FCC PART 15.247
TEST REPORT

For

Changzhou Sound Dragon Electronics And Acoustics Co., Ltd.

128 Zhenzhong Road, Xixiashu, Xinbei District, Changzhou, China

FCC ID: 2AGOQY900B

Report Type:	**Product Type:**
Original Report	Sound Bar

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Report Number:	RKS170713001-00A
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant	Changzhou Sound Dragon Electronics And Acoustics Co., Ltd.
Tested Model	Y900B
Product Type	Sound Bar
Dimension	655 mm(L)×108.5 mm(W)×127 mm(H)
Power Supply	DC12V

Adapter Information:
Model: SAPB12024US
Input: AC100-240 V 50/60Hz 0.6A
Output:12V, 2.0A

**All measurement and test data in this report was gathered from production sample serial number: 20170713001. (Assigned by the BACL. The EUT supplied by the applicant was received on 2017-07-13)*

Objective

This test report is prepared on behalf of Changzhou Sound Dragon Electronics And Acoustics Co., Ltd. in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commissions rules.

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

Related Submittal(s)/Grant(s)

N/A

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. (Kunshan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Item		Uncertainty
AC Power Lines Conducted Emissions		3.19dB
RF conducted test with spectrum		0.9dB
RF Output Power with Power meter		0.5dB
Radiated emission	30MHz~1GHz	6.11dB
	1GHz~6GHz	4.45dB
	6GHz~18GHz	5.23dB
Occupied Bandwidth		0.5kHz
Temperature		1.0℃
Humidity		6%

Test Facility

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

Bay Area Compliance Laboratories Corp. (Kunshan) Lab is accredited to ISO/IEC 17025 by A2LA (Lab code: 4323.01) and the FCC designation No. CN1185 under the FCC KDB 974614 D01. 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.: 815570. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

For Bluetooth, 79 channels are provided for testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	40	2442
1	2403	…	…
…	…	…	…
…	…	77	2479
39	2441	78	2480

EUT was tested with Channel 0, 39 and 78.

EUT Exercise Software

RF Test Tool: BK32xxRF Test V1.5

GFSK: Power level 3
π /4-DQPSK: Power level 3
8-DPSK: Power level 3

Special Accessories

No special accessory.

Equipment Modifications

No modification was made to the EUT tested.

Support Equipment List and Details

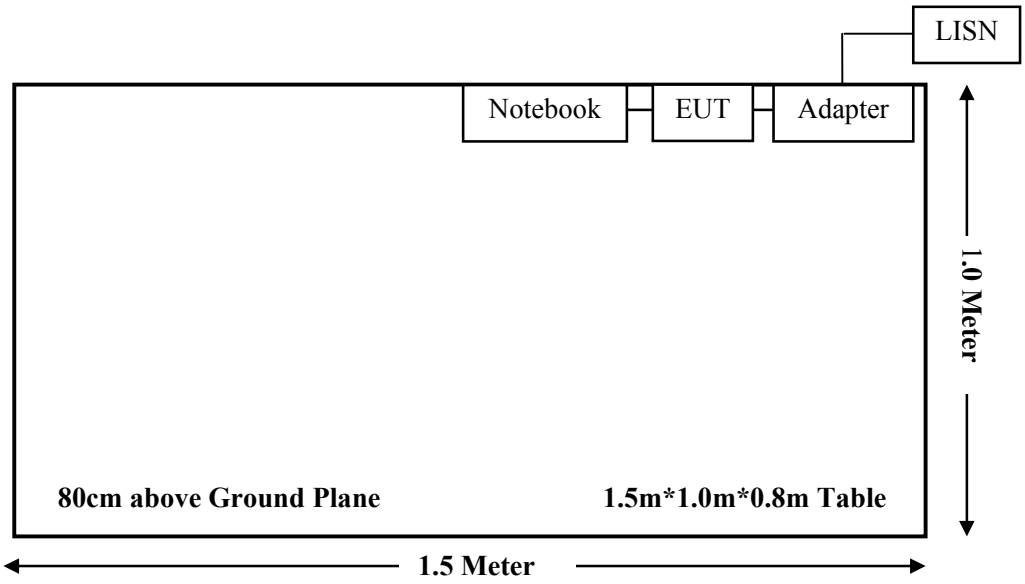
Manufacturer	Description	Model	Serial Number
DELL	PC	GX620	D65874152

External I/O Cable

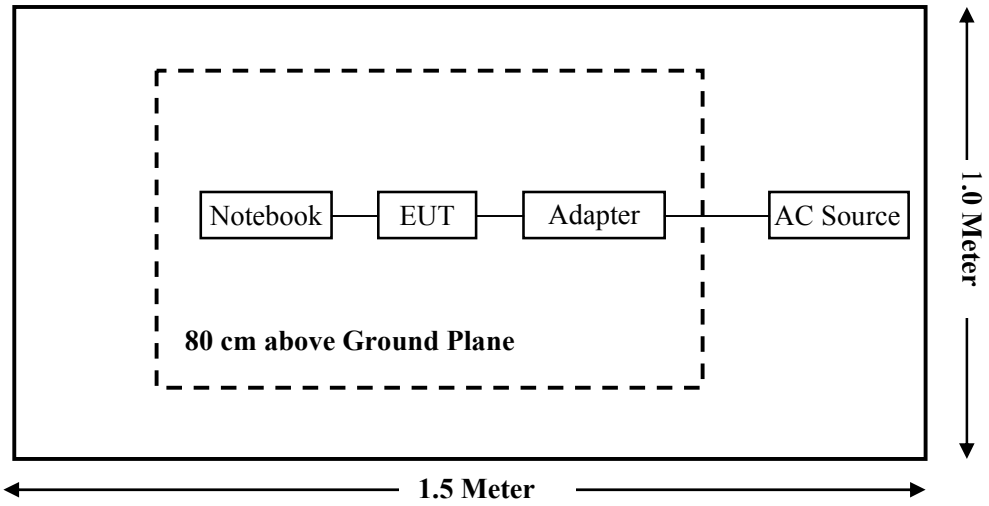
Cable Description	Shielding Type	Length (m)	From Port	To
USB Cable	Unshielding	0.8	Notebook	EUT

Block Diagram of Test Setup

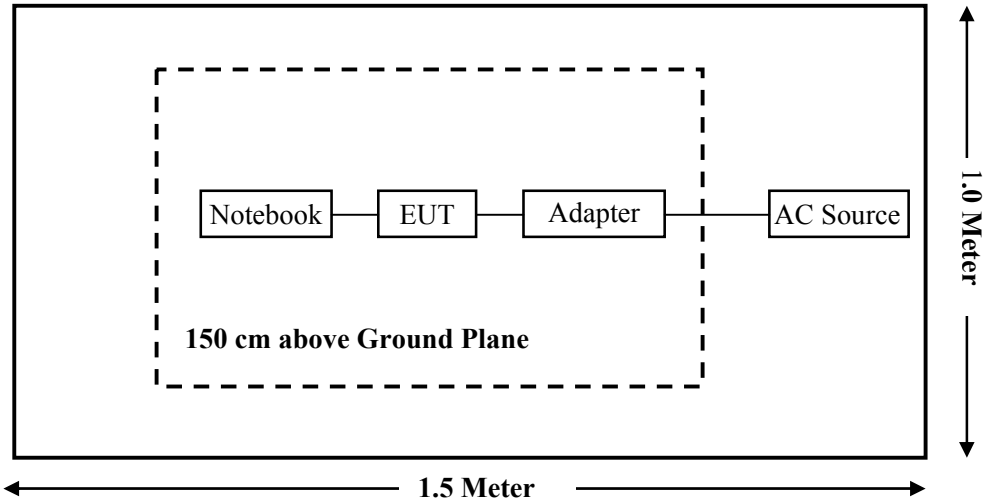
For Conducted Emissions:



For Radiated Emissions (Below 1GHz):



For Radiated Emissions (Above 1GHz):



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (i), §1.1310 & §2.1091	Maximum Permissible Exposure (MPE)	Compliance
§15.203	Antenna Requirement	Compliance
§15.207(a)	AC Line Conducted Emissions	Compliance
§15.205, §15.209 & §15.247(d)	Radiated Emissions	Compliance
§15.247(a)(1)	20 dB Emission Bandwidth	Compliance
§15.247(a)(1)	Channel Separation Test	Compliance
§15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	Compliance
§15.247(a)(1)(iii)	Quantity of hopping channel Test	Compliance
§15.247(b)(1)	Peak Output Power Measurement	Compliance
§15.247(d)	Band edges	Compliance

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test					
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2016-11-25	2017-11-24
Rohde & Schwarz	Signal Analyzer	FSIQ26	100048	2016-11-25	2017-11-24
Sunol Sciences	Broadband Antenna	JB3	A090314-2	2016-01-09	2019-01-08
ETS	Horn Antenna	3115	6229	2016-01-11	2019-01-10
ETS-LINDGREN	Horn Antenna	3116	00084159	2016-10-18	2019-10-17
Sonoma Instrunent	Pre-amplifier	330	171377	2016-12-12	2017-12-11
Narda	Pre-amplifier	AFS42-00101800	2001270	2016-12-12	2017-12-11
Heatsink Required	Amplifier	QLW-18405536-J0	15964001009	2016-12-12	2017-12-11
R&S	Auto test Software	EMC32	100361	/	/
Haojintech	Coaxial Cable	Cable-1	001	2016-12-12	2017-12-11
Haojintech	Coaxial Cable	Cable-2	002	2016-12-12	2017-12-11
Haojintech	Coaxial Cable	Cable-3	003	2016-12-12	2017-12-11
MICRO-COAX	Coaxial Cable	Cable-4	004	2016-12-12	2017-12-11
MICRO-COAX	Coaxial Cable	Cable-5	005	2016-12-12	2017-12-11
RF Conducted Test					
Rohde & Schwarz	Signal Analyzer	FSIQ26	836131/009	2016-09-21	2017-09-20
Sound Dragon	RF Cable	N/A	N/A	2017-07-21	2018-07-20
Conducted Emission Test					
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2016-11-25	2017-11-24
Rohde & Schwarz	LISN	ESH3-Z5	862770/011	2016-10-10	2017-10-09
ROHDE&SCHWARZ	LISN	ENV216	3560655016	2016-11-25	2017-11-24
Rohde & Schwarz	CE Test software	EMC 32	100357	/	/
MICRO-COAX	Coaxial Cable	Cable-6	006	2016-09-08	2017-09-07

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

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

Applicable Standard

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

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

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm²)**	**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 Formulary:
Predication of MPE limit at a given distance
$S = PG/4\pi R^2$ = 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);

Measurement Result

Mode	Frequency Range	Antenna Gain		Target Output Power		Evaluation Distance	Power Density	MPE Limit
	(MHz)	(dBi)	(numeric)	(dBm)	(mW)	(cm)	(mW/cm^2)	(mW/cm^2)
BT	2402-2480	0	1.00	1.00	1.26	20	0.0003	1

Note: For the above target output power is declared by the manufacturer.

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

FCC §15.203 – ANTENNA REQUIREMENT

Applicable Standard

According to FCC § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

Antenna Connector Construction

The EUT has a PCB antenna arrangement for Bluetooth, which the antenna gain is 0 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

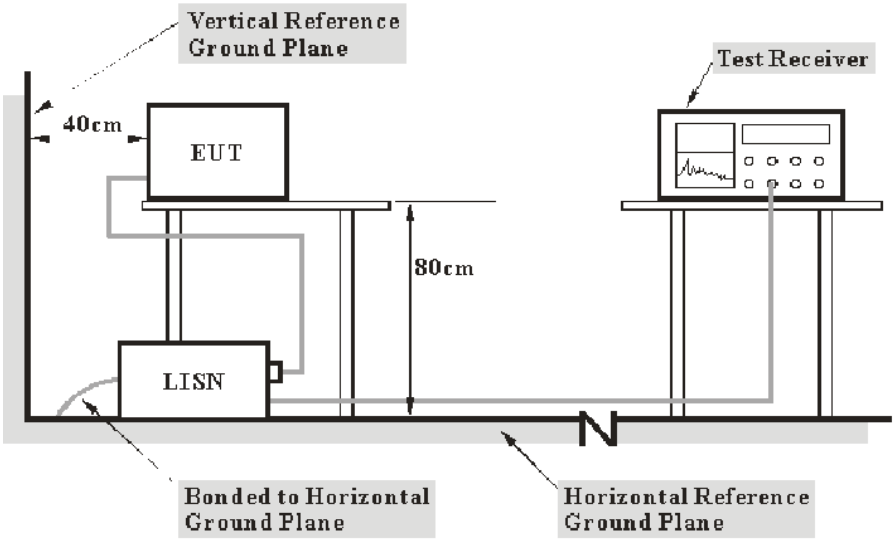
Result: Compliance.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC §15.207(a)

EUT Setup



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

The measurement procedure of EUT setup is according with ANSI C63.10-2013. The related limit was specified in FCC Part 15.207.

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 LISN.

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

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

Corrected Factor & Margin Calculation

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

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

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

Margin = Limit – Corrected Amplitude

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207.

Test Data

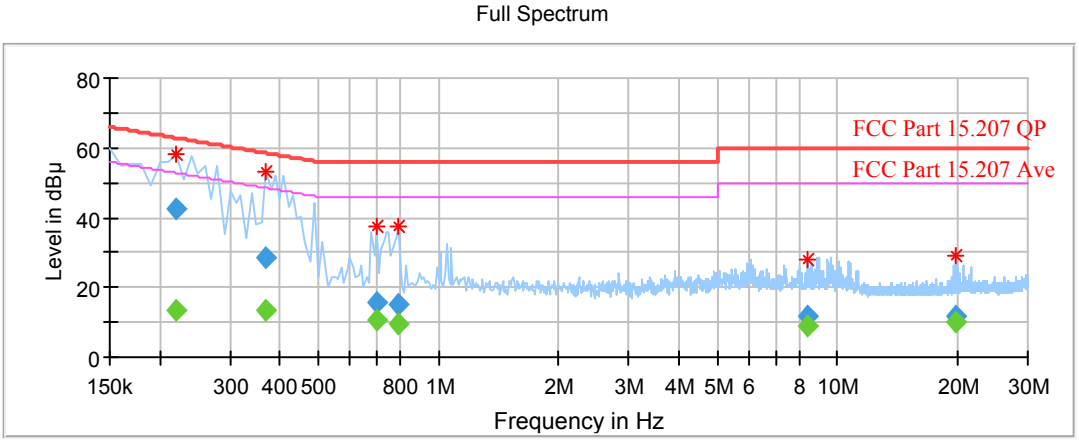
Environmental Conditions

Temperature:	20.2 ℃
Relative Humidity:	55 %
ATM Pressure:	101.3 kPa

The testing was performed by Bernie Zhang on 2017-07-21.

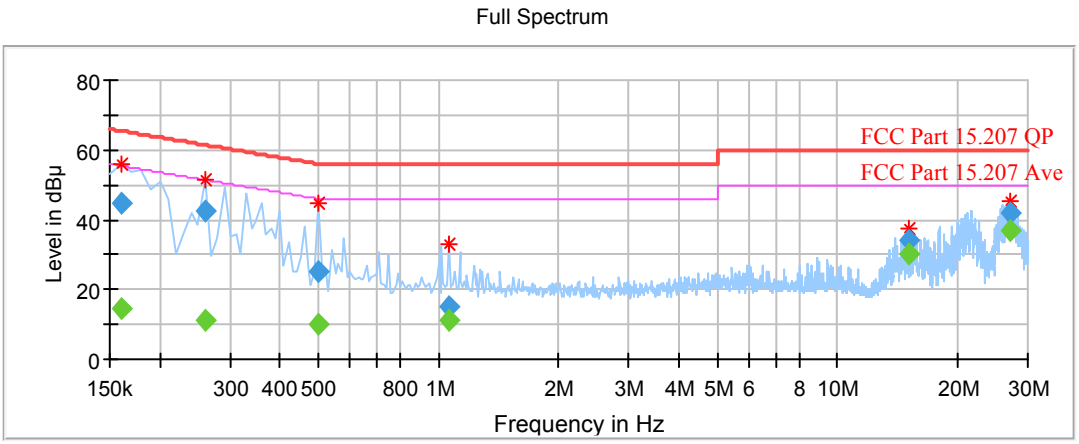
EUT operation mode: Transmitting in high channel of GFSK (Worst case)

AC 120V/60 Hz, Line



Frequency (MHz)	QuasiPeak (dBµV)	Average (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.220000	---	13.52	9.000	L1	10.2	39.30	52.82	Compliance
0.220000	42.67	---	9.000	L1	10.2	20.15	62.82	Compliance
0.370000	---	13.69	9.000	L1	10.1	34.81	48.50	Compliance
0.370000	28.31	---	9.000	L1	10.1	30.19	58.50	Compliance
0.700000	---	10.49	9.000	L1	10.0	35.51	46.00	Compliance
0.700000	15.92	---	9.000	L1	10.0	40.08	56.00	Compliance
0.790000	---	9.30	9.000	L1	9.9	36.70	46.00	Compliance
0.790000	15.28	---	9.000	L1	9.9	40.72	56.00	Compliance
8.400000	---	9.20	9.000	L1	10.0	40.80	50.00	Compliance
8.400000	11.60	---	9.000	L1	10.0	48.40	60.00	Compliance
19.700000	---	9.80	9.000	L1	10.2	40.20	50.00	Compliance
19.700000	11.58	---	9.000	L1	10.2	48.42	60.00	Compliance

AC 120V/60 Hz, Neutral



Frequency (MHz)	QuasiPeak (dBµV)	Average (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.160000	---	14.43	9.000	N	10.1	41.03	55.46	Compliance
0.160000	44.69	---	9.000	N	10.1	20.77	65.46	Compliance
0.260000	---	11.21	9.000	N	10.1	40.22	51.43	Compliance
0.260000	42.50	---	9.000	N	10.1	18.93	61.43	Compliance
0.500000	---	10.29	9.000	N	10.1	35.71	46.00	Compliance
0.500000	25.10	---	9.000	N	10.1	30.90	56.00	Compliance
1.060000	---	11.22	9.000	N	9.9	34.78	46.00	Compliance
1.060000	14.99	---	9.000	N	9.9	41.01	56.00	Compliance
15.030000	---	30.42	9.000	N	10.0	19.58	50.00	Compliance
15.030000	34.09	---	9.000	N	10.0	25.91	60.00	Compliance
27.100000	---	36.74	9.000	N	10.3	13.26	50.00	Compliance
27.100000	42.22	---	9.000	N	10.3	17.78	60.00	Compliance

Note:
1) Corr.=LISN VDF (Voltage Division Factor) + Cable Loss
2) Corrected Amplitude = Reading + Corr.
3) Margin = Limit –Corrected Amplitude

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

Applicable Standard

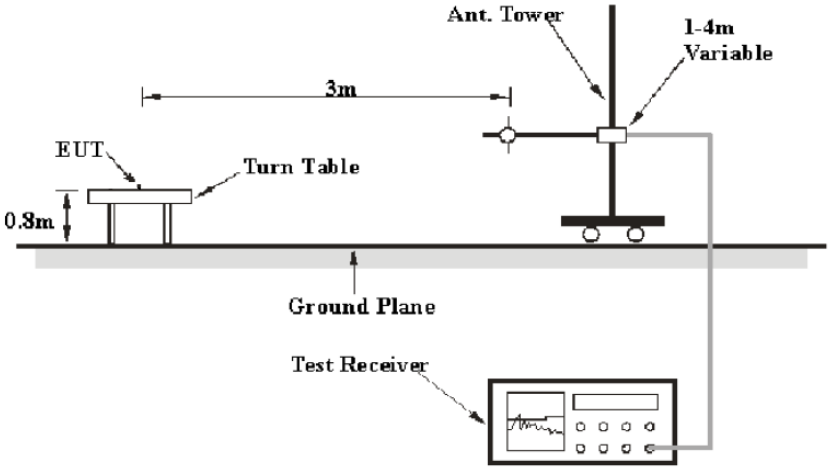
FCC §15.205; §15.209; §15.247(d)

Measurement Uncertainty

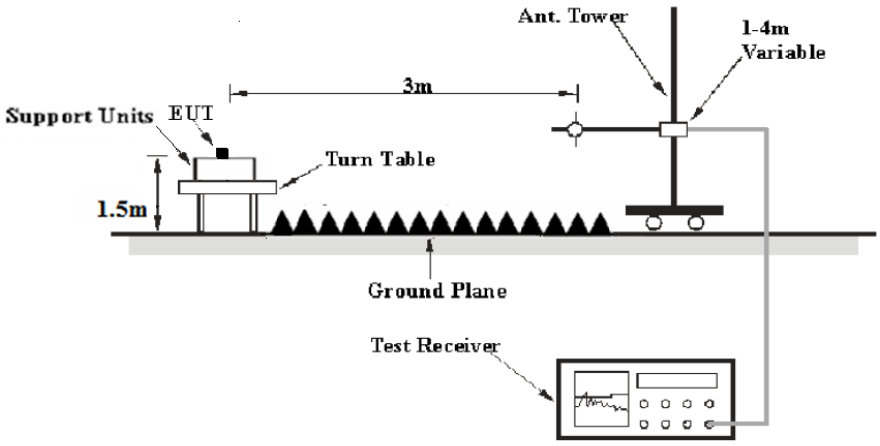
All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency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

EUT Setup

Below 1 GHz:



Above 1GHz:



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

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

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

Frequency Range	RBW	Video B/W	IF B/W	Detector
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP

Frequency Range	RBW	Video B/W	Detector
1GHz – 25GHz	1MHz	3 MHz	PK
	1MHz	10 Hz	Ave.

Test Procedure

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

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

Corrected Amplitude & Margin Calculation

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

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, section 15.205, 15.209 and 15.247.

Test Data

Environmental Conditions

Temperature:	20.2 ℃
Relative Humidity:	55 %
ATM Pressure:	101.3 kPa

The testing was performed by Bernie Zhang on 2017-07-21.

EUT operation mode: Transmitting

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

Frequency (MHz)	Receiver		Turn table Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247/205/209	
	Reading (dBμV)	Detector (PK/QP /Ave.)		Height (cm)	Polar (H/V)			Limit (dB μ V/m)	Margin (dB)
Low Channel (2402 MHz)									
74.00	45.25	QP	295	114	V	-16.93	28.32	40	11.68
2402.00	99.90	PK	161	135	V	-6.19	93.71	/	/
2402.00	89.58	Ave	161	135	V	-6.19	83.39	/	/
2402.00	100.31	PK	230	173	H	-6.19	94.12	/	/
2402.00	89.62	Ave	230	173	H	-6.19	83.43	/	/
2390.00	47.52	PK	45	202	H	-6.22	41.30	74	32.70
2390.00	31.68	Ave	45	202	H	-6.22	25.46	54	28.54
2400.00	72.52	PK	227	199	H	-6.19	66.33	74	7.67
2400.00	53.34	Ave	227	199	H	-6.19	47.15	54	6.85
1721.00	47.17	PK	40	202	V	-8.41	38.76	74	35.24
1721.00	27.96	Ave	40	202	V	-8.41	19.55	54	34.45
4804.00	63.62	PK	152	122	H	1.61	65.23	74	8.77
4804.00	45.72	Ave	152	122	H	1.61	47.33	54	6.67
7206.00	42.28	PK	212	229	H	7.55	49.83	74	24.17
7206.00	27.14	Ave	212	229	H	7.55	34.69	54	19.31

Frequency (MHz)	Receiver		Turn table Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247/205/209	
	Reading (dBμV)	Detector (PK/QP /Ave.)		Height (cm)	Polar (H/V)			Limit (dB μ V/m)	Margin (dB)
Middle Channel (2441 MHz)									
74.00	45.14	QP	309	199	V	-16.93	28.21	40	11.79
2441.00	96.82	PK	296	212	V	-6.17	90.65	/	/
2441.00	85.43	Ave	296	212	V	-6.17	79.26	/	/
2441.00	97.94	PK	304	221	H	-6.17	91.77	/	/
2441.00	86.47	Ave	304	221	H	-6.17	80.30	/	/
1721.00	48.14	PK	42	163	H	-11.25	36.89	74	37.11
1721.00	29.39	Ave	42	163	H	-11.25	18.14	54	35.86
3180.00	45.67	PK	113	121	H	-2.77	42.90	74	31.10
3180.00	31.42	Ave	113	121	H	-2.77	28.65	54	25.35
4882.00	62.39	PK	241	110	V	1.79	64.18	74	9.82
4882.00	44.88	Ave	241	110	V	1.79	46.67	54	7.33
6566.00	43.76	PK	275	129	H	6.10	49.86	74	24.14
6566.00	29.62	Ave	275	129	H	6.10	35.72	54	18.28
7323.00	41.24	PK	134	188	H	7.67	48.91	74	25.09
7323.00	28.12	Ave	134	188	H	7.67	35.79	54	18.21
High Channel (2480MHz)									
74.00	45.27	QP	112	144	V	-16.93	28.34	40	11.66
2480.00	95.68	PK	189	183	V	-6.01	89.67	/	/
2480.00	86.85	Ave	189	183	V	-6.01	80.84	/	/
2480.00	98.32	PK	203	183	H	-6.01	92.31	/	/
2480.00	88.31	Ave	203	183	H	-6.01	82.30	/	/
2483.50	61.24	PK	85	102	H	-6.01	55.23	74	18.77
2483.50	42.36	Ave	85	102	H	-6.01	36.35	54	17.65
2584.00	48.69	PK	185	191	H	-5.51	43.18	74	30.82
2584.00	31.89	Ave	185	191	H	-5.51	26.38	54	27.62
4960.00	59.25	PK	124	105	V	1.97	61.22	74	12.78
4960.00	41.65	Ave	124	105	V	1.97	43.62	54	10.38
6566.00	44.95	PK	310	219	H	6.10	51.05	74	22.95
6566.00	29.32	Ave	310	219	H	6.10	35.42	54	18.58
7440.00	41.26	PK	174	153	H	7.79	49.05	74	24.95
7440.00	22.40	Ave	174	153	H	7.79	30.19	54	23.81

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

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

Applicable Standard

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

Test Procedure

1. Set the EUT in hopping mode.
2. Span wide enough to capture the peaks of two adjacent channels.
3. Use the marker-delta function to determine the separation.

Test Data

Environmental Conditions

Temperature:	20.3 ℃
Relative Humidity:	55 %
ATM Pressure:	101.3 kPa

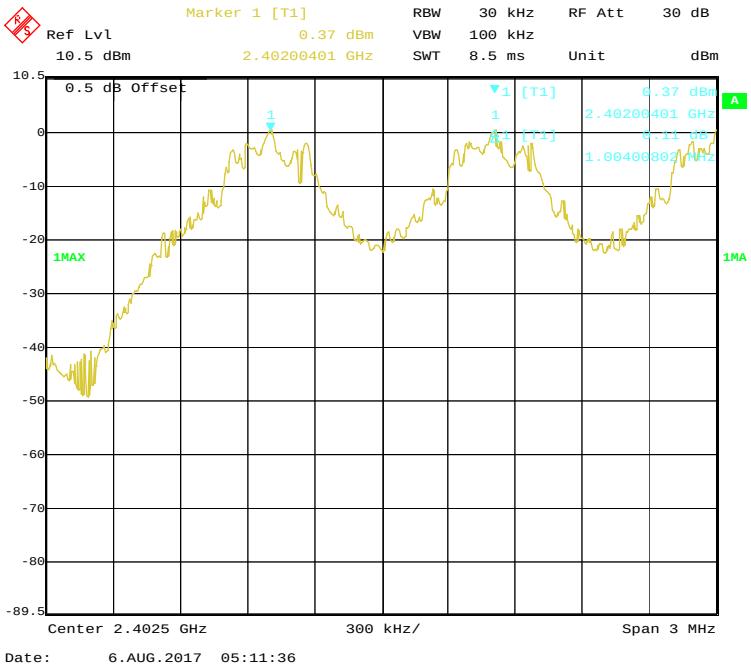
The testing was performed by Bernie Zhang on 2017-08-06.

EUT operation mode: Hopping

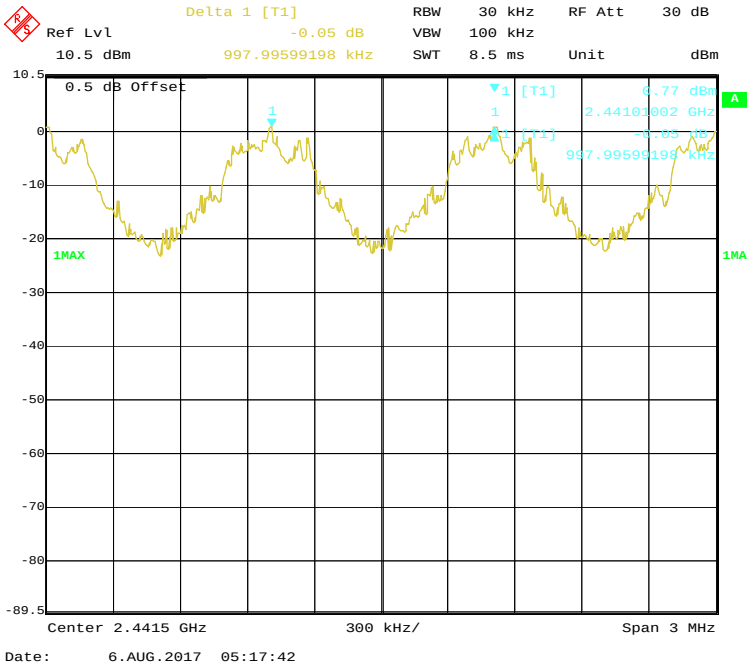
Mode	Channel	Frequency (MHz)	Channel Separation (MHz)	Limit	Result
BDR (GFSK)	Low	2402	1.004	0.637	Pass
	Adjacent	2403			
	Middle	2441	0.998	0.637	Pass
	Adjacent	2442			
	High	2480	0.998	0.641	Pass
	Adjacent	2479			
EDR (π/4-DQPSK)	Low	2402	0.998	0.866	Pass
	Adjacent	2403			
	Middle	2441	0.998	0.842	Pass
	Adjacent	2442			
	High	2480	1.004	0.834	Pass
	Adjacent	2479			
EDR (8-DPSK)	Low	2402	1.004	0.821	Pass
	Adjacent	2403			
	Middle	2441	1.016	0.821	Pass
	Adjacent	2442			
	High	2480	0.998	0.821	Pass
	Adjacent	2479			

Note: Limit = 20 dB bandwidth*2/3

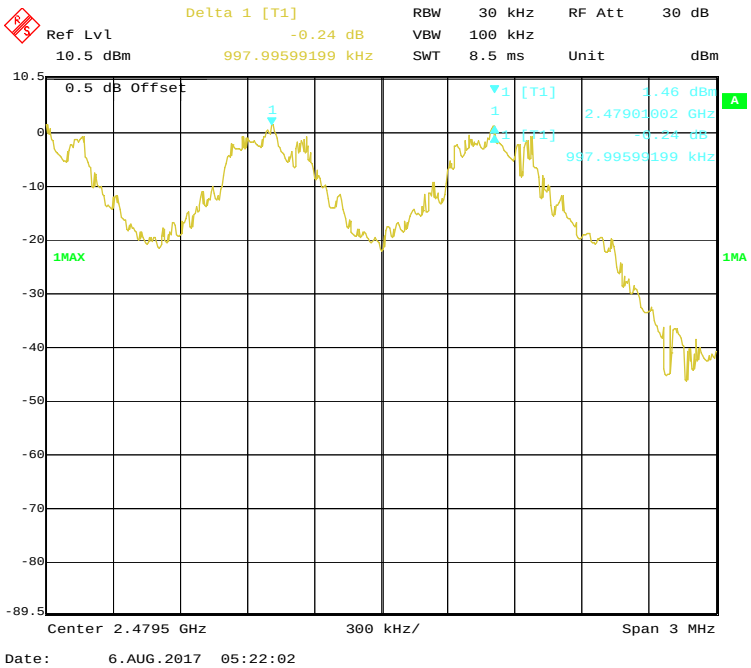
BDR (GFSK): Low Channel



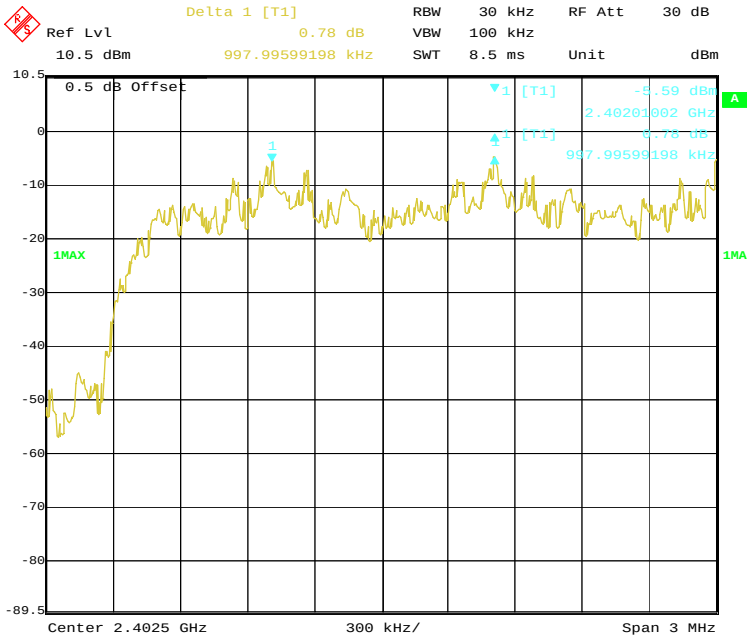
BDR (GFSK): Middle Channel



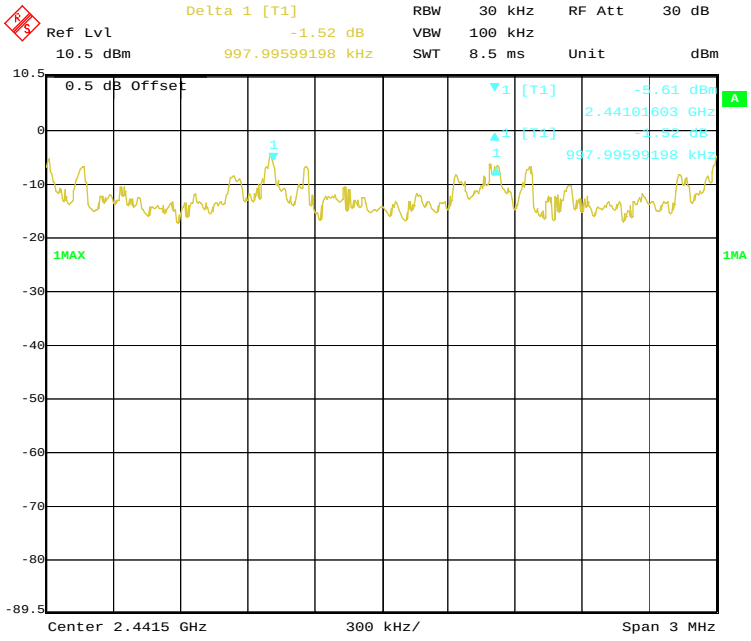
BDR (GFSK): High Channel



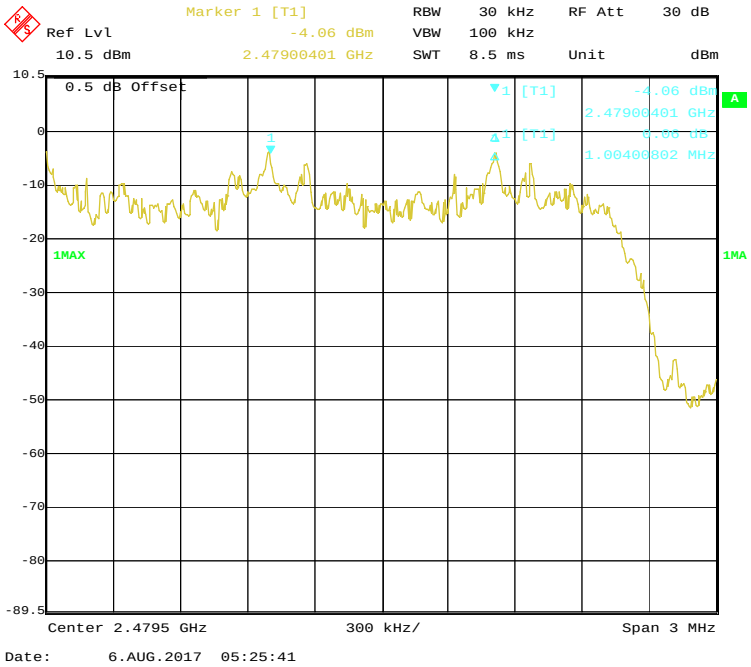
EDR (π/4-DQPSK): Low Channel



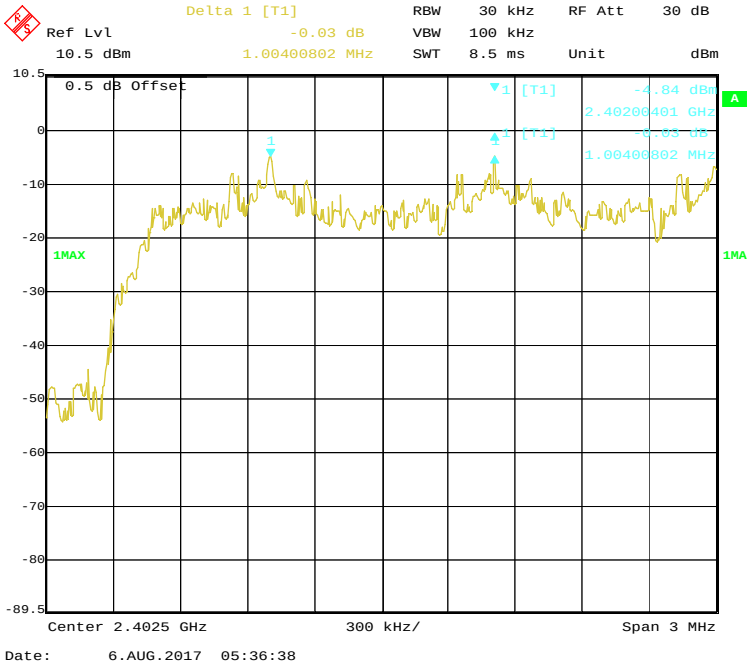
EDR (π/4-DQPSK): Middle Channel



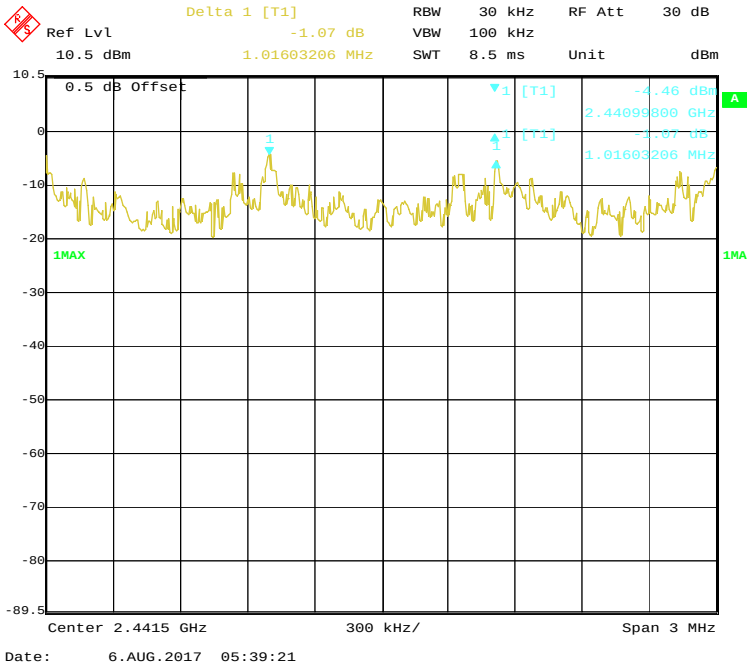
EDR (π/4-DQPSK): High Channel



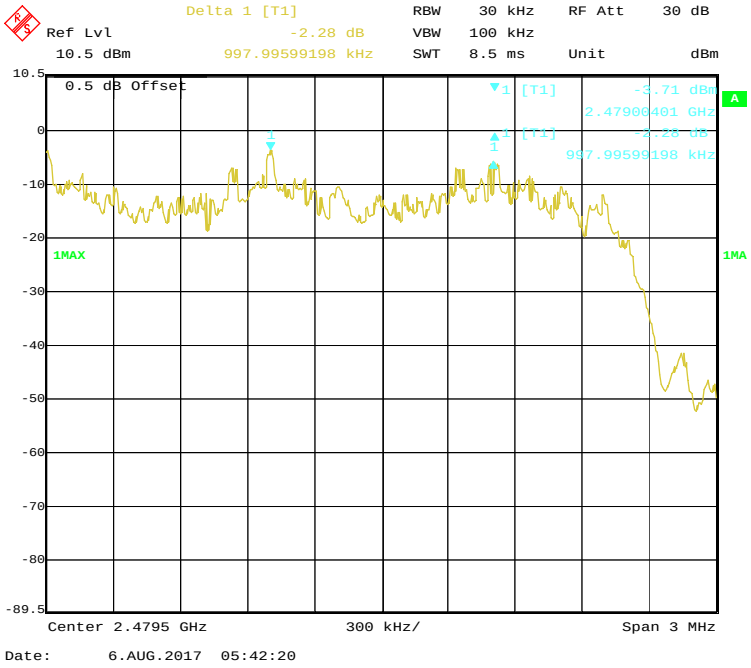
EDR (8-DPSK): Low Channel



EDR (8-DPSK): Middle Channel



EDR (8-DPSK): High Channel



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

Applicable Standard

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

Test Procedure

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

Test Data

Environmental Conditions

Temperature:	20.3 ℃
Relative Humidity:	55 %
ATM Pressure:	101.3 kPa

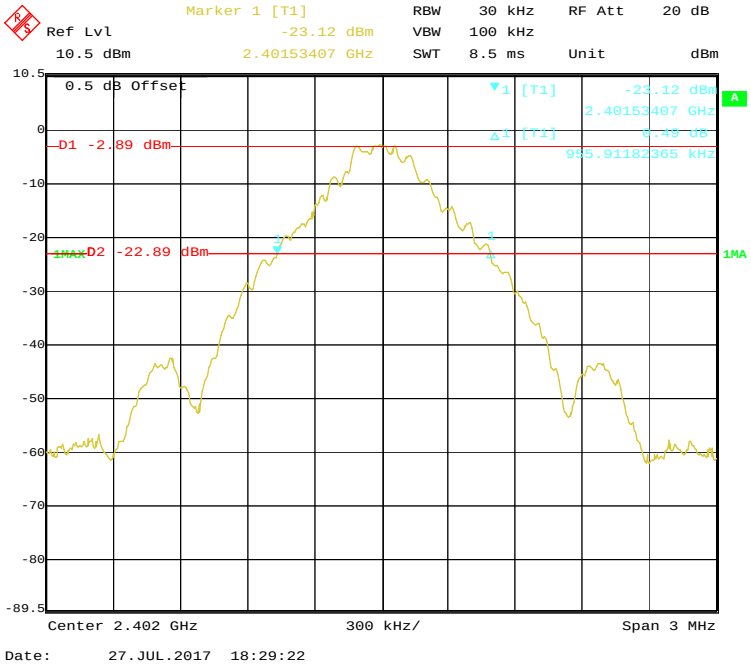
The testing was performed by Bernie Zhang on 2017-07-27.

EUT operation mode: Transmitting

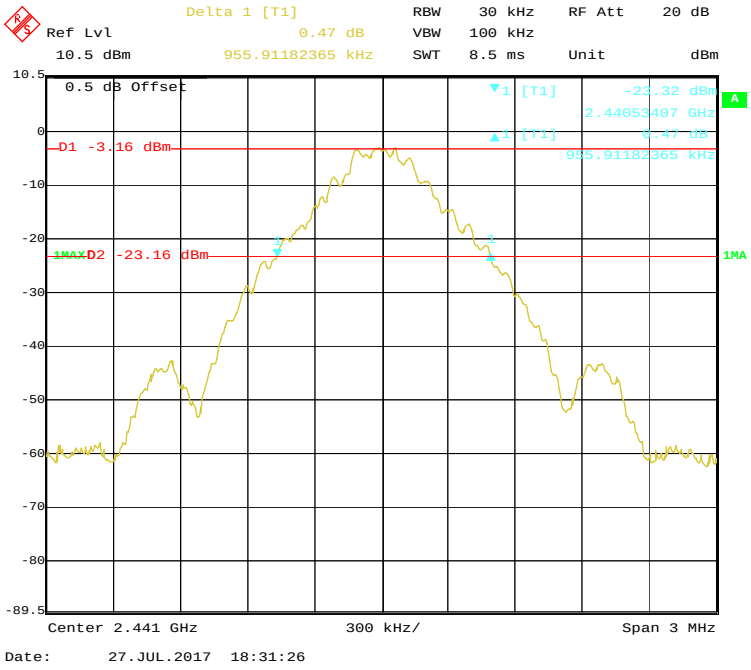
Test Result: Compliance

Mode	Channel	Frequency (MHz)	20 dB Emission Bandwidth (MHz)
BDR (GFSK)	Low	2402	0.956
	Middle	2441	0.956
	High	2480	0.962
EDR (π/4-DQPSK)	Low	2402	1.299
	Middle	2441	1.263
	High	2480	1.251
EDR (8-DPSK)	Low	2402	1.232
	Middle	2441	1.232
	High	2480	1.232

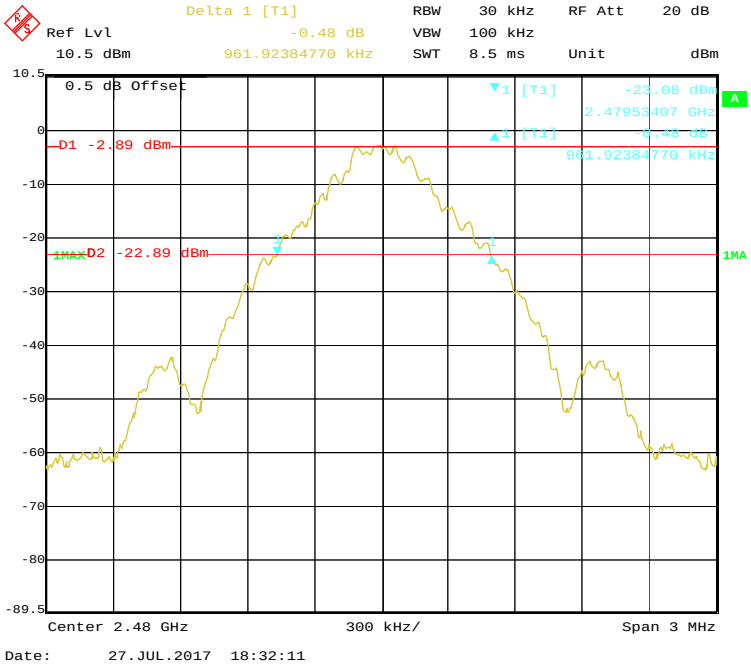
BDR (GFSK): Low Channel



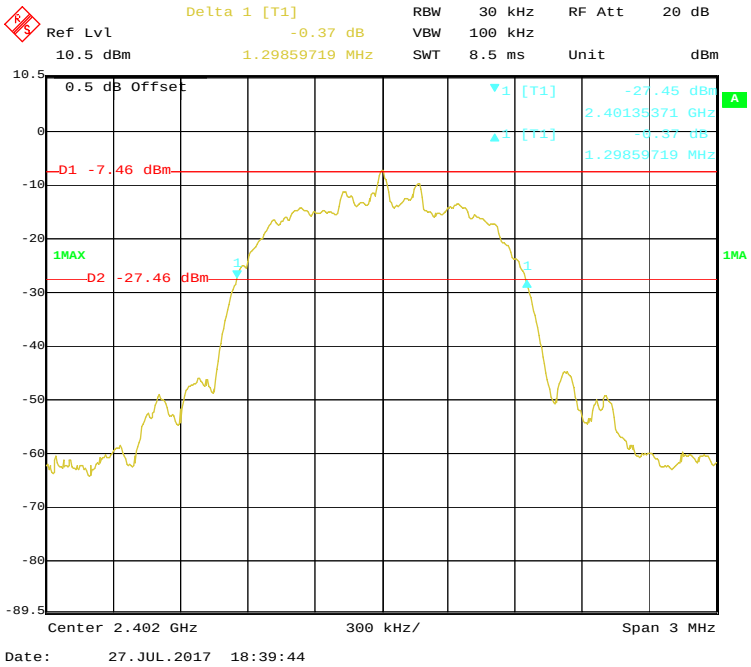
BDR (GFSK): Middle Channel



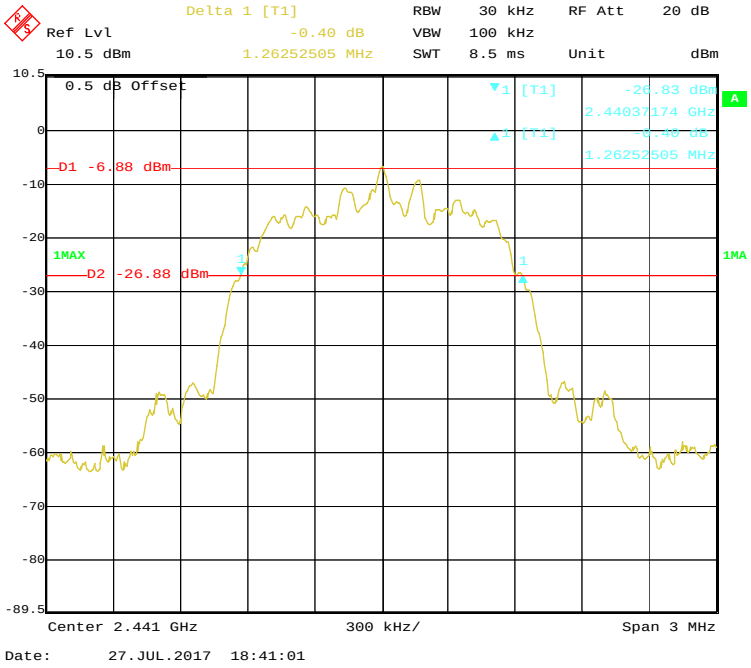
BDR (GFSK): High Channel



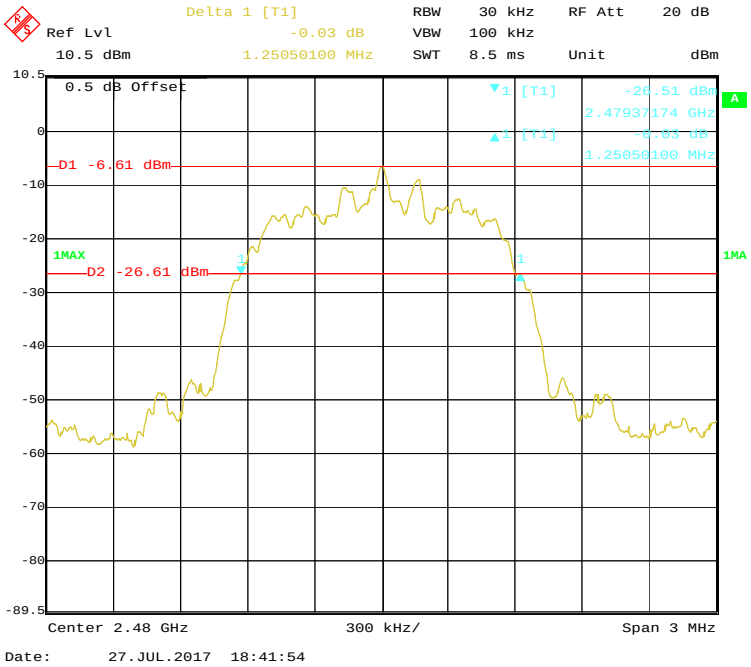
EDR (π/4-DQPSK): Low Channel



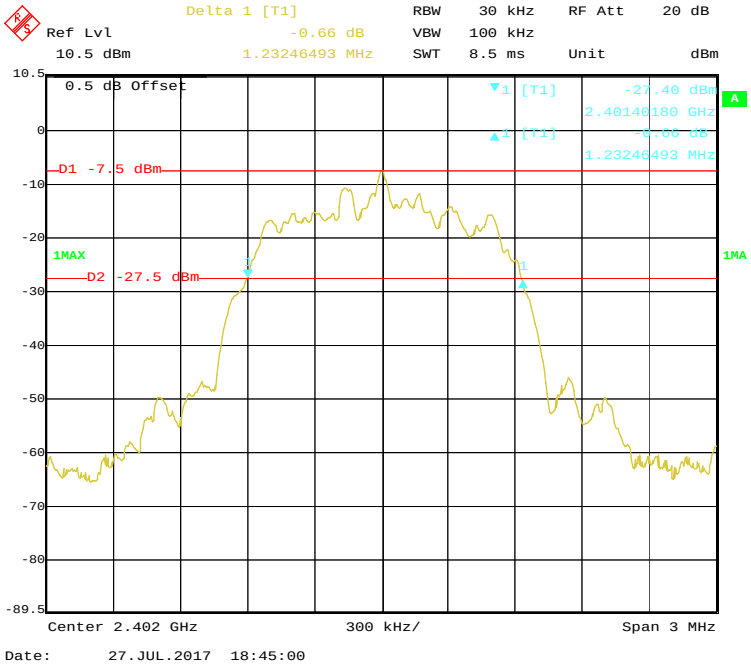
EDR(π/4-DQPSK): Middle Channel



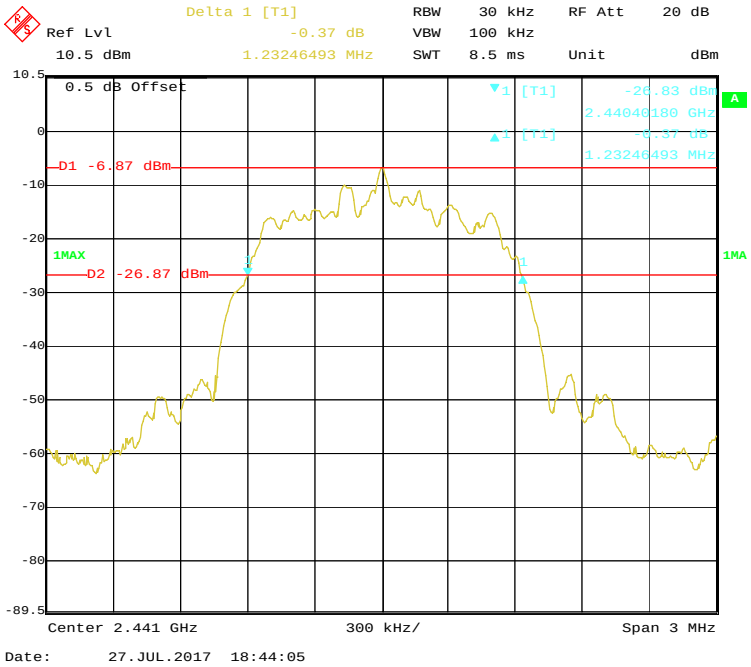
EDR (π/4-DQPSK): High Channel



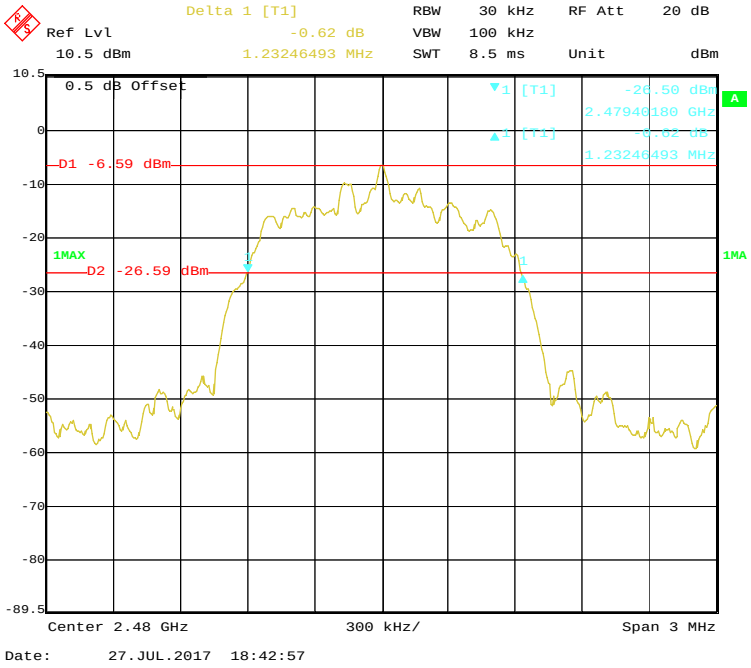
EDR (8-DPSK): Low Channel



EDR (8-DPSK): Middle Channel



EDR (8-DPSK): High Channel



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

Applicable Standard

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

Test Procedure

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.

2. Set the EUT in hopping mode from first channel to last.

3. By using the max-hold function record the quantity of the channel.

Test Data

Environmental Conditions

Temperature:	20.1 ℃
Relative Humidity:	55 %
ATM Pressure:	101.3 kPa

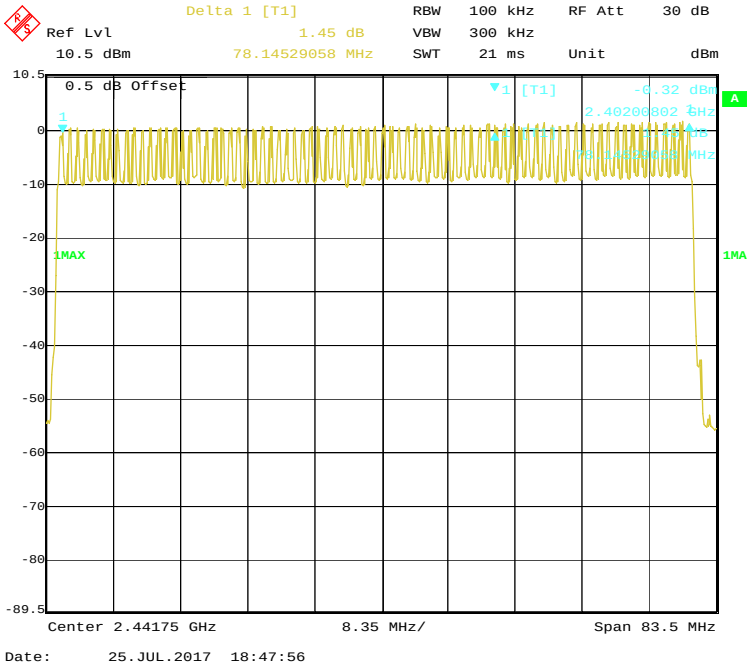
The testing was performed by Bernie Zhang on 2017-07-25.

EUT operation mode: Hopping

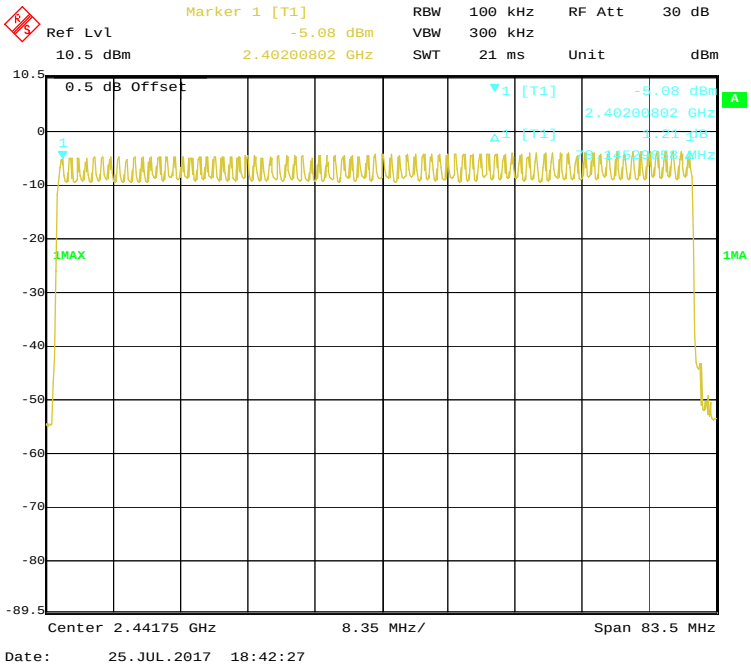
Test Result: Compliance

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

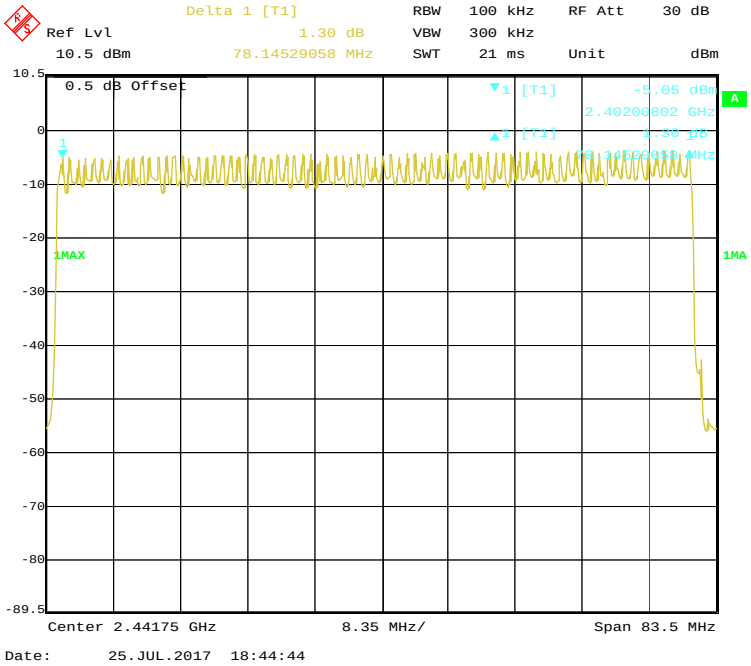
BDR (GFSK): Number of Hopping Channels



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



EDR (8-DPSK): Number of Hopping Channels



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

Applicable Standard

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

Test Procedure

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

Test Data

Environmental Conditions

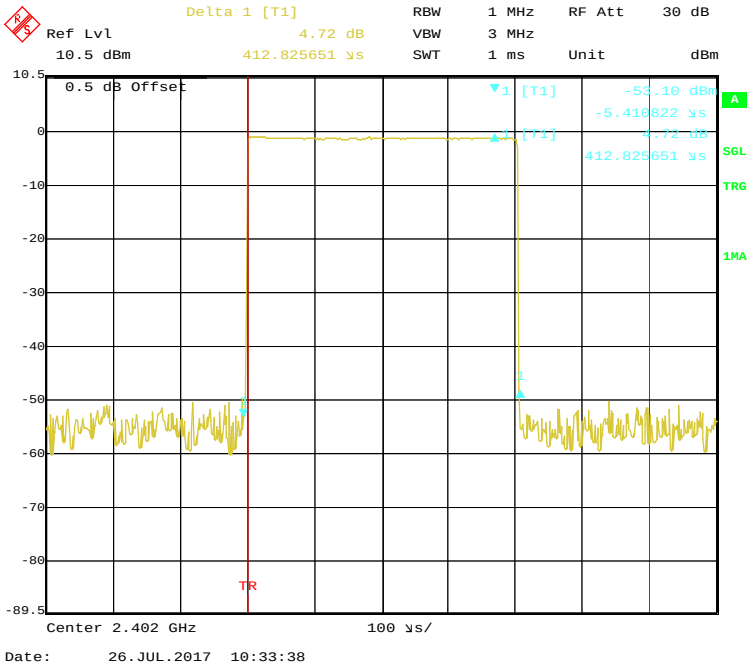
Temperature:	20.1 ℃
Relative Humidity:	55 %
ATM Pressure:	101.3 kPa

The testing was performed by Bernie Zhang on 2017-07-26.

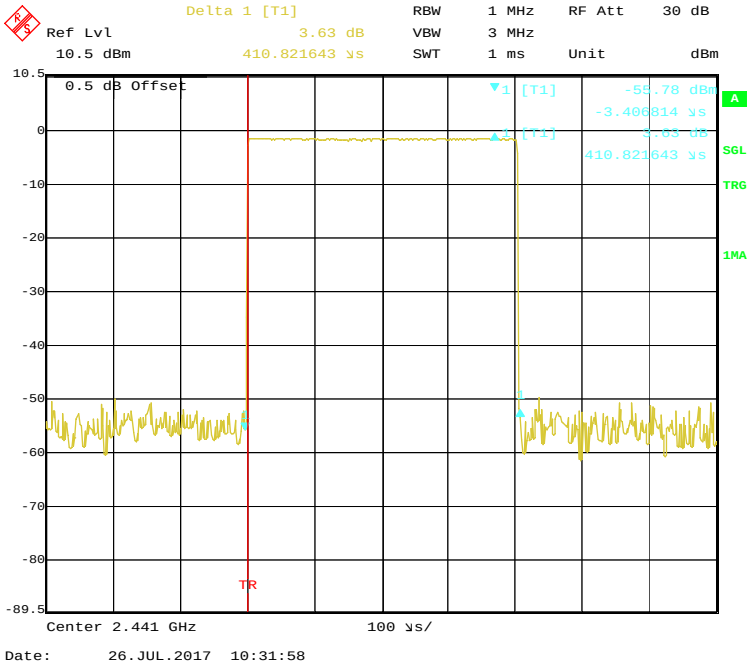
EUT operation mode: Hopping

Mode		Channel	Pulse Width (ms)	Dwell Time (S)	Limit (S)	Result
BDR (GFSK)	DH 1	Low	0.413	0.132	0.4	Pass
		Middle	0.411	0.132	0.4	Pass
		High	0.411	0.132	0.4	Pass
		Note: DH1:Dwell time = Pulse time*(1600/2/79)*31.6S				
	DH 3	Low	1.701	0.272	0.4	Pass
		Middle	1.689	0.270	0.4	Pass
		High	1.683	0.269	0.4	Pass
		Note: DH3:Dwell time = Pulse time*(1600/4/79)*31.6S				
	DH 5	Low	2.952	0.315	0.4	Pass
		Middle	2.962	0.316	0.4	Pass
		High	2.942	0.314	0.4	Pass
		Note: DH5:Dwell time = Pulse time*(1600/6/79)*31.6S				
EDR (π/4-DQPSK)	2DH 1	Low	0.419	0.134	0.4	Pass
		Middle	0.421	0.135	0.4	Pass
		High	0.417	0.133	0.4	Pass
		Note: 2DH1:Dwell time = Pulse time*(1600/2/79)*31.6S				
	2DH 3	Low	1.701	0.272	0.4	Pass
		Middle	1.701	0.272	0.4	Pass
		High	1.689	0.270	0.4	Pass
		Note: 2DH3:Dwell time = Pulse time*(1600/4/79)*31.6S				
	2DH 5	Low	2.962	0.316	0.4	Pass
		Middle	2.942	0.314	0.4	Pass
		High	2.932	0.313	0.4	Pass
		Note: 2DH5:Dwell time = Pulse time*(1600/6/79)*31.6S				
EDR (8-DPSK)	3DH 1	Low	0.417	0.133	0.4	Pass
		Middle	0.417	0.133	0.4	Pass
		High	0.419	0.134	0.4	Pass
		Note:3 DH1:Dwell time = Pulse time*(1600/2/79)*31.6S				
	3DH 3	Low	1.695	0.271	0.4	Pass
		Middle	1.695	0.271	0.4	Pass
		High	1.687	0.270	0.4	Pass
		Note: 3DH3:Dwell time = Pulse time*(1600/4/79)*31.6S				
	3DH 5	Low	2.942	0.314	0.4	Pass
		Middle	2.932	0.313	0.4	Pass
		High	2.922	0.312	0.4	Pass
		Note: 3DH5:Dwell time = Pulse time*(1600/6/79)*31.6S				

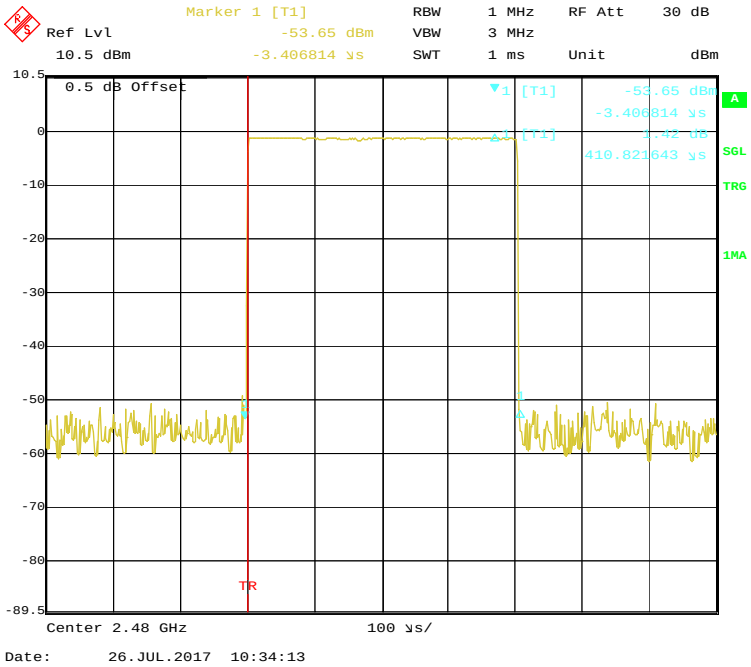
BDR (GFSK): Pulse time, Low Channel, DH1



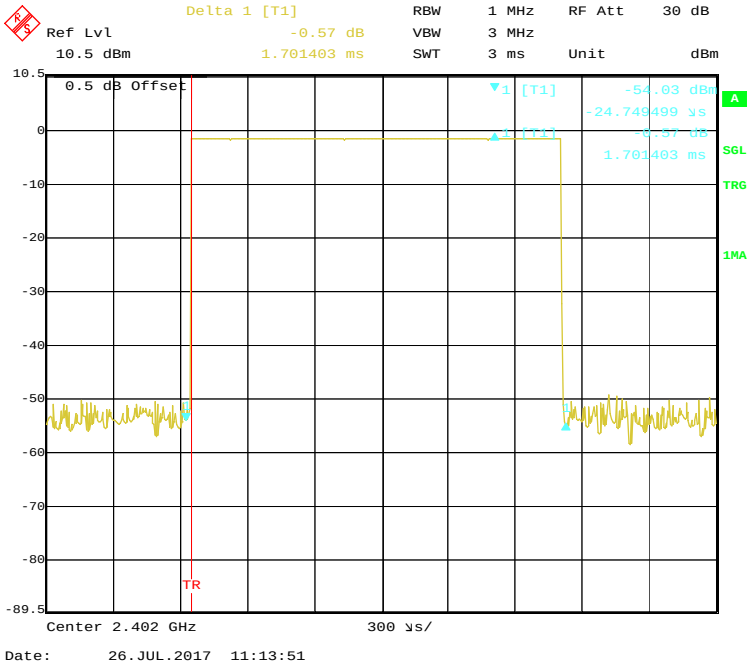
BDR (GFSK): Pulse time, Middle Channel, DH1



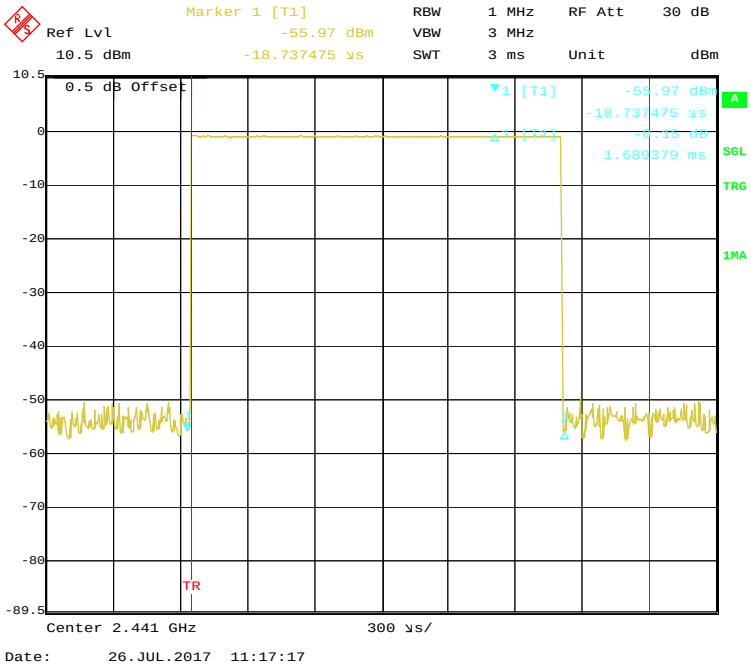
BDR (GFSK): Pulse time, High Channel, DH1



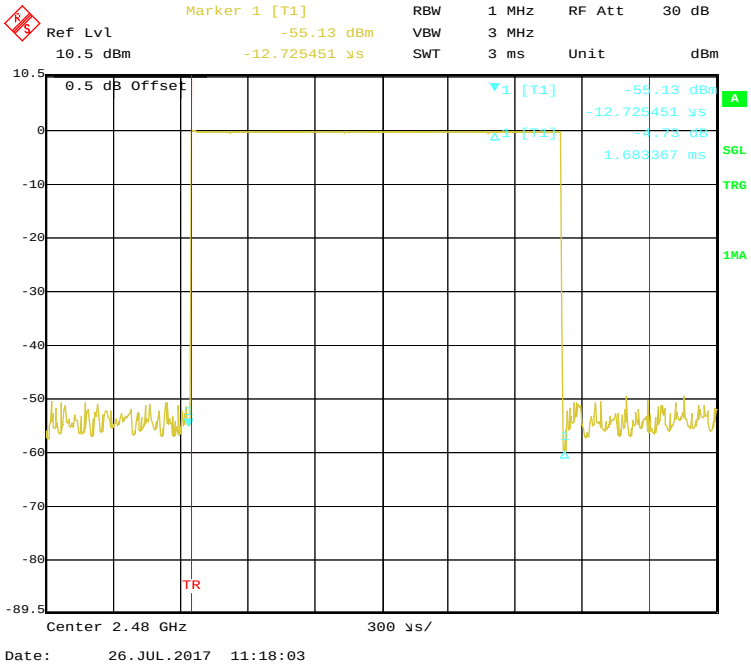
BDR (GFSK): Pulse time, Low Channel, DH3



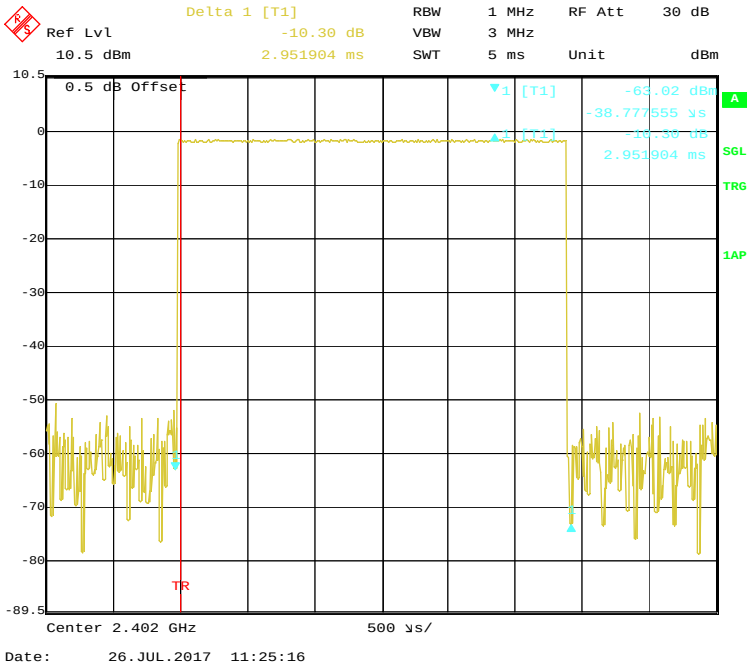
BDR (GFSK): Pulse time, Middle Channel, DH3



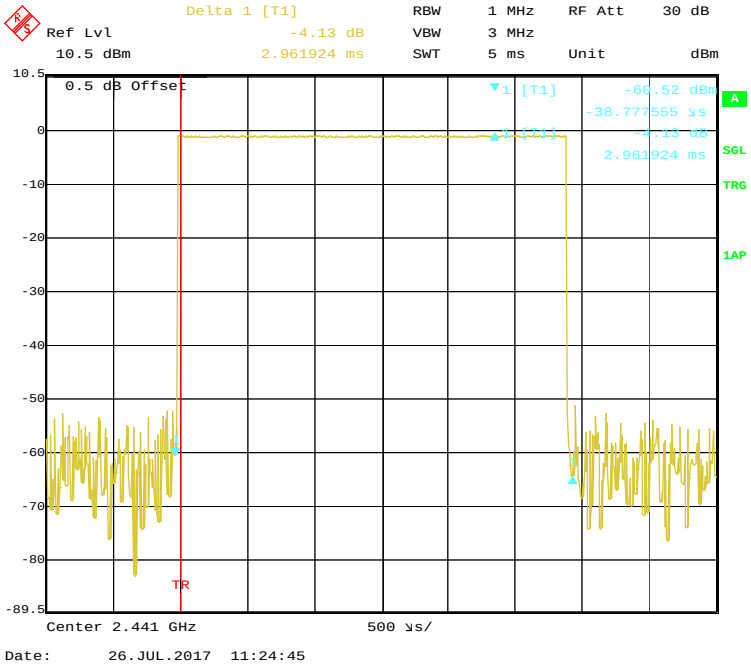
BDR (GFSK): Pulse time, High Channel, DH3



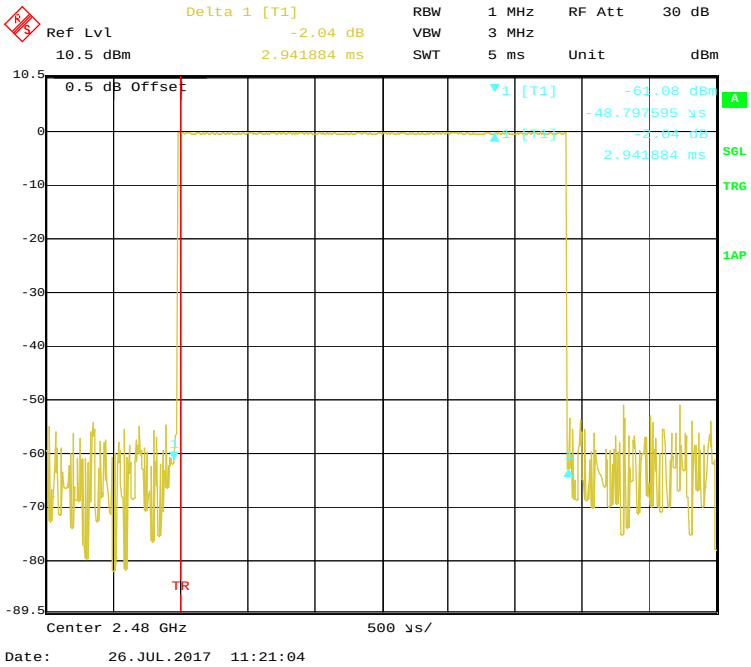
BDR (GFSK): Pulse time, Low Channel, DH5



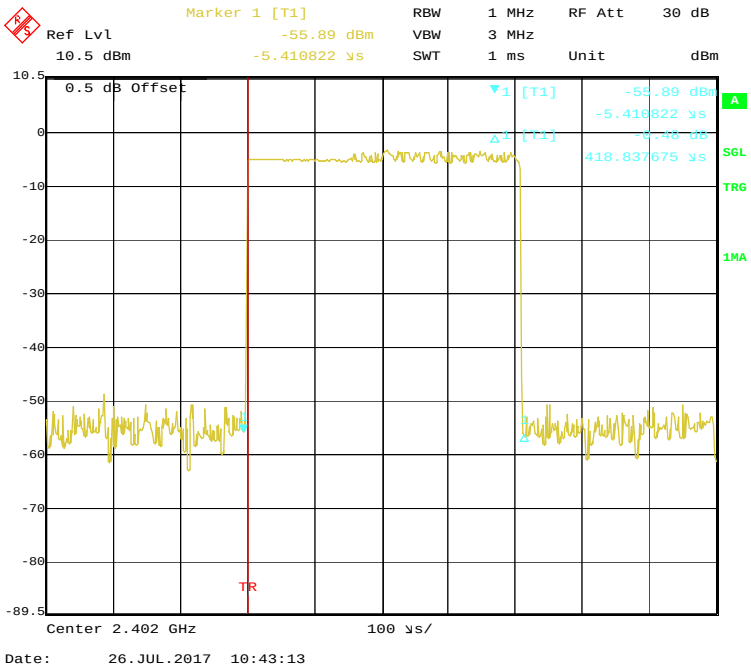
BDR (GFSK): Pulse time, Middle Channel, DH5



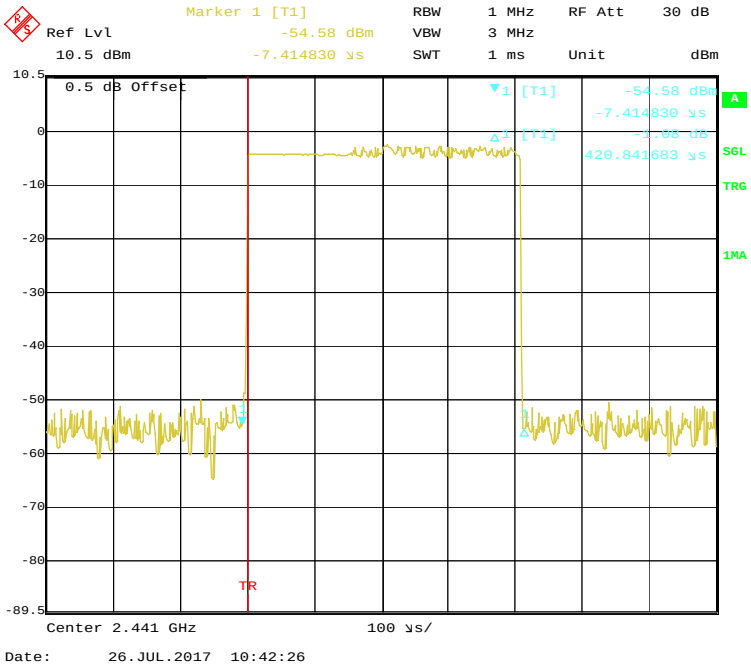
BDR (GFSK): Pulse time, High Channel, DH5



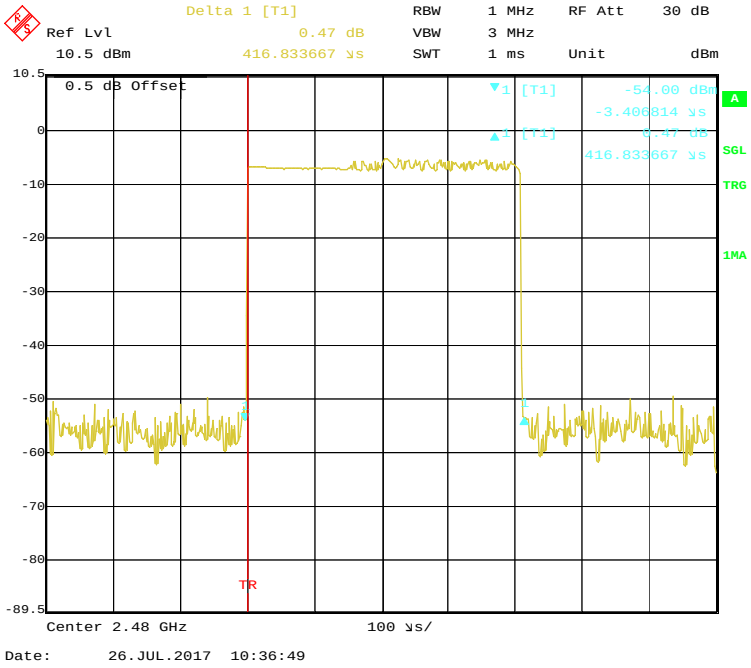
EDR (π/4-DQPSK): Pulse time, Low Channel, 2DH1



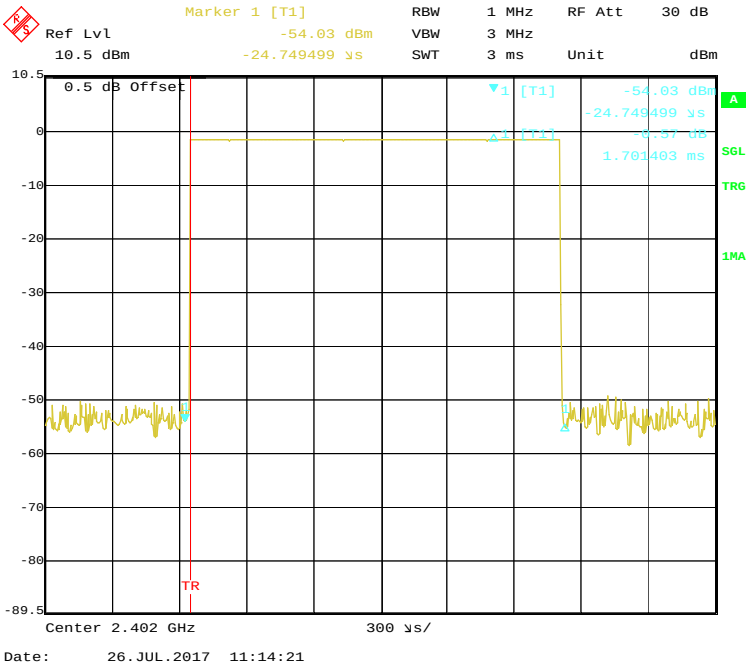
EDR (π/4-DQPSK):Pulse time, Middle Channel, 2DH1



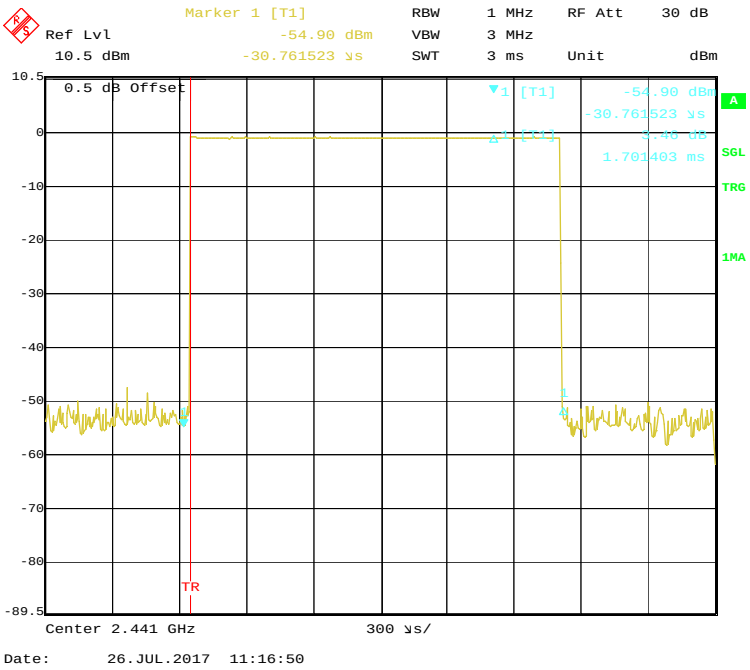
EDR (π/4-DQPSK):Pulse time, High Channel, 2DH1



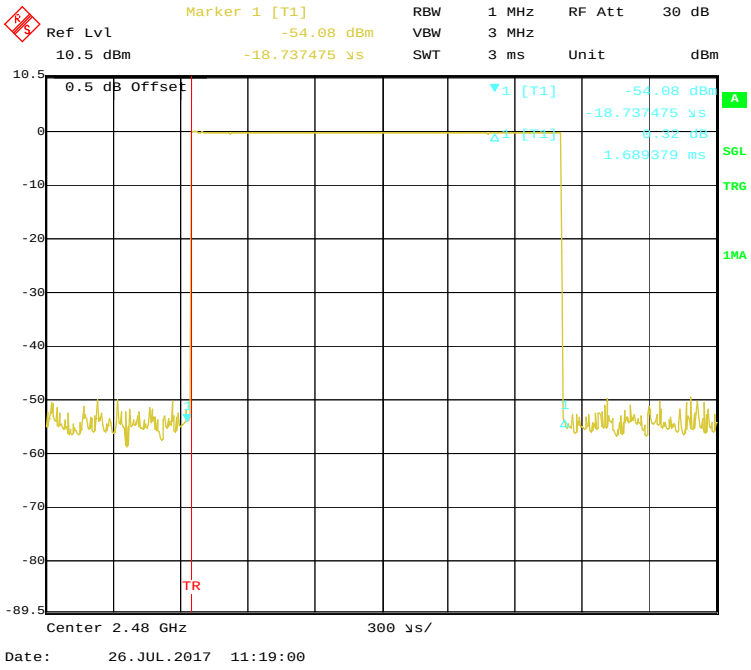
EDR (π/4-DQPSK):Pulse time, Low Channel, 2DH3



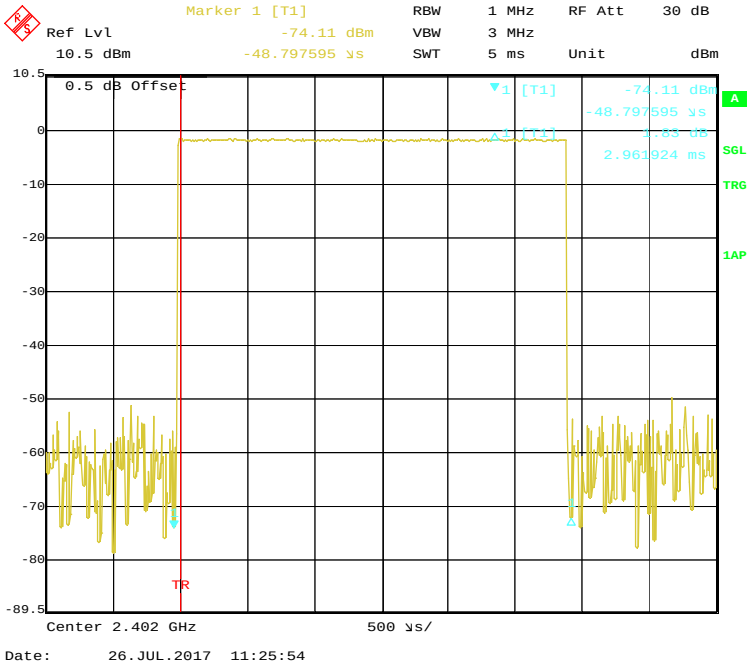
EDR (π/4-DQPSK):Pulse time, Middle Channel, 2DH3



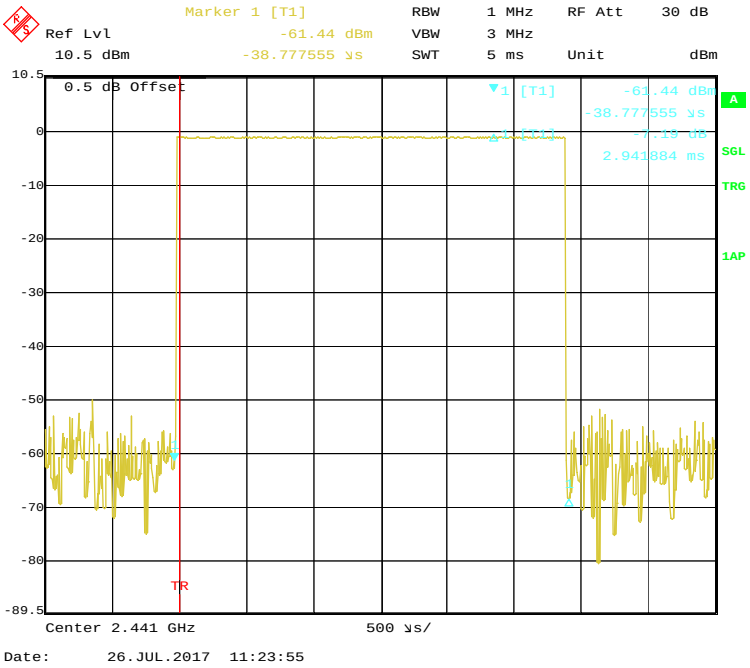
EDR (π/4-DQPSK):Pulse time, High Channel, 2DH3



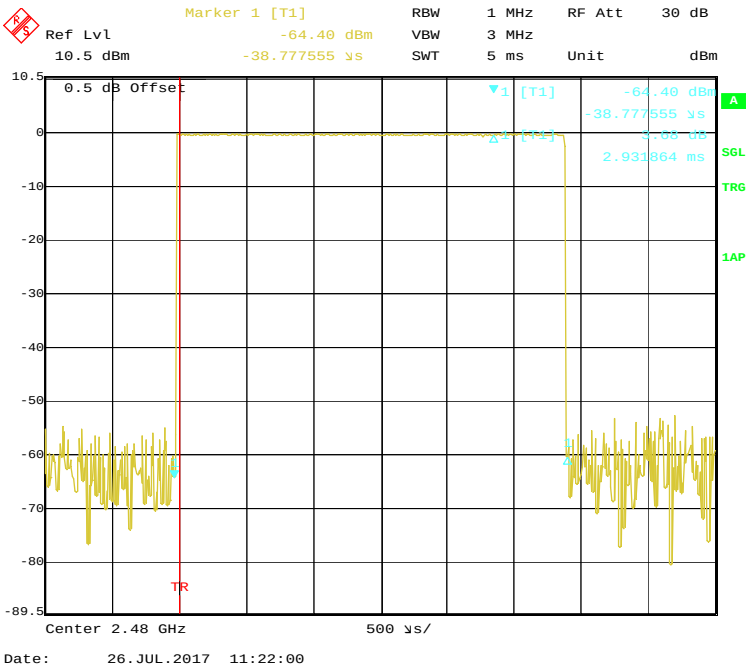
EDR (π/4-DQPSK):Pulse time, Low Channel, 2DH5



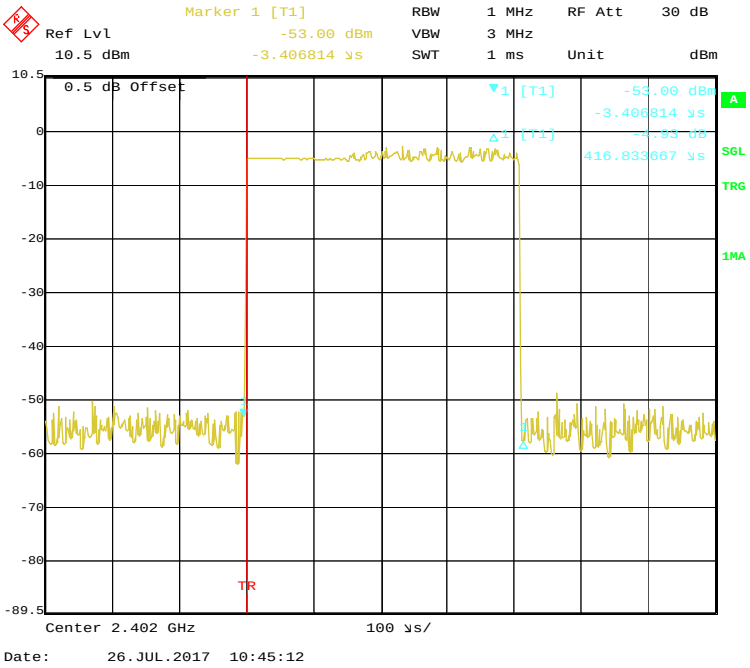
EDR (π/4-DQPSK):Pulse time, Middle Channel, 2DH5



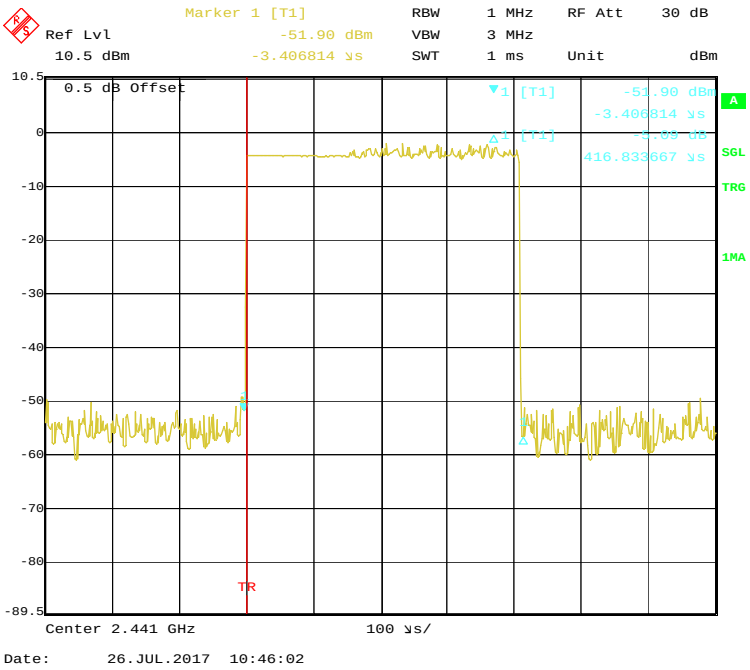
EDR (π/4-DQPSK):Pulse time, High Channel, 2DH5



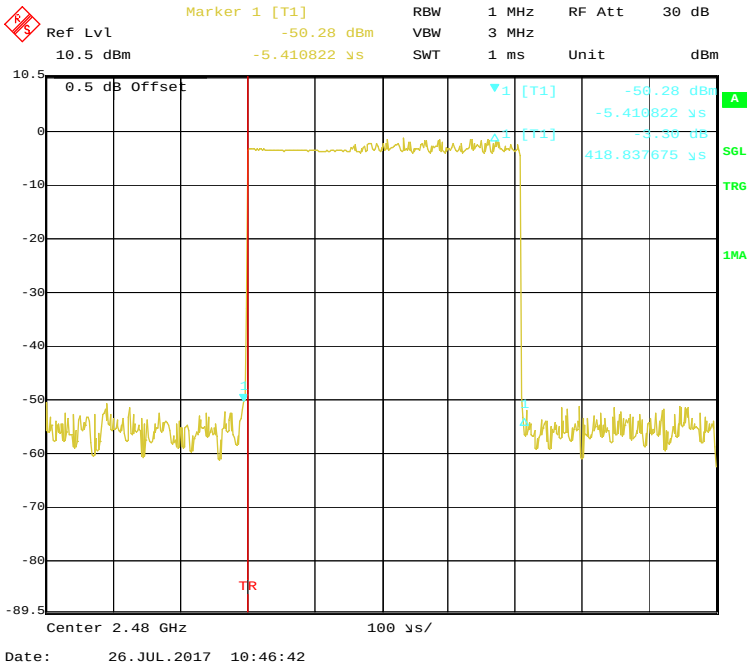
EDR (8-DPSK): Pulse time, Low Channel, 3DH1



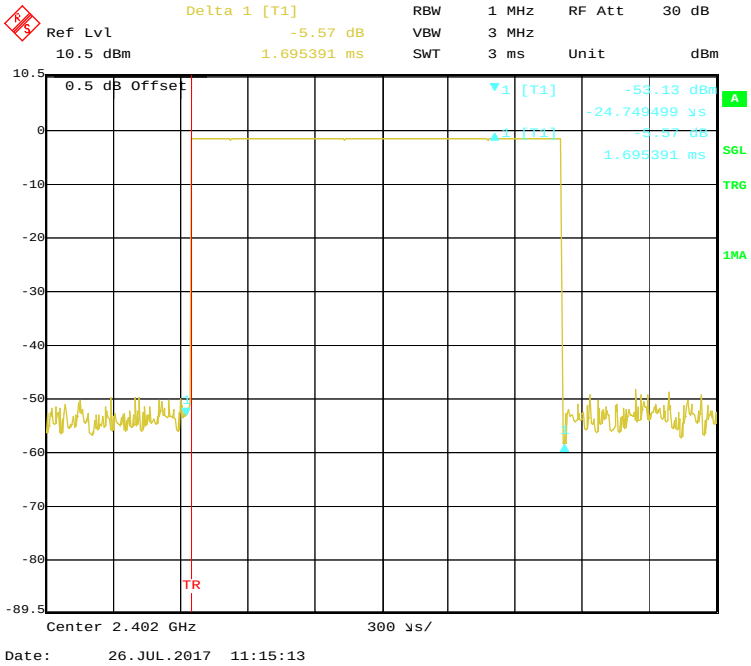
EDR (8-DPSK): Pulse time, Middle Channel, 3DH1



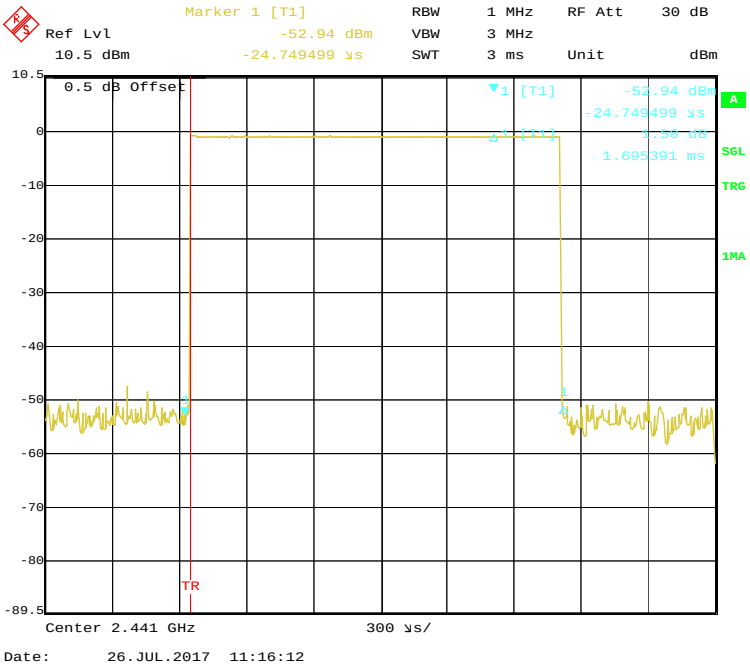
EDR (8-DPSK): Pulse time, High Channel, 3DH1



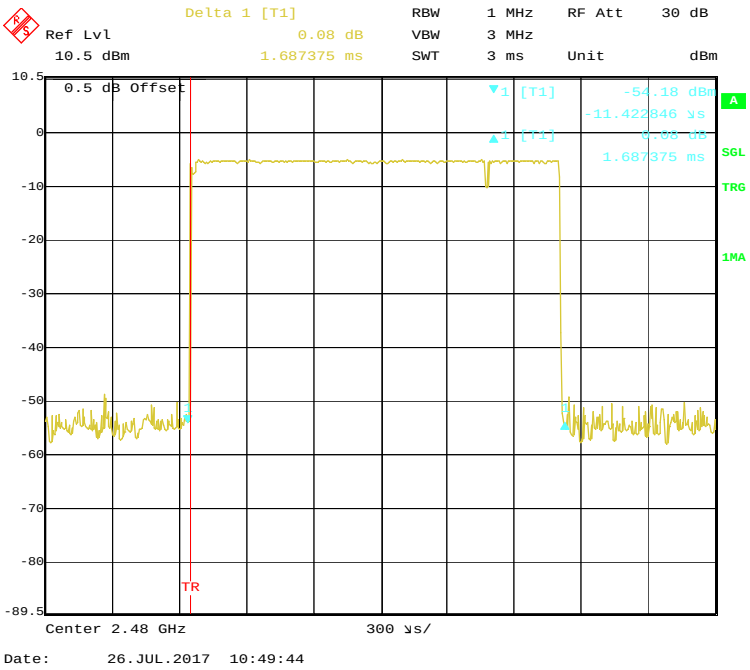
EDR (8-DPSK): Pulse time, Low Channel, 3DH3



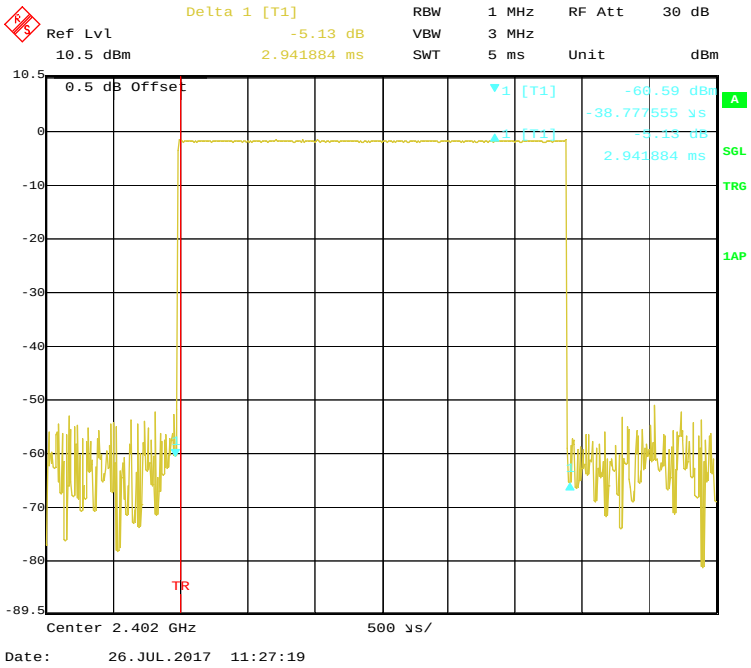
EDR (8-DPSK): Pulse time, Middle Channel, 3DH3



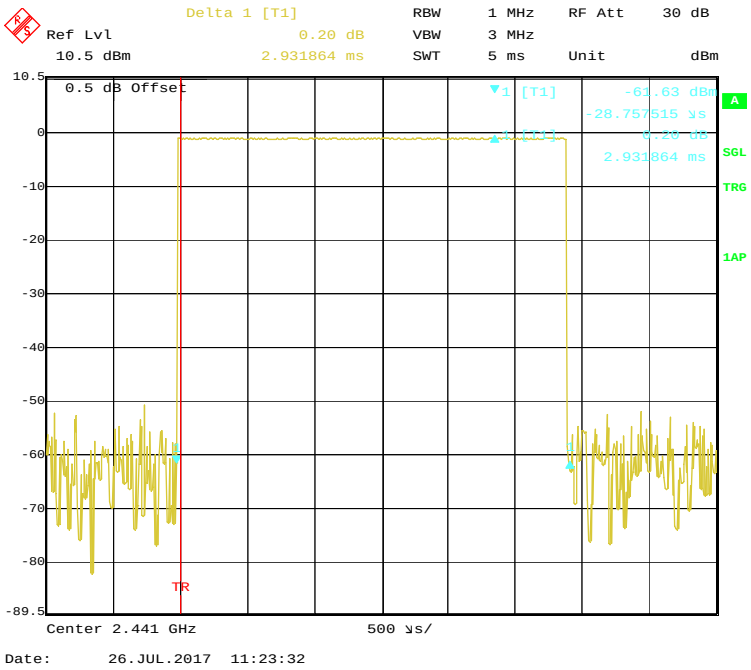
EDR (8-DPSK): Pulse time, High Channel, 3DH3



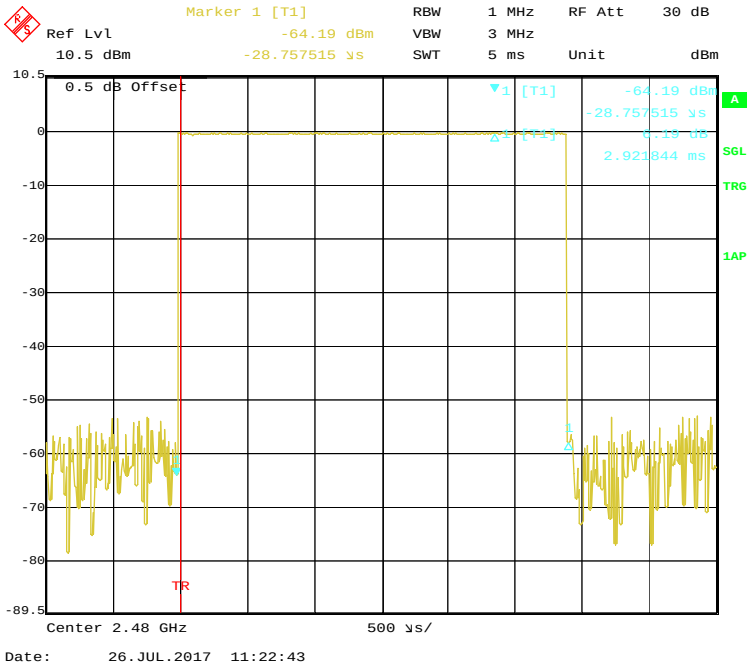
EDR (8-DPSK): Pulse time, Low Channel, 3DH5



EDR (8-DPSK): Pulse time, Middle Channel, 3DH5



EDR (8-DPSK): Pulse time, High Channel, 3DH5



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

Applicable Standard

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

Test Procedure

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

Test Data

Environmental Conditions

Temperature:	20.2 ℃
Relative Humidity:	55 %
ATM Pressure:	101.3 kPa

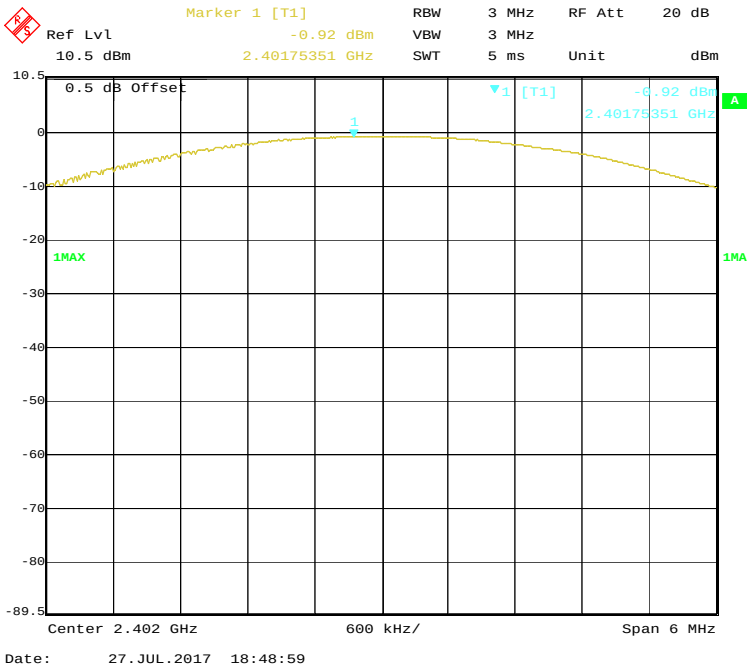
The testing was performed by Bernie Zhang on 2017-07-27.

EUT operation mode: Transmitting

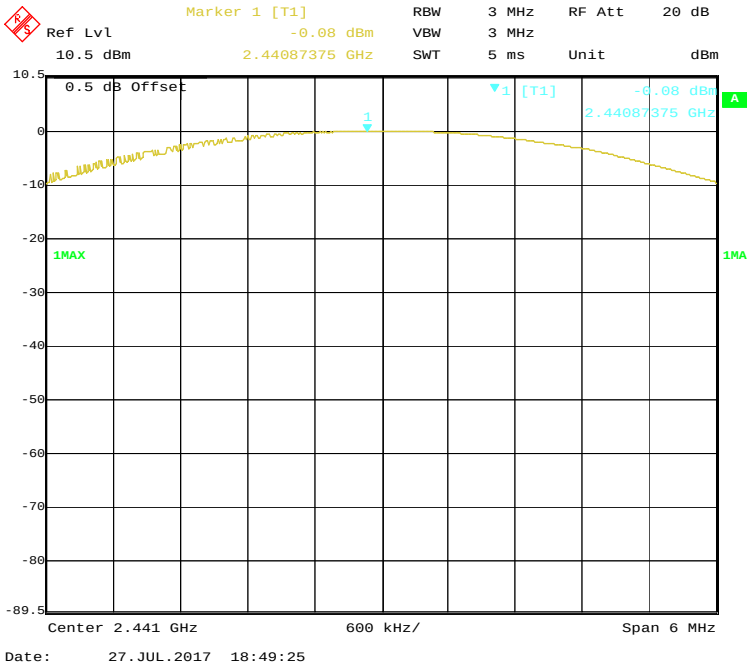
Test Result: Compliance

Mode	Channel	Frequency (MHz)	Output Power		Limit (mW)
			(dBm)	(mW)	
BDR (GFSK)	Low	2402	-0.92	0.81	1000
	Middle	2441	-0.08	0.98	1000
	High	2480	0.48	1.12	1000
EDR (π/4-DQPSK)	Low	2402	-4.12	0.39	1000
	Middle	2441	-3.32	0.47	1000
	High	2480	-2.85	0.52	1000
EDR (8-DPSK)	Low	2402	-3.61	0.44	1000
	Middle	2441	-2.84	0.52	1000
	High	2480	-2.37	0.58	1000

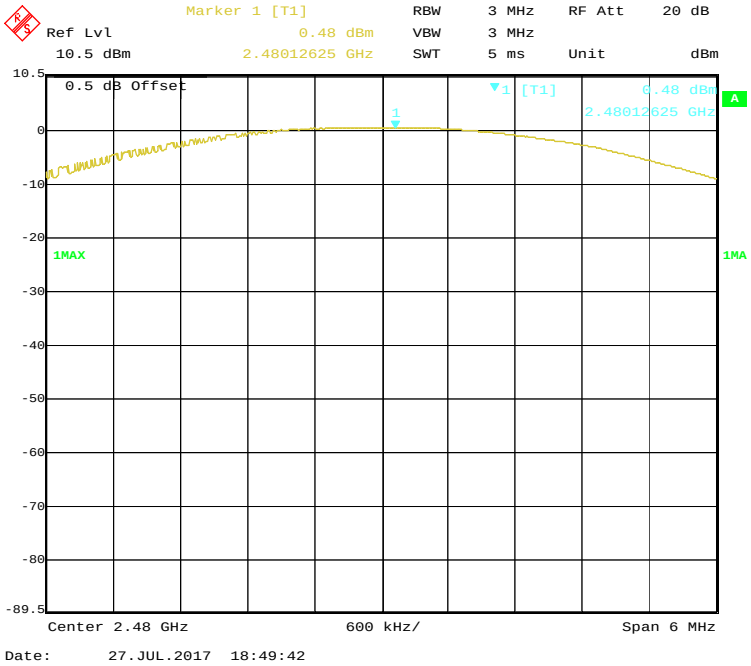
BDR (GFSK): Low Channel Power



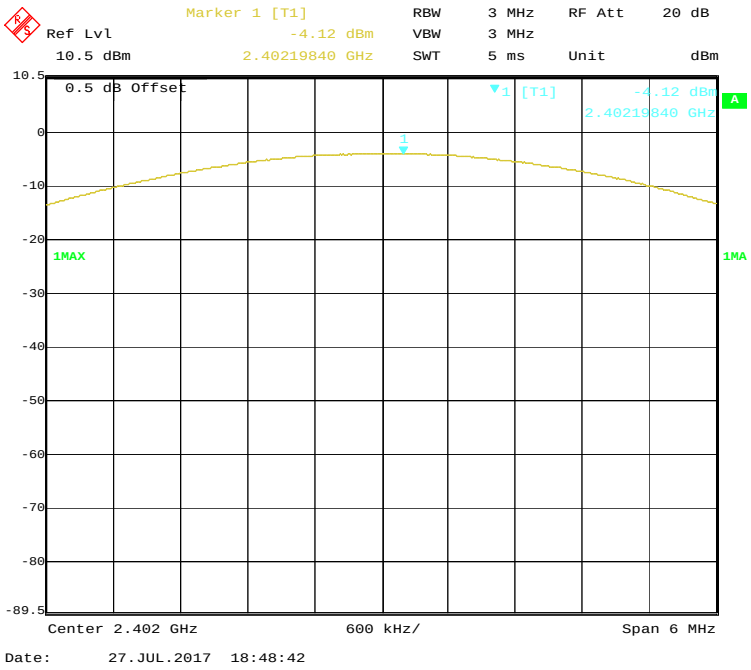
BDR (GFSK): Middle Channel Power



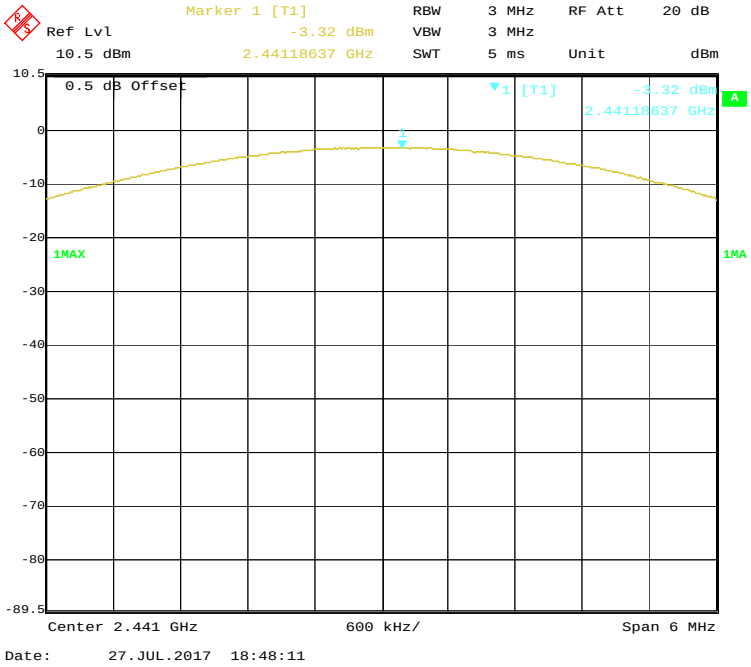
BDR (GFSK): High Channel Power



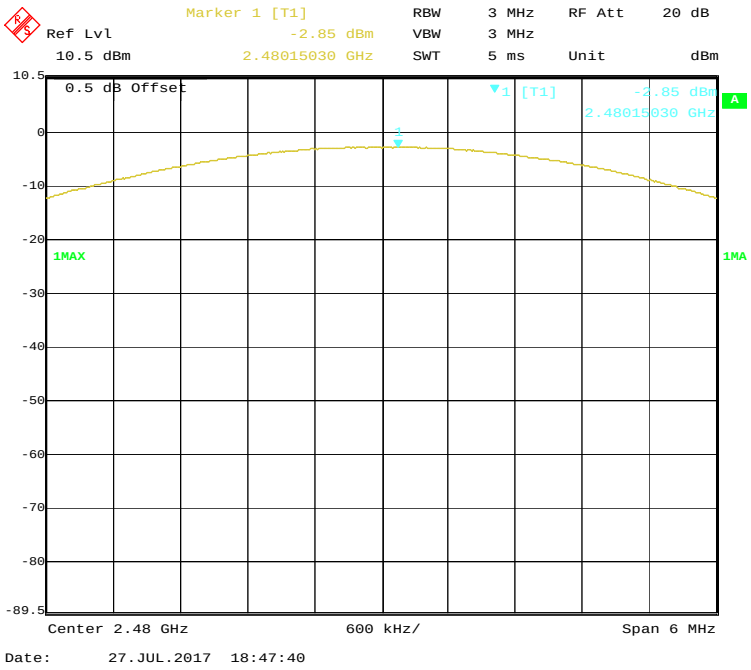
EDR(π/4-DQPSK): Low Channel Power



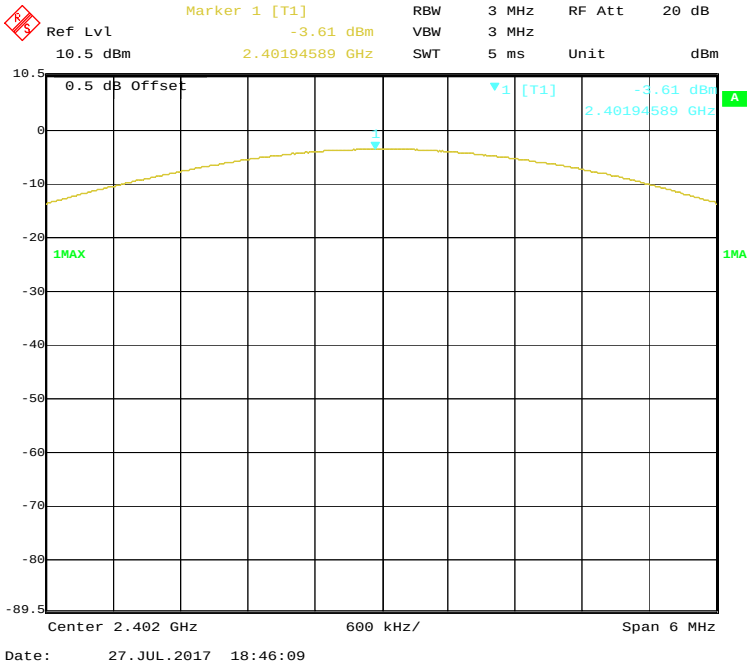
EDR(π/4-DQPSK): Middle Channel Power



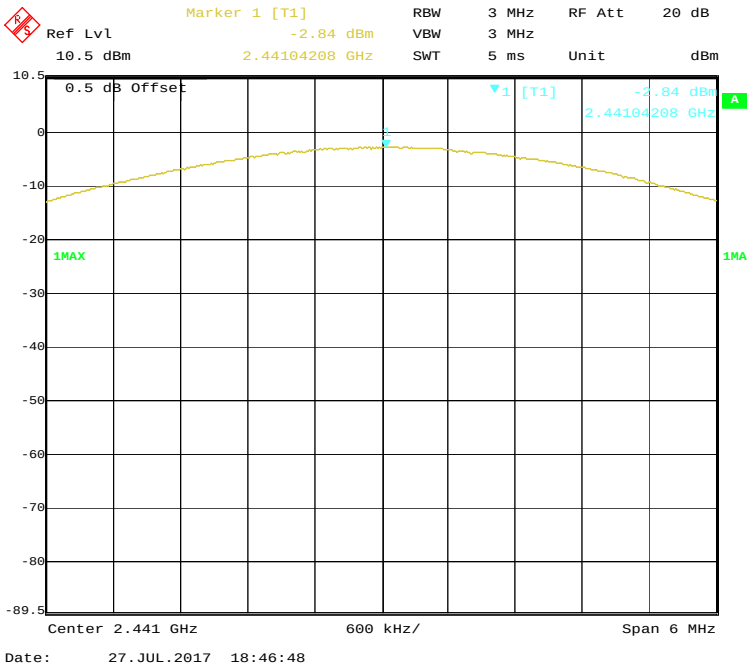
EDR(π/4-DQPSK): High Channel Power



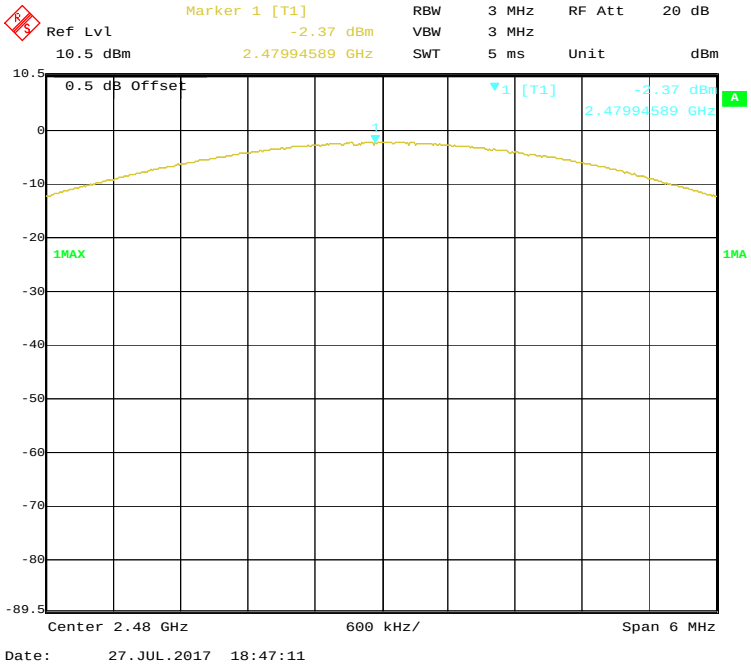
EDR(8-DPSK): Low Channel Power



EDR(8-DPSK): Middle Channel Power



EDR(8-DPSK): High Channel Power



FCC §15.247(d) - BAND EDGES TESTING

Applicable Standard

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

Test Procedure

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

Test Data

Environmental Conditions

Temperature:	20.2 ℃
Relative Humidity:	55 %
ATM Pressure:	101.3 kPa

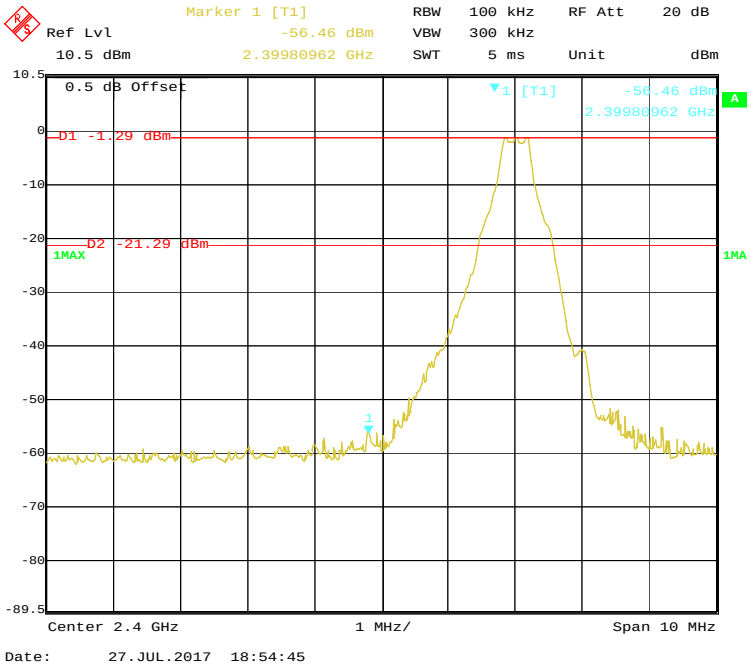
The testing was performed by Bernie Zhang on 2017-07-27 & 2017-08-06.

EUT operation mode: Transmitting & Hopping

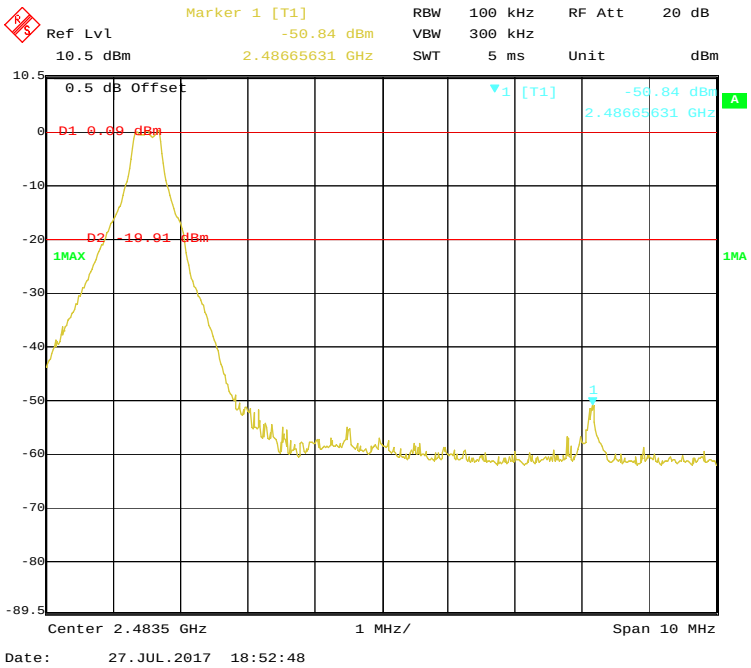
Test Result: Compliance

Band Edge

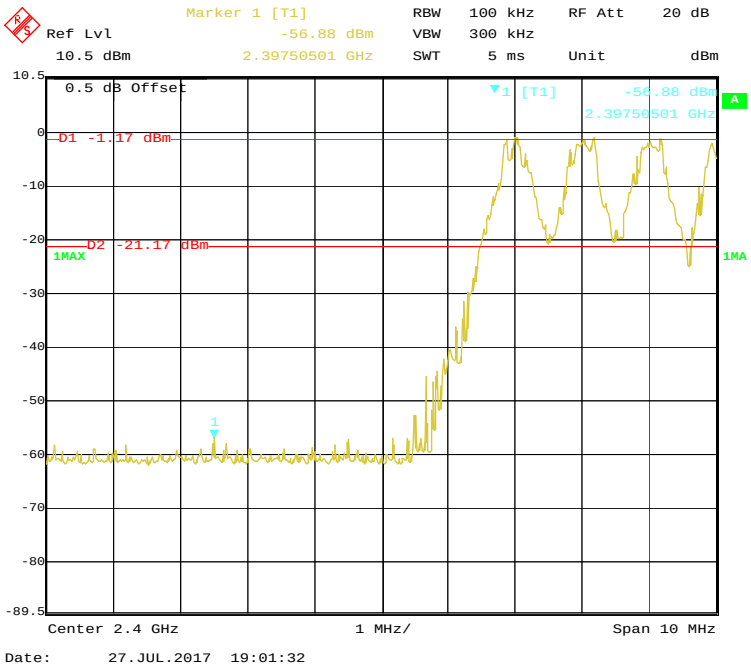
BDR (GFSK): Transmitting_Left Side



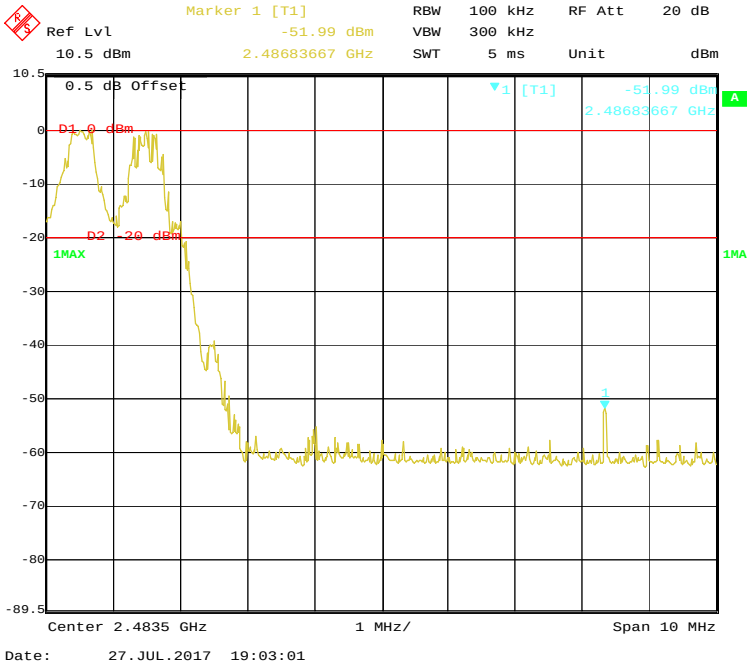
BDR (GFSK): Transmitting_Right Side



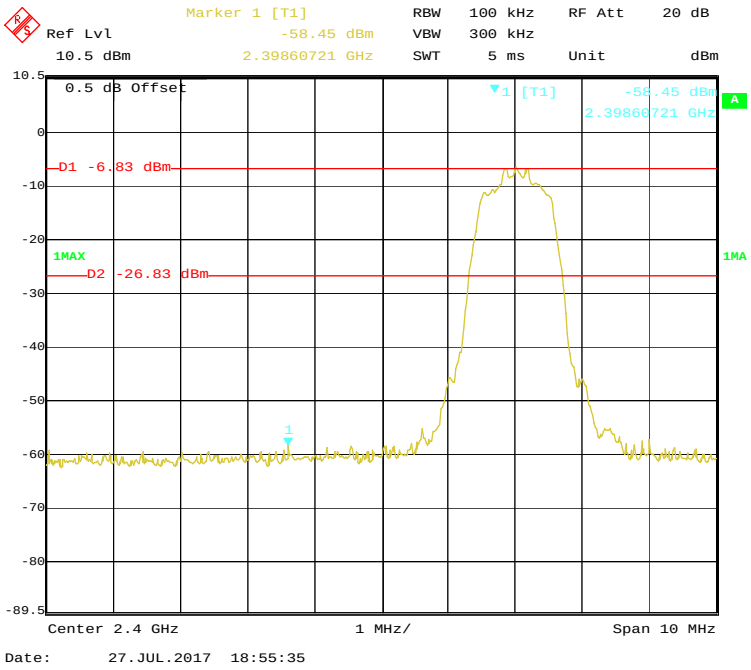
BDR (GFSK): Hopping_Left Side



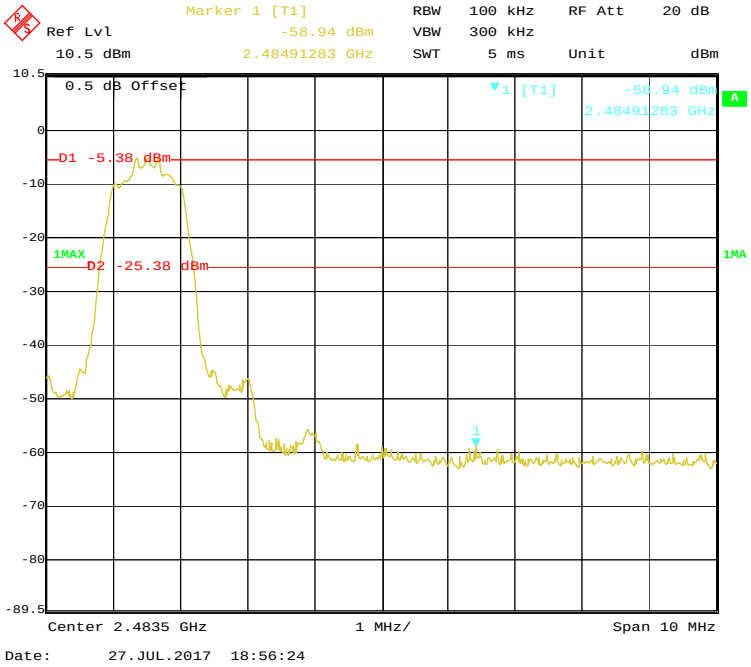
BDR (GFSK): Hopping_Right Side



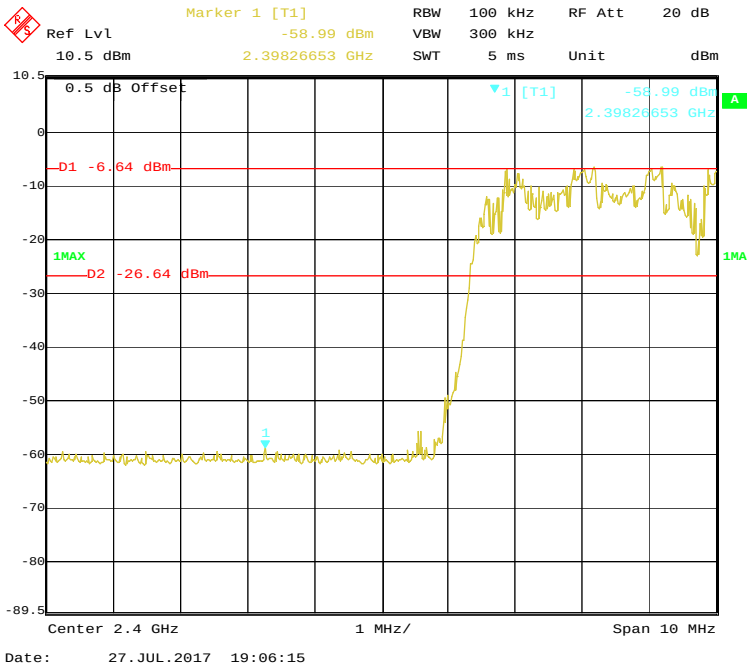
EDR (π/4-DQPSK): Transmitting_Left Side



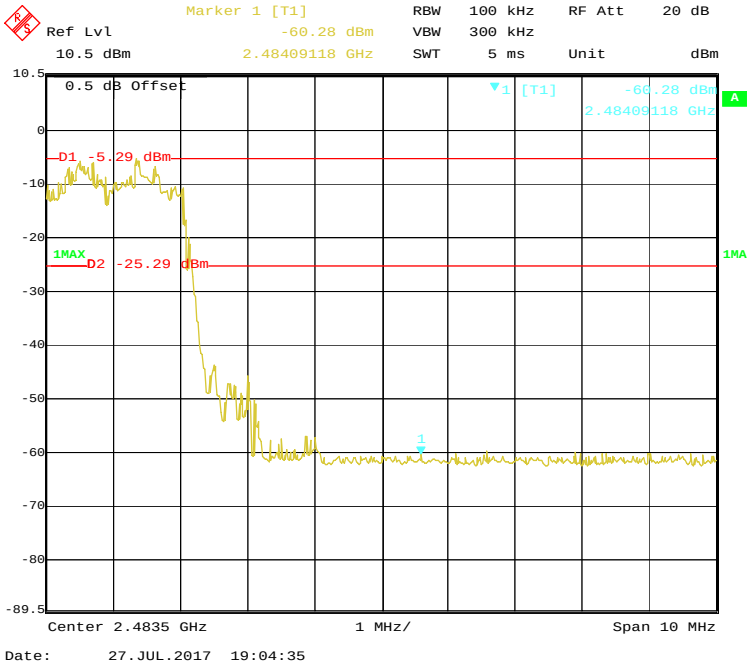
EDR (π/4-DQPSK): Transmitting_Right Side



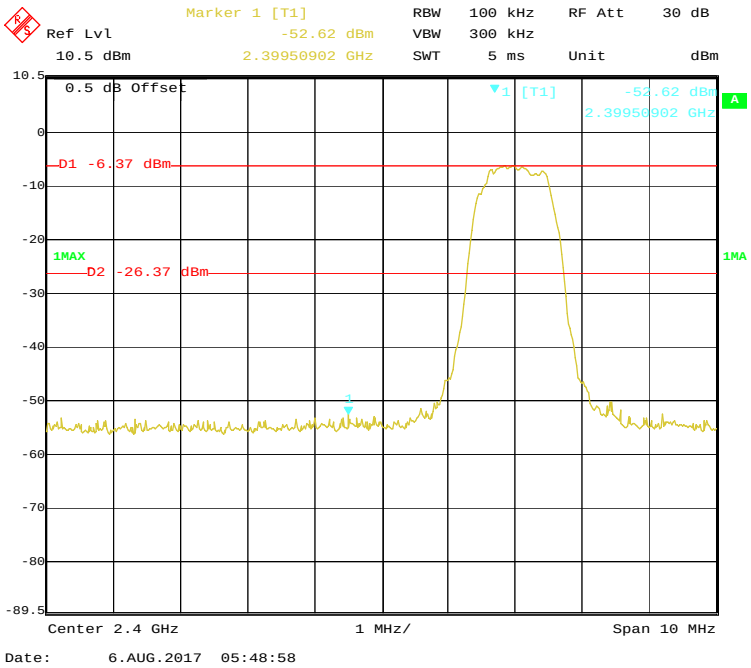
EDR (π/4-DQPSK): Hopping_Left Side



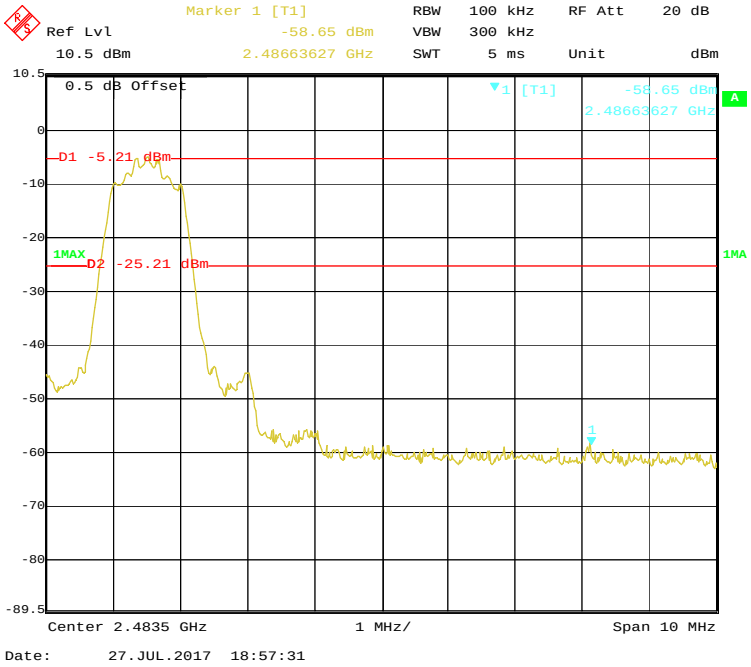
EDR (π/4-DQPSK): Hopping_Right Side



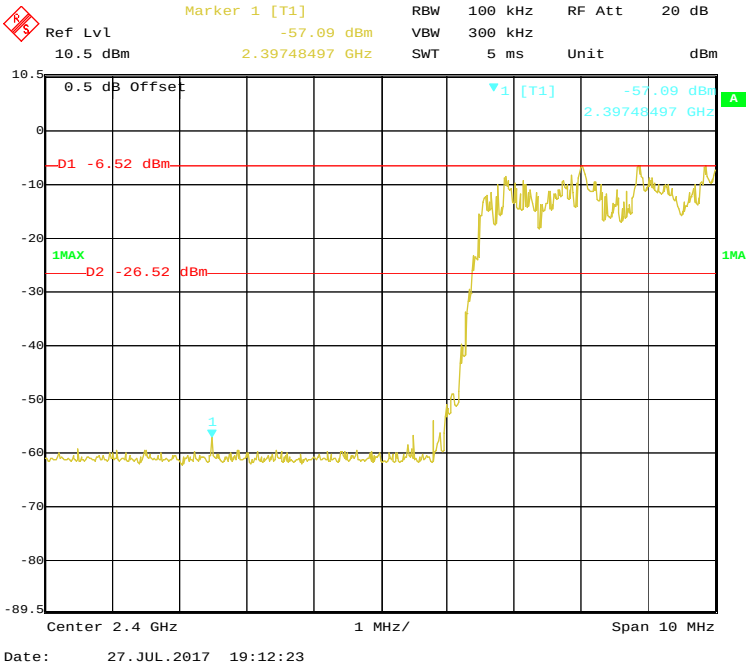
EDR (8-DPSK): Transmitting_Left Side



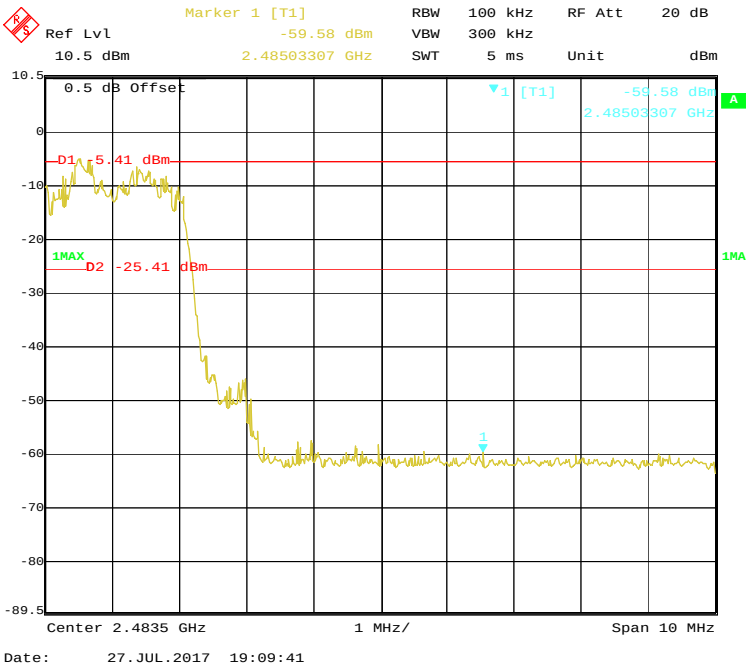
EDR (8-DPSK): Transmitting_Right Side



EDR (8-DPSK): Hopping_Left Side



EDR (8-DPSK): Hopping_Right Side



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