TEST REPORT

Applicant Name :	Chillax Care Limited
Address :	Room 118, Flat A, 8/F, William Industrial Building, 23-25 Ng Fong Street, San Po Kong, Kowloon, Hong Kong
Report Number :	RA221213-61312E-RFB
FCC ID:	2AZ8M-BCX620BU
IC:	27169-BCX620BU

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:	Smart Mood Light Soother
Model No.:	DM620BU
Multiple Model(s) No.:	N/A
Trade Mark:	ChillaxBaby
Date Received:	2022/12/13
Report Date:	2023/02/09

Test Result:	Pass*

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

Prepared and Checked By:

Andy Yu
EMC Engineer

Approved By:

Candy Li
EMC Engineer

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

Revision Number	Report Number	Description of Revision	Date of Revision
0	RA221213-61312E-RFB	Original Report	2023-02-09

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

HVIN	BCX620BU
FVIN	Vl.4.66
Frequency Range	2402-2480MHz
Maximum conducted Peak output power	7.69dBm
Modulation Technique	GFSK
Antenna Specification*	0 dBi(It is provided by the applicant)
Voltage Range	DC 3.7V from battery or DC5V from adapter
Sample number	1XQX-1 for Conducted and Radiation Emissions Test 1XQY-2 for RF Conducted Test (Assigned by ATC)
Sample/EUT Status	Good condition
Adapter 1 information	Model: YWK-AD050200-U Input: AC 100-240V, 50/60Hz, 0.3A Output: DC 5.0V, 2000 mA
Adapter 2 information	Model: KA12H-0502000US Input: AC 100-240V, 50/60Hz, 0.4A Max Output: DC 5.0V, 2000 mA

Objective

This report is in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commission's rules and RSS-GEN issue 5, February 2021 amendment 2 and RSS-247, Issue 2, February 2017 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.

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

Each test item follows test standards and with no deviation.

Measurement Uncertainty

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

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

Test Facility

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

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 708358, the FCC Designation No.: CN1189. Accredited by American Association for Laboratory Accreditation (A2LA) The Certificate Number is 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)
1	2402	11	2422	21	2442	31	2462
2	2404	12	2424	22	2444	32	2464
3	2406	13	2426	23	2446	33	2466
4	2408	14	2428	24	2448	34	2468
5	2410	15	2430	25	2450	35	2470
6	2412	16	2432	26	2452	36	2472
7	2414	17	2434	27	2454	37	2474
8	2416	18	2436	28	2456	38	2476
9	2418	19	2438	29	2458	39	2478
10	2420	20	2440	30	2460	40	2480

EUT was tested with Channel 1, 20 and 40.

EUT Exercise Software

"SecureCRT"* exercise software was used, and the power level is default*. The software and power level was provided by the applicant.

Special Accessories

No special accessory.

Equipment Modifications

No modification was made to the EUT tested.

Support Equipment List and Details

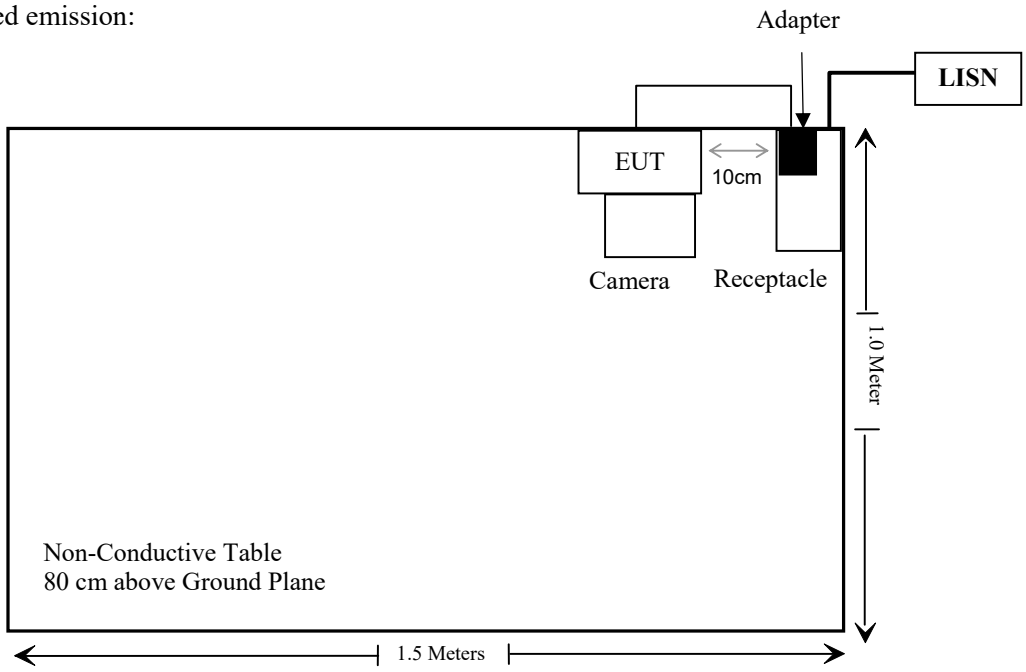
Manufacturer	Description	Model	Serial Number
Chillax Care Limited	Camera	DM680	Unknown

External I/O Cable

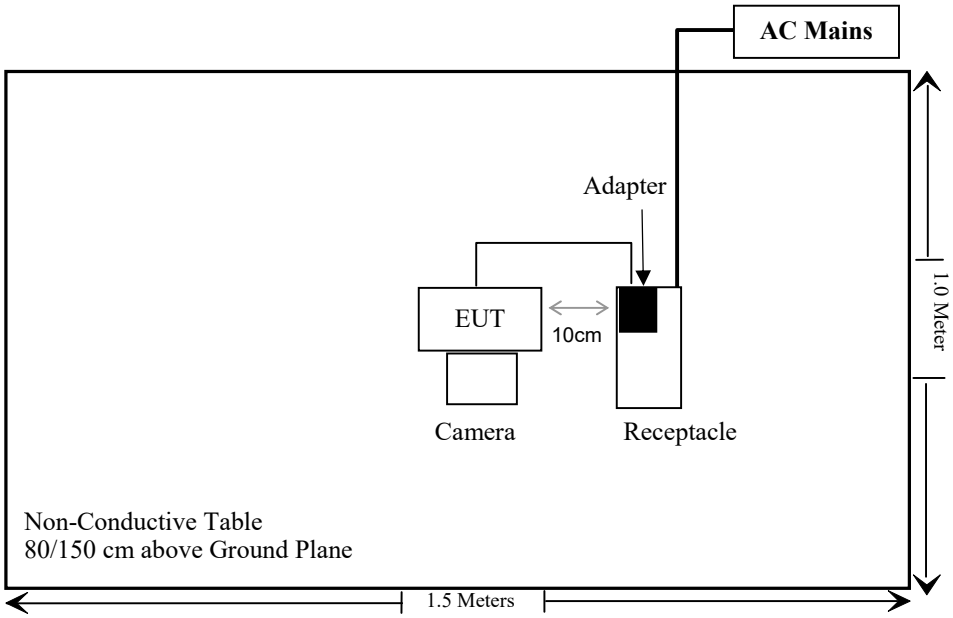
Cable Description	Length (m)	From Port	To
Un-shielding Un-Detachable DC Cable	1.5	EUT	Adapter

Block Diagram of Test Setup

For conducted emission:



For Radiated Emissions:



SUMMARY OF TEST RESULTS

FCC Rules	ISEDC Rules	Description of Test	Result
15.247 (i) & §1.1307 (b) (3) & §2.1091	RSS-102 § 2.5.2	MPE-Based Exemption & Exemption Limits For Routine Evaluation-RF Exposure Evaluation	Compliant
§15.203	RSS-Gen §6.8	Antenna Requirement	Compliant
§15.207(a)	RSS-Gen §8.8	AC Line Conducted Emissions	Compliant
§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

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emissions Test					
Rohde& Schwarz	EMI Test Receiver	ESCI	100784	2022/11/25	2023/11/24
Rohde & Schwarz	L.I.S.N.	ENV216	101314	2022/11/25	2023/11/24
Anritsu Corp	50 Coaxial Switch	MP59B	6100237248	2022/12/07	2023/12/06
Unknown	RF Coaxial Cable	No.17	N0350	2022/11/25	2023/11/24
Conducted Emission Test Software: e3 19821b (V9)					
Radiated Emissions Test					
Rohde& Schwarz	Test Receiver	ESR	102725	2022/11/25	2023/11/24
Rohde&Schwarz	Spectrum Analyzer	FSV40	101949	2022/11/25	2023/11/24
SONOMA INSTRUMENT	Amplifier	310 N	186131	2022/11/08	2023/11/07
A.H. Systems, inc.	Preamplifier	PAM-0118P	135	2022/11/08	2023/11/07
Quinstar	Amplifier	QLW-18405536-J0	15964001002	2022/11/08	2023/11/07
Schwarzbeck	Bilog Antenna	VULB9163	9163-323	2021/07/06	2024/07/05
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-1067	2022/11/30	2025/11/29
Schwarzbeck	HORN ANTENNA	BBHA9170	9170-359	2022/12/26	2025/12/25
Radiated Emission Test Software: e3 19821b (V9)					
Unknown	RF Coaxial Cable	No.10	N050	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.11	N1000	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.12	N040	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.13	N300	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.14	N800	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.15	N600	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.16	N650	2022/11/25	2023/11/24
Wainwright	High Pass Filter	WHKX3.6/18 G-10SS	5	2022/11/25	2023/11/24

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
Rohde&Schwarz	Spectrum Analyzer	FSV-40	101948	2022/11/25	2023/11/24
WEINSCHEL	10dB Attenuator	5324	AU 3842	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.31	RF-01	Each time	Each time
Unknown	RF Cable	No.01	RF-02	Each time	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- MPE-Based Exemption

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

Result

Mode	Frequency (MHz)	Tune up conducted power	Antenna Gain		ERP		Evaluation Distance (m)	ERP Limit (mW)
		(dBm)	(dBi)	(dBd)	(dBm)	(mW)		
FHSS	2402-2480	8.0	0	-2.15	5.85	3.846	0.2	768

Note: 1. The tune up conducted power and antenna gain was declared by the applicant.
2. The FHSS and Wi-Fi cannot transmit at same time.

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

Result: Compliant.

RSS-102 § 2.5.2 –EXEMPTION LIMITS FOR ROUTINE EVALUATION-RF EXPOSURE EVALUATION

Applicable Standard

According to RSS-102 § (2.5.2):

2.5.2 Exemption Limits for Routine Evaluation — RF Exposure Evaluation

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz[6] and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $22.48/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

Calculated Data:

For worst case:

Mode	Frequency (MHz)	Maximum tune-up conducted power	Antenna Gain	Maximum tune-up EIRP		Evaluation Distance (cm)	Limit (W)
		(dBm)	(dBi)	(dBm)	(W)		
FHSS	2402-2480	8.0	0	8.0	0.006	20	2.68

Note: 1. The tune up conducted power and antenna gain was declared by the applicant.
2. The FHSS and Wi-Fi cannot transmit at same time.

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

Result: The RF Exposure evaluation can be exempted.

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

Applicable Standard

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

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	0 dBi	50 Ω

Result: Compliant.

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

Applicable Standard

FCC §15.207(a) & RSS-Gen §8.8

Unless stated otherwise in the applicable RSS, for radio apparatus that are designed to be connected to the public utility AC power network, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the range 150 kHz to 30 MHz shall not exceed the limits in table 4, as measured using a 50 µH / 50 Ω line impedance stabilization network. This requirement applies for the radio frequency voltage measured between each power line and the ground terminal of each AC power-line mains cable of the EUT.

For an EUT that connects to the AC power lines indirectly, through another device, the requirement for compliance with the limits in table 4 shall apply at the terminals of the AC power-line mains cable of a representative support device, while it provides power to the EUT. The lower limit applies at the boundary between the frequency ranges. The device used to power the EUT shall be representative of typical applications.

Table 4 - AC Power Lines Conducted Emission Limits

Frequency range (MHz)	Conducted limit (dBµV)	
	Quasi-Peak	Average
0.15 – 0.5	66 to 56[1]	56 to 46[1]
0.5 – 5	56	46
5 – 30	60	50

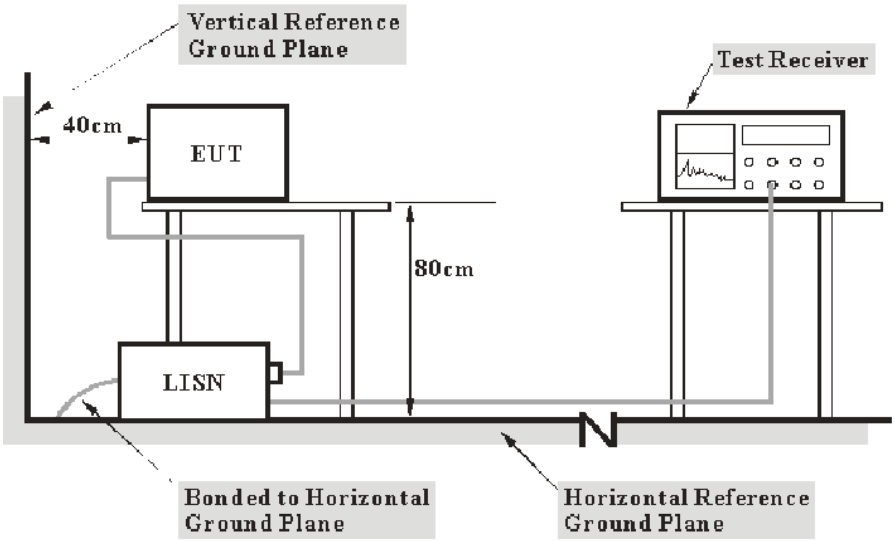
Note 1: The level decreases linearly with the logarithm of the frequency.

For an EUT with a permanent or detachable antenna operating between 150 kHz and 30 MHz, the AC power-line conducted emissions must be measured using the following configurations:

(a) Perform the AC power-line conducted emissions test with the antenna connected to determine compliance with the limits of table 4 outside the transmitter's fundamental emission band.

(b) Retest with a dummy load instead of the antenna to determine compliance with the limits of table 4 within the transmitter's fundamental emission band. For a detachable antenna, remove the antenna and connect a suitable dummy load to the antenna connector. For a permanent antenna, remove the antenna and terminate the RF output with a dummy load or network that simulates the antenna in the fundamental frequency band.

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 and RSS-Gen limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

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

During the conducted emission test, the adapter was connected to the outlet of the LISN.

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

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

Corrected Factor & Margin Calculation

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

Factor = LISN VDF + Cable Loss

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

Over limit = Level – Limit
Level= read level + factor

Test Data

Environmental Conditions

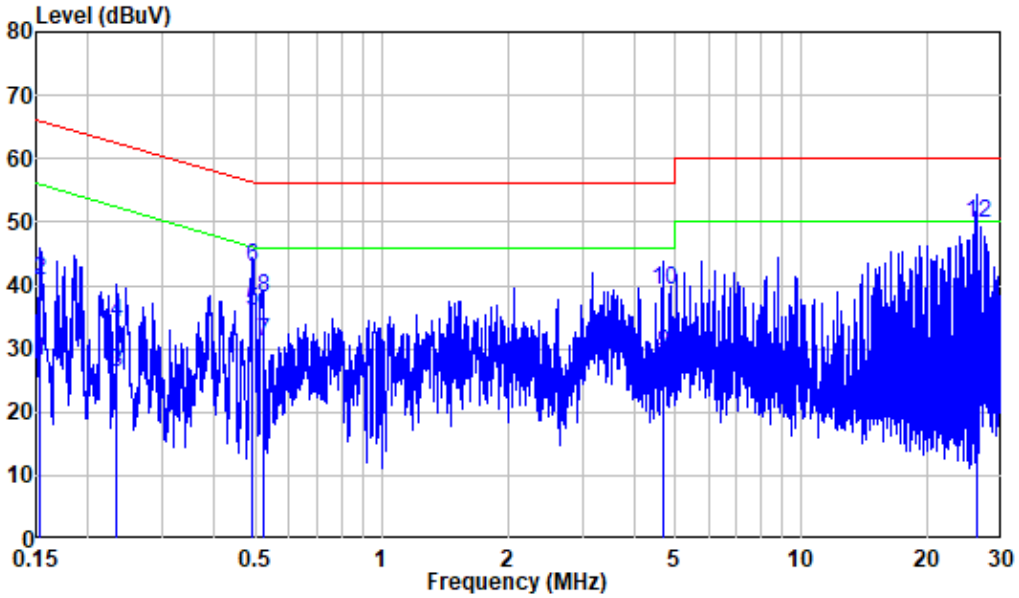
Temperature:	23 ℃
Relative Humidity:	52%
ATM Pressure:	101.0 kPa

The testing was performed by Jason Liu on 2023-02-02.

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

Adapter 1(Model: YWK-AD050200-U):

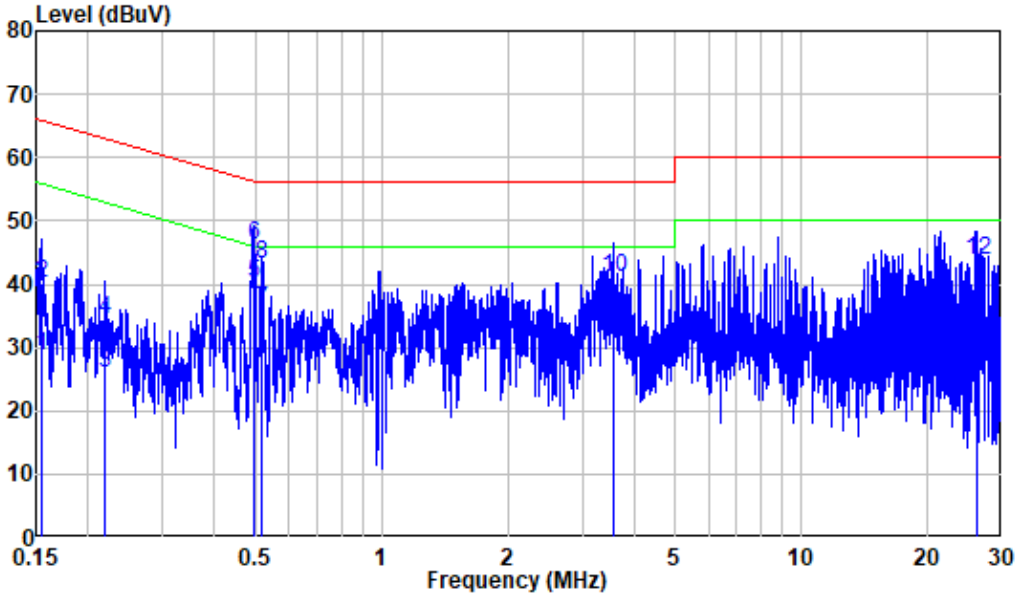
AC 120V/60 Hz, Line



Site : Shielding Room
Condition: Line
Job No. : RA221213-61312E-RF
Mode : Charging+Transmitting
Note : YWK-AD050200-U

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.154	9.90	18.20	28.10	55.79	-27.69	Average
2	0.154	9.90	30.79	40.69	65.79	-25.10	QP
3	0.233	9.88	16.41	26.29	52.33	-26.04	Average
4	0.233	9.88	24.34	34.22	62.33	-28.11	QP
5	0.493	9.80	26.19	35.99	46.11	-10.12	Average
6	0.493	9.80	33.11	42.91	56.11	-13.20	QP
7	0.520	9.82	21.13	30.95	46.00	-15.05	Average
8	0.520	9.82	28.36	38.18	56.00	-17.82	QP
9	4.690	9.95	19.35	29.30	46.00	-16.70	Average
10	4.690	9.95	29.38	39.33	56.00	-16.67	QP
11	26.278	10.13	21.39	31.52	50.00	-18.48	Average
12	26.278	10.13	39.55	49.68	60.00	-10.32	QP

AC 120V/60 Hz, Neutral

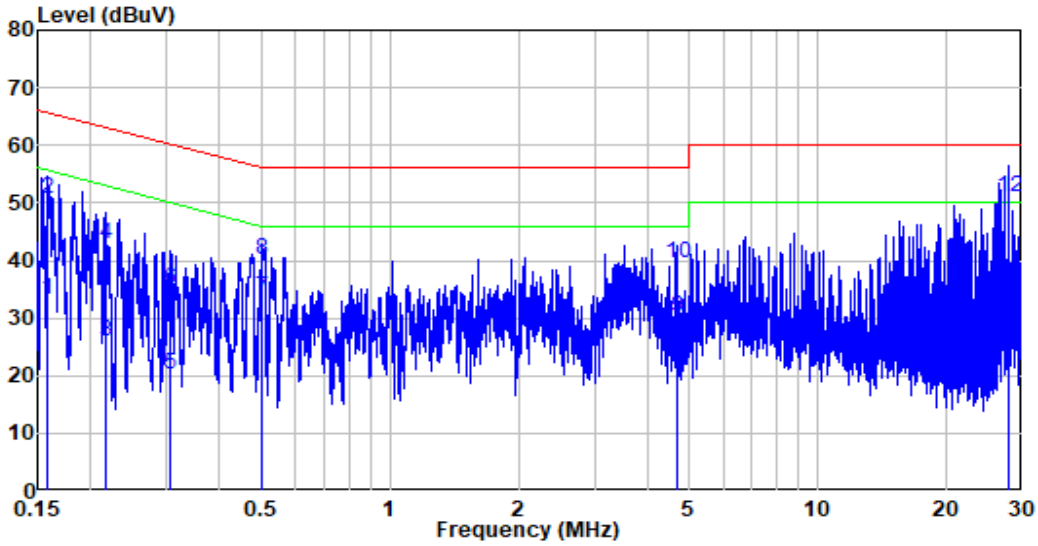


Site : Shielding Room
Condition: Neutral
Job No. : RA221213-61312E-RF
Mode : Charging+Transmitting
Note : YWK-AD050200-U

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.154	9.80	18.96	28.76	55.77	-27.01	Average
2	0.154	9.80	30.26	40.06	65.77	-25.71	QP
3	0.219	9.81	16.14	25.95	52.85	-26.90	Average
4	0.219	9.81	24.59	34.40	62.85	-28.45	QP
5	0.495	9.90	30.25	40.15	46.08	-5.93	Average
6	0.495	9.90	36.44	46.34	56.08	-9.74	QP
7	0.518	9.90	25.93	35.83	46.00	-10.17	Average
8	0.518	9.90	33.23	43.13	56.00	-12.87	QP
9	3.563	9.84	22.02	31.86	46.00	-14.14	Average
10	3.563	9.84	31.29	41.13	56.00	-14.87	QP
11	26.278	10.19	20.47	30.66	50.00	-19.34	Average
12	26.278	10.19	33.70	43.89	60.00	-16.11	QP

Adapter 2(Model: KA12H-0502000US):

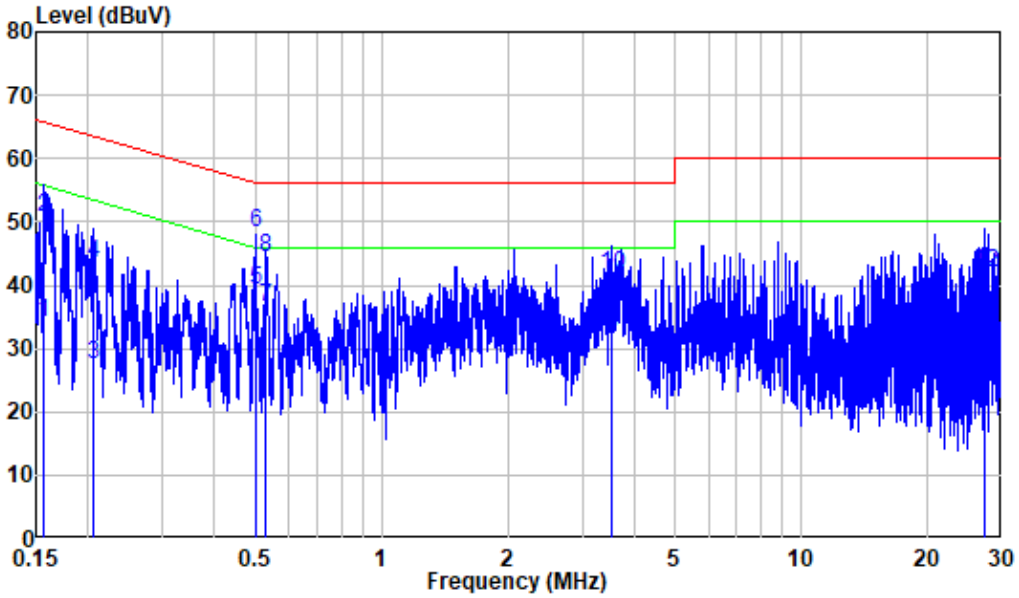
AC 120V/60 Hz, Line



Site : Shielding Room
Condition: Line
Job No. : RA221213-61312E-RF
Mode : Charging+Transmitting
Note : KA12H-0502000US

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.159	9.90	23.46	33.36	55.53	-22.17	Average
2	0.159	9.90	40.95	50.85	65.53	-14.68	QP
3	0.216	9.89	16.04	25.93	52.98	-27.05	Average
4	0.216	9.89	32.88	42.77	62.98	-20.21	QP
5	0.308	9.85	10.47	20.32	50.03	-29.71	Average
6	0.308	9.85	25.28	35.13	60.03	-24.90	QP
7	0.502	9.80	23.59	33.39	46.00	-12.61	Average
8	0.502	9.80	30.44	40.24	56.00	-15.76	QP
9	4.690	9.95	20.10	30.05	46.00	-15.95	Average
10	4.690	9.95	29.62	39.57	56.00	-16.43	QP
11	27.763	10.16	21.76	31.92	50.00	-18.08	Average
12	27.763	10.16	40.87	51.03	60.00	-8.97	QP

AC 120V/60 Hz, Neutral



Site : Shielding Room
Condition: Neutral
Job No. : RA221213-61312E-RF
Mode : Charging+Transmitting
Note : KA12H-0502000US

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dBuV	dBuV	dB	
1	0.156	9.80	24.25	34.05	55.65	-21.60	Average
2	0.156	9.80	41.04	50.84	65.65	-14.81	QP
3	0.205	9.80	17.76	27.56	53.39	-25.83	Average
4	0.205	9.80	33.73	43.53	63.39	-19.86	QP
5	0.500	9.90	29.40	39.30	46.00	-6.70	Average
6	0.500	9.90	38.47	48.37	56.00	-7.63	QP
7	0.530	9.89	26.67	36.56	46.00	-9.44	Average
8	0.530	9.89	34.38	44.27	56.00	-11.73	QP
9	3.542	9.84	22.04	31.88	46.00	-14.12	Average
10	3.542	9.84	31.90	41.74	56.00	-14.26	QP
11	27.398	10.19	18.92	29.11	50.00	-20.89	Average
12	27.398	10.19	31.85	42.04	60.00	-17.96	QP

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

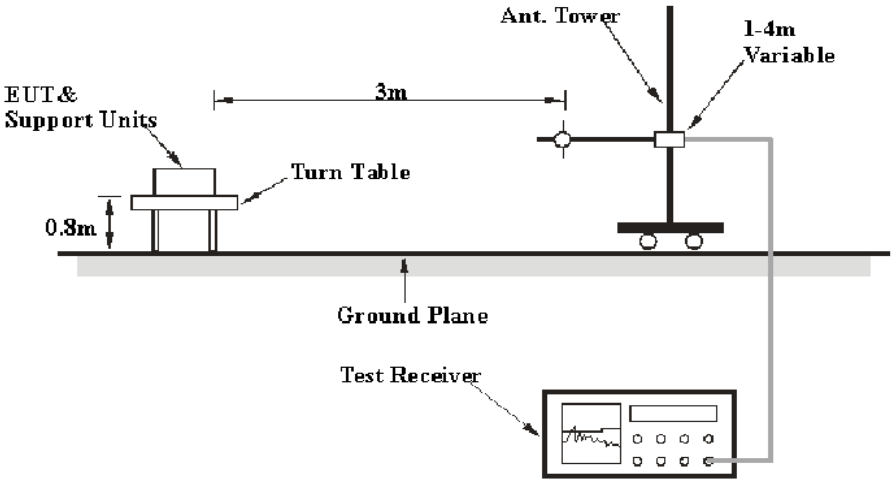
Applicable Standard

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

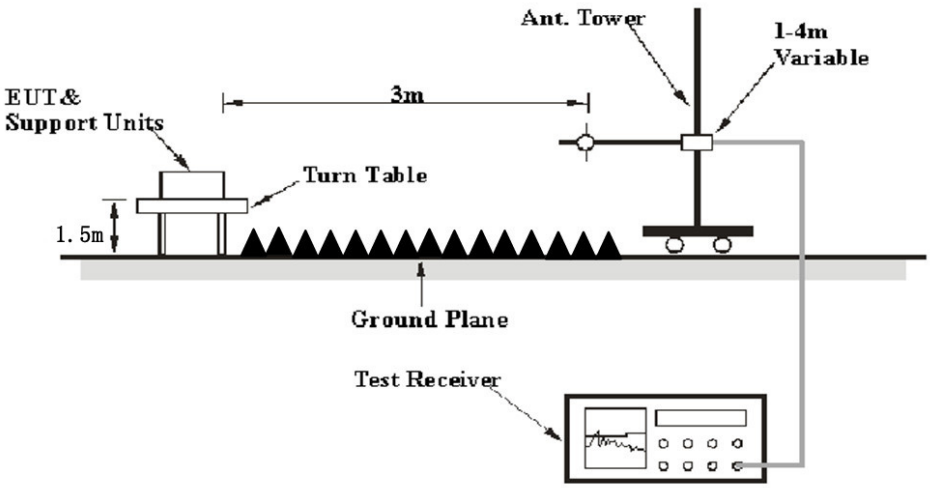
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either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

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

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

Test Data

Environmental Conditions

Temperature:	24~24.5℃
Relative Humidity:	50~62%
ATM Pressure:	101.0 kPa

The testing was performed by Jimi zheng on 2023-01-16 for below 1GHz, Jaosn Liu on 2023-02-09 for above 1GHz.

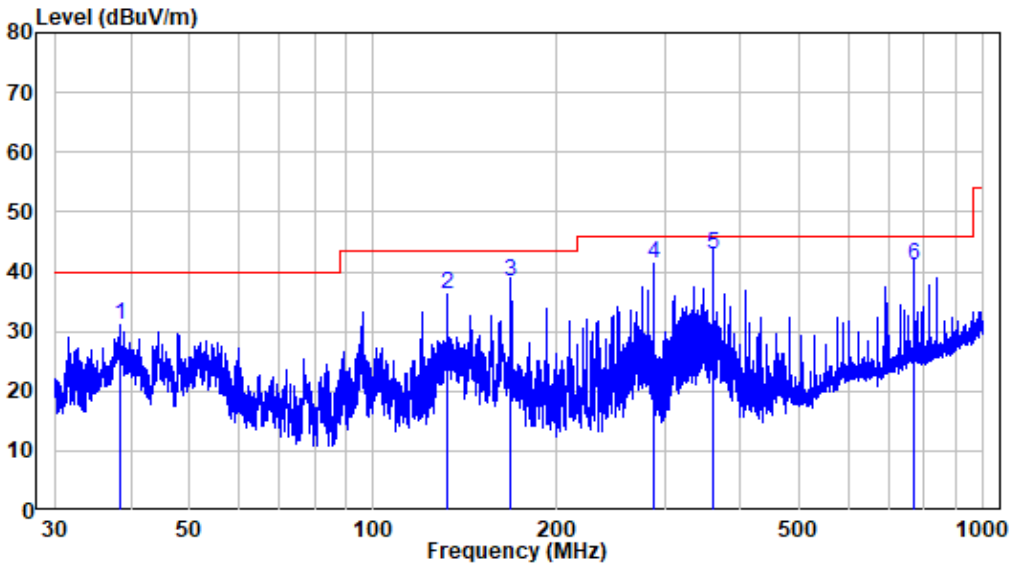
EUT operation mode: Transmitting (Pre-scan in the X,Y and Z axes of orientation, the worst case X-axis of orientation was recorded)

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

Note: when the test result of peak was less than the limit of QP more than 6dB, just peak values were recorded.

Adapter 1(Model: YWK-AD050200-U)

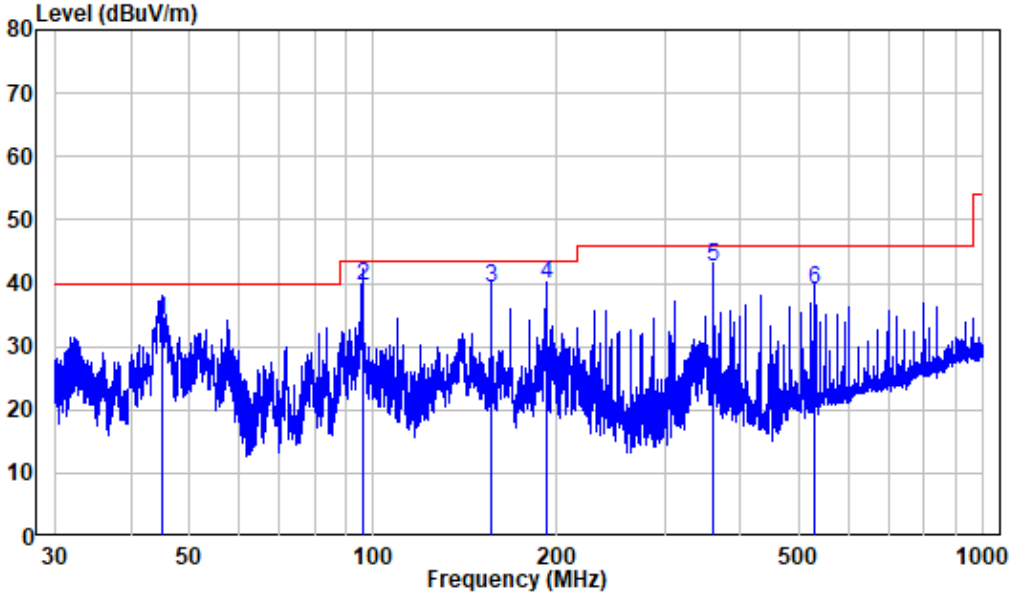
Horizontal:



Site : chamber
Condition: 3m HORIZONTAL
Job No. : RA221213-61312E-RF
Test Mode: Charging+Transmitting
Note : YWK-AD050200-U

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	38.397	-10.72	41.93	31.21	40.00	-8.79	Peak
2	132.105	-14.98	51.28	36.30	43.50	-7.20	Peak
3	168.193	-13.76	52.20	38.44	43.50	-5.06	QP
4	287.990	-9.36	50.80	41.44	46.00	-4.56	QP
5	359.974	-7.68	50.50	42.82	46.00	-3.18	QP
6	767.738	-0.29	41.30	41.01	46.00	-4.99	QP

Vertical

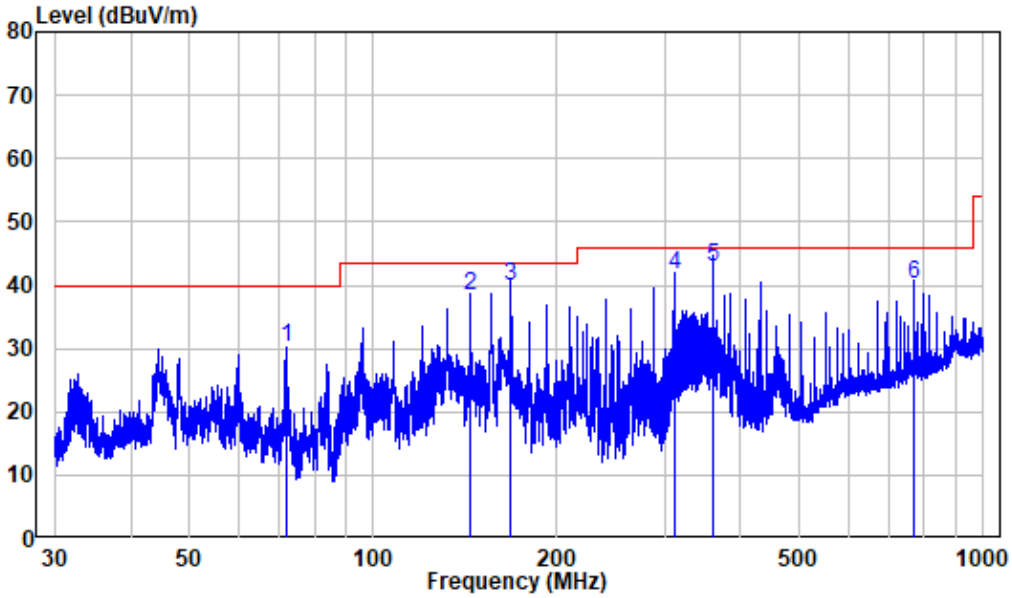


Site : chamber
Condition: 3m VERTICAL
Job No. : RA221213-61312E-RF
Test Mode: Charging+Transmitting
Note : YWK-AD050200-U

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	44.920	-9.94	44.10	34.16	40.00	-5.84	QP
2	96.014	-12.30	51.90	39.60	43.50	-3.90	QP
3	156.115	-14.80	54.10	39.30	43.50	-4.20	QP
4	191.913	-11.26	51.00	39.74	43.50	-3.76	QP
5	361.714	-7.64	50.31	42.67	46.00	-3.33	QP
6	528.014	-4.48	43.50	39.02	46.00	-6.98	QP

Adapter 2(Model: KA12H-0502000US)

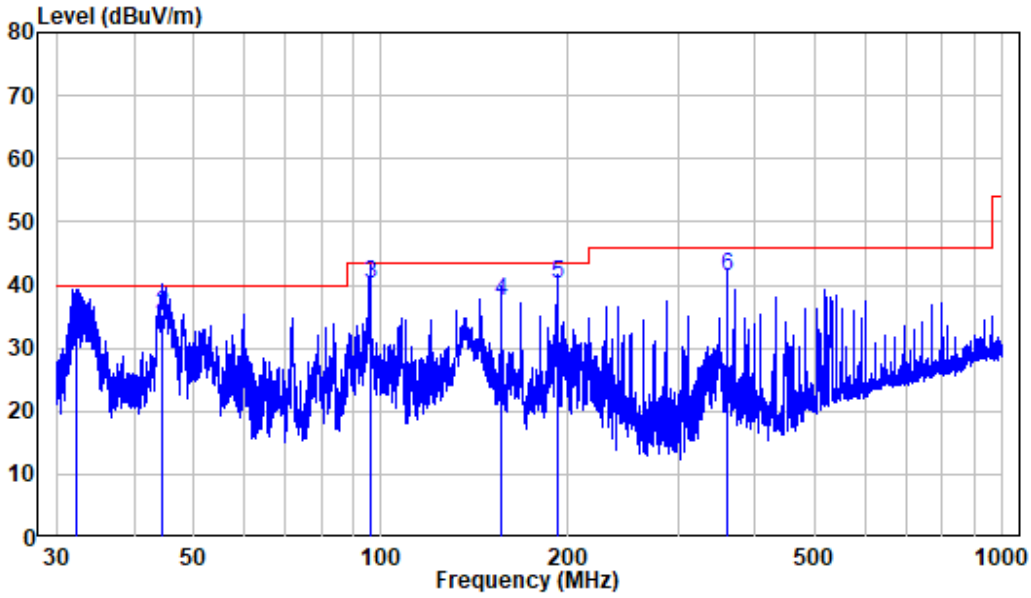
Horizontal:



Site : chamber
Condition: 3m HORIZONTAL
Job No. : RA221213-61312E-RF
Test Mode: Charging+Transmitting
Note : KA12H-0502000US

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	72.116	-15.64	45.82	30.18	40.00	-9.82	Peak
2	144.019	-15.52	53.80	38.28	43.50	-5.22	QP
3	167.898	-13.79	53.60	39.81	43.50	-3.69	QP
4	312.043	-8.82	50.50	41.68	46.00	-4.32	QP
5	359.974	-7.68	50.40	42.72	46.00	-3.28	QP
6	768.075	-0.28	40.51	40.23	46.00	-5.77	QP

Vertical



Site : chamber
Condition: 3m VERTICAL
Job No. : RA221213-61312E-RF
Test Mode: Charging+Transmitting
Note : KA12H-0502000US

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	32.236	-12.13	46.49	34.36	40.00	-5.64	QP
2	44.372	-9.92	45.11	35.19	40.00	-4.81	QP
3	96.014	-12.30	52.40	40.10	43.50	-3.40	QP
4	155.979	-14.82	52.30	37.48	43.50	-6.02	QP
5	191.997	-11.25	51.40	40.15	43.50	-3.35	QP
6	360.132	-7.68	48.90	41.22	46.00	-4.78	QP

Above 1GHz: Worst case is Adapter 1(Model: YWK-AD050200-U)

Frequency (MHz)	Receiver		Turntable Angle Degree	Rx Antenna		Factor (dB/m)	Corrected. Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/Ave		Height (m)	Polar (H/V)				
Low Channel(2402MHz)									
2310	62.70	PK	333	1.1	H	-7.24	55.46	74	-18.54
2310	62.85	PK	293	1.5	V	-7.24	55.61	74	-18.39
2390	64.69	PK	282	1.8	H	-7.22	57.47	74	-16.53
2390	65.06	PK	259	1.2	V	-7.22	57.84	74	-16.16
4804	59.82	PK	158	2	H	-3.51	56.31	74	-17.69
4804	61.34	PK	235	2	V	-3.51	57.83	74	-16.17
Middle Channel(2440MHz)									
4880	60.05	PK	261	1.9	H	-3.38	56.67	74	-17.33
4880	61.34	PK	188	1.9	V	-3.38	57.96	74	-16.04
High Channel(2480 MHz)									
2483.5	72.49	PK	137	1.8	H	-7.20	65.29	74	-8.71
2483.5	75.20	PK	51	1.5	V	-7.20	68.00	74	-6.00
2500	63.83	PK	46	1.7	H	-7.18	56.65	74	-17.35
2500	63.66	PK	123	1.1	V	-7.18	56.48	74	-17.52
4960	59.17	PK	13	1.8	H	-3.01	56.16	74	-17.84
4960	60.72	PK	326	1.8	V	-3.01	57.71	74	-16.29

Field Strength of Average							
Frequency (MHz)	**Peak Measurement @3m (dBμV/m)**	**Polar (H/V)**	**Duty Cycle Correction Factor (dB)**	**Corrected. Amplitude (dBμV/m)**	**Limit (dBμV/m)**	**Margin (dB)**	**Comment**
Low Channel(2402MHz)							
2310	55.46	H	-53.90	1.56	54	-52.44	Band Edge
2310	55.61	V	-53.90	1.71	54	-52.29	Band Edge
2390	57.47	H	-53.90	3.57	54	-50.43	Band Edge
2390	57.84	V	-53.90	3.94	54	-50.06	Band Edge
4804	56.31	H	-53.90	2.41	54	-51.59	Harmonic
4804	57.83	V	-53.90	3.93	54	-50.07	Harmonic
Middle Channel(2440MHz)							
4880	56.67	H	-53.90	2.77	54	-51.23	Harmonic
4880	57.96	V	-53.90	4.06	54	-49.94	Harmonic
High Channel(2480MHz)							
2483.5	65.29	H	-53.90	11.39	54	-42.61	Band Edge
2483.5	68.00	V	-53.90	14.1	54	-39.90	Band Edge
2500	56.65	H	-53.90	2.75	54	-51.25	Band Edge
2500	56.48	V	-53.90	2.58	54	-51.42	Band Edge
4960	56.16	H	-53.90	2.26	54	-51.74	Harmonic
4960	57.71	V	-53.90	3.81	54	-50.19	Harmonic

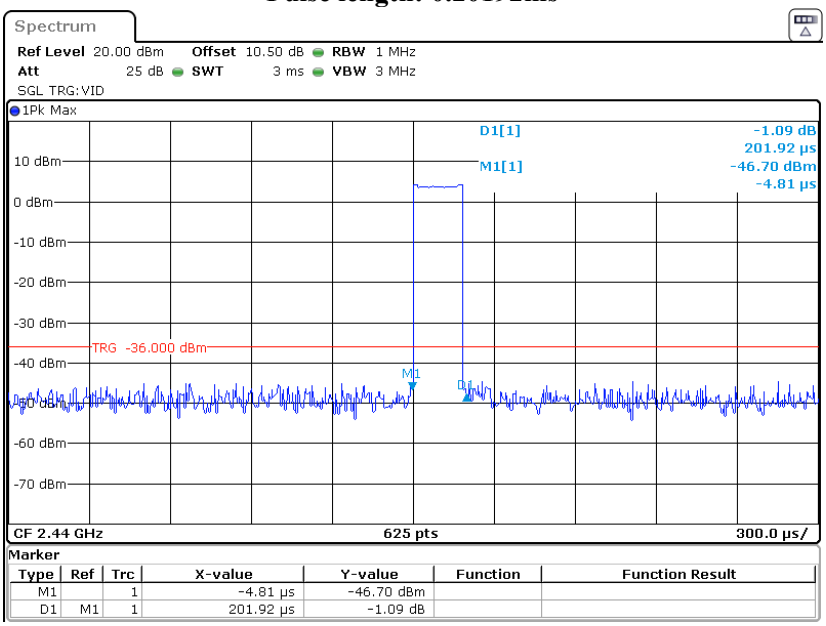
Note:

Corrected. Amplitude = Factor + Reading
Margin = Corrected. Amplitude - Limit
Average level= Peak level+ Duty Cycle Corrected Factor

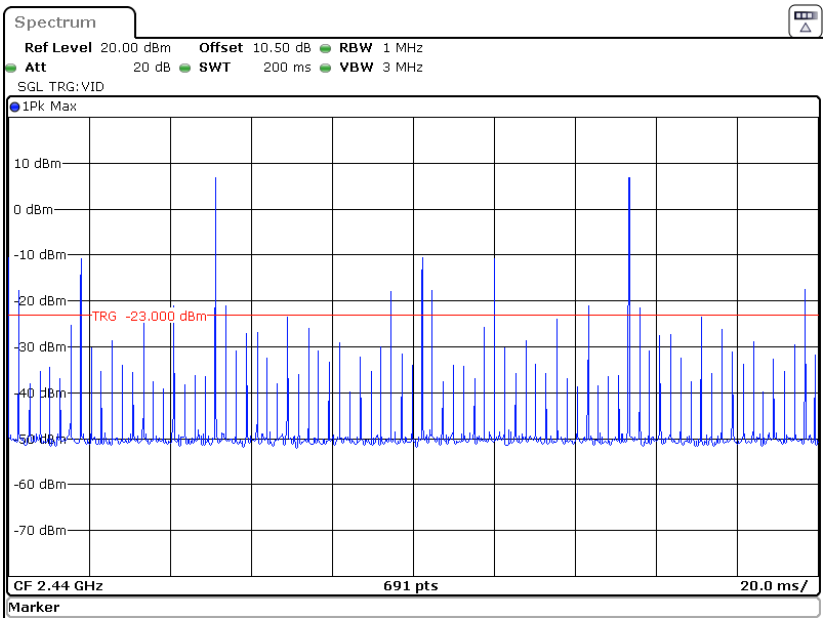
Through observe the test plots below, the maximum hops in 100ms period is 1times (the second high signals from other channel), the worst case duty cycle as below:
Duty cycle = Ton/100ms = 0.20192*1/100=0.0020192
Duty Cycle Corrected Factor = 20lg (Duty cycle) = 20lg0.0020192 = -53.90

Duty cycle:

Pulse length: 0.20192ms



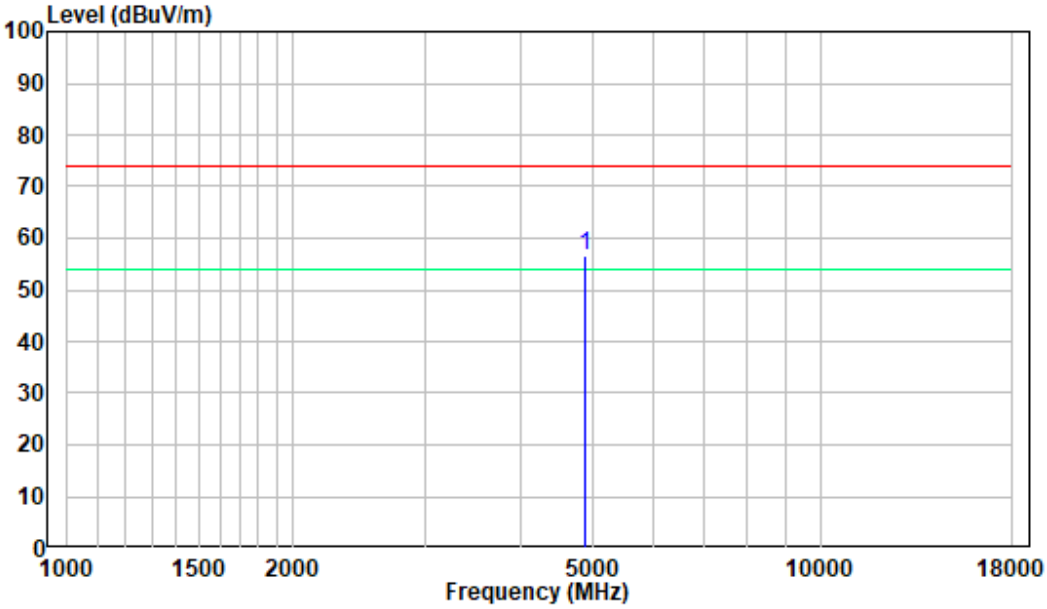
Maximum Pulse number in 100ms: 1



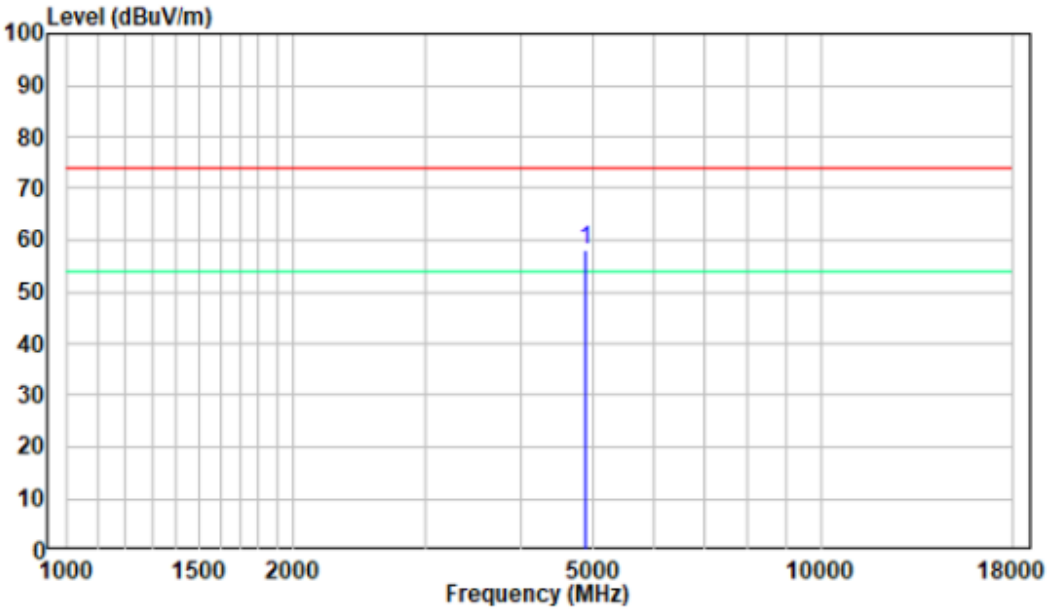
1-18GHz

Pre-scan for Middle Channel

Horizontal:

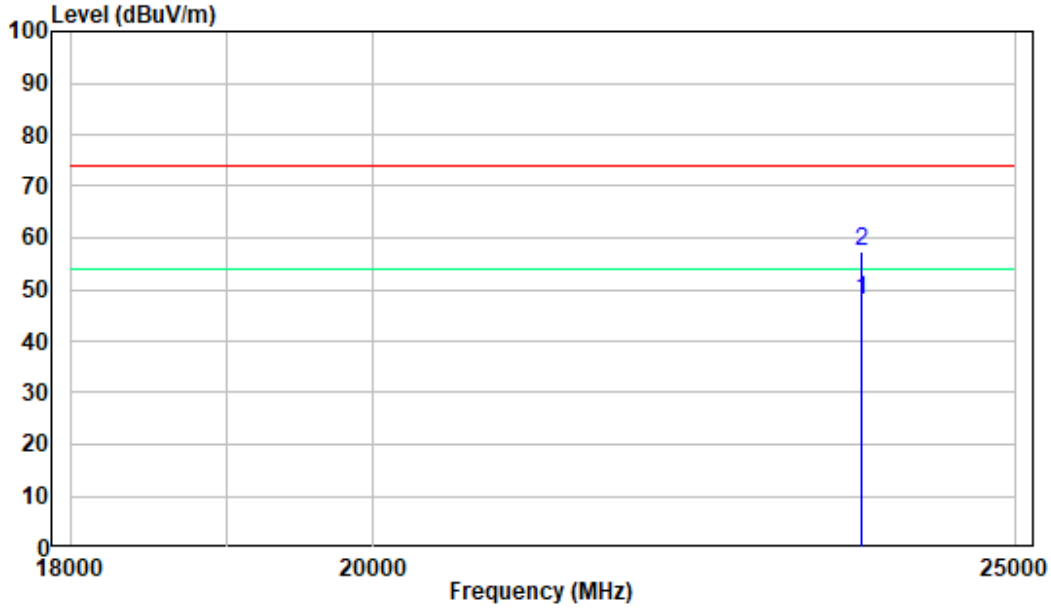


Vertical:

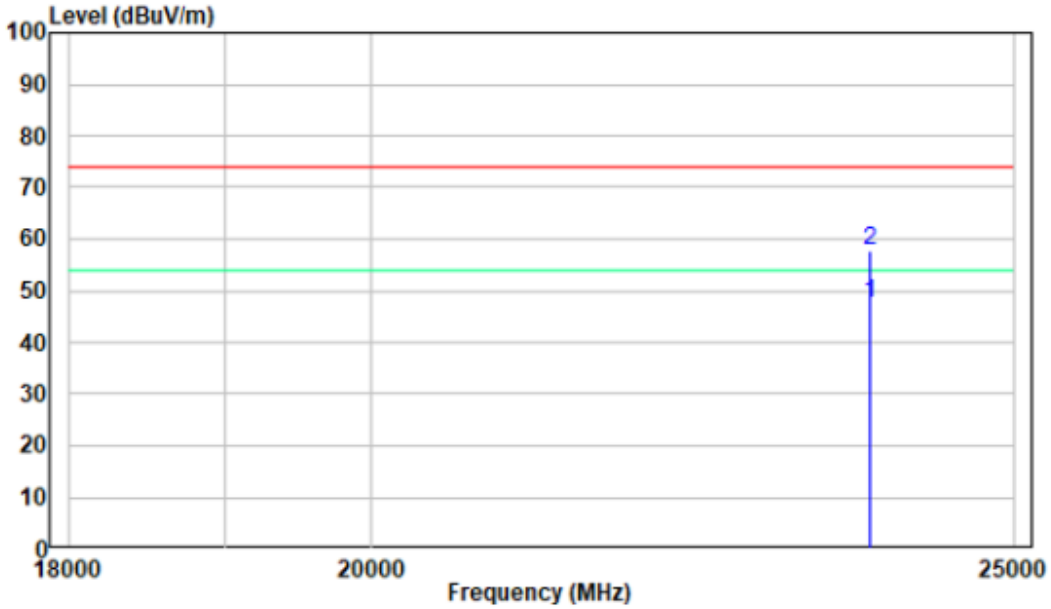


18-25GHz

Pre-scan for Middle Channel
Horizontal:



Vertical:



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

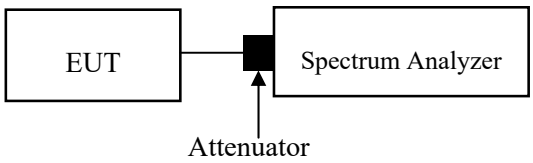
Applicable Standard

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

Test Method: ANSI C63.10-2013 Clause 7.8.2

1. Set the EUT in transmitting mode, maxhold the channel and in Operating mode, RBW was set at 500 kHz, VBW≥ RBW 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:	22 ℃
Relative Humidity:	55%
ATM Pressure:	101.0 kPa

The testing was performed by Green Jiang on 2022-12-28.

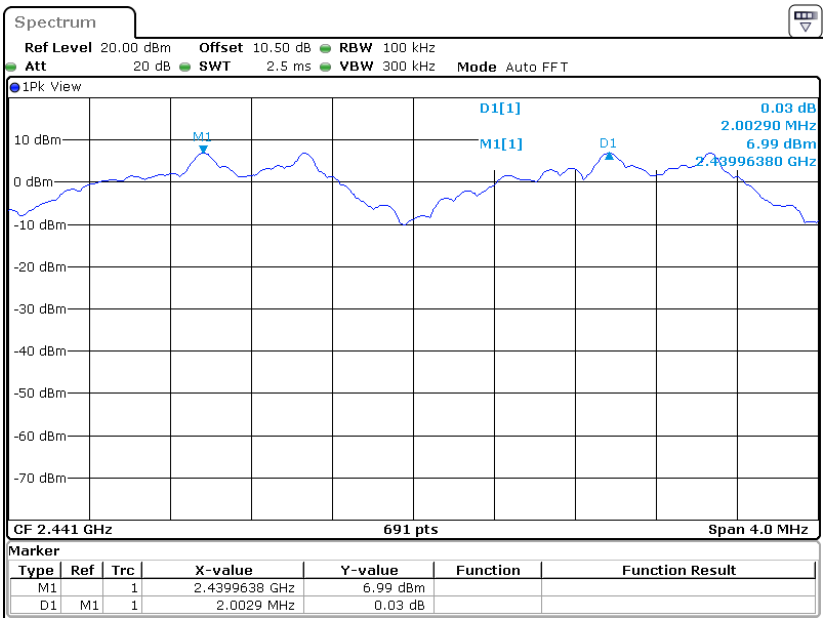
EUT operation mode: Transmitting

Test Result: Compliant.

The worst case 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	2.003	1.951	1.301	> two-thirds of the 20 dB bandwidth	Pass

Please refer to the below plots:


Spectrum
Ref Level 20.00 dBm Offset 10.50 dB RBW 100 kHz
Att 20 dB SWT 2.5 ms VBW 300 kHz Mode Auto FFT
1Pk View
D1[1] 0.03 dB
2.00290 MHz
M1[1] 6.99 dBm
2.43996380 GHz
M1
D1
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
CF 2.441 GHz
691 pts
Span 4.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.4399638 GHz 6.99 dBm
D1 M1 1 2.0029 MHz 0.03 dB
Date: 28.DEC.2022 17:22:01

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

Test Method: ANSI C63.10-2013 Clause 7.8.7 & Clause 6.9.2

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

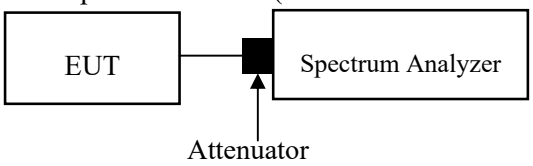
The following conditions shall be observed for measuring the occupied bandwidth and 20 dB bandwidth:
• The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

• 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:	22 ℃
Relative Humidity:	55%
ATM Pressure:	101.0 kPa

The testing was performed by Green Jiang on 2022-12-28.

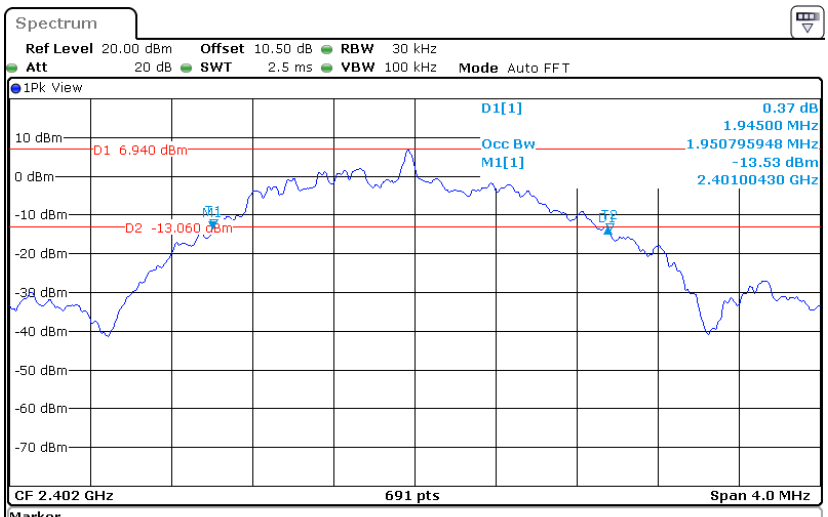
EUT operation mode: Transmitting

Test Result: Compliant.

Channel	Frequency (MHz)	20 dB Emission Bandwidth (MHz)	OBW (MHz)
Low	2402	1.945	1.951
Middle	2440	1.951	1.957
High	2480	1.933	1.968

Please refer to the below plots:

Low Channel



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4010043 GHz	-13.53 dBm		
T1		1	2.40101013 GHz	-13.15 dBm	Occ Bw	1.950795948 MHz
T2		1	2.40296093 GHz	-14.14 dBm		
D1	M1	1	1.945 MHz	0.37 dB		

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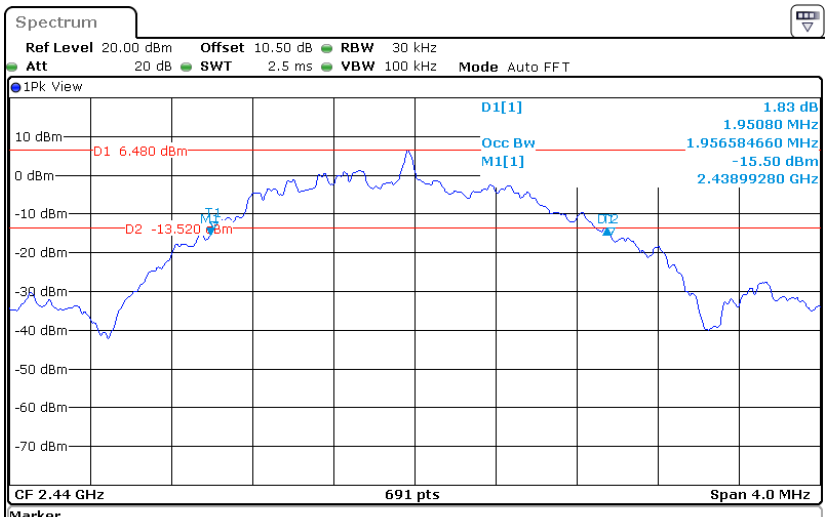
Middle Channel



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4389928 GHz	-15.50 dBm		
T1		1	2.43901013 GHz	-13.75 dBm	Occ Bw	1.95658466 MHz
T2		1	2.44096671 GHz	-15.44 dBm		
D1	M1	1	1.9508 MHz	1.83 dB		

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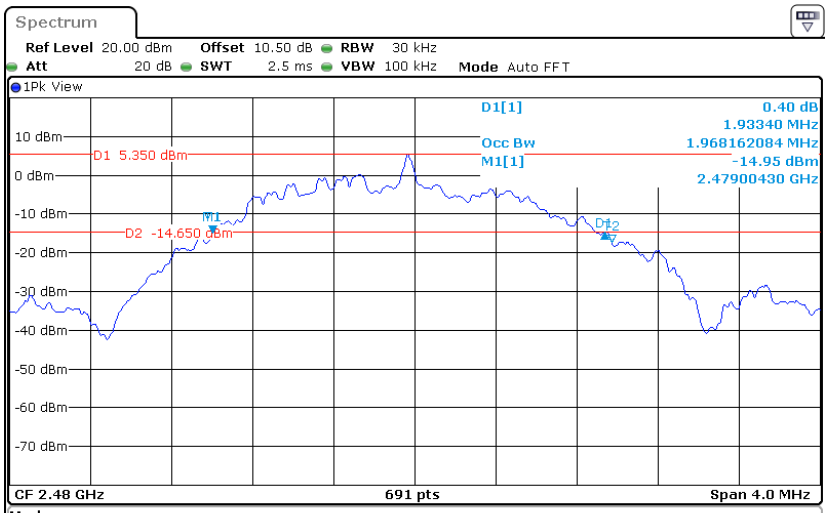
High Channel



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4790043 GHz	-14.95 dBm		
T1		1	2.47900434 GHz	-14.95 dBm	Occ Bw	1.968162084 MHz
T2		1	2.4809725 GHz	-17.40 dBm		
D1	M1	1	1.9334 MHz	0.40 dB		

Date: 28.DEC.2022 17:40:46

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.

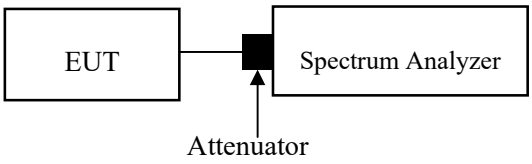
Test Procedure

Test Method: ANSI C63.10-2013 Clause 7.8.3

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:	22 ℃
Relative Humidity:	55%
ATM Pressure:	101.0 kPa

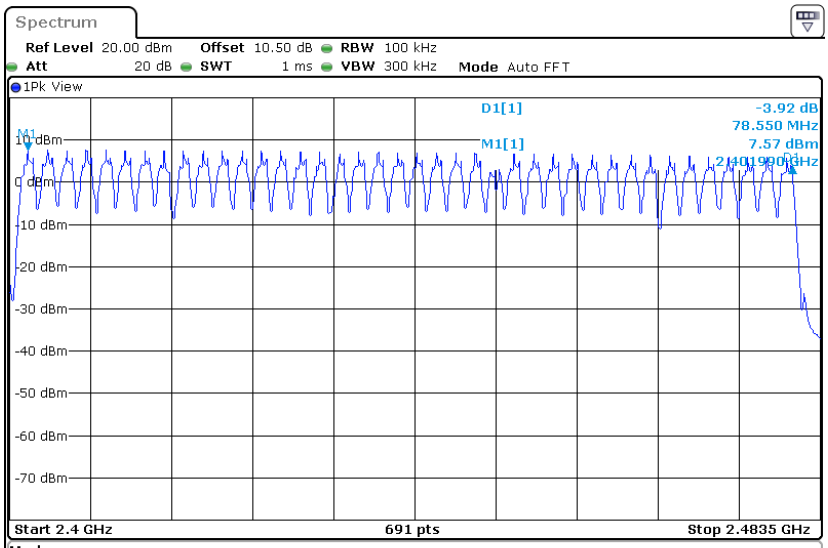
The testing was performed by Green Jiang on 2022-12-28.

EUT operation mode: Transmitting

Test Result: Compliant.

Mode	Frequency Range (MHz)	Number of Hopping Channel (CH)	Limit (CH)
Hopping	2400-2483.5	40	≥15

Hop



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.40199 GHz	7.57 dBm		
D1	M1	1	78.55 MHz	-3.92 dB		

Date: 28.DEC.2022 17:10:06

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

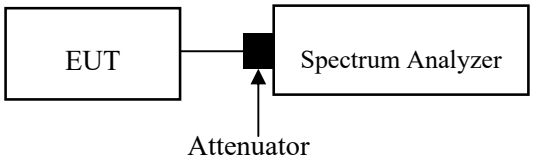
Applicable Standard

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

Test Method: ANSI C63.10-2013 Clause 7.8.4

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:	22~26 ℃
Relative Humidity:	53~55%
ATM Pressure:	101.0 kPa

The testing was performed by Green Jiang from 2022-12-28 to 2023-01-30.

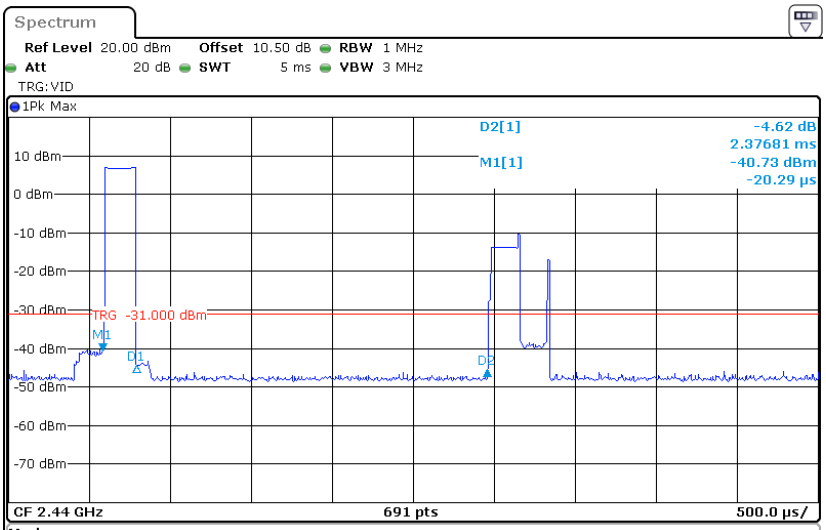
EUT operation mode: Transmitting

Test Result: Compliant.

Test Mode	Channel	Pulse Time [ms]	Total Hops [Num]	Result[s]	Limit[s]	Verdict
Hopping	Hop	0.210	156	0.033	<=0.4	PASS

Note: A period time=0.4*40=16(S), Result= Pulse Time*Total hops

Pulse Time



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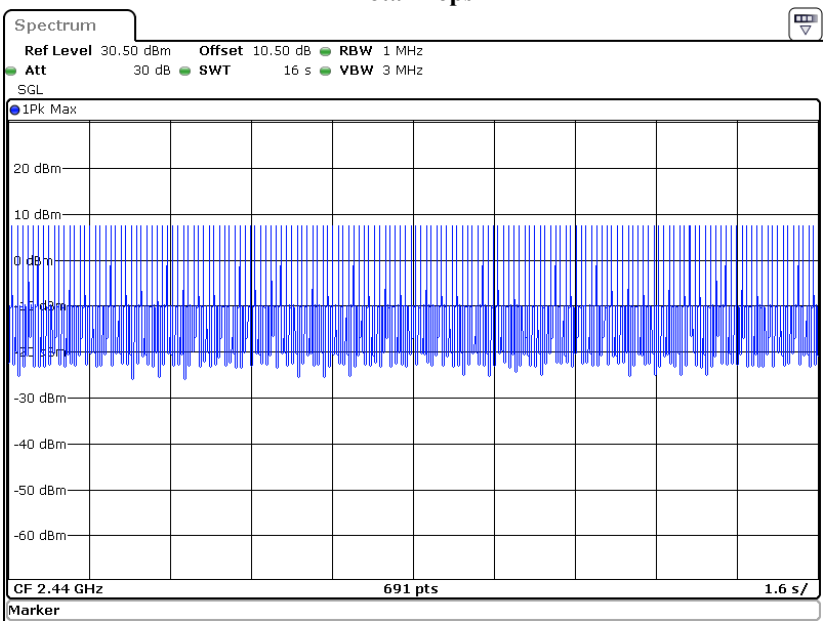
Total Hops



Date: 30.JAN.2023 15:28:04

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.

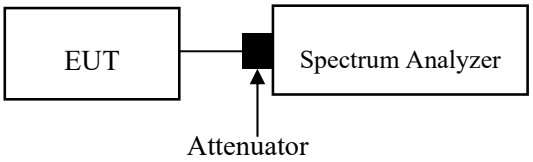
For frequency hopping systems (FHSs) operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channels. 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

Test Method: ANSI C63.10-2013 Clause 7.8.5

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:	22 ℃
Relative Humidity:	55%
ATM Pressure:	101.0 kPa

The testing was performed by Green Jiang on 2022-12-28.

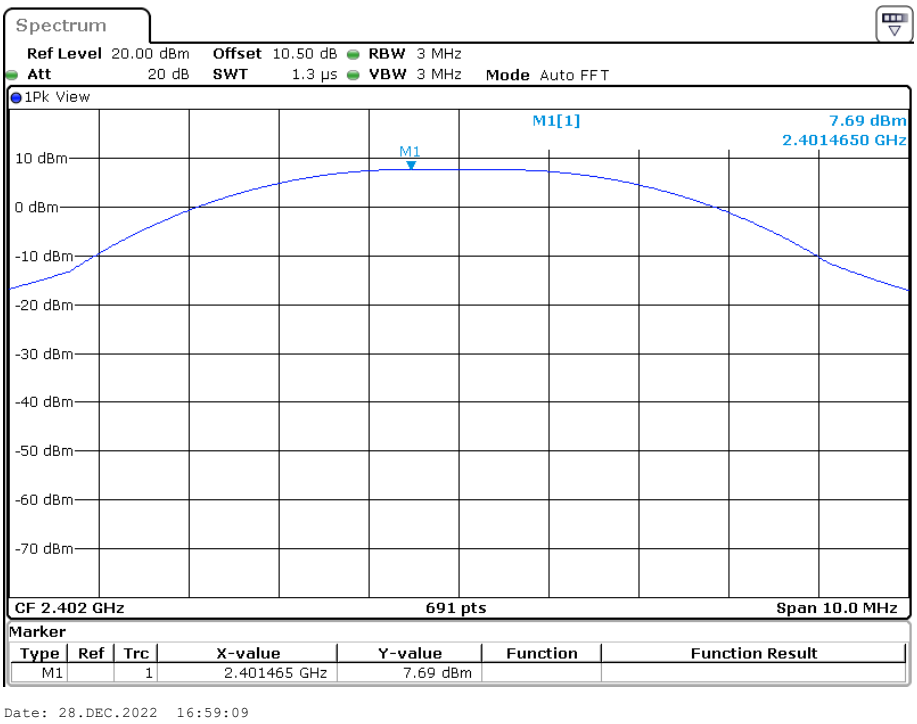
EUT operation mode: Transmitting

Test Result: Compliant.

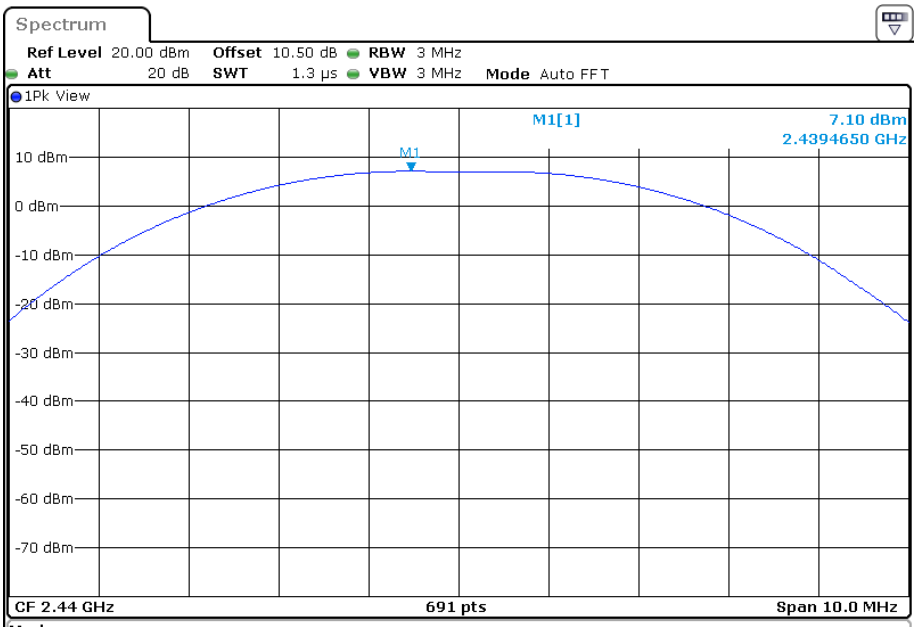
Mode	Channel	Frequency (MHz)	Peak Output Power (dBm)	Limit (dBm)
GFSK	Low	2402	7.69	20.97
	Middle	2440	7.10	20.97
	High	2480	5.89	20.97

Note: the antenna gain is 0dBi, the maximum EIRP=7.69dBm+0dBi=7.69dBm<36dBm, so it's compliance with EIRP limit of ISEDC.

Low Channel



Middle Channel



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.439465 GHz	7.10 dBm		

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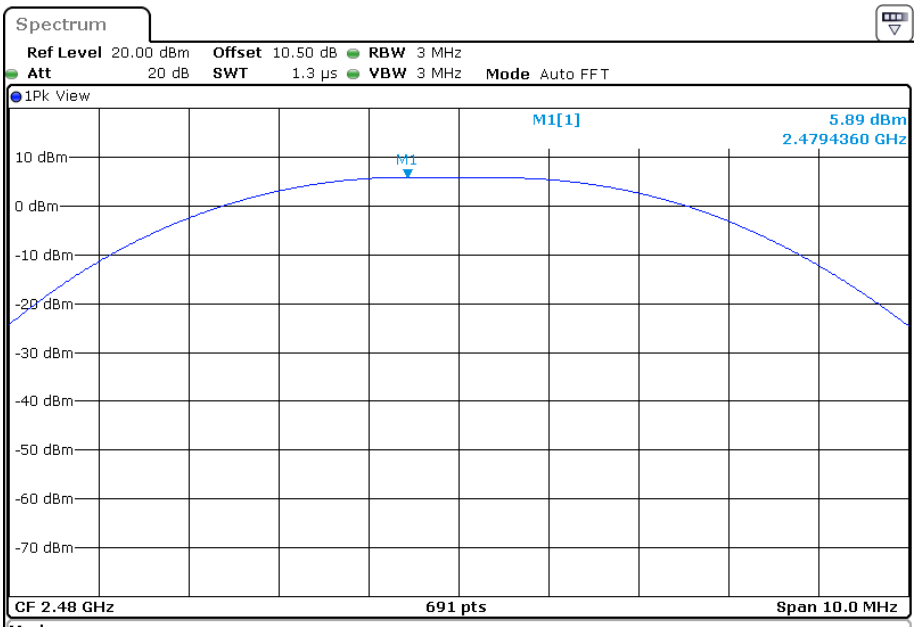
High Channel



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.479436 GHz	5.89 dBm		

Date: 28.DEC.2022 17:01:02

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

Applicable Standard

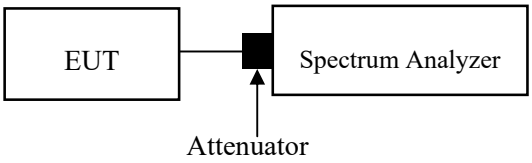
According to FCC §15.247(d) & RSS-247 § 5.5.

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

Test Method: ANSI C63.10-2013 Clause 7.8.6 & Clause 6.10

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



Test Data

Environmental Conditions

Temperature:	26 ℃
Relative Humidity:	53%
ATM Pressure:	101.0 kPa

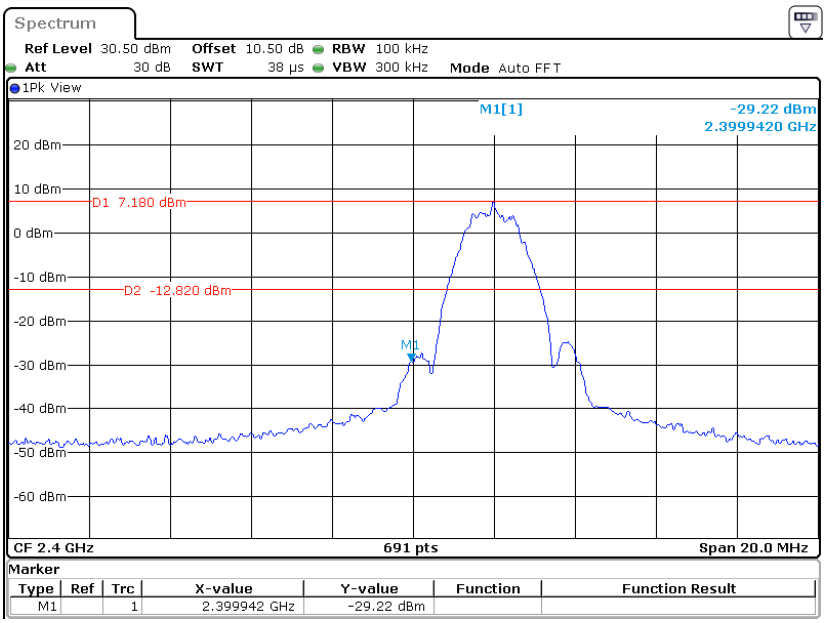
The testing was performed by Green Jiang on 2023-01-30.

EUT operation mode: Transmitting

Test Result: Compliant.

Conducted Band Edge Result:

Low Channel



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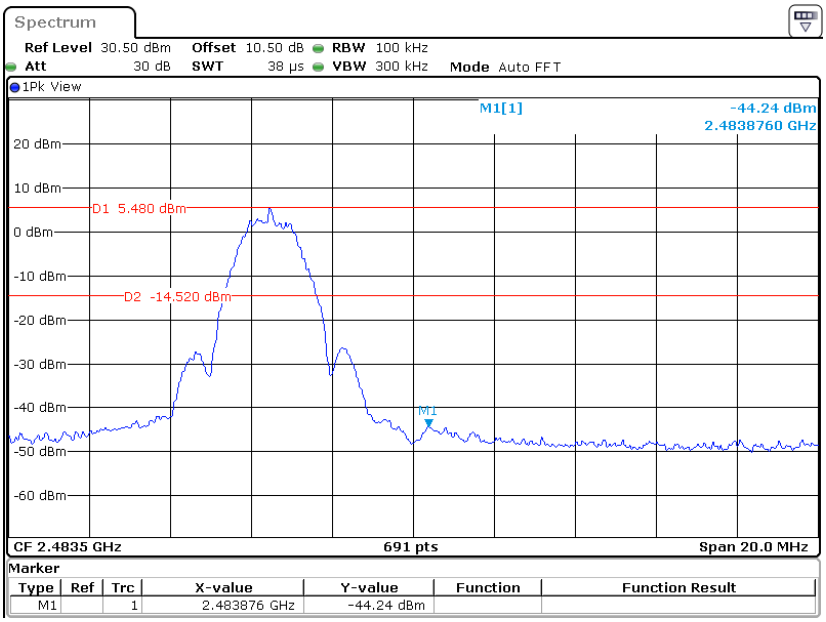
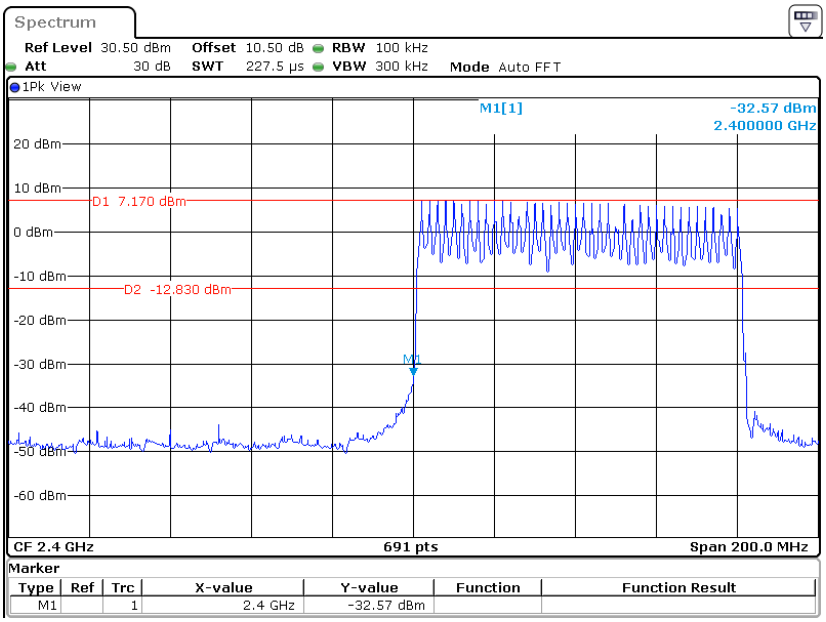
High Channel

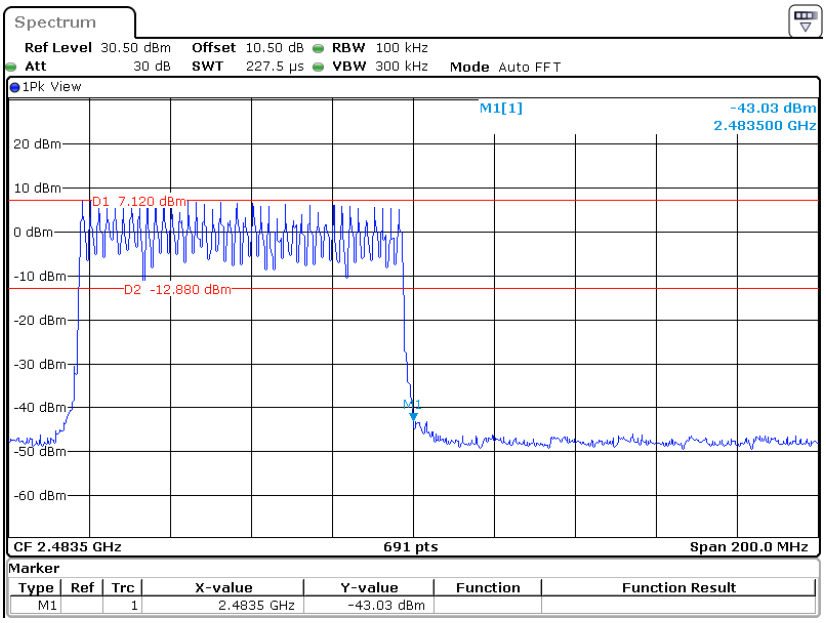


Date: 30.JAN.2023 16:00:40

Hop_Low Channel



Hop_High Channel



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