CONFORMANCE TEST REPORT
FOR
FCC 47 CFR, Part 15 Subpart C

Report No.: 21-05-MAW-007-01

Client:	KAIWOOD Technology Co., Ltd.
Product:	Rapid Test Reader
Model:	CHR-631W, CHR-63xy (x can be 0~9 for different shell colors, y can be W for enabling WiFi and bluetooth functions, or not shown for disabling wireless functions.) For example, CHR-631.
FCC ID:	VGG-KWCHR006
Manufacturer/supplier:	KAIWOOD Technology Co., Ltd.

Date test item received:	2021/05/07
Date test campaign completed:	2022/01/11
Date of issue:	2024/06/14

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Total number of pages of this test report: 85 pages
Total number of pages of photos: External photos 5 pages
Internal photos 10 pages
Setup photos 4 pages

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Manufacturer	: KAIWOOD Technology Co., Ltd.
Address	: 5F, No. 12 & 16, Lane 31, Sec. 1, Huandong Rd., Xinshi District, Tainan City 74146, Taiwan
EUT	: Rapid Test Reader
Trade name	: KAIWOOD
Model No.	: CHR-631W, CHR-63xy (x can be 0~9 for different shell colors, y can be W for enabling WiFi and bluetooth functions, or not shown for disabling wireless functions.) For example, CHR-631.
Power Source	: Adapter: Good Opportunity Electronic Co,.Ltd/GS2U-015-050-M Input: AC 100-240V~0.5A Output: DC 5.0V ⎓ 3000mA, 15W Max
Regulations applied	: FCC 47 CFR, Part 15 Subpart C

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The compliance test is only certified for the test equipment and the results of the testing report relate only to the item tested. The compliance test of this report was conducted in accordance with the appropriate standards. The test result(s) does not consider the uncertainty of measurement when the test standard(s) and/or test method which refer by the labs has the limit or judgments for the test result(s).

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1 GENERAL INFORMATION

1.1 Product Description

a) Type of EUT : Rapid Test Reader
b) Trade Name : KAIWOOD
c) Model No. : CHR-631W, CHR-63xy (x can be 0~9 for different shell colors, y can be W for enabling WiFi and bluetooth functions, or not shown for disabling wireless functions.) For example, CHR-631.
d) FCC ID : VGG-KWCHR006

1.2 Characteristics of Device

The EUT is a Rapid Test Reader based on the Bluetooth technology. Bluetooth operates in the unlicensed ISM Band at 2.4GHz. In this band, 79 RF channels spaced 1MHz apart are defined. The rated output power is 9.94 dBm (9.86 mW).

1.3 Test Methodology

All testing were performed according to the procedures in ANSI C63.10 (2013) and FCC CFR 47 Part 2 and Part 15.

1.4 Modifiction List of EUT

N/A

1.5 Test Facility

The Semi-Anechoic Chamber and conducted measurement facility used to collect the radiated and conducted data are located inside the Building at No.8, Lane 29, Wenming Rd., Guishan Dist., Taoyuan City 33383, Taiwan, R.O.C.
This site has been accreditation as a FCC filing site.

1.6 Test Summary

Requirement	FCC Paragraph #	Test Pass
Radiated Emission	15.247 (d)	Pass
Conducted Emission	15.207	Pass
Antenna Requirement	15.203	Pass
20dB Emission Bandwidth	15.247 (a)(1)	Pass
Output Power	15.247 (b)(1)	Pass
OUT-OF-BAND RF Conducted Spurious Emission	15.247 (d)	Pass
Number of Hopping Channels	15.247 (a)(1)(iii)	Pass
Hopping Channel Carrier Frequency Seperated	15.247 (a)(1)	Pass
Dwell Time	15.247 (a)(1)(iii)	Pass
Maximum Permissible Exposure	2.1093	Pass

2 PROVISIONS APPLICABLE

2.1 Definition

Unintentional radiator:
A device that intentionally generates and radio frequency energy for use within the device, or that sends radio frequency signals by conduction to associated Equipment via connecting wiring, but which is not intended to emit RF energy by radiation or induction.

Class A Digital Device:
A digital device that is marketed for use in a commercial, industrial or business environment, exclusive of a device which is marketed for use by the general public or is intended to be used in the home.

Class B Digital Device :
A digital device that is marketed for use in a residential environment notwithstanding use in commercial, business and industrial environments. Examples of such devices include, but are not limited to, personal computers, calculators, and similar electronic devices that are marketed for use by the general public.

Note : The responsible party may also qualify a device intended to be marketed in a commercial, business or industrial environment as a Class B device, and in fact is encouraged to do so, provided the device complies with the technical specifications for a Class B digital device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a digital device as a Class B digital device, regardless of its intended use.

Intentional radiator:
A device that intentionally generates and emits radio frequency energy by radiation or induction.

2.2 Requirement for Compliance

(1) Conducted Emission Requirement

For unintentional device, according to §15.107(a) Line Conducted Emission Limits is as following:

Frequency MHz	Quasi Peak dB μV	Average dB μV
0.15 - 0.5	66-56*	56-46*
0.5 - 5.0	56	46
5.0 - 30.0	60	50

*Decreases with the logarithm of the frequency.

For intentional device, according to §15.207(a) Line Conducted Emission Limits is same as above table.

(2) Radiated Emission Requirement

For unintentional device, according to §15.109(a), except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency MHz	Distance Meters	Radiated dB μV/m	Radiated μV/m
30 - 88	3	40.0	100
88 - 216	3	43.5	150
216 - 960	3	46.0	200
above 960	3	54.0	500

For intentional radiator device, according to §15.209(a), the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72MHz, 76-88MHz, 174-216MHz or 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

For intentional device, according to §15.209(a), the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the above table.

(3) Antenna Requirement

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.
And according to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(4) 20dB Bandwidth Requirement

For frequency hopping systems, according to 15.247(a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

(5) Output Power Requirement

For frequency hopping systems, 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. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

And according to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(6) 100 kHz Bandwidth of Frequency Band Edges Requirement

According to 15.247(d), in any 100 kHz bandwidth outside these frequency bands, the radio frequency power that is produced by the modulation products of the spreading sequence, the information sequence and the carrier frequency shall be either at least 20 dB below that in any 100 kHz bandwidth within the band that contains the highest level of the desired power or shall not exceed the general levels specified in §15.209(a), whichever results in the lesser attenuation.

(7) Number of Hopping Channels

According to 15.247(a)(iii), frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

(8) Channel Carrier Frequencies Seperation

According to 15.247(a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

(9) Dwell Time

According to 15.247(a)(1)(iii), frequency hopping system in the 2400-2483.5MHz band employing at least 15 non-overlapping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 second multiplied by the number of hopping channels employed.

2.3 Restricted Bands of Operation

Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42-16.423	399.9-410	4.5-5.15
0.495 - 0.505 **	16.69475 - 16.69525	608-614	5.35-5.46
2.1735 - 2.1905	16.80425 - 16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475 - 156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

Remark "**": Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz

2.4 Labeling Requirement

The device shall bear the following statement in a conspicuous location on the device :

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

2.5 User Information

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the Equipment.

For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual.

The Federal Communications Commission Radio Frequency Interference Statement includes the following paragraph.

This Equipment has been tested and found to comply with the limits for a Class B Digital Device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This Equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction may cause harmful interference to radio communication. However, there is no guarantee that interference will not occur in a particular installation.

If this Equipment does cause harmful interference to radio or television reception, which can be determined by turning the Equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

-- Reorient or relocate the receiving antenna.

-- Increase the separation between the Equipment and receiver.

-- Connect the Equipment into an outlet on a circuit different from that to which the receiver is connected.

-- Consult the dealer or an experienced radio / TV technician for help.

To comply with the FCC RF exposure compliance requirement, this device and its antenna must not be co-located or operating to conjunction with any other antenna or transmitter.

3. SYSTEM TEST CONFIGURATION

3.1 Justification

For the purposes of this test report ancillary Equipment is defined as Equipment which is used in conjunction with the EUT to provide operational and control features to the EUT during the test. Notebook PC was used to control the RF channel under the hightest, middle and lowest frequency and transmit the maximun RF power. Customer would not use it. But never the less ancillary Equipment can influence the test results.

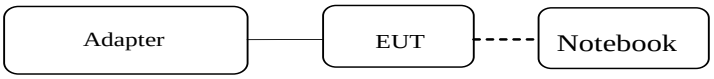
3.2 Devices for Tested System

3.2.1

Device	Trade Name	Model No.	Cable Description
*Rapid Test Reader	KAIWOOD	CHR-631W	Adapter: Good Opportunity Electronic Co,.Ltd/GS2U-015-050-M Input: AC 100-240V~0.5A Output: DC 5.0V ⎓ 3000mA, 15W Max
Notebook	HP	Probook 650G1	0.8m*1 Unshielded USB Cable

Remark

1. "*" means Equipment under test.



After completing the test mode setting, Notebook is removed from the above test configuration for final test to reduce noise interference.

2. Test Software: adb.exe

3.2.2 Test Mode Description

3.2.2.1 Modulation Type

Test Mode	Type	Note
A	NON-EDR	GFSK
B	EDR	π/4-DQPSK, 8-DPSK (note 1)
Power setting: Default		

Test Channel	Frequency (MHz)
Channel Low(L)	2402(note)
Channel Mid(M)	2441(note)
Channel High(H)	2480(note)

3.2.2.2 Test Mode and Worse Case Determination

The EUT was set in continuous operation function for all measurements.

Item	Test Item	Test Mode	Test Frequency (MHz)
1	Output Power	A	L, M, H
		B	L, M, H
	Worse Case	Mode A (note 1)	
2.	20dB Emission Bandwidth	A、B	M (Worse Case)
3	Conducted Emission	A	M (Worse Case)
4	Out of Band Conducted Emission	A、B	L, M, H
5.1	Number of Channel	A	L~H
5.2	Channel Seperation	A	M (note 2)
5.3	Dwell Time	A	M (note 2)
6.1	Radiated Emission (below 1GHz)	A	M (Worse Case)
6.2	Radiated Emission (above 1GHz)	A	L, M, H
6.3	Radiated Emission (BandEdge)	A, B	L, H

note:

1. 8-DPSK is the worse case determined as the modulation with highest output power.
2. Pretest result is no difference in three test modes by channl low, middle and high. Choose one for final testing and record the result.
3. The worse case is determined as the modulation with highest output power.
4. Pretest result is no difference in three test modes by channl low, middle and high. Choose mode A, channel middle for final testing and record the result.

3.3 Test site

Item	Test site
1	■ RE02 — EMC B1 — N2
2	■ CE04 — 10M 2F
3	■ RF — Cond01
4	□ RF — Cond02

4 RADIATED EMISSION MEASUREMENT

4.1 Applicable Standard

For unintentional radiator, the radiated emission shall comply with §15.109(a).

For intentional radiators, according to §15.247 (a), operation under this provision is limited to frequency hopping and digitally modulated, and the out band emission shall be comply with § 15.247 (d)

4.2 Measurement Procedure

The testing follows FCC KDB 558074 D01 15.247 Meas Guidance v05r02.

A.Preliminary Measurement For Portable Devices.

For movable devices, the following procedure was performed to determine the maximum emission axis of EUT (X, Y and Z axis):

1. With the receiving antenna is H polarization, rotate the EUT in turns with three orthogonal axes to determine the axis of maximum emission.
2. With the receiving antenna is V polarization, rotate the EUT in turns with three orthogonal axes to determine the axis of maximum emission.
3. Compare the results derived from above two steps. The axis of maximum emission from EUT was determined and the configuration was used to perform the final measurement.
4. The position in which the maximum noise occurred was “Y axis”. (Please see the test setup photos)

B. Final Measurement

1. Setup the configuration per figure 1 to 3 for frequencies measured below and above 1 GHz respectively. Turn on EUT and make sure that it is in continuous operating function.
2. For emission frequencies measured below 1 GHz, a pre-scan is performed in a semi-anechoic chamber to determine the accurate frequencies of higher emissions and then each selected frequency is precisely measured. As the same purpose, for emission measured above 1 GHz, a pre-scan also be performed with a 1 meter measuring distance before final test.
3. For emission measured below and above 1 GHz, set the spectrum analyzer on a 120 kHz and 1 MHz and 9 KHz resolution bandwidth respectively for each frequency measured in step 2.
4. For emission frequencies measured below 30 MHz, The measurement antenna shall be positioned with its plane perpendicular to the ground at the specified distance. When perpendicular to the ground plane, the lowest height of the magnetic antenna shall be 1 m above the ground and shall be positioned at the specified distance from the EUT. When the EUT contains a loop antenna that can only be placed in a vertical axis, normal measurements shall be made aligning the measurement antenna along the site axis, and then orthogonal to the axis. For each measurement antenna alignment, the EUT shall be rotated through 0° to 360° on a turntable. When the EUT contains a loop antenna that can be placed in a horizontal or vertical axis, normal measurements

shall be made aligning the measurement antenna along the site axis, orthogonal to the axis, and then with the measurement antenna horizontal. For each measurement antenna alignment, the EUT shall be rotated through 0° to 360° on a turntable.

Figure 1: Frequencies measured below 1 GHz configuration

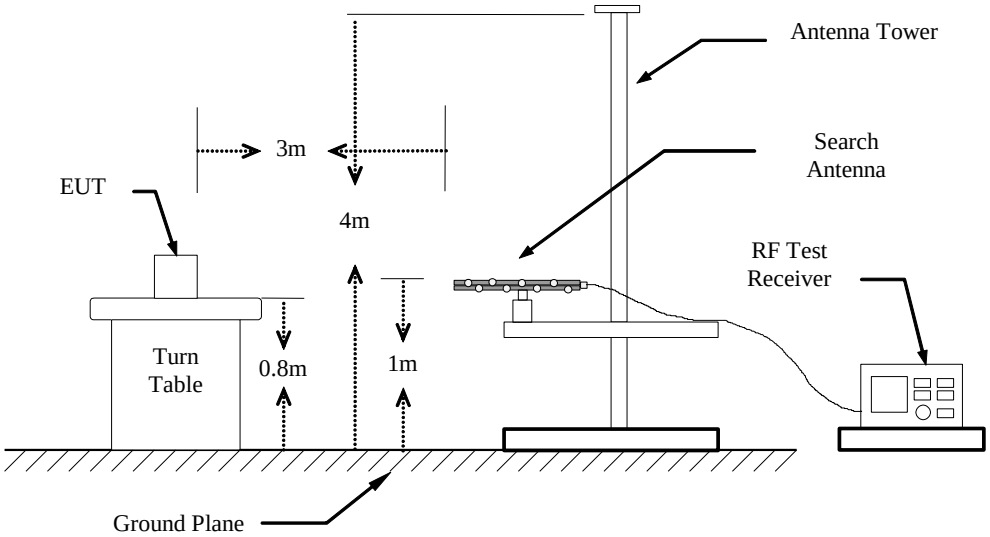


Figure 2: Frequencies measured above 1 GHz configuration

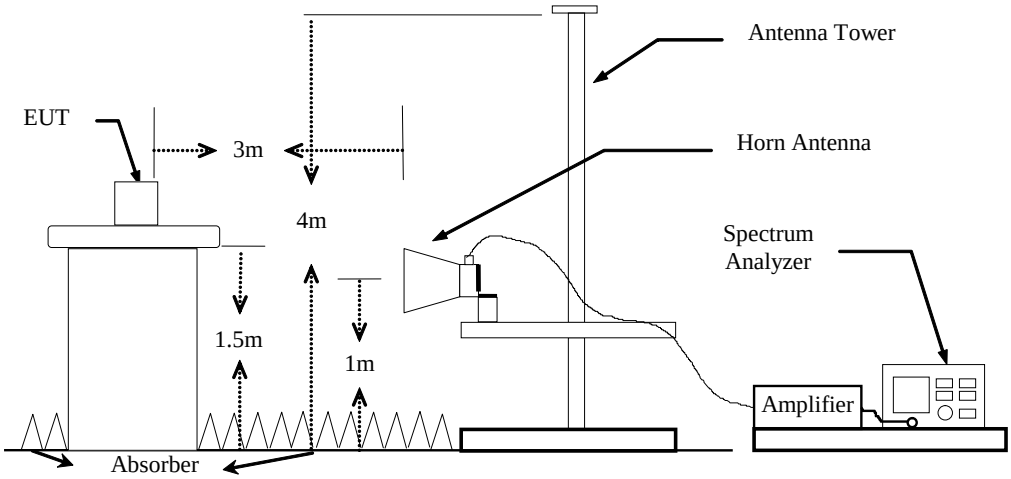
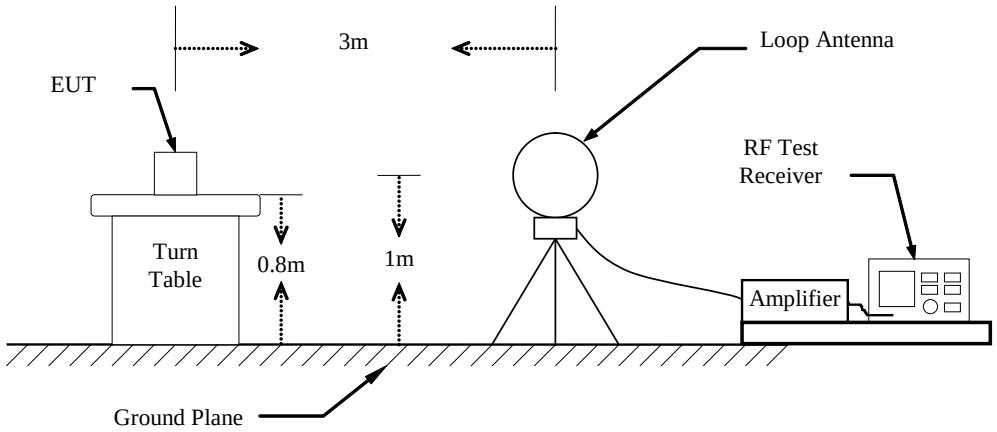


Figure 3: Frequencies measured 9 KHz to 30 MHz configuration



4.3 Measuring Instrument

The following instrument are used for radiated emissions measurement :

Equipment	Trade Name	Model No.
EMI Receiver	R&S	ESCI
Spectrum Analyzer	R&S	FSU46
Spectrum Analyzer	R&S	FSV40
Horn Antenna	EMCO	3117
Horn Antenna	EMCO	3116
Loop Antenna	ETS-LINDREN	6512
PRE-Amplifier	Agilent	8449B
PRE-Amplifier	Agilent	8447D
BiLog Antenna	ETC	MCTD 2786
Trilog Broadband Antenna with 5dB Pad	SCHWARZBECK&EMCI	VULB 9168 & EMCI-N-6-05

Software: LZ-RF (Ver. ETC-3A2)

Measuring instrument setup in measured frequency band when specified detector function is used :

Frequency Band (MHz)	Instrument	Function	Resolution Bandwidth	Video Bandwidth
0.009 to 30	RF Test Receiver	Quasi-Peak	9 kHz	30 kHz
	RF Test Receiver	Average	9 kHz	30 kHz
30 to 1000	RF Test Receiver	Quasi-Peak	120 kHz	300 kHz
	Spectrum Analyzer	Peak	120 kHz	300 kHz
Above 1000	Spectrum Analyzer	Peak	1 MHz	1 MHz
	Spectrum Analyzer	Average	1 MHz	10 Hz

4.4 Radiated Emission Data

4.4.1 RF Portion

4.4.1.1 Channel 0

Operation Mode : TX
Fundamental Frequency : 2402 MHz
Test Date : Dec. 07, 2021 Temperature : 23℃ Humidity : 60%

Frequency	Ant Pol	Reading (dBuV/m)@3m		Correct Factor	Result (dBuV/m)@3m		Limit (dBuV/m)@3m		Margin (worse)
(MHz)	H/V	Peak	AVG	(dB)	Peak	AVG	Peak	AVG	(dB)
4804.0000	H	---	---	1.08	---	---	74.0	54.0	---
4804.0000	V	---	---	1.08	---	---	74.0	54.0	---
7206.0000	H	---	---	3.30	---	---	74.0	54.0	---
7206.0000	V	---	---	3.30	---	---	74.0	54.0	---
9608.0000	H	---	---	4.28	---	---	74.0	54.0	---
9608.0000	V	---	---	4.28	---	---	74.0	54.0	---
12010.0000	H	---	---	7.22	---	---	74.0	54.0	---
12010.0000	V	---	---	7.22	---	---	74.0	54.0	---
14412.0000	H	---	---	9.98	---	---	74.0	54.0	---
14412.0000	V	---	---	9.98	---	---	74.0	54.0	---

Note : 1. Remark "---" means that the emissions level is too low to be measured.
2. If the peak result is under the average limit, that is deemed to meet the average limit.
3. The estimated measurement uncertainty of the result measurement is
VER: ±5.32dB(1GHz≦f<6GHz) ;HOR: ±5.05dB(1GHz≦f<6GHz)
VER: ±4.71dB(6GHz≦f<18GHz) ;HOR: ±4.96dB(6GHz≦f<18GHz)
VER: ±5.37dB(18GHz≦f≦40GHz) ;HOR: ±5.61dB(18GHz≦f≦40GHz)

4.4.1.2 Channel 39

Fundamental Frequency : 2441 MHz

Test Date: Dec. 07, 2021 Temperature: 23℃ Humidity: 60%

Frequency	Ant Pol	Reading (dBuV/m)@3m		Correct Factor	Result (dBuV/m)@3m		Limit (dBuV/m)@3m		Margin (worse)
(MHz)	H/V	Peak	AVG	(dB)	Peak	AVG	Peak	AVG	(dB)
4882.0000	H	---	---	1.35	---	---	74.0	54.0	---
4882.0000	V	---	---	1.35	---	---	74.0	54.0	---
7323.0000	H	---	---	3.39	---	---	74.0	54.0	---
7323.0000	V	---	---	3.39	---	---	74.0	54.0	---
9764.0000	H	---	---	4.45	---	---	74.0	54.0	---
9764.0000	V	---	---	4.45	---	---	74.0	54.0	---
12205.0000	H	---	---	7.58	---	---	74.0	54.0	---
12205.0000	V	---	---	7.58	---	---	74.0	54.0	---
14646.0000	H	---	---	10.04	---	---	74.0	54.0	---
14646.0000	V	---	---	10.04	---	---	74.0	54.0	---

Note : 1. Remark "---" means that the emissions level is too low to be measured.

2. If the peak result is under the average limit, that is deemed to meet the average limit.

3. The estimated measurement uncertainty of the result measurement is

VER: ±5.32dB(1GHz≦f<6GHz) ;HOR: ±5.05dB(1GHz≦f<6GHz)

VER: ±4.71dB(6GHz≦f<18GHz) ;HOR: ±4.96dB(6GHz≦f<18GHz)

VER: ±5.37dB(18GHz≦f≦40GHz) ;HOR: ±5.61dB(18GHz≦f≦40GHz)

4.4.1.3 Channel 78

Fundamental Frequency : 2480 MHz

Test Date: Dec. 07, 2021 Temperature: 23℃ Humidity: 60%

Frequency	Ant Pol	Reading (dBuV/m)@3m		Correct Factor	Result (dBuV/m)@3m		Limit (dBuV/m)@3m		Margin (worse)
(MHz)	H/V	Peak	AVG	(dB)	Peak	AVG	Peak	AVG	(dB)
4960.0000	H	---	---	1.62	---	---	74.0	54.0	---
4960.0000	V	---	---	1.62	---	---	74.0	54.0	---
7440.0000	H	---	---	3.47	---	---	74.0	54.0	---
7440.0000	V	---	---	3.47	---	---	74.0	54.0	---
9920.0000	H	---	---	4.65	---	---	74.0	54.0	---
9920.0000	V	---	---	4.65	---	---	74.0	54.0	---
12400.0000	H	---	---	7.94	---	---	74.0	54.0	---
12400.0000	V	---	---	7.94	---	---	74.0	54.0	---
14880.0000	H	---	---	10.14	---	---	74.0	54.0	---
14880.0000	V	---	---	10.14	---	---	74.0	54.0	---

Note : 1. Remark "---" means that the emissions level is too low to be measured.

2. If the peak result is under the average limit, that is deemed to meet the average limit.

3. The estimated measurement uncertainty of the result measurement is

VER: ±5.32dB(1GHz≦f<6GHz) ;HOR: ±5.05dB(1GHz≦f<6GHz)

VER: ±4.71dB(6GHz≦f<18GHz) ;HOR: ±4.96dB(6GHz≦f<18GHz)

VER: ±5.37dB(18GHz≦f≦40GHz) ;HOR: ±5.61dB(18GHz≦f≦40GHz)

4.4.2 Above 1GHz test charts for Harmonic and spurious emission

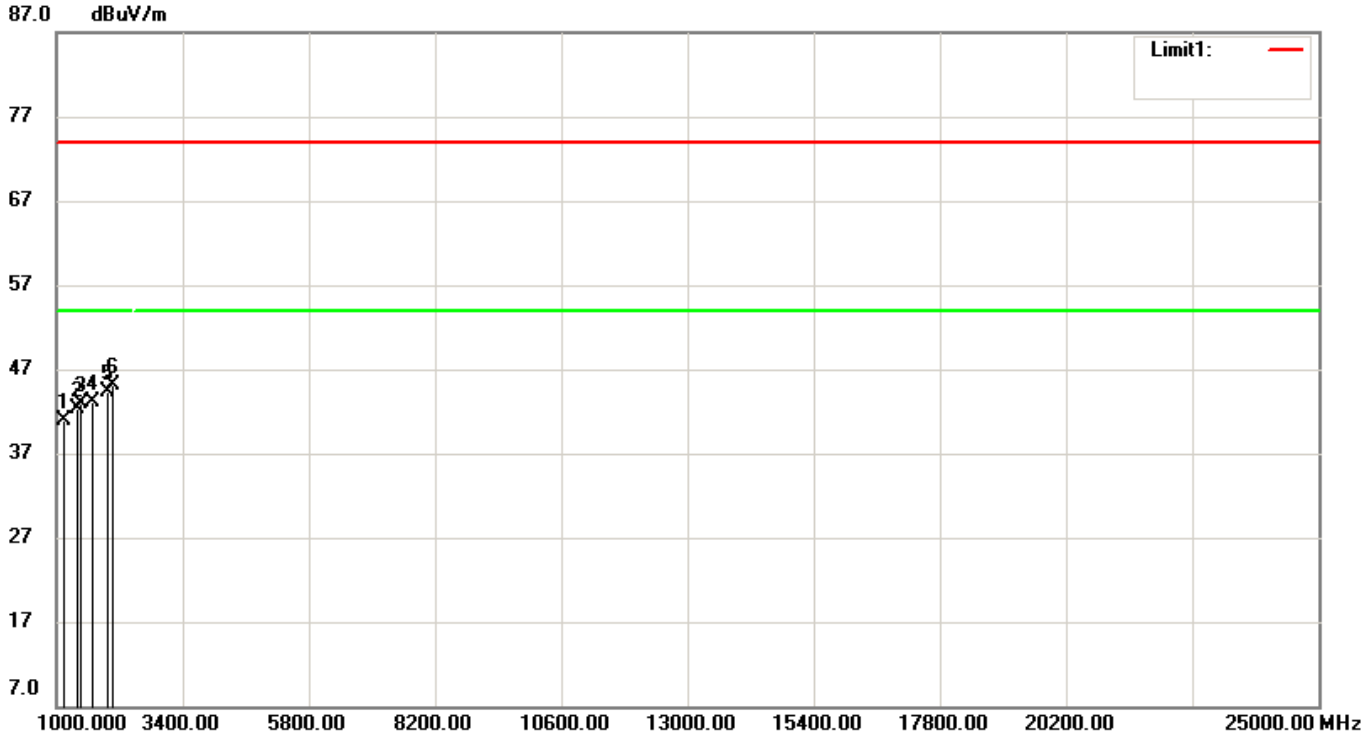
4.4.2.1 Channel Low

Operated mode : TX / RX

Fundamental Frequency : 2402 MHz

File: **21-05-MAW-007_EDR** **#35** **Date:** **2021/12/7** **Temperature:** **23 ℃**

Site: **RE02-EMC B1-N2** **Humidity:** **60 %**



Condition: **FCC Part15 RE-Class B_Above 1GHz_PK** **Polarization:** **Horizontal**
EUT: **Rapid Test Reader** **Distance:** **3m**
Model: **CHR-631W**
Test Mode: **BT** **Operator:** **Phillip**
Note: **CH LOW-1**

No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Corrected dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)
1	1118.91020	50.07	peak	-9.09	40.98	74.00	-33.02	152	24
2	1367.94870	50.69	peak	-8.32	42.37	74.00	-31.63	152	87
3	1441.98710	50.94	peak	-8.08	42.86	74.00	-31.14	148	122
4	1670.83330	49.69	peak	-6.54	43.15	74.00	-30.85	165	103
5	1933.33330	48.69	peak	-4.46	44.23	74.00	-29.77	142	310
6	2052.24350	48.91	peak	-3.79	45.12	74.00	-28.88	150	330

Note: 1. If the peak result is under the average limit, that is deemed to meet the average limit.

2. The estimated measurement uncertainty of the result measurement is:

VER: ±5.32dB(1GHz≦f<6GHz) ;HOR: ±5.05dB(1GHz≦f<6GHz)

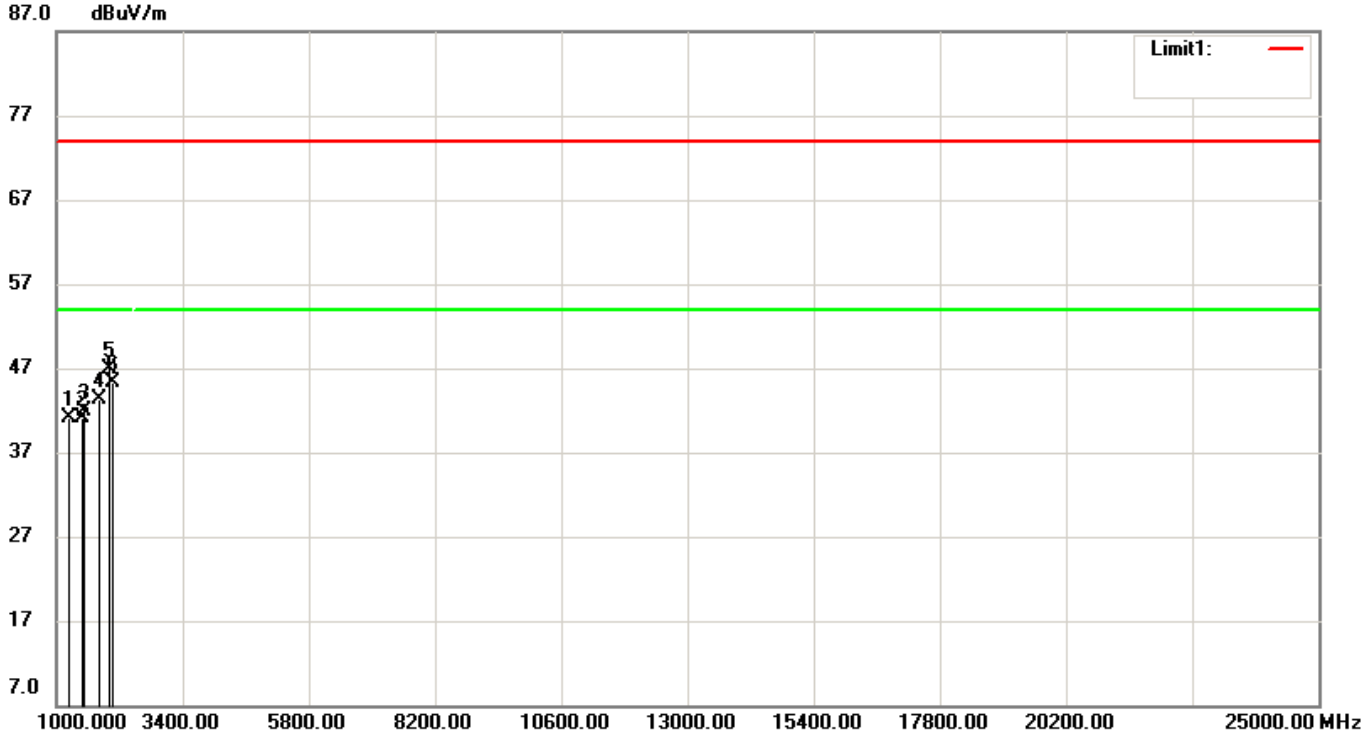
VER: ±4.71dB(6GHz≦f<18GHz) ;HOR: ±4.96dB(6GHz≦f<18GHz)

VER: ±5.37dB(18GHz≦f≦40GHz) ;HOR: ±5.61dB(18GHz≦f≦40GHz)

Operated mode : TX / RX
Fundamental Frequency : 2402 MHz

File: **21-05-MAW-007_EDR** **#36** **Date:** **2021/12/7** **Temperature:** **23 ℃**

Site: **RE02-EMC B1-N2** **Humidity:** **60 %**



Condition: **FCC Part15 RE-Class B_Above 1GHz_PK** **Polarization:** **Vertical**

EUT: **Rapid Test Reader** **Distance:** **3m**

Model: **CHR-631W**

Test Mode: **BT** **Operator:** **Phillip**

Note: **CH LOW-1**

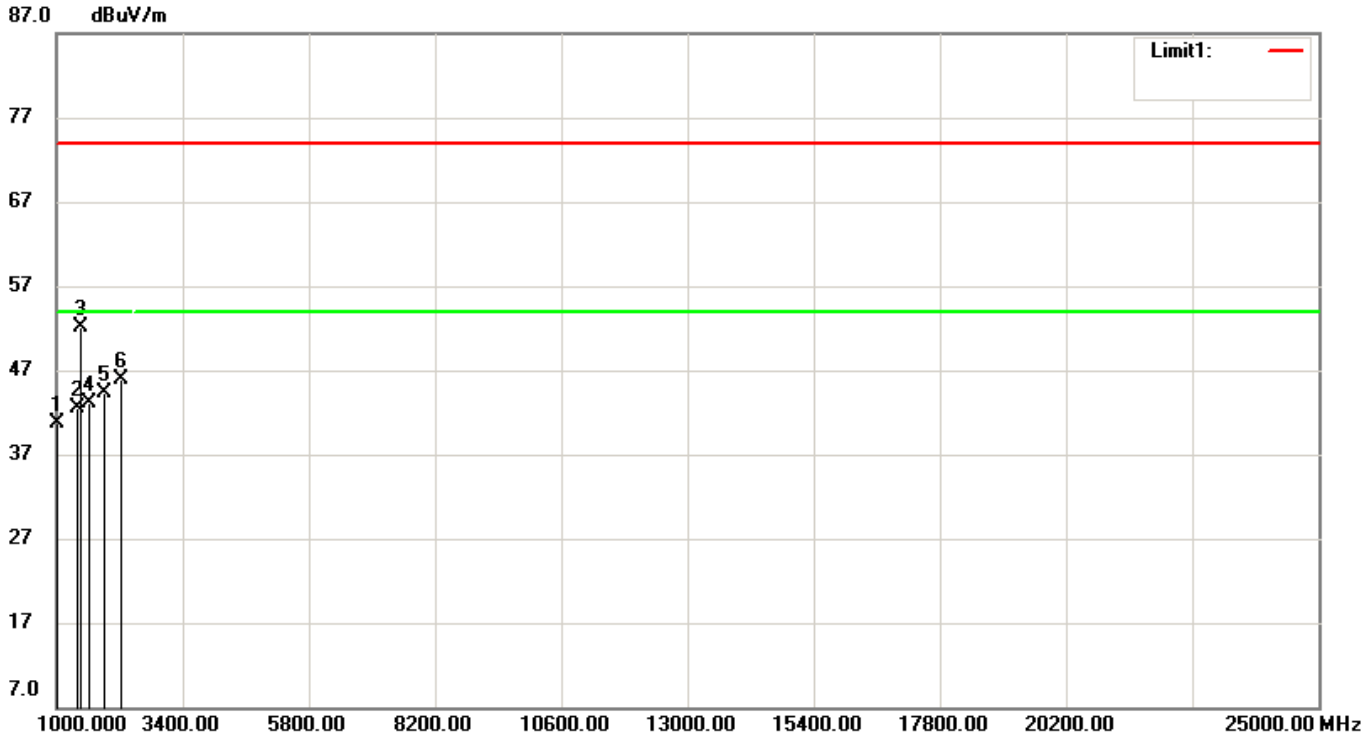
No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Corrected dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)
1	1195.19230	49.94	peak	-8.85	41.09	74.00	-32.91	150	101
2	1498.07700	49.01	peak	-7.90	41.11	74.00	-32.89	134	45
3	1516.02560	49.61	peak	-7.78	41.83	74.00	-32.17	149	83
4	1798.71800	48.89	peak	-5.53	43.36	74.00	-30.64	150	316
5	1996.15380	50.93	peak	-3.94	46.99	74.00	-27.01	153	270
6	2047.75640	49.09	peak	-3.79	45.30	74.00	-28.70	162	127

Note: 1. If the peak result is under the average limit, that is deemed to meet the average limit.
2. The estimated measurement uncertainty of the result measurement is:
VER: ±5.32dB(1GHz≦f<6GHz) ;HOR: ±5.05dB(1GHz≦f<6GHz)
VER: ±4.71dB(6GHz≦f<18GHz) ;HOR: ±4.96dB(6GHz≦f<18GHz)
VER: ±5.37dB(18GHz≦f≦40GHz) ;HOR: ±5.61dB(18GHz≦f≦40GHz)

4.4.2.2 Channel Mid
Operated mode : TX / RX
Fundamental Frequency : 2441 MHz

File: **21-05-MAW-007_EDR** **#37** **Date:** **2021/12/7** **Temperature:** **23 ℃**

Site: **RE02-EMC B1-N2** **Humidity:** **60 %**



Condition: **FCC Part15 RE-Class B_Above 1GHz_PK** **Polarization:** **Horizontal**
EUT: **Rapid Test Reader** **Distance:** **3m**
Model: **CHR-631W**
Test Mode: **BT** **Operator:** **Phillip**
Note: **CH MID-1**

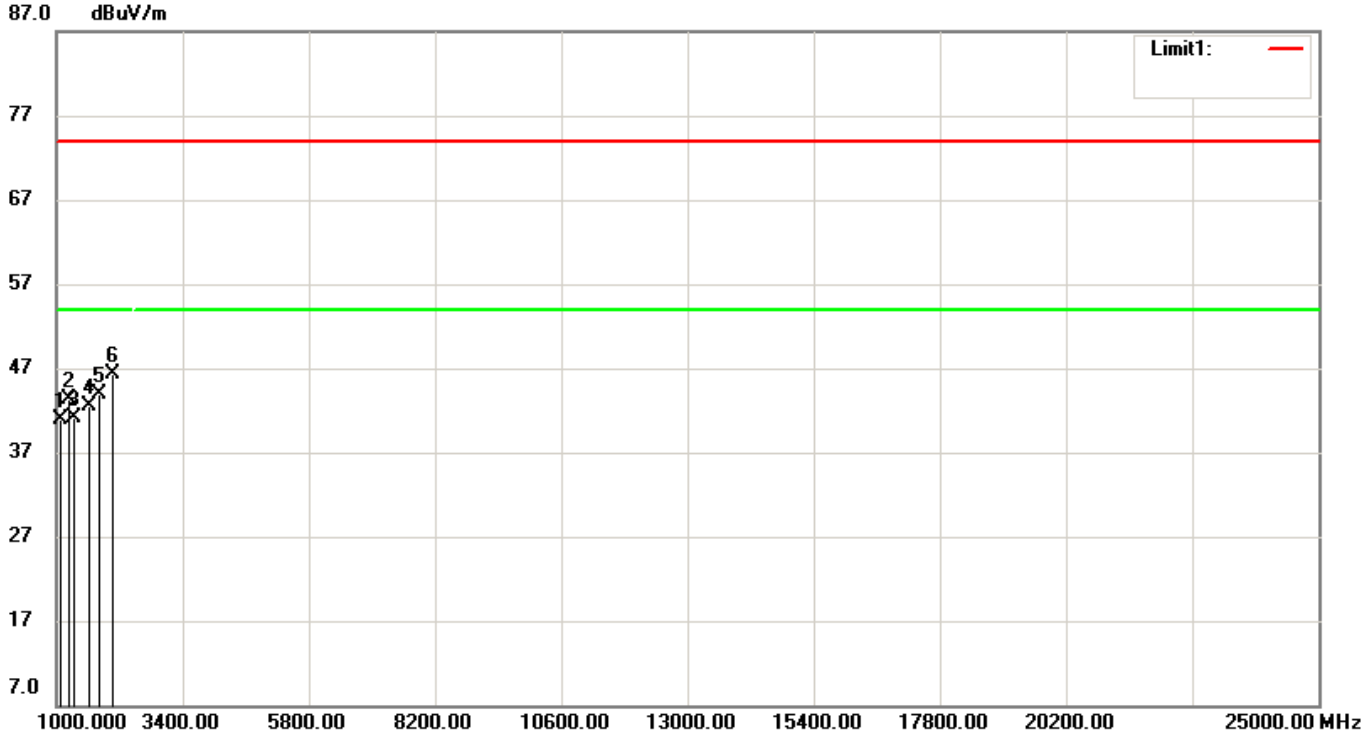
No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Corrected dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)
1	1035.89740	50.13	peak	-9.36	40.77	74.00	-33.23	144	100
2	1363.46150	50.86	peak	-8.33	42.53	74.00	-31.47	123	231
3	1450.96150	60.16	peak	-8.06	52.10	74.00	-21.90	151	72
4	1601.28200	50.19	peak	-7.09	43.10	74.00	-30.90	172	155
5	1904.16660	49.02	peak	-4.68	44.34	74.00	-29.66	150	143
6	2204.80760	49.29	peak	-3.38	45.91	74.00	-28.09	150	208

Note: 1. If the peak result is under the average limit, that is deemed to meet the average limit.
2. The estimated measurement uncertainty of the result measurement is:
VER: ±5.32dB(1GHz≦f<6GHz) ;HOR: ±5.05dB(1GHz≦f<6GHz)
VER: ±4.71dB(6GHz≦f<18GHz) ;HOR: ±4.96dB(6GHz≦f<18GHz)
VER: ±5.37dB(18GHz≦f≦40GHz) ;HOR: ±5.61dB(18GHz≦f≦40GHz)

Operated mode : TX / RX
Fundamental Frequency : 2441 MHz

File: **21-05-MAW-007_EDR** **#38** **Date:** **2021/12/7** **Temperature:** **23 ℃**

Site: **RE02-EMC B1-N2** **Humidity:** **60 %**



Condition: **FCC Part15 RE-Class B_Above 1GHz_PK** **Polarization:** **Vertical**

EUT: **Rapid Test Reader** **Distance:** **3m**

Model: **CHR-631W**

Test Mode: **BT** **Operator:** **Phillip**

Note: **CH MID-1**

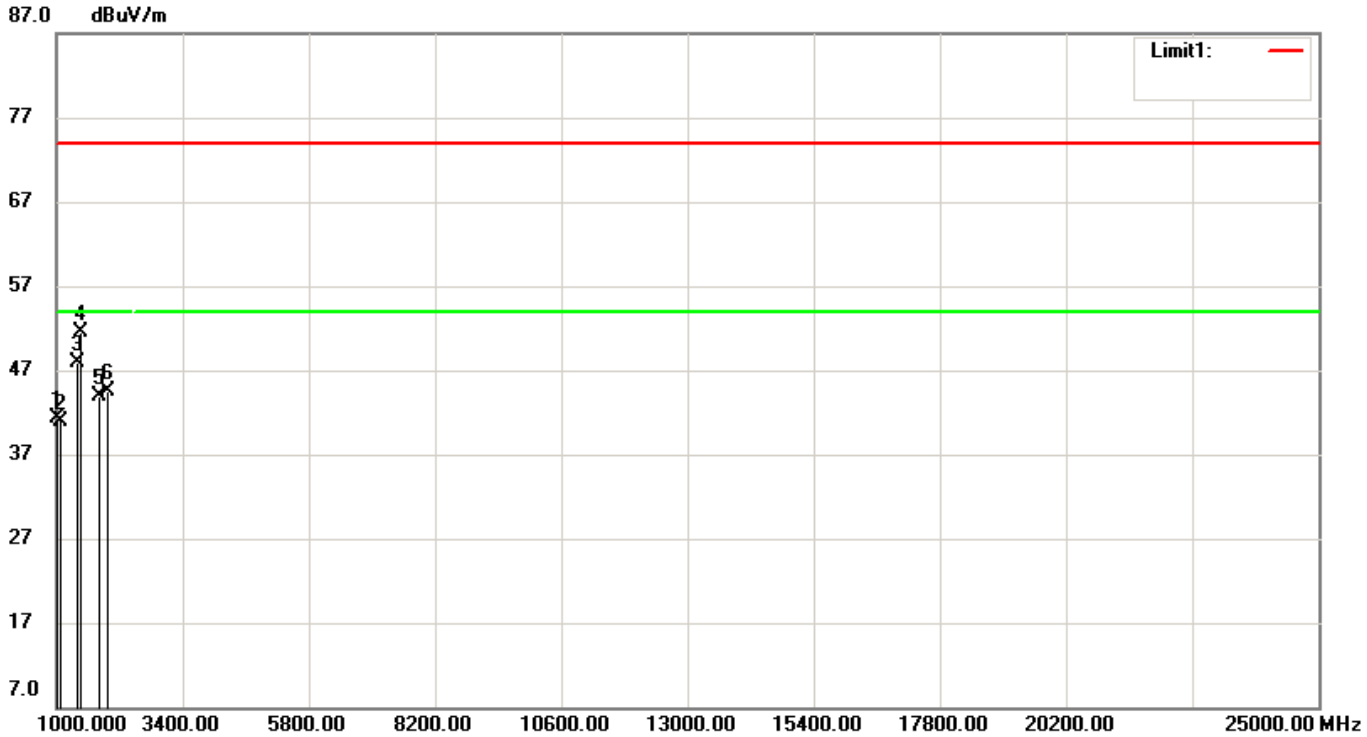
No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Corrected dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)
1	1040.38460	50.18	peak	-9.35	40.83	74.00	-33.17	152	51
2	1197.43580	52.16	peak	-8.85	43.31	74.00	-30.69	150	77
3	1320.83330	49.63	peak	-8.46	41.17	74.00	-32.83	150	199
4	1612.50000	49.53	peak	-7.00	42.53	74.00	-31.47	173	16
5	1800.96150	49.39	peak	-5.51	43.88	74.00	-30.12	161	360
6	2045.51280	50.13	peak	-3.80	46.33	74.00	-27.67	144	182

Note: 1. If the peak result is under the average limit, that is deemed to meet the average limit.
2. The estimated measurement uncertainty of the result measurement is:
VER: ±5.32dB(1GHz≦f<6GHz) ;HOR: ±5.05dB(1GHz≦f<6GHz)
VER: ±4.71dB(6GHz≦f<18GHz) ;HOR: ±4.96dB(6GHz≦f<18GHz)
VER: ±5.37dB(18GHz≦f≦40GHz) ;HOR: ±5.61dB(18GHz≦f≦40GHz)

4.4.2.3 Channel High
Operated mode : TX / RX
Fundamental Frequency : 2480 MHz

File: **21-05-MAW-007_EDR** **#39** **Date:** **2021/12/7** **Temperature:** **23 ℃**

Site: **RE02-EMC B1-N2** **Humidity:** **60 %**



Condition: **FCC Part15 RE-Class B_Above 1GHz_PK** **Polarization:** **Horizontal**
EUT: **Rapid Test Reader** **Distance:** **3m**
Model: **CHR-631W**
Test Mode: **BT** **Operator:** **Phillip**
Note: **CH HIGH-1**

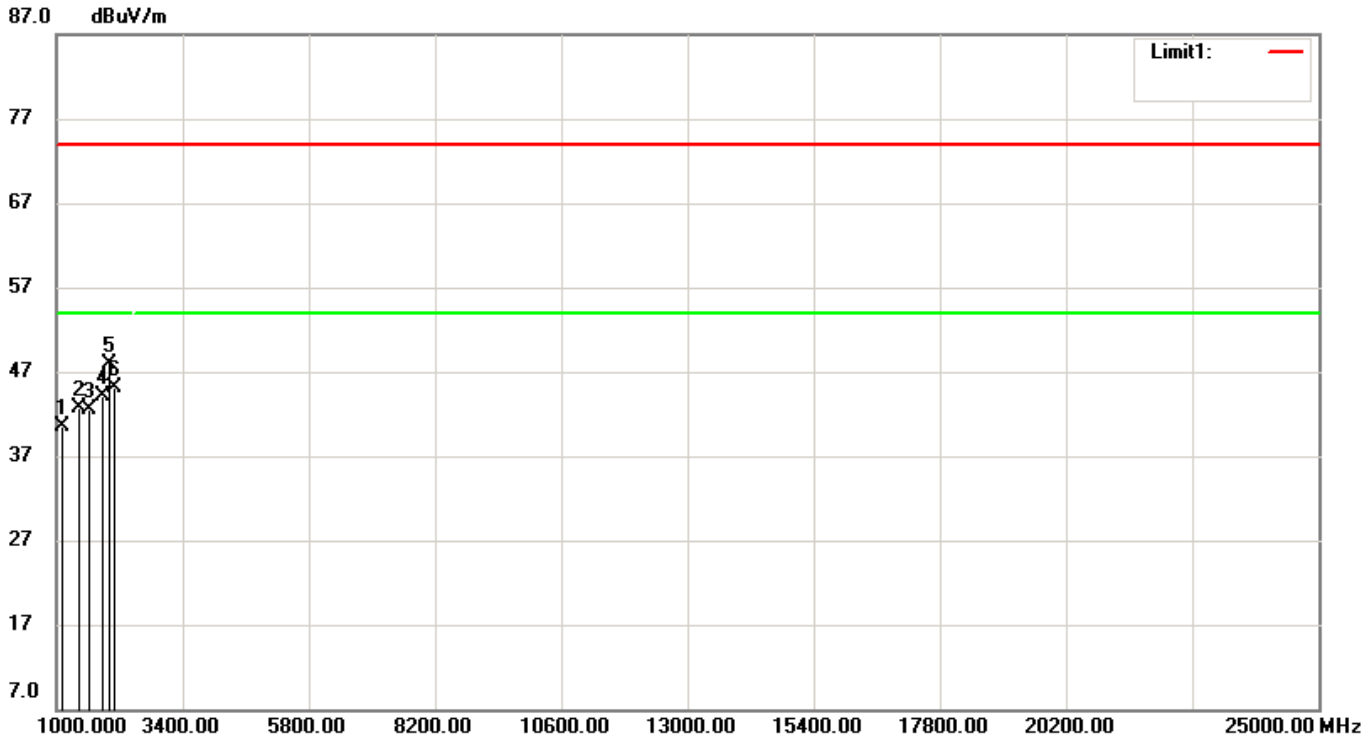
No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Corrected dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)
1	1004.48710	50.78	peak	-9.46	41.32	74.00	-32.68	149	129
2	1042.62820	50.25	peak	-9.34	40.91	74.00	-33.09	171	309
3	1374.67940	56.14	peak	-8.30	47.84	74.00	-26.16	151	74
4	1426.28200	59.59	peak	-8.13	51.46	74.00	-22.54	152	68
5	1796.47430	49.49	peak	-5.54	43.95	74.00	-30.05	164	256
6	1928.84610	49.02	peak	-4.49	44.53	74.00	-29.47	139	171

Note: 1. If the peak result is under the average limit, that is deemed to meet the average limit.
2. The estimated measurement uncertainty of the result measurement is:
VER: ±5.32dB(1GHz≦f<6GHz) ;HOR: ±5.05dB(1GHz≦f<6GHz)
VER: ±4.71dB(6GHz≦f<18GHz) ;HOR: ±4.96dB(6GHz≦f<18GHz)
VER: ±5.37dB(18GHz≦f≦40GHz) ;HOR: ±5.61dB(18GHz≦f≦40GHz)

Operated mode : TX / RX
Fundamental Frequency : 2480 MHz

File: **21-05-MAW-007_EDR** **#40** **Date:** **2021/12/7** **Temperature:** **23 ℃**

Site: **RE02-EMC B1-N2** **Humidity:** **60 %**



Condition: **FCC Part15 RE-Class B_Above 1GHz_PK** **Polarization:** **Vertical**

EUT: **Rapid Test Reader** **Distance:** **3m**

Model: **CHR-631W**

Test Mode: **BT** **Operator:** **Phillip**

Note: **CH HIGH-1**

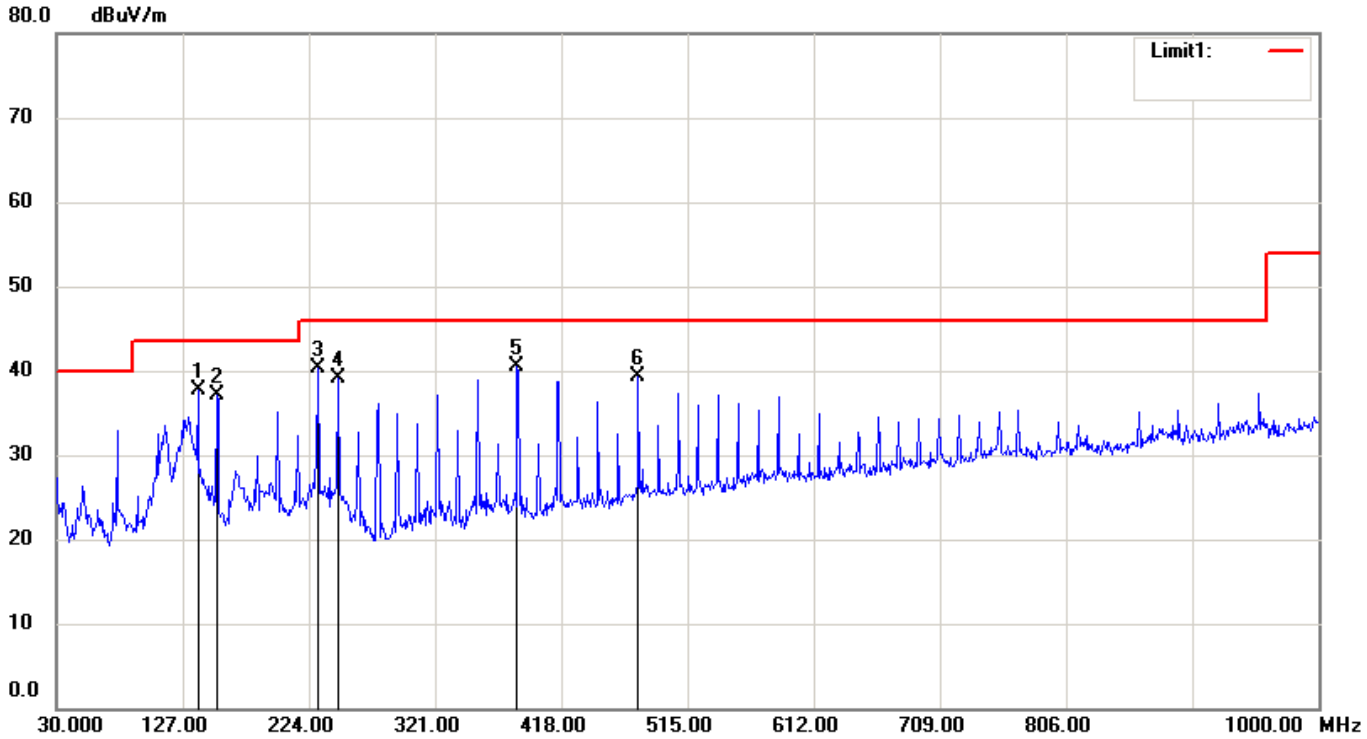
No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Corrected dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)
1	1089.74350	49.68	peak	-9.19	40.49	74.00	-33.51	152	241
2	1397.11530	50.90	peak	-8.22	42.68	74.00	-31.32	150	58
3	1601.28200	49.66	peak	-7.09	42.57	74.00	-31.43	155	66
4	1877.24350	49.00	peak	-4.90	44.10	74.00	-29.90	150	190
5	1996.15380	51.86	peak	-3.94	47.92	74.00	-26.08	144	170
6	2085.89740	48.78	peak	-3.70	45.08	74.00	-28.92	167	210

Note: 1. If the peak result is under the average limit, that is deemed to meet the average limit.
2. The estimated measurement uncertainty of the result measurement is:
VER: ±5.32dB(1GHz≦f<6GHz) ;HOR: ±5.05dB(1GHz≦f<6GHz)
VER: ±4.71dB(6GHz≦f<18GHz) ;HOR: ±4.96dB(6GHz≦f<18GHz)
VER: ±5.37dB(18GHz≦f≦40GHz) ;HOR: ±5.61dB(18GHz≦f≦40GHz)

4.4.3 Other Emission

4.4.3.1 30MHz to 1GHz

File:	**21-05-MAW-007_Below 1G**	**#5**	**Date:**	**2021/12/6**	**Temperature:**	**22 ℃**
Site:	**RE02-EMC B1-N2**				**Humidity:**	**59 %**



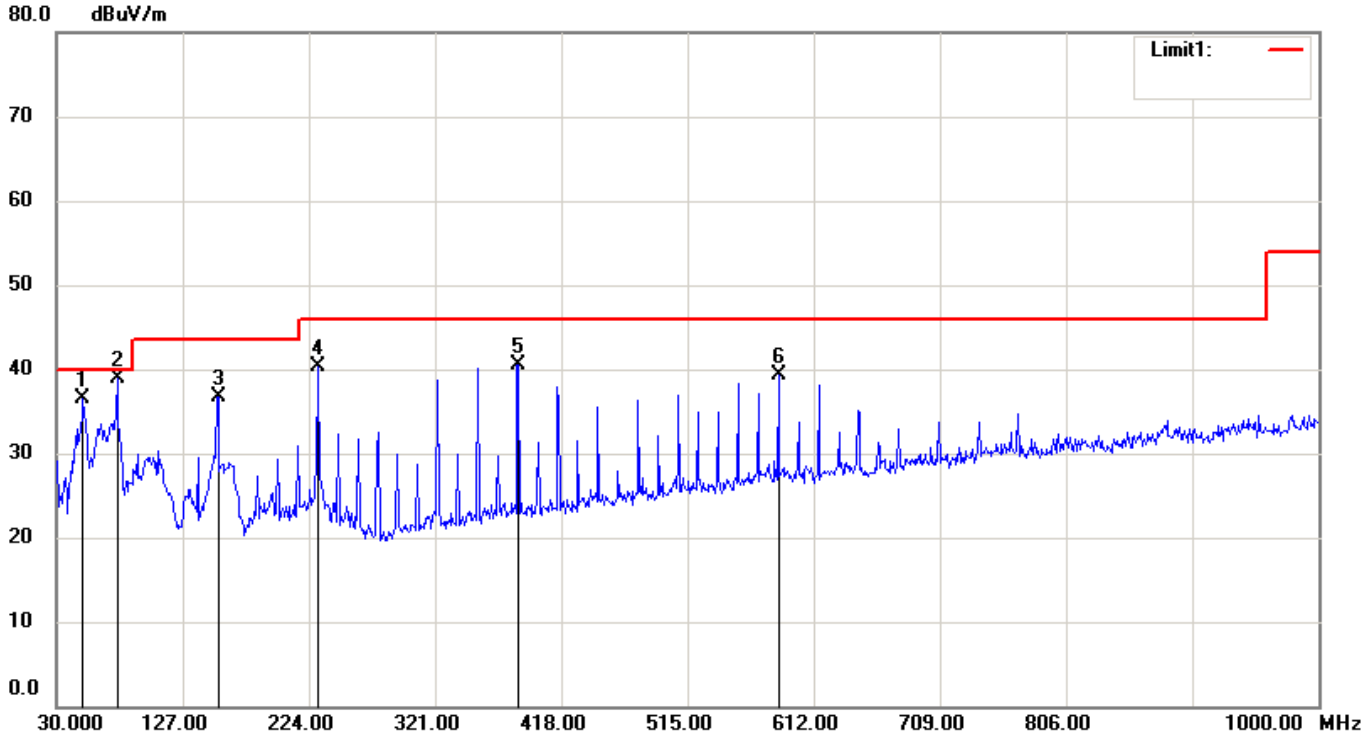
Condition:	**FCC Part15 RE-Class B_30-1000MHz**	**Polarization:**	**Horizontal**
EUT:	**Rapid Test Reader**	**Distance:**	**3m**
Model:	**CHR-631W**		
Test Mode:	**BT**	**Operator:**	**Phillip**

Note:

No.	Frequency	Reading	Detector	Corrected	Result	Limit	Margin	Height	Degree
	(MHz)	(dBuV/m)		dB/m	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(°)
1	138.6400	45.41	peak	-7.67	37.74	43.50	-5.76	101	63
2	153.1900	43.97	peak	-6.94	37.03	43.50	-6.47	100	74
3	230.7900	48.50	peak	-8.19	40.31	46.00	-5.69	121	150
4	246.3100	46.45	peak	-7.38	39.07	46.00	-6.93	112	145
5	384.0500	44.36	peak	-3.82	40.54	46.00	-5.46	146	87
6	477.1700	41.42	peak	-2.06	39.36	46.00	-6.64	134	59

File: **21-05-MAW-007_Below 1G** **#6** **Date:** **2021/12/6** **Temperature:** **22 ℃**

Site: **RE02-EMC B1-N2** **Humidity:** **59 %**



Condition: **FCC Part15 RE-Class B_30-1000MHz** **Polarization:** **Vertical**

EUT: **Rapid Test Reader** **Distance:** **3m**

Model: **CHR-631W**

Test Mode: **BT** **Operator:** **Phillip**

Note:

No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Corrected dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)
1	50.3700	44.28	QP	-7.68	36.60	40.00	-3.40	100	205
2	76.5600	50.08	QP	-11.16	38.92	40.00	-1.08	100	17
3	154.1600	43.71	QP	-6.92	36.79	43.50	-6.71	121	130
4	230.7900	48.55	QP	-8.19	40.36	46.00	-5.64	150	66
5	385.0200	44.23	QP	-3.80	40.43	46.00	-5.57	150	42
6	584.8400	38.90	QP	0.31	39.21	46.00	-6.79	102	49

4.4.3.2 below 30MHz

Frequency (MHz)	. Reading (dBuV/m) Peak	Duty (dB)	Factor (dB)	Result @3m (dBuV/m) Peak	QP	AVG	Limit @3m (dBuV/m) Peak	AVG
Radiated emission frequencies from 9 kHz to 30 MHz were too low to be measured.								

Note: 1. Place of Measurement: Measuring site of the ETC.
2. Item of margin shown in above table refer to average limit.
3. Remark "---" means that the emissions level is too low to be measured.
4. If the peak result is under the average limit, that is deemed to meet the average limit.
5. If there is only peak result, item "Margin" referred to "peak result – average limit".
6. The radiation emissions have been measured to beyond the tenth harmonic of the fundamental frequency and show the significant frequencies, other means the value is too low to be detected.
7. The estimated measurement uncertainty of the result measurement is
±4.2dB (9kHz≦f≦30MHz)
±4.6dB (30MHz≦f<300MHz).
±4.4dB (300MHz≦f<1000MHz).
±2.9dB (1GHz≦f<18GHz).
±3.5dB (18GHz≦f≦40GHz).

4.4.4 Radiated Measurement at Bandedge with Fundamental Frequencies

4.4.4.1 Operation Mode : NON-EDR

Operation Mode : Transmitting
Test Date: Dec. 07, 2021 Temperature : 23℃ Humidity : 60%

Frequency	Reading @3m (dBuV/m)				Factor	Result		Limit @3m		Margin (worse)	
	H		V			(dBuV/m)		(dBuV/m)		(dB)	
(MHz)	Peak	Ave	Peak	Ave	(dB)	Peak	Ave	Peak	Ave	Peak	Ave
2390.000	27.52	14.00	27.94	14.01	34.44	62.38	48.45	74.00	54.00	-11.62	-5.55
2483.500	28.12	14.88	28.69	14.45	34.66	63.35	49.54	74.00	54.00	-10.65	-4.46

Electric field strength (dBuV/m)	CH L	CH M	CH Hi
	104.05	104.16	105.14

Note:1. The result is the highest value of radiated emission from restrict band of 2310~2390 MHz.
2. The estimated measurement uncertainty of the result measurement is:
VER: ±5.32dB(1GHz≦f<6GHz) ;HOR: ±5.05dB(1GHz≦f<6GHz)

4.4.4.2 Operation Mode : EDR

Test Date: Dec. 07, 2021 Temperature : 23℃ Humidity : 60%

Frequency	Reading @3m (dBuV/m)				Factor	Result		Limit @3m		Margin (worse)	
	H		V			(dBuV/m)		(dBuV/m)		(dB)	
(MHz)	Peak	Ave	Peak	Ave	(dB)	Peak	Ave	Peak	Ave	Peak	Ave
2390.000	27.59	14.01	27.41	14.02	34.44	62.03	48.46	74.00	54.00	-11.97	-5.54
2483.500	28.16	14.39	28.17	14.24	34.66	62.83	49.05	74.00	54.00	-11.17	-4.95

Electric field strength (dBuV/m)	CH L	CH M	CH Hi
	100.80	101.42	102.68

Note:1. The result is the highest value of radiated emission from restrict band of 2310~2390 MHz.
2. The estimated measurement uncertainty of the result measurement is:
VER: ±5.32dB(1GHz≦f<6GHz) ;HOR: ±5.05dB(1GHz≦f<6GHz)

4.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor, High Pass Filter Loss(if used) and Cable Loss, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation calculation is as follows:

Result = Reading + Corrected Factor + Duty Factor (if needed)

where

Corrected Factor = Antenna Factor + Cable Loss + High Pass Filter Loss - Amplifier Gain

5 CONDUCTED EMISSION MEASUREMENT

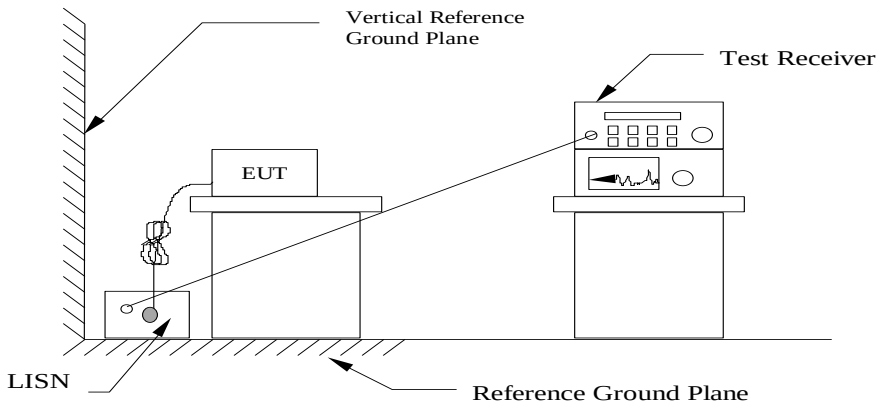
5.1 Standard Applicable

Line Conducted Emission Limits are in accordance to §§15.207(a).

5.2 Measurement Procedure

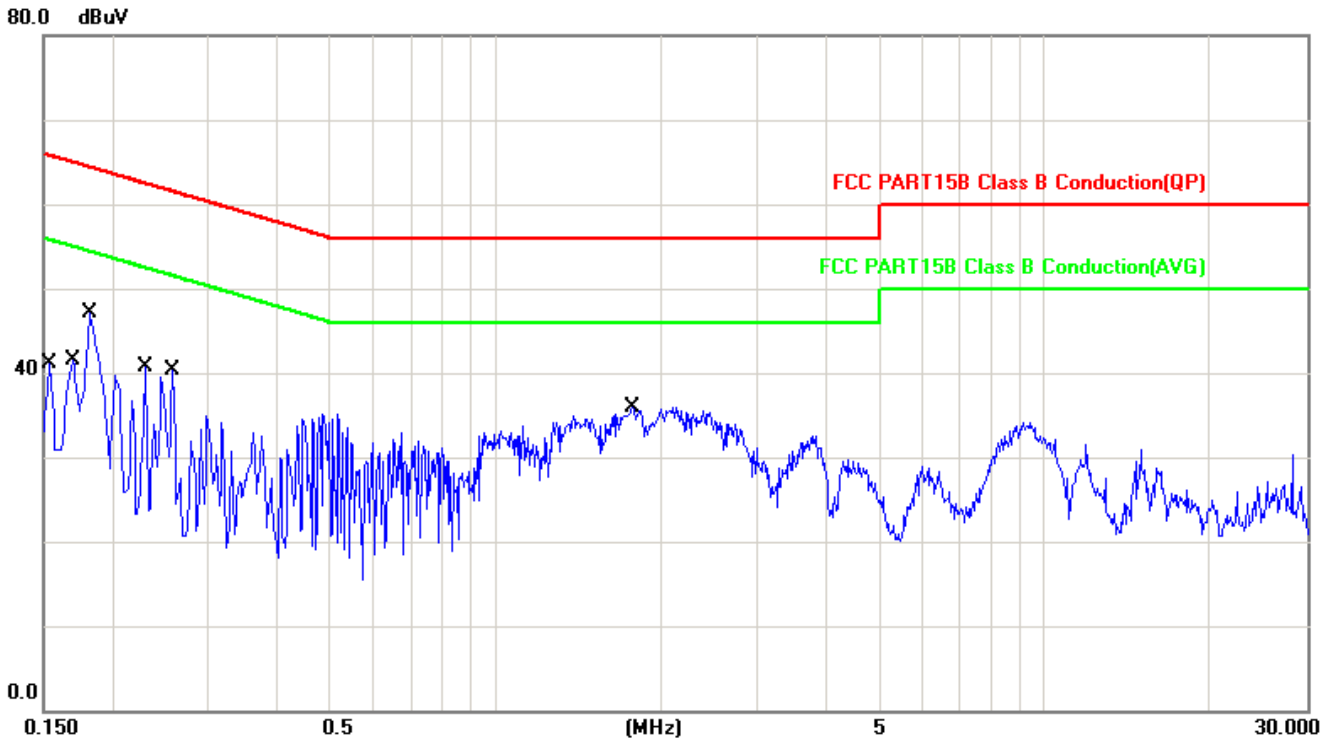
1. The testing follows ANSI C63.10 (2013).
2. Setup the configuration per figure 3.
3. A preliminary scan with a spectrum monitor is performed to identify the frequency of emission that has the highest amplitude relative to the limit by operating the EUT in selected modes of operation, typical cable positions, and with a typical system configuration.
4. Record the 6 highest emissions relative to the limit.
5. Measure each frequency obtained from step 3 by a test receiver set on quasi peak detector function, and then record the accuracy frequency and emission level. If all emissions measured in the specified band are attenuated more than 20 dB from the limit, this step would be ignored, and the peak detector function would be used.
6. Confirm the highest three emissions with variation of the EUT cable configuration and record the final data.
7. Repeat all above procedures on measuring each operation mode of EUT.

Figure 3: Conducted emissions measurement configuration



5.3 Conducted Emission Data

File:	**21-05-MAW-007**	**#4**	**Date:**	**2021/12/23**	**Temperature:**	**24 ℃**
			Time:	**PM 06:19:24**	**Humidity:**	**58 %**



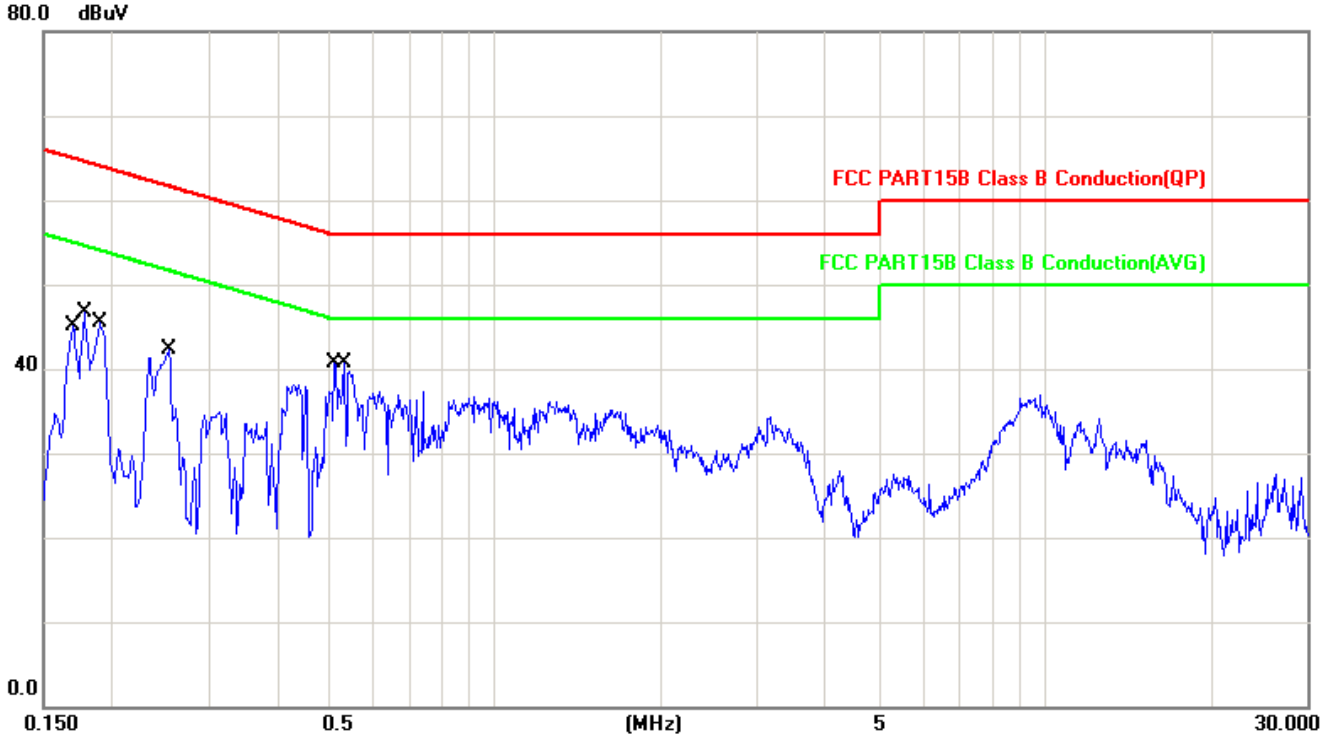
Site:	**CE04-10M 2F**		
Condition:	**FCC PART15B Class B Conduction(QP)**	**Phase:**	**L1**
EUT:	**Rapid Test Reader**	**Power:**	**AC 110V/60Hz**
Model:	**CHR-631**		
Test Mode:	**BT**	**Operator:**	**Phillip**

No.	Frequency (MHz)	Reading (dBuV)	Detector	Corrected (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)
1	0.154	31.49	QP	9.65	41.14	65.78	-24.64
2	0.170	31.80	QP	9.65	41.45	64.96	-23.51
*3	0.182	37.54	QP	9.64	47.18	64.39	-17.21
4	0.230	31.01	QP	9.64	40.65	62.45	-21.80
5	0.258	30.57	QP	9.64	40.21	61.50	-21.29
6	1.778	26.24	QP	9.69	35.93	56.00	-20.07

Note: 1. Place of measurement: EMC LAB. of the ETC.
2. "***" means the value was too low to be measured.
3. If the data table appeared symbol of "----" means the Q.P. value is under the limit of AVG. so, the AVG. value doesn't need to be measured.
4. "#" means the noise was too low, so record the peak value.
5. The estimated measurement uncertainty of the result measurement is ±2.5dB.
6. The estimated measurement uncertainty of the result measurement is: ±3.04dB(150kHz≦f≦30MHz)

File: **21-05-MAW-007** **#3** **Date:** **2021/12/23** **Temperature:** **24 ℃**

Time: **PM 06:17:21** **Humidity:** **58 %**



Site: **CE04-10M 2F**

Condition: **FCC PART15B Class B Conduction(QP)** **Phase:** **N**

EUT: **Rapid Test Reader** **Power:** **AC 110V/60Hz**

Model: **CHR-631**

Test Mode: **BT** **Operator:** **Phillip**

No.	Frequency (MHz)	Reading (dBuV)	Detector	Corrected (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)
1	0.170	35.48	QP	9.59	45.07	64.96	-19.89
2	0.178	37.16	QP	9.58	46.74	64.58	-17.84
3	0.190	35.93	QP	9.58	45.51	64.04	-18.53
4	0.254	32.71	QP	9.58	42.29	61.63	-19.34
5	0.510	31.10	QP	9.59	40.69	56.00	-15.31
*6	0.530	31.21	QP	9.59	40.80	56.00	-15.20

Note: 1. Place of measurement: EMC LAB. of the ETC.
2. "***" means the value was too low to be measured.
3. If the data table appeared symbol of "----" means the Q.P. value is under the limit of AVG. so, the AVG. value doesn't need to be measured.
4. "#" means the noise was too low, so record the peak value.
5. The estimated measurement uncertainty of the result measurement is ±2.5dB.
6. The estimated measurement uncertainty of the result measurement is: ±3.04dB(150kHz≦f≦30MHz)

5.4 Result Data Calculation

The result data is calculated by adding the LISN Factor to the measured reading. The basic equation with a sample calculation is as follows:

RESULT = READING + LISN FACTOR (Included Cable Loss)

5.5 Conducted Measurement Equipment

The following test equiPMent are used during the conducted test.

Equipment	Trade Name	Model No.
EMI Test Receiver	R&S	ESCI
V-LISN	R&S	ENV216

Software: EZ-EMC (Ver. ETC-03A1)

6 ANTENNA REQUIREMENT

6.1 Standard Applicable

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And according to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

6.2 Antenna Construction and Directional Gain

The antenna is a Dipole antenna.

Antenna Type	Dipole antenna
Operation Frequency Range	2.4 - 2.5 GHz
Antenna Gain	3.2 dBi

Remark: The antenna specification is provided by manufacturer/applicant to ETC as reference. We, ETC, trust manufacturer/applicant's antenna specification is true. If there is any loss or damage occurred, the responsibility goes to manufacturer/applicant.

The directional gain of antenna doesn't greater than 6 dBi, the power won't be reduced.

7 20dB EMISSION BANDWIDTH MEASUREMENT

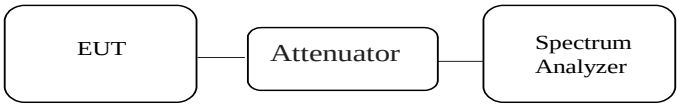
7.1 Standard Applicable

According to 15.247(a)(1), for frequency hopping systems, hopping channel carrier frequencies seperated by a minimum of 25kHz or the 20dB bandwidth of 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.

7.2 Measurement Procedure

1. The testing follows FCC KDB 558074 D01 15.247 Meas Guidance v05r02.
2. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
3. The setup of the EUT as shown in figure 4. Turn on the EUT and connect it to measurement instrument. Then set it to any convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
4. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
5. Repeat above procedures until all frequencies measured were complete.

Figure 4: Emission bandwidth measurement configuration.



7.3 Measurement Equipment

Equipment	Trade Name	Model No.
Spectrum Analyzer	R&S	FSV40
Attenuator	WEINSCHEL	56-10

Software: LZ-RF (Ver. ETC-3A2)

7.4 Measurement Data

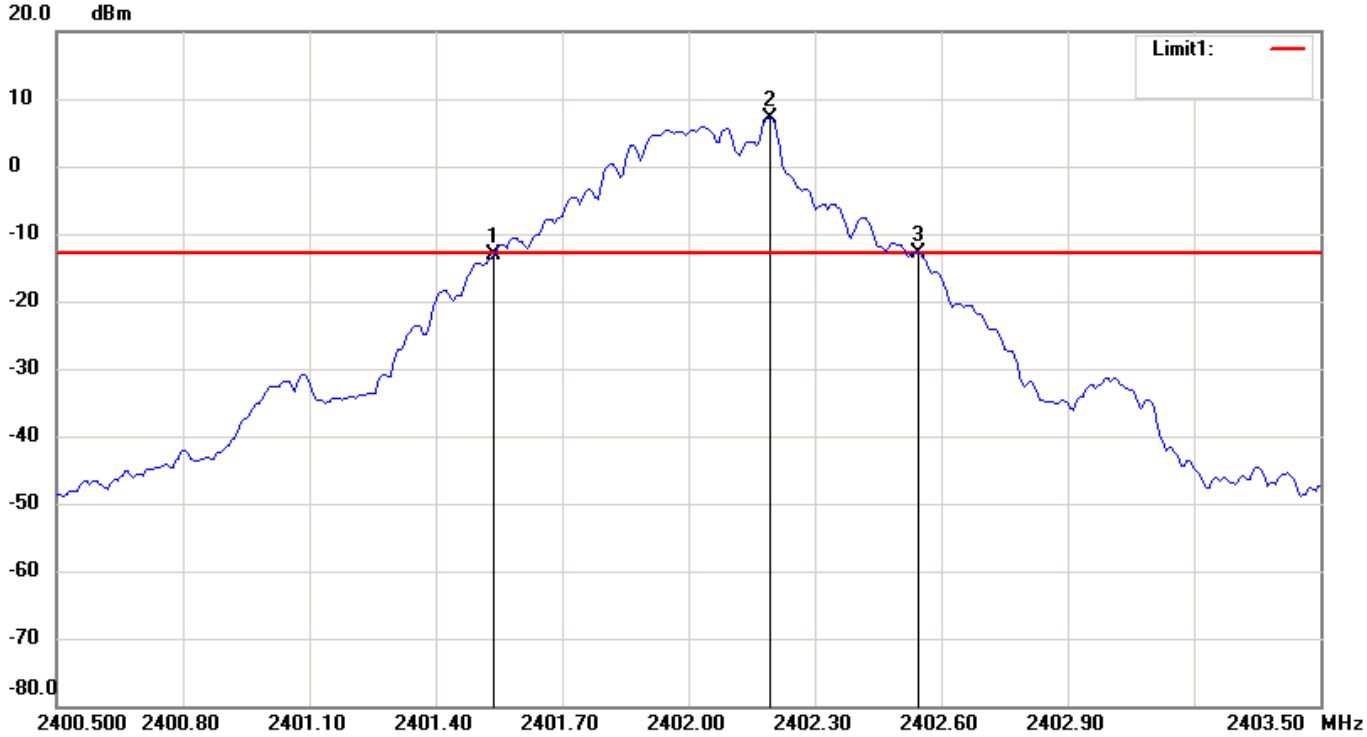
7.4.1 Operation Mode: NON-EDR

Test Date: Aug. 04, 2021 Temperature : 24℃ Humidity: 50%

Channel	20 dB Bandwidth (MHz)	Chart
L	1.008	Page 39
M	1.014	Page 40
H	1.014	Page 41

Note: Please refer to page 39 to page 41 for chart.

File: **21-05-MAW-007_BT** **#2** **Date:** **2021/8/4** **Temperature:** **24 ℃**
Site: **RF-Cond01** **Humidity:** **50 %**

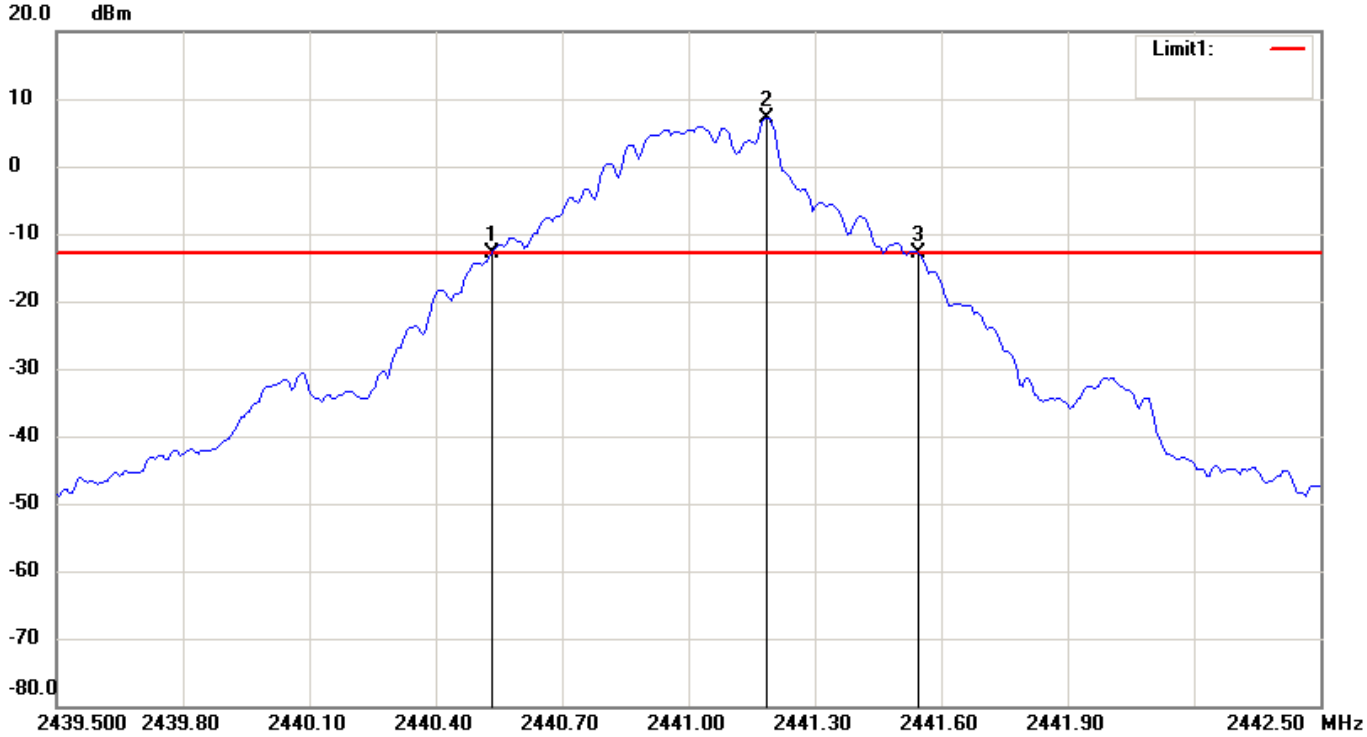


Condition: **-12.84dBm** **RF Conducted**
EUT: **Rapid Test Reader** **Sweep Time: 1.05ms** **Att.: 25dB**
Model: **CHR-631W** **RBW: 30 KHz** **VBW: 100 KHz**
Test Mode: **BT** **Operator:** **Phillip**
Note: **FCC_BT CH00-20dB EBW**

No.	Frequency(MHz)	Level(dBm)
1	2401.53800	-13.10
2	2402.19200	7.16
3	2402.54600	-12.86

No.		△Frequency(MHz)	△Level(dB)
1	mk3-mk1	1.008	0.24

File: **21-05-MAW-007_BT** **#10** **Date:** **2021/8/4** **Temperature:** **24 ℃**
Site: **RF-Cond01** **Humidity:** **50 %**

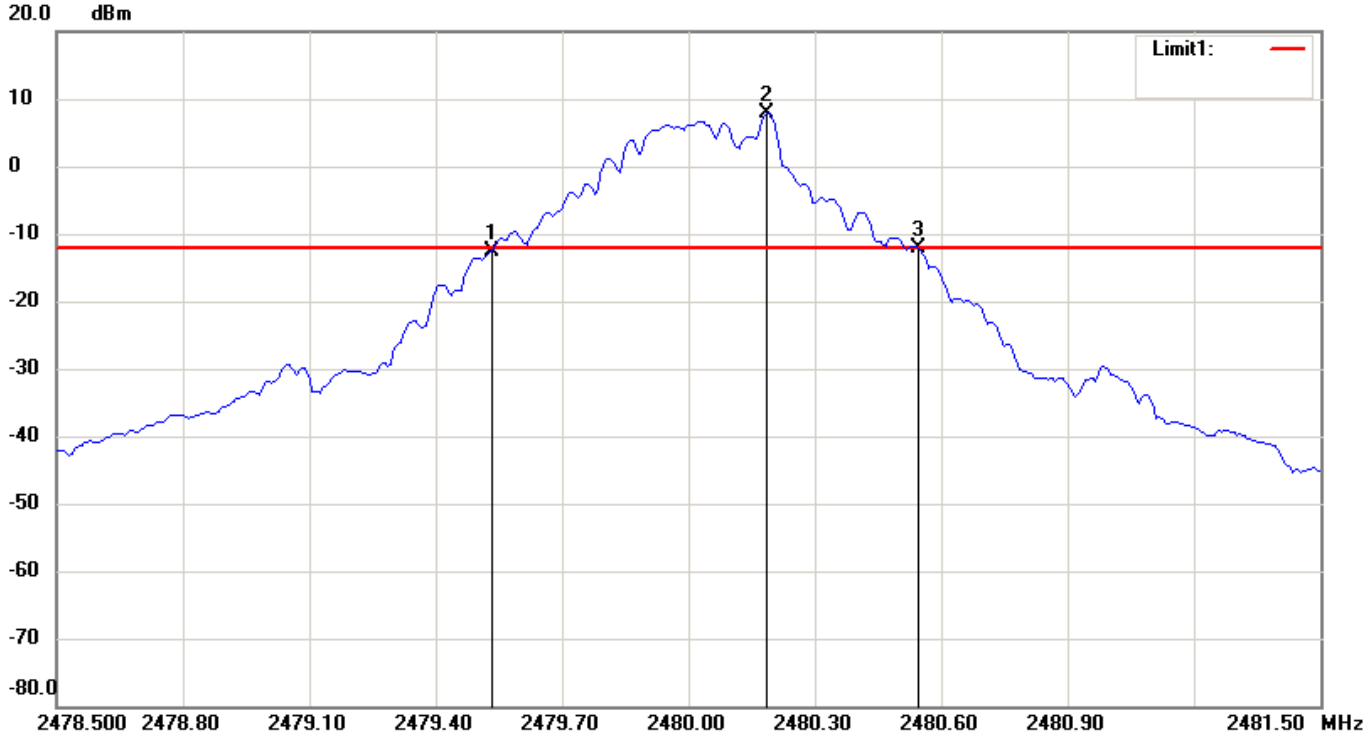


Condition: **-12.84dBm** **RF Conducted**
EUT: **Rapid Test Reader** **Sweep Time: 1.05ms** **Att.: 25dB**
Model: **CHR-631W** **RBW: 30 KHz** **VBW: 100 KHz**
Test Mode: **BT** **Operator:** **Phillip**
Note: **FCC_BT CH39-20dB EBW**

No.	Frequency(MHz)	Level(dBm)
1	2440.53200	-12.93
2	2441.18600	7.16
3	2441.54600	-12.88

No.		△Frequency(MHz)	△Level(dB)
1	mk3-mk1	1.014	0.05

File: **21-05-MAW-007_BT** **#6** **Date:** **2021/8/4** **Temperature:** **24 ℃**
Site: **RF-Cond01** **Humidity:** **50 %**



Condition: **-12.09dBm** **RF Conducted**
EUT: **Rapid Test Reader** **Sweep Time: 1.05ms** **Att.: 25dB**
Model: **CHR-631W** **RBW: 30 KHz** **VBW: 100 KHz**
Test Mode: **BT** **Operator:** **Phillip**
Note: **FCC_BT CH78-20dB EBW**

No.	Frequency(MHz)	Level(dBm)
1	2479.53200	-12.53
2	2480.18600	7.91
3	2480.54600	-12.22

No.		△Frequency(MHz)	△Level(dB)
1	mk3-mk1	1.014	0.31

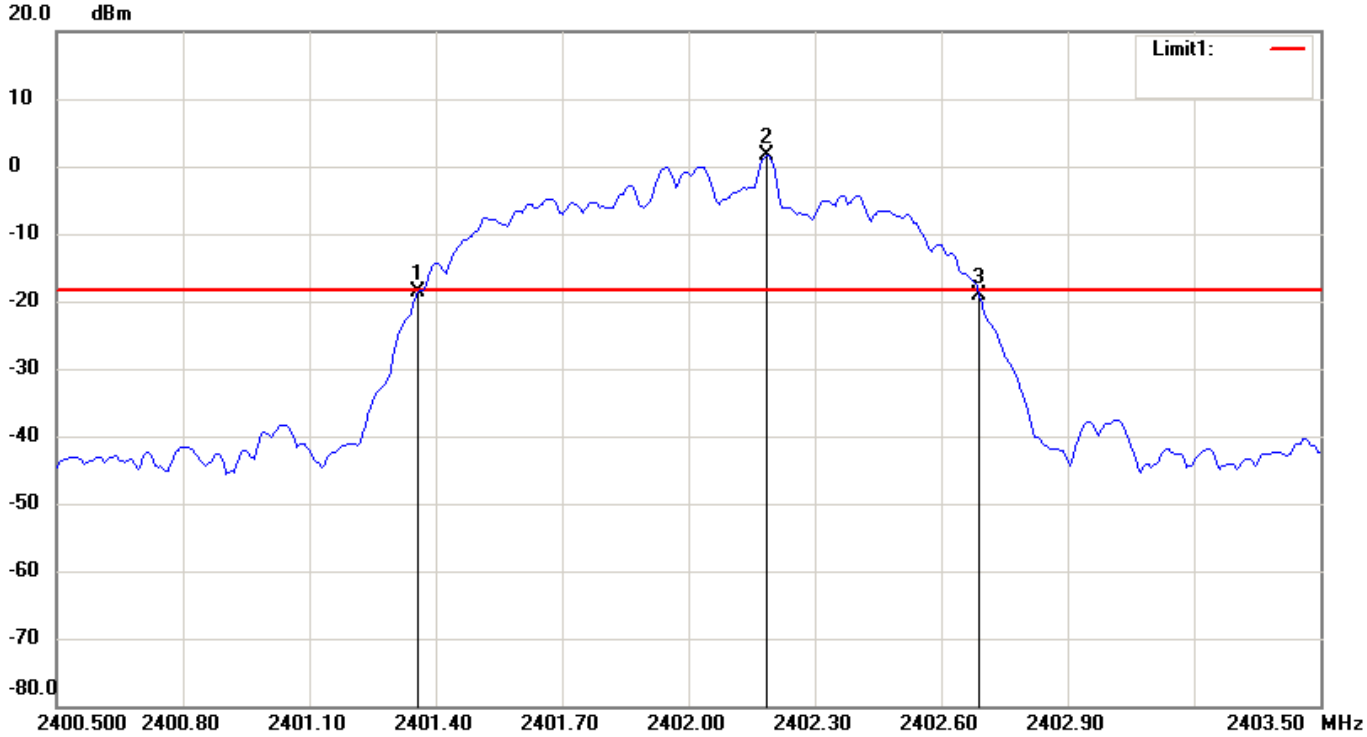
7.4.2 Operation Mode: EDR

Test Date: Aug. 04, 2021 Temperature : 24℃ Humidity: 50%

Channel	20 dB Bandwidth (MHz)	Chart
L	1.332	Page 43
M	1.338	Page 44
H	1.338	Page 45

Note: Please refer to page 43 to page 45 for chart.

File: **21-05-MAW-007_BT** **#25** **Date:** **2021/8/4** **Temperature:** **24 ℃**
Site: **RF-Cond01** **Humidity:** **50 %**

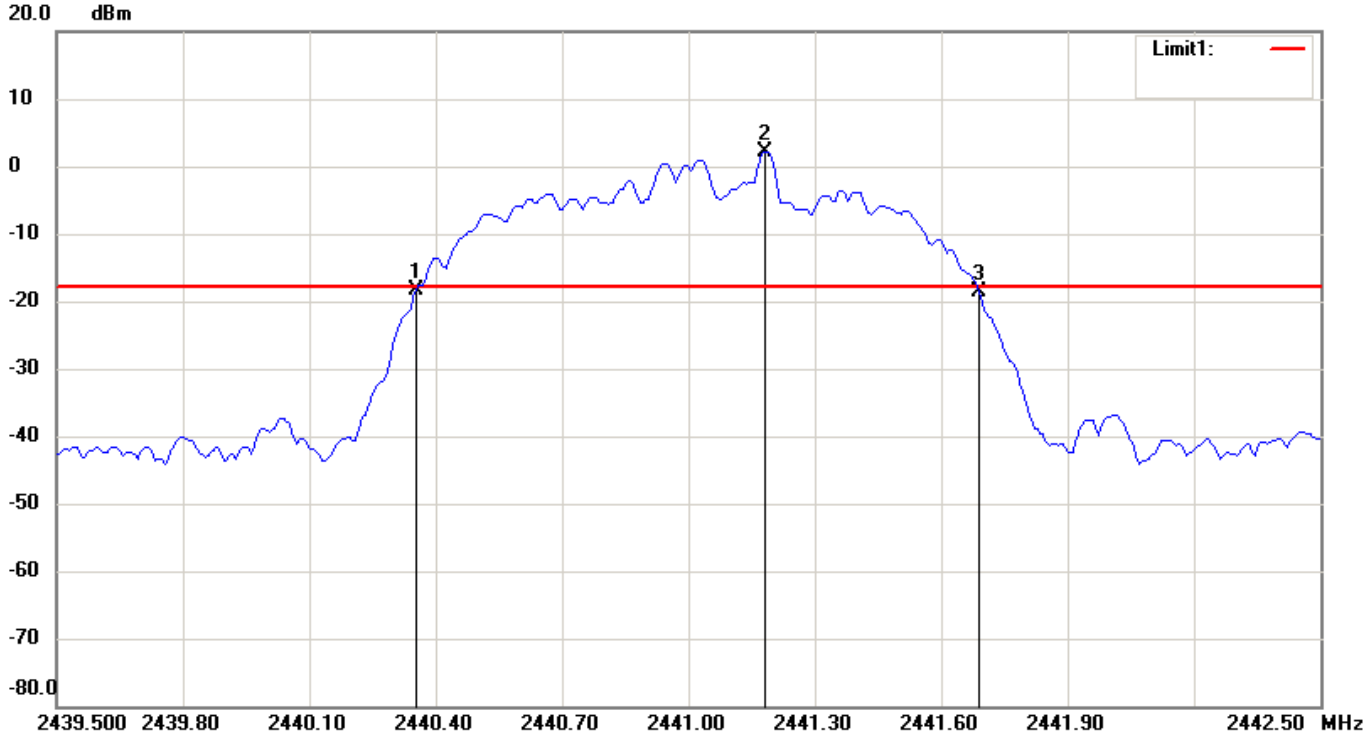


Condition: **-18.49dBm** **RF Conducted**
EUT: **Rapid Test Reader** **Sweep Time: 1.05ms** **Att.: 25dB**
Model: **CHR-631W** **RBW: 30 KHz** **VBW: 100 KHz**
Test Mode: **BT** **Operator:** **Phillip**
Note: **FCC_BT CH00-20dB EBW**

No.	Frequency(MHz)	Level(dBm)
1	2401.35800	-18.52
2	2402.18600	1.51
3	2402.69000	-19.17

No.		△Frequency(MHz)	△Level(dB)
1	mk3-mk1	1.332	-0.65

File: **21-05-MAW-007_BT** **#33** **Date:** **2021/8/4** **Temperature:** **24 ℃**
Site: **RF-Cond01** **Humidity:** **50 %**

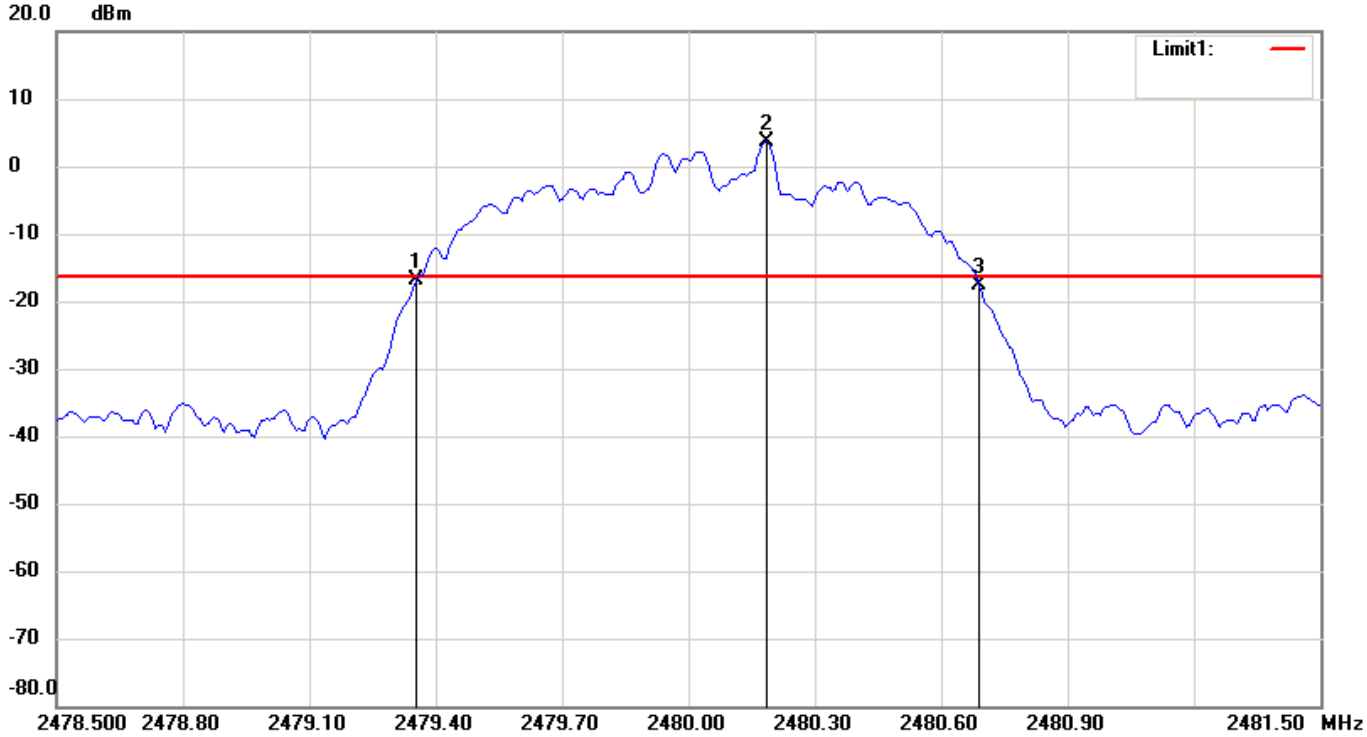


Condition: **-17.82dBm** **RF Conducted**
EUT: **Rapid Test Reader** **Sweep Time: 1.05ms** **Att.: 25dB**
Model: **CHR-631W** **RBW: 30 KHz** **VBW: 100 KHz**
Test Mode: **BT** **Operator:** **Phillip**
Note: **FCC_BT CH39-20dB EBW**

No.	Frequency(MHz)	Level(dBm)
1	2440.35200	-18.29
2	2441.18000	2.18
3	2441.69000	-18.64

No.		△Frequency(MHz)	△Level(dB)
1	mk3-mk1	1.338	-0.35

File: **21-05-MAW-007_BT** **#29** **Date:** **2021/8/4** **Temperature:** **24 ℃**
Site: **RF-Cond01** **Humidity:** **50 %**



Condition: **-16.44dBm** **RF Conducted**
EUT: **Rapid Test Reader** **Sweep Time: 1.05ms** **Att.: 25dB**
Model: **CHR-631W** **RBW: 30 KHz** **VBW: 100 KHz**
Test Mode: **BT** **Operator:** **Phillip**
Note: **FCC_BT CH78-20dB EBW**

No.	Frequency(MHz)	Level(dBm)
1	2479.35200	-16.93
2	2480.18600	3.56
3	2480.69000	-17.53

No.		△Frequency(MHz)	△Level(dB)
1	mk3-mk1	1.338	-0.6

8 OUTPUT POWER MEASUREMENT

8.1 Standard Applicable

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. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

And according to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

8.2 Measurement Procedure

1. The testing follows FCC 558074 D01 15.247 Meas Guidance v05r02.
2. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
3. The setup of the EUT as shown in figure 4. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Add cable loss factor to measurement instrument to get maximum peak output power. Then set it to any measured frequency within its operating range and make sure the instrument is operated in its linear range.
4. Set RBW of spectrum analyzer to 2 MHz and VBW to 2 MHz.
5. Measure the highest amplitude appearing on spectral display and record the level to calculate result data.
6. Repeat above procedures until all frequencies measured were complete.

8.3 Measurement Equipment

Equipment	Trade Name	Model No.
Spectrum Analyzer	R&S	FSV40
Attenuator	WEINSCHEL	56-10

Software: LZ-RF (Ver. ETC-3A2)

8.4 Measurement Data

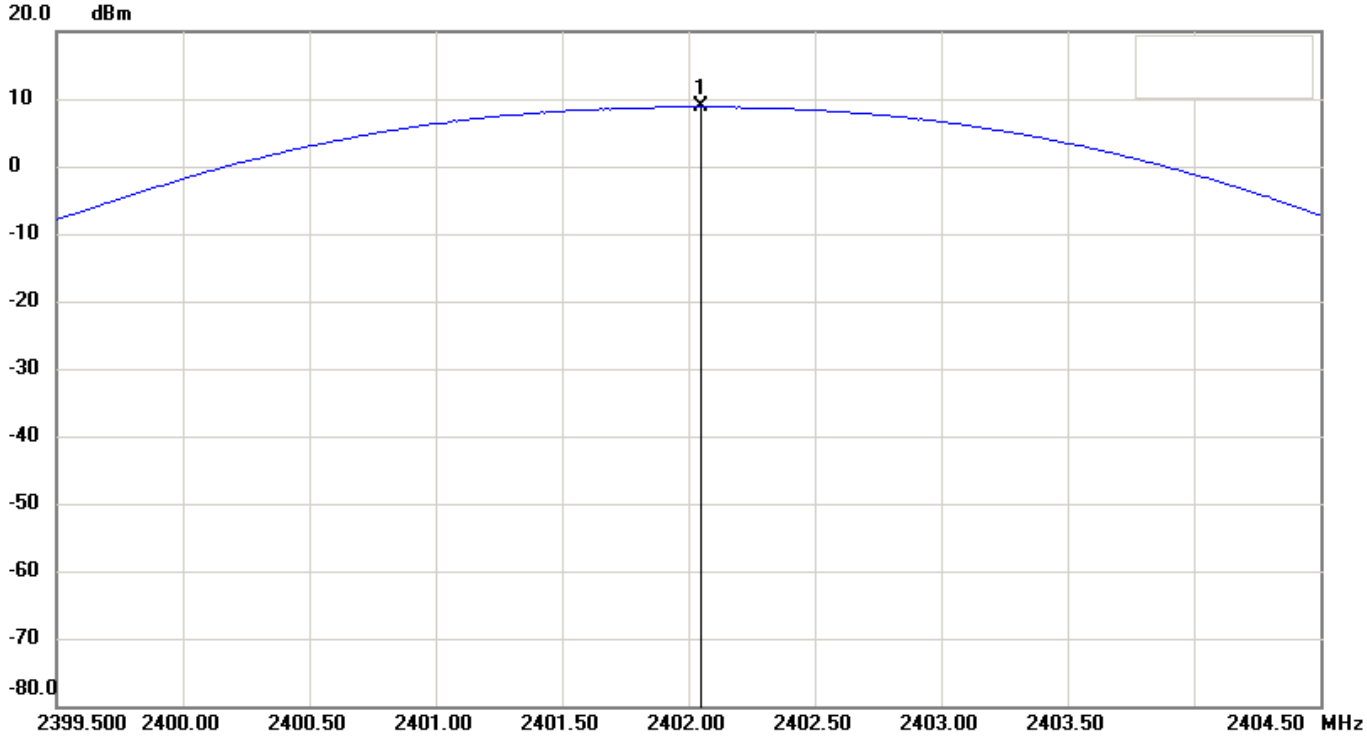
8.4.1 Operation Mode: NON-EDR

Test Date: Aug. 04, 2021 Temperature : 24℃ Humidity: 50%

Channel	Maximum Peak Output Power (dBm)	Maximum Peak Output Power (mW)	FCC Limit (mW)	Chart
L	8.85	7.67	125	Page 48
M	8.96	7.87	125	Page 49
H	9.94	9.86	125	Page 50

Note: Please refer to page 48 to page 50 for chart.

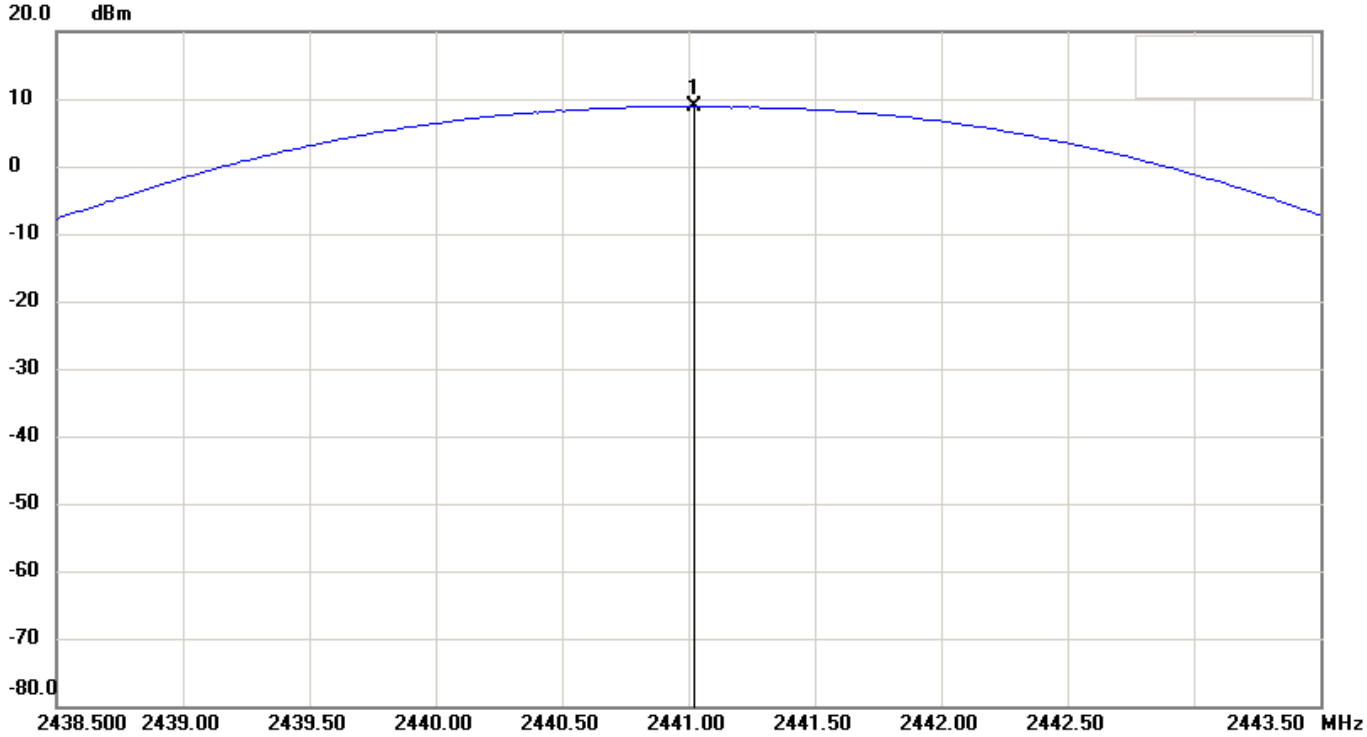
File: **21-05-MAW-007_BT** **#1** **Date:** **2021/8/4** **Temperature:** **24 ℃**
Site: **RF-Cond01** **Humidity:** **50 %**



Condition: **RF Conducted**
EUT: **Rapid Test Reader** **Sweep Time: 1ms** **Att.: 25dB**
Model: **CHR-631W** **RBW: 2000 KHz** **VBW: 2000 KHz**
Test Mode: **BT** **Operator:** **Phillip**
Note: **FCC_BT CH00 Output Power (NON-EDR)**

No.	Frequency(MHz)	Level(dBm)
1	2402.05000	8.85

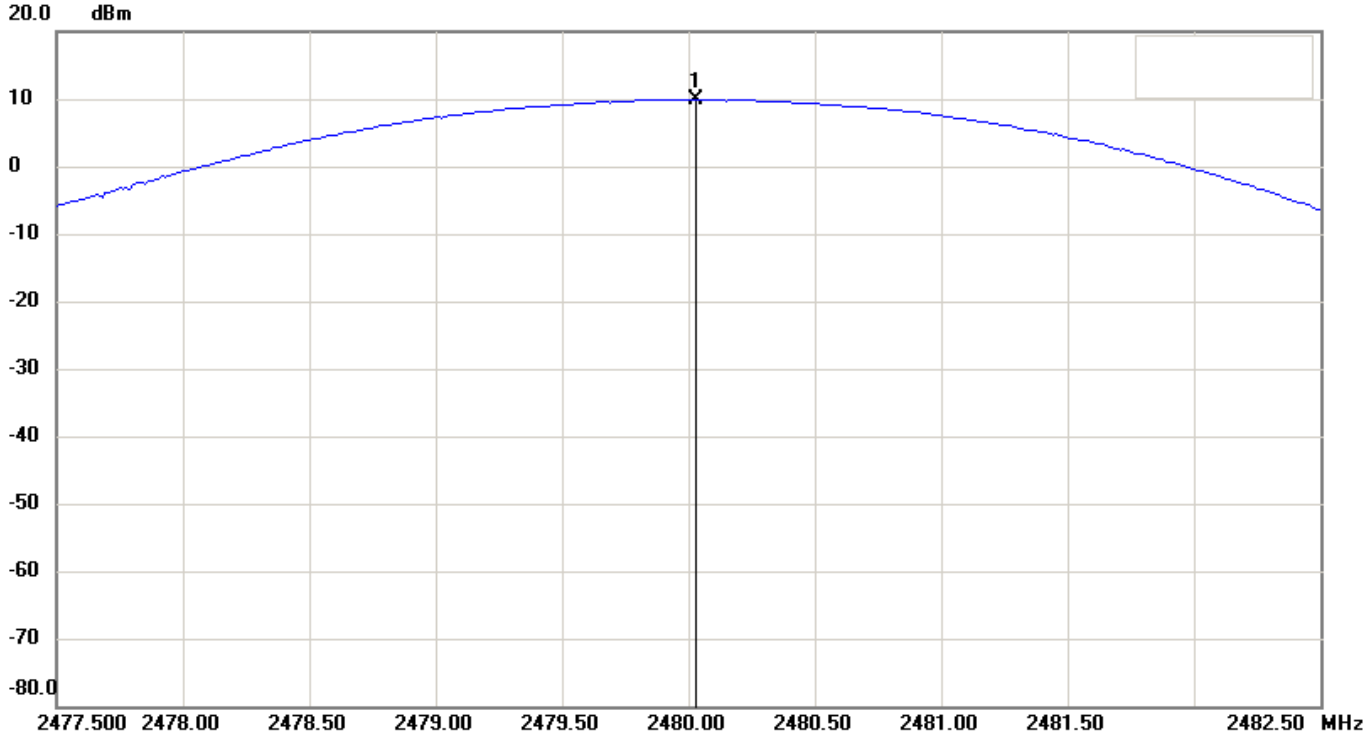
File: **21-05-MAW-007_BT** **#9** **Date:** **2021/8/4** **Temperature:** **24 ℃**
Site: **RF-Cond01** **Humidity:** **50 %**



Condition: **RF Conducted**
EUT: **Rapid Test Reader** **Sweep Time: 1ms** **Att.: 25dB**
Model: **CHR-631W** **RBW: 2000 KHz** **VBW: 2000 KHz**
Test Mode: **BT** **Operator:** **Phillip**
Note: **FCC_BT CH39 Output Power (NON-EDR)**

No.	Frequency(MHz)	Level(dBm)
1	2441.02000	8.96

File: **21-05-MAW-007_BT** **#5** **Date:** **2021/8/4** **Temperature:** **24 ℃**
Site: **RF-Cond01** **Humidity:** **50 %**



Condition: **RF Conducted**
EUT: **Rapid Test Reader** **Sweep Time: 1ms** **Att.: 25dB**
Model: **CHR-631W** **RBW: 2000 KHz** **VBW: 2000 KHz**
Test Mode: **BT** **Operator:** **Phillip**
Note: **FCC_BT CH78 Output Power (NON-EDR)**

No.	Frequency(MHz)	Level(dBm)
1	2480.03000	9.94

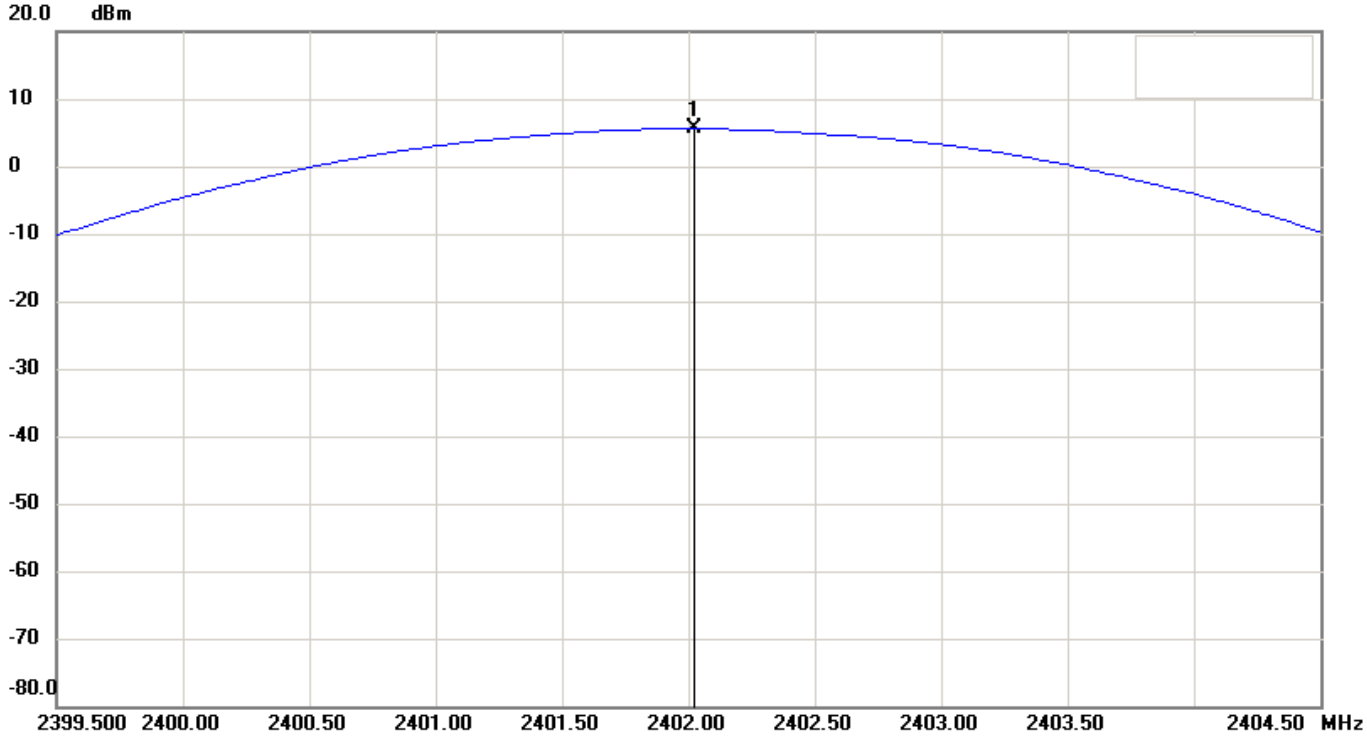
8.4.2 Operation Mode: EDR

Test Date: Aug. 04, 2021 Temperature : 24℃ Humidity: 50%

Channel	Maximum Peak Output Power (dBm)	Maximum Peak Output Power (mW)	FCC Limit (mW)	Chart
L	5.60	3.63	125	Page 52
M	6.22	4.19	125	Page 53
H	7.48	5.60	125	Page 54

Note: Please refer to page 52 to page 54 for chart.

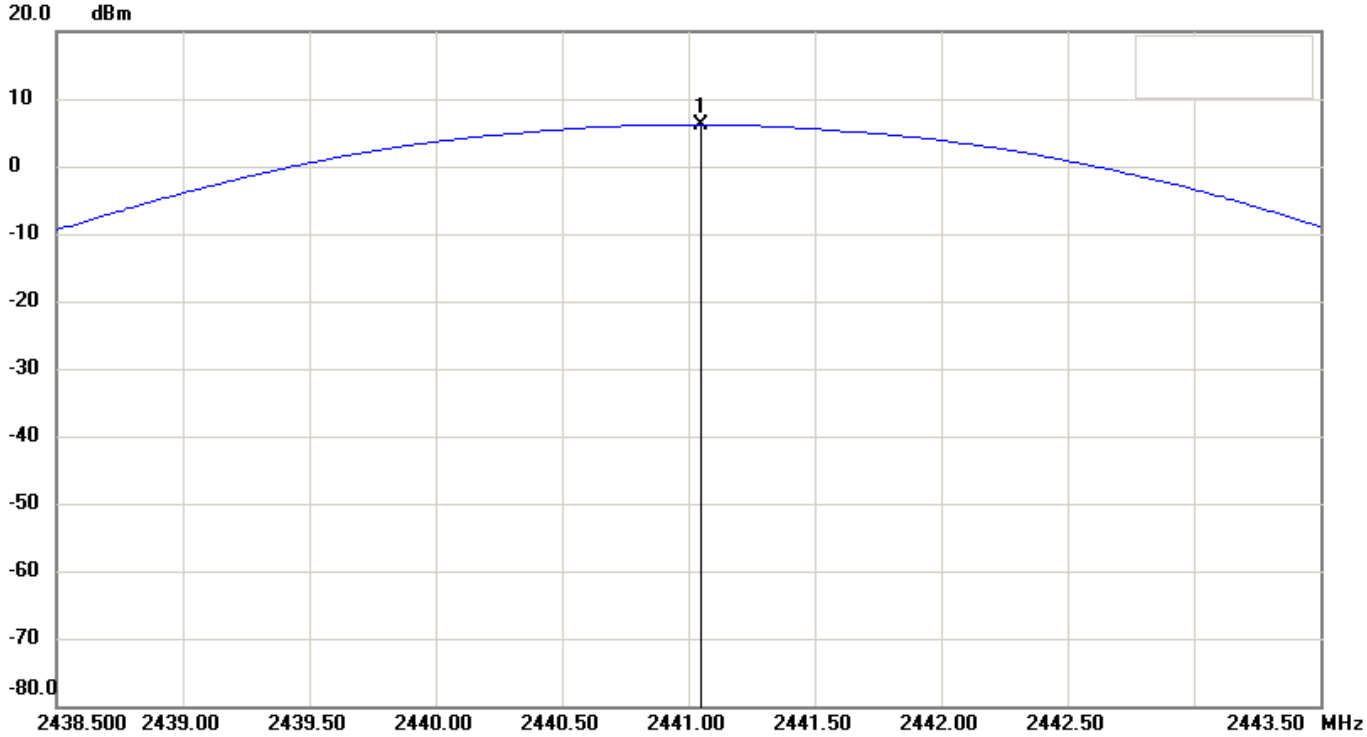
File: **21-05-MAW-007_BT** **#24** **Date:** **2021/8/4** **Temperature:** **24 ℃**
Site: **RF-Cond01** **Humidity:** **50 %**



Condition: **RF Conducted**
EUT: **Rapid Test Reader** **Sweep Time: 1ms** **Att.: 25dB**
Model: **CHR-631W** **RBW: 2000 KHz** **VBW: 2000 KHz**
Test Mode: **BT** **Operator:** **Phillip**
Note: **FCC_BT CH00 Output Power (EDR)**

No.	Frequency(MHz)	Level(dBm)
1	2402.02000	5.60

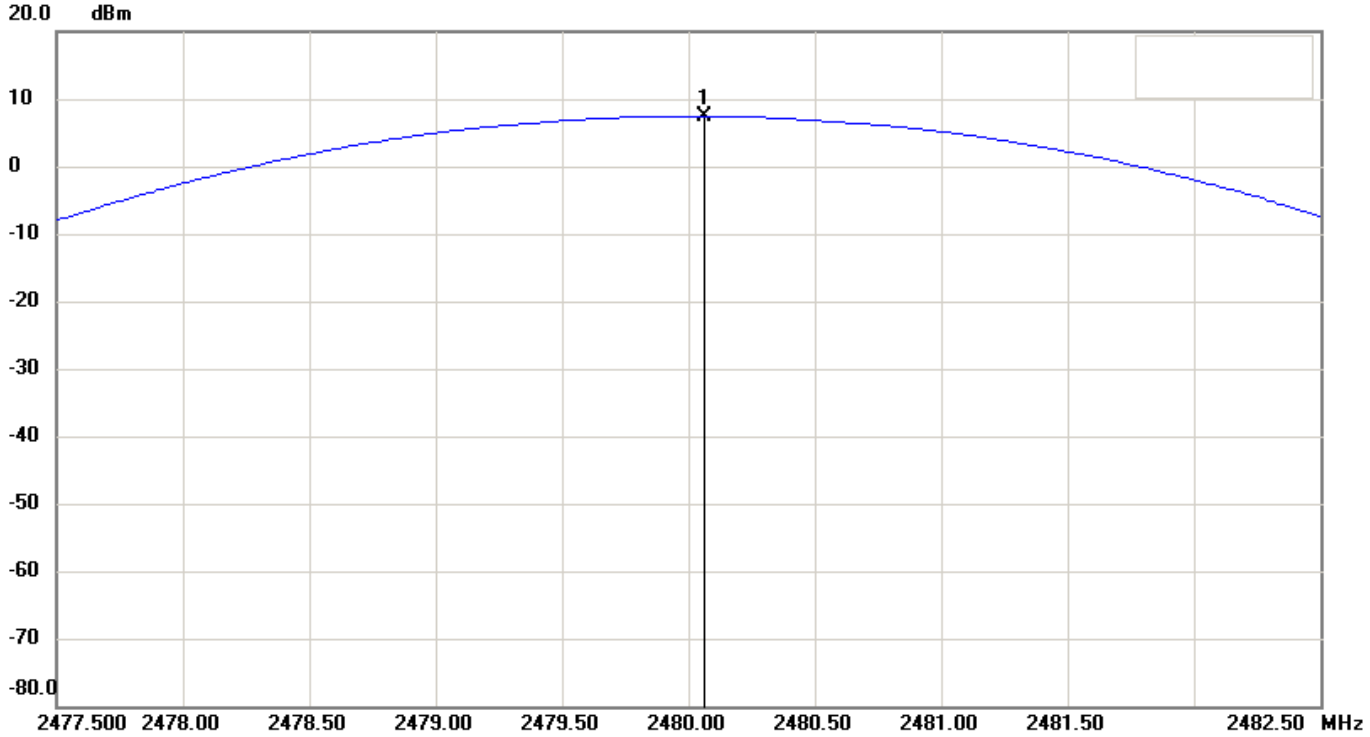
File: **21-05-MAW-007_BT** **#32** **Date:** **2021/8/4** **Temperature:** **24 ℃**
Site: **RF-Cond01** **Humidity:** **50 %**



Condition: **RF Conducted**
EUT: **Rapid Test Reader** **Sweep Time: 1ms** **Att.: 25dB**
Model: **CHR-631W** **RBW: 2000 KHz** **VBW: 2000 KHz**
Test Mode: **BT** **Operator:** **Phillip**
Note: **FCC_BT CH39 Output Power (EDR)**

No.	Frequency(MHz)	Level(dBm)
1	2441.05000	6.22

File: **21-05-MAW-007_BT** **#28** **Date:** **2021/8/4** **Temperature:** **24 ℃**
Site: **RF-Cond01** **Humidity:** **50 %**



Condition: **RF Conducted**
EUT: **Rapid Test Reader** **Sweep Time: 1ms** **Att.: 25dB**
Model: **CHR-631W** **RBW: 2000 KHz** **VBW: 2000 KHz**
Test Mode: **BT** **Operator:** **Phillip**
Note: **FCC_BT CH78 Output Power (EDR)**

No.	Frequency(MHz)	Level(dBm)
1	2480.06000	7.48

9 OUT-OF-BAND RF CONDUCTED SPURIOUS EMISSION MEASUREMENT

9.1 Standard Applicable

According to 15.247(d), in any 100 kHz bandwidth outside these frequency bands, the radio frequency power that is produced by the modulation products of the spreading sequence, the information sequence and the carrier frequency shall be either at least 20 dB below that in any 100 kHz bandwidth within the band that contains the highest level of the desired power or shall not exceed the general levels specified in §15.209(a), whichever results in the lesser attenuation.

9.2 Measurement Procedure

1. The testing follows FCC 558074 D01 15.247 Meas Guidance v05r02.
2. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
3. The setup of the EUT as shown in figure 4. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any measured frequency within its operating range and make sure the instrument is operated in its linear range.
4. Set RBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge.
5. 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.
6. Repeat above procedures until all measured frequencies were complete.

9.3 Measurement Equipment

Equipment	Trade Name	Model No.
Spectrum Analyzer	R&S	FSV40
Attenuator	WEINSCHEL	56-10

Software: LZ-RF (Ver. ETC-3A2)

9.4 Measurement Data

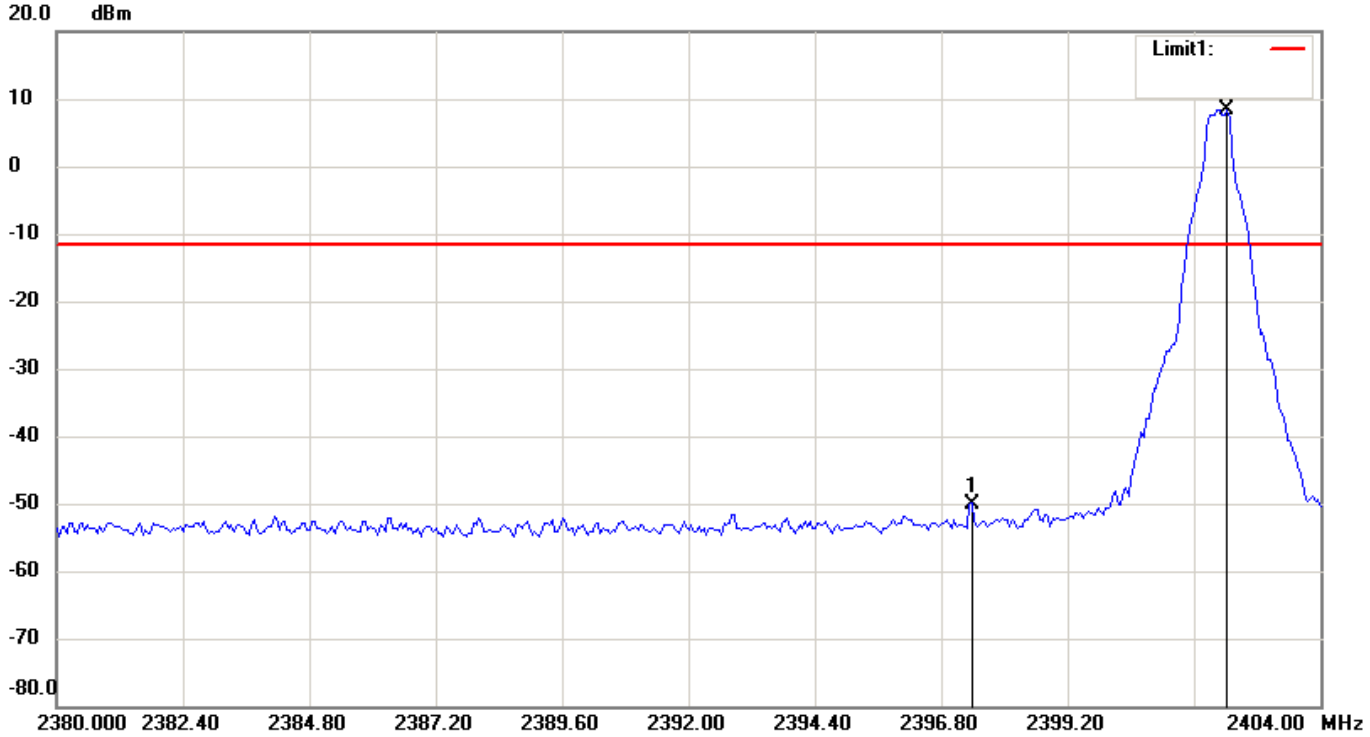
9.4.1 Operation Mode: NON-EDR

Test Date: Aug. 04, 2021 Temperature : 24℃ Humidity: 50%

Channel	Test Frequency Range	Note	Chart
0	2380 MHz - 2404 MHz	Lower Band Edge	Page 57-58
78	2478 MHz - 2500 MHz	Upper Band Edge	Page 59-60
0	30 MHz - 25 GHz		Page 61
39	30 MHz - 25 GHz		Page 62
78	30 MHz - 25 GHz		Page 63

Note: Please refer to page 57 to page 63 for chart.

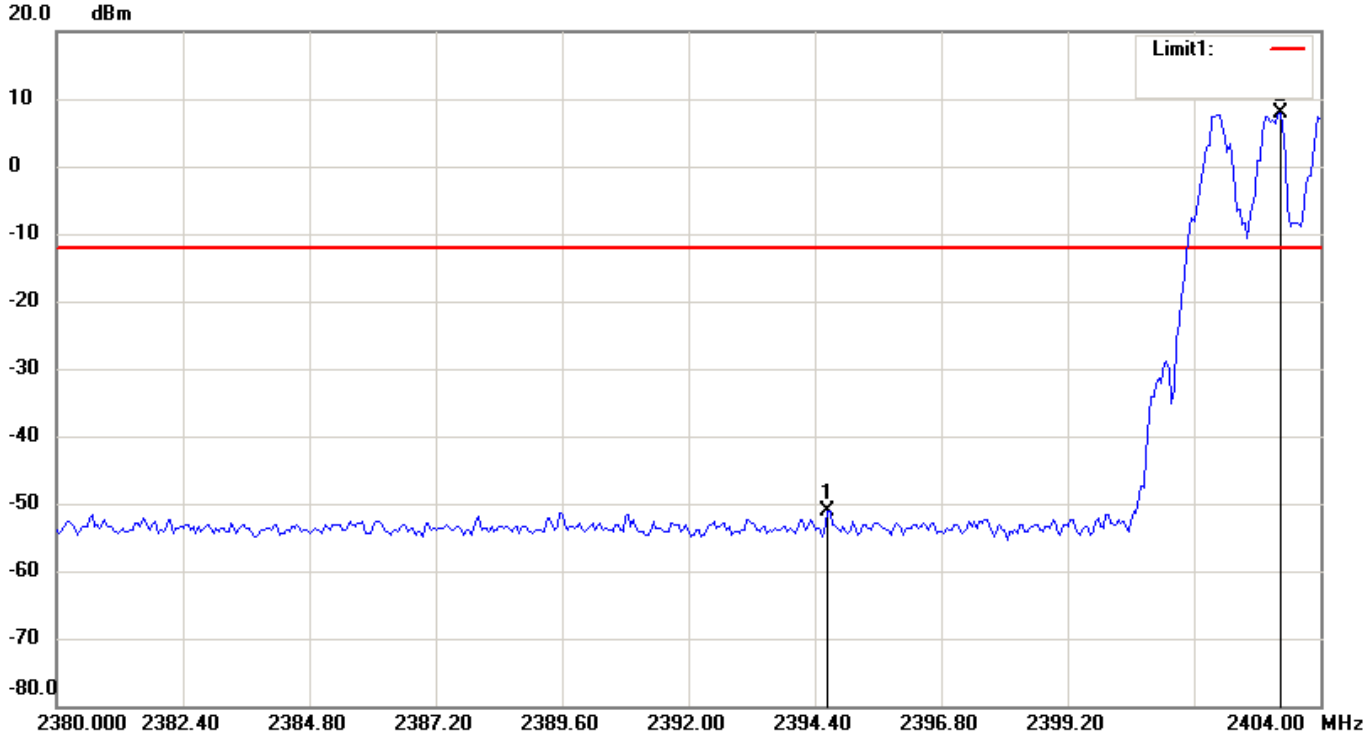
File: **21-05-MAW-007_BT** **#4** **Date:** **2021/8/4** **Temperature:** **24 ℃**
Site: **RF-Cond01** **Humidity:** **50 %**



Condition: **-11.58dBm** **RF Conducted**
EUT: **Rapid Test Reader** **Sweep Time: 1.01ms** **Att.: 25dB**
Model: **CHR-631W** **RBW: 100 KHz** **VBW: 300 KHz**
Test Mode: **BT** **Operator:** **Phillip**
Note: **FCC_BT CH00-Bandedge (Fixed)**

No.	Frequency(MHz)	Level(dBm)
1	2397.37600	-50.00
2	2402.22400	8.42

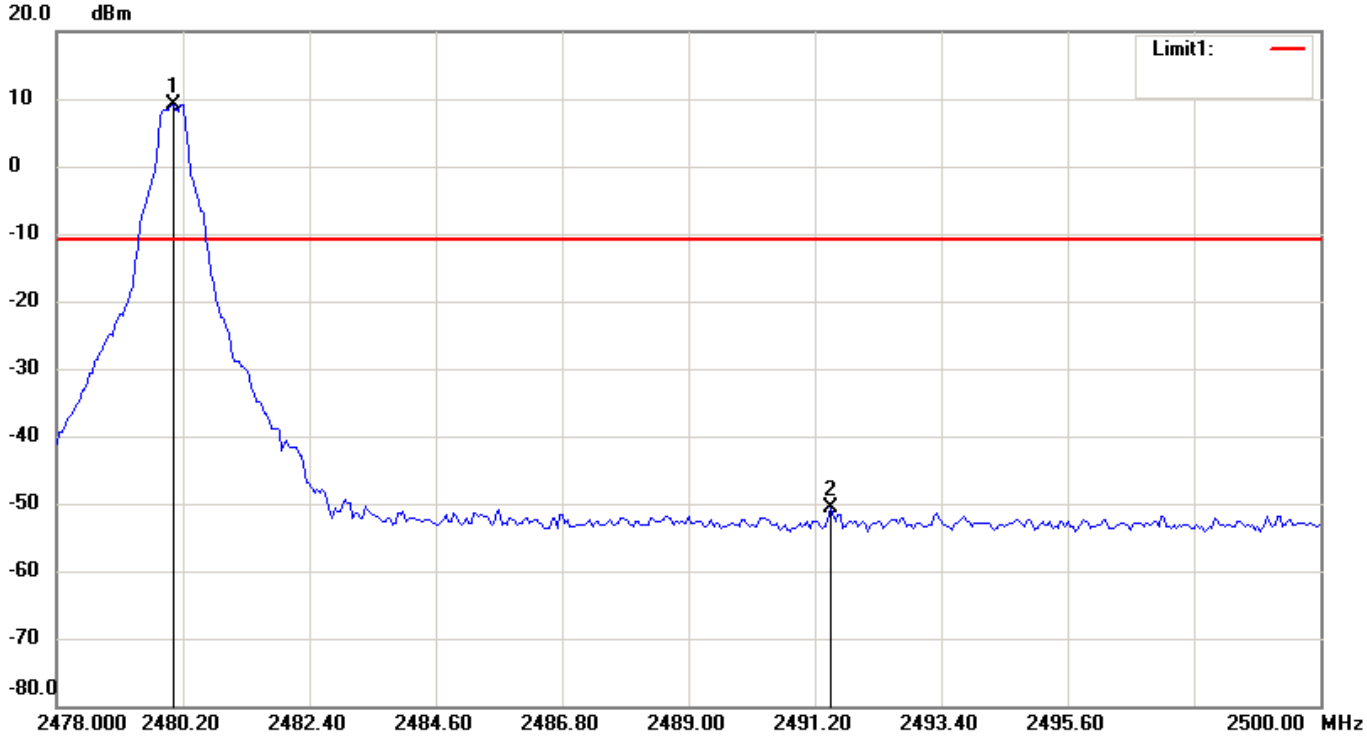
File: **21-05-MAW-007_BT** **#12** **Date:** **2021/8/4** **Temperature:** **24 ℃**
Site: **RF-Cond01** **Humidity:** **50 %**



Condition: **-12.21dBm** **RF Conducted**
EUT: **Rapid Test Reader** **Sweep Time: 1.01ms** **Att.: 25dB**
Model: **CHR-631W** **RBW: 100 KHz** **VBW: 300 KHz**
Test Mode: **BT** **Operator:** **Phillip**
Note: **FCC_BT CH00-Bandedge (Hopping)**

No.	Frequency(MHz)	Level(dBm)
1	2394.64000	-51.17
2	2403.23200	7.79

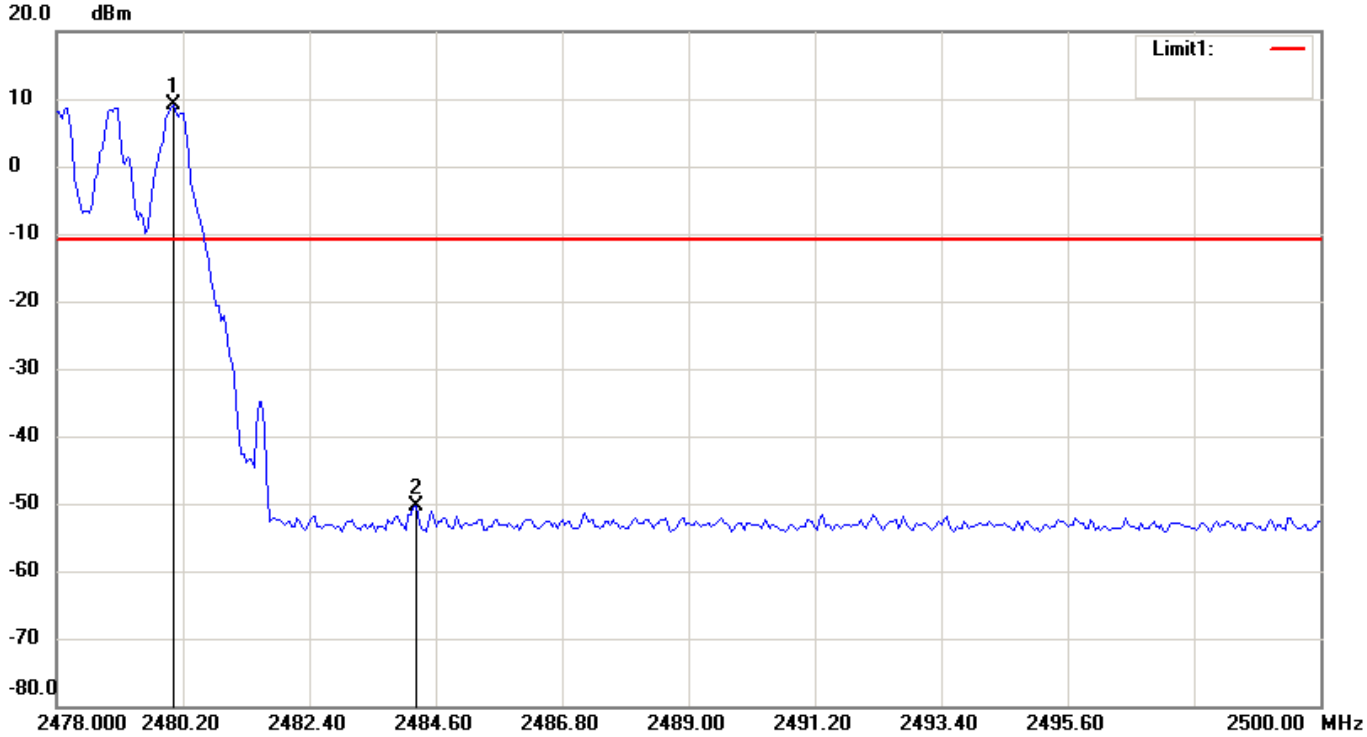
File: **21-05-MAW-007_BT** **#8** **Date:** **2021/8/4** **Temperature:** **24 ℃**
Site: **RF-Cond01** **Humidity:** **50 %**



Condition: **-10.76dBm** **RF Conducted**
EUT: **Rapid Test Reader** **Sweep Time: 1.02ms** **Att.: 25dB**
Model: **CHR-631W** **RBW: 100 KHz** **VBW: 300 KHz**
Test Mode: **BT** **Operator:** **Phillip**
Note: **FCC_BT CH78-Bandedge (Fixed)**

No.	Frequency(MHz)	Level(dBm)
1	2480.02400	9.24
2	2491.46400	-50.58

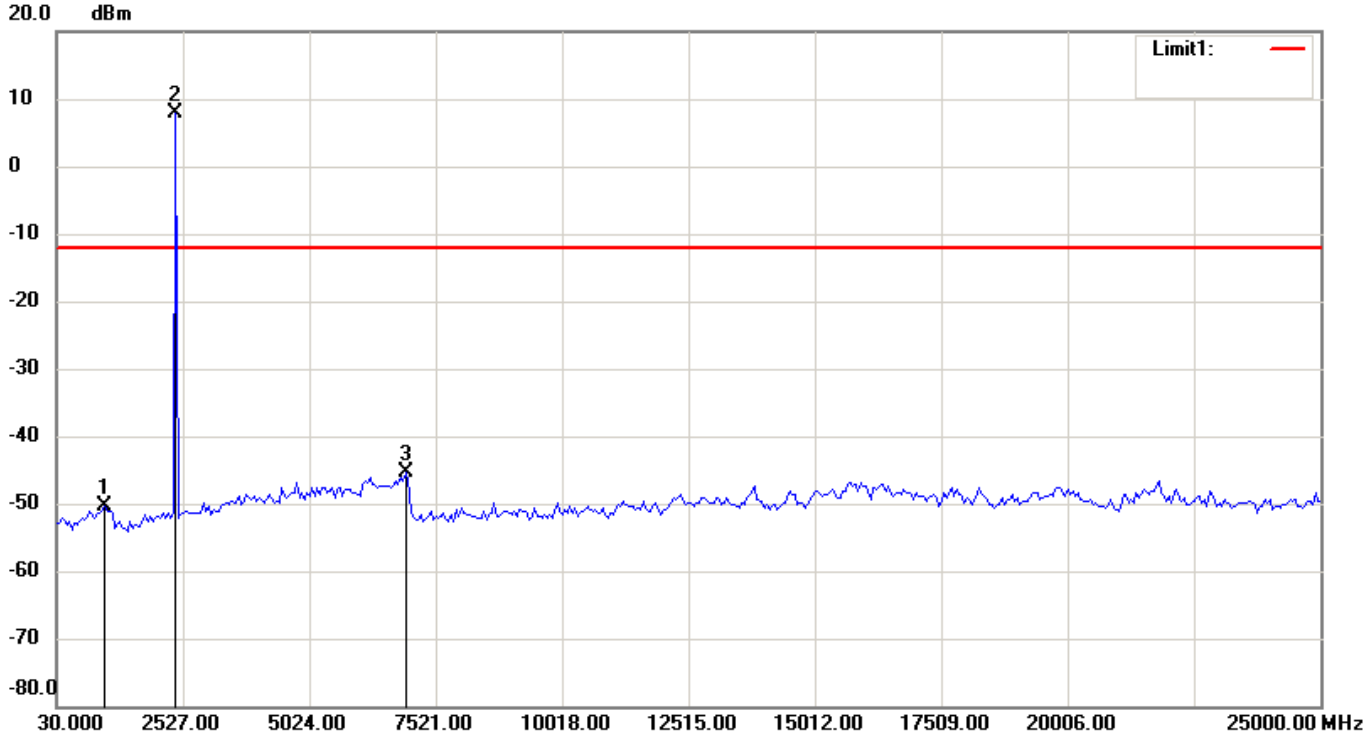
File: **21-05-MAW-007_BT** **#13** **Date:** **2021/8/4** **Temperature:** **24 ℃**
Site: **RF-Cond01** **Humidity:** **50 %**



Condition: **-10.97dBm** **RF Conducted**
EUT: **Rapid Test Reader** **Sweep Time: 1.02ms** **Att.: 25dB**
Model: **CHR-631W** **RBW: 100 KHz** **VBW: 300 KHz**
Test Mode: **BT** **Operator:** **Phillip**
Note: **FCC_BT CH78-Bandedge (Hopping)**

No.	Frequency(MHz)	Level(dBm)
1	2480.02400	9.03
2	2484.24800	-50.47

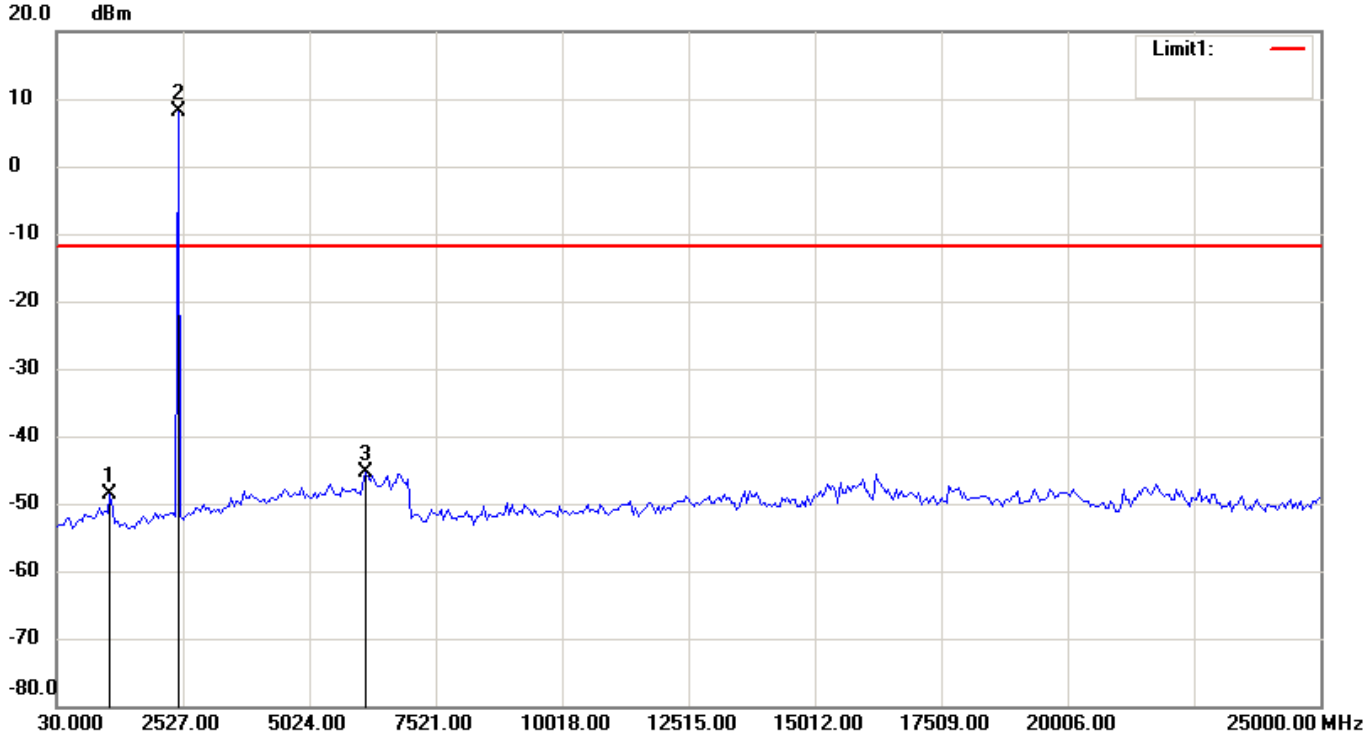
File: **21-05-MAW-007_BT** **#3** **Date:** **2021/8/4** **Temperature:** **24 ℃**
Site: **RF-Cond01** **Humidity:** **50 %**



Condition: **-12.03dBm** **RF Conducted**
EUT: **Rapid Test Reader** **Sweep Time: 250ms** **Att.: 25dB**
Model: **CHR-631W** **RBW: 100 KHz** **VBW: 300 KHz**
Test Mode: **BT** **Operator:** **Phillip**
Note: **FCC_BT CH00-Conducted Spurious**

No.	Frequency(MHz)	Level(dBm)
1	978.8600	-50.44
2	2377.18000	7.97
3	6921.72000	-45.34

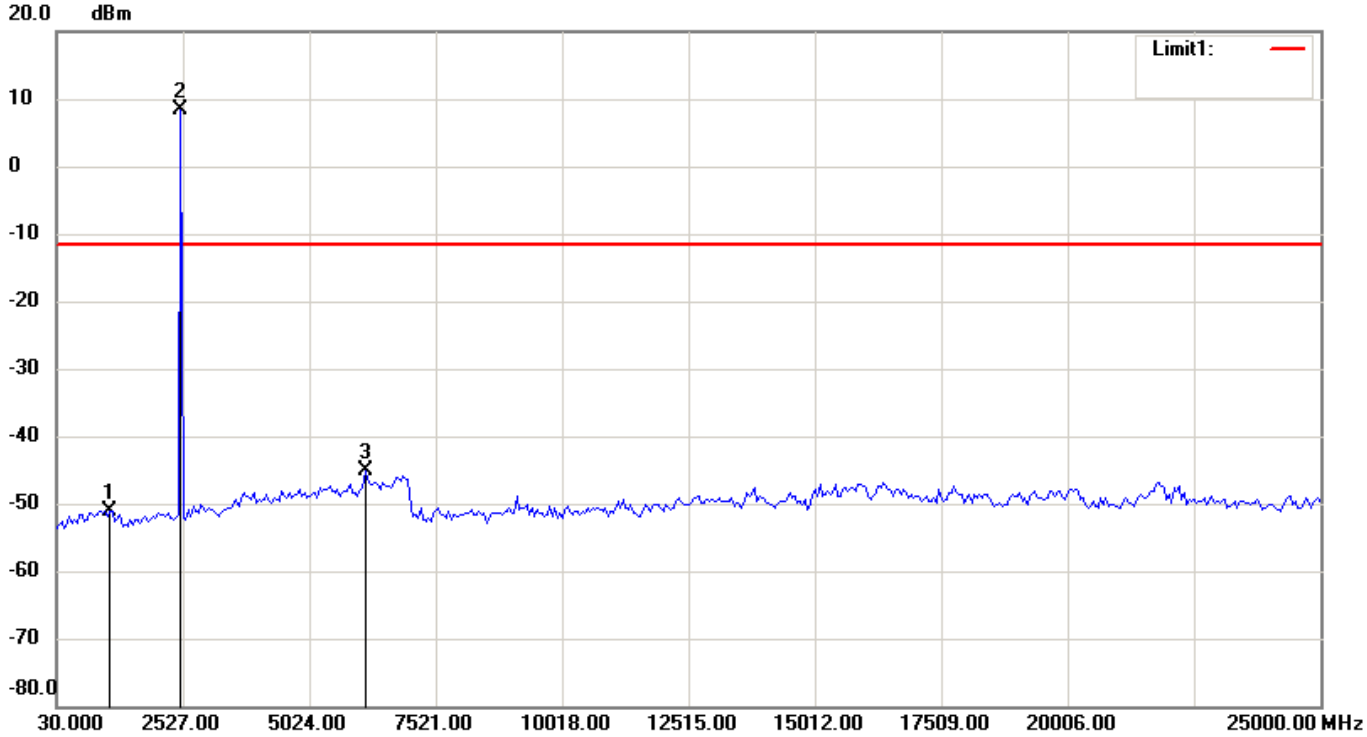
File: **21-05-MAW-007_BT** **#11** **Date:** **2021/8/4** **Temperature:** **24 ℃**
Site: **RF-Cond01** **Humidity:** **50 %**



Condition: **-11.78dBm** **RF Conducted**
EUT: **Rapid Test Reader** **Sweep Time: 250ms** **Att.: 25dB**
Model: **CHR-631W** **RBW: 100 KHz** **VBW: 300 KHz**
Test Mode: **BT** **Operator:** **Phillip**
Note: **FCC_BT CH39-Conducted Spurious**

No.	Frequency(MHz)	Level(dBm)
1	1078.74000	-48.67
2	2427.12000	8.22
3	6122.68000	-45.46

File: **21-05-MAW-007_BT** **#7** **Date:** **2021/8/4** **Temperature:** **24 ℃**
Site: **RF-Cond01** **Humidity:** **50 %**



Condition: **-11.57dBm** **RF Conducted**
EUT: **Rapid Test Reader** **Sweep Time: 250ms** **Att.: 25dB**
Model: **CHR-631W** **RBW: 100 KHz** **VBW: 300 KHz**
Test Mode: **BT** **Operator:** **Phillip**
Note: **FCC_BT CH78-Conducted Spurious**

No.	Frequency(MHz)	Level(dBm)
1	1078.74000	-51.04
2	2477.06000	8.43
3	6122.68000	-45.18

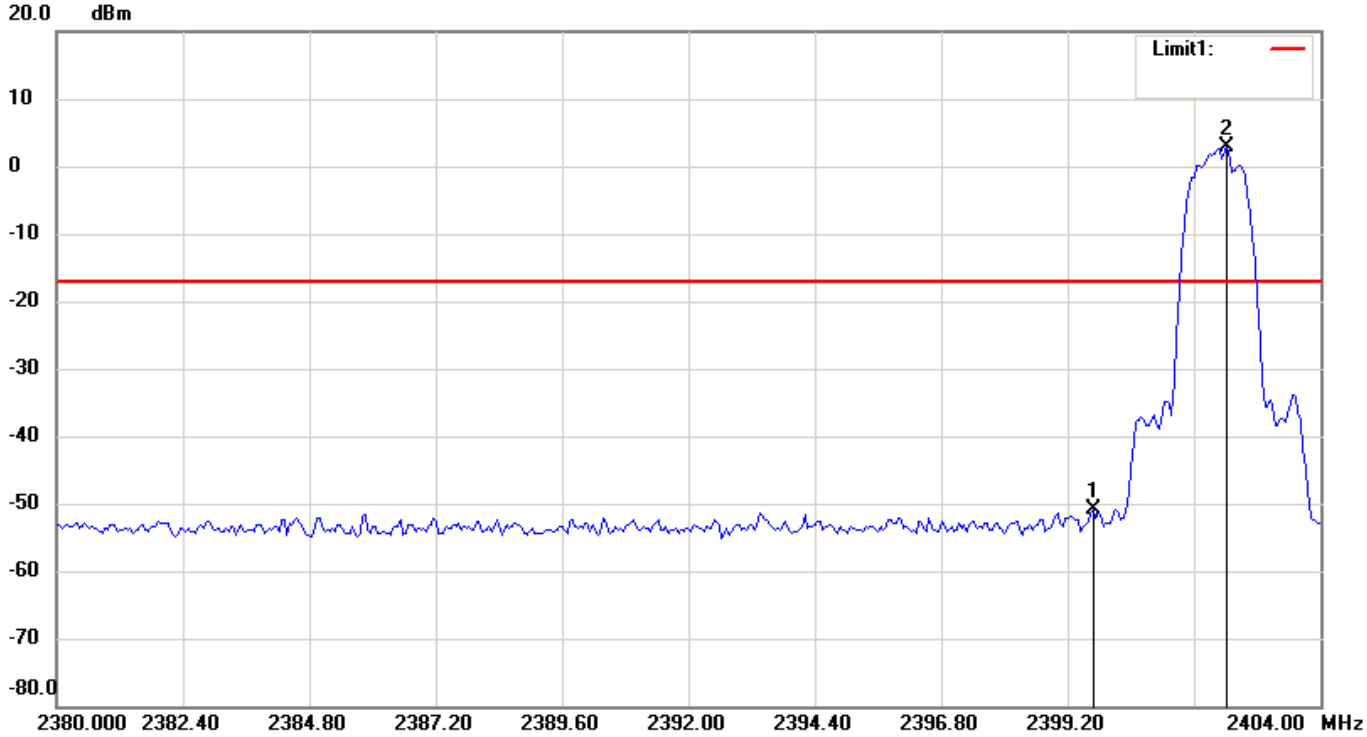
9.4.2 Operation Mode: EDR

Test Date: Aug. 04, 2021 Temperature : 24℃ Humidity: 50%

Channel	Test Frequency Range	Note	Chart
0	2380 MHz - 2404 MHz	Lower Band Edge	Page 65-66
78	2478 MHz - 2500 MHz	Upper Band Edge	Page 67-68
0	30 MHz - 25 GHz		Page 69
39	30 MHz - 25 GHz		Page 70
78	30 MHz - 25 GHz		Page 71

Note: Please refer to page 65 to page 71 for chart.

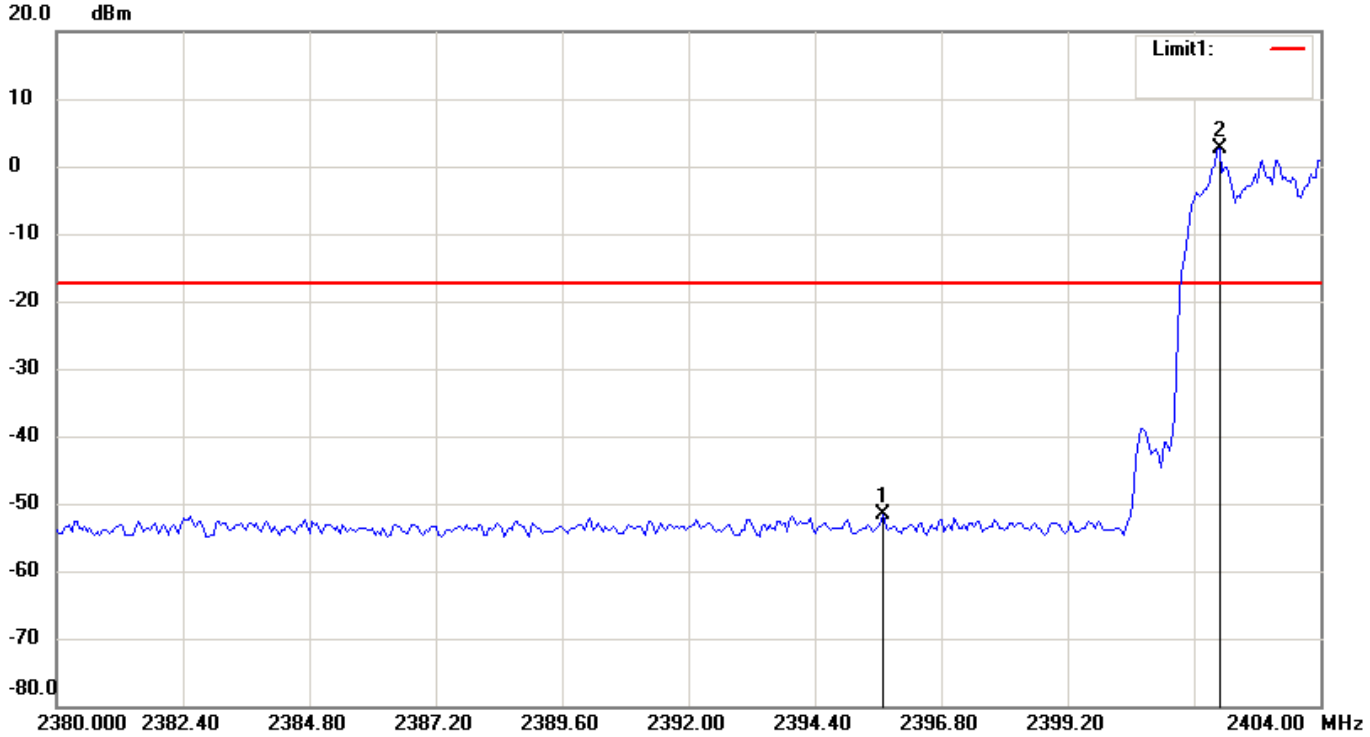
File: **21-05-MAW-007_BT** **#27** **Date:** **2021/8/4** **Temperature:** **24 ℃**
Site: **RF-Cond01** **Humidity:** **50 %**



Condition: **-17.23dBm** **RF Conducted**
EUT: **Rapid Test Reader** **Sweep Time: 1.01ms** **Att.: 25dB**
Model: **CHR-631W** **RBW: 100 KHz** **VBW: 300 KHz**
Test Mode: **BT** **Operator:** **Phillip**
Note: **FCC_BT CH00-Bandedge (Fixed)**

No.	Frequency(MHz)	Level(dBm)
1	2399.68000	-50.95
2	2402.22400	2.77

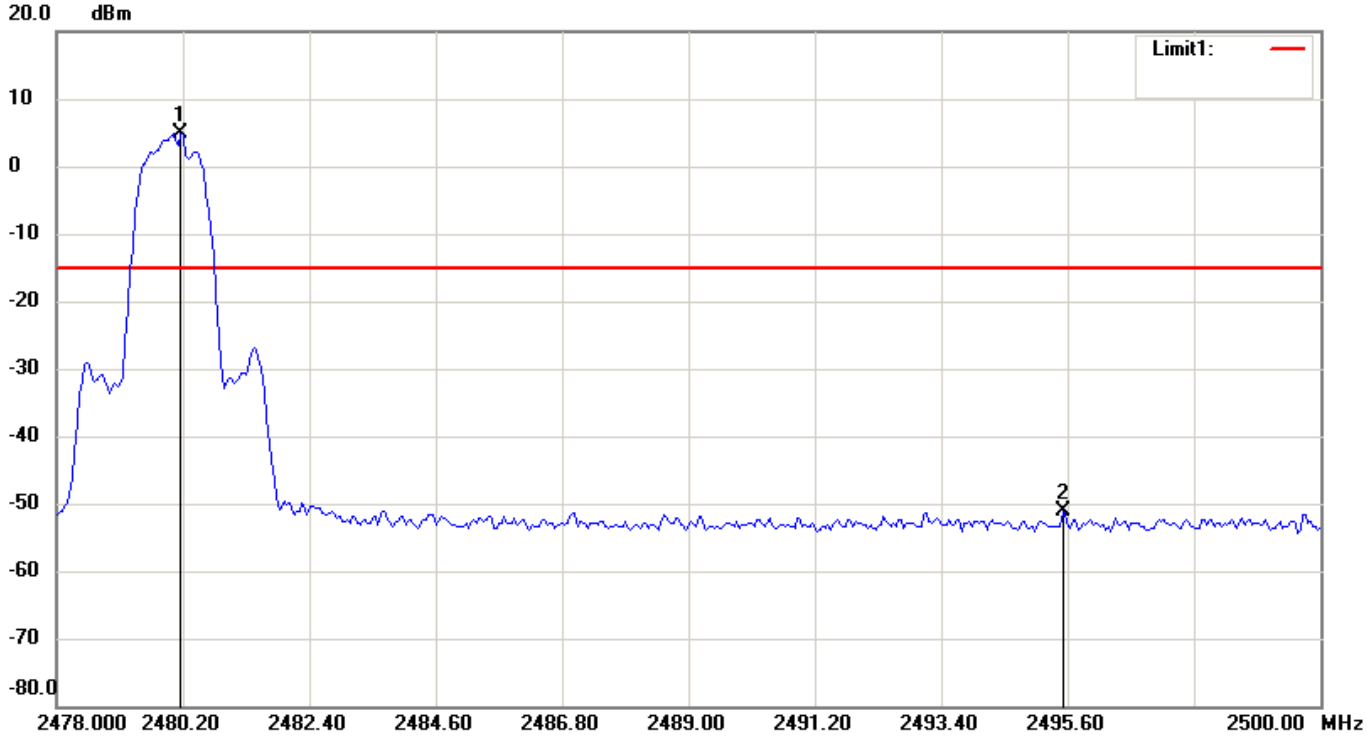
File: **21-05-MAW-007_BT** **#35** **Date:** **2021/8/4** **Temperature:** **24 ℃**
Site: **RF-Cond01** **Humidity:** **50 %**



Condition: **-17.47dBm** **RF Conducted**
EUT: **Rapid Test Reader** **Sweep Time: 1.01ms** **Att.: 25dB**
Model: **CHR-631W** **RBW: 100 KHz** **VBW: 300 KHz**
Test Mode: **BT** **Operator:** **Phillip**
Note: **FCC_BT CH00-Bandedge (Hopping)**

No.	Frequency(MHz)	Level(dBm)
1	2395.69600	-51.70
2	2402.08000	2.53

File: **21-05-MAW-007_BT** **#31** **Date:** **2021/8/4** **Temperature:** **24 ℃**
Site: **RF-Cond01** **Humidity:** **50 %**

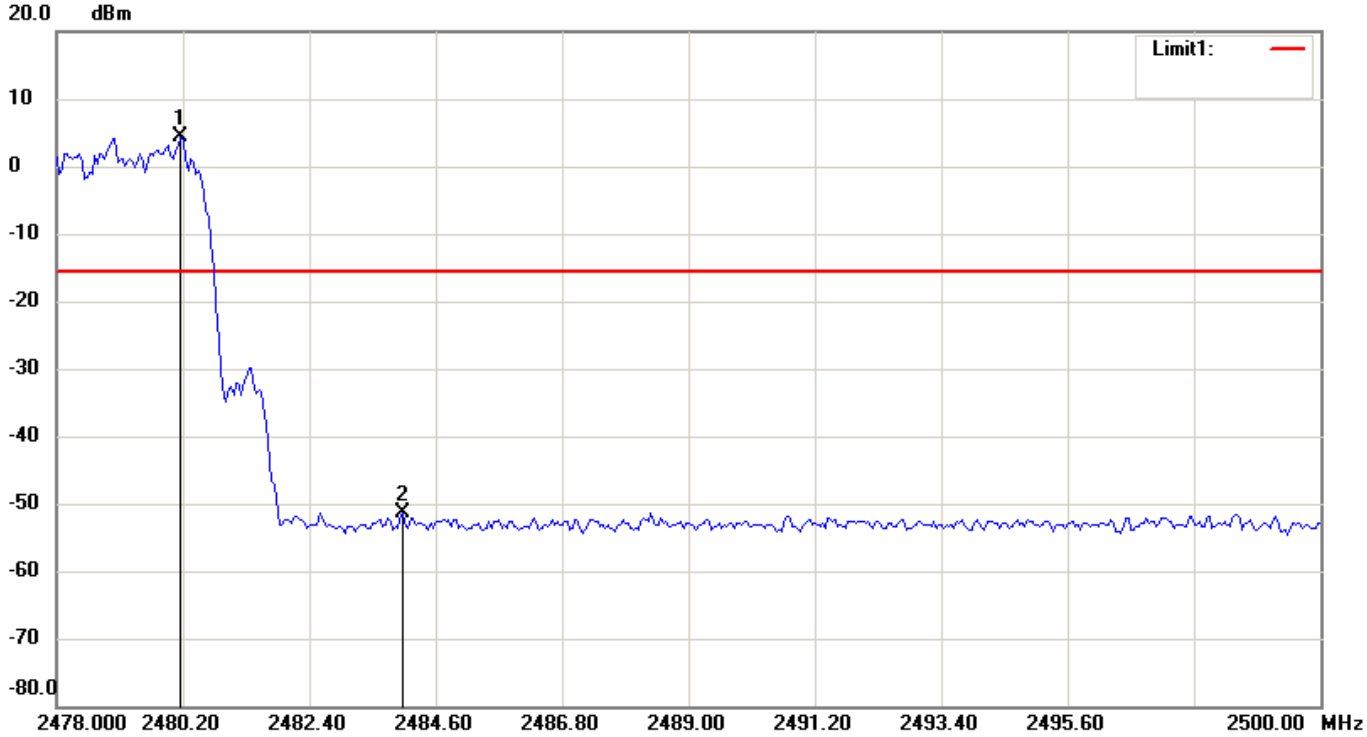


Condition: **-15.16dBm**
EUT: **Rapid Test Reader**
Model: **CHR-631W**
Test Mode: **BT**
Note: **FCC_BT CH78-Bandedge (Fixed)**

RF Conducted
Sweep Time: 1.02ms **Att.: 25dB**
RBW: 100 KHz **VBW: 300 KHz**
Operator: **Phillip**

No.	Frequency(MHz)	Level(dBm)
1	2480.15600	4.84
2	2495.51200	-51.01

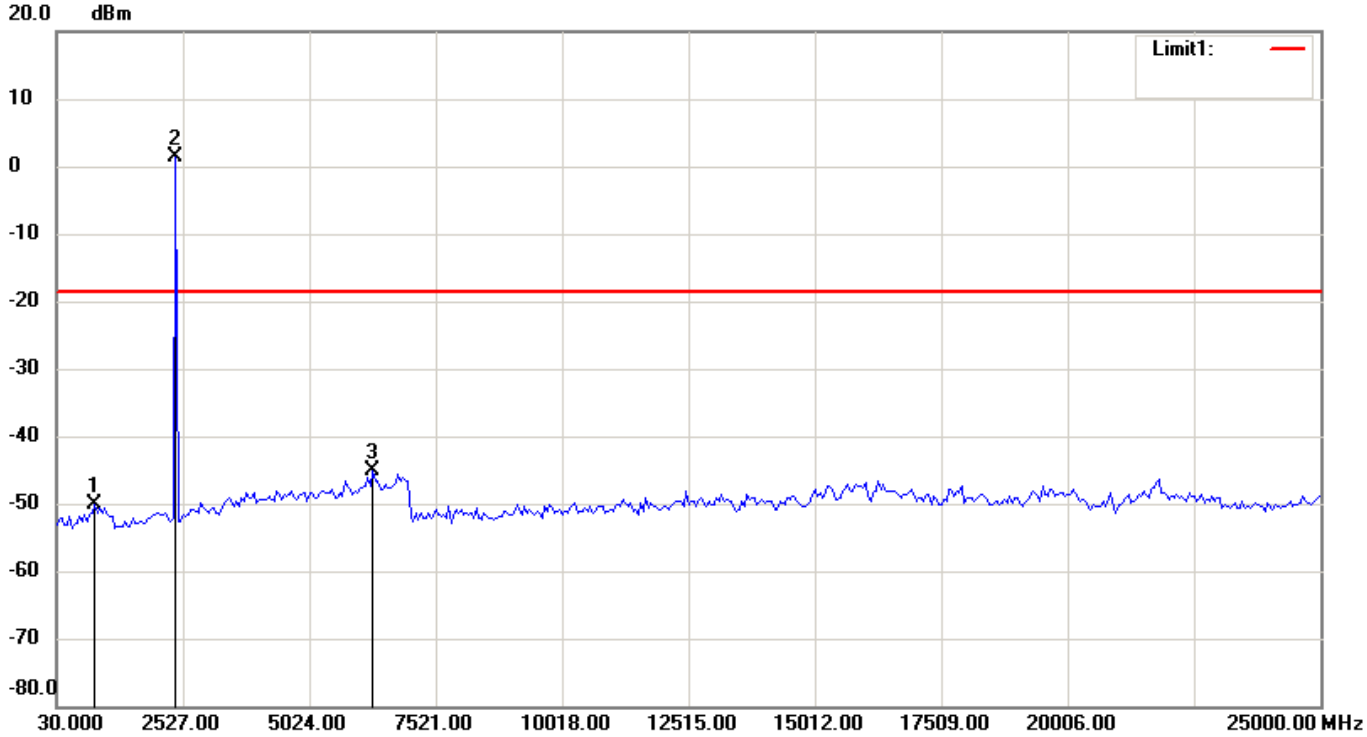
File: **21-05-MAW-007_BT** **#36** **Date:** **2021/8/4** **Temperature:** **24 ℃**
Site: **RF-Cond01** **Humidity:** **50 %**



Condition: **-15.52dBm** **RF Conducted**
EUT: **Rapid Test Reader** **Sweep Time: 1.02ms** **Att.: 25dB**
Model: **CHR-631W** **RBW: 100 KHz** **VBW: 300 KHz**
Test Mode: **BT** **Operator:** **Phillip**
Note: **FCC_BT CH78-Bandedge (Hopping)**

No.	Frequency(MHz)	Level(dBm)
1	2480.15600	4.48
2	2484.02800	-51.44

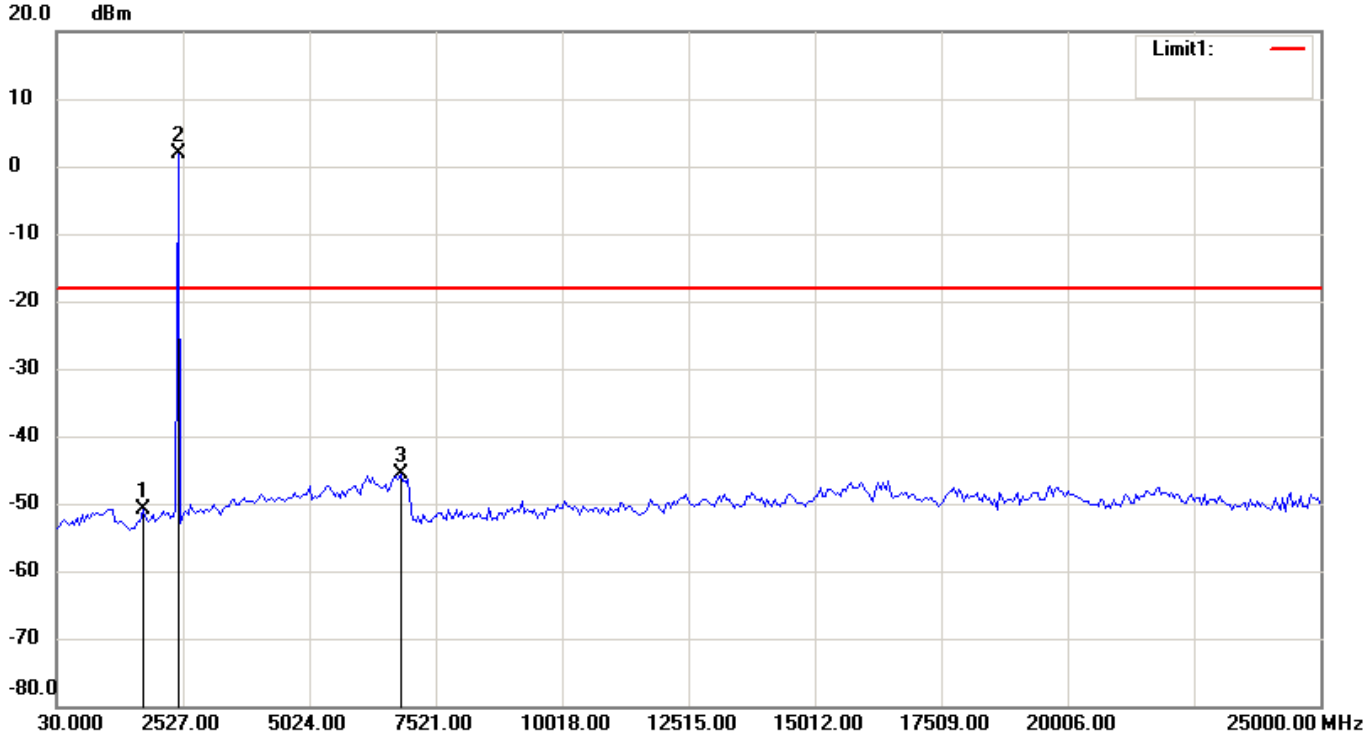
File: **21-05-MAW-007_BT** **#26** **Date:** **2021/8/4** **Temperature:** **24 ℃**
Site: **RF-Cond01** **Humidity:** **50 %**



Condition: **-18.72dBm** **RF Conducted**
EUT: **Rapid Test Reader** **Sweep Time: 250ms** **Att.: 25dB**
Model: **CHR-631W** **RBW: 100 KHz** **VBW: 300 KHz**
Test Mode: **BT** **Operator:** **Phillip**
Note: **FCC_BT CH00-Conducted Spurious**

No.	Frequency(MHz)	Level(dBm)
1	779.1000	-50.08
2	2377.18000	1.28
3	6272.50000	-45.20

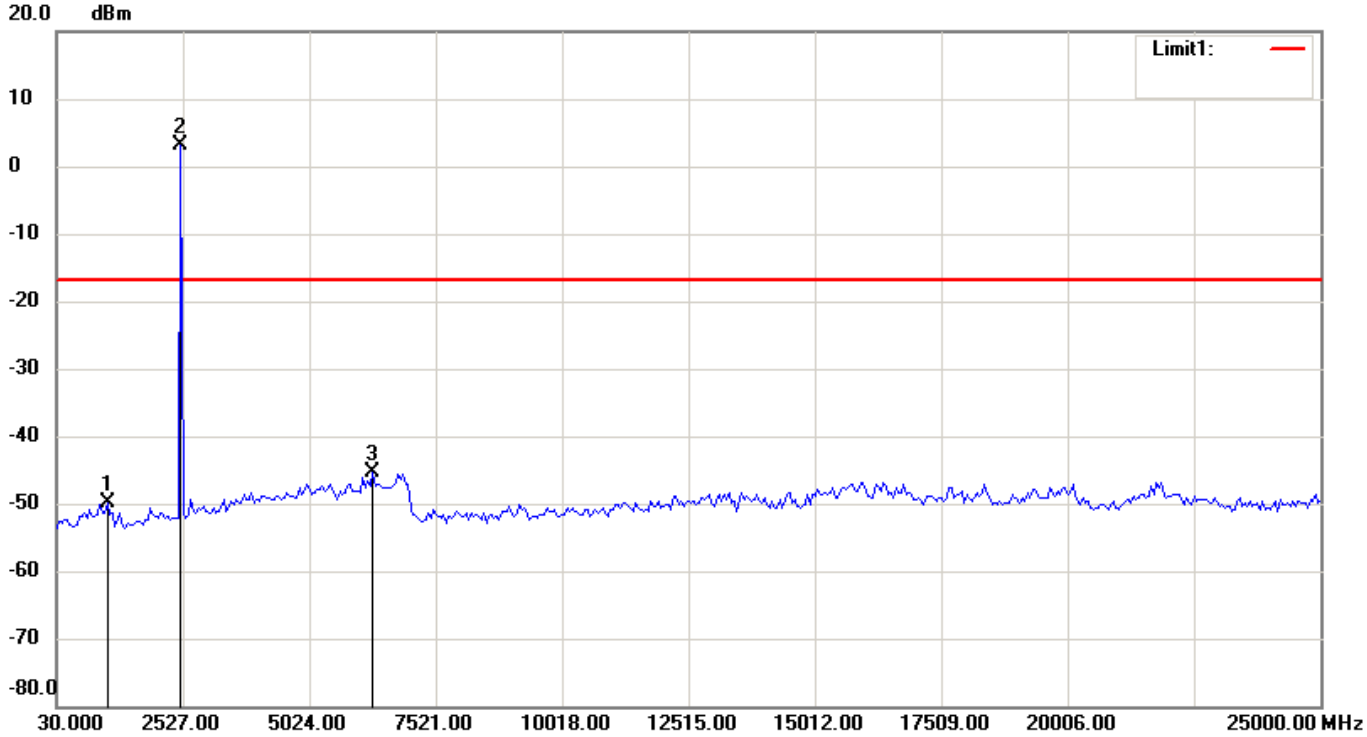
File: **21-05-MAW-007_BT** **#34** **Date:** **2021/8/4** **Temperature:** **24 ℃**
Site: **RF-Cond01** **Humidity:** **50 %**



Condition: **-18.09dBm** **RF Conducted**
EUT: **Rapid Test Reader** **Sweep Time: 250ms** **Att.: 25dB**
Model: **CHR-631W** **RBW: 100 KHz** **VBW: 300 KHz**
Test Mode: **BT** **Operator:** **Phillip**
Note: **FCC_BT CH39-Conducted Spurious**

No.	Frequency(MHz)	Level(dBm)
1	1727.96000	-50.77
2	2427.12000	1.91
3	6821.84000	-45.56

File: **21-05-MAW-007_BT** **#30** **Date:** **2021/8/4** **Temperature:** **24 ℃**
Site: **RF-Cond01** **Humidity:** **50 %**



Condition: **-16.83dBm** **RF Conducted**
EUT: **Rapid Test Reader** **Sweep Time: 250ms** **Att.: 25dB**
Model: **CHR-631W** **RBW: 100 KHz** **VBW: 300 KHz**
Test Mode: **BT** **Operator:** **Phillip**
Note: **FCC_BT CH78-Conducted Spurious**

No.	Frequency(MHz)	Level(dBm)
1	1028.80000	-49.81
2	2477.06000	3.17
3	6272.50000	-45.49

10 NUMBER of HOPPING CHANNELS

10.1 Standard Applicable

According to 15.247(a)(1)(iii), frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

10.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. The setup of the EUT as shown in figure 4. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set EUT to hopping operating mode and set spectrum analyzer miximum to measure the number of hopping channels.

10.3 Measurement Equipment

Equipment	Trade Name	Model No.
Spectrum Analyzer	R&S	FSV40
Attenuator	WEINSCHEL	56-10

Software: LZ-RF (Ver. ETC-3A2)

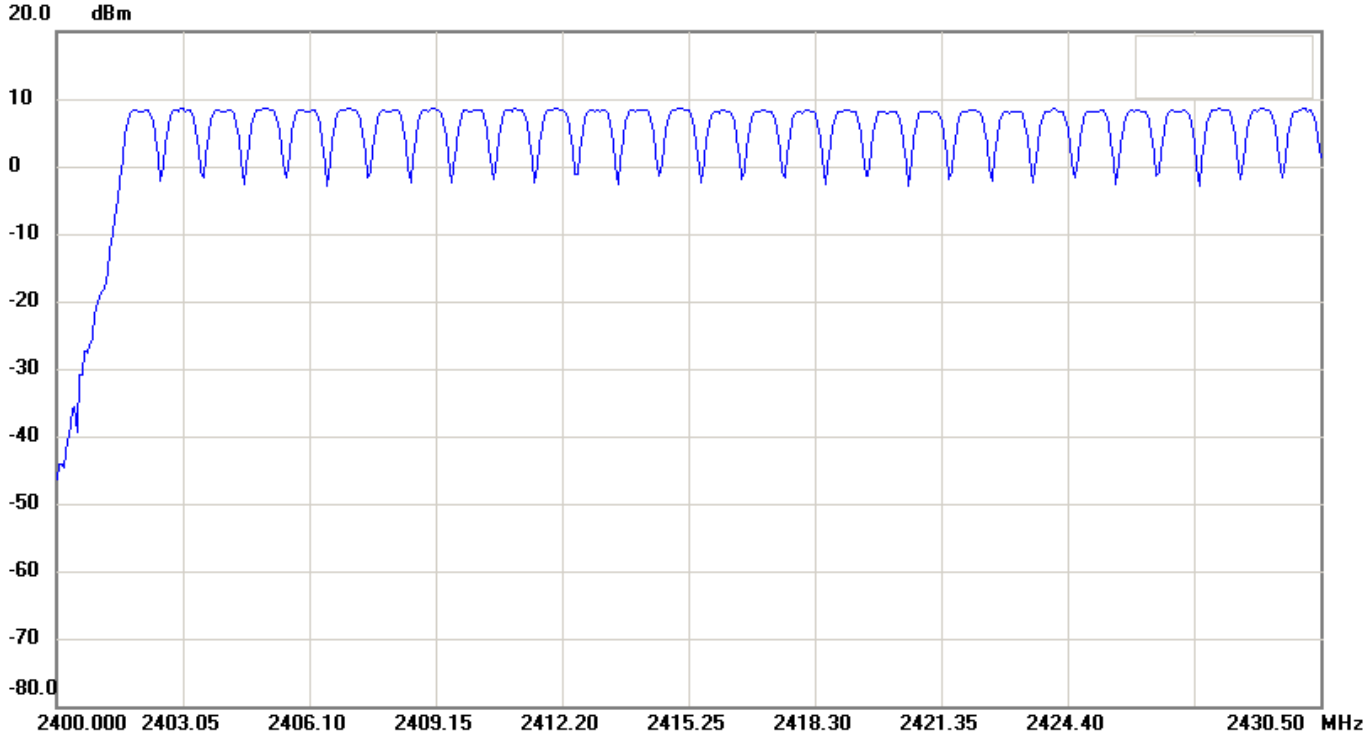
10.4 Measurement Data

Test Date: Aug. 04, 2021 Temperature : 24℃ Humidity: 50%

Number of hopping channels = 79 channels

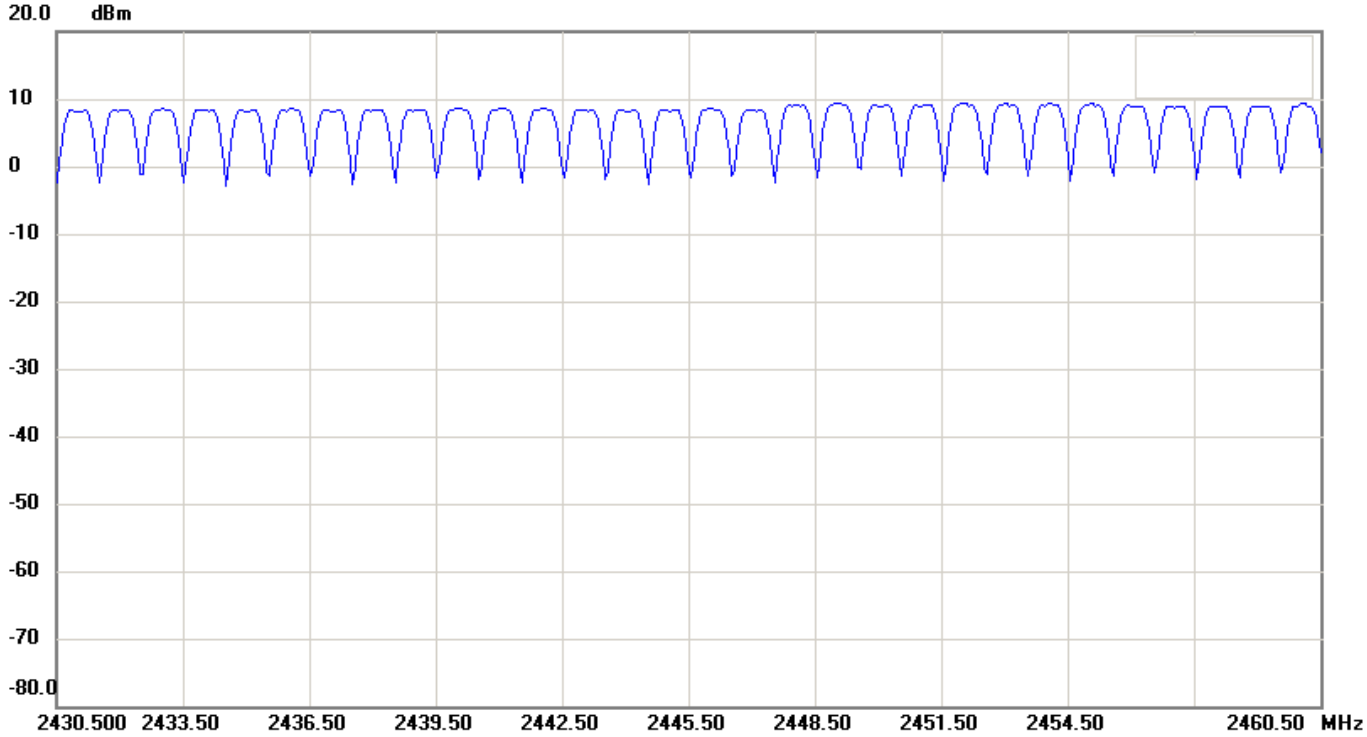
Note: Please refer to page 73 to page 75 for chart.

File: **21-05-MAW-007_BT** **#21** **Date:** **2021/8/4** **Temperature:** **24 ℃**
Site: **RF-Cond01** **Humidity:** **50 %**



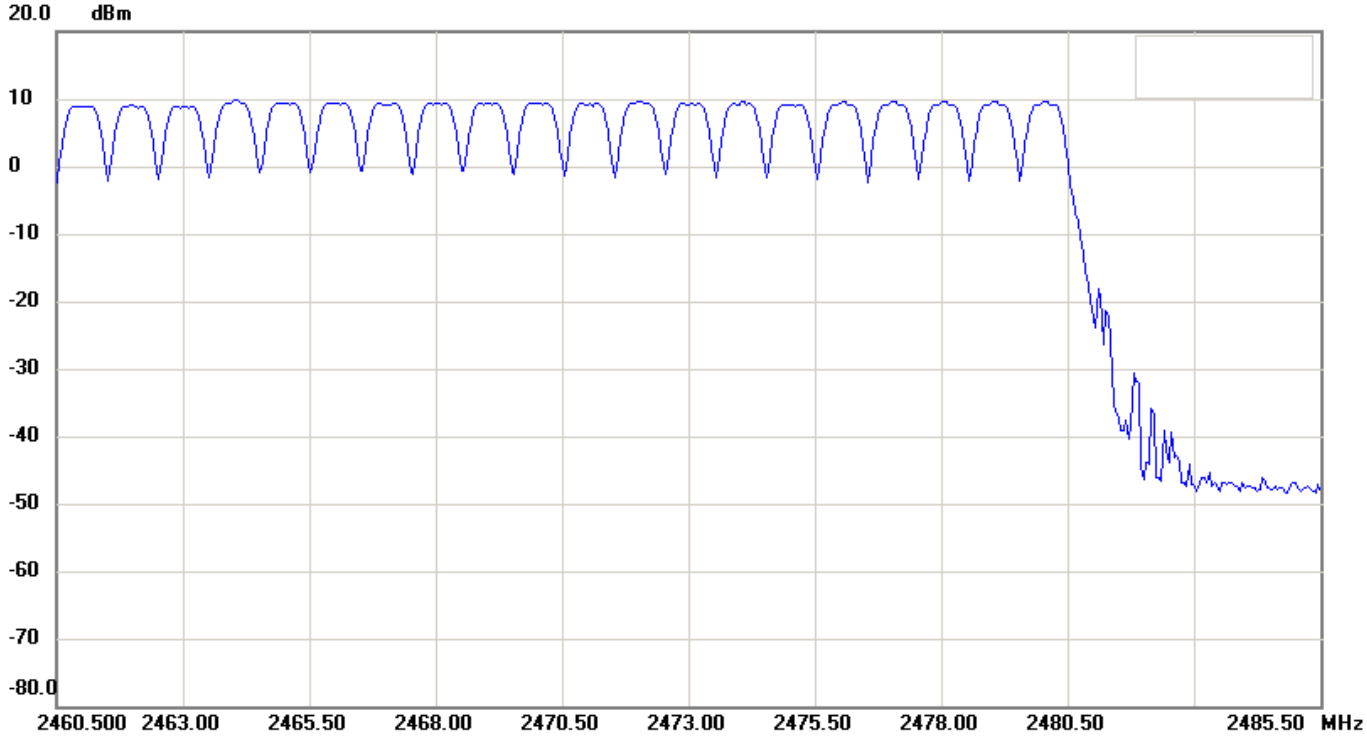
Condition:		**RF Conducted**	
EUT:	**Rapid Test Reader**	**Sweep Time: 1ms**	**Att.: 25dB**
Model:	**CHR-631W**	**RBW: 300 KHz**	**VBW: 300 KHz**
Test Mode:	**BT**	**Operator:**	**Phillip**
Note:	**FCC_BT Number of Hopping Channels -Part1**		

File: **21-05-MAW-007_BT** **#22** **Date:** **2021/8/4** **Temperature:** **24 ℃**
Site: **RF-Cond01** **Humidity:** **50 %**



Condition: **RF Conducted**
EUT: **Rapid Test Reader** **Sweep Time: 1ms** **Att.: 25dB**
Model: **CHR-631W** **RBW: 300 KHz** **VBW: 300 KHz**
Test Mode: **BT** **Operator:** **Phillip**
Note: **FCC_BT Number of Hopping Channels -Part2**

File: **21-05-MAW-007_BT** **#23** **Date:** **2021/8/4** **Temperature:** **24 ℃**
Site: **RF-Cond01** **Humidity:** **50 %**



Condition:		**RF Conducted**	
EUT:	**Rapid Test Reader**	**Sweep Time: 1ms**	**Att.: 25dB**
Model:	**CHR-631W**	**RBW: 300 KHz**	**VBW: 300 KHz**
Test Mode:	**BT**	**Operator:**	**Phillip**
Note:	**FCC_BT Number of Hopping Channels -Part3**		

11 HOPPING CHANNEL CARRIER FREQUENCY SEPARATED

11.1 Standard Applicable

According to 15.247(a)(1), the frequency hopping system shall have hopping channel carrier frequencies seperated by minimum of 25kHz or the 20dB bandwidth of 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 125mW.

11.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. The setup of the EUT as shown in figure 4. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any measurement frequency within its operating ragne and make sure the instrument is operated in its linear range.
3. Set spectrum analyzer maximum hold to measure channel carrier frequency , then adjust channel carrier frequency to adjacent channel.
4. Repeat above procedure until all measured frequencies were complete.

11.3 Measurement Equipment

Equipment	Trade Name	Model No.
Spectrum Analyzer	R&S	FSV40
Attenuator	WEINSCHEL	56-10

Software: LZ-RF (Ver. ETC-3A2)

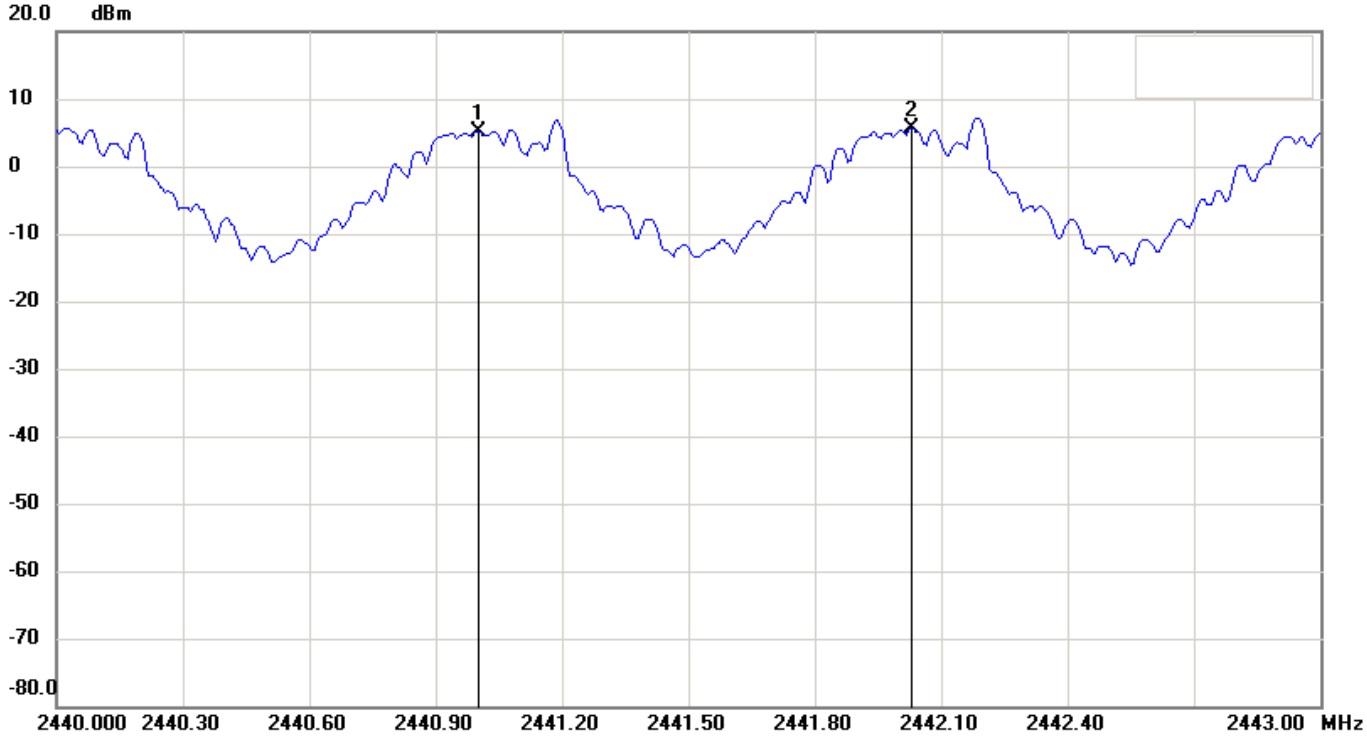
11.4 Measurement Data

Test Date: Aug. 04, 2021 Temperature : 24℃ Humidity: 50%

Channel	Hopping Channel Carrier Frequency Separated (MHz)	Chart
M	1.026	Page 78

Note: 1. Please refer to page 78 for chart.
2. CH Low, CH Mid and CH High have the same test result. Only CH Mid test result showed in the test report.

File: **21-05-MAW-007_BT** **#20** **Date:** **2021/8/4** **Temperature:** **24 ℃**
Site: **RF-Cond01** **Humidity:** **50 %**



Condition: **RF Conducted**
EUT: **Rapid Test Reader** **Sweep Time: 1.05ms** **Att.: 25dB**
Model: **CHR-631W** **RBW: 30 KHz** **VBW: 100 KHz**
Test Mode: **BT** **Operator:** **Phillip**
Note: **FCC_BT Carrier Frequency Separation**

No.	Frequency(MHz)	Level(dBm)
1	2441.00200	5.19
2	2442.02800	5.73

No.		△Frequency(MHz)	△Level(dB)
1	mk2-mk1	1.026	0.54

12 Dwell Time

12.1 Standard Applicable

According to 15.247(a)(1)(iii), frequency hopping system in the 2400-2483.5MHz band employing at least 15 non-overlapping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 second multiplied by the number of hopping channels employed.

12.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. The setup of the EUT as shown in figure 4.

12.3 Measurement Equipment

Equipment	Trade Name	Model No.
Spectrum Analyzer	R&S	FSV40
Attenuator	WEINSCHEL	56-10

Software: LZ-RF (Ver. ETC-3A2)

12.4 Measurement Data

Test Date: Aug. 04, 2021 Temperature : 24℃ Humidity: 50%

12.4.1 3DH1

Test period=0.4(second/channel)×79 channel=31.6sec

Calculation of frequency hopping in test period:

The system frequency hopping 1600 times per second, so each time the frequency hopping 1/1600 = 0.625ms. And each package requires 1 transmission and 1 receive, So only in the 79 channels per second only 800 times, the average number of transmissions per channel per channel is 800/79 = 10.13 times. The number of transmissions per channel in the period (31.6 seconds) is 10.13 x 31.6 = 320.1 times.

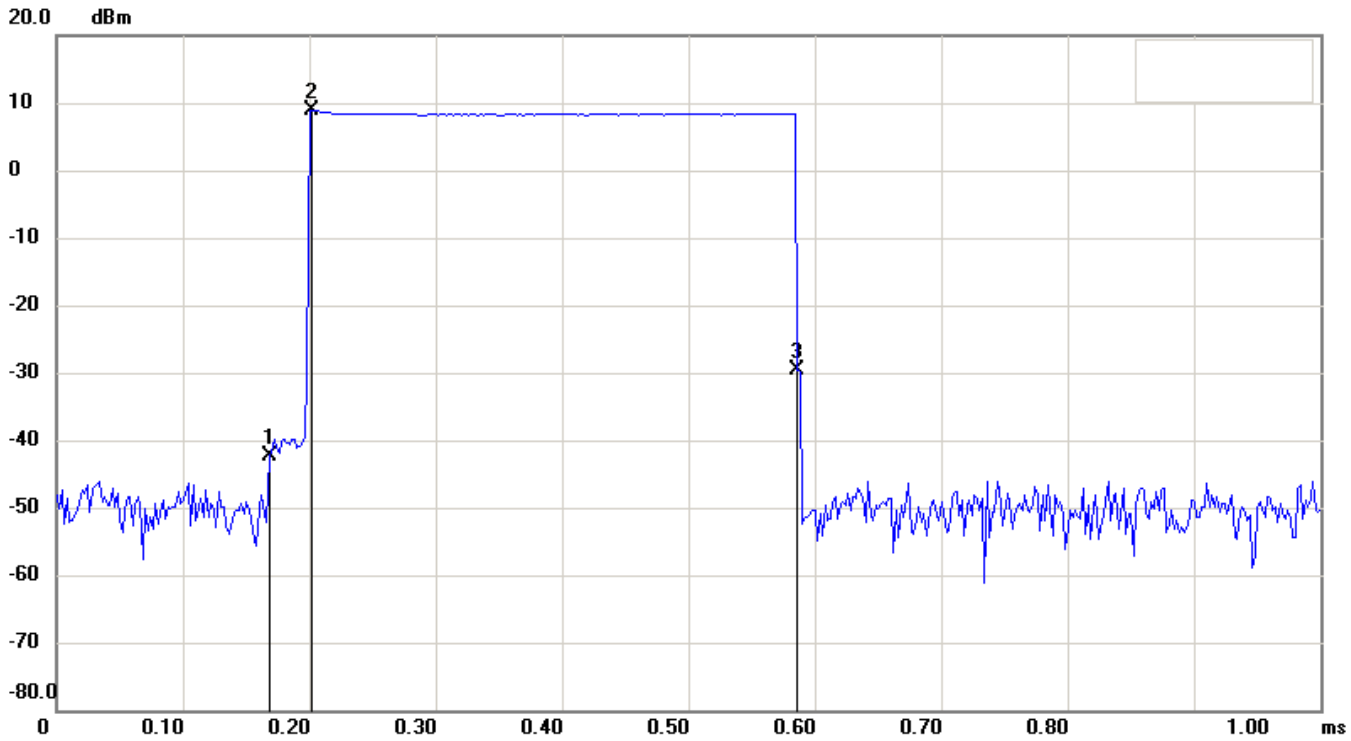
The dwell time in test period = 0.418 ms×320.1= 133.8 ms.

Note: 1.Please refer to page 80 for chart.

2. This device complies with the Bluetooth specifications and can operate in hopping mode on N channels, where 20 <or= N <or= 79. As the same pseudo random hopping channel selection mechanism is used for all cases of N, by complying with the dwell time requirements of channel occupancy < 0.4s in N x 0.4s for N = 79, compliance with any value for N is demonstrated.

File: **21-05-MAW-007_BT** **#15** **Date:** **2021/8/4** **Temperature:** **24 ℃**

Site: **RF-Cond01** **Humidity:** **50 %**



Condition: **-11.11dBm** **RF Conducted**

EUT: **Rapid Test Reader** **Sweep Time: 1ms** **Att.: 25dB**

Model: **CHR-631W** **RBW: 1000 KHz** **VBW: 1000 KHz**

Test Mode: **BT** **Operator:** **Phillip**

Note: **FCC_DH1 pulse width**

No.	Sweep time(ms)	Level(dBm)
1	0.1680	-42.30
2	0.2020	8.89
3	0.5860	-29.74

No.		△Time(ms)	△Level(dB)
1	mk3-mk1	0.418	12.56

12.4.2 3DH3

Test period=0.4(second/channel)$\times$79 channel=31.6sec

Calculation of frequency hopping in test period:
The system frequency hopping 1600 times per second, so each time the frequency hopping 1/1600 = 0.625ms. And each package requires 3 transmissions and 1 receive, So only in the 79 channels per second only 400 times, the average number of transmissions per channel per channel is 400/79 = 5.06 times. The number of transmissions per channel in the period (31.6 seconds) is 5.06 x 31.6 = 159.9 times.

The dwell time in test period = 1.656 ms$\times$159.9= 264.8 ms.

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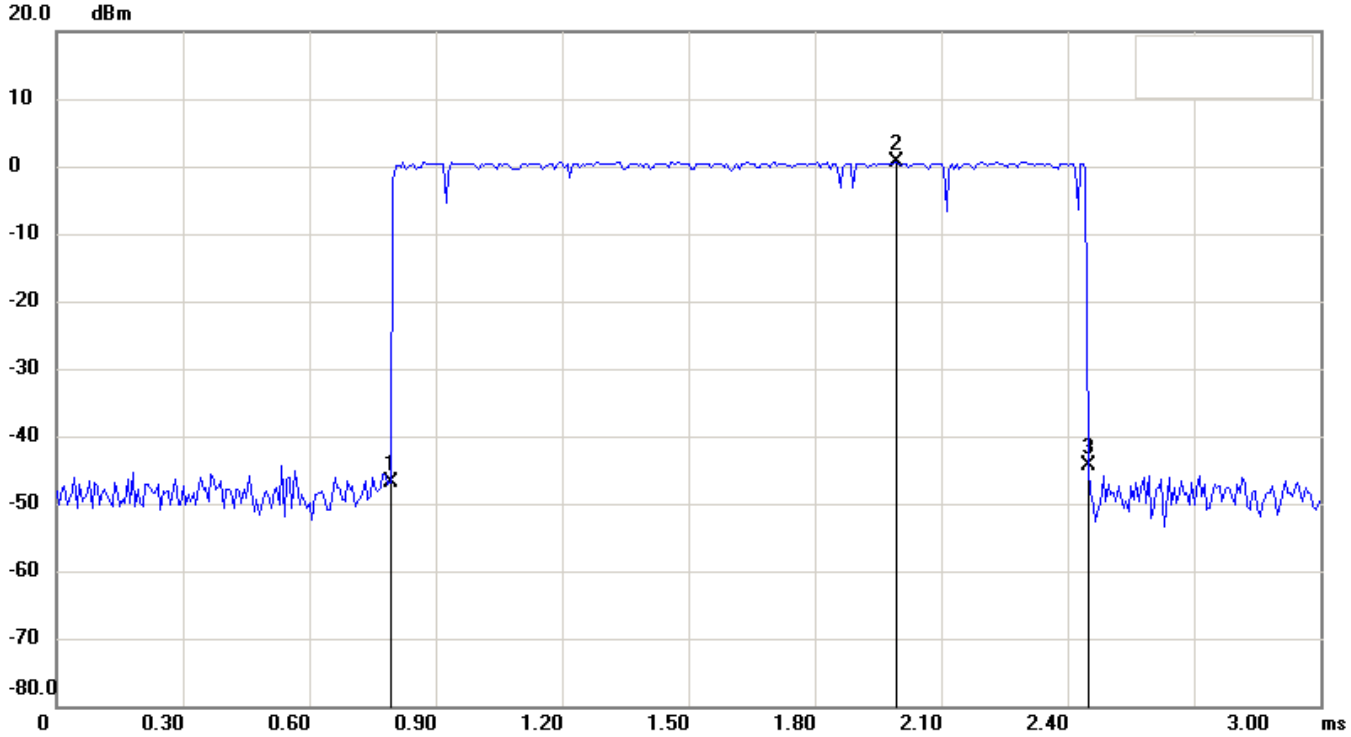
Note: 1.Please refer to page 82 for chart.

2. This device complies with the Bluetooth specifications and can operate in hopping mode on N channels, where 20 <or= N <or= 79. As the same pseudo random hopping channel selection mechanism is used for all cases of N, by complying with the dwell time requirements of channel occupancy < 0.4s in N x 0.4s for N = 79, compliance with any value for N is demonstrated.

File: **21-05-MAW-007_BT** **#17** **Date:** **2021/8/4** **Temperature:** **24 ℃**
Site: **RF-Cond01** **Humidity:** **50 %**



Condition: **-19.39dBm** **RF Conducted**
EUT: **Rapid Test Reader** **Sweep Time: 3ms** **Att.: 25dB**
Model: **CHR-631W** **RBW: 1000 KHz** **VBW: 1000 KHz**
Test Mode: **BT** **Operator:** **Phillip**
Note: **FCC_DH3 pusle width**

No.	Sweep time(ms)	Level(dBm)
1	0.7920	-46.78
2	1.9920	0.61
3	2.4480	-44.45

No.		△Time(ms)	△Level(dB)
1	mk3-mk1	1.656	2.33

12.4.3 3DH5

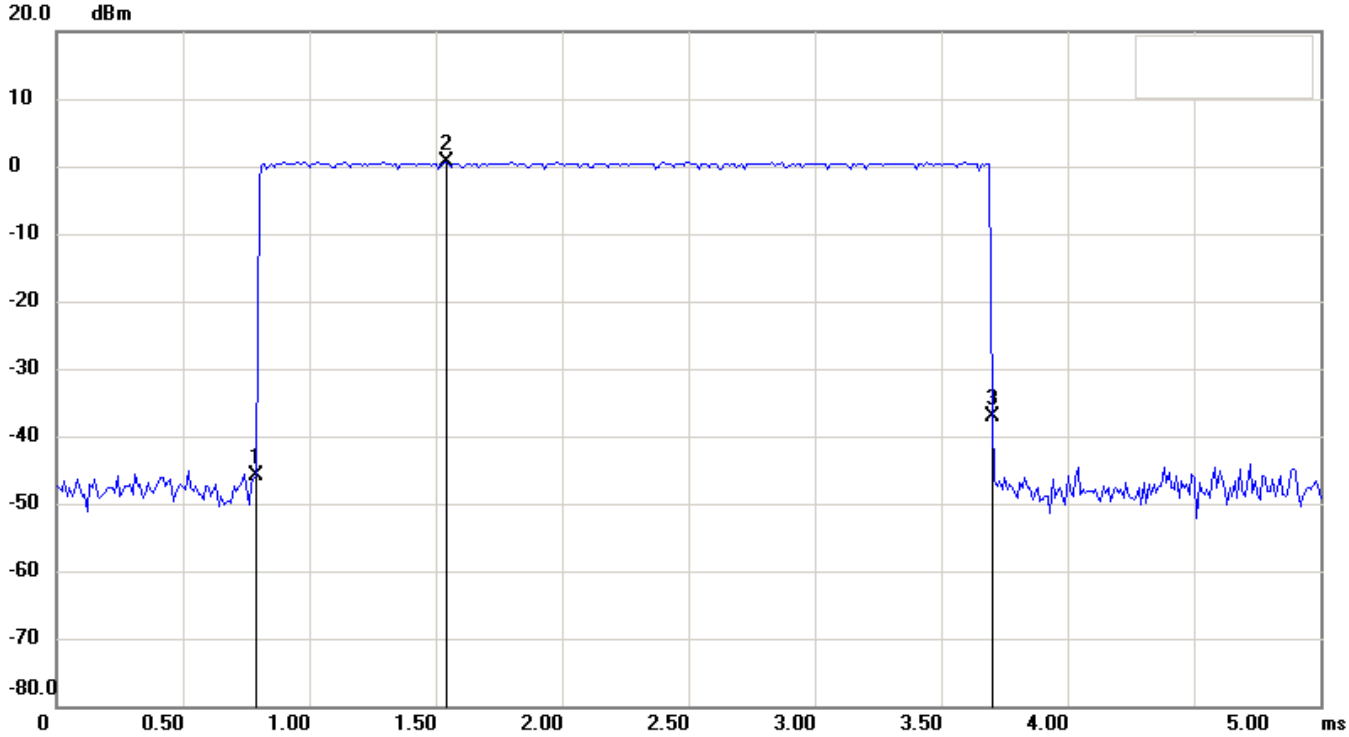
Test period=0.4(second/channel)$\times$79 channel=31.6sec

Calculation of frequency hopping in test period:
The system frequency hopping 1600 times per second, so each time the frequency hopping 1/1600 = 0.625ms. And each package requires 5 transmissions and 1 receive, So only in the 79 channels per second only 266.7 times, the average number of transmissions per channel per channel is 266.7/79 = 3.38 times. The number of transmissions per channel in the period (31.6 seconds) is 3.38 x 31.6 = 106.81 times.

The dwell time in test period = 2.910 ms$\times$106.81= 310.8 ms.

Note: 1.Please refer to page 84 for chart.
2. This device complies with the Bluetooth specifications and can operate in hopping mode on N channels, where 20 <or= N <or= 79. As the same pseudo random hopping channel selection mechanism is used for all cases of N, by complying with the dwell time requirements of channel occupancy < 0.4s in N x 0.4s for N = 79, compliance with any value for N is demonstrated.

File: **21-05-MAW-007_BT** **#19** **Date:** **2021/8/4** **Temperature:** **24 ℃**
Site: **RF-Cond01** **Humidity:** **50 %**



Condition: **-19.39dBm**
EUT: **Rapid Test Reader**
Model: **CHR-631W**
Test Mode: **BT**
Note: **FCC_DH5 pulse width**

RF Conducted
Sweep Time: 5ms **Att.: 25dB**
RBW: 1000 KHz **VBW: 1000 KHz**
Operator: **Phillip**

No.	Sweep time(ms)	Level(dBm)
1	0.7900	-45.78
2	1.5400	0.61
3	3.7000	-37.09

No.		△Time(ms)	△Level(dB)
1	mk3-mk1	2.91	8.69

13 Measurement Equipment

Equipment	Trade Name	Model No.	S/N	Calibration Date	Next Cal. Due
EMI Test Receiver	R&S	ESCI	13054418-001	11/05/2021	11/04/2022
V-LISN	R&S	ENV216	13057719-001	05/13/2021	05/12/2022
Spectrum Analyzer	R&S	FSV40	13052017-001	05/27/2021	05/26/2022
Attenuator	WEINSCHEL	56-10	58772	05/03/2021	05/02/2022
EMI Receiver	R&S	ESCI	13054423-001	11/24/2021	11/23/2022
Spectrum Analyzer	R&S	FSU46	13040904-001	05/13/2021	05/12/2022
Horn Antenna	EMCO	3117	13059211-004	04/09/2021	04/08/2022
Horn Antenna	EMCO	3116	13059202-001	11/04/2021	11/03/2022
Loop Antenna	ETS-LINDREN	6512	13054106-001	06/15/2021	06/14/2022
PRE-Amplifier	Agilent	8449B	13040709-001	12/01/2021	11/30/2022
PRE-Amplifier	Agilent	8447D	13040715-002	05/03/2021	05/02/2022
BiLog Antenna	ETC	MCTD 2786	BL19J04024	03/11/2021	03/10/2022
Trilog Broadband Antenna with 5dB Pad	SCHWARZBECK &EMCI	VULB 9168 & EMCI-N-6-05	1211&AT-N0569	05/10/2021	05/09/2022