FCC PART 15.247

TEST REPORT

For

Chengdu Vantron Technology, Ltd.

No.5 GaoPeng Road, Hi-Tech Zone, Chengdu, SiChuan, P.R. China 610045

Tested Model: VT-TABLET-5081G
FCC ID: 2AAGE5081G

Report Type:	**Equipment Name:**
Original Report	Tablet

Report Number:	RSC191025001-0D
Date of Report Issue:	2019-12-10
Reviewed By:	Sula Huang
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)

Applicant	Chengdu Vantron Technology, Ltd.
Product	Tablet
Tested Model	VT-TABLET-5081G
FCC ID	2AAGE5081G
Frequency Range	2402MHz-2480MHz
Modulation Type:	GFSK,π/4-DQPSK,8DPSK
Voltage Range	DC 3.8V rechargeable Li-ion battery or DC5V from adapter
Measure approximately	246 mm (L) x 151 mm (W) x 23.5 mm (H)
Sample serial number	191025001/01 (assigned by the BACL, Chengdu)
Sample/EUT Status	The test sample was in good condition and received:2019-10-25

Note: Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

Objective

This report is prepared on behalf of **Chengdu Vantron Technology, 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 15C DTS submissions with FCC ID: 2AAGE5081G
FCC Part 15C DXX submissions with FCC ID: 2AAGE5081G
FCC Part 15E NII submissions with FCC ID: 2AAGE5081G

Measurement Uncertainty

Item			Uncertainty
AC power line conducted emission			2.24 dB
Radiated Emission(Field Strength)	30MHz-200MHz	H	4.47 dB
		V	4.73 dB
	200MHz-1GHz	H	4.87 dB
		V	5.93 dB
	1GHz-6GHz		4.51 dB
	6GHz-18GHz		4.49 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℃

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the corresponding inclusion factor K when the inclusion probability is about 95%.

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.

Bay Area Compliance Laboratories Corp. (Chengdu) lab is accredited to ISO/IEC 17025 by A2LA (Lab code: 4324.01) and the FCC designation No. CN1186 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.

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: “RF test tool” installed in device was used during test, the setting was configured as below:

Test Software Version		RF test tool		
Test Frequency		2402MHz	2441MHz	2480MHz
GFSK	Power Level	0	0	0
π/4-DQPSK	Power Level	0	0	0
8PSK	Power Level	0	0	0

Support Equipment List and Details

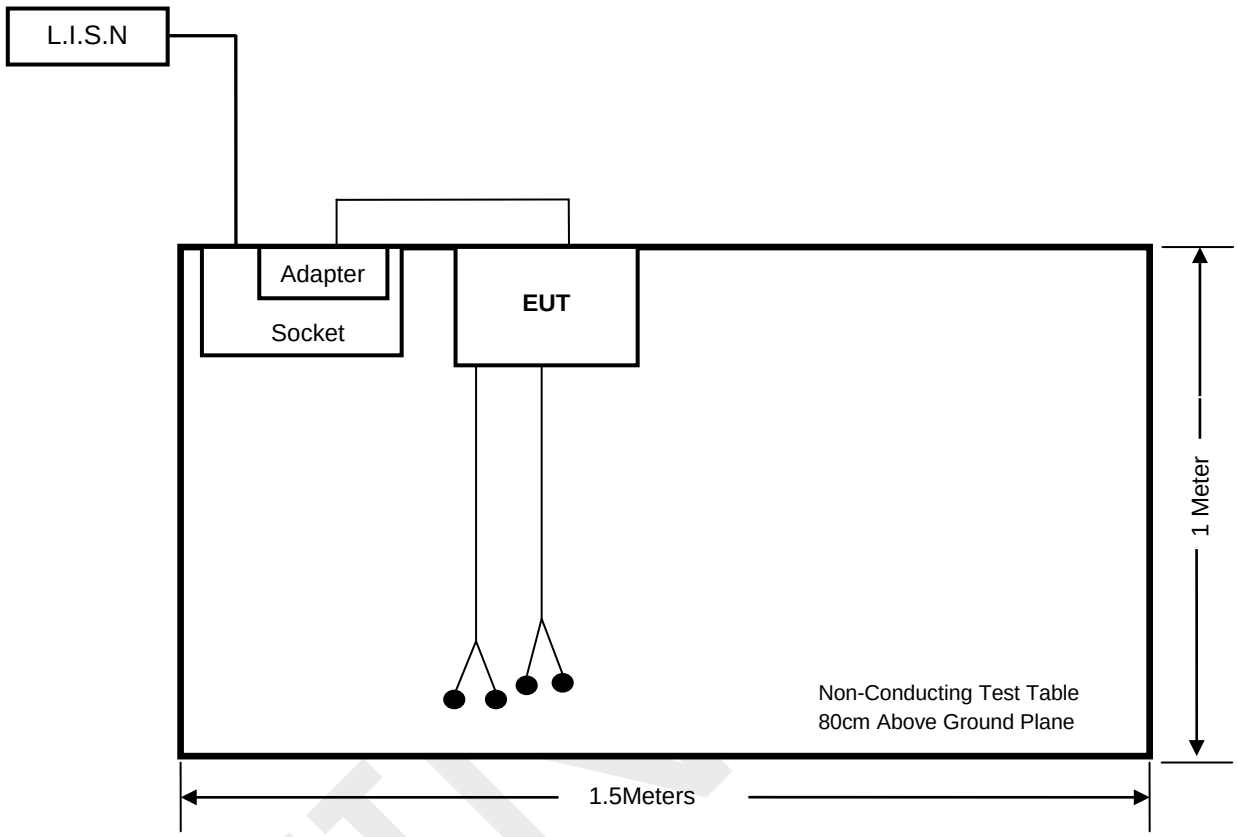
Manufacturer	Description	Model	Serial Number
XIAOMI	Adapter Input: 100-240VAC, 50/60Hz,0.5A Output:5V,2A/9V,1.2A/ 12V,1A	MD3-03-EB	14102116834
Huawei	Earphone	Unknown	Unknown
SS	Earphone	Unknown	Unknown

External I/O Cable

Cable Description	Length (m)	From	To
Unshielded Power Cable	1.8	Adapter	EUT
Unshielded Earphone Cable*2	1.5	EUT	Earphone

Block Diagram of Test Setup

Conducted Emissions



SUMMARY OF TEST RESULTS

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

Note: Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

TEST EQUIPMENTS LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emission					
Rohde & Schwarz	EMI Test Receiver	ESCI	100028	2019-04-15	2020-04-14
ROHDE&SCHWARZ	L.I.S.N.	ENV216	3560.6550.16	2019-02-25	2020-02-24
HP	RF Limiter	11947A	3107A01270	2019-10-18	2020-10-17
Unknown	Conducted Cable	L-E003	000003	2019-08-05	2020-08-04
Rohde & Schwarz	EMC32	EMC32	V 8.52.0	NCR	NCR
Radiated Emission					
EMCT	Semi-Anechoic Chamber	966	001	2017-05-18	2020-05-17
SONOMA INSTRUMENT	Amplifier	310 N	186684	2019-09-06	2020-09-05
SUNOL SCIENCES	Broadband Antenna	JB3	A121808	2017-05-19	2020-05-18
INMET	Attenuator	18N-6dB	N/A	2019-10-17	2020-10-16
Rohde & Schwarz	EMI Test Receiver	ESR3	102456	2019-04-15	2020-04-14
Rohde & Schwarz	Spectrum Analyzer	FSU26	200835	2019-04-15	2020-04-14
EMCO	Horn Antenna	3115	2192	2019-09-25	2021-09-24
A.H. Systems, Inc	Amplifier	PAM-0118P	467	2019-08-30	2020-08-29
EM Electronics	RF Pre-Amplifier	EM18G40	060725	2019-07-24	2020-07-23
Rohde & Schwarz	EMI Test Receiver	ESIB 40	100215	2019-04-15	2020-04-14
A.H. Systems, Inc	Horn Antenna	SAS-574	510	2019-09-02	2021-09-01
Sinoscite.,Co Ltd	Reject Band Filter	BSF 2402-2480MN	0898-005	2019-11-10	2020-11-09
MICRO-TRONICS	High Pass Filter	HPM50111	G216	2019-11-10	2020-11-09
Unknown	RF Cable (Below 1GHz)	L-E005	000005	2019-09-06	2020-09-05
Unknown	RF Cable (Below 1GHz)	T-E128	000128	2019-10-17	2020-10-16
MICRO-COAX	Flexible microwave cable	T-E237	233522-001	2019-07-19	2020-07-18
Unknown	RF Cable (Above 1GHz)	T-E069	000069	2019-07-24	2020-07-23
Micro-coax	RF Cable (Above 1GHz)	T-E209	MFR 64639 2310	2019-07-19	2020-07-18
Rohde & Schwarz	EMC32	EMC32	V9.10.00	NCR	NCR

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
Rohde & Schwarz	Spectrum Analyzer	FSEM30	100018	2019-04-15	2020-04-14
WEINSCHEL ENGINEERING	Attenuator	1A 10dB	AB1165	2019-08-05	2020-08-04
E-Microwave	DC Block	EMDCB-00036	OE01304225	2019-08-05	2020-08-04
Unknown	RF Cable	Unknown	000007	Each Time	Each Time

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

Applicable Standard

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

According to KDB447498 D01 General RF Exposure Guidance v06:

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

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

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

Measurement Result

The max conducted power including tune-up tolerance is 8.2 dBm (6.61mW).
[(max. power of channel, mW)/(min. test separation distance, mm)][√f(GHz)]
= 6.61/5*(√2.48) = 2.1< 3.0

So the stand-alone SAR evaluation is not necessary.

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

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

The EUT has one WIFI antenna, one WIFI/Bluetooth antenna, four 4G antennas and one NFC antenna, which are permanently attached and fulfill the requirement of this section. Please refer to the table below and EUT photos.

Antenna	Manufacturer	Antenna Model Number	Max. Antenna Gain	Antenna Type
2.4G/5G WIFI; Bluetooth Antenna (Chain 0)	Dongguan Yijia Electronics communication Technology Co.,Ltd	YJS01.042.002.305C	2.4G:1.1dBi 5G: 4.6dBi	FPC Antenna
2.4G/5G WIFI Antenna (Chain 1)		YJS01.042.002.306C	2.4G: 0.7dBi 5G: 2.7dBi	
4G Antenna (Diversity)	Dongguan Yijia Electronics communication Technology Co.,Ltd	YJS01.042.002.301C	1.9dBi	FPC Antenna
4G Antenna (Main)		YJS01.042.002.302C	2.1dBi	
4G Antenna (Diversity)		YJS01.042.002.303C	1.9dBi	
4G Antenna (Diversity)		YJS01.042.002.304C	1.9dBi	
NFC Antenna	SHENZHEN SUNSHINE GOOD ELECTRONICS CO.,LTD	P134FQ2137A0	0dBi	FPC Antenna

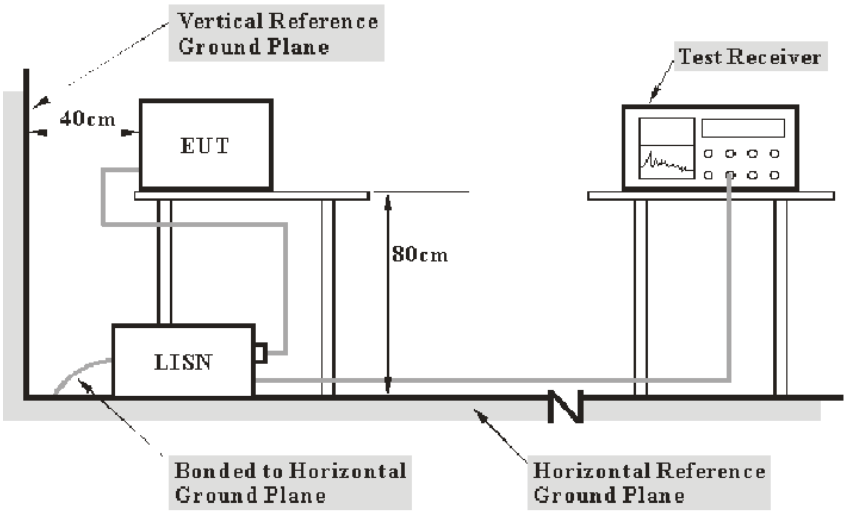
Result: Compliance.

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.

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

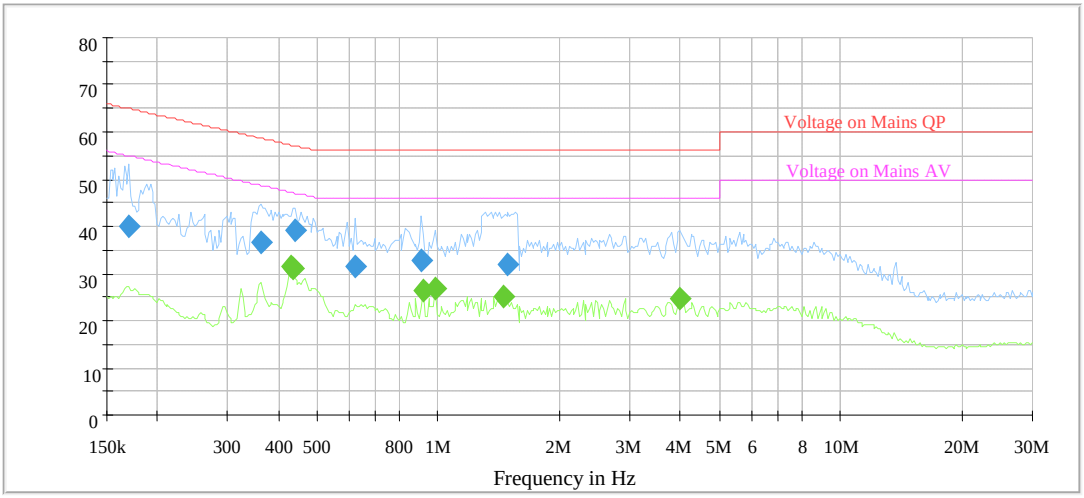
Temperature:	18 °C
Relative Humidity:	63 %
ATM Pressure:	94.8 kPa

The testing was performed by Eric Xiao on 2019-11-24.

Test Mode: Transmitting

Low channel of EDR (8DPSK) mode - Worst Case

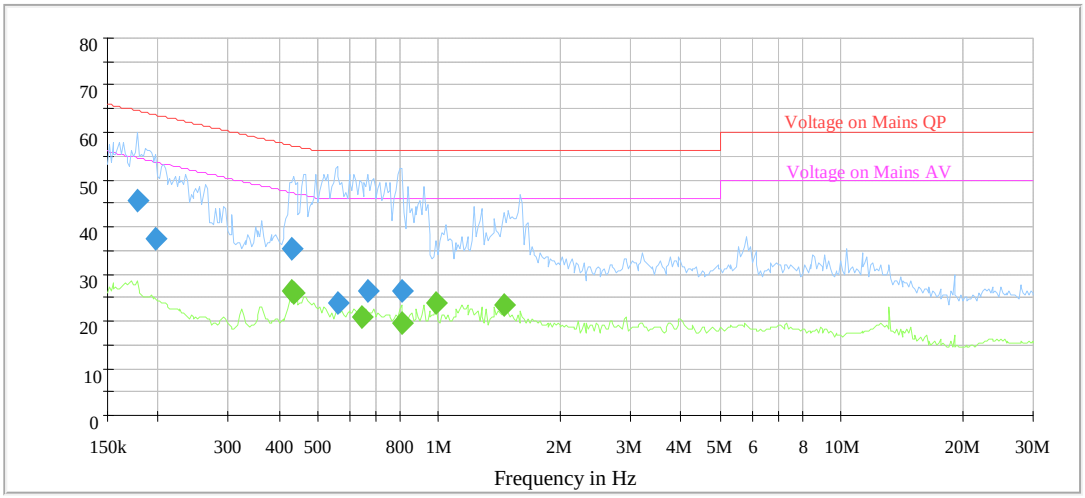
AC120 V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.170714	40.2	200.0	9.000	L1	19.6	24.7	64.9
0.363659	36.5	200.0	9.000	L1	19.6	22.1	58.6
0.439339	39.3	200.0	9.000	L1	19.6	17.8	57.1
0.622369	31.3	200.0	9.000	L1	19.6	24.7	56.0
0.908365	32.9	200.0	9.000	L1	19.6	23.1	56.0
1.493925	31.8	200.0	9.000	L1	19.6	24.2	56.0

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.430682	31.5	200.0	9.000	L1	19.6	15.7	47.2
0.434989	30.9	200.0	9.000	L1	19.6	16.3	47.2
0.917448	26.3	200.0	9.000	L1	19.6	19.7	46.0
0.983629	26.7	200.0	9.000	L1	19.6	19.3	46.0
1.449989	25.0	200.0	9.000	L1	19.6	21.0	46.0
4.000782	24.7	200.0	9.000	L1	19.7	21.3	46.0

AC120 V, 60 Hz, Neutral:



Frequency (MHz)	QuasiPeak (dB µ V)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.177646	45.4	200.0	9.000	N	19.6	19.2	64.6
0.198194	37.4	200.0	9.000	N	19.6	26.3	63.7
0.430682	35.2	200.0	9.000	N	19.6	22.0	57.2
0.557844	24.0	200.0	9.000	N	19.6	32.0	56.0
0.667264	26.6	200.0	9.000	N	19.7	29.4	56.0
0.806127	26.3	200.0	9.000	N	19.7	29.7	56.0

Frequency (MHz)	Average (dB µ V)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.430682	26.5	200.0	9.000	N	19.6	20.7	47.2
0.434989	25.8	200.0	9.000	N	19.6	21.4	47.2
0.641227	20.8	200.0	9.000	N	19.6	25.2	46.0
0.806127	19.4	200.0	9.000	N	19.7	26.6	46.0
0.983629	23.9	200.0	9.000	N	19.6	22.1	46.0
1.449989	23.3	200.0	9.000	N	19.6	22.7	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

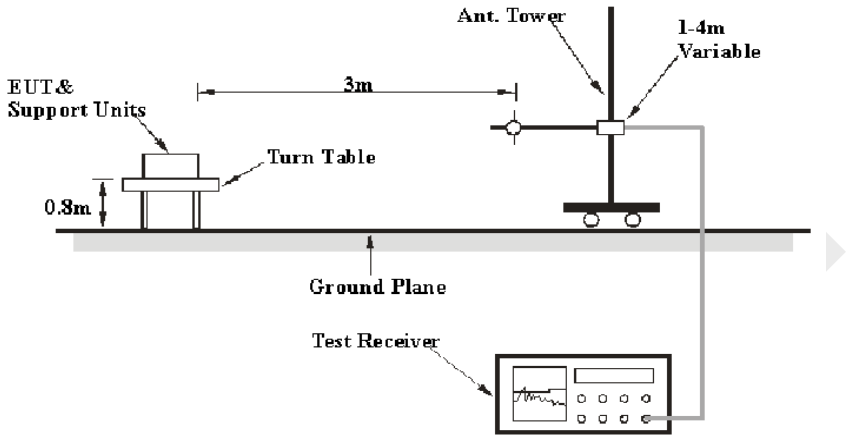
FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

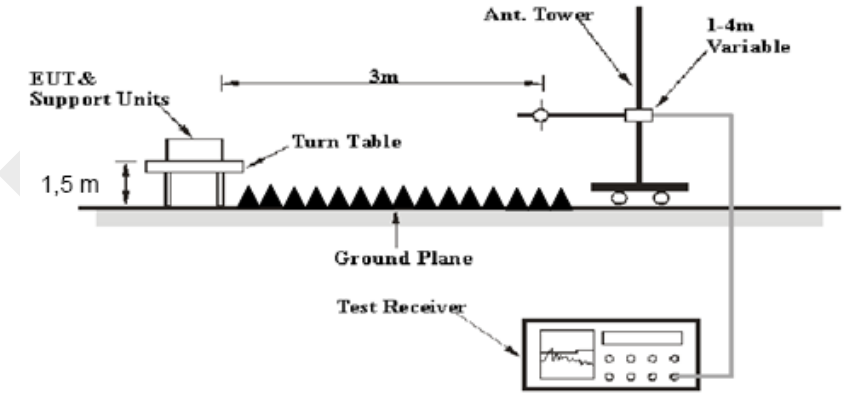
FCC §15.247 (d); §15.209; §15.205;

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.

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	Detector
30 MHz–1000 MHz	120 kHz	300 kHz	120 kHz	QP
Above 1GHz	1MHz	3 MHz	/	PK
	1MHz	3 MHz	/	AV

If the maximized peak measured value complies with under the QP/Average limit more than 6dB, then it is unnecessary to perform an QP/Average measurement.

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

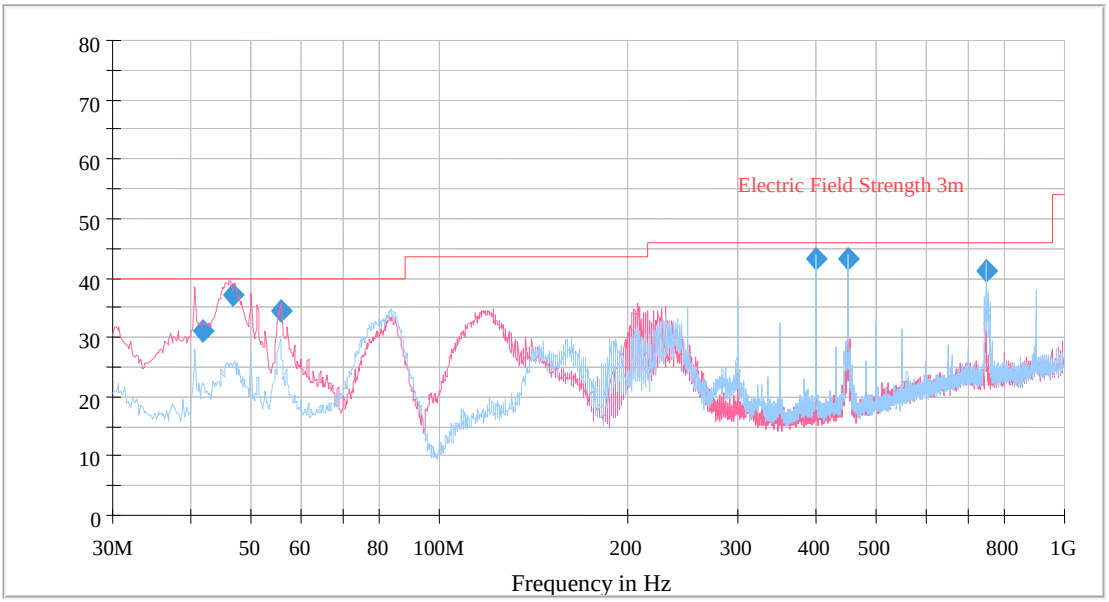
Temperature:	21 °C
Relative Humidity:	65 %
ATM Pressure:	95.3 kPa

The testing was performed by Eric Xiao on 2019-11-24.

Test Mode: Transmitting
(Pre-Scan with GFSK, π/4-DQPSK, 8DPSK mode and the worst case is 8DPSK mode)

30 MHz to 1 GHz

Low channel of EDR mode(8DPSK)—Worst Case



Frequency (MHz)	QuasiPeak (dB µ V/m)	Limit (dB µ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
41.709800	30.99	40.00	9.01	200.0	120.000	103.0	V	358.0	-12.1
46.599900	37.13	40.00	2.87	200.0	120.000	102.0	V	15.0	-15.0
55.728000	34.50	40.00	5.50	200.0	120.000	105.0	V	68.0	-17.4
400.014400	43.25	46.00	2.75	200.0	120.000	103.0	H	62.0	-8.7
450.013000	43.27	46.00	2.73	200.0	120.000	104.0	H	278.0	-8.2
750.094500	41.12	46.00	4.88	200.0	120.000	122.0	H	178.0	-3.3

Above 1GHz:

EDR Mode (8DPSK)-Worst Case

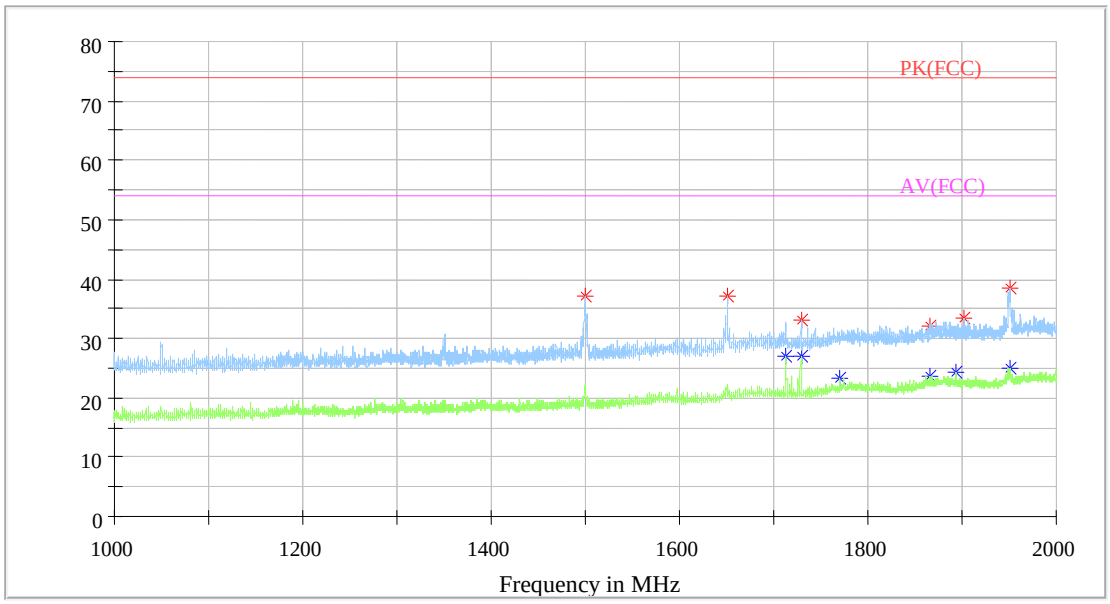
Frequency	Receiver		Rx Antenna		Cable loss	Amplifier Gain	Corrected Amplitude	Limit	Margin
	Reading	Measurement	Polar	Factor					
MHz	dBµV	PK/AV	H/V	(dB/m)	dB	dB	dBµV/m	dBµV/m	dB
Frequency: 2402 MHz									
2402	68.09	PK	H	29.14	3.55	0.00	100.78	N/A	N/A
2402	52.59	AV	H	29.14	3.55	0.00	85.28	N/A	N/A
2390	26.3	PK	H	29.15	3.54	0.00	58.99	74.00	15.01
2390	12.46	AV	H	29.15	3.54	0.00	45.15	54.00	8.85
2700	60.31	PK	V	29.48	3.76	42.14	51.41	74.00	22.59
2700	33.52	AV	V	29.48	3.76	42.14	24.62	54.00	29.38
2850	62.25	PK	V	29.84	3.87	42.17	53.79	74.00	20.21
2850	42.34	AV	V	29.84	3.87	42.17	33.88	54.00	20.12
4804	40.38	PK	V	32.99	5.05	42.88	35.54	74.00	38.46
4804	30.51	AV	V	32.99	5.05	42.88	25.67	54.00	28.33
7206	42.48	PK	V	35.75	6.43	43.54	41.12	74.00	32.88
7206	32.64	AV	V	35.75	6.43	43.54	31.28	54.00	22.72
Frequency: 2441 MHz									
2441	68.12	PK	H	29.08	3.58	0.00	100.78	N/A	N/A
2441	53.21	AV	H	29.08	3.58	0.00	85.87	N/A	N/A
2700	60.12	PK	V	29.48	3.76	42.14	51.22	74.00	22.78
2700	34.05	AV	V	29.48	3.76	42.14	25.15	54.00	28.85
2850	61.85	PK	V	29.84	3.87	42.17	53.39	74.00	20.61
2850	42.04	AV	V	29.84	3.87	42.17	33.58	54.00	20.42
4882	41.52	PK	V	33.19	5.09	42.93	36.87	74.00	37.13
4882	30.89	AV	V	33.19	5.09	42.93	26.24	54.00	27.76
7323	41.57	PK	V	36.01	6.49	43.56	40.51	74.00	33.49
7323	31.22	AV	V	36.01	6.49	43.56	30.16	54.00	23.84

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: 2480 MHz									
2480	68.43	PK	H	29.03	3.61	0.00	101.07	N/A	N/A
2480	52.91	AV	H	29.03	3.61	0.00	85.55	N/A	N/A
2483.5	26.52	PK	H	29.02	3.61	0.00	59.15	74.00	14.85
2483.5	13.32	AV	H	29.02	3.61	0.00	45.95	54.00	8.05
2700	60.03	PK	V	29.48	3.76	42.14	51.13	74.00	22.87
2700	34.21	AV	V	29.48	3.76	42.14	25.31	54.00	28.69
2850	62.33	PK	V	29.84	3.87	42.17	53.87	74.00	20.13
2850	41.85	AV	V	29.84	3.87	42.17	33.39	54.00	20.61
4960	41.57	PK	V	33.40	5.14	42.98	37.13	74.00	36.87
4960	30.29	AV	V	33.40	5.14	42.98	25.85	54.00	28.15
7440	42.17	PK	V	36.27	6.55	43.59	41.40	74.00	32.60
7440	32.74	AV	V	36.27	6.55	43.59	31.97	54.00	22.03

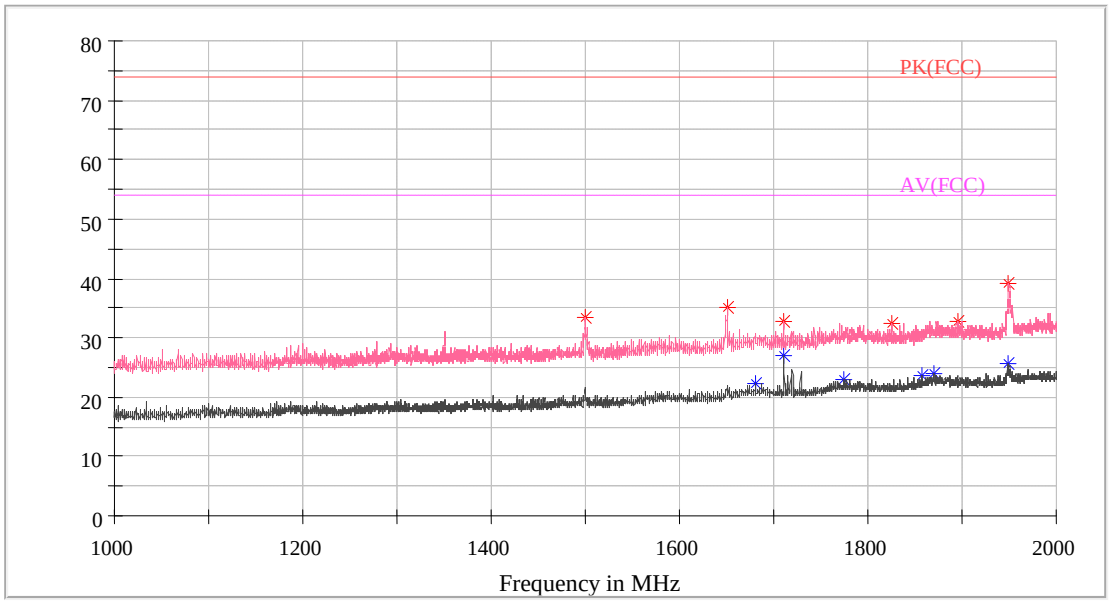
Note:
Corrected Amplitude = Corrected Factor + Reading
Corrected Factor=Antenna factor (RX) + Cable Loss – Amplifier Factor
Margin = Limit- Corr. Amplitude

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

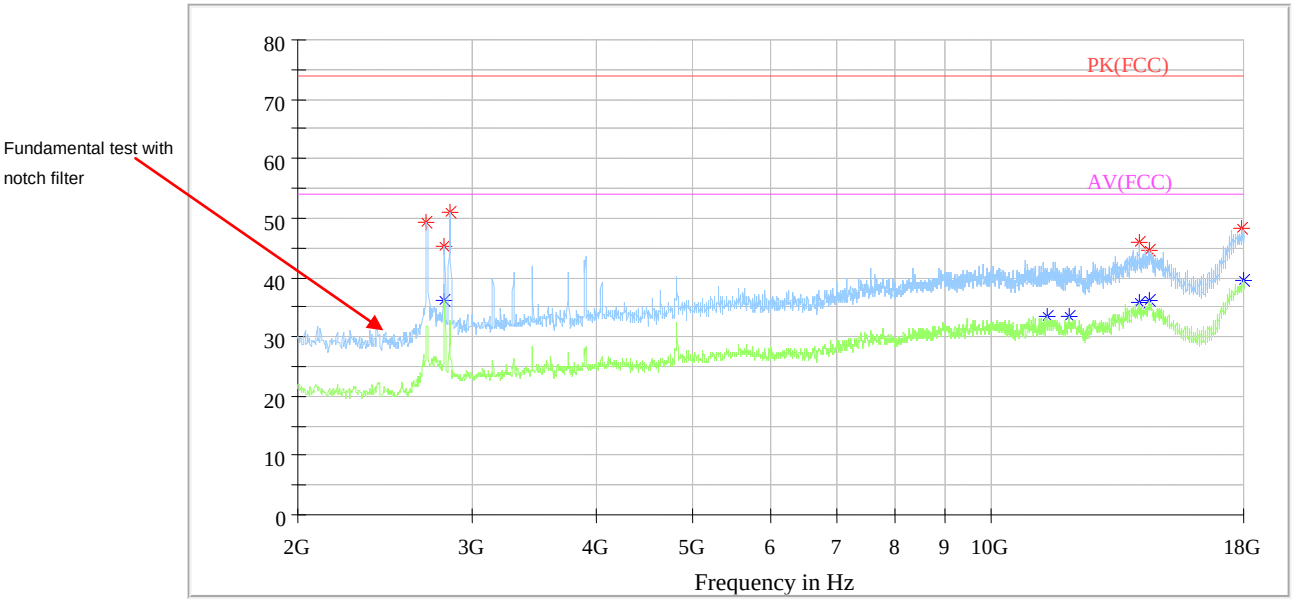
EDR Mode (8DPSK): Low Channel_Horizontal_1GHz-2GHz



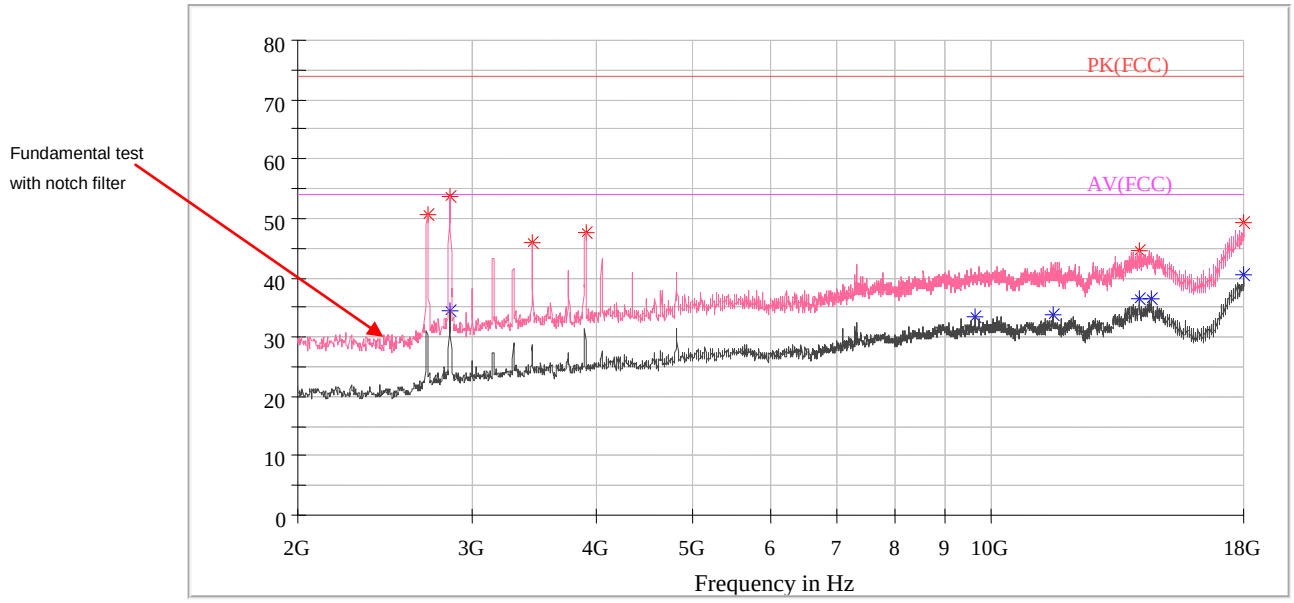
EDR Mode (8DPSK): Low Channel_Vertical_1GHz-2GHz



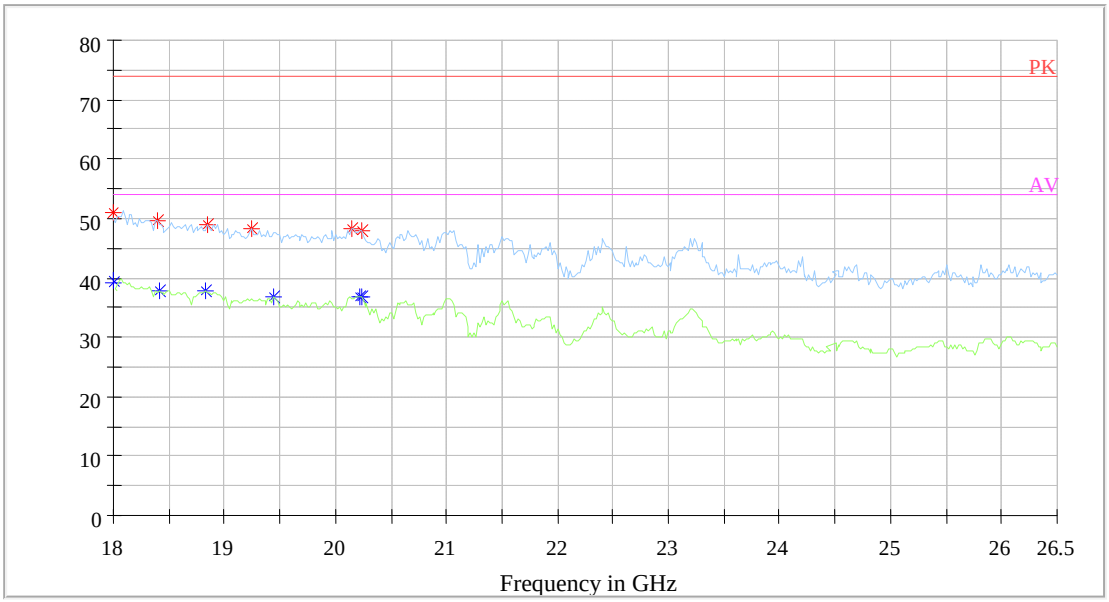
EDR Mode (8DPSK): Low Channel_Horizontal_2GHz-18GHz



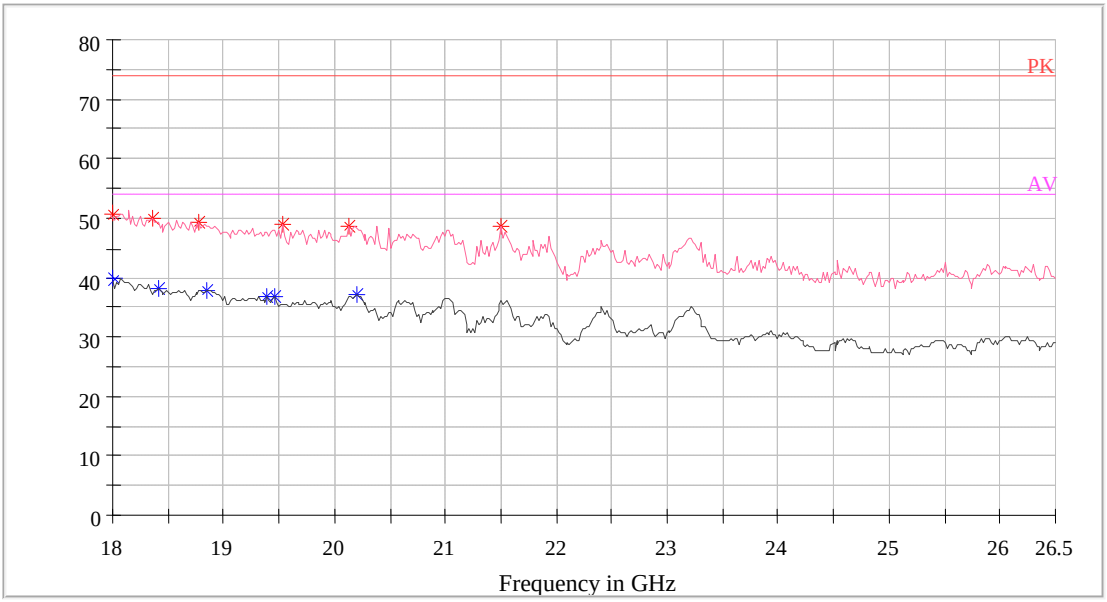
EDR Mode (8DPSK): Low Channel_Vertical_2GHz-18GHz



EDR Mode (8DPSK): Low Channel_Horizontal_18GHz-26.5GHz



BDR Mode (GFSK): Low Channel_Vertical_18GHz-26.5GHz



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:	22 °C
Relative Humidity:	51 %
ATM Pressure:	95.5 kPa

The testing was performed by Eric Xiao on 2019-11-18.

Test Result: Compliance.

Please refer to following tables and plots.

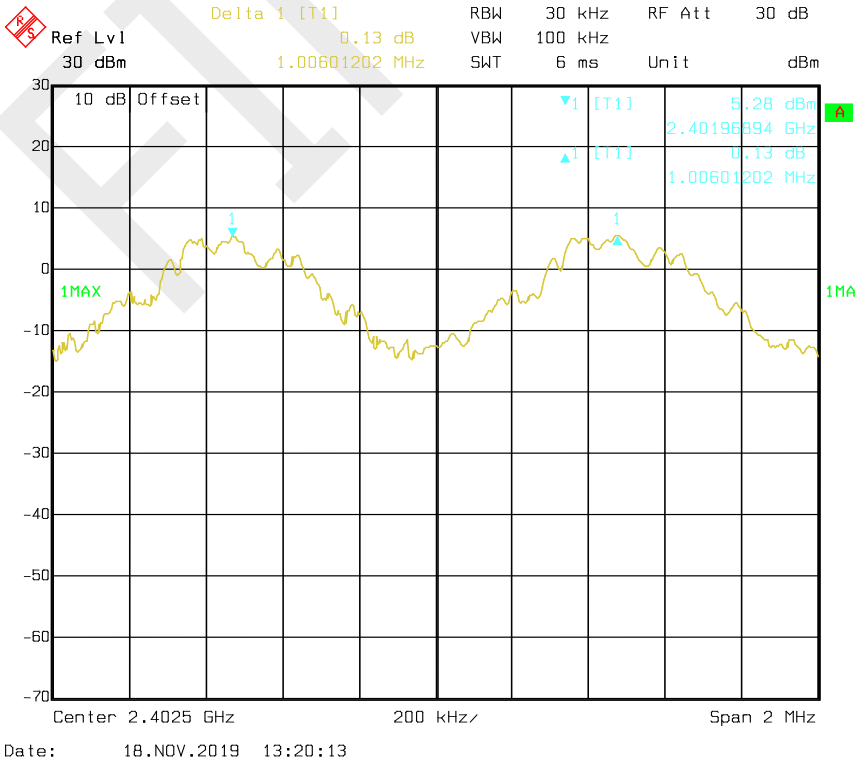
Test Mode: Transmitting

Mode	Channel	Frequency	Channel Separation	Limit
		MHz	MHz	MHz
BDR (GFSK)	Low	2402	1.01	0.69
	Adjacent	2403		
	Middle	2440	1.00	0.70
	Adjacent	2441		
	High	2480	1.00	0.66
	Adjacent	2479		
EDR (π/4-DQPSK)	Low	2402	1.00	0.90
	Adjacent	2403		
	Middle	2440	1.00	0.90
	Adjacent	2441		
	High	2480	1.00	0.90
	Adjacent	2479		
EDR (8DPSK)	Low	2402	0.99	0.88
	Adjacent	2403		
	Middle	2440	1.01	0.87
	Adjacent	2441		
	High	2480	1.00	0.88
	Adjacent	2479		

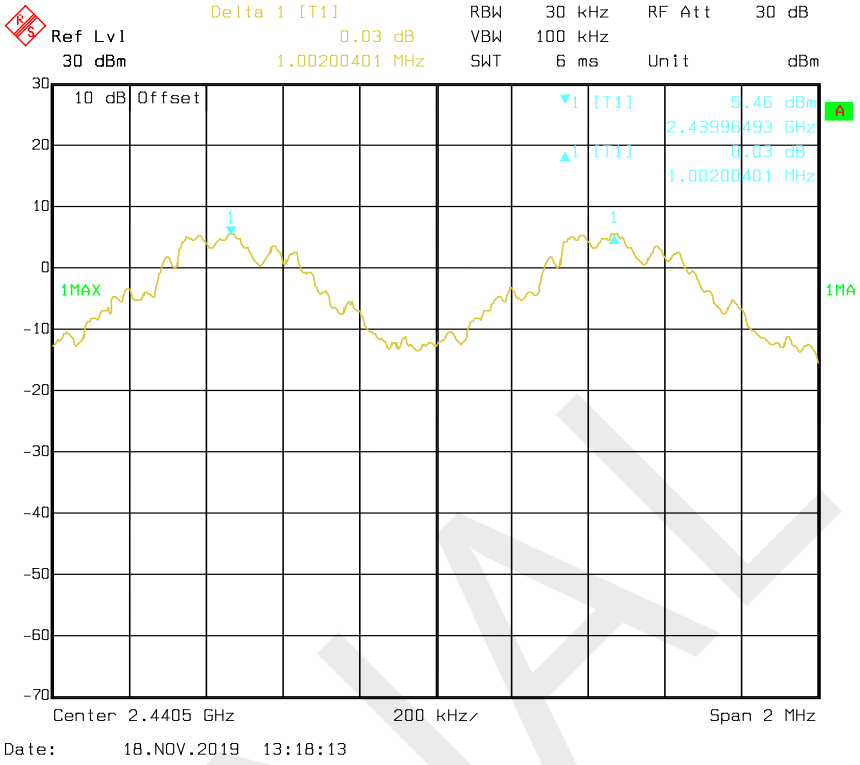
Note: Limit= (2/3) × 20dB bandwidth

BDR Mode (GFSK):

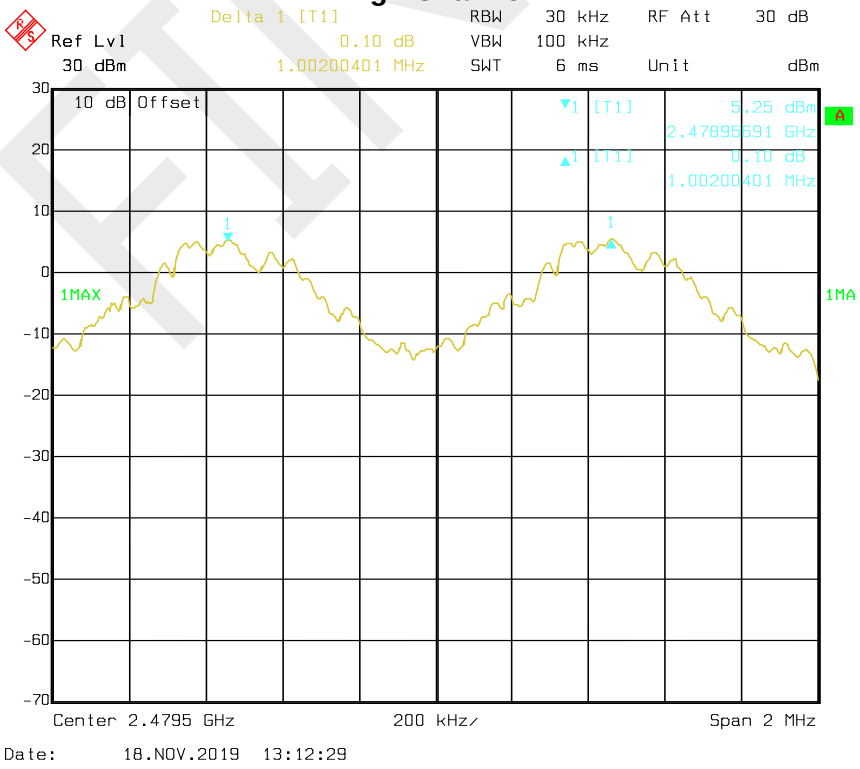
Low Channel



Middle Channel

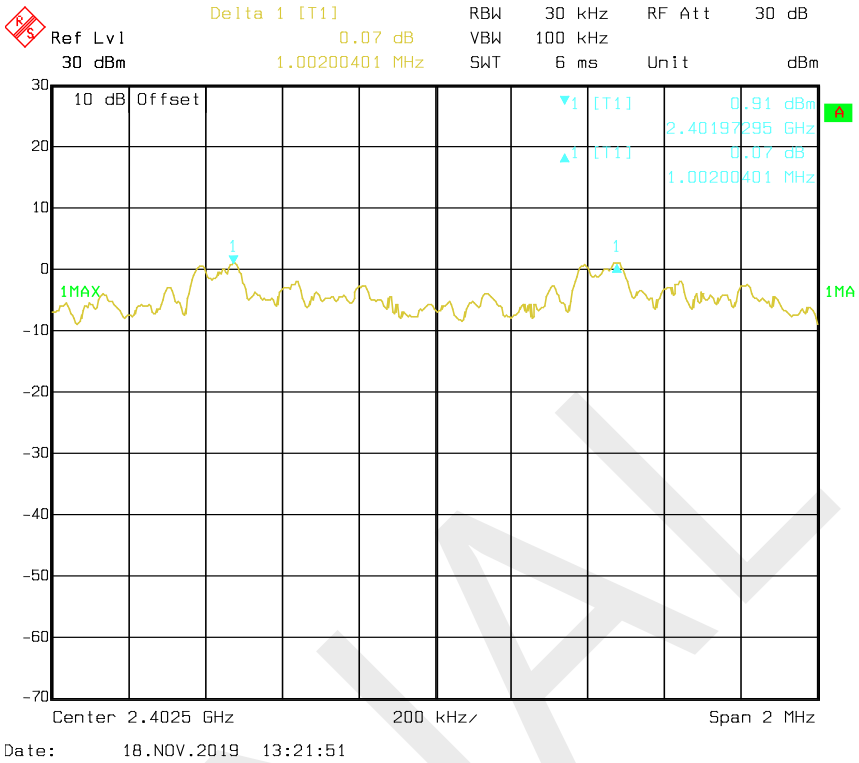


High Channel

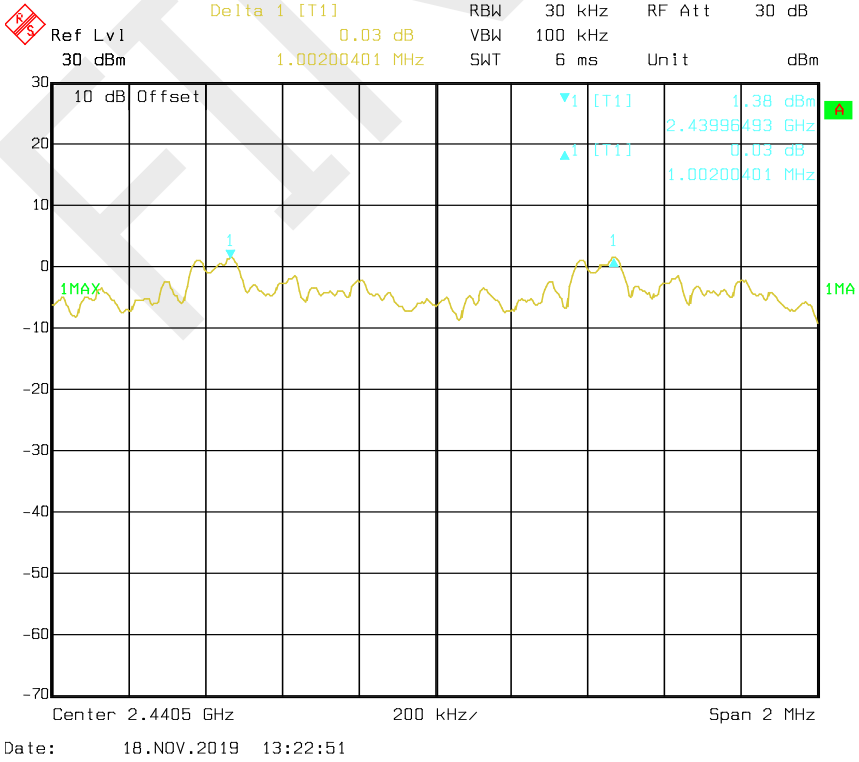


EDR Mode (π/4-DQPSK):

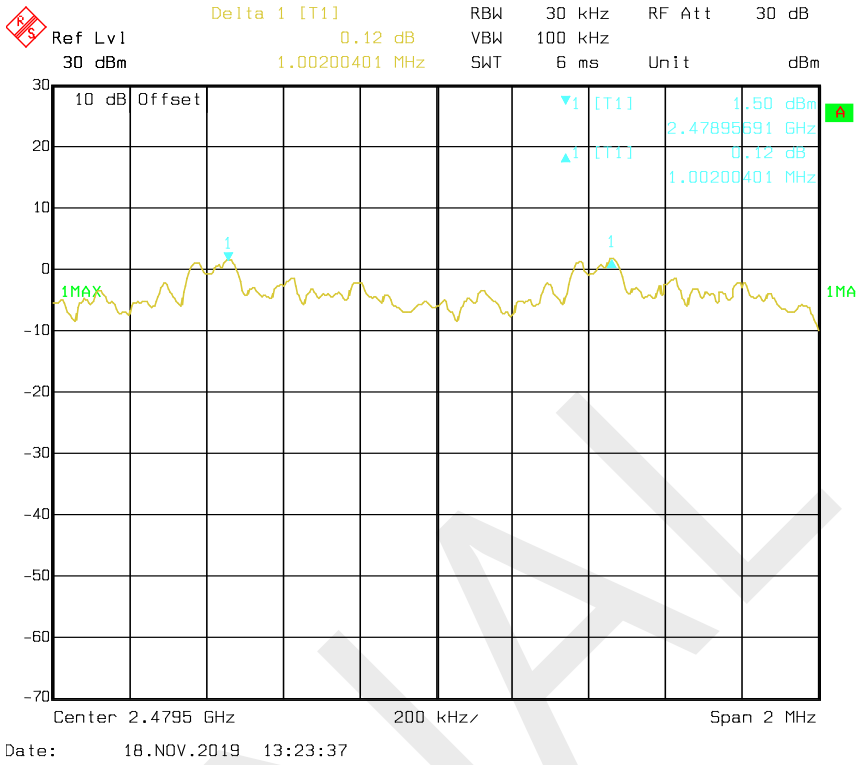
Low Channel



Middle Channel

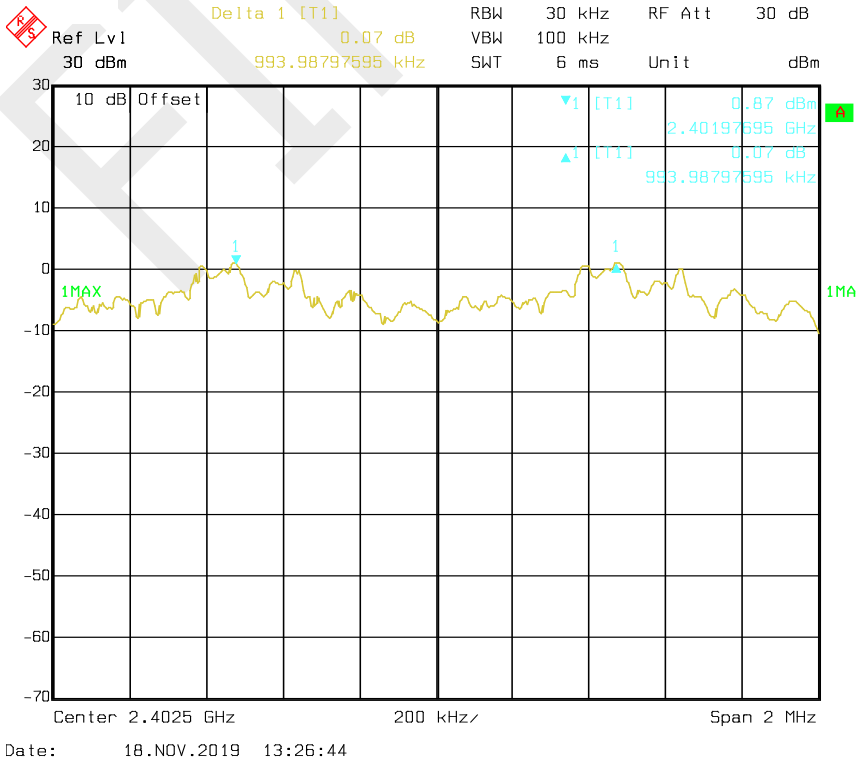


High Channel

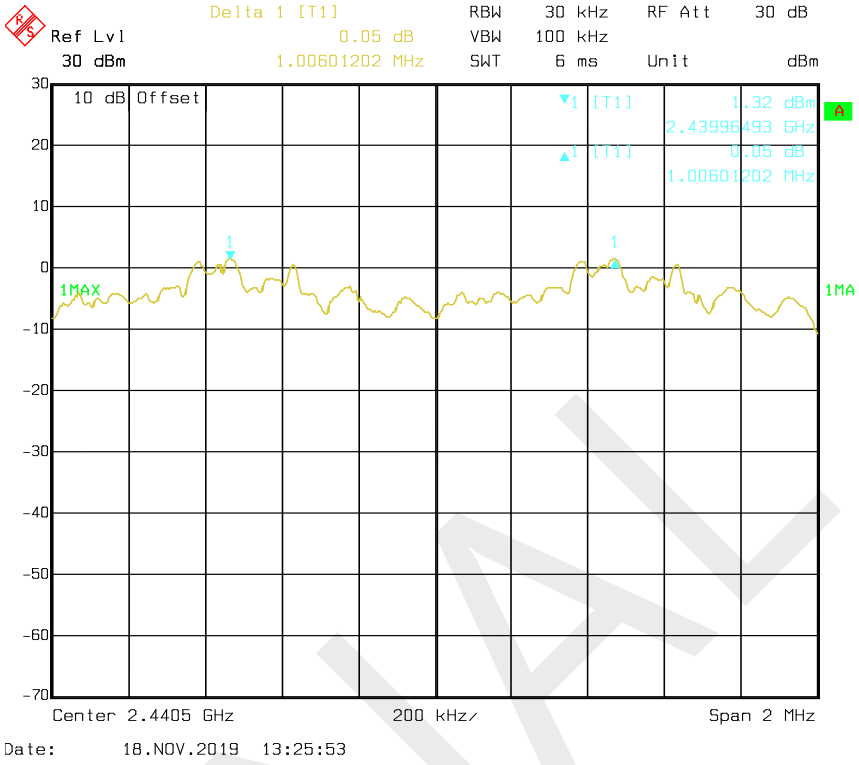


EDR Mode (8DPSK):

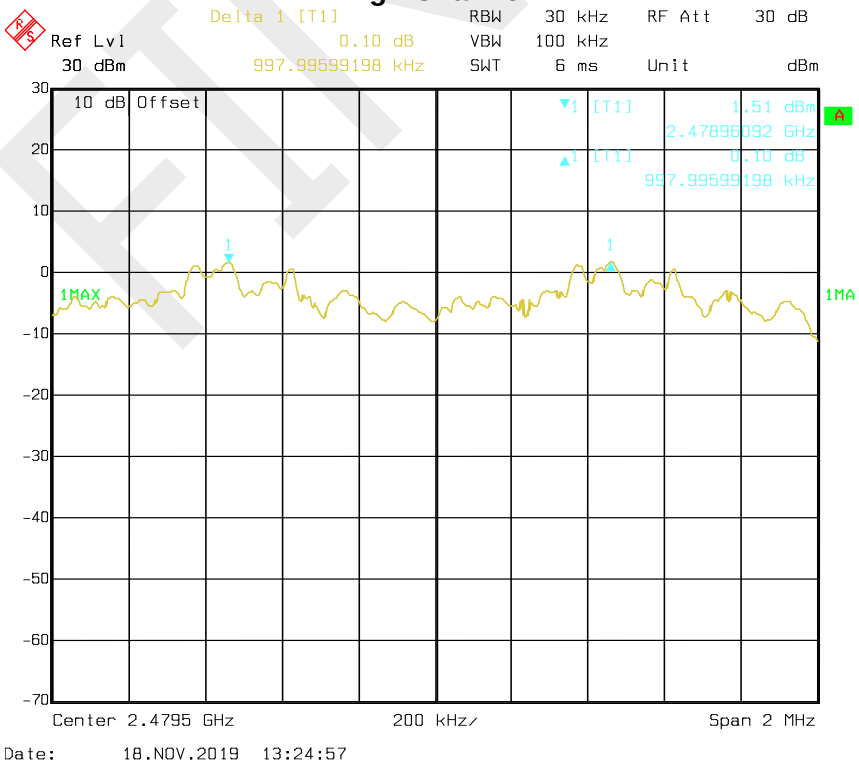
Low Channel



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:	22 °C
Relative Humidity:	51 %
ATM Pressure:	95.5 kPa

The testing was performed by Eric Xiao on 2019-11-18.

Test Result: Compliance.

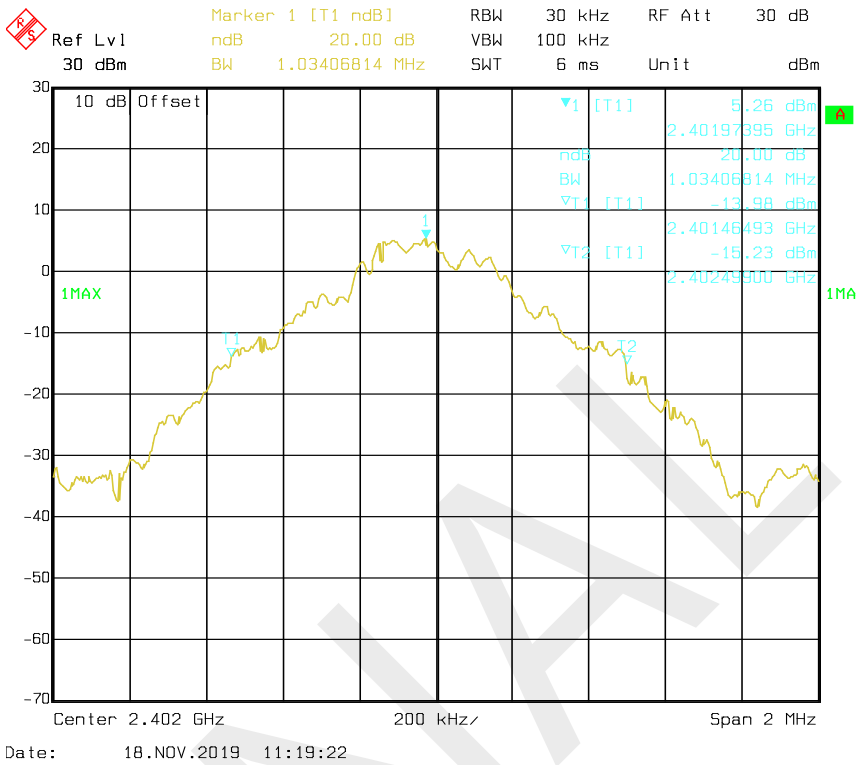
Please refer to following tables and plots

Test Mode: Transmitting

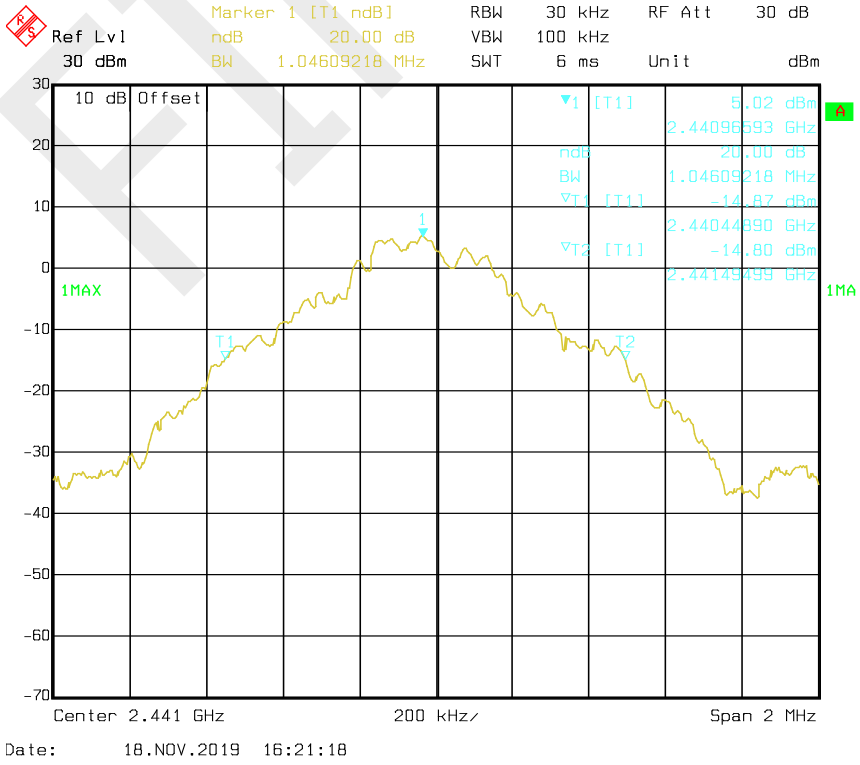
Mode	Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
BDR Mode (GFSK)	Low	2402	1.03
	Middle	2441	1.05
	High	2480	0.99
EDR Mode (π/4-DQPSK)	Low	2402	1.35
	Middle	2441	1.35
	High	2480	1.35
EDR Mode (8DPSK)	Low	2402	1.32
	Middle	2441	1.31
	High	2480	1.31

BDR Mode (GFSK):

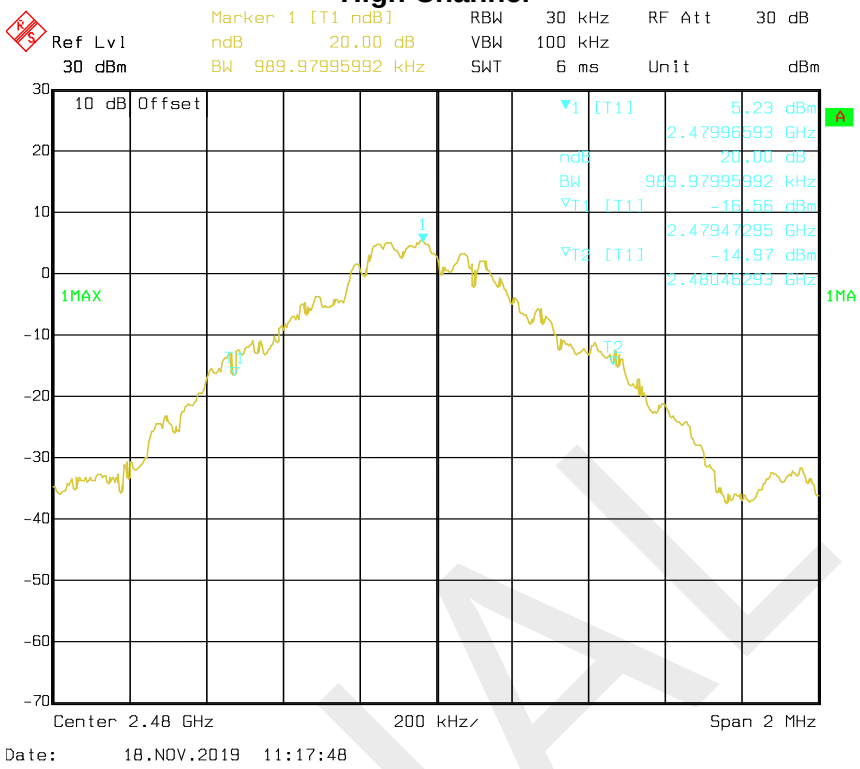
Low Channel



Middle Channel

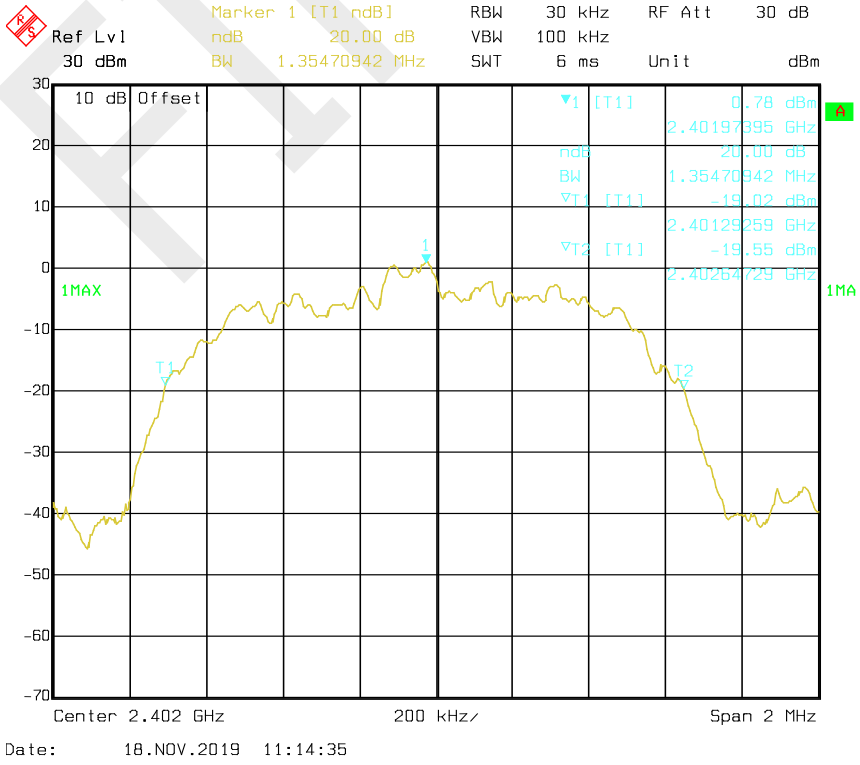


High Channel

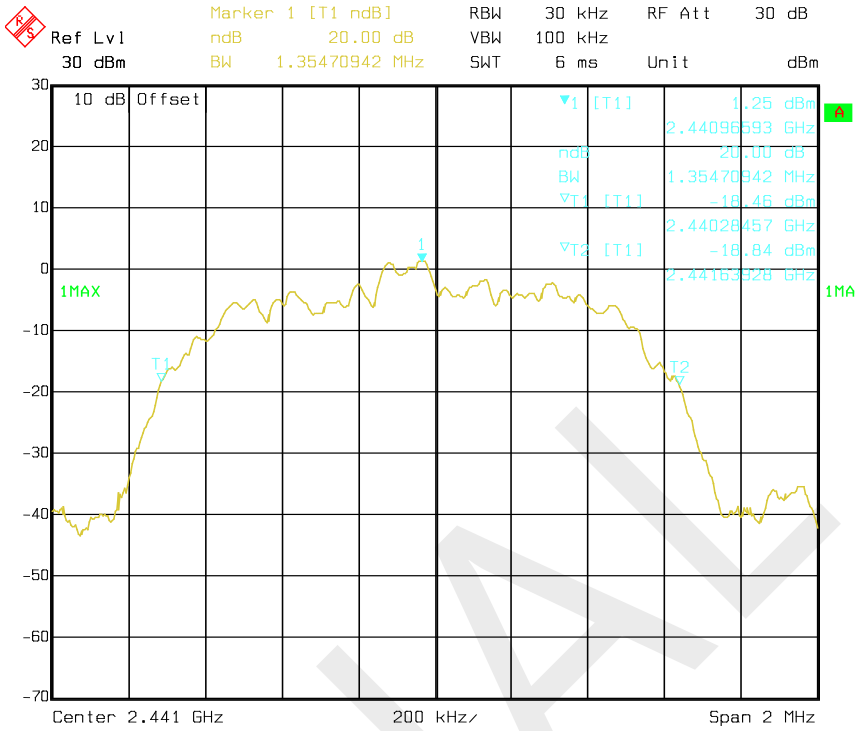


EDR Mode (π/4-DQPSK):

Low Channel

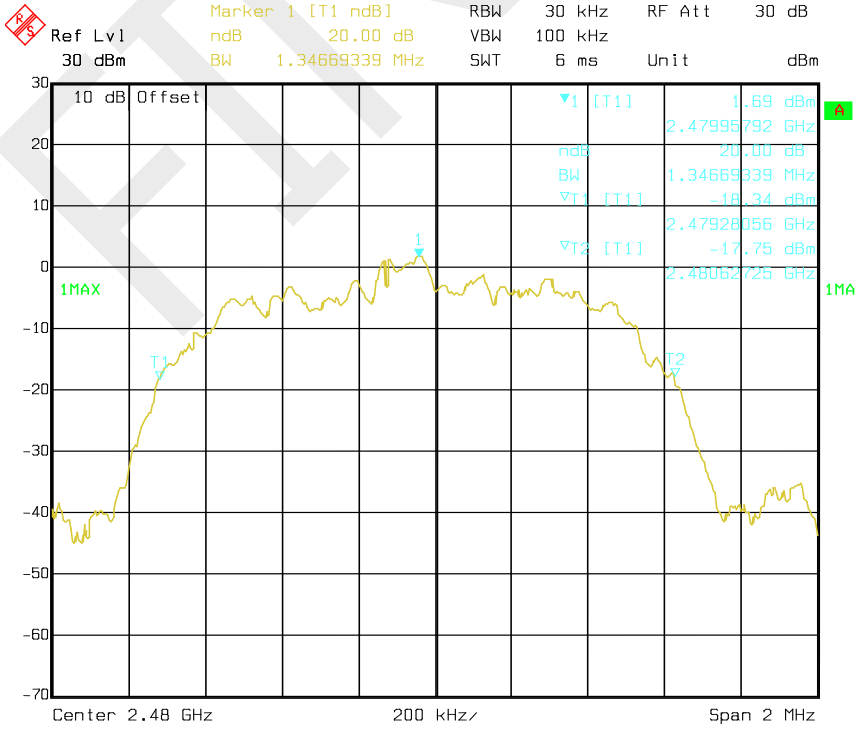


Middle Channel



Date: 18.NOV.2019 16:19:41

High Channel



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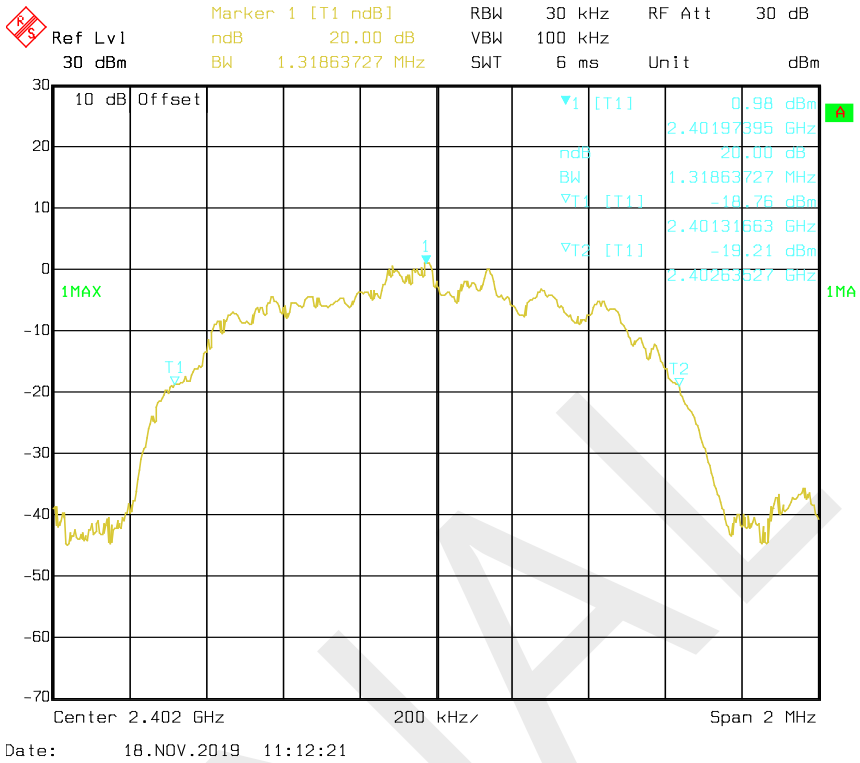
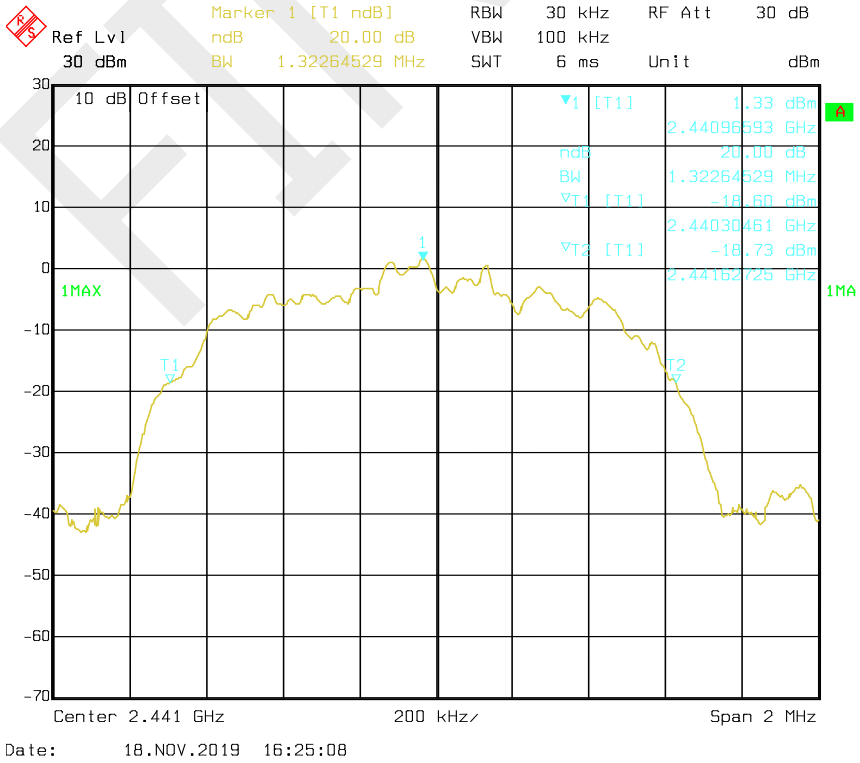
EDR Mode (8DPSK):

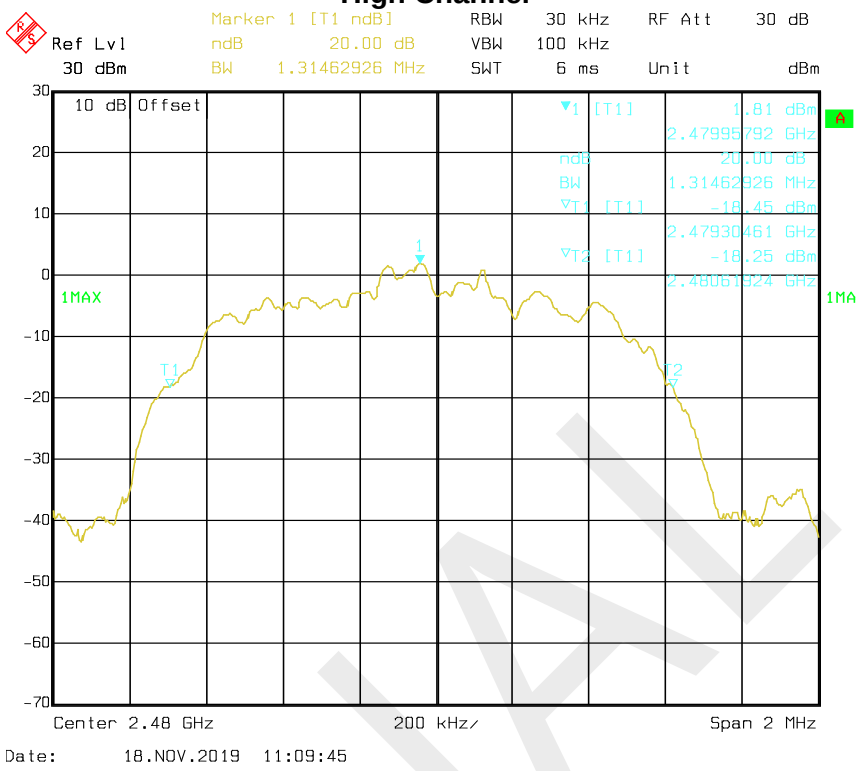
Low Channel



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:	22 °C
Relative Humidity:	51 %
ATM Pressure:	95.5 kPa

The testing was performed by Eric Xiao on 2019-11-18.

Test Result: Compliance.

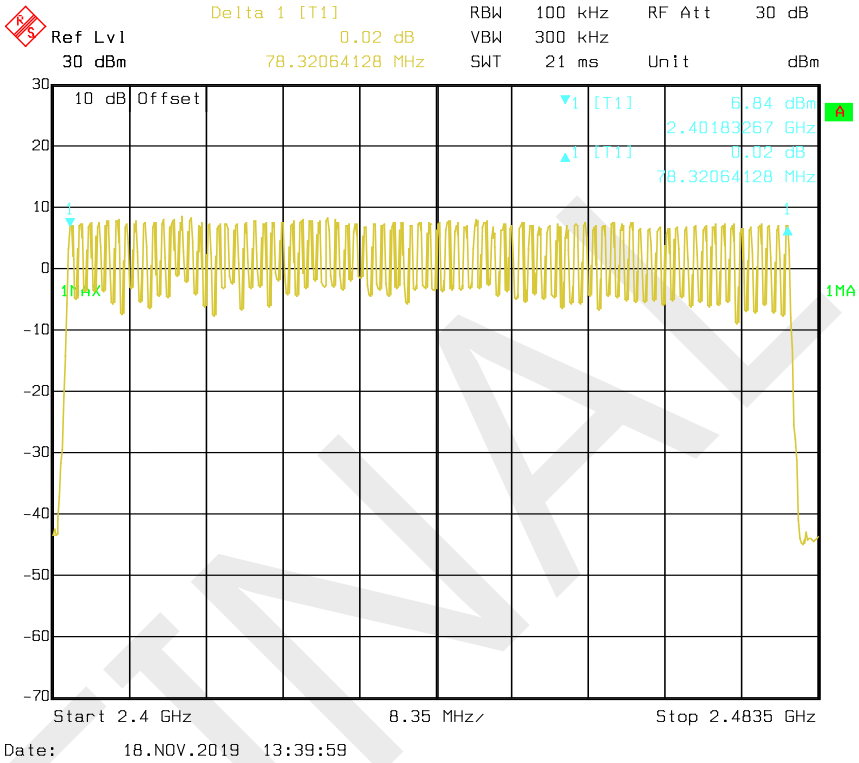
Please refer to following tables and plots.

Test Mode: Transmitting

BDR Mode (GFSK):

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

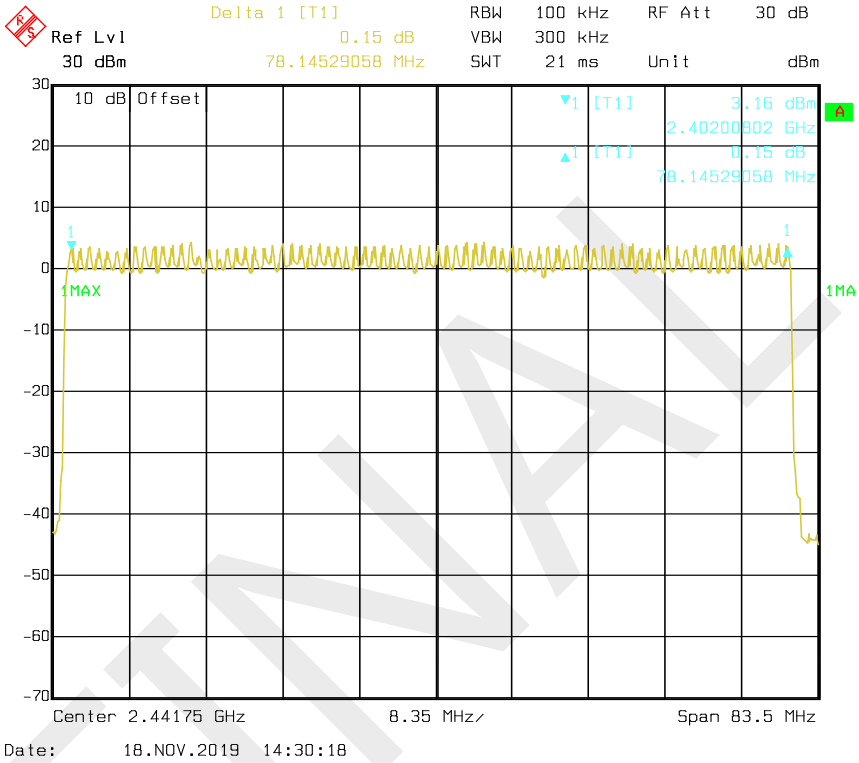
Number of Hopping Channels



EDR Mode (π/4-DQPSK):

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

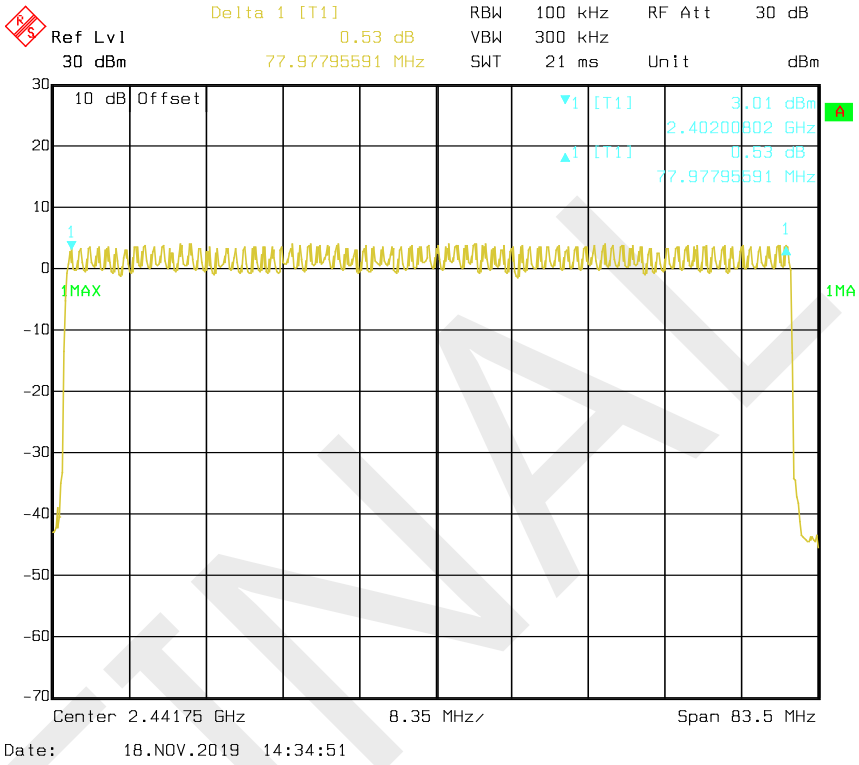
Number of Hopping Channels



EDR Mode (8DPSK):

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:	22 °C
Relative Humidity:	51 %
ATM Pressure:	95.5 kPa

The testing was performed by Eric Xiao on 2019-11-18.

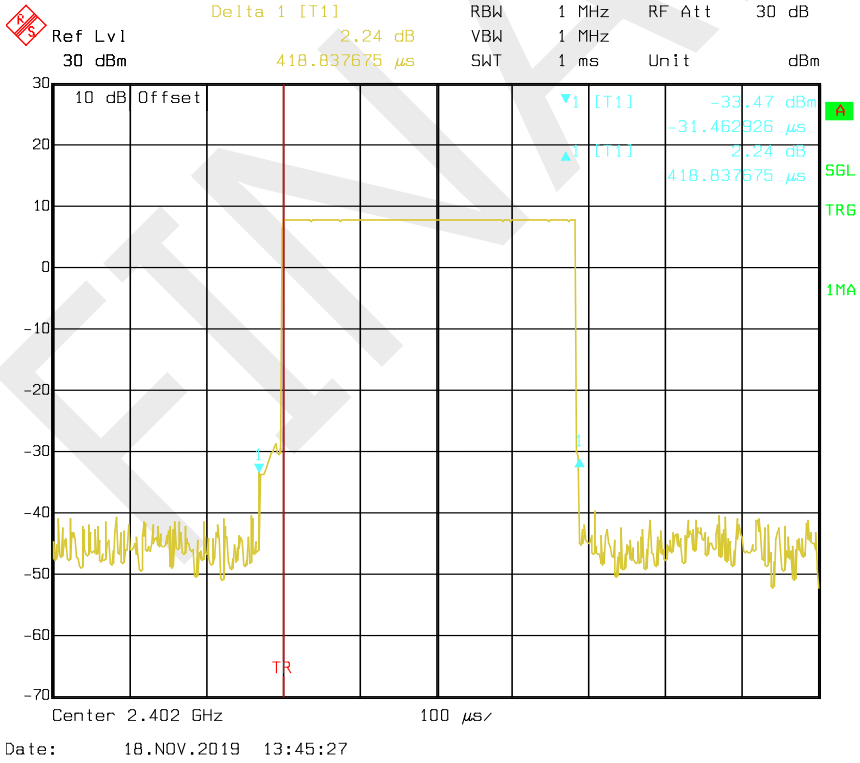
Test Result: Compliance. Please refer to following tables and plots

Test Mode: Transmitting

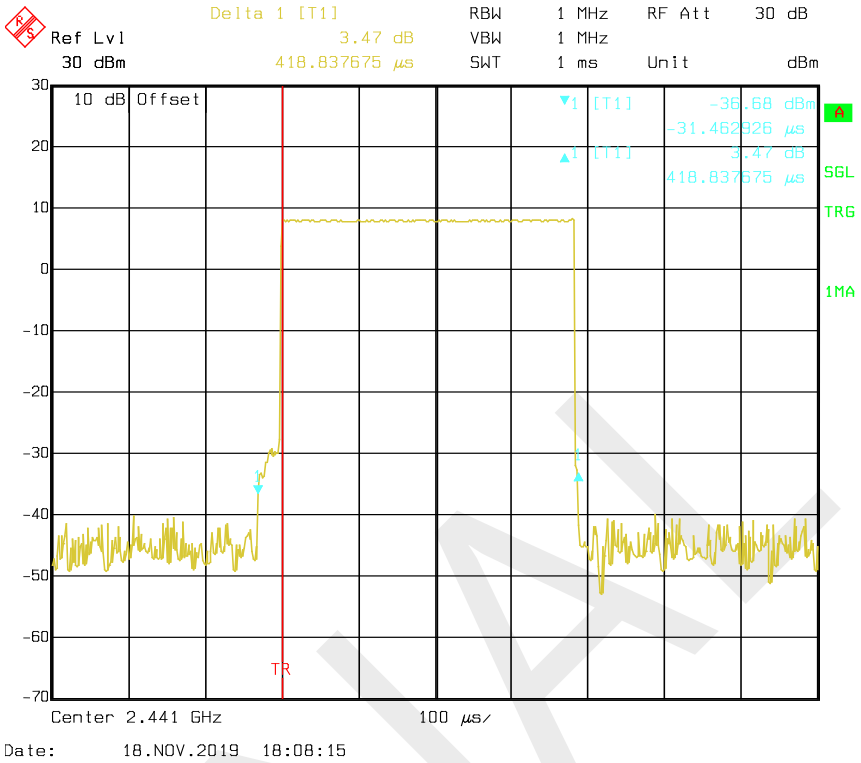
BDR Mode (GFSK):

Mode	Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
DH1	Low	0.42	0.13	0.4	Compliance
	Middle	0.42	0.13	0.4	Compliance
	High	0.42	0.13	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/2/79) ×31.6 s				
DH3	Low	1.72	0.27	0.4	Compliance
	Middle	1.68	0.27	0.4	Compliance
	High	1.66	0.27	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/4/79) ×31.6 s				
DH5	Low	2.94	0.31	0.4	Compliance
	Middle	2.94	0.31	0.4	Compliance
	High	2.94	0.31	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/6/79) ×31.6 s				

DH1: Low Channel

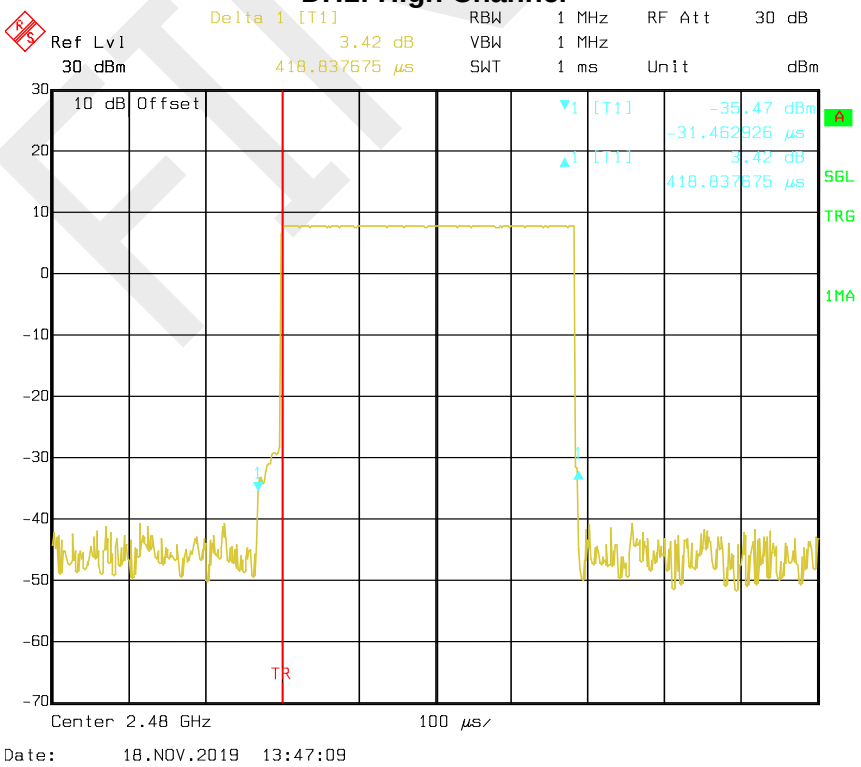


DH1: Middle Channel



Date: 18.NOV.2019 18:08:15

DH1: High Channel



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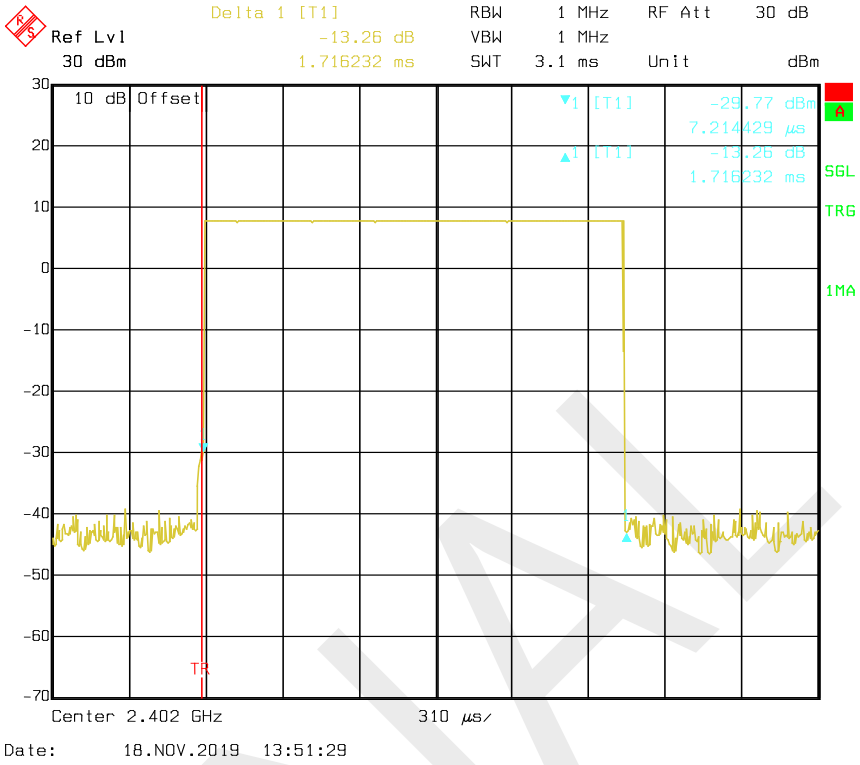
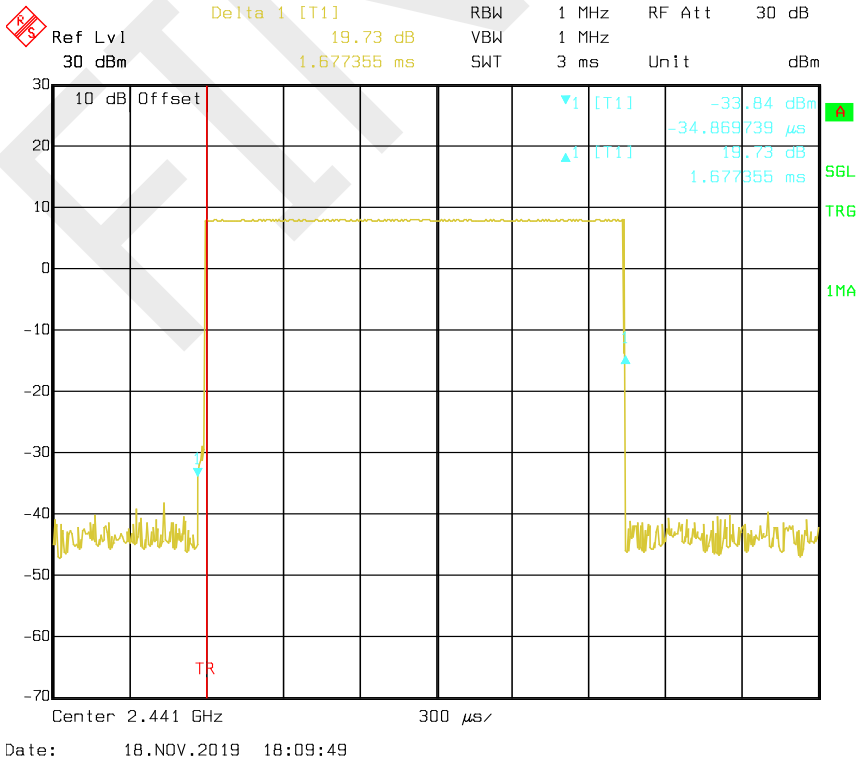
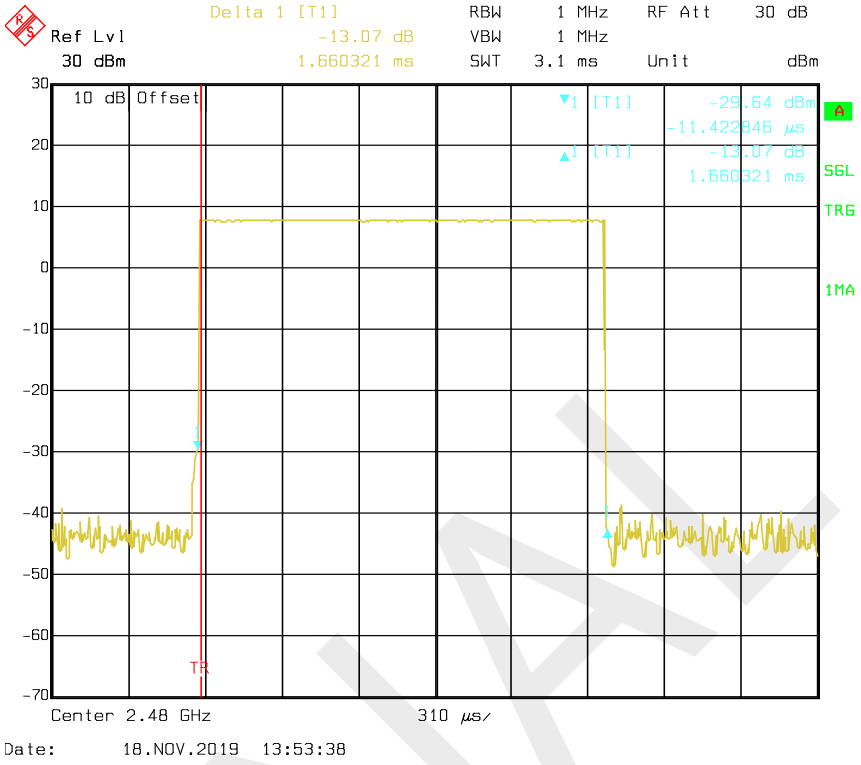
DH3: Low Channel



DH3: Middle Channel



DH3: High Channel



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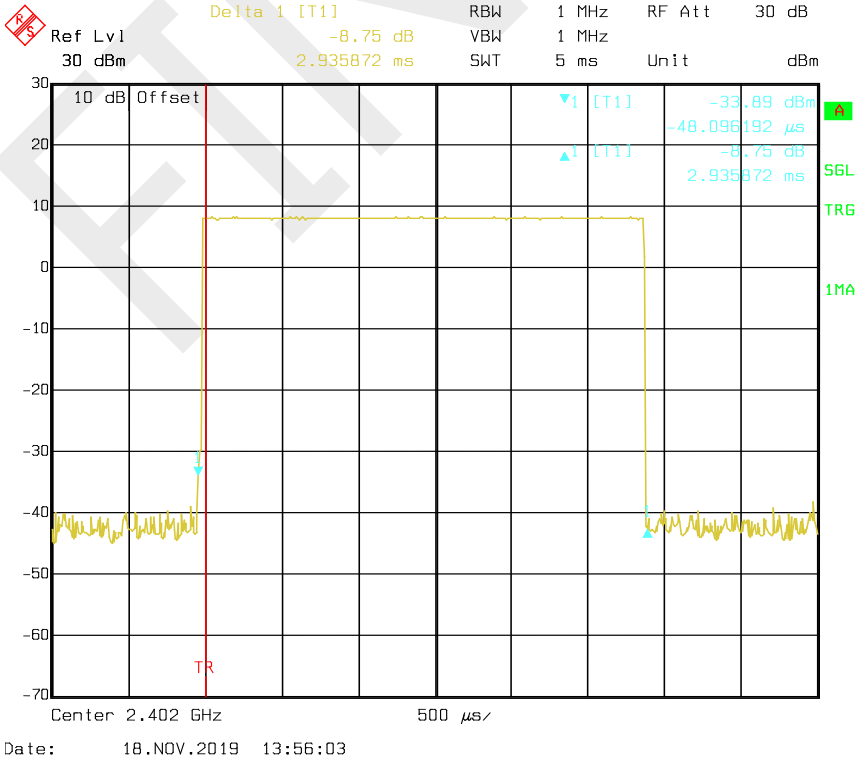
DH5: Low Channel



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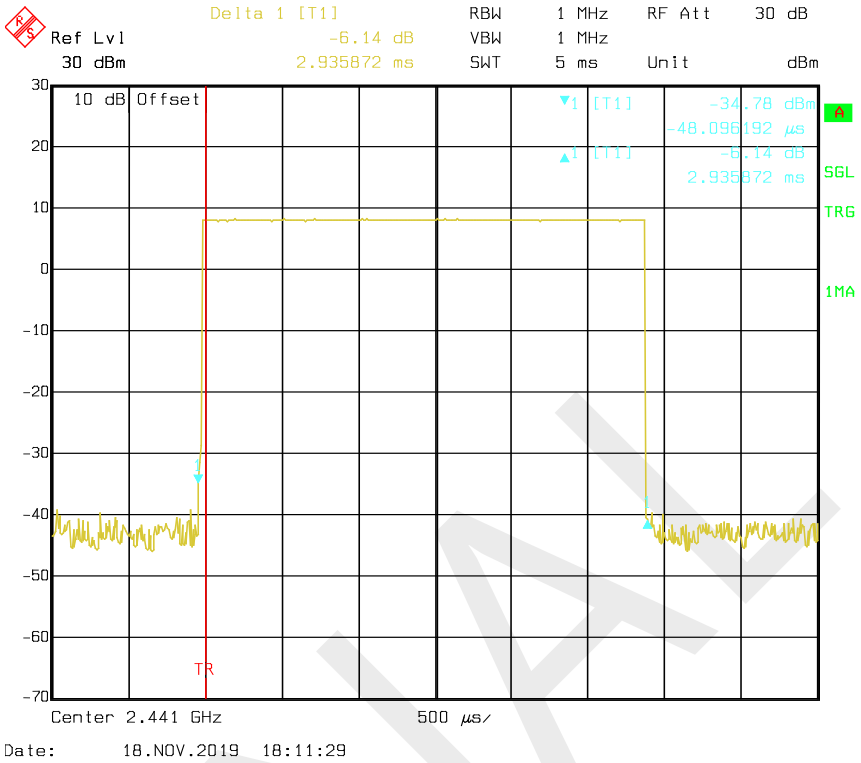
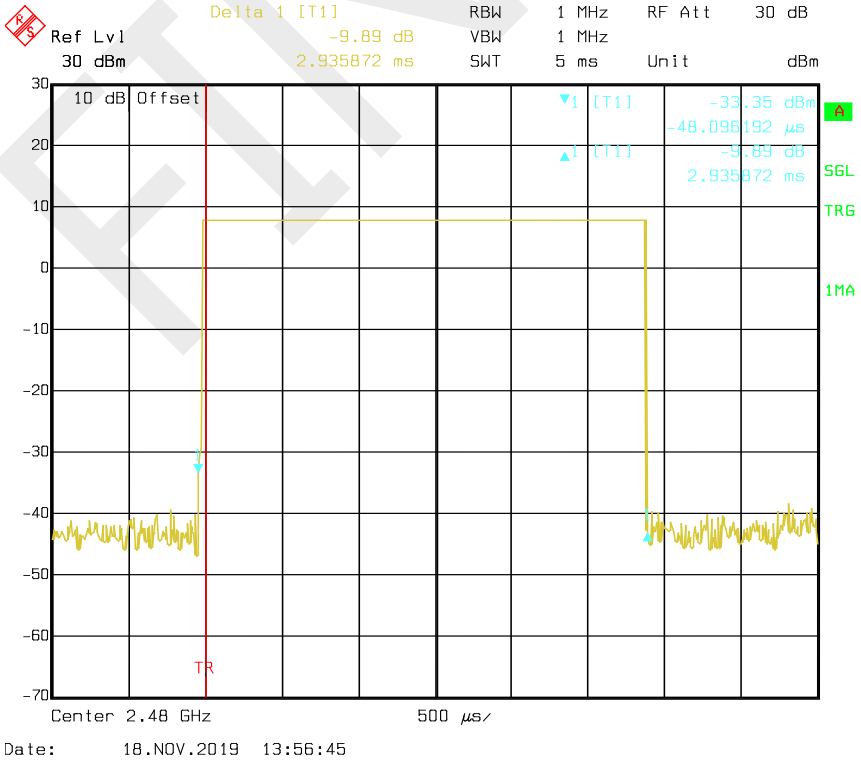
DH5: Middle Channel



Date: 18.NOV.2019 18:11:29

DH5: High Channel

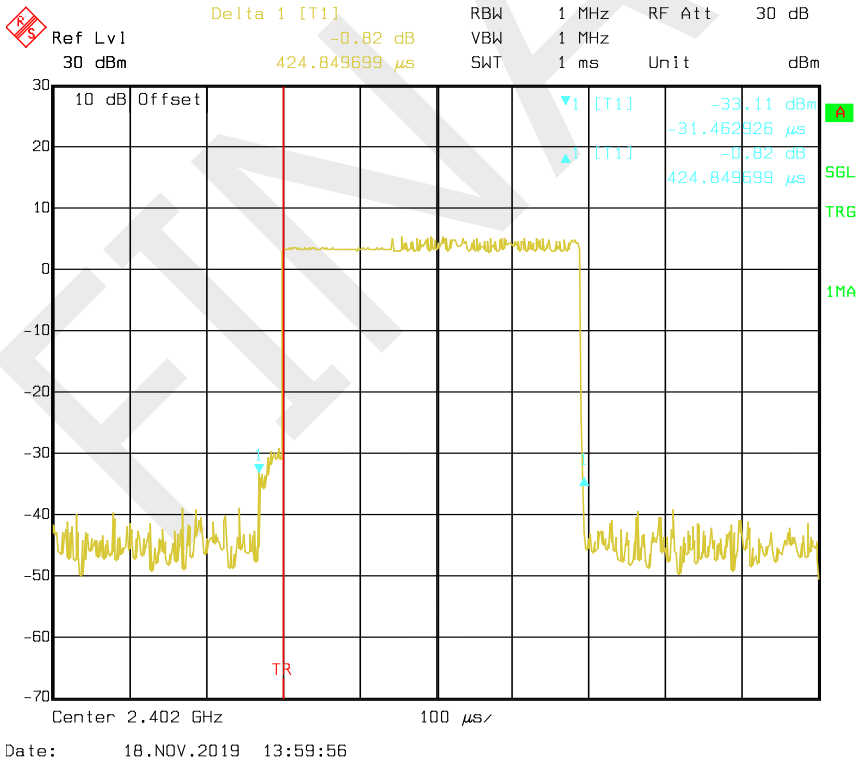


Date: 18.NOV.2019 13:56:45

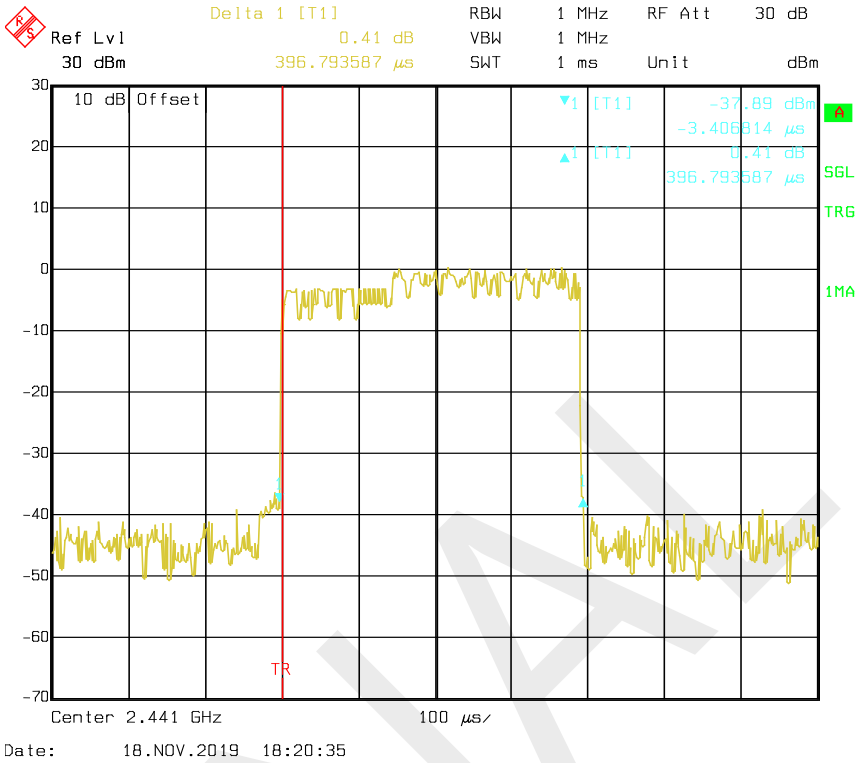
EDR Mode (π/4-DQPSK):

Mode	Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
2DH1	Low	0.42	0.14	0.4	Compliance
	Middle	0.40	0.13	0.4	Compliance
	High	0.42	0.14	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/2/79) ×31.6 s				
2DH3	Low	1.68	0.27	0.4	Compliance
	Middle	1.68	0.27	0.4	Compliance
	High	1.68	0.27	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/4/79) ×31.6 s				
2DH5	Low	2.93	0.31	0.4	Compliance
	Middle	2.94	0.31	0.4	Compliance
	High	2.93	0.31	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/6/79) ×31.6 s				

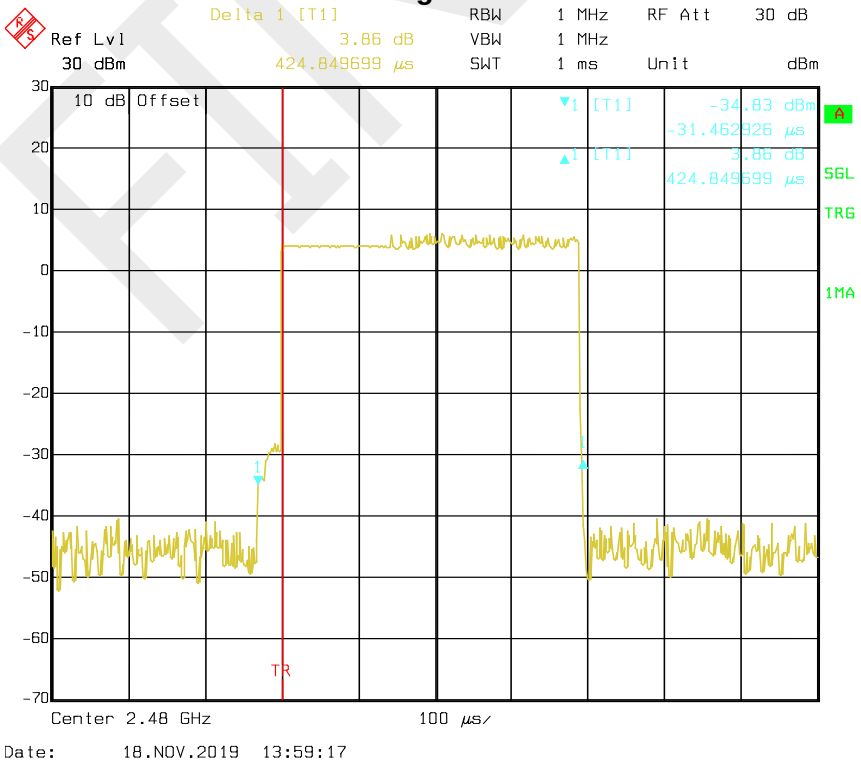
2DH1: Low Channel



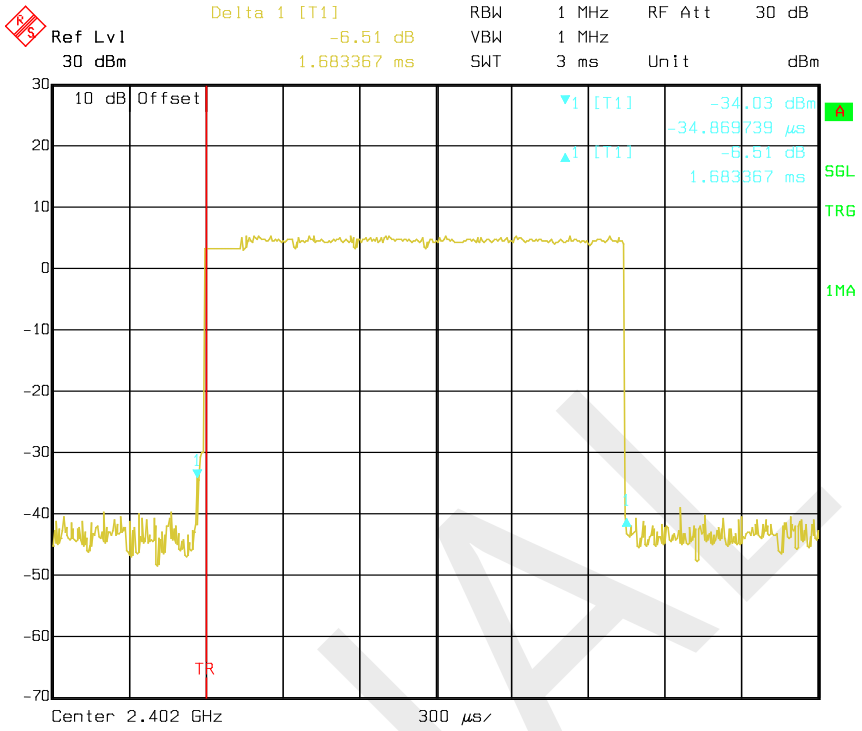
2DH1: Middle Channel



2DH1: High Channel



2DH3: Low Channel



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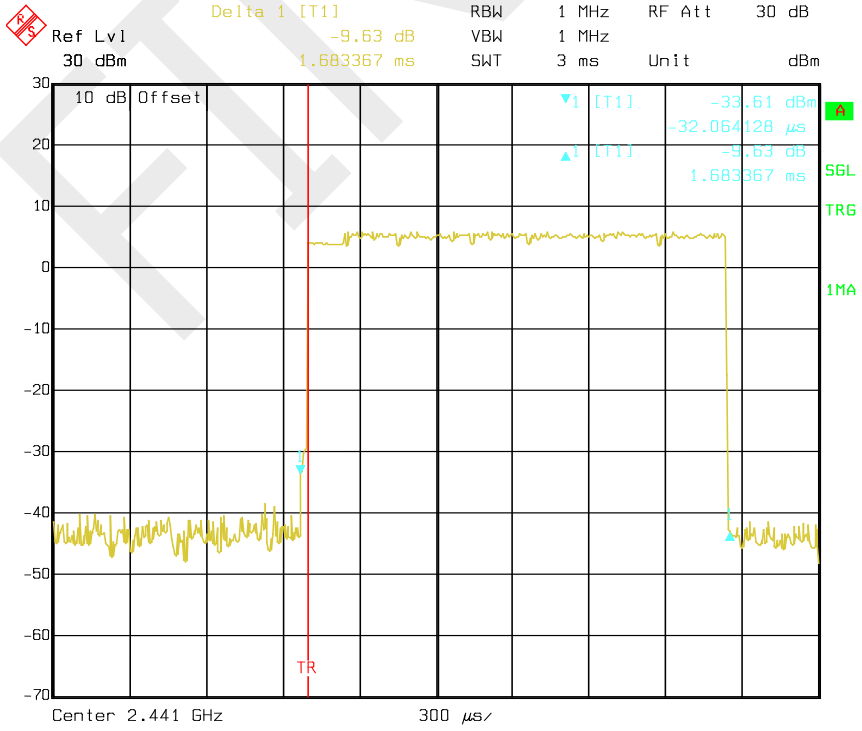
2DH3: Middle Channel



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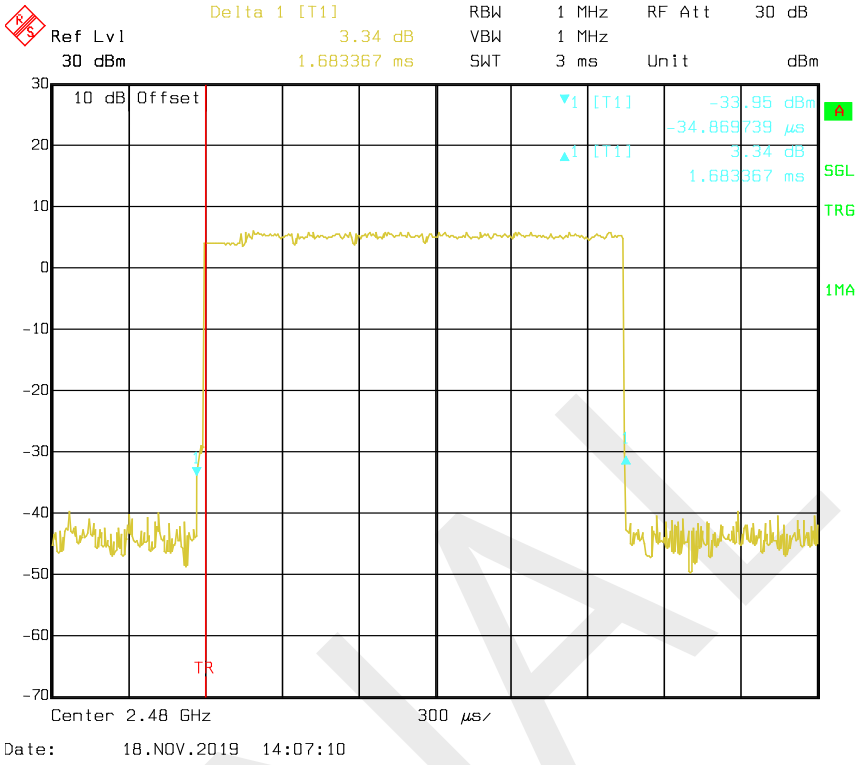
2DH3: High Channel



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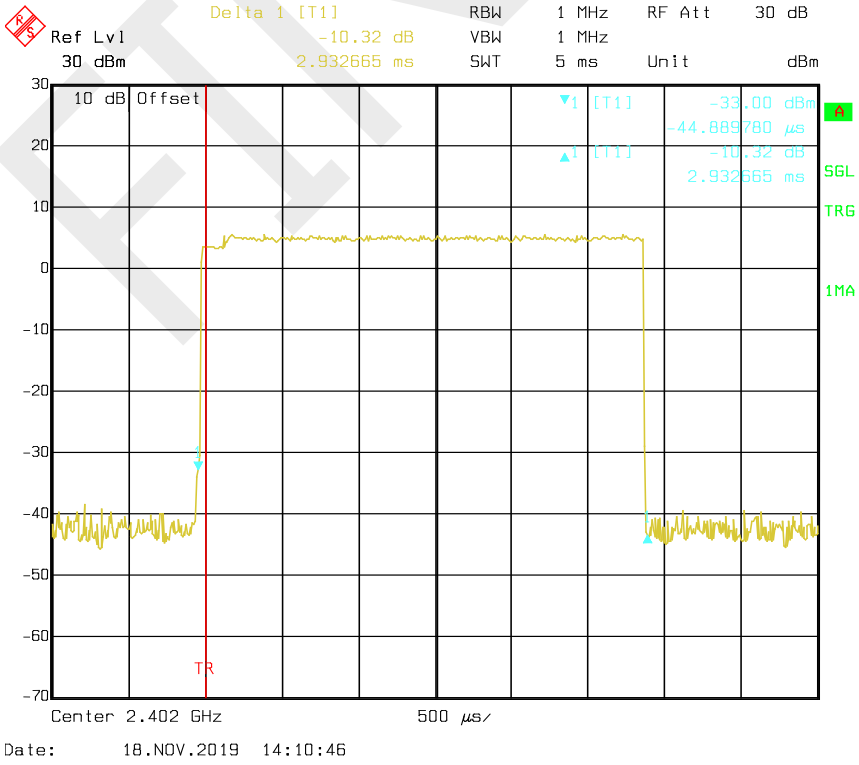
2DH5: Low Channel



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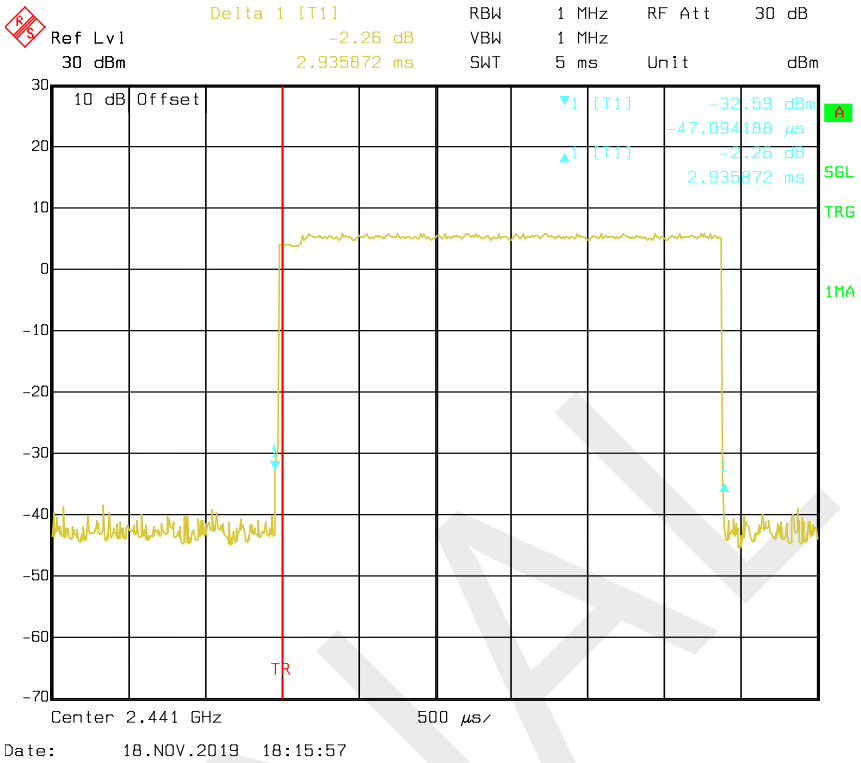
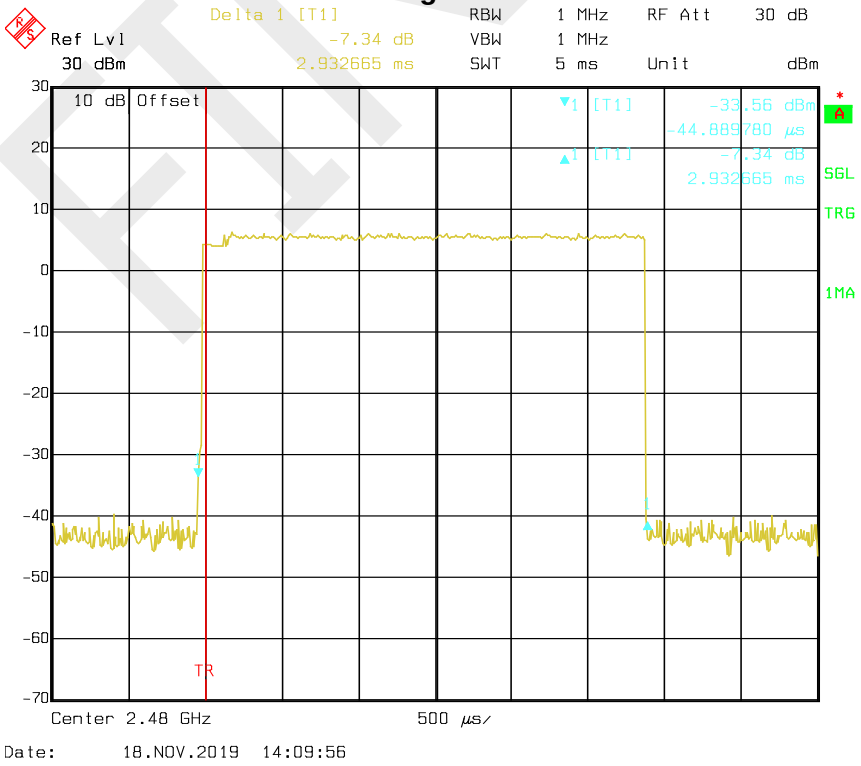
2DH5: Middle Channel



Date: 18.NOV.2019 18:15:57

2DH5: High Channel



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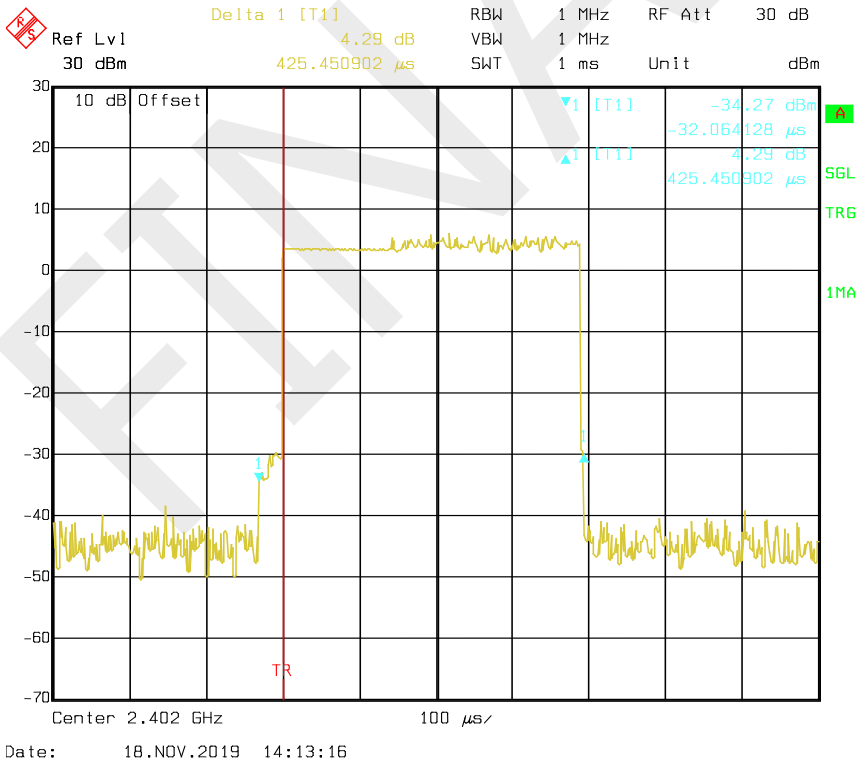
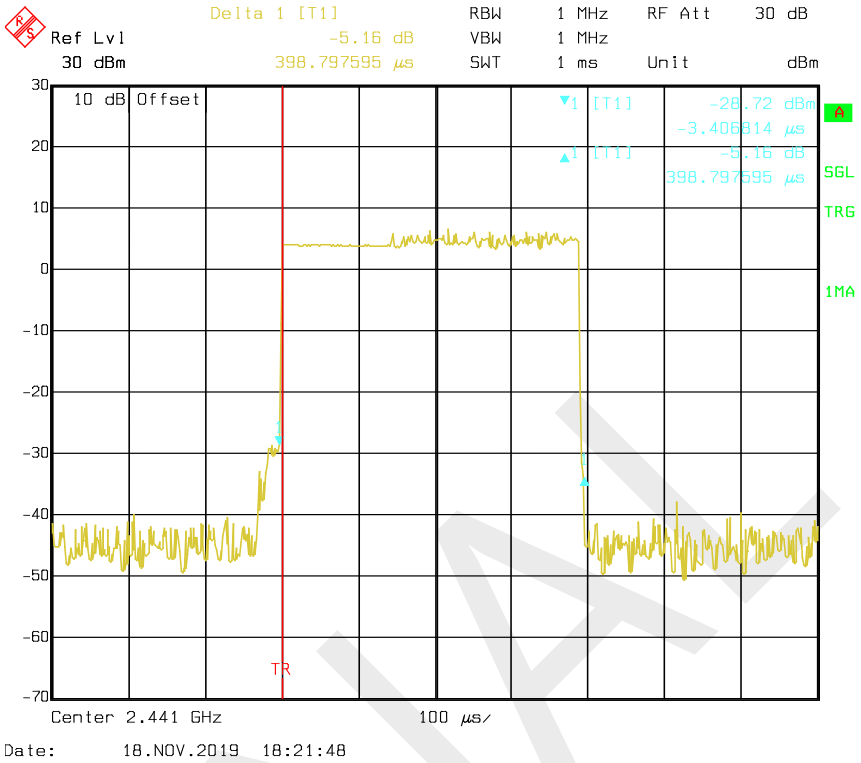
EDR Mode (8DPSK):

Mode	Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
3DH1	Low	0.43	0.14	0.4	Compliance
	Middle	0.40	0.13	0.4	Compliance
	High	0.43	0.14	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/2/79) ×31.6 s				
3DH3	Low	1.68	0.27	0.4	Compliance
	Middle	1.68	0.27	0.4	Compliance
	High	1.68	0.27	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/4/79) ×31.6 s				
3DH5	Low	2.94	0.31	0.4	Compliance
	Middle	2.94	0.31	0.4	Compliance
	High	2.94	0.31	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/6/79) ×31.6 s				

3DH1: Low Channel



3DH1: Middle Channel



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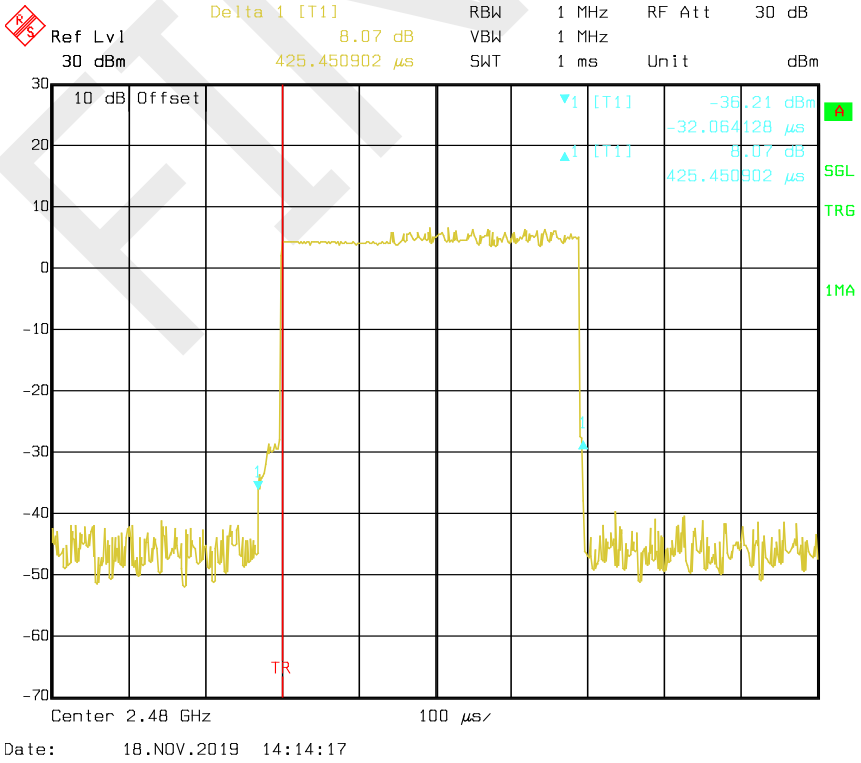
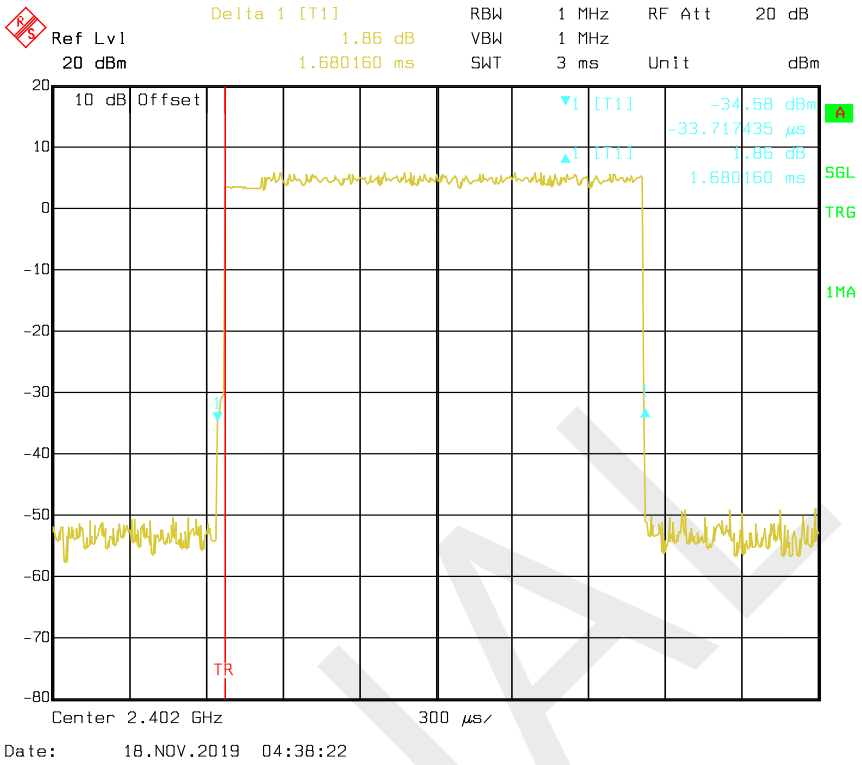
3DH1: High Channel



Date: 18.NOV.2019 14:14:17

3DH3: Low Channel



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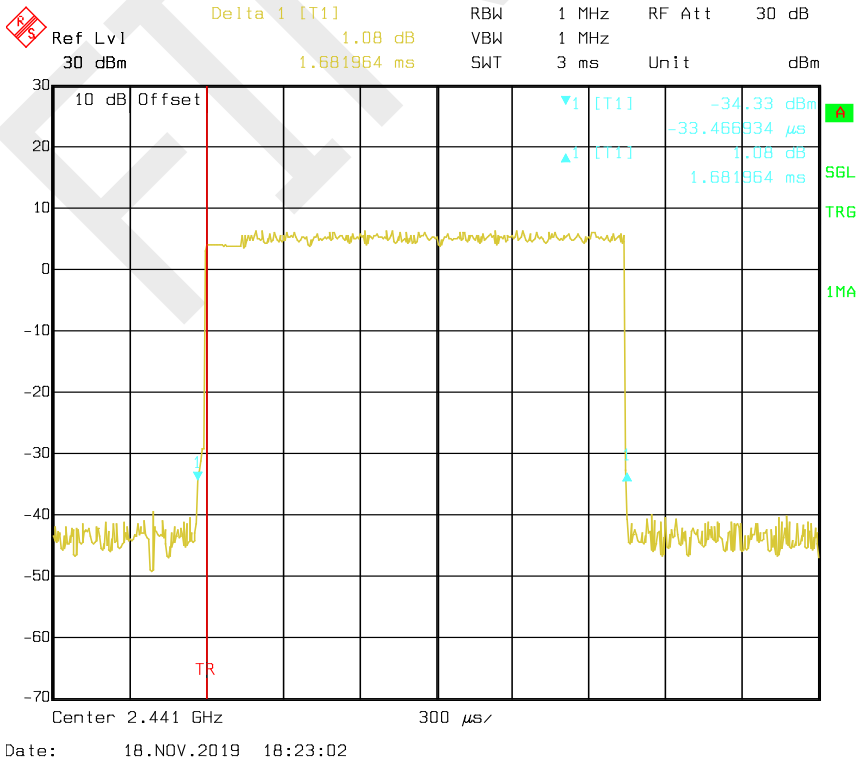
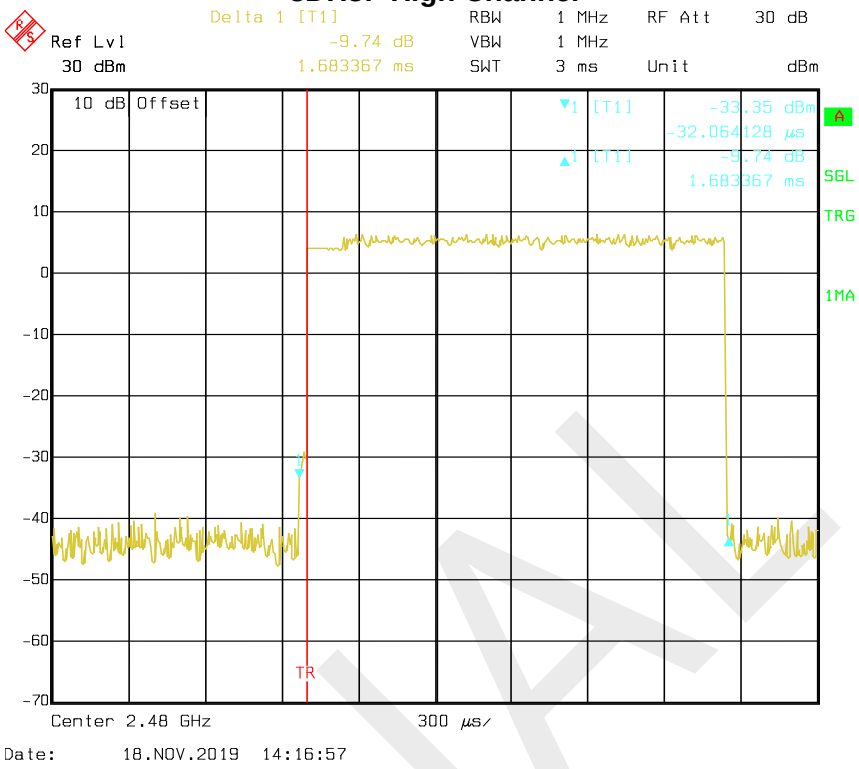
3DH3: Middle Channel



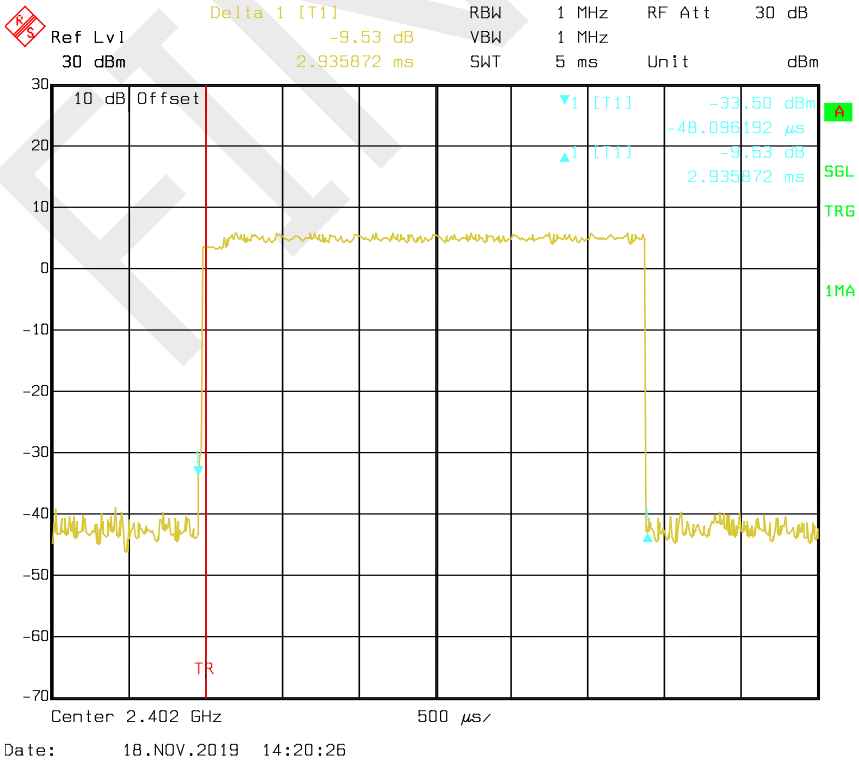
Date: 18.NOV.2019 18:23:02

3DH3: High Channel



Date: 18.NOV.2019 14:16:57

3DH5: Low Channel



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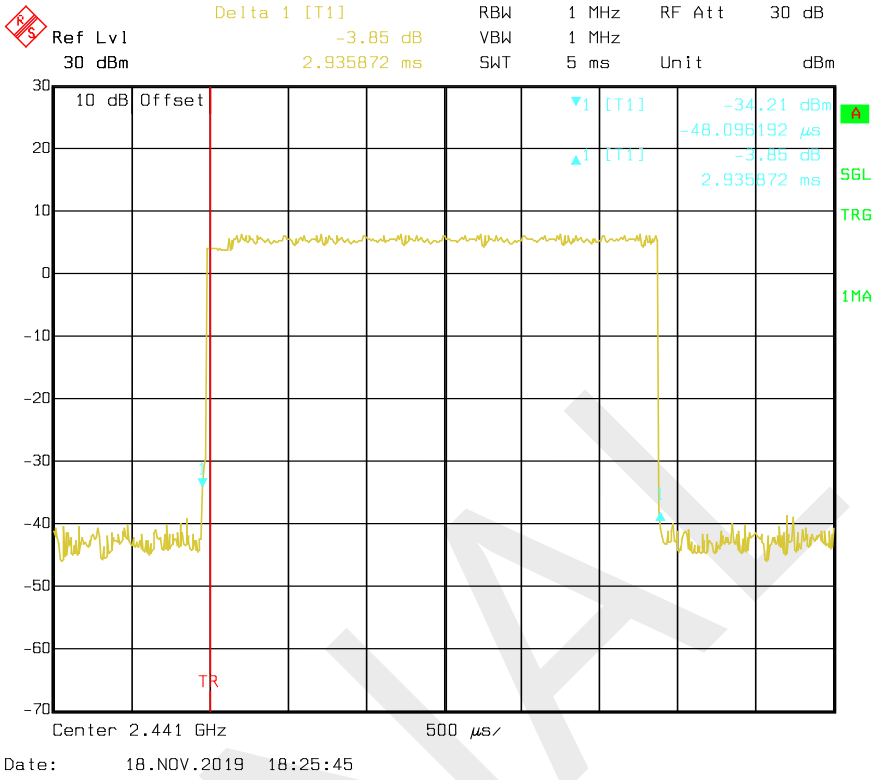
3DH5: Middle Channel



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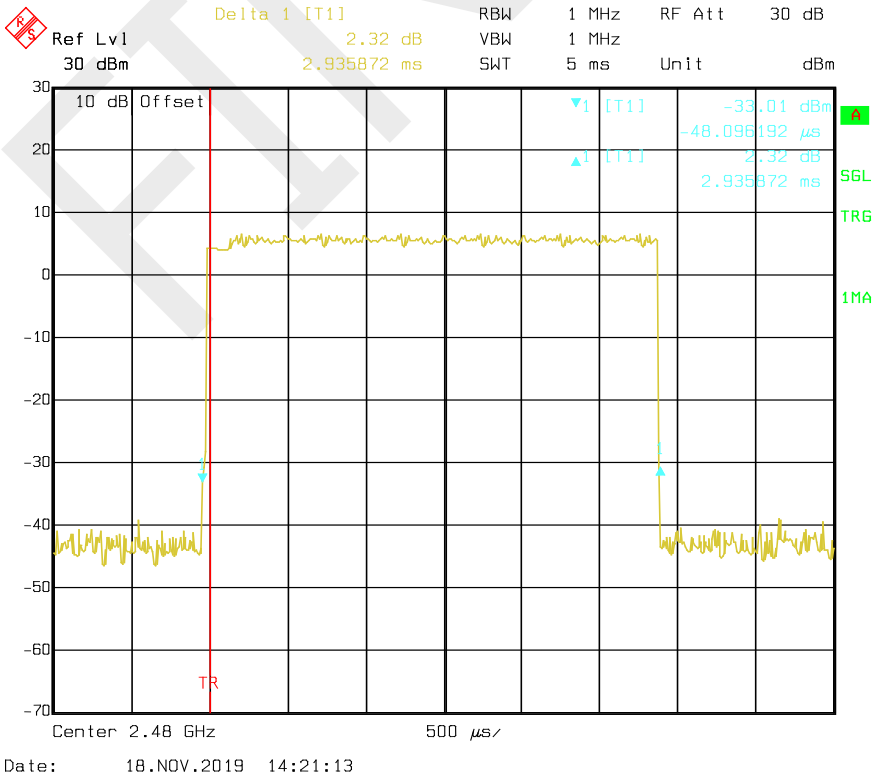
3DH5: High Channel



Date: 18.NOV.2019 14:21:13

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:	22 °C
Relative Humidity:	51 %
ATM Pressure:	95.5 kPa

The testing was performed by Eric Xiao on 2019-11-18.

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

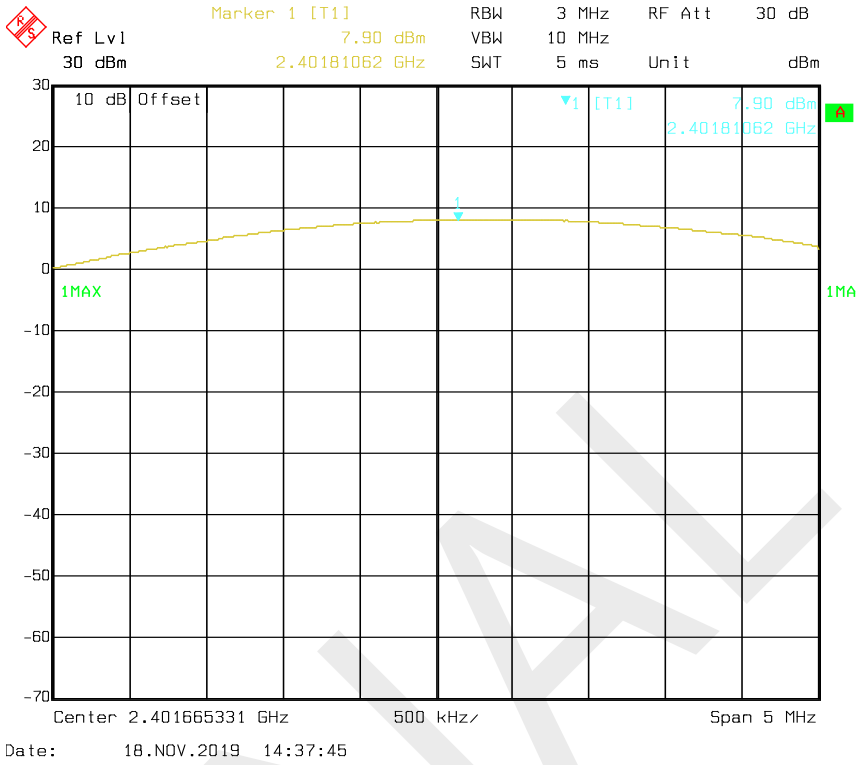
Test Mode: Transmitting

Mode	Channel	Frequency (MHz)	Peak Output Power (dBm)	Limit (dBm)
BDR Mode (GFSK)	Low	2402	7.90	21
	Middle	2441	8.15	21
	High	2480	7.78	21
EDR Mode (π/4-DQPSK)	Low	2402	5.79	21
	Middle	2441	6.42	21
	High	2480	6.43	21
EDR Mode (8DPSK)	Low	2402	6.43	21
	Middle	2441	6.95	21
	High	2480	6.95	21

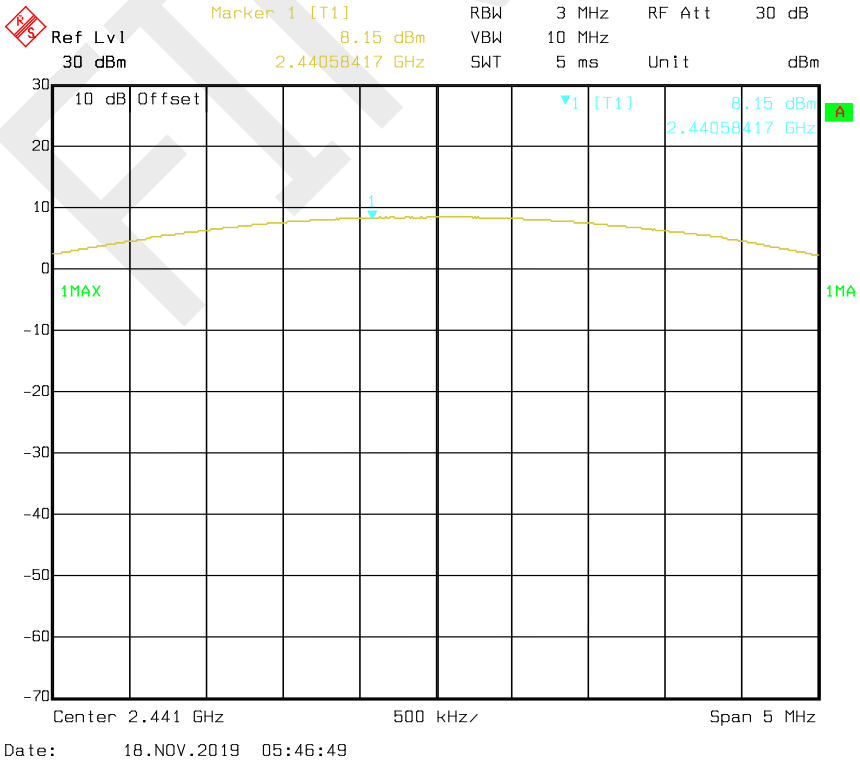
Note: The data above was tested in conducted mode.

BDR Mode (GFSK):

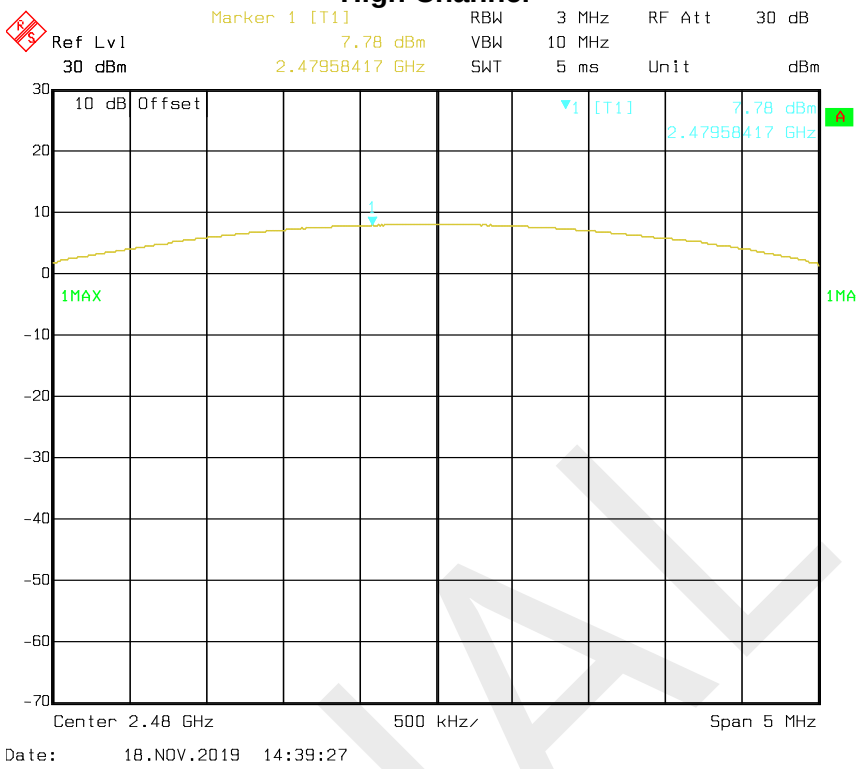
Low Channel



Middle Channel

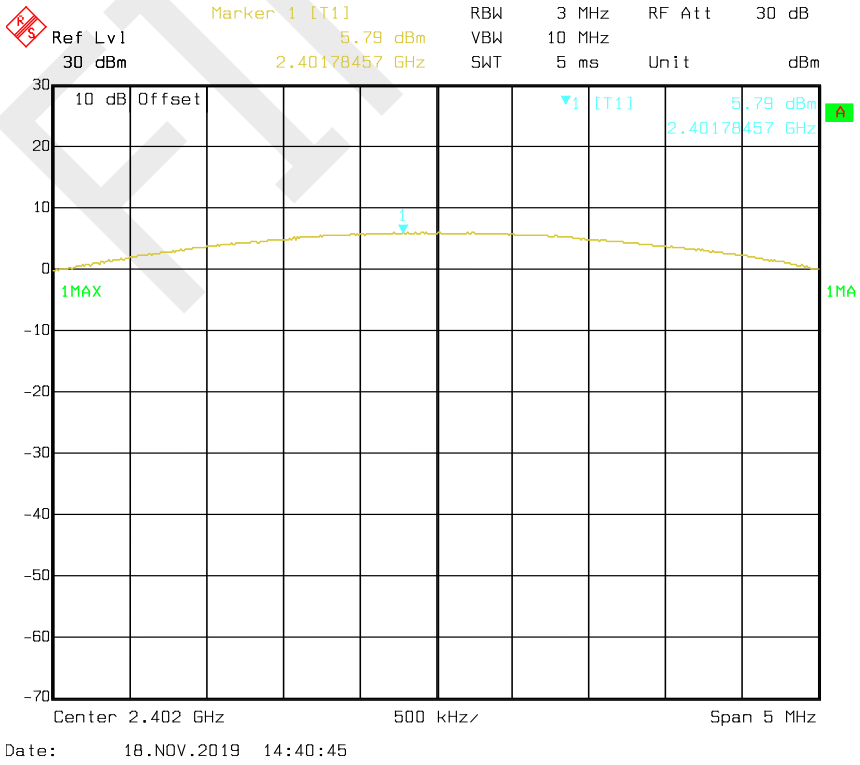


High Channel

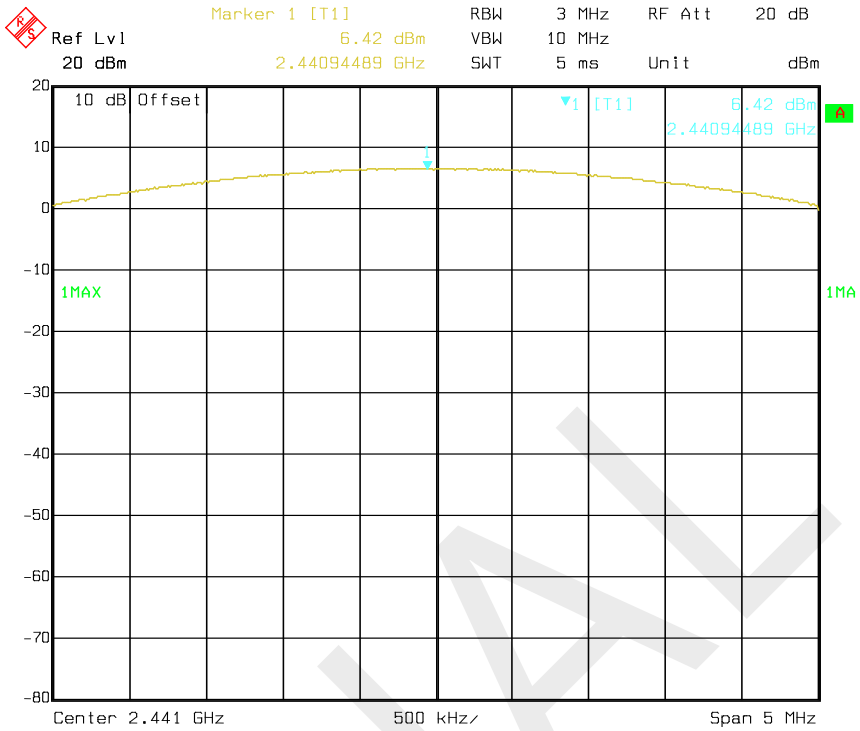


EDR Mode (π/4-DQPSK):

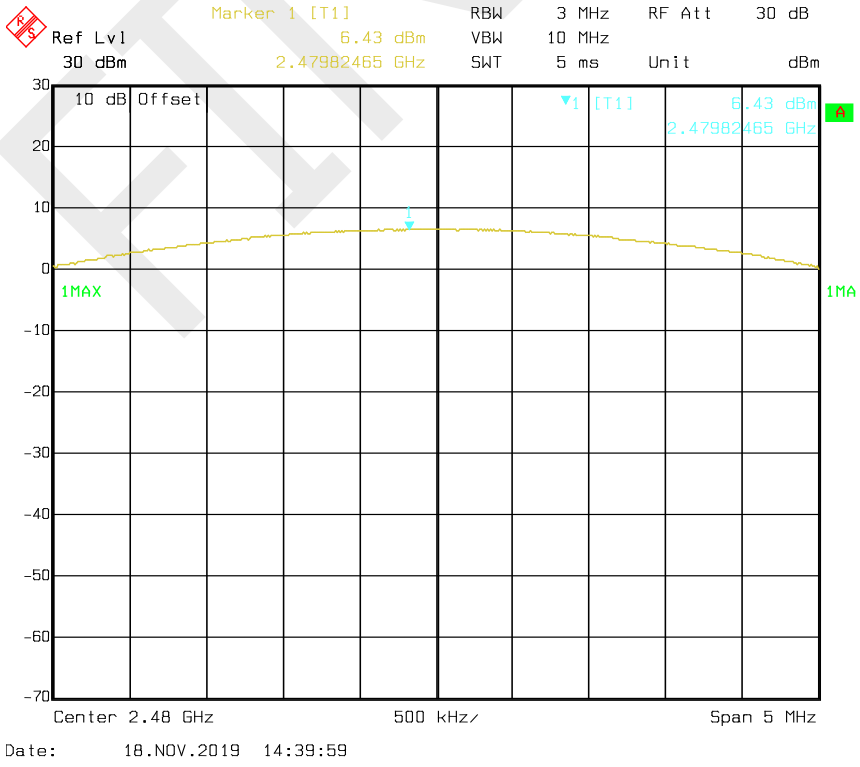
Low Channel



Middle Channel

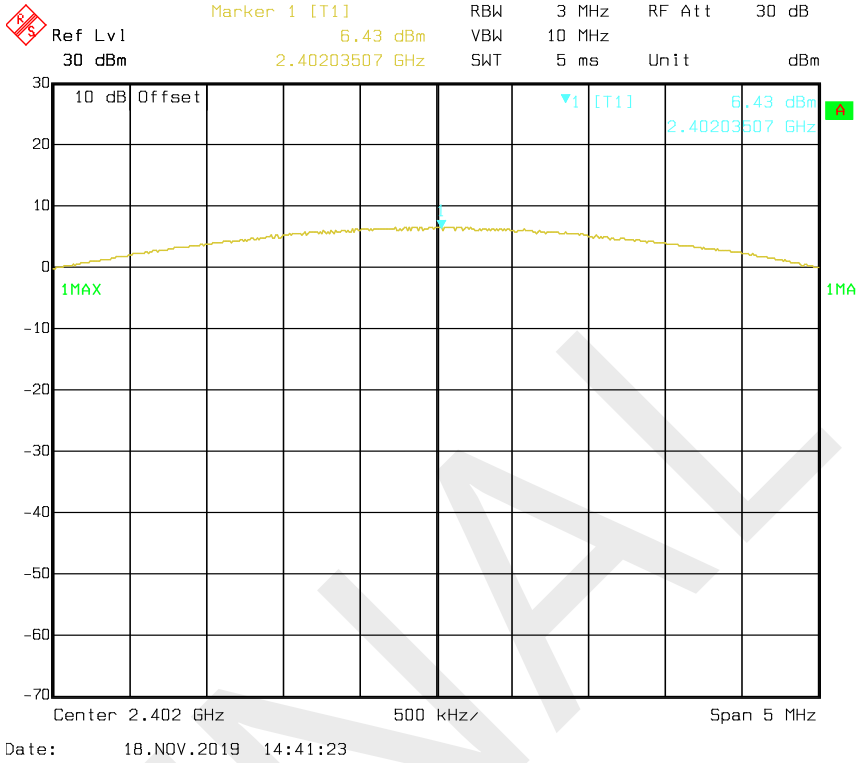


High Channel

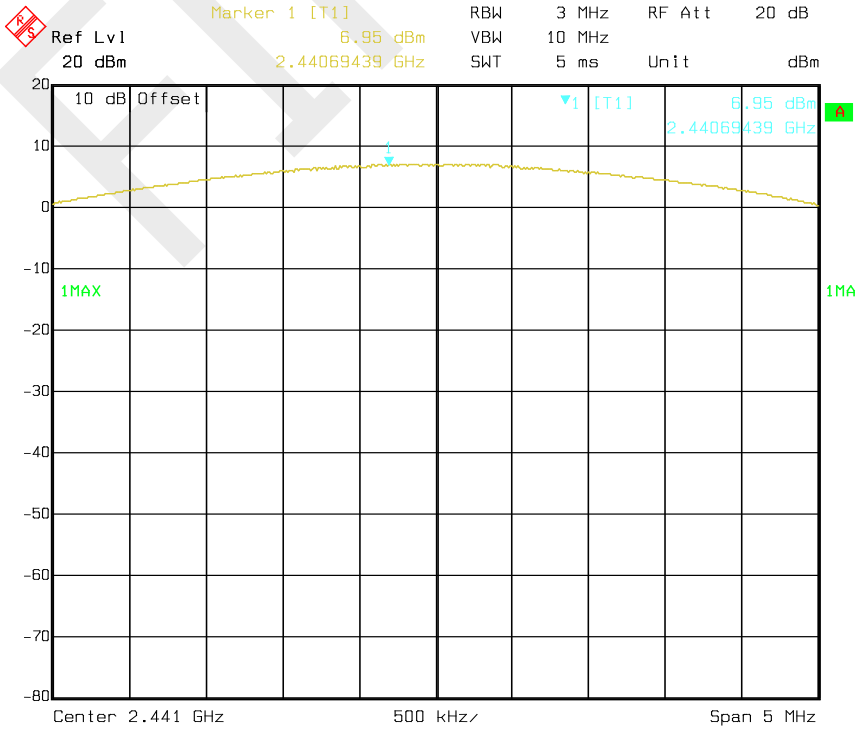


EDR Mode (8DPSK):

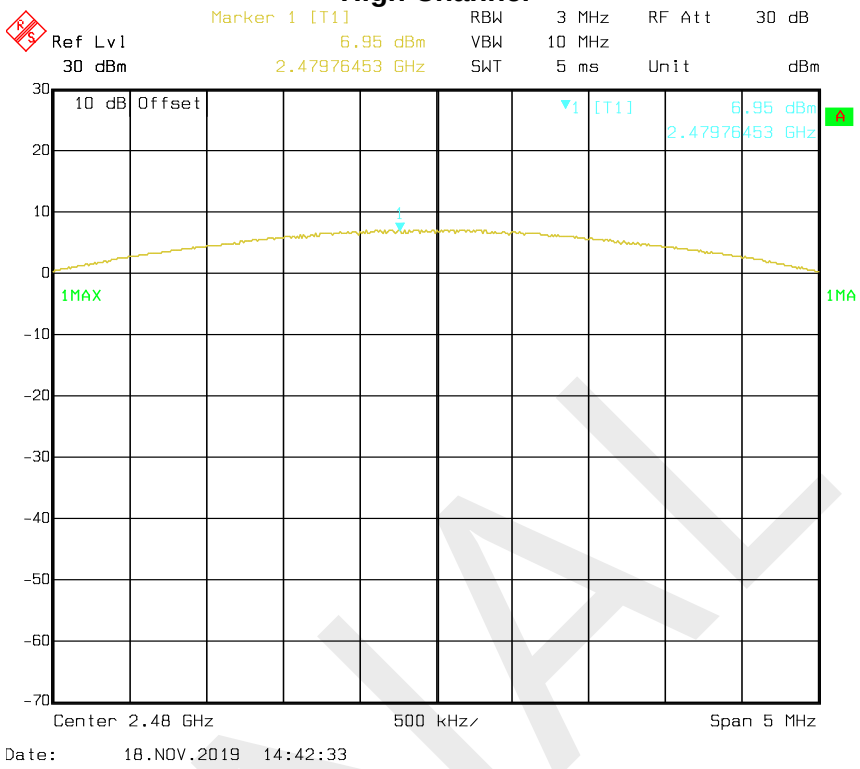
Low Channel



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

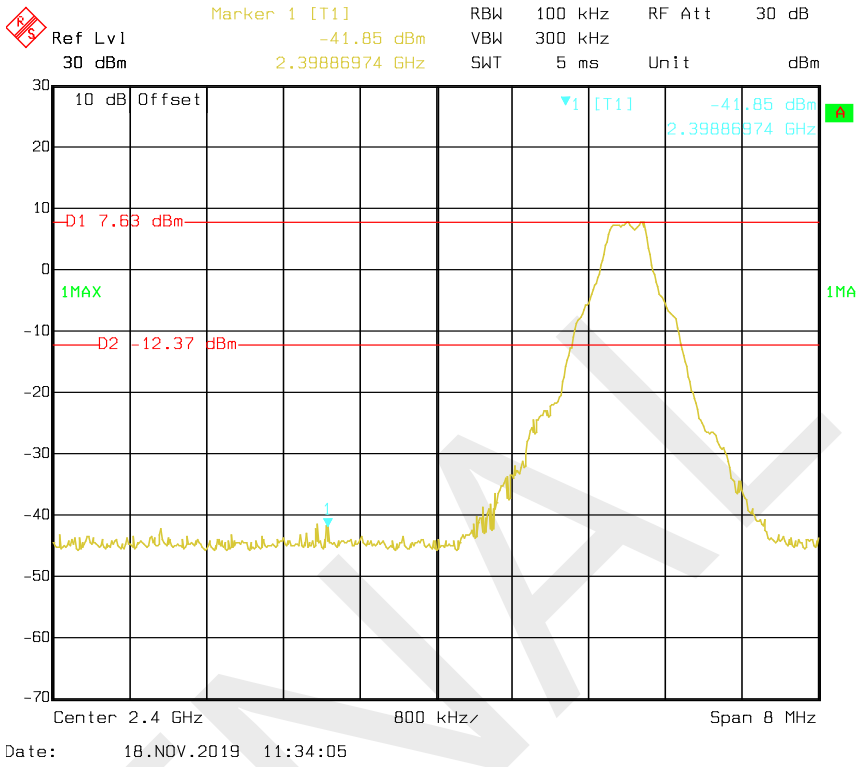
Temperature:	22 °C
Relative Humidity:	51 %
ATM Pressure:	95.5 kPa

The testing was performed by Eric Xiao on 2019-11-18.

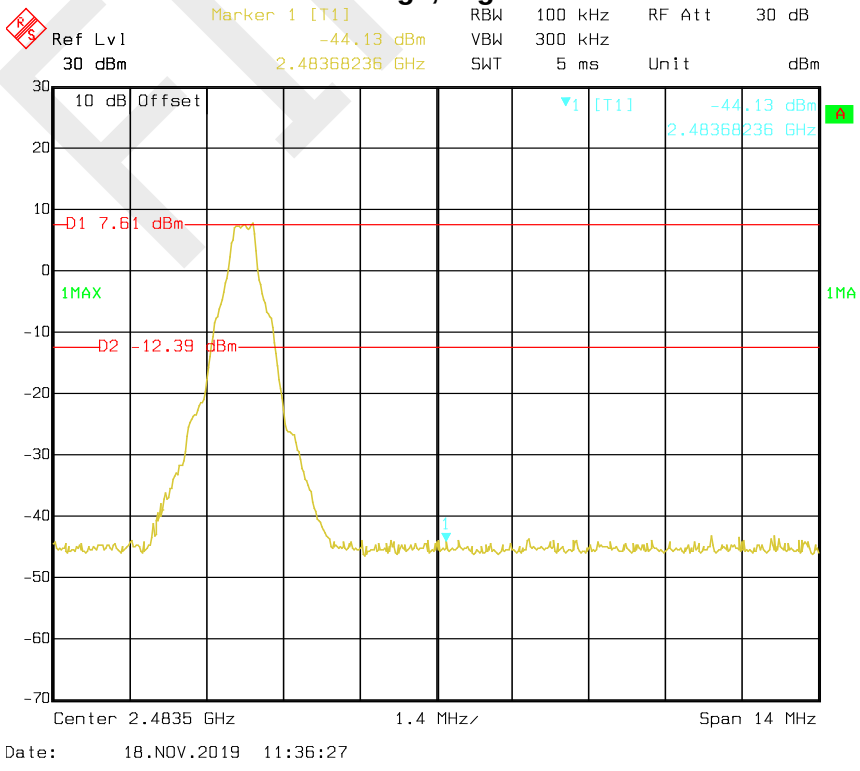
Test Result: Compliance. Please refer to the below plots:

Single Channel
BDR Mode (GFSK):

Band Edge, Left Side

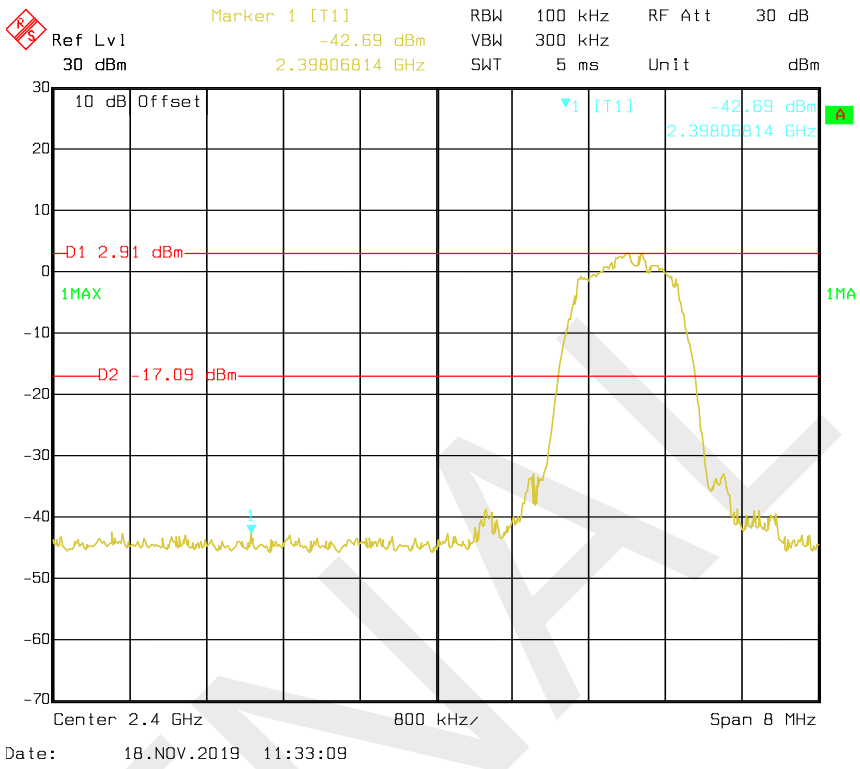


Band Edge, Right Side

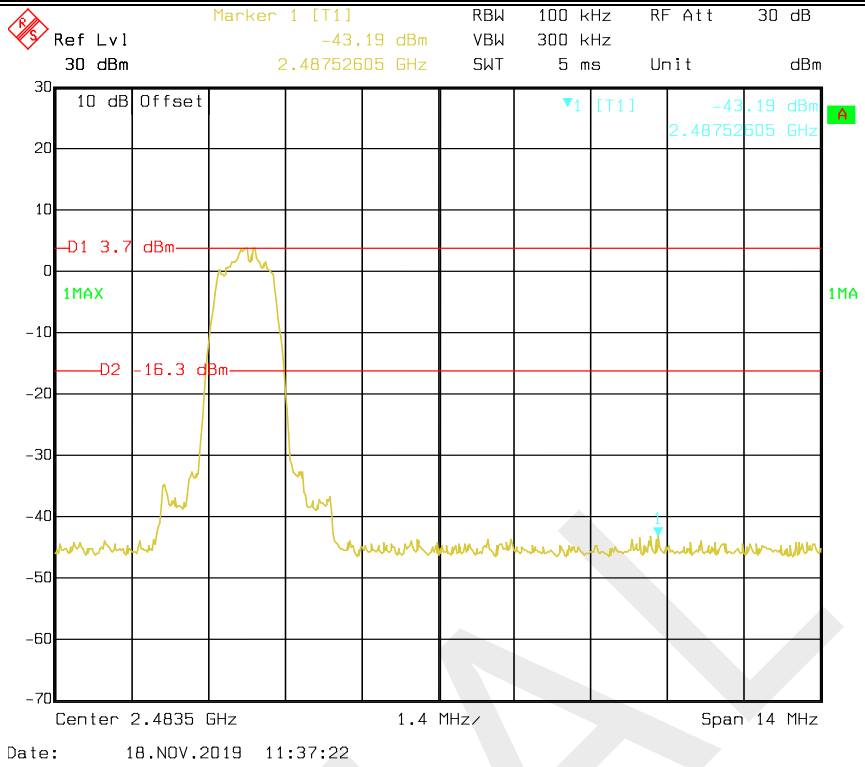


EDR Mode (π/4-DQPSK):

Band Edge, Left Side

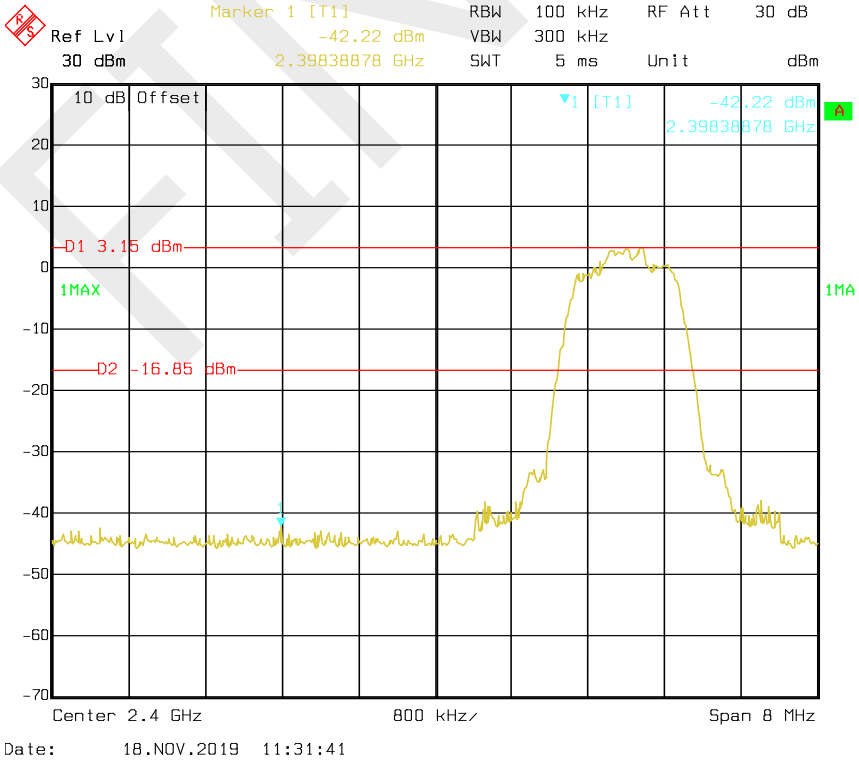


Band Edge, Right Side

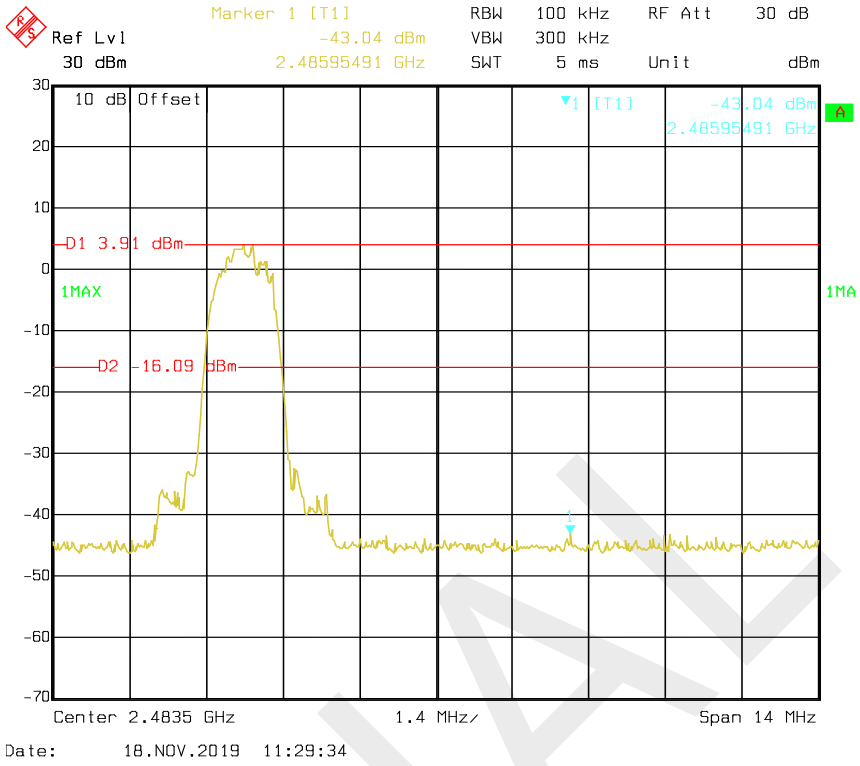


EDR Mode (8DPSK):

Band Edge, Left Side



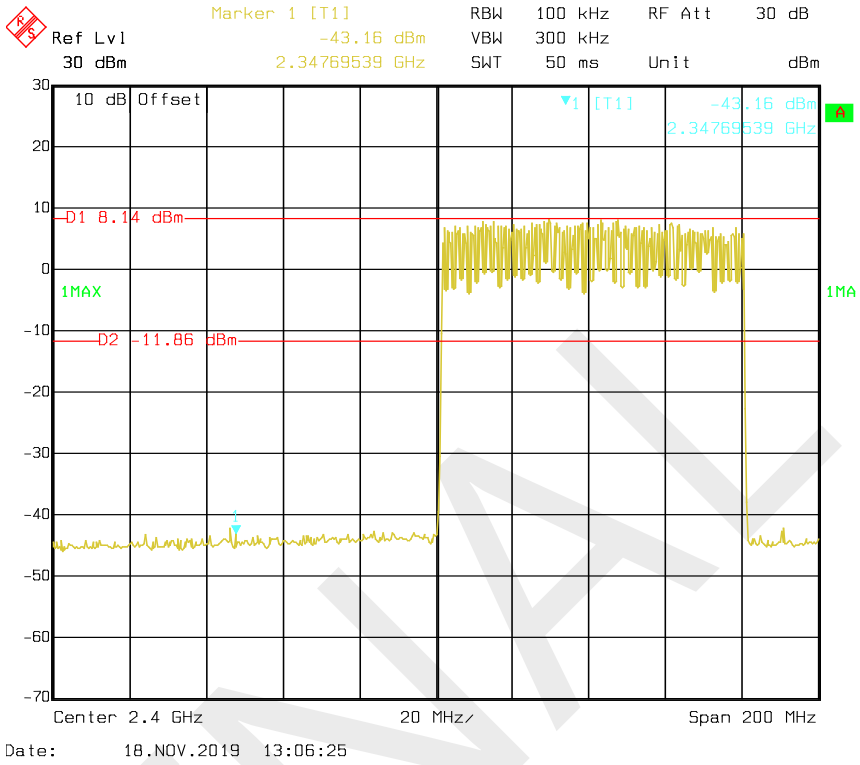
Band Edge, Right Side



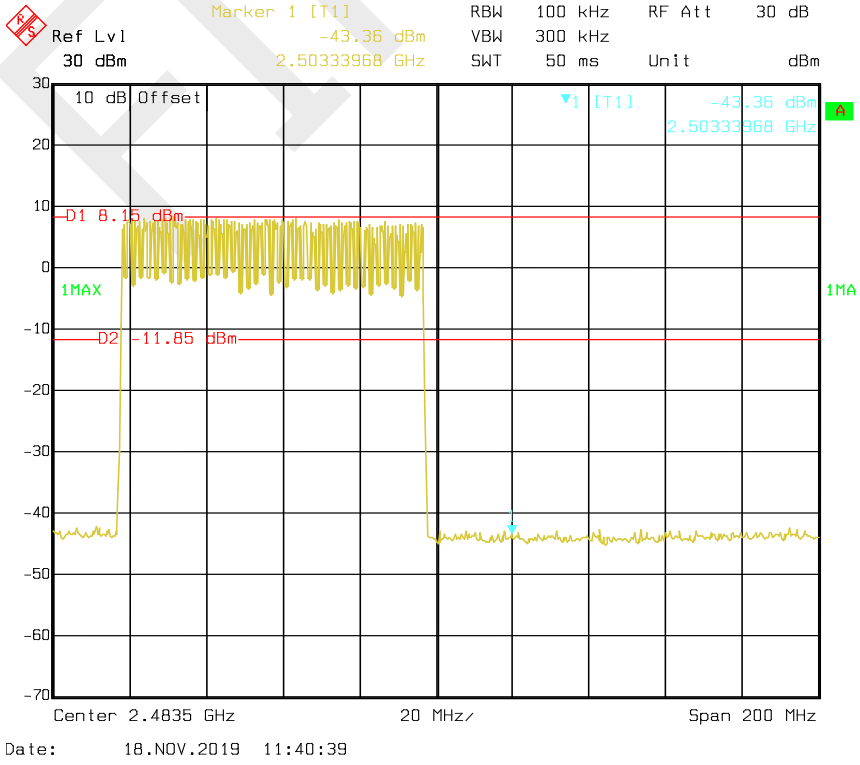
Hopping:

BDR Mode (GFSK):

Band Edge, Left Side

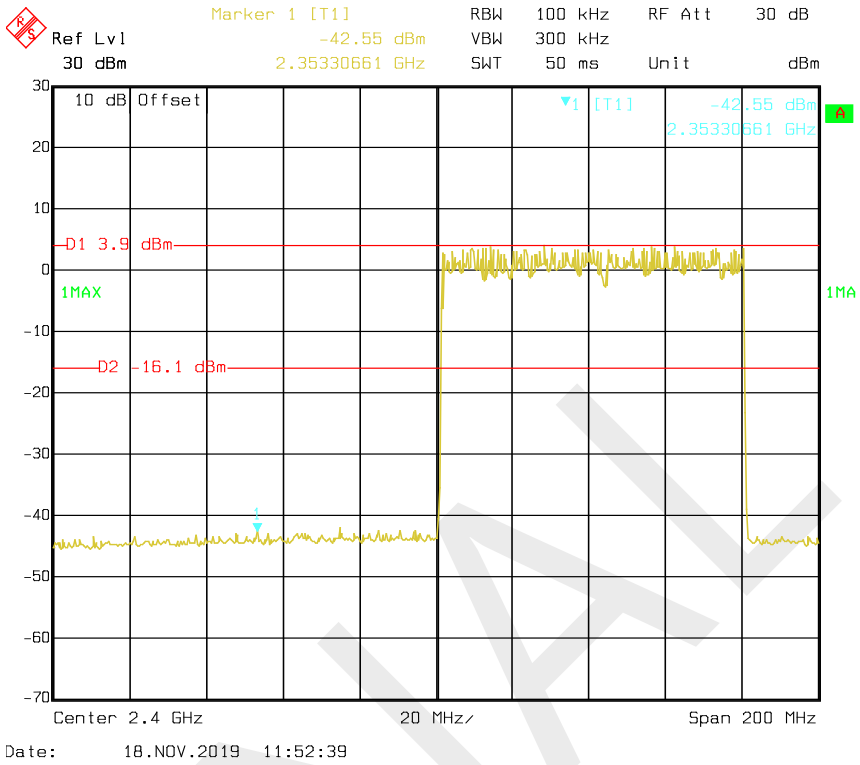


Band Edge, Right Side

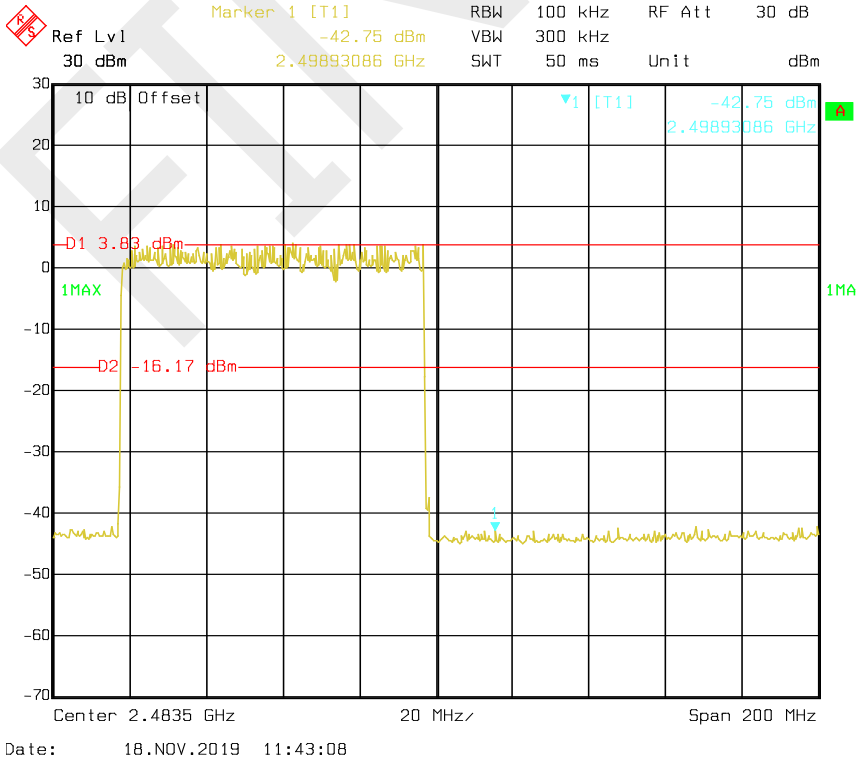


EDR Mode (π/4-DQPSK):

Band Edge, Left Side

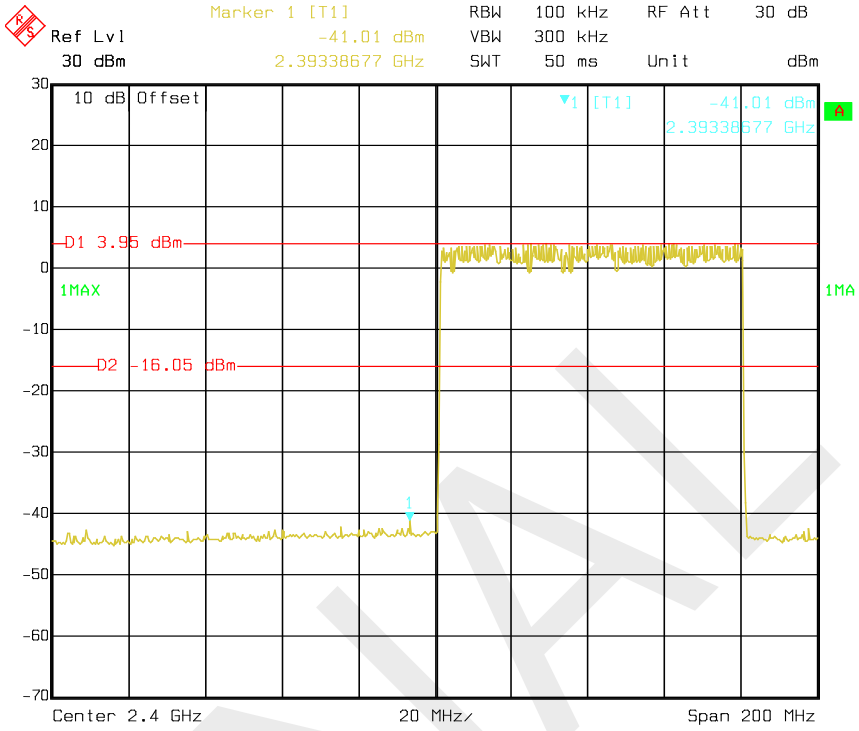


Band Edge, Right Side

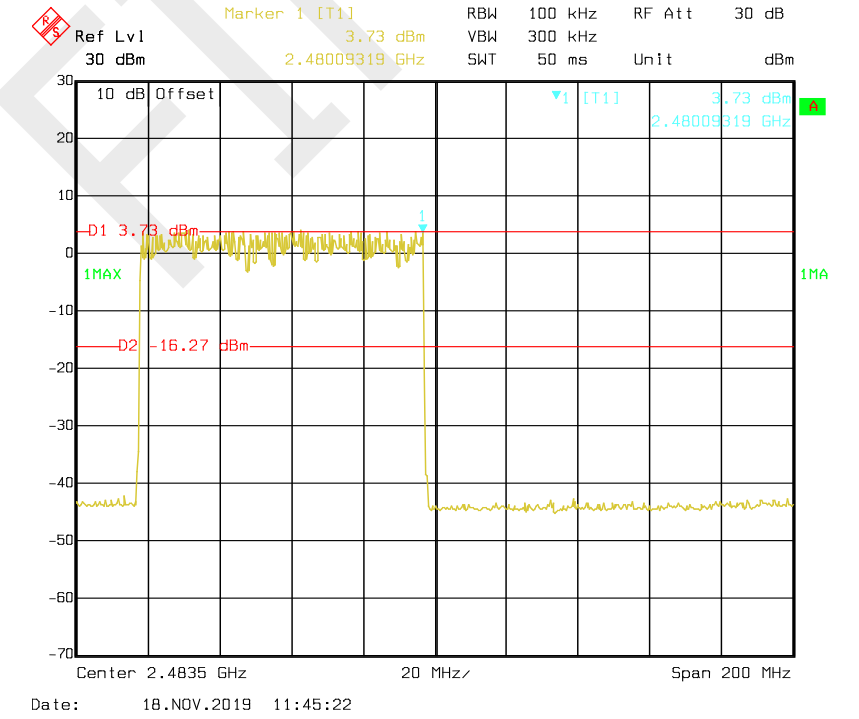


EDR Mode (8DPSK):

Band Edge, Left Side



Band Edge, Right Side



END OF REPORT