FCC PART 15.247

TEST REPORT

For

Chengdu XGimi Technology Co., Ltd.

Building A4, Tianfu Software Park, Hi-tech Zone, Chengdu, China

FCC ID: 2AFENXH05L

Report Type:	**Equipment Name:**
Original Report	LED Projector

Report Number:	RSC180413001-0D
Report Date:	2018-05-23
Reviewed By:	Sula Huang Engineering Director
Prepared By:	Bay Area Compliance Laboratories Corp. (Chengdu) No.5040, Huilongwan Plaza, No. 1, Shawan Road, Jinniu District, Chengdu, Sichuan, China Tel: +86-28-65525123 Fax: +86-28-65525125 www.baclcorp.com

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The ***Chengdu XGimi Technology Co., Ltd.***'s product, model number: **XH05L (FCC ID: 2AFENXH05L)** or the "EUT" as referred to in this report was the **LED Projector**.

Mechanical Description of EUT

The EUT was measured approximately: 192 mm (L) x 192 mm (W) x 47 mm (H).
Rated input voltage: DC19V from adapter.

Adapter Information
Manufacturer: Shenzhen Huntkey Electric Co., Ltd.
Model: HKA06519034-6J
Input: AC 100-240V; 50/60Hz, 1.5A
Output: DC 19V, 3.42A

Note: The products, test model: XH05L, multiple models: XH06L, XH07L, XH08L, XH09L, XH10L, XH11L, XH12L, XH13L, XH14L, XH15L, XH16L, XH17L, XH18L, XH19L, XH20L, XH21L, XH22L, XH23L, XH24L, XH25L, XH26L, XH27L, XH28L, XH29L, XH30L, XH31L, XH32L, XH33L, XH34L, their differences were presented in Product Difference Statement provided by the applicant. So we selected model XH05L to fully test.

**All measurement and test data in this report was gathered from final production sample, serial number: 180413001/01 (assigned by the BACL, Chengdu). It may have deviation from any other sample. The EUT supplied by the applicant was received on 2018-04-13, and EUT conformed to test requirement.*

Objective

This report is prepared on behalf of ***Chengdu XGimi Technology 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 Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

Related Submittal(s)/Grant(s)

FCC Part 15.247 DTS submissions with FCC ID: 2AFENXH05L
FCC Part 15.407 NII submissions with FCC ID: 2AFENXH05L
FCC Part 15.247 DTS submissions with FCC ID: 2AFENB914C

Measurement Uncertainty

Item			Uncertainty
AC power line conducted emission			2.71 dB
Radiated Emission(Field Strength)	30MHz-200MHz	H	4.57 dB
		V	4.81 dB
	200MHz-1GHz	H	5.69 dB
		V	6.07 dB
	1GHz-6GHz		5.49 dB
	6GHz-18GHz		5.57 dB
	18GHz-40GHz		5.48 dB
Conducted RF Power			±0.61dB
Power Spectrum Density			±0.61dB
Occupied Bandwidth			±5%
Conducted Emission			±1.5dB
Humidity			±5%
Temperature			±1℃

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.

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Chengdu) to collect test data is located No.5040, Huilongwan Plaza, No. 1, Shawan Road, Jinniu District, Chengdu, Sichuan, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 910975, the FCC Designation No. : CN1186.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062C-1.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in engineering mode.

Equipment Modifications

No modification was made to the EUT.

EUT Exercise Software

Test software: “WCN_Combo_Tool” installed in device was used during test, the setting was configured as below:

Test Software Version		WCN_Combo_Tool		
Test Frequency		2402MHz	2441MHz	2480MHz
GFSK	Power Level	4	4	4
π/4-DQPSK	Power Level	4	4	4
8PSK	Power Level	4	4	4

Support Equipment List and Details

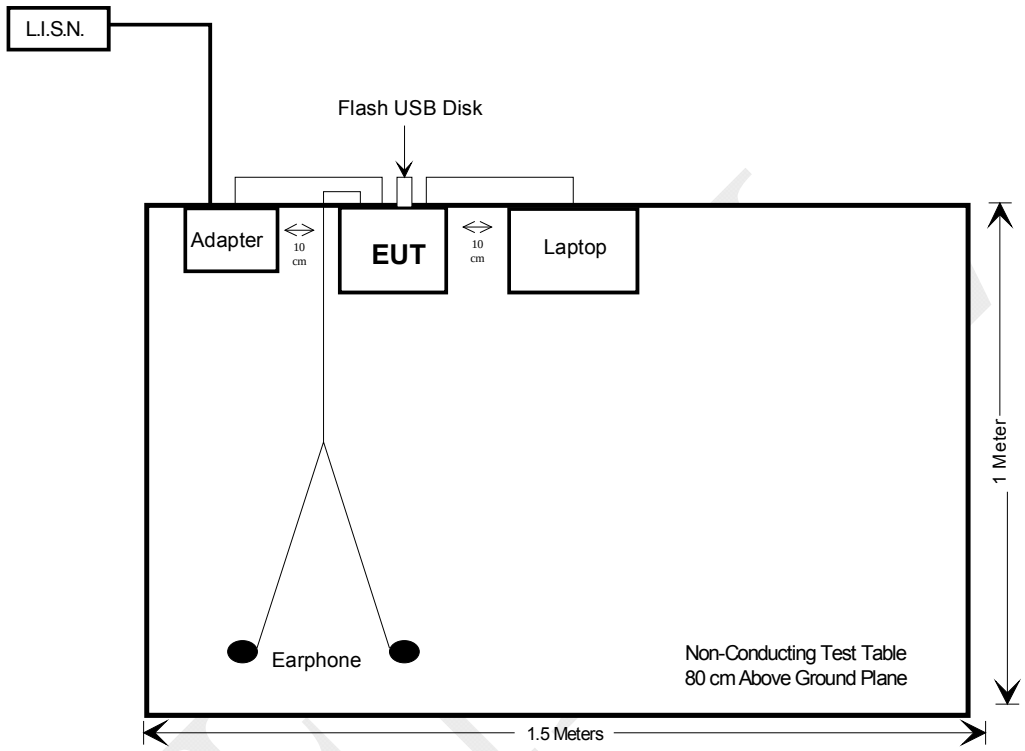
Manufacturer	Description	Model	Serial Number
SONY	Laptop	SVF143A1QT	None
Kingston	Flash USB Disk	DTSE9	7869951
HUAWEI	Earphone	P9	None

External I/O Cable

Cable Description	Length (m)	From / Port	To
Unshielded Power Cable	1.2	Adapter	EUT
Shielded detachable HDMI Cable with Ferrite Core	1.8	EUT /HDMI port	Laptop
Unshielded Earphone Cable	1.0	EUT/ Earphone	Earphone

Block Diagram of Test Setup

Conducted Emissions



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
FCC §15.247 & §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

TEST EQUIPMENTS LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emission					
Rohde & Schwarz	EMI Test Receiver	ESCS 30	836858/0016	2017-12-02	2018-12-01
Rohde & Schwarz	L.I.S.N.	ENV216	100018	2017-05-20	2018-05-19
Rohde & Schwarz	RF Limiter	ESH3Z2	DE14781	2017-11-10	2018-11-09
N/A	Conducted Cable	L-E003	N/A	2017-11-10	2018-11-09
Rohde & Schwarz	EMC32	N/A	V 8.52.0	N/A	N/A
Radiated Emission					
EMCT	Semi-Anechoic Chamber	966	N/A	2017-05-18	2020-05-17
Sonoma	Pre-Amplifier	310N	186684	2017-08-18	2018-08-17
Rohde & Schwarz	EMI Test Receiver	ESIB 40	100215	2017-09-12	2018-09-11
Rohde & Schwarz	EMI Test Receiver	ESCI	100028	2017-05-20	2018-05-19
A.H. Systems, Inc	Amplifier	PAM-0118P	467	2017-08-10	2018-08-09
EM Electronics	RF Pre-Amplifier	EM18G40	060725	2018-03-28	2019-03-27
SUNOL SCIENCES	Broadband Antenna	JB3	A121808	2017-05-19	2020-05-18
ETS	Horn Antenna	3115	003-6076	2017-05-19	2020-05-18
A.H. Systems, Inc	Horn Antenna	SAS-574	510	2017-05-19	2020-05-18
INMET	Attenuator	18N-6dB	64671	2017-11-10	2018-11-09
Sinoscite.,Co Ltd	Reject Band Filter	BSF 2402-2480MN	0898-005	2017-11-10	2018-11-09
N/A	RF Cable (below 1GHz)	L-E005	N/A	2017-11-10	2018-11-09
N/A	RF Cable (below 1GHz)	T-E128	N/A	2017-11-10	2018-11-09
N/A	RF Cable (below 1GHz)	T-E129	N/A	2017-11-10	2018-11-09
N/A	RF Cable (above 1GHz)	T-E069	N/A	2017-11-10	2018-11-09
Micro-coax	RF Cable (above 1GHz)	T-E209	MFR 64639 2310	2018-03-14	2019-03-13
Rohde & Schwarz	EMC32	N/A	V 8.52.0	N/A	N/A

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
Rohde & Schwarz	Spectrum Analyzer	FSEM30	100018	2017-05-18	2018-05-17
WEINSCHEL ENGINEERING	Attenuator	1A10dB	AA4135	2017-11-10	2018-11-09
N/A	RF Cable	NO.3	N/A	2017-11-10	2018-11-09
E-Microwave	DC Block	EMDCB-00036	OE01304225	2017-12-09	2018-12-08
N/A	RF Cable	N/A	N/A	Each Time	/

*** Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

FCC §15.247 & §1.1310 & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

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

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

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

Per 447498 D01 General RF Exposure Guidance v06**,** simultaneous transmission MPE test exclusion applies when the sum of the MPE for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modeled or measured field strengths or power density, is ≤ 1.0.

Calculated Formulary:

Predication of MPE limit at a given distance

$$S = PG/4\pi R^2$$

Where:
S = power density (in appropriate units, e.g. mW/cm^2);
P = power input to the antenna (in appropriate units, e.g., mW);
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

Calculated Data:

MPE evaluation for single transmission:

Mode	Frequency Range (MHz)	Antenna Gain		Tune-up Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)			
WLAN	2412-2462	3.52	2.25	16.50	44.67	20	0.020	1.00
	5150-5250	5.50	3.55	15.50	35.48	20	0.025	1.00
	5725-5850	5.50	3.55	16.00	39.81	20	0.028	1.00
BT3.0	2402-2480	1.36	1.37	4.50	2.82	20	0.001	1.00
BLE	2402-2480	1.36	1.37	3.00	2.00	20	0.001	1.00

Note: The Wi-Fi(2.4G) or Wi-Fi(5G) and Bluetooth can transmit simultaneously.

MPE evaluation for simultaneous transmission:

Wi-Fi(2.4G) or Wi-Fi(5G) and Bluetooth can transmit at the same time, MPE evaluation is as below formula:

PD1/Limit1+PD2/Limit2+……＜1, PD (Power Density)

MPE evaluation:

5 G(Wi-Fi) and Bluetooth:

Max MPE of 5G(Wi-Fi) + Max MPE of Bluetooth =0.028/1+0.001/1=0.029＜1.0

Result: MPE evaluation of single transmission meets the requirement of standard.

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 used three built in FPC antennas, two of them for Wi-Fi, another for Bluetooth, which connected to the main board with IPEX socket, fulfill the requirement of this section. Please refer to the EUT internal photos and the below table for detail.

Antenna Information

Antenna Model Number	Manufacturer	Band	Antenna Gain
Antenna 0 AG-041533-1427	ZHONGSHAN B&T TECHNOLOGY Co,.Ltd	Wi-Fi 2.4GHz	3.52 dBi
		Wi-Fi 5GHz	5.50 dBi
Antenna 1 AG-041533-1428	ZHONGSHAN B&T TECHNOLOGY Co,.Ltd	Wi-Fi 2.4GHz	1.77 dBi
		Wi-Fi 5GHz	5.12 dBi
AG-041333-1429	ZHONGSHAN B&T TECHNOLOGY Co,.Ltd	Bluetooth	1.36 dBi

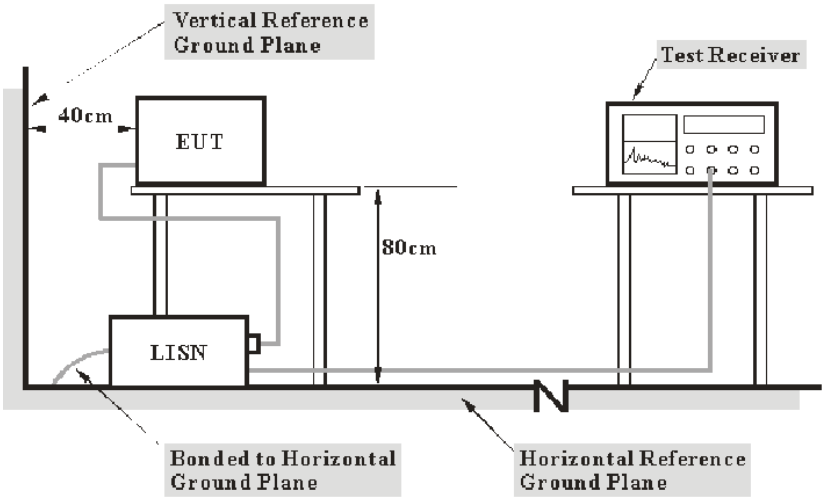
Result: Compliance.

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 a AC 120 V/60 Hz power source.

EMI Test Receiver Setup

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

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

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

Test Procedure

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

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

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

Corrected Amplitude & Margin Calculation

The basic equation is as follows:

$V_C = V_R + A_C + VDF$

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

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

Margin = Limit – Corrected Amplitude

Test Data

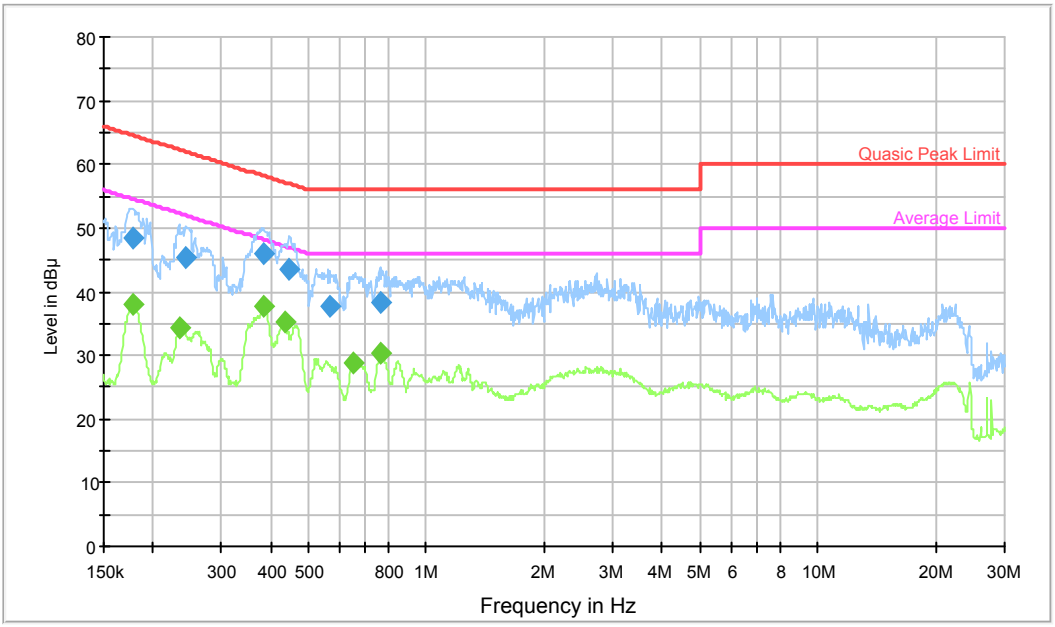
Environmental Conditions

Temperature:	25 °C
Relative Humidity:	54 %
ATM Pressure:	95.6 kPa

The testing was performed by Tom Tang on 2018-04-18.

Test Mode: Transmitting (Low channel of EDR mode(8DPSK))-Worst Case

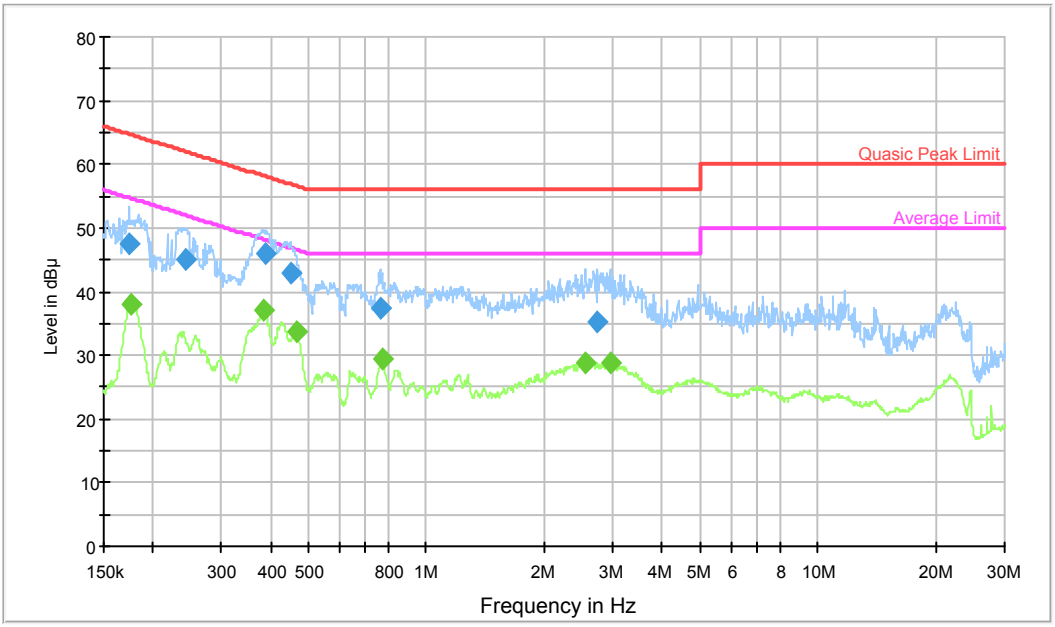
AC120 V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Margin (dB)	Limit (dBµV)
0.177381	48.5	9.000	L1	19.6	16.1	64.6
0.244121	45.5	9.000	L1	19.7	16.5	62.0
0.383278	46.1	9.000	L1	19.7	12.1	58.2
0.447846	43.5	9.000	L1	19.7	13.4	56.9
0.566784	37.6	9.000	L1	19.7	18.4	56.0
0.761575	38.2	9.000	L1	19.6	17.8	56.0

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Margin (dB)	Limit (dBµV)
0.178091	38.1	9.000	L1	19.6	16.5	54.6
0.233633	34.4	9.000	L1	19.7	17.9	52.3
0.386351	37.6	9.000	L1	19.7	10.5	48.1
0.433770	35.2	9.000	L1	19.7	12.0	47.2
0.654382	28.8	9.000	L1	19.7	17.2	46.0
0.767680	30.2	9.000	L1	19.6	15.8	46.0

AC120 V, 60 Hz, Neutral:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Margin (dB)	Limit (dBµV)
0.173876	47.4	9.000	N	19.7	17.4	64.8
0.244121	45.0	9.000	N	19.8	17.0	62.0
0.389447	46.0	9.000	N	19.8	12.1	58.1
0.449638	42.9	9.000	N	19.8	14.0	56.9
0.761575	37.3	9.000	N	19.7	18.7	56.0
2.743055	35.3	9.000	N	19.8	20.7	56.0

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corrected Factor (dB)	Margin (dB)	Limit (dBµV)
0.176674	38.1	9.000	N	19.7	16.5	54.6
0.383278	37.0	9.000	N	19.8	11.2	48.2
0.464229	33.7	9.000	N	19.8	12.9	46.6
0.770750	29.4	9.000	N	19.7	16.6	46.0
2.552864	28.7	9.000	N	19.8	17.3	46.0
2.959205	28.8	9.000	N	19.9	17.2	46.0

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

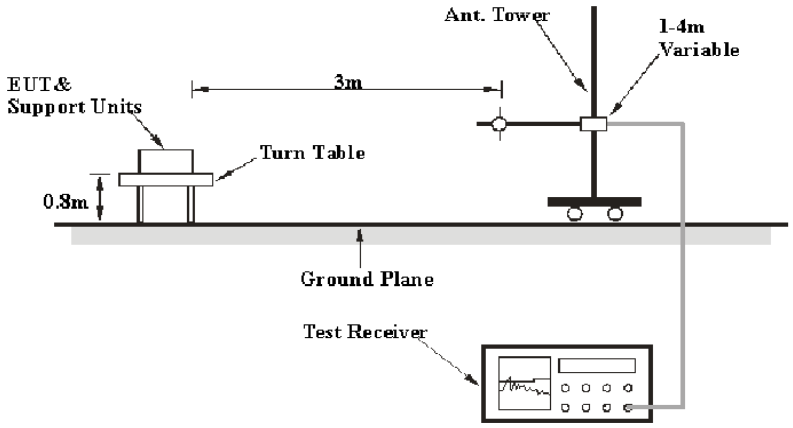
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

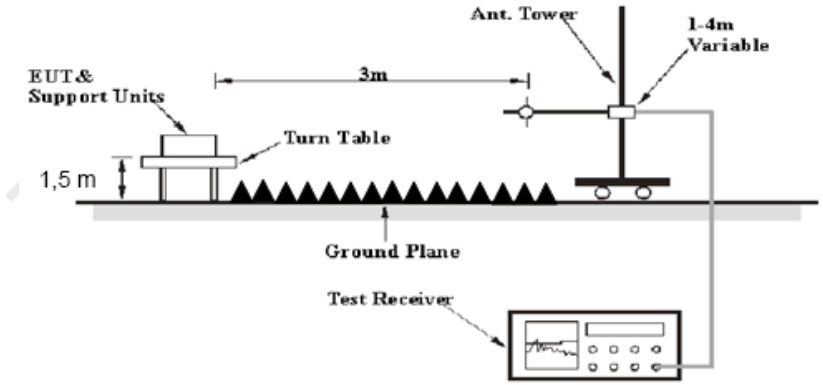
FCC §15.247 (d); §15.209; §15.205;

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.

The adapter was connected to one AC 120 V/60 Hz power source.

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

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

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

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

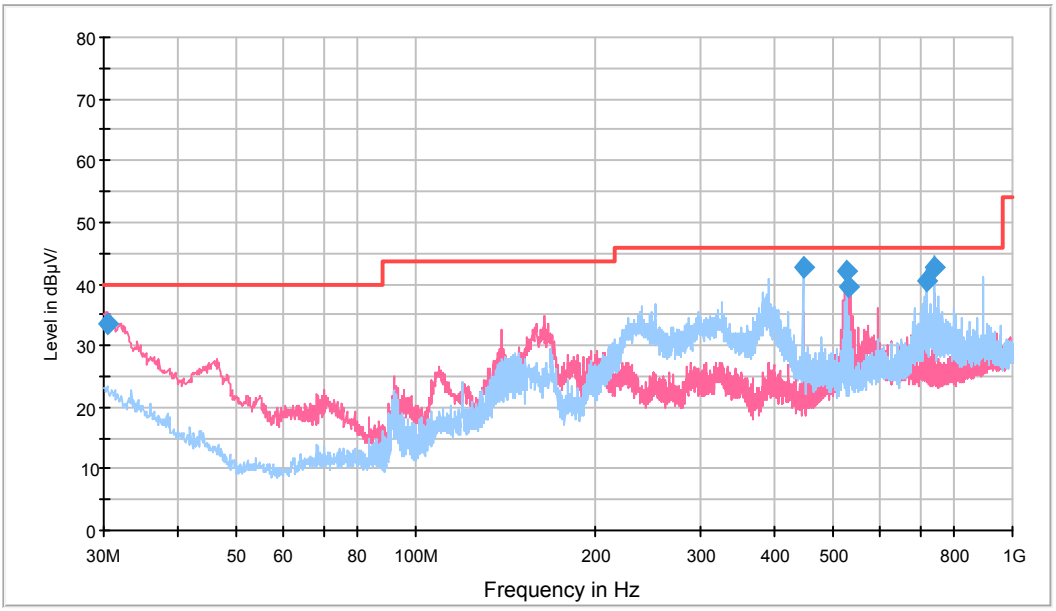
Environmental Conditions

Temperature:	27 °C
Relative Humidity:	51 %
ATM Pressure:	96.2 kPa

** The testing was performed by Tom Tang on 2018-05-03.*

Test Mode: Transmitting (Low channel of EDR mode(8DPSK))-Worst Case

30 MHz to 1 GHz:



Frequency (MHz)	QuasiPeak (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Corrected Factor (dB/m)	Margin (dB)	Limit (dBµV/m)
30.363750	33.4	100.0	V	180.0	-5.0	6.6	40.0
445.523750	42.6	115.0	H	291.0	-7.8	3.4	46.0
527.973750	41.9	100.0	V	69.0	-6.0	4.1	46.0
532.702500	39.6	150.0	V	61.0	-5.8	6.4	46.0
720.033750	40.5	100.0	H	106.0	-2.9	5.5	46.0
742.586250	42.7	150.0	H	298.0	-2.9	3.3	46.0

**Within measurement uncertainty!*

1GHz-25GHz:

BDR Mode (GFSK):

Frequency	Receiver		Rx Antenna		Cable loss	Amplifier Gain	Corrected Amplitude	Limit	Margin
	Reading	Measurement	Polar	Factor					
MHz	dBµV	PK/AV	H/V	(dB/m)	dB	dB	dBµV/m	dBµV/m	dB
Frequency:2402 MHz									
2402	66.24	PK	H	28.71	3.06	0.00	98.01	N/A	N/A
2402	49.32	AV	H	28.71	3.06	0.00	81.09	N/A	N/A
2402	61.65	PK	V	28.71	3.06	0.00	93.42	N/A	N/A
2402	44.78	AV	V	28.71	3.06	0.00	76.55	N/A	N/A
2390	29.42	PK	H	28.67	3.06	0.00	61.15	74.00	12.85
2390	15.41	AV	H	28.67	3.06	0.00	47.14	54.00	6.86
4804	51.27	PK	H	33.85	4.35	44.73	44.74	74.00	29.26
4804	39.16	AV	H	33.85	4.35	44.73	32.63	54.00	21.37
7206	43.78	PK	H	36.39	5.41	43.92	41.66	74.00	32.34
7206	30.68	AV	H	36.39	5.41	43.92	28.56	54.00	25.44
Frequency: 2441MHz									
2441	66.02	PK	H	28.82	3.09	0.00	97.93	N/A	N/A
2441	49.09	AV	H	28.82	3.09	0.00	81.00	N/A	N/A
2441	60.71	PK	V	28.82	3.09	0.00	92.62	N/A	N/A
2441	43.53	AV	V	28.82	3.09	0.00	75.44	N/A	N/A
4882	49.17	PK	H	34.07	4.40	44.72	42.92	74.00	31.08
4882	36.85	AV	H	34.07	4.40	44.72	30.60	54.00	23.40
7323	44.74	PK	H	36.55	5.44	44.23	42.50	74.00	31.50
7323	31.61	AV	H	36.55	5.44	44.23	29.37	54.00	24.63
Frequency:2480MHz									
2480	66.17	PK	H	28.94	3.12	0.00	98.23	N/A	N/A
2480	49.15	AV	H	28.94	3.12	0.00	81.21	N/A	N/A
2480	59.87	PK	V	28.94	3.12	0.00	91.93	N/A	N/A
2480	42.95	AV	V	28.94	3.12	0.00	75.01	N/A	N/A
2483.5	29.69	PK	H	28.95	3.12	0.00	61.76	74.00	12.24
2483.5	13.48	AV	H	28.95	3.12	0.00	45.55	54.00	8.45
4960	47.59	PK	H	34.29	4.44	44.71	41.61	74.00	32.39
4960	34.88	AV	H	34.29	4.44	44.71	28.90	54.00	25.10
7440	45.81	PK	H	36.72	5.48	44.54	43.47	74.00	30.53
7440	32.56	AV	H	36.72	5.48	44.54	30.22	54.00	23.78

EDR Mode (π/4-DQPSK):

Frequency	Receiver		Rx Antenna		Cable loss	Amplifier Gain	Corrected Amplitude	Limit	Margin
	Reading	Measurement	Polar	Factor					
MHz	dBμV	PK/AV	H/V	(dB/m)	dB	dB	dBμV/m	dBμV/m	dB
Frequency:2402 MHz									
2402	68.59	PK	H	28.71	3.06	0.00	100.36	N/A	N/A
2402	49.15	AV	H	28.71	3.06	0.00	80.92	N/A	N/A
2402	63.97	PK	V	28.71	3.06	0.00	95.74	N/A	N/A
2402	44.59	AV	V	28.71	3.06	0.00	76.36	N/A	N/A
2390	29.64	PK	H	28.67	3.06	0.00	61.37	74.00	12.63
2390	15.57	AV	H	28.67	3.06	0.00	47.30	54.00	6.70
4804	51.57	PK	H	33.85	4.35	44.73	45.04	74.00	28.96
4804	38.82	AV	H	33.85	4.35	44.73	32.29	54.00	21.71
7206	43.46	PK	H	36.39	5.41	43.92	41.34	74.00	32.66
7206	30.59	AV	H	36.39	5.41	43.92	28.47	54.00	25.53
Frequency:2441 MHz									
2441	68.28	PK	H	28.82	3.09	0.00	100.19	N/A	N/A
2441	48.90	AV	H	28.82	3.09	0.00	80.81	N/A	N/A
2441	62.39	PK	V	28.82	3.09	0.00	94.30	N/A	N/A
2441	43.13	AV	V	28.82	3.09	0.00	75.04	N/A	N/A
4882	49.65	PK	H	34.07	4.40	44.72	43.40	74.00	30.60
4882	36.33	AV	H	34.07	4.40	44.72	30.08	54.00	23.92
7323	44.30	PK	H	36.55	5.44	44.23	42.06	74.00	31.94
7323	31.30	AV	H	36.55	5.44	44.23	29.06	54.00	24.94
Frequency:2480 MHz									
2480	68.38	PK	H	28.94	3.12	0.00	100.44	N/A	N/A
2480	48.97	AV	H	28.94	3.12	0.00	81.03	N/A	N/A
2480	61.18	PK	V	28.94	3.12	0.00	93.24	N/A	N/A
2480	41.94	AV	V	28.94	3.12	0.00	74.00	N/A	N/A
2483.5	29.71	PK	V	28.95	3.12	0.00	61.78	74.00	12.22
2483.5	15.56	AV	H	28.95	3.12	0.00	47.63	54.00	6.37
4960	47.97	PK	H	34.29	4.44	44.71	41.99	74.00	32.01
4960	34.33	AV	H	34.29	4.44	44.71	28.35	54.00	25.65
7440	45.65	PK	H	36.72	5.48	44.54	43.31	74.00	30.69
7440	32.04	AV	H	36.72	5.48	44.54	29.70	54.00	24.30

EDR Mode (8-DPSK):

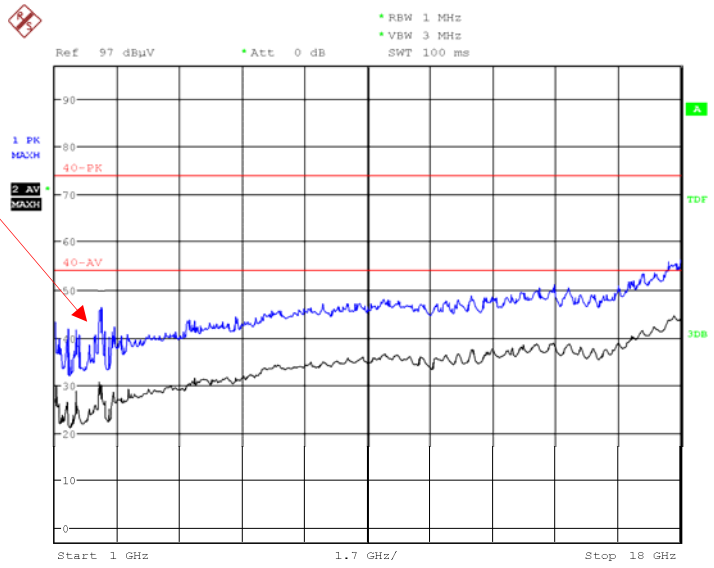
Frequency	Receiver		Rx Antenna		Cable loss	Amplifier Gain	Corrected Amplitude	Limit	Margin
	Reading	Measurement	Polar	Factor					
MHz	dBµV	PK/AV	H/V	(dB/m)	dB	dB	dBµV/m	dBµV/m	dB
Frequency:2402 MHz									
2402	68.74	PK	H	28.71	3.06	0.00	100.51	N/A	N/A
2402	49.15	AV	H	28.71	3.06	0.00	80.92	N/A	N/A
2402	64.17	PK	V	28.71	3.06	0.00	95.94	N/A	N/A
2402	44.66	AV	V	28.71	3.06	0.00	76.43	N/A	N/A
2390	29.28	PK	H	28.67	3.06	0.00	61.01	74.00	12.99
2390	15.67	AV	H	28.67	3.06	0.00	47.40	54.00	6.60
4804	52.04	PK	H	33.85	4.35	44.73	45.51	74.00	28.49
4804	38.97	AV	H	33.85	4.35	44.73	32.44	54.00	21.56
7206	43.97	PK	H	36.39	5.41	43.92	41.85	74.00	32.15
7206	30.78	AV	H	36.39	5.41	43.92	28.66	54.00	25.34
Frequency: 2441 MHz									
2441	68.62	PK	H	28.82	3.09	0.00	100.53	N/A	N/A
2441	48.88	AV	H	28.82	3.09	0.00	80.79	N/A	N/A
2441	62.69	PK	V	28.82	3.09	0.00	94.60	N/A	N/A
2441	43.06	AV	V	28.82	3.09	0.00	74.97	N/A	N/A
4882	49.74	PK	H	34.07	4.40	44.72	43.49	74.00	30.51
4882	36.71	AV	H	34.07	4.40	44.72	30.46	54.00	23.54
7323	45.18	PK	H	36.55	5.44	44.23	42.94	74.00	31.06
7323	31.26	AV	H	36.55	5.44	44.23	29.02	54.00	24.98
Frequency: 2480 MHz									
2480	68.52	PK	H	28.94	3.12	0.00	100.58	N/A	N/A
2480	49.01	AV	H	28.94	3.12	0.00	81.07	N/A	N/A
2480	61.76	PK	V	28.94	3.12	0.00	93.82	N/A	N/A
2480	41.69	AV	V	28.94	3.12	0.00	73.75	N/A	N/A
2483.5	29.17	PK	H	28.95	3.12	0.00	61.24	74.00	12.76
2483.5	15.76	AV	H	28.95	3.12	0.00	47.83	54.00	6.17
4960	48.07	PK	H	34.29	4.44	44.71	42.09	74.00	31.91
4960	35.01	AV	H	34.29	4.44	44.71	29.03	54.00	24.97
7440	46.47	PK	H	36.72	5.48	44.54	44.13	74.00	29.87
7440	32.37	AV	H	36.72	5.48	44.54	30.03	54.00	23.97

Note:
Corrected Amplitude = Corrected Factor + Reading
Corrected Factor=Antenna factor (RX) + Cable Loss – Amplifier Factor
Margin = Limit- Corr. Amplitude
Spurious emissions more than 20 dB below the limit were not reported.

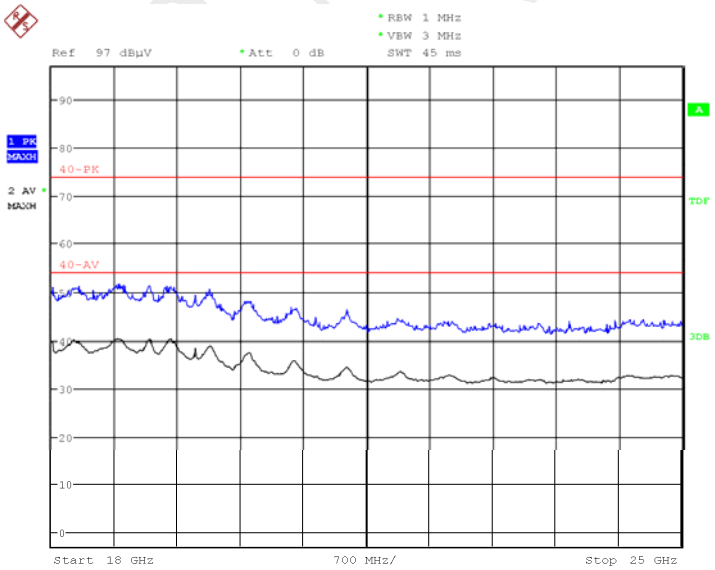
Please refer to the below pre-scan plot of worst case:

EDR Mode (8DPSK): Low Channel_Horizontal_1GHz-18GHz

Fundamental with Reject Band Filter

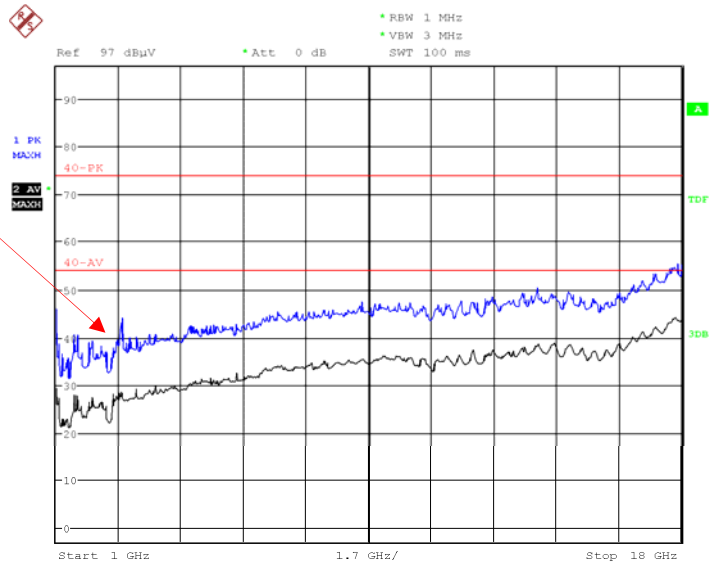


EDR Mode (8DPSK): Low Channel_Horizontal_18GHz-25GHz



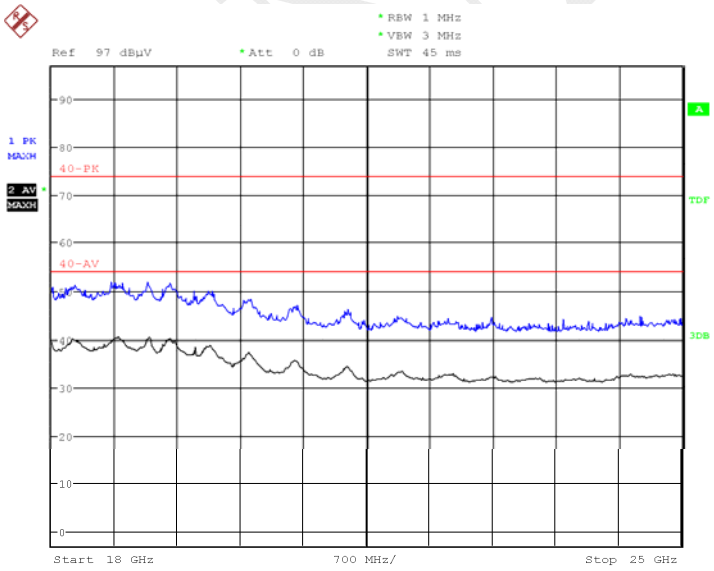
EDR Mode (8DPSK): Low Channel_Vertical_1GHz-18GHz

Fundamental with Reject Band Filter



Date: 3.MAY.2018 09:31:11

EDR Mode (8DPSK): Low Channel_Vertical_18GHz-25GHz



Date: 3.MAY.2018 09:24:24

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 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:	23 °C
Relative Humidity:	52 %
ATM Pressure:	95.7 kPa

** The testing was performed by Tom Tang on 2018-04-24.*

Test Result: Compliance.

Please refer to following tables and plots.

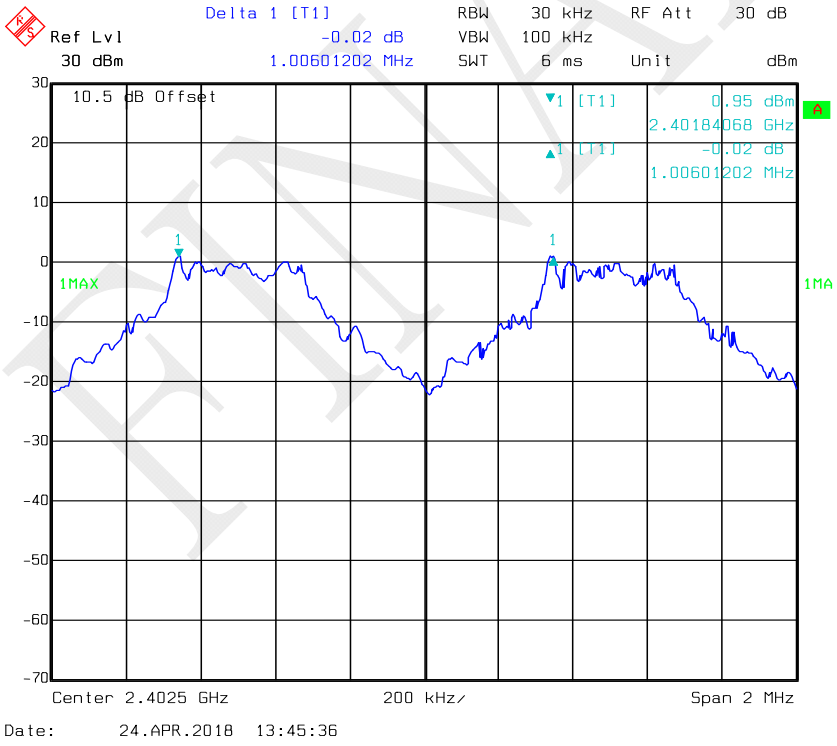
Test Mode: Transmitting

Mode	Channel	Frequency	Channel Separation	Limit
		MHz	MHz	MHz
BDR (GFSK)	Low	2402	1.006	0.62
	Middle	2441	0.994	0.62
	High	2480	0.990	0.62
EDR (π/4-DQPSK)	Low	2402	1.002	0.85
	Middle	2441	1.002	0.85
	High	2480	0.998	0.84
EDR (8DPSK)	Low	2402	0.998	0.85
	Middle	2441	0.998	0.86
	High	2480	0.998	0.86

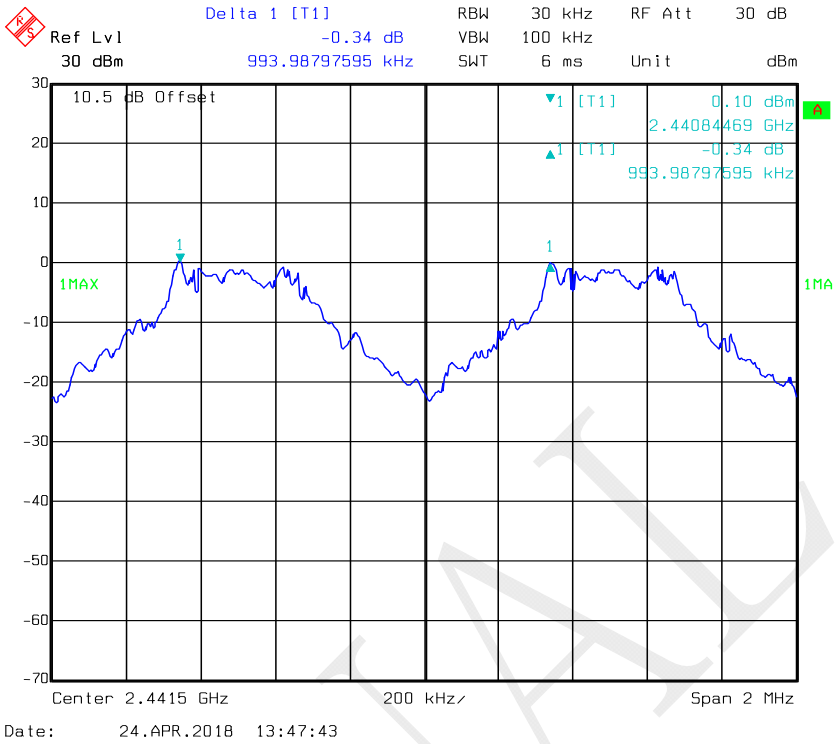
Note: Limit= (2/3) × 20dB bandwidth

BDR Mode (GFSK):

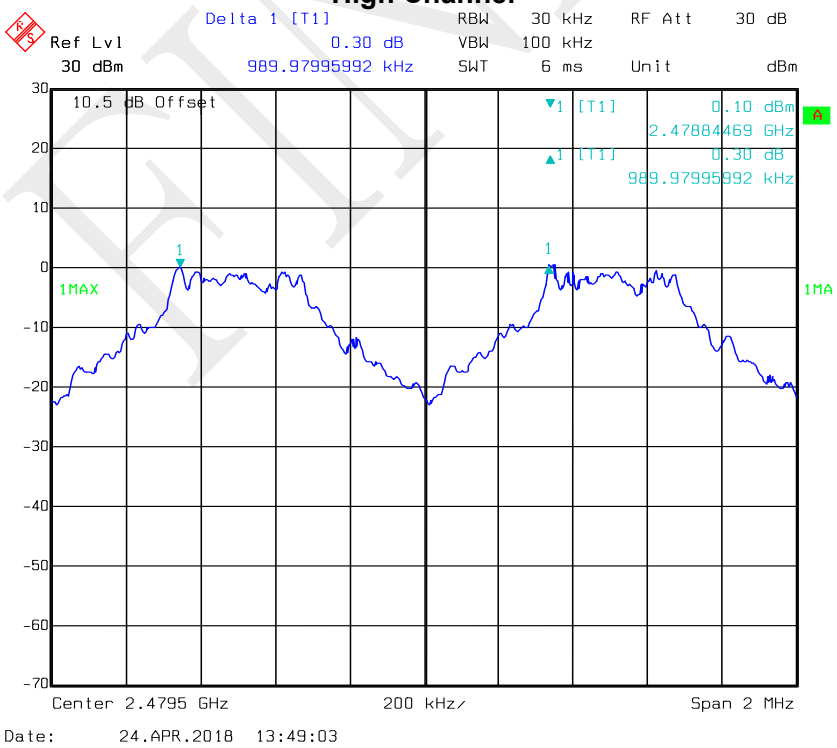
Low Channel



Middle Channel

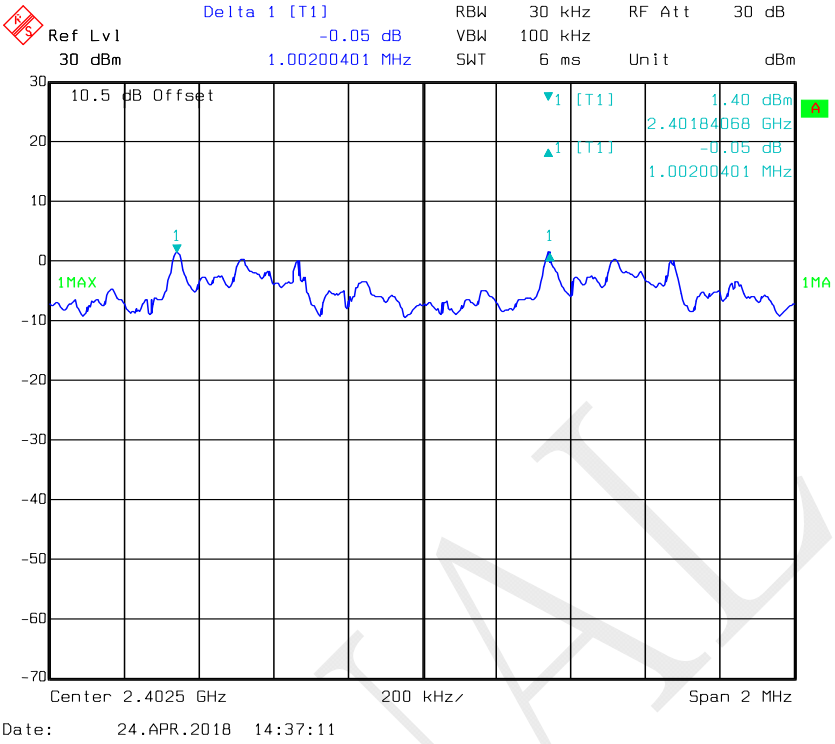


High Channel



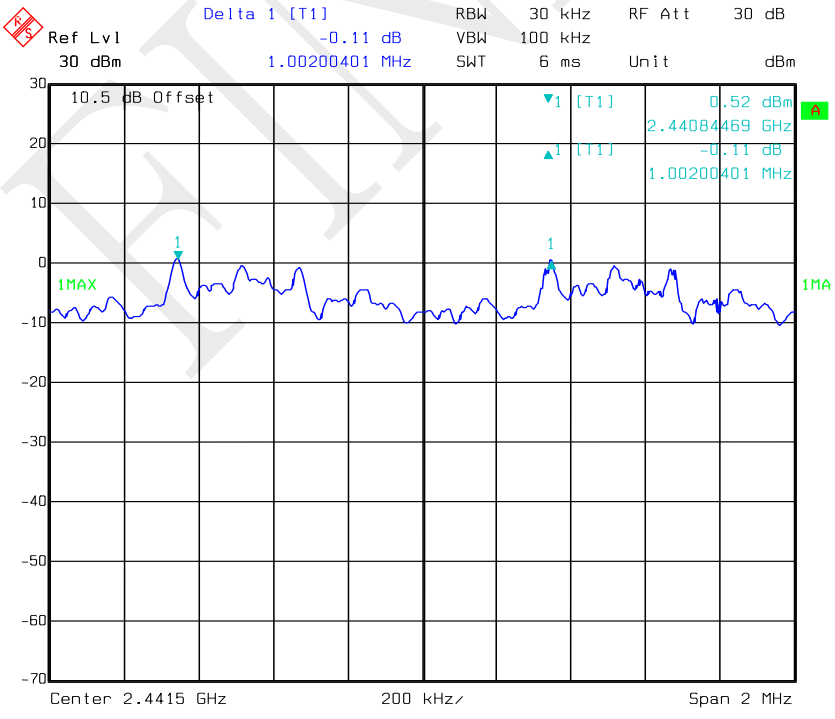
EDR Mode (π/4-DQPSK):

Low Channel



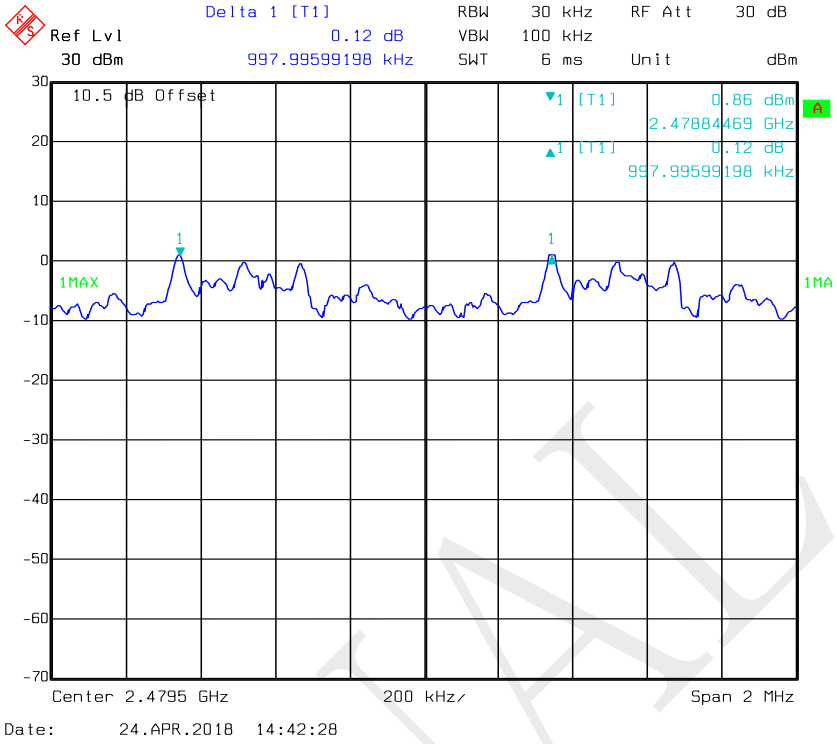
Date: 24.APR.2018 14:37:11

Middle Channel



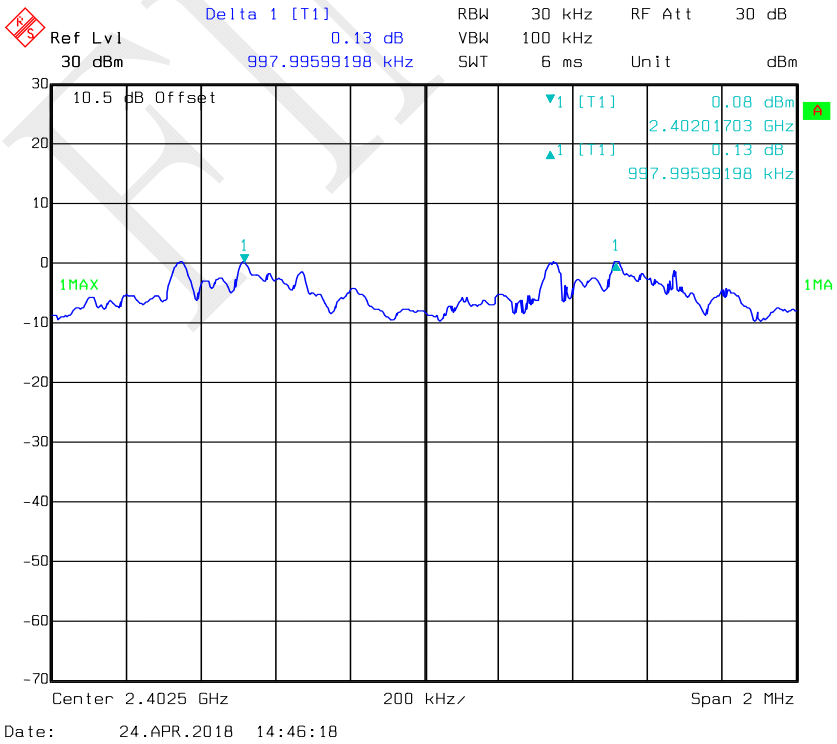
Date: 24.APR.2018 14:40:35

High Channel

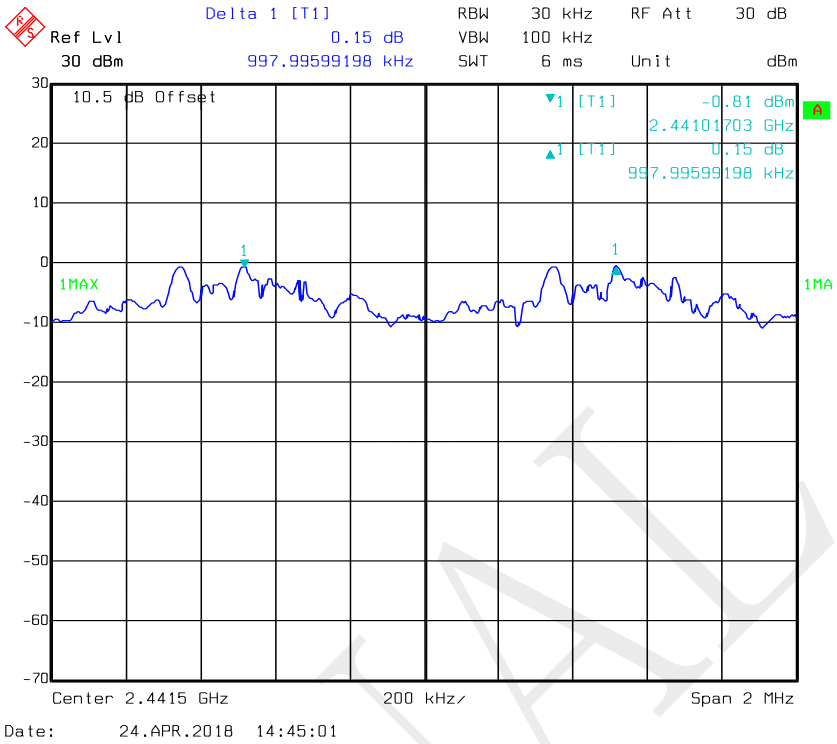


EDR Mode (8-DPSK):

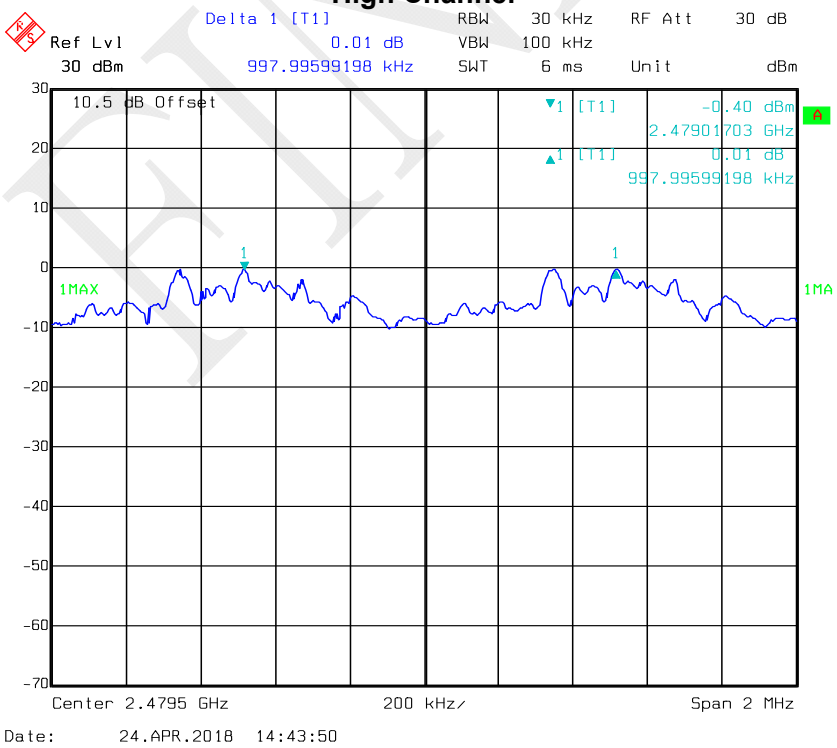
Low Channel



Middle Channel



High Channel



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 Data

Environmental Conditions

Temperature:	23 °C
Relative Humidity:	52 %
ATM Pressure:	95.7 kPa

** The testing was performed by Tom Tang on 2018-04-24.*

Test Result: Compliance.

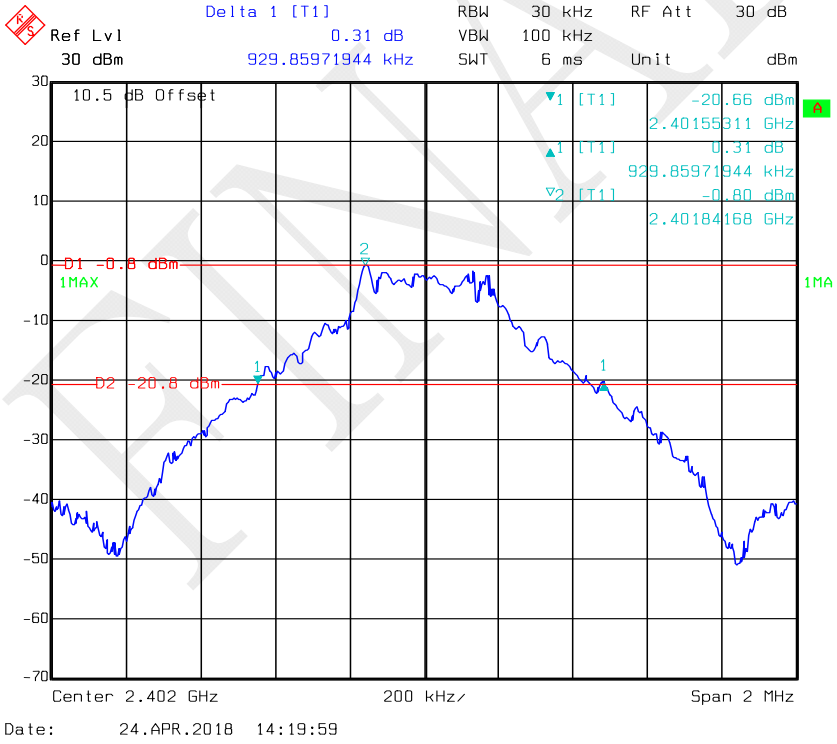
Please refer to following tables and plots

Test Mode: Transmitting

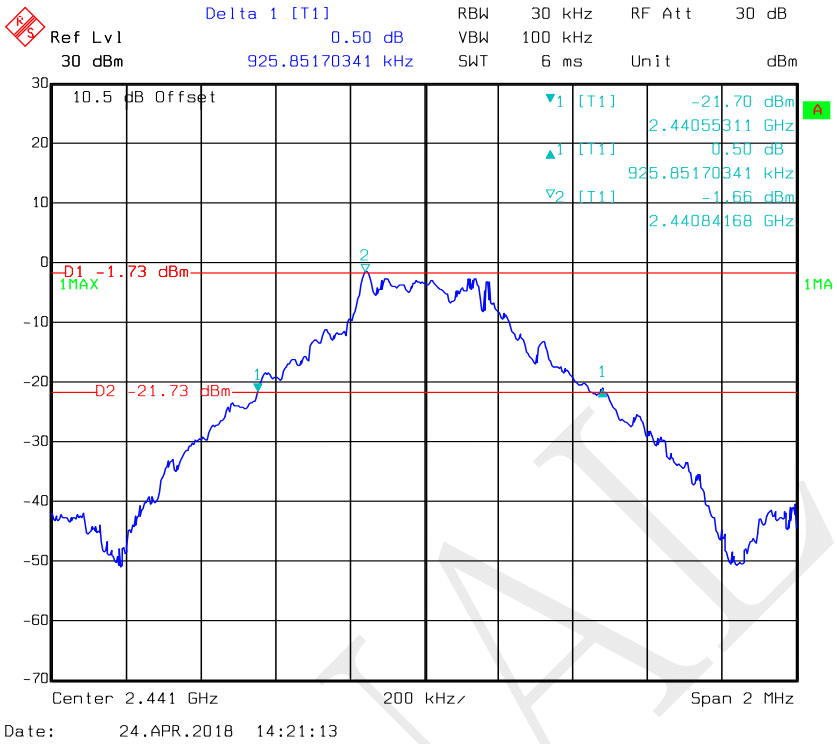
Mode	Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
BDR Mode (GFSK)	Low	2402	0.93
	Middle	2441	0.93
	High	2480	0.93
EDR Mode (π/4-DQPSK)	Low	2402	1.28
	Middle	2441	1.27
	High	2480	1.26
EDR Mode (8-DPSK)	Low	2402	1.28
	Middle	2441	1.29
	High	2480	1.29

BDR Mode (GFSK):

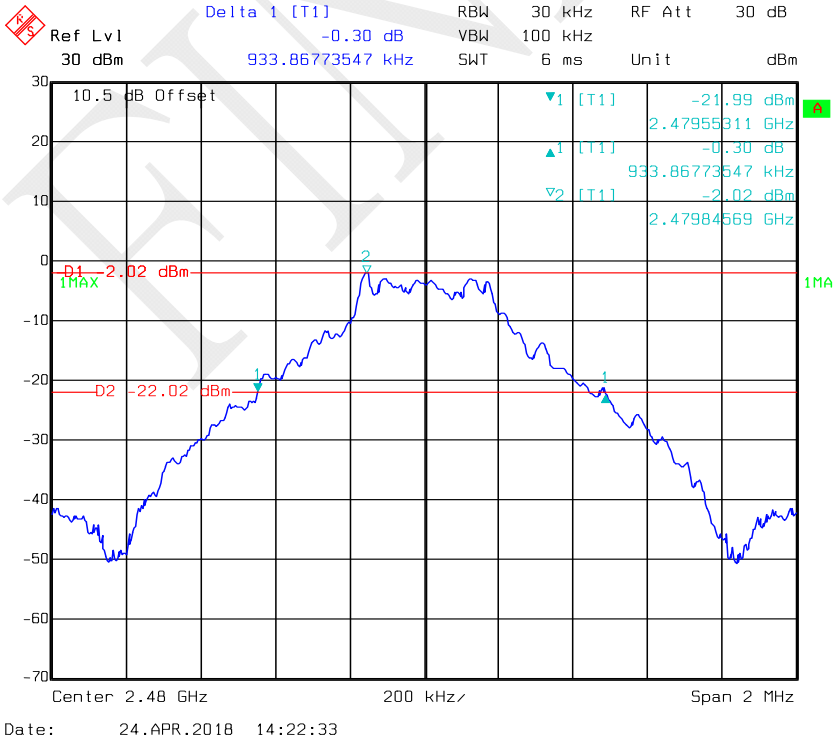
Low Channel



Middle Channel

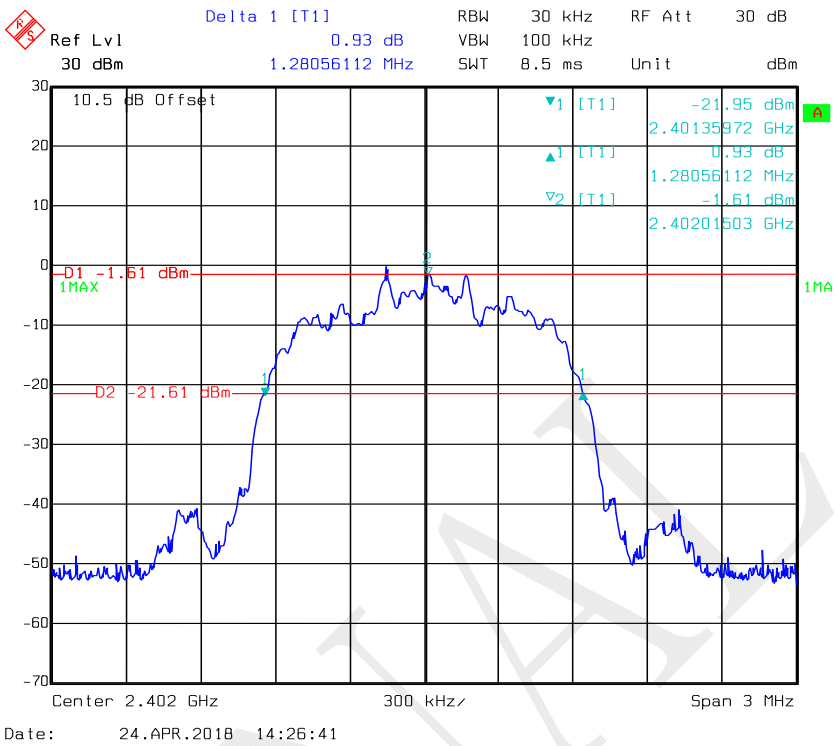


High Channel

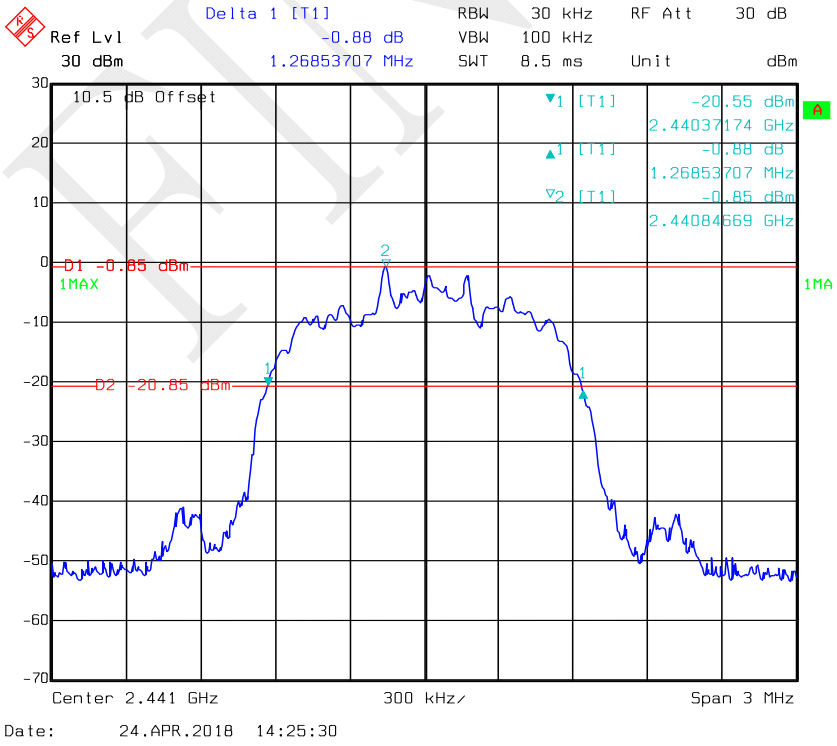


EDR Mode (π/4-DQPSK):

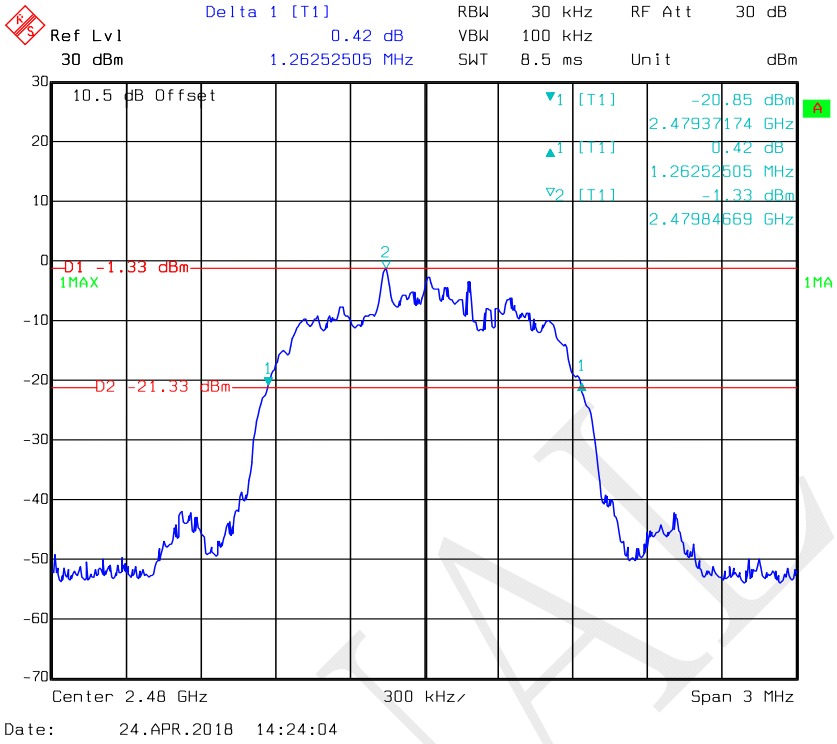
Low Channel



Middle Channel

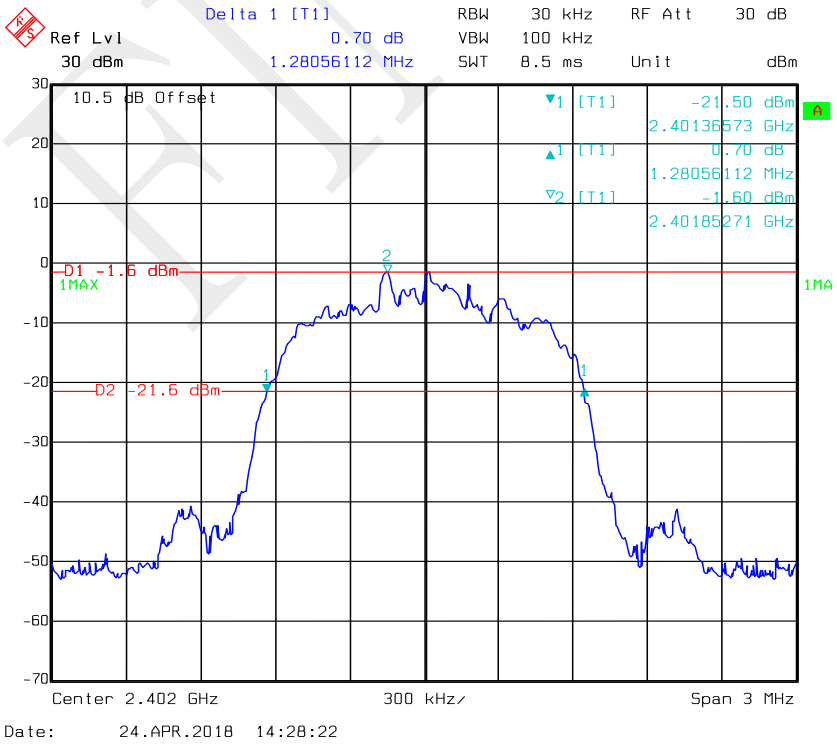


High Channel

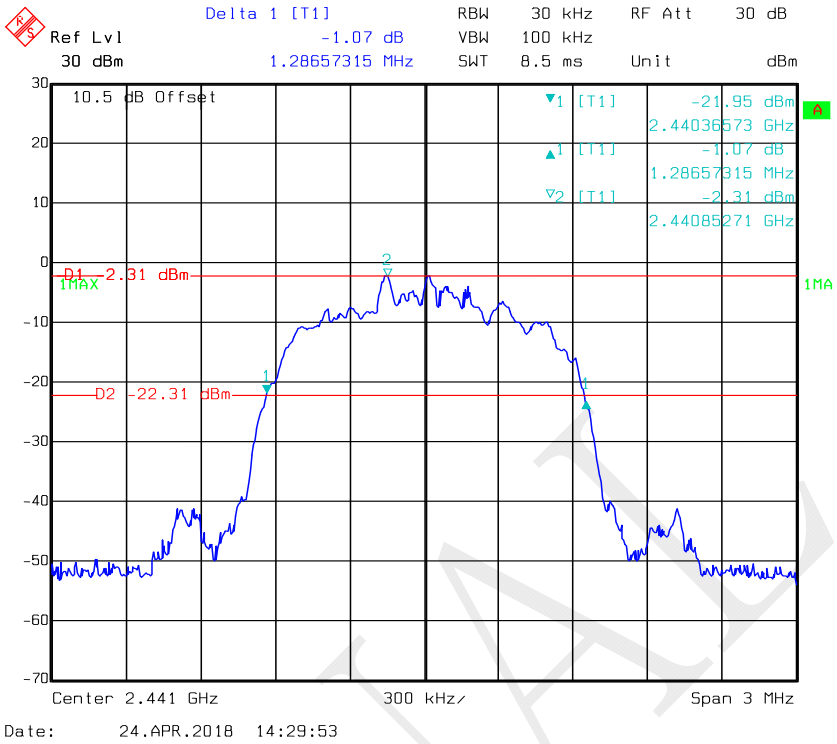


EDR Mode (8-DPSK):

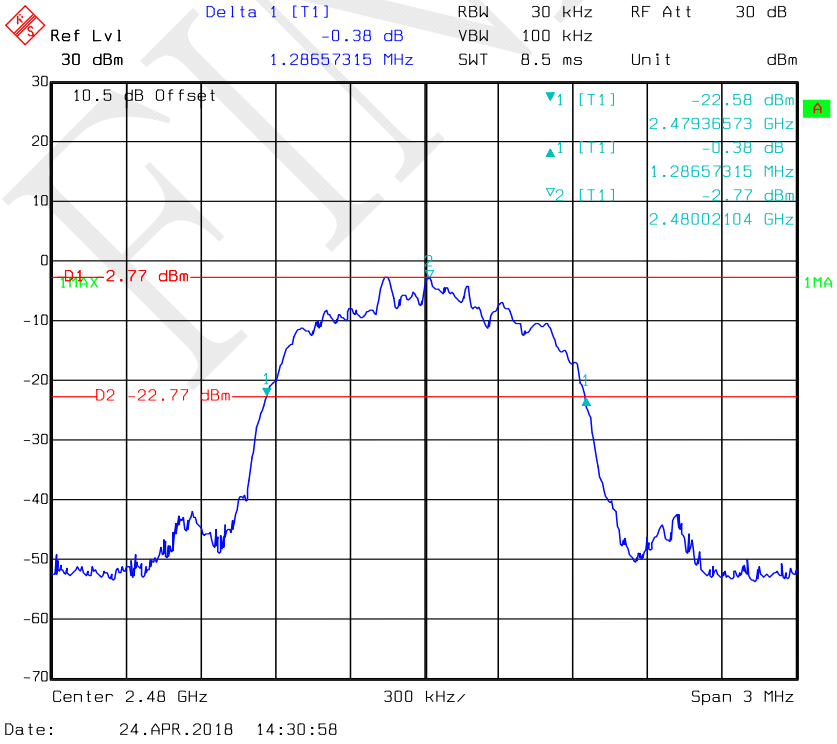
Low Channel



Middle Channel



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:	23 °C
Relative Humidity:	52 %
ATM Pressure:	95.7 kPa

** The testing was performed by Tom Tang on 2018-04-24.*

Test Result: Compliance.

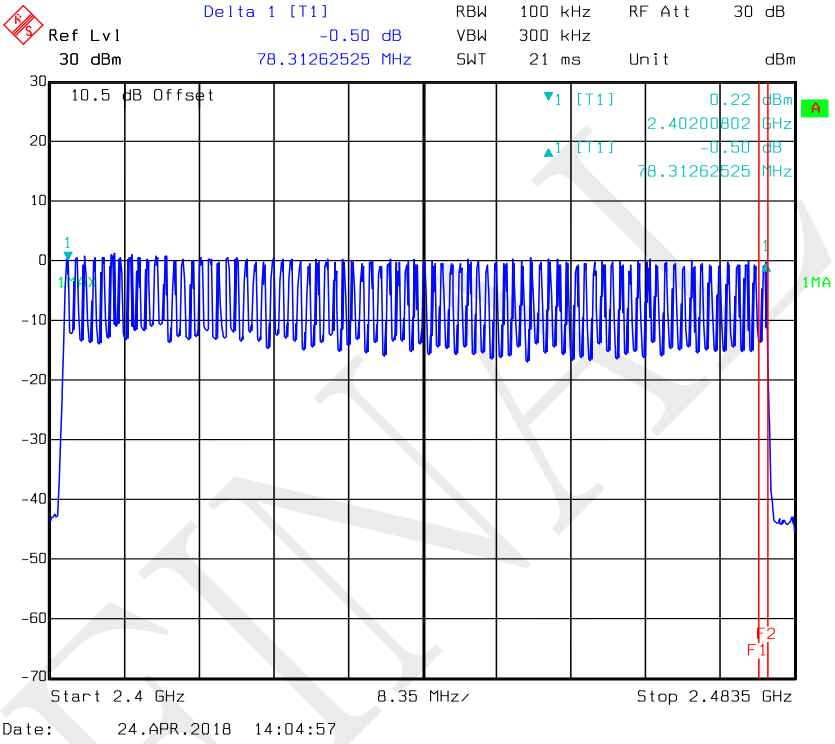
Please refer to following tables and plots.

Test Mode: Transmitting

BDR Mode (GFSK):

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

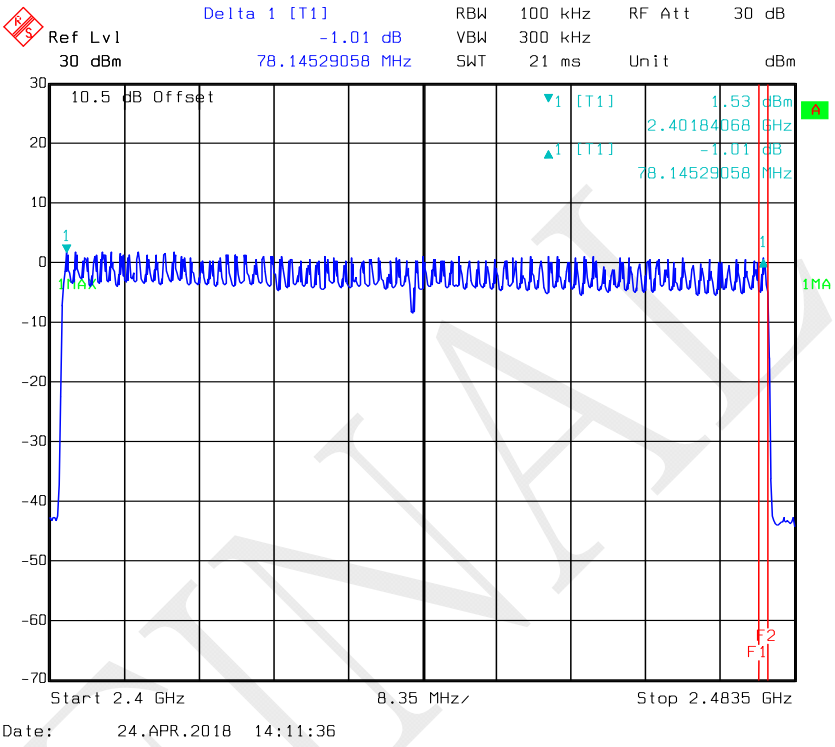
Number of Hopping Channels



EDR Mode (π/4-DQPSK):

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

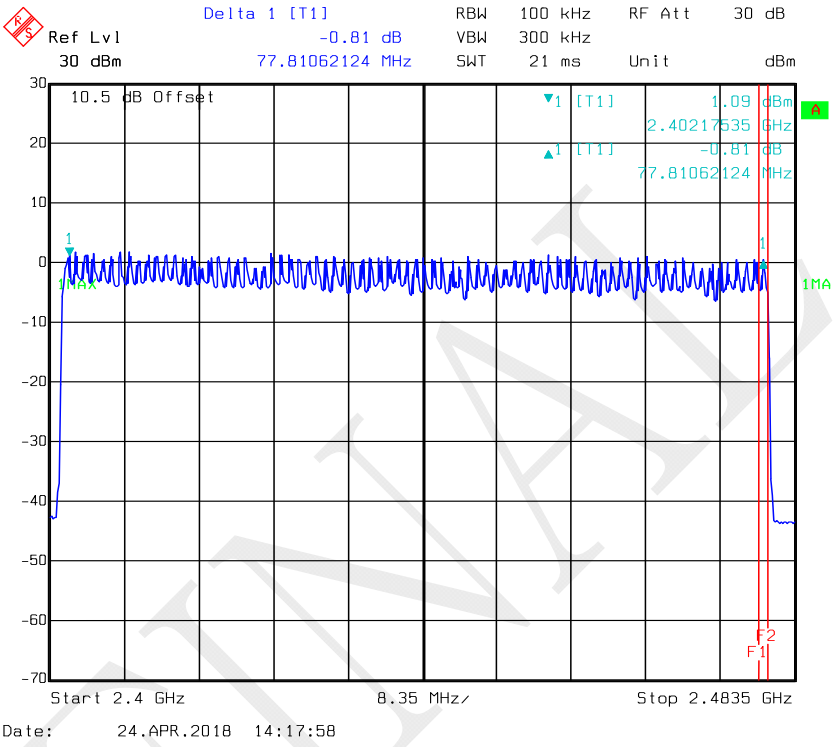
Number of Hopping Channels



EDR Mode (8-DPSK):

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

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 hopping mode, Spectrum Analyzer SPAN was set as 0, the time of single pulse was tested.

Test Data

Environmental Conditions

Temperature:	23 °C
Relative Humidity:	52 %
ATM Pressure:	95.7 kPa

** The testing was performed by Tom Tang on 2018-04-24.*

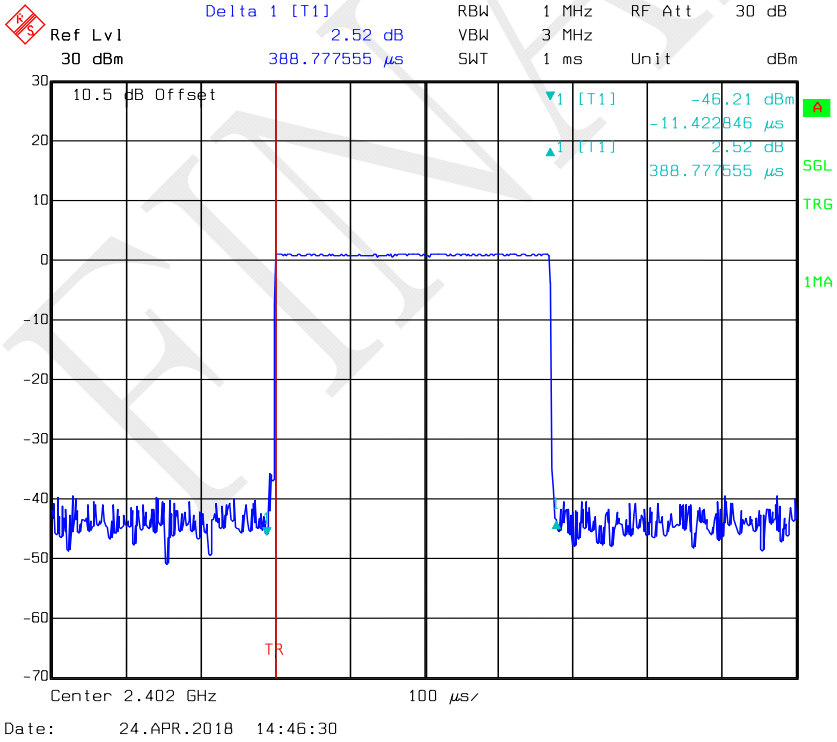
Test Result: Compliance. Please refer to following tables and plots

Test Mode: Transmitting

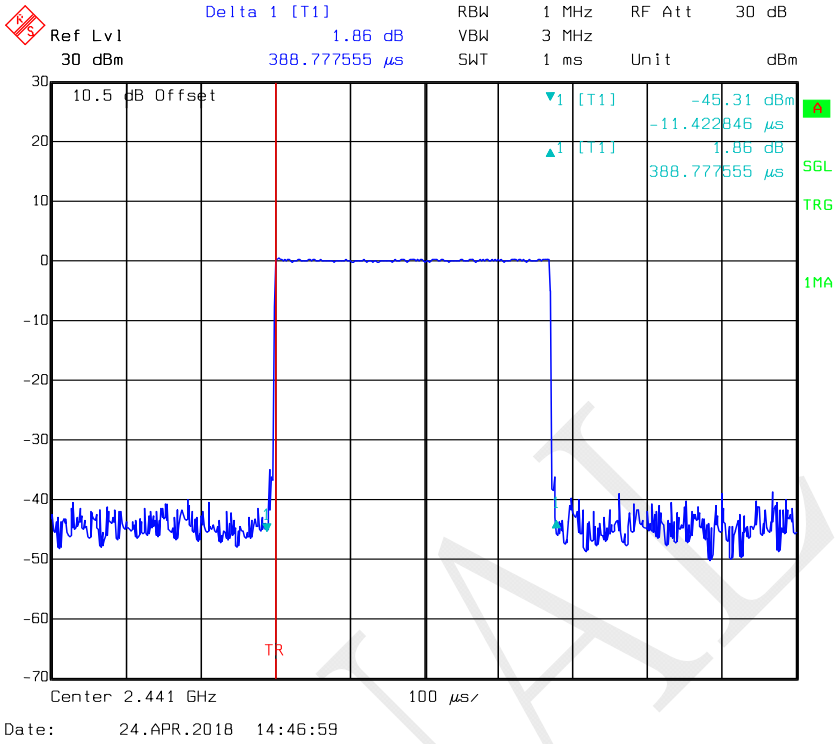
BDR Mode (GFSK):

Mode	Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
DH1	Low	2402	0.389	0.124	Compliance
	Middle	2441	0.389	0.124	Compliance
	High	2480	0.389	0.124	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/2/79) ×31.6 s				
DH3	Low	2402	1.659	0.265	Compliance
	Middle	2441	1.659	0.265	Compliance
	High	2480	1.659	0.265	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/4/79) ×31.6 s				
DH5	Low	2402	2.910	0.310	Compliance
	Middle	2441	2.910	0.310	Compliance
	High	2480	2.910	0.310	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/6/79) ×31.6 s				

DH1: Low Channel

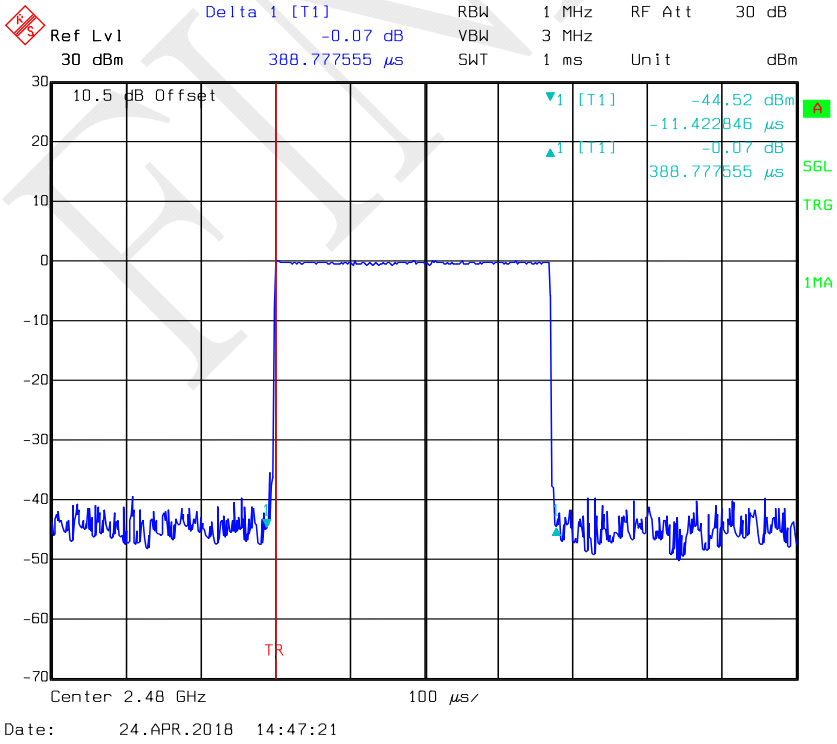


DH1: Middle Channel



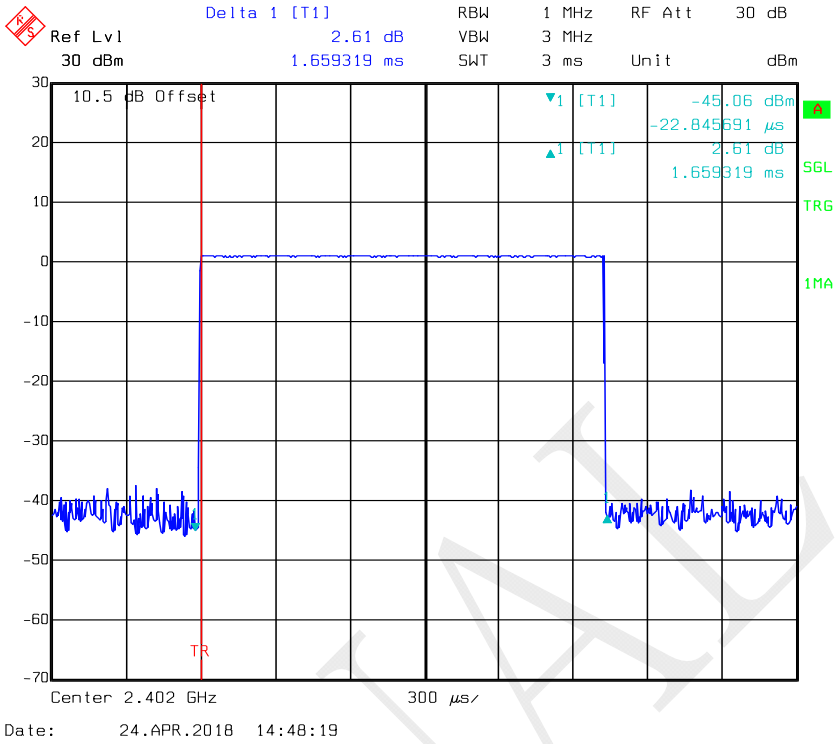
Date: 24.APR.2018 14:46:59

DH1: High Channel



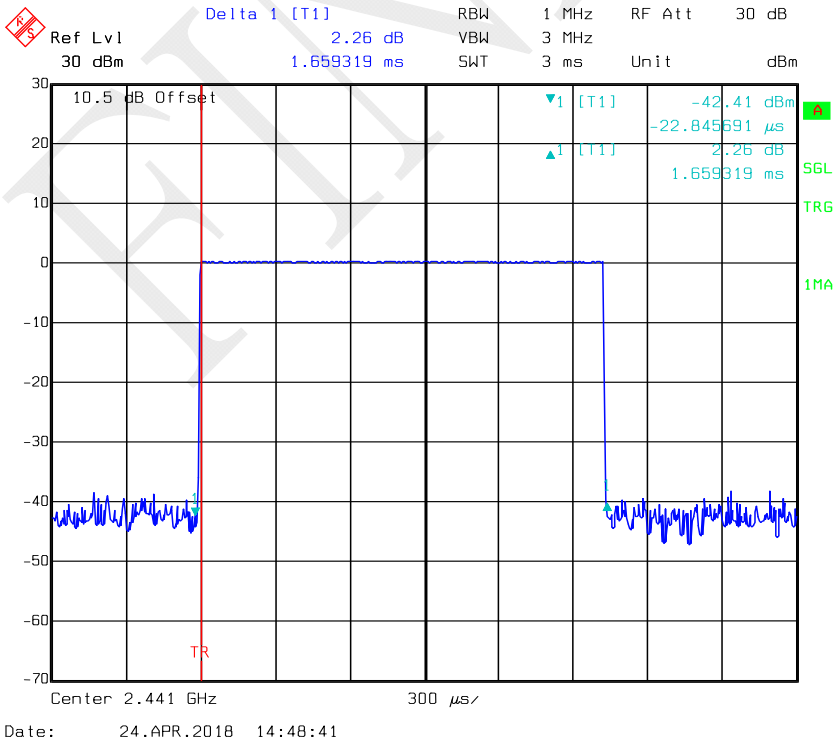
Date: 24.APR.2018 14:47:21

DH3: Low Channel



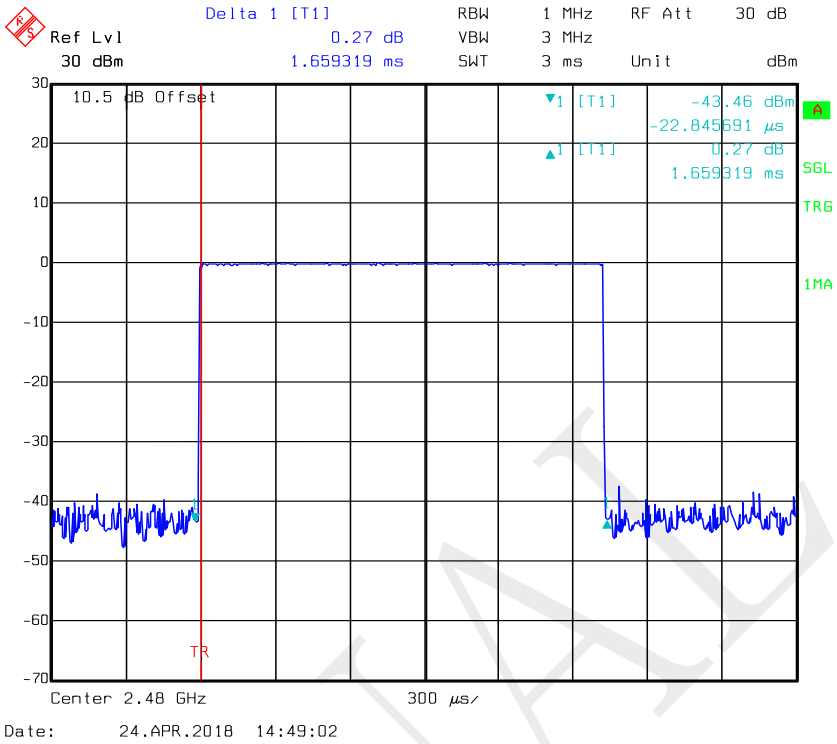
Date: 24.APR.2018 14:48:19

DH3: Middle Channel

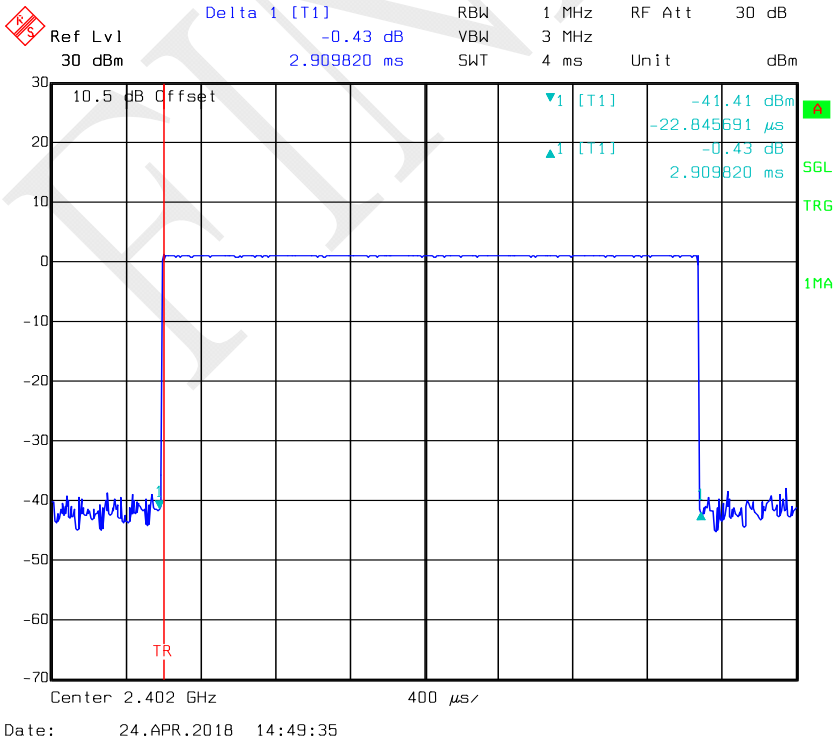


Date: 24.APR.2018 14:48:41

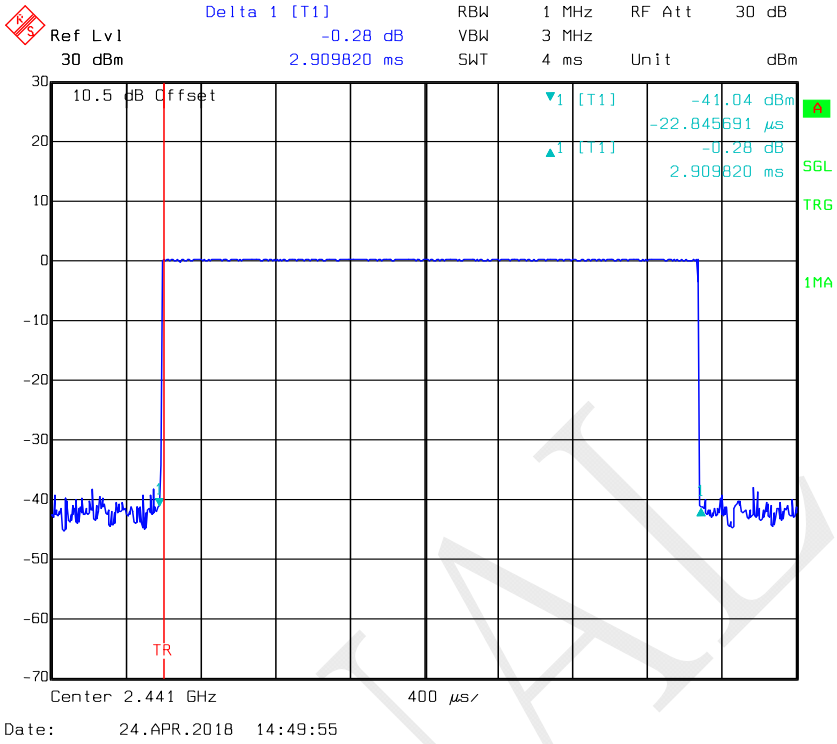
DH3: High Channel



DH5: Low Channel

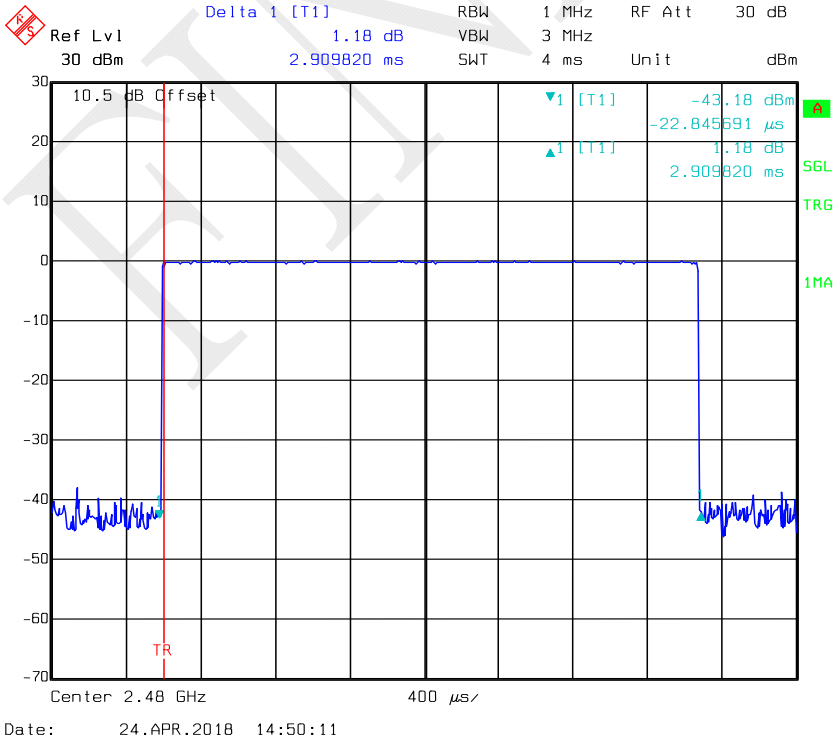


DH5: Middle Channel



Date: 24.APR.2018 14:49:55

DH5: High Channel

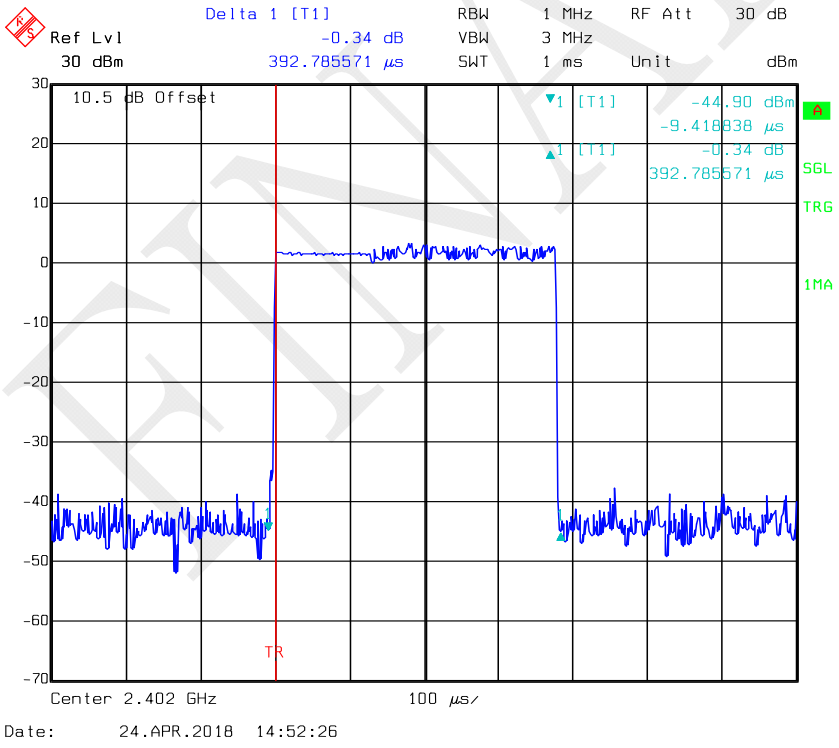


Date: 24.APR.2018 14:50:11

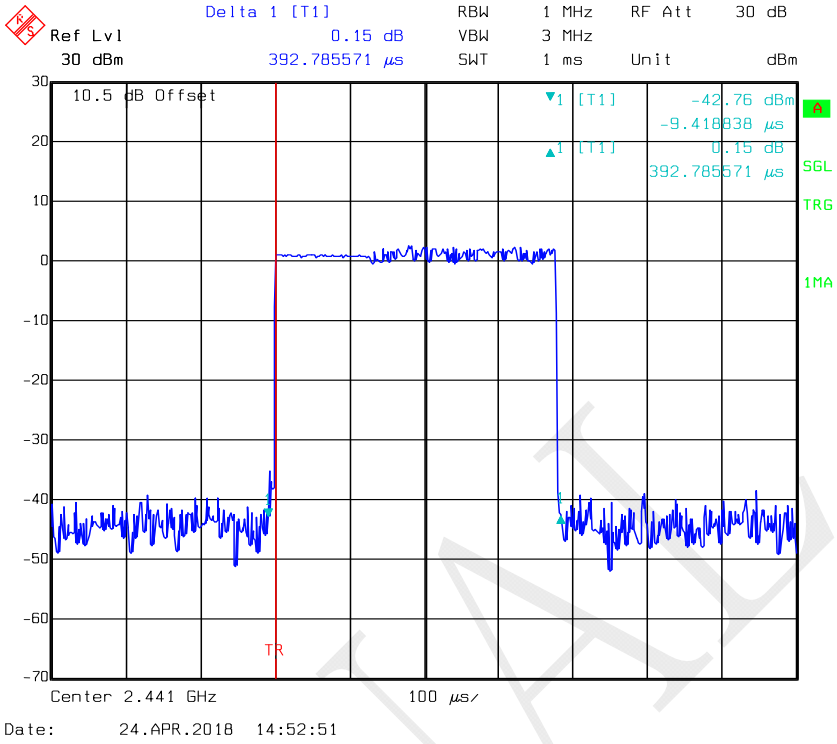
EDR Mode (π/4-DQPSK):

Mode	Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
2DH1	Low	2402	0.393	0.126	Compliance
	Middle	2441	0.393	0.126	Compliance
	High	2480	0.393	0.126	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/2/79) ×31.6 s				
2DH3	Low	2402	1.659	0.265	Compliance
	Middle	2441	1.659	0.265	Compliance
	High	2480	1.659	0.265	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/4/79) ×31.6 s				
2DH5	Low	2402	2.910	0.310	Compliance
	Middle	2441	2.910	0.310	Compliance
	High	2480	2.910	0.310	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/6/79) ×31.6 s				

2DH1: Low Channel

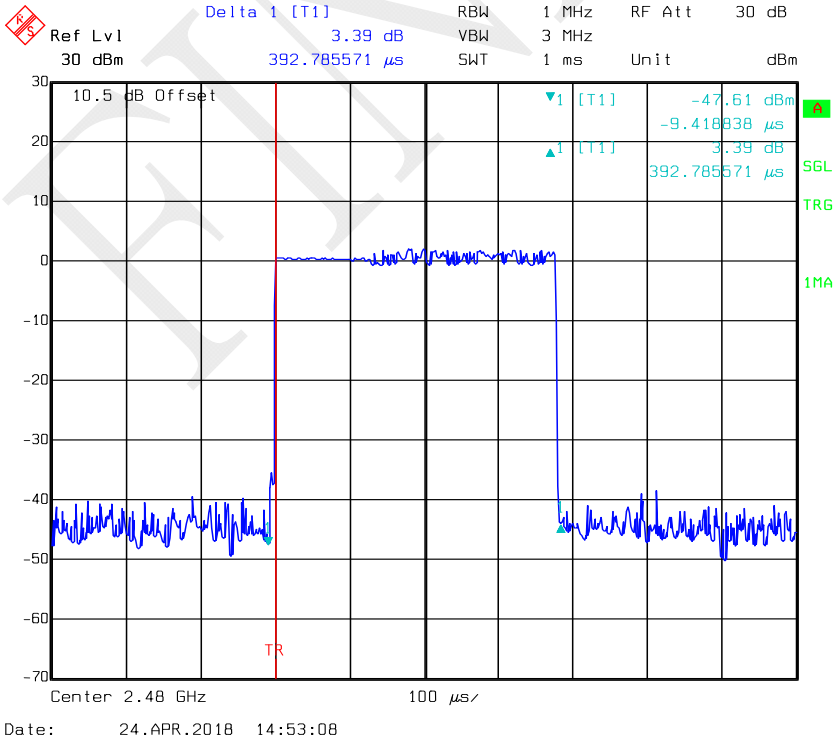


2DH1: Middle Channel



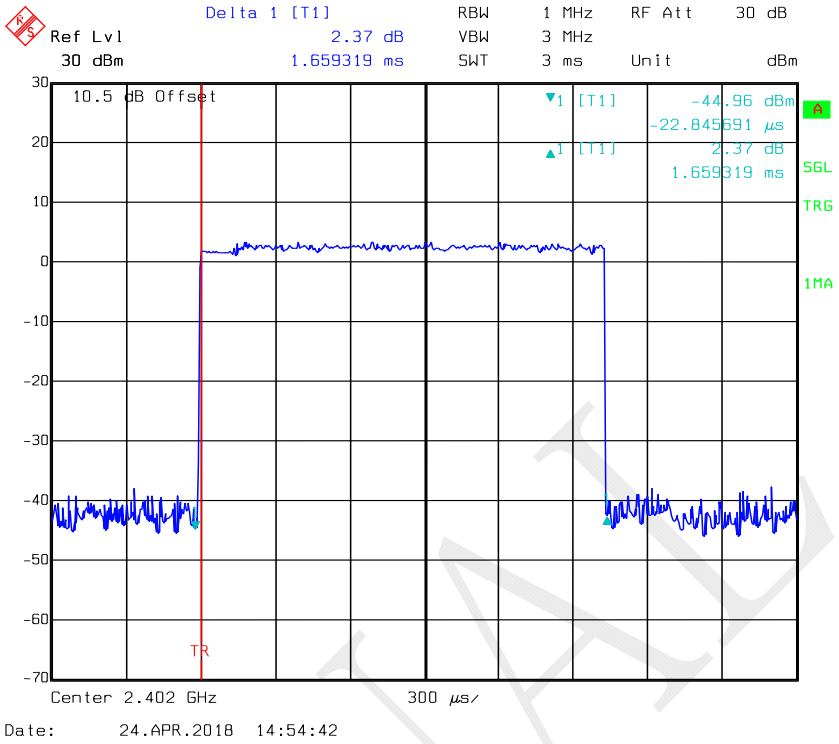
Date: 24.APR.2018 14:52:51

2DH1: High Channel

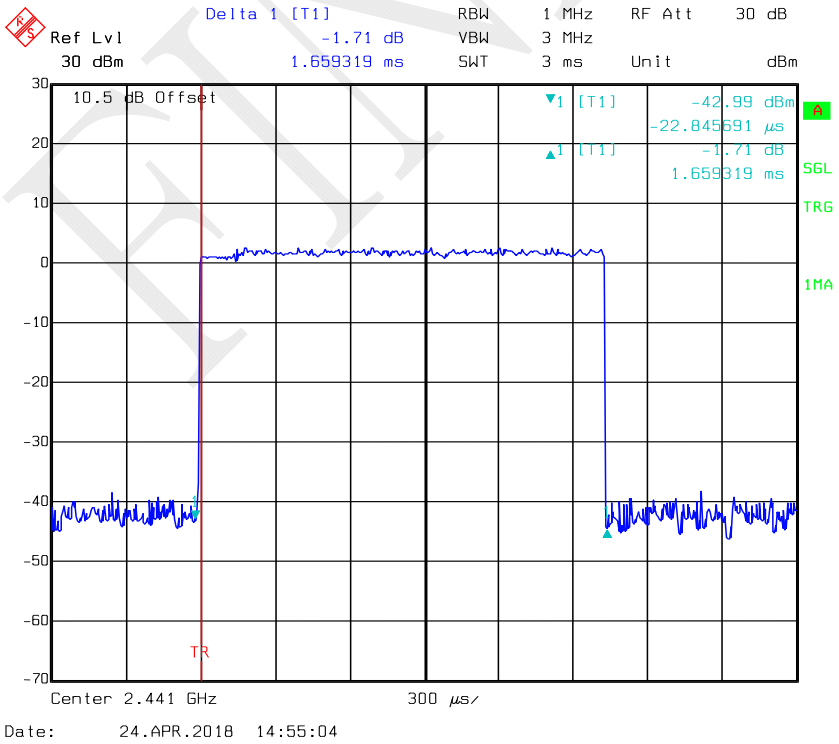


Date: 24.APR.2018 14:53:08

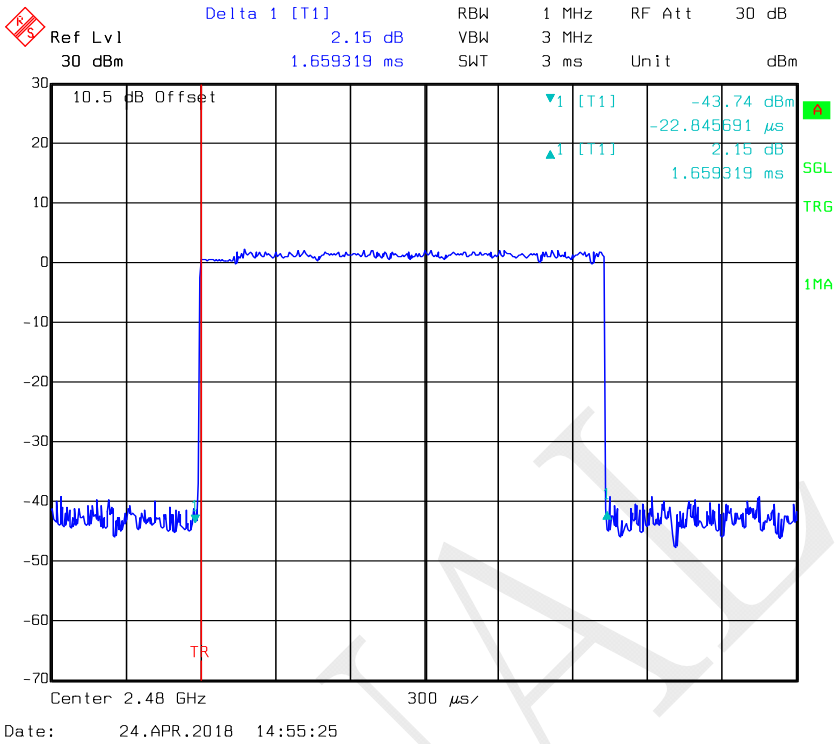
2DH3: Low Channel



2DH3: Middle Channel

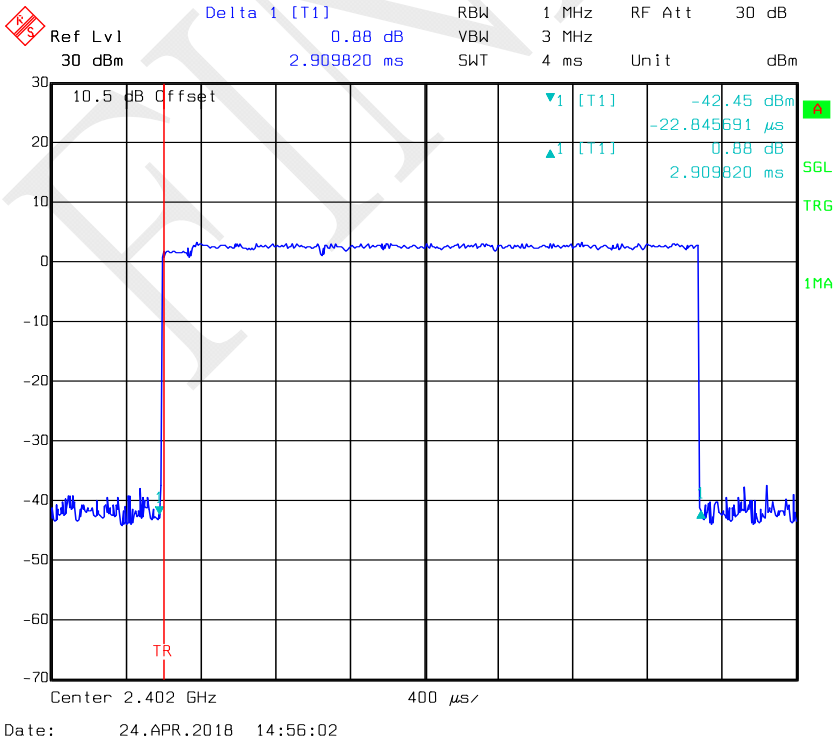


2DH3: High Channel



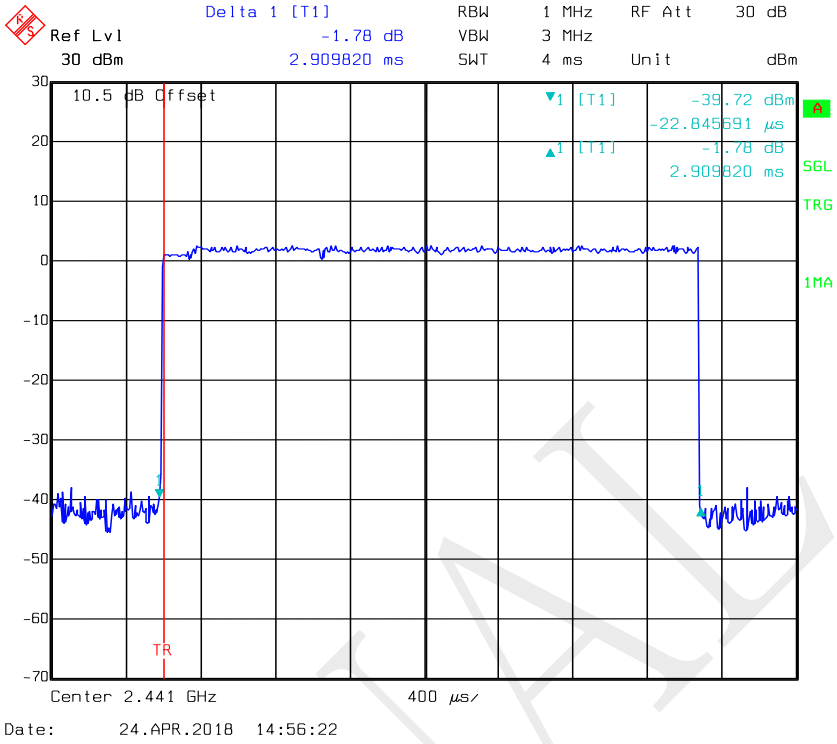
Date: 24.APR.2018 14:55:25

2DH5: Low Channel



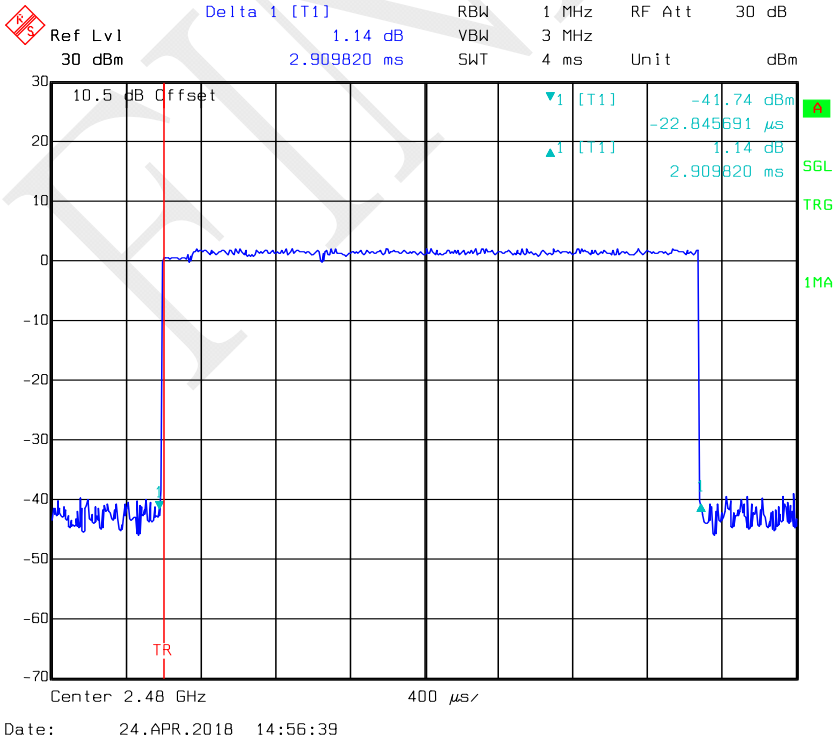
Date: 24.APR.2018 14:56:02

2DH5: Middle Channel



Date: 24.APR.2018 14:56:22

2DH5: High Channel

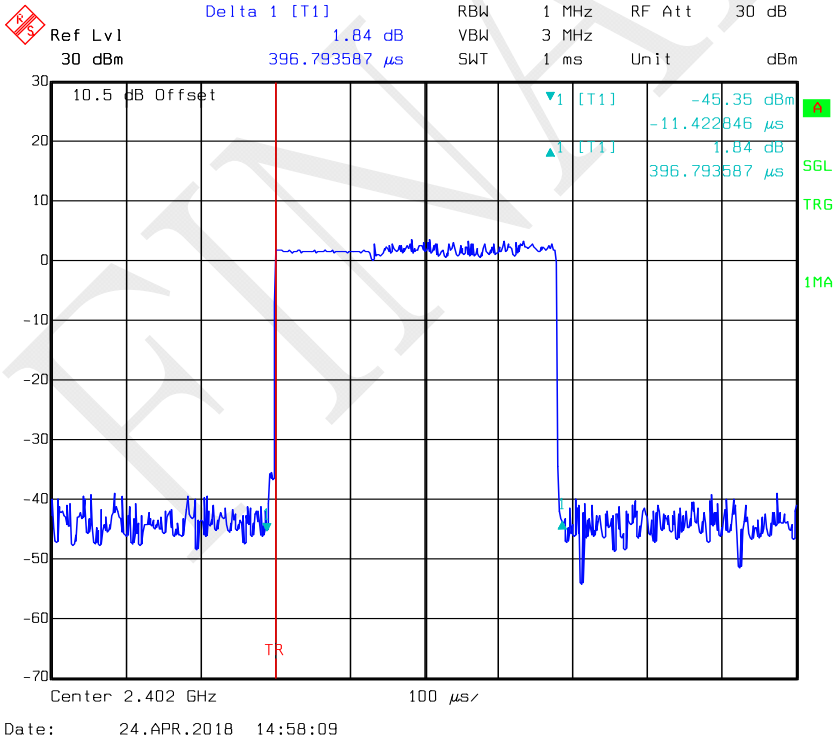


Date: 24.APR.2018 14:56:39

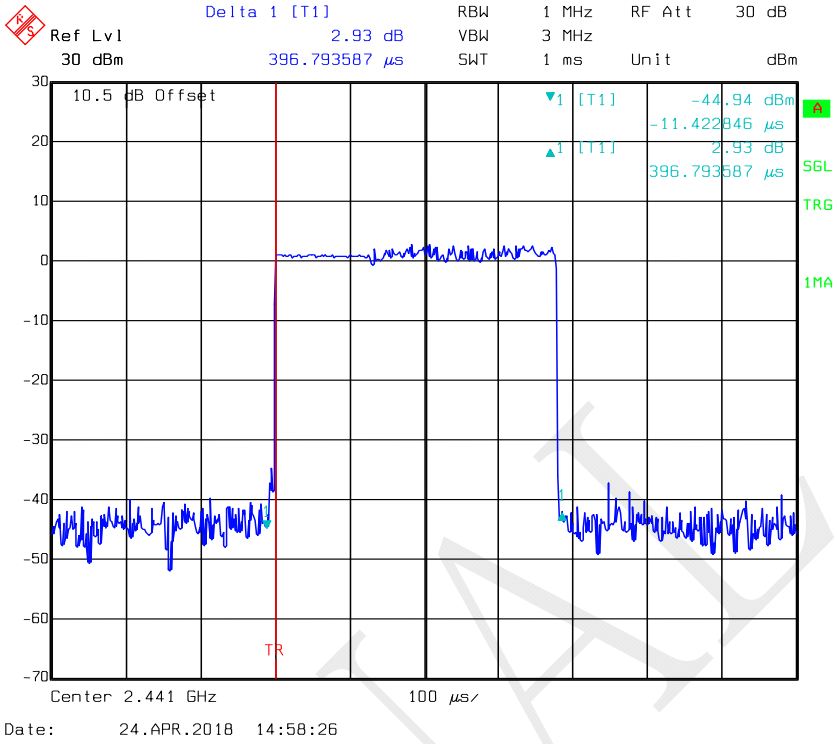
EDR Mode (8-DPSK):

Mode	Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
3DH1	Low	2402	0.397	0.127	Compliance
	Middle	2441	0.397	0.127	Compliance
	High	2480	0.397	0.127	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/2/79) ×31.6 s				
3DH3	Low	2402	1.659	0.265	Compliance
	Middle	2441	1.659	0.265	Compliance
	High	2480	1.659	0.265	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/4/79) ×31.6 s				
3DH5	Low	2402	2.934	0.313	Compliance
	Middle	2441	2.934	0.313	Compliance
	High	2480	2.934	0.313	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/6/79) ×31.6 s				

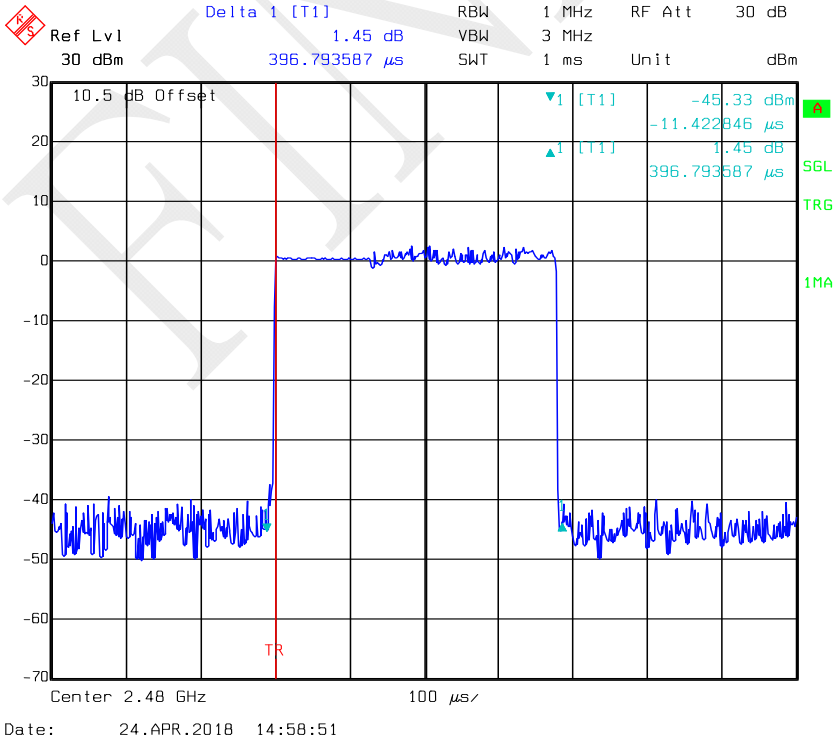
3DH1: Low Channel



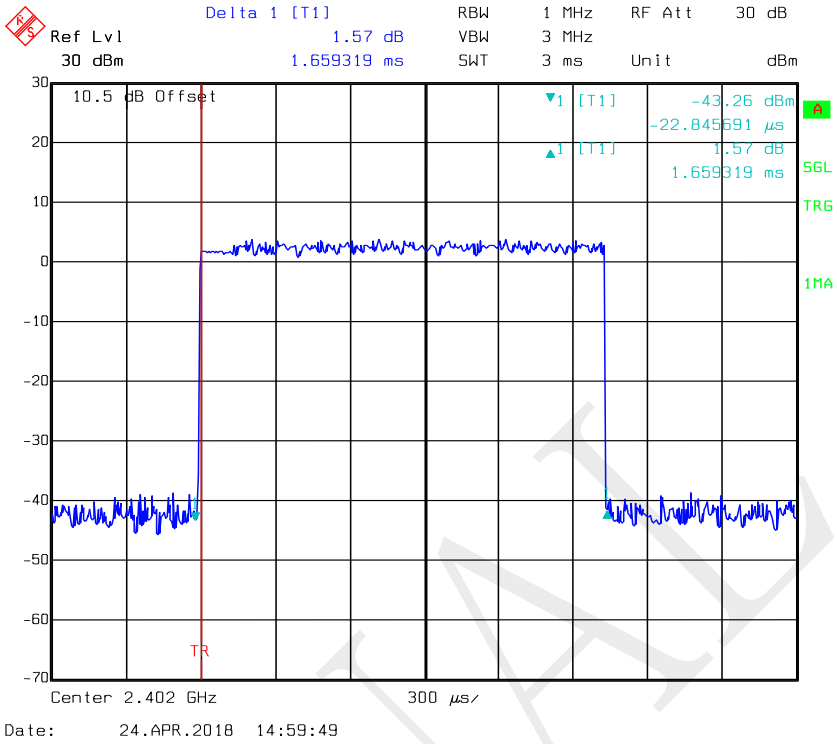
3DH1: Middle Channel



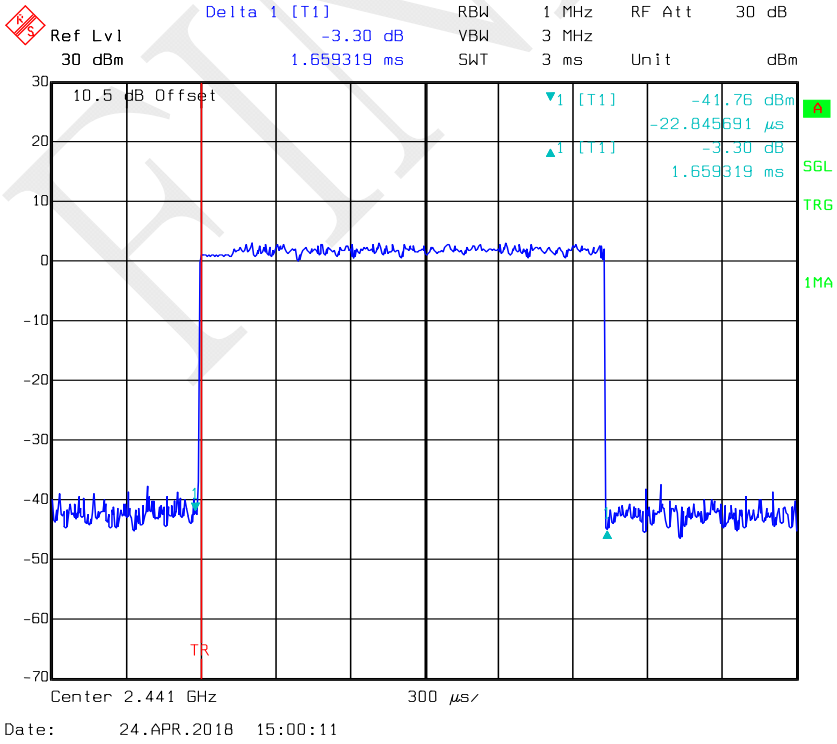
3DH1: High Channel



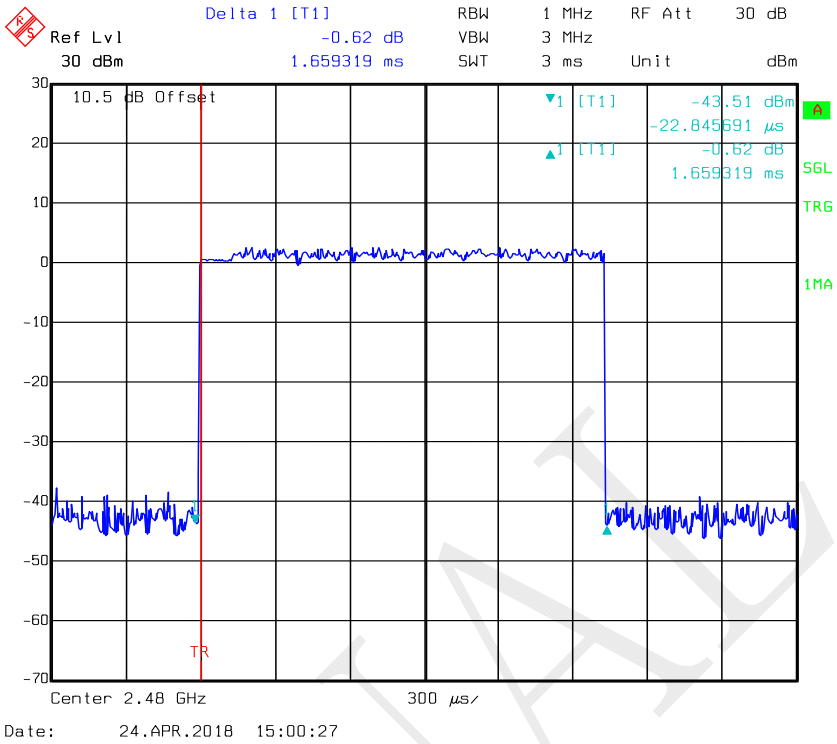
3DH3: Low Channel



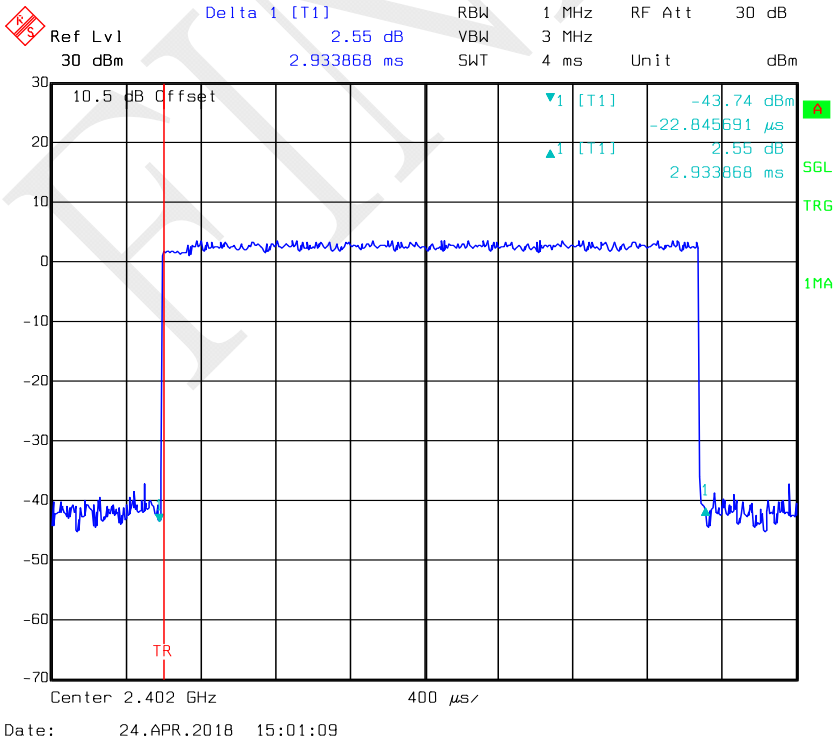
3DH3: Middle Channel



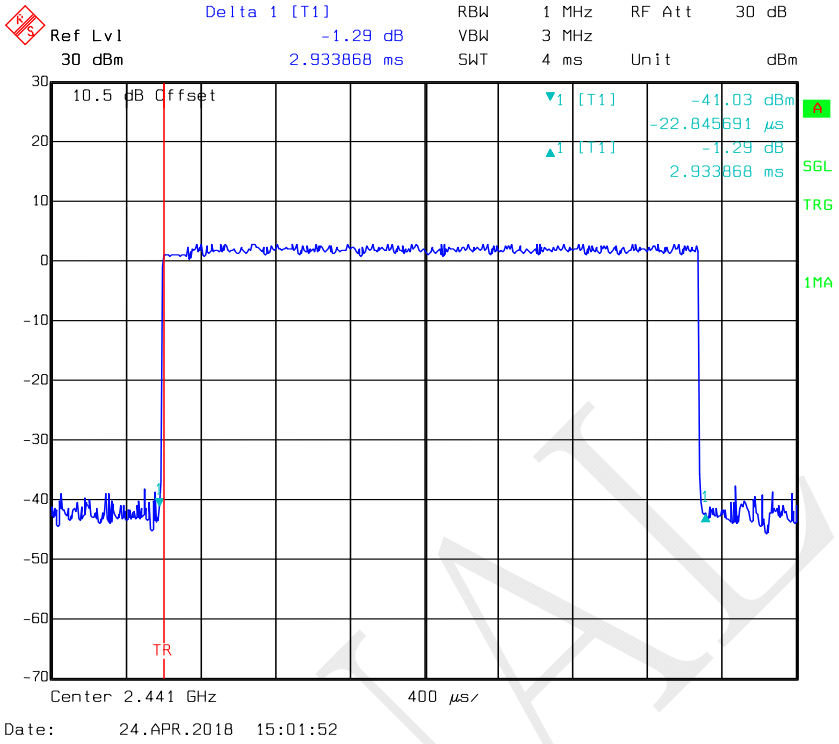
3DH3: High Channel



3DH5: Low Channel



3DH5: Middle Channel



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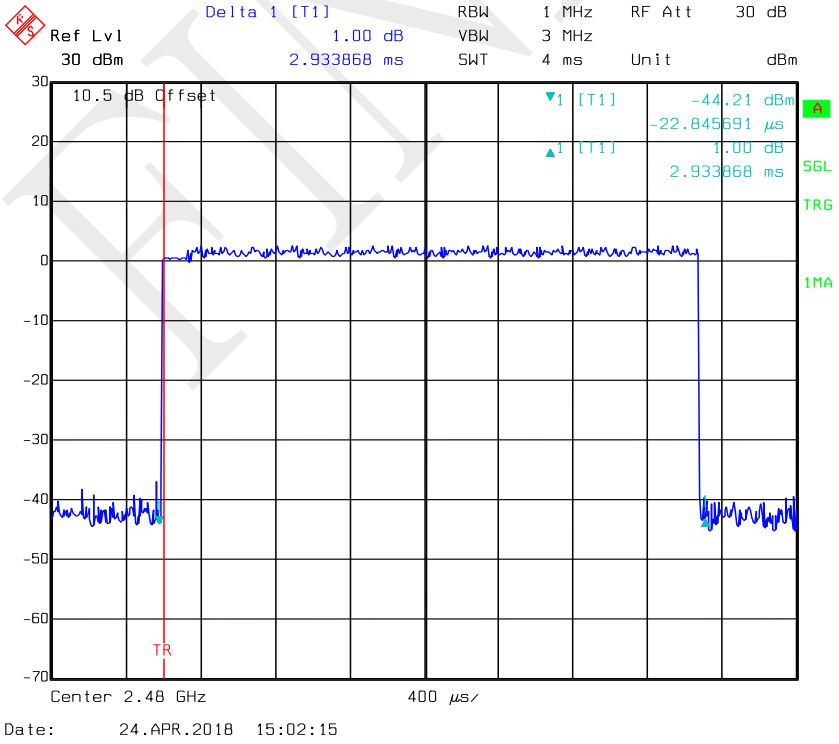
3DH5: High Channel



Date: 24.APR.2018 15:02:15

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 Data

Environmental Conditions

Temperature:	23 °C
Relative Humidity:	52 %
ATM Pressure:	95.7 kPa

** The testing was performed by Tom Tang on 2018-04-24.*

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

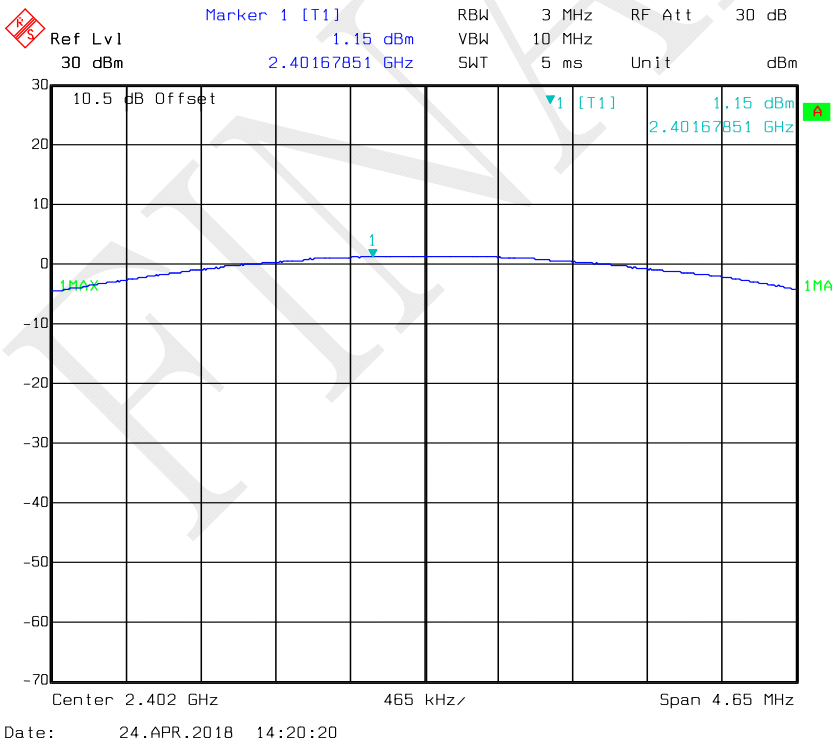
Test Mode: Transmitting

Mode	Channel	Frequency (MHz)	Peak Output power (dBm)	Limit (dBm)
BDR Mode (GFSK)	Low	2402	1.15	21
	Middle	2441	0.36	21
	High	2480	0.10	21
EDR Mode (π/4-DQPSK)	Low	2402	3.88	21
	Middle	2441	3.13	21
	High	2480	2.60	21
EDR Mode (8-DPSK)	Low	2402	4.27	21
	Middle	2441	3.38	21
	High	2480	3.00	21

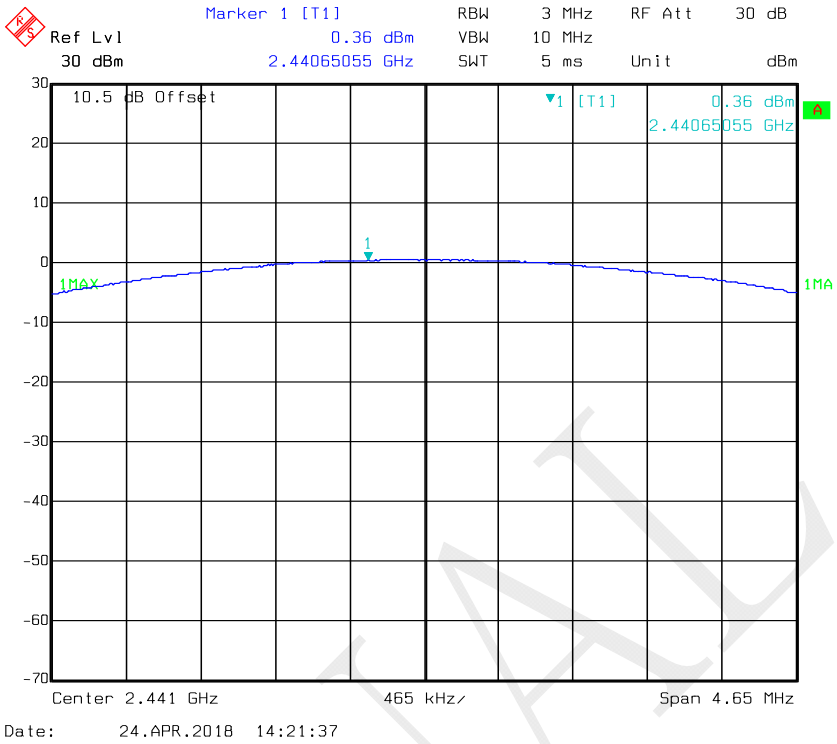
Note: The data above was tested in conducted mode.

BDR Mode (GFSK):

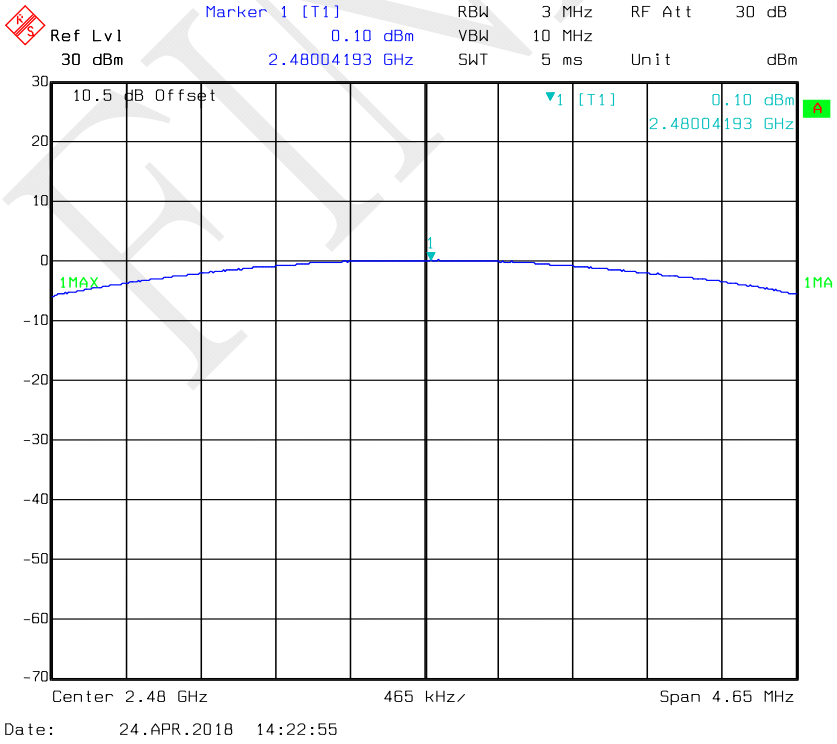
Low Channel



Middle Channel

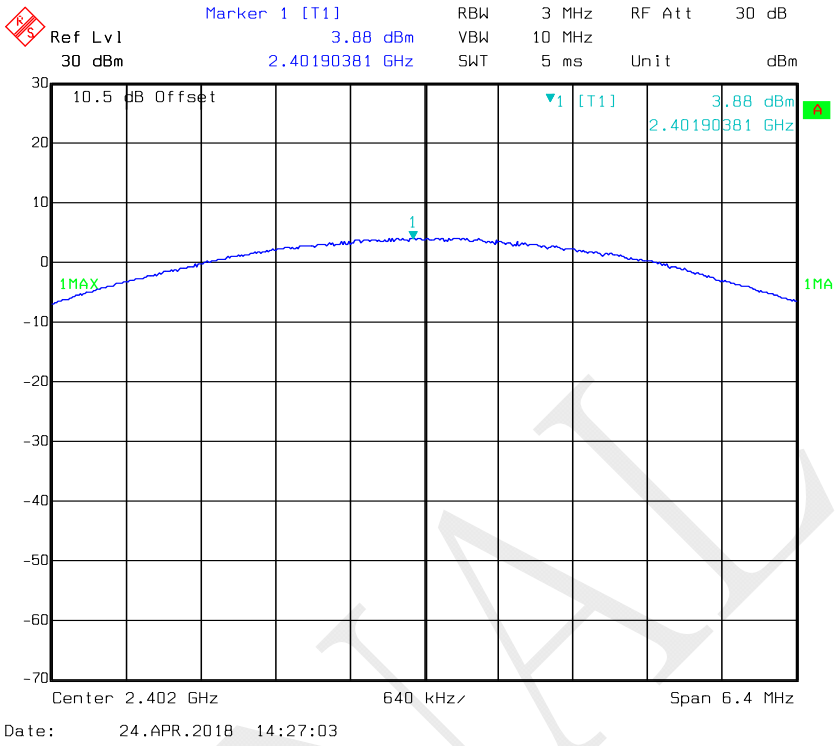


High Channel

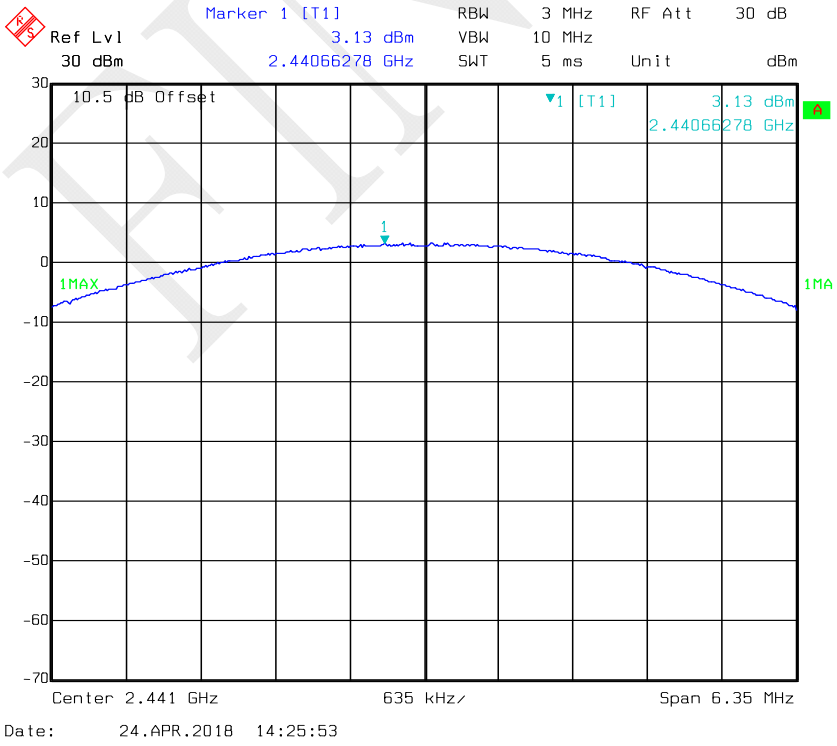


EDR Mode (π/4-DQPSK):

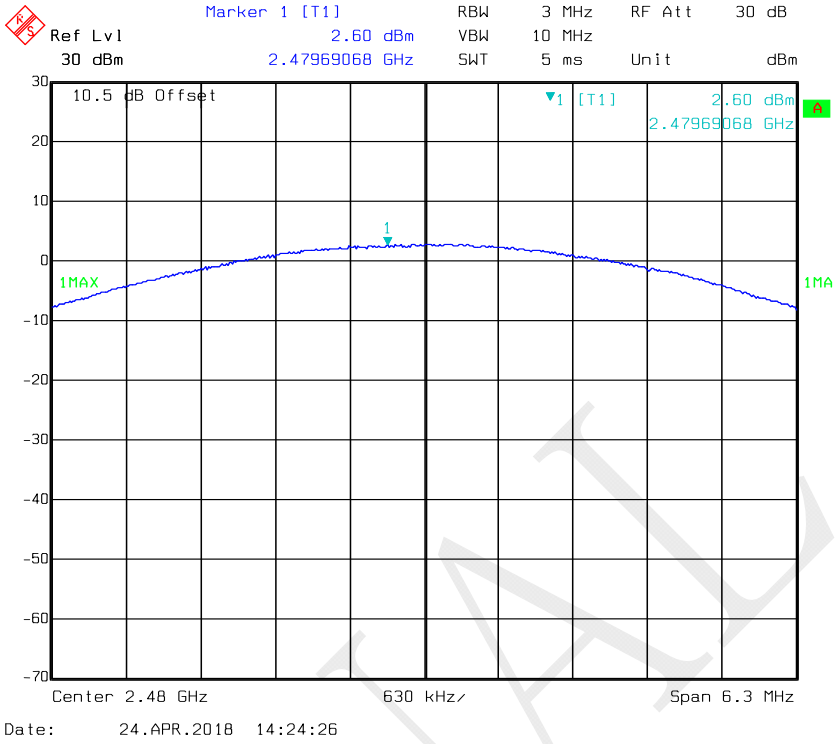
Low Channel



Middle Channel

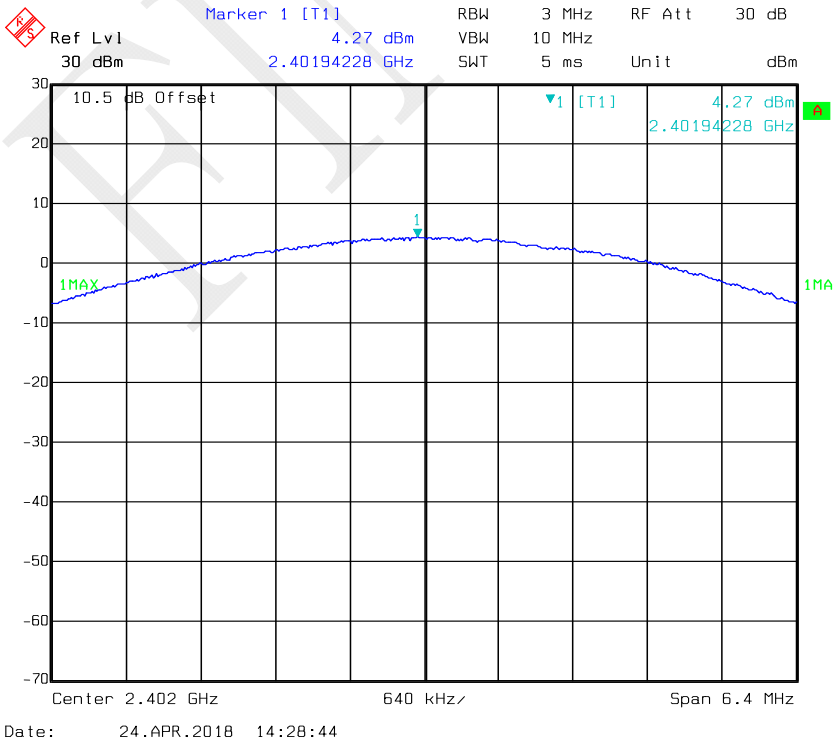


High Channel

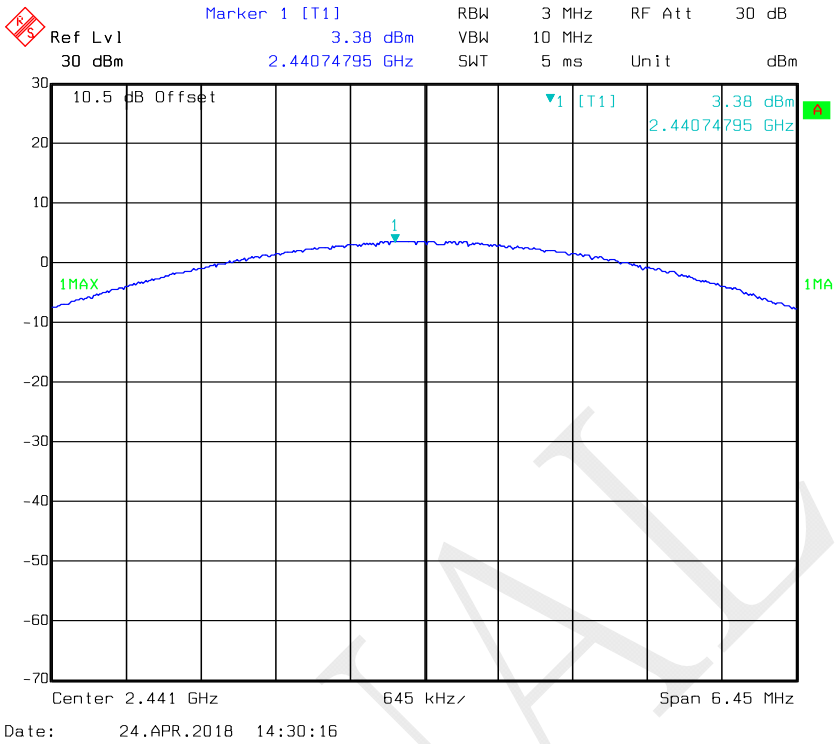


EDR Mode (8-DPSK):

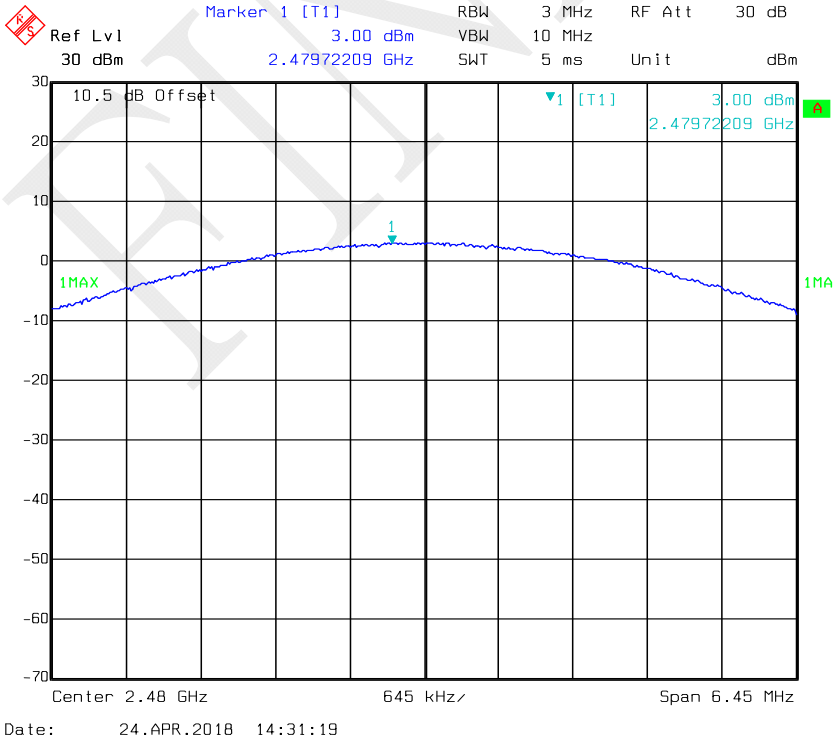
Low Channel



Middle Channel



High Channel



FCC §15.247(d) - BAND EDGES TESTING

Applicable Standard

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

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW=100 kHz; VBW=300 kHz.
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

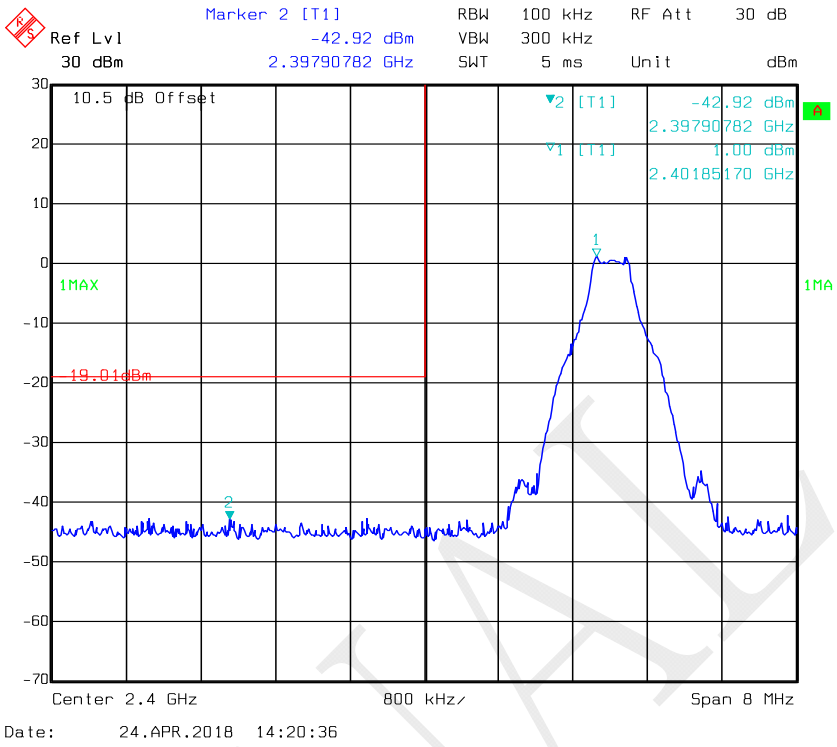
Temperature:	23 °C
Relative Humidity:	52 %
ATM Pressure:	95.7 kPa

** The testing was performed by Tom Tang on 2018-04-24.*

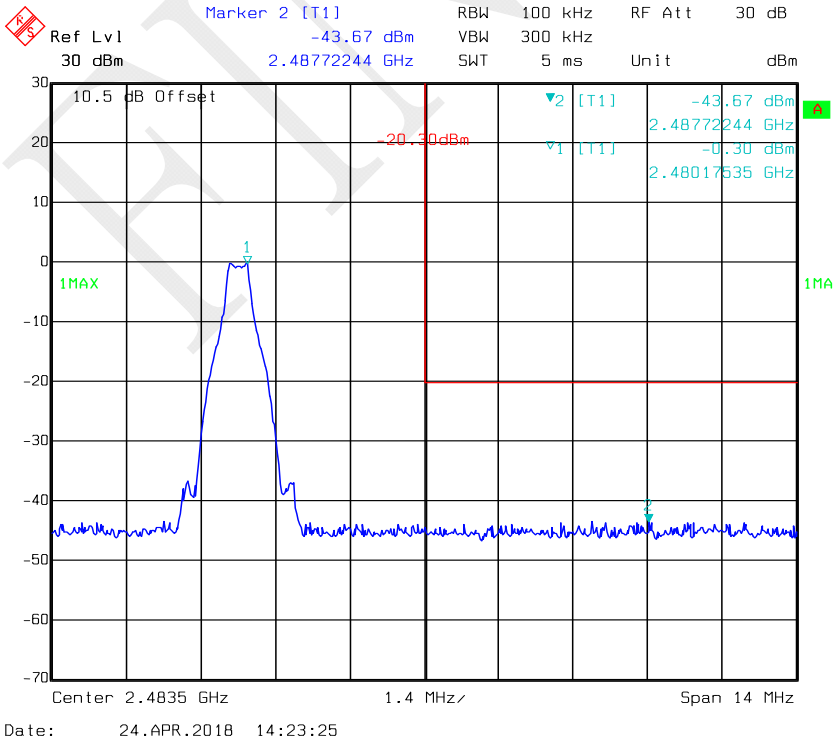
Test Result: Compliance. Please refer to the below plots:

BDR Mode (GFSK):

Band Edge, Left Side

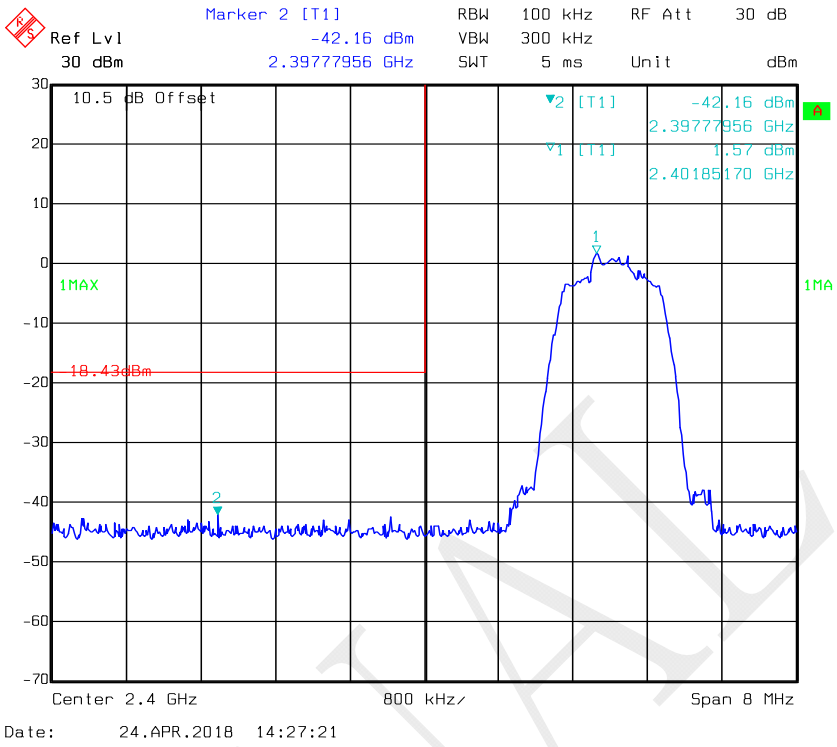


Band Edge, Right Side

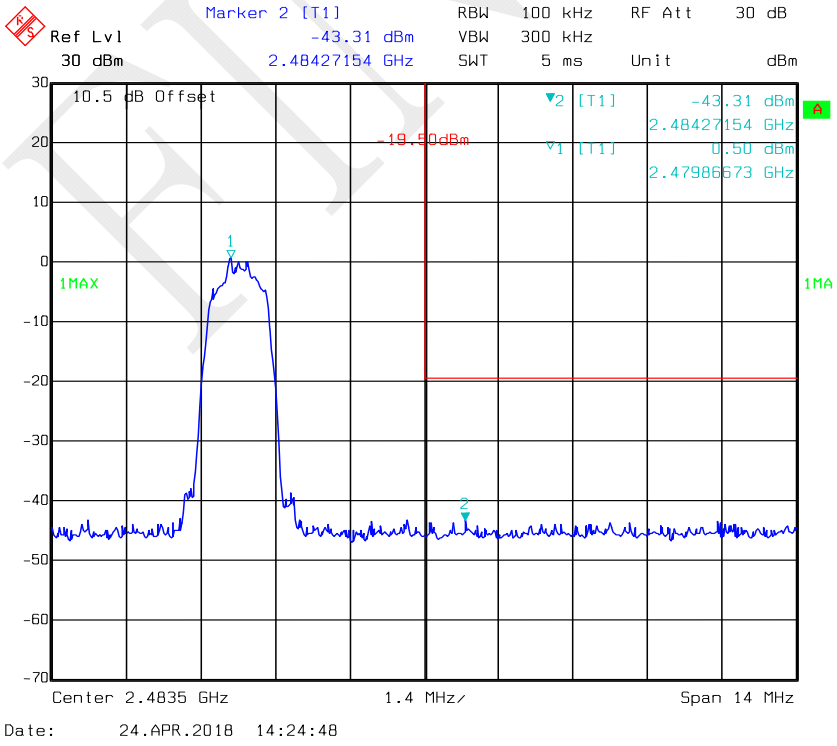


EDR Mode (π/4-DQPSK):

Band Edge, Left Side

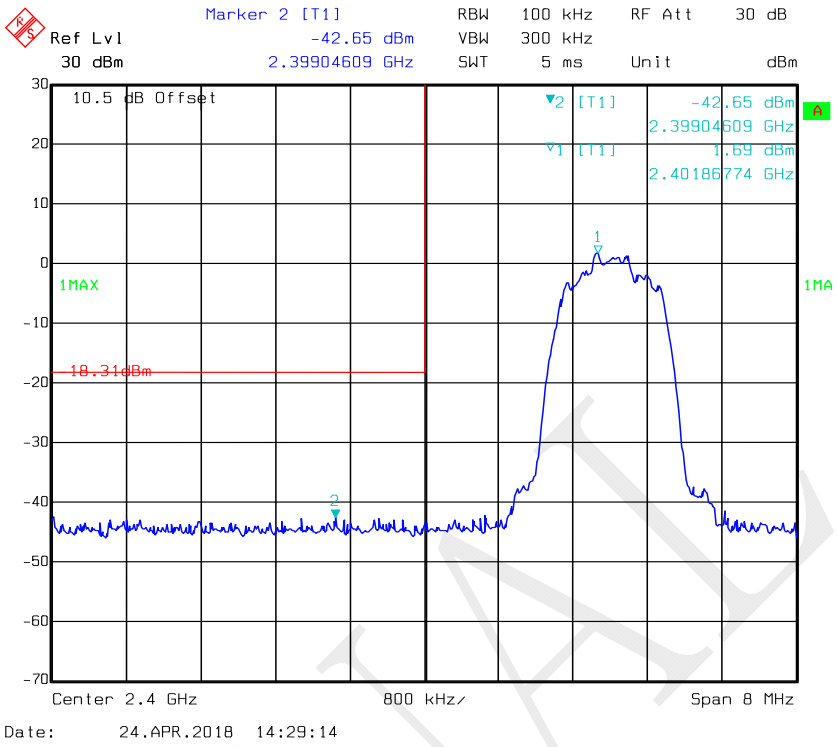


Band Edge, Right Side

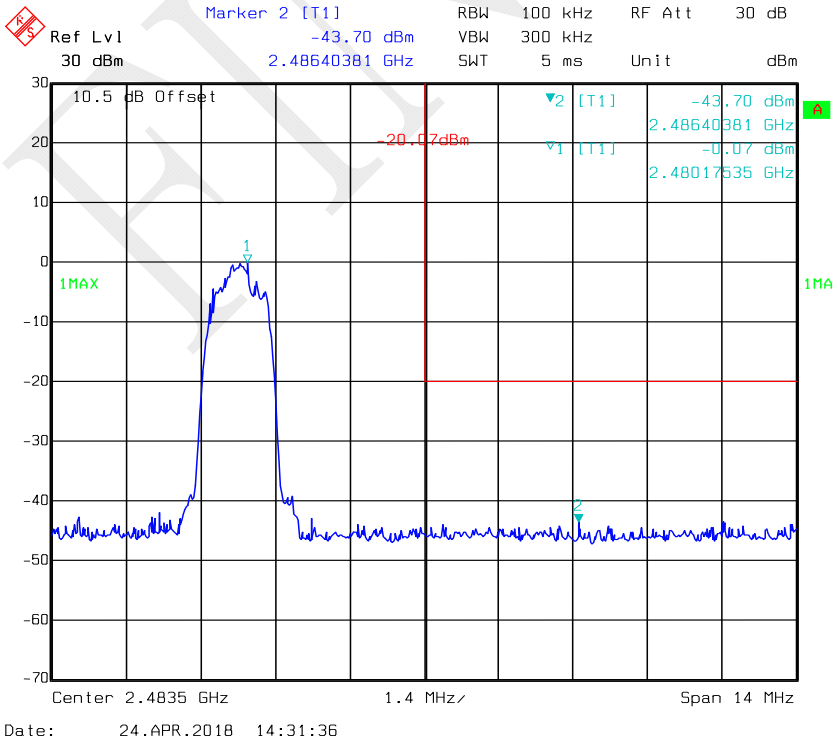


EDR Mode (8-DPSK):

Band Edge, Left Side



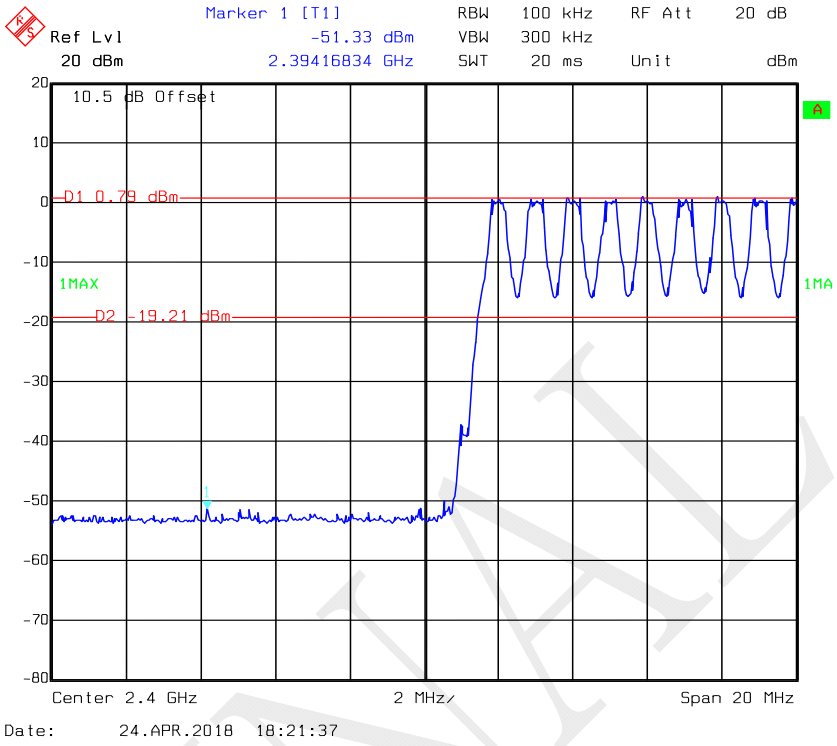
Band Edge, Right Side



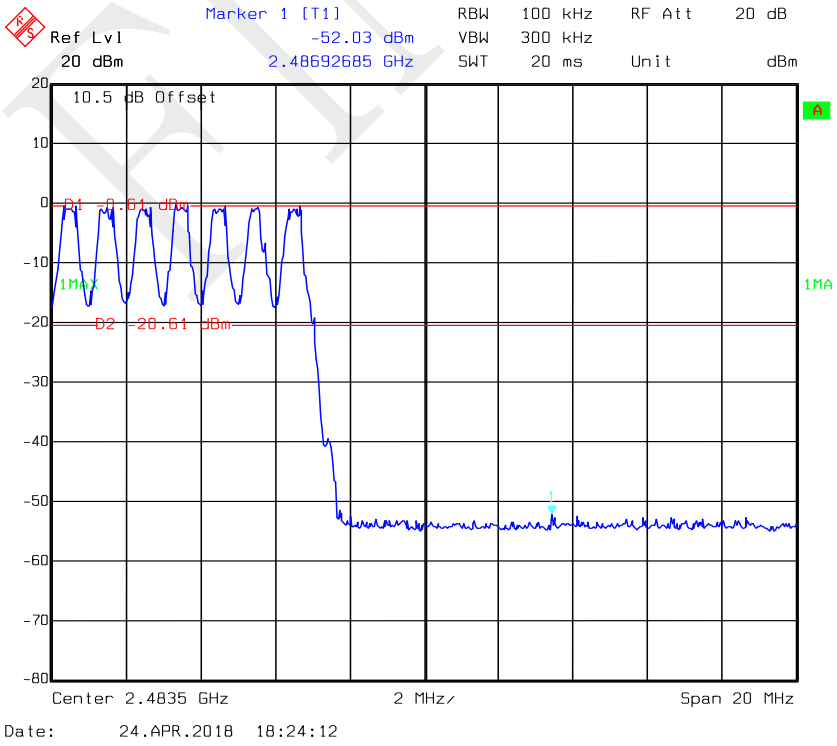
Hopping:

BDR Mode (GFSK):

Band Edge, Left Side

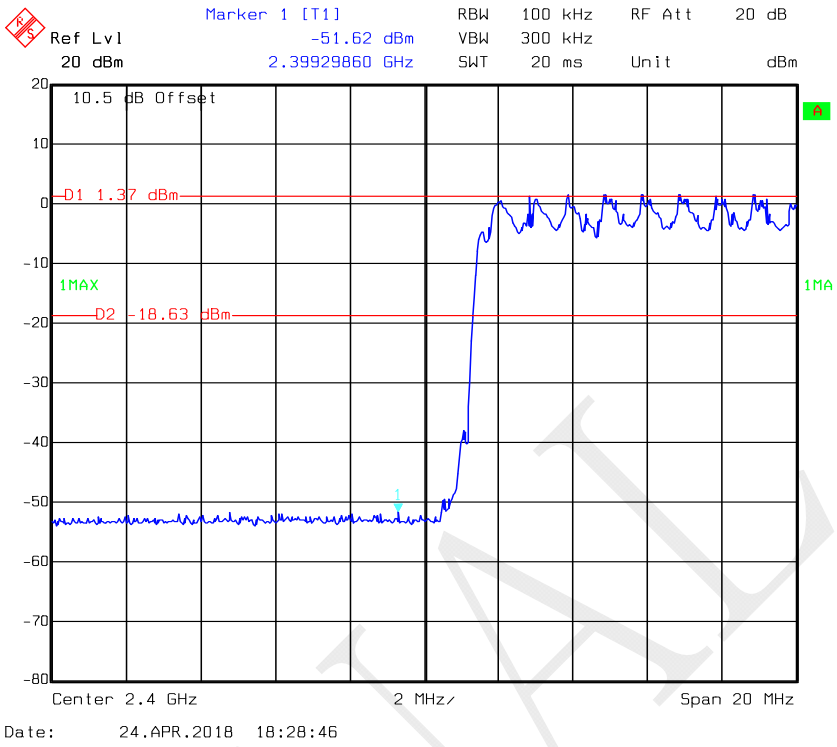


Band Edge, Right Side

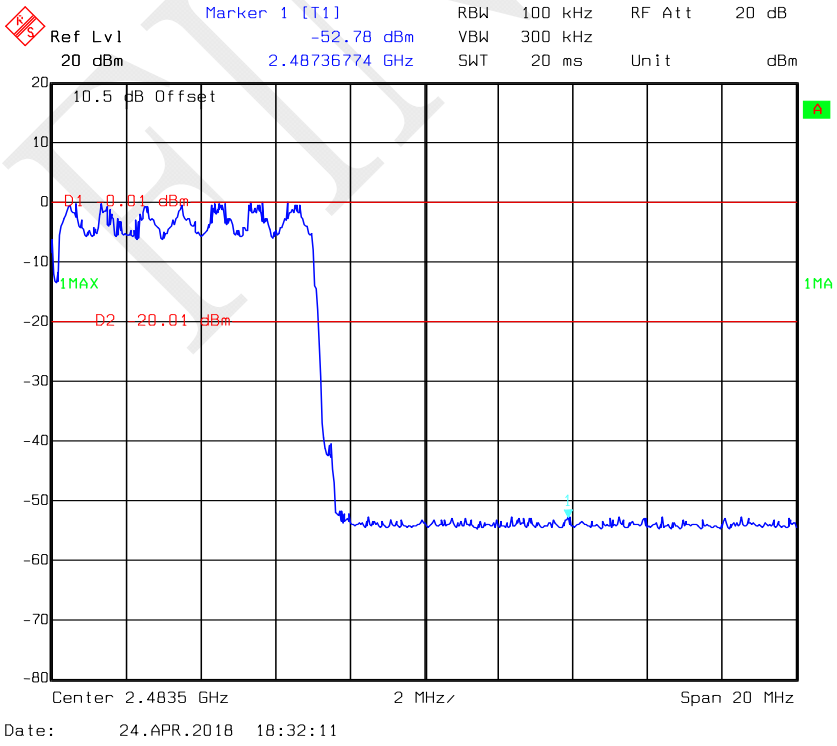


EDR Mode (π/4-DQPSK):

Band Edge, Left Side

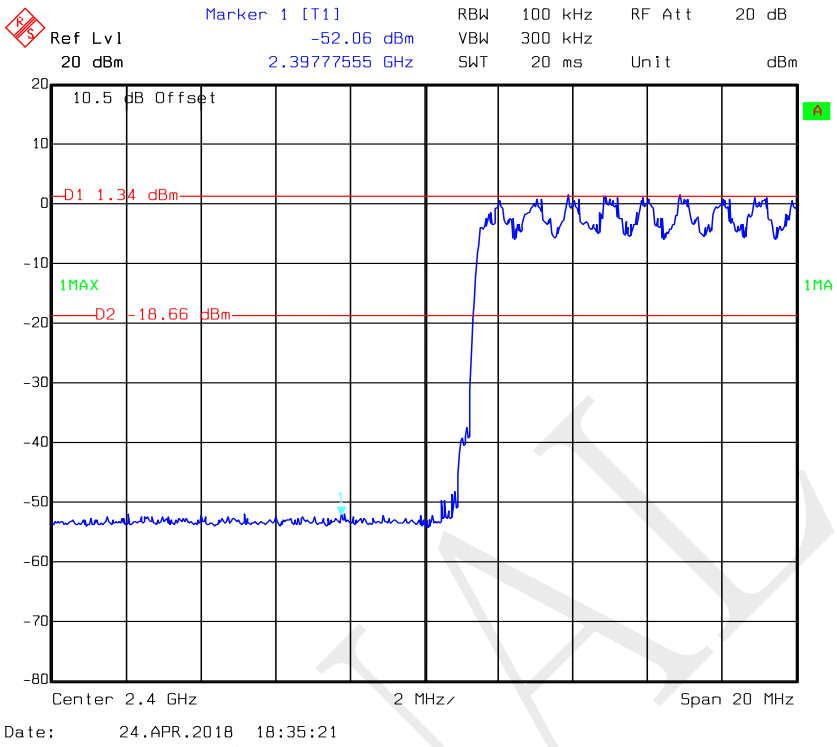


Band Edge, Right Side

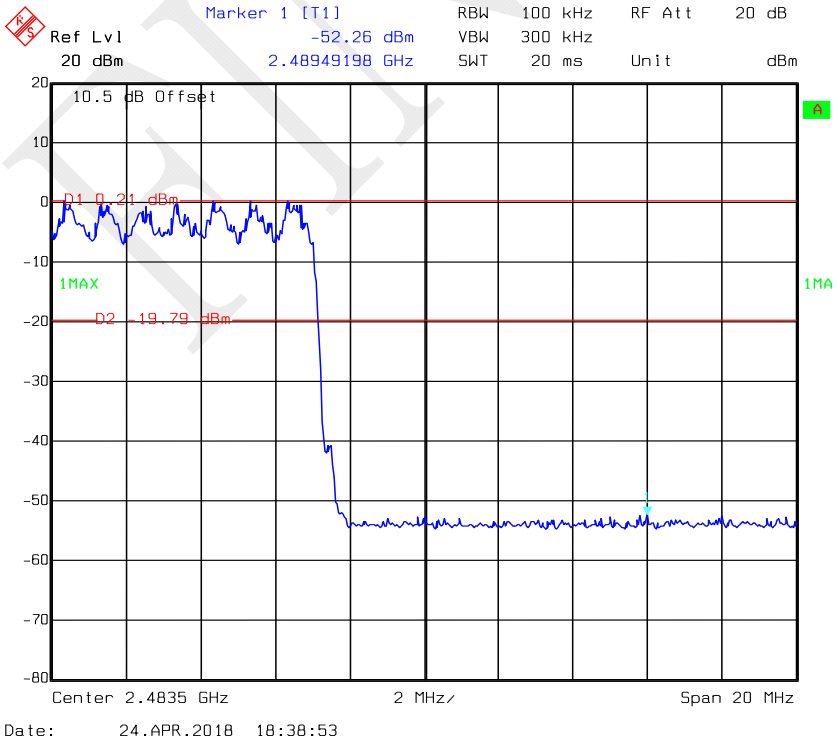


EDR Mode (8-DPSK):

Band Edge, Left Side



Band Edge, Right Side



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