TEST REPORT

Applicant Name :	Shenzhen Intellirocks Tech. Co., Ltd.
Address :	No.2901-2904, 3002, Block C, Section 1, Chuangzhi, Yuncheng Building, Liuxian Avenue,Xili Community, Xili Street, Nanshan District, Shenzhen, Guangdong, China
Report Number :	SZNS220711-31250E-RFA
FCC ID:	2AQA6-H6057
IC:	25450-H6057

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:	Govee Night Light
Model No.:	H6057
Multiple Model(s) No.:	N/A
Trade Mark:	Govee
Date Received:	2022/07/11
Report Date:	2022/09/08

Test Result:	Pass*

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

Prepared and Checked By:

Roger Ling
EMC Engineer

Approved By:

Candy Li
EMC Engineer

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

HVIN	H6057
FVIN	1.00.15
Frequency Range	Bluetooth: 2402~2480MHz
Transmit Peak Power	-0.42dBm
Modulation Technique	Bluetooth: GFSK, π/4-DQPSK, 8DPSK
Antenna Specification*	2.0dBi
Voltage Range	DC 3.7V from battery or DC 5V from adapter
Sample serial number	SZNS220711-31250E-RF-S1 for Conducted and Radiated Emissions SZNS220711-31250E-RF-S2 for RF Conducted Test (Assigned by ATC)
Sample/EUT Status	Good condition
Adapter Information	Model: BI12T-050200-BdUU Input: AC 100-240V,50/60Hz,0.5A Output: DC 5V,2A

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
Audio Frequency Response		0.1dB
Low Pass Filter Response		1.2dB
Modulation Limiting		1%
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

"FCC_CE_Tools_fr5080_config_1207.exe"* exercise software was made to the EUT tested and the power level is 16 *. 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

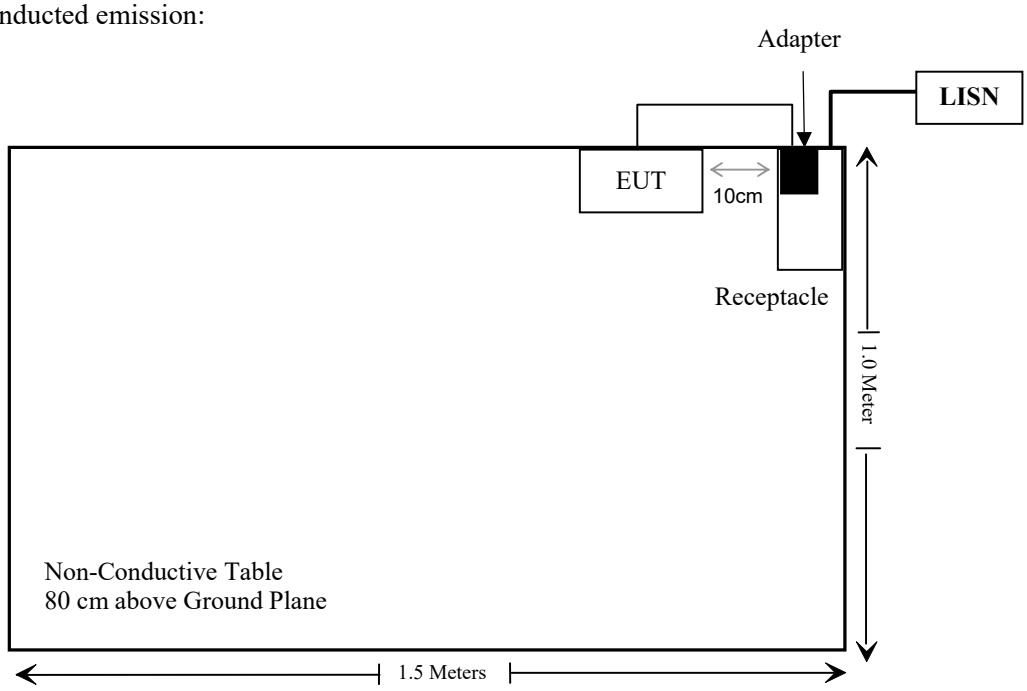
Manufacturer	Description	Model	Serial Number	Specification
/	/	/	/	/

External I/O Cable

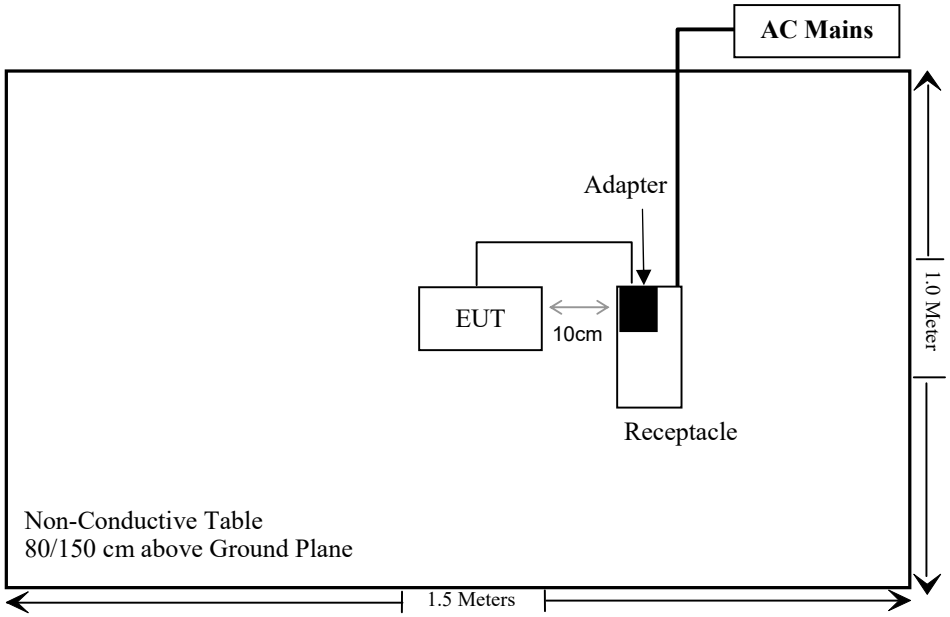
Cable Description	Length (m)	From Port	To
Un-shielding Detachable USB Cable	1.0	EUT	Adapter

Block Diagram of Test Setup

For conducted emission:



For Radiated Emissions:



SUMMARY OF TEST RESULTS

Rules	Description of Test	Result
FCC §15.247 (i) & §2.1091	Maximum Permissible Exposure (MPE)	Compliant
RSS-102 § 4	RF Exposure Limit	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

Note: the device have two kinds of lamp, the main board(include the RF circuit) of the two lamps is electrical identical, only the LED difference, the test item “AC Line Conducted Emissions” and “radiated emission for below 1GHz” was test on the two lamps, other item only test on lamp 1.

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	WHKX3.6/18G-10SS	5	2021/12/14	2022/12/13

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
SPECTRUM ANALYZER	Rohde & Schwarz	FSU26	200982	2022/07/06	2023/07/05
Unknown	3dB Attenuator	Unknown	06151	2021/12/14	2022/12/13
Unknown	RF Cable	Unknown	2	Each time	/

*** 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) (3) & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 15.247 (i) and subpart 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

According to KDB 447498 D04 Interim General RF Exposure Guidance

MPE-Based Exemption:

General frequency and separation-distance dependent MPE-based effective radiated power(ERP) thresholds are in Table B.1 [Table 1 of § 1.1307(b)(1)(i)(C)] to support an exemptionfrom further evaluation from 300 kHz through 100 GHz.

Table 1 to § 1.1307(b)(3)(i)(C) - Single RF Sources Subject to Routine Environmental Evaluation

RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	1,920 R^2.
1.34-30	3,450 R^2/f^2.
30-300	3.83 R^2.
300-1,500	0.0128 R^2f.
1,500-100,000	19.2R^2.

Ris the minimum separation distance in meters
f = frequency in MHz

For multiple RF sources: Multiple RF sources are exempt if:

in the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation:

$$\sum_{i=1}^{a}\frac{P_i}{P_{th,i}}+\sum_{j=1}^{b}\frac{ERP_j}{ERP_{th,j}}+\sum_{k=1}^{c}\frac{Evaluated_k}{Exposure\ Limit_k}\leq 1$$

Result

Mode	Frequency (MHz)	Tune up conducted power	Antenna Gain		ERP		Evaluation Distance (m)	ERP Limit (W)
		(dBm)	(dBi)	(dBd)	(dBm)	(W)		
BT	2402-2480	0	2.0	-0.15	-0.15	0.0010	0.2	0.768
BLE	2402-2480	-4.0	2.0	-0.15	-4.15	0.0004	0.2	0.768
Wi-Fi	2412-2462	21.0	1.0	-1.15	19.85	0.0966	0.2	0.768

Note: 1. The tune up conducted power and antenna gain was declared by the applicant.
2. The BT/BLE can transmit at the same time with the Wi-Fi.

Simultaneous transmitting consideration (worst case):

The ratio=ERP_{BT}/limit+$ERP_{Wi\text{-}Fi}$/limit=0.0010/0.768+0.0966/0.768=0.127＜1.0, so simultaneous exposure is compliant.

To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

Result: Compliant.

RSS-102 § 4 – EXPOSURE LIMITS

Applicable Standard

According to RSS-102 §4:

Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m^2)	Reference Period (minutes)
0.003-10[21]	83	90	-	Instantaneous*
0.1-10	-	0.73/ f	-	6**
1.1-10	87/ $f^{0.5}$	-	-	6**
10-20	27.46	0.0728	2	6
20-48	58.07/ $f^{0.25}$	0.1540/ $f^{0.25}$	8.944/ $f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	3.142 $f^{0.3417}$	0.008335 $f^{0.3417}$	0.02619 $f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ $f^{1.2}$
150000-300000	0.158 $f^{0.5}$	4.21 x 10^{-4} $f^{0.5}$	6.67 x 10^{-5} f	616000/$f^{1.2}$

Note: f is frequency in MHz.
* Based on nerve stimulation (NS).
** Based on specific absorption rate (SAR).

Calculated Formulary:

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

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

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

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

Mode	Frequency (MHz)	Antenna Gain		Turn up Power		Evaluation Distance (m)	Power Density (W/m^2)	MPE Limit (W/m^2)
		(dBi)	(numeric)	(dBm)	(W)			
BT	2402-2480	2.0	1.58	0	0.0010	0.2	0.0031	5.35
BLE	2402-2480	2.0	1.58	-4.0	0.0004	0.2	0.0013	5.35
Wi-Fi	2412-2462	1.0	1.26	21.0	0.1259	0.2	0.3158	5.37

Note: 1. The tune up conducted power and antenna gain was declared by the applicant.
2. The BT/BLE can transmit at the same time with the Wi-Fi.

Simultaneous transmitting consideration (worst case):

The ratio=MPE_{BT}/limit+$MPE_{Wi\text{-}Fi}$/limit=0.0031/5.35+0.3158/5.37=0.059＜1.0, so simultaneous exposure is compliant.

To maintain compliance with the ISEDC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

Result: Compliant.

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 antenna arrangement which was permanently attached and the maximum antenna gain is 2.0dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Antenna Type	Antenna Gain	Impedance	Frequency Range
PCB	2.0dBi	50 Ω	2.4~2.5GHz

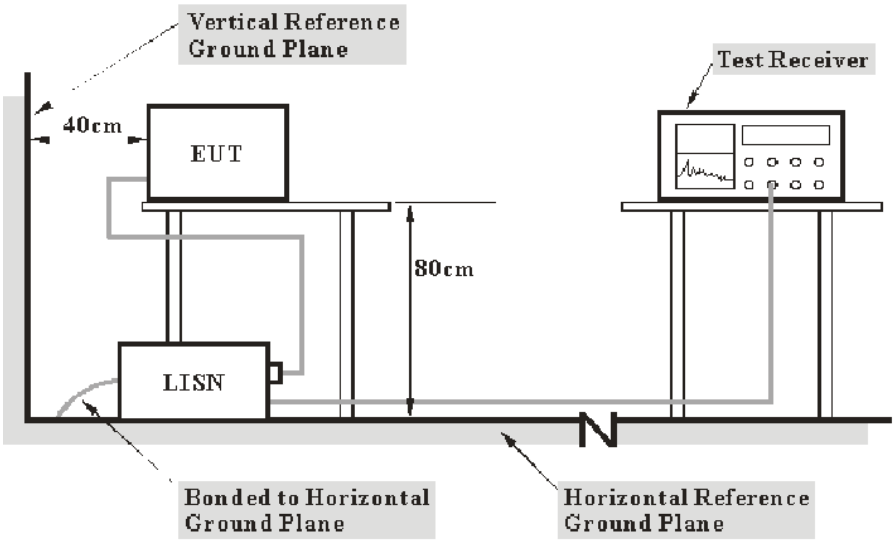
Result: Compliance

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, an Over limit of -7 dB means the emission is 7 dB below the limit. The equation for calculation is as follows:

Over Limit = Level – Limit
Level = Read Level + Factor

Test Data

Environmental Conditions

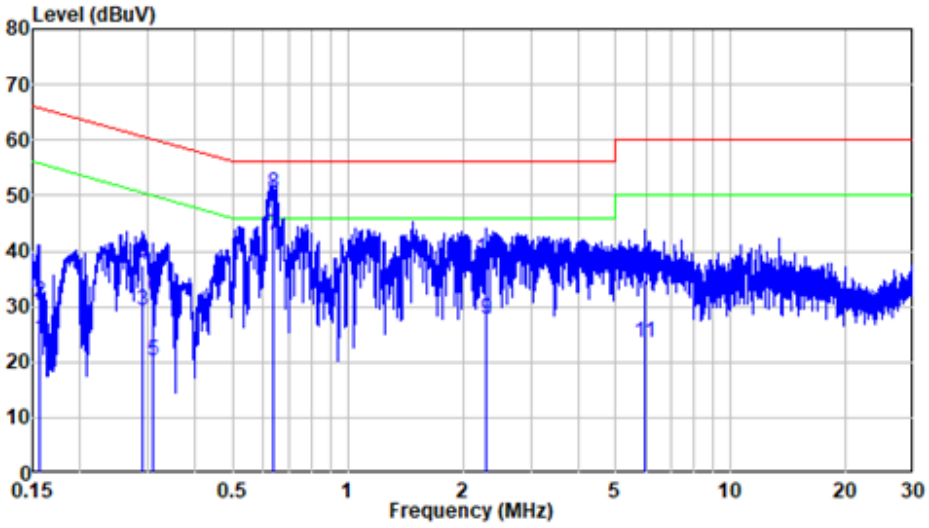
Temperature:	21~25 ℃
Relative Humidity:	41~59 %
ATM Pressure:	101.0 kPa

The testing was performed by Jason from 2022-07-29 to 2022-08-12.

EUT operation mode: Transmitting(worst case is BDR high channel)

Lamp 1:

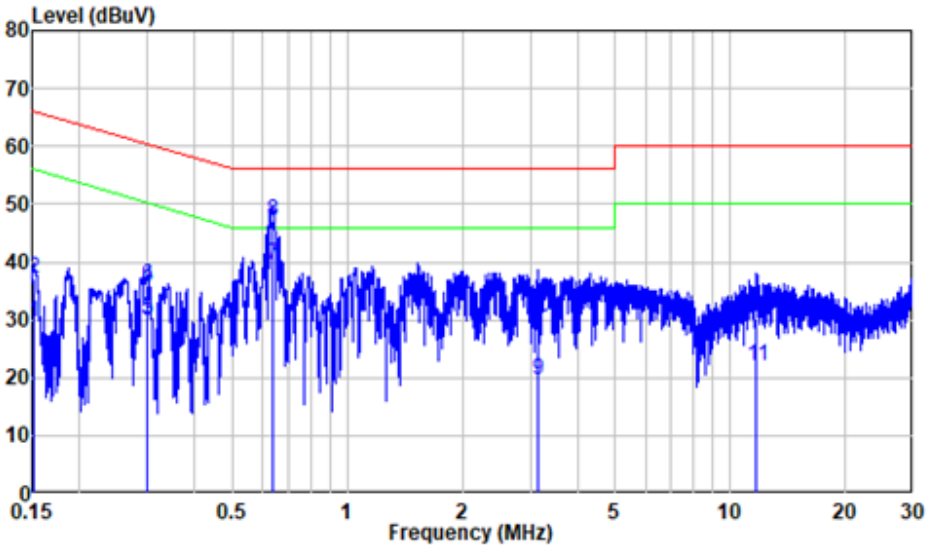
AC 120V/60 Hz, Line



Site : Shielding Room
Condition: Line
Mode : BT
Model : H6057
Power : AC 120V 60Hz

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.156	9.80	14.34	24.14	55.69	-31.55	Average
2	0.156	9.80	21.08	30.88	65.69	-34.81	QP
3	0.292	9.80	19.46	29.26	50.48	-21.22	Average
4	0.292	9.80	27.50	37.30	60.48	-23.18	QP
5	0.309	9.80	10.54	20.34	50.00	-29.66	Average
6	0.309	9.80	21.83	31.63	60.00	-28.37	QP
7	0.637	9.81	33.19	43.00	46.00	-3.00	Average
8	0.637	9.81	40.48	50.29	56.00	-5.71	QP
9	2.301	9.82	18.00	27.82	46.00	-18.18	Average
10	2.301	9.82	28.75	38.57	56.00	-17.43	QP
11	5.957	9.86	13.55	23.41	50.00	-26.59	Average
12	5.957	9.86	24.80	34.66	60.00	-25.34	QP

AC 120V/60 Hz, Neutral

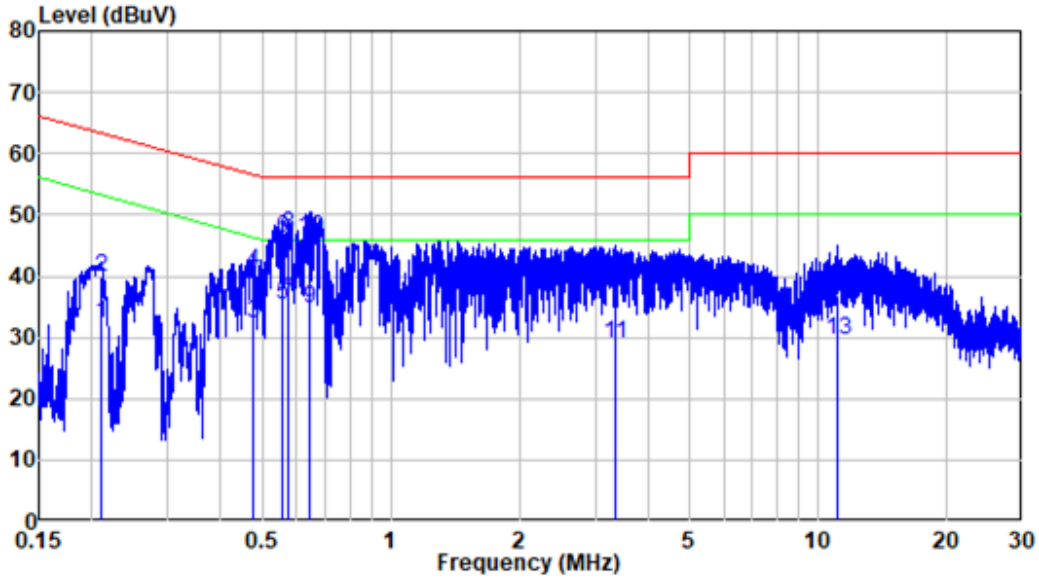


Site : Shielding Room
Condition: Neutral
Mode : BT
Model : H6057
Power : AC 120V 60Hz

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.151	9.80	19.91	29.71	55.94	-26.23	Average
2	0.151	9.80	27.32	37.12	65.94	-28.82	QP
3	0.299	9.80	20.00	29.80	50.26	-20.46	Average
4	0.299	9.80	25.75	35.55	60.26	-24.71	QP
5	0.301	9.80	20.49	30.29	50.22	-19.93	Average
6	0.301	9.80	26.21	36.01	60.22	-24.21	QP
7	0.638	9.81	29.71	39.52	46.00	-6.48	Average
8	0.638	9.81	37.19	47.00	56.00	-9.00	QP
9	3.154	9.83	9.76	19.59	46.00	-26.41	Average
10	3.154	9.83	20.66	30.49	56.00	-25.51	QP
11	11.729	10.02	12.02	22.04	50.00	-27.96	Average
12	11.729	10.02	20.29	30.31	60.00	-29.69	QP

Lamp 2:

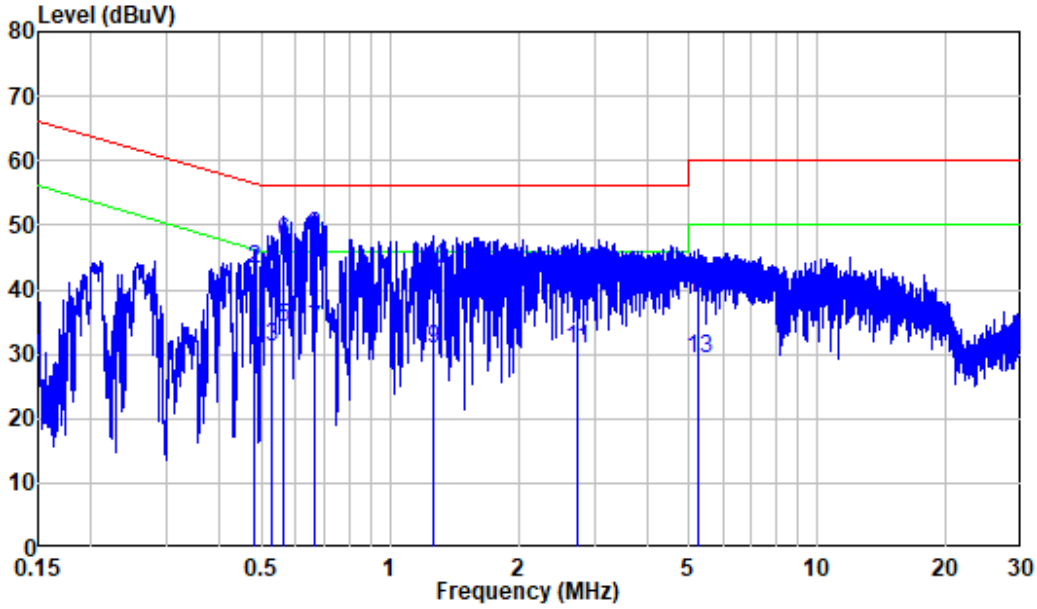
AC 120V/60 Hz, Line



Site : Shielding Room
Condition: Line
Mode : BT
Model : H6057
Power : AC 120V 60Hz

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.210	9.80	22.41	32.21	53.19	-20.98	Average
2	0.210	9.80	30.00	39.80	63.19	-23.39	QP
3	0.475	9.80	22.44	32.24	46.42	-14.18	Average
4	0.475	9.80	30.94	40.74	56.42	-15.68	QP
5	0.556	9.81	25.50	35.31	46.00	-10.69	Average
6	0.556	9.81	36.44	46.25	56.00	-9.75	QP
7	0.575	9.81	26.03	35.84	46.00	-10.16	Average
8	0.575	9.81	36.95	46.76	56.00	-9.24	QP
9	0.647	9.81	24.93	34.74	46.00	-11.26	Average
10	0.647	9.81	36.23	46.04	56.00	-9.96	QP
11	3.332	9.83	19.11	28.94	46.00	-17.06	Average
12	3.332	9.83	28.81	38.64	56.00	-17.36	QP
13	11.102	9.91	19.76	29.67	50.00	-20.33	Average
14	11.102	9.91	26.98	36.89	60.00	-23.11	QP

AC 120V/60 Hz, Neutral



Site : Shielding Room
Condition: Neutral
Mode : BT
Model : H6057
Power : AC 120V 60Hz

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.480	9.80	23.28	33.08	46.34	-13.26	Average
2	0.480	9.80	33.42	43.22	56.34	-13.12	QP
3	0.530	9.81	21.23	31.04	46.00	-14.96	Average
4	0.530	9.81	33.59	43.40	56.00	-12.60	QP
5	0.563	9.81	24.24	34.05	46.00	-11.95	Average
6	0.563	9.81	37.69	47.50	56.00	-8.50	QP
7	0.665	9.81	23.93	33.74	46.00	-12.26	Average
8	0.665	9.81	38.42	48.23	56.00	-7.77	QP
9	1.263	9.81	21.06	30.87	46.00	-15.13	Average
10	1.263	9.81	33.36	43.17	56.00	-12.83	QP
11	2.737	9.83	20.97	30.80	46.00	-15.20	Average
12	2.737	9.83	31.61	41.44	56.00	-14.56	QP
13	5.266	9.90	19.37	29.27	50.00	-20.73	Average
14	5.266	9.90	28.79	38.69	60.00	-21.31	QP

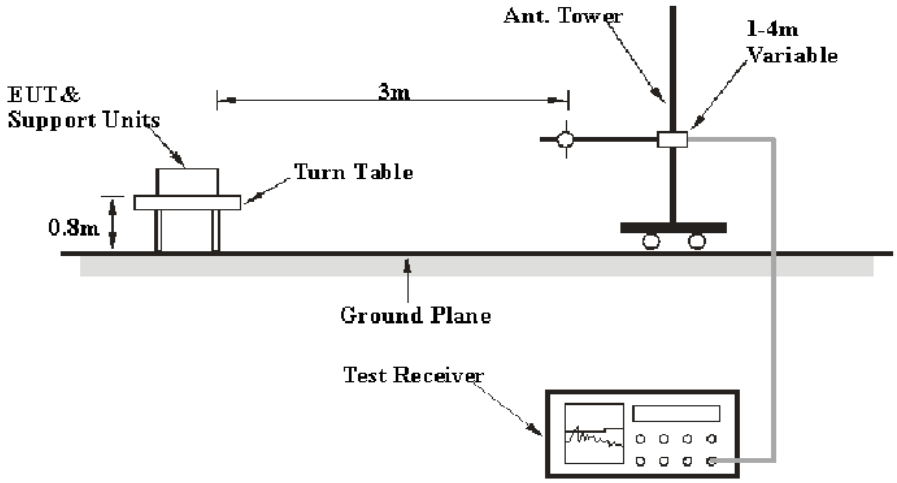
FCC §15.209, §15.205 & §15.247(d) & RSS-247§ 5.5 - Spurious Emissions

Applicable Standard

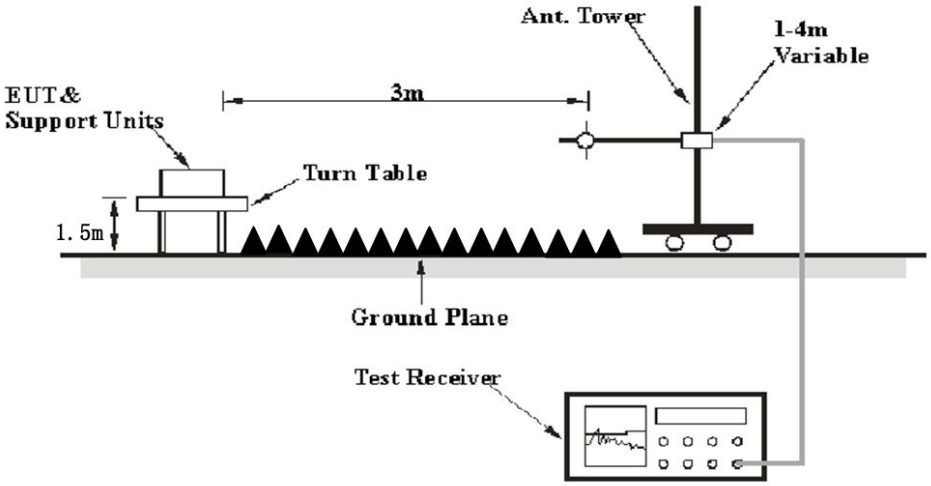
FCC §15.205; §15.209; §15.247(d); RSS-247§ 5.5; RSS-GEN § 8.10

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

For average measurement:

use the duty cycle factor correction factor method per 15.35(c).
Duty cycle=On time/100milliseconds, On time=N1*L1+N2*L2+…Nn-1*Ln-1+Nn*Ln,
where N1 is number of type 1 pulses, L1 is length of type 1 pulse, etc.
Average Emission Level=Peak Emission Level+20*log(Duty cycle)

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.

Corrected Factor & Margin Calculation

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

Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain

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

Margin/Over Limit = Corrected Amplitude/Level-Limit
Corrected Amplitude/Level = Reading + Corrected Factor

Test Data

Environmental Conditions

Temperature:	25~25.6 ℃
Relative Humidity:	59~62 %
ATM Pressure:	101.0 kPa

The testing was performed by Level from 2022-07-29 to 2022-08-12 for below 1GHz,Jeff Jiang on 2022-07-26 for above 1GHz

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

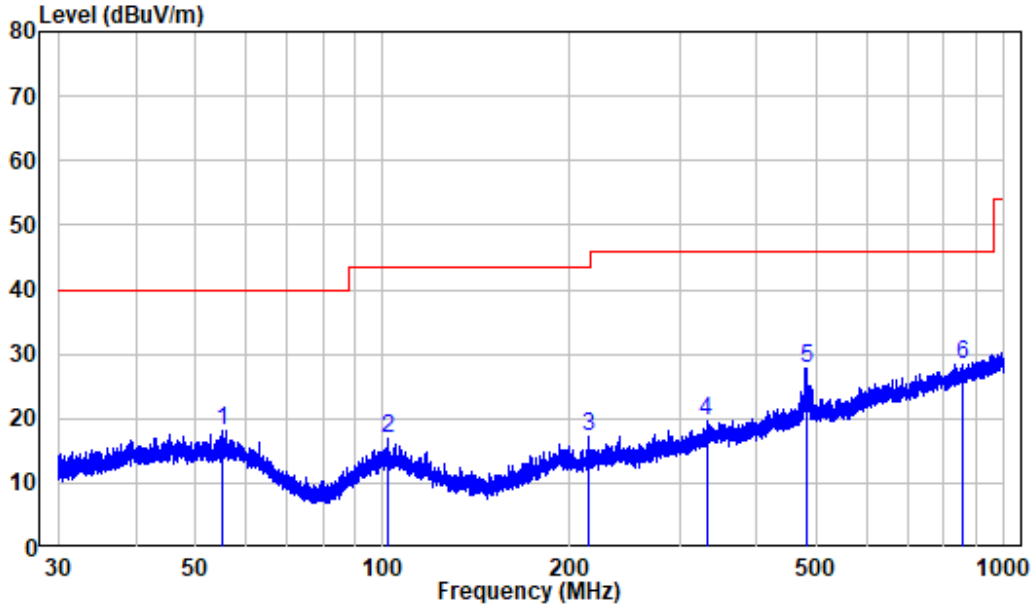
Note: Pre-scan in the X,Y and Z axes of orientation, the worst case X-axes of orientation was recorded

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

Note: When the test result of Peak was below the limit of QP more than 6dB, just the peak value was recorded.

Lamp 1:

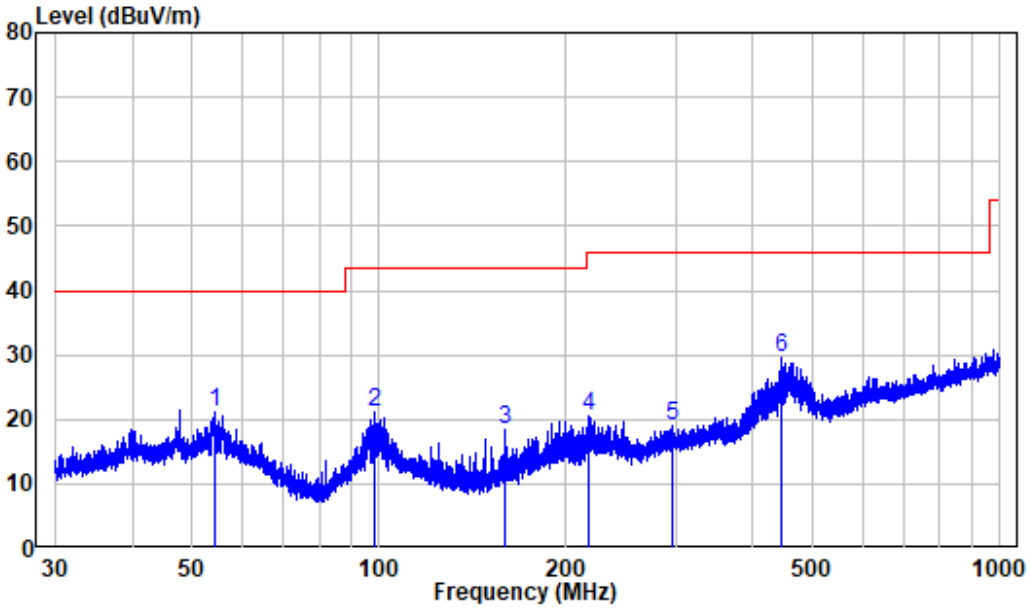
Horizontal



Site : chamber
Condition: 3m HORIZONTAL
Job No. : SZNS220711-31250E-RF
Test Mode: BT

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	55.293	-10.26	28.34	18.08	40.00	-21.92	Peak
2	101.867	-11.58	28.60	17.02	43.50	-26.48	Peak
3	214.514	-11.70	28.95	17.25	43.50	-26.25	Peak
4	331.791	-7.86	27.60	19.74	46.00	-26.26	Peak
5	480.107	-5.00	32.82	27.82	46.00	-18.18	Peak
6	858.529	0.28	28.11	28.39	46.00	-17.61	Peak

Vertical

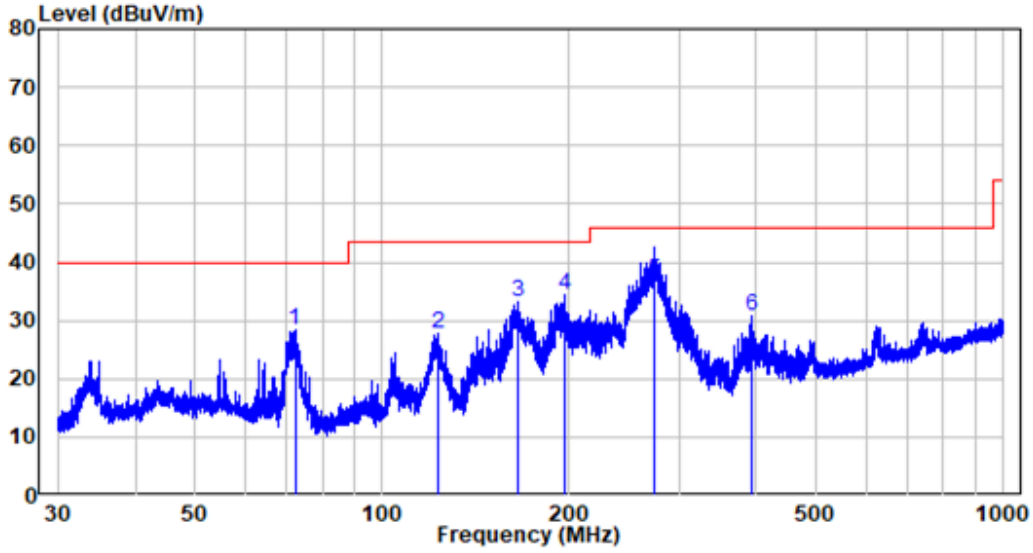


Site : chamber
Condition: 3m VERTICAL
Job No. : SZNS220711-31250E-RF
Test Mode: BT

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	54.190	-10.33	31.45	21.12	40.00	-18.88	Peak
2	98.400	-12.16	33.36	21.20	43.50	-22.30	Peak
3	159.574	-14.25	32.53	18.28	43.50	-25.22	Peak
4	217.735	-11.53	32.07	20.54	46.00	-25.46	Peak
5	295.794	-9.26	28.40	19.14	46.00	-26.86	Peak
6	444.657	-5.64	35.07	29.43	46.00	-16.57	Peak

Lamp 2:

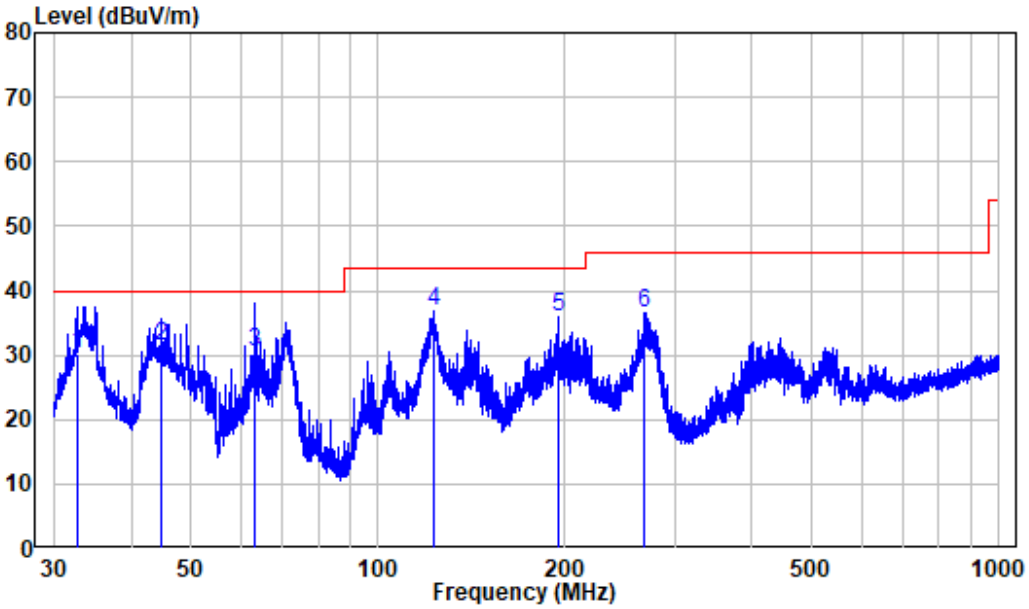
Horizontal



Site : chamber
Condition: 3m HORIZONTAL
Job No. : SZNS220711-31250E-RF
Test Mode: BT

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	72.306	-15.69	44.02	28.33	40.00	-11.67	Peak
2	122.511	-14.00	41.86	27.86	43.50	-15.64	Peak
3	165.414	-14.08	47.30	33.22	43.50	-10.28	Peak
4	196.682	-11.56	45.97	34.41	43.50	-9.09	Peak
5	274.074	-9.97	46.80	36.83	46.00	-9.17	QP
6	394.509	-6.81	37.71	30.90	46.00	-15.10	Peak

Vertical



Site : chamber
Condition: 3m VERTICAL
Job No. : SZNS220711-31250E-RF
Test Mode: BT

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	32.720	-12.06	42.30	30.24	40.00	-9.76	QP
2	44.763	-9.93	41.20	31.27	40.00	-8.73	QP
3	63.369	-11.92	42.29	30.37	40.00	-9.63	QP
4	122.619	-14.01	50.91	36.90	43.50	-6.60	Peak
5	195.479	-11.50	47.31	35.81	43.50	-7.69	Peak
6	267.546	-10.34	46.89	36.55	46.00	-9.45	Peak

Above 1GHz: (worst case for 8DPSK)

Frequency (MHz)	Receiver		Turntable Angle Degree	Rx Antenna		Factor (dB/m)	Absolute Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/Ave		Height (m)	Polar (H/V)				
Low Channel(2402MHz)									
2310	67.15	PK	198	1.4	H	-7.24	59.91	74	-14.09
2310	68.03	PK	308	2	V	-7.24	60.79	74	-13.21
2390	71.80	PK	356	2.4	H	-7.22	64.58	74	-9.42
2390	74.52	PK	146	2.2	V	-7.22	67.30	74	-6.70
4804	56.41	PK	343	2.4	H	-3.51	52.90	74	-21.10
4804	53.82	PK	71	2.4	V	-3.51	50.31	74	-23.69
7206	67.90	PK	284	1.3	H	2.70	70.60	74	-3.40
7206	67.22	PK	342	1.4	V	2.70	69.92	74	-4.08
Middle Channel(2441MHz)									
4882	54.52	PK	276	1.7	H	-3.37	51.15	74	-22.85
4882	53.65	PK	194	1.7	V	-3.37	50.28	74	-23.72
7323	66.80	PK	12	2.4	H	3.31	70.11	74	-3.89
7323	63.39	PK	316	1.5	V	3.31	66.70	74	-7.30
High Channel(2480 MHz)									
2483.5	67.53	PK	246	1.1	H	-7.20	60.33	74	-13.67
2483.5	68.48	PK	188	2	V	-7.20	61.28	74	-12.72
2500	79.14	PK	228	1.3	H	-7.18	71.96	74	-2.04
2500	77.42	PK	141	1.3	V	-7.18	70.24	74	-3.76
4960	58.56	PK	345	1.7	H	-3.16	55.40	74	-18.60
4960	55.12	PK	298	1.7	V	-3.16	51.96	74	-22.04
7440	66.94	PK	177	1.8	H	3.53	70.47	74	-3.53
7440	63.74	PK	77	1.8	V	3.53	67.27	74	-6.73

Field Strength of Average						
Frequency (MHz)	Peak Measurement @3m (dBμV/m)	Polar (H/V)	Duty Cycle Correction Factor (dB)	Corrected Ampitude (dBμV/m)	FCC Part 15.247/RSS-247	
					Limit (dBμV/m)	Margin (dB)
Low Channel(2402MHz)						
2310	59.91	H	-25.68	34.23	54	-19.77
2310	60.79	V	-25.68	35.11	54	-18.89
2390	64.58	H	-25.68	38.90	54	-15.10
2390	67.30	V	-25.68	41.62	54	-12.38
4804	52.90	H	-25.68	27.22	54	-26.78
4804	50.31	V	-25.68	24.63	54	-29.37
7206	70.60	H	-25.68	44.92	54	-9.08
7206	69.92	V	-25.68	44.24	54	-9.76
Middle Channel(2441MHz)						
4882	51.15	H	-25.68	25.47	54	-28.53
4882	50.28	V	-25.68	24.60	54	-29.40
7323	70.11	H	-25.68	44.43	54	-9.57
7323	66.70	V	-25.68	41.02	54	-12.98
High Channel(2480MHz)						
2483.5	60.33	H	-25.68	34.65	54	-19.35
2483.5	61.28	V	-25.68	35.60	54	-18.40
2500	71.96	H	-25.68	46.28	54	-7.72
2500	70.24	V	-25.68	44.56	54	-9.44
4960	55.40	H	-25.68	29.72	54	-24.28
4960	51.96	V	-25.68	26.28	54	-27.72
7440	70.47	H	-25.68	44.79	54	-9.21
7440	67.27	V	-25.68	41.59	54	-12.41

Note:

Absolute Level = Corrected Factor + Reading
Margin = Corrected. Amplitude - Limit
Average level= Peak level+ Duty Cycle Corrected Factor
For the simultaneous transmitting condition test data, please refer DTS report.

The worst case duty cycle as below:
Duty cycle = Ton/100ms = 2.6*2/100=0.052
Duty Cycle Corrected Factor = 20lg (Duty cycle) = 20lg0.052 = -25.68
3DH5 has the highest duty cycle which is the worst case

Duty Cycle Correction Factor Consideration for AFH mode:
Bluetooth normal hopping rate is 1600Hz and reduced to 800Hz in AFH mode; due to the reduced number of hopping frequencies, with the same packet configuration the dwell time in each channel frequency within 100msec period is longer in AFH mode than normal mode.
In AFH mode, the minimum hopping frequencies are 20, to get the longest dwell time 3DH5 packet is observed; the on time period to have 3DH5 packet completing one hopping sequence is: 2.6 ms*20 channels = 52 ms
There cannot be 2 complete hopping sequences within 100ms period, considering the random hopping behavior, maximum 2 hops can be possibly observed within the period. [100 ms /52 ms] = 2 hops
Thus, the maximum possible ON time:

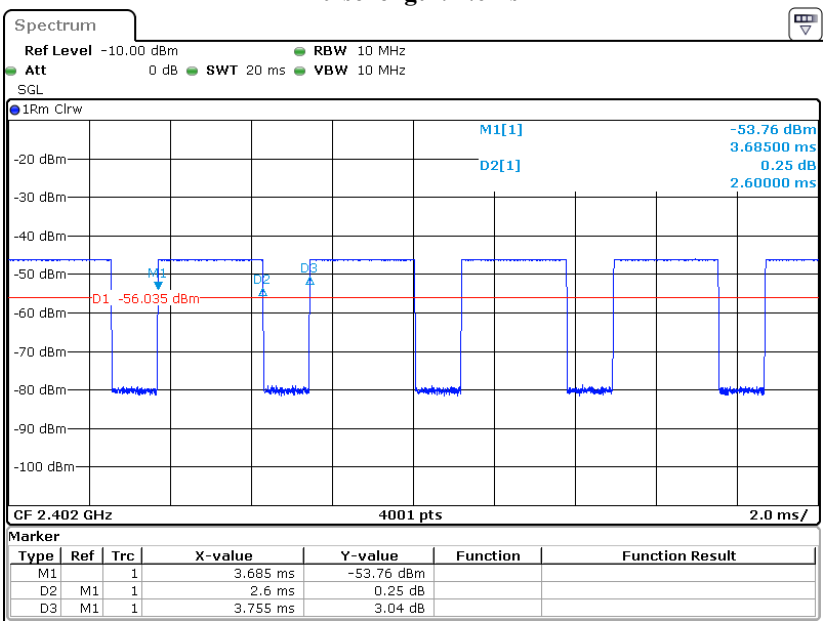
2.6 ms*2 = 5.2 ms

Worst case Duty Cycle Correction factor, which is derived from the maximum possible ON time:

20*log(5.2 ms/100 ms) = -25.68dB

Duty Cycle:

Pulse length: 2.6ms



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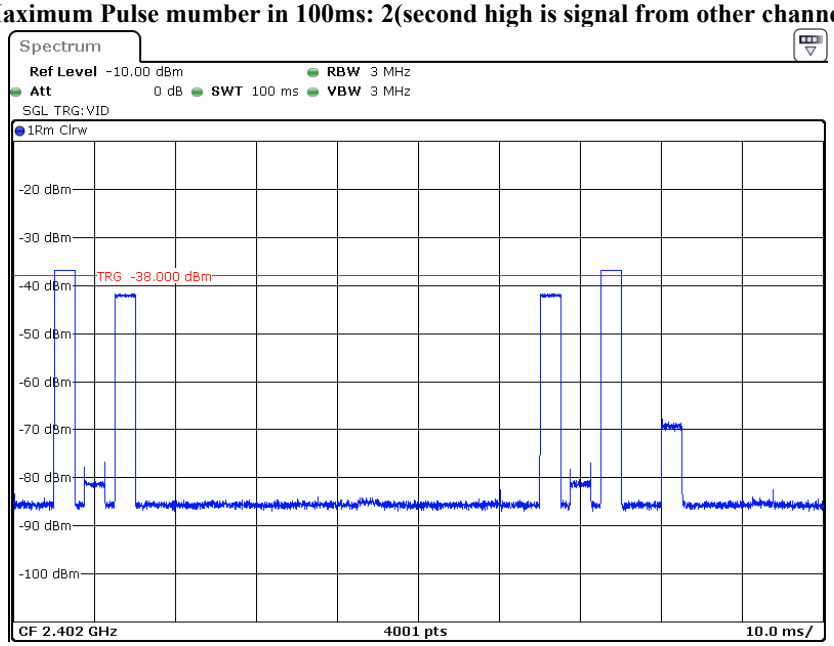
Maximum Pulse mumber in 100ms: 2(second high is signal from other channel)



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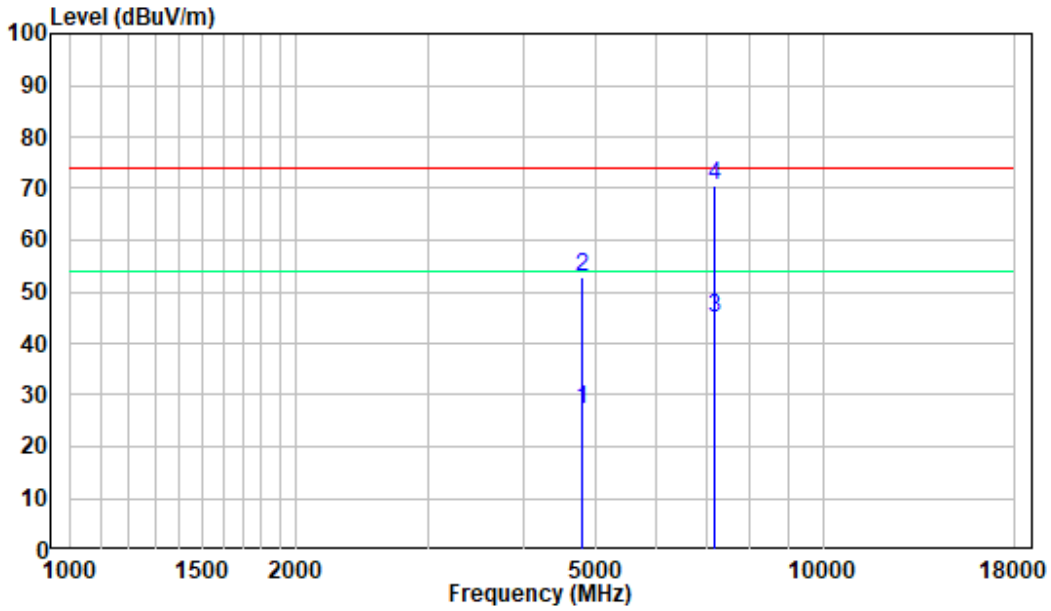
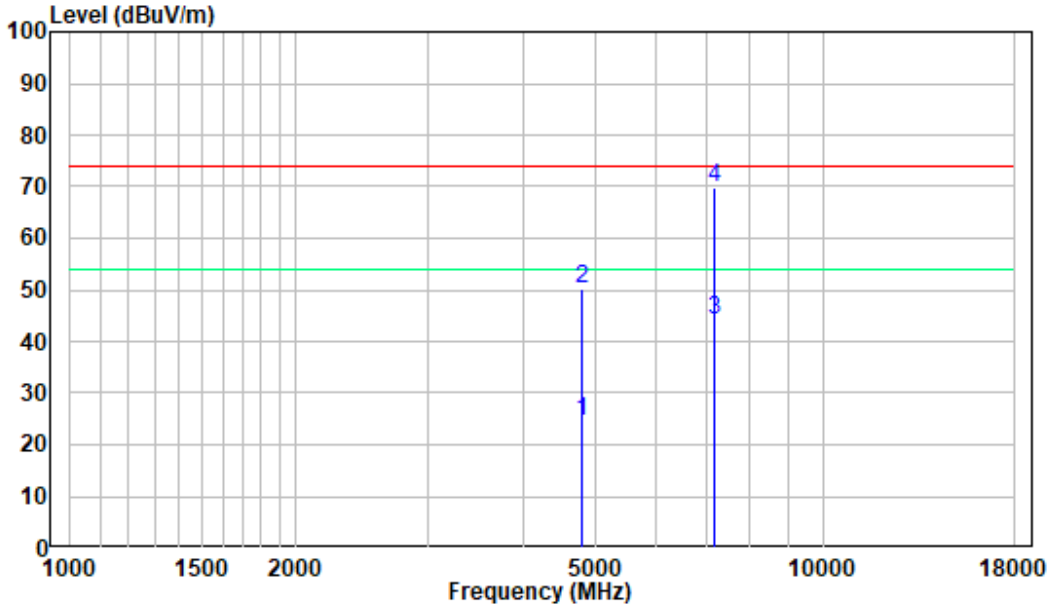
1 GHz - 18 GHz: (Pre-Scan plots)

Low channel

Horizontal



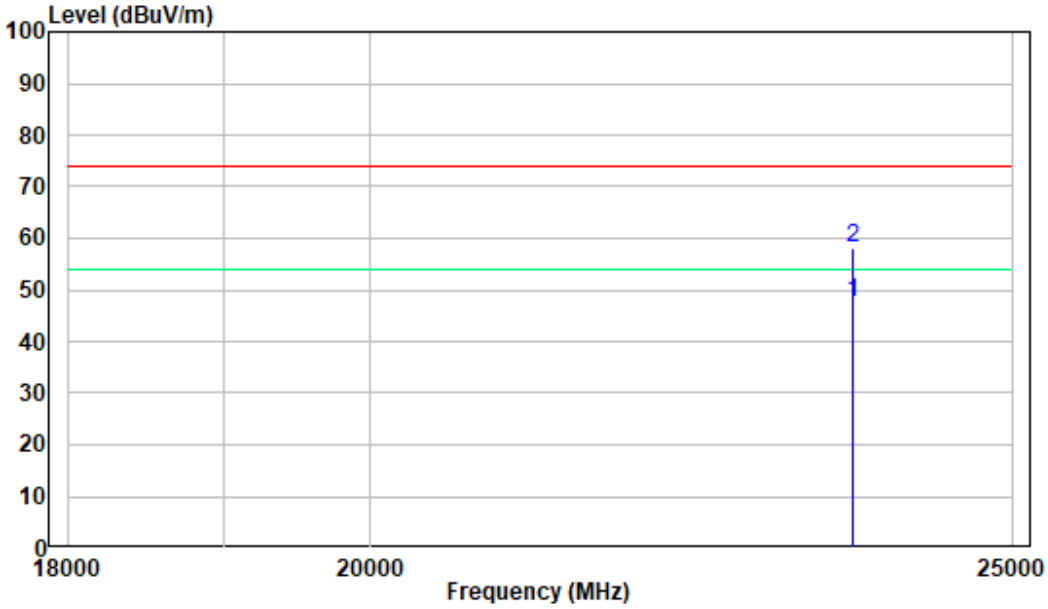
Vertical



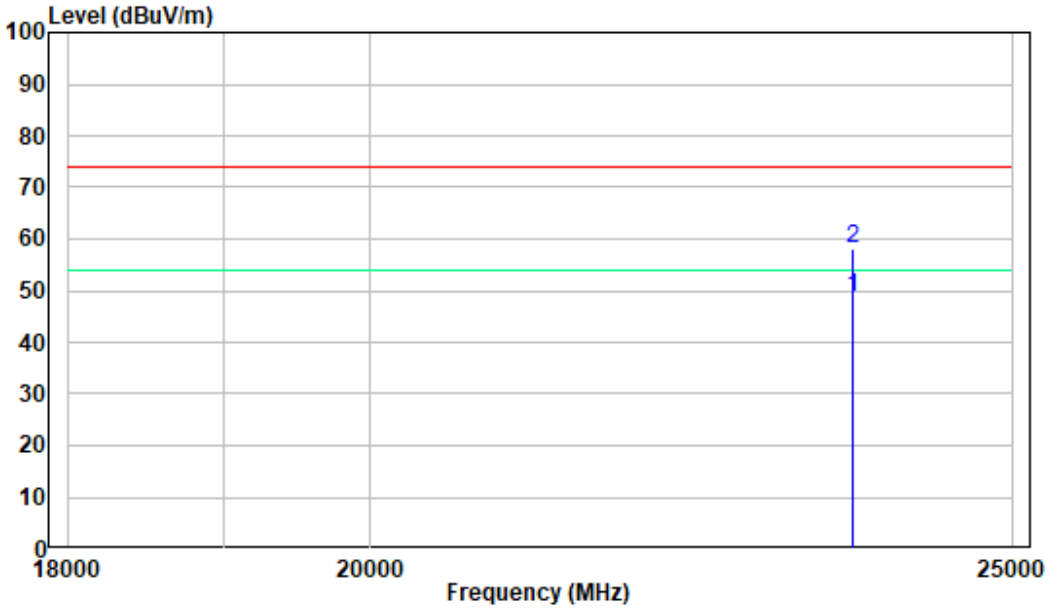
18-25GHz: (Pre-Scan plots)

Low 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):

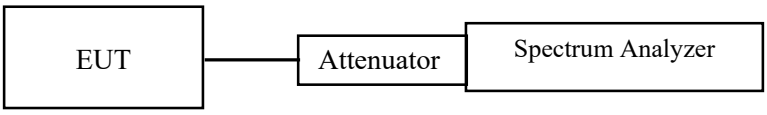
Frequency hopping systems shall have hoping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that 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:	27.1 ℃
Relative Humidity:	58 %
ATM Pressure:	101.0 kPa

The testing was performed by Roger Ling on 2022-07-26.

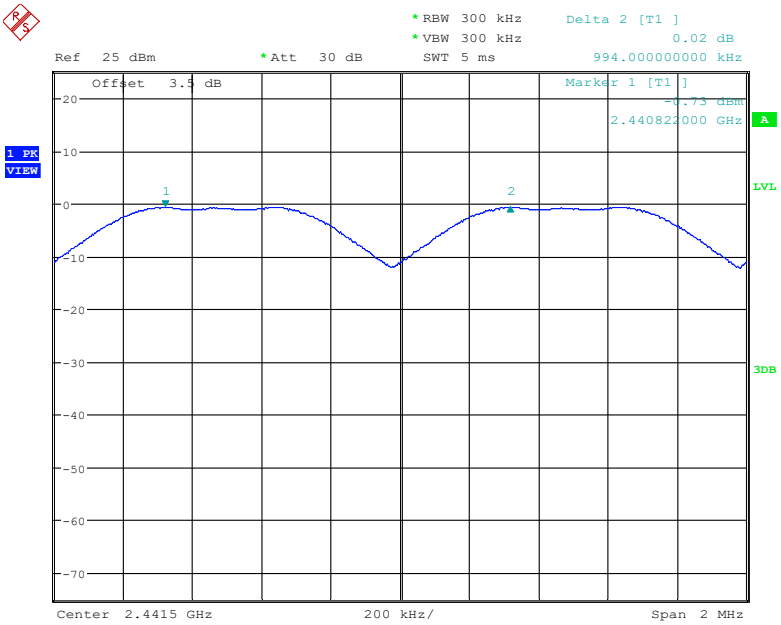
EUT operation mode: Transmitting

Test Result: Pass

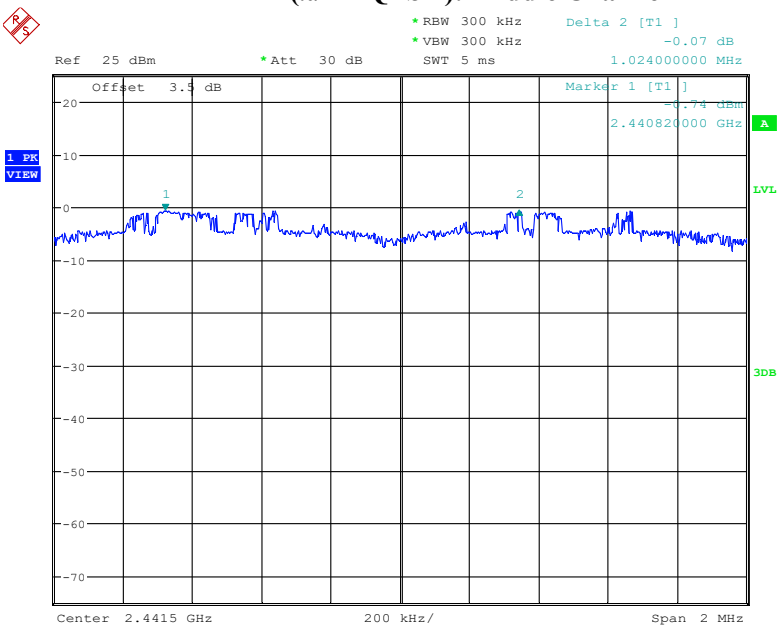
Please refer to following table and plots.

Channel	Channel Separation (MHz)	20 dBc BW (MHz)	Two-thirds of the 20 dB bandwidth (MHz)	Channel Separation Limit
BDR(GFSK)				
Middle	0.994	0.993	0.662	> two-thirds of the 20 dB bandwidth
EDR(π/4-DQPSK)				
Middle	1.024	1.287	0.858	> two-thirds of the 20 dB bandwidth
EDR(8DPSK)				
Middle	1.018	1.275	0.850	> two-thirds of the 20 dB bandwidth

BDR (GFSK): Middle Channel



EDR (π/4-DQPSK): Middle Channel



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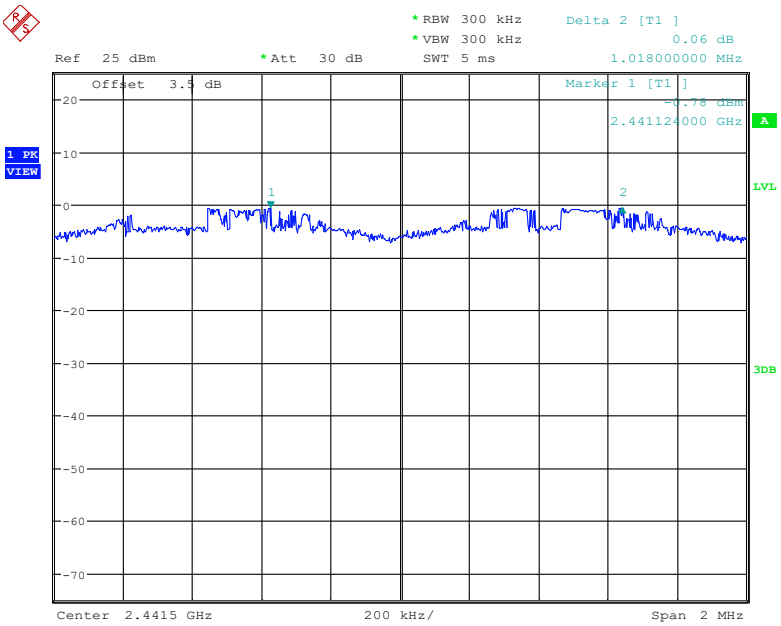
EDR (8DPSK): Middle Channel



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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:

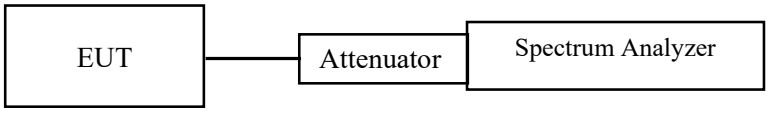
• The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

• 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).



Test Data

Environmental Conditions

Temperature:	27.1 ℃
Relative Humidity:	58 %
ATM Pressure:	101.0 kPa

The testing was performed by Roger Ling on 2022-07-26.

EUT operation mode: Transmitting

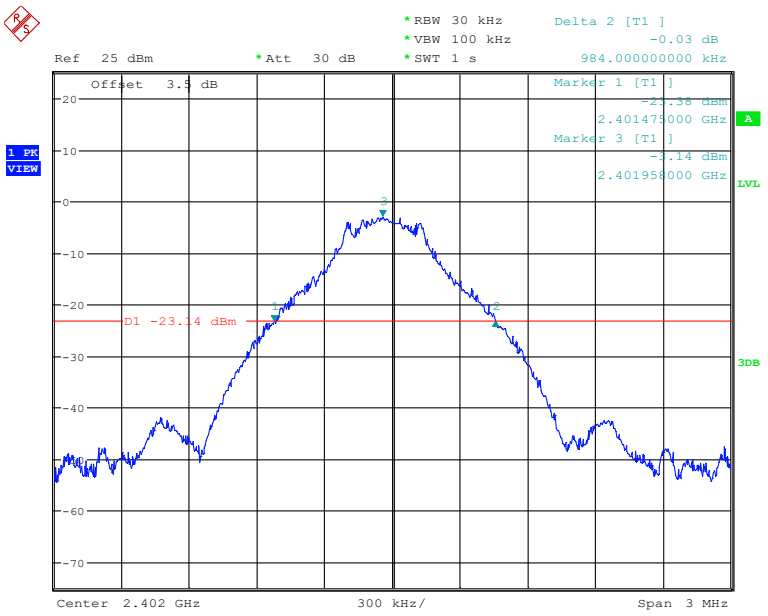
Test Result: Pass

Please refer to following table and plots.

Mode	Channel	Frequency (MHz)	99% Emission Bandwidth (MHz)	20 dB Emission Bandwidth (MHz)
BDR (GFSK)	Low	2402	0.876	0.984
	Middle	2441	0.879	0.993
	High	2480	0.876	0.990
EDR (π/4-DQPSK)	Low	2402	1.158	1.278
	Middle	2441	1.161	1.287
	High	2480	1.158	1.272
EDR (8DPSK)	Low	2402	1.158	1.266
	Middle	2441	1.158	1.272
	High	2480	1.158	1.275

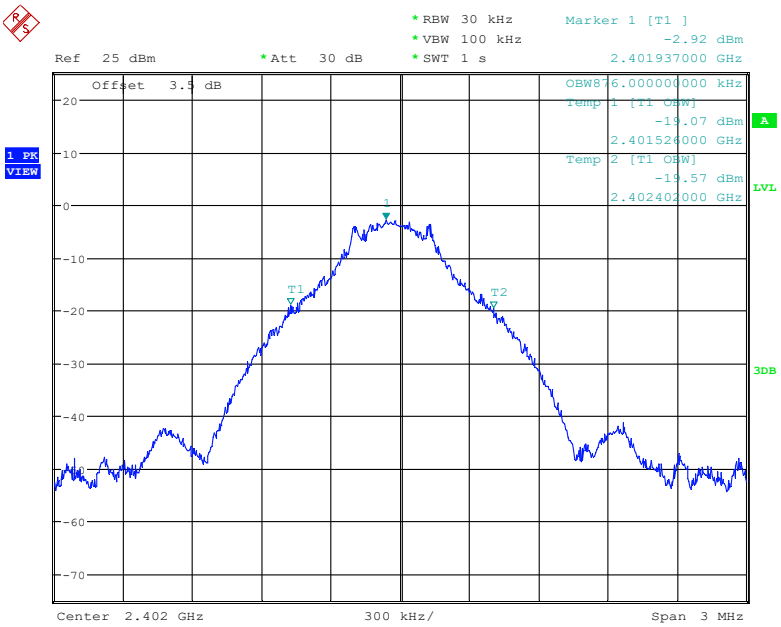
BDR (GFSK):

20dB Emission Bandwidth, Low Channel



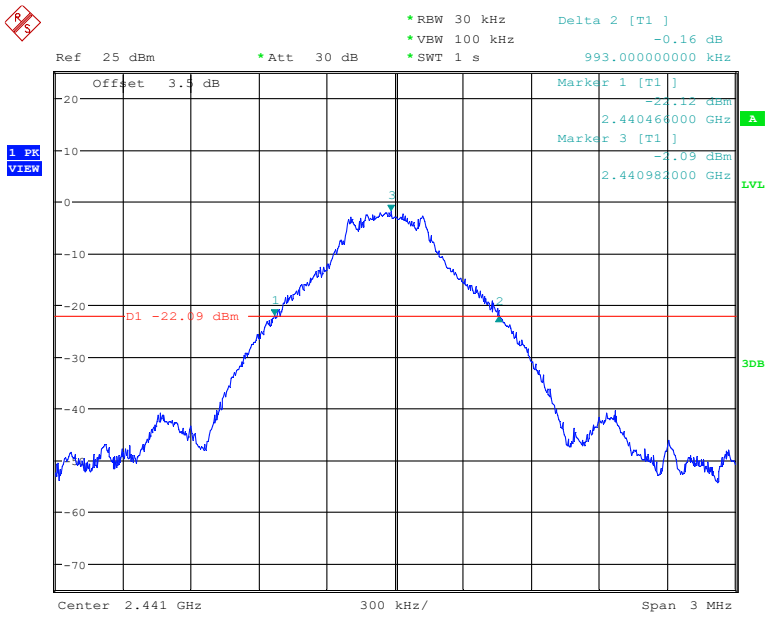
Date: 26.JUL.2022 20:48:03

99% Occupied Bandwidth, Low Channel



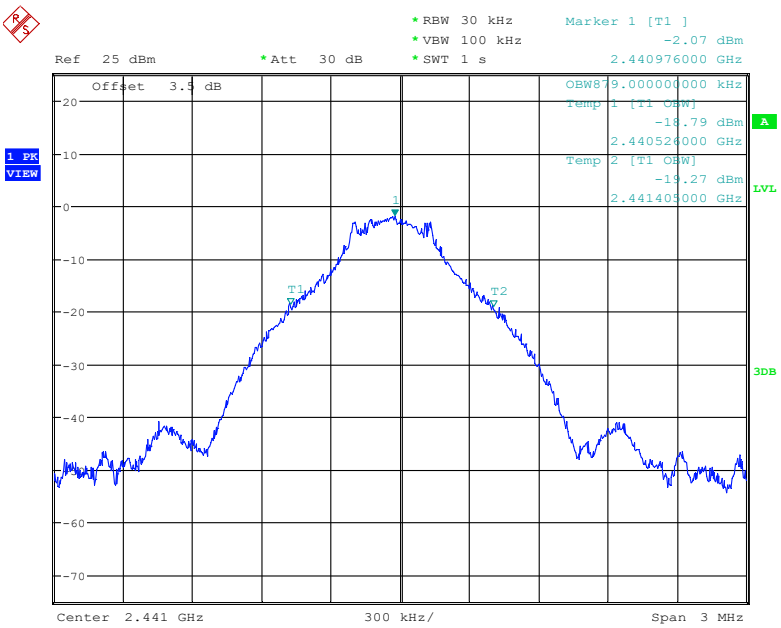
Date: 26.JUL.2022 20:47:25

20dB Emission Bandwidth, Middle Channel



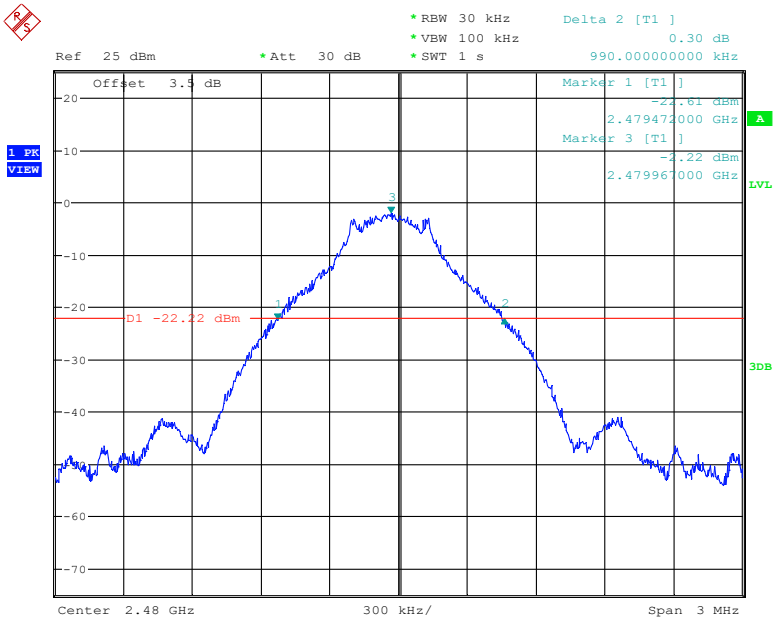
Date: 26.JUL.2022 20:57:19

99% Occupied Bandwidth, Middle Channel



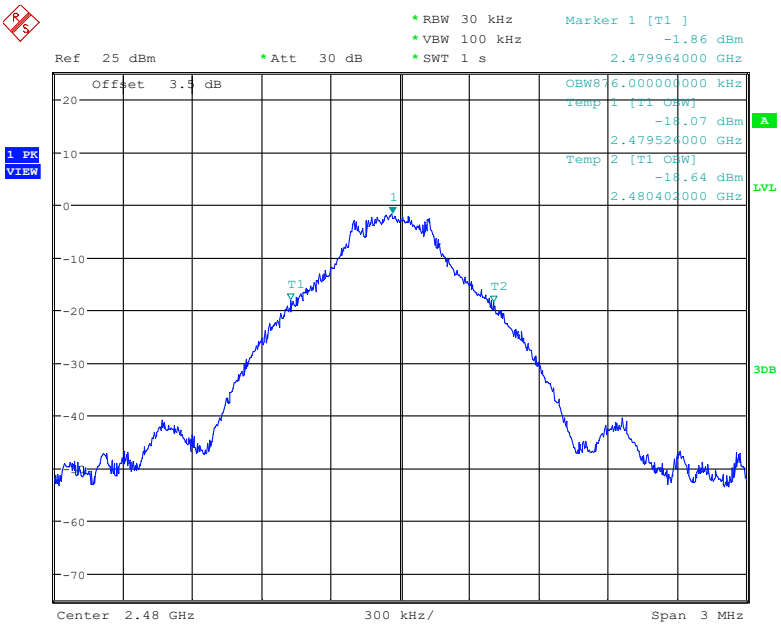
Date: 26.JUL.2022 20:56:41

20dB Emission Bandwidth, High Channel



Date: 27.JUL.2022 00:09:27

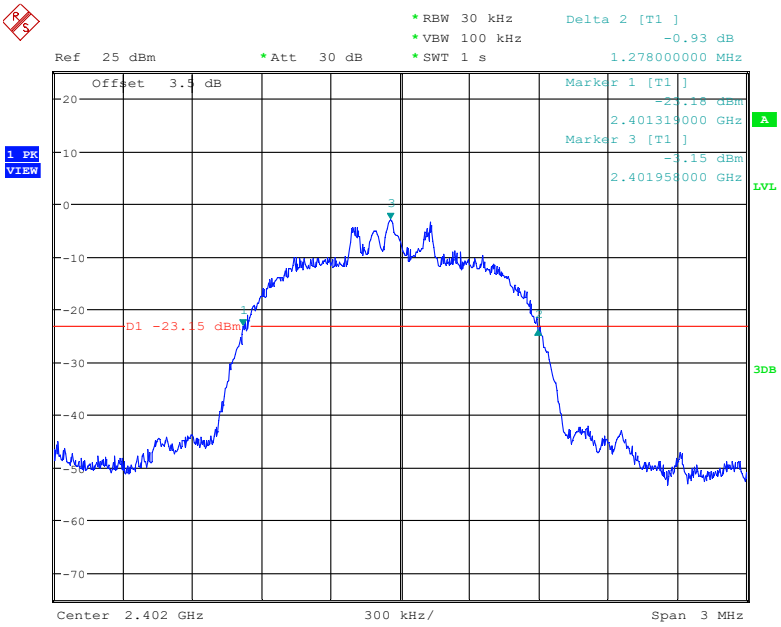
99% Occupied Bandwidth, High Channel



Date: 26.JUL.2022 21:05:49

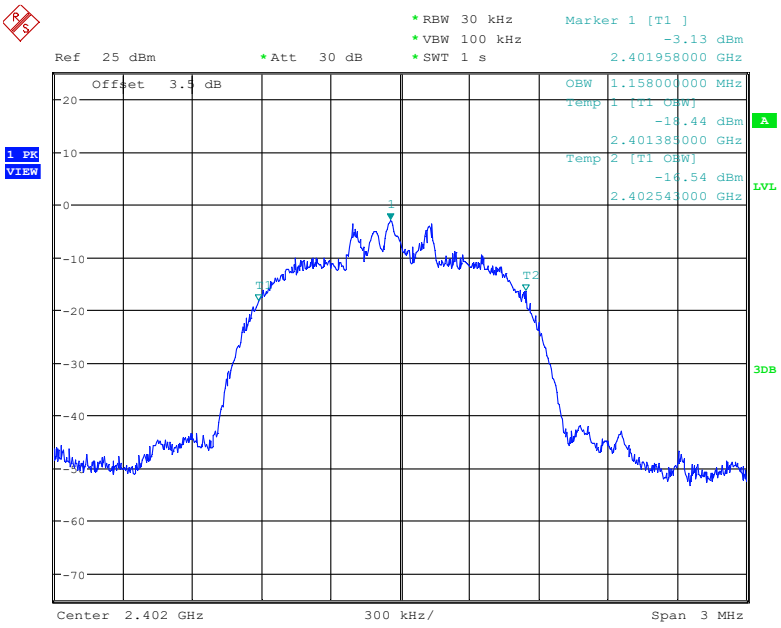
EDR (π/4-DQPSK):

20dB Emission Bandwidth, Low Channel



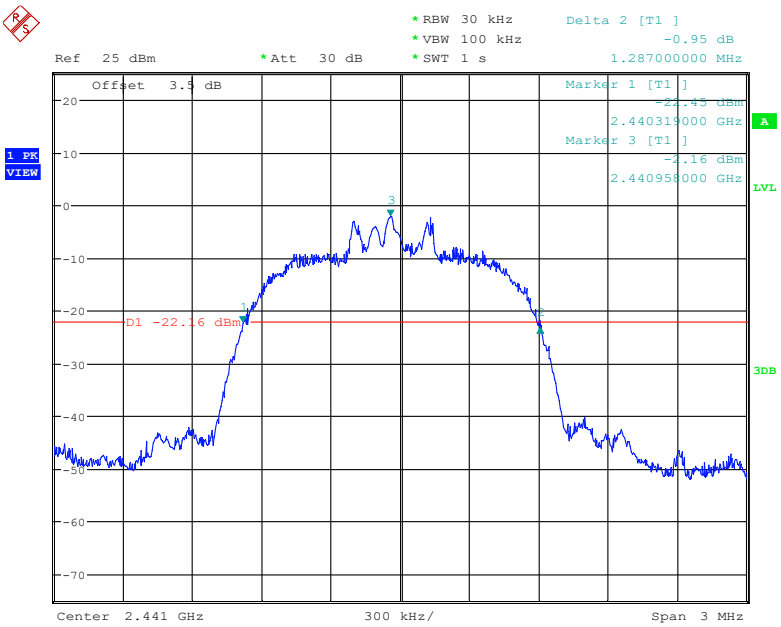
Date: 26.JUL.2022 20:51:11

99% Occupied Bandwidth, Low Channel



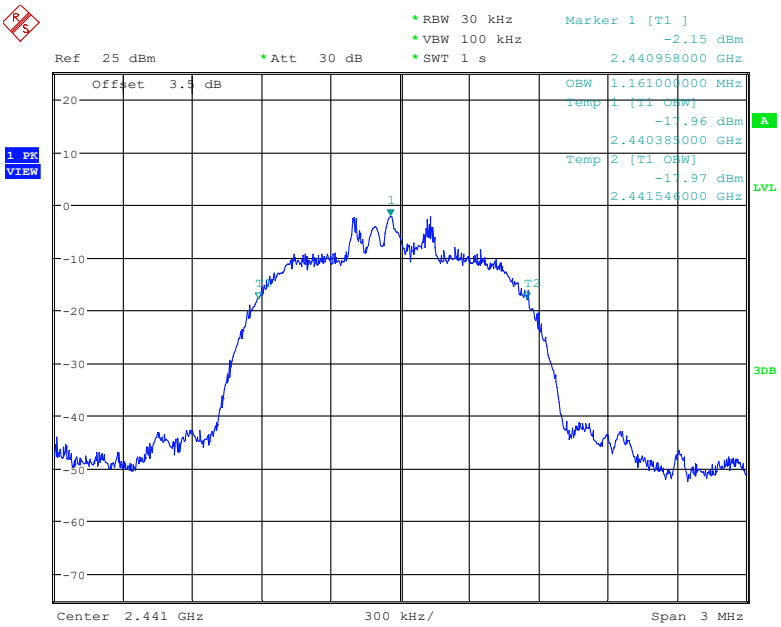
Date: 26.JUL.2022 20:50:33

20dB Emission Bandwidth, Middle Channel



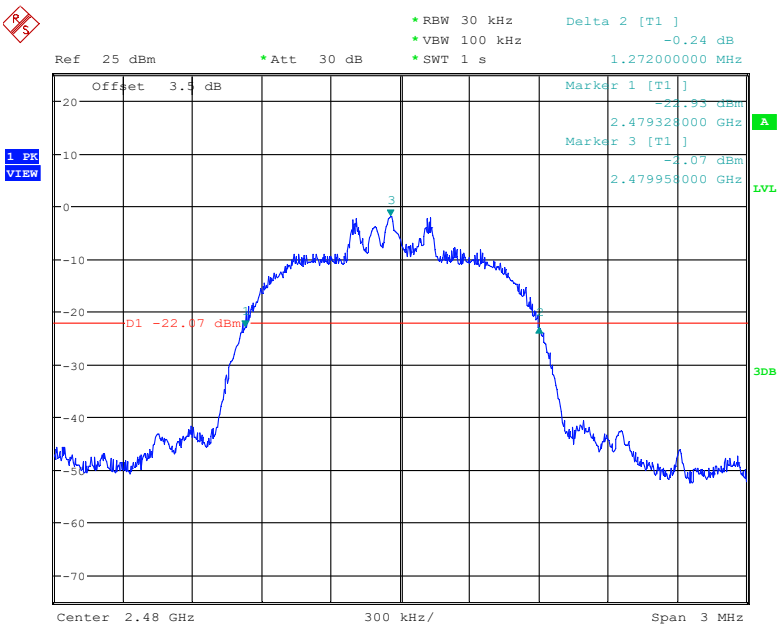
Date: 26.JUL.2022 21:01:08

99% Occupied Bandwidth, Middle Channel



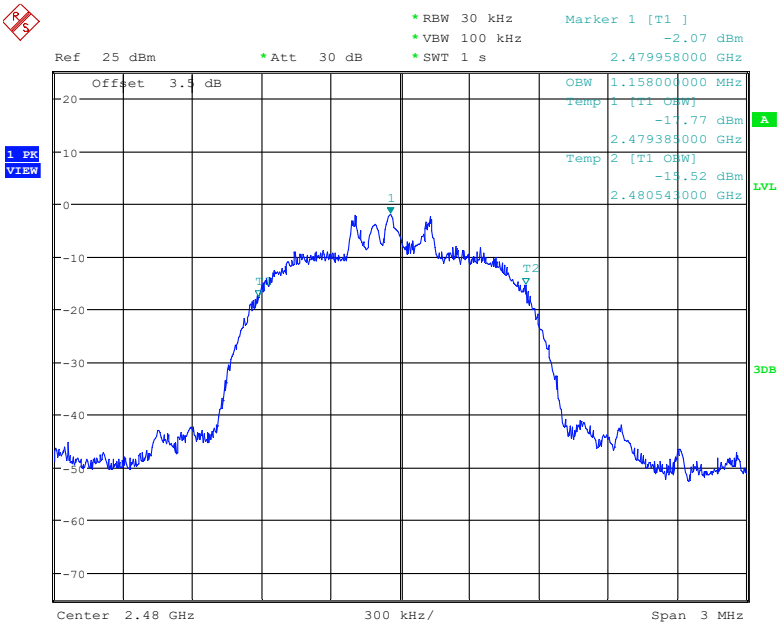
Date: 26.JUL.2022 21:00:31

20dB Emission Bandwidth, High Channel



Date: 26.JUL.2022 21:09:07

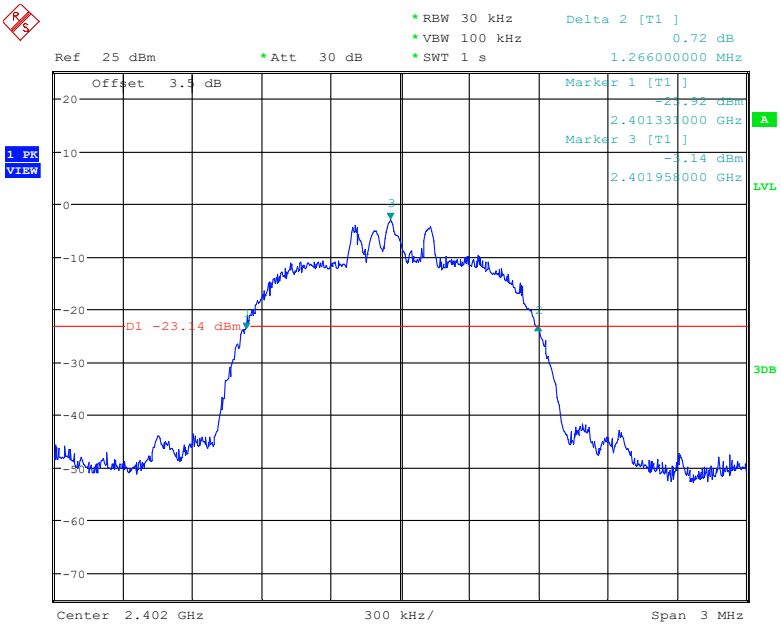
99% Occupied Bandwidth, High Channel



Date: 26.JUL.2022 21:08:30

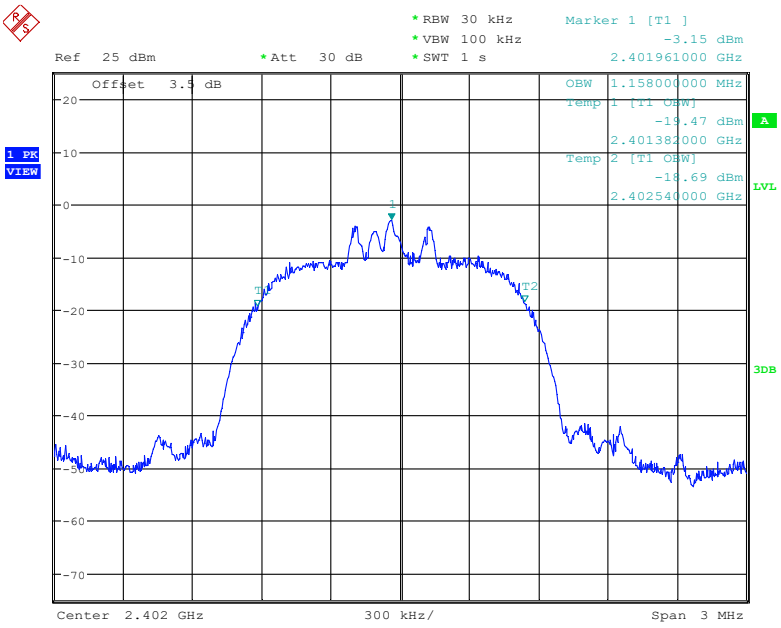
EDR (8DPSK):

20dB Emission Bandwidth, Low Channel



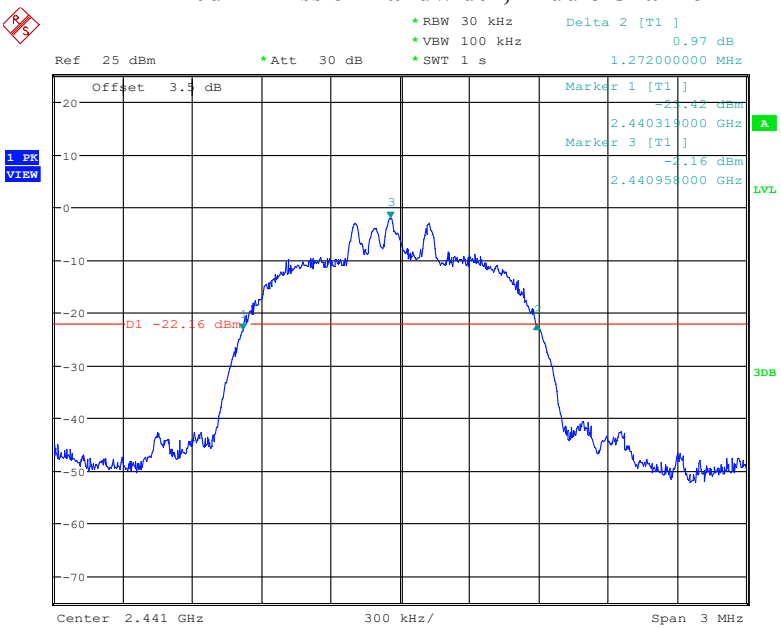
Date: 26.JUL.2022 20:54:18

99% Occupied Bandwidth, Low Channel



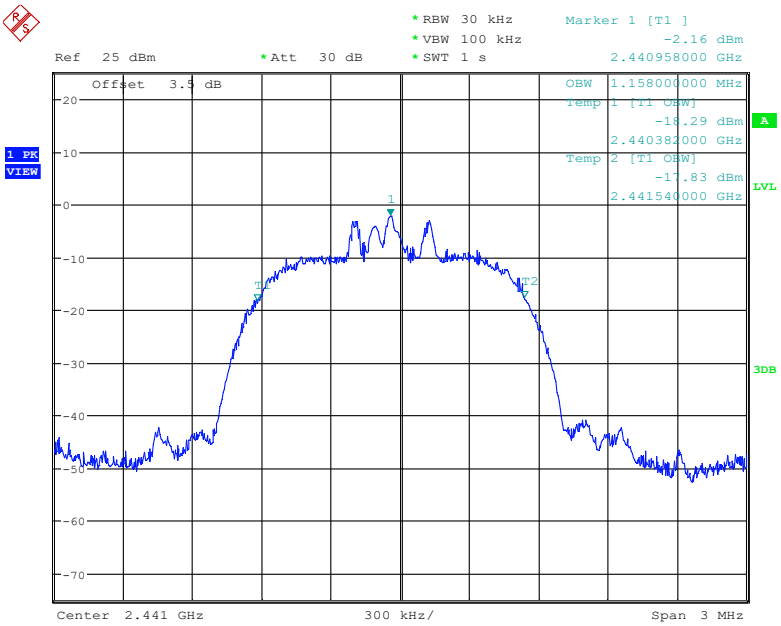
Date: 26.JUL.2022 20:53:40

20dB Emission Bandwidth, middle Channel



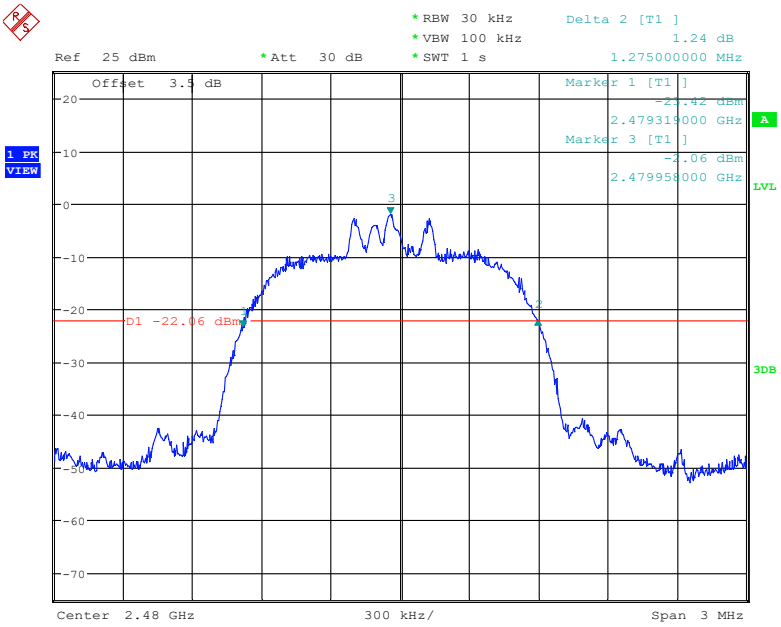
Date: 26.JUL.2022 21:03:27

99% Occupied Bandwidth, Middle Channel



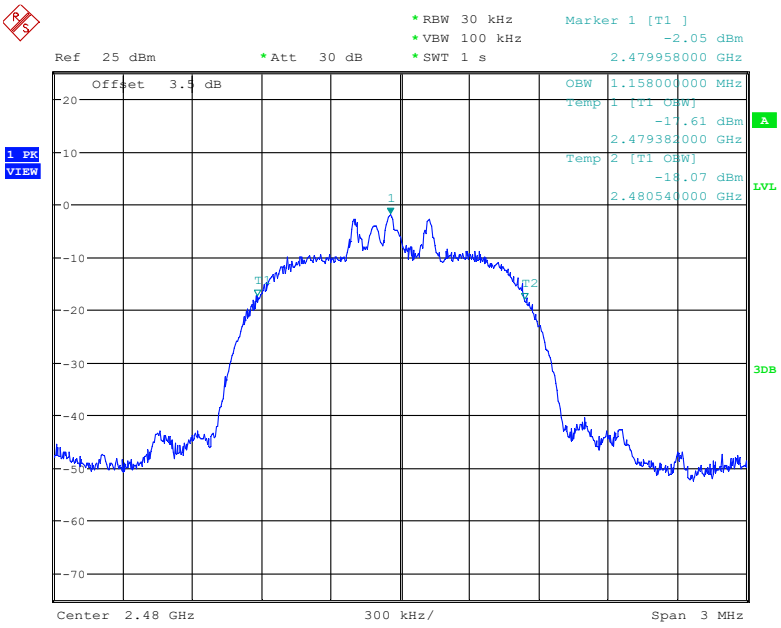
Date: 26.JUL.2022 21:02:50

20dB Emission Bandwidth, High Channel



Date: 26.JUL.2022 21:12:04

99% Occupied Bandwidth, High Channel



Date: 26.JUL.2022 21:11:27

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):

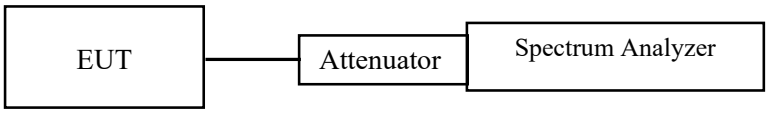
Frequency hopping systems (FHSS) operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds, multiplied by the number of hopping channels employed. Transmissions on particular 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.



Test Data

Environmental Conditions

Temperature:	27.1 ℃
Relative Humidity:	58 %
ATM Pressure:	101.0 kPa

The testing was performed by Roger Ling from 2022-07-26 to 2022-09-08.

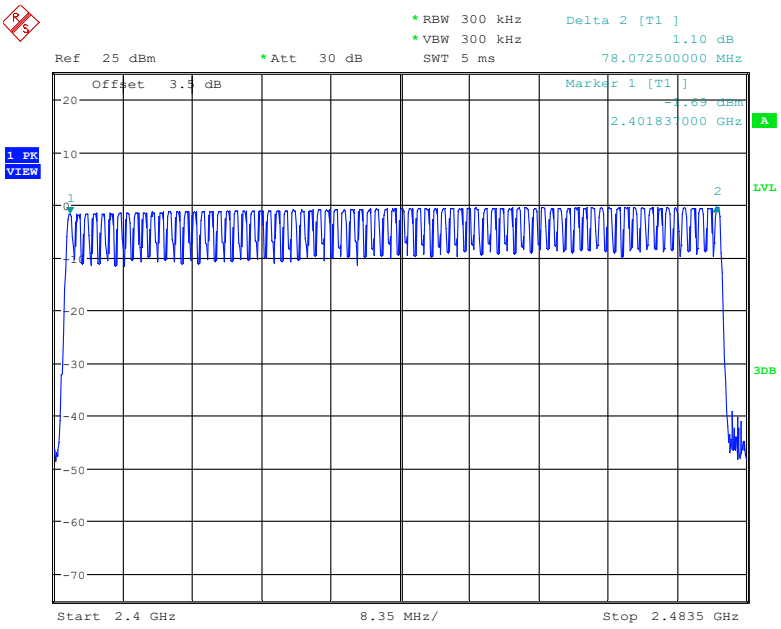
EUT operation mode: Transmitting

Test Result: Pass

Please refer to following table and plots.

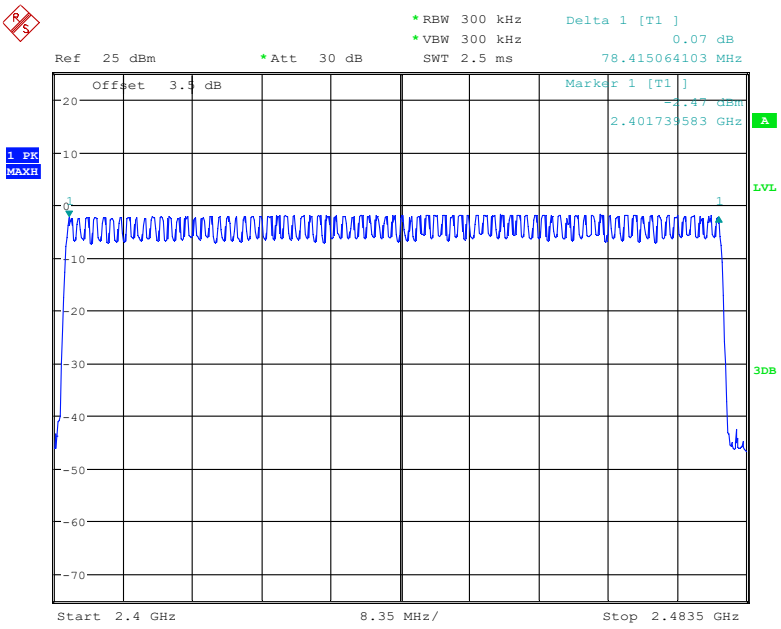
Mode	Frequency Range (MHz)	Number of Hopping Channel (CH)	Limit (CH)
BDR (GFSK)	2400-2483.5	79	≥15
EDR (π/4-DQPSK)	2400-2483.5	79	≥15
EDR (8DPSK)	2400-2483.5	79	≥15

BDR (GFSK): Number of Hopping Channels



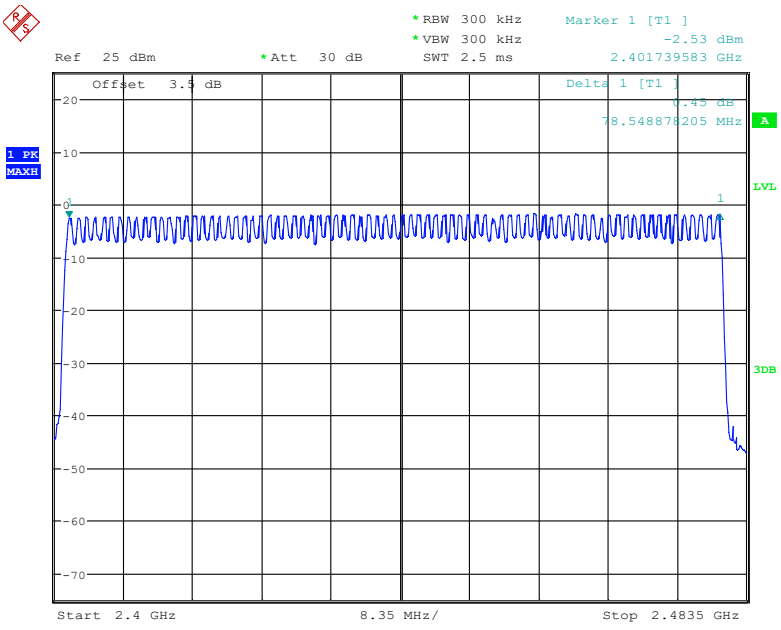
Date: 26.JUL.2022 21:18:43

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



Date: 8.SEP.2022 09:39:09

EDR (8DPSK): Number of Hopping Channels



Date: 8.SEP.2022 09:45:26

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):

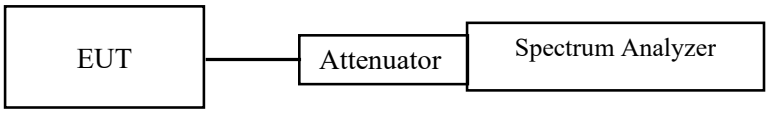
Frequency hopping systems in the 2400-2483.5 MHz shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions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



Test Data

Environmental Conditions

Temperature:	27.1 ℃
Relative Humidity:	58 %
ATM Pressure:	101.0 kPa

The testing was performed by Roger Ling on 2022-07-26.

EUT operation mode: Transmitting

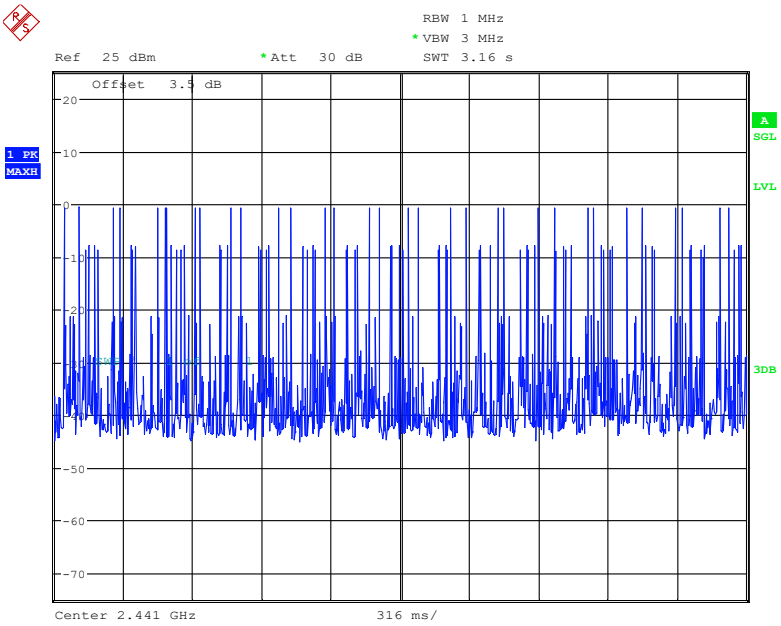
Test Result: Pass

Please refer to following table and plots

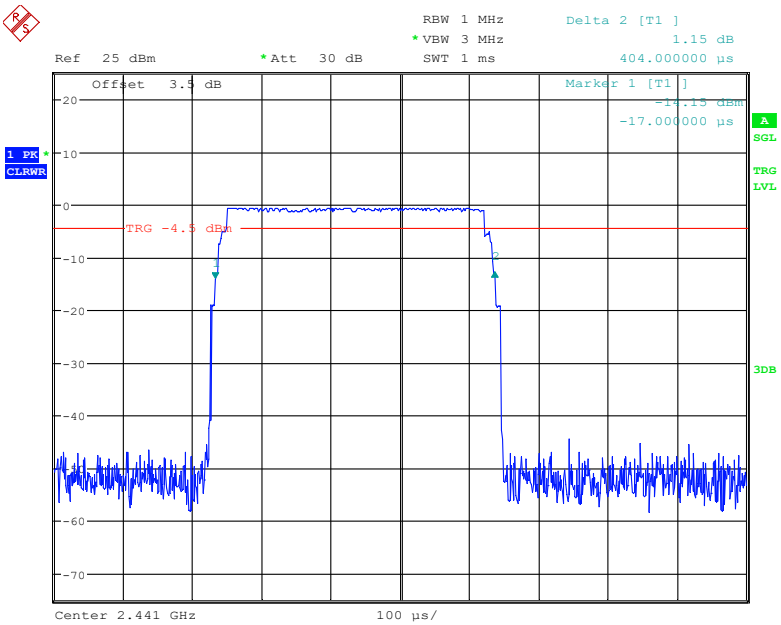
Test Mode	Channel	Pulse Time [ms]	Total Hops [Num]	Result[s]	Limit[s]	Verdict
DH1	Hop	0.404	320	0.129	<=0.4	PASS
DH3	Hop	1.578	180	0.284	<=0.4	PASS
DH5	Hop	2.630	130	0.342	<=0.4	PASS
2DH1	Hop	0.411	320	0.132	<=0.4	PASS
2DH3	Hop	1.611	160	0.258	<=0.4	PASS
2DH5	Hop	2.625	140	0.368	<=0.4	PASS
3DH1	Hop	0.419	320	0.134	<=0.4	PASS
3DH3	Hop	1.407	220	0.310	<=0.4	PASS
3DH5	Hop	2.620	110	0.288	<=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

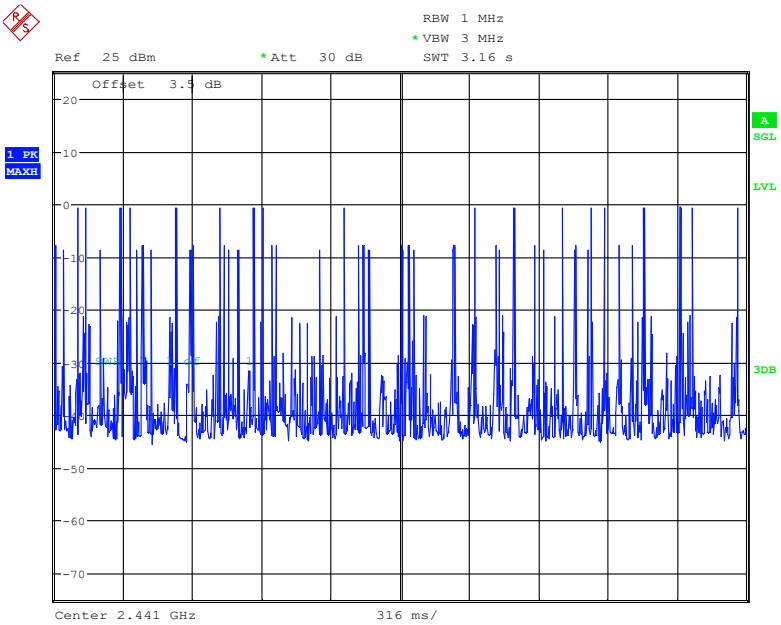


Date: 26.JUL.2022 21:13:34

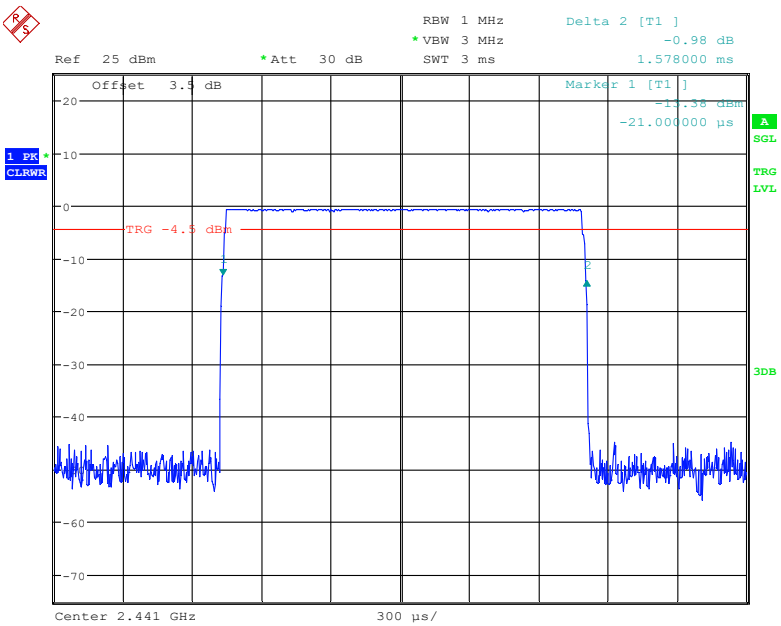


Date: 26.JUL.2022 21:13:50

DH3

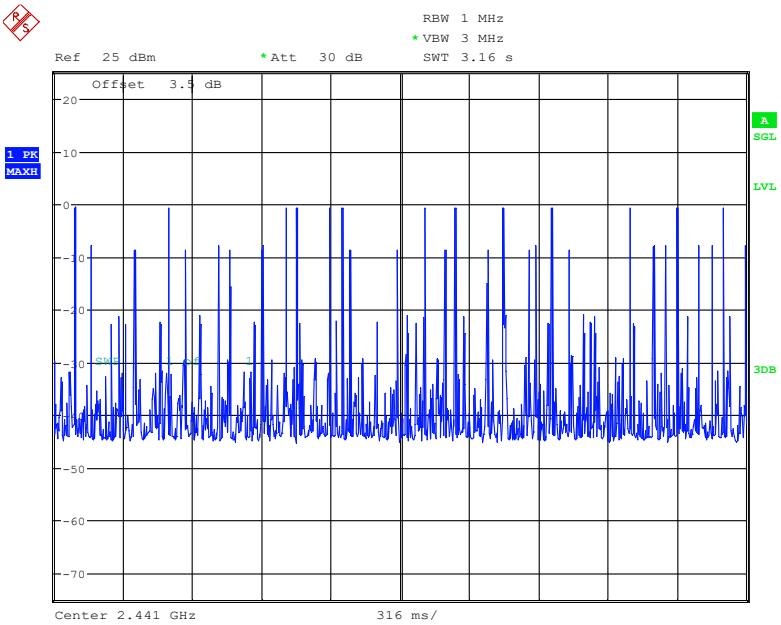


Date: 26.JUL.2022 21:15:25

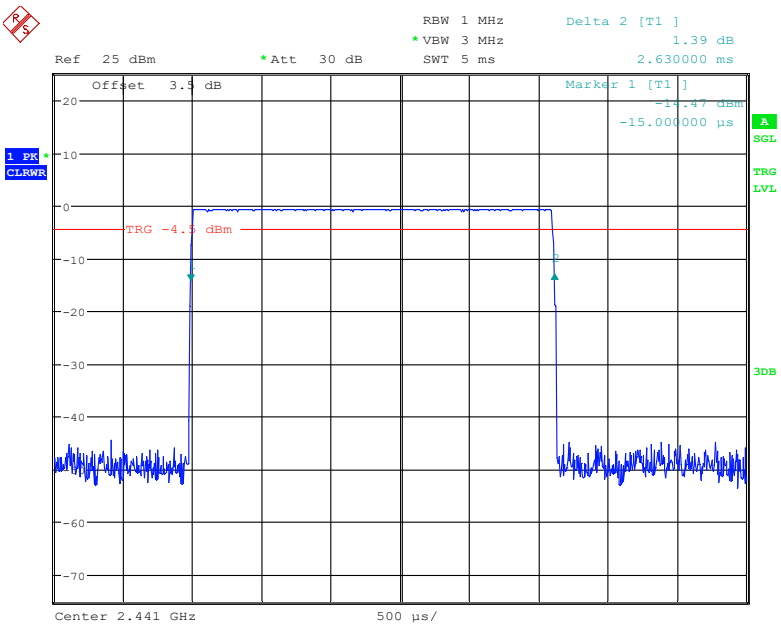


Date: 26.JUL.2022 21:15:41

DH5

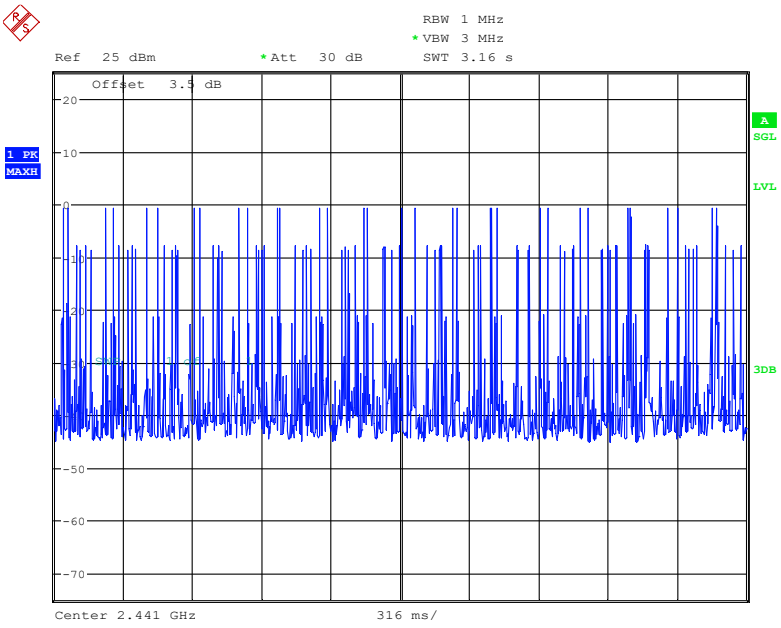


Date: 26.JUL.2022 21:20:15

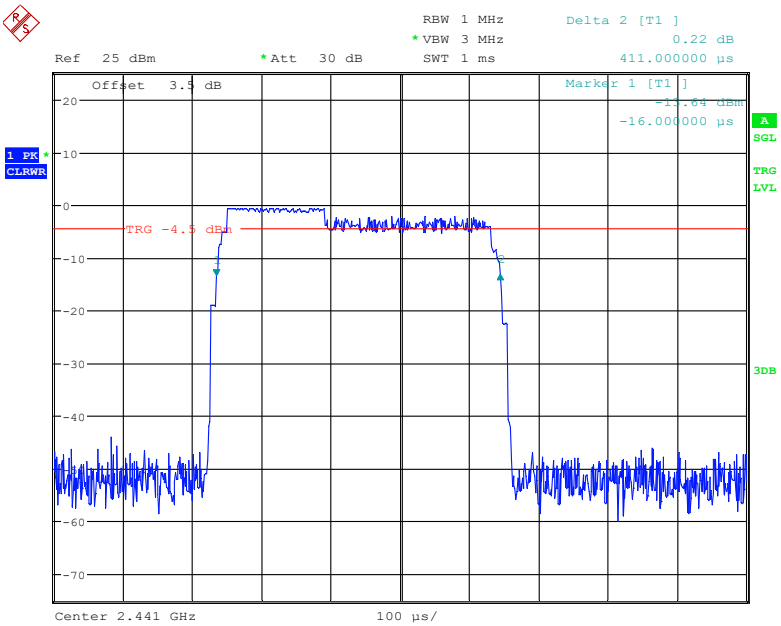


Date: 26.JUL.2022 21:20:30

EDR(π/4-DQPSK):
2DH1

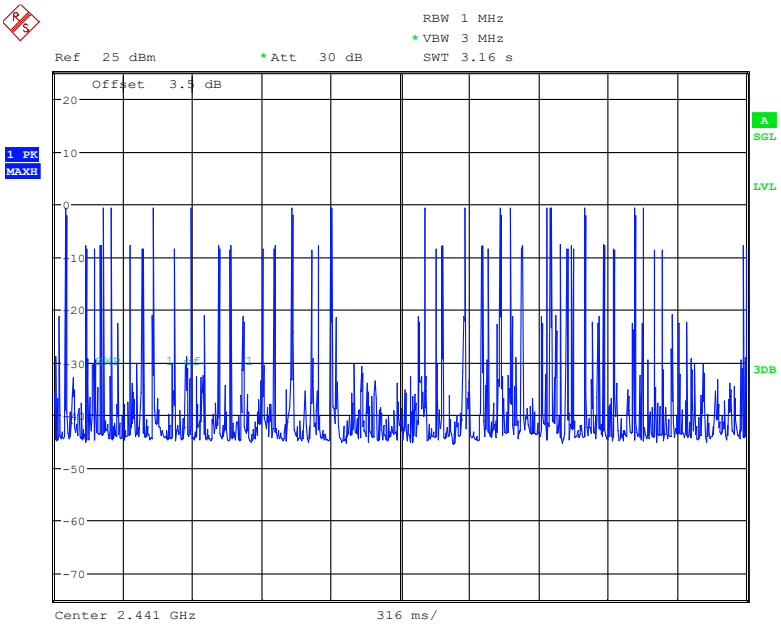


Date: 26.JUL.2022 21:24:34

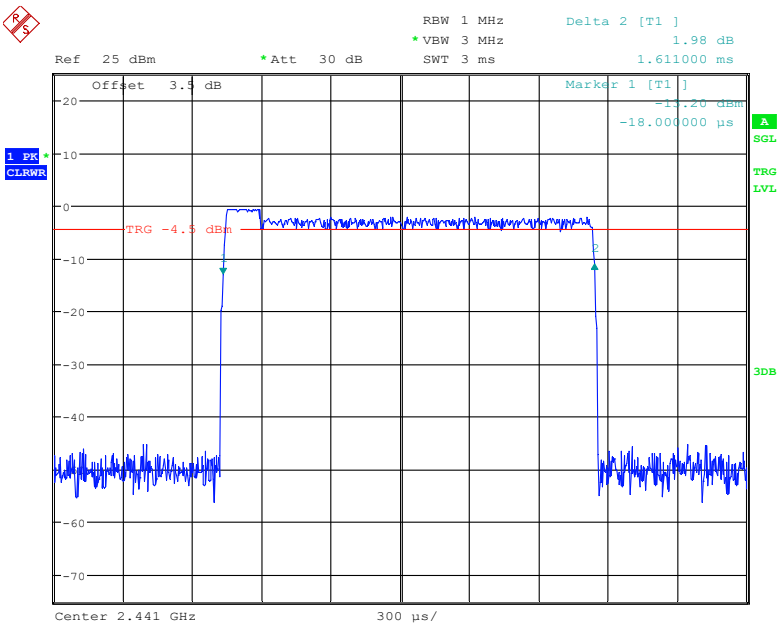


Date: 26.JUL.2022 21:24:50

2DH3

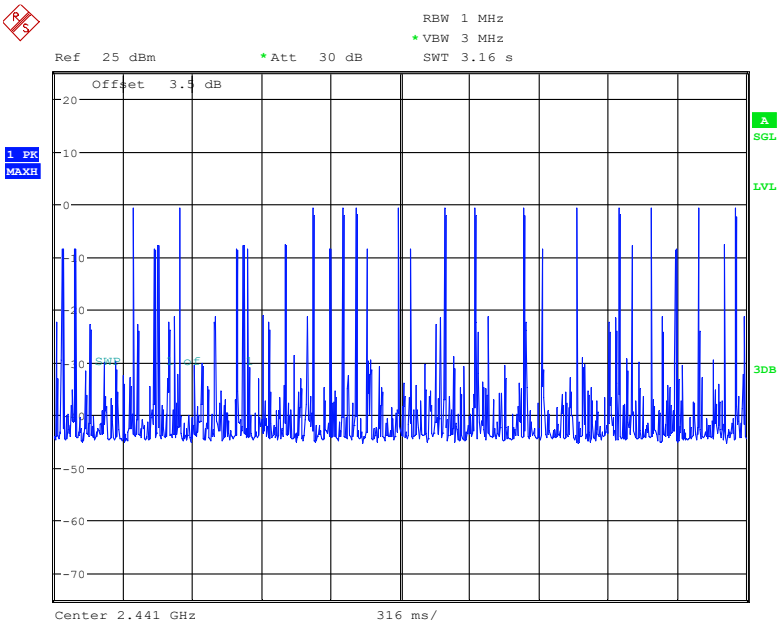


Date: 26.JUL.2022 21:25:14

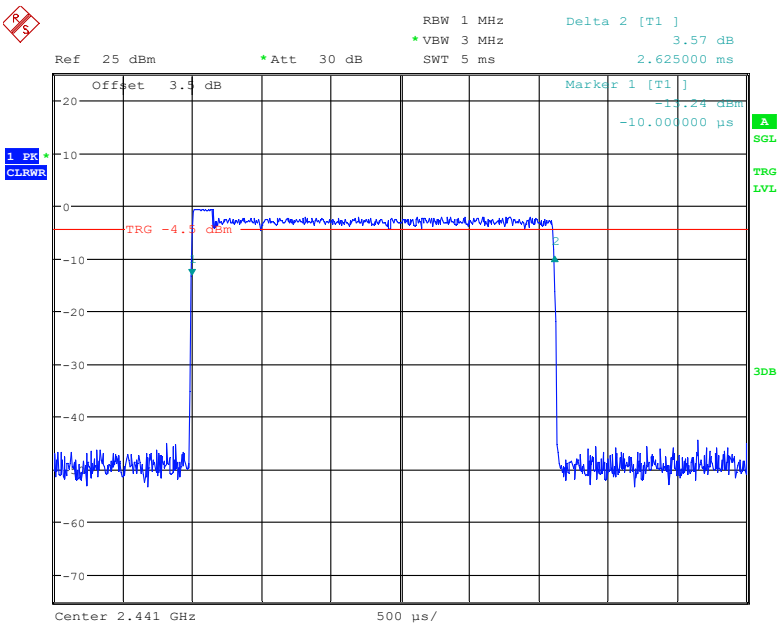


Date: 26.JUL.2022 21:25:29

2DH5

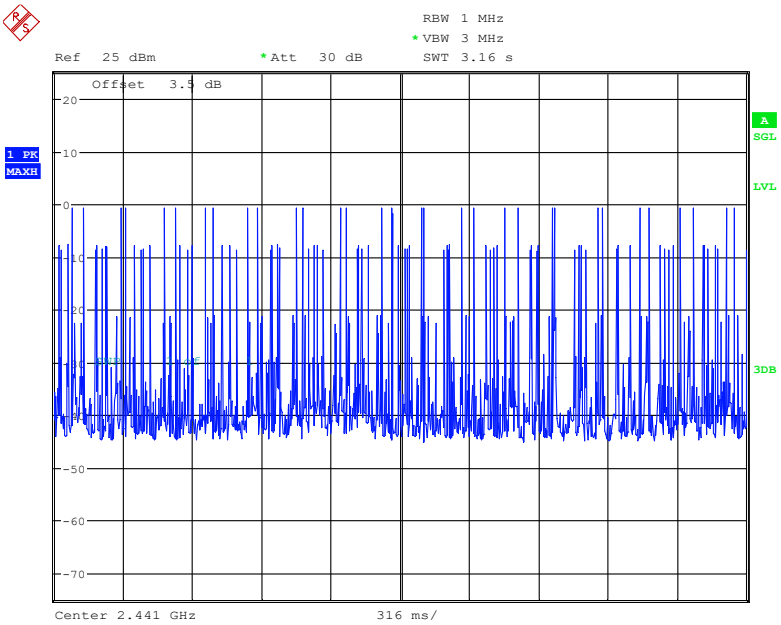


Date: 26.JUL.2022 21:29:01

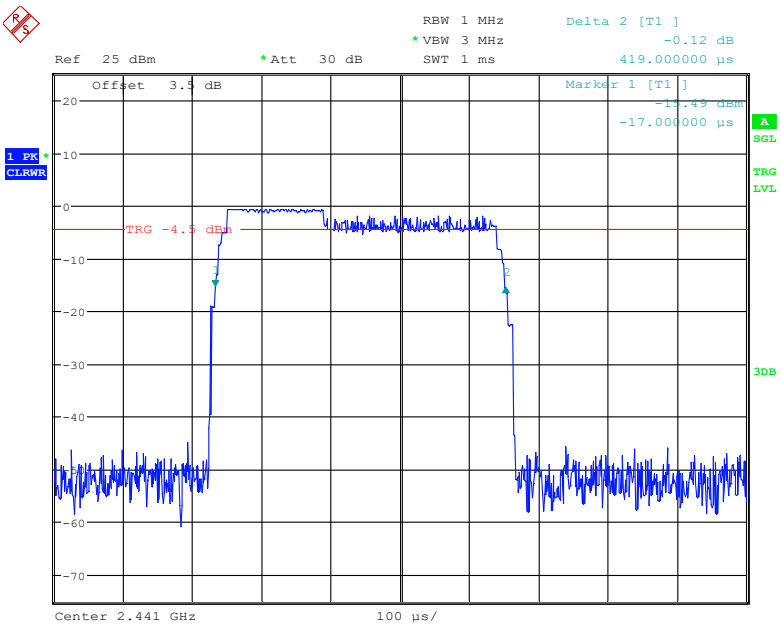


Date: 26.JUL.2022 21:29:17

EDR (8DPSK):
3DH1

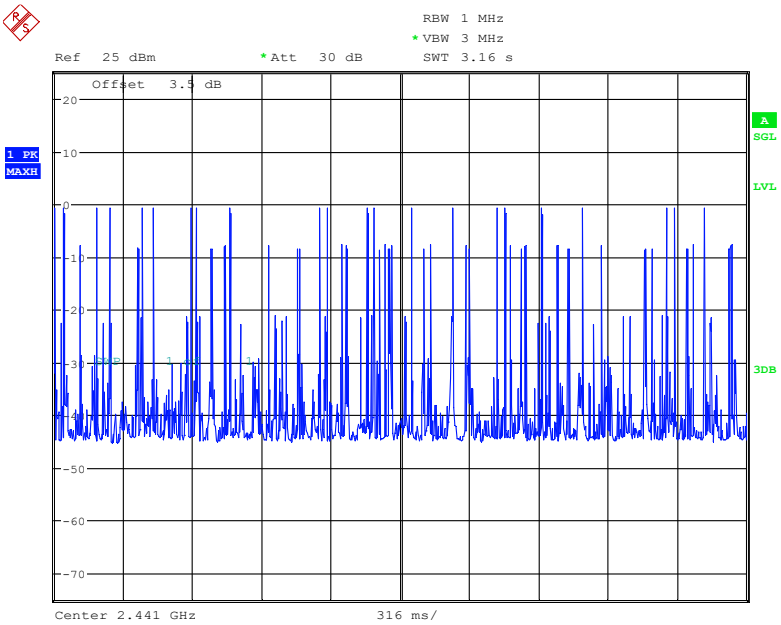


Date: 26.JUL.2022 21:34:06

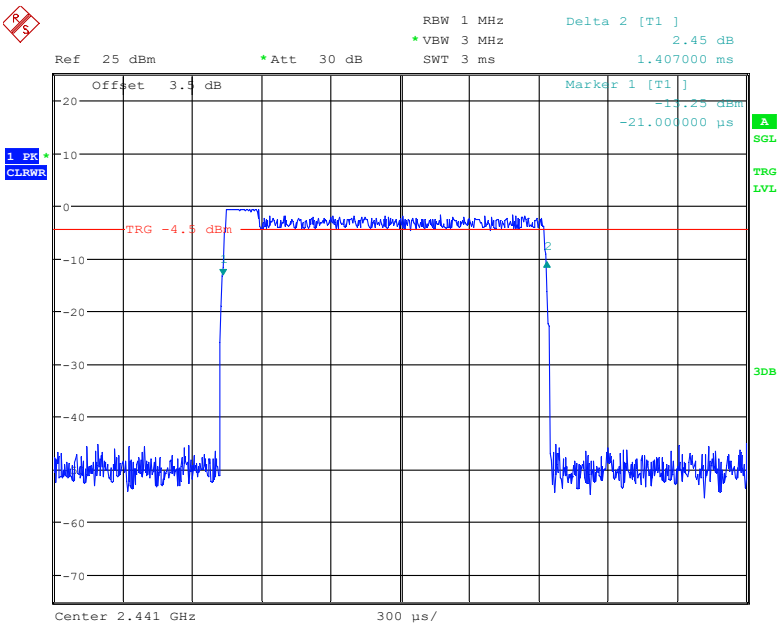


Date: 26.JUL.2022 21:34:21

3DH3

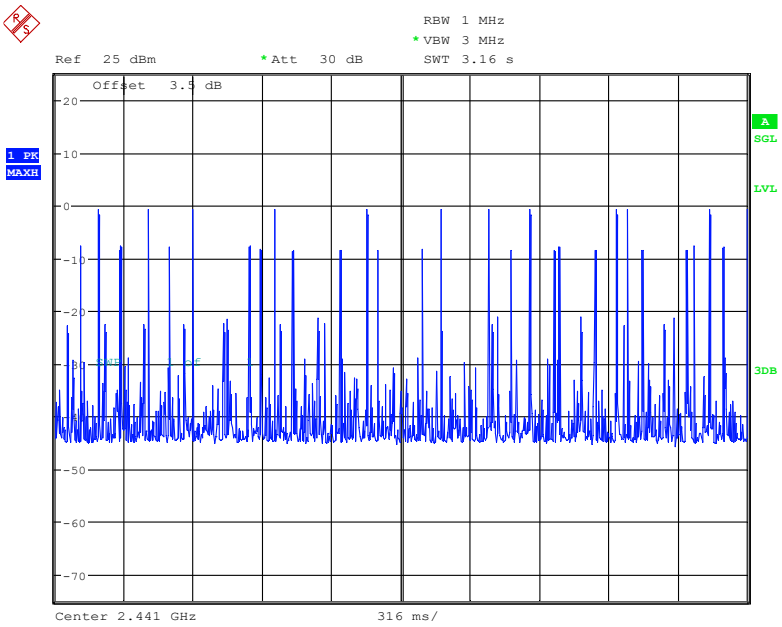


Date: 26.JUL.2022 21:34:55

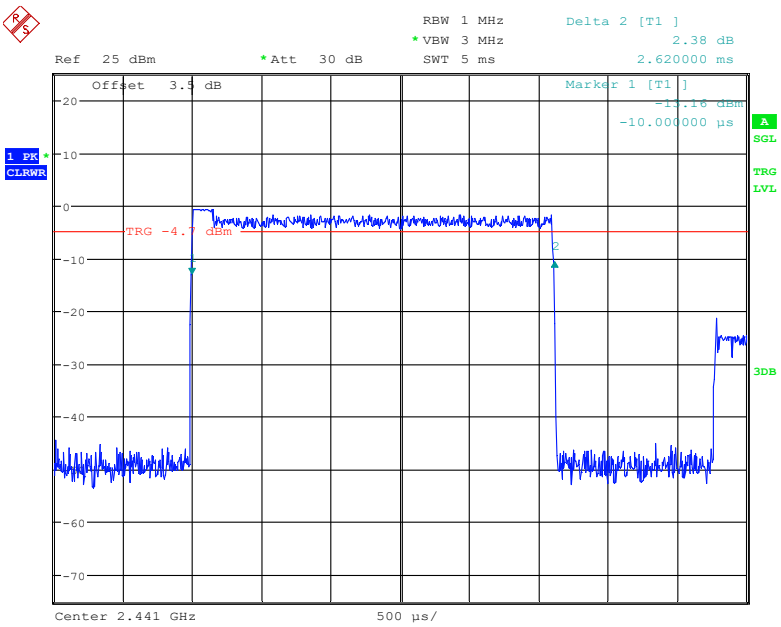


Date: 26.JUL.2022 21:35:10

3DH5



Date: 26.JUL.2022 21:38:11



Date: 26.JUL.2022 21:38:26

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.

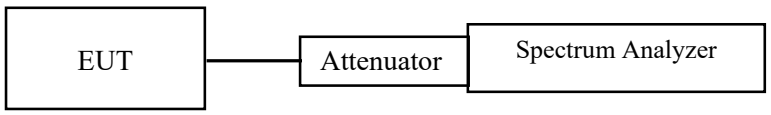
According to RSS-247§ 5.1(b) &§ 5.4(b):

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:	27.1 ℃
Relative Humidity:	58 %
ATM Pressure:	101.0 kPa

The testing was performed by Roger Ling on 2022-07-26.

EUT operation mode: Transmitting

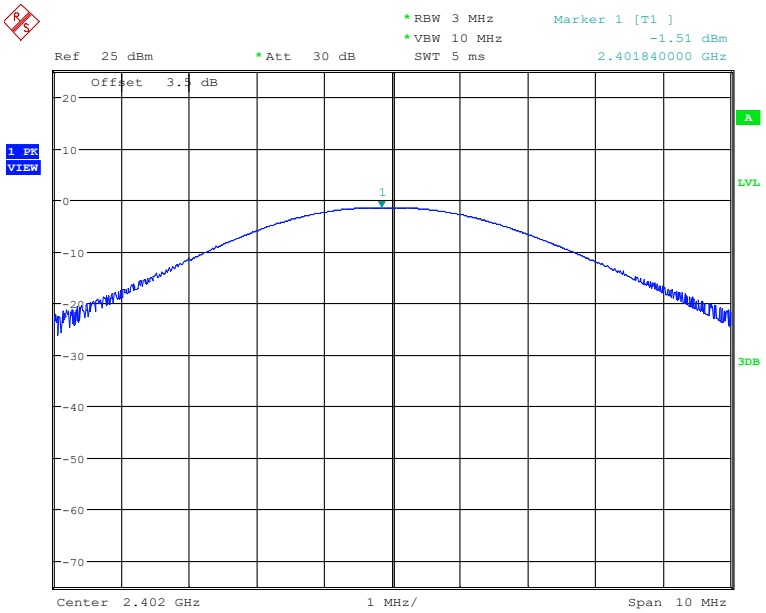
Test Result: Pass

Please refer to following table and plots.

Mode	Channel	Frequency (MHz)	Peak Output Power (dBm)	Limit (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)
BDR (GFSK)	Low	2402	-1.51	21	2.0	0.49	36
	Middle	2441	-0.61	21	2.0	1.39	36
	High	2480	-0.42	21	2.0	1.58	36
EDR (π/4-DQPSK)	Low	2402	-1.56	21	2.0	0.44	36
	Middle	2441	-0.61	21	2.0	1.39	36
	High	2480	-0.44	21	2.0	1.56	36
EDR (8DPSK)	Low	2402	-1.51	21	2.0	0.49	36
	Middle	2441	-0.60	21	2.0	1.40	36
	High	2480	-0.46	21	2.0	1.54	36

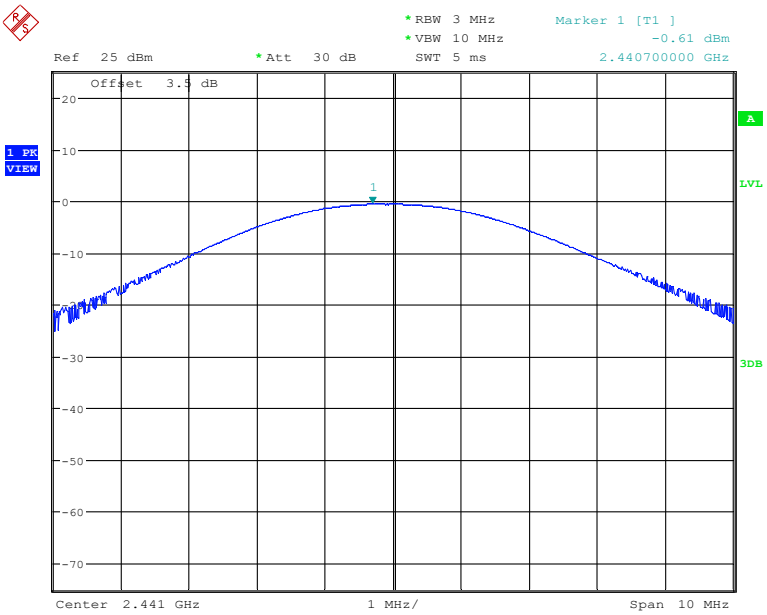
BDR (GFSK):

Low Channel



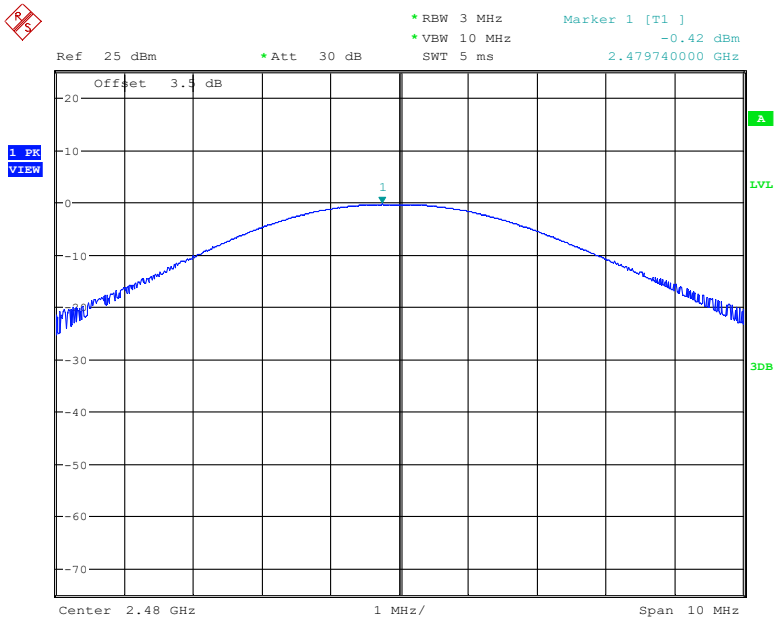
Date: 26.JUL.2022 20:46:47

Middle Channel



Date: 26.JUL.2022 20:56:03

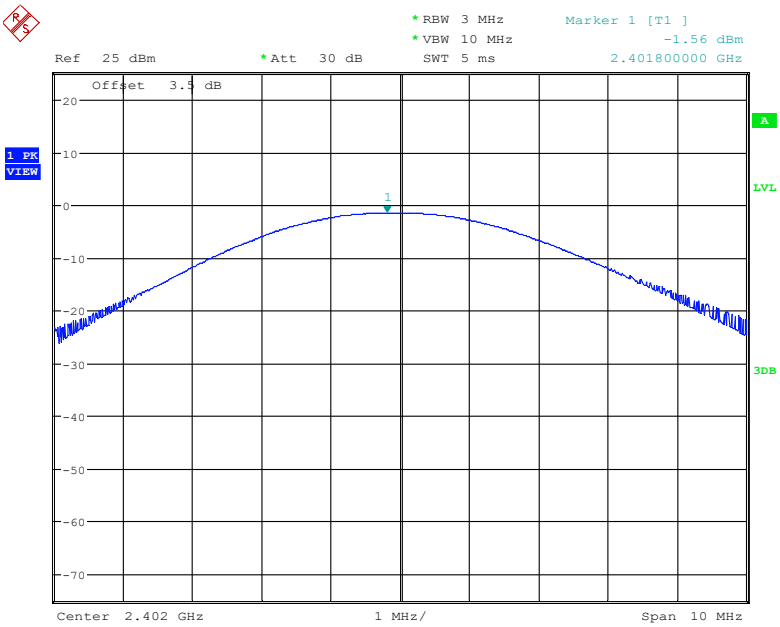
High Channel



Date: 26.JUL.2022 21:05:11

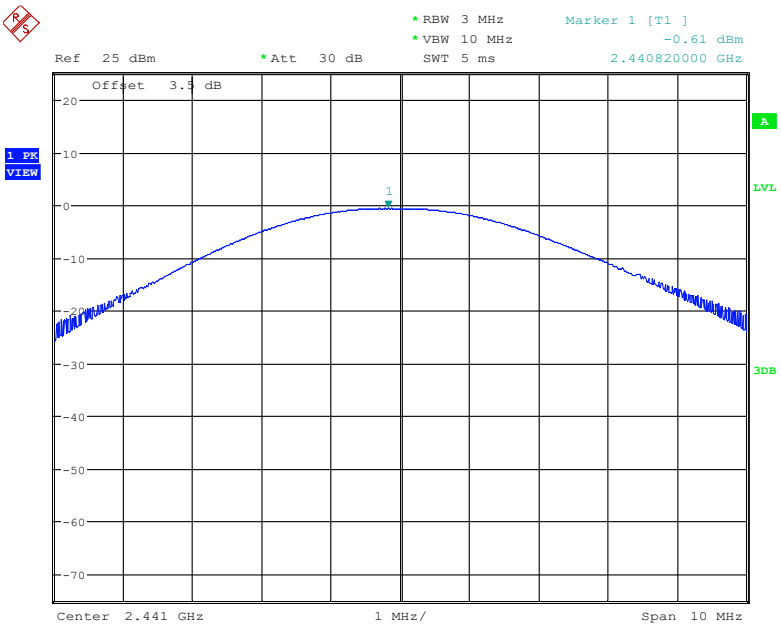
EDR (π/4-DQPSK):

Low Channel



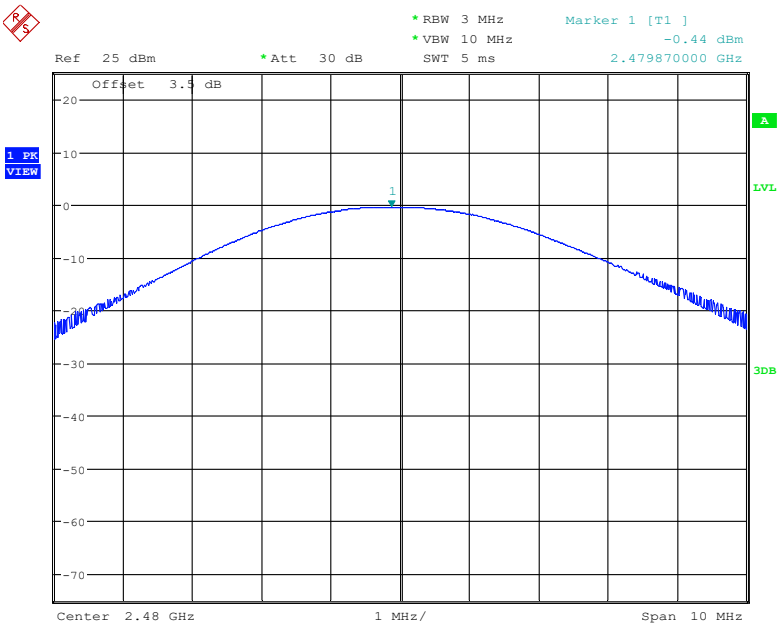
Date: 26.JUL.2022 20:49:55

Middle Channel



Date: 26.JUL.2022 20:59:53

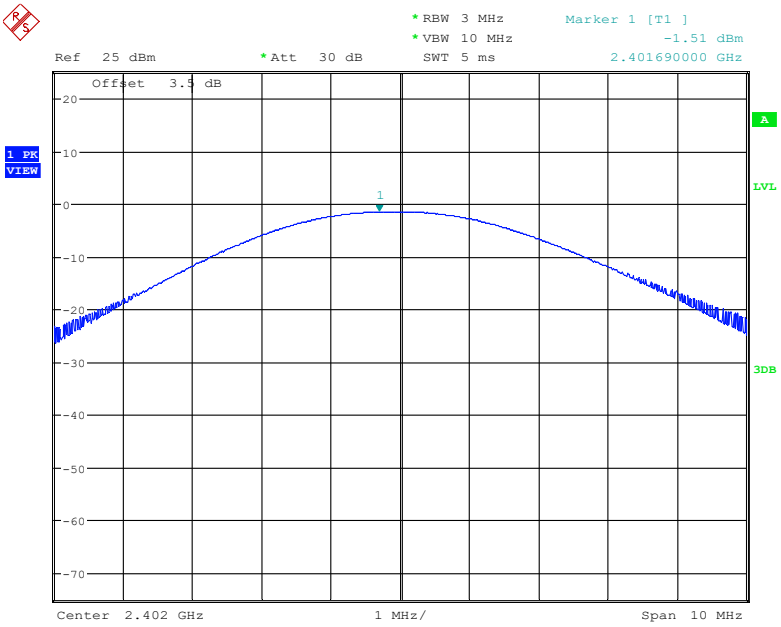
High Channel



Date: 26.JUL.2022 21:07:52

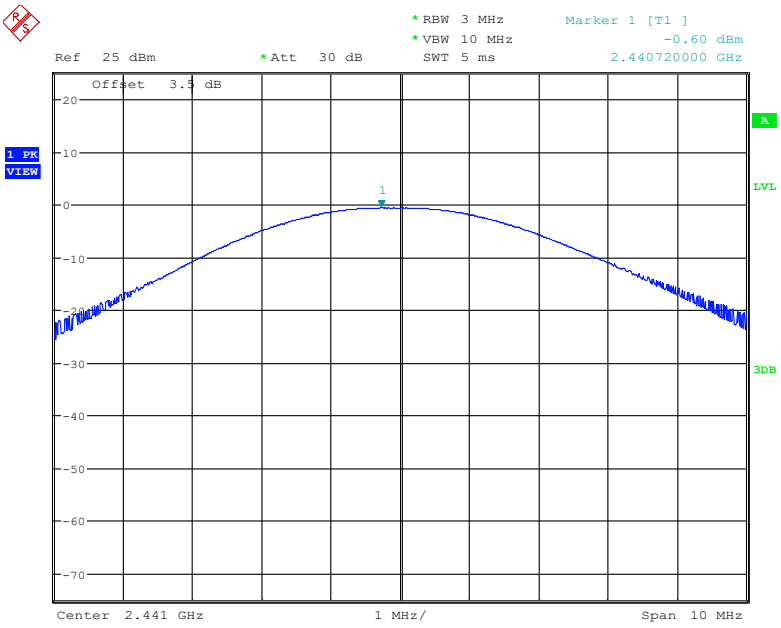
EDR (8DPSK):

Low Channel



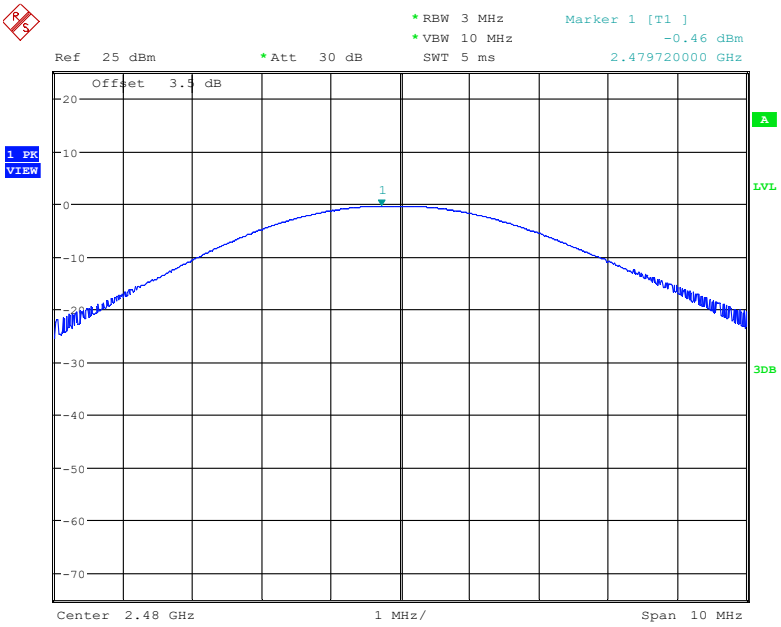
Date: 26.JUL.2022 20:53:02

middle Channel



Date: 26.JUL.2022 21:02:12

High Channel



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

Applicable Standard

According to FCC §15.247(d).

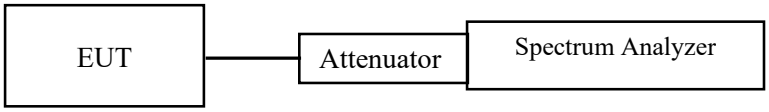
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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:	27.1 ℃
Relative Humidity:	58 %
ATM Pressure:	101.0 kPa

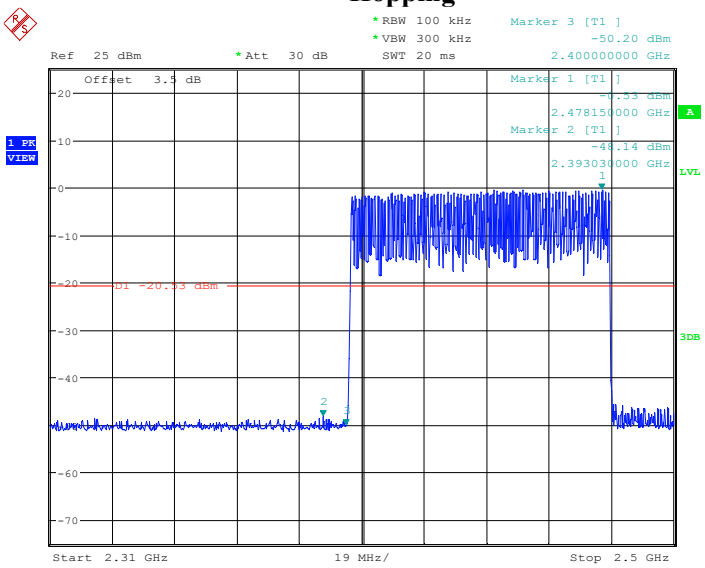
The testing was performed by Roger Ling on 2022-07-26.

EUT operation mode: Transmitting

Test Result: Pass

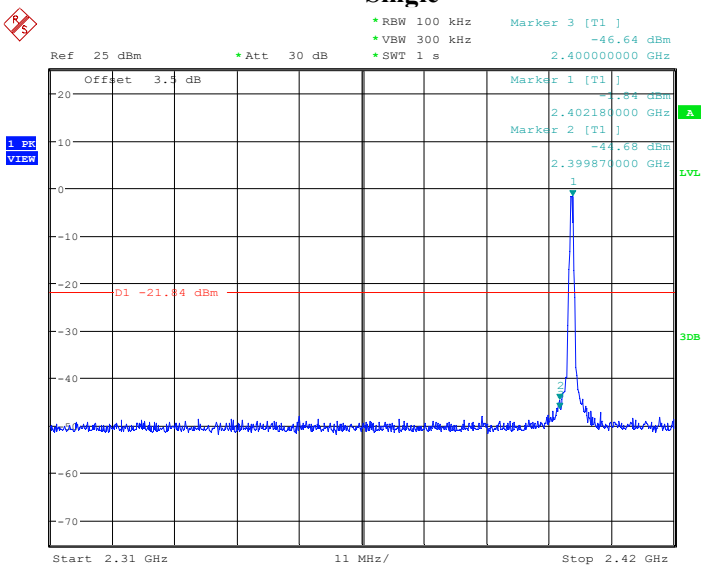
Please refer to following plots

BDR (GFSK): Band Edge-Left Side Hopping



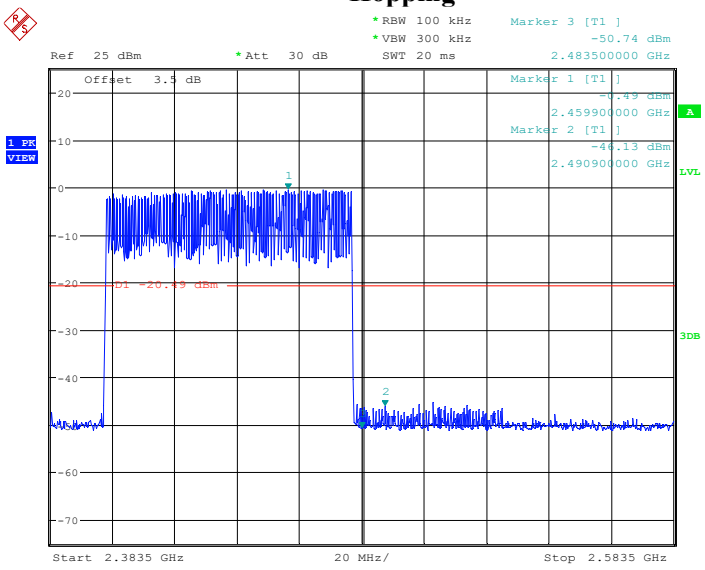
Date: 26.JUL.2022 21:22:19

Single



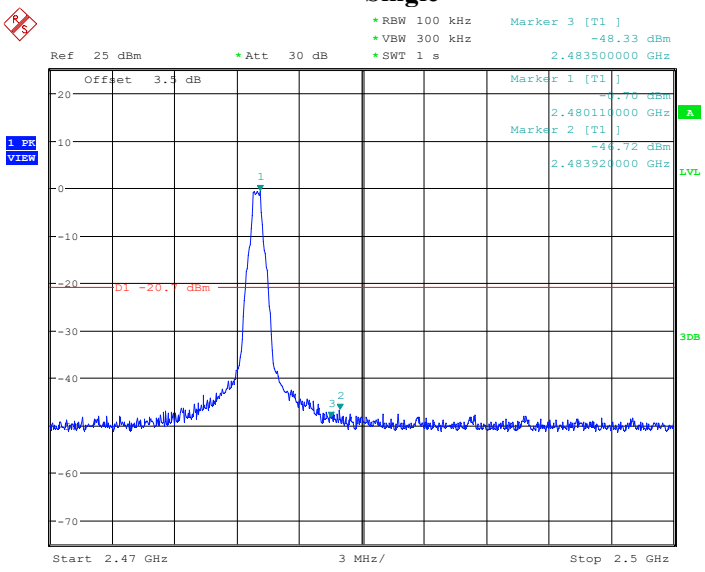
Date: 26.JUL.2022 20:48:41

BDR (GFSK): Band Edge-Right Side Hopping



Date: 26.JUL.2022 21:24:08

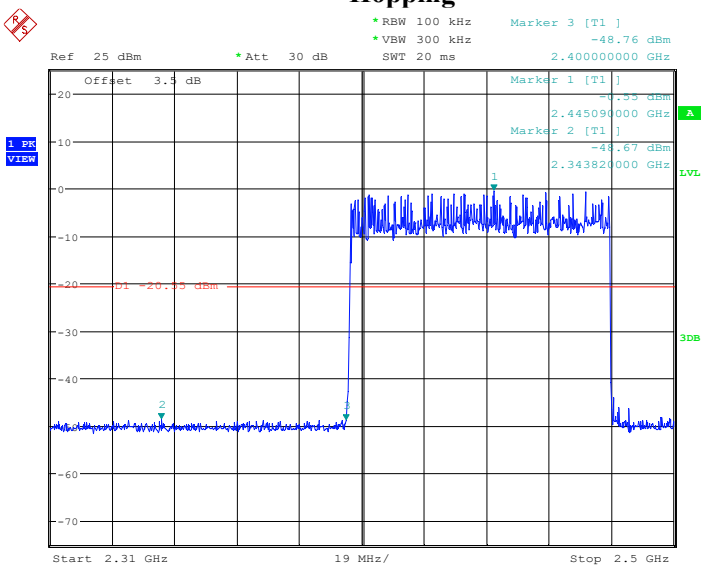
Single



Date: 26.JUL.2022 21:07:05

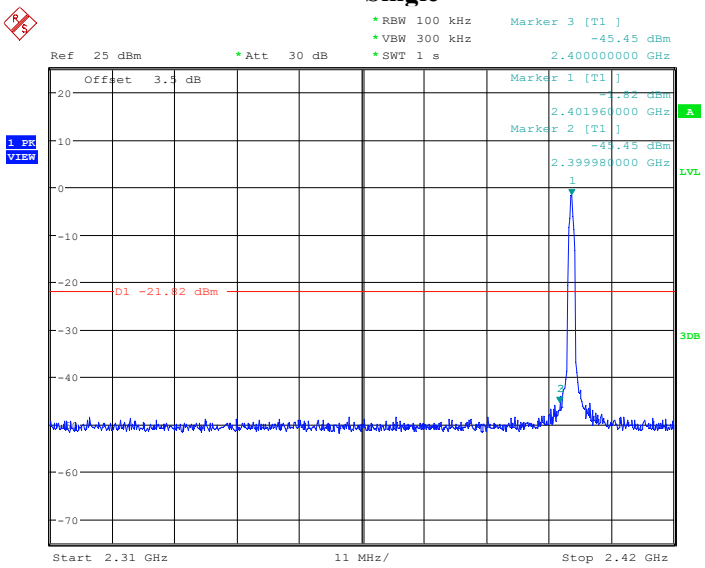
EDR (π/4-DQPSK): Band Edge-Left Side

Hopping



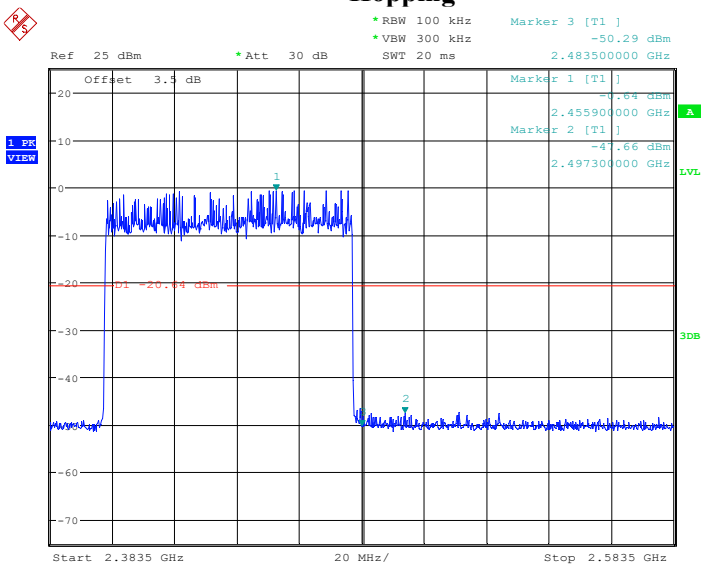
Date: 26.JUL.2022 21:31:06

Single



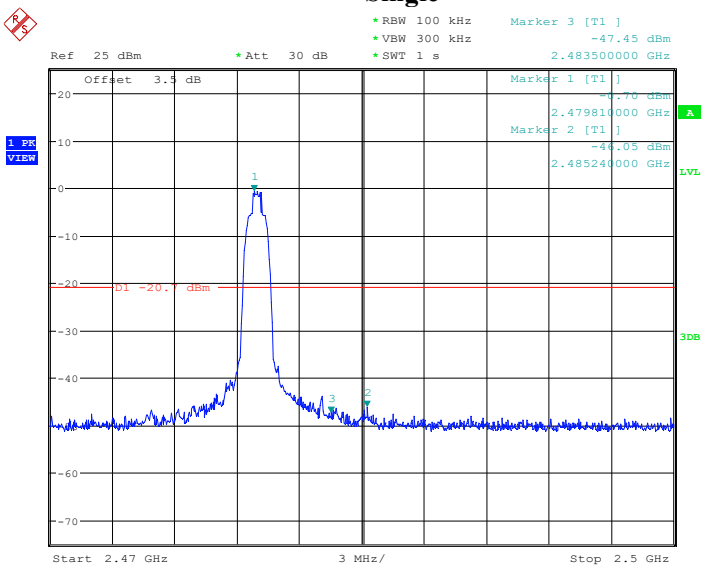
Date: 26.JUL.2022 20:51:49

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



Date: 26.JUL.2022 21:32:55

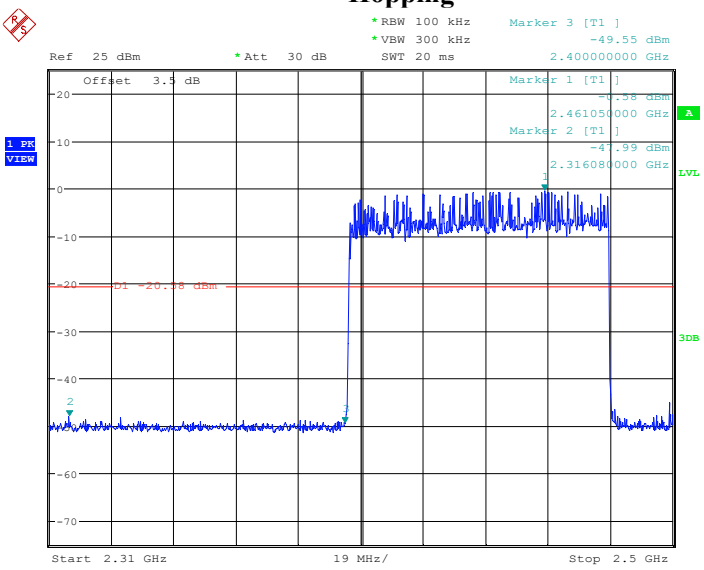
Single



Date: 26.JUL.2022 21:09:46

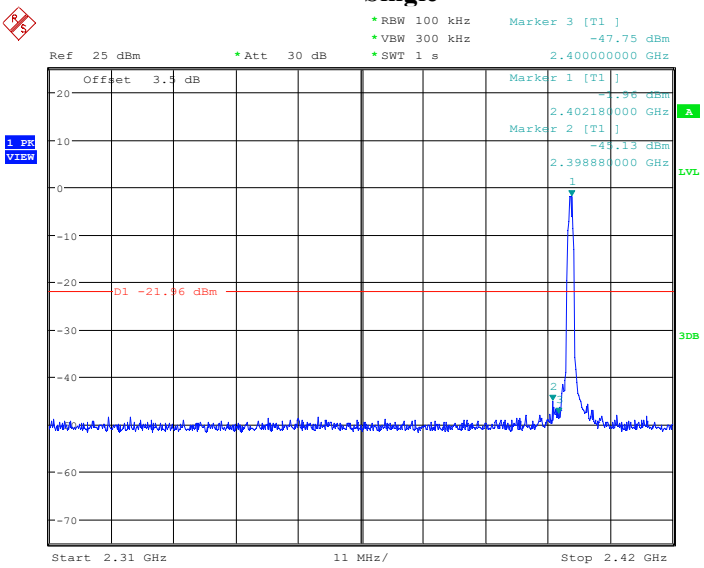
EDR (8DPSK): Band Edge-Left Side

Hopping



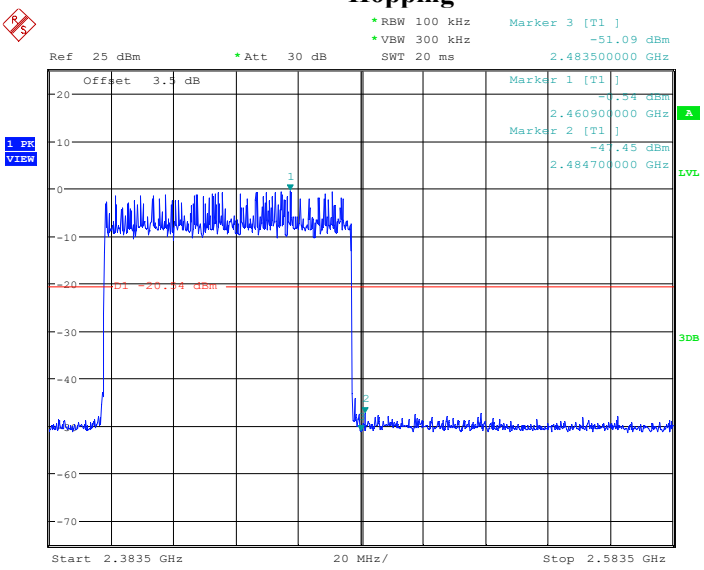
Date: 26.JUL.2022 21:40:15

Single



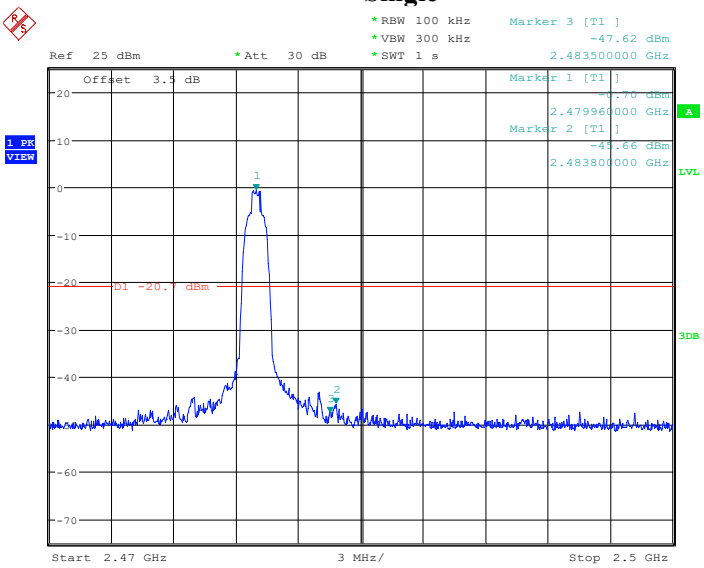
Date: 26.JUL.2022 20:54:56

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



Date: 26.JUL.2022 21:42:04

Single



Date: 26.JUL.2022 21:12:43

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