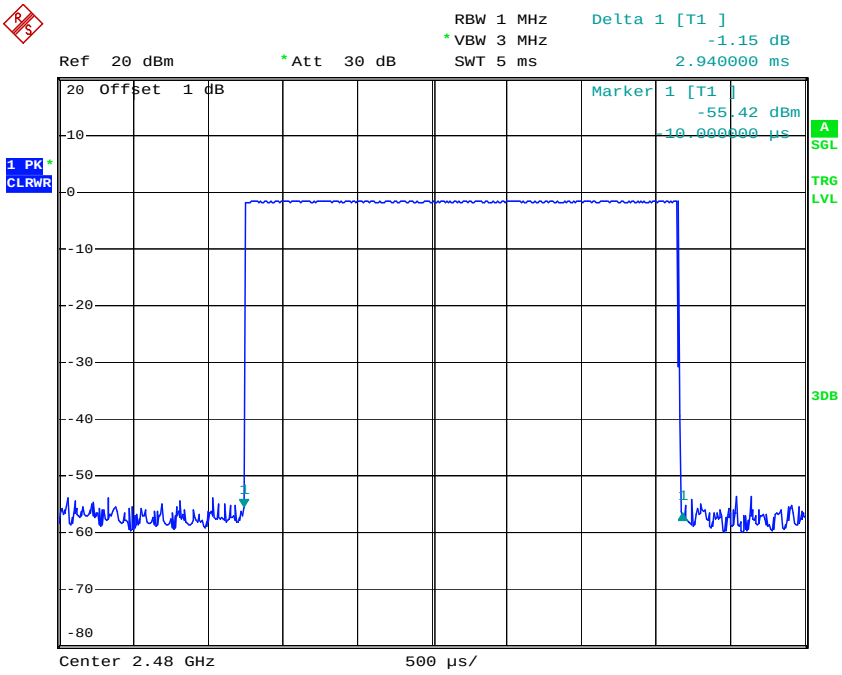
Date: 1.SEP.2016 22:40:20

DH5: Middle Channel



Date: 1.SEP.2016 22:40:37

DH5: High Channel

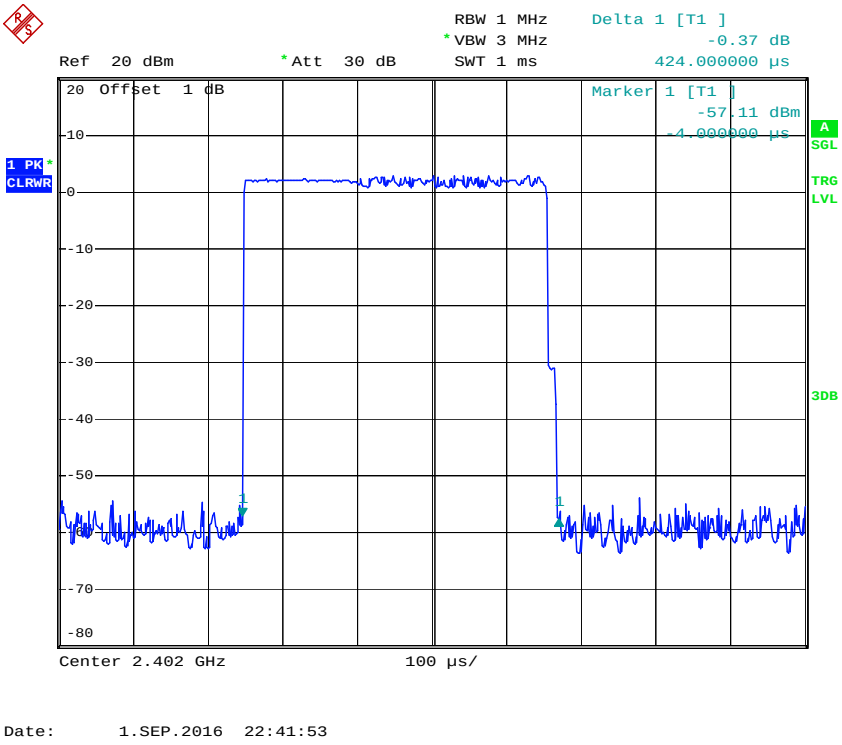


Date: 1.SEP.2016 22:40:53

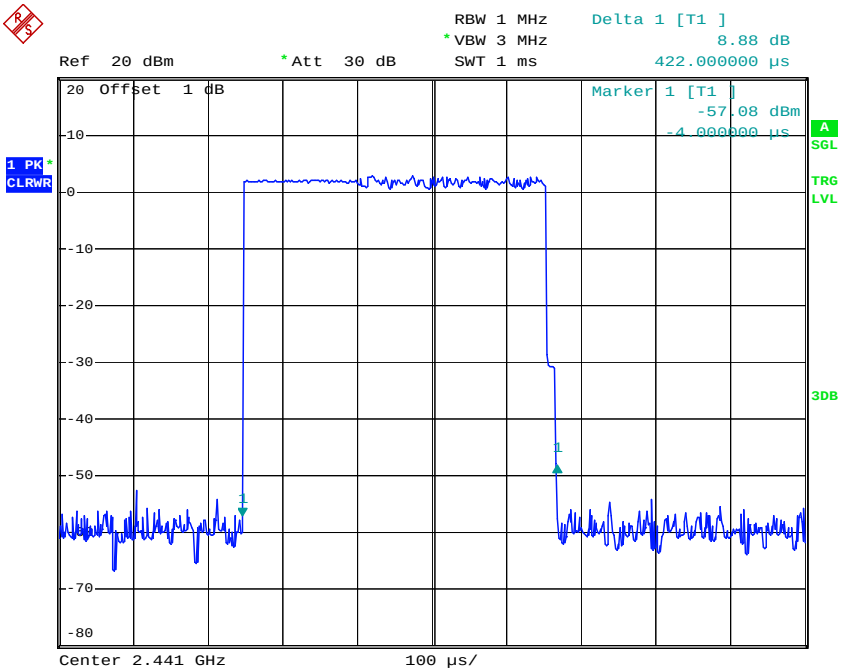
EDR Mode (π/4-DQPSK):

Mode	Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
2DH1	Low	0.424	0.136	0.4	Compliance
	Middle	0.422	0.135	0.4	Compliance
	High	0.424	0.136	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/2/79) ×31.6 s				
2DH3	Low	1.692	0.271	0.4	Compliance
	Middle	1.692	0.271	0.4	Compliance
	High	1.692	0.271	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/4/79) ×31.6 s				
2DH5	Low	2.940	0.314	0.4	Compliance
	Middle	2.940	0.314	0.4	Compliance
	High	2.950	0.315	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/6/79) ×31.6 s				

2DH1: Low Channel

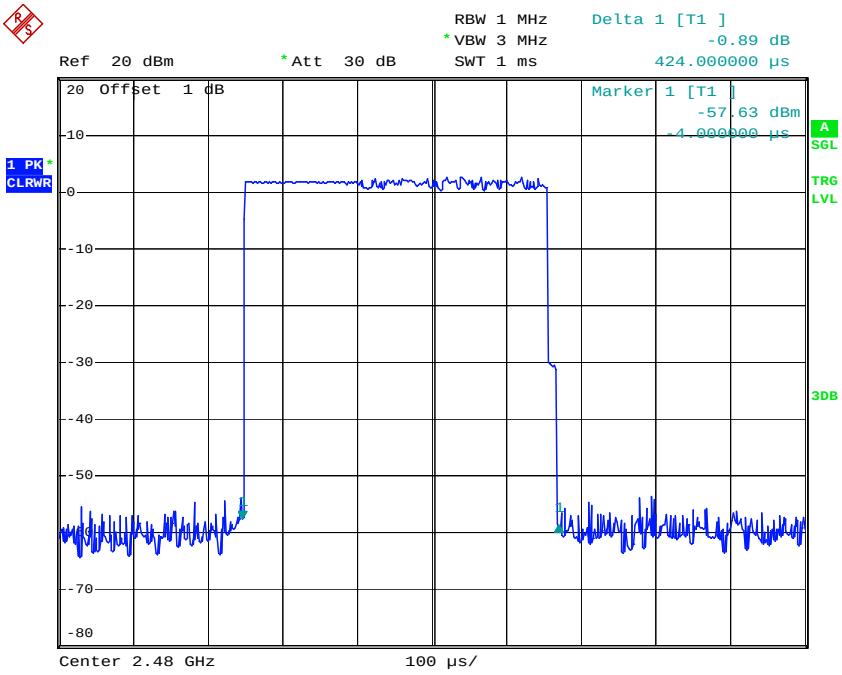


2DH1: Middle Channel



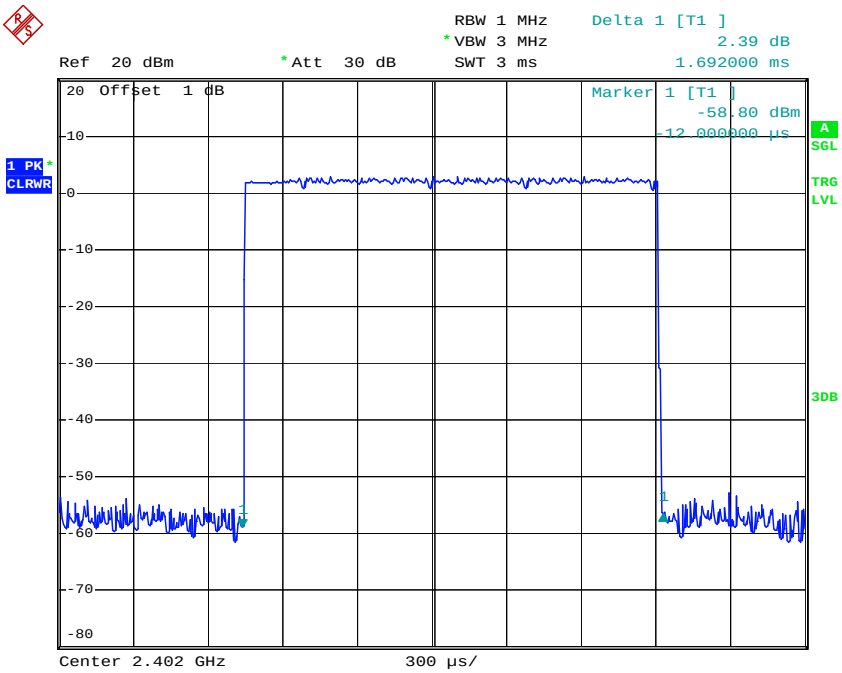
Date: 1.SEP.2016 22:42:06

2DH1: High Channel



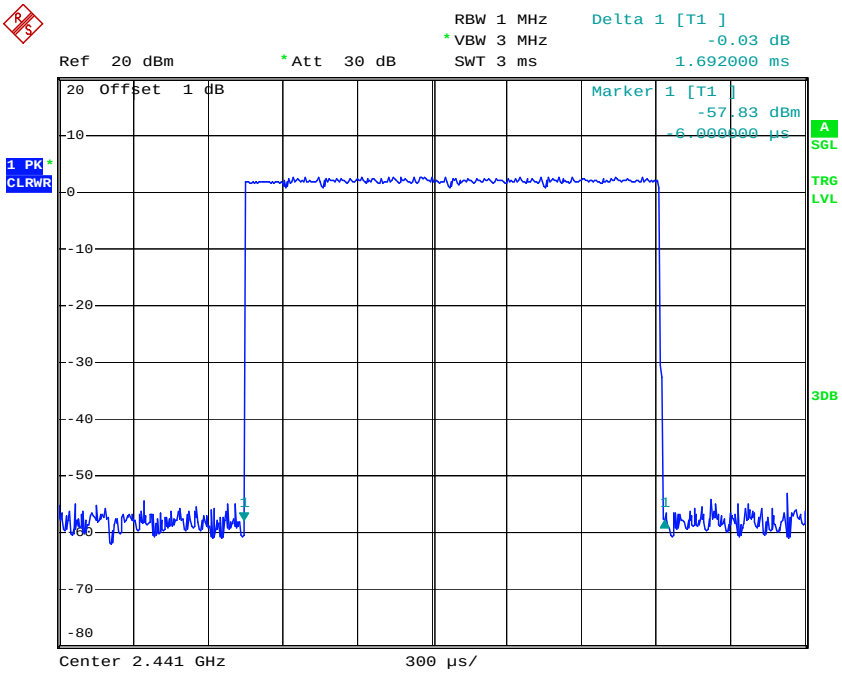
Date: 1.SEP.2016 22:42:18

2DH3: Low Channel



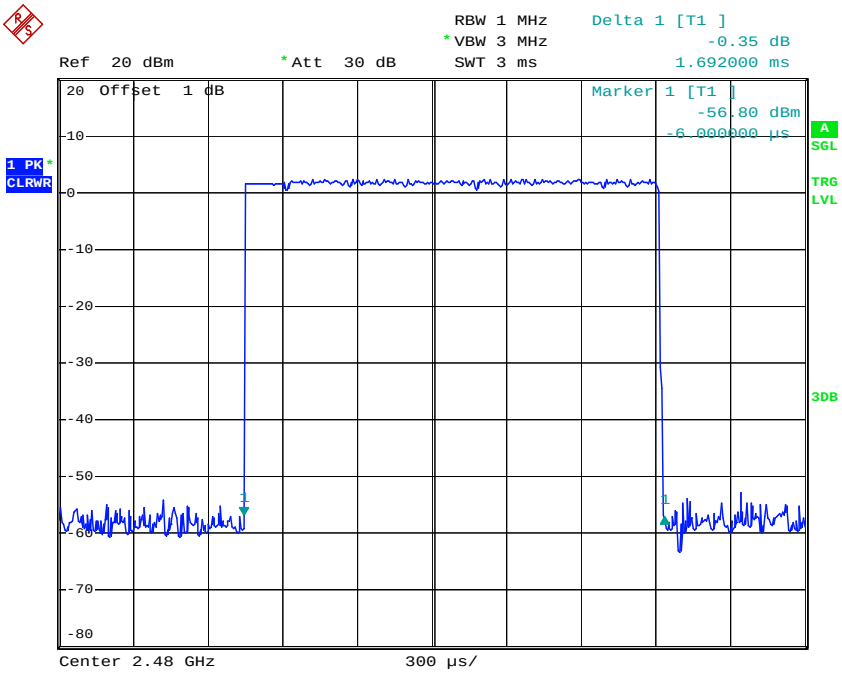
Date: 1.SEP.2016 23:29:43

2DH3: Middle Channel



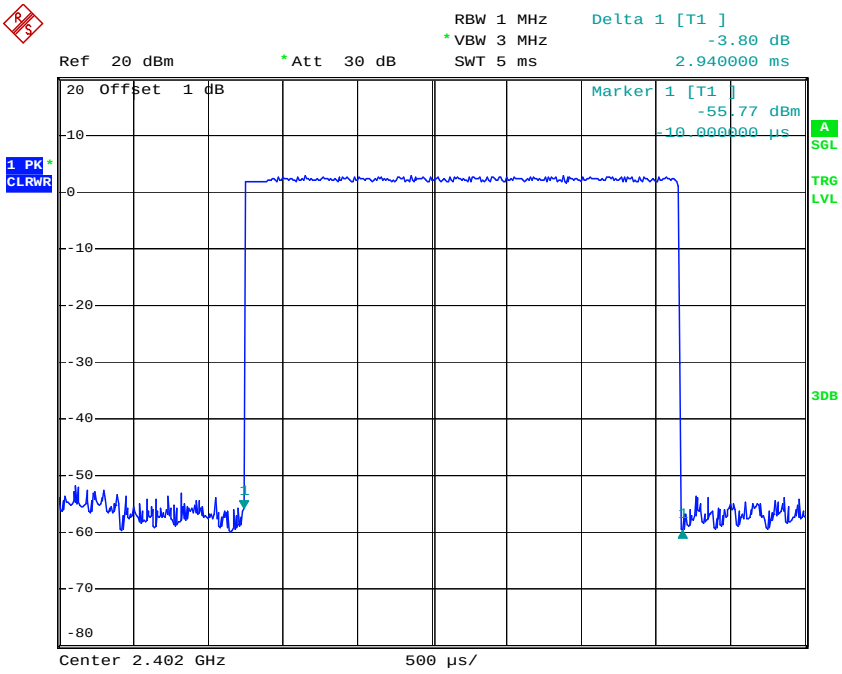
Date: 1.SEP.2016 23:29:56

2DH3: High Channel



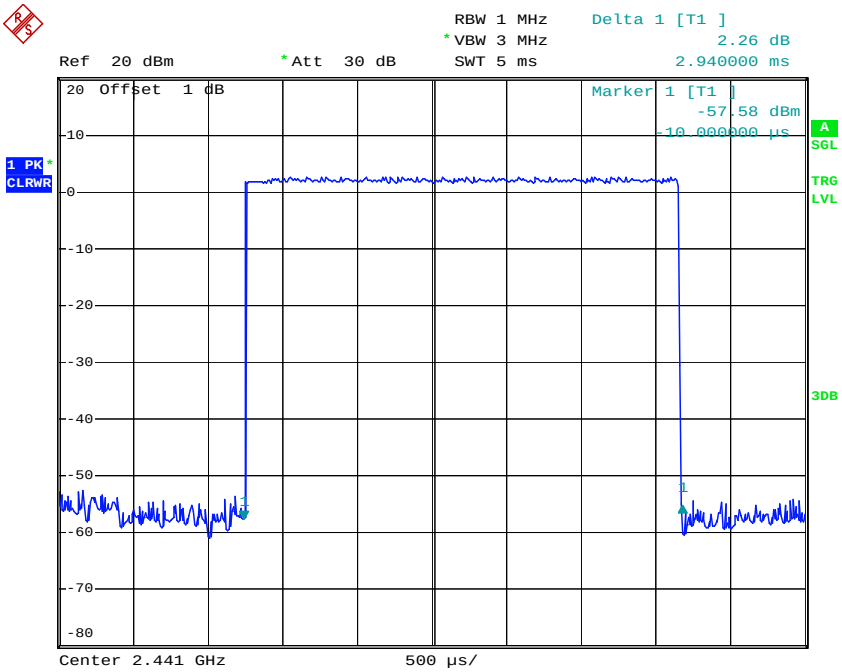
Date: 1.SEP.2016 23:30:09

2DH5: Low Channel



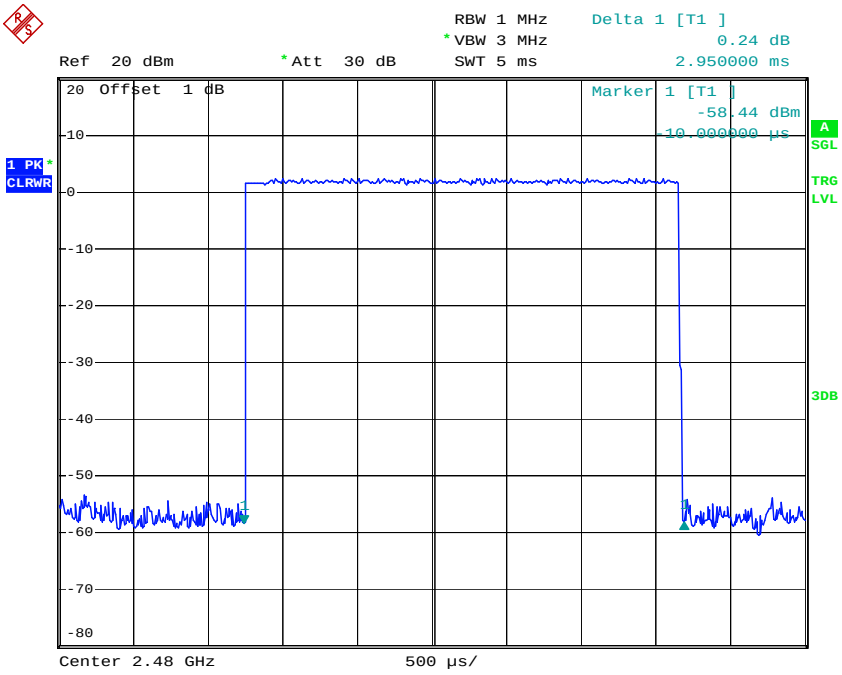
Date: 1.SEP.2016 23:30:40

2DH5: Middle Channel



Date: 1.SEP.2016 23:30:56

2DH5: High Channel

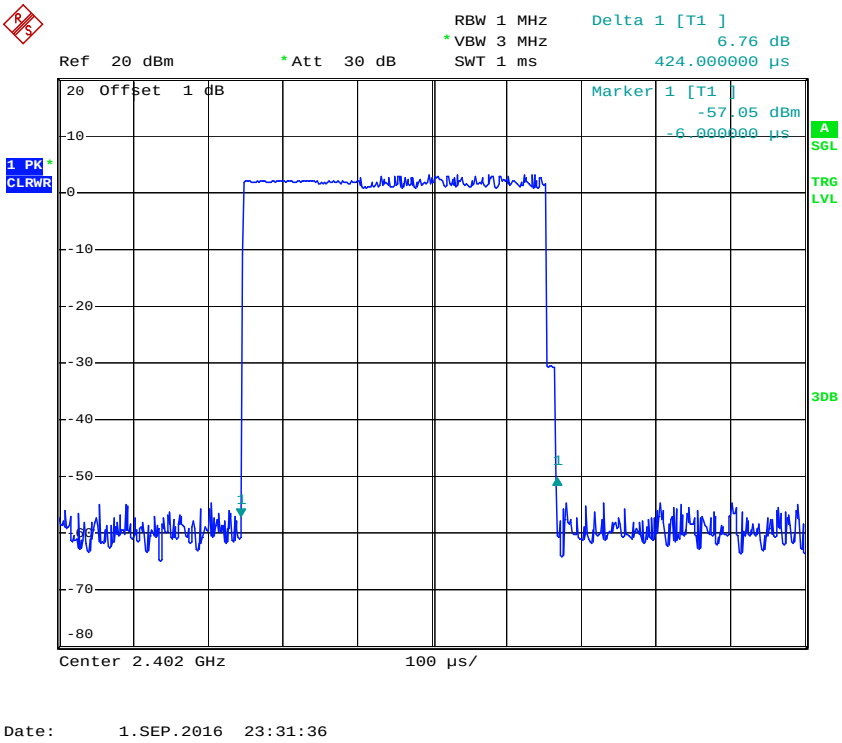


Date: 1.SEP.2016 23:31:09

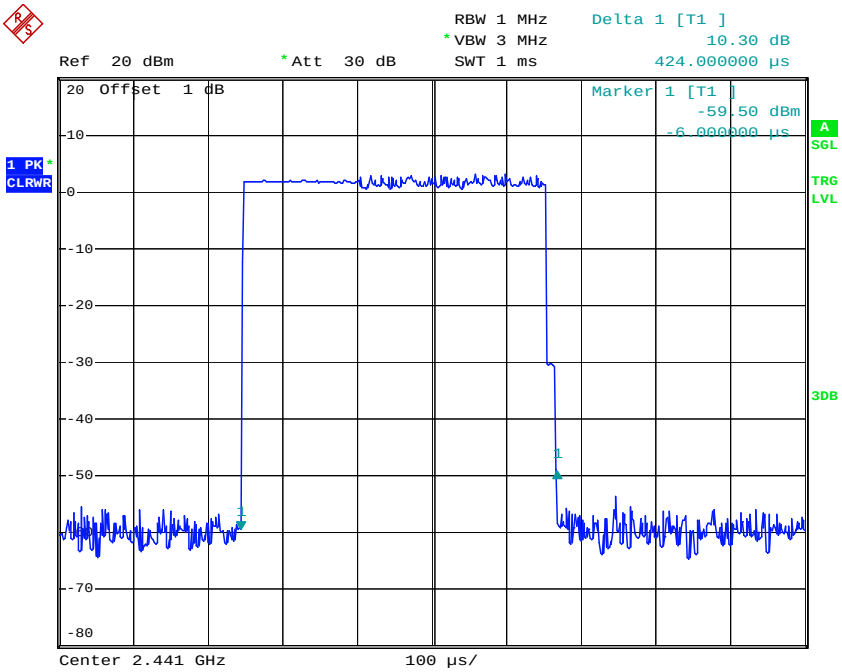
EDR Mode (8-DPSK):

Mode	Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
3DH1	Low	0.424	0.136	0.4	Compliance
	Middle	0.424	0.136	0.4	Compliance
	High	0.424	0.136	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/2/79) ×31.6 s				
3DH3	Low	1.686	0.270	0.4	Compliance
	Middle	1.686	0.270	0.4	Compliance
	High	1.692	0.271	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/4/79) ×31.6 s				
3DH5	Low	2.950	0.315	0.4	Compliance
	Middle	2.950	0.315	0.4	Compliance
	High	2.950	0.315	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/6/79) ×31.6 s				

3DH1: Low Channel

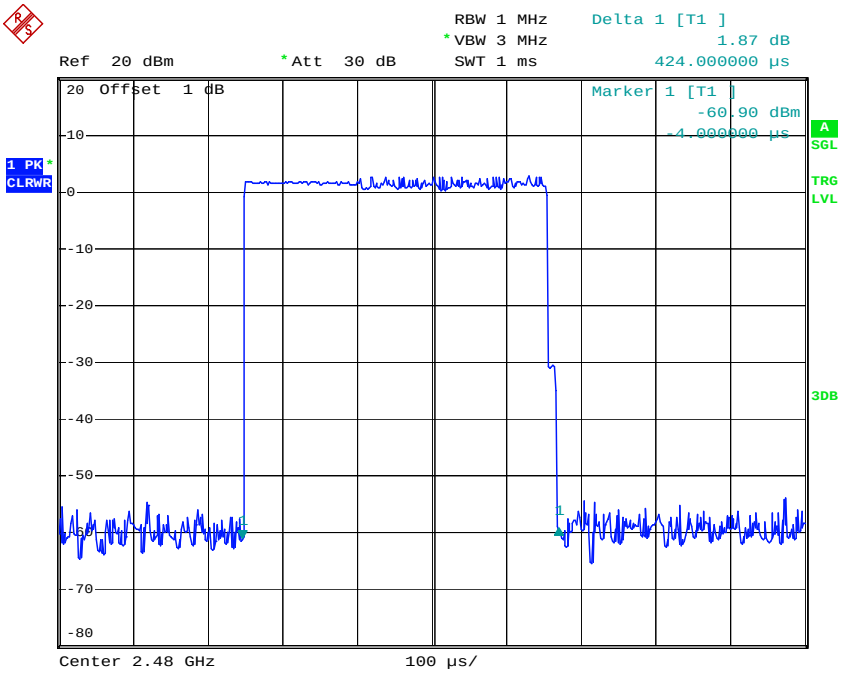


3DH1: Middle Channel



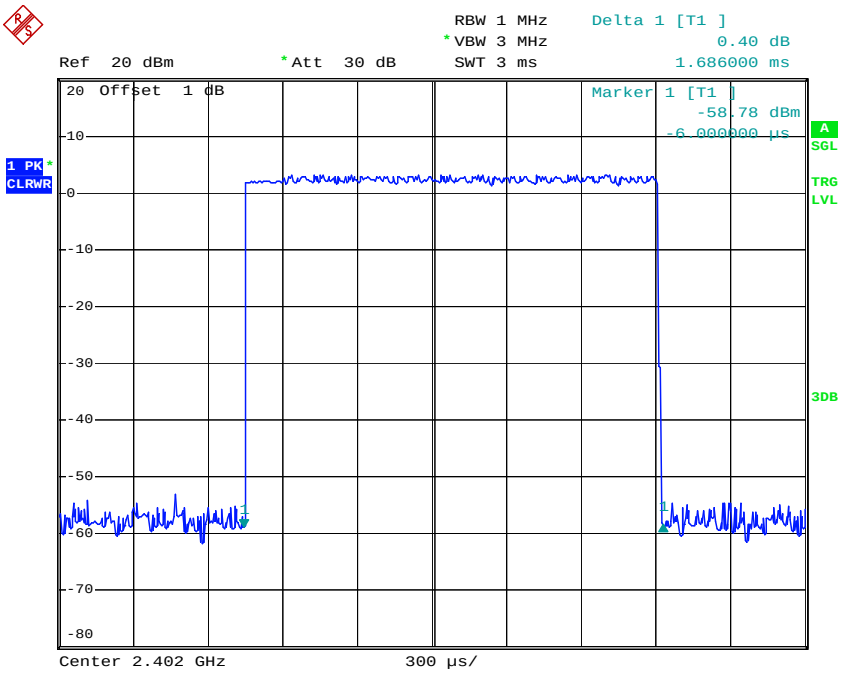
Date: 1.SEP.2016 23:31:48

3DH1: High Channel



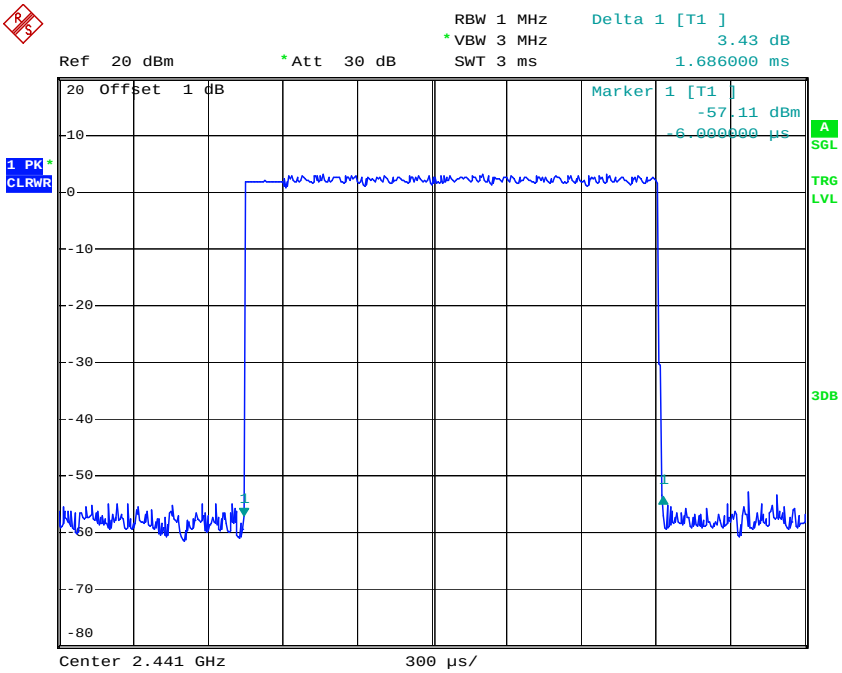
Date: 1.SEP.2016 23:32:00

3DH3: Low Channel



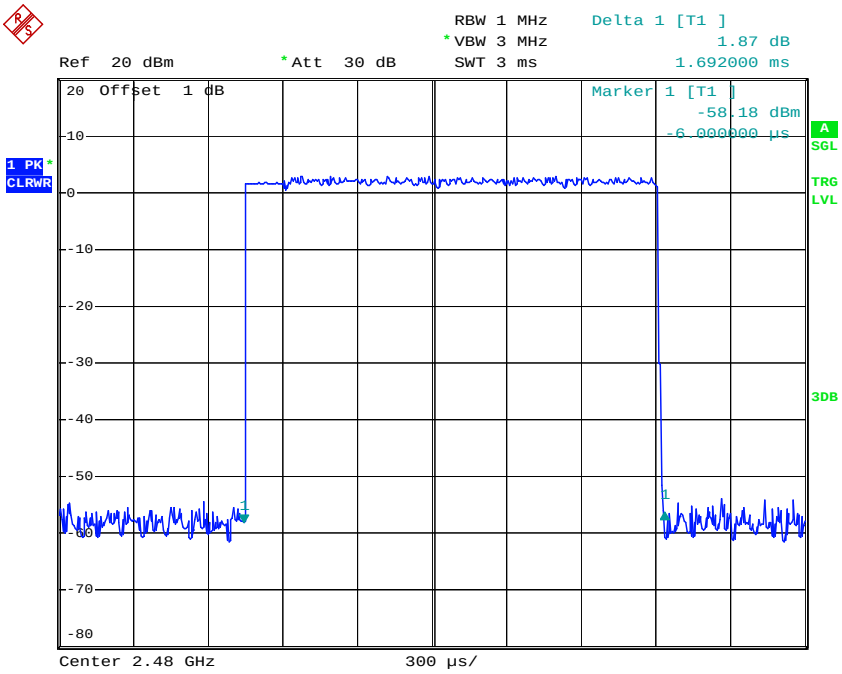
Date: 1.SEP.2016 23:32:30

3DH3: Middle Channel



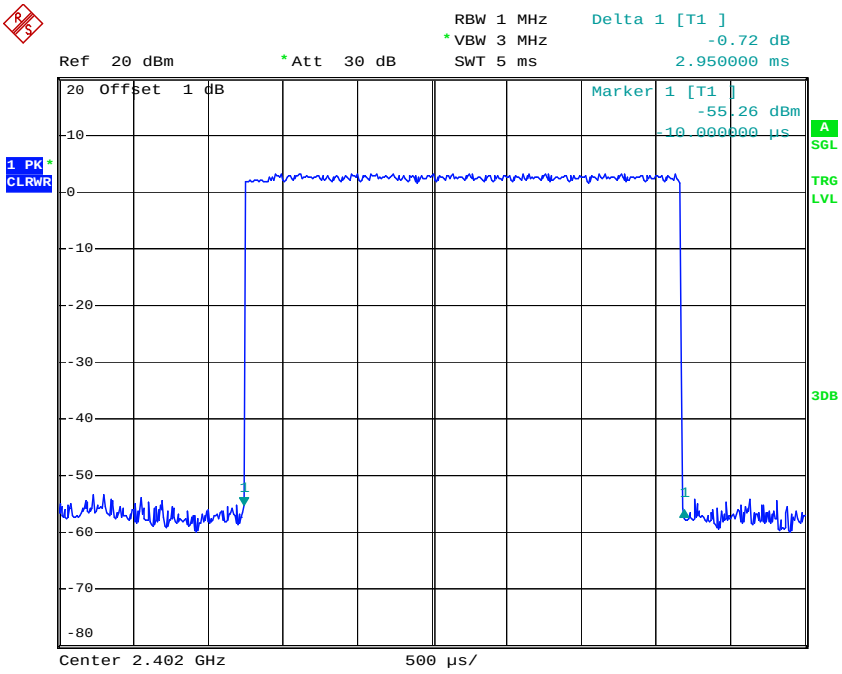
Date: 1.SEP.2016 23:32:42

3DH3: High Channel



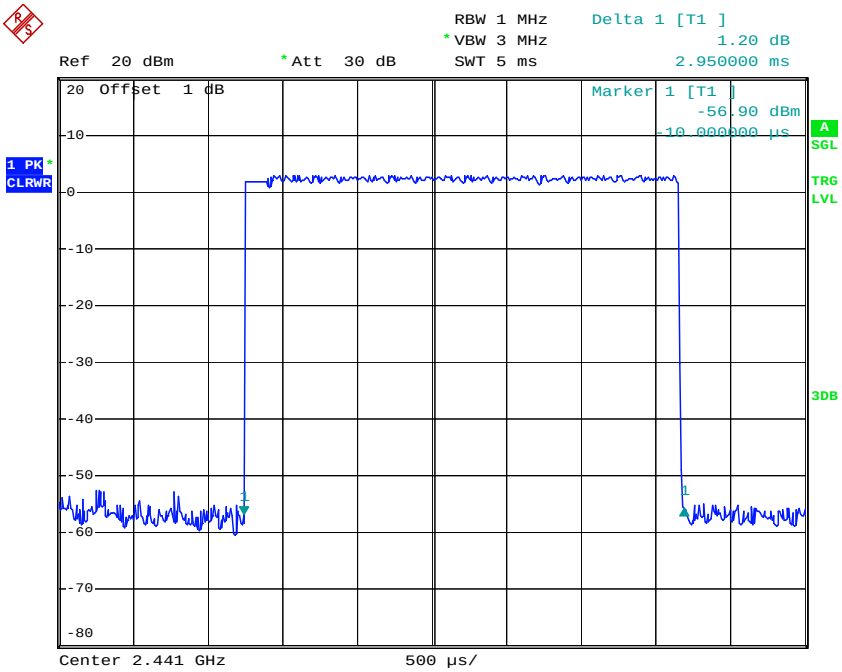
Date: 1.SEP.2016 23:33:12

3DH5: Low Channel



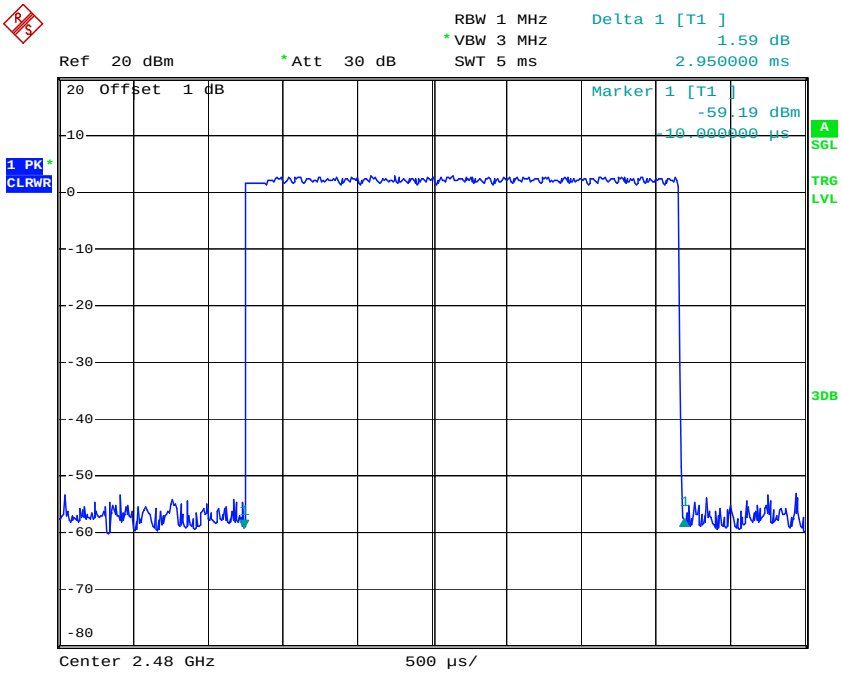
Date: 1.SEP.2016 23:33:40

3DH5: Middle Channel



Date: 1.SEP.2016 23:34:07

3DH5: High Channel



Date: 1.SEP.2016 23:34:30

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

Applicable Standard

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

Test Procedure

1. Place the EUT on a bench and set in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to 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	Spectrum Analyzer	FSP 38	100478	2015-11-23	2016-11-22
N/A	Coaxial Cable	0.1m	N/A	2016-05-06	2017-05-06
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	2016-05-06	2017-05-06

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

Test Data

Environmental Conditions

Temperature:	28.1°C
Relative Humidity:	42 %
ATM Pressure:	99.8 kPa

** The testing was performed by Gavin Xu on 2016-09-01.*

Test Result: Compliance.

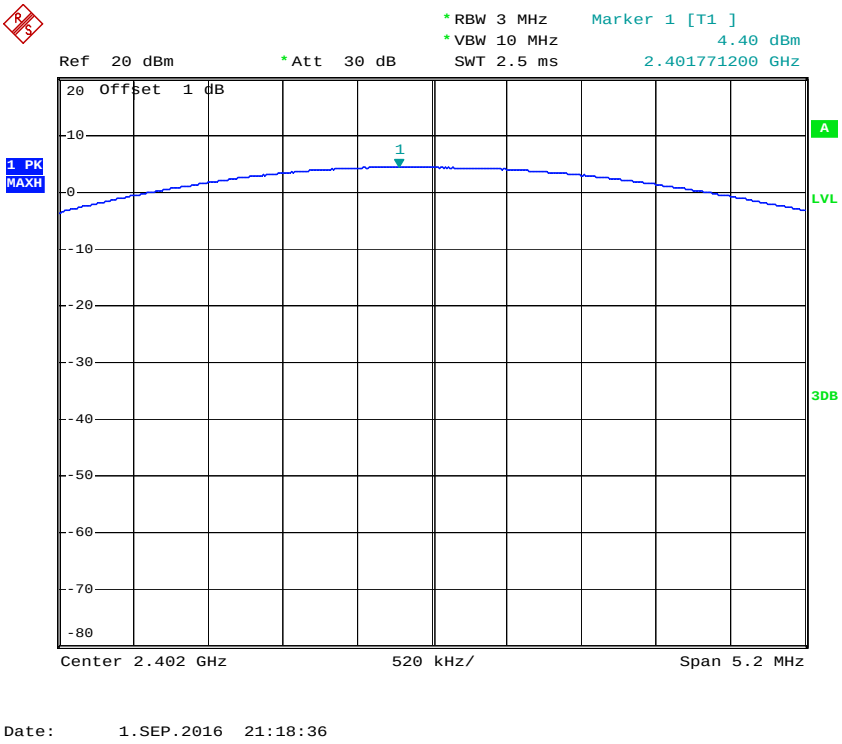
Test Mode: Transmitting

Mode	Channel	Frequency (MHz)	Output power (dBm)	Limit (dBm)
BDR Mode (GFSK)	Low	2402	4.4	30
	Middle	2441	4.47	30
	High	2480	4.37	30
EDR Mode (π/4-DQPSK)	Low	2402	5.72	30
	Middle	2441	5.75	30
	High	2480	5.72	30
EDR Mode (8-DPSK)	Low	2402	6.02	30
	Middle	2441	6.05	30
	High	2480	6.02	30

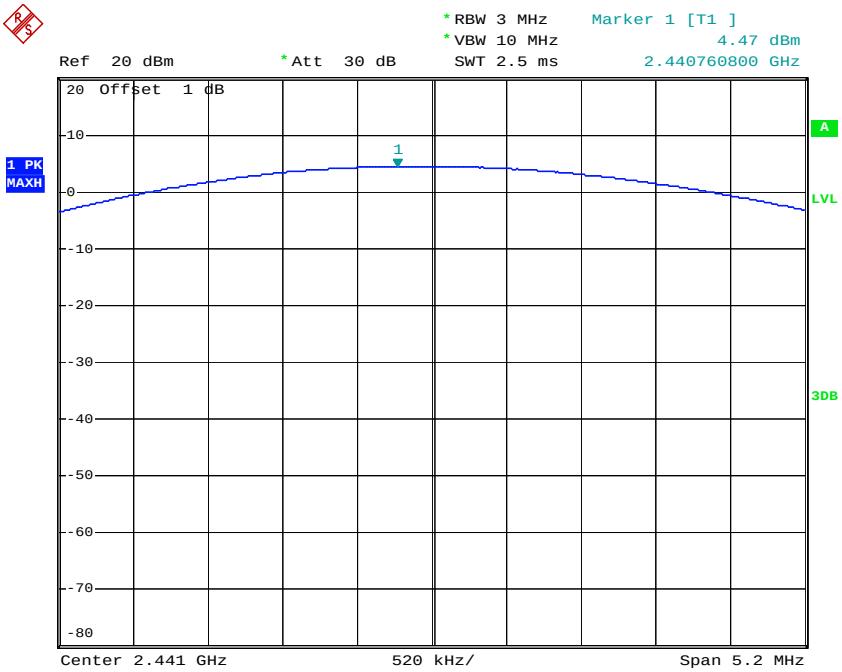
Note: The data above was tested in conducted mode.

BDR Mode (GFSK):

Output Power, Low Channel

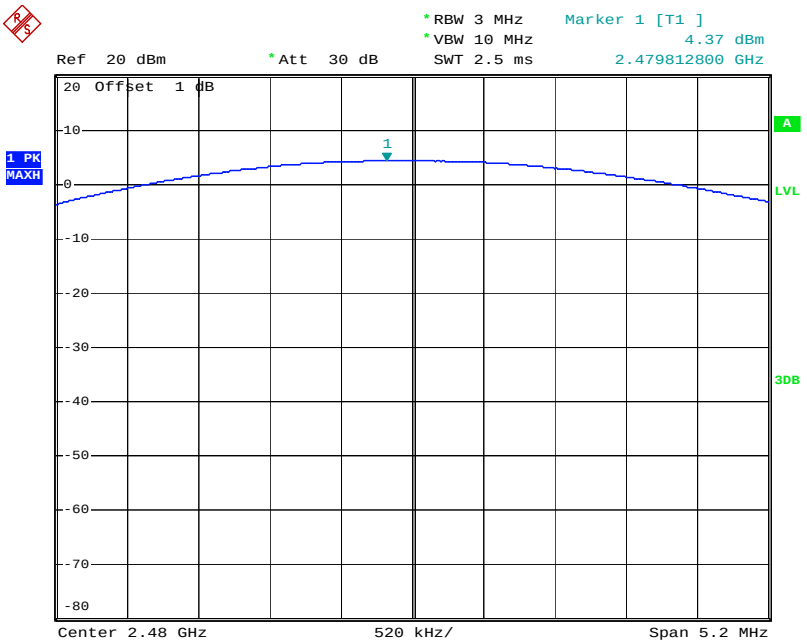


Output Power, Middle Channel



Date: 1.SEP.2016 21:21:10

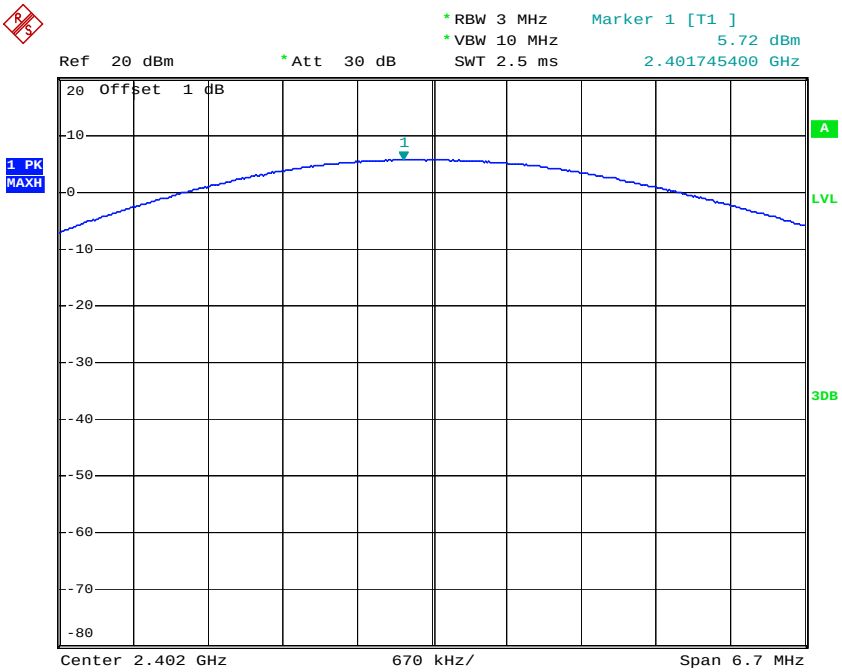
Output Power, High Channel



Date: 1.SEP.2016 21:23:09

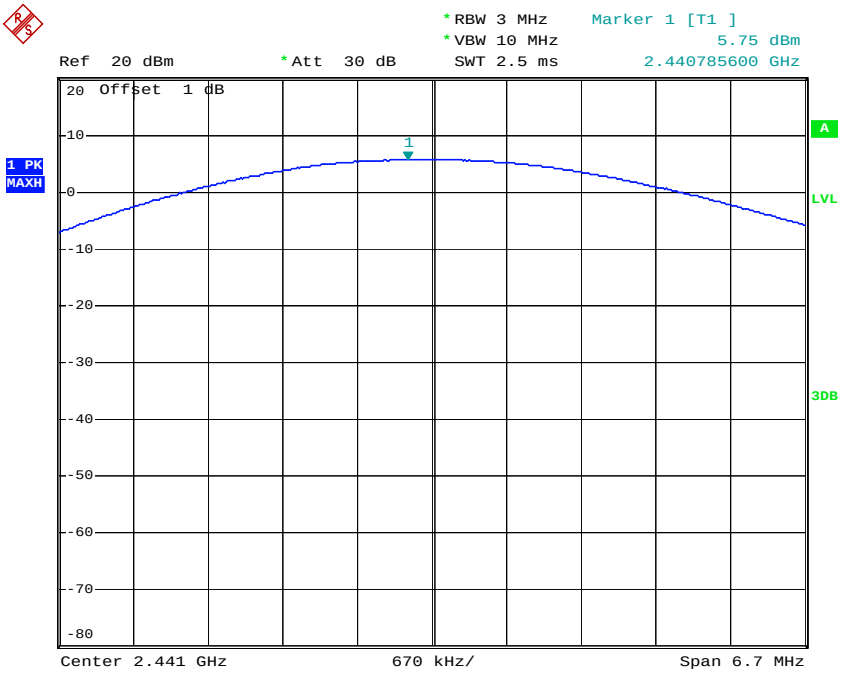
EDR Mode (π/4-DQPSK):

Output Power, Low Channel



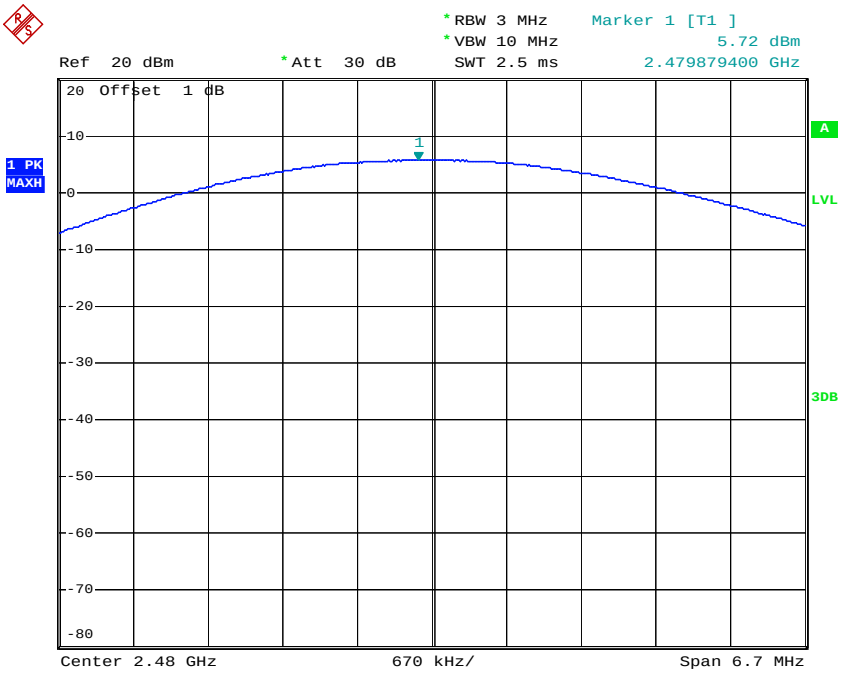
Date: 1.SEP.2016 21:32:57

Output Power, Middle Channel



Date: 1.SEP.2016 21:31:16

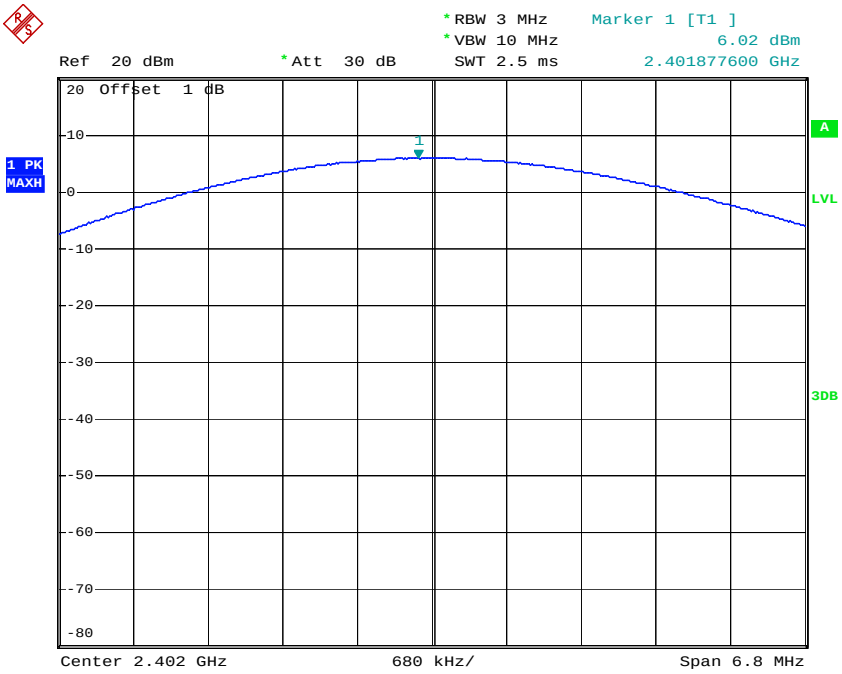
Output Power, High Channel



Date: 1.SEP.2016 21:29:30

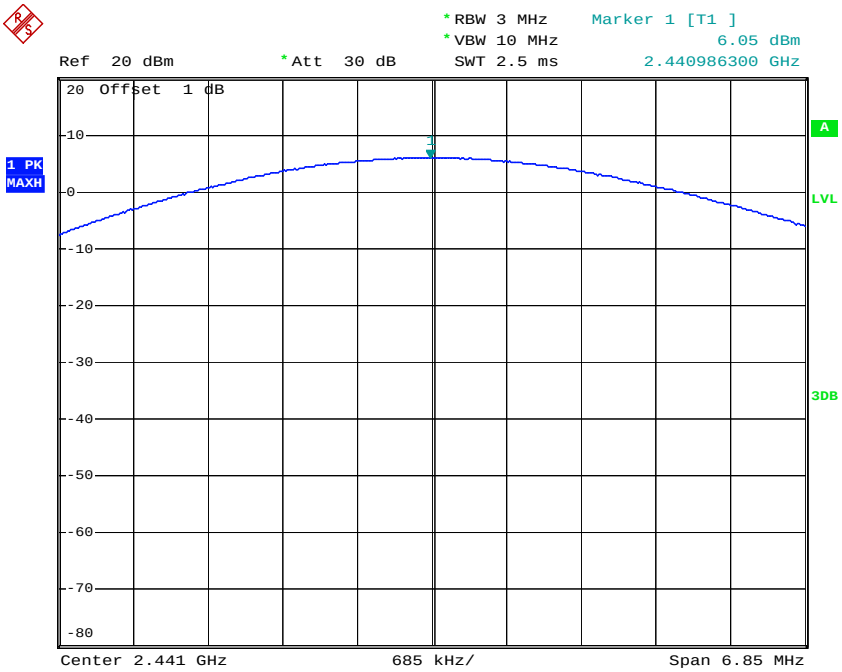
EDR Mode (8-DPSK):

Output Power, Low Channel



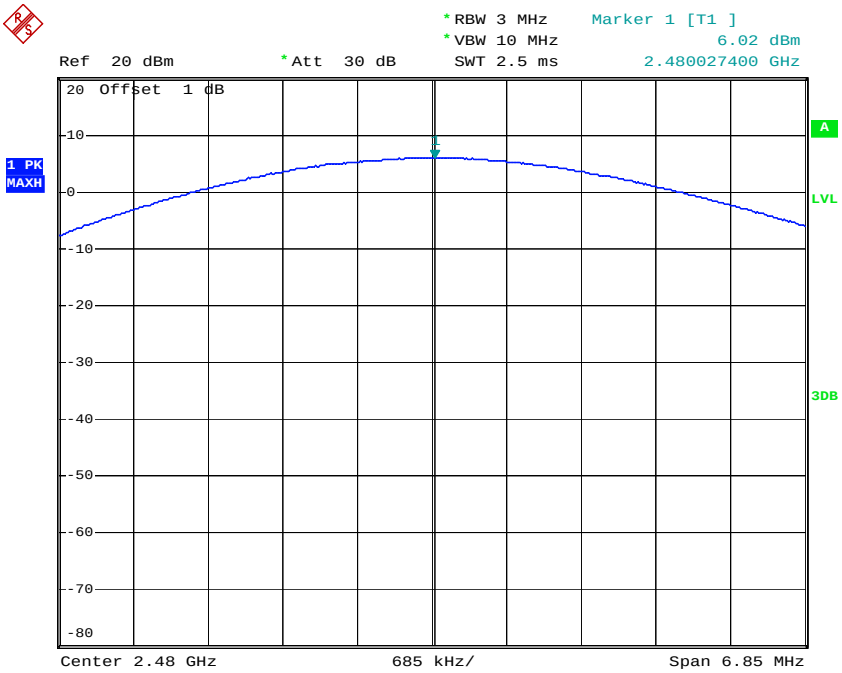
Date: 1.SEP.2016 21:34:46

Output Power, Middle Channel



Date: 1.SEP.2016 21:37:03

Output Power, High Channel



Date: 1.SEP.2016 21:39:28

FCC §15.247(d) - BAND EDGES TESTING

Applicable Standard

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

Test Procedure

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2015-11-23	2016-11-22
N/A	Coaxial Cable	0.1m	N/A	2016-05-06	2017-05-06
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	2016-05-06	2017-05-06

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

Test Data

Environmental Conditions

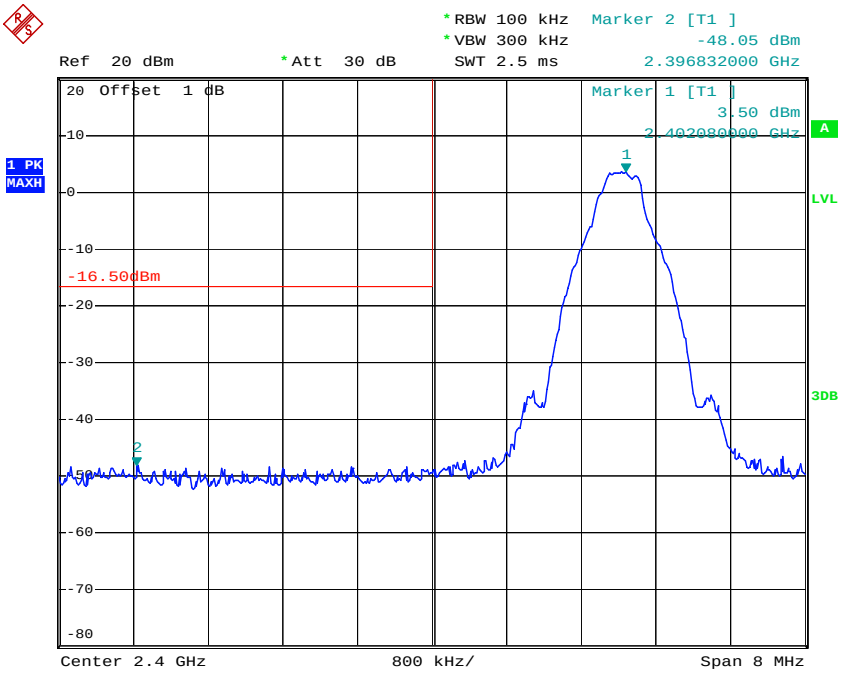
Temperature:	28.7 °C
Relative Humidity:	42 %
ATM Pressure:	99.8 kPa

** The testing was performed by Gavin Xu on 2016-09-01.*

Test Result: Compliance

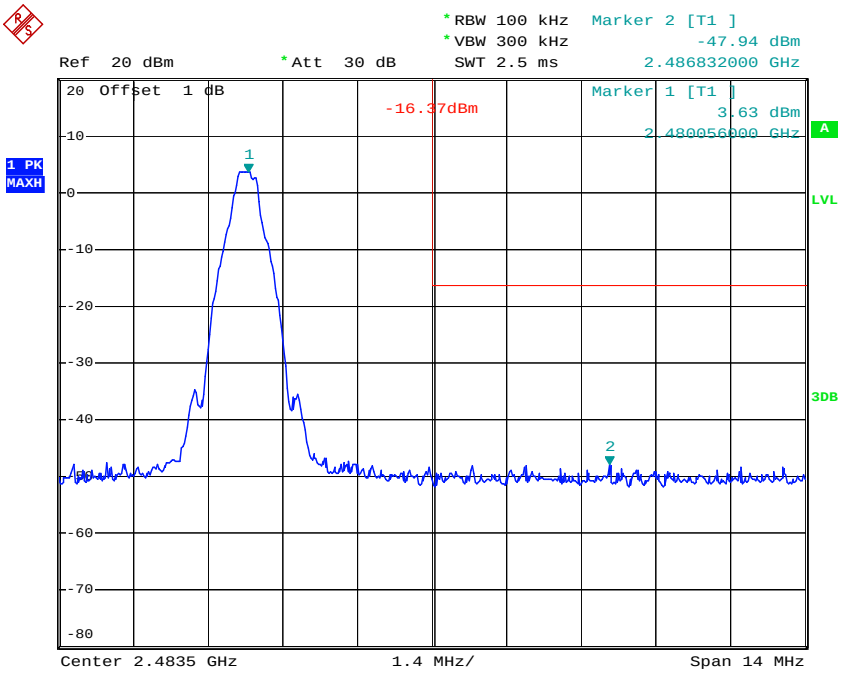
BDR Mode (GFSK):

Band Edge, Left Side



Date: 1.SEP.2016 21:19:17

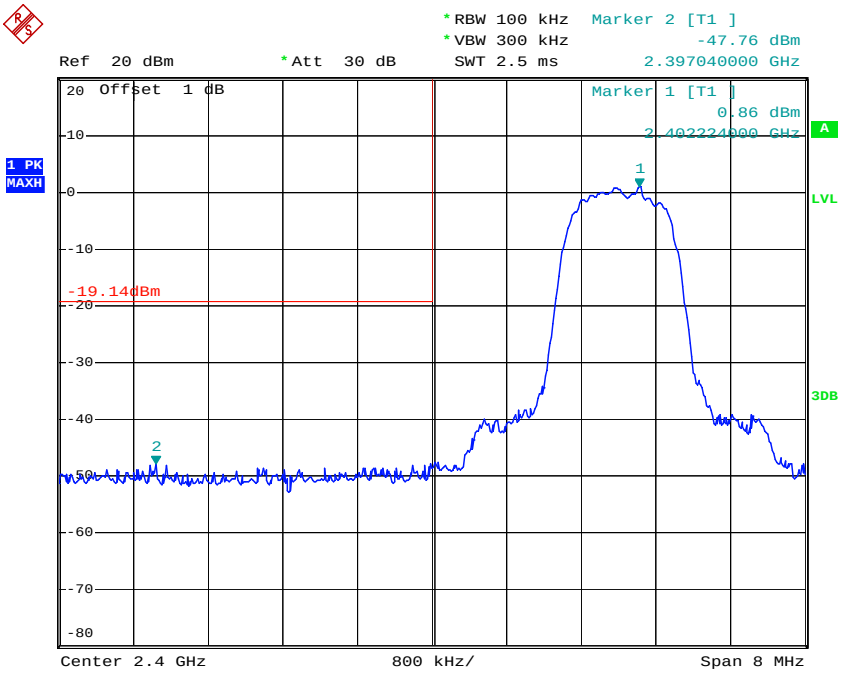
Band Edge, Right Side



Date: 1.SEP.2016 21:23:31

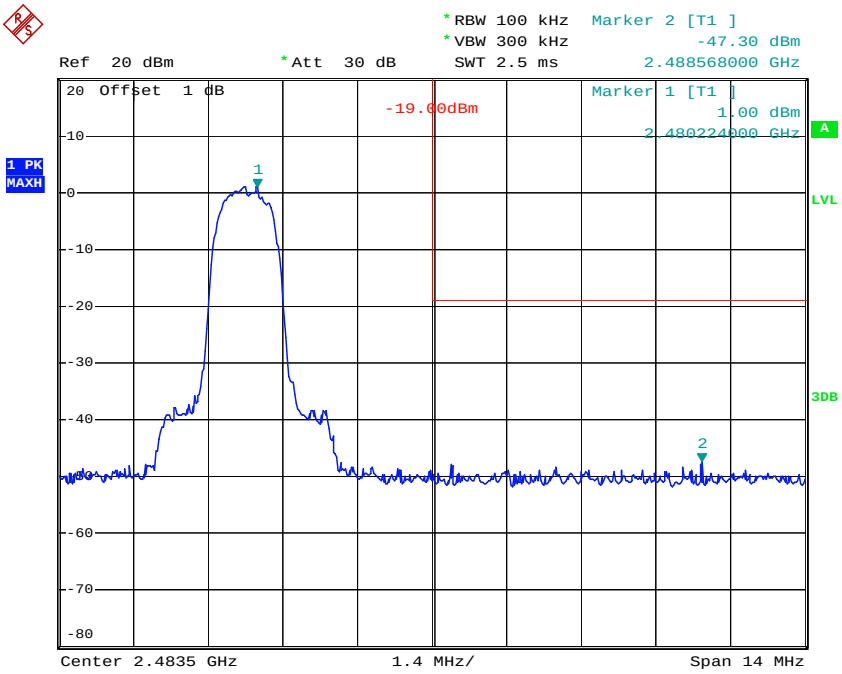
EDR Mode (π/4-DQPSK):

Band Edge, Left Side



Date: 1.SEP.2016 21:33:19

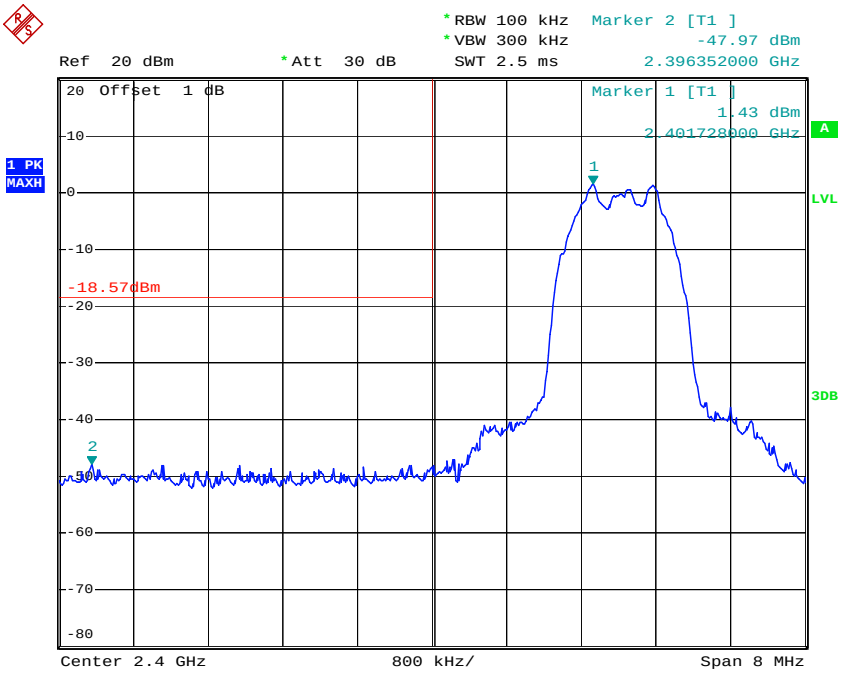
Band Edge, Right Side



Date: 1.SEP.2016 21:29:51

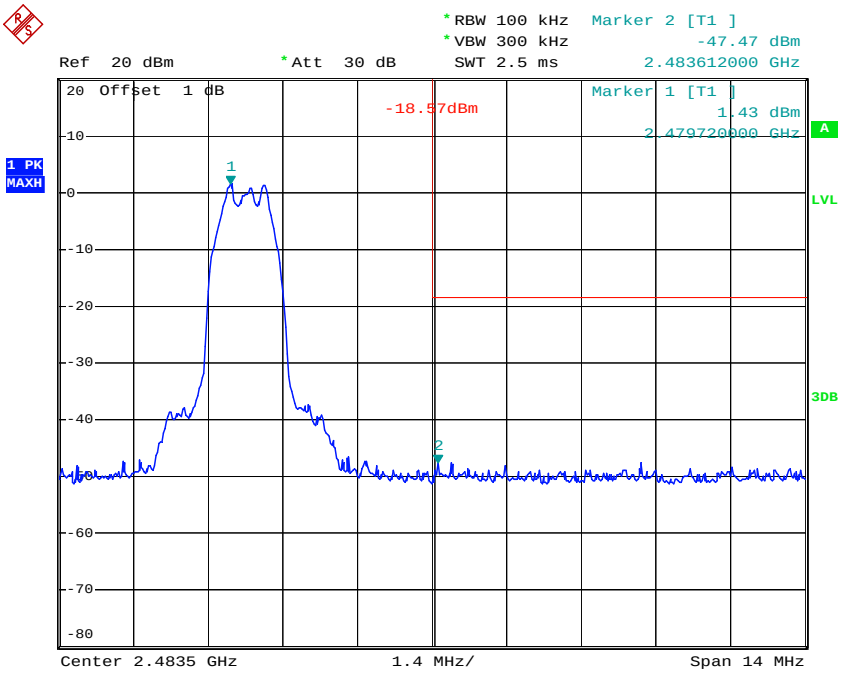
EDR Mode (8-DPSK):

Band Edge, Left Side



Date: 1.SEP.2016 21:35:07

Band Edge, Right Side



Date: 1.SEP.2016 21:39:56

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