FCC Part 15.247

TEST REPORT

For

YOGADA TECH.CORP.LTD.

7F.,NO.8,Ln.298,Xinming Rd.,Neihu Dist.,Taipei City 11470,Taiwan(R.O.C)

FCC ID: 2AQMKBDS010018

Report Type:	**Product Type:**
Original Report	Bluetooth speakerphone

Report Producer : Kaylee Chiang

Report Number : RXZ1806026-00B

Report Date : 2018-08-23

Reviewed By: Jerry Chang

Prepared By: Bay Area Compliance Laboratories Corp.(Taiwan)
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Revision History

Revision	No.	Report Number	Issue Date	Description	Author/ Revised by
1.0	RXZ1806026	RXZ1806026-00B	2018.08.23	Original Report	Kaylee

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1 General Information

1.1 Product Description for Equipment under Test (EUT)

Applicant	YOGADA TECH.CORP.LTD.
	7F.,NO.8,Ln.298,Xinming Rd.,Neihu Dist.,Taipei City 11470,Taiwan(R.O.C)
Manufacturer	YOGADA TECH.CORP.LTD.
	7F.,NO.8,Ln.298,Xinming Rd.,Neihu Dist.,Taipei City 11470,Taiwan(R.O.C)
Brand(Trade) Name	YOGADA
Product (Equipment)	Bluetooth speakerphone
Model Name	BDS01
Frequency Range	2402 ~ 2480 MHz
Transmit Power	BR(GFSK) Mode: 1.51 dBm (0.00142W) EDR(π/4-DQPSK) Mode: 2.02 dBm (0.00159W) EDR(8DPSK) Mode: 2.19 dBm (0.00166W)
Modulation Technique	BR Mode: GFSK EDR Mode: π/4-DQPSK EDR Mode: 8DPSK
Transmit Data Rate	BR(GFSK) Mode: 1 Mbps EDR (π/4-DQPSK) Mode: 2 Mbps EDR (8DPSK) Mode: 3 Mbps
Number of Channels	79 Channels
Antenna Specification	PCB Antenna / 4 dBi
Output:	5V from USB 3.7V from Battery
Received Date	June 29, 2018
Date of Test	July 13, 2018 ~ Aug 23, 2018

**All measurement and test data in this report was gathered from production sample serial number: 1806026 (Assigned by BACL, Taiwan).*

1.2 Objective

This report is prepared on behalf of *YOGADA TECH.CORP.LTD.* 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.

1.3 Related Submittal(s)/Grant(s)

NA

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.

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

For BT mode, 79 channels are provided to testing:

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

2.2 Equipment Modifications

No modification was made to the EUT.

2.3 EUT Exercise Software

Test Software		FCC Test tools v1.07		
Test Frequency		2402MHz	2441MHz	2480MHz
Power Level Setting	GFSK	0	0	0
	π/4-DQPSK	0	0	0
	8DPSK	0	0	0

2.4 Support Equipment List and Details

Description	Manufacturer	Model Number	BSMI	FCC ID	S/N
NB	DELL	E6410	N/A	N/A	N/A

2.5 External Cable List and Details

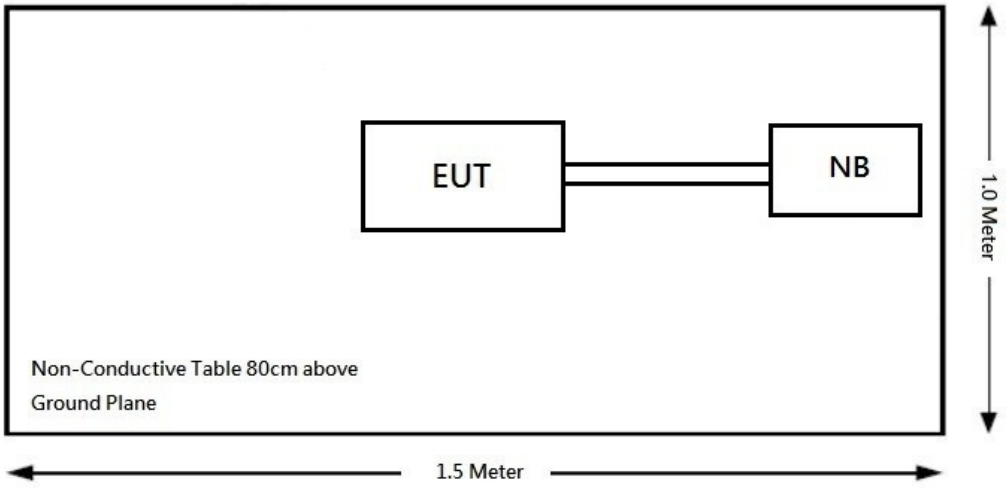
Cable Description	Length (m)	From	To
Micro USB Cable	1.5	NB	EUT
Micro USB Cable	1.5	NB	EUT

2.6 Block Diagram of Test Setup

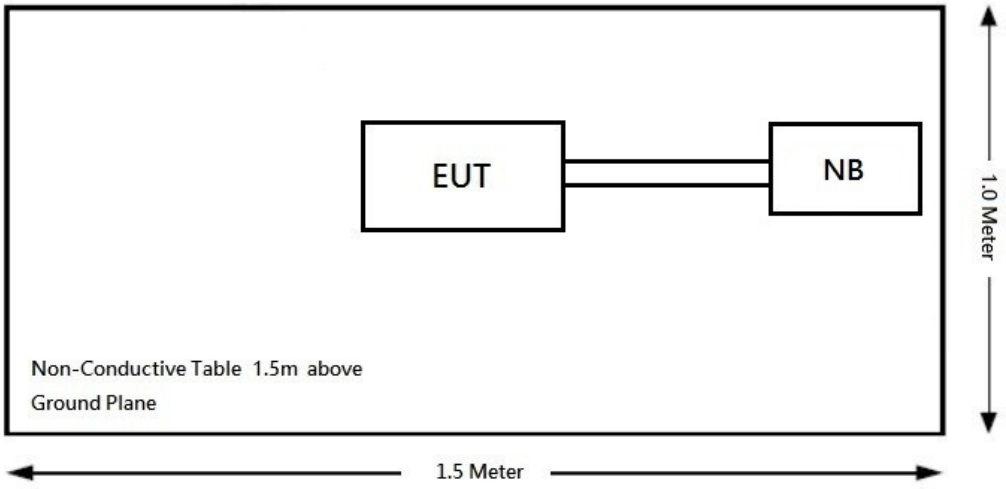
See test photographs attached in annex setup photos for the actual connections between EUT and support equipment.

Radiation:

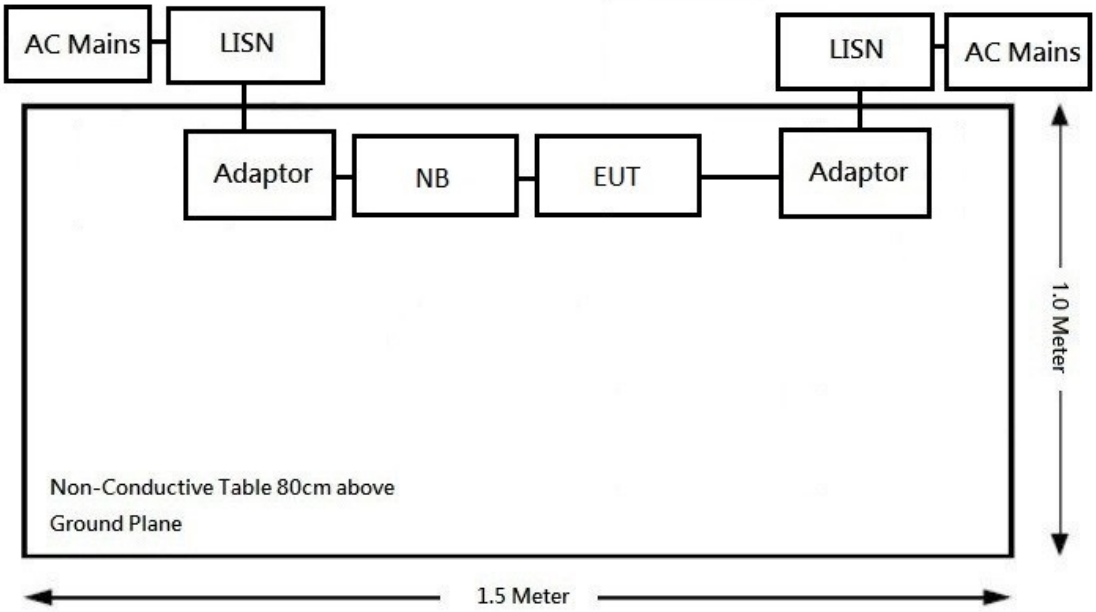
Below 1GHz:



Above 1GHz:



Conduction:


AC Mains
LISN
LISN
AC Mains
Adaptor
NB
EUT
Adaptor
1.0 Meter
Non-Conductive Table 80cm above
Ground Plane
1.5 Meter

3 Summary of Test Results

FCC Rules	Description of Test	Results
§15.247(i), §2.1093	RF Exposure	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 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
AC Line Conduction Room (CON-A)					
LISN	Rohde & Schwarz	ENV216	101248	2017/07/20	2018/07/19
EMI Test Receiver	Rohde & Schwarz	ESR7	101419	2017/11/06	2018/11/05
Pulse Limiter	Rohde & Schwarz	ESH3Z2	TXZEM104	2017/08/10	2018/08/09
RF Cable	EMEC	EM-CB5D	001	2018/07/02	2019/07/01
Software	AUDIX	E3	V9.150826k	N.C.R	N.C.R
Radiated Room (966-A)					
Bilog Antenna with 6 dB Attenuator	SUNOL SCIENCES & MINI-CIRCUITS	JB6/UNAT-6+	A050115/15542_01	2017/12/20	2018/12/19
Horn Antenna	EMCO	3115	9311-4158	2018/04/20	2019/04/19
Horn Antenna	ETS-Lindgren	3116	62638	2017/09/13	2018/09/12
Preamplifier	Sonoma	310N	130602	2018/07/04	2019/07/03
Preamplifier	EM Electronics Corp.	EM01G18G	060657	2017/12/14	2018/12/13
Microware Preamplifier	EM Electronics Corporatino	EM18G40G	060656	2018/01/15	2019/01/14
EMI Test Receiver	Rohde & Schwarz	ESR7	101419	2017/11/06	2018/11/05
Spectrum Analyzer	Rohde & Schwarz	FSV40	101203	2018/02/12	2019/02/13
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	2018/03/05	2019/03/04
Microflex Cable	ROSNOL	K1K50-UP0264-K1K50-80CM	160309-2	2018/01/17	2019/01/16
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	60772	N.C.R	N.C.R
Software	Farad	EZ_EMC	BACL-03A1	N.C.R	N.C.R
NSA	BACL	966-A	N/A	2017/07/24	2018/07/23
VSWR	BACL	966-A	N/A	2017/07/25	2018/07/24

Conducted Room					
Spectrum Analyzer	Rohde & Schwarz	FSU26	200268	2018/05/04	2019/05/03
Cable	WOKEN	SFL402	S02-160323-07	2018/02/12	2019/02/11
Attenuator	MINI-CIRCUITS	BW-S10W5+	N/A	2018/03/08	2019/03/07
Power Sensor	KEYSIGHT	U2021XA	MY54080018	2018/03/07	2019/03/06

***Statement of Traceability:** BACL Corp. attests that all of the calibrations on the equipment items listed above were traceable to the SI System of Units via the R.O.C. Center for Measurement Standards of the Electronics Testing Center, Taiwan (ETC) or to another internationally recognized National Metrology Institute (NMI), and were compliant with the current Taiwan Accreditation Foundation (TAF) requirements*

5 FCC §15.247(i) & 2.1093 - RF Exposure

5.1 Applicable Standard

According to FCC §15.247(i)

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 KDB 447498 D01 General RF Exposure Guidance, 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

1. f(GHz) is the RF channel transmit frequency in GHz.
2. Power and distance are rounded to the nearest mW and mm before calculation.
3. The result is rounded to one decimal place for comparison.
4. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test Exclusion.

5.2 RF Exposure Evaluation Result

FCC

Worse case:

SAR evaluation:

Mode	Frequency	Tunp-up Power		Evaluation Distrance	Calculated Value	Threshold	SAR Test Exclusion
	(MHz)	(dBm)	(mW)	(mm)		(1-g SAR)	
BT	2402-2480	2.5	1.778	5	0.6	3	Yes

Result: SAR test is exempted.

6 FCC §15.203 – Antenna Requirements

6.1 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.

6.2 Measurement Uncertainty

Manufacturer	Type	Antenna Gain	Result
MICROCHIP	PCB Antenna	4 dBi	Compliance

The EUT has one integral antenna arrangement, which was permanently attached; fulfill the requirement of this section.

7 FCC §15.207(a) – AC Line Conducted Emissions

7.1 Applicable Standard

According to §15.207

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56 Note 1	56 to 46 Note 2
0.5-5	56	46
5-30	60	50

Note 1: Decreases with the logarithm of the frequency.

Note 2: A linear average detector is required

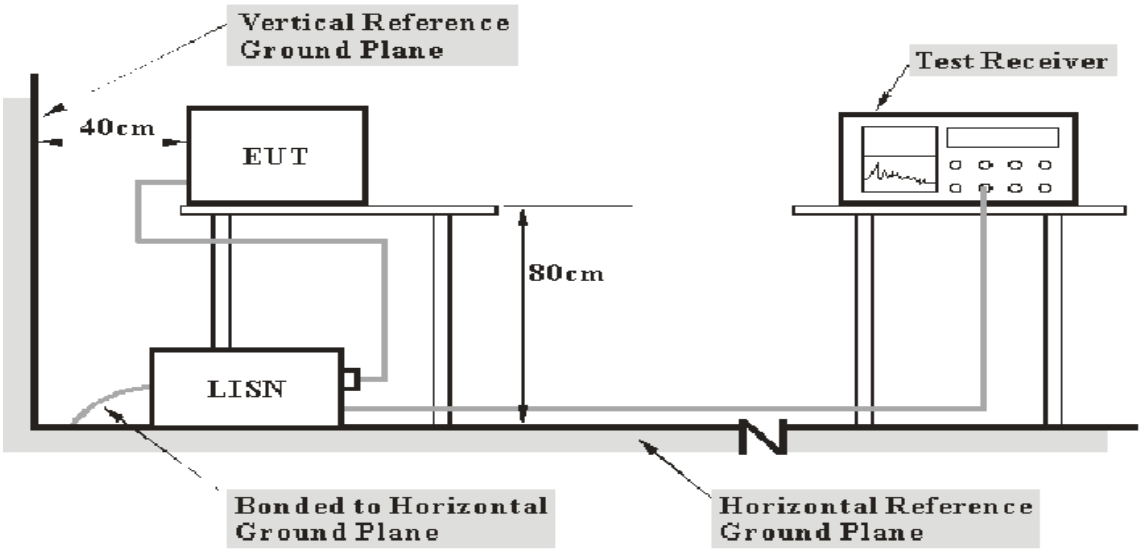
7.2 Measurement Uncertainty

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)

7.3 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.

7.4 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	IF B/W
150 kHz – 30 MHz	9 kHz

7.5 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.

7.6 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

7.7 Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	55 %
ATM Pressure:	1010 hPa

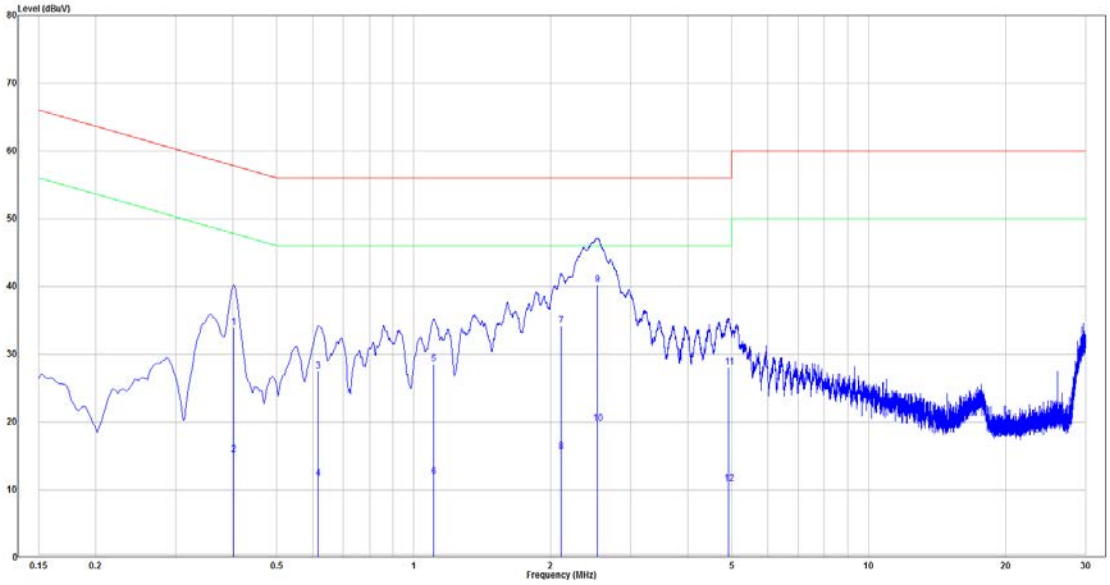
The testing was performed by Tom Hsu on 2018-07-17.

7.8 Test Results: PASS

7.9 Test Data

Test Mode: Transmitting

AC120 V, 60 Hz, Line



No.	Frequency	Reading	Correct	Result	Limit	Over limit	Remark
	(MHz)	(dBµV)	Factor(dB)	(dBµV)	(dBµV)	(dB)	
1	0.402	14.48	19.52	34.00	57.81	-23.82	QP
2	0.402	-4.34	19.52	15.18	47.81	-32.64	Average
3	0.616	7.96	19.52	27.48	56.00	-28.52	QP
4	0.616	-7.84	19.52	11.68	46.00	-34.32	Average
5	1.108	9.01	19.53	28.54	56.00	-27.46	QP
6	1.108	-7.56	19.53	11.98	46.00	-34.02	Average
7	2.110	14.58	19.60	34.18	56.00	-21.82	QP
8	2.110	-3.97	19.60	15.63	46.00	-30.37	Average
9	2.539	20.67	19.61	40.28	56.00	-15.72	QP
10	2.539	0.14	19.61	19.76	46.00	-26.24	Average
11	4.929	8.40	19.65	28.05	56.00	-27.95	QP
12	4.929	-8.80	19.65	10.86	46.00	-35.14	Average

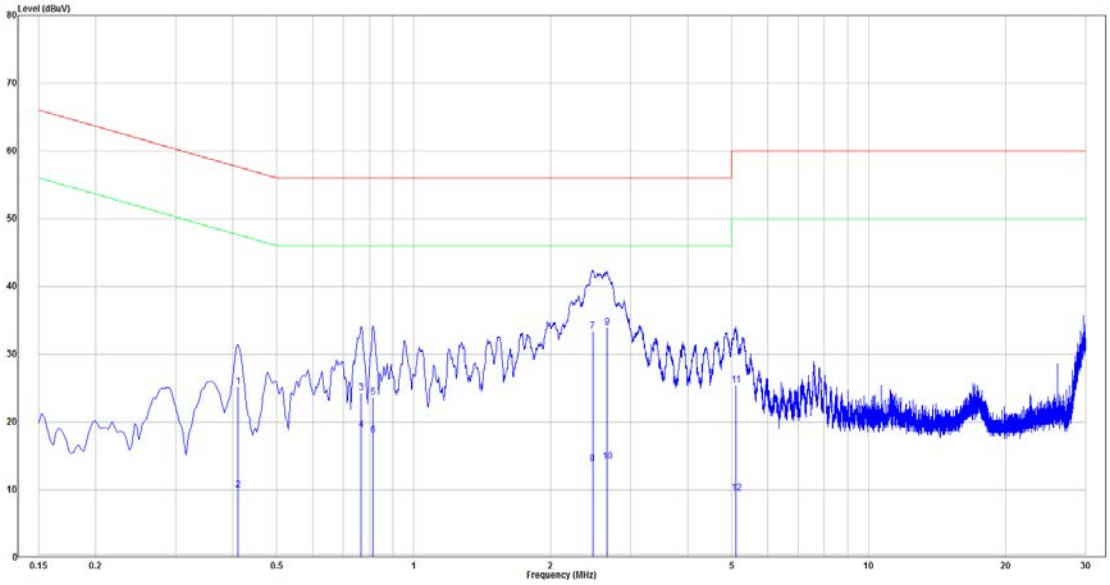
Note:

Level = Read Level + Factor

Over Limit = Level – Limit Line

Factor = (LISN, ISN, PLC or current probe) Factor + Cable Loss + Attenuator

AC120 V, 60 Hz, Neutral



No.	Frequency	Reading	Correct	Result	Limit	Over limit	Remark
	(MHz)	(dBµV)	Factor(dB)	(dBµV)	(dBµV)	(dB)	
1	0.411	5.60	19.65	25.25	57.63	-32.38	QP
2	0.411	-9.63	19.65	10.02	47.63	-37.61	Average
3	0.766	4.66	19.66	24.32	56.00	-31.68	QP
4	0.766	-0.82	19.66	18.84	46.00	-27.16	Average
5	0.814	3.97	19.66	23.62	56.00	-32.38	QP
6	0.814	-1.56	19.66	18.09	46.00	-27.91	Average
7	2.474	13.70	19.75	33.45	56.00	-22.55	QP
8	2.474	-5.89	19.75	13.86	46.00	-32.14	Average
9	2.659	14.20	19.75	33.95	56.00	-22.05	QP
10	2.659	-5.56	19.75	14.19	46.00	-31.81	Average
11	5.113	5.67	19.80	25.48	60.00	-34.52	QP
12	5.113	-10.21	19.80	9.59	50.00	-40.41	Average

Note:

Level = Read Level + Factor

Over Limit = Level – Limit Line

Factor = (LISN, ISN, PLC or current probe) Factor + Cable Loss + Attenuator

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

8.1 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) 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	16.42 – 16.423	960 – 1240	4. 5 – 5. 15
0.495 – 0.505	16.69475 – 16.69525	1300 – 1427	5. 35 – 5. 46
2.1735 – 2.1905	25.5 – 25.67	1435 – 1626.5	7.25 – 7.75
4.125 – 4.128	37.5 – 38.25	1645.5 – 1646.5	8.025 – 8.5
4.17725 – 4.17775	73 – 74.6	1660 – 1710	9.0 – 9.2
4.20725 – 4.20775	74.8 – 75.2	1718.8 – 1722.2	9.3 – 9.5
6.215 – 6.218	108 – 121.94	2200 – 2300	10.6 – 12.7
6.26775 – 6.26825	123 – 138	2310 – 2390	13.25 – 13.4
6.31175 – 6.31225	149.9 – 150.05	2483.5 – 2500	14.47 – 14.5
8.291 – 8.294	156.52475 – 156.52525	2690 – 2900	15.35 – 16.2
8.362 – 8.366	156.7 – 156.9	3260 – 3267	17.7 – 21.4
8.37625 – 8.38675	162.0125 –167.17	3.332 – 3.339	22.01 – 23.12
8.41425 – 8.41475	167.72 – 173.2	3 3458 – 3 358	23.6 – 24.0
12.29 – 12.293	240 – 285	3.600 – 4.400	31.2 – 31.8
12.51975 – 12.52025	322 – 335.4		36.43 – 36.5
12.57675 – 12.57725	399.9 – 410		Above 38.6
13.36 – 13.41	608 – 614		

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).

8.2 Measurement Uncertainty

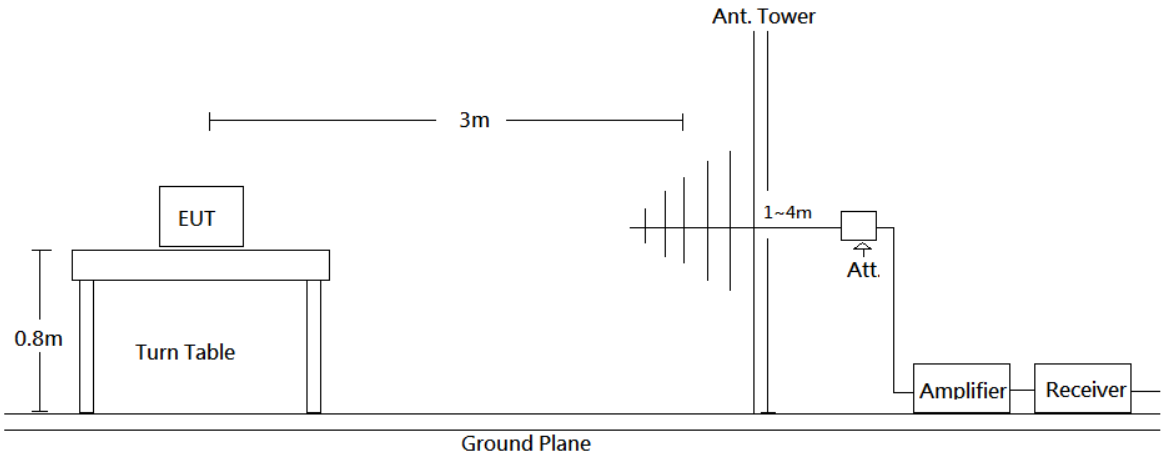
All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency 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.

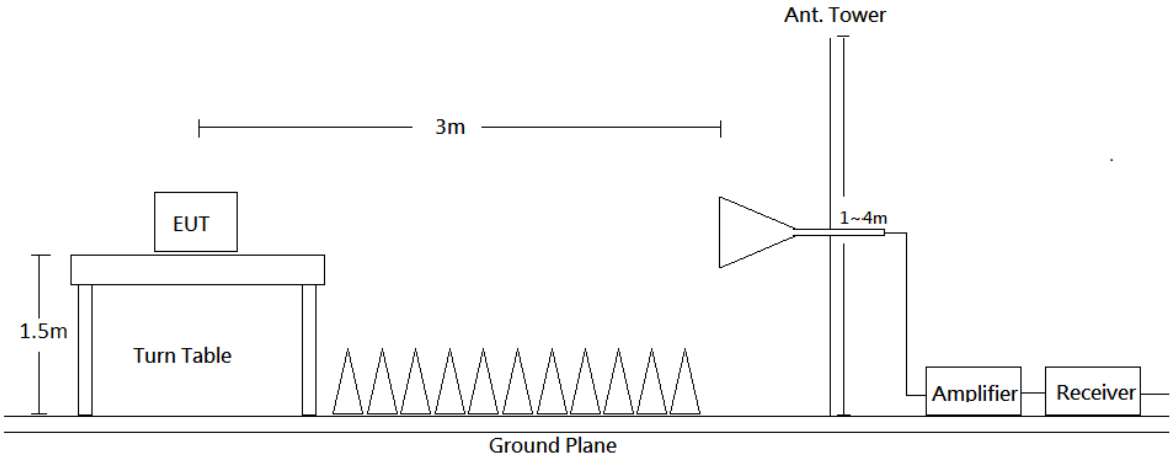
Frequency	Measurement uncertainty
30 MHz~200 MHz	4.21 dB (k=2, 95% level of confidence)
200 MHz~1 GHz	4.41 dB (k=2, 95% level of confidence)
1 GHz~6 GHz	4.51 dB (k=2, 95% level of confidence)
6 GHz~18 GHz	4.88 dB (k=2, 95% level of confidence)
18 GHz~26 GHz	4.30 dB (k=2, 95% level of confidence)
26 GHz~40 GHz	4.30 dB (k=2, 95% level of confidence)

8.3 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.

8.4 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

8.5 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.

8.6 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

8.7 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.

8.8 Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	55 %
ATM Pressure:	1010 hPa

The Radiation Spurious Emissions testing was performed by Tom Hsu on 2018-07-14.

The Conducted Spurious Emissions testing was performed by Tom Hsu on 2018-07-13.

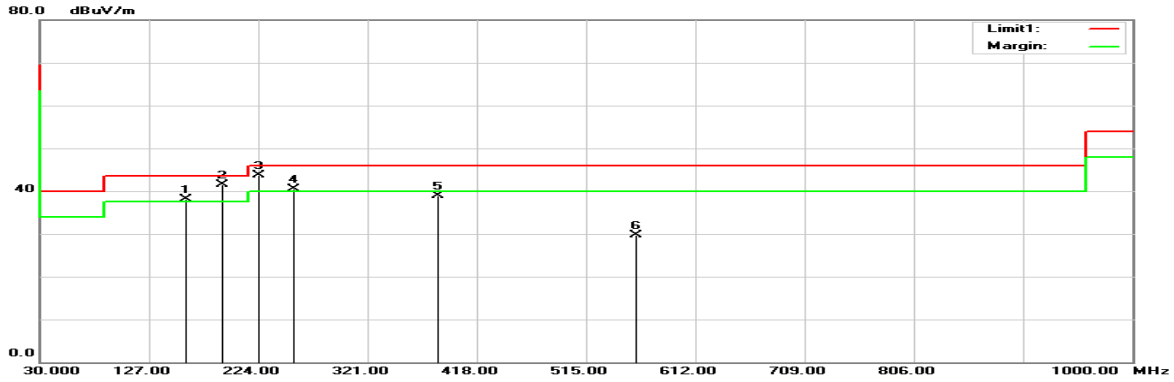
8.9 Test Results: PASS

8.10 Test Data

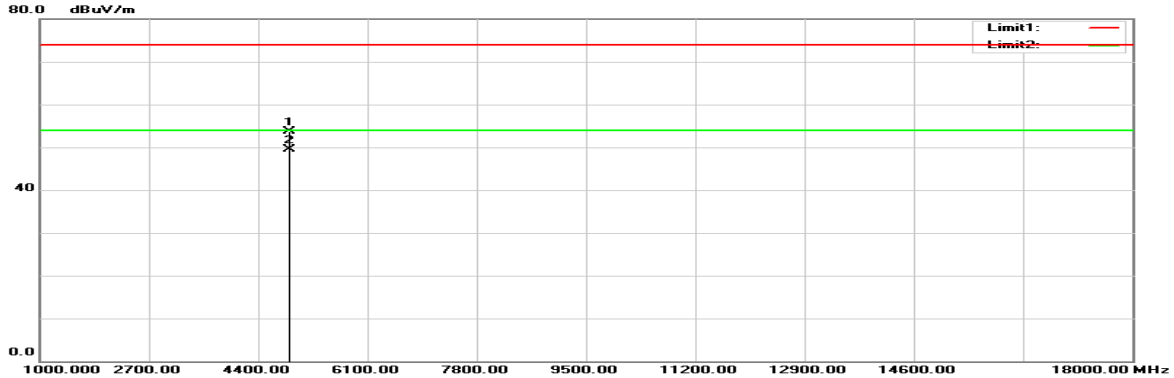
BR (GFSK) Mode

Horizontal (*worst case is BR (GFSK) mode middle channel*)

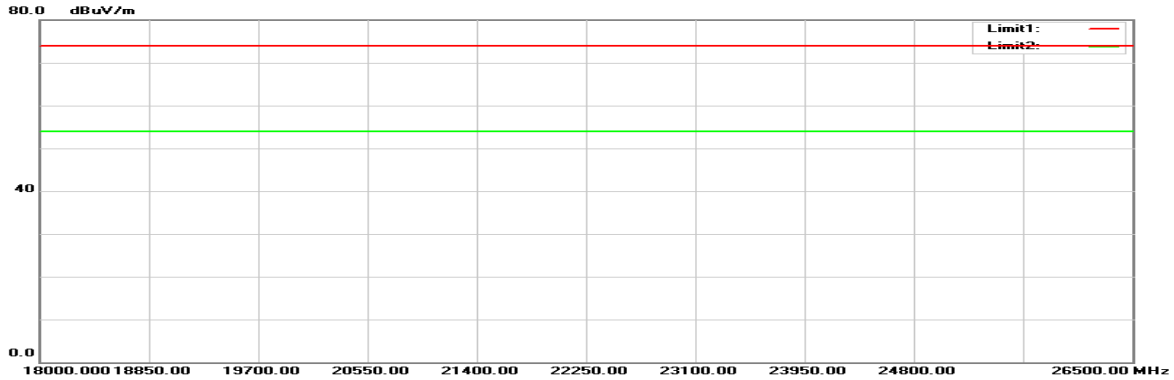
30MHz-1GHz:



1GHz-18GHz:

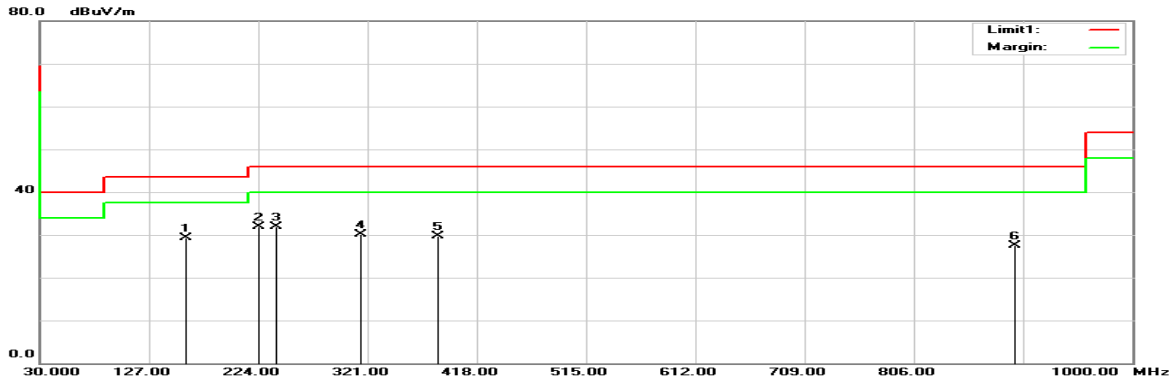


18GHz-26.5GHz:

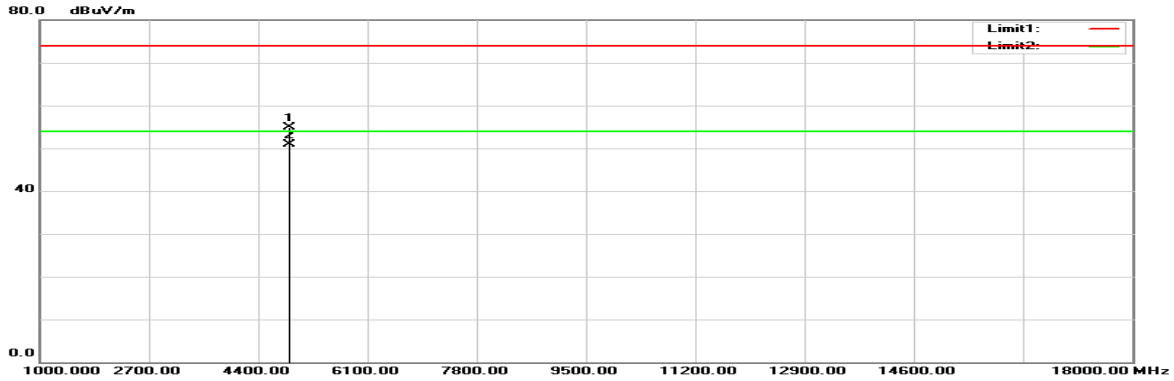


Vertical (*worst case is BR (GFSK) mode middle channel*)

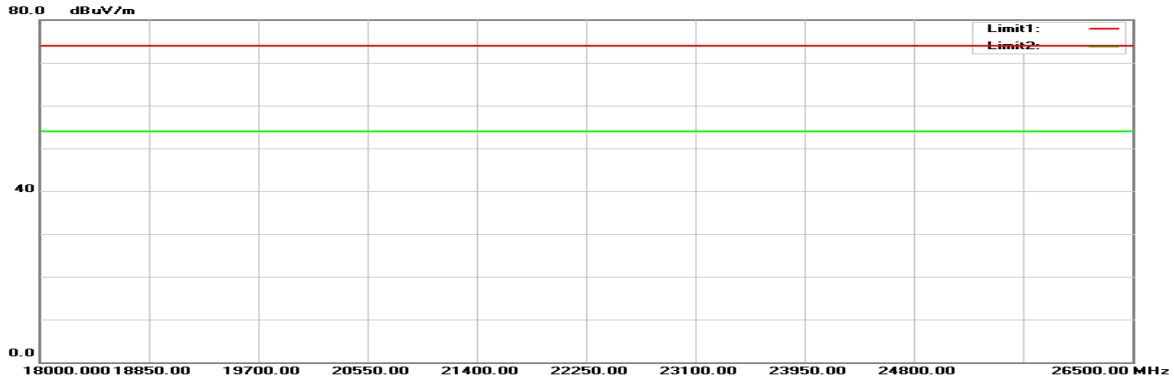
30MHz-1GHz:



1GHz-18GHz:



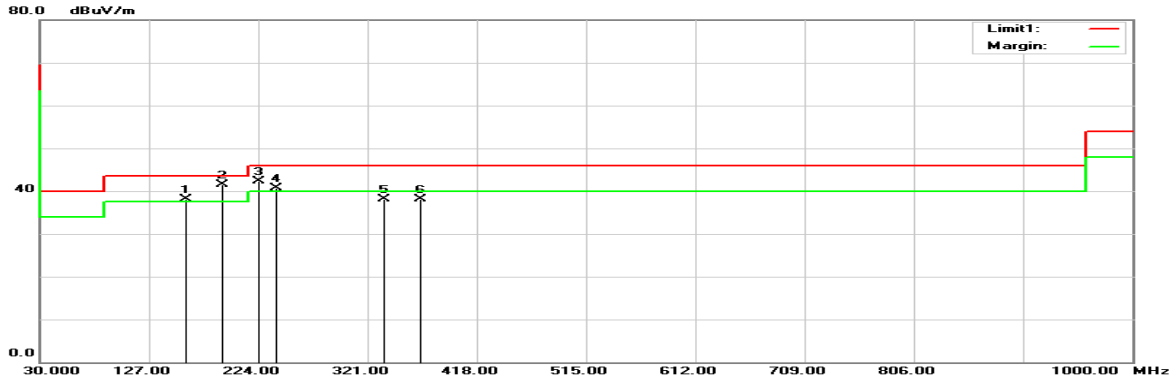
18GHz-26.5GHz:



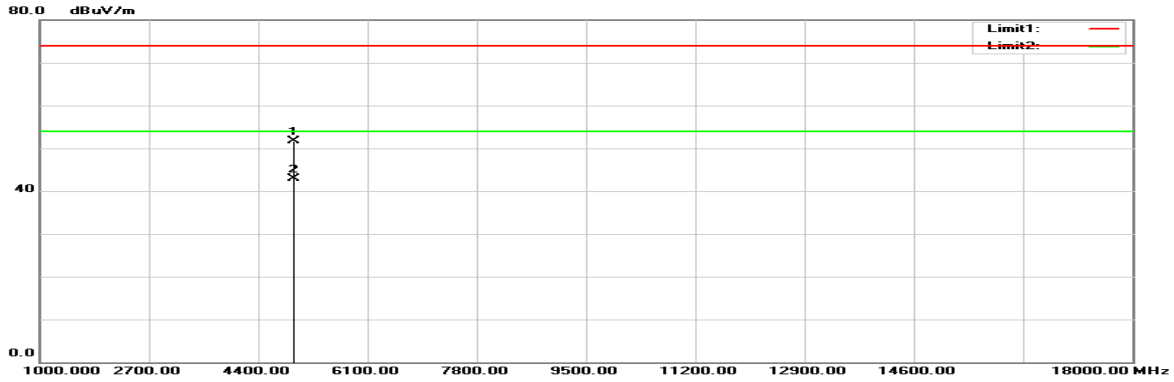
EDR (π/4-DQPSK) Mode

Horizontal (*worst case is EDR (π/4-DQPSK) mode high channel*)

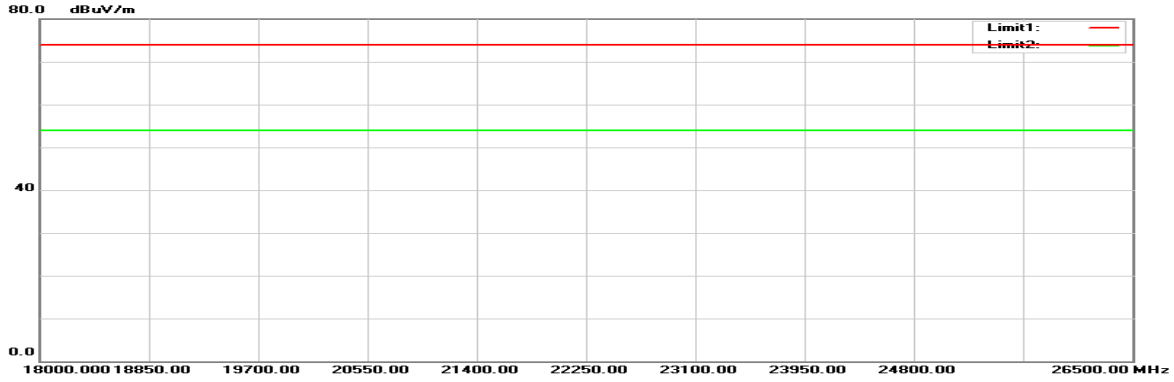
30MHz-1GHz:



1GHz-18GHz:

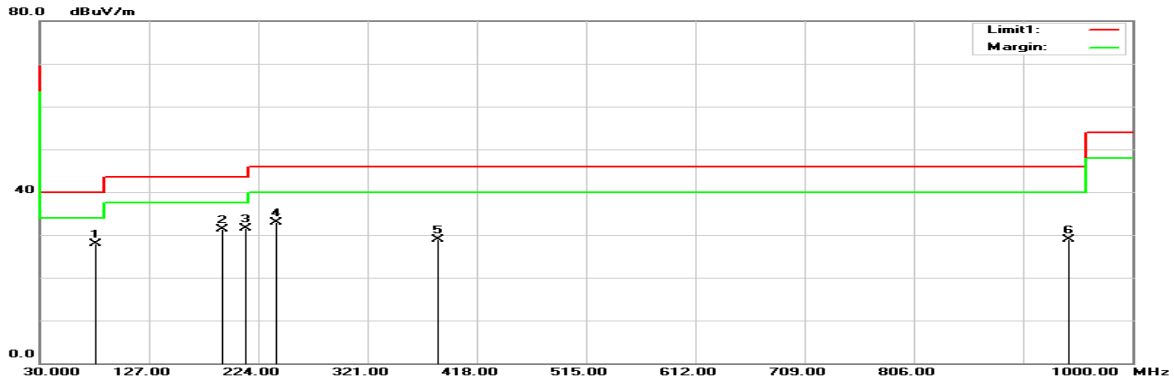


18GHz-26.5GHz:

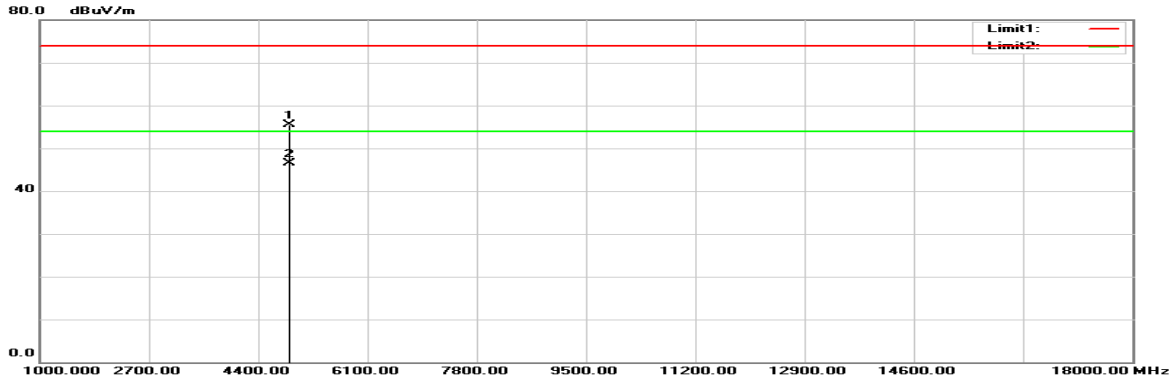


Vertical (*worst case is EDR (π/4-DQPSK) mode middle channel*)

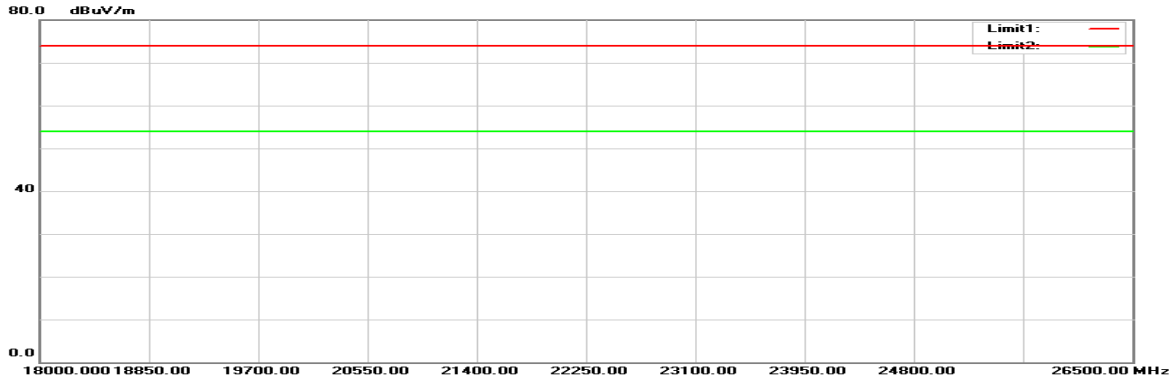
30MHz-1GHz:



1GHz-18GHz:



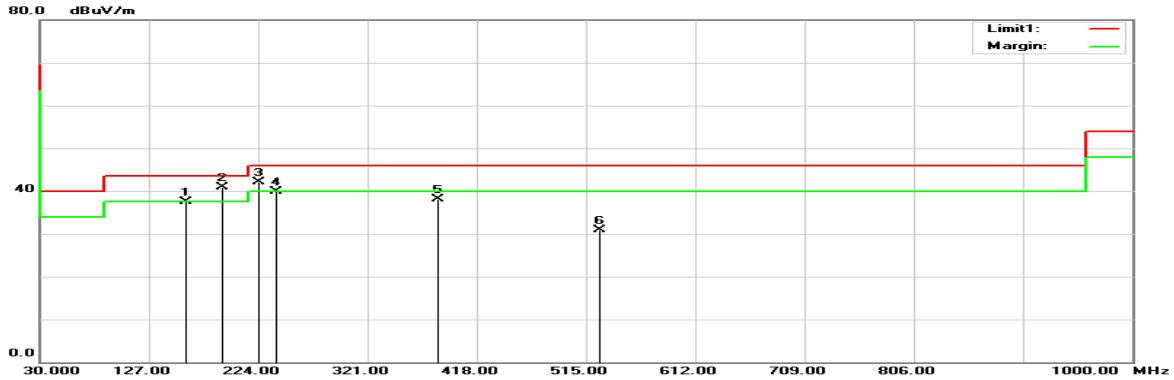
18GHz-26.5GHz:



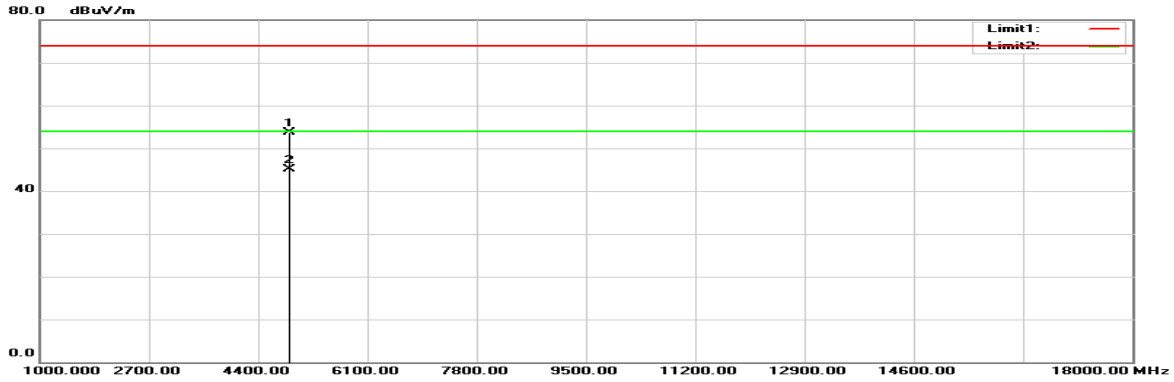
EDR (8DPSK) Mode

Horizontal (*worst case is EDR (8DPSK) mode middle channel*)

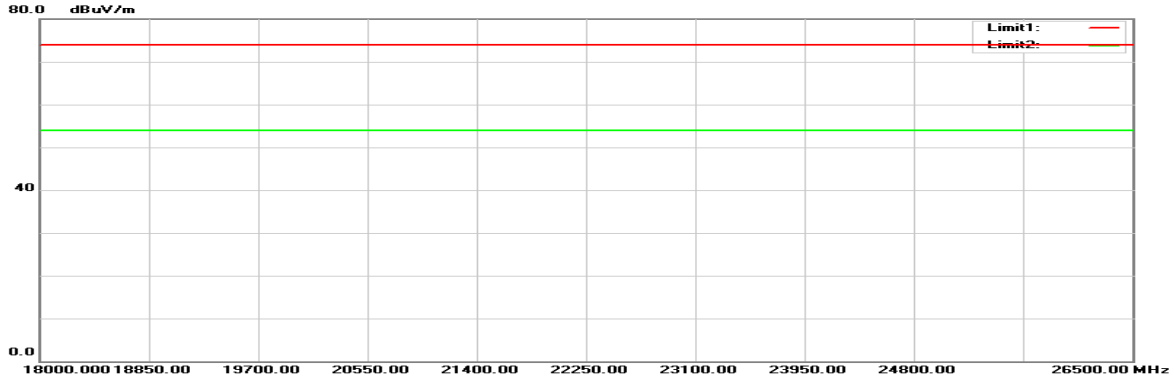
30MHz-1GHz:



1GHz-18GHz:

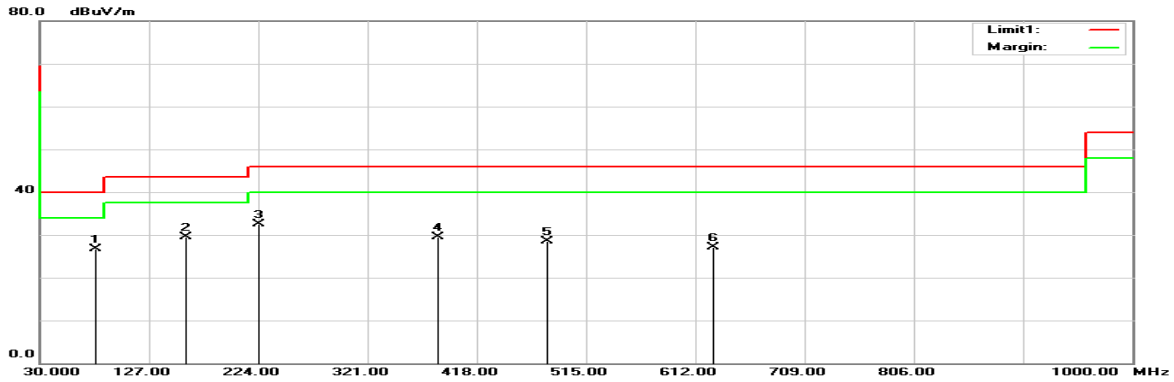


18GHz-26.5GHz:

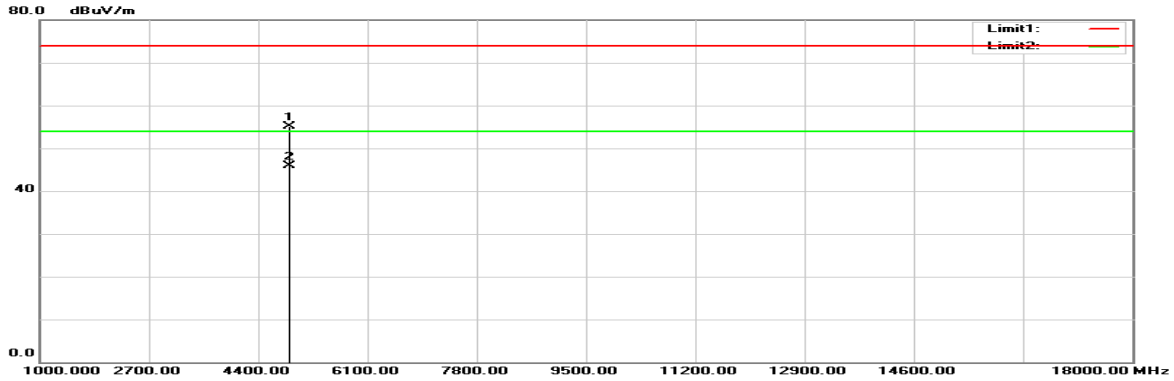


Vertical (*worst case is EDR (8DPSK) mode middle channel*)

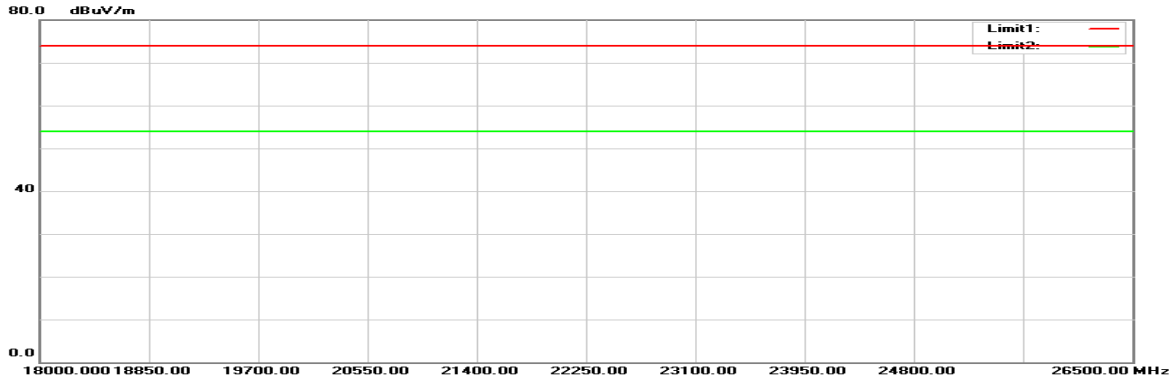
30MHz-1GHz:



1GHz-18GHz:



18GHz-26.5GHz:



Below 1GHz

Horizontal

Frequency (MHz)	Reading (dBμV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
BR (GFSK)								
159.980	48.41	-10.32	38.09	43.50	-5.41	100	1	QP
191.990	52.66	-11.18	41.48	43.50	-2.02	100	1	QP
224.000	55.05	-11.32	43.73	46.00	-2.27	100	159	QP
256.010	50.92	-10.48	40.44	46.00	-5.56	100	164	QP
384.050	45.89	-7.05	38.84	46.00	-7.16	100	19	QP
559.620	34.51	-4.90	29.61	46.00	-16.39	100	46	QP
EDR (π/4-DQPSK)								
159.980	48.34	-10.32	38.02	43.50	-5.48	100	162	QP
191.990	52.70	-11.18	41.52	43.50	-1.98	100	170	QP
224.000	53.70	-11.32	42.38	46.00	-3.62	100	159	QP
239.520	51.72	-11.02	40.70	46.00	-5.30	100	356	QP
335.550	46.14	-7.96	38.18	46.00	-7.82	100	150	QP
367.560	45.41	-7.35	38.06	46.00	-7.94	100	16	QP
EDR (8DPSK)								
159.980	47.91	-10.32	37.59	43.50	-5.91	100	2	QP
191.990	52.03	-11.18	40.85	43.50	-2.65	100	22	QP
224.000	53.36	-11.32	42.04	46.00	-3.96	100	1	QP
239.520	50.94	-11.02	39.92	46.00	-6.08	100	6	QP
384.050	45.24	-7.05	38.19	46.00	-7.81	100	1	QP
527.610	36.12	-5.17	30.95	46.00	-15.05	100	136	QP

Vertical

Frequency (MHz)	Reading (dBμV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
BR (GFSK)								
159.980	39.70	-10.32	29.38	43.50	-14.12	100	62	QP
224.000	43.16	-11.32	31.84	46.00	-14.16	100	116	QP
239.520	42.85	-11.02	31.83	46.00	-14.17	100	104	QP
315.180	38.57	-8.38	30.19	46.00	-15.81	100	281	QP
384.050	36.69	-7.05	29.64	46.00	-16.36	100	307	QP
896.210	27.83	-0.40	27.43	46.00	-18.57	100	326	QP
EDR (π/4-DQPSK)								
79.470	43.93	-15.93	28.00	40.00	-12.00	100	219	QP
191.990	42.46	-11.18	31.28	43.50	-12.22	100	113	QP
213.330	43.15	-11.61	31.54	43.50	-11.96	100	99	QP
239.520	43.98	-11.02	32.96	46.00	-13.04	100	79	QP
384.050	35.87	-7.05	28.82	46.00	-17.18	100	316	QP
943.740	28.11	0.74	28.85	46.00	-17.15	100	241	QP
EDR (8DPSK)								
79.470	42.69	-15.93	26.76	40.00	-13.24	100	181	QP
159.980	39.79	-10.32	29.47	43.50	-14.03	100	108	QP
224.000	43.91	-11.32	32.59	46.00	-13.41	100	91	QP
384.050	36.54	-7.05	29.49	46.00	-16.51	100	324	QP
480.080	34.06	-5.64	28.42	46.00	-17.58	100	251	QP
628.490	31.14	-4.11	27.03	46.00	-18.97	100	217	QP

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.

Above 1GHz

Horizontal

Frequency (MHz)	Reading (dBμV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
BR (GFSK), Low channel								
2390.000	63.85	-4.81	59.04	74.00	-14.96	300	105	peak
2390.000	49.76	-4.81	44.95	54.00	-9.05	300	105	AVG
2402.000	97.21	-4.78	92.43	N/A	N/A	322	196	peak
2402.000	96.71	-4.78	91.93	N/A	N/A	322	196	AVG
4804.000	50.68	1.16	51.84	74.00	-22.16	274	30	peak
4804.000	46.18	1.16	47.34	54.00	-6.66	274	30	AVG
BR (GFSK), Middle channel								
2441.000	95.82	-4.67	91.15	N/A	N/A	352	192	peak
2441.000	95.38	-4.67	90.71	N/A	N/A	352	192	AVG
4882.000	52.36	1.43	53.79	74.00	-20.21	286	38	peak
4882.000	48.07	1.43	49.50	54.00	-4.50	286	38	AVG
BR (GFSK), High channel								
2480.000	93.71	-4.57	89.14	N/A	N/A	302	43	peak
2480.000	93.15	-4.57	88.58	N/A	N/A	302	43	AVG
2483.500	64.06	-4.57	59.49	74.00	-14.51	300	260	peak
2483.500	49.66	-4.57	45.09	54.00	-8.91	300	260	AVG
4960.000	49.99	1.69	51.68	74.00	-22.32	245	31	peak
4960.000	45.43	1.69	47.12	54.00	-6.88	245	31	AVG

Vertical

Frequency (MHz)	Reading (dBμV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
BR (GFSK), Low channel								
2390.000	63.95	-4.81	59.14	74.00	-14.86	100	308	peak
2390.000	49.81	-4.81	45.00	54.00	-9.00	100	308	AVG
2402.000	101.07	-4.78	96.29	N/A	N/A	112	162	peak
2402.000	100.64	-4.78	95.86	N/A	N/A	112	162	AVG
4804.000	51.85	1.16	53.01	74.00	-20.99	100	22	peak
4804.000	47.26	1.16	48.42	54.00	-5.58	100	22	AVG
BR (GFSK), Middle channel								
2441.000	102.08	-4.67	97.41	N/A	N/A	108	159	peak
2441.000	101.69	-4.67	97.02	N/A	N/A	108	159	AVG
4882.000	53.41	1.43	54.84	74.00	-19.16	100	26	peak
4882.000	49.40	1.43	50.83	54.00	-3.17	100	26	AVG
BR (GFSK), High channel								
2480.000	101.56	-4.57	96.99	N/A	N/A	100	149	peak
2480.000	101.15	-4.57	96.58	N/A	N/A	100	149	AVG
2483.500	63.83	-4.57	59.26	74.00	-14.74	100	334	peak
2483.500	49.87	-4.57	45.30	54.00	-8.70	100	334	AVG
4960.000	51.31	1.69	53.00	74.00	-21.00	100	39	peak
4960.000	46.75	1.69	48.44	54.00	-5.56	100	39	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.

Horizontal

Frequency (MHz)	Reading (dBμV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
EDR (π/4-DQPSK), Low channel								
2390.000	63.85	-4.81	59.04	74.00	-14.96	300	333	peak
2390.000	49.77	-4.81	44.96	54.00	-9.04	300	333	AVG
2402.000	97.44	-4.78	92.66	N/A	N/A	327	197	peak
2402.000	93.80	-4.78	89.02	N/A	N/A	327	197	AVG
4804.000	51.10	1.16	52.26	74.00	-21.74	268	33	peak
4804.000	42.07	1.16	43.23	54.00	-10.77	260	33	AVG
EDR (π/4-DQPSK), Middle channel								
2441.000	96.22	-4.67	91.55	N/A	N/A	354	196	peak
2441.000	92.55	-4.67	87.88	N/A	N/A	354	196	AVG
4882.000	51.99	1.43	53.42	74.00	-20.58	284	35	peak
4882.000	43.58	1.43	45.01	54.00	-8.99	284	35	AVG
EDR (π/4-DQPSK), High channel								
2480.000	94.13	-4.57	89.56	N/A	N/A	302	70	peak
2480.000	90.53	-4.57	85.96	N/A	N/A	302	70	AVG
2483.500	64.17	-4.57	59.60	74.00	-14.40	300	84	peak
2483.500	49.84	-4.57	45.27	54.00	-8.73	300	84	AVG
4960.000	50.07	1.69	51.76	74.00	-22.24	276	208	peak
4960.000	41.18	1.69	42.87	54.00	-11.13	276	208	AVG

Vertical

Frequency (MHz)	Reading (dBμV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
EDR (π/4-DQPSK), Low channel								
2390.000	63.44	-4.81	58.63	74.00	-15.37	100	142	peak
2390.000	49.78	-4.81	44.97	54.00	-9.03	100	142	AVG
2402.000	101.71	-4.78	96.93	N/A	N/A	112	181	peak
2402.000	98.21	-4.78	93.43	N/A	N/A	112	181	AVG
4804.000	52.08	1.16	53.24	74.00	-20.76	100	37	peak
4804.000	43.09	1.16	44.25	54.00	-9.75	100	37	AVG
EDR (π/4-DQPSK), Middle channel								
2441.000	102.41	-4.67	97.74	N/A	N/A	108	150	peak
2441.000	98.89	-4.67	94.22	N/A	N/A	108	150	AVG
4882.000	53.99	1.43	55.42	74.00	-18.58	100	27	peak
4882.000	45.17	1.43	46.60	54.00	-7.40	100	27	AVG
EDR (π/4-DQPSK), High channel								
2480.000	101.86	-4.57	97.29	N/A	N/A	114	150	peak
2480.000	98.29	-4.57	93.72	N/A	N/A	114	150	AVG
2483.500	63.65	-4.57	59.08	74.00	-14.92	100	17	peak
2483.500	49.93	-4.57	45.36	54.00	-8.64	100	17	AVG
4960.000	51.62	1.69	53.31	74.00	-20.69	100	38	peak
4960.000	42.84	1.69	44.53	54.00	-9.47	100	38	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.

Horizontal

Frequency (MHz)	Reading (dBμV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
EDR (8DPSK), Low channel								
2390.000	63.57	-4.81	58.76	74.00	-15.24	300	252	peak
2390.000	50.01	-4.81	45.20	54.00	-8.80	300	252	AVG
2402.000	97.83	-4.78	93.05	N/A	N/A	326	196	peak
2402.000	93.73	-4.78	88.95	N/A	N/A	326	196	AVG
4804.000	51.59	1.16	52.75	74.00	-21.25	267	33	peak
4804.000	42.17	1.16	43.33	54.00	-10.67	267	33	AVG
EDR (8DPSK), Middle channel								
2441.000	97.39	-4.67	92.72	N/A	N/A	351	195	peak
2441.000	93.28	-4.67	88.61	N/A	N/A	351	195	AVG
4882.000	52.32	1.43	53.75	74.00	-20.25	286	36	peak
4882.000	43.77	1.43	45.20	54.00	-8.80	286	36	AVG
EDR (8DPSK), High channel								
2480.000	95.19	-4.57	90.62	N/A	N/A	301	43	peak
2480.000	90.90	-4.57	86.33	N/A	N/A	301	43	AVG
2483.500	63.79	-4.57	59.22	74.00	-14.78	300	160	peak
2483.500	49.91	-4.57	45.34	54.00	-8.66	300	160	AVG
4960.000	49.81	1.69	51.50	74.00	-22.50	245	33	peak
4960.000	41.02	1.69	42.71	54.00	-11.29	245	33	AVG

Vertical

Frequency (MHz)	Reading (dBμV)	Correct Factor(dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
EDR (8DPSK), Low channel								
2390.000	63.64	-4.81	58.83	74.00	-15.17	100	342	peak
2390.000	49.91	-4.81	45.10	54.00	-8.90	100	342	AVG
2402.000	101.95	-4.78	97.17	N/A	N/A	117	183	peak
2402.000	97.82	-4.78	93.04	N/A	N/A	117	183	AVG
4804.000	52.10	1.16	53.26	74.00	-20.74	100	36	peak
4804.000	43.02	1.16	44.18	54.00	-9.82	100	36	AVG
EDR (8DPSK), Middle channel								
2441.000	103.55	-4.67	98.88	N/A	N/A	107	159	peak
2441.000	99.48	-4.67	94.81	N/A	N/A	107	159	AVG
4882.000	53.72	1.43	55.15	74.00	-18.85	100	37	peak
4882.000	44.51	1.43	45.94	54.00	-8.06	100	37	AVG
EDR (8DPSK), High channel								
2480.000	102.87	-4.57	98.30	N/A	N/A	112	149	peak
2480.000	98.69	-4.57	94.12	N/A	N/A	112	149	AVG
2483.500	64.53	-4.57	59.96	74.00	-14.04	100	17	peak
2483.500	50.01	-4.57	45.44	54.00	-8.56	100	17	AVG
4960.000	52.24	1.69	53.93	74.00	-20.07	100	26	peak
4960.000	43.08	1.69	44.77	54.00	-9.23	100	26	AVG

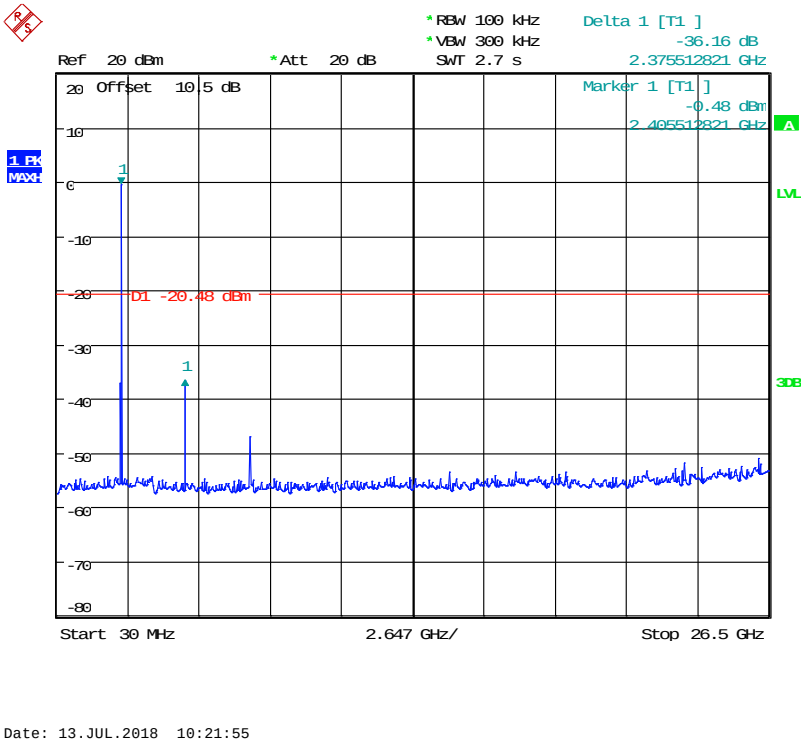
Result = Reading + Correct Factor
Margin = Result – Limit
Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain
Spurious emissions more than 20 dB below the limit were not reported.

Conducted Spurious Emissions:

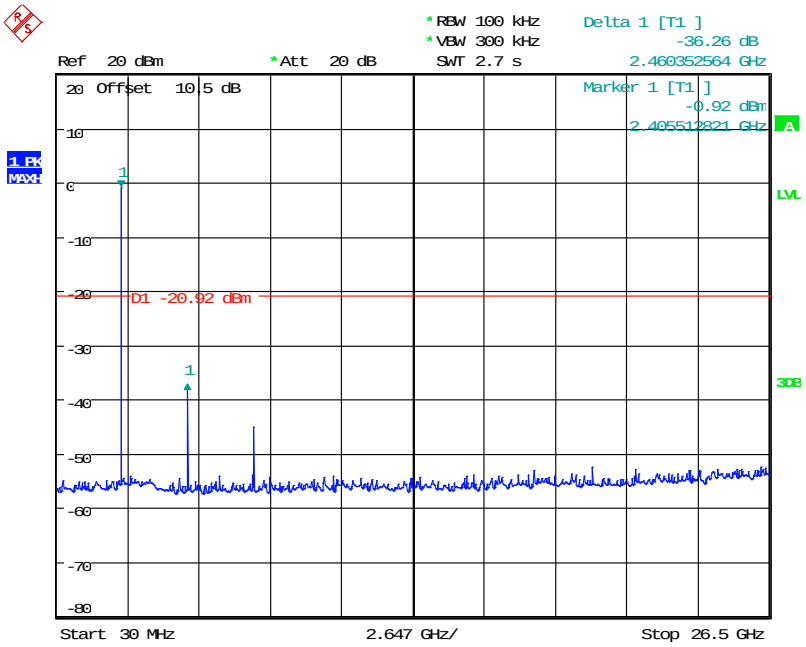
Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	Result
BR Mode (GFSK)				
Low	2402	36.16	≥ 20	PASS
Mid	2441	36.26	≥ 20	PASS
High	2480	36.92	≥ 20	PASS
EDR Mode (π/4-DQPSK):				
Low	2402	35.32	≥ 20	PASS
Mid	2441	36.02	≥ 20	PASS
High	2480	33.17	≥ 20	PASS
EDR Mode (8DPSK):				
Low	2402	39.03	≥ 20	PASS
Mid	2441	37.75	≥ 20	PASS
High	2480	38.11	≥ 20	PASS

BR Mode (GFSK)

Low Channel

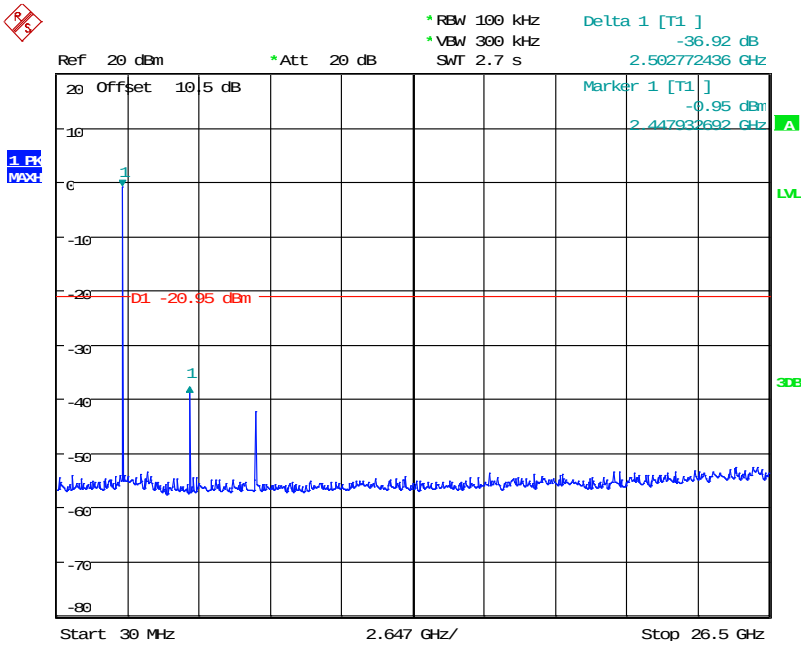


Middle Channel



Date: 13.JUL.2018 10:27:11

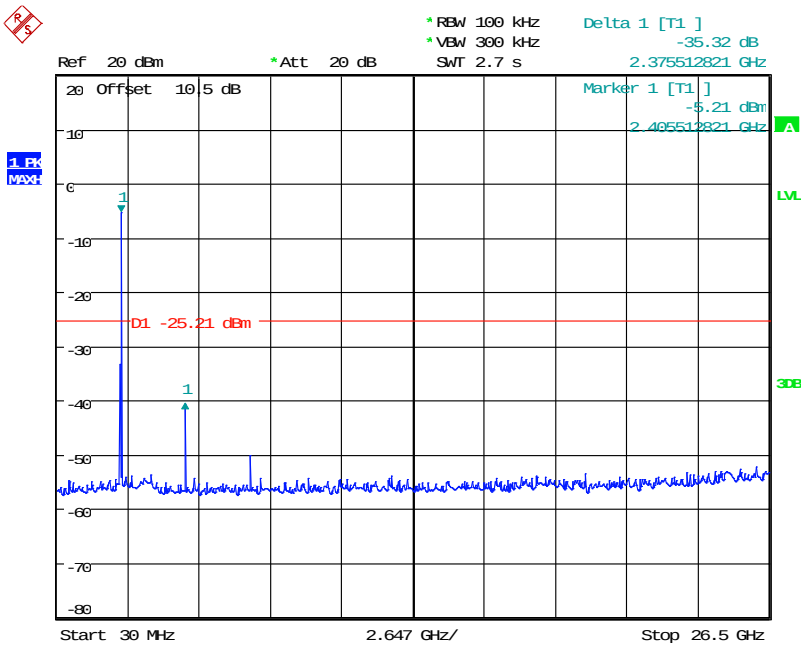
High Channel



Date: 13.JUL.2018 10:29:01

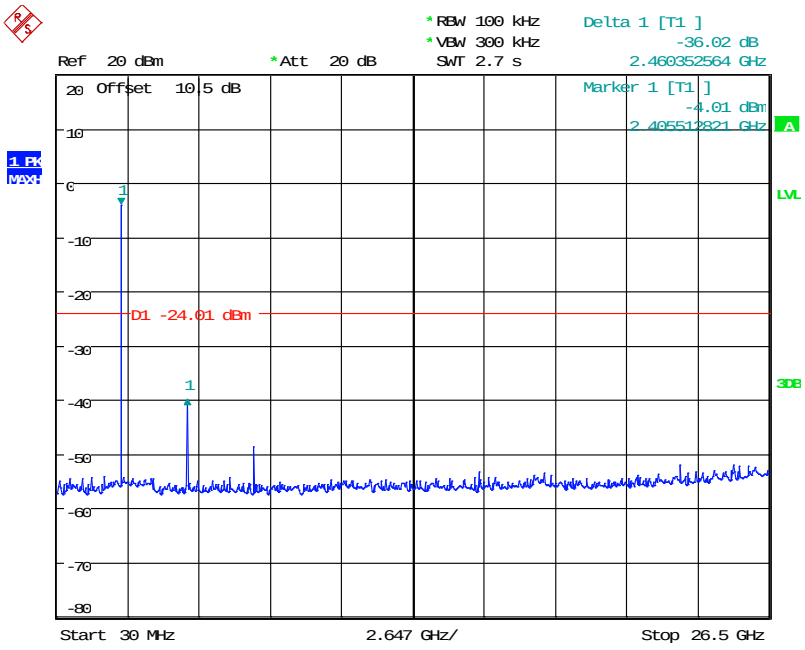
EDR Mode (π/4-DQPSK)

Low Channel



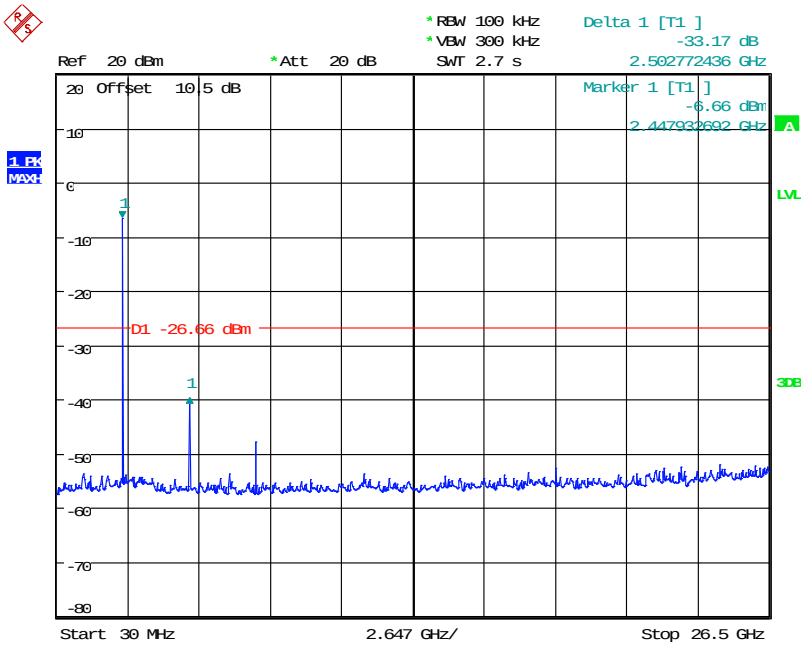
Date: 13.JUL.2018 10:56:46

Middle Channel



Date: 13.JUL.2018 10:58:05

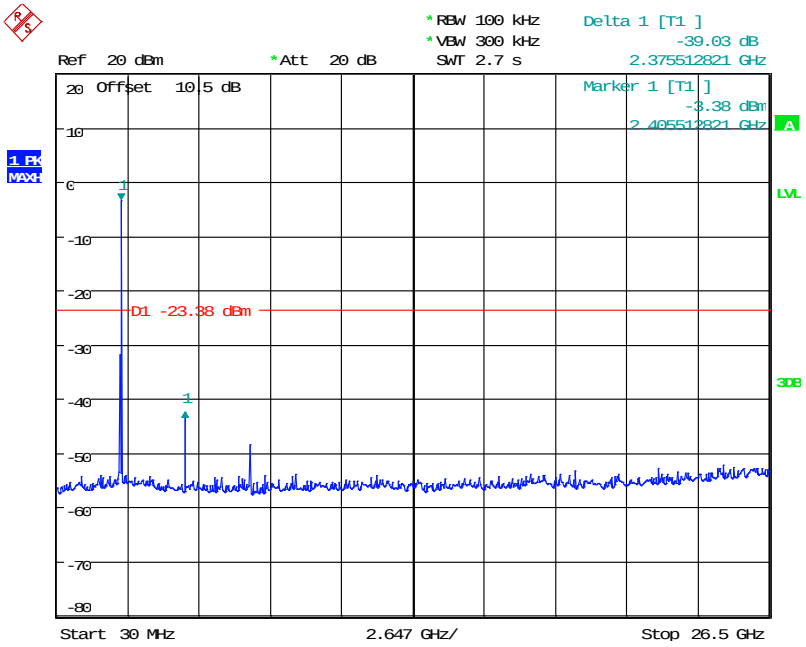
High Channel



Date: 13.JUL.2018 10:59:49

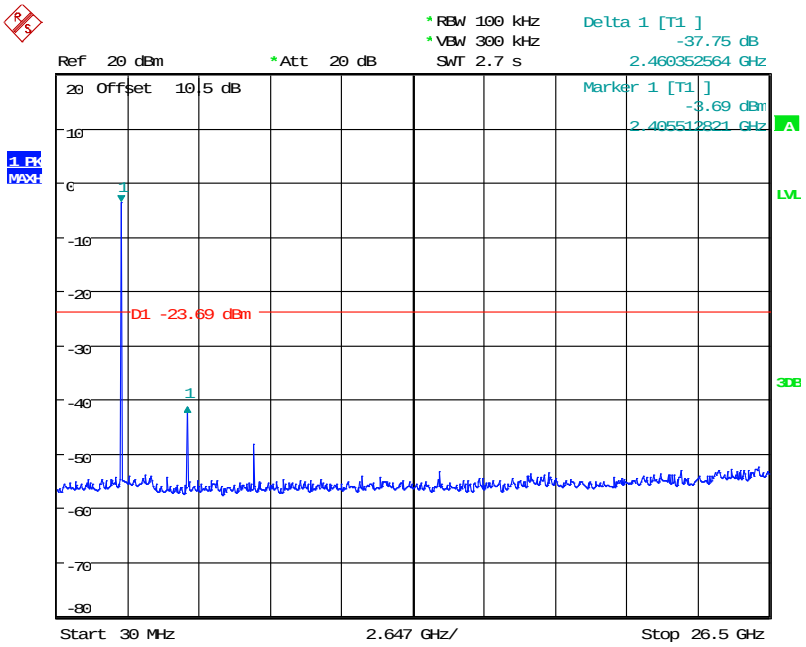
EDR Mode (8DPSK)

Low Channel



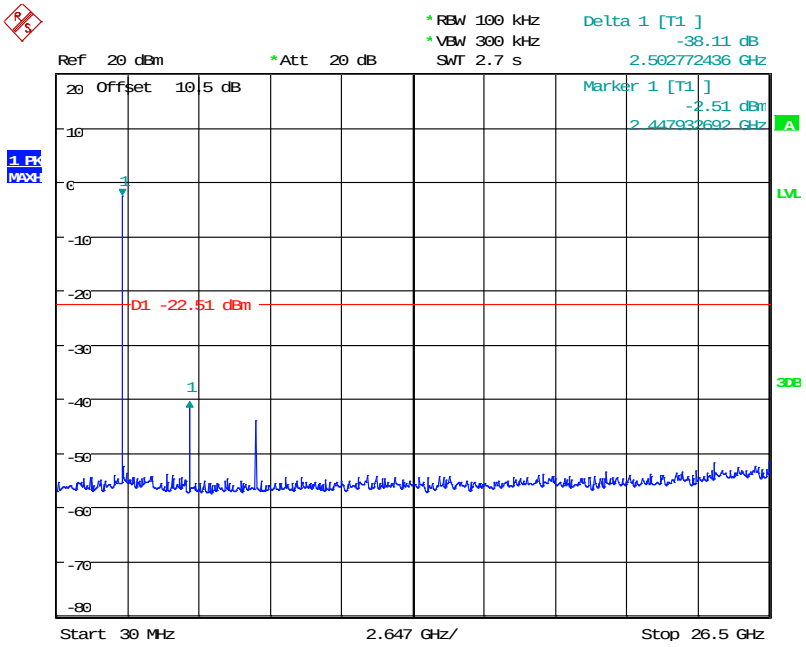
Date: 13.JUL.2018 11:36:22

Middle Channel



Date: 13.JUL.2018 11:37:43

High Channel



Date: 13.JUL.2018 11:39:18

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

9.1 Applicable Standard

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

9.2 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.

9.3 Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	55 %
ATM Pressure:	1010 hPa

The testing was performed by Tom Hsu on 2018-07-13.

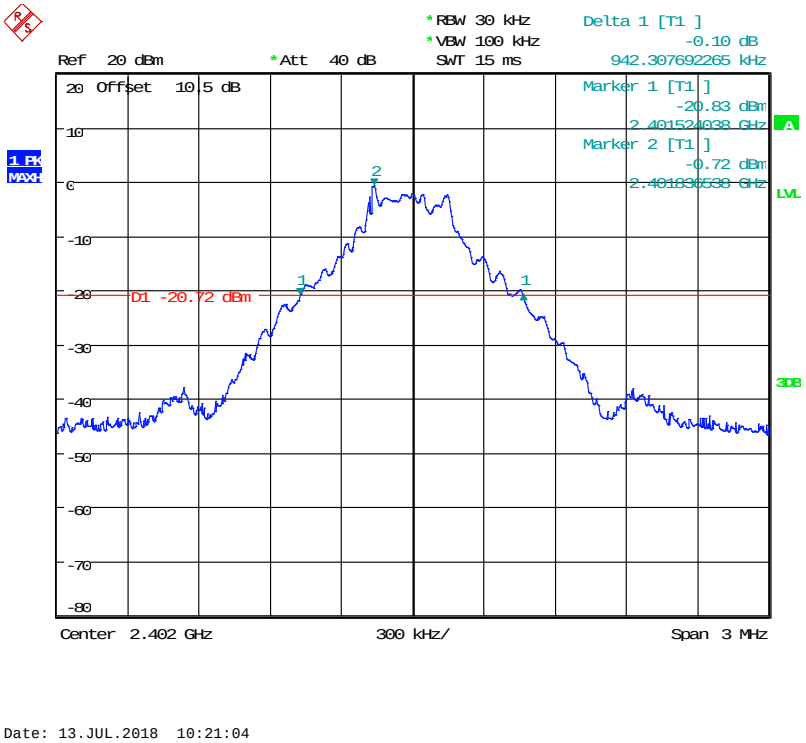
9.4 Test Results

Channel	Frequency (MHz)	20 dBc BW (MHz)
BR Mode (GFSK)		
Low	2402	0.94
Middle	2441	0.94
High	2480	0.94
EDR Mode (π/4-DQPSK)		
Low	2402	1.26
Middle	2441	1.27
High	2480	1.27
EDR Mode (8DPSK)		
Low	2402	1.29
Middle	2441	1.29
High	2480	1.29

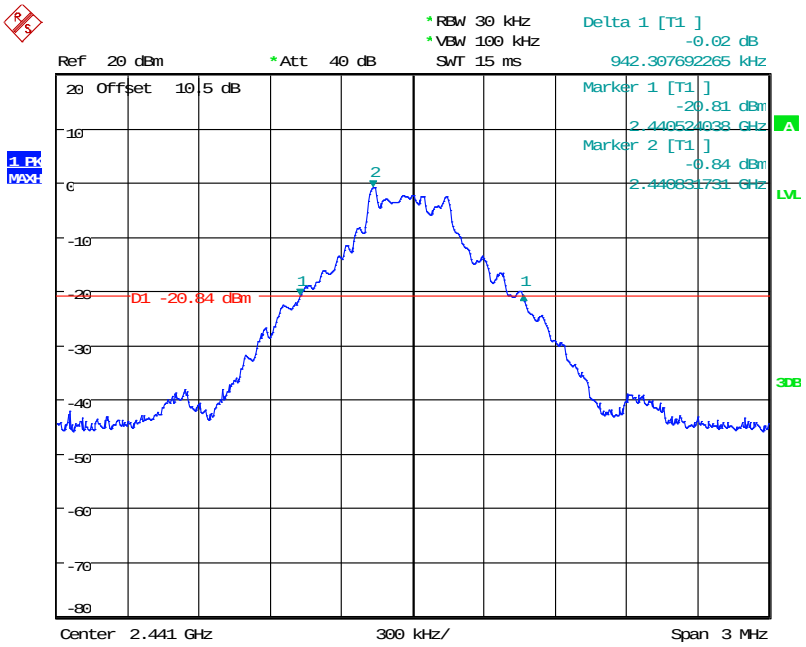
Please refer to the following plots

BR Mode (GFSK)

Low Channel

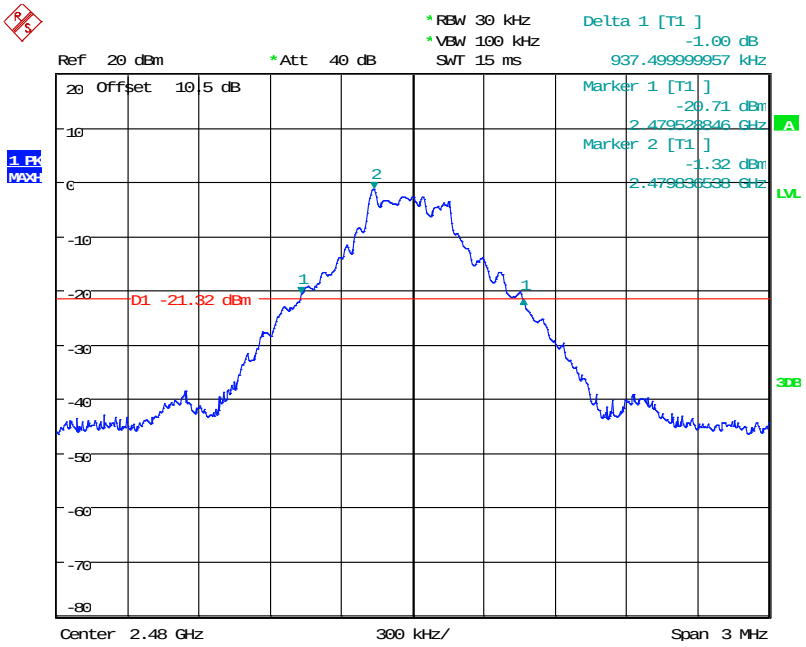


Middle Channel



Date: 13.JUL.2018 10:26:37

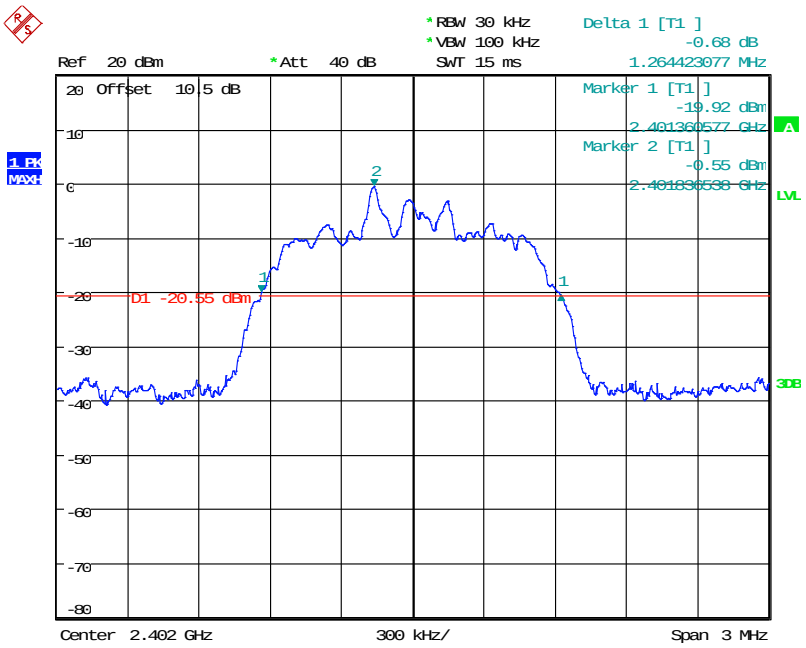
High Channel



Date: 13.JUL.2018 10:28:10

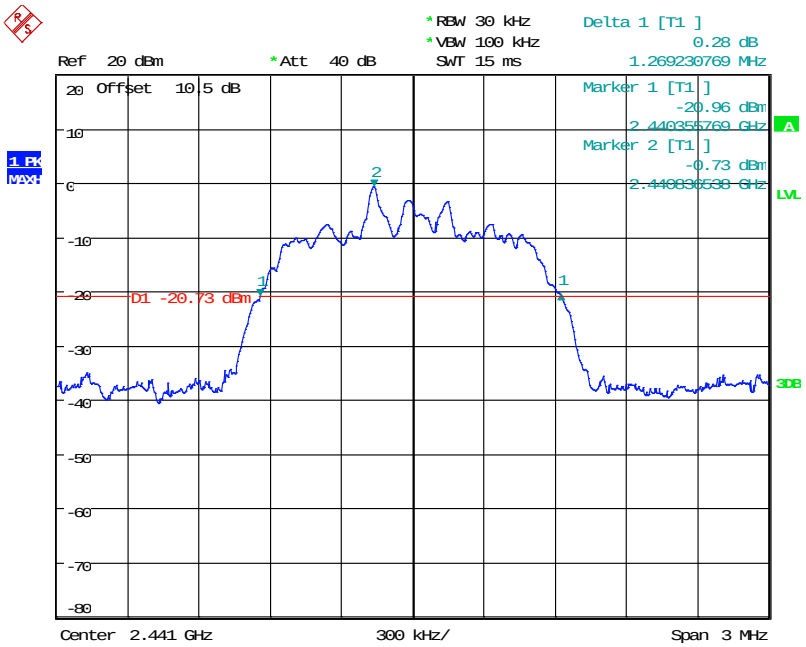
EDR Mode (π/4-DQPSK)

Low Channel



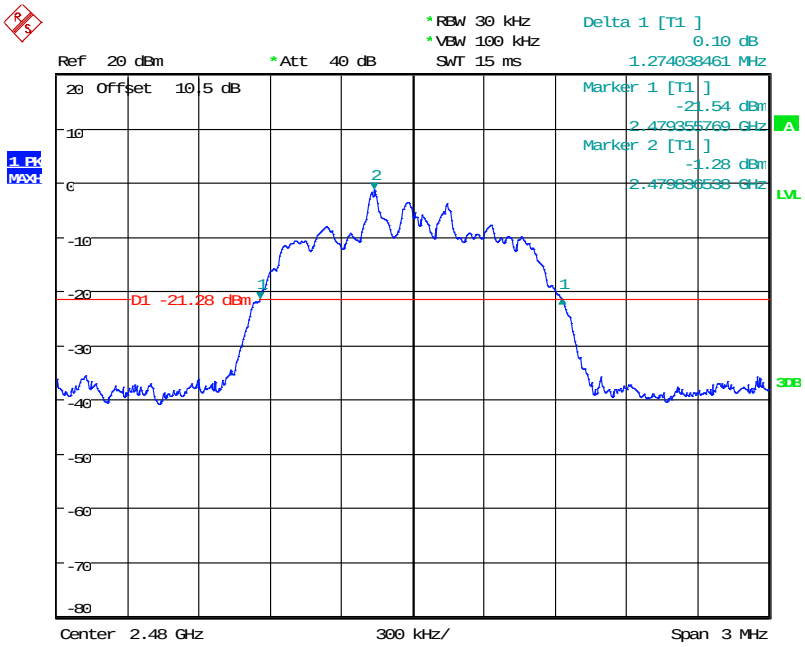
Date: 13.JUL.2018 10:55:55

Middle Channel



Date: 13.JUL.2018 10:57:31

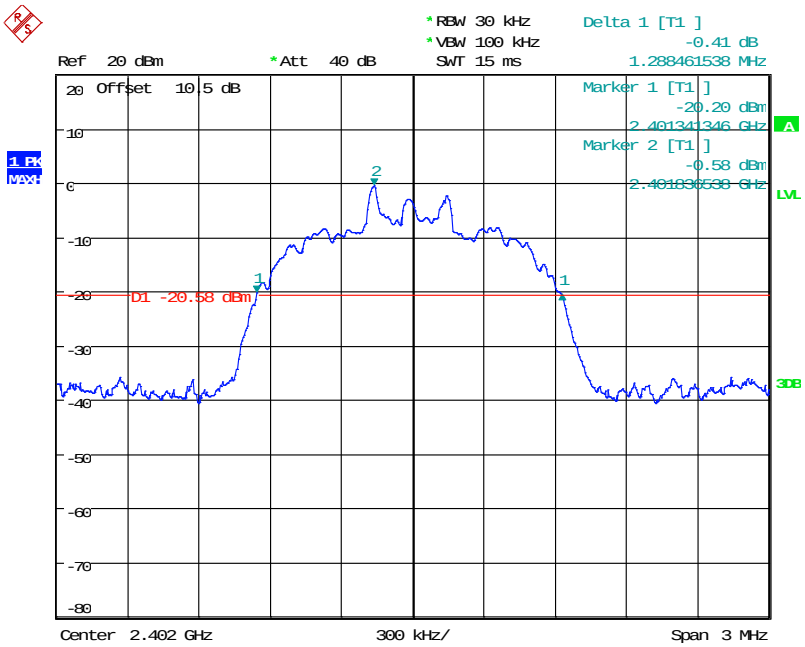
High Channel



Date: 13.JUL.2018 10:58:58

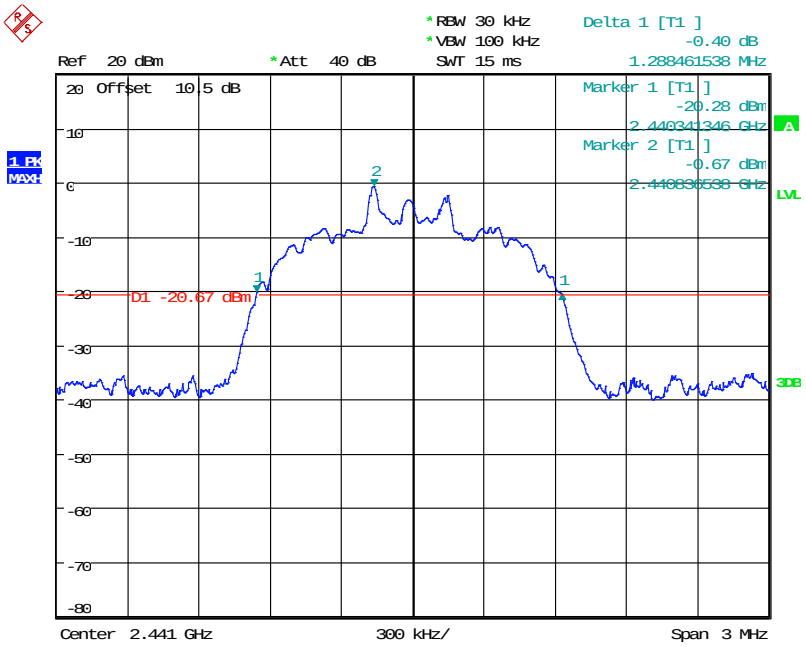
EDR Mode (8DPSK)

Low Channel



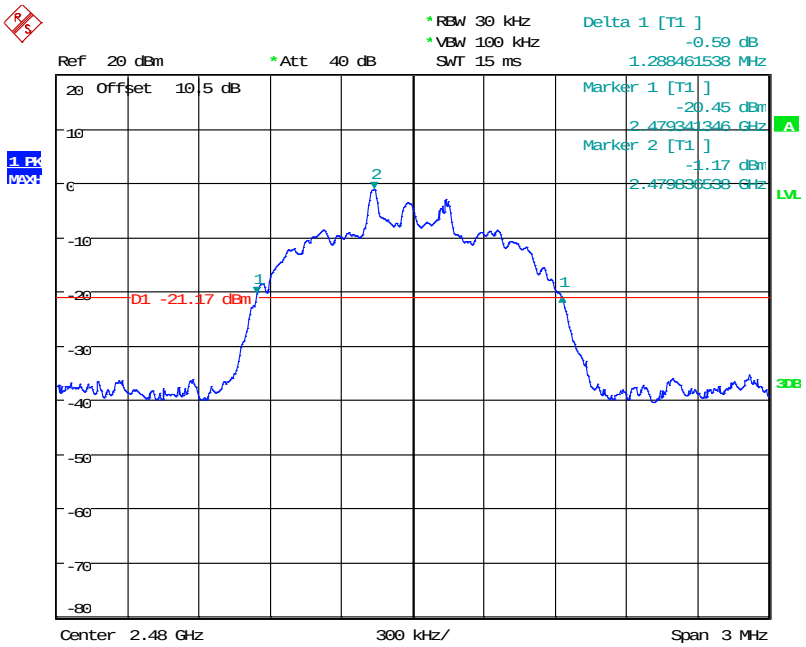
Date: 13.JUL.2018 11:35:31

Middle Channel



Date: 13.JUL.2018 11:37:09

High Channel



Date: 13.JUL.2018 11:38:27

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

10.1 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.

10.2 Test Procedure

1. Set the EUT in transmitting mode, max hold the channel.
2. Set the adjacent channel of the EUT and max hold another trace.
3. Measure the channel separation.

10.3 Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	55 %
ATM Pressure:	1010 hPa

The testing was performed by Tom Hsu on 2018-07-13.

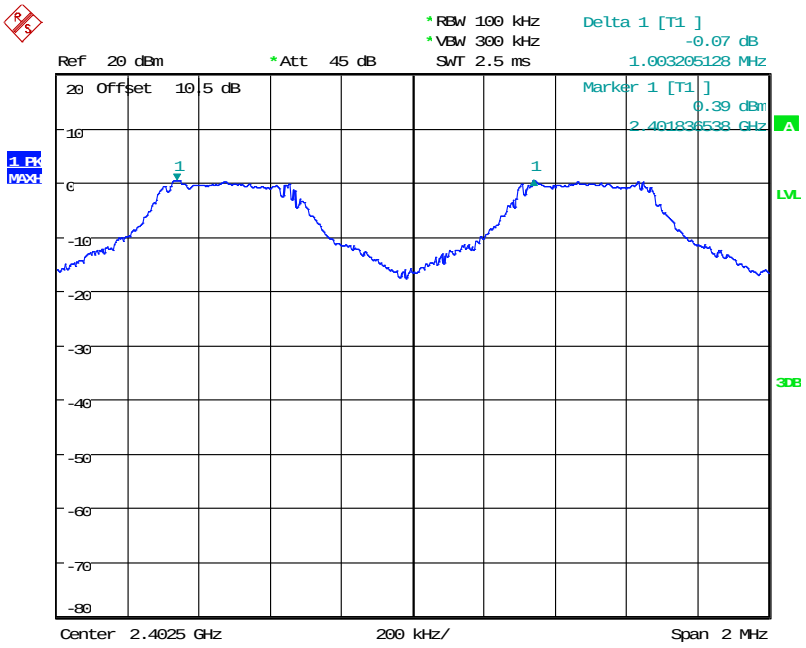
10.4 Test Results

Channel	Channel Separation (MHz)	20 dBc BW (MHz)	Two-thirds of the 20 dB bandwidth (MHz)	Channel Separation Limit	Result
BR Mode *(GFSK)*					
Low	1.00	0.94	0.627	>two-thirds of the 20 dB bandwidth	Compliance
Middle	0.87	0.94	0.627	>two-thirds of the 20 dB bandwidth	Compliance
High	1.02	0.94	0.627	>two-thirds of the 20 dB bandwidth	Compliance
EDR Mode *(π/4-DQPSK)*					
Low	1.01	1.26	0.840	>two-thirds of the 20 dB bandwidth	Compliance
Middle	0.99	1.27	0.847	>two-thirds of the 20 dB bandwidth	Compliance
High	0.99	1.27	0.847	>two-thirds of the 20 dB bandwidth	Compliance
EDR Mode *(8DPSK)*					
Low	1.00	1.29	0.860	>two-thirds of the 20 dB bandwidth	Compliance
Middle	0.99	1.29	0.860	>two-thirds of the 20 dB bandwidth	Compliance
High	1.00	1.29	0.860	>two-thirds of the 20 dB bandwidth	Compliance

Please refer to the following plots

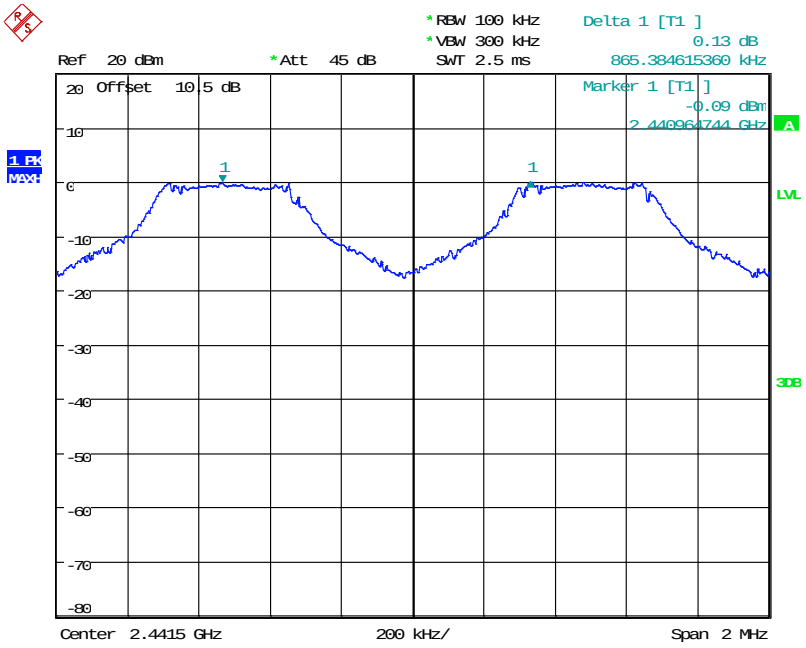
BR Mode (GFSK)

Low Channel



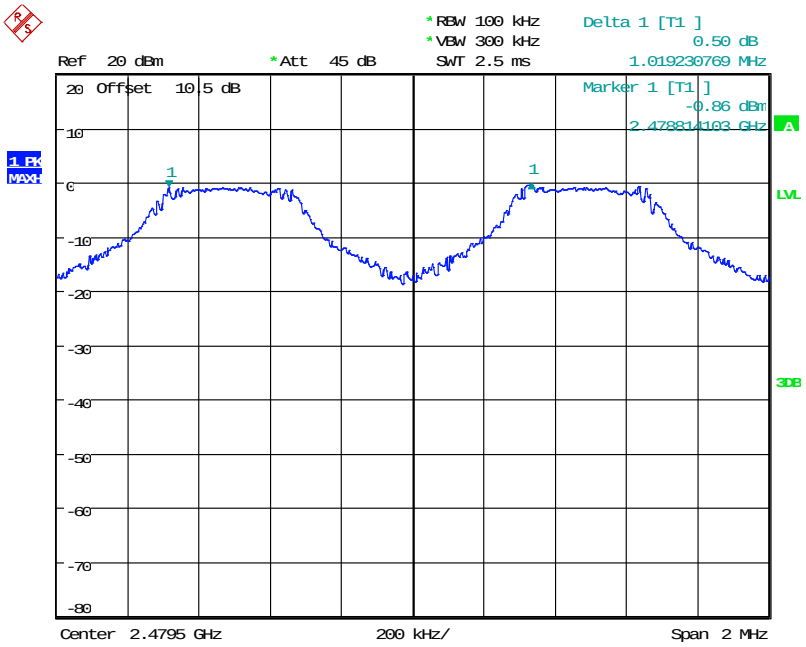
Date: 13.JUL.2018 10:18:17

Middle Channel



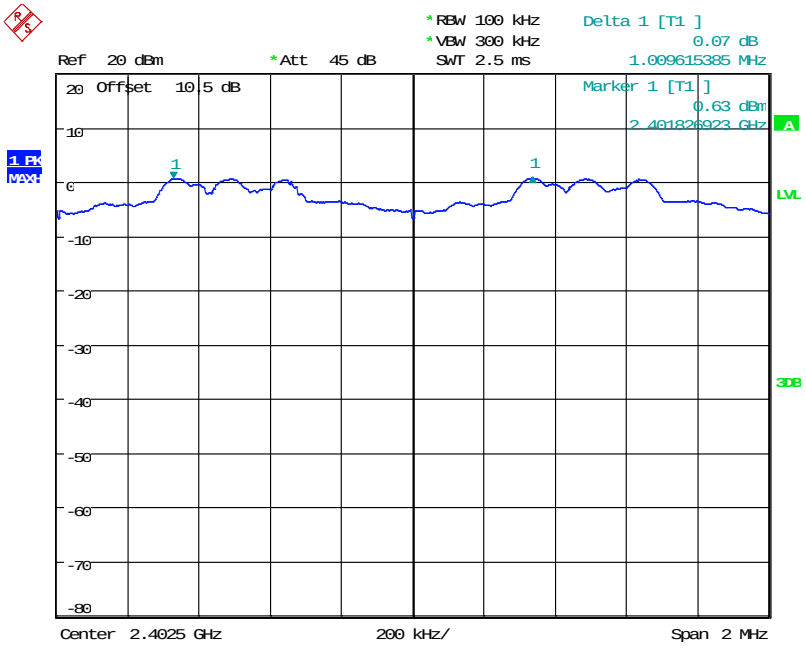
Date: 13.JUL.2018 10:15:25

High Channel

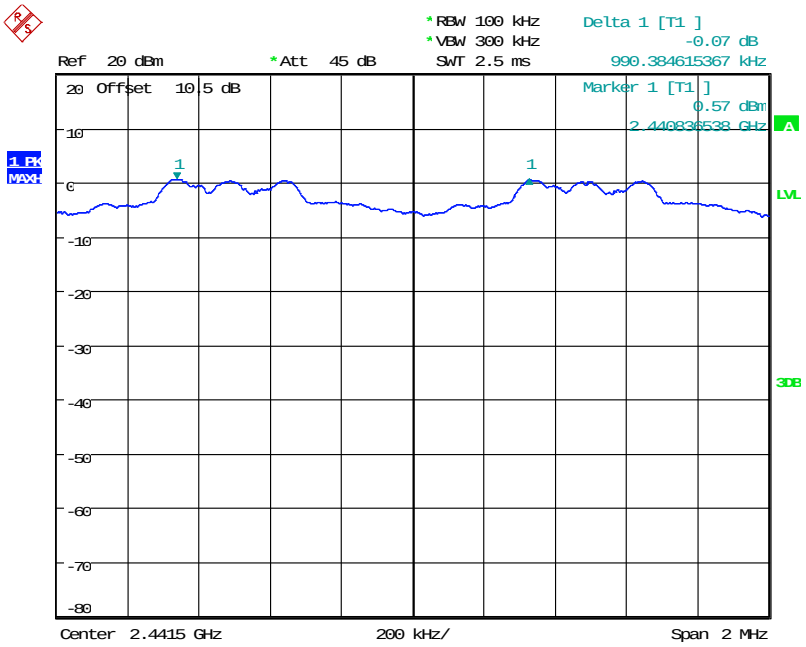


*EDR Mode (*π/4-DQPSK*)*

Low Channel

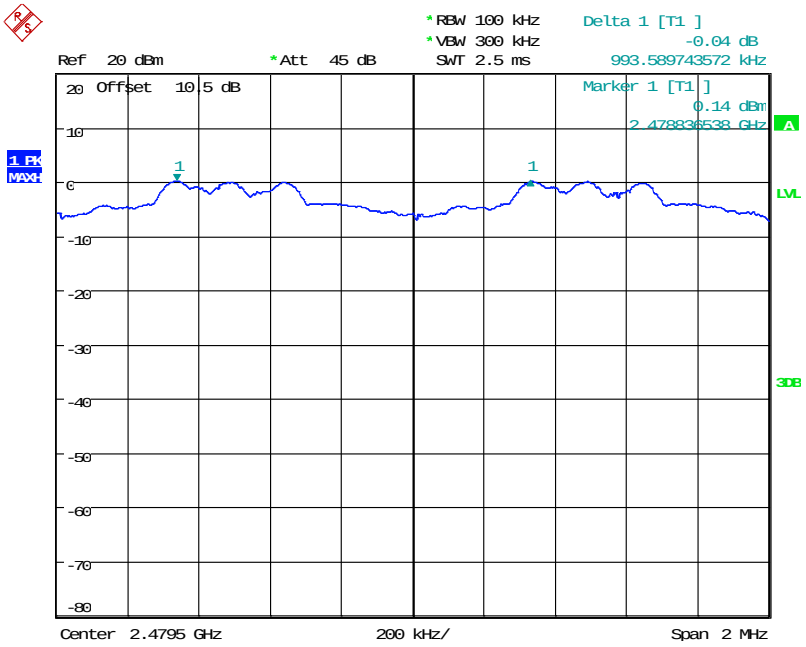


Middle Channel



Date: 13.JUL.2018 10:48:52

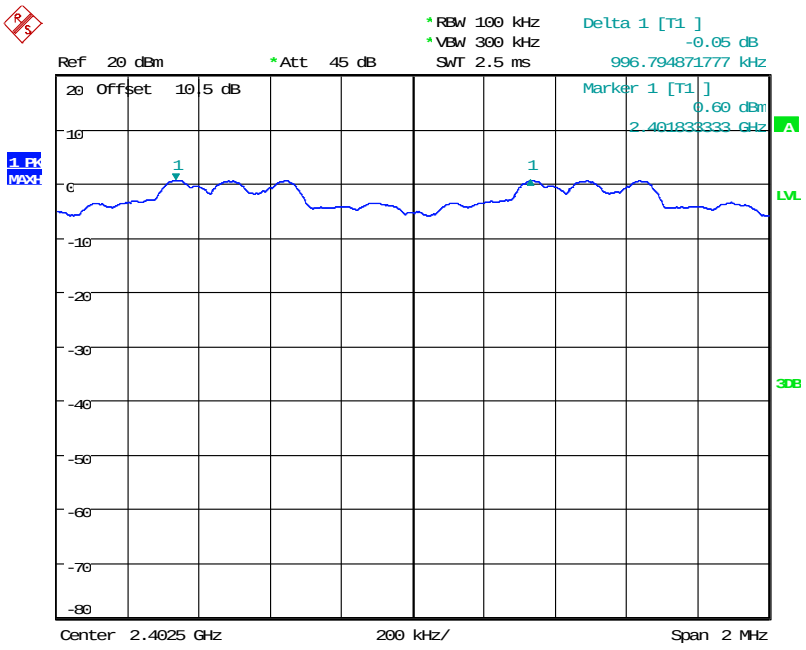
High Channel



Date: 13.JUL.2018 10:47:35

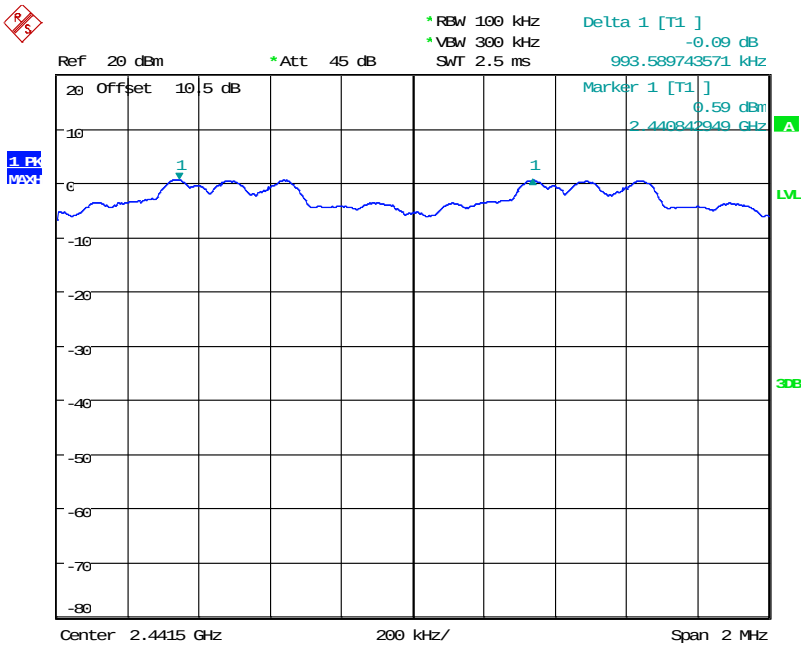
EDR Mode (8DPSK)

Low Channel



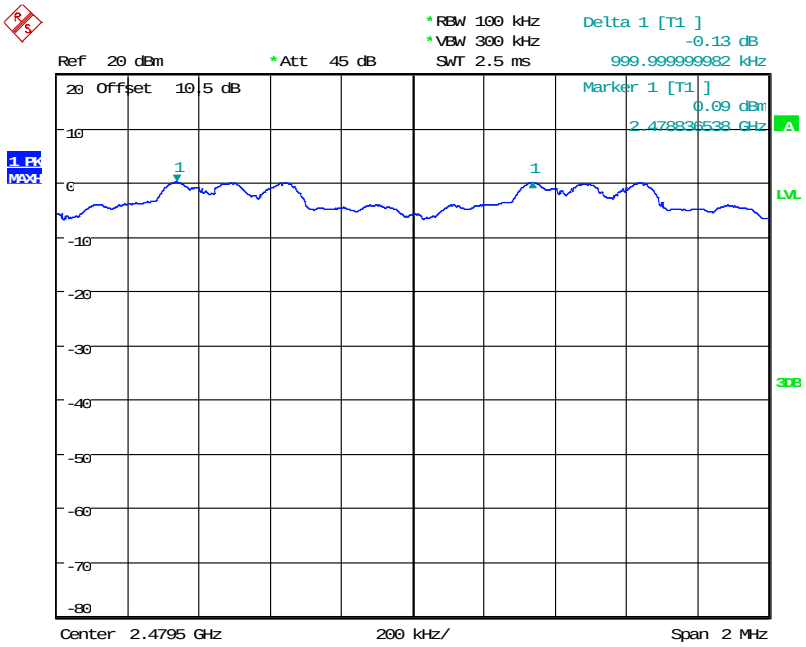
Date: 13.JUL.2018 11:17:49

Middle Channel



Date: 13.JUL.2018 11:16:07

High Channel



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

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

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.

11.3 Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	55 %
ATM Pressure:	1010 hPa

The testing was performed by Tom Hsu on 2018-08-23.

11.4 Test Results

Test mode: BR mode / 2402 ~ 2480MHz (*GFSK*)						
Mode	**Pulse Time (ms)**	**Hopping Number**	**Period Time (s)**	**Total of Dwell (ms)**	**Limit (ms)**	**Result**
DH1	0.38	320	31.6	121.60	<400	PASS
DH3	1.64	160	31.6	262.40	<400	PASS
DH5	2.88	80	31.6	230.40	<400	PASS
Test mode: EDR mode / 2402 ~ 2480MHz (*π/4-DQPSK*)						
Mode	**Pulse Time (ms)**	**Hopping Number**	**Period Time (s)**	**Total of Dwell (ms)**	**Limit (ms)**	**Result**
2DH1	0.38	320	31.6	121.60	<400	PASS
2DH3	1.64	160	31.6	262.40	<400	PASS
2DH5	2.87	80	31.6	229.60	<400	PASS
Test mode: EDR mode / 2402 ~ 2480MHz (*8DPSK*)						
Mode	**Pulse Time (ms)**	**Hopping Number**	**Period Time (s)**	**Total of Dwell (ms)**	**Limit (ms)**	**Result**
3DH1	0.38	320	31.6	121.60	<400	PASS
3DH3	1.64	150	31.6	246.00	<400	PASS
3DH5	2.88	80	31.6	230.40	<400	PASS

Note 1: A period time = 0.4*79 = 31.6 (s), Total of Dwell=Pulse Time * Hopping Number

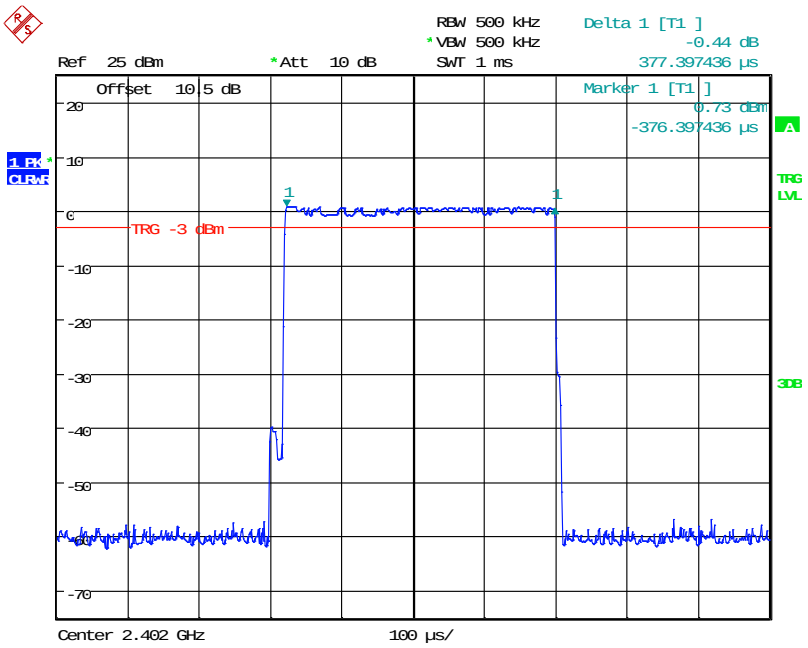
Note 2: Hopping Number = Hopping Number/10 * 10

Note 3: Hopping Number/10 = Total of highest signals in 3.16s. (Second high signals were other channel)

Please refer to the following plots

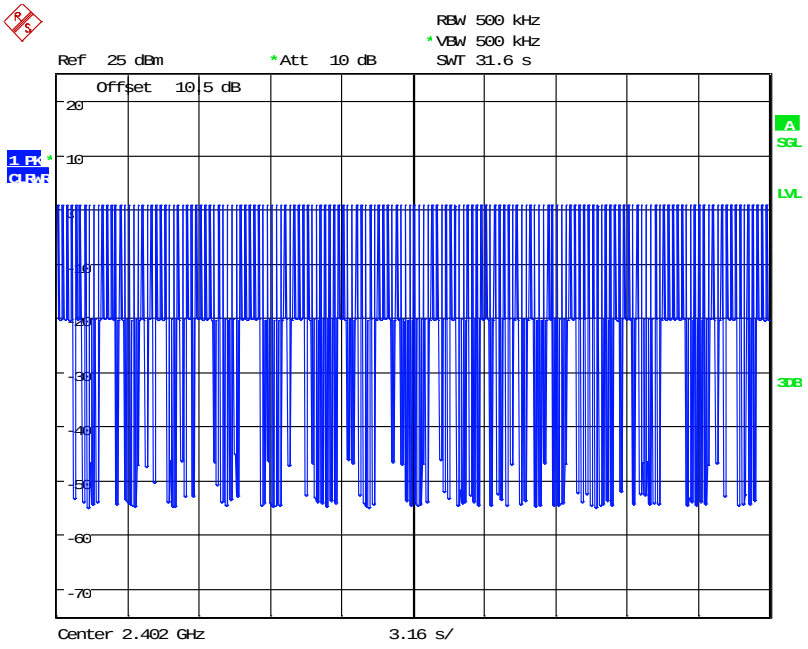
BR Mode (GFSK)

DH1: Pulse Width



Date: 23.AUG.2018 13:32:00

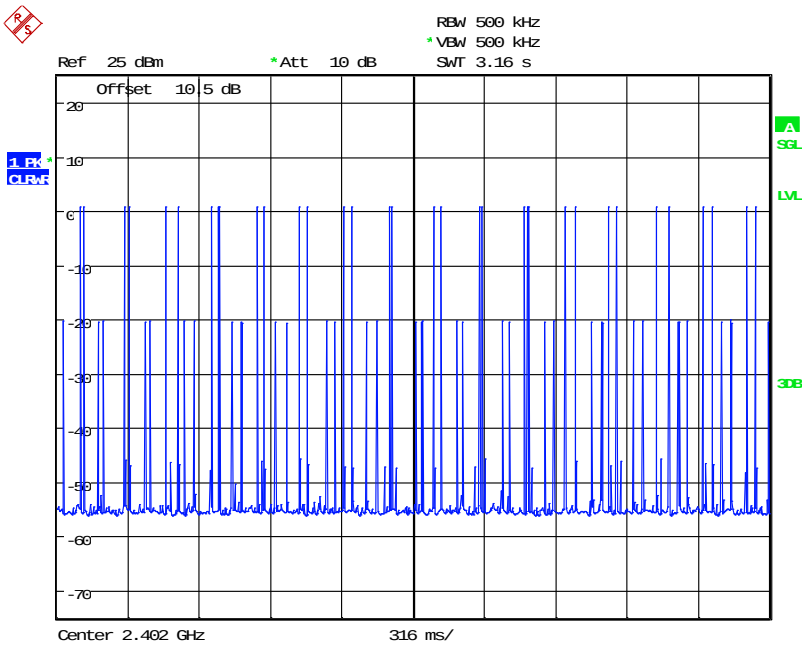
DH1: Hopping Number



Date: 23.AUG.2018 13:32:33

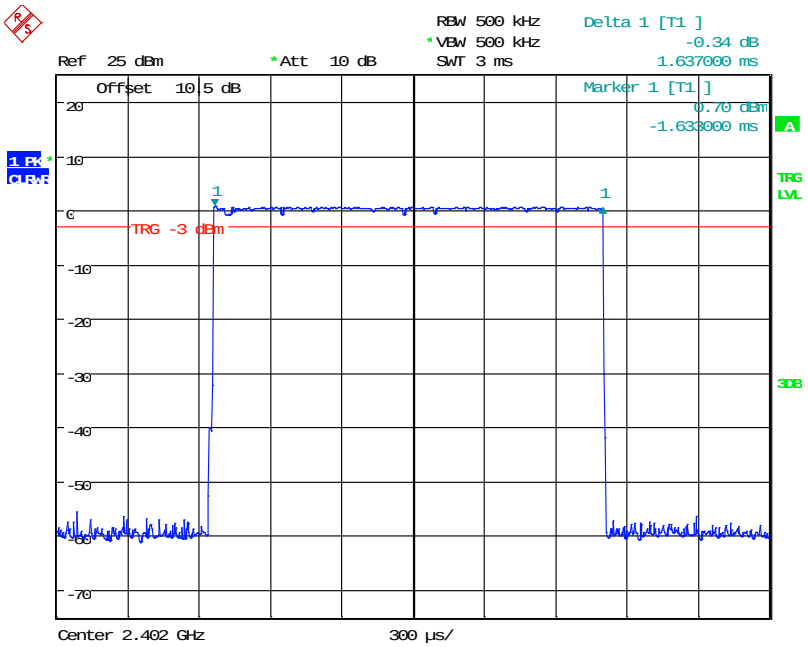
DH1: Hopping Number /10

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



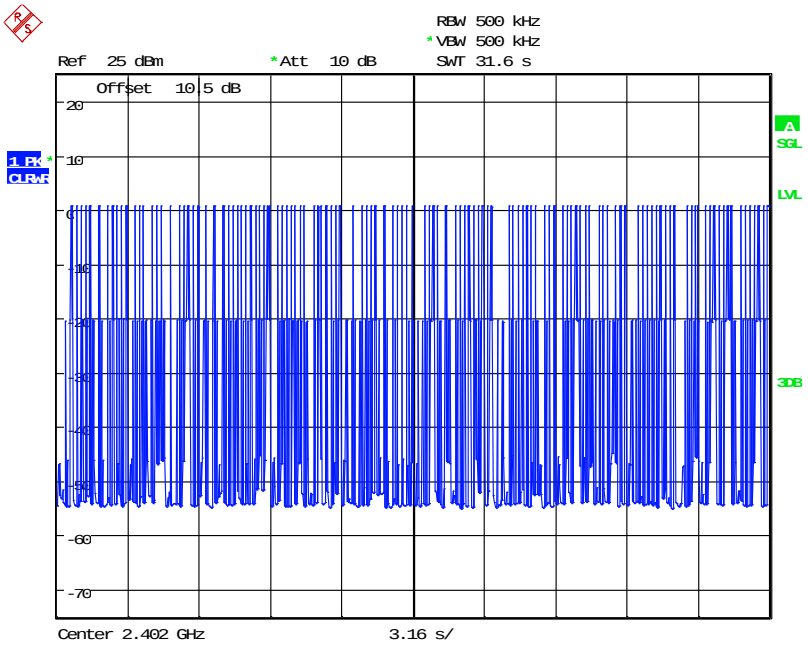
Date: 23.AUG.2018 13:34:22

DH3: Pulse Width



Date: 23.AUG.2018 13:36:28

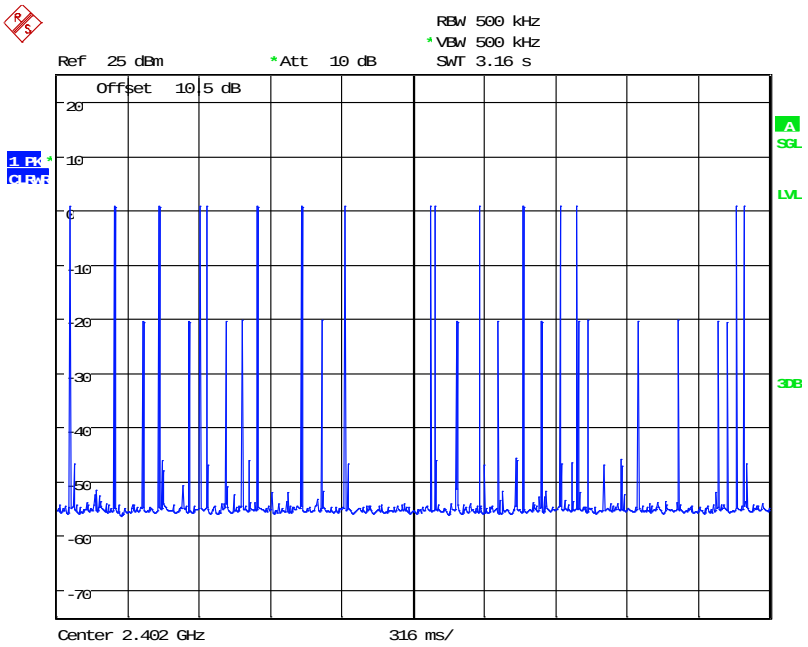
DH3: Hopping Number



Date: 23.AUG.2018 13:37:01

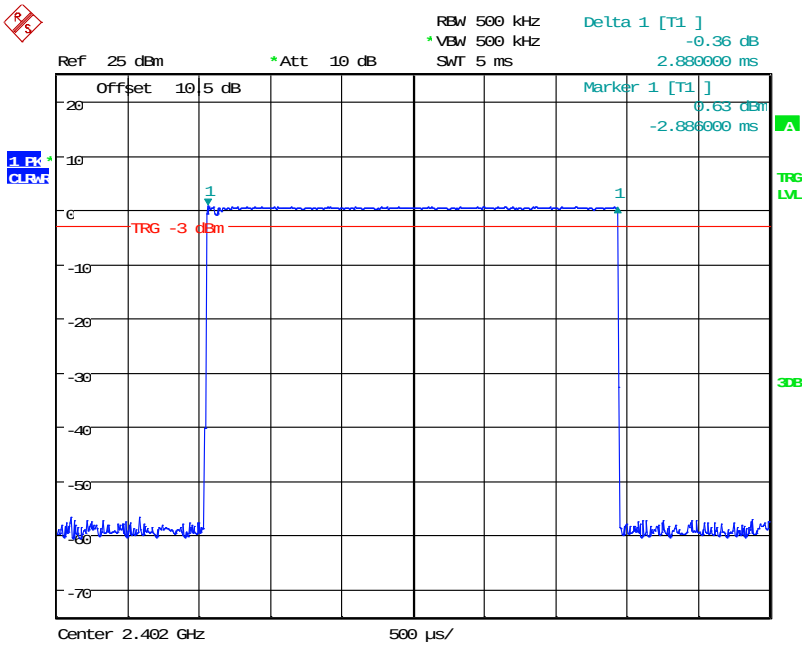
DH3: Hopping Number /10

(Hopping Number = 16 in 1/10 period of highest signals, Second High signals were other channel)



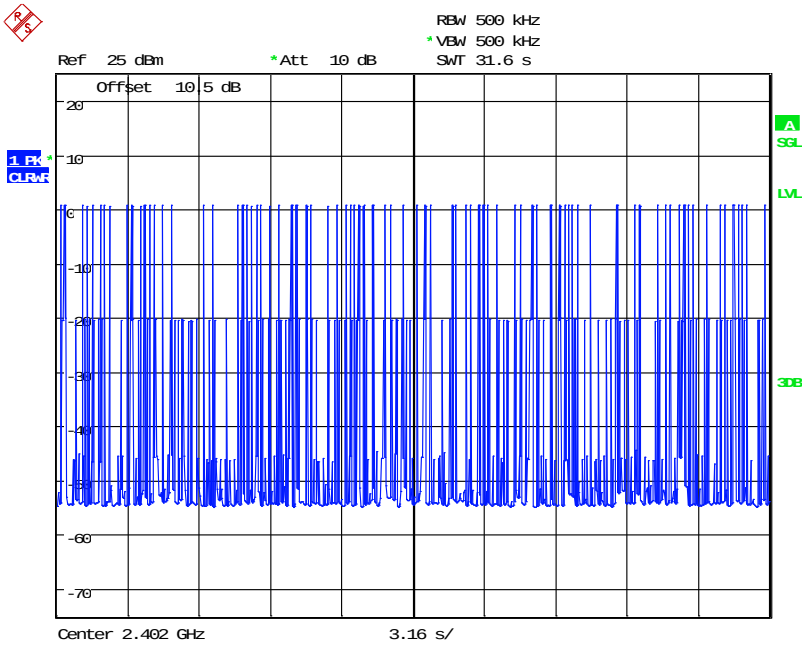
Date: 23.AUG.2018 13:37:23

DH5: Pulse Width



Date: 23.AUG.2018 13:39:45

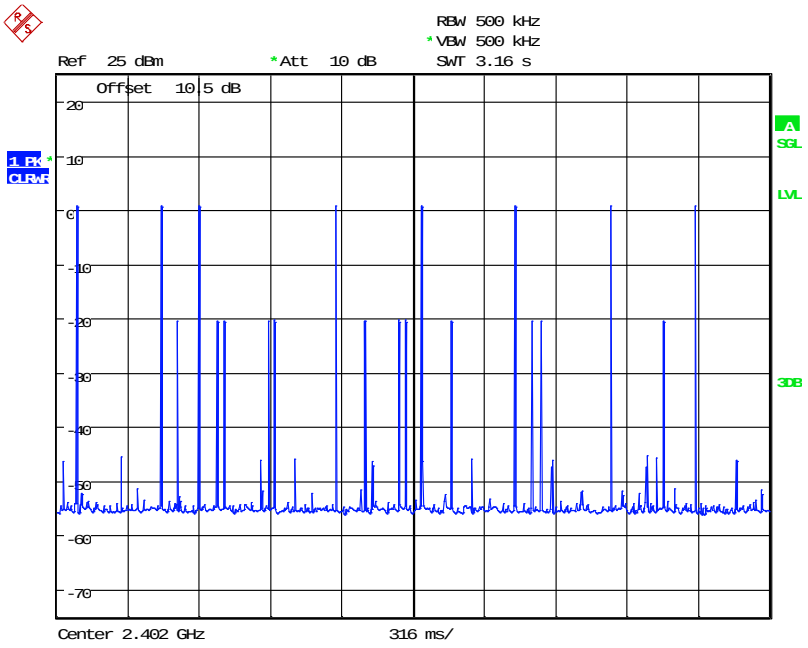
DH5: Hopping Number



Date: 23.AUG.2018 13:40:18

DH5: Hopping Number /10

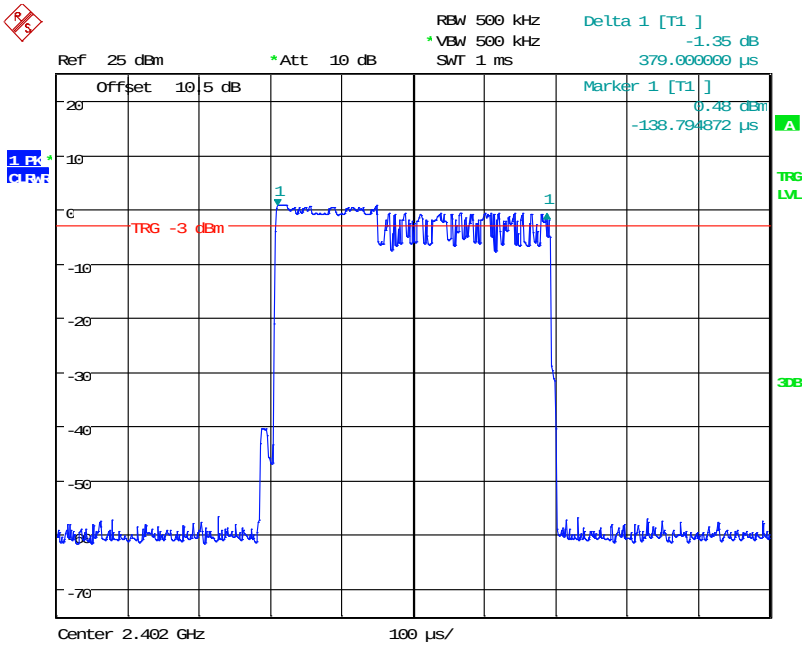
(Hopping Number = 8 in 1/10 period of highest signals, Second High signals were other channel)



Date: 23.AUG.2018 13:41:41

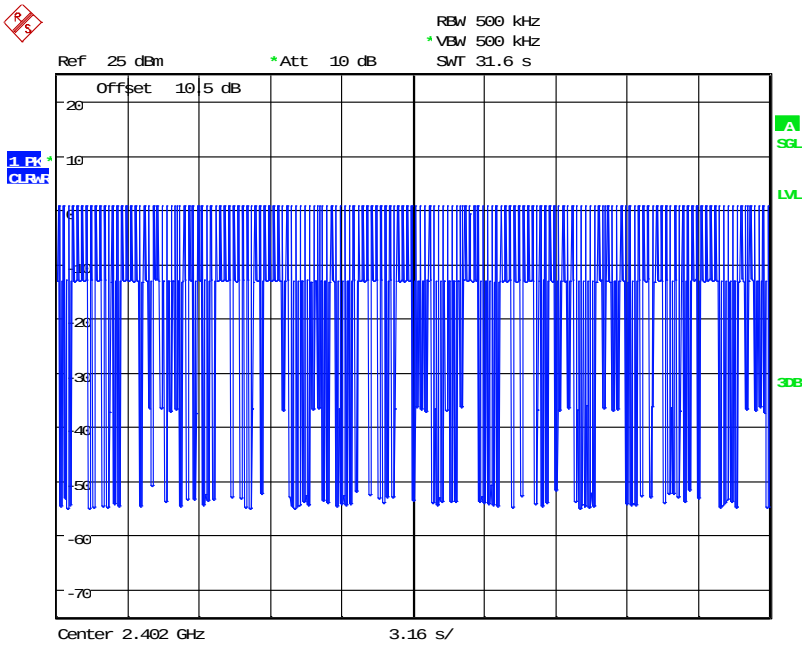
EDR Mode (π/4-DQPSK)

2DH1: Pulse Width



Date: 23.AUG.2018 13:44:04

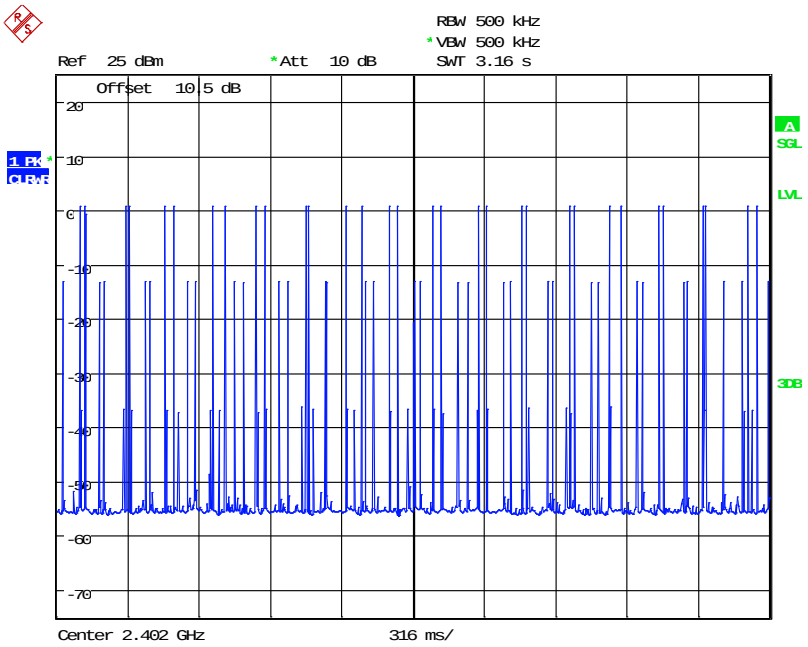
2DH1: Hopping Number



Date: 23.AUG.2018 13:44:36

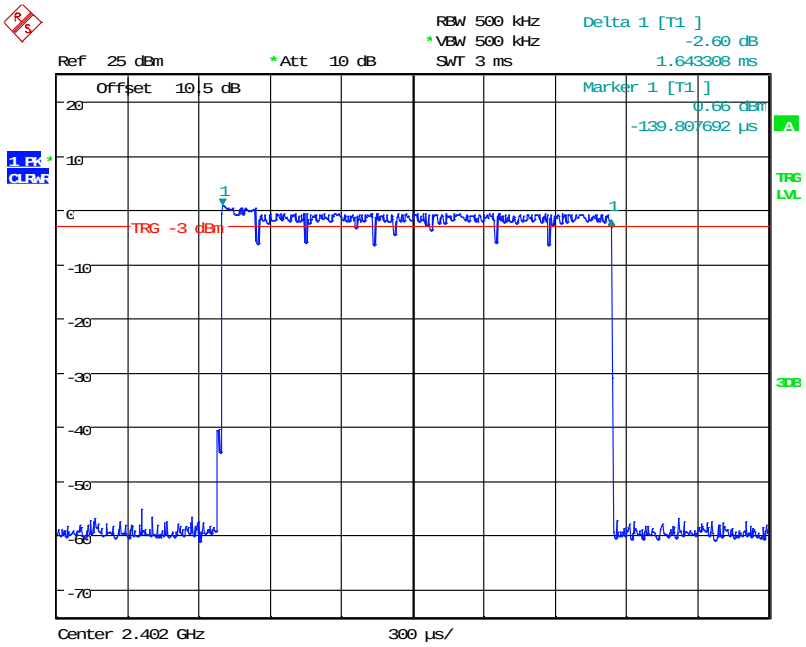
2DH1: Hopping Number /10

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



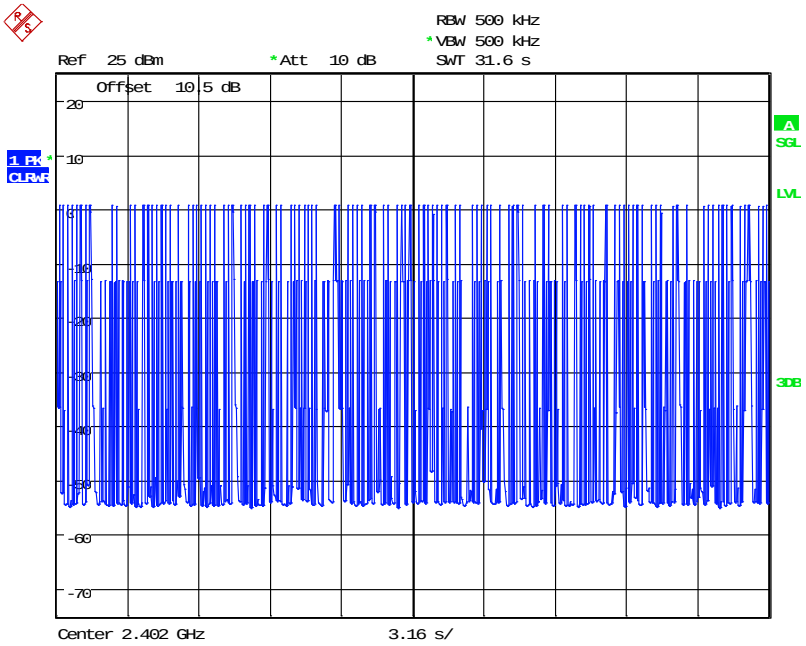
Date: 23.AUG.2018 13:46:12

2DH3: Pulse Width



Date: 23.AUG.2018 13:47:36

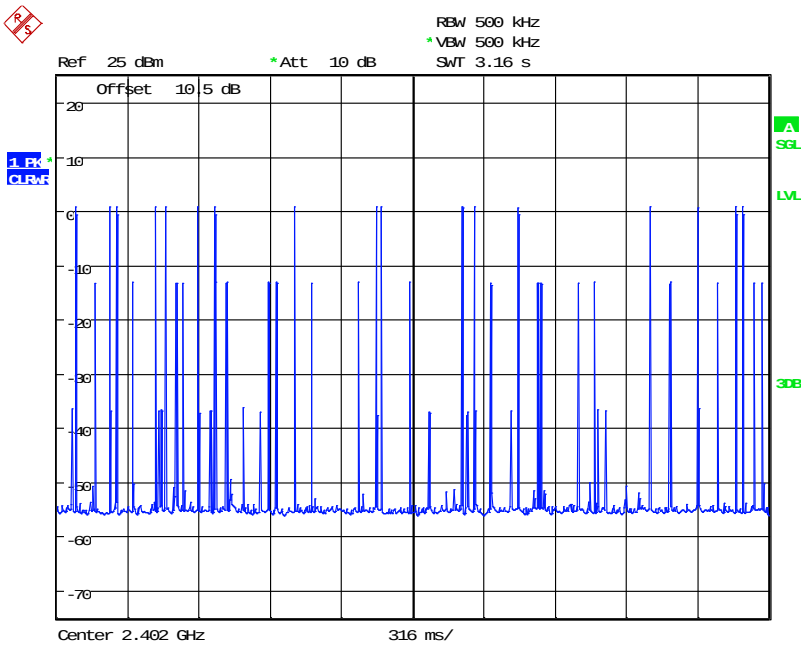
2DH3: Hopping Number



Date: 23.AUG.2018 13:48:09

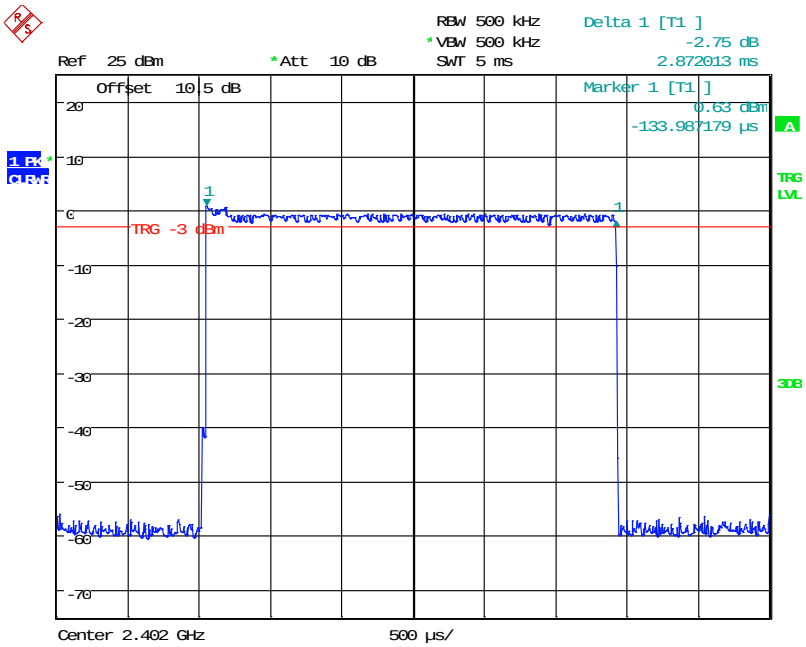
2DH3: Hopping Number /10

(Hopping Number = 16 in 1/10 period of highest signals, Second High signals were other channel)



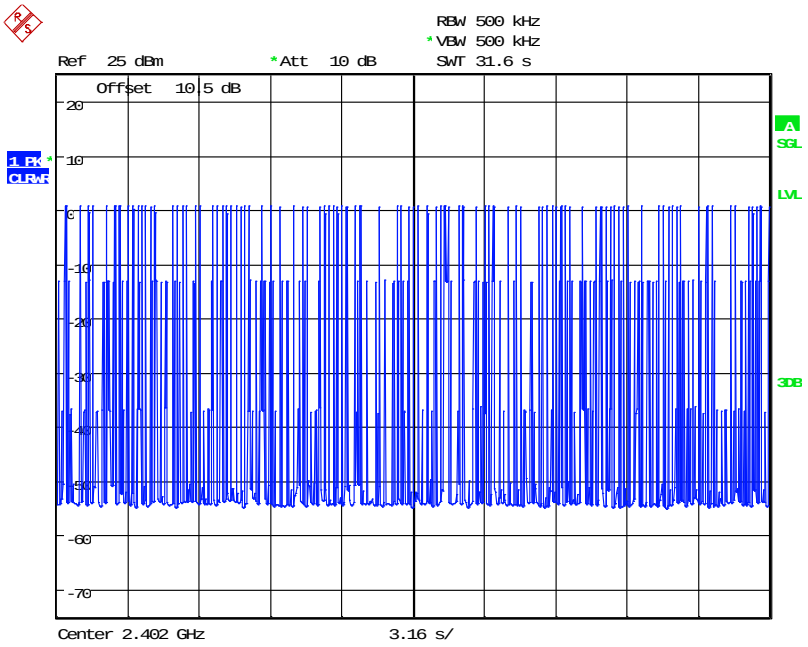
Date: 23.AUG.2018 13:48:23

2DH5: Pulse Width



Date: 23.AUG.2018 13:50:54

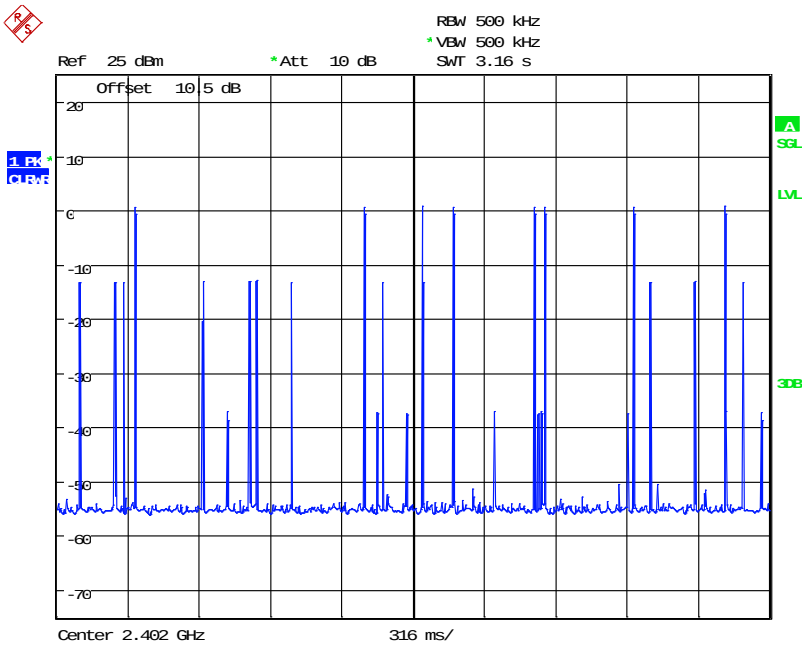
2DH5: Hopping Number



Date: 23.AUG.2018 13:51:27

2DH5: Hopping Number /10

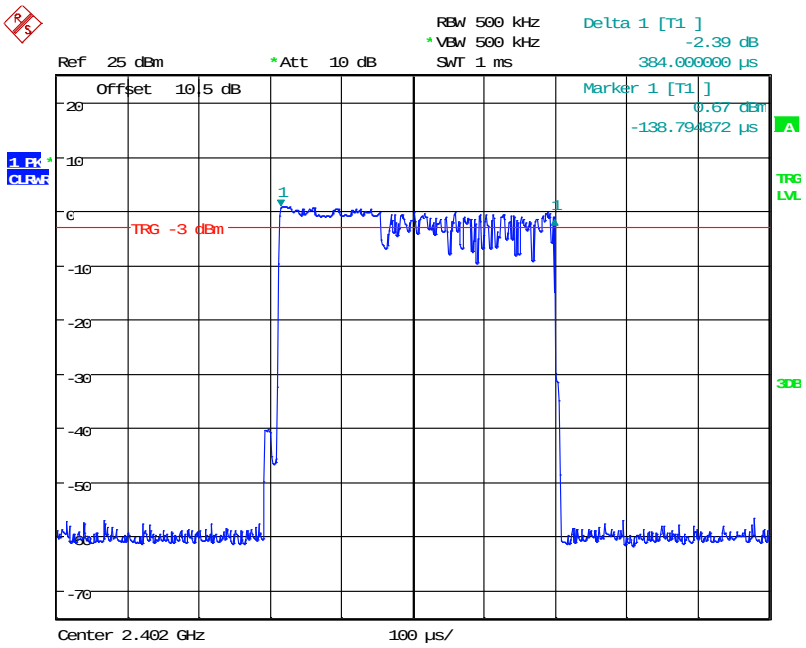
(Hopping Number = 8 in 1/10 period of highest signals, Second High signals were other channel)



Date: 23.AUG.2018 13:51:36

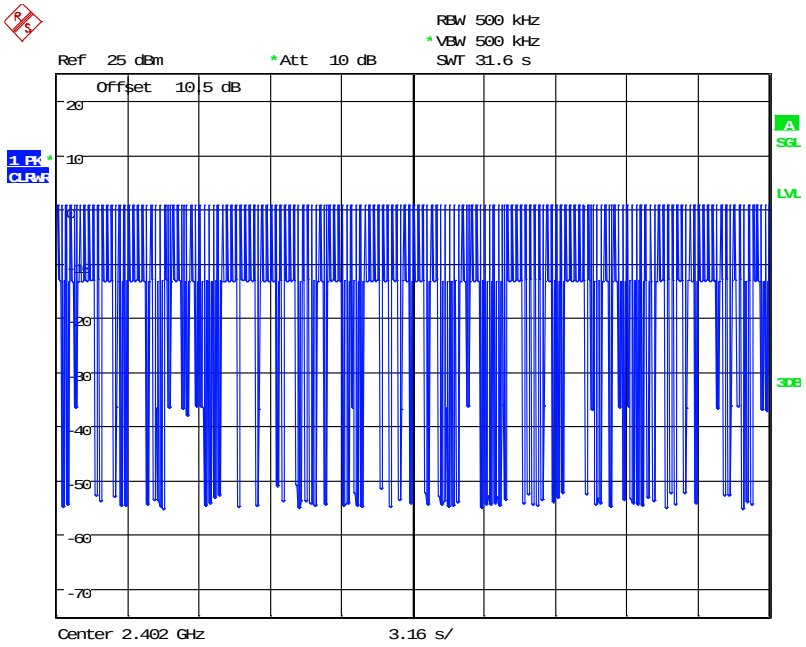
EDR Mode (8DPSK)

3DH1: Pulse Width



Date: 23.AUG.2018 13:54:13

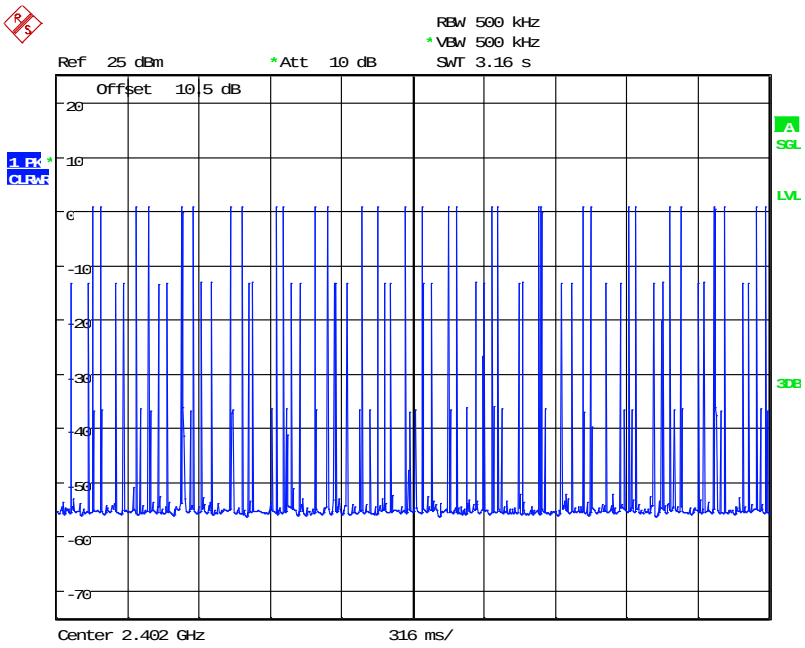
3DH1: Hopping Number



Date: 23.AUG.2018 13:54:46

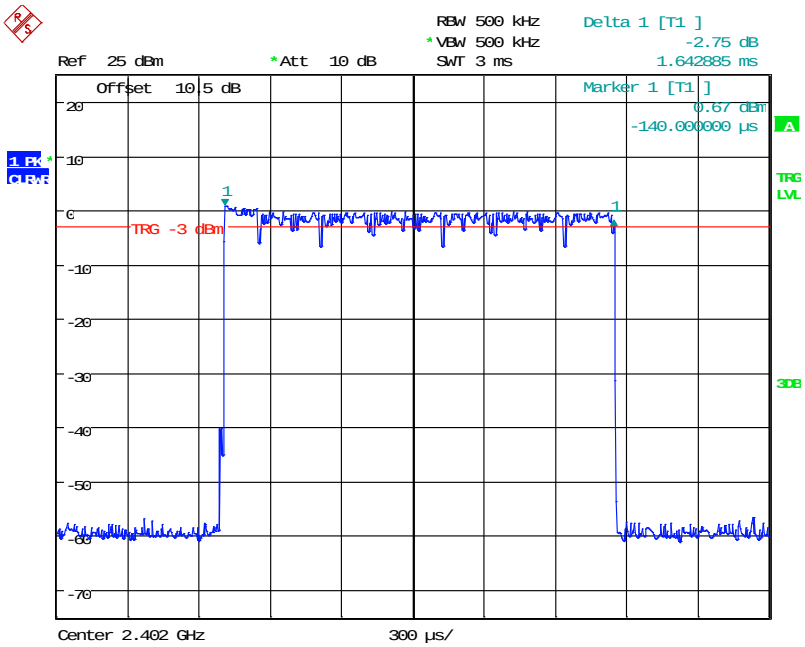
3DH1: Hopping Number /10

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



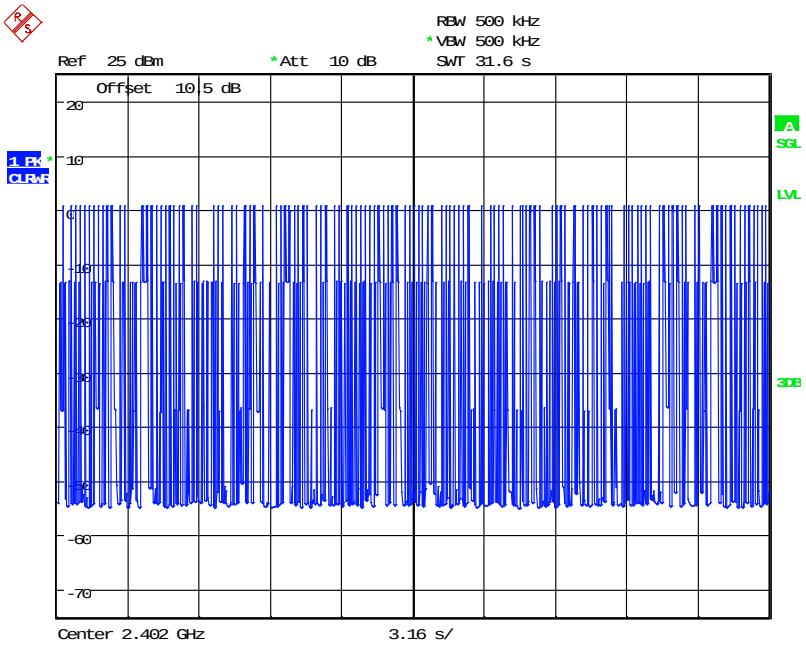
Date: 23.AUG.2018 13:55:00

3DH3: Pulse Width



Date: 23.AUG.2018 13:56:35

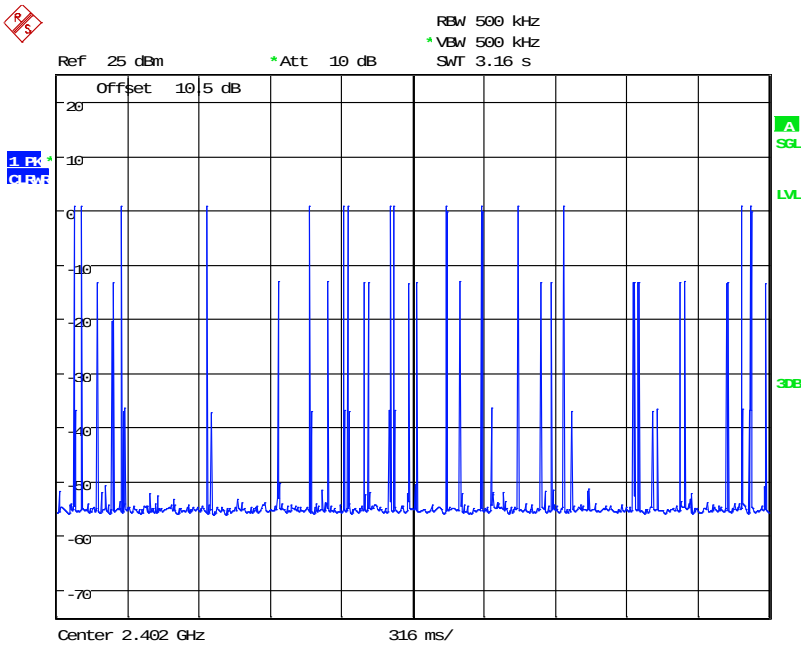
3DH3: Hopping Number



Date: 23.AUG.2018 13:57:08

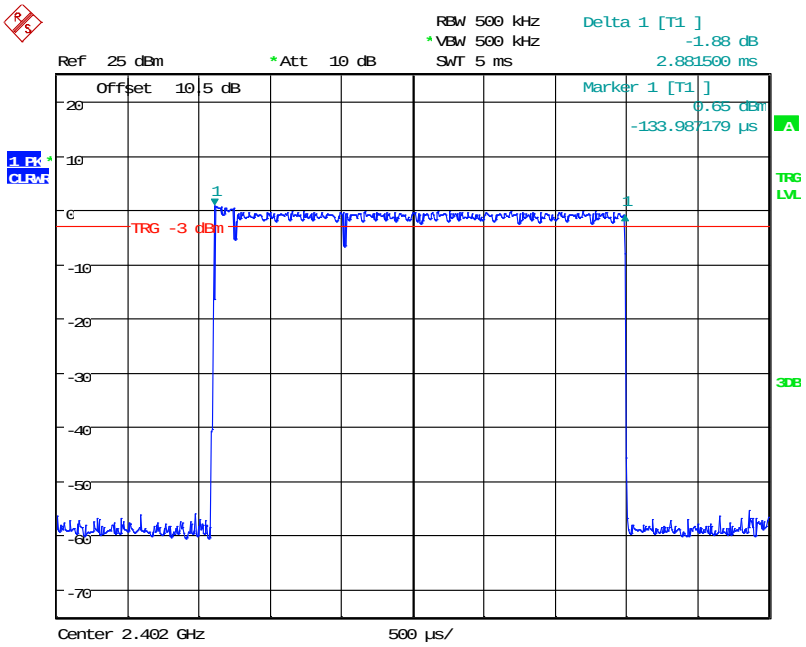
3DH3: Hopping Number /10

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



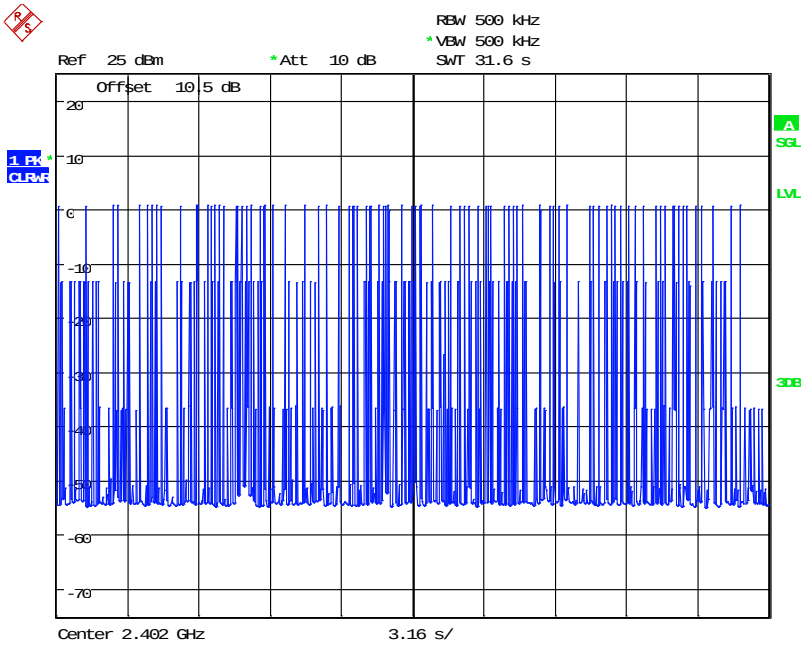
Date: 23.AUG.2018 13:58:02

3DH5: Pulse Width



Date: 23.AUG.2018 14:01:25

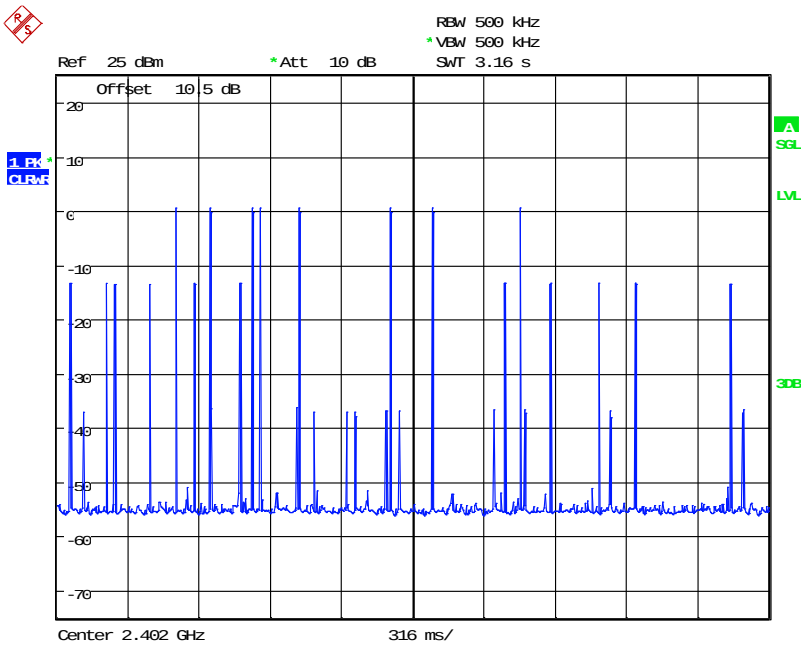
3DH5: Hopping Number



Date: 23.AUG.2018 14:01:58

3DH5: Hopping Number /10

(Hopping Number = 8 in 1/10 period of highest signals, Second High signals were other channel)



Date: 23.AUG.2018 14:03:06

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

12.1 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.

12.2 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.

12.3 Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	55 %
ATM Pressure:	1010 hPa

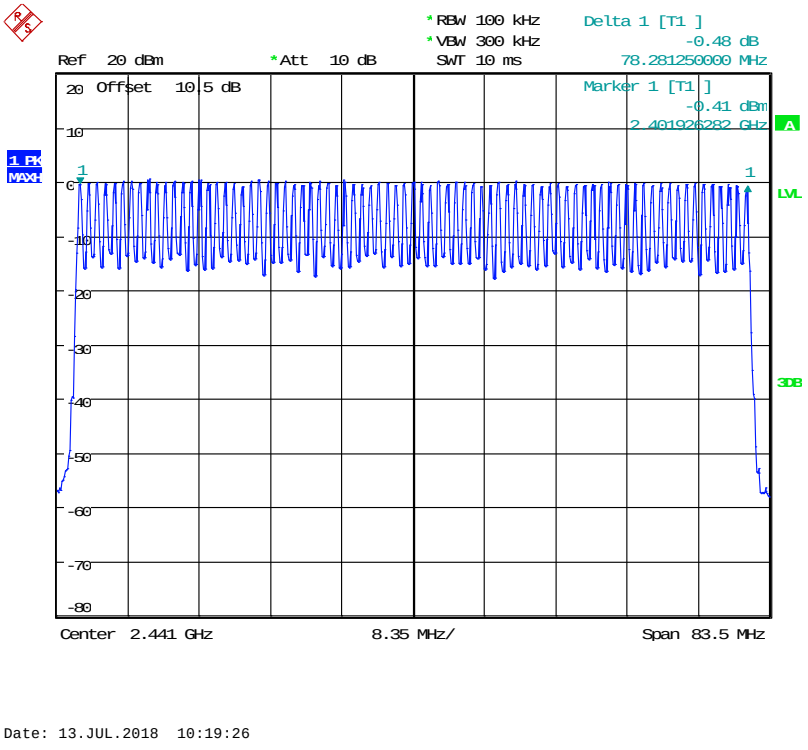
The testing was performed by Tom Hsu on 2018-07-13.

12.4 Test Results

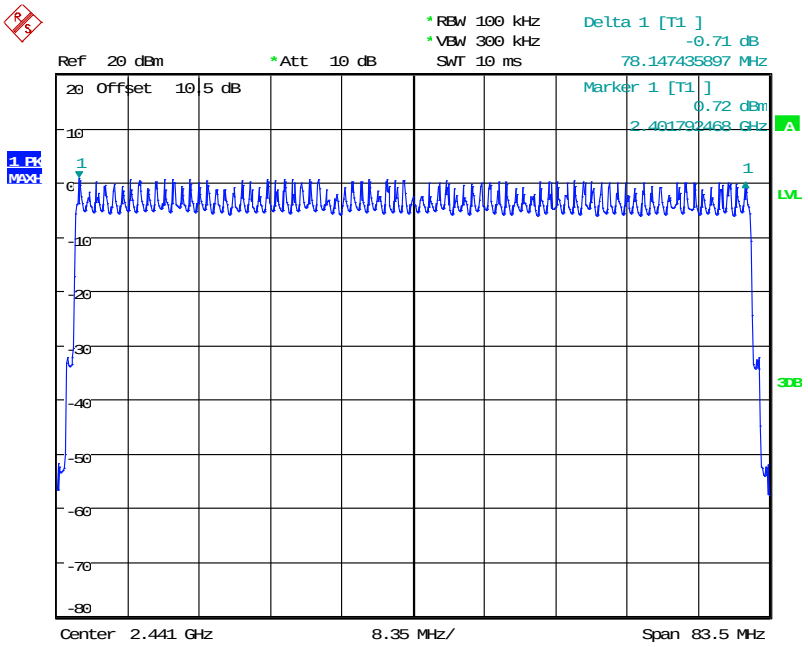
Mode	Frequency Range (MHz)	Number of Hopping Channel (CH)	Limit (CH)	Result
GFSK	2402-2480	79	>15	Compliance
π/4-DQPSK	2402-2480	79	>15	Compliance
8DPSK	2402-2480	79	>15	Compliance

Please refer to the following plots

BR Mode (GFSK)

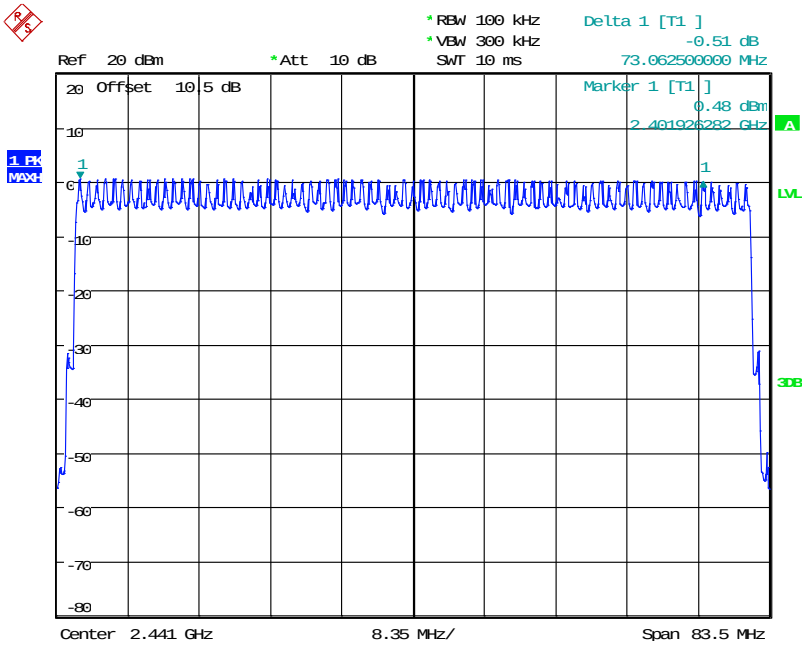


EDR Mode (π/4-DQPSK)



Date: 13.JUL.2018 10:55:07

EDR Mode (8DPSK)



Date: 13.JUL.2018 11:25:00

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

13.1 Applicable Standard

According to FCC §15.247(b) (1).

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.

13.2 Test Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to measuring equipment.

13.3 Test Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	55 %
ATM Pressure:	1010 hPa

The testing was performed by Tom Hsu on 2018-07-13.

13.4 Test Results

Channel	Frequency (MHz)	Peak Conducted Output Power		Limit (W)	Result
		(dBm)	(W)		
BR Mode (GFSK)					
Low	2402	1.51	0.00142	0.125	Compliance
Middle	2441	1.22	0.00132	0.125	Compliance
High	2480	0.74	0.00119	0.125	Compliance
EDR Mode (π/4-DQPSK)					
Low	2402	2.02	0.00159	0.125	Compliance
Middle	2441	1.89	0.00155	0.125	Compliance
High	2480	1.38	0.00137	0.125	Compliance
EDR Mode (8DPSK)					
Low	2402	2.19	0.00166	0.125	Compliance
Middle	2441	1.82	0.00152	0.125	Compliance
High	2480	1.53	0.00142	0.125	Compliance

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

14.1 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)

14.2 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

14.3 Test Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	55 %
ATM Pressure:	1010 hPa

The testing was performed by Tom Hsu on 2018-07-13.

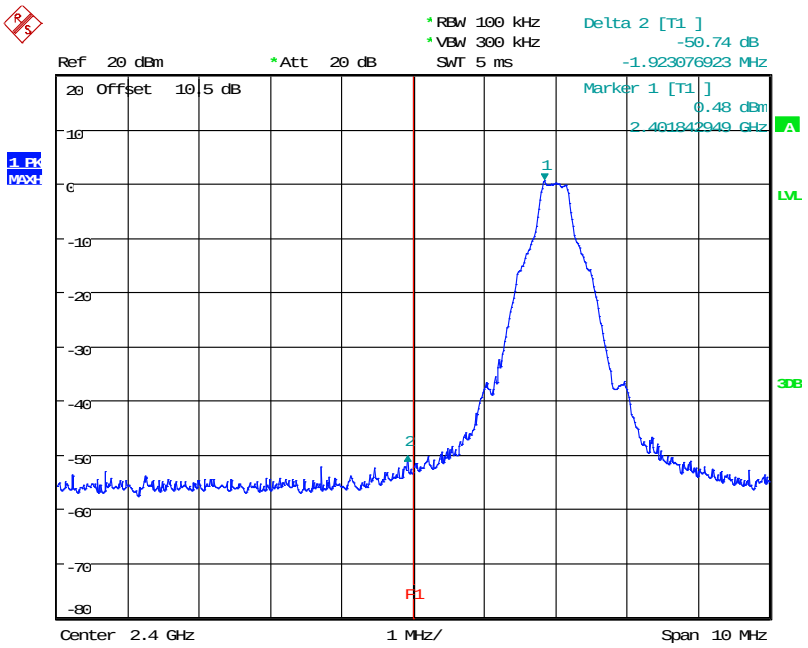
14.4 Test Results

Channel	Frequency (MHz)	Delta Peak to Band Emission (dBc)	Limit (dBc)	RESULT
BR Mode (GFSK)				
Low	2402	50.74	≥ 20	PASS
High	2480	53.10	≥ 20	PASS
BR Hopping Mode (GFSK)				
Low	2402-2480	42.27	≥ 20	PASS
High	2402-2480	43.41	≥ 20	PASS
EDR Mode (π/4-DQPSK)				
Low	2402	49.71	≥ 20	PASS
High	2480	53.44	≥ 20	PASS
EDR Hopping Mode (π/4-DQPSK)				
Low	2402-2480	49.53	≥ 20	PASS
High	2402-2480	45.11	≥ 20	PASS
EDR Mode (8DPSK)				
Low	2402	50.53	≥ 20	PASS
High	2480	53.49	≥ 20	PASS
EDR Hopping Mode (8DPSK)				
Low	2402-2480	44.21	≥ 20	PASS
High	2402-2480	43.09	≥ 20	PASS

Please refer to the following plots

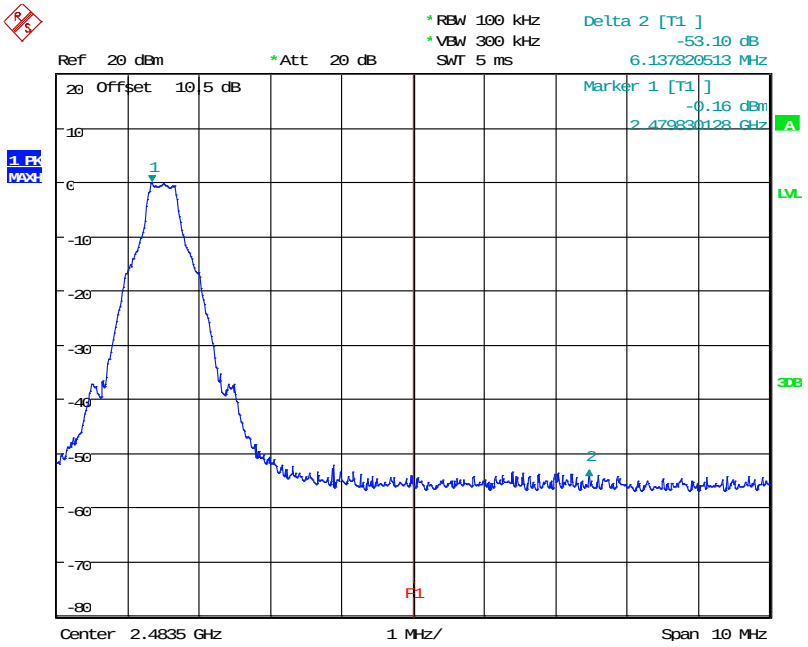
BR Mode (GFSK)

Band Edge, CH Low



Date: 13.JUL.2018 10:25:48

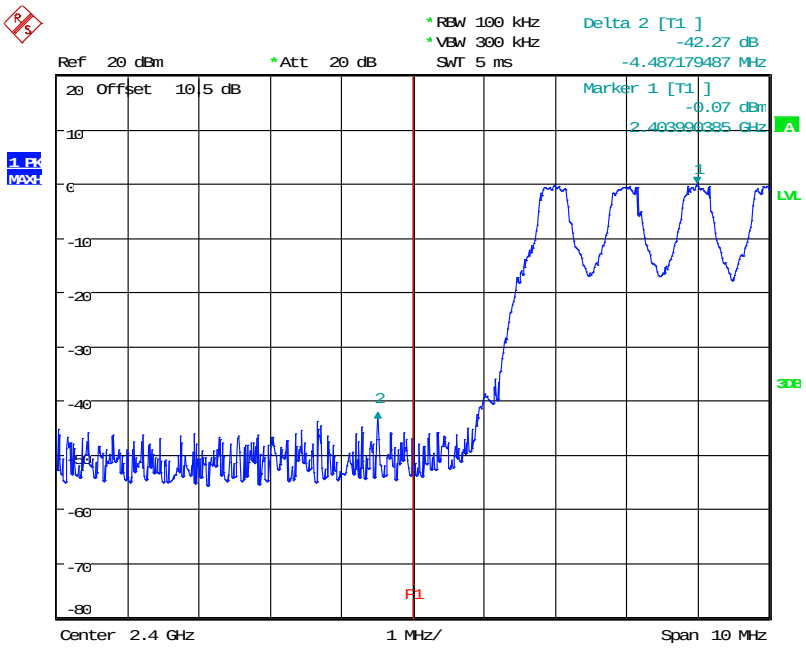
Band Edge, CH High



Date: 13.JUL.2018 10:28:44

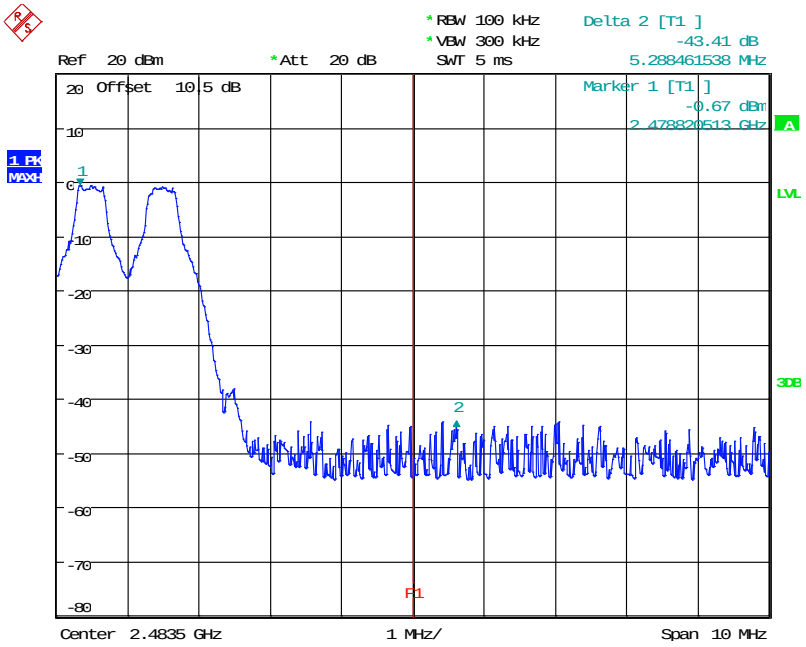
BR Hopping Mode (GFSK)

Band Edge, CH Low



Date: 13.JUL.2018 10:08:18

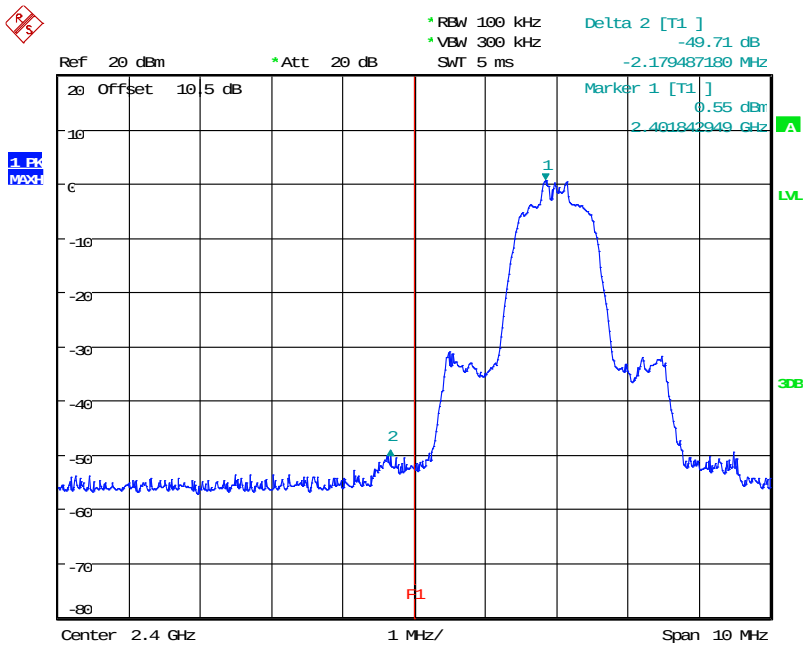
Band Edge, CH High



Date: 13.JUL.2018 10:10:57

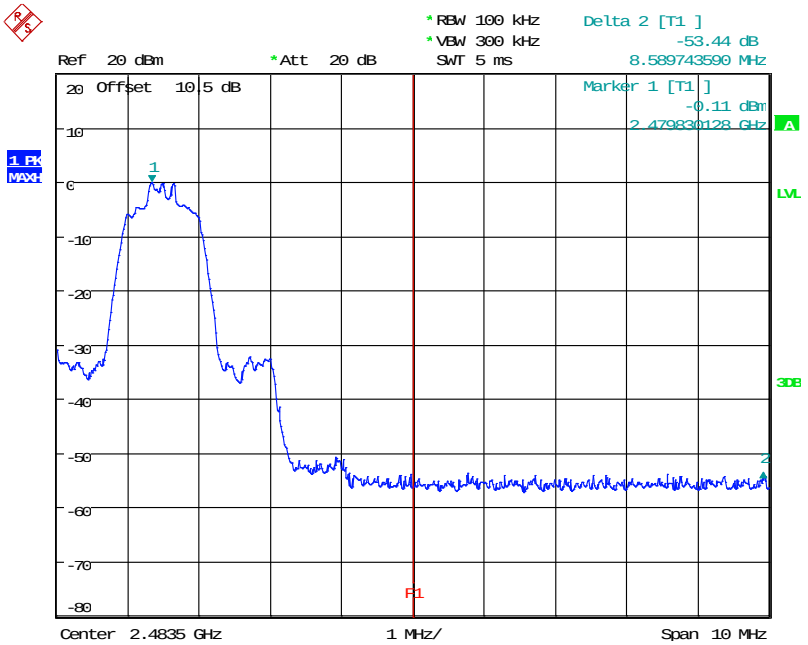
EDR Mode (π/4-DQPSK)

Band Edge, CH Low



Date: 13.JUL.2018 10:56:29

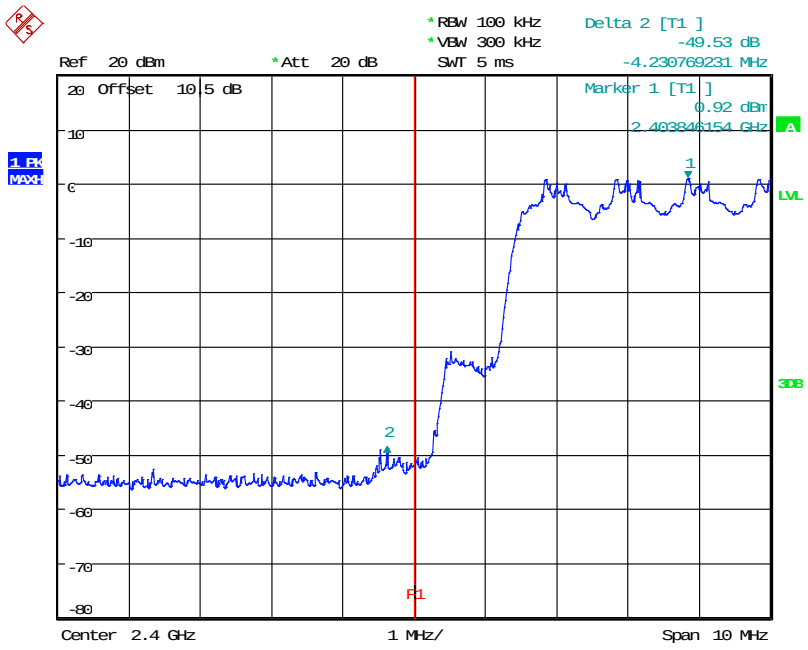
Band Edge, CH High



Date: 13.JUL.2018 10:59:32

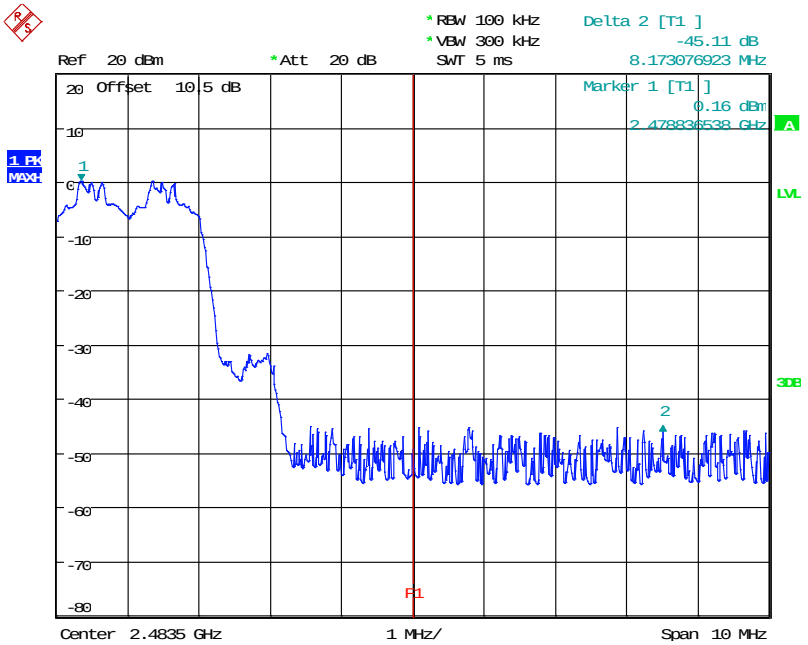
EDR Hopping Mode (π/4-DQPSK)

Band Edge, CH Low



Date: 13.JUL.2018 10:45:59

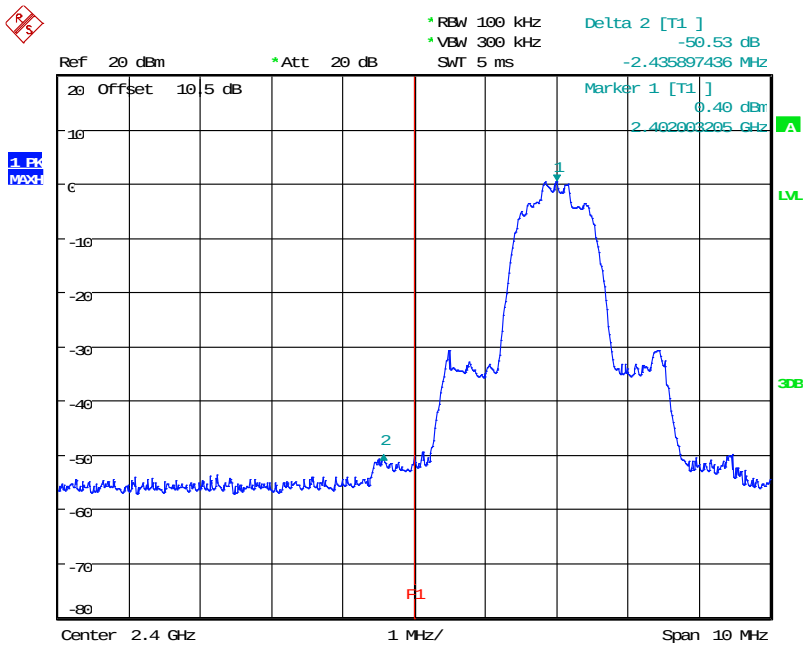
Band Edge, CH High



Date: 13.JUL.2018 10:46:30

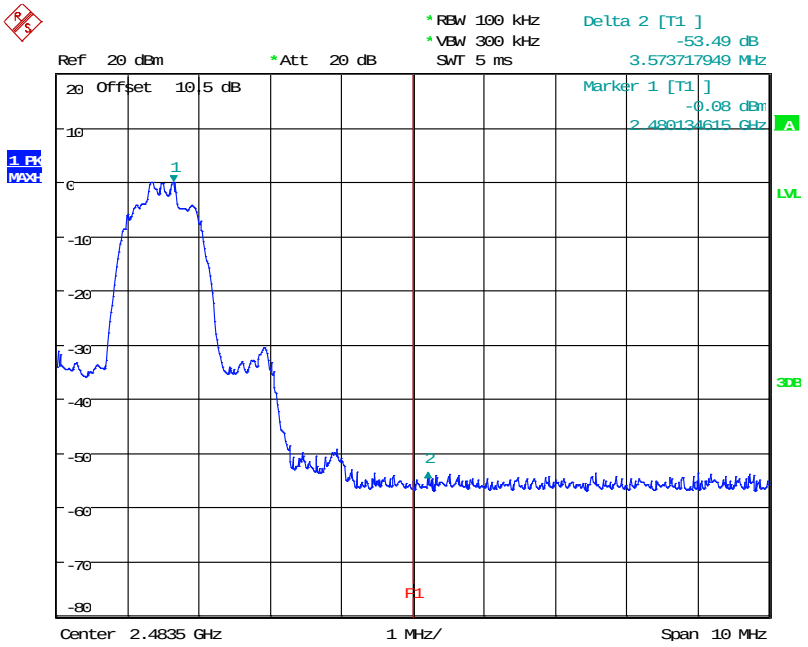
EDR Mode (8DPSK)

Band Edge, CH Low



Date: 13.JUL.2018 11:36:05

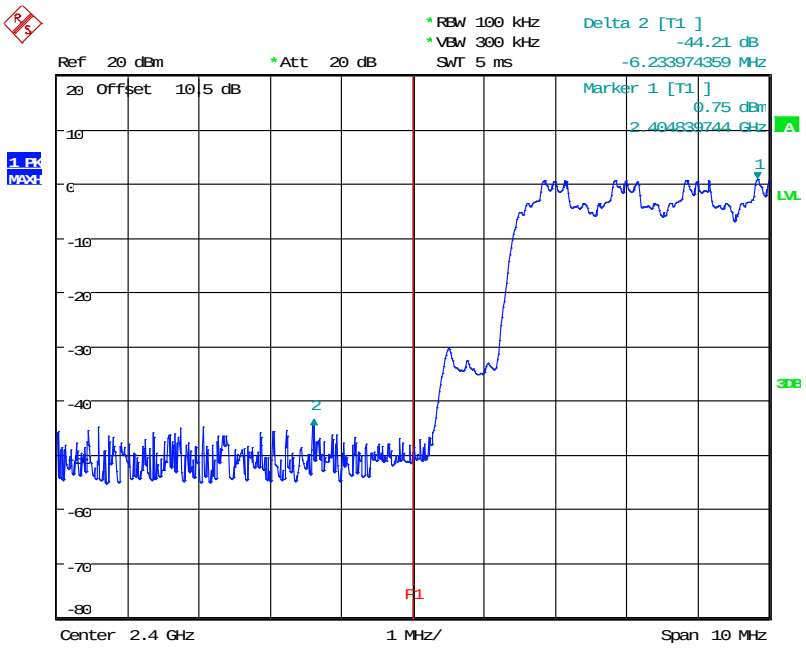
Band Edge, CH High



Date: 13.JUL.2018 11:39:01

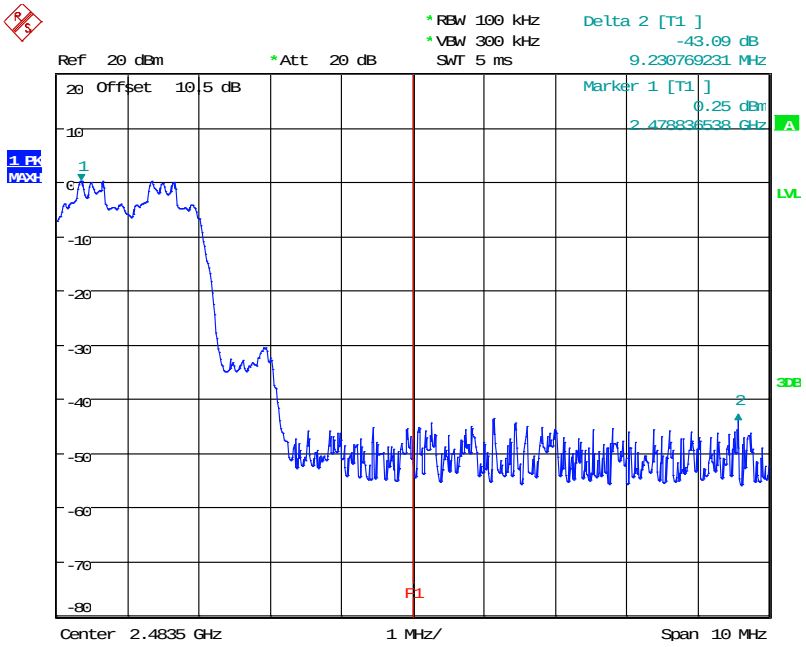
EDR Hopping Mode (8DPSK)

Band Edge, CH Low



Date: 13.JUL.2018 11:13:06

Band Edge, CH High



Date: 13.JUL.2018 11:13:48

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