TEST REPORT

Applicant Name :	YEALINK (XIAMEN) NETWORK TECHNOLOGY CO., LTD.
Address :	FCC: 309, 3rd Floor, No.16, Yun Ding North Road, Huli District, Xiamen City, Fujian, China
	ISEDC: 309, 3rd Floor, No.16, Yun Ding North Road, Huli District Xiamen City Fujian 361008 China (Peoples Republic Of)
Report Number :	SZNS220118-02711E-RF
FCC ID:	T2C-BT51A
IC:	10741A-BT51A

Test Standard (s)

FCC PART 15.247; RSS-GEN ISSUE 5, FEBRUARY 2021 AMENDMENT 2; RSS-247, ISSUE 2, FEBRUARY 2017

Sample Description

Product Type:	Bluetooth USB Dongle
Model No.:	BT51A
Multiple Model(s) No.:	N/A
Trade Mark:	YEALINK
Date Received:	2022/01/18
Date of Test:	2022/01/24~2022/02/14
Report Date:	2022/02/14

Test Result:	Pass*

* In the configuration tested, the EUT complied with the standards above.

Prepared and Checked By: **Approved By:**

(signature: Fan Yang)   _(signature: Robert Li)_

_____   _____

Fan Yang   Robert Li

EMC Engineer   EMC Engineer

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

HVIN	BT51A
Frequency Range	Bluetooth: 2402~2480MHz
Transmit Peak Power	0.51dBm
Modulation Technique	Bluetooth: GFSK, π/4-DQPSK, 8DPSK
Antenna Specification*	3.0dBi
Voltage Range	DC 5.0V
Sample serial number	SZNS220118-02711E-RF-S2 for Conducted and Radiated Emissions SZNS220118-02711E-RF-S1 for RF Conducted Test (Assigned by ATC)
Sample/EUT Status	Good condition

Objective

This test report is in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commissions rules and RSS-247, Issue 2, February 2017, RSS-GEN Issue 5, Feb. 2021Amendment 2 of the Innovation, Science and Economic Development Canada rules.

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 and RSS-247, Issue 2, February 2017, RSS-GEN Issue 5, Feb. 2021Amendment 2 of the Innovation, Science and Economic Development Canada rules.

All emissions measurement was performed at Shenzhen Accurate Technology Co., Ltd. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Each test item follows test standards and with no deviation.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		5%
RF Frequency		$0.082*10^{-7}$
RF output power, conducted		0.73dB
Unwanted Emission, conducted		1.6dB
AC Power Lines Conducted Emissions		2.72dB
Emissions, Radiated	9kHz - 30MHz	2.66dB
	30MHz - 1GHz	4.28dB
	1GHz - 18GHz	4.98dB
	18GHz - 26.5GHz	5.06dB
	26.5GHz- 40GHz	4.72dB
Temperature		1℃
Humidity		6%
Supply voltages		0.4%

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

Test Facility

The test site used by Shenzhen Accurate Technology Co., Ltd. to collect test data is located on the 1/F., Building A, Changyuan New Material Port, Science & Industry Park, Nanshan District, Shenzhen, Guangdong, P.R. China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 708358, the FCC Designation No.: CN1189.

Accredited by American Association for Laboratory Accreditation (A2LA). The Certificate Number is 4297.01

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0016. The Registration Number is 5077A.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in an engineering mode.

EUT Exercise Software

"Authentic Tool_1.1.17.0.exe "* exercise software was use to the set EUT to signaling mode and the power level is default*. The software and power level was provided by the applicant.

Special Accessories

No special accessory.

Equipment Modifications

No modification was made to the EUT tested.

Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
DELL	Laptop	Latitude E4710	PC201911252059
DELL	Adapter	XY30W-1396-C+AY	XY0003
Rohde & Schwarz	Wideband Radio Communication Tester	CMW500	154606

External I/O Cable

Cable Description	Length (m)	From Port	To
Un-shielded Un-detachable AC cable	1.2	AC Power	CMW500
Un-shielded Detachable AC cable	1.0	LISN	Adapter
Un-shielded Un-detachable DC cable	1.2	Adapter	Laptop

Block Diagram of Test Setup

For Conducted Emission

```
                                              EUT                      ┌──────┐
                                          ┌────────┐                   │ LISN │
                                          │        │                   └──────┘
┌─ ─ ─ ─ ─ ─ ─┐  ┌──────────────────────────────────────────────────────────┐
│ ┌─────────┐ │  │  ┌──────────┐         ┌───────┐ ▮ ┌─────────┐            │
│ │ CMW500  │─┼──┼──│ Antenna  │         │ Laptop│   │ Adapter │            │
│ └────┬────┘ │  │  └──────────┘         └───────┘   └─────────┘            │
│      │      │  │                         10cm                             │
│ ┌────┴────┐ │  │                                                          │
│ │AC Power │ │  │                                                  1.0 Meter│
│ │ Source  │ │  │                                                          │
│ └─────────┘ │  │                                                          │
└─ ─ ─ ─ ─ ─ ─┘  │  Non-Conductive Table                                    │
                 │  80 cm above Ground Plane                                 │
                 └──────────────────────────────────────────────────────────┘
                          |◄────────── 1.5 Meters ──────────►|
```

For Radiated Emissions:
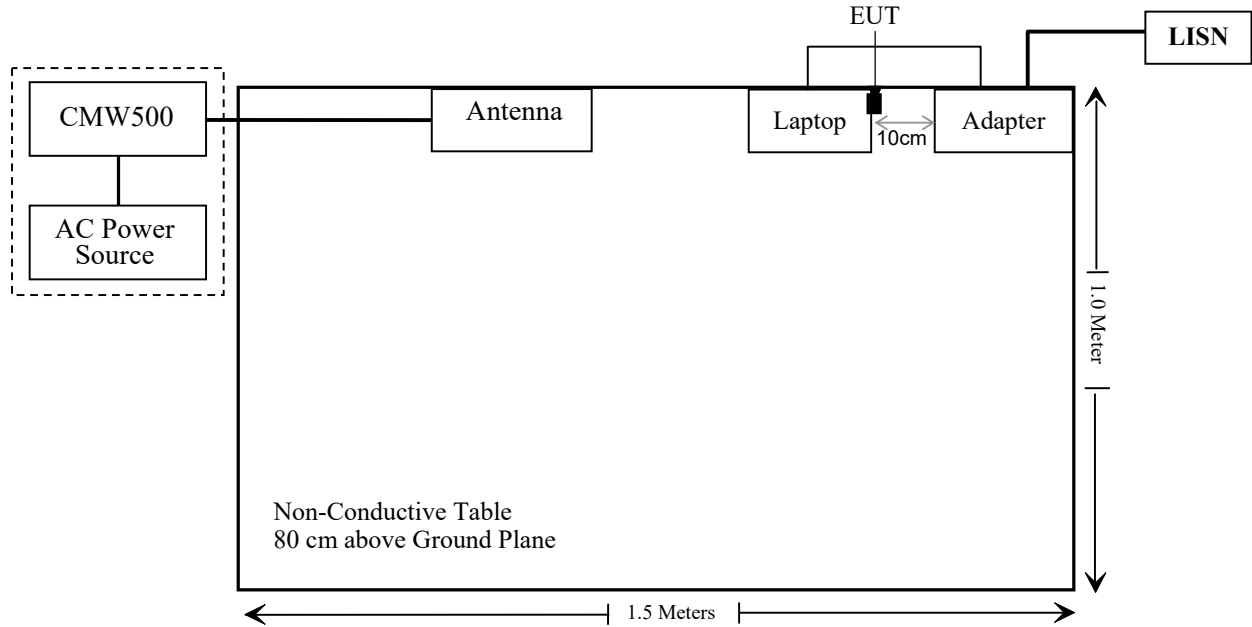
```
                                     ┌─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┐
                                     │ ┌──────────┐   ┌──────────┐ │
                                     │ │ CMW500   │───│ AC Power │ │
                                     │ └────┬─────┘   │ Source   │ │
                                     │      │         └──────────┘ │
                                     └─ ─ ─ ┼─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┘
          ┌──────────────────────────────── │ ───────────────────────┐
          │                                  │                        │
          │                                  │                        │
          │                                  │                        │
          │                                  │                1.0 Meter│
          │         EUT──►▮ ┌───────┐    ┌───┴──────┐                │
          │                 │ Laptop│    │ Antenna  │                │
          │                 └───────┘    └──────────┘                │
          │                                                          │
          │  Non-Conductive Table                                    │
          │  80/150 cm above Ground Plane                            │
          └──────────────────────────────────────────────────────────┘
                   |◄────────── 1.5 Meters ──────────►|
```
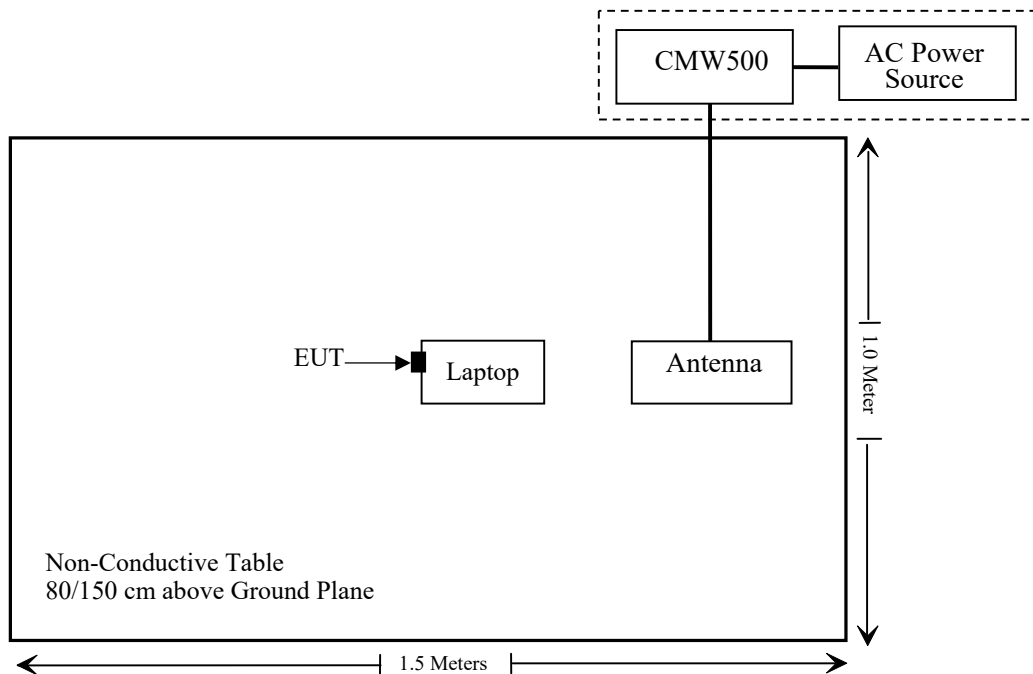
SUMMARY OF TEST RESULTS

Rules	Description of Test	Result
§15.247 (i), §1.1307 (b) (1) & §2.1093	RF Exposure	Compliant
RSS-102 § 2.5.1	Exemption Limits for Routine Evaluation – SAR Evaluation	Compliant
FCC §15.203 RSS-Gen §6.8	Antenna Requirement	Compliant
FCC §15.207(a) RSS-Gen §8.8	AC Line Conducted Emissions	Compliant
FCC §15.205, 15.209, 15.247(d) RSS-247 § 5.5, RSS-GEN § 8.10	Radiated Emissions	Compliant
FCC §15.247(a)(1) RSS-247 § 5.1(a), RSS-GEN § 6.7	20 dB Emission Bandwidth & 99% Occupied Bandwidth	Compliant
FCC §15.247(a)(1) RSS-247 § 5.1 (b)	Channel Separation Test	Compliant
FCC §15.247(a)(1)(iii) RSS-247 § 5.1 (d)	Time of Occupancy (Dwell Time)	Compliant
FCC §15.247(a)(1)(iii) RSS-247 § 5.1 (d)	Quantity of hopping channel Test	Compliant
FCC §15.247(b)(1) RSS-247 § 5.1(b) &§ 5.4(b)	Peak Output Power Measurement	Compliant
FCC §15.247(d) RSS-247 § 5.5	Band edges	Compliant

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emissions Test					
Rohde& Schwarz	EMI Test Receiver	ESCI	100784	2021/12/13	2022/12/12
Rohde & Schwarz	L.I.S.N.	ENV216	101314	2021/12/13	2022/12/12
Anritsu Corp	50 Coaxial Switch	MP59B	6100237248	2021/12/13	2022/12/12
Unknown	RF Coaxial Cable	No.17	N0350	2021/12/14	2022/12/13
Conducted Emission Test Software: e3 19821b (V9)					
Radiated Emissions Test					
Rohde& Schwarz	Test Receiver	ESR	102725	2021/12/13	2022/12/12
Rohde&Schwarz	Spectrum Analyzer	FSV40	101949	2021/12/13	2022/12/12
SONOMA INSTRUMENT	Amplifier	310 N	186131	2021/11/09	2022/11/08
A.H. Systems, inc.	Preamplifier	PAM-0118P	135	2021/11/09	2022/11/08
Quinstar	Amplifier	QLW-18405536-J0	15964001002	2021/11/11	2022/11/10
Schwarzbeck	Bilog Antenna	VULB9163	9163-323	2021/07/06	2024/07/05
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-1067	2020/01/05	2023/01/04
Schwarzbeck	HORN ANTENNA	BBHA9170	9170-359	2020/01/05	2023/01/04
Radiated Emission Test Software: e3 19821b (V9)					
Unknown	RF Coaxial Cable	No.10	N050	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.11	N1000	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.12	N040	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.13	N300	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.14	N800	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.15	N600	2021/12/14	2022/12/13
Unknown	RF Coaxial Cable	No.16	N650	2021/12/14	2022/12/13
Wainwright	High Pass Filter	WHKX3.6/18 G-10SS	5	2021/12/25	2022/12/24

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
Rohde & Schwarz	Spectrum Analyzer	FSV-40	101495	2021/12/13	2022/12/12
Rohde & Schwarz	SPECTRUM ANALYZER	FSU26	200982	2021/07/06	2022/07/05
Rohde & Schwarz	Wideband Radio Communication Tester	CMW500	154606	2021/12/13	2022/12/12
Mini-Circuits	Power Splitter	DC-18000MHz	SF10944151S	2021/12/14	2022/12/13

* Statement of Traceability: Shenzhen Accurate Technology Co., Ltd. attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC§15.247 (i), §1.1307 (b) (1) & §2.1093 – RF EXPOSURE

Applicable Standard

According to FCC §2.1093 and §1.1307(b) (1), 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)] ·
[$\sqrt{f(GHz)}$] ≤ 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.

Measurement Result

For worst case:

Frequency (MHz)	Tune-up power (dBm)	Tune-up power (mW)	Distance (mm)	Calculated value	Threshold (1-g SAR)	SAR Test Exclusion
2480	1.0	1.26	5.0	0.4	3.0	**Yes**

Result: No SAR test is required

RSS-102 § 2.5.1 –EXEMPTION LIMITS FOR ROUTINE EVALUATION-SAR EVALUATION

Applicable Standard

According to RSS-102 Issue 5 § (2.5.1), SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in Table 1.

Table 1: SAR evaluation – Exemption limits for routine evaluation based on frequency and separation distance[4,5]

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of 30 mm	At separation distance of 35 mm	At separation distance of 40 mm	At separation distance of 45 mm	At separation distance of ≥50 mm
≤300	223 mW	254 mW	284 mW	315 mW	345 mW
450	141 mW	159 mW	177 mW	195 mW	213 mW
835	80 mW	92 mW	105 mW	117 mW	130 mW
1900	99 mW	153 mW	225 mW	316 mW	431 mW
2450	83 mW	123 mW	173 mW	235 mW	309 mW
3500	86 mW	124 mW	170 mW	225 mW	290 mW
5800	56 mW	71 mW	85 mW	97 mW	106 mW

4. The exemption limits in Table 1 are based on measurements and simulations of half-wave dipole antennas at separation distances of 5 mm to 25 mm from a flat phantom, providing a SAR value of approximately 0.4 W/kg for 1 g of tissue. For low frequencies (300 MHz to 835 MHz), the exemption limits are derived from a linear fit. For high frequencies (1900 MHz and above), the exemption limits are derived from a third order polynomial fit.
5. Transmitters operating between 0.003-10 MHz, meeting the exemption from routine SAR evaluation, shall demonstrate compliance to the instantaneous limits in Section 4.

Output power level shall be the higher of the maximum conducted or equivalent isotropically radiated power (e.i.r.p.) source-based, time-averaged output power. For controlled use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 5. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 2.5. If the operating frequency of the device is between two frequencies located in Table 1, linear interpolation shall be applied for the applicable separation distance. For test separation distance less than 5 mm, the exemption limits for a separation distance of 5 mm can be applied to determine if a routine evaluation is required.

For medical implants devices, the exemption limit for routine evaluation is set at 1 mW. The output power of a medical implants device is defined as the higher of the conducted or e.i.r.p to determine whether the device is exempt from the SAR evaluation.

Test Result:

For worst case:

The higher of the conducted or equivalent isotropically radiated power (e.i.r.p.) source-based, time-averaged output power:

$$(2480-2450)/(3500-2450)= (4-P)/(4-2)$$

The exemption limit of 2480MHz is P= 3.94mW

The maximum tune-up conducted power is 1 dBm, The antenna gain is 3dBi, so the EIRP is 4dBm (2.51 mW), which less than 3.94 mW@2480MHz exemption limit

So the stand-alone SAR evaluation can be exempted.

FCC §15.203 & RSS-GEN §6.8 – ANTENNA REQUIREMENT

Applicable Standard

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

According to FCC § 15.203, the applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).

When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.

The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.

For licence-exempt equipment with detachable antennas, the user manual shall also contain the following notice in a conspicuous location:

This radio transmitter [enter the device's ISED certification number] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device. Immediately following the above notice, the manufacturer shall provide a list of all antenna types which can be used with the transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna type.

Antenna Connector Construction

The EUT has one internal PCB antenna arrangement which was permanently attached and the maximum antenna gain is 3.0dBi, fulfill the requirement of this section. Please refer to the EUT photos.

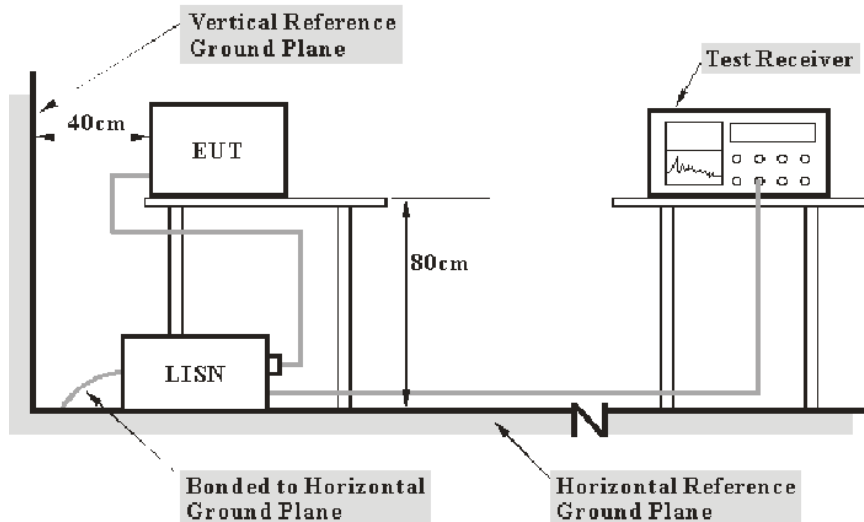| Antenna Type	Antenna Gain	Impedance	Frequency Range
PCB	3.0dBi	50 Ω	2.4~2.5GHz

Result: Compliance

FCC §15.207 (a) & RSS-GEN § 8.8 – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC §15.207(a), RSS-GEN § 8.8

EUT Setup

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

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

The spacing between the peripherals was 10 cm.

EMI Test Receiver Setup

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

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

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

Test Procedure

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

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

Transd Factor & Margin Calculation

The Transd factor is calculated by adding LISN VDF (Voltage Division Factor) and Cable Loss. The basic equation is as follows:

Transd Factor = LISN VDF + Cable Loss

The "**Over limit**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a 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
Level= Reading level+ Transd Factor

Test Data

Environmental Conditions

Temperature:	23 ℃
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Bin Duan on 2022-01-26.

EUT operation mode: Transmitting(worst case is 8DPSK, low channel)

AC 120V/60 Hz, Line
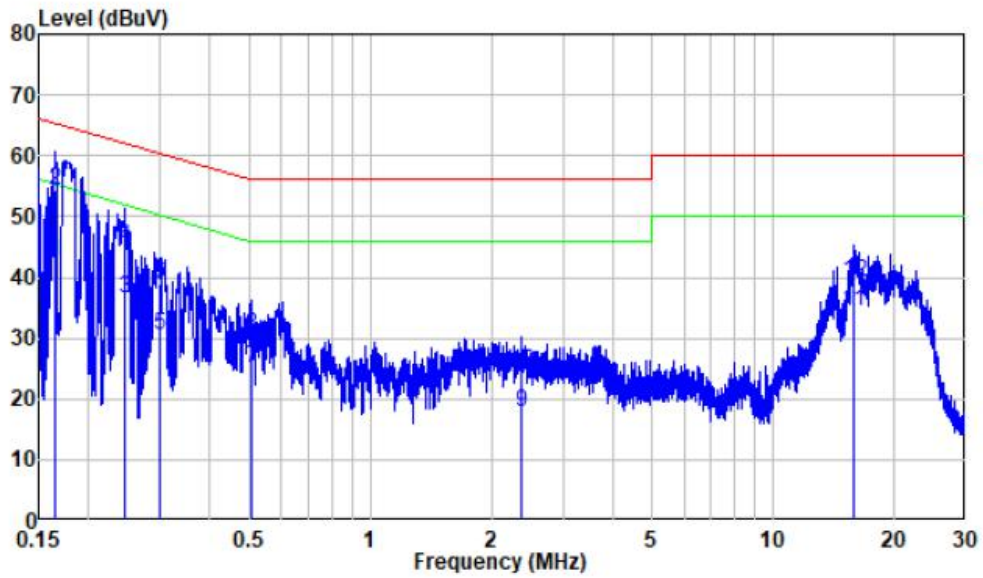
	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.165	9.87	32.70	42.57	55.19	-12.62	Average
2	0.165	9.87	44.45	54.32	65.19	-10.87	QP
3	0.245	9.80	26.69	36.49	51.92	-15.43	Average
4	0.245	9.80	35.20	45.00	61.92	-16.92	QP
5	0.300	9.80	20.82	30.62	50.24	-19.62	Average
6	0.300	9.80	29.05	38.85	60.24	-21.39	QP
7	0.507	9.80	15.37	25.17	46.00	-20.83	Average
8	0.507	9.80	20.74	30.54	56.00	-25.46	QP
9	2.371	9.92	7.81	17.73	46.00	-28.27	Average
10	2.371	9.92	14.39	24.31	56.00	-31.69	QP
11	15.760	10.08	24.30	34.38	50.00	-15.62	Average
12	15.760	10.08	29.03	39.11	60.00	-20.89	QP

AC 120V/60 Hz, Neutral
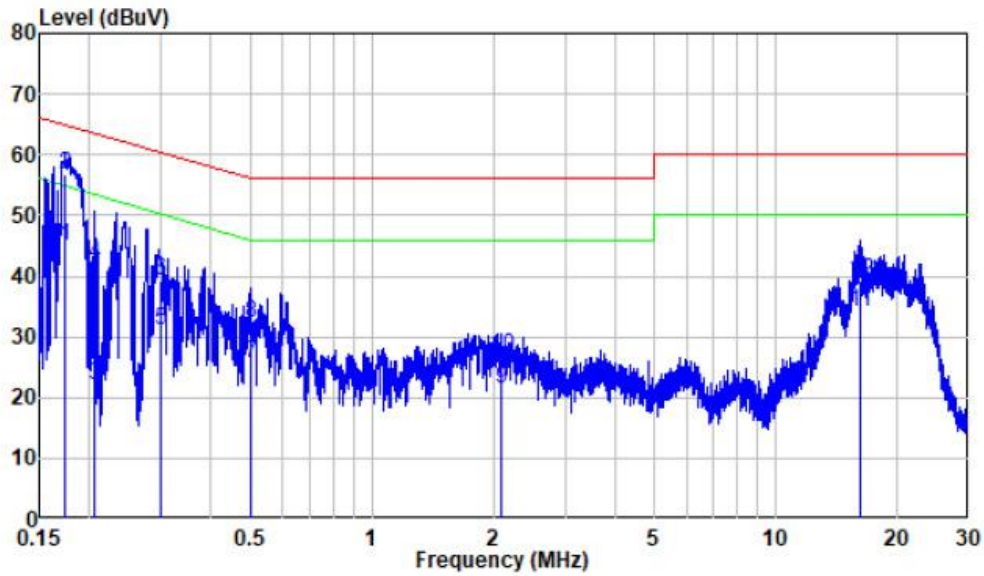
	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.174	9.80	35.09	44.89	54.78	-9.89	Average
2	0.174	9.80	46.85	56.65	64.78	-8.13	QP
3	0.206	9.80	12.27	22.07	53.35	-31.28	Average
4	0.206	9.80	32.23	42.03	63.35	-21.32	QP
5	0.301	9.80	21.28	31.08	50.21	-19.13	Average
6	0.301	9.80	29.43	39.23	60.21	-20.98	QP
7	0.500	9.80	15.82	25.62	46.00	-20.38	Average
8	0.500	9.80	22.48	32.28	56.00	-23.72	QP
9	2.089	9.82	11.53	21.35	46.00	-24.65	Average
10	2.089	9.82	17.08	26.90	56.00	-29.10	QP
11	16.151	10.06	24.09	34.15	50.00	-15.85	Average
12	16.151	10.06	29.24	39.30	60.00	-20.70	QP

FCC §15.209, §15.205 & §15.247(d) & RSS-247§ 5.5 - SPURIOUS EMISSIONS

Applicable Standard

FCC §15.205; §15.209; §15.247(d); RSS-247§ 5.5; RSS-GEN § 8.10

EUT Setup

Below 1 GHz:
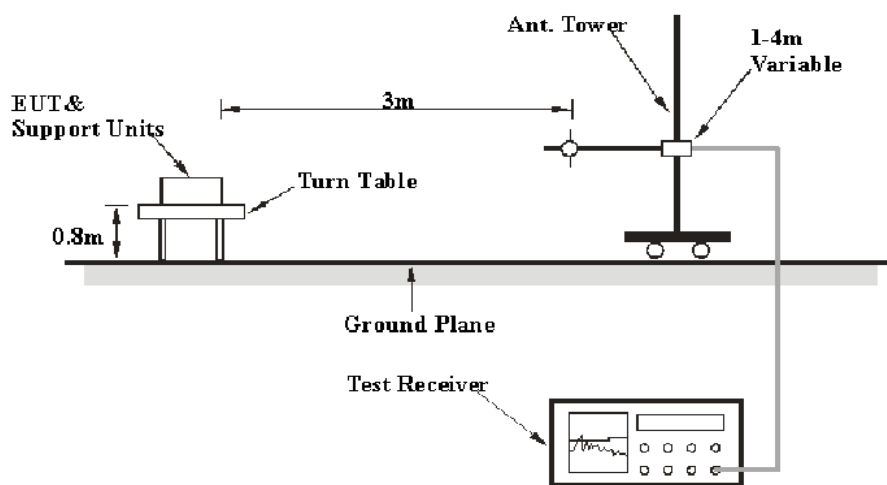
Above 1GHz:
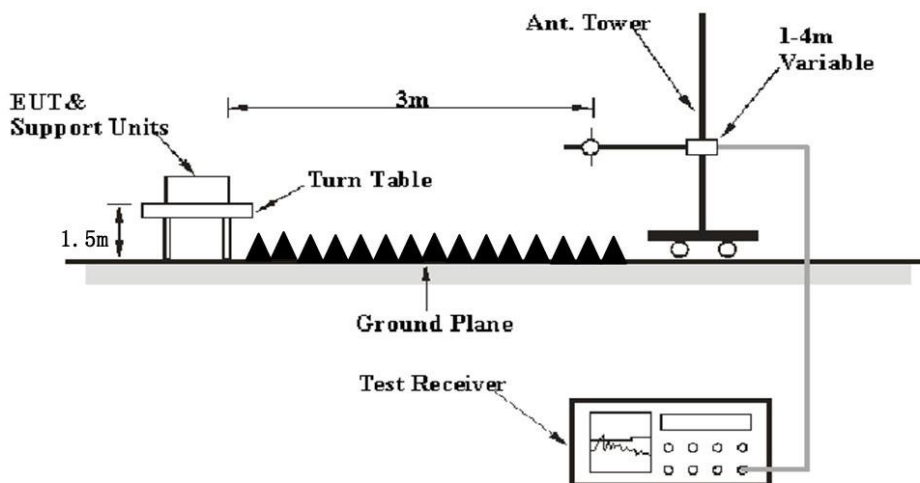
The radiated emission performed in the 3 meters, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, FCC 15.247, RSS-247, RSS-Gen limits.

EMI Test Receiver & Spectrum Analyzer Setup

The EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30 MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1 MHz	3 MHz	/	PK
	1 MHz	10 Hz	/	Average

Test Procedure

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

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

Factor & Margin Calculation

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

Factor = Antenna Factor + Cable Loss - Amplifier Gain

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

Over Limit/Margin = Level / Corrected Amplitude – Limit
Level / Corrected Amplitude = Read Level + Factor

Test Data

Environmental Conditions

Temperature:	21~25 ℃
Relative Humidity:	62~64 %
ATM Pressure:	101.0 kPa

*The testing was performed by Chao Mo on 2022-01-25 for below 1GHz and Bin Deng on 2022-01-24 for above 1GHz.*

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

(Pre-scan in the X,Y and Z axes of orientation, the worst case X-axis of orientation was recorded)

Below 1GHz: *(worst case is 8DPSK, low channel)*

When the test result of peak was less than the limit of QP more than 6dB, just peak value were recorded.

Horizontal
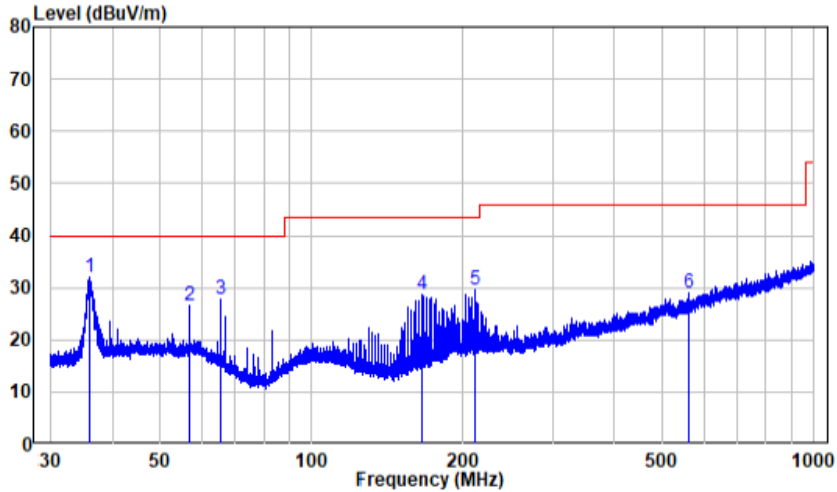

```
Site      : chamber
Condition: 3m HORIZONTAL
Job No.   : SZNS220118-02711E-RF
Test Mode: BT
```

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	36.127	-11.17	43.13	31.96	40.00	-8.04	Peak
2	57.041	-10.05	36.54	26.49	40.00	-13.51	Peak
3	65.372	-12.65	40.34	27.69	40.00	-12.31	Peak
4	164.980	-14.14	42.88	28.74	43.50	-14.76	Peak
5	210.971	-11.82	41.51	29.69	43.50	-13.81	Peak
6	560.693	-4.02	33.11	29.09	46.00	-16.91	Peak

Vertical
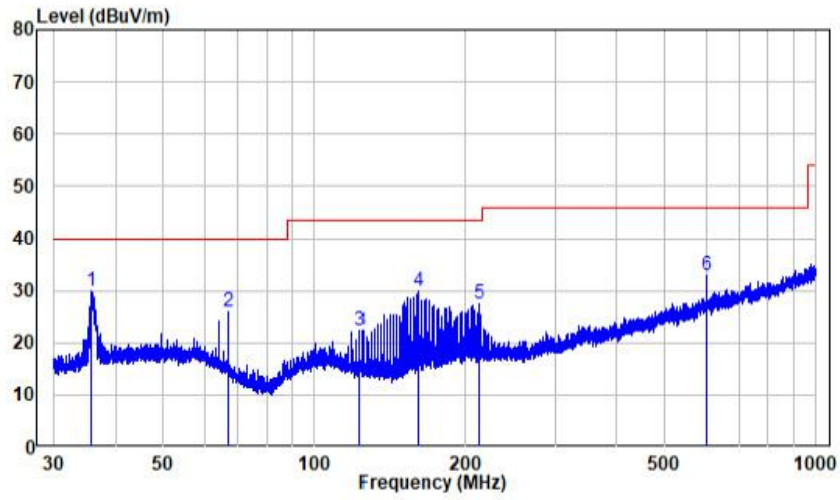

```
Site      : chamber
Condition: 3m VERTICAL
Job No.   : SZNS220118-02711E-RF
Test Mode: BT
```

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	35.875	-11.24	41.14	29.90	40.00	-10.10	Peak
2	67.173	-13.44	39.51	26.07	40.00	-13.93	Peak
3	122.942	-14.06	36.26	22.20	43.50	-21.30	Peak
4	160.980	-14.24	44.16	29.92	43.50	-13.58	Peak
5	212.922	-11.75	39.15	27.40	43.50	-16.10	Peak
6	600.110	-2.43	35.27	32.84	46.00	-13.16	Peak

Above 1GHz: (worst case for 8DPSK)

| Frequency (MHz) | Receiver | | Turntable Angle Degree | Rx Antenna | | Factor (dB/m) | Absolute Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
	Reading (dBuV)	PK/AV		Height (m)	Polar (H/V)				
Low Channel									
2310	67.35	PK	286	1.7	H	-7.24	60.11	74	-13.89
2310	52.93	AV	286	1.7	H	-7.24	45.69	54	-8.31
2310	67.31	PK	241	1.9	V	-7.24	60.07	74	-13.93
2310	52.90	AV	241	1.9	V	-7.24	45.66	54	-8.34
2390	68.30	PK	109	1.0	H	-7.22	61.08	74	-12.92
2390	54.10	AV	109	1.0	H	-7.22	46.88	54	-7.12
2390	67.47	PK	152	1.4	V	-7.22	60.25	74	-13.75
2390	54.08	AV	152	1.4	V	-7.22	46.86	54	-7.14
4804	54.39	PK	32	1.9	H	-3.52	50.87	74	-23.13
4804	54.40	PK	192	1.1	V	-3.52	50.88	74	-23.12
Middle Channel									
4882	54.35	PK	106	1.4	H	-3.37	50.98	74	-23.02
4882	54.79	PK	54	1.8	V	-3.37	51.42	74	-22.58
High Channel									
2483.5	69.80	PK	190	1.5	H	-7.20	62.60	74	-11.40
2483.5	54.84	AV	190	1.5	H	-7.20	47.64	54	-6.36
2483.5	69.31	PK	108	2.1	V	-7.20	62.11	74	-11.89
2483.5	54.80	AV	108	2.1	V	-7.20	47.60	54	-6.40
2500	68.69	PK	357	2.5	H	-7.18	61.51	74	-12.49
2500	54.24	AV	357	2.5	H	-7.18	47.06	54	-6.94
2500	68.71	PK	93	1.6	V	-7.18	61.53	74	-12.47
2500	54.18	AV	93	1.6	V	-7.18	47.00	54	-7.00
4960	54.56	PK	238	1.7	H	-3.01	51.55	74	-22.45
4960	54.33	PK	189	1.5	V	-3.01	51.32	74	-22.68

Note:
Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor
Corrected Amplitude = Corrected Factor + Reading
Margin = Corrected. Amplitude - Limit
The other spurious emission which is 20dB to the limit was not recorded.
When the test result of peak was less than the limit of average, just peak value were recorded.
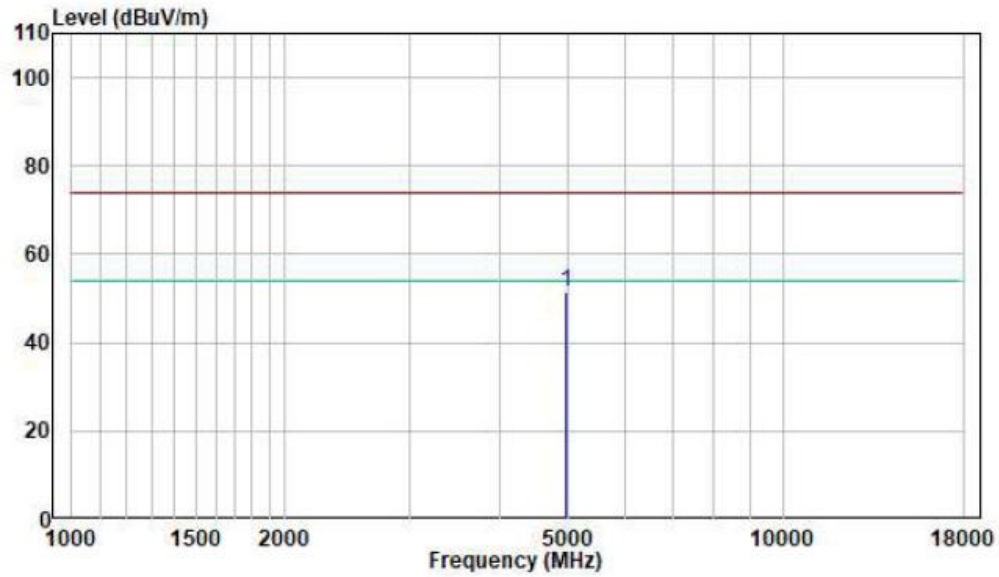
1 GHz - 18 GHz: (Pre-Scan plots)
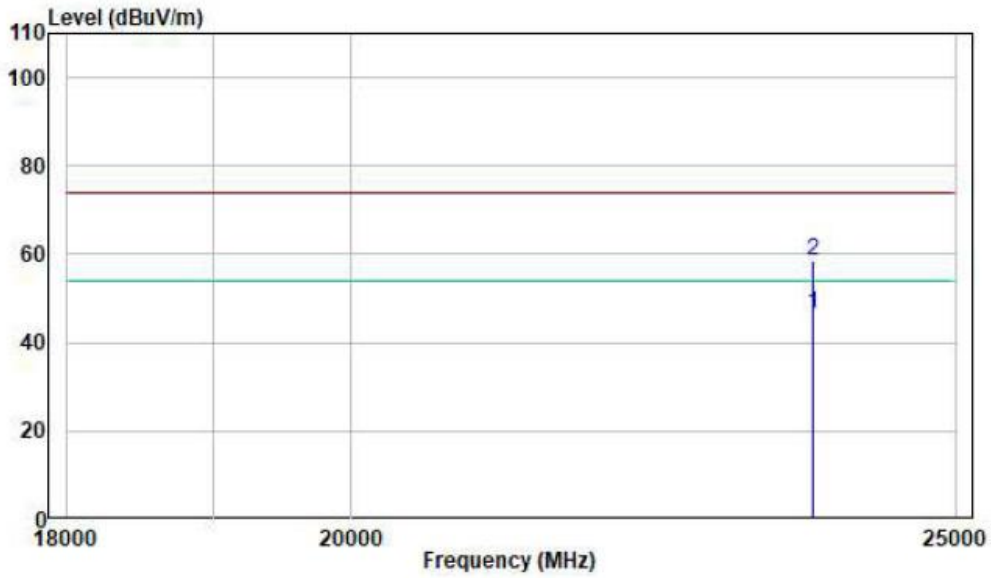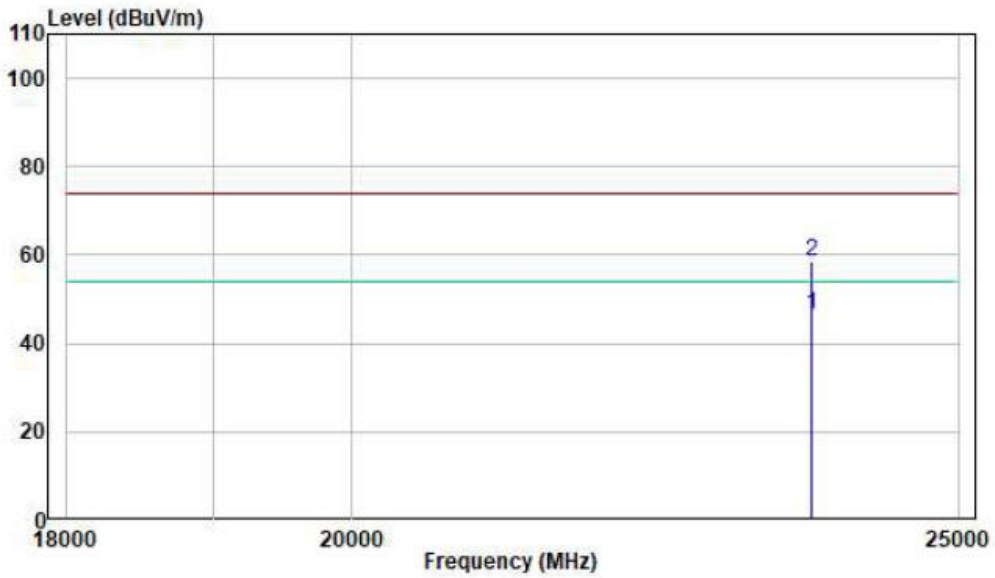
Middle channel
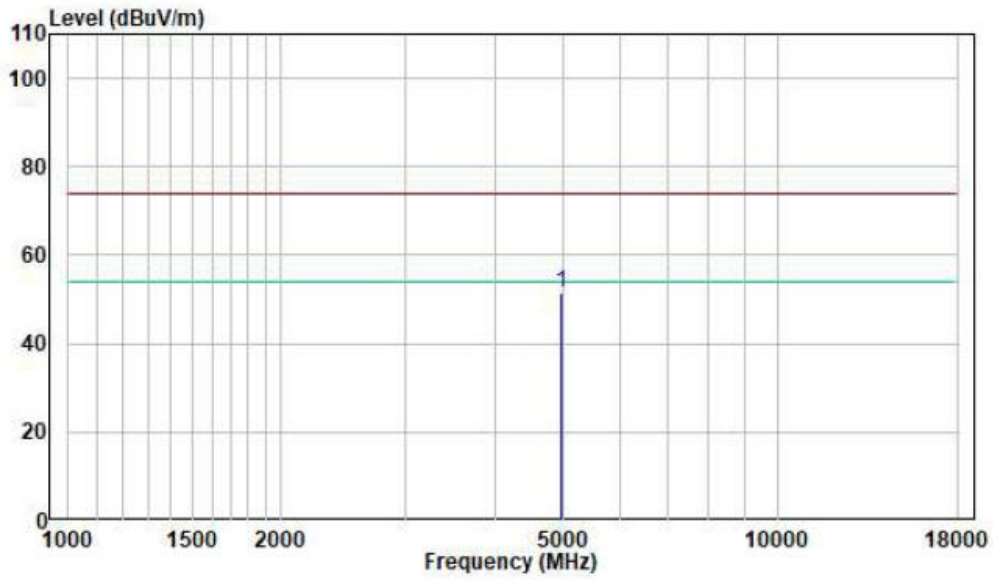
Horizontal

Vertical

18-25GHz: (Pre-Scan plots)

Middle channel

Horizontal

Vertical

FCC §15.247(a) (1) & RSS-247 § 5.1 (b) -CHANNEL SEPARATION TEST

Applicable Standard

According to FCC §15.247(a) (1):

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

According to RSS-247 § 5.1 (b):

Frequency hopping systems (FHSs) 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, FHSs operating in the band 2400-2483.5 MHz 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 that the systems operate with an output power no greater than 0.125 W. 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.

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.
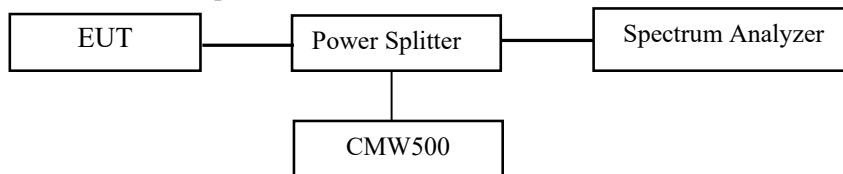
Test Data

Environmental Conditions

Temperature:	26.3 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

*The testing was performed by Black Ding on 2022-01-24.*

EUT operation mode: Transmitting

Test Result: Pass

Please refer to following table and plots.

Channel	Channel Separation (MHz)	20 dBc BW (MHz)	Two-thirds of the 20 dB bandwidth (MHz)	Channel Separation Limit
BDR(GFSK)				
Middle	1.006	0.865	0.577	> two-thirds of the 20 dB bandwidth
EDR(π/4-DQPSK)				
Middle	1.013	1.244	0.829	> two-thirds of the 20 dB bandwidth
EDR(8DPSK)				
Middle	1.000	1.224	0.816	> two-thirds of the 20 dB bandwidth

BDR (GFSK): Middle Channel
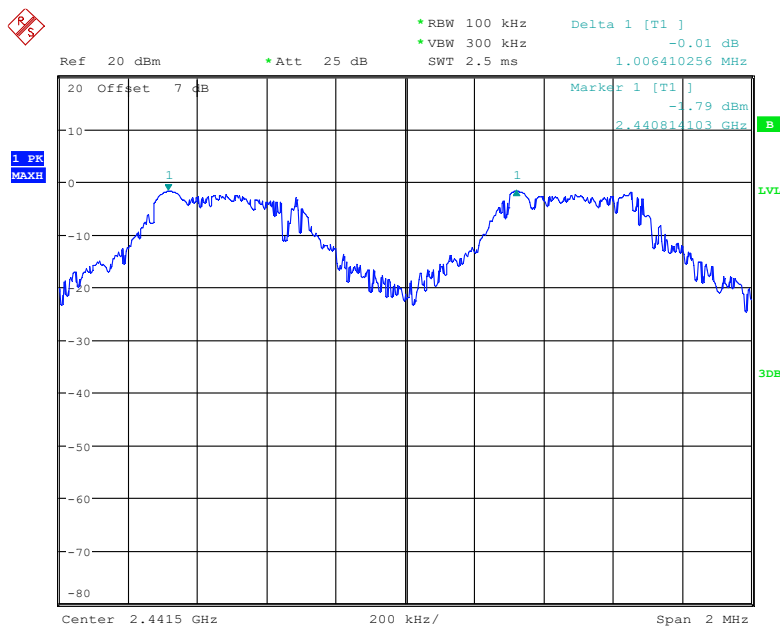
Date: 24.JAN.2022 15:35:45

EDR (π/4-DQPSK): Middle Channel
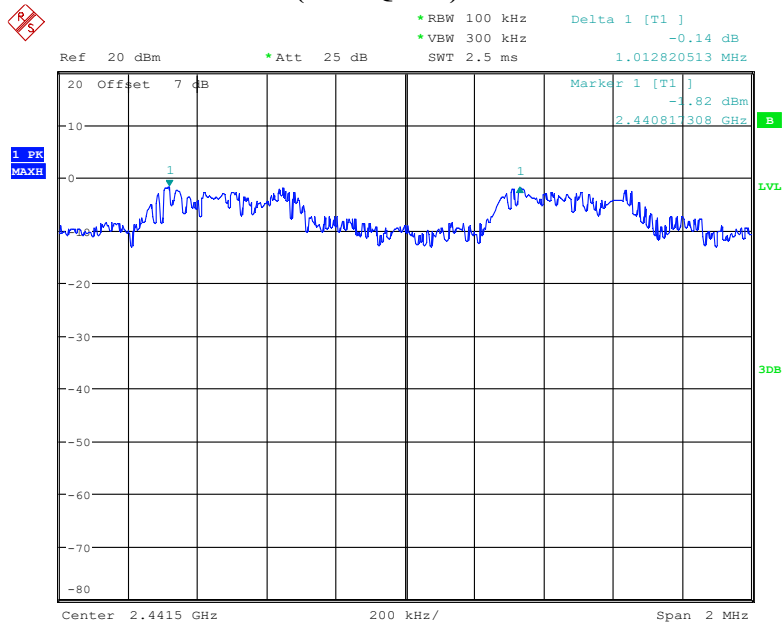
Date: 24.JAN.2022 15:36:57

EDR (8DPSK): Middle Channel
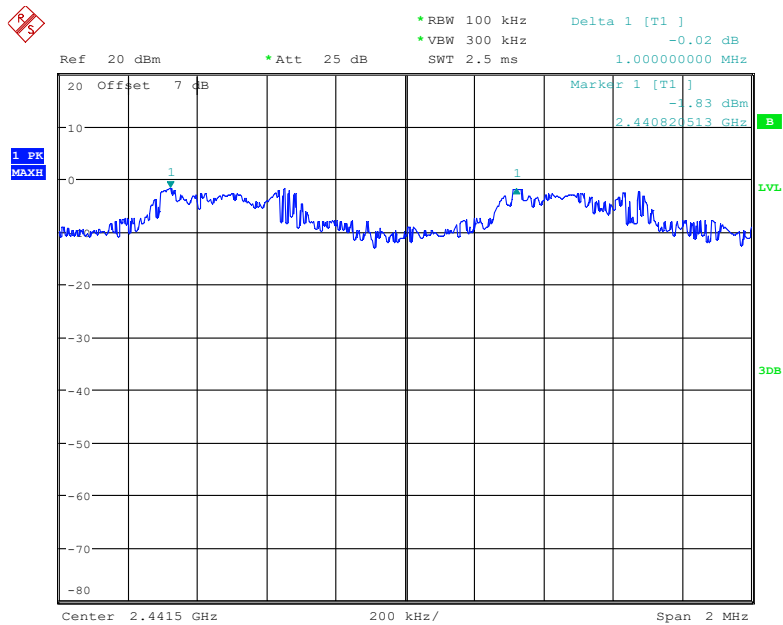
Date: 24.JAN.2022 15:31:30

FCC §15.247(a) (1) & RSS-247 § 5.1 (a), RSS-GEN § 6.7 – 20 dB EMISSION BANDWIDTH & 99% OCCUPIED BANDWIDTH

Applicable Standard

According to FCC §15.247(a) (1):

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.

According to RSS-247 § 5.1 (a), RSS-GEN § 6.7:

The occupied bandwidth or the "99% emission bandwidth" is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

In some cases, the "20 dB bandwidth" is required, which is defined as the frequency range between two points, one at the lowest frequency below and one at the highest frequency above the carrier frequency, at which the maximum power level of the transmitted emission is attenuated 20 dB below the maximum in-band power level of the modulated signal, where the two points are on the outskirts of the in-band emission.
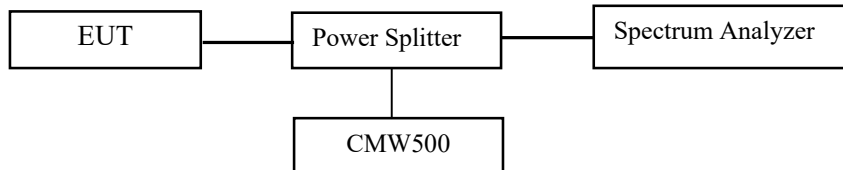
Test Procedure

The following conditions shall be observed for measuring the occupied bandwidth and 20 dB bandwidth:

• The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

• The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.

• The detector of the spectrum analyzer shall be set to "Sample". However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or "Max Hold") may be necessary to determine the occupied / 20 dB bandwidth if the device is not transmitting continuously.

• The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / 20 dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

Note: It may be necessary to repeat the measurement a few times until the RBW and VBW are in compliance with the above requirement.

For the 99% emission bandwidth, the trace data points are recovered and directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached, and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the occupied bandwidth (or the 99% emission bandwidth).

```
┌──────────┐      ┌────────────────┐      ┌─────────────────────┐
│   EUT    │──────│ Power Splitter │──────│ Spectrum Analyzer   │
└──────────┘      └────────────────┘      └─────────────────────┘
                          │
                  ┌────────────────┐
                  │    CMW500      │
                  └────────────────┘
```

Test Data

Environmental Conditions

Temperature:	26.3 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Black Ding from 2022-01-24 to 2022-02-14.

EUT operation mode: Transmitting

Test Result: Pass

Please refer to following table and plots.

| Mode	Channel	Frequency (MHz)	99% Emission Bandwidth (MHz)	20 dB Emission Bandwidth (MHz)
BDR (GFSK)	Low	2402	0.822	0.871
	Middle	2441	0.819	0.865
	High	2480	0.825	0.819
EDR (π/4-DQPSK)	Low	2402	1.128	1.210
	Middle	2441	1.128	1.244
	High	2480	1.122	1.244
EDR (8DPSK)	Low	2402	1.115	1.224
	Middle	2441	1.119	1.224
	High	2480	1.119	1.218

BDR (GFSK):
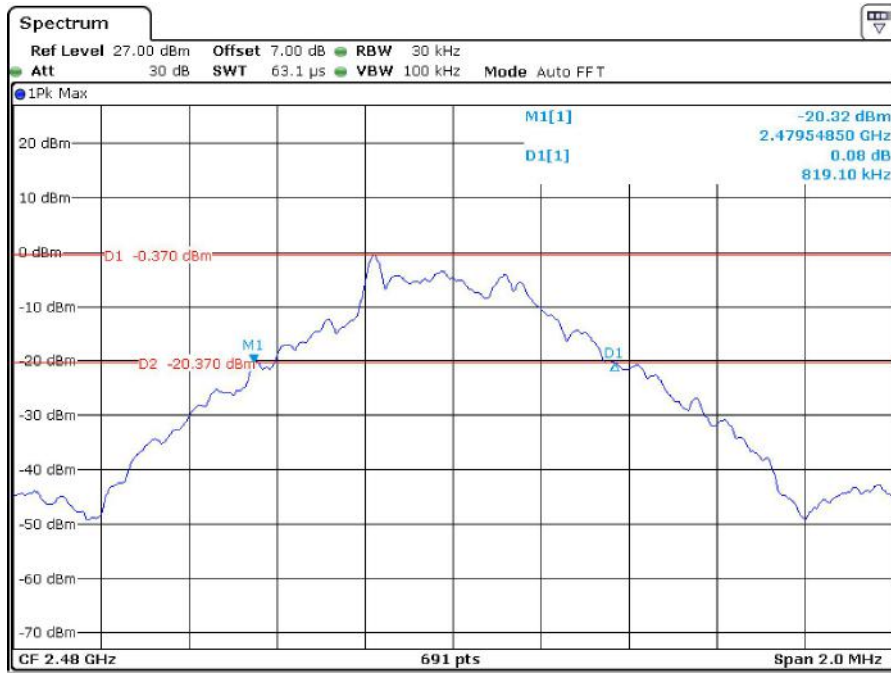
20dB Emission Bandwidth, Low Channel
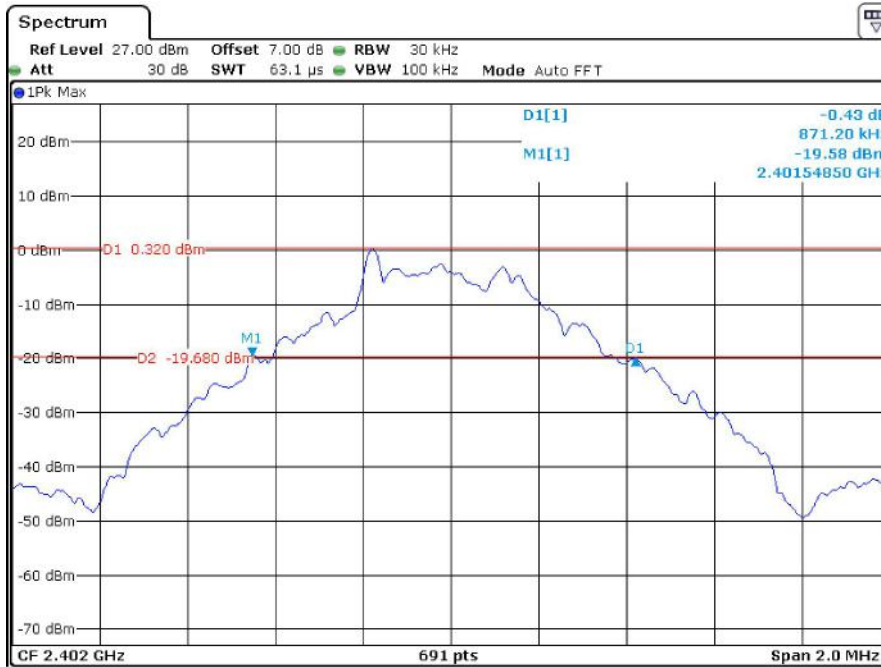
Date: 25.JAN.2022 18:40:08
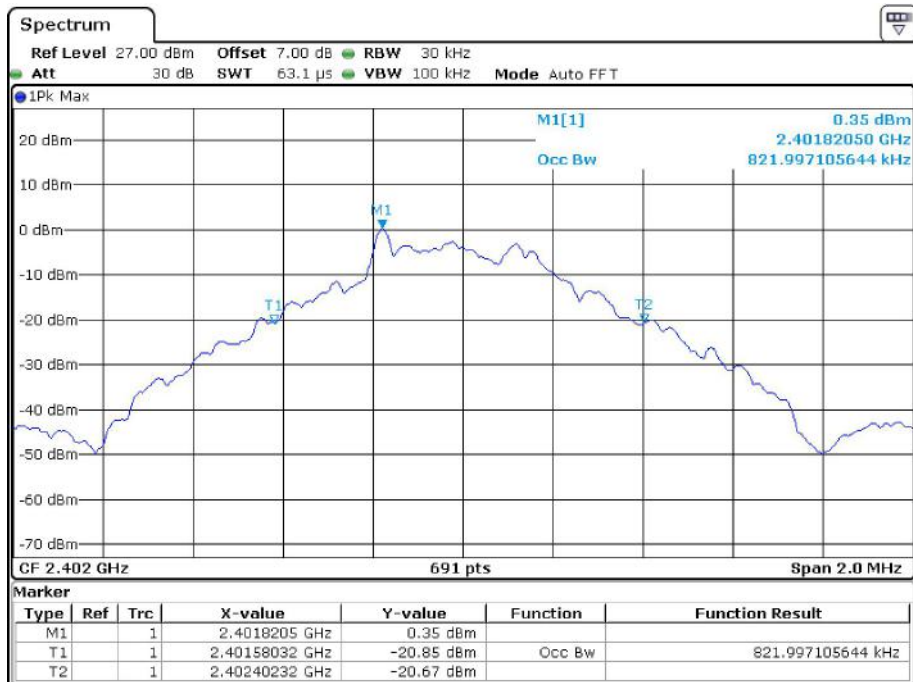
20dB Emission Bandwidth, Middle Channel
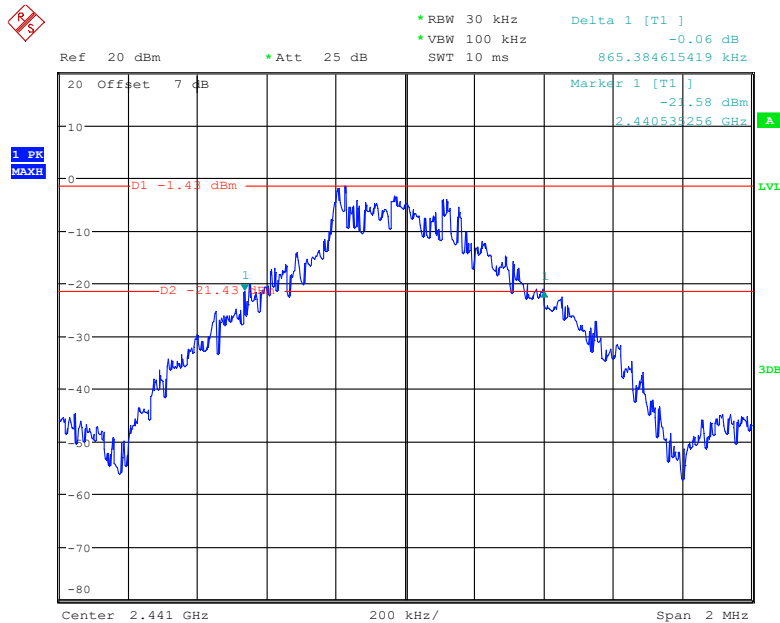
Date: 25.JAN.2022 13:12:58

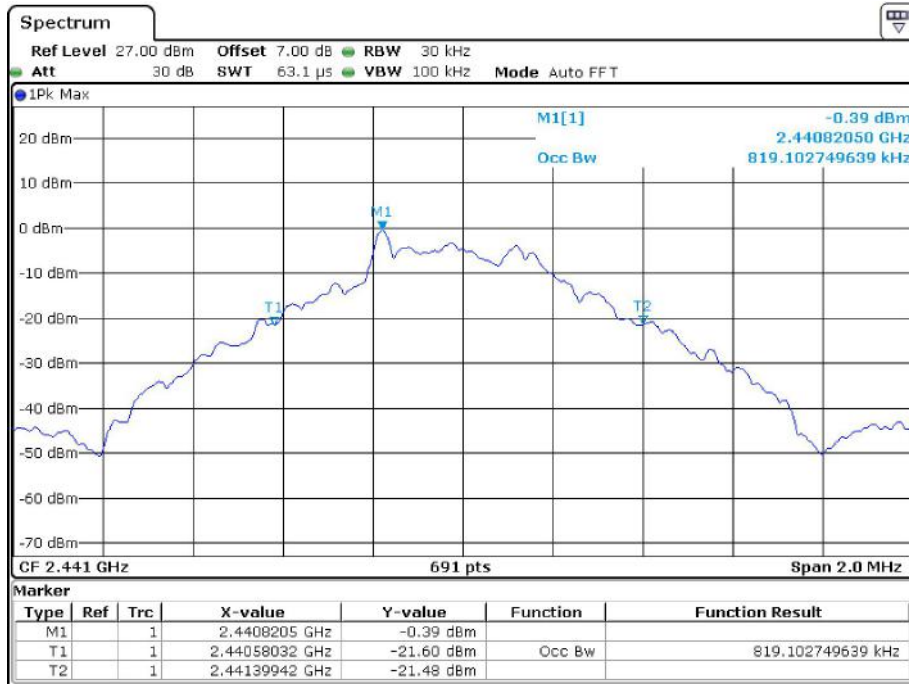## 20dB Emission Bandwidth, High Channel

Date: 25.JAN.2022 18:41:42
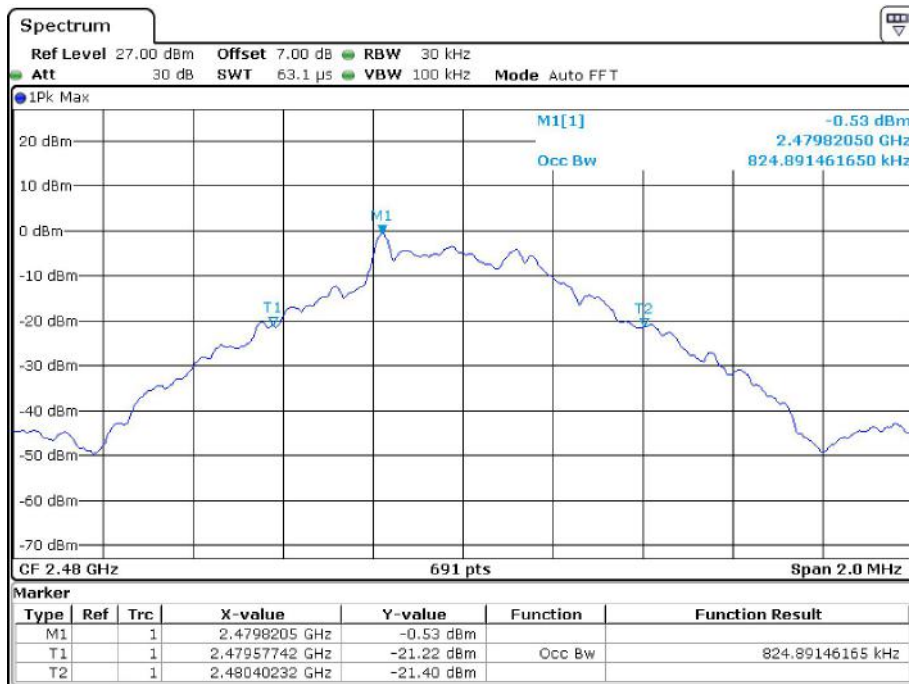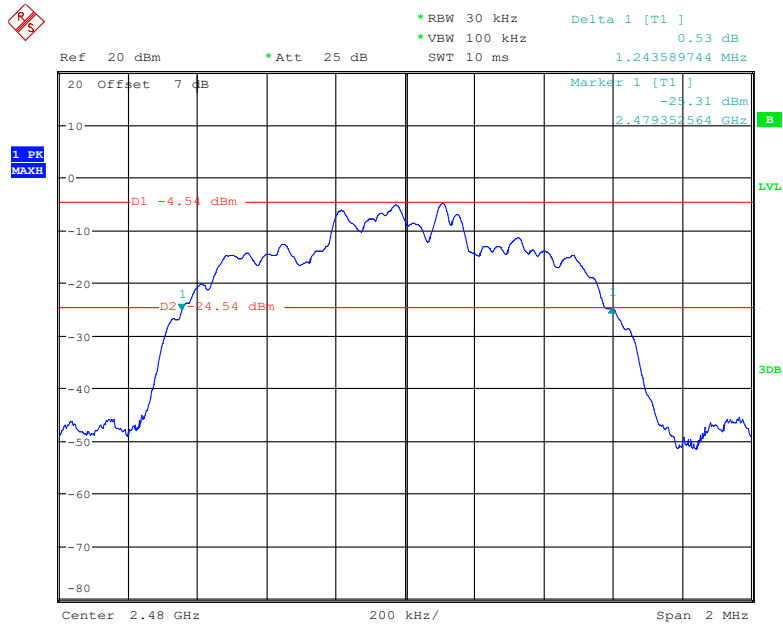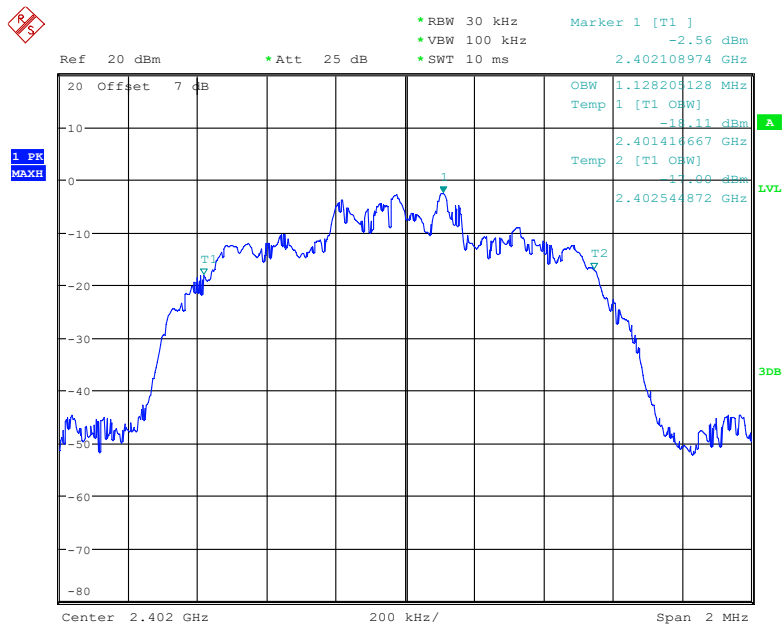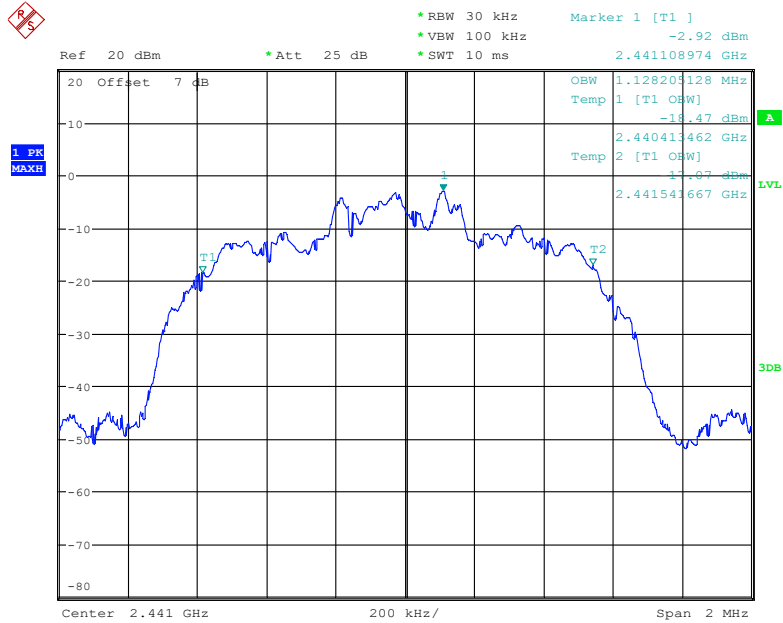
99% Occupied Bandwidth, Low Channel

Marker						
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4018205 GHz	0.35 dBm		
T1		1	2.40158032 GHz	-20.85 dBm	Occ Bw	821.997105644 kHz
T2		1	2.40240232 GHz	-20.67 dBm		

Date: 25.JAN.2022 18:44:55

99% Occupied Bandwidth, Middle Channel

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4408205 GHz	-0.39 dBm		
T1		1	2.44058032 GHz	-21.60 dBm	Occ Bw	819.102749639 kHz
T2		1	2.44139942 GHz	-21.48 dBm		

Date: 25.JAN.2022 18:45:23

99% Occupied Bandwidth, High Channel

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4798205 GHz	-0.53 dBm		
T1		1	2.47957742 GHz	-21.22 dBm	Occ Bw	824.89146165 kHz
T2		1	2.48040232 GHz	-21.40 dBm		

Date: 25.JAN.2022 18:44:20

EDR (π/4-DQPSK):

20dB Emission Bandwidth, Low Channel
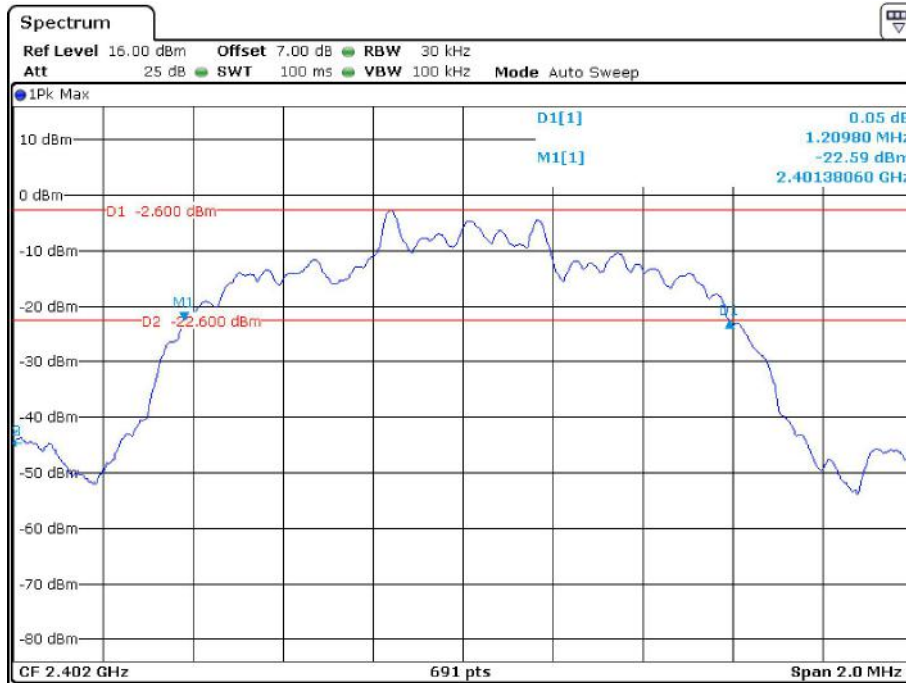
Date: 14.FEB.2022 13:53:59

20dB Emission Bandwidth, Middle Channel
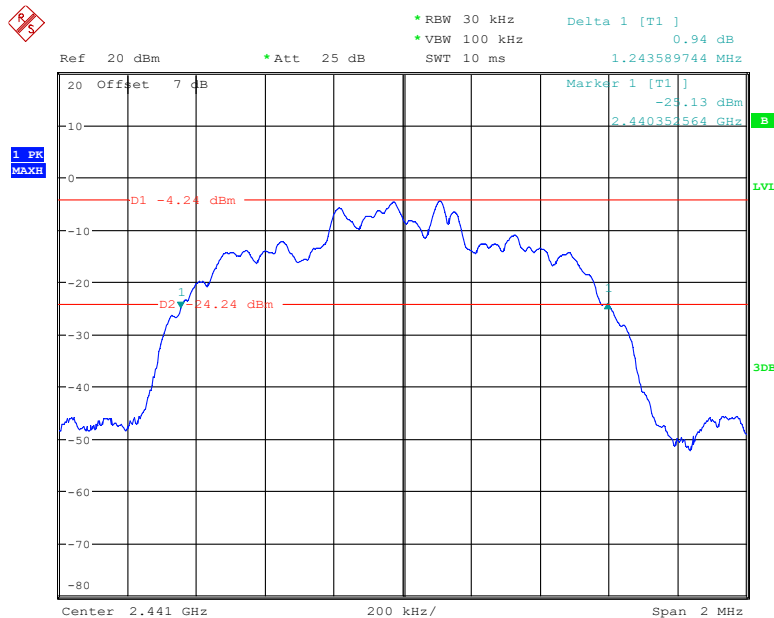
Date: 24.JAN.2022 15:10:08

20dB Emission Bandwidth, High Channel


```
                                      *RBW 30 kHz      Delta 1 [T1 ]
                                      *VBW 100 kHz              0.53 dB
       Ref  20 dBm      *Att  25 dB    SWT 10 ms        1.243589744 MHz
       20 Offset   7 dB                               Marker 1 [T1 ]
                                                            -25.31 dBm     B
                                                       2.479352564 GHz
                                                                           LVL
       D1 -4.54 dBm

       D2 -24.54 dBm

                                                                           3DB

       Center  2.48 GHz        200 kHz/              Span  2 MHz
```
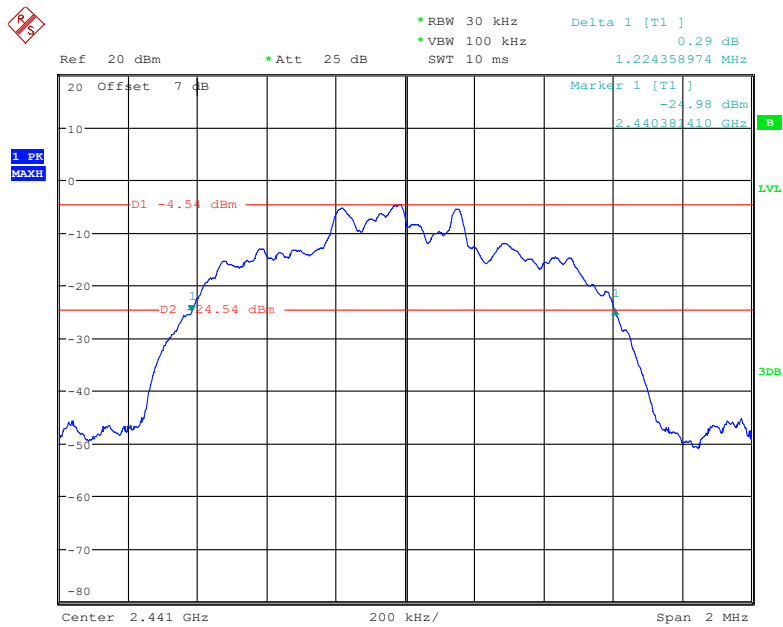
Date: 24.JAN.2022 15:11:11

99% Occupied Bandwidth, Low Channel


```
                                      *RBW 30 kHz      Marker 1 [T1 ]
                                      *VBW 100 kHz             -2.56 dBm
       Ref  20 dBm      *Att  25 dB   *SWT 10 ms        2.402108974 GHz
       20 Offset   7 dB                               OBW 1.128205128 MHz
                                                      Temp 1 [T1 OBW]
                                                            -18.11 dBm     A
                                                       2.401416667 GHz
                                                      Temp 2 [T1 OBW]
                                                            -17.00 dBm     LVL
                                                       2.402544872 GHz

                                                                           3DB

       Center  2.402 GHz       200 kHz/              Span  2 MHz
```

Date: 24.JAN.2022 19:15:31

99% Occupied Bandwidth, Middle Channel

Date: 24.JAN.2022 19:15:18

99% Occupied Bandwidth, High Channel
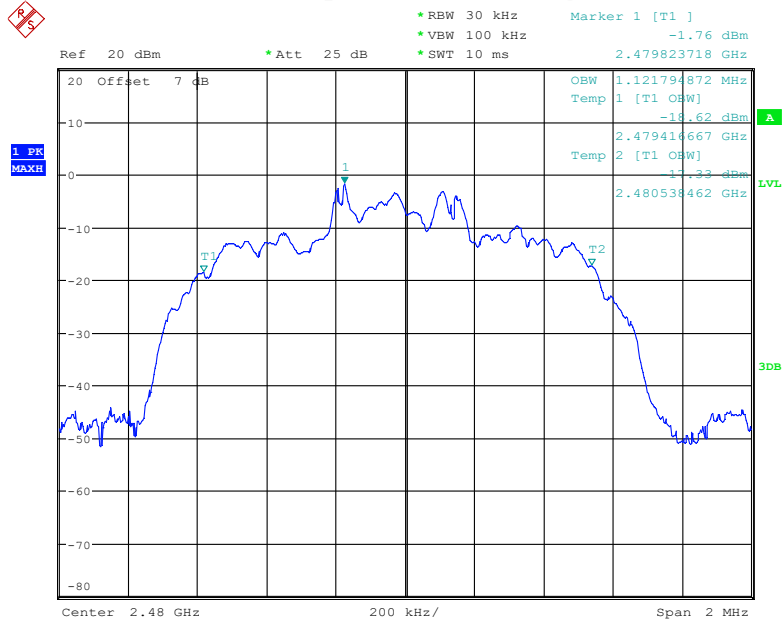
Date: 24.JAN.2022 19:14:55

EDR (8DPSK):

20dB Emission Bandwidth, Low Channel
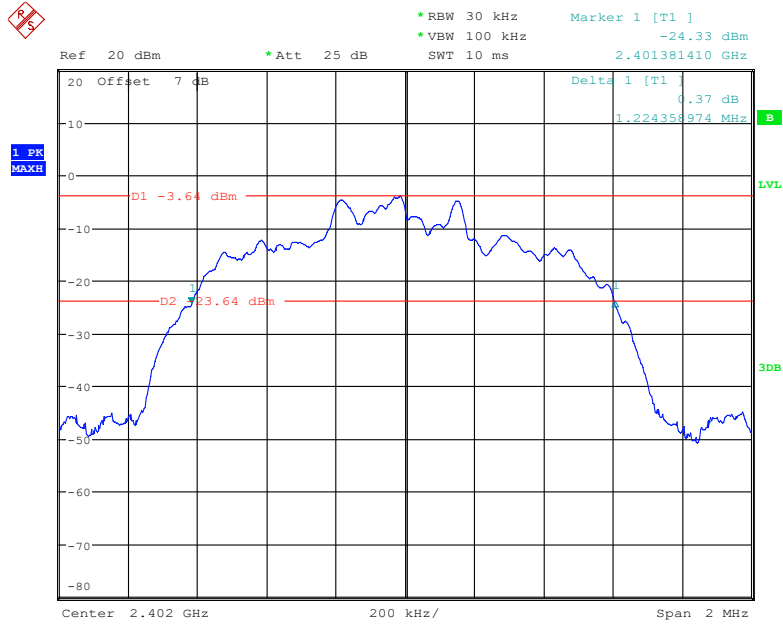
Date: 24.JAN.2022 15:14:38
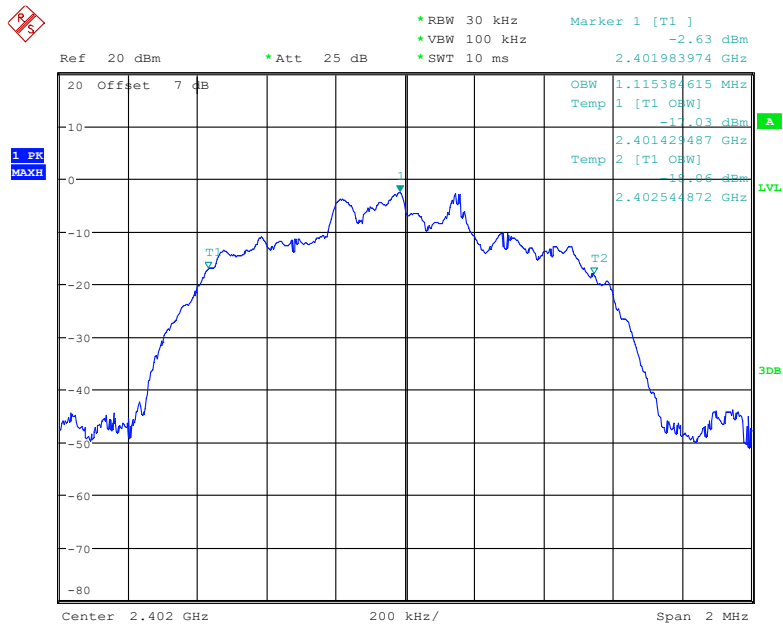
20dB Emission Bandwidth, Middle Channel

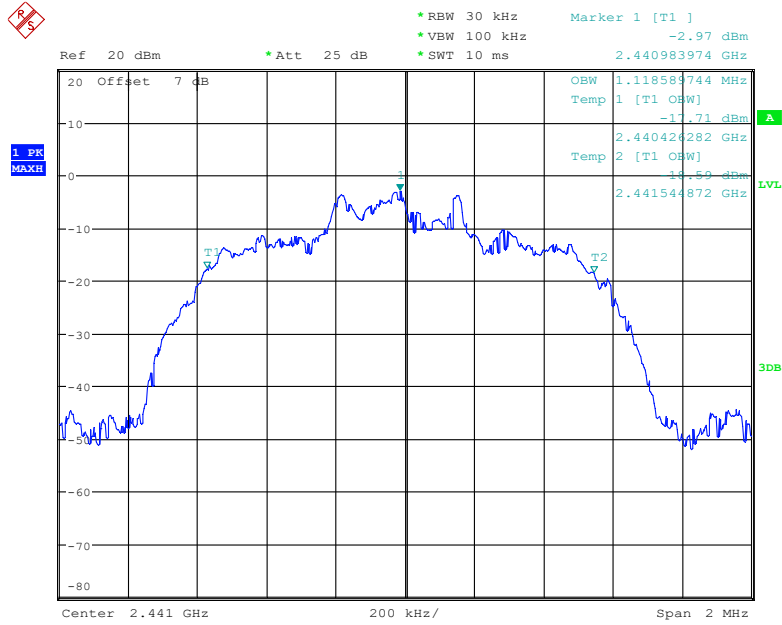Date: 24.JAN.2022 15:13:39

20dB Emission Bandwidth, High Channel
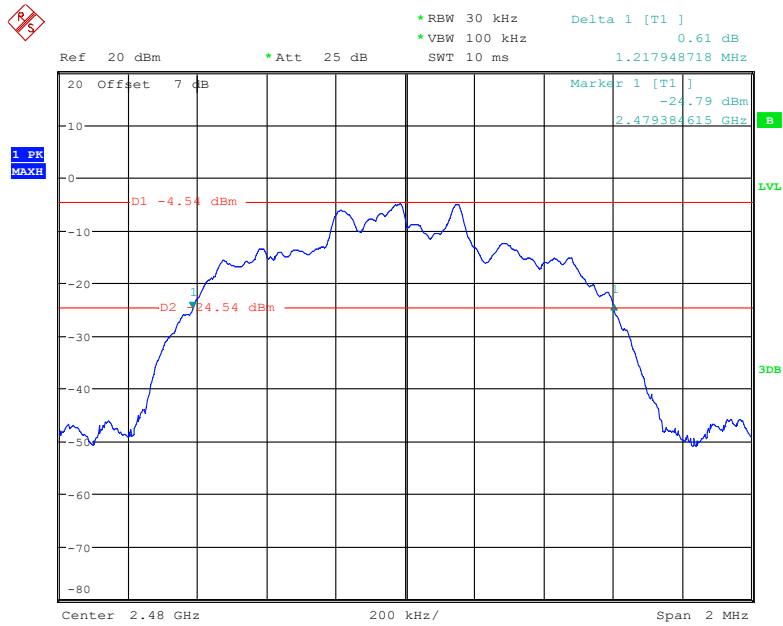
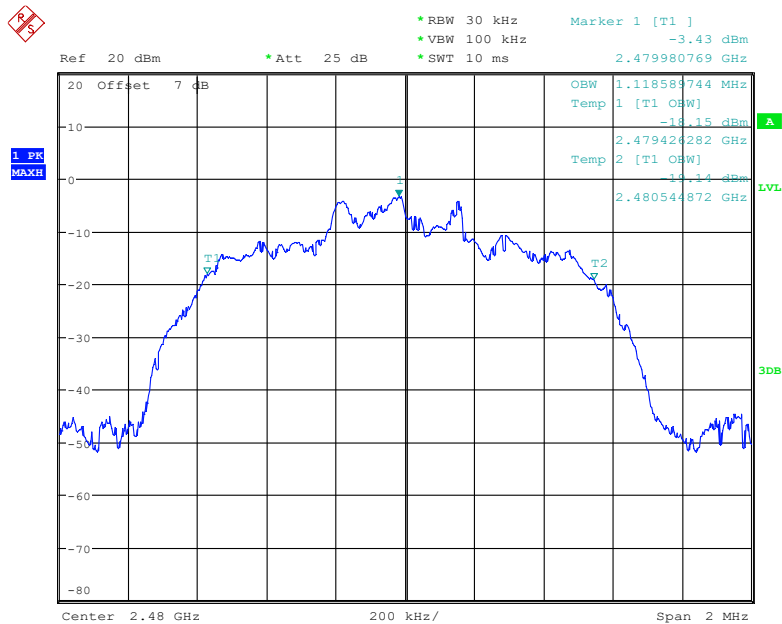Date: 24.JAN.2022 15:12:31

99% Occupied Bandwidth, Low Channel

Date: 24.JAN.2022 19:15:47

99% Occupied Bandwidth, Middle Channel

Date: 24.JAN.2022 19:16:12

99% Occupied Bandwidth, High Channel

Date: 24.JAN.2022 19:16:34

FCC §15.247(a) (1) (iii) & RSS-247 § 5.1 (d) - QUANTITY OF HOPPING CHANNEL TEST

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.

According to RSS-247 § 5.1 (d):

Frequency hopping systems (FHSS) operating in the band 2400-2483.5 MHz shall use at least 15 hopping 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. Transmissions on particular hopping frequencies may be avoided or suppressed provided that at least 15 hopping channels are used.

Test Procedure

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

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

3. By using the max-hold function record the quantity of the channel.
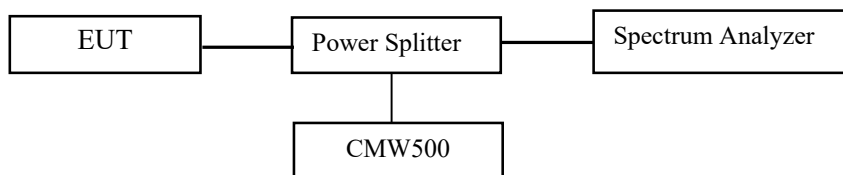
| EUT | — | Power Splitter | — | Spectrum Analyzer |

CMW500

Test Data

Environmental Conditions

Temperature:	26.3 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

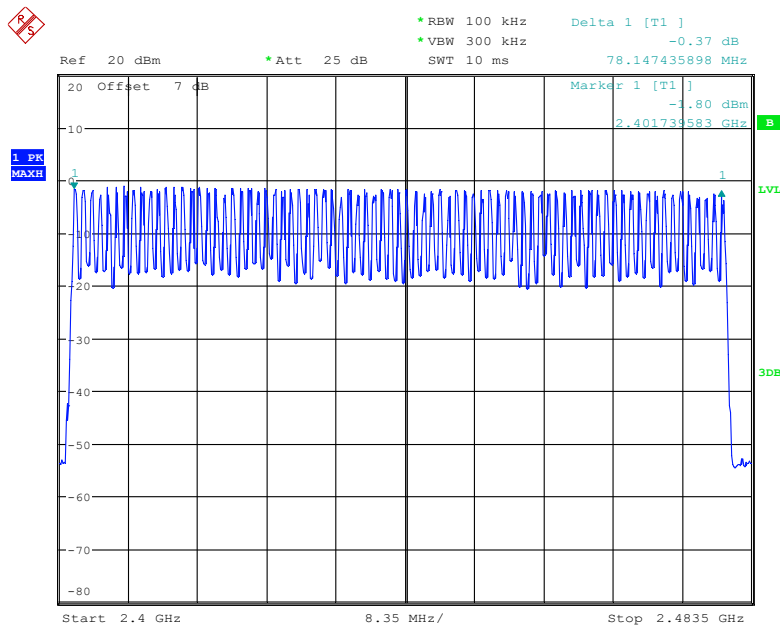*The testing was performed by Black Ding on 2022-01-24.*

EUT operation mode: Transmitting

Test Result: Pass

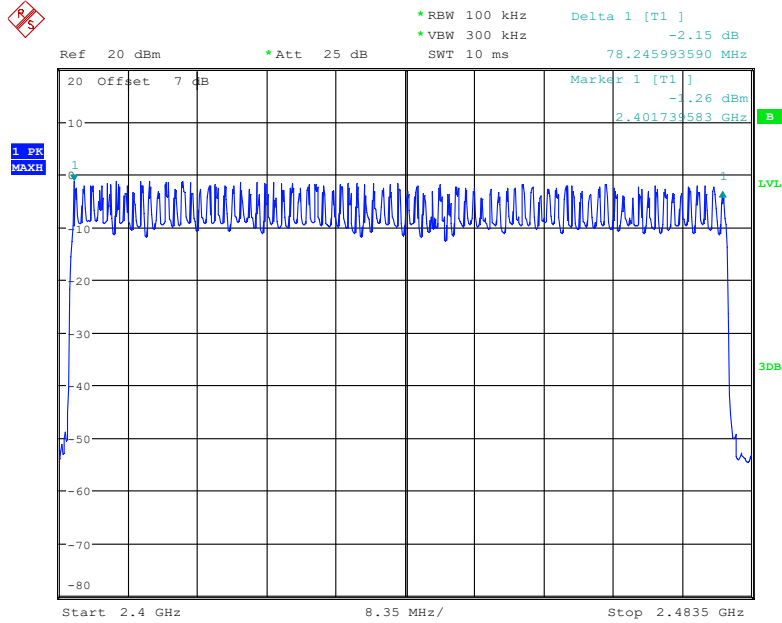*Please refer to following table and plots.*

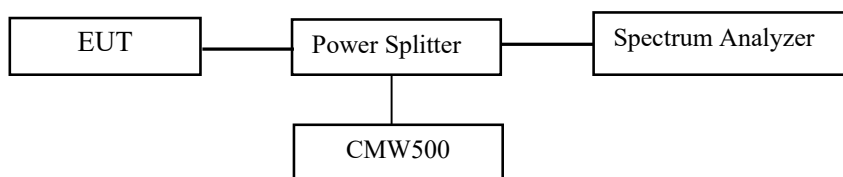| Mode	Frequency Range (MHz)	Number of Hopping Channel (CH)	Limit (CH)
BDR (GFSK)	2400-2483.5	79	≥15
EDR (π/4-DQPSK)	2400-2483.5	79	≥15
EDR (8DPSK)	2400-2483.5	79	≥15

BDR (GFSK): Number of Hopping Channels

Date: 24.JAN.2022 15:43:42

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


```
                              *RBW 100 kHz    Delta 1 [T1 ]
                              *VBW 300 kHz              -2.15 dB
        Ref  20 dBm    *Att 25 dB   SWT 10 ms    78.245993590 MHz
```

Date: 24.JAN.2022 15:40:30

EDR (8DPSK): Number of Hopping Channels


```
                              *RBW 100 kHz    Marker 1 [T1 ]
                              *VBW 300 kHz              -1.82 dBm
        Ref  20 dBm    *Att 25 dB   SWT 10 ms    2.402007212 GHz
```
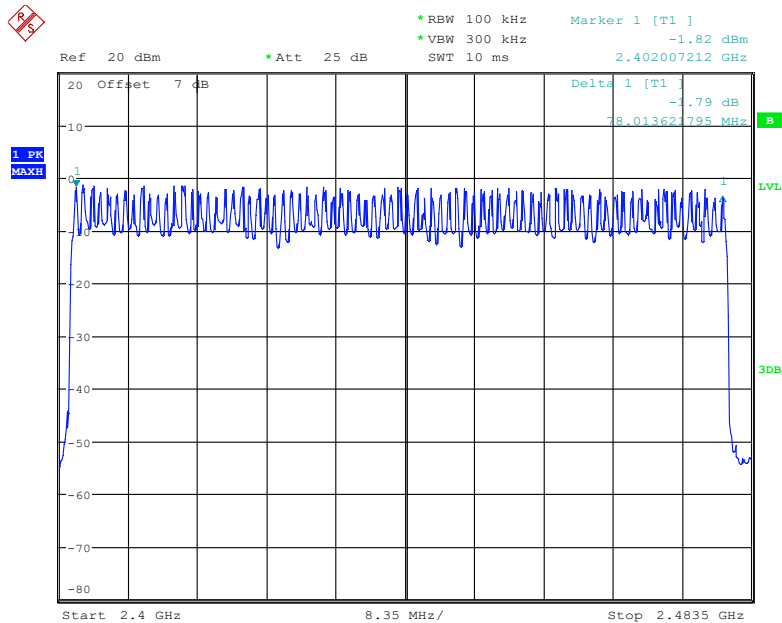
Date: 24.JAN.2022 15:42:31

FCC §15.247(a) (1) (iii) & RSS-247 § 5.1 (d) - TIME OF OCCUPANCY (DWELL TIME)

Applicable Standard

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

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

According to RSS-247 § 5.1 (d):

Frequency hopping systems (FHSs) operating in the band 2400-2483.5 MHz shall use at least 15 hopping 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. Transmissions on particular hopping frequencies may be avoided or suppressed provided that at least 15 hopping channels are used.

Test Procedure

1. The EUT was worked in channel hopping.
2. Set the RBW to: 1MHz.
3. Set the VBW ≥ 3×RBW.
4. Set the span to 0Hz.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Recorded the time of single pulses

```
 ┌─────────┐      ┌─────────────────┐      ┌─────────────────────┐
 │   EUT   │──────│  Power Splitter │──────│  Spectrum Analyzer  │
 └─────────┘      └─────────────────┘      └─────────────────────┘
                          │
                  ┌───────────────┐
                  │    CMW500     │
                  └───────────────┘
```

Test Data

Environmental Conditions

Temperature:	26.3 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Black Ding from 2022-01-24 to 2022-01-26.

EUT operation mode: Transmitting

Test Result: Pass

Please refer to following table and plots

Test Mode	Channel	Pulse Time [ms]	Total Hops [Num]	Result[s]	Limit[s]	Verdict
DH1	Hop	0.464	320	0.148	<=0.4	PASS
DH3	Hop	1.730	180	0.311	<=0.4	PASS
DH5	Hop	2.999	110	0.330	<=0.4	PASS
2DH1	Hop	0.461	320	0.148	<=0.4	PASS
2DH3	Hop	1.717	180	0.309	<=0.4	PASS
2DH5	Hop	2.984	130	0.388	<=0.4	PASS
3DH1	Hop	0.461	310	0.143	<=0.4	PASS
3DH3	Hop	1.717	170	0.292	<=0.4	PASS
3DH5	Hop	2.991	130	0.389	<=0.4	PASS

Note 1: A period time=0.4*79=31.6(S), Result= Pulse Time *Total hops
Note 2: Total hops=Hopping Number in 3.16s*10
Note 3: Hopping Number in 3.16s=Total of highest signals in 3.16s (Second high signals were other channel)

BDR (GFSK):
DH1
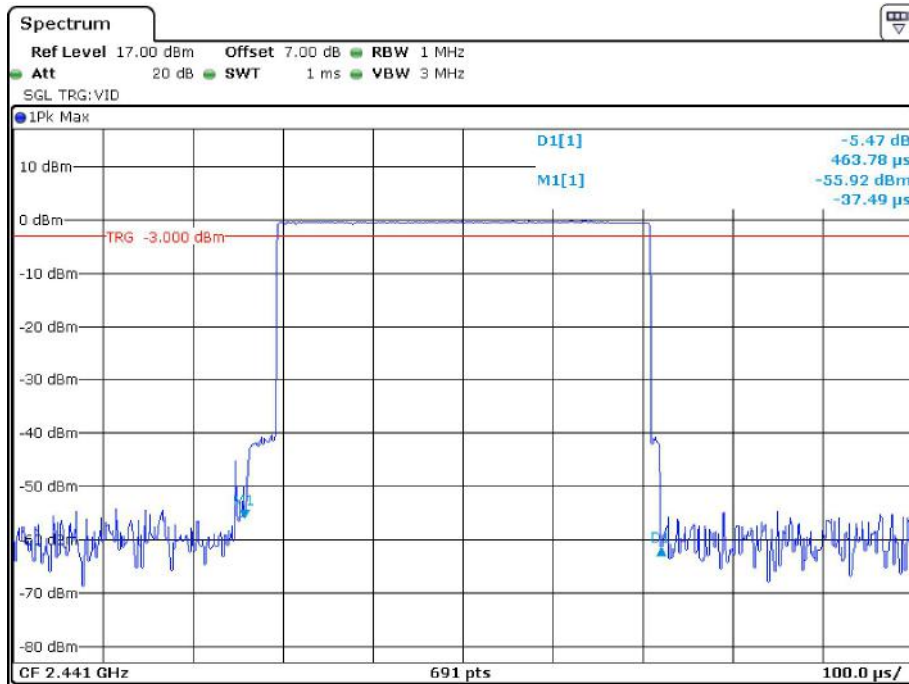
Date: 25.JAN.2022 18:52:23
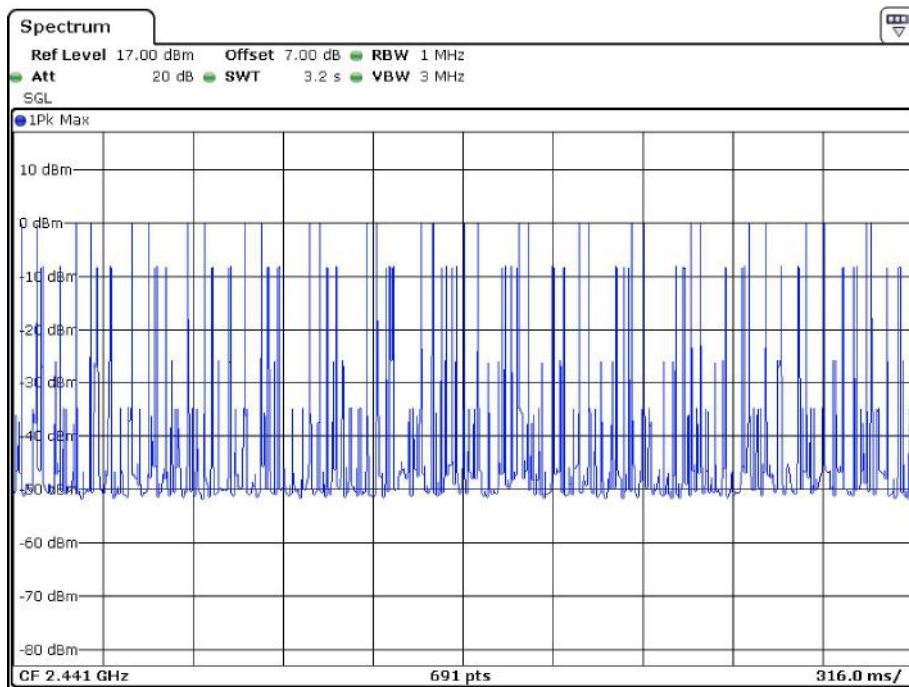
Date: 25.JAN.2022 19:05:11

DH3
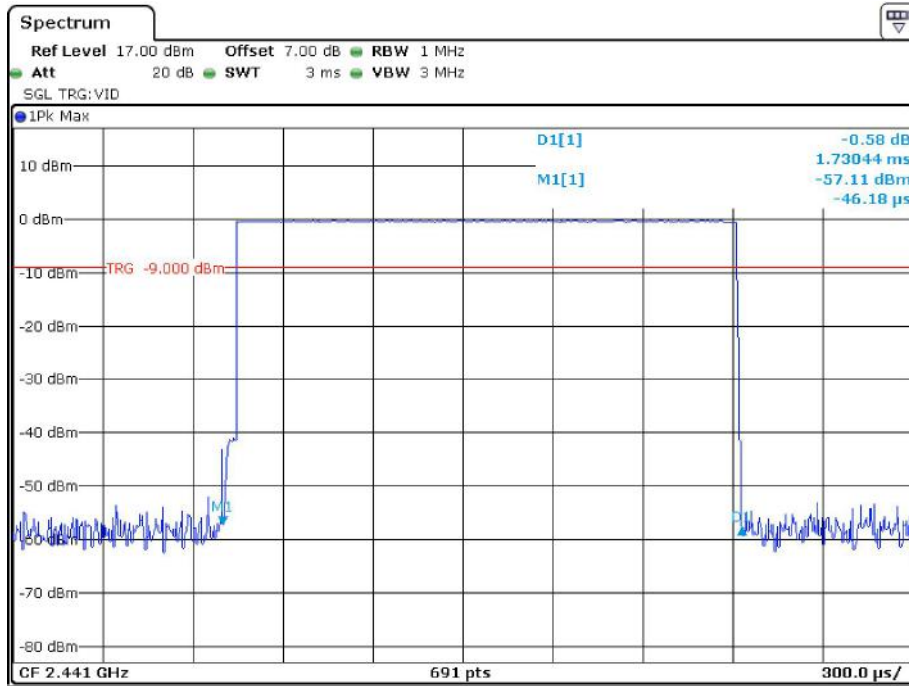
Date: 25.JAN.2022 18:57:17
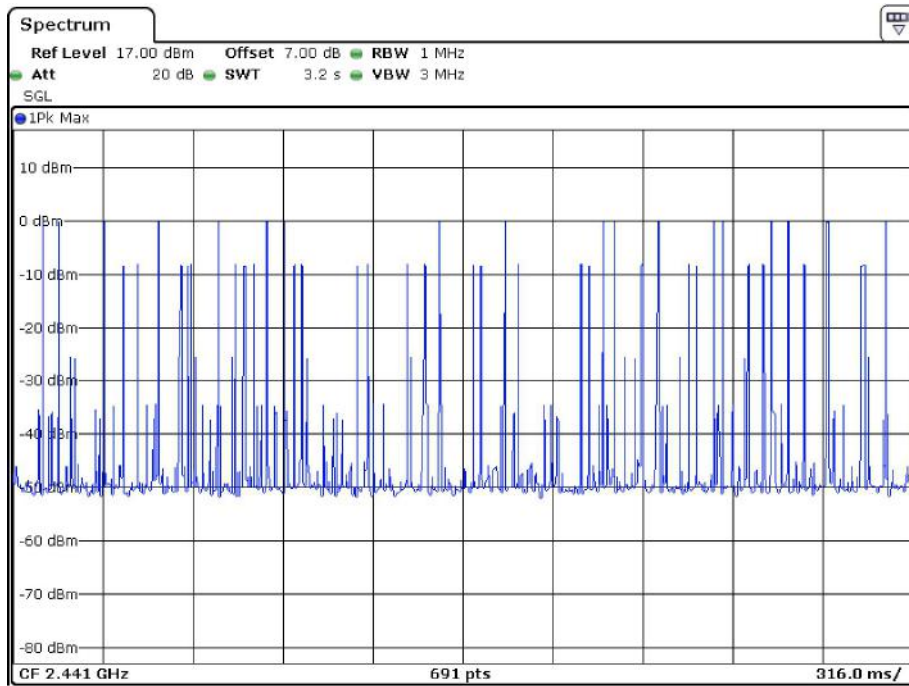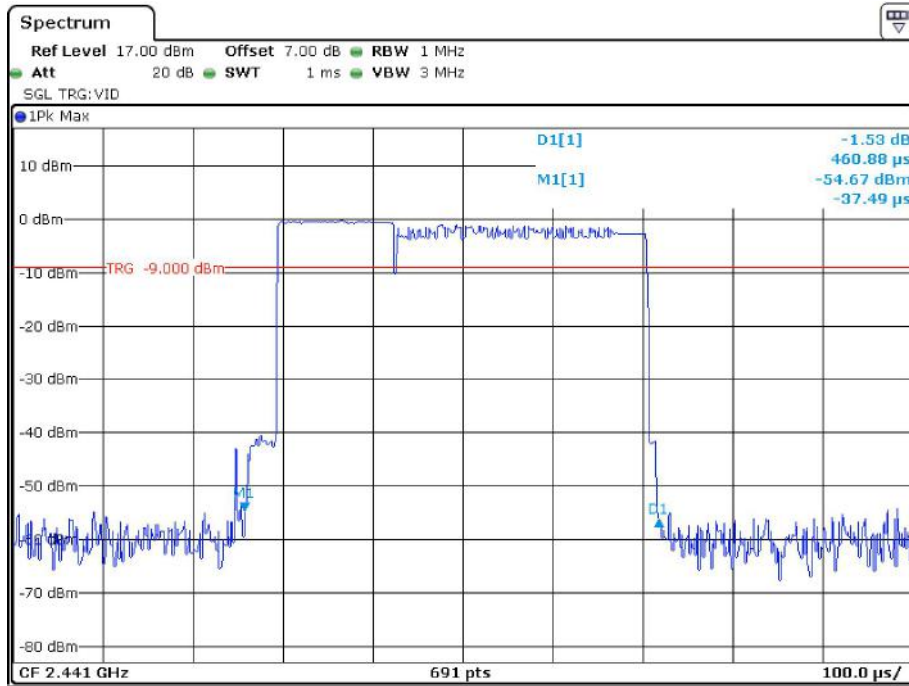

Date: 25.JAN.2022 19:04:58
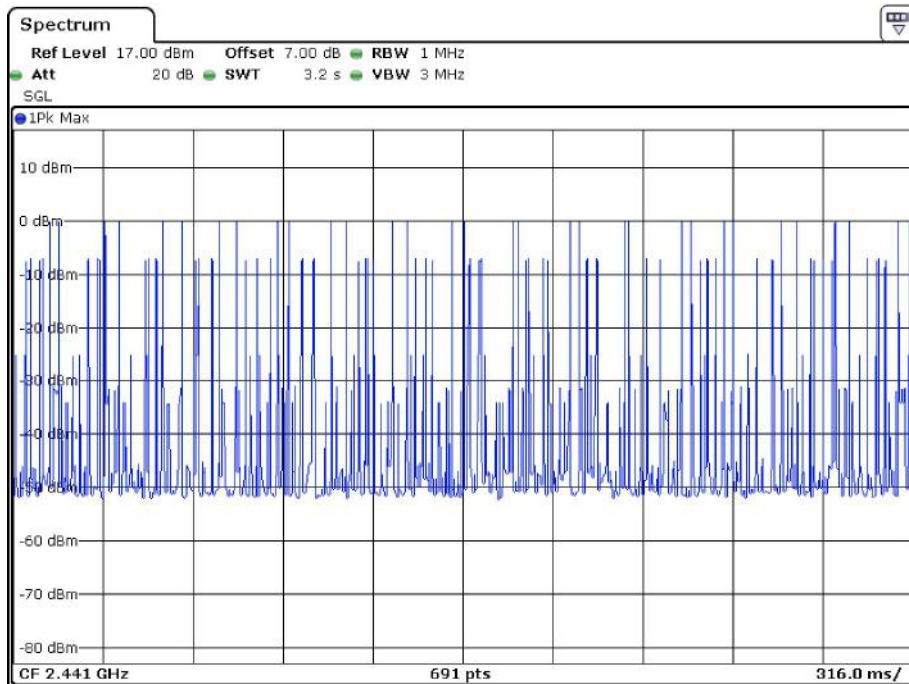
DH5
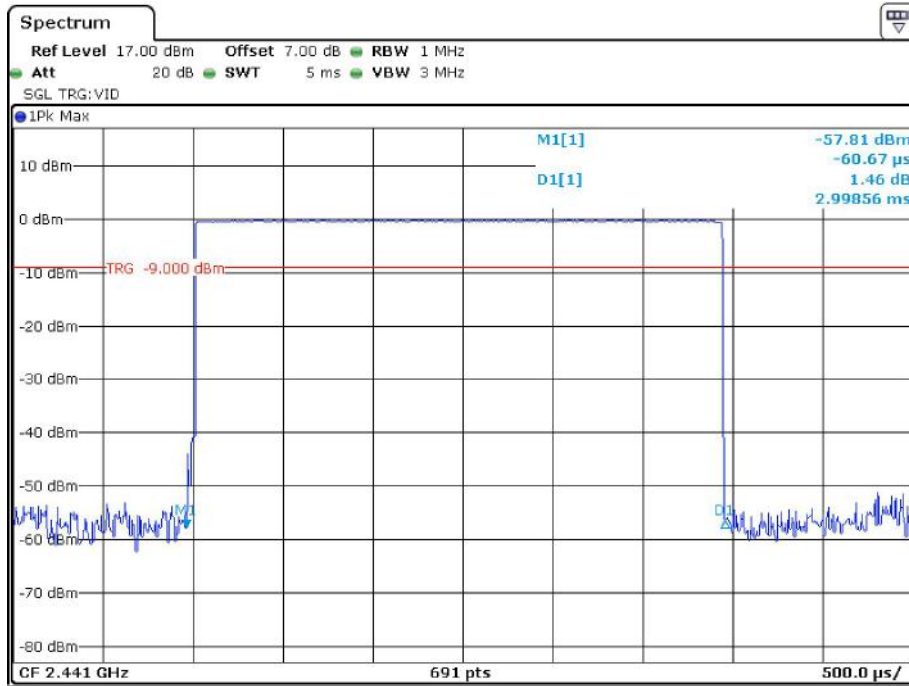
Date: 25.JAN.2022 18:58:55
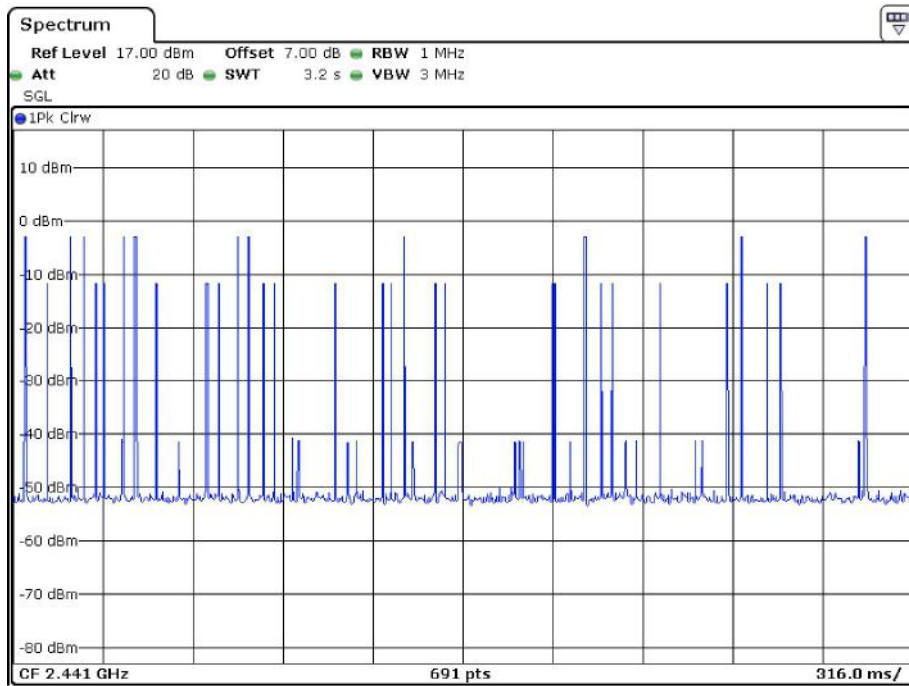
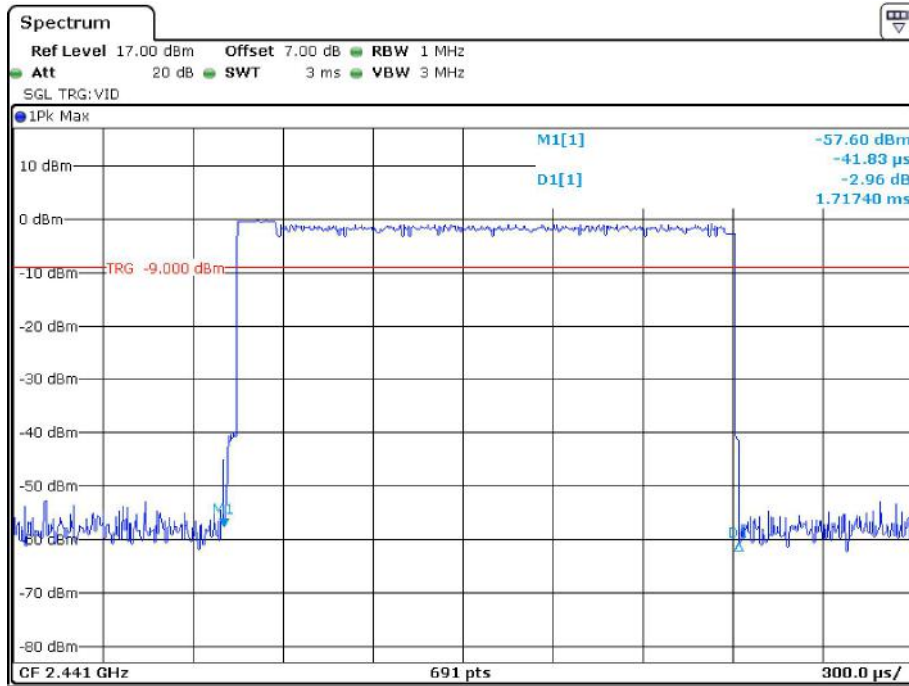Date: 26.JAN.2022 17:39:40

EDR(π/4-DQPSK):
2DH1

Date: 25.JAN.2022 18:54:34
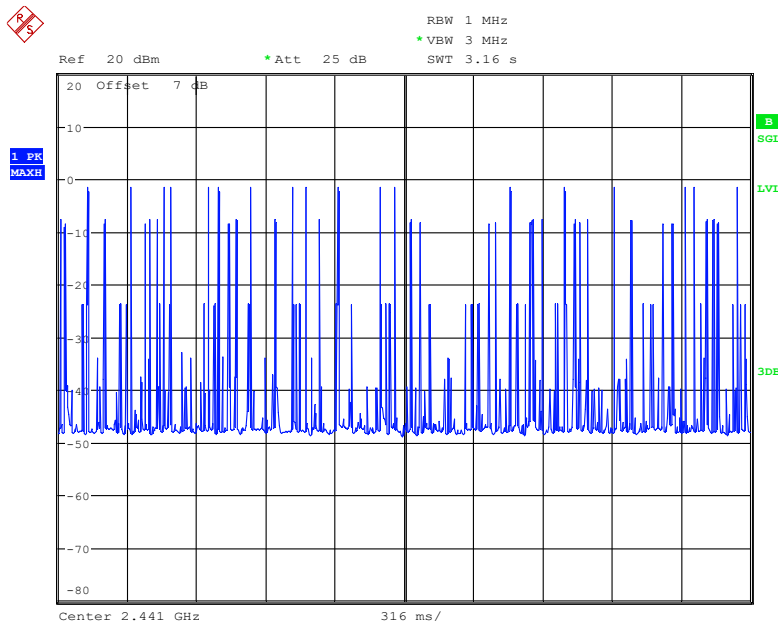

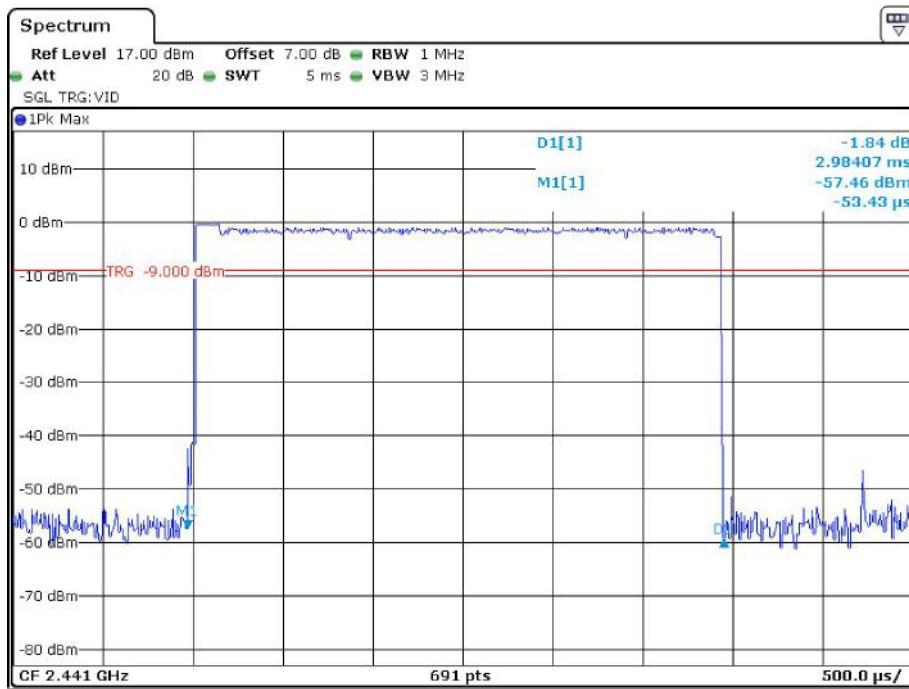Date: 25.JAN.2022 19:03:24
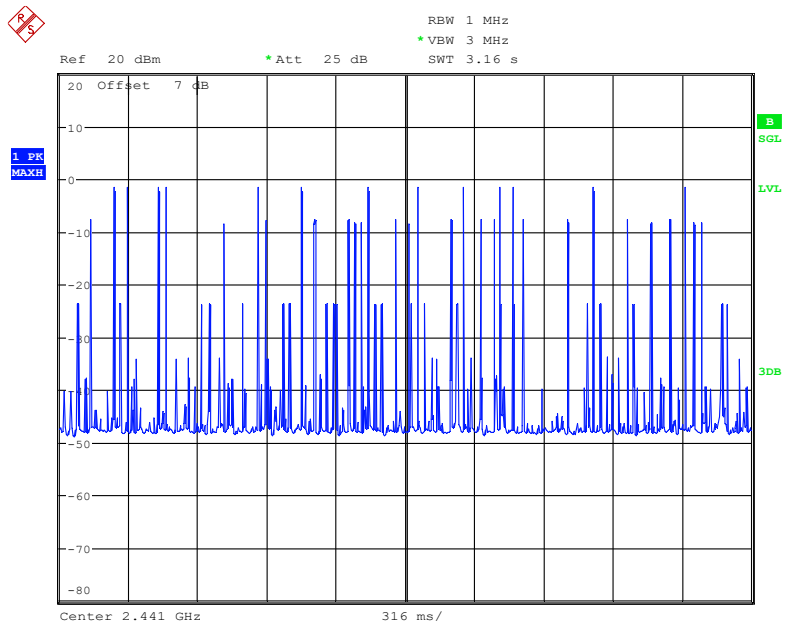
2DH3

Date: 25.JAN.2022 18:55:52

Date: 24.JAN.2022 15:48:07

2DH5

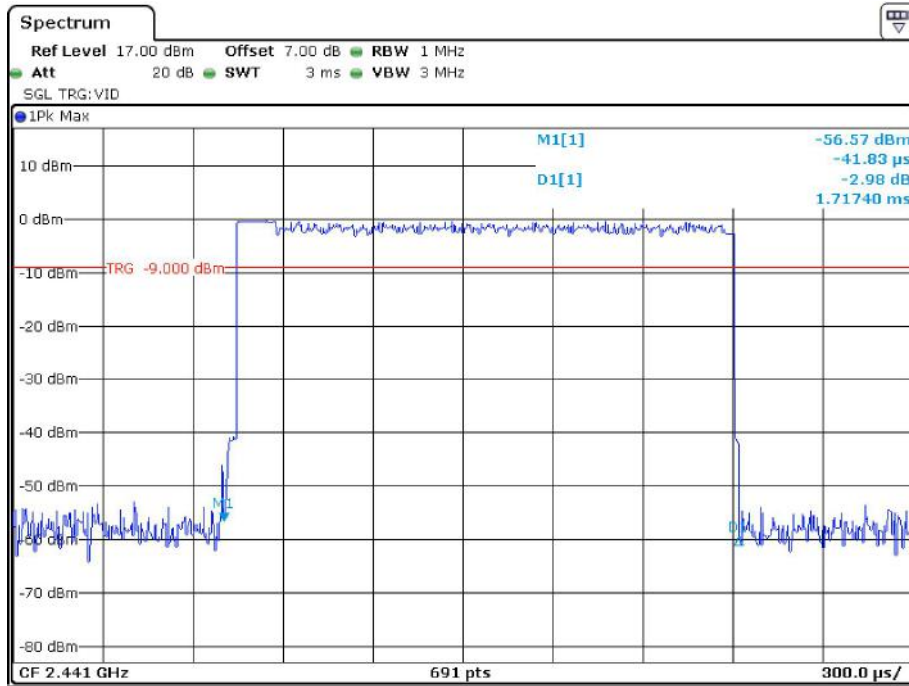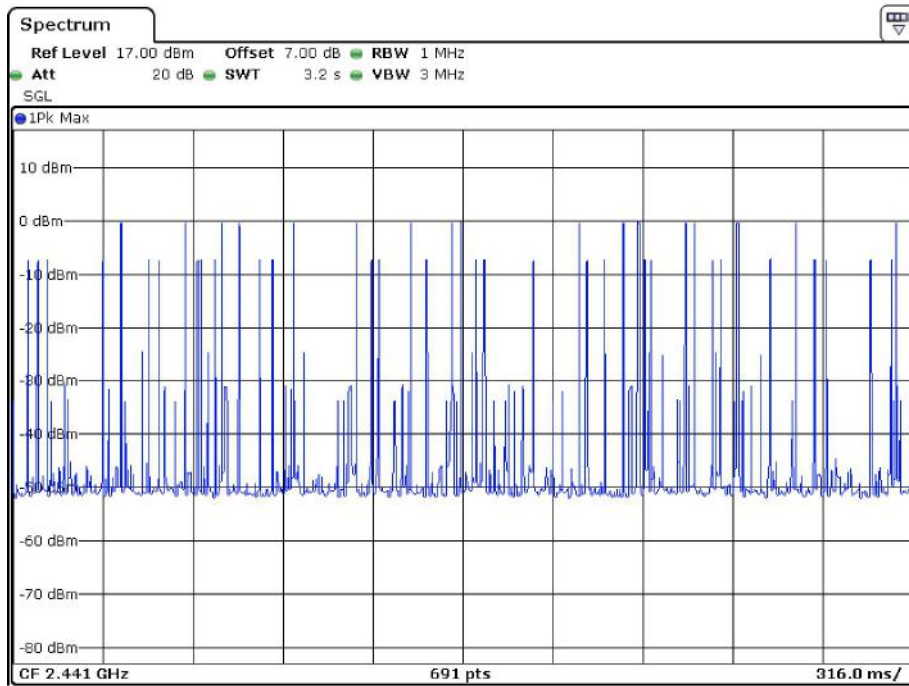
Date: 25.JAN.2022 19:00:20

Date: 24.JAN.2022 15:48:29

EDR (8DPSK):
3DH1

Spectrum

Ref Level 17.00 dBm   Offset 7.00 dB   RBW 1 MHz
Att   20 dB   SWT   1 ms   VBW 3 MHz
SGL TRG:VID
●1Pk Max

D1[1]   -2.77 dB
                                      460.88 μs
M1[1]   -58.01 dBm
                                      -37.49 μs

10 dBm

0 dBm

TRG -9.000 dBm
-10 dBm

-20 dBm

-30 dBm

-40 dBm

-50 dBm

-60 dBm

-70 dBm

-80 dBm
CF 2.441 GHz   691 pts   100.0 μs/

Date: 25.JAN.2022 18:53:42

Spectrum

Ref Level 17.00 dBm   Offset 7.00 dB   RBW 1 MHz
Att   20 dB   SWT   3.2 s   VBW 3 MHz
SGL
●1Pk Max

10 dBm

0 dBm

-10 dBm

-20 dBm

-30 dBm

-40 dBm

-50 dBm

-60 dBm

-70 dBm

-80 dBm
CF 2.441 GHz   691 pts   316.0 ms/

Date: 25.JAN.2022 19:03:02

3DH3

Date: 25.JAN.2022 18:56:31

Date: 25.JAN.2022 19:02:35

3DH5

Spectrum

Ref Level 17.00 dBm   Offset 7.00 dB   RBW 1 MHz
Att   20 dB   SWT   5 ms   VBW 3 MHz
SGL TRG:VID
1Pk Max

M1[1]   -57.98 dBm
                         -53.43 μs
D1[1]   -1.36 dB
                         2.99131 ms

10 dBm

0 dBm

TRG -9.000 dBm
-10 dBm

-20 dBm

-30 dBm

-40 dBm

-50 dBm

-60 dBm

-70 dBm

-80 dBm

CF 2.441 GHz   691 pts   500.0 μs/

Date: 25.JAN.2022 19:01:02

RBW 1 MHz
*VBW 3 MHz
Ref 20 dBm   *Att 25 dB   SWT 3.16 s

20 Offset 7 dB

B
SGL

1 PK
MAXH

LVL

3DB

Center 2.441 GHz   316 ms/
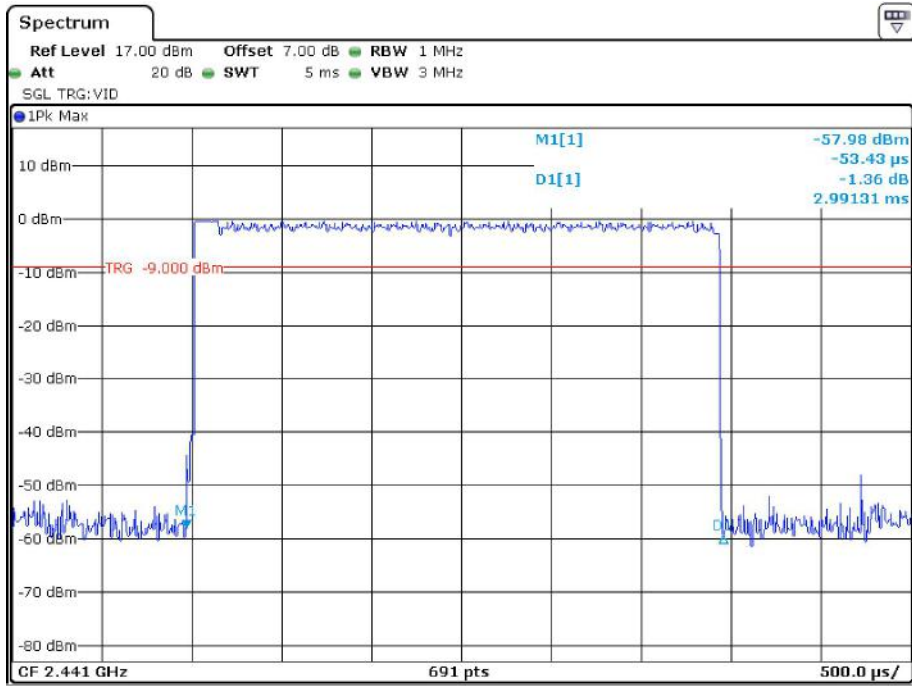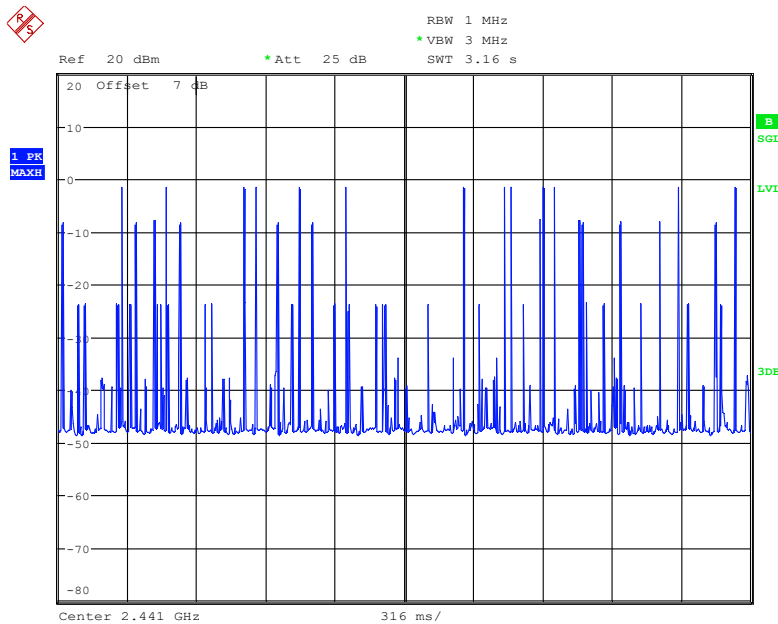
Date: 24.JAN.2022 15:49:37

FCC §15.247(b) (1) & RSS-247§ 5.1(b) &§ 5.4(b) - PEAK OUTPUT POWER MEASUREMENT

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. And for all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

According to RSS-247§ 5.1(b) &§ 5.4(b):

For frequency hopping systems (FHSs) operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channels. The e.i.r.p. shall not exceed 4 W (see Section 5.4(e) for exceptions).

Frequency hopping systems (FHSs) 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, FHSs operating in the band 2400-2483.5 MHz 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 that the systems operate with an output power no greater than 0.125 W.

Test Procedure

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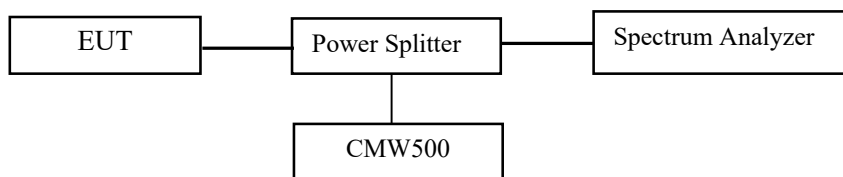
Test Data

Environmental Conditions

Temperature:	26.3 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Black Ding on 2022-01-25.

EUT operation mode: Transmitting

**Test Result: Pass**

Please refer to following table and plots.

Mode	Channel	Frequency (MHz)	Peak Output Power (dBm)	Limit (dBm)
BDR (GFSK)	Low	2402	0.51	21
	Middle	2441	-0.18	21
	High	2480	-0.29	21
EDR (π/4-DQPSK)	Low	2402	0.45	21
	Middle	2441	-0.28	21
	High	2480	-0.33	21
EDR (8DPSK)	Low	2402	0.50	21
	Middle	2441	-0.22	21
	High	2480	-0.35	21

Note 1: The data above was tested in conducted mode.
Note 2: The maximum EIRP is 0.51dBm+3.0dBi=3.51dBm<36dBm, so it can meet the EIRP limit of ISEDC.
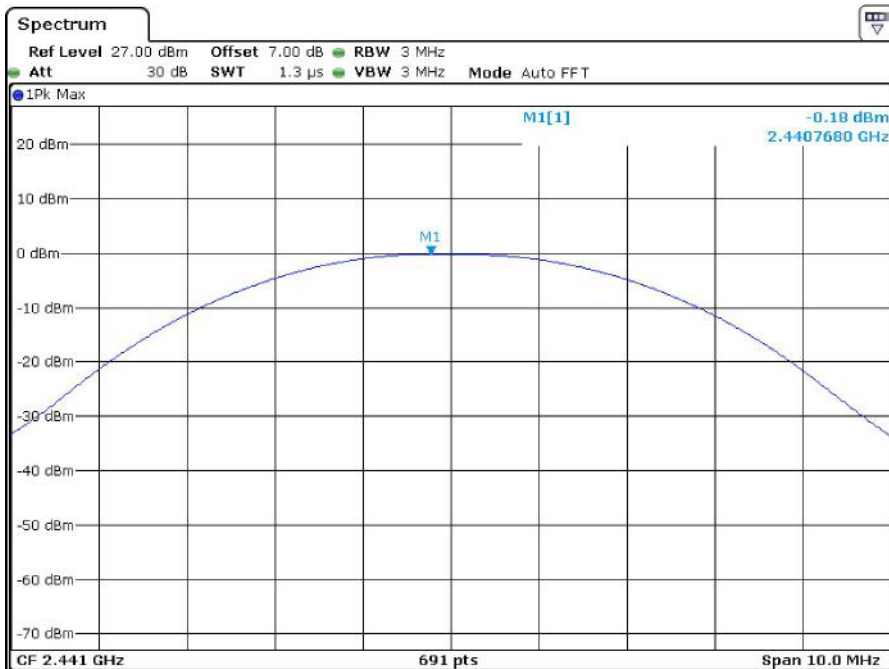
BDR (GFSK):
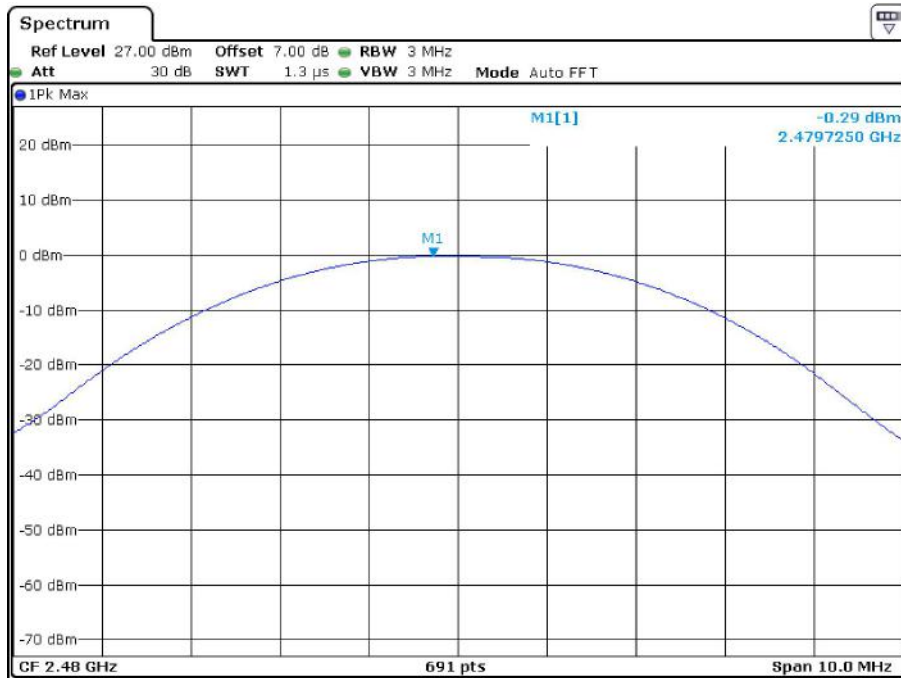
Low Channel
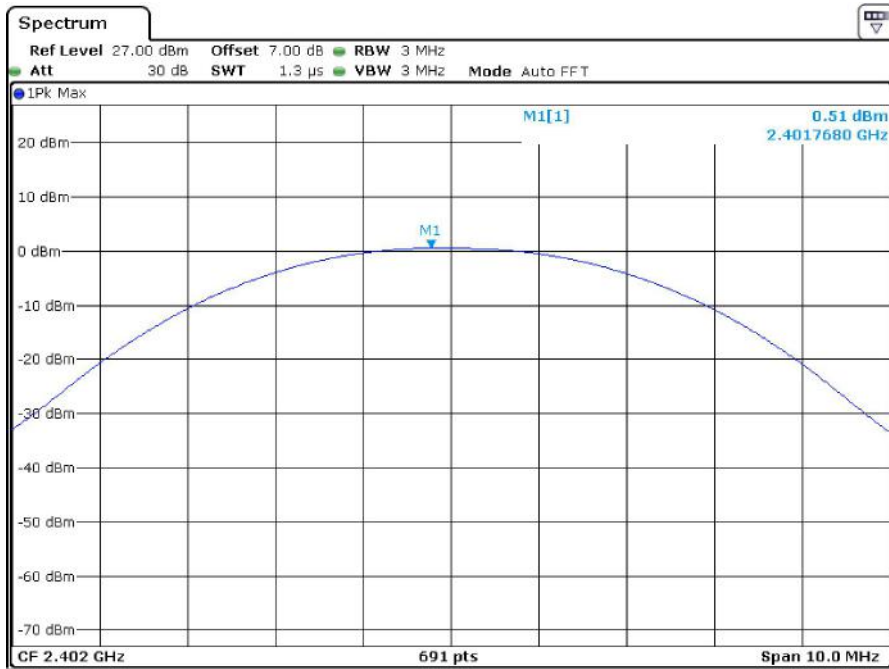
Date: 25.JAN.2022 18:27:59

Middle Channel

Date: 25.JAN.2022 18:27:40

High Channel

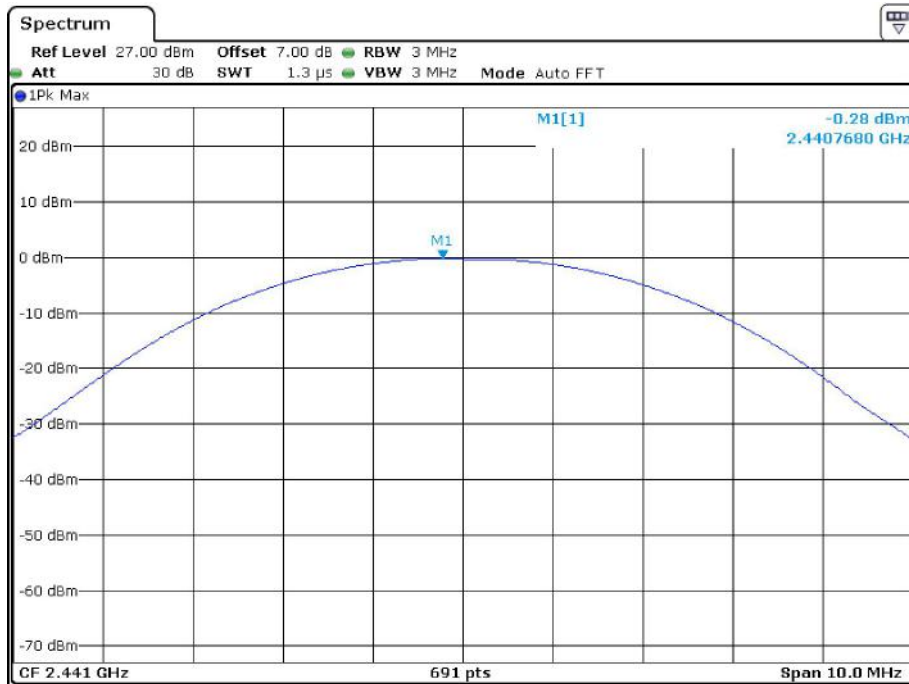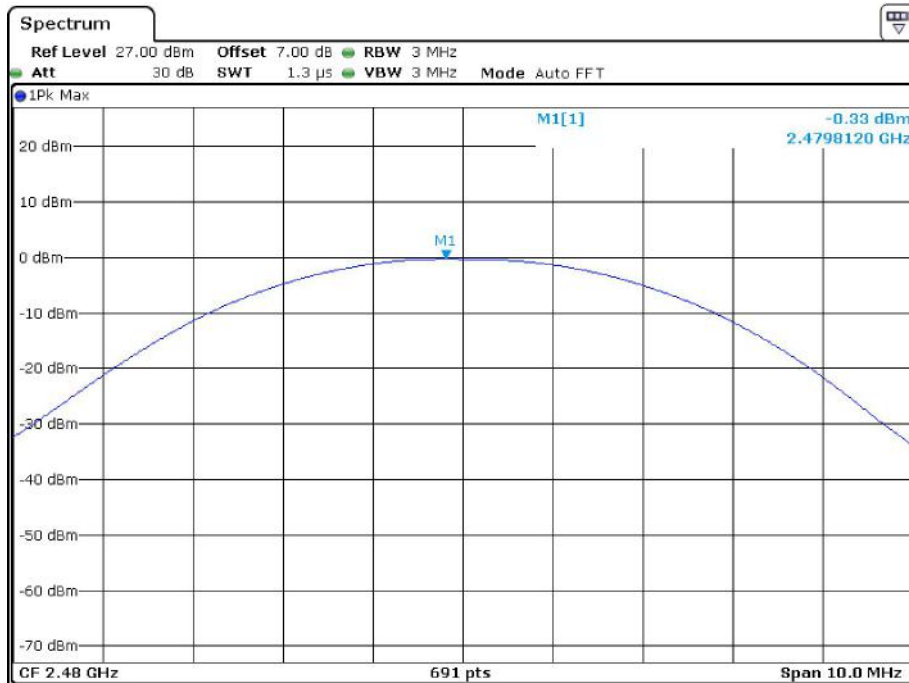Date: 25.JAN.2022 18:28:40

EDR (π/4-DQPSK):

Low Channel
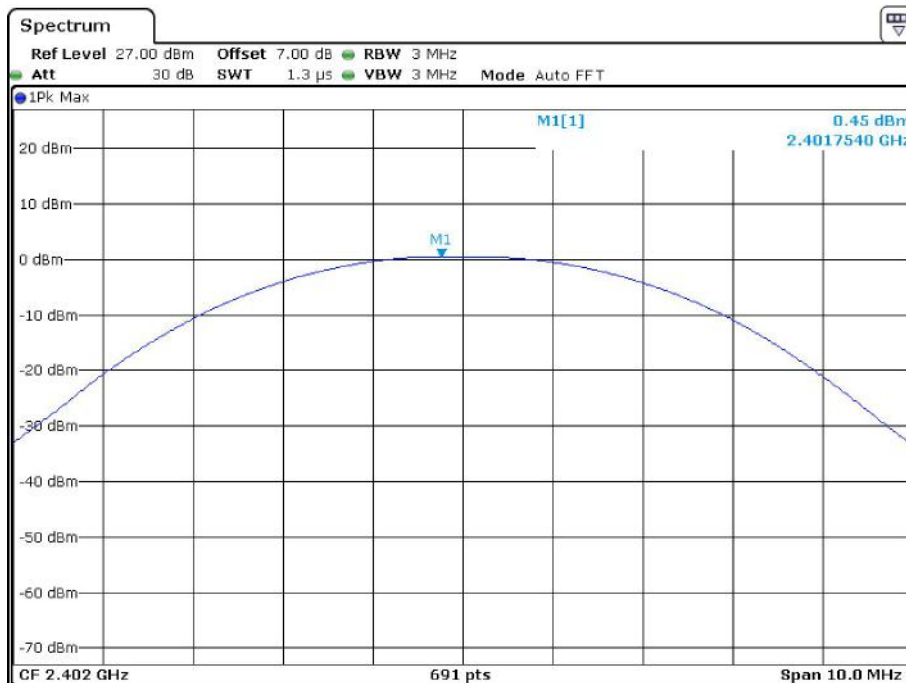
Date: 25.JAN.2022 18:29:57

Middle Channel

```
Spectrum

  Ref Level  27.00 dBm   Offset  7.00 dB  ● RBW  3 MHz
● Att         30 dB      SWT    1.3 µs  ● VBW  3 MHz    Mode Auto FFT
●1Pk Max
                                        M1[1]                      -0.28 dBm
 20 dBm                                                         2.4407680 GHz

 10 dBm

  0 dBm                              M1
                                      ▼
-10 dBm

-20 dBm

-30 dBm

-40 dBm

-50 dBm

-60 dBm

-70 dBm
CF 2.441 GHz                     691 pts                    Span 10.0 MHz
```

Date: 25.JAN.2022   18:30:20

High Channel

```
Spectrum

  Ref Level  27.00 dBm   Offset  7.00 dB  ● RBW  3 MHz
● Att         30 dB      SWT    1.3 µs  ● VBW  3 MHz    Mode Auto FFT
●1Pk Max
                                        M1[1]                      -0.33 dBm
 20 dBm                                                         2.4798120 GHz

 10 dBm

  0 dBm                              M1
                                      ▼
-10 dBm

-20 dBm

-30 dBm

-40 dBm

-50 dBm

-60 dBm

-70 dBm
CF 2.48 GHz                      691 pts                    Span 10.0 MHz
```
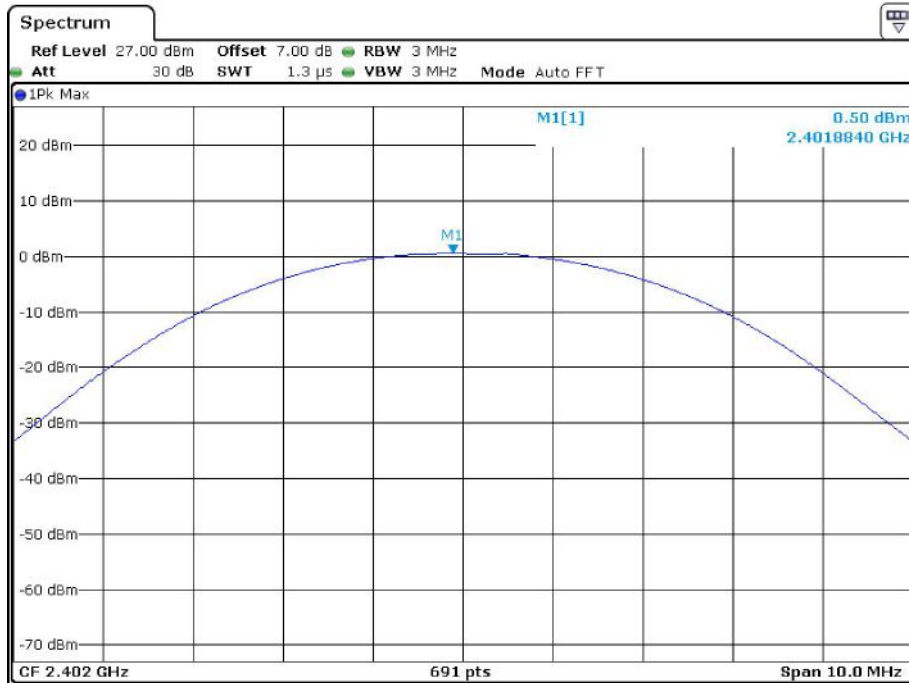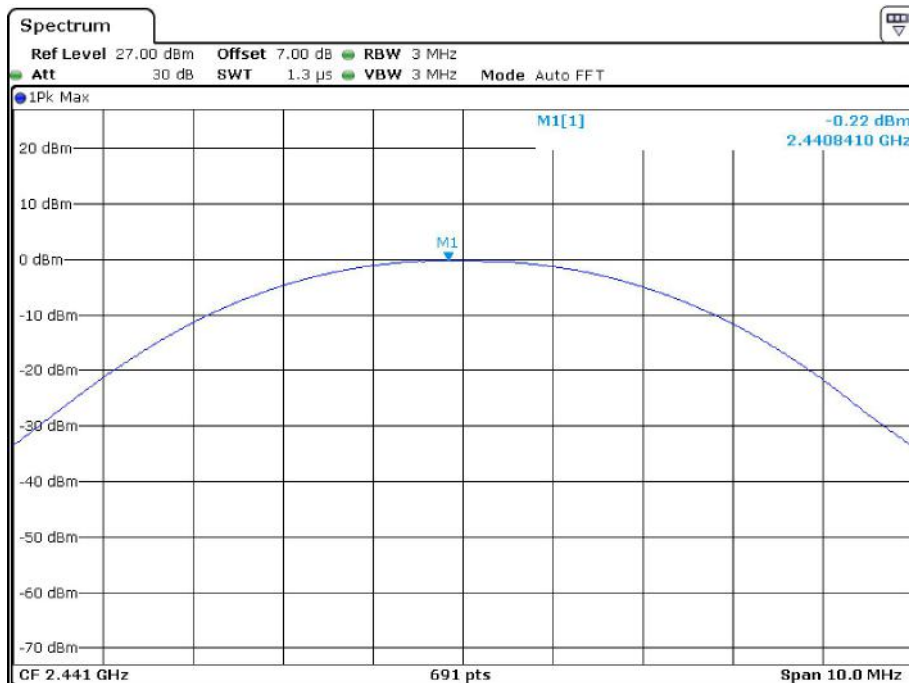
Date: 25.JAN.2022   18:29:33
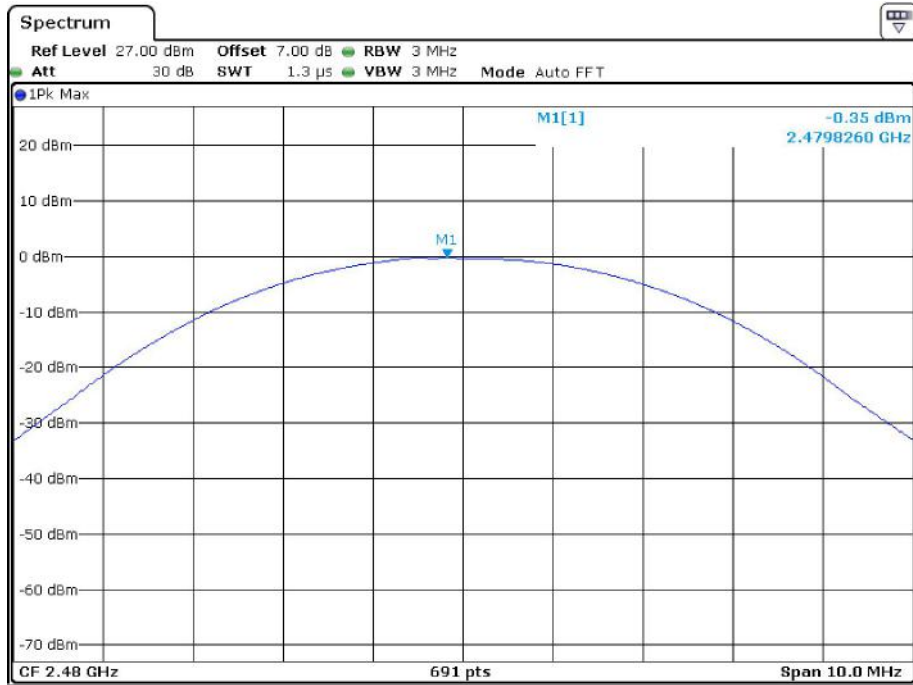
EDR (8DPSK):

Low Channel

Date: 25.JAN.2022 18:31:47

middle Channel

Date: 25.JAN.2022 18:30:52

High Channel

Date: 25.JAN.2022 18:32:06

FCC §15.247(d) & RSS-247 § 5.5 - BAND EDGES TESTING

### Applicable Standard

According to 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)).

According to RSS-247 § 5.5.

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(e), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

Test Procedure

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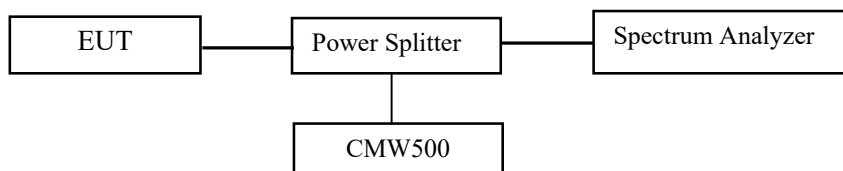
Test Data

Environmental Conditions

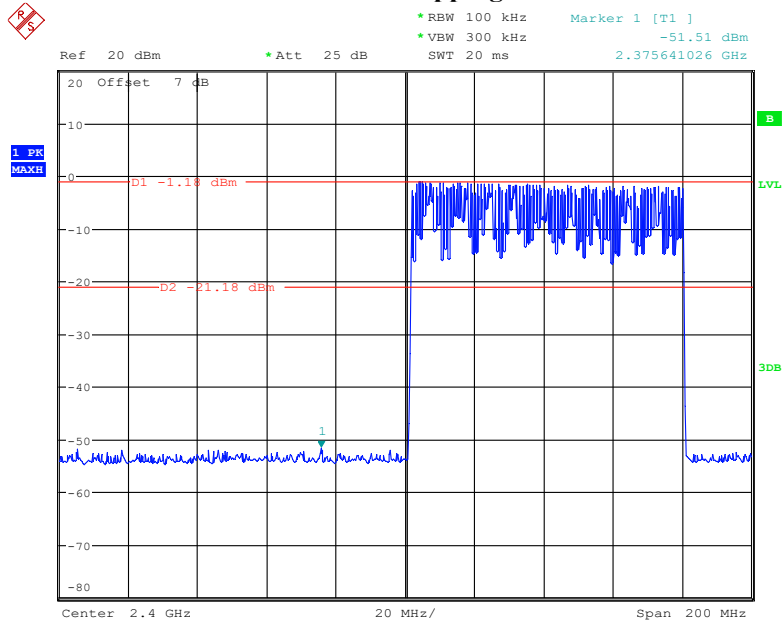|	
Temperature:	26.3 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Black Ding on 2022-01-24.
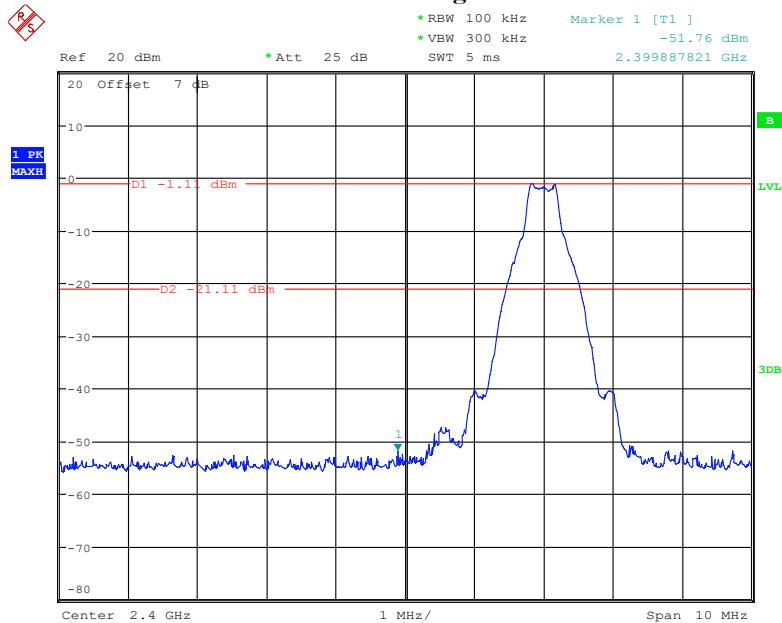
EUT operation mode: Transmitting

Test Result: Pass

Please refer to following table and plots
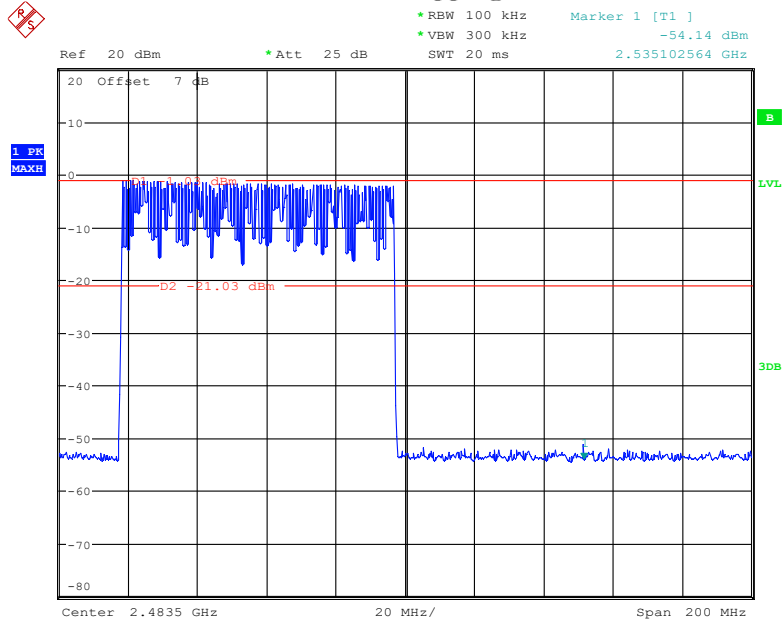
BDR (GFSK): Band Edge-Left Side
Hopping

```
                                    *RBW  100 kHz      Marker 1 [T1 ]
                                    *VBW  300 kHz               -51.51 dBm
        Ref   20 dBm      *Att  25 dB   SWT 20 ms         2.375641026 GHz
```



```
Center  2.4 GHz              20 MHz/                    Span  200 MHz
```

Date: 24.JAN.2022 15:23:04

Single

```
                                    *RBW  100 kHz      Marker 1 [T1 ]
                                    *VBW  300 kHz               -51.76 dBm
        Ref   20 dBm      *Att  25 dB   SWT 5 ms          2.399887821 GHz
```



```
Center  2.4 GHz               1 MHz/                    Span  10 MHz
```
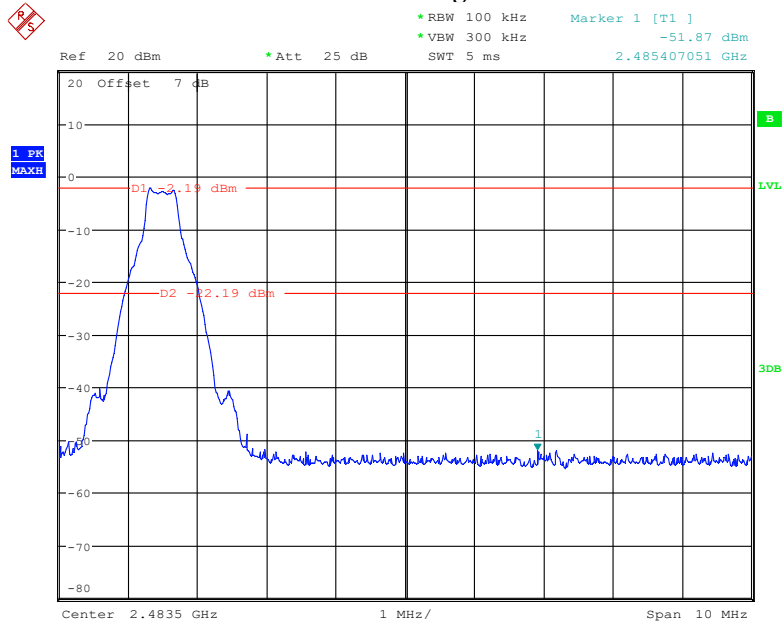
Date: 24.JAN.2022 15:19:07

BDR (GFSK): Band Edge-Right Side
Hopping

Date: 24.JAN.2022 15:21:38

Single

Date: 24.JAN.2022 15:19:59
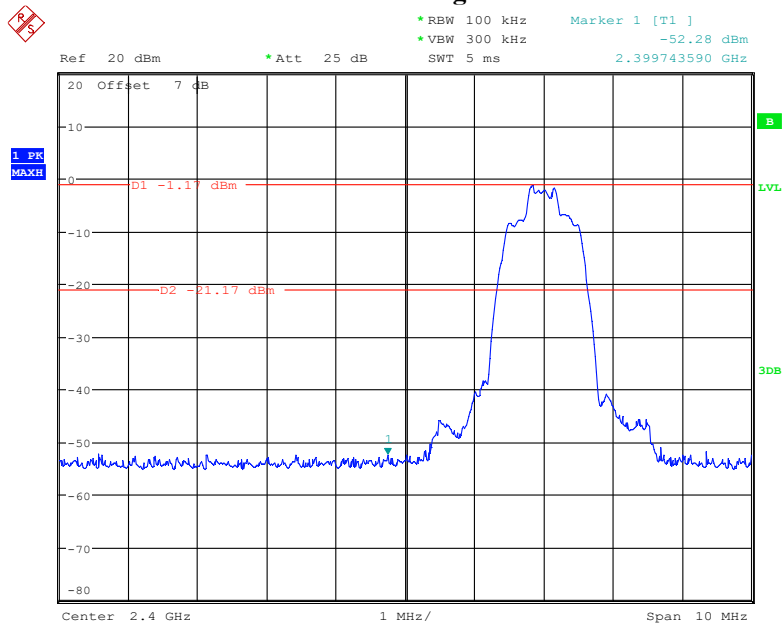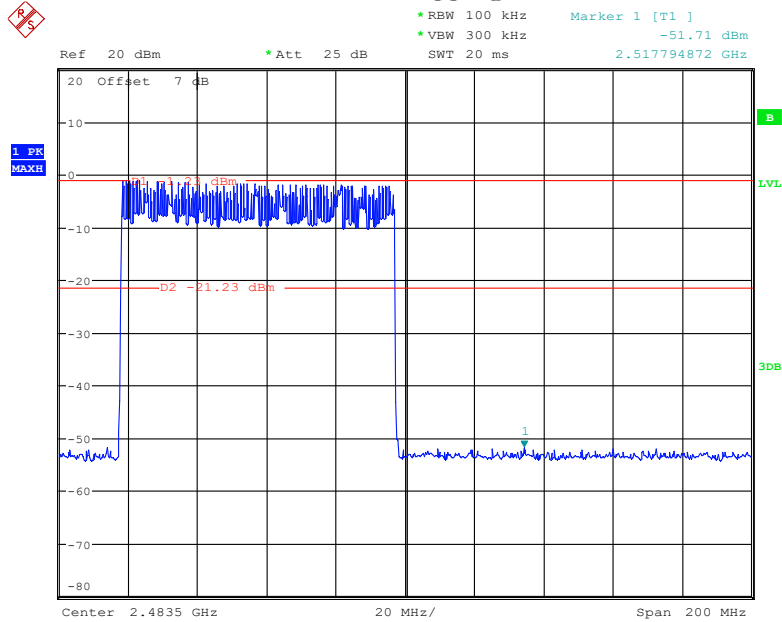
EDR (π/4-DQPSK): Band Edge-Left Side
Hopping

```
                              * RBW  100 kHz      Marker 1 [T1 ]
                              * VBW  300 kHz              -52.06 dBm
    Ref  20 dBm    * Att  25 dB    SWT  20 ms      2.398397436 GHz
```



```
Center  2.4 GHz            20 MHz/              Span  200 MHz
```
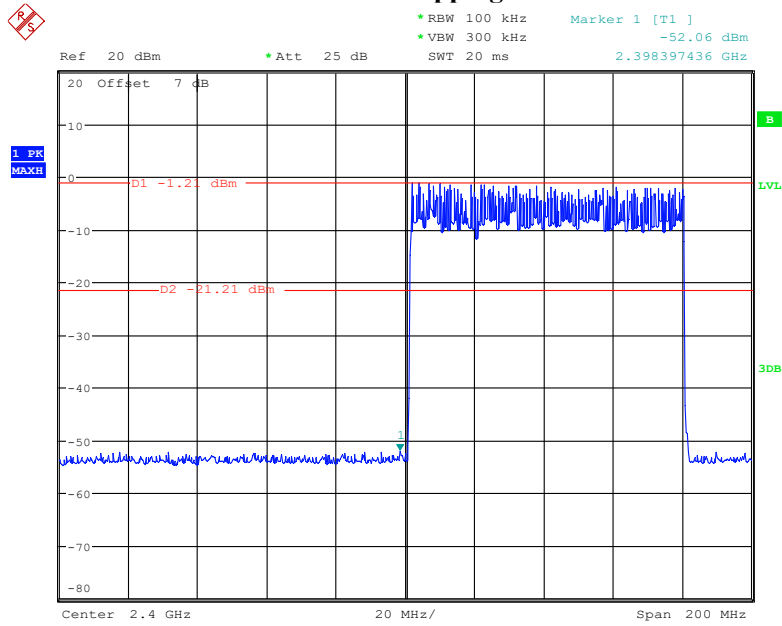
Date: 24.JAN.2022 15:24:27

Single

```
                              * RBW  100 kHz      Marker 1 [T1 ]
                              * VBW  300 kHz              -52.28 dBm
    Ref  20 dBm    * Att  25 dB    SWT  5 ms       2.399743590 GHz
```



```
Center  2.4 GHz            1 MHz/               Span  10 MHz
```
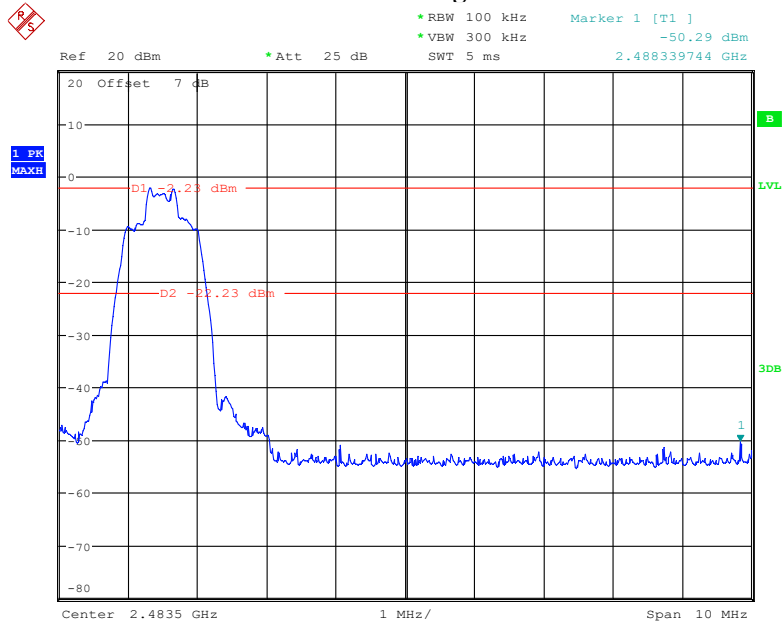
Date: 24.JAN.2022 15:18:32

EDR (π/4-DQPSK): Band Edge-Right Side
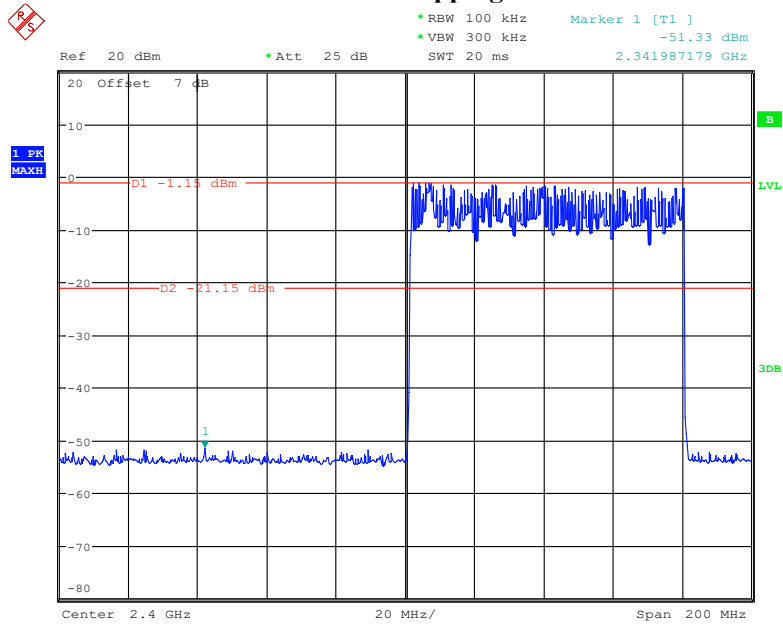### Hopping

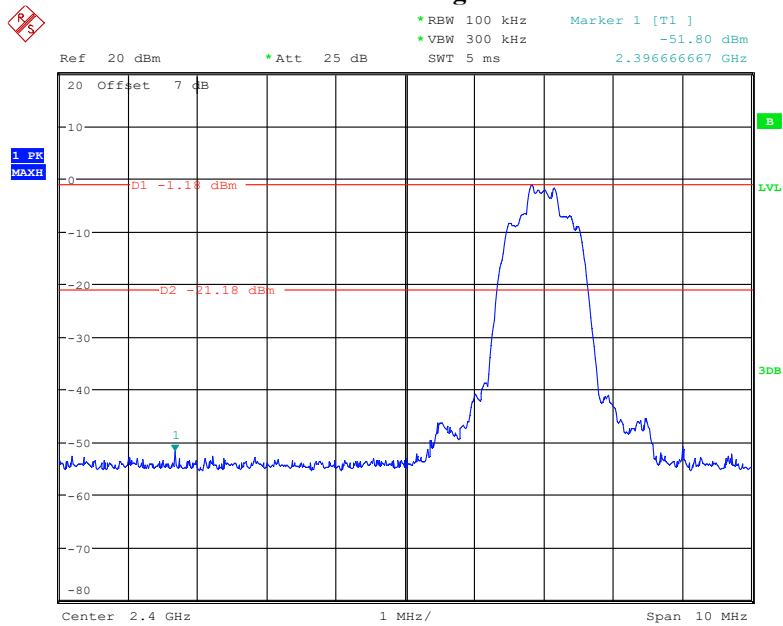Date: 24.JAN.2022 15:26:25

Single

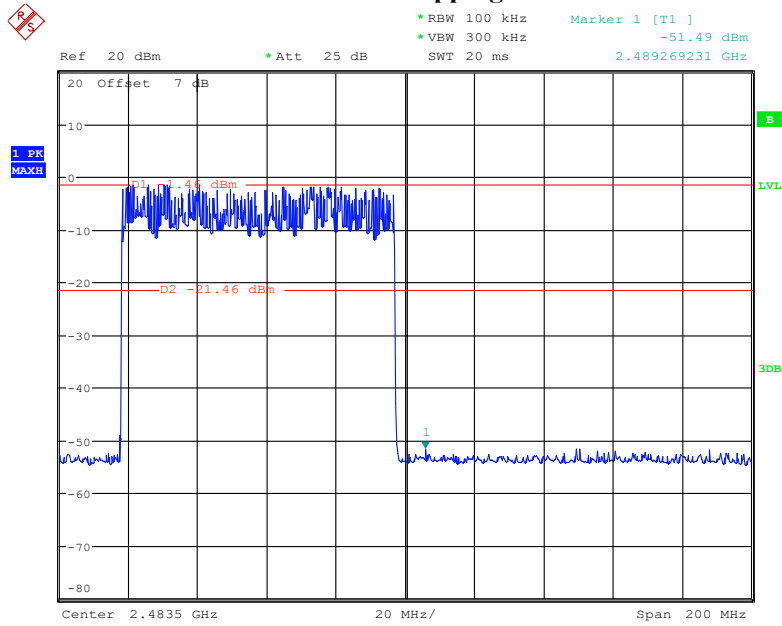Date: 24.JAN.2022 15:17:30

EDR (8DPSK): Band Edge-Left Side
Hopping

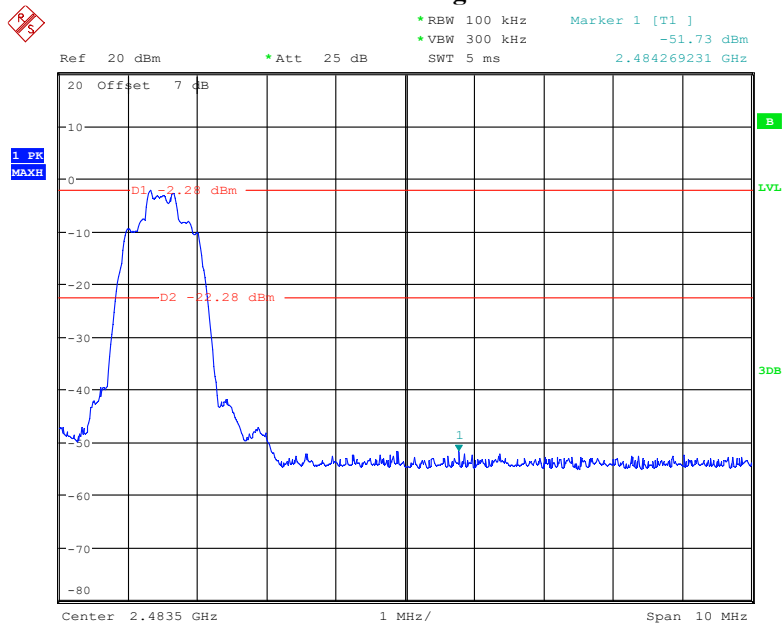Date: 24.JAN.2022 15:29:26

Single

Date: 24.JAN.2022 15:15:45

EDR (8DPSK): Band Edge-Right Side
Hopping

```
                              * RBW  100 kHz    Marker 1 [T1 ]
                              * VBW  300 kHz            -51.49 dBm
   Ref  20 dBm     * Att  25 dB   SWT  20 ms     2.489269231 GHz
```

Center 2.4835 GHz   20 MHz/   Span 200 MHz

Date: 24.JAN.2022 15:27:42

Single

```
                              * RBW  100 kHz    Marker 1 [T1 ]
                              * VBW  300 kHz            -51.73 dBm
   Ref  20 dBm     * Att  25 dB   SWT  5 ms      2.484269231 GHz
```

Center 2.4835 GHz   1 MHz/   Span 10 MHz

Date: 24.JAN.2022 15:16:40

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