FCC Part 15.247

TEST REPORT

For

AAEON Technology. Inc.

5F, No. 135, Lane 235, Pao Chiao Rd., Taipei City, Taiwan

FCC ID: OHBRICORK88WB

Report Type:	**Product Type:**
Original Report	Embedded Controller

Report Producer:	Jane Lee
Report Number:	RTWL171229001-00B
Report Date:	2018-02-12
Reviewed By:	Jerry Chang

Bay Area Compliance Laboratories Corp.(Taiwan)
70, Lane 169, Sec. 2, Datong Road,
Xizhi Dist., New Taipei City 22183, Taiwan, R.O.C.
Tel: +886 (2) 2647 6898
Fax: +886 (2) 2647 6895
www.bacl.com.tw

REVISION HISTORY

Revision	No.	Report Number	Issue Date	Description	Author/ Revised by
1.0	RTWL171229001	RTWL171229001-00B	2018.02.12	Original Report	Jane

TABLE OF CONTENTS

1 General Information

1.1 Product Description for Equipment under Test (EUT)

Applicant	AAEON Technology. Inc. 5F, No. 135, Lane 235, Pao Chiao Rd., Taipei City, Taiwan
Manufacturer	AAEON Technology. Inc. 5F, No. 135, Lane 235, Pao Chiao Rd., Taipei City, Taiwan
Brand(Trade) Name	AAEON
Product (Equipment)	Embedded Controller
Model Name	BOXER-RK88-0001
Series Model	xxBOXER-RK88xxxxxx
EUT Function	BT4.1 backward compatibility (BT+EDR)
Frequency Range	2402 – 2480 MHz
Number of Channels	79 Channels
Output Power	BT BR(GFSK) Mode: -6.24 dBm (0.00024W) BT EDR(π/4-DQPSK) Mode: -10.34 dBm(0.00009W) BT EDR(8-DPSK) Mode: -10.62 dBm (0.00009W)
Received Date	Dec 25, 2017.
Date of Test	Dec 27, 2017 ~ Feb 12, 2018
Related Submittal(s)/Grant(s)	DTS FCC Part 15.247, FCC ID : OHBRICORK88WB
Modulation Type	BT BR Mode: GFSK BT EDR-2M Mode: π/4-DQPSK BT EDR-3M Mode: 8-DPSK
Software(Firmware) Version	3.10.0

**All measurement and test data in this report was gathered from production sample serial number: 171229001 (Assigned by BACL, Taiwan).*

**Model Discrepancy:*

The major electrical and mechanical constructions of series models are identical to the basic model, except different Market segmentation. The model, BOXER-RK88-0001 is the testing sample, and the final test data are shown on this test report.

Series Model :xxBOXER-3288xxxxxx
(x - Where x may be any combination of alphanumeric characters or "-" or blank.)

1.2 Operation Condition of EUT

Power Operation (Voltage Range)	☐ AC 120V/60Hz ☐ Adapter ☐ By Power Cord ☐ PoE
	☒ DC Type ☒ DC :12V ☐ DC Power Supply ☐ Battery ☐ External from USB Cable ☐ External DC Adapter
	☐ Host System

1.3 Objective

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

The tests were performed in order to determine the Bluetooth BR 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

1.4 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

1.5 Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Taiwan) to collect test data is located on
☒70, Lane 169, Sec. 2, Datong Road, Xizhi Dist., New Taipei City 22183, Taiwan, R.O.C.
☒68-3, Lane 169, Sec. 2, Datong Road, Xizhi Dist., New Taipei City 22183, Taiwan, R.O.C.

Bay Area Compliance Laboratories Corp. (Taiwan) Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code: 3180) and the FCC designation No.TW3180 under the Mutual Recognition Agreement (MRA) in FCC Test. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.10-2013.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 974454. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

2 System Test Configuration

2.1 Description of Test Configuration

The system was configured for testing in engineering mode which was selected by manufacturer.

For BR/EDR mode, there are totally 79 channels.

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	40	2441
1	2403	-	-
2	2404	-	-
3	2405	-	-
4	2406	77	2478
-	-	78	2479
39	2440	79	2480

For BT BR/EDR modes: Channel 0, 40 and 79 were tested.

Radiated below 1G were tested worst output power mode.

2.2 Equipment Modifications

No modification was made to the EUT

2.3 Description of Worst Test Configuration

Modulation Used for Conformance Test	
Configuration	**Data Rate**
BR (GFSK) mode	1 Mbps
EDR (π/4-DQPSK) mode	2 Mbps
EDR (8DPSK) mode	3 Mbps

Worst Case of Power Setting			
EUT Exercise Software	Ampak RFTestTool VER: 5.5 7		
Configuration	**Low CH**	**Mid CH**	**High CH**
BR (GFSK) mode	Default	Default	Default
EDR (π/4-DQPSK) mode	Default	Default	Default
EDR (8DPSK) mode	Default	Default	Default

2.4 Support Equipment List and Details

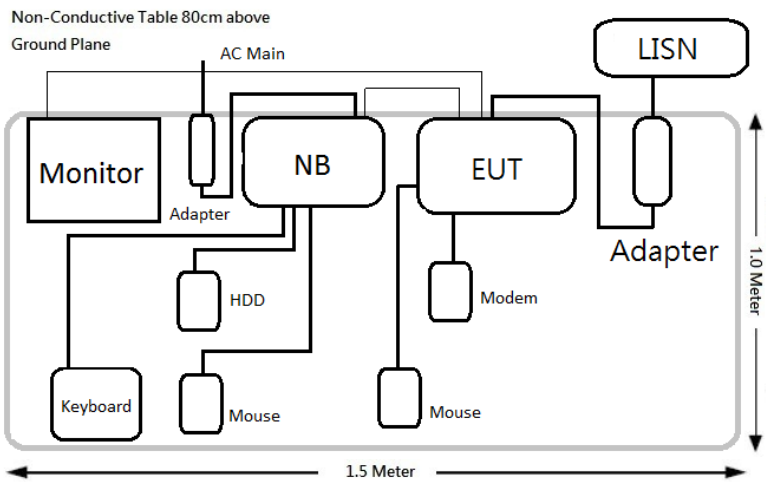
Description	Manufacturer	Model	BSMI	FCC ID / DoC
Notebook	Dell	P62G	N/A	PD98260NGU
Adapter	FSP GROUP INC.	FSP060-DIBAN2	R43001	DoC
USB Keyboard	DELL	SK-8120	R3A002	DoC
Mouse	DELL	MS111-P	R41108	DoC
Monitor	AOC	U2868PQU	R33037	DoC
Modem	DigiFusion	AL-56ERM	N/A	DoC
Mouse	DELL	MS111-P	R41108	DoC
HDD	WD	My Passport Ultra	D33015	DoC
NB	ASUS	P2538U	R31018	DoC

2.5 External Cable List and Details

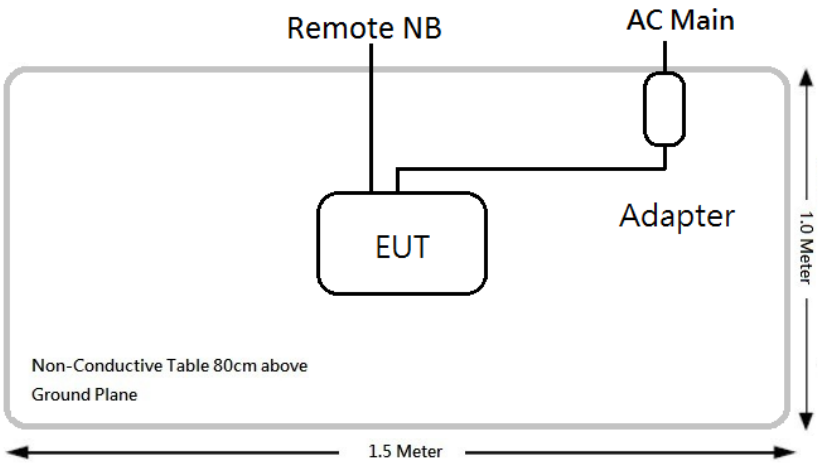
Description	Shielded Type	Ferrite Core	Length
USB Cable	Non-Shielded	N/A	1.8M
USB Cable	Non-Shielded	N/A	1.8M
HDMI Cable	Shielded	N/A	1.8M
RS-232 Cable	Shielded	N/A	1.6M
OTG Cable	Shielded	N/A	1.0M
USB Cable	Non-Shielded	N/A	1.8M
USB Cable	Shielded	N/A	1.0M
LAN Cable	Non-Shielded	N/A	10M
DC Cable	Non-Shielded	N/A	1.6M

2.6 Block Diagram of Test Setup

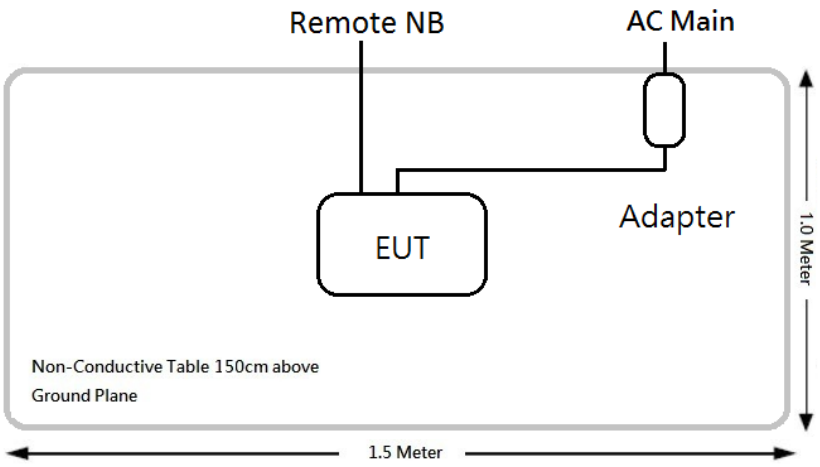
Conduction



Radiation below 1G



Radiation above 1G



3 Summary of Test Results

FCC Rules	Description of Test	Result
§15.247(i), §1.1310 ,§ 2.1091	Maximum Permissible Exposure (MPE)	Compliance
§15.203	Antenna Requirement	Compliance
§15.207(a)	AC Line Conducted Emissions	Compliance
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
§15.247(a)(1)	20 dB Emission Bandwidth	Compliance
§15.247 (a)(1)	Channel Separation Test	Compliance
§15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	Compliance
§15.247(a)(1)(iii)	Quantity of hopping channel Test	Compliance
§15.247(b)(3)	Maximum Peak Output Power	Compliance
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliance

4 FCC § 15.247(i), §1.1310, § 2.1091 - Maximum Permissible Exposure (MPE)

4.1 Applicable Standard

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

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

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

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

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

Calculated Formulary:

Predication of MPE limit at a given distance
$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm^2);
P = power input to the antenna (in appropriate units, e.g., mW);
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

4.2 RF Exposure Evaluation Result

MPE evaluation:

Mode	Frequency Range (MHz)	Antenna Gain		Target Power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)			
Wi-Fi	2412-2462	2.09	1.618	21.0	125.893	20	0.0405	1
BLE	2402-2480	2.09	1.618	6.0	3.981	20	0.0013	1
BT	2402-2480	2.09	1.618	-6.00	0.251	20	0.0001	1

BLE, BT and Wi-Fi will not be launched at the same time, so there will be no co-located.

Result: MPE evaluation meet 20 cm the requirement of standard.

5 FCC §15.203 – Antenna Requirements

5.1 Applicable Standard

According to § 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 user of a standard antenna jack or electrical connector is prohibited.

And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna does not exceed 6 dBi

5.2 Antenna List and Details

Manufacturer	Antenna Type	Antenna Gain	Result
ARiSTOTLE ENTERPPRISES INC.	Dipole Antenna (Reversed SMA)	2.09 dBi	Compliance

The EUT has an external detachable antenna arrangement, fulfill the requirement of this section.

6 FCC §15.207 - AC Line Conducted Emissions

6.1 Applicable Standard

FCC §15.207

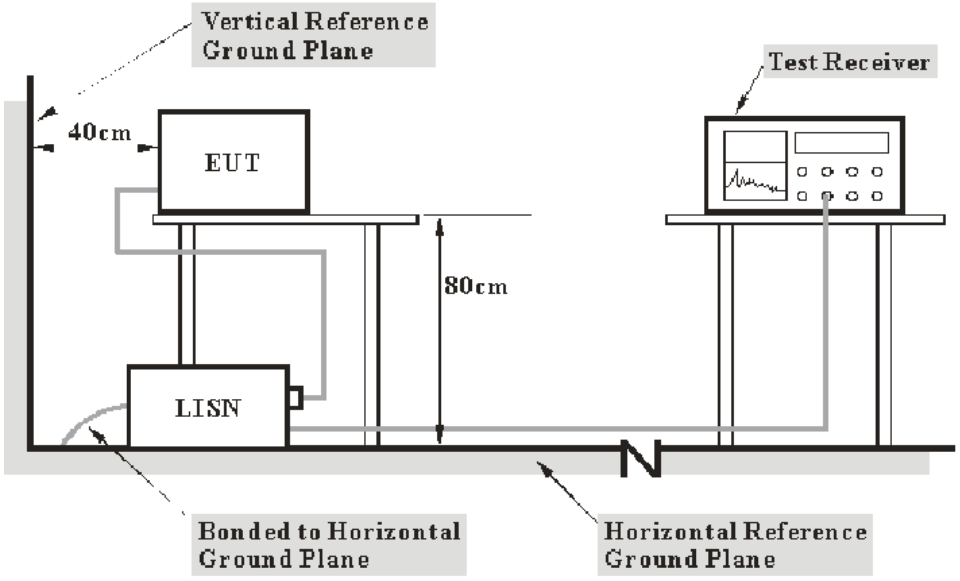
6.2 Measurement Uncertainty

Input quantities to be considered for conducted disturbance measurements maybe receiver reading, attenuation of the connection between LISN/ISN and receiver, LISN/ISN voltage division factor, LISN/ISN VDF frequency interpolation and receiver related input quantities, etc.

Based on CISPR 16-4-2:2011, the expended combined standard uncertainty of conducted disturbance test at Bay Area Compliance Laboratories Corp. (Taiwan) is shown as below. And the uncertainty will not be taken into consideration for the test data recorded in the report

Port	Expanded Measurement uncertainty
AC Mains	4.64 dB (k=2, 95% level of confidence)

6.3 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.

6.4 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	Receiver RBW
150 kHz - 30 MHz	9 kHz

6.5 Test Procedure

During the conducted emission test, the adapter was connected to the outlet of the LISN. Maximizing procedure was performed on the six (6) highest emissions of the EUT. All data was recorded in the Quasi-peak and average detection mode.

6.6 Corrected Factor & Margin Calculation

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

Factor = LISN VDF + Cable Loss + Transient Limiter Attenuation

The "Over Limit" column of the following data tables indicates the degree of compliance with the applicable limit. For example, an over limit of -7 dB means the emission is 7 dB below the limit. The equation for Over Limit calculation is as follows:

Over Limit = Level – Limit Line

6.7 Test Equipment List and Details

Manufacturers	Descriptions	Models	Serial Numbers	Calibration Date	Calibration Due Date
LISN	Rohde & Schwarz	ENV216	101248	2017/07/20	2018/07/19
LISN	EMCO	3816/2	00075848	2017/08/02	2018/08/01
EMI Test Receiver	Rohde & Schwarz	ESR7	101419	2017/11/06	2018/11/05
Pulse Limiter	Rohde & Schwarz	ESH3Z2	TXZEM025	2017/08/11	2018/08/10
RF Cable	EMEC	EM-CB5D	001	2017/07/24	2018/07/23
Software	AUDIX	E3	V9.150826k	N.C.R	N.C.R

*** *Statement of Traceability:*** BACL Corp. attests that all calibrations have been performed according to TAF requirements, traceable to the ETC.

6.8 Test Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	58 %
ATM Pressure:	1010 hPa

The testing was performed by Ian Tu on 2018-01-22.

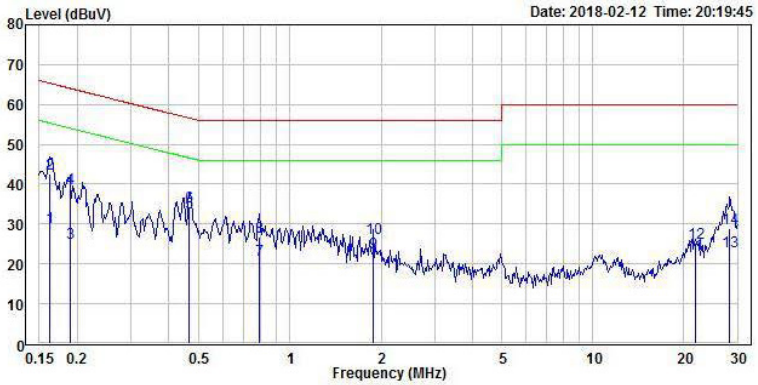
6.9 Test Results

Please refer to the following plots and tables.

Test mode: Transmitting mode

BT Worst Mode:

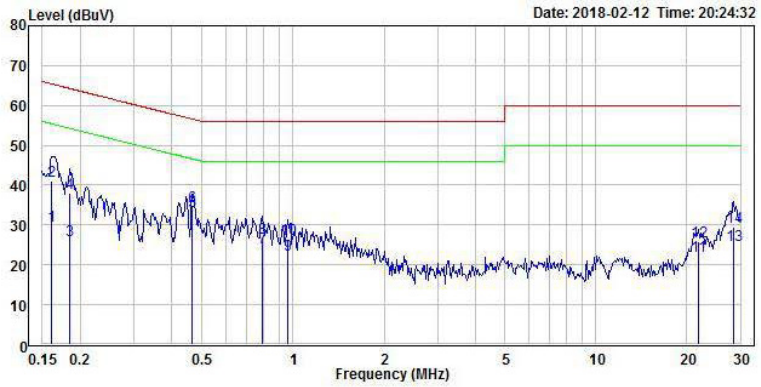
Main: AC 120V/60 Hz, Line



Condition: limit\FCC\FCC Part15B CLASS-B QP.csv Line
EUT :
Model : RICO-3288
Note : 120V/60Hz
: BT Test Mode

	Freq	Level	Limit Line	Over Limit	Factor	Read Level	Remark	Pol/Phase
	MHz	dBuV	dBuV	dB	dB	dBuV		
1	0.162	29.08	55.34	-26.26	19.50	9.58	Average	Line
2	0.162	42.44	65.34	-22.90	19.50	22.94	QP	Line
3	0.189	25.38	54.08	-28.70	19.50	5.88	Average	Line
4	0.189	39.08	64.08	-25.00	19.50	19.58	QP	Line
5	0.465	32.83	46.60	-13.77	19.51	13.32	Average	Line
6	0.465	34.37	56.60	-22.23	19.51	14.86	QP	Line
7	0.793	21.09	46.00	-24.91	19.52	1.57	Average	Line
8	0.793	26.77	56.00	-29.23	19.52	7.25	QP	Line
9	1.890	22.90	46.00	-23.10	19.58	3.32	Average	Line
10	1.890	26.33	56.00	-29.67	19.58	6.75	QP	Line
11	21.813	22.40	50.00	-27.60	19.86	2.54	Average	Line
12	21.813	25.12	60.00	-34.88	19.86	5.26	QP	Line
13	28.373	23.20	50.00	-26.80	19.89	3.31	Average	Line
14	28.373	29.04	60.00	-30.96	19.89	9.15	QP	Line

Main: AC 120V/60 Hz, Neutral



Condition: limit\FCC\FCC Part15B CLASS-B QP.csv Neutral
EUT :
Model : RICO-3288
Note : 120V/60Hz
: BT Test Mode

	Freq	Level	Limit Line	Over Limit	Factor	Read Level	Remark	Pol/Phase
	MHz	dBuV	dBuV	dB	dB	dBuV		
1	0.161	29.94	55.40	-25.46	19.63	10.31	Average	Neutral
2	0.161	41.16	65.40	-24.24	19.63	21.53	QP	Neutral
3	0.185	26.09	54.28	-28.19	19.63	6.46	Average	Neutral
4	0.185	38.14	64.28	-26.14	19.63	18.51	QP	Neutral
5	0.465	33.52	46.60	-13.08	19.64	13.88	Average	Neutral
6	0.465	34.66	56.60	-21.94	19.64	15.02	QP	Neutral
7	0.793	24.29	46.00	-21.71	19.66	4.63	Average	Neutral
8	0.793	26.81	56.00	-29.19	19.66	7.15	QP	Neutral
9	0.960	22.44	46.00	-23.56	19.67	2.77	Average	Neutral
10	0.960	26.41	56.00	-29.59	19.67	6.74	QP	Neutral
11	21.813	22.35	50.00	-27.65	20.07	2.28	Average	Neutral
12	21.813	25.98	60.00	-34.02	20.07	5.91	QP	Neutral
13	28.600	24.95	50.00	-25.05	20.14	4.81	Average	Neutral
14	28.600	29.61	60.00	-30.39	20.14	9.47	QP	Neutral

7 FCC §15.209, §15.205, §15.247(d) – Spurious Emissions

7.1 Applicable Standard

As per FCC §15.35(d): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz.

As Per FCC §15.205(a) and RSS-Gen except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110 0.495 – 0.505 2.1735 – 2.1905 4.125 – 4.128 4.17725 – 4.17775 4.20725 – 4.20775 6.215 – 6.218 6.26775 – 6.26825 6.31175 – 6.31225 8.291 – 8.294 8.362 – 8.366 8.37625 – 8.38675 8.41425 – 8.41475 12.29 – 12.293 12.51975 – 12.52025 12.57675 – 12.57725 13.36 – 13.41	16.42 – 16.423 16.69475 – 16.69525 25.5 – 25.67 37.5 – 38.25 73 – 74.6 74.8 – 75.2 108 – 121.94 123 – 138 149.9 – 150.05 156.52475 – 156.52525 156.7 – 156.9 162.0125 –167.17 167.72 – 173.2 240 – 285 322 – 335.4 399.9 – 410 608 – 614	960 – 1240 1300 – 1427 1435 – 1626.5 1645.5 – 1646.5 1660 – 1710 1718.8 – 1722.2 2200 – 2300 2310 – 2390 2483.5 – 2500 2690 – 2900 3260 – 3267 3.332 – 3.339 3 3458 – 3 358 3.600 – 4.400	4. 5 – 5. 15 5. 35 – 5. 46 7.25 – 7.75 8.025 – 8.5 9.0 – 9.2 9.3 – 9.5 10.6 – 12.7 13.25 – 13.4 14.47 – 14.5 15.35 – 16.2 17.7 – 21.4 22.01 – 23.12 23.6 – 24.0 31.2 – 31.8 36.43 – 36.5 Above 38.6

As per FCC §15.209(a): Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

As per FCC §15.247 (d) 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).

7.2 Measurement Uncertainty

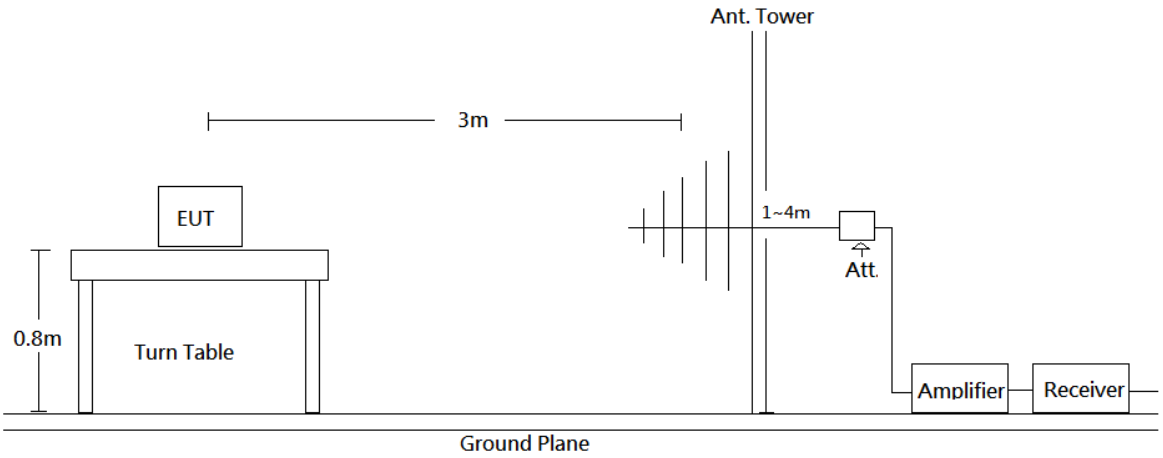
All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency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

Based on CISPR 16-4-2:2011, the expended combined standard uncertainty of radiation emissions at Bay Area Compliance Laboratories Corp. (Taiwan) is shown in below table. And the uncertainty will not be taken into consideration for the test data recorded in the report.

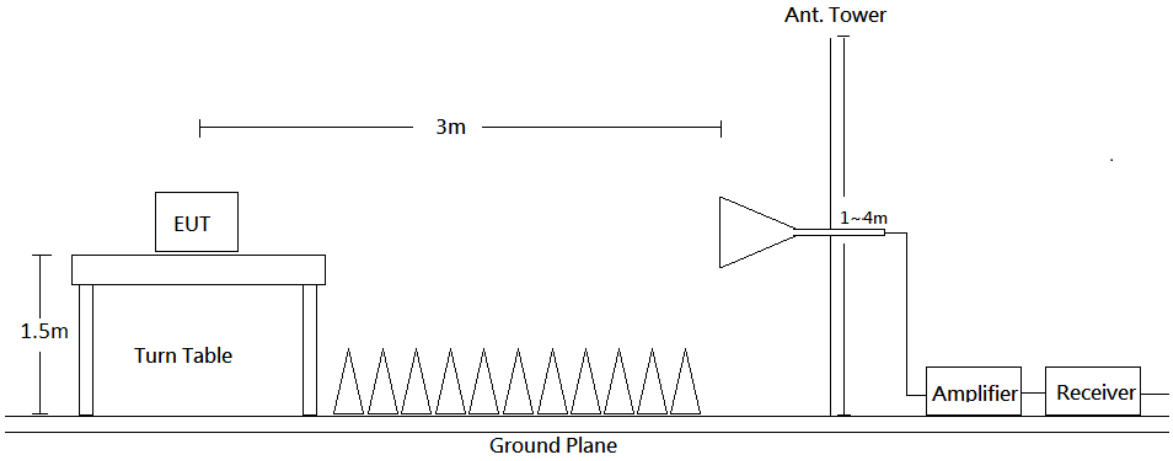
Frequency	Measurement uncertainty
30 MHz~200 MHz	3.76 dB (k=2, 95% level of confidence)
200 MHz~1 GHz	4.12 dB (k=2, 95% level of confidence)
1 GHz~6 GHz	4.84 dB (k=2, 95% level of confidence)
6 GHz~18 GHz	5.16 dB (k=2, 95% level of confidence)
18 GHz~26 GHz	4.84 dB (k=2, 95% level of confidence)
26 GHz~40 GHz	4.30 dB (k=2, 95% level of confidence)

7.3 EUT Setup

Blow 1 GHz:



Above 1 GHz:



Radiated emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC Part 15.209 and FCC 15.247 Limits.

7.4 EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 26.5 GHz. During the radiated emission test, the EMI test receiver was set with the following configurations measurement method 6.3 in ANSI C63.10.

Frequency Range	RBW	VBW	Measurement method
30-1000 MHz	120 kHz	/	QP
Above 1 GHz	1 MHz	3 MHz	PK
	1 MHz	10 Hz	Ave

7.5 Test Procedure

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

All data was recorded in the Quasi-peak detector mode from 30 MHz to 1 GHz and PK and average detector modes for frequencies above 1 GHz.

7.6 Corrected Factor & Margin Calculation

The Correct Factor 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:

Correct Factor = 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 -7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

Margin = Result –Limit

7.7 Test Results Summary

According to the data in the following table, the EUT complied with the FCC §15.209 Limit. Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$Lm + U(Lm) \leq Llim + Ucispr$

In BACL, U(Lm) is less than Ucispr, if Lm is less than Llim, it implies that the EUT complies with the limit.

7.8 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
966A Room					
Bilog Antenna	Sunol & Mini-Circuits	JB6/ UNAT-6+	A050115 / 15542_01	2017/12/20	2018/12/19
Horn Antenna	EMCO	3115	9311-4158	2017/05/31	2018/05/30
Horn Antenna	ETS-Lindgren	3116	00062638	2017/09/02	2018/09/01
Preamplifier	Sonoma	310N	130602	2017/07/03	2018/07/02
Preamplifier	EMEC	EM01G18G	060697	2017/04/14	2018/04/13
Preamplifier	EMEC	EM18G40G	060656	2018/01/15	2019/01/14
EMI Test Receiver	R & S	ESR7	101419	2017/11/06	2018/11/05
Spectrum Analyzer	Rohde & Schwarz	FSV40	101203	2017/07/13	2018/07/12
Microflex Cable	UTIFLEX	UFB311A-Q-1440-300300	220490-006	2017/10/31	2018/10/30
Microflex Cable	UTIFLEX	UFA210A-1-3149-300300	MFR64639 226389-001	2017/11/10	2018/11/09
Microflex Cable	ROSNOL	K1K50-UP0264-K1K50-450CM	160309-1	2017/03/24	2018/03/23
Microflex Cable	ROSNOL	K1K50-UP0264-K1K50-80CM	160309-2	2018/01/29	2019/01/28
Turn Table	Champro	TT-2000	060772-T	N.C.R	N.C.R
Antenna Tower	Champro	AM-BS-4500-B	060772-A	N.C.R	N.C.R
Controller	Champro	EM1000	060772	N.C.R	N.C.R
Software	Farad	EZ_EMC	BACL-03A1	N.C.R	N.C.R
Conducted Room					
Spectrum Analyzer	Rohde & Schwarz	FSU26	200268	2017/05/08	2018/05/07
Cable	WOKEN	SFL402	S02-160323-07	2017/02/22	2018/02/21

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

7.9 Test Environmental Conditions

Temperature:	25° C
Relative Humidity:	58 %
ATM Pressure:	1010 hPa

The testing was performed by Ian Tu from 2018-01-02 to 2018-01-05

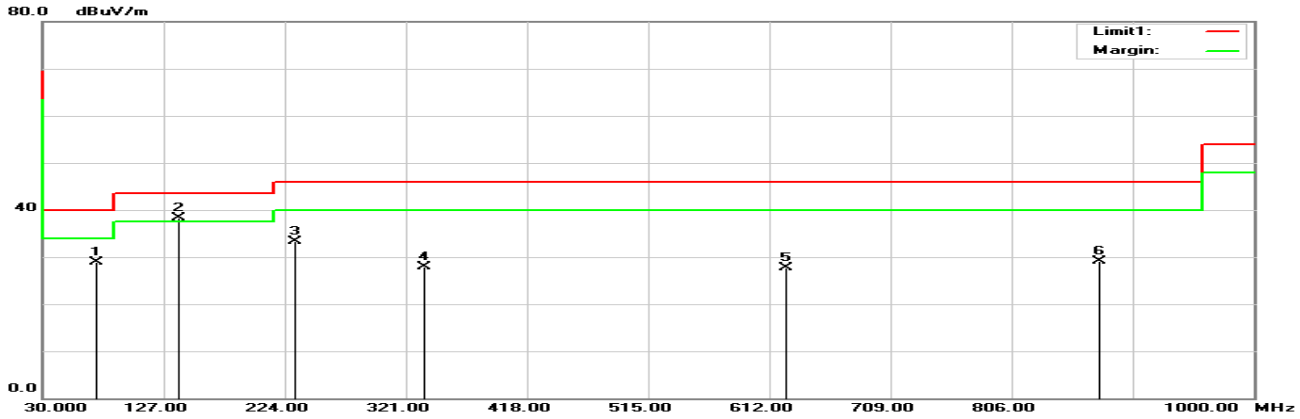
7.10 Test Results

Mode: *Transmitting Mode*

BT Mode *(Pre-scan with three orthogonal axis, and worse case as Z axis)*

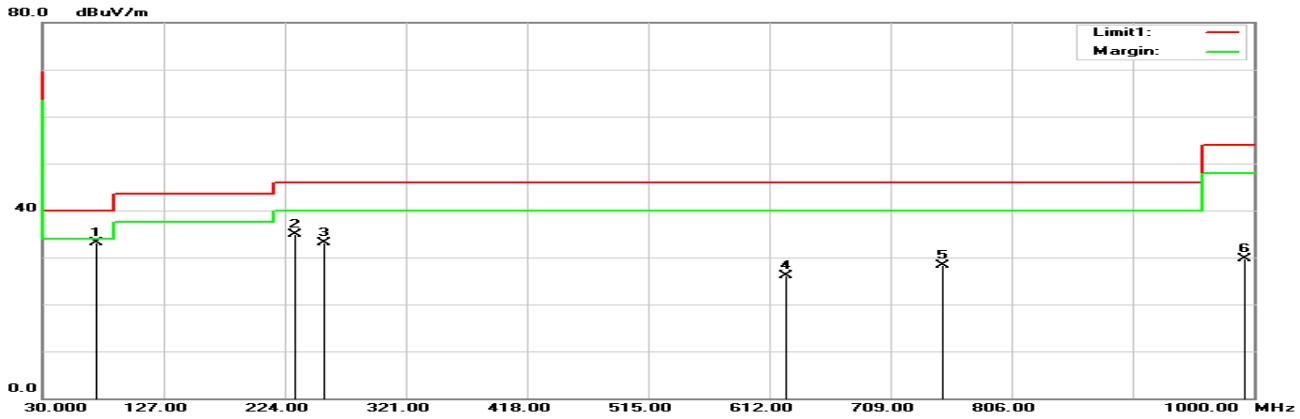
Below 1G (30 MHz-1 GHz) test the output power worst mode: Worst case is BR (GFSK) Low Channel

Horizontal



Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (˚)	Remark
73.6500	45.78	-16.89	28.89	40.00	-11.11	100	187	peak
139.6100	49.36	-10.99	38.37	43.50	-5.13	100	31	peak
231.7600	45.53	-12.30	33.23	46.00	-12.77	100	82	peak
335.5500	37.13	-9.13	28.00	46.00	-18.00	100	215	peak
625.5800	31.37	-3.66	27.71	46.00	-18.29	100	37	peak
875.8400	28.24	0.87	29.11	46.00	-16.89	100	51	peak

Vertical

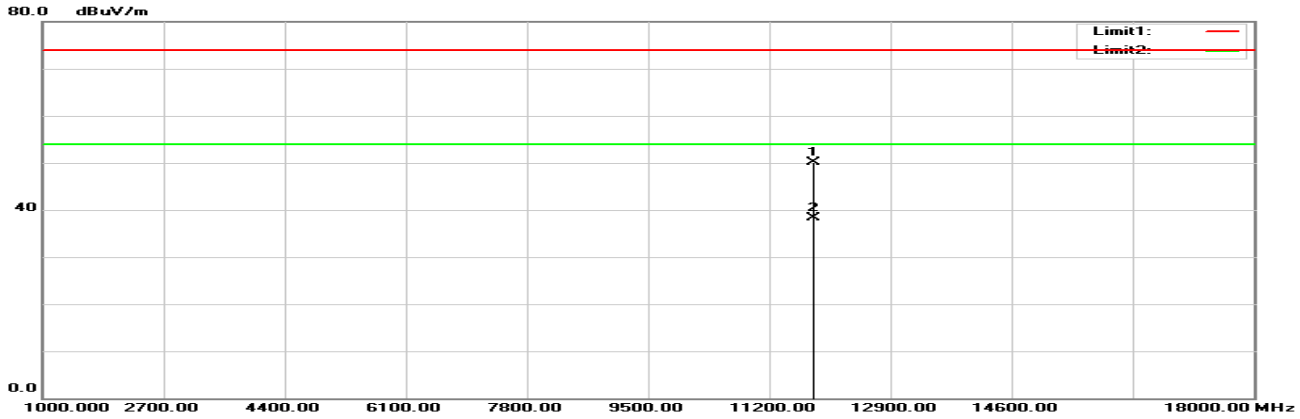


Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (˚)	Remark
73.6500	50.01	-16.89	33.12	40.00	-6.88	100	360	peak
232.7300	47.15	-12.27	34.88	46.00	-11.12	100	1	peak
256.0100	44.86	-11.67	33.19	46.00	-12.81	100	159	peak
625.5800	29.85	-3.66	26.19	46.00	-19.81	100	86	peak
750.7100	30.19	-1.80	28.39	46.00	-17.61	100	64	peak
993.2100	26.06	3.69	29.75	54.00	-24.25	100	39	peak

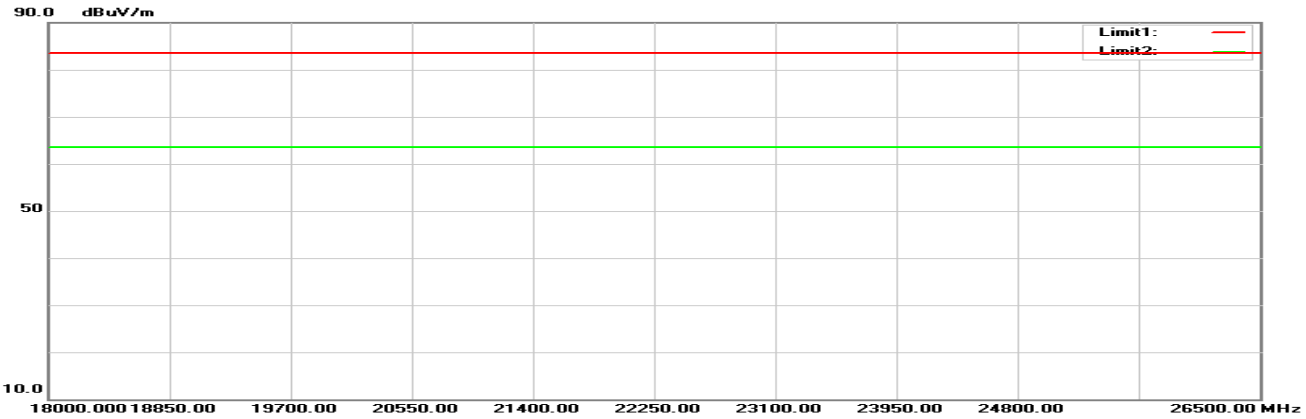
Above 1G (1 GHz-26.5 GHz) test the output power worst mode: Worst case is EDR mode (8DPSK) High channel)

Horizontal

1GHz-18GHz:

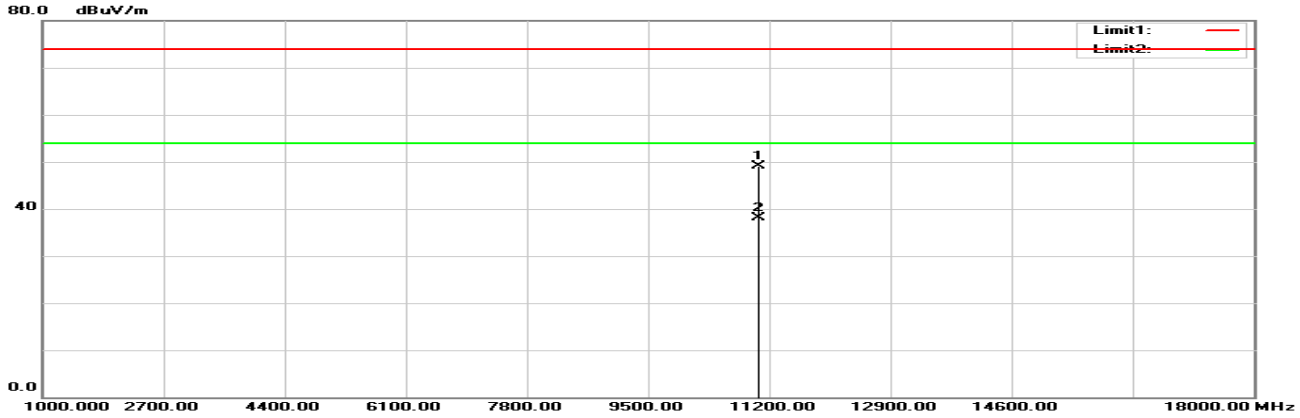


18GHz-26.5GHz:

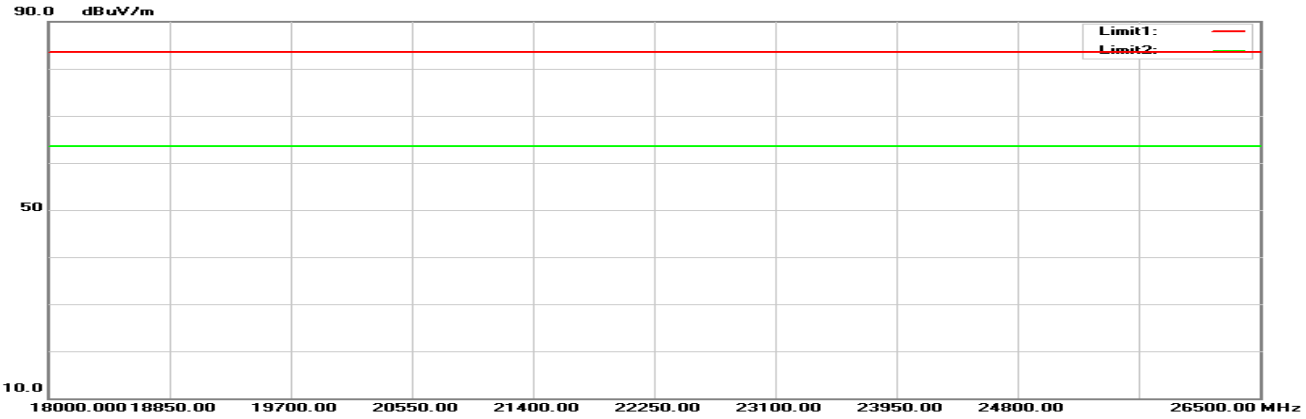


Vertical

1GHz-18GHz:



18GHz-26.5GHz:



BR mode (GFSK):

Horizontal

Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (˚)	Remark
Low Channel								
2356.360	45.99	-4.96	41.03	74.00	-32.97	150	244	peak
2356.360	30.04	-4.96	25.08	54.00	-28.92	150	244	AVG
2402.150	87.91	-4.86	83.05	N/A	N/A	150	350	peak
2402.150	75.81	-4.86	70.95	N/A	N/A	150	350	AVG
9177.000	36.73	10.52	47.25	74.00	-26.75	150	72	peak
9177.000	23.62	10.52	34.14	54.00	-19.86	150	72	AVG
Mid Channel								
2388.850	46.48	-4.89	41.59	74.00	-32.41	150	243	peak
2388.850	29.79	-4.89	24.90	54.00	-29.10	150	243	AVG
2440.910	88.14	-4.76	83.38	N/A	N/A	150	350	peak
2440.910	76.60	-4.76	71.84	N/A	N/A	150	350	AVG
2484.040	49.45	-4.68	44.77	74.00	-29.23	150	282	peak
2484.040	30.40	-4.68	25.72	54.00	-28.28	150	282	AVG
9228.000	36.99	10.60	47.59	74.00	-26.41	150	122	peak
9228.000	23.89	10.60	34.49	54.00	-19.51	150	122	AVG
High Channel								
2479.930	85.39	-4.68	80.71	N/A	N/A	150	348	peak
2479.930	73.36	-4.68	68.68	N/A	N/A	150	348	AVG
2485.090	49.30	-4.67	44.63	74.00	-29.37	150	282	peak
2485.090	30.64	-4.67	25.97	54.00	-28.03	150	282	AVG
9160.000	37.04	10.49	47.53	74.00	-26.47	150	191	peak
9160.000	26.24	10.49	36.73	54.00	-17.27	150	191	AVG

Result = Reading + Correct Factor
Margin = Result – Limit
Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain
Spurious emissions more than 20 dB below the limit were not reported

Vertical

Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
Low Channel								
2381.155	44.64	-4.91	39.73	74.00	-34.27	150	234	peak
2381.155	32.17	-4.91	27.26	54.00	-26.74	150	234	AVG
2402.150	94.63	-4.86	89.77	N/A	N/A	150	310	peak
2402.150	80.80	-4.86	75.94	N/A	N/A	150	310	AVG
8582.000	36.74	9.68	46.42	74.00	-27.58	150	283	peak
8582.000	24.28	9.68	33.96	54.00	-20.04	150	283	AVG
Mid Channel								
2377.830	44.05	-4.92	39.13	74.00	-34.87	150	232	peak
2377.830	31.76	-4.92	26.84	54.00	-27.16	150	232	AVG
2441.100	94.10	-4.76	89.34	N/A	N/A	150	311	peak
2441.100	80.49	-4.76	75.73	N/A	N/A	150	311	AVG
2493.160	45.02	-4.66	40.36	74.00	-33.64	150	278	peak
2493.160	30.02	-4.66	25.36	54.00	-28.64	150	278	AVG
8939.000	37.41	10.15	47.56	74.00	-26.44	150	98	peak
8939.000	23.56	10.15	33.71	54.00	-20.29	150	98	AVG
High Channel								
2479.810	91.21	-4.68	86.53	N/A	N/A	150	311	peak
2479.810	78.00	-4.68	73.32	N/A	N/A	150	311	AVG
2483.920	45.56	-4.68	40.88	74.00	-33.12	150	294	peak
2483.920	30.28	-4.68	25.60	54.00	-28.40	150	294	AVG
7222.000	39.24	6.63	45.87	74.00	-28.13	150	344	peak
7222.000	25.39	6.63	32.02	54.00	-21.98	150	344	AVG

Result = Reading + Correct Factor
Margin = Result – Limit
Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain
Spurious emissions more than 20 dB below the limit were not reported

EDR mode (8DPSK):

Horizontal

Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (˚)	Remark
Low Channel								
2377.165	47.32	-4.92	42.40	74.00	-31.60	150	241	peak
2377.165	32.20	-4.92	27.28	54.00	-26.72	150	241	AVG
2402.055	83.86	-4.86	79.00	N/A	N/A	150	350	peak
2402.055	70.62	-4.86	65.76	N/A	N/A	150	350	AVG
8582.000	38.42	9.68	48.10	74.00	-25.90	150	2	peak
8582.000	24.31	9.68	33.99	54.00	-20.01	150	2	AVG
Mid Channel								
2366.050	46.66	-4.93	41.73	74.00	-32.27	150	242	peak
2366.050	32.75	-4.93	27.82	54.00	-26.18	150	242	AVG
2441.100	84.04	-4.76	79.28	N/A	N/A	150	349	peak
2441.100	69.74	-4.76	64.98	N/A	N/A	150	349	AVG
2490.880	49.51	-4.66	44.85	74.00	-29.15	150	283	peak
2490.880	30.86	-4.66	26.20	54.00	-27.80	150	283	AVG
9194.000	36.56	10.54	47.10	74.00	-26.90	150	342	peak
9194.000	25.97	10.54	36.51	54.00	-17.49	150	342	AVG
High Channel								
2479.930	81.31	-4.68	76.63	N/A	N/A	150	349	peak
2479.930	67.96	-4.68	63.28	N/A	N/A	150	349	AVG
2486.110	49.81	-4.67	45.14	74.00	-28.86	150	281	peak
2486.110	30.21	-4.67	25.54	54.00	-28.46	150	281	AVG
11812.000	36.83	13.35	50.18	74.00	-23.82	150	244	peak
11812.000	24.99	13.35	38.34	54.00	-15.66	150	244	AVG

Result = Reading + Correct Factor
Margin = Result – Limit
Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain
Spurious emissions more than 20 dB below the limit were not reported

Vertical

Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
Low Channel								
2379.350	44.91	-4.91	40.00	74.00	-34.00	150	228	peak
2379.350	33.81	-4.91	28.90	54.00	-25.10	150	228	AVG
2402.055	90.54	-4.86	85.68	N/A	N/A	150	308	peak
2402.055	74.76	-4.86	69.90	N/A	N/A	150	308	AVG
8684.000	37.11	9.81	46.92	74.00	-27.08	150	202	peak
8684.000	25.39	9.81	35.20	54.00	-18.80	150	202	AVG
Mid Channel								
2339.830	44.01	-5.01	39.00	74.00	-35.00	150	249	peak
2339.830	29.85	-5.01	24.84	54.00	-29.16	150	249	AVG
2441.100	90.16	-4.76	85.40	N/A	N/A	150	311	peak
2441.100	74.53	-4.76	69.77	N/A	N/A	150	311	AVG
2488.790	43.13	-4.67	38.46	74.00	-35.54	150	259	peak
2488.790	30.27	-4.67	25.60	54.00	-28.40	150	259	AVG
8055.000	37.81	8.46	46.27	74.00	-27.73	150	359	peak
8055.000	26.48	8.46	34.94	54.00	-19.06	150	359	AVG
High Channel								
2479.840	87.02	-4.68	82.34	N/A	N/A	150	312	peak
2479.840	72.12	-4.68	67.44	N/A	N/A	150	312	AVG
2497.390	44.41	-4.64	39.77	74.00	-34.23	150	287	peak
2497.390	30.22	-4.64	25.58	54.00	-28.42	150	287	AVG
11047.000	36.00	13.02	49.02	74.00	-24.98	150	82	peak
11047.000	25.01	13.02	38.03	54.00	-15.97	150	82	AVG

Result = Reading + Correct Factor
Margin = Result – Limit
Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain
Spurious emissions more than 20 dB below the limit were not reported

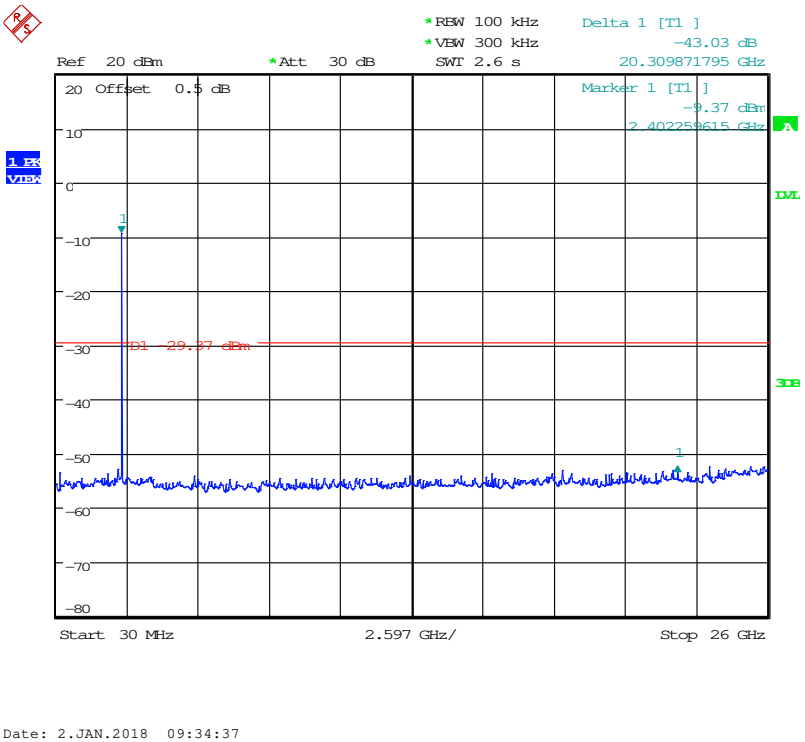
Conducted Spurious Emissions:

Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Result
BR mode (GFSK)				
Low	2402	43.03	≥ 20	Compliance
Mid	2441	40.41	≥ 20	Compliance
High	2480	39.61	≥ 20	Compliance
EDR mode (π/4-DQPSK)				
Low	2402	33.64	≥ 20	Compliance
Mid	2441	32.95	≥ 20	Compliance
High	2480	32.80	≥ 20	Compliance
EDR mode (8DPSK)				
Low	2402	34.30	≥ 20	Compliance
Mid	2441	33.38	≥ 20	Compliance
High	2480	30.43	≥ 20	Compliance

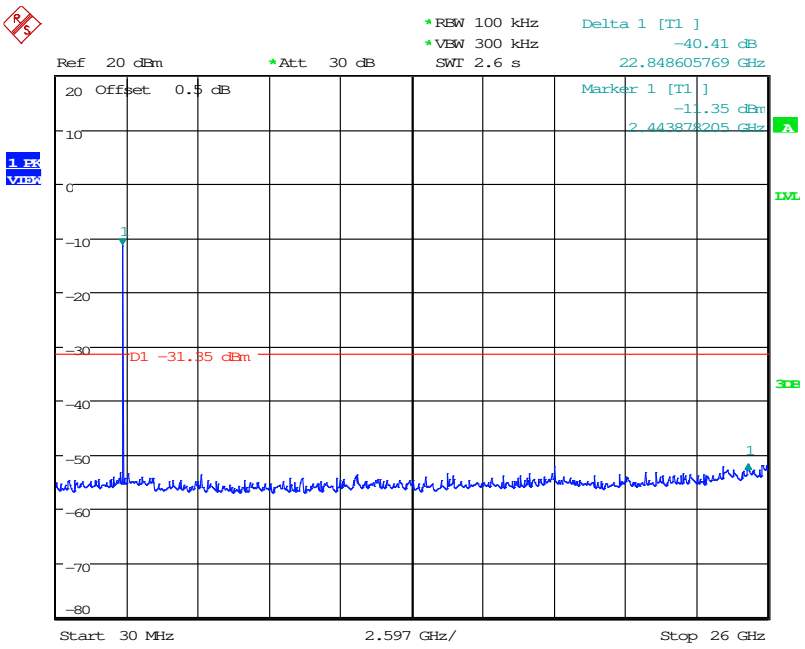
Please refer to the following plots

BR mode (GFSK):

Low Channel

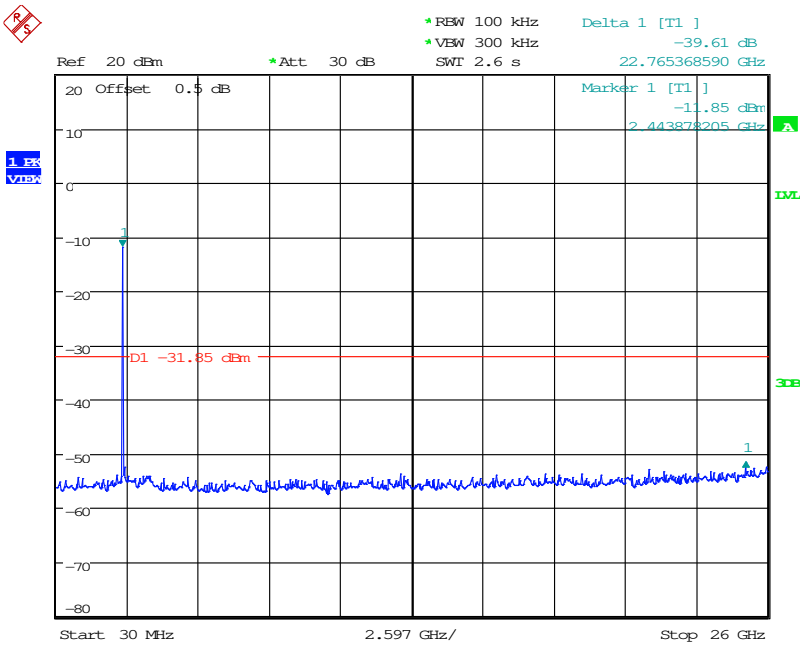


Middle Channel



Date: 2.JAN.2018 09:46:59

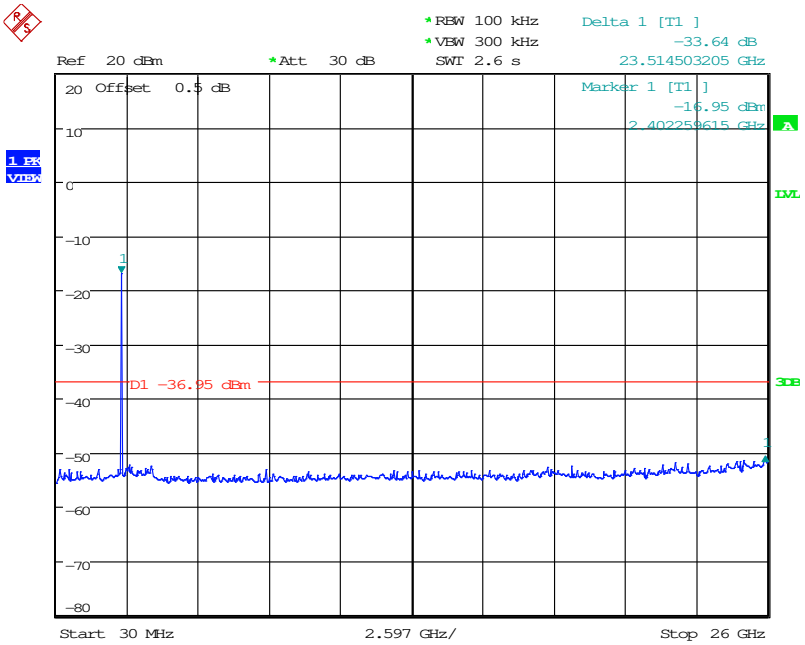
High Channel



Date: 2.JAN.2018 10:00:35

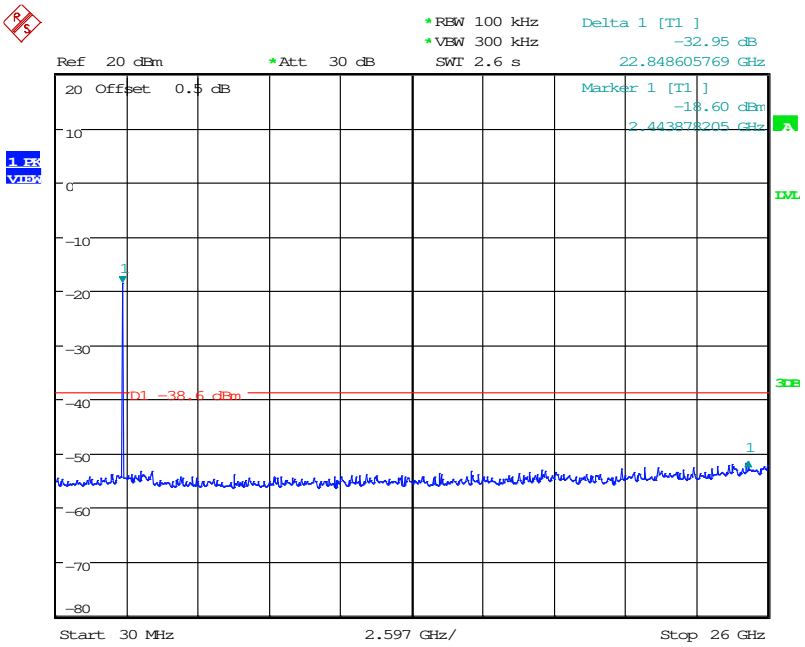
EDR mode (π/4-DQPSK):

Low Channel



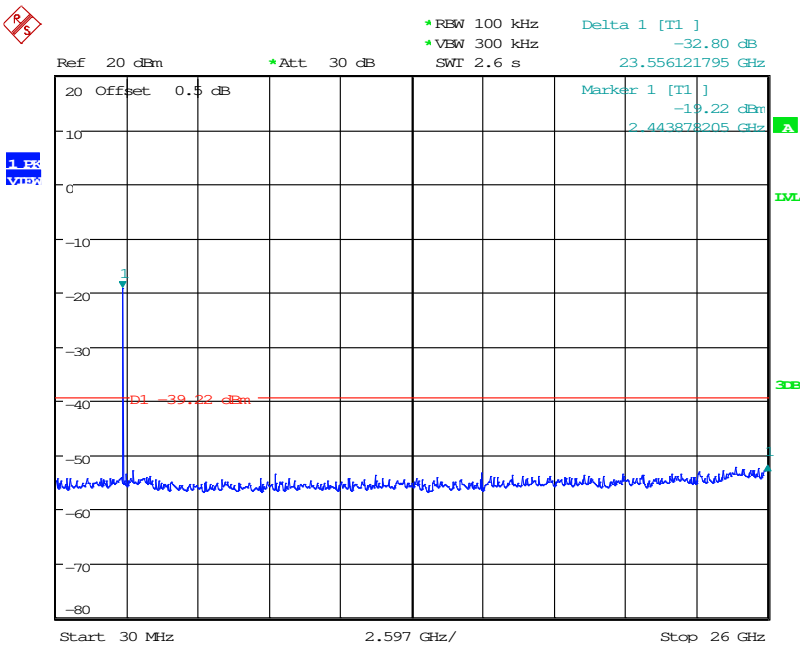
Date: 2.JAN.2018 12:09:46

Middle Channel



Date: 2.JAN.2018 12:23:24

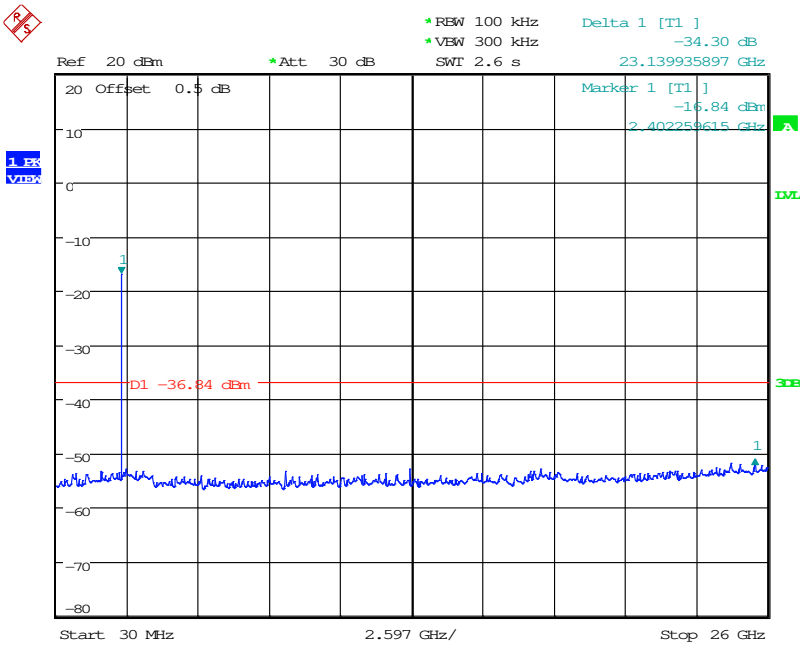
High Channel



Date: 2.JAN.2018 12:30:28

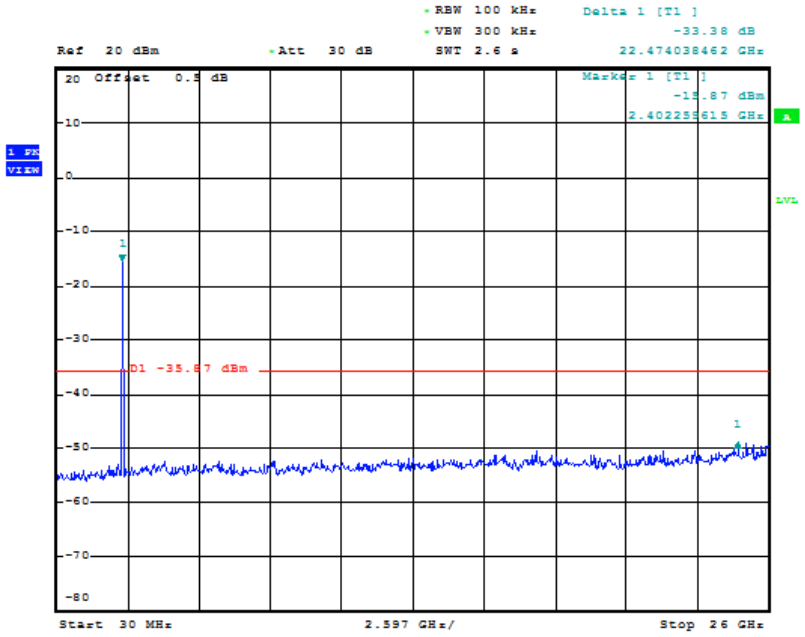
EDR mode (8DPSK):

Low Channel



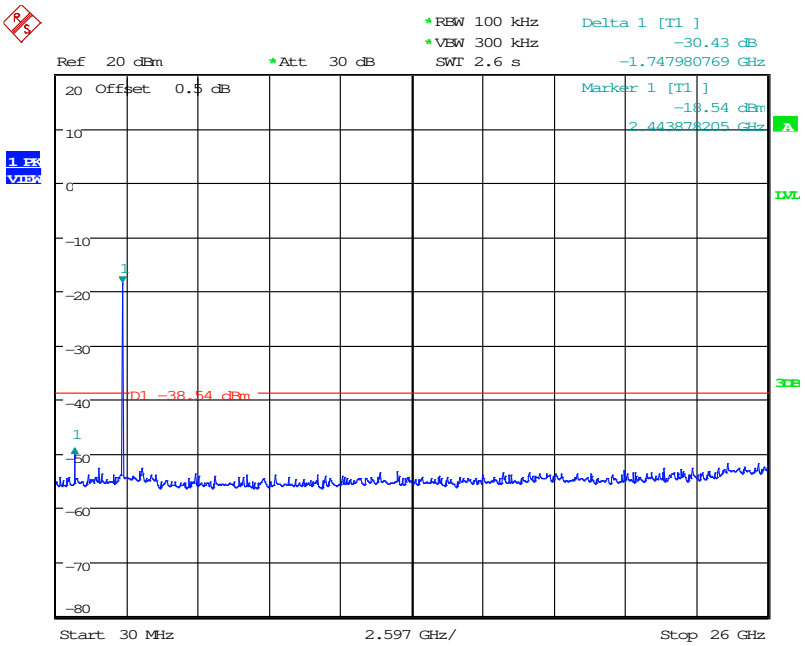
Date: 2.JAN.2018 13:05:13

Middle Channel



Date: 2.JAN.2018 13:10:22

High Channel



Date: 2.JAN.2018 13:20:59

8 FCC §15.247(a)(1) – 20 dB Emission Bandwidth

8.1 Applicable Standard

According to FCC §15.247(a) (1) the maximum 20 dB bandwidth of the hopping channel shall be presented.

8.2 Test Procedure

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

8.3 Test Equipment List and Details

Descriptions	Manufacturers	Models	Serial Numbers	Calibration Date	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSU26	200268	2017/05/08	2018/05/07
Cable	WOKEN	SFL402	S02-160323-07	2017/02/22	2018/02/21

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

8.4 Test Environmental Conditions

Temperature:	26° C
Relative Humidity:	58 %
ATM Pressure:	1010 hPa

The testing was performed by Ian Tu on 2018-01-02.

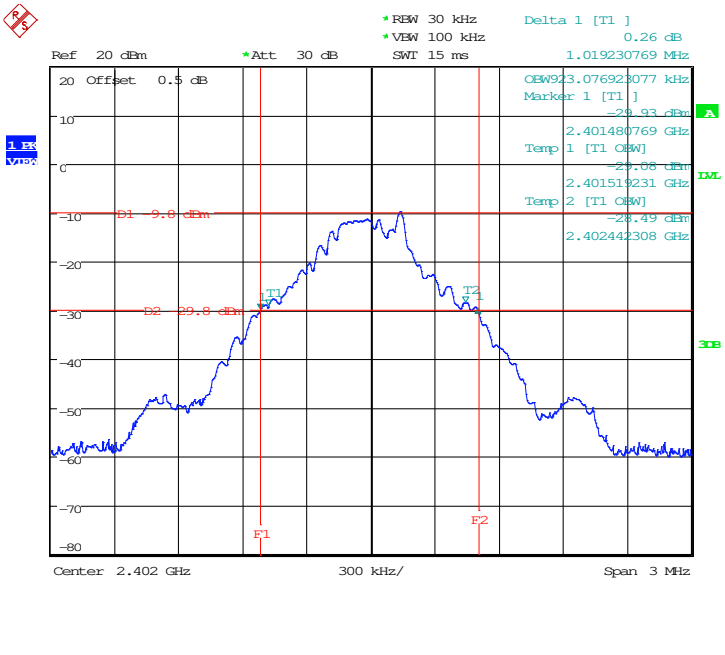
8.5 Test Results

Channel	Frequency (MHz)	20 dB OBW (MHz)
BR Mode (GFSK)		
Low	2402	1.0192
Middle	2441	1.0240
High	2480	1.0144
EDR Mode (π/4-DQPSK)		
Low	2402	1.3557
Middle	2441	1.3653
High	2480	1.3653
EDR Mode (8DPSK)		
Low	2402	1.3269
Middle	2441	1.3269
High	2480	1.3317

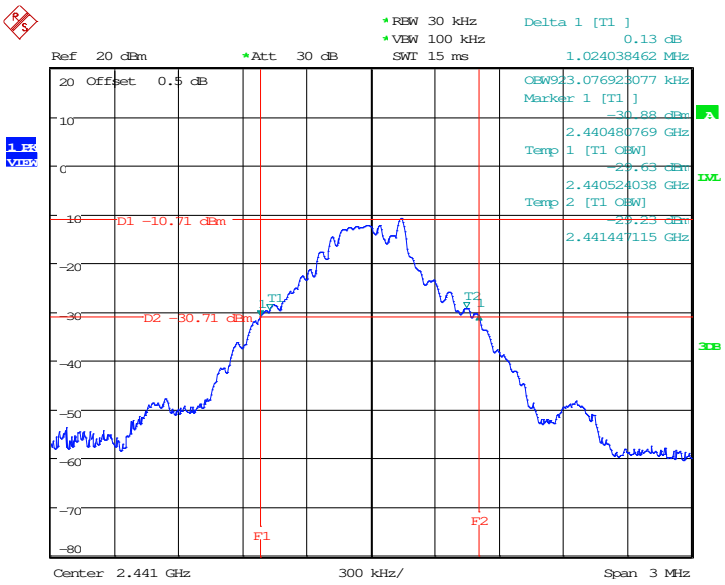
Please refer to the following plots

BR Mode (GFSK):

Low Channel

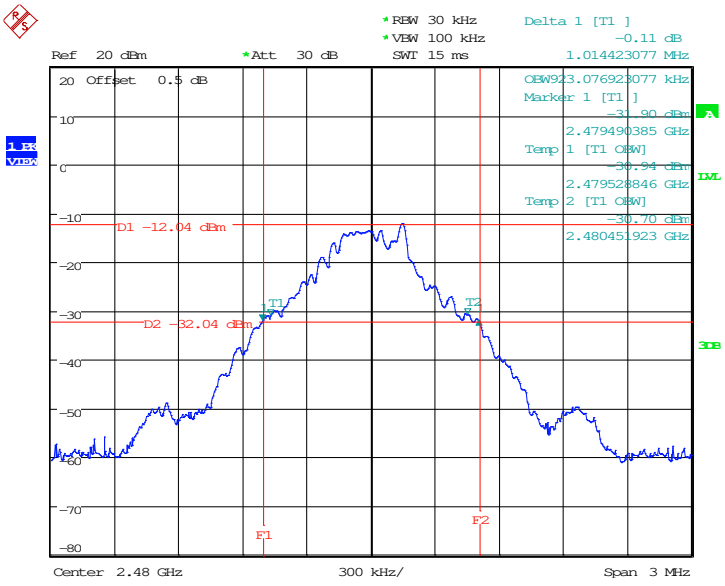


Middle Channel



Date: 2.JAN.2018 10:14:16

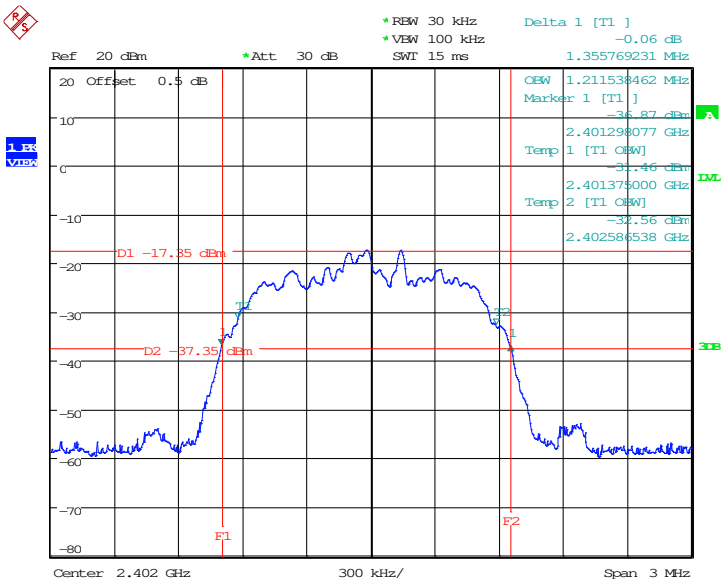
High Channel



Date: 2.JAN.2018 09:58:13

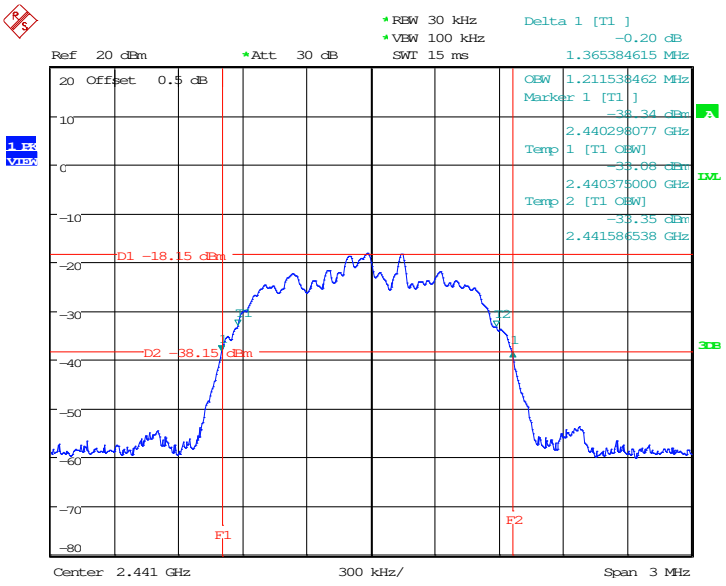
EDR Mode (π/4-DQPSK):

Low Channel



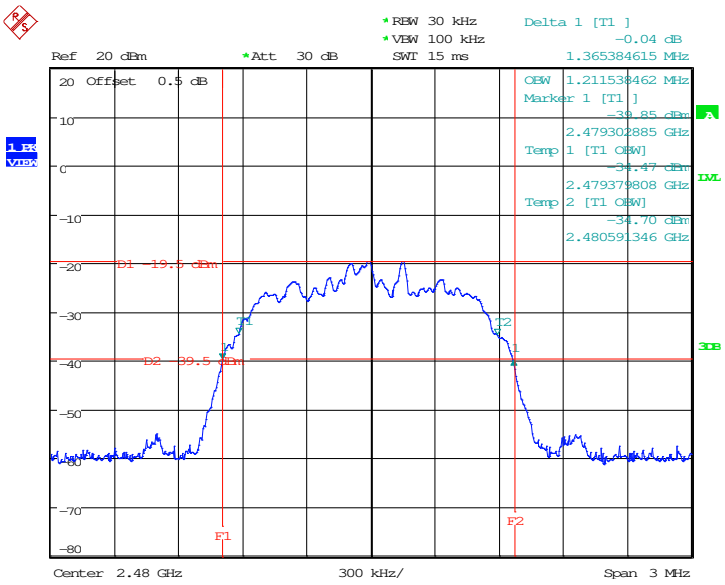
Date: 2.JAN.2018 10:53:14

Middle Channel



Date: 2.JAN.2018 12:21:58

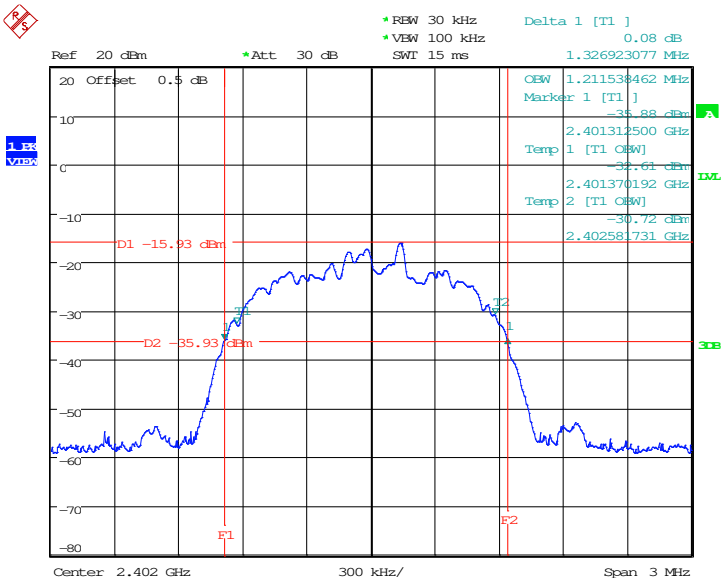
High Channel



Date: 2.JAN.2018 12:28:52

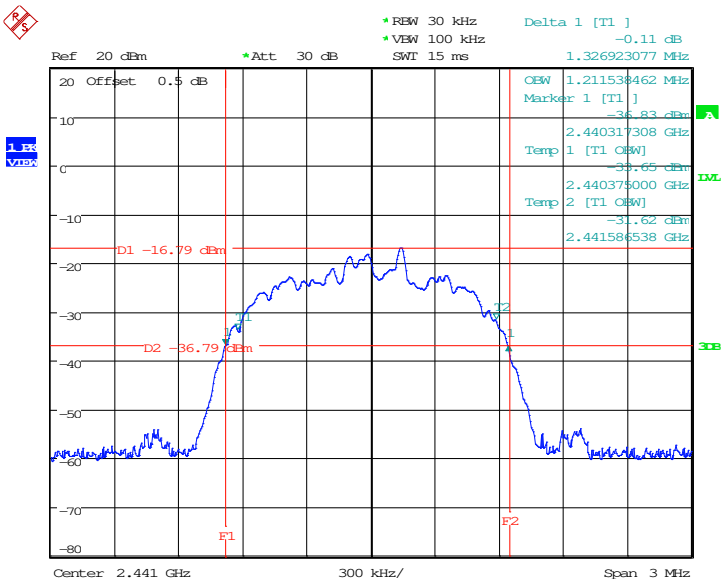
EDR Mode (8DPSK):

Low Channel



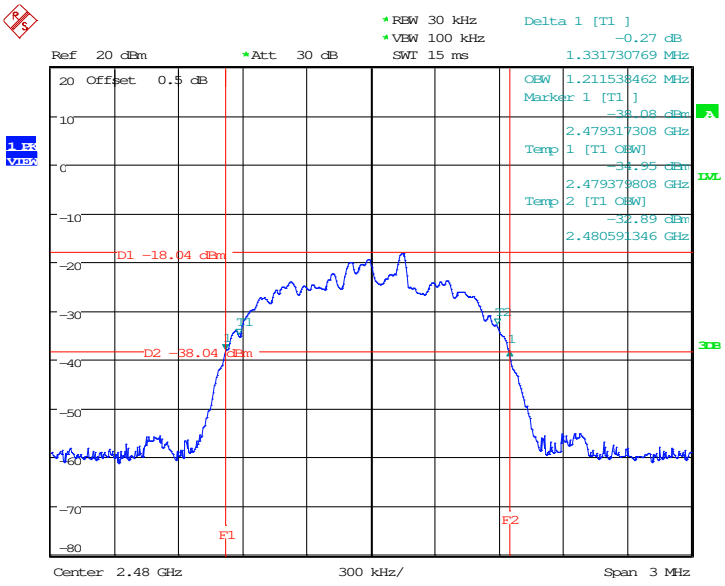
Date: 2.JAN.2018 13:01:49

Middle Channel



Date: 2.JAN.2018 13:09:18

High Channel



Date: 2.JAN.2018 13:18:38

9 FCC §15.247(a)(1) – Channel Separation Test

9.1 Applicable Standard

According to FCC §15.247(a) (1): Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

9.2 Test Procedure

Span = wide enough to capture the peaks of two adjacent channels
Resolution (or IF) Bandwidth (RBW) ≈ 30% of the channel spacing, adjust as necessary to best identify the center of each individual channel
Video (or Average) Bandwidth (VBW) ≥RBW
Sweep = auto
Detector function = peak Trace = max hold

9.3 Test Equipment List and Details

Descriptions	Manufacturers	Models	Serial Numbers	Calibration Date	Calibration Due Date
Power Sensor	KEYSIGHT	U2021XA	MY54080018	2017/03/21	2018/03/20
Cable	WOKEN	SFL402	S02-160323-07	2017/02/22	2018/02/21

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

9.4 Test Environmental Conditions

Temperature:	26° C
Relative Humidity:	58 %
ATM Pressure:	1010 hPa

The testing was performed by Ian Tu on 2018-01-02.

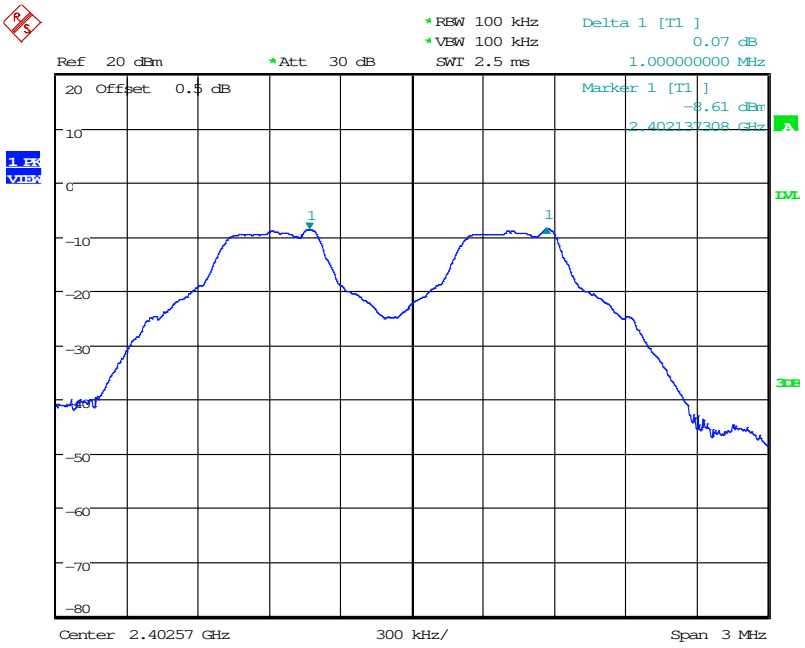
9.5 Test Results

Channel	Channel Separation (MHz)	20 dBc BW (MHz)	Two-thirds of the 20 dB bandwidth (MHz)	Limit (dBm)	Result
BR mode (GFSK)					
Low	1.0000	1.0192	0.679	>two-thirds of the 20 dB bandwidth	Compliance
Middle	1.0048	1.0240	0.683	>two-thirds of the 20 dB bandwidth	Compliance
High	1.0000	1.0144	0.676	>two-thirds of the 20 dB bandwidth	Compliance
EDR mode (π/4-DQPSK)					
Low	1.0000	1.3557	0.904	>two-thirds of the 20 dB bandwidth	Compliance
Middle	0.9999	1.3653	0.910	>two-thirds of the 20 dB bandwidth	Compliance
High	1.0000	1.3653	0.910	>two-thirds of the 20 dB bandwidth	Compliance
EDR mode (8DPSK)					
Low	1.0000	1.3269	0.885	>two-thirds of the 20 dB bandwidth	Compliance
Middle	1.0000	1.3269	0.885	>two-thirds of the 20 dB bandwidth	Compliance
High	1.0048	1.3317	0.888	>two-thirds of the 20 dB bandwidth	Compliance

Please refer to the following plots

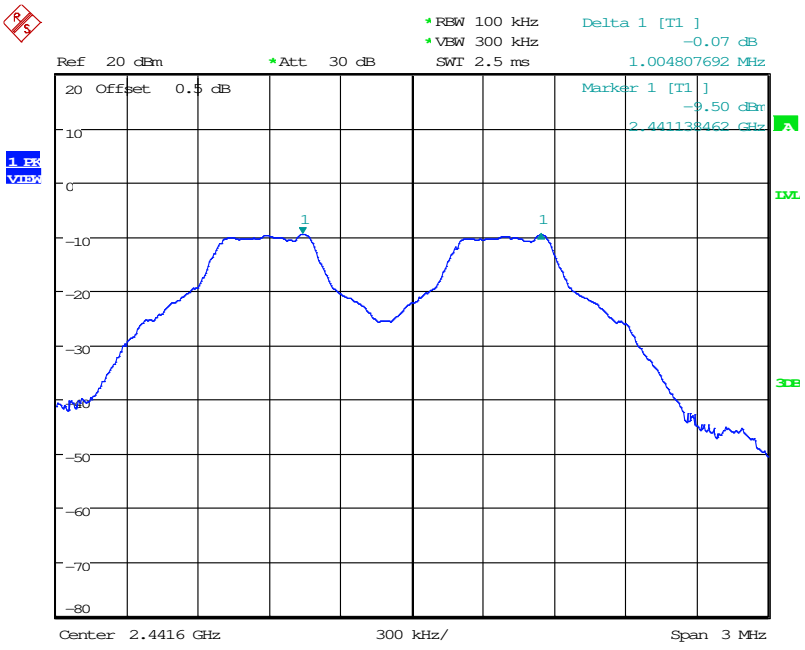
BR mode (GFSK):

Low Channel



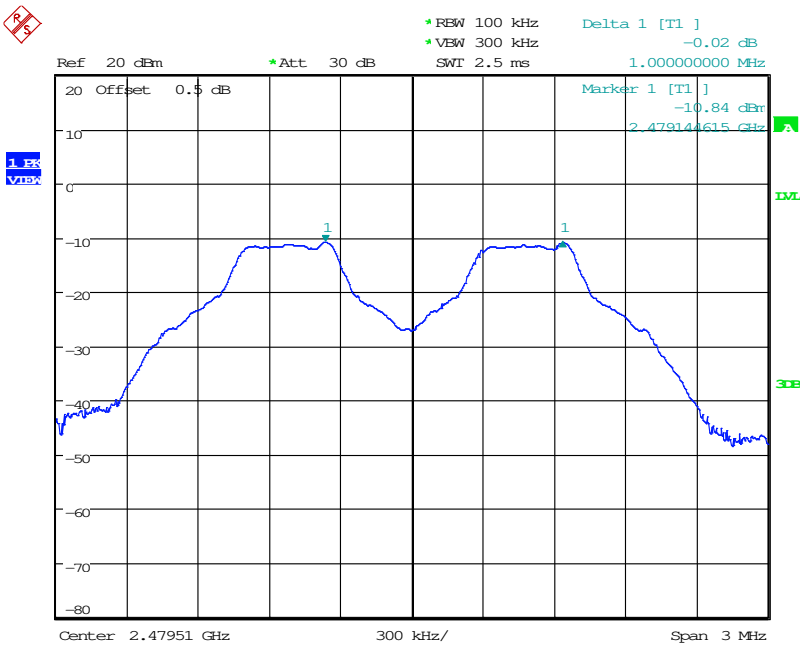
Date: 2.JAN.2018 10:11:24

Middle Channel



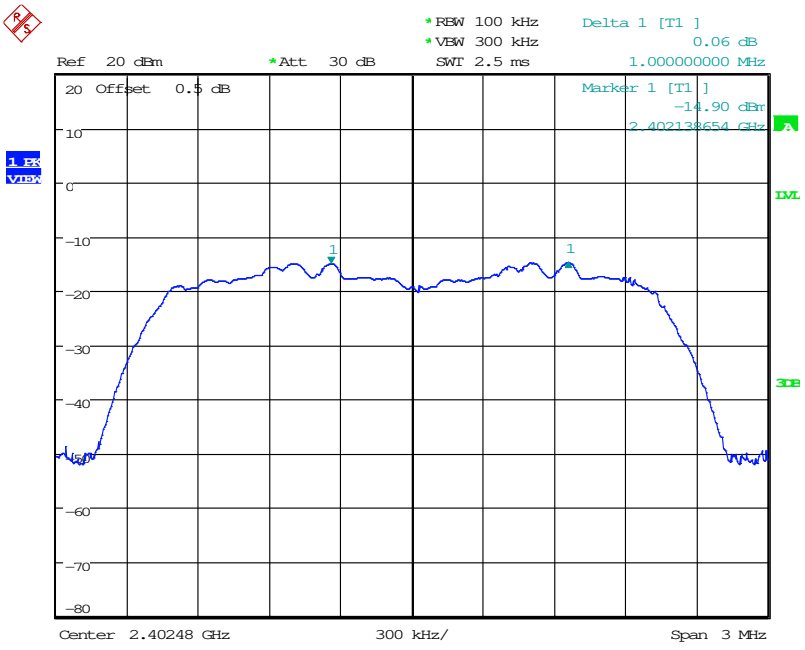
Date: 2.JAN.2018 10:16:27

High Channel

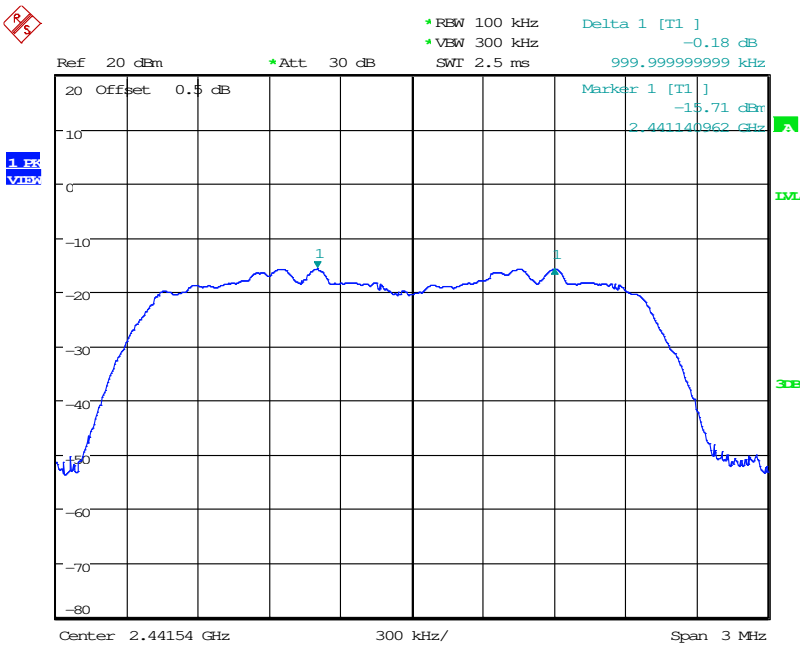


EDR mode (π/4-DQPSK):

Low Channel

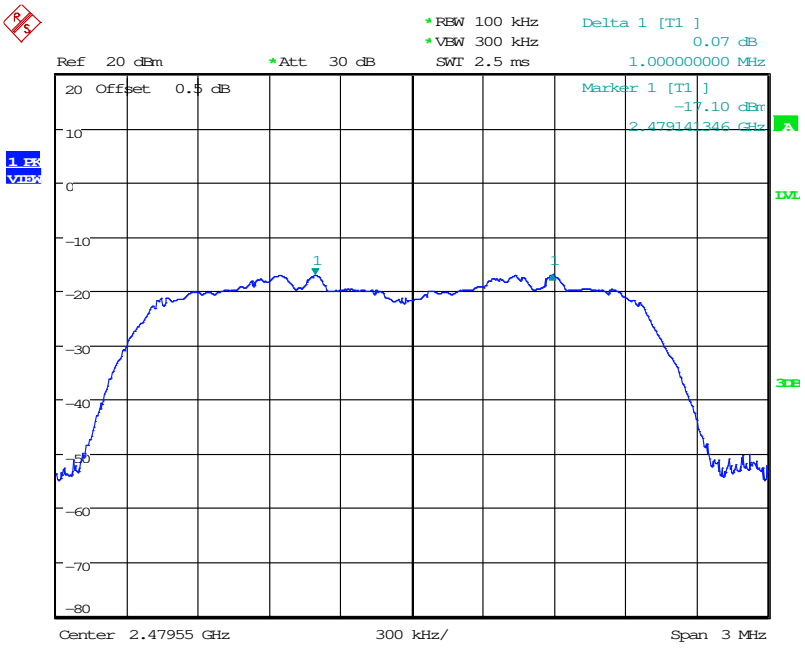


Middle Channel



Date: 2.JAN.2018 12:25:13

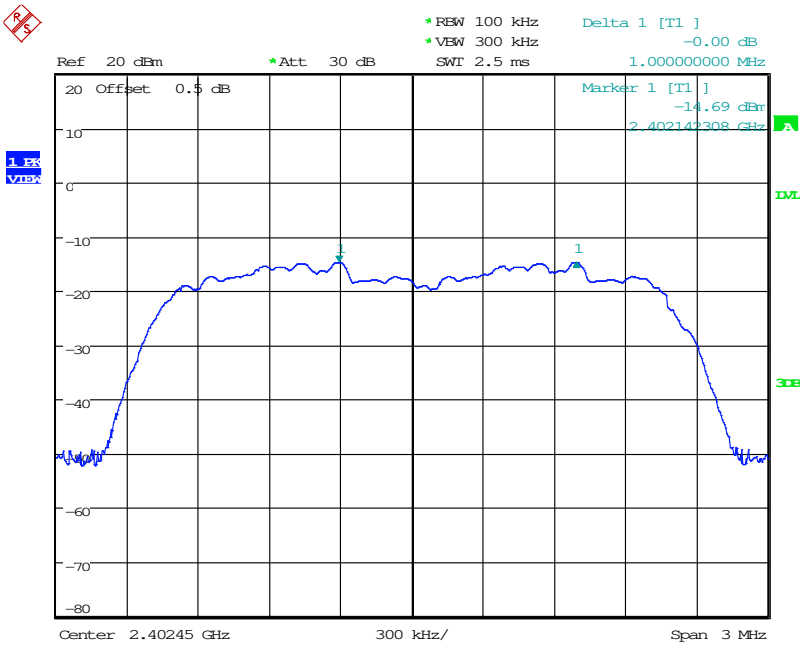
High Channel



Date: 2.JAN.2018 12:33:24

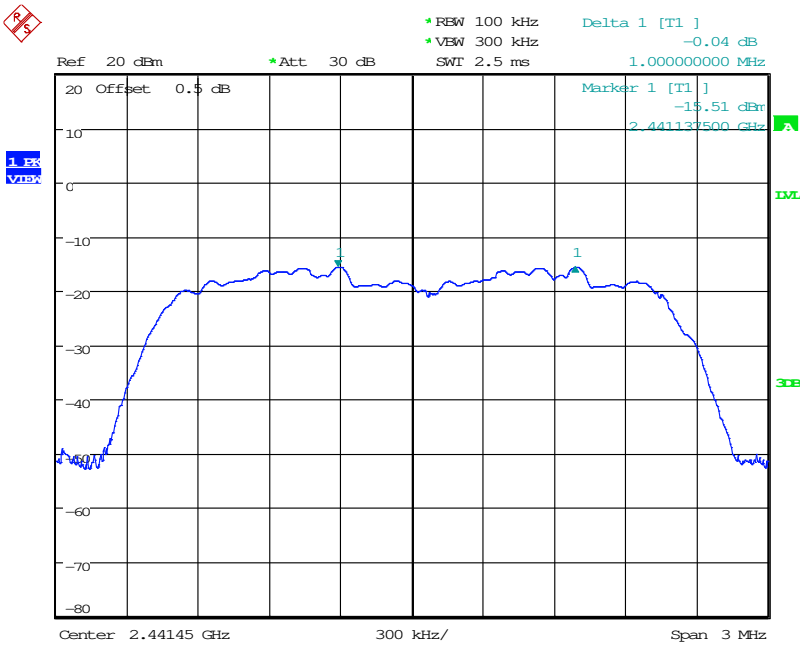
EDR mode (8DPSK):

Low Channel



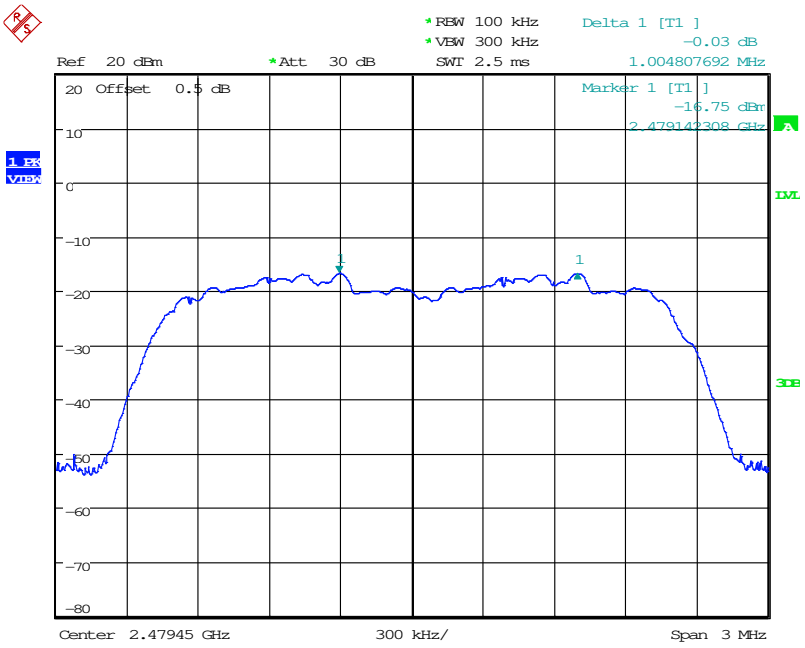
Date: 2.JAN.2018 13:16:52

Middle Channel



Date: 2.JAN.2018 13:12:24

High Channel



10 FCC §15.247(a)(1)(iii) – Time of Occupancy (Dwell Time)

10.1 Applicable Standard

According to FCC §15.247(a) (1)(iii).

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.

10.2 Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel
RBW ≤ channel spacing and where possible RBW should be set >> 1/T, where T is the expected dwell time per channel
Sweep = as necessary to capture the entire dwell time per hopping channel Detector function = peak
Trace = max hold
Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time.
Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements.
Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:
(Number of hops in the period specified in the requirements) = (number of hops on spectrum analyzer) x (period specified in the requirements / analyzer sweep time)
The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified. If the number of hops in a specific time varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation.

10.3 Test Equipment List and Details

Descriptions	Manufacturers	Models	Serial Numbers	Calibration Date	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSU26	200268	2017/05/08	2018/05/07
Cable	WOKEN	SFL402	S02-160323-07	2017/02/22	2018/02/21

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

10.4 Test Environmental Conditions

Temperature:	26° C
Relative Humidity:	58 %
ATM Pressure:	1010 hPa

The testing was performed by Ian Tu on 2018-01-02.

10.5 Test Results

Mode	Pulse Time (ms)	Hopping Number/10	Hopping Number	Period Time (s)	Total of Dwell (ms)	Limit (ms)	Result
BR mode (GFSK) : 2402-2480 MHz							
DH1	0.44	32	320	31.6	140.80	<400	Compliance
DH3	1.71	15	150	31.6	256.50	<400	Compliance
DH5	2.96	13	130	31.6	384.80	<400	Compliance
EDR mode (π/4-DQPSK) : 2402-2480 MHz							
2DH1	0.44	32	320	31.6	140.80	<400	Compliance
2DH3	1.71	15	150	31.6	256.50	<400	Compliance
2DH5	2.96	13	130	31.6	384.80	<400	Compliance
EDR mode (8DPSK) : 2402-2480 MHz							
3DH1	0.44	32	320	31.6	140.80	<400	Compliance
3DH3	1.71	15	150	31.6	256.50	<400	Compliance
3DH5	2.96	13	130	31.6	384.80	<400	Compliance

**A period time = 0.4 * 79 = 31.6 (s), Total of Dwell= Pulse Time * Hopping Number*

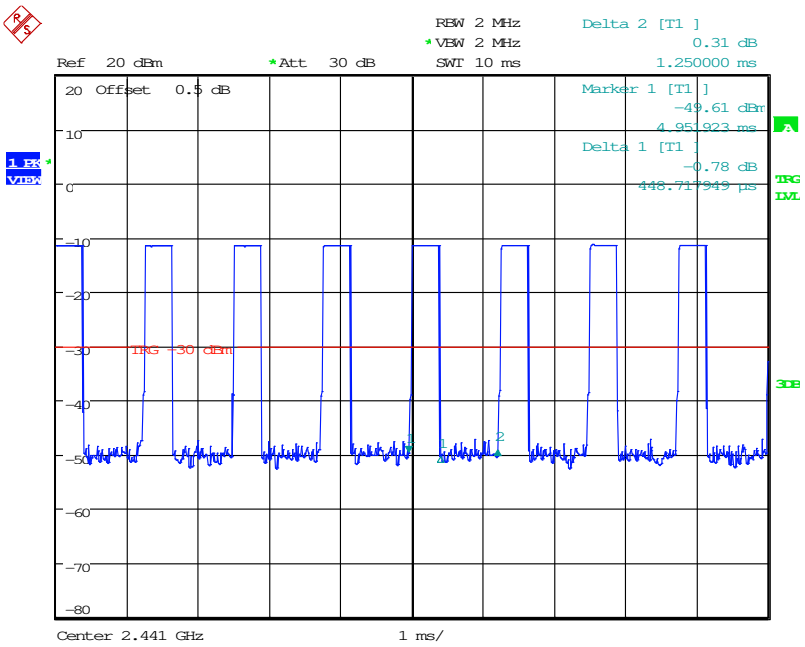
**Hopping Number = Hopping Number/10 * 10*

** Hopping Number/10 = Total of highest signals. (Second High signals were other channel)*

Please refer to the following plots

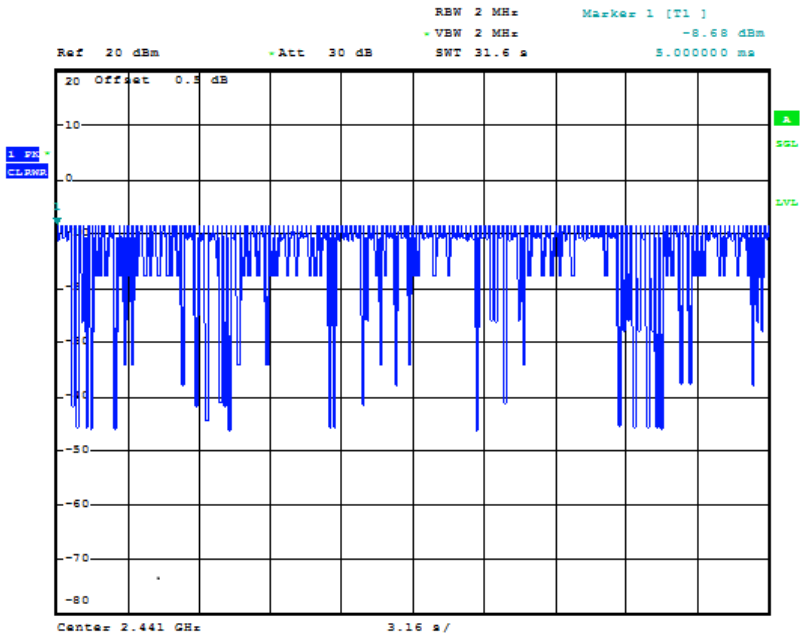
BR mode (GFSK):

DH1: Pulse Width



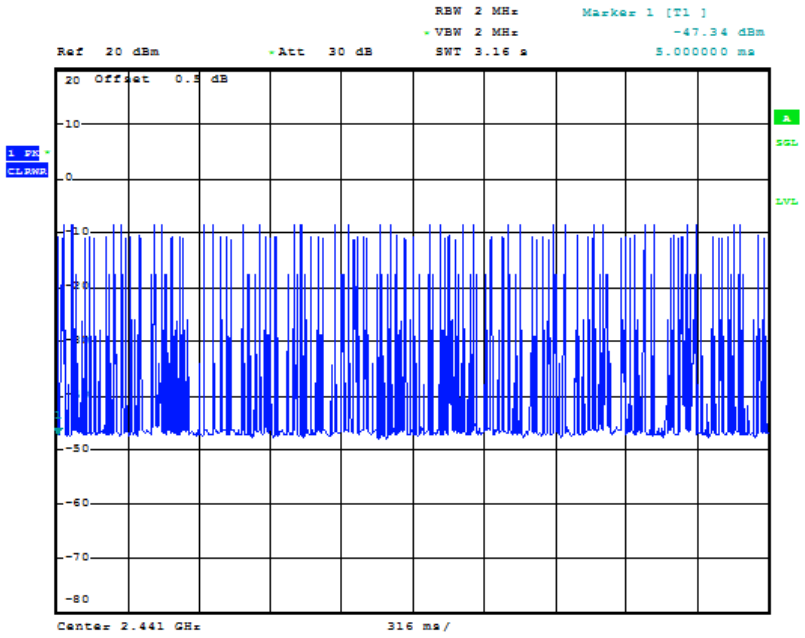
Date: 2.JAN.2018 10:27:37

DH1: Hopping Number



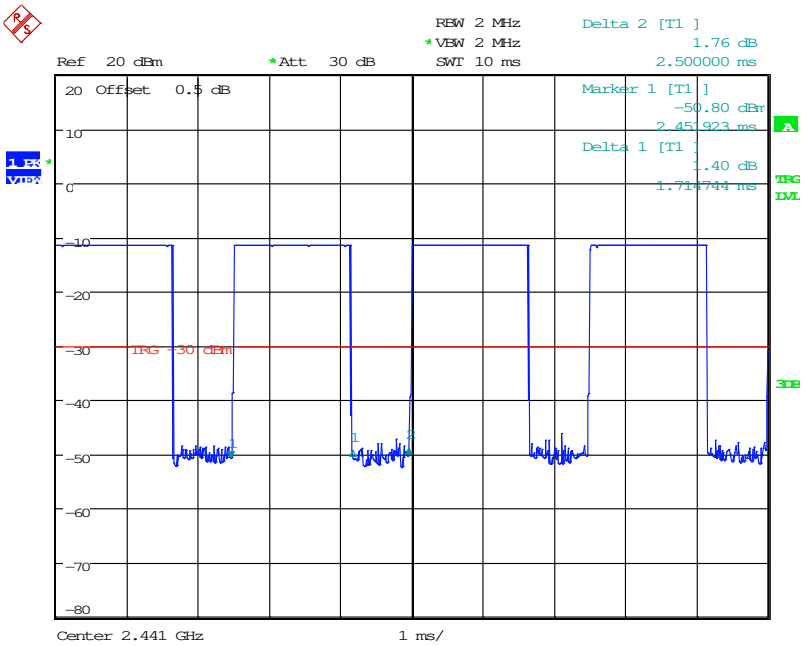
Date: 2.JAN.2018 10:30:26

DH1: Hopping Number/10
(Hopping Number = 32 in 1/10 period of highest signals, Second High signals were other channel)



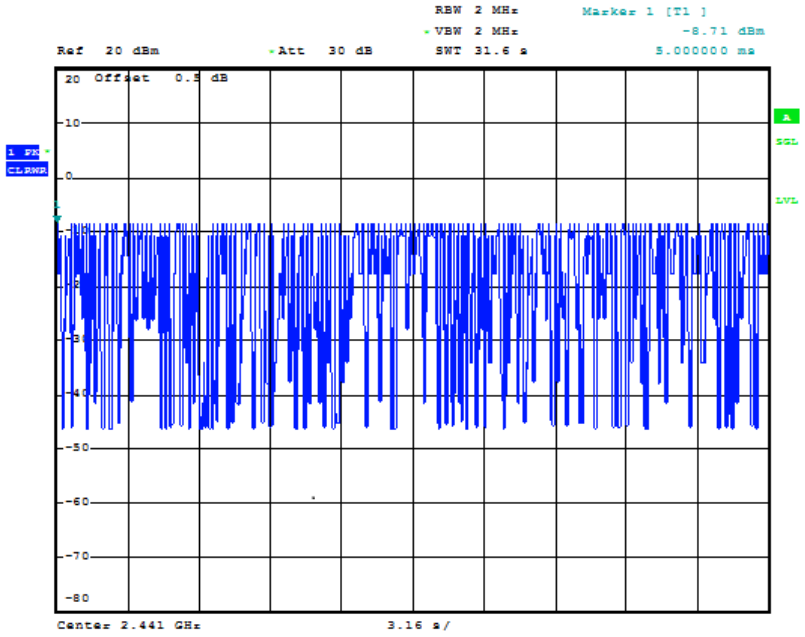
Date: 2.JAN.2018 10:29:29

DH3: Pulse Width

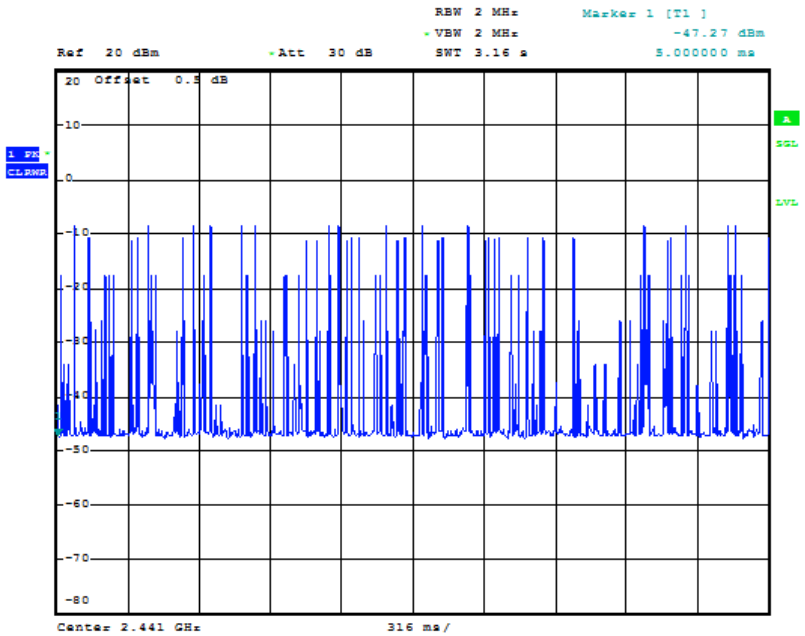


Date: 2.JAN.2018 10:27:01

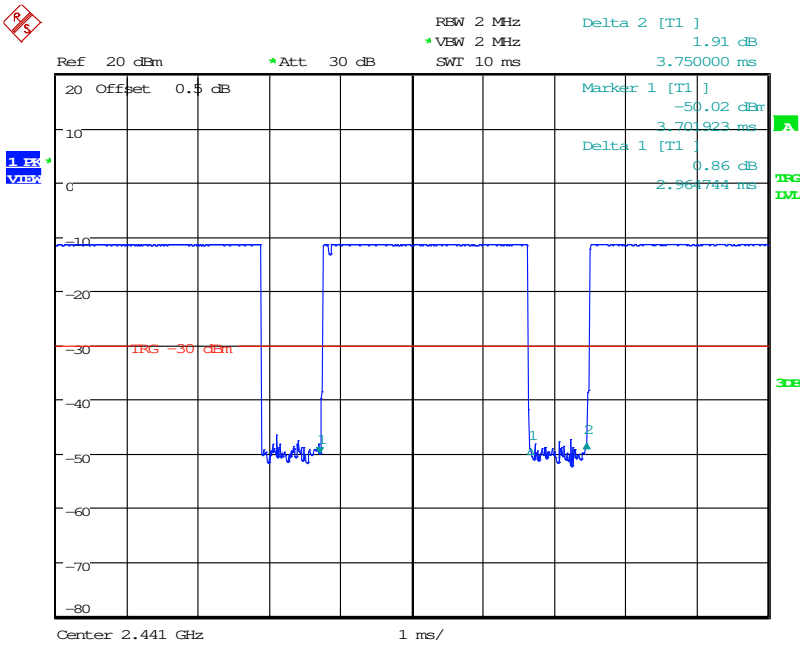
DH3: Hopping Number



DH3: Hopping Number/10
(Hopping Number = 15 in 1/10 period of highest signals, Second High signals were other channel)

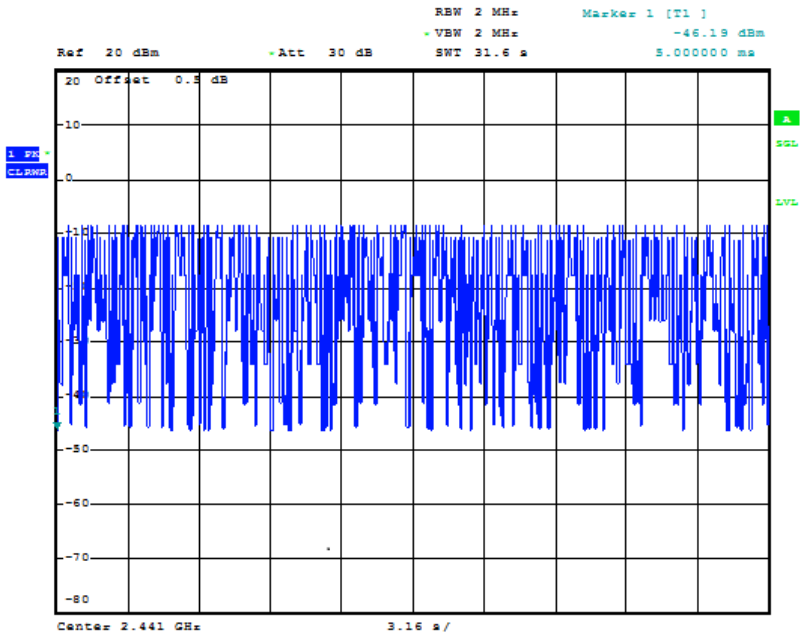


DH5: Pulse Width



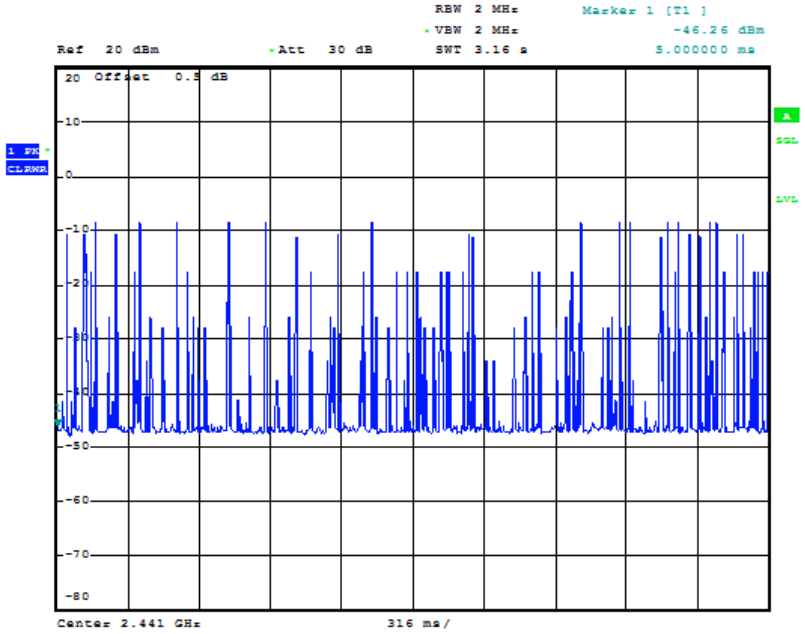
Date: 2.JAN.2018 10:26:13

DH5: Hopping Number



Date: 2.JAN.2018 10:32:27

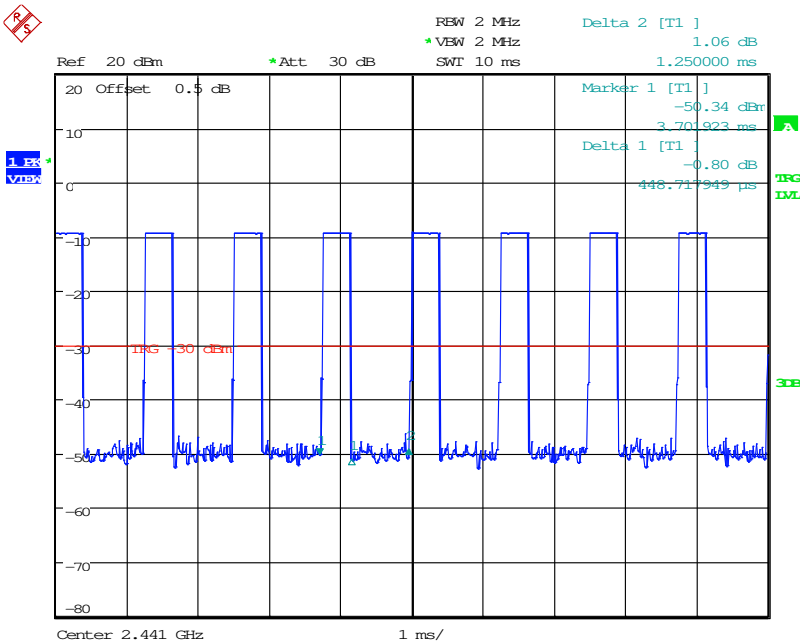
DH5: Hopping Number/10
(Hopping Number = 13 in 1/10 period of highest signals, Second High signals were other channel)



Date: 2.JAN.2018 10:31:43

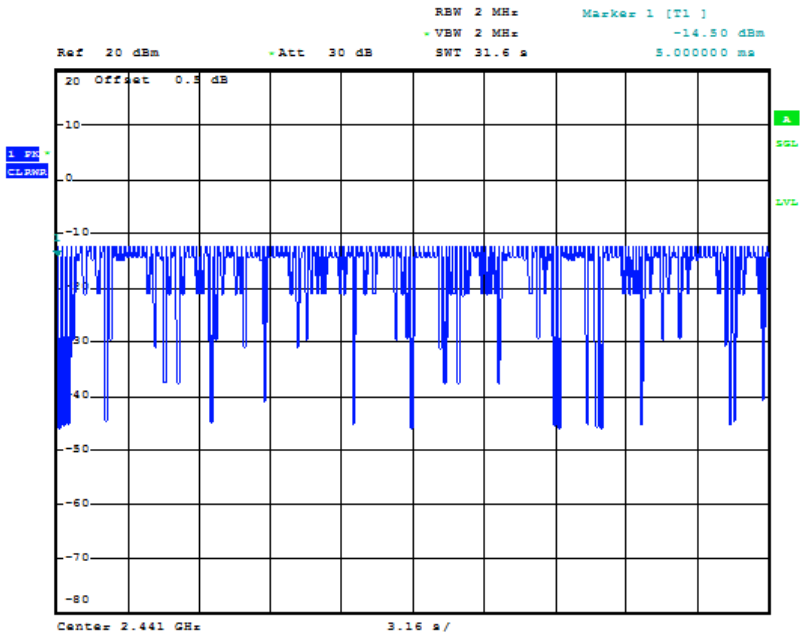
EDR mode (π/4-DQPSK):

DH1: Pulse Width



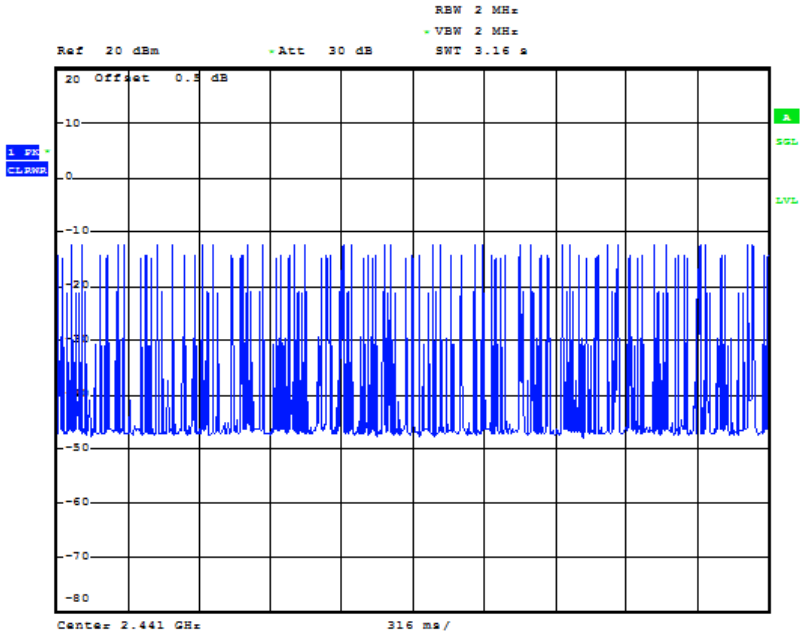
Date: 2.JAN.2018 16:40:45

DH1: Hopping Number



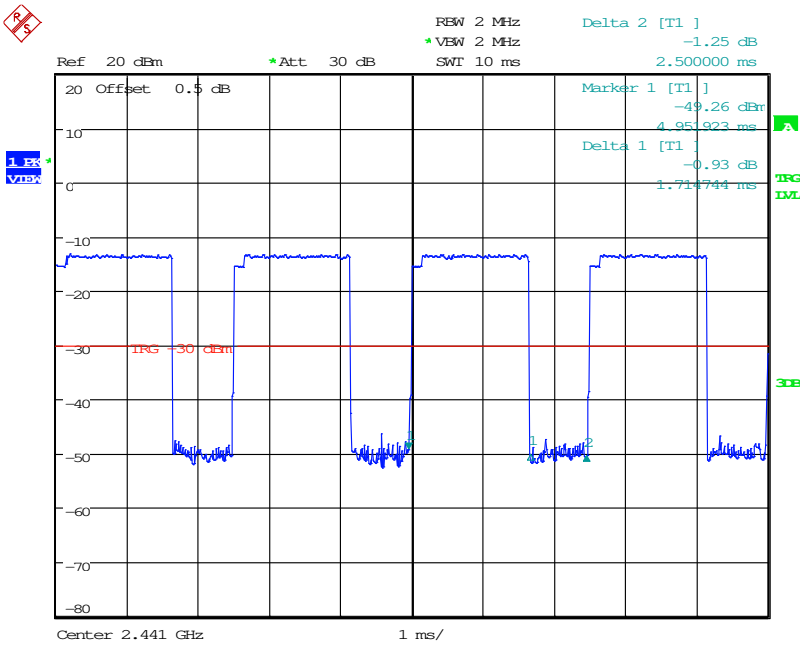
Date: 2.JAN.2018 12:41:21

DH1: Hopping Number/10
(Hopping Number = 32 in 1/10 period of highest signals, Second High signals were other channel)



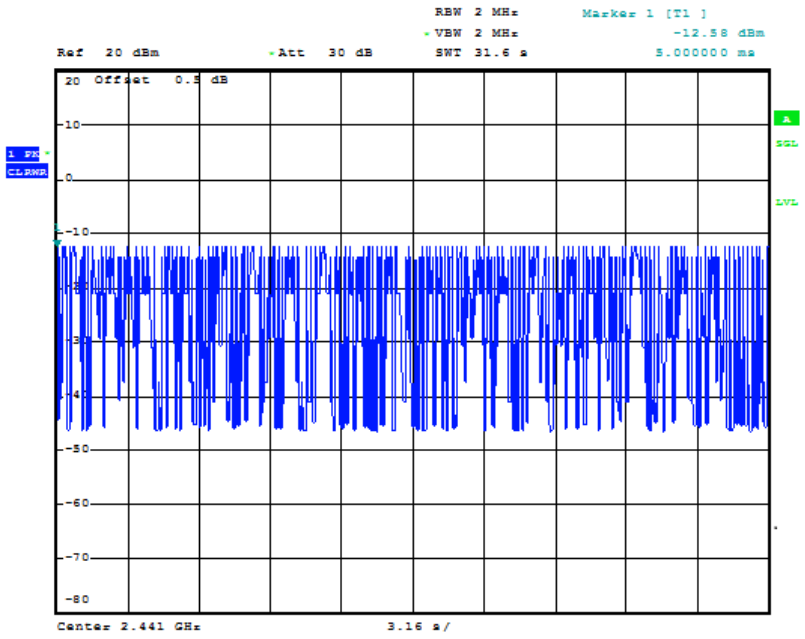
Date: 2.JAN.2018 12:40:36

DH3: Pulse Width



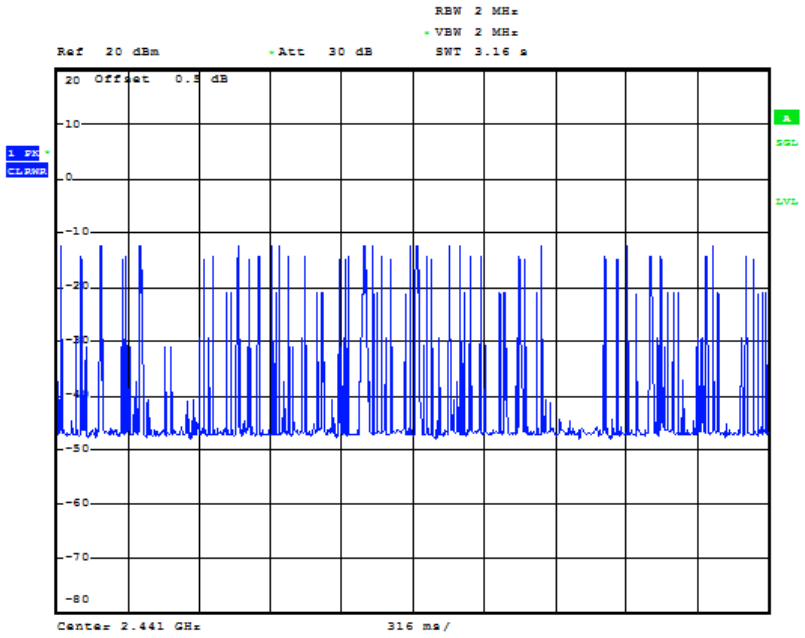
Date: 2.JAN.2018 12:37:17

DH3: Hopping Number



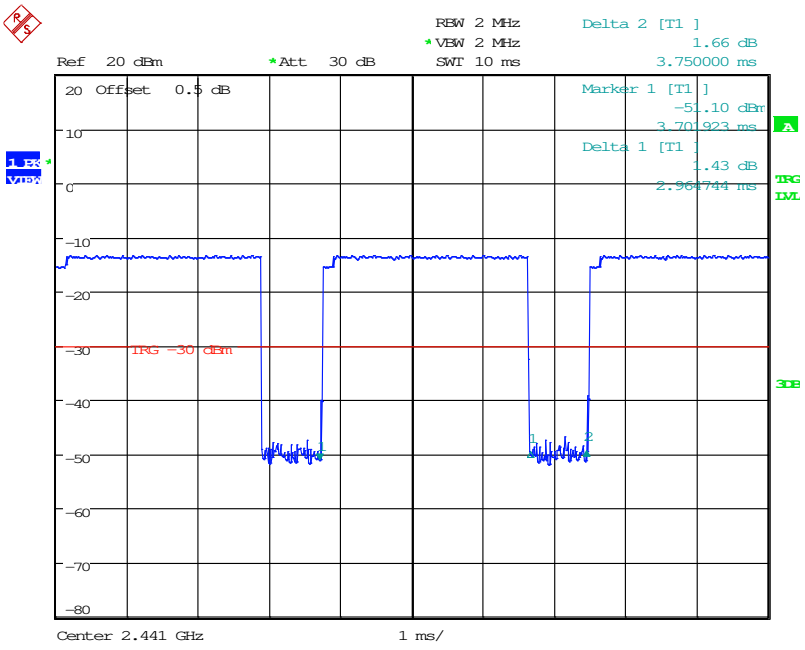
Date: 2.JAN.2018 12:42:14

DH3: Hopping Number/10
(Hopping Number = 15 in 1/10 period of highest signals, Second High signals were other channel)



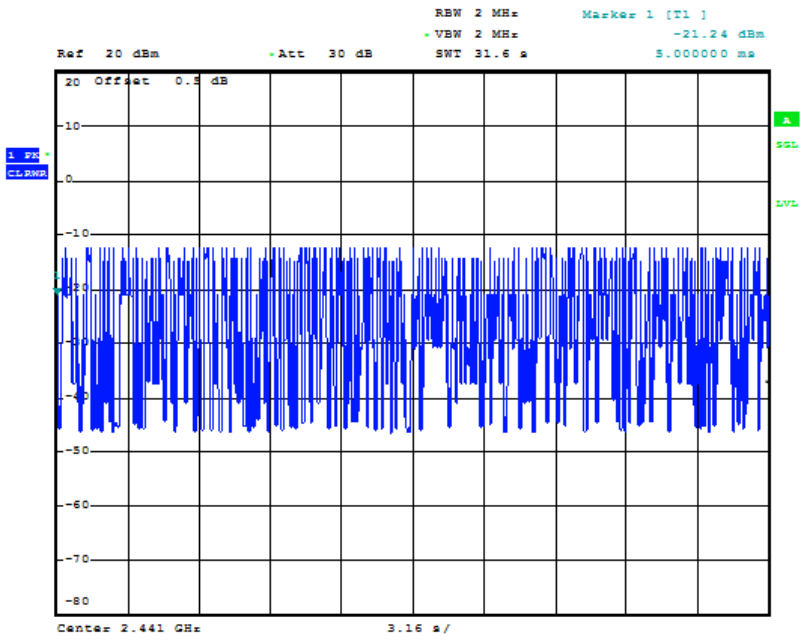
Date: 2.JAN.2018 12:42:28

DH5: Pulse Width



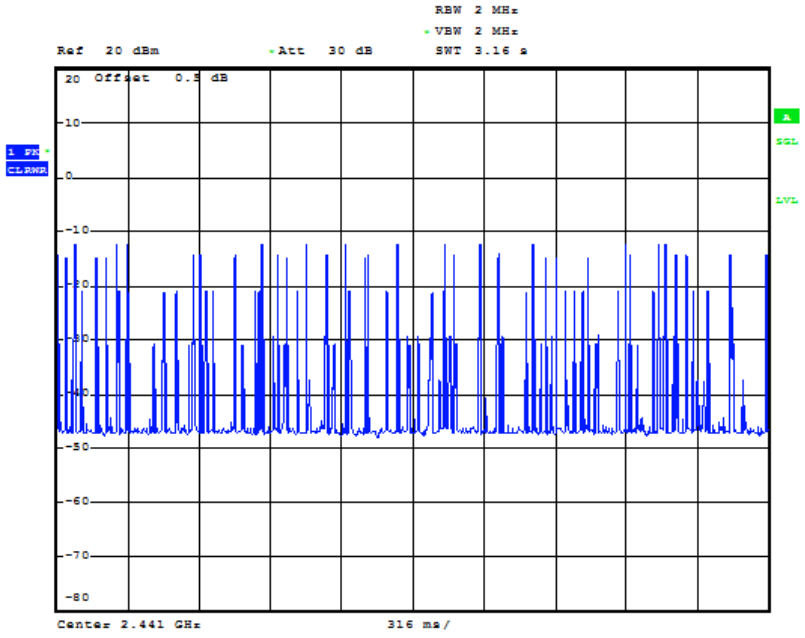
Date: 2.JAN.2018 12:36:36

DH5: Hopping Number



Date: 2.JAN.2018 12:43:41

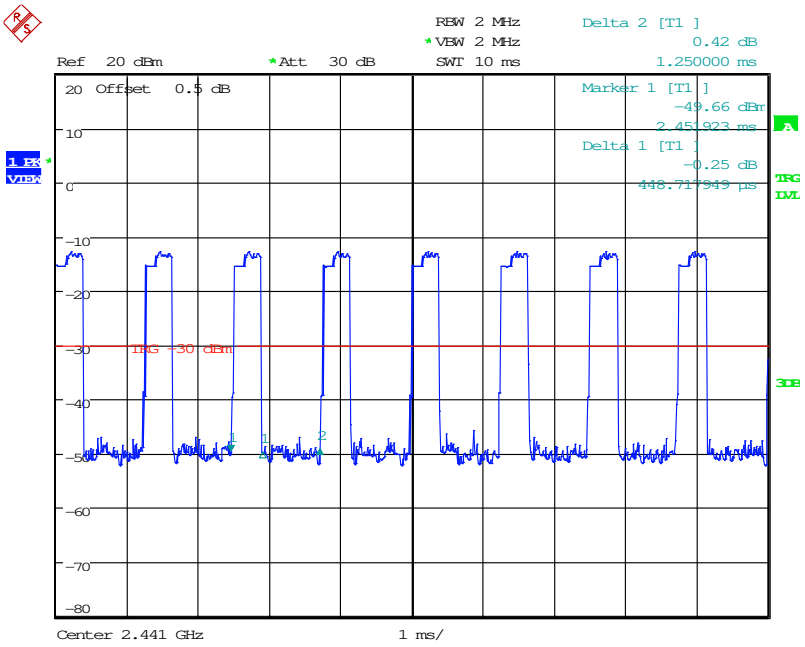
DH5: Hopping Number/10
(Hopping Number = 13 in 1/10 period of highest signals, Second High signals were other channel)



Date: 2.JAN.2018 12:42:49

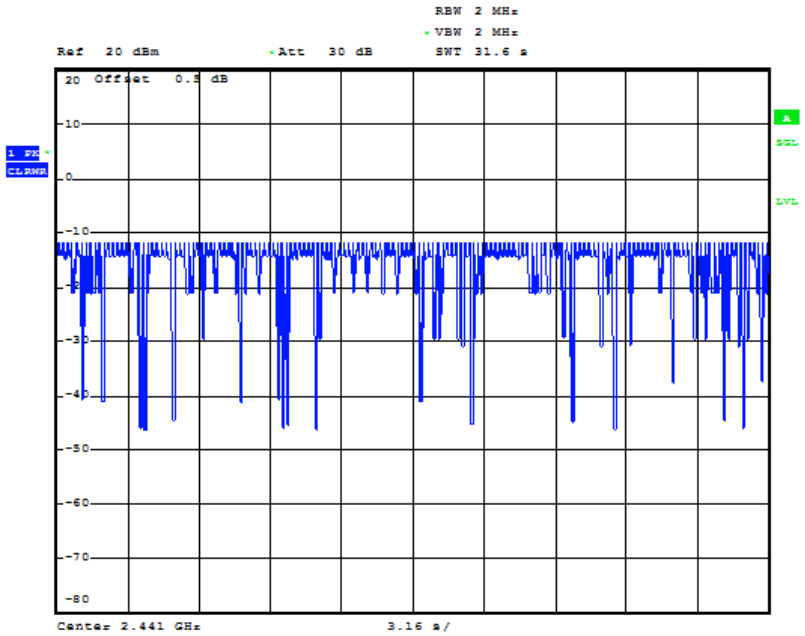
EDR mode (8DPSK):

DH1: Pulse Width



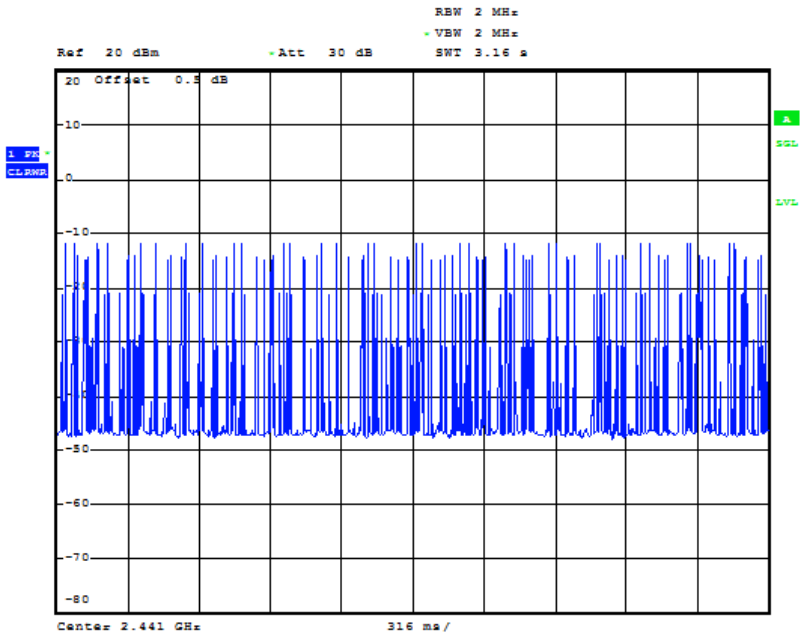
Date: 2.JAN.2018 14:06:48

DH1: Hopping Number



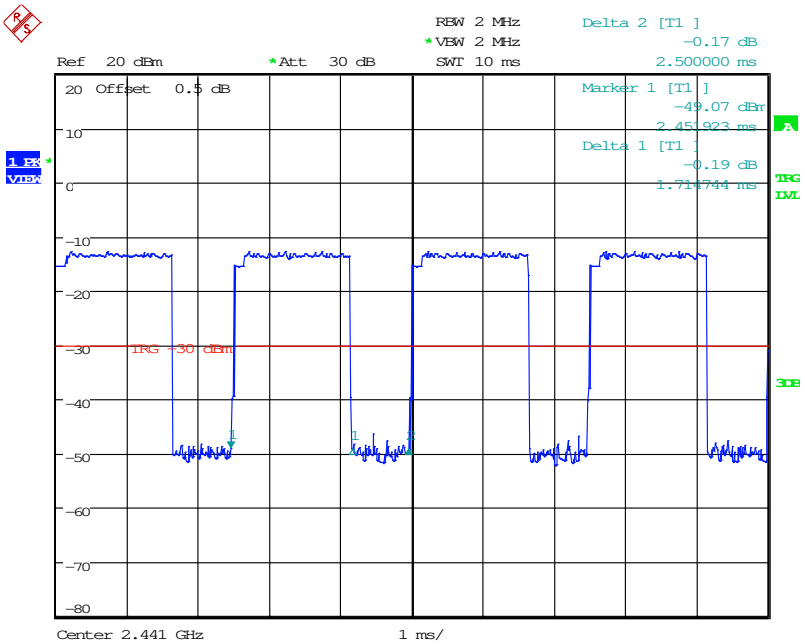
Date: 2.JAN.2018 14:10:55

DH1: Hopping Number/10
(Hopping Number = 32 in 1/10 period of highest signals, Second High signals were other channel)



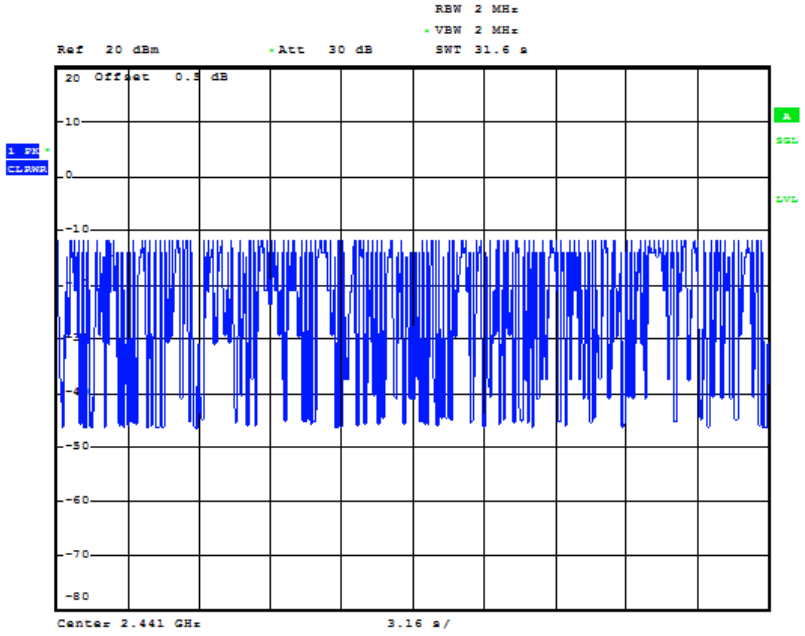
Date: 2.JAN.2018 14:10:11

DH3: Pulse Width



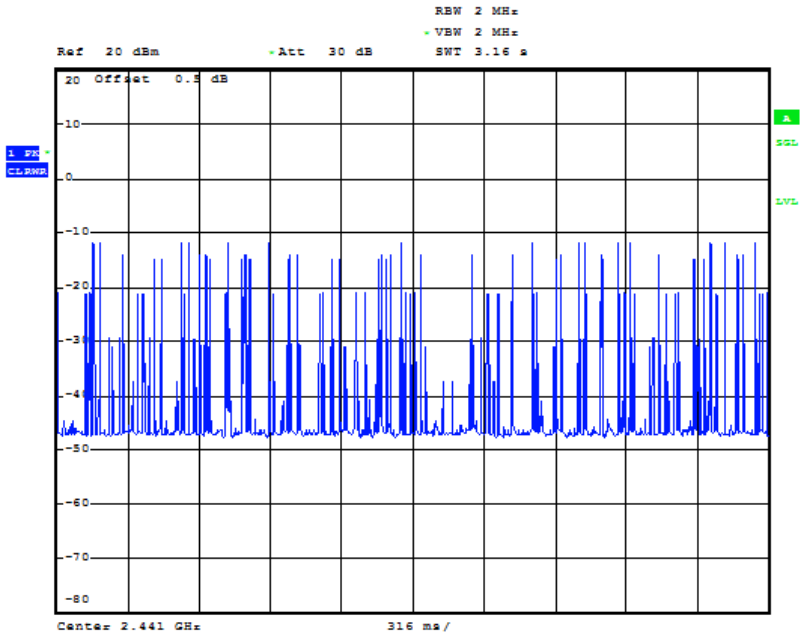
Date: 2.JAN.2018 14:06:12

DH3: Hopping Number



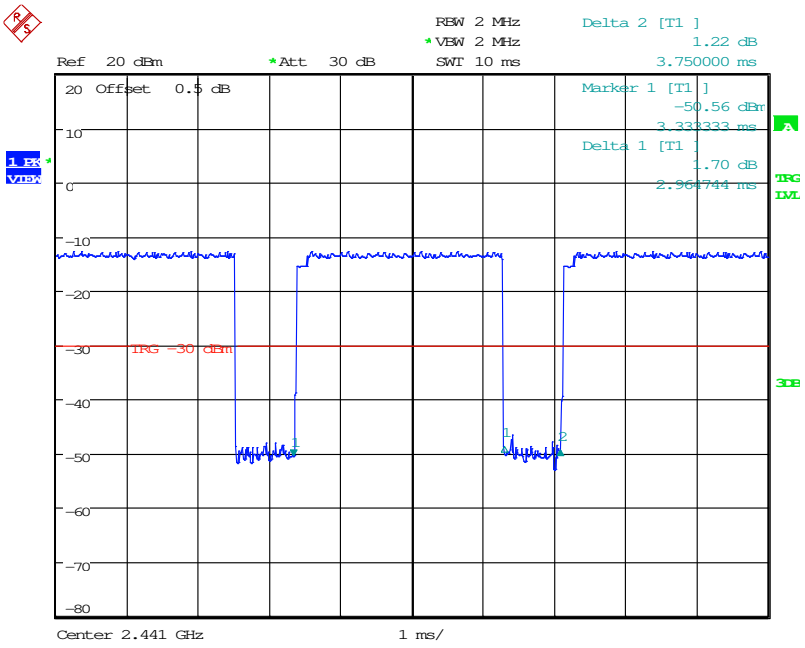
Date: 2.JAN.2018 14:12:06

DH3: Hopping Number/10
(Hopping Number = 15 in 1/10 period of highest signals, Second High signals were other channel)



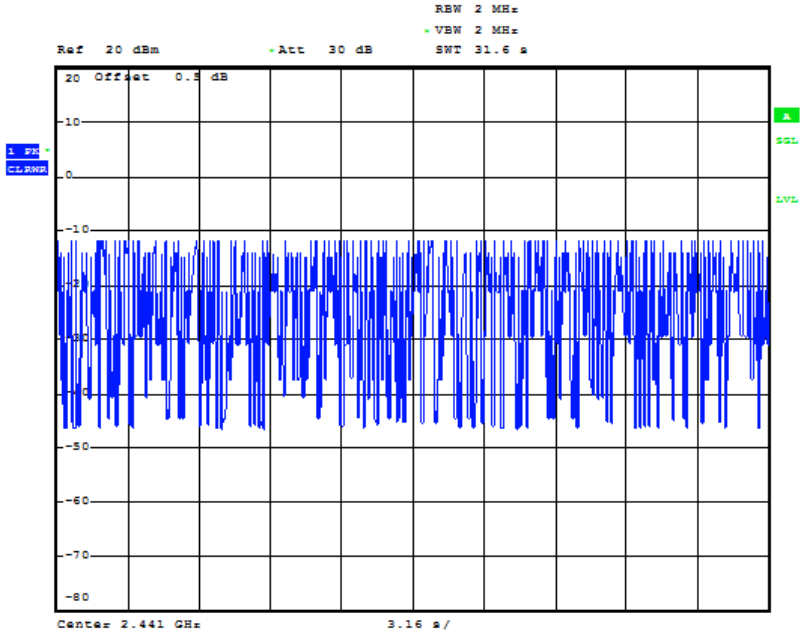
Date: 2.JAN.2018 14:11:23

DH5: Pulse Width



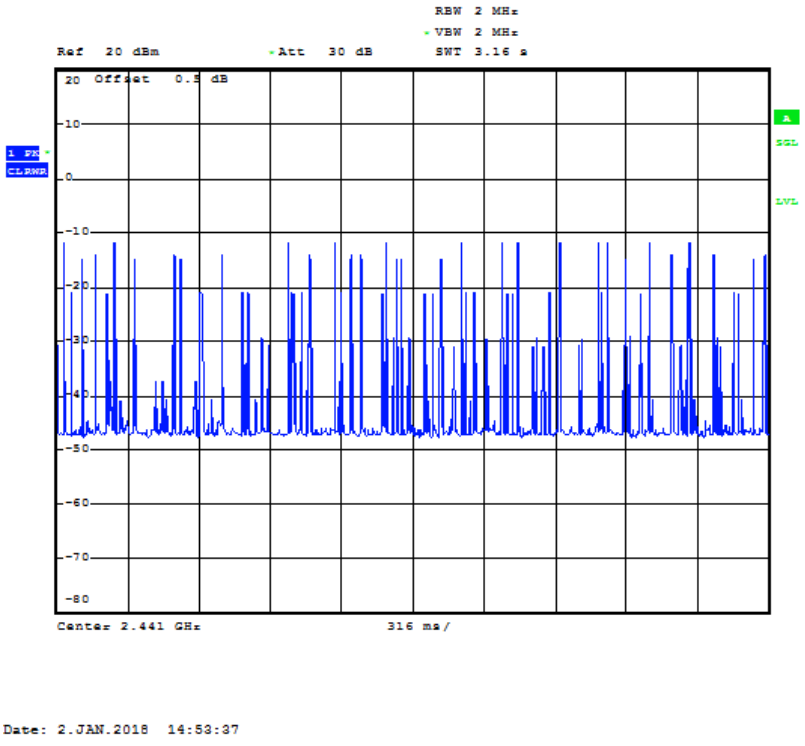
Date: 2.JAN.2018 14:05:02

DH5: Hopping Number



Date: 2.JAN.2018 14:53:22

DH5: Hopping Number/10
(Hopping Number = 13 in 1/10 period of highest signals, Second High signals were other channel)



11 FCC §15.247(a)(1)(iii) –Quantity of hopping channel Test

11.1 Applicable Standard

According to FCC §15.247(a) (1) (iii).

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.

11.2 Test Procedure

Span = the frequency band of operation
RBW < 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller VBW ⩾ RBW
Sweep = auto
Detector function = peak Trace = max hold

11.3 Test Equipment List and Details

Descriptions	Manufacturers	Models	Serial Numbers	Calibration Date	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSU26	200268	2017/05/08	2018/05/07
Cable	WOKEN	SFL402	S02-160323-07	2017/02/22	2018/02/21

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

11.4 Test Environmental Conditions

Temperature:	26° C
Relative Humidity:	58 %
ATM Pressure:	1010 hPa

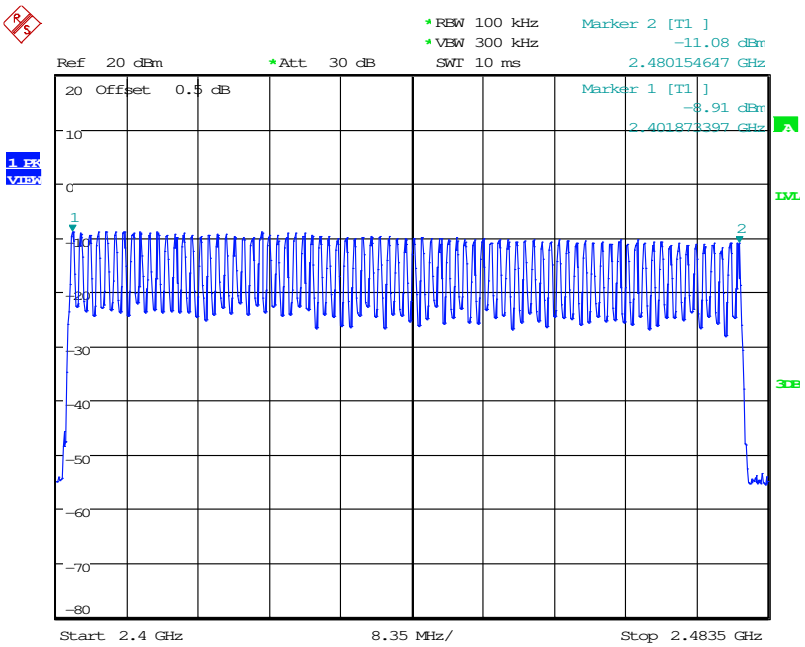
The testing was performed by Ian Tu on 2018-01-02

11.5 Test Results

Mode	Frequency Range (MHz)	Number of Hopping Channel	Limit (CH)	Result
GFSK	*2402-2480*	*79*	*>15*	*Compliance*
π/4-DQPSK	*2402-2480*	79	*>15*	Compliance
8DPSK	*2402-2480*	79	*>15*	Compliance

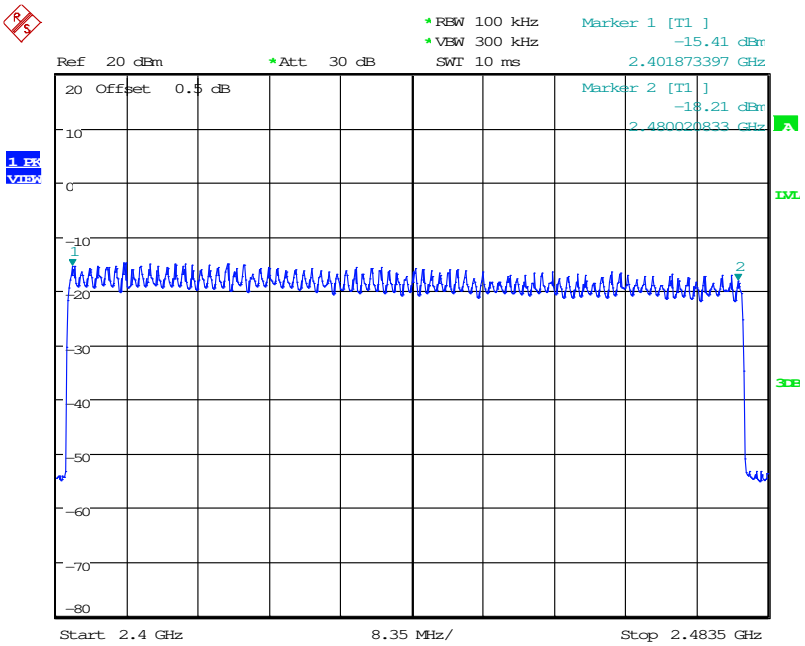
Please refer to the following plots

BR mode (GFSK):



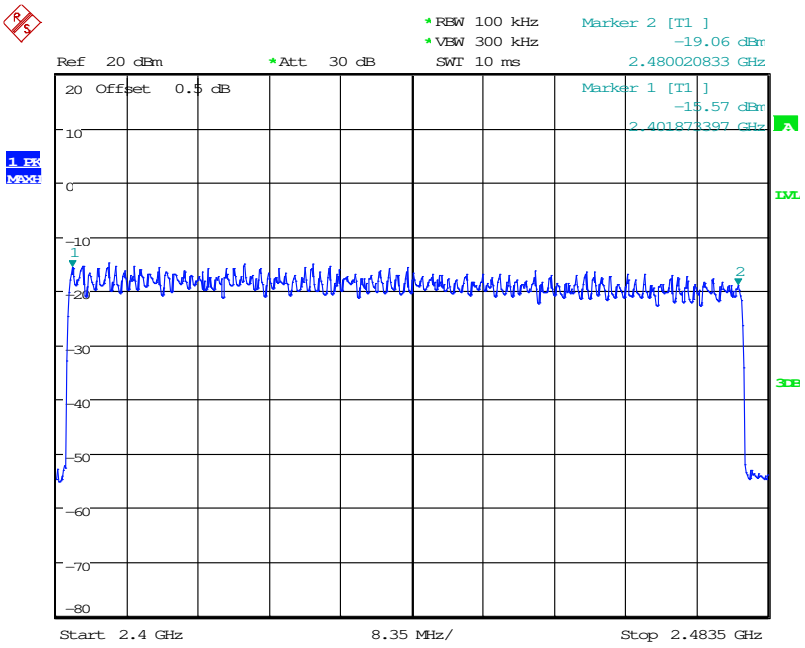
Date: 2.JAN.2018 13:44:35

EDR mode (π/4-DQPSK):



Date: 2.JAN.2018 13:49:23

EDR mode (8DPSK):



12 FCC §15.247(b)(1) – Maximum Output Power

12.1 Applicable Standard

According to FCC §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.

12.2 Test Procedure

Place the EUT on a bench and set it in transmitting mode.
Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to an Power sensor.

12.3 Test Equipment List and Details

Descriptions	Manufacturers	Models	Serial Numbers	Calibration Date	Calibration Due Date
Power Sensor	KEYSIGHT	U2021XA	MY54080018	2017/03/21	2018/03/20
Cable	WOKEN	SFL402	S02-160323-07	2017/02/22	2018/02/21

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

12.4 Test Environmental Conditions

Temperature:	26° C
Relative Humidity:	58 %
ATM Pressure:	1010 hPa

The testing was performed by Ian Tu on 2018-01-02

12.5 Test Results

Channel	Frequency (MHz)	Maximum peak Conducted Output Power (dBm)	Limit (dBm)	Result
BR mode (GFSK)				
Low	2402	-6.24	30	Compliance
Middle	2441	-7.21	30	Compliance
High	2480	-8.67	30	Compliance
EDR mode (π/4-DQPSK)				
Low	2402	-10.34	30	Compliance
Middle	2441	-11.31	30	Compliance
High	2480	-12.53	30	Compliance
EDR mode (8DPSK)				
Low	2402	-10.62	30	Compliance
Middle	2441	-11.52	30	Compliance
High	2480	-12.96	30	Compliance

13 FCC §15.247(d) – 100 kHz Bandwidth of Frequency Band Edge

13.1 Applicable Standard

According to FCC §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum 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. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emissions limits specified in §15.209(a) see §15.205(c).

13.2 Test Procedure

Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation
RBW = 100 kHz VBW = 300 kHz
Sweep = coupled
Detector function = peak Trace = max hold

13.3 Test Equipment List and Details

Descriptions	Manufacturers	Models	Serial Numbers	Calibration Date	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSV40	101140	2017/3/21	2018/3/20
Cable	WOKEN	SFL402	S02-160323-07	2017/02/22	2018/02/21

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

13.4 Test Environmental Conditions

Temperature:	26° C
Relative Humidity:	58 %
ATM Pressure:	1010 hPa

The testing was performed by Ian Tu on 2018-01-02

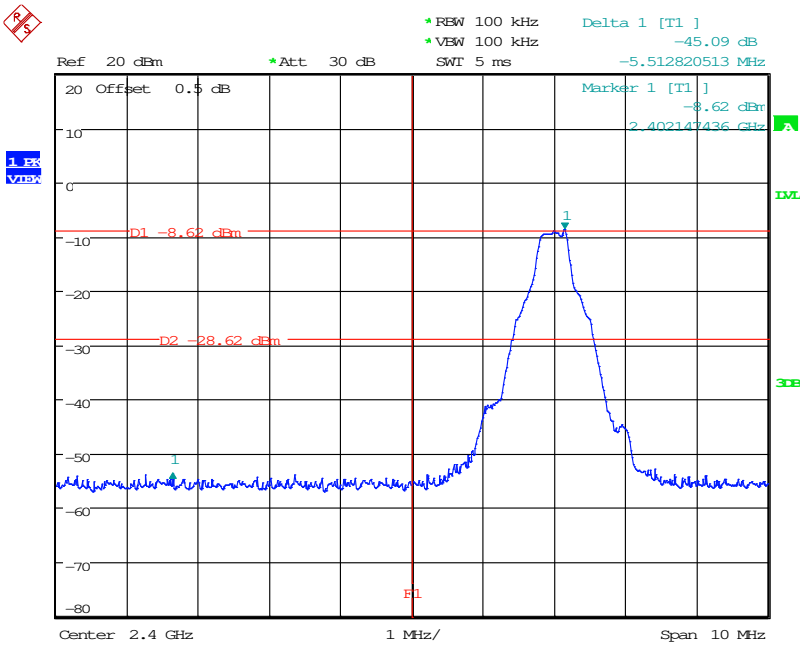
13.5 Test Results

Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Result
BR mode (GFSK)				
Low	2402	45.09	≥ 20	Compliance
High	2480	42.67	≥ 20	Compliance
BR Hopping mode (GFSK)				
Low	2402	43.70	≥ 20	Compliance
High	2480	43.26	≥ 20	Compliance
EDR mode (π/4-DQPSK)				
Low	2402	38.71	≥ 20	Compliance
High	2480	36.17	≥ 20	Compliance
EDR Hopping mode (π/4-DQPSK)				
Low	2402	37.71	≥ 20	Compliance
High	2480	36.69	≥ 20	Compliance
EDR mode (8DPSK)				
Low	2402	38.36	≥ 20	Compliance
High	2480	36.04	≥ 20	Compliance
EDR Hopping mode (8DPSK)				
Low	2402	37.54	≥ 20	Compliance
High	2480	36.96	≥ 20	Compliance

Please refer to the following plots

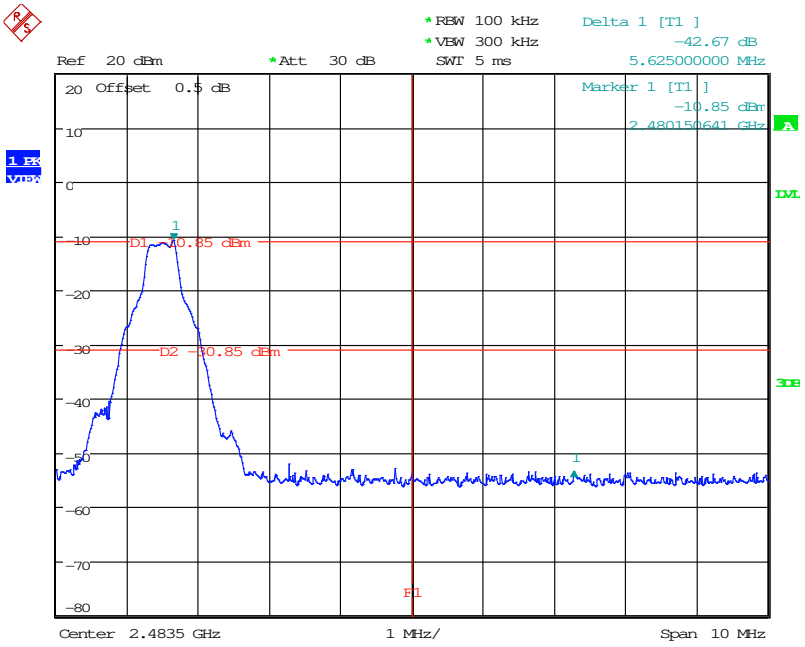
BR mode (GFSK):

Band Edge, Left Side



Date: 2.JAN.2018 10:09:33

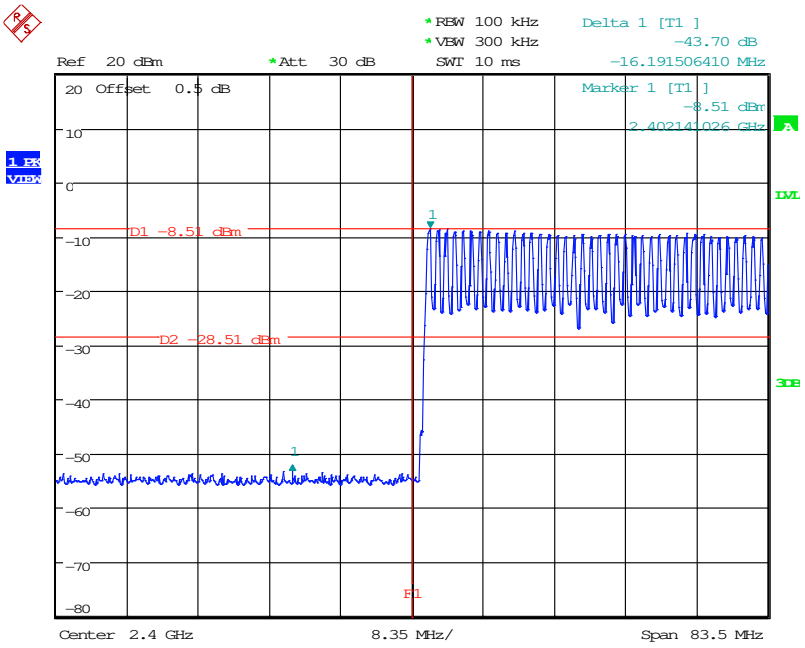
Band Edge, Right Side



Date: 2.JAN.2018 09:59:29

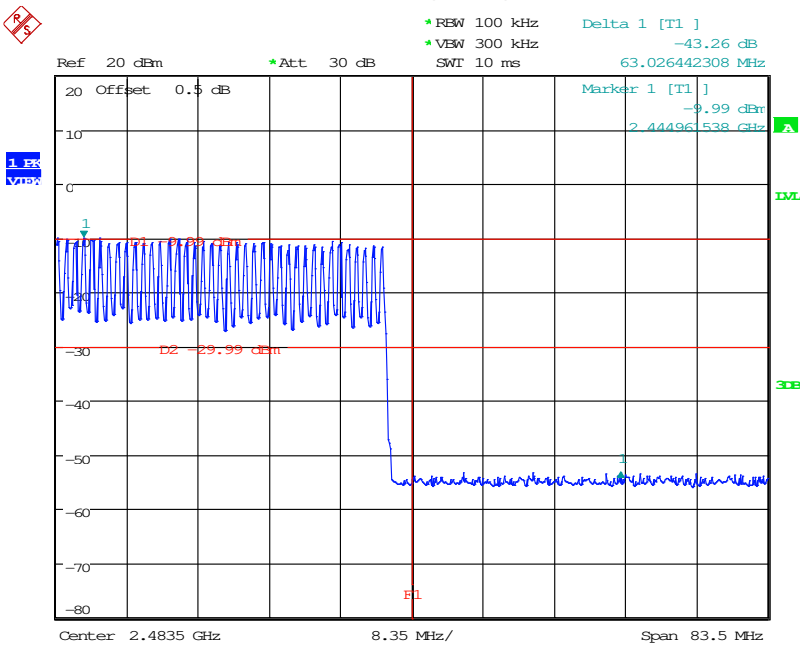
BR Hopping mode (GFSK):

Band Edge, Left Side



Date: 2.JAN.2018 13:37:00

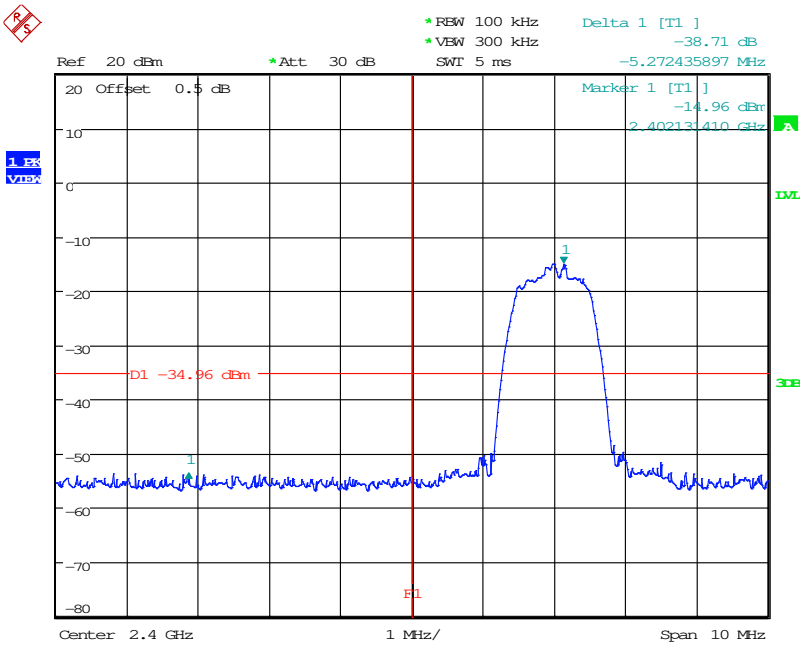
Band Edge, Right Side



Date: 2.JAN.2018 13:35:29

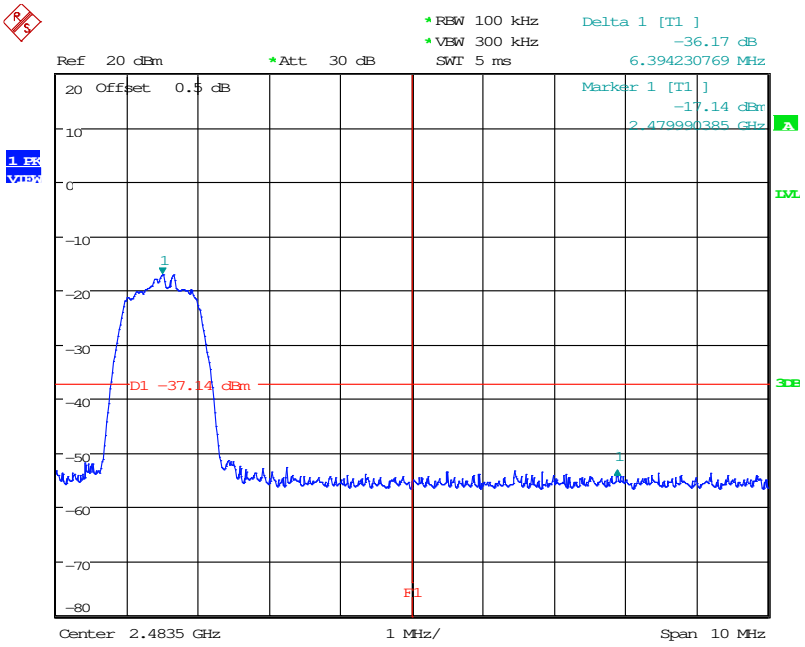
EDR mode (π/4-DQPSK):

Band Edge, Left Side



Date: 2.JAN.2018 12:10:49

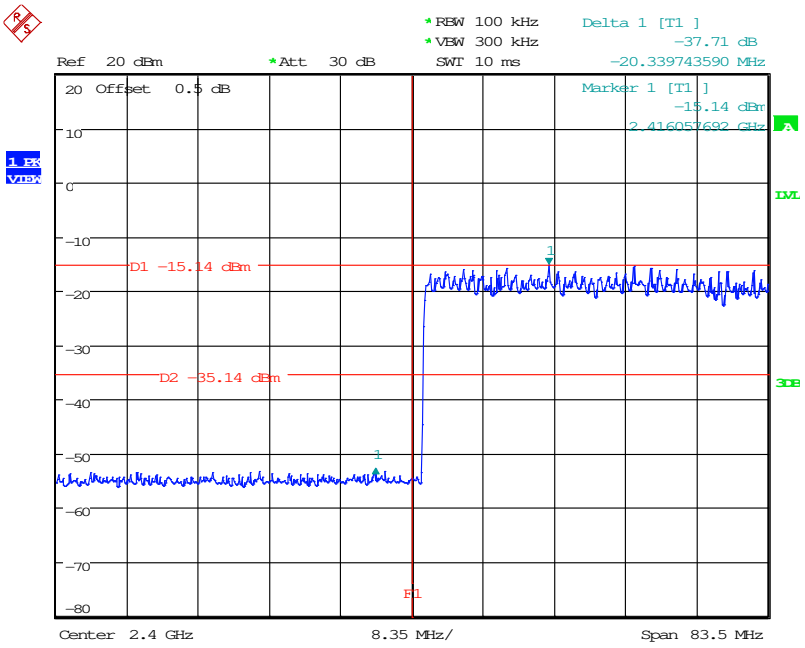
Band Edge, Right Side



Date: 2.JAN.2018 12:31:30

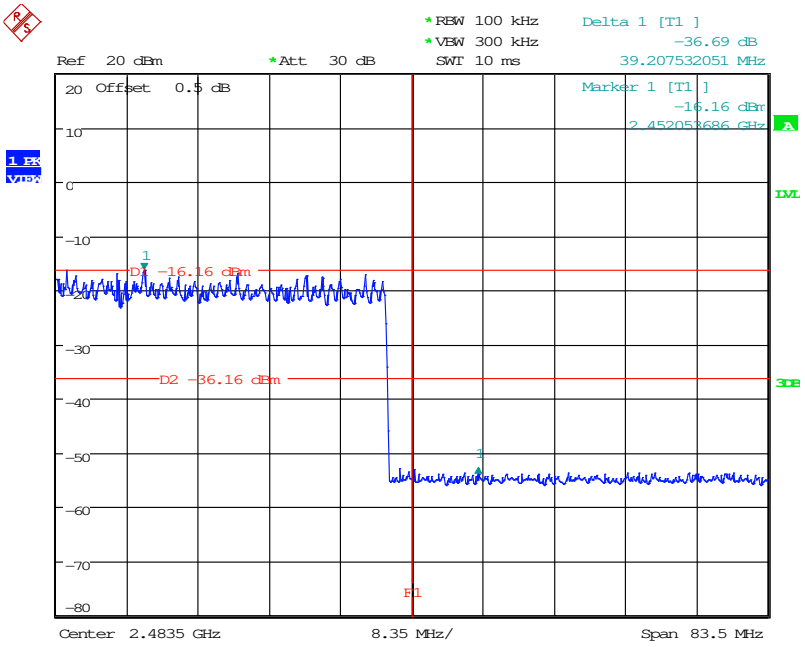
EDR Hopping mode (π/4-DQPSK):

Band Edge, Left Side



Date: 2.JAN.2018 13:51:03

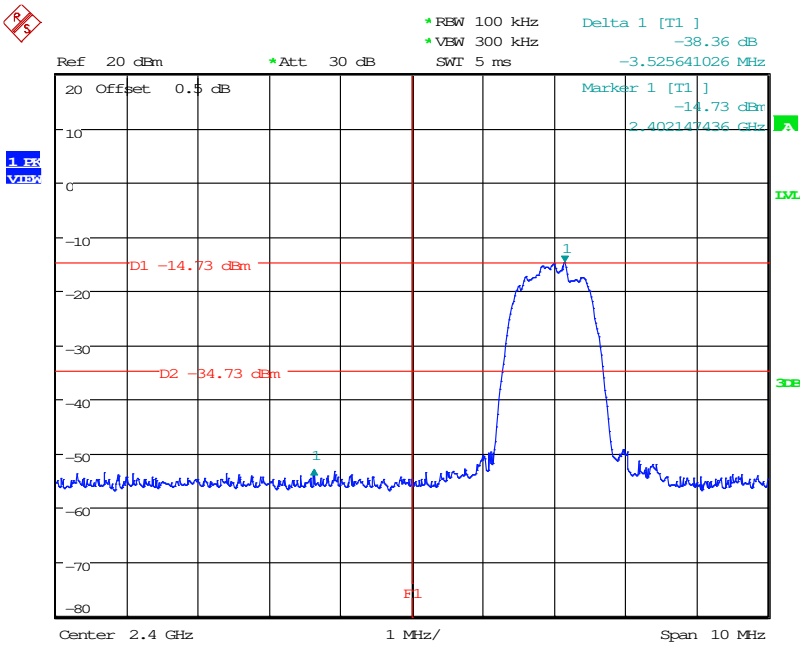
Band Edge, Right Side



Date: 2.JAN.2018 13:52:30

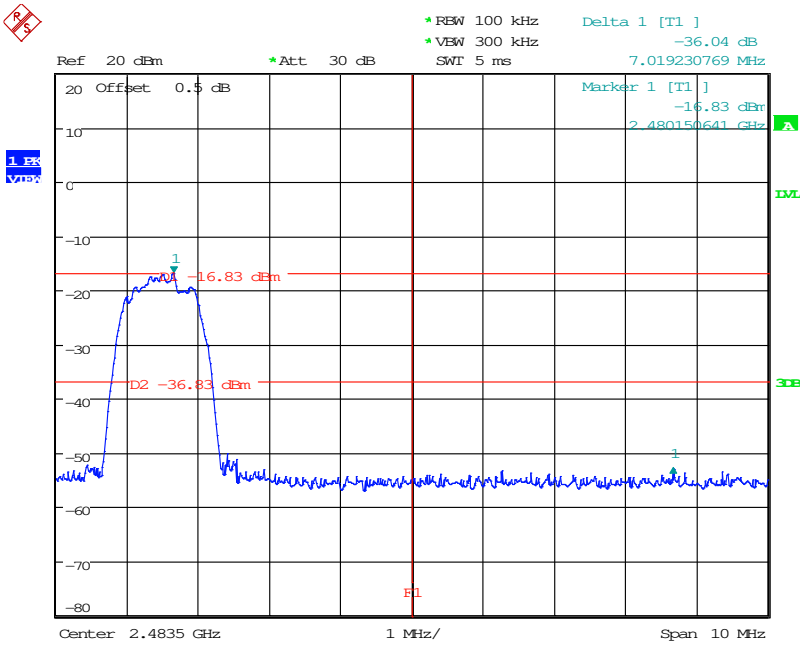
EDR mode (8DPSK):

Band Edge, Left Side



Date: 2.JAN.2018 13:03:53

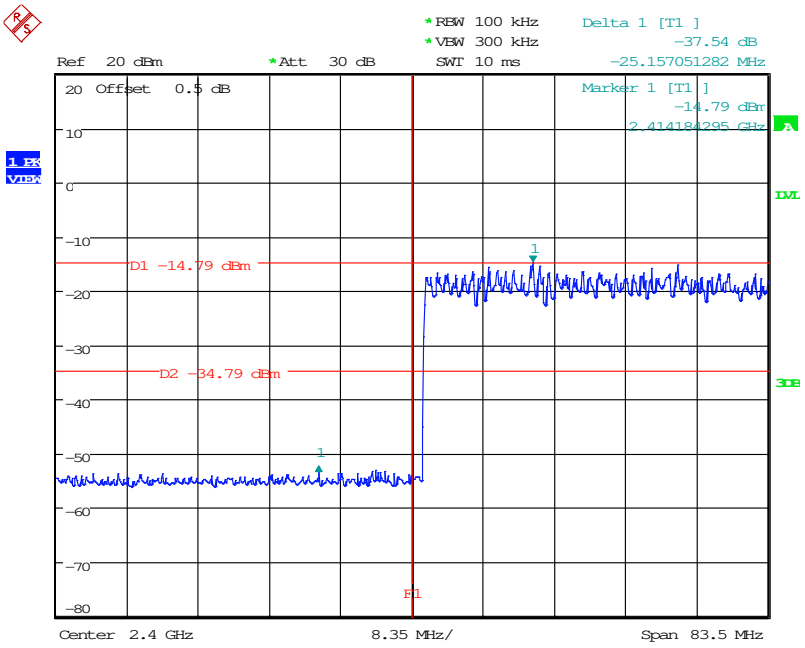
Band Edge, Right Side



Date: 2.JAN.2018 13:19:53

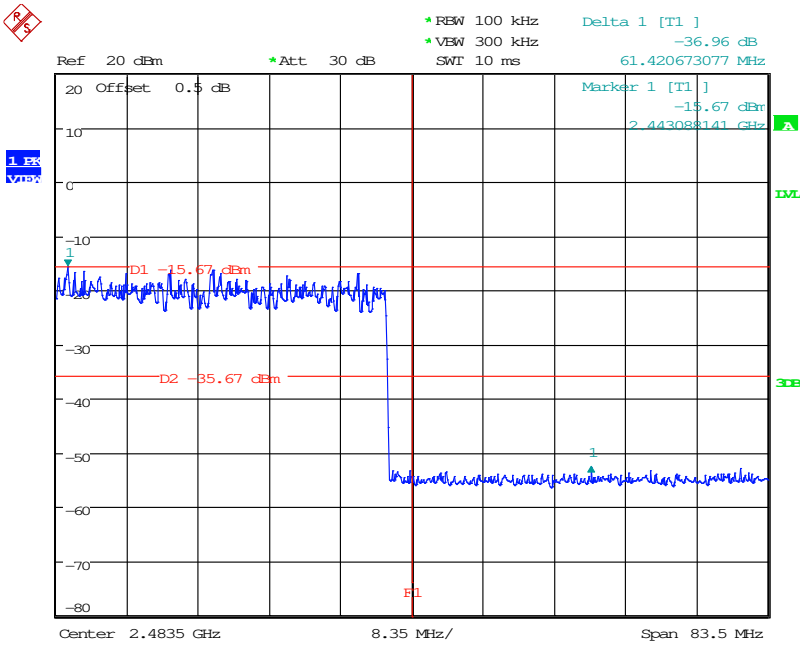
EDR Hopping mode (8DQSK):

Band Edge, Left Side



Date: 2.JAN.2018 14:00:36

Band Edge, Right Side



Date: 2.JAN.2018 14:01:48

----- END OF REPORT -----