FCC PART 15.247

TEST REPORT

For

QUADRANT TECHNOLOGY (SHENZHEN) CO., LTD

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FCC ID: A5JC356712

Report Type:	**Product Name:**
Original Report	MinionCam

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Report Number:	RDG170405006A
Report Date:	2017-05-07
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The ***QUADRANT TECHNOLOGY (SHENZHEN) CO., LTD*** 's product, model number: ***QCP-A356M (FCC ID: A5JC356712)*** (the "EUT") in this report was a ***MinionCam,*** which was measured approximately: 67.7 mm (L) × 95 mm (W) × 123.3 mm (H), rated input voltage: DC5V from adapter.

Adapter Information:
MODEL: S006AKU0500100
Input: AC100-240V 50/60Hz 200mA
Output: DC5V 1000mA

**All measurement and test data in this report was gathered from final production sample, serial number: 170405006 (assigned by the BACL, Chengdu). It may have deviation from any other sample. The EUT supplied by the applicant was received on 2017-04-07, and EUT conformed to test requirement.*

Objective

This report is prepared on behalf of ***QUADRANT TECHNOLOGY (SHENZHEN) CO., LTD*** in accordance with Part 2, Subpart J, Part 15, Subparts A, 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 Rules Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

This application for model number: ***QCP-A356M*** *is* base on Model number: ***QCP-A356,*** FCC ID: ***A5JC35621***, granted on 2016-07-03, the difference between the original device and the current one is as follows:

1. Enabled Bluetooth function by software.

2. AP6212 and 1.12V power system circuit designing were be optimized.

The change made to the device affected the data of wifi radiation spurious emissions below 1GHz and all Bluetooth test data.

Related Submittal(s)/Grant(s)

FCC Part 15C DTS submissions with FCC ID: A5JC356712.

Test Methodology

All measurements detailed in this Test Report were performed in accordance with ANSI C63.10-2013 “American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices”.

All of the measurements detailed in this Test Report were performed by Bay Area Compliance Laboratories Corp. (Chengdu).

The Bay Area Compliance Laboratories Corp. Chengdu’s measurement Uncertainties (calculated for a k=2 Coverage Factor corresponding to approximately 95% Coverage) were as follows:

-For all of the AC Line Conducted Emissions Tests reported herein: ±3.17 dB.
-For of all of the Direct Antenna Conducted Emissions Tests reported herein: ±0.56 dB.

-For of all of the direct Radiated Emissions Tests reported herein are:
30 MHz to 200 MHz: ±4.7 dB;
200 MHz to 1 GHz: ±6.0 dB;
1 GHz to 6 GHz: ±5.13dB; and,
6 GHz to 40 GHz: ±5.47dB.

And the uncertainty will not be taken into consideration for all test data recorded in the report.

Test Facility

The test site used by BACL to collect test data is located in the No.5040, Huilongwan Plaza, No.1, Shawan Road, Jinniu District, Chengdu, Sichuan, China.

Test site at BACL 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 April 24, 2015. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 560332. 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 worst condition (maximum power) was setting by the the test software as following table:

Test Software Version	PUTTY		
Test Frequency	2402MHz	2441MHz	2480MHz
GFSK	0	0	0
π/4-DQPSK	0	0	0
8DPSK	0	0	0

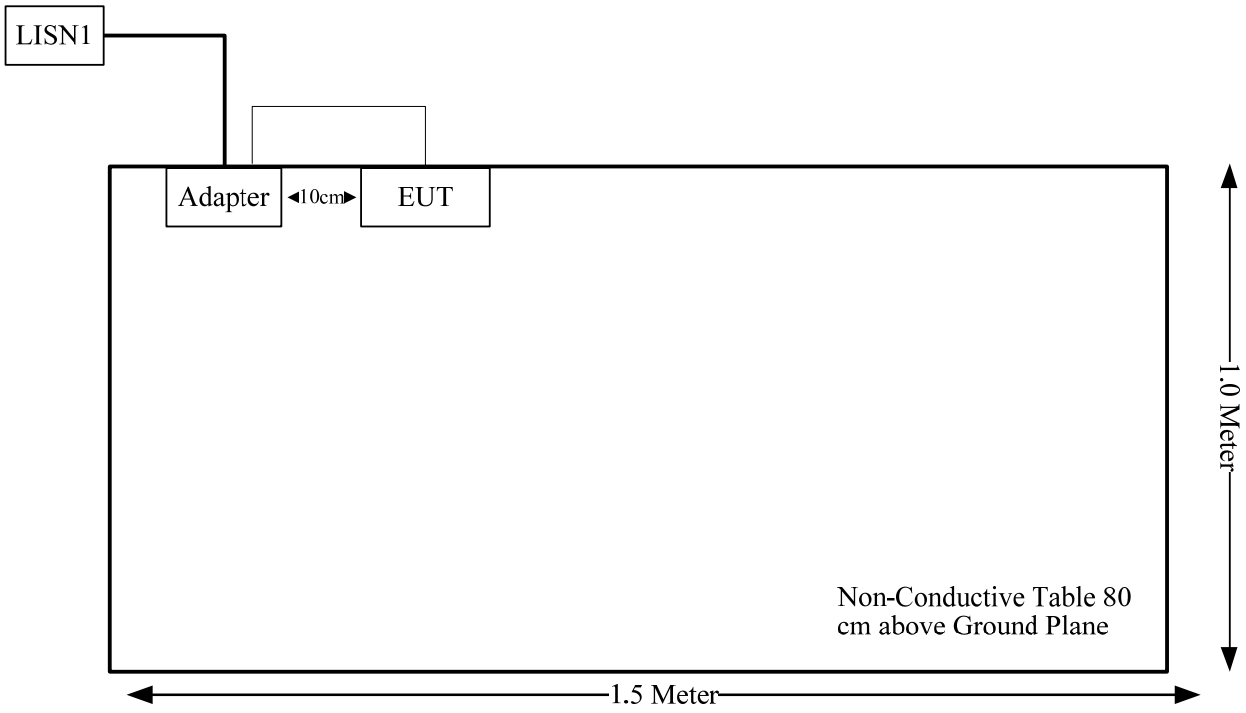
Equipment Modifications

No modification was made to the EUT.

External Cable

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
USB Cable	Yes	No	3.08	USB Port of Adapter	EUT

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
FCC §15.247 (i) & §1.1310 & §2.1091	Maximum Permissible Exposure(MPE)	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

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

Applicable Standard

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

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

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f²)	30
30–300	27.5	0.073	0.2	30
300–1500	/	/	f/1500	30
1500–100,000	/	/	1.0	30

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

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

Calculated Formula:

Prediction of power density at the distance of the applicable MPE limit
$S = PG/4\pi R^2$ = 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);

Calculated Data:

Mode	Frequency (MHz)	Antenna Gain		Maximum Power including tolerance		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)			
Bluetooth	2402-2480	1.5	1.41	9	7.94	20.00	0.0022	1.0
Wifi	2012-2462	1.5	1.41	15.5	35.48	20.00	0.0100	1.0

Note: The tune-up power including tolerance is declared by manufacturer.

Result: Compliance, The device meets MPE requirement for Devices Used by the General Public (Uncontrolled Environment) at distance ≥20 cm.

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 internal antenna arrangement for Wifi/BT, and the antenna gain is 1.5 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

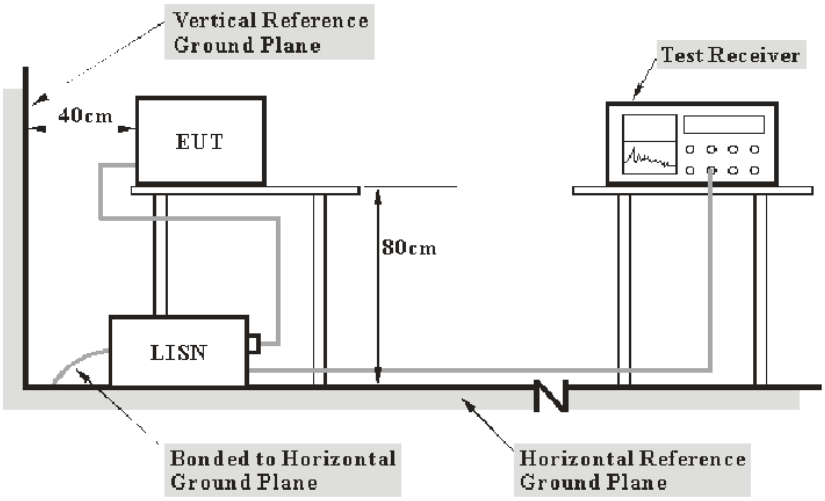
Result: Compliance.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207

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 LISN with a 120 V/60 Hz AC power.

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
Rohde & Schwarz	EMI Test Receiver	ESCS 30	836858/0016	2016-12-02	2017-12-01
Rohde & Schwarz	L.I.S.N.	ENV216	3560.6550.06	2016-12-02	2017-12-01
Rohde & Schwarz	PULSE LIMITER	ESH3Z2	357.8810.52	2016-10-31	2017-10-30
Unknown	Conducted Cable	Unknown	NO.5	2016-11-10	2017-11-09
R&S	Test Software	EMC32	Version8.53.0	N/A	N/A

*** Statement of Traceability:** BACL(Chengdu) attests that all of the calibrations on the equipment items listed above were traceable to NIM or to another internationally recognized National Metrology Institute (NMI), and were compliant with the NIST HB 150-2016 Normative Annex B “Implementation of traceability policy in accredited laboratories”.

Test Data

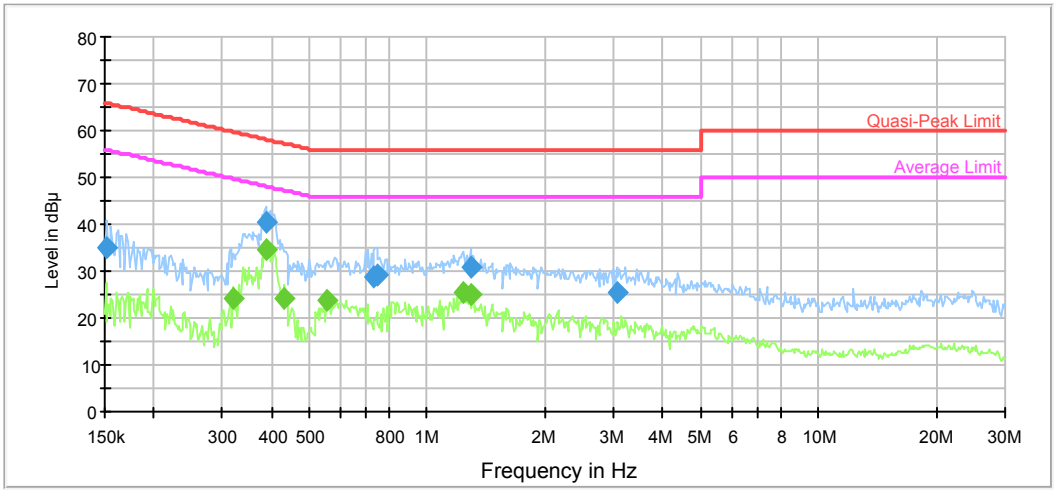
Environmental Conditions

Temperature:	24.9 °C
Relative Humidity:	54.2 %
ATM Pressure:	100.6 kPa

The testing was performed by Tom Tang on 2017-05-03.

Test Mode: Transmitting

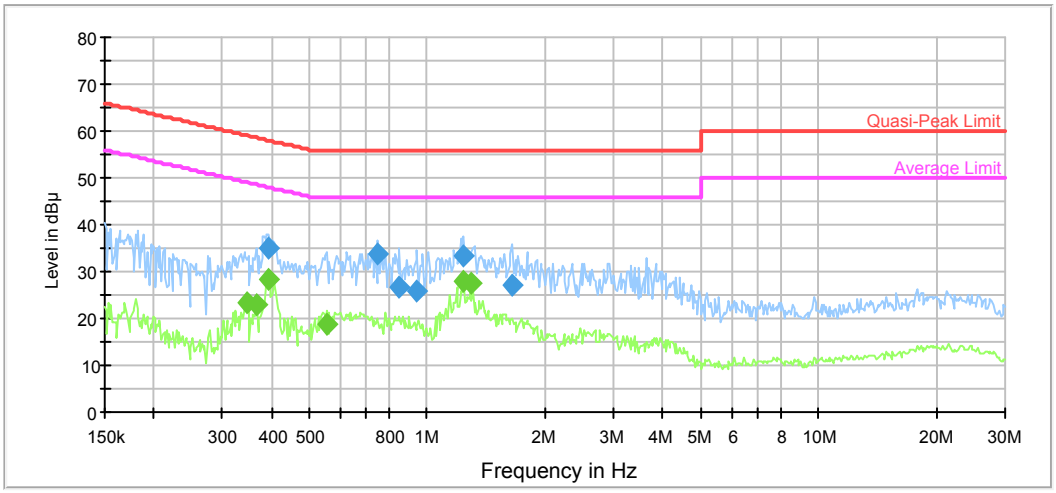
AC120 V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.152410	34.9	9.000	L1	19.7	31.0	65.9	Compliance
0.387164	40.3	9.000	L1	19.8	17.8	58.1	Compliance
0.732382	28.8	9.000	L1	19.7	27.2	56.0	Compliance
0.744147	29.1	9.000	L1	19.7	26.9	56.0	Compliance
1.289541	31.0	9.000	L1	19.7	25.0	56.0	Compliance
3.049107	25.4	9.000	L1	19.7	30.6	56.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.319773	24.1	9.000	L1	19.7	25.6	49.7	Compliance
0.387164	34.6	9.000	L1	19.8	13.5	48.1	Compliance
0.432855	24.3	9.000	L1	19.7	22.9	47.2	Compliance
0.554139	23.9	9.000	L1	19.7	22.1	46.0	Compliance
1.239175	25.6	9.000	L1	19.7	20.4	46.0	Compliance
1.289541	24.9	9.000	L1	19.7	21.1	46.0	Compliance

AC120 V, 60 Hz, Neutral:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.393383	34.8	9.000	N	19.6	23.2	58.0	Compliance
0.750100	33.7	9.000	N	19.6	22.3	56.0	Compliance
0.852094	26.5	9.000	N	19.6	29.5	56.0	Compliance
0.945093	25.7	9.000	N	19.7	30.3	56.0	Compliance
1.239175	33.5	9.000	N	19.6	22.5	56.0	Compliance
1.650866	27.1	9.000	N	19.7	28.9	56.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.393383	34.8	9.000	N	19.6	23.2	58.0	Compliance
0.750100	33.7	9.000	N	19.6	22.3	56.0	Compliance
0.852094	26.5	9.000	N	19.6	29.5	56.0	Compliance
0.945093	25.7	9.000	N	19.7	30.3	56.0	Compliance
1.239175	33.5	9.000	N	19.6	22.5	56.0	Compliance
1.650866	27.1	9.000	N	19.7	28.9	56.0	Compliance

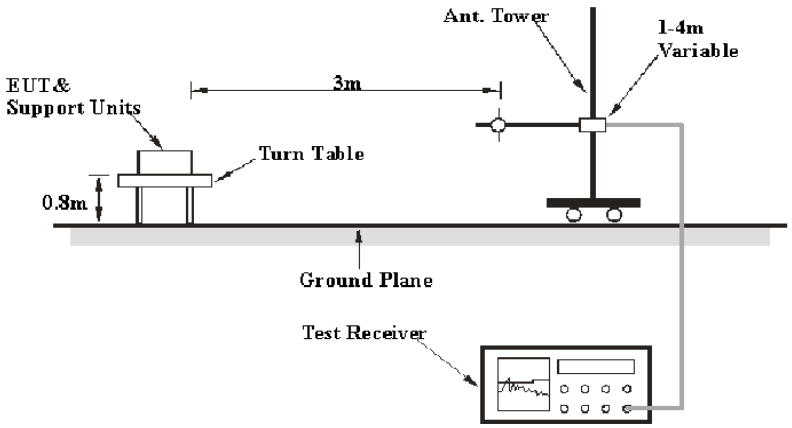
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

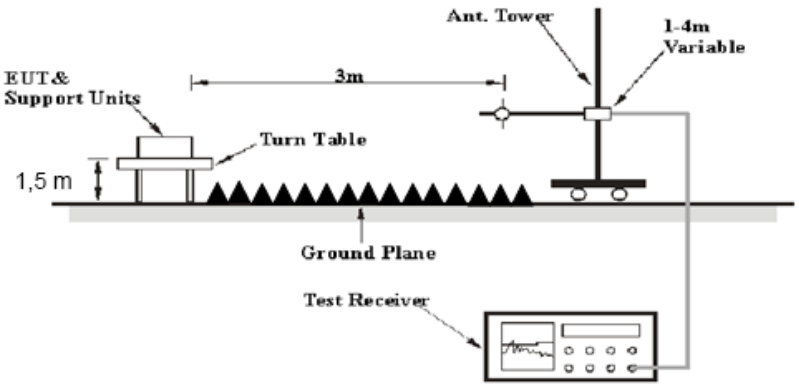
FCC §15.247 (d); §15.209; §15.205;

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
Agilent	Amplifier	8447D	2944A10442	2016-12-02	2017-12-01
Rohde & Schwarz	EMI Test Receiver	ESCI	100028	2016-12-02	2017-12-01
Sunol Sciences	Broadband Antenna	JB3	A121808	2016-04-10	2019-04-09
Rohde & Schwarz	Spectrum Analyzer	FSEM30	100018	2016-12-02	2017-12-01
ETS	Horn Antenna	3115	003-6076	2016-12-02	2017-12-01
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-0113024	2014-06-16	2017-06-15
Mini-circuits	Amplifier	ZVA-183-S+	771001215	2016-05-20	2017-05-19
HP	Amplifier	8449B	3008A00277	2016-12-02	2017-12-01
EMCT	Semi-Anechoic Chamber	966	966-1	2015-04-24	2018-04-23
Unknown	RF Cable (below 1GHz)	Unknown	NO.1	2016-11-10	2017-11-09
Unknown	RF Cable (below 1GHz)	Unknown	NO.4	2016-11-10	2017-11-09
Unknown	RF Cable (above 1GHz)	Unknown	NO.2	2016-11-10	2017-11-09

*** Statement of Traceability:** BACL(Chengdu) attests that all of the calibrations on the equipment items listed above were traceable to NIM or to another internationally recognized National Metrology Institute (NMI), and were compliant with the NIST HB 150-2016 Normative Annex B “Implementation of traceability policy in accredited laboratories”.

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 Data

Environmental Conditions

Temperature:	28.9 °C
Relative Humidity:	52.6 %
ATM Pressure:	100.5kPa

** The testing was performed by Tom Tang on 2017-05-02.*

Test Mode: Transmitting

30 MHz-25GHz:

BDR Mode (GFSK):

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	FCC 15.247	
	Reading (dBμV)	Detector	Polar (H/V)	Factor (dB)				Limit (dBμV/m)	Margin (dB)
Low Channel: 2402 MHz									
2402	70.76	PK	H	23.53	3.00	0.00	97.29	N/A	N/A
2402	69.81	AV	H	23.53	3.00	0.00	96.34	N/A	N/A
2402	75.25	PK	V	23.53	3.00	0.00	101.78	N/A	N/A
2402	74.54	AV	V	23.53	3.00	0.00	101.07	N/A	N/A
2390	28.57	PK	V	23.57	3.00	0.00	55.14	74	18.86
2390	14.22	AV	V	23.57	3.00	0.00	40.79	54	13.21
4804	34.64	PK	V	30.77	5.12	26.87	43.66	74	30.34
4804	23.65	AV	V	30.77	5.12	26.87	32.67	54	21.33
7206	32.61	PK	V	34.71	6.16	26.35	47.13	74	26.87
7206	22.77	AV	V	34.71	6.16	26.35	37.29	54	16.71
1425	31.16	PK	V	23.91	2.57	26.40	31.24	74	42.76
1425	20.65	AV	V	23.91	2.57	26.40	20.73	54	33.27
215.27	43.92	QP	H	11.46	0.97	27.70	28.65	43.50	14.85
239.52	44.24	QP	H	12.28	1.07	27.55	30.04	46.00	15.96
Middle Channel: 2441 MHz									
2441	72.67	PK	H	23.40	3.00	0.00	99.07	N/A	N/A
2441	70.89	AV	H	23.40	3.00	0.00	97.29	N/A	N/A
2441	76.25	PK	V	23.40	3.00	0.00	102.65	N/A	N/A
2441	75.81	AV	V	23.40	3.00	0.00	102.21	N/A	N/A
4882	34.14	PK	V	31.02	5.09	26.87	43.38	74	30.62
4882	24.88	AV	V	31.02	5.09	26.87	34.12	54	19.88
7323	32.72	PK	V	34.95	6.22	26.40	47.49	74	26.51
7323	23.24	AV	V	34.95	6.22	26.40	38.01	54	15.99
1468	31.08	PK	V	24.02	2.63	26.36	31.37	74	42.63
1468	20.77	AV	V	24.02	2.63	26.36	21.06	54	32.94
2119	31.66	PK	V	24.50	3.04	26.84	32.36	74	41.64
2119	21.10	AV	V	24.50	3.04	26.84	21.8	54	32.2
215.27	44.19	QP	H	11.46	0.97	27.70	28.92	43.50	14.58
239.52	44.38	QP	H	12.28	1.07	27.55	30.18	46.00	15.82
High Channel: 2480 MHz									
2480	72.41	PK	H	23.27	2.99	0.00	98.67	N/A	N/A
2480	71.18	AV	H	23.27	2.99	0.00	97.44	N/A	N/A
2480	76.25	PK	V	23.27	2.99	0.00	102.51	N/A	N/A
2480	75.60	AV	V	23.27	2.99	0.00	101.86	N/A	N/A
2483.5	30.39	PK	V	23.26	2.99	0.00	56.64	74	17.36
2483.5	15.87	AV	V	23.26	2.99	0.00	42.12	54	11.88
4960	35.03	PK	V	31.27	5.05	26.88	44.47	74	29.53
4960	23.57	AV	V	31.27	5.05	26.88	33.01	54	20.99
7440	34.41	PK	V	35.18	6.27	26.45	49.41	74	24.59
7440	23.98	AV	V	35.18	6.27	26.45	38.98	54	15.02
1503	31.84	PK	V	24.10	2.67	26.33	32.28	74	41.72
1503	22.10	AV	V	24.10	2.67	26.33	22.54	54	31.46
215.27	45.03	QP	H	11.46	0.97	27.70	29.76	43.50	13.74
239.52	44.8	QP	H	12.28	1.07	27.55	30.60	46.00	15.40

EDR Mode (π/4-DQPSK):

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	FCC 15.247	
	Reading (dBμV)	Detector	Polar (H/V)	Factor (dB)				Limit (dBμV/m)	Margin (dB)
Low Channel: 2402 MHz									
2402	70.56	PK	H	23.53	3.00	0.00	97.09	N/A	N/A
2402	67.97	AV	H	23.53	3.00	0.00	94.5	N/A	N/A
2402	73.72	PK	V	23.53	3.00	0.00	100.25	N/A	N/A
2402	70.55	AV	V	23.53	3.00	0.00	97.08	N/A	N/A
2390	28.29	PK	V	23.57	3.00	0.00	54.86	74	19.14
2390	15.42	AV	V	23.57	3.00	0.00	41.99	54	12.01
4804	34.49	PK	V	30.77	5.12	26.87	43.51	74	30.49
4804	24.11	AV	V	30.77	5.12	26.87	33.13	54	20.87
7206	32.68	PK	V	34.71	6.16	26.35	47.2	74	26.8
7206	22.84	AV	V	34.71	6.16	26.35	37.36	54	16.64
1425	31.44	PK	V	23.91	2.57	26.40	31.52	74	42.48
1425	20.13	AV	V	23.91	2.57	26.40	20.21	54	33.79
215.27	44.56	QP	H	11.46	0.97	27.70	29.29	43.50	14.21
239.52	45.24	QP	H	12.28	1.07	27.55	31.04	46.00	14.96
Middle Channel: 2441 MHz									
2441	71.00	PK	H	23.40	3.00	0.00	97.4	N/A	N/A
2441	68.13	AV	H	23.40	3.00	0.00	94.53	N/A	N/A
2441	73.81	PK	V	23.40	3.00	0.00	100.21	N/A	N/A
2441	71.28	AV	V	23.40	3.00	0.00	97.68	N/A	N/A
4882	34.36	PK	V	31.02	5.09	26.87	43.6	74	30.4
4882	24.08	AV	V	31.02	5.09	26.87	33.32	54	20.68
7323	32.89	PK	V	34.95	6.22	26.40	47.66	74	26.34
7323	23.08	AV	V	34.95	6.22	26.40	37.85	54	16.15
1468	31.27	PK	V	24.02	2.63	26.36	31.56	74	42.44
1468	20.19	AV	V	24.02	2.63	26.36	20.48	54	33.52
2119	32.15	PK	V	24.50	3.04	26.84	32.85	74	41.15
2119	20.49	AV	V	24.50	3.04	26.84	21.19	54	32.81
215.27	44.09	QP	H	11.46	0.97	27.70	28.82	43.50	14.68
239.52	45.68	QP	H	12.28	1.07	27.55	31.48	46.00	14.52
High Channel: 2480 MHz									
2480	72.10	PK	H	23.27	2.99	0.00	98.36	N/A	N/A
2480	68.65	AV	H	23.27	2.99	0.00	94.91	N/A	N/A
2480	73.61	PK	V	23.27	2.99	0.00	99.87	N/A	N/A
2480	70.33	AV	V	23.27	2.99	0.00	96.59	N/A	N/A
2483.5	29.84	PK	V	23.26	2.99	0.00	56.09	74	17.91
2483.5	15.39	AV	V	23.26	2.99	0.00	41.64	54	12.36
4960	34.43	PK	V	31.27	5.05	26.88	43.87	74	30.13
4960	23.97	AV	V	31.27	5.05	26.88	33.41	54	20.59
7440	33.67	PK	V	35.18	6.27	26.45	48.67	74	25.33
7440	23.23	AV	V	35.18	6.27	26.45	38.23	54	15.77
1503	31.76	PK	V	24.10	2.67	26.33	32.2	74	41.8
1503	20.03	AV	V	24.10	2.67	26.33	20.47	54	33.53
215.27	44.25	QP	H	11.46	0.97	27.70	28.98	43.50	14.52
239.52	45.07	QP	H	12.28	1.07	27.55	30.87	46.00	15.13

EDR Mode (8-DPSK):

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	FCC 15.247	
	Reading (dBμV)	Detector	Polar (H/V)	Factor (dB)				Limit (dBμV/m)	Margin (dB)
Low Channel: 2402 MHz									
2402	70.28	PK	H	23.53	3.00	0.00	96.81	N/A	N/A
2402	67.10	AV	H	23.53	3.00	0.00	93.63	N/A	N/A
2402	73.12	PK	V	23.53	3.00	0.00	99.65	N/A	N/A
2402	69.75	AV	V	23.53	3.00	0.00	96.28	N/A	N/A
2390	28.90	PK	V	23.57	3.00	0.00	55.47	74	18.53
2390	15.39	AV	V	23.57	3.00	0.00	41.96	54	12.04
4804	34.76	PK	V	30.77	5.12	26.87	43.78	74	30.22
4804	24.39	AV	V	30.77	5.12	26.87	33.41	54	20.59
7206	33.30	PK	V	34.71	6.16	26.35	47.82	74	26.18
7206	23.04	AV	V	34.71	6.16	26.35	37.56	54	16.44
1425	31.20	PK	V	23.91	2.57	26.40	31.28	74	42.72
1425	20.27	AV	V	23.91	2.57	26.40	20.35	54	33.65
215.27	44.52	QP	H	11.46	0.97	27.70	29.25	43.50	14.25
239.52	45.21	QP	H	12.28	1.07	27.55	31.01	46.00	14.99
Middle Channel: 2441 MHz									
2441	70.74	PK	H	23.40	3.00	0.00	97.14	N/A	N/A
2441	67.83	AV	H	23.40	3.00	0.00	94.23	N/A	N/A
2441	73.62	PK	V	23.40	3.00	0.00	100.02	N/A	N/A
2441	70.88	AV	V	23.40	3.00	0.00	97.28	N/A	N/A
4882	34.33	PK	V	31.02	5.09	26.87	43.57	74	30.43
4882	23.86	AV	V	31.02	5.09	26.87	33.1	54	20.9
7323	33.19	PK	V	34.95	6.22	26.40	47.96	74	26.04
7323	22.72	AV	V	34.95	6.22	26.40	37.49	54	16.51
1468	30.88	PK	V	24.02	2.63	26.36	31.17	74	42.83
1468	19.96	AV	V	24.02	2.63	26.36	20.25	54	33.75
2119	32.21	PK	V	24.50	3.04	26.84	32.91	74	41.09
2119	21.62	AV	V	24.50	3.04	26.84	22.32	54	31.68
215.27	45.36	QP	H	11.46	0.97	27.70	30.09	43.50	13.41
239.52	45.63	QP	H	12.28	1.07	27.55	31.43	46.00	14.57
High Channel: 2480 MHz									
2480	70.70	PK	H	23.27	2.99	0.00	96.96	N/A	N/A
2480	67.37	AV	H	23.27	2.99	0.00	93.63	N/A	N/A
2480	73.33	PK	V	23.27	2.99	0.00	99.59	N/A	N/A
2480	70.41	AV	V	23.27	2.99	0.00	96.67	N/A	N/A
2483.5	29.73	PK	V	23.26	2.99	0.00	55.98	74	18.02
2483.5	16.10	AV	V	23.26	2.99	0.00	42.35	54	11.65
4960	34.46	PK	V	31.27	5.05	26.88	43.9	74	30.1
4960	24.38	AV	V	31.27	5.05	26.88	33.82	54	20.18
7440	33.91	PK	V	35.18	6.27	26.45	48.91	74	25.09
7440	23.29	AV	V	35.18	6.27	26.45	38.29	54	15.71
1503	31.40	PK	V	24.10	2.67	26.33	31.84	74	42.16
1503	20.46	AV	V	24.10	2.67	26.33	20.9	54	33.1
215.27	44.89	QP	H	11.46	0.97	27.70	29.62	43.50	13.88
239.52	46.07	QP	H	12.28	1.07	27.55	31.87	46.00	14.13

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
Rohde & Schwarz	EMI Test Receiver	ESCI	100028	2016-12-02	2017-12-01
Unknown	RF Cable	Unknown	NO.3	Each Time	/

*** Statement of Traceability:** BACL(Chengdu) attests that all of the calibrations on the equipment items listed above were traceable to NIM or to another internationally recognized National Metrology Institute (NMI), and were compliant with the NIST HB 150-2016 Normative Annex B “Implementation of traceability policy in accredited laboratories”.

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:	22.6 °C
Relative Humidity:	50.1%
ATM Pressure:	100.4kPa

** The testing was performed by Tom Tang on 2017-04-22.*

Test Result: Compliance.

Please refer to following tables and plots

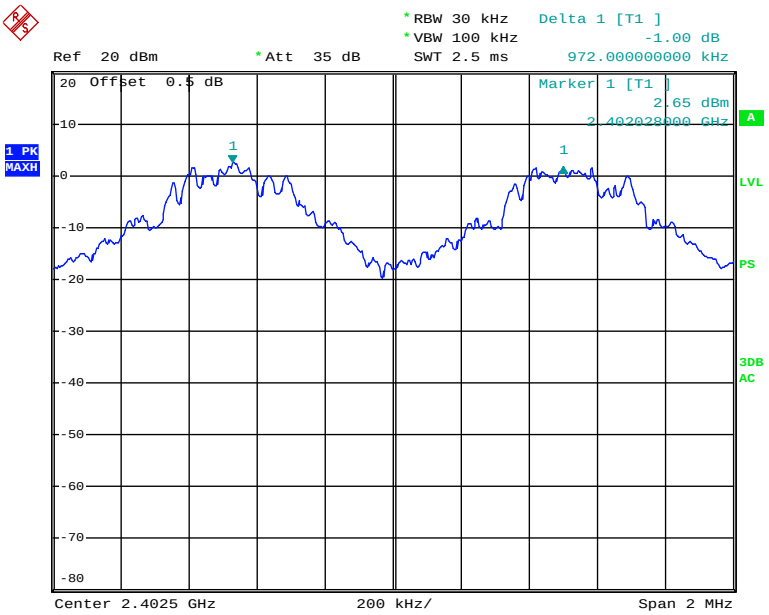
Test Mode: Transmitting

Mode	Channel	Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)
BDR (GFSK)	Low	2402	0.972	0.69
	Middle	2441	1.012	0.69
	High	2480	1.000	0.69
EDR (π/4-DQPSK)	Low	2402	1.016	0.93
	Middle	2441	1.000	0.93
	High	2480	1.000	0.94
EDR (8DPSK)	Low	2402	1.000	0.93
	Middle	2441	1.004	0.93
	High	2480	1.000	0.93

Note: Limit= (2/3)× 20dB bandwidth

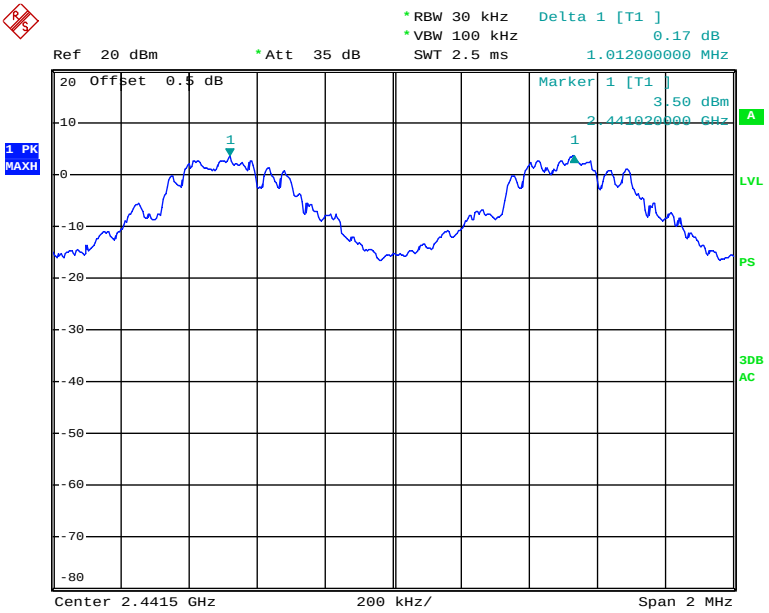
BDR Mode (GFSK):

Low Channel



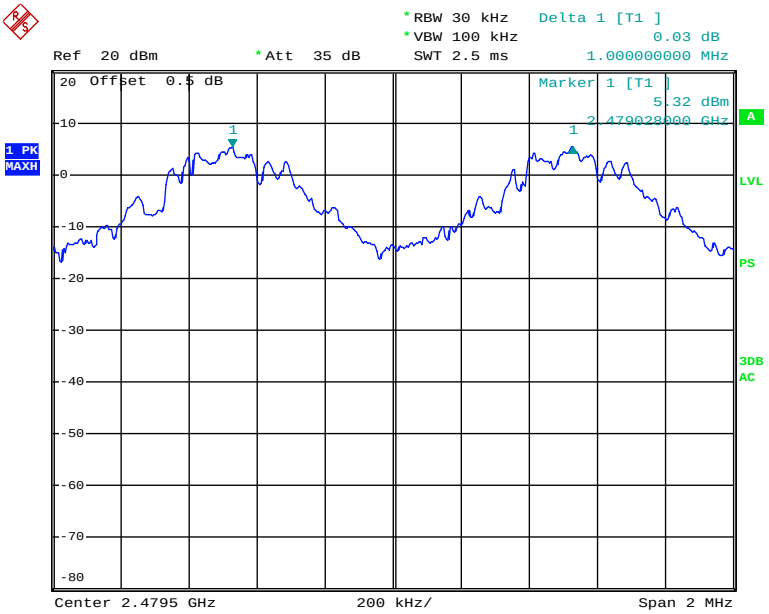
Date: 22.APR.2017 13:27:20

Middle Channel



Date: 22.APR.2017 13:31:34

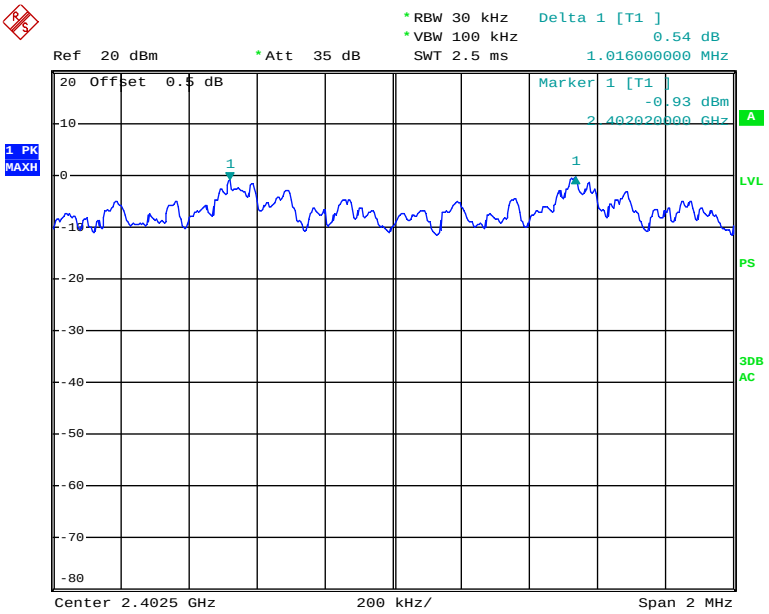
High Channel



Date: 22.APR.2017 13:34:47

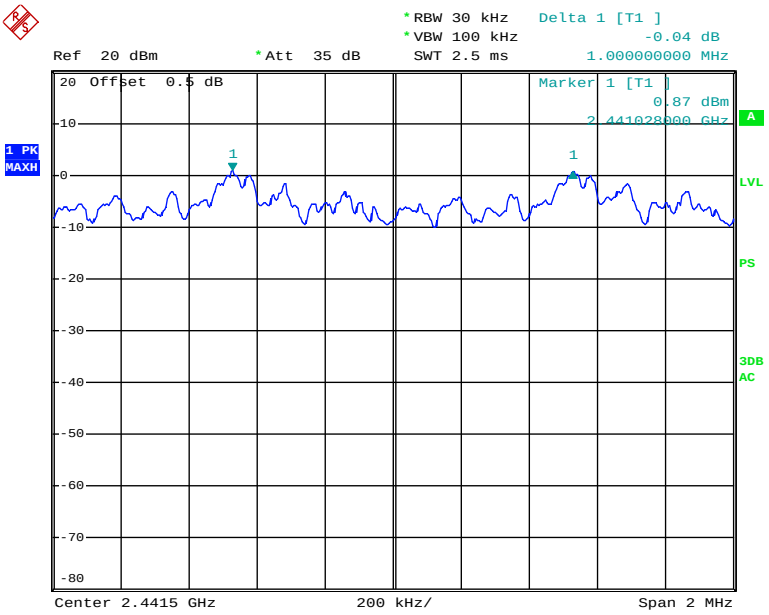
EDR Mode (π/4-DQPSK):

Low Channel



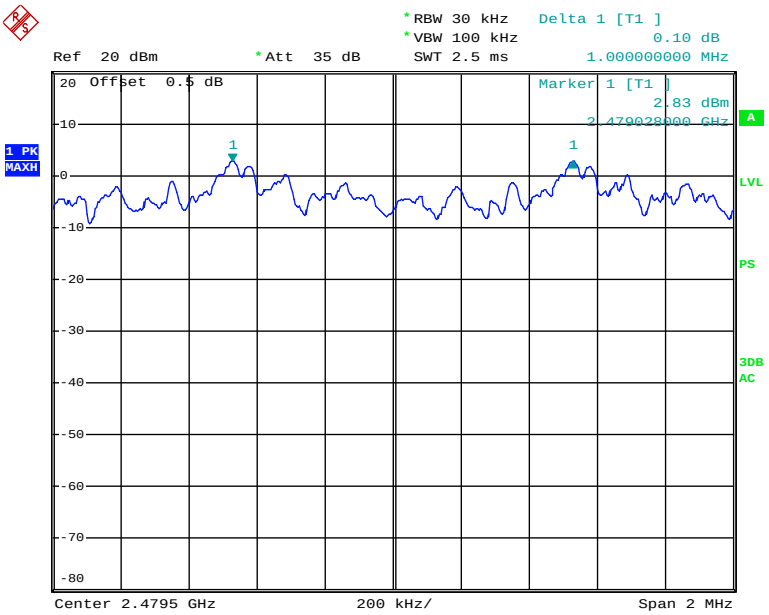
Date: 22.APR.2017 13:40:45

Middle Channel



Date: 22.APR.2017 13:45:22

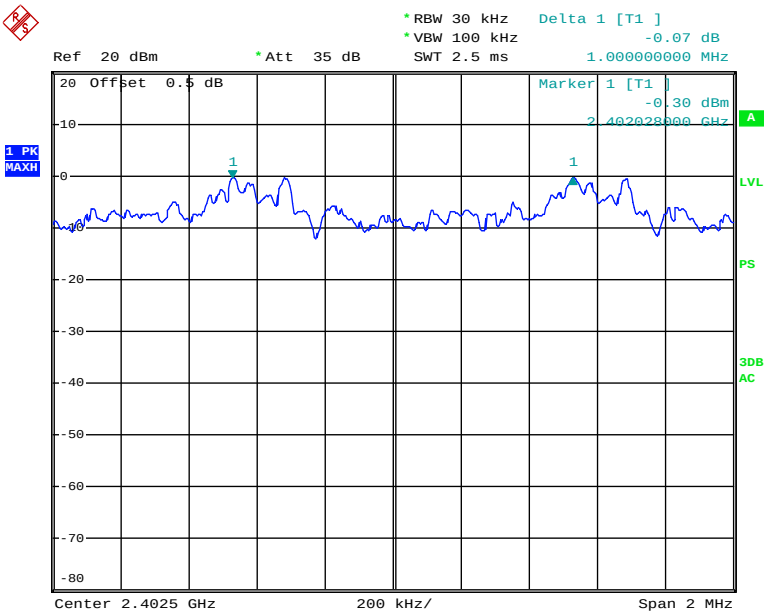
High Channel



Date: 22.APR.2017 13:49:38

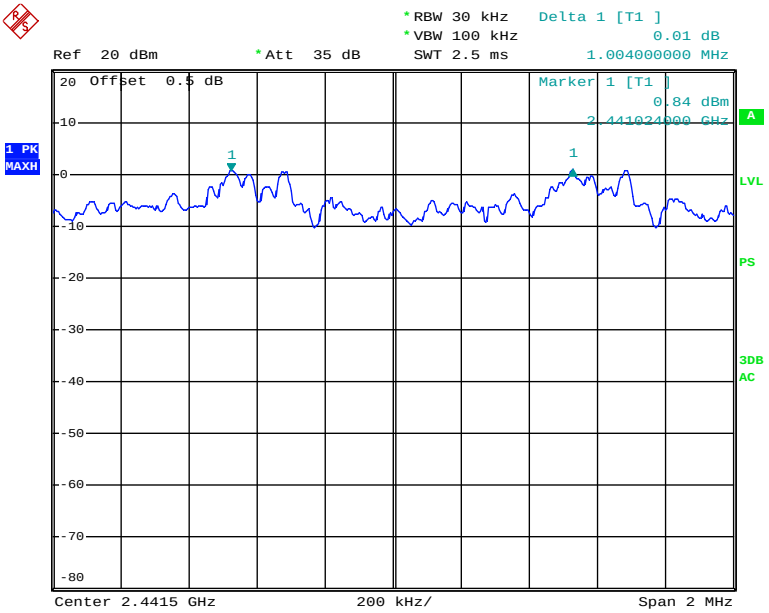
EDR Mode (8-DPSK):

Low Channel



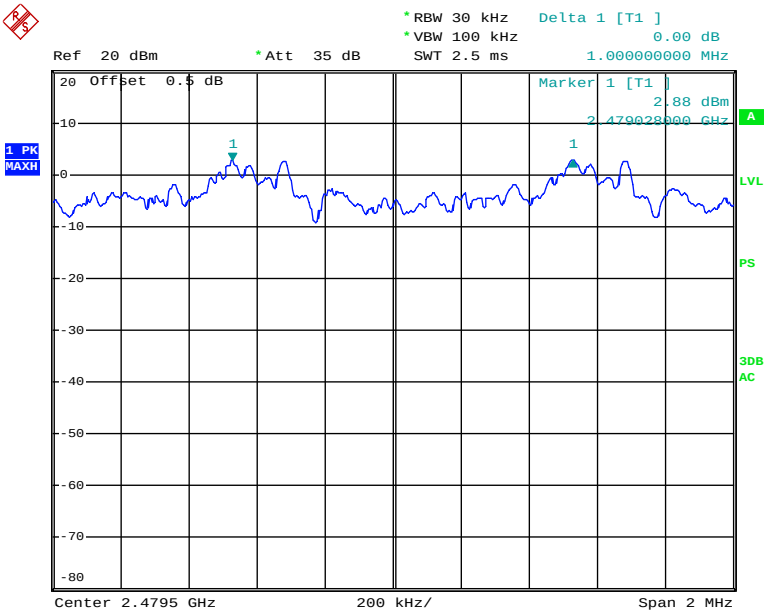
Date: 22.APR.2017 13:54:55

Middle Channel



Date: 22.APR.2017 13:59:34

High Channel



Date: 22.APR.2017 14:03:10

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

Applicable Standard

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

Test Procedure

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	100028	2016-12-02	2017-12-01
Unknown	RF Cable	Unknown	NO.3	Each Time	/

*** Statement of Traceability:** BACL(Chengdu) attests that all of the calibrations on the equipment items listed above were traceable to NIM or to another internationally recognized National Metrology Institute (NMI), and were compliant with the NIST HB 150-2016 Normative Annex B “Implementation of traceability policy in accredited laboratories”.

Test Data

Environmental Conditions

Temperature:	22.6 °C
Relative Humidity:	50.1%
ATM Pressure:	100.4kPa

** The testing was performed by Tom Tang on 2017-04-22.*

Test Result: Compliance.

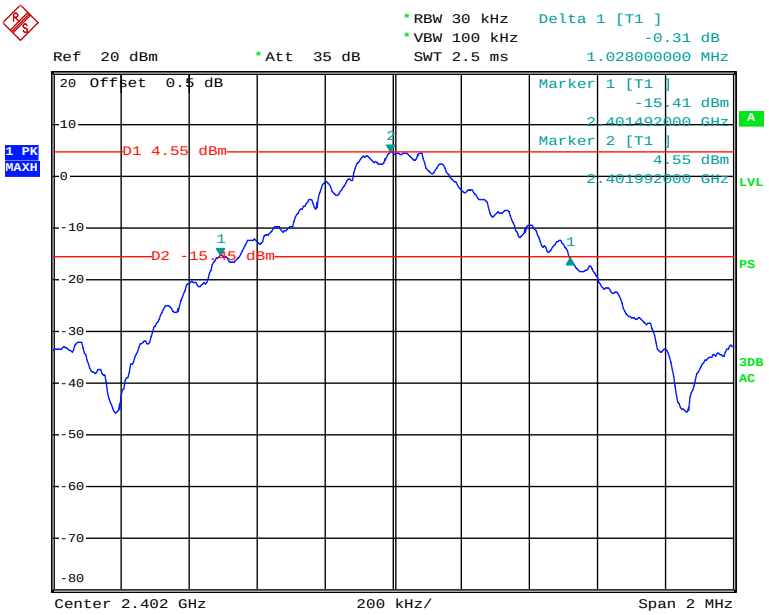
Please refer to following tables and plots

Test Mode: Transmitting

Mode	Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
BDR Mode (GFSK)	Low	2402	1.03
	Middle	2441	1.03
	High	2480	1.03
EDR Mode (π/4-DQPSK)	Low	2402	1.40
	Middle	2441	1.40
	High	2480	1.41
EDR Mode (8-DPSK)	Low	2402	1.39
	Middle	2441	1.39
	High	2480	1.40

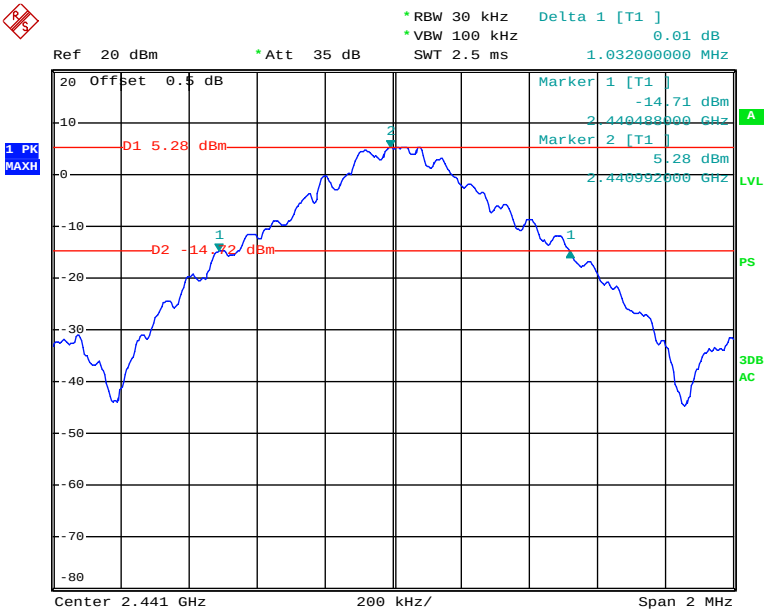
BDR Mode (GFSK):

Low Channel



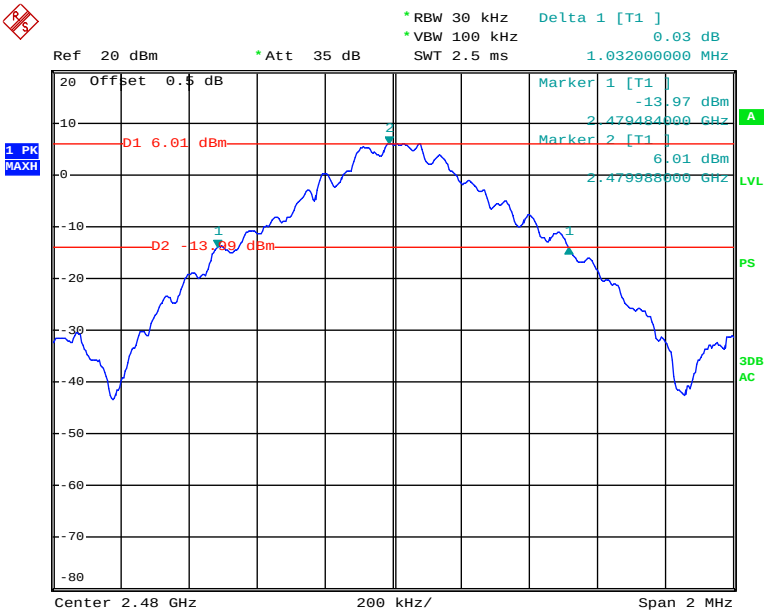
Date: 22.APR.2017 12:11:03

Middle Channel



Date: 22.APR.2017 12:13:54

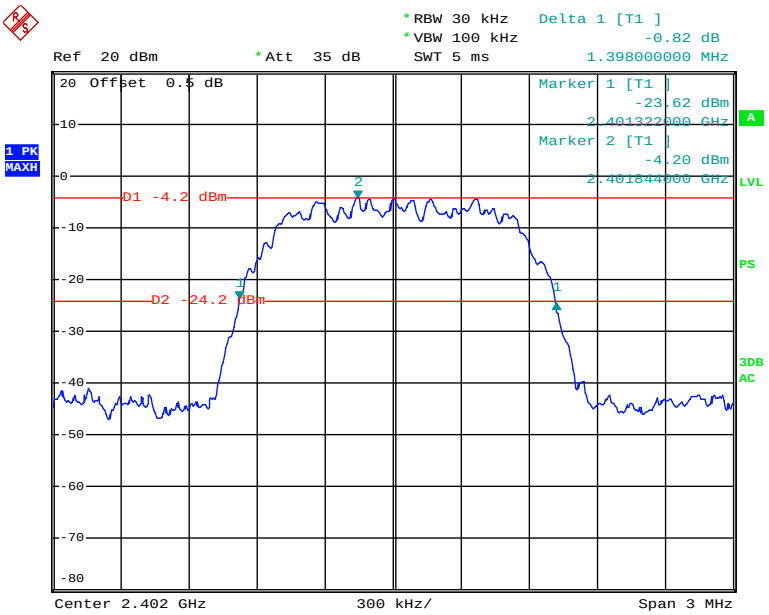
High Channel



Date: 22.APR.2017 12:15:25

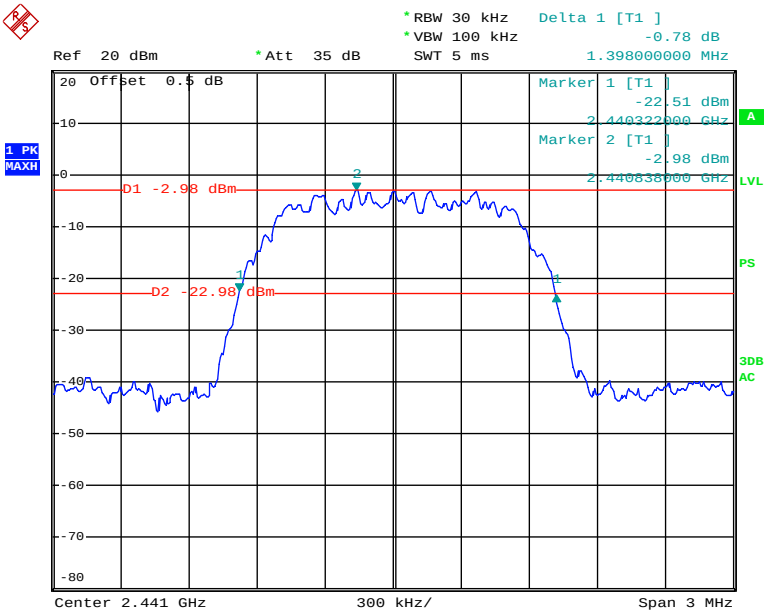
EDR Mode (π/4-DQPSK):

Low Channel



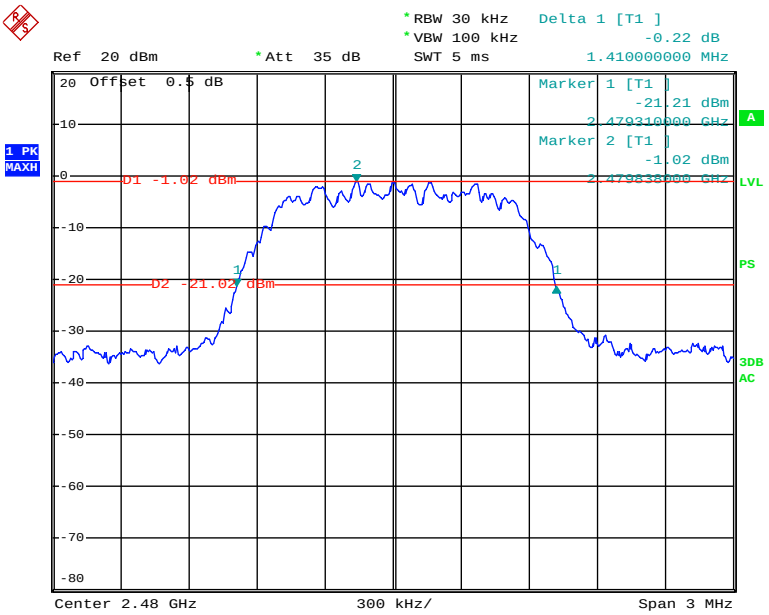
Date: 22.APR.2017 12:17:19

Middle Channel



Date: 22.APR.2017 12:19:31

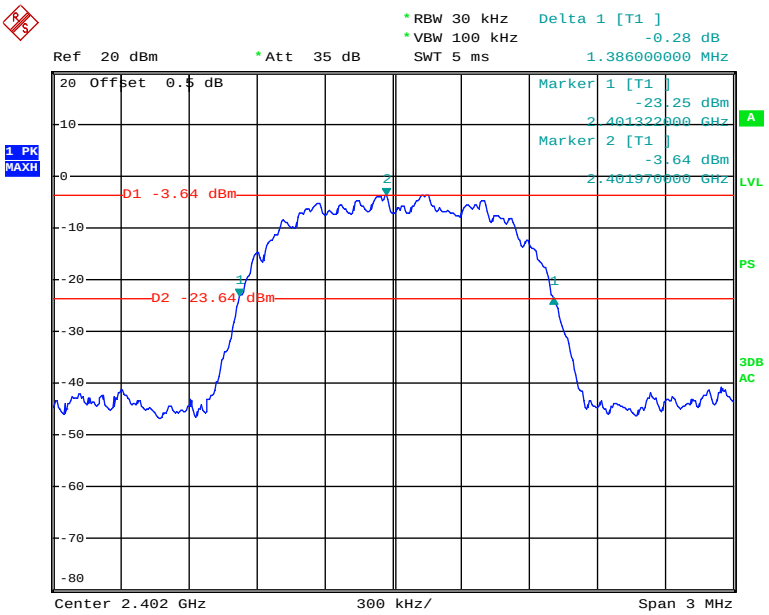
High Channel



Date: 22.APR.2017 12:20:51

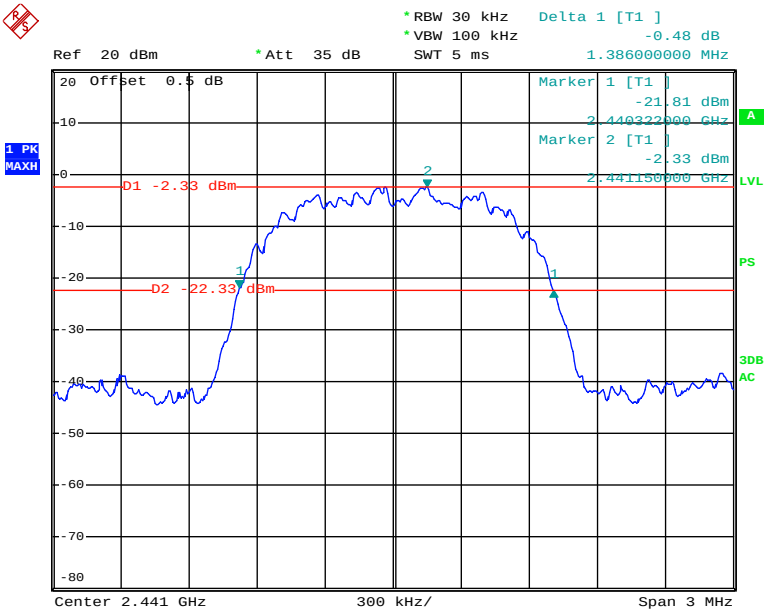
EDR Mode (8-DPSK):

Low Channel



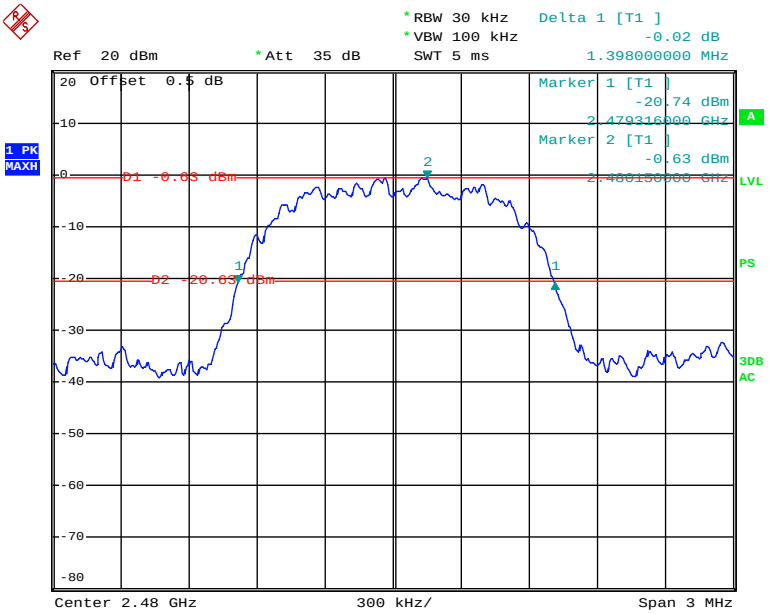
Date: 22.APR.2017 12:23:04

Middle Channel



Date: 22.APR.2017 12:24:40

High Channel



Date: 22.APR.2017 12:25:49

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

Applicable Standard

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

Test Procedure

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	100028	2016-12-02	2017-12-01
Unknown	RF Cable	Unknown	NO.3	Each Time	/

*** Statement of Traceability:** BACL(Chengdu) attests that all of the calibrations on the equipment items listed above were traceable to NIM or to another internationally recognized National Metrology Institute (NMI), and were compliant with the NIST HB 150-2016 Normative Annex B “Implementation of traceability policy in accredited laboratories”.

Test Data

Environmental Conditions

Temperature:	22.6 °C
Relative Humidity:	50.1%
ATM Pressure:	100.4kPa

** The testing was performed by Tom Tang on 2017-04-22.*

Test Result: Compliance.

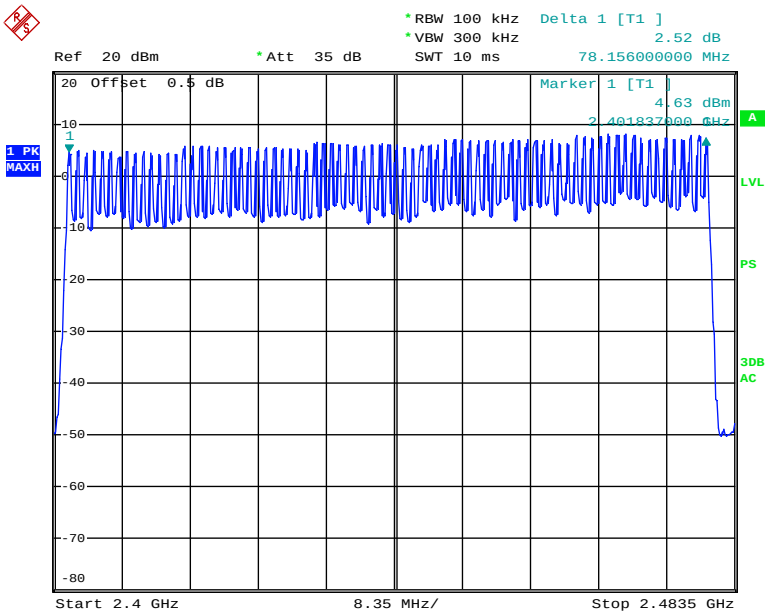
Please refer to following tables and plots

Test Mode: Transmitting

BDR Mode (GFSK):

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

Number of Hopping Channels

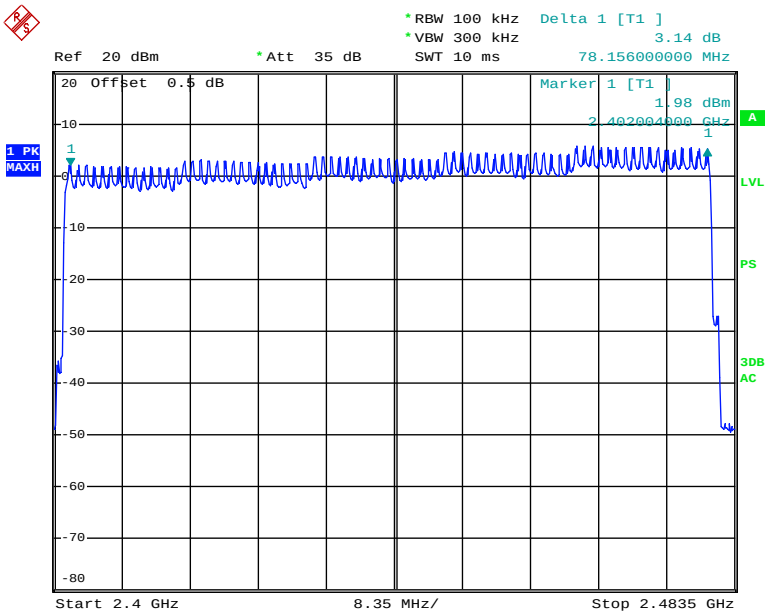


Date: 22.APR.2017 12:36:04

EDR Mode (π/4-DQPSK):

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

Number of Hopping Channels

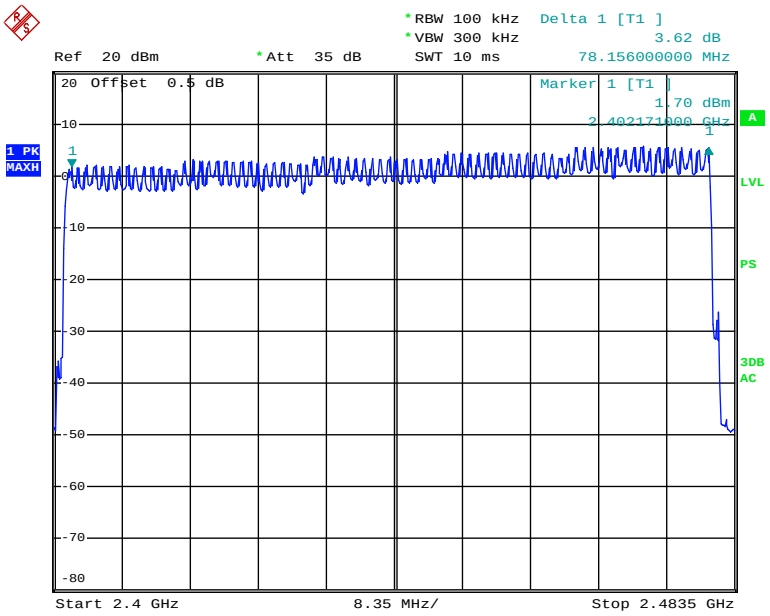


Date: 22.APR.2017 12:48:57

EDR Mode (8-DPSK):

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

Number of Hopping Channels



Date: 22.APR.2017 12:55:56

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. the time of single pulses was tested.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	100028	2016-12-02	2017-12-01
Unknown	RF Cable	Unknown	NO.3	Each Time	/

*** Statement of Traceability:** BACL(Chengdu) attests that all of the calibrations on the equipment items listed above were traceable to NIM or to another internationally recognized National Metrology Institute (NMI), and were compliant with the NIST HB 150-2016 Normative Annex B “Implementation of traceability policy in accredited laboratories”.

Test Data

Environmental Conditions

Temperature:	22.6 °C
Relative Humidity:	50.1%
ATM Pressure:	100.4kPa

** The testing was performed by Tom Tang on 2017-04-22.*

Test Result: Compliance.

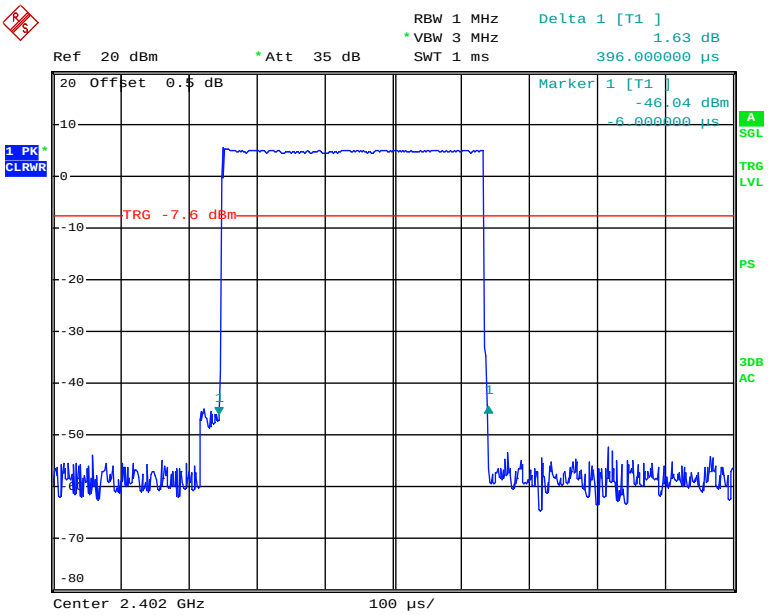
Please refer to following tables and plots

Test Mode: Transmitting

BDR Mode (GFSK):

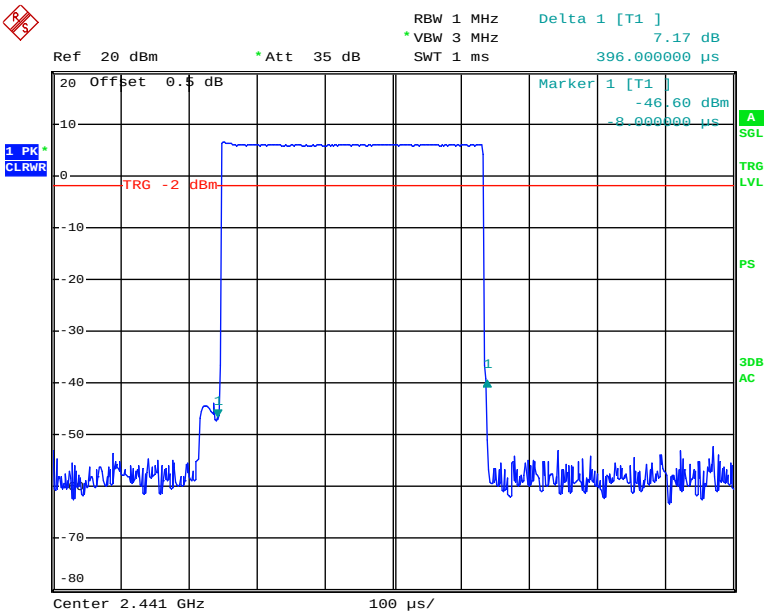
Mode	Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
DH1	Low	0.396	0.127	0.4	Compliance
	Middle	0.396	0.127	0.4	Compliance
	High	0.428	0.137	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/2/79) ×31.6 s				
DH3	Low	1.668	0.267	0.4	Compliance
	Middle	1.668	0.267	0.4	Compliance
	High	1.668	0.267	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/4/79) ×31.6 s				
DH5	Low	2.920	0.311	0.4	Compliance
	Middle	2.920	0.311	0.4	Compliance
	High	2.920	0.311	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/6/79) ×31.6 s				

DH1: Low Channel



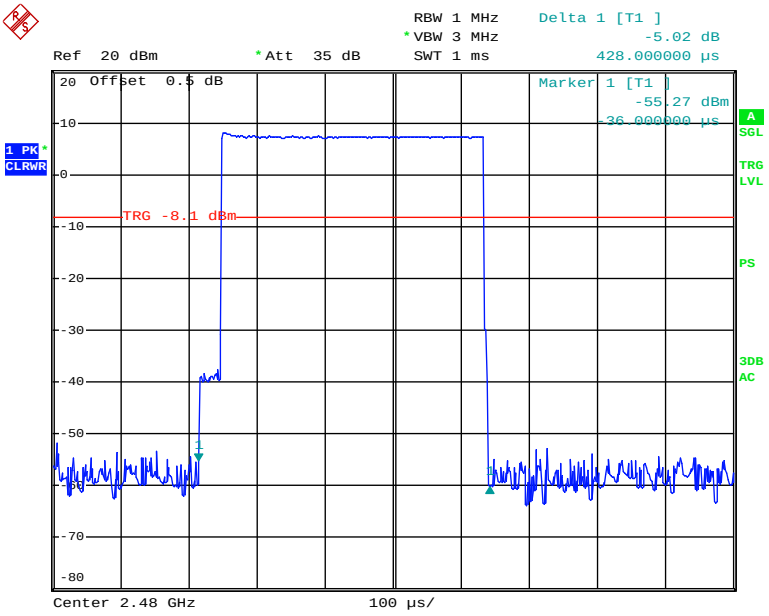
Date: 22.APR.2017 12:59:17

DH1: Middle Channel



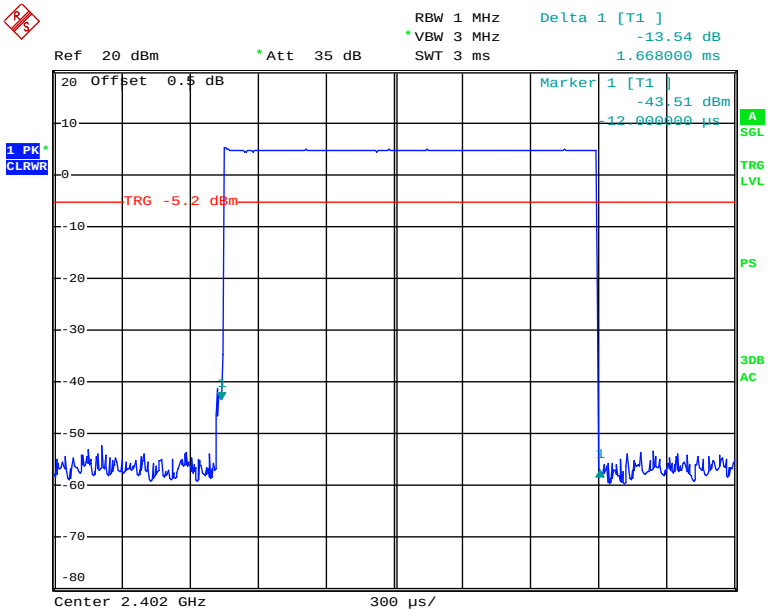
Date: 22.APR.2017 13:00:11

DH1: High Channel



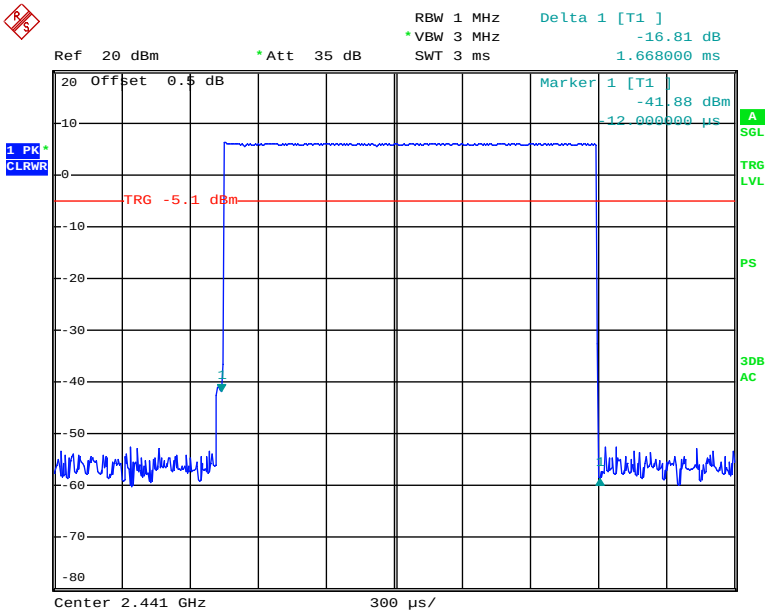
Date: 22.APR.2017 13:00:18

DH3: Low Channel



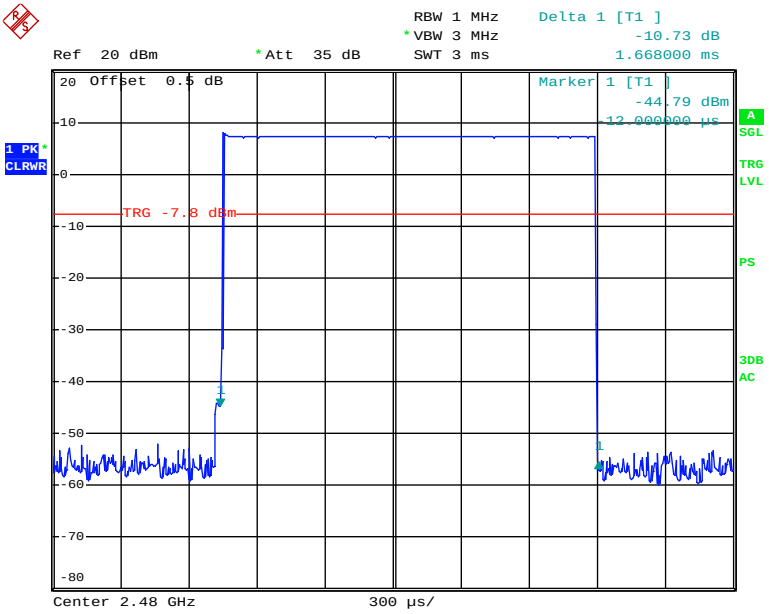
Date: 22.APR.2017 13:02:55

DH3: Middle Channel



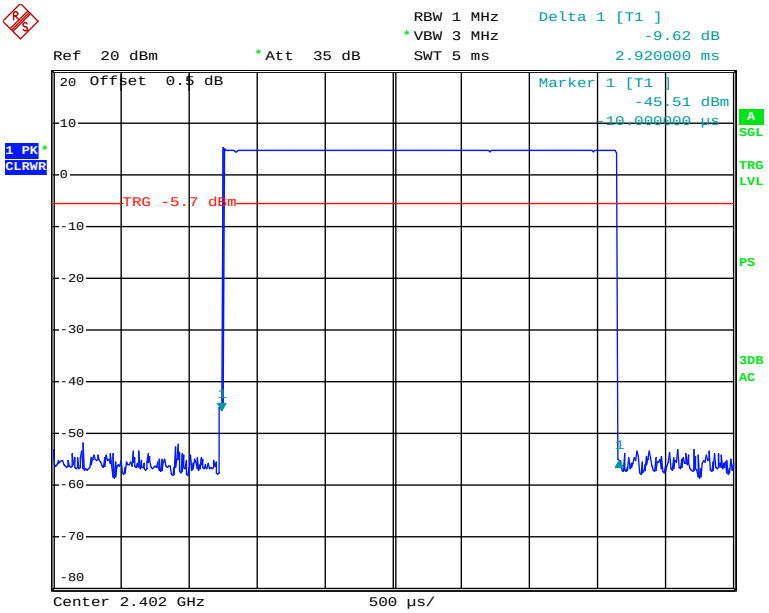
Date: 22.APR.2017 13:03:02

DH3: High Channel



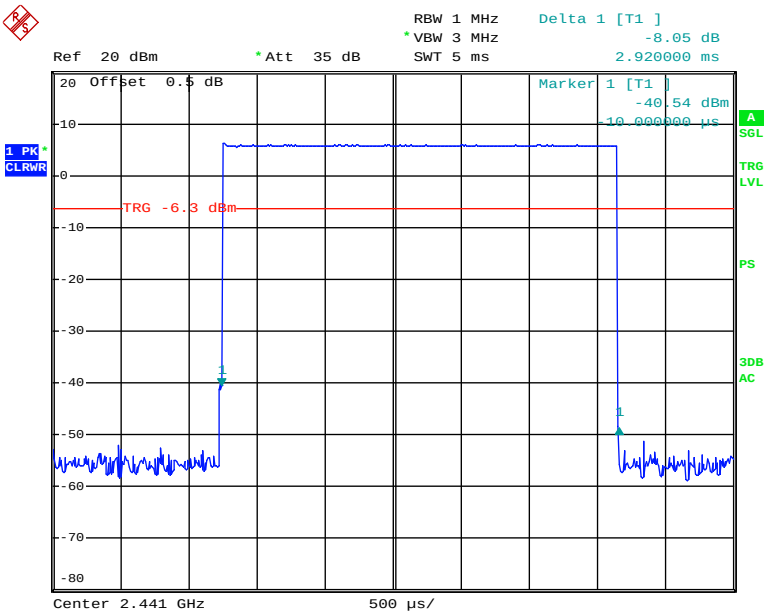
Date: 22.APR.2017 13:03:08

DH5: Low Channel



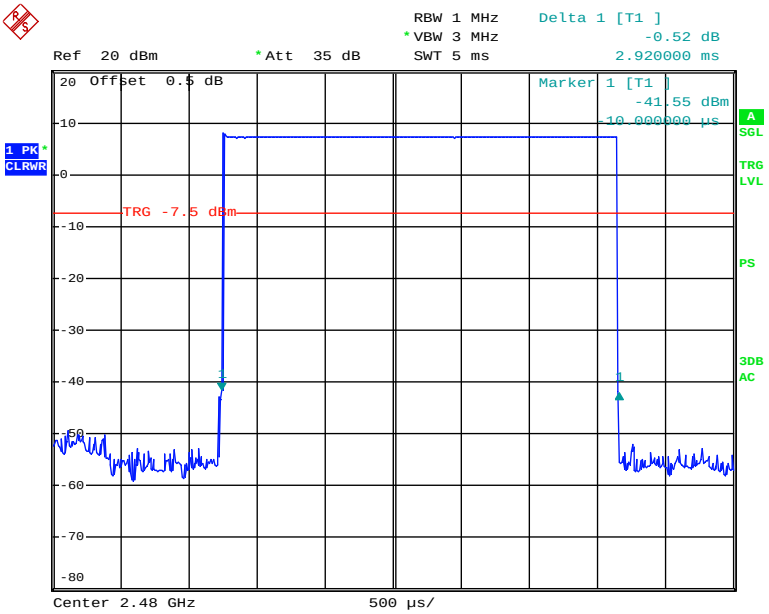
Date: 22.APR.2017 13:05:57

DH5: Middle Channel



Date: 22.APR.2017 13:06:17

DH5: High Channel

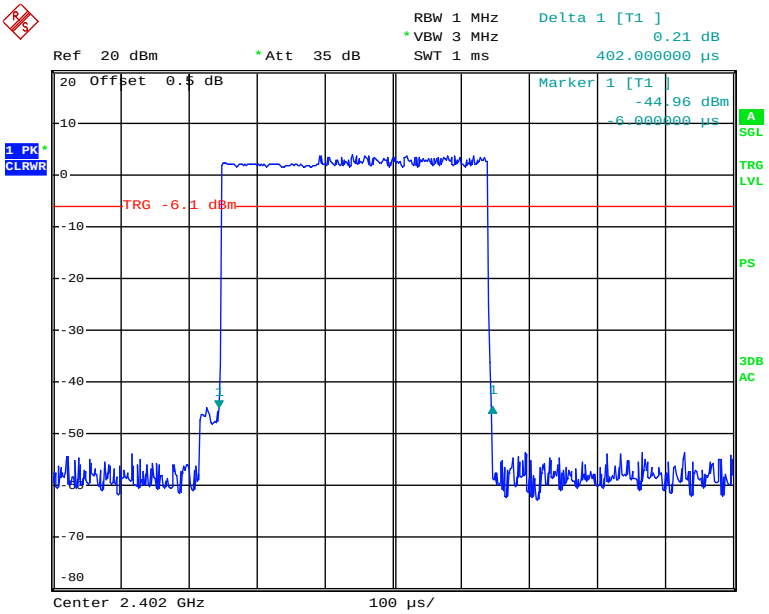


Date: 22.APR.2017 13:06:23

EDR Mode (π/4-DQPSK):

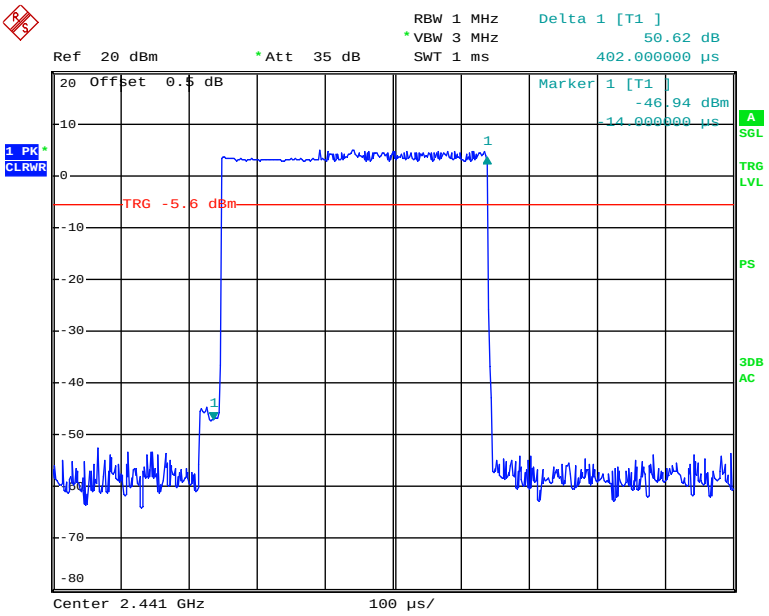
Mode	Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
2DH1	Low	0.402	0.129	0.4	Compliance
	Middle	0.402	0.129	0.4	Compliance
	High	0.402	0.129	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/2/79) ×31.6 s				
2DH3	Low	1.668	0.267	0.4	Compliance
	Middle	1.674	0.268	0.4	Compliance
	High	1.662	0.266	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/4/79) ×31.6 s				
2DH5	Low	2.920	0.311	0.4	Compliance
	Middle	2.930	0.313	0.4	Compliance
	High	2.920	0.311	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/6/79) ×31.6 s				

2DH1: Low Channel



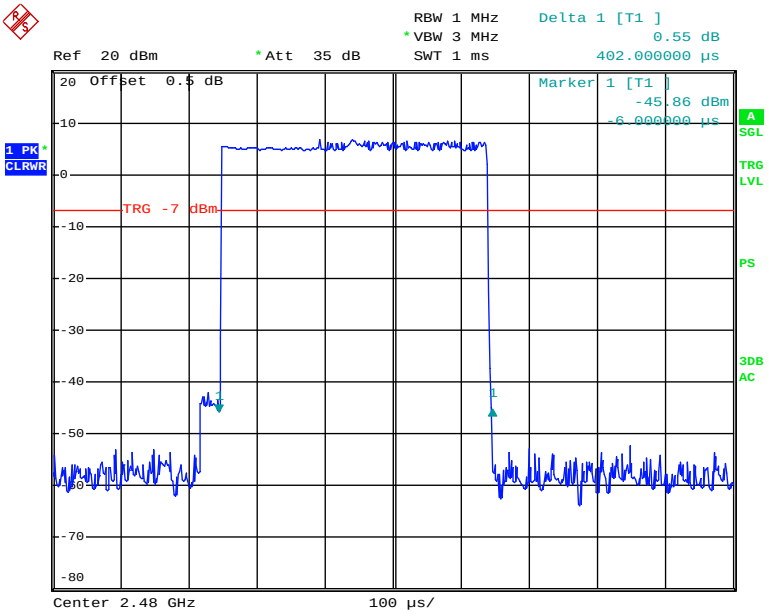
Date: 22.APR.2017 13:09:08

2DH1: Middle Channel



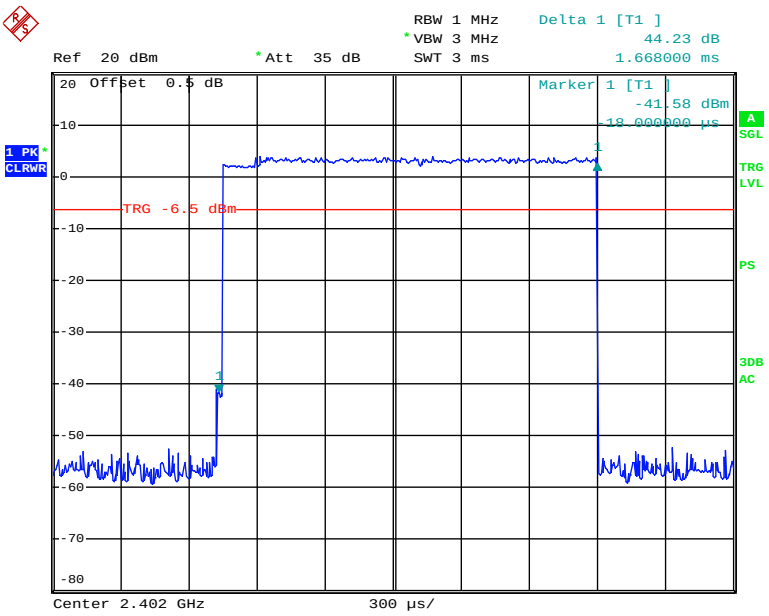
Date: 22.APR.2017 13:09:23

2DH1: High Channel



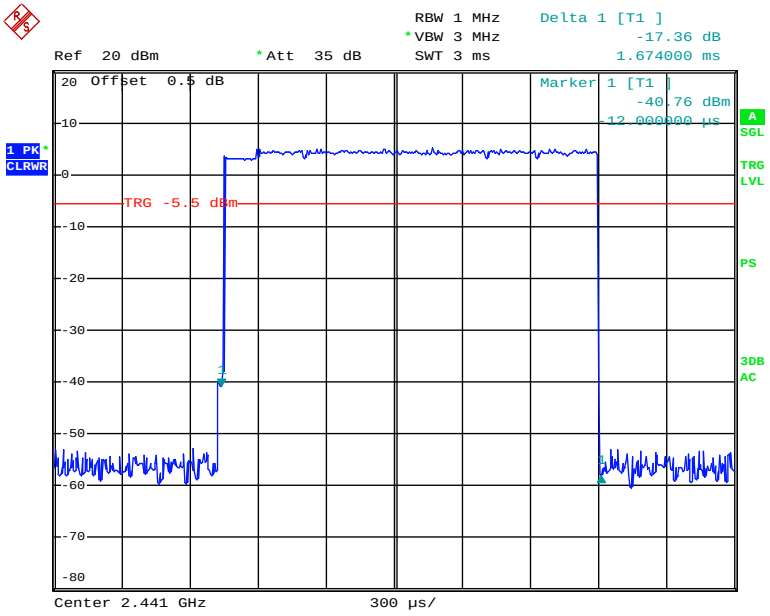
Date: 22.APR.2017 13:09:40

2DH3: Low Channel



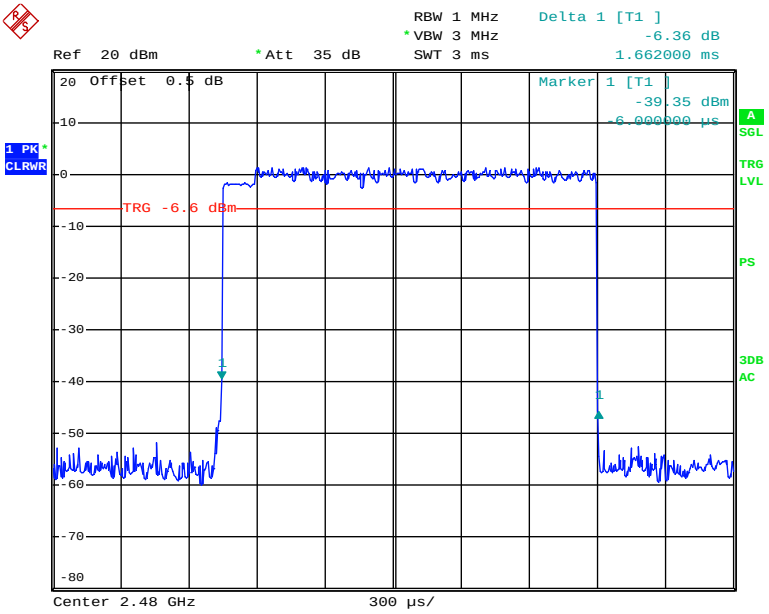
Date: 22.APR.2017 13:12:45

2DH3: Middle Channel



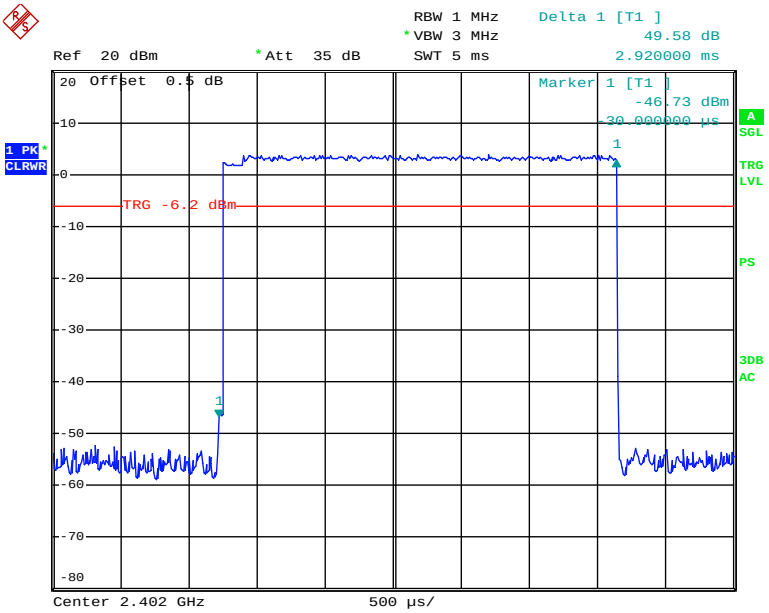
Date: 22.APR.2017 13:12:52

2DH3: High Channel



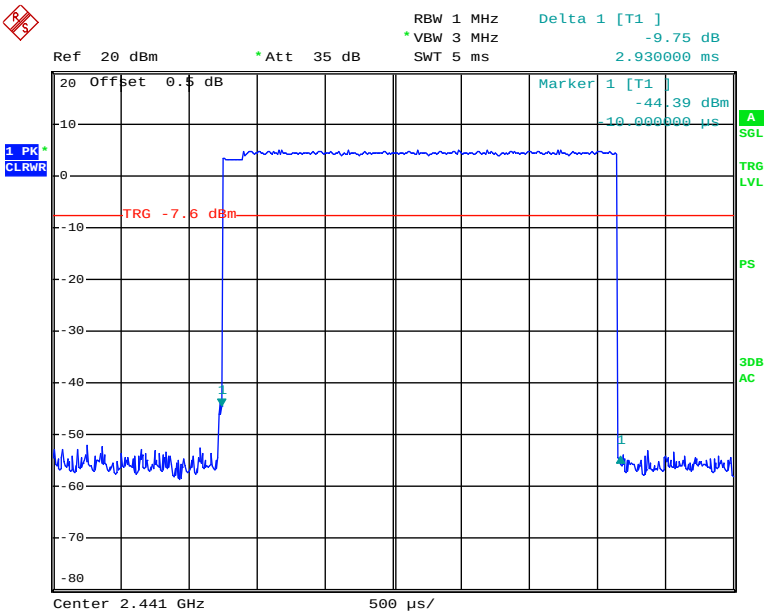
Date: 22.APR.2017 13:12:58

2DH5: Low Channel



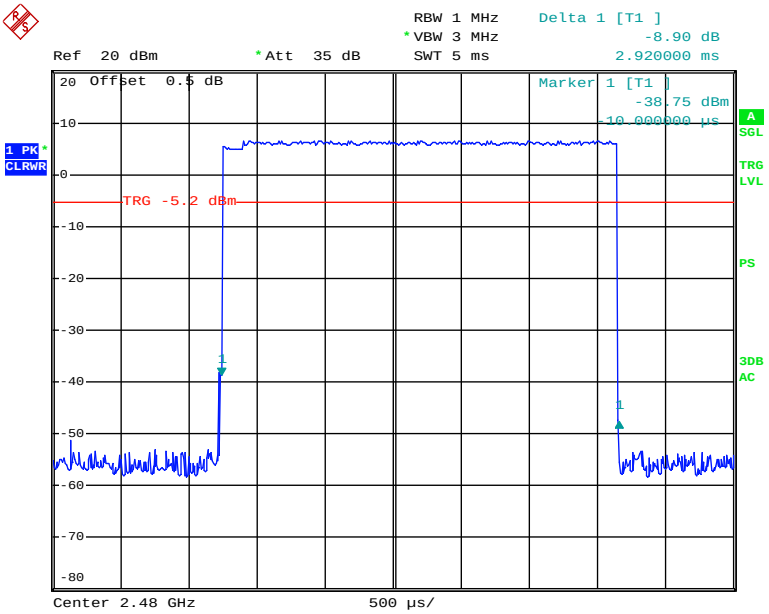
Date: 22.APR.2017 13:15:09

2DH5: Middle Channel



Date: 22.APR.2017 13:15:31

2DH5: High Channel

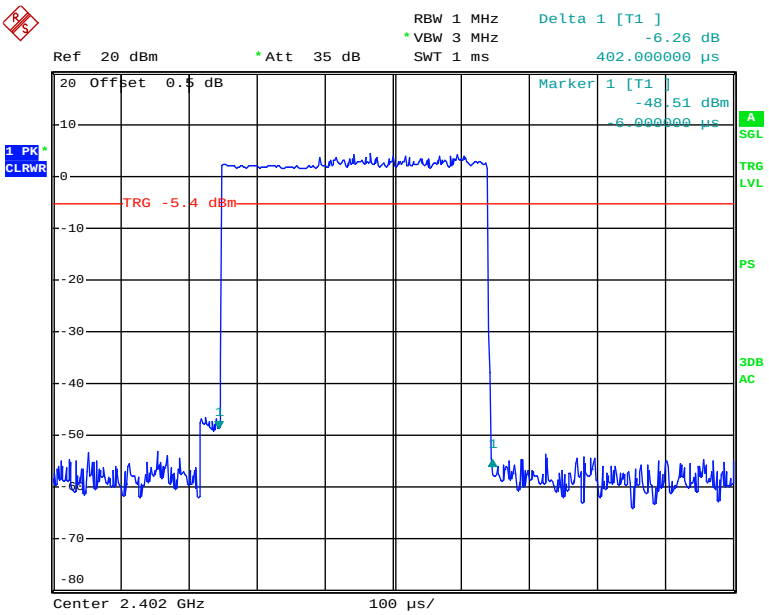


Date: 22.APR.2017 13:15:37

EDR Mode (8-DPSK):

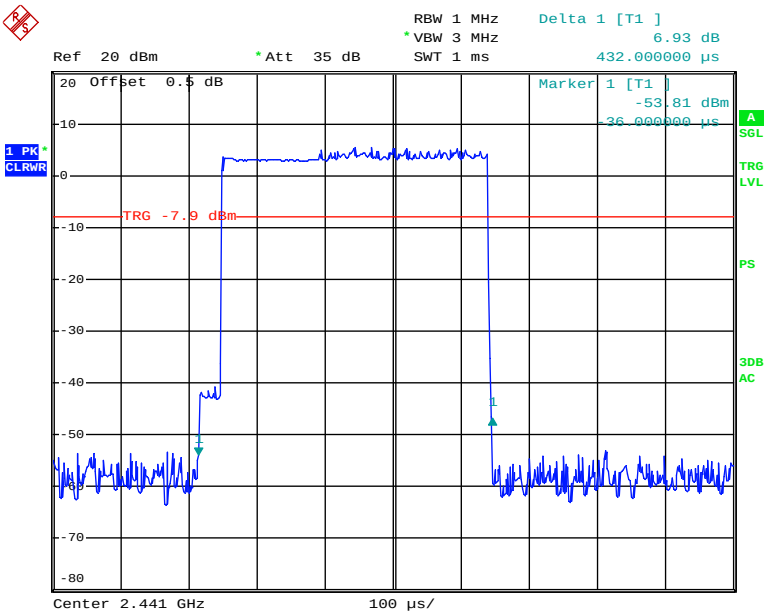
Mode	Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
3DH1	Low	0.402	0.129	0.4	Compliance
	Middle	0.432	0.138	0.4	Compliance
	High	0.404	0.129	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/2/79) ×31.6 s				
3DH3	Low	1.668	0.267	0.4	Compliance
	Middle	1.668	0.267	0.4	Compliance
	High	1.698	0.272	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/4/79) ×31.6 s				
3DH5	Low	2.930	0.313	0.4	Compliance
	Middle	2.920	0.311	0.4	Compliance
	High	2.920	0.311	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/6/79) ×31.6 s				

3DH1: Low Channel



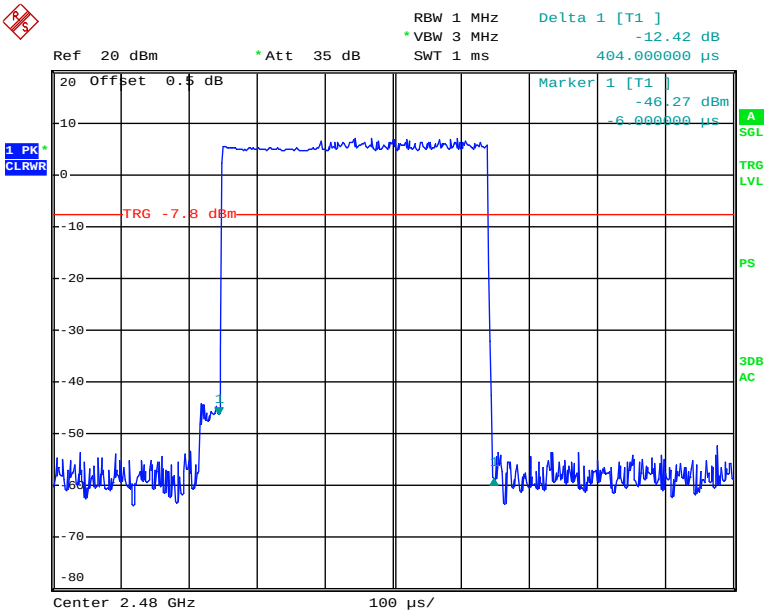
Date: 22.APR.2017 13:17:22

3DH1: Middle Channel



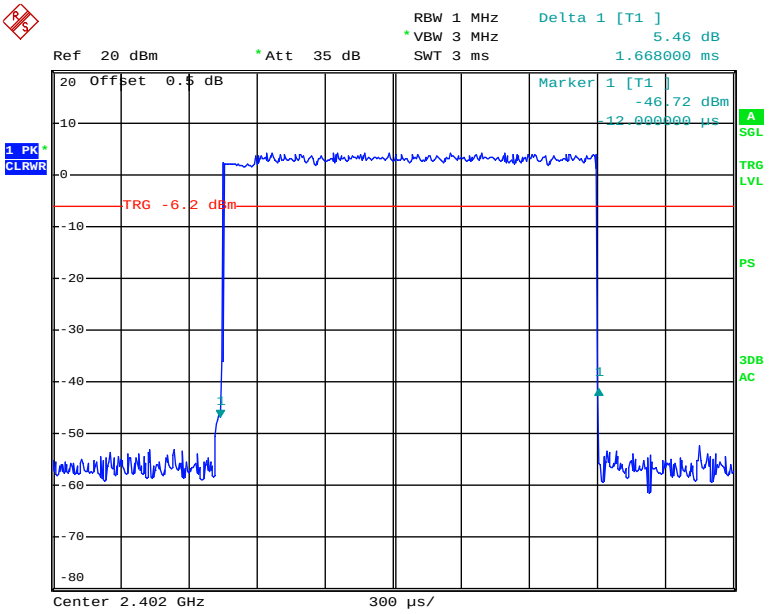
Date: 22.APR.2017 13:17:30

3DH1: High Channel



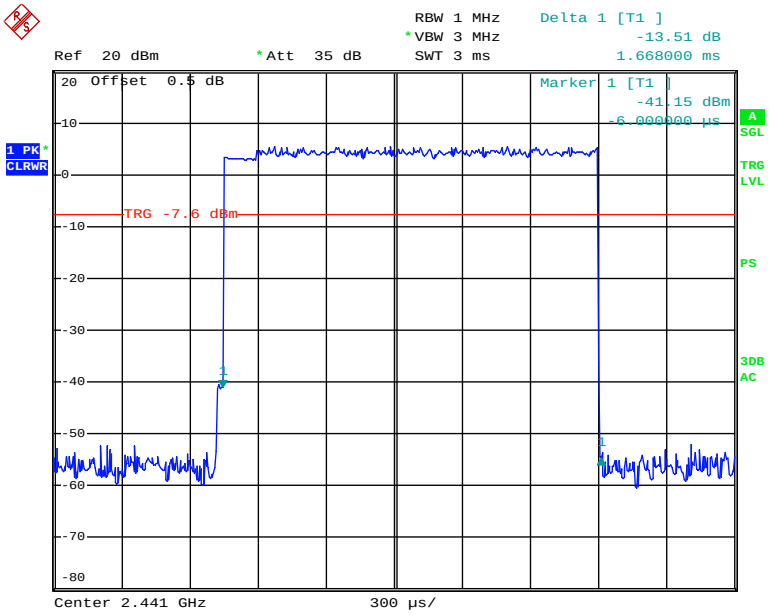
Date: 22.APR.2017 13:17:36

3DH3: Low Channel



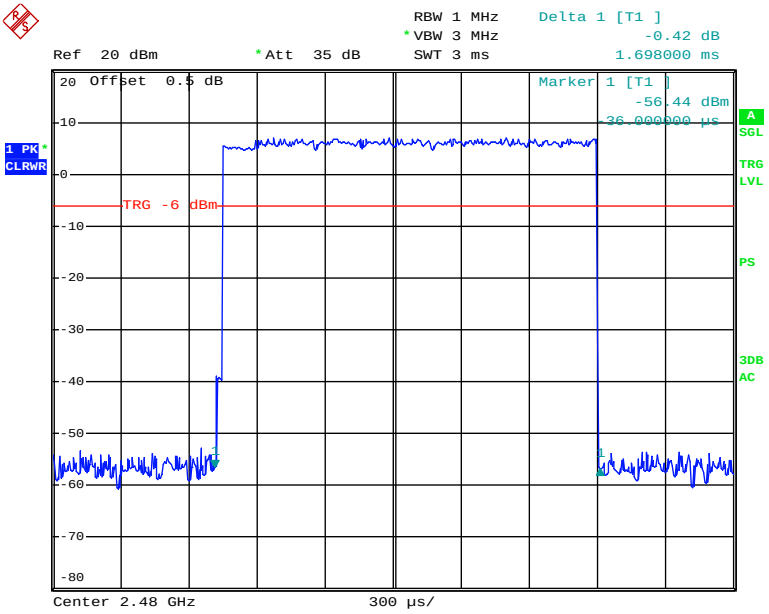
Date: 22.APR.2017 13:18:47

3DH3: Middle Channel



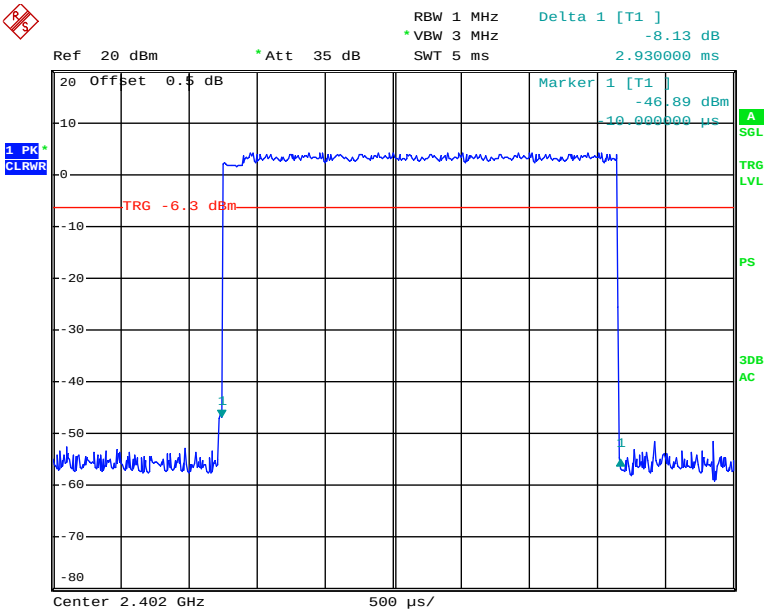
Date: 22.APR.2017 13:18:54

3DH3: High Channel



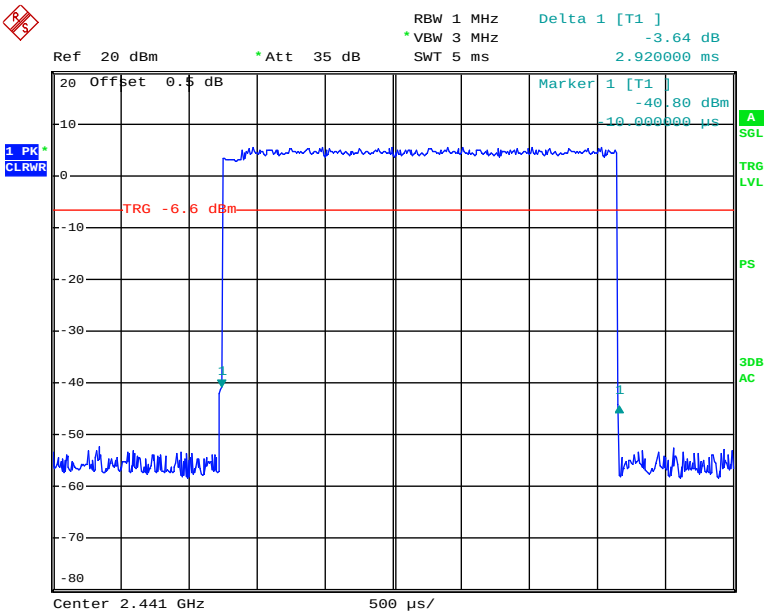
Date: 22.APR.2017 13:19:00

3DH5: Low Channel



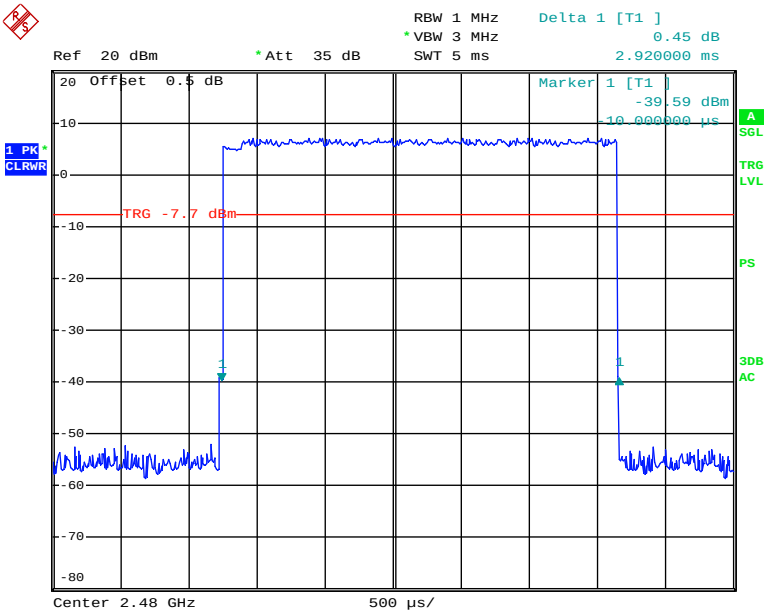
Date: 22.APR.2017 13:21:25

3DH5: Middle Channel



Date: 22.APR.2017 13:21:41

3DH5: High Channel



Date: 22.APR.2017 13:21:47

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
Rohde & Schwarz	EMI Test Receiver	ESCI	100028	2016-12-02	2017-12-01
Unknown	RF Cable	Unknown	NO.3	Each Time	/

*** Statement of Traceability:** BACL(Chengdu) attests that all of the calibrations on the equipment items listed above were traceable to NIM or to another internationally recognized National Metrology Institute (NMI), and were compliant with the NIST HB 150-2016 Normative Annex B “Implementation of traceability policy in accredited laboratories”.

Test Data

Environmental Conditions

Temperature:	22.6 °C
Relative Humidity:	50.1%
ATM Pressure:	100.4kPa

** The testing was performed by Tom Tang on 2017-04-22.*

Test Result: Compliance.

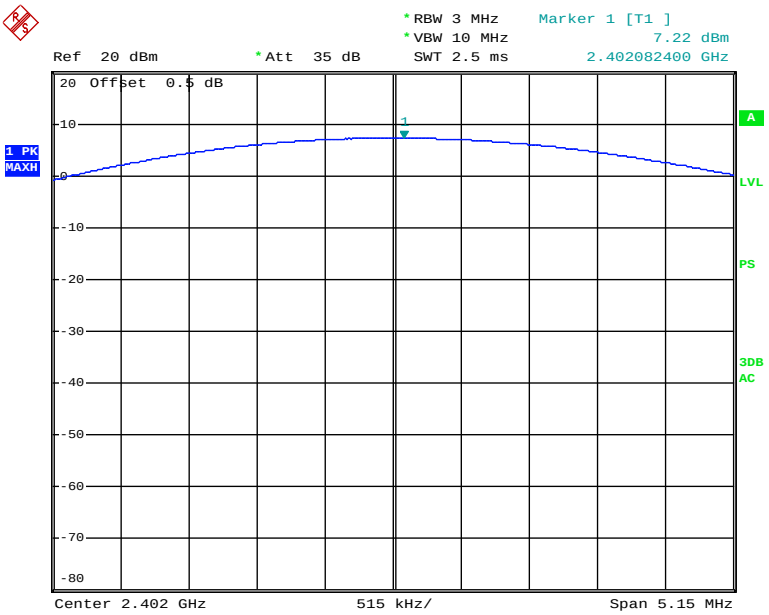
Test Mode: Transmitting

Mode	Frequency (MHz)	Peak Output power (dBm)	Limit (dBm)
BDR Mode (GFSK)	2402	7.22	30
	2441	7.92	30
	2480	8.65	30
EDR Mode (π/4-DQPSK)	2402	4.32	30
	2441	5.48	30
	2480	7.18	30
EDR Mode (8-DPSK)	2402	4.74	30
	2441	5.90	30
	2480	7.49	30

Note: The data above was tested in conducted mode.

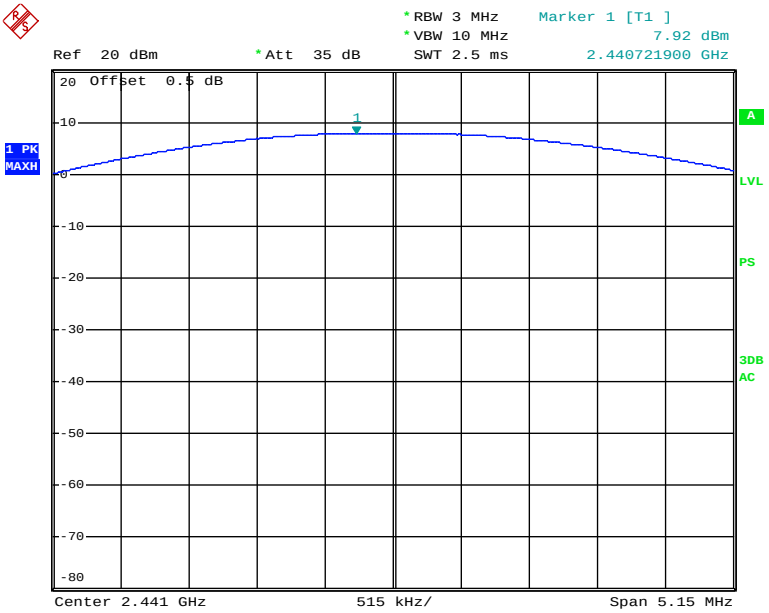
BDR Mode (GFSK):

Low Channel



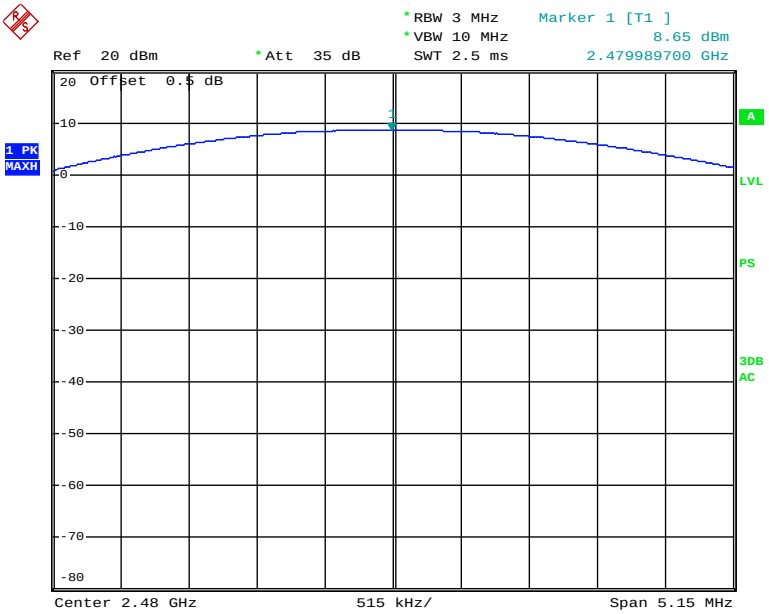
Date: 22.APR.2017 12:11:24

Middle Channel



Date: 22.APR.2017 12:14:14

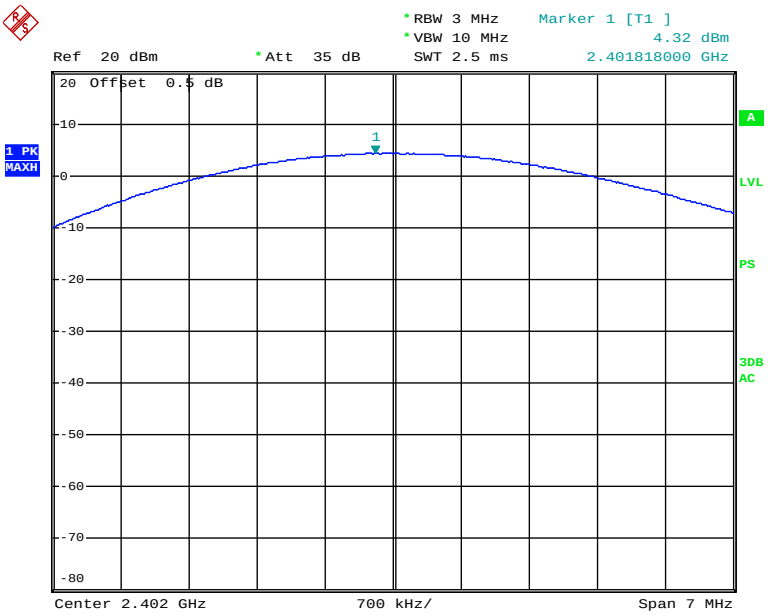
High Channel



Date: 22.APR.2017 12:15:45

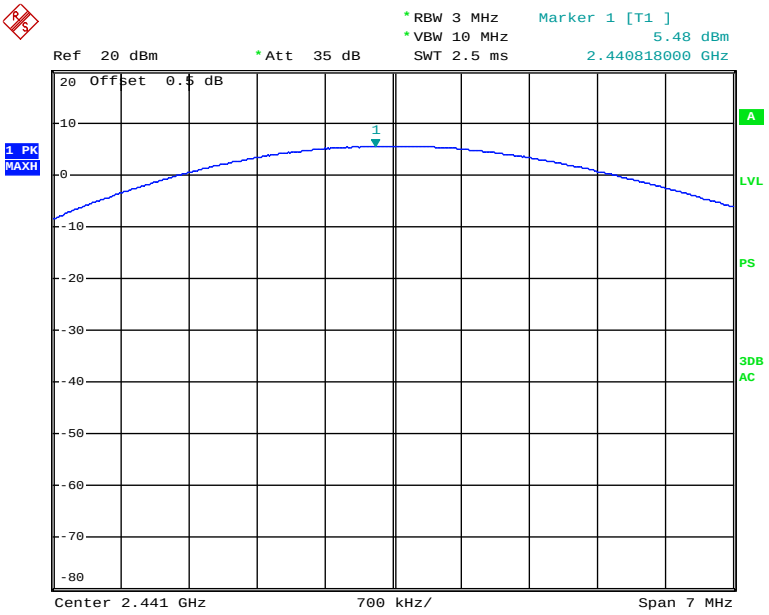
EDR Mode (π/4-DQPSK):

Low Channel



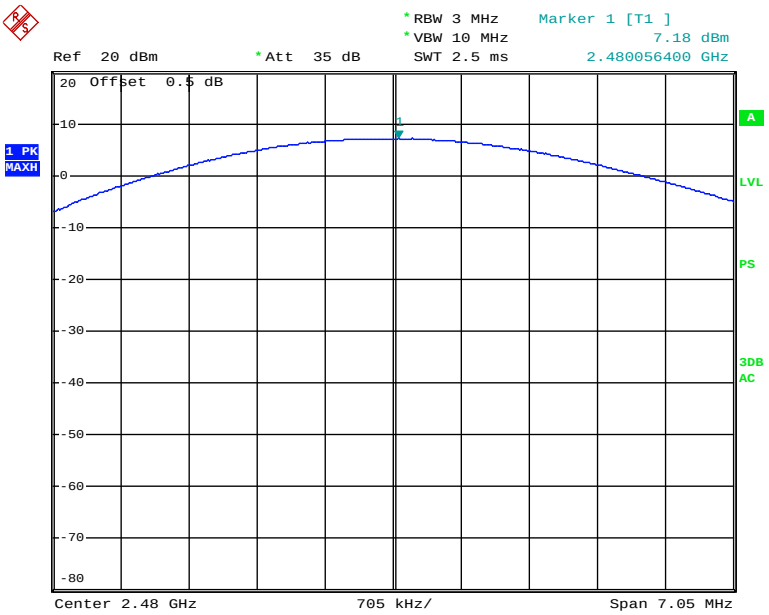
Date: 22.APR.2017 12:17:39

Middle Channel



Date: 22.APR.2017 12:19:50

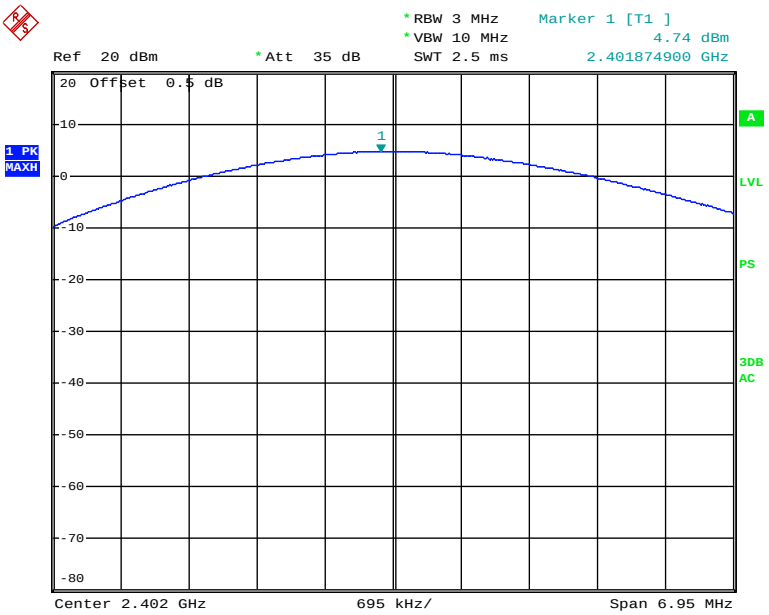
High Channel



Date: 22.APR.2017 12:21:12

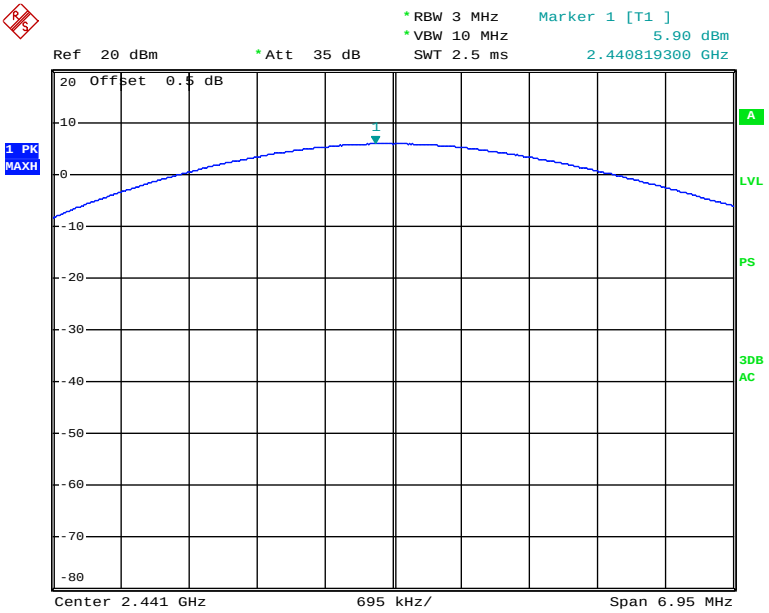
EDR Mode (8-DPSK):

Low Channel



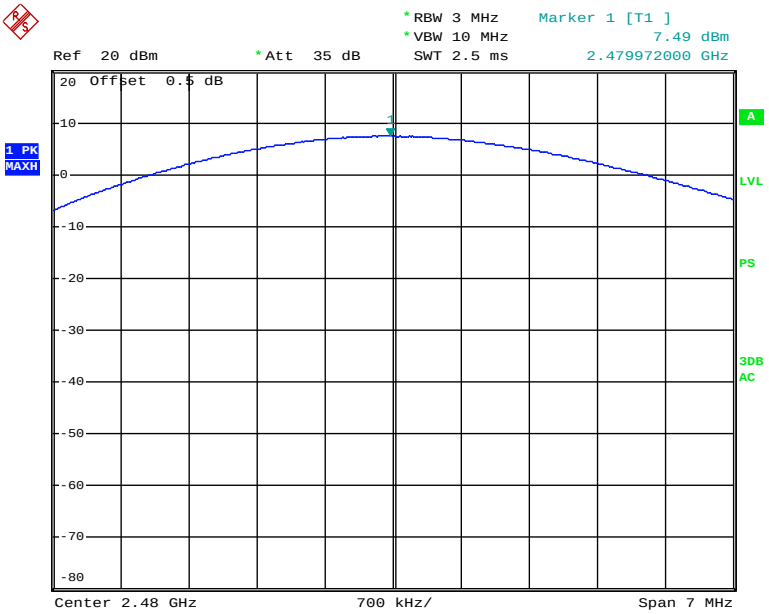
Date: 22.APR.2017 12:23:25

Middle Channel



Date: 22.APR.2017 12:25:00

High Channel



Date: 22.APR.2017 12:26:08

FCC §15.247(d) - BAND EDGES TESTING

Applicable Standard

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

Test Procedure

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	100028	2016-12-02	2017-12-01
Unknown	RF Cable	Unknown	NO.3	Each Time	/

*** Statement of Traceability:** BACL(Chengdu) attests that all of the calibrations on the equipment items listed above were traceable to NIM or to another internationally recognized National Metrology Institute (NMI), and were compliant with the NIST HB 150-2016 Normative Annex B “Implementation of traceability policy in accredited laboratories”.

Test Data

Environmental Conditions

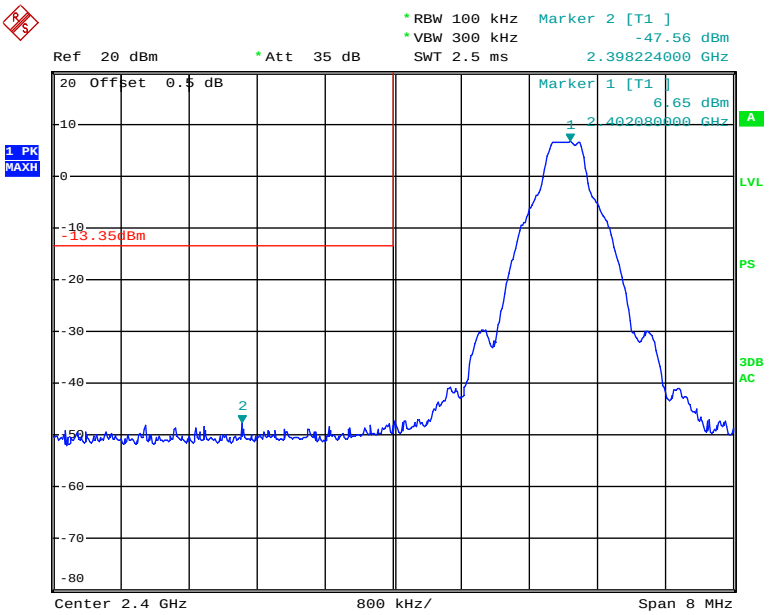
Temperature:	22.6 °C
Relative Humidity:	50.1%
ATM Pressure:	100.4kPa

** The testing was performed by Tom Tang on 2017-04-22.*

Test Result: Compliance

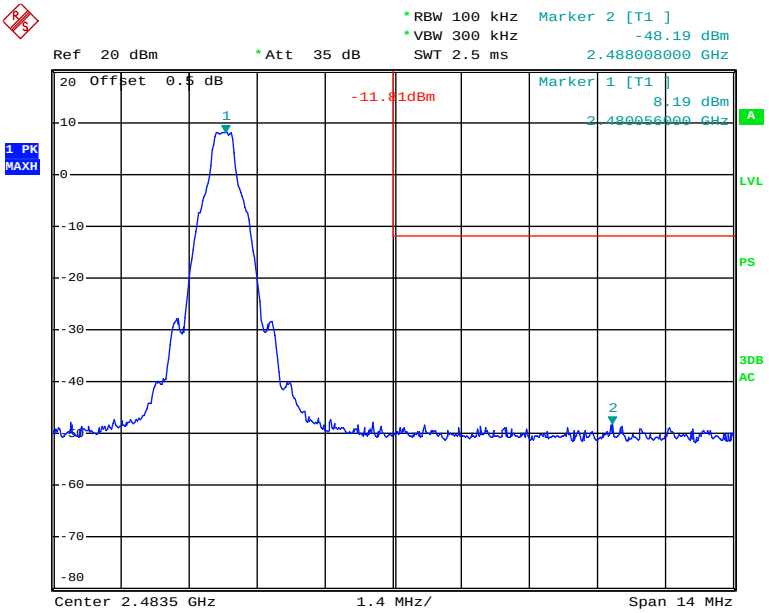
BDR Mode (GFSK):

Band Edge, Left Side



Date: 22.APR.2017 12:11:45

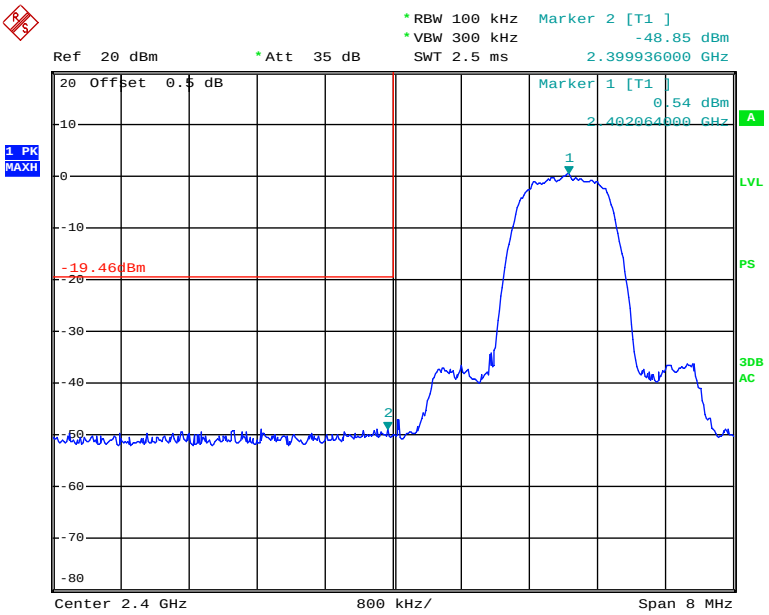
Band Edge, Right Side



Date: 22.APR.2017 12:16:12

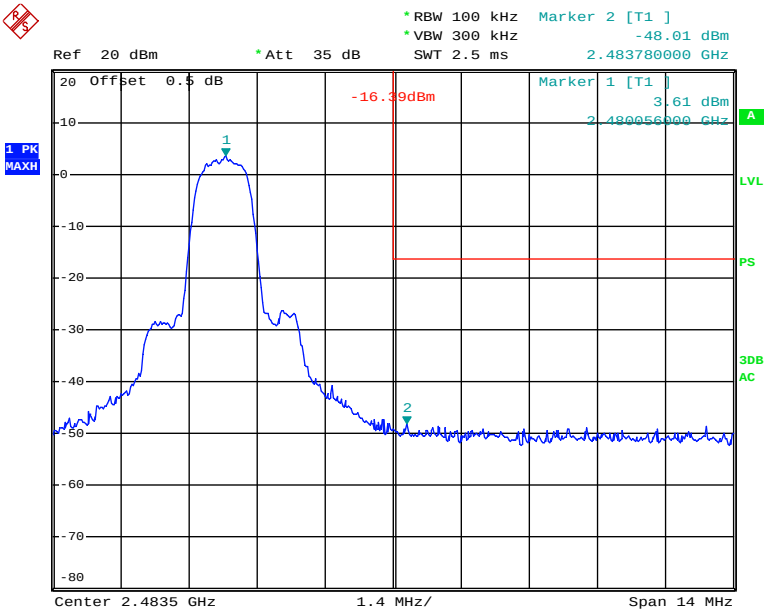
EDR Mode (π/4-DQPSK):

Band Edge, Left Side



Date: 22.APR.2017 12:18:01

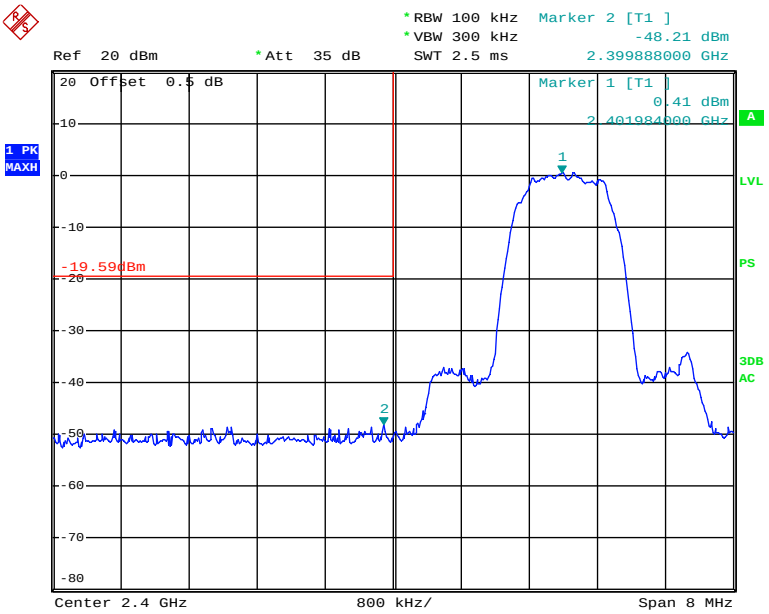
Band Edge, Right Side



Date: 22.APR.2017 12:21:33

EDR Mode (8-DPSK):

Band Edge, Left Side



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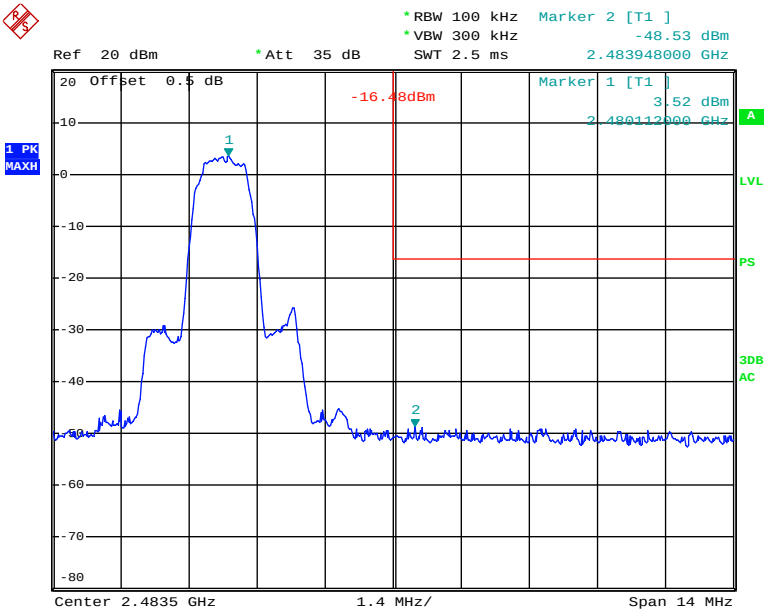
Band Edge, Right Side



Date: 22.APR.2017 12:26:22

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