TEST REPORT

Applicant Name :	FCC: Porta Phone Company Inc ISEDC: PORTA PHONE CO., INC.
Address :	FCC: 145 Dean Knauss Drive Narragansett, Rhode Island 02882 United States ISEDC: 145 Dean Knauss Drive Narragansett, RI 02882, United States of America
Report Number :	SZNS211206-61772E-RFA
FCC ID:	B4HDBXR
IC	3064A-DBXR

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:	Full Duplex 900 MHz / 2.4 GHz Transceiver-Remote
Model No.:	DBX-RS
Multiple Model(s) No.:	DBX-RD,DBX-RSW,DBX-RDW (Please refer to DOS for Model difference)
Trade Mark:	N/A
Date Received:	2021/12/06
Date of Test:	2021/12/25~2022/02/23
Report Date:	2022/02/28

Test Result:	Pass*

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

Prepared and Checked By:

Black Ding

EMC Engineer

Approved By:

Robert Li

EMC Engineer

Note: This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "★ ".

Shenzhen Accurate Technology Co., Ltd. is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with an asterisk '*'. Customer model name, addresses, names, trademarks etc. are not considered data.

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

HVIN	DBX-RS
Frequency Range	2407-2475MHz
Maximum conducted Peak output power	18.60dBm
Modulation Technique	GFSK
Antenna Specification*	0 dBi(It is provided by the applicant)
Voltage Range	DC3.7V from battery
Sample number	SZNS211206-61772E-RF-S1for RF conducted SZNS211206-61772E-RF-S2 for radiated 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. 2021 Amendment 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.

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 429 7.01.

Listed by Innovation, Science and Economic Development Canada (ISEDC), the Registration Number is 5077A.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in an engineering mode.

Channel list

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	**2407**	15	2425	30	2443	45	2461
1	2408	16	2426	31	2444	46	2462
2	2409	17	2427	32	2445	47	2466
3	2410	18	2428	33	2446	48	2467
4	2411	19	2429	**34**	**2450**	49	2468
5	2412	20	2430	35	2451	50	2469
6	2413	21	2434	36	2452	51	2470
7	2414	22	2435	37	2453	52	2471
8	2418	23	2436	38	2454	53	2472
9	2419	24	2437	39	2455	54	2473
10	2420	25	2438	40	2456	55	2474
11	2421	26	2439	41	2457	**56**	**2475**
12	2422	27	2440	42	2458	/	/
13	2423	28	2441	43	2459	/	/
14	2424	29	2442	44	2460	/	/

The equipment has designed 57 channels totally, but only 20 channels selected from the 57 channels active at same time, which were separated by more than 2MHz.

EUT was test in channel 0, 34, 56.

EUT Exercise Software

EUT was configured to testing mode by applicant and power level is default*.

Special Accessories

No special accessory.

Equipment Modifications

No modification was made to the EUT tested.

Support Equipment List and Details

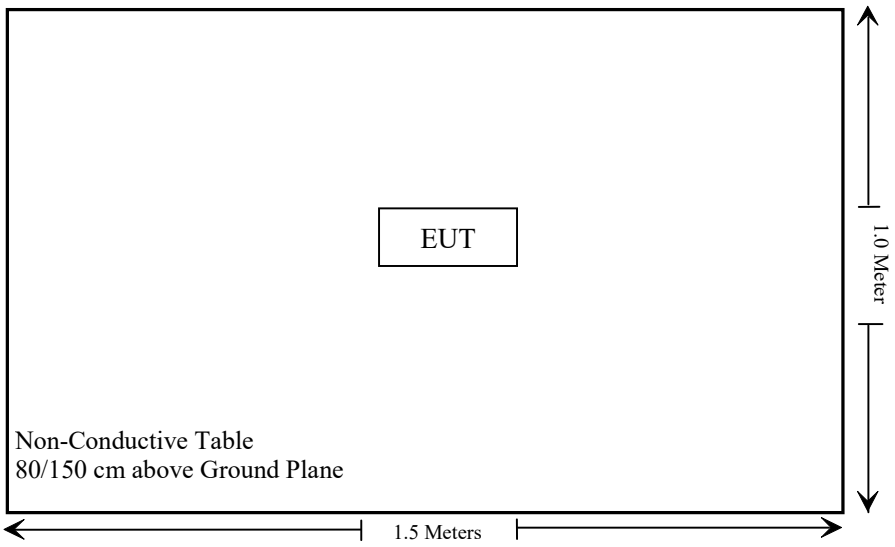
Manufacturer	Description	Model	Serial Number
/	/	/	/

External I/O Cable

Cable Description	Length (m)	From Port	To
/	/	/	/

Block Diagram of Test Setup

For Radiated Emission



SUMMARY OF TEST RESULTS

FCC Rules	ISEDC Rules	Description of Test	Result
§15.247 (i), §2.1093	RSS-102	RF EXPOSURE	Compliant
§15.203	RSS-Gen §6.8	Antenna Requirement	Compliant
§15.207(a)	RSS-Gen §8.8	AC Line Conducted Emissions	Not Applicable
§15.205, §15.209 & §15.247(d)	RSS-247 § 5.5	Radiated Emissions	Compliant
§15.247(a)(1)	RSS- Gen§6.7, RSS-247 § 5.1 (a)	99% Occupied Bandwidth & 20 dB Emission Bandwidth	Compliant
§15.247(a)(1)	RSS-247 § 5.1 (b)	Channel Separation Test	Compliant
§15.247(a)(1)(iii)	RSS-247 § 5.1 (d)	Time of Occupancy (Dwell Time)	Compliant
§15.247(a)(1)(iii)	RSS-247 § 5.1 (d)	Quantity of hopping channel Test	Compliant
§15.247(b)(1)	RSS-247 § 5.1(b) &§ 5.4(b)	Peak Output Power Measurement	Compliant
§15.247(d)	RSS-247 § 5.5	Band edges	Compliant

Not Applicable: EUT only powered by battery.
Note: Pre-scan all models, the worst case model DBX-RS was selected to test.

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
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)					
Wainwright	High Pass Filter	WHKX3.6/18 G-10SS	5	2021/12/14	2022/12/13
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
RF Conducted Test					
SPECTRUM ANALYZER	Rohde & Schwarz	FSU26	200982	2021/07/06	2022/07/05
WEINSCHEL	10dB Attenuator	5324	AU 3842	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.

Measurement Result

Please refer to SAR test report: SZNS211206-62024E-SA

RSS-102 – RF EXPOSURE

Applicable Standard

According to RSS-102, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

Result: Compliance.

Please refer to SAR Report *Number:* SZNS211206-62024E-SA

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.

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 arrangements which were permanently attached and the gain is 0dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Type	Antenna Gain	Impedance
Monopole	0dBi	50 Ω

Result: Compliance.

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

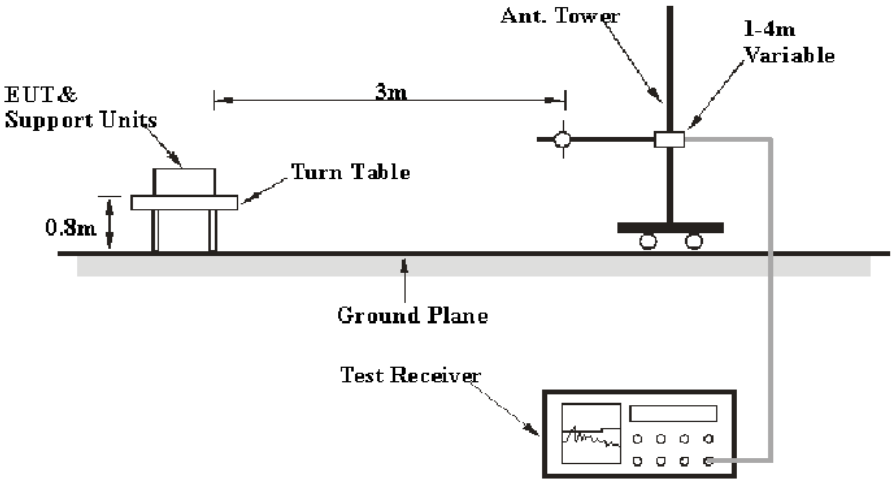
Applicable Standard

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

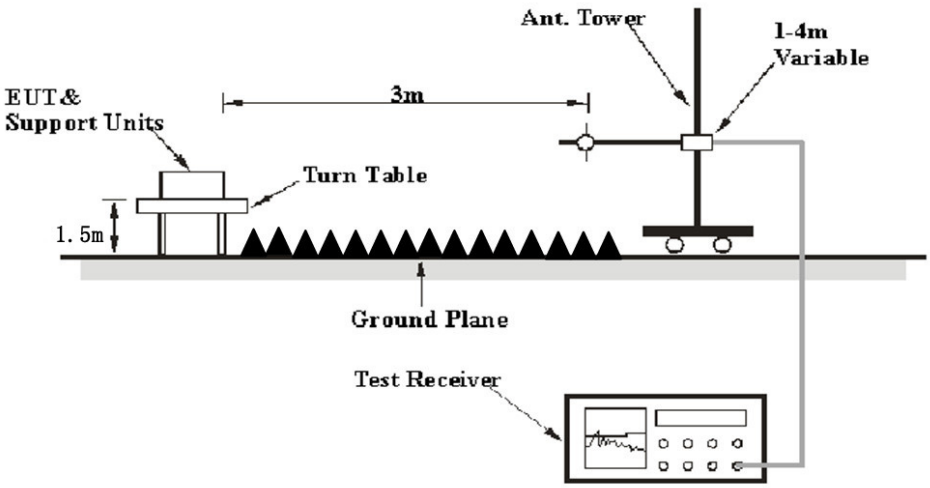
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either 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(d), 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.

EUT Setup

Below 1 GHz:



Above 1GHz:



The radiated emission tests were 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 limits and RSS-247/RSS-Gen limits.

EMI Test Receiver & Spectrum Analyzer Setup

During the radiated emission test, 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.

Corrected 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 or Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a over limit/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

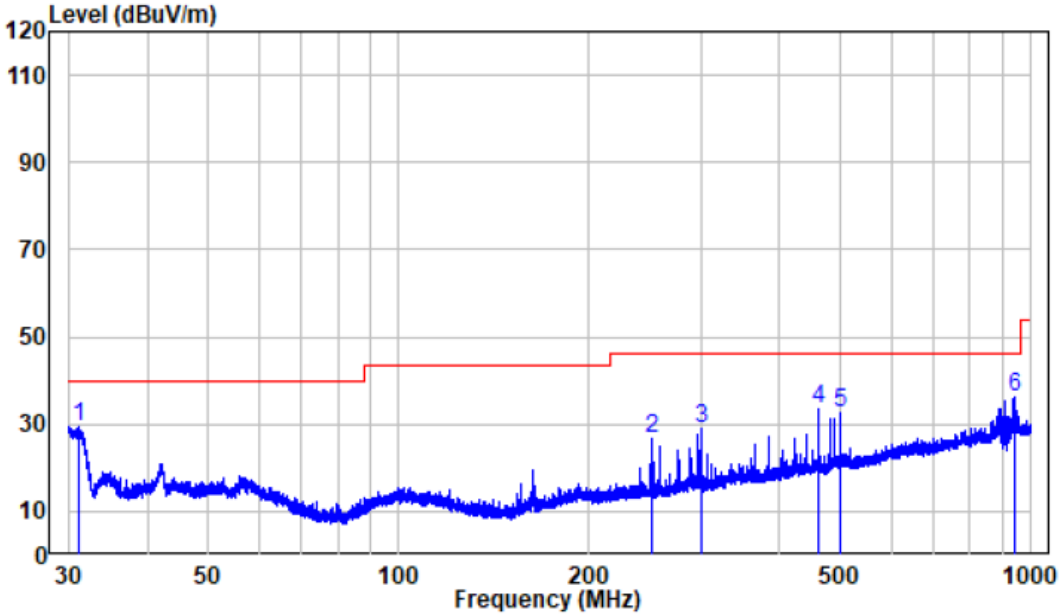
Temperature:	25 ℃
Relative Humidity:	64 %
ATM Pressure:	101.0 kPa

The testing was performed by Bin Deng on 2021-12-28.

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

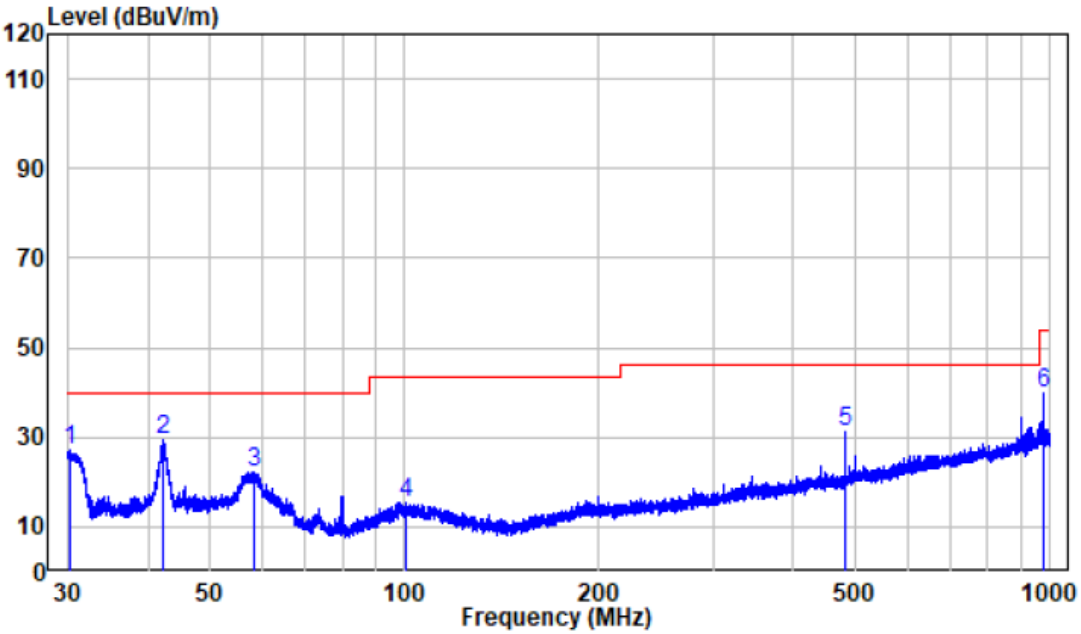
30MHz-1GHz: *(worst case for Middle channel)*

Horizontal:



	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	31.152	-12.27	41.59	29.32	40.00	-10.68	Peak
2	252.063	-10.69	37.25	26.56	46.00	-19.44	Peak
3	299.973	-9.23	38.39	29.16	46.00	-16.84	Peak
4	460.929	-5.42	38.83	33.41	46.00	-12.59	Peak
5	499.425	-4.27	37.07	32.80	46.00	-13.20	Peak
6	944.198	1.86	34.53	36.39	46.00	-9.61	Peak

Vertical



	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	30.304	-12.36	39.50	27.14	40.00	-12.86	Peak
2	42.265	-10.01	39.37	29.36	40.00	-10.64	Peak
3	58.305	-10.01	32.14	22.13	40.00	-17.87	Peak
4	100.669	-11.72	27.17	15.45	43.50	-28.05	Peak
5	480.107	-5.00	36.06	31.06	46.00	-14.94	Peak
6	975.325	2.35	37.71	40.06	54.00	-13.94	Peak

Above 1GHz:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/QP/Ave.		Height (m)	Polar (H/V)				
Low Channel (2407 MHz)									
2310	68.55	PK	172	2.0	H	-7.24	61.31	74	-12.69
2310	53.56	AV	172	2.0	H	-7.24	46.32	54	-7.68
2310	67.83	PK	334	2.4	V	-7.24	60.59	74	-13.41
2310	53.64	AV	334	2.4	V	-7.24	46.40	54	-7.60
2390	73.11	PK	90	1.6	H	-7.22	65.89	74	-8.11
2390	54.14	AV	90	1.6	H	-7.22	46.92	54	-7.08
2390	73.64	PK	214	1.9	V	-7.22	66.42	74	-7.58
2390	54.19	AV	214	1.9	V	-7.22	46.97	54	-7.03
4814	55.06	PK	88	1.7	H	-3.51	51.55	74	-22.45
4814	55.62	PK	90	1.4	V	-3.51	52.11	74	-21.89
Middle Channel (2450 MHz)									
4900	55.25	PK	58	1.8	H	-3.28	51.97	74	-22.03
4900	55.91	PK	319	1.8	V	-3.28	52.63	74	-21.37
High Channel (2475 MHz)									
2483.5	75.50	PK	277	2.3	H	-7.20	68.30	74	-5.70
2483.5	54.85	AV	277	2.3	H	-7.20	47.65	54	-6.35
2483.5	77.26	PK	176	1.2	V	-7.20	70.06	74	-3.94
2483.5	54.92	AV	176	1.2	V	-7.20	47.72	54	-6.28
2500	69.05	PK	155	2.3	H	-7.18	61.87	74	-12.13
2500	54.91	AV	155	2.3	H	-7.18	47.73	54	-6.27
2500	68.97	PK	29	1.8	V	-7.18	61.79	74	-12.21
2500	54.85	AV	29	1.8	V	-7.18	47.67	54	-6.33
4950	54.91	PK	246	2.1	H	-3.04	51.87	74	-22.13
4950	55.75	PK	78	1.4	V	-3.04	52.71	74	-21.29

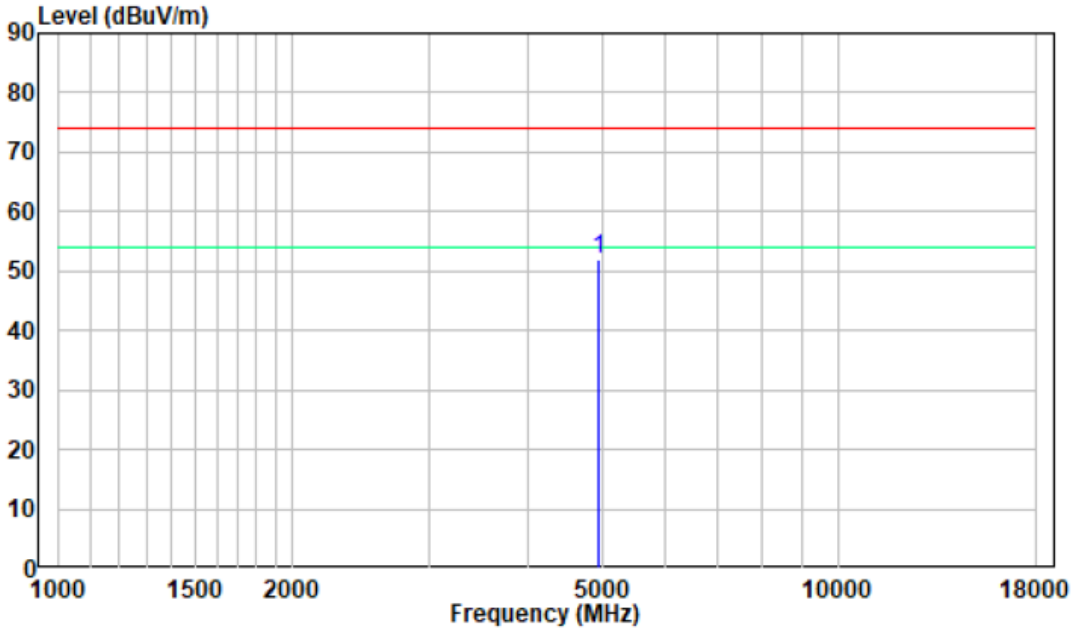
Note:
Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor
Corrected Amplitude = Corrected Factor + Reading
Margin = Corrected. Amplitude - Limit
The other spurious emission which is in the noise floor level was not recorded.
The test result of peak was less than the limit of average, so just peak value were recorded.

1-18GHz

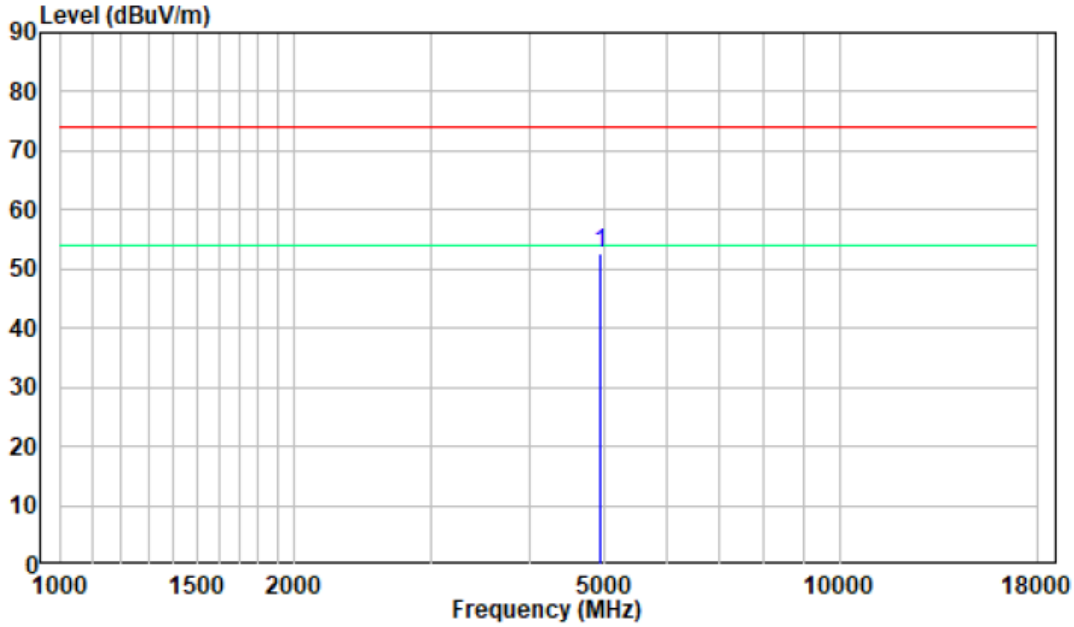
Pre-scan for Peak

High Channel

Horizontal:



Vertical:

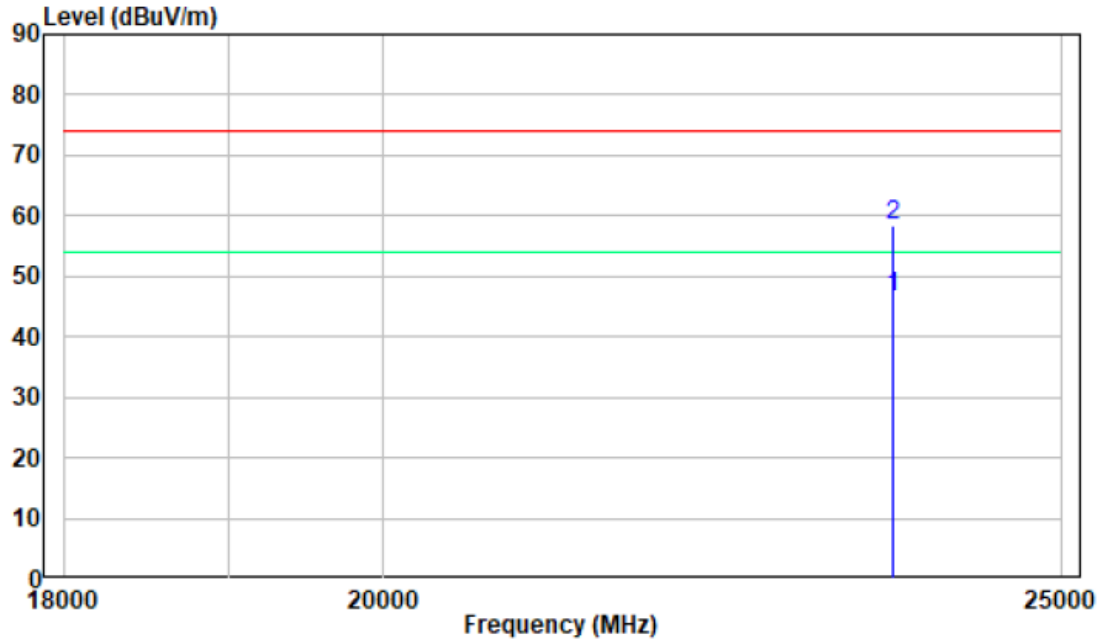


18-25GHz

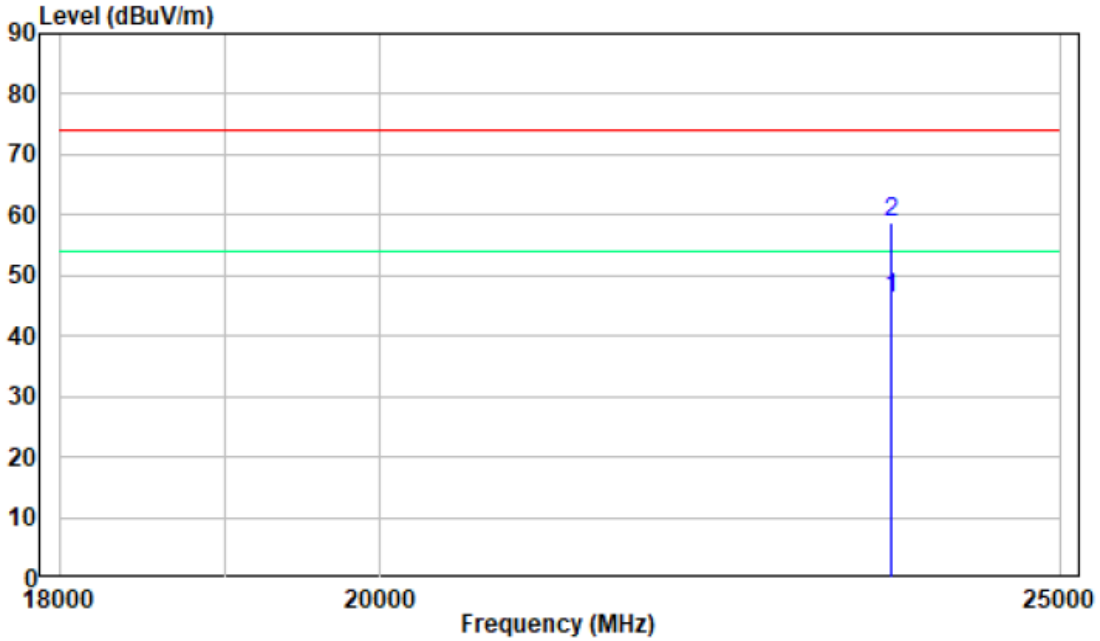
Pre-scan for Peak

High Channel

Horizontal:



Vertical:



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

Applicable Standard

Frequency hopping systems (FHSs) 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.

Test Procedure

1. Set the EUT in transmitting mode, maxhold the channel and in Operating mode, RBW was set at 30 kHz, VBW⩾ 3RBW max-hold the channel.
2. Set the adjacent channel of the EUT and maxhold another trace.
3. Measure the channel separation.

Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Fan Yang on 2022-02-23.

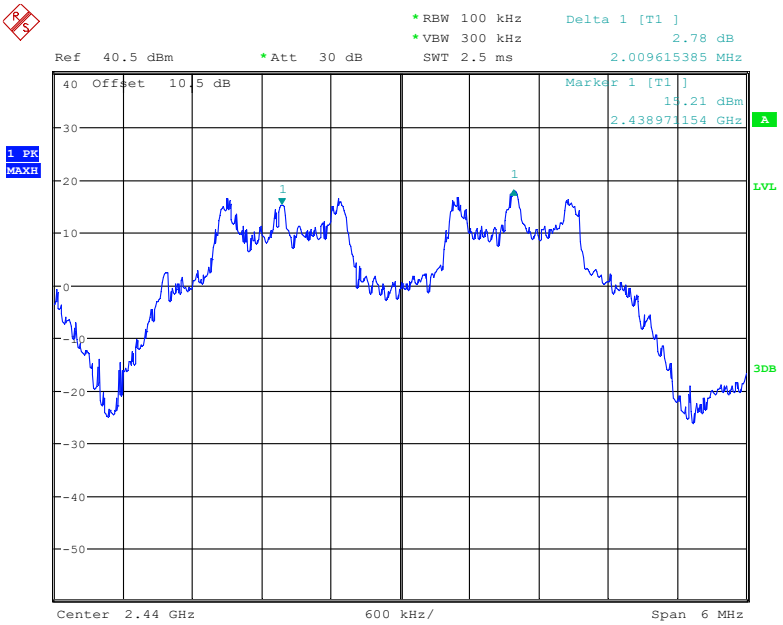
EUT operation mode: Transmitting

Test Result: Compliant.

Note: According to frequency table in page 6 and inverstigating the hopping channel test in page 28, the minimum channel separation is the worst case which was recorded as below:

Test Mode	Channel Separation (MHz)	20 dBc BW (MHz)	Two-thirds of the 20 dB bandwidth (MHz)	Channel Separation Limit	Result
GFSK					
Hopping	2.010	2.064	1.376	> two-thirds of the 20 dB bandwidth	Pass

Please refer to the below plots:



Date: 23.FEB.2022 19:08:19

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

Applicable Standard

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

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

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

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

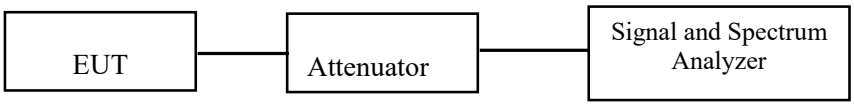
• The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

• 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:	25 ℃
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Fan Yang on 2021-12-25 and 2022-01-06.

EUT operation mode: Transmitting

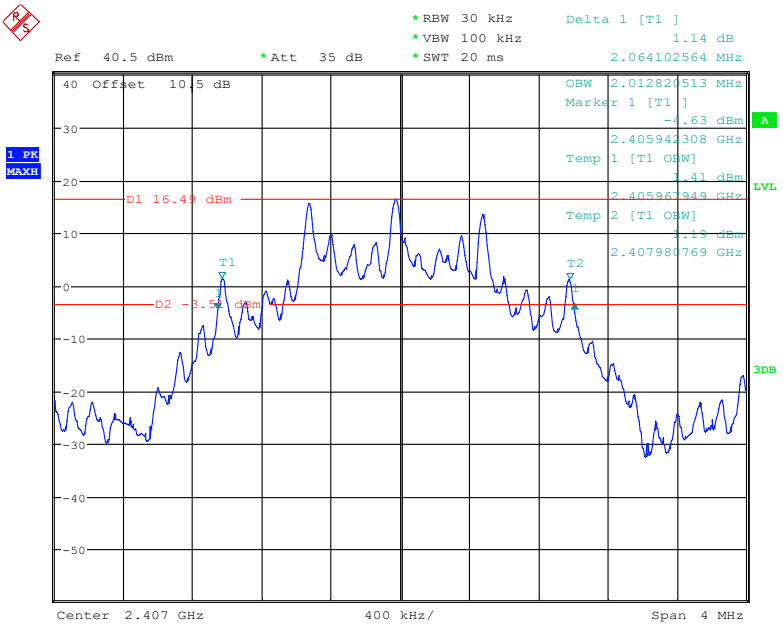
Test Result: Compliant.

Channel	Frequency (MHz)	20 dB Emission Bandwidth (MHz)	OBW (MHz)
Low	2407	2.064	2.013
Middle	2450	2.064	2.026
High	2475	2.064	2.026

Please refer to the below plots:

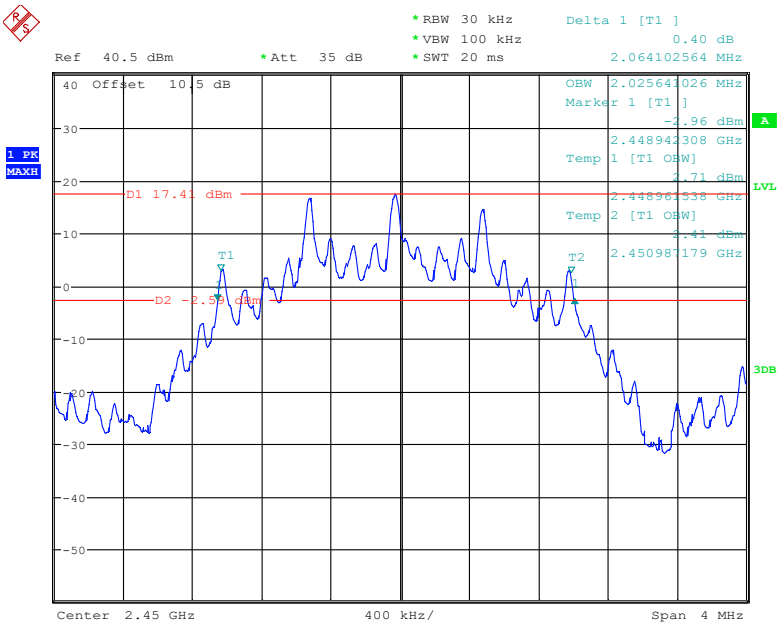
20 dB EMISSION BANDWIDTH& OBW

Low Channel



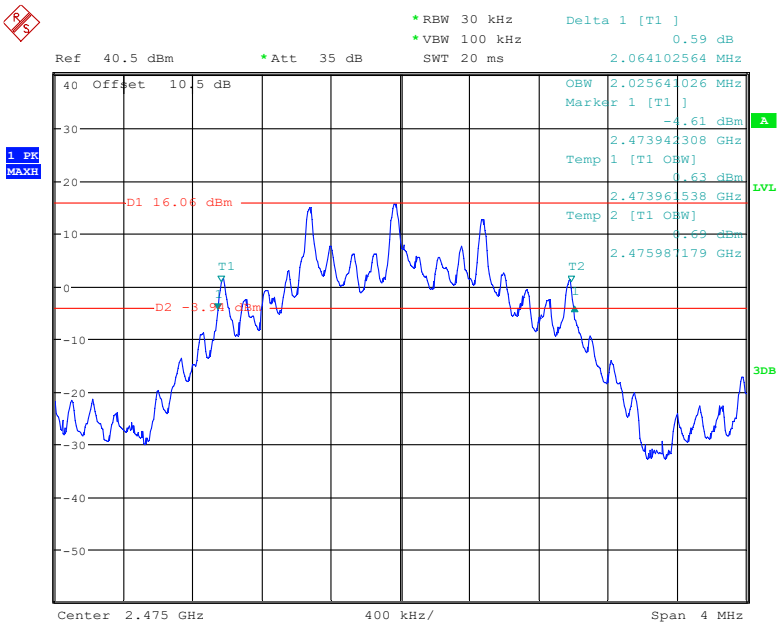
Date: 25.DEC.2021 14:29:22

Middle Channel



Date: 25.DEC.2021 14:31:37

High Channel



Date: 6.JAN.2022 16:08:57

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

Applicable Standard

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

Test Procedure

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

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

10. By using the max-hold function record the quantity of the channel.

Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

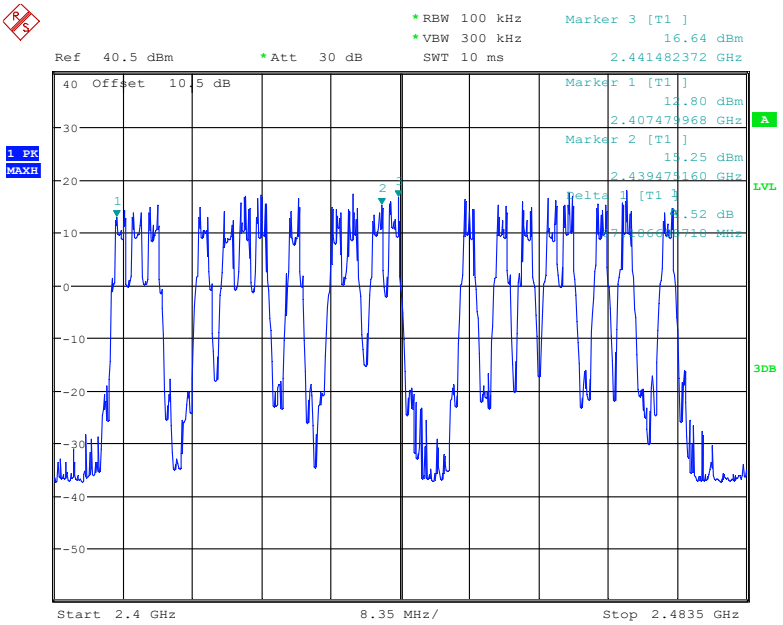
The testing was performed by Fan Yang on 2022-02-23.

EUT operation mode: Transmitting

Test Result: Compliant.

Mode	Frequency Range (MHz)	Number of Hopping Channel (CH)	Limit (CH)
GFSK	2400-2483.5	20	≥15

Hop



Date: 23.FEB.2022 19:23:30

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

Applicable Standard

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

Test Procedure

11. The EUT was worked in channel hopping.
12. Set the RBW to: 1MHz.
13. Set the VBW ≥ 3×RBW.
14. Set the span to 0Hz.
15. Detector = peak.
16. Sweep time = auto couple.
17. Trace mode = max hold.
18. Allow trace to fully stabilize.
19. Recorded the time of single pulses

Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Fan Yang on 2021-12-25.

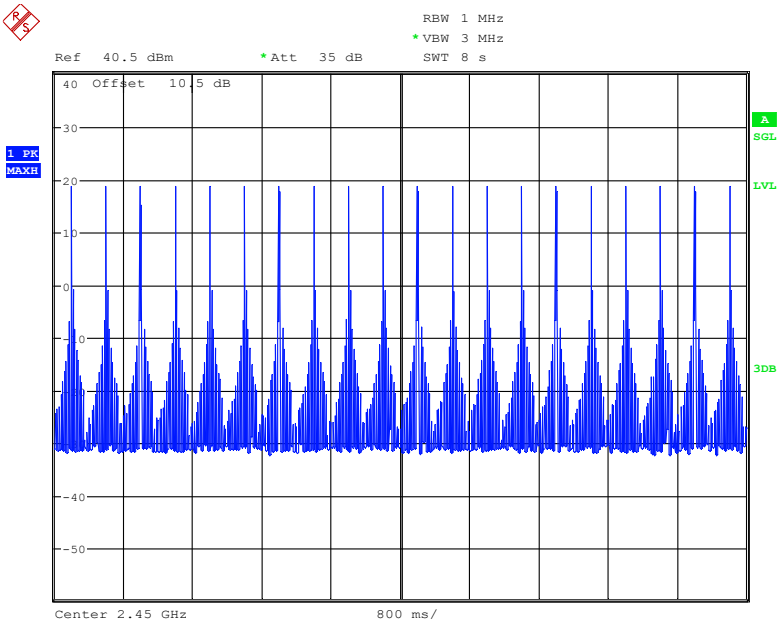
EUT operation mode: Transmitting

Test Result: Compliant.

Test Mode	Channel	Pulse Time [ms]	Total Hops [Num]	Result[s]	Limit[s]	Verdict
GFSK	Hop	0.529	20	0.011	<=0.4	PASS

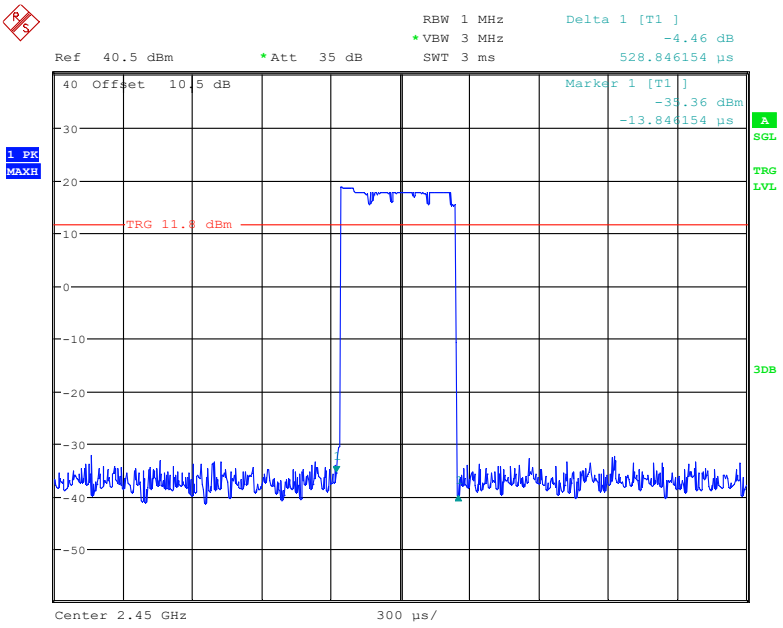
Note: A period time=0.4*20=8(s), Result= Pulse Time *Total hops

Hops



Date: 25.DEC.2021 15:08:48

Pulse time



Date: 25.DEC.2021 15:07:44

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

Applicable Standard

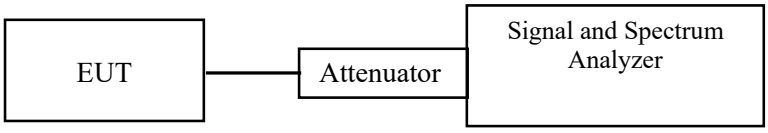
According to §15.247(b) (1), for frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. And for all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

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:	25 ℃
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Fan Yang on 2021-12-25.

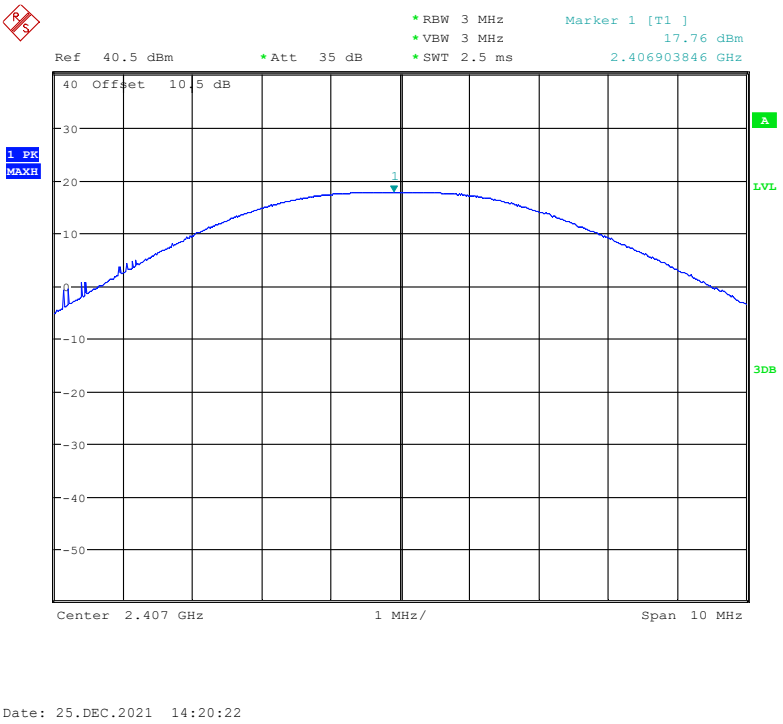
EUT operation mode: Transmitting

Test Result: Compliant.

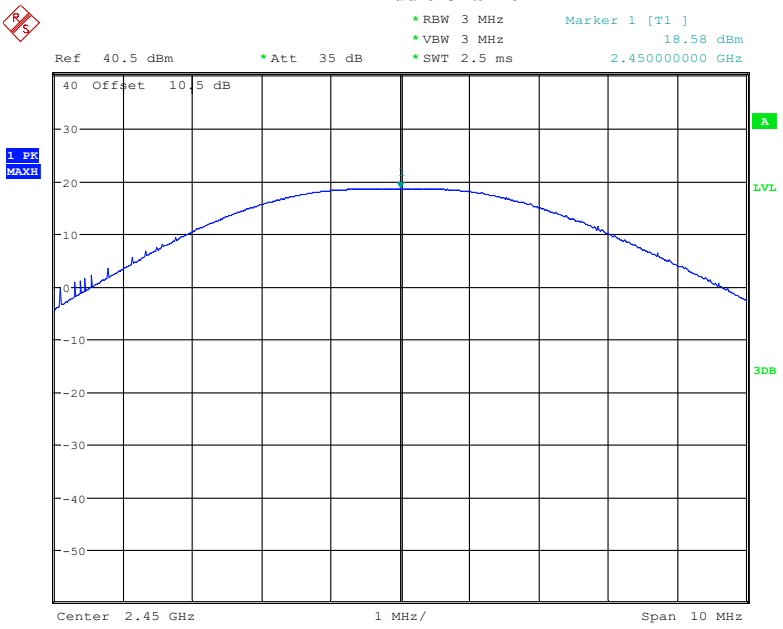
Mode	Channel	Frequency (MHz)	Peak Output Power (dBm)	Limit (dBm)
GFSK	Low	2407	17.76	21
	Middle	2450	18.58	21
	High	2475	18.60	21

Note: the antenna gain is 0dBi, the maximum EIRP=18.60dBm+0dBi=18.60dBm<36dBm, so it's compliance with the EIRP limit of ISEDC.

Low Channel

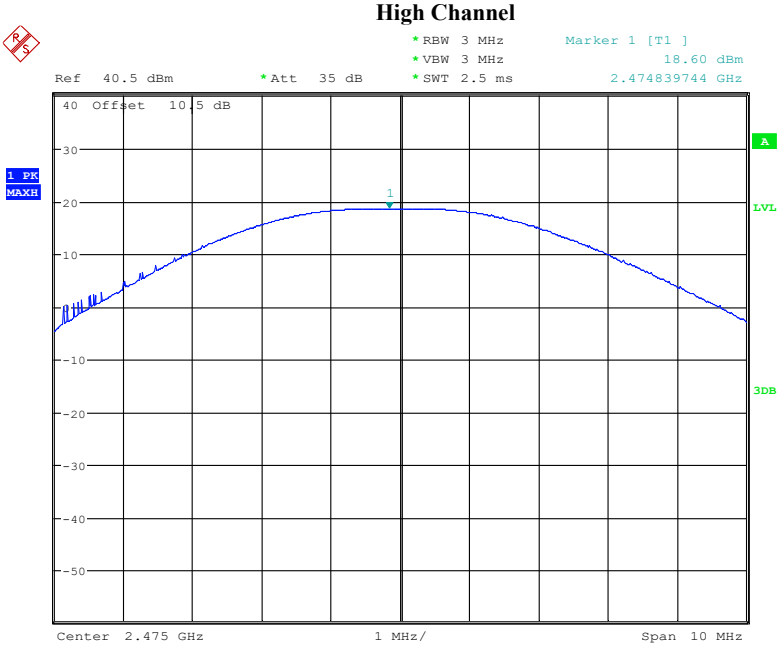


Middle Channel



Date: 25.DEC.2021 14:21:21

High Channel



Date: 25.DEC.2021 14:21:48

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

Applicable Standard

According to FCC §15.247(d) & RSS-247 § 5.5.

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)) & RSS-Gen.

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:	25 ℃
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

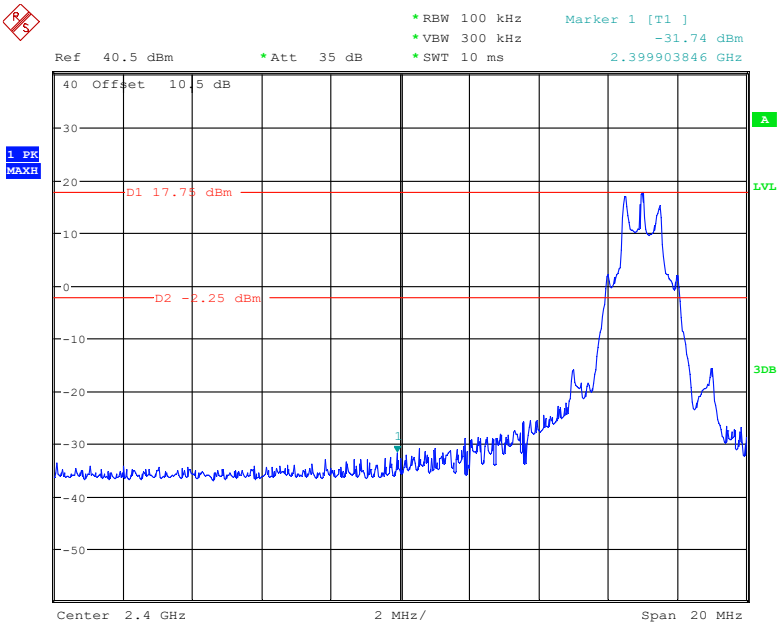
The testing was performed by Fan Yang on 2021-12-25 and 2022-01-06.

EUT operation mode: Transmitting

Test Result: Compliant.

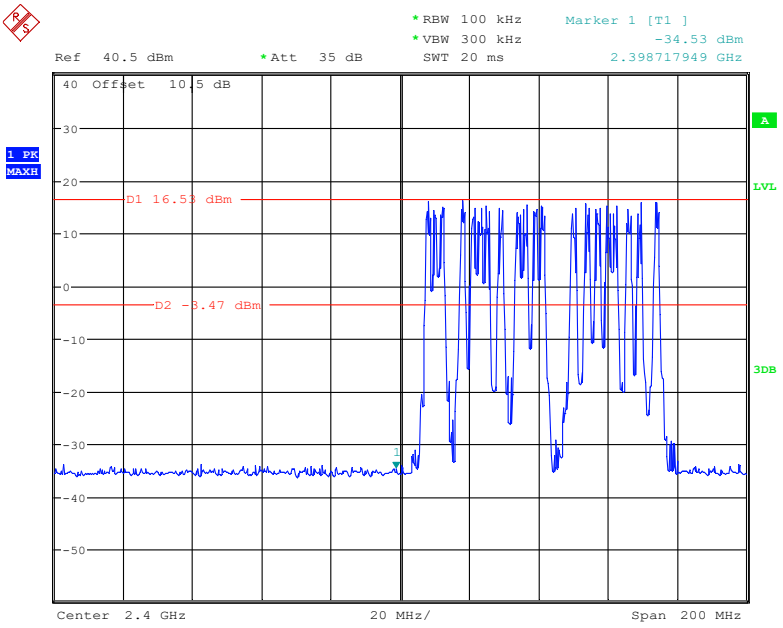
Conducted Band Edge Result:

GFSK_Low Channel



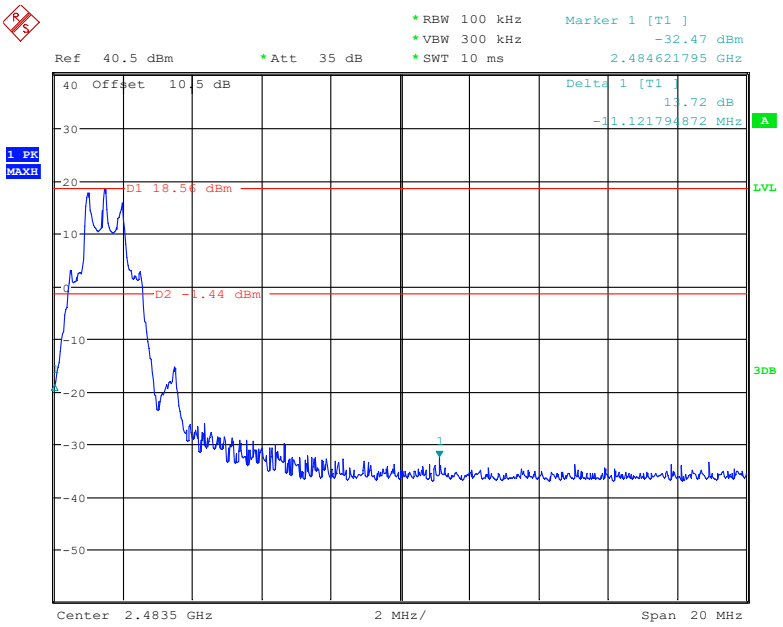
Date: 25.DEC.2021 13:42:30

GFSK_Hop_Low Channel



Date: 6.JAN.2022 15:23:26

GFSK_High Channel



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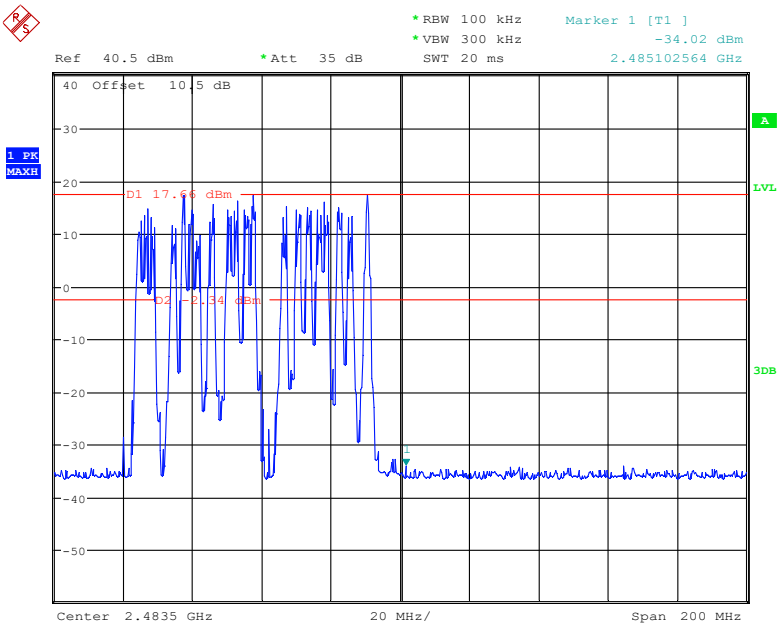
GFSK_Hop_High Channel



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